Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

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1 Executive Summary

The vertical distributions of water column biota were evaluated to estimate the volumetric densities (# m^{-3}) of organisms within broad depth ranges sampled by the gear used to quantify abundance. For example, the Southeast Area Monitoring and Assessment Program (SEAMAP) plankton program sampled plankton using bongo nets deployed from 200m (or from just above the sea floor on the shelf) to the surface, but many of the species captured actually occupy narrower depth ranges. A literature review was conducted and existing depth-discrete datasets were examined to estimate appropriate depth ranges. However, available literature on vertical depth ranges is either very general across species groups, life stages, time frames, and locations, or specific to a few taxa in localized areas and conditions, limiting its usefulness for the assignment of taxa-specific depth ranges for Gulf of Mexico biota potentially exposed to the spilled oil. Therefore, depth distributions were developed for individual taxa through depth-discrete dataset analysis and the application of default (or proxy) depth ranges informed by literature when the depth-discrete information was incomplete.

Available depth-discrete data sets collected by Multiple Opening and Closing Net and Environmental Sensing System (MOCNESS) were used to evaluate vertical depth ranges and evidence of diel vertical migration behavior. The SEAMAP Ichthyoplankton Historical 1-m^2 MOCNESS, NRDA 1-m^2 MOCNESS, and NRDA 10-m^2 MOCNESS datasets included sufficient sampling locations and net samples to evaluate vertical depth ranges of plankton and small nektonic fish. Criteria for depth range analysis were developed with guidance from Mary Christman of MCC Statistical Consulting LLC. The SEAMAP Ichthyoplankton Historical 1 m^2 MOCNESS dataset was the focus of the analysis as it was the most extensive dataset across both time and space and sampled a high priority life stage (fish larvae).

Given the complexities of the vertical distribution patterns shown by the data and potential under-sampling of some taxa, modeling was performed assuming even depth distributions within specified depth ranges. Taking into account the statistical analyses and nature of the dataset, uniformity was assumed over a depth range that contained 95% of a taxon's average abundance in the MOCNESS datasets. Restricting the depth range reduced the influence of outlier or rare individuals caught at either the shallow or deep end of the range. This report describes derivation of vertical ranges for plankton, both fish (ichthyoplankton) and invertebrate, which encompass 95% of their abundances in MOCNESS samples.

2 Vertical Distributions of Fish and Invertebrates

2.1 Vertical Distribution and Migration of Gulf of Mexico Species

2.1.1 Overview Based on Literature Review

Throughout the world's oceans, marine organism populations are vertically stratified by depth, existing in different zones of the water column. These zones represent habitats with distinct characteristics that the organisms inhabit for a variety of reasons. The epipelagic zone (0 – 200 m depth) is the warmest and most productive layer of the ocean, containing the most dissolved oxygen and light available for photosynthesis (Barton 2007). Fish that inhabit this zone tend to be powerful swimmers, with high fecundities and coloration that helps them avoid detection by visual predators from certain angles (blue/green dorsal, silvery ventral side; Barton 2007). Due to marked differences between surface waters (affected by wind and waves) and the waters beneath, the epipelagic zone is further divided into the mixed layer (approximately 0-40 m in the Gulf of Mexico (GOM) during April-September of 2010) and below the mixed layer (40-200 m). The mesopelagic zone (200-1,000 m depth) is only dimly lit with light extinguishing somewhere below 700 m, which is approximately where the zone is subdivided into upper and lower subzones (Barton 2007). Plots of abundance over depth support this zone division with a marked break or change in the vertical distributions of some taxa in the 600 – 800 m depth range (see Appendix E or F for plots and Section 3 for details of the analysis).The mesopelagic zone retains some phytoplankton and high nektonic species diversity (Cook et al. 2012), nourished by detritus falling from above. Many fish in these zones are specialized in some way to fill particular niches and most vertical migrations take place between the mesopelagic and epipelagic zones (Barton 2007). The bathypelagic zone (1,000-4,000 m depth) is devoid of light and very cold, with nutrient input from above driving production. Fishes in this zone have incredible adaptations to maximize rare feeding opportunities like huge gapes, distensible stomachs, and luminous lures to attract prey. Most fish located below 1,000 m do not have gas swim bladders (Barton 2007) and migration is less prevalent overall; although there are a few deep-water fish species known to move vertically, aiding energy transfer between zones (Neilson and Perry 1990, Cook et al. 2012).

Depth zones can differ across physical-chemical gradients of light, temperature, hydrostatic pressure, and salinity as well as biological gradients of production, community structure, predation pressure, and food or nutrient availability (Angel 1985). These gradients serve as drivers of vertical distributions and migration behavior in organisms adapted to optimize resource availability. The rate of change of light intensity is a primary driver of most vertical migrations, influencing production and food availability as well as the depths at which organisms are vulnerable to visual predation (Angel 1985. Temperature has a strong effect as well, with some organisms believed to migrate for bioenergetic advantages (using less energy for metabolism in deeper waters with cooler temperatures), although the cost of migrating can negate such advantages in some cases (Torres and Childress 1983,cited within Angel 1985). There are other factors influencing migration such as current shear, broad-scale circulation patterns, fine-scale mixing, tides, and seasonality (Angel 1985). Some organisms use differential currents that occur within shallow and deep layers of water at strategic times to avoid drifting out of a system or for horizontal transport to different areas within an estuary for particular life stage activities, such as spawning (Angel 1985).

In the GOM, water column characteristics are affected primarily by inputs from the Mississippi River and the Loop Current. The Mississippi River creates a laterally homogenous freshwater

layer (lens) above the salt water of the shelf that ranges from 1-10 m in depth (Walker et al. 2005). The nutrient inflow from the Mississippi River makes the GOM shelf a highly productive area, though it also contributes to recurring hypoxia in the bottom layers west of the bird-foot delta during the summer when surface temperatures are around 28-29°C (Walker et al. 2005). Both temperature and salinity are heavily influenced by the Loop Current, which is a mass of warm water with >36.8 salinity above 200 m depth that flows in through the Yucatán Channel and moves clockwise (anticyclonic direction) out through the Florida Straits, with the largest intrusion during the spring and summer (Monreal-Gomez et al. 2004). As described by Hamilton et al. (2011), current measurements taken across a water column in the center of the Loop Current during the summer revealed a two-layer current structure with an interface between 700 – 1,000 m, above which the water moved quickly (1.9 m/s) and below which the water moved slowly (0.11 m/s). In the northeastern GOM, the thermocline typically begins at 200 m depth and extends to 1,200 m, while in the eastern GOM it begins at 50 m and extends to 1,600 m depth where it reaches 4.25°C (Espino and Rojas 2004). Additionally, there is a layer of minimum salinity (34.8-34.9) at depths of 500-1,000 m in the GOM (Espino and Rojas 2004). Dissolved oxygen is uniform in the mixing layer (to 200 m) and at a minimum between 200-600 m depths depending on local circulation conditions (Espino and Rojas 2004). These circulation patterns and differences in water column characteristics suggest a marked change in habitat type around 700 m depth (between the upper and lower mesopelagic zones) which likely affects the habitat use and vertical distribution of organisms in the water column.

When the vertical distribution of a population varies rhythmically throughout the day, it is called diel vertical migration (DVM). There are two kinds of DVM patterns: Type I – when the population is higher in the water column at night and lower during the day, and Type II – when the population is deeper in the water column at night and nearer the surface during the day (Neilson and Perry 1990). Type II is also commonly referred to as reverse DVM. The type I pattern is most common but there are key species that exhibit type II behavior; for example, *Brevoortia patronus* (Gulf menhaden) larvae were found in the top 0 - 70 m water at night but most were concentrated at the surface at midday (Sogard et al. 1987). While some species display these migration patterns regularly and distinctly, many seem to vary their behavior between seasons, life stages, or even between individuals. Migration can be synchronous, where all individuals of a group migrate similarly, or asynchronous, sometimes resulting in a bimodal or homogenous distribution within the water column.

Based on literature review, summarized above and in Appendix A, many of the fish and invertebrates found in the shelf and slope waters of the Northeastern GOM inhabit, or are common to, specific depth ranges and some populations routinely vertically migrate to and from various depths. In general, vertical stratification tends to increase as overall water column depth increases. Vertical migratory ranges are greater further offshore in deeper slope waters as compared to shallower near shore shelf areas. Vertical distribution and movement behavior can vary by life stage for epipelagic, mesopelagic, and bathypelagic organisms.

2.1.2 Approach for Assignment of Depth Ranges

The vertical depth range occupied by a population or taxonomic group of individuals would have directly affected the extent of their exposure to concentrations of oil components during and after the DWH release. However, available literature on vertical depth ranges is either very general across species groups, life stages, time frames, and locations, or specific to a few taxa in localized areas and conditions, limiting its usefulness for the development of taxa-specific model inputs, which are needed for modeling the distribution and movements of larvae (Gray 1993). Therefore, depth distributions were developed for individual taxa through depth-discrete

dataset analysis and the application of default (or proxy) depth ranges from related taxa when the depth-discrete information was incomplete.

An extensive review of GOM biological density datasets was conducted to characterize and identify the water column organisms potentially exposed to oil from the DWH release (for a review of datasets see French McCay et al. 2015; as well as Section 3 of this report). These datasets consisted of long-term state and federal biological monitoring surveys, as well as academic studies conducted in the GOM. Historical and contemporary sources were examined and included in the review.

Available depth-discrete data sets collected by MOCNESS were used to evaluate vertical depth ranges and for evidence of vertical migratory behavior. The SEAMAP historical NRDA 1-m^2 MOCNESS (Figure 2-1), NRDA 1-m^2 MOCNESS, and NRDA 10-m^2 MOCNESS datasets included sufficient sampling locations and net samples to evaluate vertical depth ranges of plankton and small nektonic fish. (NRDA station maps are available in French McCay et al., 2015.) In addition, the SEAMAP historical 1-m^2 MOCNESS dataset contained sufficient data to evaluate day-night differences in vertical distributions of ichthyoplankton.

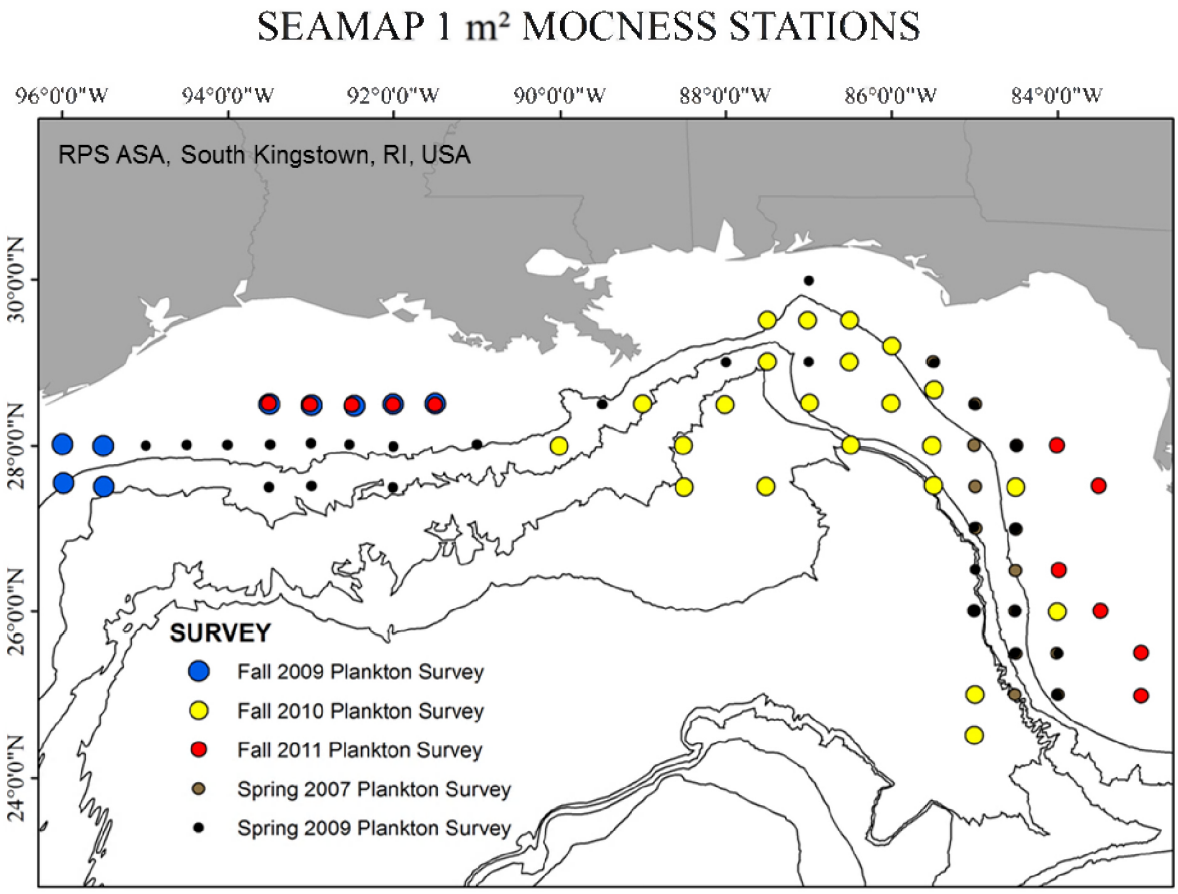


Figure 2-1. Stations for 1 m^2 MOCNESS sampling, symbolized by survey. Black lines are the 200, 1,000, 2,000 and 3,000 m depth contours.

Criteria for depth range analysis were developed with statistical guidance from Dr. Mary Christman. The SEAMAP Ichthyoplankton Historical 1 m^2 MOCNESS dataset was the focus of

the analysis as it was the most extensive dataset across both time and space and sampled a high priority life stage (fish larvae). See Appendix B for a description of the statistical analyses by Christman and Keller; key points are highlighted here.

A complete 1-m^2 MOCNESS deployment involved 7 non-overlapping nets that each sampled 20 m of the vertical water column between the surface and 140 m. However, many deployments involved fewer nets per deployment due in part to varying bottom depths over the survey area. Additionally, many of the nets did not begin or end sampling near a 20 m depth multiple, nor did they always tow over a 20 m range. Thus, the volume filtered was used to standardize all net catches as densities, as numbers of individuals caught per 250 m^3 filtered, and applied to the depth range actually sampled. Similarly, the 10-m^2 MOCNESS nets were nominally deployed at 200-m intervals, but the start and end depths varied by deployment and net.

Due to the inconsistency in net sampling depths, an entire series of nets deployed at a single station or location was considered to be the unit of sampling. For each net in a single deployment, the density of each taxon caught was divided evenly over 1 m ranges within the sampling range of the net (giving abundance by 1-m interval in number of individuals/m^3). This was repeated for each station and taxon; then the 1-m distributions were summed across all deployments within which a taxon was caught, and summarized into 20-m (1m^2-MOCNESS) or 200-m (10m^2 MOCNESS) depth bins yielding a relative frequency distribution of abundance over depth. (See Appendices B and C-F of this report for more details.)

In order to assign appropriate depth ranges for a taxon based on its relative frequency distribution of abundance over depth, a minimum amount of data was needed. After considerable analysis, sufficiency criteria developed included that a minimum of occurrences at 5 stations was required for a depth range to be assigned for a taxon based on the dataset alone. This criterion essentially provided an average distribution across 5 deployments and ensured that there were minimal gaps in the vertical distribution for each taxon. Secondary criteria involving the number of individuals caught in total and per net were also considered to reduce the influence of rare high catches (such as the net encountering a large patch of larvae) on the overall distribution.

Tests for non-uniform distribution were conducted for each possible depth range (minimum of 20 m) within the observed vertical range of a taxon's density distribution. For many taxa, uniformity was not rejected by the statistical tests, whereas for some taxa multiple parts of its range proved non-uniform while other parts were not statistically different from uniform. Much of this non-uniformity was likely due to the patchy nature of larval distributions, as well as the sporadic sampling in both space and time. Since MOCNESS deployments are essentially snapshots of distributions at specific points in time and space, it is possible that if additional samples taken at a higher frequency and spatial regularity were available, more uniform average distributions for some species would become evident, or alternatively the structure of the vertical distribution would be clarified.

Given these complexities, including potential under-sampling of some rare taxa or over-sampling of taxa that happened to be concentrated in higher-than-average-density patches at the time of sampling, modeling was performed assuming even depth distributions within specified depth ranges. Taking into account the statistical analyses and nature of the dataset, uniformity was assumed over a depth range that contained 95% of a taxon's average abundance. Restricting the depth range reduced the influence of outlier or rare individuals caught at either the shallow or deep end of the range. Christman and Keller (Appendix B) created a series of plots that represent bootstrapped abundances of fish larvae over depth for each taxon compared to a line that represented a homogenous distribution of abundance over a

depth range covering either 100% or 95% of the binned abundance (see Appendix B, and its Supplement II). The use of 95% of the depth range eliminated outliers. In general, the restriction of depth range to 95% of a taxon's abundance placed the line of homogeneity closer to (as compared to the full range of all individuals observed) or within the bootstrapped range of distributions, supporting the assumption of uniformity over the 95% depth ranges.

The statistical criteria were applied to the SEAMAP Ichthyoplankton dataset and the NRDA MOCNESS datasets. Details of the criteria and methods applied for depth range assignments for taxa in each density dataset can be found in Section 3.

Finally, a statistical analysis of day/night differences in density distributions was conducted, as described in Section 3. Details of the test used are in Appendix B and its Supplement I. This analysis was conducted to determine if diel vertical migration was evident in the SEAMAP Ichthyoplankton MOCNESS distributions.

2.2 Behavior Group Development

A master list of fish and invertebrate taxa that occurred in the density datasets (i.e., in French McCay et al. 2015) was developed and life history and behavior characteristics were compiled for every taxon on the list, including:

- life stage (larvae vs. juvenile/adult)
- movement pattern (drifting plankton or swimming nekton)
- vertical depth range (region of the water column where 95% of the density occurred on average)
- migration behavior (depth ranges statistically different during day vs. night), and
- habitat ("inshore" or "shelf" indicating within the 200 m bathymetric contour or "offshore" indicating in waters > 200 m deep).

Taxa with similar behavior characteristics were assigned the same behavior code that represented the appropriate life stage, movement pattern (i.e., plankton), vertical depth range, and habitat. The behavior code was used for those taxa identified as plankton to assign the depth range within which the taxon was distributed for injury quantification. The methods used to assign vertical depth ranges to planktonic taxa are described in Section 3, while the ultimate depth range assignments are described by organism type (i.e., fish versus invertebrate plankton) in Section 4. The complete list of taxa with associated depth range assignments is presented in Appendix G, with an analysis conducted at a higher taxonomic analysis presented in Appendix H.

3 Methods for Depth Range Analysis of GOM Density Datasets

3.1 Introduction

A review of multiple density datasets revealed several data gaps in available biological information for the GOM region. These data gaps exist primarily because of the difficult nature of quantitative sampling for many species, as well as under-sampling in remote areas of the deep ocean and difficulty with taxonomic identification of some species. Most numerical abundance data sets are collected by natural resource management agencies on shelf waters, often with focus on species of commercial and recreational importance. Organism groups having the largest gaps in numerical data included small epipelagic and deep water slope mesopelagic/bathypelagic species, as well as species associated with deep sea reefs and benthic structure. (Refer to Section 4 in French McCay et al. 2015, for discussion of available baseline datasets.)

For taxonomic groups and stages (e.g., fish larvae) where MOCNESS sampling was performed, analyses of depth-discrete density distributions were conducted to determine the vertical depth ranges occupied in the water column for each analysis taxa. In the absence of depth-discrete sampling, methods were developed to assign default depth ranges to each taxon. Detailed depth assignment methods are presented in the following sections.

3.2 Plankton Dataset Analysis Methods

3.2.1 Overview of Datasets

Density data for ichthyoplankton and invertebrate zooplankton (except for decapods) in the upper 200 m were primarily derived from the NMFS SEAMAP Plankton Survey, a multiple-year, gridded station survey conducted during spring and summer seasons since 1982. Gridded stations, repeatedly sampled year to year, extend from the Florida shelf to the Texas shelf. Samples are collected via three gear types: bongo nets that sampled to a maximum depth of 200 m, a rectangular neuston net that towed half-submerged at the surface and a 1 m^2 MOCNESS net that collected organisms at 20-m depth intervals between 0 m and a maximum of 136 m in the water column. For further details on the NMFS Plankton Survey see Sections 7.1 and 7.2 in French McCay et al. (2015).

Plankton samples from the NRDA Survey Program served as secondary sources for ichthyoplankton and zooplankton abundances and depth range assignment. NRDA sampling assessed the plankton community during and after the Macondo blowout. (See Section 5 of French McCay et al. 2015 for a summary). Vertical distributions of ichthyoplankton and larval decapods were assessed using 1 m^2 MOCNESS samples taken with two strategies: shallow deployments that extended to a maximum of 160 m (or less if over the continental shelf) with nets sampling each 20 m of the water column, and deep deployments that sampled offshore to a maximum of 2,200 m, with discrete samples at a 200-m resolution. Only samples from the Walton Smith Cruise 4 were used for vertical distribution analyses, as these were the only samples that had been released as part of Tier 1A of the NRDA program at the time of analysis.

The master taxonomic lists for ichthyoplankton and decapod zooplankton analyses of NRDA sampling were derived from NMFS SEAMAP Plankton Survey bongo nets (SEAMAP Bongo), as well as the NRDA Bongo and 1 m^2 MOCNESS nets (below 200 m) where densities were calculated. Vertical distribution information was derived from these datasets: SEAMAP Historical

1 m^2 MOCNESS (historical MOC1), NRDA Tier1A 1 m^2 MOCNESS shallow series (Tier1A Shallow), and NRDA Tier1A 1 m^2 MOCNESS deep series (Tier1A Deep). In addition, invertebrate zooplankton densities and vertical distributions were derived from NRDA 10 m^2 MOCNESS samples (MOC10).

The primary goal of the SEAMAP Plankton Survey was to collect bongo and neuston net samples; 1 m^2 MOCNESS tows were a secondary objective conducted as time allowed. However, the historical MOC1 was still the most extensive ichthyoplankton dataset available at the time of analysis. Sampling was conducted on a 24-hour continuous basis, so both day and night samples were collected; however, the samples were not day/night station replicates. For each taxon, vertical density distribution analyses were performed using all samples pooled together, as well as for samples taken during the day and those taken at night. Densities were summarized within 20-m vertical bins from the surface to the maximum depth sampled (136 m). There were 97 stations sampled in the pooled historical MOC1 dataset (55 day, 42 night). Stations (a.k.a. unique locations or deployments) were considered to be the basic unit of sampling (rather than individual nets within a MOCNESS deployment), as a deployment sampled the entire water column (down to the maximum sampling depth) at a given location.

Two sets of NRDA 1 m^2 MOCNESS data were also used for vertical depth range analyses. Eight stations were sampled for the shallow series (Tier1A Shallow), which consisted of 20-m vertical bins sampled from the surface to 160 m. Twenty stations were sampled for the deep series (Tier1A Deep), which consisted of 200-m bins sampled from the surface to 2,200 m. Due to its more extensive sampling in both time and space, the historical MOC1 dataset was considered the primary source of vertical distribution information for ichthyoplankton, with the Tier1A Shallow and Deep datasets used as secondary sources to provide depths for taxa that either were not identified in or existed below the maximum sampling depth of the historical MOC1 dataset.

For each analysis taxa within each dataset, a plot of vertical density distribution was generated along with several statistics, including the number of stations at which the taxon occurred, the total number of individuals caught at all stations, the average number of individuals caught per station, and the percent of the total density that was distributed across each vertical depth bin. See Appendices C-F for plots of vertical distributions of abundance for analysis taxa within each dataset.

3.2.2 Criteria and Methodology for Vertical Depth Range Assignments

3.2.2.1 Ichthyoplankton Depth Ranges

A set of criteria were developed to eliminate from analysis taxa that were too rare or insufficiently sampled to assign depth ranges (see Section 2.1.2 for the approach). The minimum requirement for inclusion in the depth range analysis was that a taxon had to have been caught at 5 stations or more in order to obtain an acceptable average distribution. Since each station is considered a unit of measurement, this requirement ensures that each average distribution for a taxon will be comprised of no fewer than 5 units, a typical statistical minimum for acceptable averages. The rationale behind this criterion was described in more detail in Appendix B. A secondary requirement for the assignment of depth range involved the average number of individuals caught per location or station (ind/loc). This secondary requirement was intended to exclude taxa that were spatially widespread (found at ≥ 5 stations) but low in abundance, so that the distributions averaged contained a minimum number of individuals to represent the vertical distributions at each station.

- If ind/loc < 2.0, considered other data sources and/or applied a default depth.
- If ind/loc was 2.0 – 2.9 and total number of individuals caught < 20, considered other data sources and/or applied default.
- If ind/loc was 2.0 – 2.9 and total number of individuals caught > 20, applied minimum and maximum depth ranges based on 95th percentiles of abundance distribution.
- If ind/loc ≥ 3.0, applied minimum and maximum ranges based on 95th percentiles of abundance distribution.

The assigned depth ranges for each taxon represent where in the water column approximately 95% of the abundance was caught on average. The cumulative percent of total abundance was calculated for each 20-m or 200-m depth bin from the surface down and from the deepest point up to the surface. The minimum 95th percentile depth range was the upper bound of the shallowest depth bin that contained 5% of the abundance from the surface downwards. The maximum 95th percentile depth range was the lower bound of the deepest depth bin that contained 5% of the abundance from the deepest point upwards. Depth plots were checked to determine if the distributions were one-tailed (the 95% thresholds cut off bins containing some density from either the surface-ward or deeper end of the distribution) or two-tailed (bins at both the top and bottom of the distribution were cut off). A majority of distributions were one-tailed. If the distribution was two-tailed, the minimum or maximum depth was adjusted as appropriate to ensure that the depth range represented the range where 95% of the abundance occurred (i.e., only cut off 5% of range, not 10%). In most cases, this adjustment made the minimum depth shallower (more surface-oriented).

Where ichthyoplankton taxa overlapped between datasets, the historical MOC1 depth ranges were given priority with two considerations:

1. If the maximum depth for a taxon was near 136 m (the maximum depth of historical MOC1 surveys), then depth ranges from Tier1A Shallow (above 200 m) and Tier1A Deep (below 200 m) surveys were considered (when the taxon was caught at ≥ 5 stations).
    - If the maximum range from Tier1A Shallow was near 160 m (the maximum depth of its survey), then a maximum depth of 200 m was applied for the taxon, under the assumption that its range likely extended beyond the maximum sampling depths of either of the shallow MOC1 surveys.
    - If maximum range from Tier1A Shallow was not at 160 m but was greater than 130 m (and had adequate sample data for estimating vertical depth range based on the established criteria), the maximum depth from Tier1A Shallow was applied instead of the historical MOC1 maximum.
    - If there was no Tier1A data, applied 140 m maximum depth for shallow range.
2. If a taxon had good historical MOC1 data and good Tier1A Deep data with maximum depths that extended below 200 m, it received two ranges: historical MOC1 was assigned for a shallow depth range and 200 m to the Tier1A Deep max was assigned for a deeper depth range. Modeling of exposure was performed separately for biota above and below 200 m; hence two adjacent ranges were applied (shallow and deep) when a taxon's depth range extended across the 200 m water column depth. Then a complete range was assigned by combining the shallow and deep vertical depth ranges.

If a taxon did not have sufficient samples in the historical MOC1 or Tier1A datasets, a depth range from related genera or families with enough data were applied as proxy. When there were

insufficient data in both datasets for a taxon as well as for corresponding genera/families, the family or order level range was applied from the higher taxonomic analysis (Section 4.2 of this report). In the absence of sufficient data in the higher level analysis as well, a generic default was applied as appropriate. There were 4 different default depths:

1. Surface layer (0 – 40 m) → This default was applied only for taxa where other taxa in the same or related family showed this distribution or knowledge from literature supported a more restricted surface distribution.
2. Upper epipelagic zone (0 – 100 m) → This range was applied as a primary default for all fish and decapod plankton since the 95th percentile range of the ALL_Larvae taxon (total of all larvae, from historical MOC1) was 0 – 100 m and the range for ALL_ZOOP (total for all invertebrates, from Tier1A Shallow) was 0 – 120 m. In addition, literature states that decapods are found above 100 m but gives no indication that they are confined to the neuston layer, especially since many invertebrates migrate vertically (Booth and Phillips 1994, Hempel and Weikert 1972, Hopkins 1982). The 0 – 100 m range is an appropriate default for all plankton taxa that were not found deeper than 200 m and had too few samples to assign their own depth range.
3. Total epipelagic zone (0 – 200 m) → This range was only applied as a default shallow depth when a taxon was caught in Tier1A Deep with a range extended below 200 m.
4. Upper mesopelagic zone (200 – 600 m) → This range was applied as a default deep depth when a taxon had more than 5 individuals caught below 200 m, but not enough locations or inds/loc to apply a 95th percentile depth range and/or had a maximum depth between 400 and 800 m.
5. Total meso/bathypelagic zone (200 – 1500 m) → This range was applied as a default deep depth when a taxon had a minimum depth of 0, 200, or 400 m and a maximum depth deeper than 800 m, but insufficient data to apply the 95th percentile depth range.

3.2.2.2 Ichthyoplankton Diel Vertical Migration Analysis

During the development of the behavior modeling approach (see Section 2.1.2), Dr. Mary Christman conducted statistical tests to detect differences between day and night vertical distributions of ichthyoplankton larvae in the historical MOC1 dataset. (Her report is appended as Appendix B and Supplement I). It is well-established that ichthyoplankton of many taxa make diel vertical migrations (Fechhelm and Gallaway 2004, Hempel and Weikert 1972, Kendall and Naplin 1981, Leis 1991), usually remaining in the surface waters at night and spreading deeper throughout the water column during the day (Type I DVM). If statistically significant diurnal differences in depth range were detected (here considered to be $p \leq 0.10$) and the assigned depth ranges differed by ≥20 m (the size of depth bins), the behavior could potentially be represented by assigning one depth range during the day, and another depth range at night. Kolmogrov-Smirnov (K-S) analyses were used to determine significant differences in abundance between day and night distributions over depth for ichthyoplankton larvae. A two-sample K–S test is a nonparametric method of comparing two samples and determines differences in shape between cumulative distribution functions (NIST/SEMATECH 2003). This detailed statistical analysis of diel vertical migration was only conducted for ichthyoplankton in the SEAMAP historical 1 m^2 MOCNESS dataset as no other dataset contained sufficient data for the analysis. Refer to Appendix B for more details.

3.2.2.3 Invertebrate Zooplankton Depth Ranges

Small invertebrate zooplankton taxa occurred in the SEAMAP Zooplankton dataset, which continuously sampled invertebrate zooplankton in the upper 200 m using a bongo net. All taxa within the SEAMAP Zooplankton dataset received the 0 – 200 m default depth range since the

sampling was not depth-discrete and other information to narrow the ranges was not available. Decapod taxonomic groups that overlapped with those present in the NRDA Bongo or NRDA Deep MOC1 density datasets were removed from the SEAMAP Zooplankton dataset since they were accounted for in the NRDA surveys with finer taxonomic and vertical distribution resolution. Depth ranges for decapod larvae were derived from the NRDA Tier1A Shallow and Deep MOC1 datasets following the same methods described for ichthyoplankton in Section 3.2.2.1.

Densities and vertical distributions of invertebrate zooplankton larger than those caught with bongo nets were derived from NRDA MOC10 samples. The abundance over depth was summarized in 200-m bins for each taxon. As in the plankton datasets, stations were considered to be the basic unit of because they represented the entire water column distribution (up to the maximum sample depth) at each unique deployment. There were 66 stations sampled in the MOC10 dataset.

As in the previous section, the same rationale was followed to develop criteria regarding the minimum number of stations required to qualify a taxon as having sufficient data to receive a 95th percentile depth distribution. Since the MOC10 dataset was smaller than datasets used in the ichthyoplankton analysis, more lenient criteria for number of individuals caught per location were applied in order to use more of the available information.

- If ind/loc < 1.5, applied appropriate default depth.
- If ind/loc was 1.5 – 2.9 and total number of individuals caught was < 20, applied default depth.
- If ind/loc was 1.5 – 2.9 and total number of individuals caught was ≥ 20, applied minimum and maximum depth ranges based on 95th percentiles of abundance distribution.
- If ind/loc ≥ 3.0, applied minimum and maximum ranges based on 95th percentiles of abundance distribution.

The assigned depth ranges represent the vertical depths over which approximately 95% of the abundance for each taxon was caught on average. The cumulative percent total abundance was calculated for each 200-m depth bin from the surface down and from the deepest point up to the surface. The minimum 95th percentile depth range was the upper bound of the shallowest depth bin that contained 5% of the density from the surface downwards. The maximum 95th percentile depth range was the lower bound of the deepest depth bin that contained 5% of the density from the deepest point upwards. Depth plots were checked to determine if the distributions were one-tailed (the 95% thresholds cut off bins containing some density from either the surface-ward or deeper end of the distribution) or two-tailed (bins at both the top and bottom of the distribution were cut off). If the distribution was two-tailed, the minimum or maximum depth was adjusted as appropriate to ensure the depth range represented where 95% of the density occurred (i.e., only cut off 5% of range, not 10%). In most cases in the MOC10 dataset, this adjustment made the deepest depth deeper.

When there were inadequate sample sizes or insufficient data available for a taxon or related higher taxonomic level, a generic default was applied as appropriate. There were 4 different default depths:

1. Shallow/epipelagic (0 – 200 m) → If the 95th percentile depth range was 0 – 200 m, this default was applied as a shallow range, with nothing applied for below 200 m.

2. Upper mesopelagic (200 – 600 m) → This default was applied when the 95th percentile minimum was 200 m and the maximum fell between 400 m and 800 m.
3. Lower meso / bathypelagic (600 – 1500 m) → This default was applied when the 95th percentile minimum was deeper than 600 m.
4. Total meso / bathypelagic (200 – 1500 m) → This default was applied when the 95th percentile minimum was 200 m and the maximum was equal to or deeper than 1,000 m.

4 Behavior Groups by Organism Type

The behavior groups (B groups) summarized multiple life history and movement characteristics into one code that classified how the organisms were modeled. The same taxa occurring in different density datasets could potentially be assigned different B groups because they were caught by different gears that more efficiently fished different size classes, and therefore represented different life stages. Thus, each dataset-taxon combination was analyzed independently for B group assignments and in the case of invertebrates, only one B group was assigned for each dataset-taxon combination. In the special case of ichthyoplankton present in the SEAMAP datasets, each analysis taxon could have up to two different B groups: one representing the depth range of 95 percent of abundance and a second if the taxa showed statistically significant diel vertical migration, described in more detail in the following subsections.

The results for the analysis taxa, at the taxonomic levels identified, are fully documented in Appendix G. Note that the tables within this section summarize data only for taxa for which density data existed (i.e., could be modeled); they do not include all taxa for which depth ranges were assigned. See Appendix G for depth ranges for all taxa, both with and without density data available.

4.1 Plankton Behavior Group Assignments

There were 27 B groups (defining depth ranges) applied to 519 plankton analysis taxa (unique dataset-taxon combinations) across all datasets that contained ichthyoplankton or invertebrate zooplankton. These groups were labeled 'BP#' (see Appendix G) and represent taxa that were modeled as planktonic (i.e., drifting with the currents). Of these taxa, 255 were ichthyoplankton (see Section 4.1.1), 127 were larval decapods (see Section 4.1.3), and 137 were other invertebrate zooplankton taxa (see Section 4.1.4). Table 4-1 provides a list of the depth ranges for the B Groups where at least one taxon was assigned.

Table 4-1. The number and percent of ichthyoplankton and invertebrate zooplankton analysis taxa assigned to behavior groups (n=519).

Behavior Code (B Group)	Depth Range (m)	Model Region	Count of Analysis Taxa	Percent of Plankton Analysis Taxa
BP2	0 - 20	shelf & offshore	2	0.39
BP3	0 - 40	shelf & offshore	39	7.51
BP4	0 - 60	shelf & offshore	42	8.09
BP5	0 - 80	shelf & offshore	41	7.90

Behavior Code (B Group)	Depth Range (m)	Model Region	Count of Analysis Taxa	Percent of Plankton Analysis Taxa
BP6	0 - 100	shelf & offshore	117	22.54
BP7	0 - 120	shelf & offshore	4	0.77
BP8	0 - 140	shelf & offshore	8	1.54
BP9	0 - 200	shelf & offshore	78	15.03
BP12	20 - 80	shelf & offshore	1	0.19
BP13	20 - 100	shelf & offshore	2	0.39
BP14	20 - 140	shelf & offshore	4	0.77
BP15	20 - 200	shelf & offshore	3	0.58
BP19	40 - 140	shelf & offshore	5	0.96
BP20	40 - 200	shelf & offshore	2	0.38
BP23	60 - 200	shelf & offshore	1	0.19
BP27	200 - 400	offshore	12	2.31
BP28	200 - 600	offshore	13	2.50
BP29	200 - 800	offshore	18	3.47
BP30	200 - 1000	offshore	5	0.96
BP31	200 - 1200	offshore	24	4.62
BP52s	400 - 1200	offshore	6	1.16
BP53s	600 - 1200	offshore	17	3.28
BP33s	0 - 400	offshore	6	1.16
BP37s	0 - 600	offshore	10	1.93
BP40s	0 - 800	offshore	6	1.16
BP44s	0 - 1000	offshore	7	1.35
BP48s	0 - 1200	offshore	46	8.86

4.1.1 Ichthyoplankton

There were 16 B groups applied to 255 ichthyoplankton analysis taxa (unique dataset-taxon combinations) across all datasets that contained fish larvae, including the SEAMAP and NRDA Plankton Surveys (Table 4-2).

Table 4-2. Vertical depth ranges exhibited by ichthyoplankton. The number and percent of ichthyoplankton analysis taxa assigned to behavior groups are listed (n=255).

B Group	Depth Range (m)	Model Region	Count of Analysis Taxa	Percent of Plankton Analysis Taxa
BP2	0 - 20	shelf & offshore	2	0.78
BP3	0 - 40	shelf & offshore	39	15.29

B Group	Depth Range (m)	Model Region	Count of Analysis Taxa	Percent of Plankton Analysis Taxa
BP4	0 - 60	shelf & offshore	41	16.08
BP5	0 - 80	shelf & offshore	34	13.33
BP6	0 - 100	shelf & offshore	85	33.33
BP8	0 - 140	shelf & offshore	5	1.96
BP13	20 - 100	shelf & offshore	1	0.39
BP14	20 - 140	shelf & offshore	3	1.18
BP15	20 - 200	shelf & offshore	1	0.39
BP19	40 - 140	shelf & offshore	5	1.96
BP20	40 - 200	shelf & offshore	2	0.78
BP23	60 - 200	shelf & offshore	1	0.39
BP27	200 - 400	offshore	11	4.31
BP28	200 - 600	offshore	11	4.31
BP29	200 - 800	offshore	11	4.31
BP30	200 - 1000	offshore	3	1.18

Fewer than 1% of ichthyoplankton taxa were restricted to the upper 20 m of the water column, but 16.1% displayed vertical distributions that were restricted to the upper 40 m. Including taxa that received a default depth range due to insufficient data, 78.8% of ichthyoplankton taxa displayed distributions within the upper 100 m of the water column and 80.8% included the surface waters in their distributions (i.e., distributions began at 0 m). It is important to note that there were a substantial number of ichthyoplankton taxa with distributions that extended below the 200 m delineation (14.1%), suggesting that some ichthyoplankton taxa regularly occupy waters below the epipelagic zone. A small percentage of ichthyoplankton taxa (5.1%) both inhabited the epipelagic zone above 200 m and did not appear to occur in surface waters (distributions began at 20, 40, or 60 m and ended above 200 m).

Only two ichthyoplankton taxa were restricted in the top 20 m of the water column: *Harengula* spp. and Gerreidae. Notable taxa with a depth range of 0 – 40 m include Exocoetoidea and various taxa within the Clupeidae, Engraulidae, Istiophoridae, Lutjanidae, Scombridae, and Xiphiidae families. Anguilliformes, Gobiidae, Carangidae, Sciaenidae, Serranidae, Gempylidae, Stromateidae, Bothidae, and Monacanthidae occupied the 0 – 60 m depth range while Congridae, Mullidae, Serranidae, Gempylidae, Scorpaenidae and Bothidae taxa were present 0 – 80 m. Many taxa within the Myctophidae, Gempylidae, Sciaenidae, Balistidae, Stomiidae, and Gonostomatidae families occupied the 0 – 100 m depth range. Ichthyoplankton of some taxa from the Myctophidae, Macrouridae, Argentinidae, Scopelarchidae, and Bathylagidae families occupied the epipelagic zone but appeared not to inhabit the surface waters (depth ranges began at 20 m or deeper), while several taxa from the Myctophidae, Bathylagidae, Sternoptychidae, Gonostomatidae, Stomiidae, and Phosichthyidae families displayed depth ranges that extended well into the mesopelagic zone, with a few reaching as deep as 1,000 m (*Hygophum benoiti*, *Cyclothone* spp., and *Sternoptyx diaphana*).

4.1.2 Ichthyoplankton Diel Vertical Migration Behavior Groups

For the number of larval diel vertical migration (DVM) behaviors reported in the literature (e.g., Collins and Stender 1987, Comyns and Lyczkowski-Shultz 2004, Kendall and Naplin 1981, Lyczkowski-Shultz and Steen 1991, Neilson and Perry 1990, Ross et al. 2007, Sogard et al. 1987) relatively few taxa exhibited dramatic enough patterns of movement to discern a DVM through statistical methods. There were 24 taxa in the SEAMAP Historical 1 m^2 MOCNESS dataset that showed K-S test results with significant p-values at the 0.10 level; however, of those only 14 taxa actually had depth ranges that differed by more than 20 m (one depth bin) between day and night. These taxa each received a migrating B group code (MBP#, Table 4-3), as well as a code based on their standard depth range.

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Table 4-3. The ichthyoplankton analysis taxa exhibiting patterns of diel vertical migration (n=14).

B Group	Day Depth Range (m)	Night Depth Range (m)	Analysis Taxa	Family
MBP2	0 - 20	0 - 40	*Sphyraena* spp.	Sphyraenidae
MBP3	0 - 20	0 - 80	Scombridae	Scombridae
MBP4	0 - 40	0 - 80	*Ceratoscopelus* spp.	Myctophidae
MBP5	0 - 60	0 - 100	*Decapterus punctatus*	Carangidae
MBP6	0 - 60	0 - 40	*Rhomboplites aurorubens*	Lutjanidae
MBP7	0 - 60	0 - 80	Scorpaenidae	Scorpaenidae
MBP8	0 - 80	0 - 60	*Trichiurus lepturus*	Trichiuridae
MBP9	0 - 80	0 - 100	*Lampanyctus* spp. & *Notoscopelus* spp.	Myctophidae
MBP10	0 - 100	0 - 60	Labridae & Serranidae	Labridae & Serranidae
MBP11	20 - 60	0 - 40	*Engyophrys senta*	Bothidae
MBP14	20 - 100	0 - 130	Melamphaidae	Melamphaidae
MBP15	20 - 200	0 - 200	*Centrobranchus nigroocellatus*	Myctophidae

About half of the taxa with statistically significant diel vertical migrations displayed Type I distributions, which were shallower during the day and shifted deeper in the water column at night, while the rest displayed the opposite pattern with Type II distributions. In all cases but one (MBP14), just one tail of the distribution differed in depth between day and night (the shallow end or the deep end), not both. The exception, Melamphaidae, showed a more restricted depth range during the day (20 – 100 m) and an expanded range at night (0 – 130 m). Four of the 14 taxa displaying patterns of DVM (28.5%) were part of the Myctophidae family, which are primarily in the epipelagic zone as larvae and become mesopelagic species known to migrate over hundreds of meters to surface waters as juveniles (Hempel and Weikert 1972, Sassa et al. 2004).

While these 14 taxa showed significantly-different day versus night ranges, the night ranges were relatively small expansions or contractions of the depth interval occupied by larvae during

the day. Thus, as a simplification, these differences were not included in the modeling of exposure; the overall depth ranges for both day and night were used.

4.1.3 Larval Decapods

There were 22 B groups applied to 127 larval decapod analysis taxa (unique dataset-taxon combinations) with densities derived from the NRDA Plankton Survey and 10 m^2 MOCNESS datasets (Table 4-4).

Table 4-4. The number and percent of larval decapod analysis taxa assigned to behavior groups (n=127).

B Group	Depth Range (m)	Model Region	Count of Analysis Taxa	Percent of Larval Decapod Analysis Taxa
BP4	0 - 60	shelf & offshore	1	0.79
BP5	0 - 80	shelf & offshore	7	5.51
BP6	0 - 100	shelf & offshore	31	24.41
BP7	0 - 120	shelf & offshore	4	3.15
BP8	0 - 140	shelf & offshore	3	2.36
BP9	0 - 200	shelf & offshore	14	11.02
BP12	20 - 80	shelf & offshore	1	0.79
BP13	20 - 100	shelf & offshore	1	0.79
BP14	20 - 140	shelf & offshore	1	0.79
BP15	20 - 200	shelf & offshore	2	1.57
BP27	200 - 400	offshore	1	0.79
BP28	200 - 600	offshore	2	1.57
BP29	200 - 800	offshore	7	5.51
BP30	200 - 1000	offshore	2	1.57
BP31	200 - 1200	offshore	15	11.81
BP52s	400 - 1200	offshore	4	3.15
BP53s	600 - 1200	offshore	8	6.30
BP33s	0 - 400	offshore	2	1.57
BP37s	0 - 600	offshore	2	1.57
BP40s	0 - 800	offshore	4	3.15
BP44s	0 - 1000	offshore	2	1.57
BP48s	0 - 1200	offshore	13	10.24

There were no larval decapod taxa with depth ranges restricted to the upper 20 m or 40 m of the water column, and fewer than 1% of taxa were restricted to the upper 60 m. This is consistent

with work that has indicated that zooplankton, and decapods in particular, are not limited to the neuston and have the ability to travel over large portions of the water column on a daily basis (Booth and Phillips 1994, Hempel and Weikert 1972, Hopkins 1982). However, sufficient data were not available to conduct diel vertical migration analyses on invertebrate taxa, as available 1m^2 MOCNESS data (NRDA Tier1A shallow) in the upper water column were limited compared to the historical SEAMAP MOCNESS data analyzed for ichthyoplankton taxa. Nevertheless, 30.7% of larval decapod taxa displayed distributions within the upper 100 m of the water column and 47.2% included the surface waters in their distributions (distributions began at 0 m and ended at 200 m), while an additional 18.1% incorporated both surface waters and mesopelagic waters below 200 m in their distributions. A relatively large percentage of larval decapod taxa displayed distributions that began at 200 m or deeper (30.7%), while a relatively small percentage (3.9%) inhabited the epipelagic zone above 200 m, but did not appear to interact with surface waters (distributions began at 20 m and ended above 200 m).

Gennadas spp., Penaeidae spp., and *Lucifer* spp. were the main larval decapod taxa confined to the upper 80 m of the water column, while taxa from the Leucosiidae, Portunidae, Palinuridae, and Scyllaridae families occupied the 0 – 100 m depth range. Shrimp from the Benthesicymidae and Sergestidae families occupied both the epipelagic and mesopelagic zones, joining other deep sea shrimp taxa below 200 m such as those in the Pandalidae, Solenoceridae, and Oplophoridae families.

4.1.4 Other Invertebrate Zooplankton

There were 10 B groups applied to 137 non-decapod zooplankton analysis taxa (unique dataset-taxon combinations) with densities derived from the NRDA Plankton Survey, NRDA 10 m^2 MOCNESS, Pisces, Shrimp Trawl, and SEAMAP Zooplankton datasets (Table 4-5).

Table 4-5. The number and percent of non-decapod invertebrate zooplankton analysis taxa assigned to behavior groups (n=137).

B Group	Depth Range (m)	Model Region	Count of Analysis Taxa	Percent of Non-Decapod Zooplankton Analysis Taxa
BP6	0 - 100	shelf & offshore	1	0.73
BP9	0 - 200	shelf & offshore	64	46.72
BP31	200 - 1200	offshore	9	6.57
BP52s	400 - 1200	offshore	2	1.46
BP53s	600 - 1200	offshore	9	6.57
BP33s	0 - 400	offshore	4	2.92
BP37s	0 - 600	offshore	8	5.84
BP40s	0 - 800	offshore	2	1.46
BP44s	0 - 1000	offshore	5	3.65
BP48s	0 - 1200	offshore	33	24.09

Since a large number of non-decapod invertebrate zooplankton taxa were caught in gears sampling between 0 and 200m without depth-discrete sampling (SEAMAP Zooplankton bongo, NRDA bongo, Shrimp Trawl), a default depth range of 0 – 200 m was applied in many cases. The remaining taxa were caught in MOCNESS nets with 200 m bin sizes, thus detailed distributions for zooplankton in the upper water column are not available. There were 47.5% of invertebrate zooplankton taxa restricted to the epipelagic zone (upper 200 m) and 37.9% that incorporated the surface and mesopelagic waters into their vertical distributions (began at 0 m and extended beyond 200 m). About 14.6% of invertebrate zooplankton taxa did not appear to utilize the surface waters at all, displaying distributions that began at 200 m or deeper.

Examples of epipelagic zooplankton occupying the upper 200 m of the water column include euphausids, isopods, mantis shrimp, barnacles, copepods, chaetognaths, larvaceans, hydozoans, hydromedusae, and undifferentiated jellyfishes. Zooplankton occupying deeper mesopelagic and bathypelagic waters include some copepods, cephalopods, and deep sea shrimp. Zooplankton taxa with ranges that spanned the entire water column include species of euphausids, cephalopods, mollusks, and jellyfishes.

4.2 Analysis of Vertical Distributions at the Family, Order or Higher Taxonomic Level

4.2.1 Planktonic Life Stages

4.2.1.1 Fish

Examination of the vertical distributions of fish larvae at the analysis taxa level (Appendix G) indicated that many of the lower level taxa within orders of fish had similar depth distributions. Literature supports that related taxa generally have similar vertical distributions during the day, although the degree of relatedness can vary among groups (Leis 1991) and this rule does not hold true for all families (Gray 1993). The Perciformes order, a very diverse group of marine fish, showed several depth range patterns amongst its taxa, but depth ranges within families of that order were relatively similar. Many of the orders and families had few taxonomic groups where data were sufficient to determine a depth range, and default ranges were applied. Therefore, a second vertical depth range analysis was performed at the order level for all orders of fish, except Perciformes, where the analysis was performed at the family level. The methods were the same as described in Section 3.2 and were applied to the ichthyoplankton taxa in the SEAMAP and NRDA 1-m^2 MOCNESS surveys. In cases where data did not meet the minimum criteria for assignment of a depth range for an analysis taxa or a related genus, it was appropriate to apply the family or order range from this higher level analysis as the default range at the analysis taxa level. The depth analysis for plankton performed at a higher taxonomic level can be found in Appendix H, as summarized in Table 4-6.

Table 4-6. Depth ranges occupied by ichthyoplankton taxa (total n = 83) summarized to the order level or higher (n = 31) for all taxa except those within Perciformes, which were summarized at the family level (n = 52). See Appendix H for details of the vertical depth range assignments. Grey taxa are catch-all categories for larvae that were not further identified.

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Gerreidae	family	no	0 - 20	surface
Beloniformes	order	YES	0 - 40	surface
Beryciformes	order	no	0 - 40	surface
Haemulidae	family	no	0 - 40	surface
Istiophoridae	family	YES	0 - 40	surface
Lutjanidae	family	no	0 - 40	surface
Luvaridae	family	no	0 - 40	surface
Microdesmidae	family	no	0 - 40	surface
Priacanthidae	family	no	0 - 40	surface
Rachycentridae	family	YES	0 - 40	surface
Scombridae	family	no	0 - 40	surface
Sphyraenidae	family	no	0 - 40	surface
Xiphiidae	family	YES	0 - 40	surface
Apogonidae	family	no	0 - 60	surface / epipelagic
Blenniidae	family	no	0 - 60	surface / epipelagic
Carangidae	family	no	0 - 60	surface / epipelagic
Clupeiformes	order	no	0 - 60	surface / epipelagic
Gobiidae	family	no	0 - 60	surface / epipelagic
Nomeidae	family	no	0 - 60	surface / epipelagic
Pomacentridae	family	no	0 - 60	surface / epipelagic
Sciaenidae	family	no	0 - 60	surface / epipelagic
Stromateidae	family	no	0 - 60	surface / epipelagic
Acanthuridae	family	no	0 - 80	surface / epipelagic
Anguilliformes	order	no	0 - 80	surface / epipelagic
Ariommatidae	family	no	0 - 80	surface / epipelagic
Aulopiformes	order	no	0 - 80	surface / epipelagic
Labridae	family	no	0 - 80	surface / epipelagic
Lophiiformes	order	no	0 - 80	surface / epipelagic
Mullidae	family	no	0 - 80	surface / epipelagic
Ophidiiformes	order	no	0 - 80	surface / epipelagic
Perciformes	order	no	0 - 80	surface / epipelagic

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Pleuronectiformes	order	no	0 - 80	surface / epipelagic
Scaridae	family	no	0 - 80	surface / epipelagic
Scorpaeniformes	order	no	0 - 80	surface / epipelagic
Serranidae	family	no	0 - 80	surface / epipelagic
Sparidae	family	no	0 - 80	surface / epipelagic
Tetraodontiformes	order	no	0 - 80	surface / epipelagic
Trichiuridae	family	no	0 - 80	surface / epipelagic
Uranoscopidae	family	no	0 - 80	surface / epipelagic
Acropomatidae	family	no	0 - 100	surface / epipelagic
All Larvae	other level	no	0 - 100	surface / epipelagic
Atheriniformes	order	YES	0 - 100	surface / epipelagic
Bramidae	family	YES	0 - 100	surface / epipelagic
Caristiidae	family	YES	0 - 100	surface / epipelagic
Chaetodontidae	family	YES	0 - 100	surface / epipelagic
Chiasmodontidae	family	YES	0 - 100	surface / epipelagic
Cirrhitidae	family	YES	0 - 100	surface / epipelagic
Coryphaenidae	family	YES	0 - 100	surface / epipelagic
Echeneidae	family	YES	0 - 100	surface / epipelagic
Eggs	other level	no	0 - 100	surface / epipelagic
Ephippidae	family	YES	0 - 100	surface / epipelagic
Epigonidae	family	YES	0 - 100	surface / epipelagic
Gadiformes	order	no	0 - 100	surface / epipelagic
Gempylidae	family	no	0 - 100	surface / epipelagic
Gobiesocidae	family	YES	0 - 100	surface / epipelagic
Kyphosidae	family	YES	0 - 100	surface / epipelagic
Lampridiformes	order	YES	0 - 100	surface / epipelagic
Lobotidae	family	YES	0 - 100	surface / epipelagic
Mugiliformes	order	no	0 - 100	surface / epipelagic
Notacanthiformes	order	YES	0 - 100	surface / epipelagic
Opistognathidae	family	no	0 - 100	surface / epipelagic
Polymixiiformes	order	YES	0 - 100	surface / epipelagic
Pomatomidae	family	YES	0 - 100	surface / epipelagic
Scombroidei	other level	YES	0 - 100	surface / epipelagic
Scombrolabracidae	family	YES	0 - 100	surface / epipelagic

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Symphysanodontidae	family	YES	0 - 100	surface / epipelagic
Syngnathiformes	order	YES	0 - 100	surface / epipelagic
Tetragonuridae	family	YES	0 - 100	surface / epipelagic
Unidentified Fish	unspecified	no	0 - 100	surface / epipelagic
Zeiformes	order	no	0 - 100	surface / epipelagic
Callionymidae	family	no	0 - 120	surface / epipelagic
Pomacanthidae	family	no	0 - 120	surface / epipelagic
Damaged Fish	unspecified	no	0 - 200	surface / epipelagic
Elopomorpha	other level	no	0 - 200	surface / epipelagic
Stromateoidei	other level	no	0 - 200	surface / epipelagic
Malacanthidae	family	no	20 - 100	surface / epipelagic
Percophidae	family	no	20 - 100	surface / epipelagic
Howellidae	family	no	0 - 400	surface / epi / mesopelagic
Osteichthyes	unspecified	no	0 - 400	surface / epi / mesopelagic
Stephanoberyciformes	order	no	0 - 400	surface / epi / mesopelagic
Myctophiformes	order	no	0 - 600	surface / epi / mesopelagic
Stomiiformes	order	no	0 - 800	surface / epi / mesopelagic
Argentiniformes (Osmeriformes)	order	no	40 - 400	epi / mesopelagic

When the data were summarized to these higher taxonomic levels, far fewer analysis taxa (n = 20) required a default depth range than when analyzed at lower taxonomic levels. The default depth rules described in Section 3.2.2.1 were applied to those taxa with insufficient sample size to assign a depth range based on data alone. In most cases, the standard default of 0 – 100 m (based on the depth range within which 95% of all larvae were collected) was applied. A surface default of 0 – 40 m was applied for select taxa known from literature to occupy surface waters. All other depth ranges in the table above were derived directly from the ichthyoplankton datasets.

4.2.1.2 Invertebrates

The level of taxonomic identification varied considerably among the invertebrates; decapods being identified to species in many cases whereas some others were only identified to higher taxonomic levels, such as phylum, class, or order. Thus, the invertebrates were grouped to higher taxonomic levels as the ichthyoplankton had been. After this pooling of density data, the vertical depth range analysis was performed at the higher taxonomic level. The methods were the same as described in Section 3.2 and were applied to the zooplankton taxa in the NRDA 1-m^2 MOCNESS surveys and NRDA MOC10. Methods were not applied to the SEAMAP bongo zooplankton, which all received a default depth range of 0 – 200 m and were not included in the

family/order level summary tables (Tables 4-7 and 4-8) below. [Note that any analysis taxa that was already present in the dataset at a higher level than family or order received 'other level' as a descriptor to separate it from the family and order level summaries that could contain multiple analysis taxa analyzed together. These "'other level' taxa were not pooled to higher taxonomic level for analysis.]

Table 4-7. Depth ranges occupied by invertebrate zooplankton summarized to the order level or higher (n = 53). See Appendix H for details of the vertical depth range assignments. Grey taxa are catch-all categories for plankton that were not further identified.

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Anthomedusae	order	YES	0 - 100	surface / epipelagic
Cephalopoda	other level	YES	0 - 100	surface / epipelagic
Gastropoda	other level	YES	0 - 100	surface / epipelagic
Hydrozoa	other level	YES	0 - 100	surface / epipelagic
Isopoda	order	YES	0 - 100	surface / epipelagic
Leptomedusae	order	YES	0 - 100	surface / epipelagic
Leptothecatae	order	YES	0 - 100	surface / epipelagic
Neotaenioglossa	order	YES	0 - 100	surface / epipelagic
Sepiolida	order	YES	0 - 100	surface / epipelagic
ALL ZOOP	unspecified	no	0 - 120	surface / epipelagic
Crustacea	other level	no	0 - 200	surface / epipelagic
Phronema test (unclear taxonomy)	unspecified	no	0 - 200	surface / epipelagic
Pteropoda	order	no	0 - 200	surface / epipelagic
Stomatopoda	order	no	0 - 200	surface / epipelagic
Thecosomata	order	no	0 - 200	surface / epipelagic
Siphonophorae	order	no	0 - 400	surface / epi / mesopelagic
Sorbeoconcha	order	no	0 - 400	surface / epi / mesopelagic
Aphragmophora	order	no	0 - 600	surface / epi / mesopelagic
Chaetognatha	other level	YES	0 - 600	surface / epi / mesopelagic
Funnel tube	unspecified	YES	0 - 600	surface / epi / mesopelagic
Teuthida	order	no	0 - 600	surface / epi / mesopelagic
ALL invert	unspecified	no	0 - 1000	surface / epi / mesopelagic
Amphipoda	order	no	0 - 1000	surface / epi / mesopelagic
Coronatae	order	no	0 - 1000	surface / epi / mesopelagic
Decapoda	order (sum of all decapods)	no	0 - 1000	surface / epi / mesopelagic
Euphausiacea	order	no	0 - 1000	surface / epi / mesopelagic

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Actiniaria	order	no	0 - 1200	surface / epi / meso / bathypelagic
Ostracoda	other level	no	0 - 1200	surface / epi / meso / bathypelagic
Phyllodocida	order	no	0 - 1200	surface / epi / meso / bathypelagic
Semaeostomeae	order	no	0 - 1200	surface / epi / meso / bathypelagic
Anemone-like Larvae	unspecified	YES	0 - 1500	surface / epi / meso / bathypelagic
Anthoathecata	order	YES	0 - 1500	surface / epi / meso / bathypelagic
Beroida	order	YES	0 - 1500	surface / epi / meso / bathypelagic
Coleoidea	other level	YES	0 - 1500	surface / epi / meso / bathypelagic
Medusozoa	other level	YES	0 - 1500	surface / epi / meso / bathypelagic
Mysida	order	no	0 - 1500	surface / epi / meso / bathypelagic
Non decapod Crustacean	other level	YES	0 - 1500	surface / epi / meso / bathypelagic
Octopoda	order	no	0 - 1500	surface / epi / meso / bathypelagic
Oegopsida	order	YES	0 - 1500	surface / epi / meso / bathypelagic
Phragmophora	order	no	0 - 1500	surface / epi / meso / bathypelagic
Trachymedusae	order	no	0 - 1500	surface / epi / meso / bathypelagic
Unidentified Crustacean	other level	no	200 - 1200	meso / bathypelagic
Copepoda	other level	no	200 - 1500	meso / bathypelagic
Sipuncula	other level	YES	200 - 1500	meso / bathypelagic
Lophogastrida	order	no	400 - 1500	meso / bathypelagic
Cnidaria	other level	YES	600 - 1500	meso / bathypelagic
Gymnosomata	order	YES	600 - 1500	meso / bathypelagic
Mollusca	other level	YES	600 - 1500	meso / bathypelagic
Narcomedusae	order	YES	600 - 1500	meso / bathypelagic
Scyphozoa	other level	no	600 - 1500	meso / bathypelagic
Unidentified body parts	unspecified	YES	600 - 1500	meso / bathypelagic

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Vampyromorphida	order	YES	600 - 1500	meso / bathypelagic

Table 4-8. Depth ranges occupied by invertebrate zooplankton within the order Decapoda, summarized to the family level where possible (n = 48). See Appendix H for details of the vertical depth range assignments.

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Decapoda	order	no	0 - 80	surface / epipelagic
Luciferidae	family	no	0 - 80	surface / epipelagic
Thalassinidea	other level	no	0 - 80	surface / epipelagic
Achelata	other level	YES	0 - 100	surface / epipelagic
Albuneidae	family	YES	0 - 100	surface / epipelagic
Alpheidae	family	YES	0 - 100	surface / epipelagic
Aristeidae	family	YES	0 - 100	surface / epipelagic
Bresilioidea	other level	YES	0 - 100	surface / epipelagic
Callianassidae	family	YES	0 - 100	surface / epipelagic
Disciadidae	family	YES	0 - 100	surface / epipelagic
Ethusidae	family	YES	0 - 100	surface / epipelagic
Galatheidae	family	YES	0 - 100	surface / epipelagic
Hippoidea	other level	YES	0 - 100	surface / epipelagic
Majoidea	other level	YES	0 - 100	surface / epipelagic
Menippidae	family	YES	0 - 100	surface / epipelagic
Paguroidea	other level	YES	0 - 100	surface / epipelagic
Palaemonidae	family	YES	0 - 100	surface / epipelagic
Palinuridae	family	YES	0 - 100	surface / epipelagic
Palinuroidea	other level	YES	0 - 100	surface / epipelagic
Parthenopidae	family	YES	0 - 100	surface / epipelagic
Pinnotheridae	family	YES	0 - 100	surface / epipelagic
Porcellanidae	family	YES	0 - 100	surface / epipelagic
Scyllaridae	family	YES	0 - 100	surface / epipelagic
Stenopodidae	family	YES	0 - 100	surface / epipelagic
Stenopodidea	other level	YES	0 - 100	surface / epipelagic
Xanthidae	family	YES	0 - 100	surface / epipelagic

Higher Level Analysis Taxon	Taxonomic Rank	Default Depth Range? (YES/no)	Vertical Depth Range (m)	General Depth Zone
Anomura	other level	no	0 - 120	surface / epipelagic
Caridea	other level	no	0 - 120	surface / epipelagic
Other Brachyura	other level	no	0 - 120	surface / epipelagic
Brachyura	other level	no	0 - 140	surface / epipelagic
Hippolytidae	family	YES	0 - 200	surface / epipelagic
Nephropidae	family	no	0 - 200	surface / epipelagic
Penaeoidea	other level	no	0 - 200	surface / epipelagic
Portunidae	family	no	0 - 200	surface / epipelagic
Sicyoniidae	family	no	0 - 200	surface / epipelagic
Galatheoidea	other level	no	20 - 100	surface / epipelagic
Xanthoidea	other level	no	20 - 140	surface / epipelagic
Sergestidae	family	no	0 - 400	surface / epi / mesopelagic
Pandalidae	family	no	0 - 800	surface / epi / mesopelagic
Unidentified Decapod	other level	no	0 - 800	surface / epi / mesopelagic
Benthesicymidae	family	no	0 - 1200	surface / epi / meso / bathypelagic
Pasiphaeidae	family	no	0 - 1200	surface / epi / meso / bathypelagic
Oplophoridae	family	no	0 - 1500	surface / epi / meso / bathypelagic
Penaeidae	family	no	0 - 1500	surface / epi / meso / bathypelagic
Solenoceridae	family	no	20 - 1200	surface / epi / meso / bathypelagic
Bresiliidae	family	no	400 - 1200	meso / bathypelagic
Acanthephyridae	family	YES	200 - 1500	meso / bathypelagic
Nematocarcinidae	family	YES	600 - 1500	meso / bathypelagic

When the data were summarized to the order level, fewer analysis taxa (n = 25) required a default depth range than when analyzed at lower taxonomic levels. The default depth rules described in Section 3.2.2.1 were applied to those taxa with insufficient sample size to assign a depth range based on data alone. In most cases, the standard default of 0 – 100 m (based on the depth range within which 95% of all larvae were collected) was applied. All other depth ranges in the tables above were derived directly from the invertebrate zooplankton ranges in the NRDA Tier1 Shallow, NRDA Tier1A Deep, and NRDA MOC10 datasets. The continued need for default ranges even when summarized at higher levels is indicative of the rarity of some of these invertebrate taxa in the datasets, as well as the small sample size of the NRDA Tier1A surveys.

Breaking the decapods into family level summaries illustrates the wide variety of vertical behaviors exhibited in the order Decapoda. When summed together (Table 4-8), the depth range for the Decapoda order was 0 – 1000 m, meanwhile taxa within the order had vertical ranges restricted to the upper epipelagic zone (0 – 80 m for Luciferidae and Thalassinidea) while other taxa were found within the meso-bathypelagic zone (400 – 1200 m for Bresiliidae).

Note that the depth ranges assigned are for 95% of the density of the pooled taxa. The reality is that there are many taxa pooled at the order or family level, and within each group there are undoubtedly species that occupy narrower depth ranges than these results for broad groupings may suggest. Some rarer species may fall outside the range of 95% of individual in the higher taxonomic group. Given this lack of taxonomic specificity for most species, densities of pooled species groups were applied to specific broad depth ranges when used for quantification of invertebrate injuries.

5 Summary of Depth Ranges for Species of Interest

5.1 Planktonic Life Stages

5.1.1 Fish

The Gulf of Mexico is an important spawning area for a wide variety of fish taxa. It provides important fishing grounds for species of both commercial and recreational interest. Several taxonomic groups with relatively high densities (based on the analyses reported in French McCay et al., 2015) and of ecological and/or fisheries importance are discussed in further detail below.

Swordfish (*Xiphias gladius*) was the least abundant taxa caught over all seasons and regions and was extremely rare in the MOCNESS surveys, with only one larva caught at one location in the 0 – 20 m net. It has been reported in the literature that swordfish larvae are neustonic (Govoni et al. 2003), so a surface layer default range (0 – 40 m) was applied. Billfish (Istiophoridae), and cobia (Rachycentridae) larvae were similarly rare but also known to occupy surface waters, so the same mixed layer range was applied (Tidwell et al. 2007, Ditty and Shaw 1992). Flying fish (Beloniformes) are surface-dwelling during some life stages and were also given the 0 – 40 m range (Hunte et al. 1995).

Taxa within the tuna and mackerel family (Scombridae) are important commercial and recreational fisheries in the Gulf of Mexico. Atlantic bluefin tuna (*Thunnus thynnus*) is of particular concern because the spawning stock in the western Atlantic has dramatically declined in recent years (Rooker et al. 2007). Bluefin tuna larvae were more abundant in the offshore than the inshore (shelf) region (394,314 larvae km^{-2} compared to 256,252 larvae km^{-2}) in the spring (when they occur). King and Spanish mackerel densities (*Scomber cavalla* and *Scomber maculatus*, respectively) were found in all seasons/regions at densities of tens to hundreds of thousands km^{-2} (French McCay et al., 2015). Most Scombridae larvae occupied the 0 – 40 m depth range. This range encompasses the mixed layer in the GOM and potentially experienced high levels of exposure from floating and oil entrained from the surface.

Coastal species were abundant in the upper water column, including clupeids (Clupeiformes, Clupeidae), anchovies (Engraulidae), Atlantic bumper (*Chloroscombrus chrysurus,* of Carangidae), red snapper (*Lutjanus campechanus,* of Lutjanidae) and seatrout (*Cynoscion* sp., of Sciaenidae), all of which had the majority of their abundance distributed within the mixed layer (0 – 40 m). Other Carangidae taxa (i.e., *Elegatis bipinnulata, Trachurus lathami, Decapterus punctatus*) were distributed between 0 – 60 m.

Major inshore ichthyoplankton taxa include flounders (e.g., *Syacium* sp., Bothidae, *Etropus* sp., of Pleuronectiformes), which were typically distributed between 0 – 80 m. Some members of the Serranidae, Mullidae, Congridae, Labridae, and Scorpaenidae families also occupied the 0 – 80 m depth range.

When abundances for all ichthyoplankton were combined across taxa, the 95th percentile depth range was 0 – 100 m, which was used as the standard default range where necessary. The vertical range of fish eggs (which were not identified to any taxonomic level) was also 0 – 100

m. A few orders and families, such as Gadiformes, Gempylidae, Mugiliformes, Zeiformes, Pomacanthidae, and Callionymidae ranged from 0 – 100 m or 120 m, as well.

When grouped to a higher taxonomic level, there were only three taxa that did not include the upper 20m in their depth range. Malacanthidae and Percophidae had depth ranges from 20 – 100 m and Argentiniformes (Osmeriformes) ranged from 40 – 400 m, instead of occupying the surface. Thus, it appears that a majority of fish larvae are exposed to the surface waters at some stage in their life cycle or as part of vertical migrations.

Small mesopelagic fish, such as lanternfish, bristlemouths and hatchet fish, were typically the most abundant ichthyoplankton in the SEAMAP dataset. Mesopelagic taxa with the greatest densities include Myctophidae (*Diaphus* sp., *Myctophum* sp., *Hygophum* sp., *Benthosema suborbitale*) and Gonostomatidae (of Stomiiformes). Bristlemouths (*Cyclothone* sp., of Stomiiformes) was the most abundant of the ichthyoplankton caught in the NRDA plankton survey samples below 200 m, while myctophids and other unidentified Stomiiformes were also very abundant (French McCay et al., 2015). Myctophiformes and Stomiiformes portrayed the widest ranging vertical distributions for ichthyoplankton, 0 – 600 m and 0 – 800 m, respectively. Such taxa comprise important forage species in the GOM food web and represent a resource pathway between the productive epipelagic zone and the light-limited deep waters (Barton 2007.

5.1.2 Invertebrates

The invertebrates include a vast number of taxa from many phyla, many of which have only been identified to higher taxonomic level in the historical and NRDA plankton programs. Invertebrates also have not been staged; however, the various gears are known to mainly capture certain life history stages (based on size and the life cycles of the groups involved). The bongos sampled the upper 200 m; thus, more refined depth distributional information is not available from those samples. The NRDA 1m^2 MOCNESS samples (Tier1A shallow) were taken each 20 m, but only decapod data are available from those samples. Both the deep 1m^2 MOCNESS (Tier1A deep) and 10m^2 MOCNESS samples (MOC10) were primarily taken each 200 m, and offer depth-discrete information at that resolution.

Arthropods dominated in sampling gears, making up 69% of the biomass identified in the MOC10 samples (French McCay et al., 2015). Copepods are the dominant group by number in the bongo samples. Mysids are present in the bongo and NRDA samples, but not one of the dominant groups. Spiny and slipper lobster larvae were counted and identified in considerable numbers in the NRDA Tier1A bongo samples from the upper 200 m.

The blue crab (*Callinectes*) is an important ecological and fishery species in the Gulf of Mexico. In the NRDA bongo samples, early life history stages of portunid crabs for most part were not identified below the family level, although about 1/3 were identified as *Callinectes* sp. Portunids were only identified in bongo and 1m^2 MOCNESS samples from the upper 200 m, and the 95th percentile depth range for the Portunidae family was 0 – 200 m.

Brachyuran (true) crabs were highly abundant in the NRDA bongo samples from the upper 200 m (French McCay et al., 2015). They were not identified in samples below 200 m, and occupied the 0 – 140 m depth range when summarized to the infraorder level Brachyura in NRDA Tier1A shallow samples.

The superfamily Penaeoidea are a diverse and abundant group of shrimp (prawns) captured primarily by the NRDA bongos and the 1m^2 MOCNESS. Many were identified at the genus,

family, or higher taxonomic level, it being difficult to distinguish the three major fishery penaeid shrimp (*Farfantepenaeus aztecus, Farfantepenaeus duorarum, Litopenaeus setiferus*) in early life history stages. Penaeid shrimp were found below 800 m, but many are most abundant in the upper 80 m. When summarized to the family level, the Penaidae depth range was 0 – 1500 m.

Lucifer, a sergestid prawn genus, was the most abundant decapod in the NRDA bongo samples (French McCay et al., 2015). The 95th percentile depth range for Lucifer in the Tier1A shallow MOCNESS samples was 0 – 80 m. The related Sergestidae family contains highly abundant prawns present in the NRDA bongos and occupied the 0 – 400 m depth range when summarized to the family level.

Caridean shrimp are highly abundant deep sea prawns present both above and below 200 m, sampled as deep as 1500 m. Individuals of many caridean shrimp families were found below 200 m, such as Bresiliidae (400 – 1200 m), Oplophoridae (0 – 1500 m), Pandalidae (0 – 800 m), and Pasiphaeidae (0 – 1200 m).

Large numbers of euphausiid species were captured by the MOC10 surveys. Most were spread over large depth ranges from the surface to >600 m. The SEAMAP bongos also captured large numbers of euphausiids, presumably of a smaller size. Amphipods (which were not identified to species) were abundant in the SEAMAP historical bongo and MOC10 samples, present at all depths 0 – 1500 m. Stomatopoda (mantis shrimp) made up 3% of the biomass in the10m^2 MOCNESS samples, with the 95th percentile range 0 - 200 m.

The mollusks (pteropods, cephalopods, and gastropods) made up ~20% of the biomass identified in the MOC10 samples (French McCay et al., 2015). Cephalopod orders occupied fairly wide depth ranges, with octopods covering the entire water column 0 – 1500 m (Octopoda) and squid (Teuthida) shallower in the water column 0 – 600 m. Pteropods (Thecosomata and Pteropoda) were epipelagic 0 – 200 m while gastropods (Sorbeoconcha) extended into the mesopelagic layer 0 – 400 m.

The biomass of tunicates (larvaceans, pyrosomes, salps, and doliolids) was quantified in the SEAMAP historical bongos, the MOC10, and the midwater trawls (sampled from the *Pisces*). Pyrosomes made up about ¼ of the biomass of the invertebrates captured in the midwater trawls, the diverse category of gelatinous organisms making up the majority. Larvaceans, salps, and doliolids were dominants in terms of biomass in the bongos. Larvaceans were not identified in MOCNESS samples taken below 200m. The depth range for the doliolids was found to be 0-1000m based on the analysis of the MOC10 data. Salps and pyrosomes were captured by the MOC10 survey, making up about 10% of the biomass in that survey. The vertical range of salps as a group was 0 m -600 m. Pyrosomes were in the upper 200m in the MOC10 samples, but were found in the Pisces mid-water trawls that extended to 1500m.

Siphonophores, an order of the class Hydrozoa, and other Cnidaria formed the largest biomass in the SEAMAP historical bongos, whereas copepods dominated by number. Cnidaria made up about 10% of the biomass identified in the MOC10 samples (French McCay et al., 2015). Actinaria, Coronatae, Semaeostomeae, and Trachymedusae were found spanning most of the water column with ranges between 0 – 1000 m and 0 – 1500 m, while Siphonophorae occupied the 0 – 400 m depth range. Chaetognaths, predators of smaller zooplankton such as copepods, are also important in the bongos by number and by biomass (French McCay et al., 2015).

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Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

Appendix A. Vertical Migration Literature Review

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Date of Report: August 31, 2015
Project Number: 2011-144
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A.1 Vertical Migration Literature Review

A literature review was conducted in 2012 to evaluate available information with which to assign vertical depth ranges in the water column to analysis taxa, and to determine the sufficiency of information with which to quantitatively evaluate diel changes in vertical distributions. The focus in deeper waters was primarily on juvenile and adult fish, as these were the life stages for which depth ranges and diving behavior could be tracked with tagged individuals, so studies on larger life stages were more prevalent in the literature. This appendix summarizes that review.

A.1.1 Epipelagic Species

Three commercially and recreationally important groups of large, predatory fishes that utilize the upper layers of the water column in the offshore areas of the GOM are Istiophoridae (marlins), Xiphiidae (swordfish), and Scombridae (tunas and mackerels). Many of these epipelgic species are temperature sensitive and the position of the thermocline (typically extending from the bottom of the mixed layer to 150 m depth) is likely to influence their vertical distribution (Sutton and Hopkins 1996). Of the Istiophoridae species, *Istiophorus albicans* (sailfish), *Kajikia albidus* (white marlin), and *Tetrapturus pfluegeri* (longbill spearfish) tend to spend most of their time in the mixed layer (30 m) near the surface, with frequent dives to the deeper layers of the epipelagic zone and occasionally beyond to 250-350 m (Arocha and Ortiz 2006, Felder and Camp 2009, Kerstetter et al. 2009, Prince et al. 2005). *Makaira nigricans* (blue marlin) similarly frequents the shallower waters within the epipelagic zone but has been known to make occasional, short duration dives to depths greater than 800 m in the Atlantic (Goodyear et al. 2008). All of the above species display some level of Type I DVM behavior by inhabiting shallower water relatively more frequently at night than during the day, with overall water temperatures ranging between 21˚C and 30˚C.

Juvenile and adult *Xiphias gladius* (swordfish, family Xiphiidae) have a broader distribution in the water column and a larger temperature range (10˚C - 28˚C) than the Istiophoridae species (Sedberry and Loefer 2001). Swordfish adults are usually found in the epipelagic and upper mesopelagic zones to about 630 m depth (Felder and Camp 2009, Carey and Robison 1981, Musyl et al. 2004). A clear Type I DVM pattern was evident in two studies: 1) one tagged adult in the Atlantic was found between 0-620 m during the day and 0-50 m at night (Carey and Robison 1981), and 2) five tagged adults in the Florida Straits were distributed between 500 and 800 m during the day and above 75 m near the surface at night, with one individual occasionally diving to depths greater than 1,400 m (Lerner 2009). In the same study swordfish were also shown to respond to lunar phase, staying deeper in the surface waters with greater lunar illumination. Furthermore, swordfish are a good example of how vertical distribution varies both between and within life stages. Govoni et al. (2003) reported that larvae inhabit different depths at different sizes: small larvae (<11 mm) inhabit the top 1 m of the water column while larger larvae (>11 mm) are neustonic or inhabit the ocean surface layer.

Many members of the Scombridae family are strong swimmers that remain almost entirely in the epipelagic and upper mesopelagic zones (above 700 m), except for occasional deep dives performed by *Thunnus obesus* (bigeye tuna; IEO 2006) and *Thunnus thynnus* (bluefin tuna; Fromentin 2006). Bluefin tuna spend most of their time in waters less than 200 m and often in the top 50 m, but both juveniles and adults frequently dive to 500-1,000 m (Rooker et al. 2007). Bluefin tuna undertake dives >1,000 m more often in the warm waters of the GOM; thus, this behavior is thought to be associated more with regulating body temperature than with feeding

(Rooker et al. 2007). Bigeye tuna is able to withstand lower dissolved oxygen concentrations than the other scombrids, so it can remain deeper in the water column (Stequert and Marsac 1989, cited by IEO 2006). It displays a distinct Type I DVM pattern of behavior, remaining near the surface around 50 m at night and at depths >500 m during the day (IEO 2006) and like the swordfish, responds to lunar illumination (Matsumoto et al. 2005, cited by IEO 2006). Spanish mackerel (*Scomberomerus maculatus*) and king mackerel (*Scomberomorus cavalla*) larvae display DVM behavior, as well, occurring more frequently at the surface at night than during the day (Collins and Stender 1987).

Other species, like those within Scombridae which primarily inhabit the epipelagic zone but occasionally dive to deeper waters, could potentially display different vertical distribution patterns if they are located inshore (<200 m isobath over the shelf) vs. offshore (>200 m isobath over the slope).

A.1.2 Mesopelagic Species

Many mesopelagic (200-1,000 m depth) species make regular nocturnal migrations (Type I) up into the epipelagic zone, typically to feed when they are less vulnerable to visual predation (Barton 2007). In the open ocean, the mesopelagic zone was found to have the highest mean diversity, species richness, and abundance of all the vertical depth zones and was dominated by the Gonostomatidae (bristlemouths), Myctophidae (lanternfish), Sternoptychidae (hatchetfish), Stomiidae (dragonfish), Melamphaidae (ridgeheads), and Bathylagidae (deepsea smelts) families (Cook et al. 2012). Sutton and Hopkins (1996) found that Stomiidae is the most diverse fish family in the GOM, with some stomiid species exhibiting asynchronous migration, suggesting that their migration is driven by food availability as well, rather than light intensity alone. For example, *Chauliodus sloani*, *Photostomias guernei*, and *Stomias affinis*—the three most abundant species sampled in the GOM—exhibited asynchronous migrations with only 50-70% of their populations vertically migrating to the epipelagic zone at night from daytime depths of 450-900 m. In contrast, distinct synchronous DVM patterns were displayed by *Aristotstomias xenostoma* and *Astronesthes spp.*, which were collected between 500-700 m during the day and between 0-200 m at night (Sutton and Hopkins 1996). *Gonostoma elongatum* also displayed distinct type I DVM behavior, found between 425-725 m during the day and 25-325 m at night, migrating primarily for nocturnal feeding on crustaceans in the epipelagic zone with larger individuals inhabiting deeper depths than smaller ones (Lancraft et al. 1988). Catul et al. (2011) reviewed mesopelagic fishes in the Myctophidae family and highlighted the diversity of migration behaviors observed and their ecological importance as a trophic link between primary consumers and top food web predators in different pelagic zones.

A.1.3 Bathypelagic Species

The deep bathypelagic zone (1,000-4,000 m depth) in the GOM is represented by species in the Macrouridae (rattails), Gadidae (deepsea hakes), Caproidae (boarfish), Merlucciidae (deepsea hakes), Ophidiidae (cusk eels), Moridae (codlings), Scorpaenidae (scorpionfish), Bathylagidae (deepsea smelts), Gonostomatidae (bristlemouths), Stomiidae (dragonfish), Giganturidae (telescopefish), Paralepididae (barracudinas), Evermannellidae (sabertooth), Ceratiidae (seadevils), and Chiasmodontidae (snaketooths) families (Barton 2007). DVM patterns of behavior are generally not thought to occur in the bathypelagic zone due to the lack of light (Cook et al. 2012); however, a few species have shown evidence of regular vertical movements.

Serrivomer beanii is typically found between 200-2,900 m by day, while at night its biomass is concentrated between 0-700 m, suggesting a shift to shallower waters. Similarly, *Maurolicus muelleri* is distributed from 0-1,900 m during the day and concentrated from 0-700 m at night (Sutton and Hopkins 1996). Two other stomiid species in the GOM suggest a large bathy-to-epipelagic DVM, *Echiostoma barbatum* and *Leptostomias bilobatus*, which were sampled between 0-300 m at night but were not sampled above 1,000 m during the day (Sutton and Hopkins 1996). *Cyclothone microdon* comprised 96% of the individuals caught in very deep water (1,900-2,900 m) and showed a broad distribution across the water column (0-2,900 m) with no DVM (Cook et al. 2012). Another bathypelagic species with little to no DVM behaviors is *Malacasteus niger* (Sutton and Hopkins 1996).

A.1.4 Neuston

Life is abundant in the upper ocean, including the wave-mixed layer and surface microlayer. The sea surface environment provides an important habitat for many organisms commonly referred to as neuston. Euneuston refers to full-time permanent inhabitants of the surface layer and are mainly small invertebrates. Hempel and Weikert (1972) observed euneuston assemblages in the tropical Atlantic surface layer as being comprised mainly of calanoid copepods.

Facultative neuston refers to part-time inhabitants spending their early life stages in the surface layer environment. The larvae of several macro-invertebrates including various families of crabs and spiny lobster have been observed in the surface layer (as well as deeper in the water column). For example, the zoeae and megalope stages of larval brachyuran crabs are noted to swarm in the surface layer to avoid predation and utilize surface currents for offshore transport (Reyns and Sponaugle 1999, Young 1995). Phyllosome larvae and puerulus larvae of spiny lobster species utilize the surface layer for predator avoidance and surface current transport (Acosta and Butler 1999). Calinski and Lyons (1983) observed in the field spiny lobster puerulus larvae of *Panulirus argus* (Caribbean spiny lobster) swimming just within a few centimeters of the surface.

There have been numerous larval fish observed in the surface layer, many of which are commercially and recreationally important, such as billfish, dolphinfish and tunas (Hempel and Weikert 1972). Certain species of fish are noted as having larval stages which are neustonic or surface dwelling (i.e., gurnards, or Dactylopteridae; Cowen 2002). However, the larvae of most fish species observed in the surface layer are also found deeper in the water column, and so should be considered facultative neuston (based on the results of this study).

Pleuston are organisms that permanently inhabit the surface and whose bodies partially projects into the air (e.g., *Velella velella*, by-the-wind sailor). The pleuston would receive high levels of exposure to surface floating oil since they permanently inhabit the surface waters.

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Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

Appendix B. Statistical Methods for the Vertical Distribution of MOCNESS Ichthyoplankton Data

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DWH – Statistical Methods for the Vertical Distribution of MOCNESS Ichthyoplankton Data

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Introduction

This document is a description of the methods used to estimate the vertical distribution of various taxa. Using these estimates we then tested whether the observed distributions differed from a uniform distribution or whether the vertical distributions differed between day and night. We start with general descriptors of the available data, the methods used to estimate the vertical distribution and then the methods used to test the hypotheses of interest. As part of this set of analyses, we describe the methods used to determine if there was sufficient data to test the hypotheses of interest.

Sampling Design*

MOCNESS nets are arranged on an assembly containing approximately 6-9 nets. At each station, the assembly is deployed and the first net is opened. This net is towed from the surface down to the maximum depth of the sampling effort, usually the max of the water column depth or 130 m whichever is smaller. Once the net reaches the bottom of the sampling depth, it is closed and the next net is opened. This net is fished from the maximum depth up to a depth of approximately 20 m shallower. It too then is closed. Each net is opened in turn, fished over a depth range of approximately 20 m and then closed. The final net is usually towed from 20 m depth to the surface. Occasionally, records in the data set contain stopping depths of 1, 2, or 3 m below the surface. These have been re-classified as stopping at the surface (0 m) per instructions from RPS/ASA. The MOCNESS data available from the SEAMAP Ichthyoplankton Surveys conducted in 2007, 2009, and 2010 is listed in Table 1. The variables available in the data set are:

- TEST.ID – Unique identifier of the station, cruise and date
- DEPTH.IBEG - Depth of net at start of tow
- DEPTH.IEND - Depth of net at end of tow
- DEPTHDIFF – The difference DEPTH.IBEG – DEPTH.IEND
- MEANDEPTH – average depth of the net ([DEPTH.IEND + DEPTHDIFF]/2)

- latDD – Latitude of the sampling location
- lonDD – Longitude of the sampling location
- WATERDEPTH - Depth at Sampling Location
- D.N - Day/Night indicator for when the assembly was deployed (D, N)
- GEAR.LOC – identifier of which net in the assembly is being used. 0 indicates the net that fishes the entire water column.
- VOL.FILT - Volume filtered during tow
- Columns 12 to 230 are named for the ichthyoplankton taxa. Each column contains the observed count of larvae for the labeled taxon.
- ALL.LARVAE – the sum of the counts of all taxa

In an ideal situation every deployment of the MOCNESS yields non-overlapping collections of plankton from defined 20 m depth bins (0-20m, 20-40m, 40-60m, …, up to 120-140m). The reality is different. For example, most stations towed 5 or 6 nets (excluding the net that sampled the entire depth range), less than the 7 required to cover the entire vertical depth range of 0 to 140 m (Table 2).

Further, because the water column depth varied over the sampling area of the SEAMAP Ichthyoplankton Surveys (min = 43.89 m, Q1 = 127.6 m, median = 210.3 m, Q3 = 825.0 m, max = 3398.0 m), the number of nets also varied over the depths of interest for the ichthyoplankton (Figure 1). Not surprisingly, the sampling effort (as number of nets by depth) decreases as the sampling depth increases (Table 3).

Another effect of the water column depth was that the nets were often deployed for depth ranges smaller than 20 m and did not necessarily start or end at a 20 m multiple (Figure 2). Further, the range over which a net was towed varied from the expected 20 m depth range that would occur under ideal deployments (Figure 3). As can be seen in Figure 3 many (> 55%) of the nets were towed over 20 m depth ranges but a significant fraction were towed over other depth ranges. Finally, although the nets were the same size, the volume filtered by each net varied (Figure 4) in part due to the different depth ranges sampled. Because of the unequal volumes filtered, all analyses were conducted using density (# individuals caught in a net / volume filtered by the net) standardized to #/250 m^3.

Table 1. Distribution of nets deployed from the MOCNESS assembly during SEAMAP by year, day versus night (D_N), and season.

YEAR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
2007	100	21.69	100	21.69
2009	238	51.63	338	73.32
2010	123	26.68	461	100.00

D_N	Frequency	Percent	Cumulative Frequency	Cumulative Percent
D	245	53.15	245	53.15
N	216	46.85	461	100.00

SEASON	Frequency	Percent	Cumulative Frequency	Cumulative Percent
FALL	177	38.39	177	38.39
SPRING	284	61.61	461	100.00

Table 2. Distribution of the number of nets towed per MOCNESS assembly (one per station) for the 88 stations sampled between 2007 and 2010. The number of nets excludes the net that started at the surface and finished at the maximum depth.

	NUMBER NETS	NUMBER STATIONS
	1	2
	2	4
	3	7
	4	9
	5	11
	6	49
	7	4
	8	2
TOTAL	460	88

Figure 1. Frequency distribution of the number of nets that sampled each 1 m depth bin for all 460 nets towed in SEAMAP. The X-axis is the depth (m) and the Y-axis is the number of nets that included that depth. For example, approximately 70 nets fished (horizontal blue line) in a depth range that included the 60-61 m depth layer (vertical blue line).

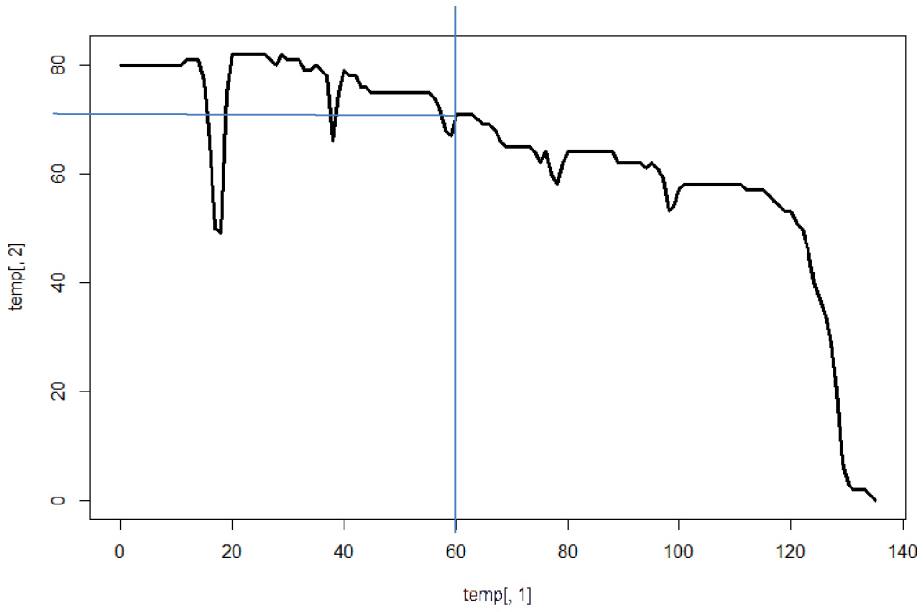


Table 3. Distribution of the mean depth [= (start depth + end depth)/2] of each net within the desired 20 m depth bins for all 460 nets deployed during SEAMAP Ichthyoplankton Surveys.

Depth Bin	Frequency	Percent
>0 - 20m	95	20.61
>21 - 40m	98	21.26
>40 - 60m	79	17.14
>60 - 80m	69	14.97
>80 -100m	62	13.45
>100-120m	58	12.58

Figure 2. Histogram showing the frequency distribution of the mean sampling depths of the 460 nets in the MOCNESS samples from SEAMAP. The mean depth represents the midpoint of the depth ranges of a towed net.

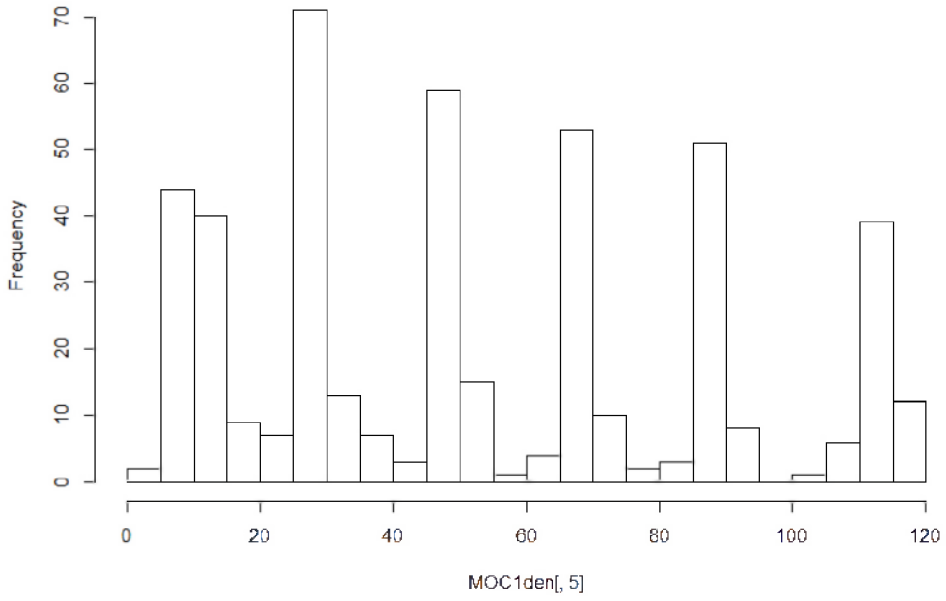


Figure 3. Histogram showing the frequencies of the depth ranges (difference between starting and finishing depth) over which the MOCNESS nets were towed.

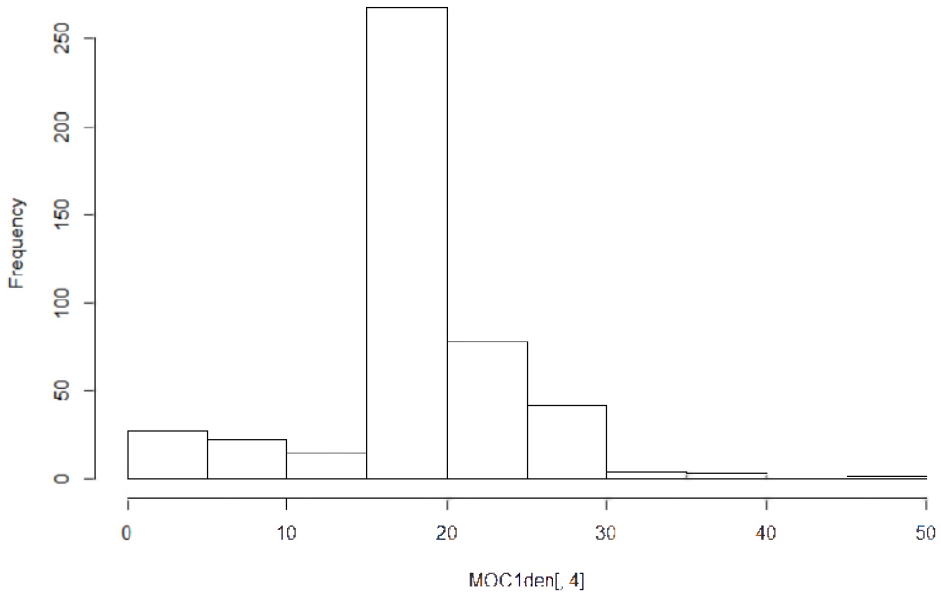
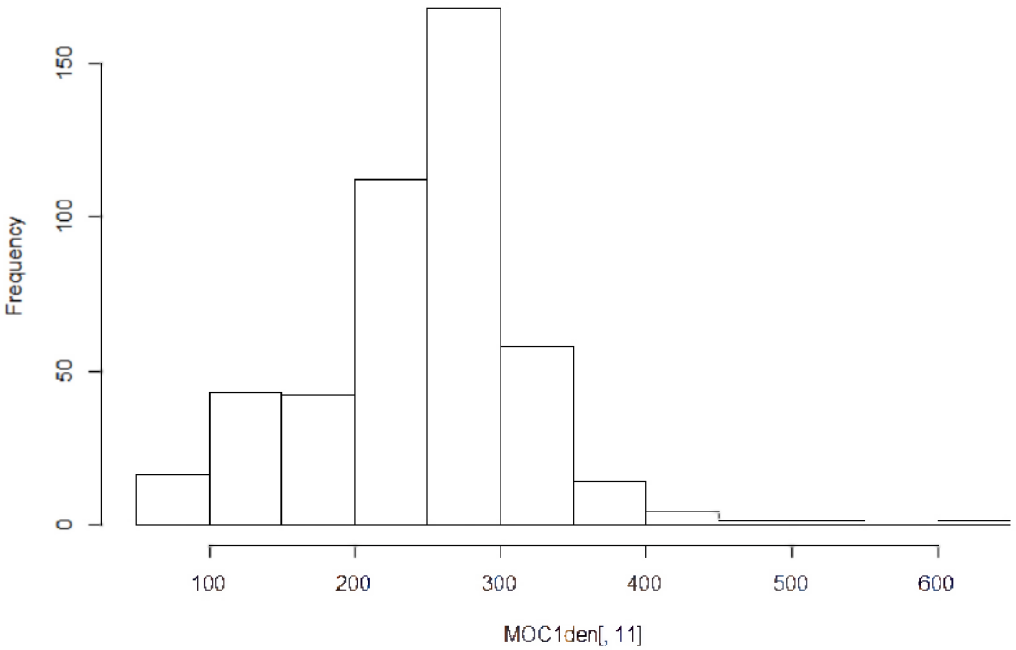


Figure 4. Histogram of the volumes filtered by the MOCNESS nets deployed in SEAMAP.



Distribution Functions for the Vertical Distribution of a Taxon

Estimation of the Vertical Distribution

We assume that the taxon is uniformly distributed within the depth range in which a single net samples and that the overall vertical distribution of the taxon is a mixture of these uniform distributions within sub-ranges of the overall vertical range. That is, the vertical distribution of a taxon is described by a mixture of N uniform distributions (N = number of nets in a deployment of the MOCNESS at a station), each with a range equal to the depth range over which the net was towed and with a height equal to density/m (m = number of meters over which the net was towed). This particular approach is based on the implicit assumption that the vertical sampling adequately covers the entire depth range over which a taxon is found and that the densities within each net tow are representative of the true density within the depth range sampled by the net. Further, we assume that the vertical distribution of a taxon is consistent over the years for which data are available and over the spatial coverage of the dataset. Finally, we assume that most taxa are distributed vertically in the depth ranges for which there are large number of observations (Figure 1).

As a very simple example, suppose we have two tows with larvae present, one between 9 m and 29 m and another between 22 and 40 m. To obtain the vertical distribution of the taxon, we construct two uniform distributions that when combined yield a vertical distribution for the taxon (Figure 5). This approach is refined by incorporating the density of larvae in each tow as a weight associated with the depths the tow sampled. If a sufficient number of tows are available with overlapping similar depth ranges, this approach provides an approximation to the likely true vertical distribution of larvae. When only a small number of tows are available, the approximated vertical distribution will depend on the exact vertical location of the tows.

The final requirement for the vertical distribution is to obtain a relative frequency distribution, that is, the proportion of total density observed in each 1 m depth bin. This is done by summing the densities over all tows and observed depth range of the taxon and then dividing each of the densities in the 1 m bins by the total density. This provides the proportion of the total density observed in each 1 m depth bin, i.e. it is the frequency distribution of the taxon for each meter of depth (Figure 5d).

Once this relative frequency distribution is obtained it is straight-forward to calculate a cumulative frequency distribution. A cumulative distribution function is given by

$$F_n(x) = \sum_{i=1}^{n} w_i x_i I[x_i \leq x]$$

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where w_i is the weight for the i^{th} observation such that $\sum_{i=1}^{n} w_i = 1$, x_i is the value of the i^{th} observation, and $I[x_i \leq x]$ is an indicator function = 0 if the condition is not true and = 1 otherwise. In this study, w_i is the proportion of the total density observed in the i^{th} 1 m depth bin and $x_i = i$, i.e. it equals identifier of the i^{th} 1 m depth bin. An example is shown in Figure 6a-b.

Figure 5. a) depth ranges of two nets (red and green lines), one covering a depth range of 9 to 29 m and the other a range of 22 to 40 m. b) uniform distributions assuming that larvae are equally likely to be anywhere in the sampled interval, so each line is actually a probability distribution with height equal to 1/width of the interval. c) The vertical distribution of the taxon that is the normalized sum of these two uniform distributions without any additional information regarding the observed densities in these two intervals. The red line is a kernel density smoother showing the approximate shape of the distribution. d) the vertical distribution of the taxon when weighted by the observed density. In this example, the density for the net from 9 to 29 m is 30/m^3 and for the 22 to 40m net is 9/m^3.

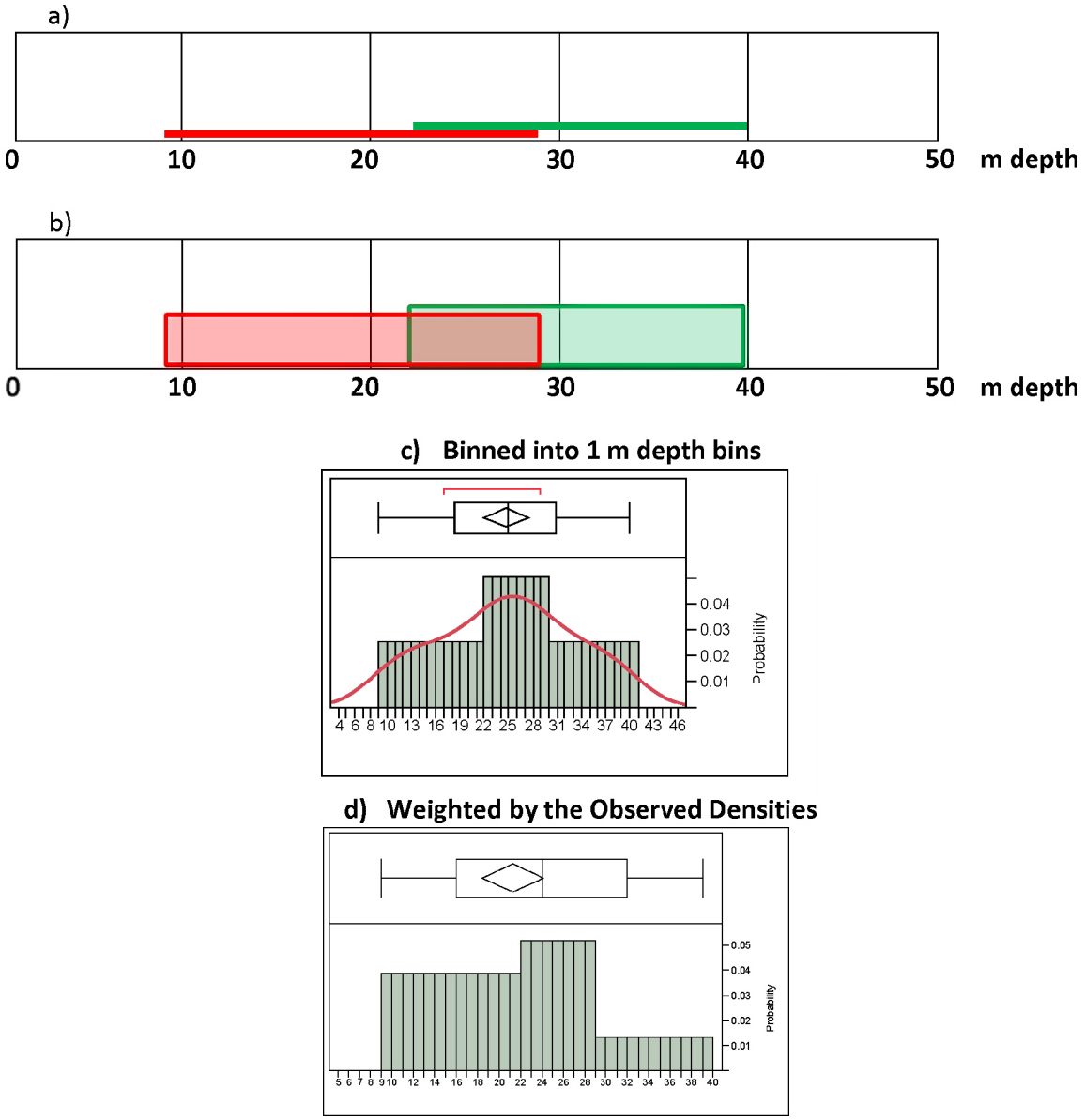
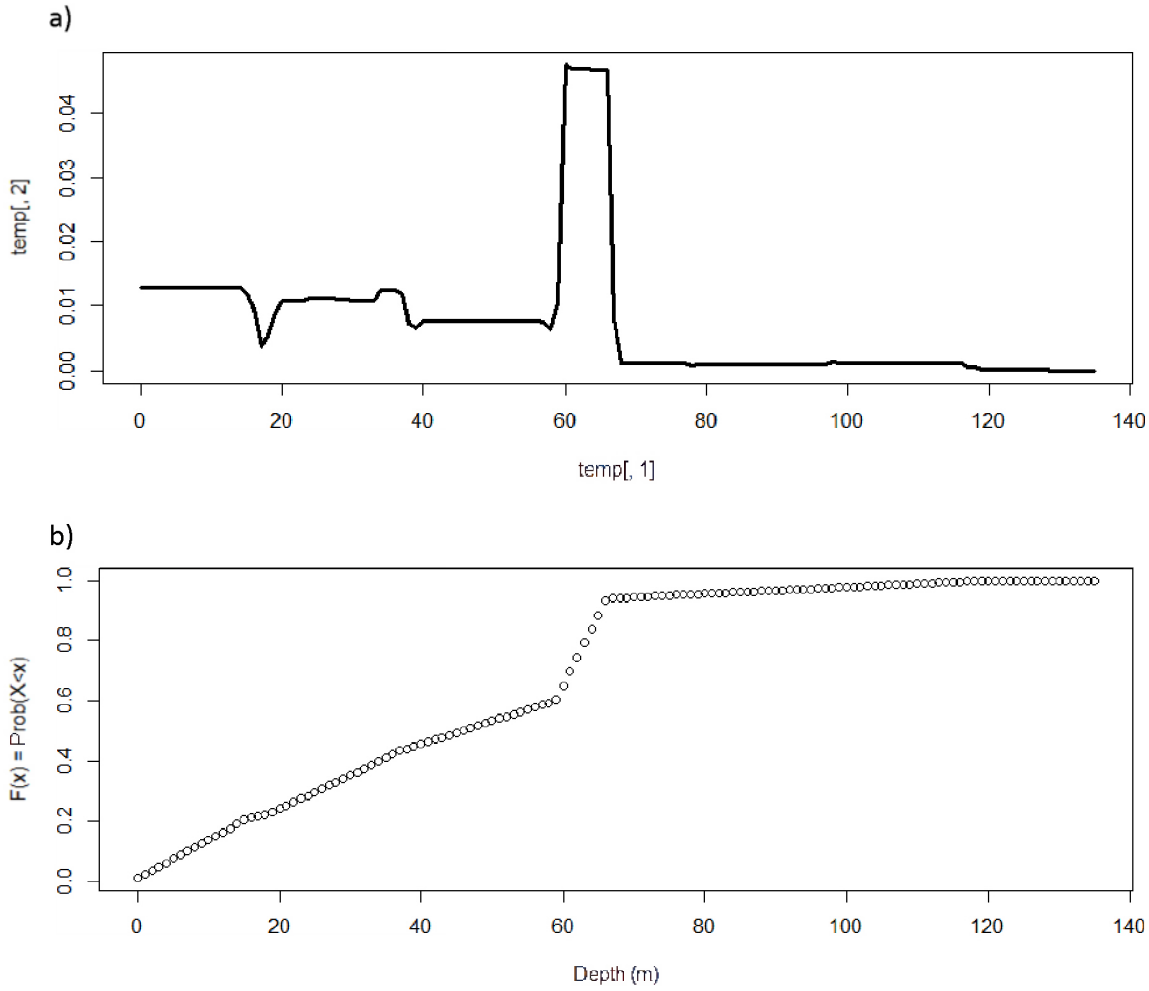


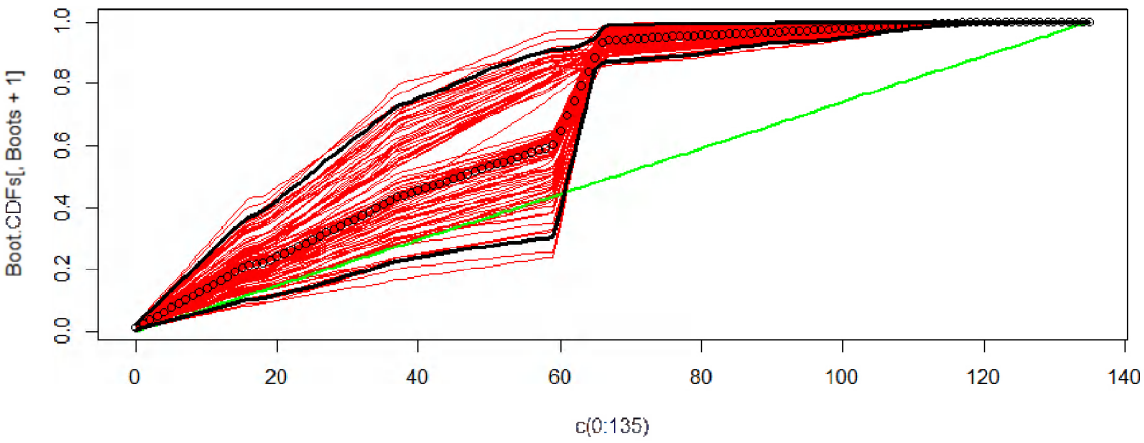
Figure 6. a) the vertical distribution of Serrininae based on the 61 non-zero stations (136 non-zero nets); b) the empirical cumulative distribution function (ECDF) for the vertical distribution of Serrininae (open circles); c) the same distribution with 100 bootstrapped ECDFs (red lines, see text), the 95% confidence bands (heavy black lines) and the CDF of a uniform distribution over the depth range of 0 to 135 m (green line).



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Figure 6 continued.

c)



Confidence Interval Estimation of the Cumulative Distribution Function

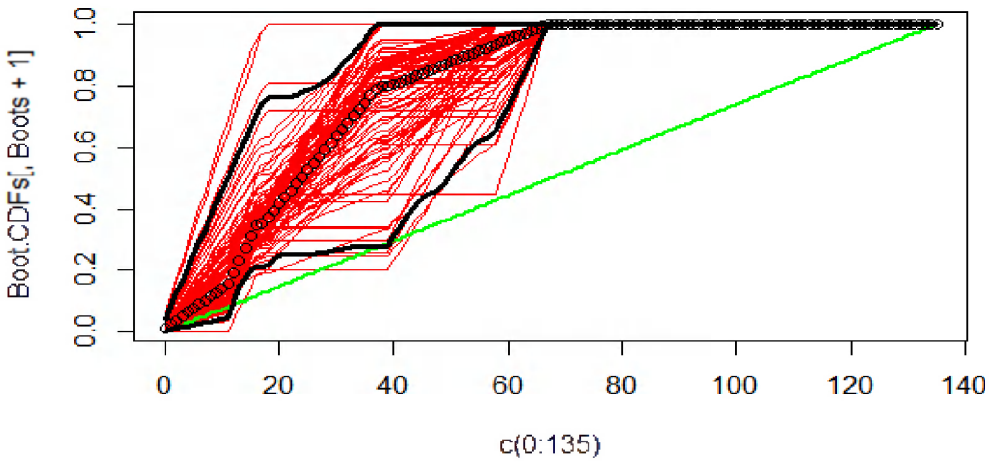
In order to obtain a measure of the uncertainty in the empirical cumulative distribution function (ECDF), we used bootstrapping to obtain a 95% confidence band envelope around the ECDF.

To do the bootstrapping, we assumed the sampled stations were random selections from an infinite population of possible stations. Hence, bootstrapping was conducted by randomly selecting n = 88 stations with replacement from the sample dataset of 88 stations. All stations were available for possible selection in the bootstrapping regardless of whether the taxon was observed at the station or not (Figure 7).

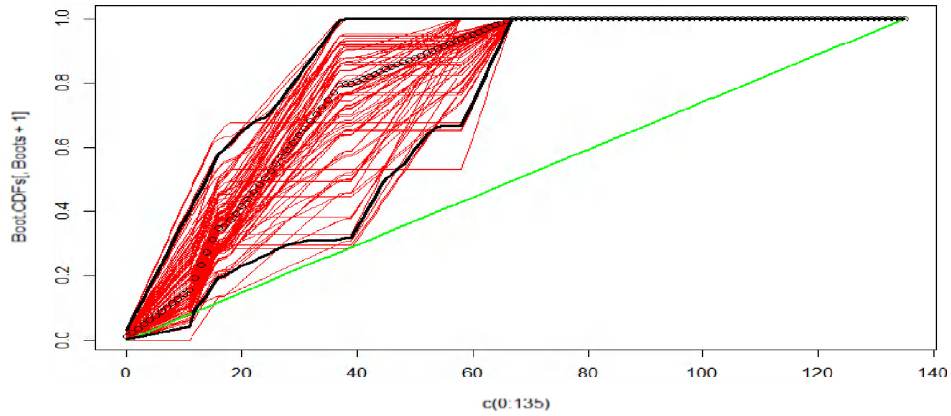
For each bootstrap sample, we calculated the ECDF and stored the results. This was repeated 100 times. To calculate the 95% confidence interval, the 2.5th and the 97.5th percentile values of the bootstrap ECDFs were obtained at each 1 m depth. The results (136 2.5th percentiles and 136 97.5the percentiles) are jointly the confidence band for the likely true CDF of the taxon.

Figure 7. The empirical cumulative distribution function (ECDF) for the vertical distribution of Blennidae (open circles) with 100 bootstrapped ECDFs (see text for detail), the 95% confidence bands (heavy black lines) and the CDF of a uniform distribution over the depth range of 0 to 135 m (green line). A) Using all 88 stations sampled by the MOCNESS gear during the SEAMAP Ichthyoplankton Survey. B) Using only the 7 non-zero stations.

a)



b)



Sample Size Issues

Precision of an Empirical Vertical Distribution

In order to estimate the vertical distribution of a taxon, sufficient information is needed. In this section we attempt to determine the minimum amount of information required to adequately estimate the histogram. The question is whether sufficiency of the data should be based on the number of non-zero nets, the number of non-zero stations (MOCNESS tows), or the number of individuals caught in the nets. Because the distributions of the different taxa are so variable (see later), we emphasize the number of non-zero stations and the total number of individuals caught. Neither of these is completely sufficient though as the variability of the number of individuals among the nets is also an important consideration.

Table 4 lists the number of non-zero stations (# non-zero nets ≥ # non-zero stations), total density, and total number of individuals collected in all 460 nets towed in the MOCNESS by taxon. As can be seen, taxa with few non-zero stations also tend to have low counts of individuals.

In addition, we used two visual methods for identifying which variables (number of tows, number of nets, number of individuals) are most important for data adequacy. We calculated a 95% confidence band around the cumulative distribution and we compared that envelope to the cumulative distribution function for a uniform distribution. The comparison of the uniform with the observed was over the entire sampling depth range of 0 to 135 m deep, not over the observed vertical range for a taxon.

To determine what factors contribute to the variability of the ECDF (and therefore of the vertical distribution) we constructed ECDFs and 95% confidence bands for several taxa that were found at exactly 5 stations (Table 5). There are several sources that should be addressed. The first is the number of stations at which the larvae were observed and the number of larvae observed and the second is the variability of the count/net in the dataset. Both of these influence the determination of whether there are sufficient data to infer the vertical distribution of the taxon (Figure 8).

We also compared different numbers of stations to identify if the effect of station was evident (Figure 9).

After review, it was decided that, for hypothesis testing related to day vs night or a null hypothesis of a uniform distribution, the taxon should have been observed from at least 5 stations and that at least 20 larvae total had to have been observed. Even when these requirements are met, it is conceivable that the observed vertical distribution of these larvae

may be too indiscriminant to be able to discern a pattern. Conversely, the taxon could be very limited vertically which would contribute to lower observed values in the dataset (*cf.* HAEMULIDAE in Figure 8). The full set of plots of the empirical cumulative distribution functions and bootstrapped confidence intervals are given in Supplement II.

Table 4. Number of stations at which taxon was collected and total density in the MOCNESS nets sampled during the SEAMAP Ichthyoplankton Surveys.

Taxon	Number of Non-zero stations	Sum(Density)	Total Num Individuals
STEPHANOLEPIS	0	0	0
CANTHERHINES.PULLUS	0	0	0
SARDA.SARDA	0	0	0
BAIRDIELLA.CHRYSOURA	0	0	0
TRICHOPSETTA	0	0	0
ANGUILLA.ROSTRATA	0	0	0
TAANINGICHTHYS	0	0	0
IDIACANTHINAE	0	0	0
MICROSTOMATIDAE	0	0	0
NOTACANTHIFORMES	1	0.685	1
LOBOTES.SURINAMENSIS	1	0.698	1
DIRETMIDAE	1	0.755	1
ANOPLOGASTRIDAE	1	0.765	1
DACTYLOPTERUS.VOLITANS	1	0.828	1
GOBIESOCIDAE	1	0.836	1
SCIAENIDAE	1	0.853	1
DERICHTHYIDAE	1	0.883	1
TRACHINOTUS	1	0.883	1
XIPHIAS.GLADIUS	1	0.883	1
SCOMBROLABRAX.HETEROLEPIS	1	0.912	1
FISTULARIIDAE	1	0.933	1
AULOPUS	1	0.951	1
MONACANTHUS.CILIATUS	1	1.092	1
TETRAGONURUS.ATLANTICUS	1	1.577	2
ALECTIS.CILIARIS	1	1.946	2
SARDINELLA.AURITA	1	2.041	2
SCOMBEROMORUS.MACULATUS	1	2.193	1
MORINGUIDAE	1	4.869	5
LAMPRIDIFORMES	2	1.513	2
BERYCIFORMES	2	1.669	2

Taxon	Number of Non-zero stations	Sum(Density)	Total Num Individuals
STROMATEIDAE	2	1.743	2
MALACOSTEINAE	2	1.789	2
ZEIFORMES	2	1.815	2
ACHIRIDAE	2	1.852	2
GIGANTURA	2	1.896	2
LEPIDOPHANES	2	1.957	2
LOPHIIFORMES	2	2.165	2
CARISTIIDAE	2	2.58	2
SYNAPHOBRANCHIDAE	2	2.836	4
ISTIOPHORIDAE	2	2.889	3
RUVETTUS.PRETIOSUS	2	2.899	3
NEALOTUS.TRIPES	2	2.909	2
ELOPIFORMES	2	4.427	4
MENTICIRRHUS	2	4.658	5
MONOLENE	2	4.917	5
OPISTHONEMA.OGLINUM	2	5.499	3
ALUTERUS	2	5.583	5
CHLOPSIDAE	2	5.624	6
BOLINICHTHYS	2	7.611	8
POECILOPSETTA	2	11.38	12
POLYMIXIA	3	2.777	3
CIRRHITIDAE	3	2.796	3
SYMBOLOPHORUS.RUFINUS	3	2.884	3
ARGENTINOIDEI	3	2.971	3
DIODONTIDAE	3	3.329	3
KYPHOSUS	3	5.615	4
OSTRACIIDAE	3	5.766	4
EXOCOETOIDEA	3	7.344	5
ACANTHOCYBIUM.SOLANDRI	3	7.753	6
LEIOSTOMUS.XANTHURUS	3	10.054	11
ECHENEIDAE	3	13.795	5
PEPRILUS	3	18.93	15
LARIMUS.FASCIATUS	3	33.797	17
CHAETODONTIDAE	4	3.318	4
CLUPEIDAE	4	3.513	4
MIRAPINNIDAE	4	4.178	4
PLEURONECTIFORMES	4	5.557	6
POMATOMUS.SALTATRIX	4	5.625	6
SYNGNATHIDAE	4	6.001	6
SYMPHYSANODON	4	7.377	7

Taxon	Number of Non-zero stations	Sum(Density)	Total Num Individuals
PEPRILUS.PARU	4	8.19	7
SERIOLA	4	11.749	10
ALEPISAURUS	5	4.032	5
CHAETODIPTERUS.FABER	5	5.796	7
SCORPAENIFORMES	5	6.004	6
GEMPYLIDAE	5	7.766	7
TETRAODONTIFORMES	5	11.504	12
THUNNUS.THYNNUS	5	15.197	13
HAEMULIDAE	5	17.56	16
NEOEPINNULA.AMERICANA	5	32.535	31
LUVARUS.IMPERIALIS	5	44.404	45
BREVOORTIA	5	132.496	140
CHLOROSCOMBRUS.CHRYSURUS	5	151.655	70
NOTOSUDIDAE	6	5.303	6
EPINNULA.MAGISTRALIS	6	9.559	10
BALISTIDAE	6	11.673	9
MICROPOGONIAS.UNDULATUS	6	14.073	17
GERREIDAE	6	24.015	14
CYNOSCION	6	58.416	71
MACRORAMPHOSUS.SCOLOPAX	7	9.473	9
EPIGONIDAE	7	14.088	15
MERLUCCIUS	7	15.515	17
BLENNIIDAE	7	15.624	18
ANTIGONIA	7	18.448	18
PERISTEDION	7	26.647	26
ELAGATIS.BIPINNULATA	7	65.821	69
TRACHIPTERIDAE	8	8.255	9
POMACANTHIDAE	8	16.972	18
NANNOBRACHIUM	8	22.842	20
CLUPEIFORMES	8	113.763	98
LUTJANUS.GRISEUS	8	115.921	61
GEMPYLUS.SERPENS	9	14.356	16
LUTJANUS.CAMPECHANUS	9	397.18	199
CARANGIDAE	10	25.139	23
PRIACANTHIDAE	10	45.064	46
HARENGULA	10	180.733	93
MORIDAE	11	12.617	14
CYCLOPSETTA	11	201.83	90
ASTRONESTHINAE	12	13.801	15
STOMIIFORMES	12	18.081	19

Taxon	Number of Non-zero stations	Sum(Density)	Total Num Individuals
MONACANTHIDAE	12	27.972	28
SELAR.CRUMENOPHTHALMUS	12	159.417	82
ENGYOPHRYS.SENTA	12	547.543	262
LOPHIIDAE	13	17.889	22
MURAENIDAE	13	22.224	18
POMACENTRIDAE	13	40.58	40
HOLOCENTRIDAE	13	67.017	72
LUTJANUS	13	132.882	68
MICRODESMIDAE	13	244.488	114
SCOMBEROMORUS.CAVALLA	13	405.053	178
EVERMANNELLIDAE	14	30.091	33
NESIARCHUS.NASUTUS	14	46.193	49
RHOMBOPLITES.AURORUBENS	14	226.15	123
MACROURIDAE	15	18.436	21
CHIASMODONTIDAE	15	19.401	19
STOMIINAE	15	38.48	40
ACANTHURIDAE	15	74.681	79
CHLOROPHTHALMIDAE	15	95.214	97
GRAMMISTINI	15	100.71	86
PRISTIPOMOIDES	15	409.182	239
PSENES	16	38.721	38
CARANX	16	98.025	76
SELENE	16	396.63	192
LUTJANIDAE	16	563.824	282
CORYPHAENA	18	29.073	25
MYCTOPHIFORMES	18	43.503	42
PHYCINAE	18	56.828	51
EPINEPHELINI	18	116.694	107
ARGENTINIDAE	19	90.249	96
EUTHYNNUS.ALLETTERATUS	19	795.918	404
ENGRAULIDAE	21	7617.991	5907
GONICHTHYS.COCCO	22	40.168	43
BOTHIDAE	22	150.413	141
SCOMBRIDAE	22	154.752	99
URANOSCOPIDAE	23	52.639	53
LOBIANCHIA	23	62.83	68
ETROPUS	23	142.187	136
THUNNUS	23	243.995	204
PEPRILUS.BURTI	24	124.036	120
MULLIDAE	24	163.041	165

Taxon	Number of Non-zero stations	Sum(Density)	Total Num Individuals
KATSUWONUS.PELAMIS	24	204.792	194
SCOMBER.COLIAS	24	617.217	655
SPHYRAENA	25	151.221	106
MUGIL	26	54.779	52
OPISTOGNATHIDAE	26	112.833	72
TRICHIURIDAE	27	73.187	82
PERCIFORMES	27	75.285	76
BRAMIDAE	28	49.955	46
DECAPTERUS.PUNCTATUS	28	122.892	107
HOWELLA	29	84.944	88
CUBICEPS.PAUCIRADIATUS	30	816.288	765
ETRUMEUS.TERES	30	1204.151	1307
AUXIS	31	188.04	163
APOGONIDAE	31	194.865	145
ANGUILLIFORMES	31	542.924	612
MELANOSTOMIINAE	32	57.942	58
SCOPELARCHIDAE	32	79.112	88
TRICHIURUS.LEPTURUS	32	189.264	154
SPARIDAE	32	585.358	588
CARAPIDAE	33	83.284	92
LAMPADENA	33	115.659	116
SYACIUM	33	2605.279	1602
PARALICHTHYIDAE	34	158.854	140
SCORPAENIDAE	34	612.879	644
NOTOSCOPELUS	36	204.375	208
BATHYLAGIDAE	37	116.88	125
PERCOPHIDAE	39	136.734	151
MALACANTHIDAE	39	158.105	172
SCARIDAE	39	517.024	554
CENTROBRANCHUS.NIGROOCELLATUS	41	104.681	111
CHAULIODONTINAE	41	124.612	135
GADIFORMES	42	143.82	160
TETRAODONTIDAE	42	166.405	170
TRACHURUS.LATHAMI	42	2446.875	2590
SERRANIDAE	43	241.498	263
SYMPHURUS	43	886.961	483
BOTHUS	45	241.836	232
OPHICHTHIDAE	46	475.499	309
CALLIONYMIDAE	47	137.874	146
STERNOPTYCHIDAE	48	1129.223	1250

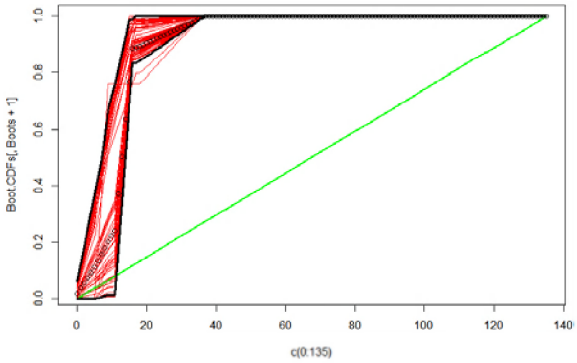
Taxon	Number of Non-zero stations	Sum(Density)	Total Num Individuals
LABRIDAE	49	2223.613	2419
MELAMPHAIDAE	50	191.013	202
DIPLOSPINUS.MULTISTRIATUS	50	196.385	222
ACROPOMATIDAE	50	297.333	321
CERATIOIDEA	52	187.734	159
CONGRIDAE	53	763.499	686
ARIOMMA	55	712.003	737
TRIGLIDAE	55	719.654	752
NETTASTOMATIDAE	57	295.021	292
NOTOLYCHNUS.VALDIVIAE	57	654.601	672
ANTHIINAE	58	724.531	711
SERRANINAE	61	805.601	725
OPHIDIIFORMES	63	946.248	872
DIOGENICHTHYS.ATLANTICUS	65	865.846	907
LAMPANYCTUS	66	869.813	903
CERATOSCOPELUS	67	1094.288	1035
PARALEPIDIDAE	68	535.104	528
SYNODONTIDAE	68	6700.961	5566
MYCTOPHIDAE	69	504.955	520
BENTHOSEMA.SUBORBITALE	69	1745.276	1841
HYGOPHUM	74	3705.829	3962
MYCTOPHUM	76	2418.148	2606
CITHARICHTHYS	77	1844.202	1731
PHOSICHTHYIDAE	77	1993.488	2067
GONOSTOMATIDAE	81	3652.071	3817
UNIDENTIFIED.FISH	82	1246.664	1212
GOBIIDAE	82	10012.06	6408
DIAPHUS	82	10284.35	10674
BREGMACEROS	86	13220.12	11799

Table 5. Taxa observed at exactly 5 stations in the MOCNESS dataset from the SEAMAP Ichthyoplankton Surveys.

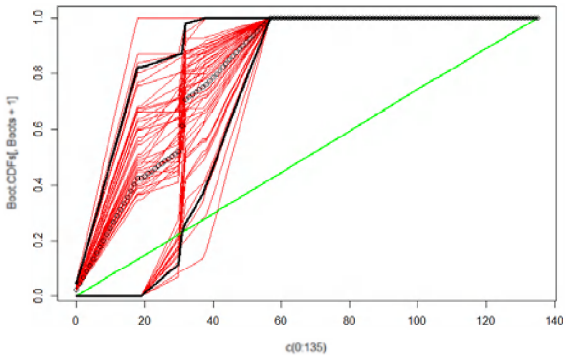
Number of Non-Zero Stations	Number of Non-Zero Nets	Sum(Density)	Total Number of Larvae	CV of Non-Zero Densities	Taxon
5	5	4.032	5	0.052	ALEPISAURUS
5	6	5.796	7	0.149	CHAETODIPTERUS.FABER
5	5	6.004	6	0.126	SCORPAENIFORMES
5	5	7.766	7	0.359	GEMPYLIDAE
5	6	11.504	12	0.335	TETRAODONTIFORMES
5	5	15.197	13	0.222	THUNNUS.THYNNUS
5	9	17.560	16	0.209	HAEMULIDAE
5	8	32.535	31	0.341	NEOEPINNULA.AMERICANA
5	6	44.404	45	0.310	LUVARUS.IMPERIALIS
5	6	132.496	140	0.512	BREVOORTIA
5	10	151.655	70	0.426	CHLOROSCOMBRUS.CHRYSURUS

Figure 8. Examples of ECDFs for those taxa observed at exactly 5 stations in the MOCNESS dataset from the SEAMAP Ichthyoplankton Surveys.

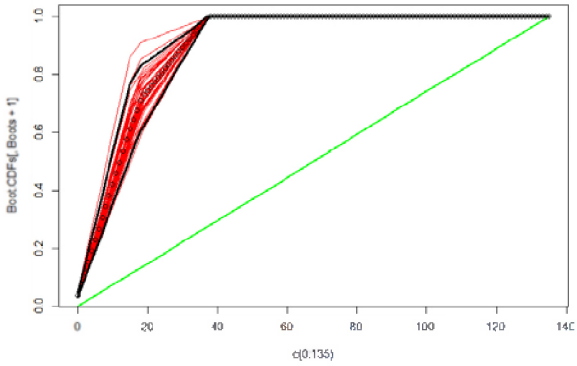
a) BREVOORTIA (140 larvae)



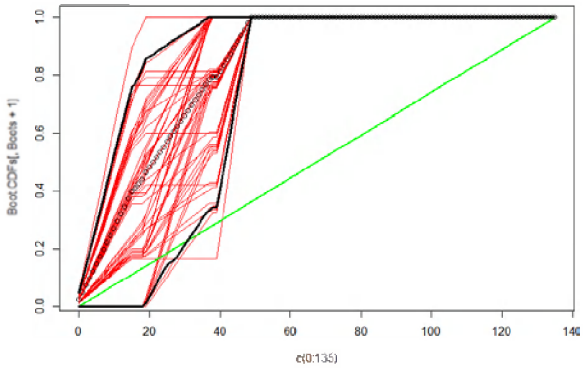
b) TETRAODONTIFORMES (12 larvae)



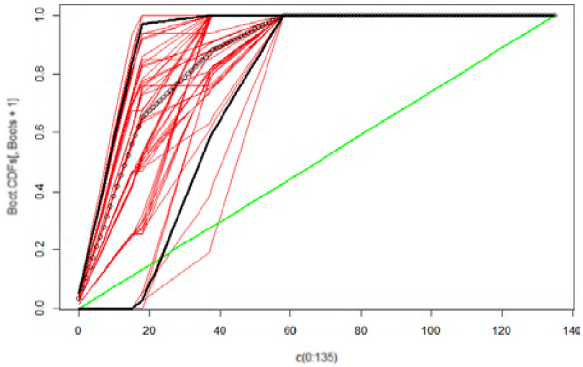
c) HAEMULIDAE (16 larvae)



d) SCORPAENIFORMES (6 larvae)



e) GEMPYLIDAE (7 larvae)



f) CHAETODIPTERUS.FABER (7 larvae)

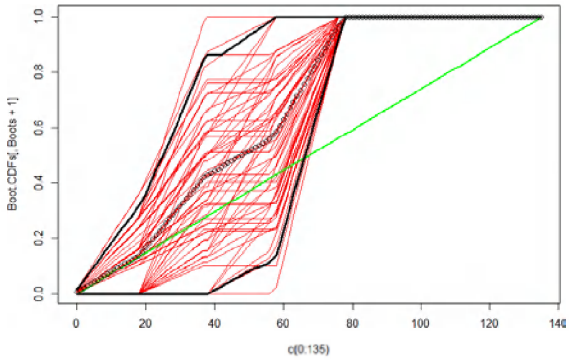
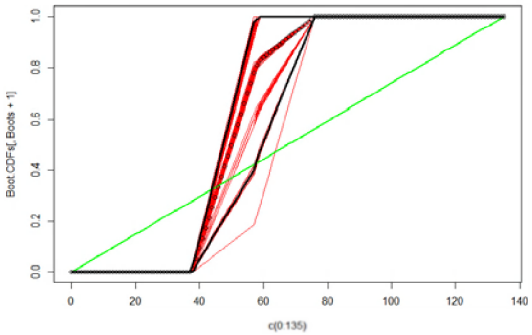
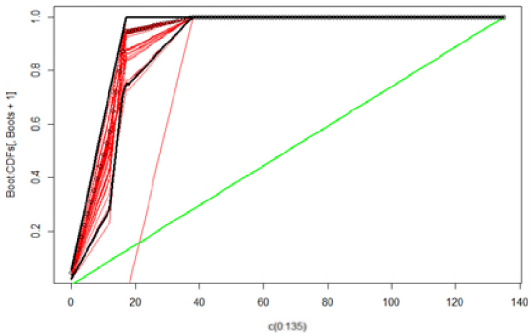


Figure 8 continued.

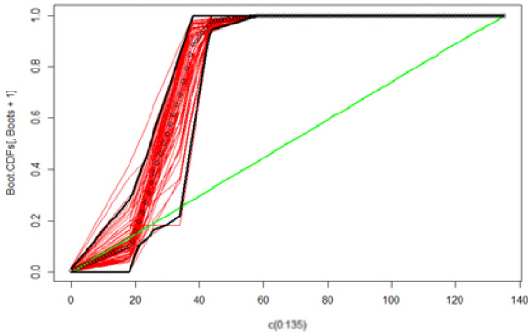
g) ALEPISAURUS (5 larvae)



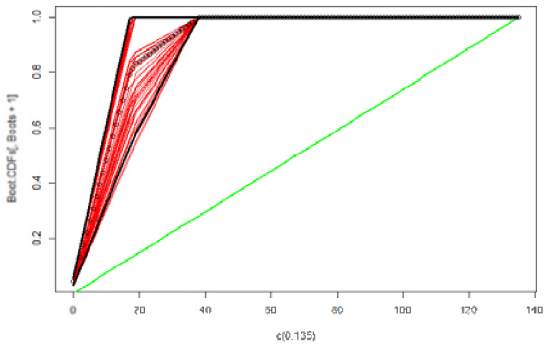
h) THUNNUS.THYNNUS (13 larvae)



i) NEOEPINNULA.AMERICANA (31 larvae)



j) LUVARUS.IMPERIALIS (45 larvae)



k) CHLOROSCOMBRUS.CHRYSURUS (70 larvae)

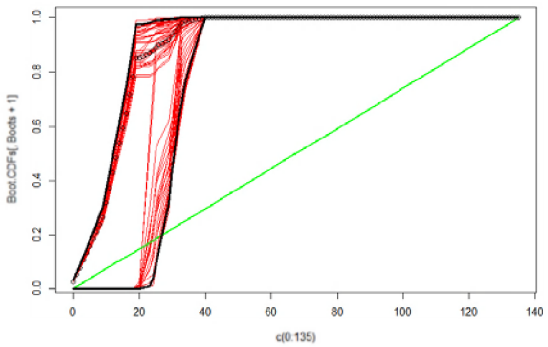
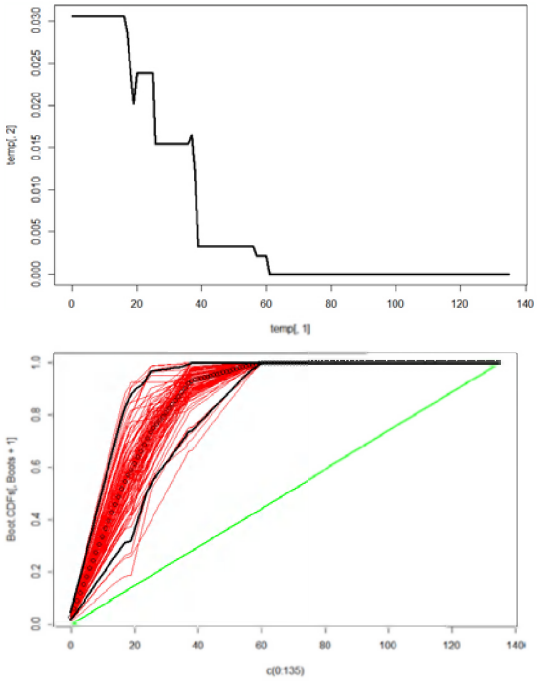
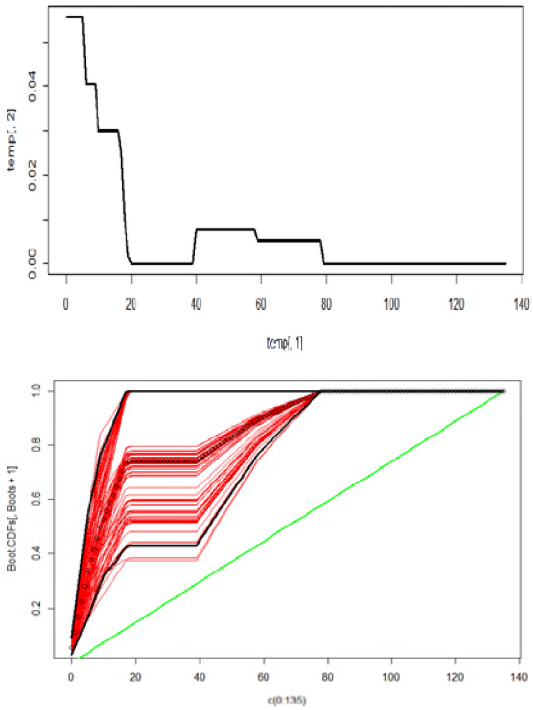


Figure 9. ECDFs for various taxa observed at between 10 and 15 stations.

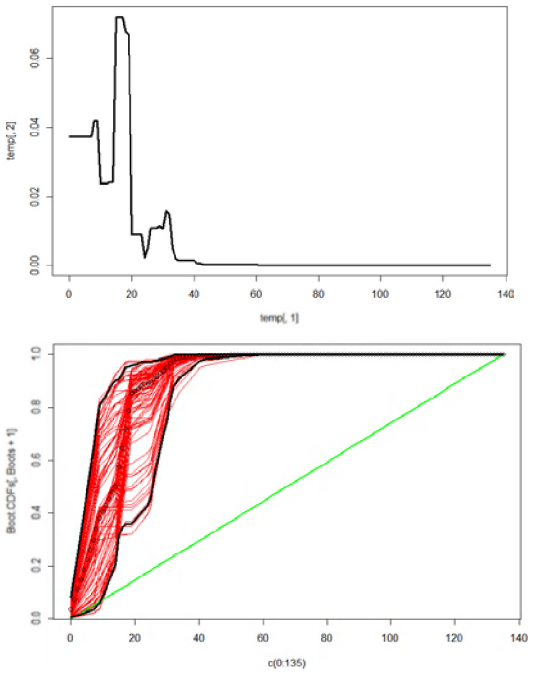
a) 10 stations (taxonID 154; 46 larvae)



c) 10 stations (taxonID 18; 23 larvae)



b) 9 stations (taxonID 197; 199 larvae)



d) 11 stations (taxonID 36; 14 larvae)

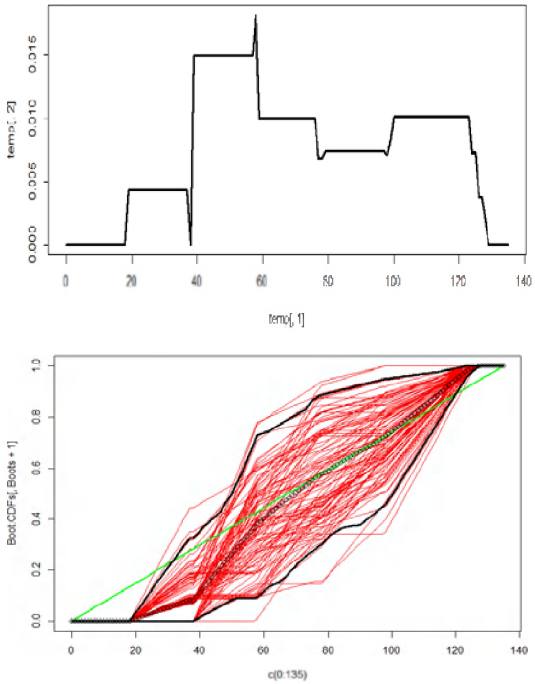
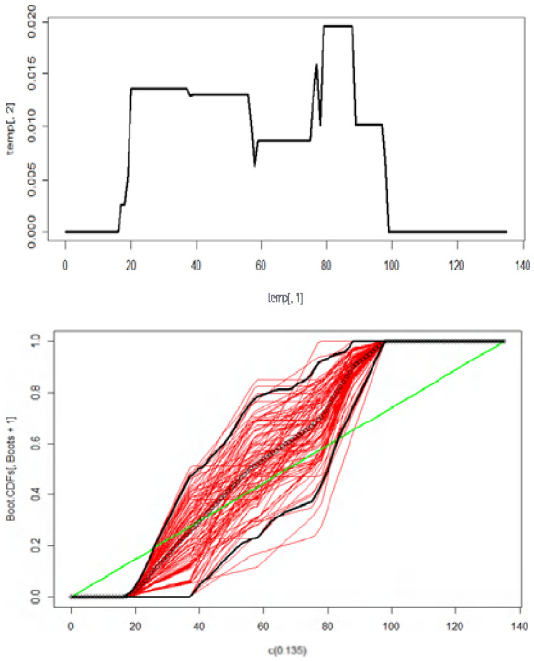
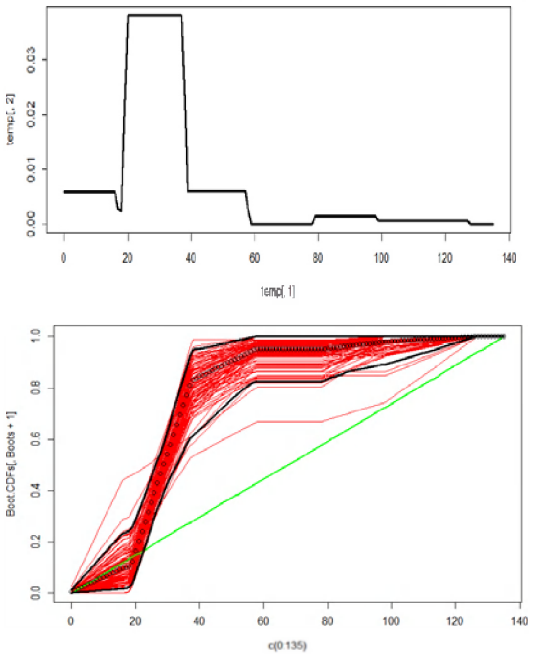


Figure 9 continued.

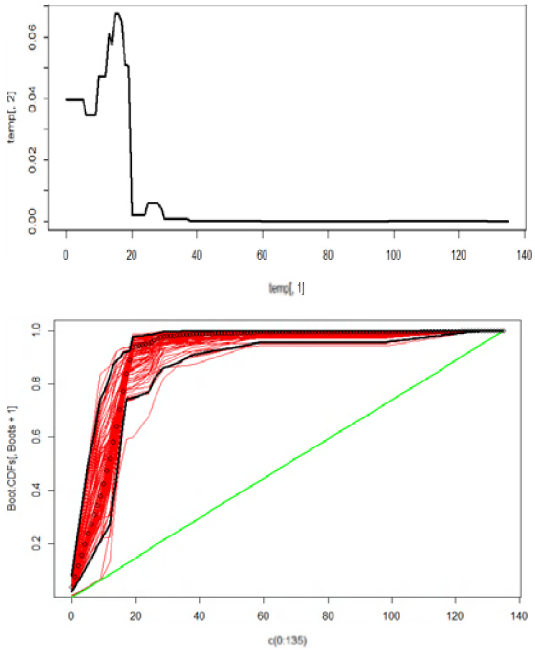
e) 12 stations (taxonID 68; 15 larvae)



f) 15 stations (taxonID 100; 40 larvae)



g) 13 stations (taxonID 148; 68 larvae)



Testing for Non-Uniform Distribution

To test if the observed distribution differed from a uniform distribution over the depth range at which a taxon's larvae were observed, we used a χ^2 test. The test statistic is given by

$$\chi^2 = \sum_{i \in \{1,\ldots,n\}} \frac{(O_i - E_i)^2}{E_i} \sim \chi^2_{n-1}$$

where *n* is the number of 1 m depth bins between the minimum depth observed and maximum depth observed for the taxon, $O_i =$ observed density in the i^{th} 1 m depth bin, and $E_i = \frac{\sum_n O_i}{n} =$ expected density in the i^{th} 1 m depth bin under the uniform distribution. The statistic is asymptotically distributed as a χ^2 on $n - 1$ degrees of freedom. We reject the null hypothesis if the right tail probability (p-value) is smaller than the chosen level of type I error.

This test was performed for the observed range over which the taxon was found as well as for selected subsets of depth ranges (Table 6). This was done to allow for the possibility that while the overall distribution might not be uniform for a taxon, there could be selected depth ranges within its observed range within which it is uniformly distributed. These specialty tests must be very carefully reviewed since the number of larvae found in selected depth ranges can be quite small. In addition, the multiplicity of tests being performed can lead to spurious results and so chosen type I error rates should be quite small to control the family-wise error rate at a reasonable value. Results of the testing are given in Supplement I. These results are not meant to be used alone as the chi-square test is approximate but instead are to be used in conjunction with the depth ranges assigned to a species for purposes of SIMAP based on data quality and a literature review to identify those taxa for which a uniform distribution is appropriate within the assigned depth range.

Table 6. Depth ranges (m) for which a test of uniformity within that depth range was performed for selected taxa.

0-20	60-100
0-40	20-80
0-60	40-80
0-80	60-80
0-100	20-60
0-136	40-60
20-136	20-40
40-136	80-100
60-136	100-136
20-100	80-136
40-100	

Testing for Diurnal Differences in Vertical Distribution

To test for the equivalence of the day versus night vertical distributions, we used a permutation test. The permutation test is a non-parametric approach in which the null hypothesis is assumed to be true so that the labels indicating whether a station was sampled with the MOCNESS during the day or the night are irrelevant. Hence we can permute the labels among the stations essentially re-assigning the stations to a random choice of day or night sampling. With each re-assignment we calculate the Kolmogorov-Smirnov (KS) test statistic for testing equivalence of two ECDFs. If we perform a sufficient number of permutations and calculations of the KS statistic we will have an empirical frequency distribution for the test statistic that relies only on the adequacy of the data rather than on asymptotic arguments. We ran 200 random permutations in order to test the hypothesis that the day and night distributions differed. The p-value of the test statistic is the proportion of permutation KS test statistics that exceeded the observed KS statistic value from the original, unpermuted data set. Table 7 shows the results of the testing.

Table 7. Results of the permutation tests for those taxa for which sufficient data were available for both day and night.

Taxon	Observed KS test Statistic Value	Permutation P-value
NOTOSCOPELUS	0.394964004	0
SPHYRAENA	0.478244274	0
GOBIIDAE	0.368844801	0.005
LABRIDAE	0.474866506	0.01
STOMIIFORMES	0.788174035	0.01
THUNNUS	0.215029709	0.01
CERATOSCOPELUS	0.350041437	0.015
KATSUWONUS PELAMIS	0.378422076	0.015
MORIDAE	0.790554033	0.02
LAMPANYCTUS	0.218230665	0.02
ENGYOPHRYS SENTA	0.43887036	0.03
SELAR CRUMENOPHTHALMUS	0.405302962	0.03
BREGMACEROS	0.423468195	0.035
MELAMPHAIDAE	0.291665179	0.04
SYNODONTIDAE	0.621547309	0.045
SCOMBRIDAE	0.438655036	0.045
MICRODESMIDAE	0.388055916	0.055
LUTJANUS	0.398336908	0.06
TRICHIURUS LEPTURUS	0.340433185	0.065
SCORPAENIDAE	0.450824841	0.07
SERRANIDAE	0.338587168	0.075
RHOMBOPLITES AURORUBENS	0.458037703	0.075
CENTROBRANCHUS NIGROOCELLATUS	0.238973094	0.08
DECAPTERUS PUNCTATUS	0.293470782	0.095
LUTJANUS CAMPECHANUS	0.612292889	0.105
GERREIDAE	0.57920251	0.11
POMACENTRIDAE	0.691395054	0.115
ETRUMEUS TERES	0.297163487	0.13
GONICHTHYS COCCO	0.401424642	0.13
LUTJANUS GRISEUS	0.70534786	0.13
PERCIFORMES	0.244881164	0.14
AUXIS	0.177417913	0.145
LUTJANIDAE	0.25968383	0.15

Taxon	Observed KS test Statistic Value	Permutation P-value
GRAMMISTINI	0.534077489	0.155
GONOSTOMATIDAE	0.183699447	0.16
SCARIDAE	0.264341258	0.165
CALLIONYMIDAE	0.337415198	0.205
MUGIL	0.290223931	0.215
CARANX	0.17381767	0.22
OPISTOGNATHIDAE	0.385804688	0.24
DIPLOSPINUS MULTISTRIATUS	0.194647472	0.245
SELENE	0.235735925	0.255
PHYCINAE	0.451962587	0.26
MYCTOPHIDAE	0.152019352	0.265
PARALEPIDIDAE	0.174939305	0.28
PRISTIPOMOIDES	0.410835029	0.28
CARAPIDAE	0.33014175	0.29
OPHIDIIFORMES	0.211296373	0.29
MULLIDAE	0.268052567	0.3
PRIACANTHIDAE	0.292258174	0.3
PHOSICHTHYIDAE	0.116697717	0.305
ACROPOMATIDAE	0.160499416	0.31
SCOMBER COLIAS	0.157123278	0.315
TRACHURUS LATHAMI	0.224320732	0.32
HOLOCENTRIDAE	0.461586905	0.32
PEPRILUS BURTI	0.247851482	0.325
EVERMANNELLIDAE	0.366592371	0.325
BOTHIDAE	0.389265474	0.33
LAMPADENA	0.220032451	0.335
APOGONIDAE	0.16005342	0.335
STOMIINAE	0.244404019	0.335
ANGUILLIFORMES	0.597485771	0.345
HYGOPHUM	0.441672143	0.345
SPARIDAE	0.152878882	0.35
CONGRIDAE	0.31085658	0.36
STERNOPTYCHIDAE	0.35228441	0.36
MELANOSTOMIINAE	0.217268859	0.365
ARIOMMA	0.121691844	0.37
PERCOPHIDAE	0.198217136	0.37
TETRAODONTIDAE	0.192812946	0.375
ACANTHURIDAE	0.391755692	0.375

Taxon	Observed KS test Statistic Value	Permutation P-value
CITHARICHTHYS	0.149544884	0.39
MALACANTHIDAE	0.198930281	0.39
ETROPUS	0.232864025	0.4
NESIARCHUS NASUTUS	0.313493557	0.4
CUBICEPS PAUCIRADIATUS	0.190156036	0.405
LOBIANCHIA	0.277571793	0.435
CLUPEIFORMES	0.422350899	0.455
CYCLOPSETTA	0.317571476	0.465
MYCTOPHUM	0.080830349	0.47
EUTHYNNUS ALLETTERATUS	0.168036615	0.48
SERRANINAE	0.351902616	0.485
SYACIUM	0.225938956	0.485
CORYPHAENA	0.199899958	0.5
HARENGULA	0.248457572	0.5
SYMPHURUS	0.352841517	0.52
DIOGENICHTHYS ATLANTICUS	0.087552793	0.525
PARALICHTHYIDAE	0.215446555	0.555
CHLOROPHTHALMIDAE	0.282701491	0.575
CHAULIODONTINAE	0.100281126	0.58
SCOMBEROMORUS CAVALLA	0.280506119	0.58
BLENNIIDAE	0.414255892	0.585
NOTOLYCHNUS VALDIVIAE	0.126293921	0.61
TRIGLIDAE	0.073978373	0.64
UNIDENTIFIED FISH	0.073912335	0.645
OPHICHTHIDAE	0.110285194	0.645
NETTASTOMATIDAE	0.132029833	0.655
BRAMIDAE	0.105174591	0.655
BENTHOSEMA SUBORBITALE	0.067475887	0.67
BATHYLAGIDAE	0.078611793	0.695
MYCTOPHIFORMES	0.171720806	0.705
SCOPELARCHIDAE	0.098701241	0.725
ARGENTINIDAE	0.227643572	0.73
CHIASMODONTIDAE	0.144628931	0.74
BOTHUS	0.089927191	0.75
EPINEPHELINI	0.107430757	0.765
ELAGATIS BIPINNULATA	0.379982129	0.815
DIAPHUS	0.061128649	0.825
ANTHIINAE	0.080102026	0.84

Taxon	Observed KS test Statistic Value	Permutation P-value
HOWELLA	0.118194465	0.845
TRICHIURIDAE	0.133087467	0.875
MURAENIDAE	0.165172917	0.88
URANOSCOPIDAE	0.126855849	0.885
MACROURIDAE	0.219610142	0.905
GADIFORMES	0.064843551	0.91
PSENES	0.182387412	0.93
CARANGIDAE	0.28516118	0.945
ENGRAULIDAE	0.053322952	0.955
MONACANTHIDAE	0.106854388	0.97
LOPHIIDAE	0.110164166	0.98
CERATIOIDEA	0.089673217	0.985

Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

Appendix B. Supplement II. ECDF Plots by Taxon for MOCNESS Ichthyoplankton Data

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marycchristman@gmail.com

Statistical Methods for Vertical Distribution of MOCNESS Ichthyoplankton Data: Supplement II

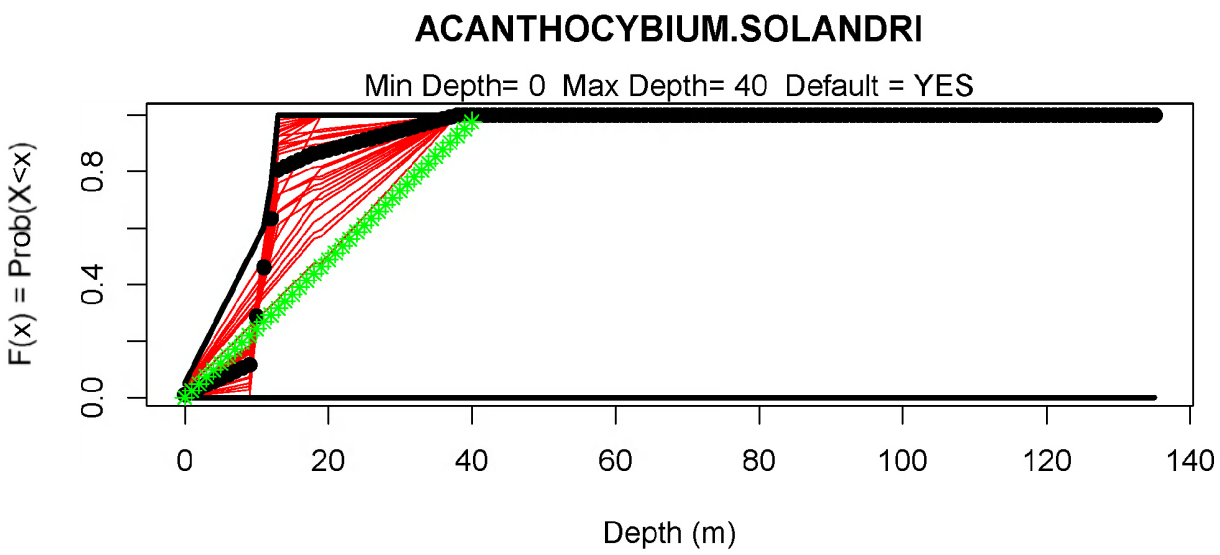
Mary C. Christman
MCC Statistical Consulting, LLC
Gainesville, FL

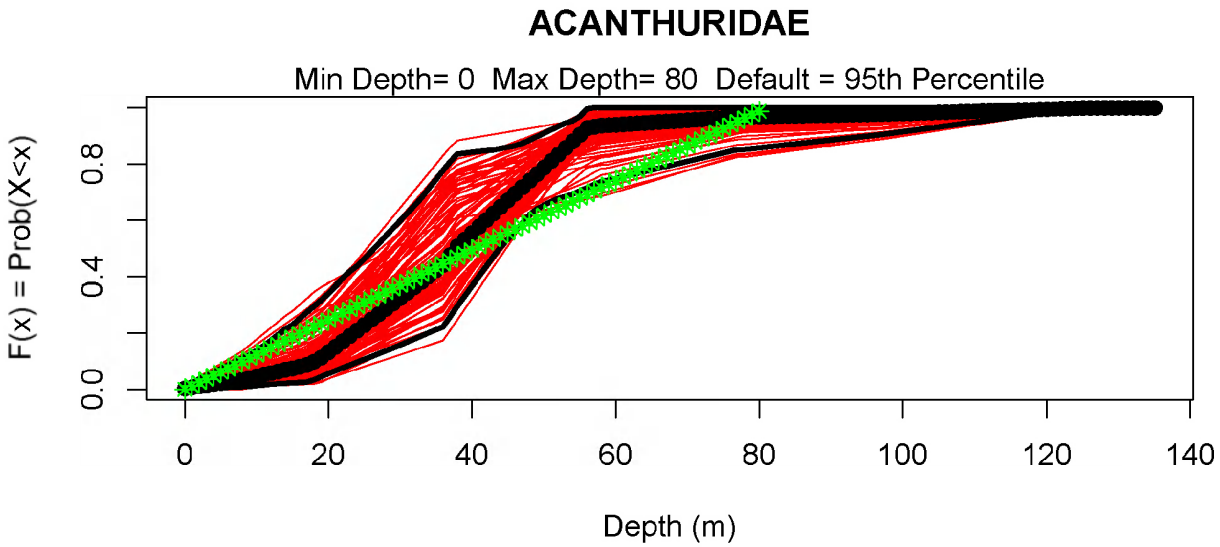
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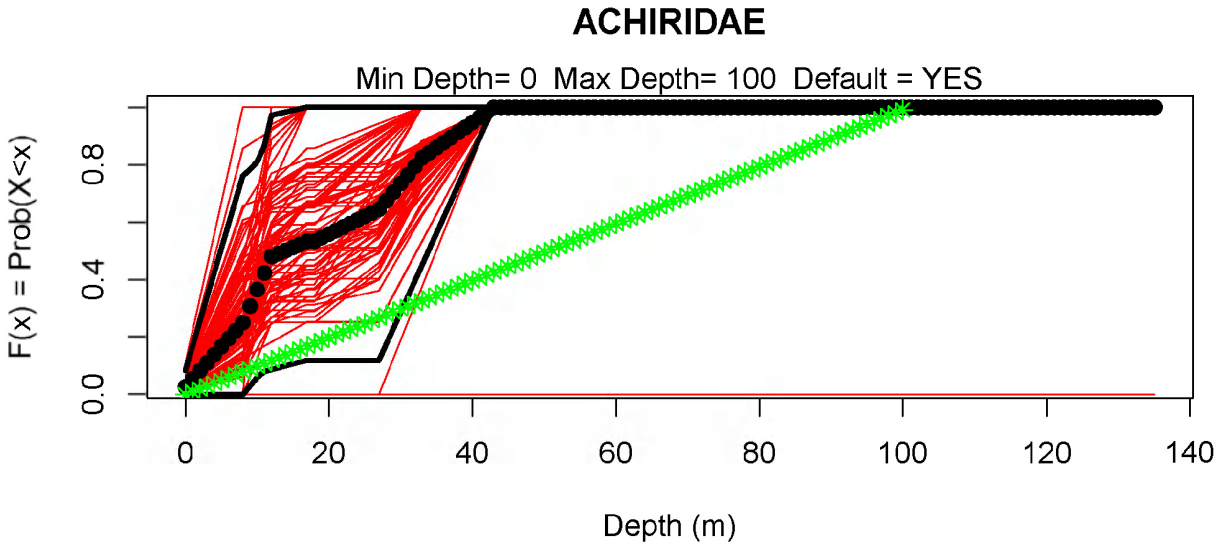
Pages 2 – 102: Empirical cumulative distribution functions (ECDFs) by taxon (black dotted line). Red lines indicate bootstrapped ECDFs, heavy black lines are the 95th percentile confidence band for the ECDF, green line is the equivalent uniform distribution CDF within the recommended vertical range for the taxon. Min and Max refer to the recommended minimum and maximum depth ranges over which the taxon is expected to be found; "Default" indicates the method by which the depth range was determined.

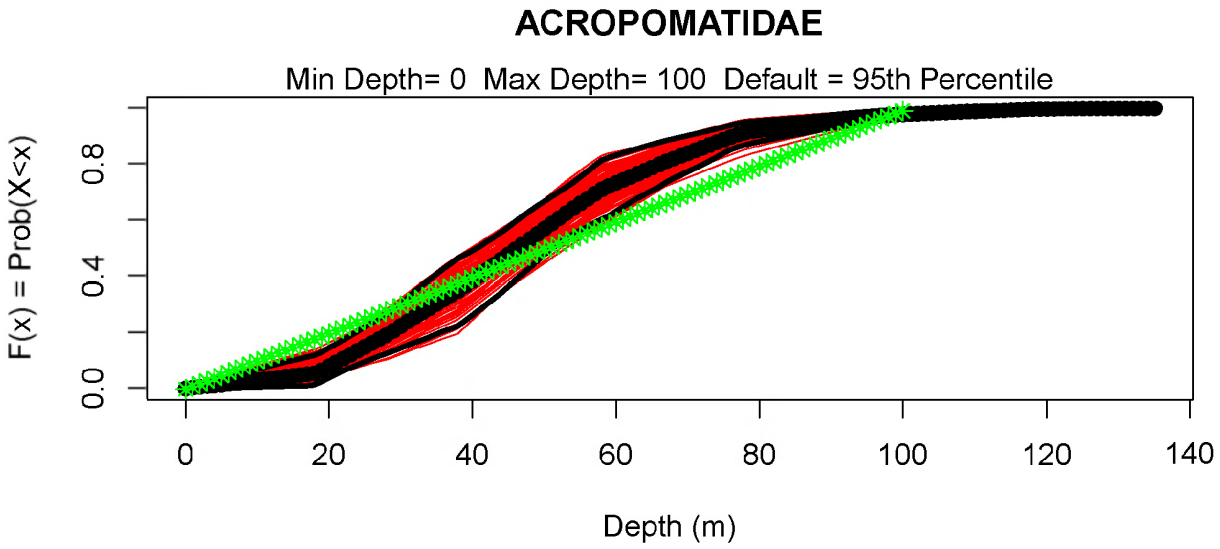
Pages 103 – 304: Top of each page shows the ECDF by taxon with bootstrapped confidence band and the equivalent uniform ECDF (green line) for the entire range in which the taxon was found in the 1m^2 MOCNESS samples. Min and Max refer to the observed minimum and maximum depth ranges over which the taxon was found; Max Width is the Kolmogorov – Smirnov test statistic for comparing the observed ECDF to the null hypothesized Uniform distribution ECDF. The bottom of each page is the equivalent observed density distribution from which the ECDF was calculated. For both graphs for a taxon, red lines indicate bootstrapped distributions, heavy black lines are the 95th percentile confidence band for the distribution, and the green line is the equivalent uniform distribution within the observed vertical range for the taxon.

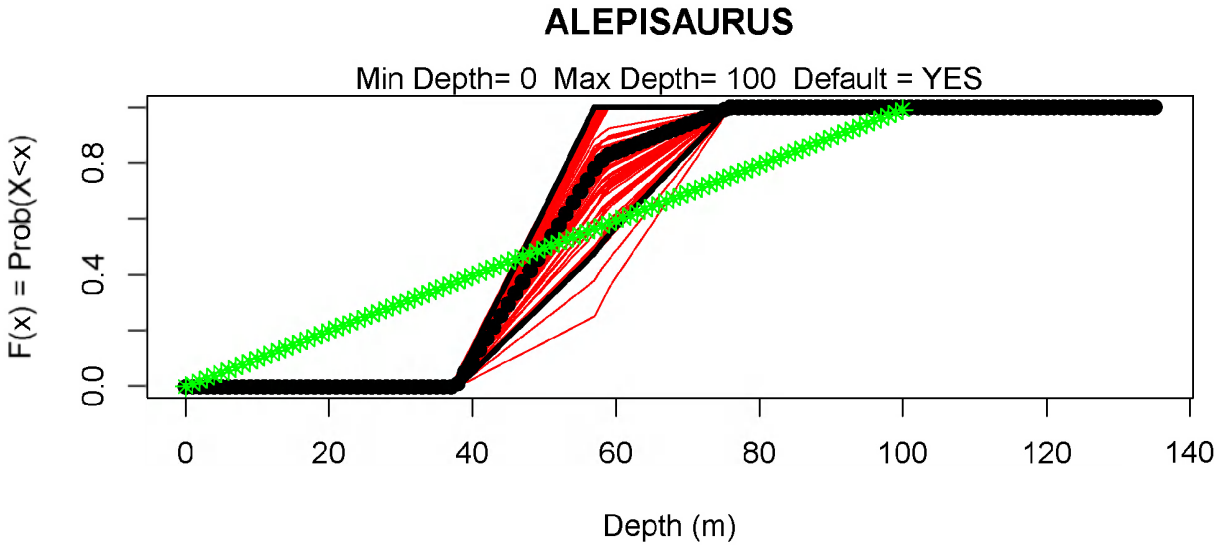
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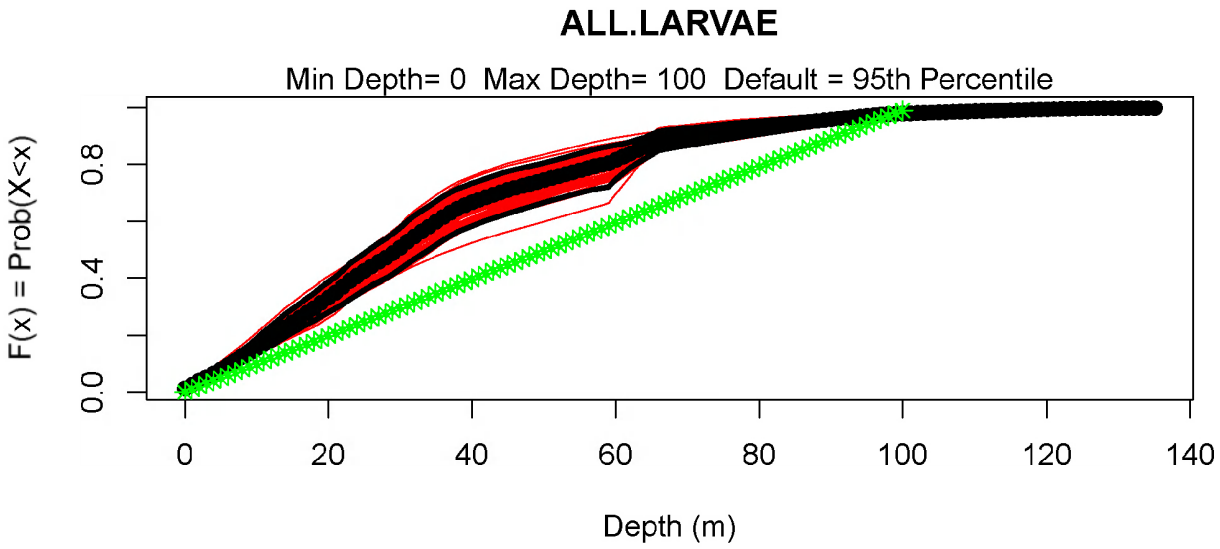

ACANTHOCYBIUM.SOLANDRI
Min Depth= 0 Max Depth= 40 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

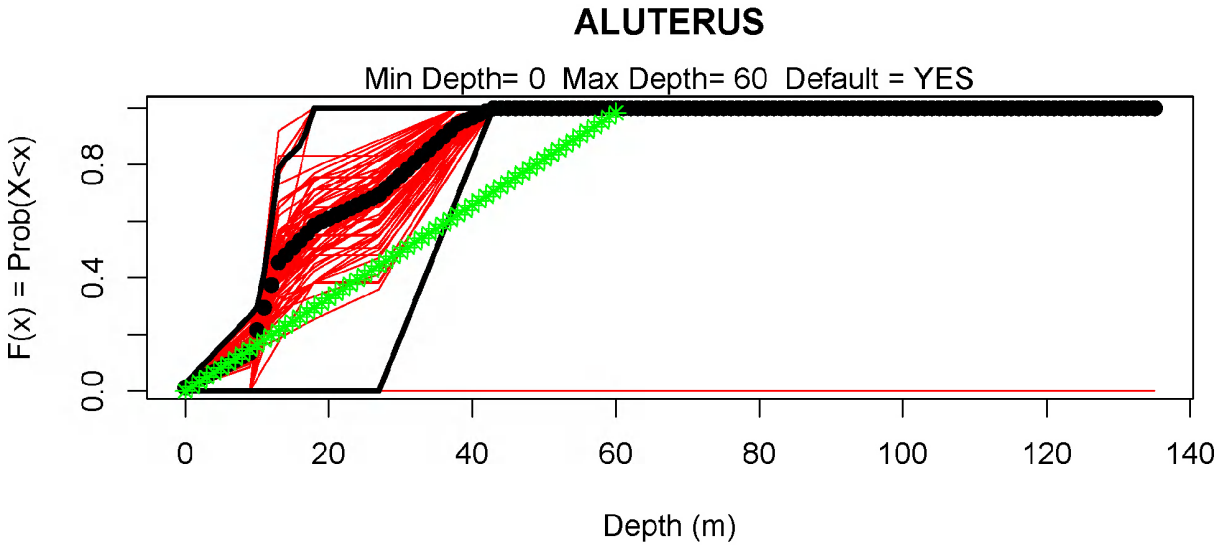

ACANTHURIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
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0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

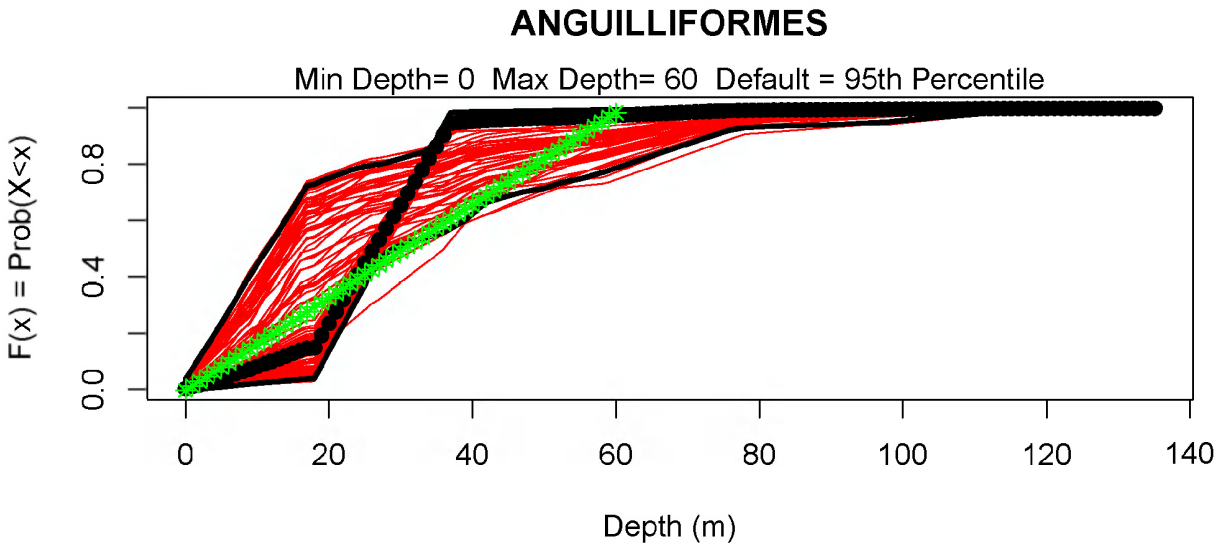

ACHIRIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

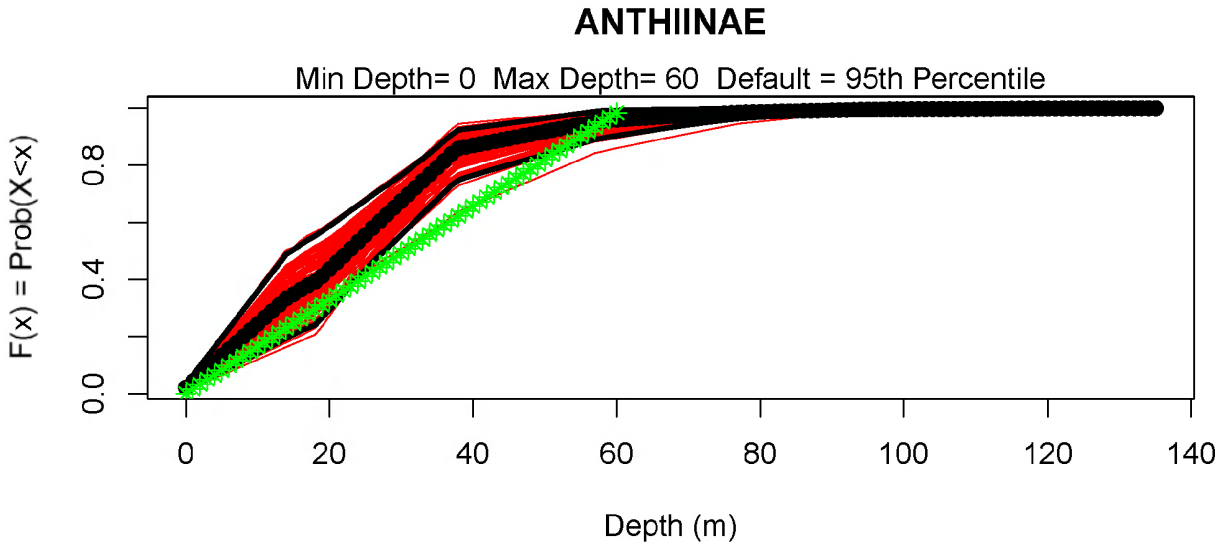

ACROPOMATIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
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0.4
0.8
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20
40
60
80
100
120
140
Depth (m)

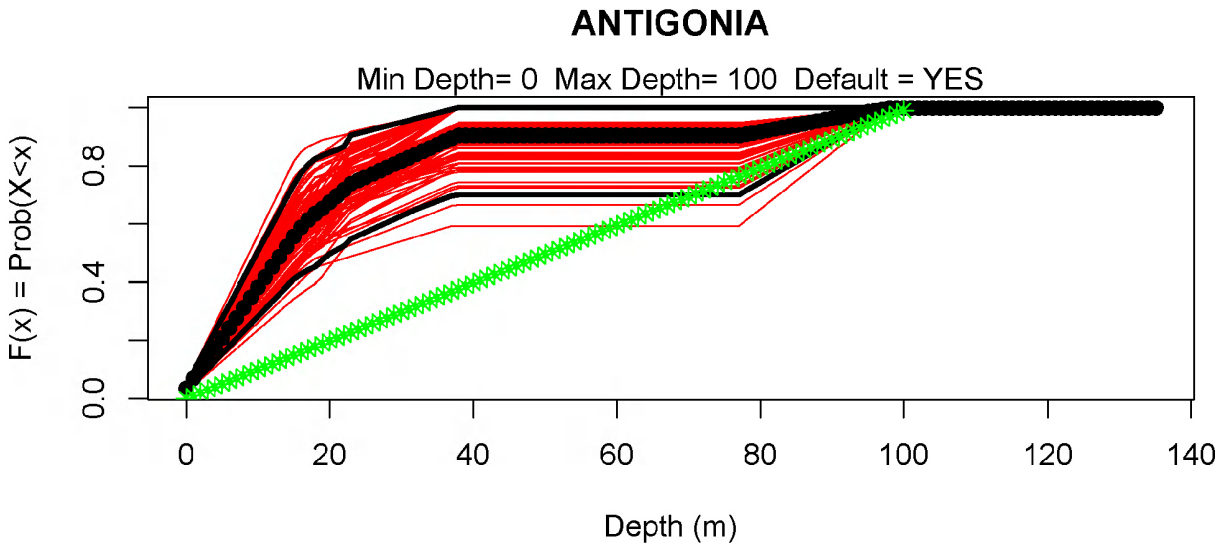

ALEPISAURUS
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0.8
0
20
40
60
80
100
120
140
Depth (m)

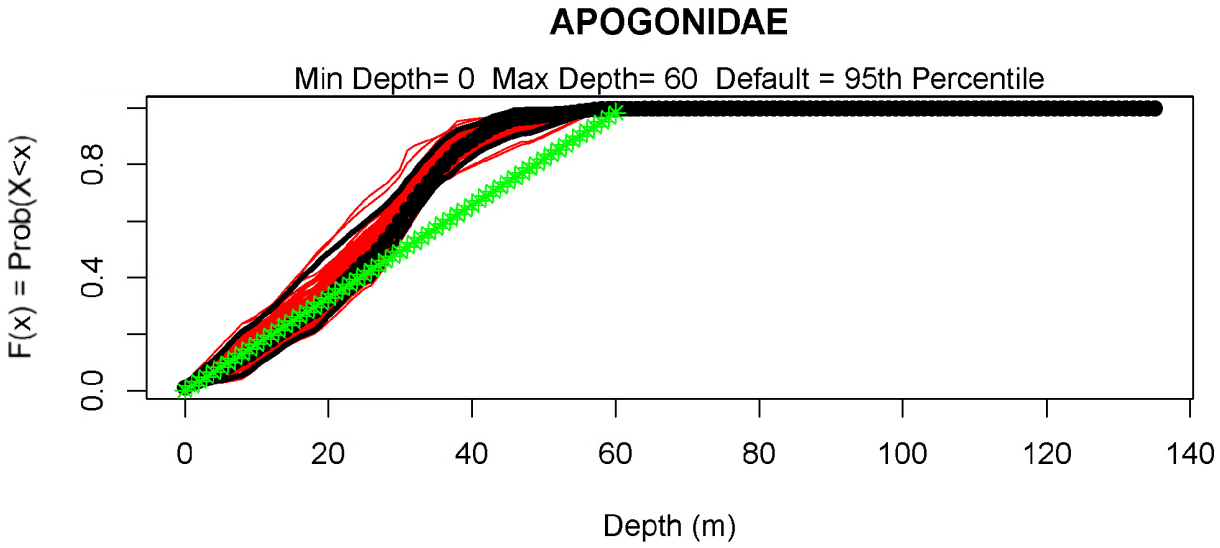

ALL.LARVAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
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0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

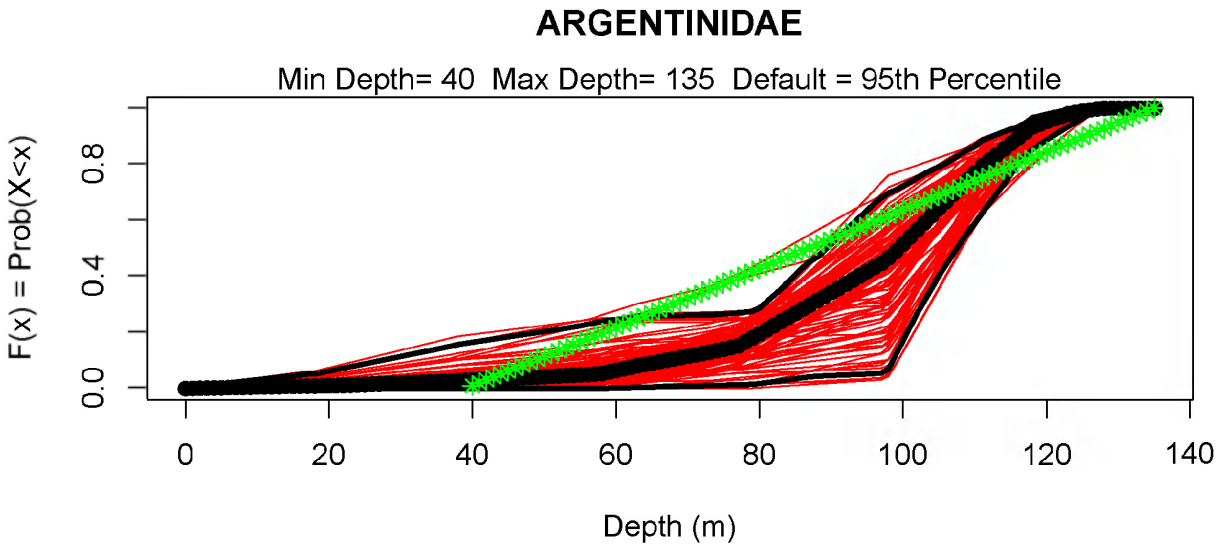

ALUTERUS
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0.4
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20
40
60
80
100
120
140
Depth (m)

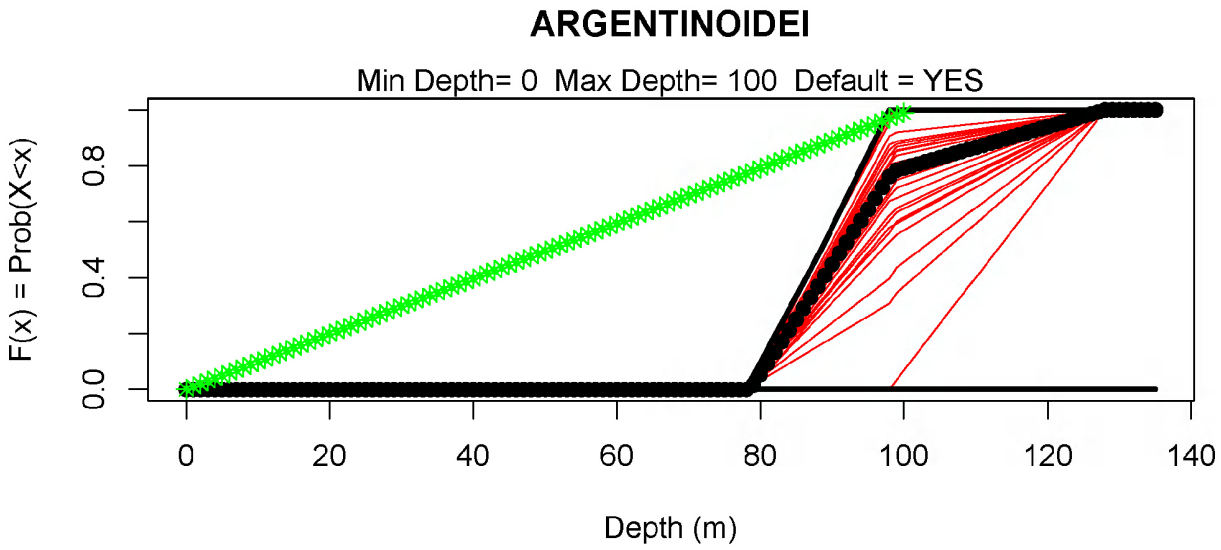

ANGUILLIFORMES
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
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0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

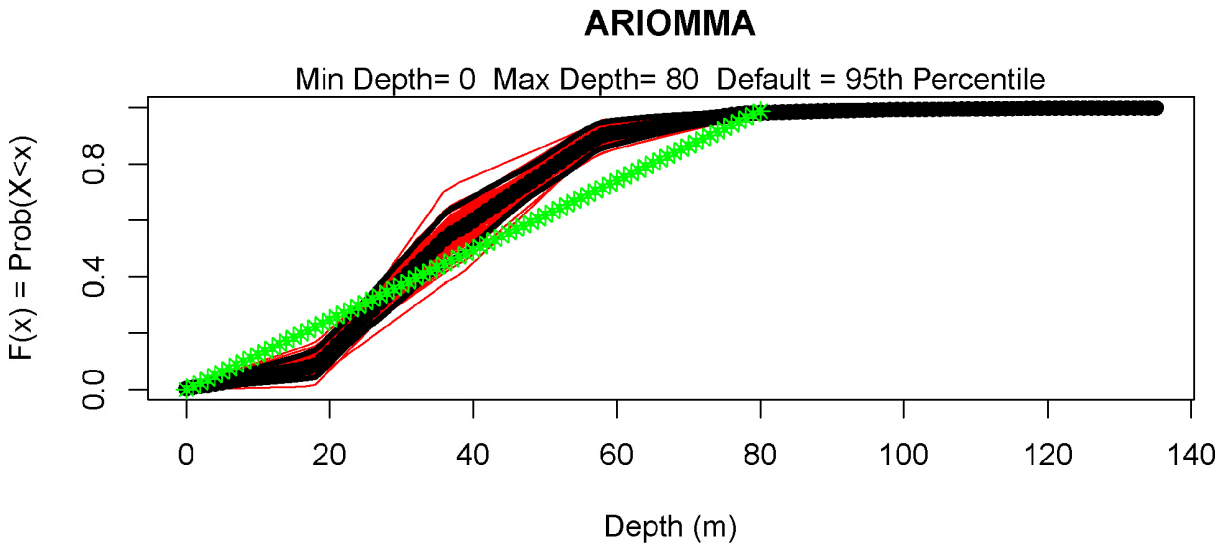

ANTHIINAE
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
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0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

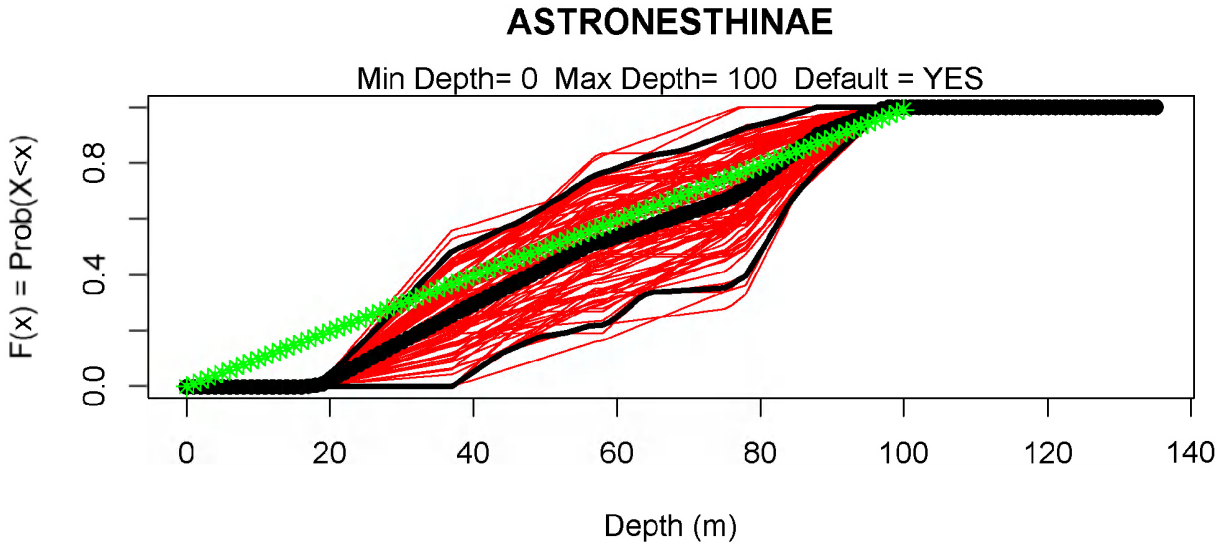

ANTIGONIA
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40
60
80
100
120
140
Depth (m)

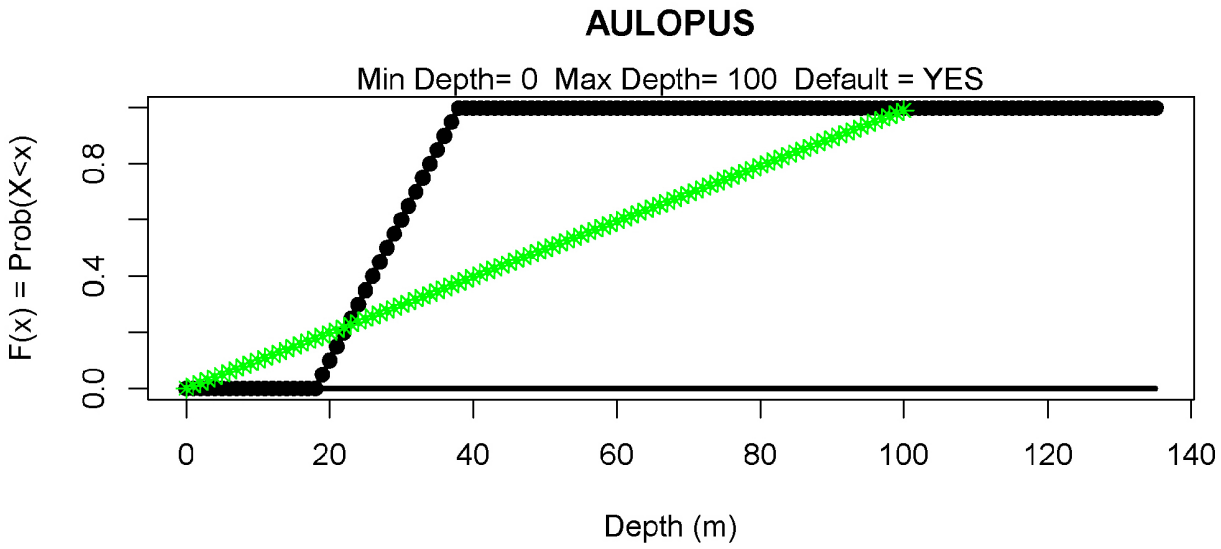

APOGONIDAE
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
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0
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40
60
80
100
120
140
Depth (m)

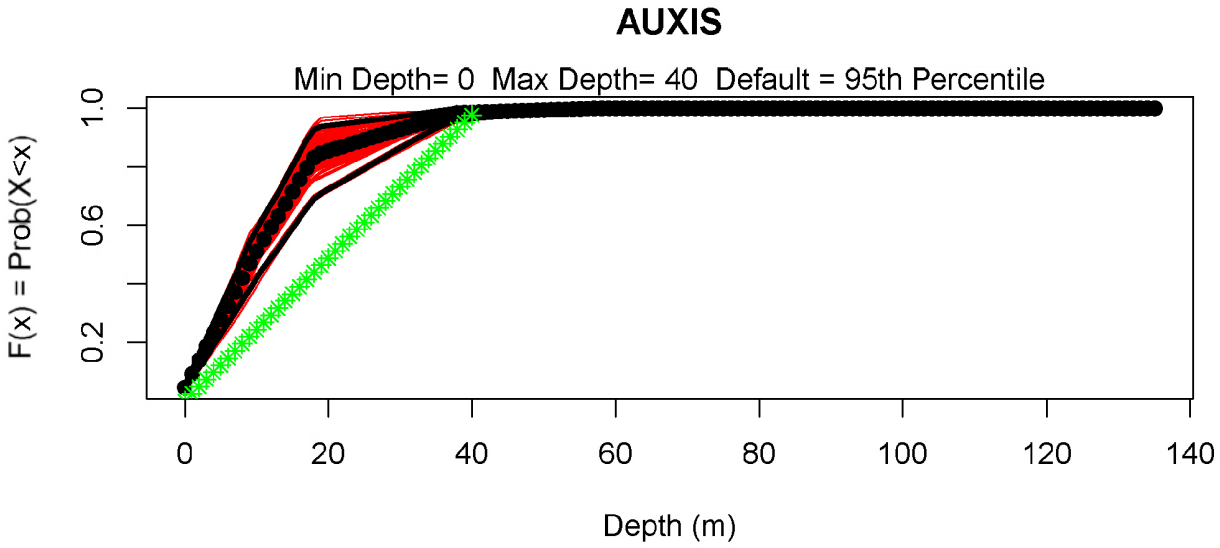

ARGENTINIDAE
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80
100
120
140
Depth (m)

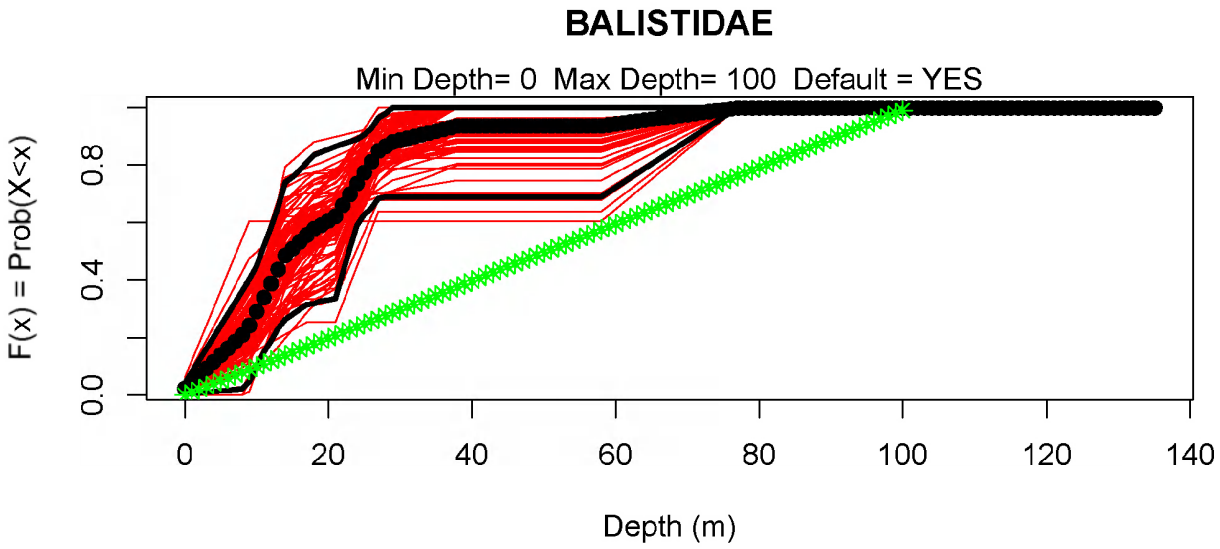

ARGENTINOIDEI
Min Depth= 0 Max Depth= 100 Default = YES
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0.4
0.8
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20
40
60
80
100
120
140
Depth (m)

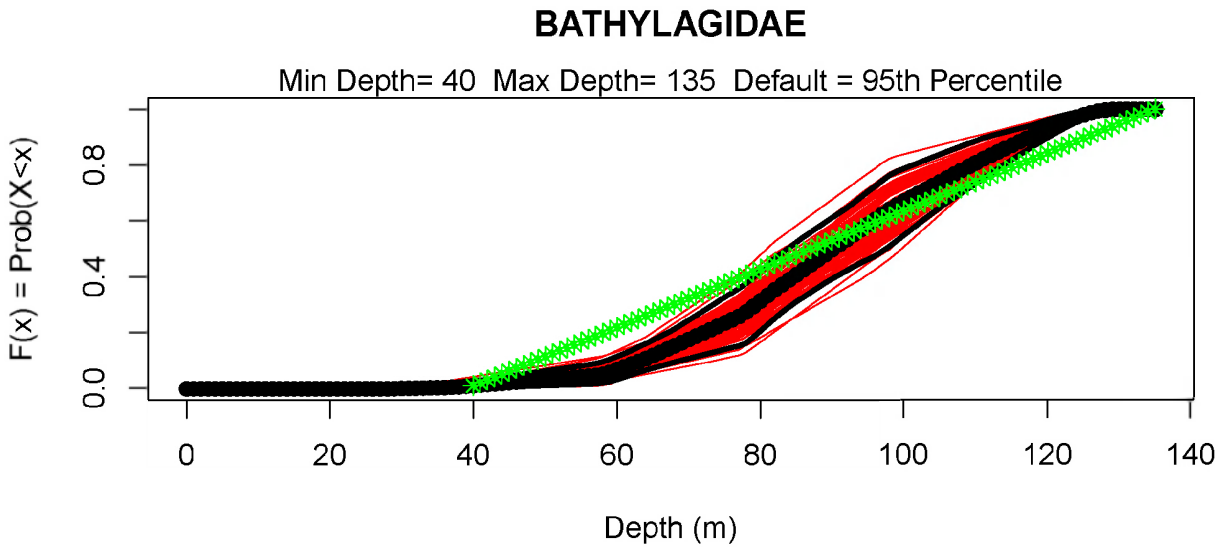

ARIOMMA
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0.8
0
20
40
60
80
100
120
140
Depth (m)

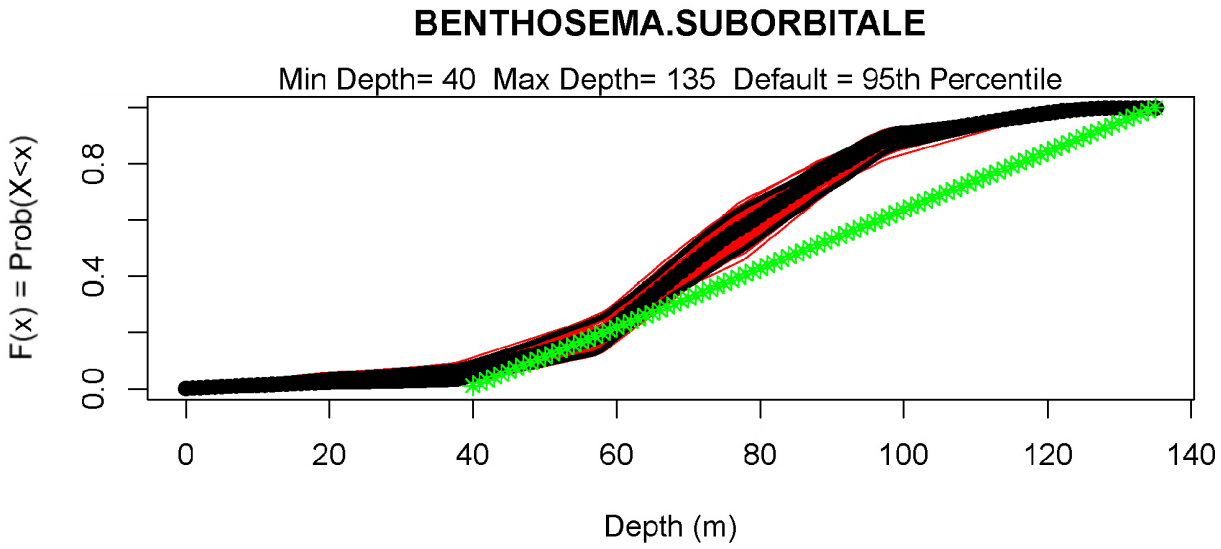

ASTRONESTHINAE
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0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

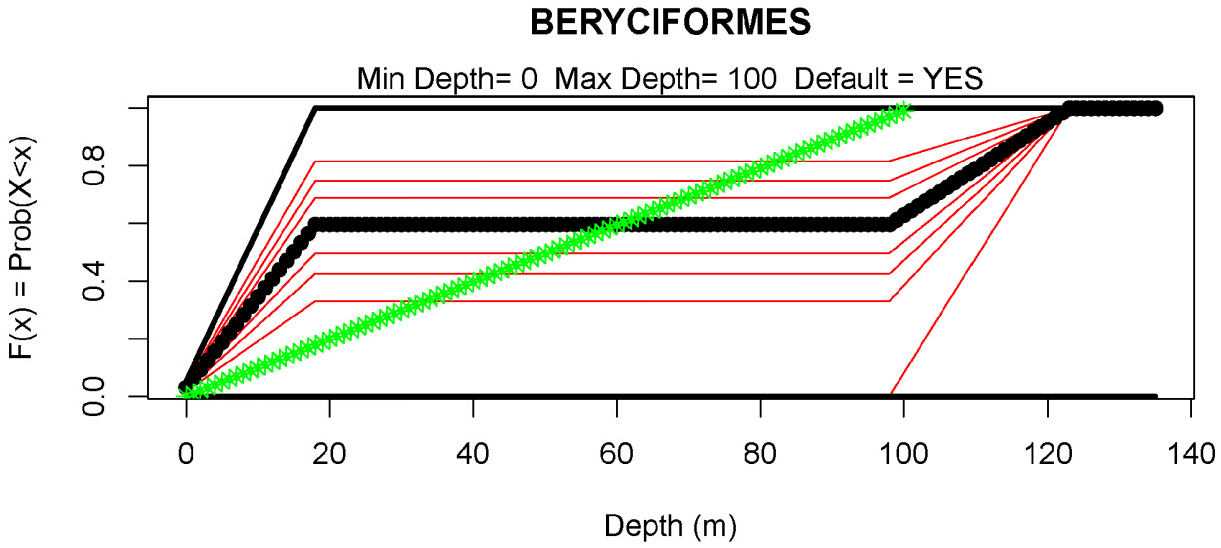

AULOPUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
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0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

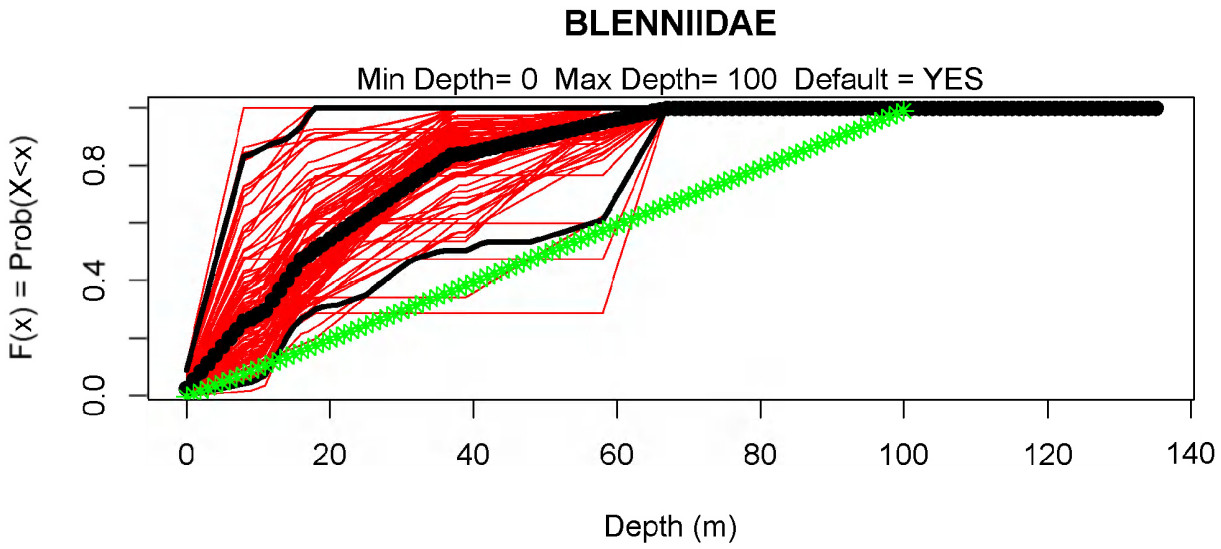

AUXIS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

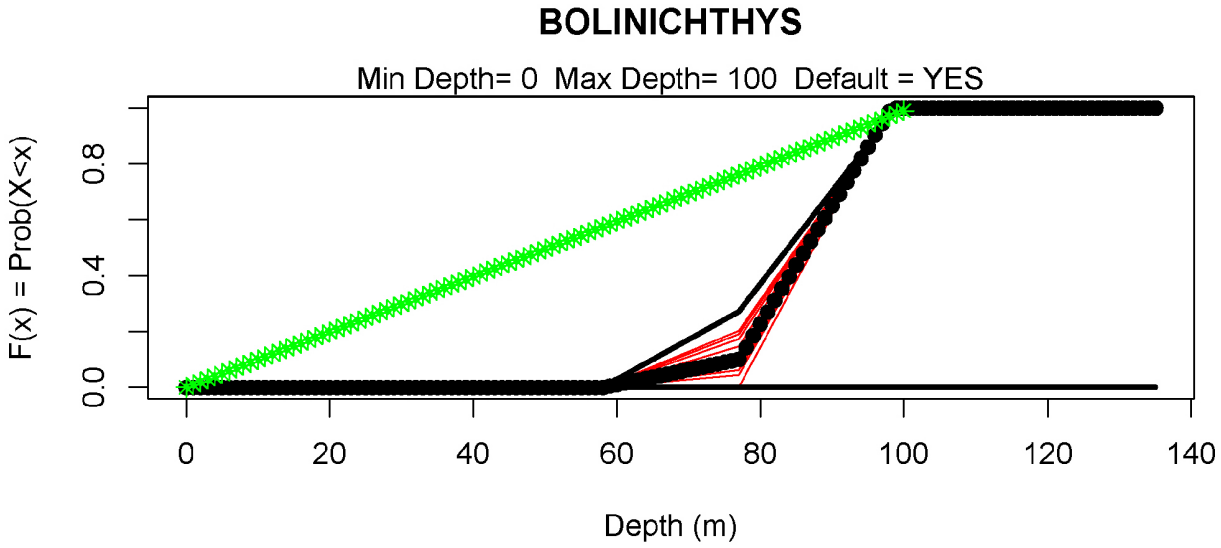

BALISTIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

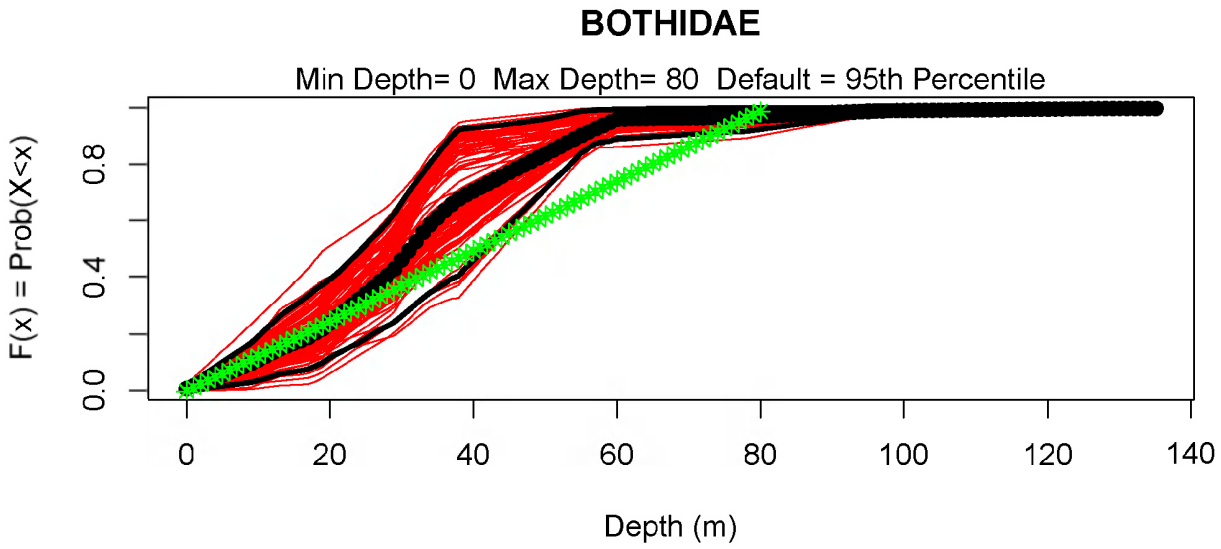

BATHYLAGIDAE
Min Depth= 40 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

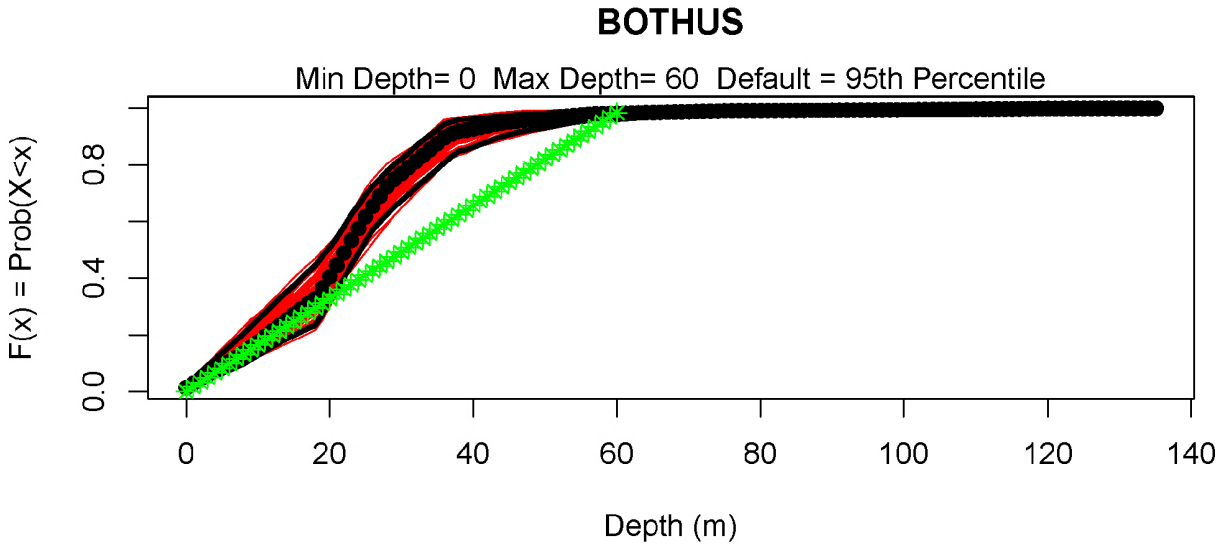

BENTHOSEMA.SUBORBITALE
Min Depth= 40 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

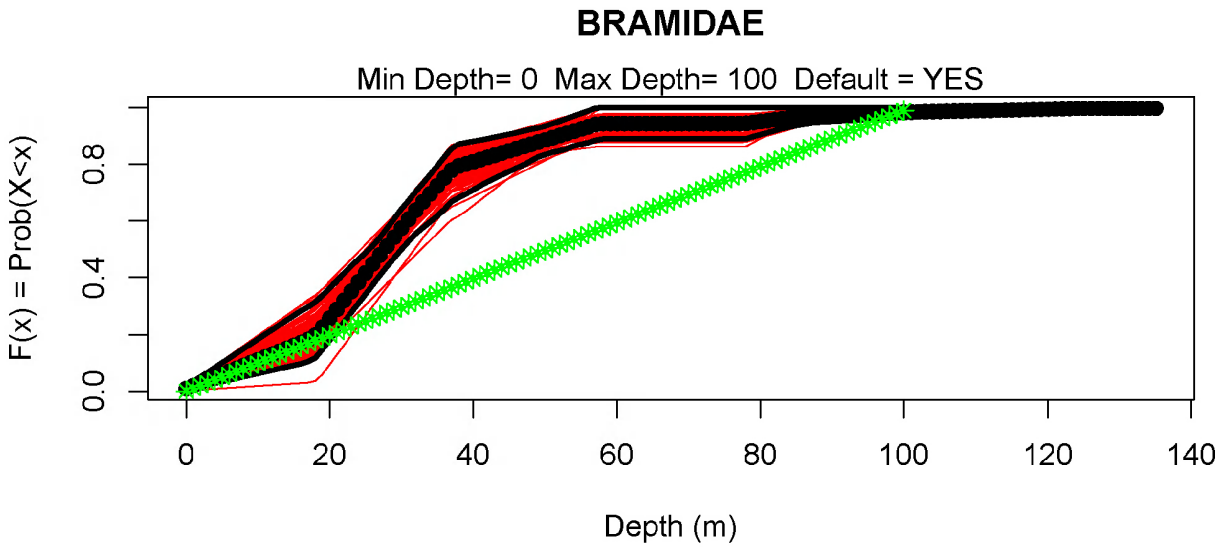

BERYCIFORMES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

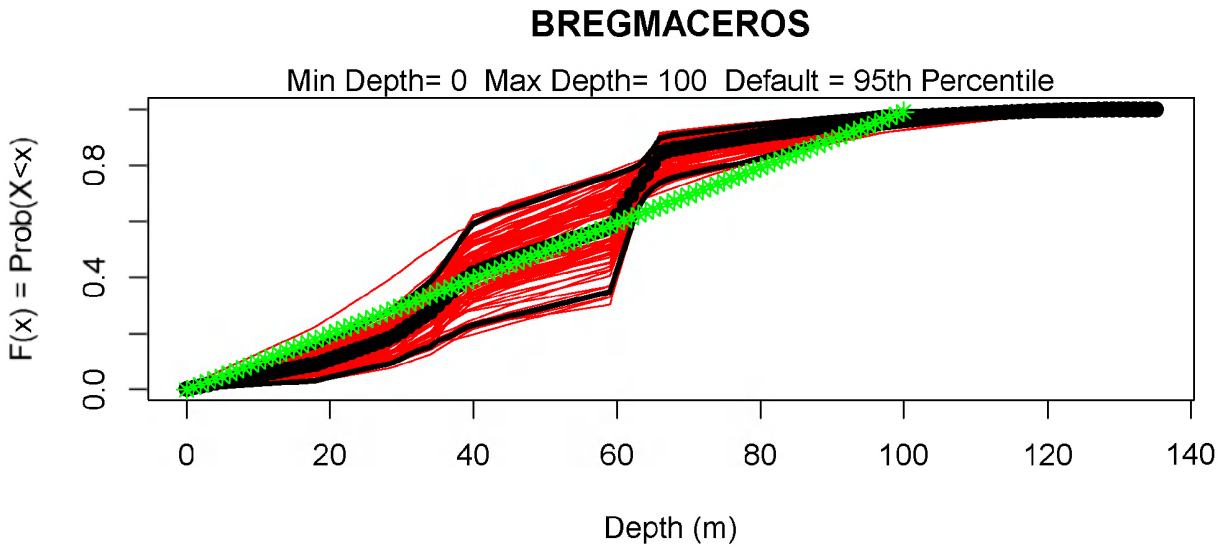

BLENNIIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

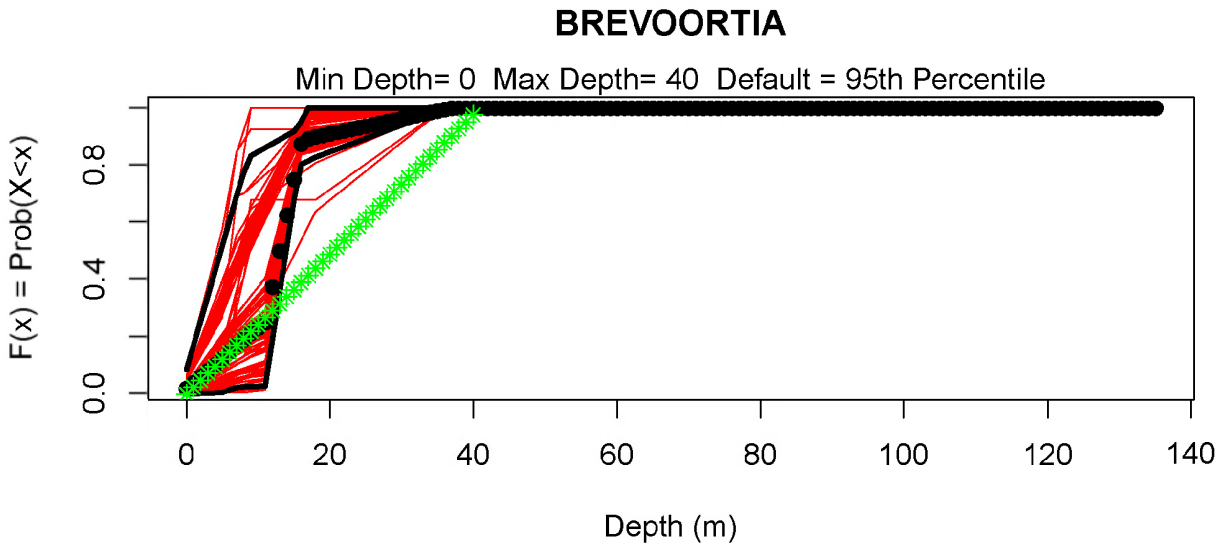

BOLINICHTHYS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

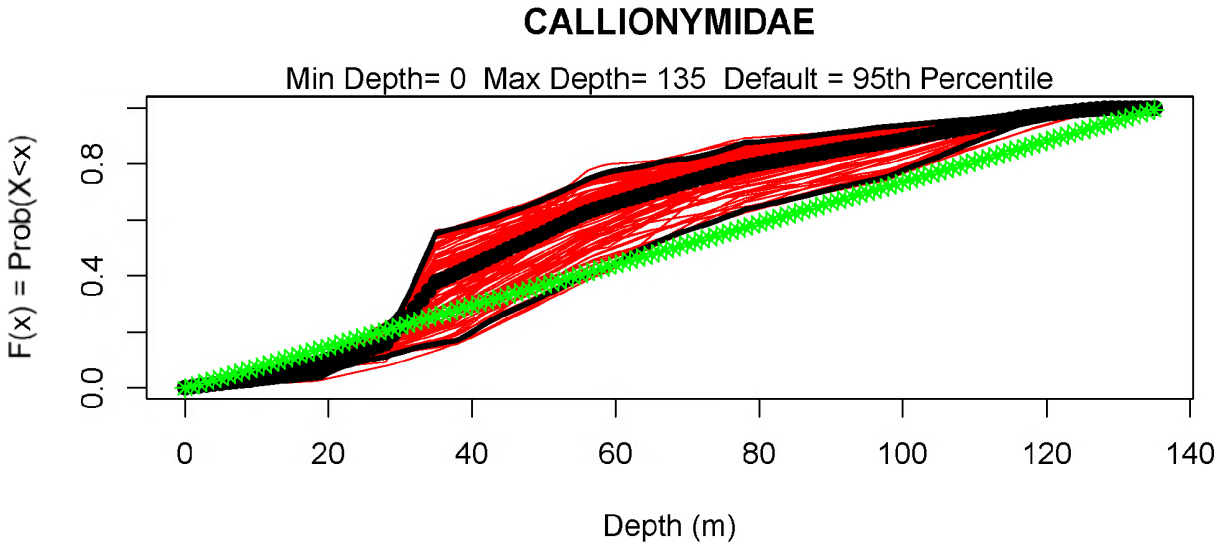

BOTHIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

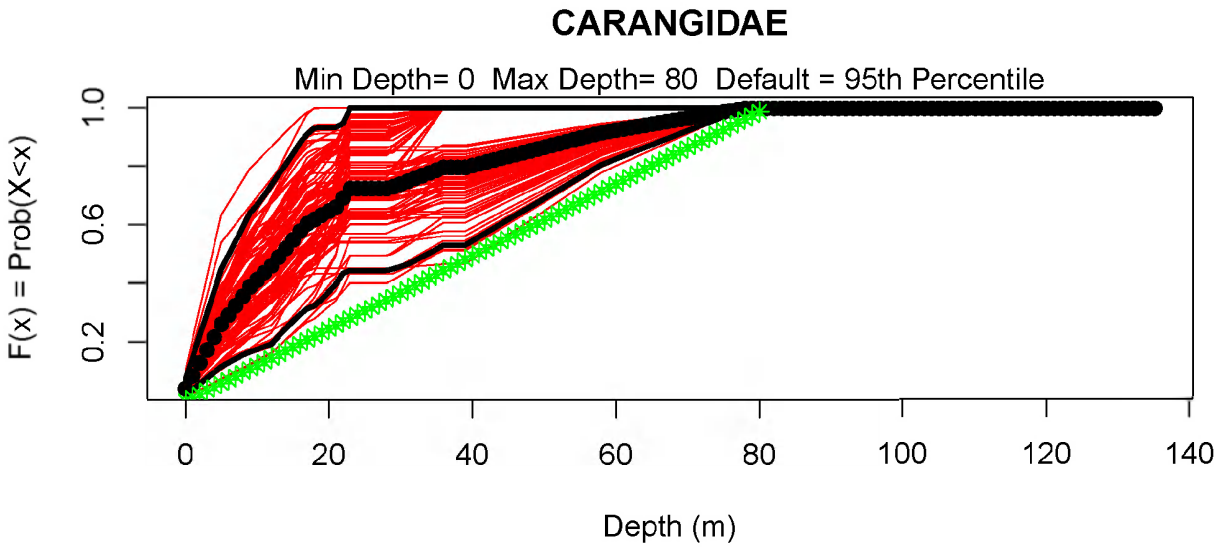

BOTHUS
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

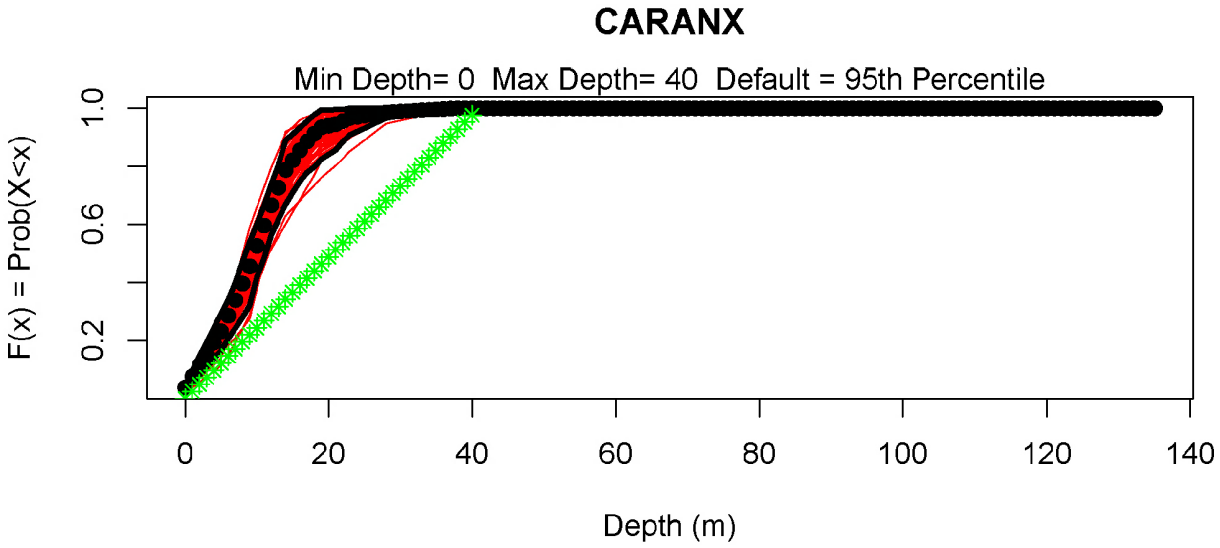

BRAMIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

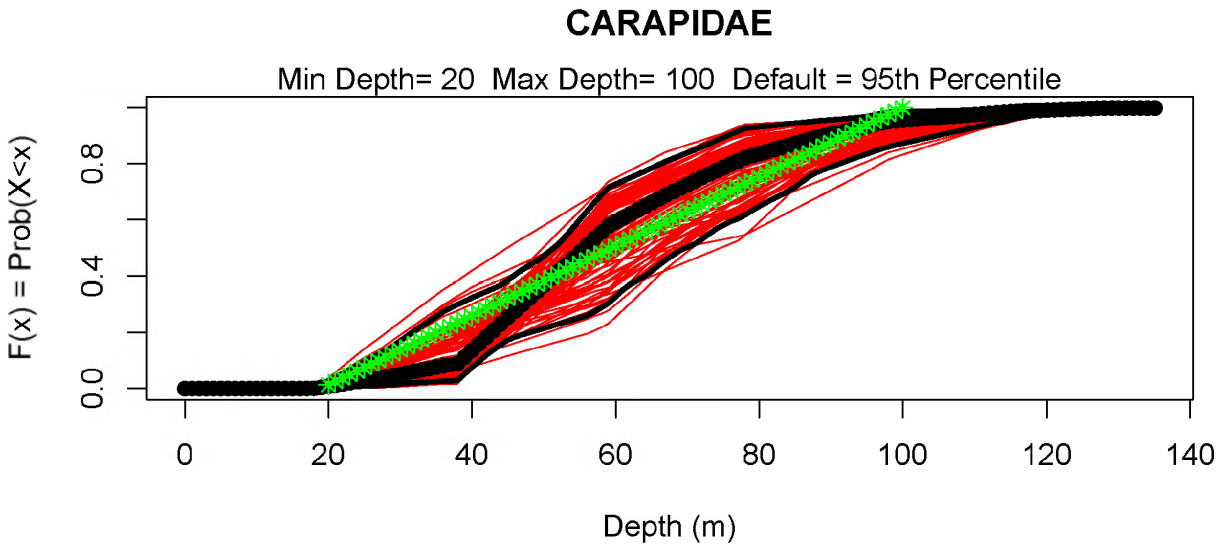

BREGMACEROS
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

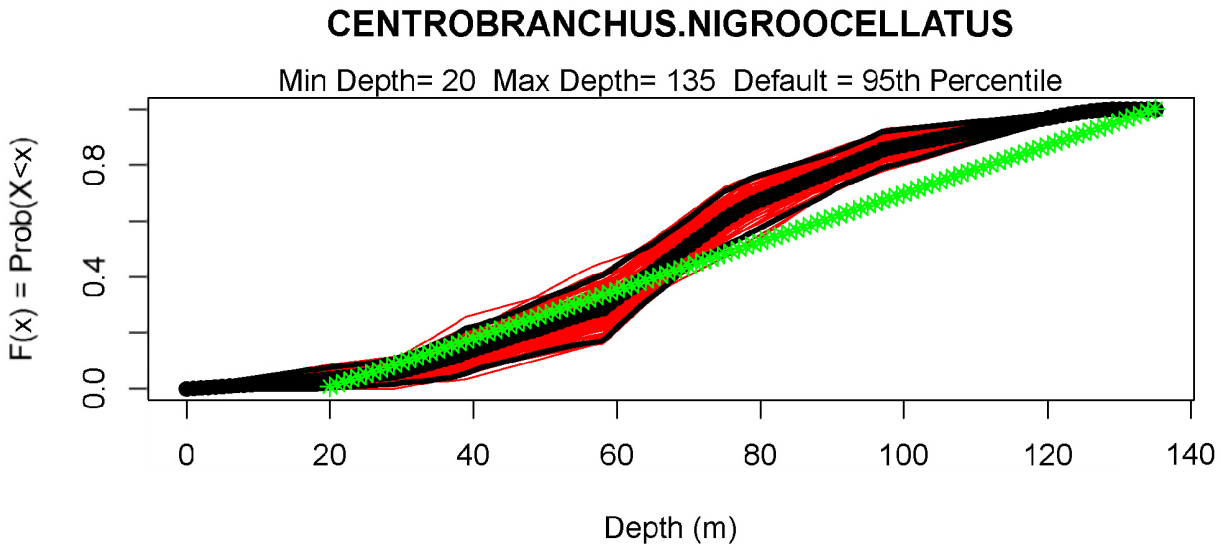

BREVOORTIA
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

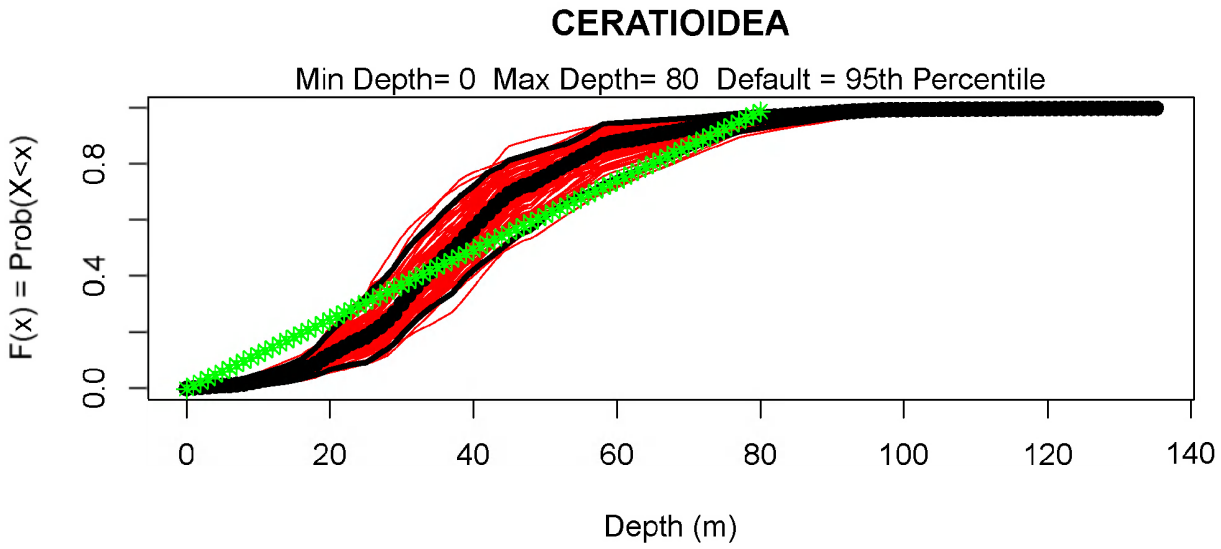

CALLIONYMIDAE
Min Depth= 0 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

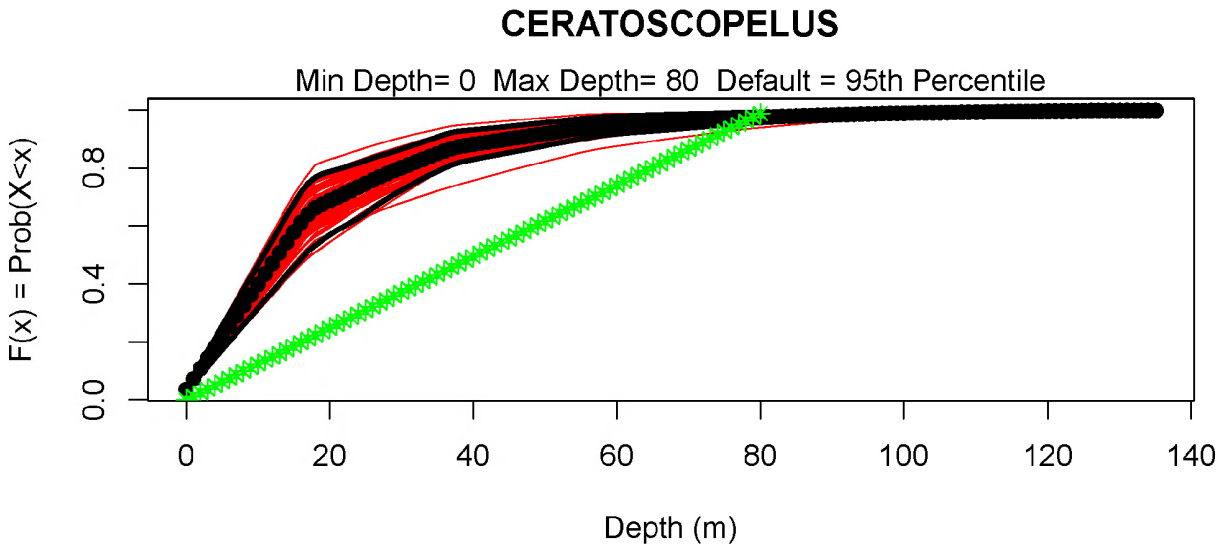

CARANGIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

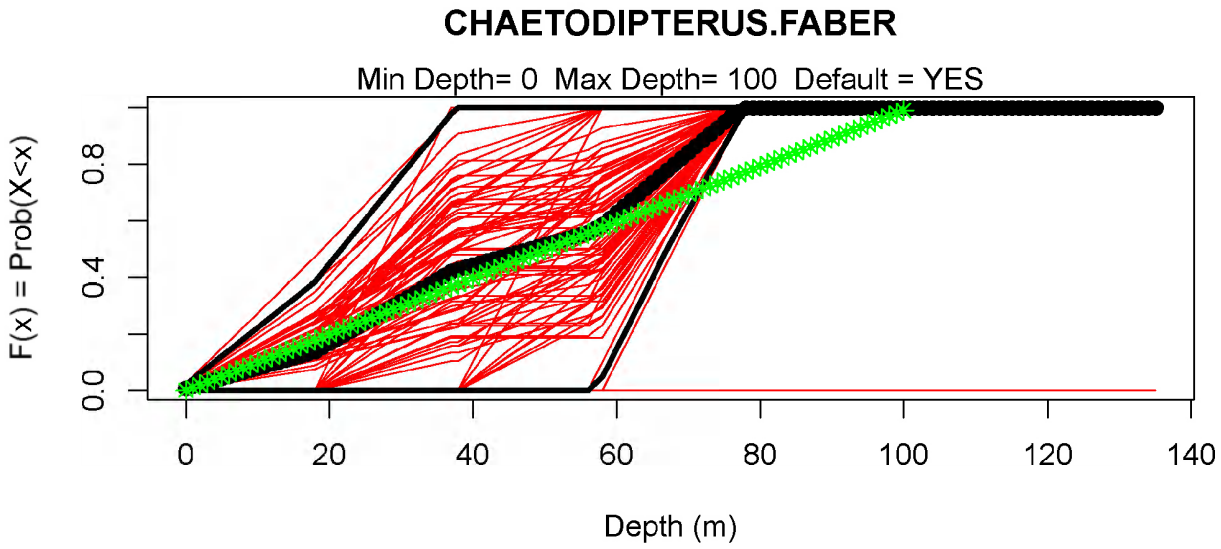

CARANX
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

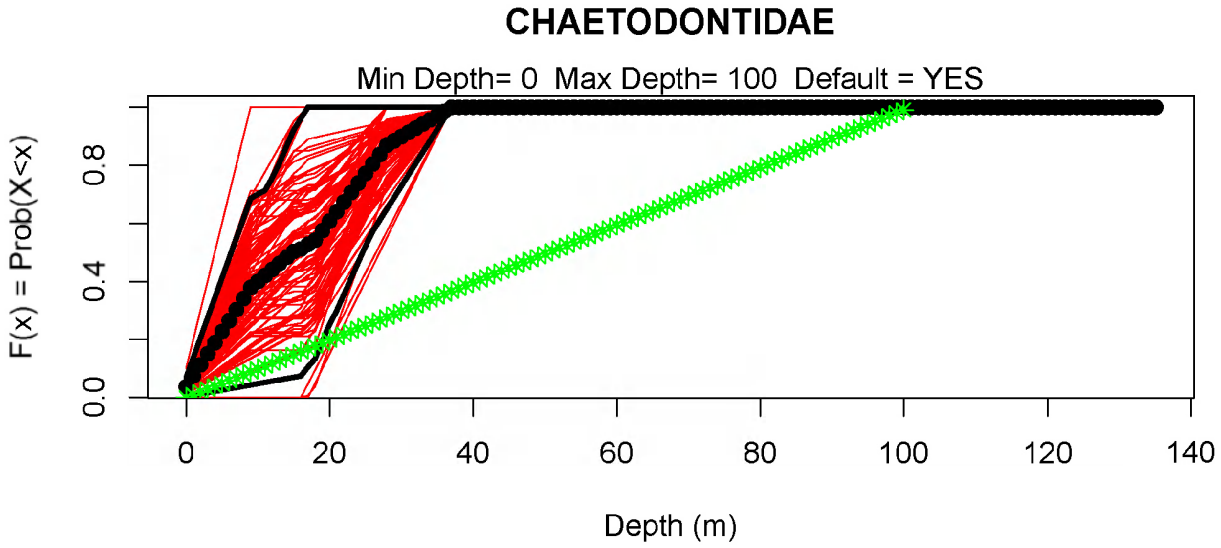

CARAPIDAE
Min Depth= 20 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

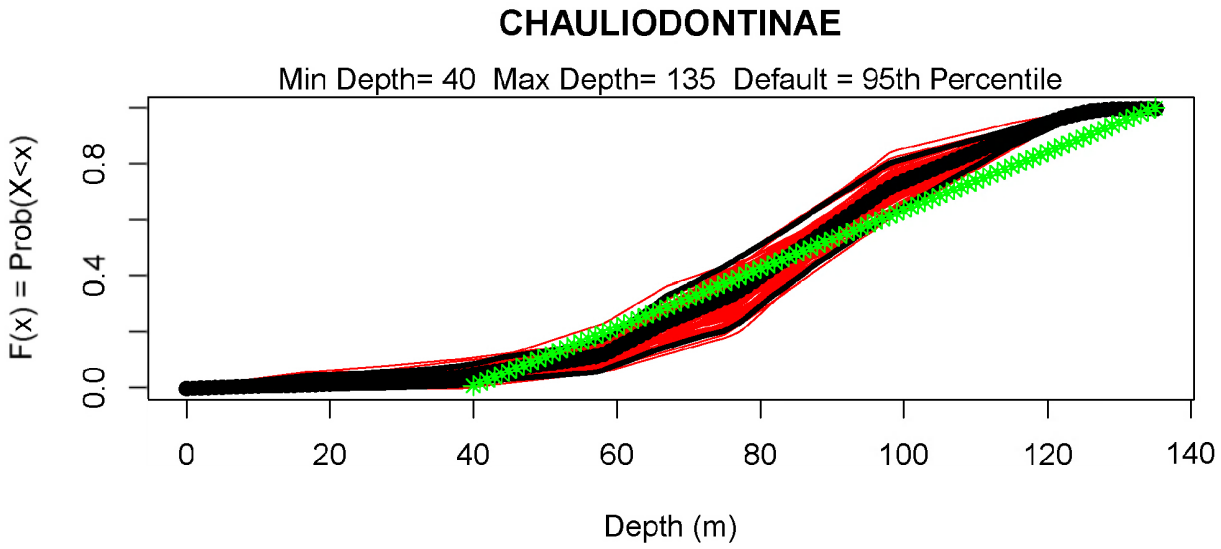

CENTROBRANCHUS.NIGROOCELLATUS
Min Depth= 20 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

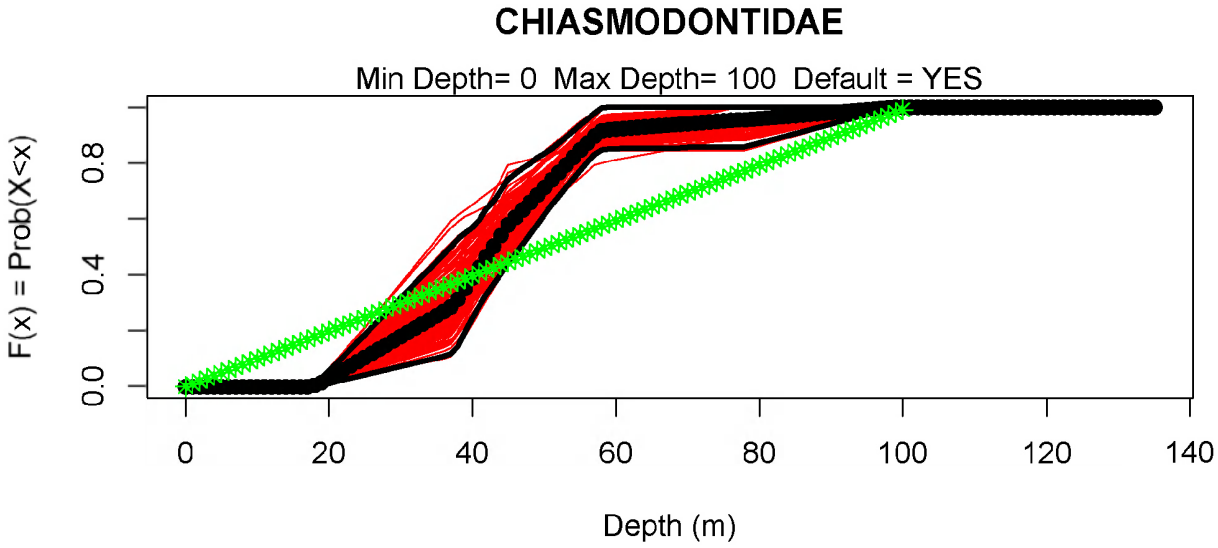

CERATIOIDEA
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

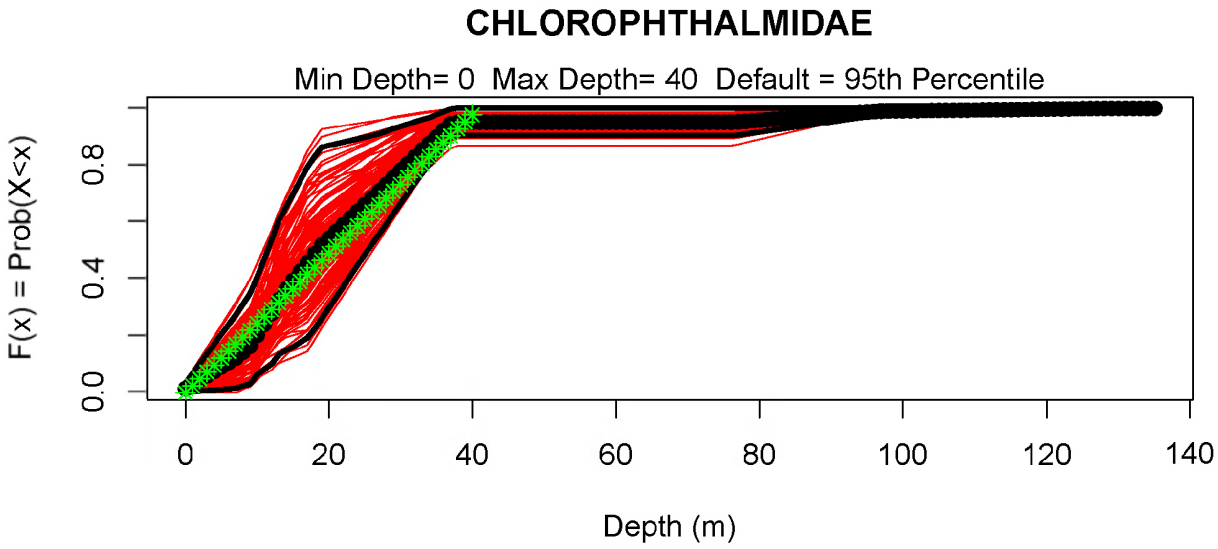

CERATOSCOPELUS
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

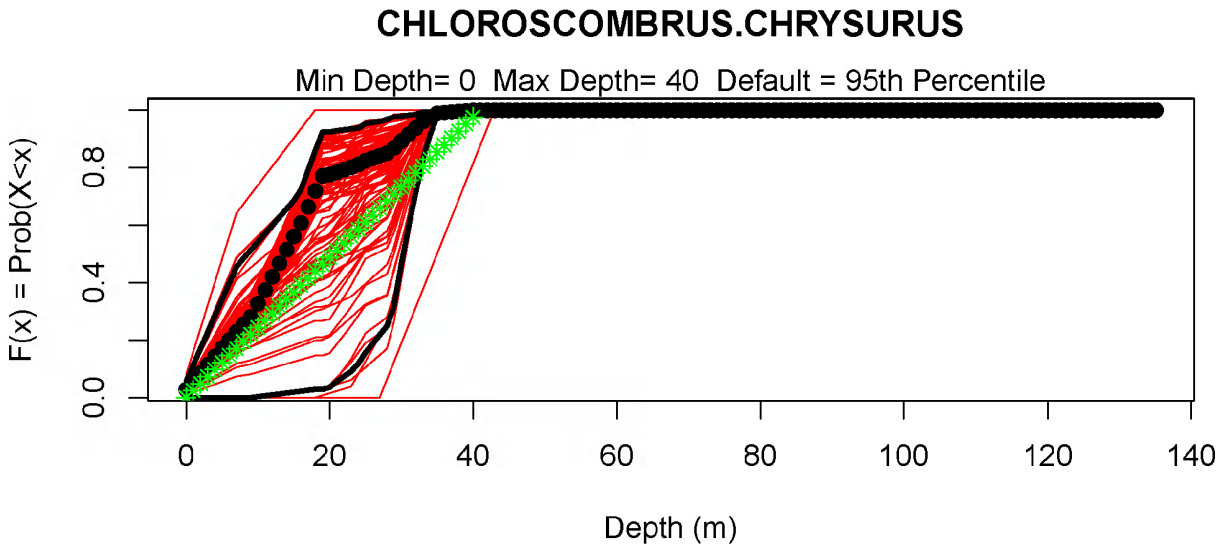

CHAETODIPTERUS.FABER
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

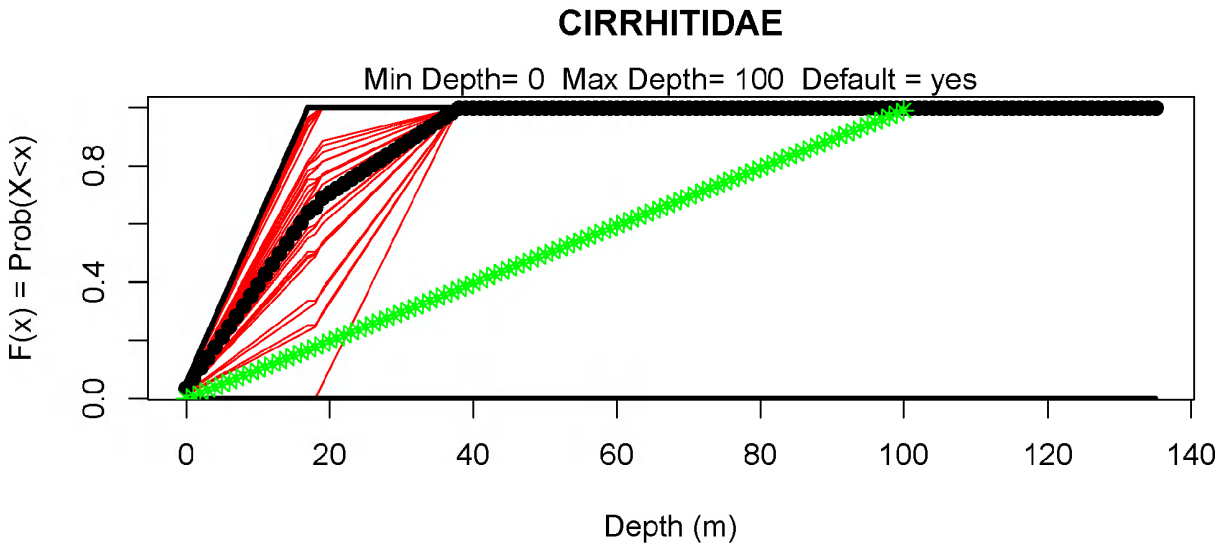

CHAETODONTIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

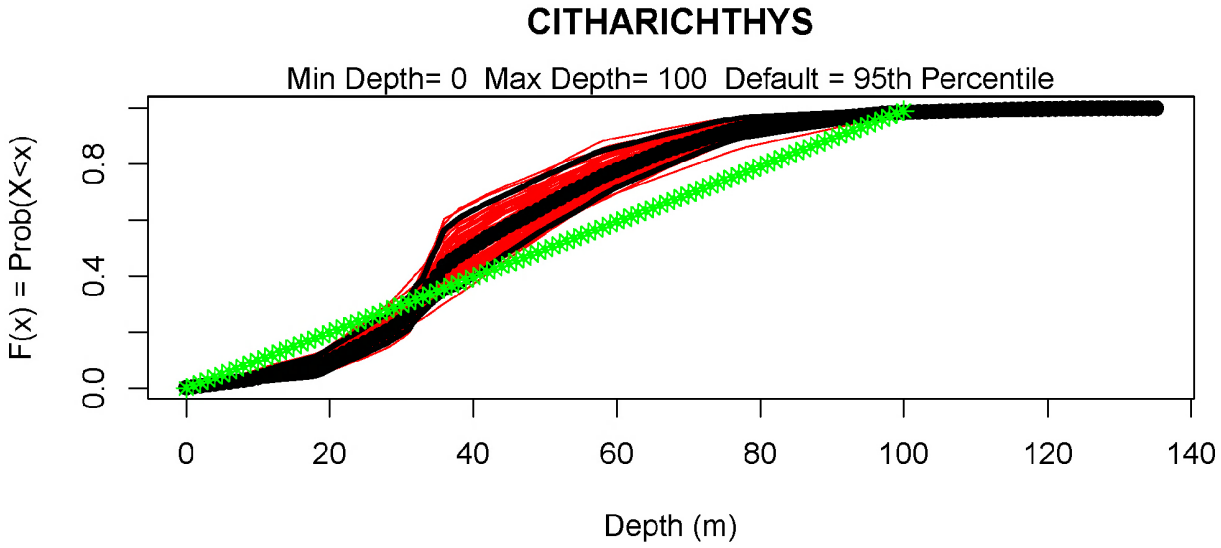

CHAULIODONTINAE
Min Depth= 40 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

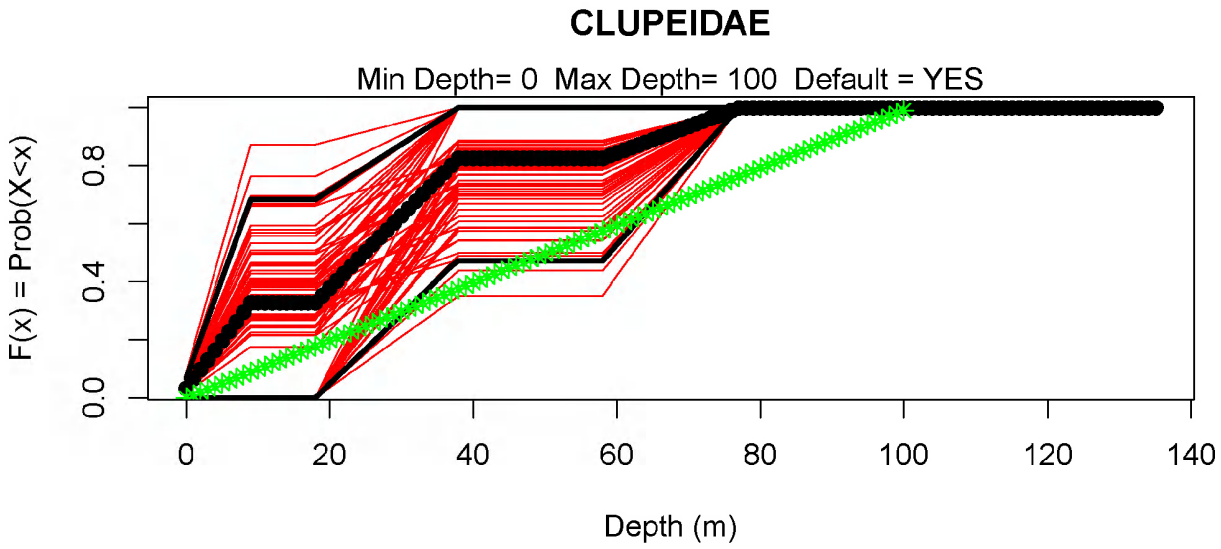

CHIASMODONTIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

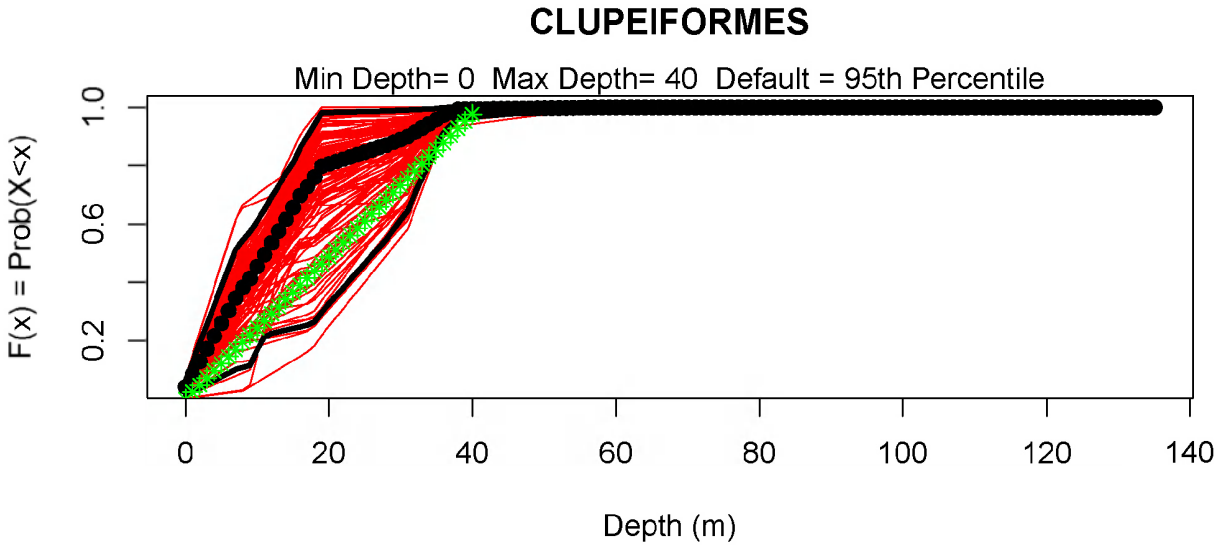

CHLOROPHTHALMIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

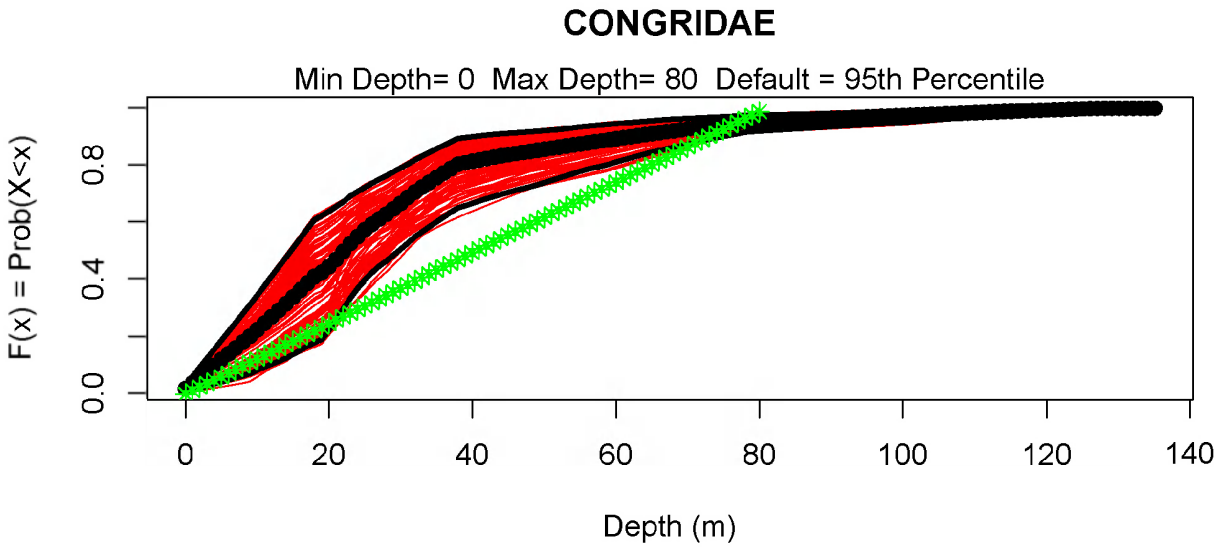

CHLOROSCOMBRUS.CHRYSURUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

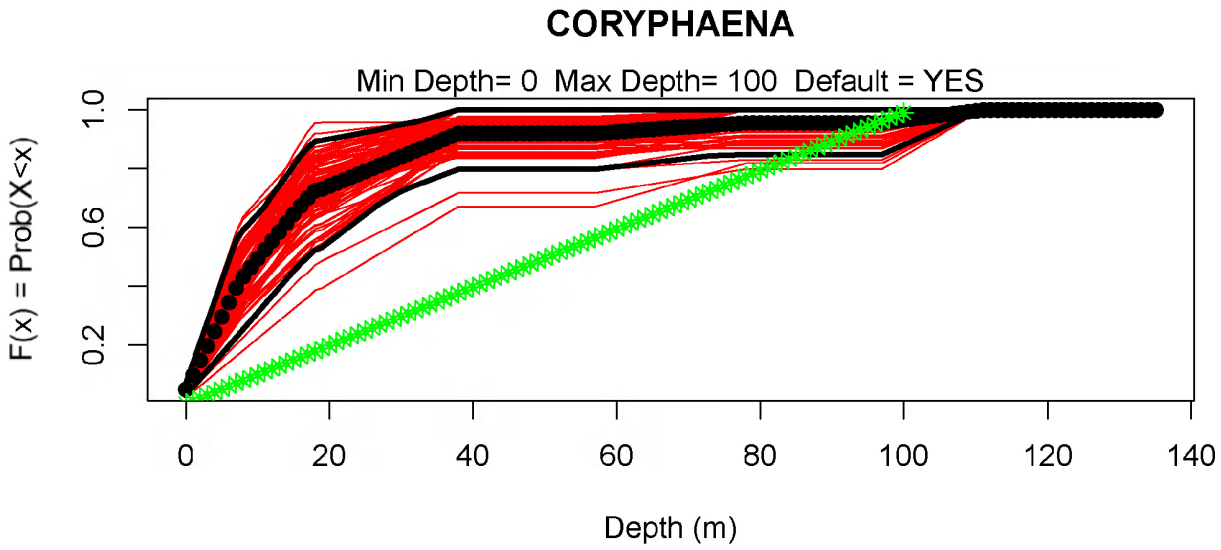

CIRRHITIDAE
Min Depth= 0 Max Depth= 100 Default = yes
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

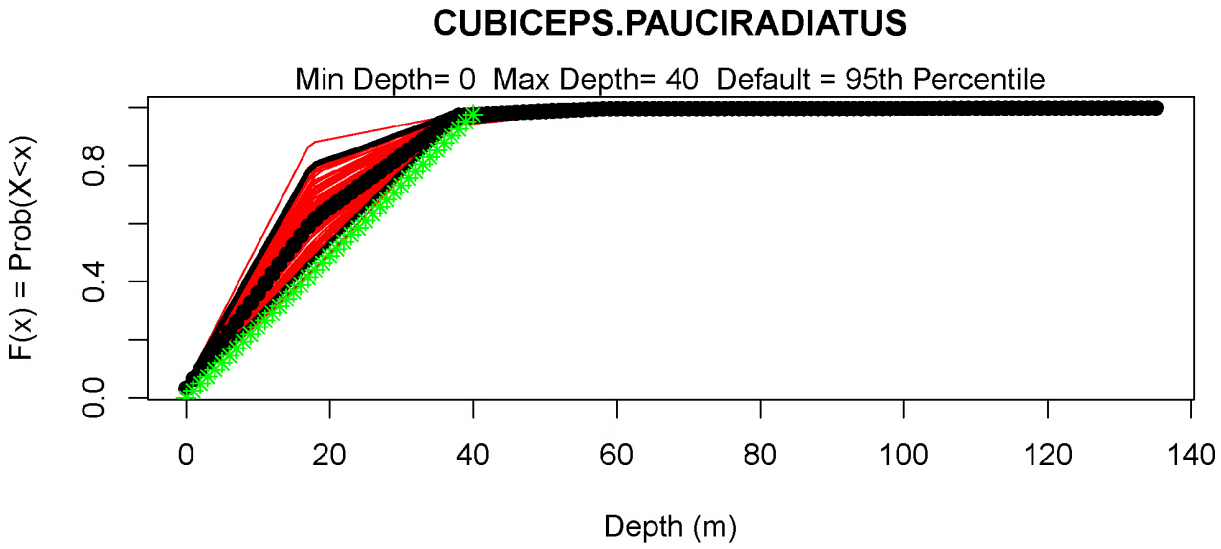

CITHARICHTHYS
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

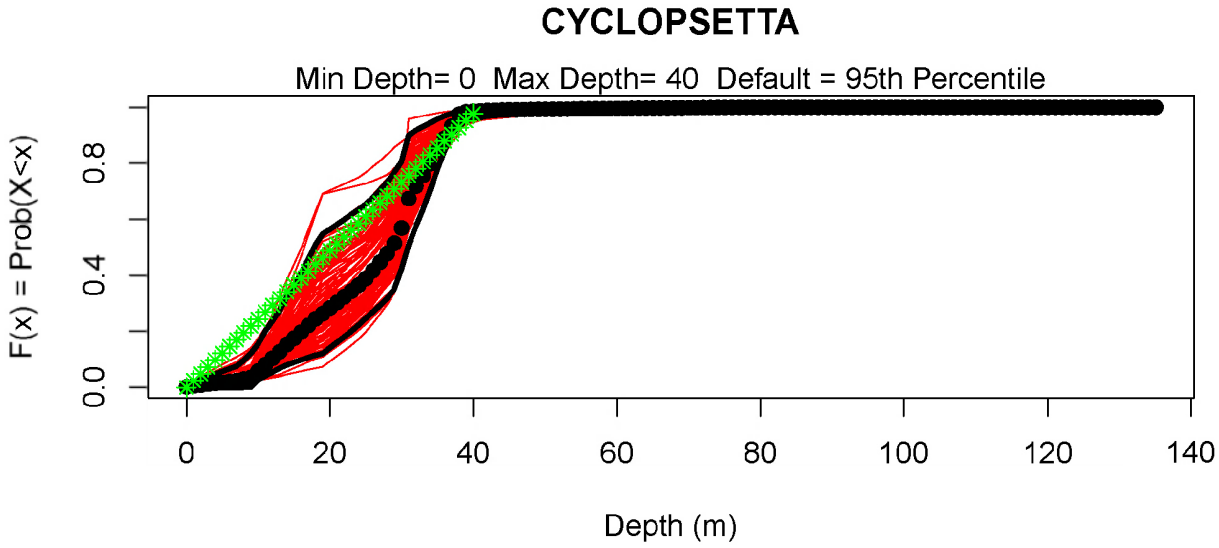

CLUPEIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

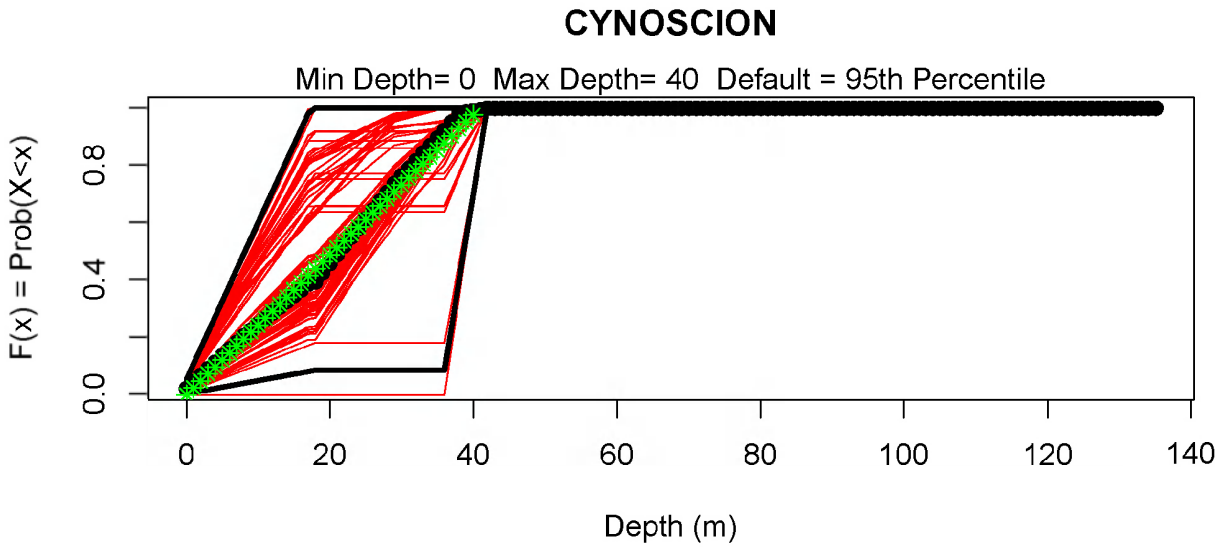

CLUPEIFORMES
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

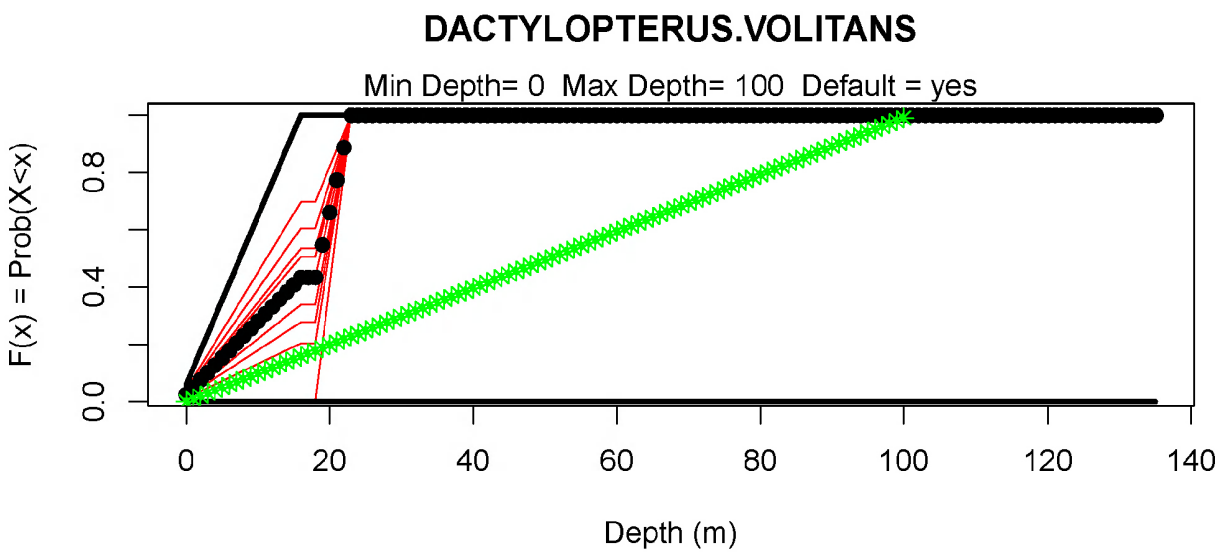

CONGRIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

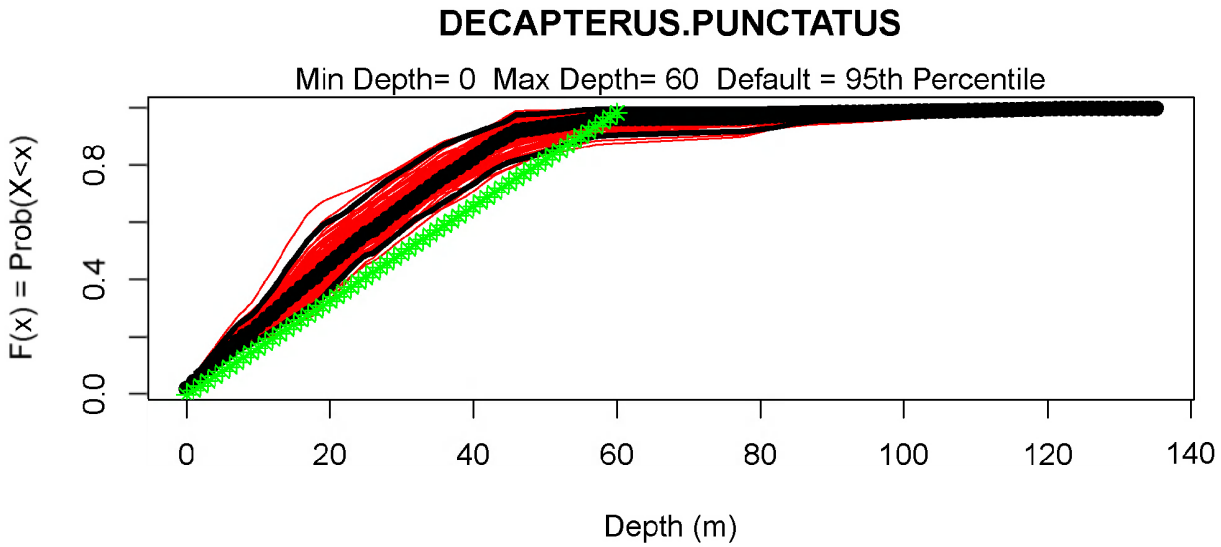

CORYPHAENA
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

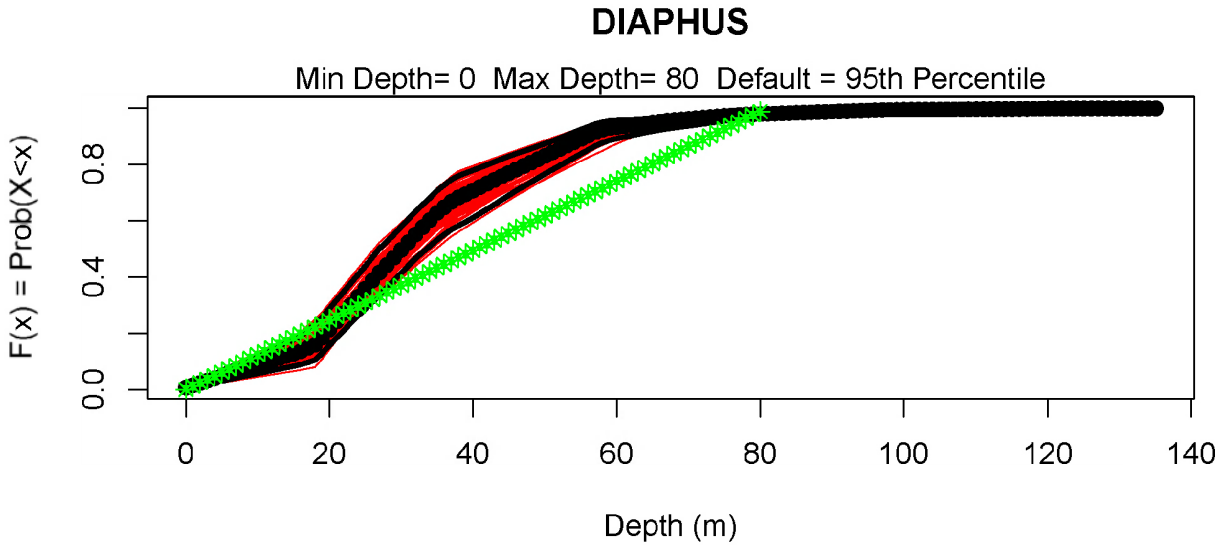

CUBICEPS.PAUCIRADIATUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

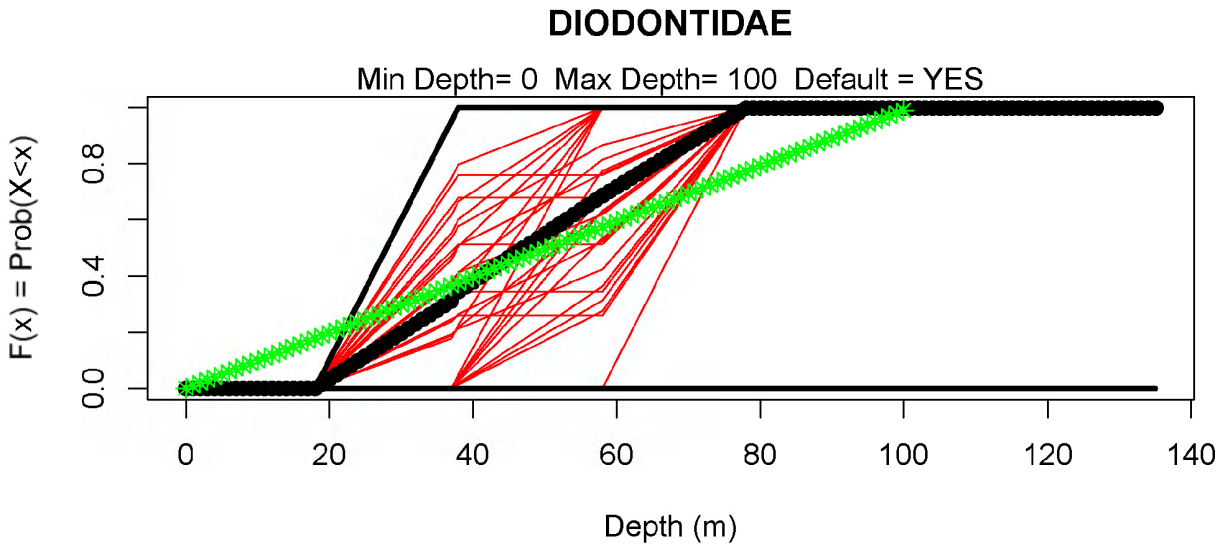

CYCLOPSETTA
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

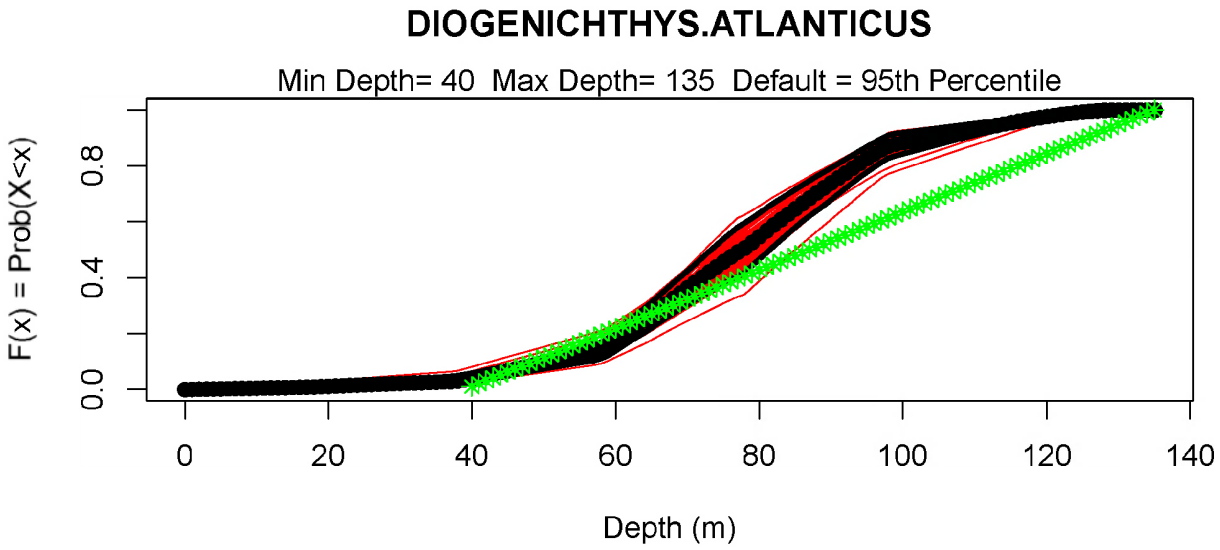

CYNOSCION
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

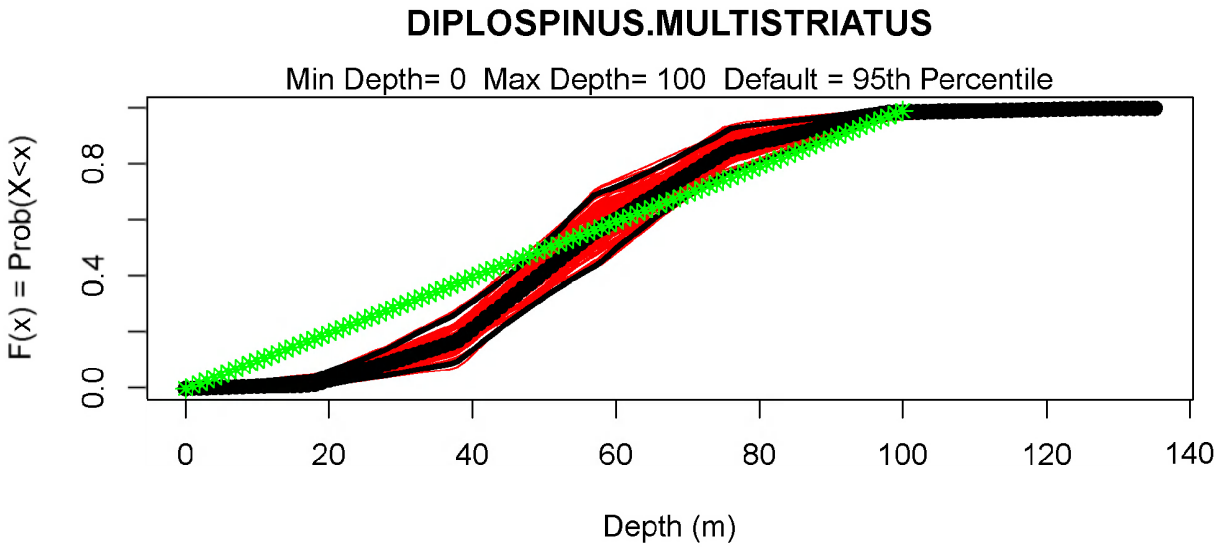

DACTYLOPTERUS.VOLITANS
Min Depth= 0 Max Depth= 100 Default = yes
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

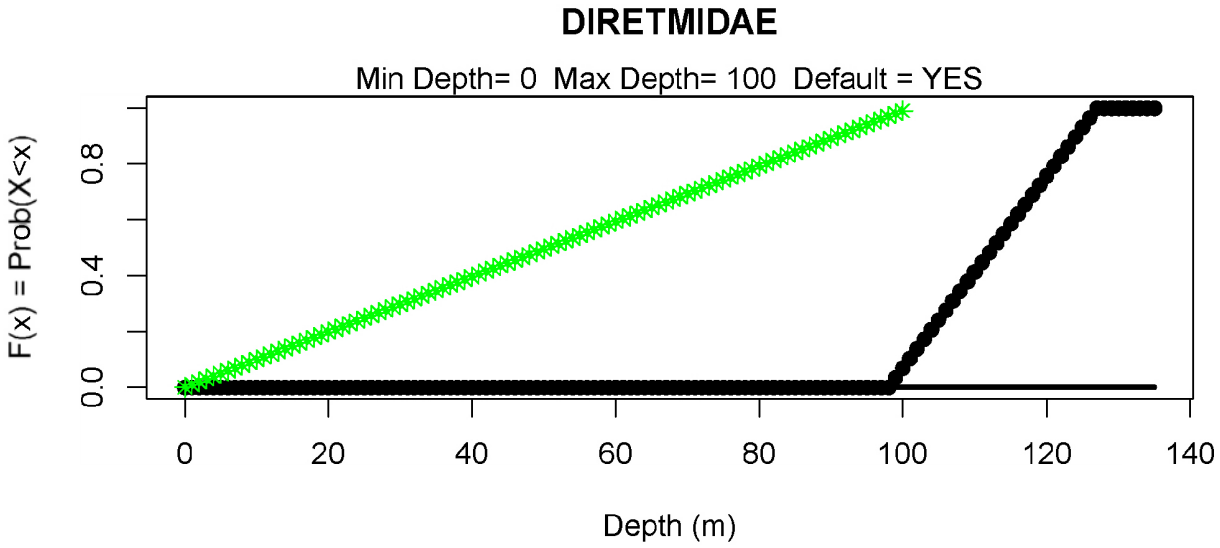

DECAPTERUS.PUNCTATUS
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

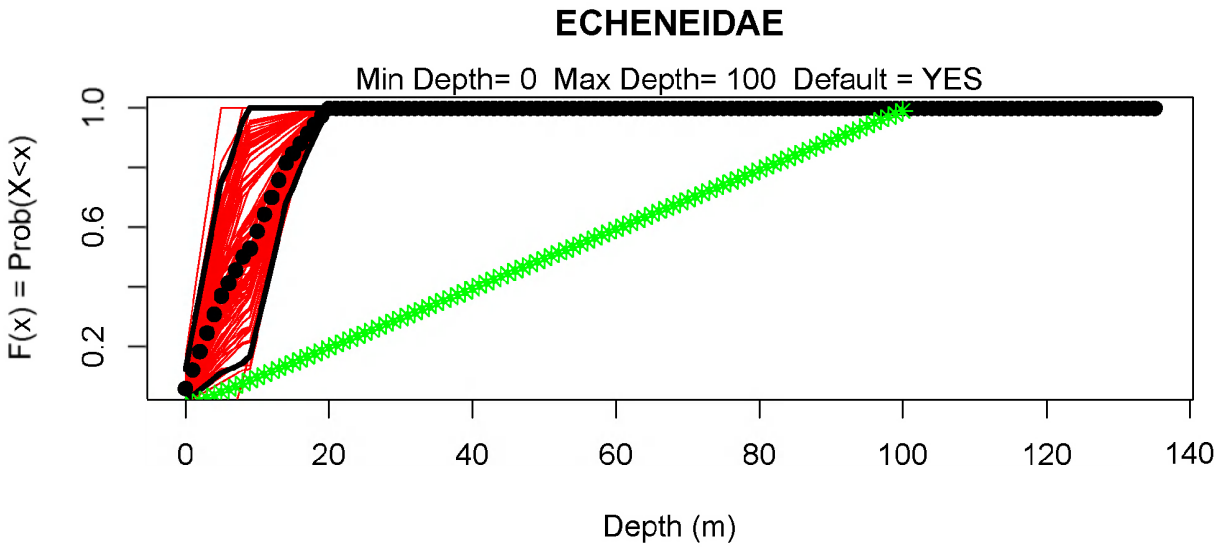

DIAPHUS
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

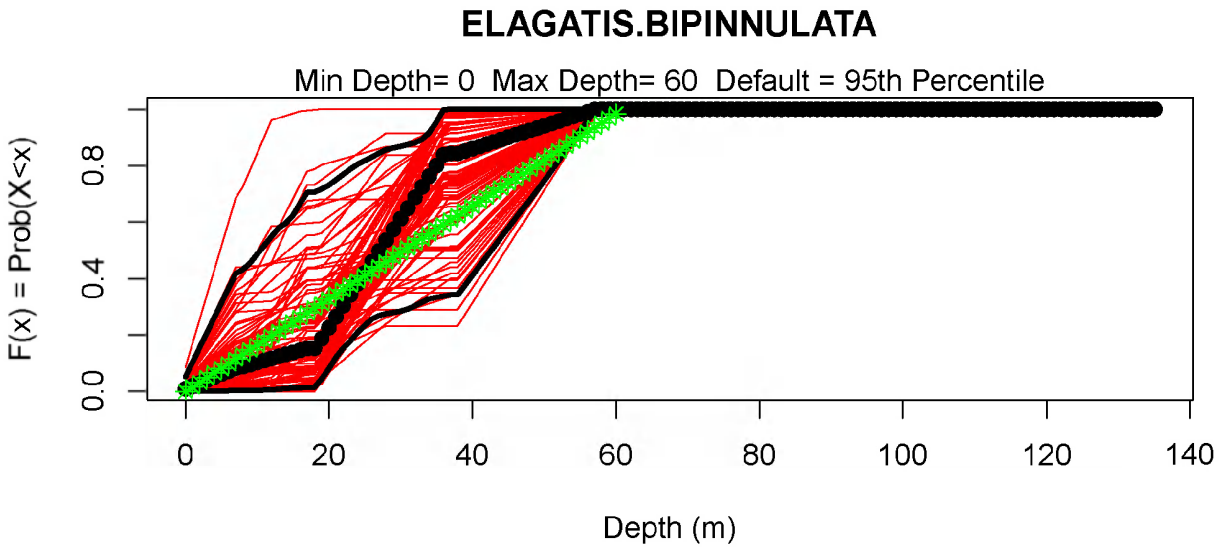

DIODONTIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

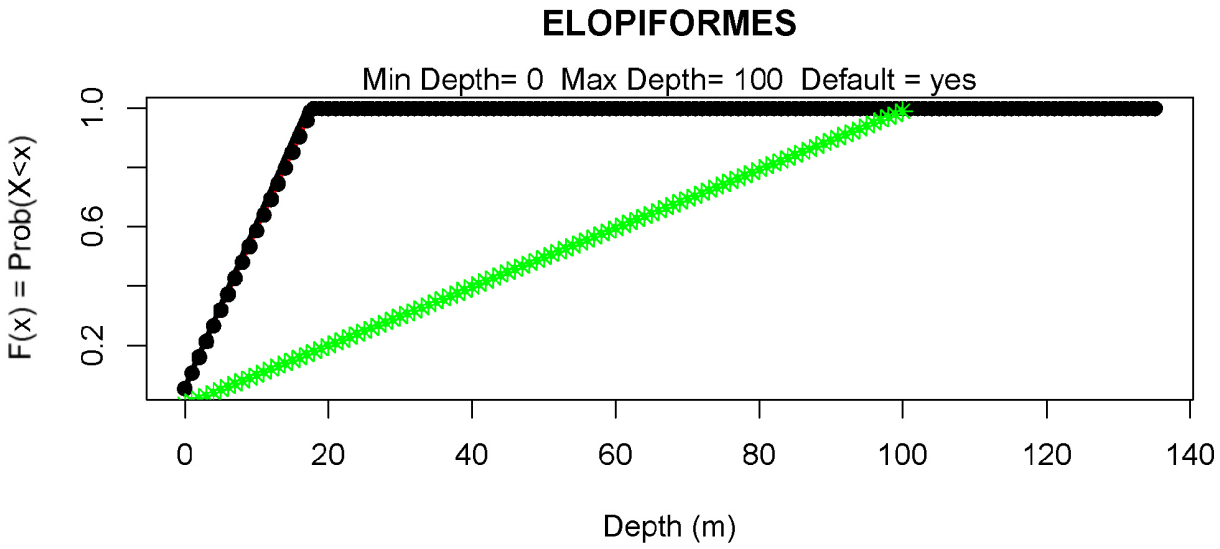

DIOGENICHTHYS.ATLANTICUS
Min Depth= 40 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

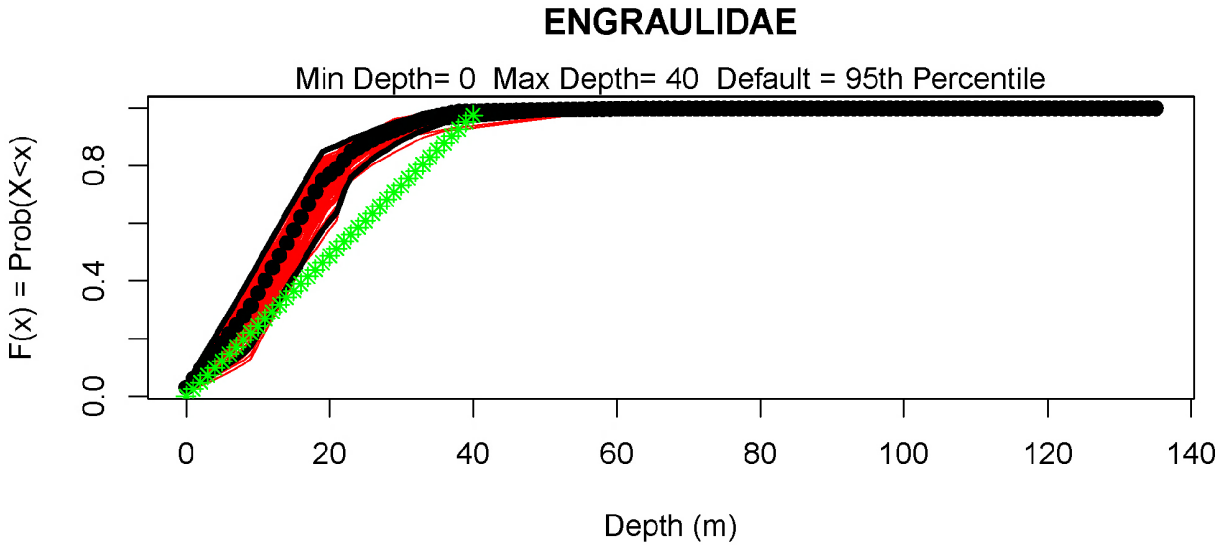

DIPLOSPINUS.MULTISTRIATUS
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

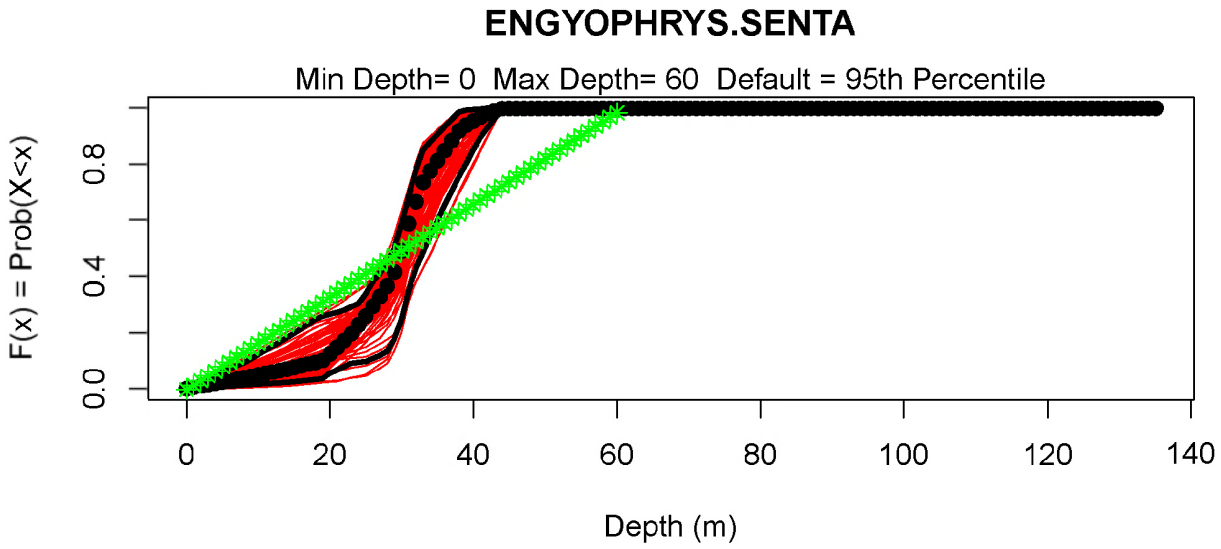

DIRETMIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

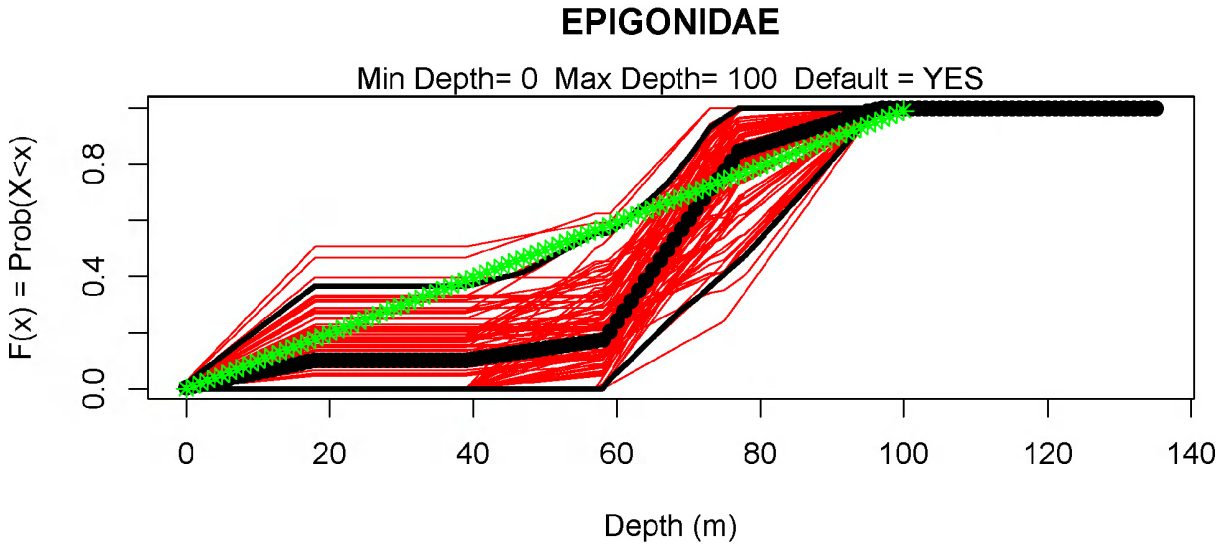

ECHENEIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

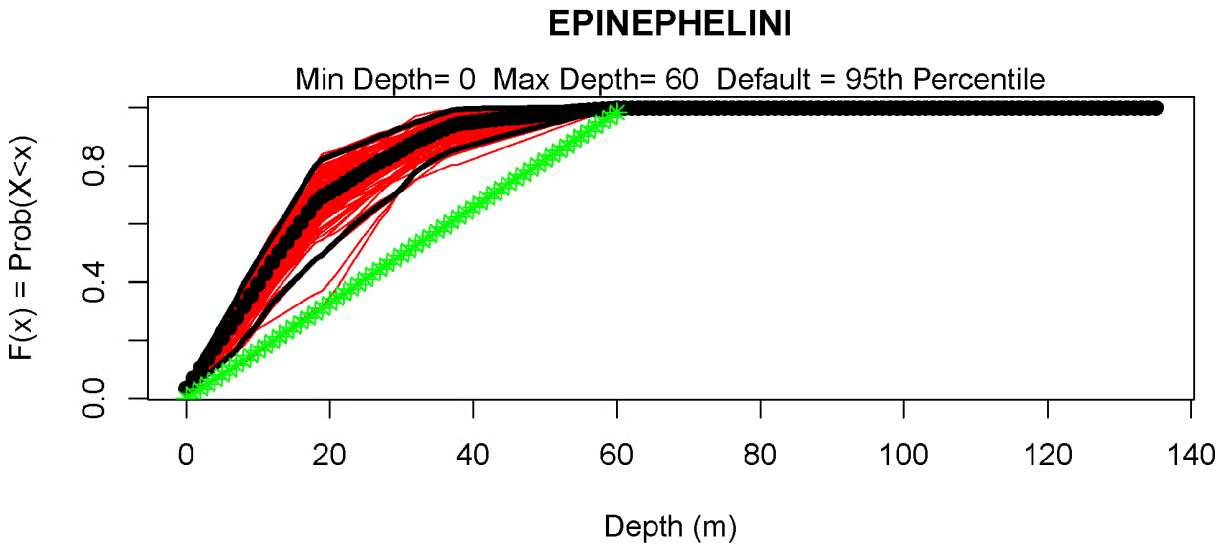

ELAGATIS.BIPINNULATA
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

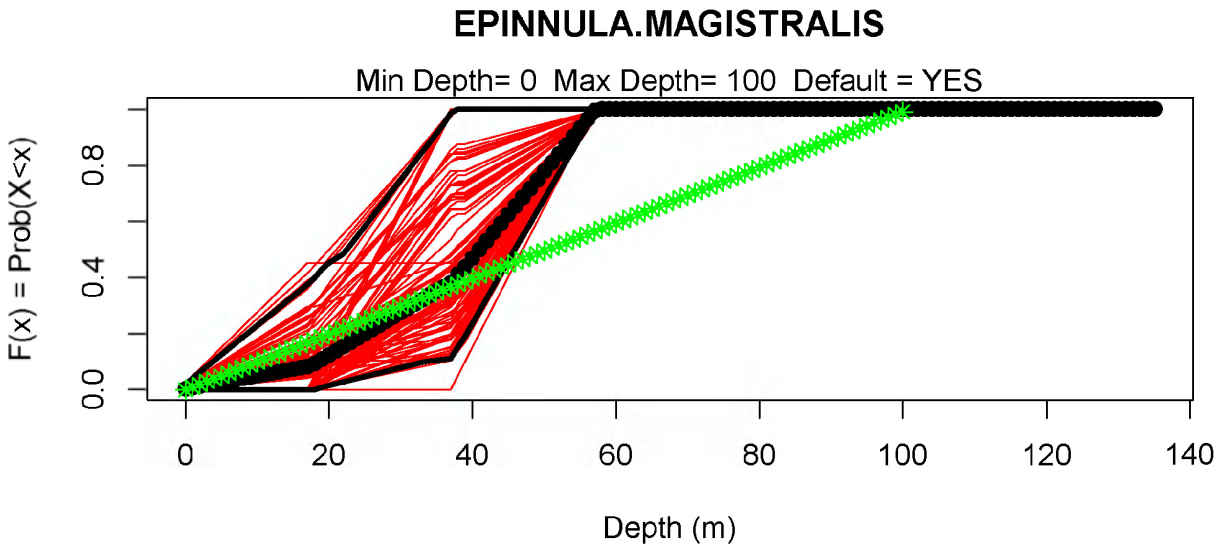

ELOPIFORMES
Min Depth= 0 Max Depth= 100 Default = yes
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

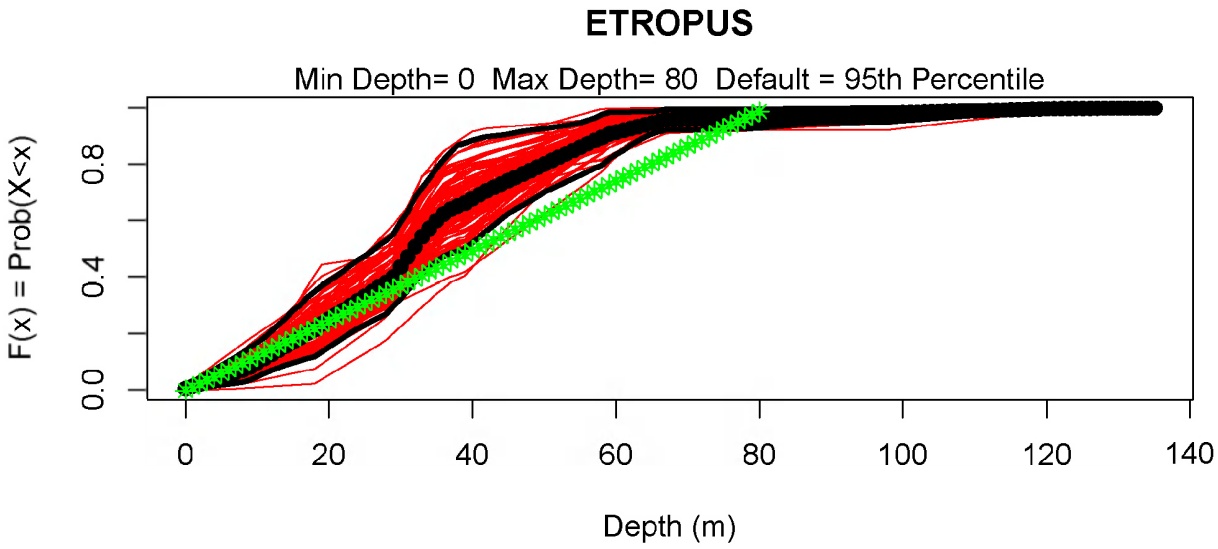

ENGRAULIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

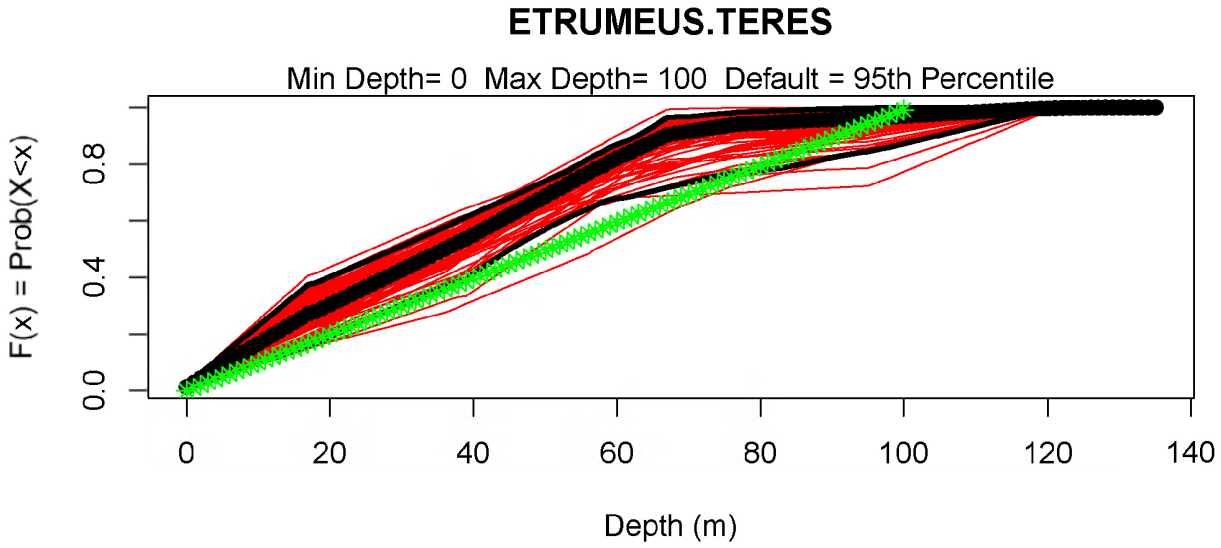

ENGYOPHRYS.SENTA
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

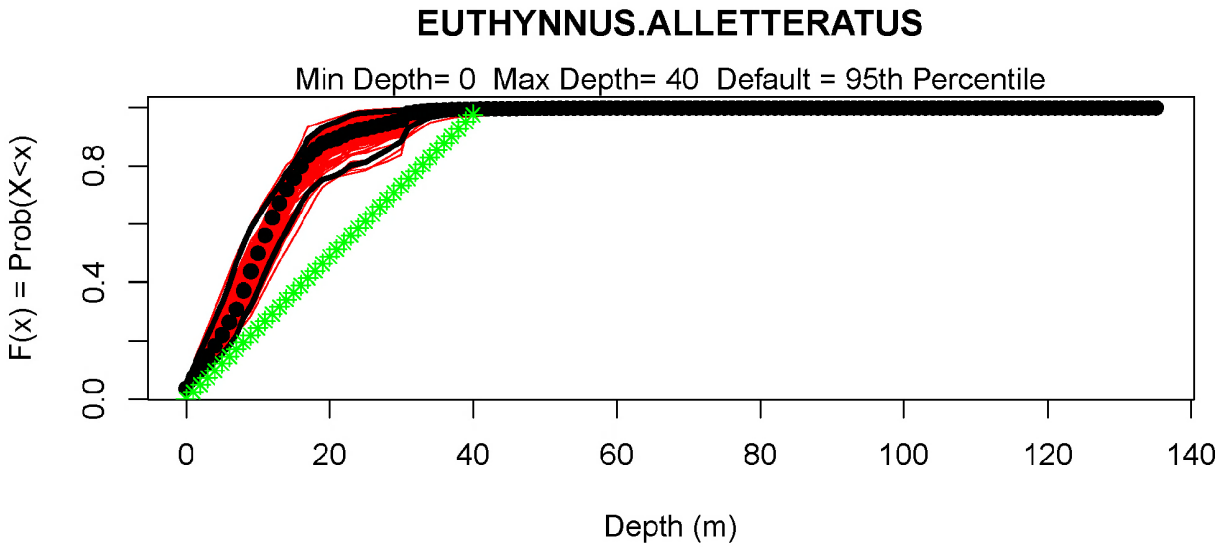

EPIGONIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

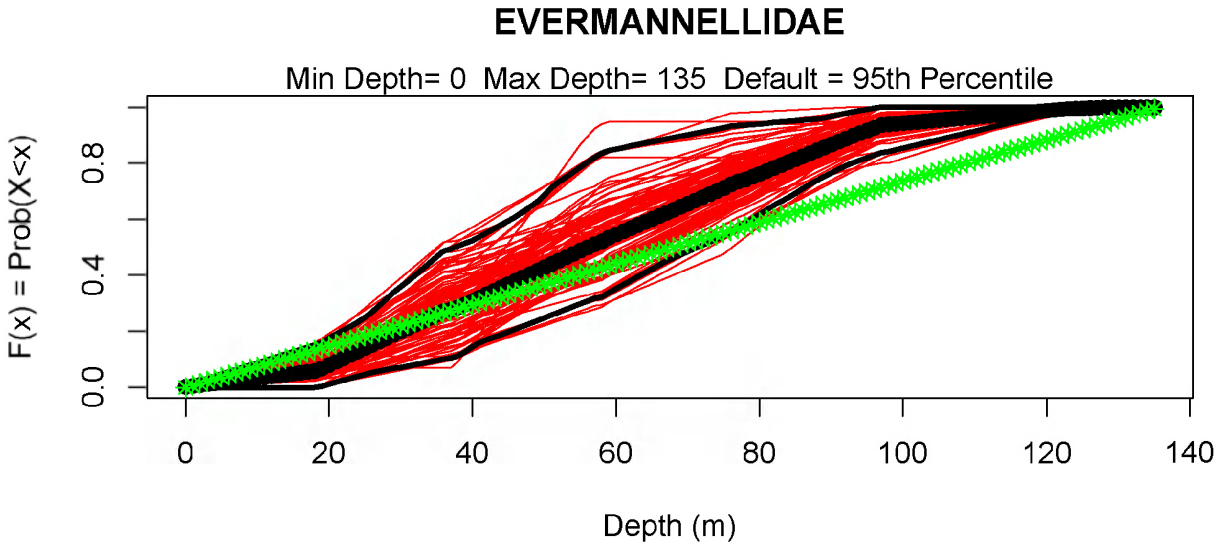

EPINEPHELINI
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

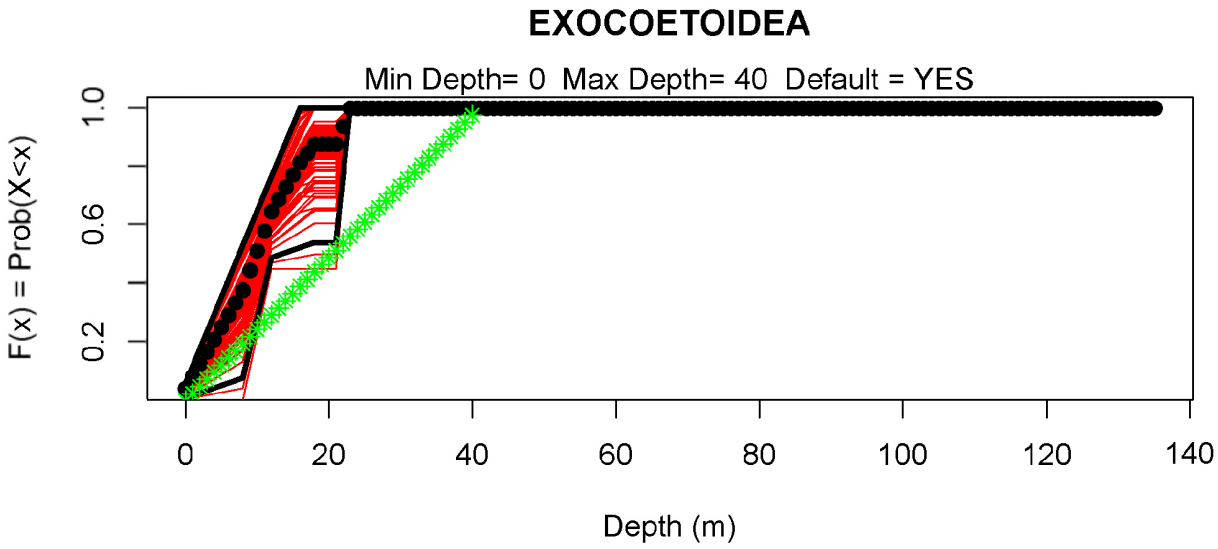

EPINNULA.MAGISTRALIS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

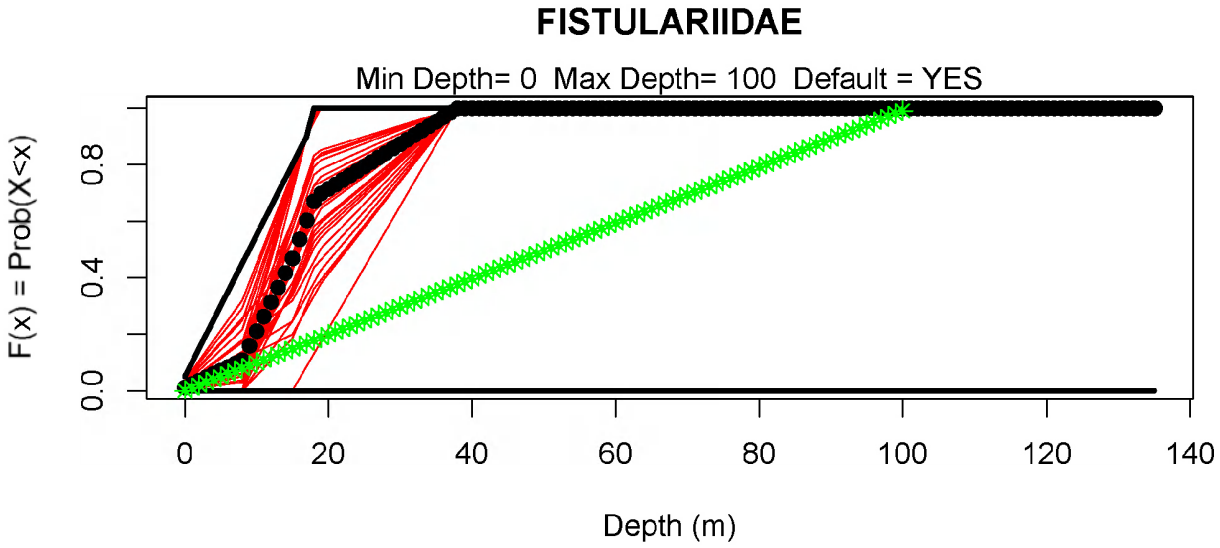

ETROPUS
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

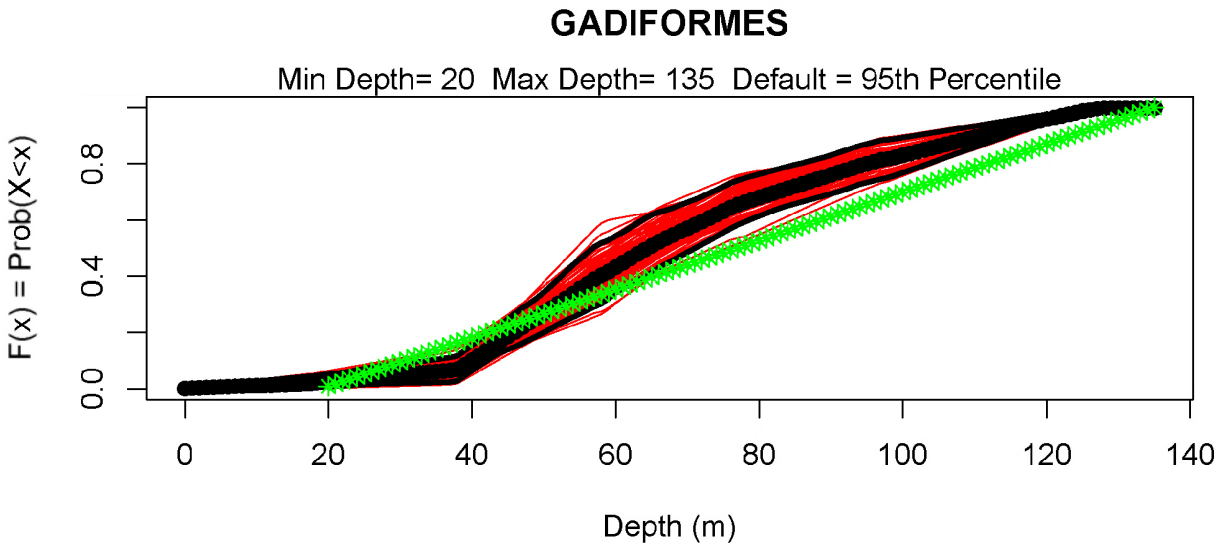

ETRUMEUS.TERES
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

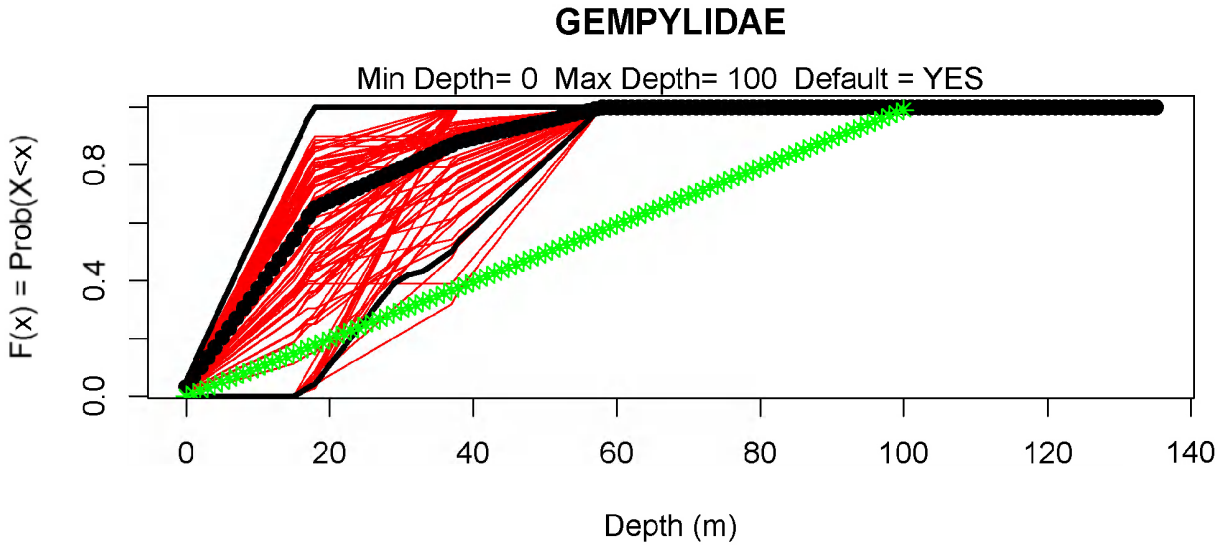

EUTHYNNUS.ALLETTERATUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

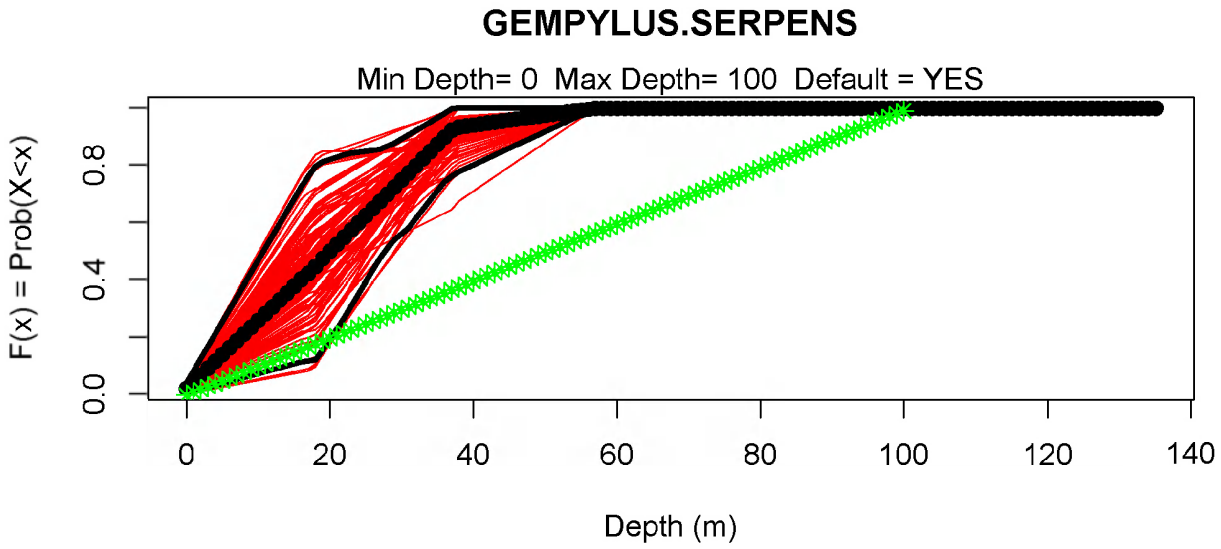

EVERMANNELLIDAE
Min Depth= 0 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

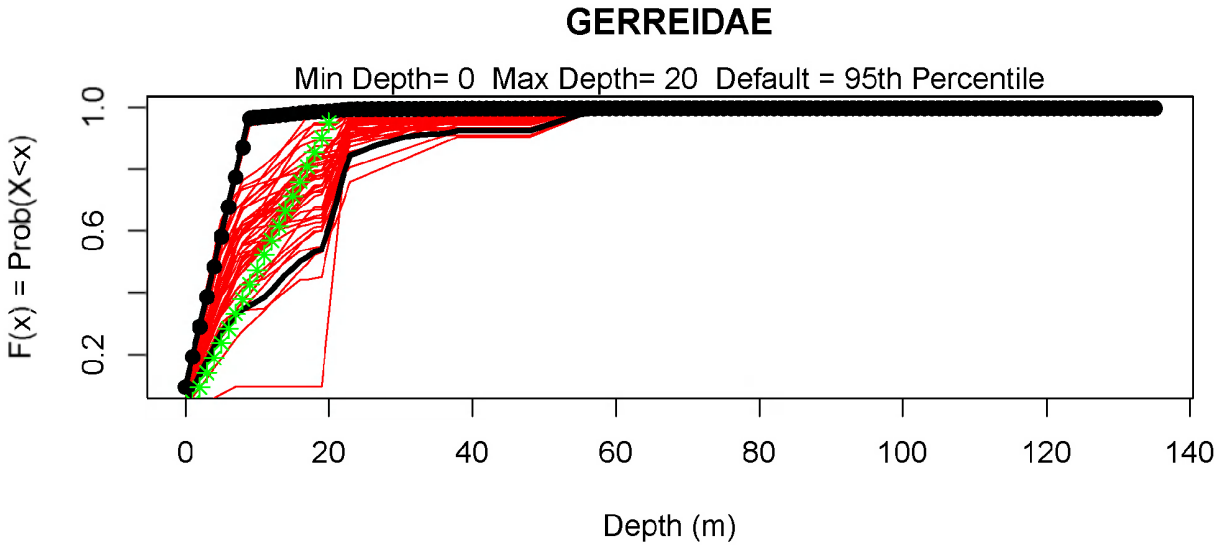

EXOCOETOIDEA
Min Depth= 0 Max Depth= 40 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

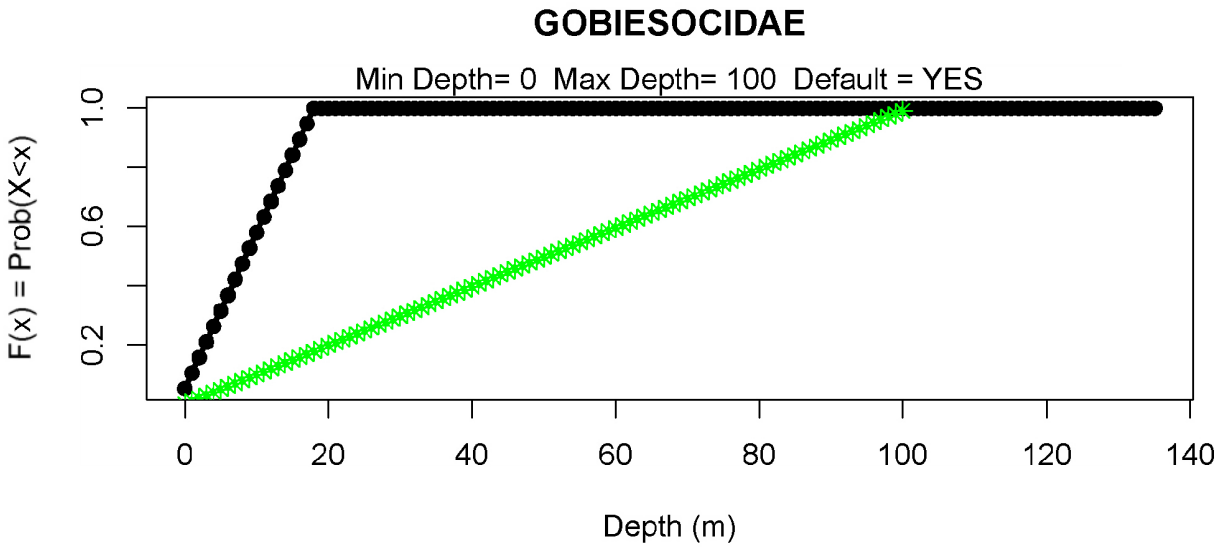

FISTULARIIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

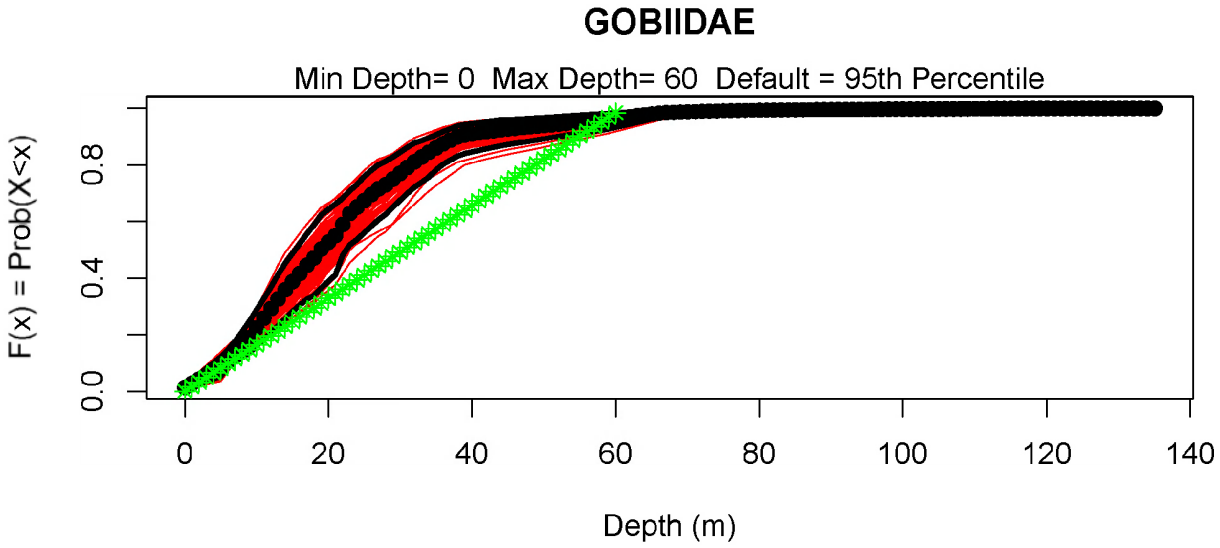

GADIFORMES
Min Depth= 20 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

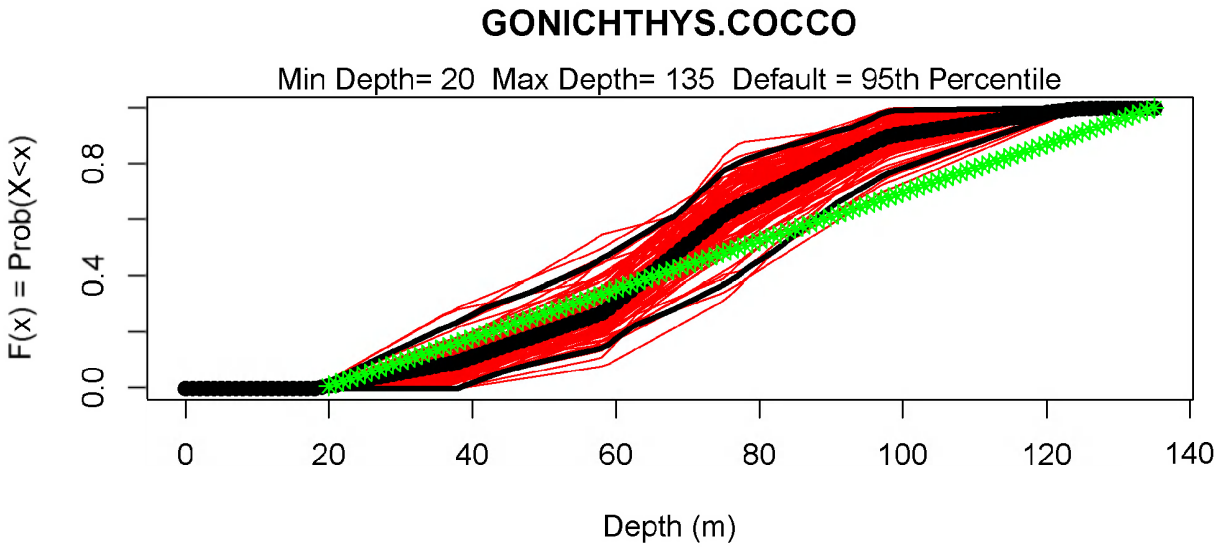

GEMPYLIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

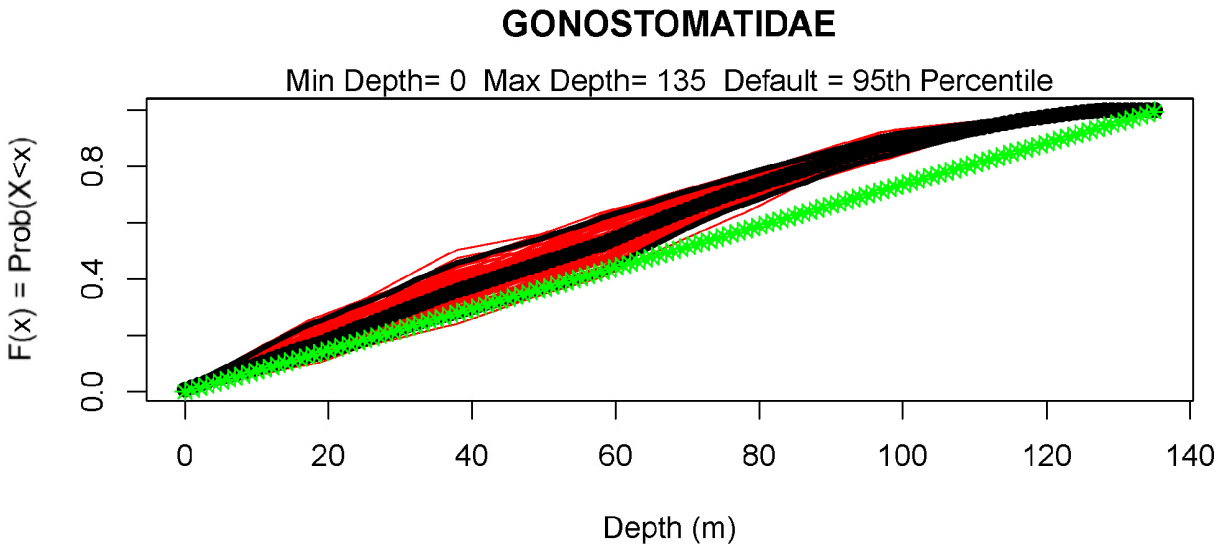

GEMPYLUS.SERPENS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

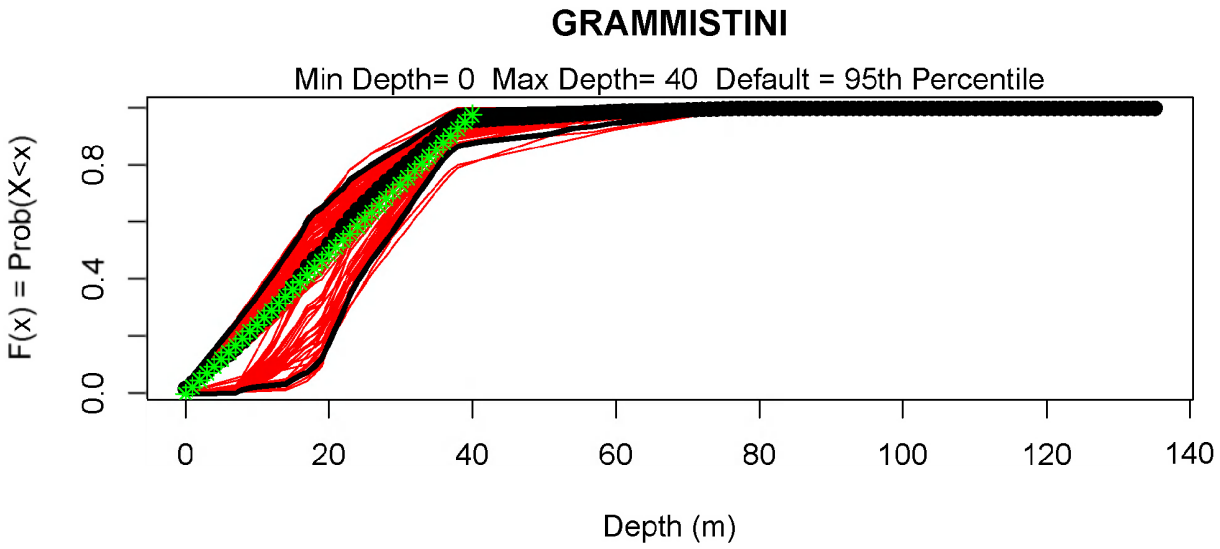

GERREIDAE
Min Depth= 0 Max Depth= 20 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

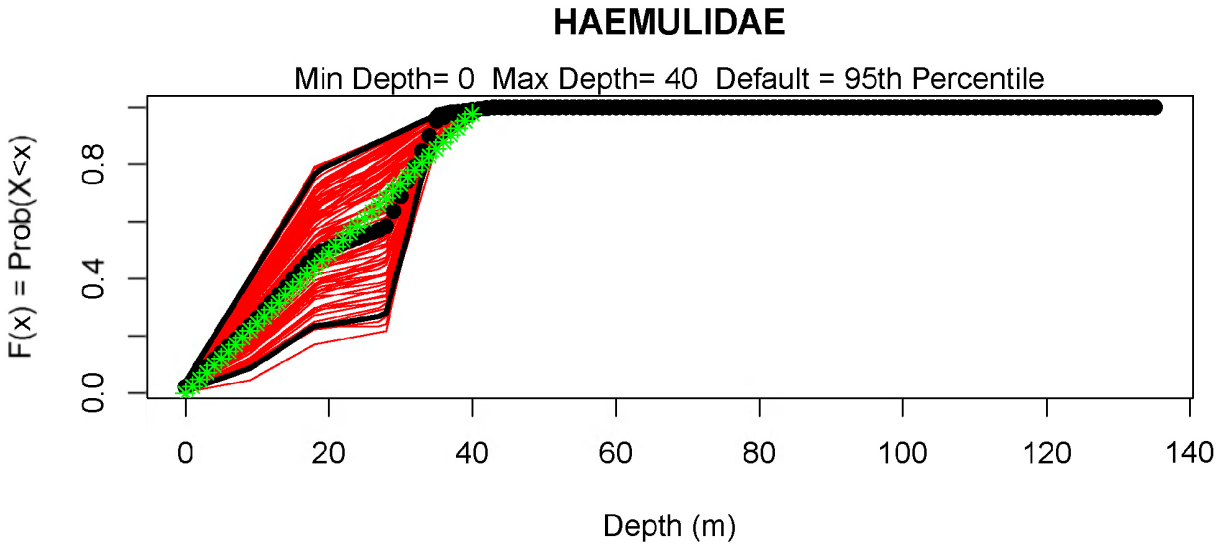

GOBIESOCIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

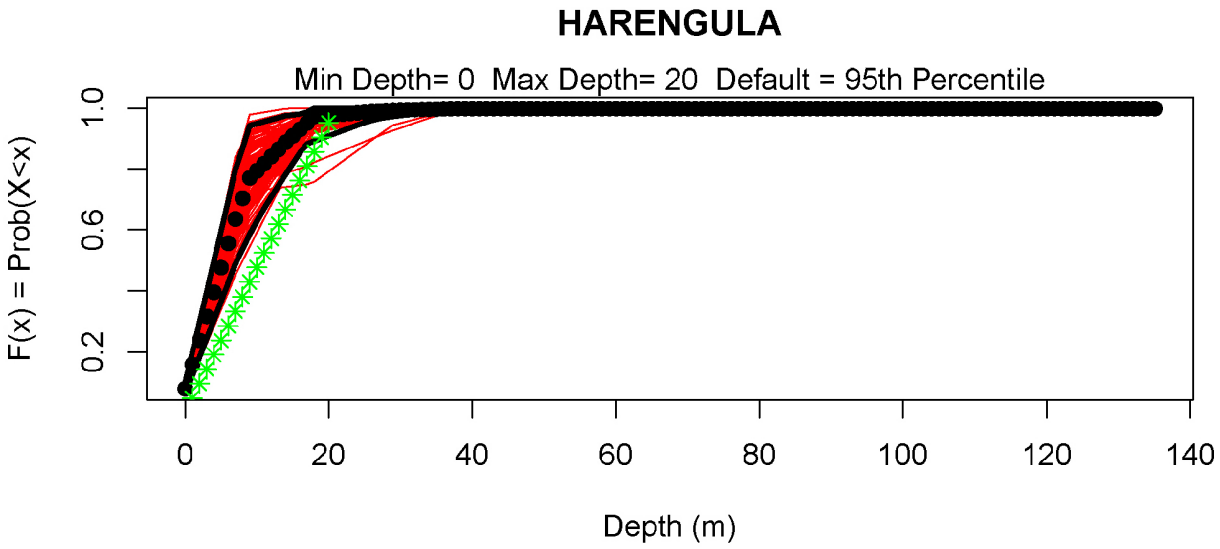

GOBIIDAE
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

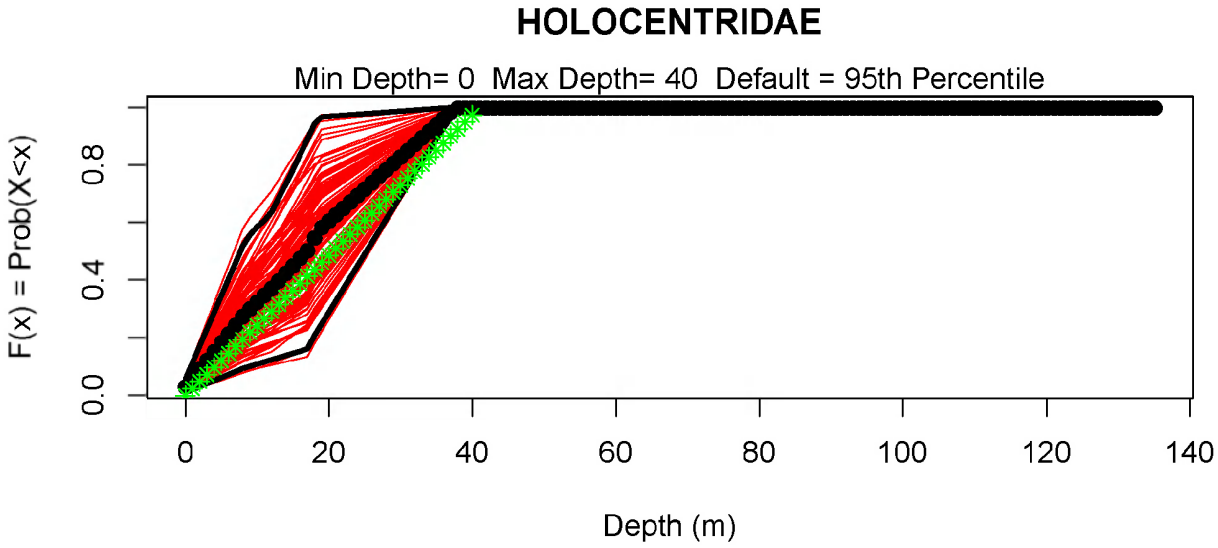

GONICHTHYS.COCCO
Min Depth= 20 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

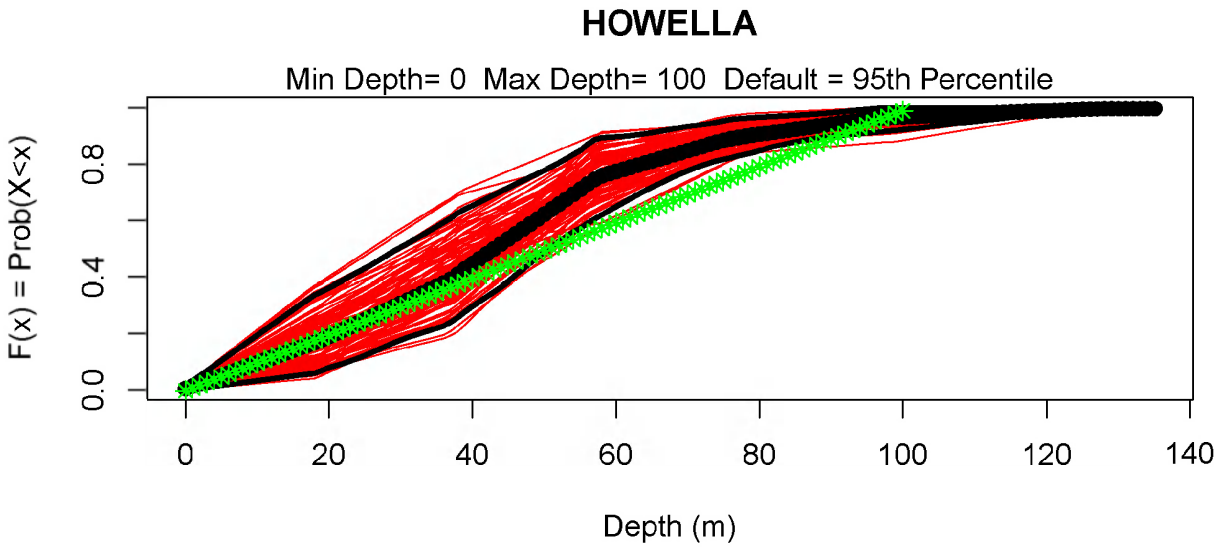

GONOSTOMATIDAE
Min Depth= 0 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

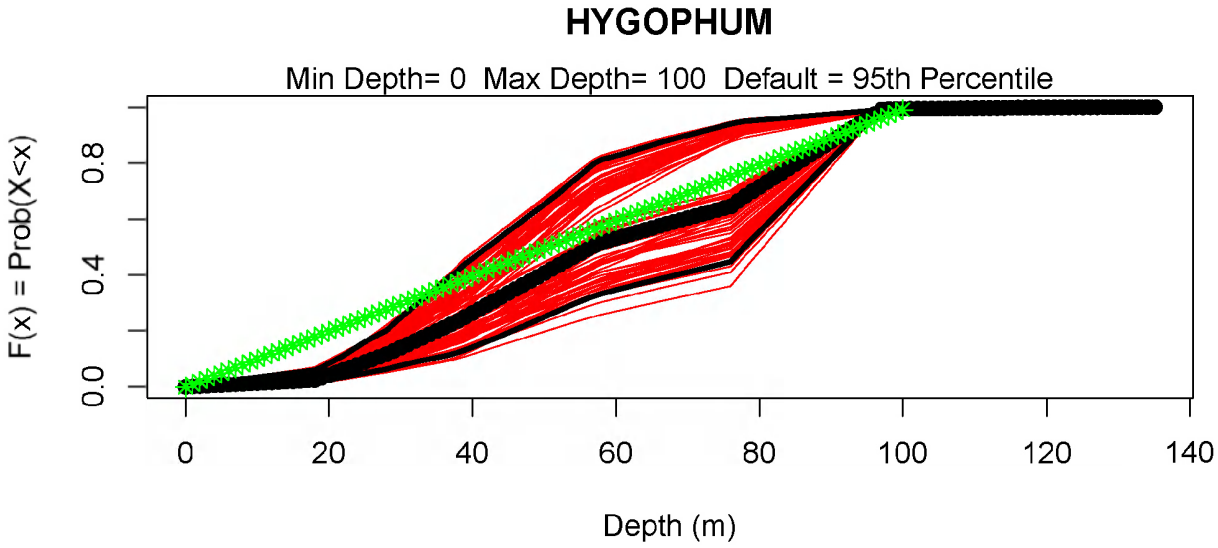

GRAMMISTINI
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

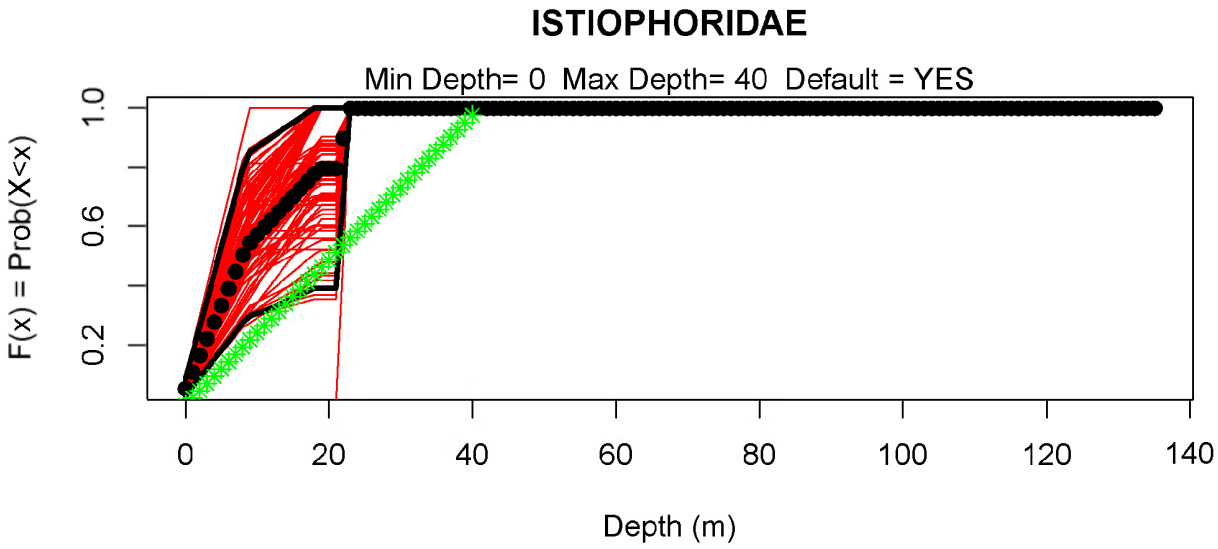

HAEMULIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

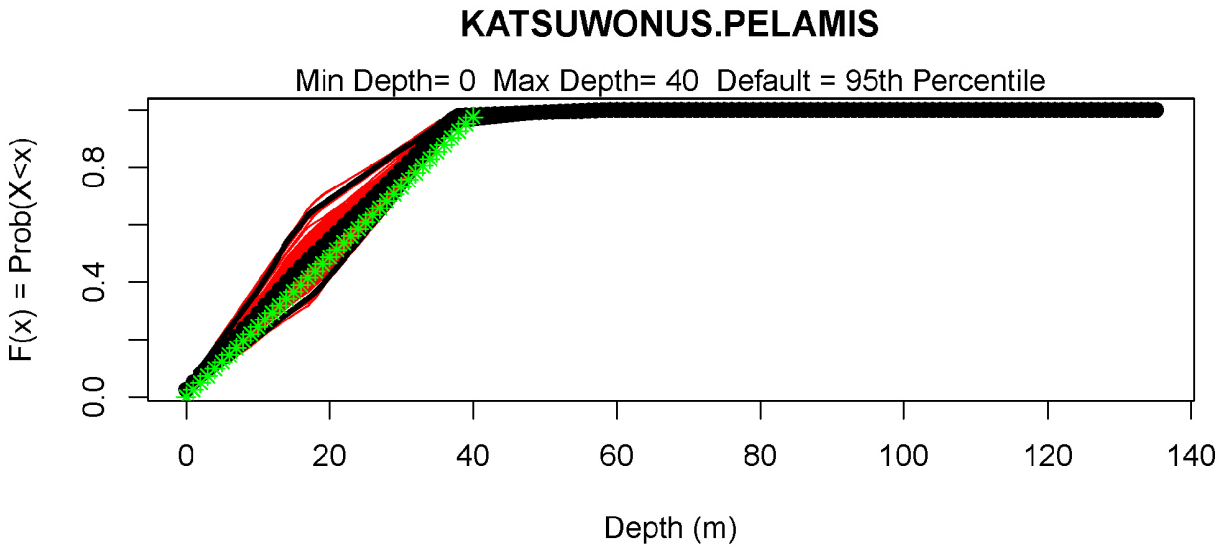

HARENGULA
Min Depth= 0 Max Depth= 20 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

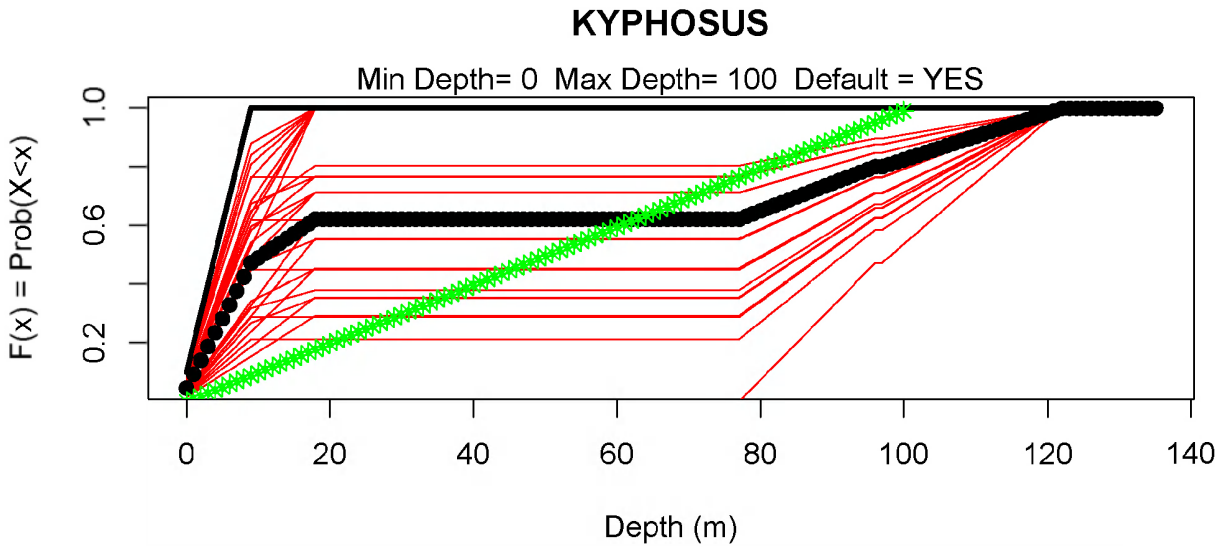

HOLOCENTRIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

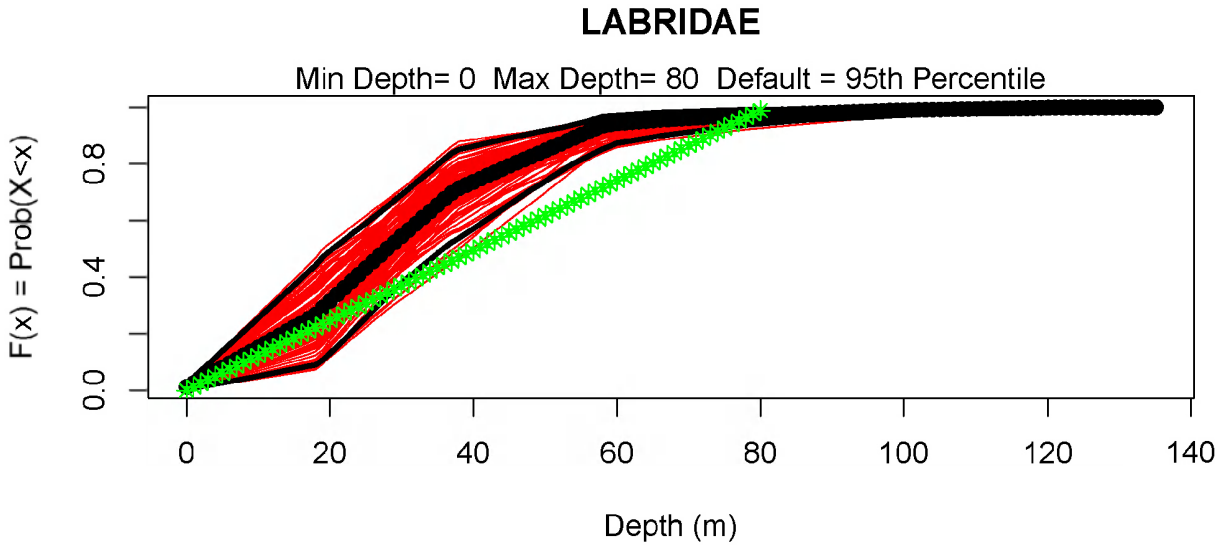

HOWELLA
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

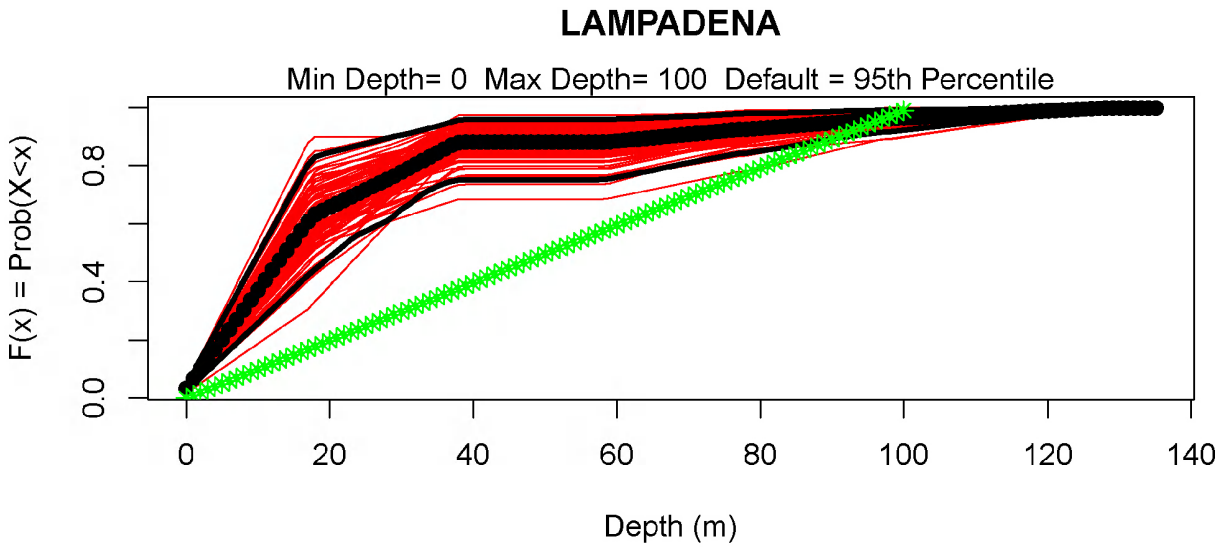

HYGOPHUM
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

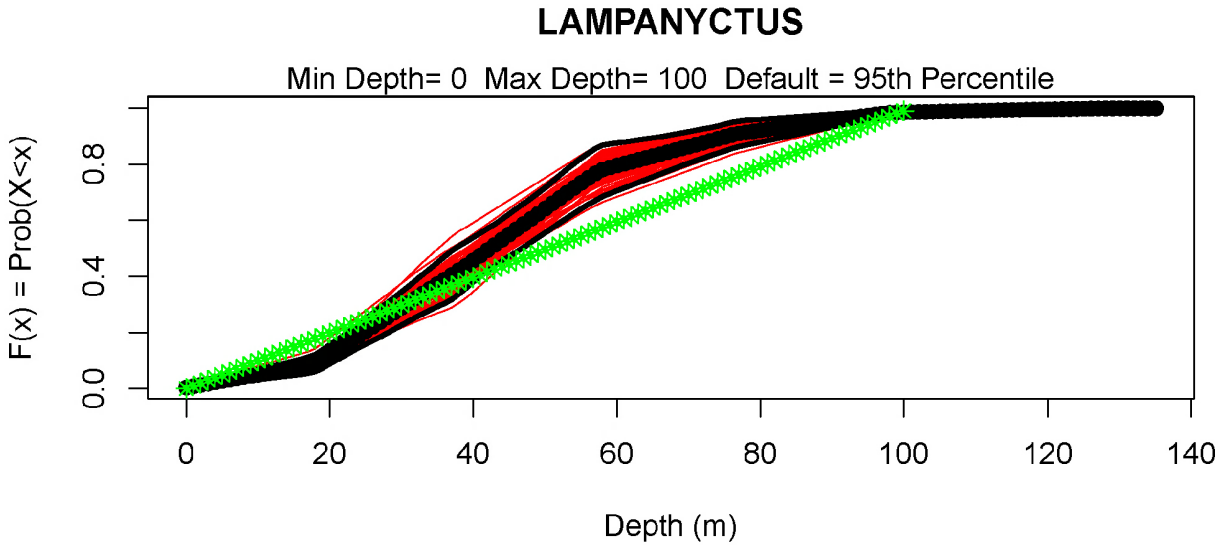

ISTIOPHORIDAE
Min Depth= 0 Max Depth= 40 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

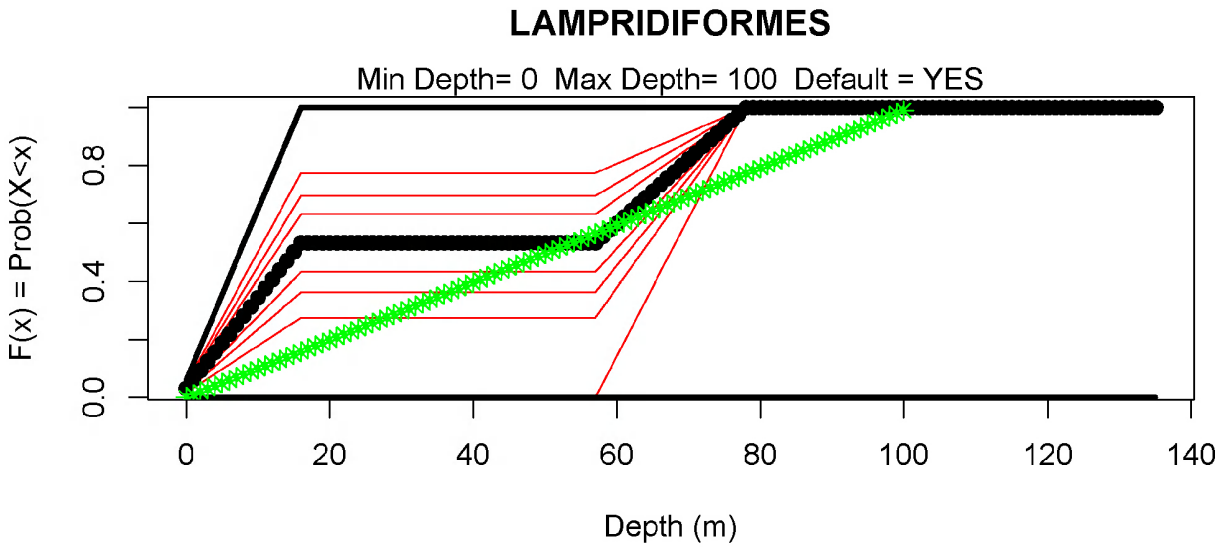

KATSUWONUS.PELAMIS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

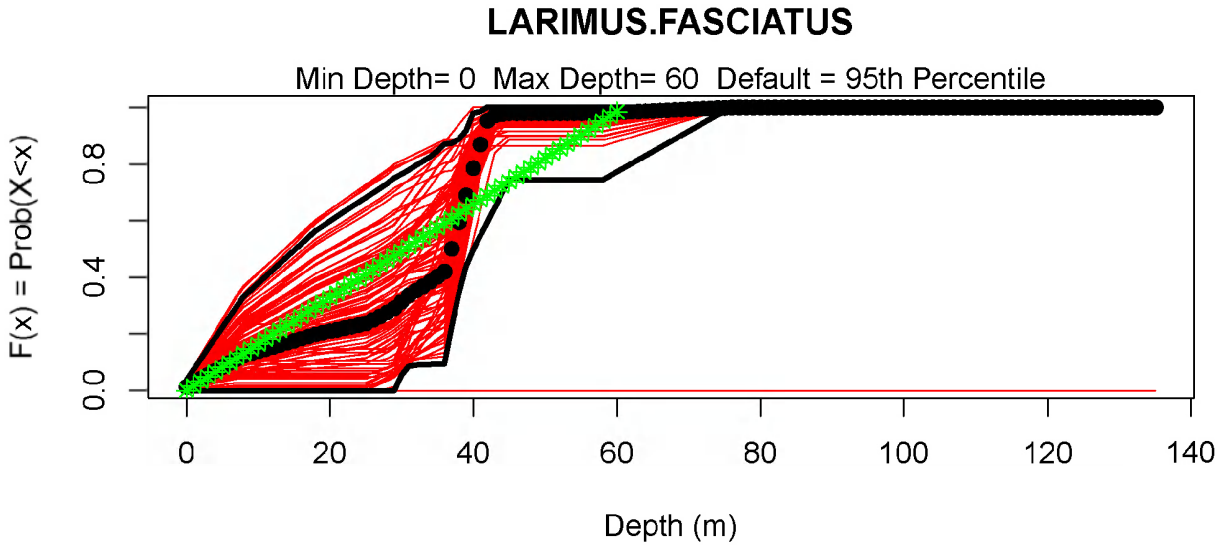

KYPHOSUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

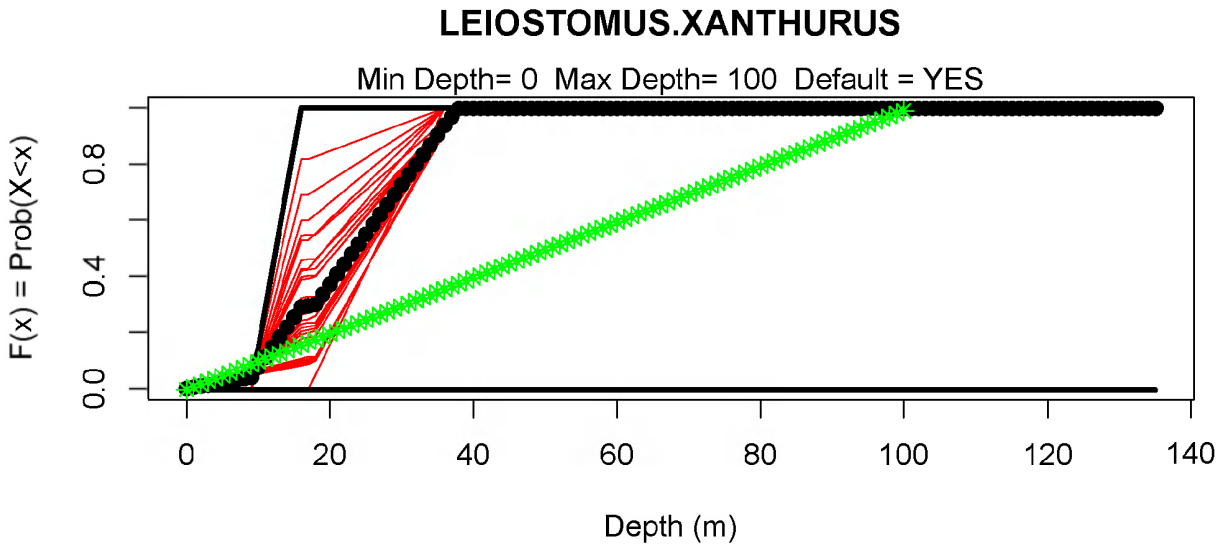

LABRIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

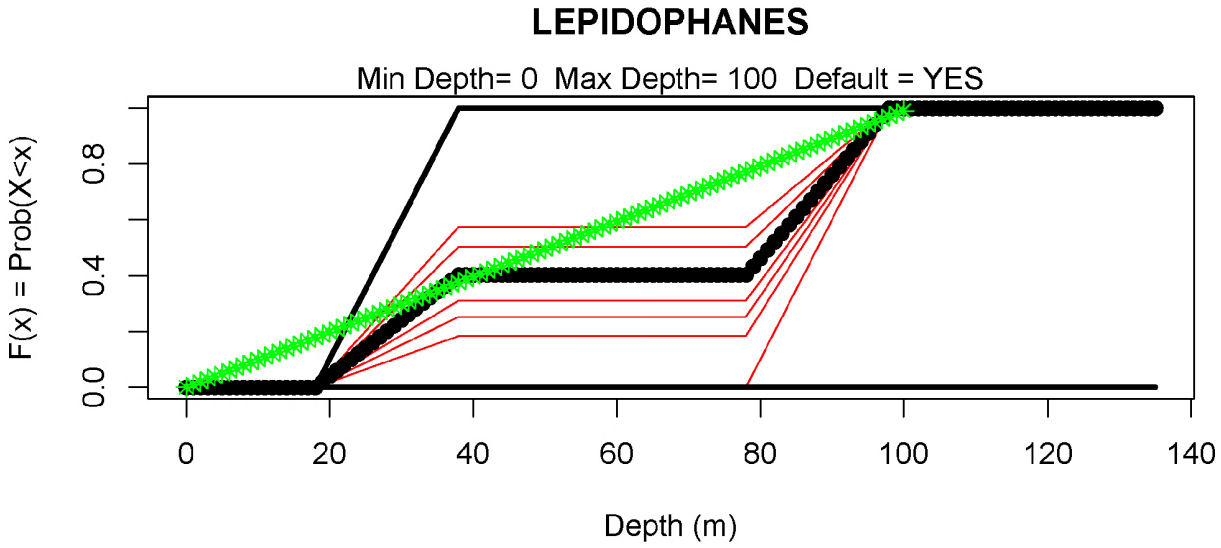

LAMPADENA
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

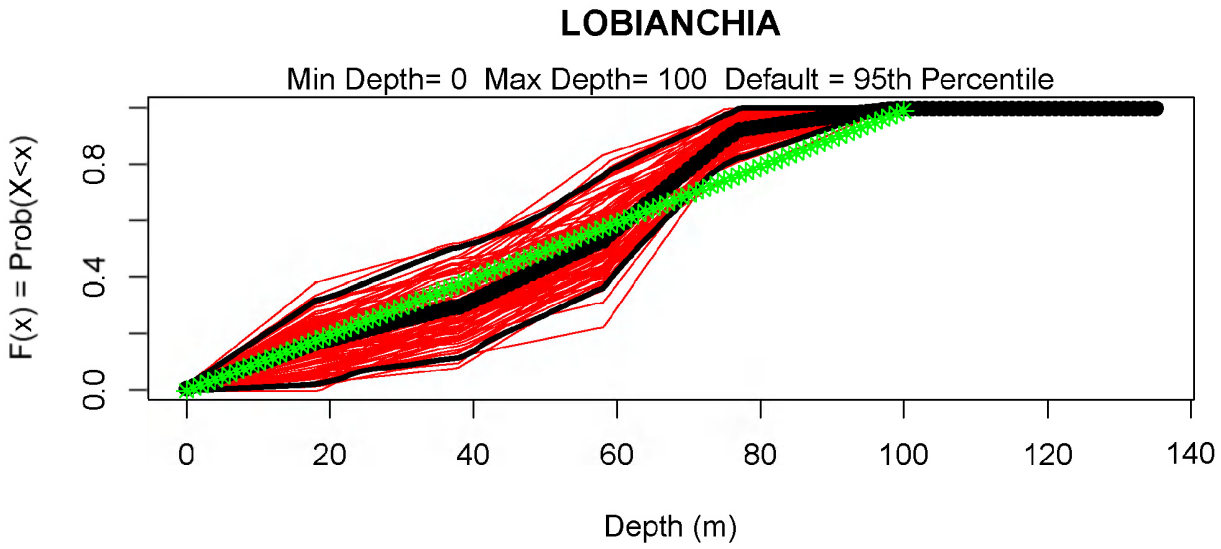

LAMPANYCTUS
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

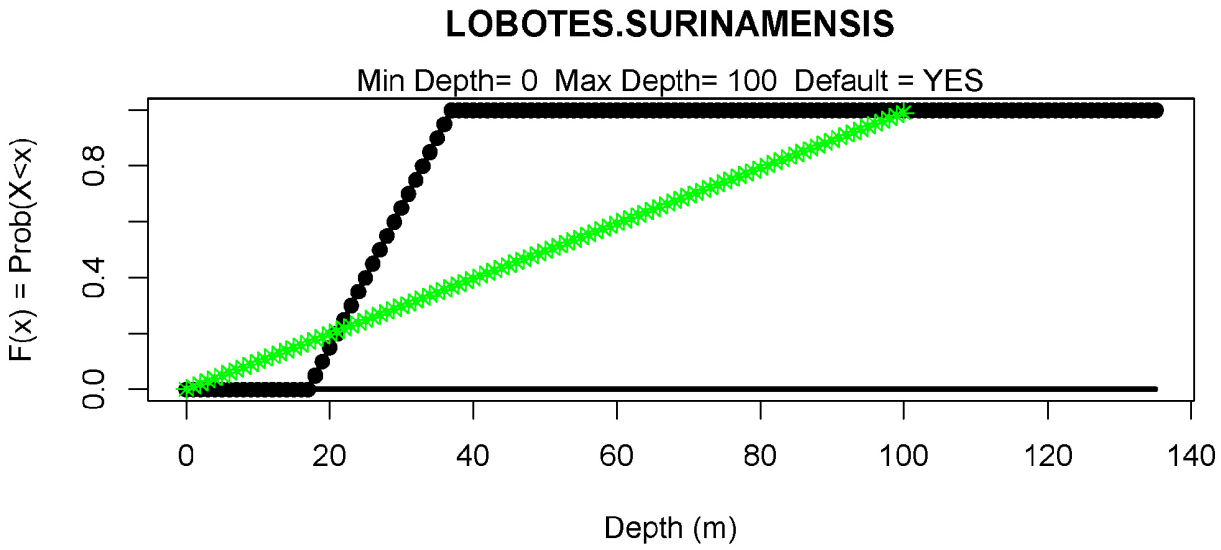

LAMPRIDIFORMES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

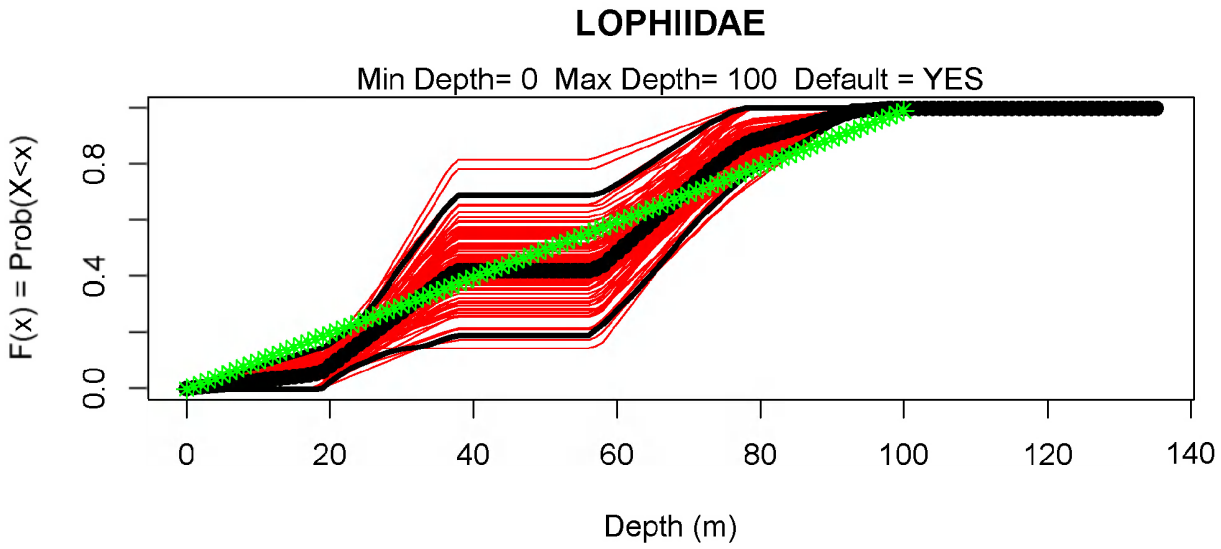

LARIMUS.FASCIATUS
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

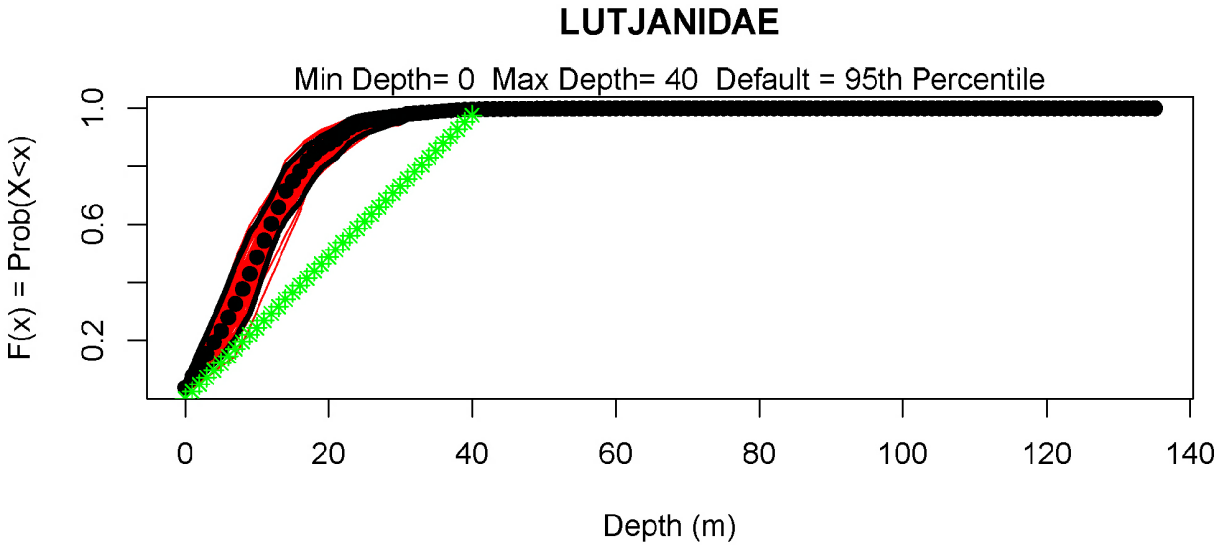

LEIOSTOMUS.XANTHURUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

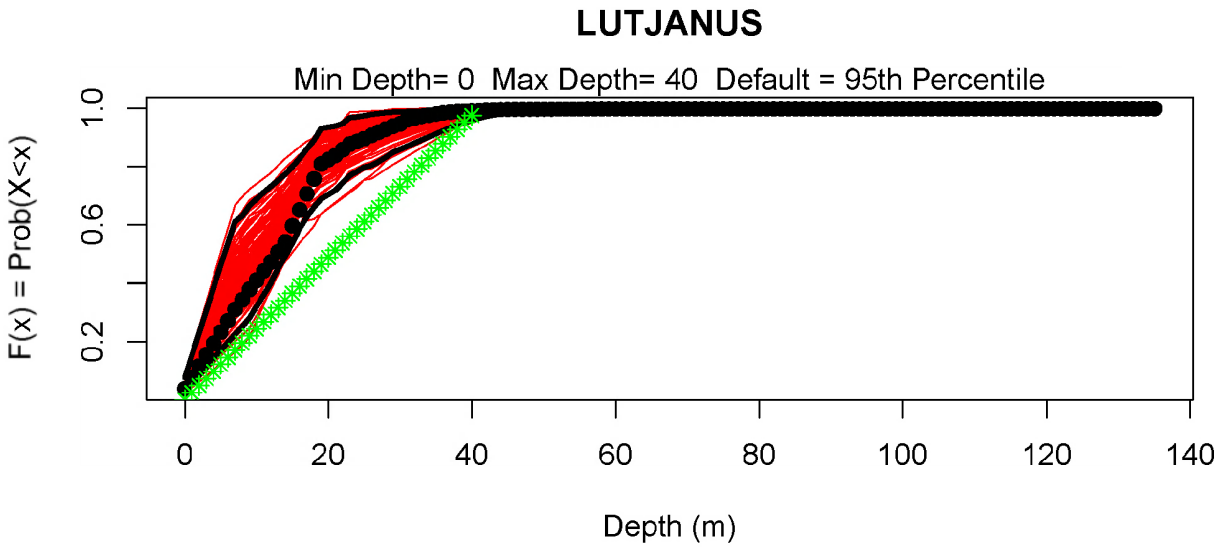

LEPIDOPHANES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

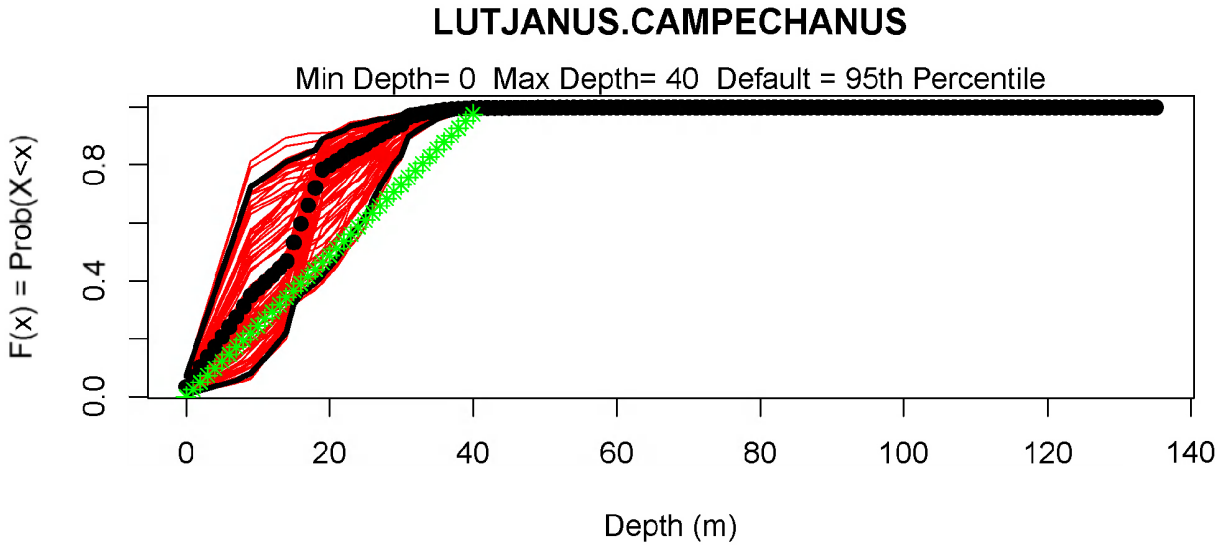

LOBIANCHIA
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

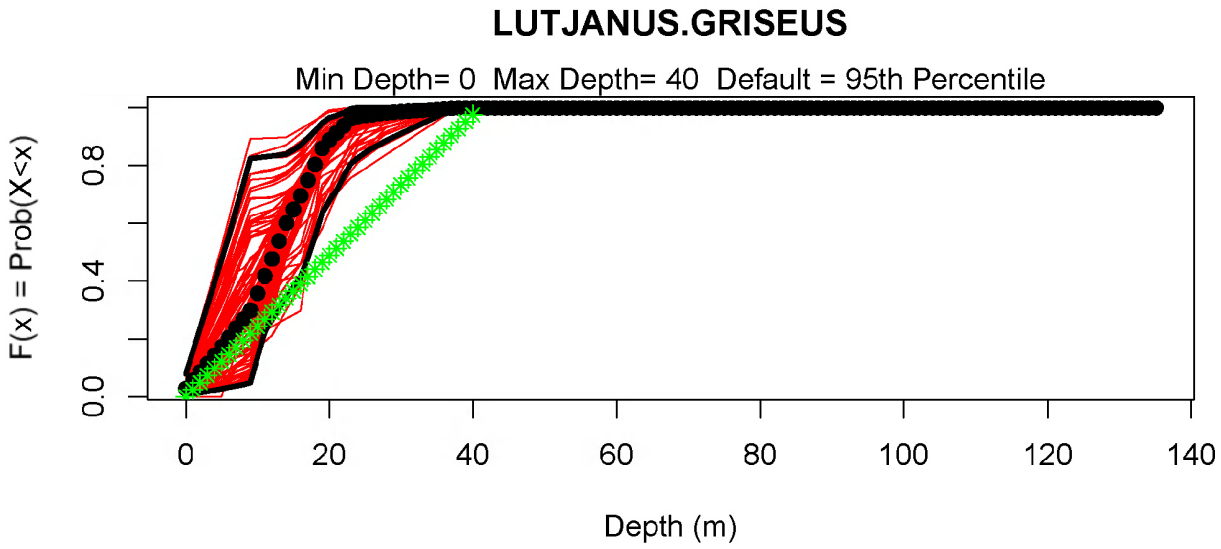

LOBOTES.SURINAMENSIS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

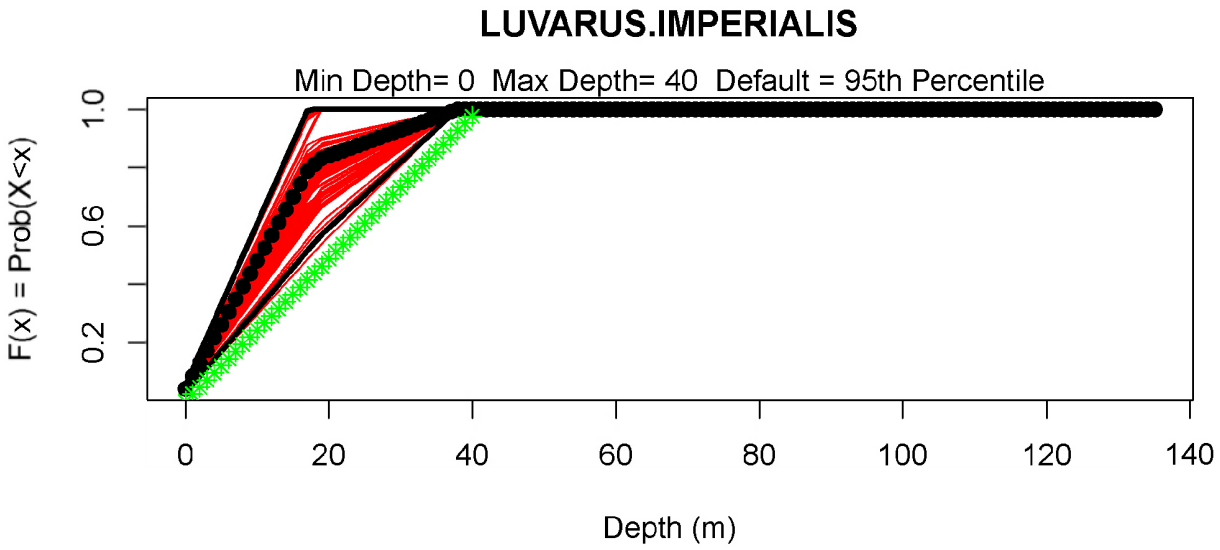

LOPHIIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

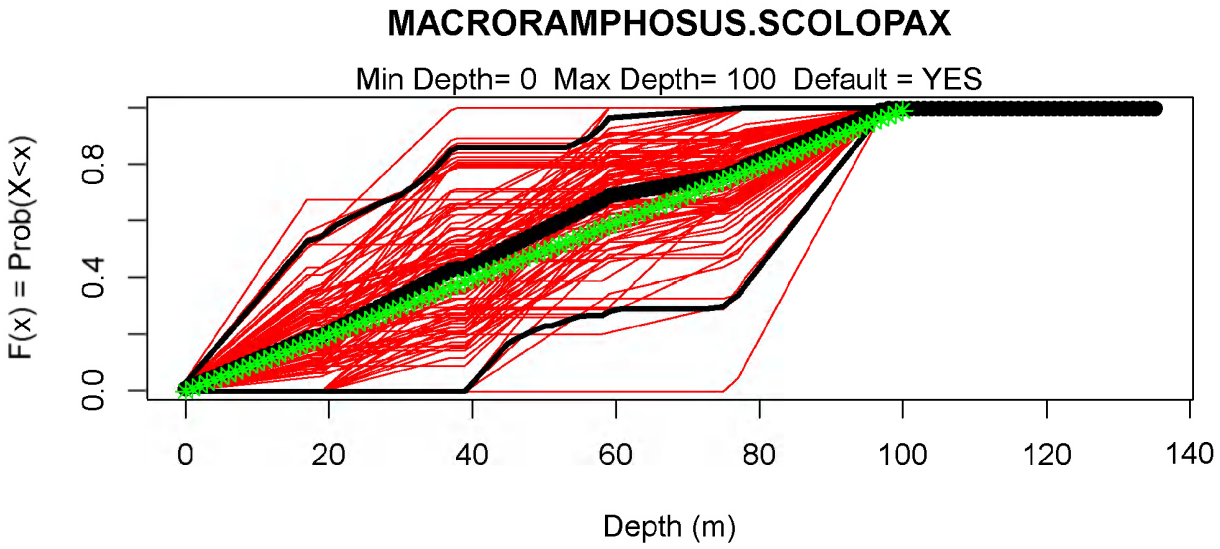

LUTJANIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

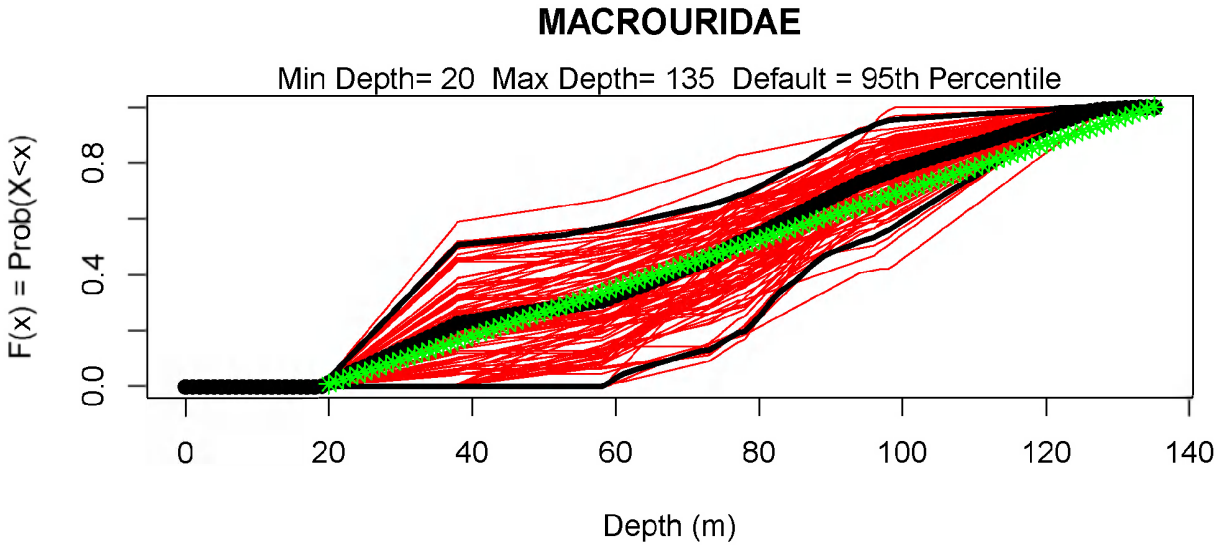

LUTJANUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

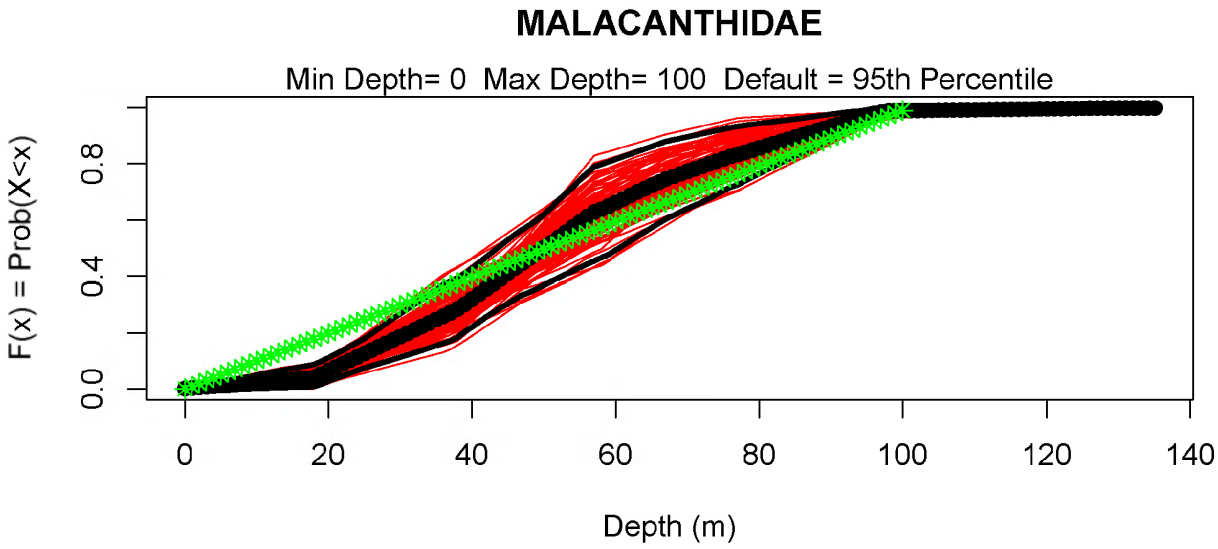

LUTJANUS.CAMPECHANUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

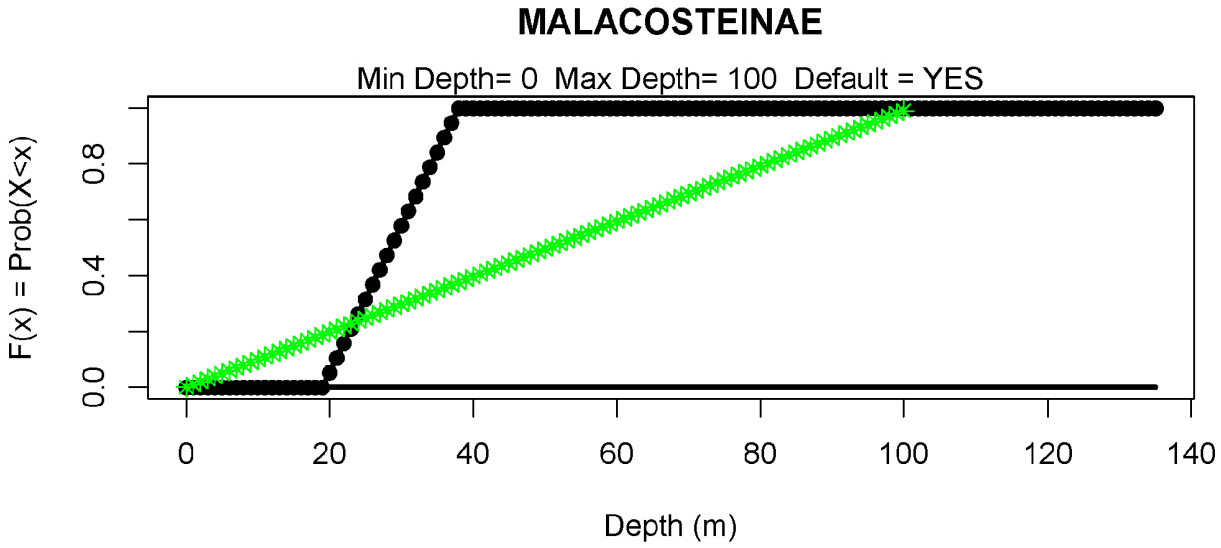

LUTJANUS.GRISEUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

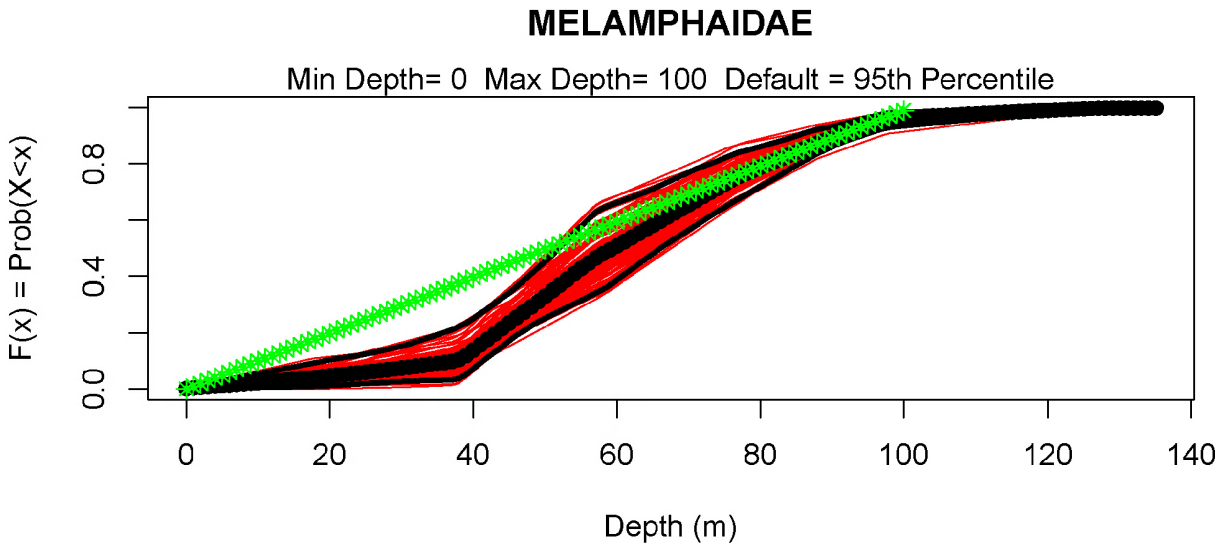

LUVARUS.IMPERIALIS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

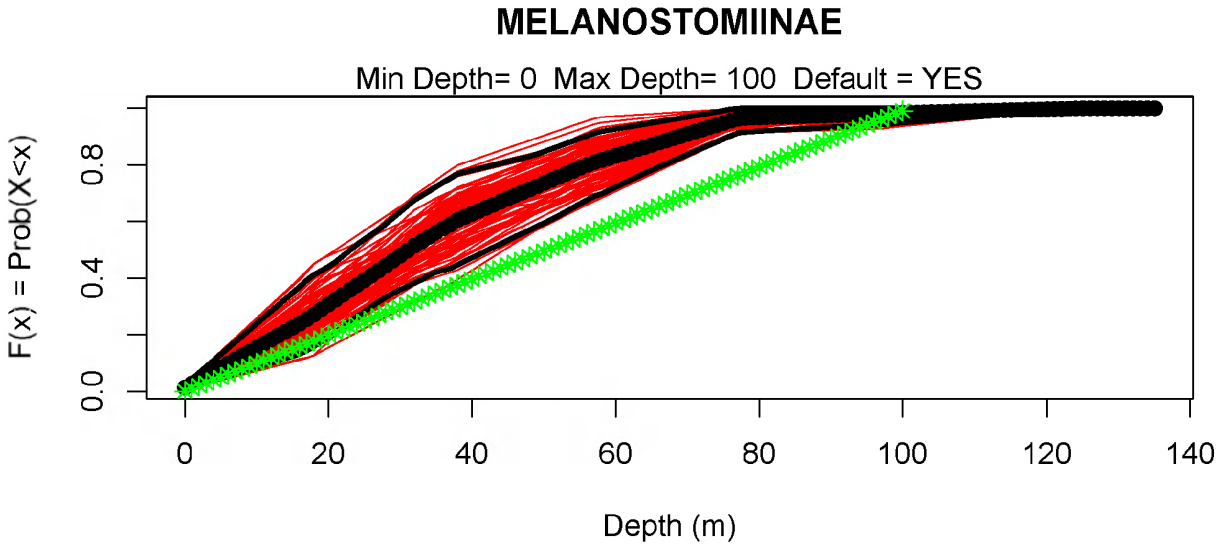

MACRORAMPHOSUS.SCOLOPAX
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

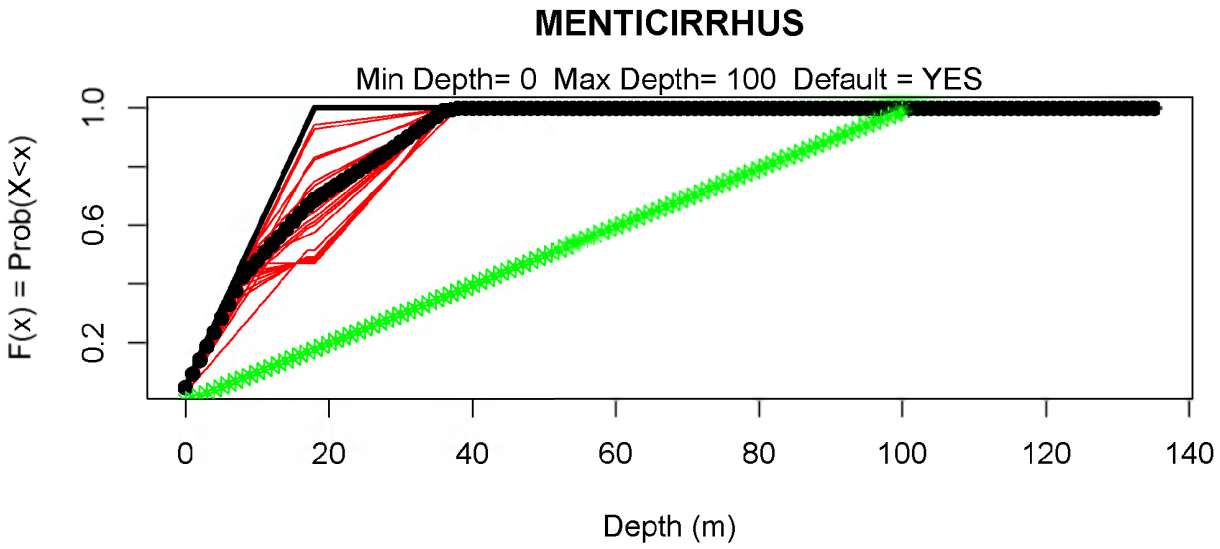

MACROURIDAE
Min Depth= 20 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

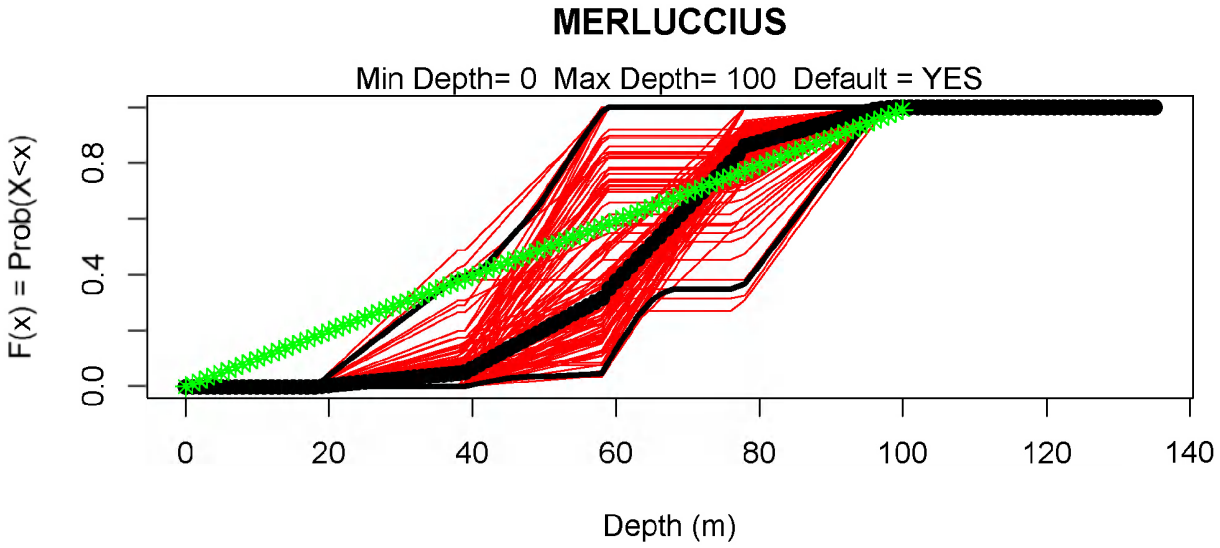

MALACANTHIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

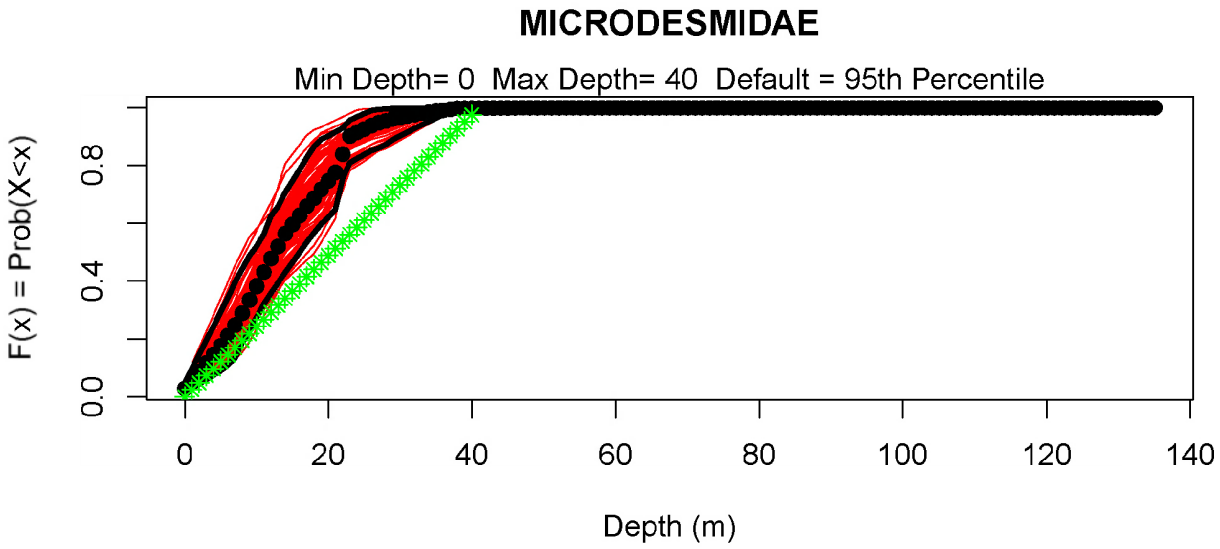

MALACOSTEINAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

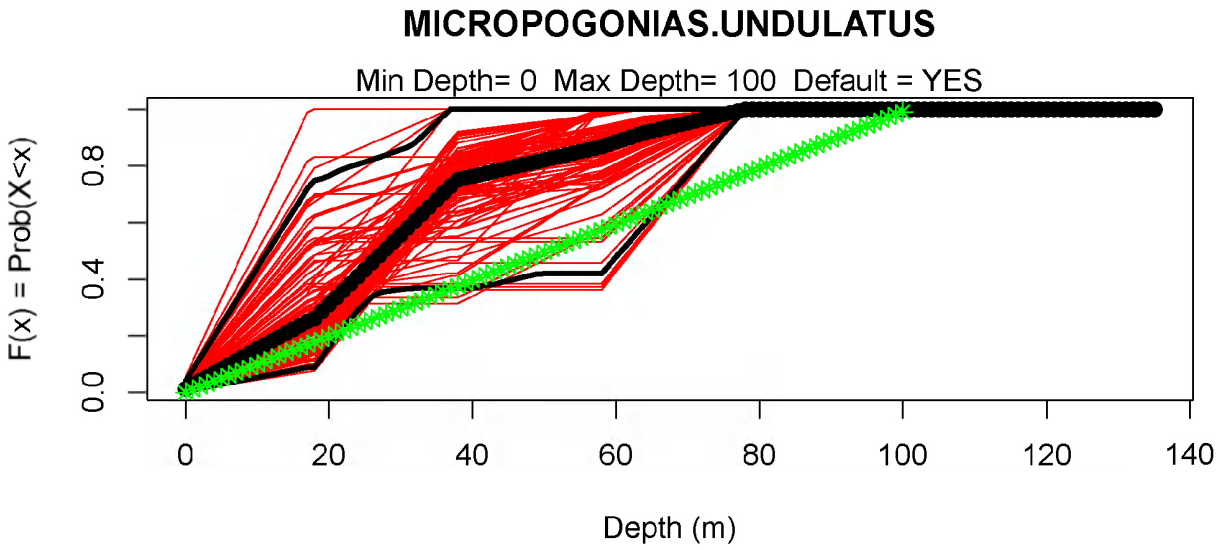

MELAMPHAIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

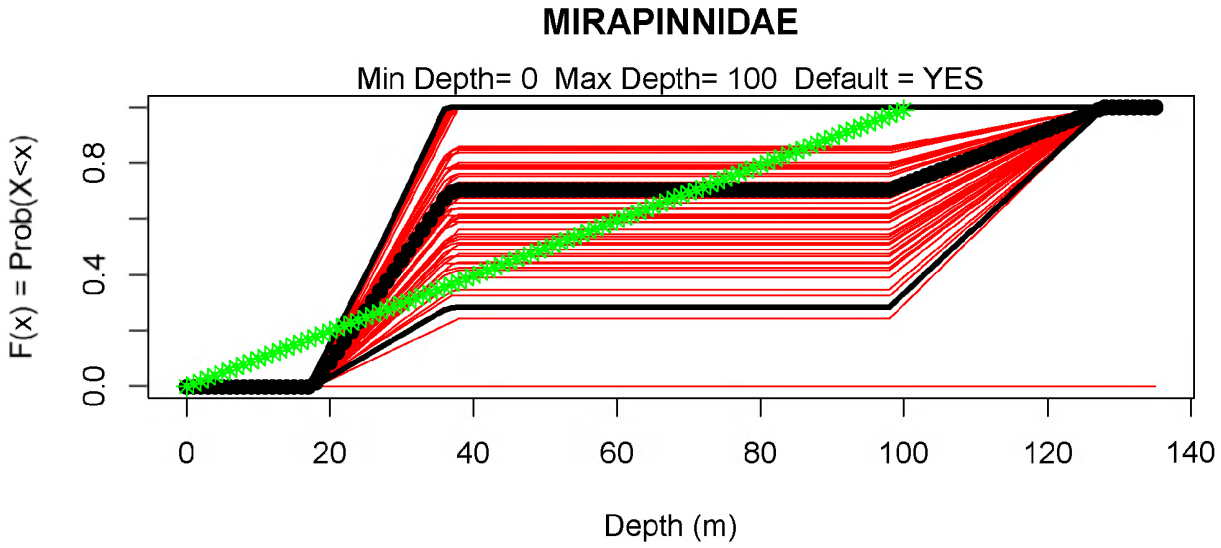

MELANOSTOMIINAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

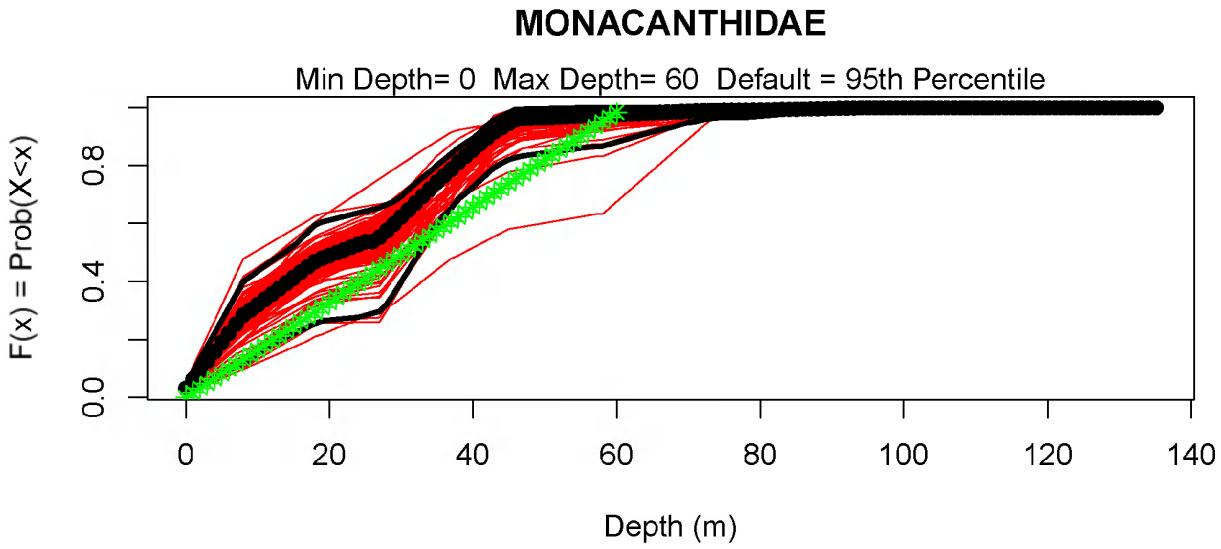

MENTICIRRHUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

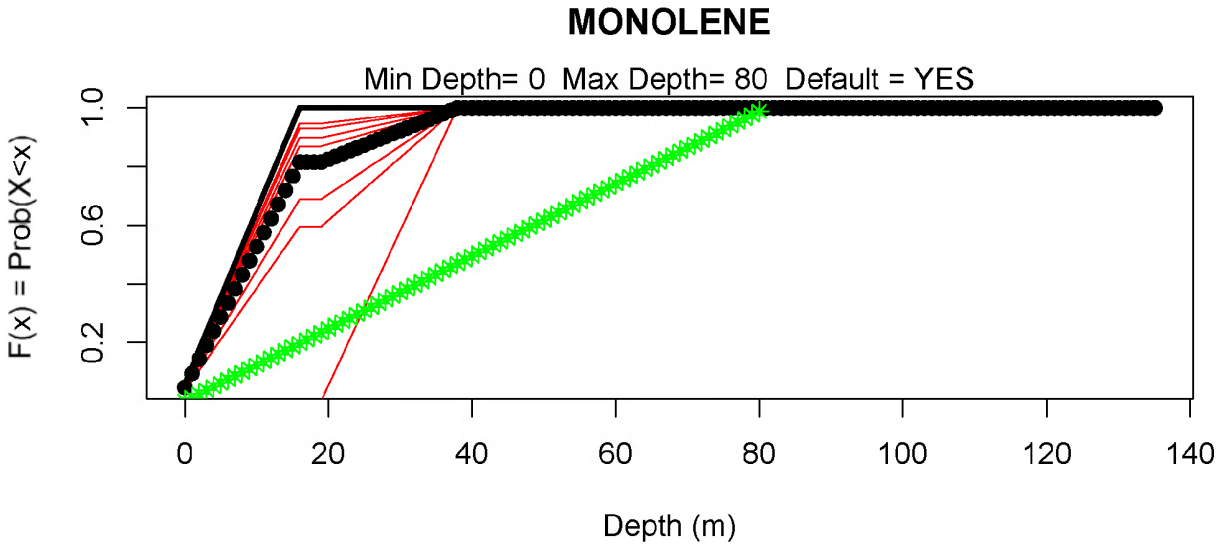

MERLUCCIUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

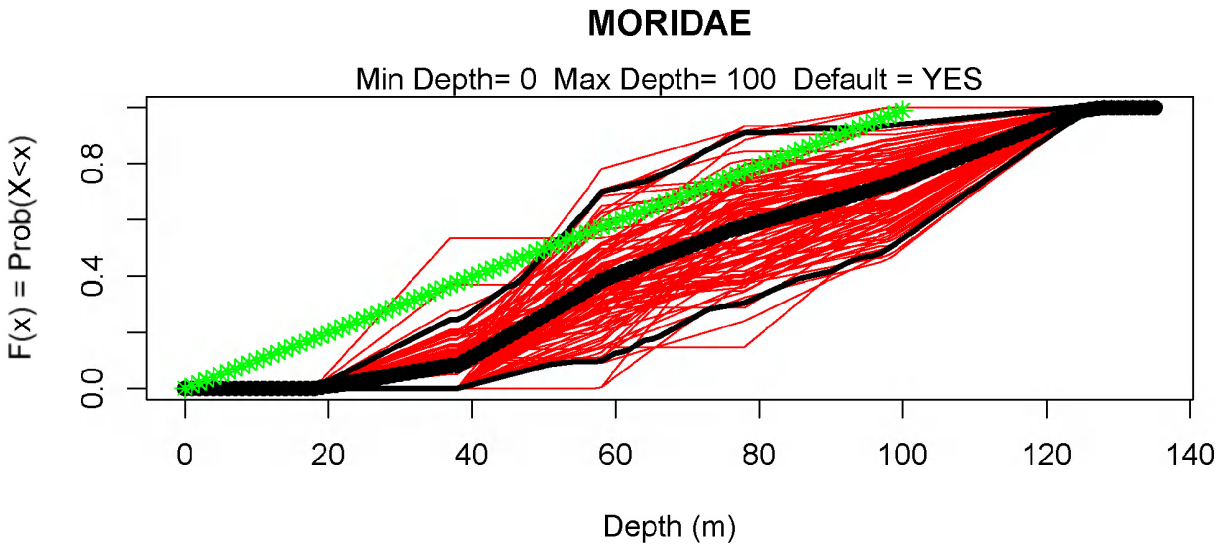

MICRODESMIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

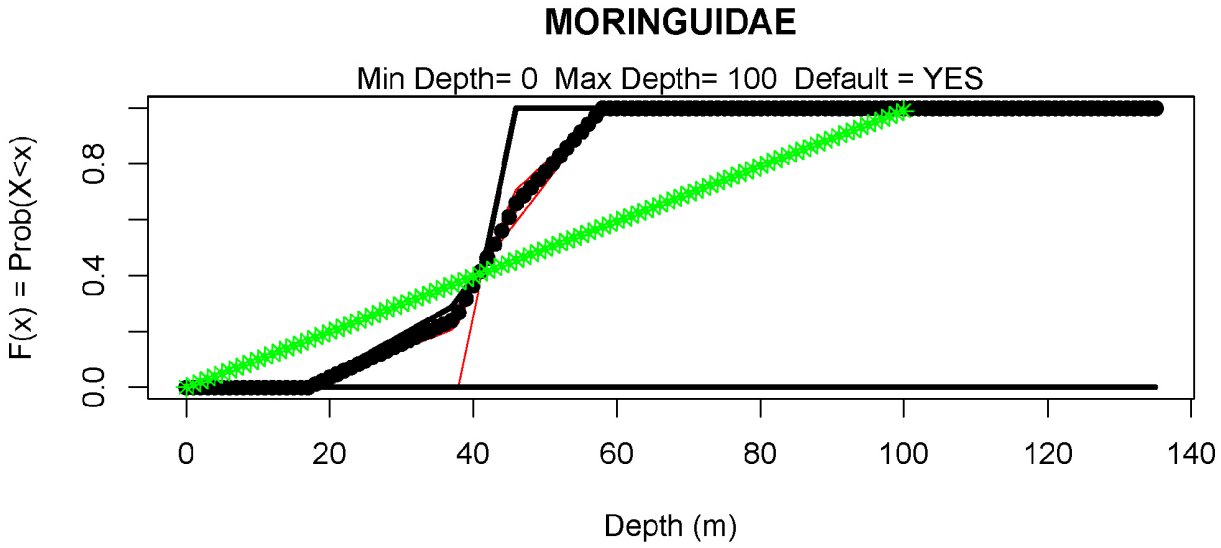

MICROPOGONIAS.UNDULATUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

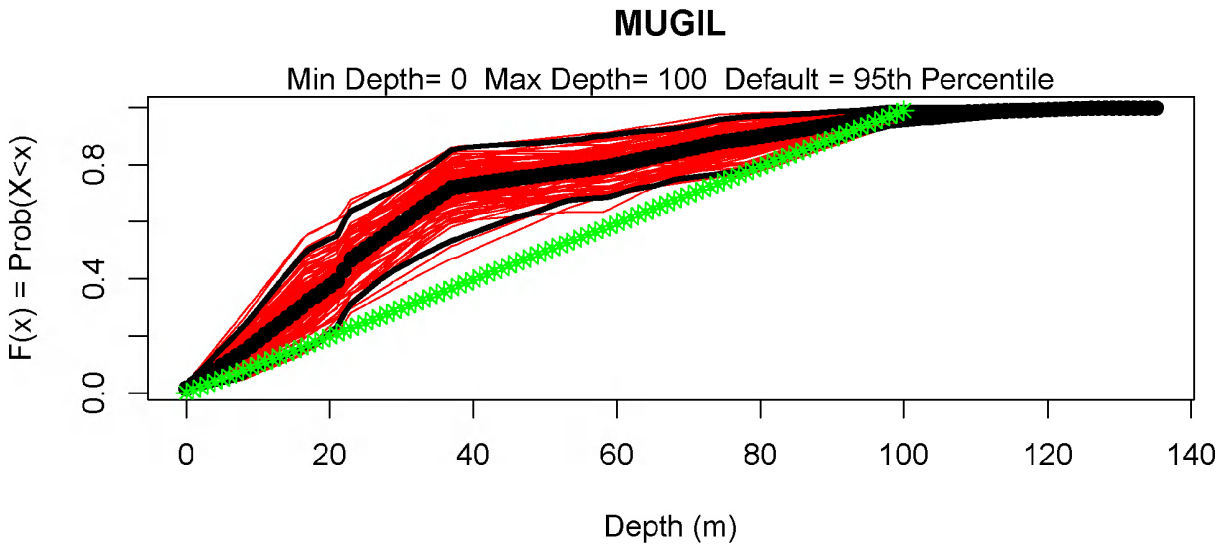

MIRAPINNIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

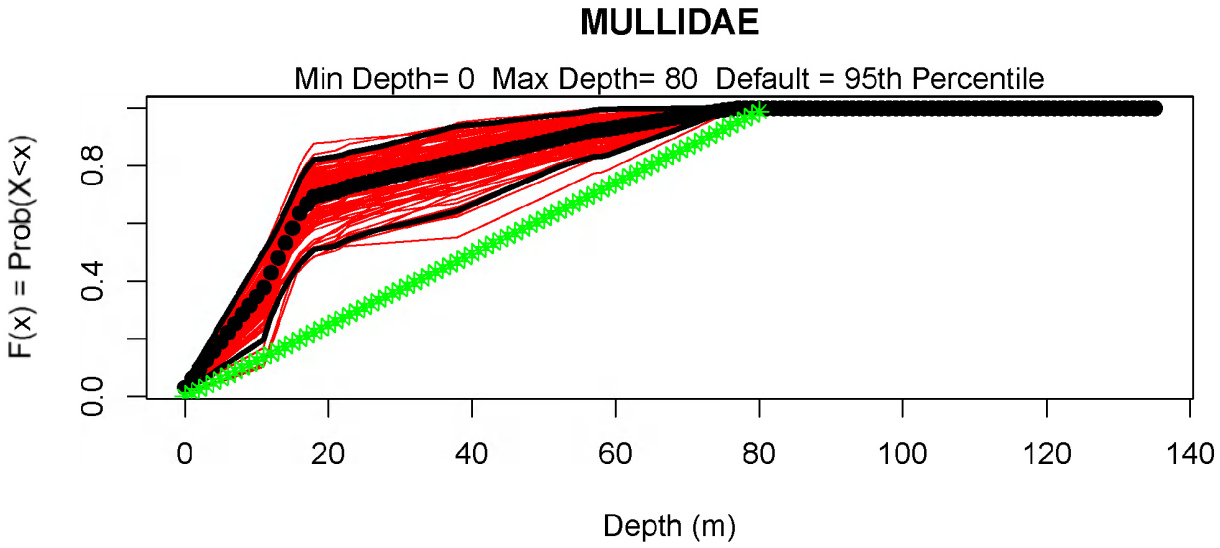

MONACANTHIDAE
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

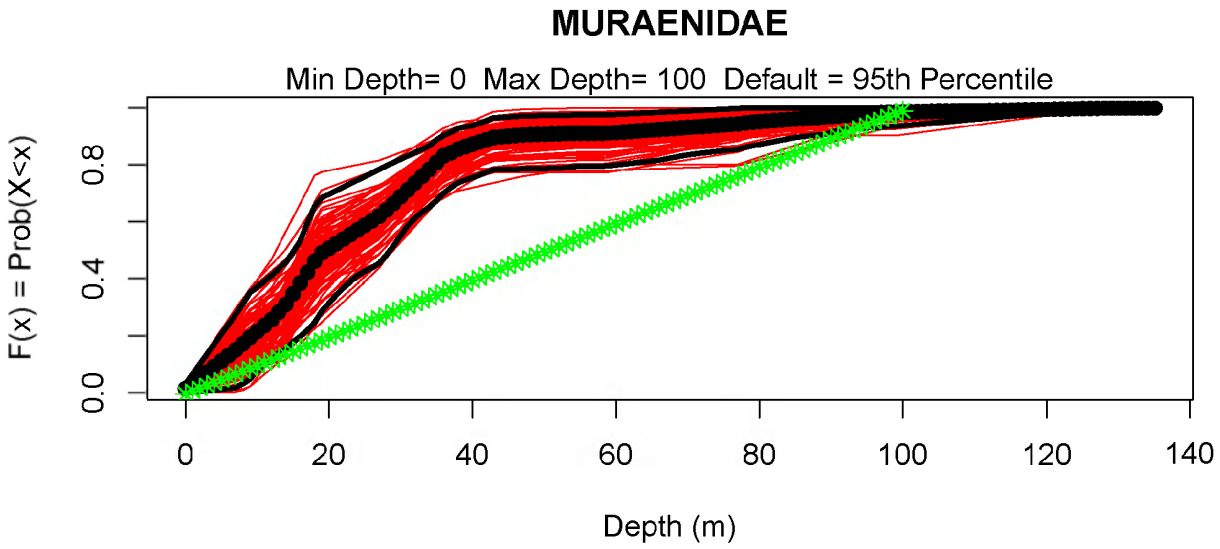

MONOLENE
Min Depth= 0 Max Depth= 80 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

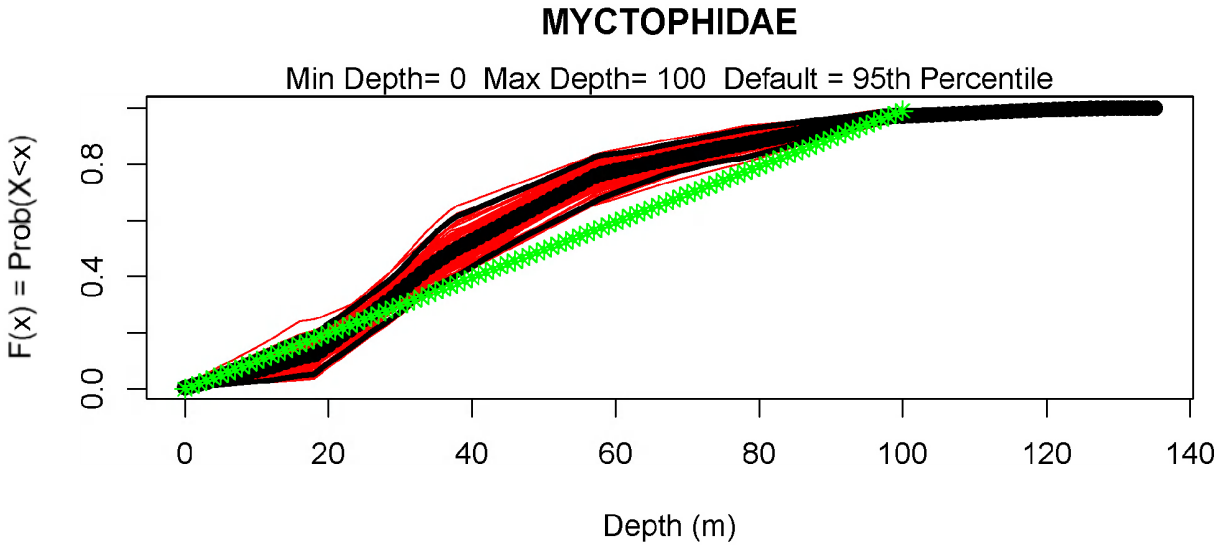

MORIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

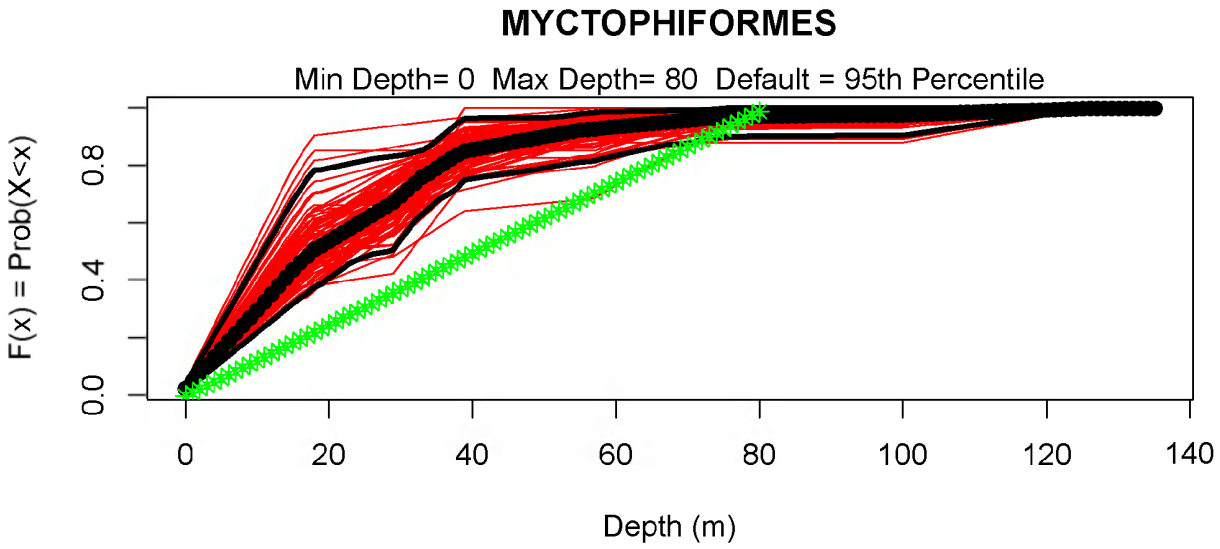

MORINGUIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

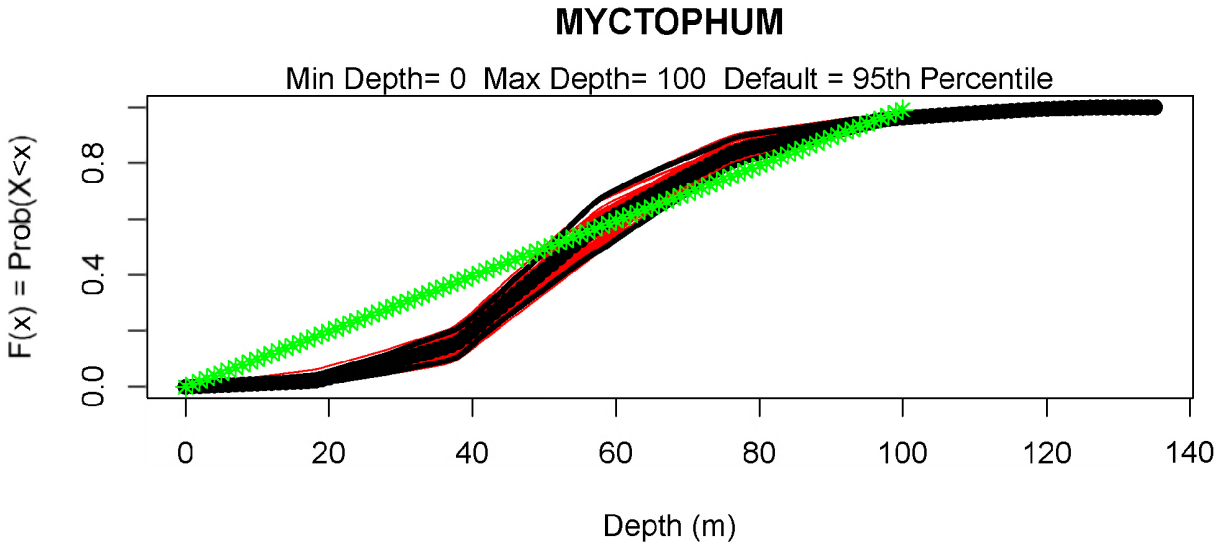

MUGIL
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

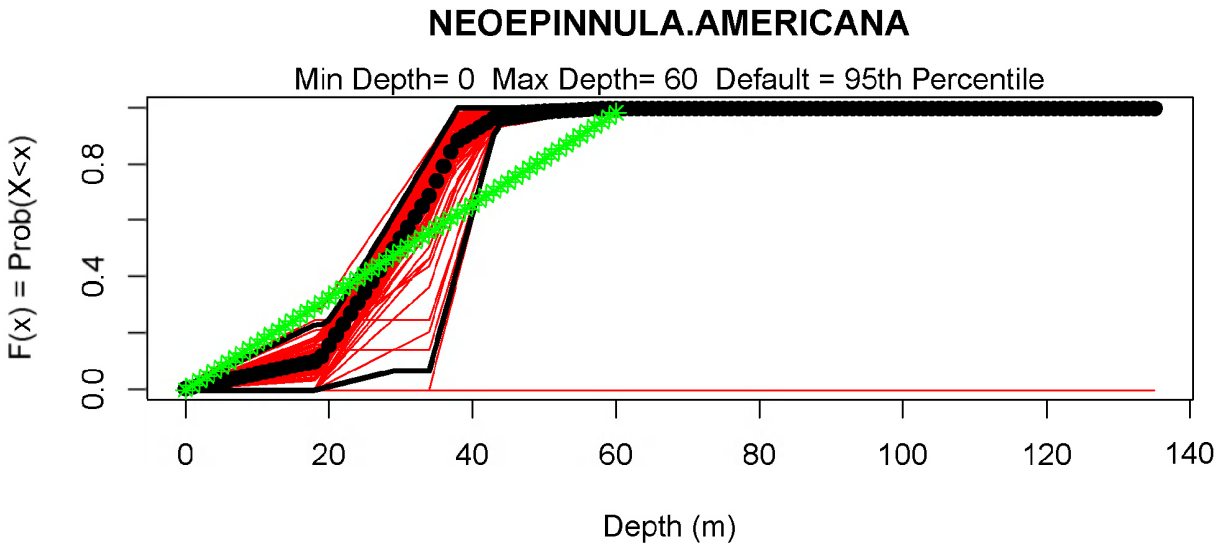

MULLIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

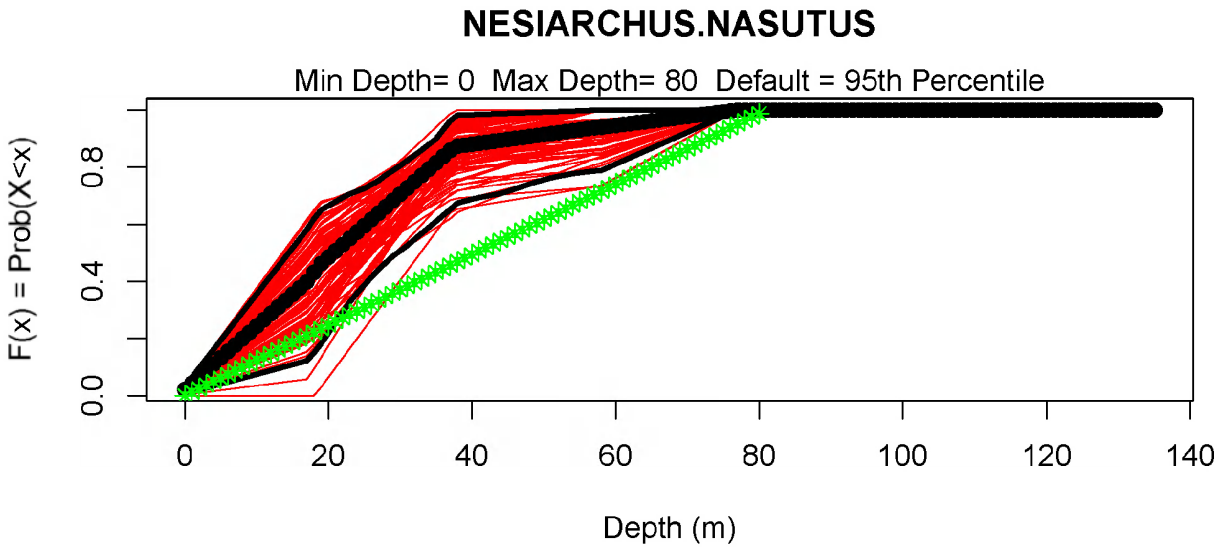

MURAENIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

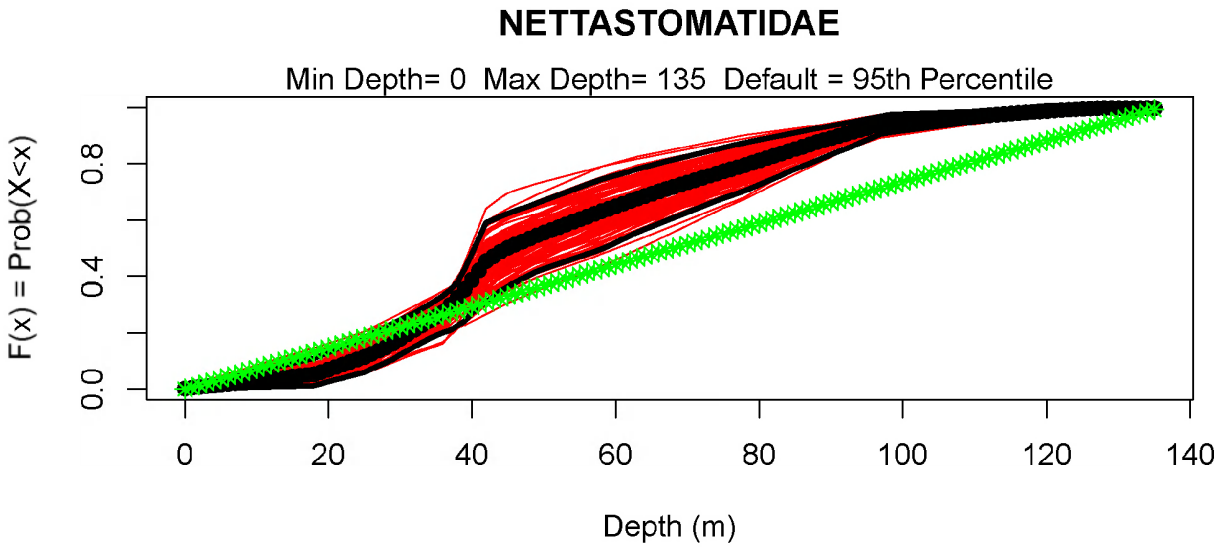

MYCTOPHIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

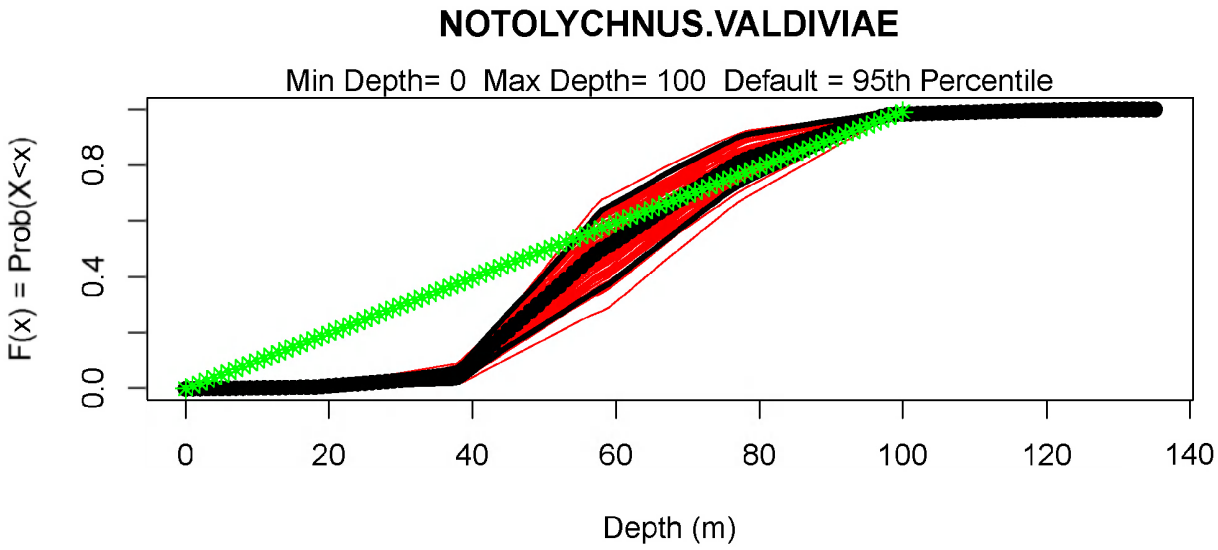

MYCTOPHIFORMES
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

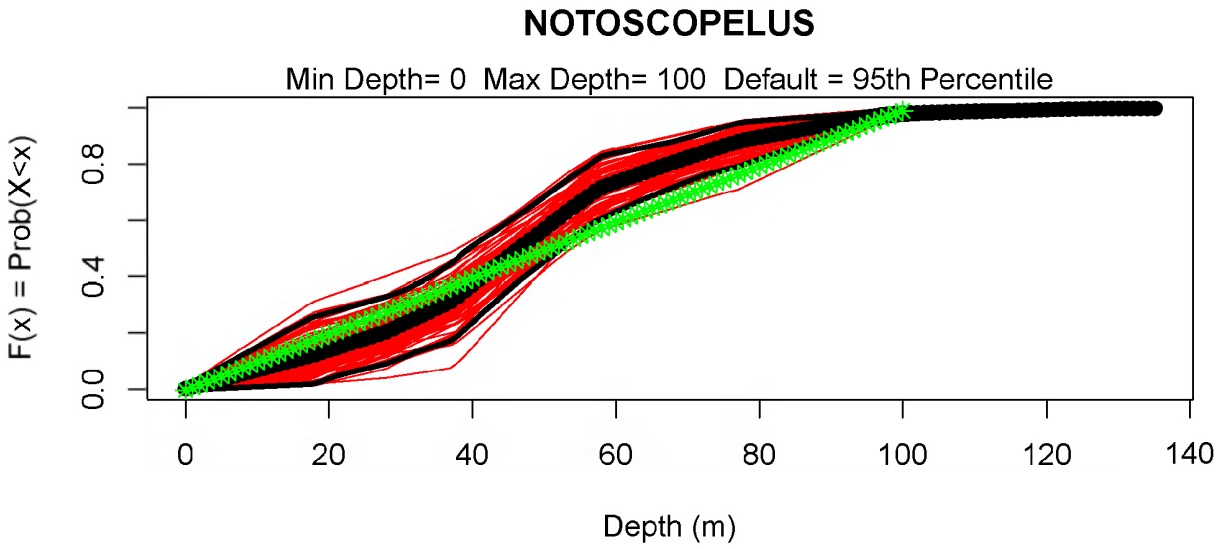

MYCTOPHUM
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

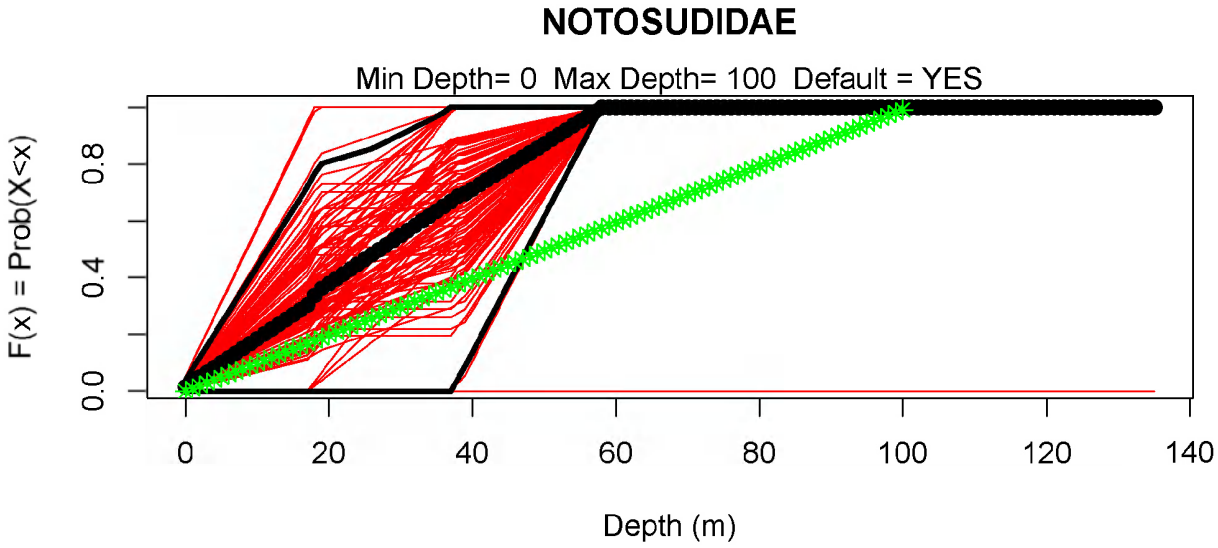

NEOEPINNULA.AMERICANA
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

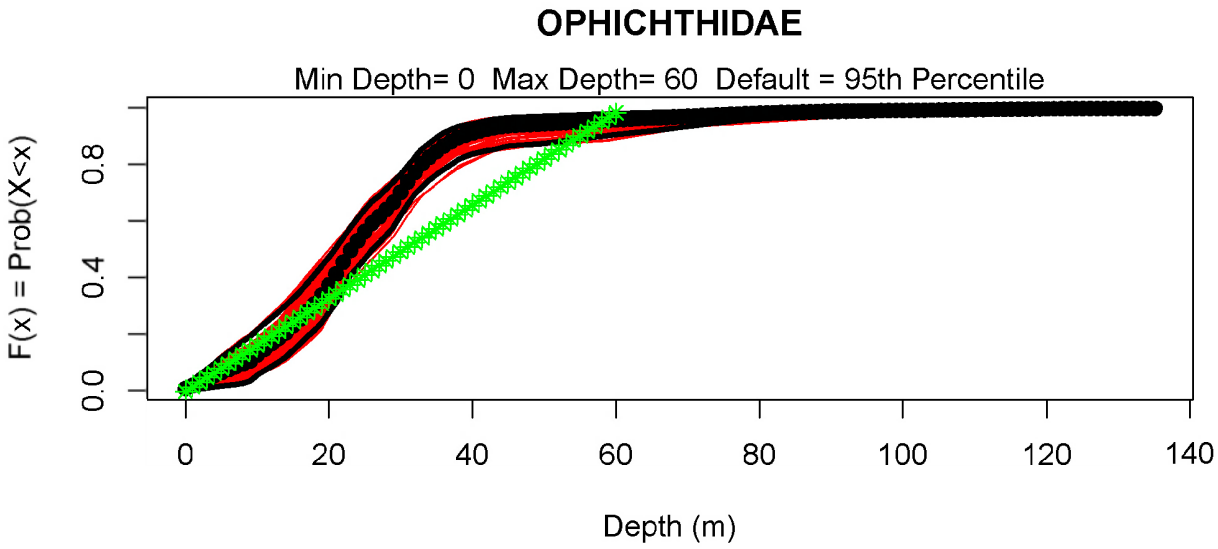

NESIARCHUS.NASUTUS
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

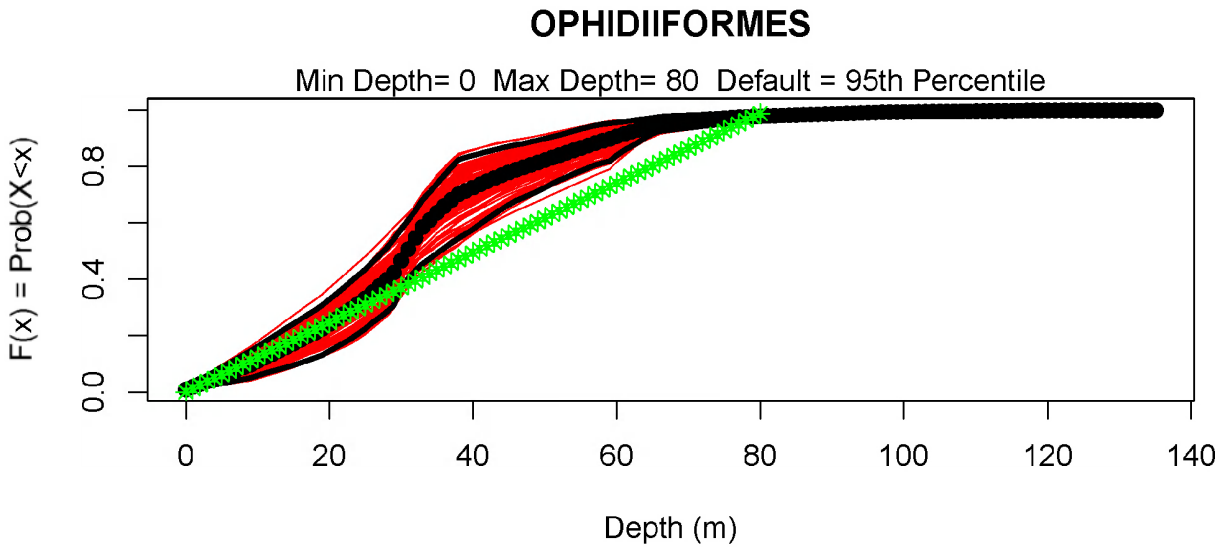

NETTASTOMATIDAE
Min Depth= 0 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

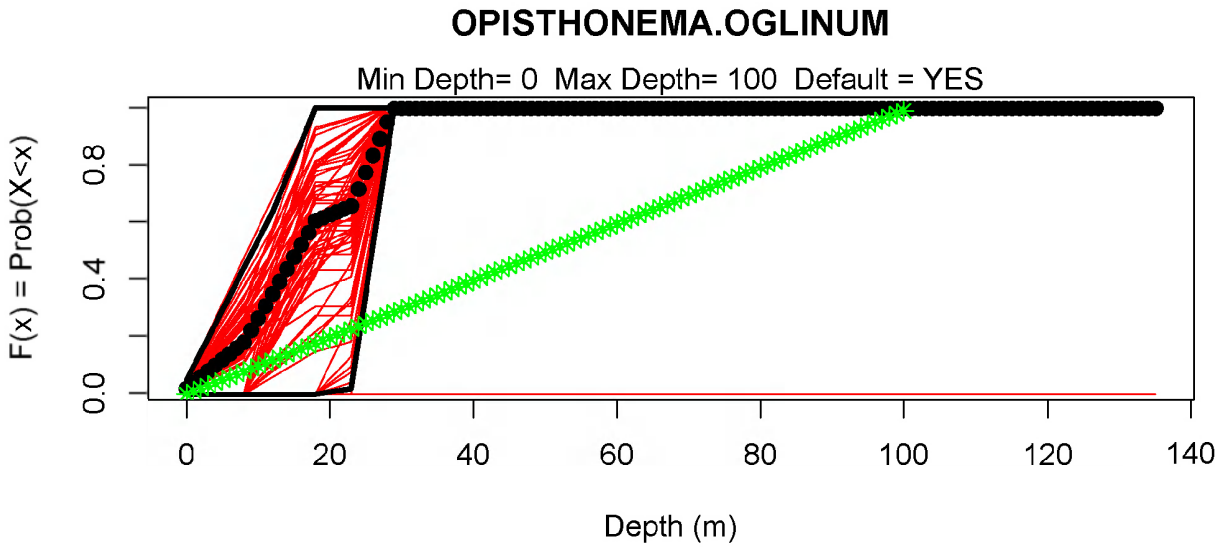

NOTOLYCHNUS.VALDIVIAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


NOTOSCOPELUS
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

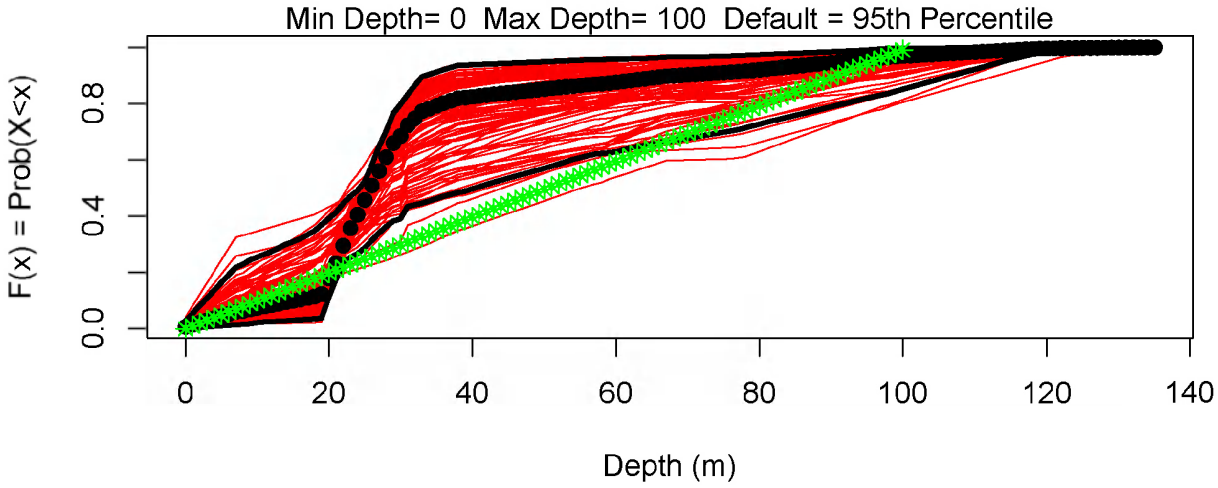

NOTOSUDIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


OPHICHTHIDAE
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

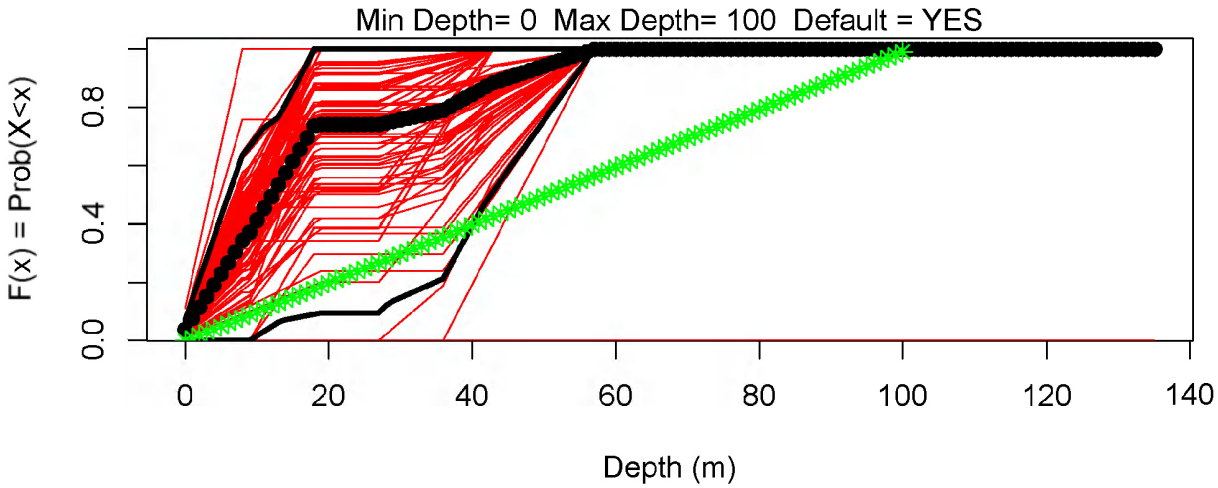

OPHIDIIFORMES
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


OPISTHONEMA.OGLINUM
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

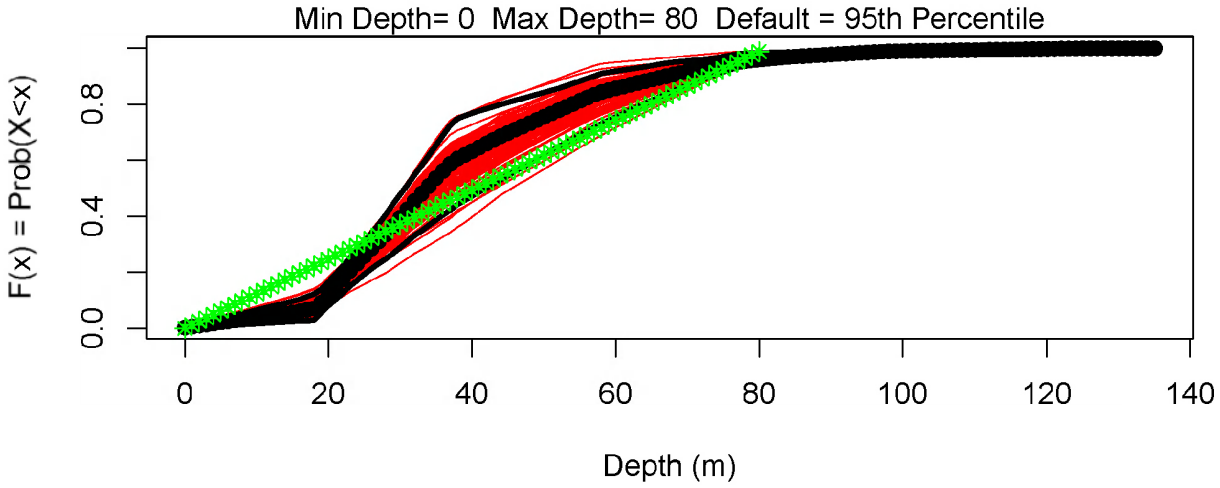
OPISTOGNATHIDAE



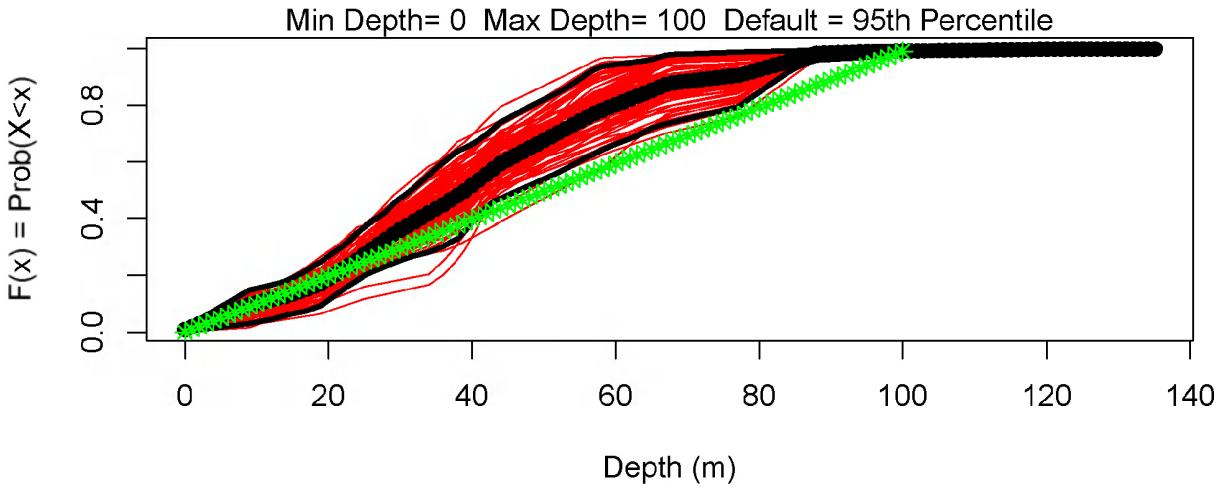
OSTRACIIDAE

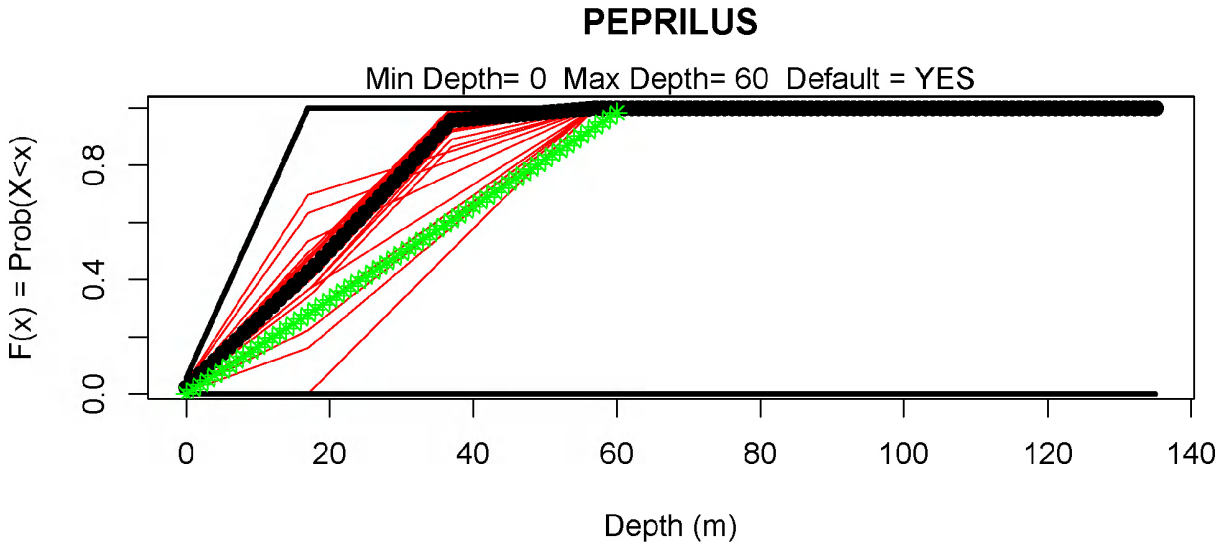


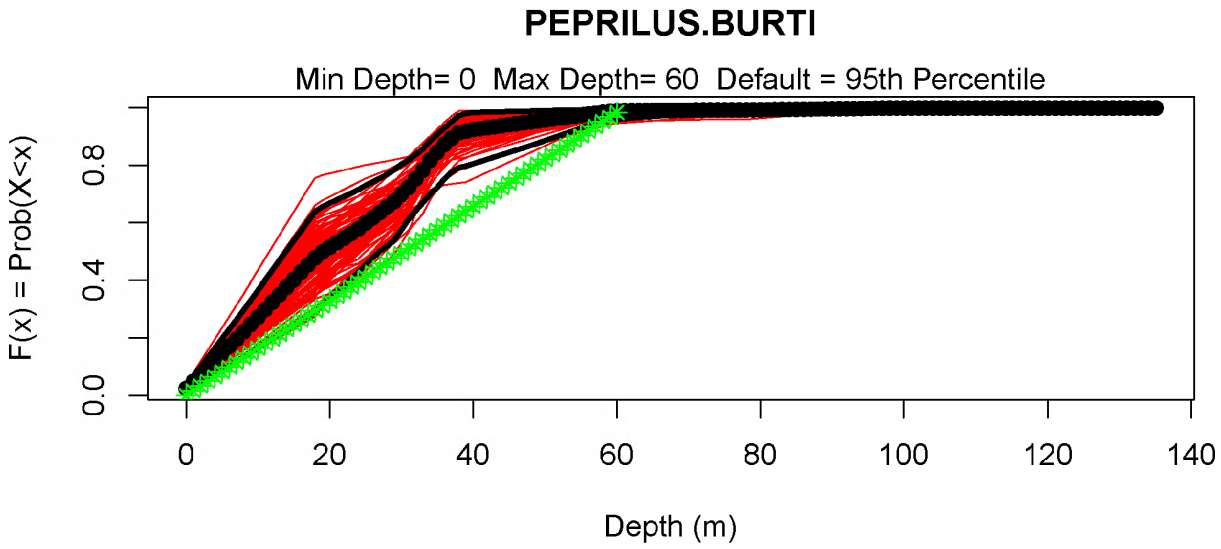
PARALEPIDIDAE

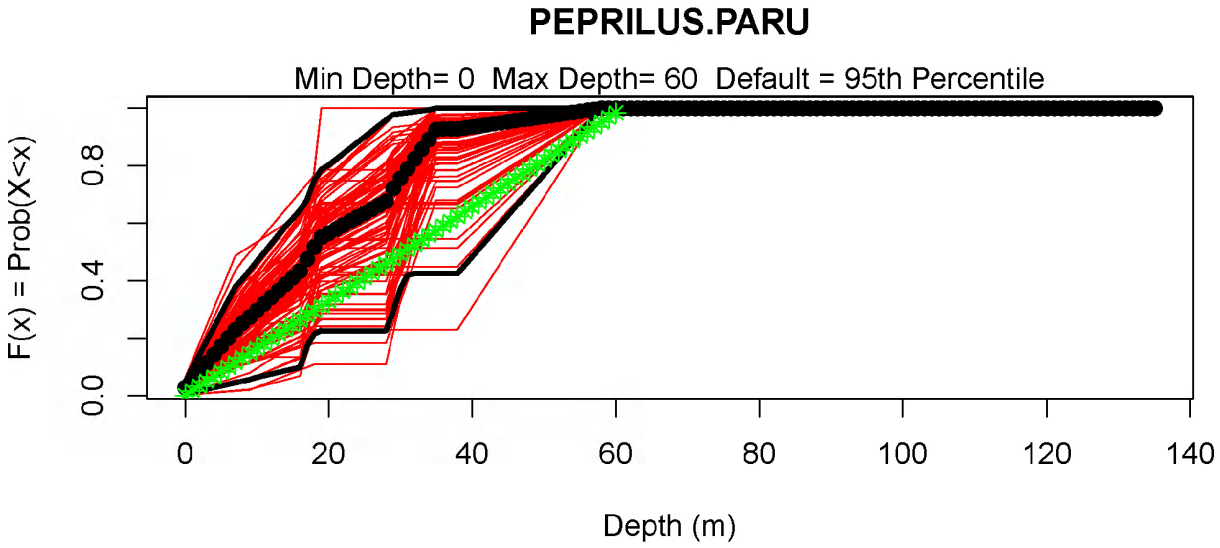


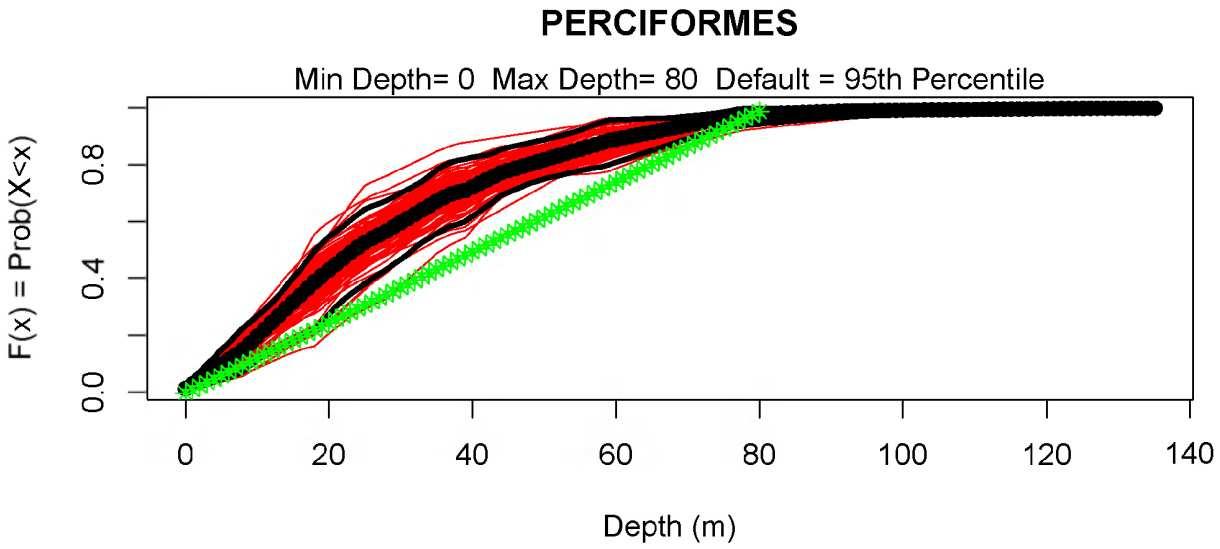
PARALICHTHYIDAE

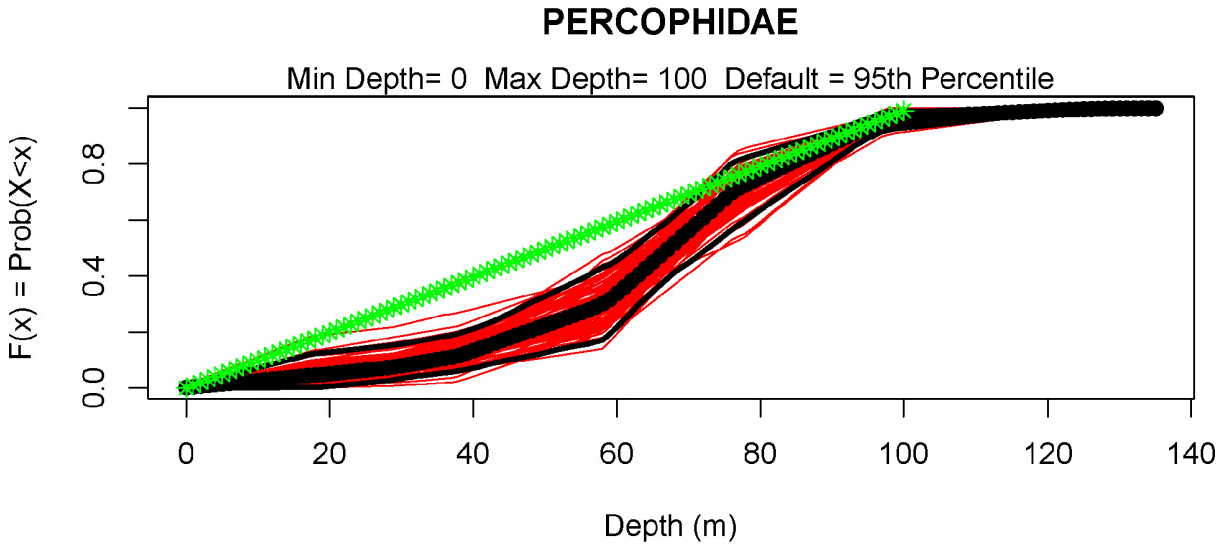


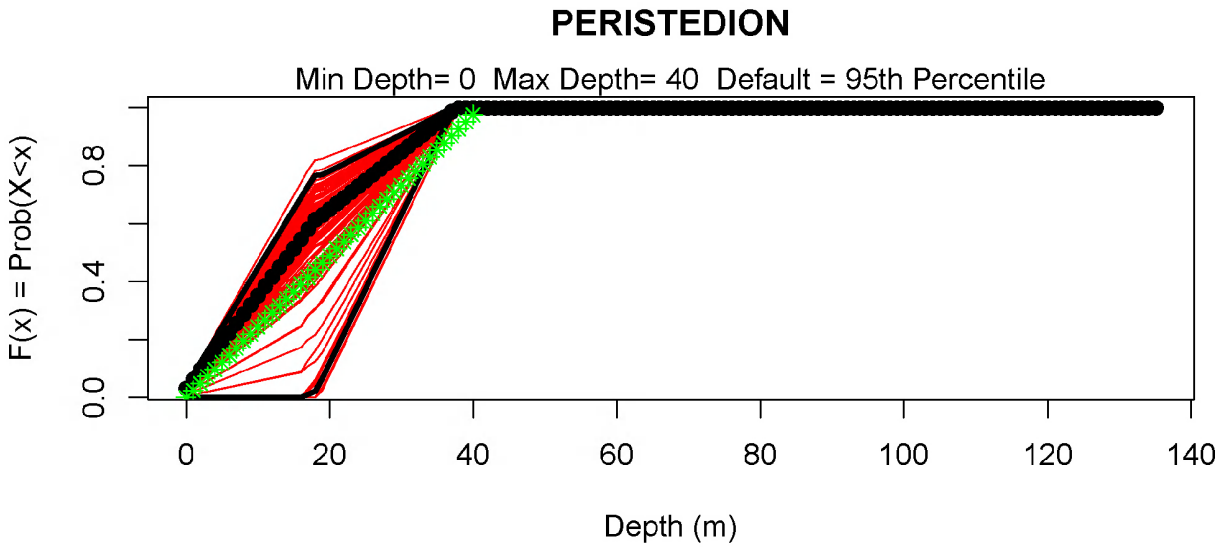

PEPRILUS
Min Depth= 0 Max Depth= 60 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

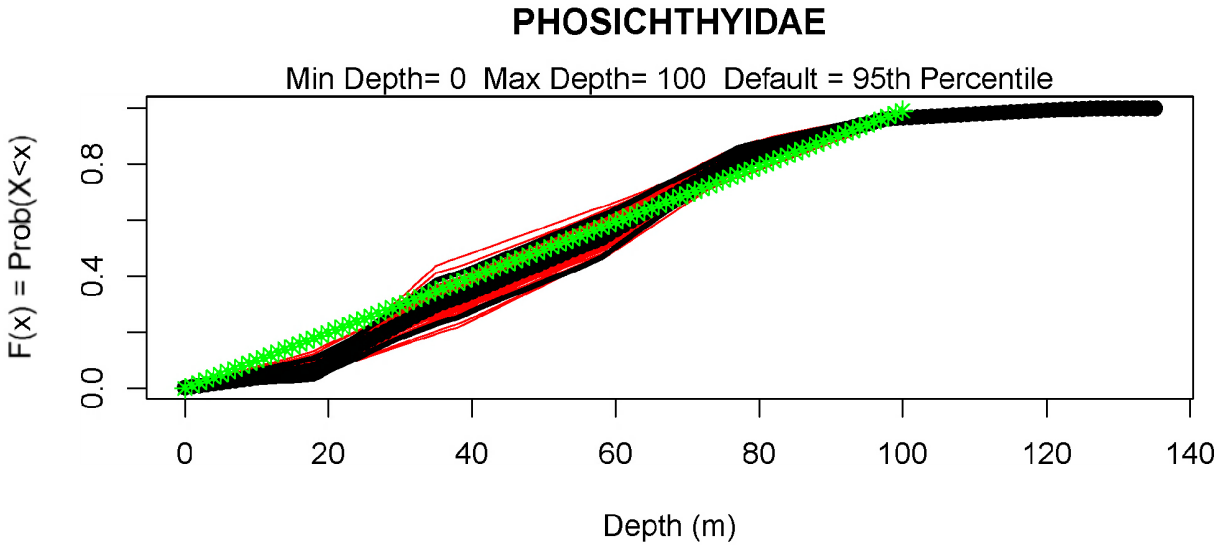

PEPRILUS.BURTI
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

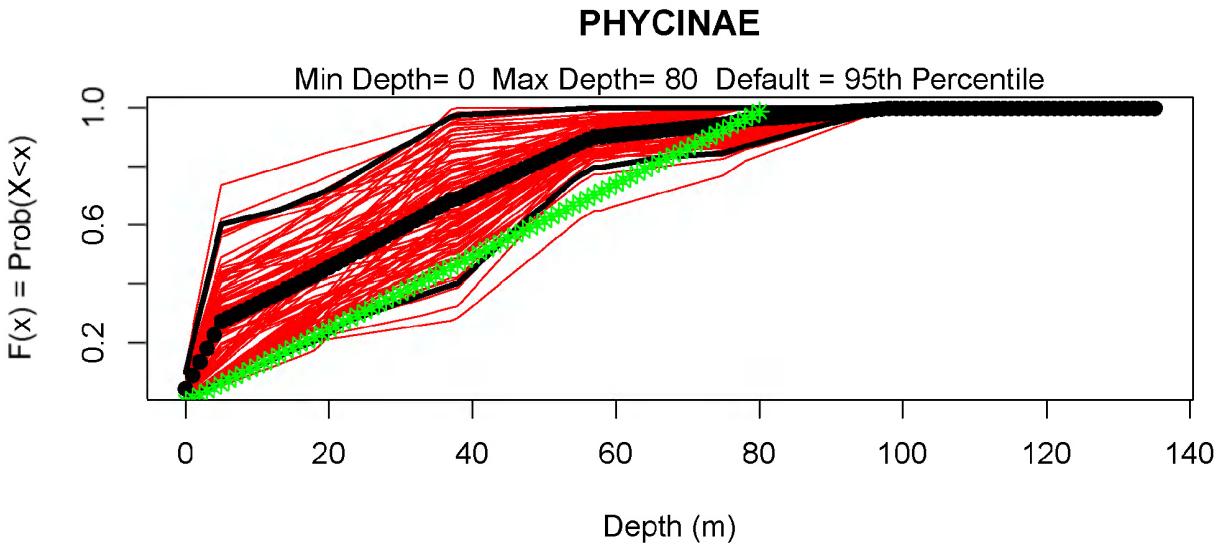

PEPRILUS.PARU
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

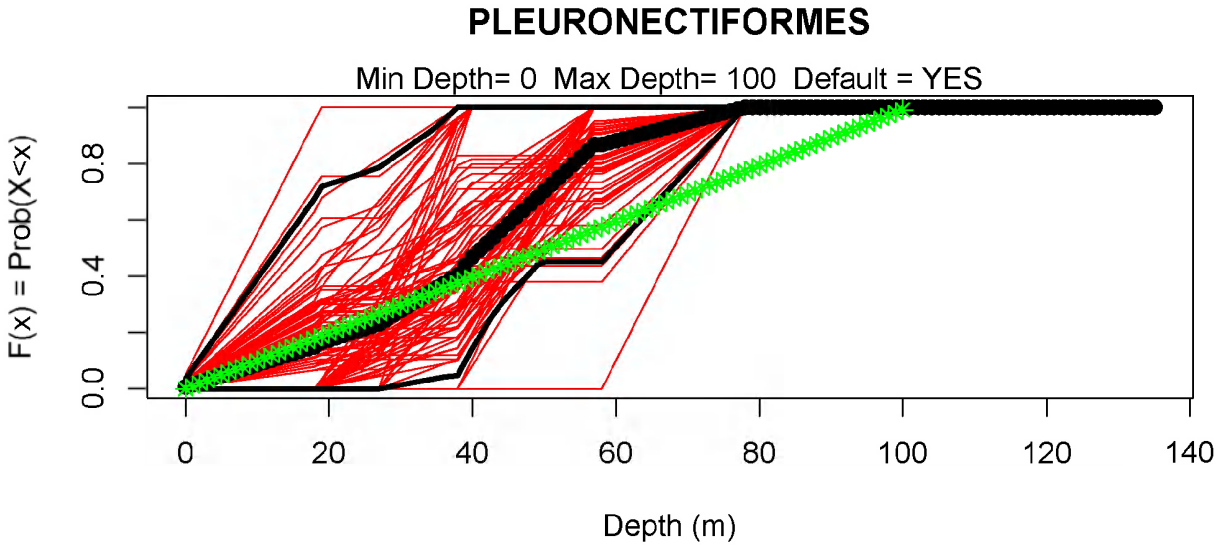

PERCIFORMES
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

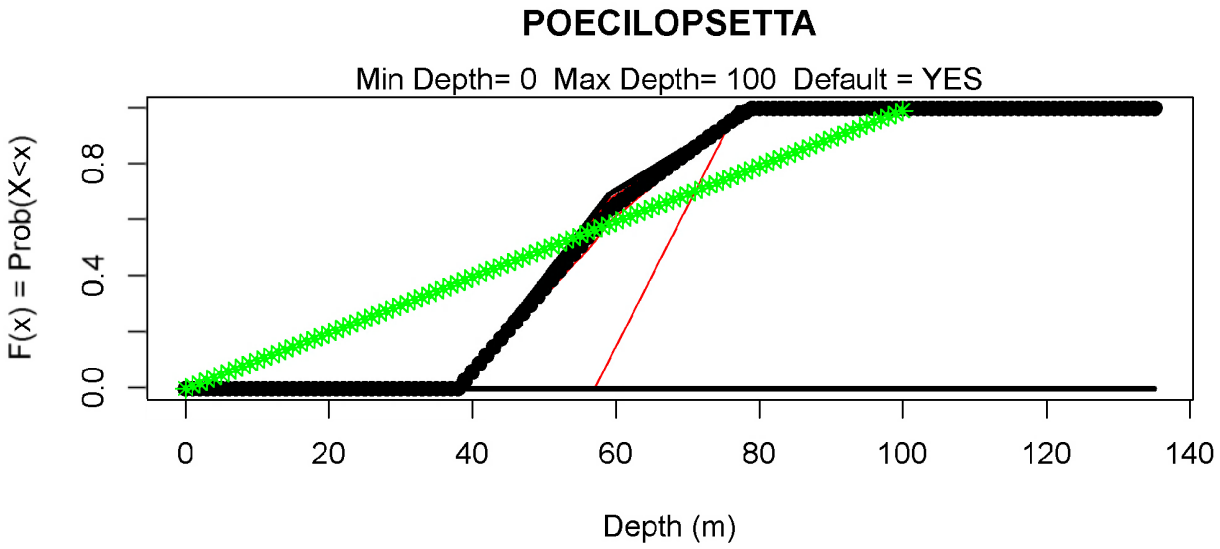

PERCOPHIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

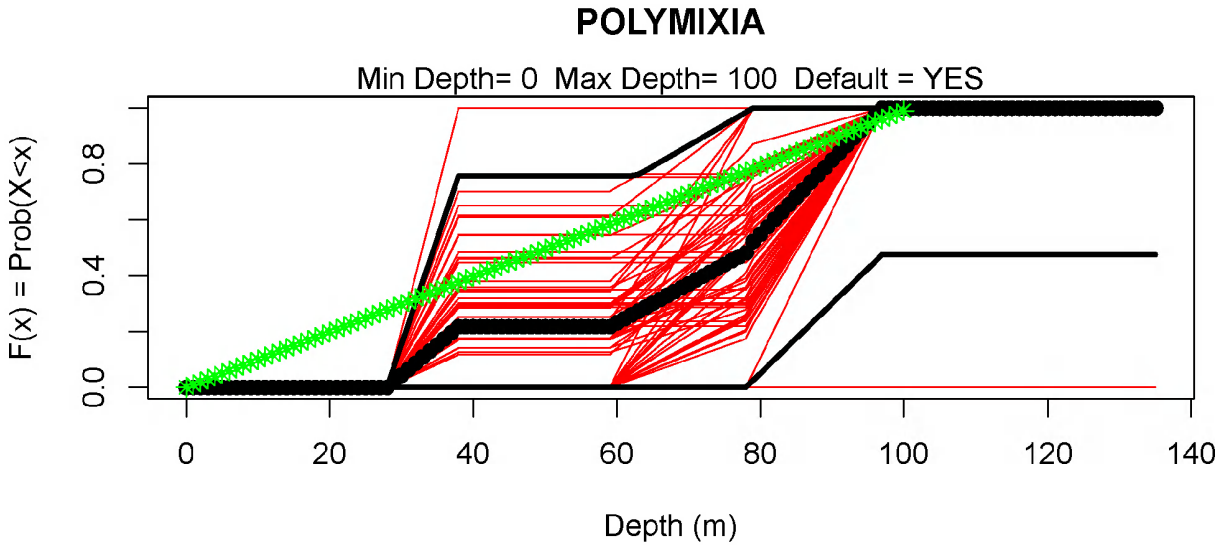

PERISTEDION
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

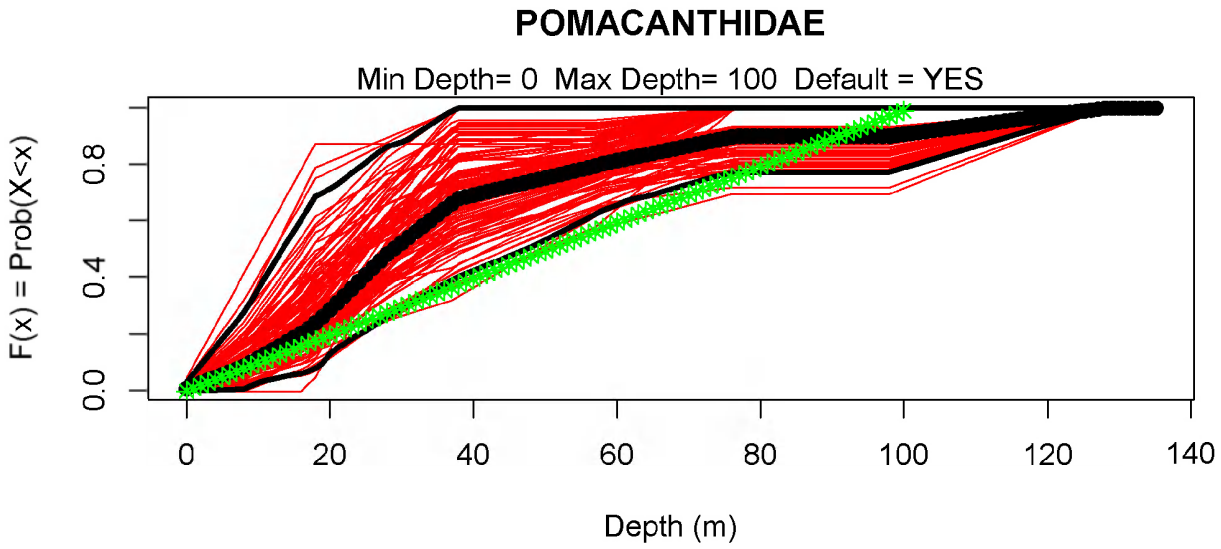

PHOSICHTHYIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

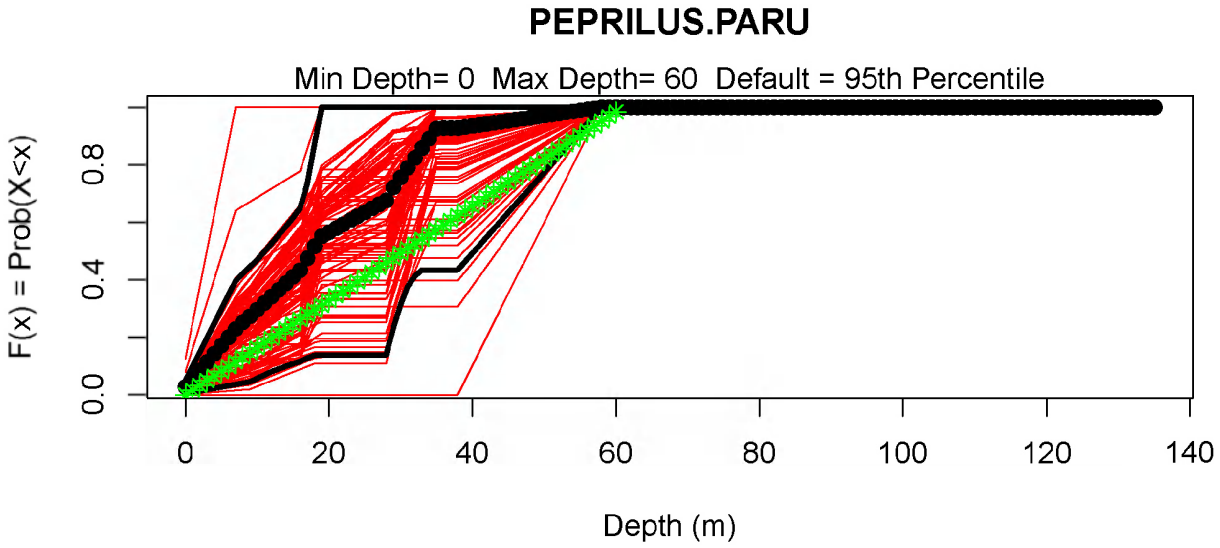

PHYCINAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

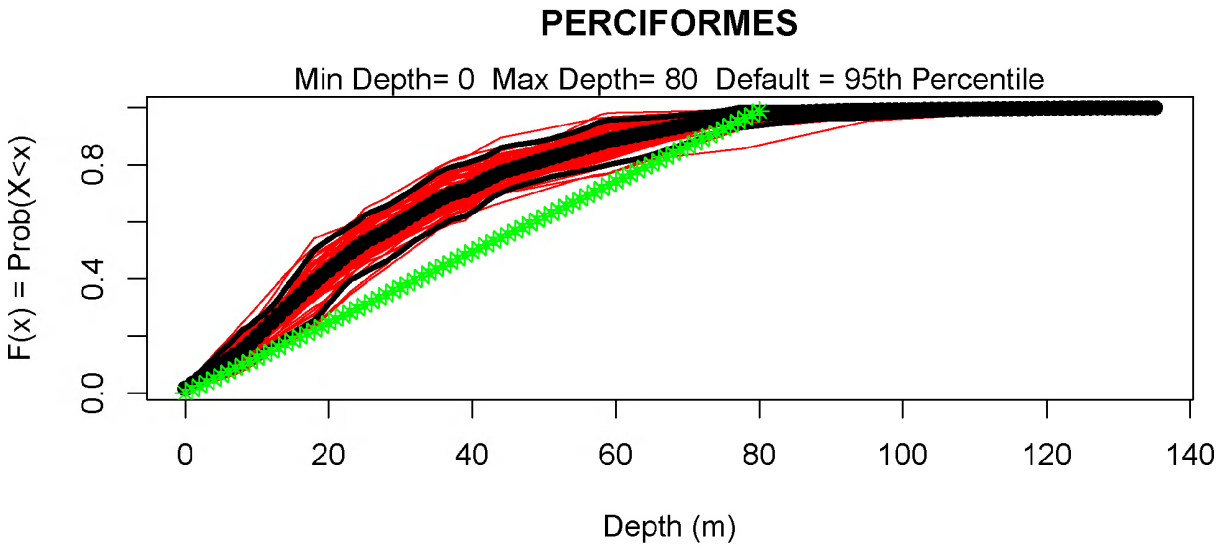

PLEURONECTIFORMES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

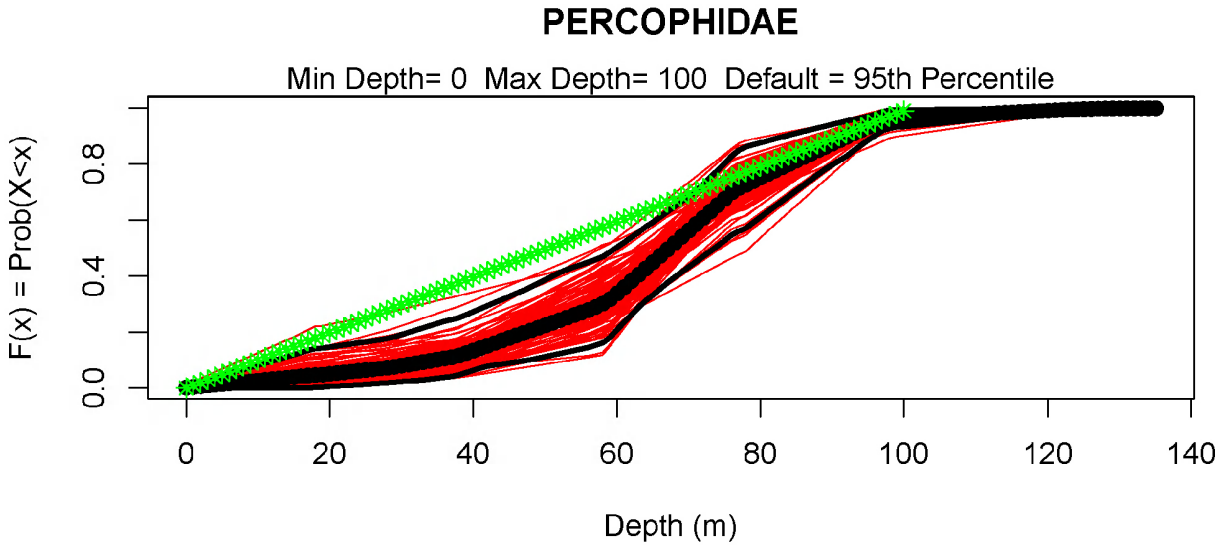

POECILOPSETTA
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

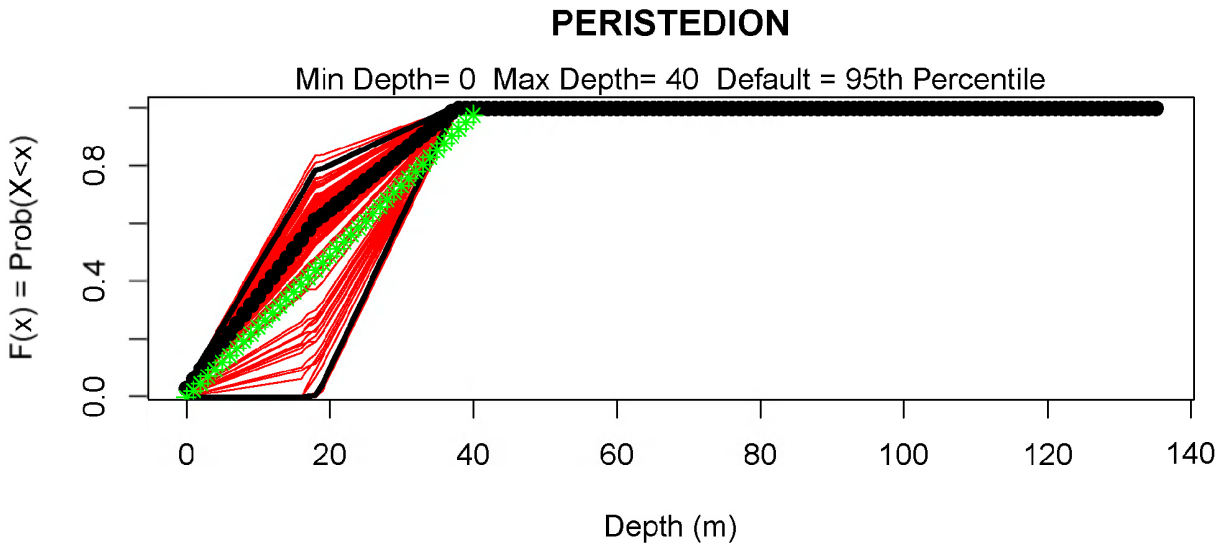

POLYMIXIA
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

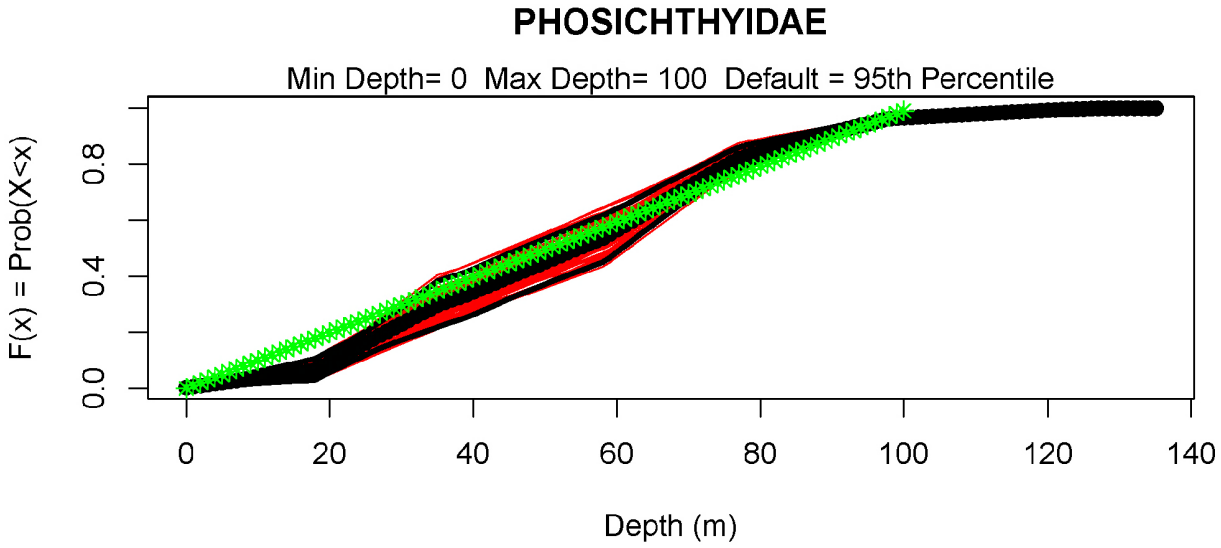

POMACANTHIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

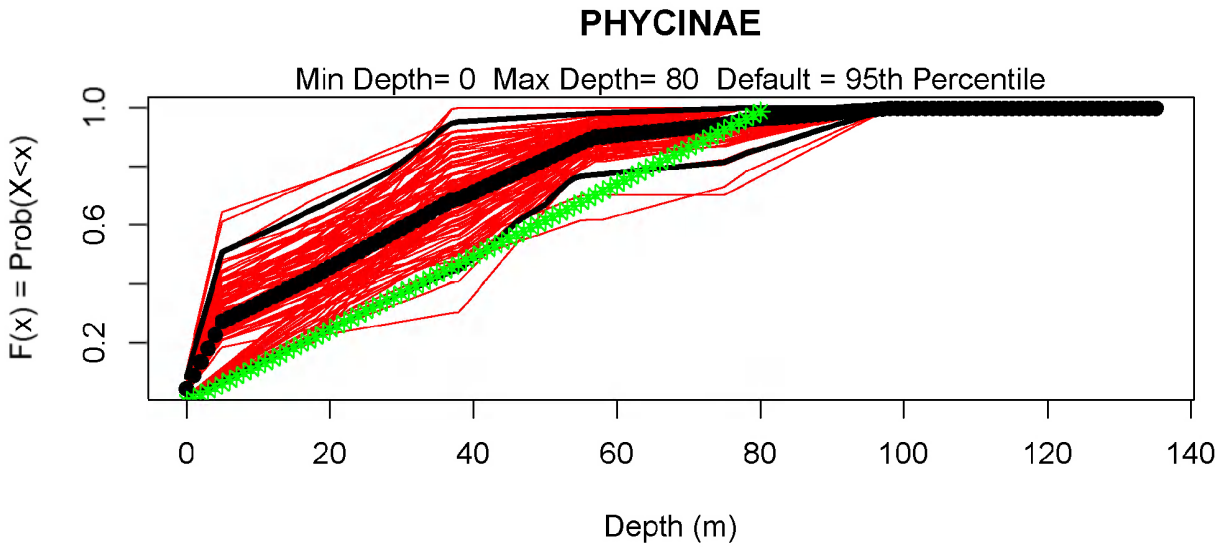

PEPRILUS.PARU
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

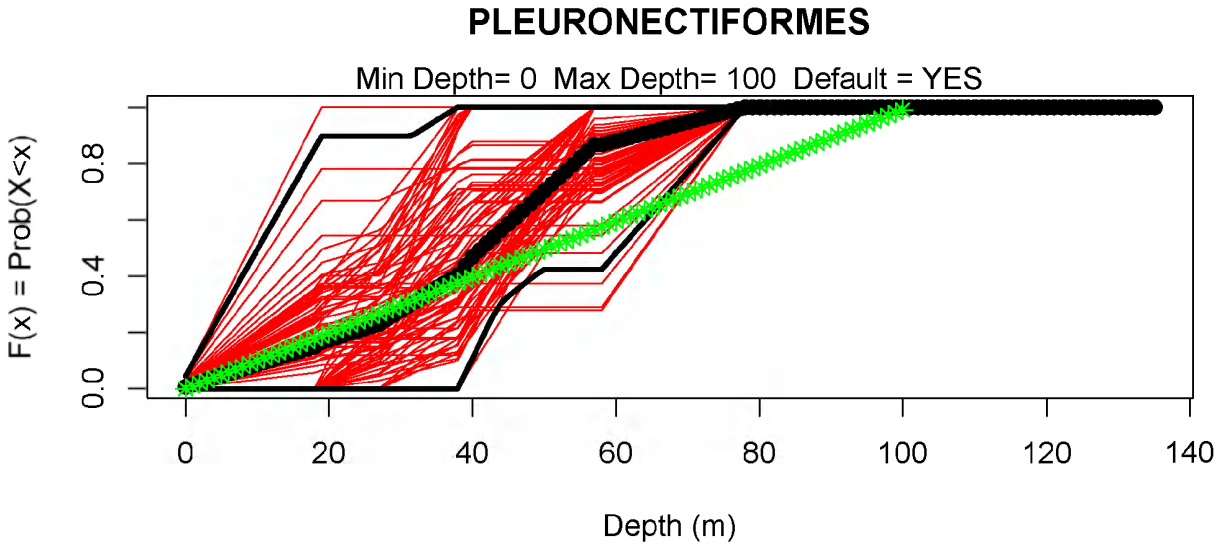

PERCIFORMES
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

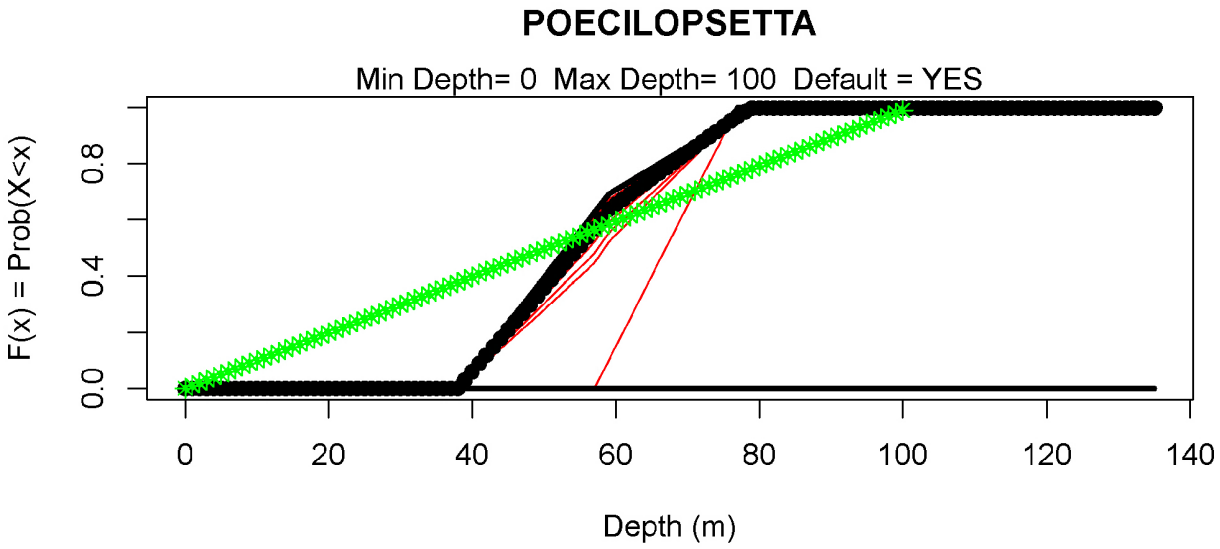

PERCOPHIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

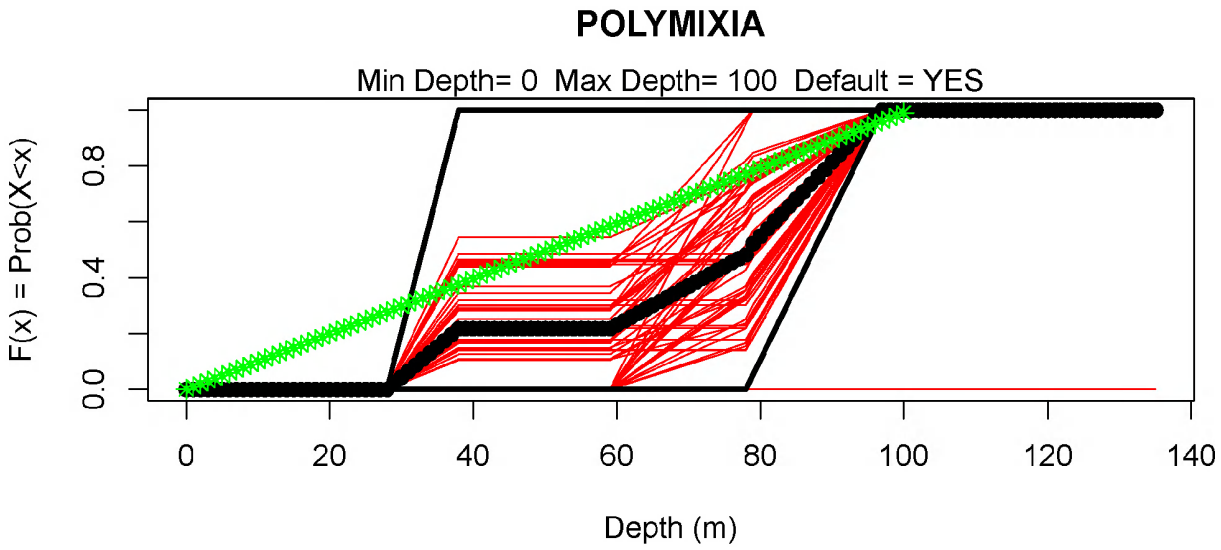

PERISTEDION
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

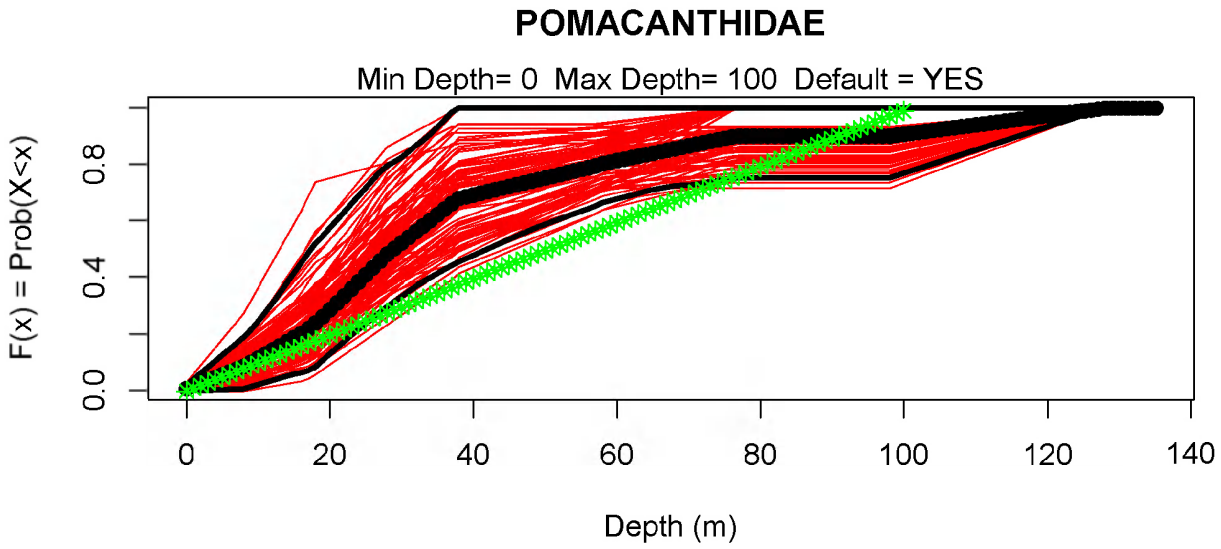

PHOSICHTHYIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

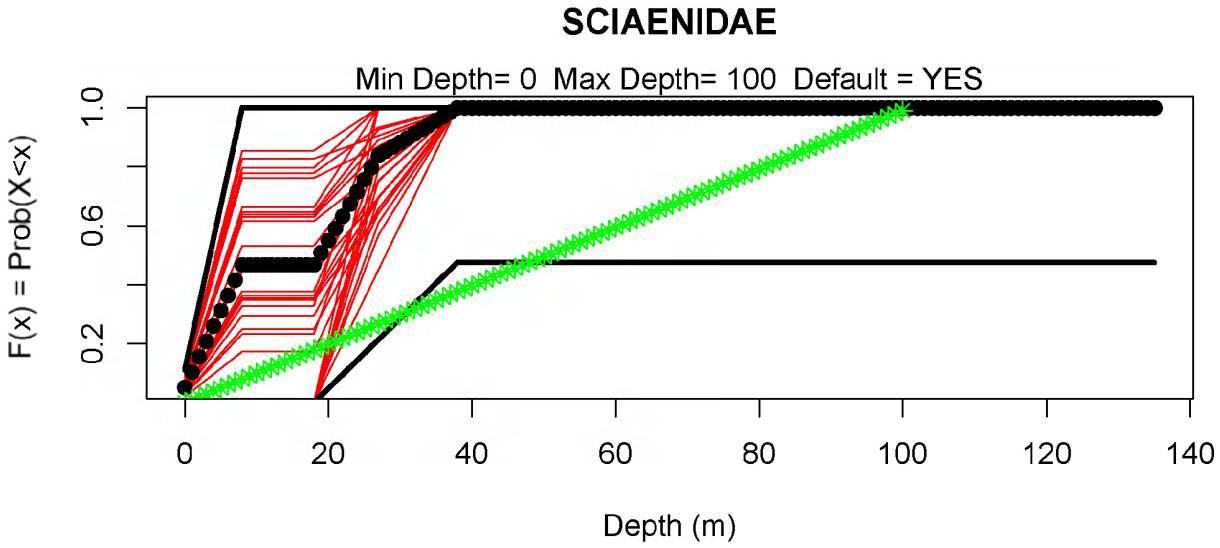

PHYCINAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

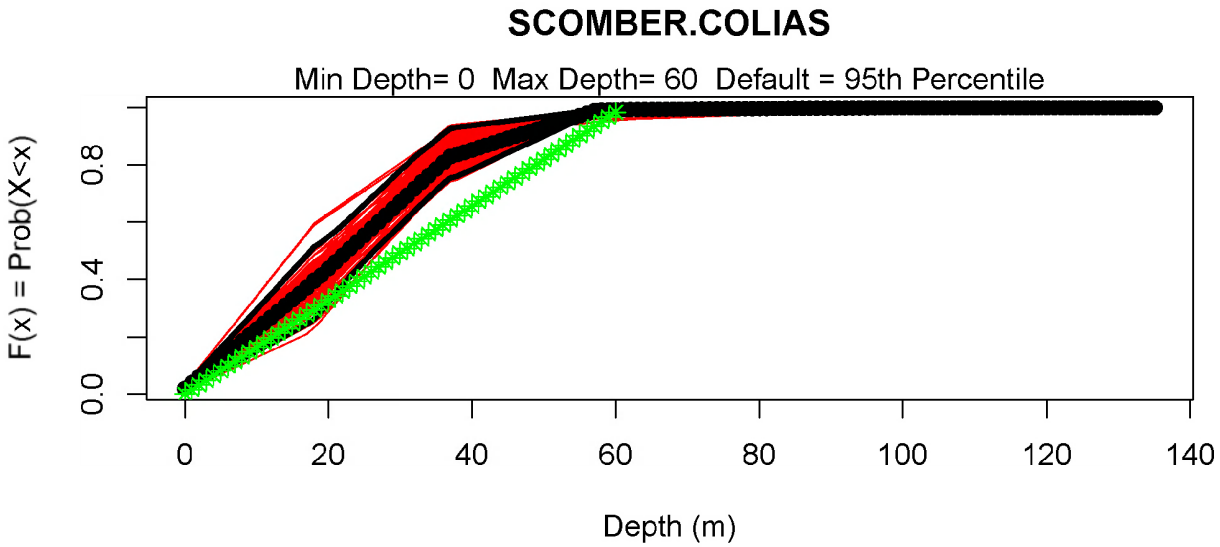

PLEURONECTIFORMES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

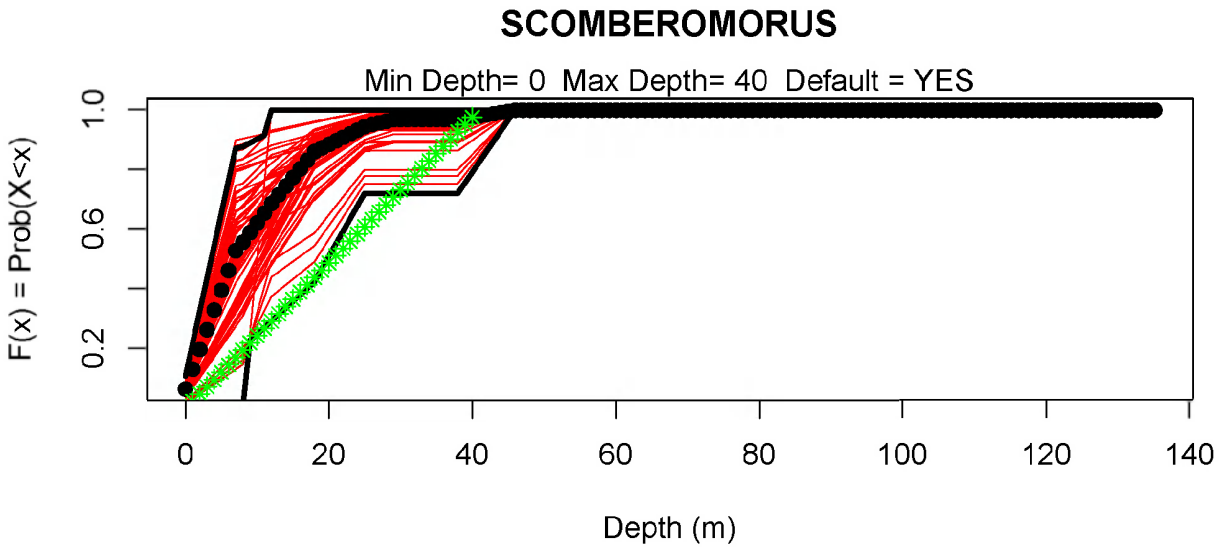

POECILOPSETTA
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

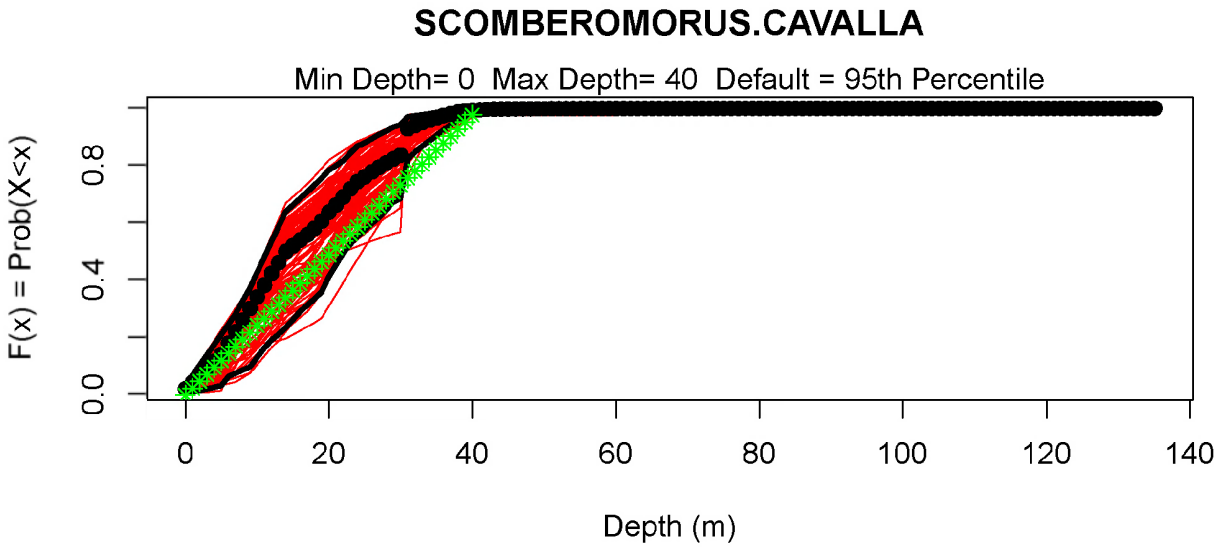

POLYMIXIA
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

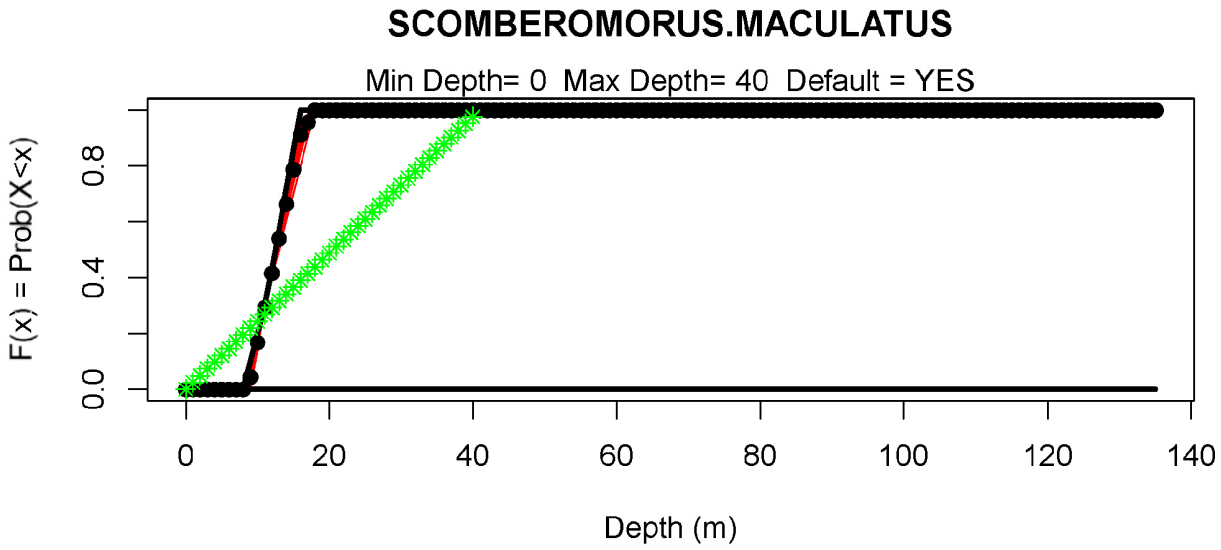

POMACANTHIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

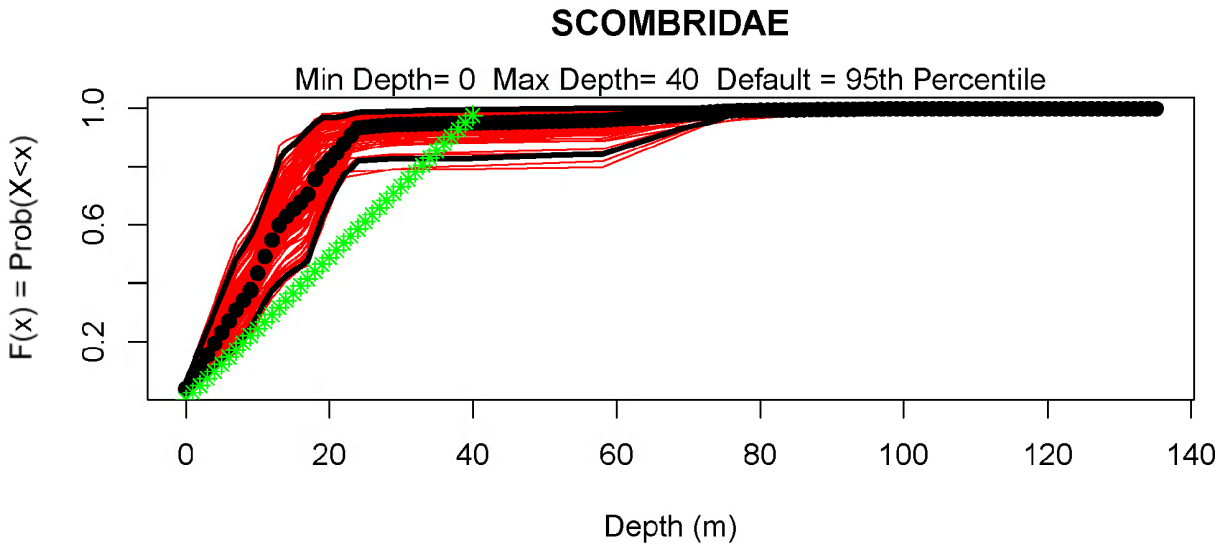

SCIAENIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

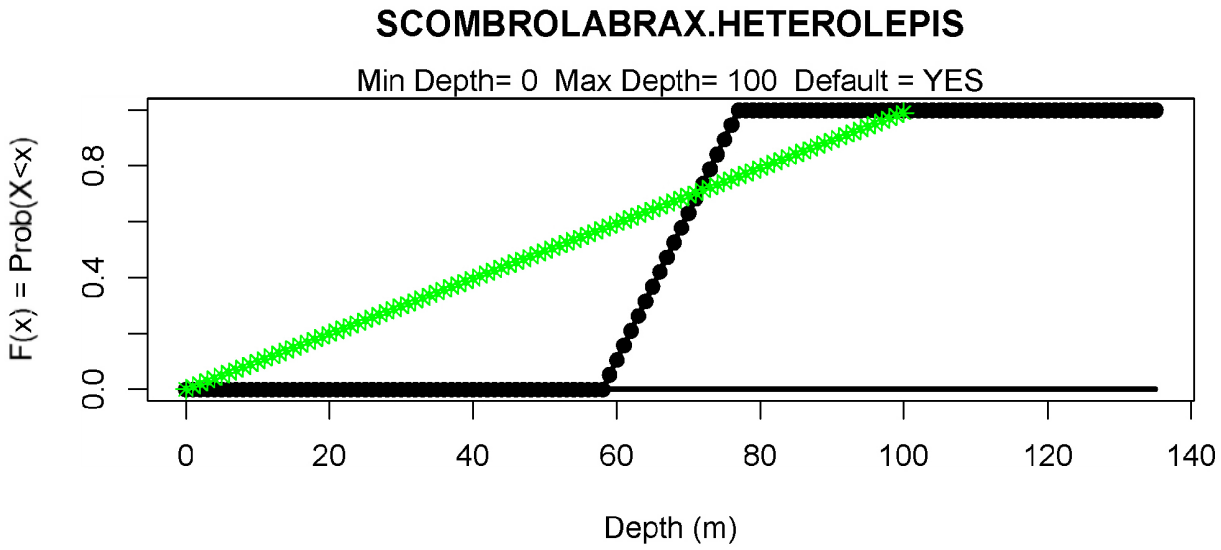

SCOMBER.COLIAS
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

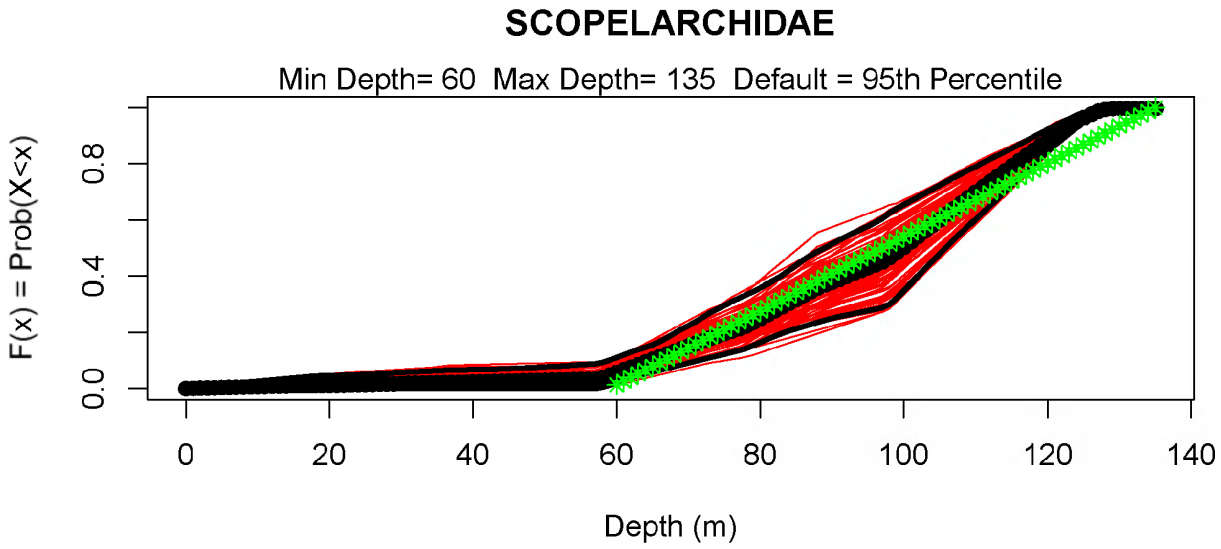

SCOMBEROMORUS
Min Depth= 0 Max Depth= 40 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

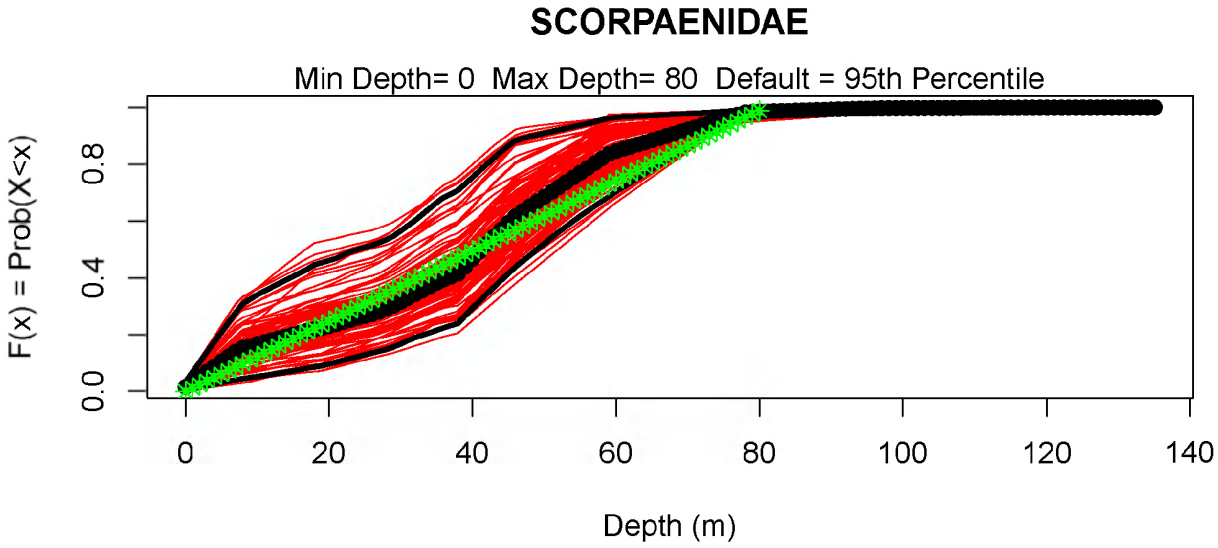

SCOMBEROMORUS.CAVALLA
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

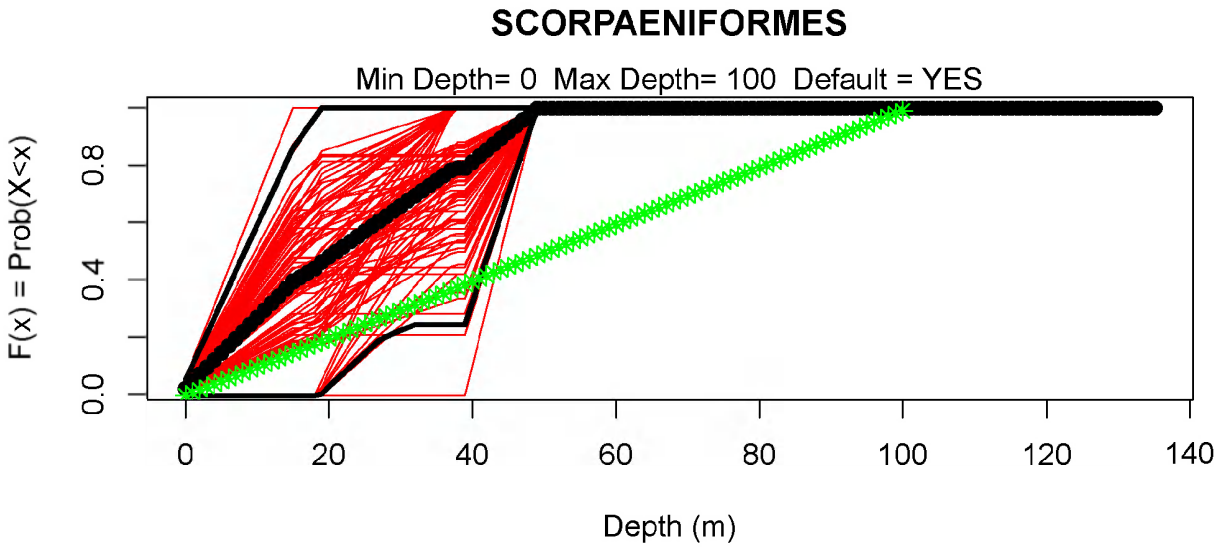

SCOMBEROMORUS.MACULATUS
Min Depth= 0 Max Depth= 40 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

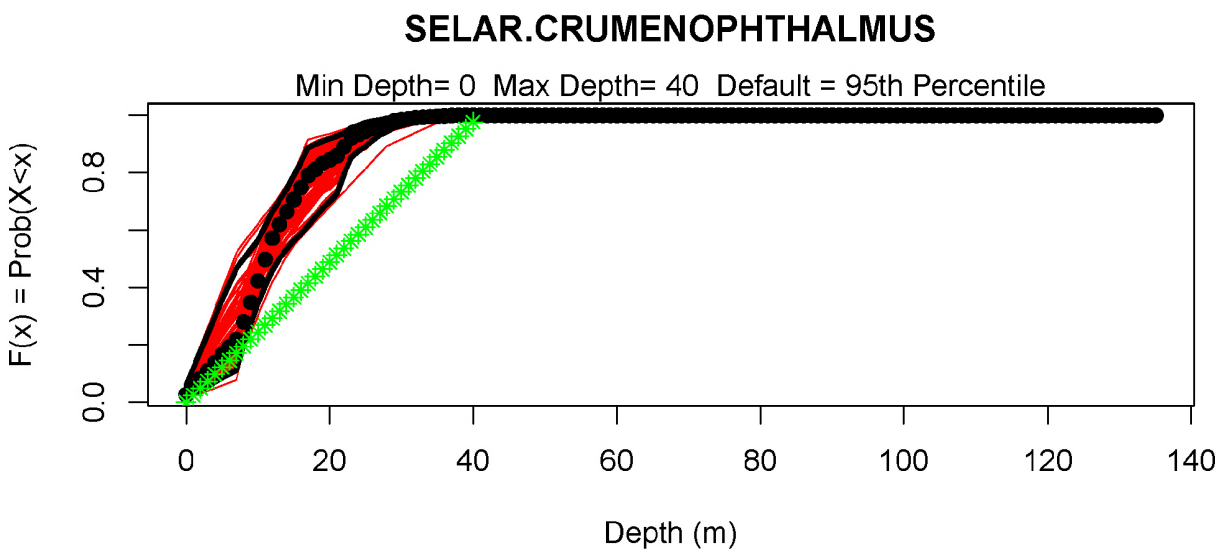

SCOMBRIDAE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

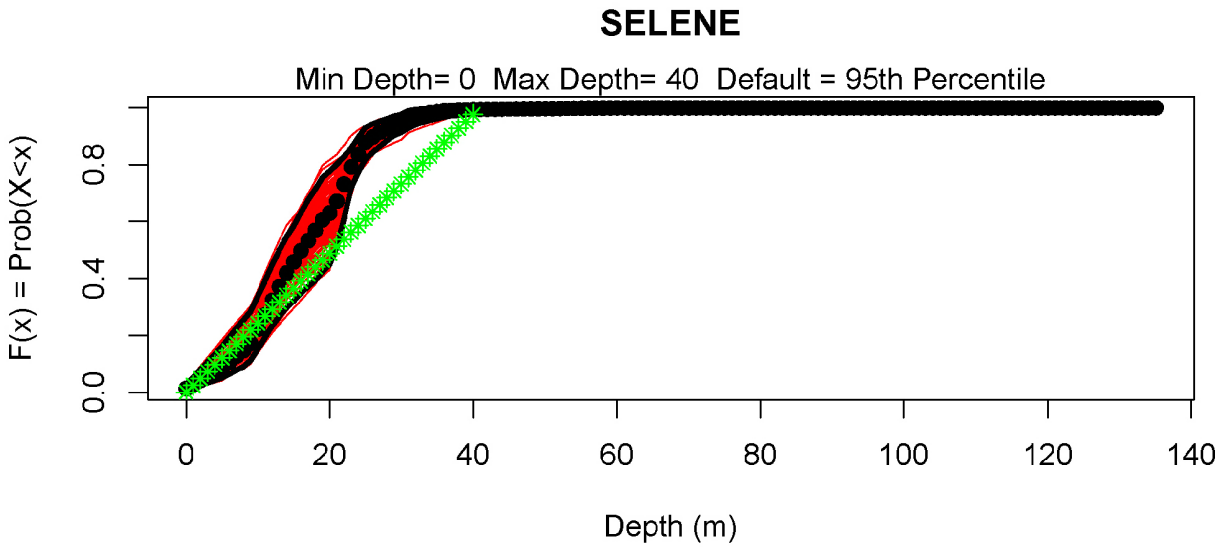

SCOMBROLABRAX.HETEROLEPIS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

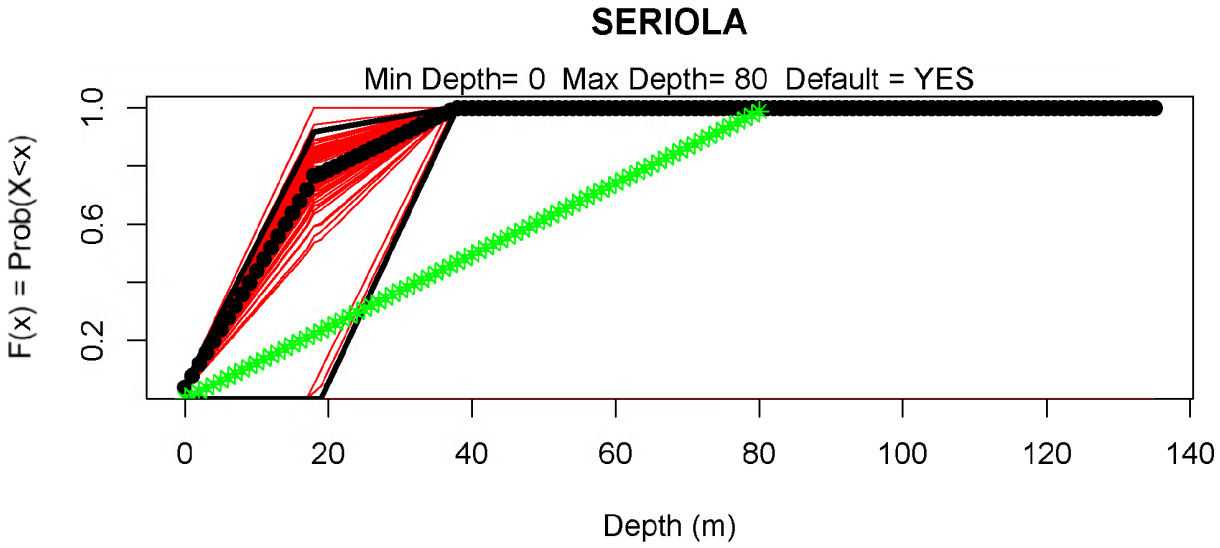

SCOPELARCHIDAE
Min Depth= 60 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

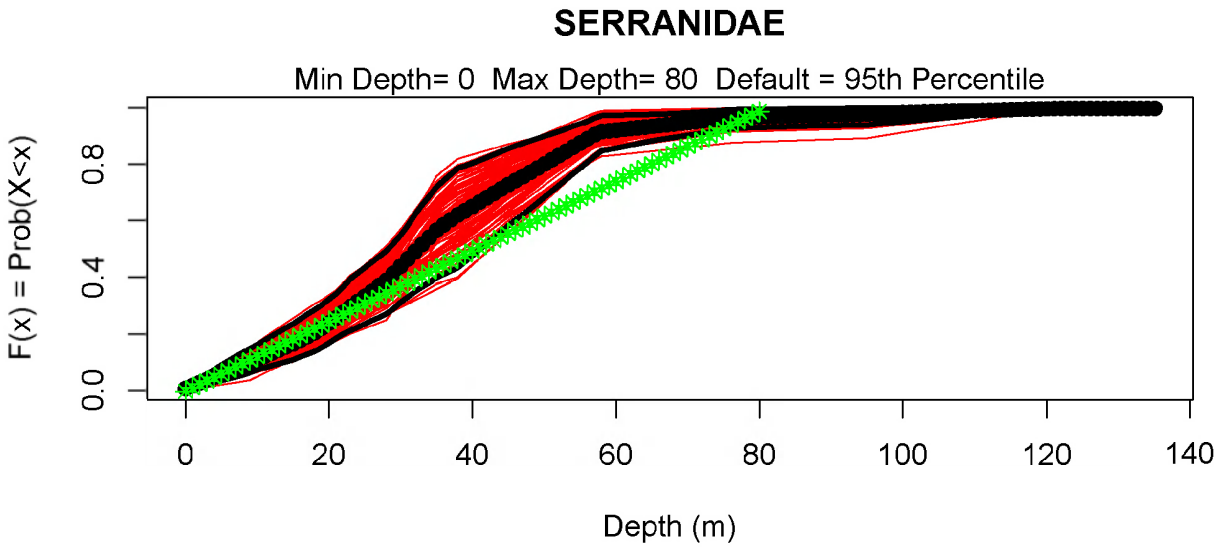

SCORPAENIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

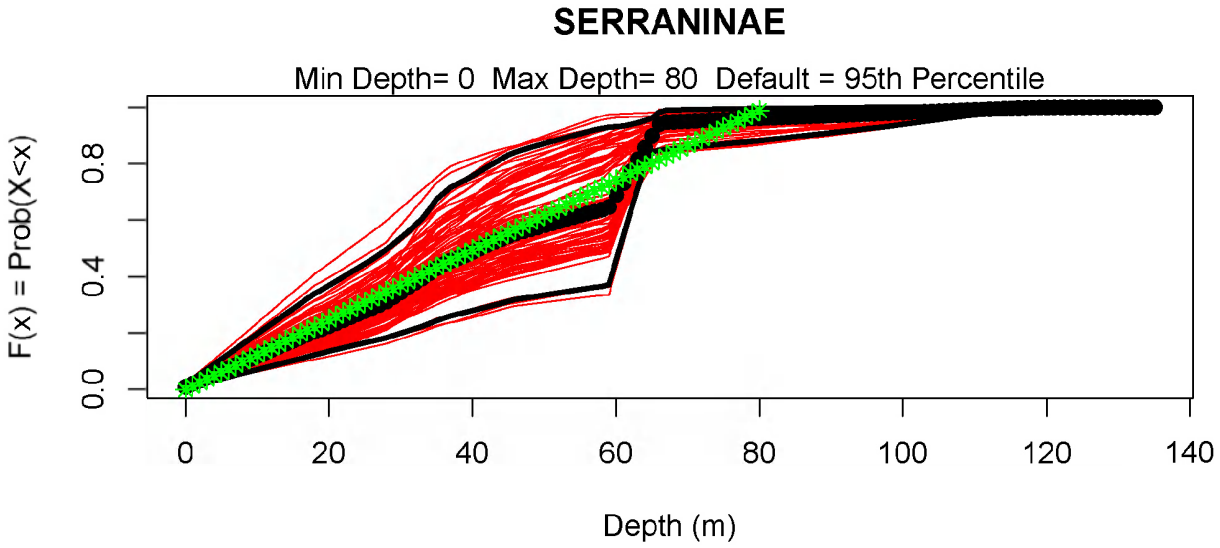

SCORPAENIFORMES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

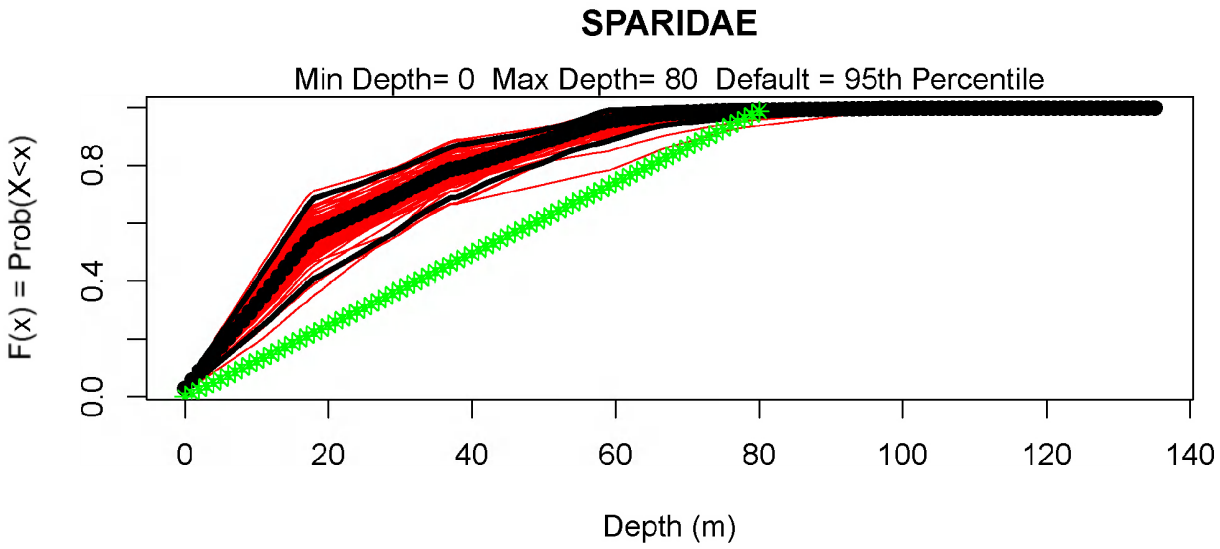

SELAR.CRUMENOPHTHALMUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

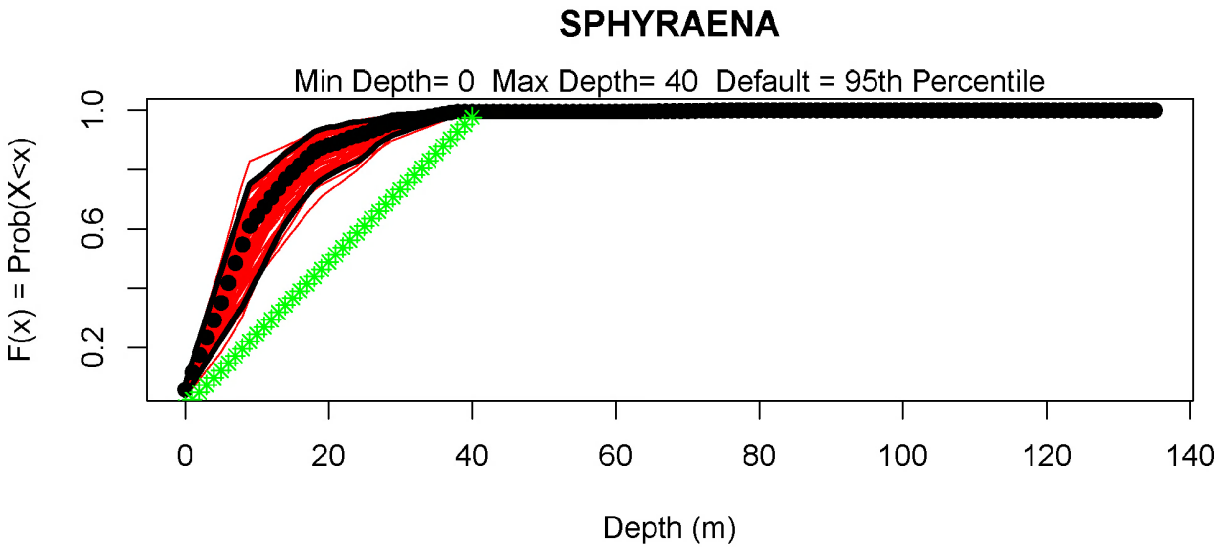

SELENE
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

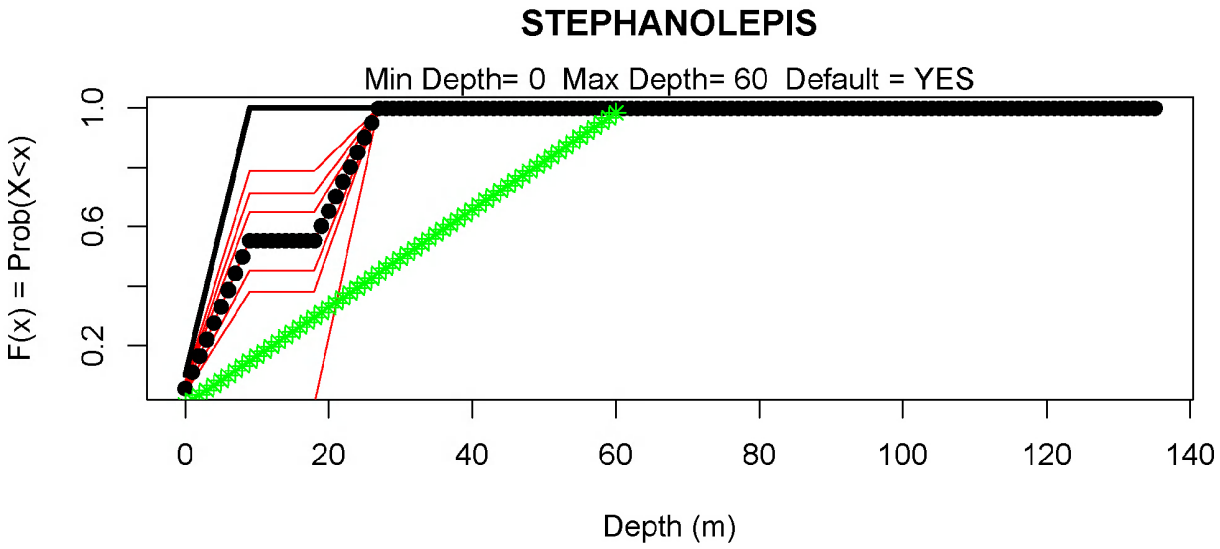

SERIOLA
Min Depth= 0 Max Depth= 80 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

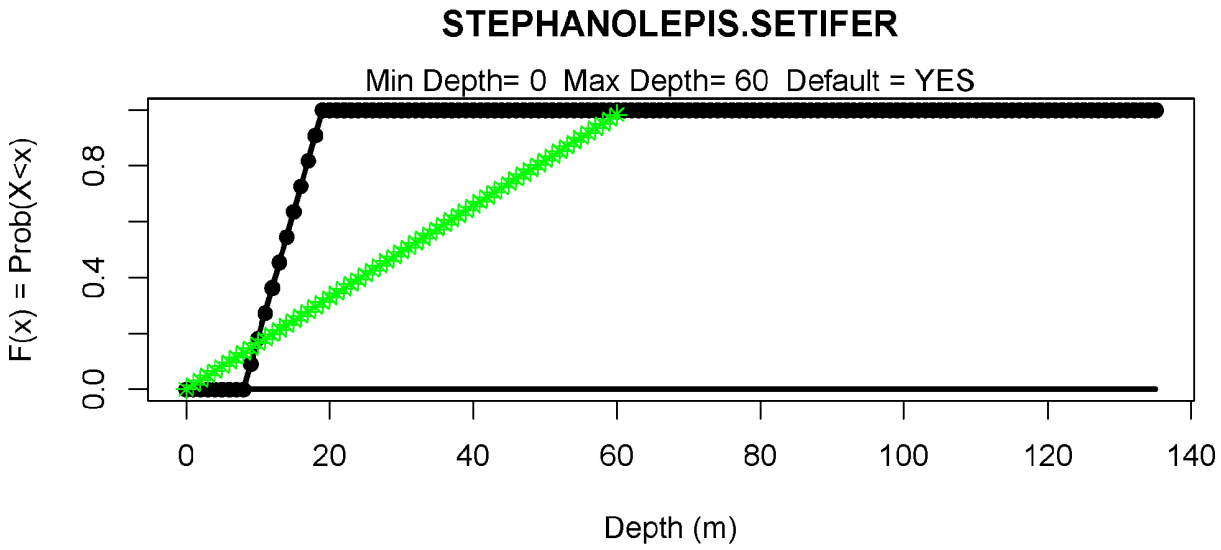

SERRANIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

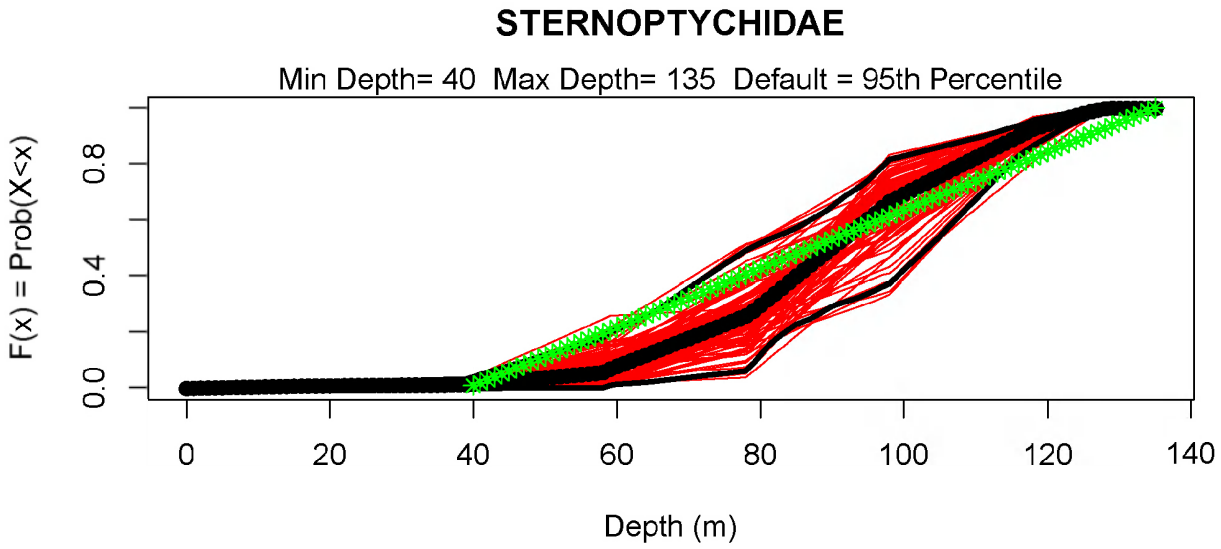

SERRANINAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

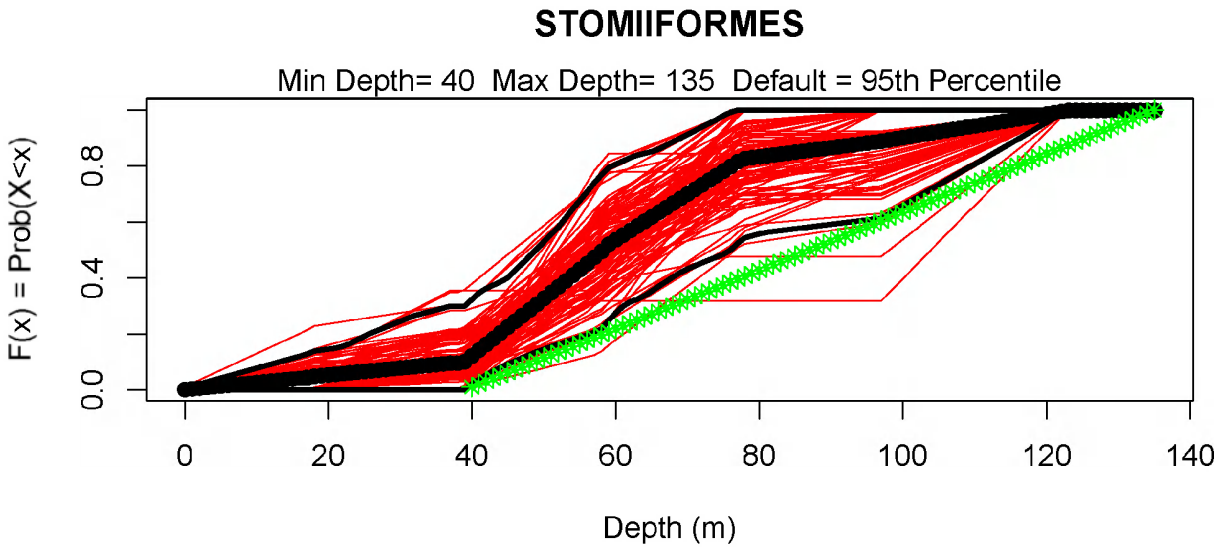

SPARIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

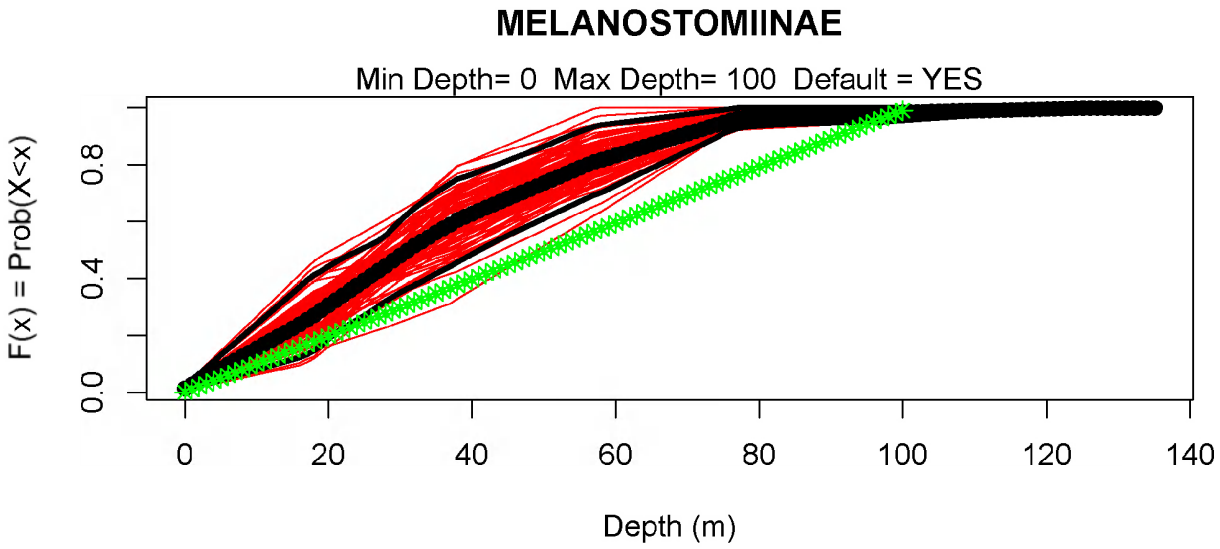

SPHYRAENA
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

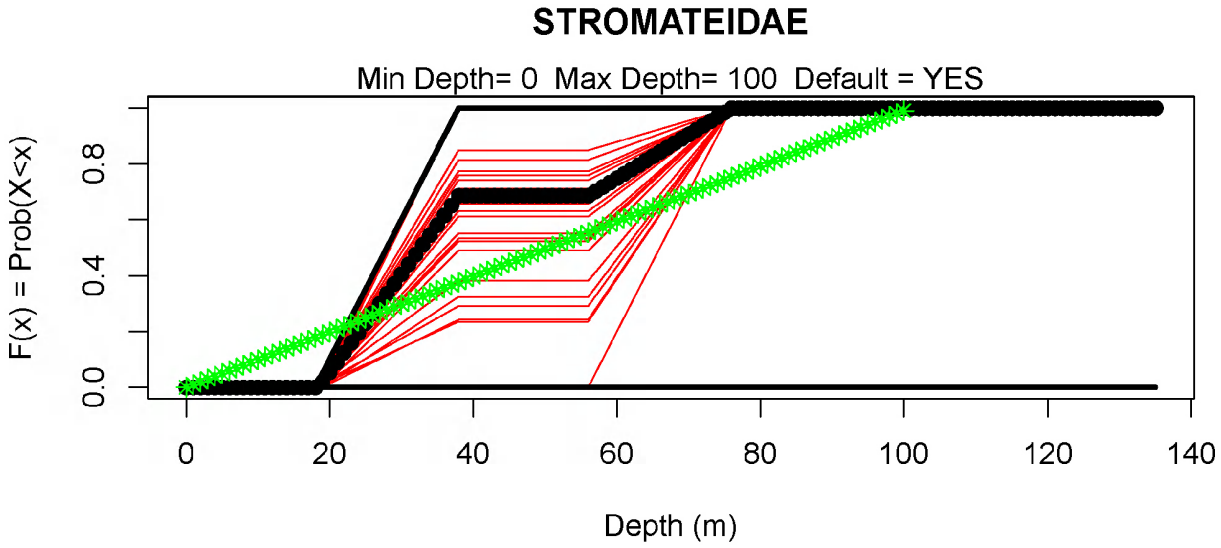

STEPHANOLEPIS
Min Depth= 0 Max Depth= 60 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

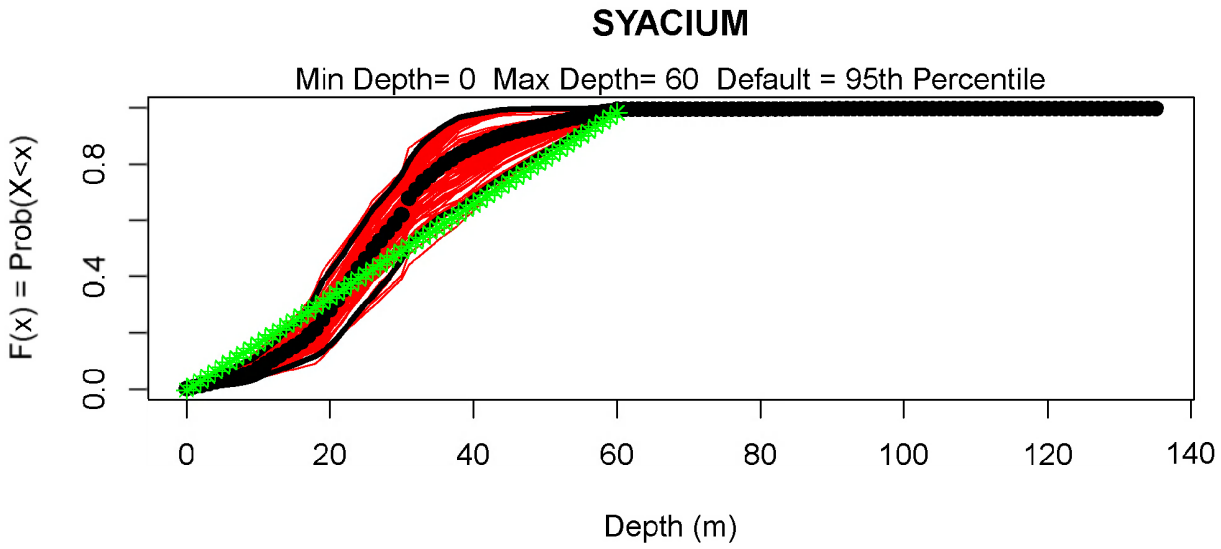

STEPHANOLEPIS.SETIFER
Min Depth= 0 Max Depth= 60 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

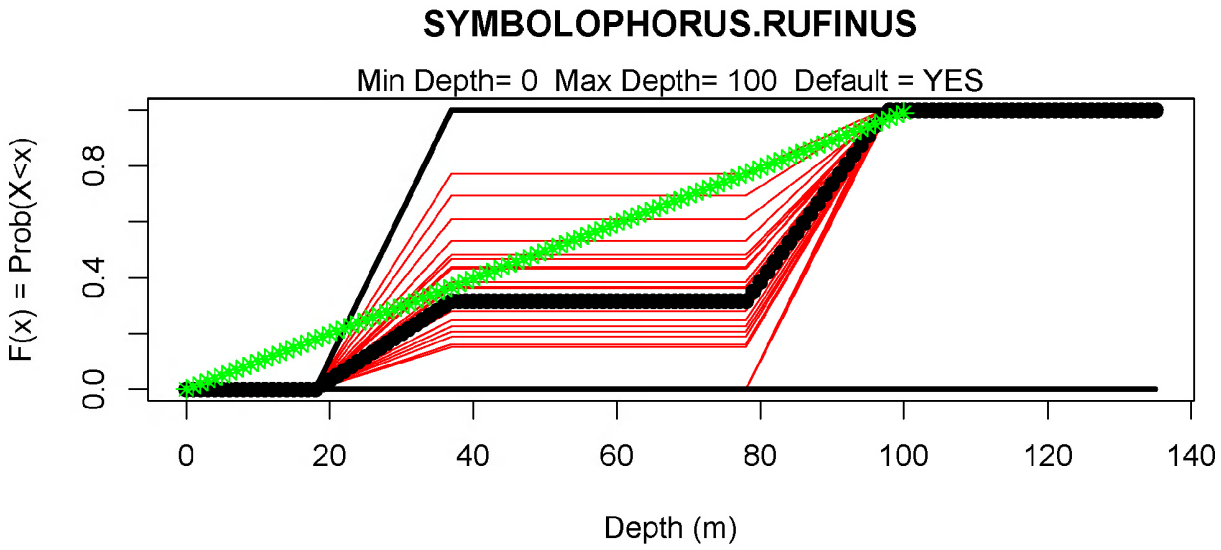

STERNOPTYCHIDAE
Min Depth= 40 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

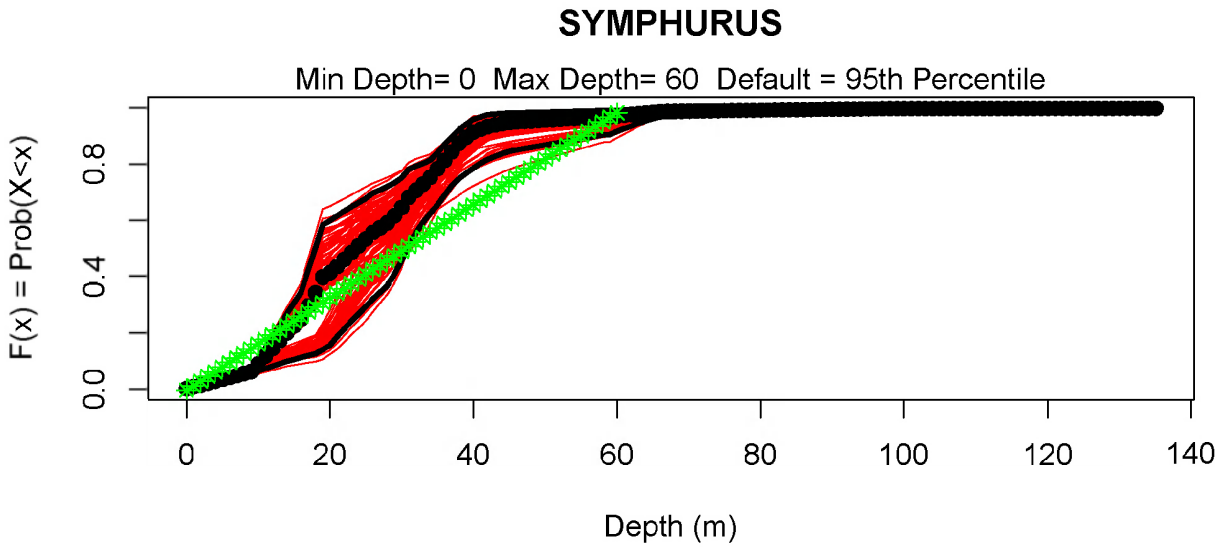

STOMIIFORMES
Min Depth= 40 Max Depth= 135 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

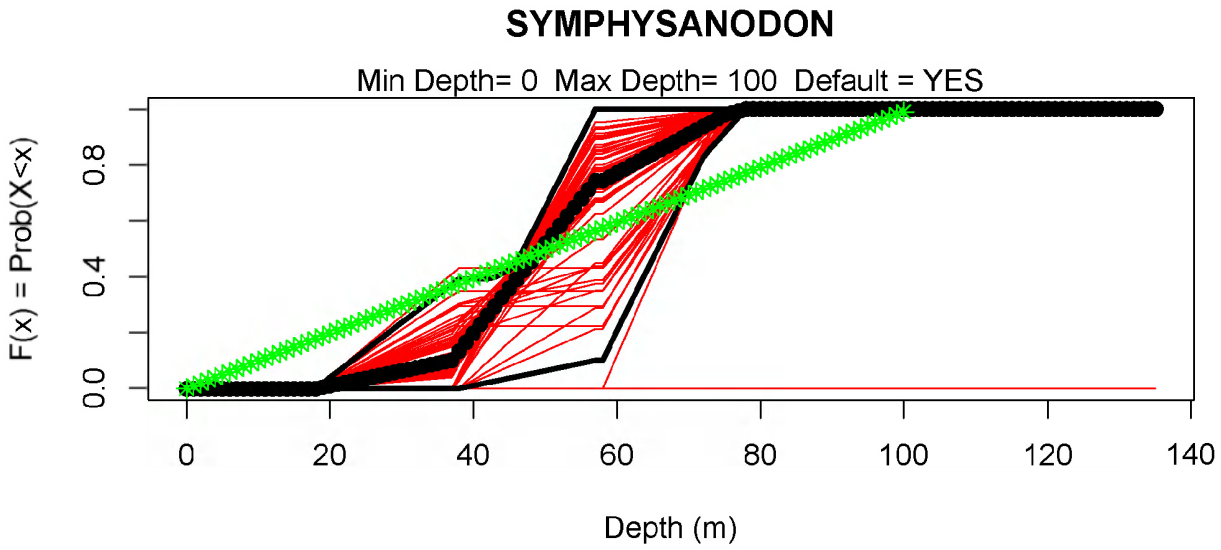

MELANOSTOMIINAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

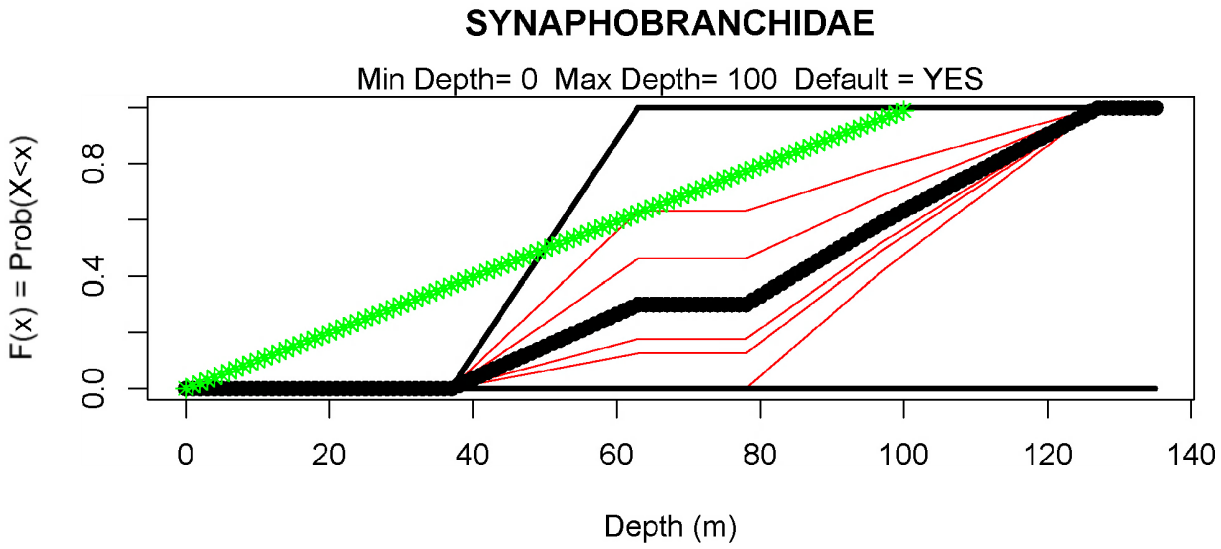

STROMATEIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

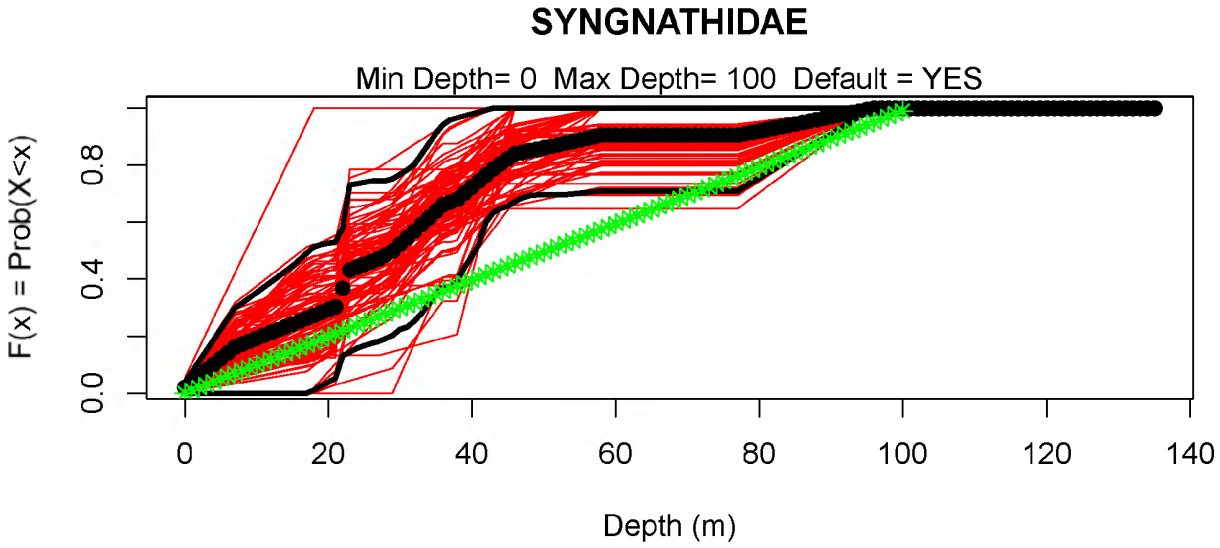

SYACIUM
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

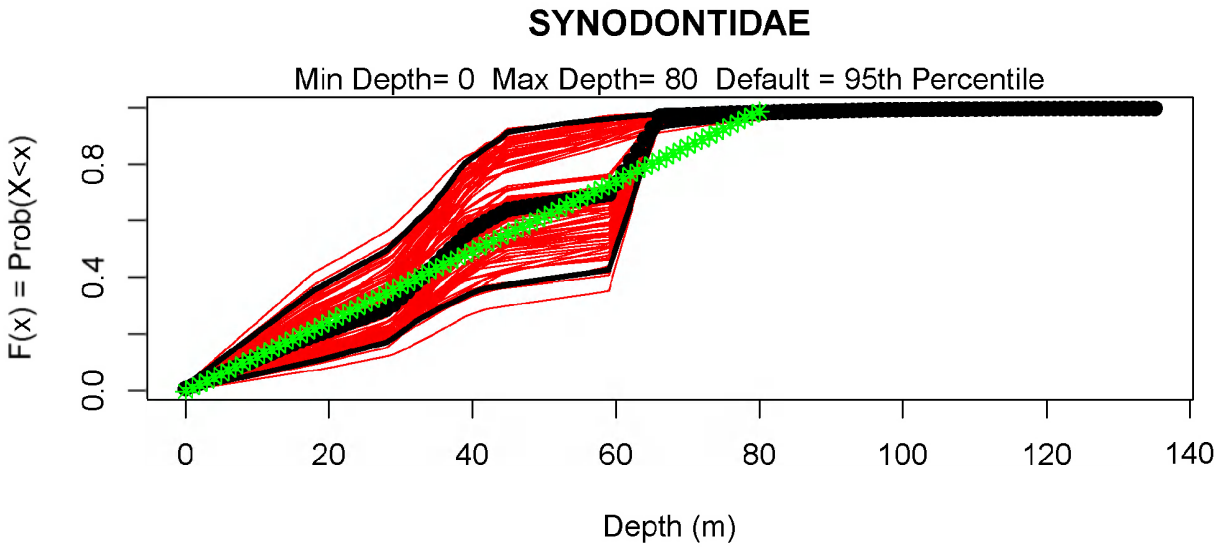

SYMBOLOPHORUS.RUFINUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

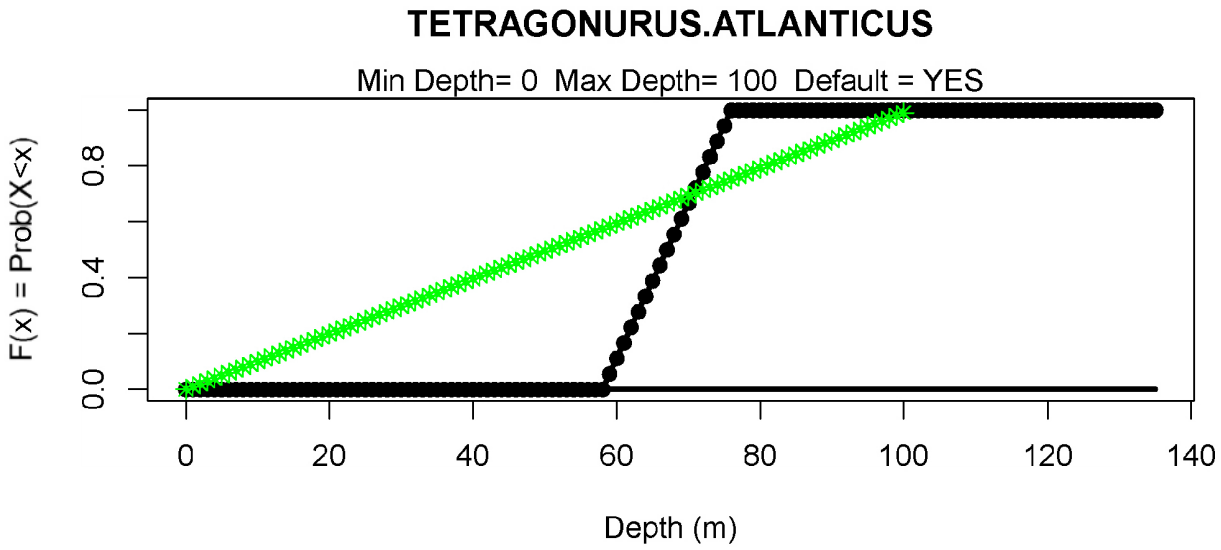

SYMPHURUS
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

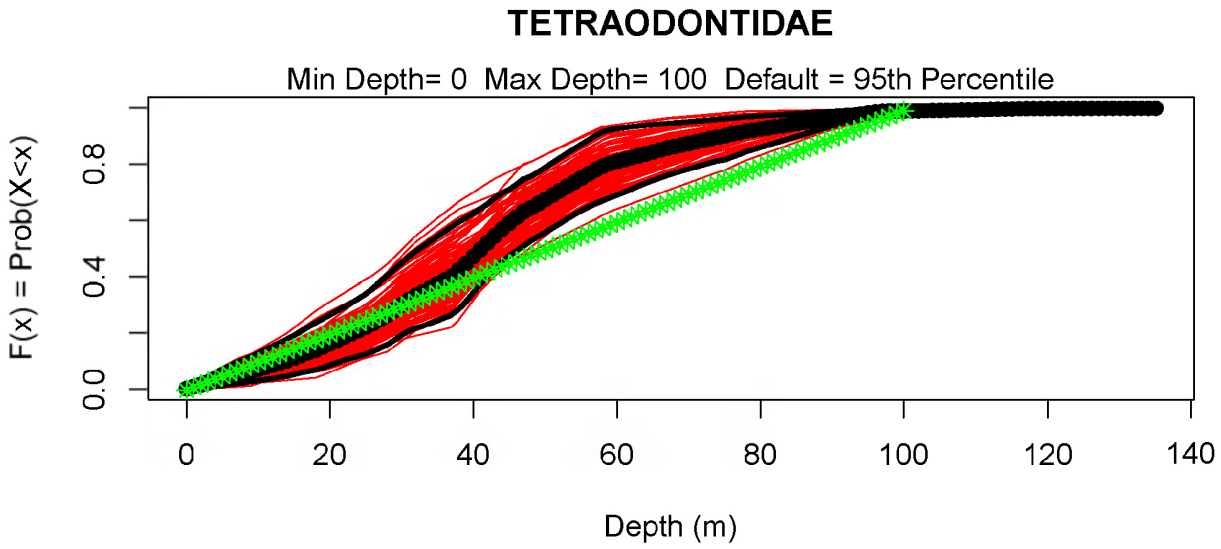

SYMPHYSANODON
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

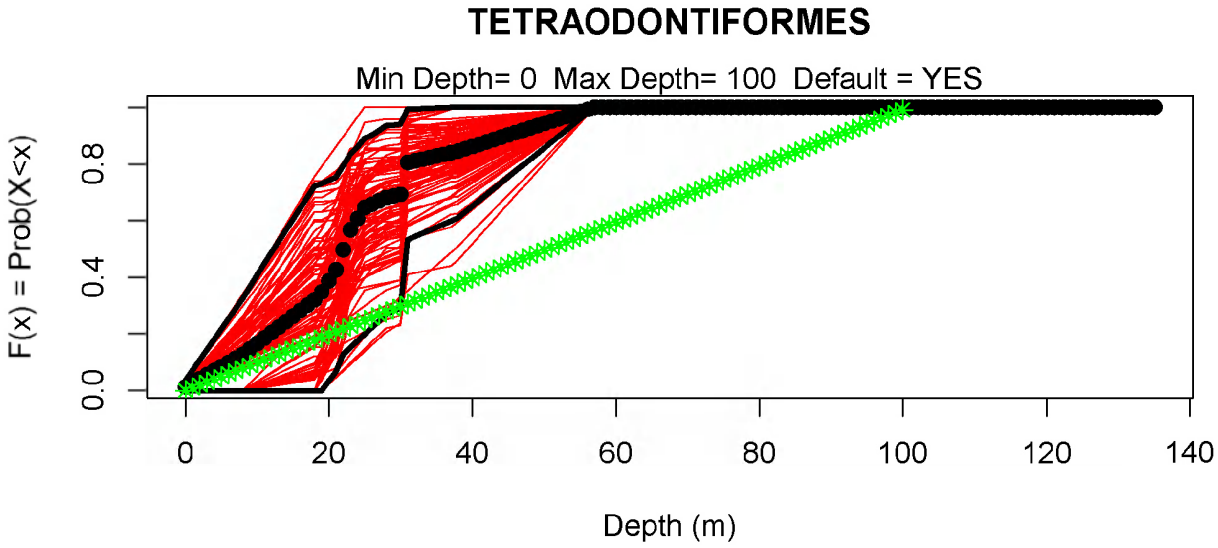

SYNAPHOBRANCHIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

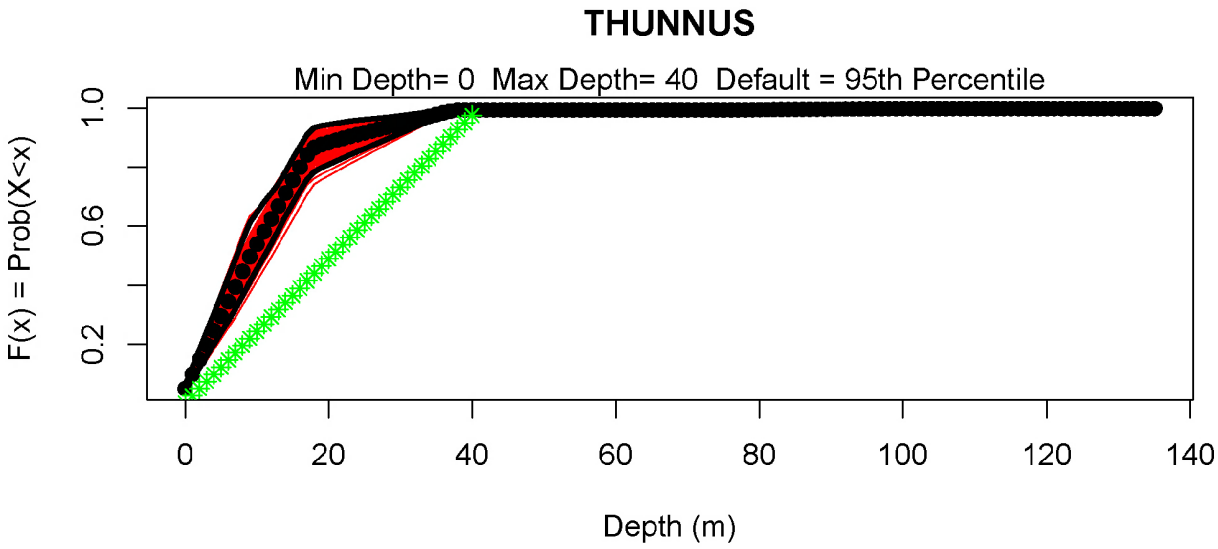

SYNGNATHIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

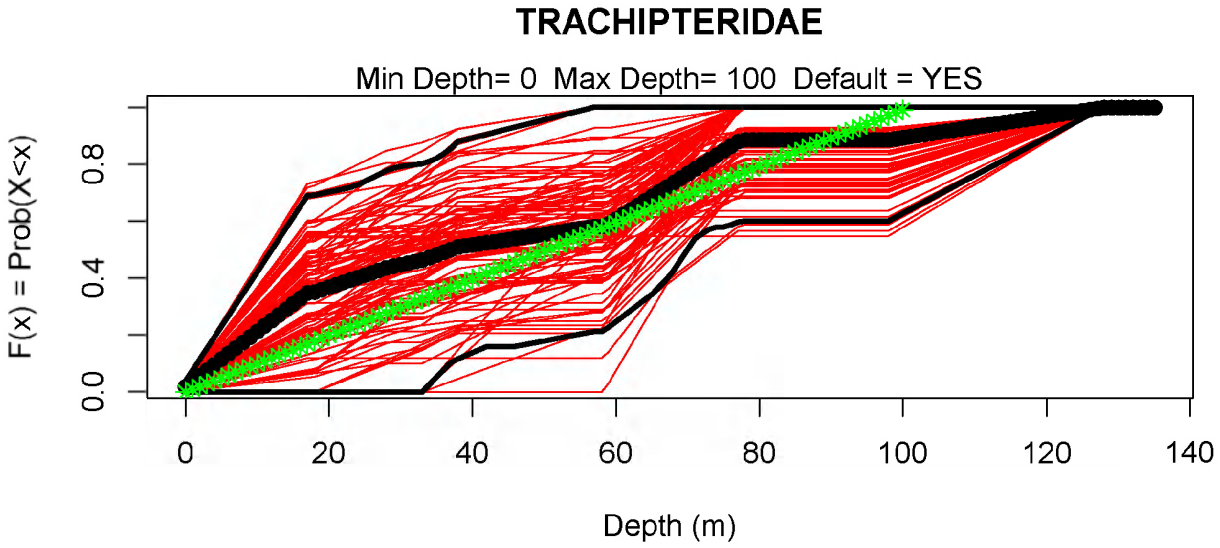

SYNODONTIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

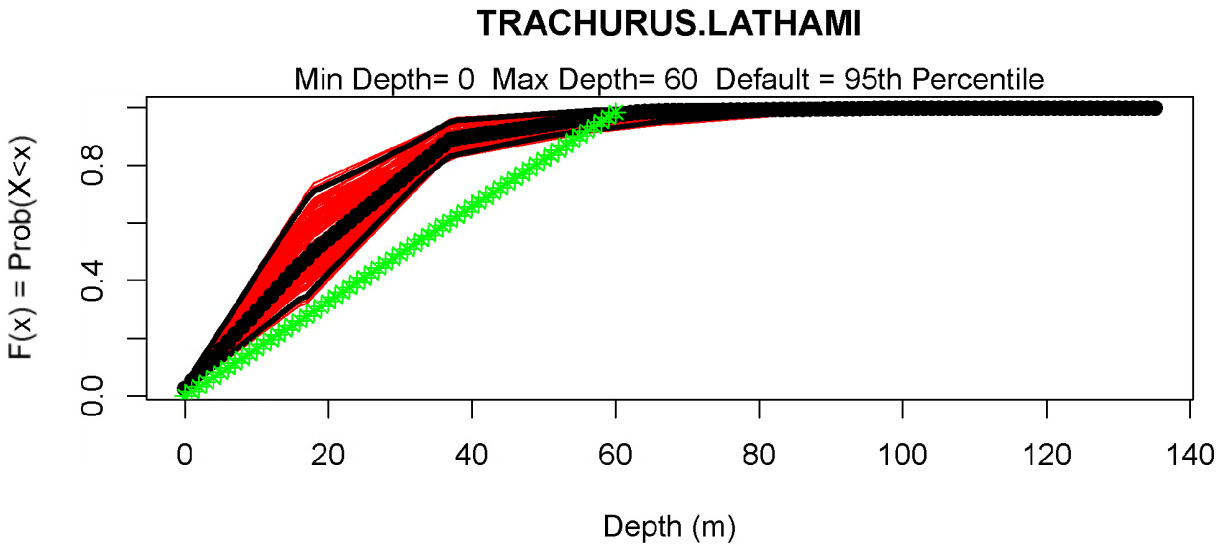

TETRAGONURUS.ATLANTICUS
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

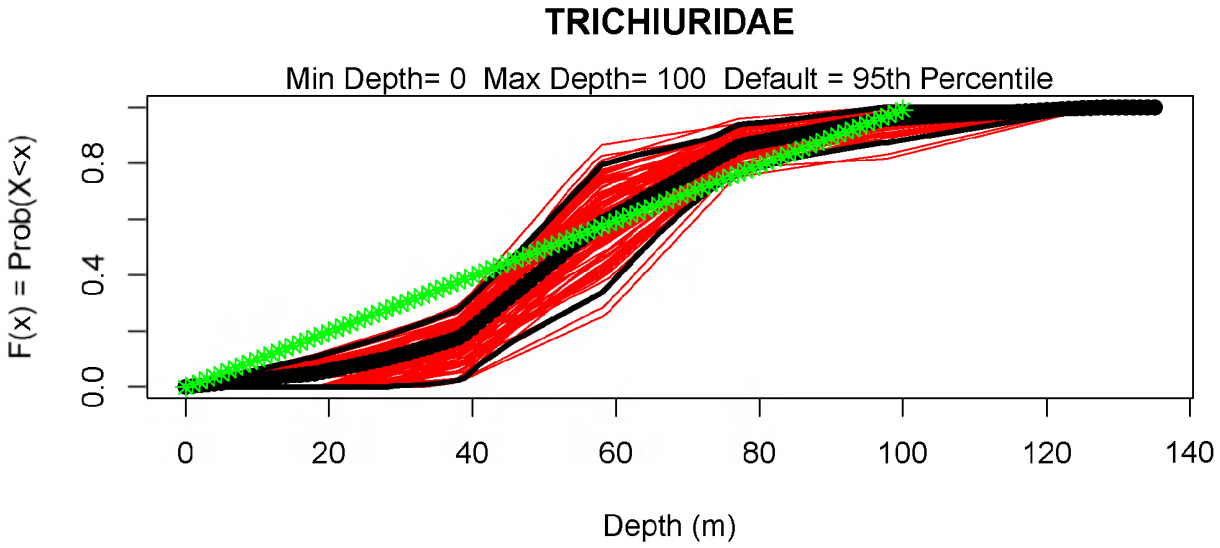

TETRAODONTIDAE
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

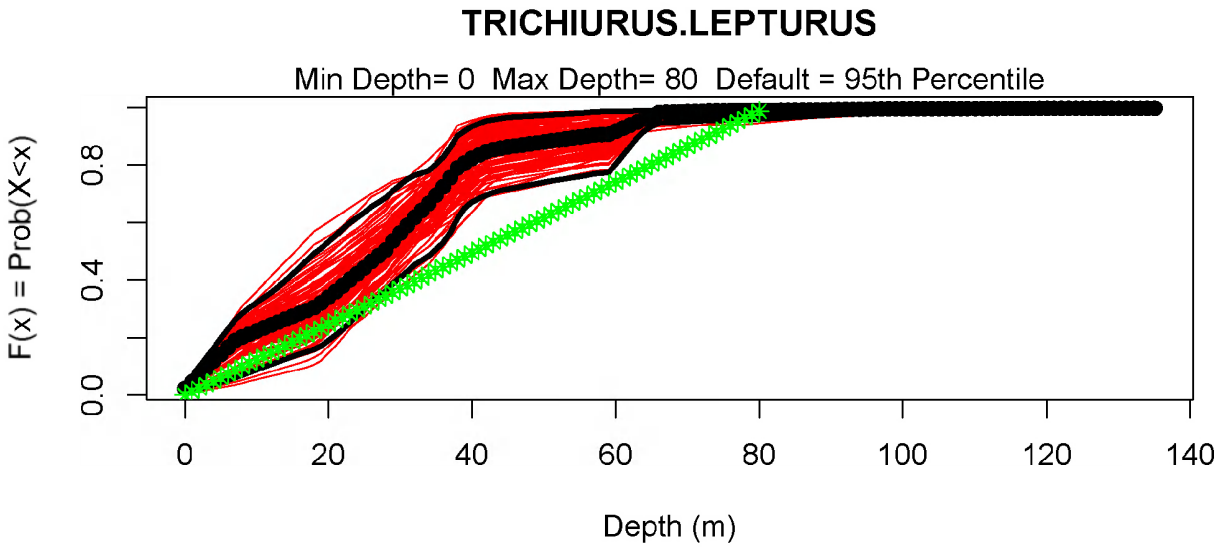

TETRAODONTIFORMES
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


THUNNUS
Min Depth= 0 Max Depth= 40 Default = 95th Percentile
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

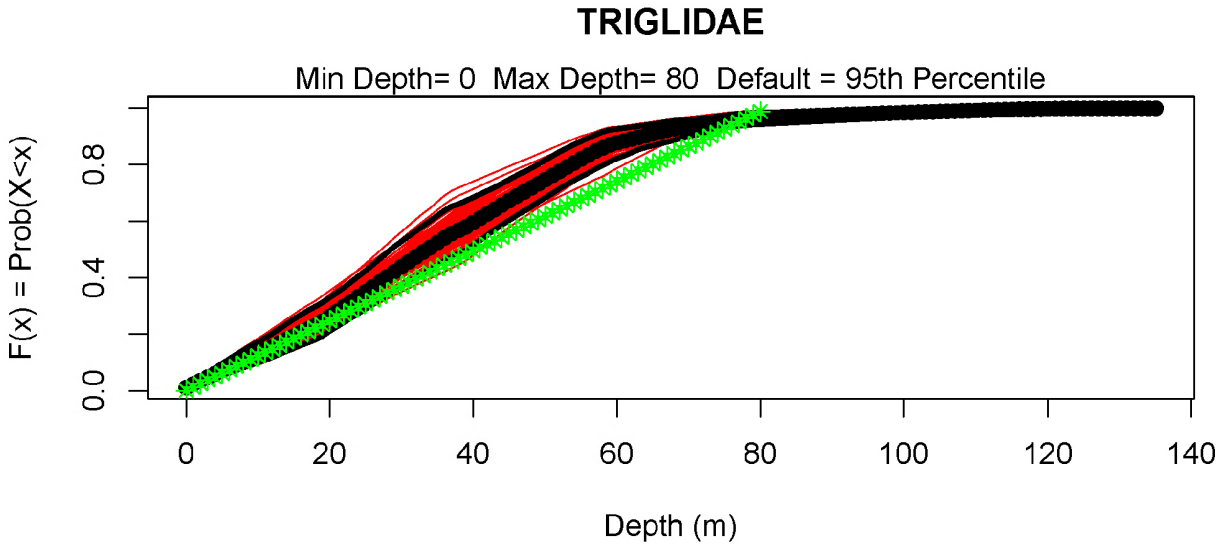

TRACHIPTERIDAE
Min Depth= 0 Max Depth= 100 Default = YES
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

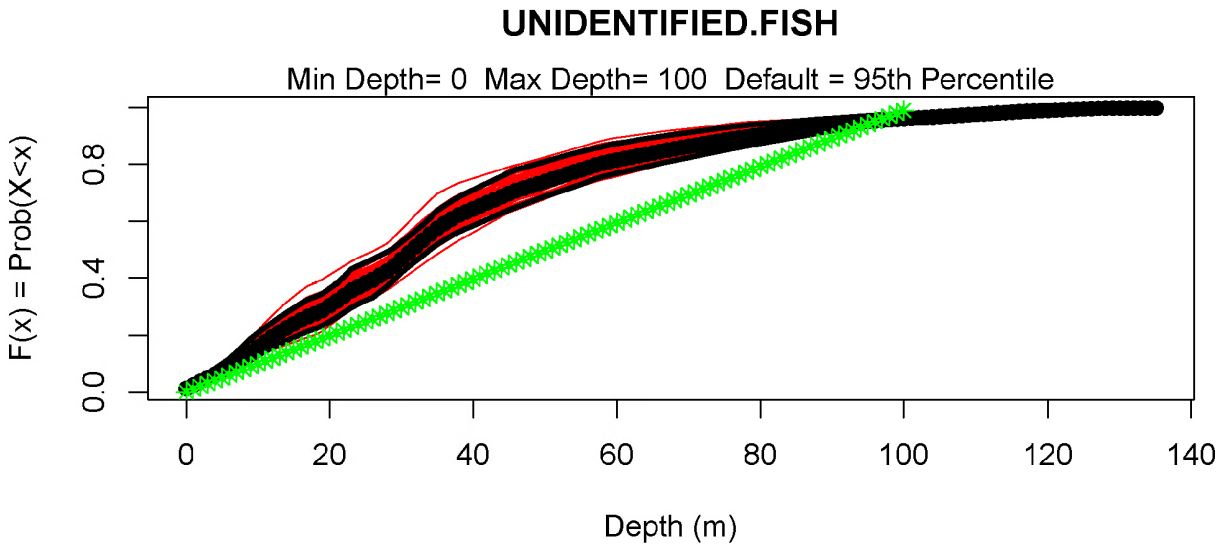

TRACHURUS.LATHAMI
Min Depth= 0 Max Depth= 60 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

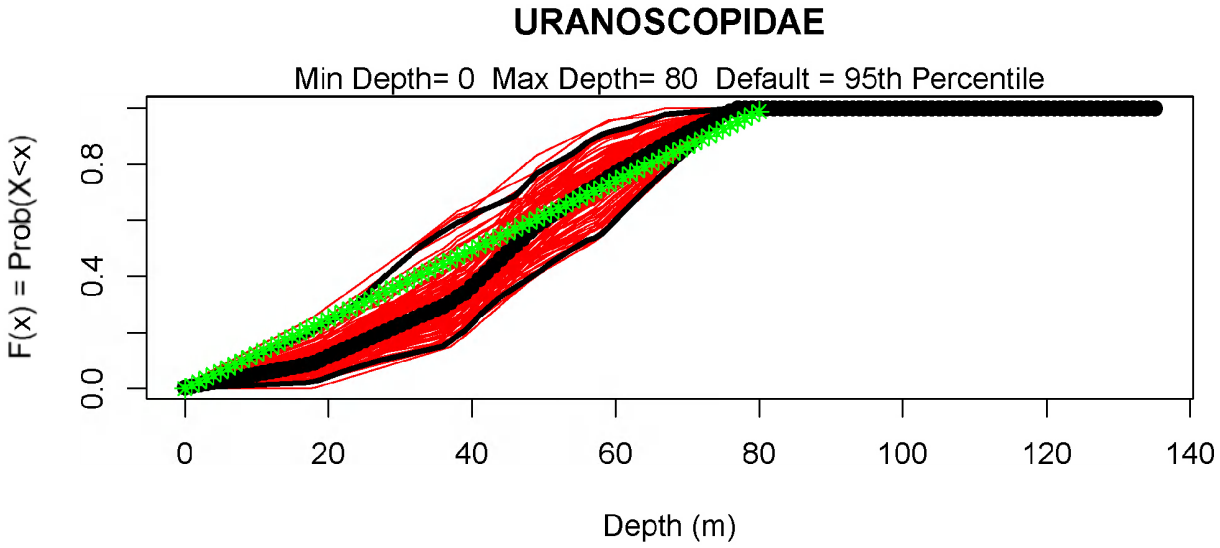


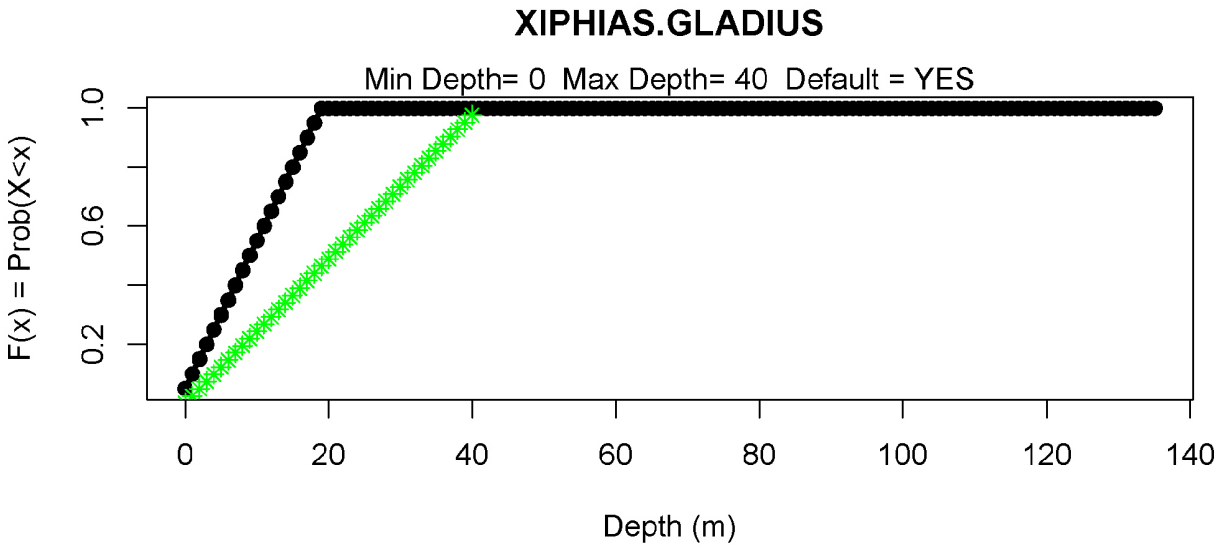


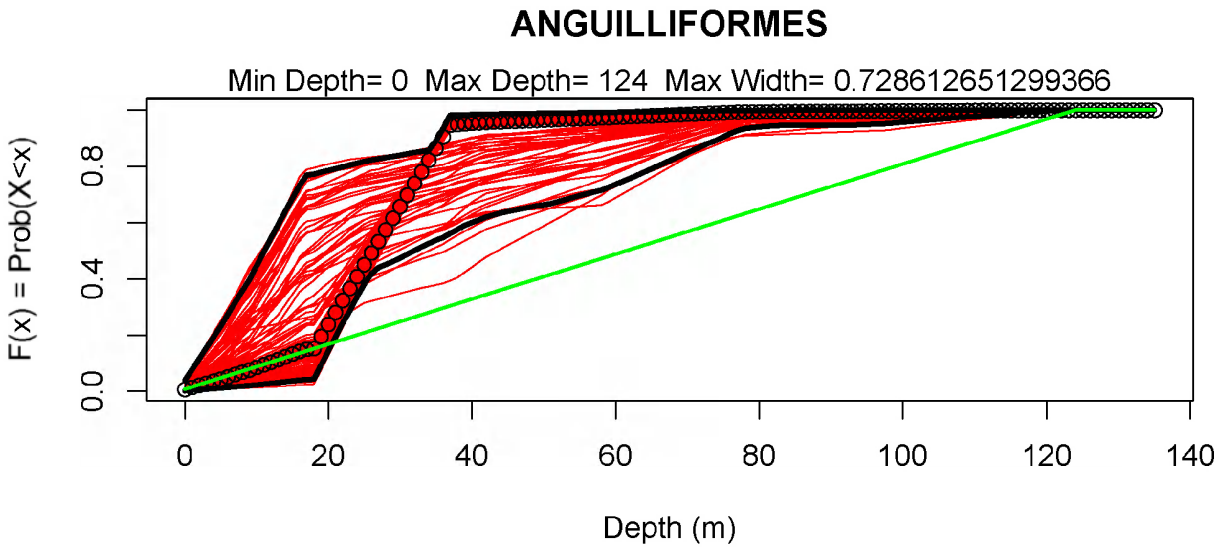
DWH-AR0196131

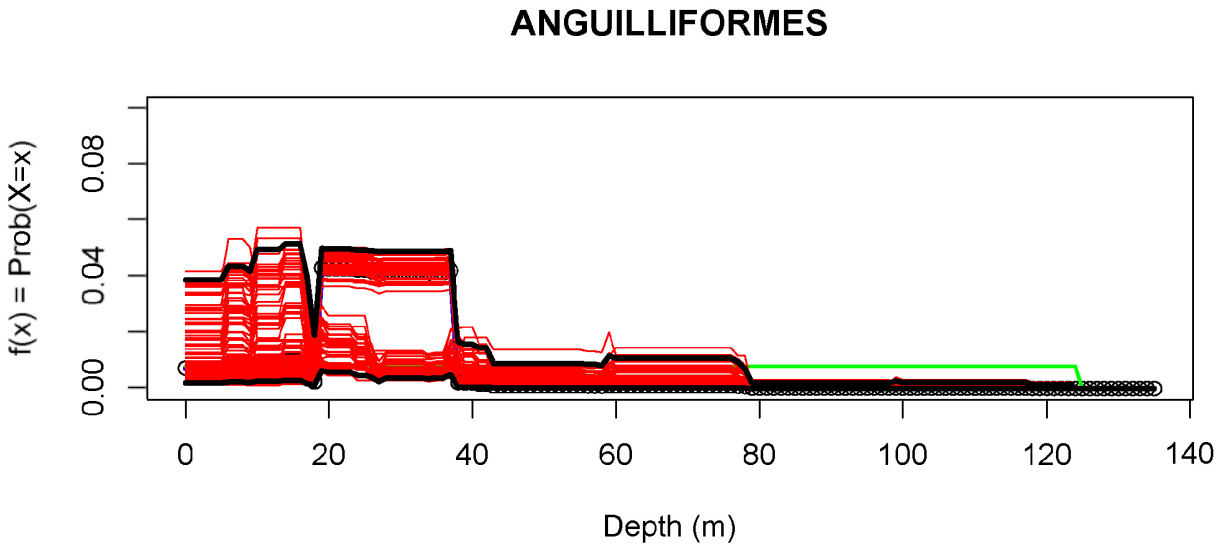

TRIGLIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

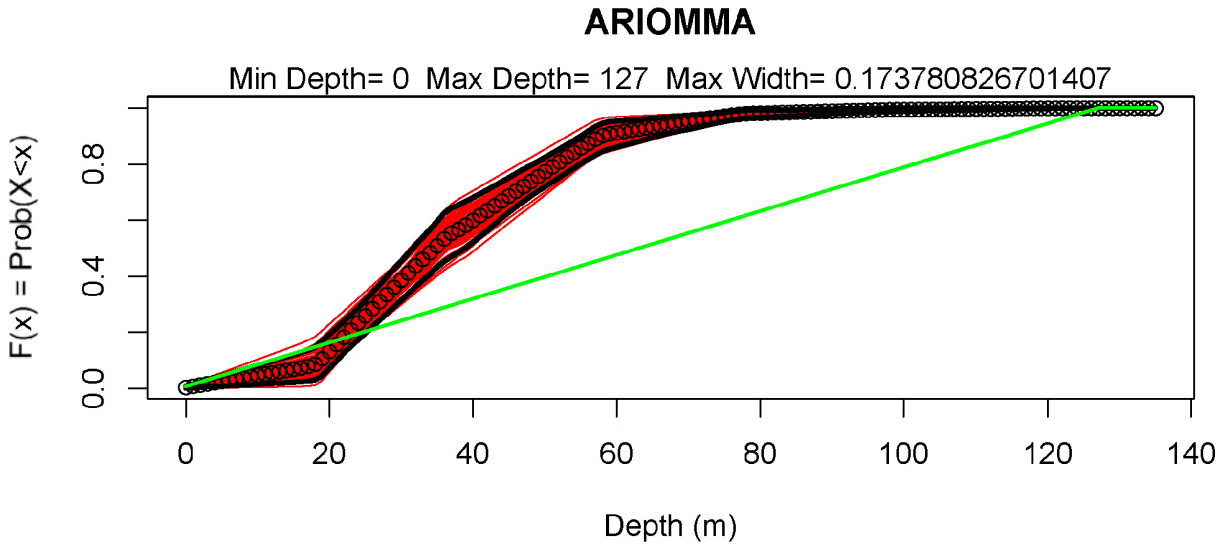

UNIDENTIFIED.FISH
Min Depth= 0 Max Depth= 100 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

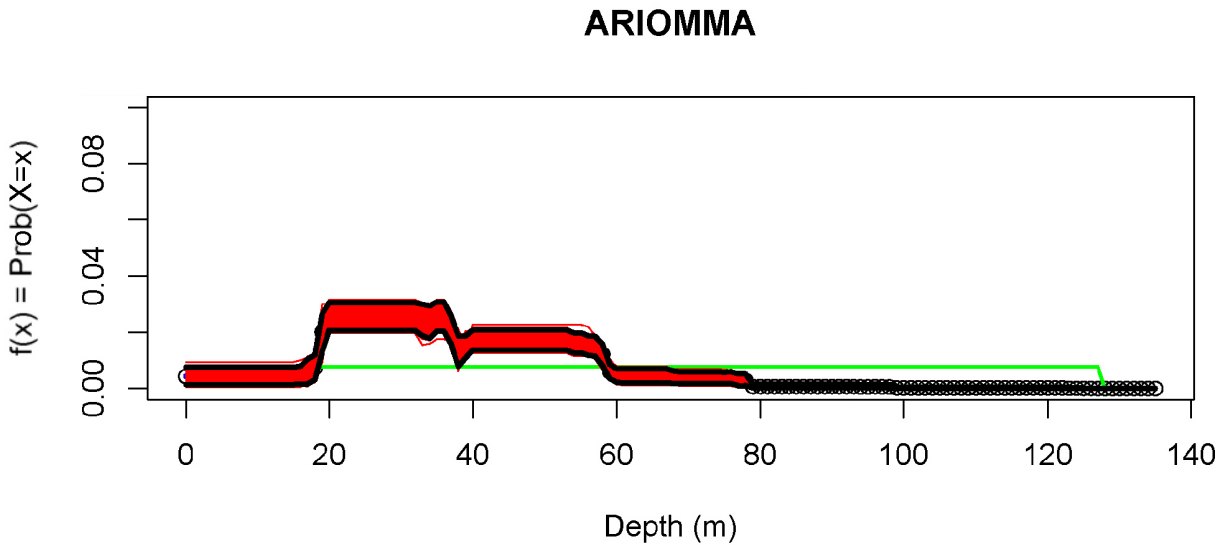

URANOSCOPIDAE
Min Depth= 0 Max Depth= 80 Default = 95th Percentile
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

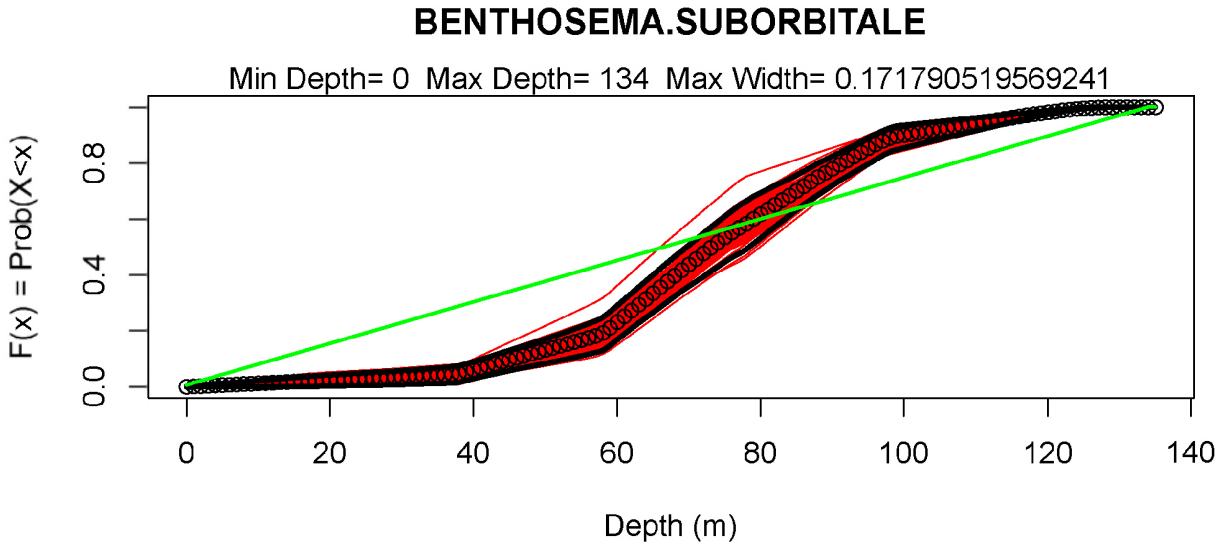

XIPHIAS.GLADIUS
Min Depth= 0 Max Depth= 40 Default = YES
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

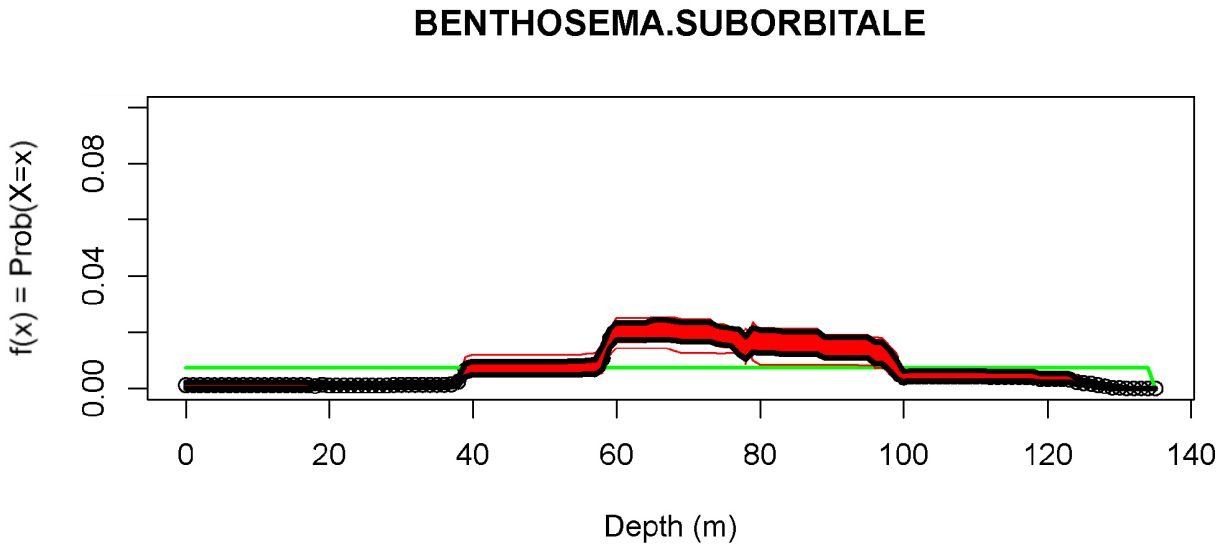

ANGUILLIFORMES
Min Depth= 0 Max Depth= 124 Max Width= 0.728612651299366
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

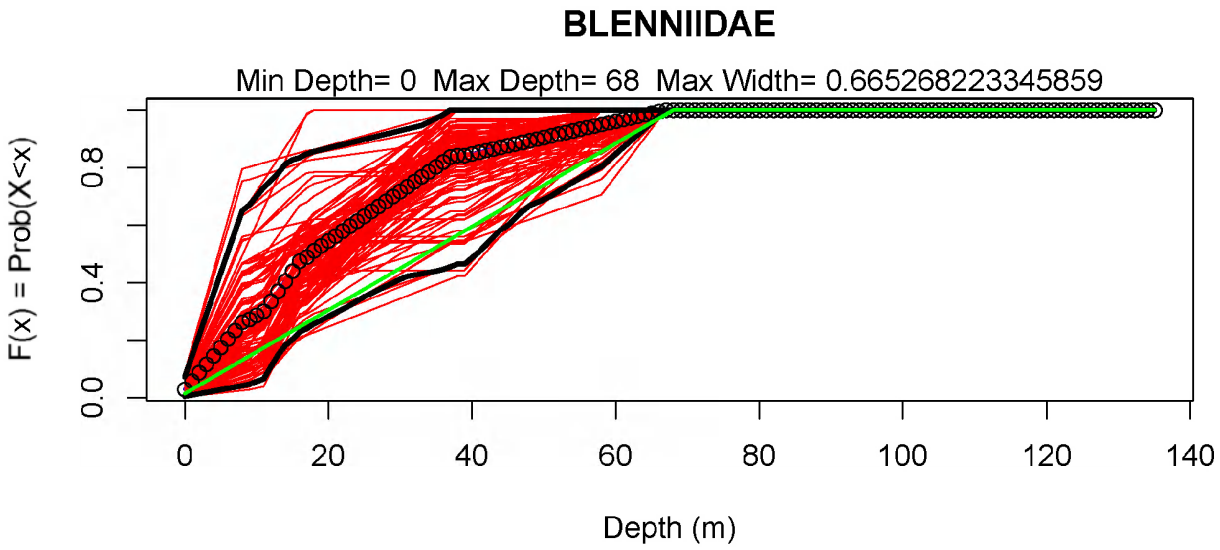

ANGUILLIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

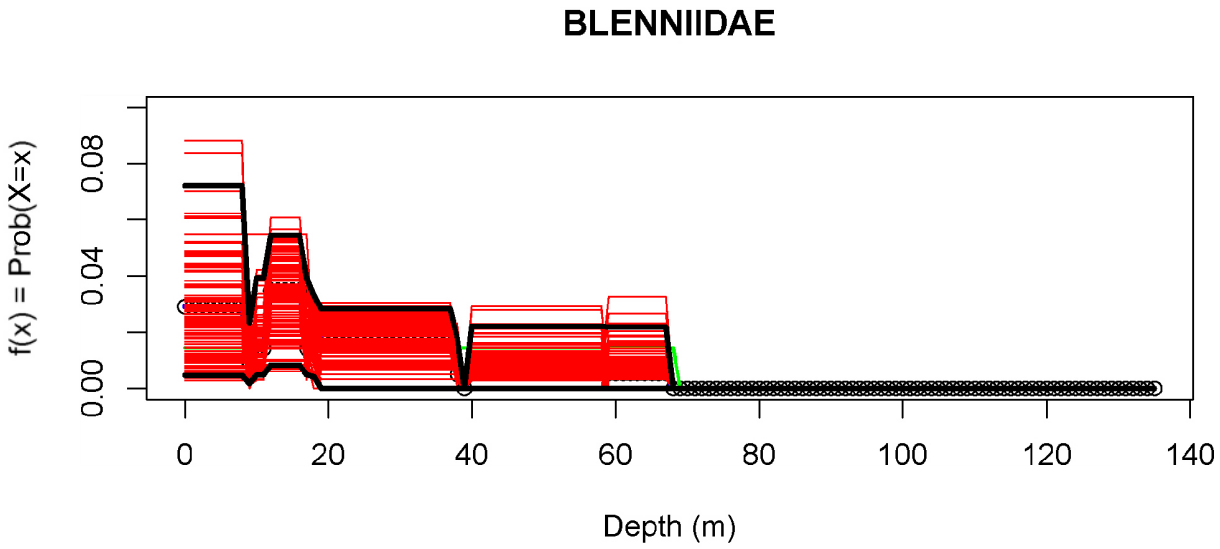

ARIOMMA
Min Depth= 0 Max Depth= 127 Max Width= 0.173780826701407
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

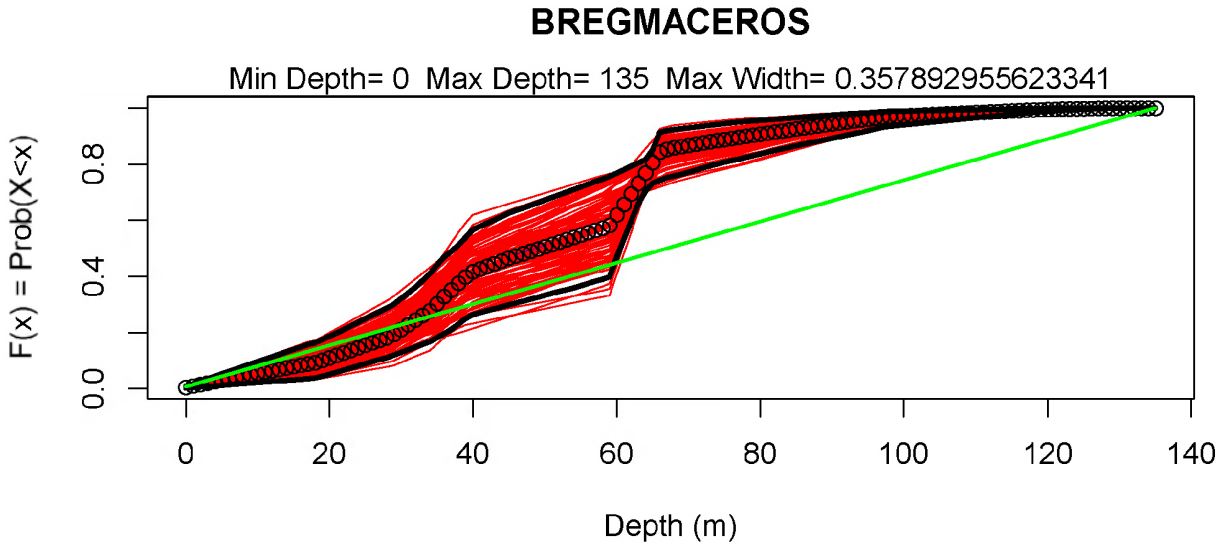

ARIOMMA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

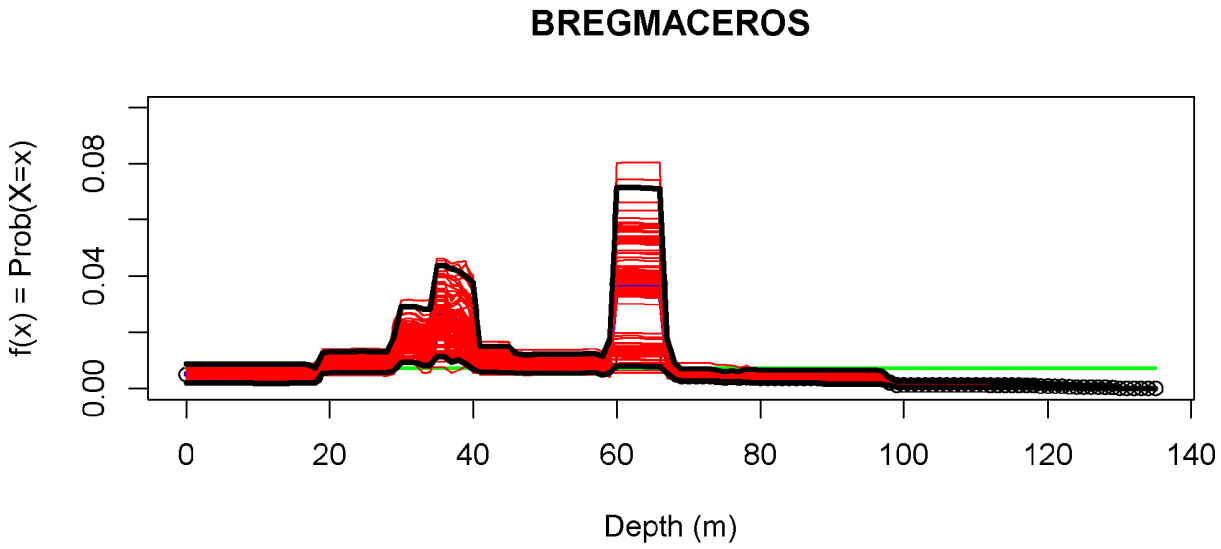

BENTHOSEMA.SUBORBITALE
Min Depth= 0 Max Depth= 134 Max Width= 0.171790519569241
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

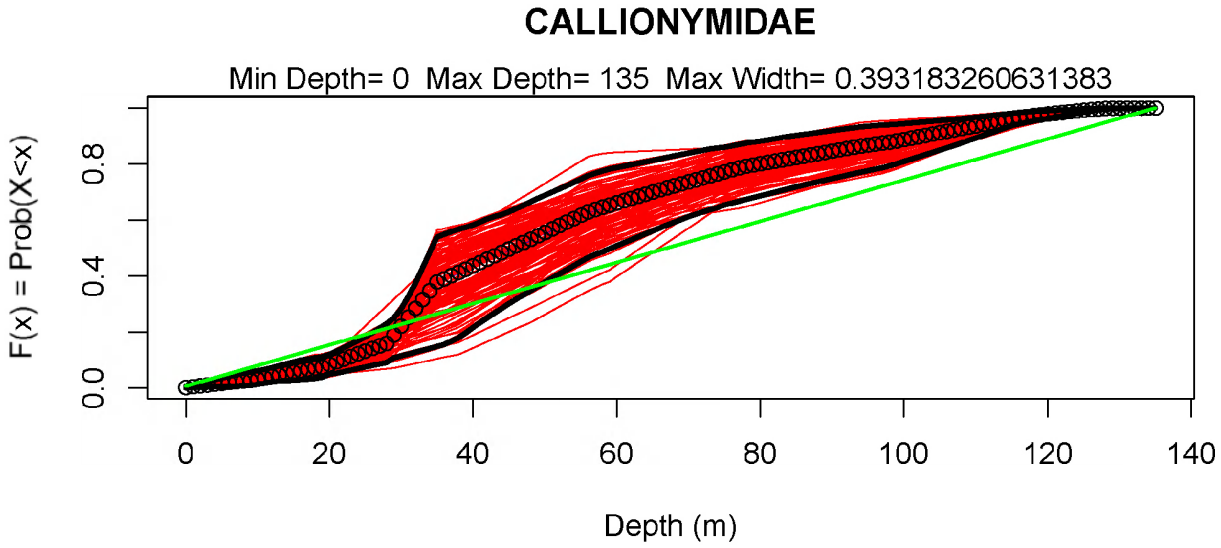

BENTHOSEMA.SUBORBITALE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

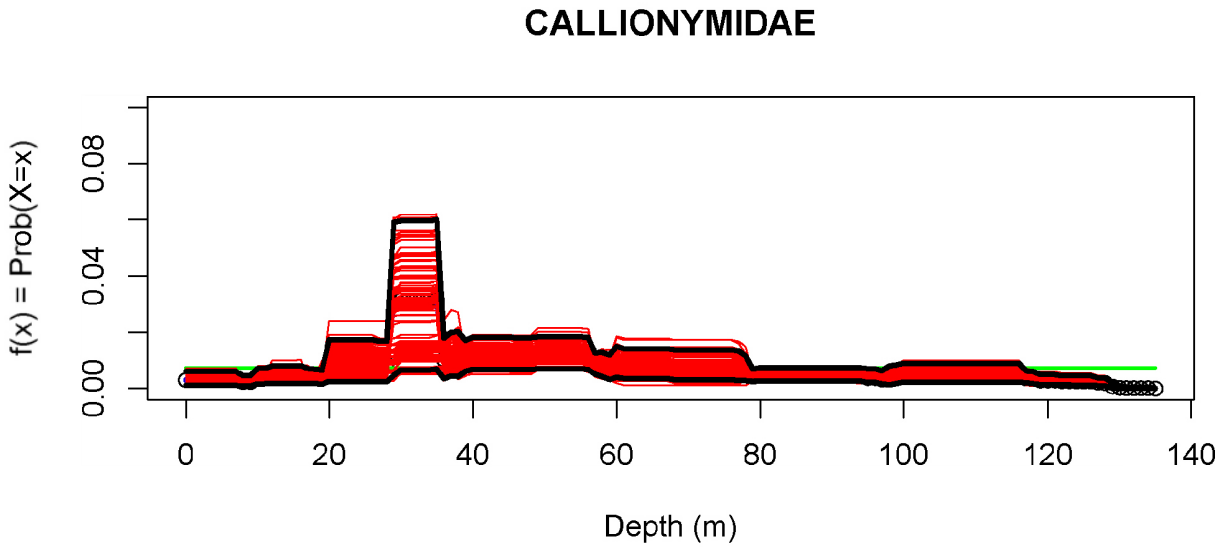

BLENNIIDAE
Min Depth= 0 Max Depth= 68 Max Width= 0.665268223345859
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

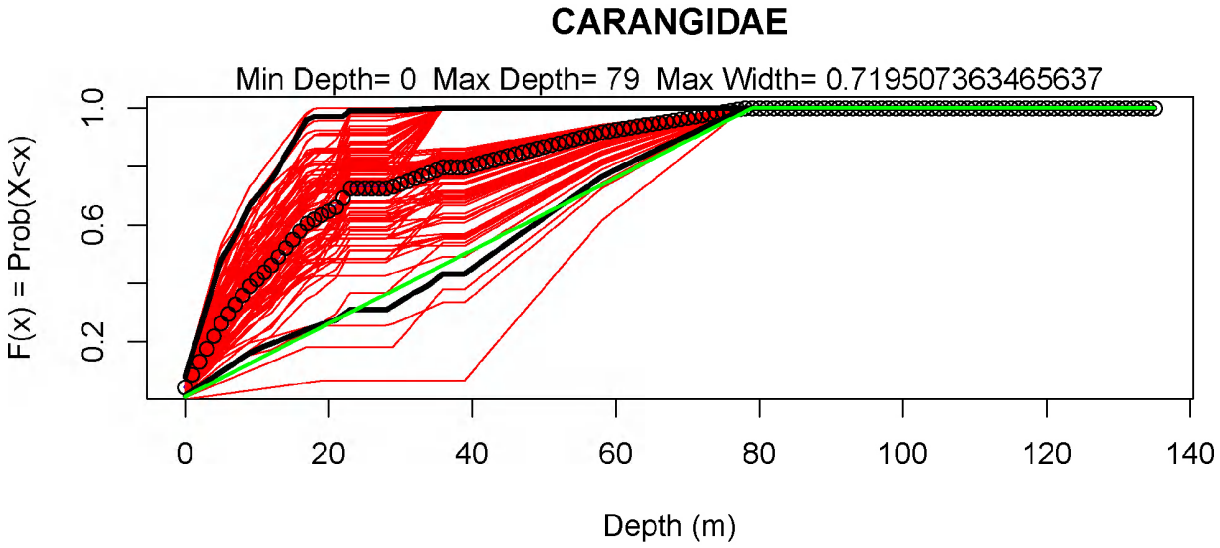

BLENNIIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

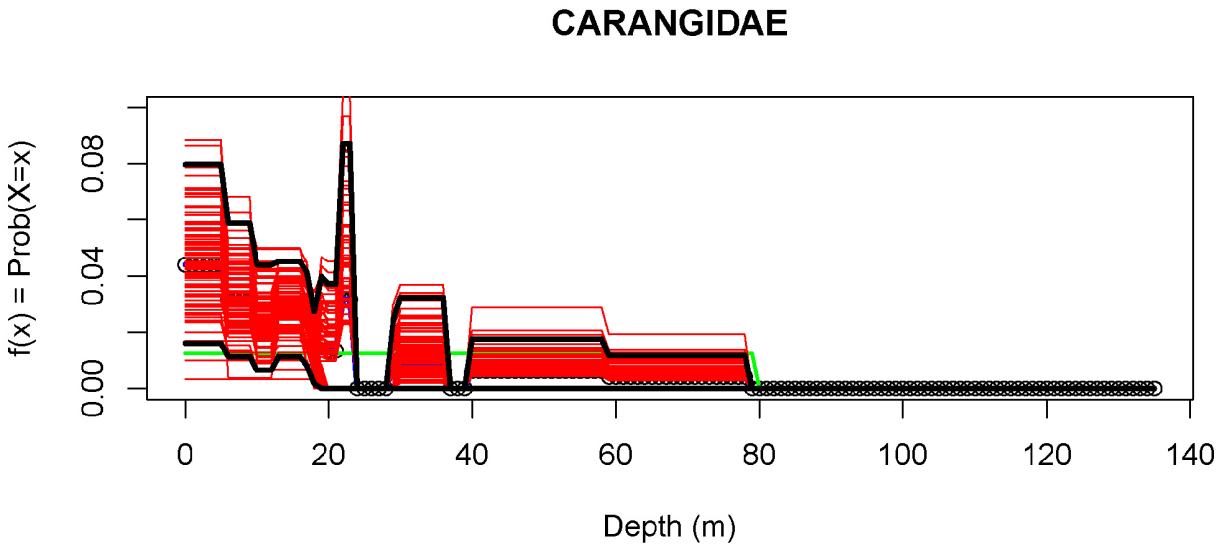

BREGMACEROS
Min Depth= 0 Max Depth= 135 Max Width= 0.357892955623341
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


BREGMACEROS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

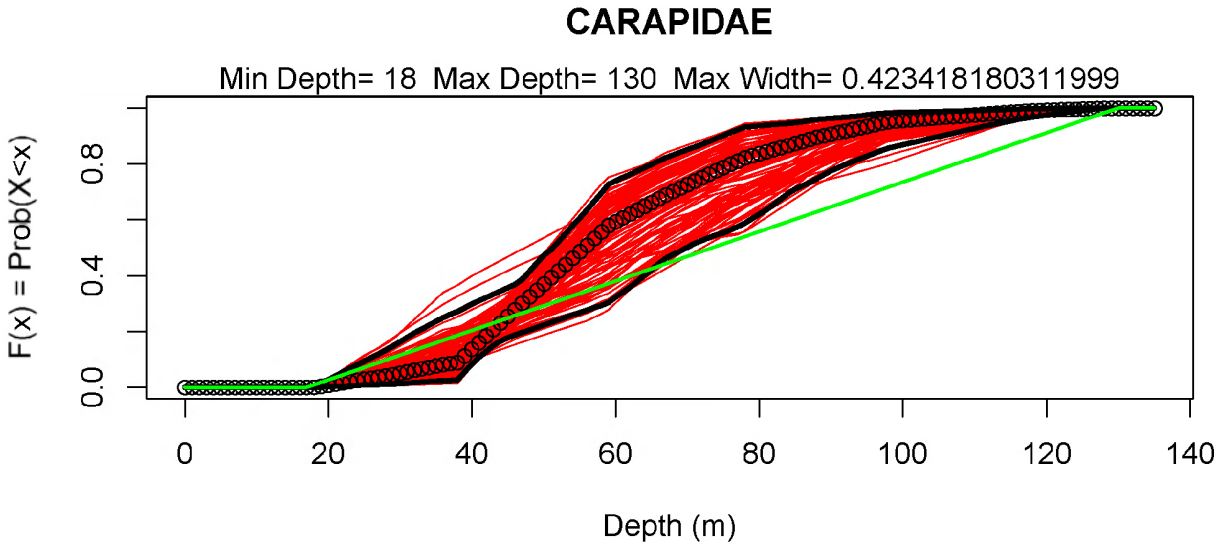

CALLIONYMIDAE
Min Depth= 0 Max Depth= 135 Max Width= 0.393183260631383
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

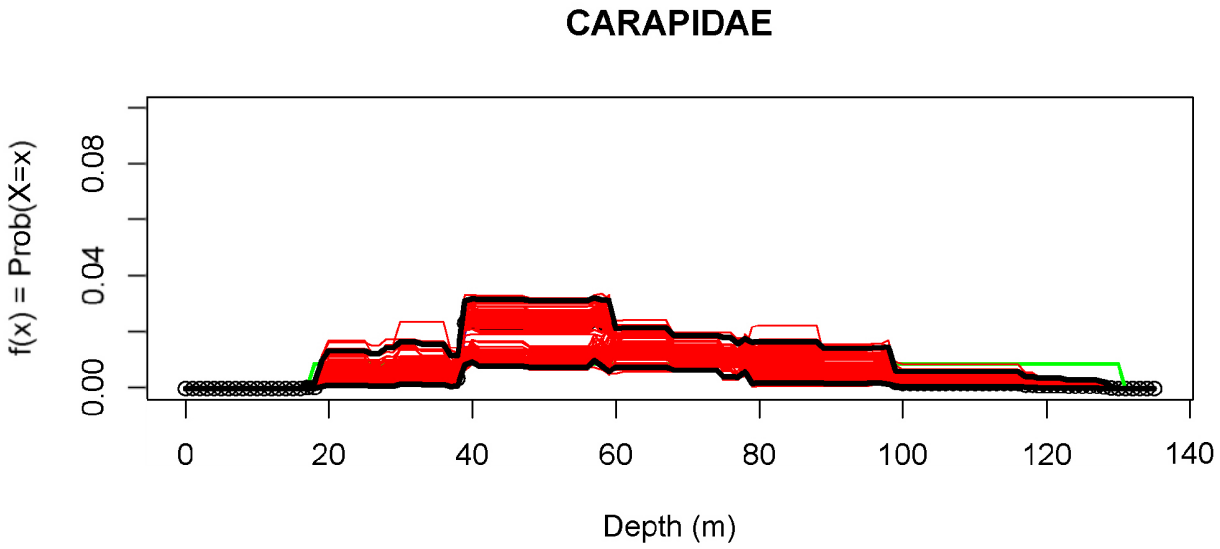

CALLIONYMIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

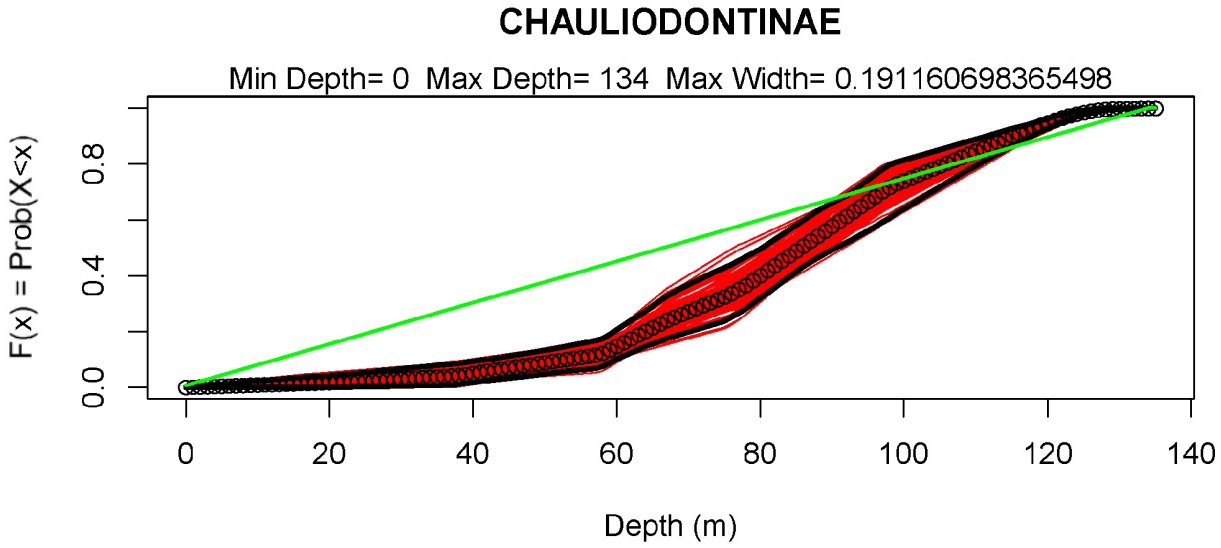


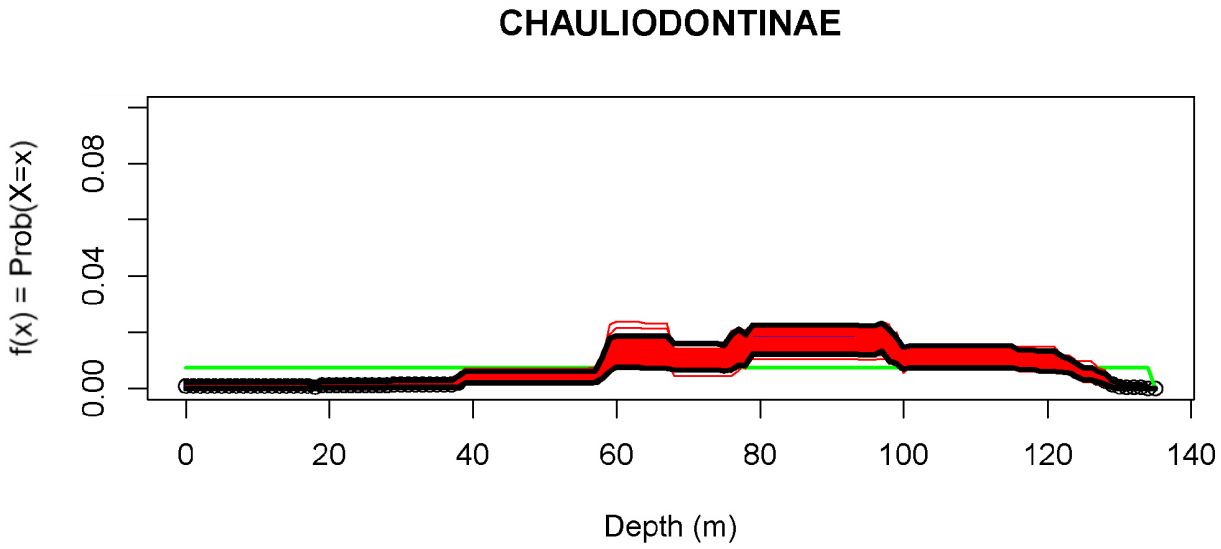


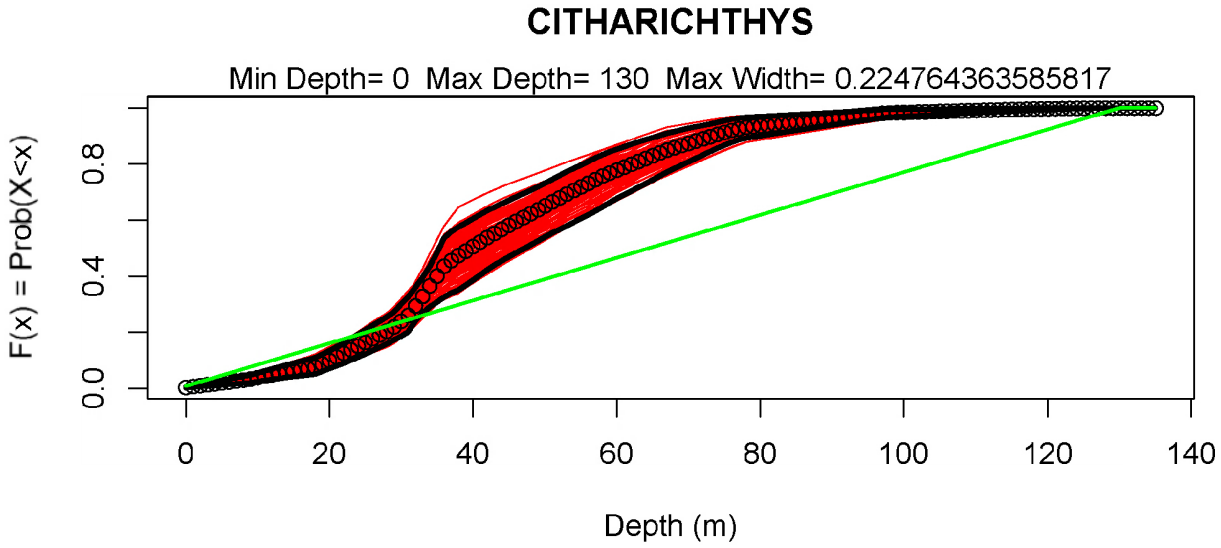
DWH-AR0196140

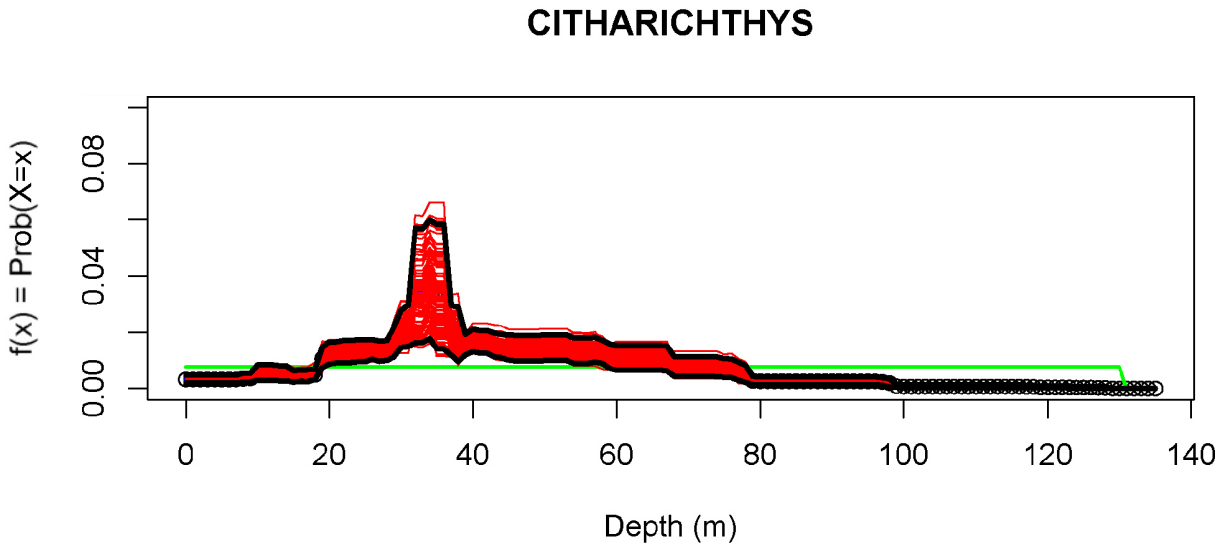

CARAPIDAE
Min Depth= 18 Max Depth= 130 Max Width= 0.423418180311999
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

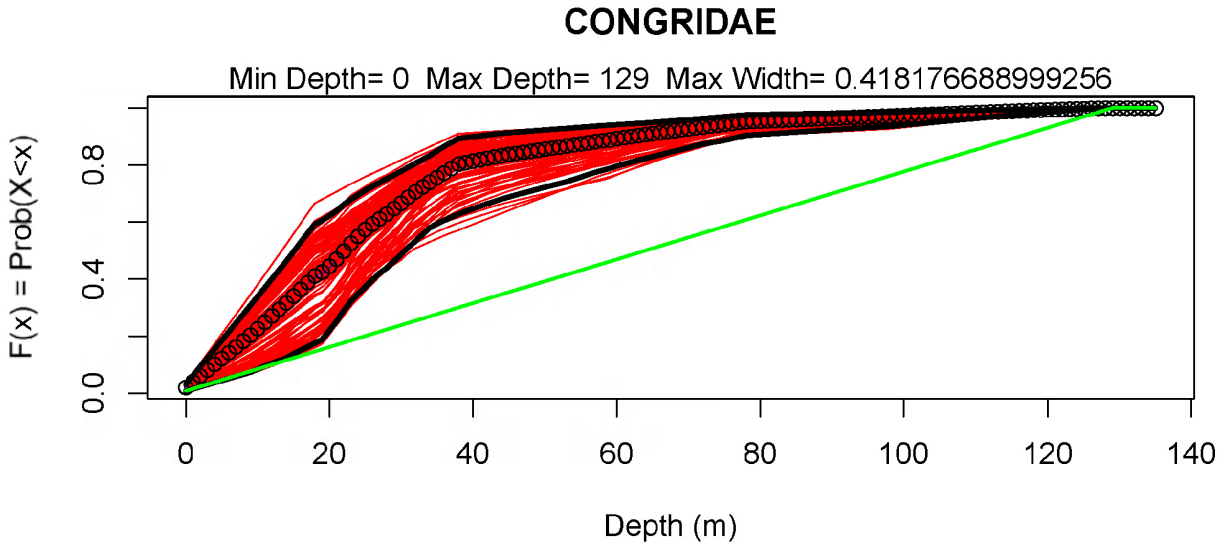

CARAPIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

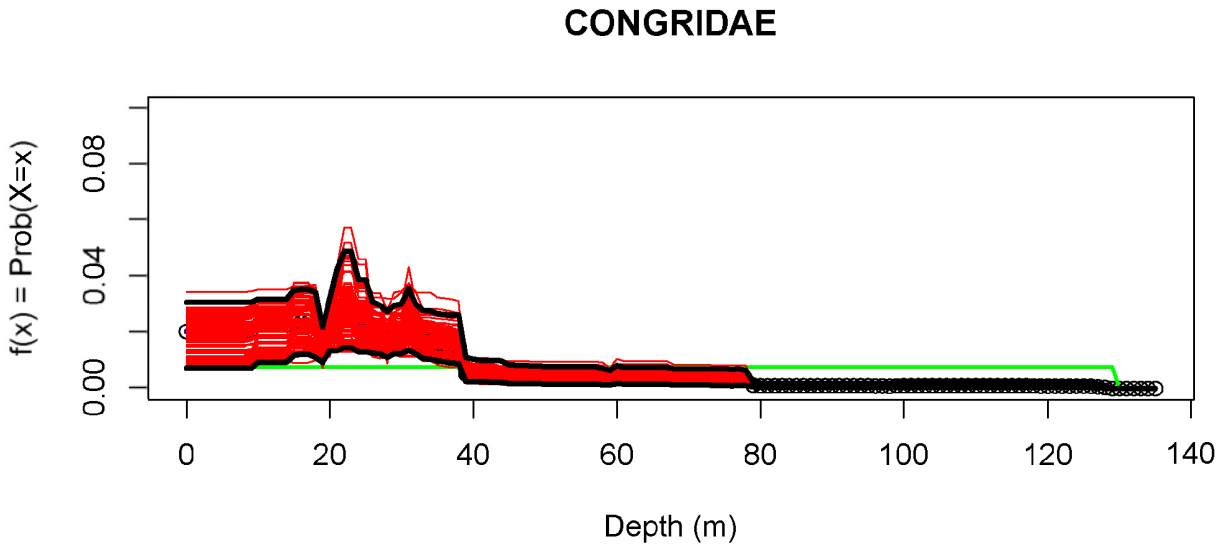

CHAULIODONTINAE
Min Depth= 0 Max Depth= 134 Max Width= 0.191160698365498
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

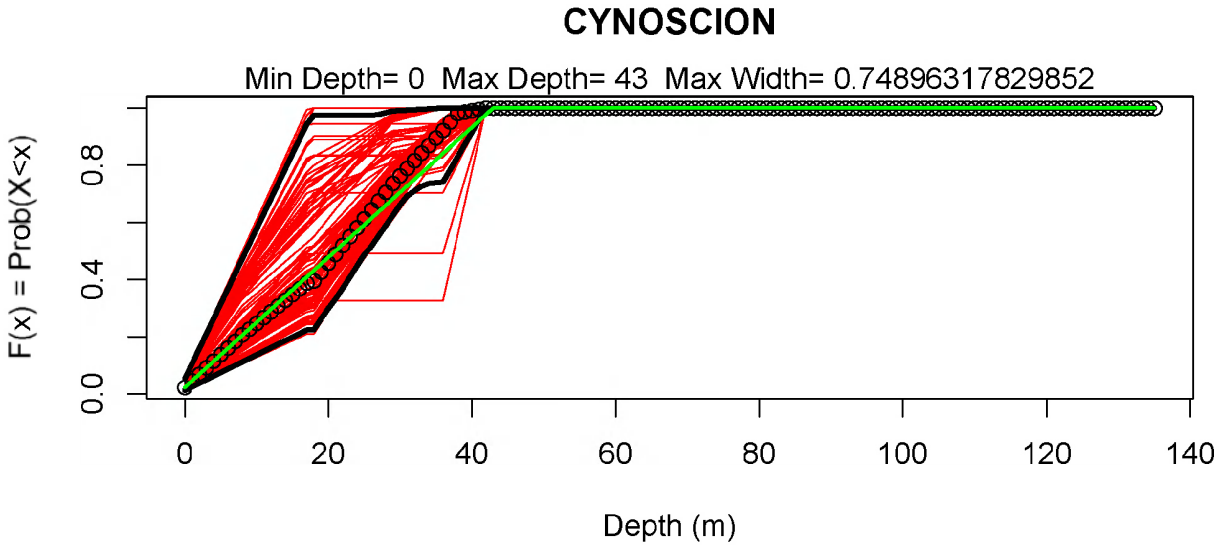

CHAULIODONTINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

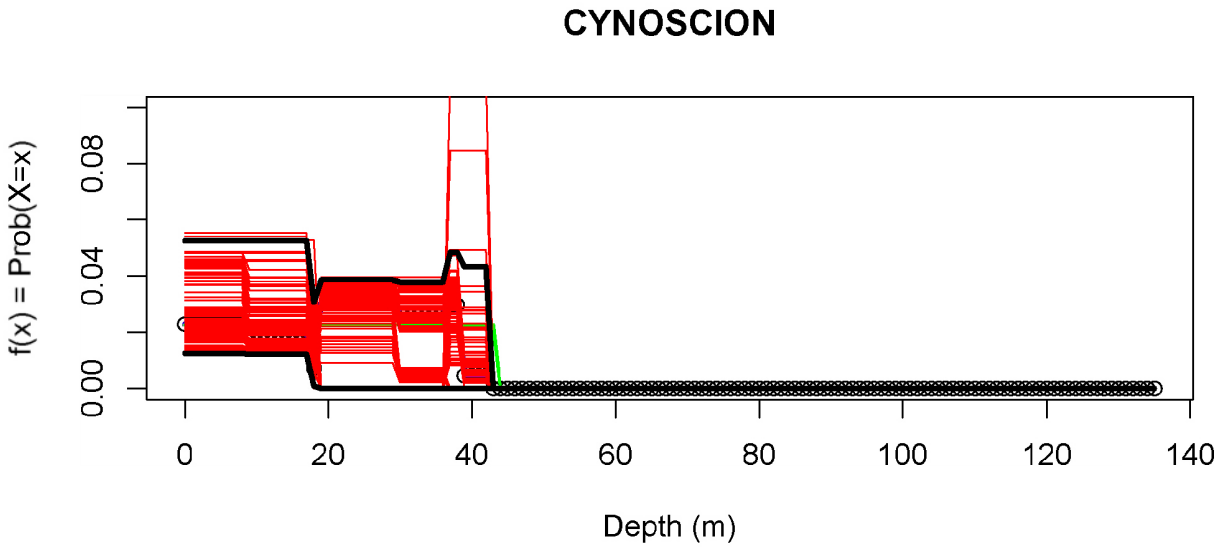

CITHARICHTHYS
Min Depth= 0 Max Depth= 130 Max Width= 0.224764363585817
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

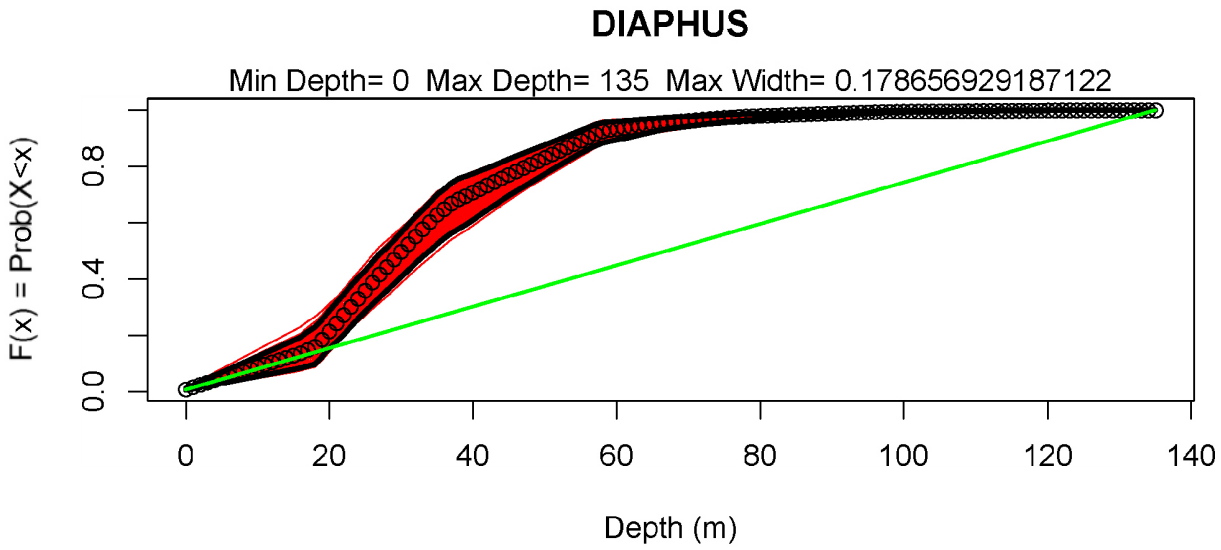

CITHARICHTHYS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

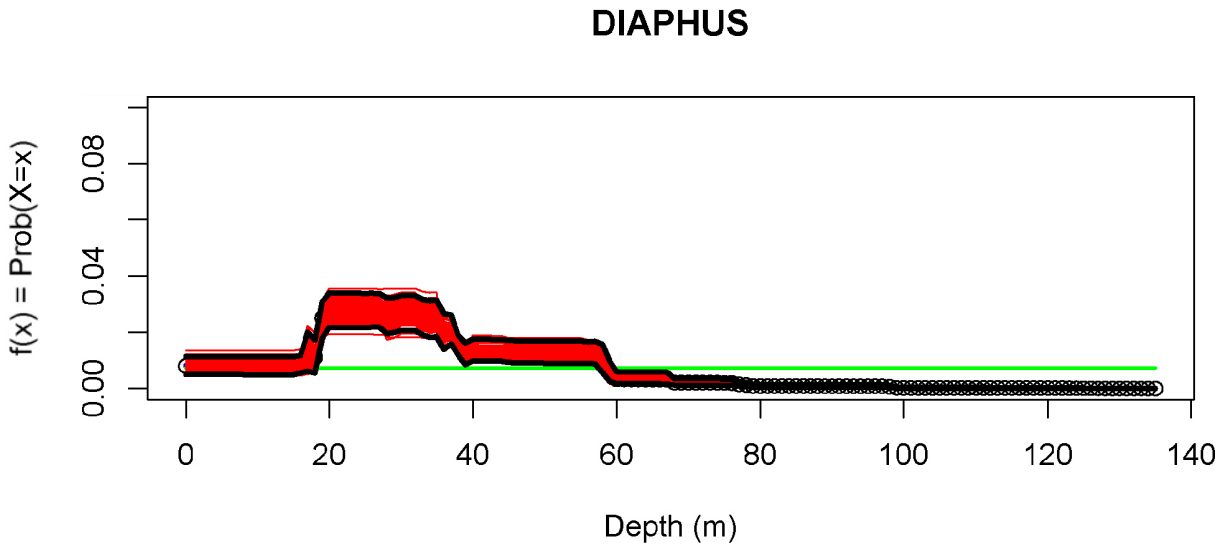

CONGRIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.418176688999256
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

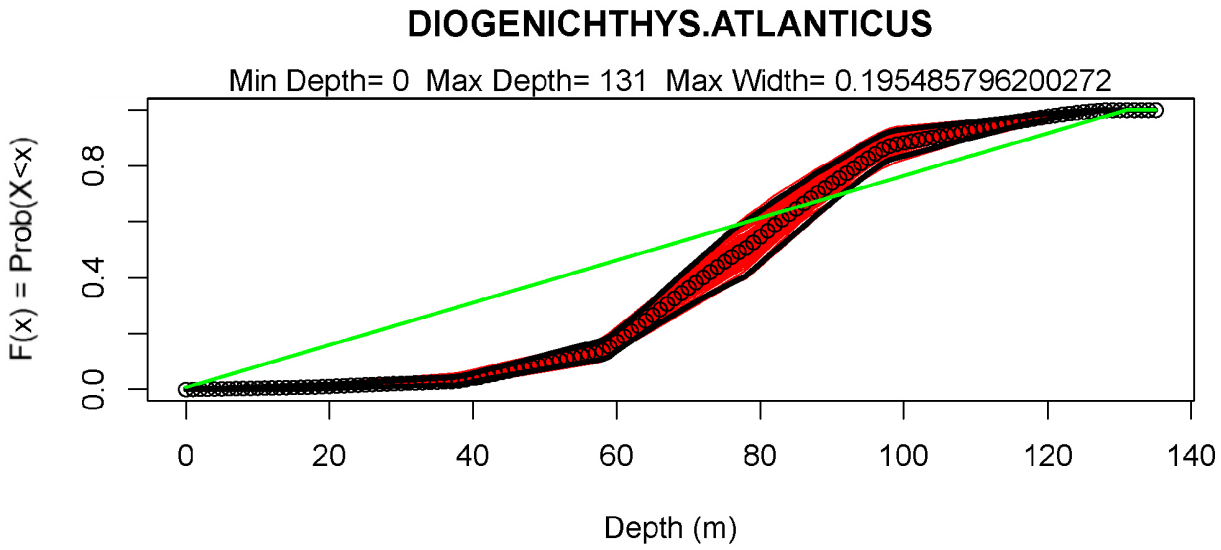

CONGRIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

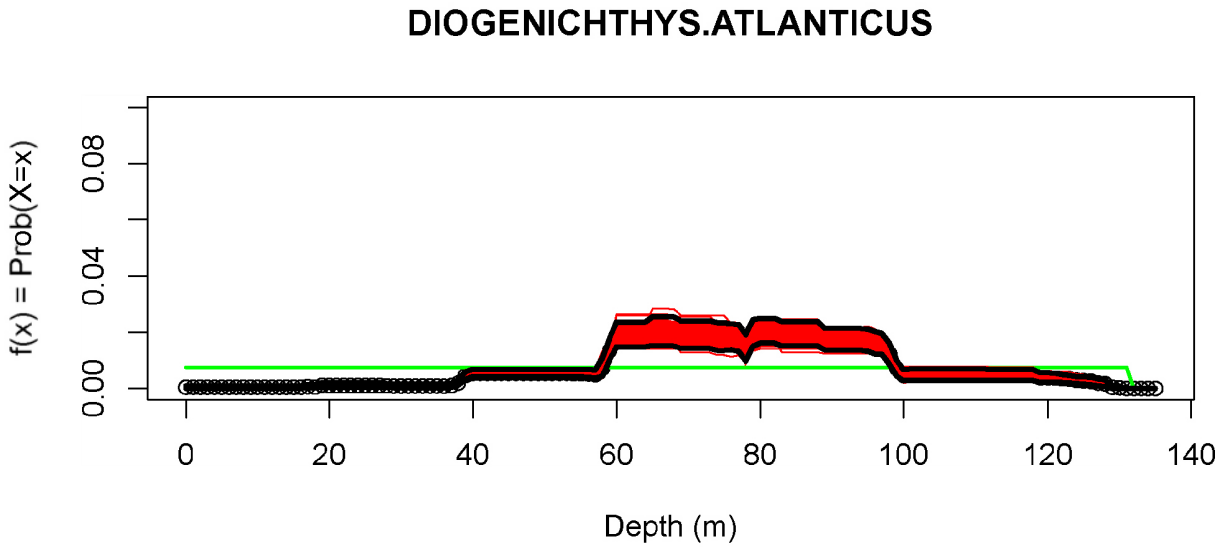

CYNOSCION
Min Depth= 0 Max Depth= 43 Max Width= 0.74896317829852
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

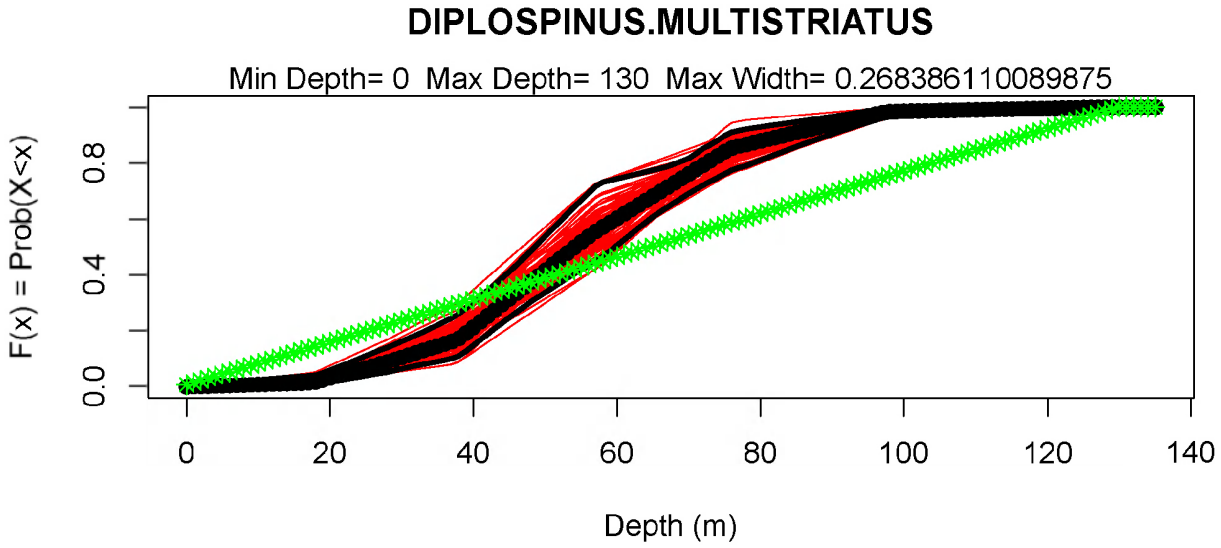

CYNOSCION
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

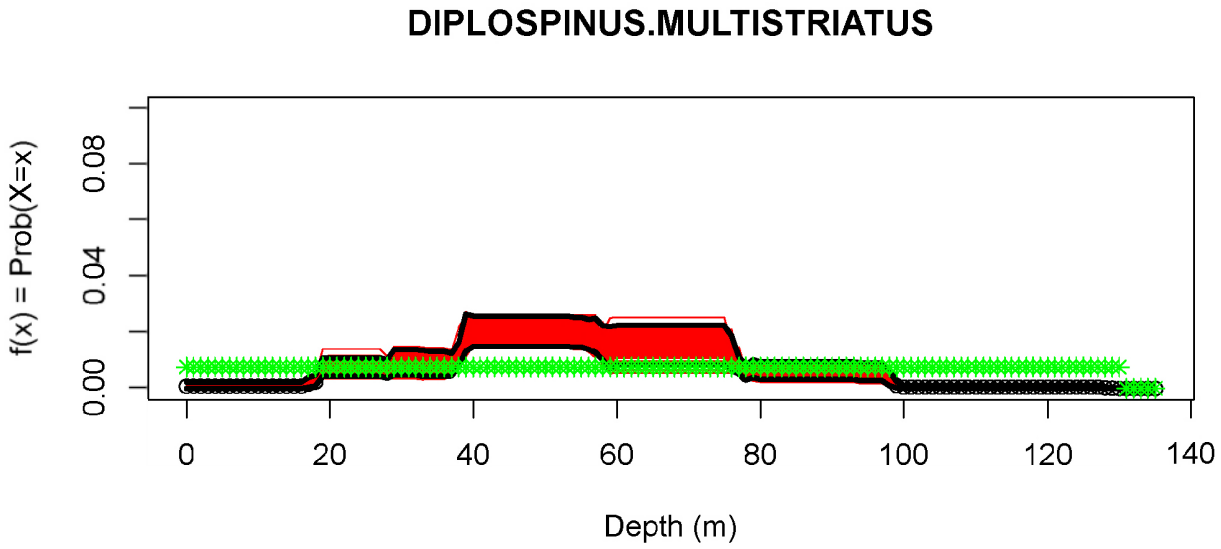

DIAPHUS
Min Depth= 0 Max Depth= 135 Max Width= 0.178656929187122
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

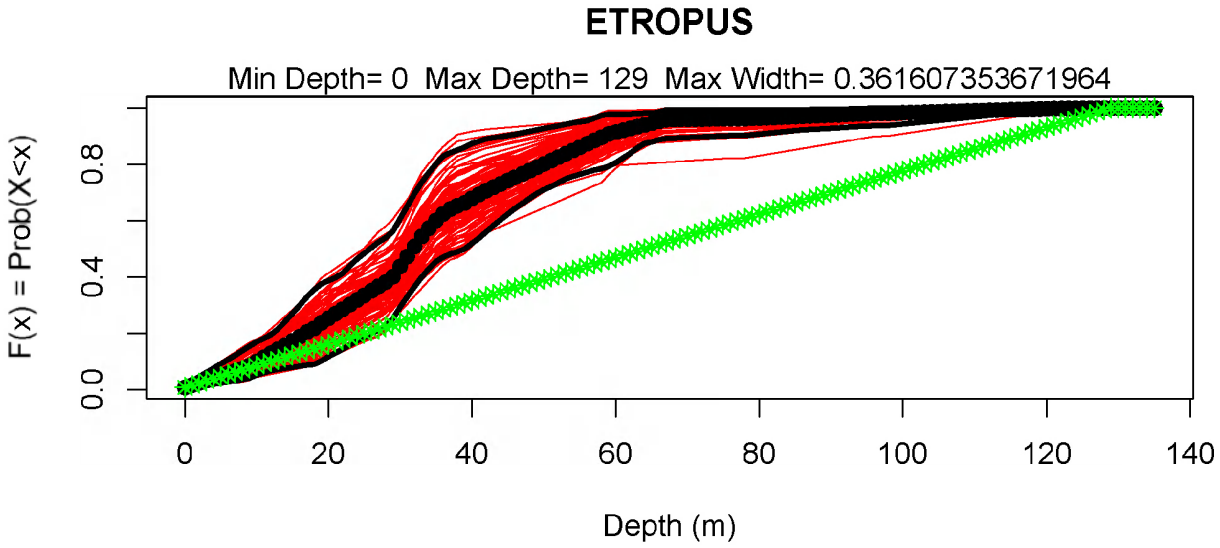

DIAPHUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

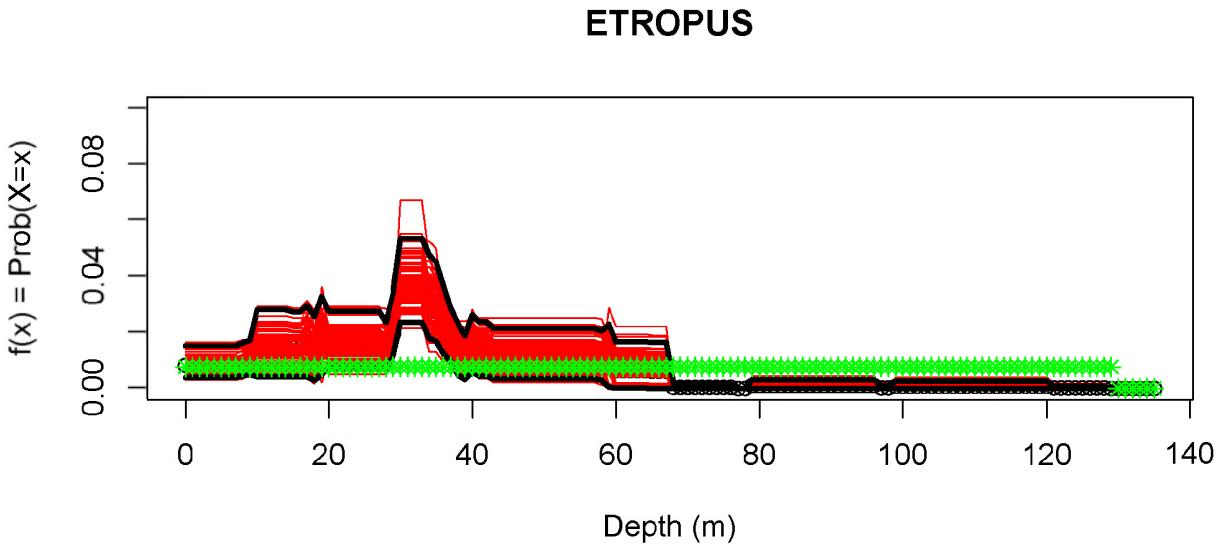

DIOGENICHTHYS.ATLANTICUS
Min Depth= 0 Max Depth= 131 Max Width= 0.195485796200272
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


DIOGENICHTHYS.ATLANTICUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

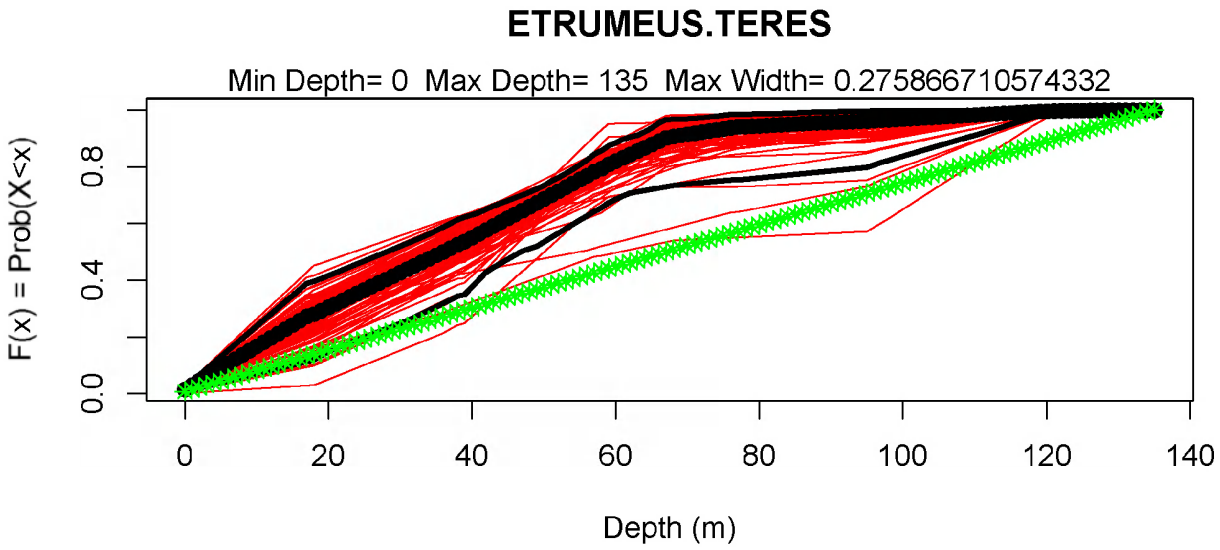

DIPLOSPINUS.MULTISTRIATUS
Min Depth= 0 Max Depth= 130 Max Width= 0.268386110089875
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

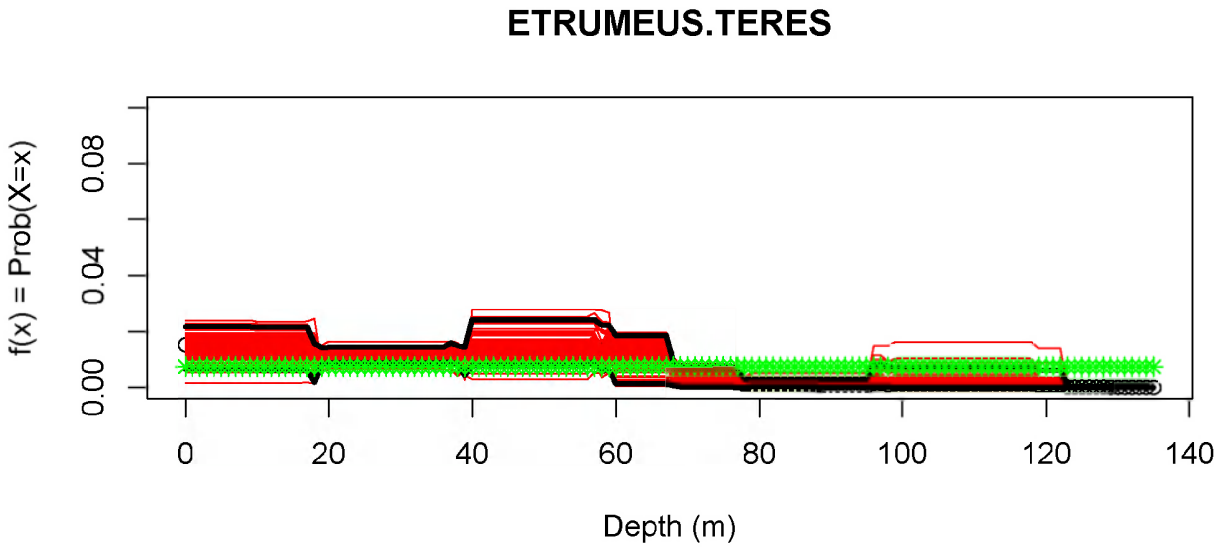

DIPLOSPINUS.MULTISTRIATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

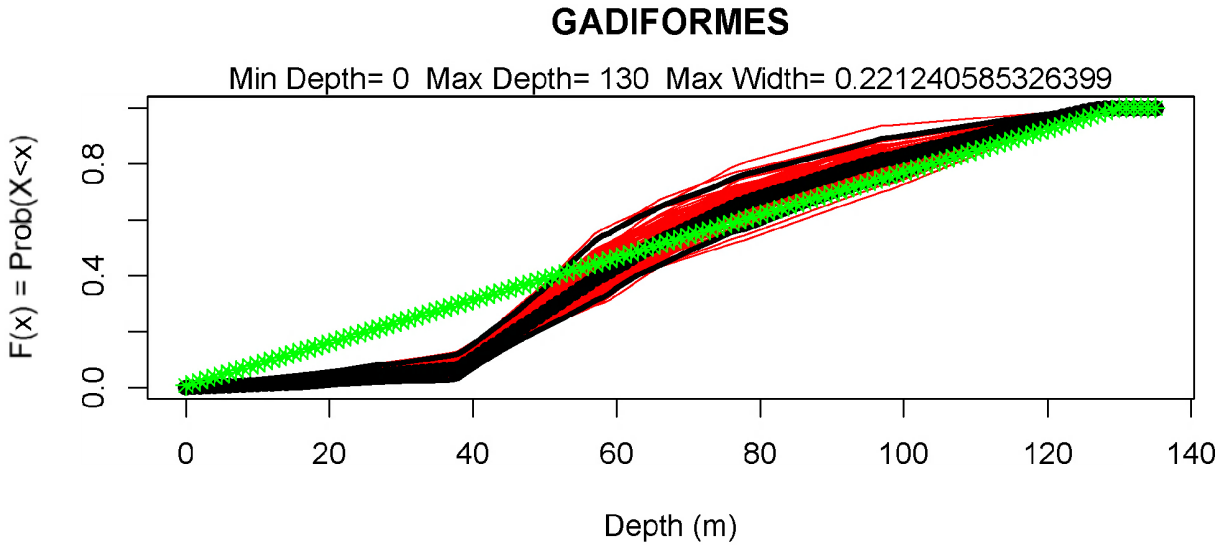


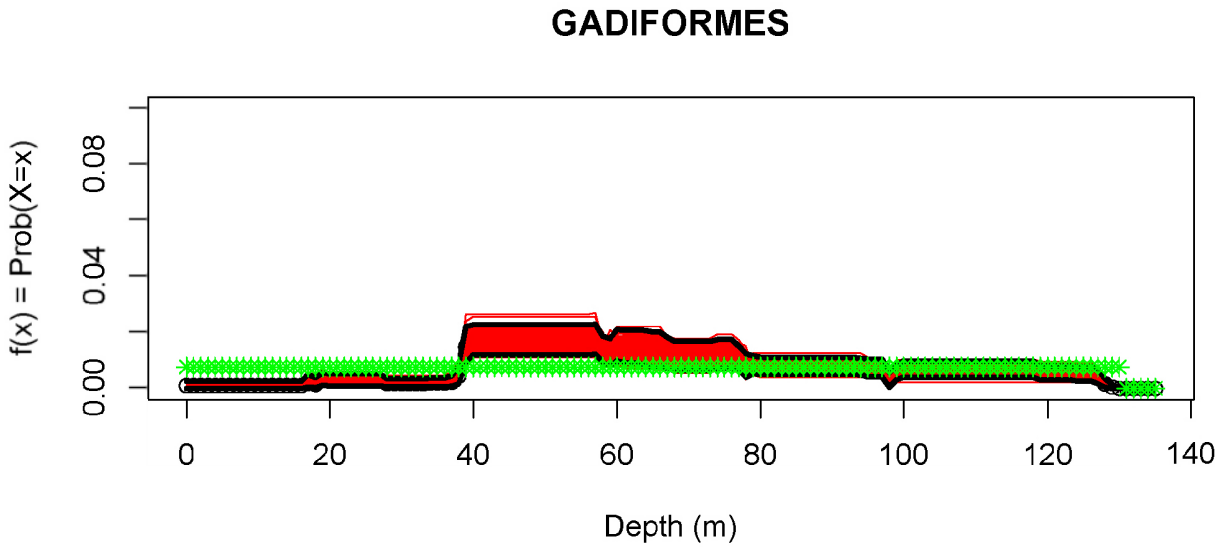


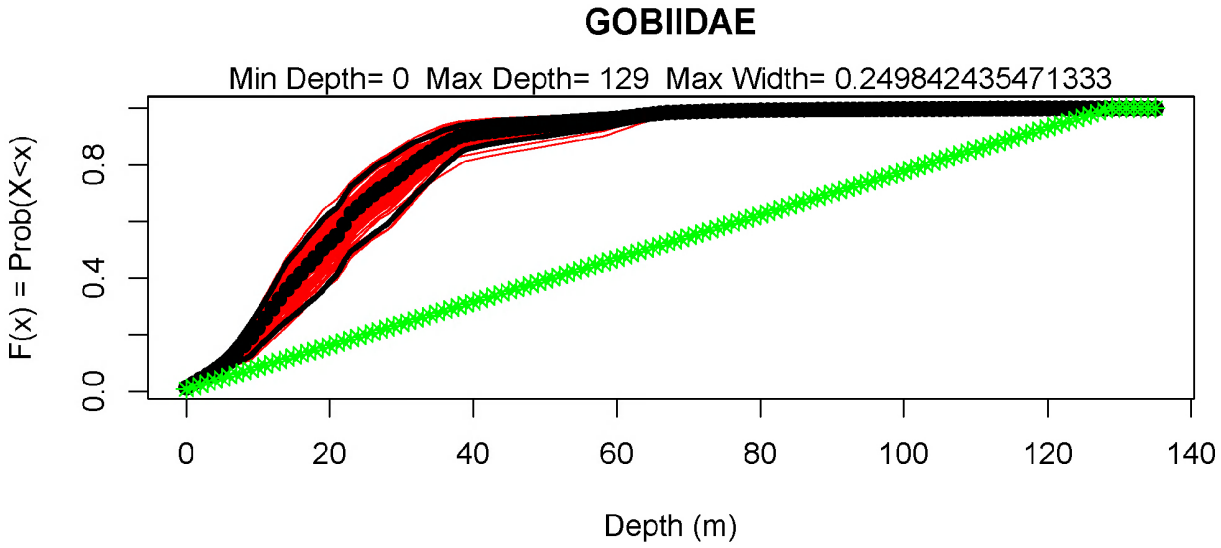
DWH-AR0196149

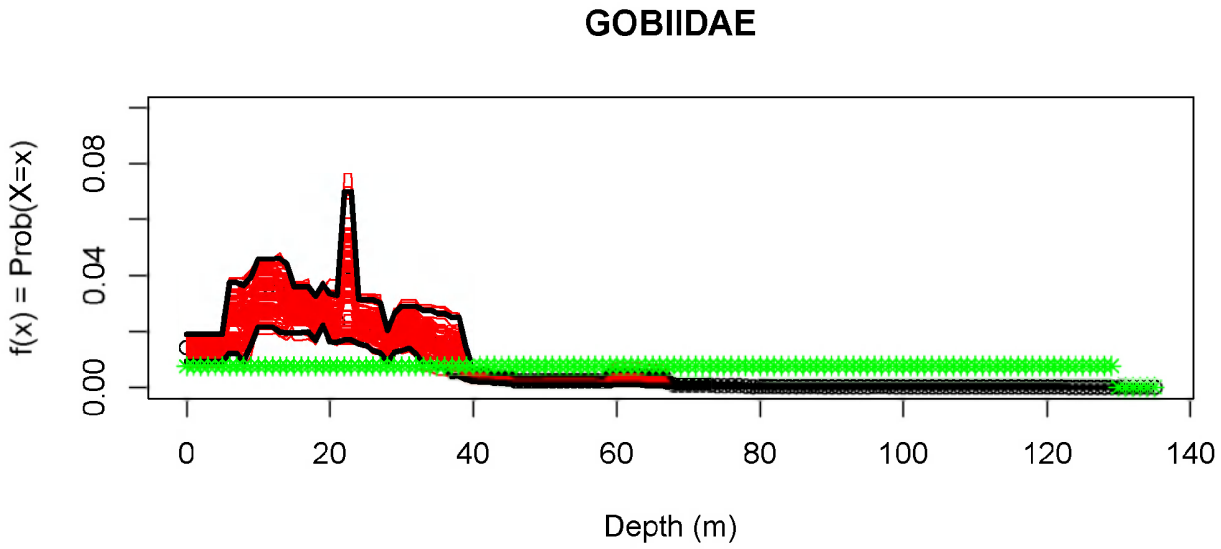

ETRUMEUS.TERES
Min Depth= 0 Max Depth= 135 Max Width= 0.275866710574332
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

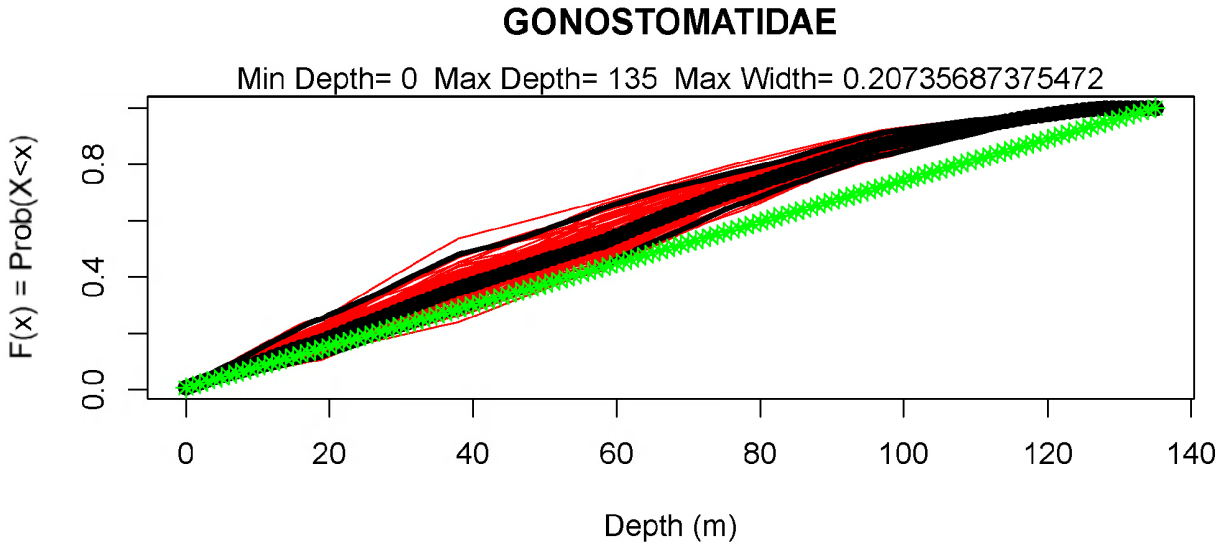

ETRUMEUS.TERES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

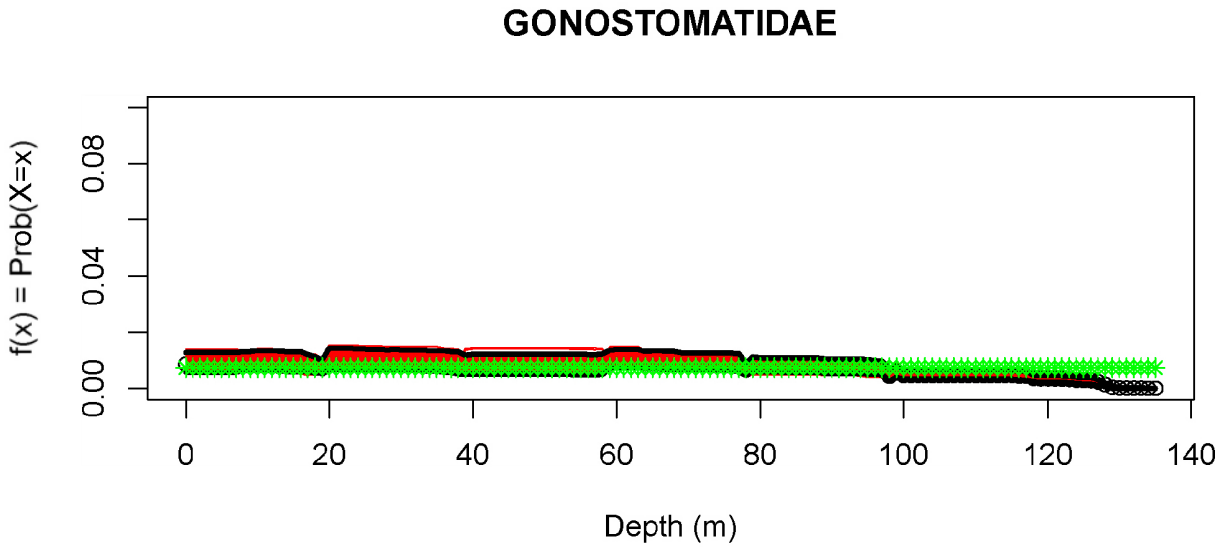

GADIFORMES
Min Depth= 0 Max Depth= 130 Max Width= 0.221240585326399
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

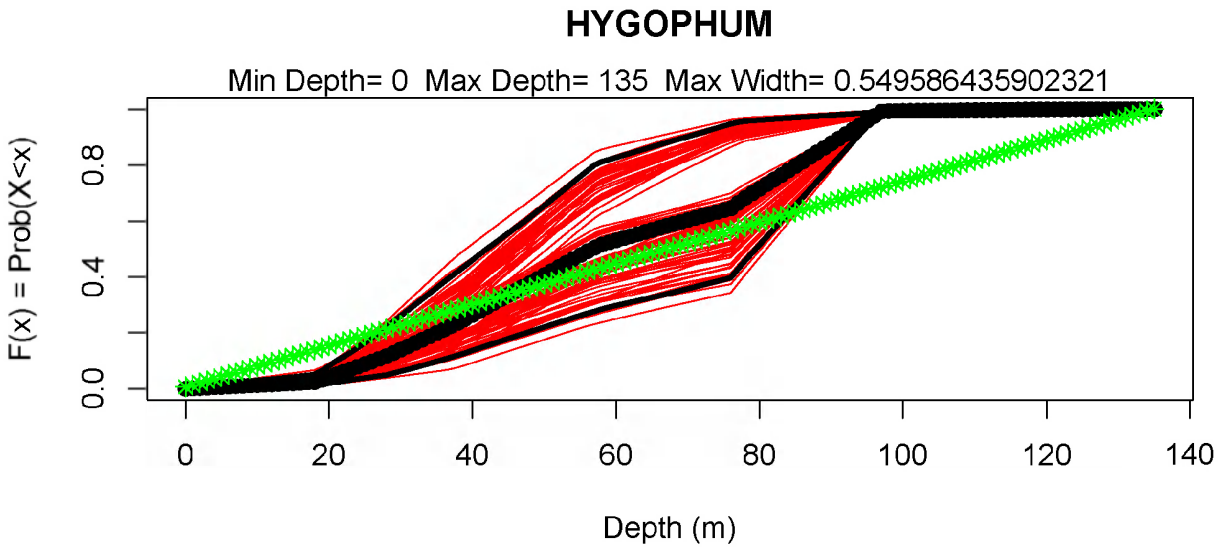

GADIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

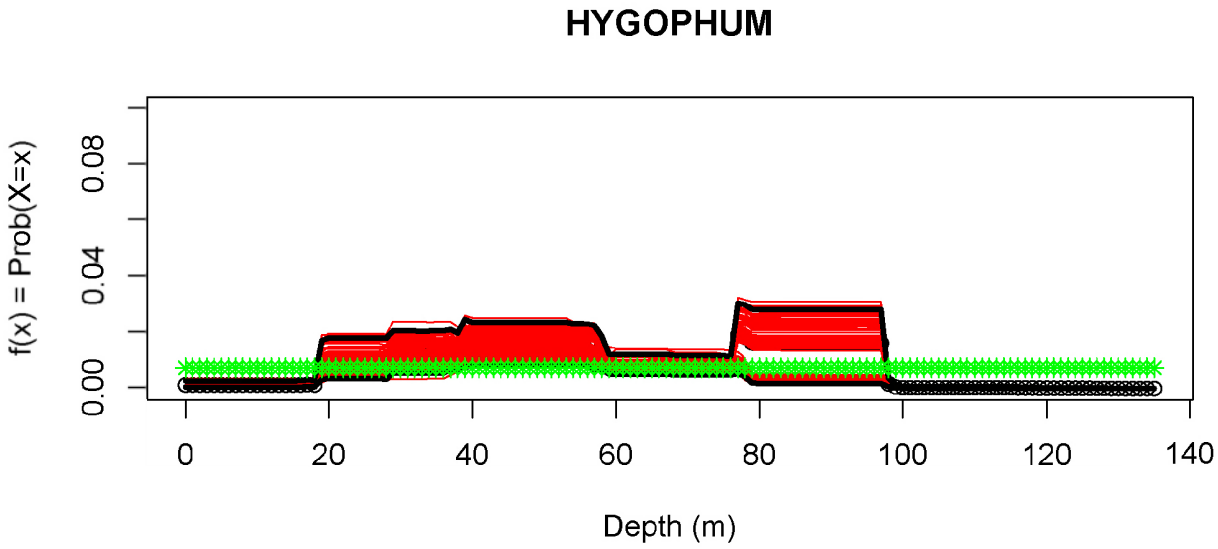

GOBIIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.249842435471333
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

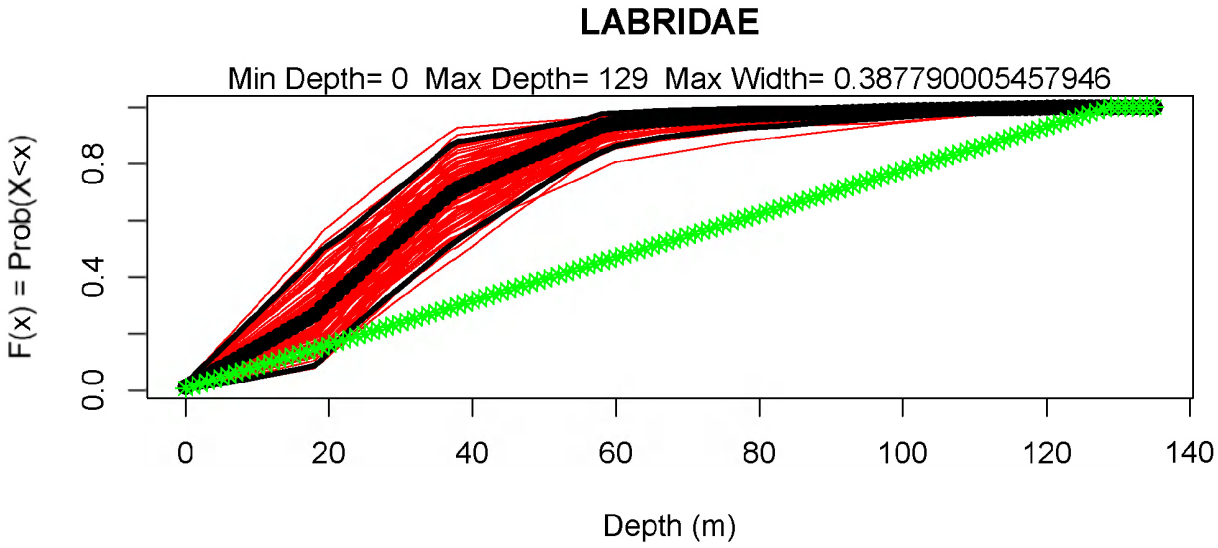

GOBIIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

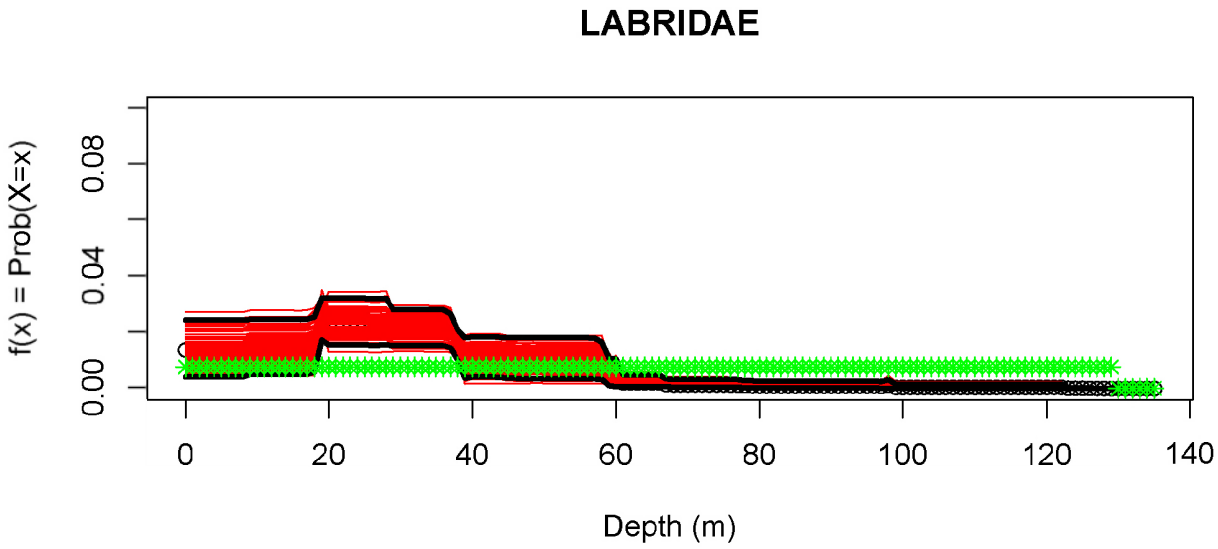

GONOSTOMATIDAE
Min Depth= 0 Max Depth= 135 Max Width= 0.20735687375472
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

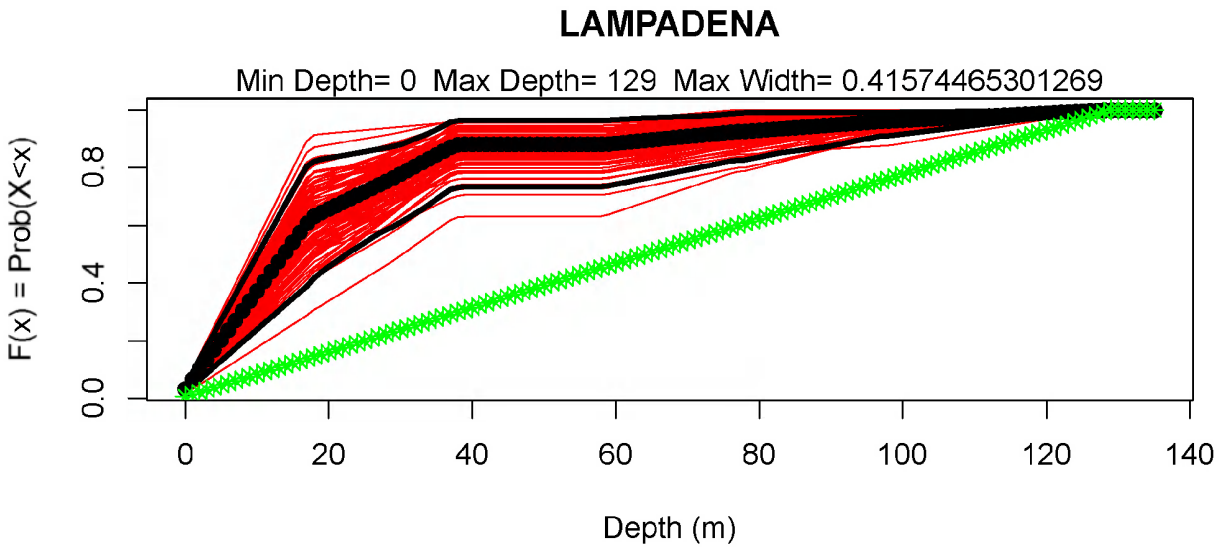

GONOSTOMATIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

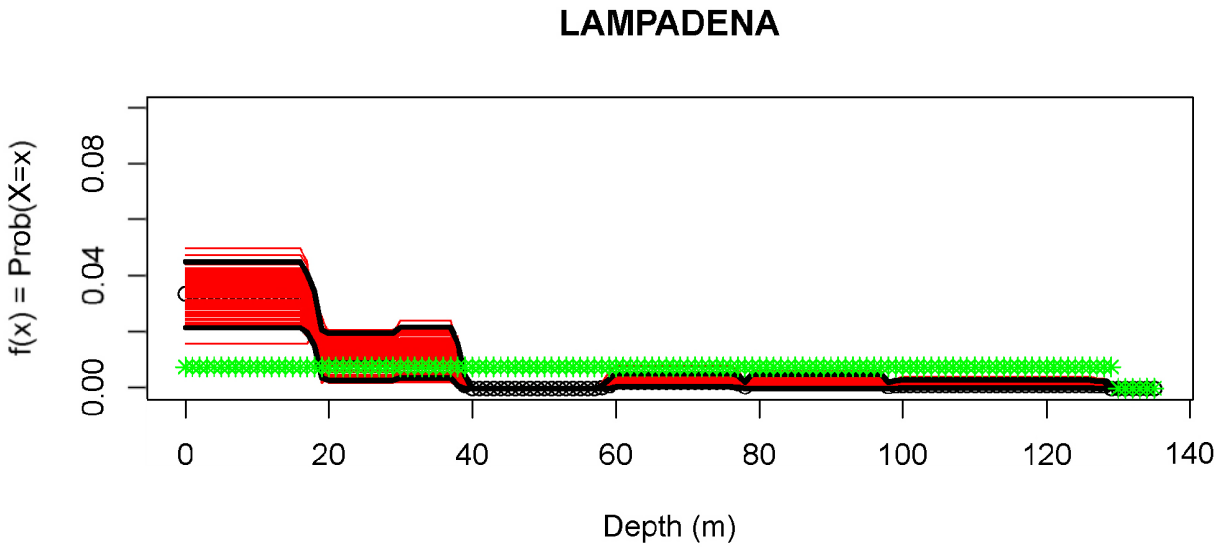

HYGOPHUM
Min Depth= 0 Max Depth= 135 Max Width= 0.549586435902321
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

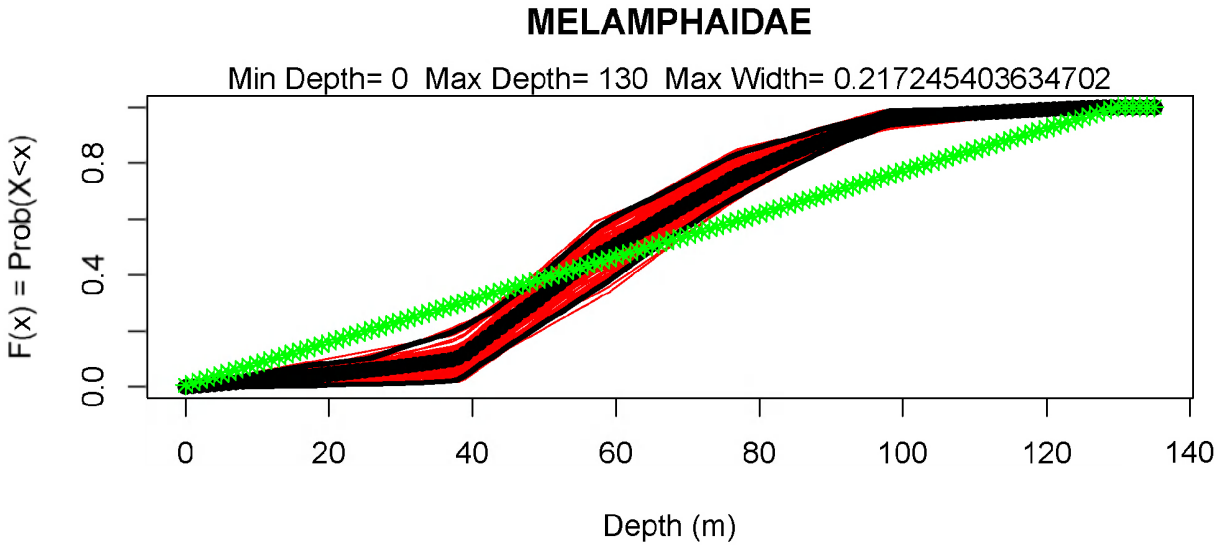

HYGOPHUM
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

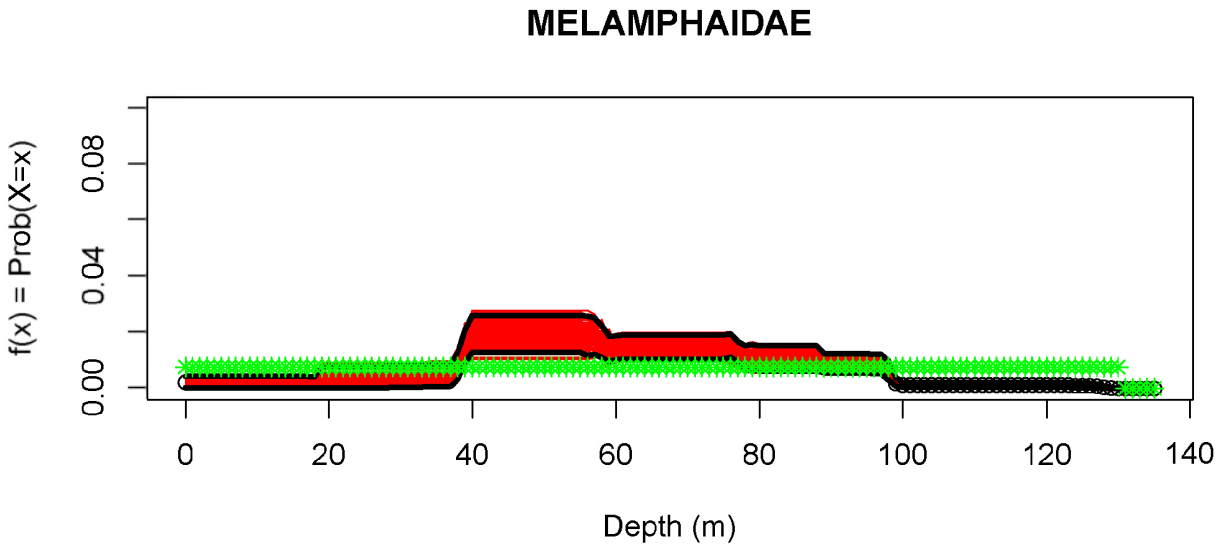

LABRIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.387790005457946
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

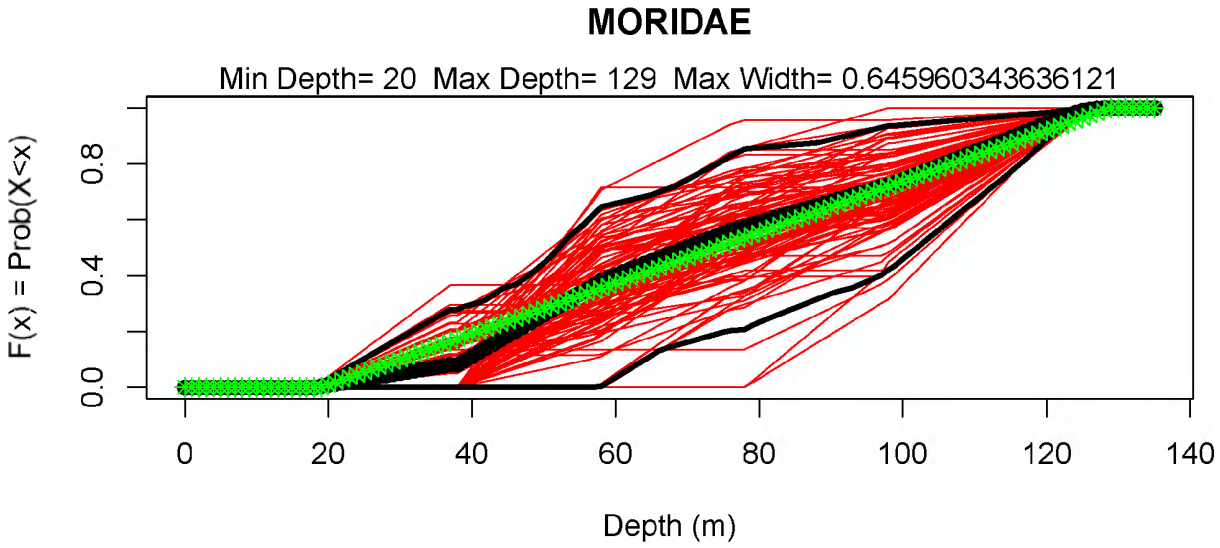

LABRIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

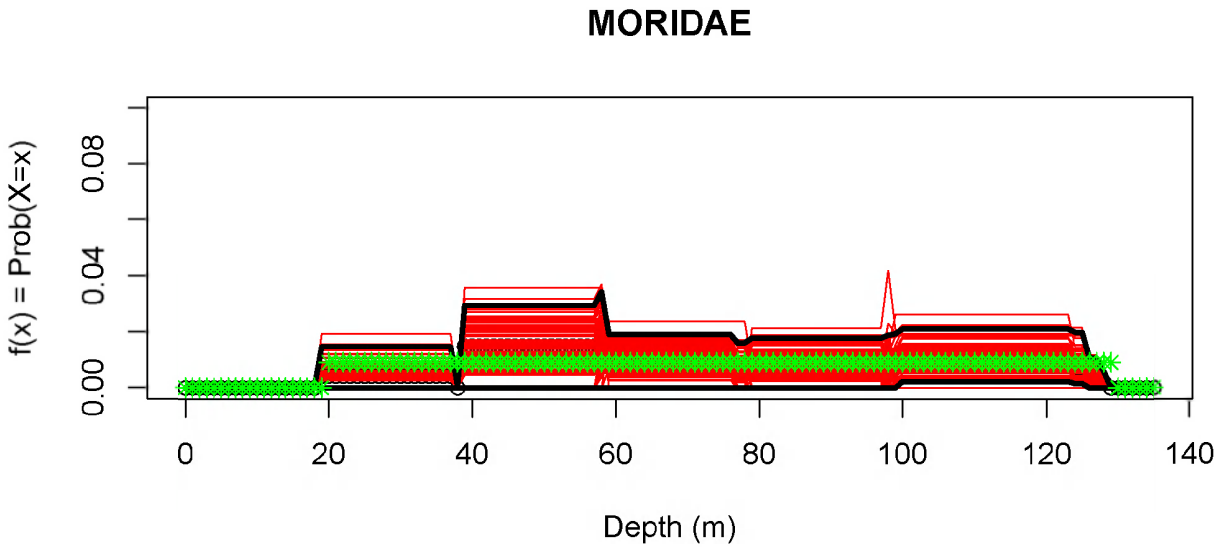

LAMPADENA
Min Depth= 0 Max Depth= 129 Max Width= 0.41574465301269
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

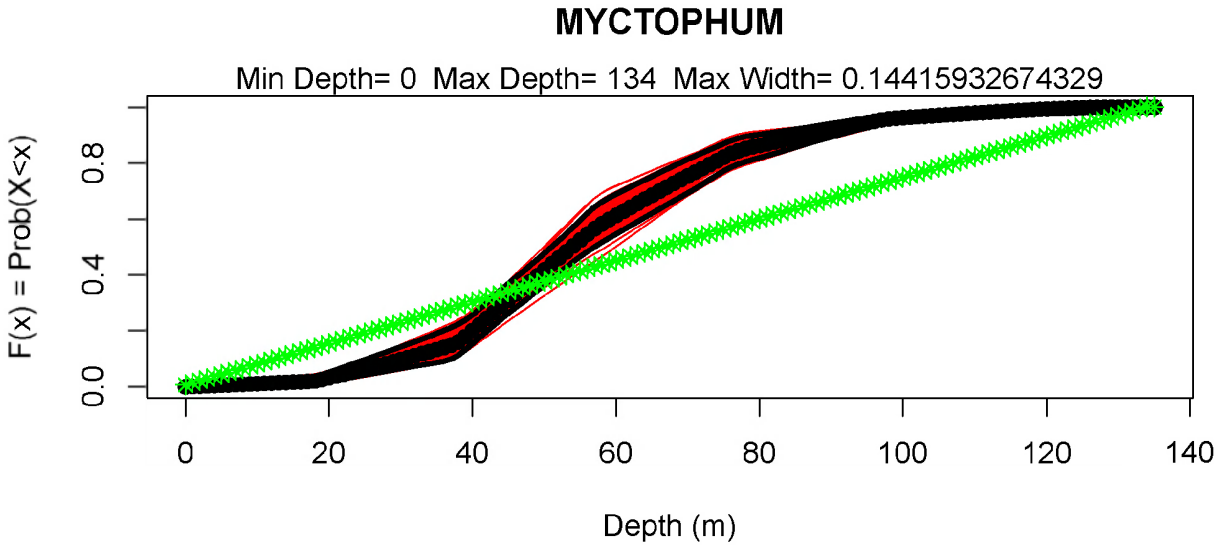

LAMPADENA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

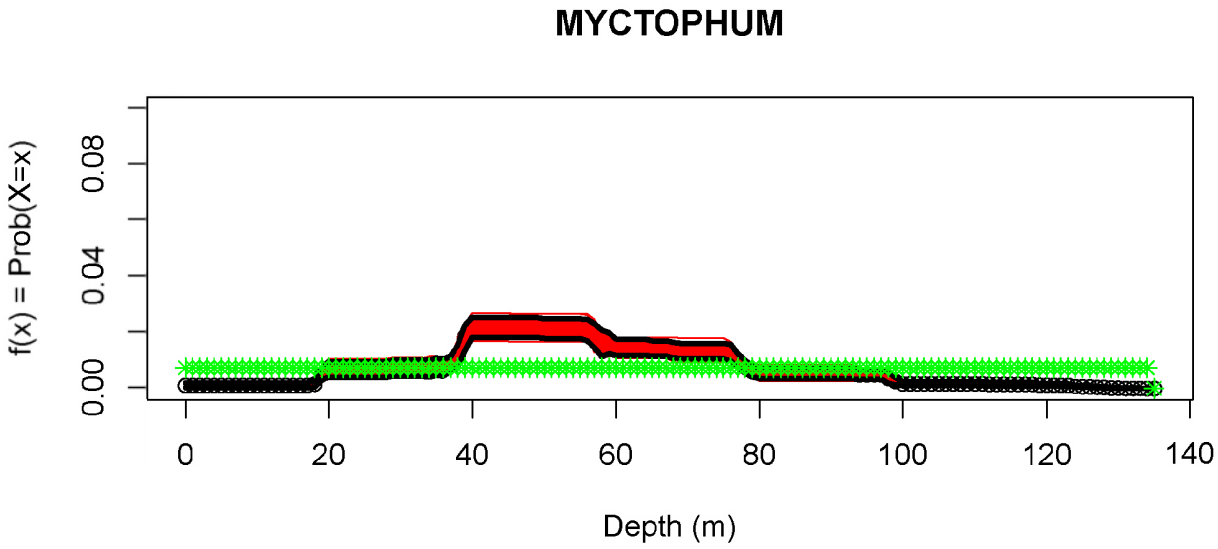

MELAMPHAIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.217245403634702
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

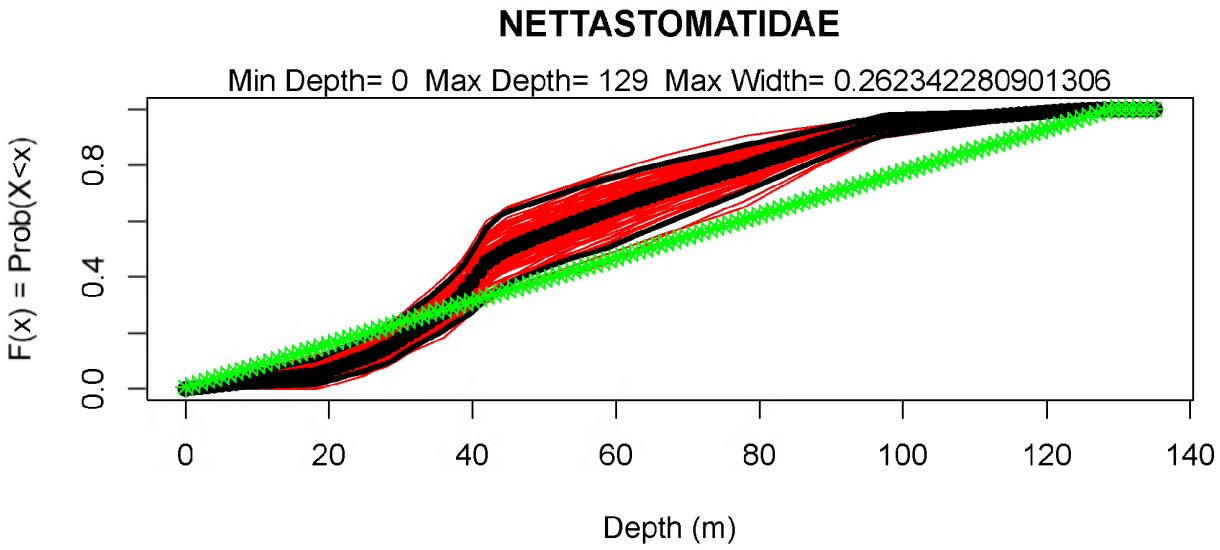

MELAMPHAIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

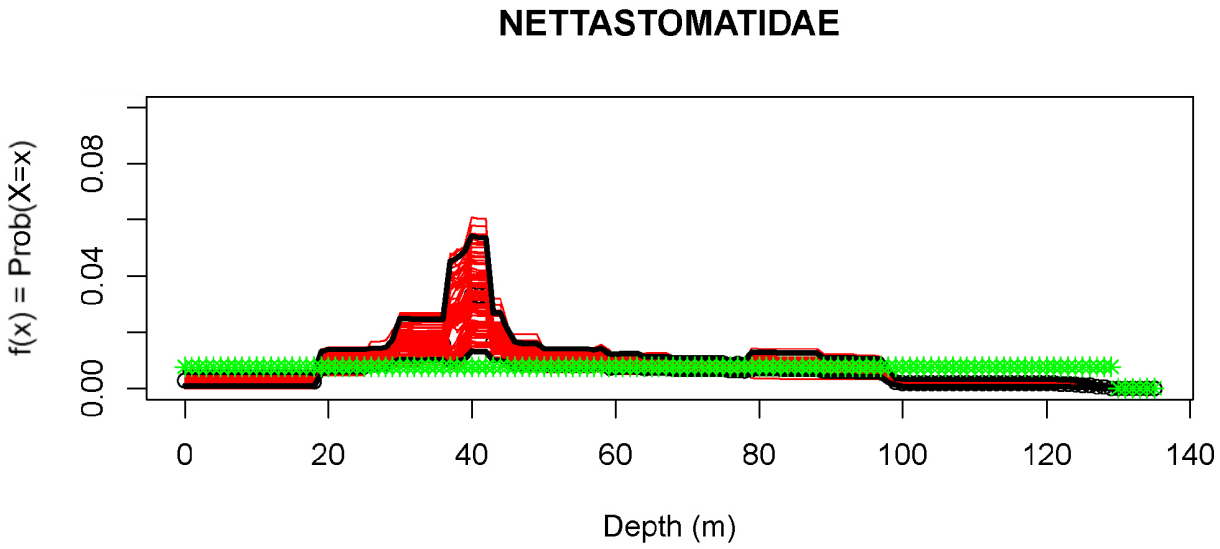

MORIDAE
Min Depth= 20 Max Depth= 129 Max Width= 0.645960343636121
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

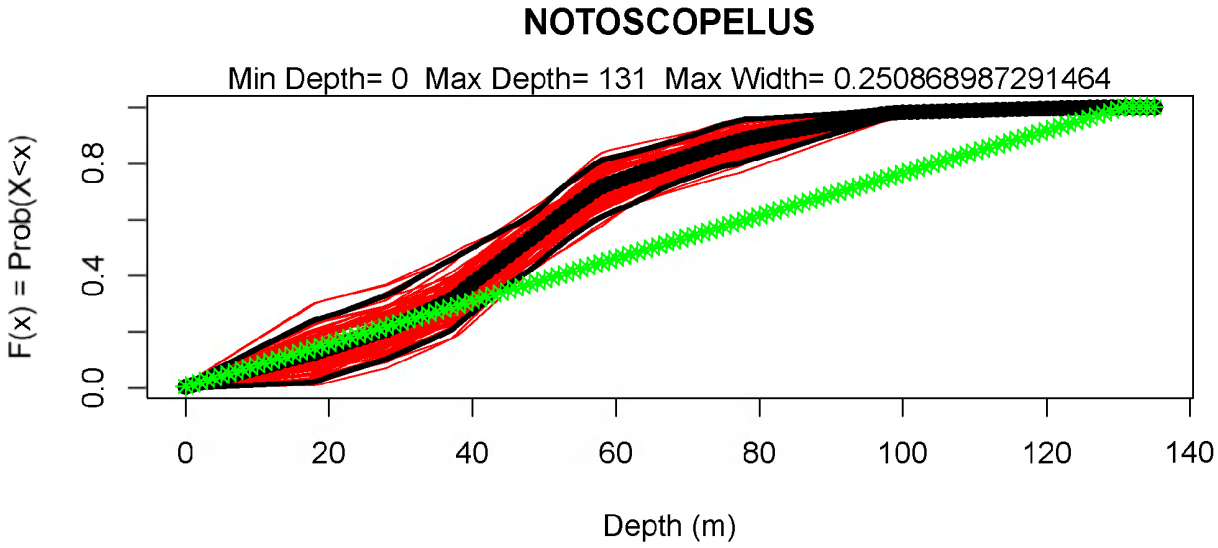

MORIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

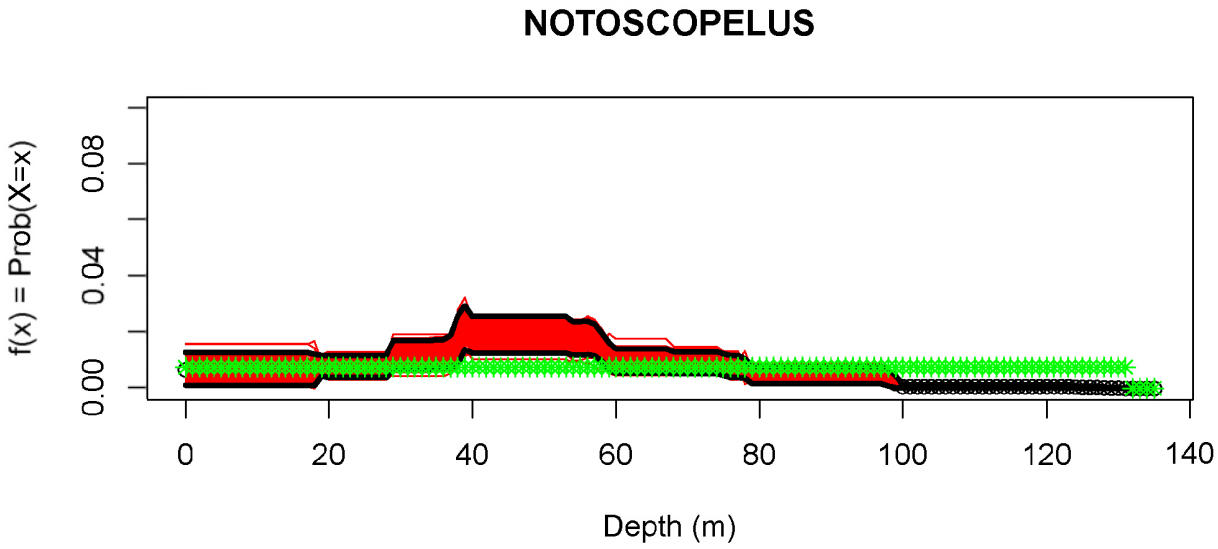

MYCTOPHUM
Min Depth= 0 Max Depth= 134 Max Width= 0.14415932674329
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

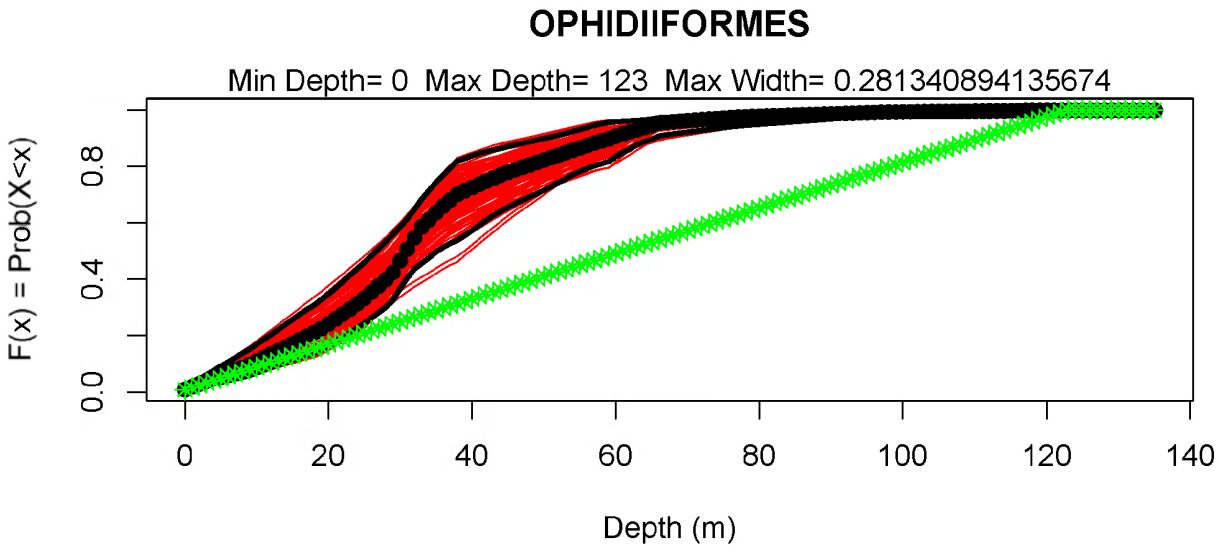

MYCTOPHUM
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

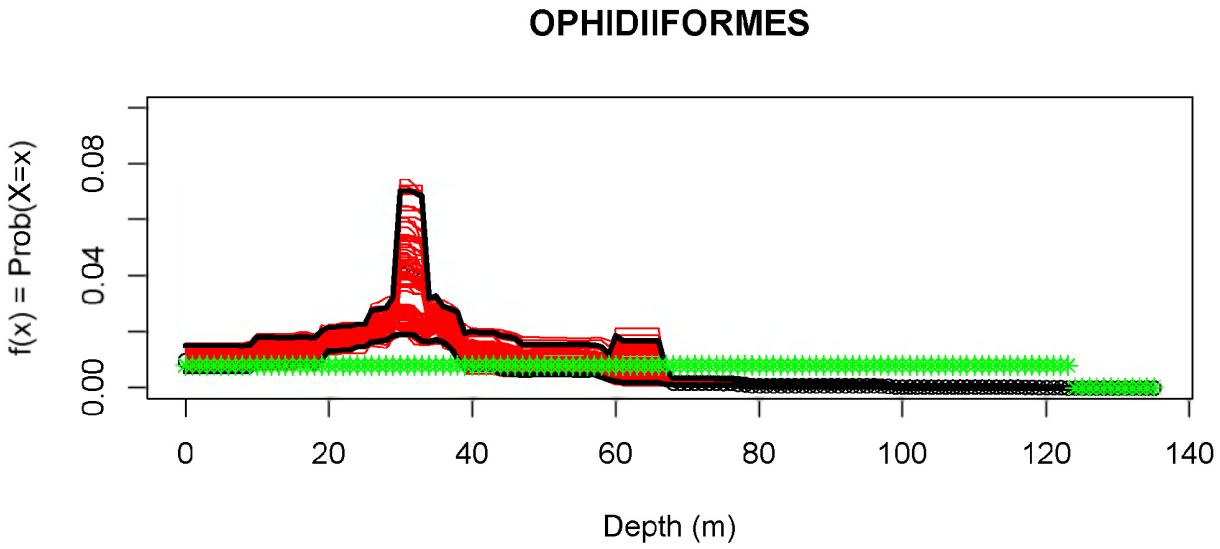

NETTASTOMATIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.262342280901306
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

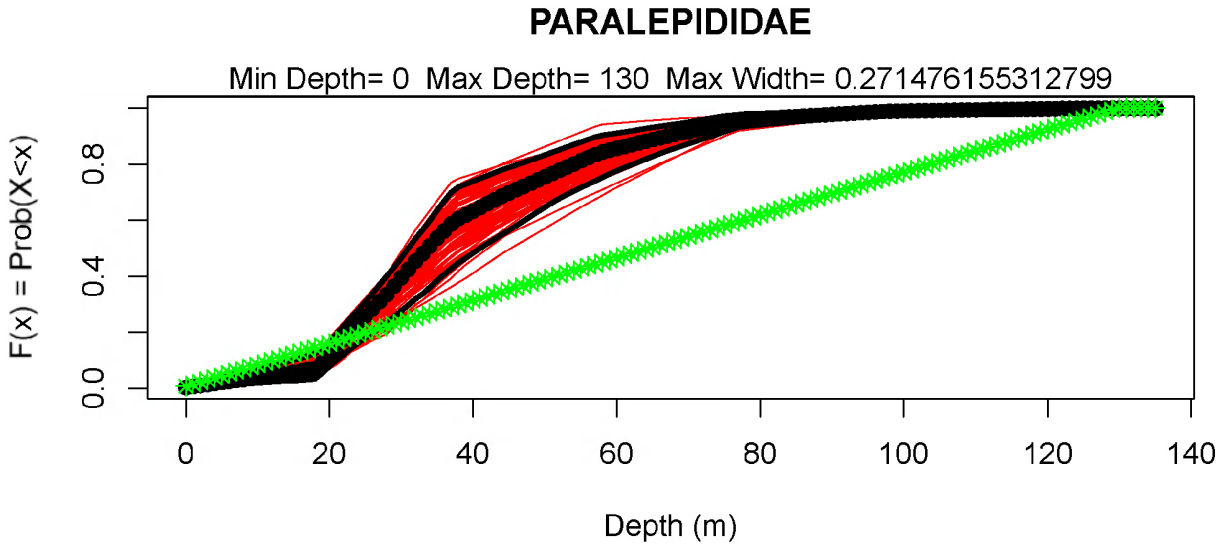

NETTASTOMATIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

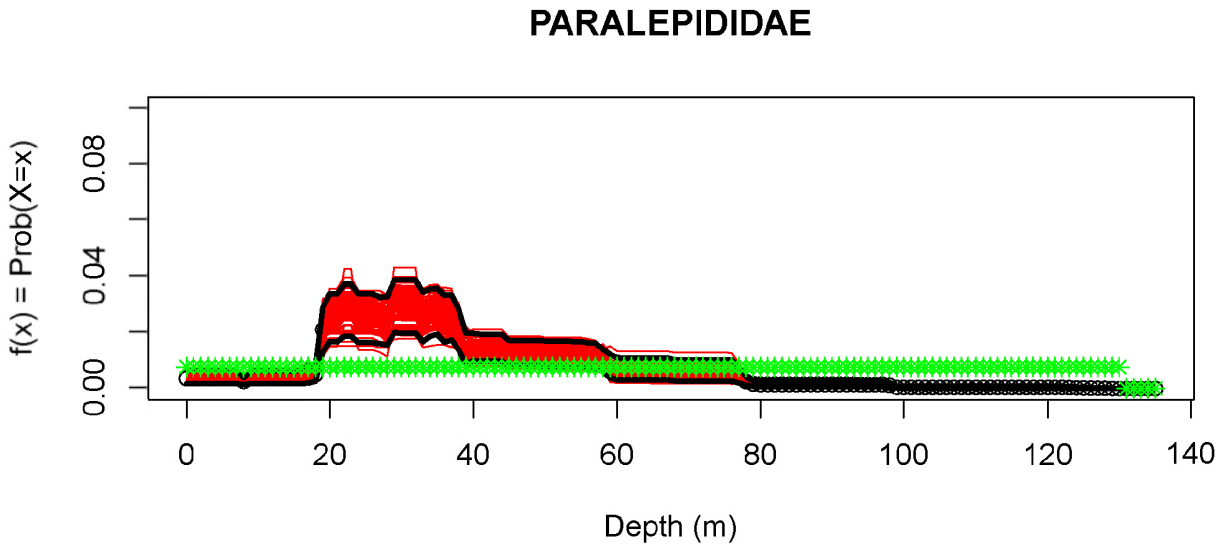

NOTOSCOPELUS
Min Depth= 0 Max Depth= 131 Max Width= 0.250868987291464
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

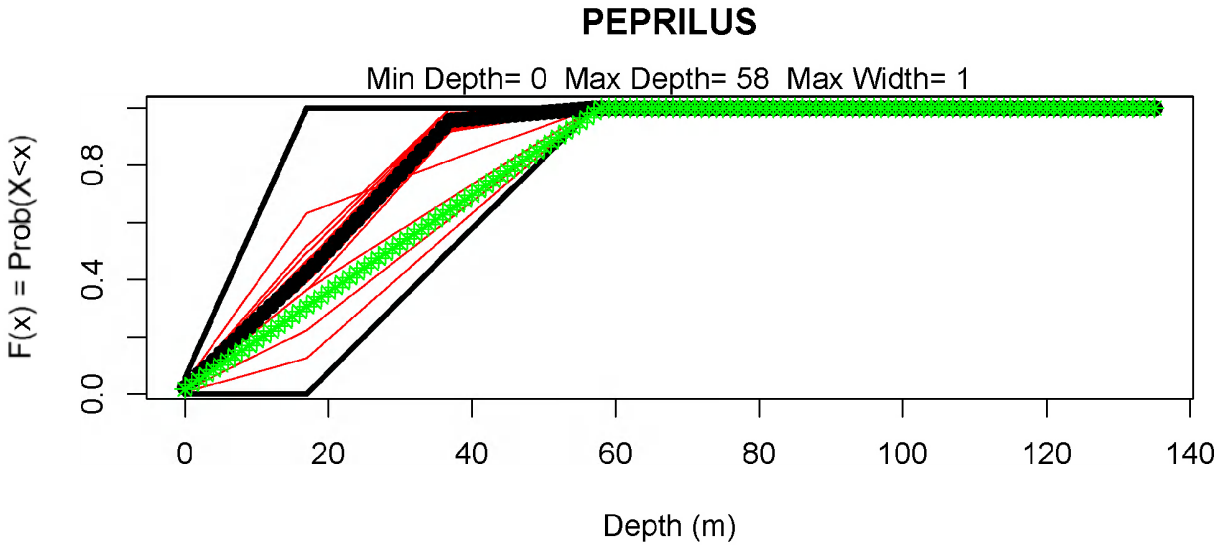

NOTOSCOPELUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

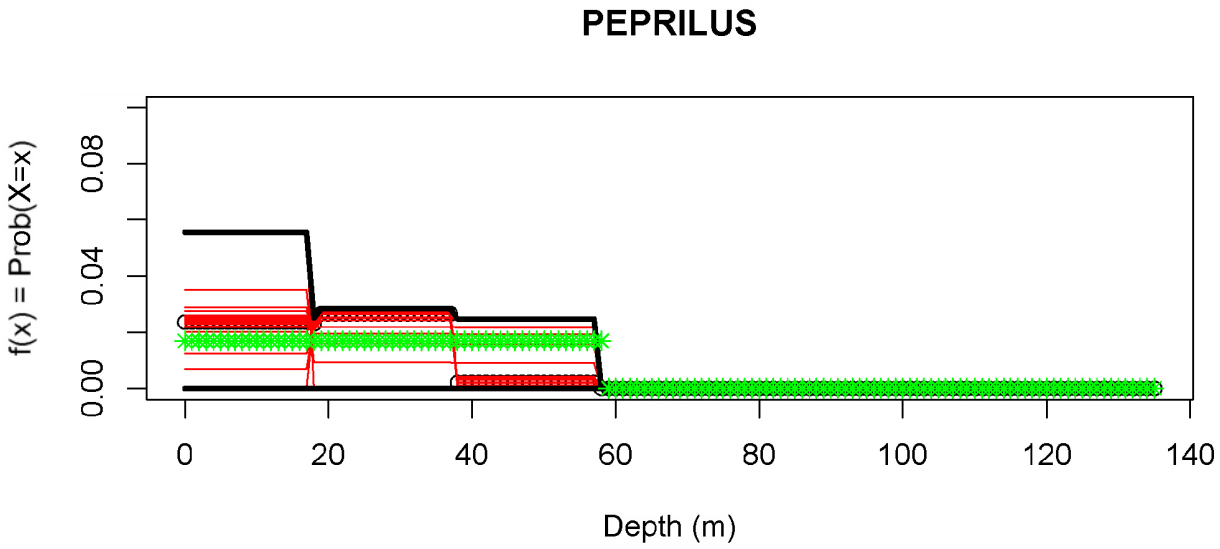

OPHIDIIFORMES
Min Depth= 0 Max Depth= 123 Max Width= 0.281340894135674
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

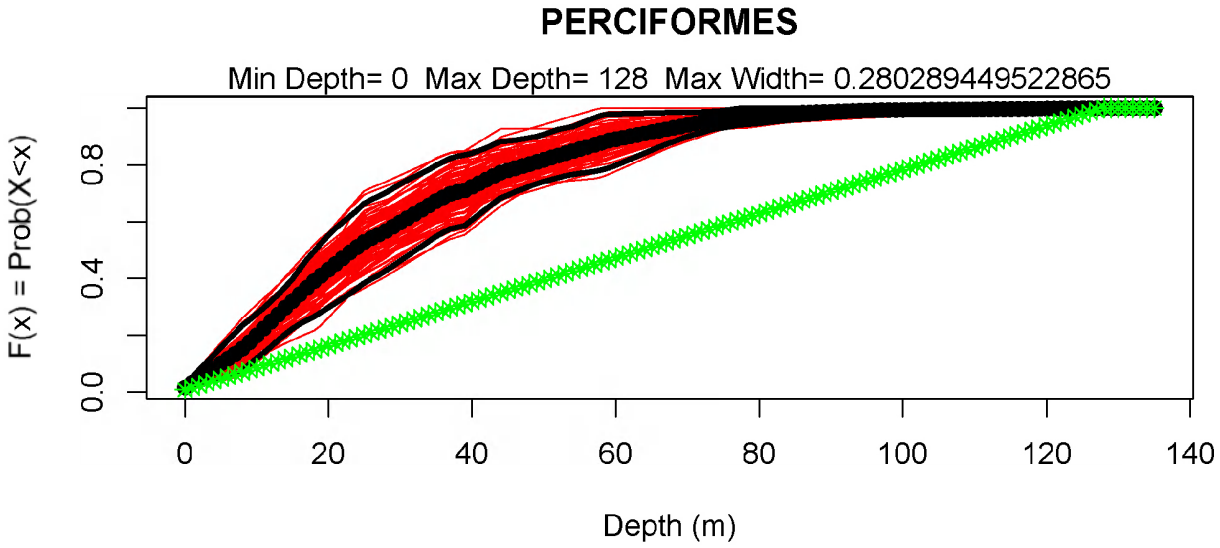

OPHIDIIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

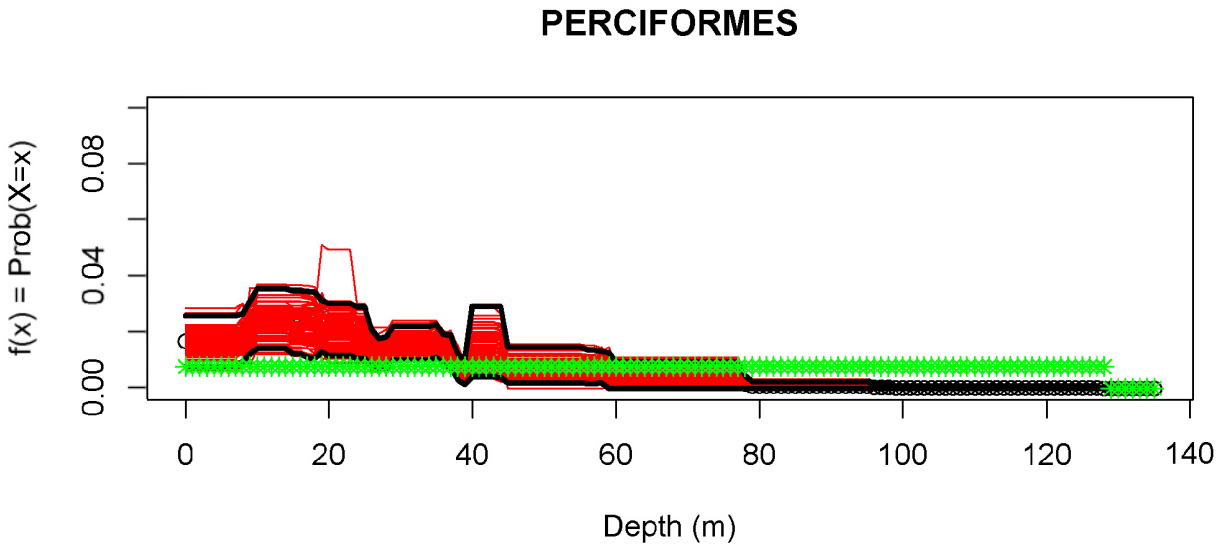

PARALEPIDIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.271476155312799
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

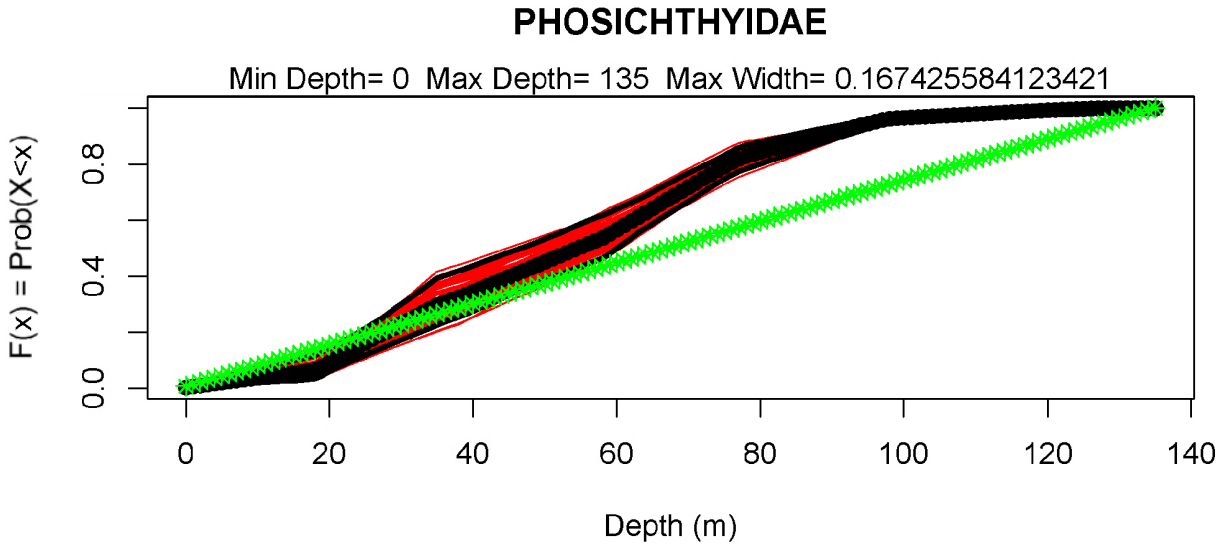

PARALEPIDIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

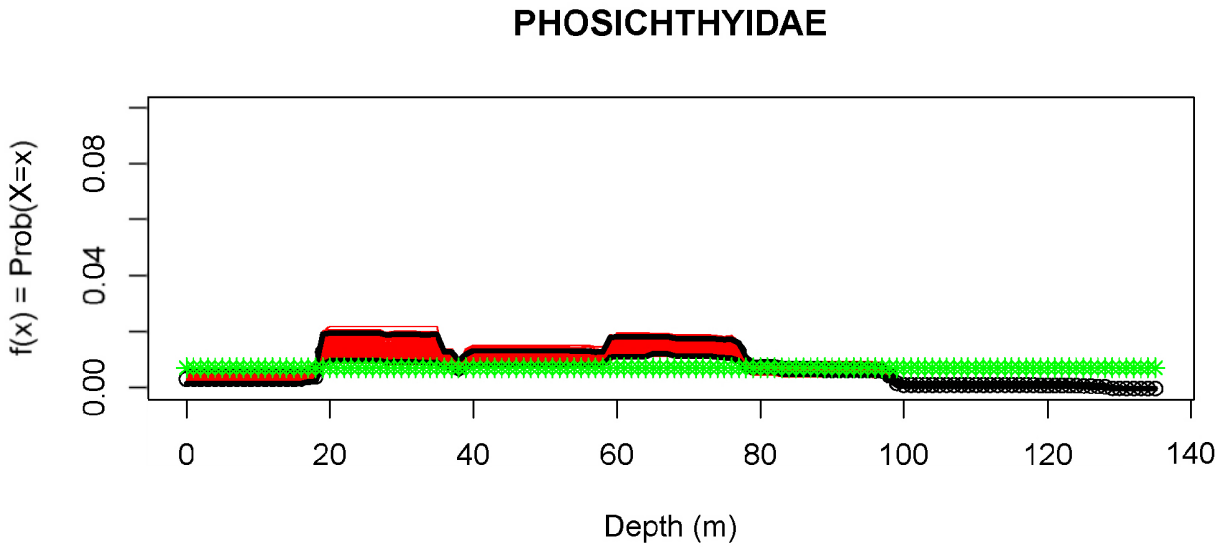

PEPRILUS
Min Depth= 0 Max Depth= 58 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

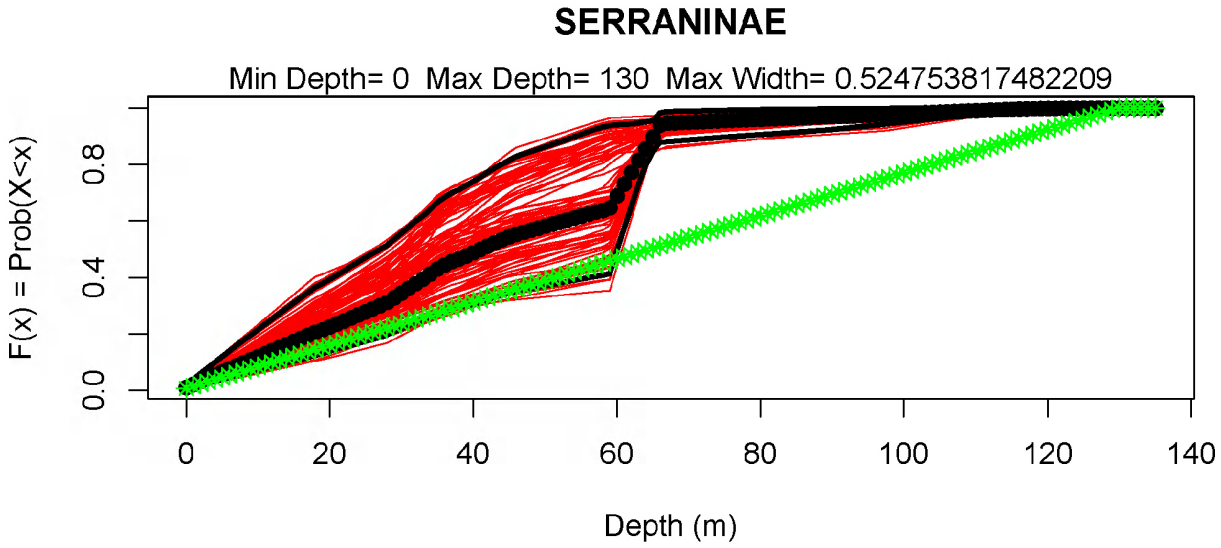

PEPRILUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

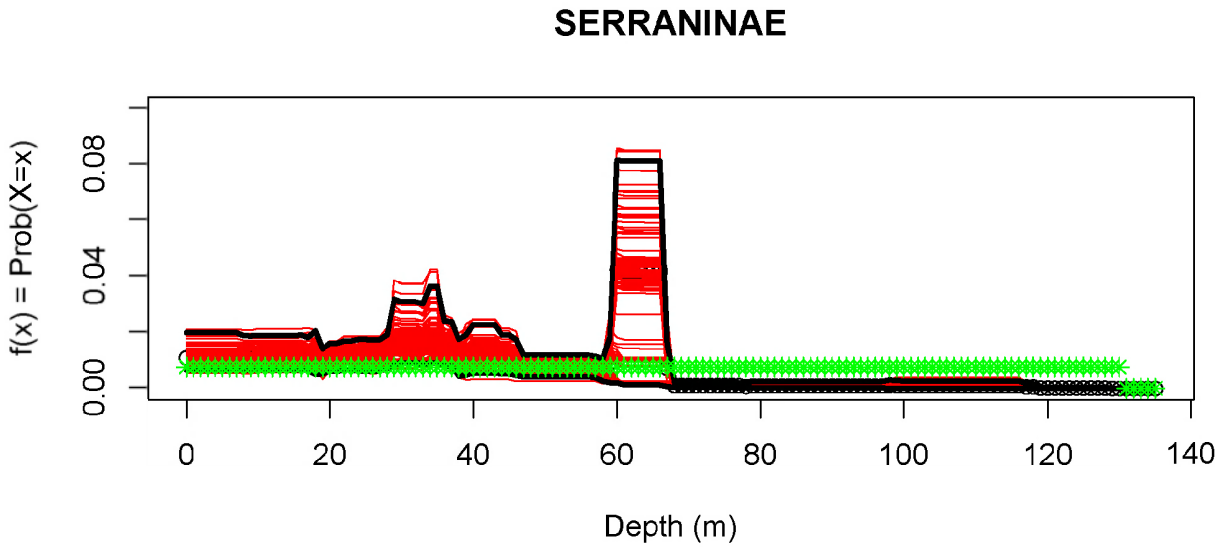

PERCIFORMES
Min Depth= 0 Max Depth= 128 Max Width= 0.280289449522865
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

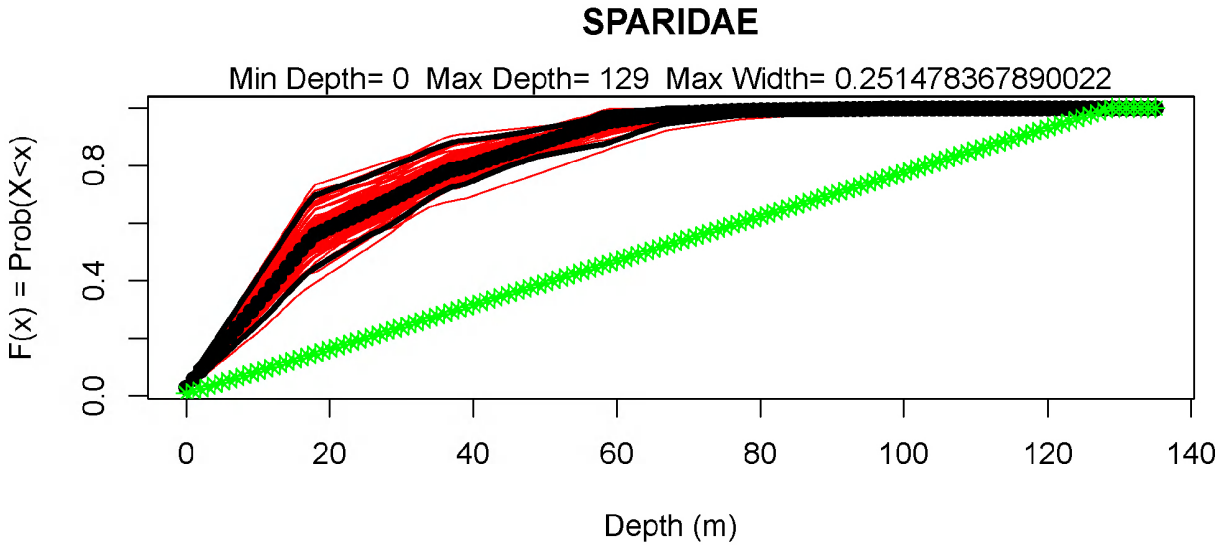

PERCIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

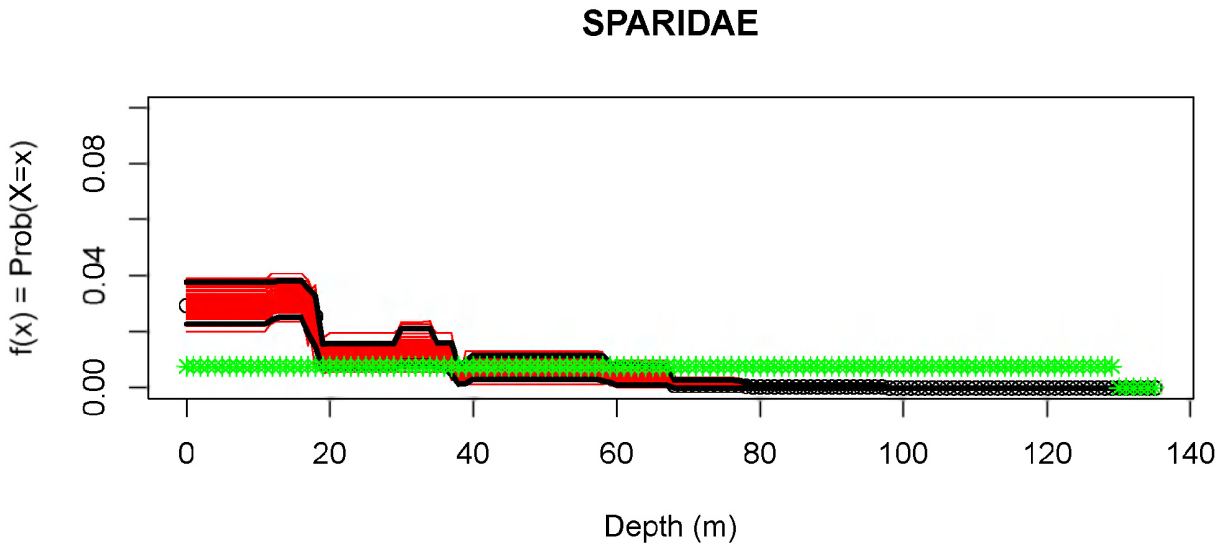

PHOSICHTHYIDAE
Min Depth= 0 Max Depth= 135 Max Width= 0.167425584123421
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

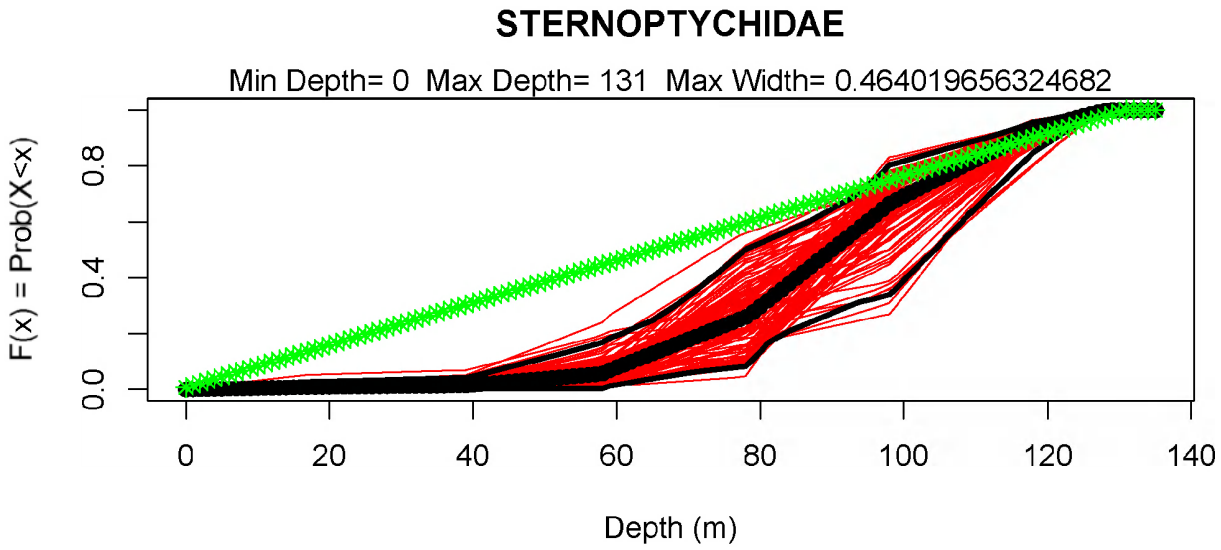

PHOSICHTHYIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

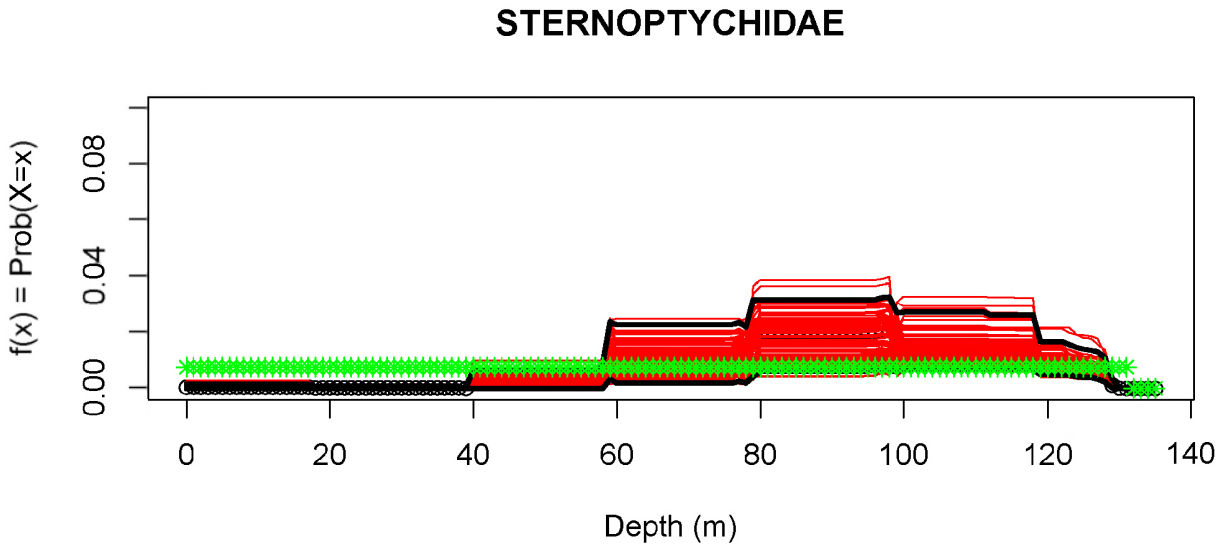

SERRANINAE
Min Depth= 0 Max Depth= 130 Max Width= 0.524753817482209
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

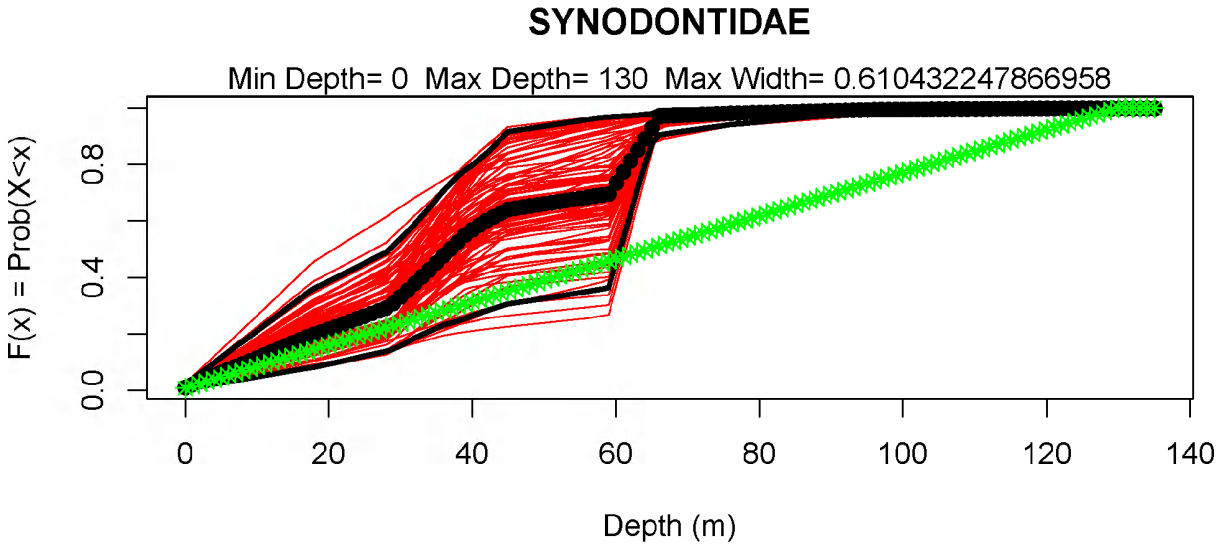

SERRANINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

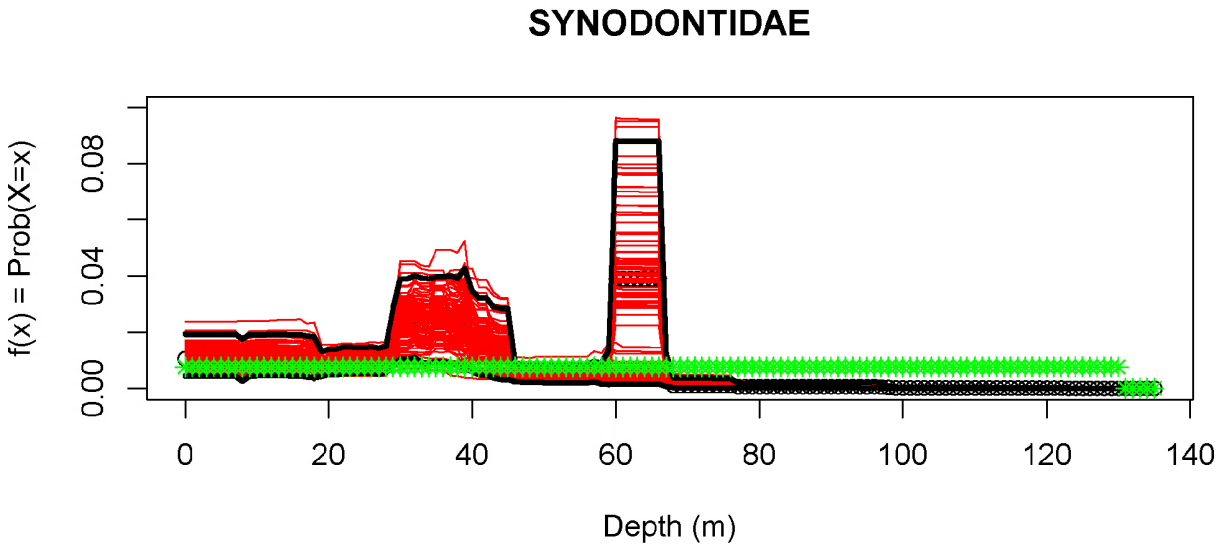

SPARIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.251478367890022
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


SPARIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

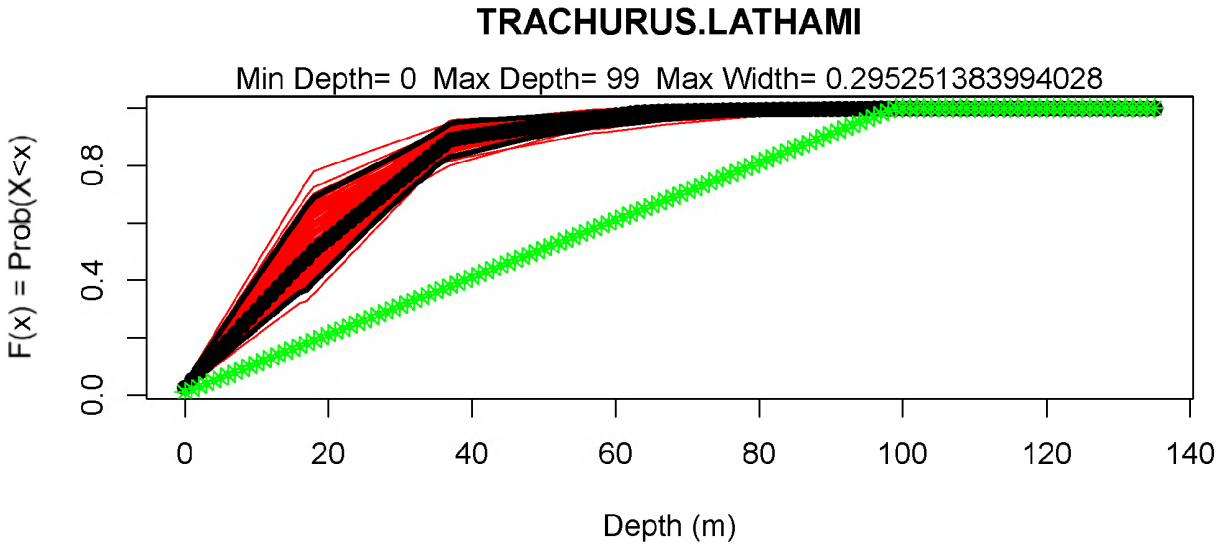

STERNOPTYCHIDAE
Min Depth= 0 Max Depth= 131 Max Width= 0.464019656324682
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

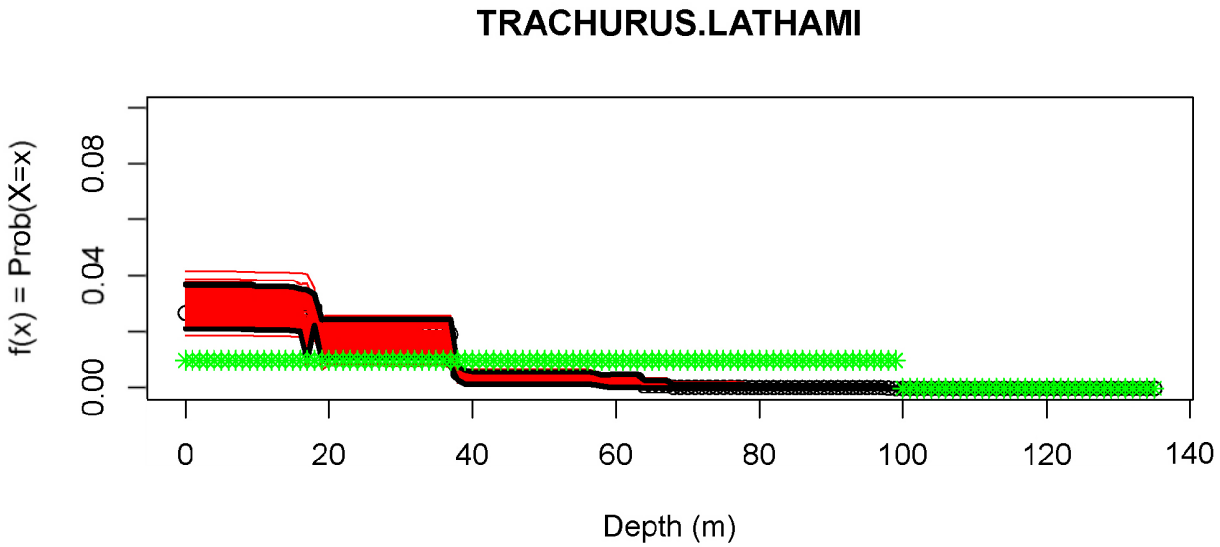

STERNOPTYCHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)



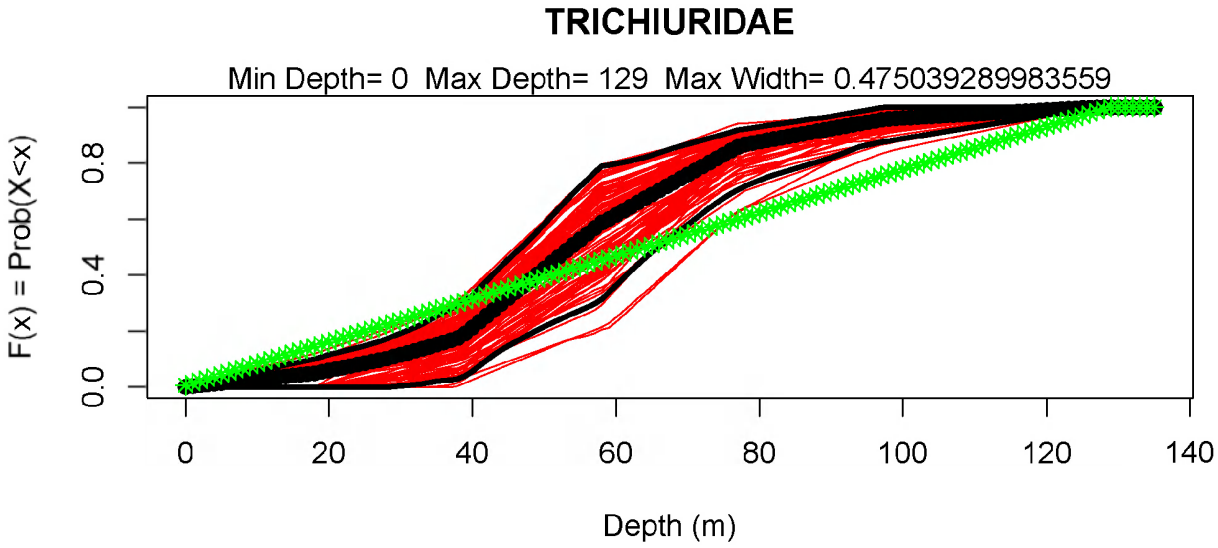


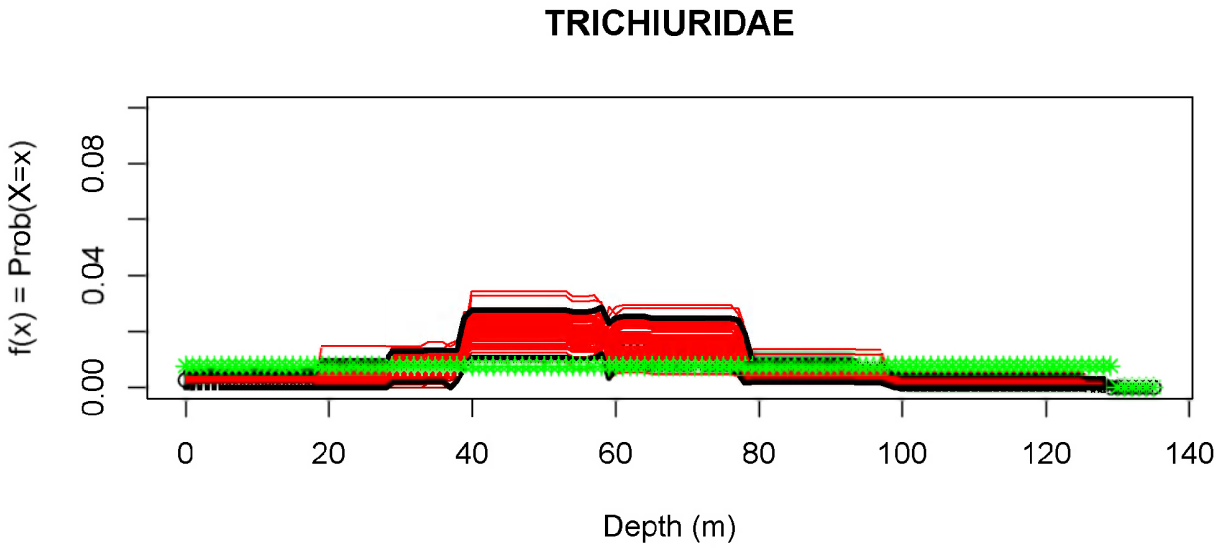
DWH-AR0196170

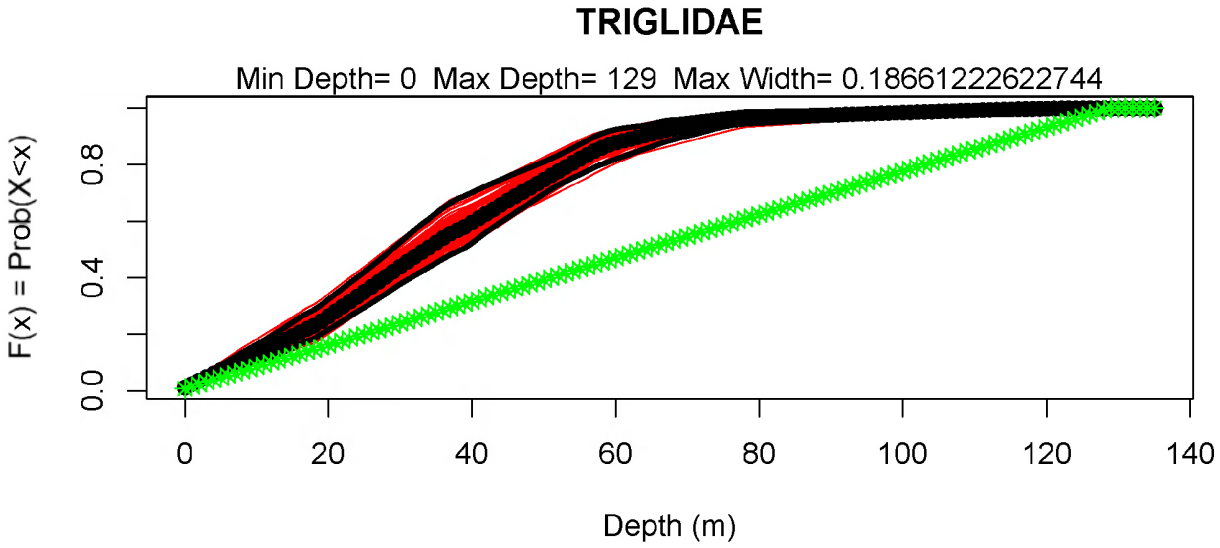


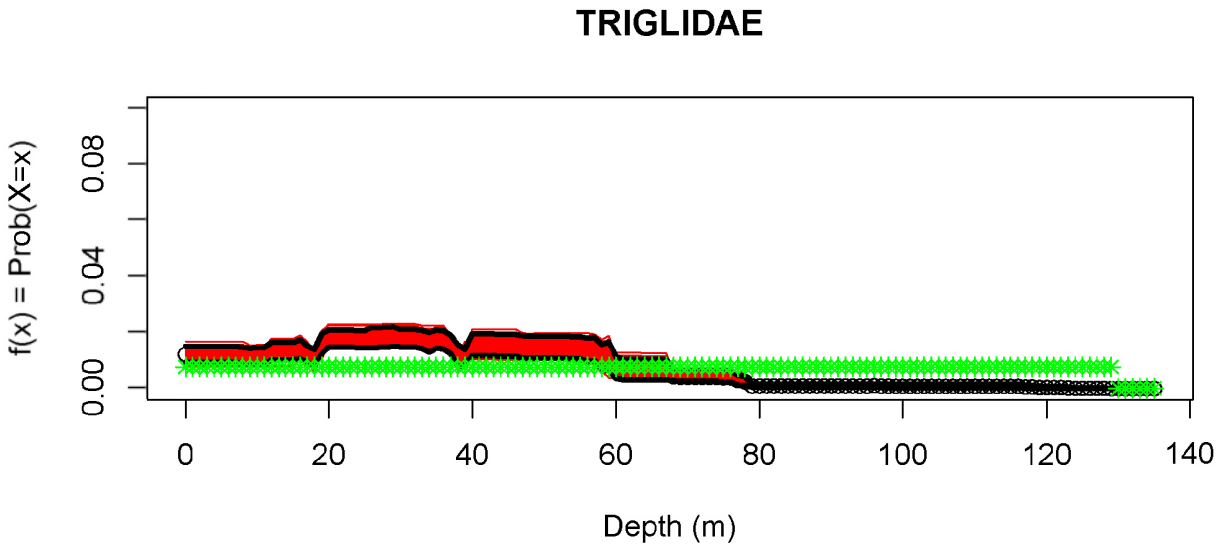


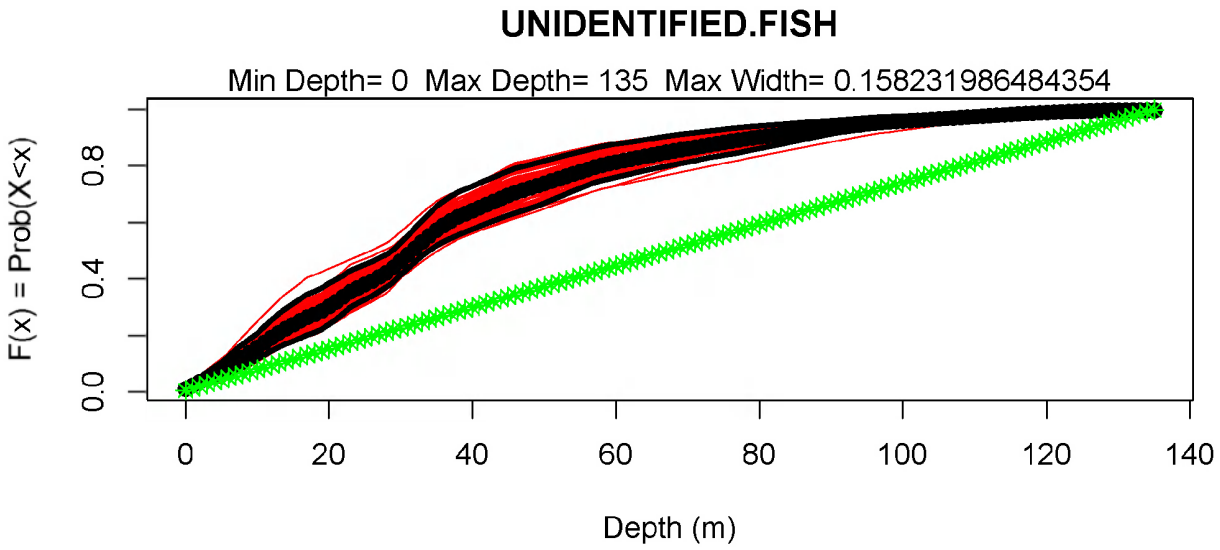
DWH-AR0196171

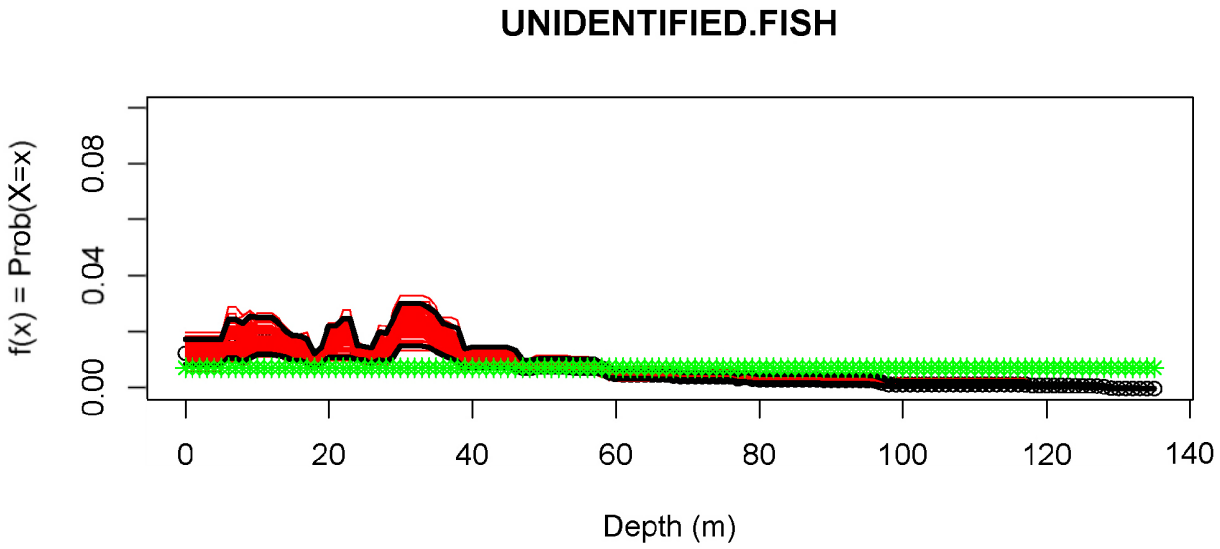

TRICHIURIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.475039289983559
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

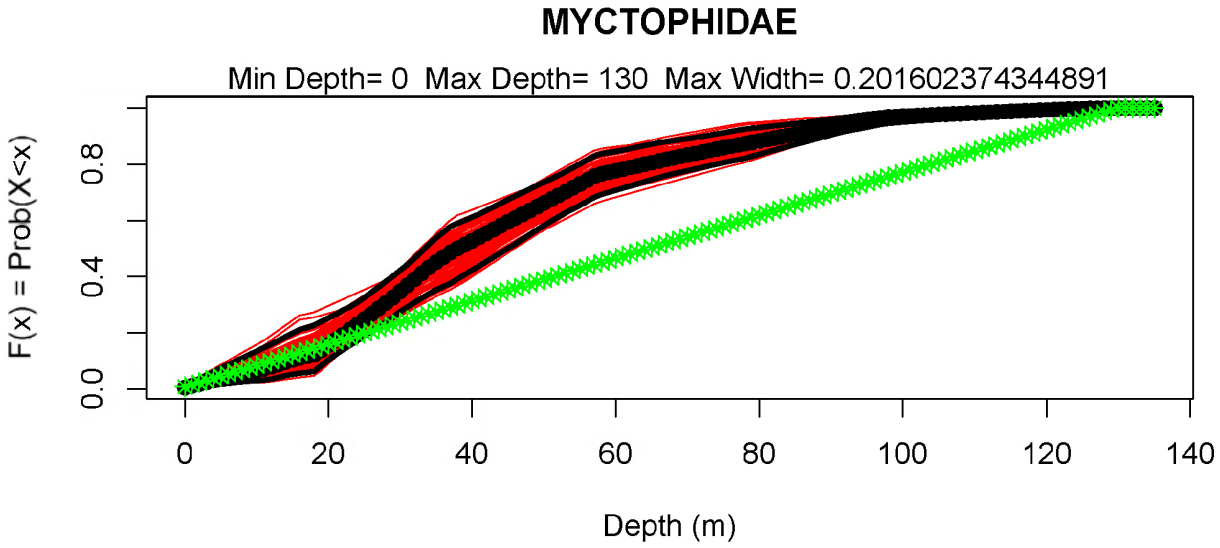

TRICHIURIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

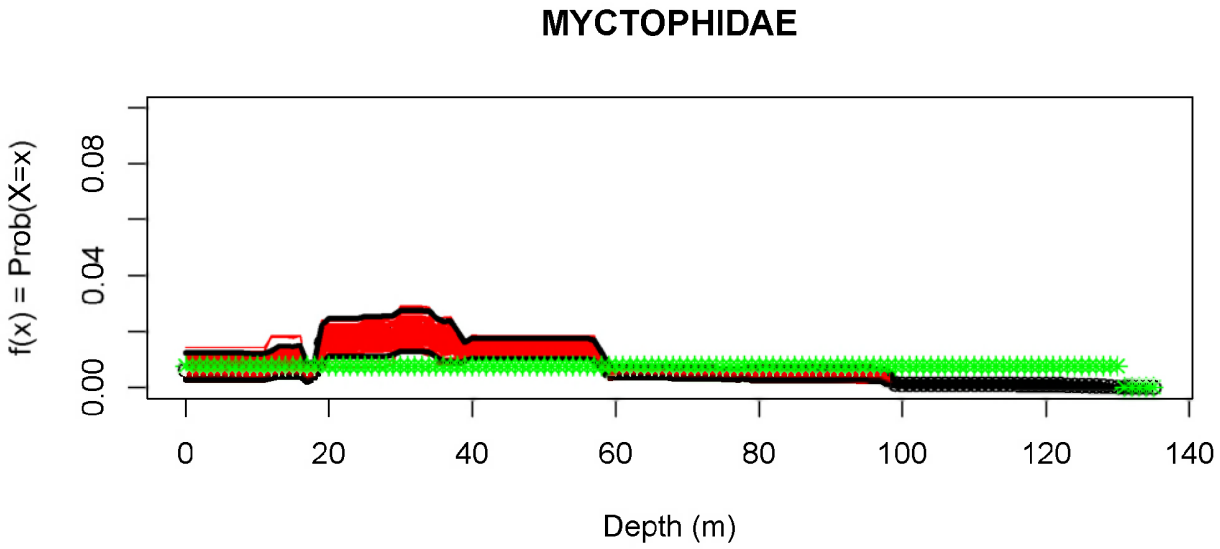

TRIGLIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.18661222622744
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

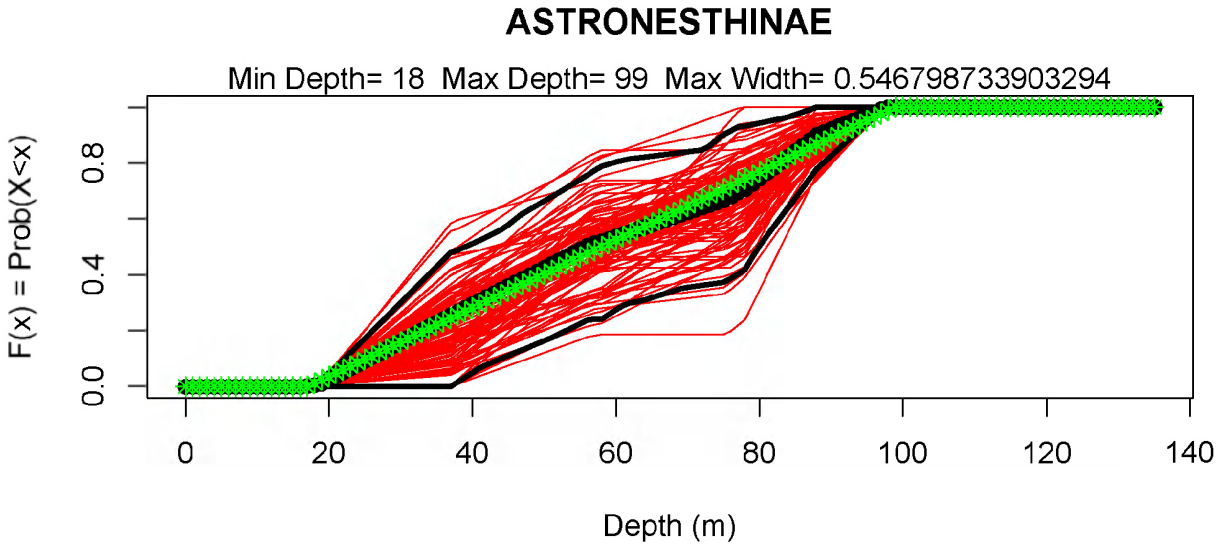

TRIGLIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

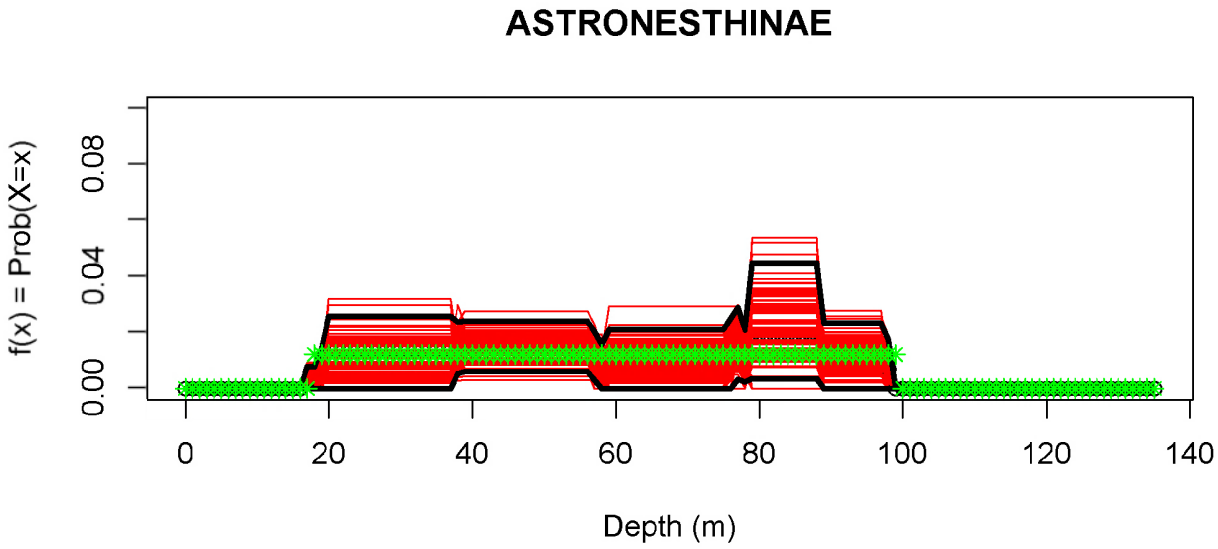

UNIDENTIFIED.FISH
Min Depth= 0 Max Depth= 135 Max Width= 0.158231986484354
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

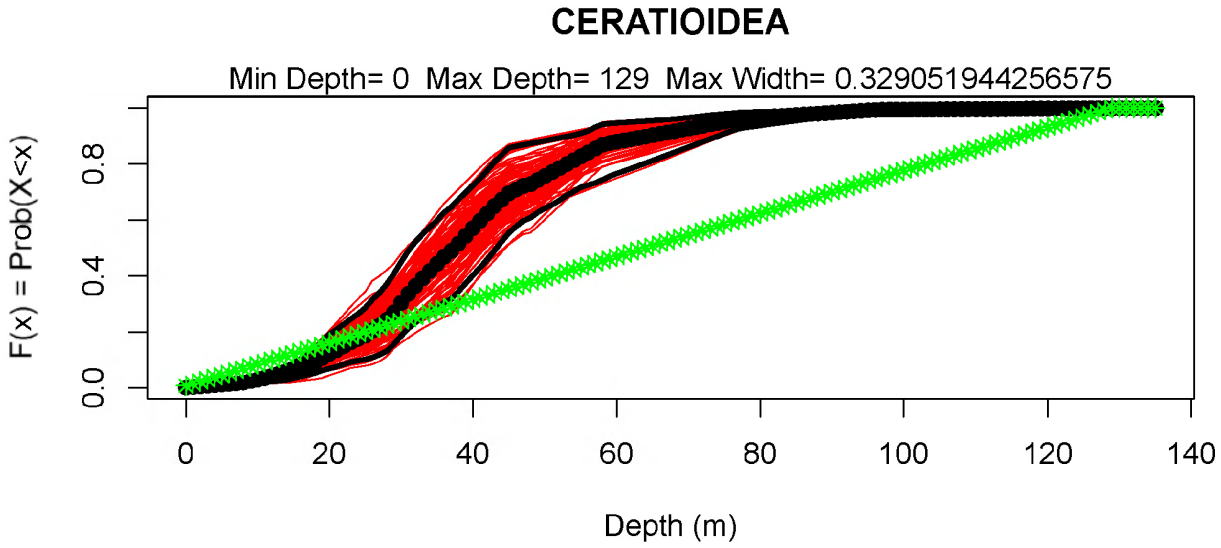

UNIDENTIFIED.FISH
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

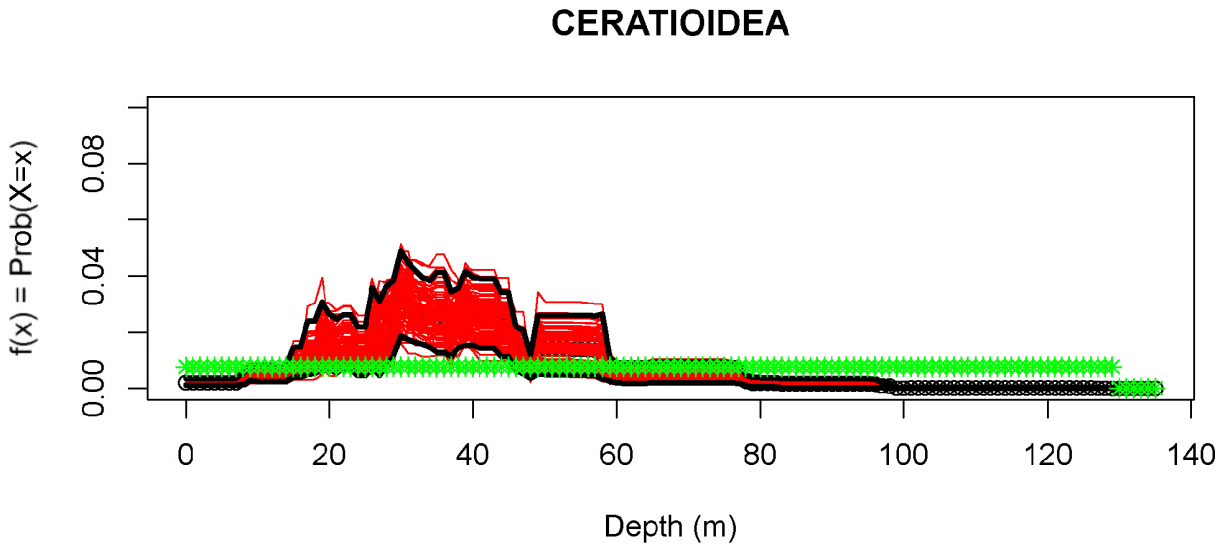

MYCTOPHIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.201602374344891
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

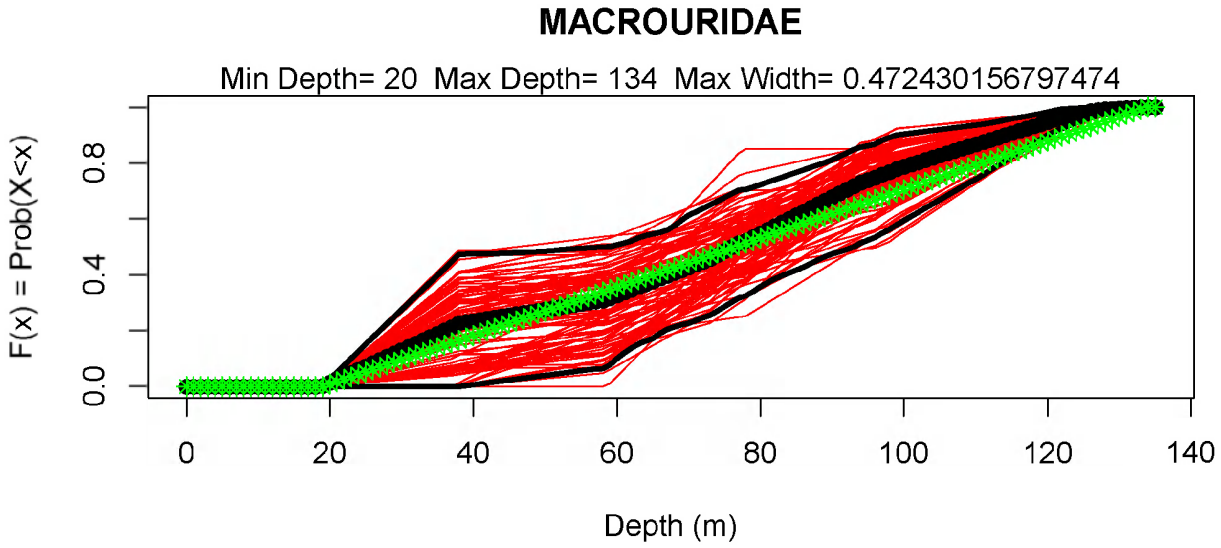

MYCTOPHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

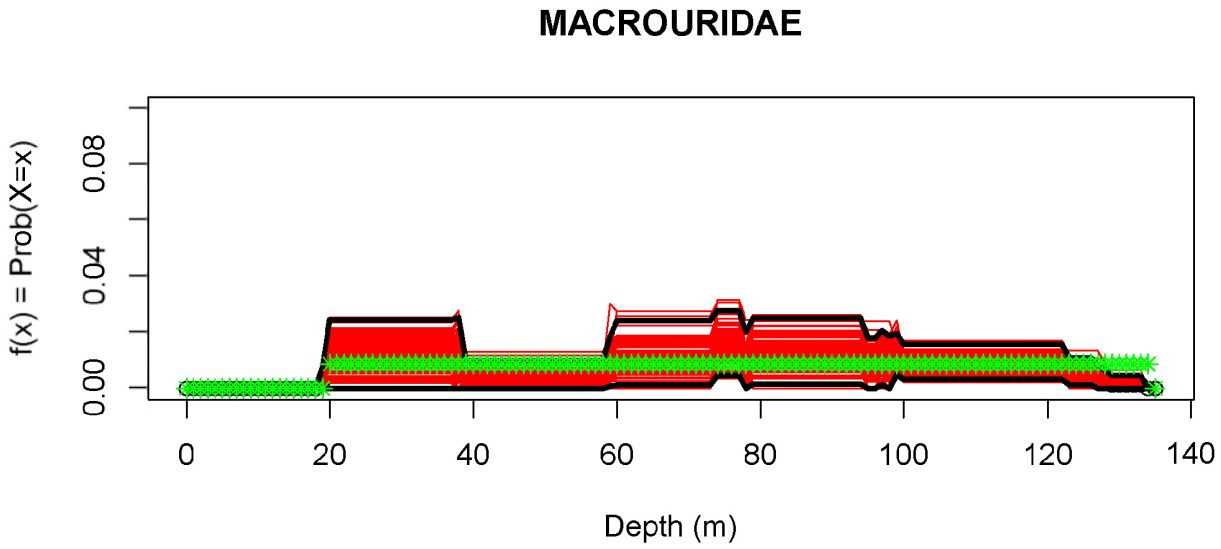

ASTRONESTHINAE
Min Depth= 18 Max Depth= 99 Max Width= 0.546798733903294
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

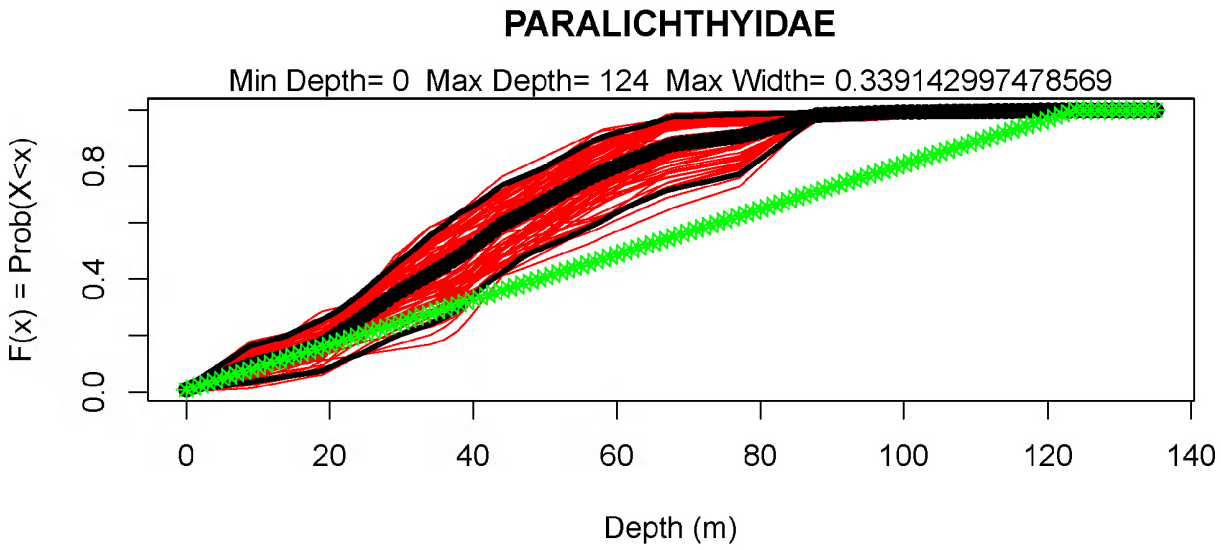

ASTRONESTHINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

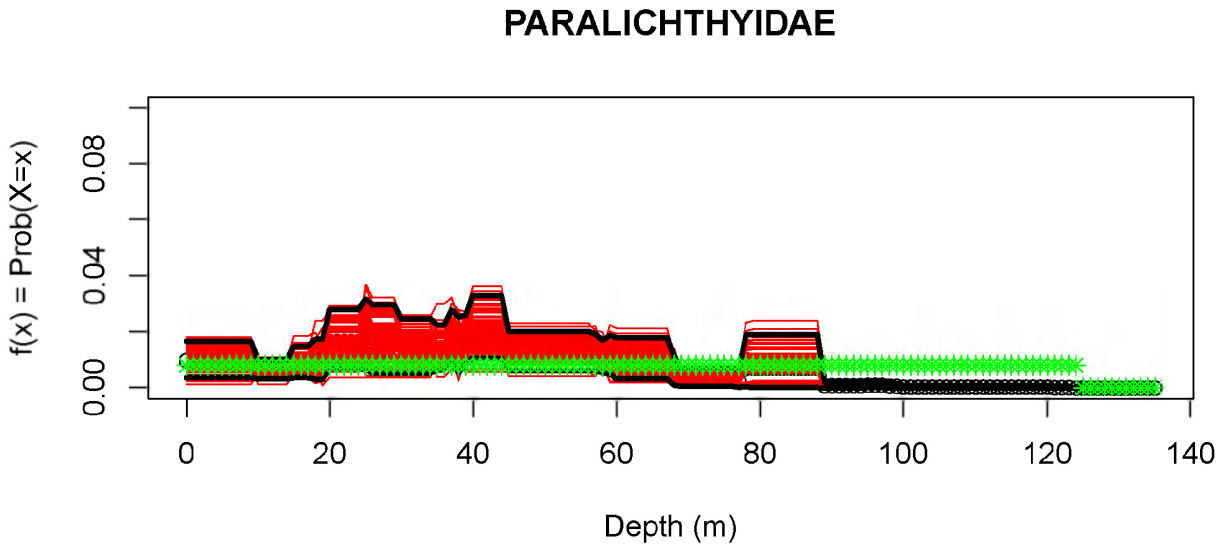

CERATIOIDEA
Min Depth= 0 Max Depth= 129 Max Width= 0.329051944256575
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

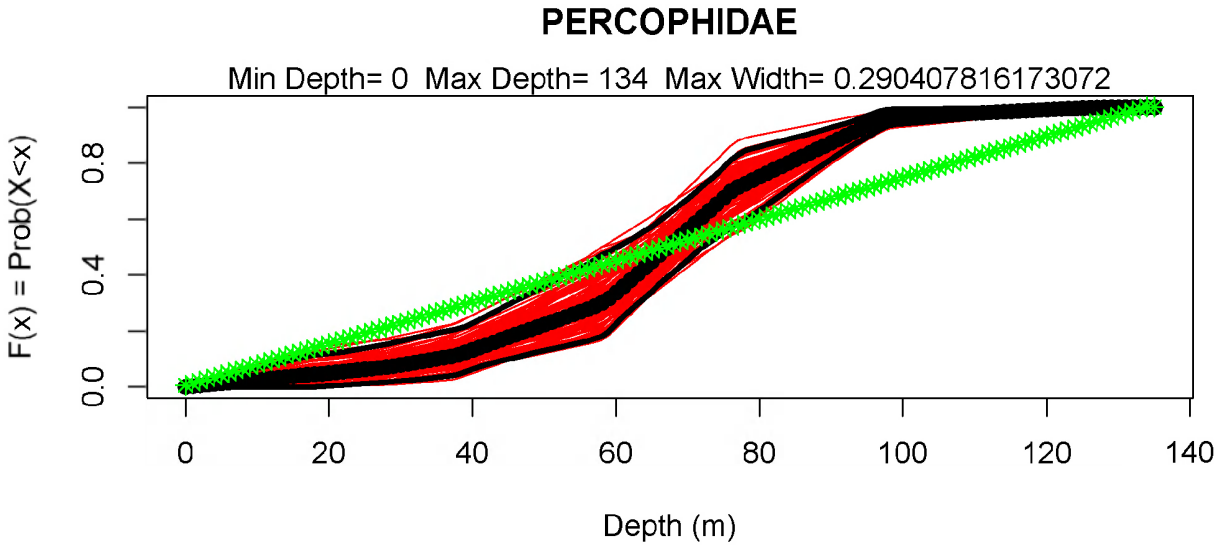

CERATIOIDEA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

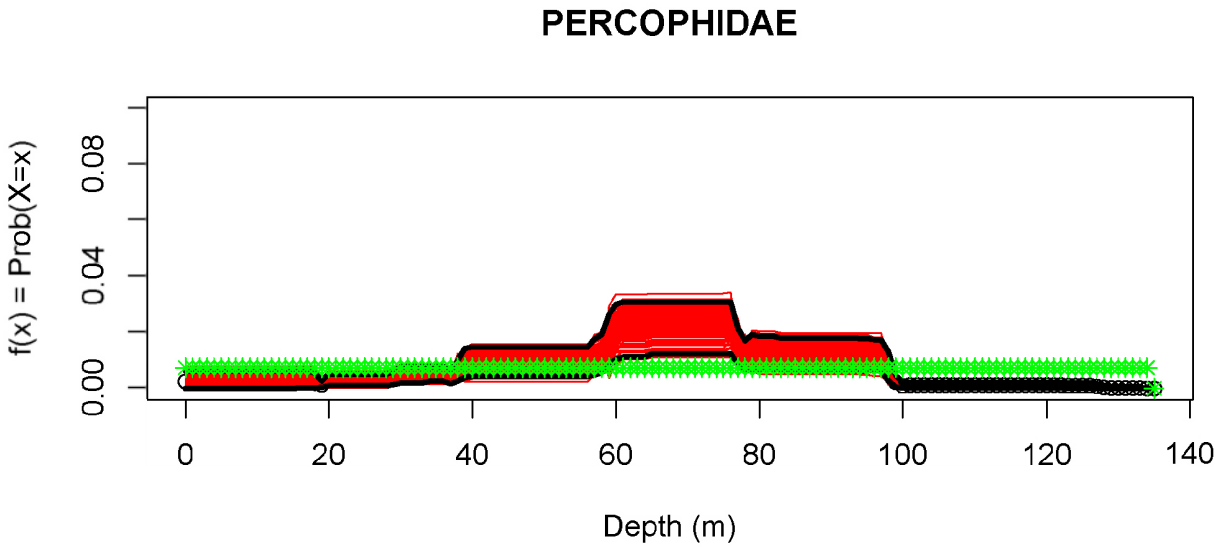

MACROURIDAE
Min Depth= 20 Max Depth= 134 Max Width= 0.472430156797474
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

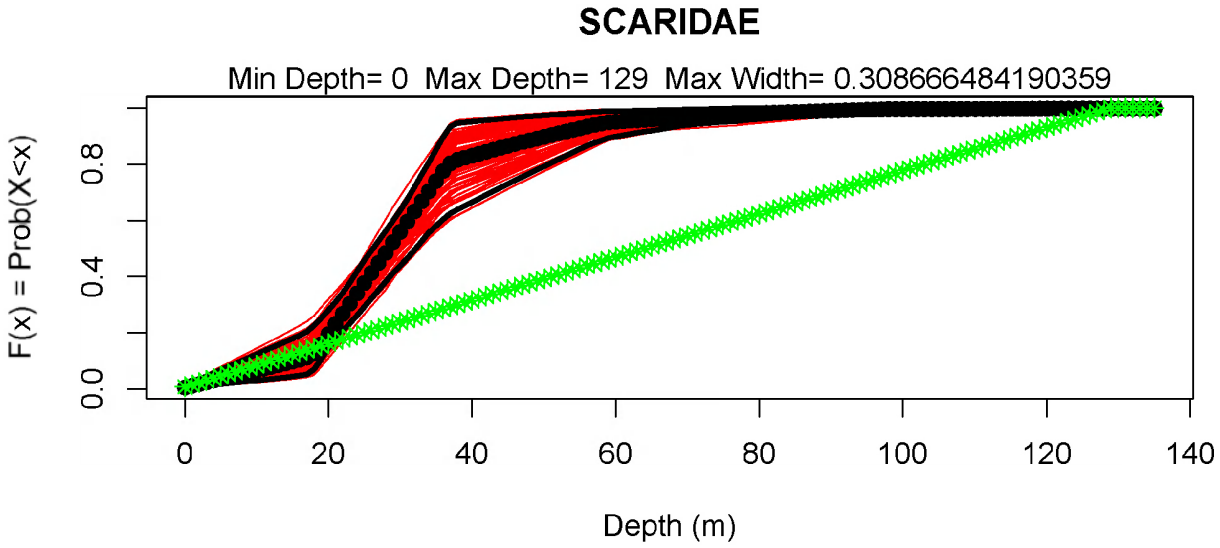

MACROURIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

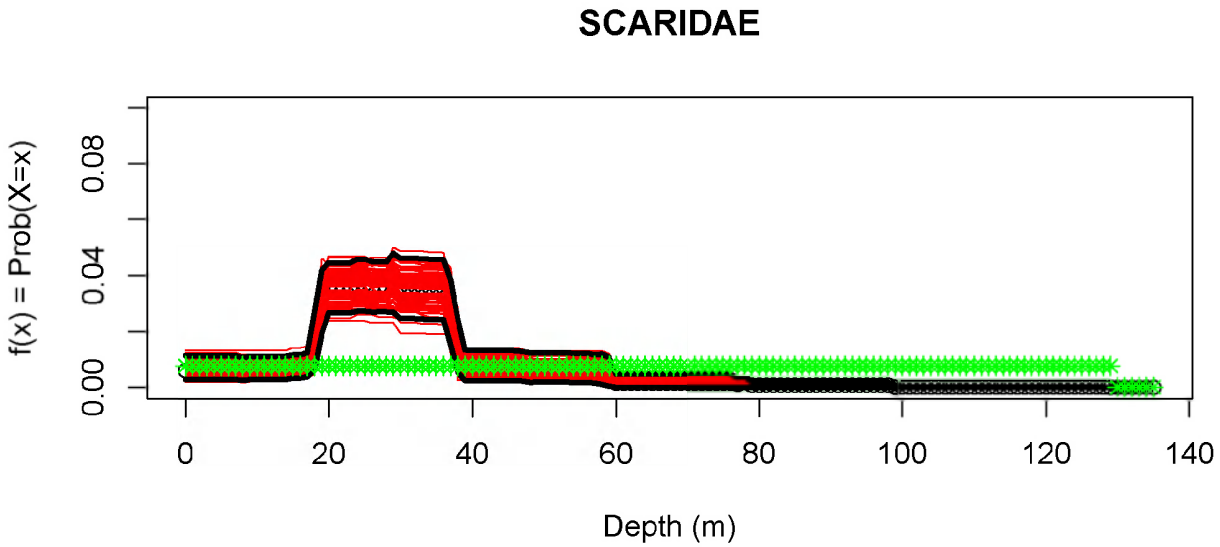

PARALICHTHYIDAE
Min Depth= 0 Max Depth= 124 Max Width= 0.339142997478569
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

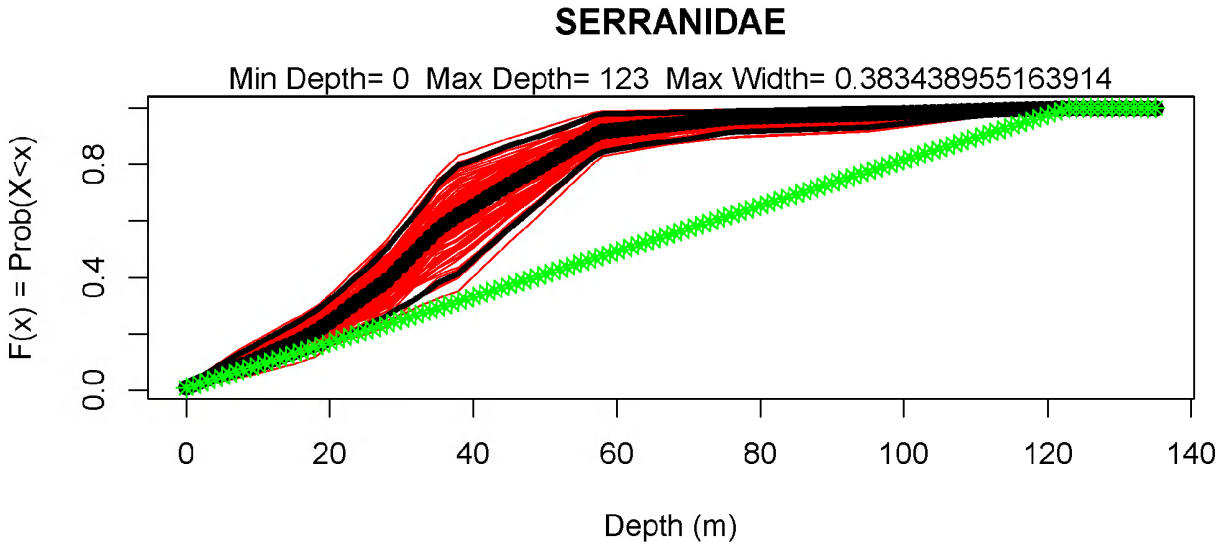

PARALICHTHYIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

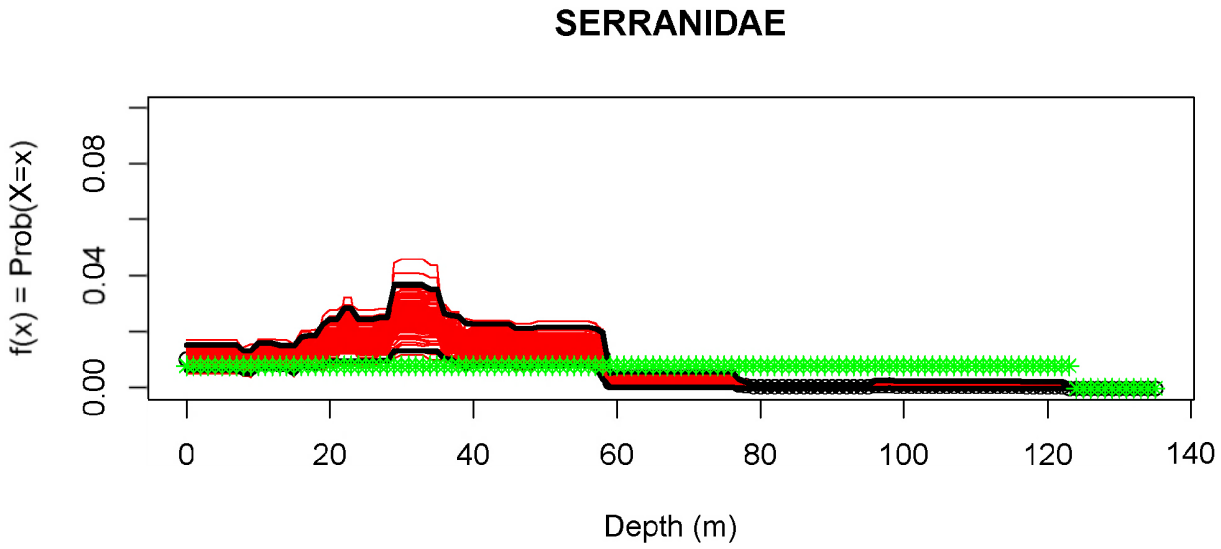

PERCOPHIDAE
Min Depth= 0 Max Depth= 134 Max Width= 0.290407816173072
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

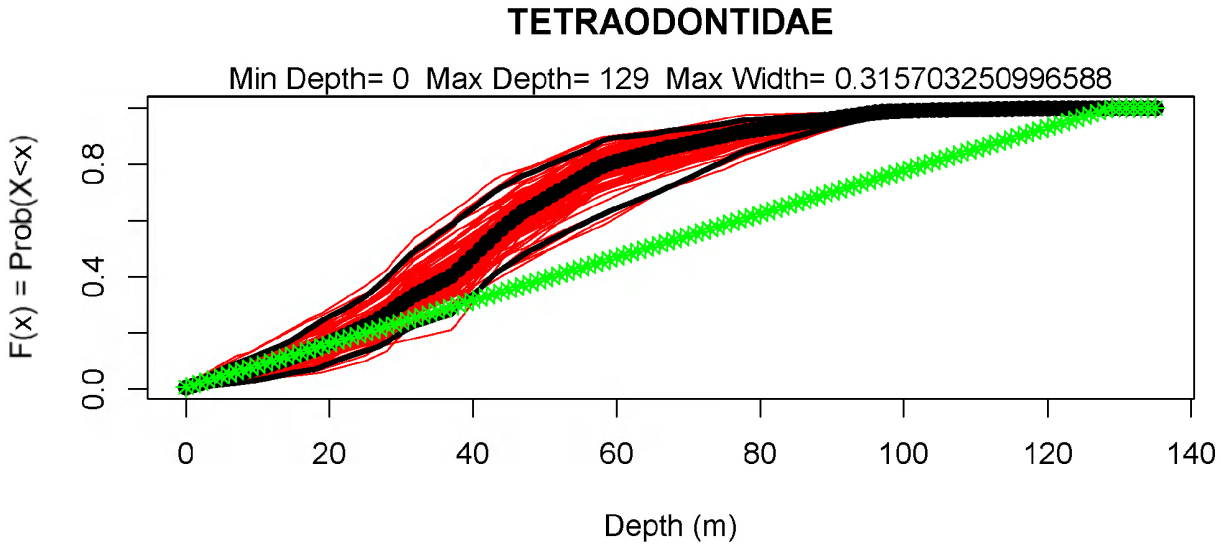

PERCOPHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

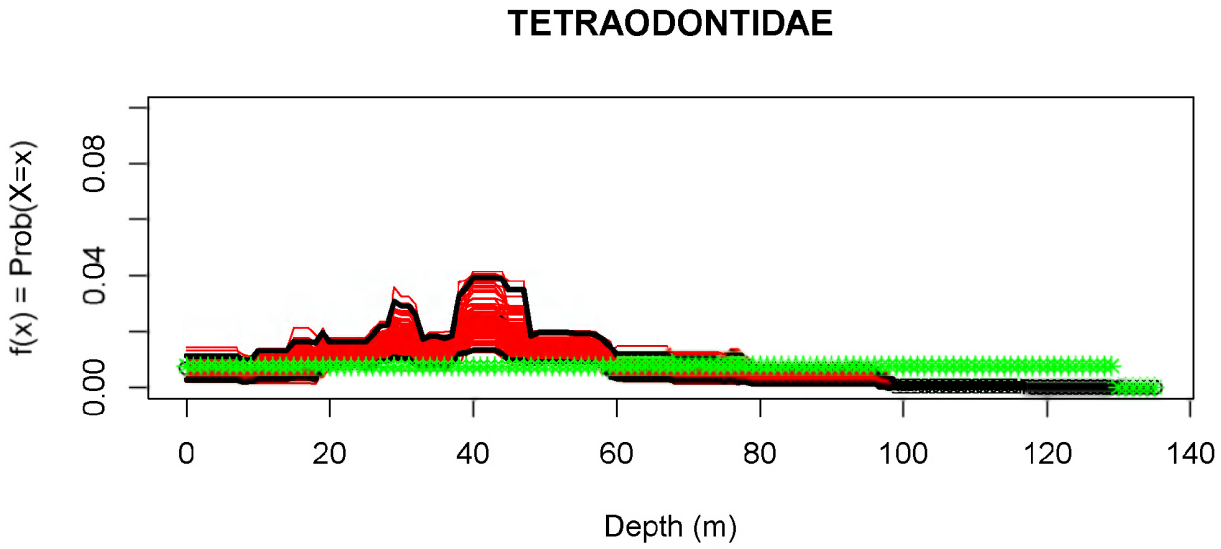

SCARIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.308666484190359
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

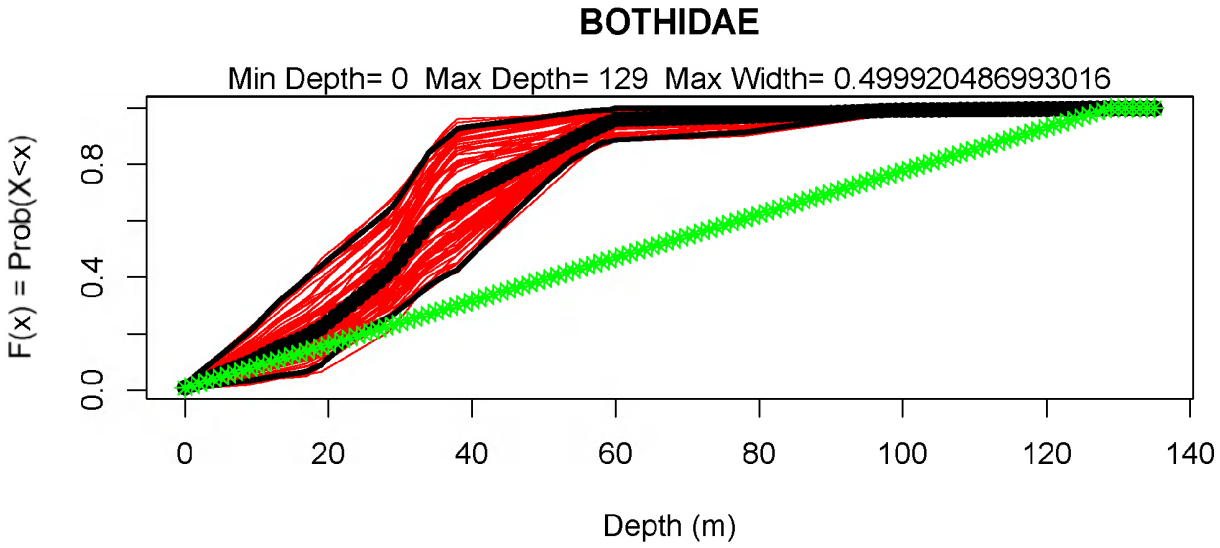

SCARIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

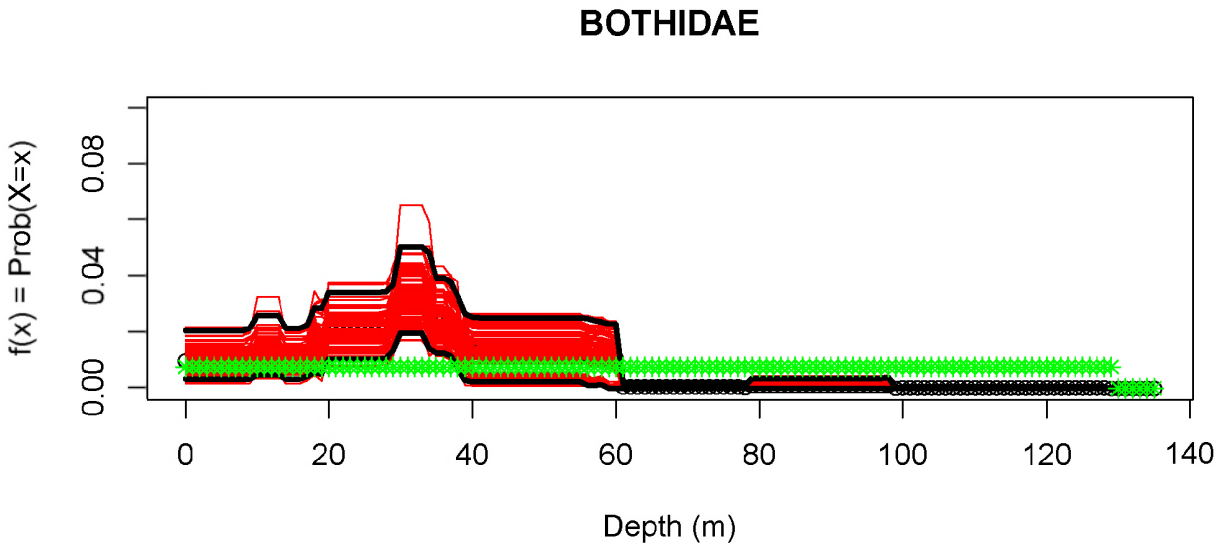

SERRANIDAE
Min Depth= 0 Max Depth= 123 Max Width= 0.383438955163914
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

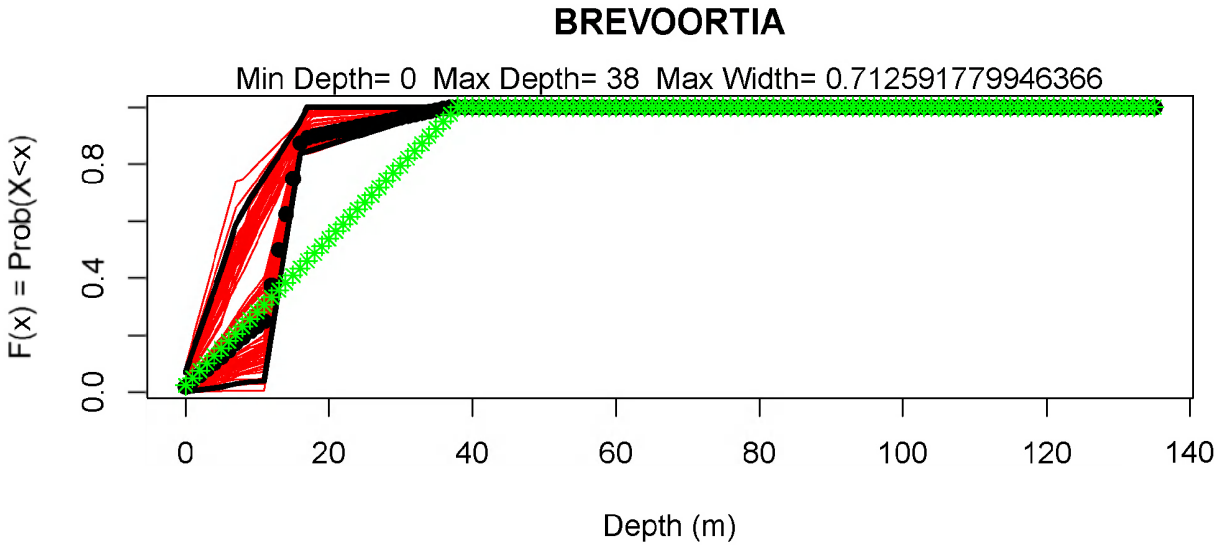

SERRANIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

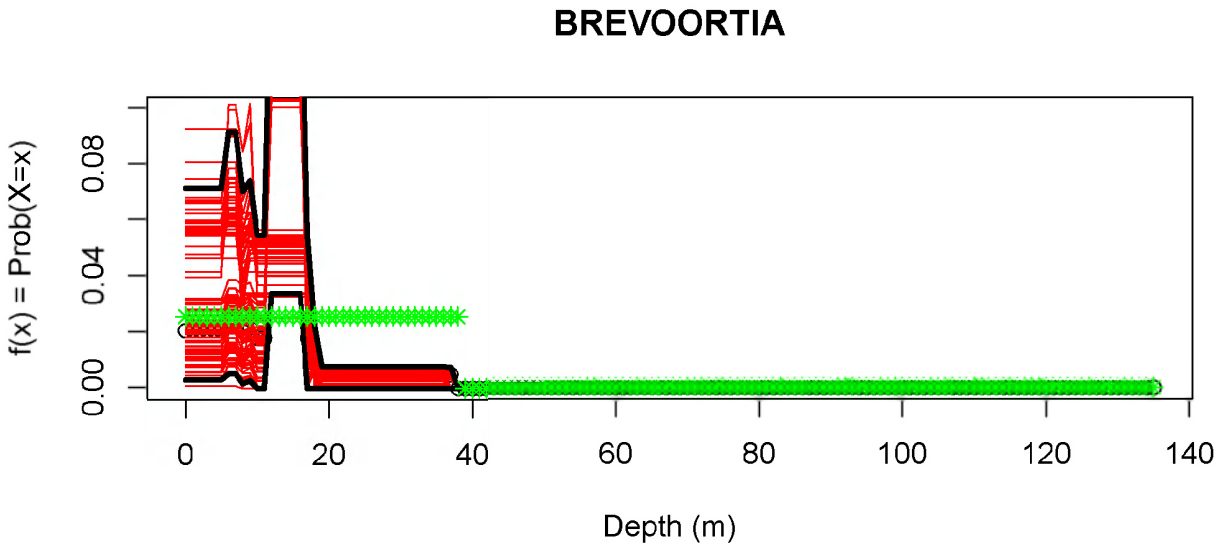

TETRAODONTIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.315703250996588
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

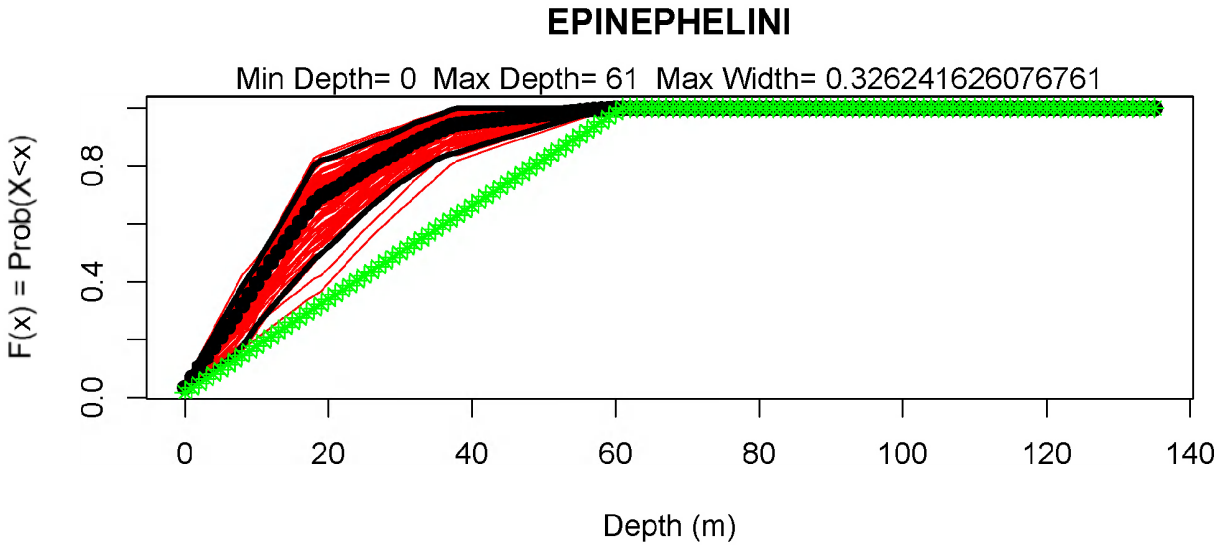

TETRAODONTIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

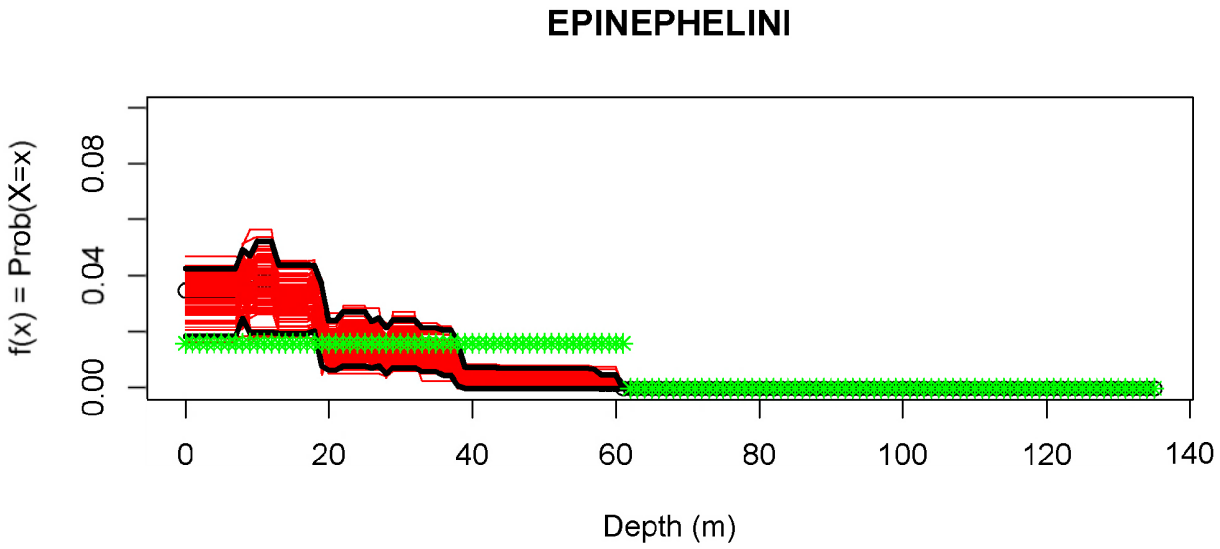

BOTHIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.499920486993016
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

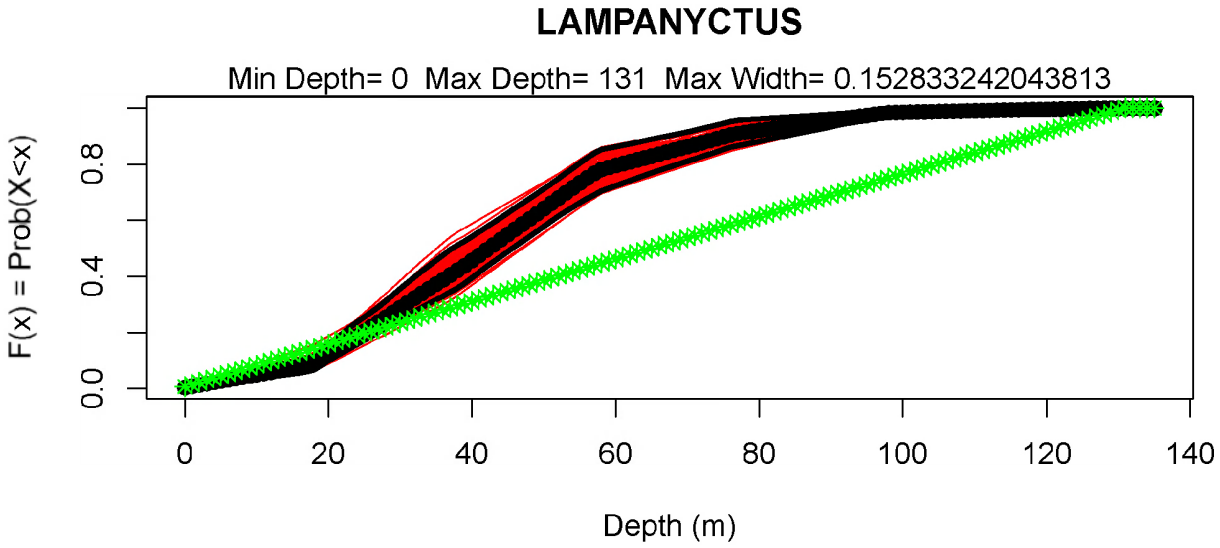

BOTHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

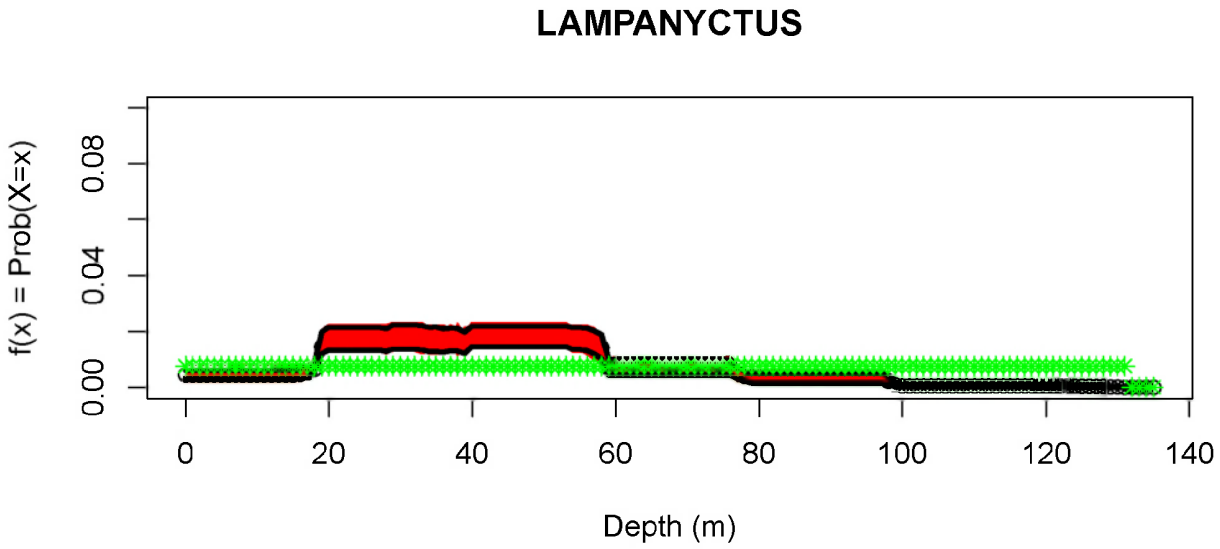

BREVOORTIA
Min Depth= 0 Max Depth= 38 Max Width= 0.712591779946366
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

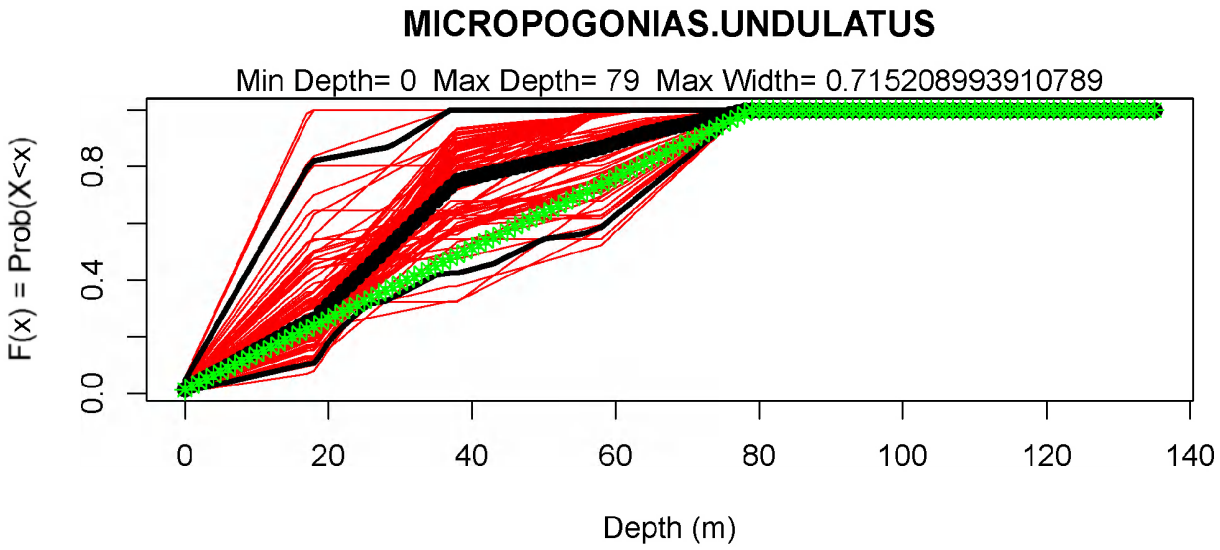

BREVOORTIA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

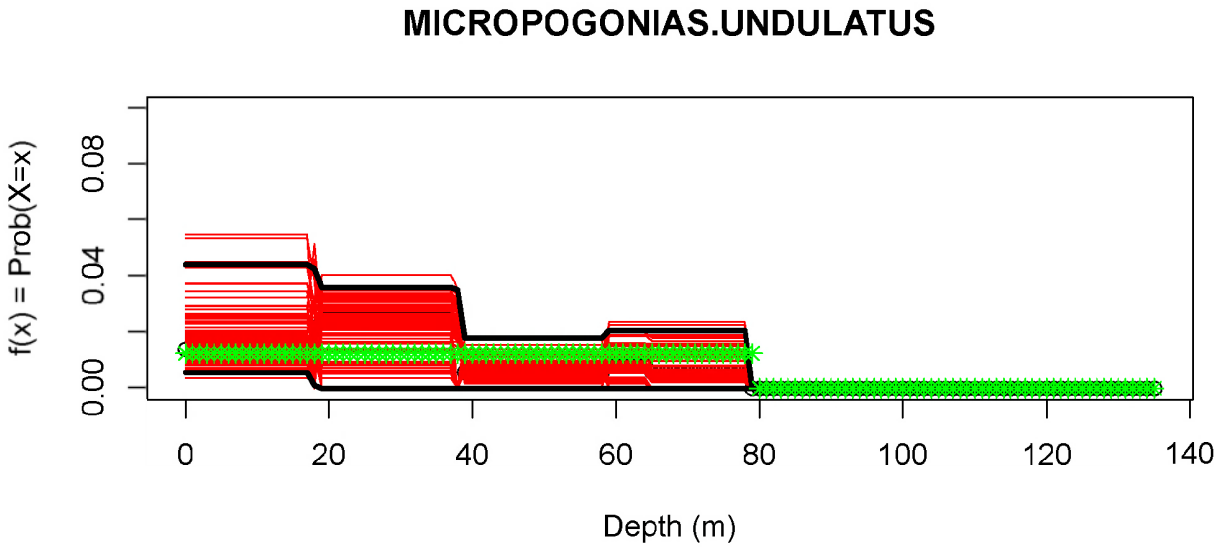

EPINEPHELINI
Min Depth= 0 Max Depth= 61 Max Width= 0.326241626076761
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

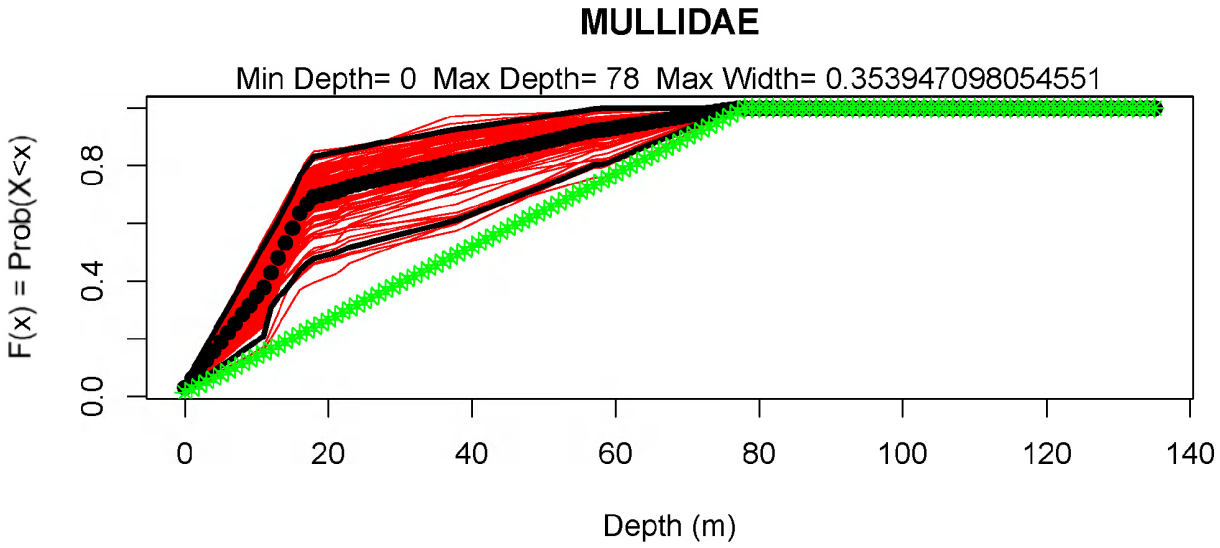

EPINEPHELINI
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

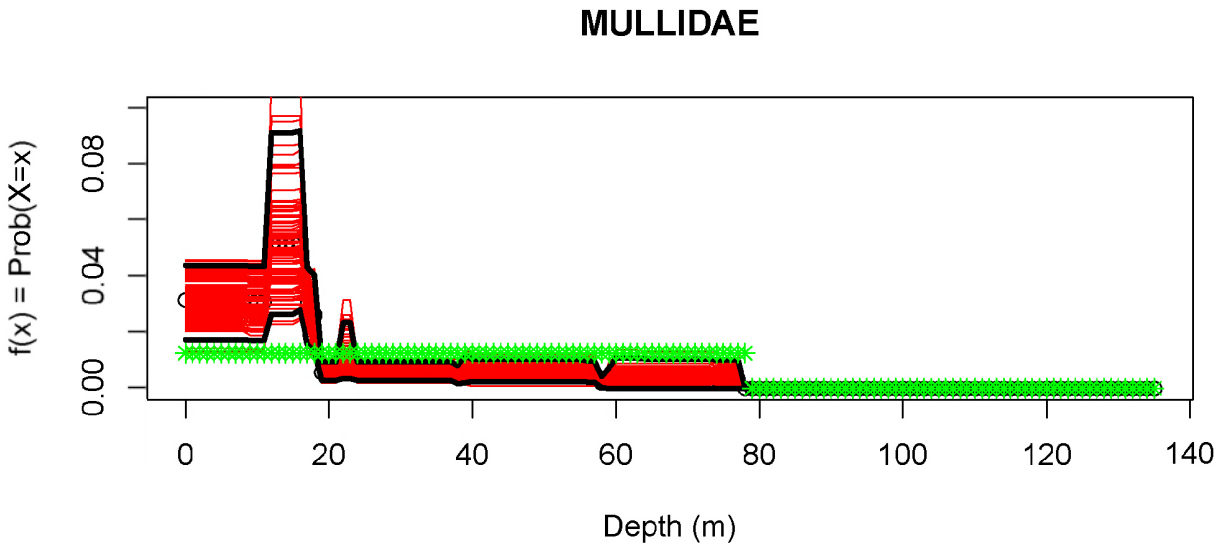

LAMPANYCTUS
Min Depth= 0 Max Depth= 131 Max Width= 0.152833242043813
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

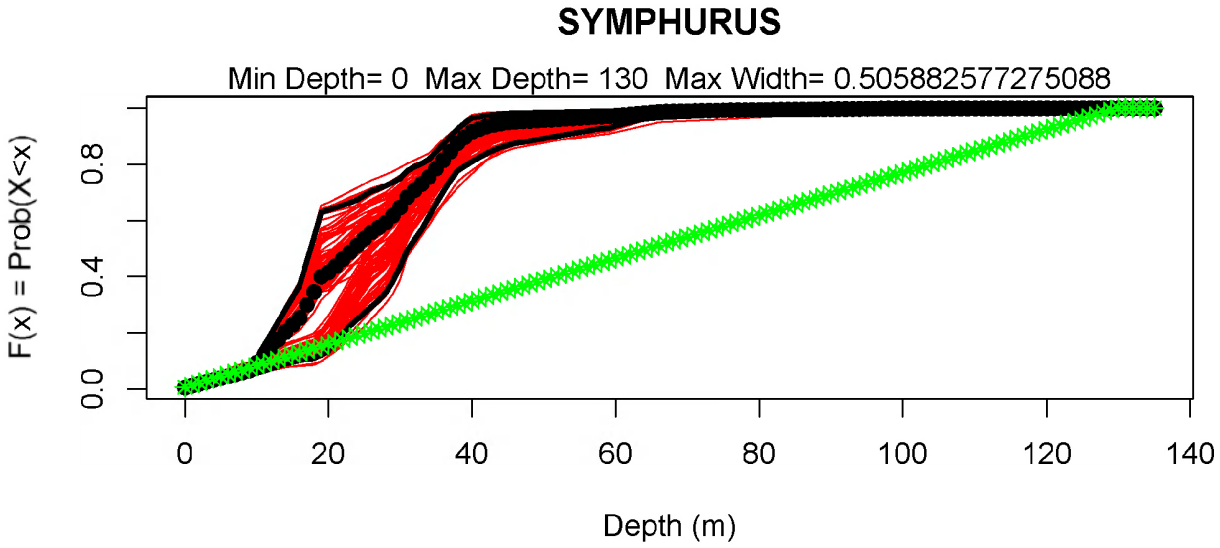

LAMPANYCTUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

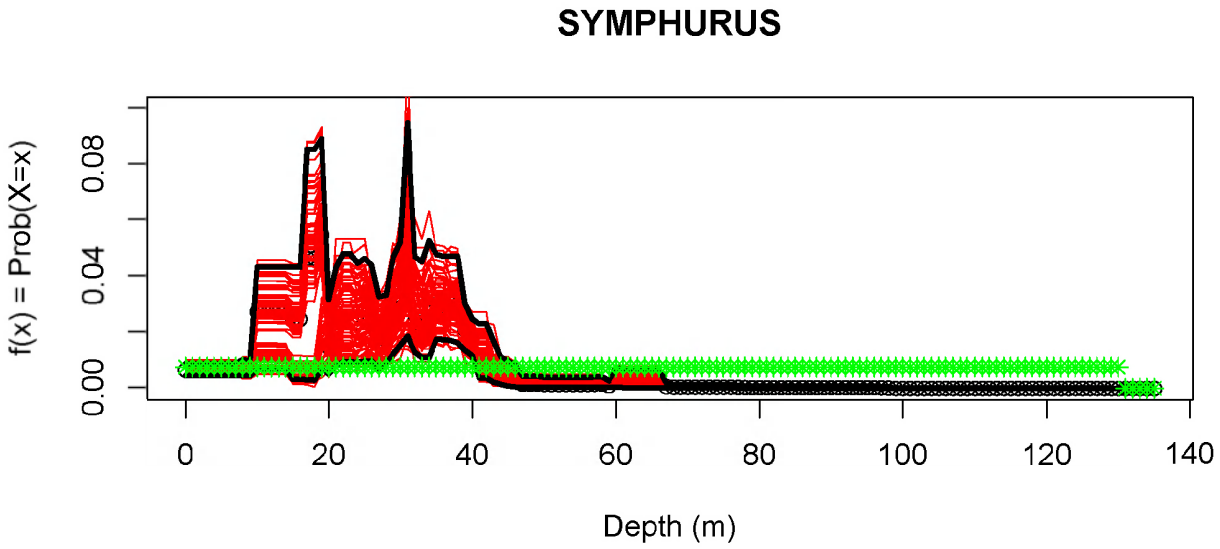

MICROPOGONIAS.UNDULATUS
Min Depth= 0 Max Depth= 79 Max Width= 0.715208993910789
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

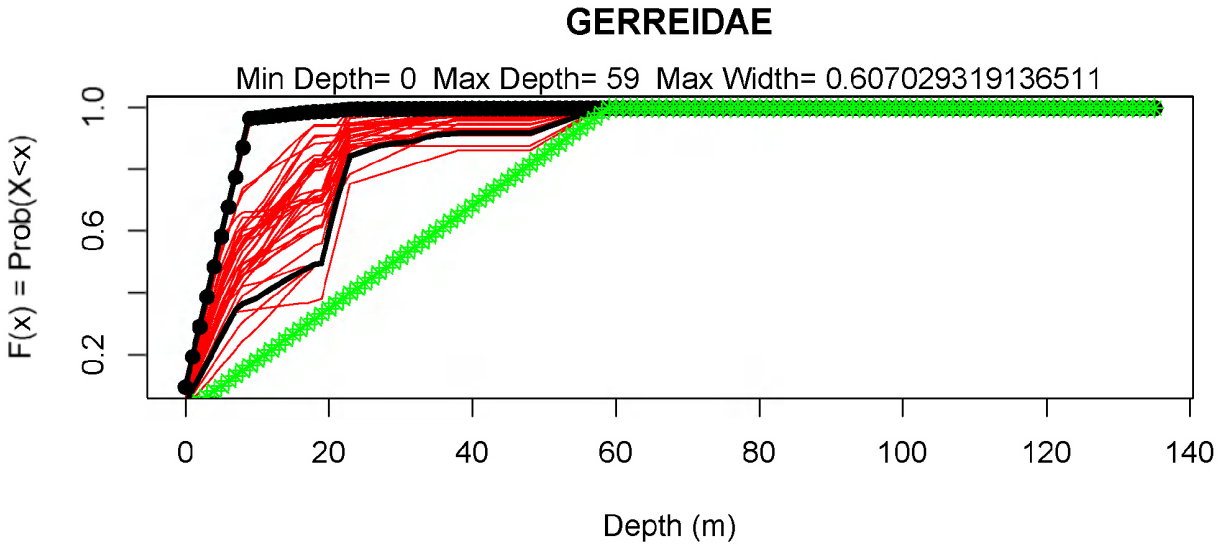

MICROPOGONIAS.UNDULATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

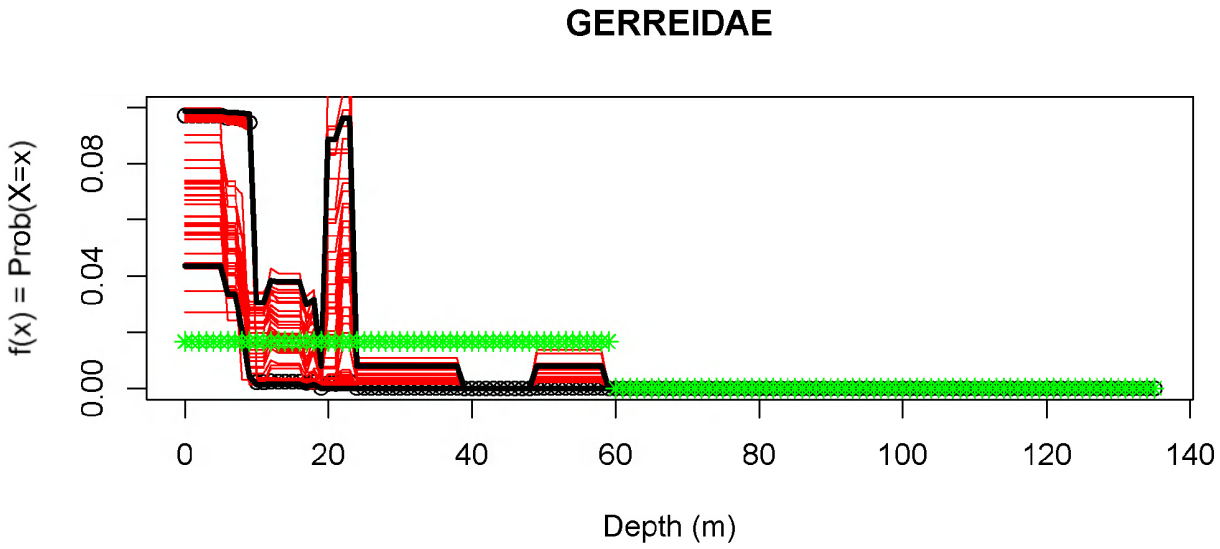

MULLIDAE
Min Depth= 0 Max Depth= 78 Max Width= 0.353947098054551
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

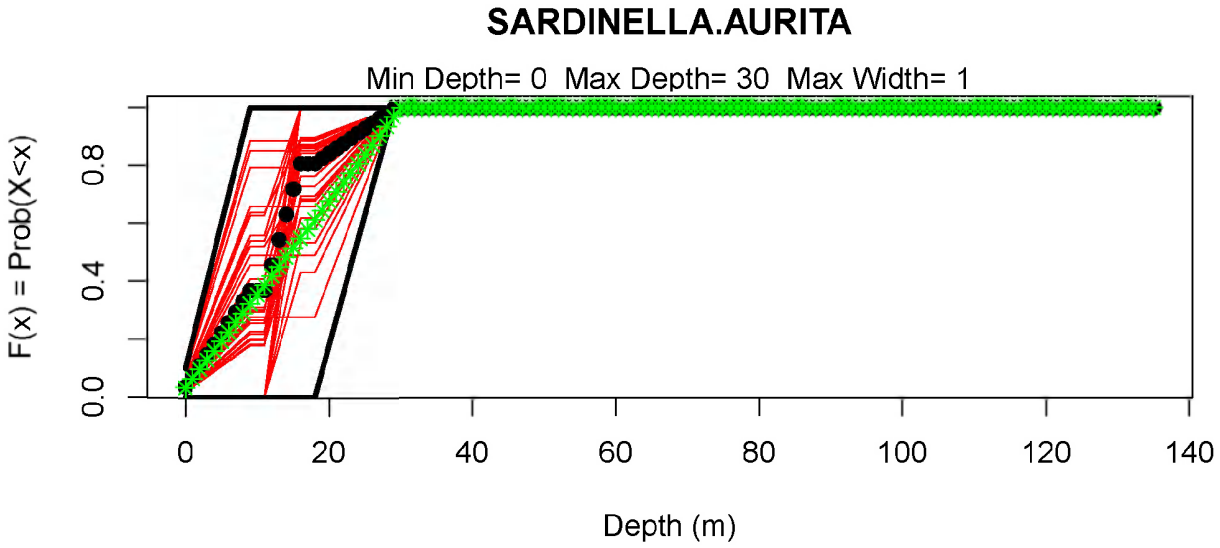

MULLIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

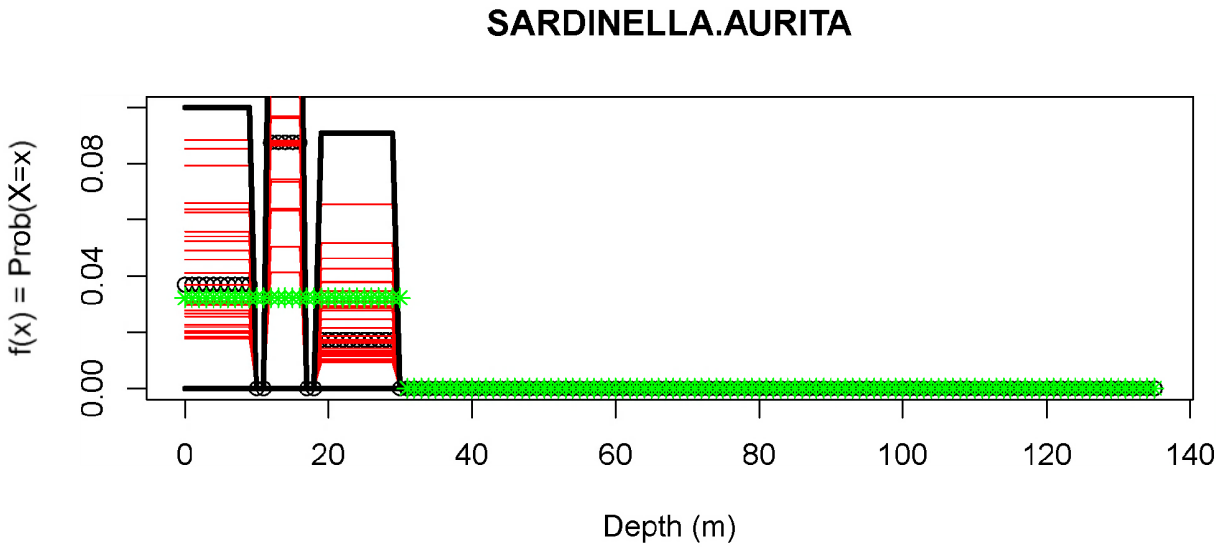

SYMPHURUS
Min Depth= 0 Max Depth= 130 Max Width= 0.505882577275088
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

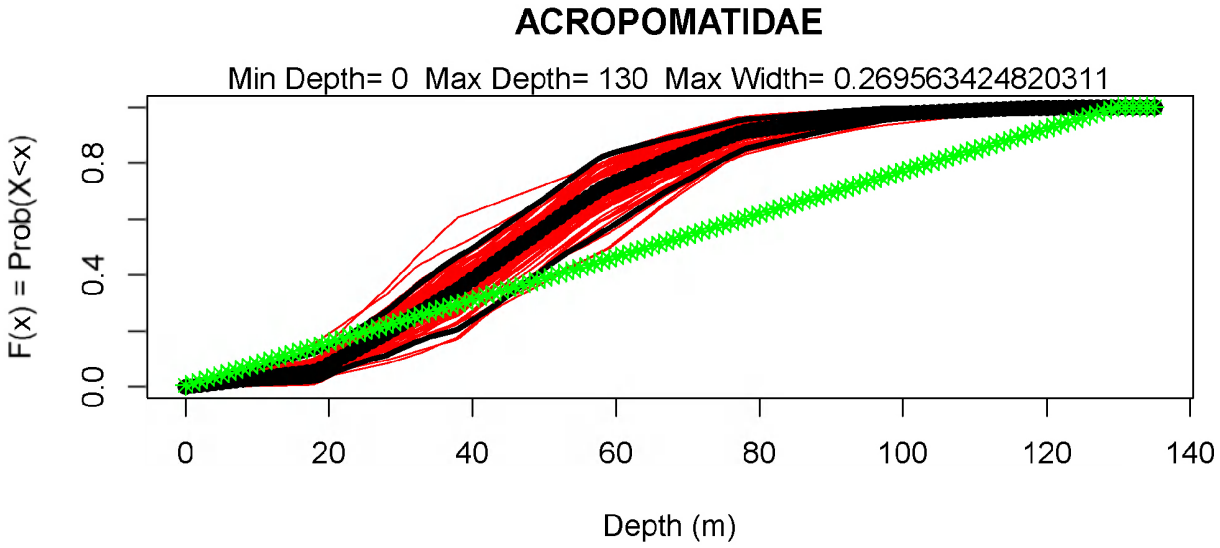

SYMPHURUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

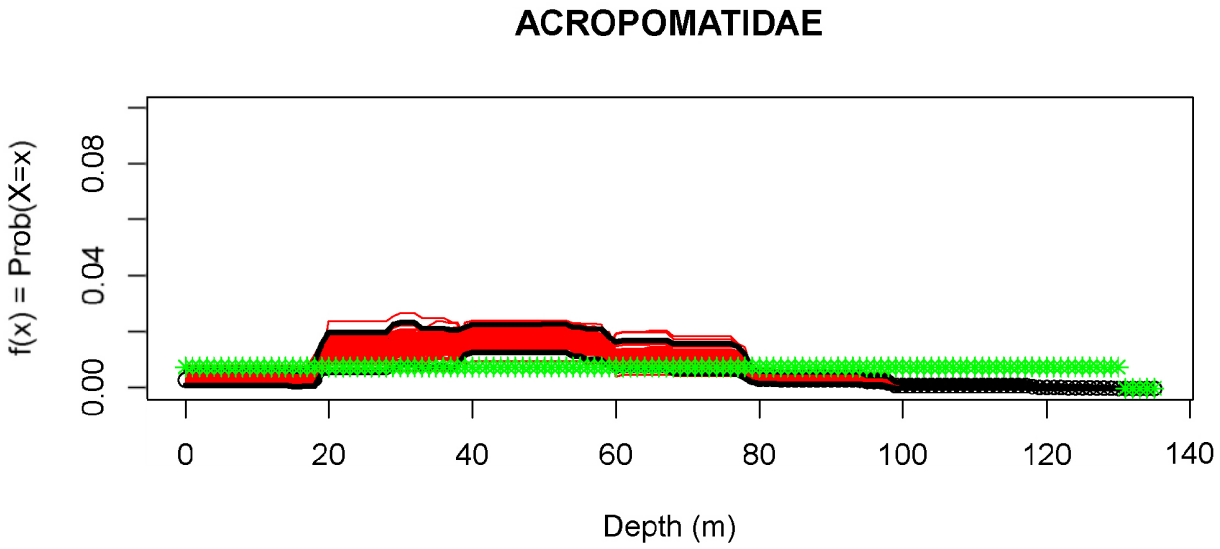

GERREIDAE
Min Depth= 0 Max Depth= 59 Max Width= 0.607029319136511
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

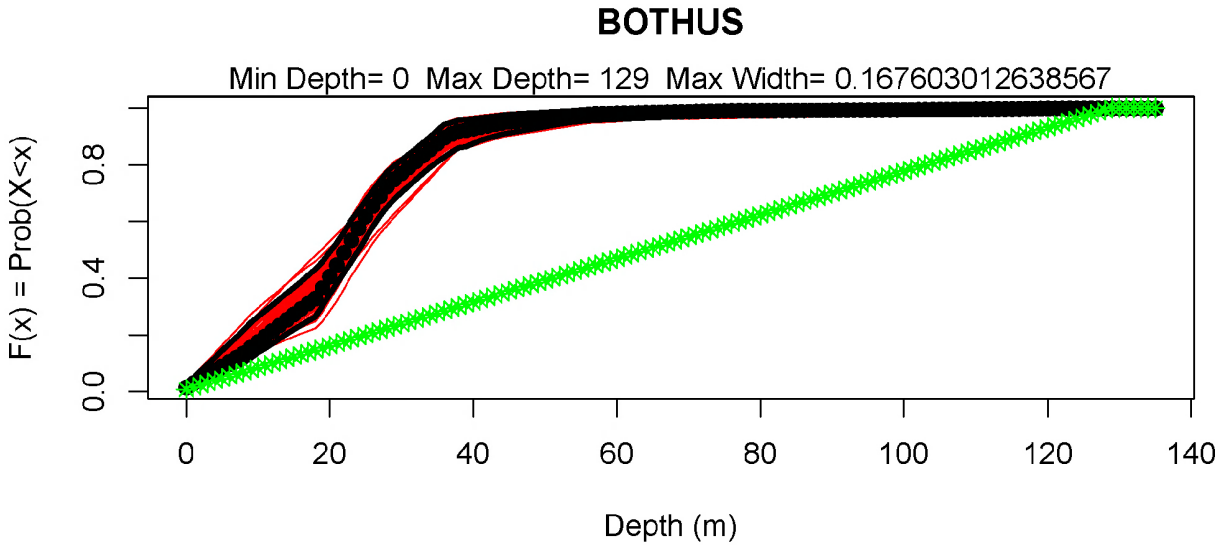

GERREIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

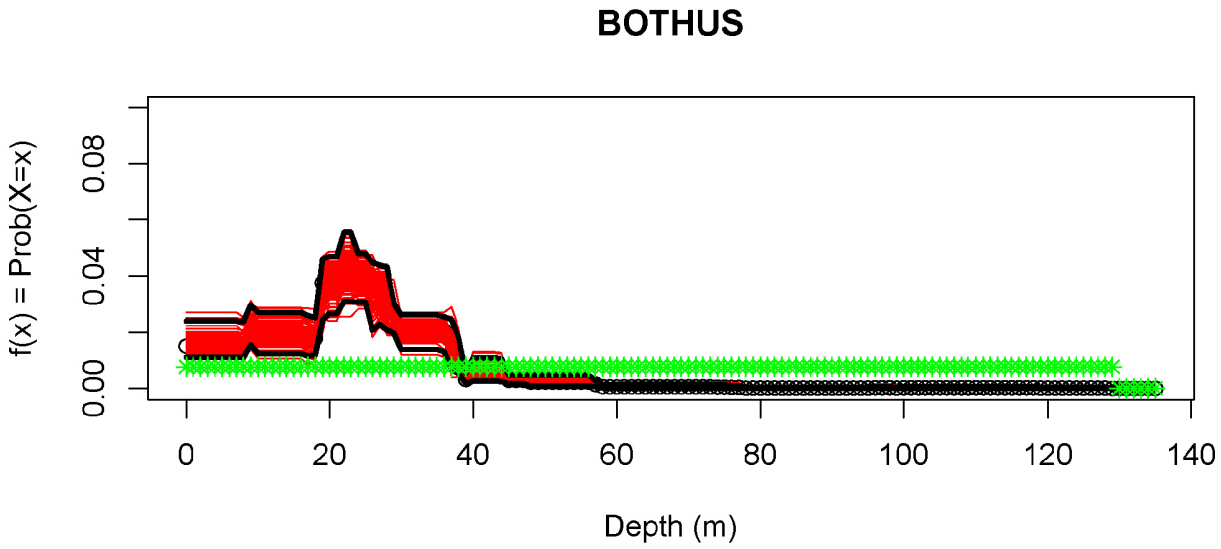

SARDINELLA.AURITA
Min Depth= 0 Max Depth= 30 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

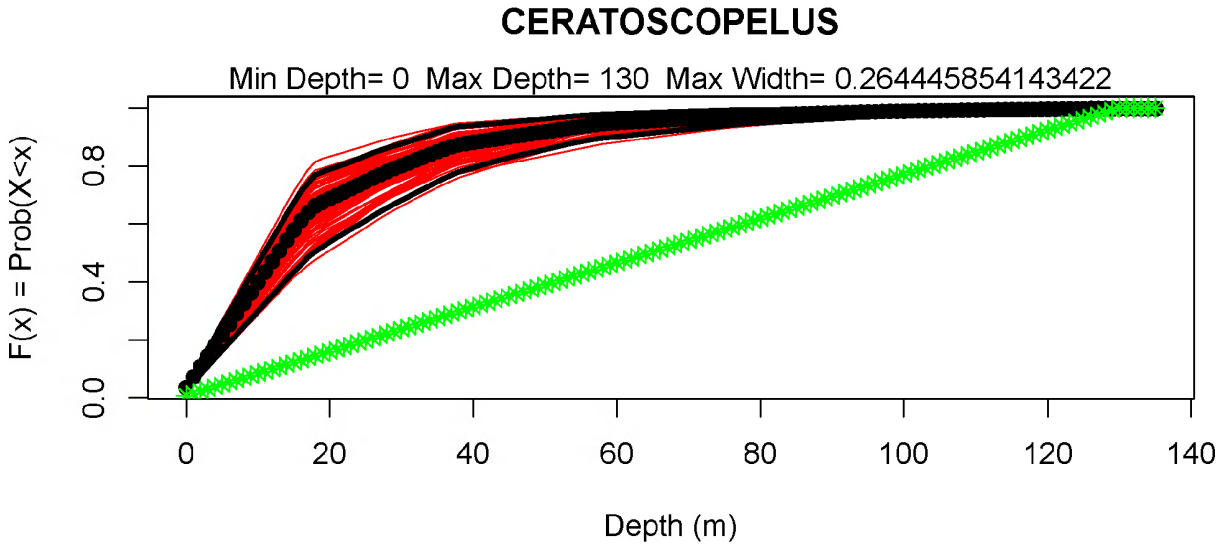

SARDINELLA.AURITA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

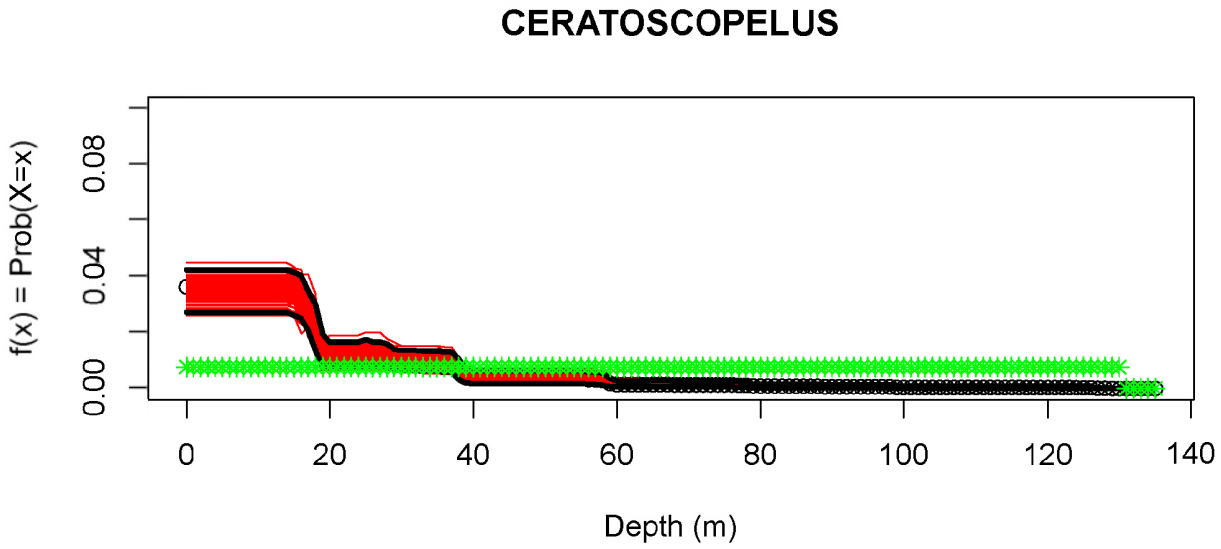

ACROPOMATIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.269563424820311
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

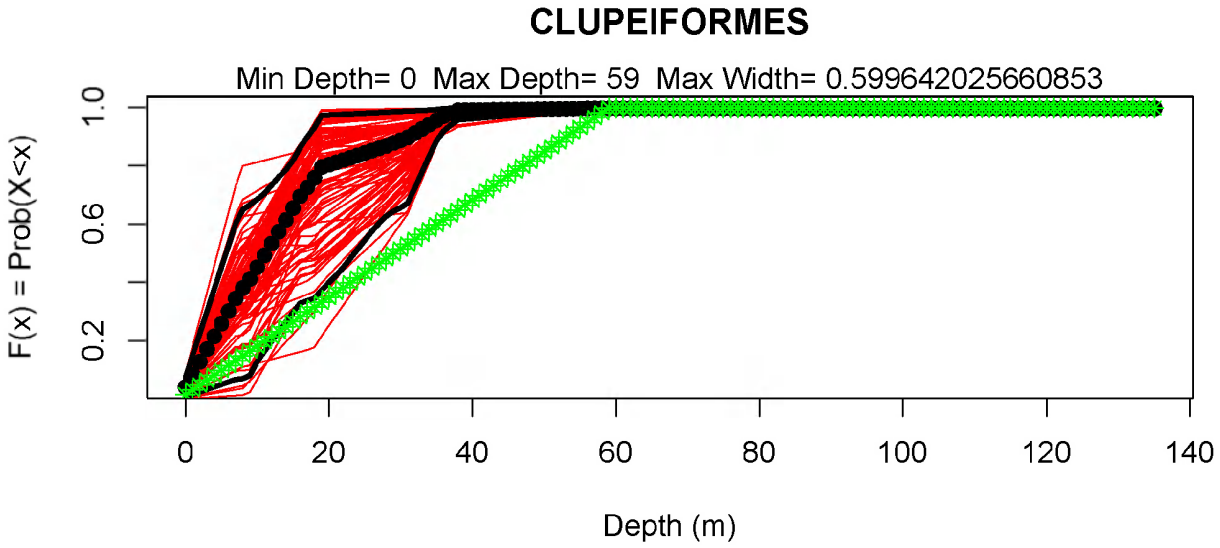

ACROPOMATIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

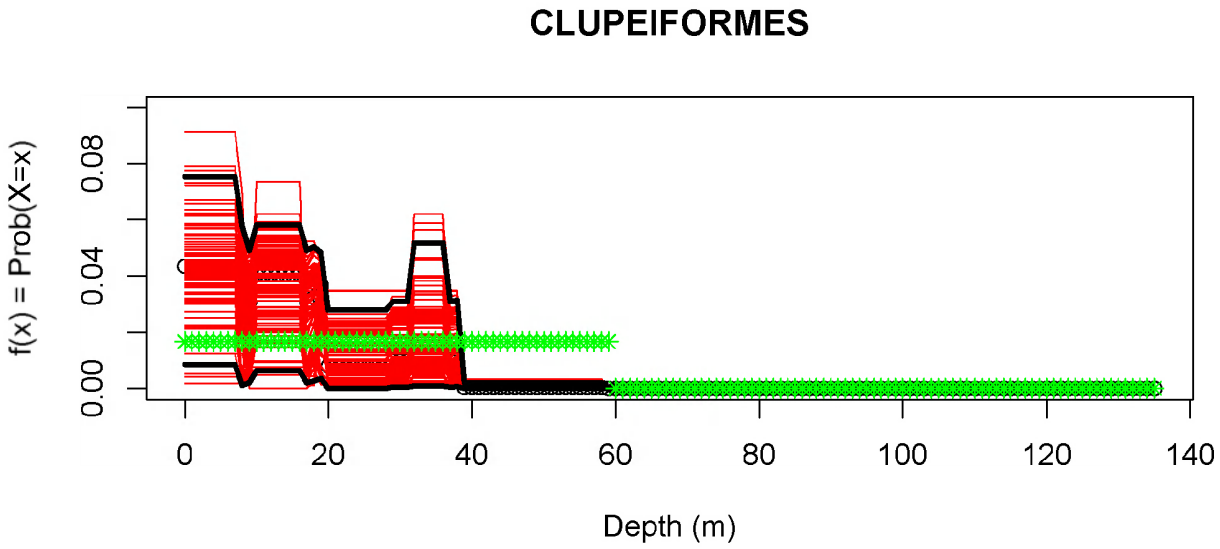

BOTHUS
Min Depth= 0 Max Depth= 129 Max Width= 0.167603012638567
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

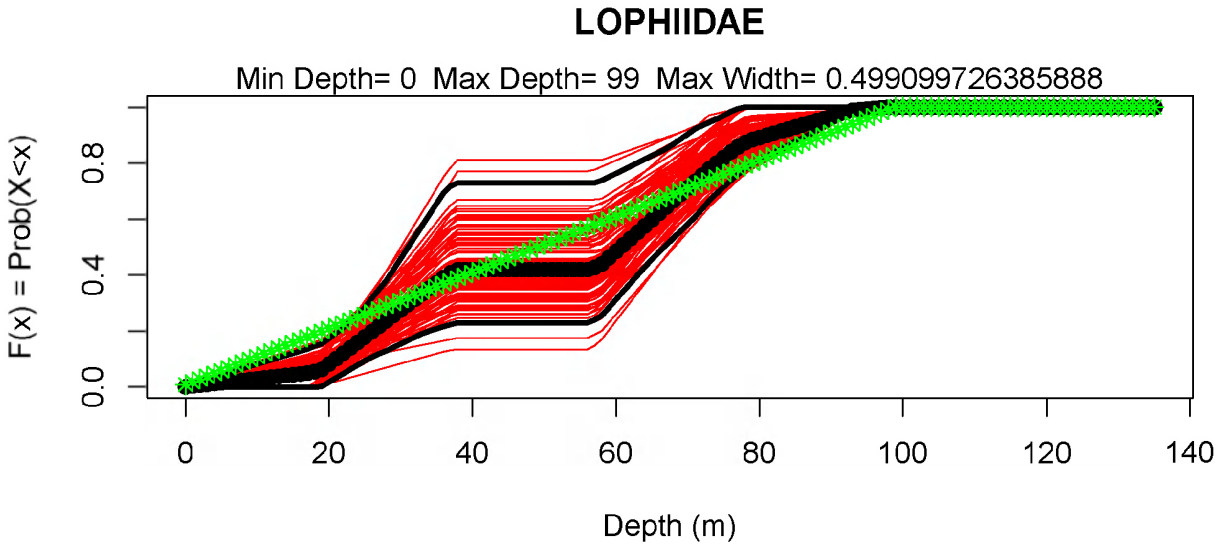

BOTHUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

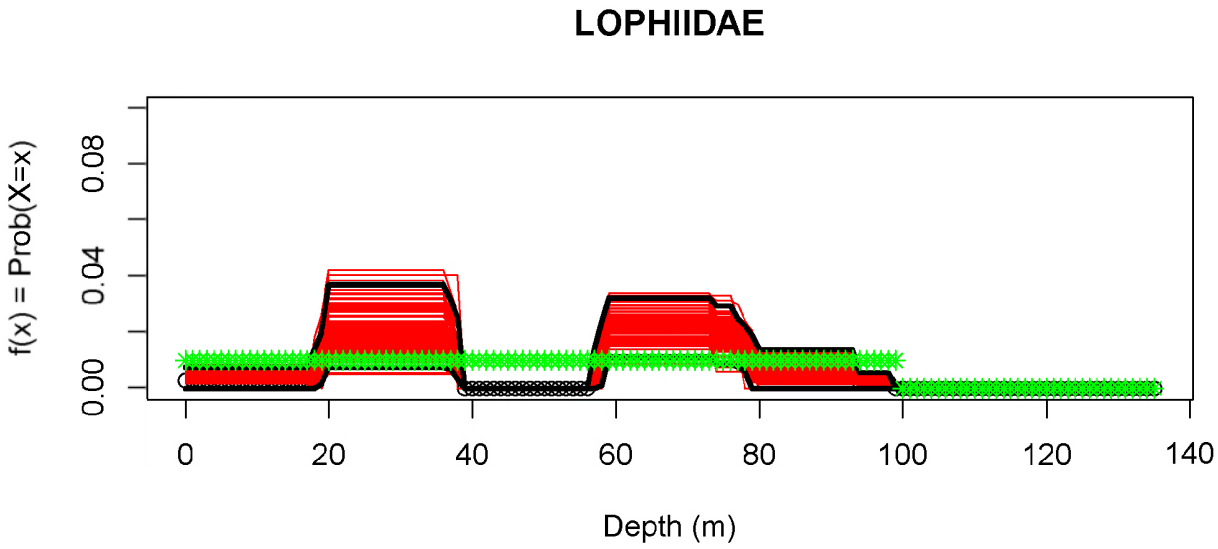

CERATOSCOPELUS
Min Depth= 0 Max Depth= 130 Max Width= 0.264445854143422
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

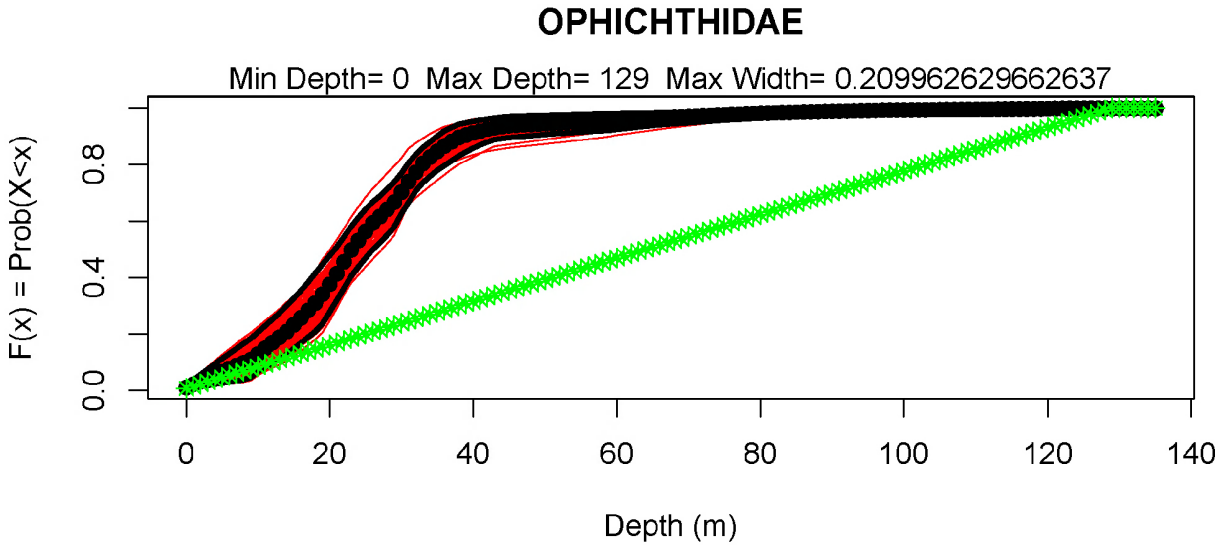

CERATOSCOPELUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

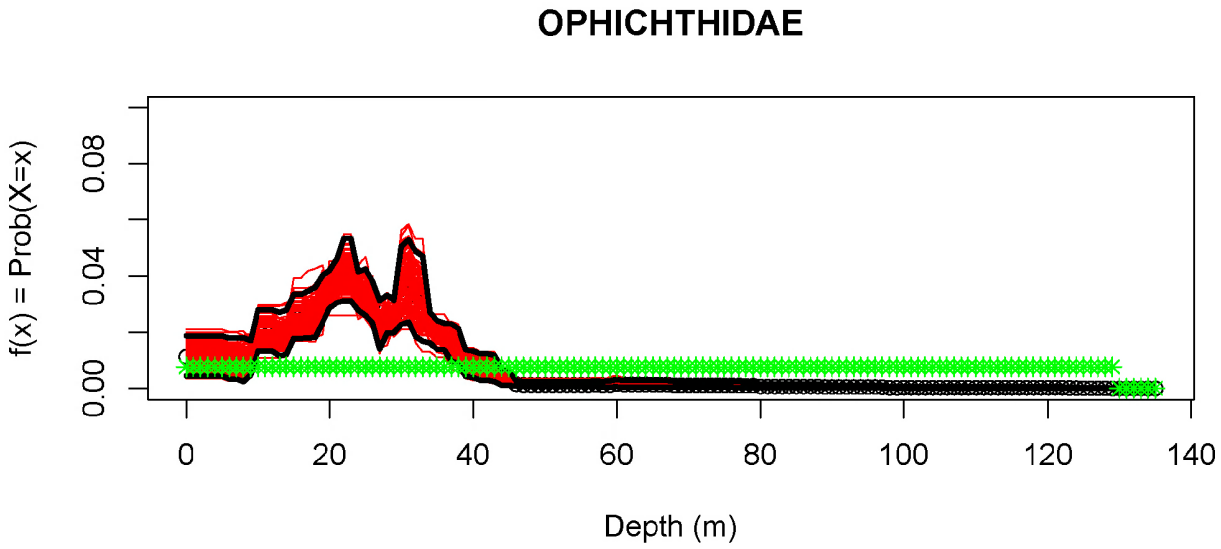

CLUPEIFORMES
Min Depth= 0 Max Depth= 59 Max Width= 0.599642025660853
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

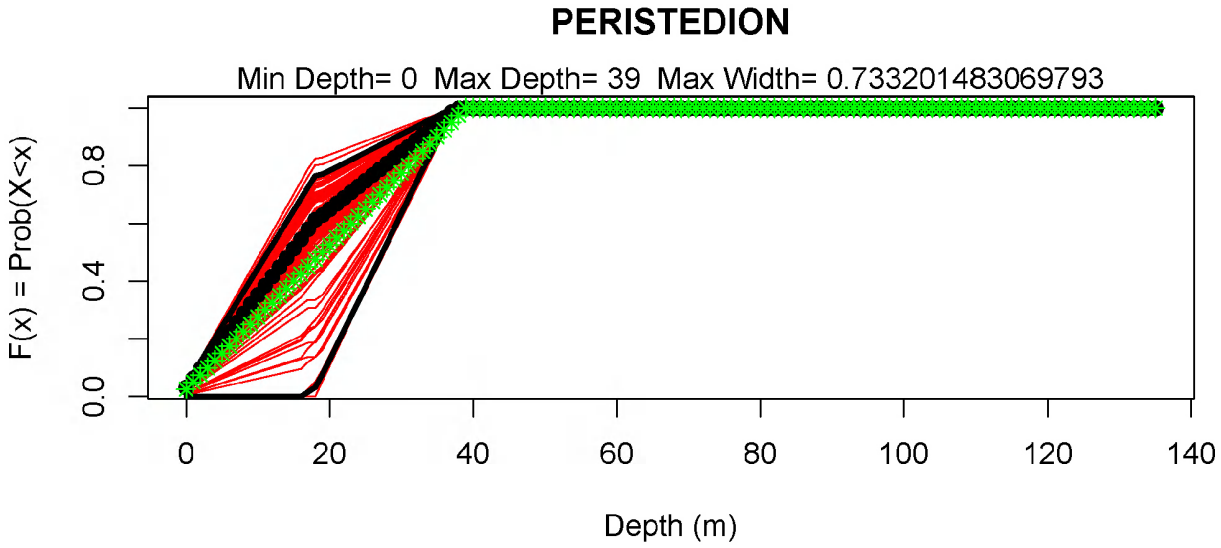

CLUPEIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

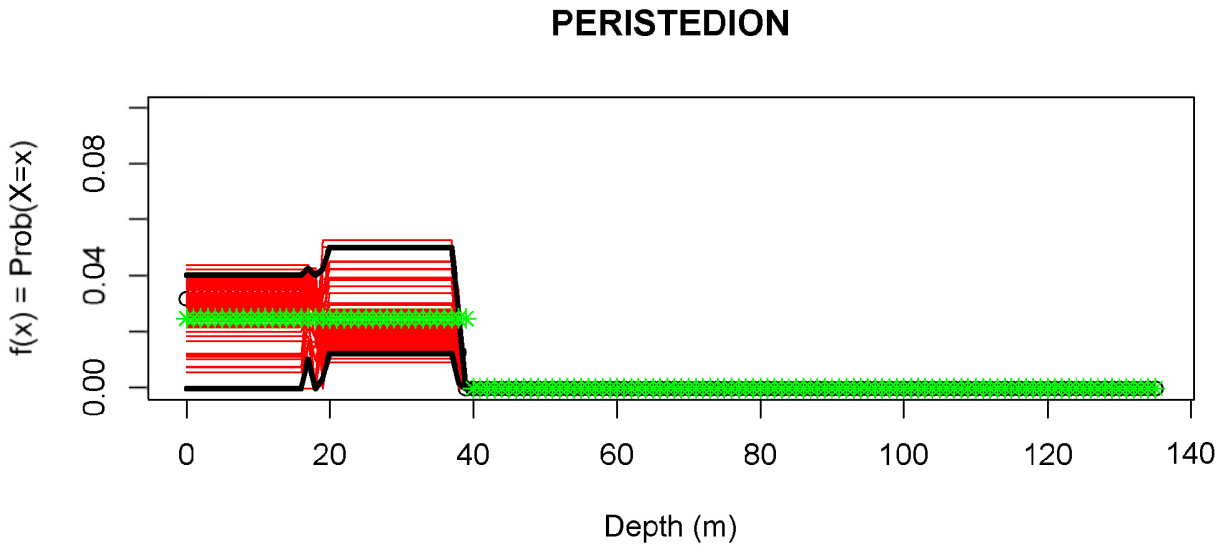

LOPHIIDAE
Min Depth= 0 Max Depth= 99 Max Width= 0.499099726385888
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

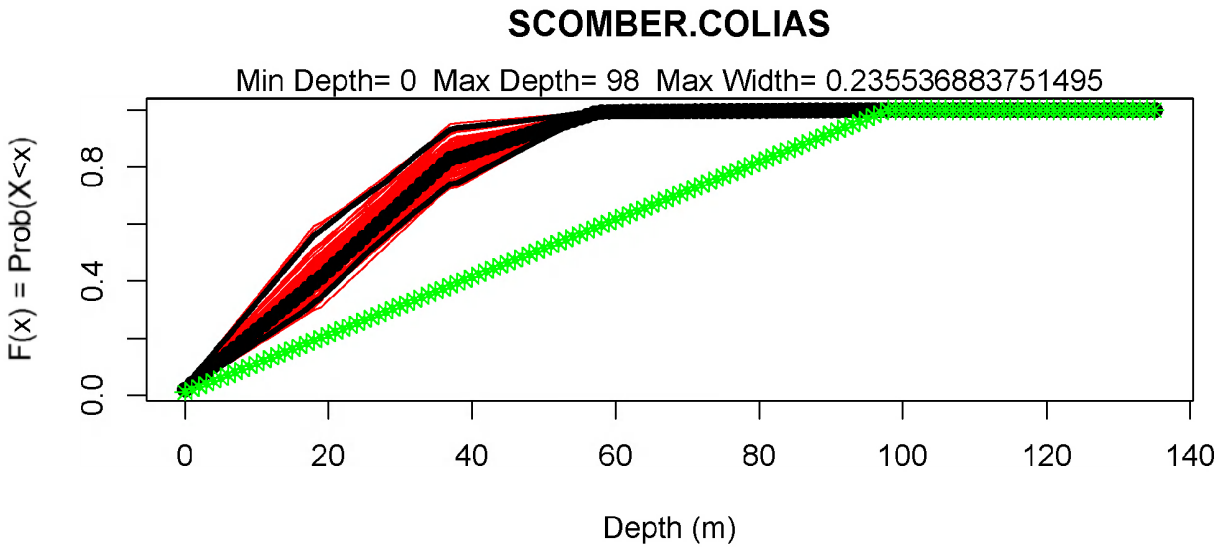

LOPHIIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

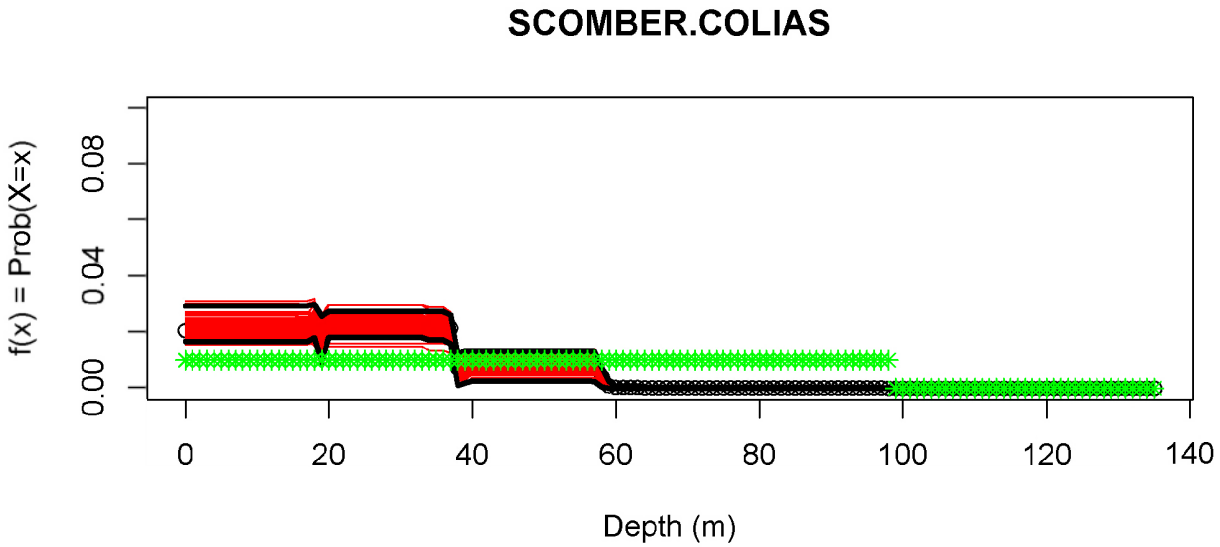

OPHICHTHIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.209962629662637
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

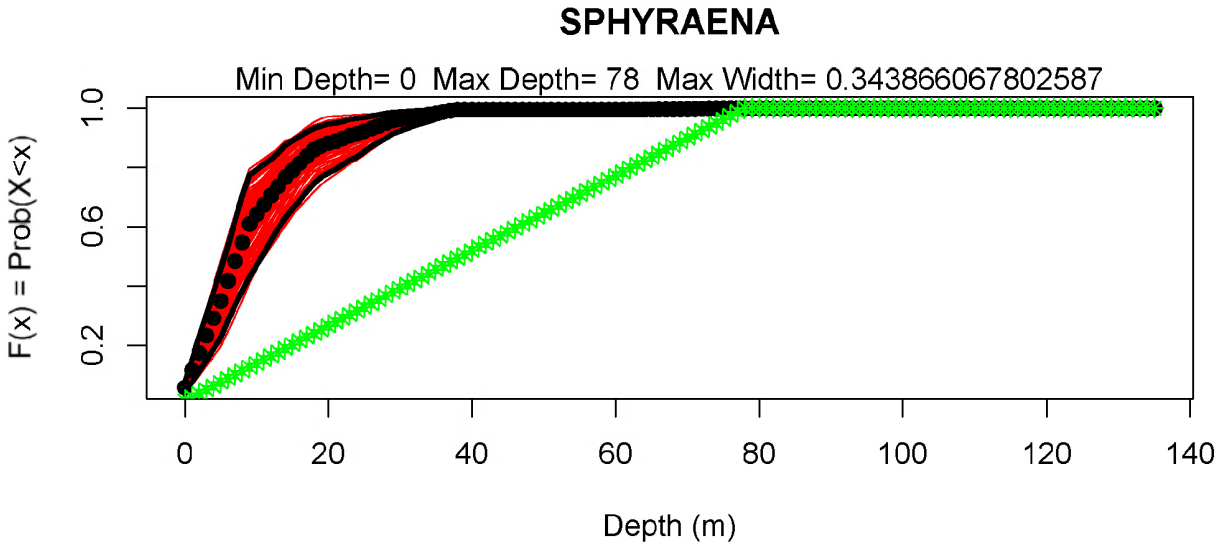

OPHICHTHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

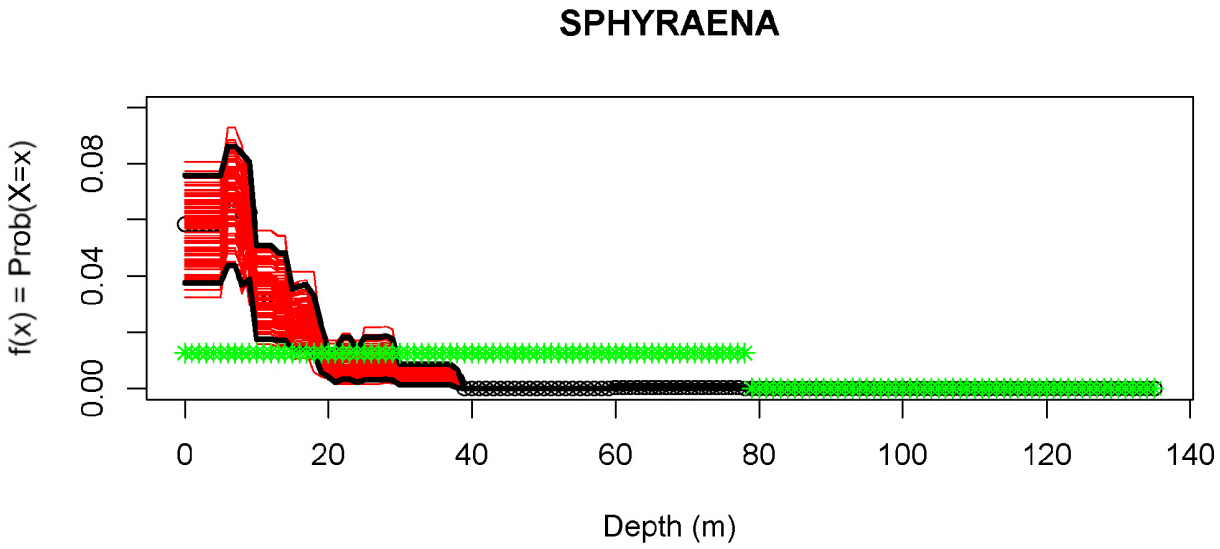

PERISTEDION
Min Depth= 0 Max Depth= 39 Max Width= 0.733201483069793
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

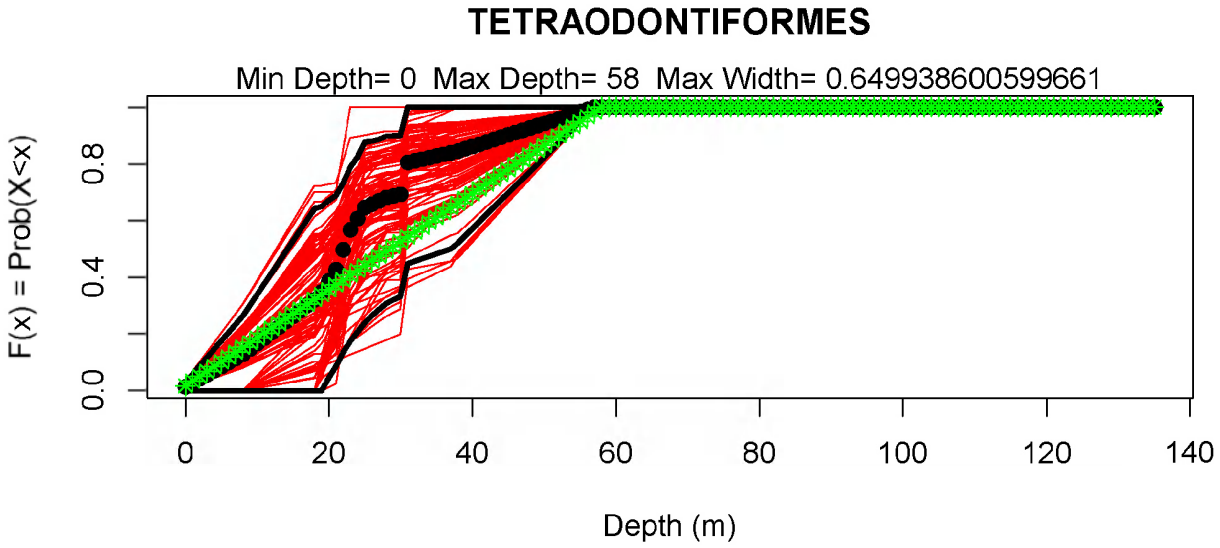

PERISTEDION
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

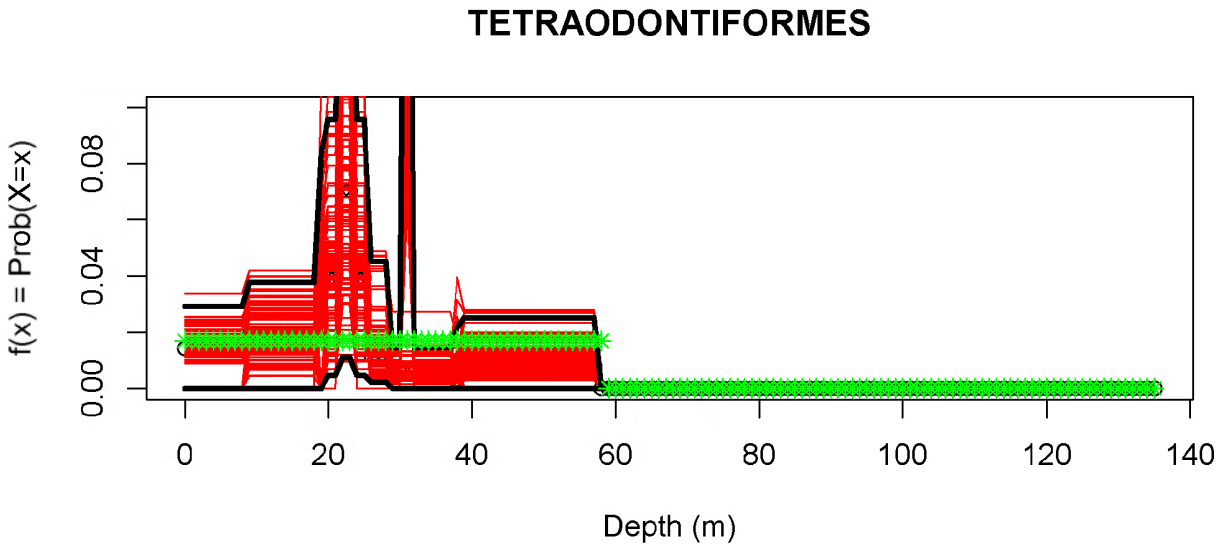

SCOMBER.COLIAS
Min Depth= 0 Max Depth= 98 Max Width= 0.235536883751495
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

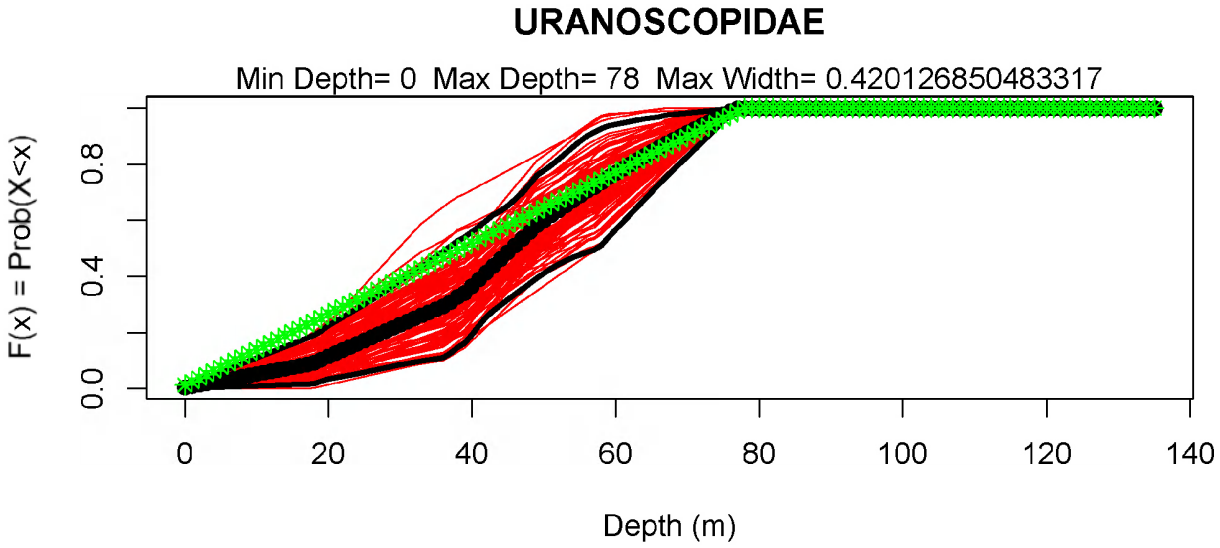

SCOMBER.COLIAS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

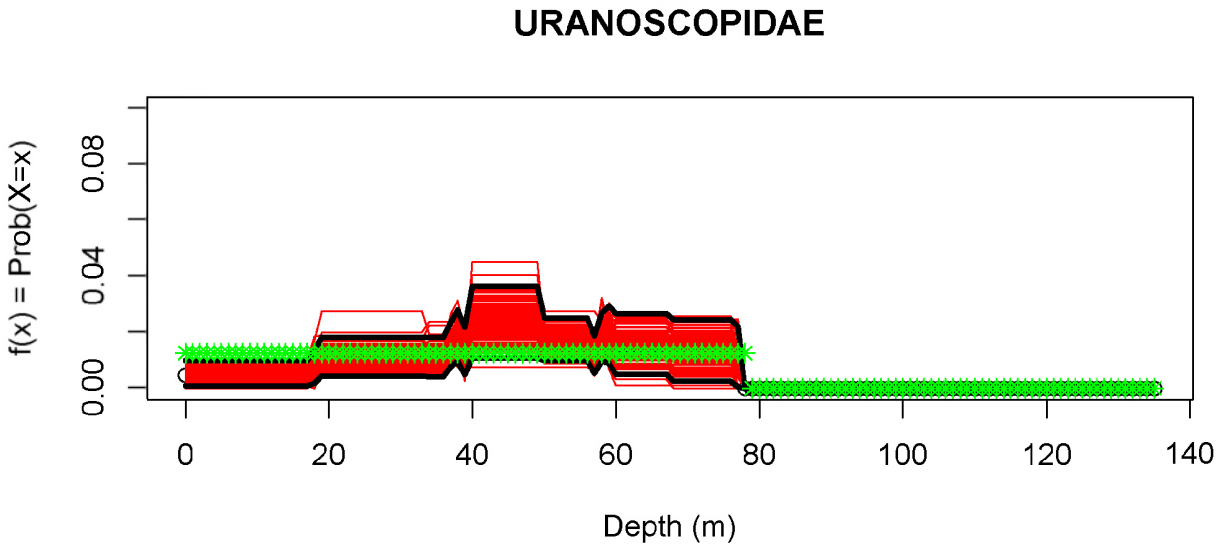

SPHYRAENA
Min Depth= 0 Max Depth= 78 Max Width= 0.343866067802587
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

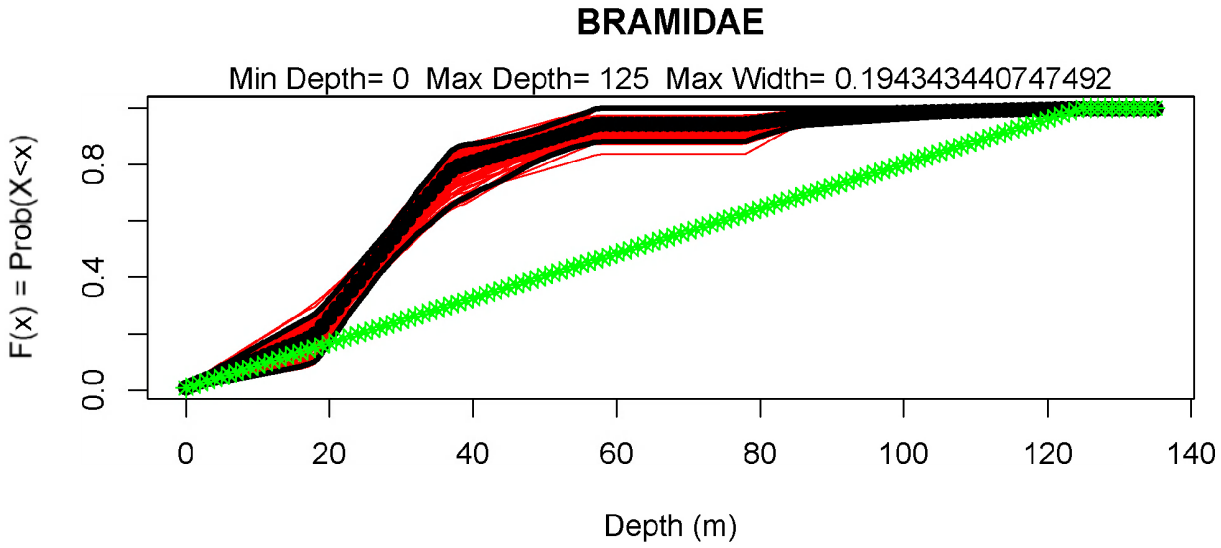

SPHYRAENA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

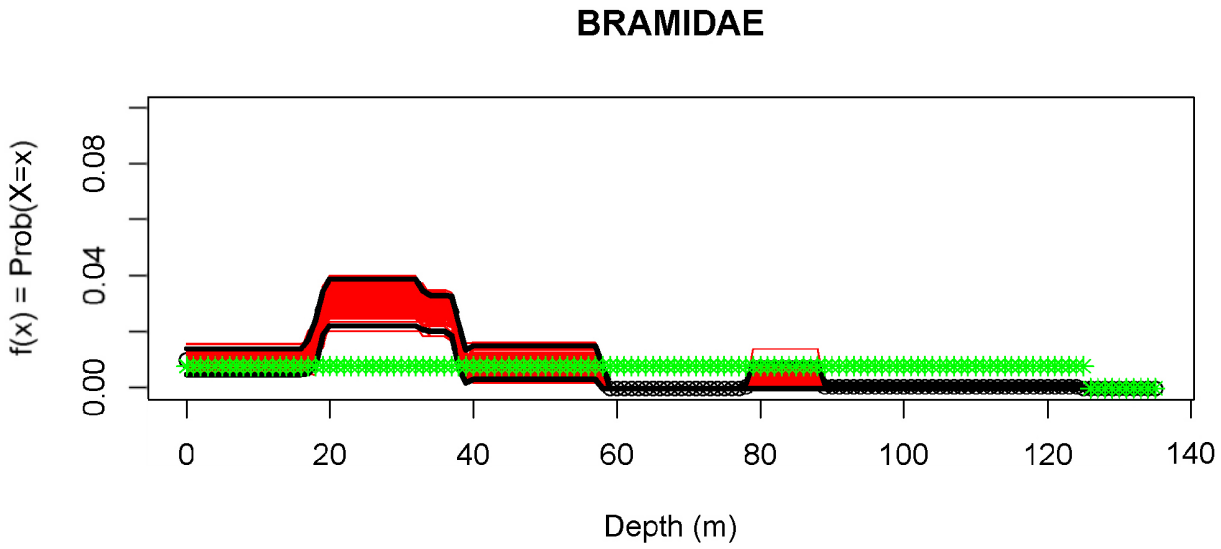

TETRAODONTIFORMES
Min Depth= 0 Max Depth= 58 Max Width= 0.649938600599661
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

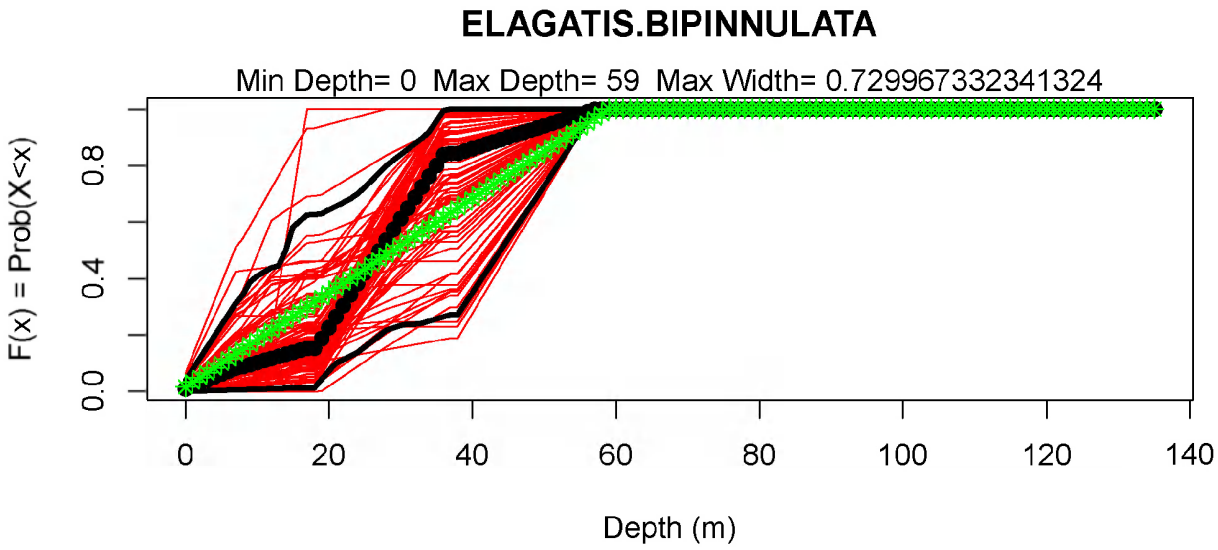

TETRAODONTIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

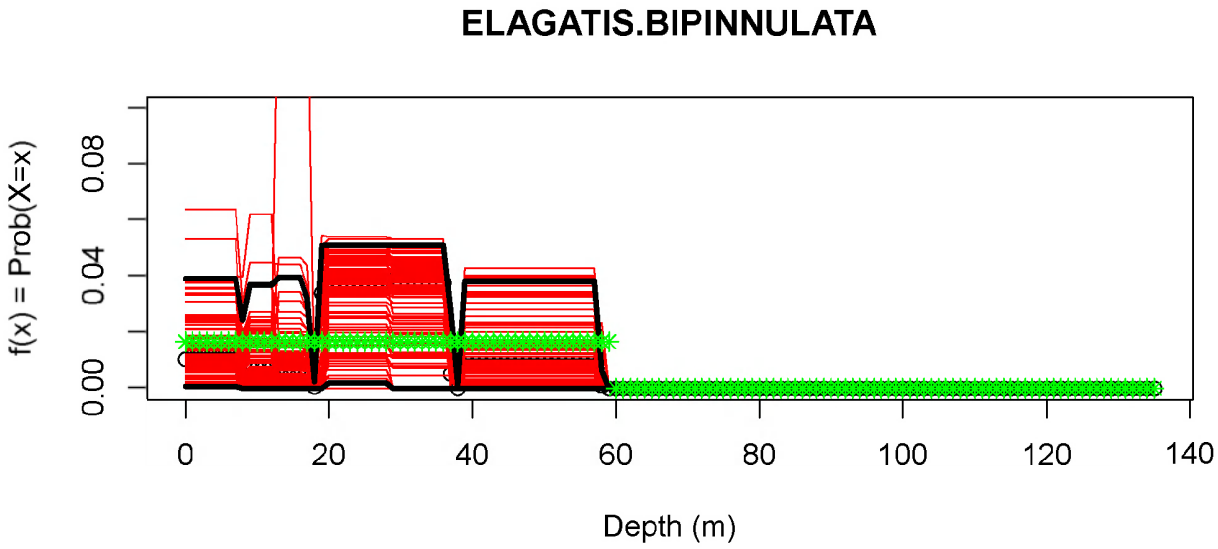

URANOSCOPIDAE
Min Depth= 0 Max Depth= 78 Max Width= 0.420126850483317
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

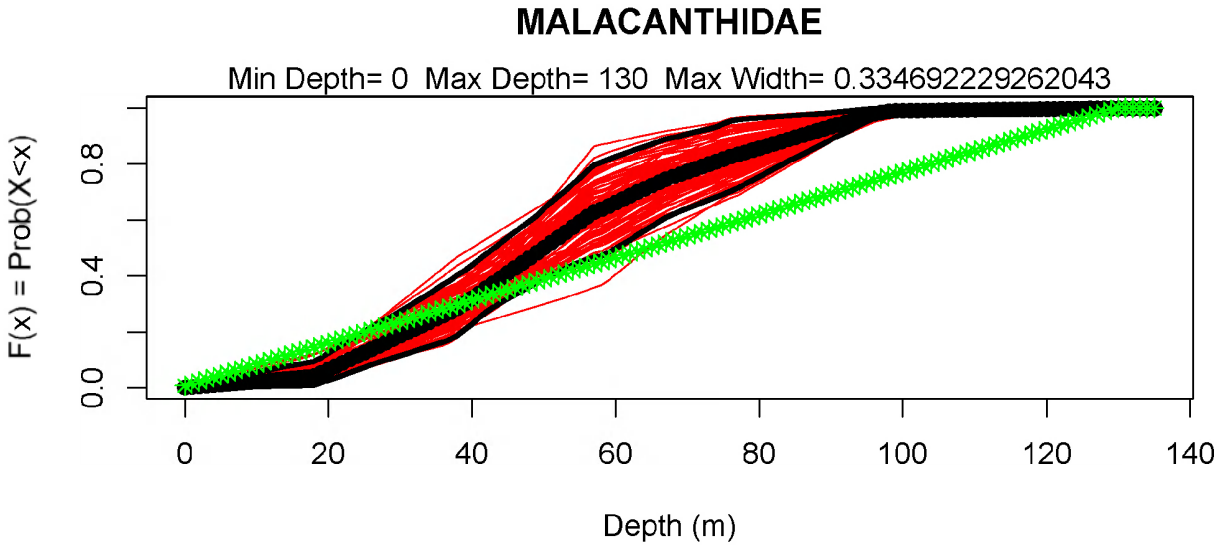

URANOSCOPIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

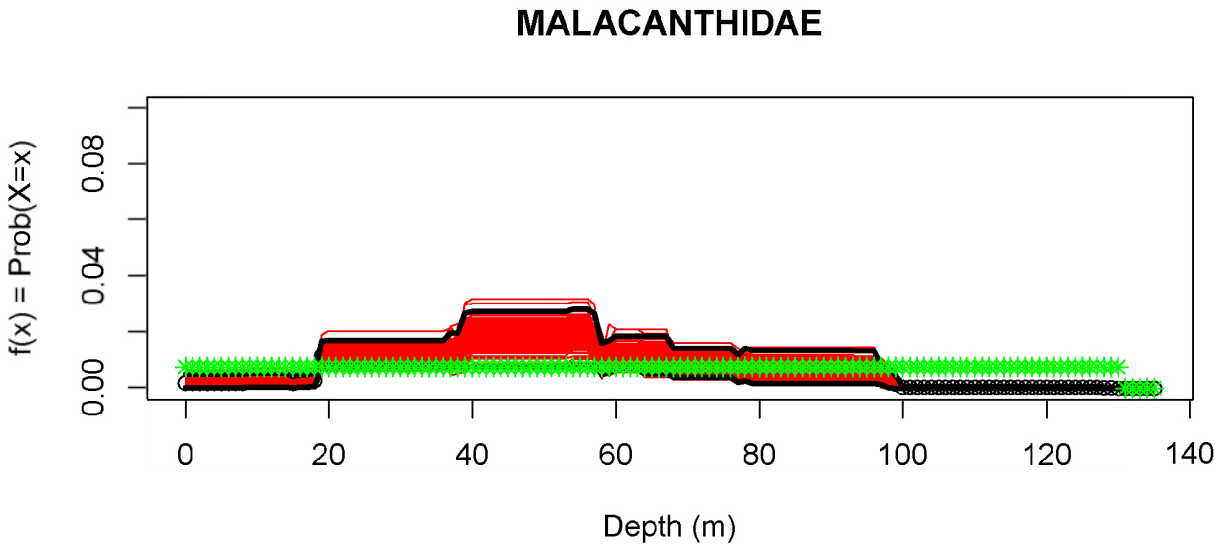

BRAMIDAE
Min Depth= 0 Max Depth= 125 Max Width= 0.194343440747492
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

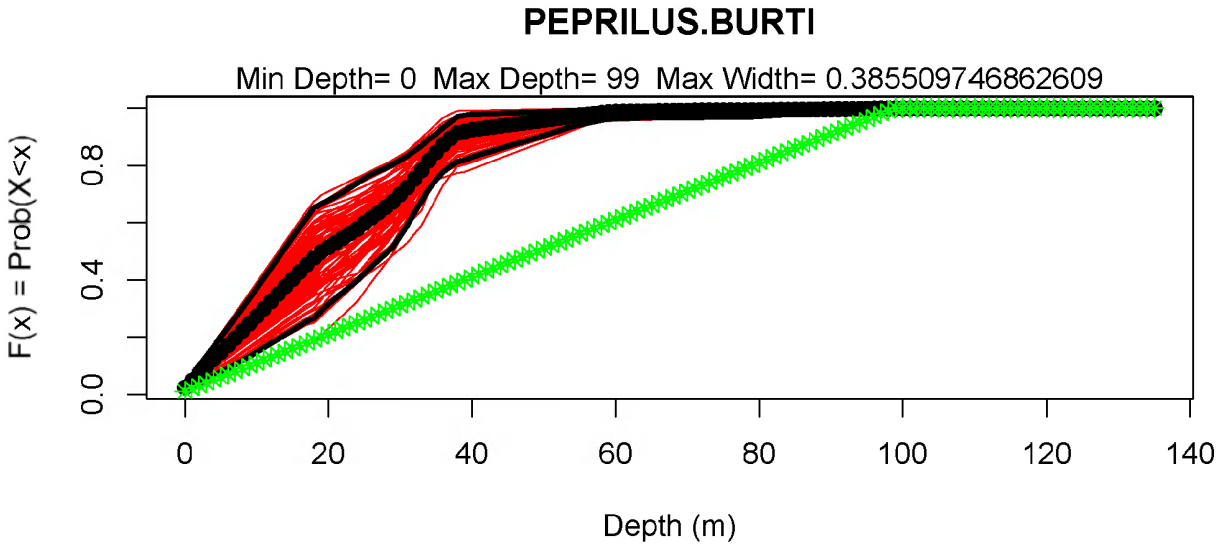

BRAMIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

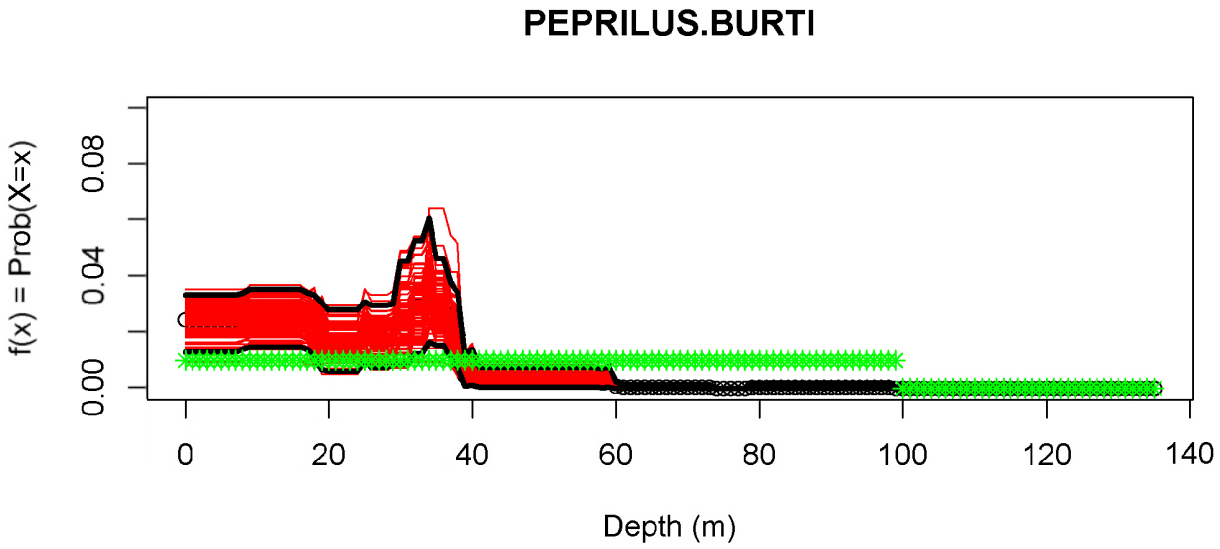

ELAGATIS.BIPINNULATA
Min Depth= 0 Max Depth= 59 Max Width= 0.729967332341324
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

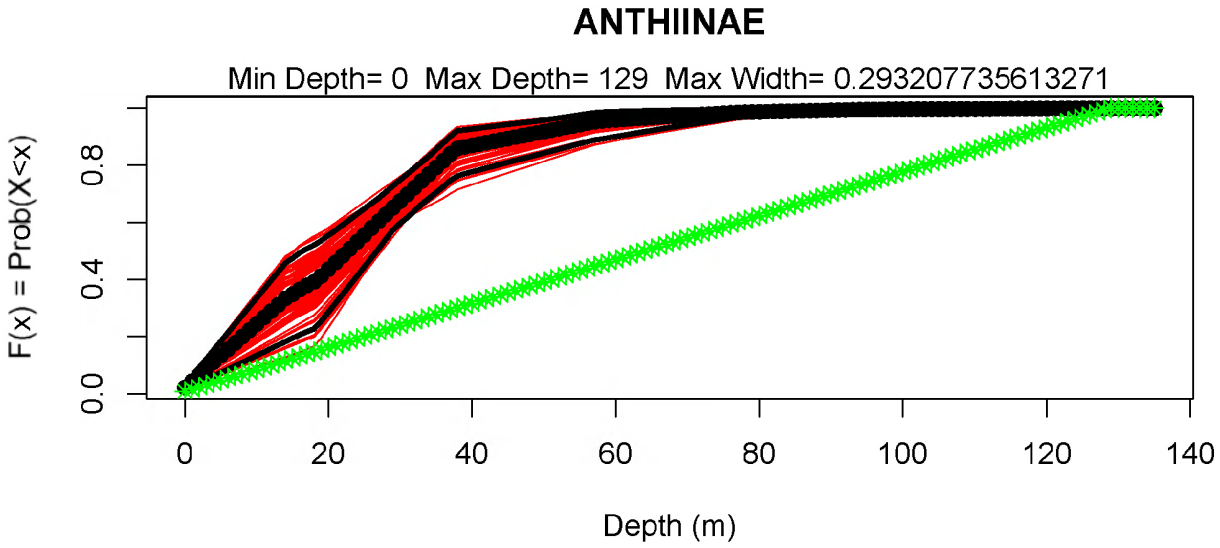

ELAGATIS.BIPINNULATA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

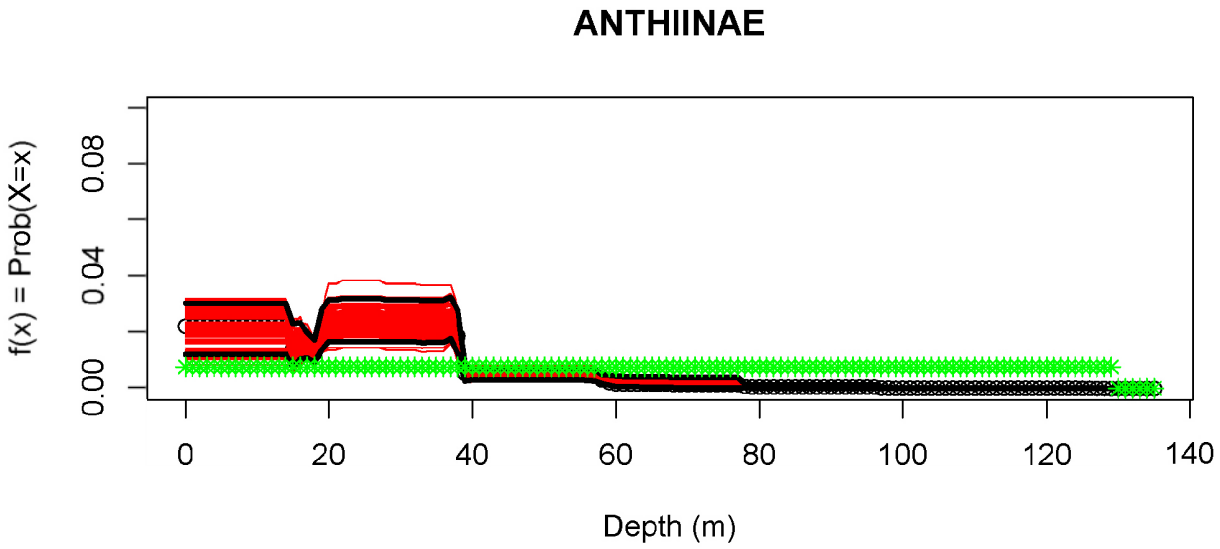

MALACANTHIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.334692229262043
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

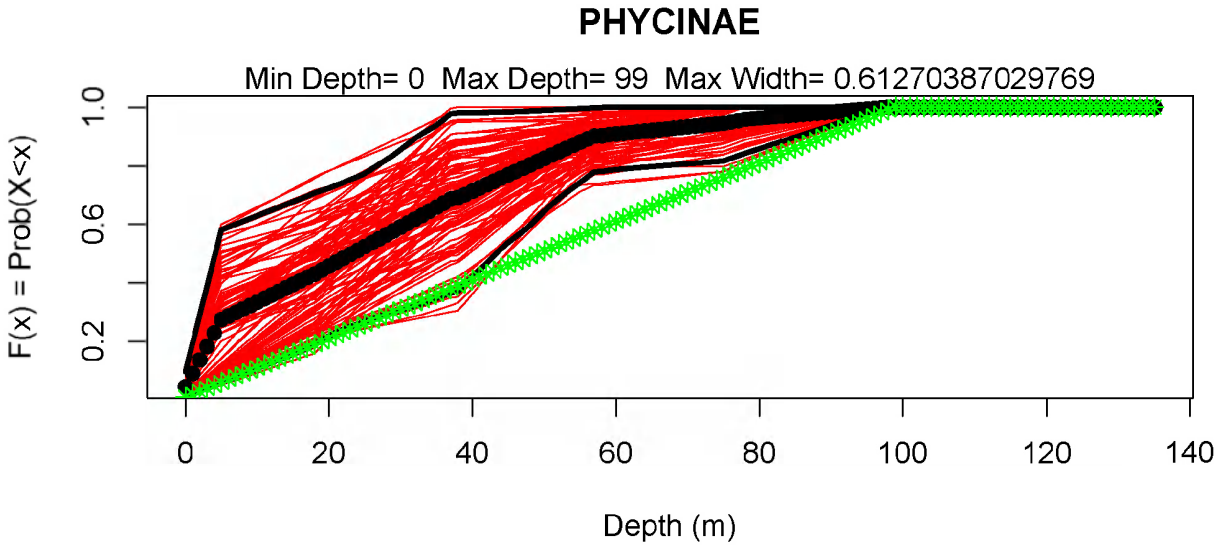

MALACANTHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

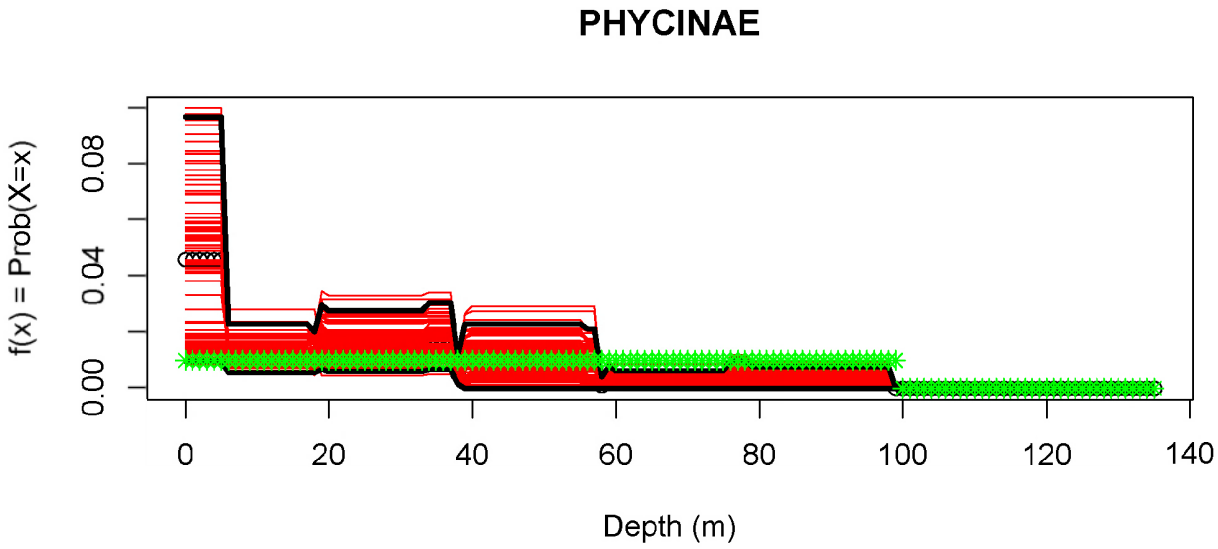

PEPRILUS.BURTI
Min Depth= 0 Max Depth= 99 Max Width= 0.385509746862609
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

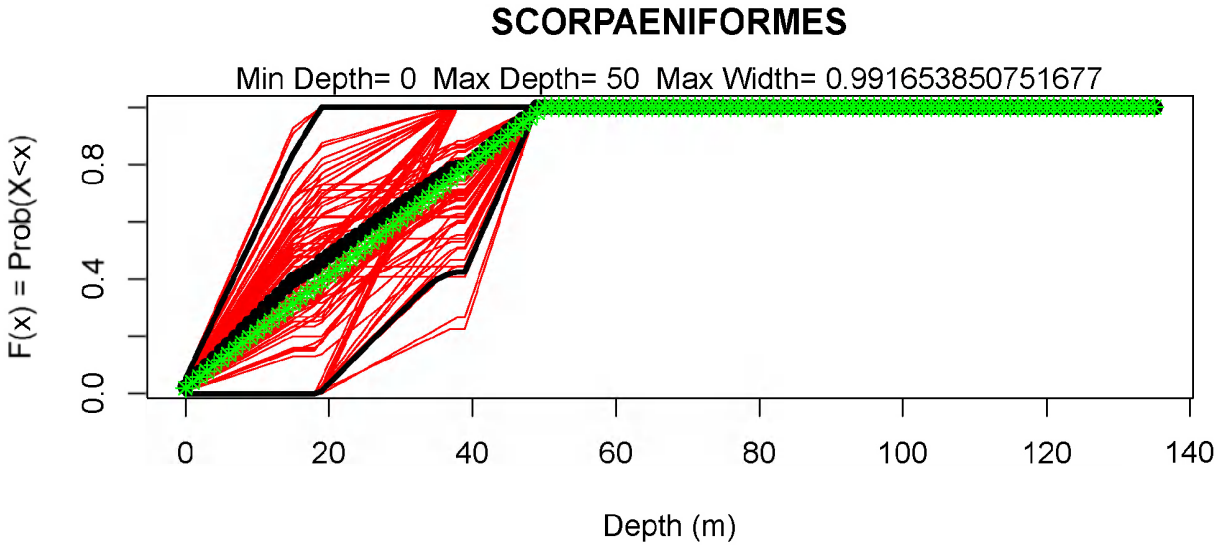

PEPRILUS.BURTI
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

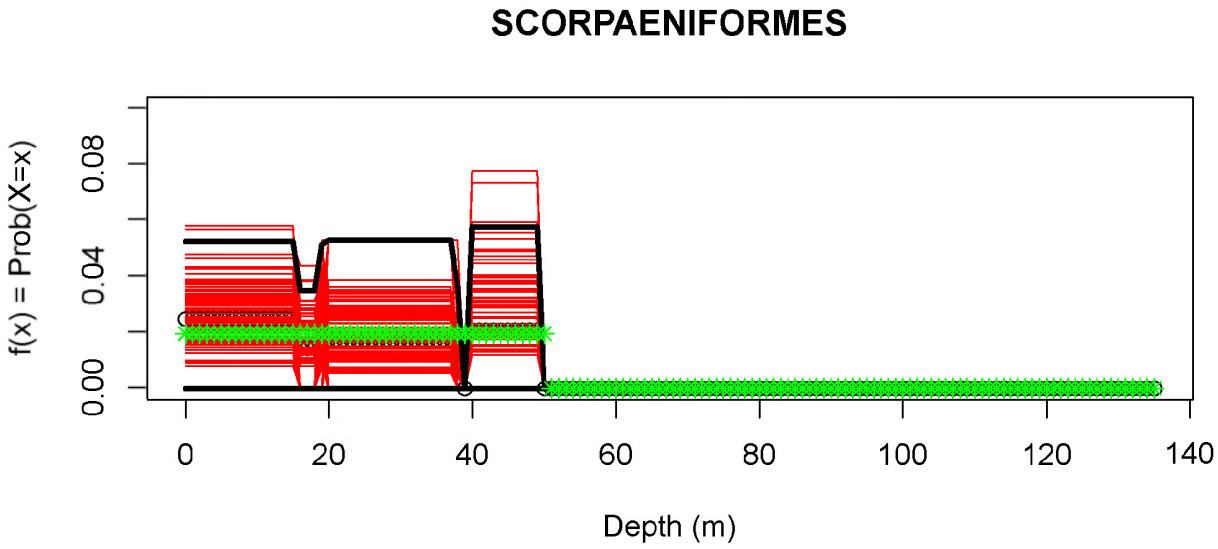

ANTHIINAE
Min Depth= 0 Max Depth= 129 Max Width= 0.293207735613271
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

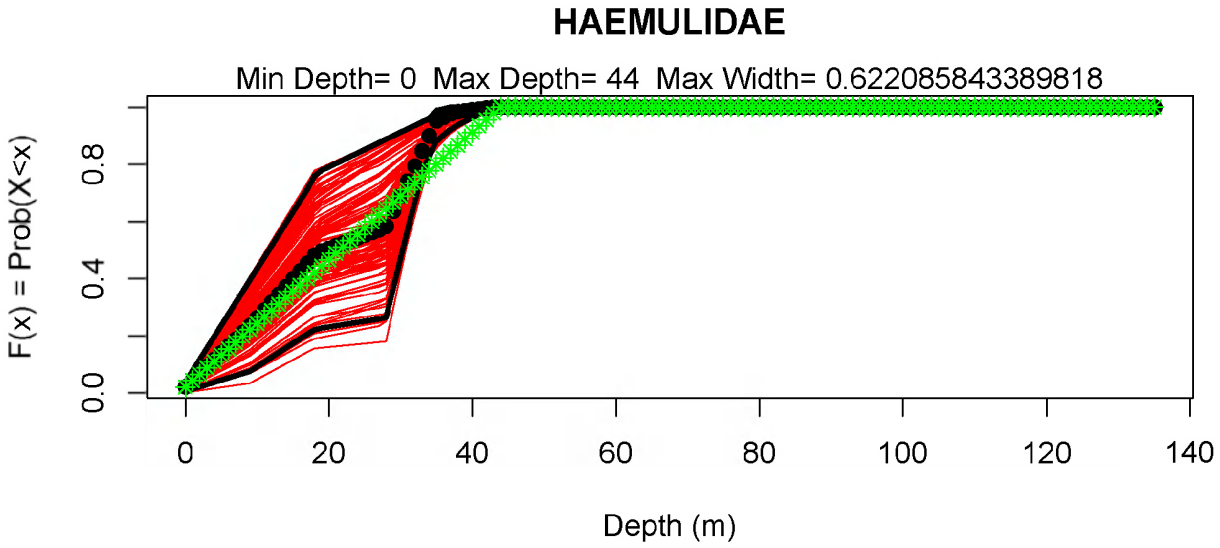

ANTHIINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

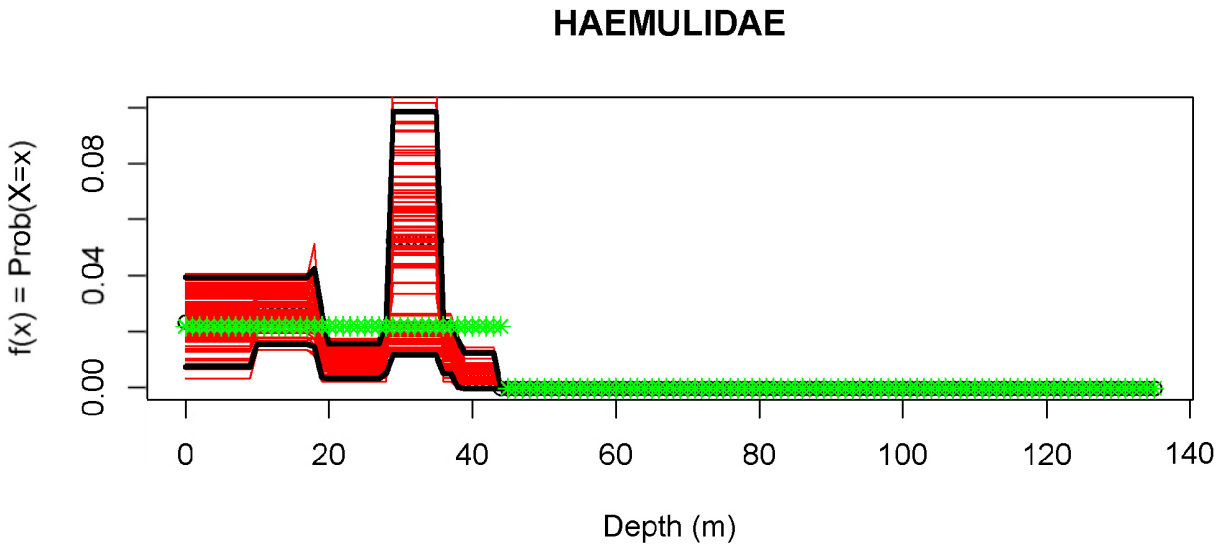

PHYCINAE
Min Depth= 0 Max Depth= 99 Max Width= 0.61270387029769
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

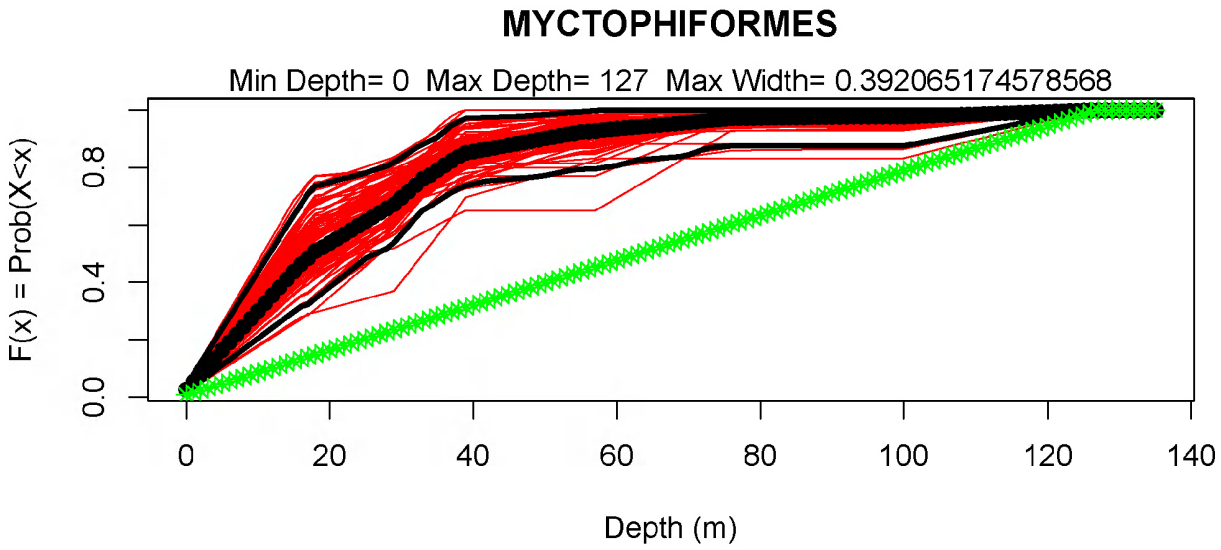

PHYCINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

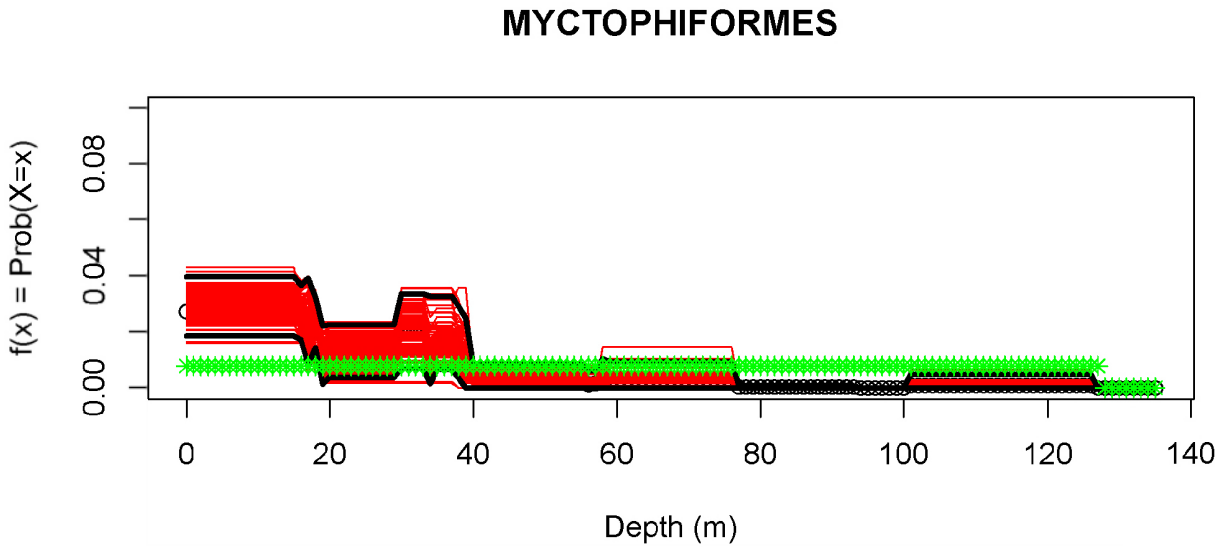

SCORPAENIFORMES
Min Depth= 0 Max Depth= 50 Max Width= 0.991653850751677
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

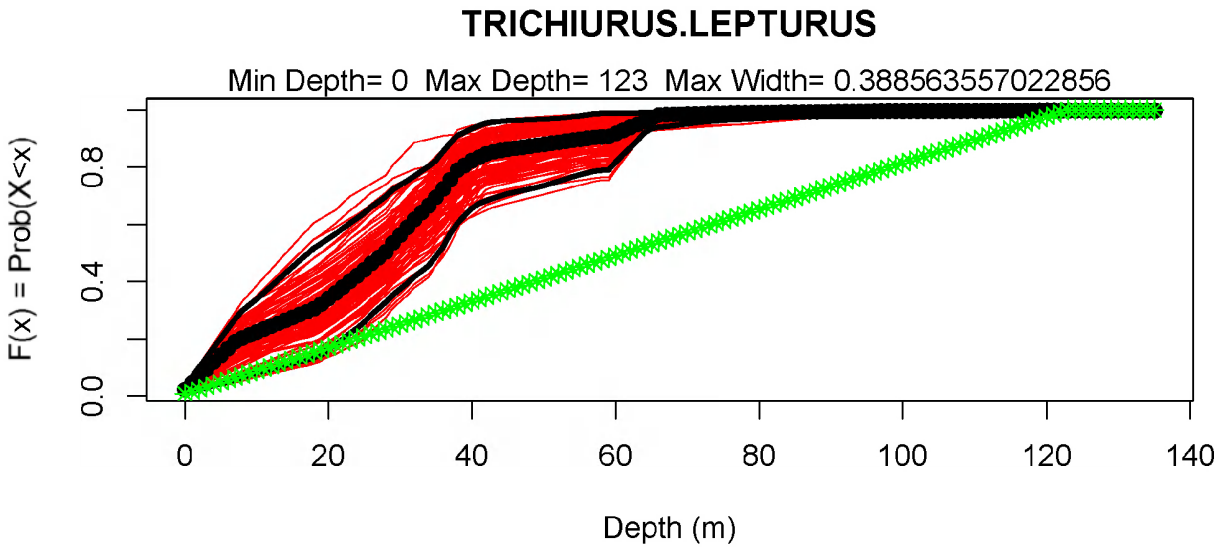

SCORPAENIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

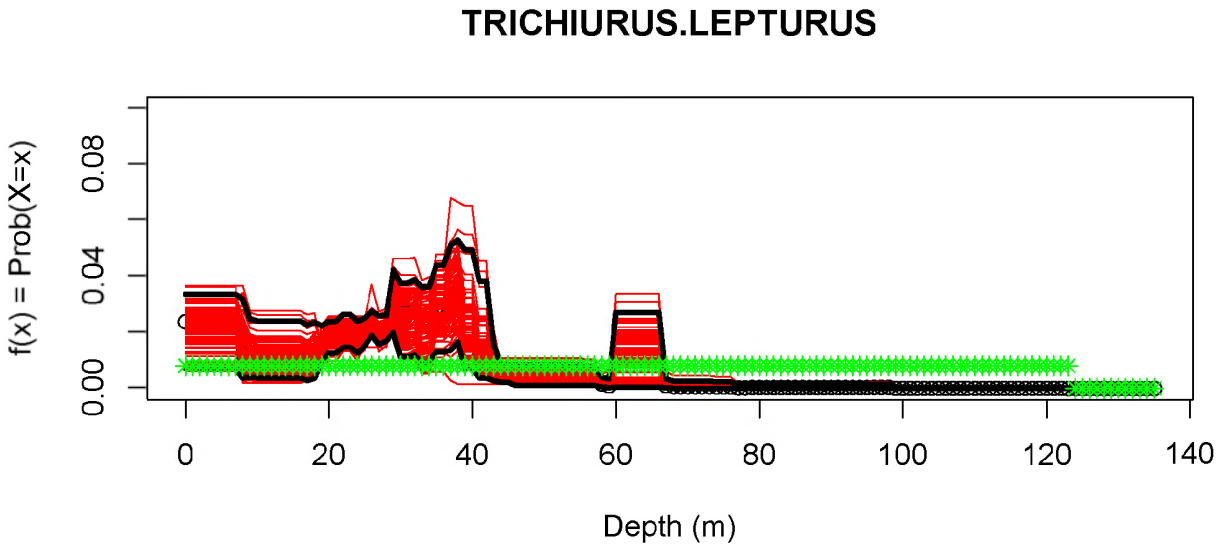

HAEMULIDAE
Min Depth= 0 Max Depth= 44 Max Width= 0.622085843389818
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

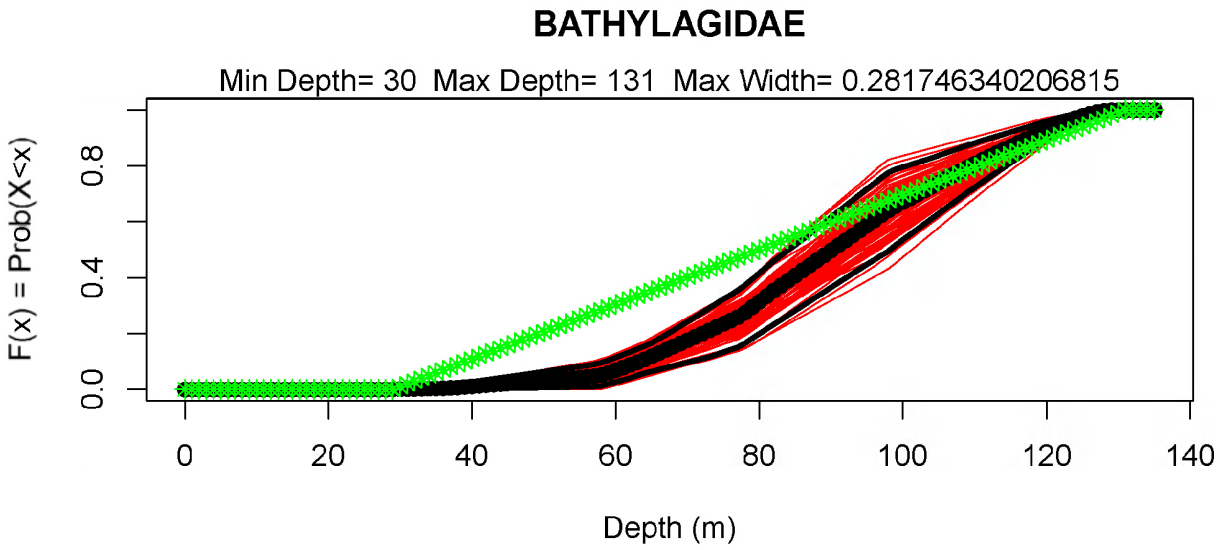

HAEMULIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

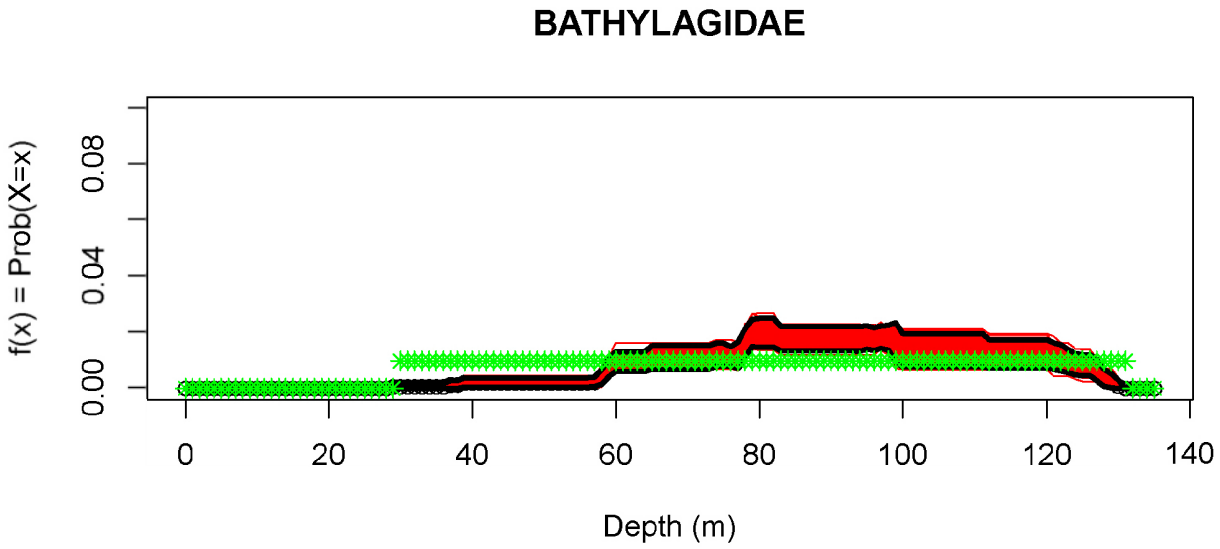

MYCTOPHIFORMES
Min Depth= 0 Max Depth= 127 Max Width= 0.392065174578568
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

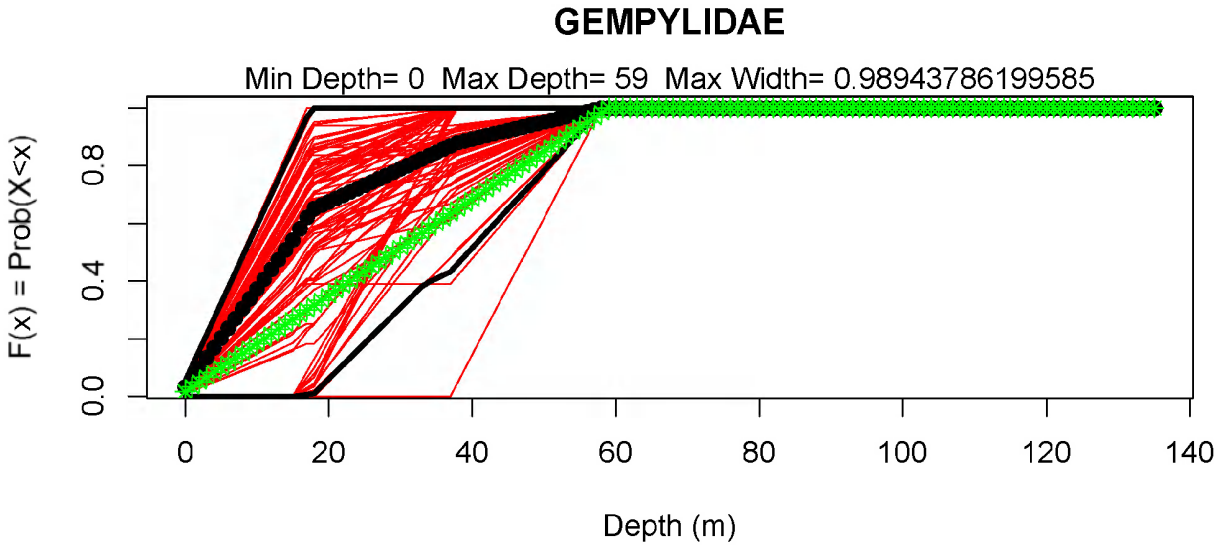

MYCTOPHIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

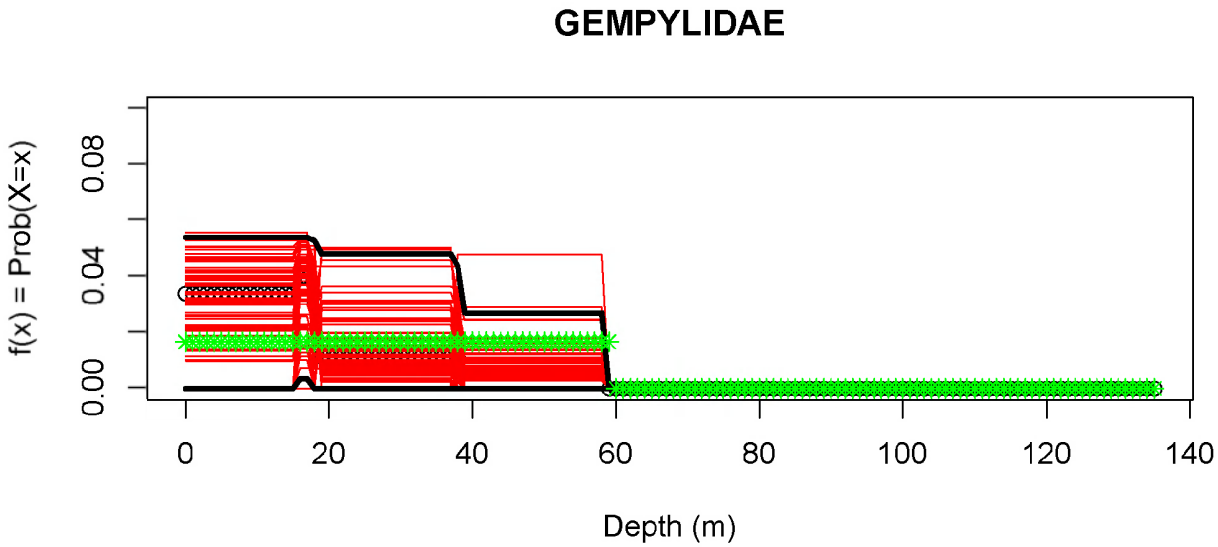

TRICHIURUS.LEPTURUS
Min Depth= 0 Max Depth= 123 Max Width= 0.388563557022856
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

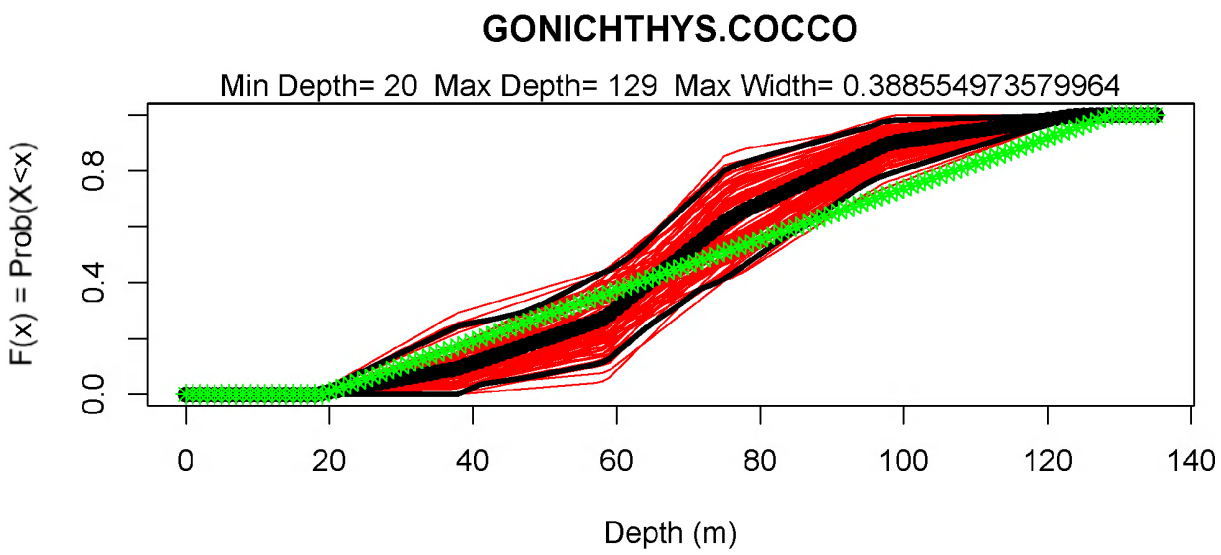

TRICHIURUS.LEPTURUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

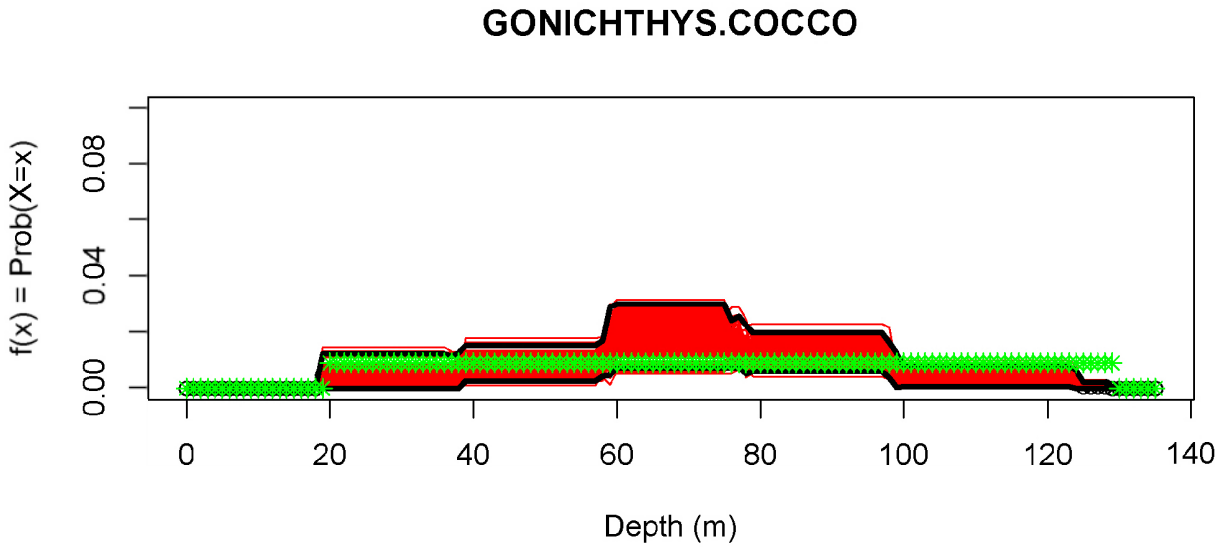

BATHYLAGIDAE
Min Depth= 30 Max Depth= 131 Max Width= 0.281746340206815
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

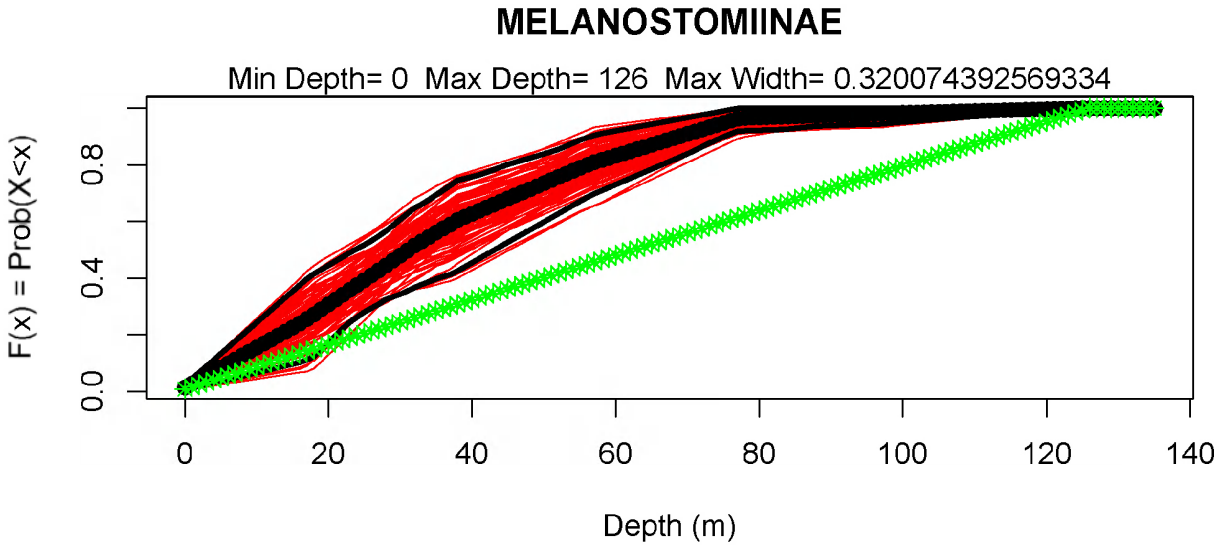

BATHYLAGIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

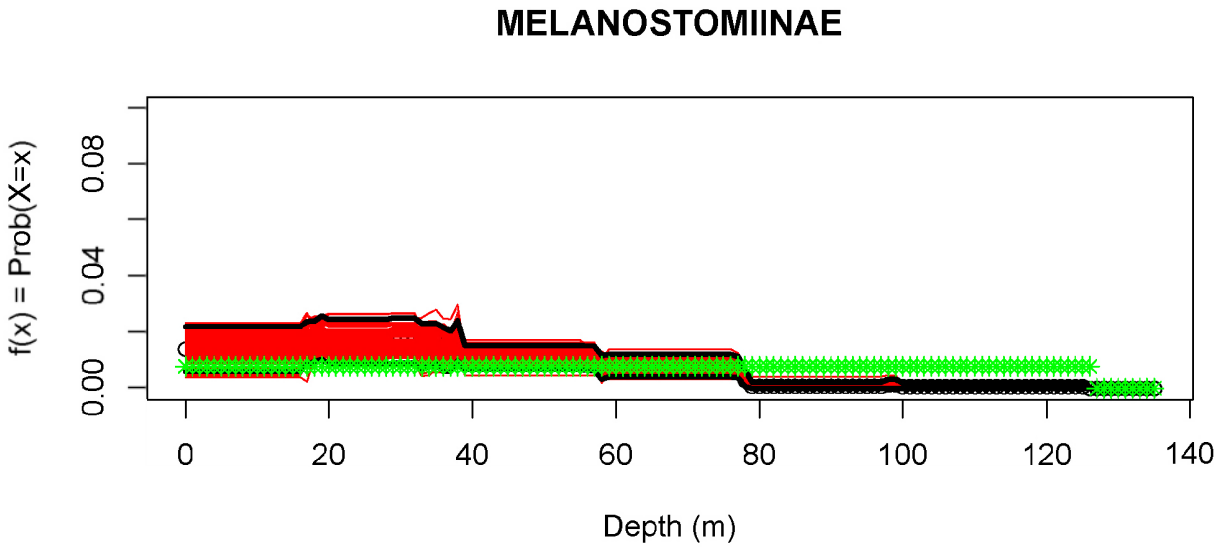

GEMPYLIDAE
Min Depth= 0 Max Depth= 59 Max Width= 0.98943786199585
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

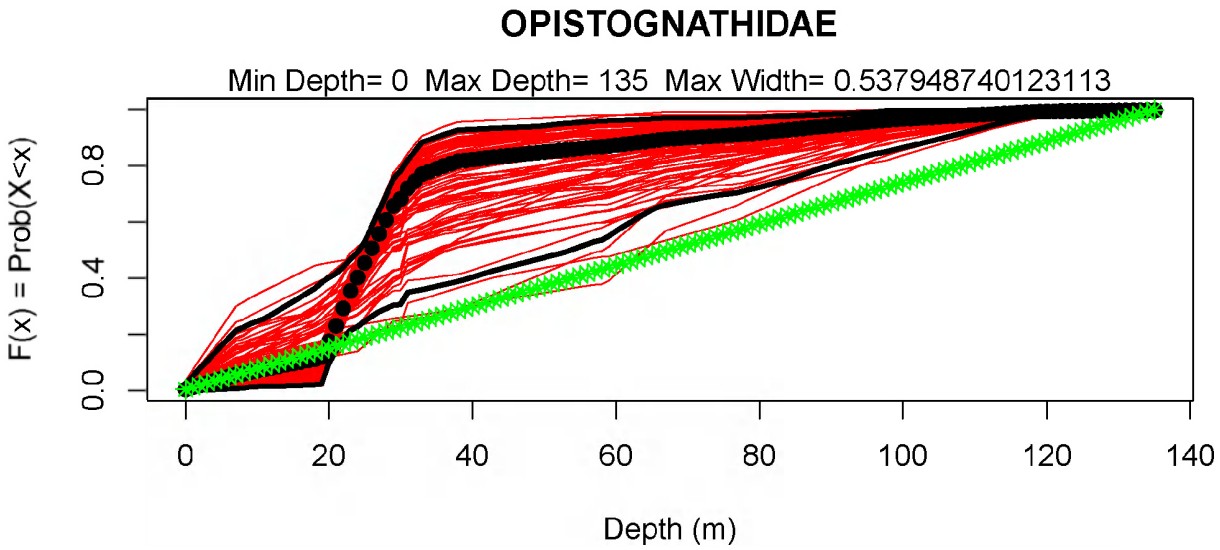

GEMPYLIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

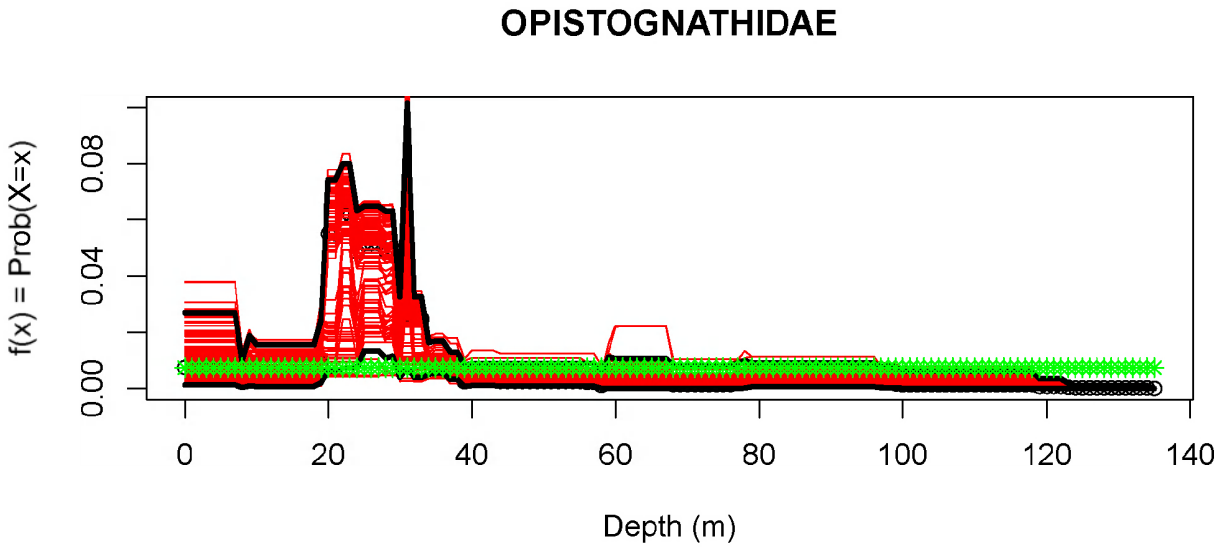

GONICHTHYS.COCCO
Min Depth= 20 Max Depth= 129 Max Width= 0.388554973579964
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

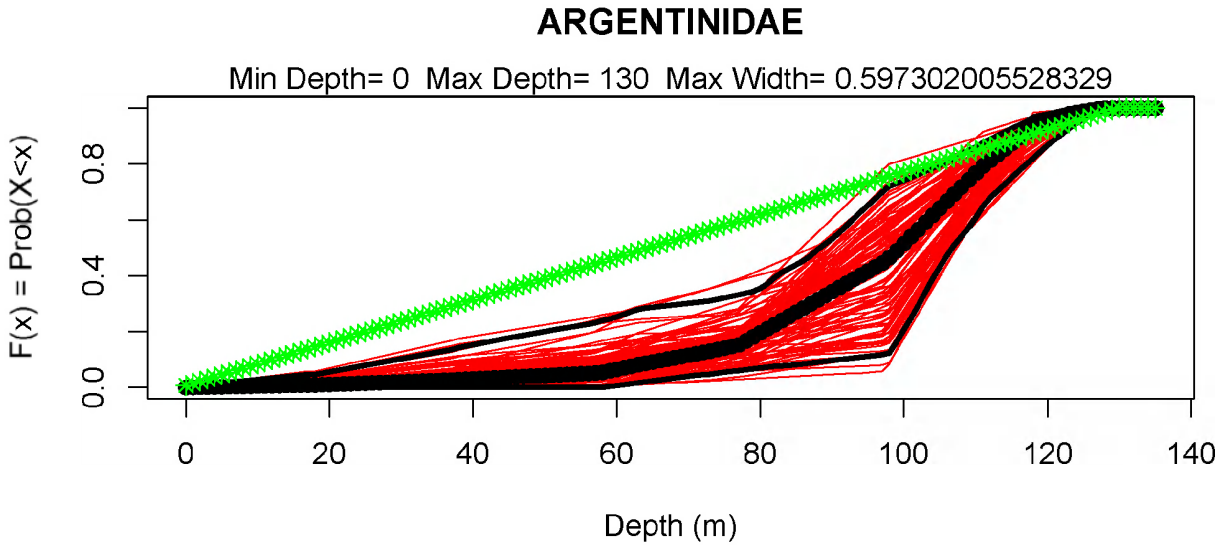

GONICHTHYS.COCCO
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

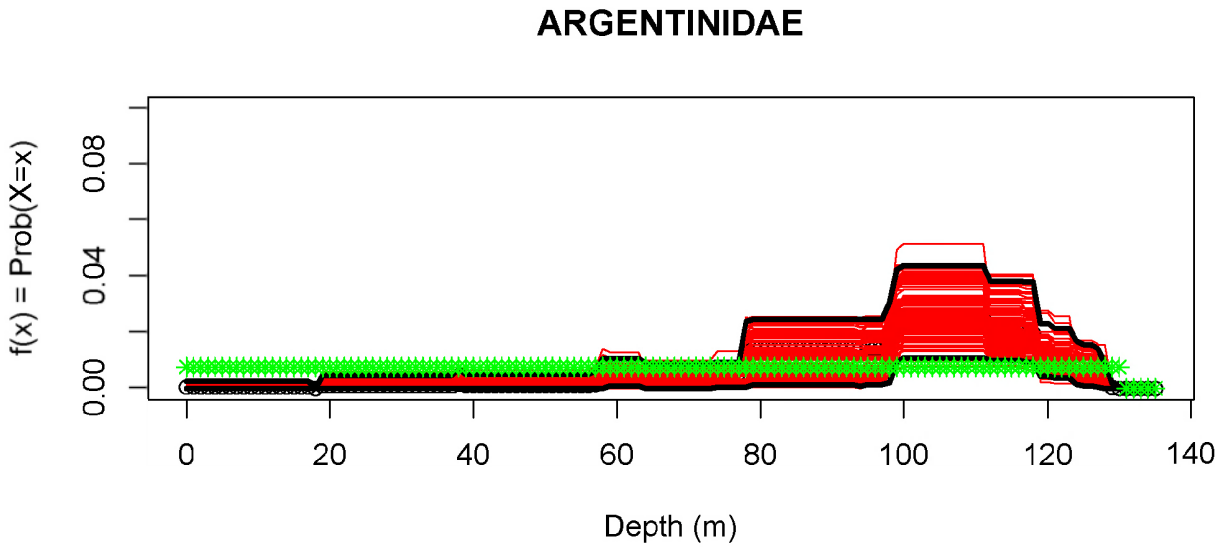

MELANOSTOMIINAE
Min Depth= 0 Max Depth= 126 Max Width= 0.320074392569334
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

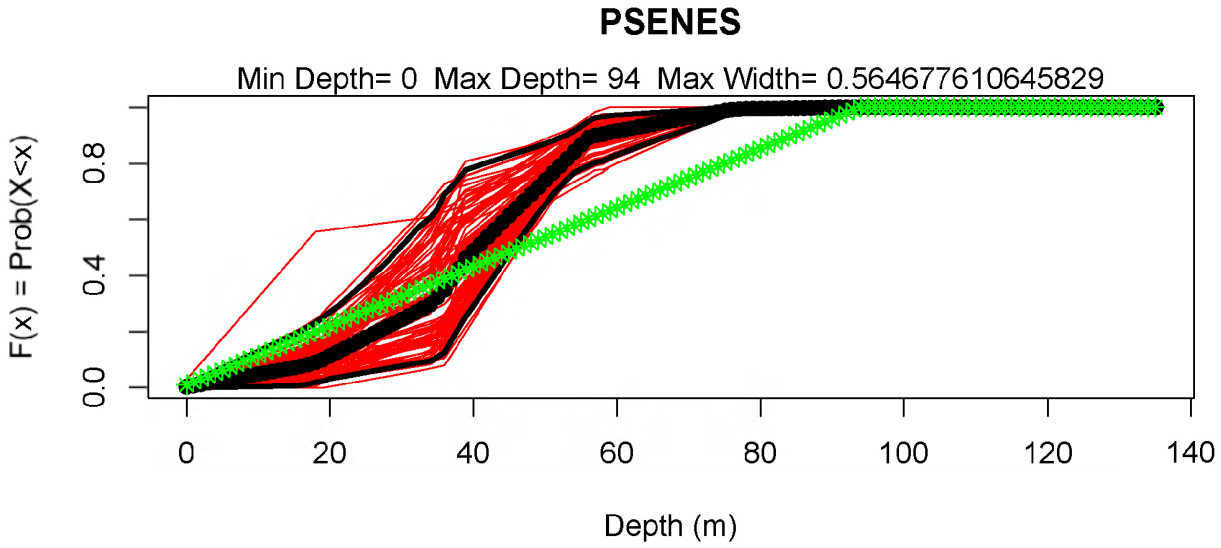

MELANOSTOMIINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

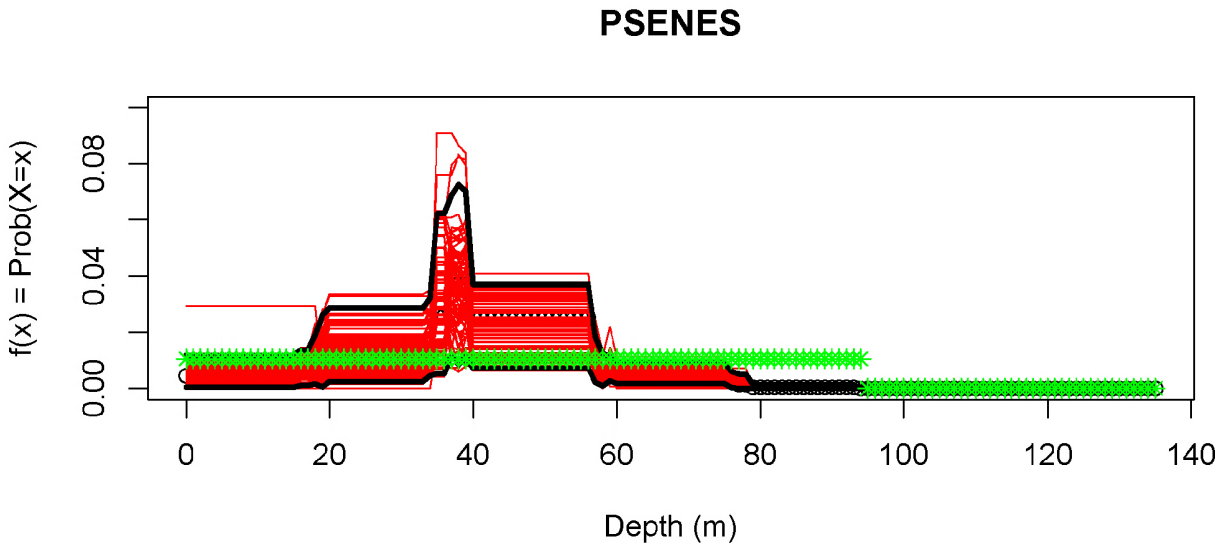

OPISTOGNATHIDAE
Min Depth= 0 Max Depth= 135 Max Width= 0.537948740123113
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

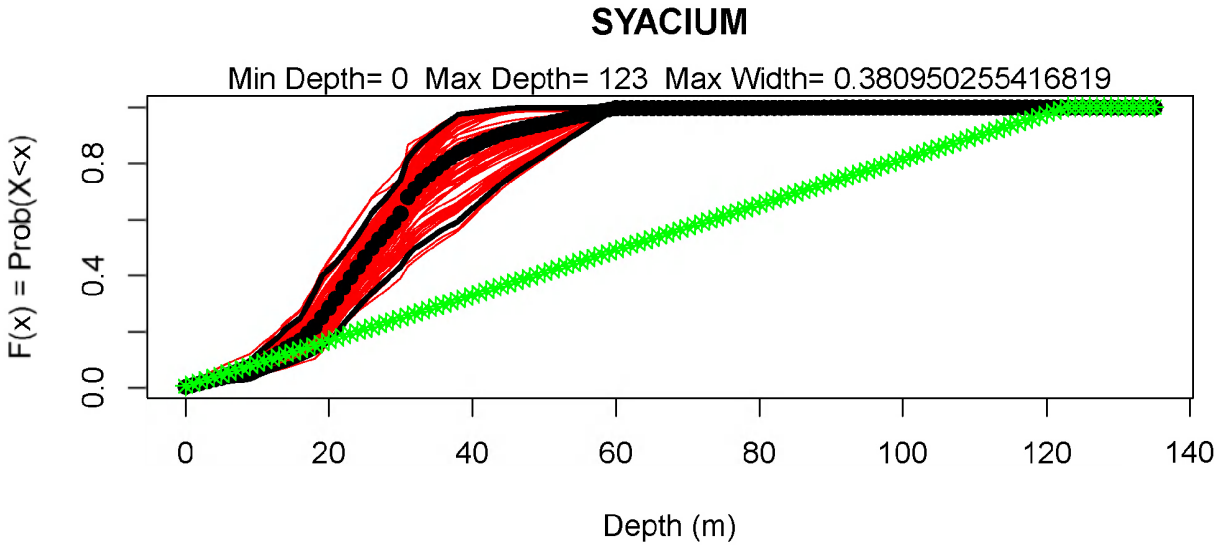

OPISTOGNATHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

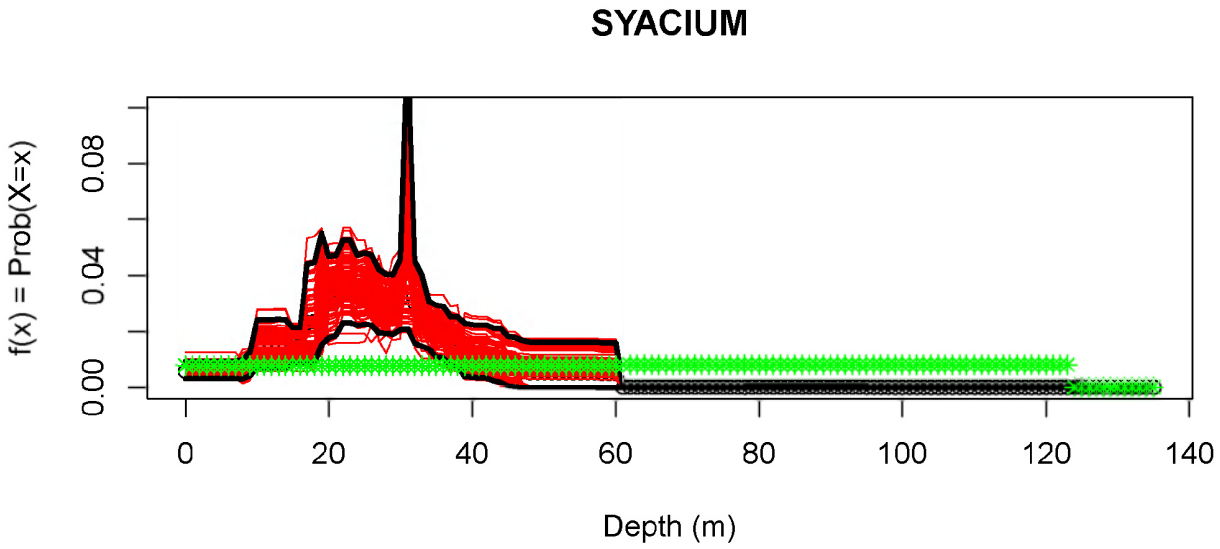

ARGENTINIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.597302005528329
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

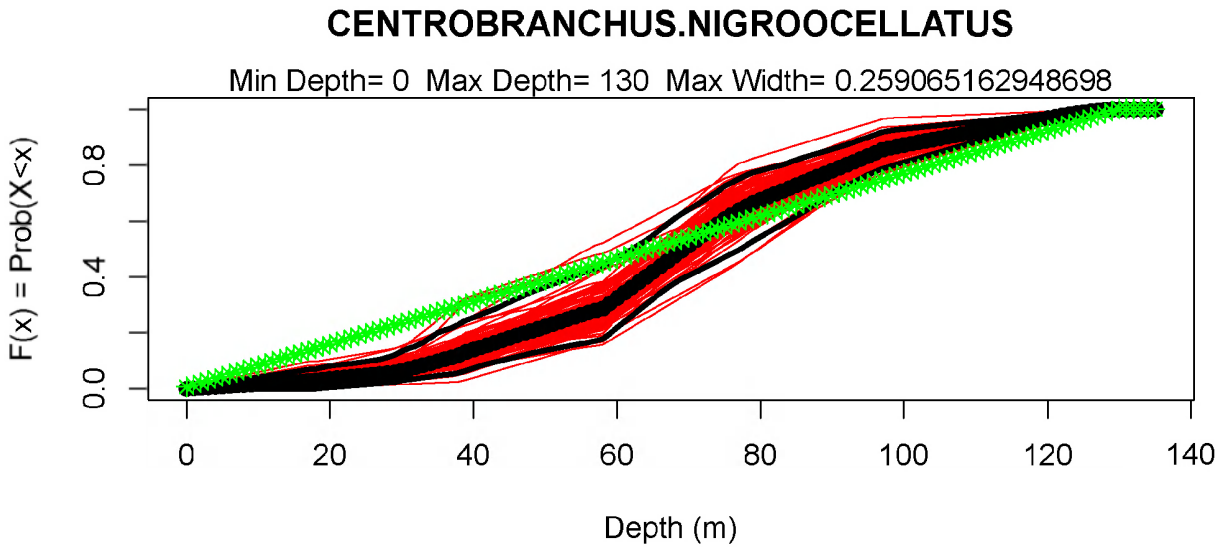

ARGENTINIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

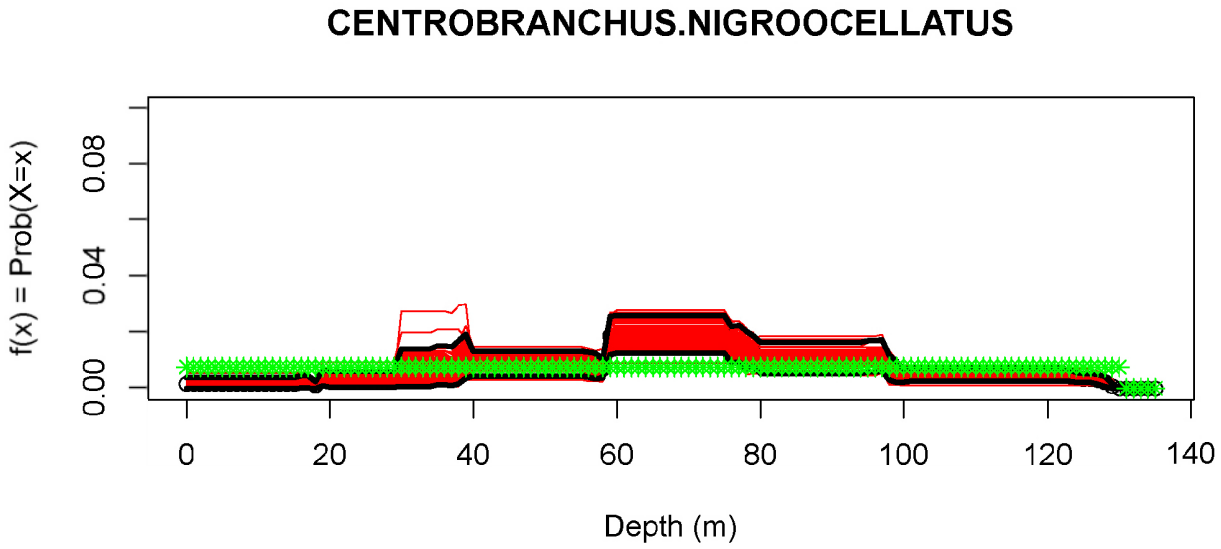

PSENES
Min Depth= 0 Max Depth= 94 Max Width= 0.564677610645829
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

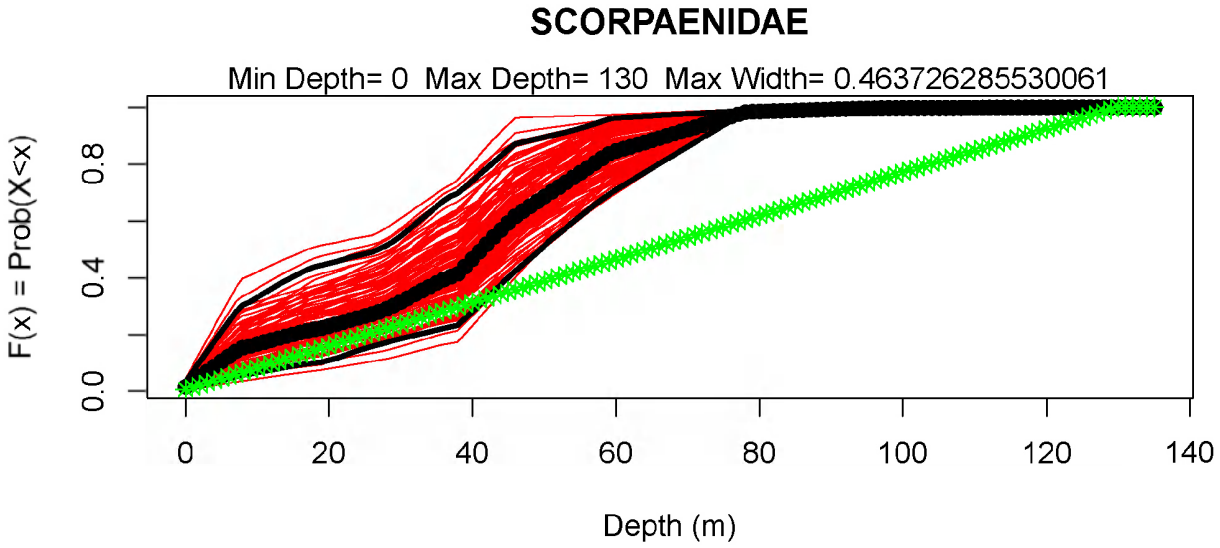

PSENES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

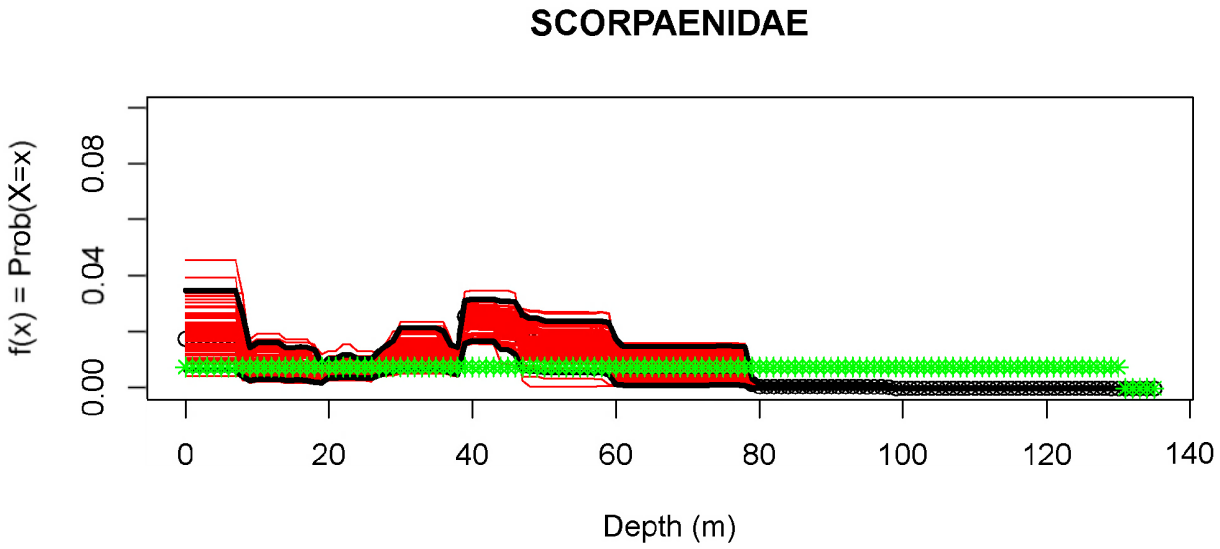

SYACIUM
Min Depth= 0 Max Depth= 123 Max Width= 0.380950255416819
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

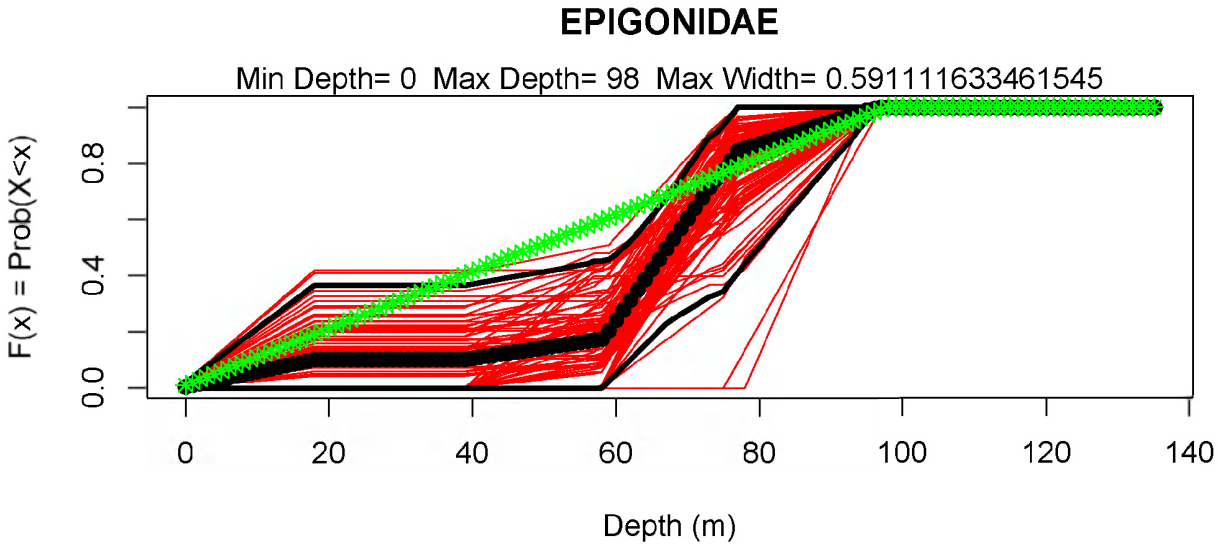

SYACIUM
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

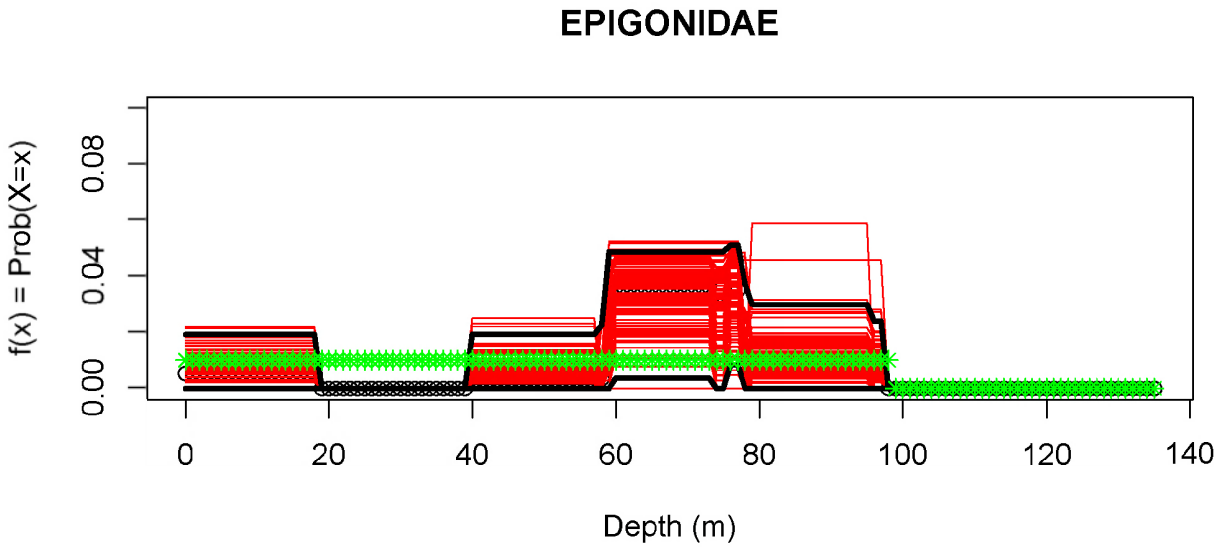

CENTROBRANCHUS.NIGROOCELLATUS
Min Depth= 0 Max Depth= 130 Max Width= 0.259065162948698
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

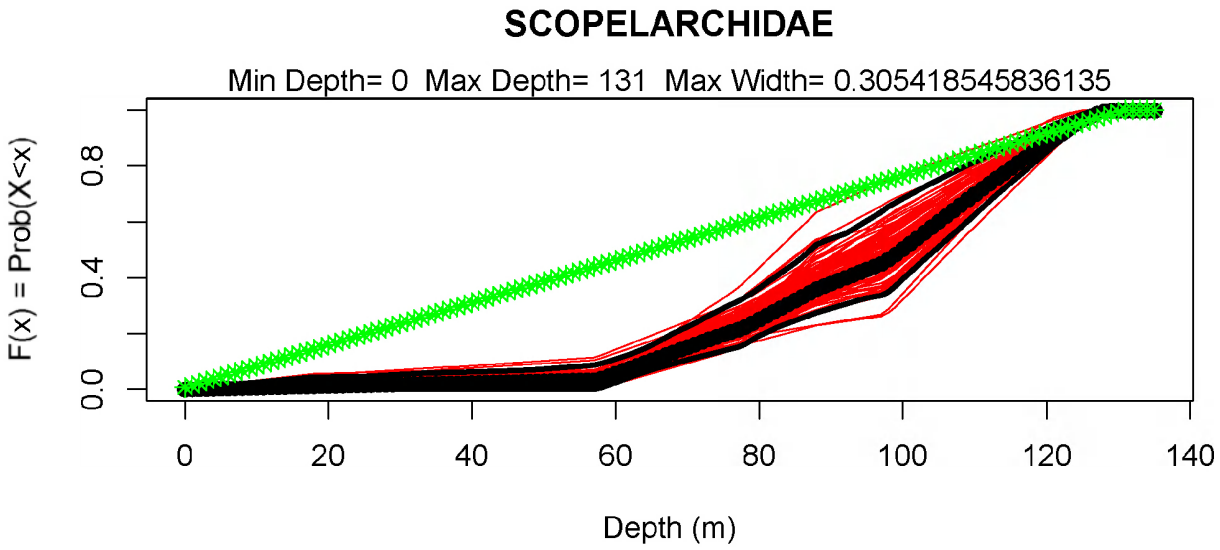

CENTROBRANCHUS.NIGROOCELLATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

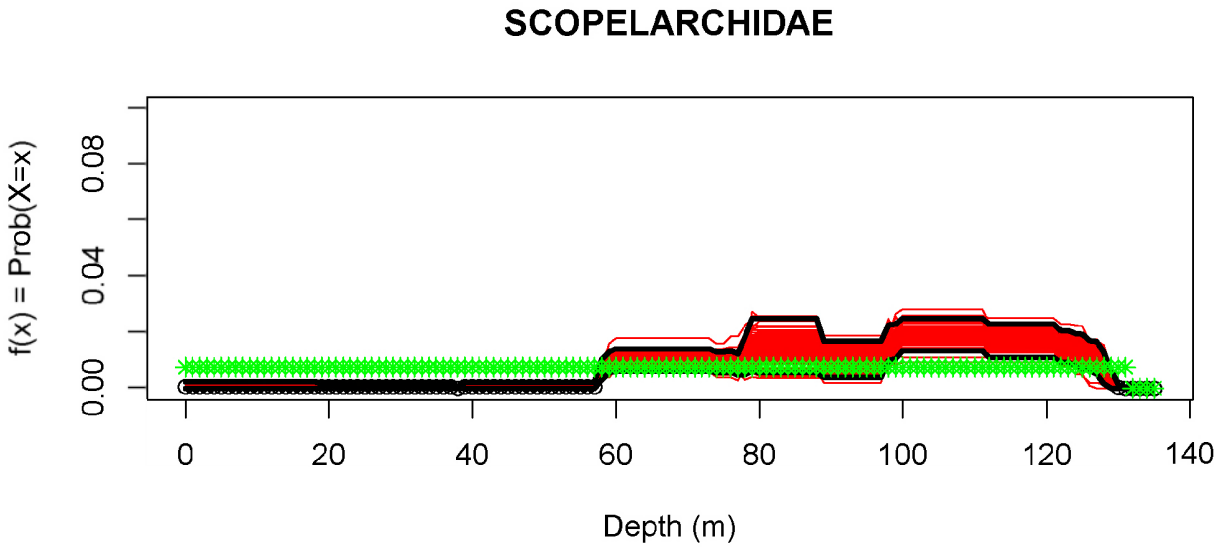

SCORPAENIDAE
Min Depth= 0 Max Depth= 130 Max Width= 0.463726285530061
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

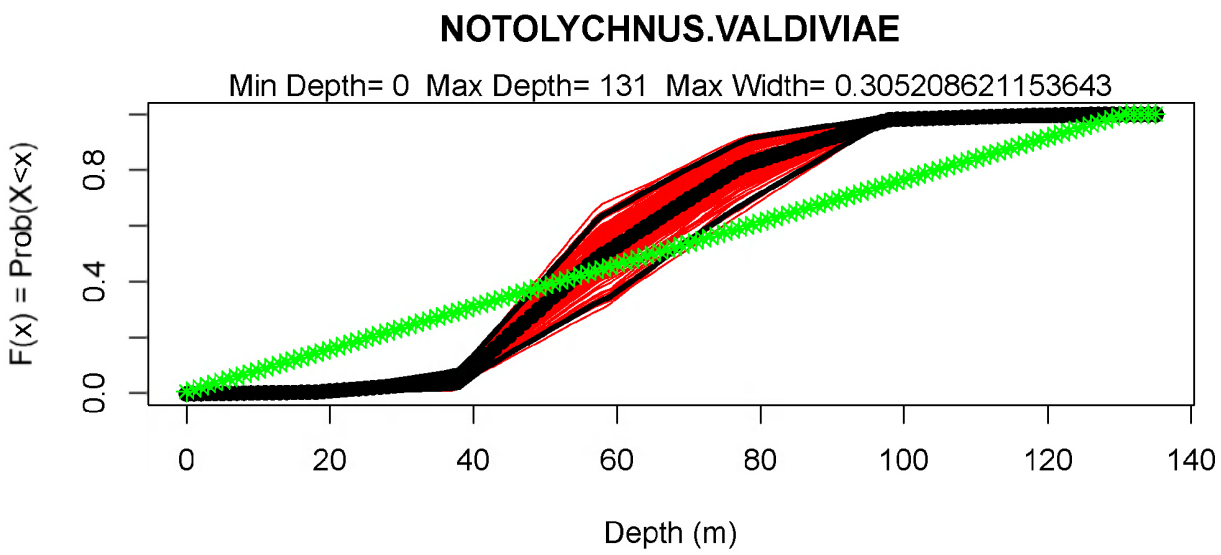

SCORPAENIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

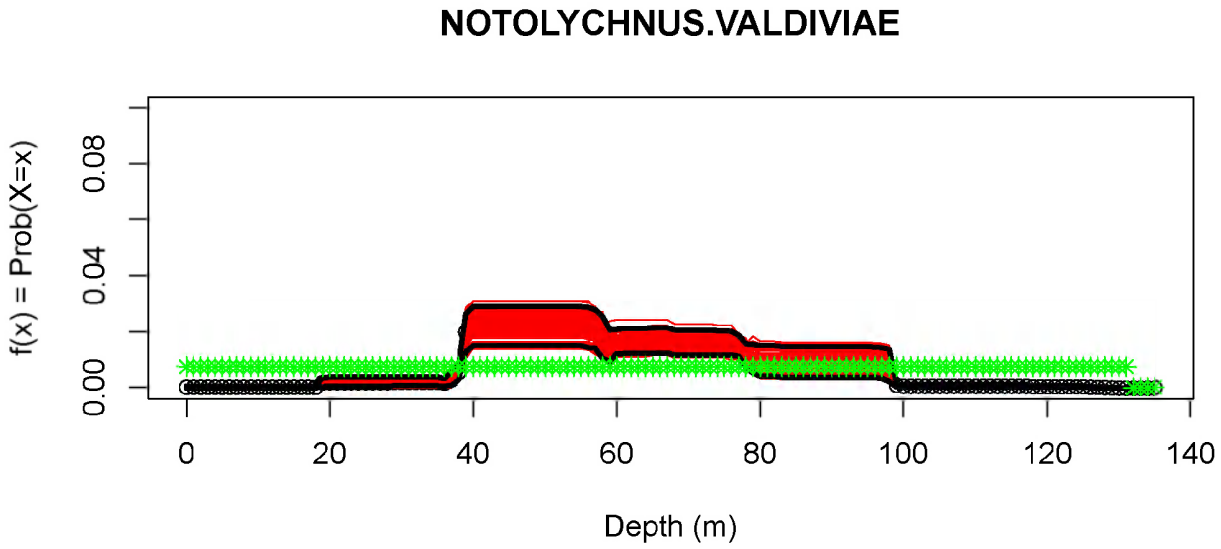

EPIGONIDAE
Min Depth= 0 Max Depth= 98 Max Width= 0.591111633461545
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

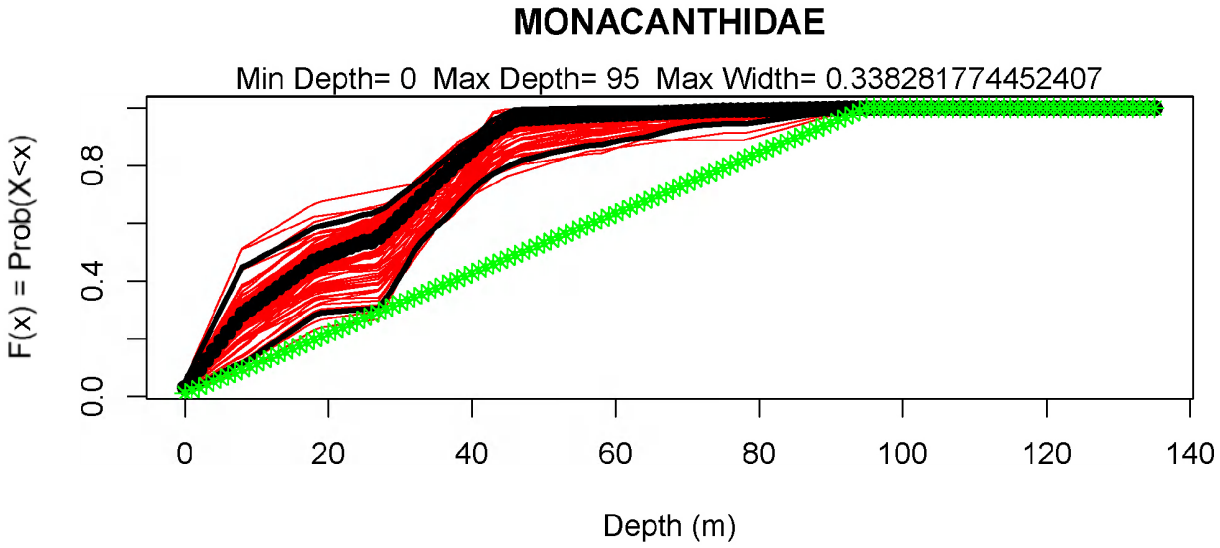

EPIGONIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

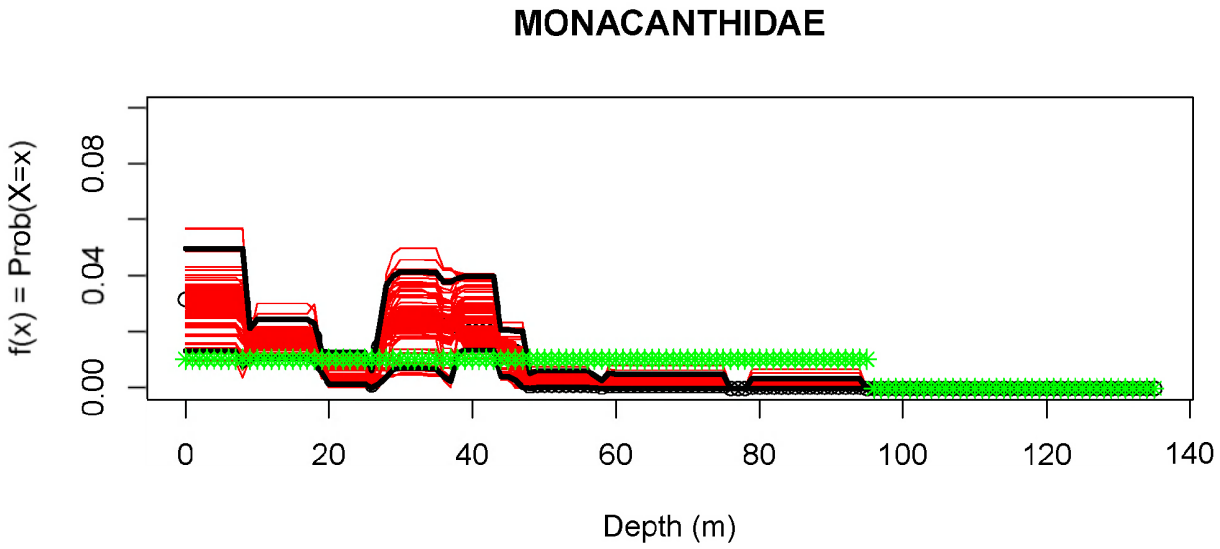

SCOPELARCHIDAE
Min Depth= 0 Max Depth= 131 Max Width= 0.305418545836135
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

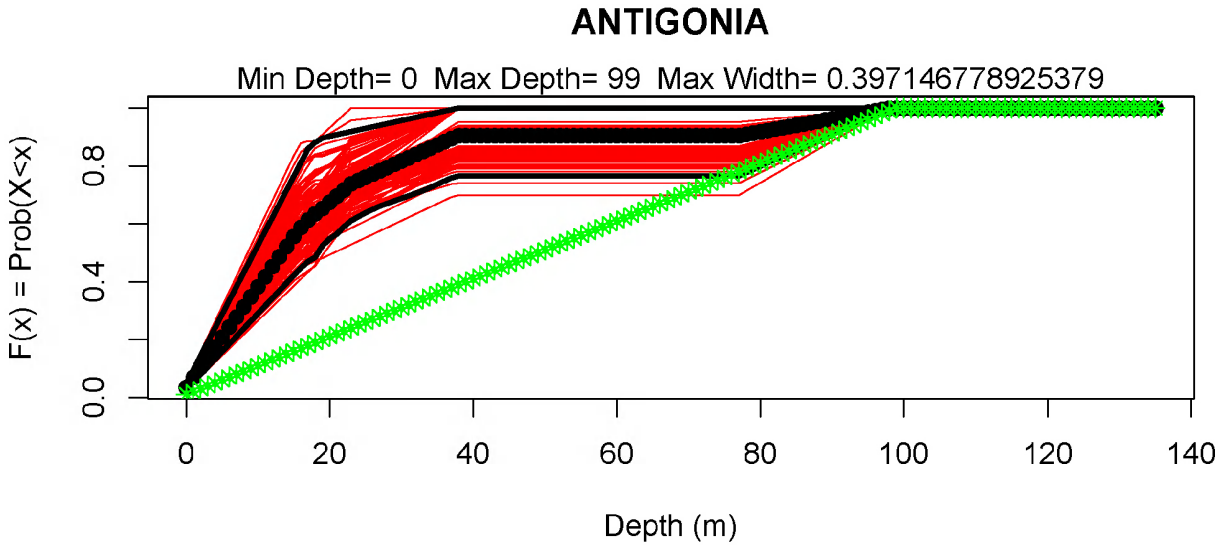

SCOPELARCHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

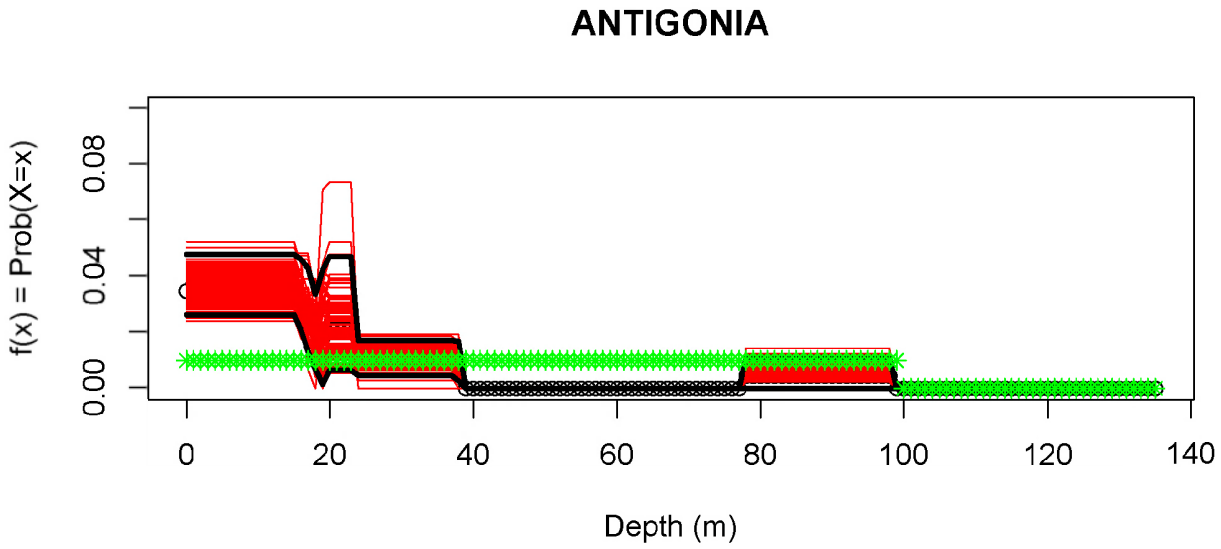

NOTOLYCHNUS.VALDIVIAE
Min Depth= 0 Max Depth= 131 Max Width= 0.305208621153643
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

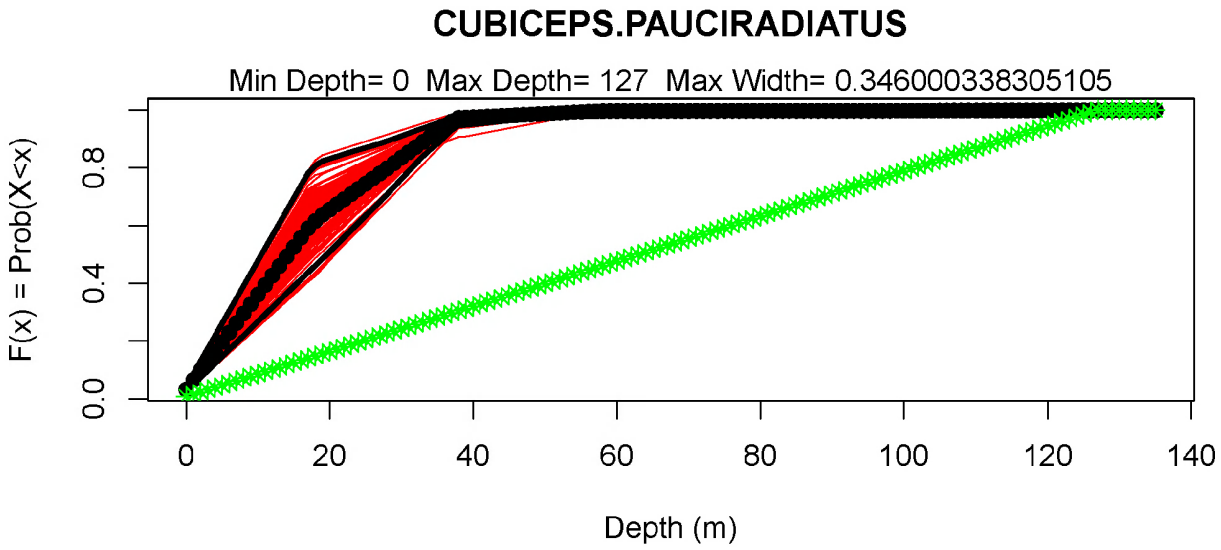

NOTOLYCHNUS.VALDIVIAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

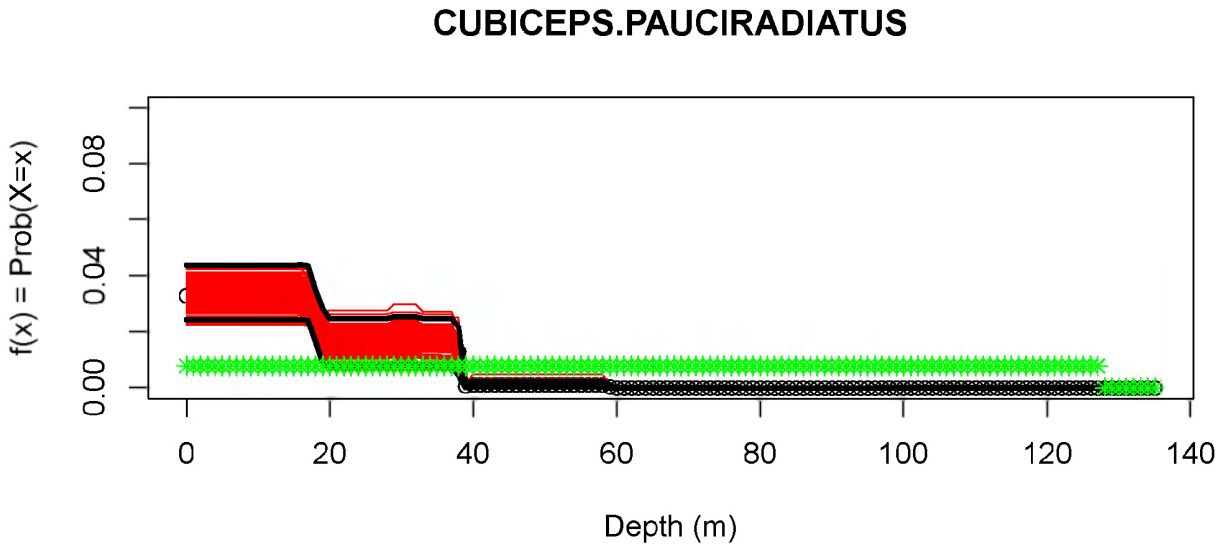

MONACANTHIDAE
Min Depth= 0 Max Depth= 95 Max Width= 0.338281774452407
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

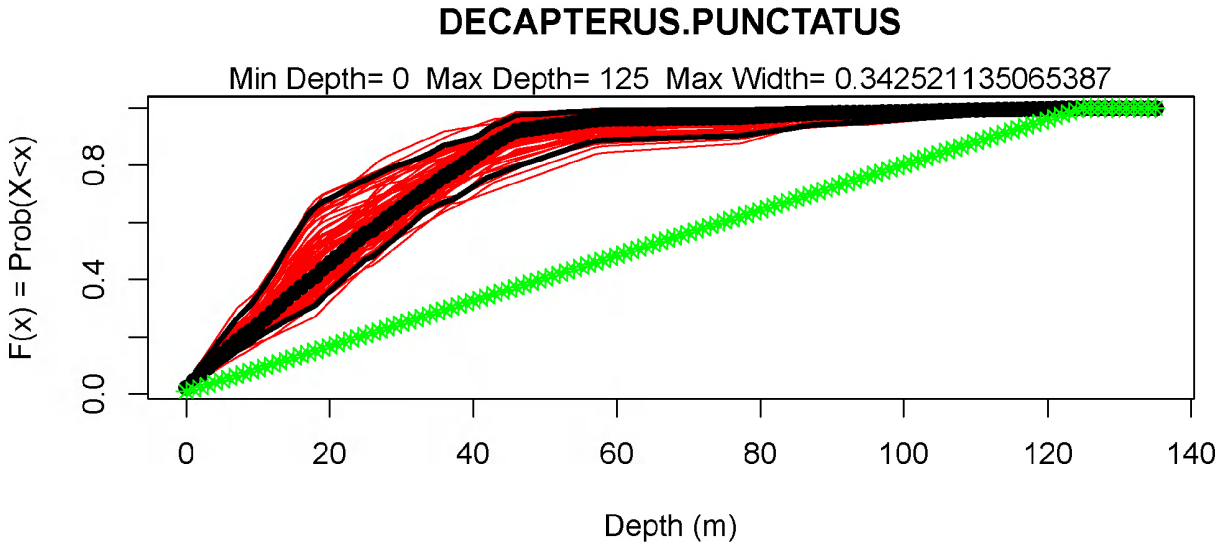

MONACANTHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

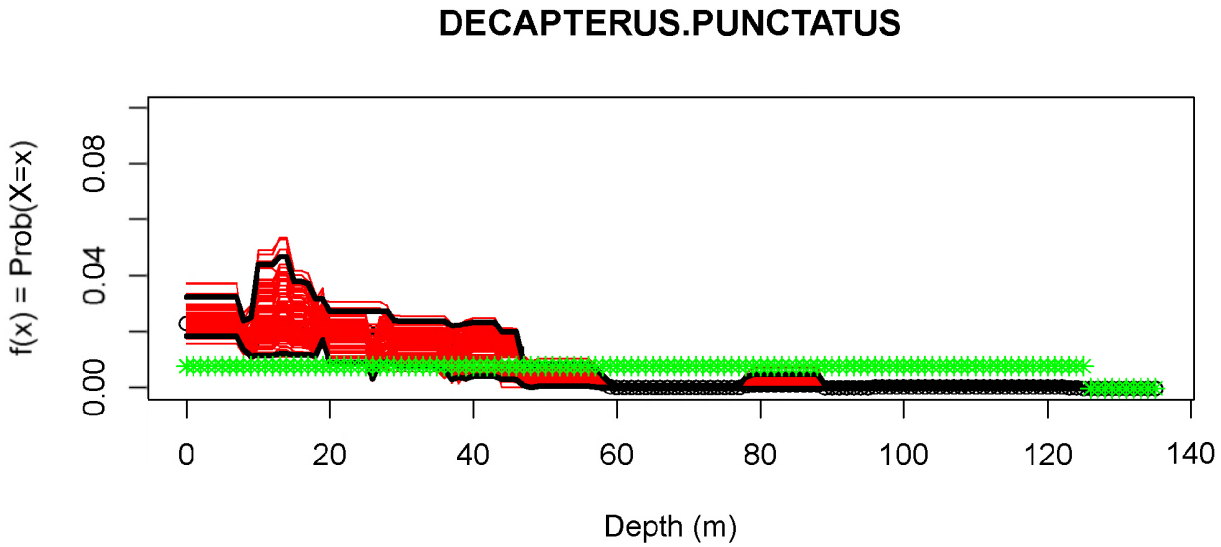

ANTIGONIA
Min Depth= 0 Max Depth= 99 Max Width= 0.397146778925379
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

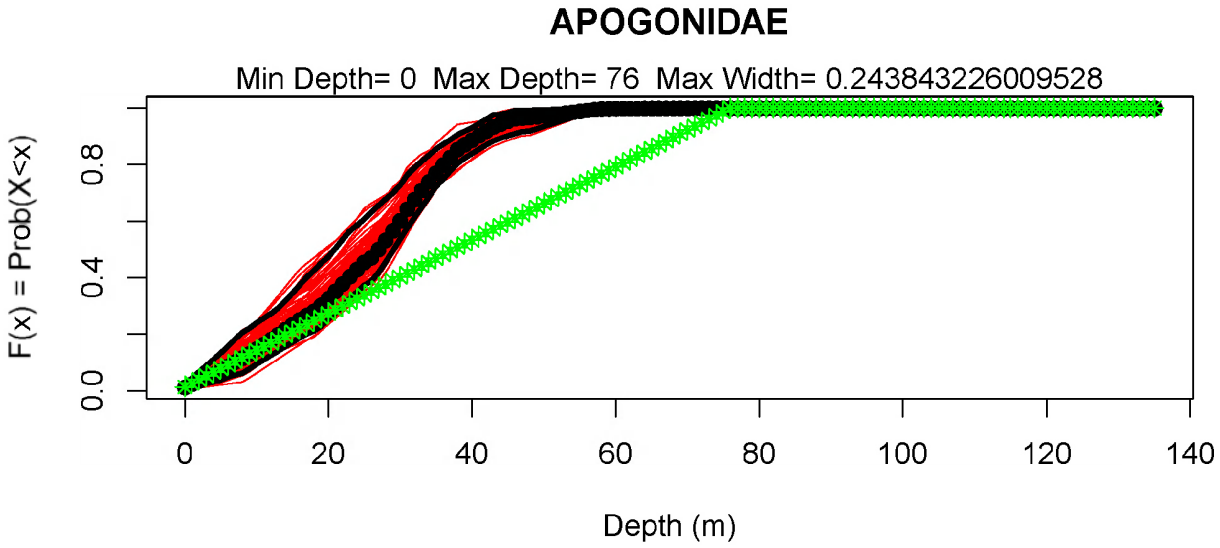

ANTIGONIA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

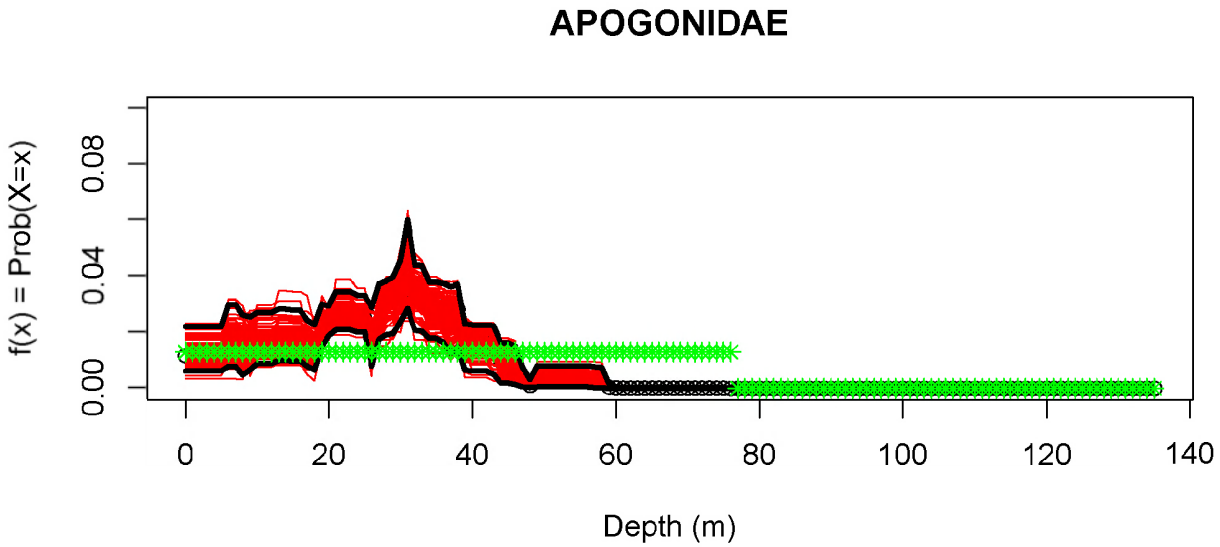

CUBICEPS.PAUCIRADIATUS
Min Depth= 0 Max Depth= 127 Max Width= 0.346000338305105
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

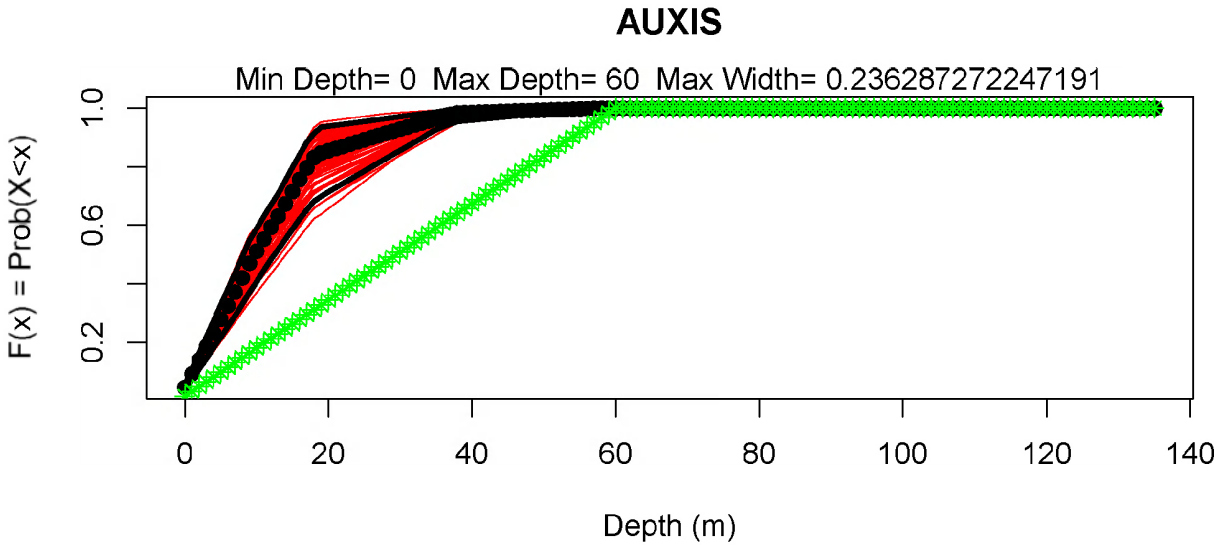

CUBICEPS.PAUCIRADIATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

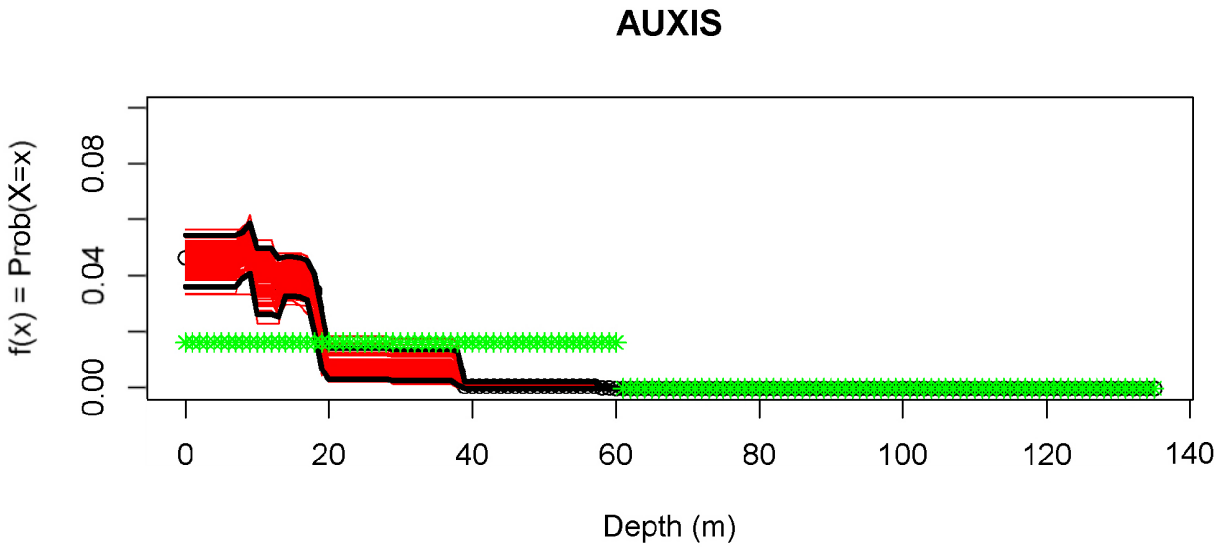

DECAPTERUS.PUNCTATUS
Min Depth= 0 Max Depth= 125 Max Width= 0.342521135065387
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

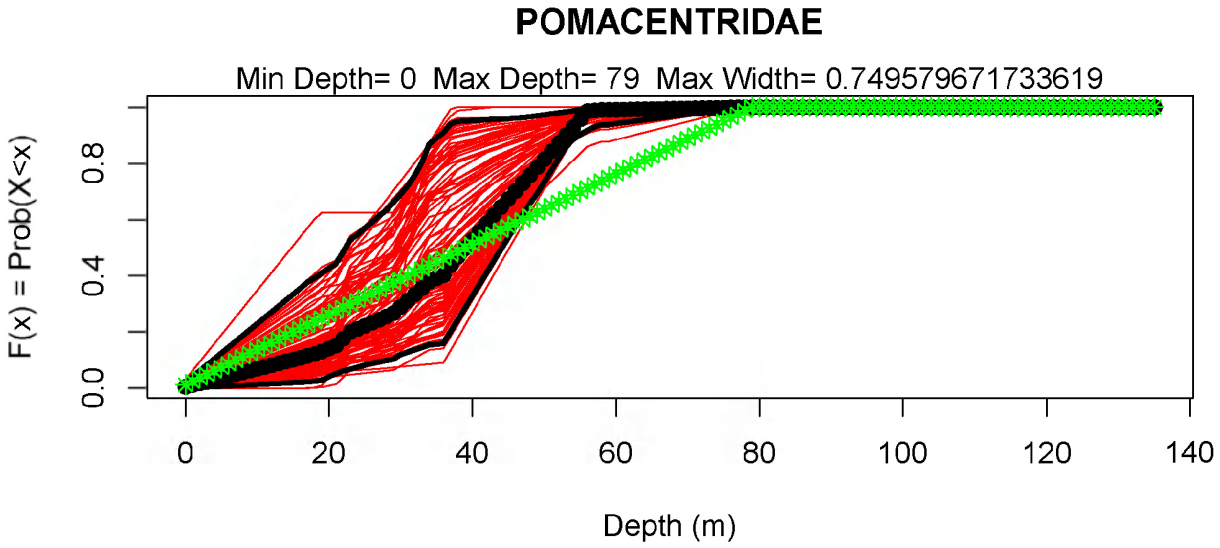

DECAPTERUS.PUNCTATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

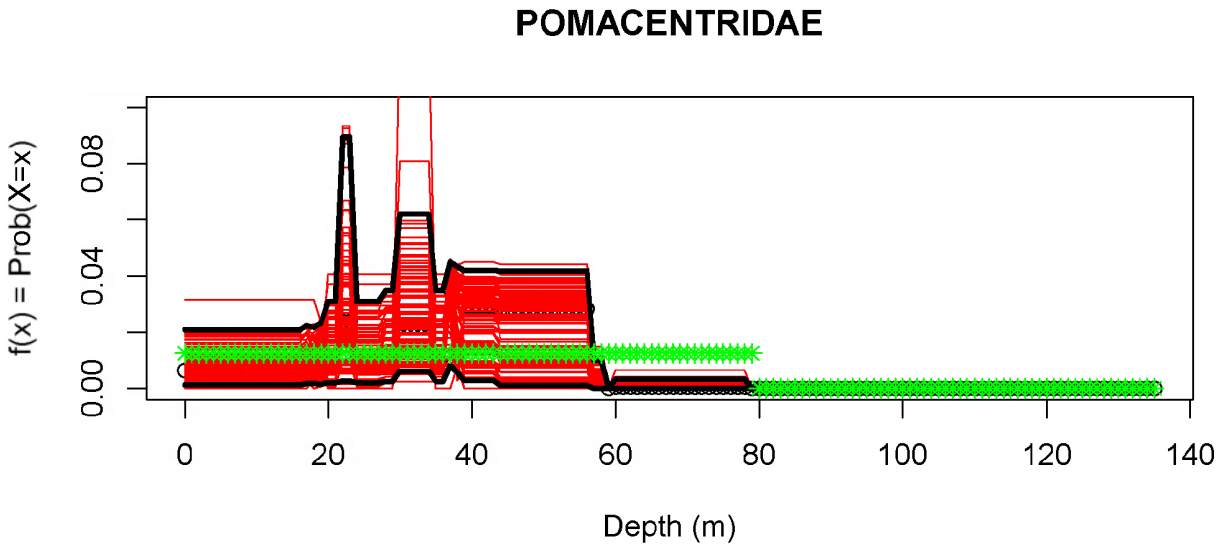

APOGONIDAE
Min Depth= 0 Max Depth= 76 Max Width= 0.243843226009528
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

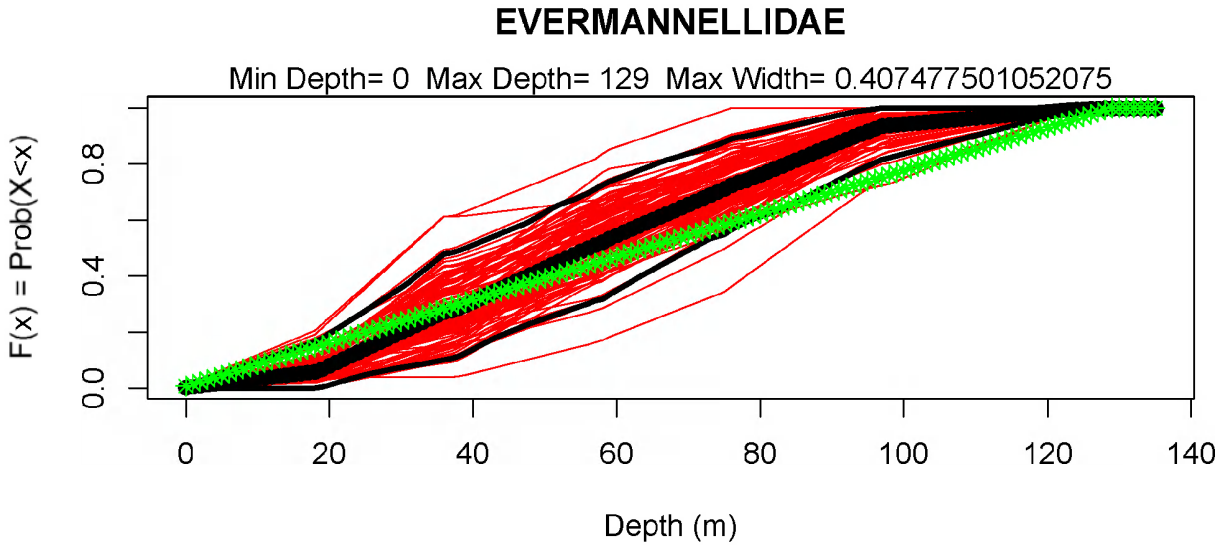

APOGONIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

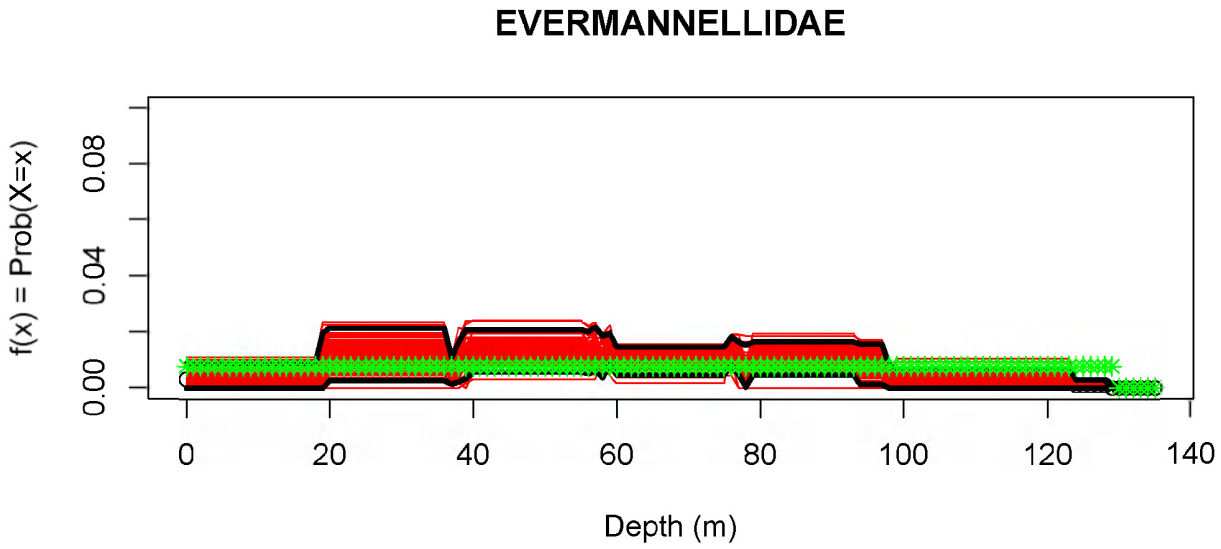

AUXIS
Min Depth= 0 Max Depth= 60 Max Width= 0.236287272247191
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

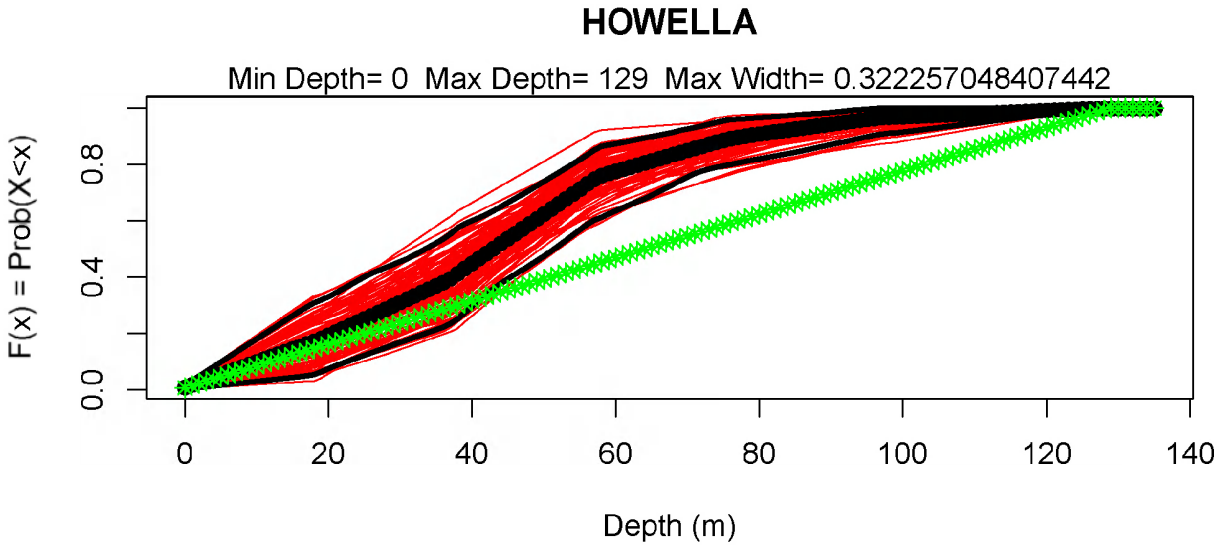

AUXIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

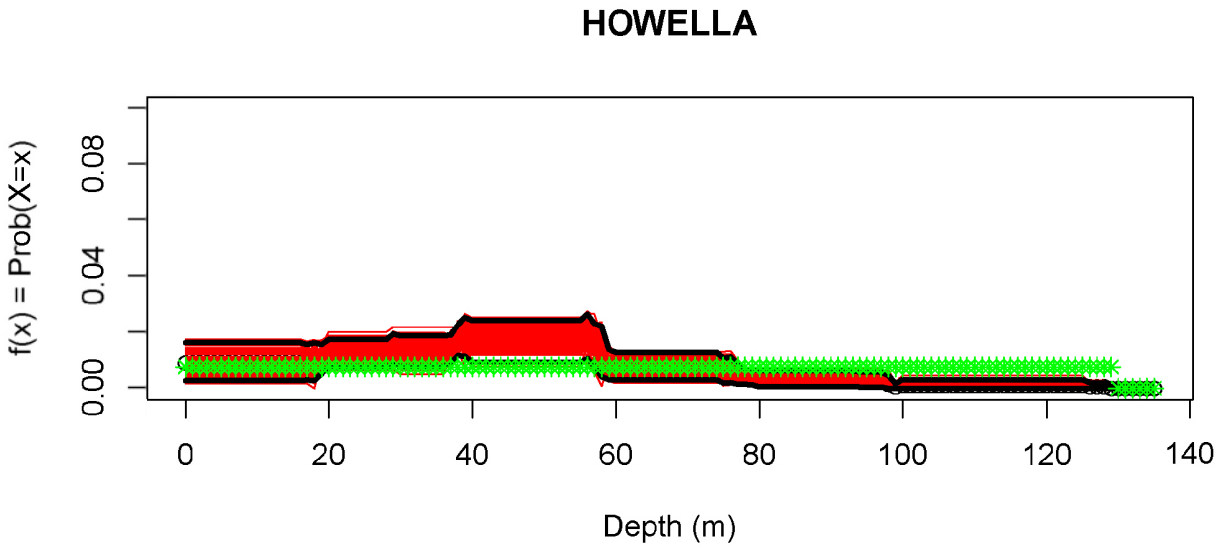

POMACENTRIDAE
Min Depth= 0 Max Depth= 79 Max Width= 0.749579671733619
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

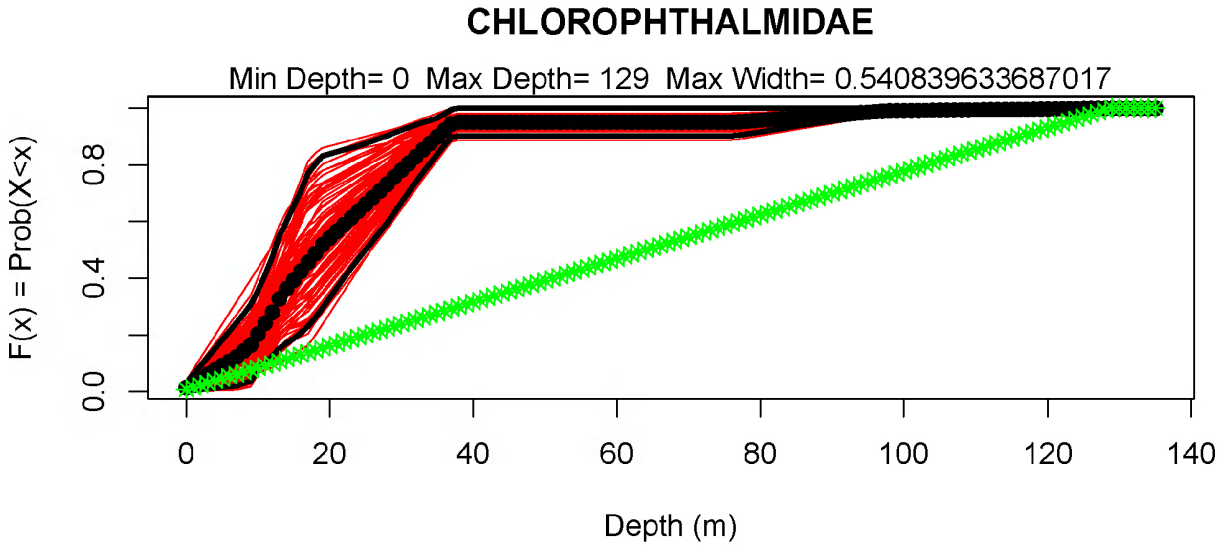

POMACENTRIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

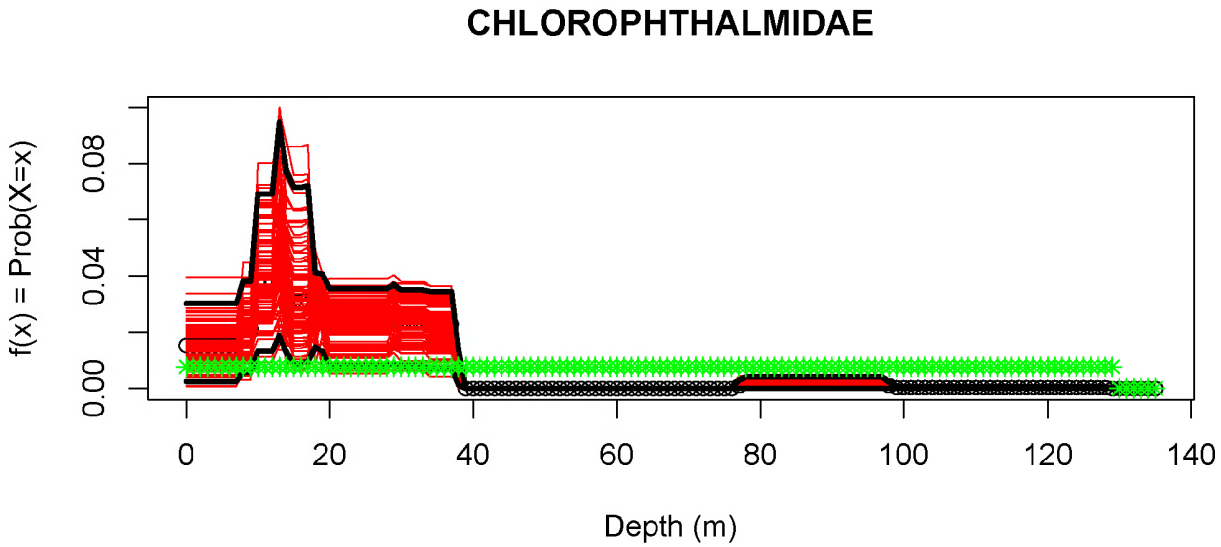

EVERMANNELLIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.407477501052075
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

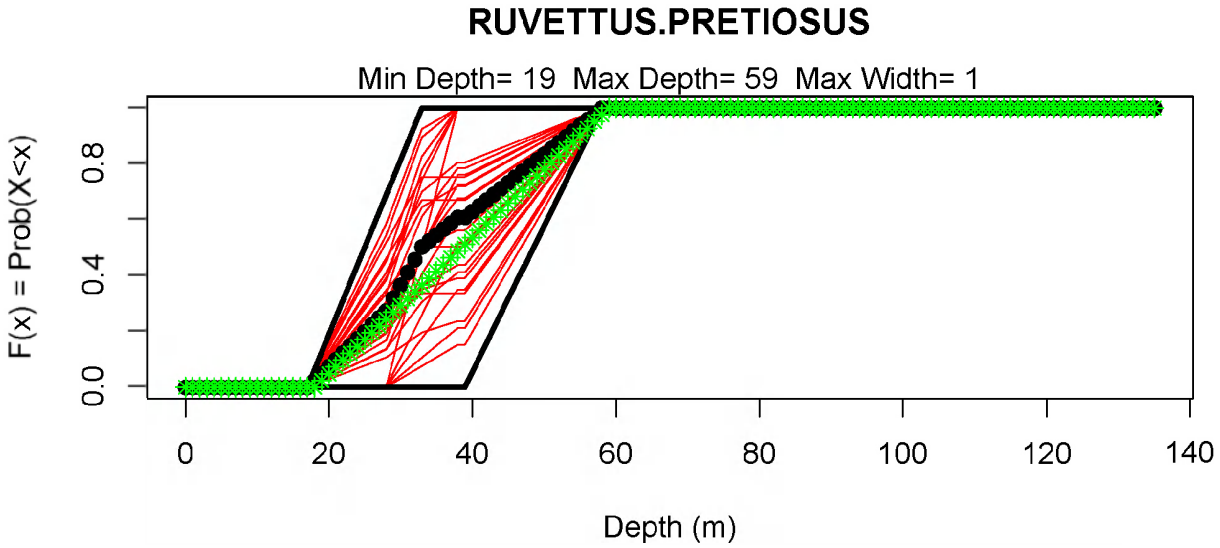

EVERMANNELLIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

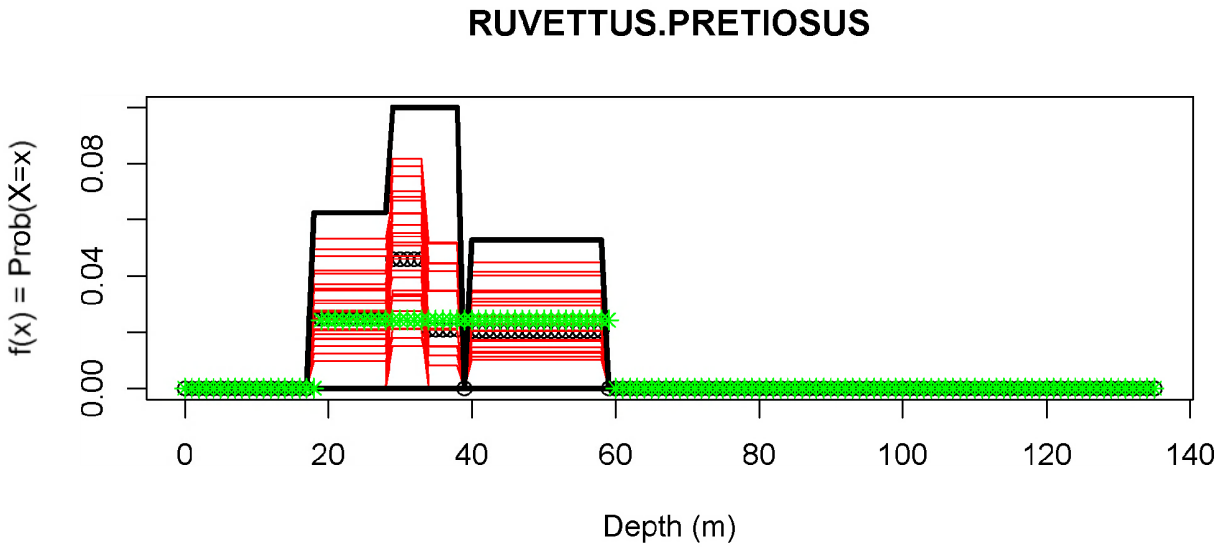

HOWELLA
Min Depth= 0 Max Depth= 129 Max Width= 0.322257048407442
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

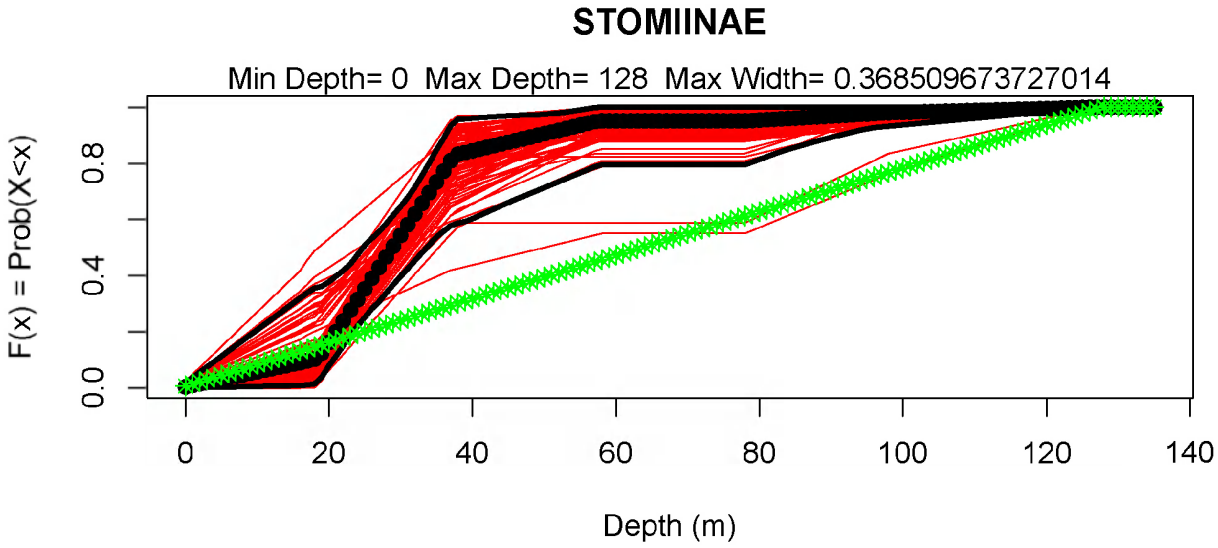

HOWELLA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

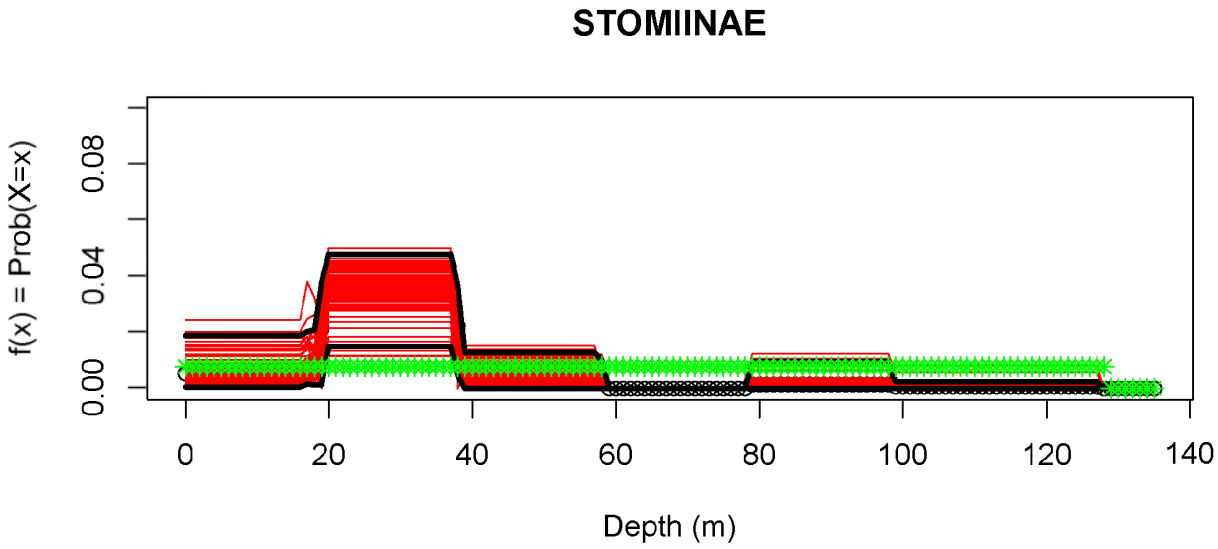

CHLOROPHTHALMIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.540839633687017
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

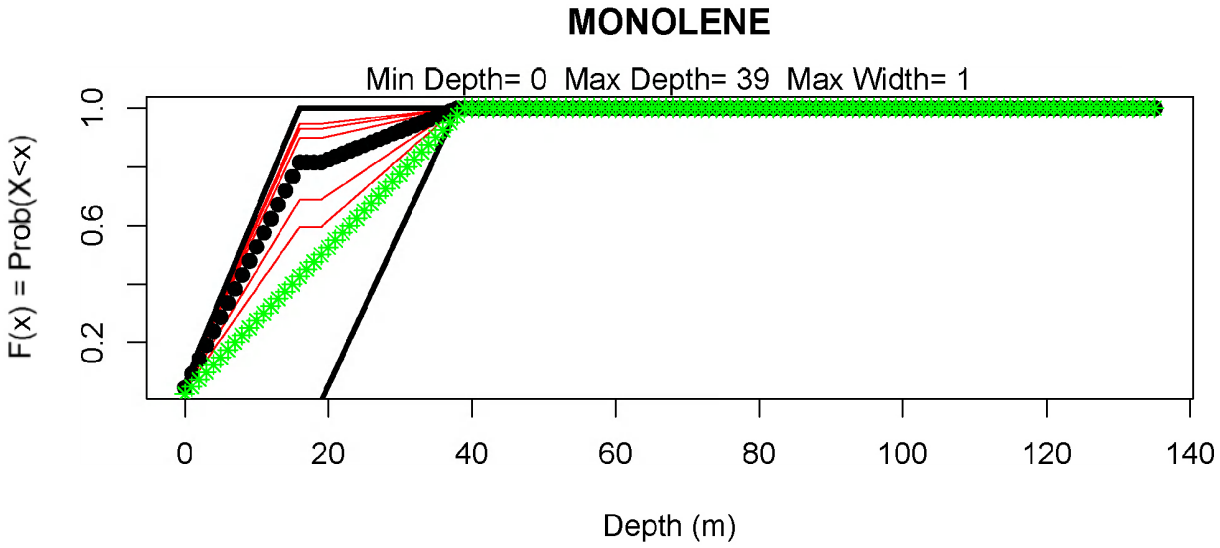

CHLOROPHTHALMIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

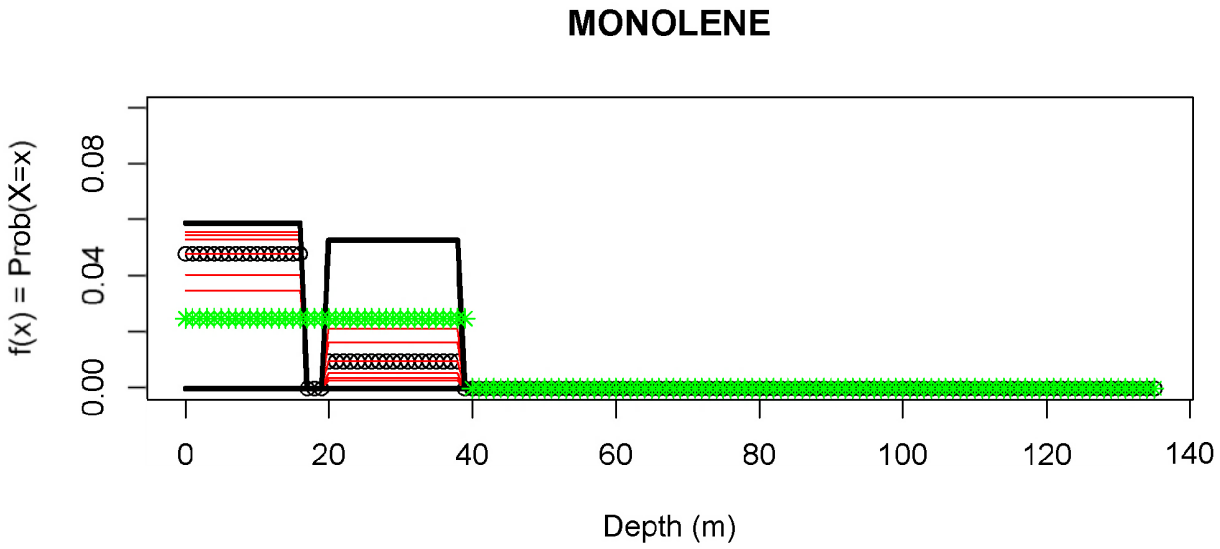

RUVETTUS.PRETIOSUS
Min Depth= 19 Max Depth= 59 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

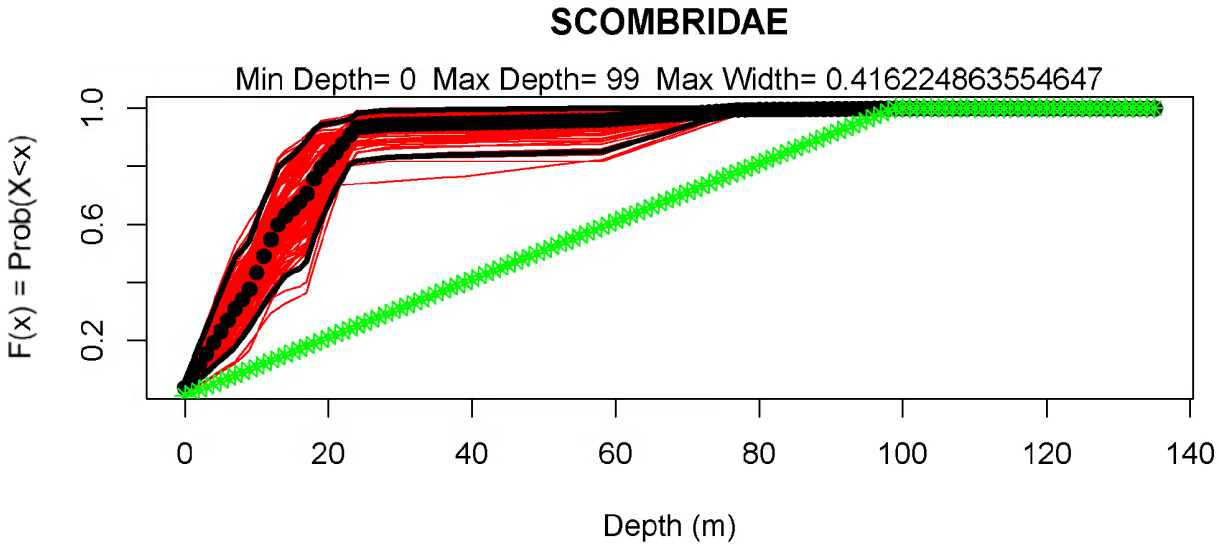

RUVETTUS.PRETIOSUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

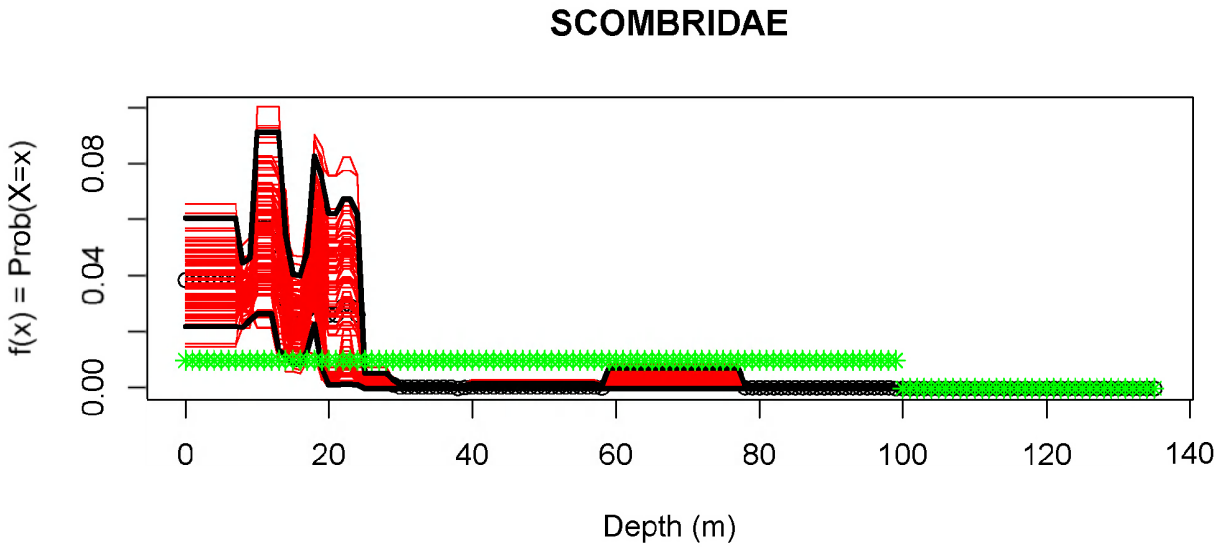

STOMIINAE
Min Depth= 0 Max Depth= 128 Max Width= 0.368509673727014
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

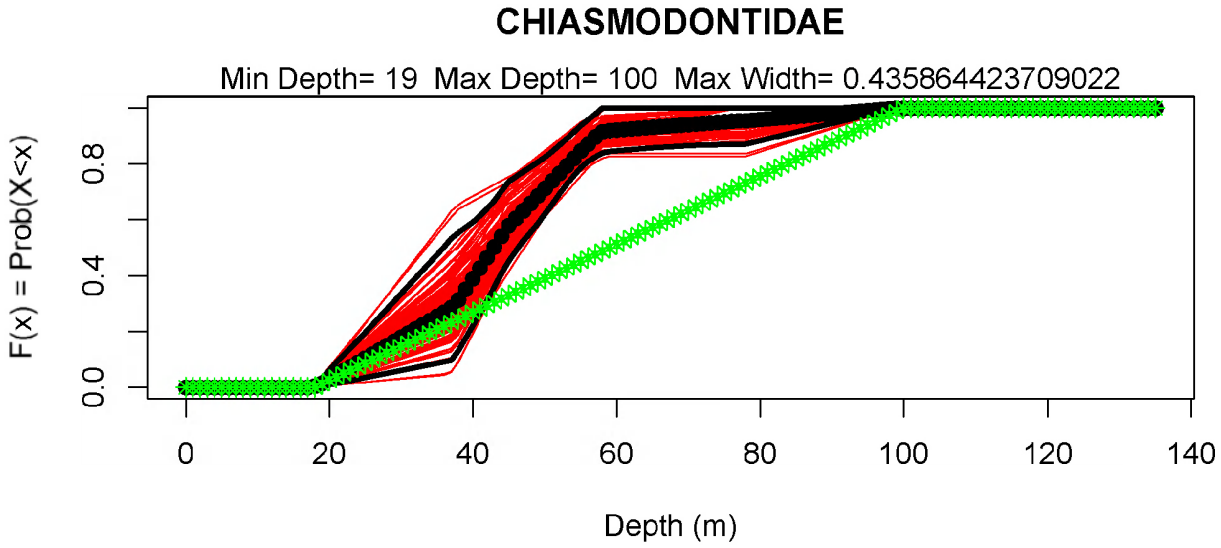

STOMIINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

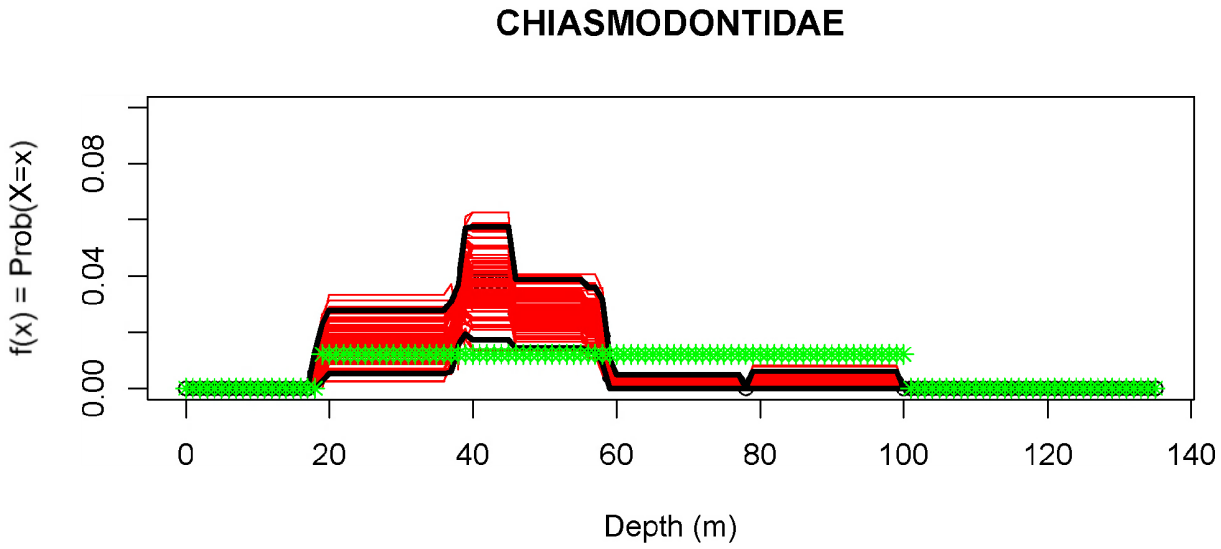

MONOLENE
Min Depth= 0 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

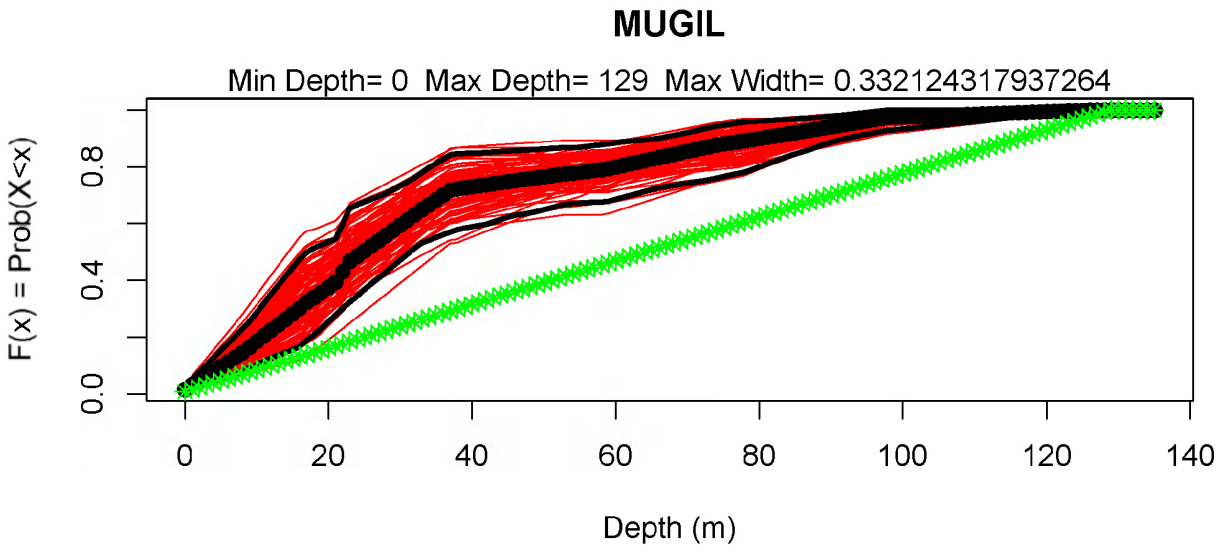

MONOLENE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

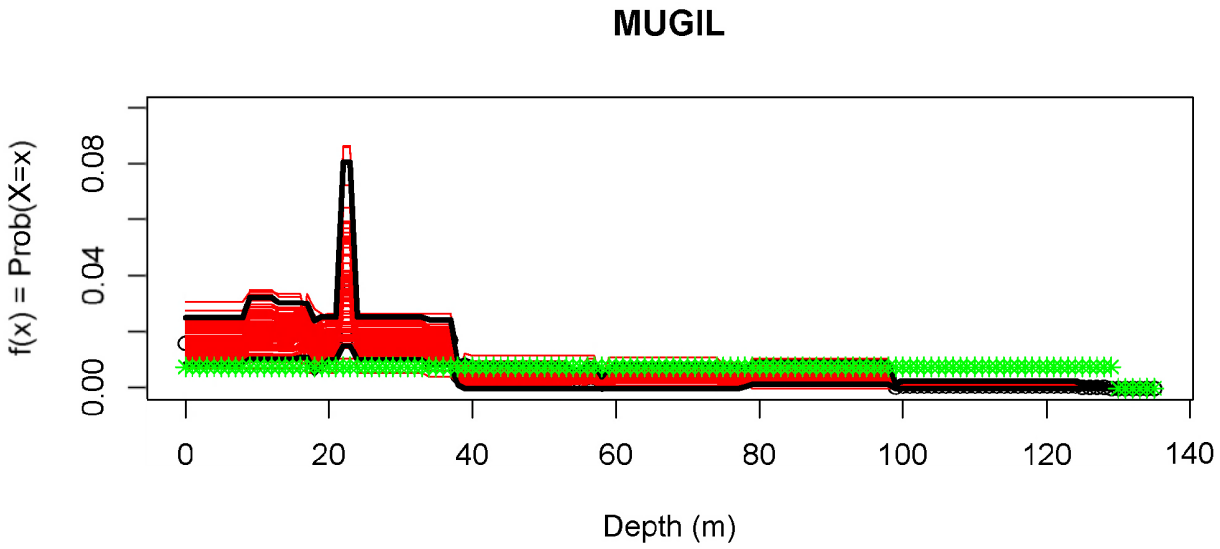

SCOMBRIDAE
Min Depth= 0 Max Depth= 99 Max Width= 0.416224863554647
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

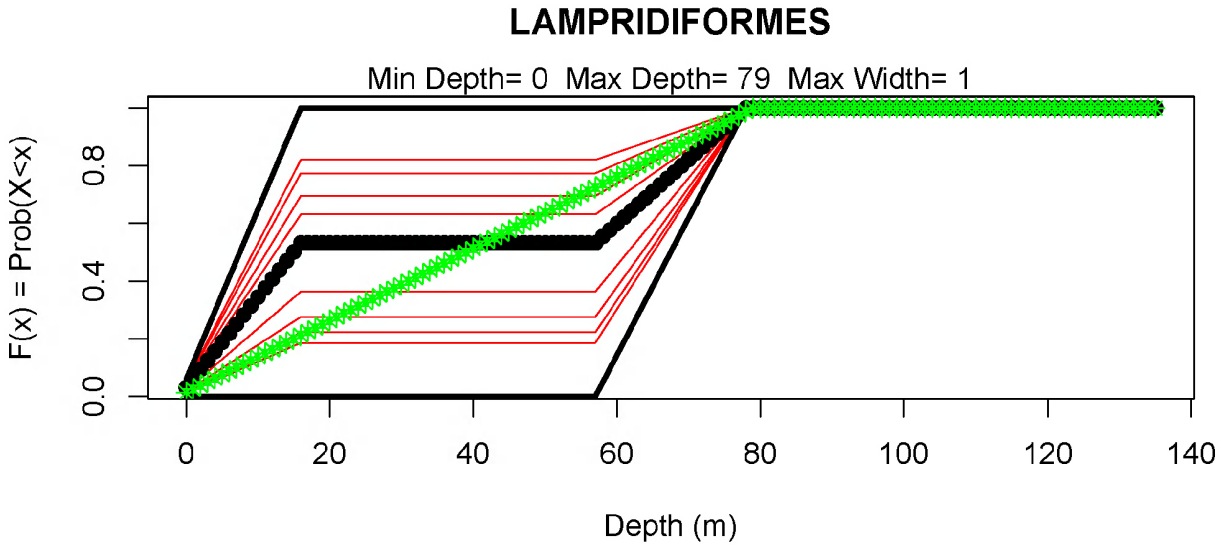

SCOMBRIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

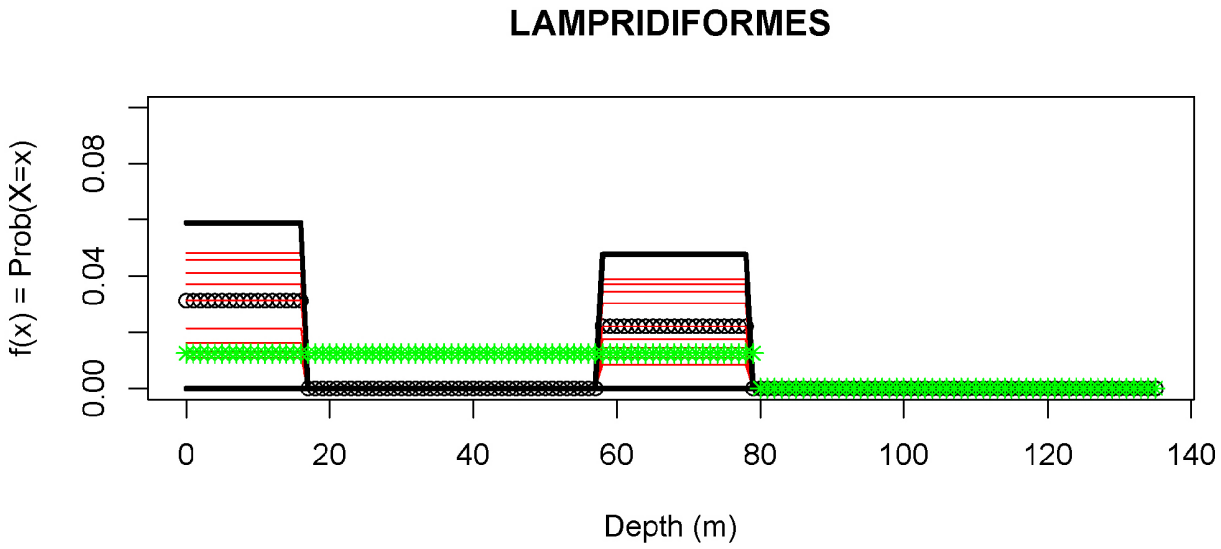

CHIASMODONTIDAE
Min Depth= 19 Max Depth= 100 Max Width= 0.435864423709022
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

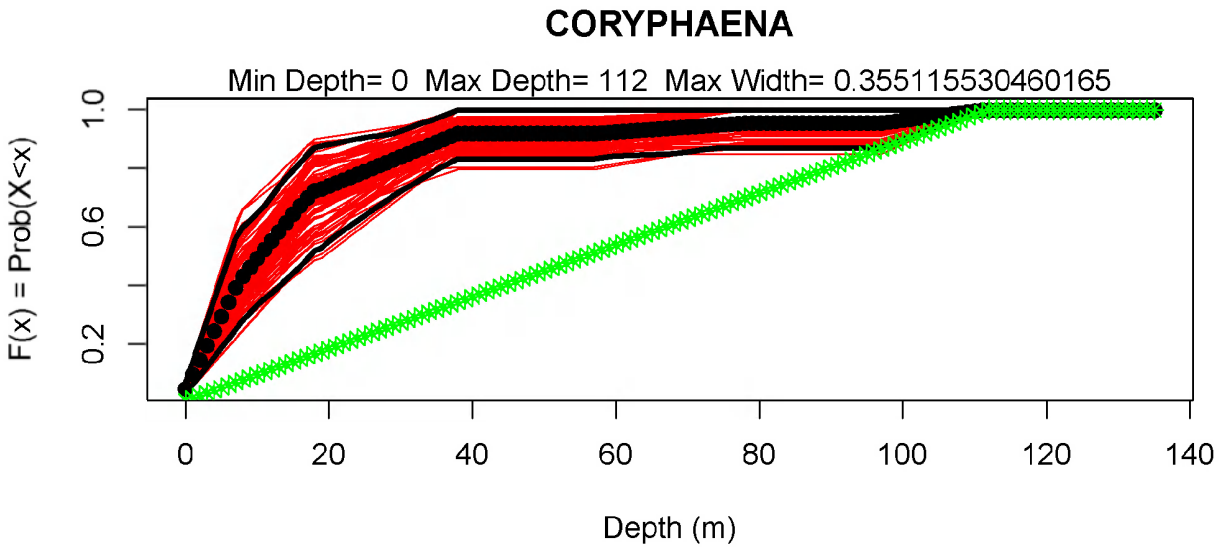

CHIASMODONTIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

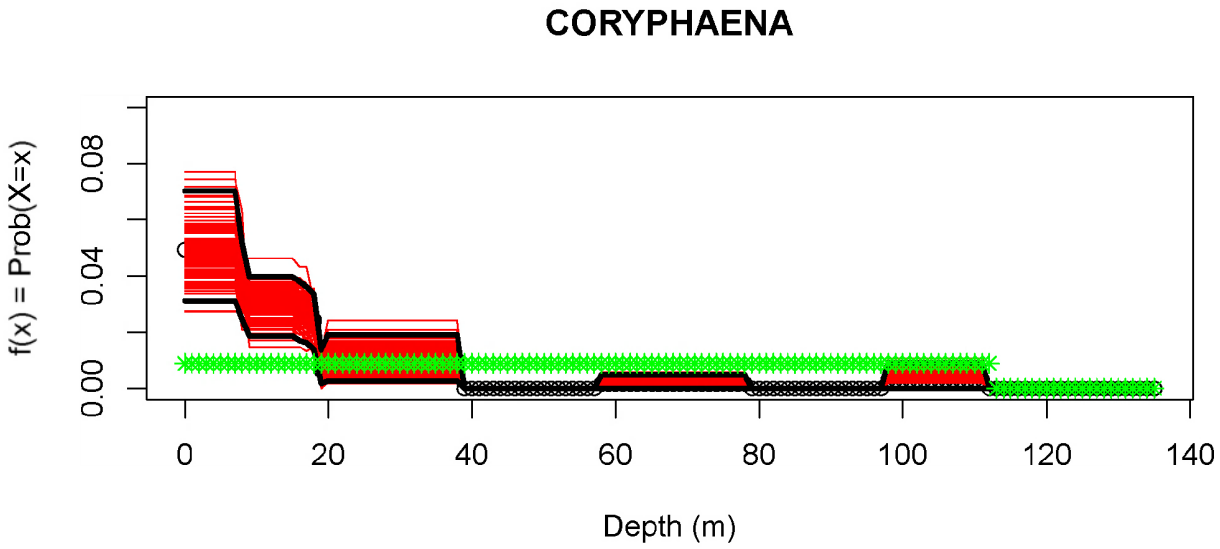

MUGIL
Min Depth= 0 Max Depth= 129 Max Width= 0.332124317937264
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

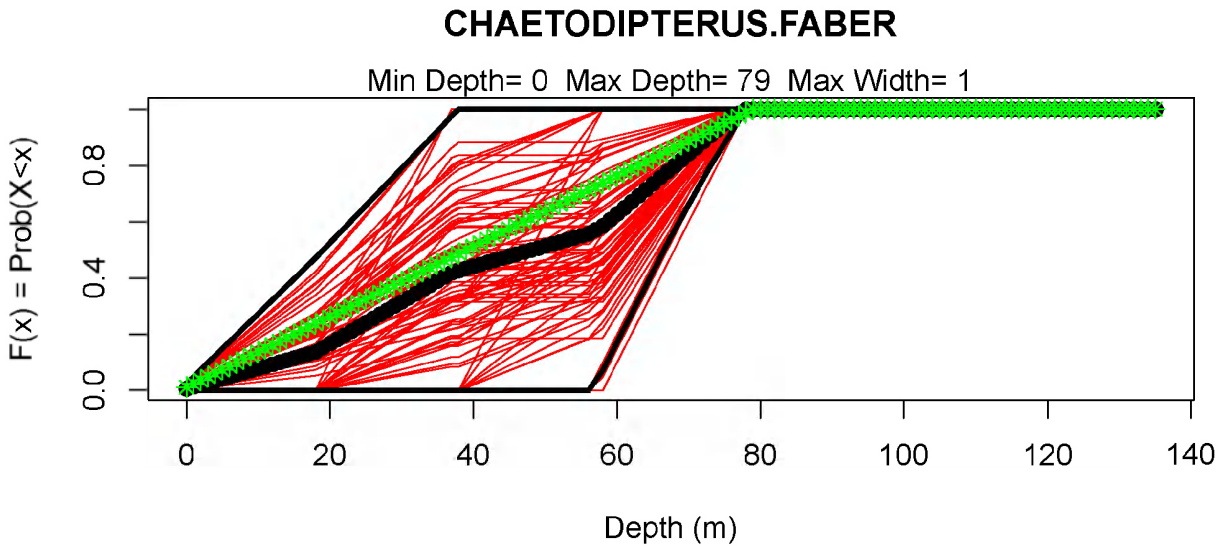

MUGIL
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

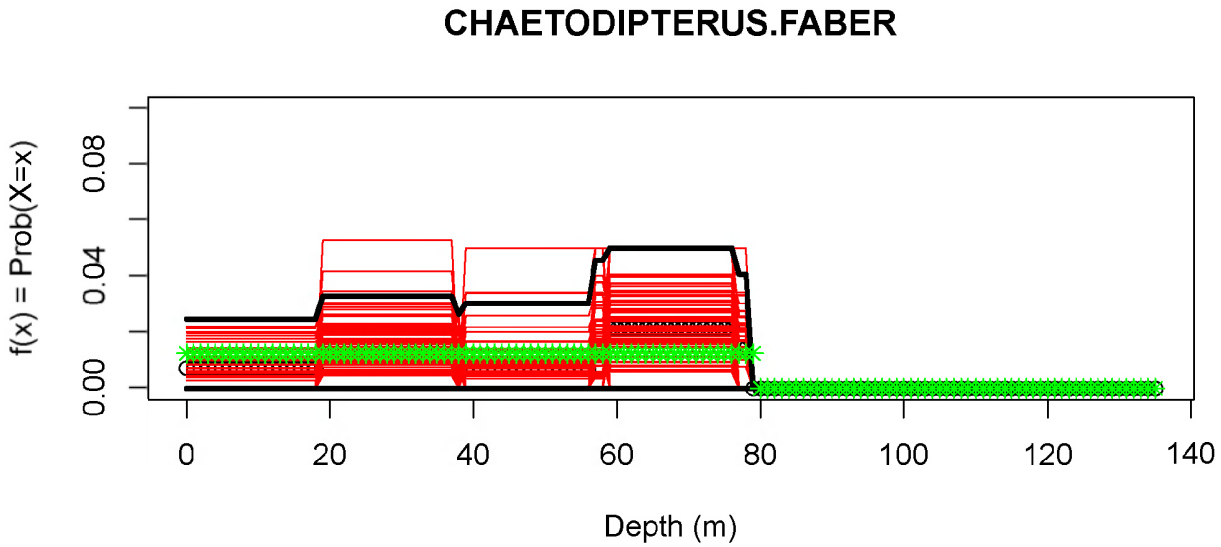

LAMPRIDIFORMES
Min Depth= 0 Max Depth= 79 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

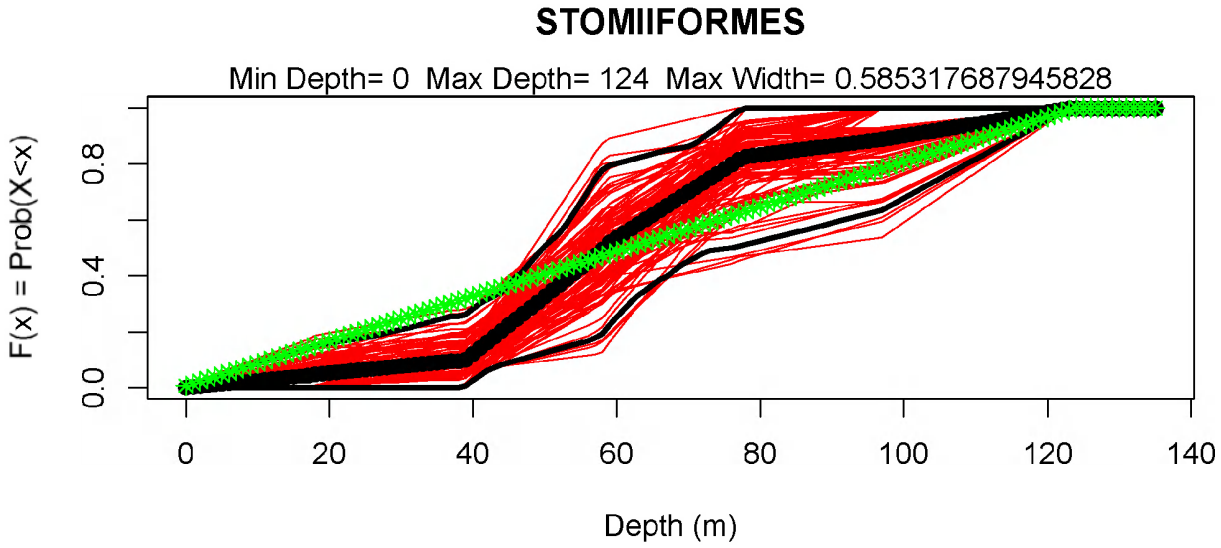

LAMPRIDIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

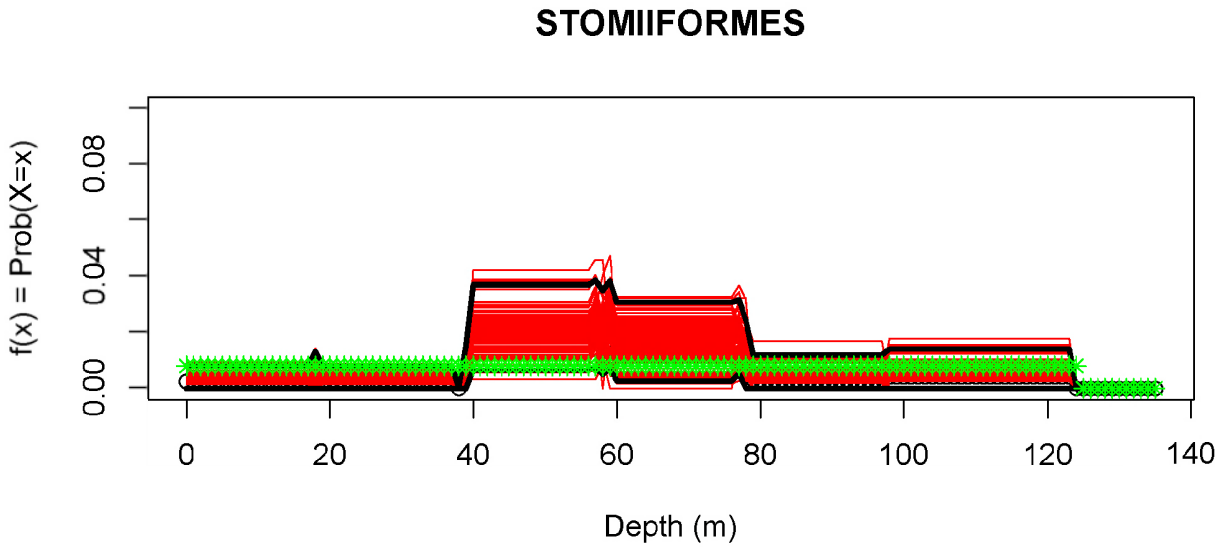

CORYPHAENA
Min Depth= 0 Max Depth= 112 Max Width= 0.355115530460165
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

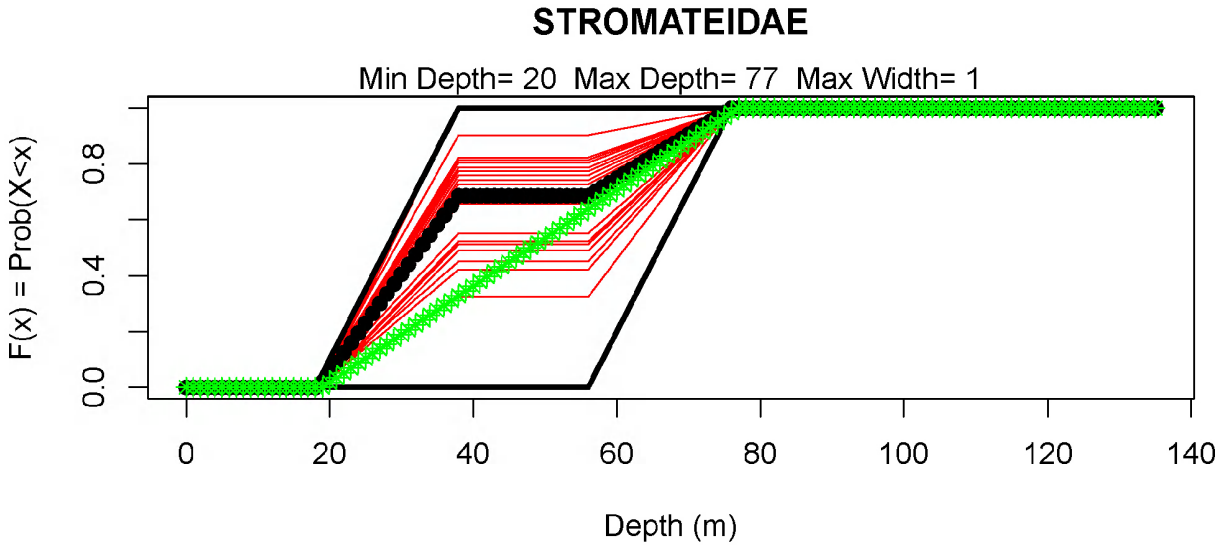

CORYPHAENA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

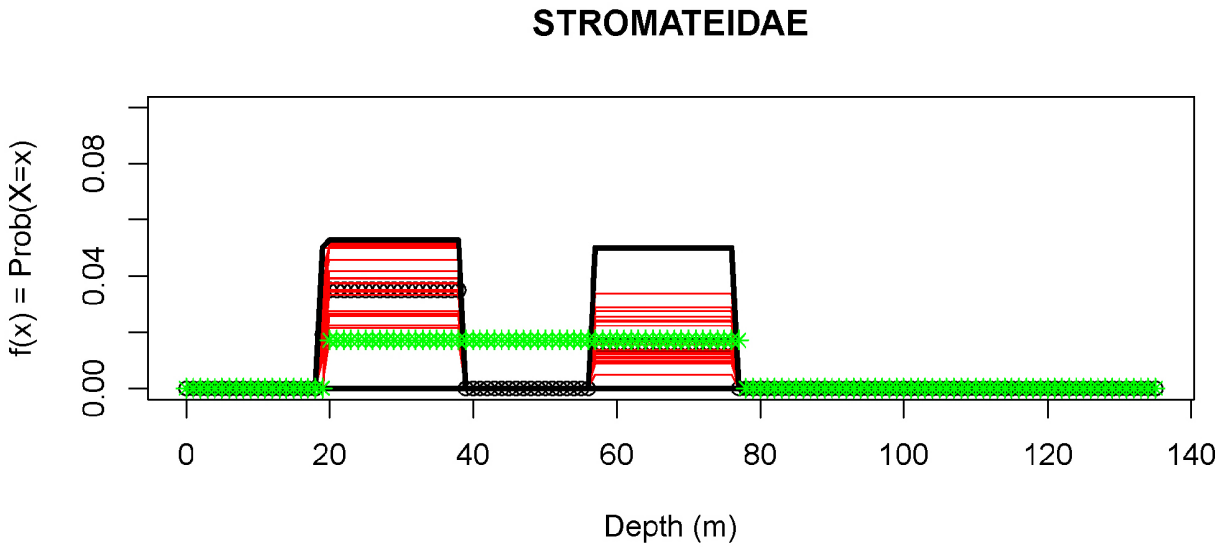

CHAETODIPTERUS.FABER
Min Depth= 0 Max Depth= 79 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

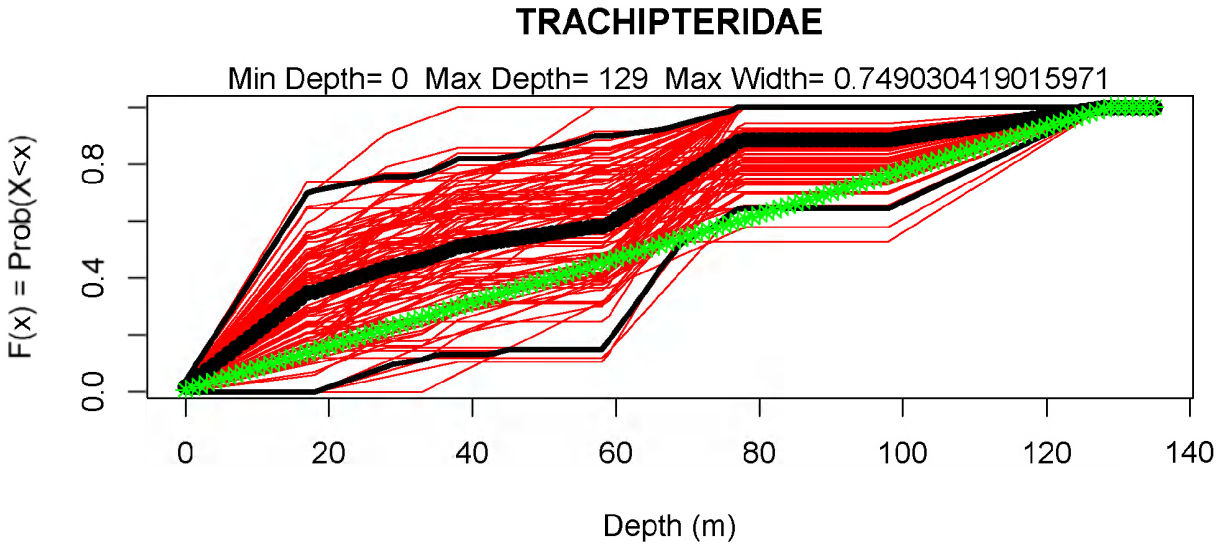

CHAETODIPTERUS.FABER
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

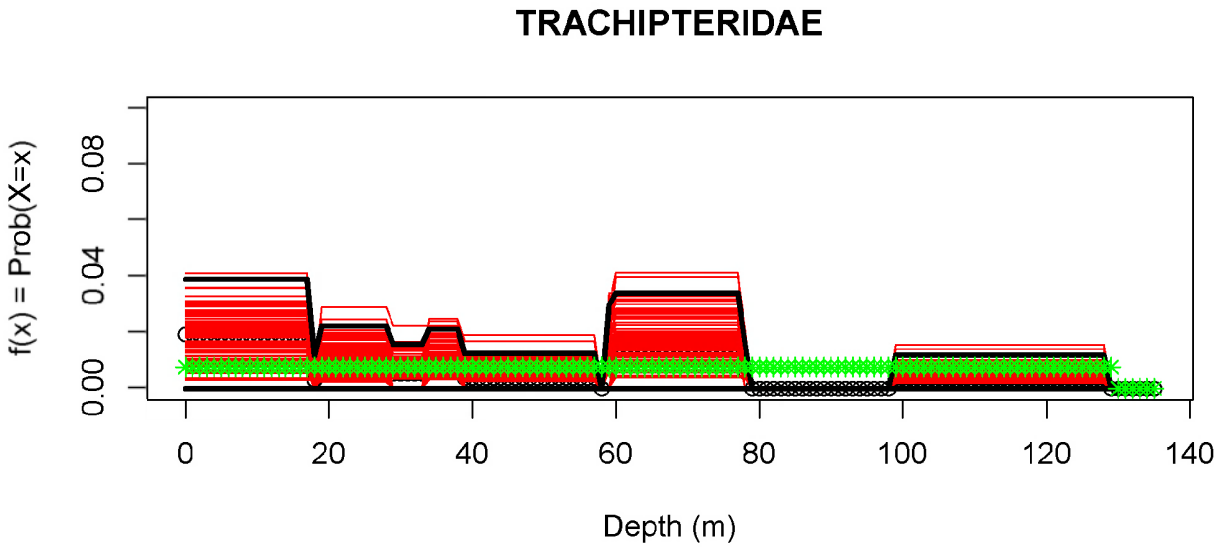

STOMIIFORMES
Min Depth= 0 Max Depth= 124 Max Width= 0.585317687945828
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

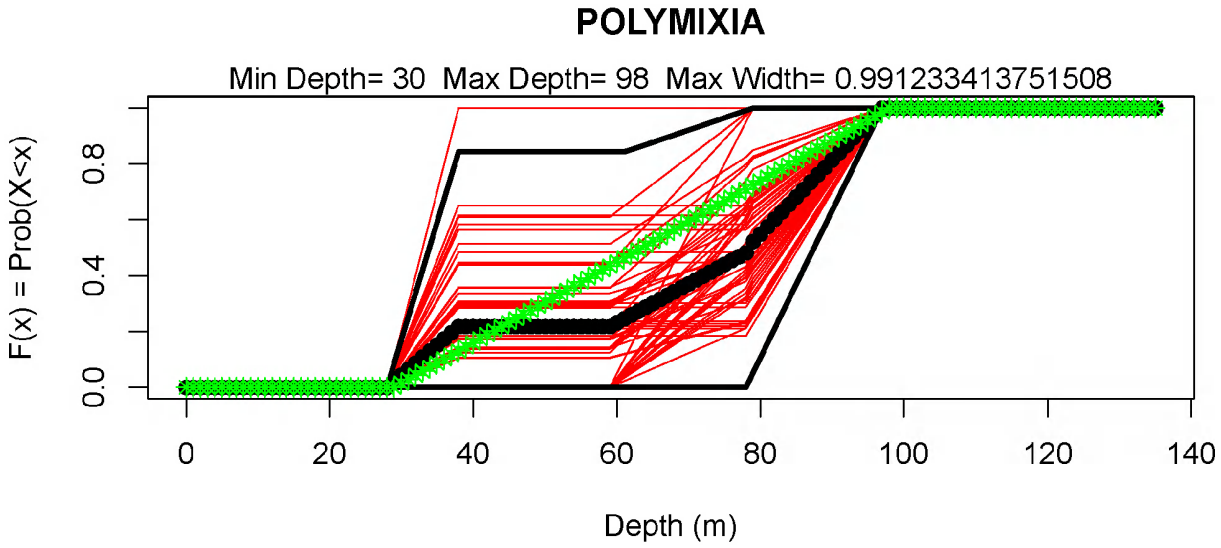

STOMIIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

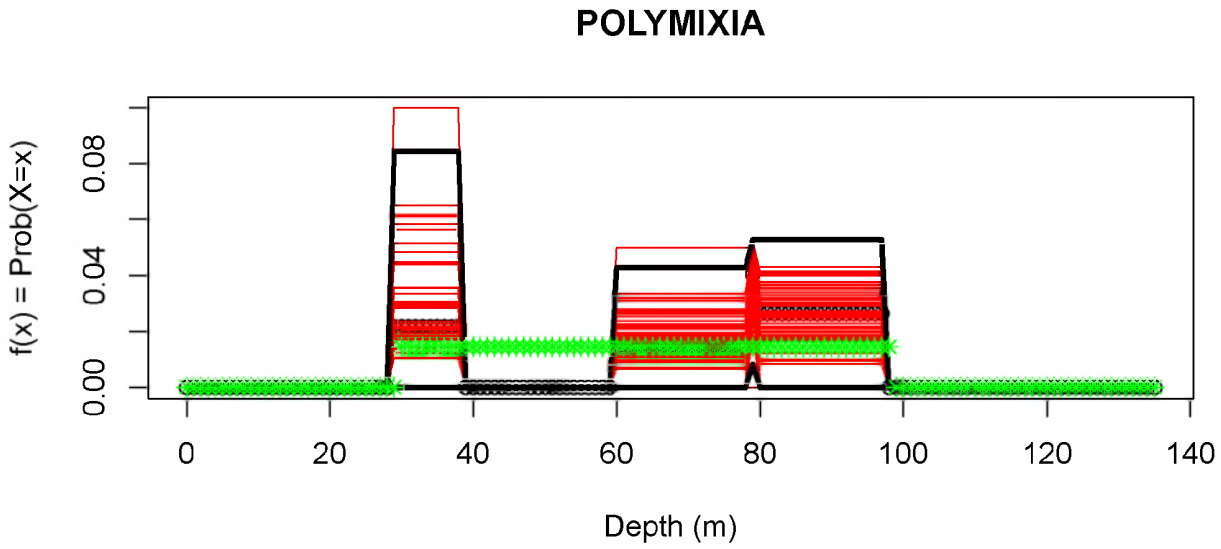

STROMATEIDAE
Min Depth= 20 Max Depth= 77 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

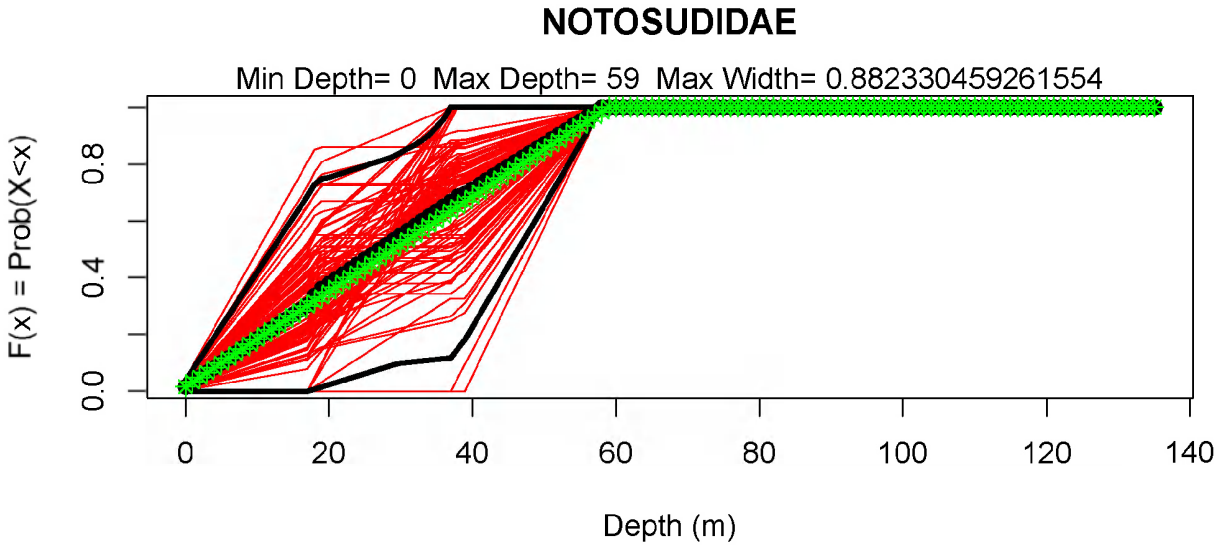

STROMATEIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

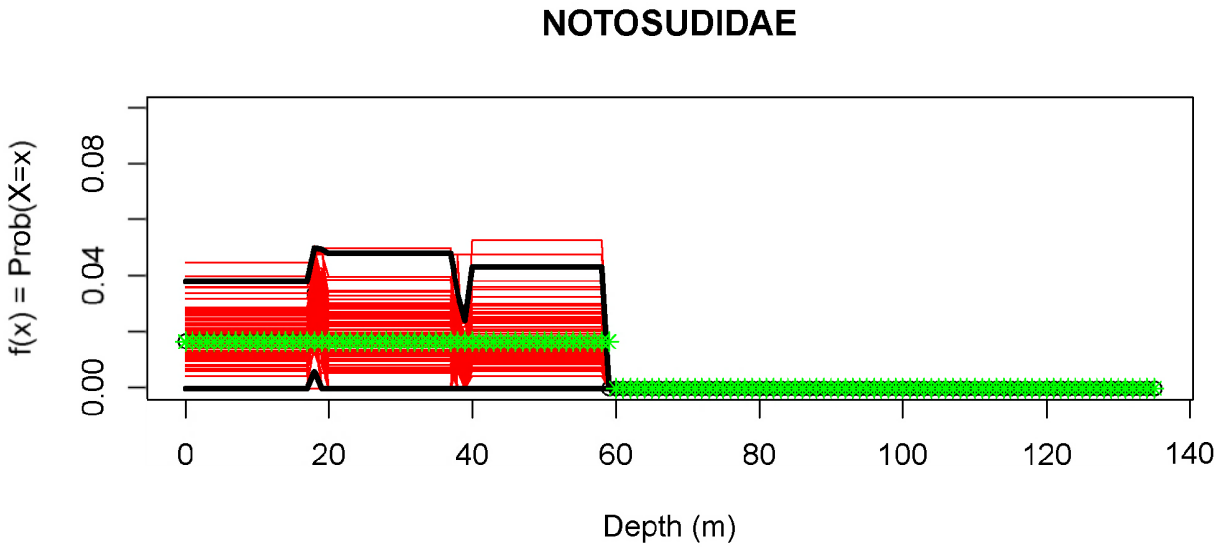

TRACHIPTERIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.749030419015971
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

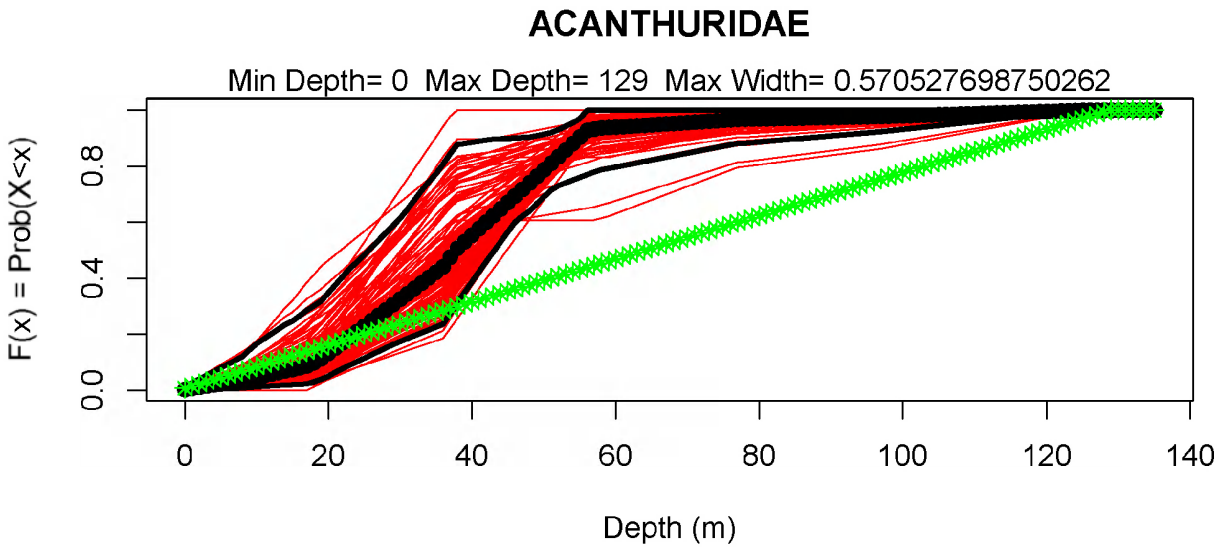

TRACHIPTERIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

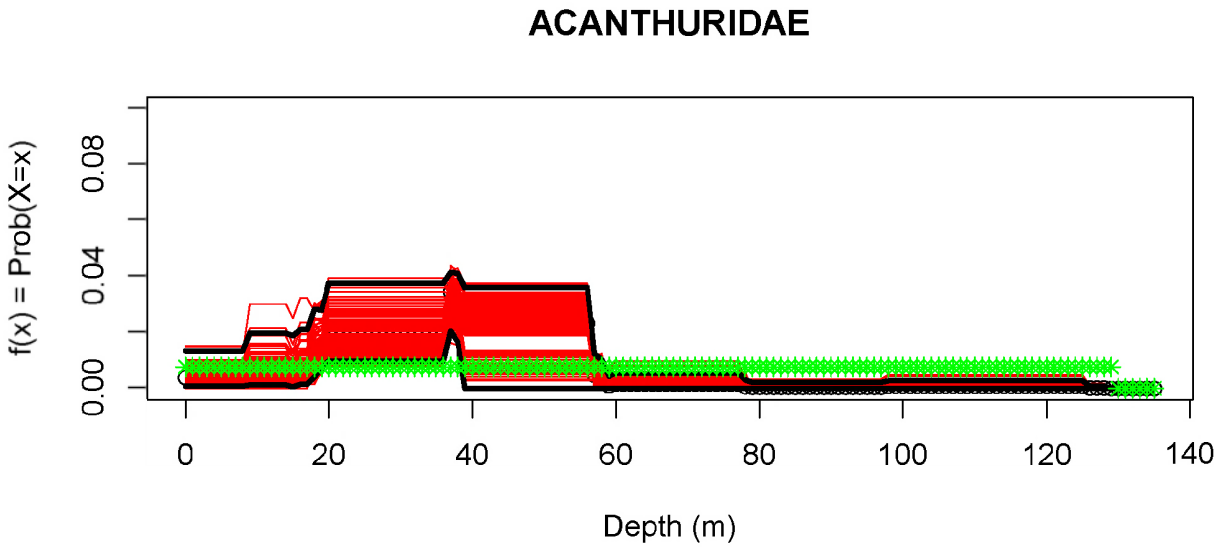

POLYMIXIA
Min Depth= 30 Max Depth= 98 Max Width= 0.991233413751508
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

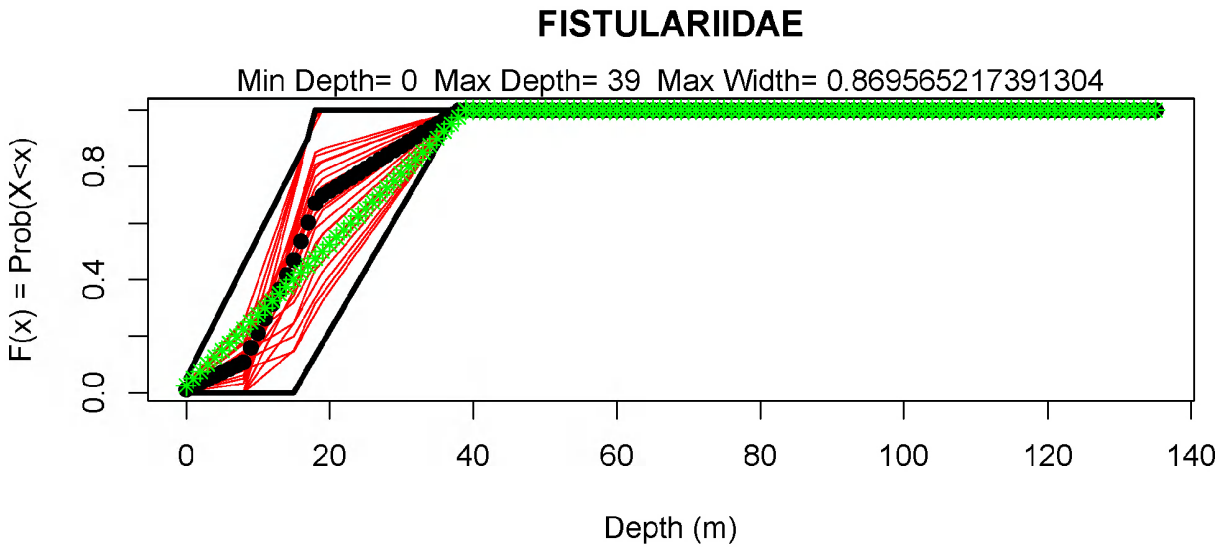

POLYMIXIA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

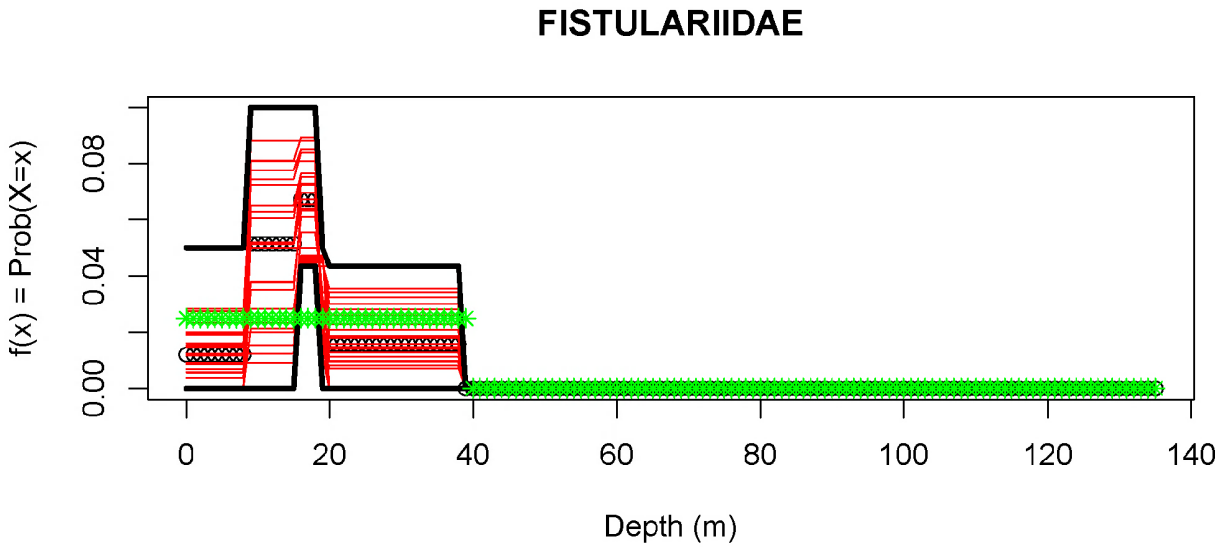

NOTOSUDIDAE
Min Depth= 0 Max Depth= 59 Max Width= 0.882330459261554
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

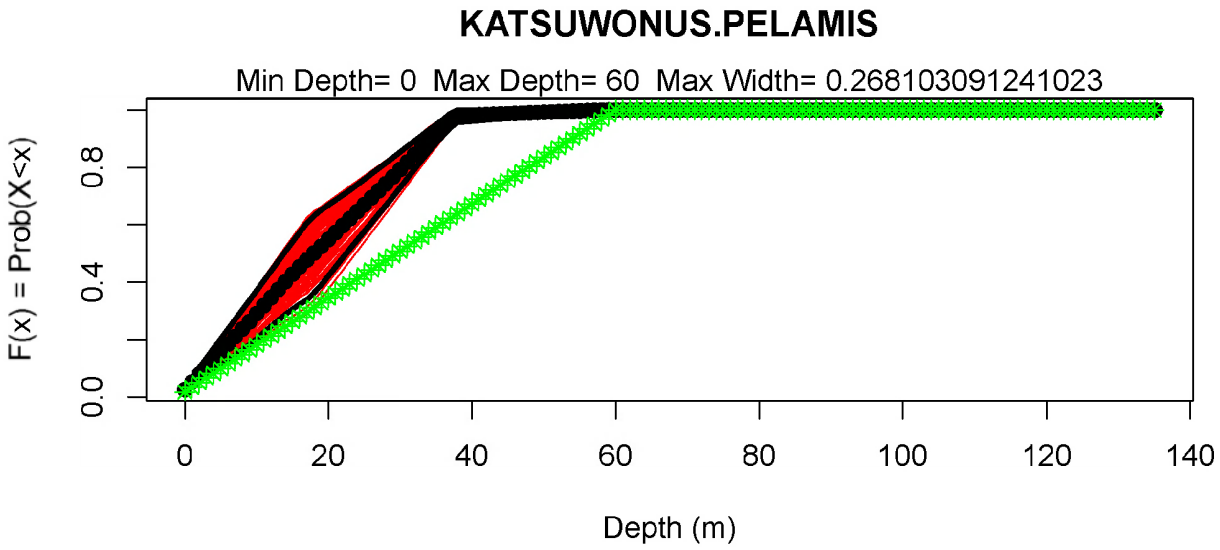

NOTOSUDIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

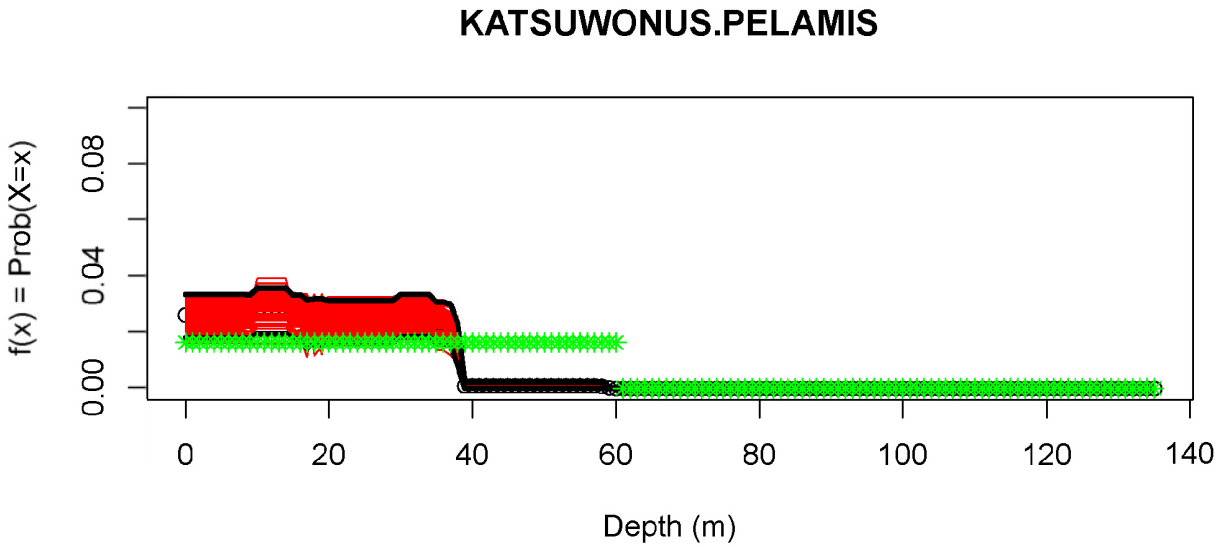

ACANTHURIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.570527698750262
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

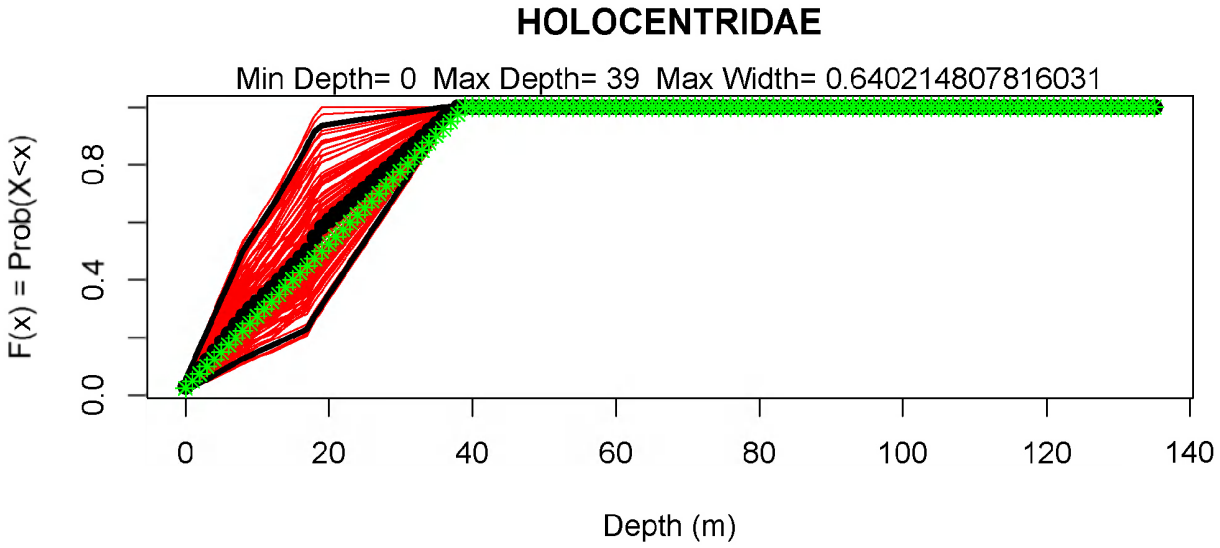

ACANTHURIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

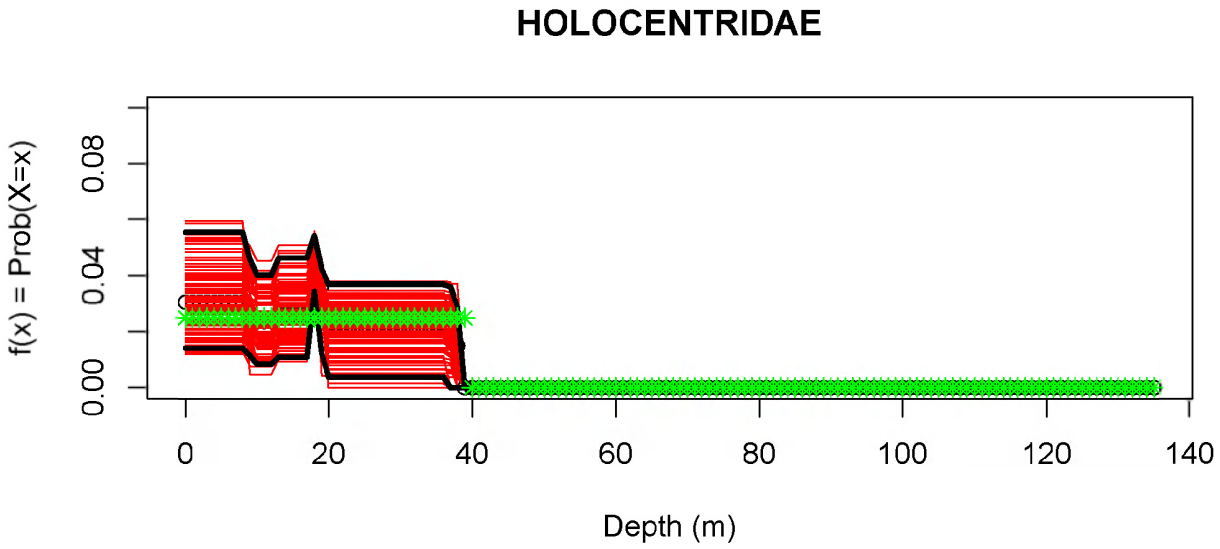

FISTULARIIDAE
Min Depth= 0 Max Depth= 39 Max Width= 0.869565217391304
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

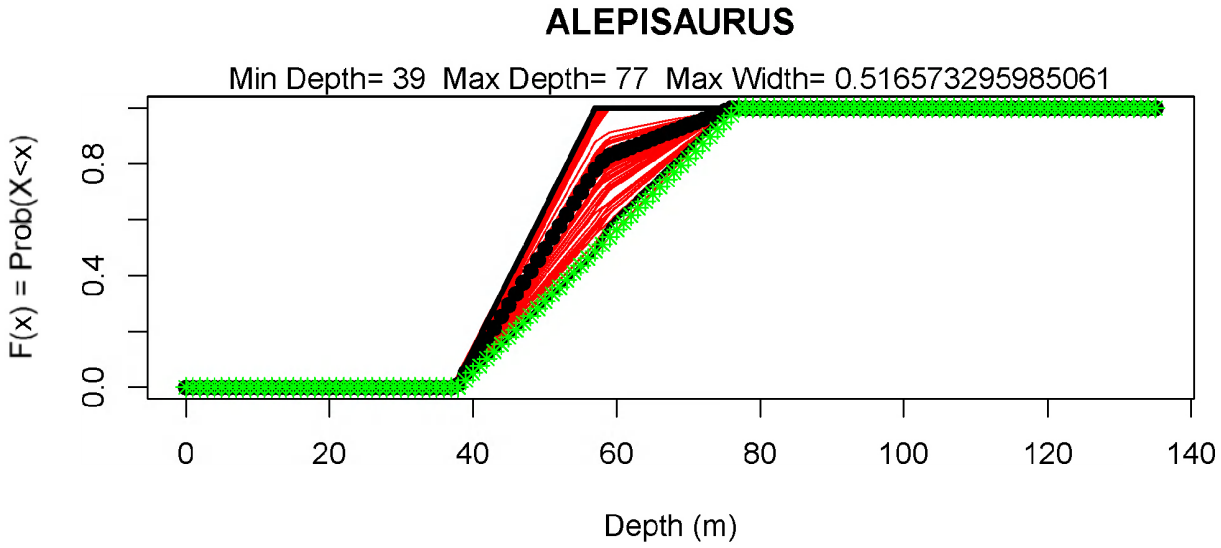

FISTULARIIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

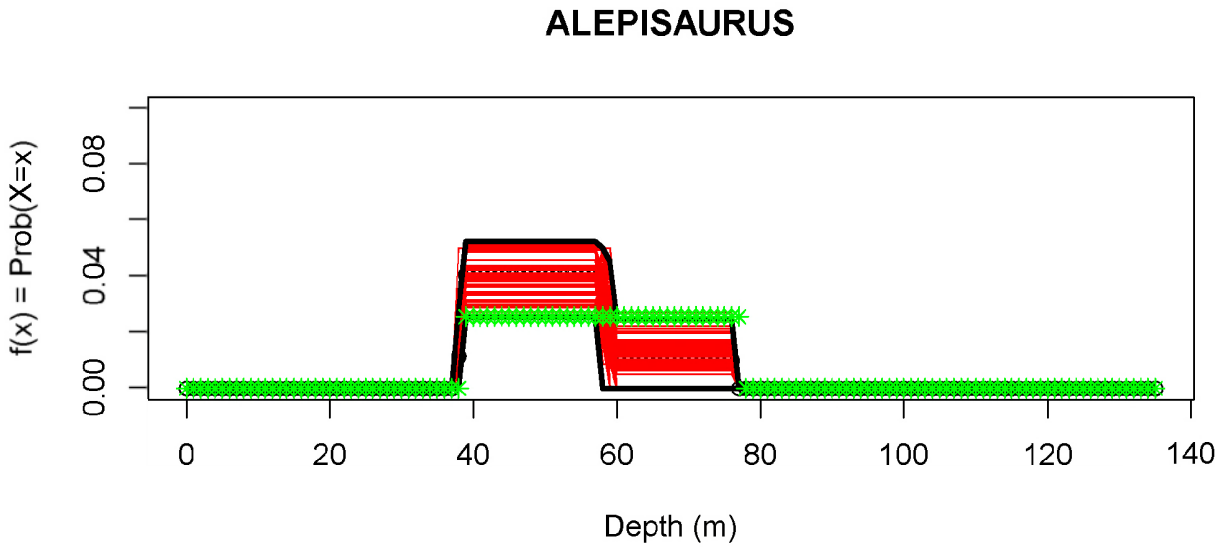

KATSUWONUS.PELAMIS
Min Depth= 0 Max Depth= 60 Max Width= 0.268103091241023
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

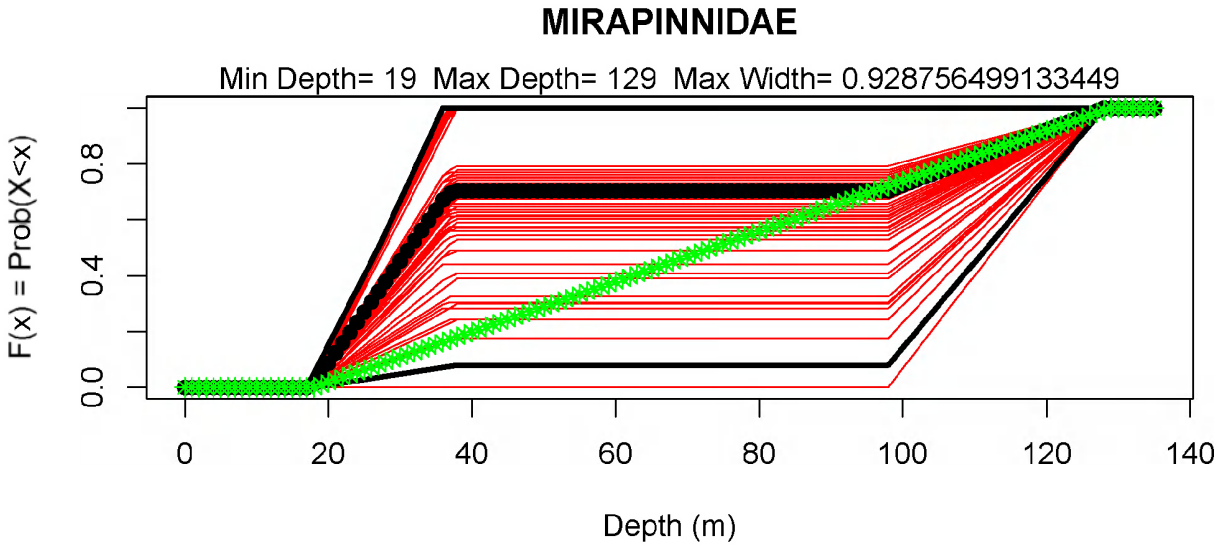

KATSUWONUS.PELAMIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

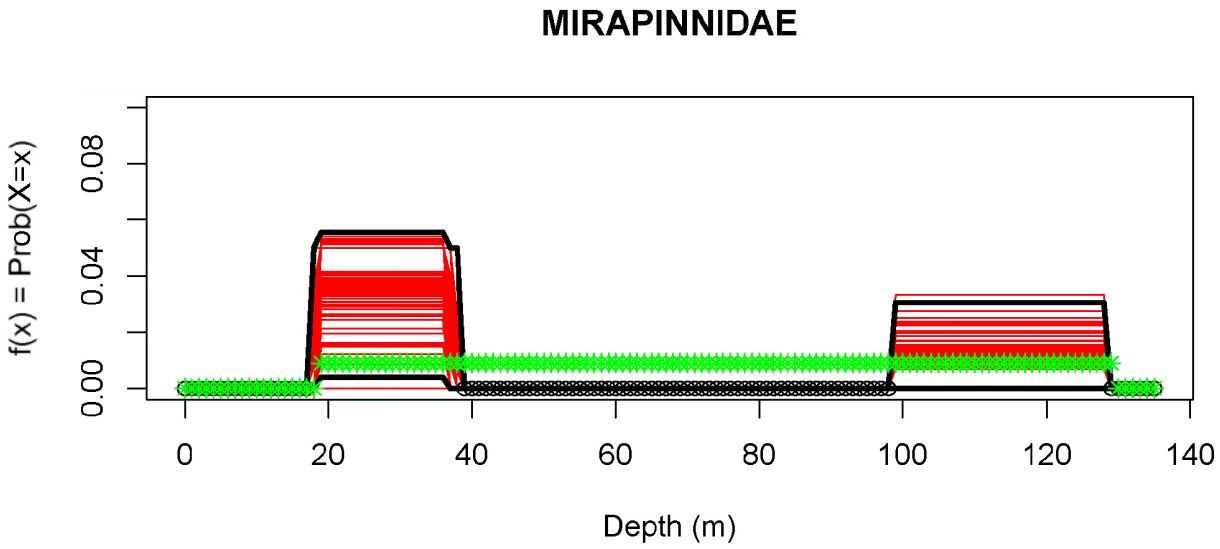

HOLOCENTRIDAE
Min Depth= 0 Max Depth= 39 Max Width= 0.640214807816031
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

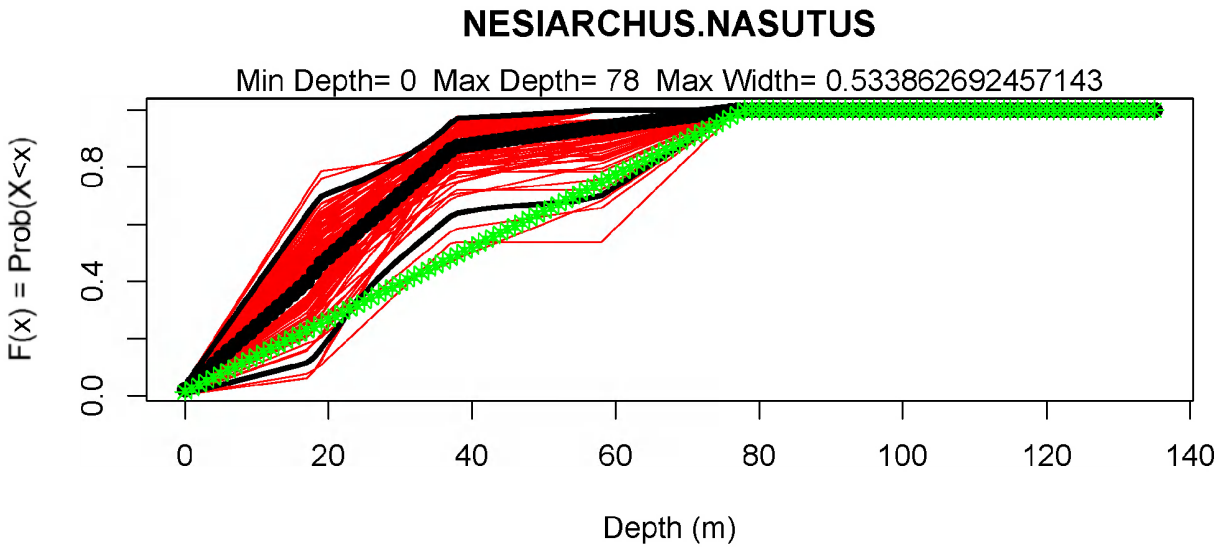

HOLOCENTRIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

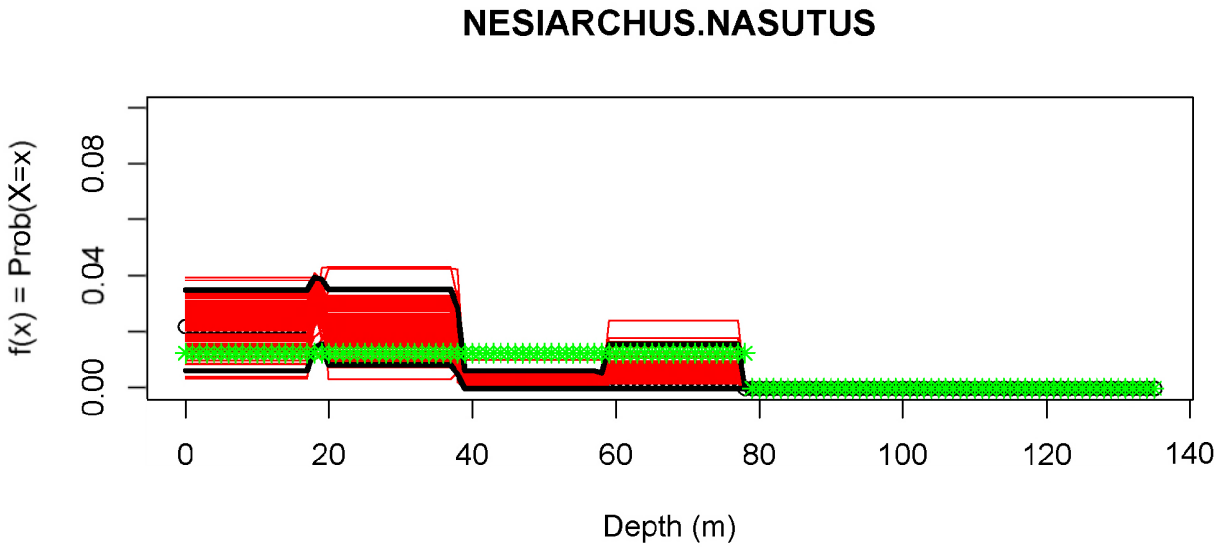

ALEPISAURUS
Min Depth= 39 Max Depth= 77 Max Width= 0.516573295985061
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

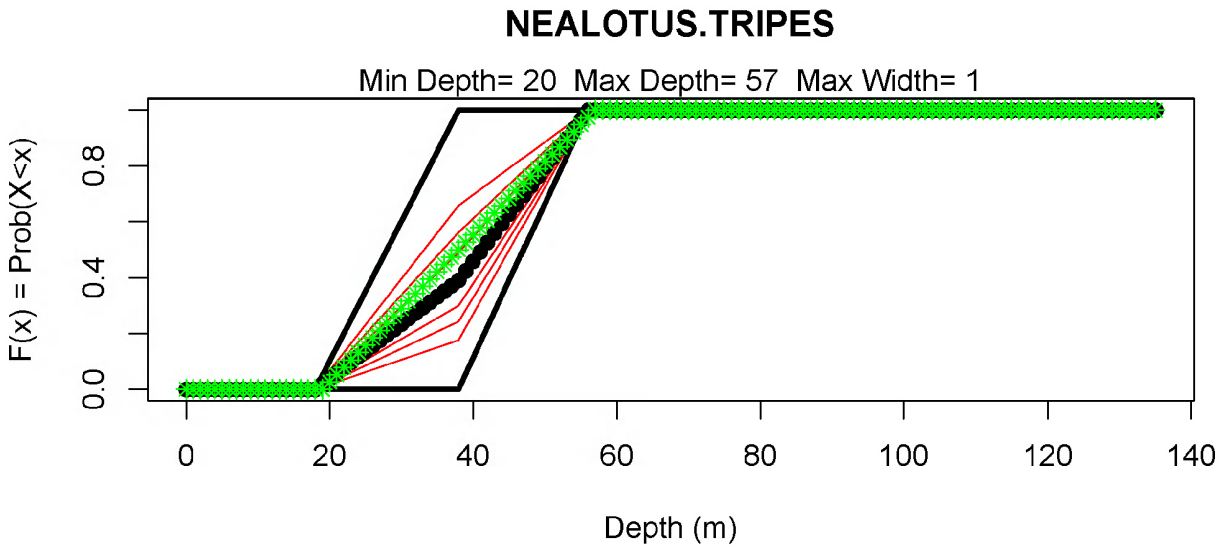

ALEPISAURUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

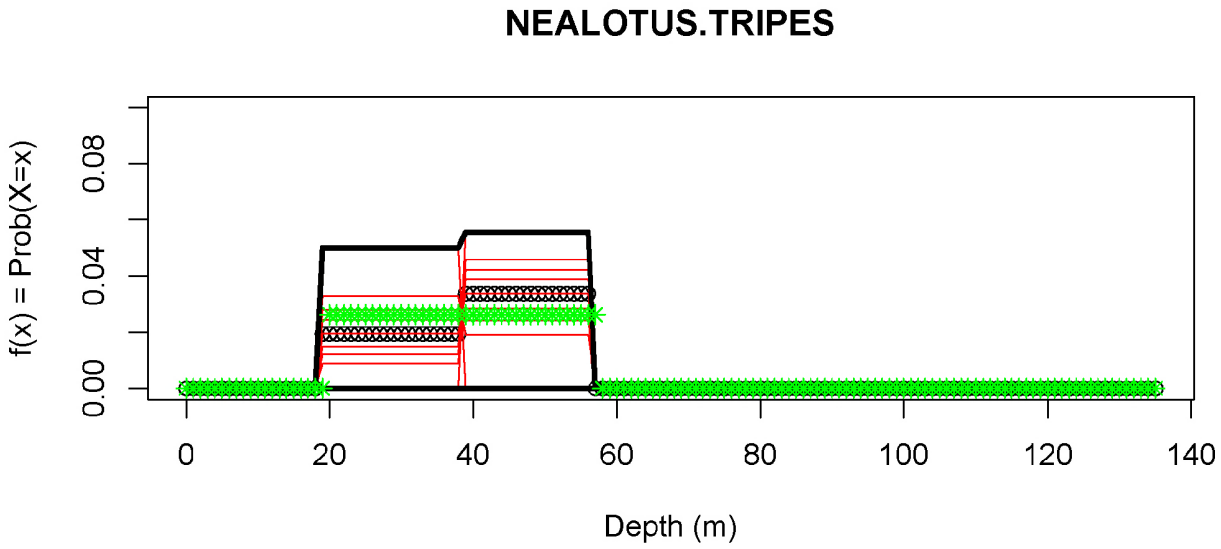

MIRAPINNIDAE
Min Depth= 19 Max Depth= 129 Max Width= 0.928756499133449
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

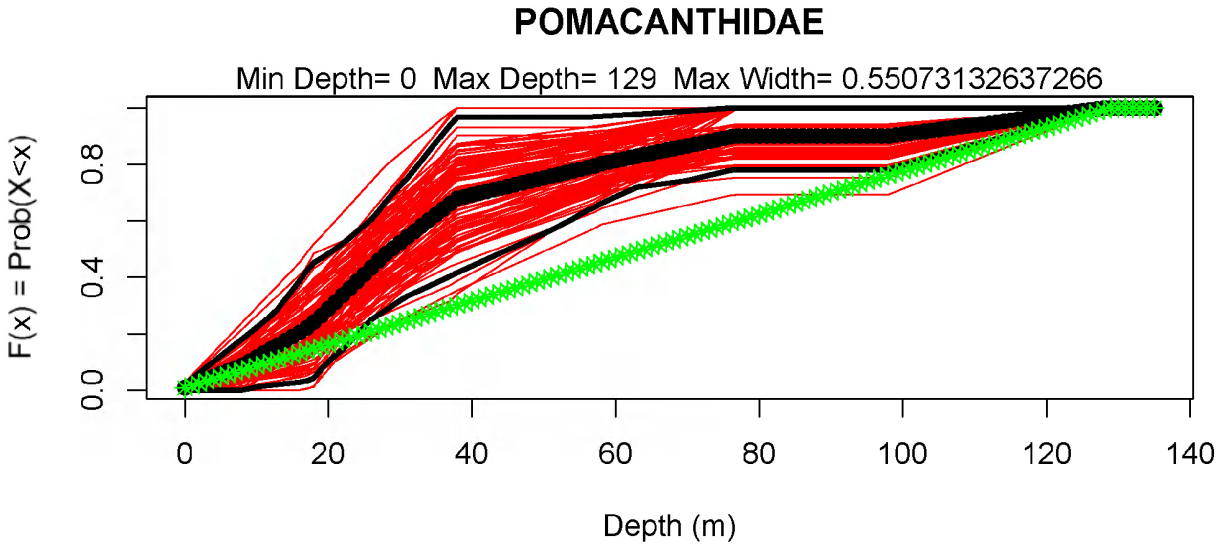

MIRAPINNIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

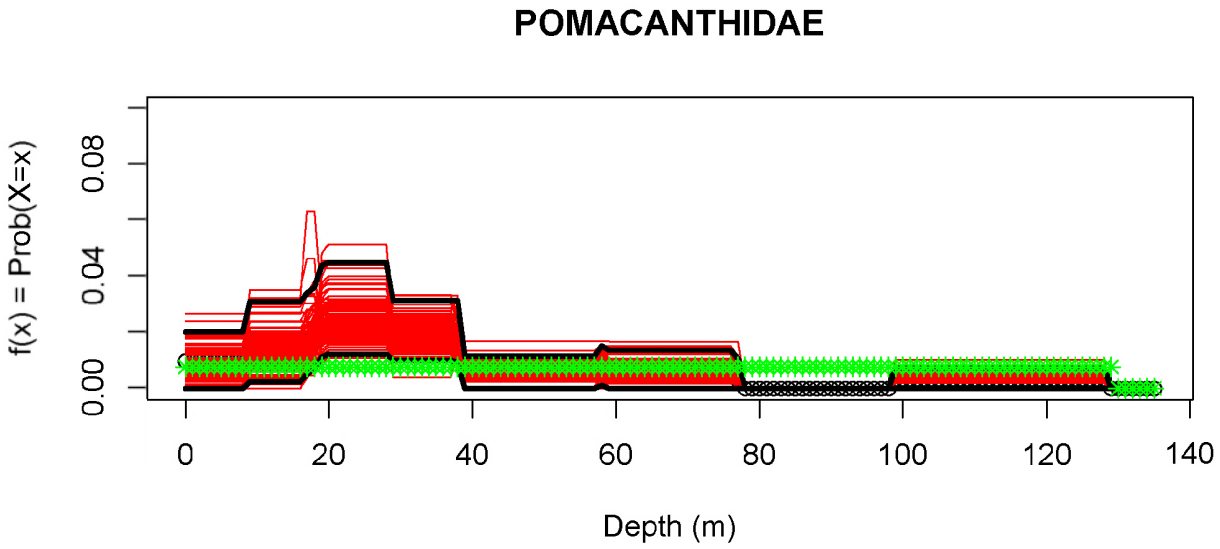

NESIARCHUS.NASUTUS
Min Depth= 0 Max Depth= 78 Max Width= 0.533862692457143
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

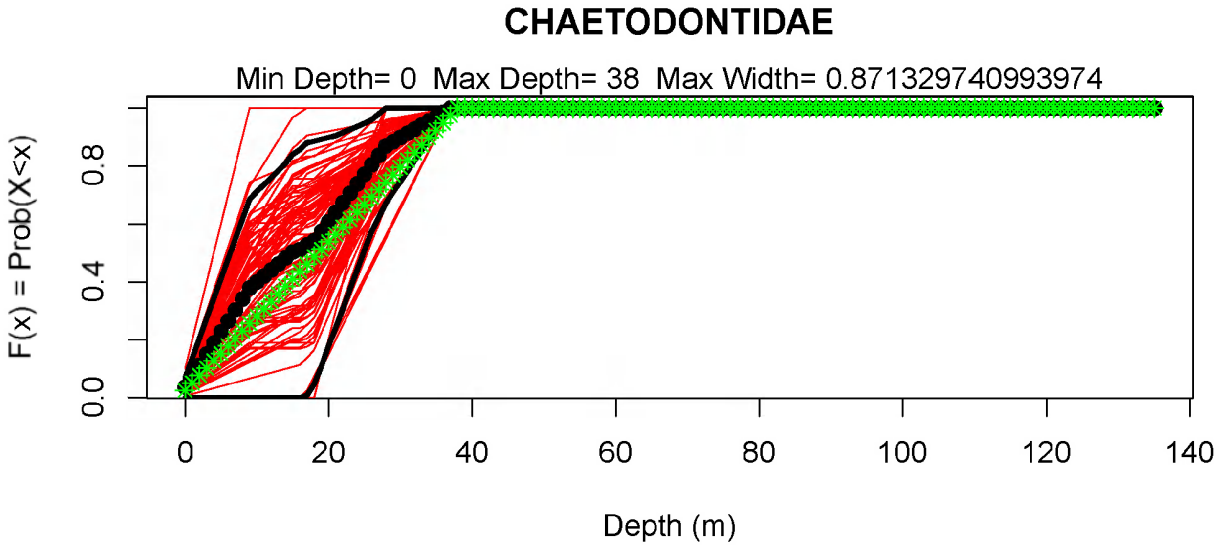

NESIARCHUS.NASUTUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

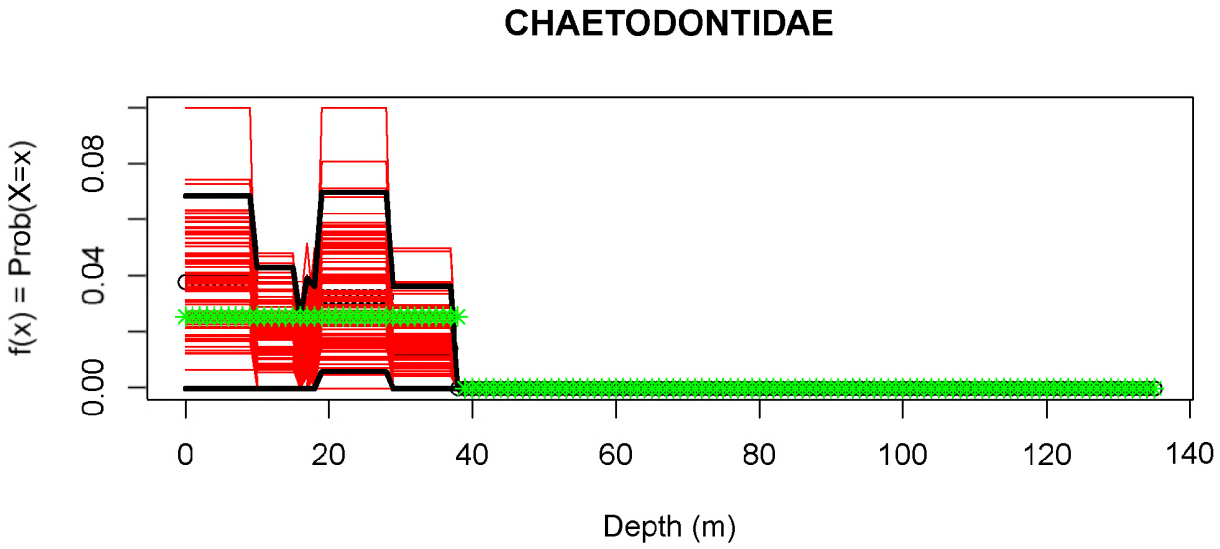

NEALOTUS.TRIPES
Min Depth= 20 Max Depth= 57 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

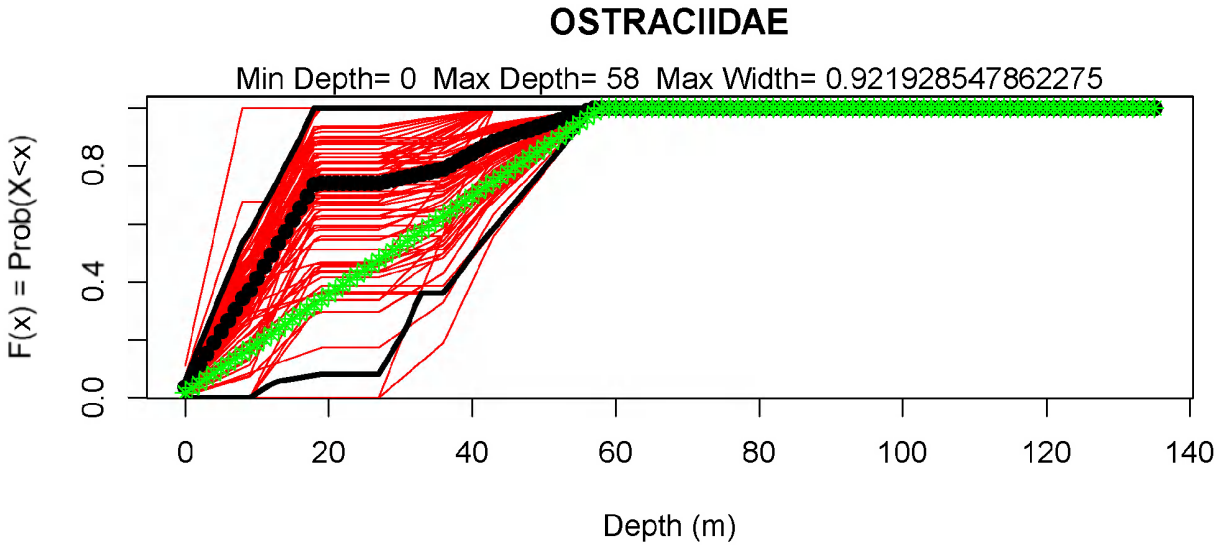

NEALOTUS.TRIPES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

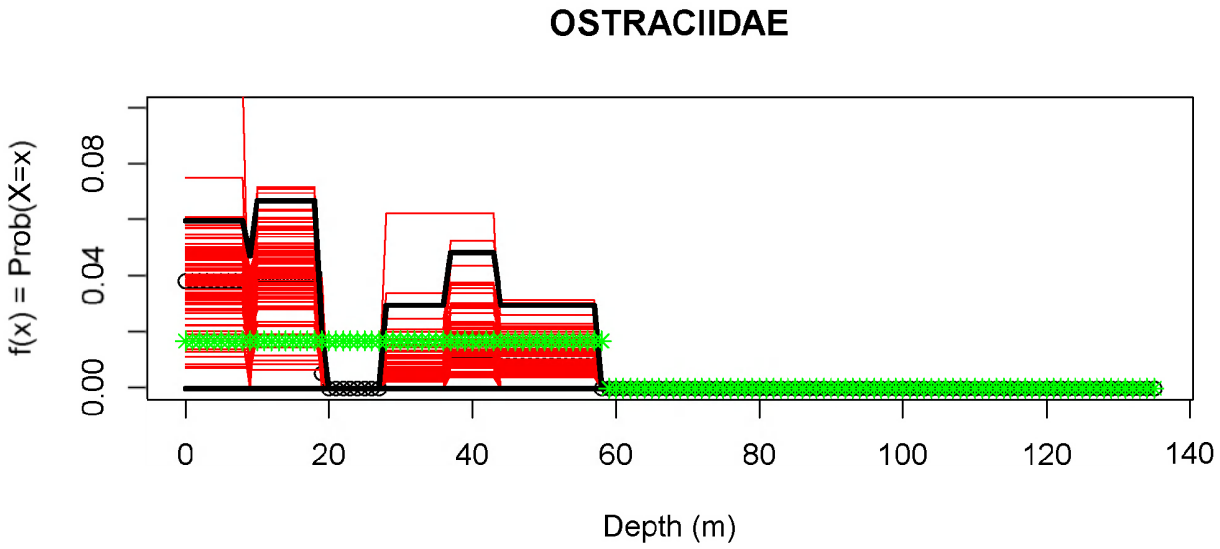

POMACANTHIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.55073132637266
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

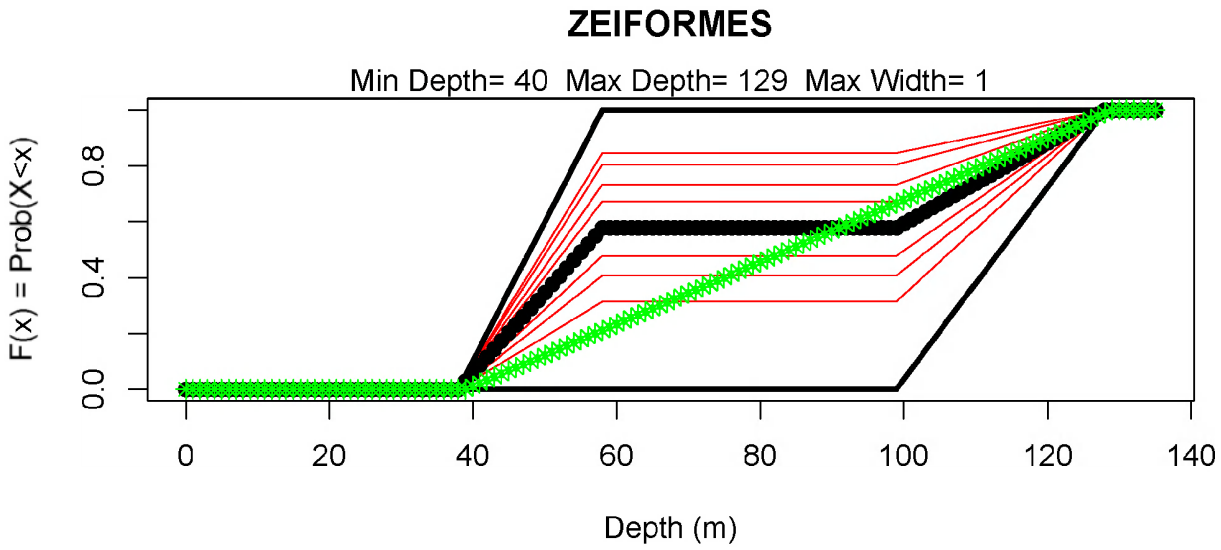

POMACANTHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

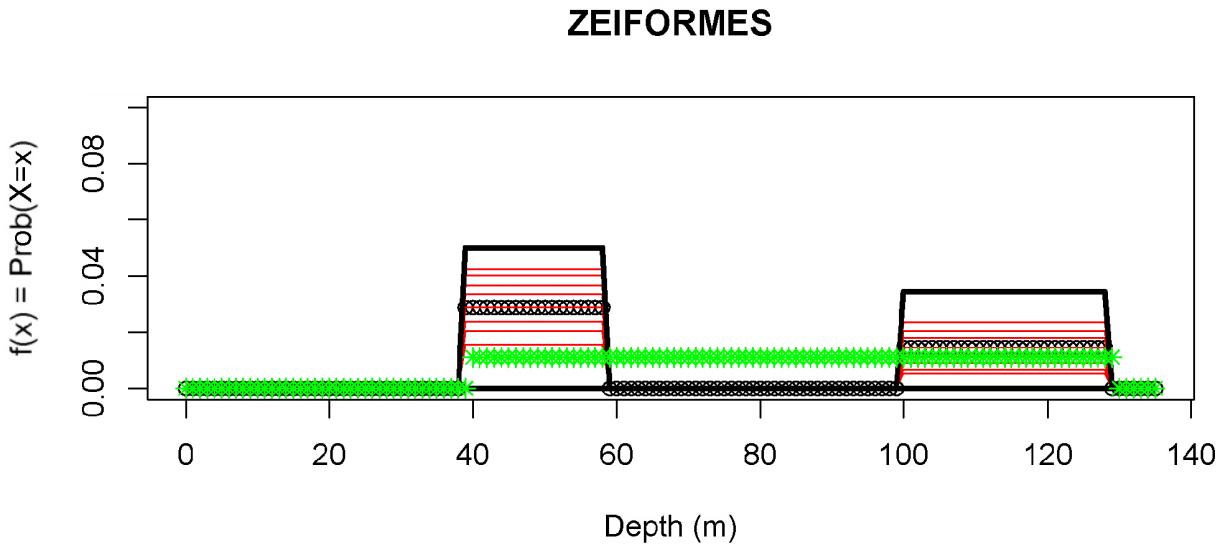

CHAETODONTIDAE
Min Depth= 0 Max Depth= 38 Max Width= 0.871329740993974
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

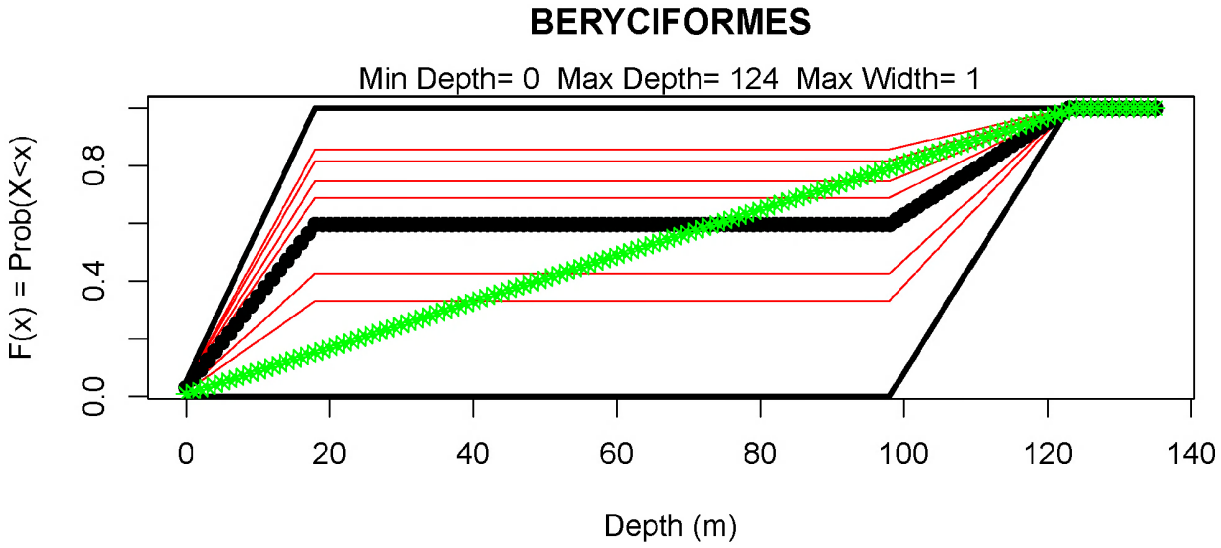

CHAETODONTIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

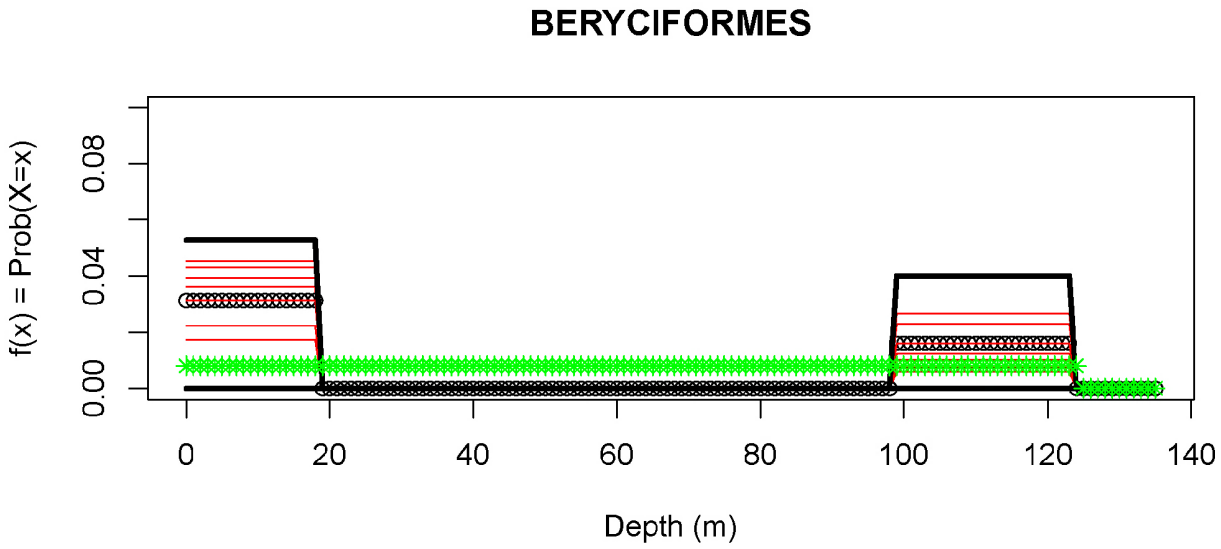

OSTRACIIDAE
Min Depth= 0 Max Depth= 58 Max Width= 0.921928547862275
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

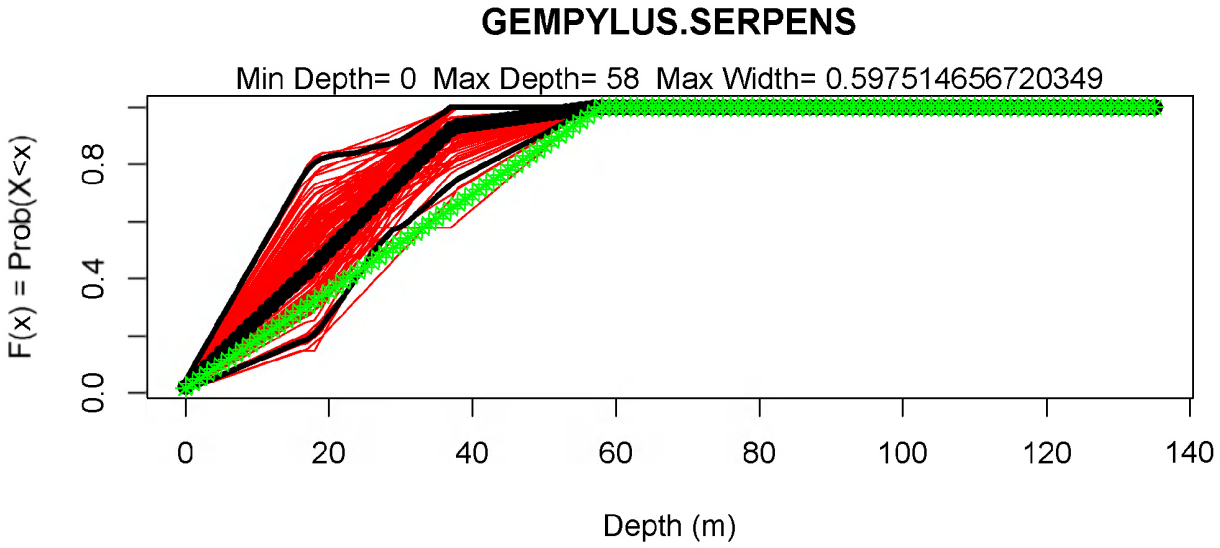

OSTRACIIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

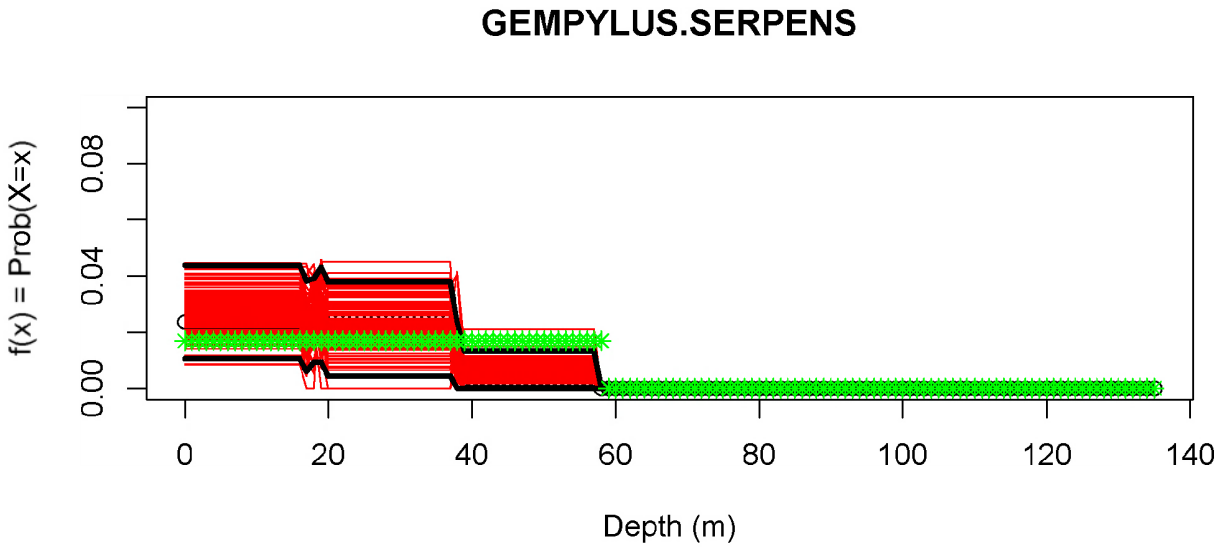

ZEIFORMES
Min Depth= 40 Max Depth= 129 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

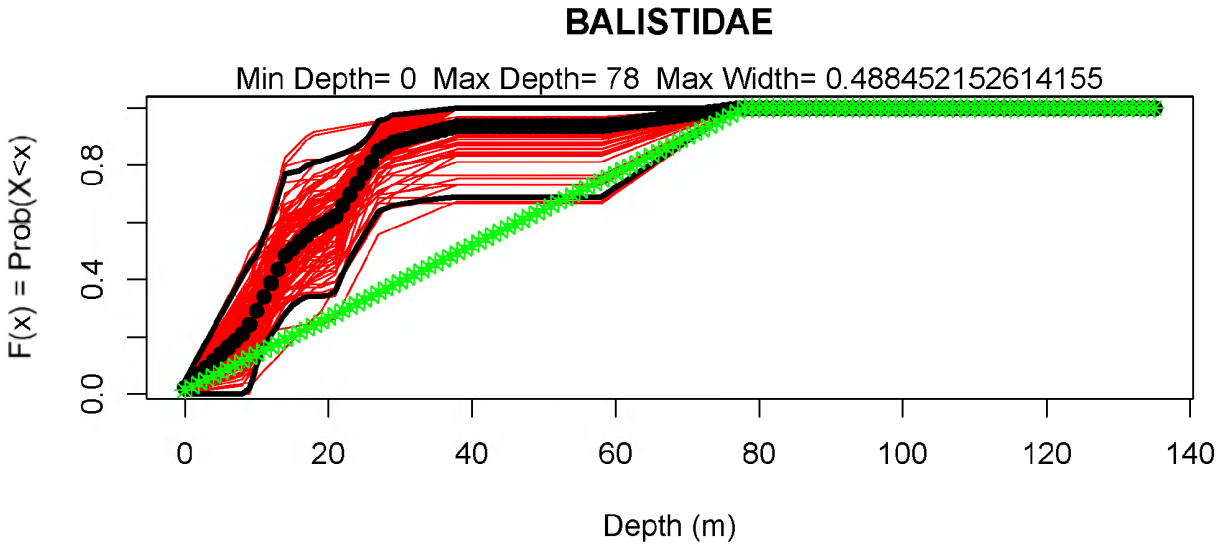

ZEIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

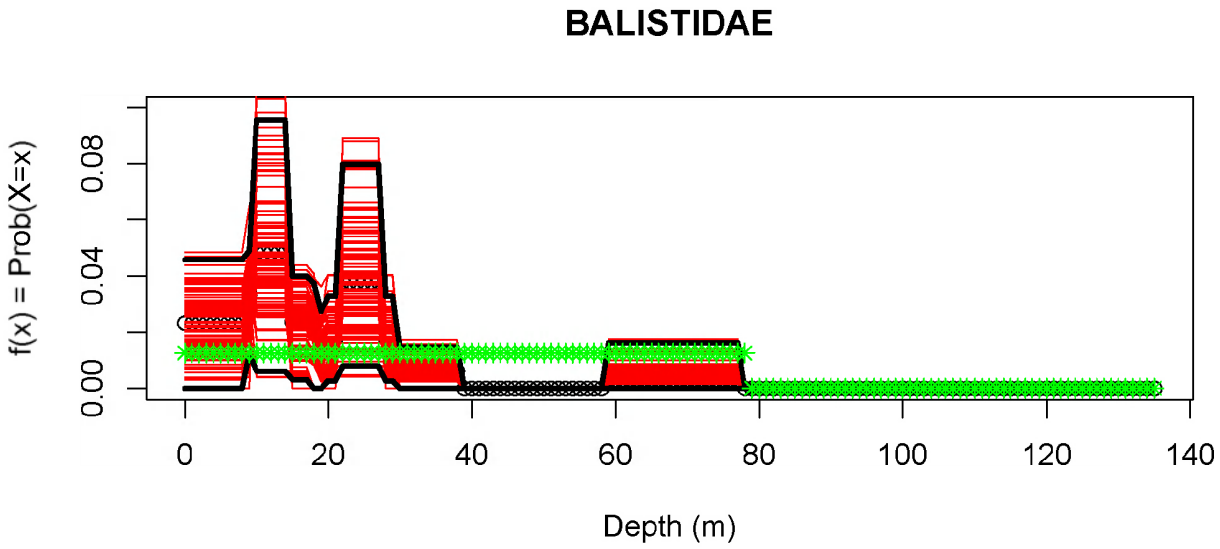

BERYCIFORMES
Min Depth= 0 Max Depth= 124 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

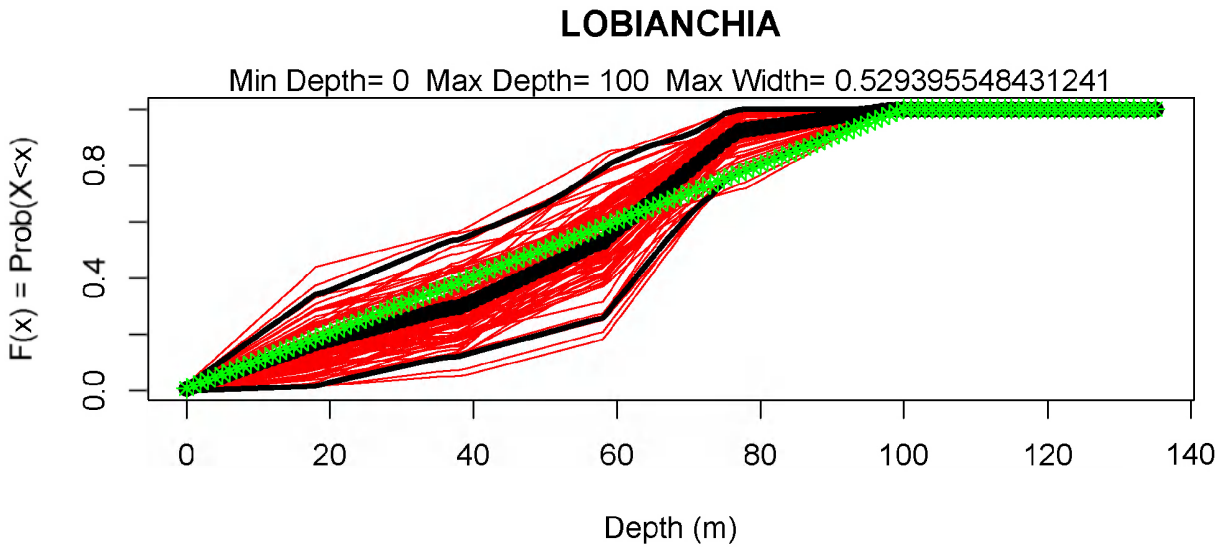

BERYCIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

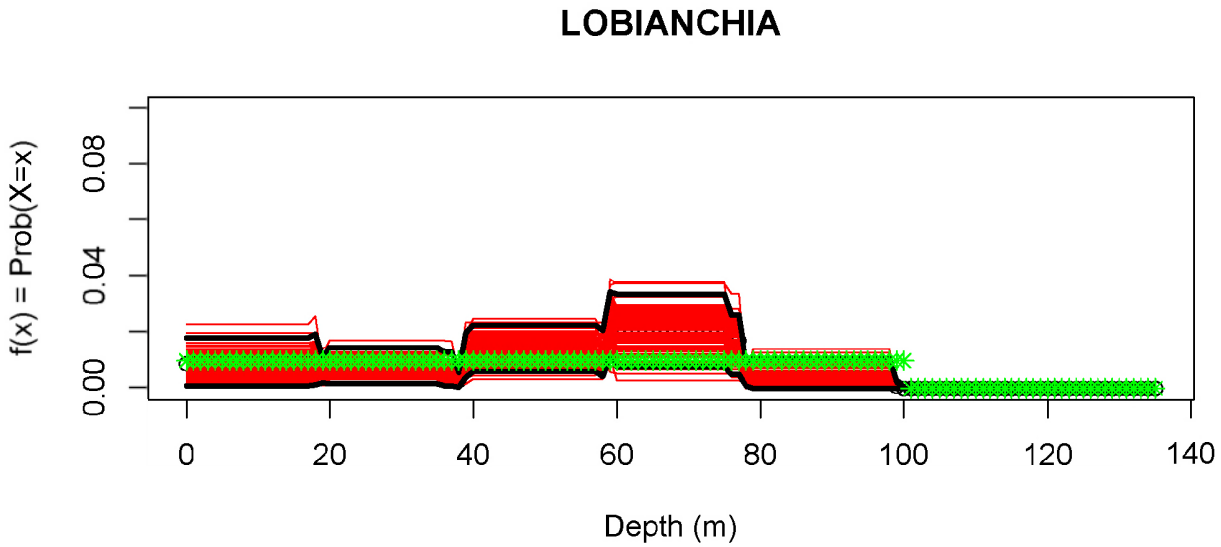

GEMPYLUS.SERPENS
Min Depth= 0 Max Depth= 58 Max Width= 0.597514656720349
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

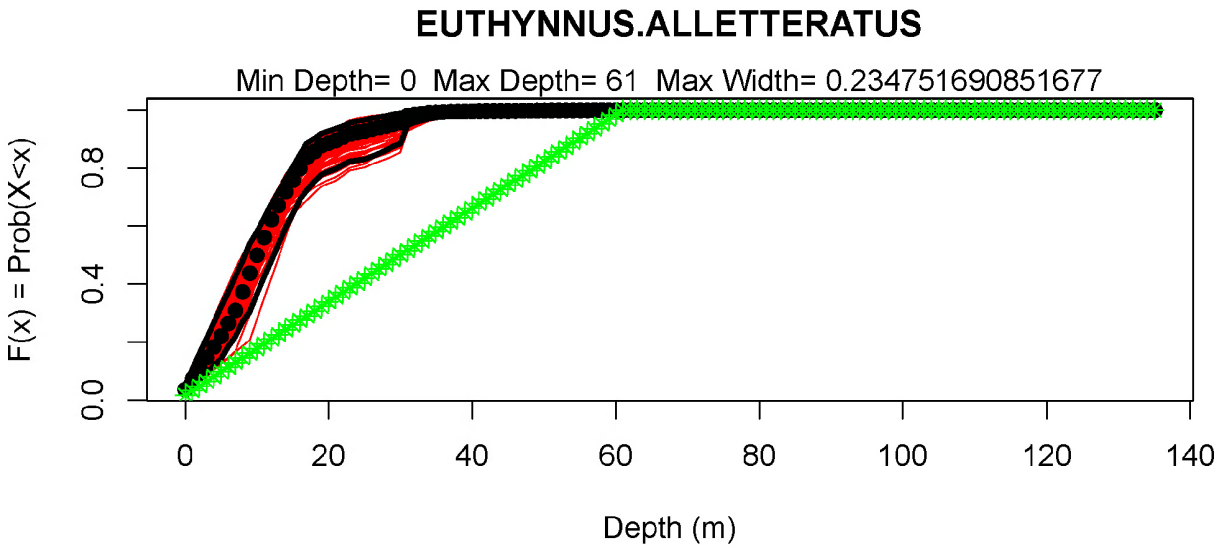

GEMPYLUS.SERPENS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

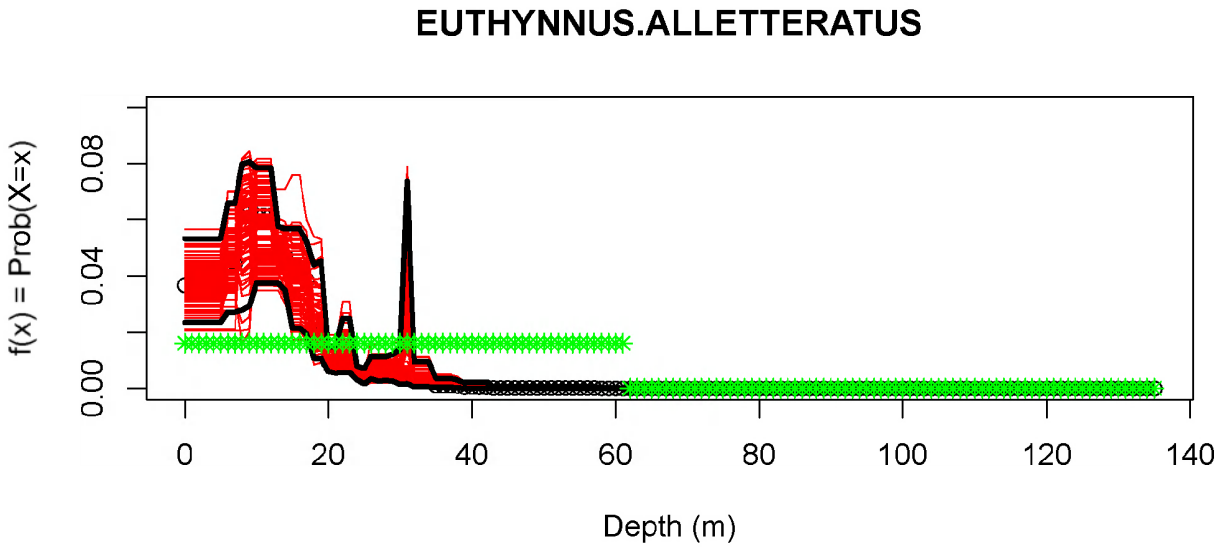

BALISTIDAE
Min Depth= 0 Max Depth= 78 Max Width= 0.488452152614155
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

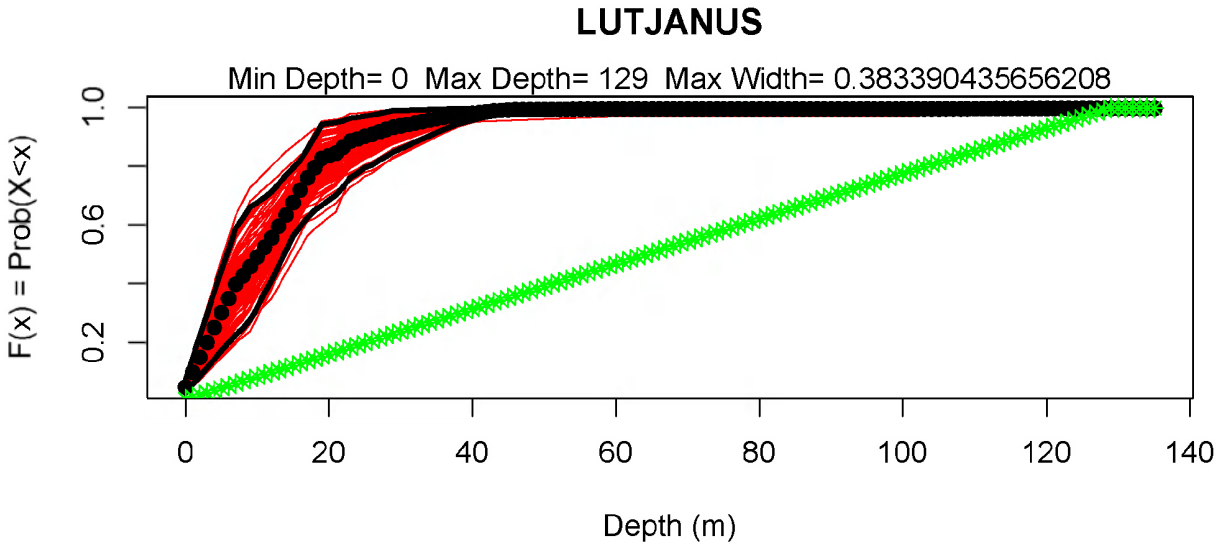

BALISTIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

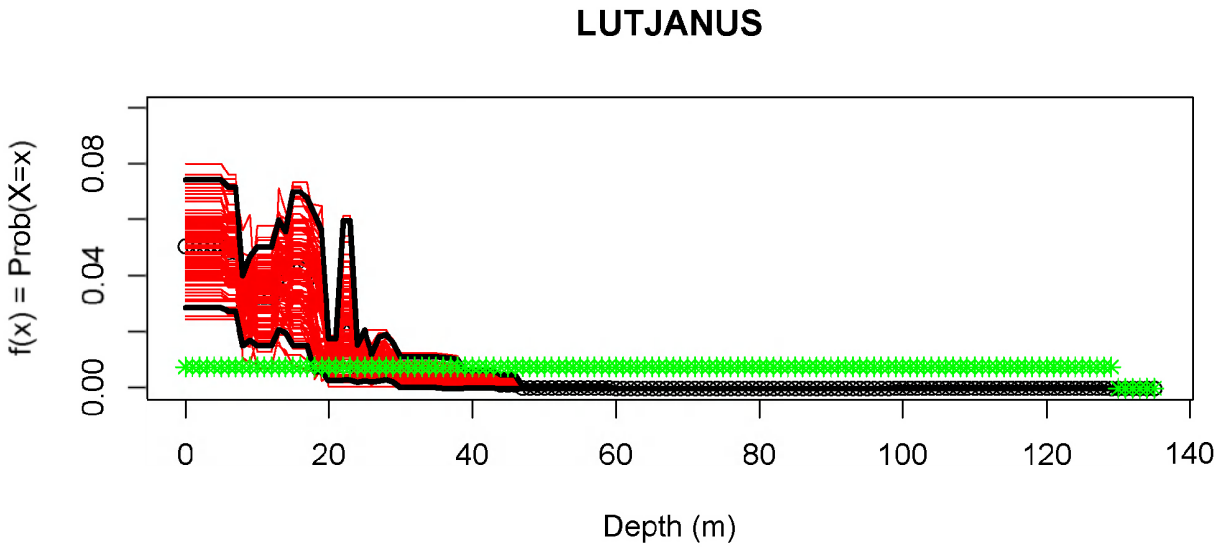

LOBIANCHIA
Min Depth= 0 Max Depth= 100 Max Width= 0.529395548431241
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

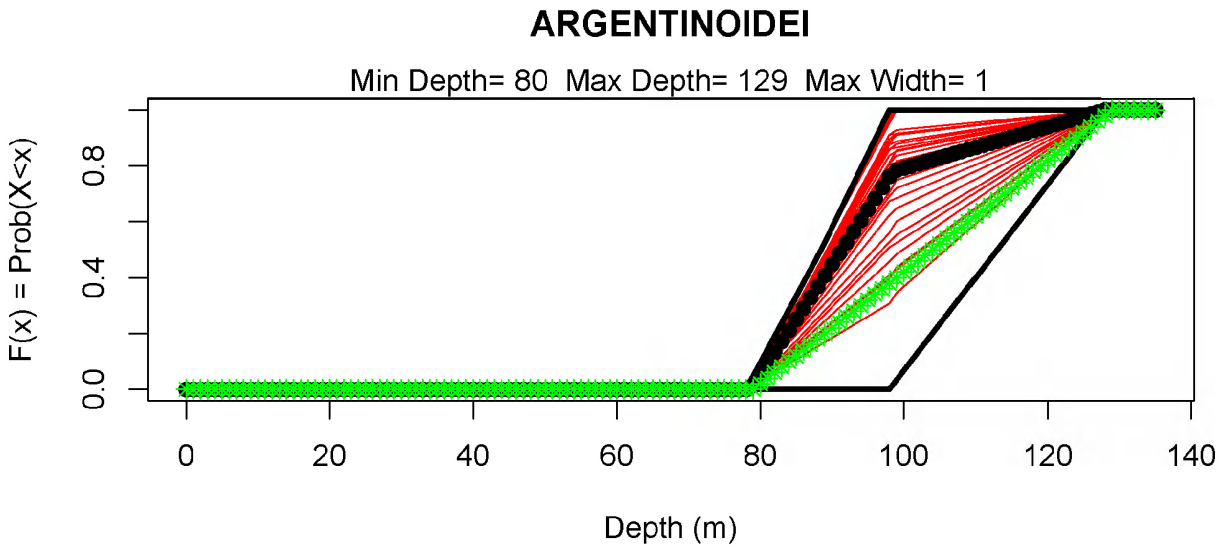

LOBIANCHIA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

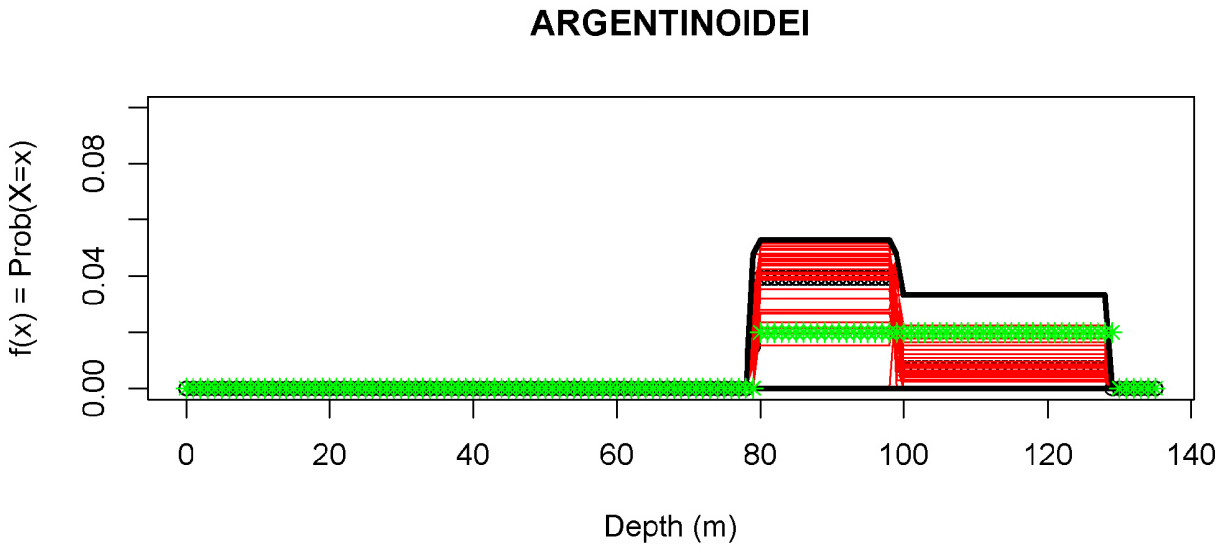

EUTHYNNUS.ALLETTERATUS
Min Depth= 0 Max Depth= 61 Max Width= 0.234751690851677
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


EUTHYNNUS.ALLETTERATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

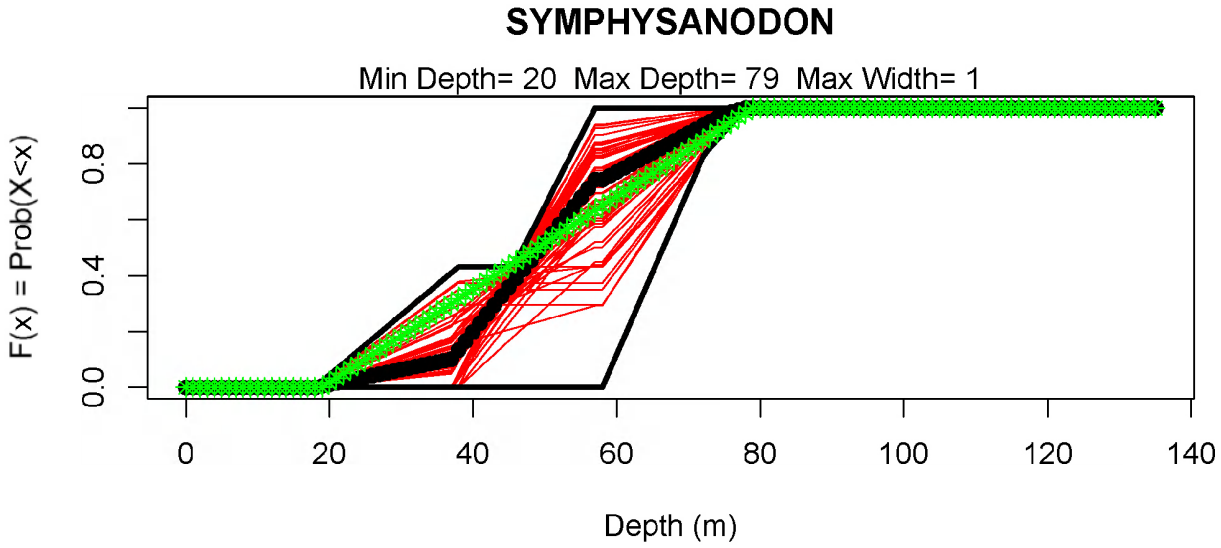

LUTJANUS
Min Depth= 0 Max Depth= 129 Max Width= 0.383390435656208
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

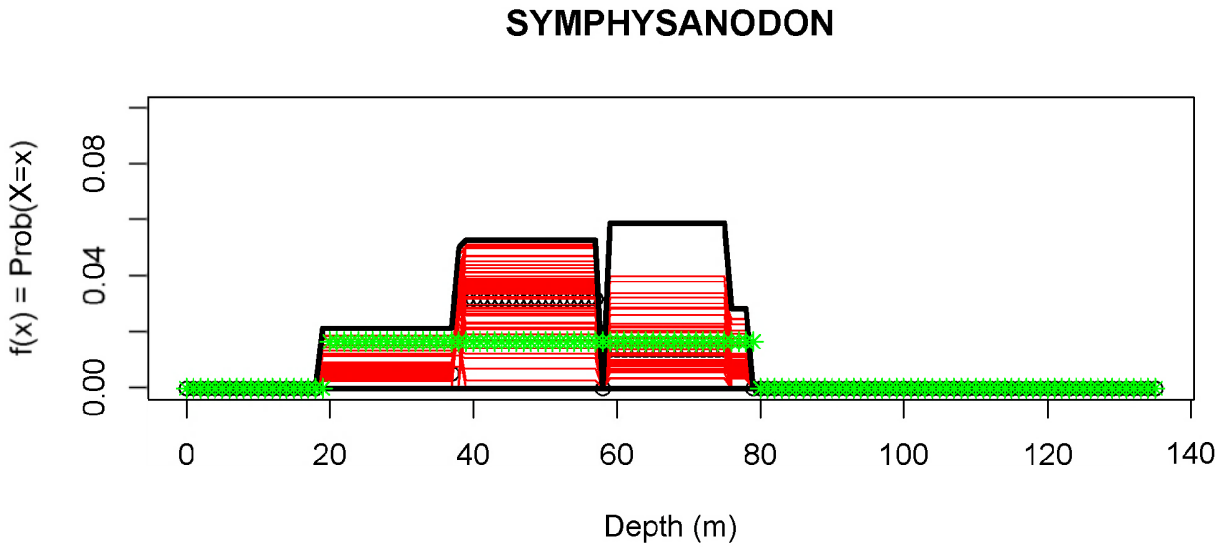

LUTJANUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

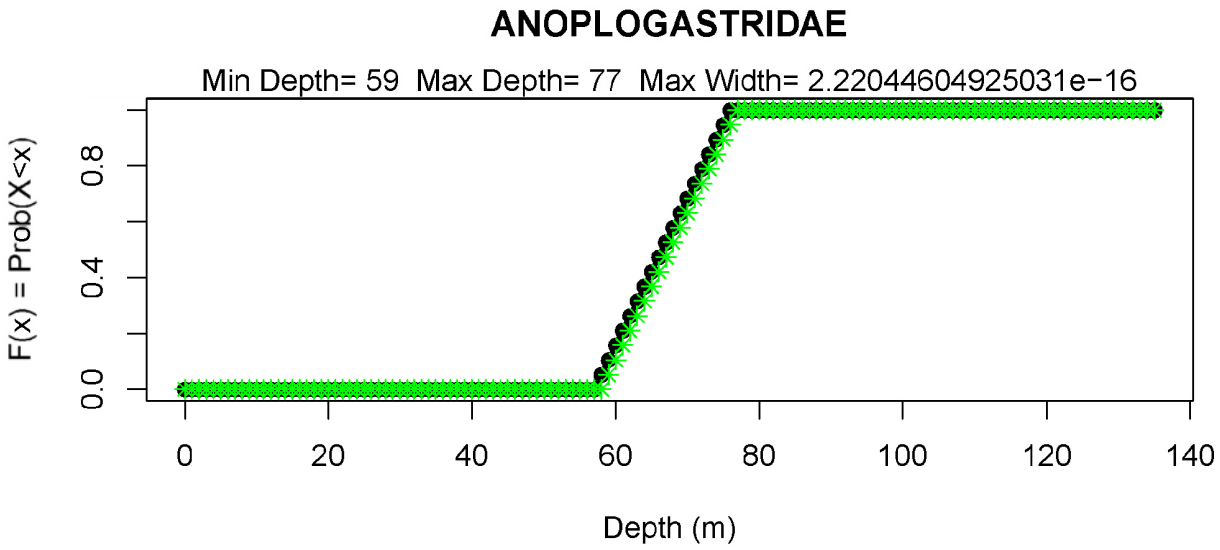


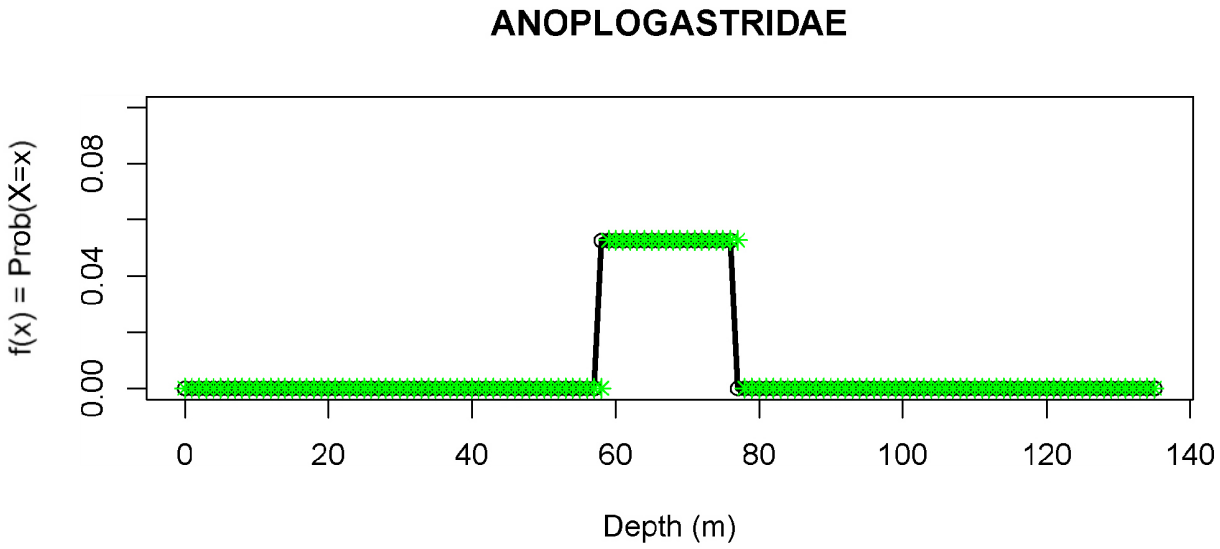


DWH-AR0196269

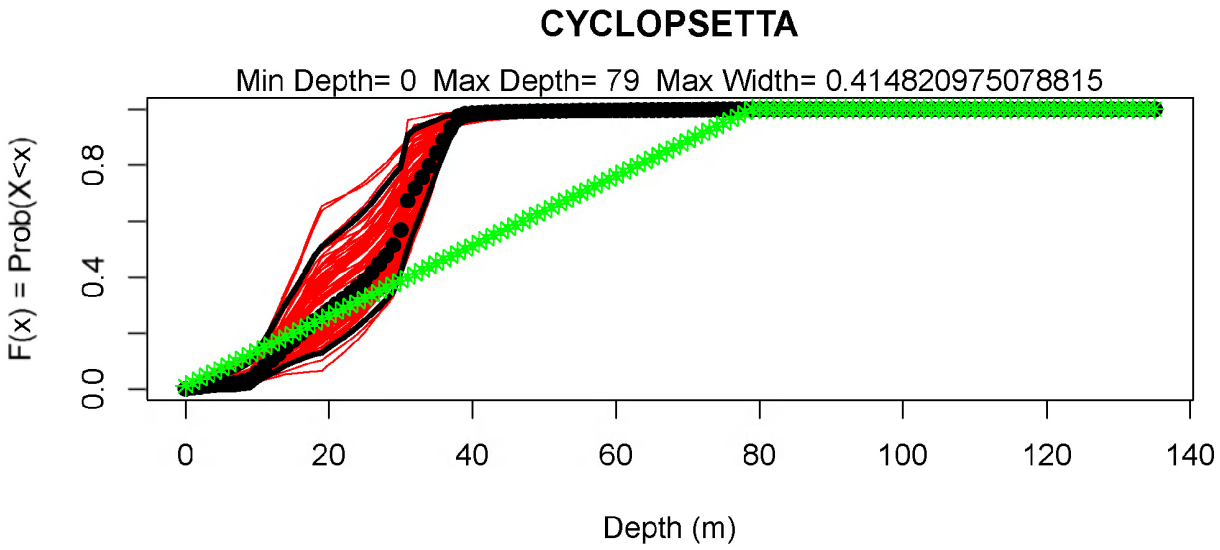

SYMPHYSANODON
Min Depth= 20 Max Depth= 79 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

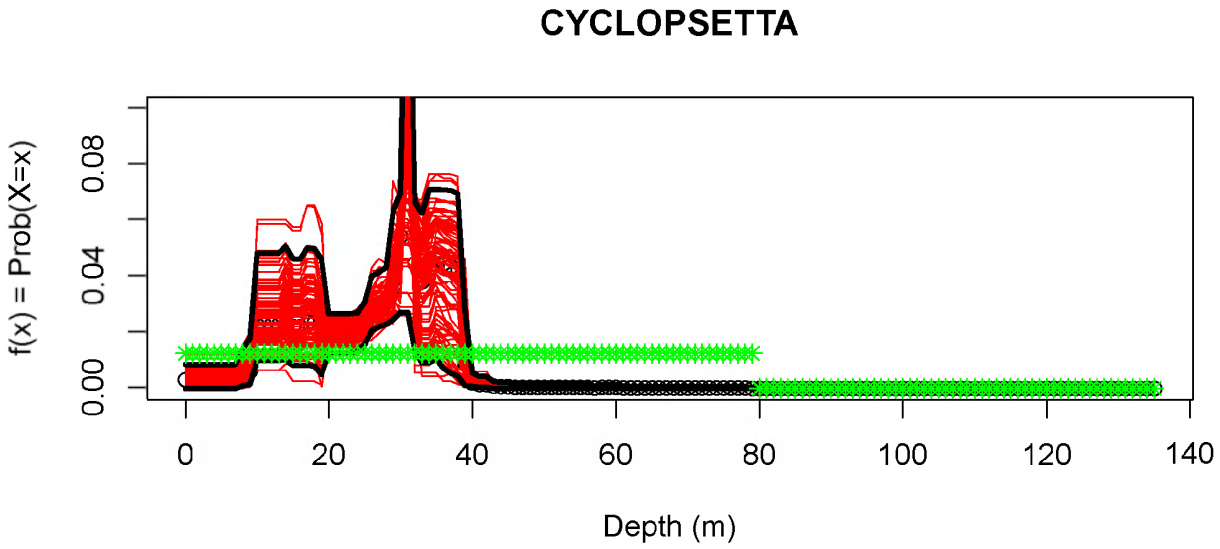

SYMPHYSANODON
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

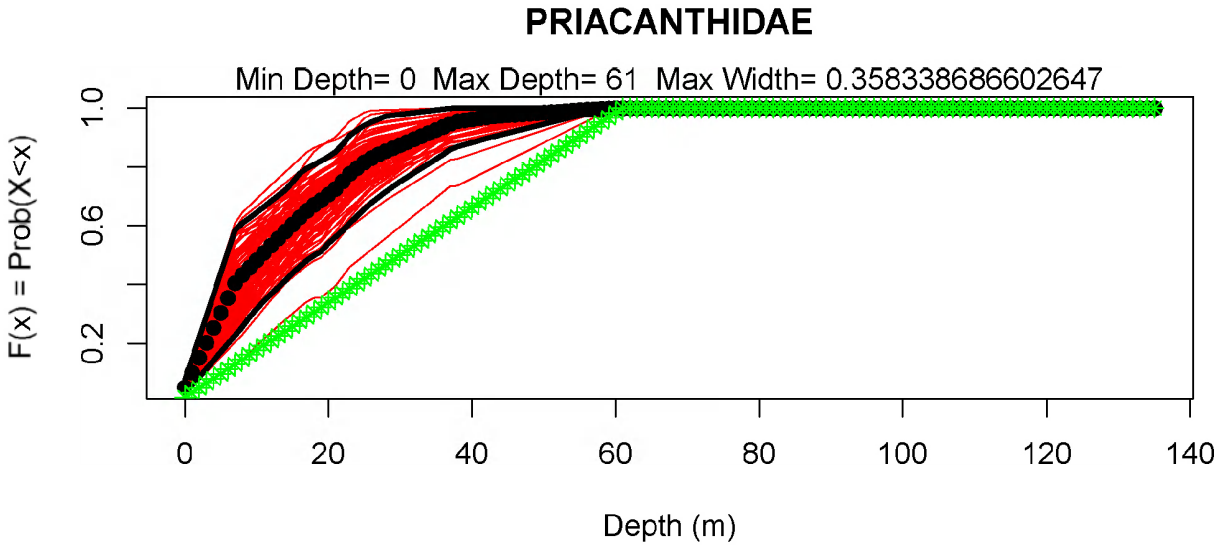


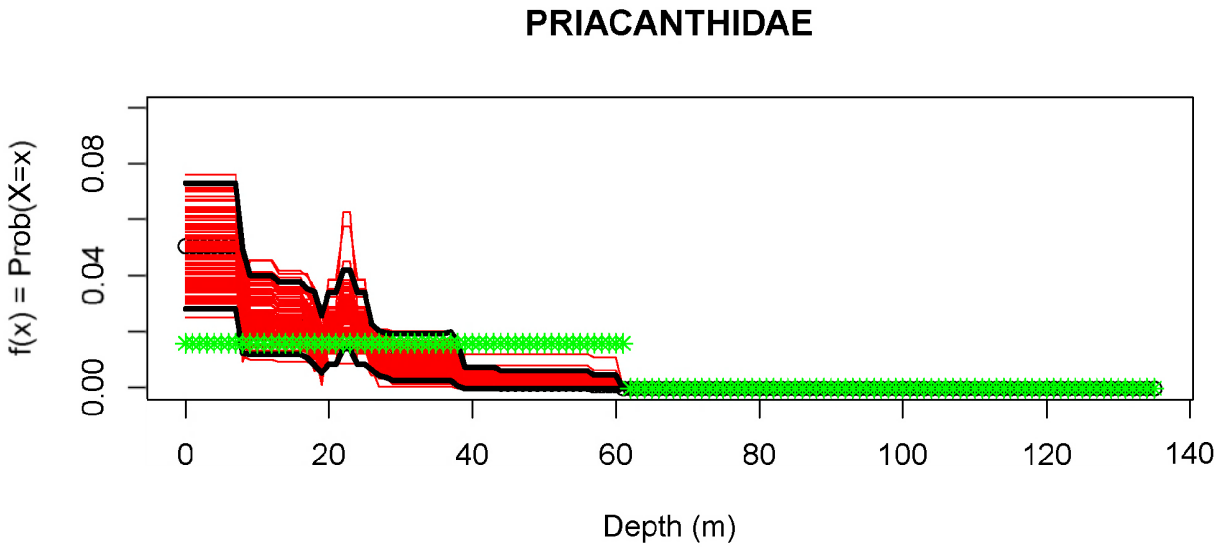


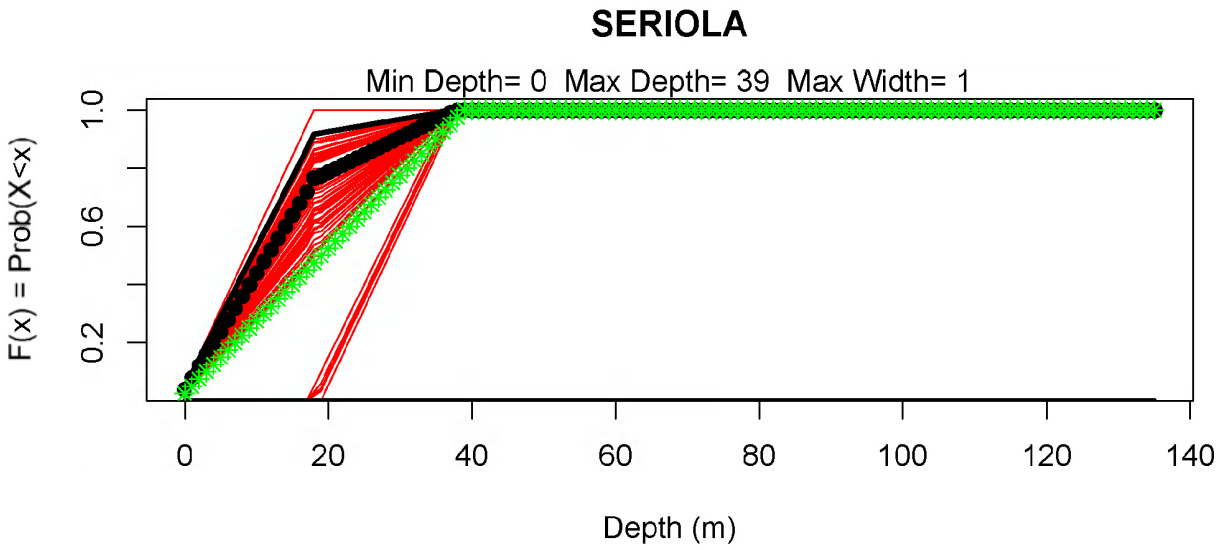
DWH-AR0196271

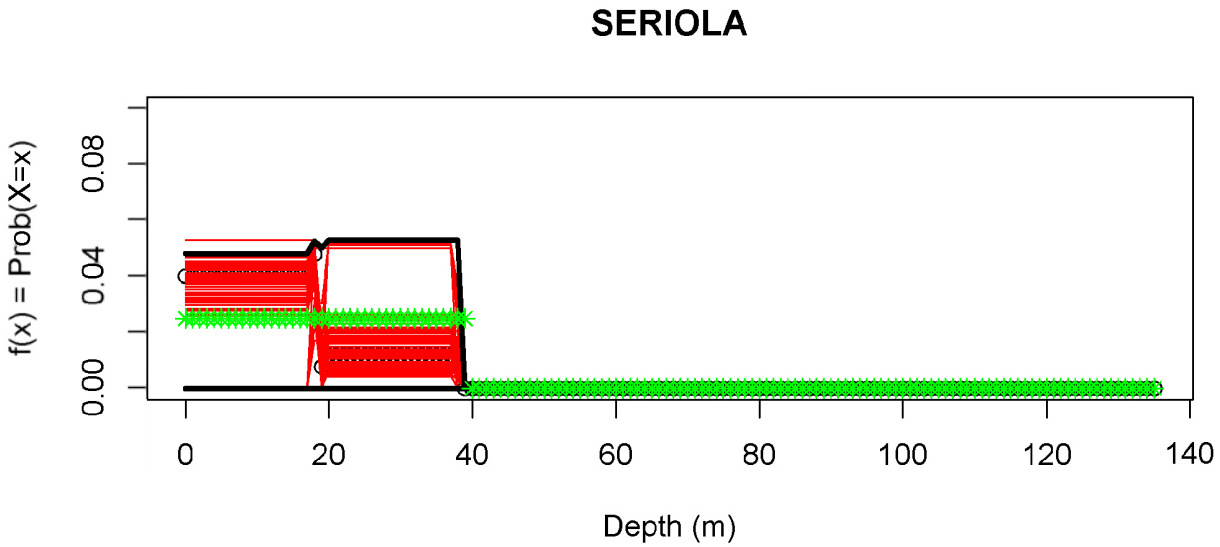

CYCLOPSETTA
Min Depth= 0 Max Depth= 79 Max Width= 0.414820975078815
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

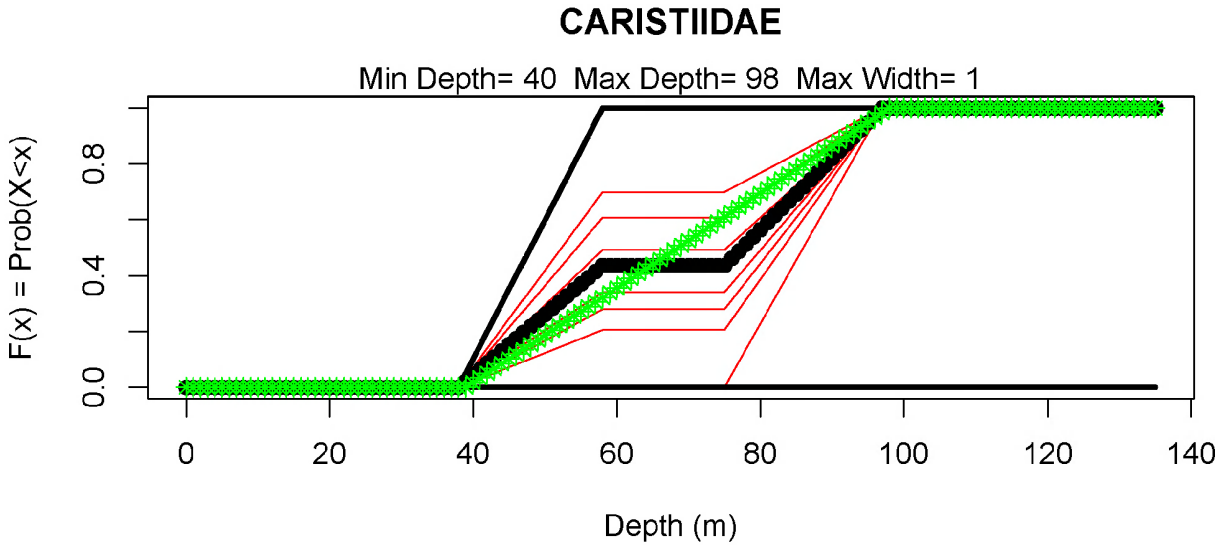

CYCLOPSETTA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

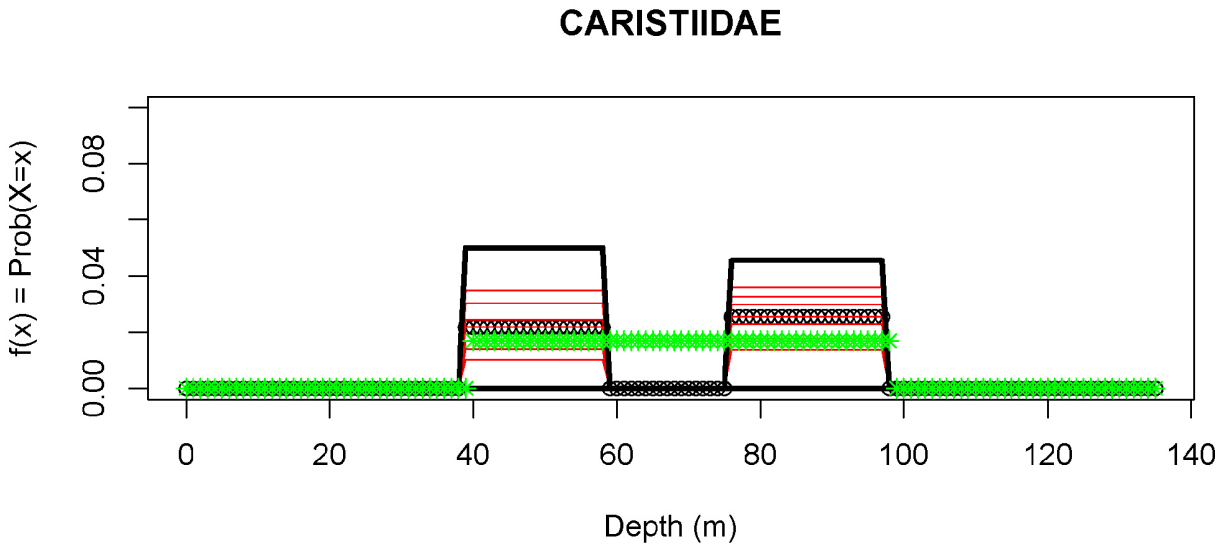

PRIACANTHIDAE
Min Depth= 0 Max Depth= 61 Max Width= 0.358338686602647
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

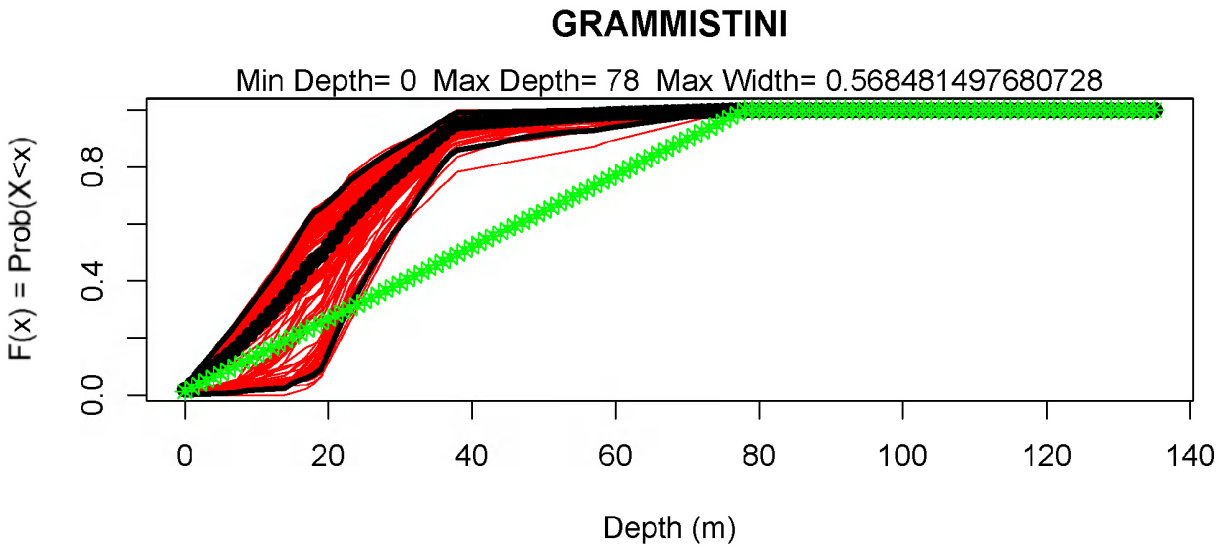

PRIACANTHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

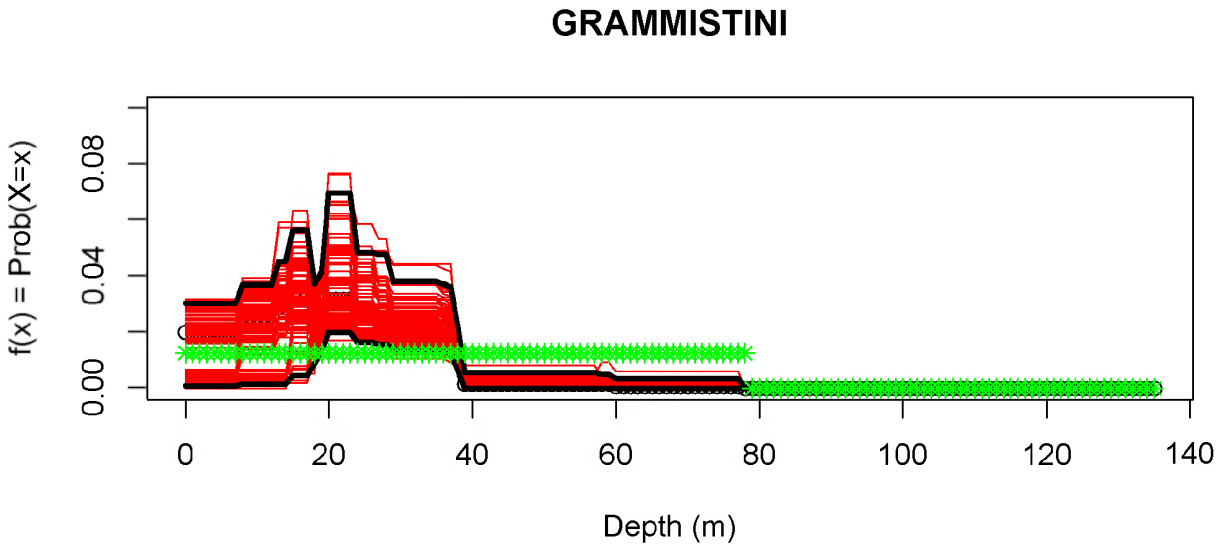

SERIOLA
Min Depth= 0 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

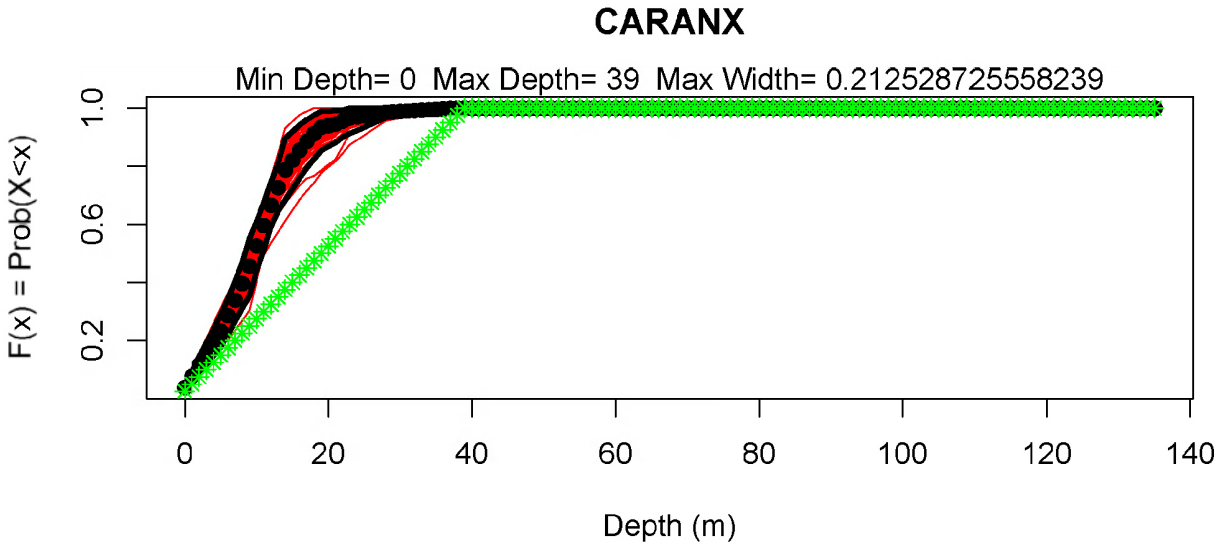

SERIOLA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

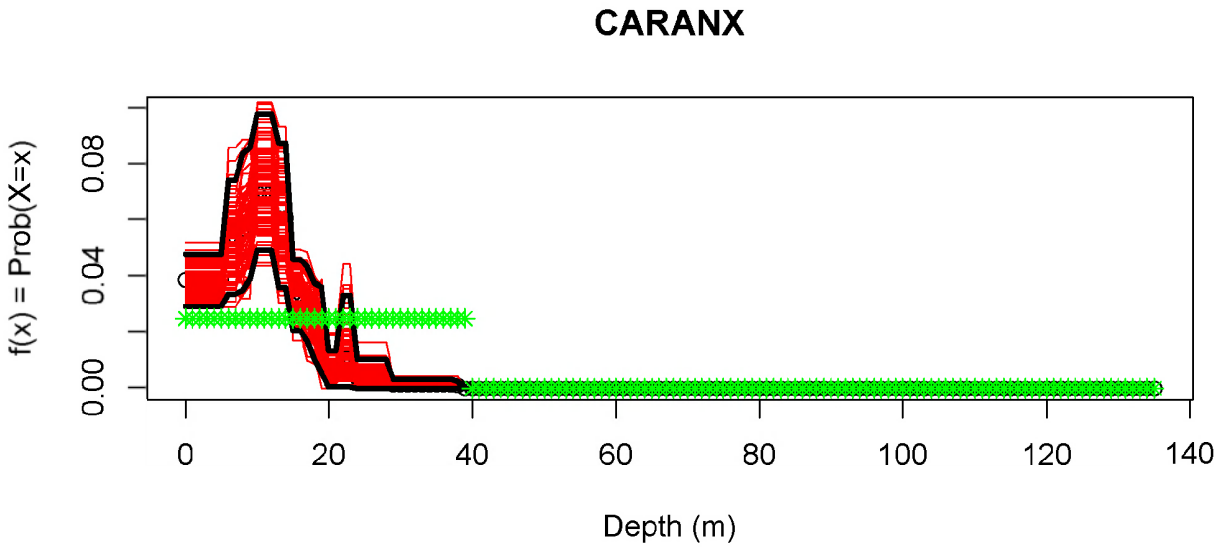

CARISTIIDAE
Min Depth= 40 Max Depth= 98 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

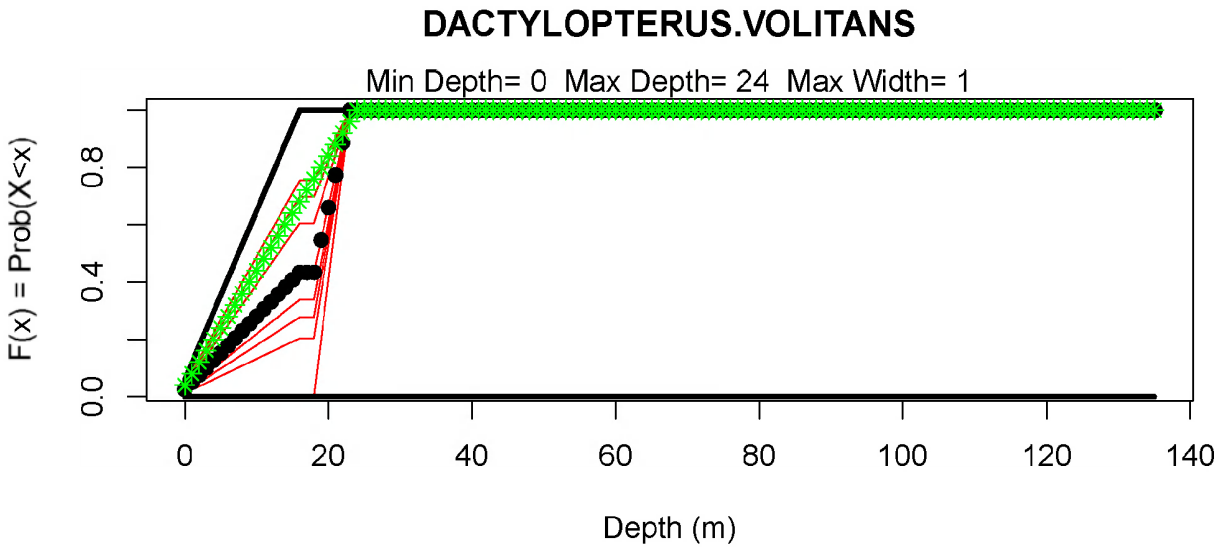

CARISTIIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

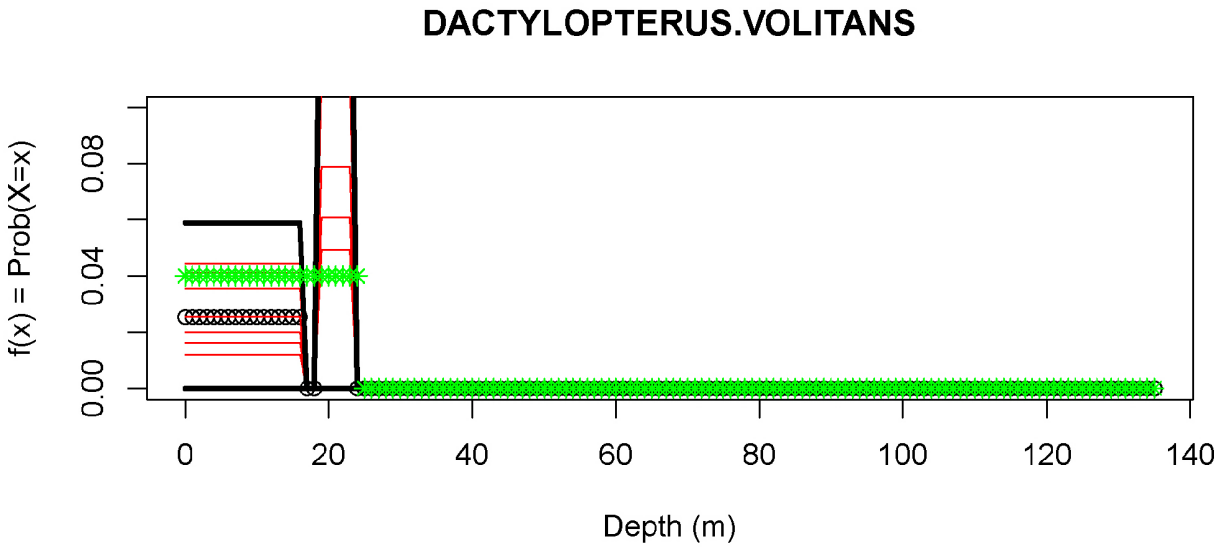

GRAMMISTINI
Min Depth= 0 Max Depth= 78 Max Width= 0.568481497680728
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

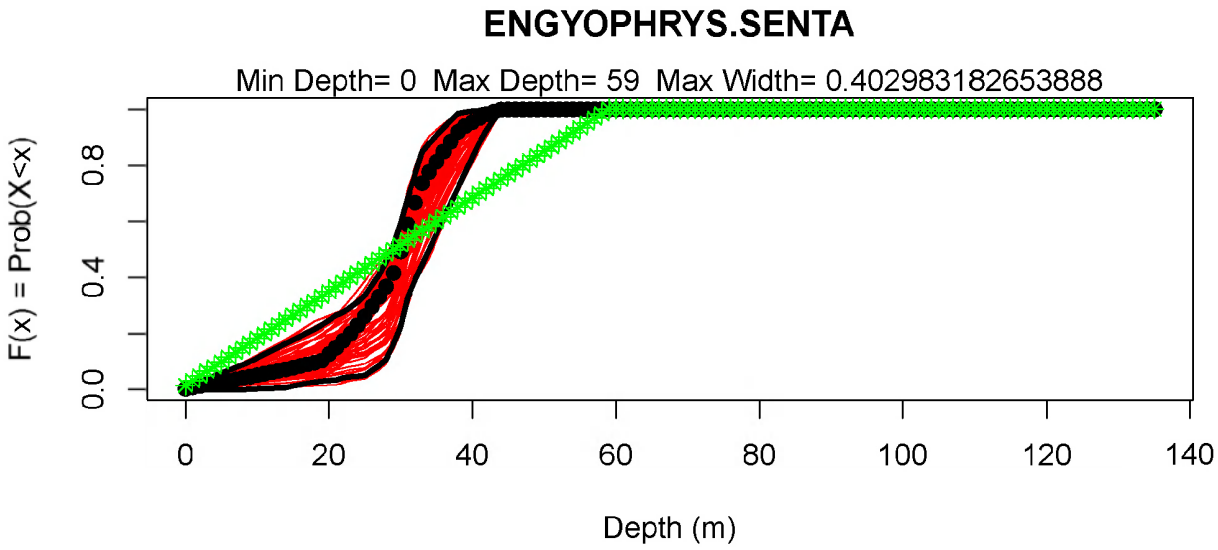

GRAMMISTINI
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

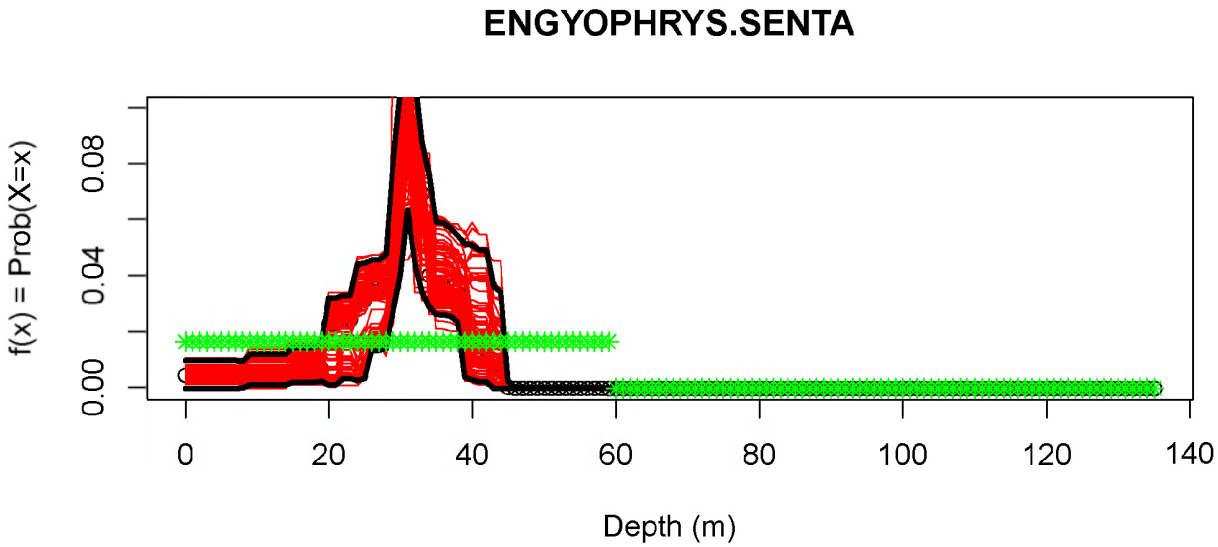

CARANX
Min Depth= 0 Max Depth= 39 Max Width= 0.212528725558239
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)


CARANX
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

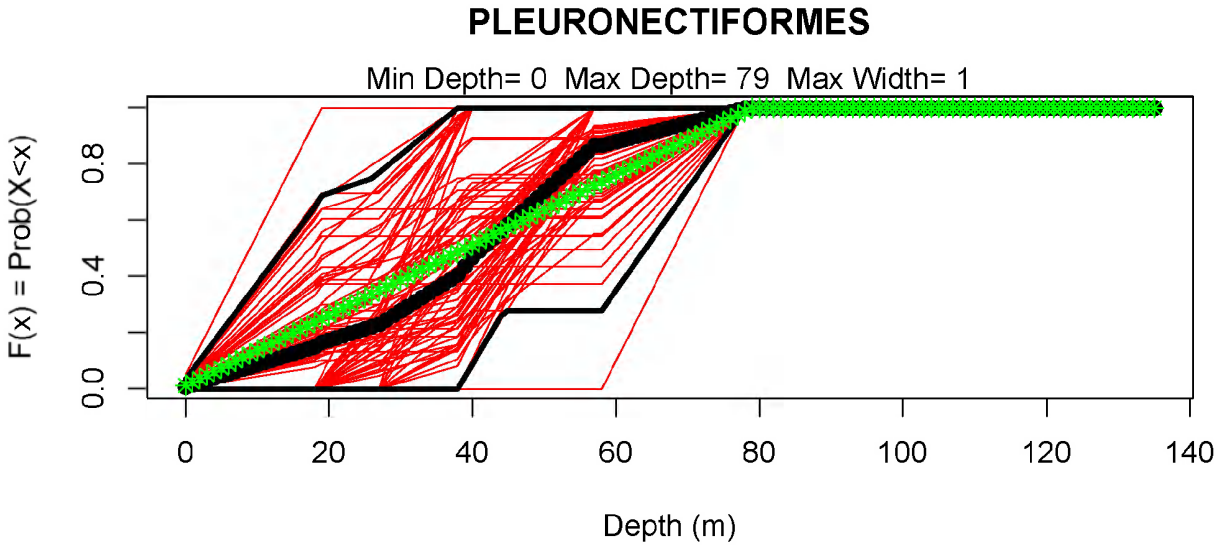

DACTYLOPTERUS.VOLITANS
Min Depth= 0 Max Depth= 24 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

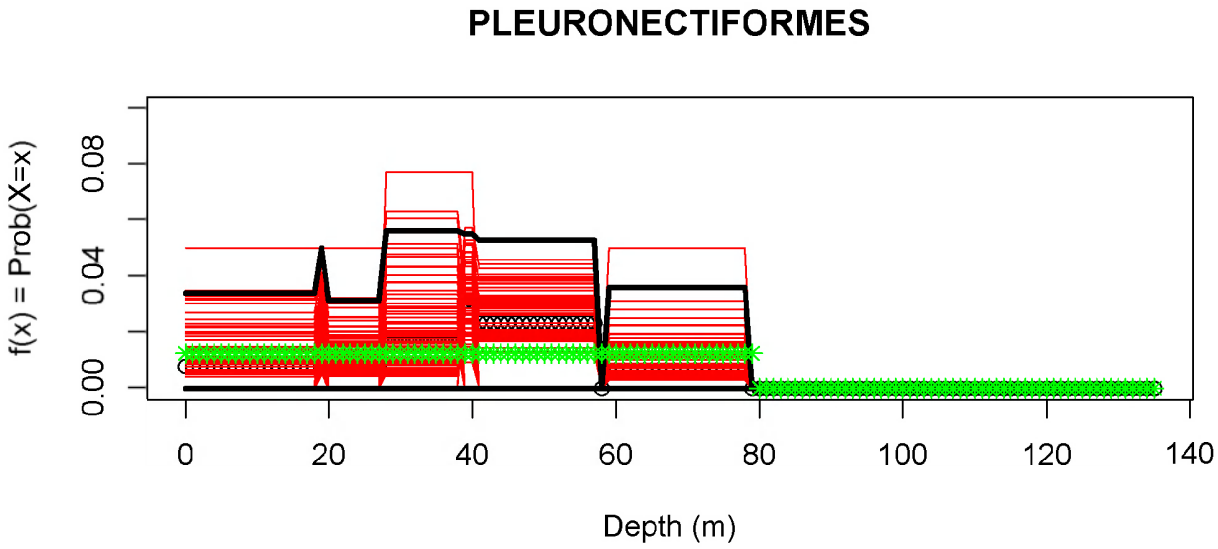

DACTYLOPTERUS.VOLITANS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

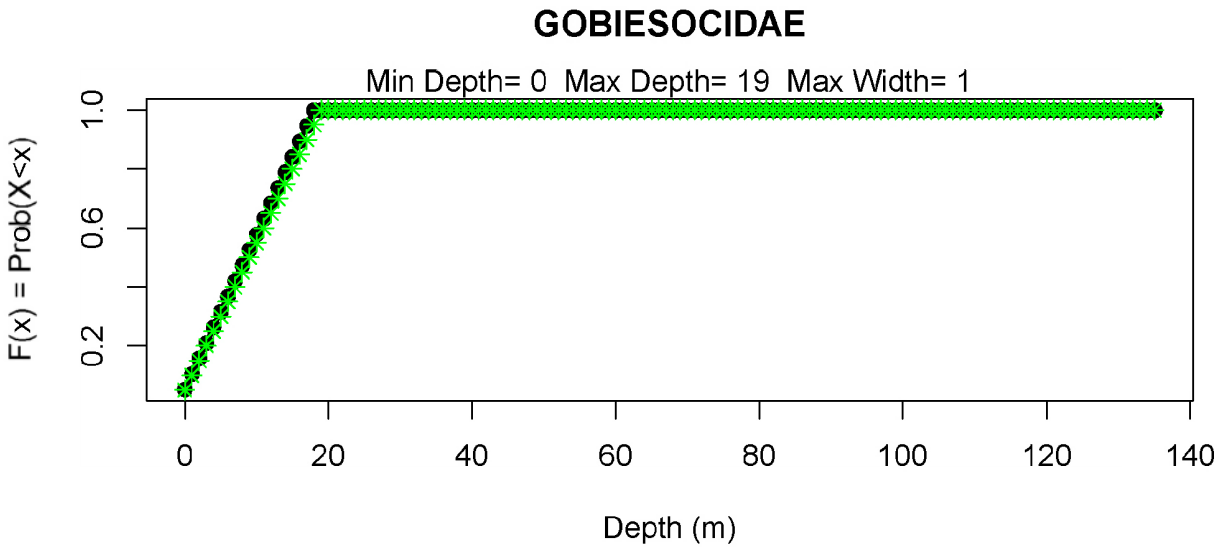


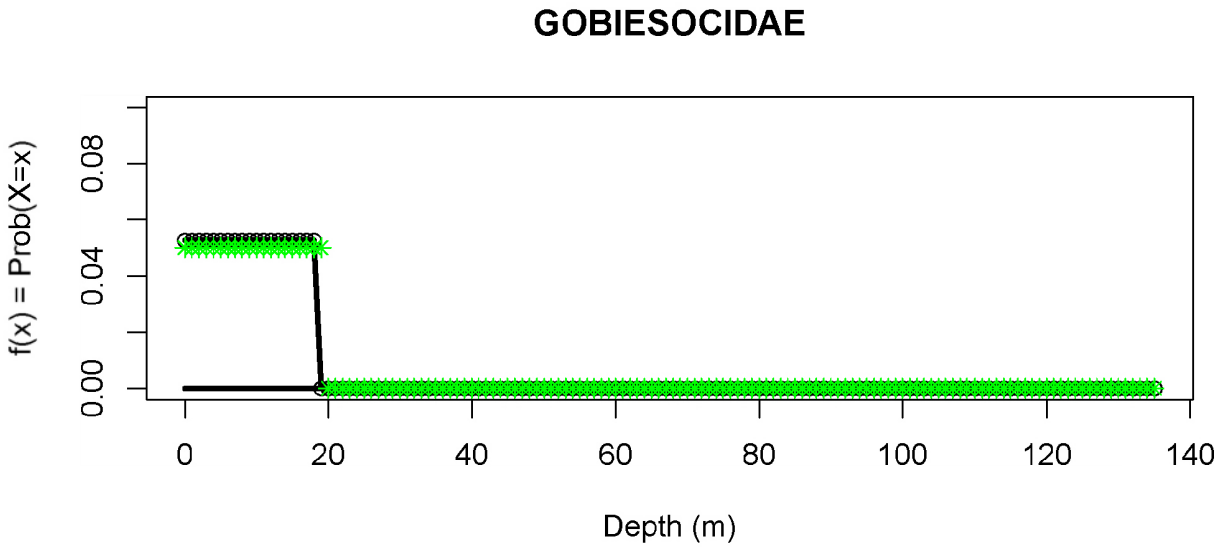


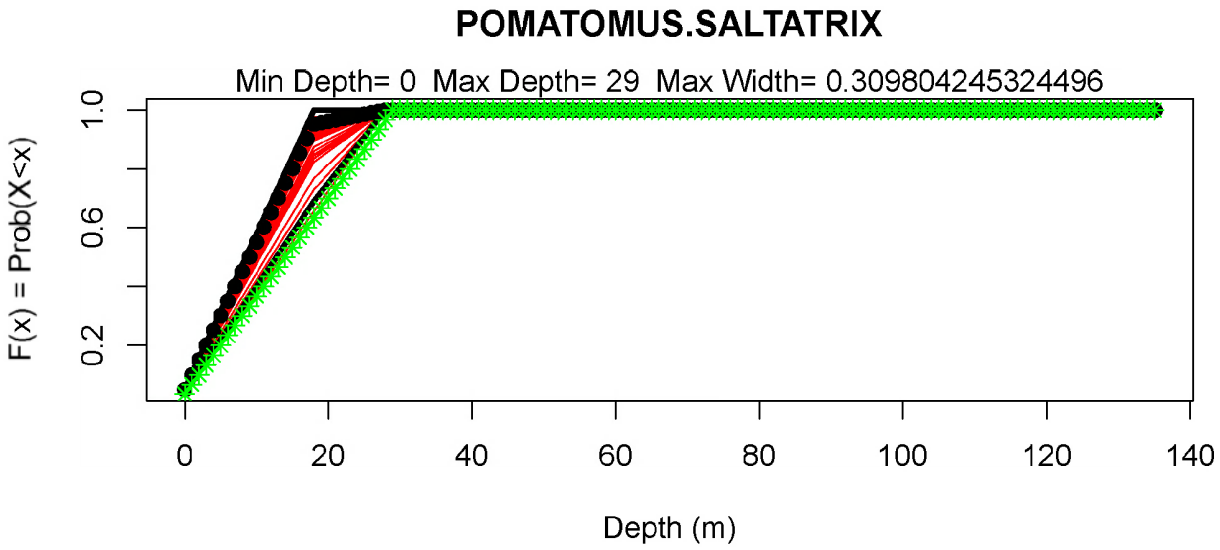
DWH-AR0196279

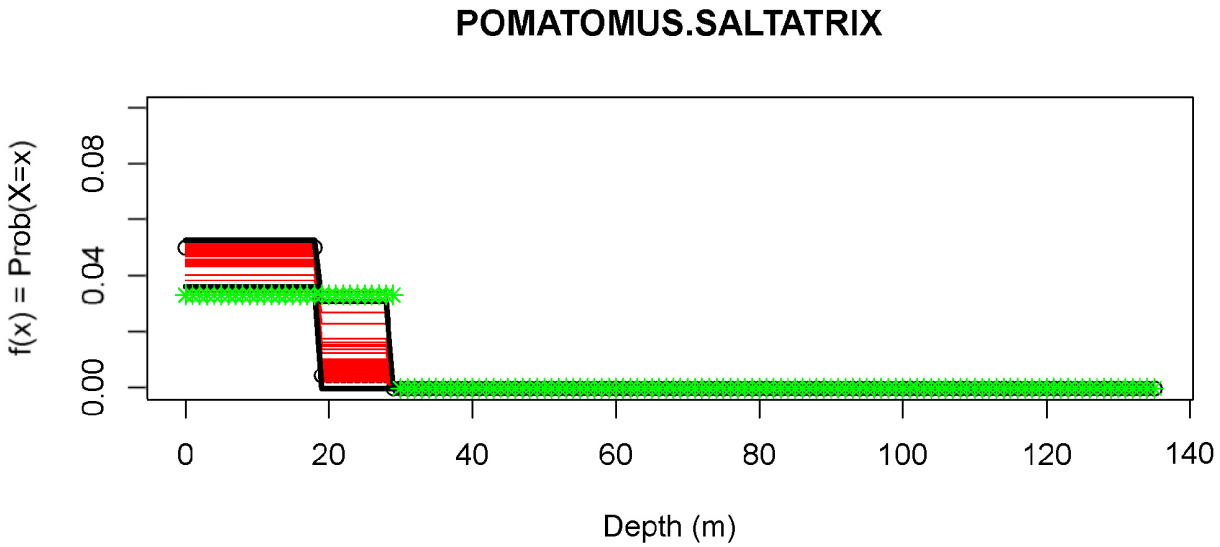

PLEURONECTIFORMES
Min Depth= 0 Max Depth= 79 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

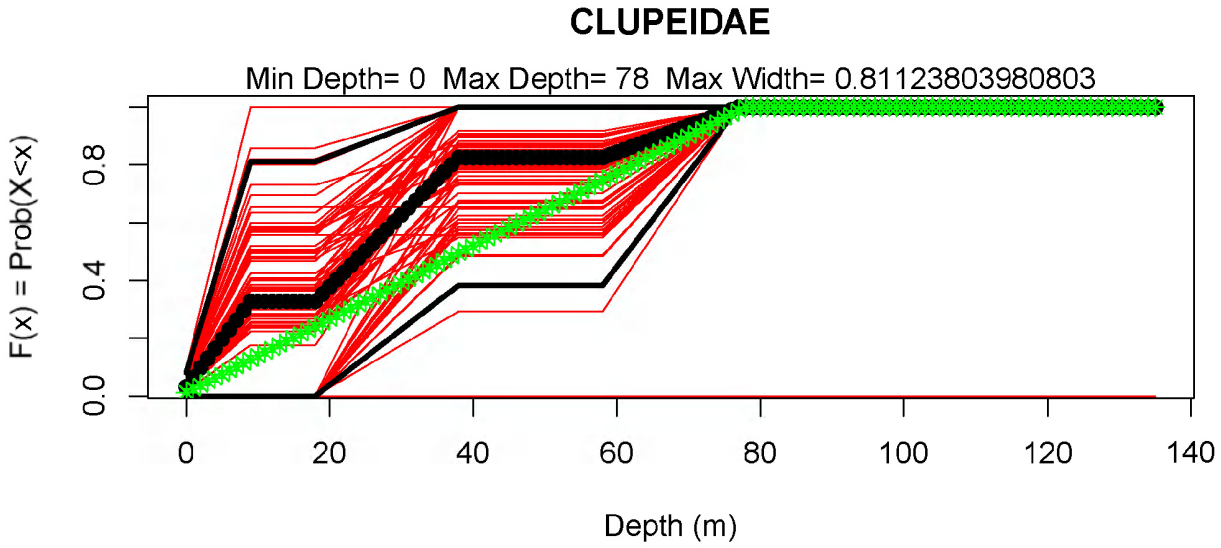

PLEURONECTIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

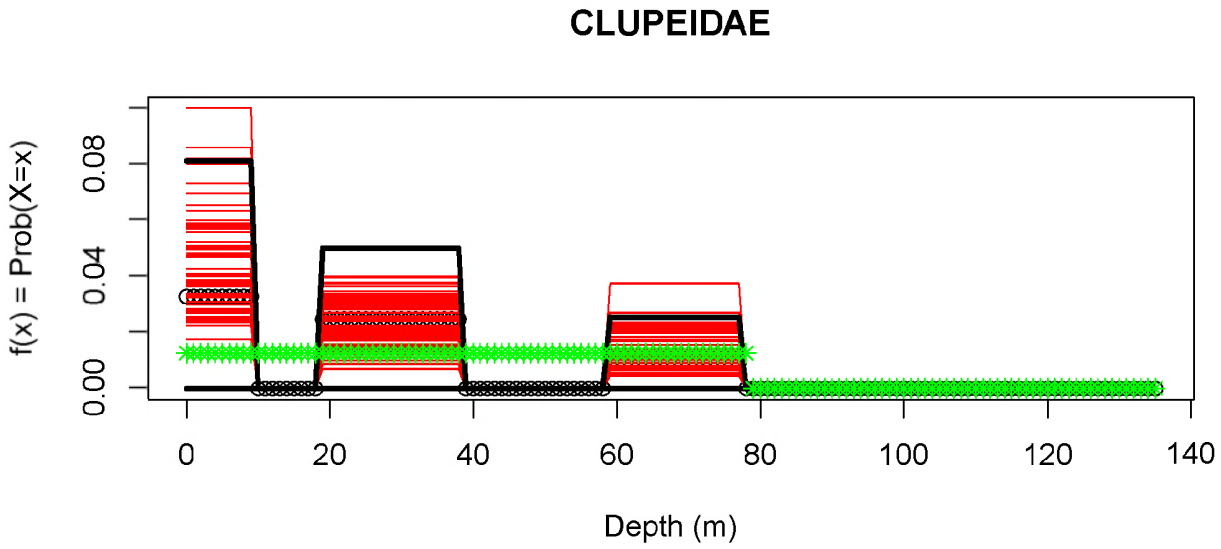

GOBIESOCIDAE
Min Depth= 0 Max Depth= 19 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

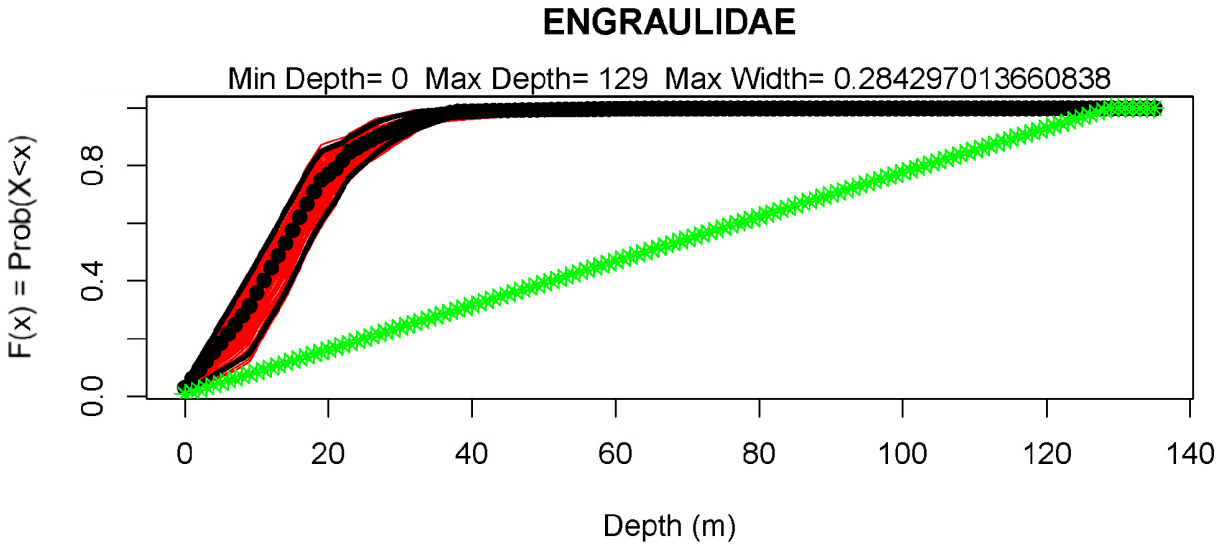

GOBIESOCIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

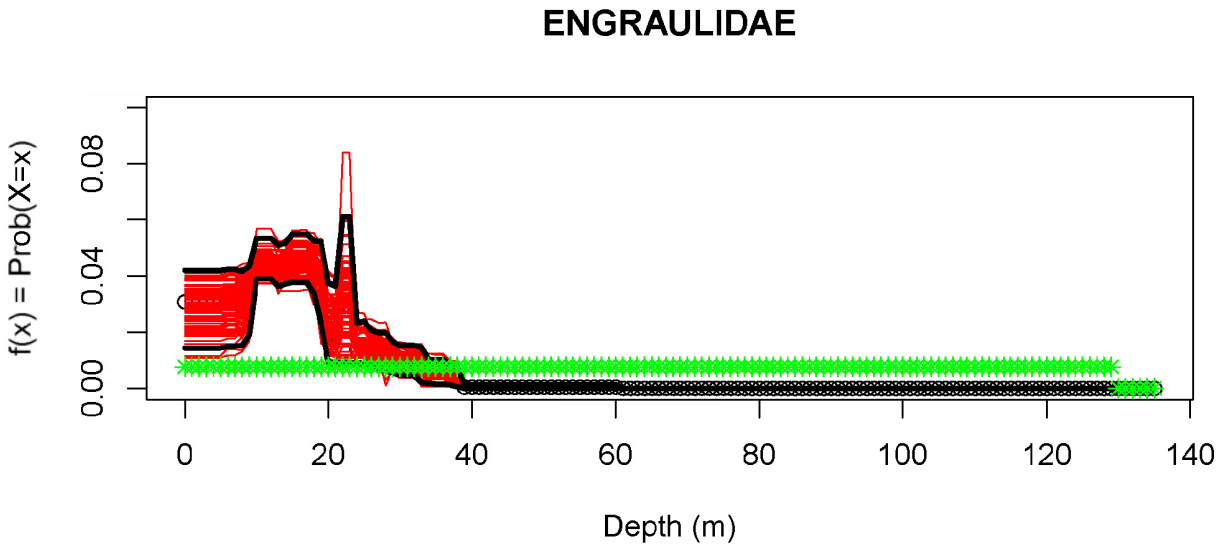

POMATOMUS.SALTATRIX
Min Depth= 0 Max Depth= 29 Max Width= 0.309804245324496
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

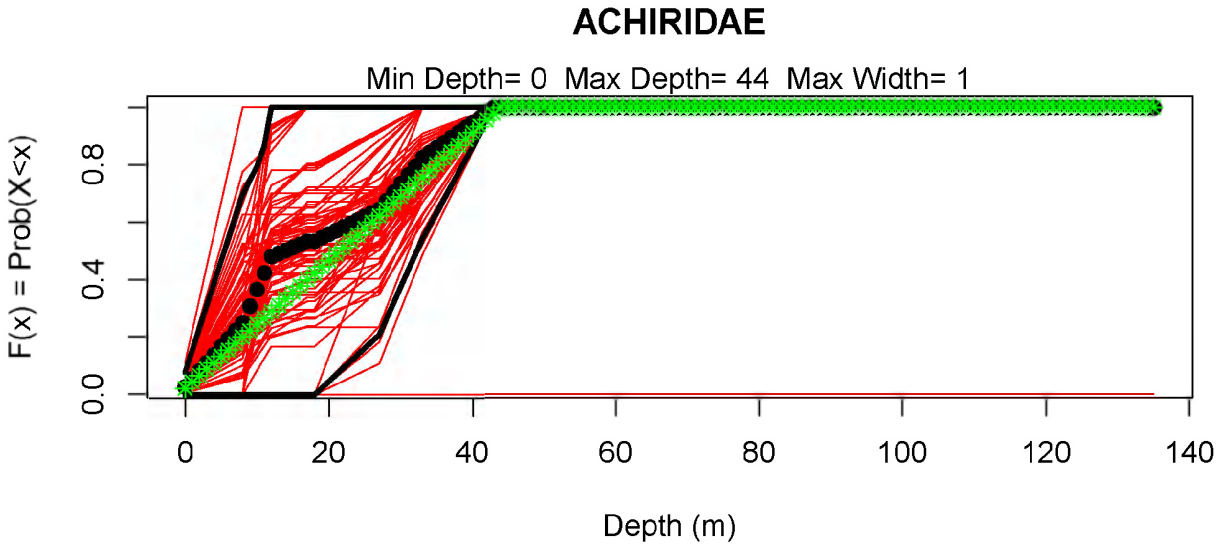

POMATOMUS.SALTATRIX
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

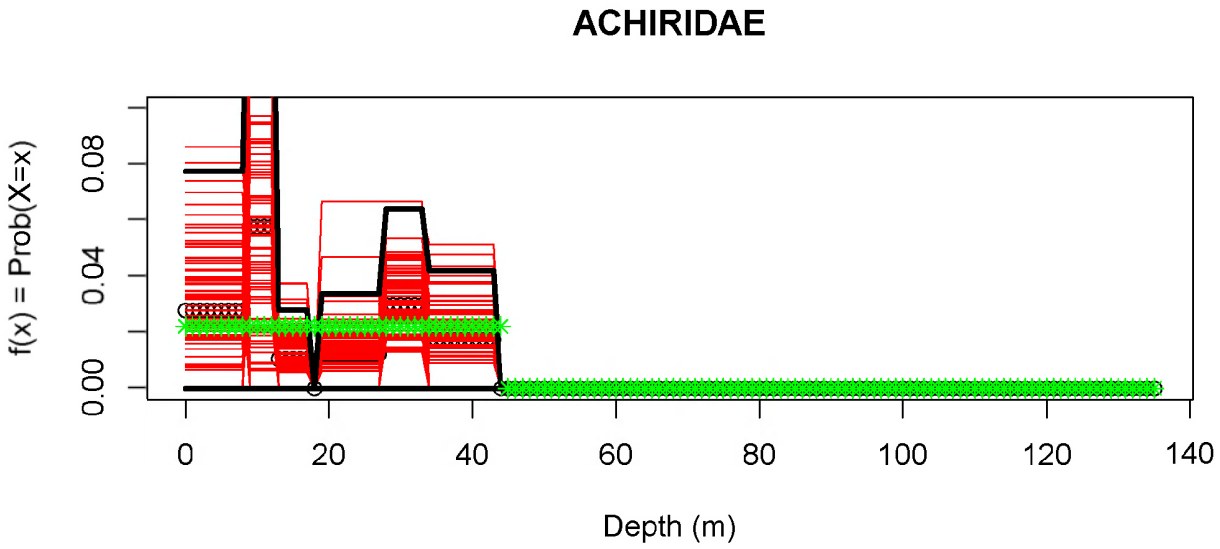

CLUPEIDAE
Min Depth= 0 Max Depth= 78 Max Width= 0.81123803980803
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

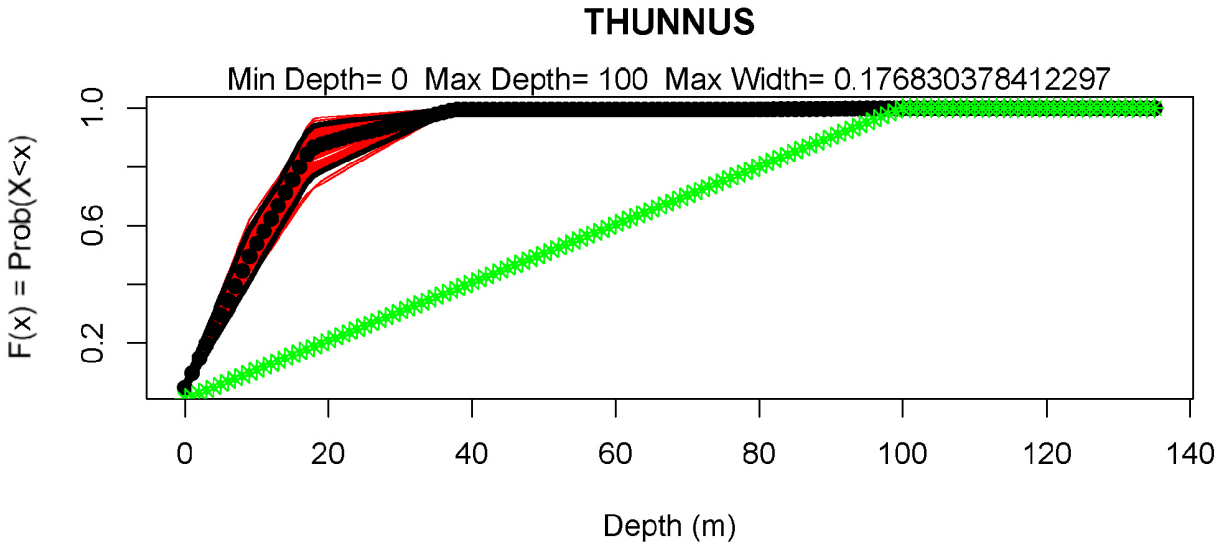

CLUPEIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

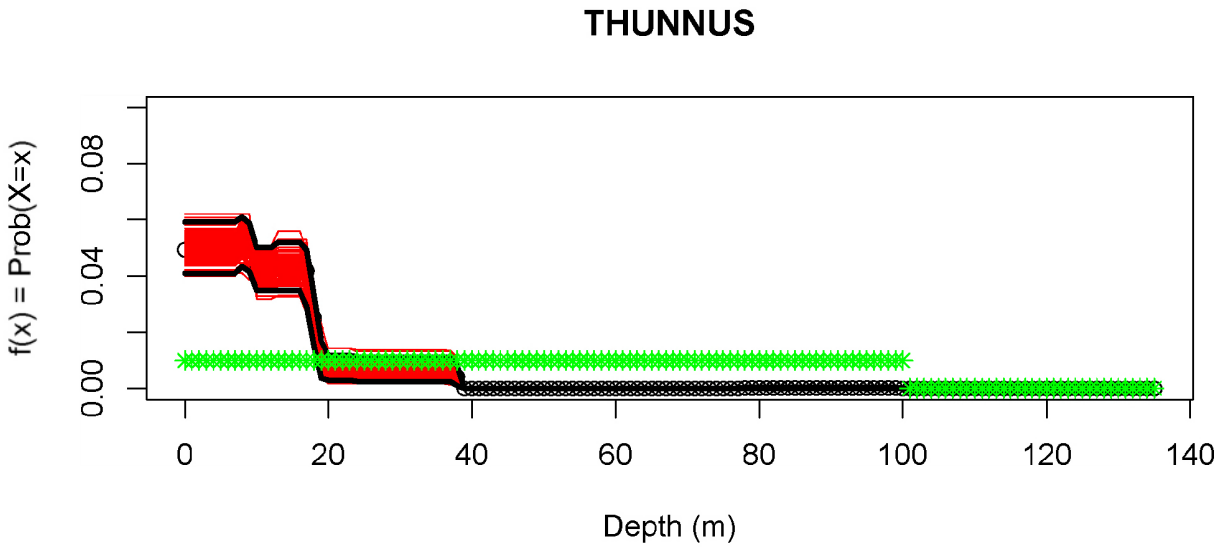

ENGRAULIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.284297013660838
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

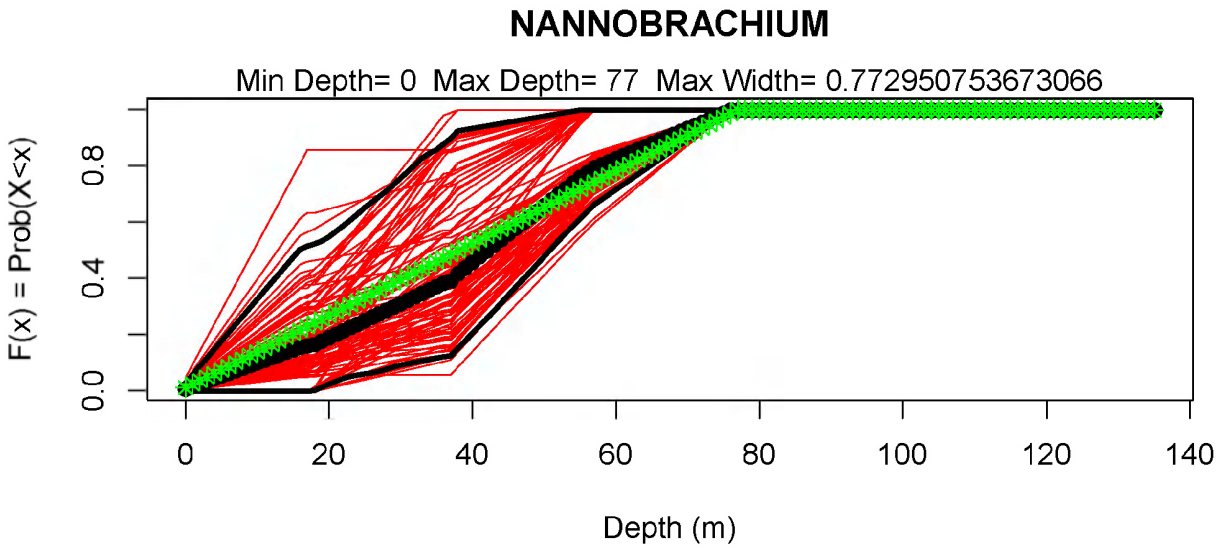

ENGRAULIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

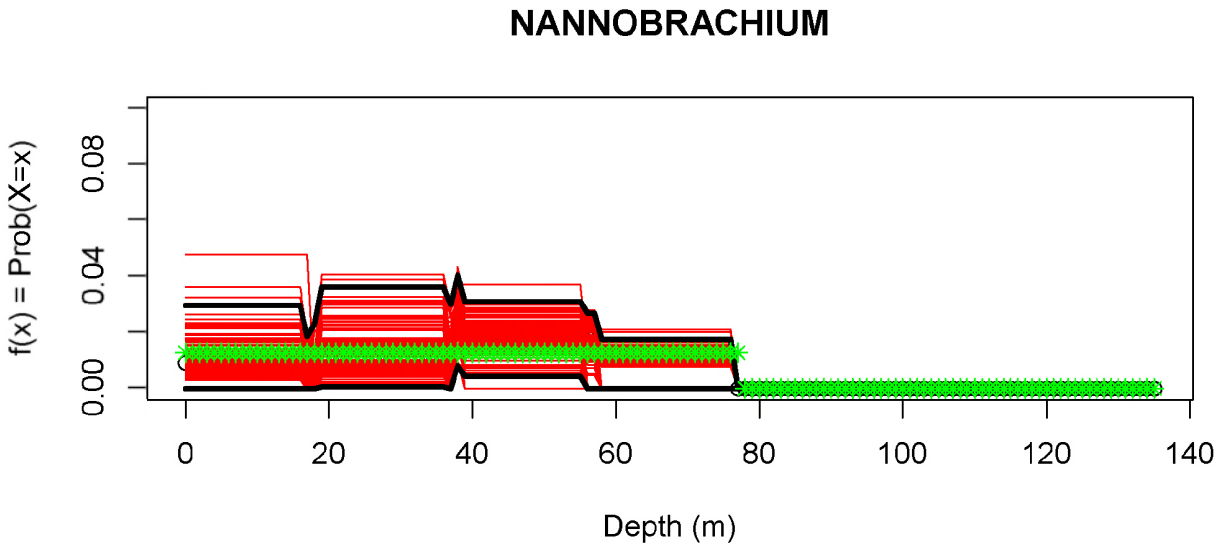

ACHIRIDAE
Min Depth= 0 Max Depth= 44 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

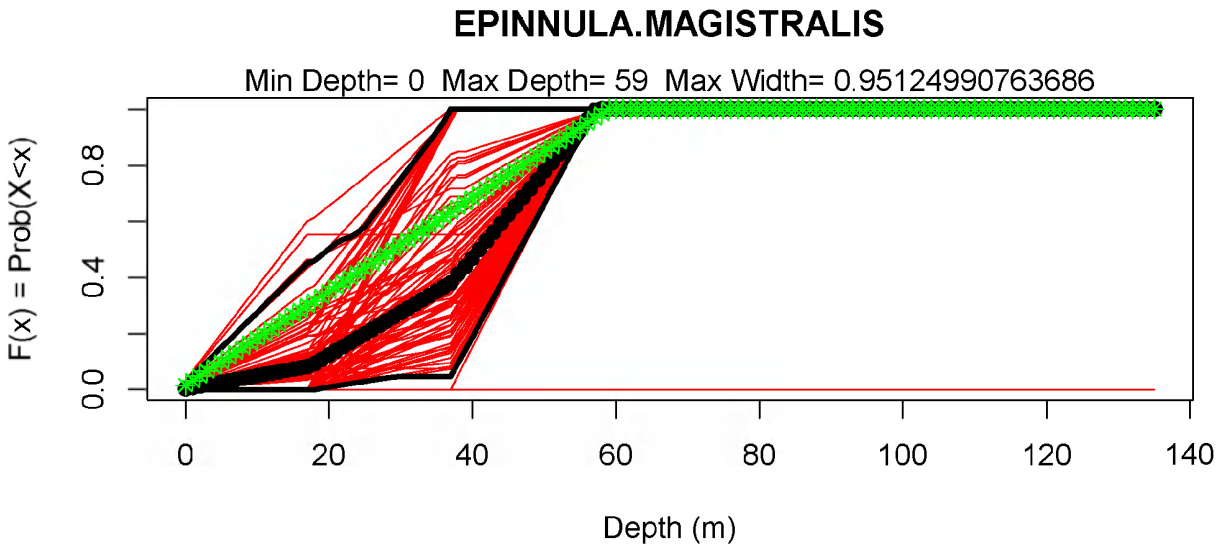

ACHIRIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

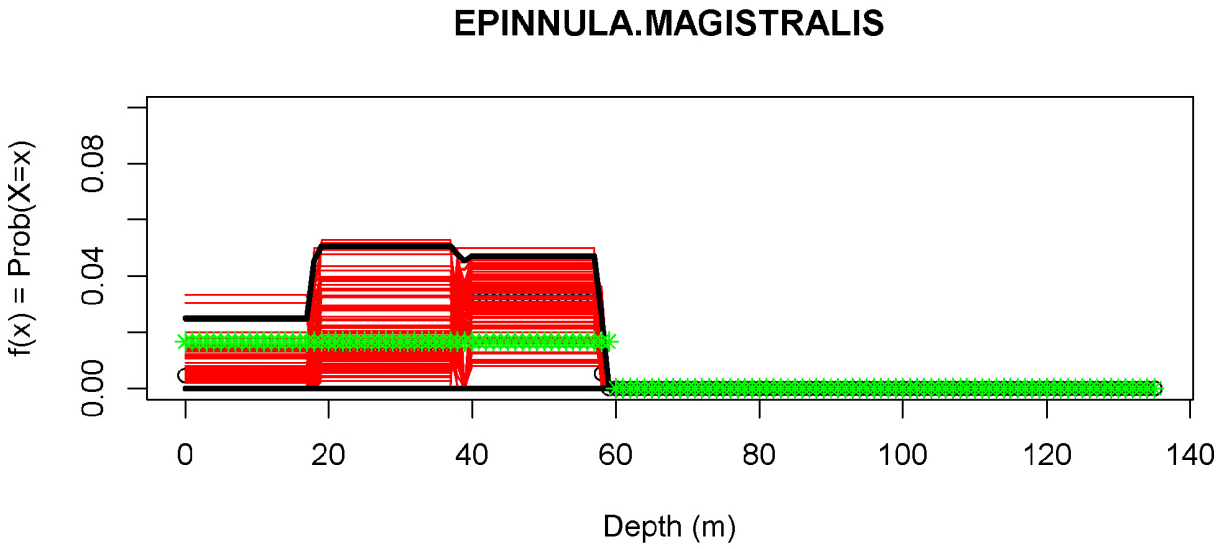

THUNNUS
Min Depth= 0 Max Depth= 100 Max Width= 0.176830378412297
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

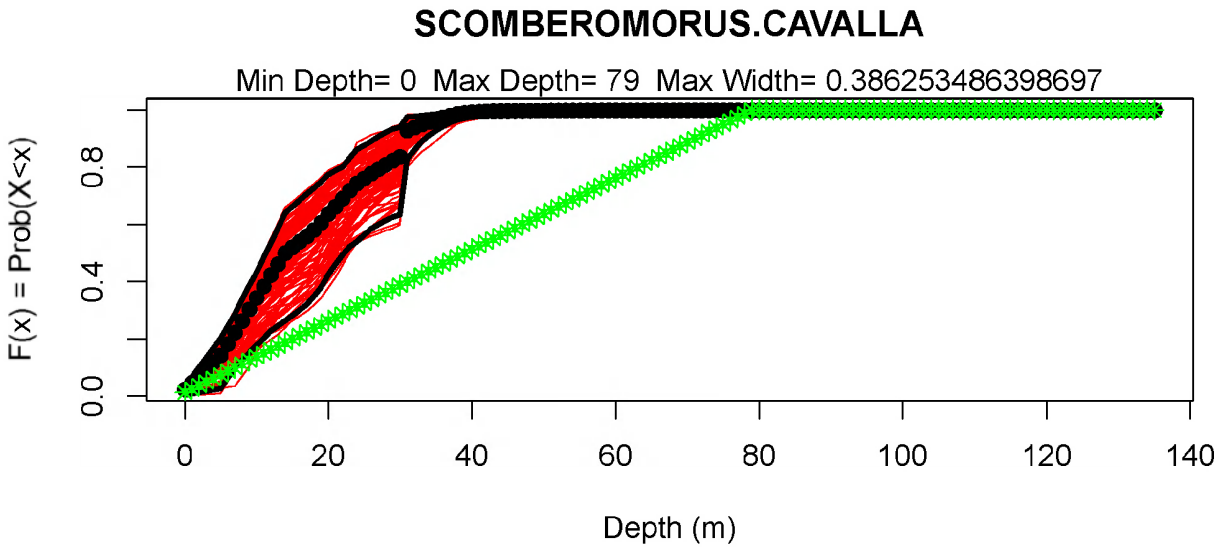

THUNNUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

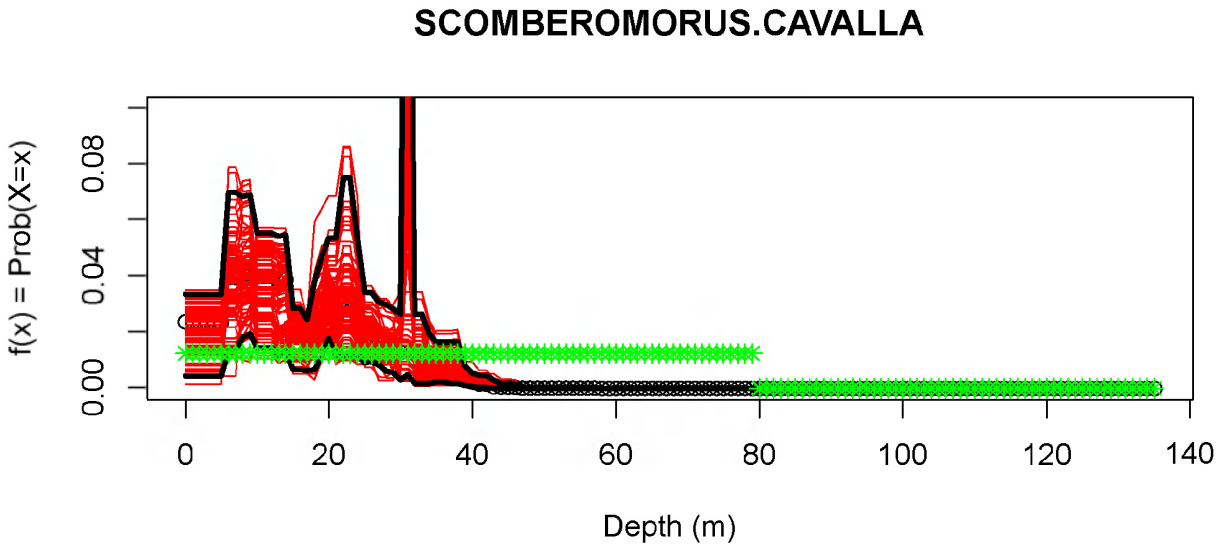

NANNOBRACHIUM
Min Depth= 0 Max Depth= 77 Max Width= 0.772950753673066
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

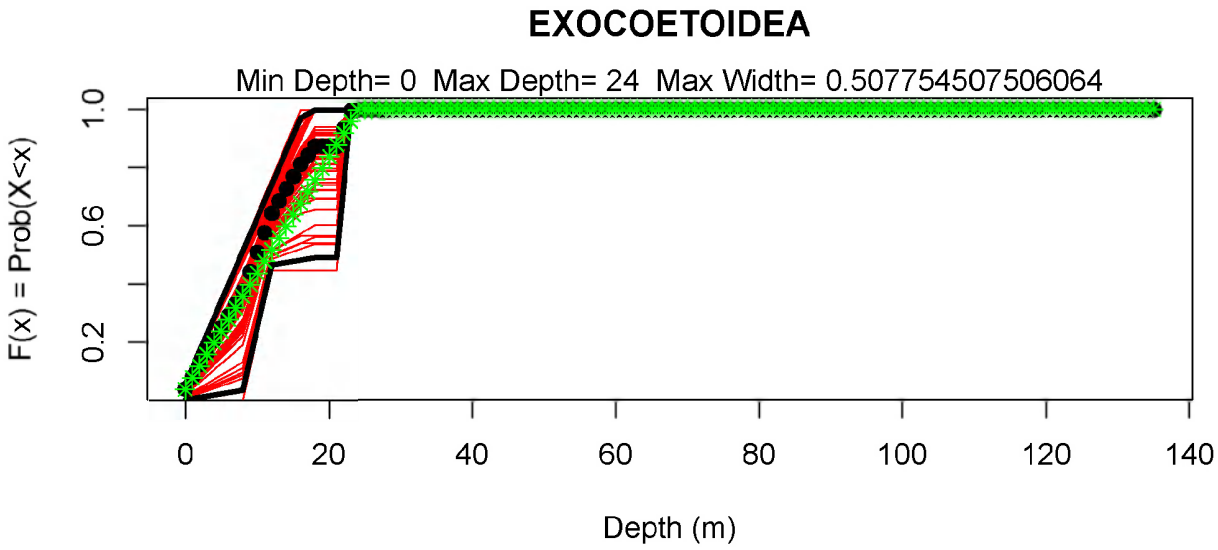

NANNOBRACHIUM
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

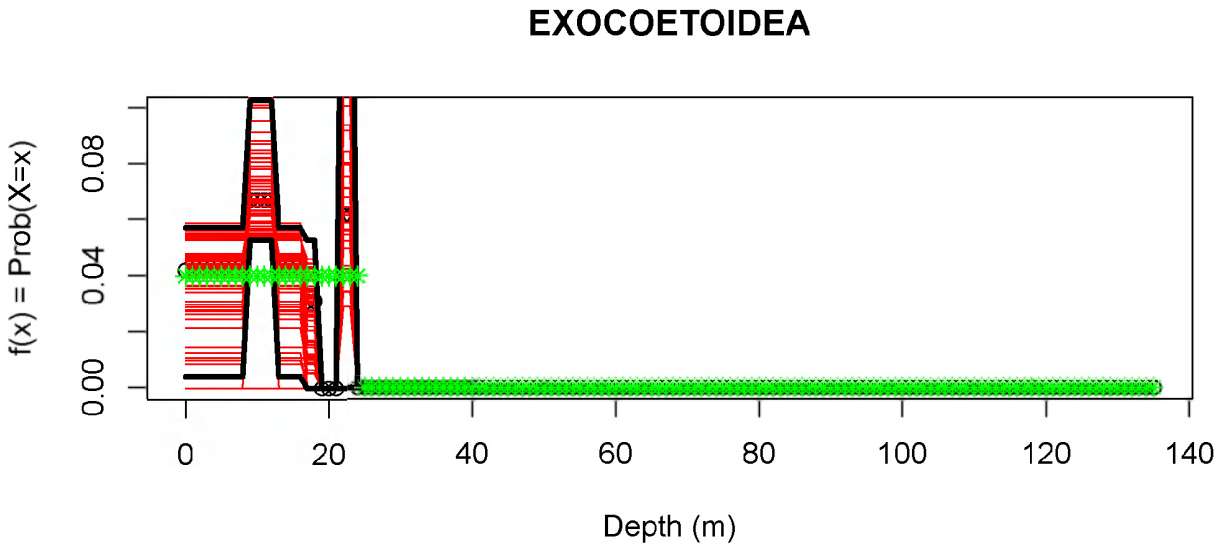

EPINNULA.MAGISTRALIS
Min Depth= 0 Max Depth= 59 Max Width= 0.95124990763686
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

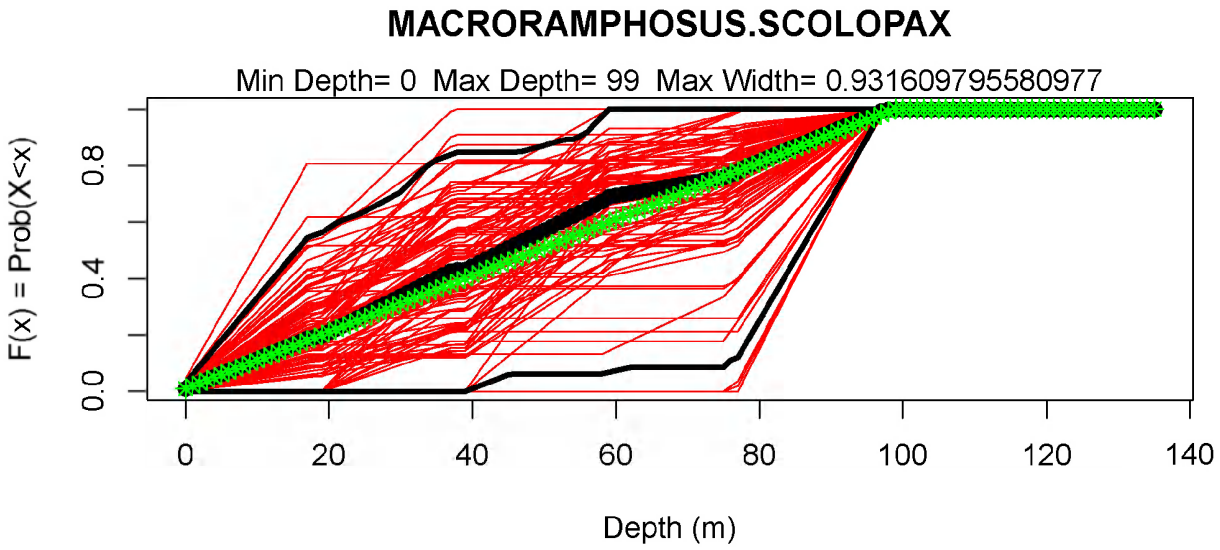

EPINNULA.MAGISTRALIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

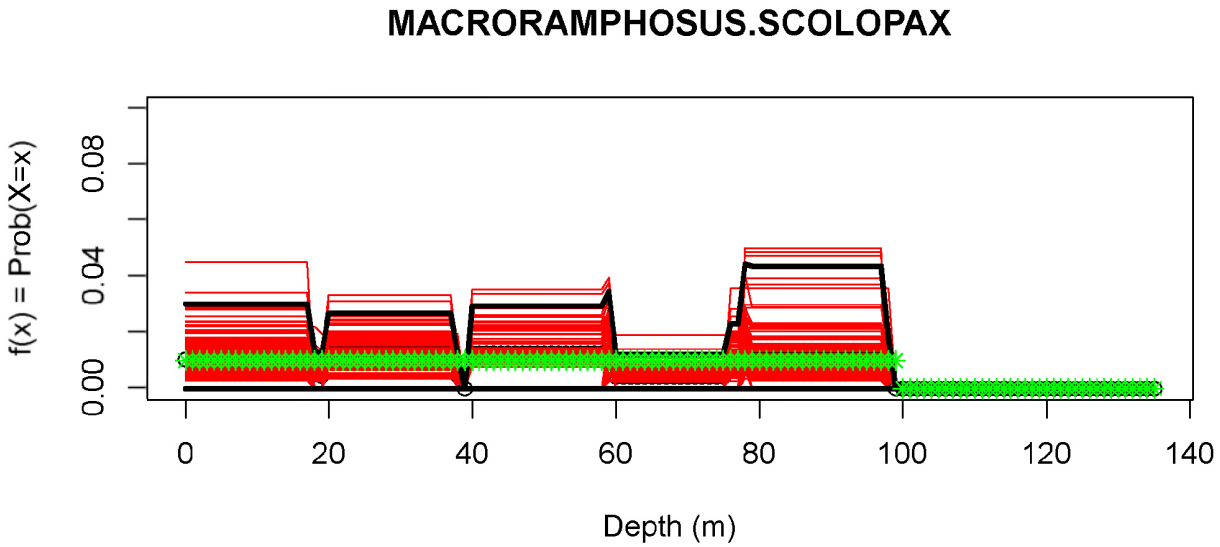

SCOMBEROMORUS.CAVALLA
Min Depth= 0 Max Depth= 79 Max Width= 0.386253486398697
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

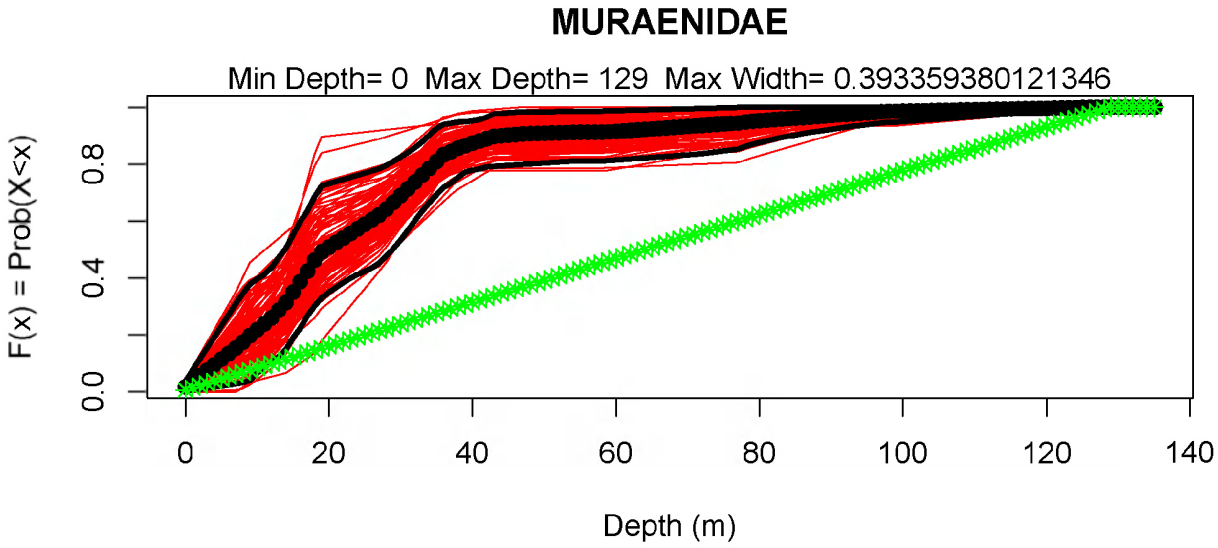

SCOMBEROMORUS.CAVALLA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

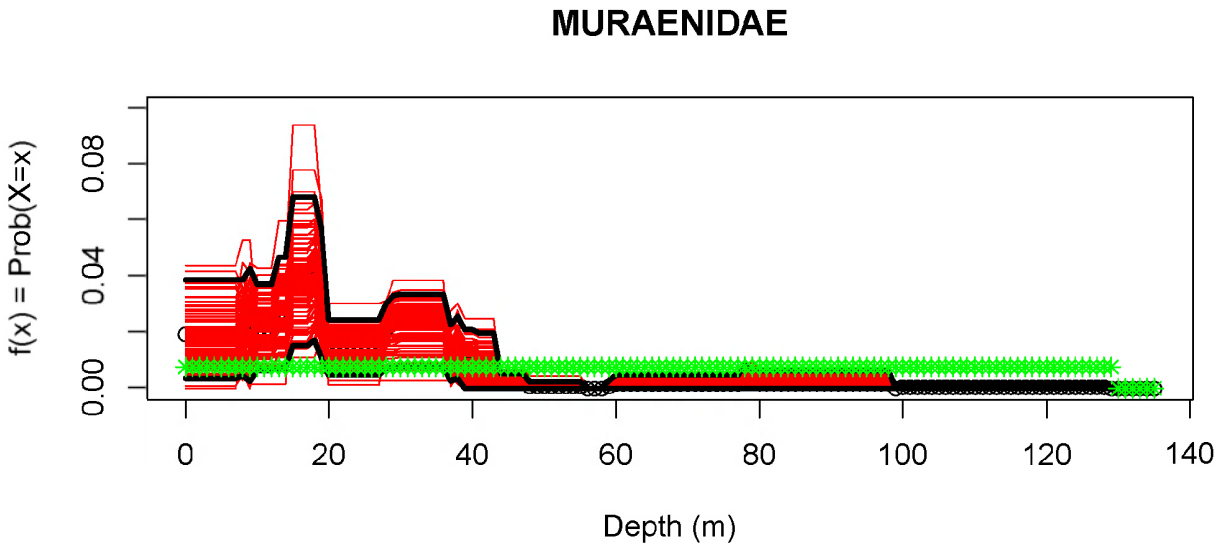

EXOCOETOIDEA
Min Depth= 0 Max Depth= 24 Max Width= 0.507754507506064
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

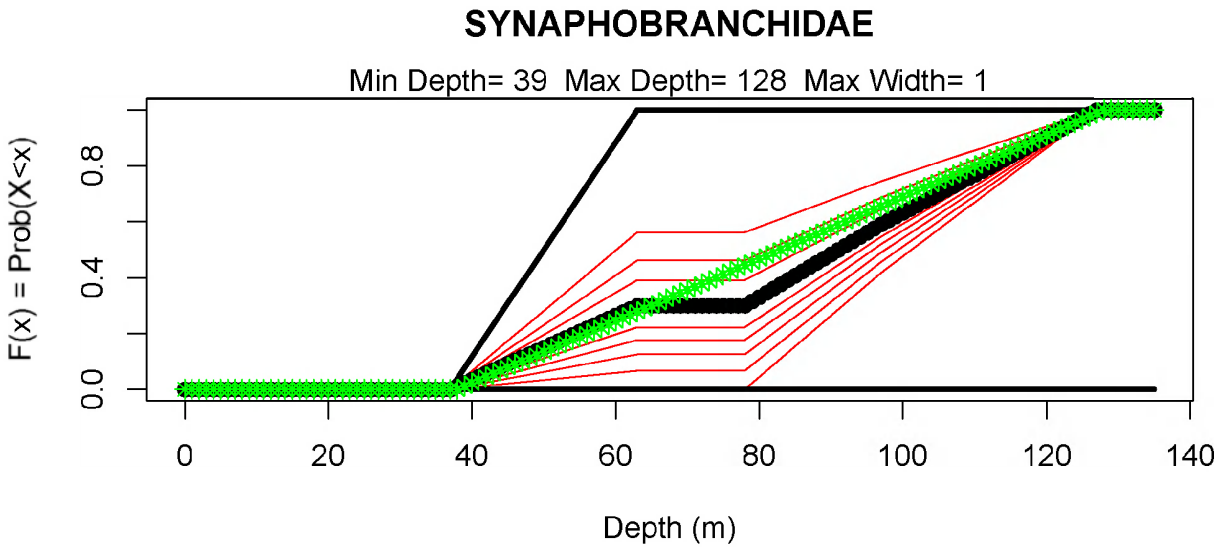

EXOCOETOIDEA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

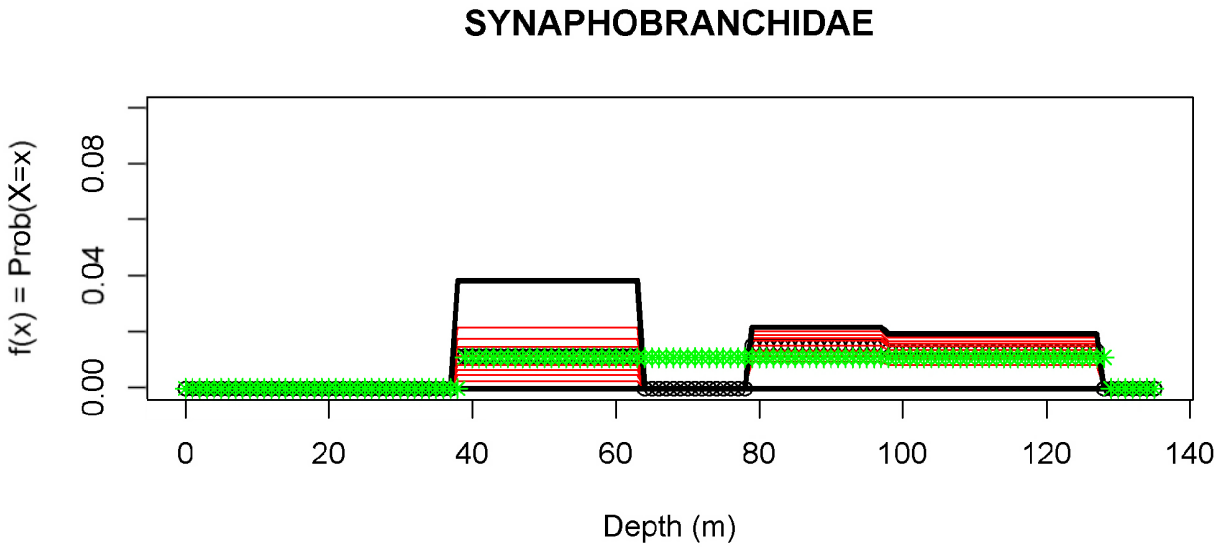

MACRORAMPHOSUS.SCOLOPAX
Min Depth= 0 Max Depth= 99 Max Width= 0.931609795580977
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

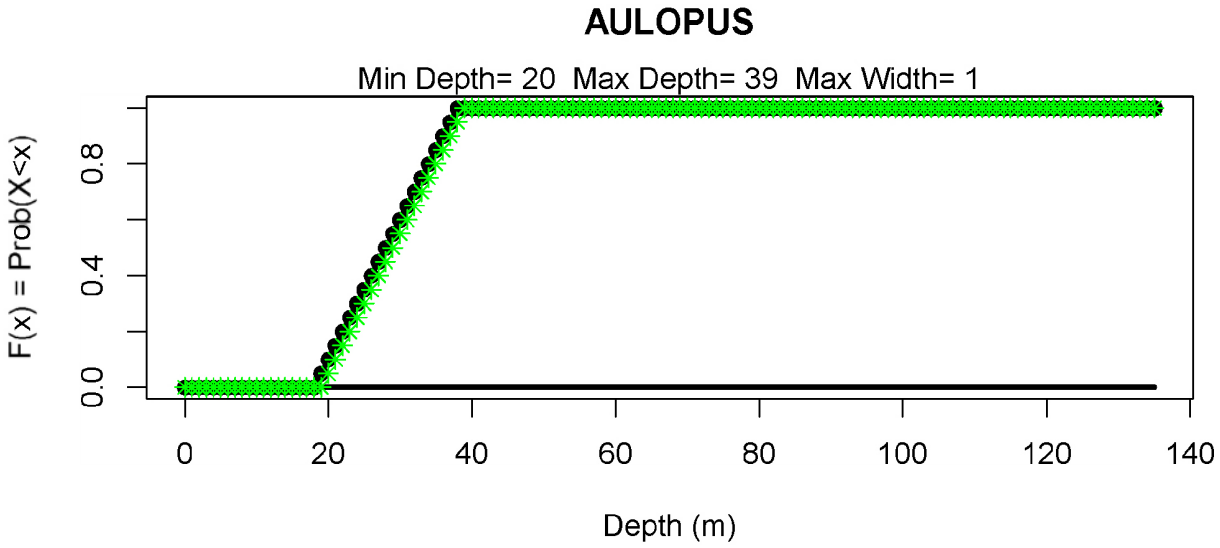

MACRORAMPHOSUS.SCOLOPAX
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

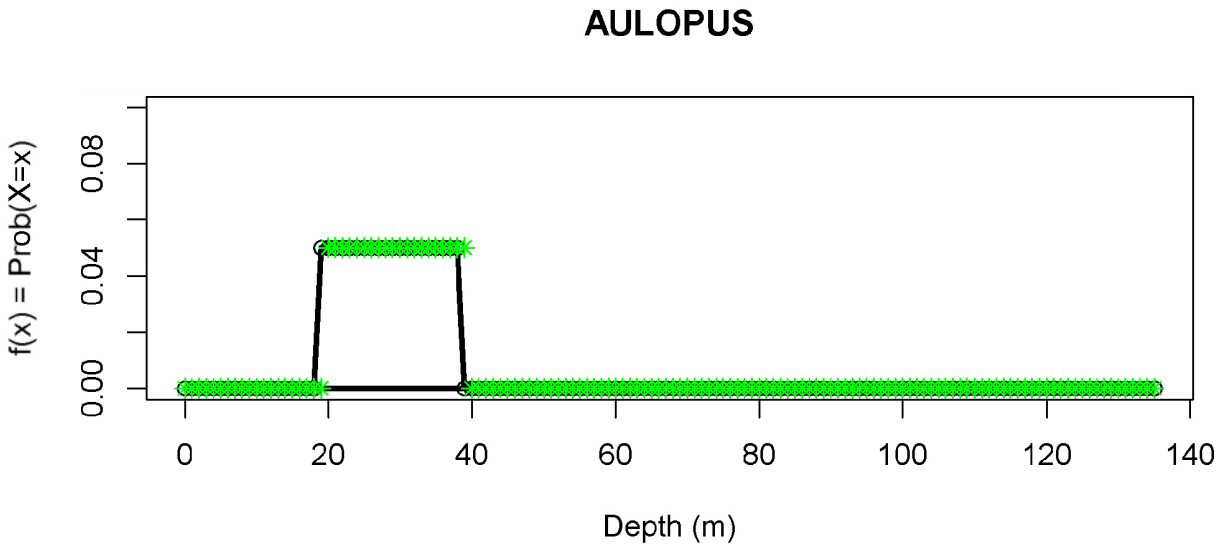

MURAENIDAE
Min Depth= 0 Max Depth= 129 Max Width= 0.393359380121346
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

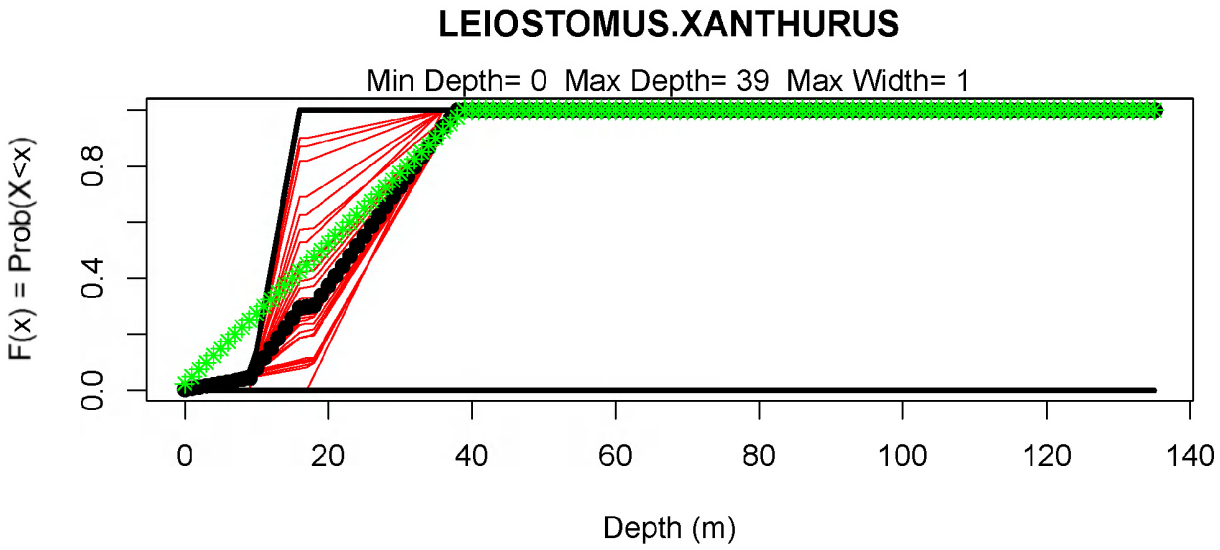

MURAENIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

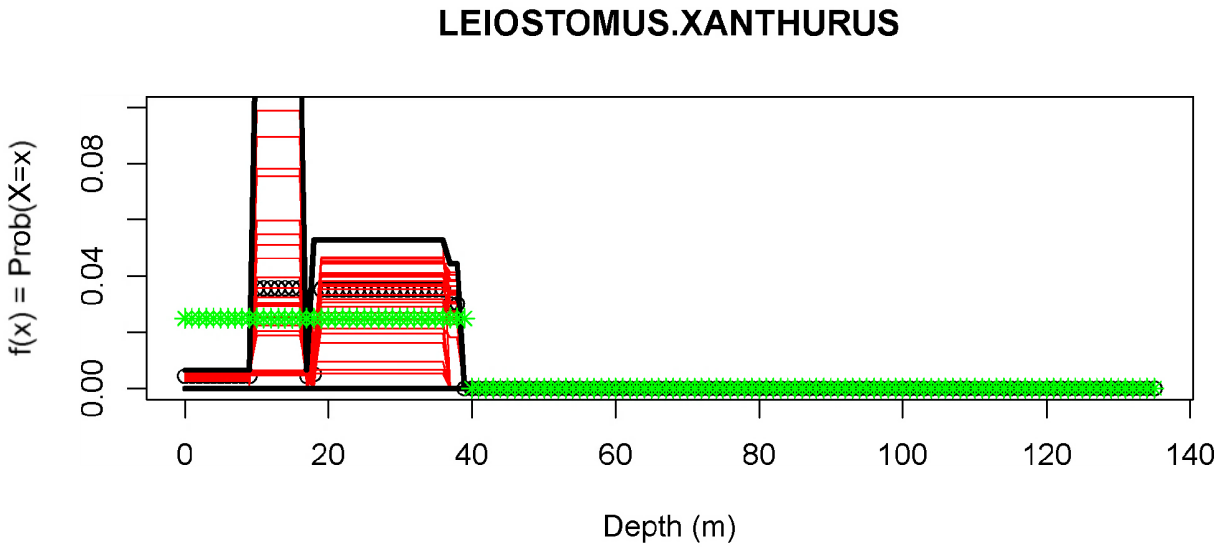

SYNAPHOBRANCHIDAE
Min Depth= 39 Max Depth= 128 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

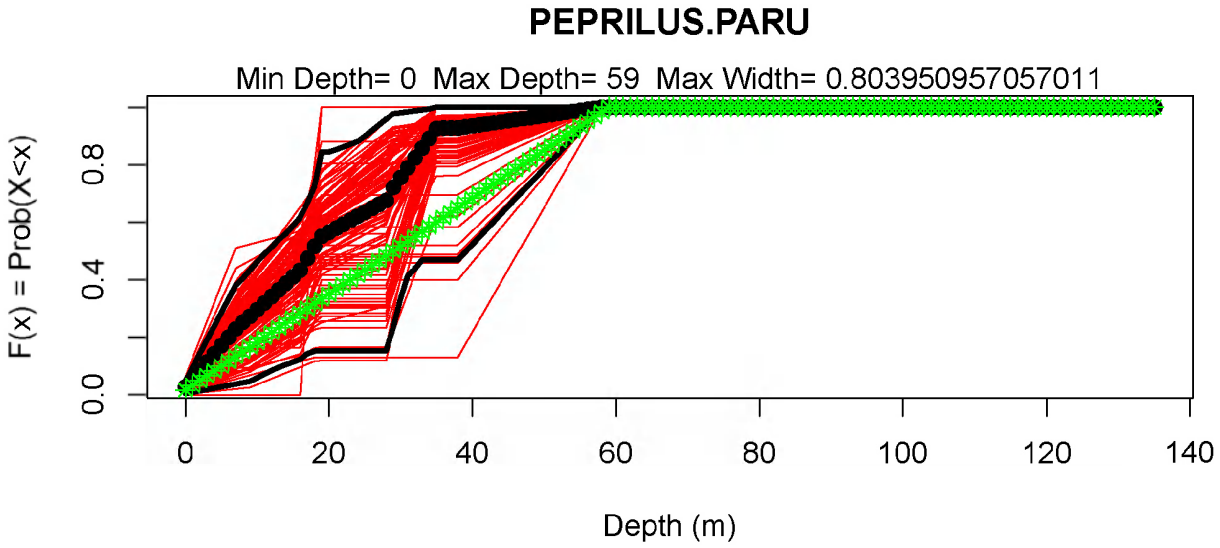

SYNAPHOBRANCHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

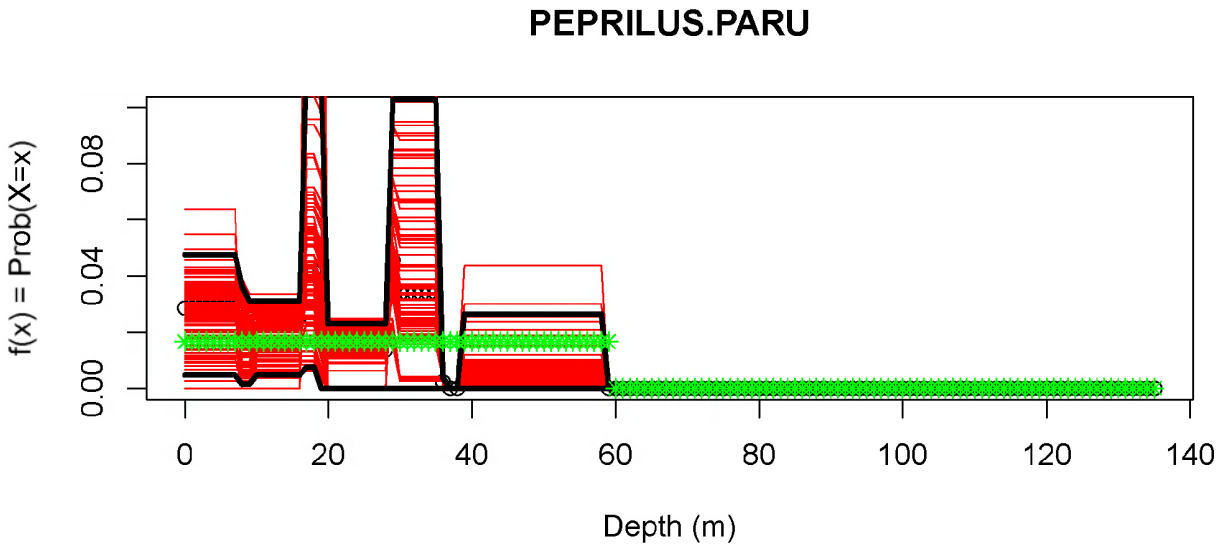

AULOPUS
Min Depth= 20 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

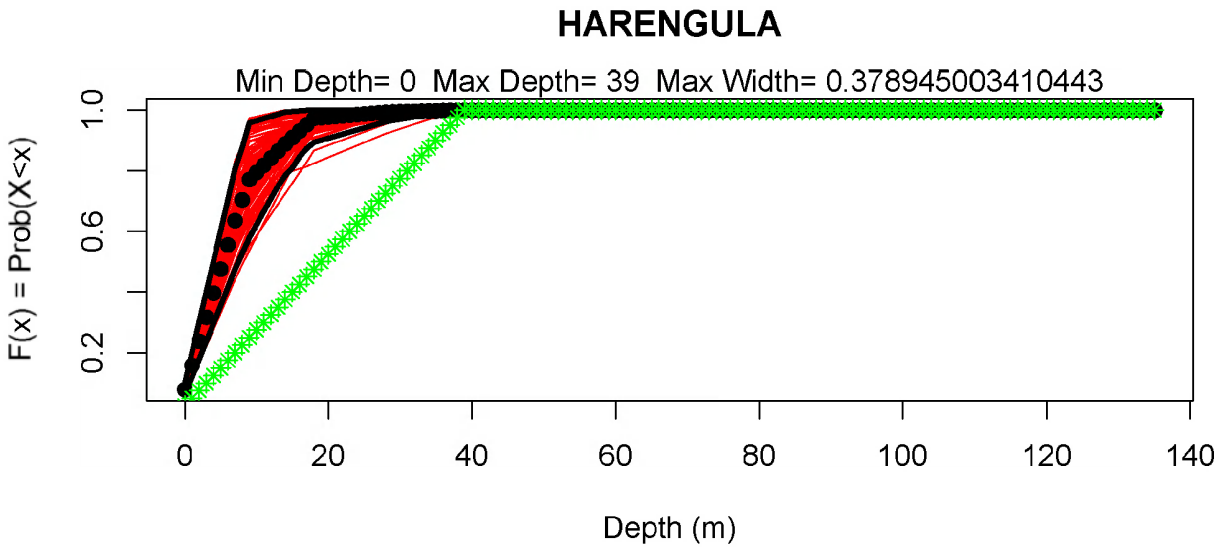

AULOPUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

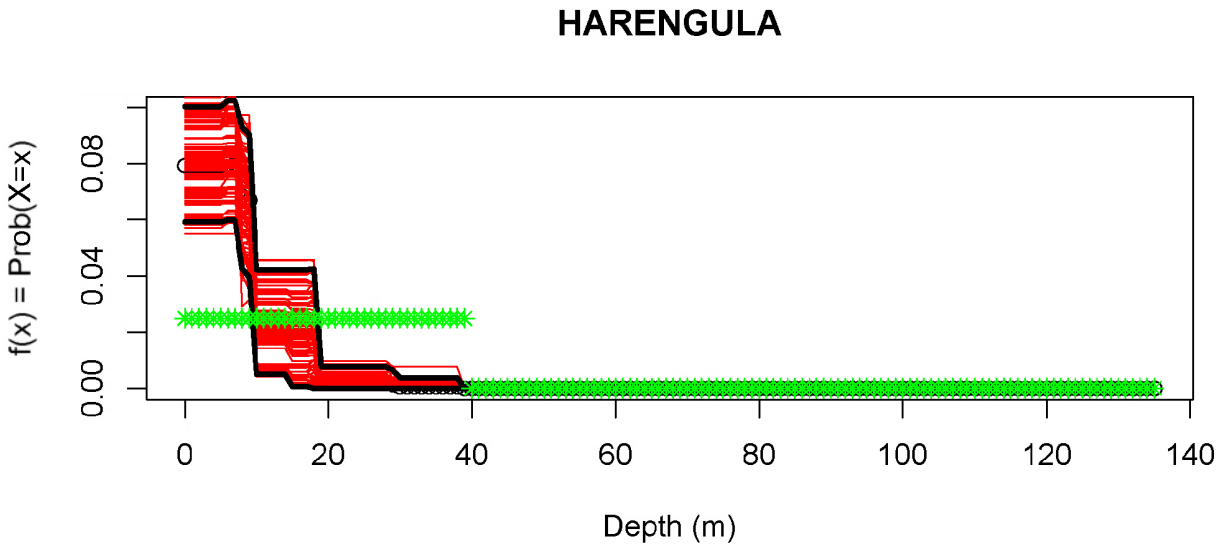

LEIOSTOMUS.XANTHURUS
Min Depth= 0 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

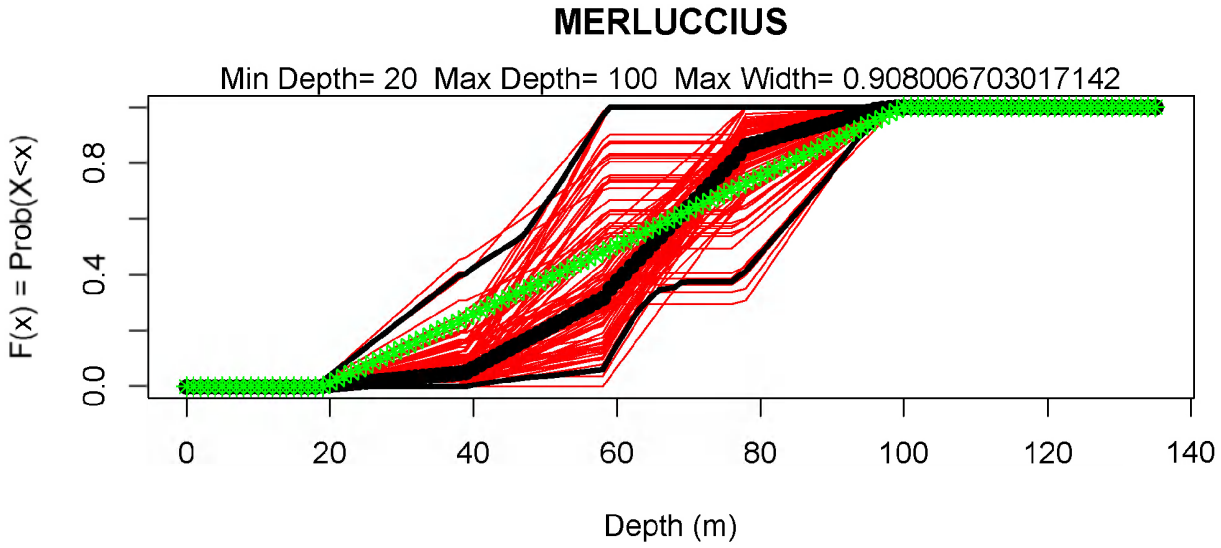

LEIOSTOMUS.XANTHURUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

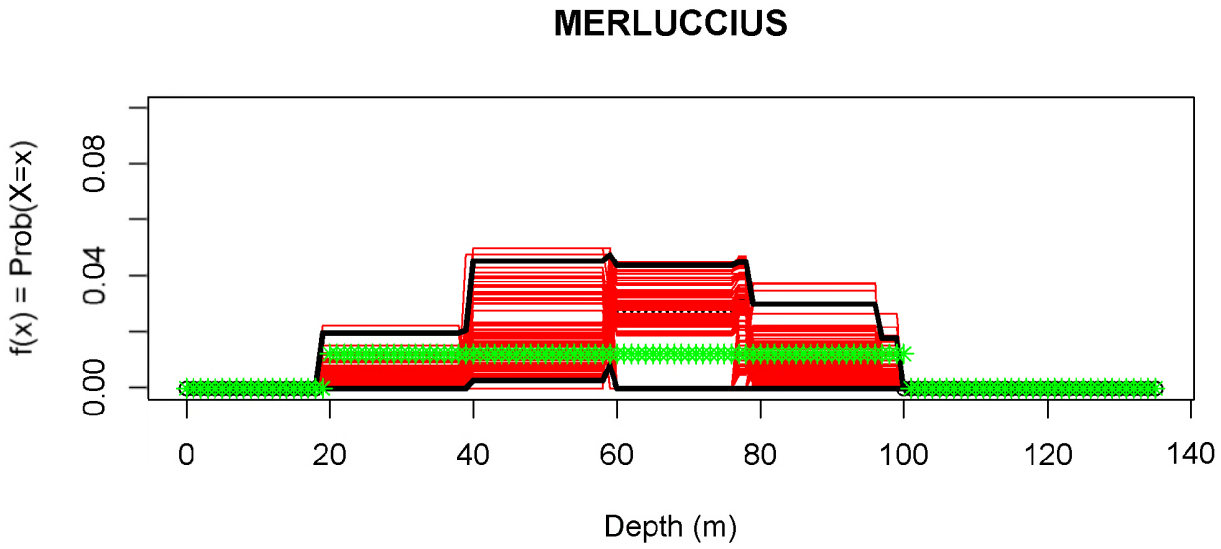

PEPRILUS.PARU
Min Depth= 0 Max Depth= 59 Max Width= 0.803950957057011
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

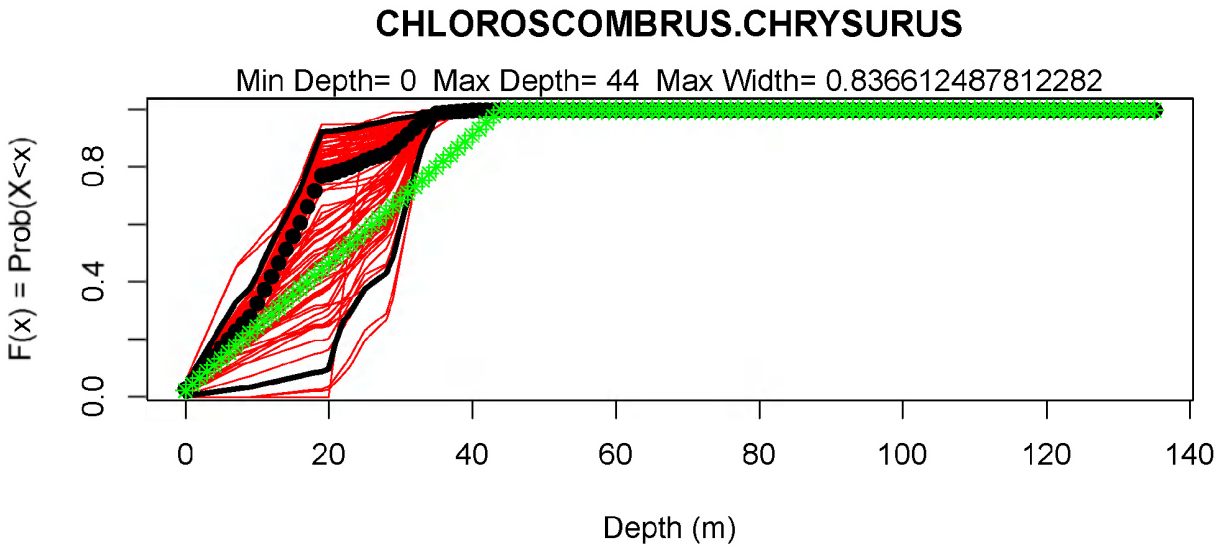

PEPRILUS.PARU
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

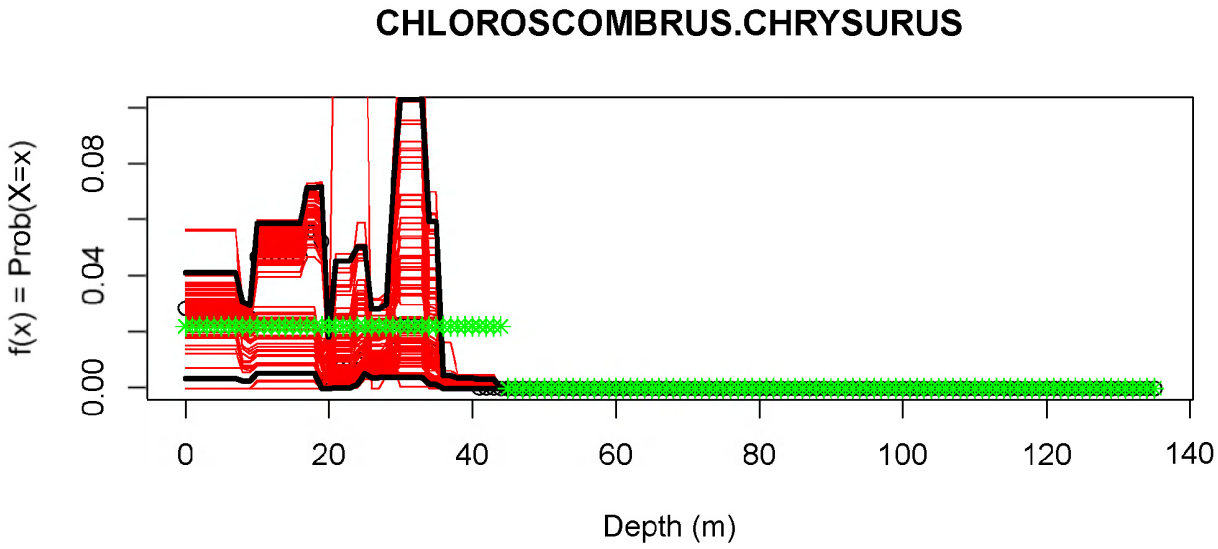

HARENGULA
Min Depth= 0 Max Depth= 39 Max Width= 0.378945003410443
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)


HARENGULA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

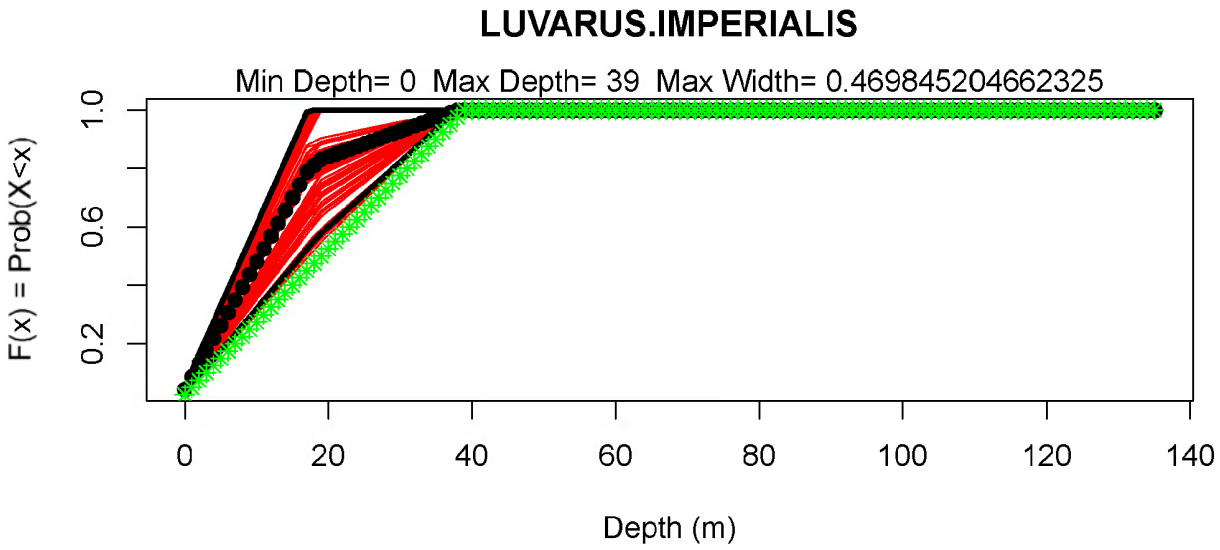

MERLUCCIUS
Min Depth= 20 Max Depth= 100 Max Width= 0.908006703017142
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

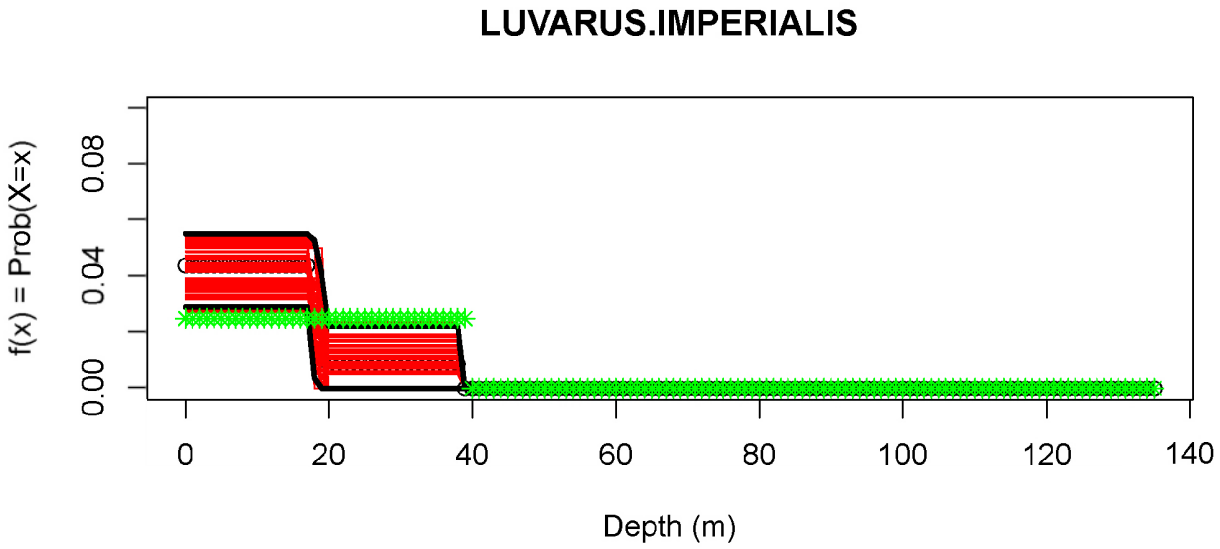

MERLUCCIUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

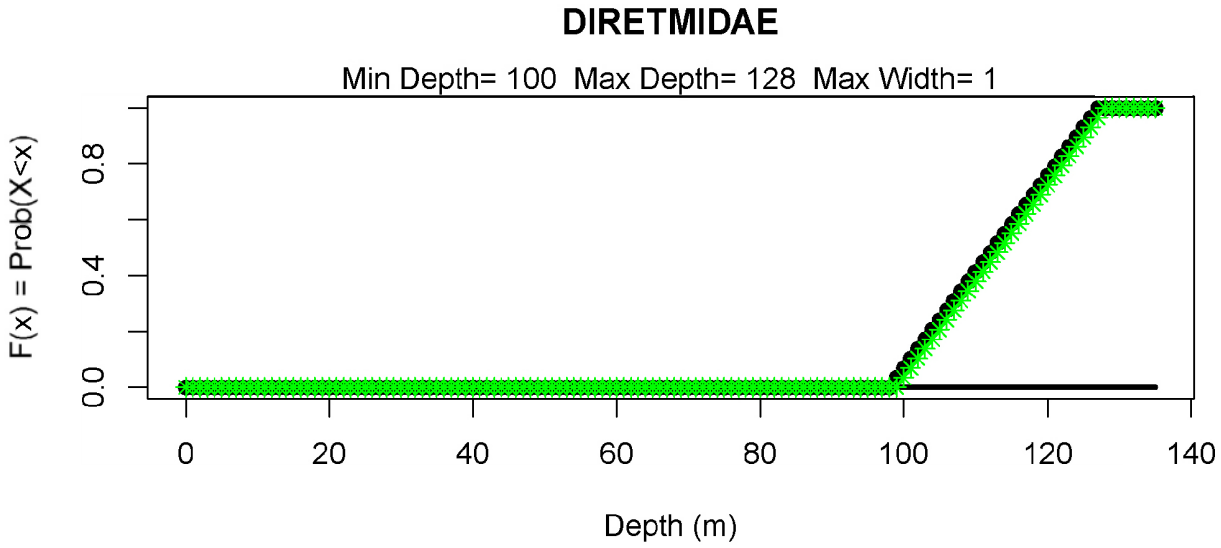


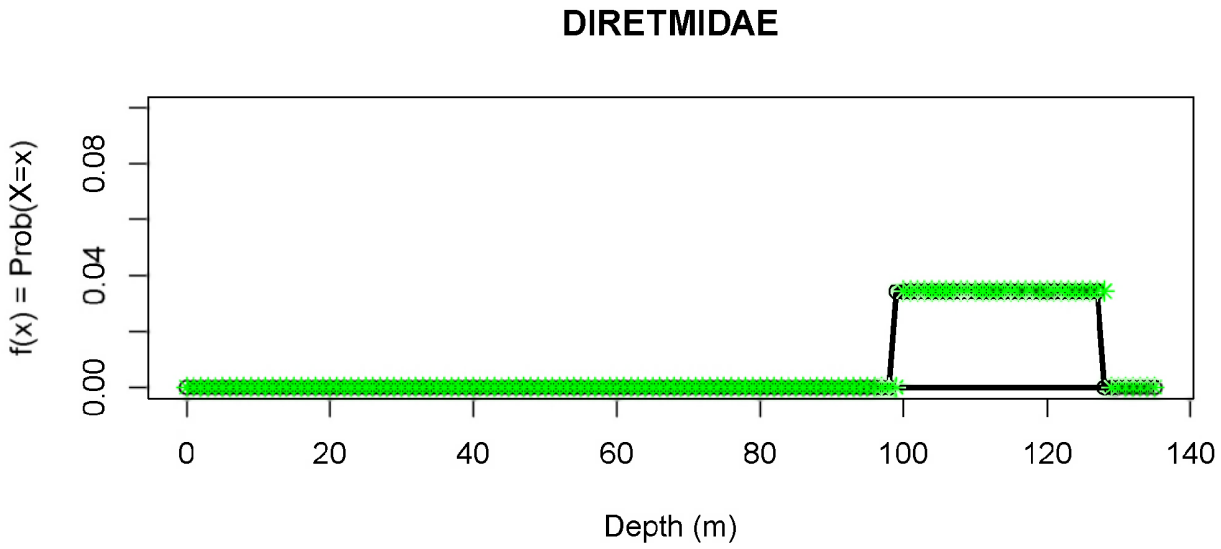


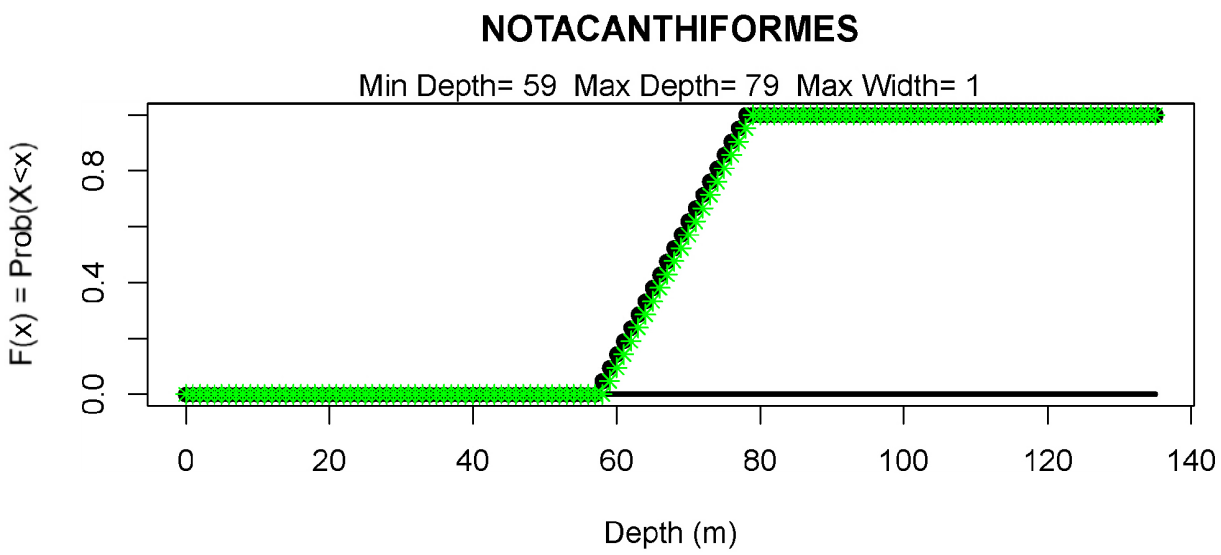
DWH-AR0196299

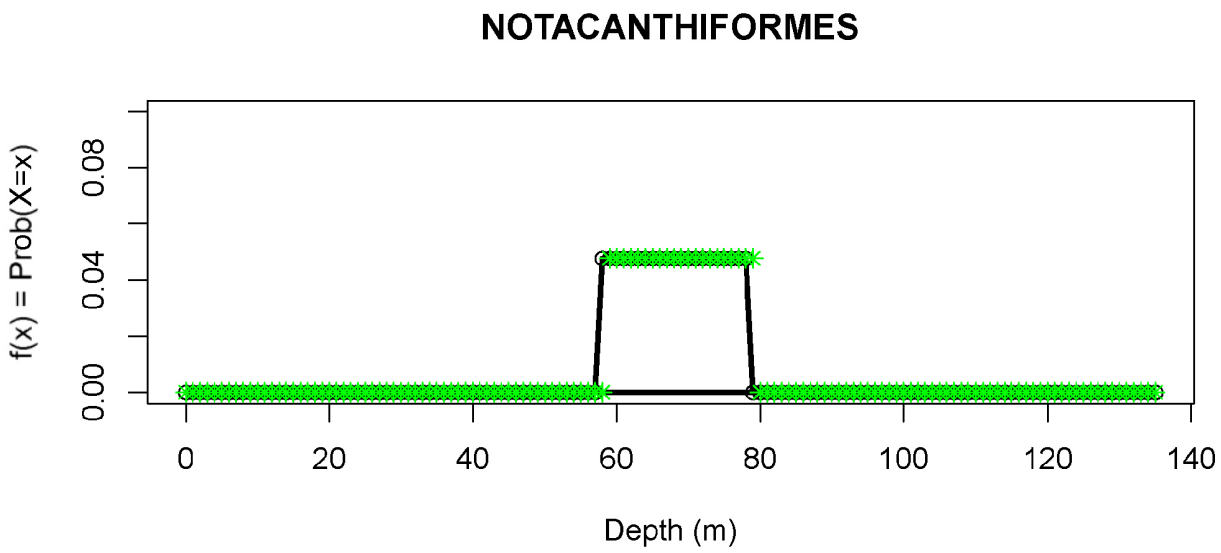

LUVARUS.IMPERIALIS
Min Depth= 0 Max Depth= 39 Max Width= 0.469845204662325
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

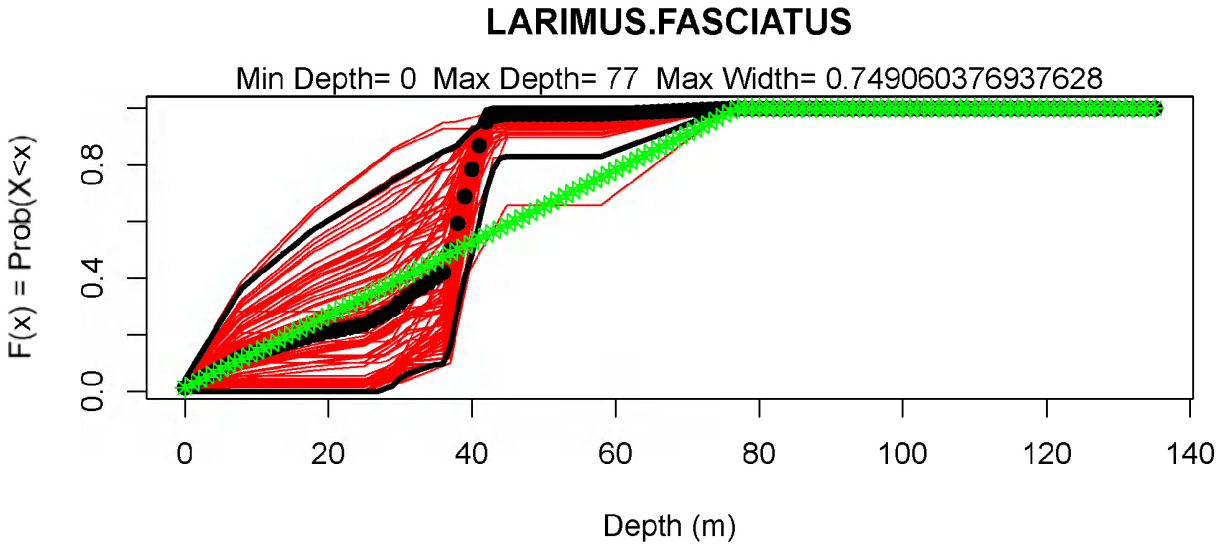

LUVARUS.IMPERIALIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

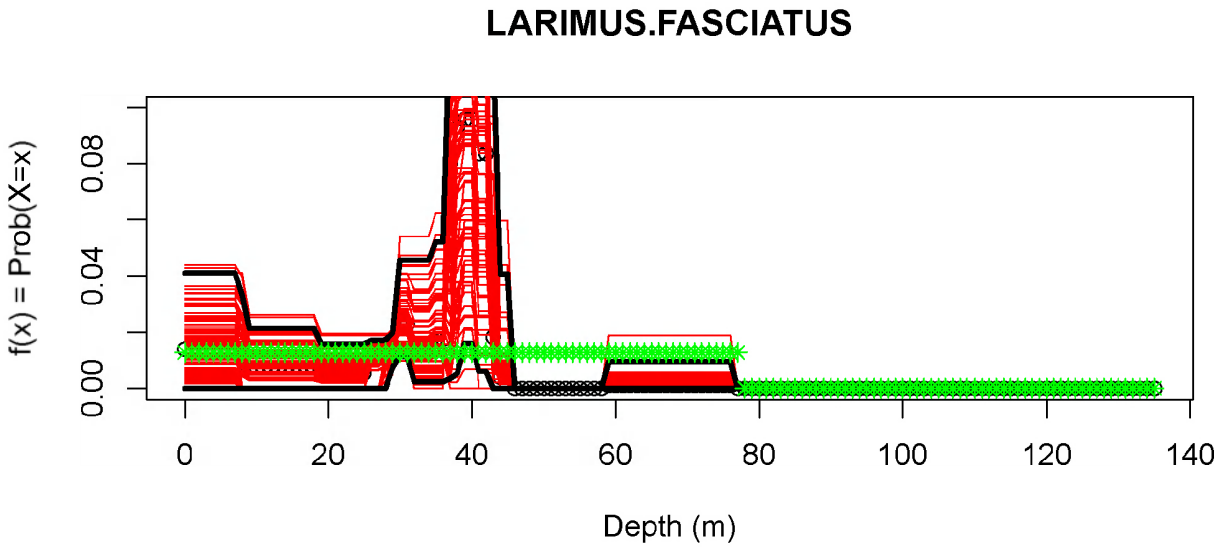

DIRETMIDAE
Min Depth= 100 Max Depth= 128 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

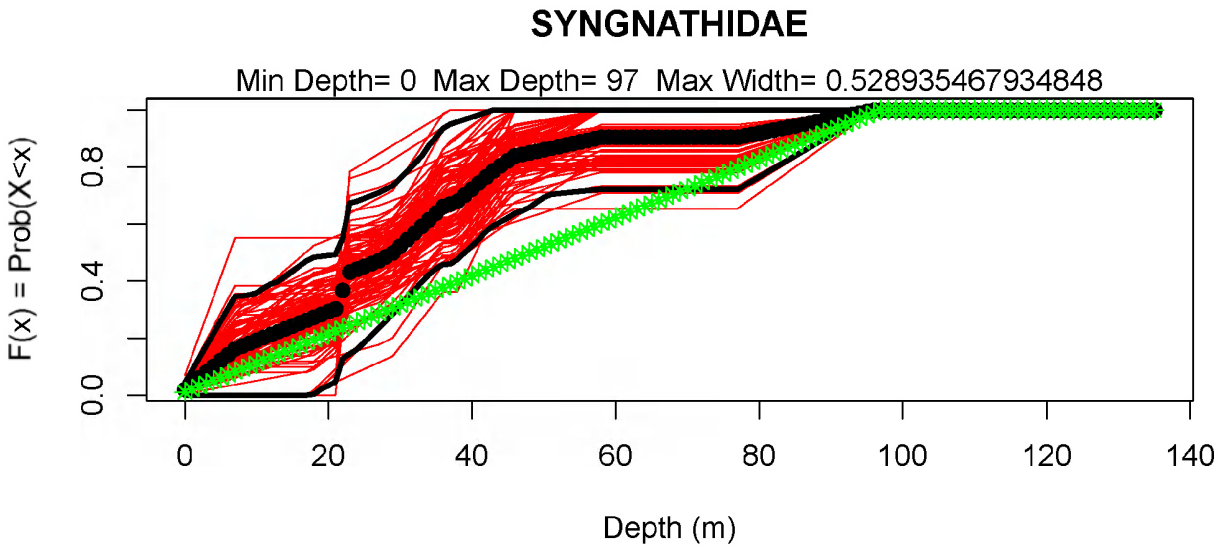

DIRETMIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

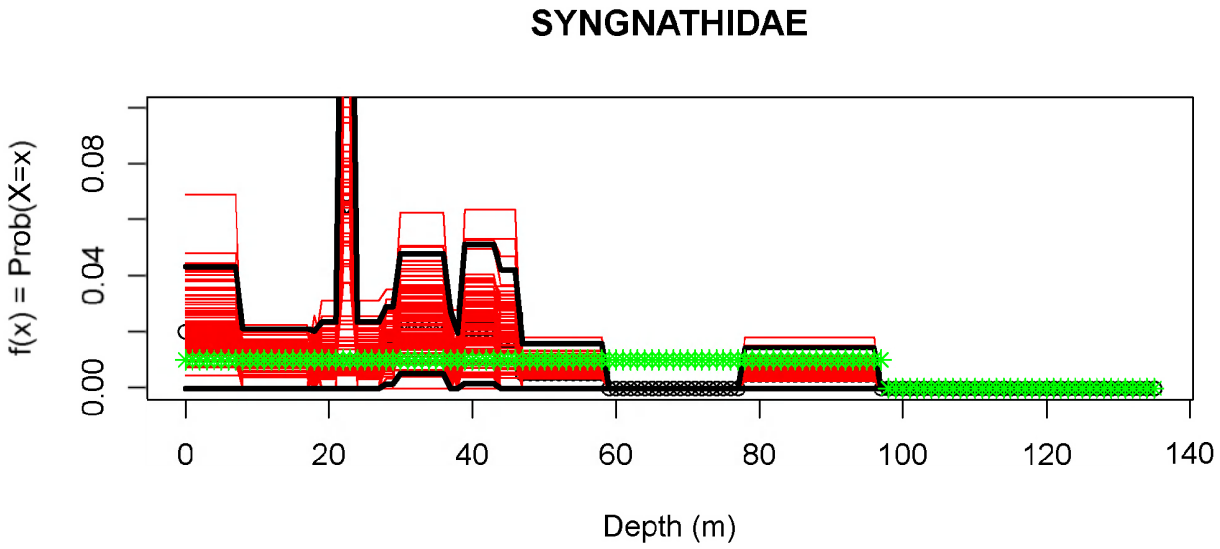

NOTACANTHIFORMES
Min Depth= 59 Max Depth= 79 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

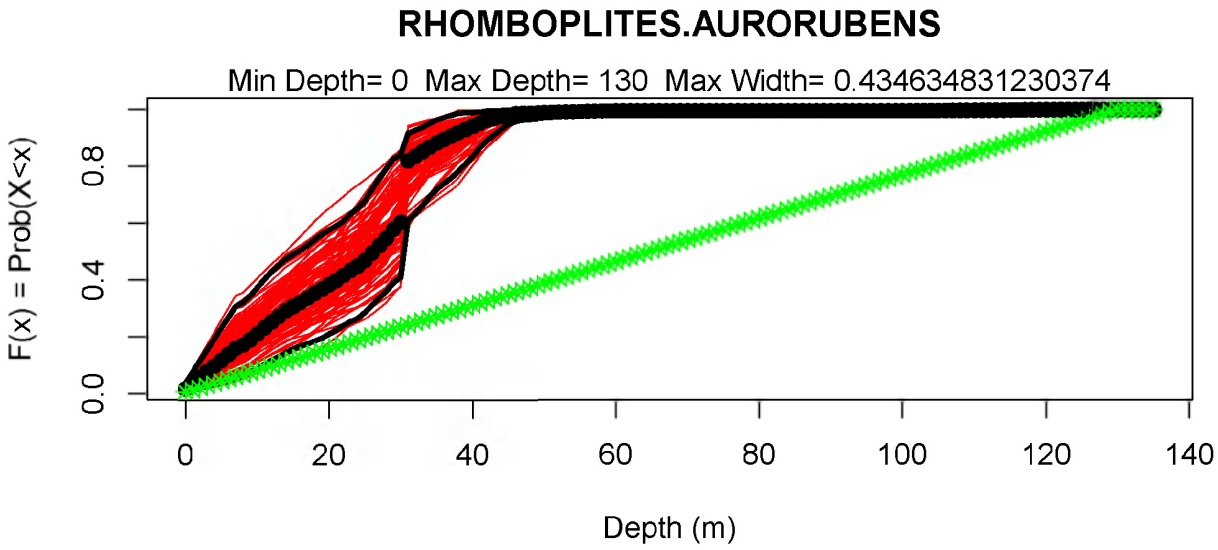

NOTACANTHIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

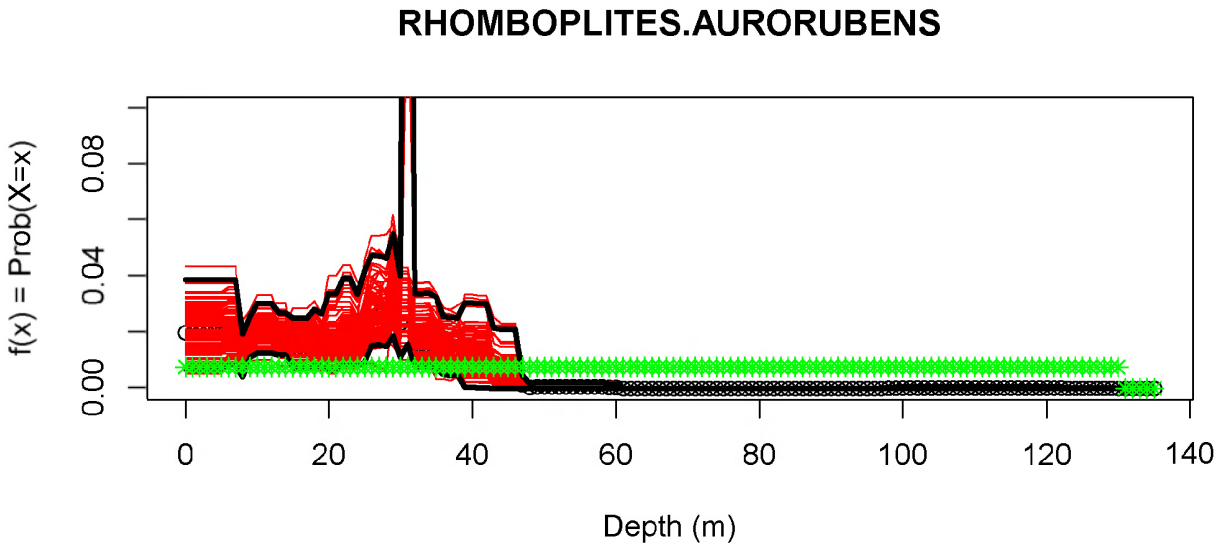

LARIMUS.FASCIATUS
Min Depth= 0 Max Depth= 77 Max Width= 0.749060376937628
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

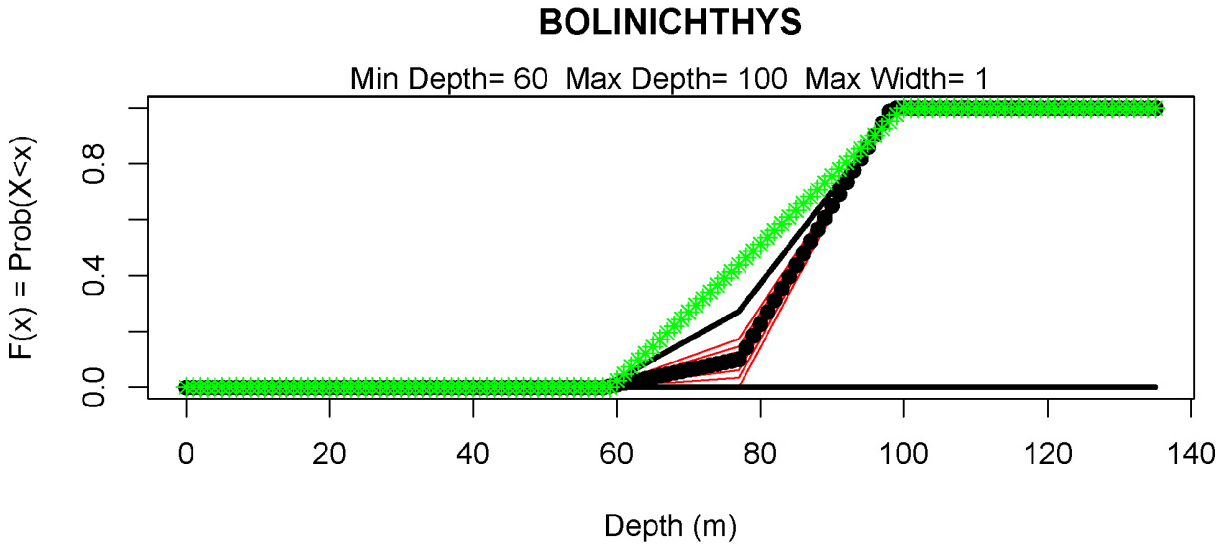

LARIMUS.FASCIATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

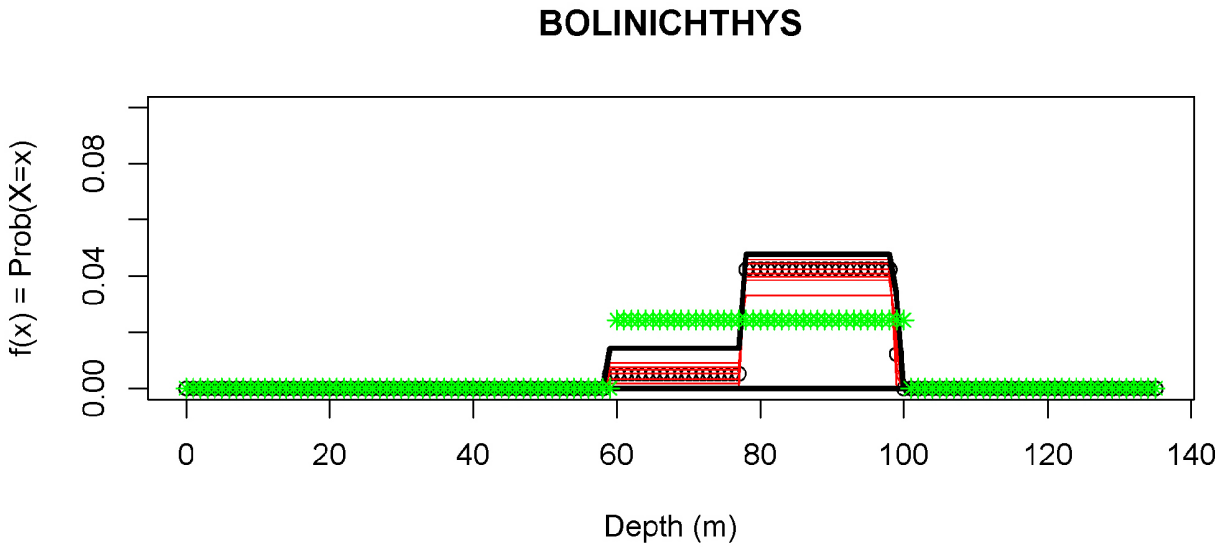

SYNGNATHIDAE
Min Depth= 0 Max Depth= 97 Max Width= 0.528935467934848
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

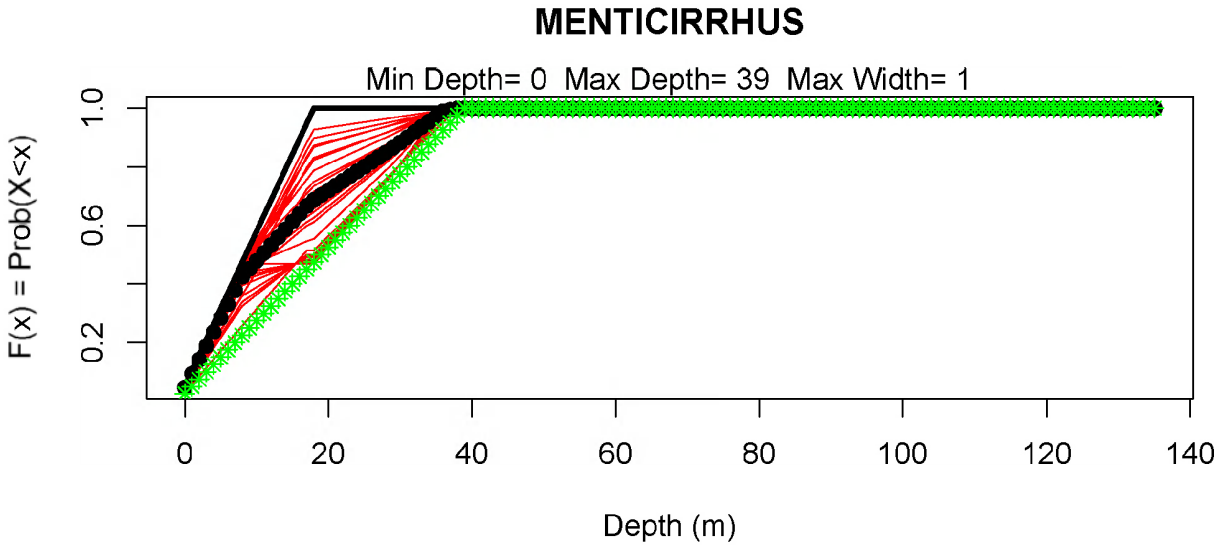

SYNGNATHIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

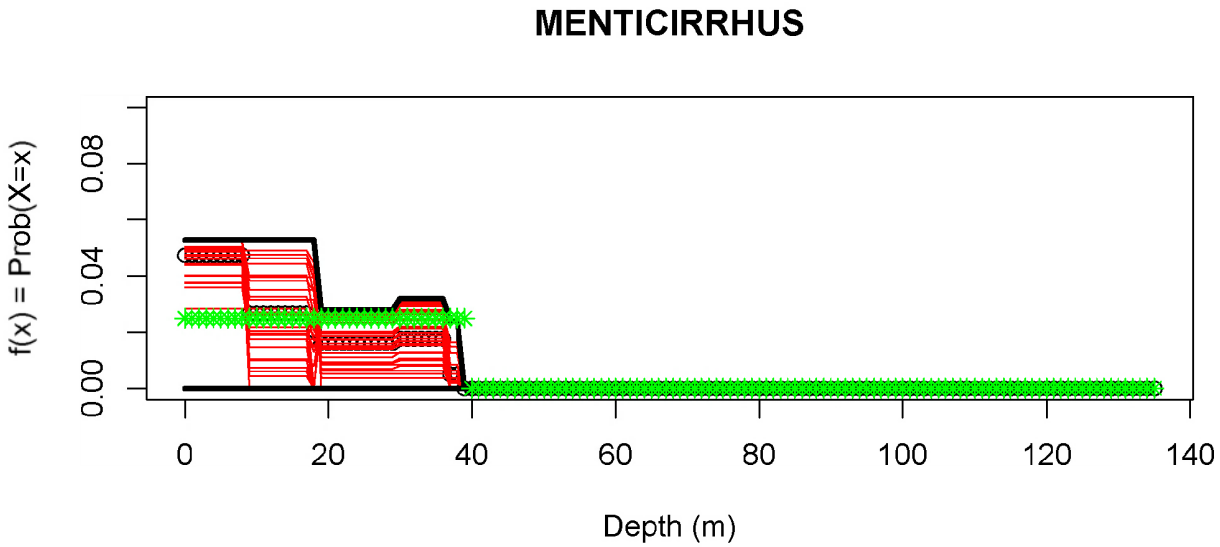

RHOMBOPLITES.AURORUBENS
Min Depth= 0 Max Depth= 130 Max Width= 0.434634831230374
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

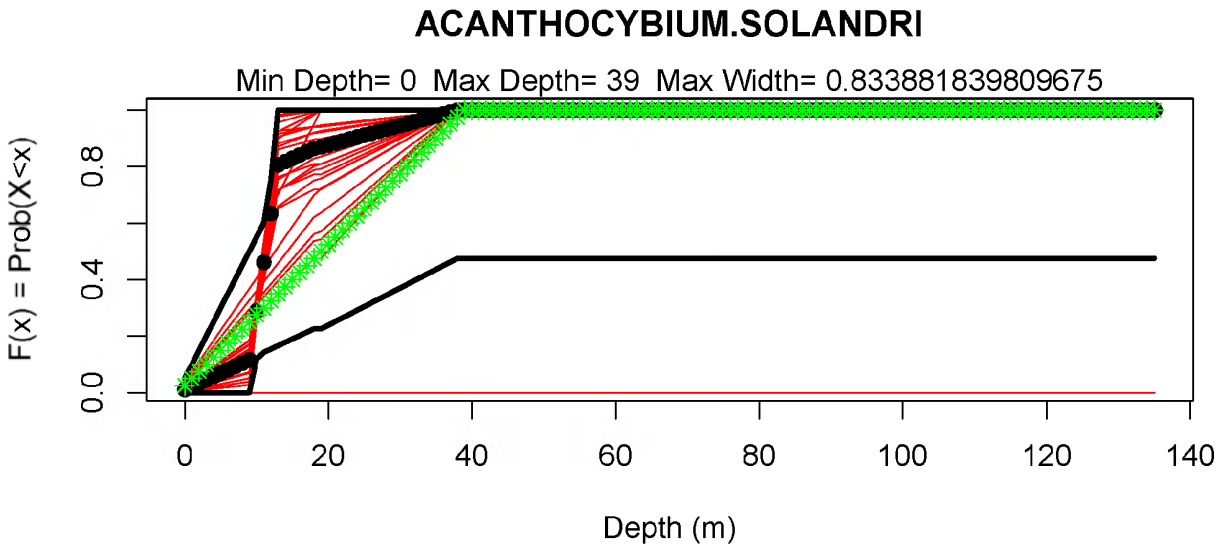

RHOMBOPLITES.AURORUBENS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

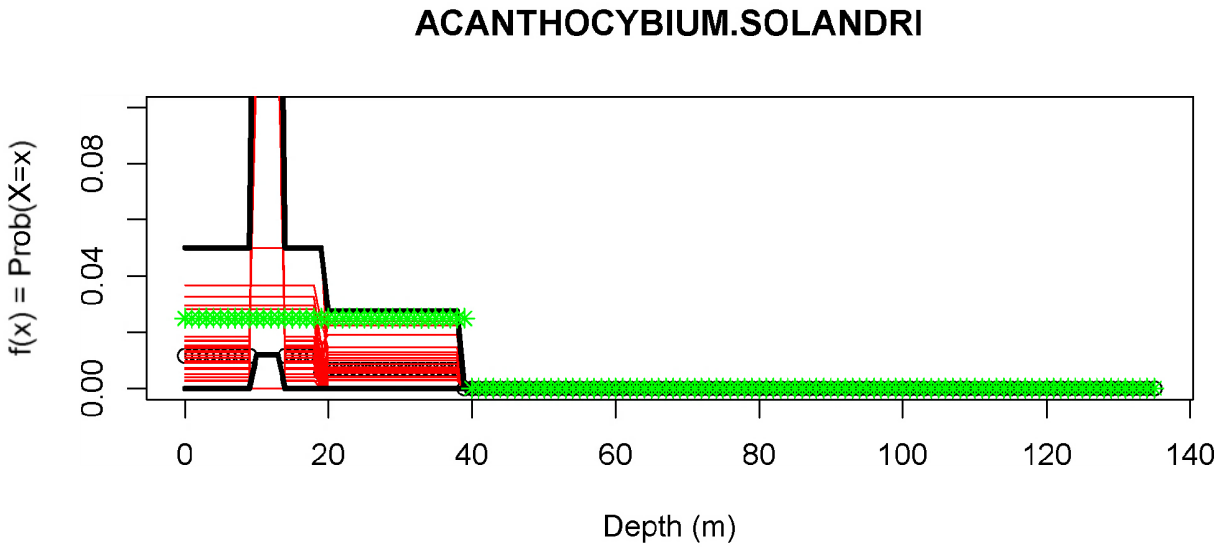

BOLINICHTHYS
Min Depth= 60 Max Depth= 100 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

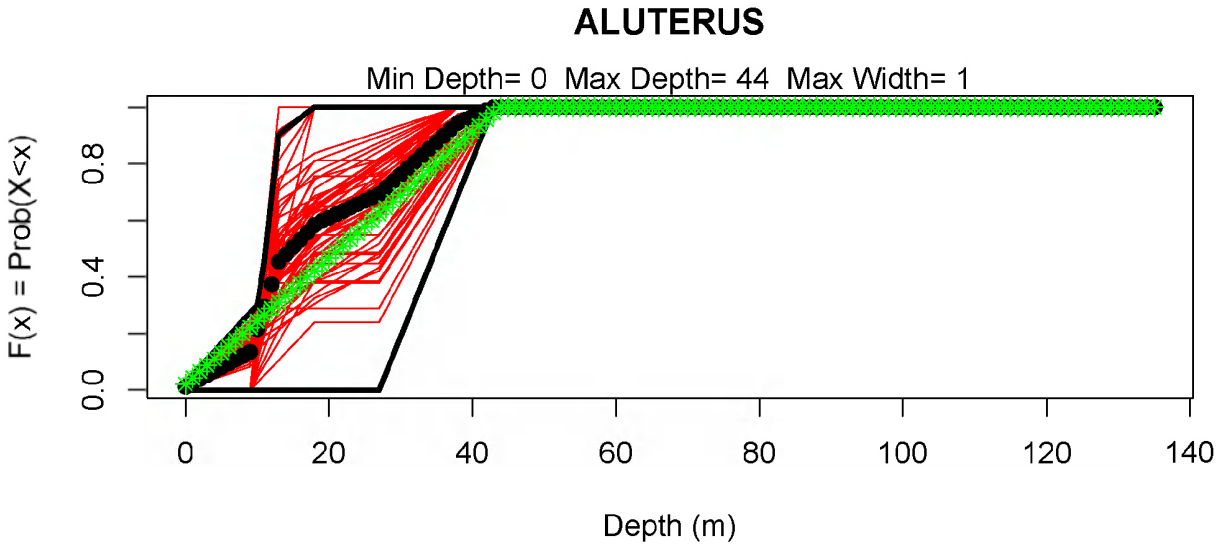

BOLINICHTHYS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

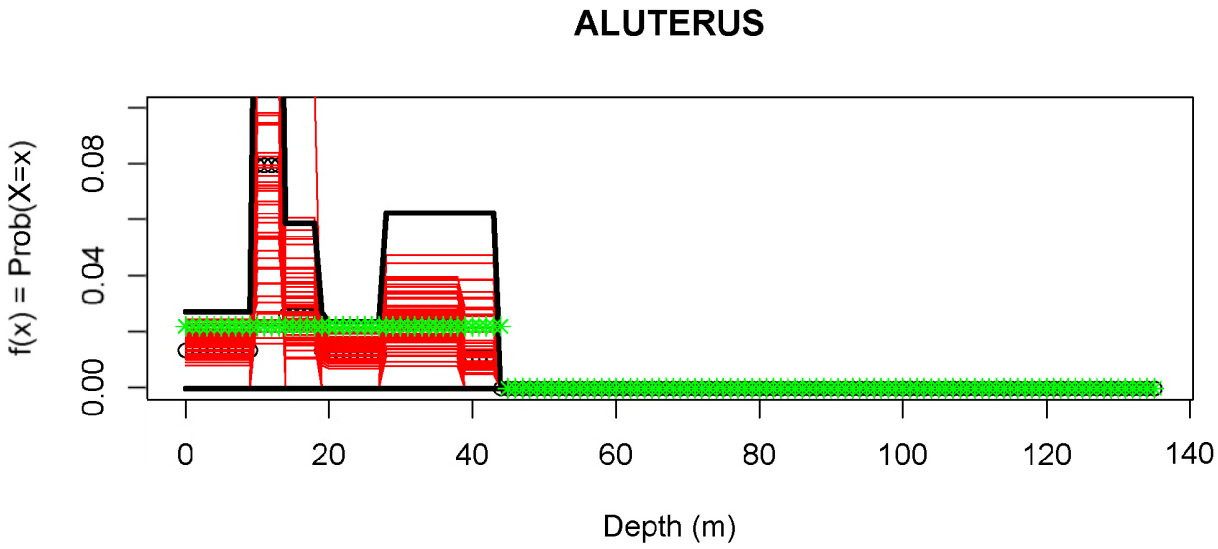

MENTICIRRHUS
Min Depth= 0 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

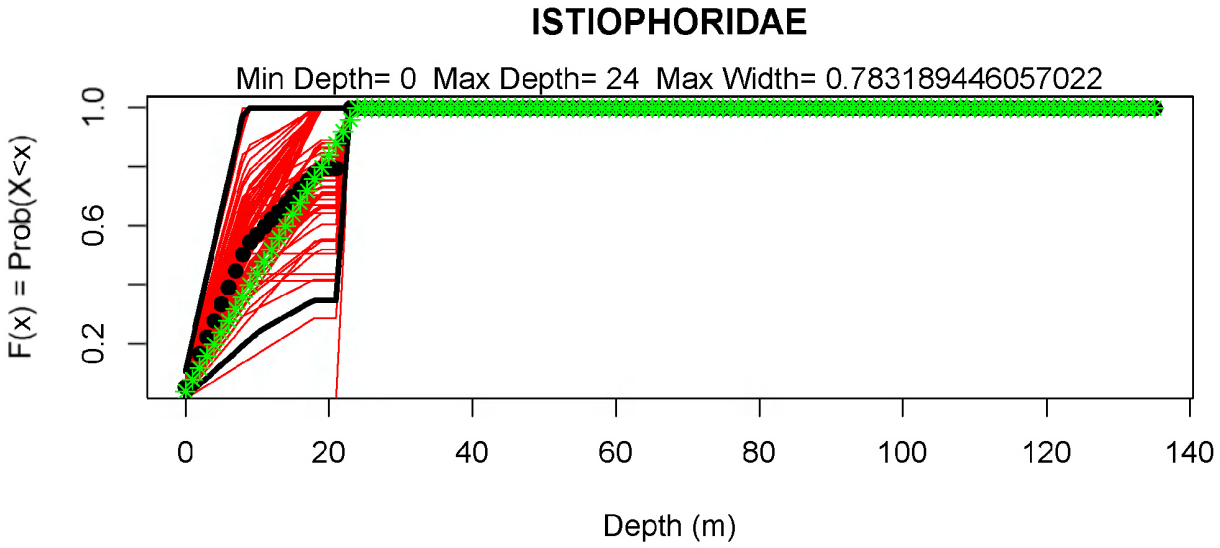

MENTICIRRHUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

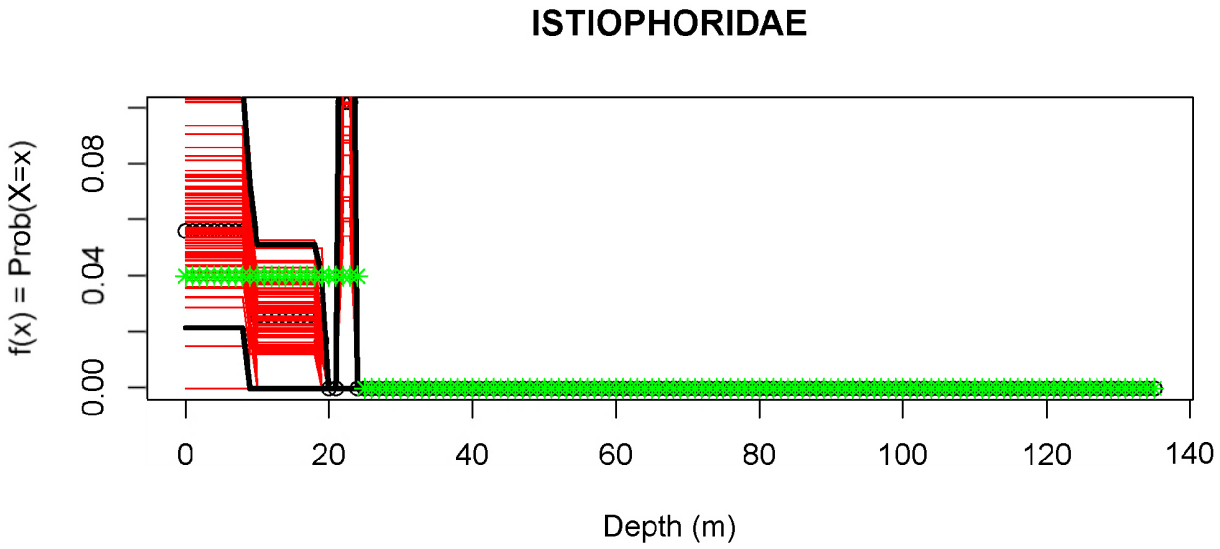

ACANTHOCYBIUM.SOLANDRI
Min Depth= 0 Max Depth= 39 Max Width= 0.833881839809675
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

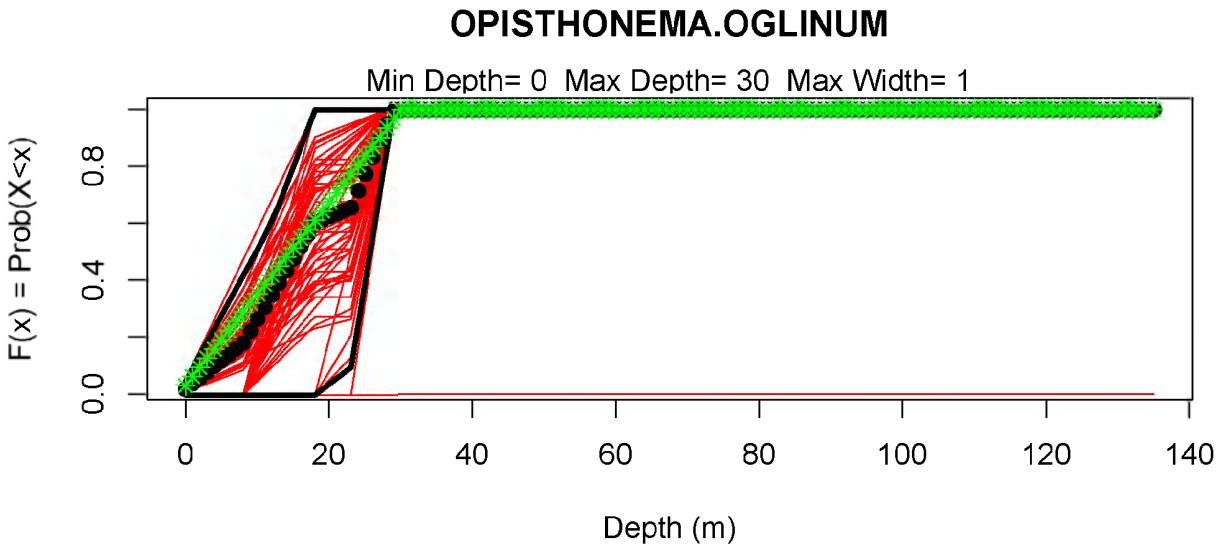

ACANTHOCYBIUM.SOLANDRI
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

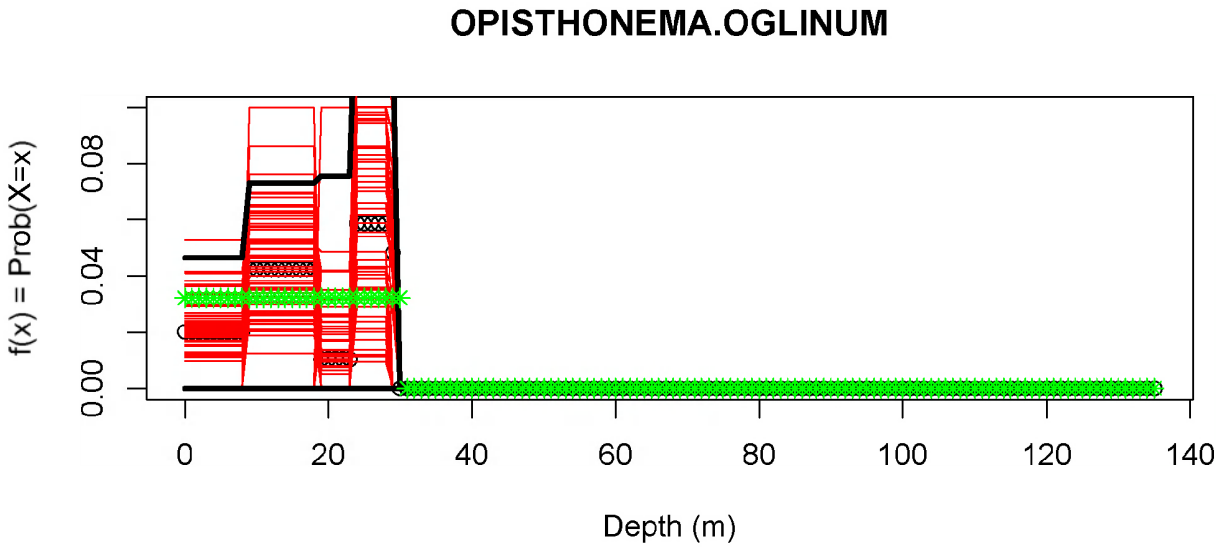

ALUTERUS
Min Depth= 0 Max Depth= 44 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

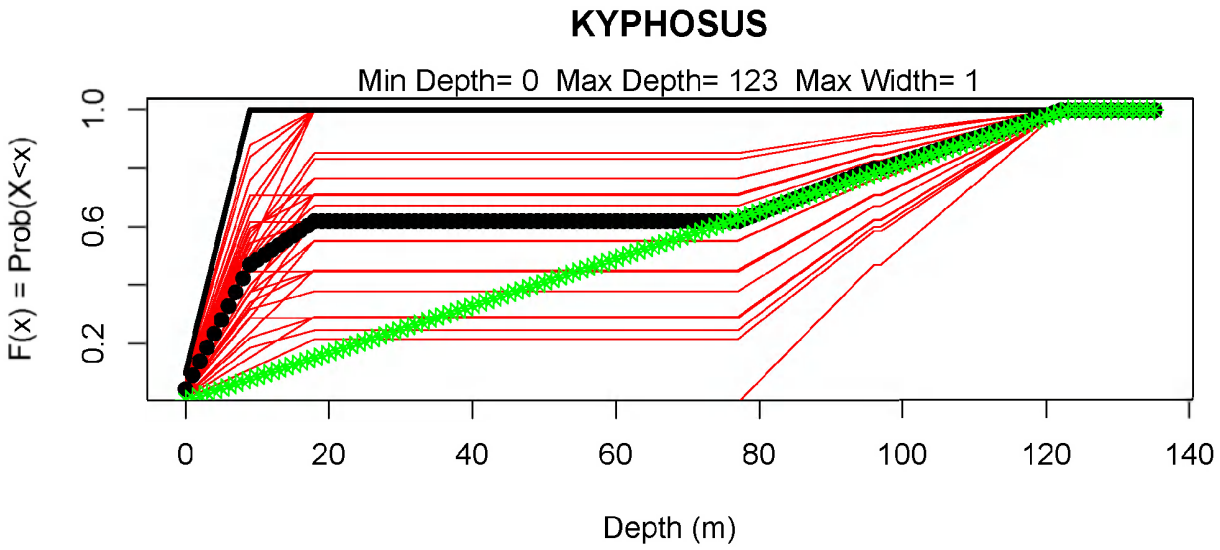

ALUTERUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

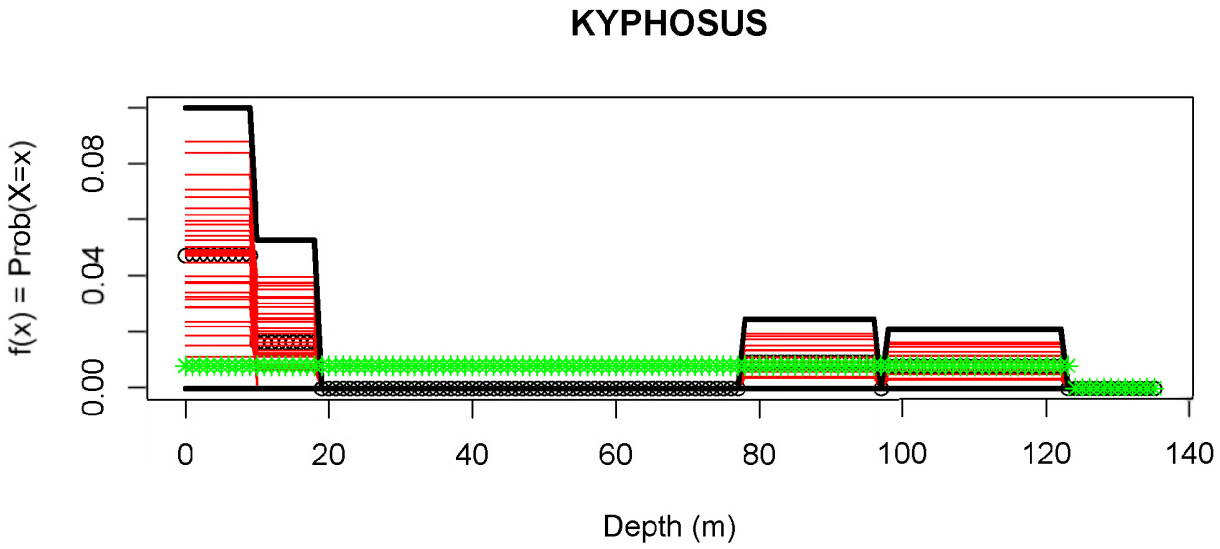

ISTIOPHORIDAE
Min Depth= 0 Max Depth= 24 Max Width= 0.783189446057022
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

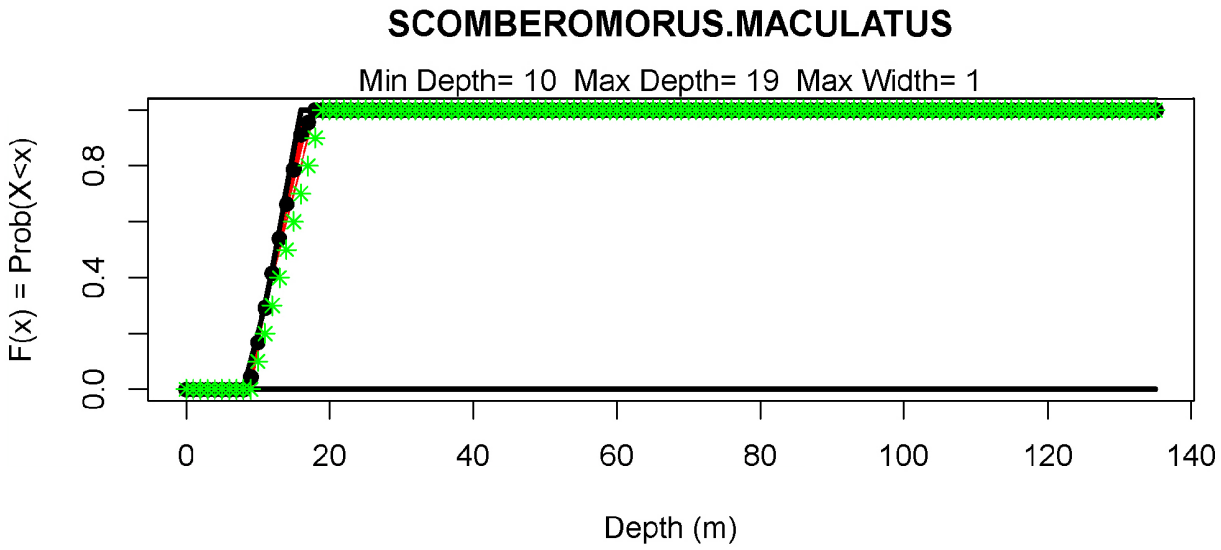

ISTIOPHORIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

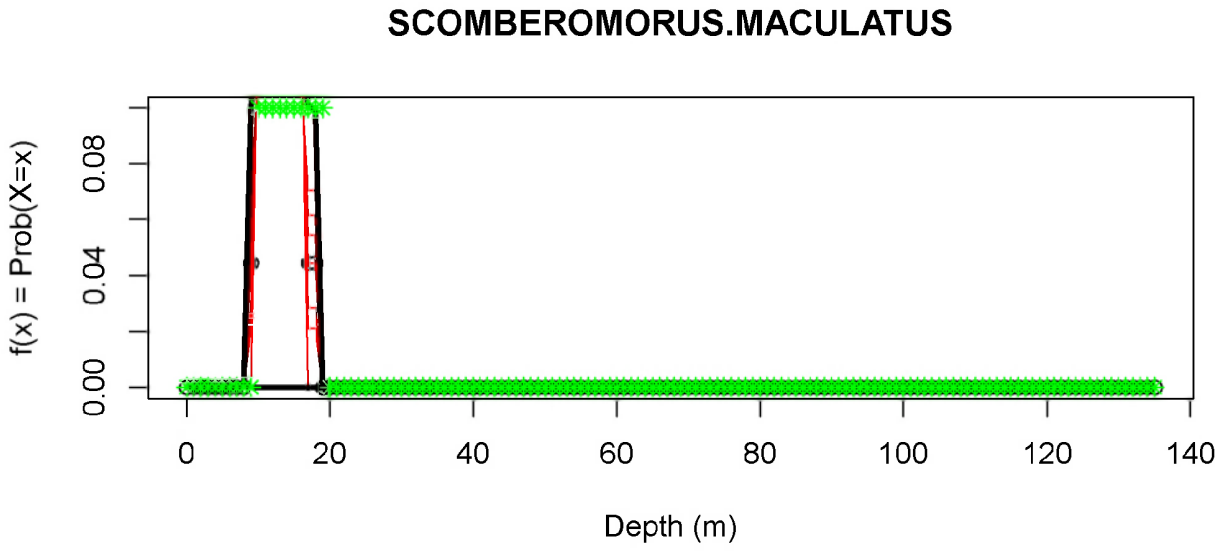

OPISTHONEMA.OGLINUM
Min Depth= 0 Max Depth= 30 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

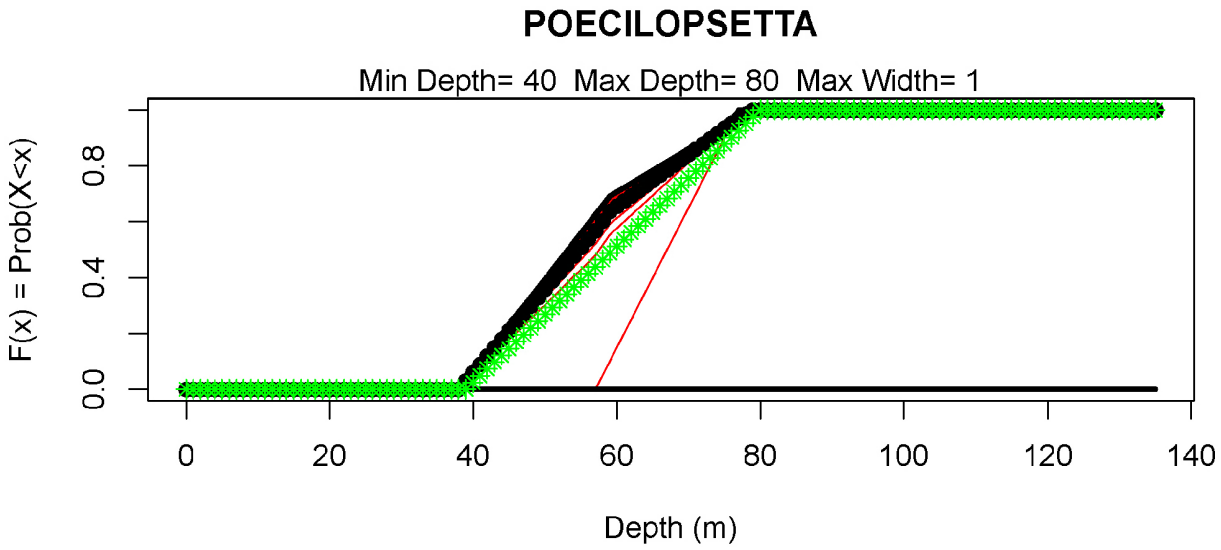

OPISTHONEMA.OGLINUM
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

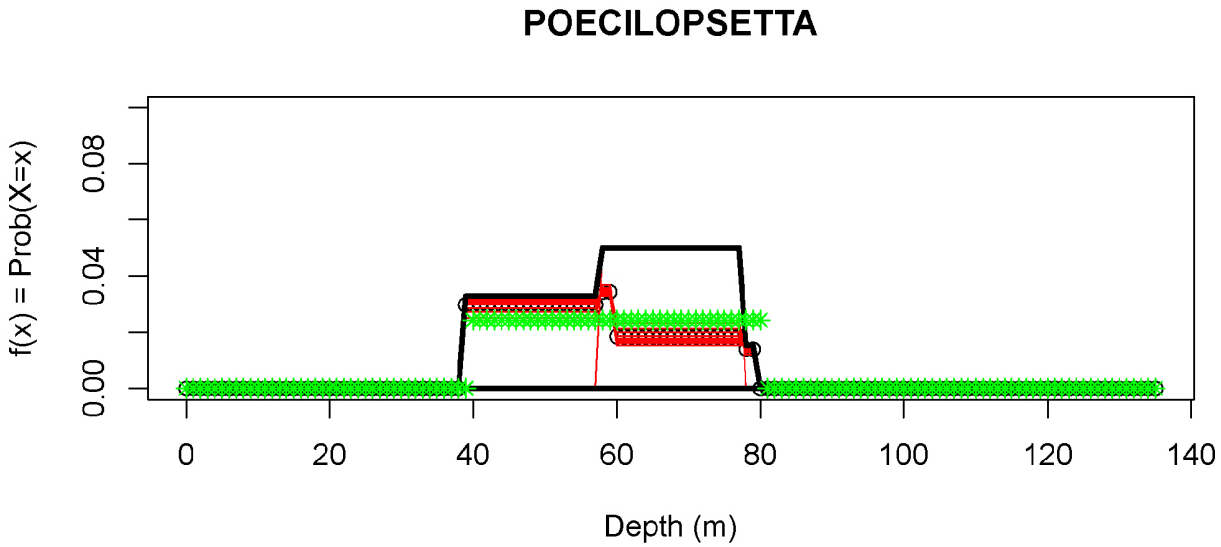

KYPHOSUS
Min Depth= 0 Max Depth= 123 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

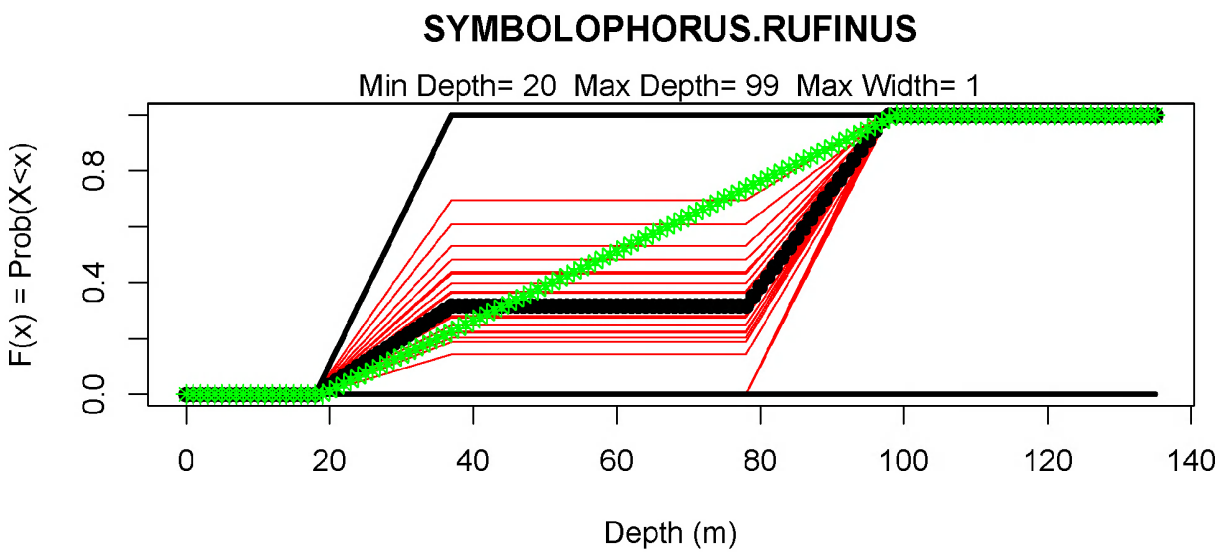

KYPHOSUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

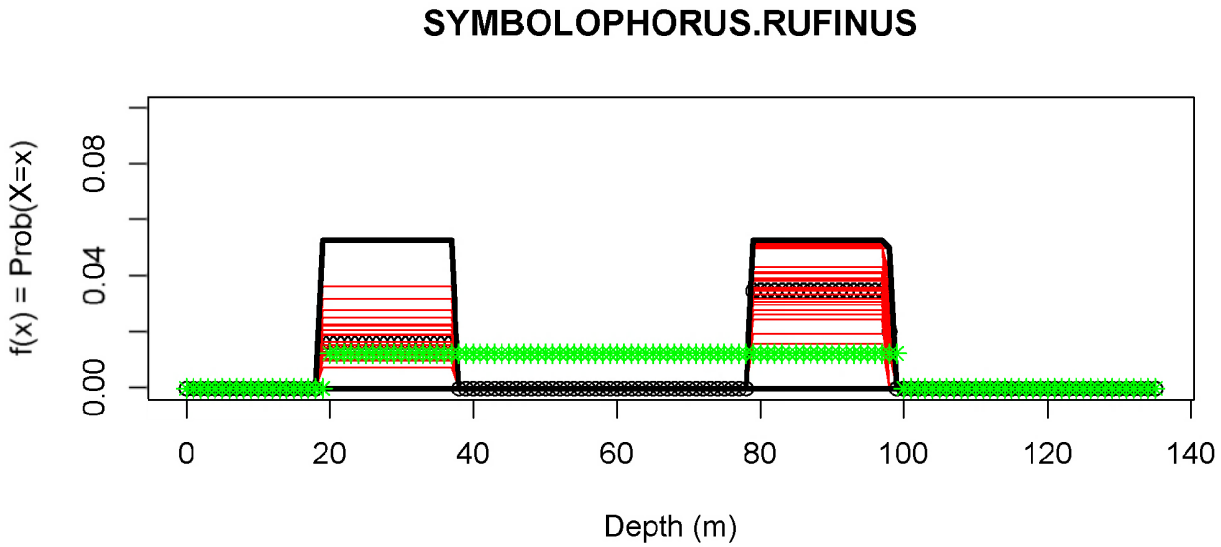

SCOMBEROMORUS.MACULATUS
Min Depth= 10 Max Depth= 19 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

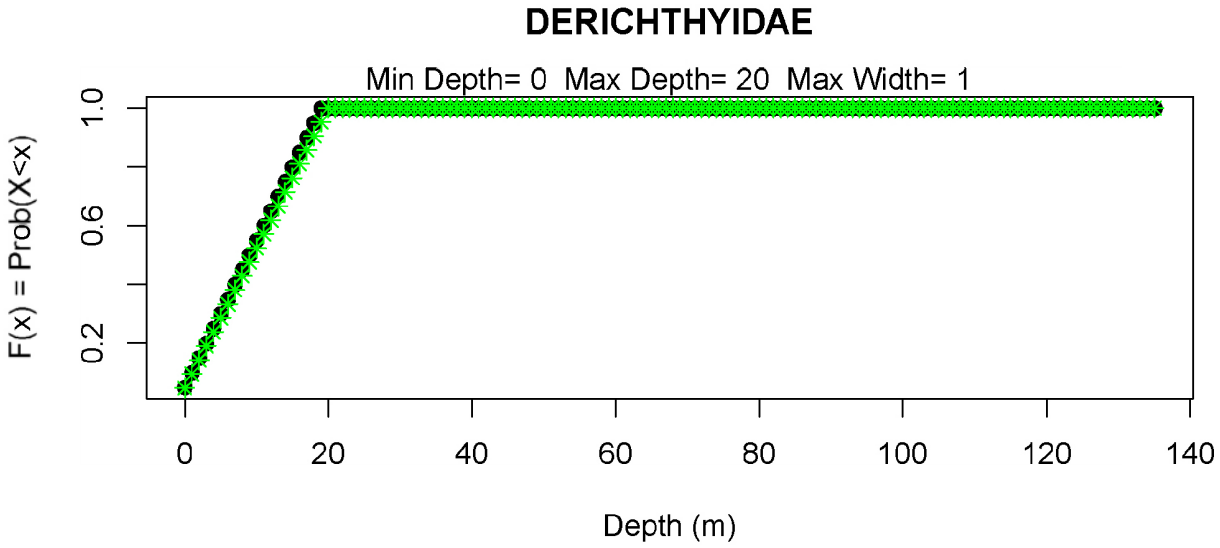

SCOMBEROMORUS.MACULATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

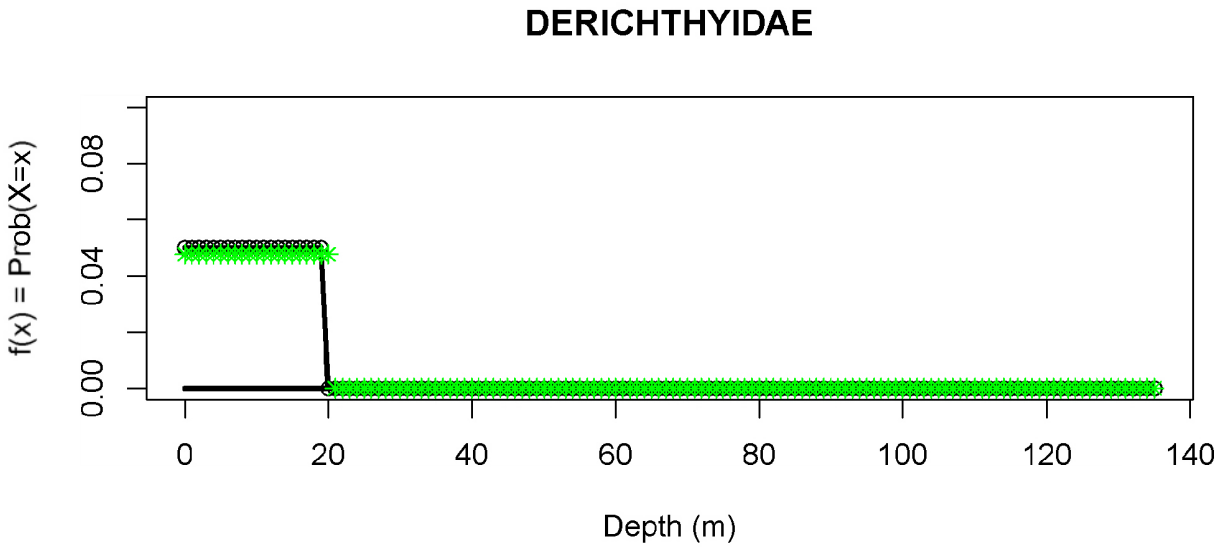

POECILOPSETTA
Min Depth= 40 Max Depth= 80 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

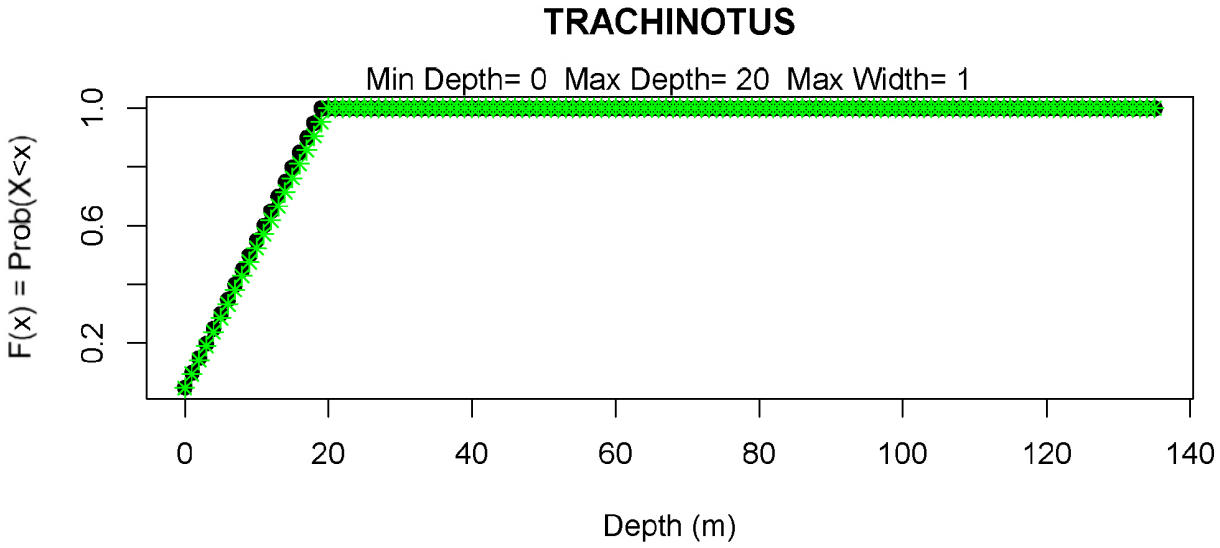

POECILOPSETTA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

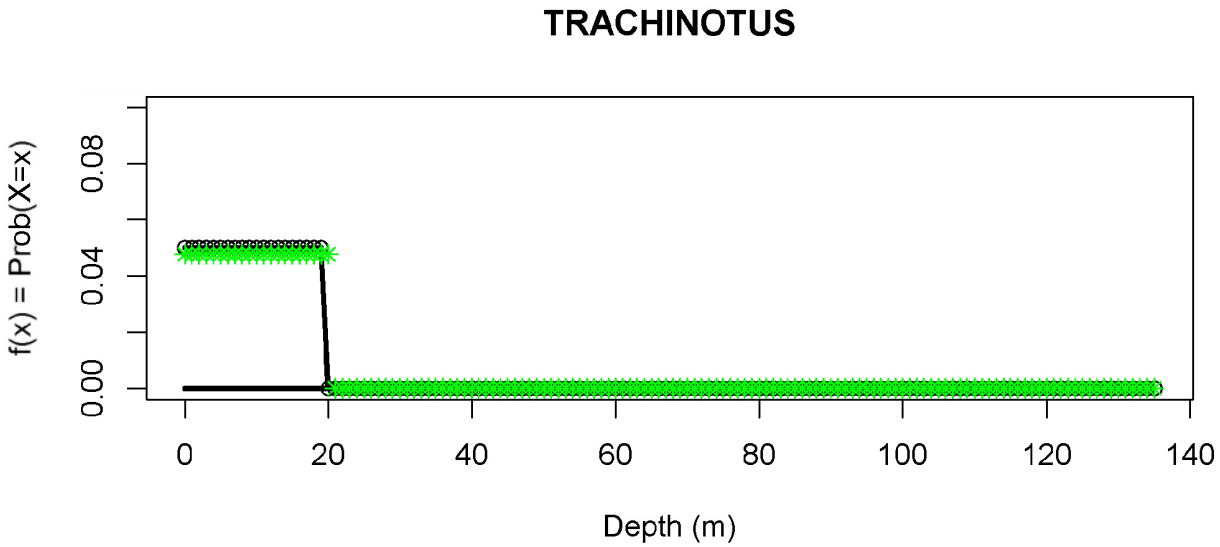

SYMBOLOPHORUS.RUFINUS
Min Depth= 20 Max Depth= 99 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

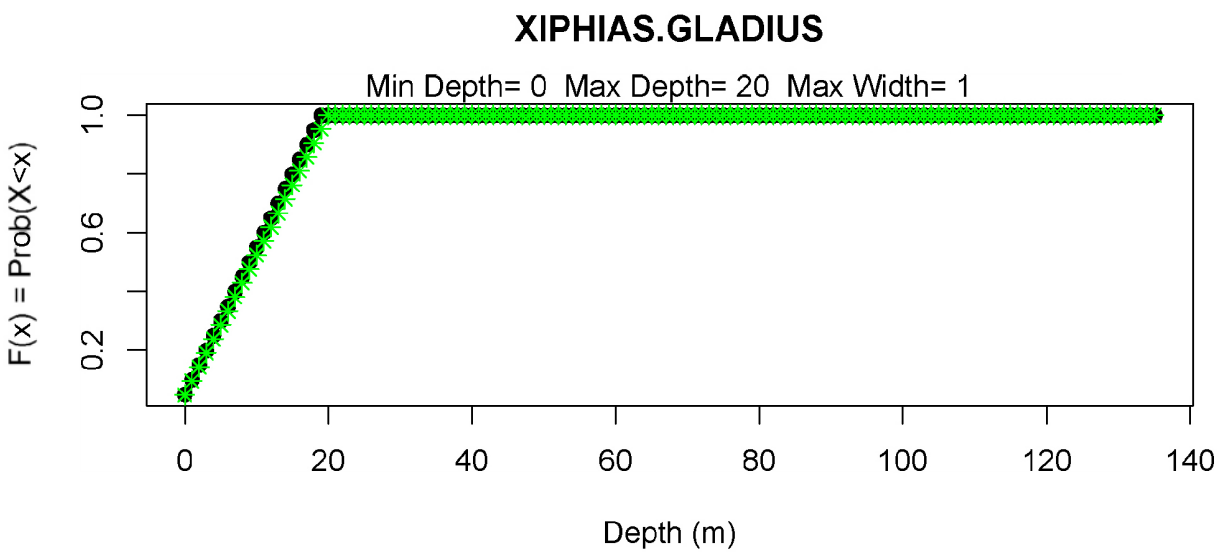

SYMBOLOPHORUS.RUFINUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

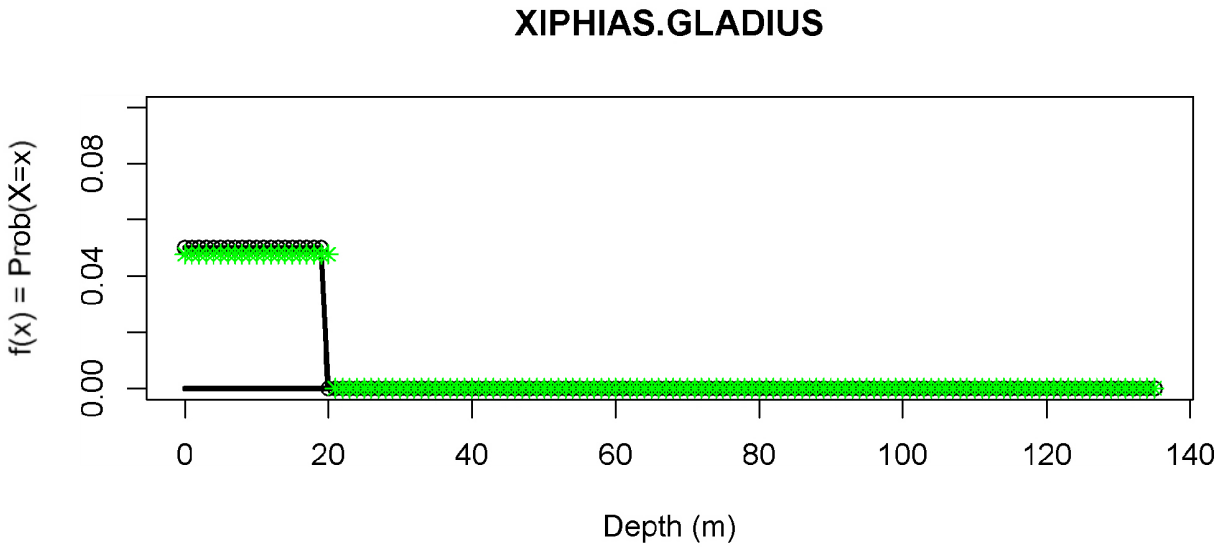

DERICHTHYIDAE
Min Depth= 0 Max Depth= 20 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

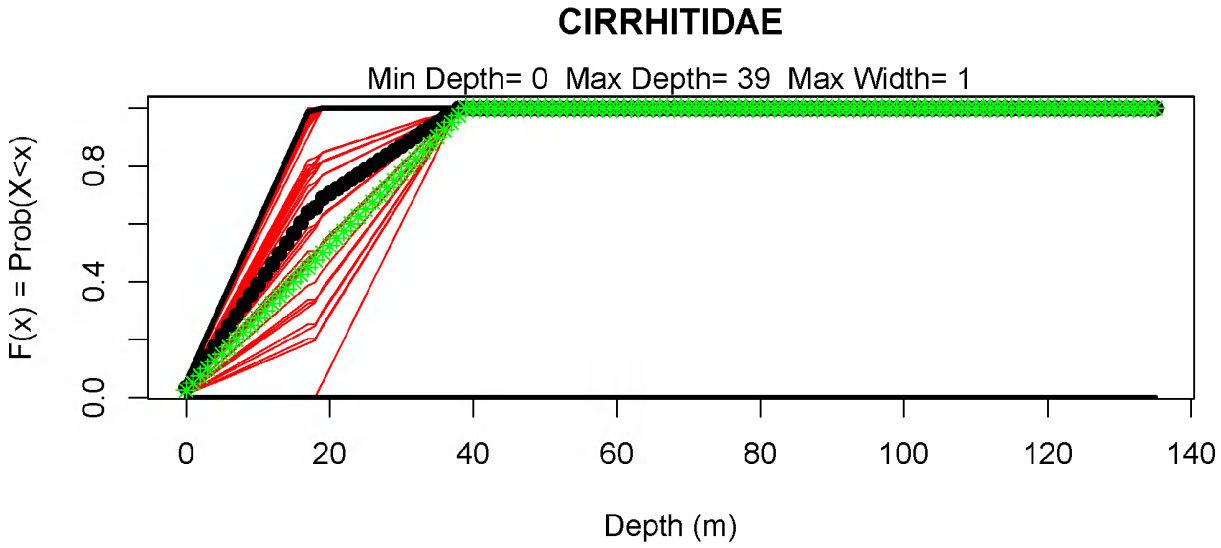

DERICHTHYIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

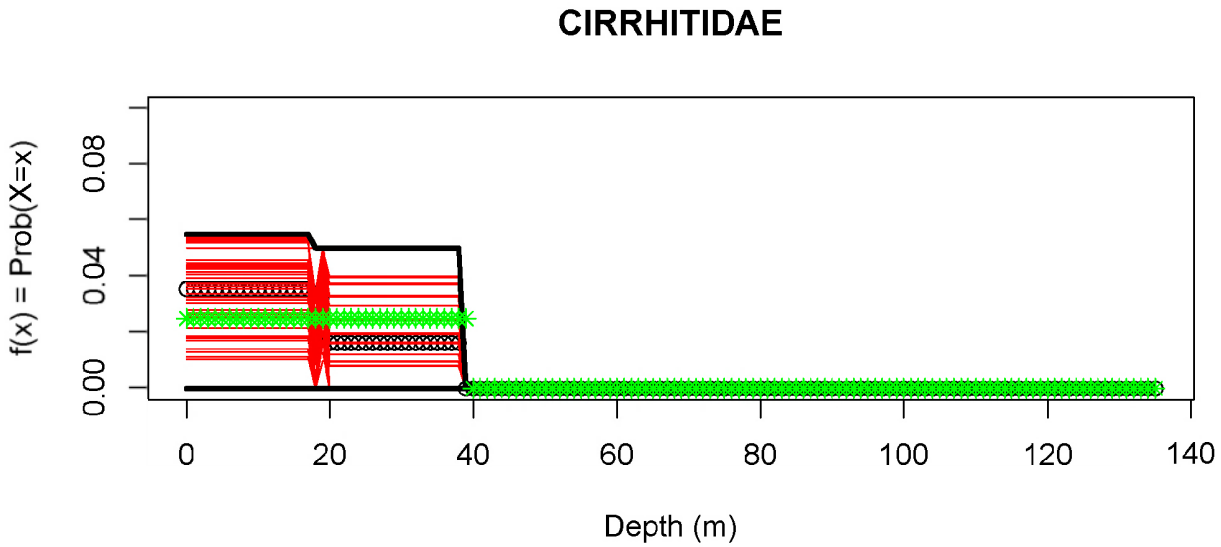

TRACHINOTUS
Min Depth= 0 Max Depth= 20 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

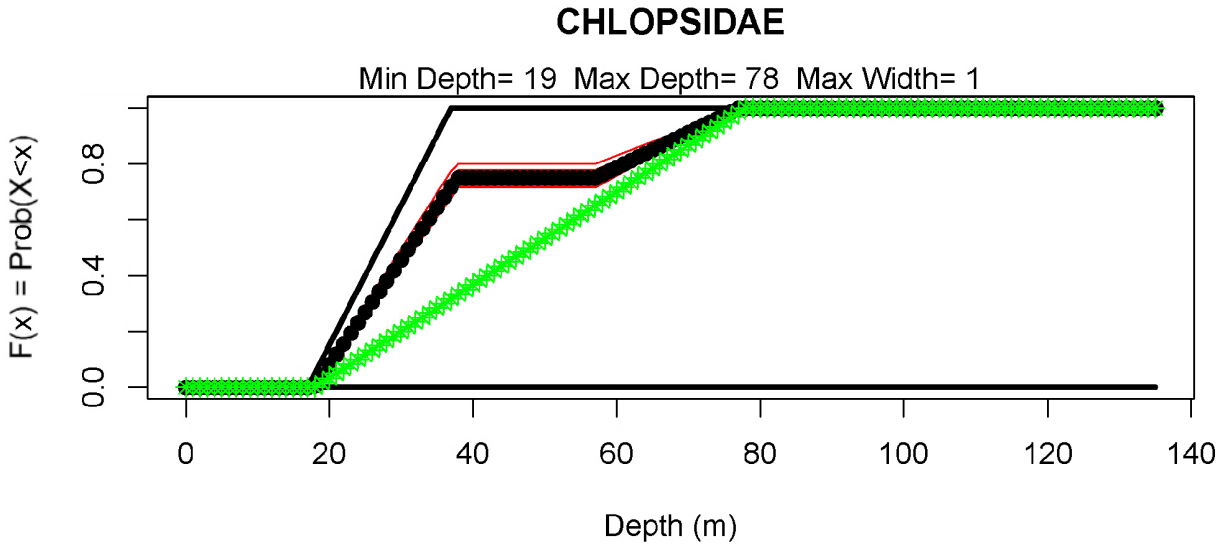

TRACHINOTUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

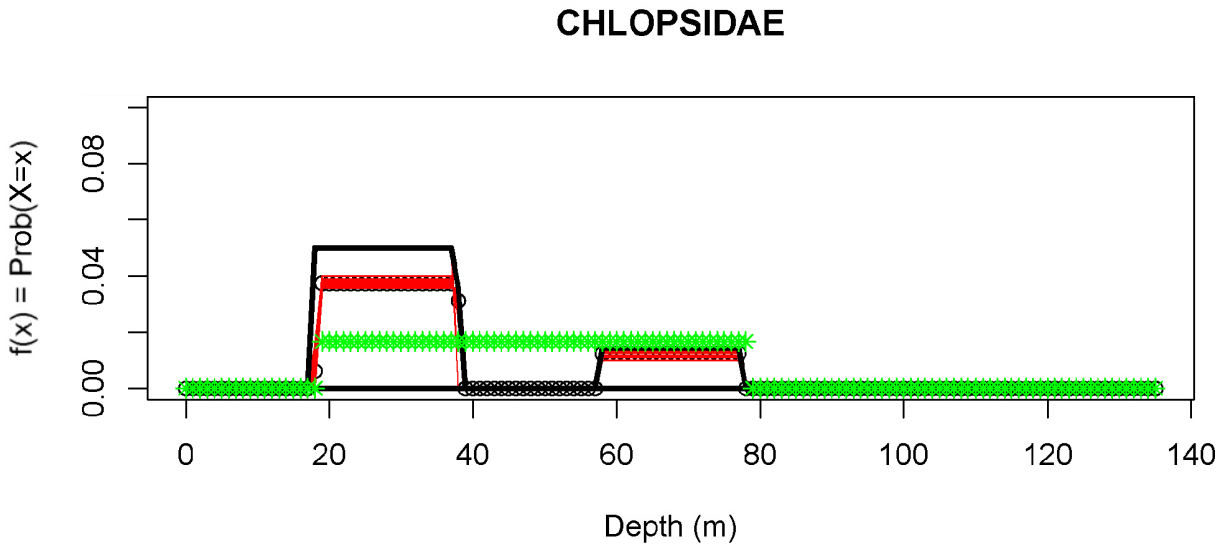

XIPHIAS.GLADIUS
Min Depth= 0 Max Depth= 20 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

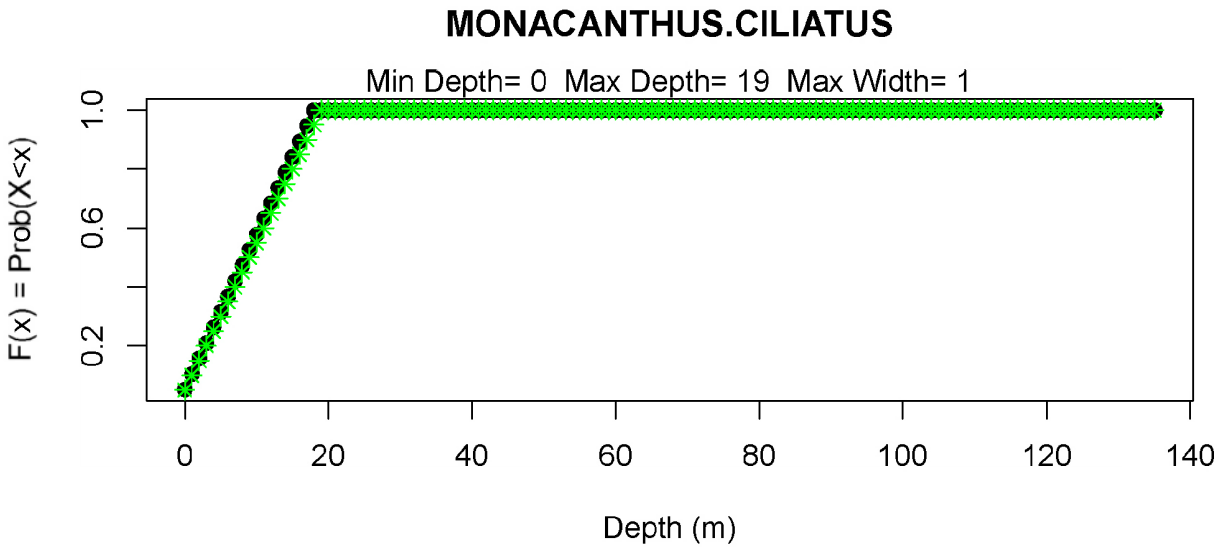

XIPHIAS.GLADIUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

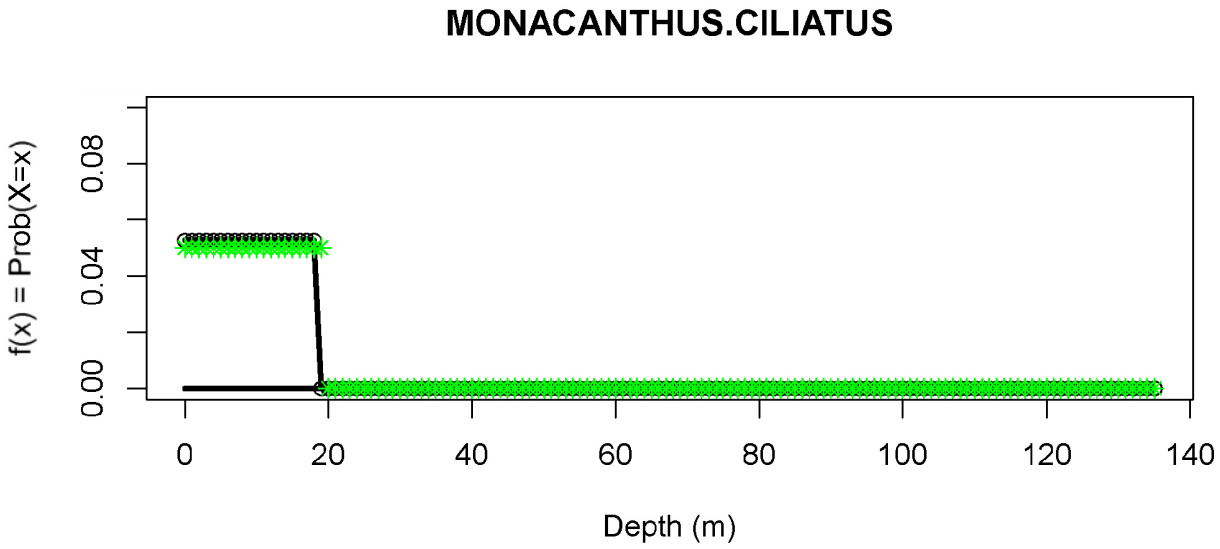

CIRRHITIDAE
Min Depth= 0 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

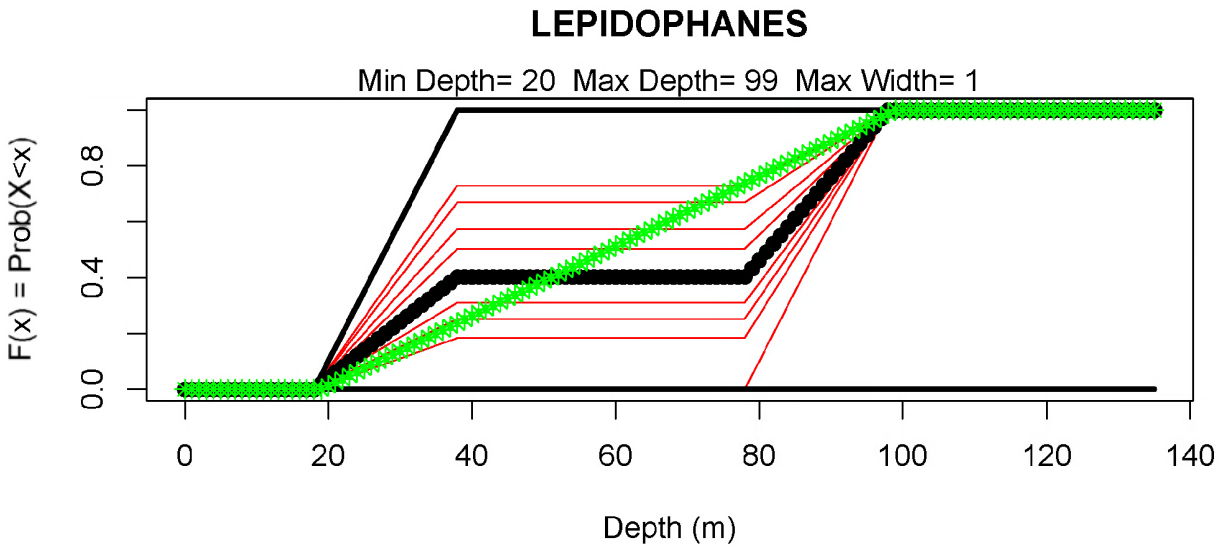

CIRRHITIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

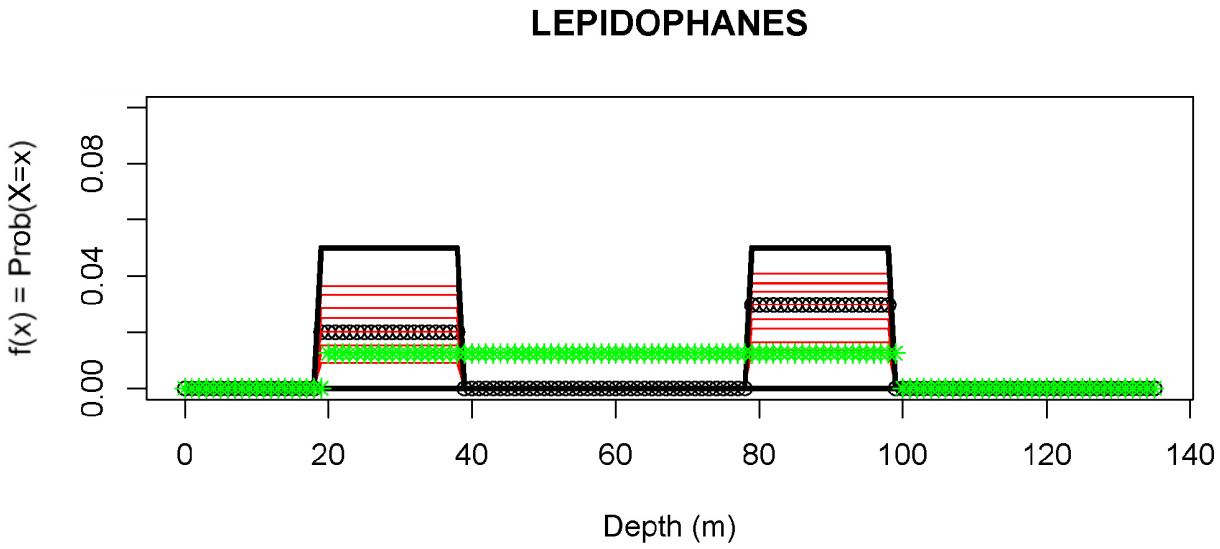

CHLOPSIDAE
Min Depth= 19 Max Depth= 78 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

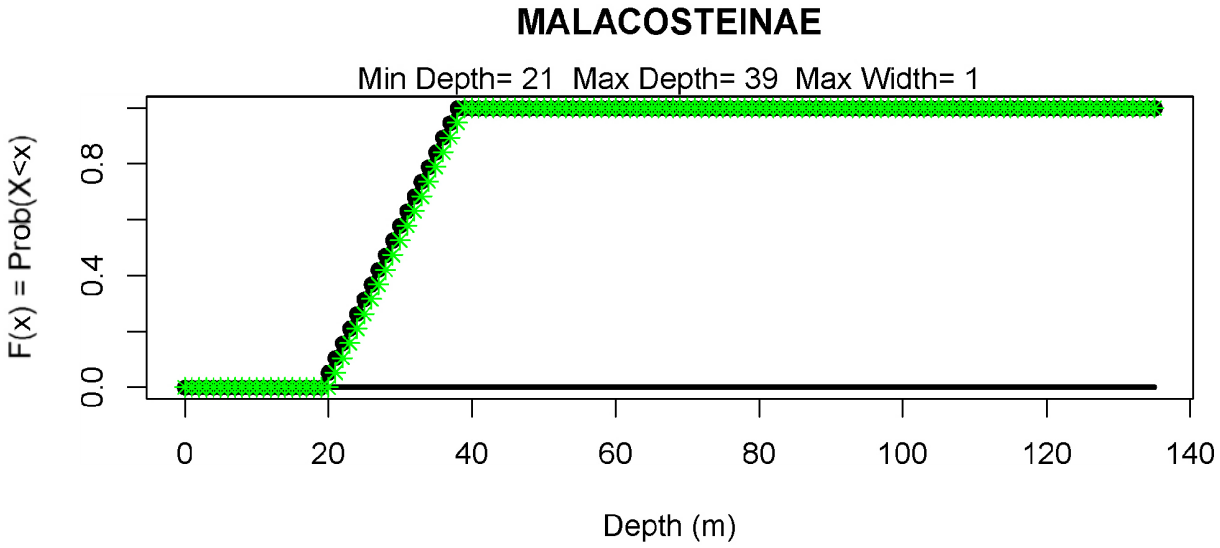

CHLOPSIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

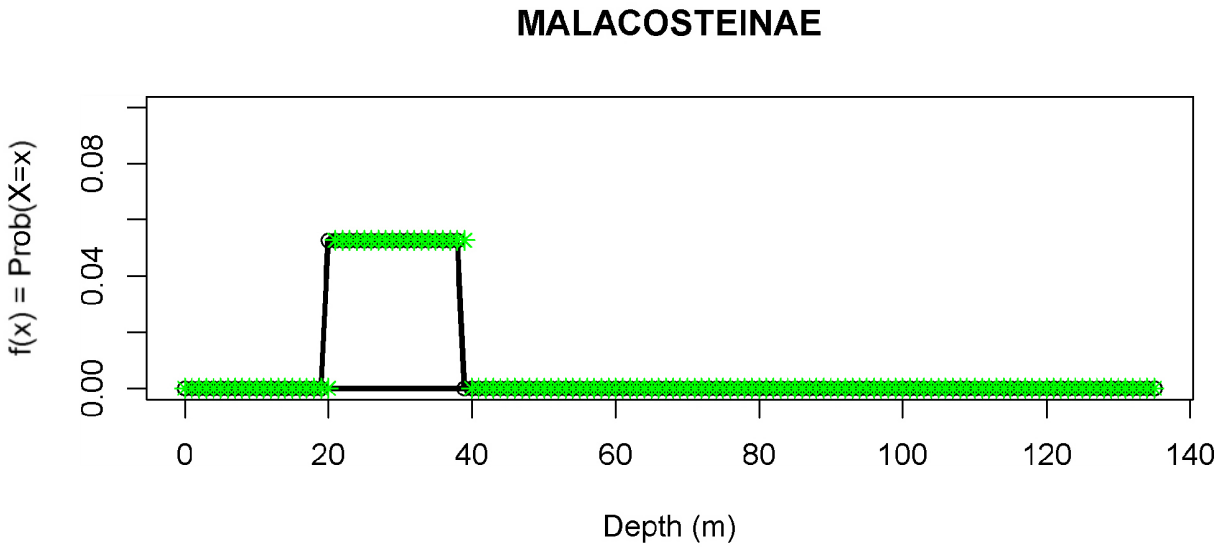

MONACANTHUS.CILIATUS
Min Depth= 0 Max Depth= 19 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

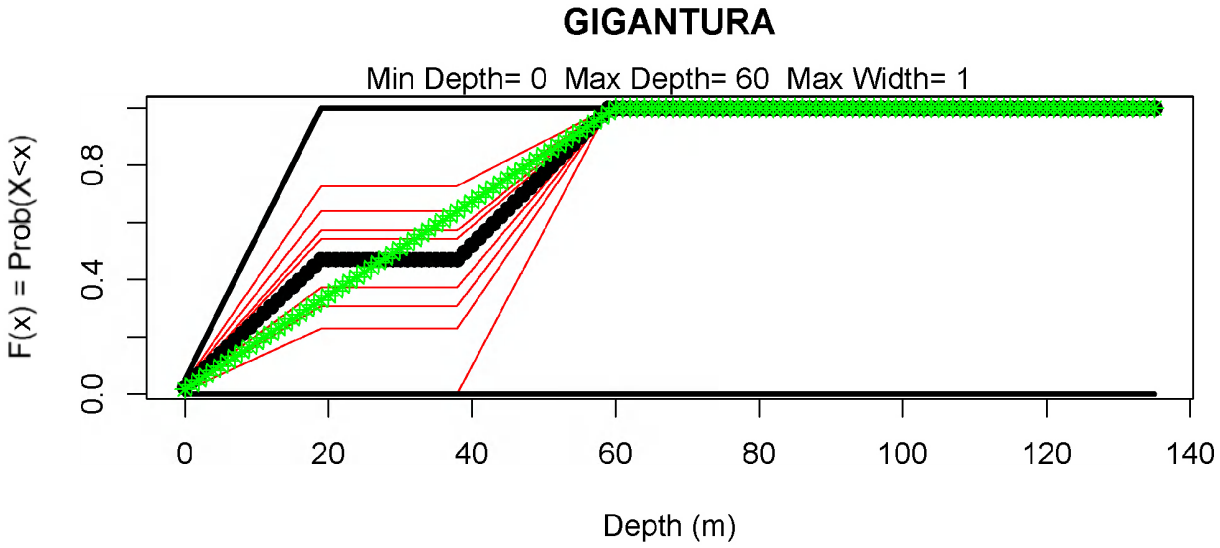

MONACANTHUS.CILIATUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

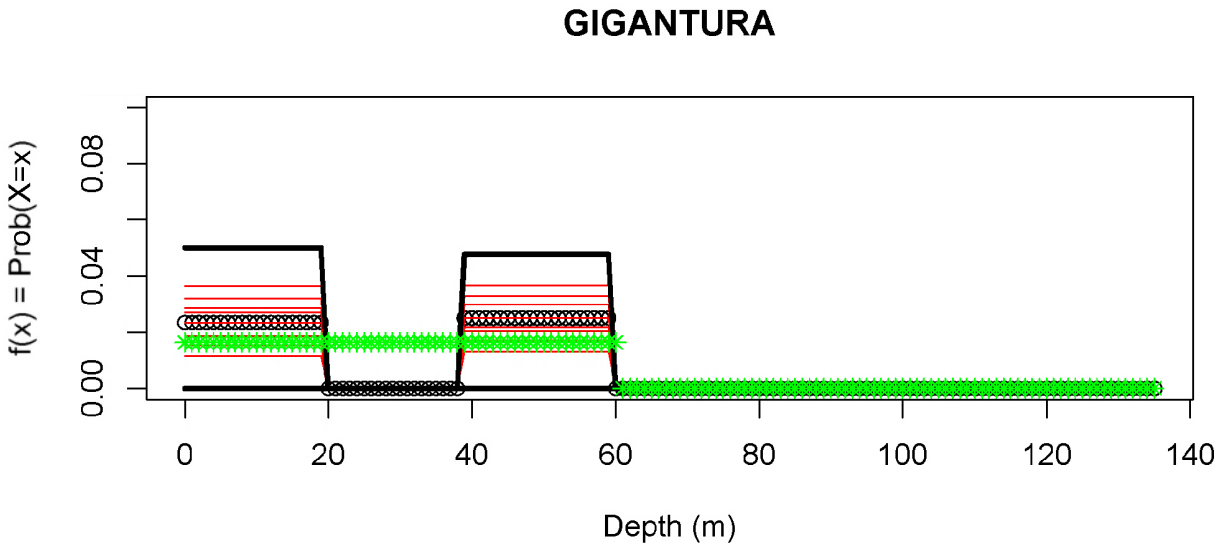

LEPIDOPHANES
Min Depth= 20 Max Depth= 99 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

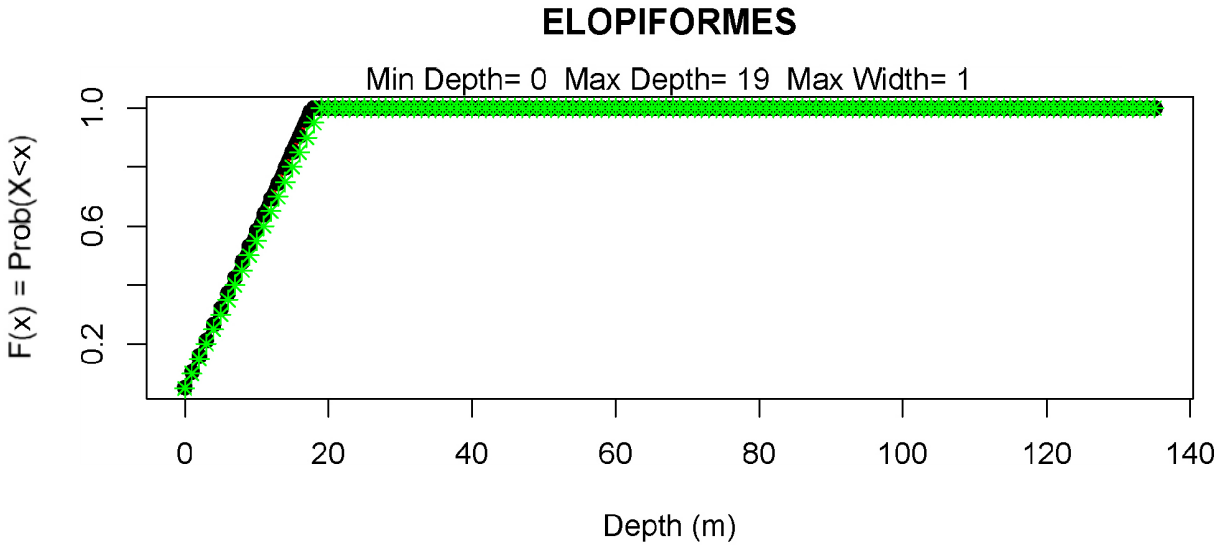

LEPIDOPHANES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

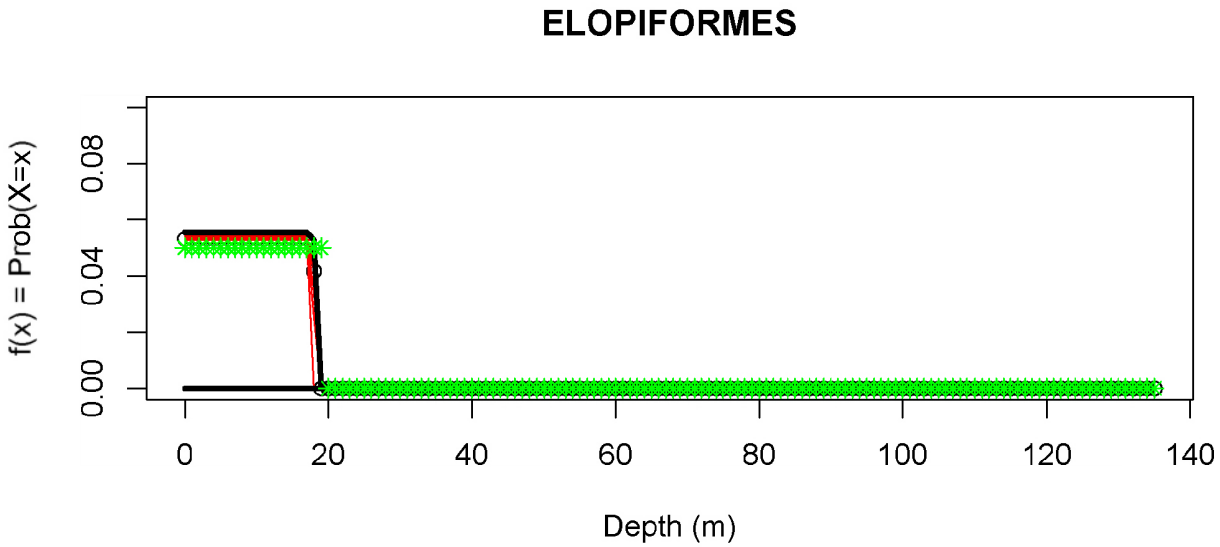

MALACOSTEINAE
Min Depth= 21 Max Depth= 39 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

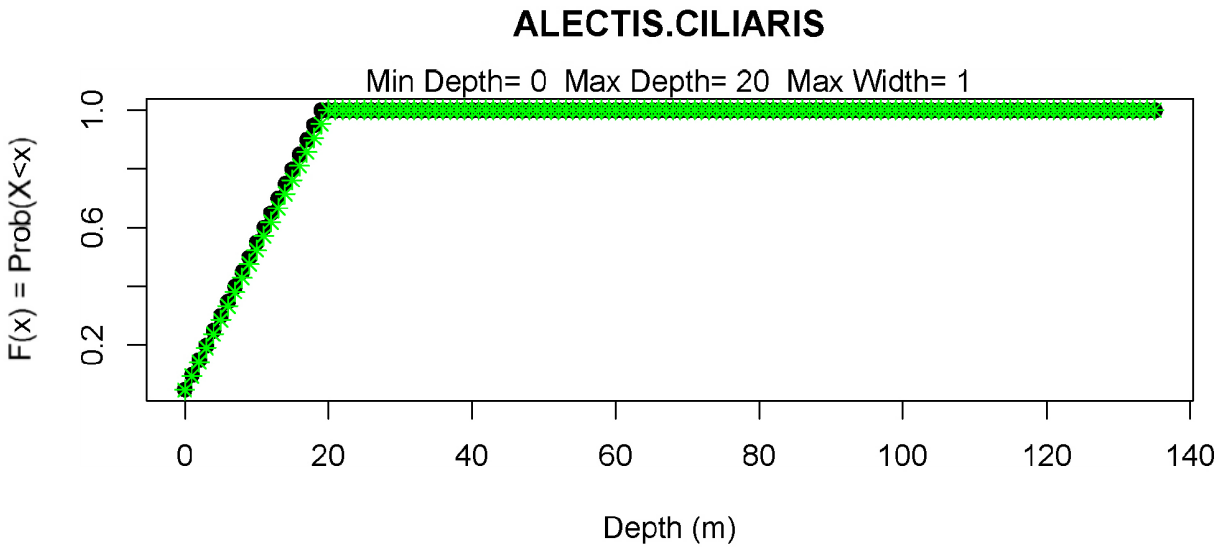

MALACOSTEINAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

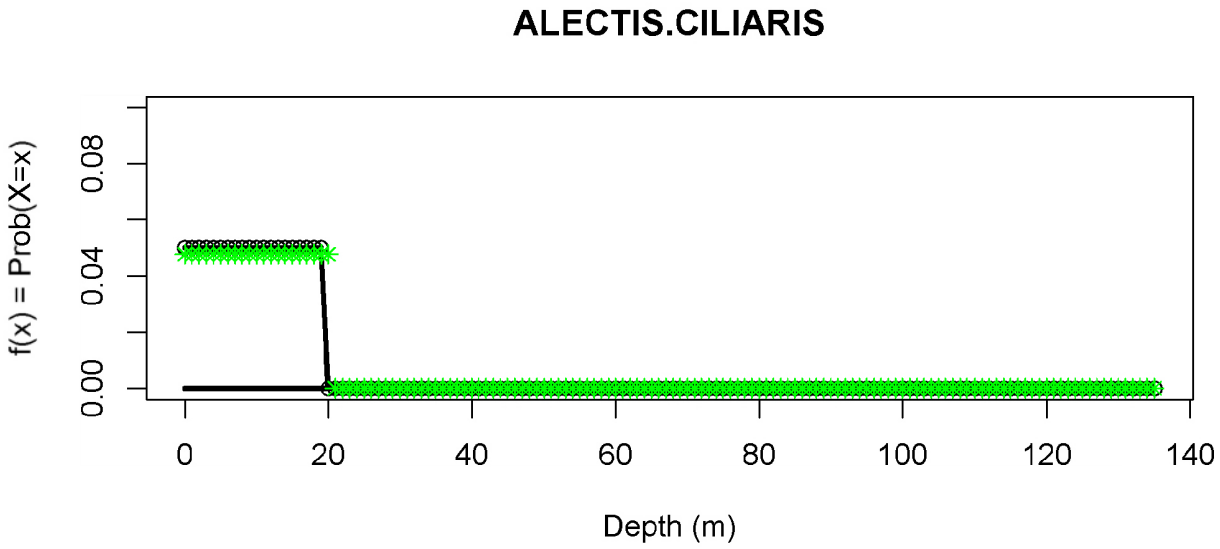

GIGANTURA
Min Depth= 0 Max Depth= 60 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

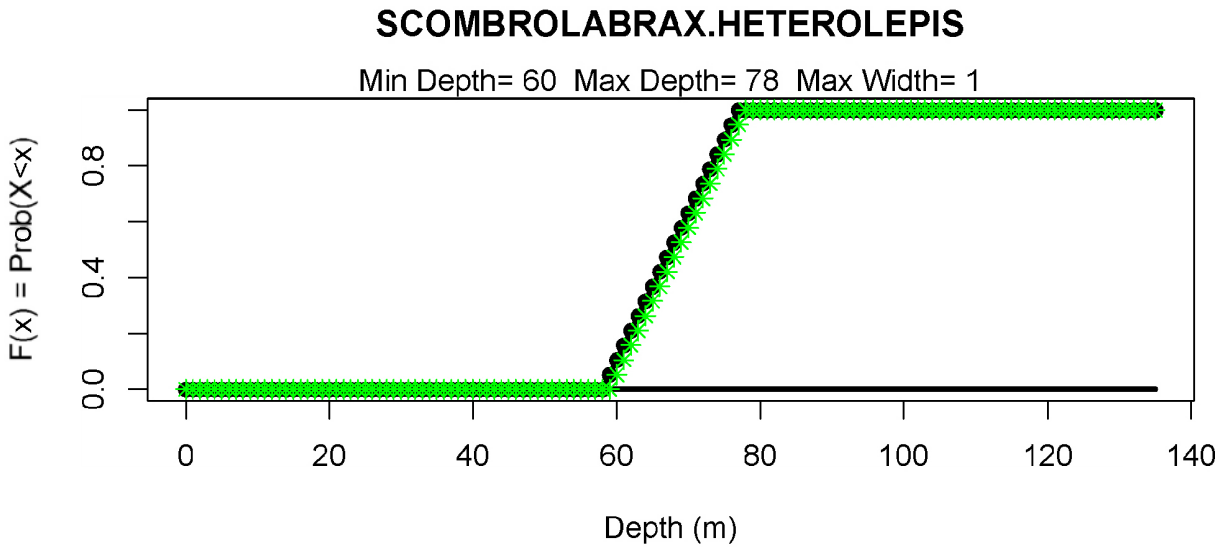

GIGANTURA
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

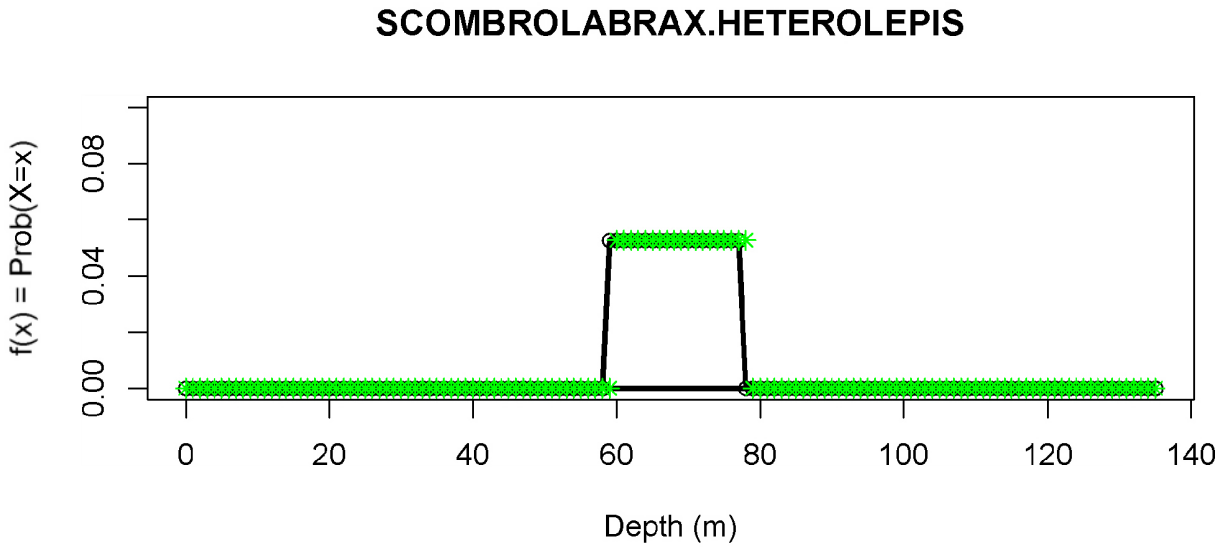

ELOPIFORMES
Min Depth= 0 Max Depth= 19 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

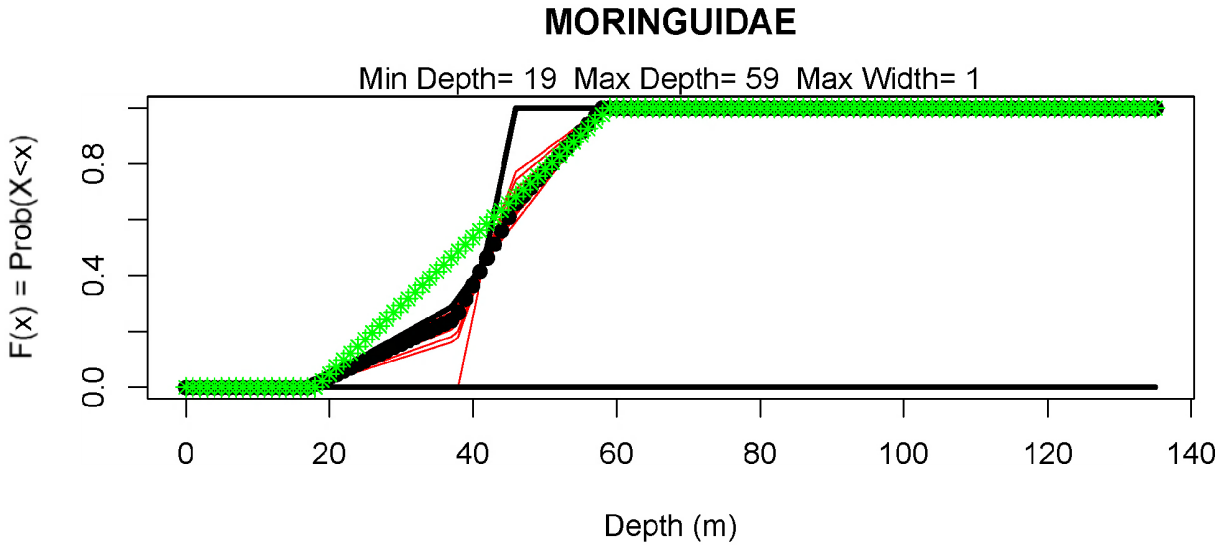

ELOPIFORMES
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

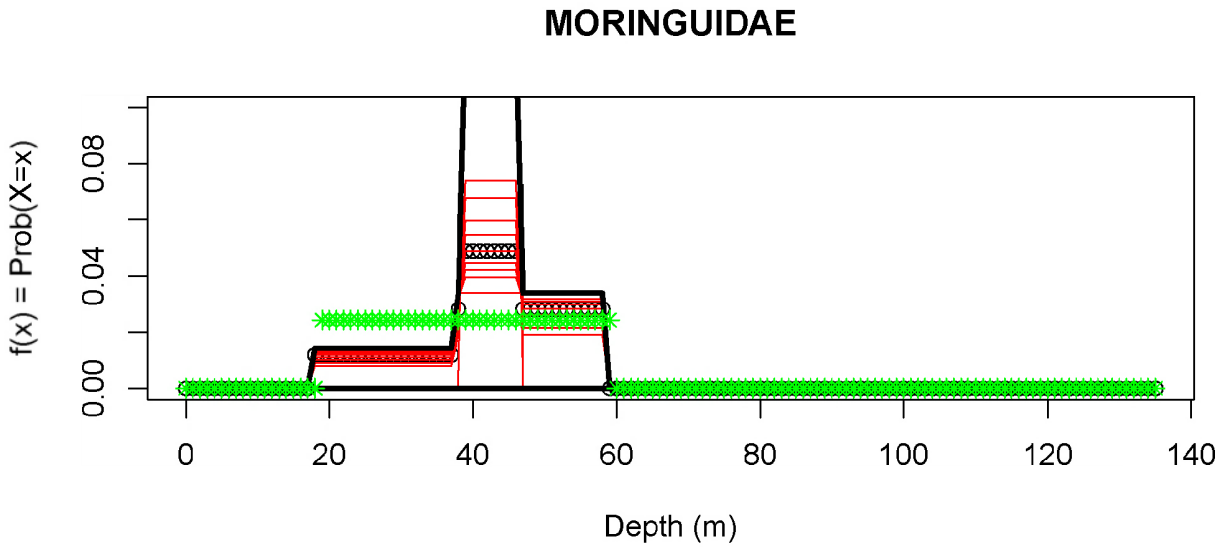

ALECTIS.CILIARIS
Min Depth= 0 Max Depth= 20 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

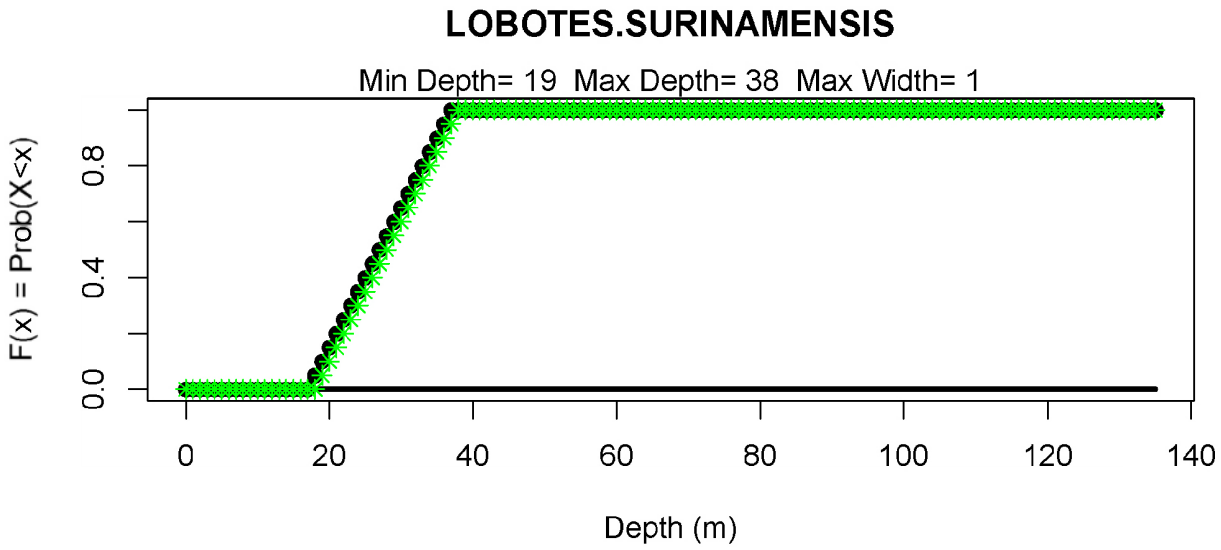

ALECTIS.CILIARIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

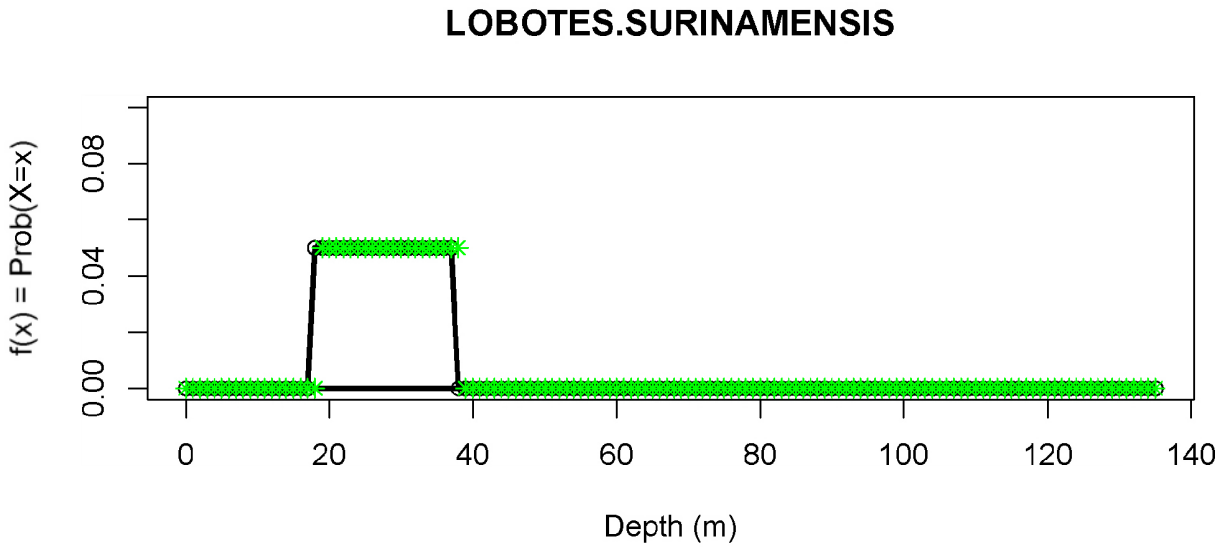

SCOMBROLABRAX.HETEROLEPIS
Min Depth= 60 Max Depth= 78 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

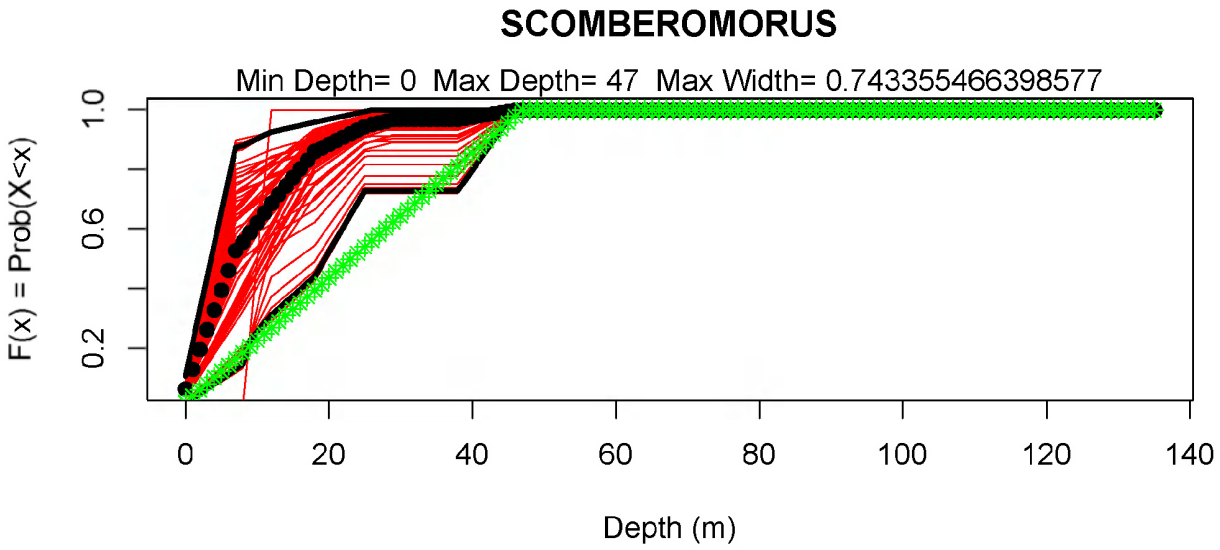

SCOMBROLABRAX.HETEROLEPIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

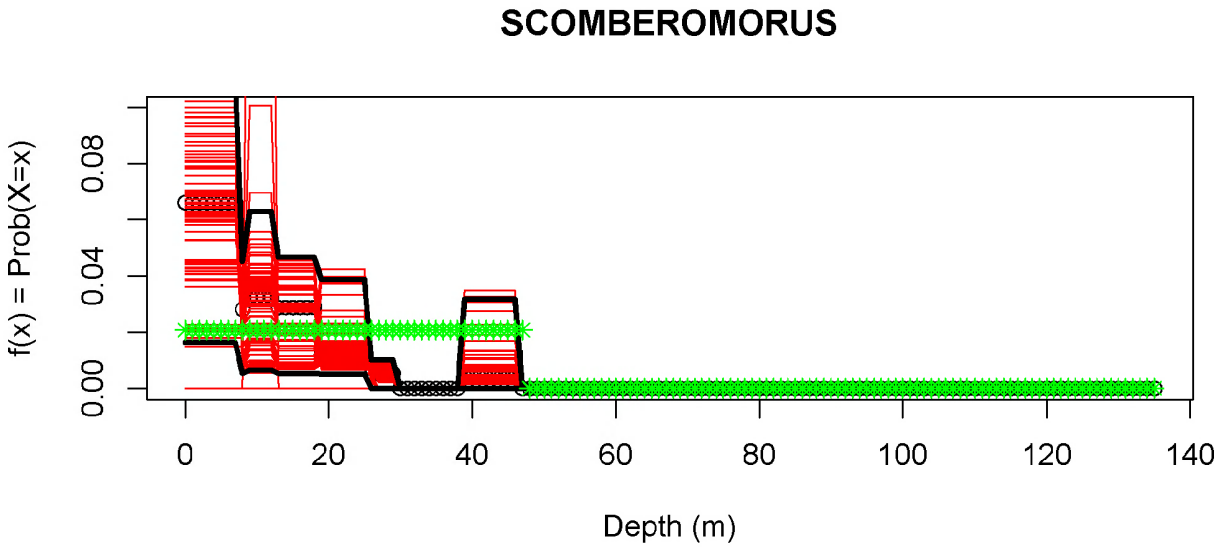

MORINGUIDAE
Min Depth= 19 Max Depth= 59 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

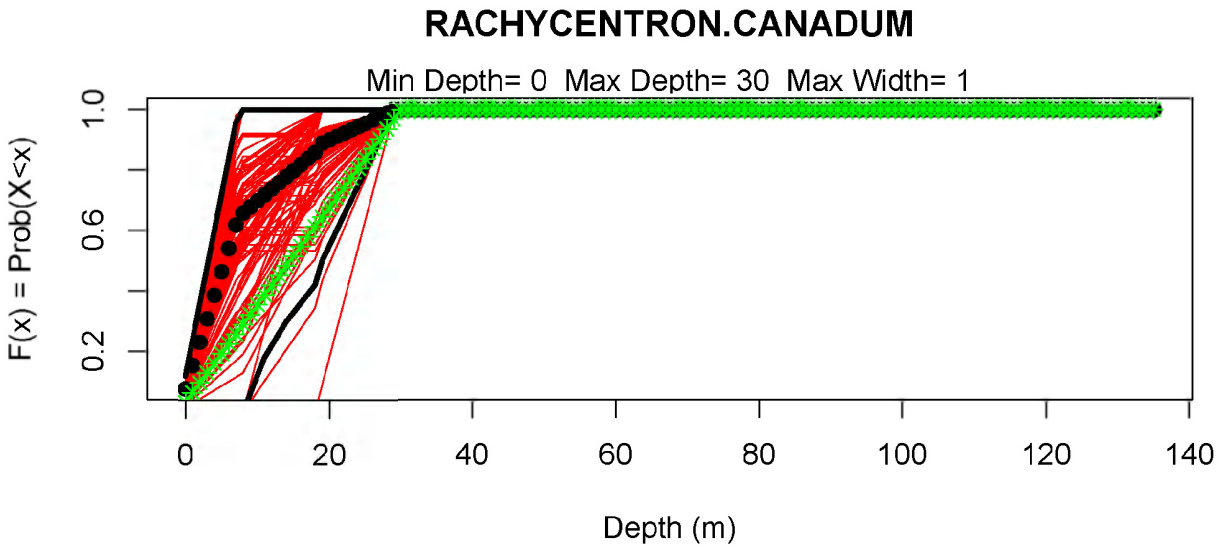

MORINGUIDAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

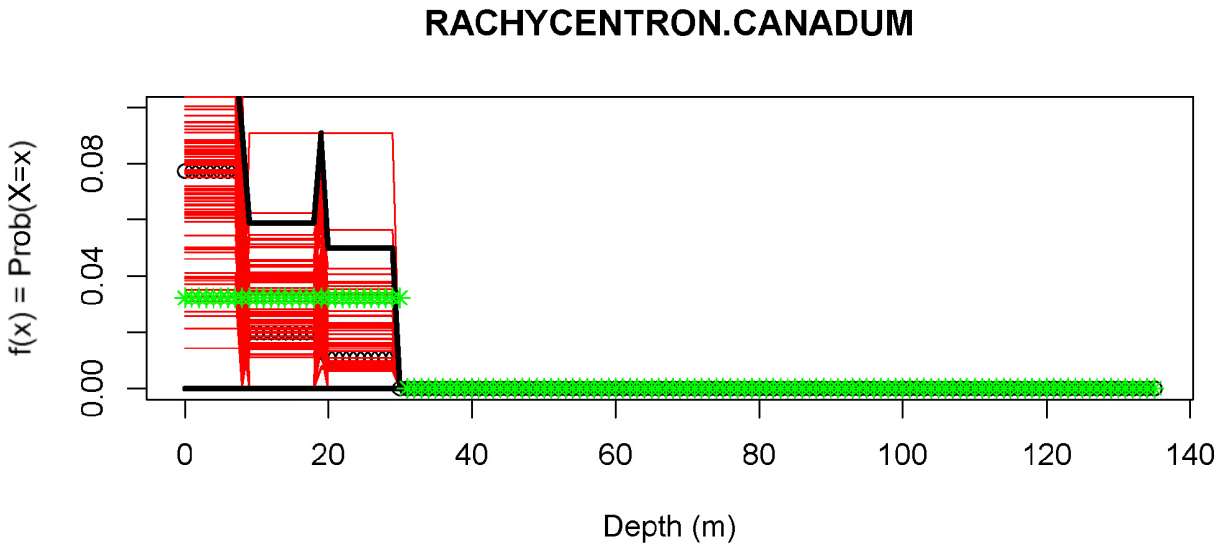

LOBOTES.SURINAMENSIS
Min Depth= 19 Max Depth= 38 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)

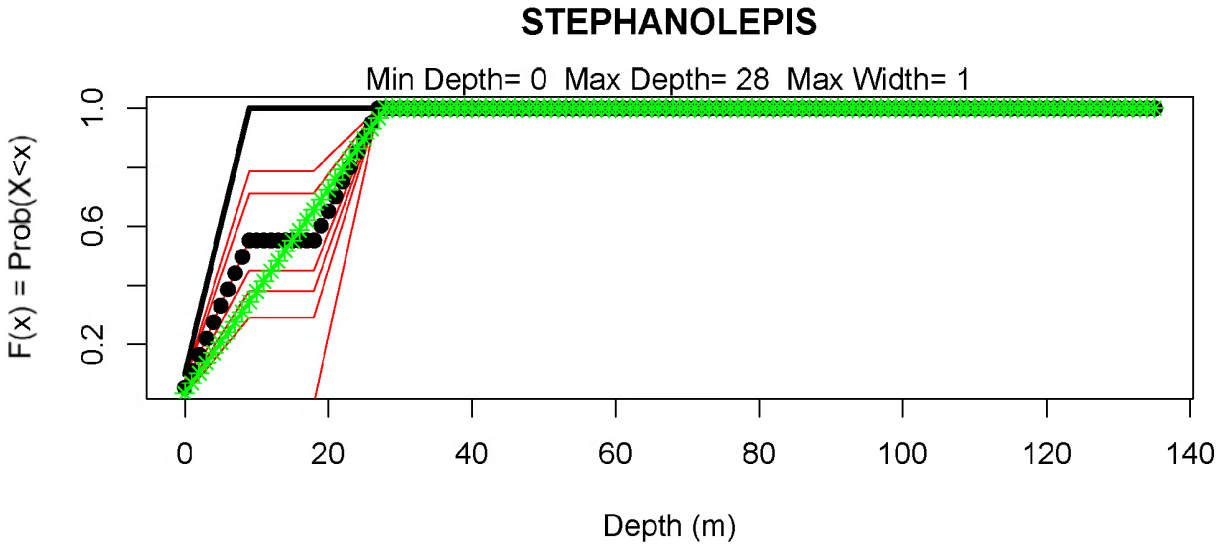

LOBOTES.SURINAMENSIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

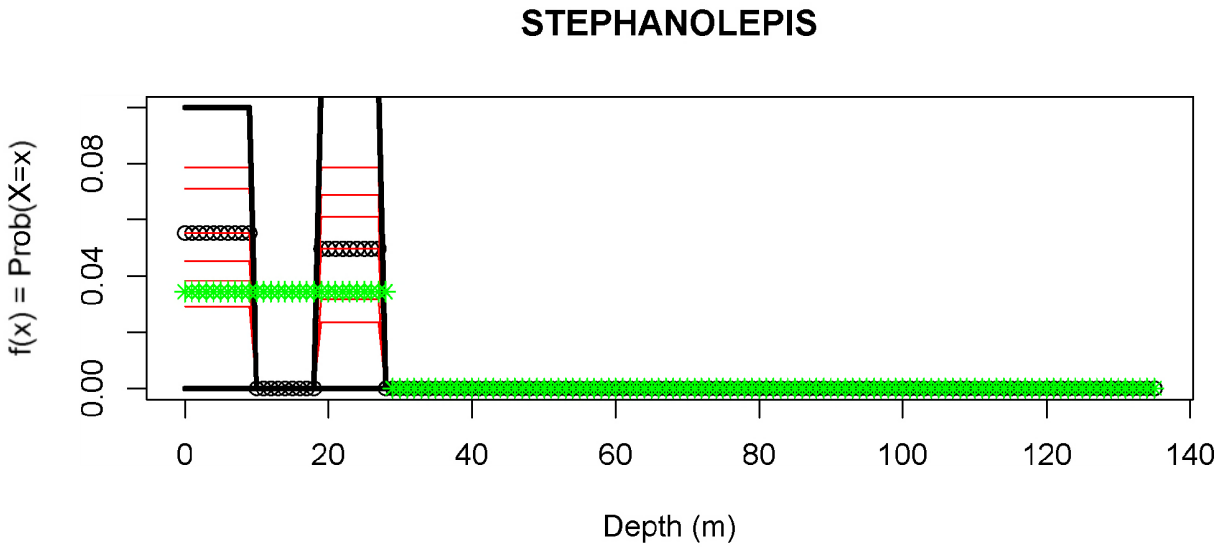

SCOMBEROMORUS
Min Depth= 0 Max Depth= 47 Max Width= 0.743355466398577
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

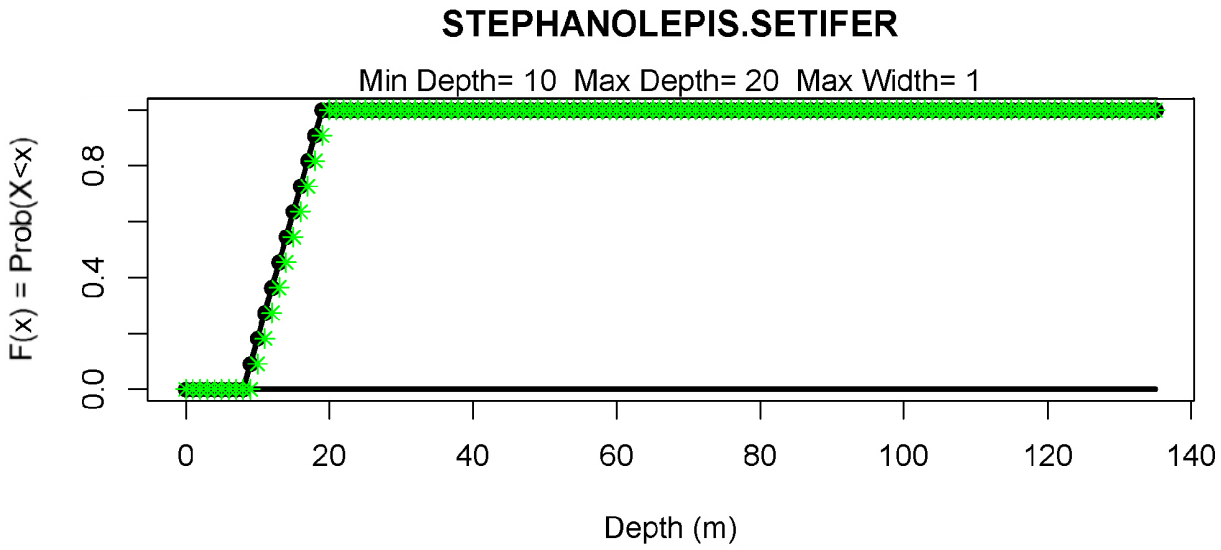

SCOMBEROMORUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

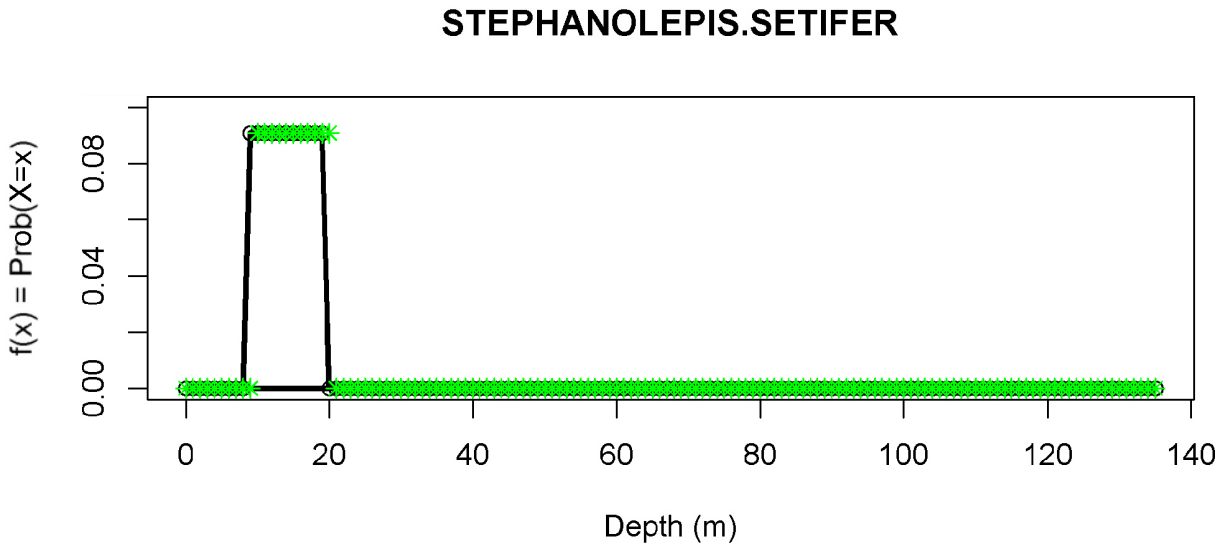

RACHYCENTRON.CANADUM
Min Depth= 0 Max Depth= 30 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

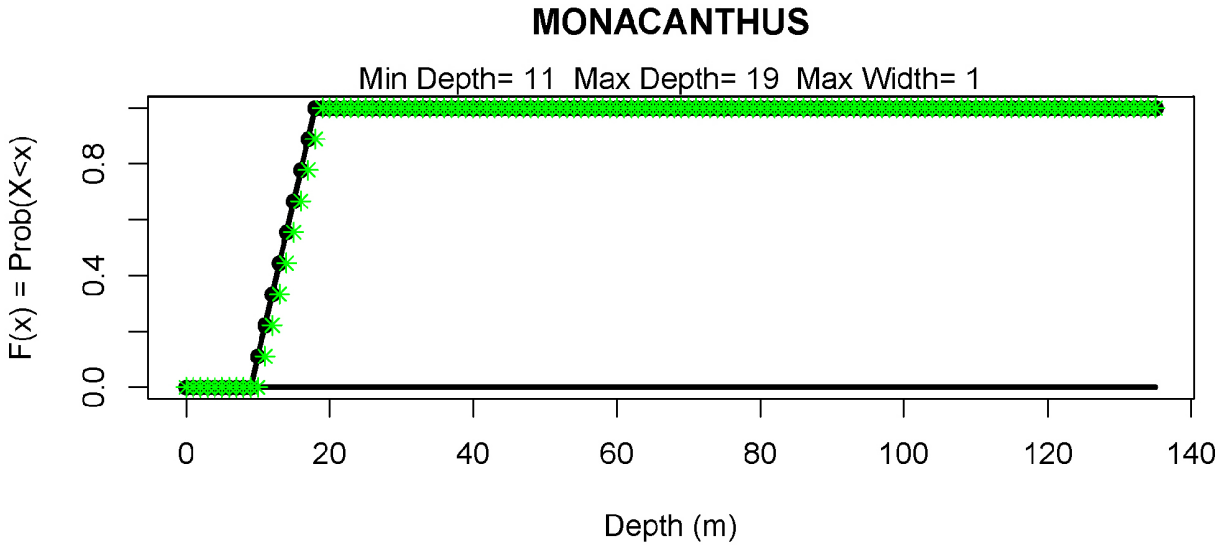

RACHYCENTRON.CANADUM
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

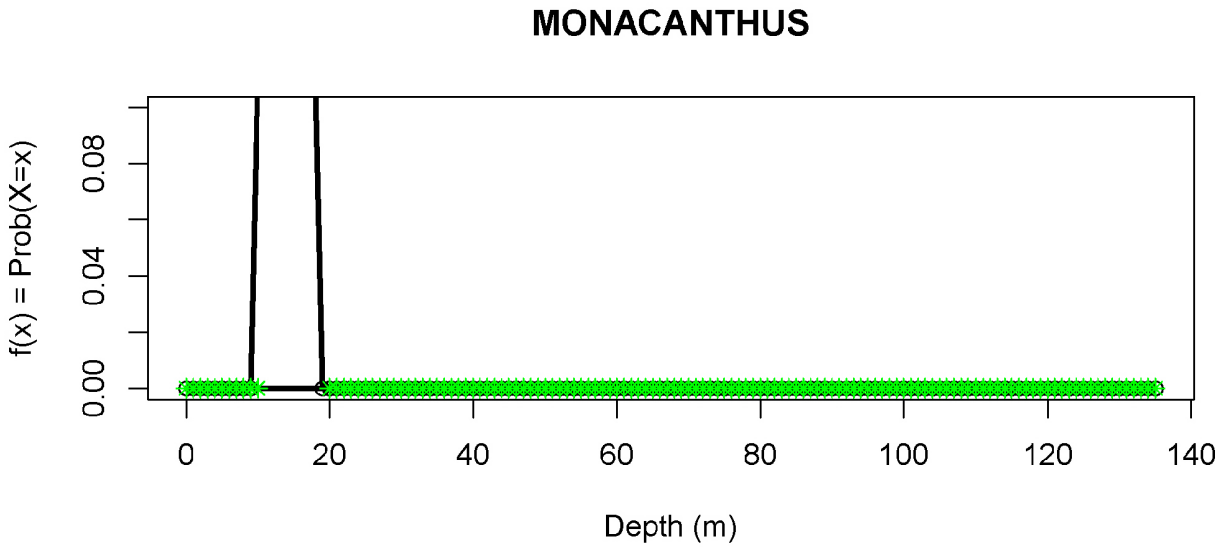

STEPHANOLEPIS
Min Depth= 0 Max Depth= 28 Max Width= 1
F(x) = Prob(X<x)
0.2
0.6
1.0
0
20
40
60
80
100
120
140
Depth (m)

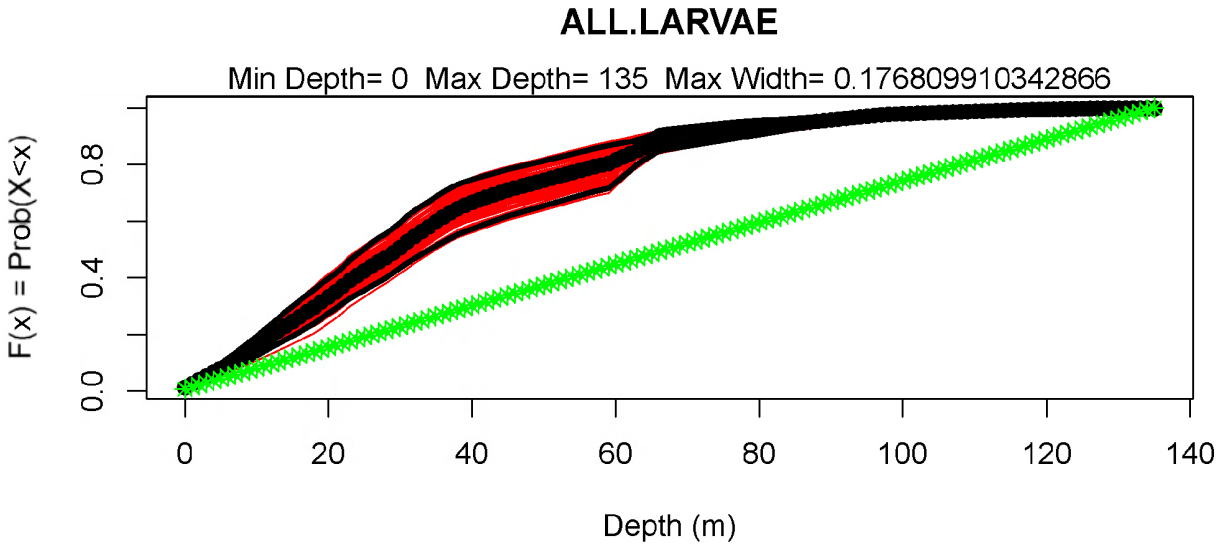

STEPHANOLEPIS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

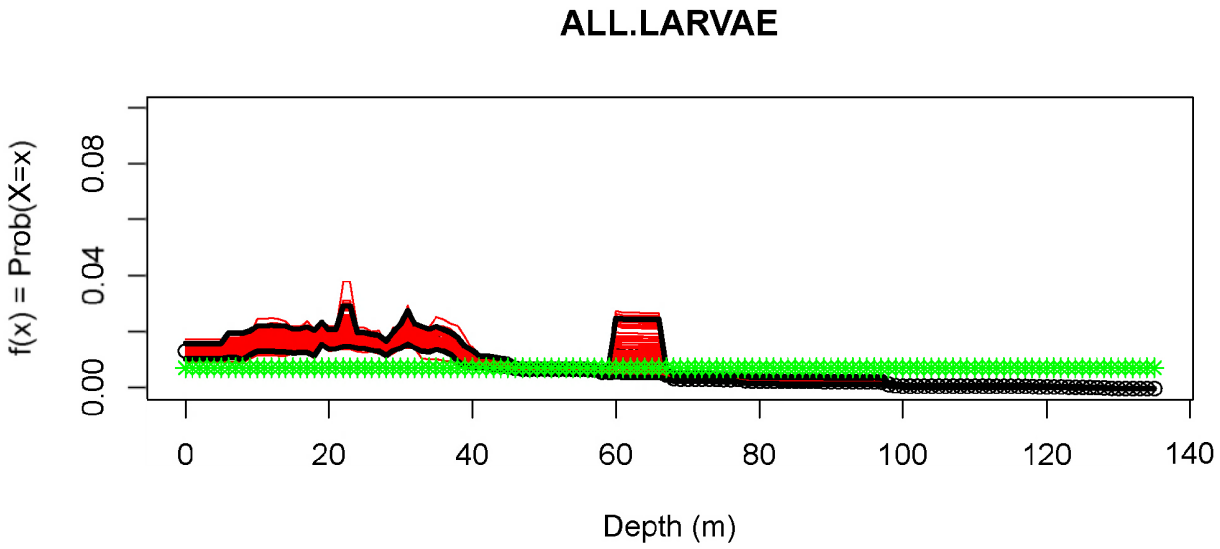

STEPHANOLEPIS.SETIFER
Min Depth= 10 Max Depth= 20 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


STEPHANOLEPIS.SETIFER
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)


MONACANTHUS
Min Depth= 11 Max Depth= 19 Max Width= 1
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


MONACANTHUS
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)


ALL.LARVAE
Min Depth= 0 Max Depth= 135 Max Width= 0.176809910342866
F(x) = Prob(X<x)
0.0
0.4
0.8
0
20
40
60
80
100
120
140
Depth (m)


ALL.LARVAE
f(x) = Prob(X=x)
0.00
0.04
0.08
0
20
40
60
80
100
120
140
Depth (m)

Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

Appendices C - F. Vertical Distribution Histograms of MOCNESS Datasets

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

Date of Report: August 31, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879

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Figure C2-2. Frequency distribution of water column depths at SEAMAP Ichthyoplankton 1-m^2 MOCNESS stations 3

Figure C2-3. Sample locations used from the NRDA 1 m^2 MOCNESS Tier1A Walton Smith 4 survey. Red circles indicate shallow deployments (Tier1A Shallow; < 200 m sample depth), whereas blue circles reflect deep casts (Tier1A Deep; > 200 m sample depth). MOC1 samples reflect the discrete nets; the number of deployments is fewer as several nets make up a deployment. The MC252 Wellhead is indicated with the black dot. Black lines represent 200 m, 1,000 m, 2,000 m, and 3,000 m bathymetry contours. 4

Figure C2-4. Locations of NRDA 10 m^2 MOCNESS samples from cruise MS7. The MC252 Wellhead is indicated with the black dot. Black lines represent 200 m, 1,000 m, 2,000 m, and 3,000 m bathymetric contours. 5

1 Introduction

This document contains the methods applied to Multiple Opening and Closing Net with an Environmental Sensing System (MOCNESS) datasets to derive information on the vertical distribution of fish larvae. The data was used to establish vertical distribution ranges for modeling analysis taxa based on relative abundance over depth. Plots were created to display the vertical distribution of abundance. For each taxon, analyses were performed using all samples pooled together, as well as for samples taken during the day and those taken at night for ichthyoplankton in the SEAMAP dataset. In the analysis of the SEAMAP data set, day and night samples excluded any samples taken within 1 hour of dawn or dusk (i.e., twilight samples).

2 MOCNESS Dataset Descriptions

2.1 SEAMAP Ichthyoplankton 1m^2 MOCNESS Sampling

Data from the NOAA/NMFS/SEFSC SEAMAP Ichthyoplankton program were used for these analyses. The data were provided by David Hanisko (NOAA/NMFS/SEFSC) on 8/30/2013. The 1 m^2 MOCNESS frame system sampled discrete depth ranges using 0.505 mm mesh nets. Surveys using the MOCNESS system were performed in the spring of 2007 and 2009, and fall of 2009, 2010, and 2011. SEAMAP stations were set up in a gridded design, covering the northern and eastern Gulf of Mexico from shallow shelf bathymetry to offshore waters >3,000 m deep; however, sampling varied depending on the year and survey (Figure C2-1, Figure C2-2).

The MOCNESS was towed obliquely through the water column from a maximum sample depth of 130 m (or less, depending on the total water column depth at the sampling location). The first net was open from the surface down to 130 m (or maximum sample depth). During the oblique tow back to the surface, the second net was opened and covered the depth range from 130 m to 100 m. Additional nets were opened and closed at approximate depth intervals of 20 m up to the surface. In each depth interval, the net was towed for a distance and steadily raised through the water column. The target volume filtered for each depth strata was 250 m^3. In waters where total water column was shallower than 130 m, fewer nets were deployed and the 20-m depth bin interval was maintained in most cases. In some shallower water instances (bathymetry <130 m), depth bin intervals were narrowed to approximately 10 m.

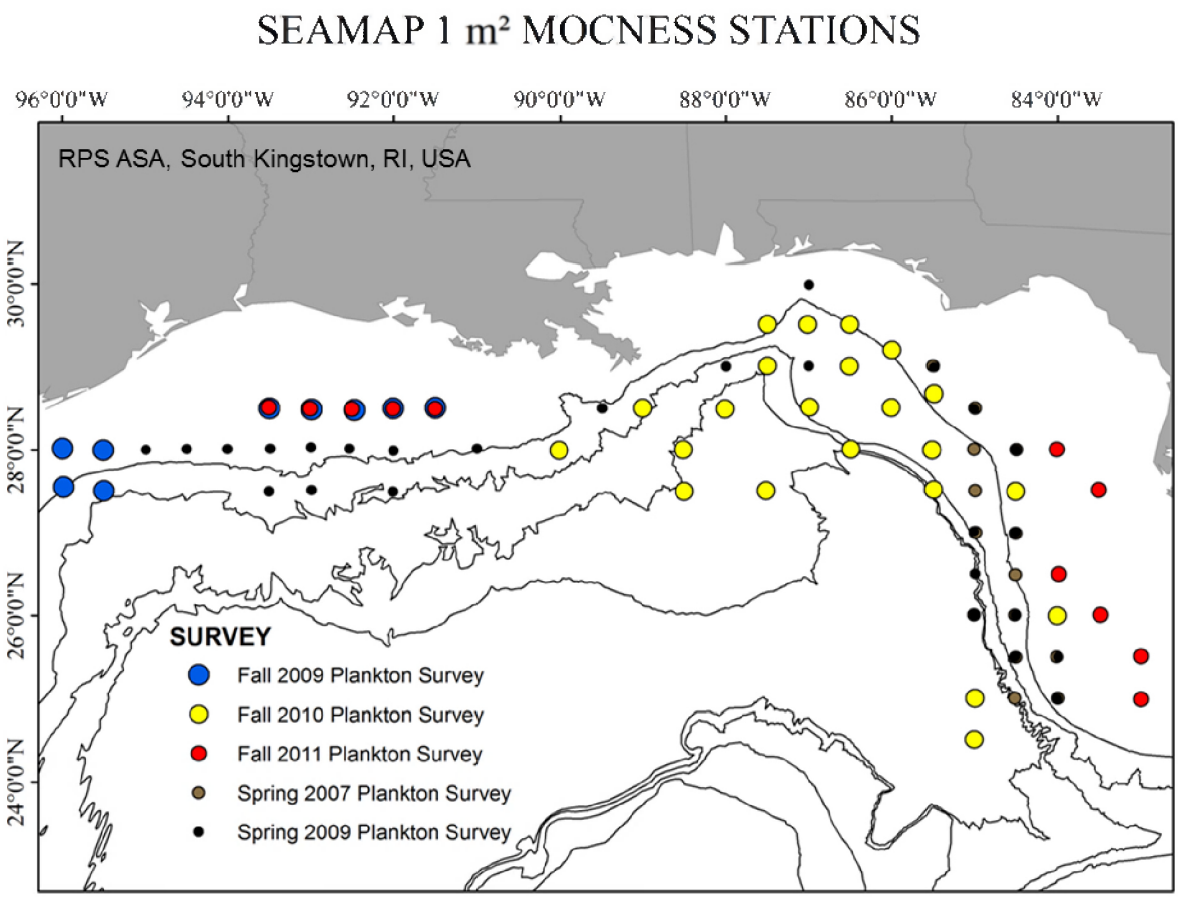


Figure C2-1. Stations for SEAMAP MOCNESS 1 m^2 sampling. Stations are symbolized by survey. Black lines are the 200, 1,000, 2,000, and 3,000-m depth contours. There were 512 nets deployed over these 97 stations. Twilight samples were not included.

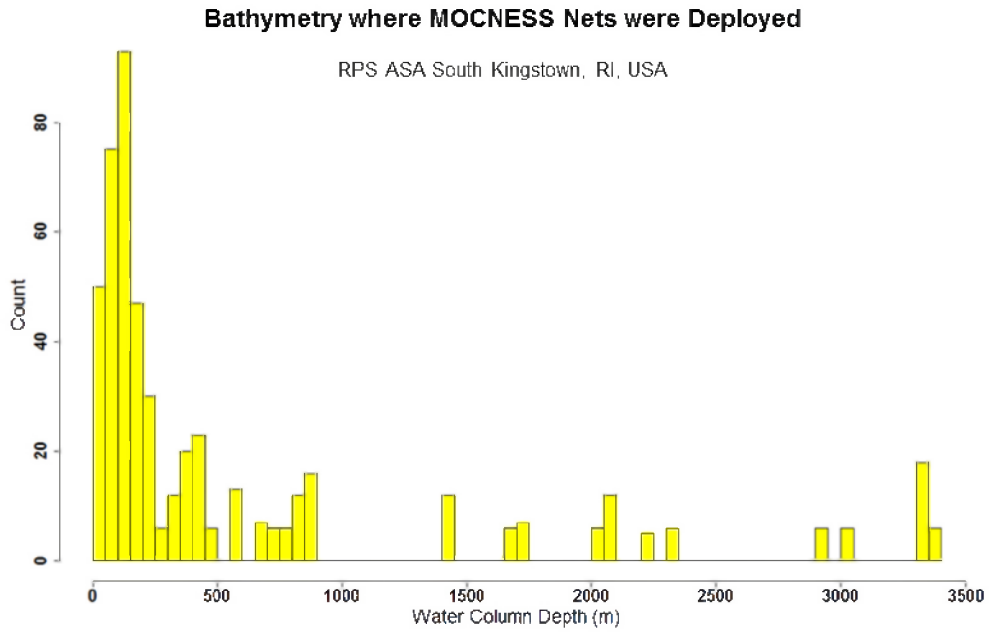


Figure C2-2. Frequency distribution of water column depths at SEAMAP Ichthyoplankton 1-m^2 MOCNESS stations.

2.2 NRDA Plankton 1 m^2 MOCNESS Sampling

NRDA Tier1A Plankton Surveys were used to complement vertical distribution information from the SEAMAP surveys (data version November, 2013) for ichthyoplankton and invertebrate zooplankton taxa. While these samples were taken after the spill, they were used to calculate biomass and injury for specific organisms and life stages because no other datasets contained the baseline information (e.g., larval decapods). The 1 m^2 MOCNESS deployments either sampled to a maximum sample depth of 160 m at 20-m discrete intervals (Tier1A Shallow deployments) or to a maximum sample depth of over 1,000 m with 200-m depth bins (Tier1A Deep deployments). The only depth range without a 200-m depth bin was 0 – 200 m, where the depth range was split into two nets sampling 0 – 25 m and 25 – 200 m. There were a total of 63 nets and 8 locations used in the Tier1A Shallow analysis, while there were 114 nets and 20 locations used in the Tier1A Deep deployment analysis (Figure C2-3).

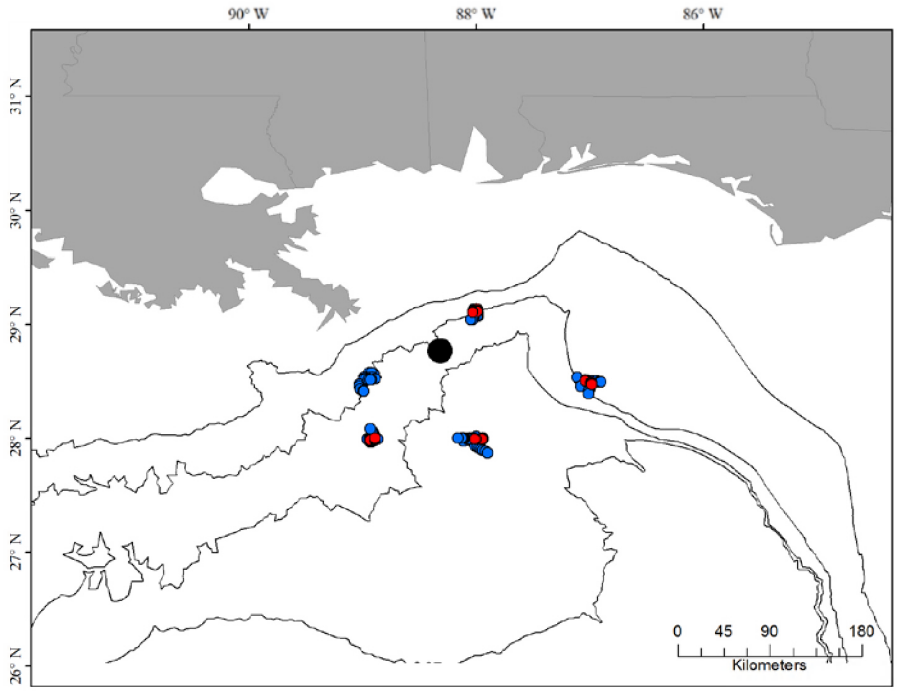


Figure C2-3. Sample locations used from the NRDA 1 m^2 MOCNESS Tier1A Walton Smith 4 survey. Red circles indicate shallow deployments (Tier1A Shallow; < 200 m sample depth), whereas blue circles reflect deep casts (Tier1A Deep; > 200 m sample depth). MOC1 samples reflect the discrete nets; the number of deployments is fewer as several nets make up a deployment. The MC252 Wellhead is indicated with the black dot. Black lines represent 200 m, 1,000 m, 2,000 m, and 3,000 m bathymetry contours.

2.3 NRDA 10 m^2 MOCNESS Sampling

NRDA 10 m^2 MOCNESS samples were used to determine the vertical depth distribution of marine organisms (both fish nekton and invertebrate zooplankton) to 1,500 m sample depth (data released March 2014). Samples were analyzed from the Meg Skansi Cruise 7 conducted during April, May, and June of 2011 (Figure C2-4). A total of 188 net samples and 66 deployment locations were used in the vertical distribution analysis.

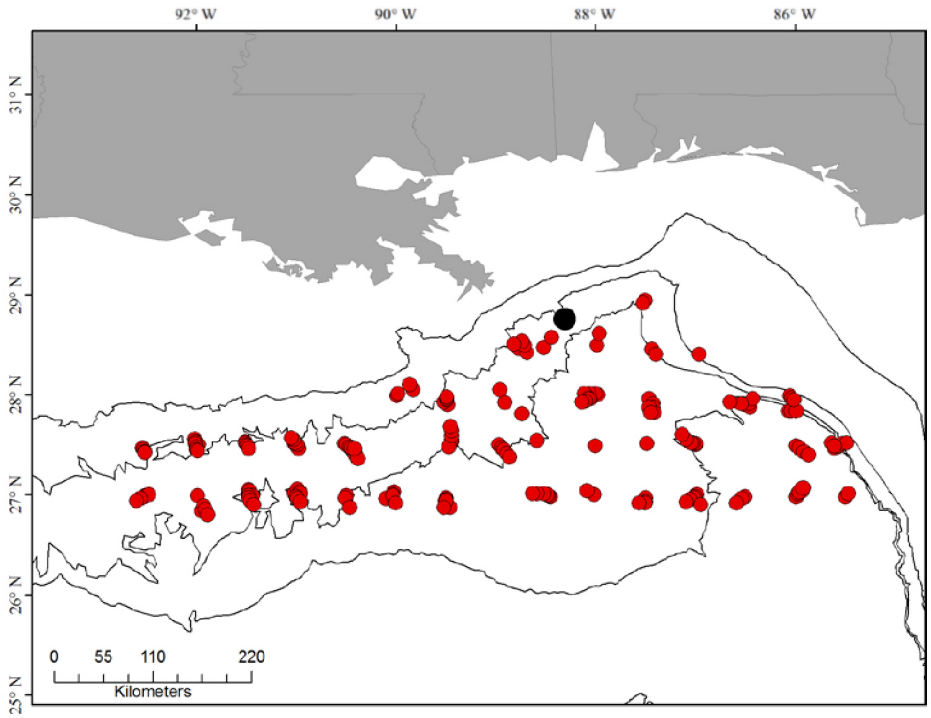


Figure C2-4. Locations of NRDA 10 m^2 MOCNESS samples from cruise MS7. The MC252 Wellhead is indicated with the black dot. Black lines represent 200 m, 1,000 m, 2,000 m, and 3,000 m bathymetric contours.

3 Abundance Analysis

Datasets for Each Analysis Taxon

The vertical distributions for all analysis taxa were plotted using day and night sample data pooled together, as well as broken out by day and night for the SEAMAP Ichthyoplankton dataset. Thus, each analysis taxon had three figures constructed: all data pooled, day samples only, and night samples only; unless the analysis taxa was never caught in the day or night, and in which case the taxa only had two figures.

Simple Statistics

Simple statistics were calculated for each taxon's distinct grouping of samples (e.g., Pooled, Day, or Night). The simple statistics were:

i. Mean density
ii. # of Samples that caught an organism
    1. A sample here is defined as a discrete depth bin net that was deployed
iii. Total Larvae (sum of raw catch or counts)
iv. Total Locations (i.e., deployments)
    1. Distinct lat/long locations at which the taxon was caught.

2. There could be fewer locations than the number of samples if the taxon was caught in multiple depth bin nets at the same location.

These statistics reflect positive presences only, all 'zero' catches were removed before analysis. These statistics are indicated in the top right hand corner of the plots.

Calculation of Density for Each Net

Counts were converted to densities by dividing the counts by the volume filtered for each net and then multiplied by 250 (to make the numbers easier to analyze). Densities are in units of number of fish or invertebrates / 250 m^3. Similar to the simple statistics, analyses here only utilize positive occurrences. The densities at this point were specific to the depth range that was surveyed by a single net (e.g., 0 - 20 m, 20 - 40 m, etc.).

Binning of Density by 1-meter Intervals

Densities (# larvae / 250 m^3) were converted to abundances per 1-m bin (# larvae / 250 m^2) by dividing the density by the number of whole meter depth bins in the sampled range. For example, if a net that sampled from 2 - 22 m depth caught 40 larvae / 250 m^3, this density was divided by 20. The resulting abundance (2 larvae / 250 m^2) was then assigned to each of the 20 1-m bins between 2 and 22 meters. Note the conversion from meters cubed (density) to meters squared (abundance) after dividing the density by the number of 1-m bins in the given range. Once this was done for each sample of a given taxon, the abundances were summed over all samples for each respective 1-m bin to obtain a vertical distribution discretized at 1-m intervals. This summation was performed for all subsets: pooled, day, and night. The 1-m abundances were then summed back up to either 20-m or 200-m depth bins for display in the plot and for depth bin assignment, as explained within the main body of this report.

4 Vertical Distribution Plots

Figures were prepared to display histogram plots of the vertical distribution for each taxon. Each figure consists of 2 plots: percent abundance over depth broken into 1-m bins and percent abundance over depths summed within the sampling plans' targeted bin size, either 20 m or 200 m. The plots have depth (y-axis, depth increasing downwards) plotted against the percent frequency of abundance in each depth bin (not the cumulative abundance) on the x-axis.

All plots are saved into .pdf files by dataset and taxonomic analysis level (listed below). Note that in the NRDA datasets, there may be a greater number of plots than taxa that were considered in the vertical distribution analysis because taxa were removed from analysis if they were caught at only one station, but a plot could still have been produced.

4.1 Appendix C – SEAMAP Historical MOC1 Plots

- C1 - SEAMAP-historical-MOC1-analysistaxa-daynight (406 plots)
- C2 - SEAMAP-historical-MOC1-analysistaxa-pooled (216 plots)
- C3 - SEAMAP-historical-MOC1-family (132 plots)
- C4 - SEAMAP-historical-MOC1-order (25 plots)

4.2 Appendix D – NRDA Tier1A Shallow MOC1 Plots

- D1 - NRDA-T1AShallow-MOC1-analysistaxa-pooled (346 plots)
- D2 - NRDA-T1AShallow -MOC1-family (137 plots)

- D3 - NRDA-T1AShallow -MOC1-order (28 plots)

4.3 Appendix E – NRDA Tier1A Deep MOC1 Plots

- E1 - NRDA-T1ADeep-MOC1-analysistaxa-pooled (449 plots)
- E2 - NRDA-T1ADeep -MOC1-family (159 plots)
- E3 - NRDA-T1ADeep -MOC1-order (31 plots)

4.4 Appendix F – NRDA MOC10 Plots

- F1 - NRDA-MOC10-analysistaxa-pooled (381 plots)
- F2 - NRDA- MOC10-family (233 plots)
- F3 - NRDA- MOC10-order (76 plots)

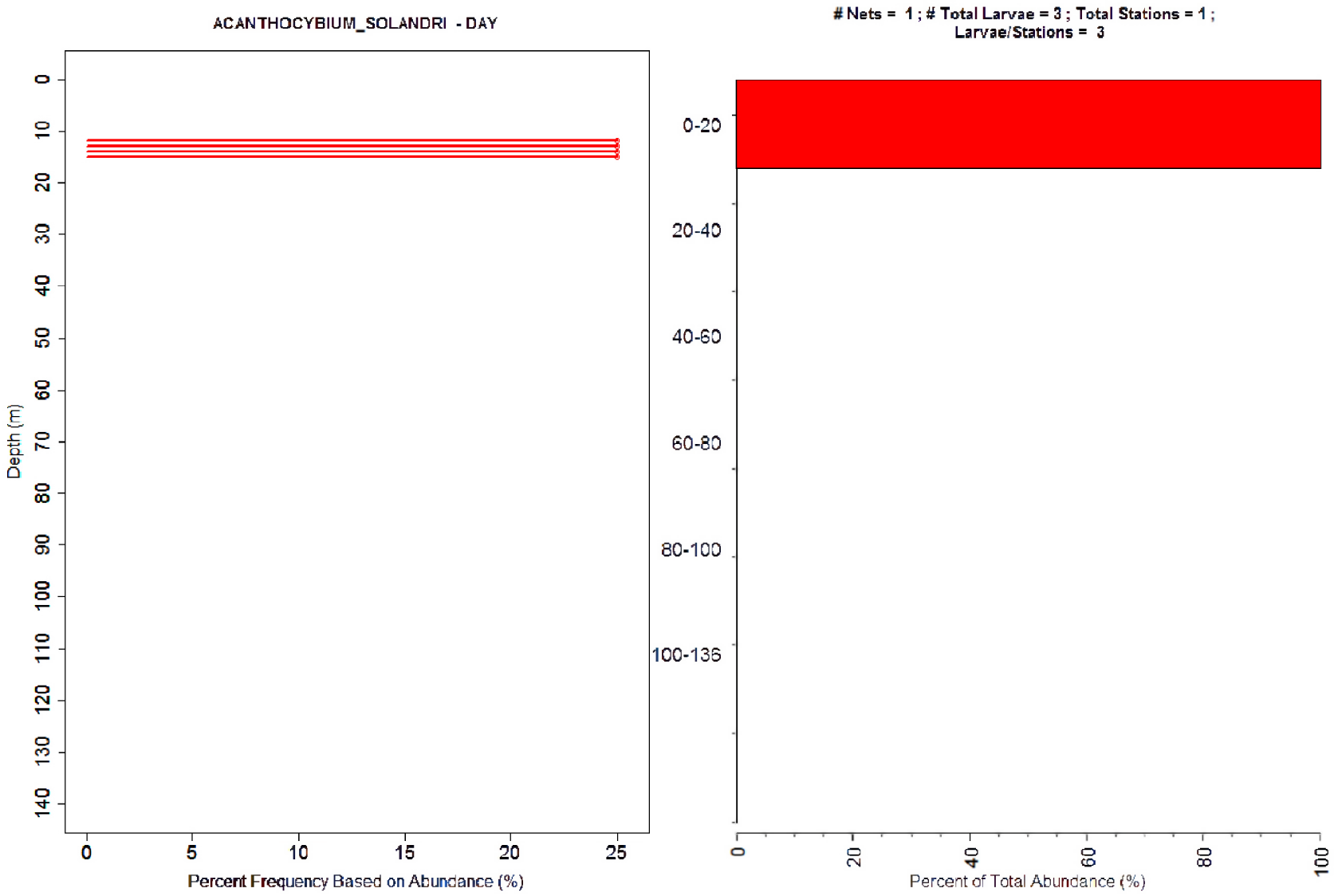
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

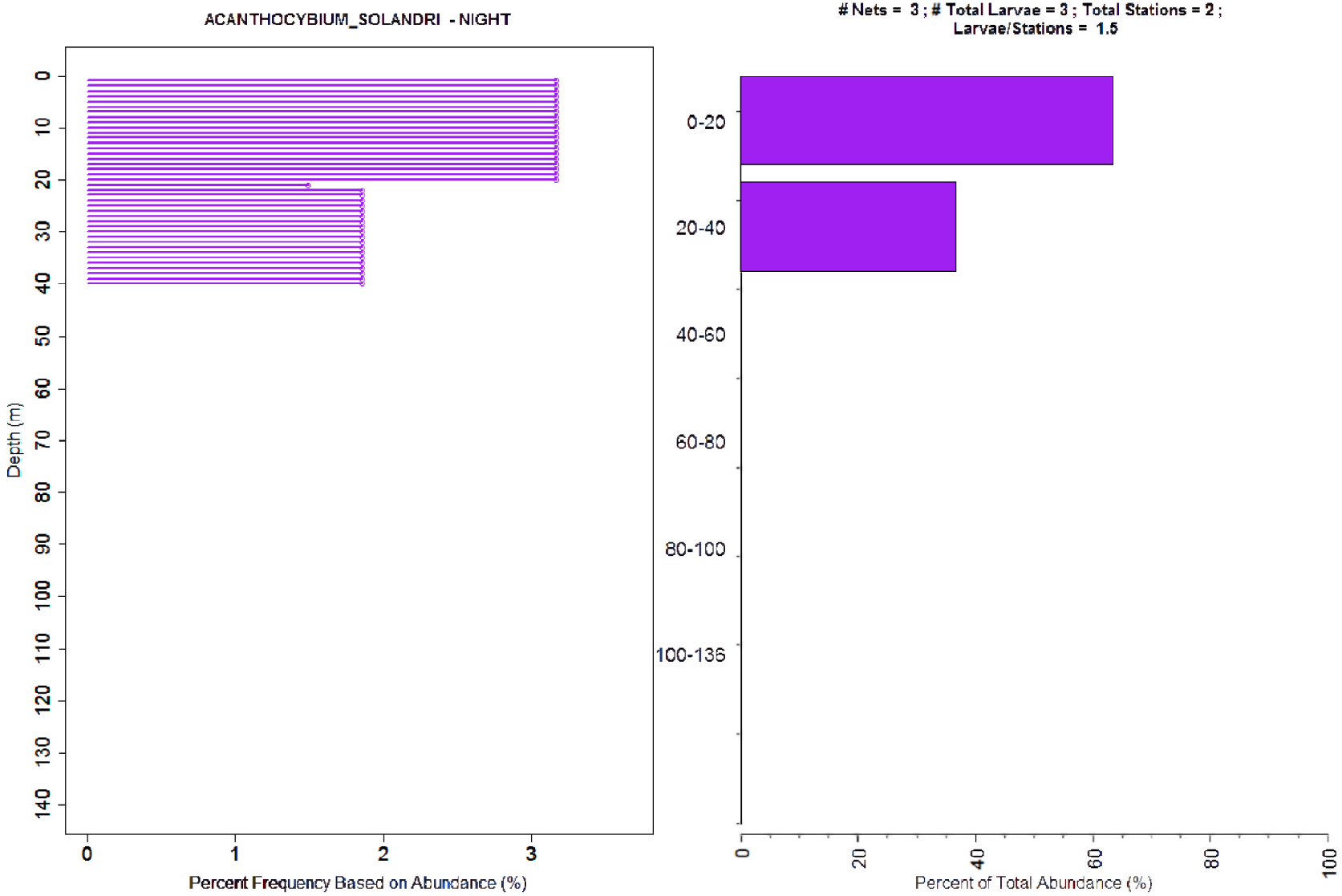
Appendix C1 – SEAMAP Historical MOC1 Plots Analysis Taxa Level, Day vs. Night Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

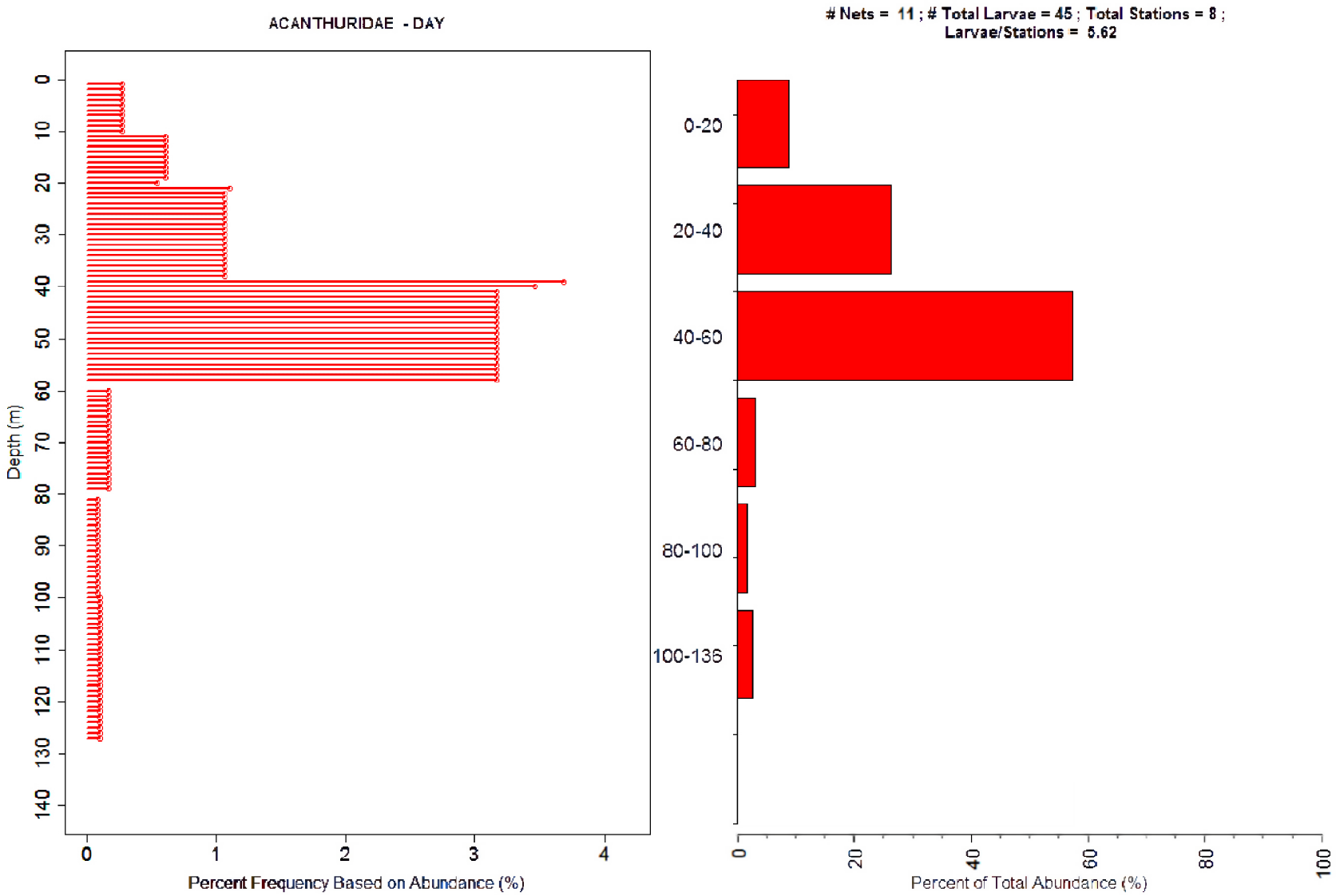
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



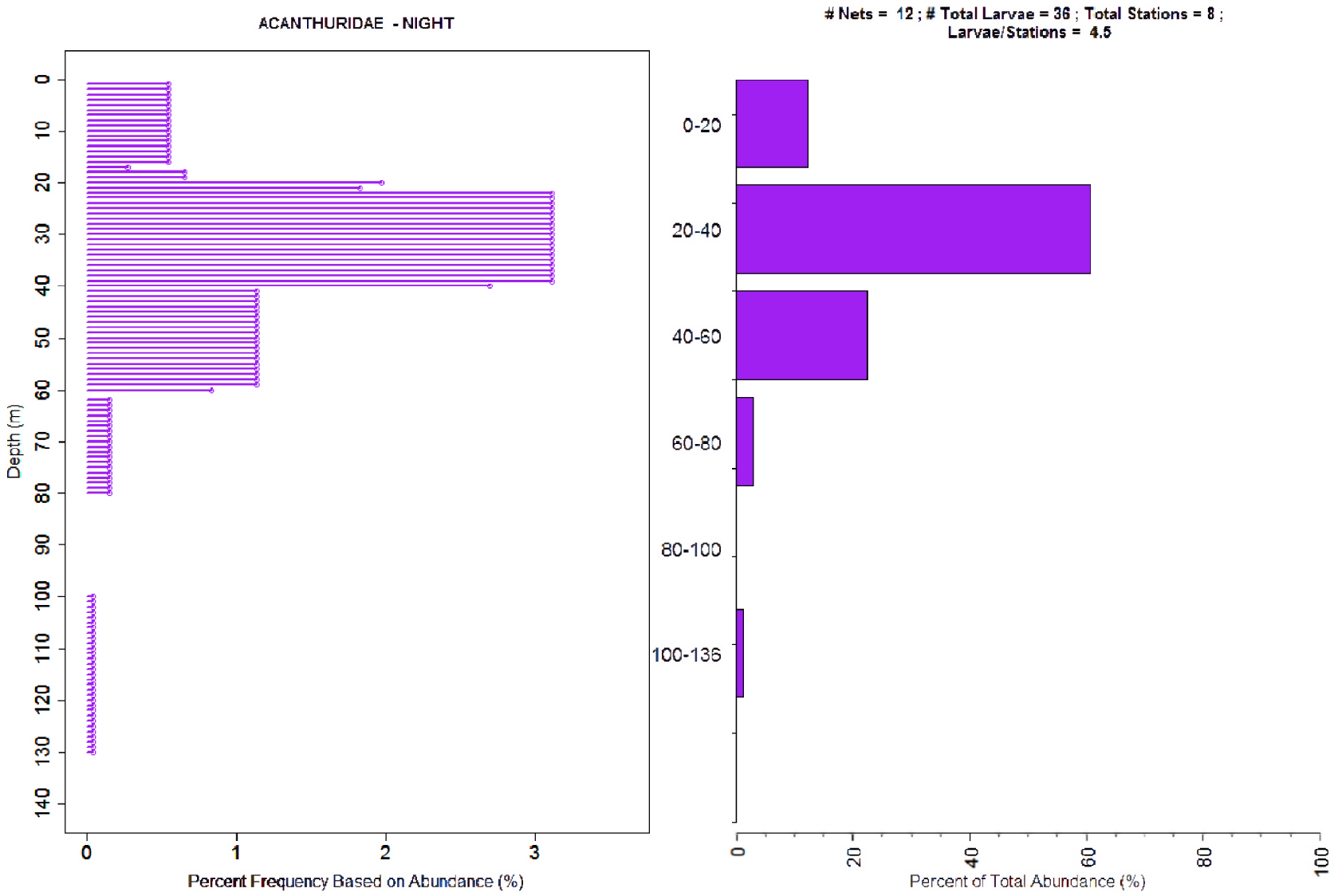
ACANTHOCYBIUM_SOLANDRI, DAY



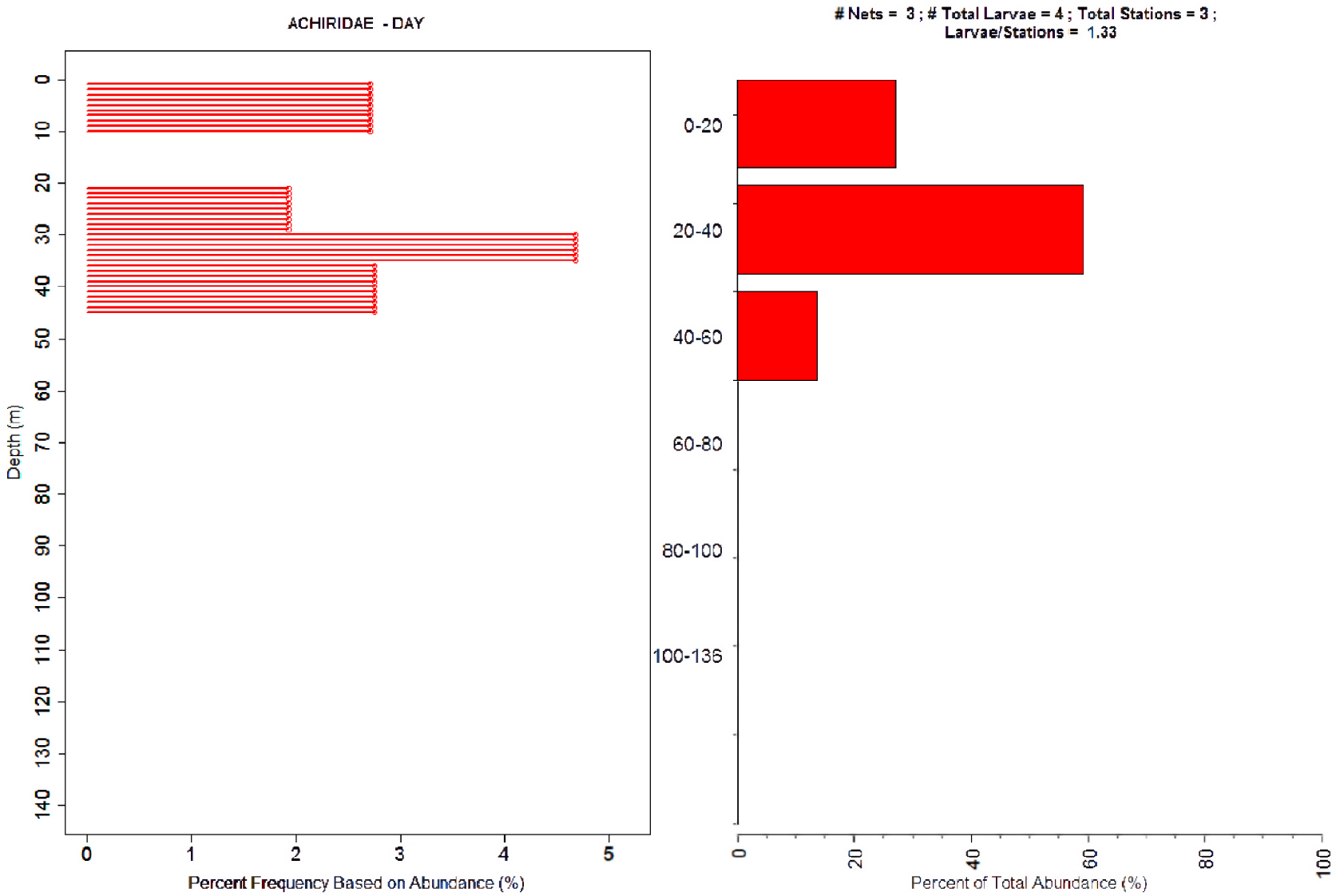
ACANTHOCYBIUM_SOLANDRI, NIGHT



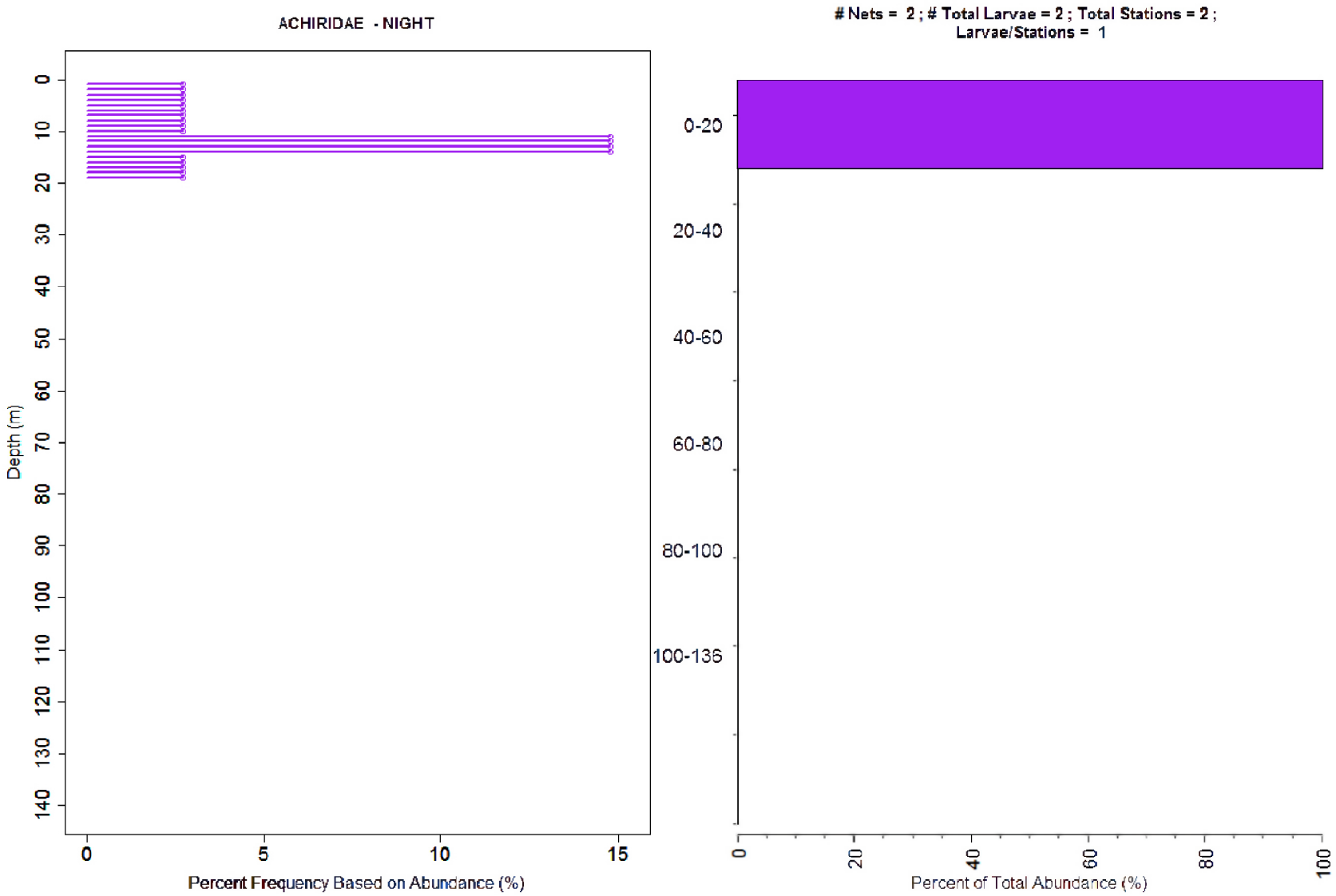
ACANTHURIDAE, DAY



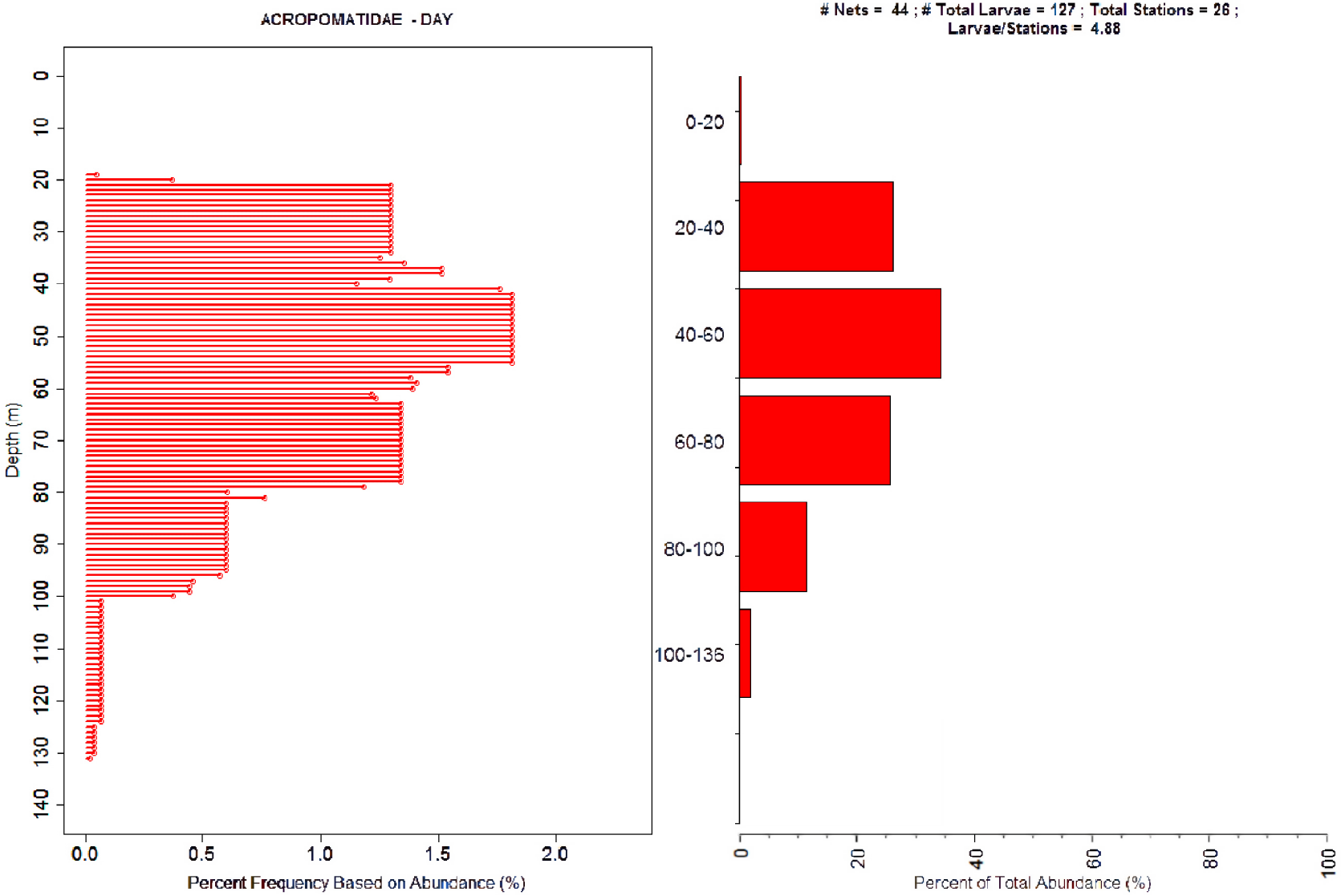
ACANTHURIDAE, NIGHT



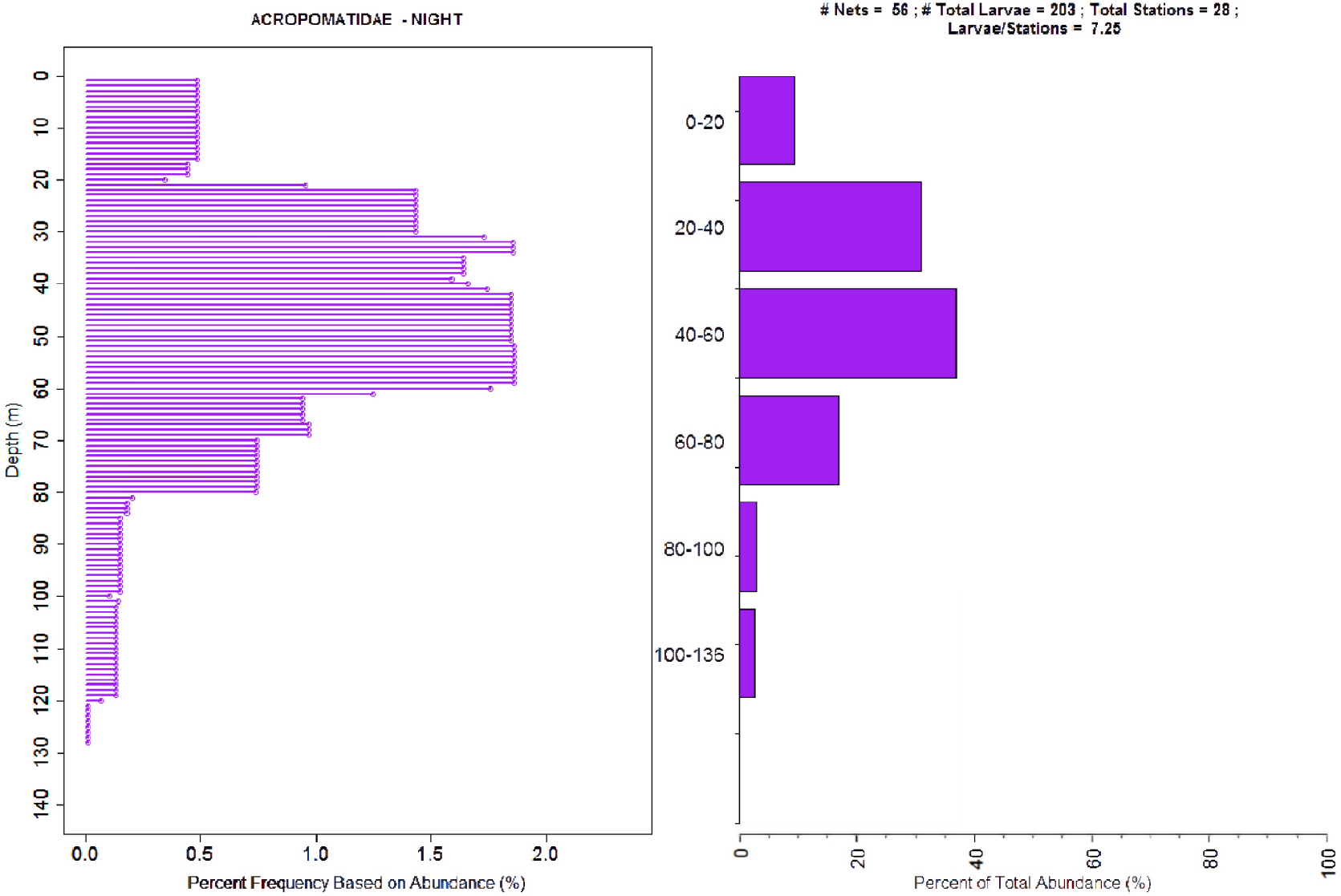
ACHIRIDAE, DAY



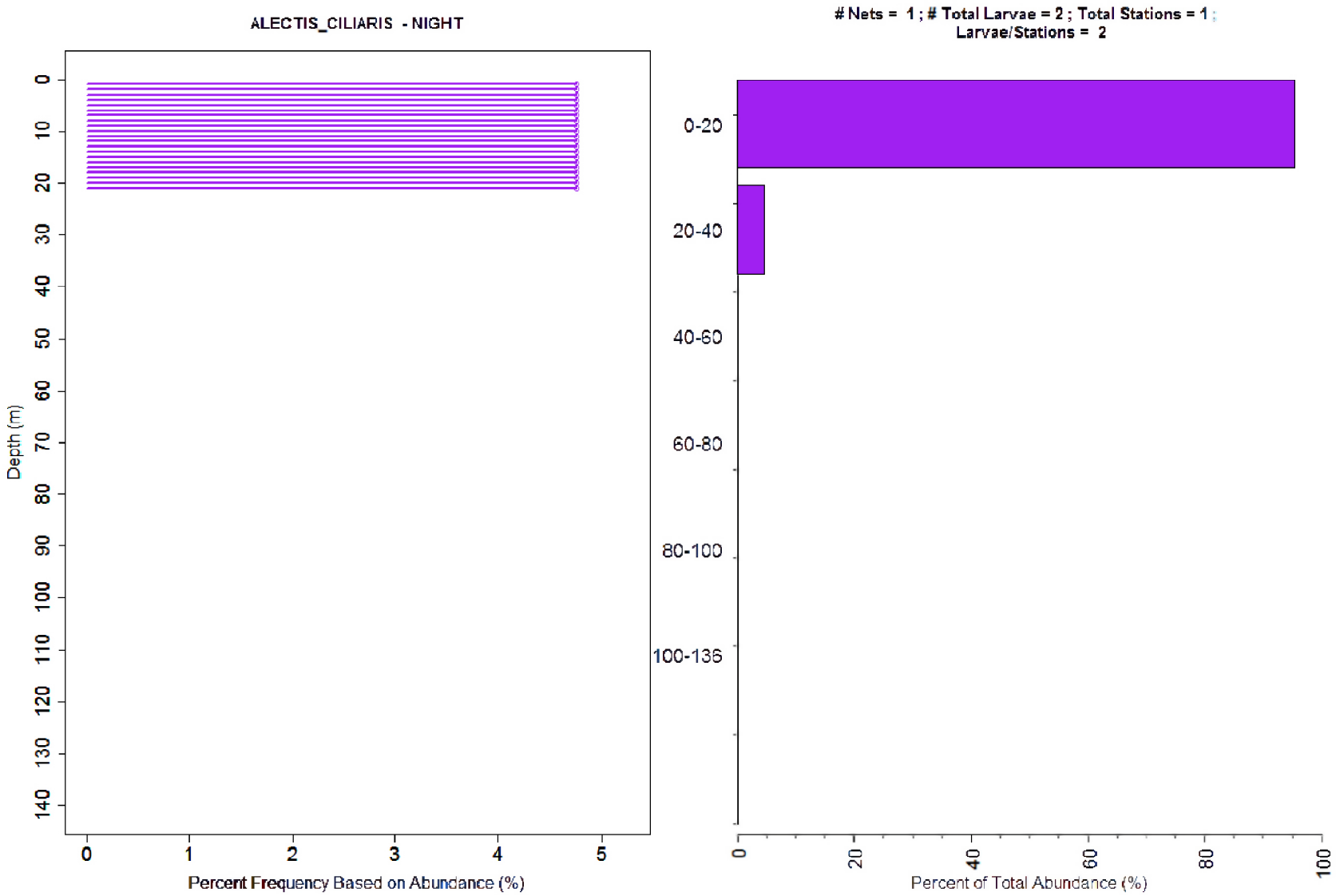
ACHIRIDAE, NIGHT



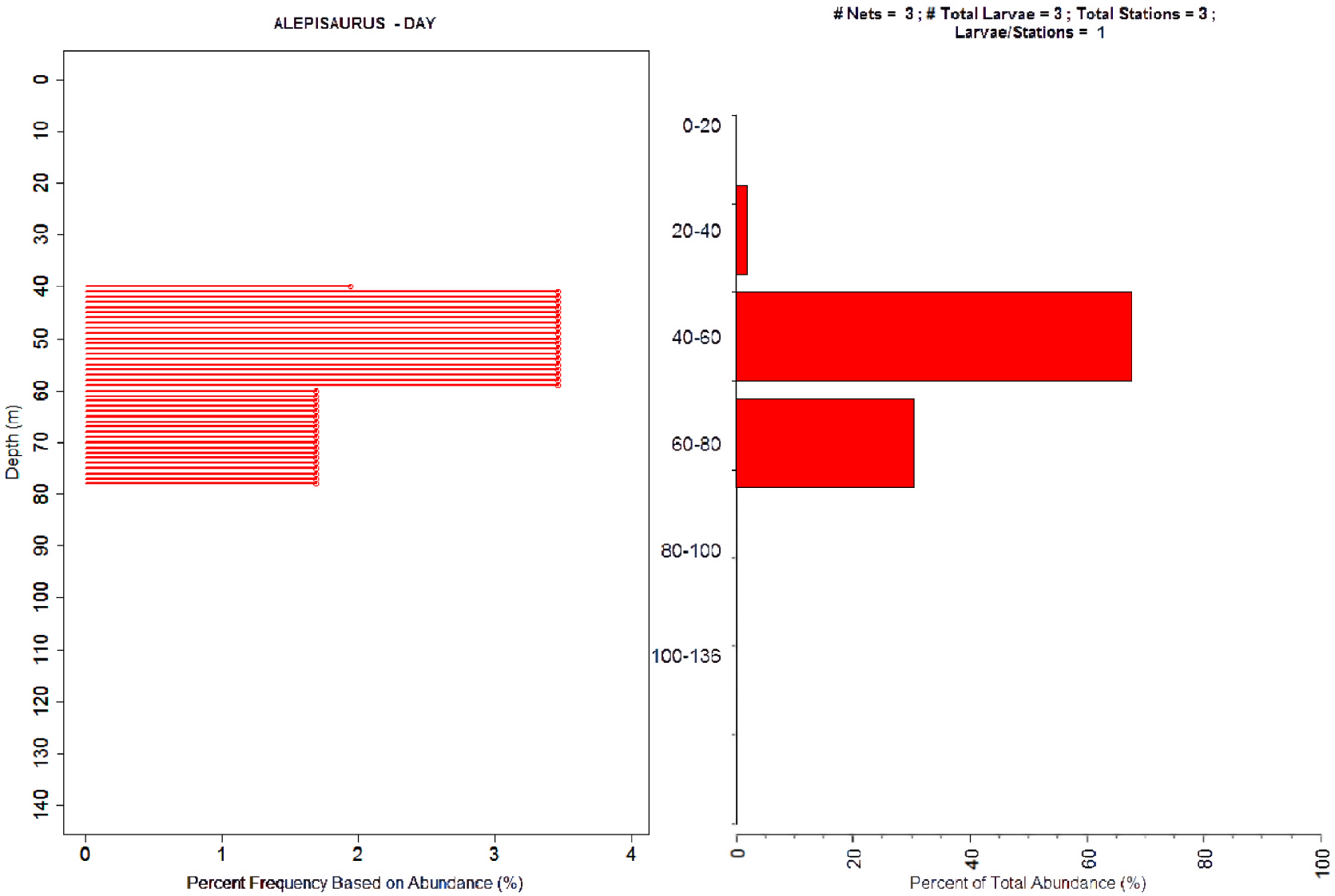
ACROPOMATIDAE, DAY



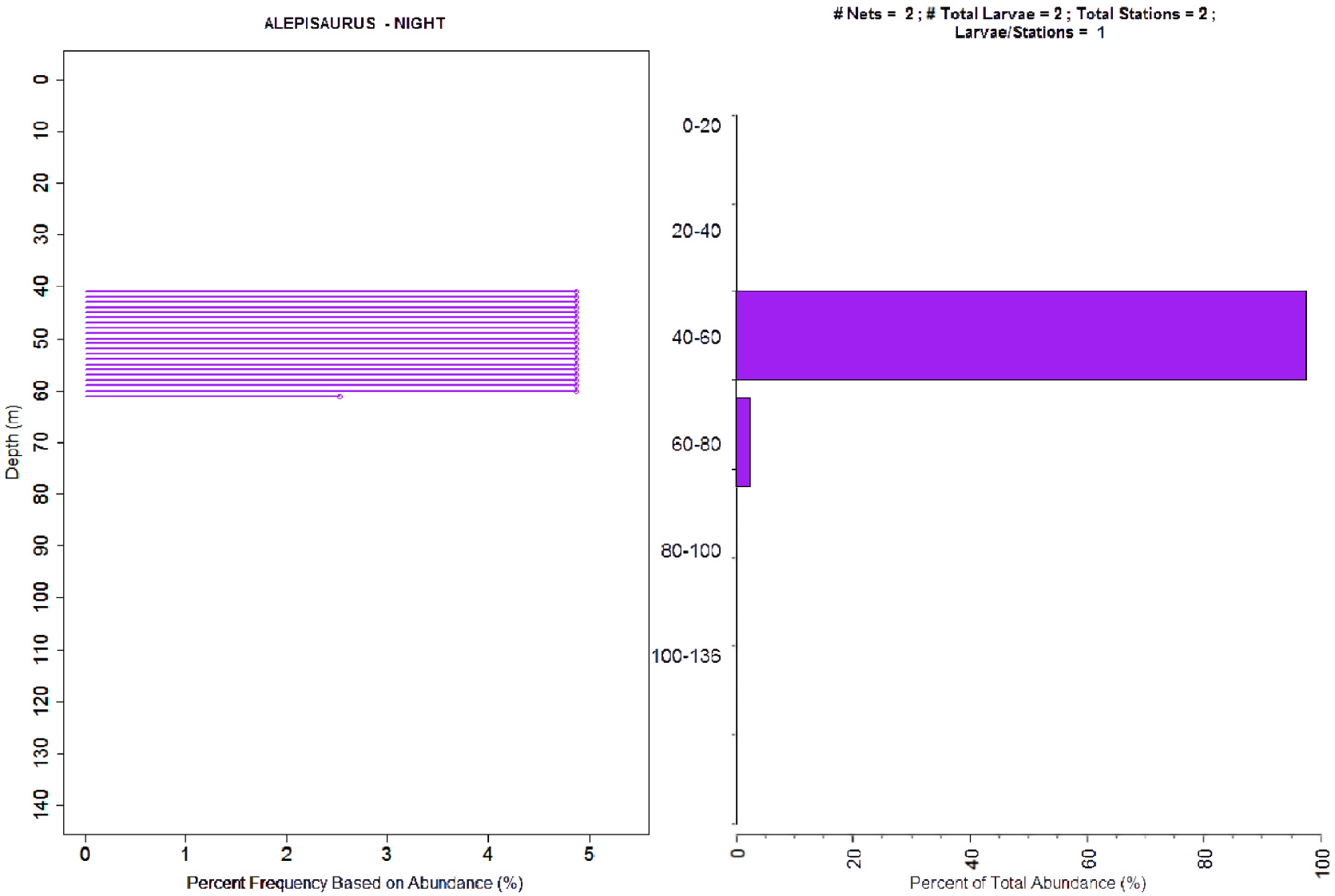
ACROPOMATIDAE, NIGHT



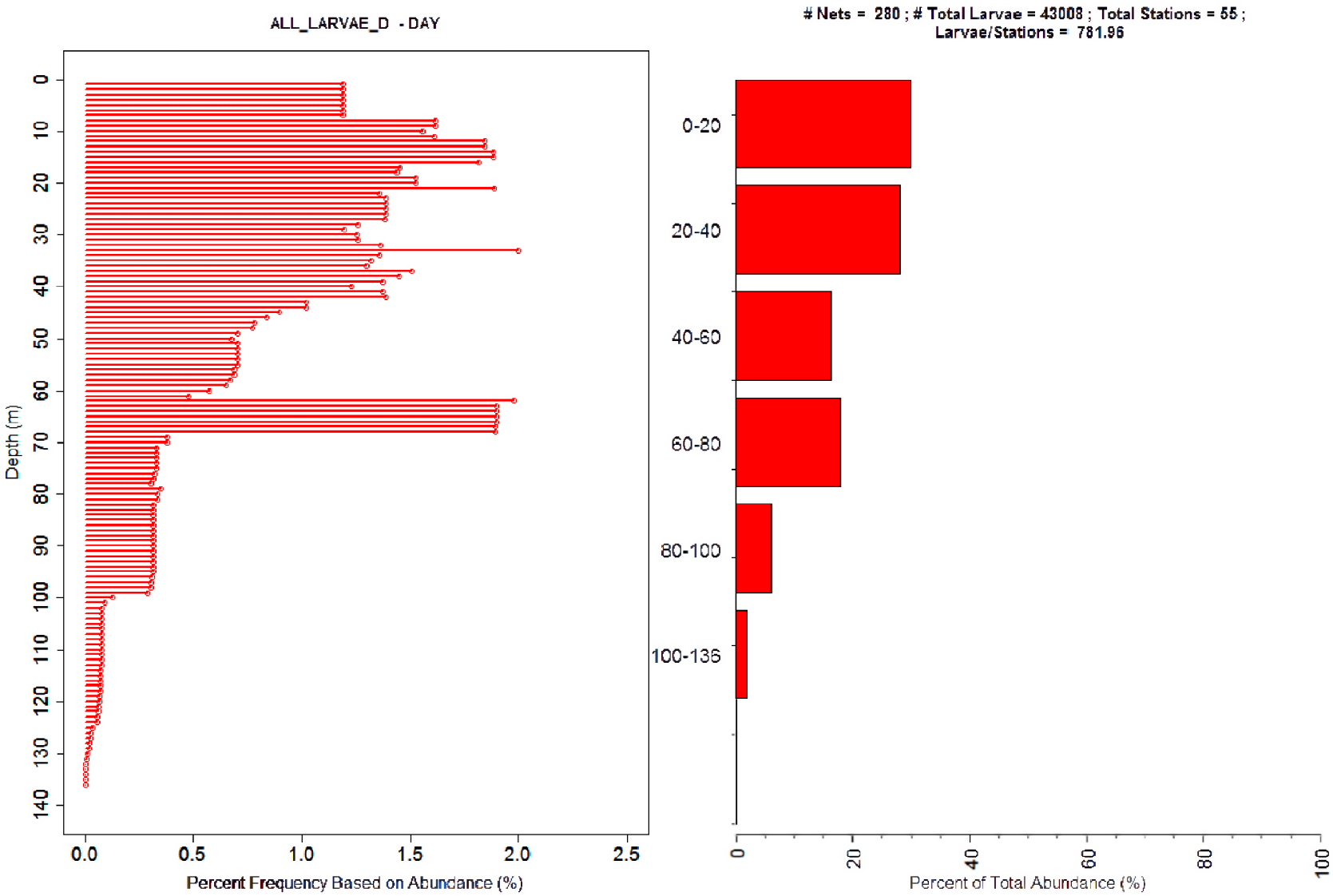
ALECTIS_CILIARIS, NIGHT



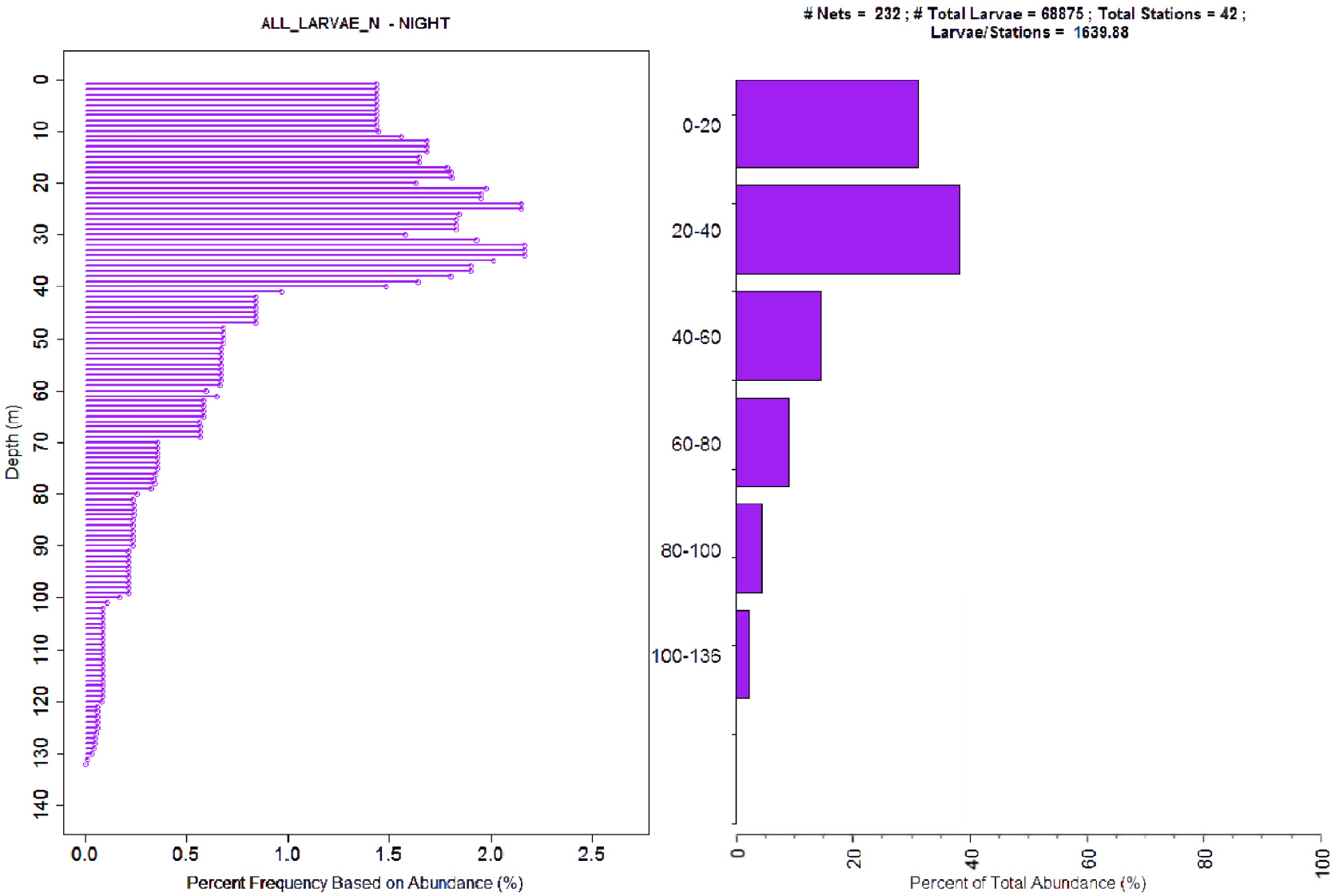
ALEPISAURUS, DAY



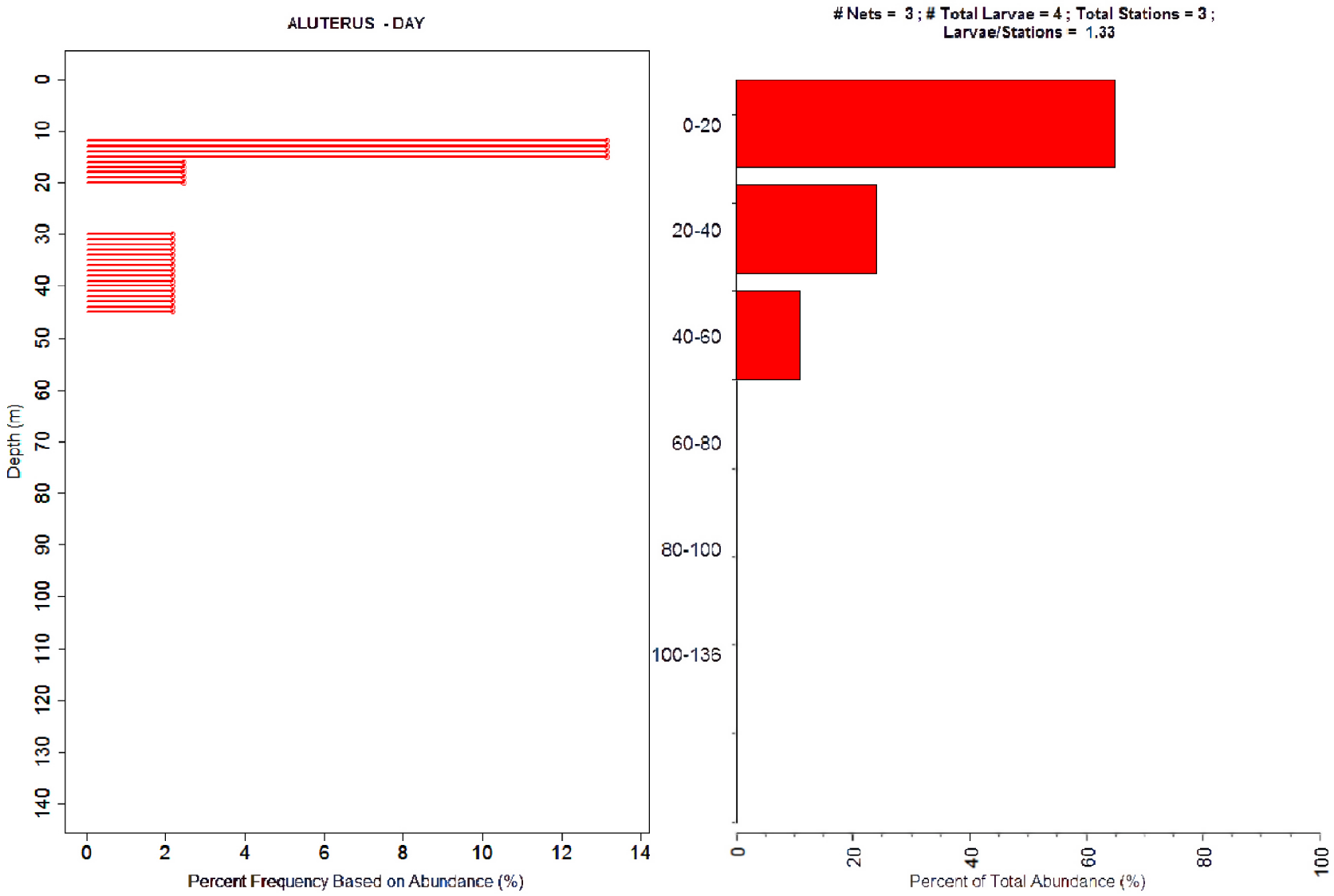
ALEPISAURUS, NIGHT



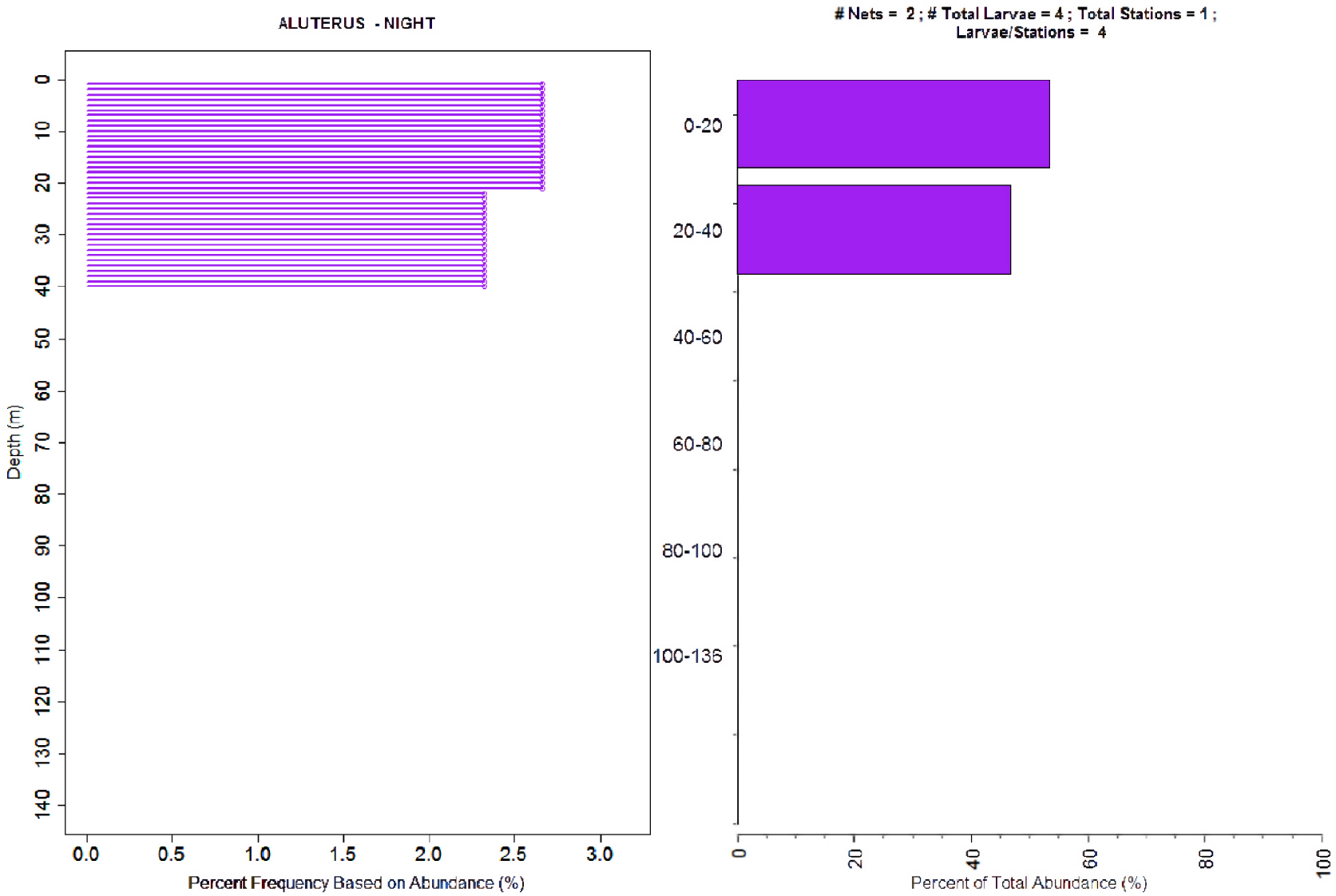
ALL_LARVAE_D, DAY



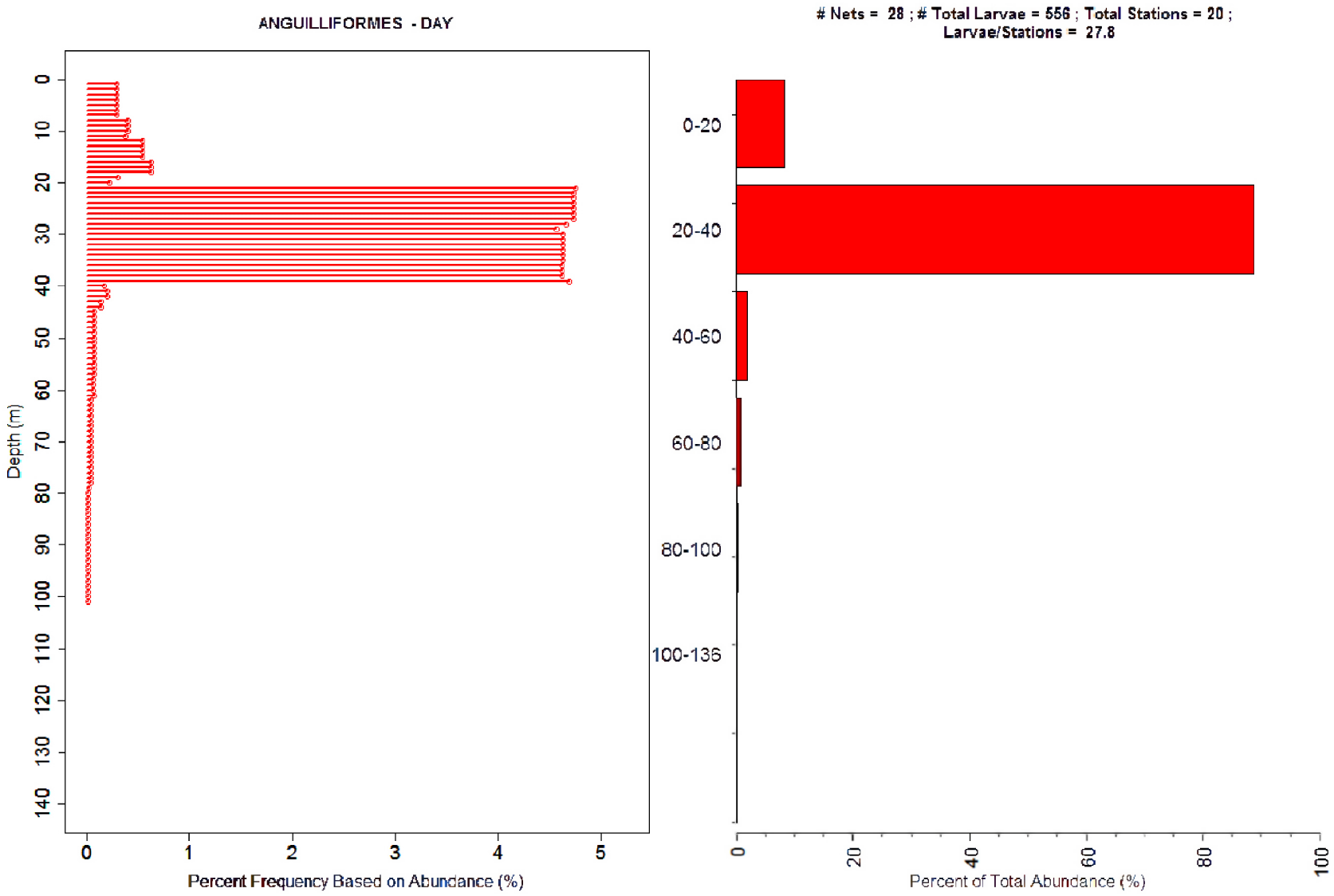
ALL_LARVAE_N, NIGHT



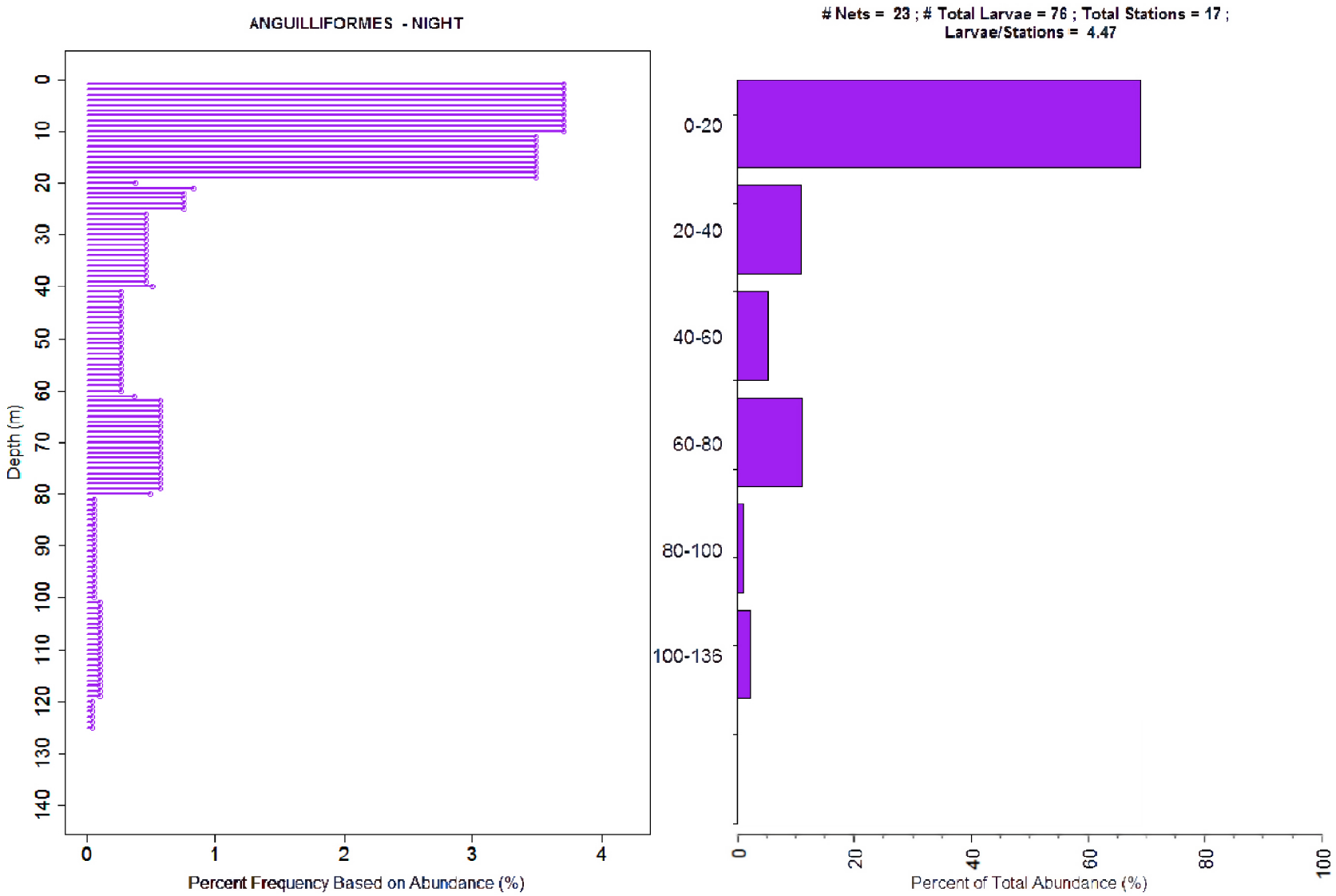
ALUTERUS, DAY



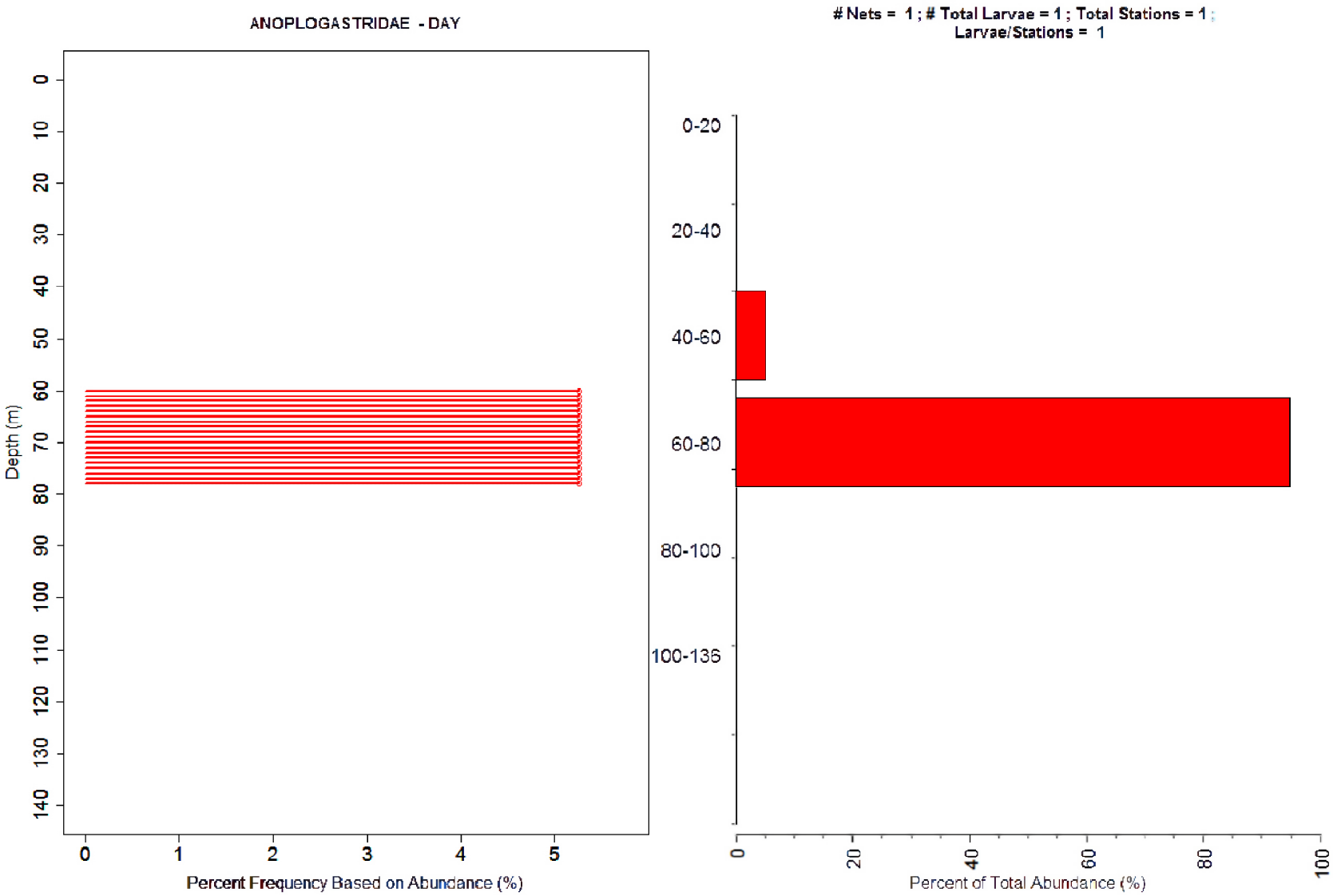
ALUTERUS, NIGHT



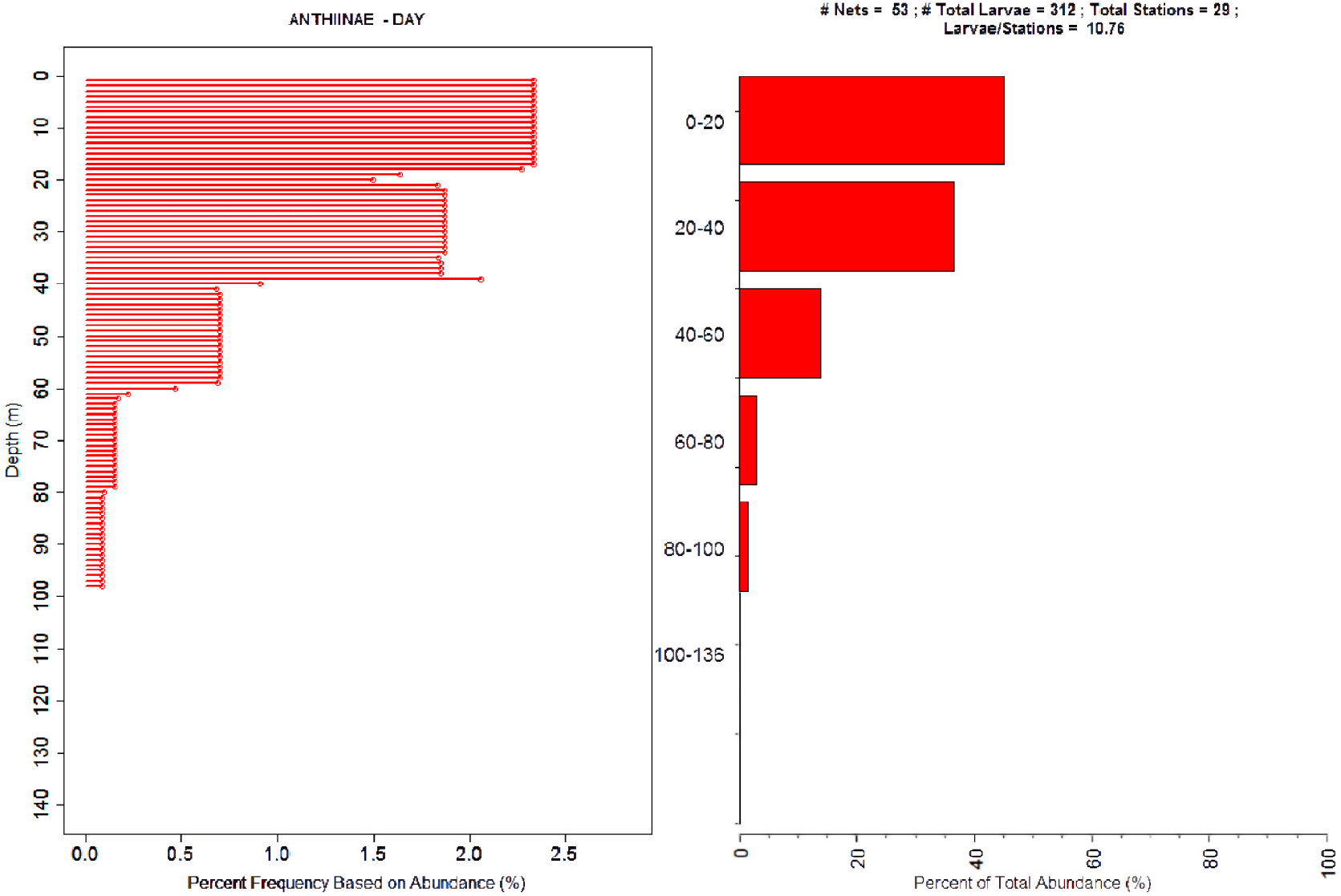
ANGUILLIFORMES, DAY



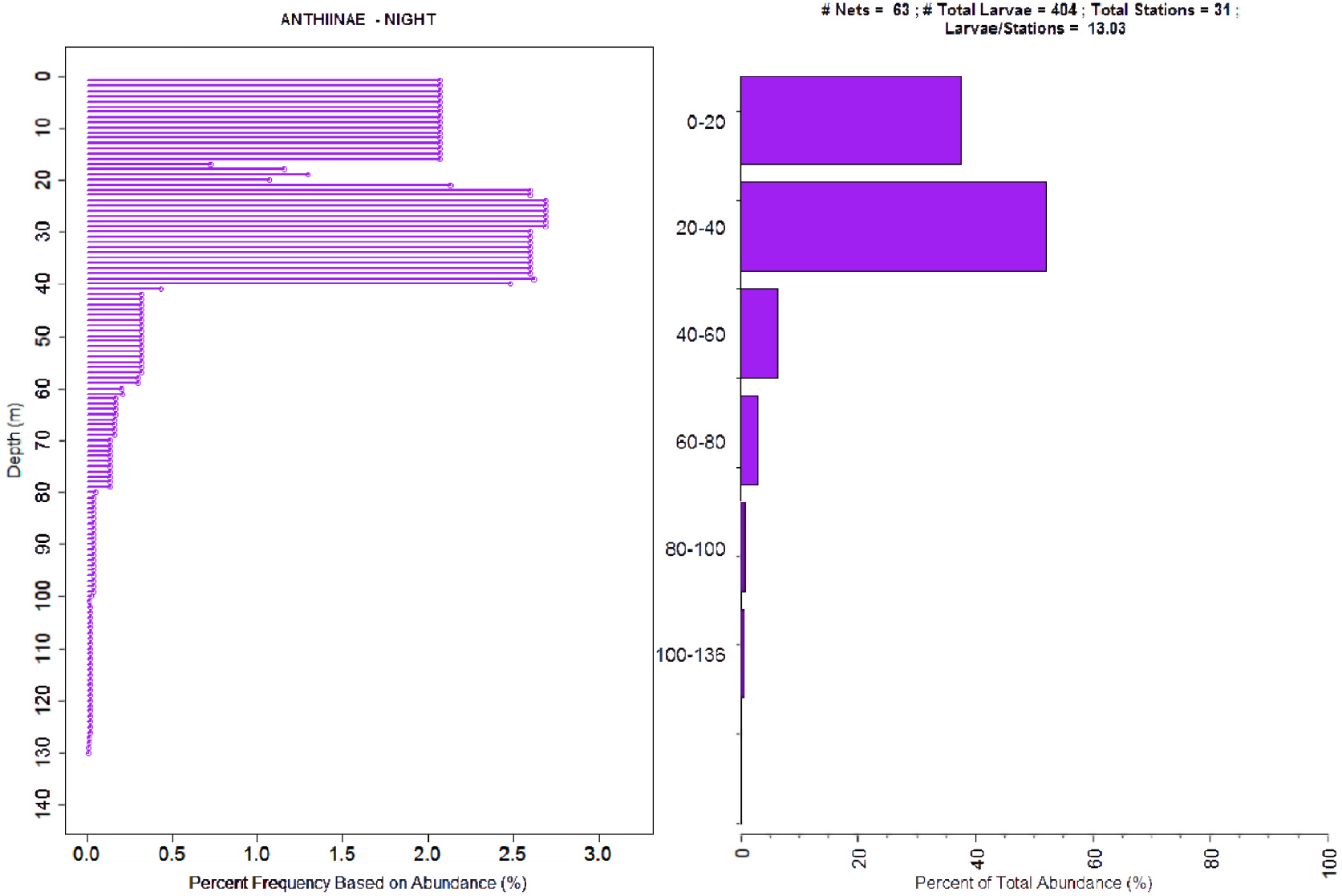
ANGUILLIFORMES, NIGHT



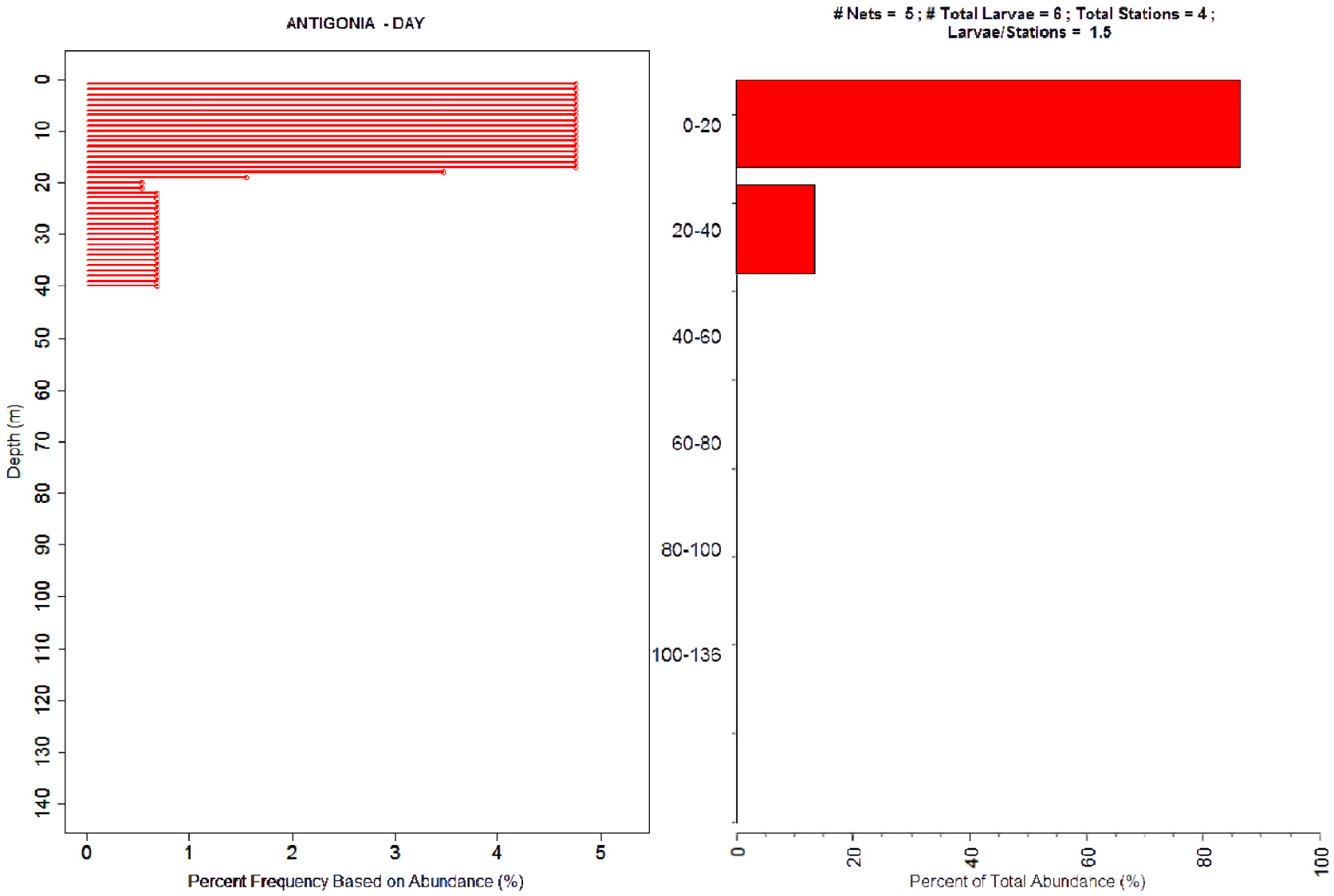
ANOPLOGASTRIDAE, DAY



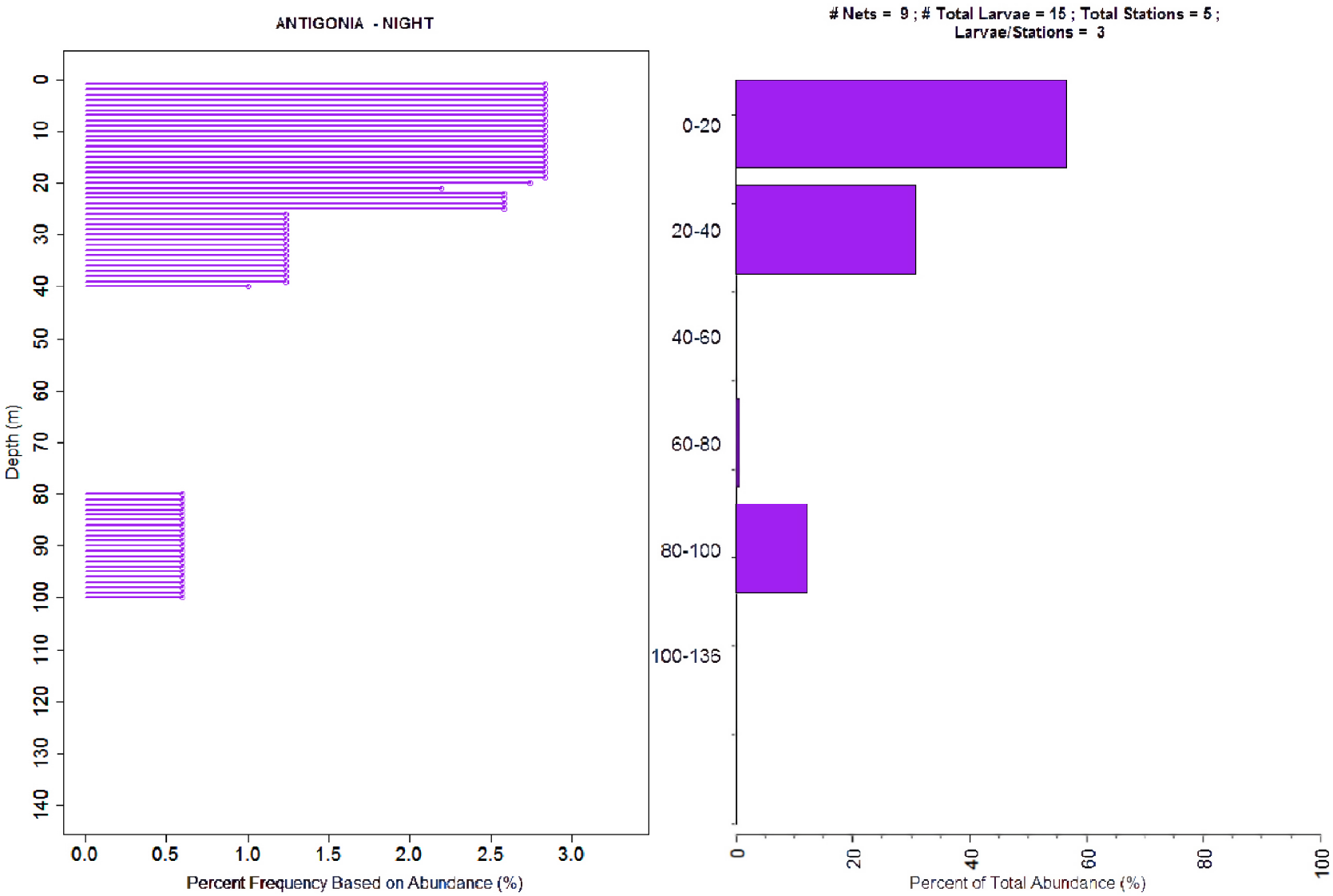
ANTHIINAE, DAY



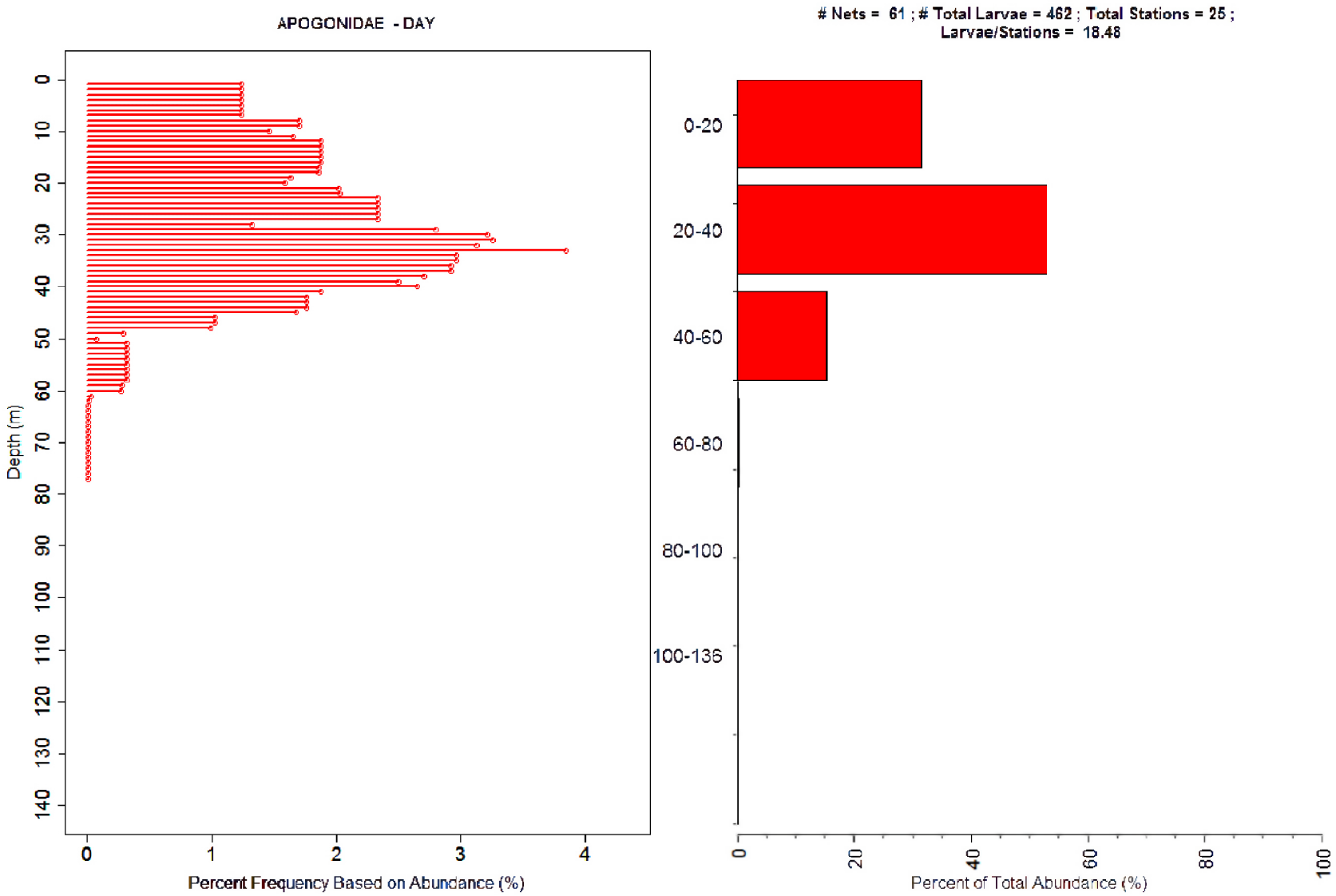
ANTHIINAE, NIGHT



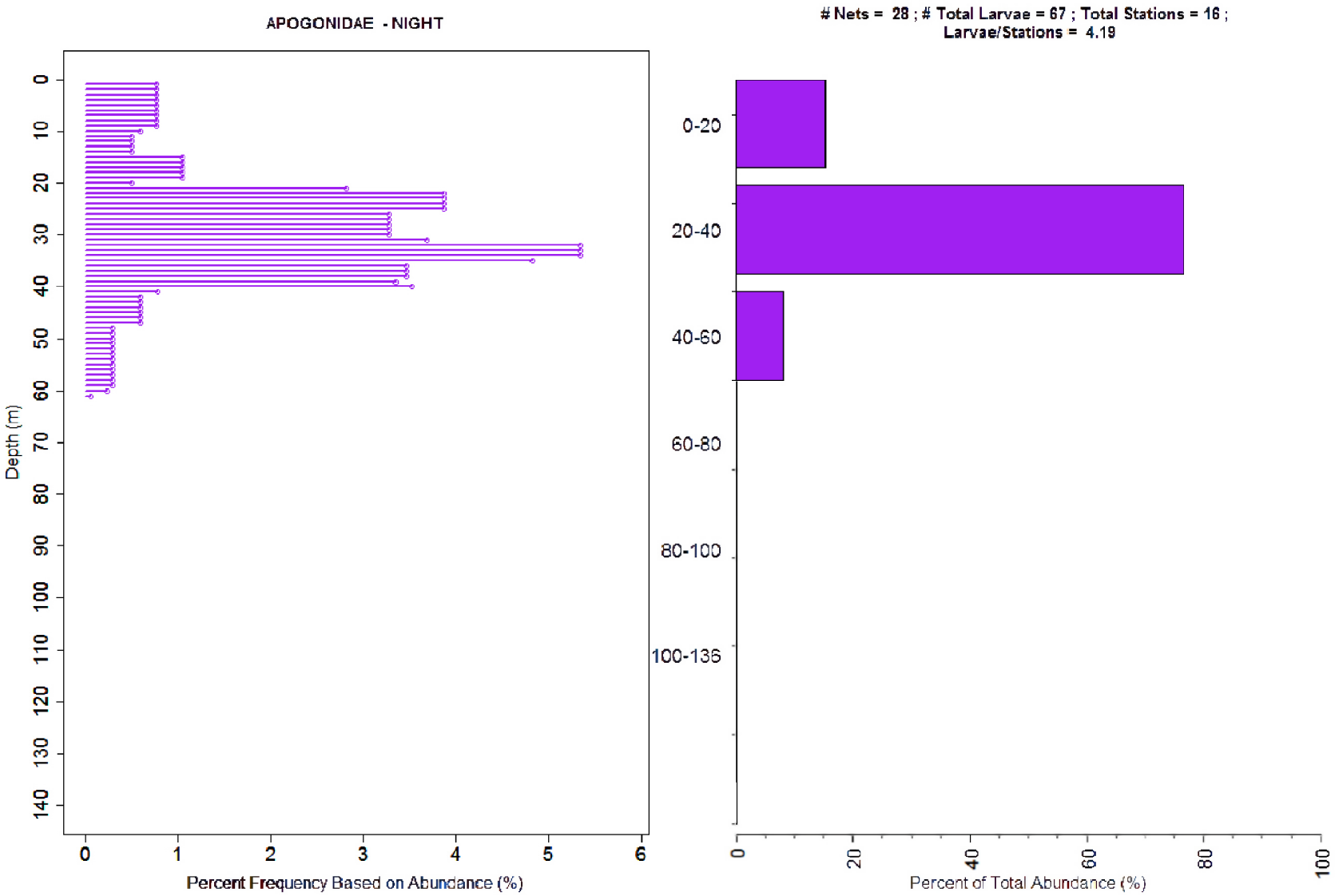
ANTIGONIA, DAY



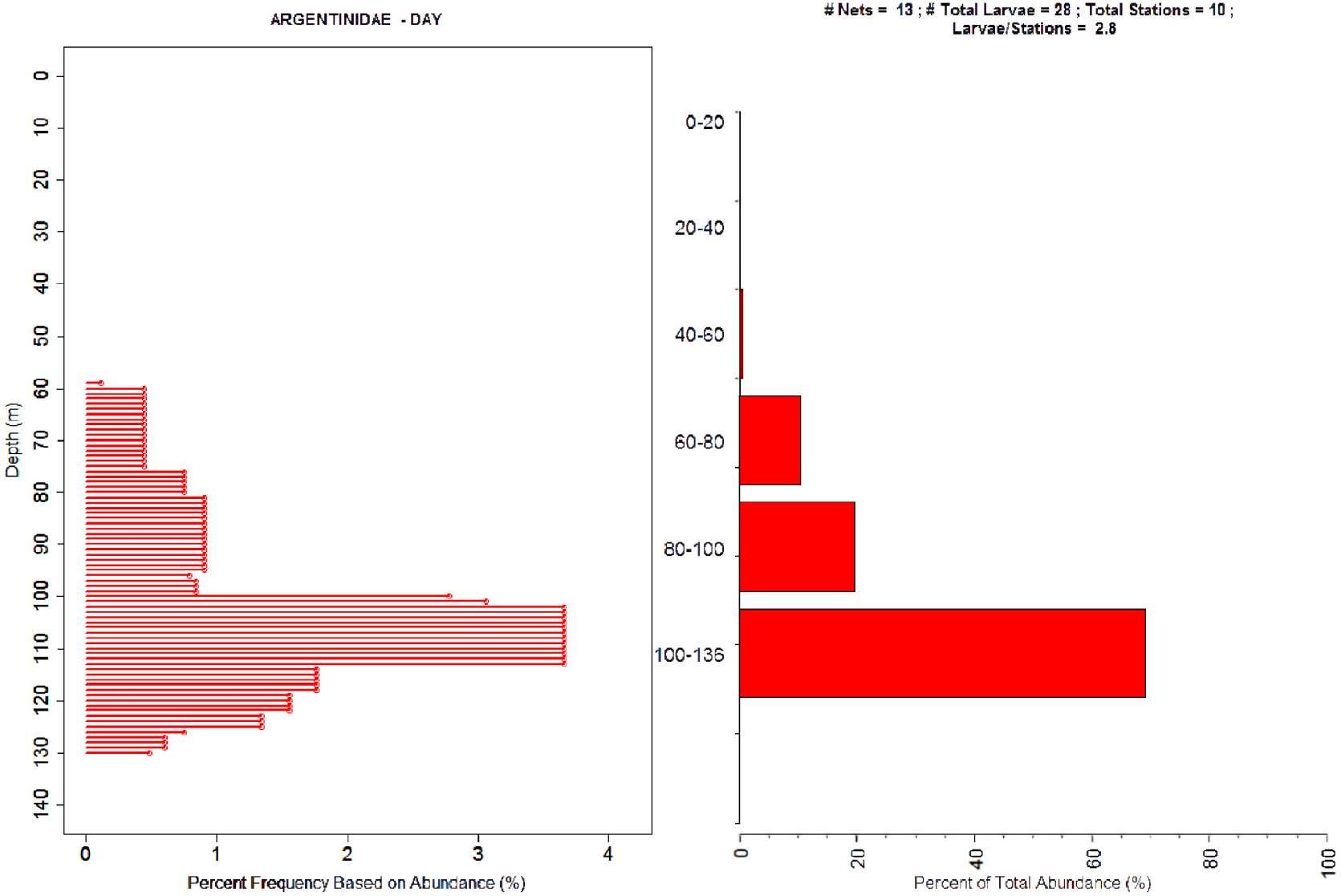
ANTIGONIA, NIGHT



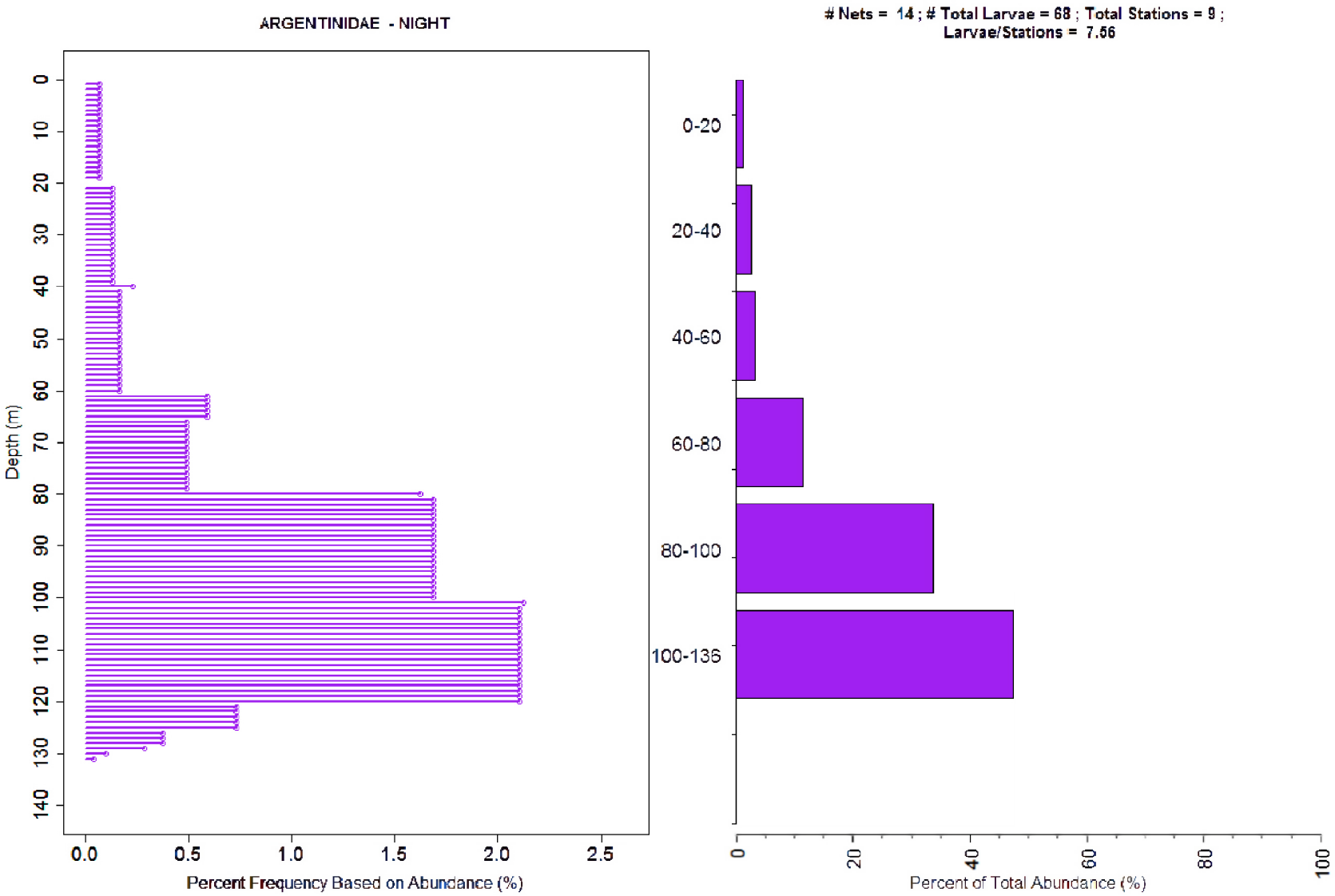
APOGONIDAE, DAY



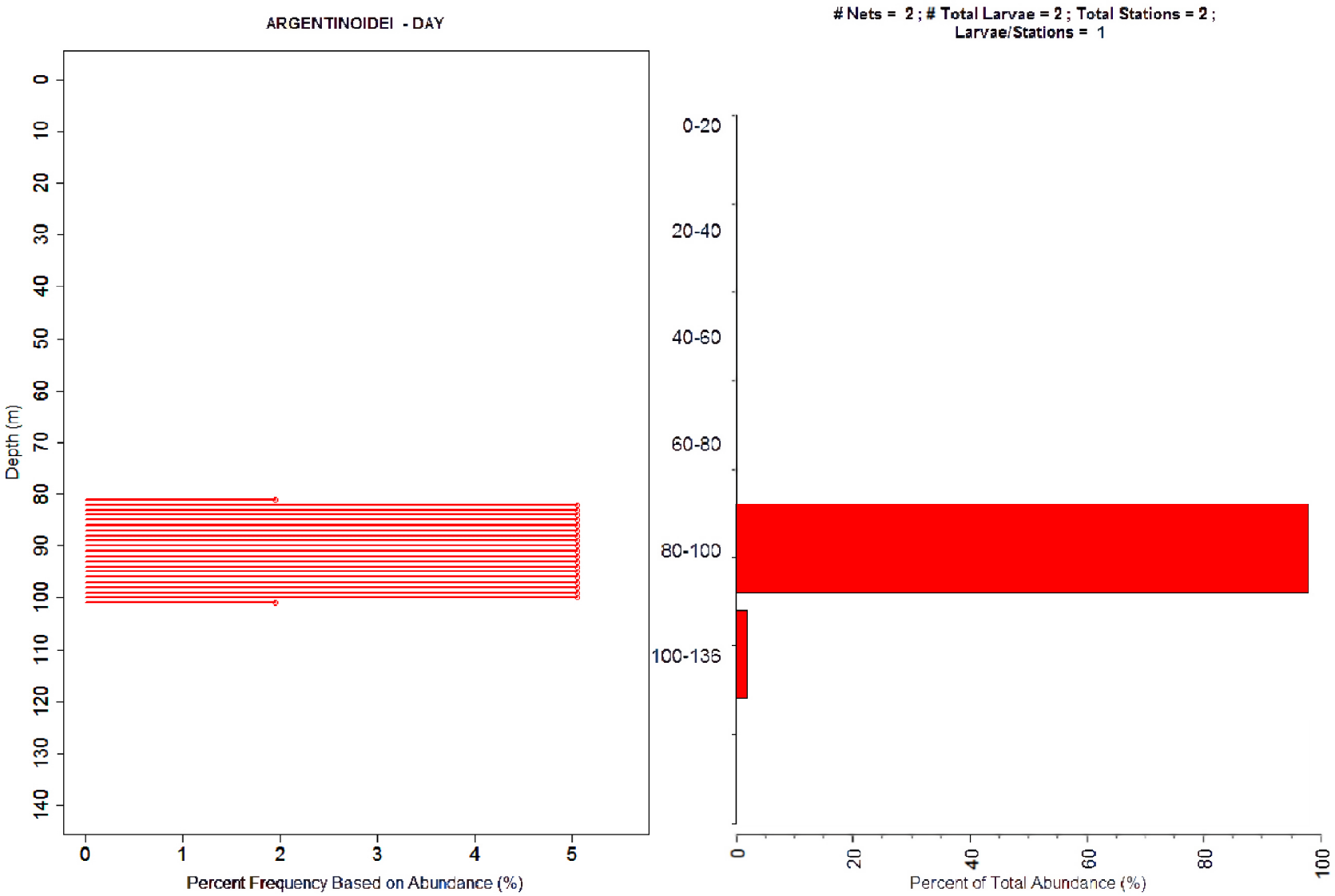
APOGONIDAE, NIGHT



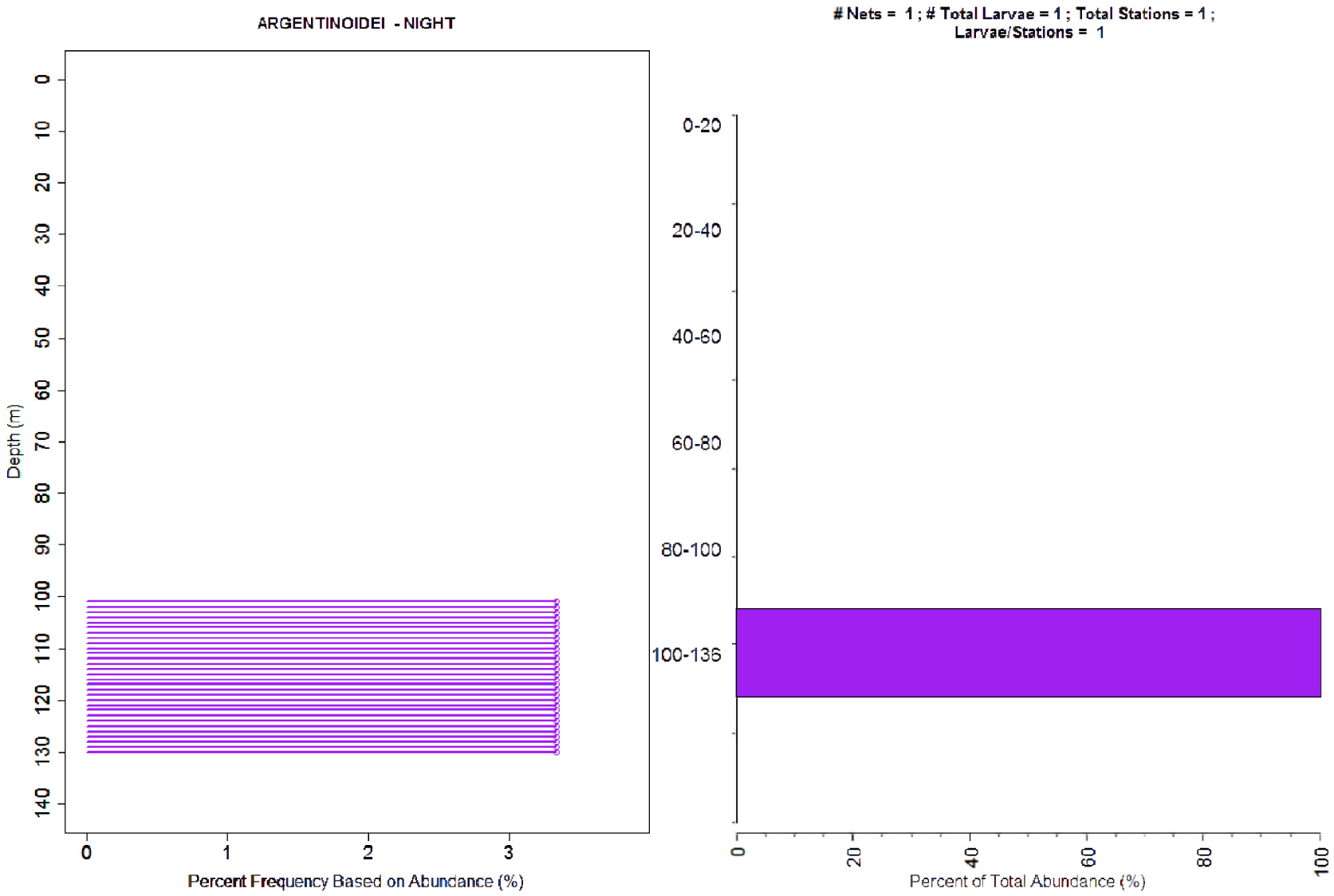
ARGENTINIDAE, DAY



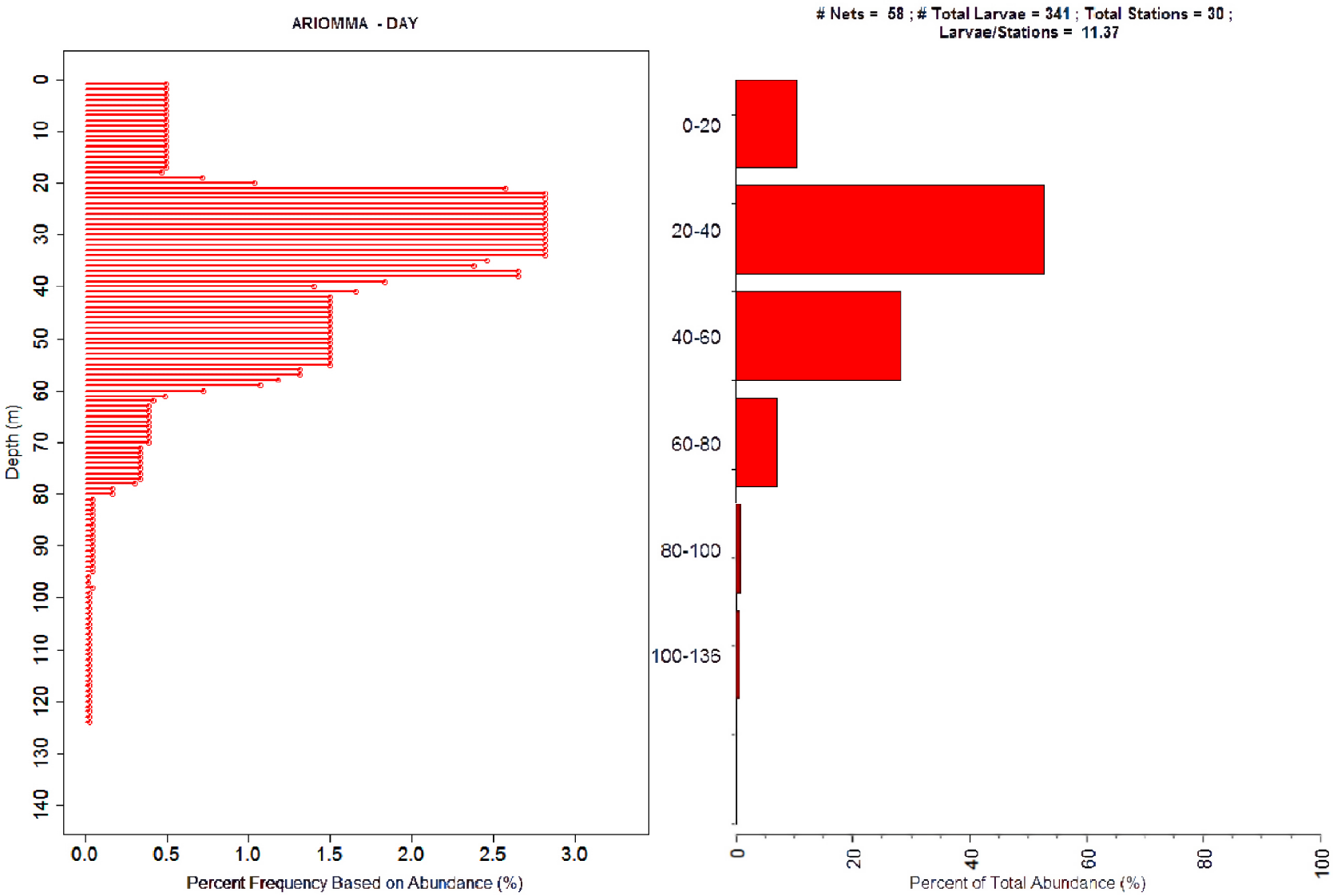
ARGENTINIDAE, NIGHT



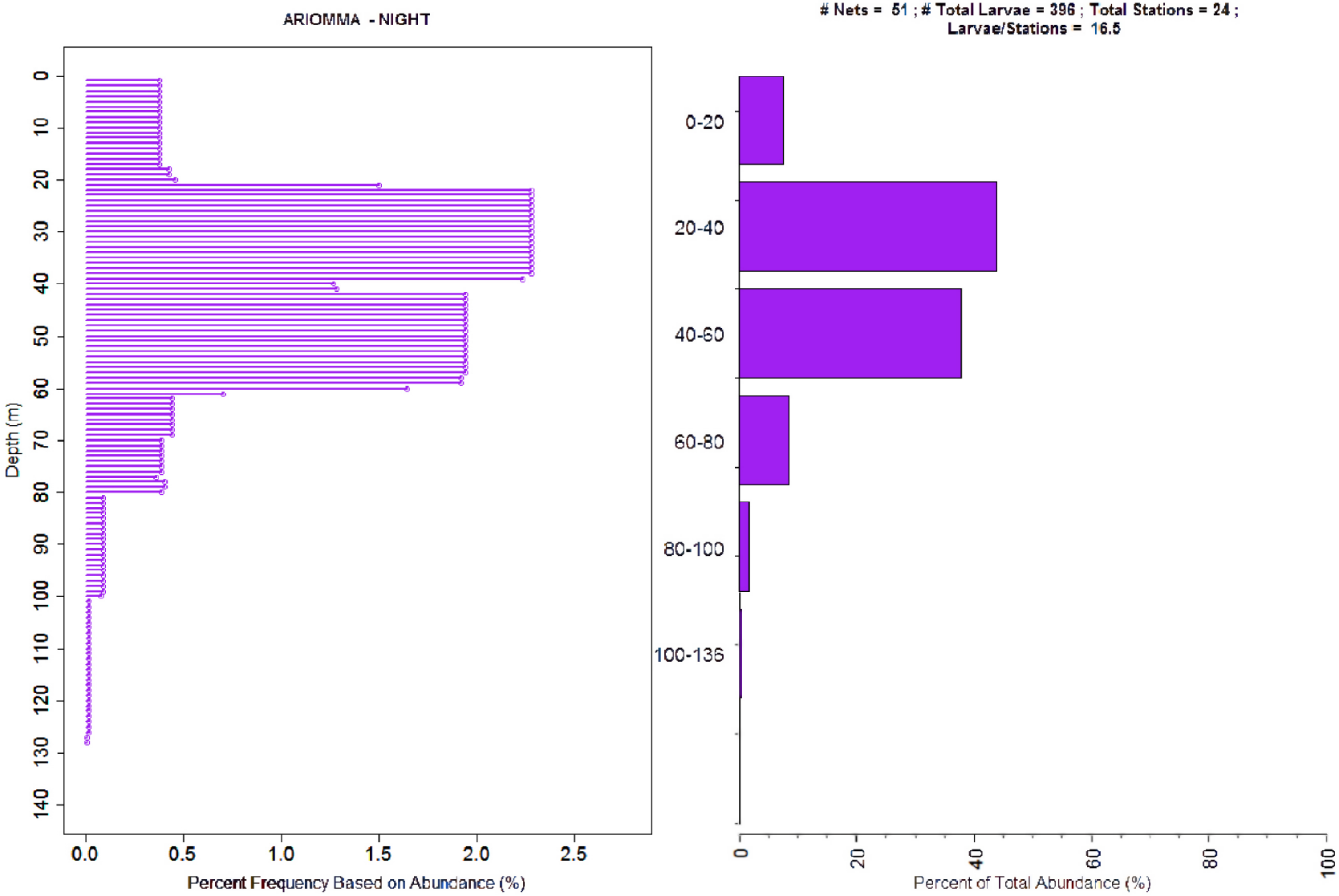
ARGENTINOIDEI, DAY



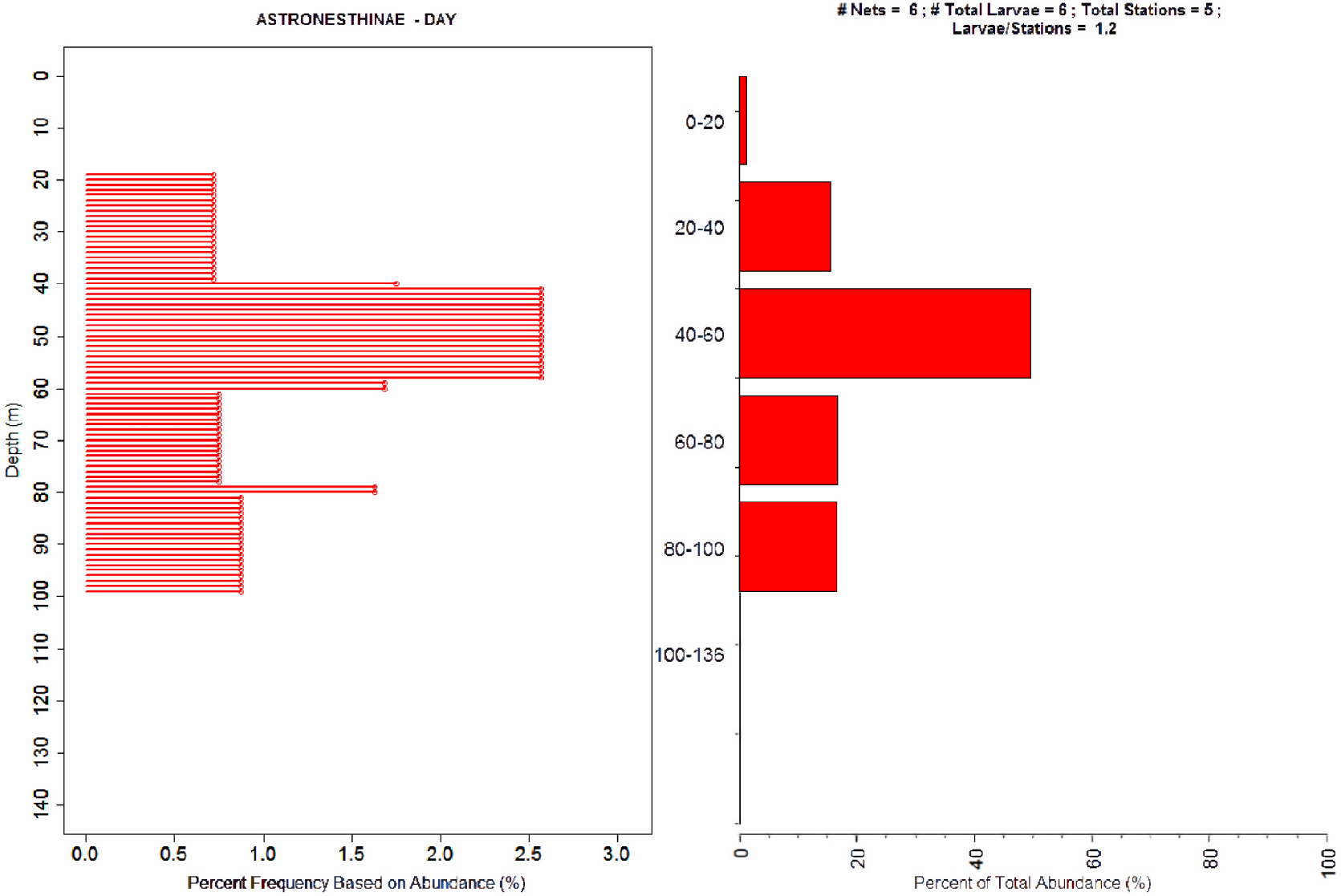
ARGENTINOIDEI, NIGHT


ARIOMMA - DAY
Nets = 58 ; # Total Larvae = 341 ; Total Stations = 30 ;
Larvae/Stations = 11.37
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

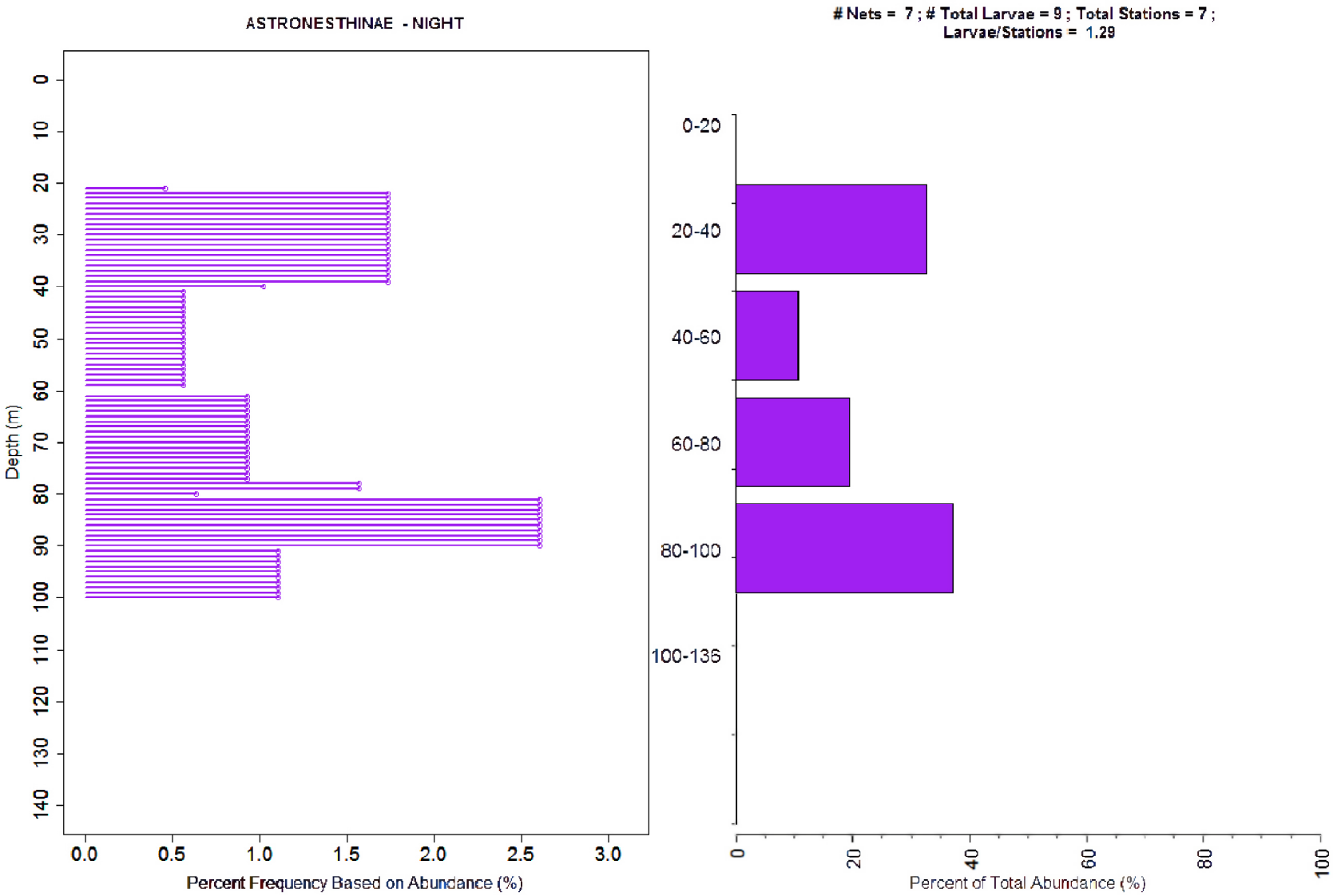
ARIOMMA, DAY



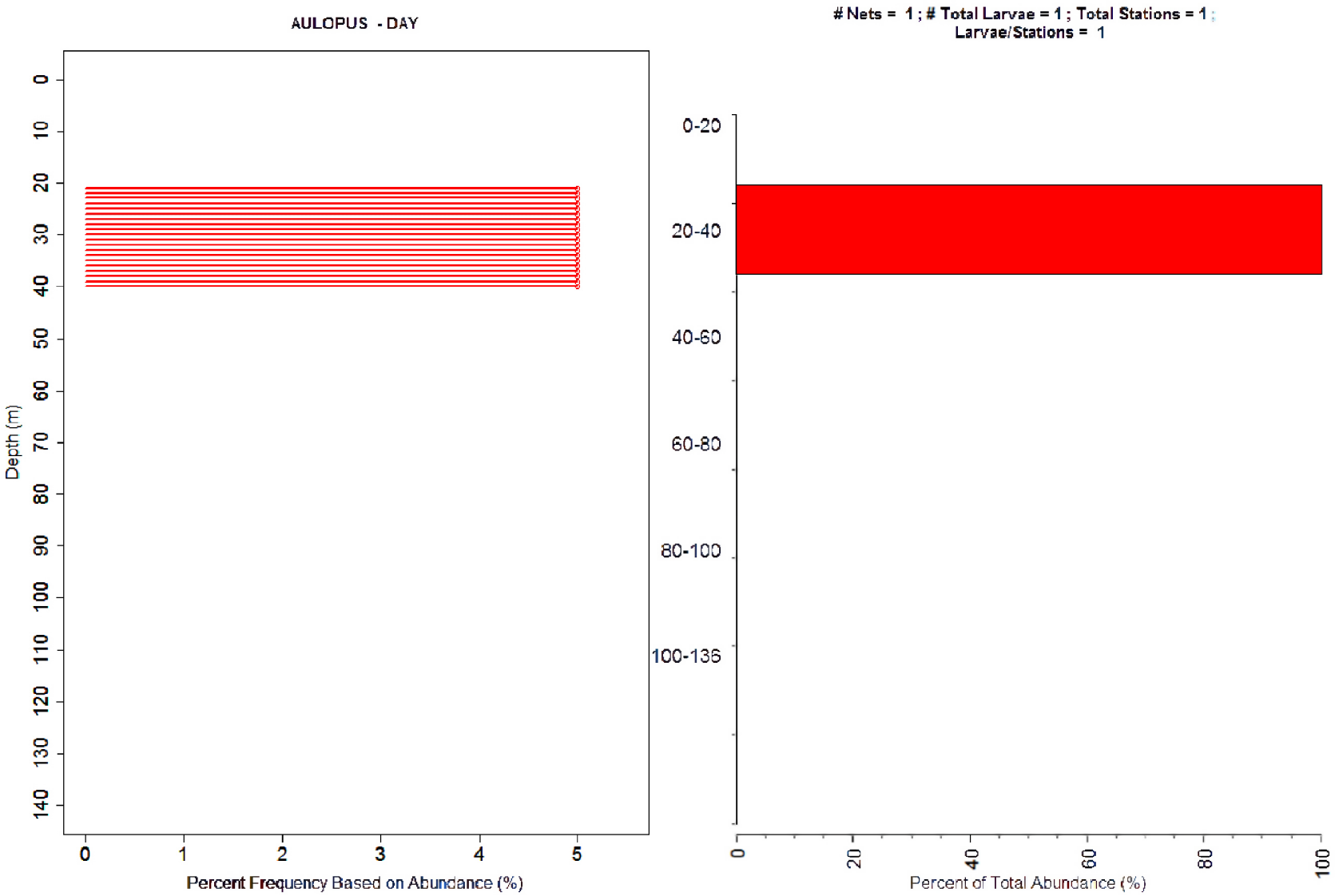
ARIOMMA, NIGHT



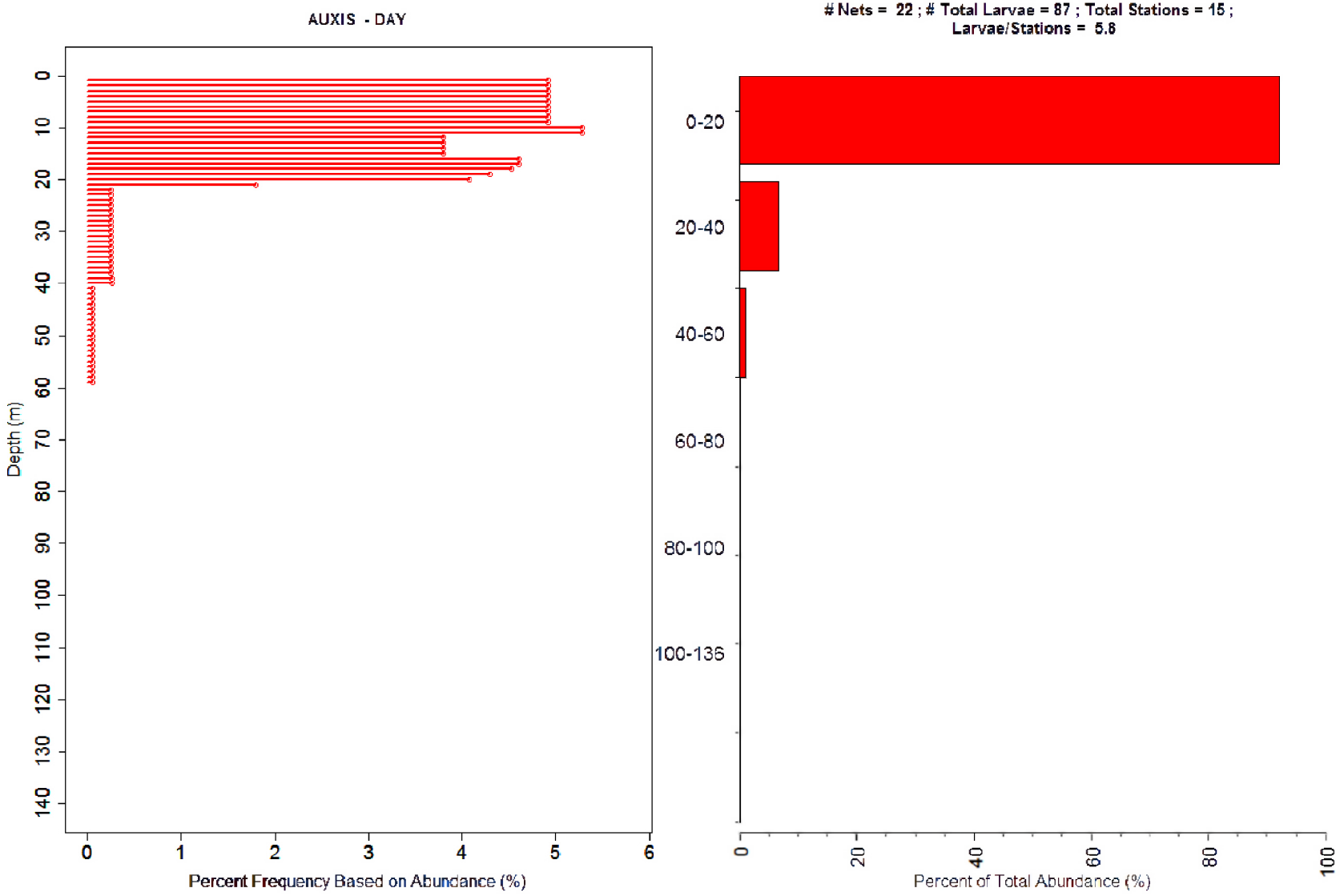
ASTRONESTHINAE, DAY



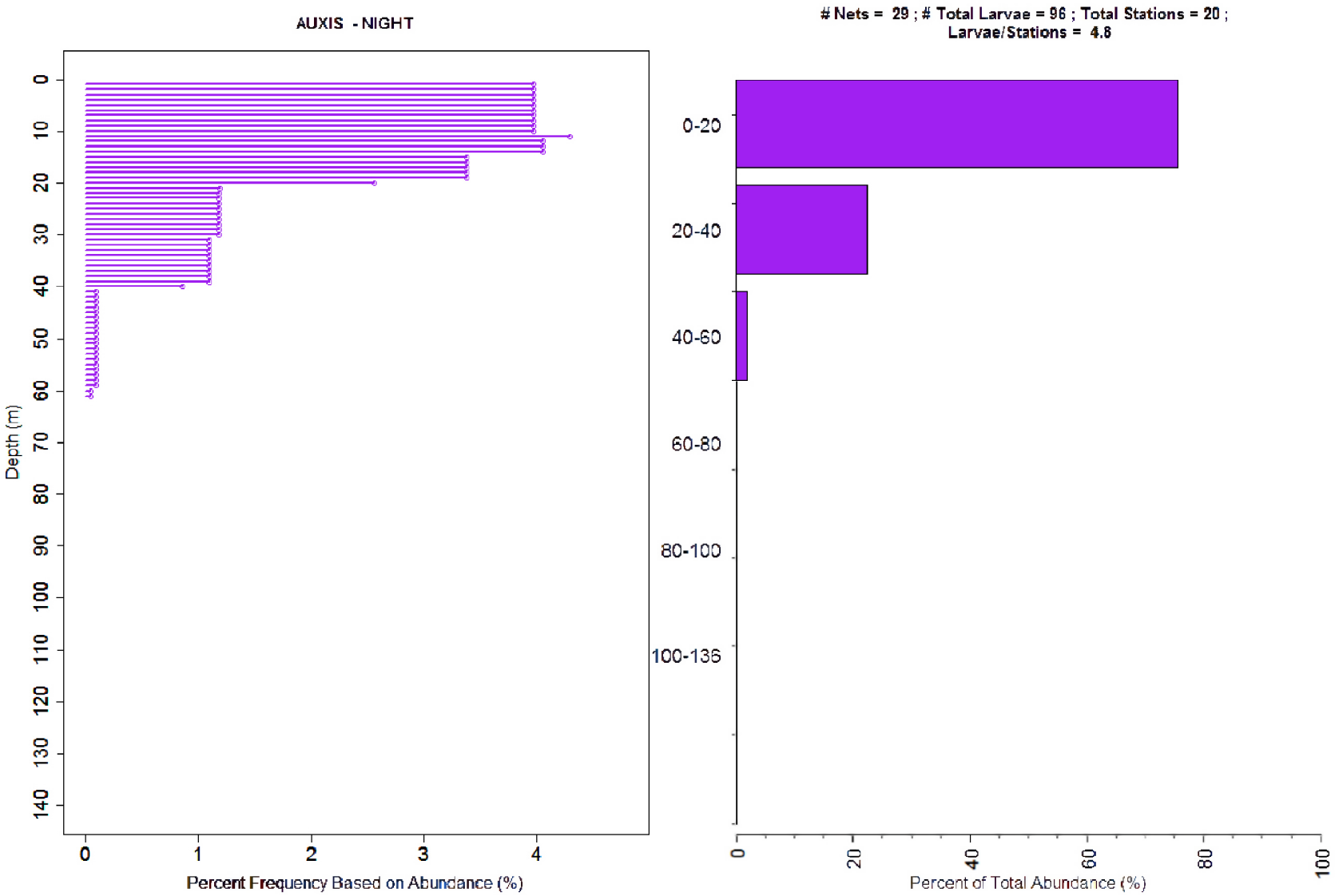
ASTRONESTHINAE, NIGHT


AULOPUS - DAY
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

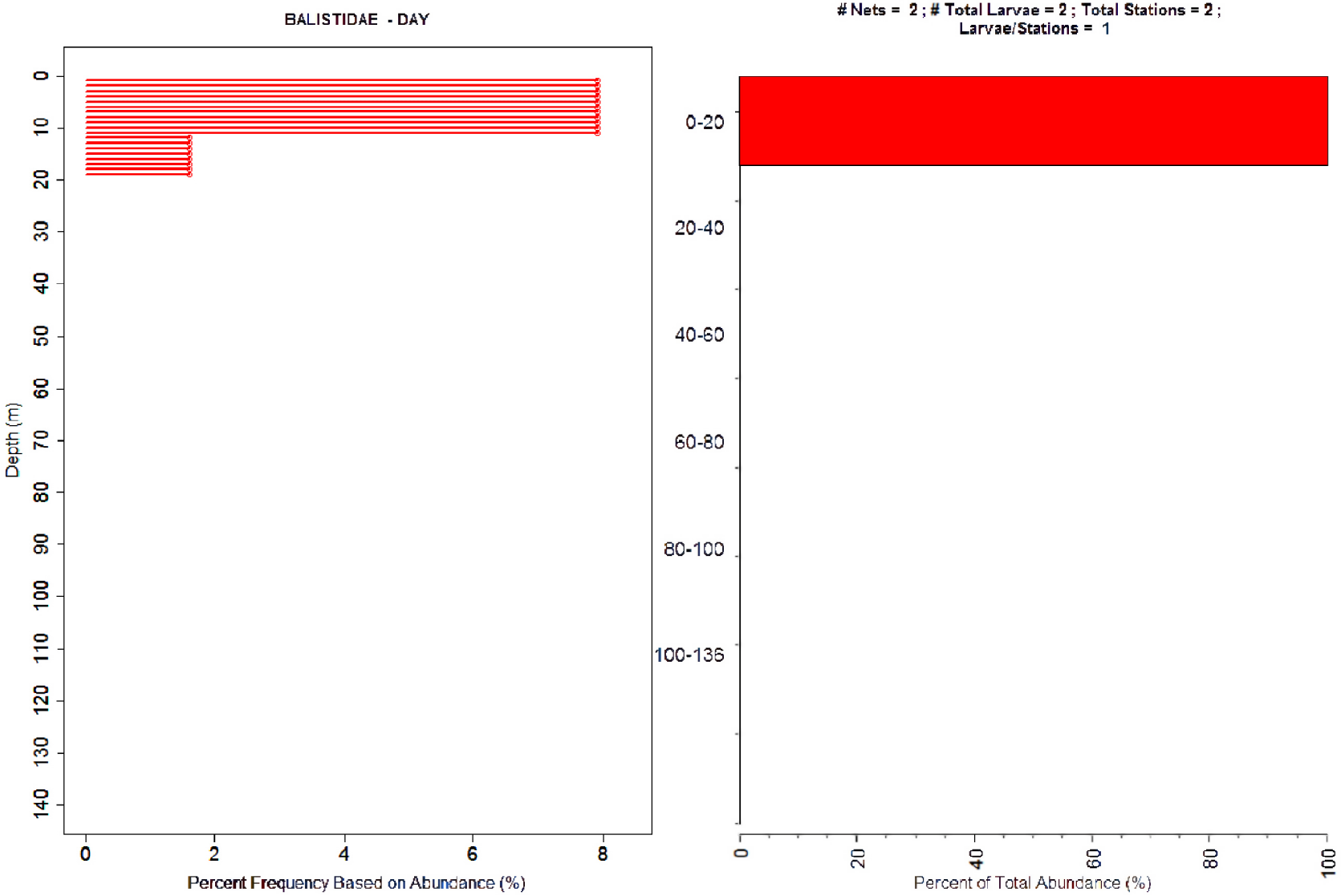
AULOPUS, DAY


AUXIS - DAY
Nets = 22 ; # Total Larvae = 87 ; Total Stations = 15 ;
Larvae/Stations = 5.8
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

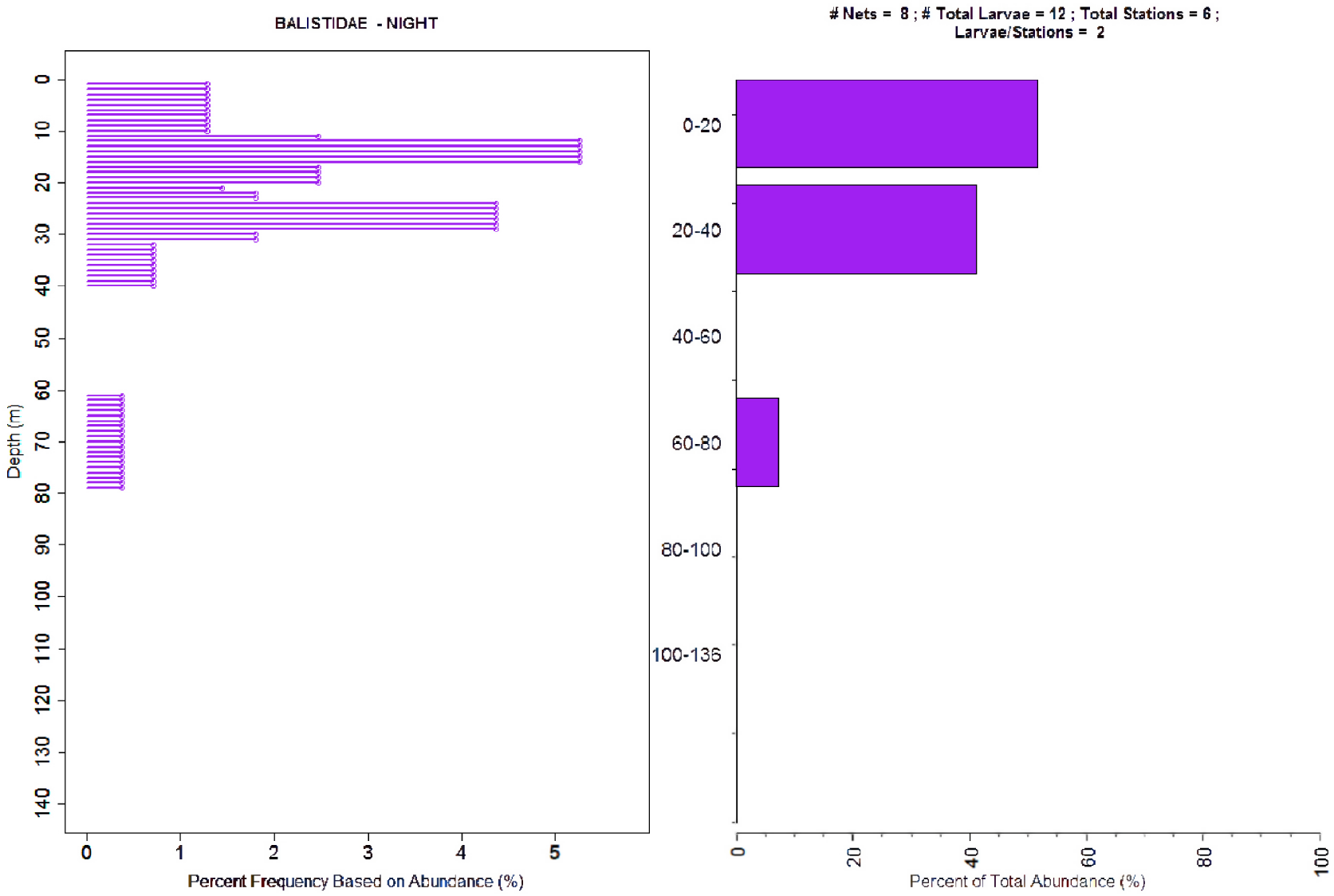
AUXIS, DAY


AUXIS - NIGHT
Nets = 29 ; # Total Larvae = 96 ; Total Stations = 20 ;
Larvae/Stations = 4.8
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

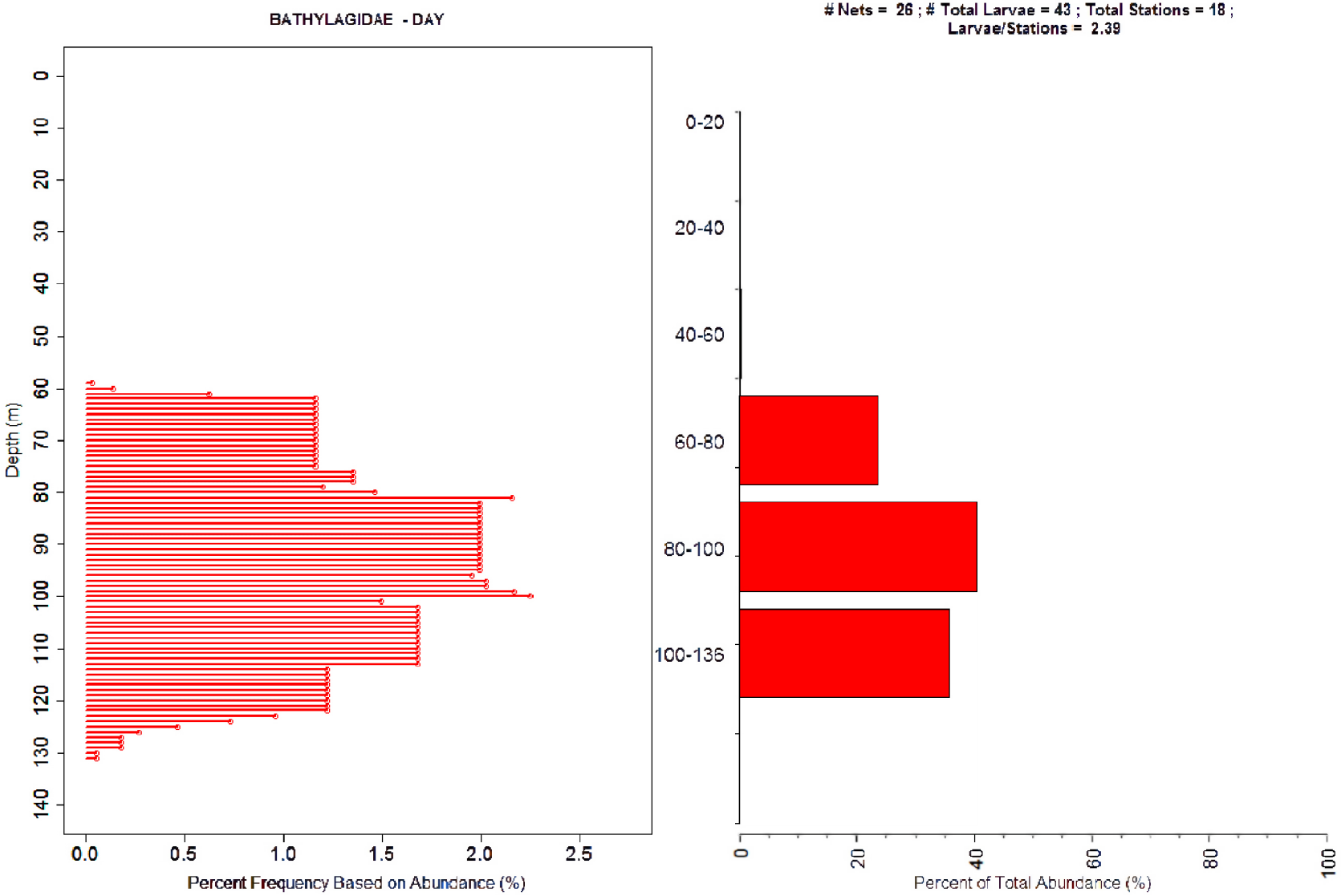
AUXIS, NIGHT



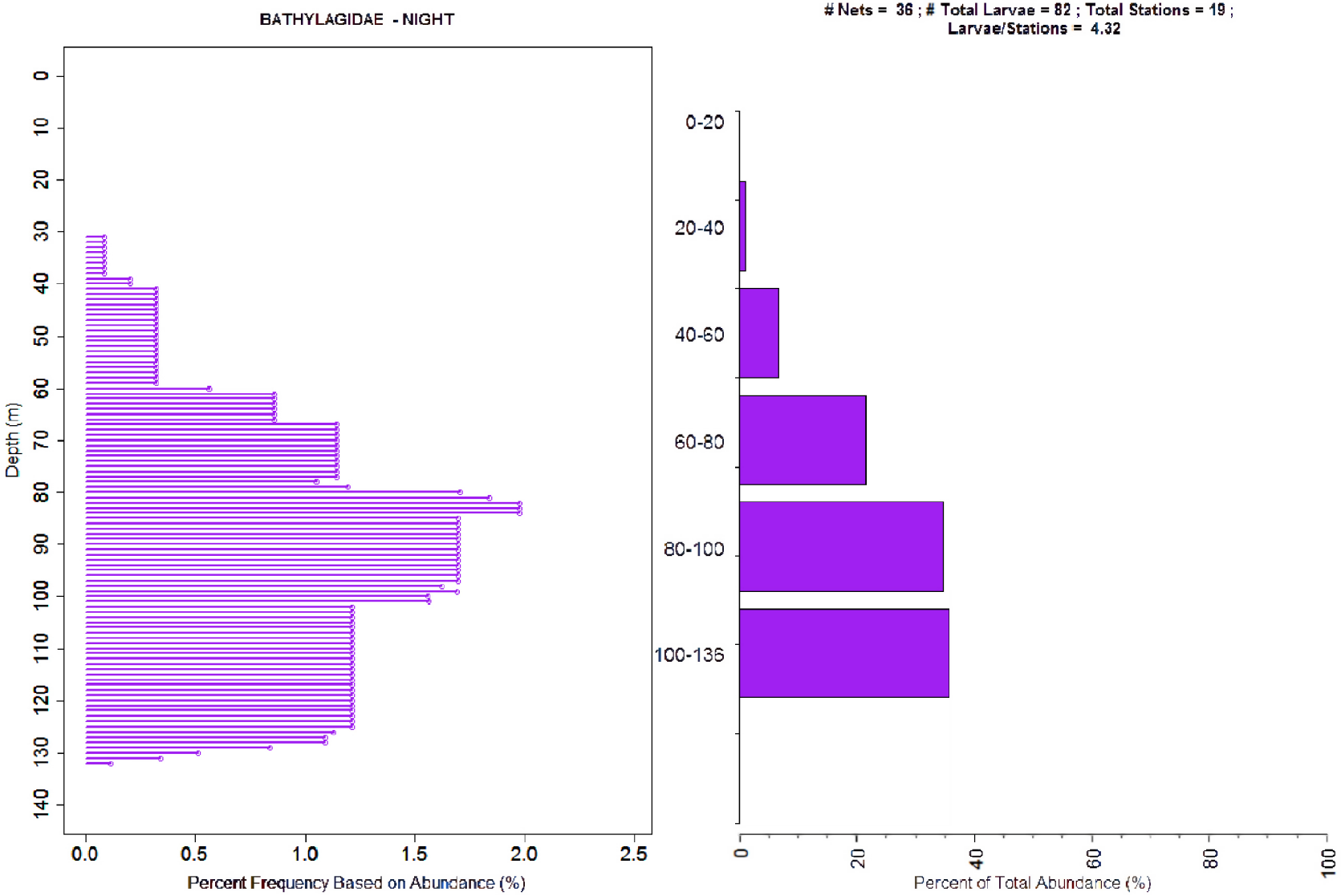
BALISTIDAE, DAY



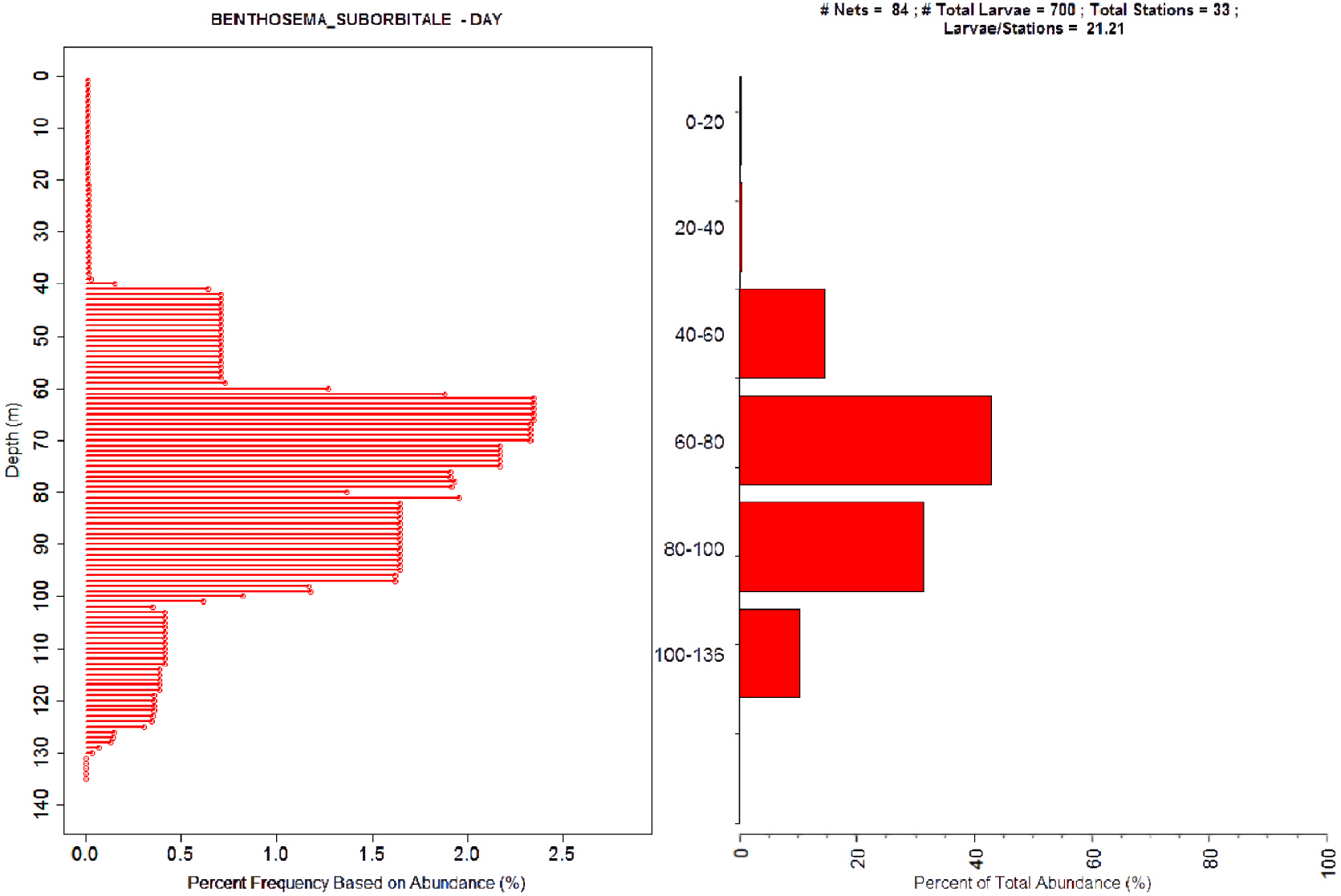
BALISTIDAE, NIGHT



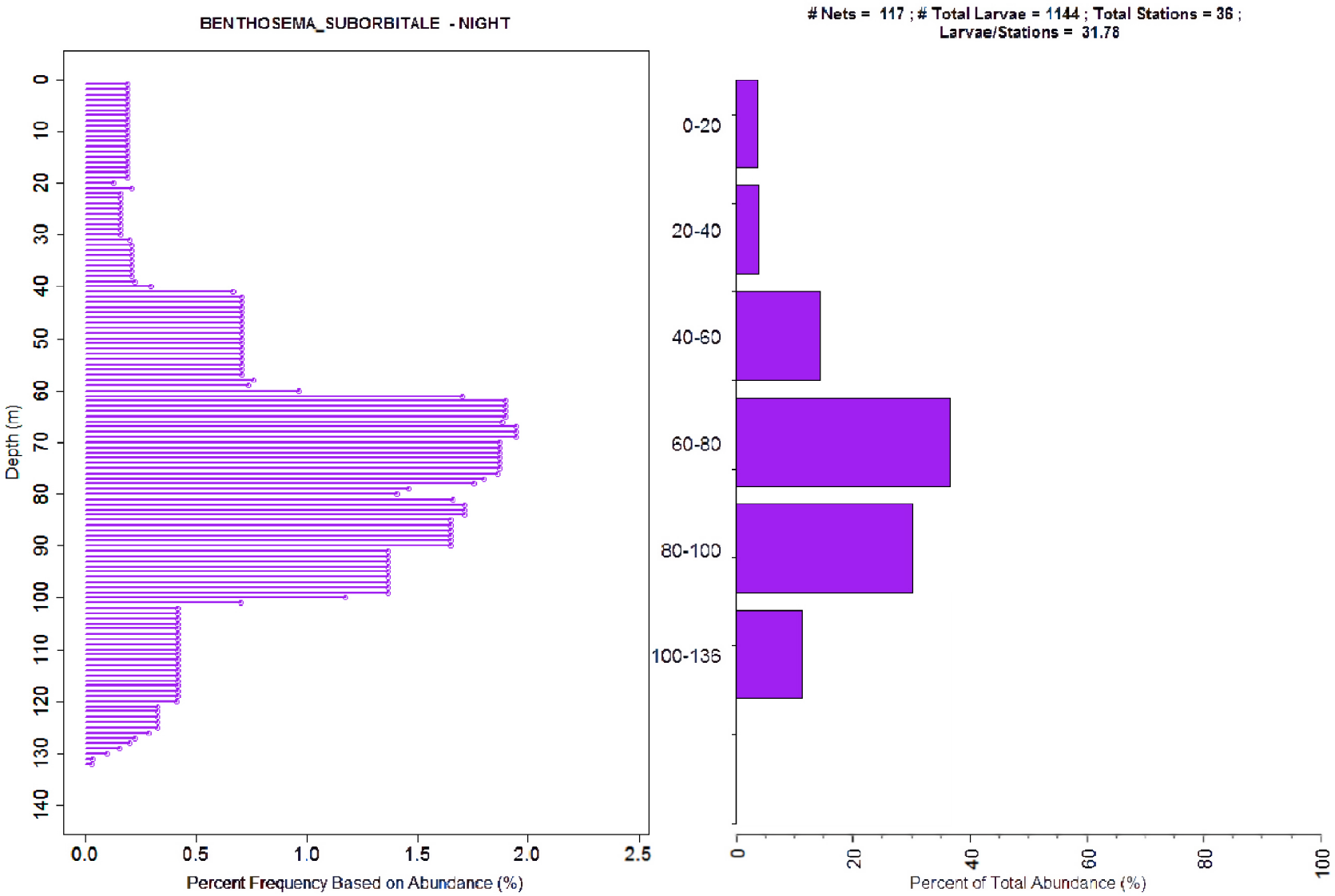
BATHYLAGIDAE, DAY



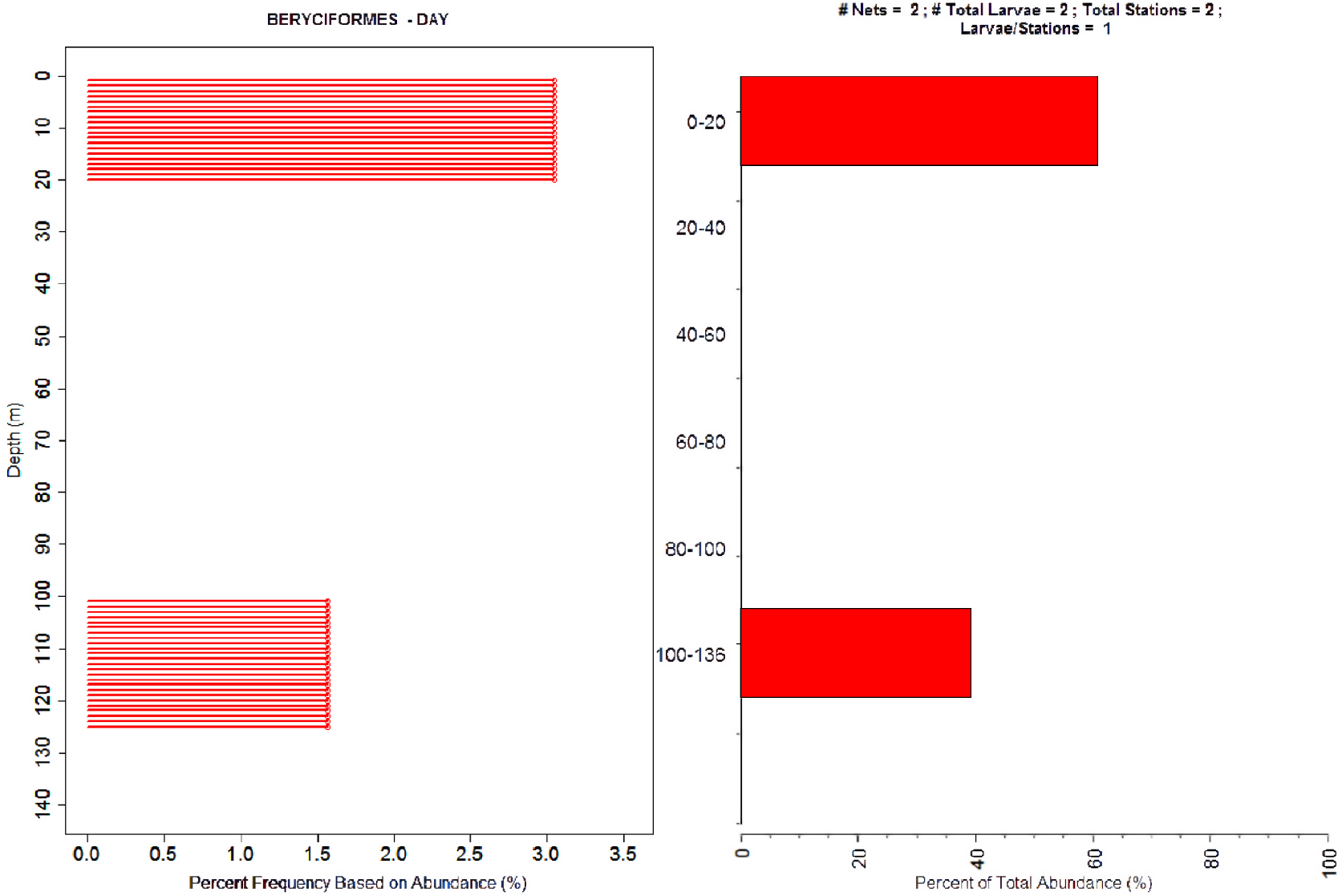
BATHYLAGIDAE, NIGHT



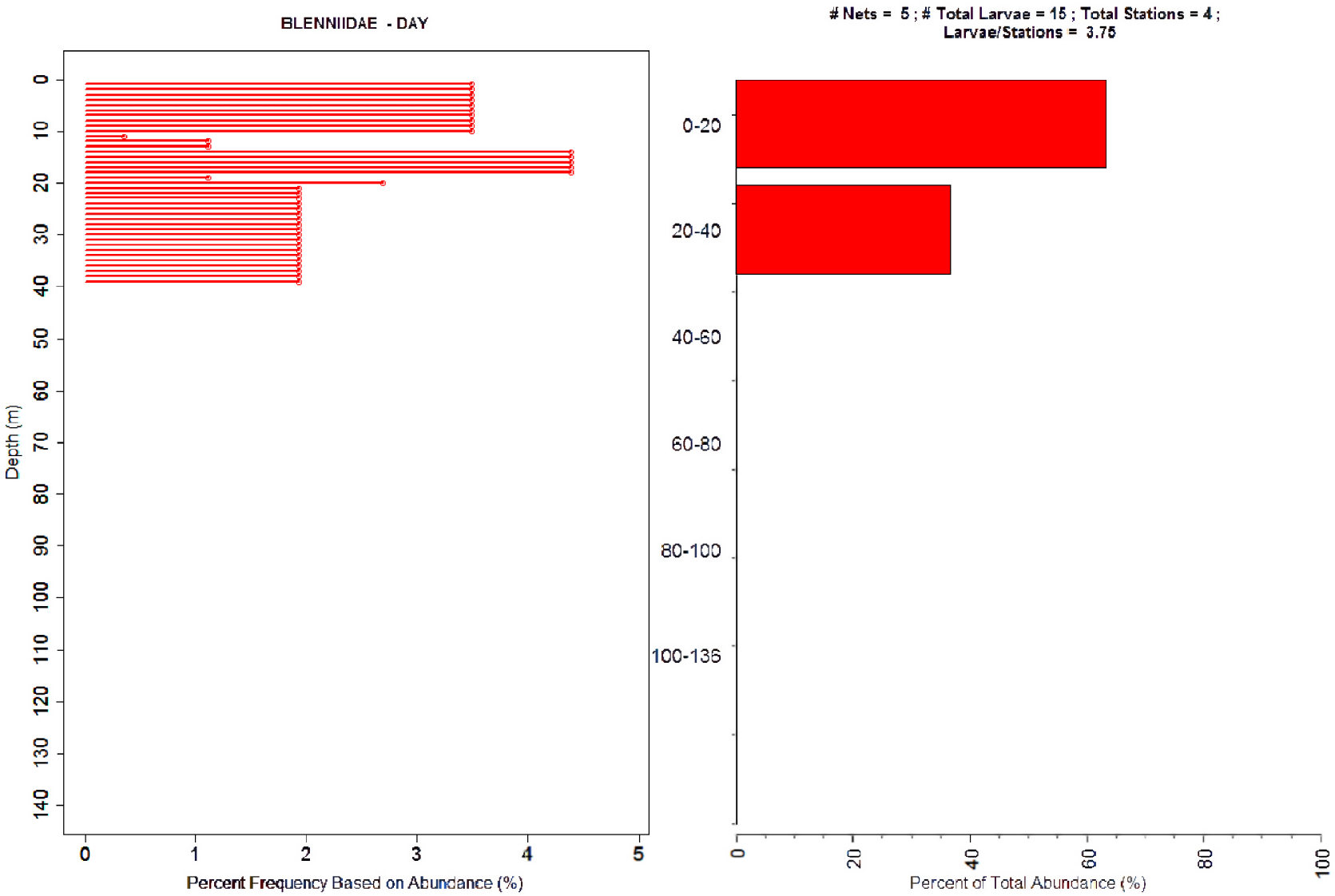
BENTHOSEMA_SUBORBITALE, DAY



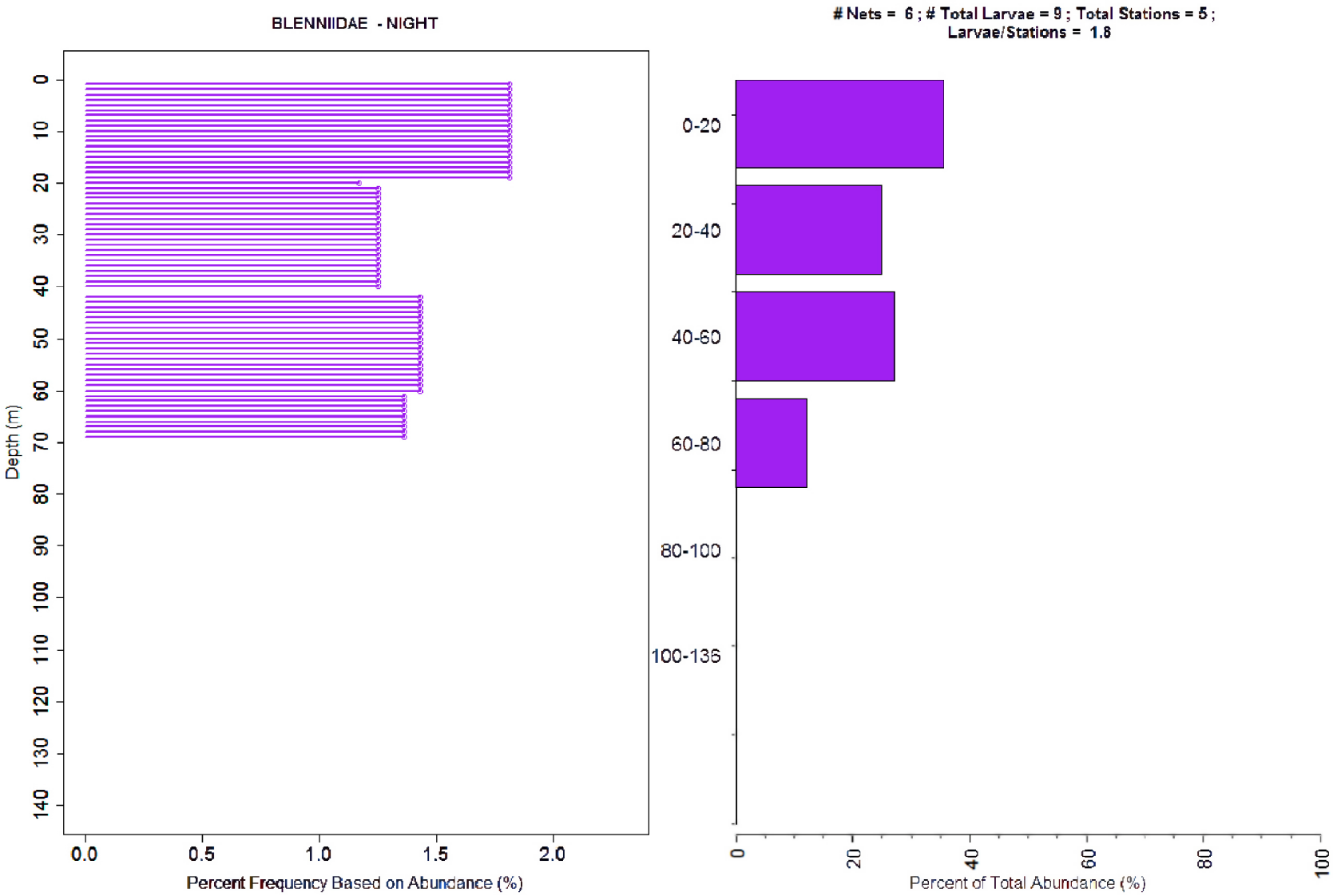
BENTHOSEMA_SUBORBITALE, NIGHT



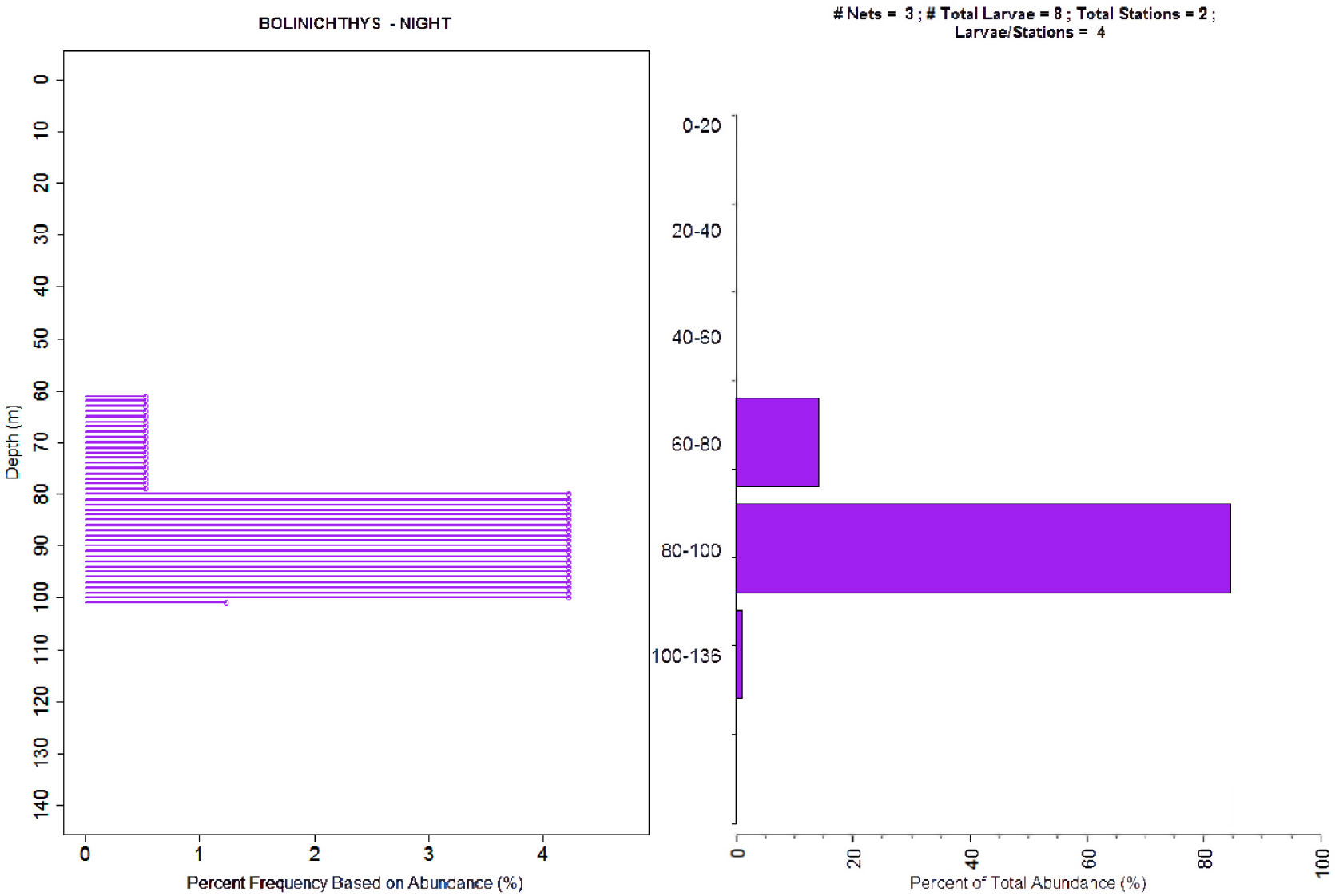
BERYCIFORMES, DAY



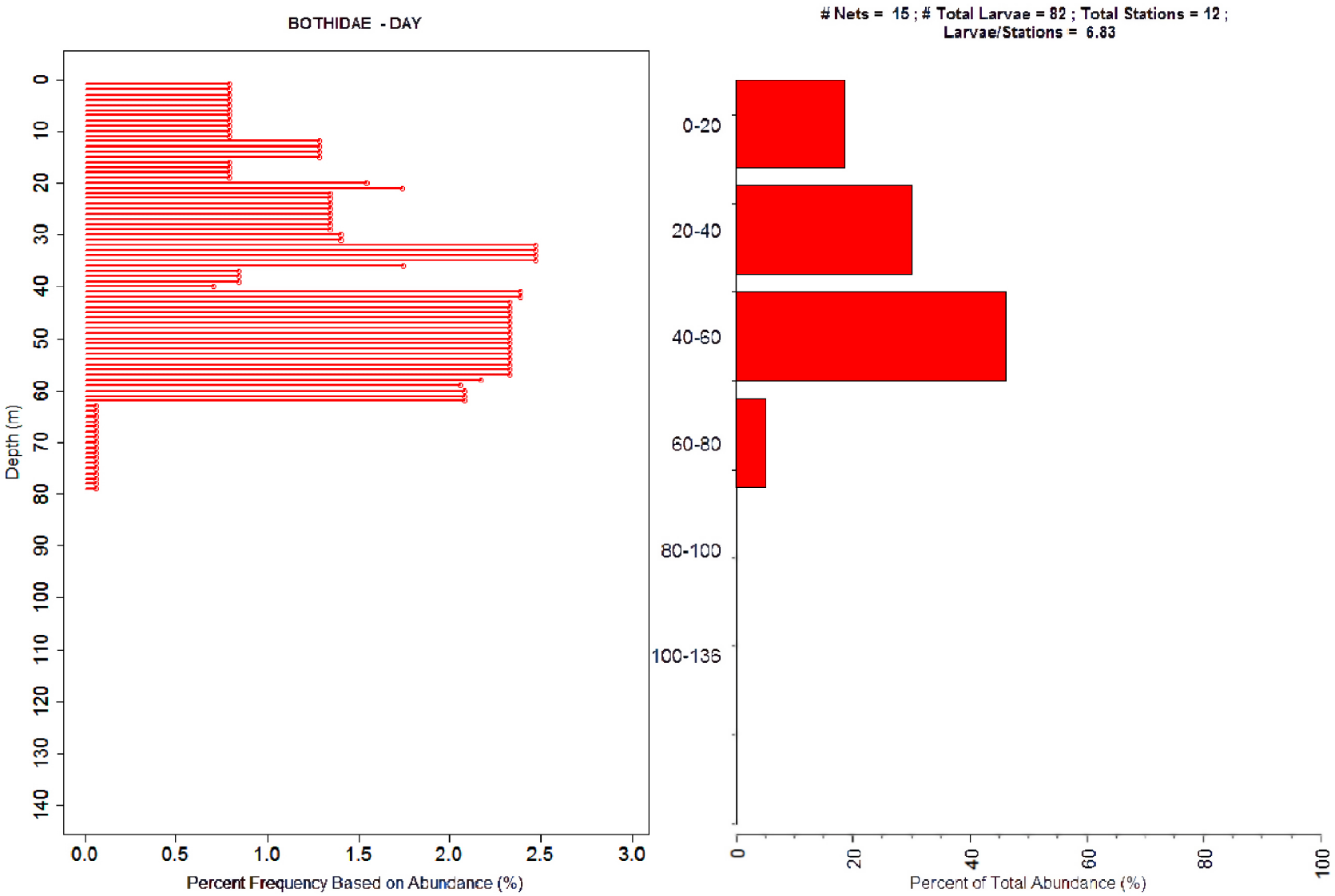
BLENNIIDAE, DAY



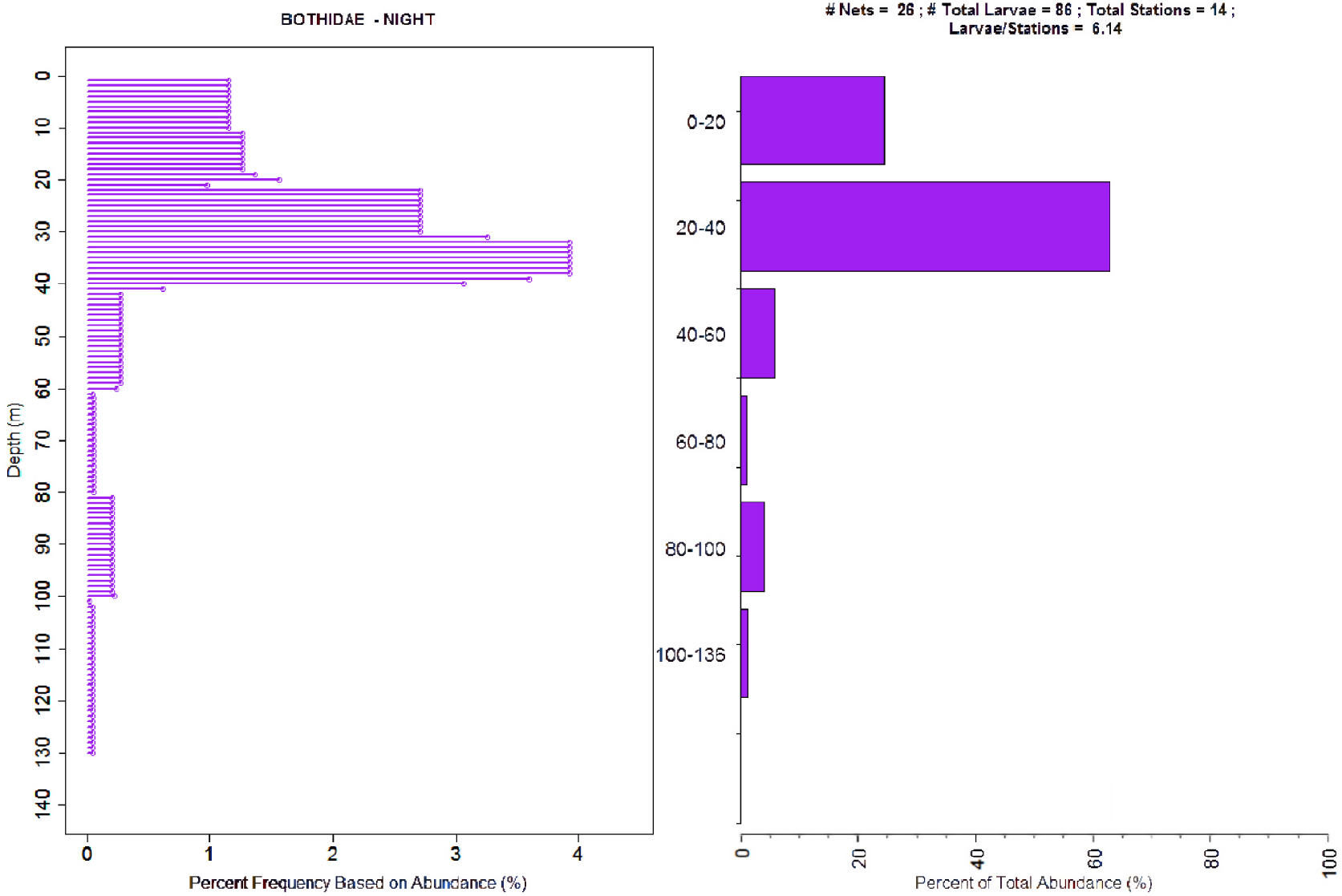
BLENNIIDAE, NIGHT



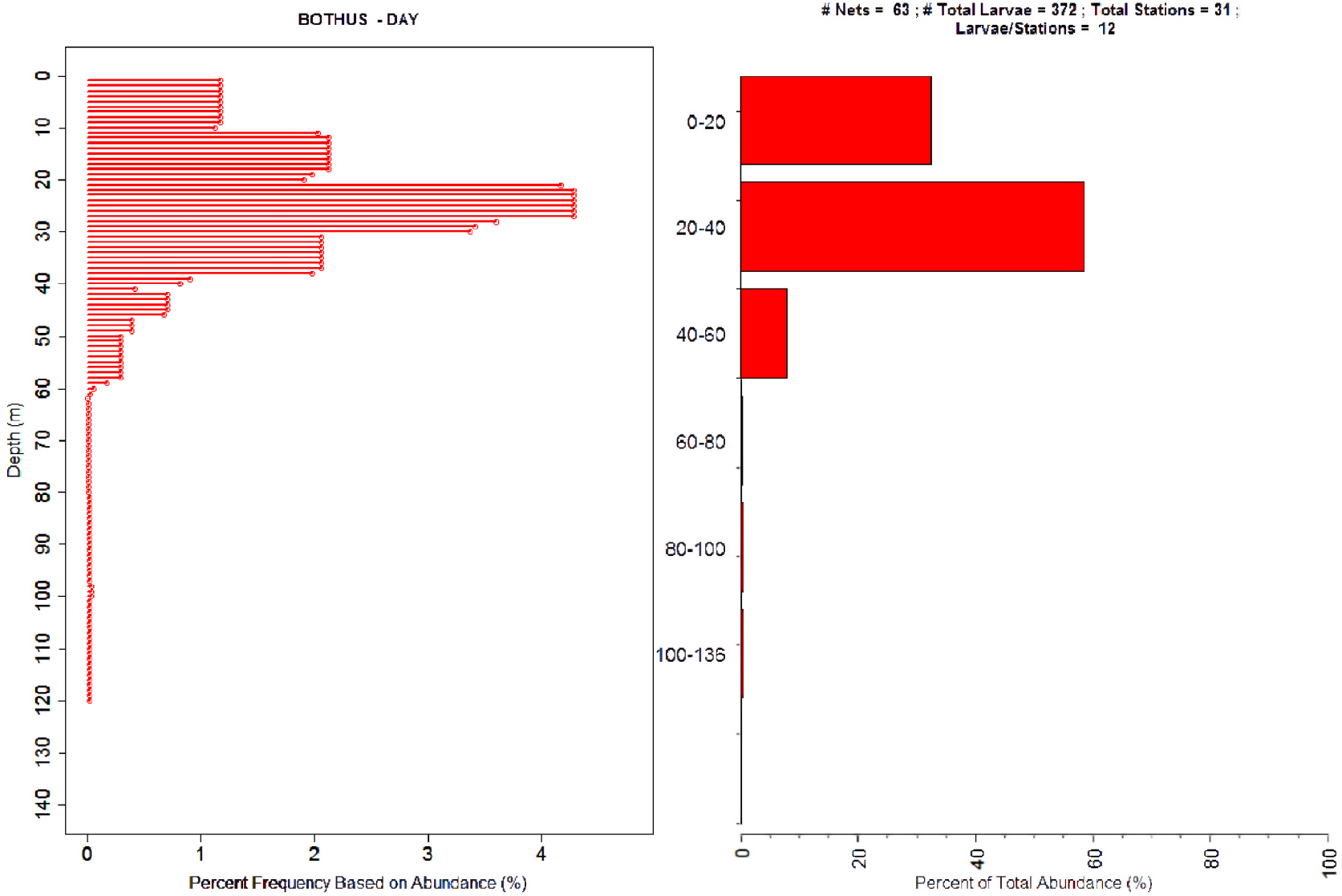
BOLINICHTHYS, NIGHT



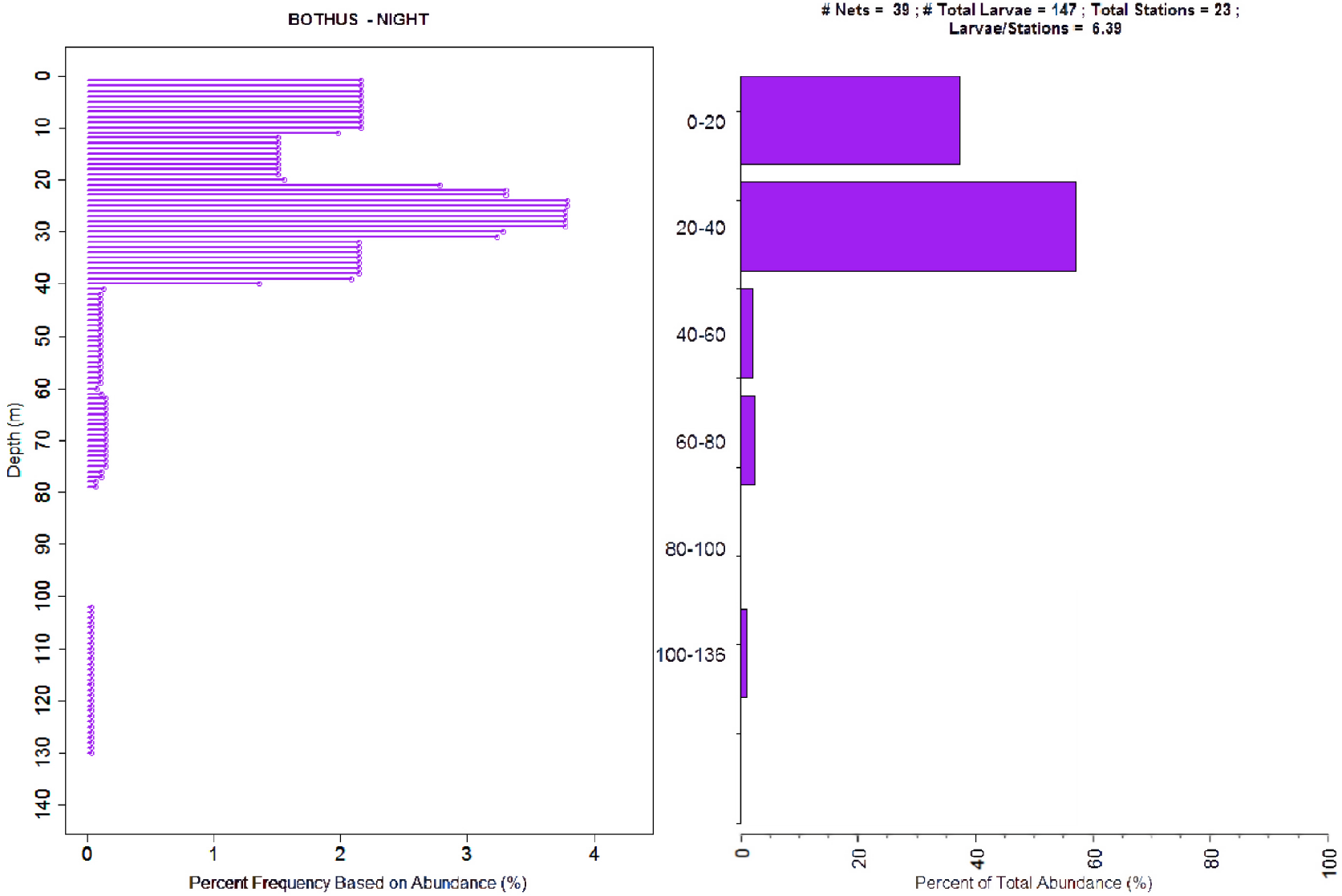
BOTHIDAE, DAY



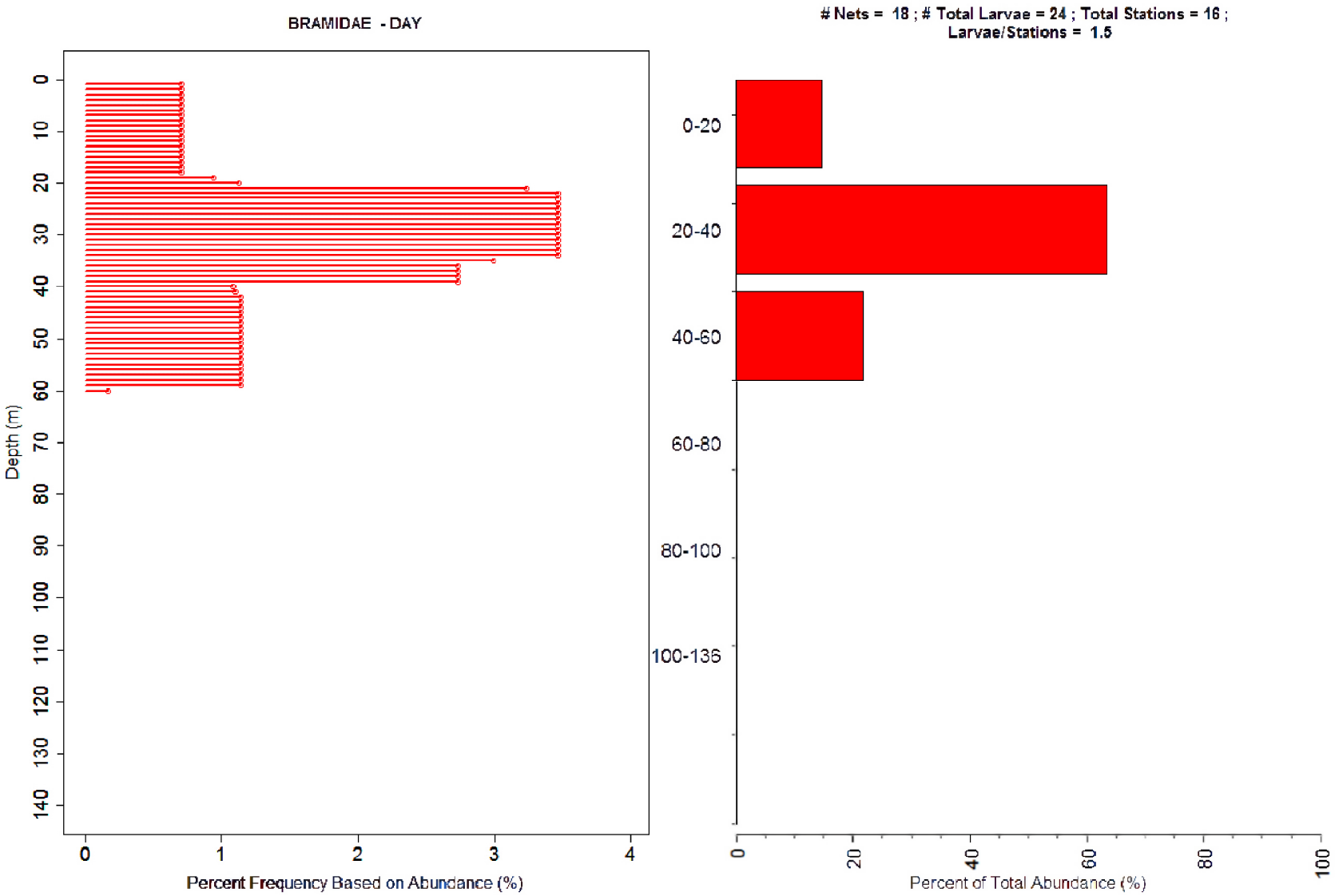
BOTHIDAE, NIGHT


BOTHUS - DAY
Nets = 63 ; # Total Larvae = 372 ; Total Stations = 31 ;
Larvae/Stations = 12
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

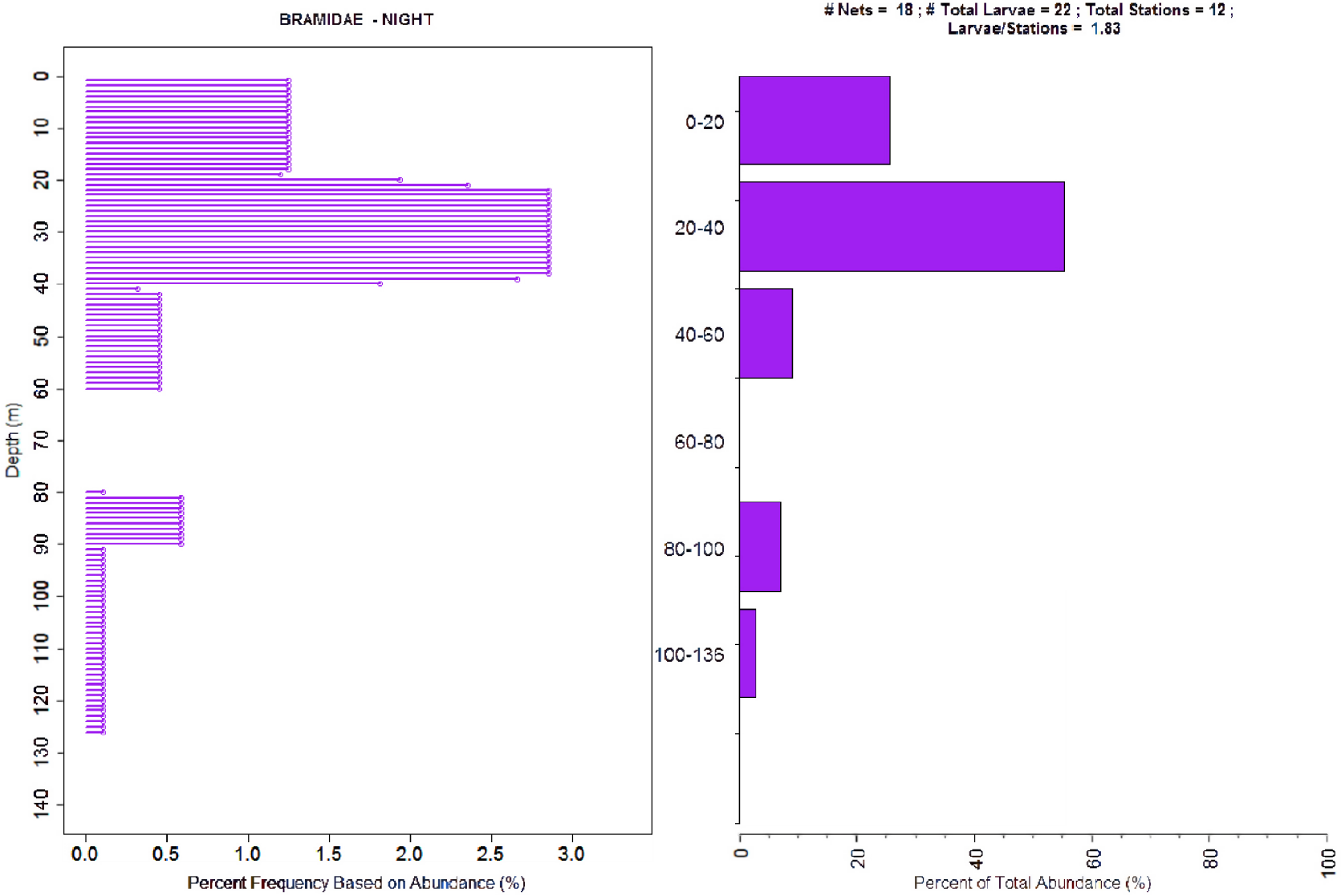
BOTHUS, DAY



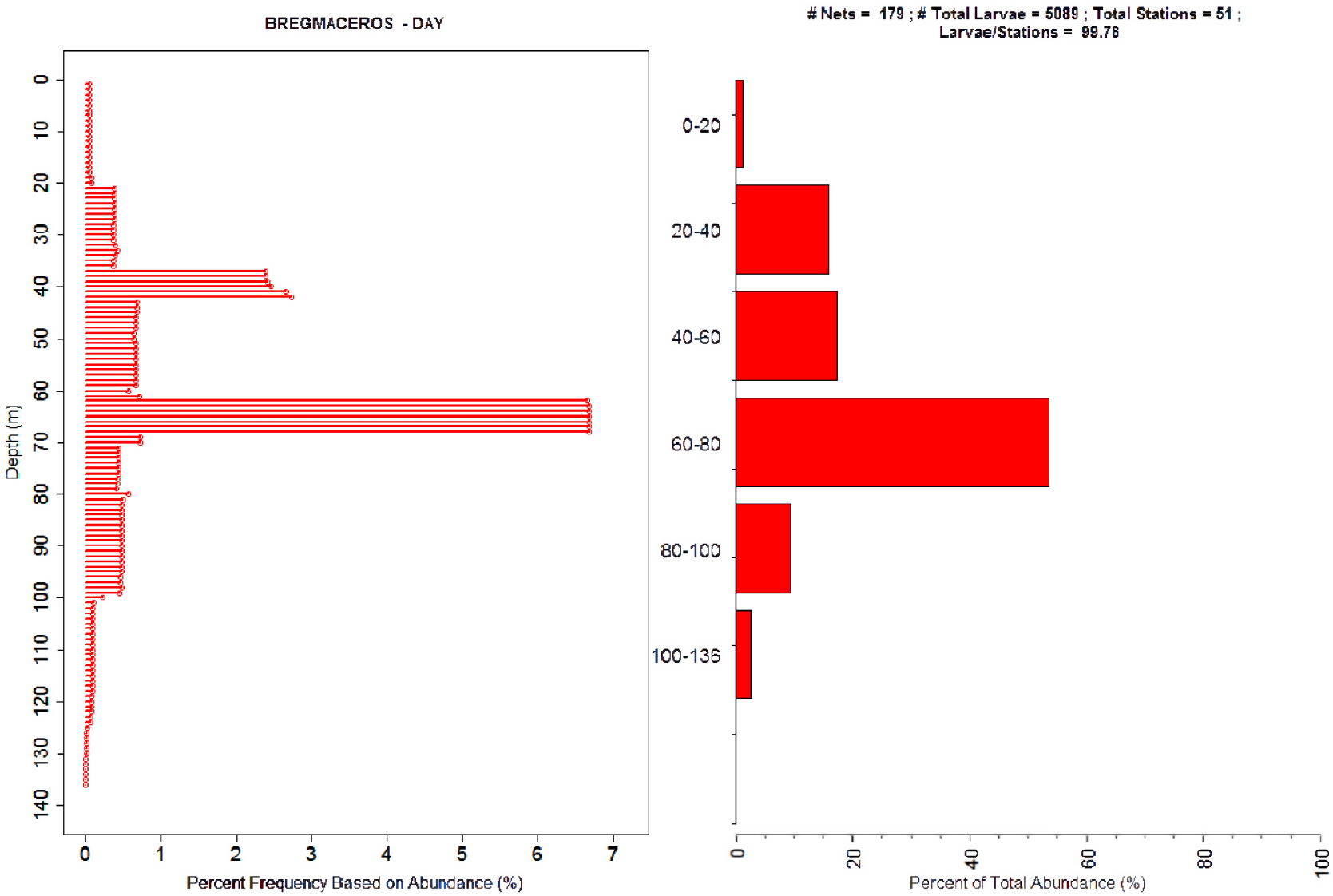
BOTHUS, NIGHT



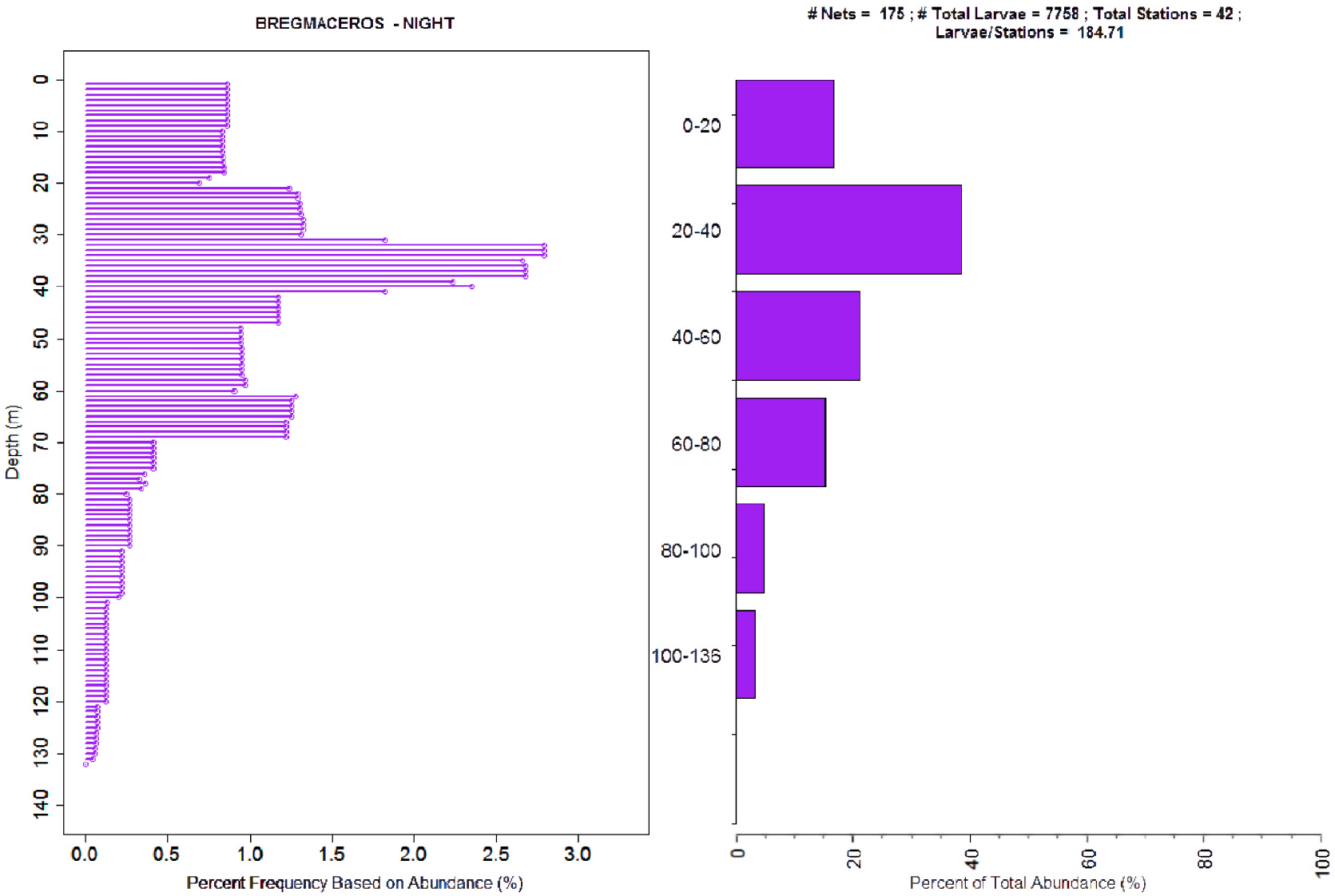
BRAMIDAE, DAY



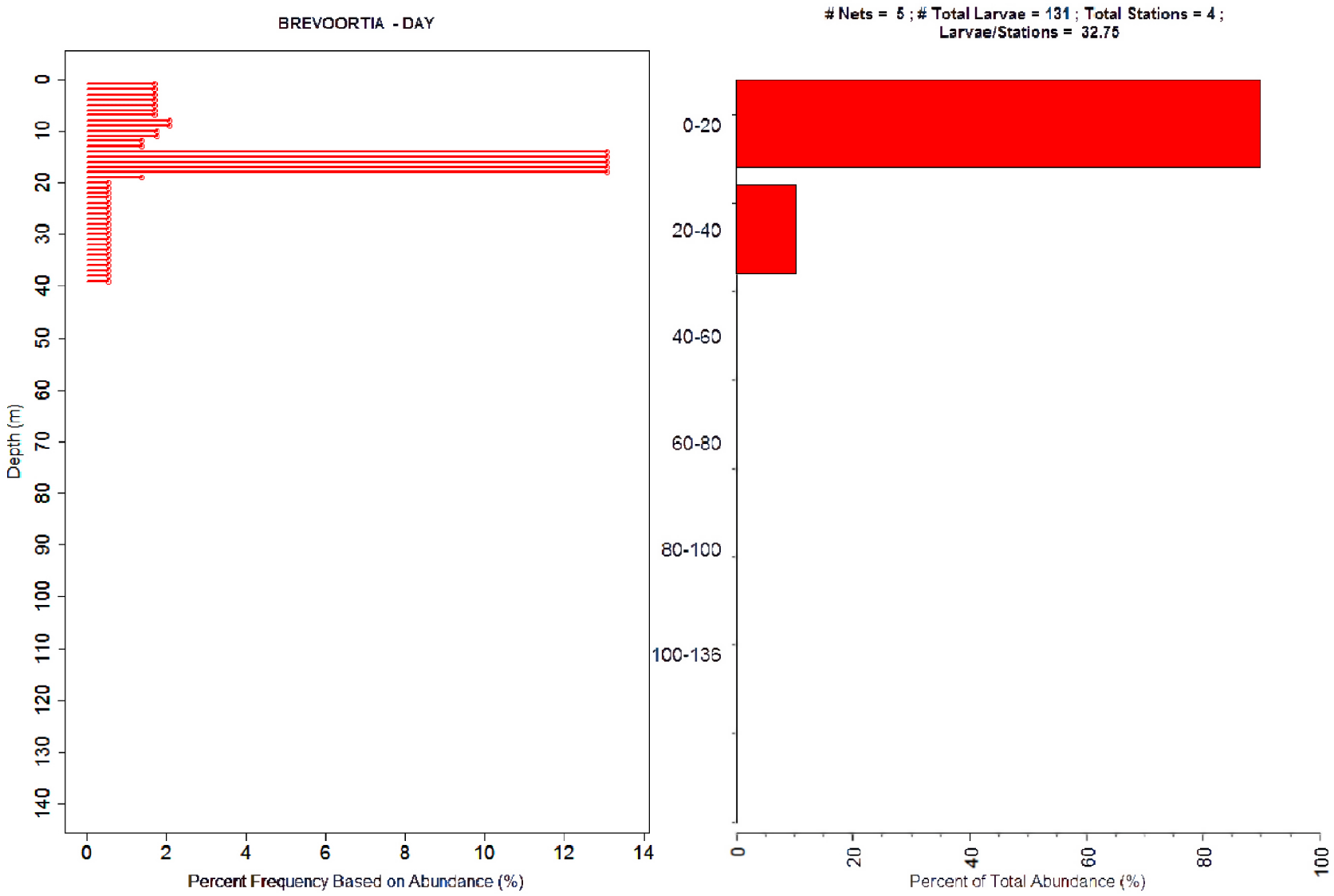
BRAMIDAE, NIGHT



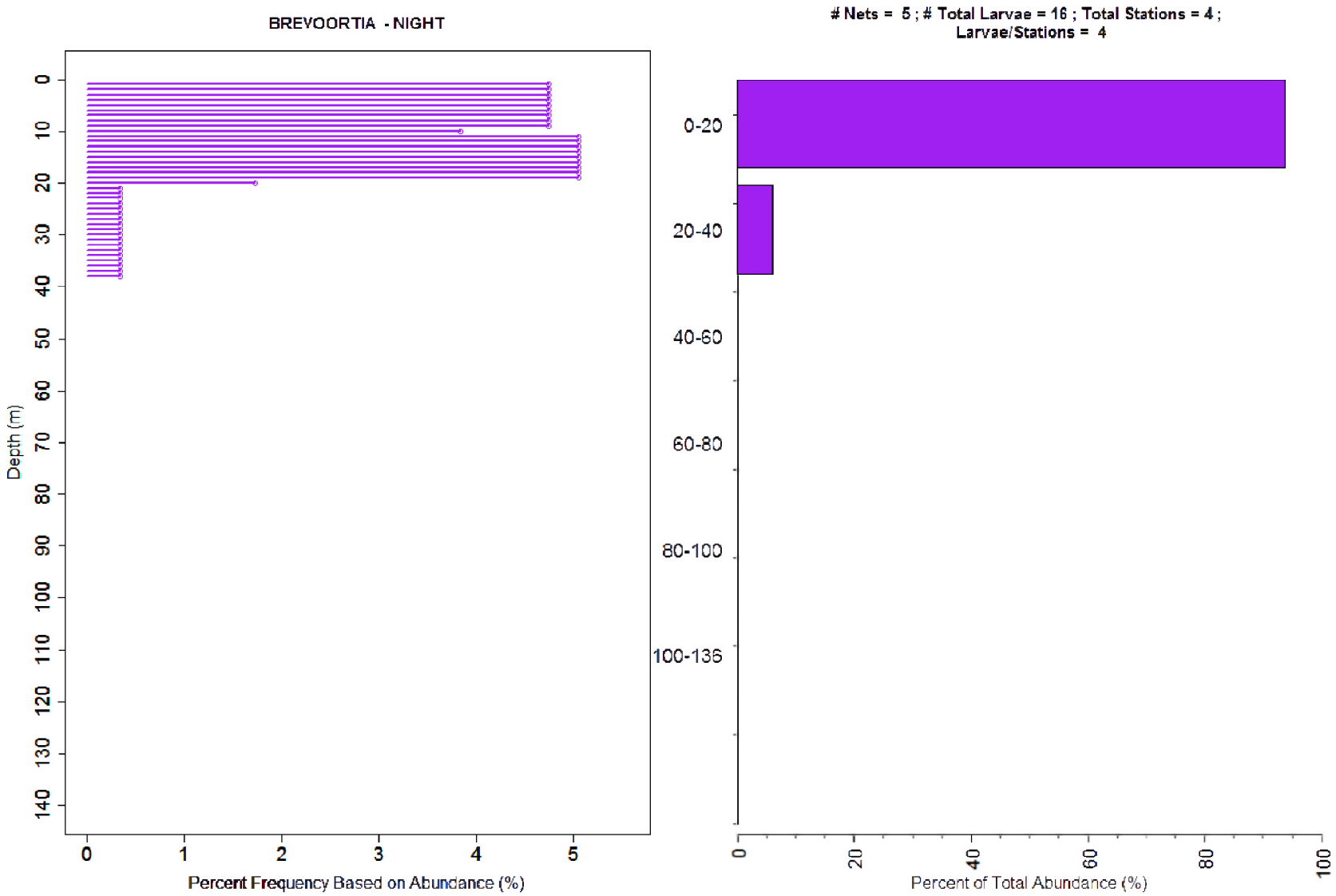
BREGMACEROS, DAY



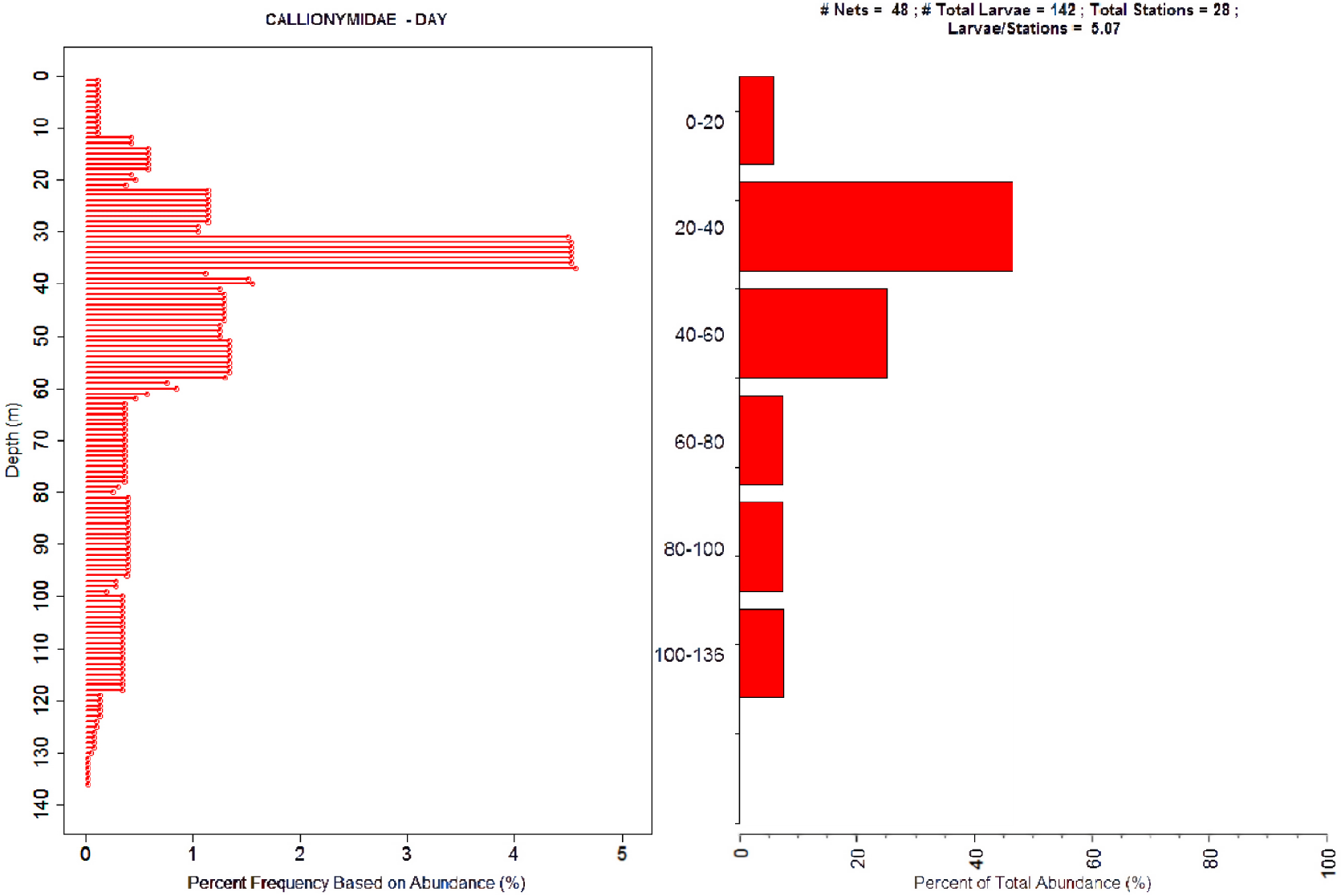
BREGMACEROS, NIGHT



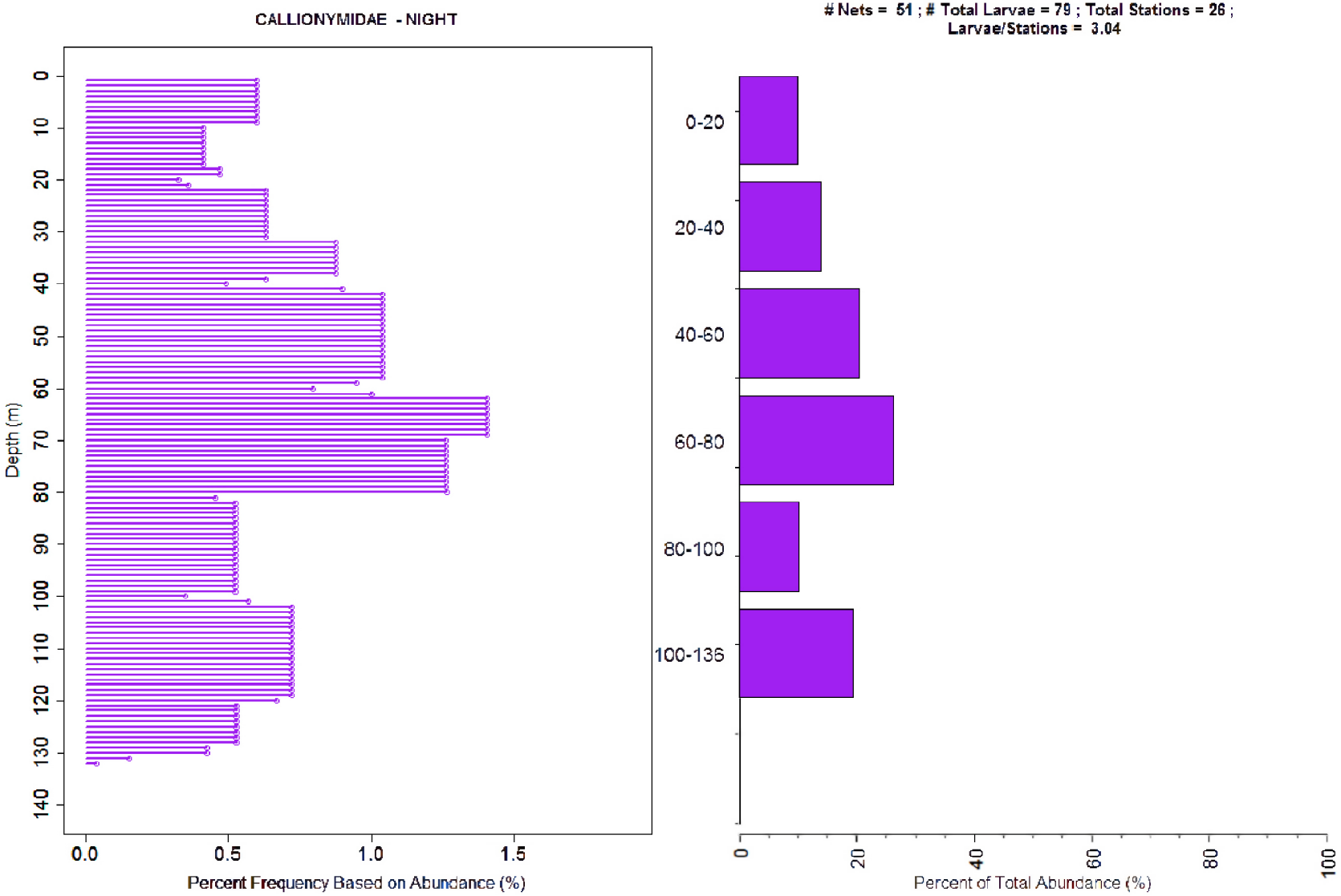
BREVOORTIA, DAY



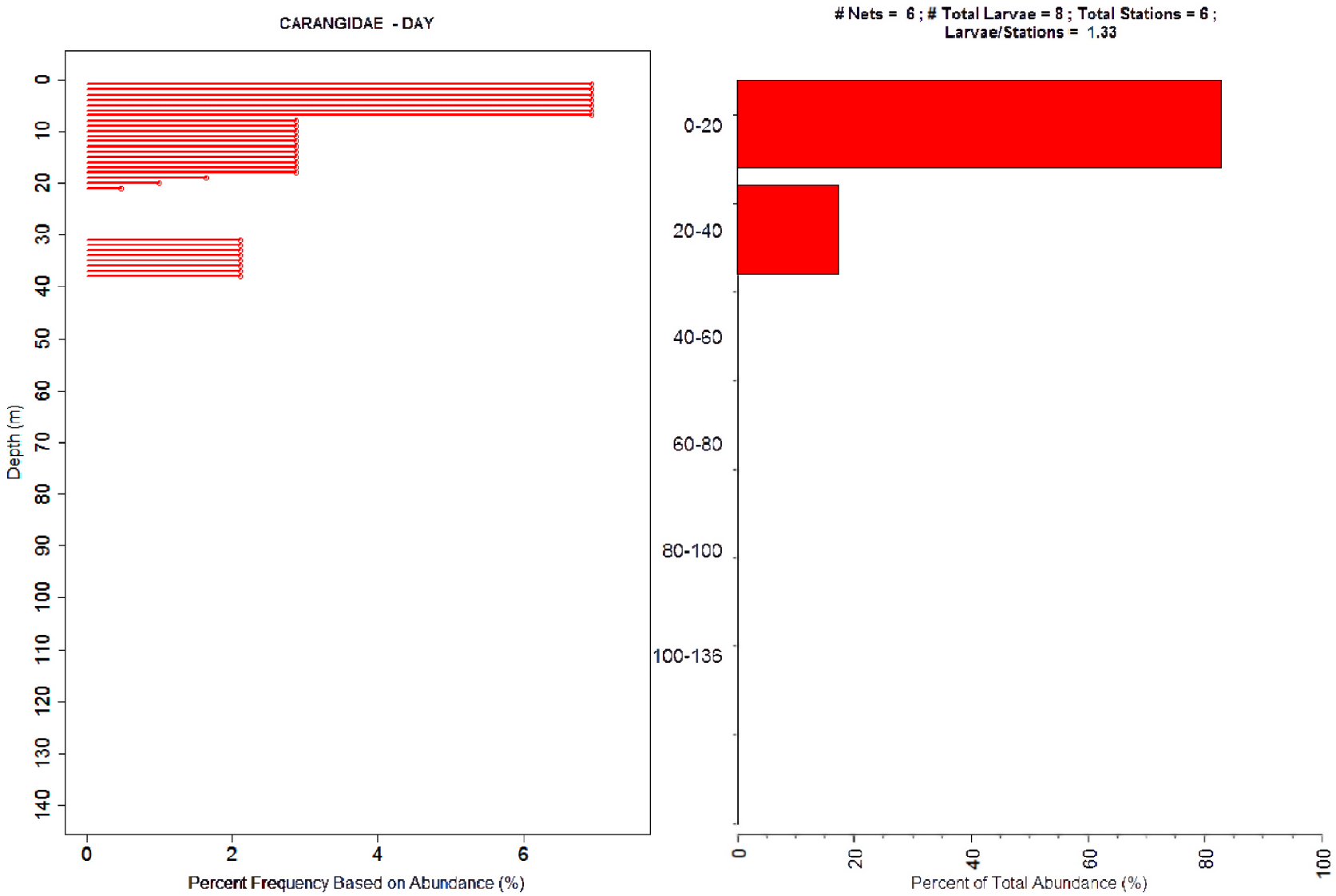
BREVOORTIA, NIGHT



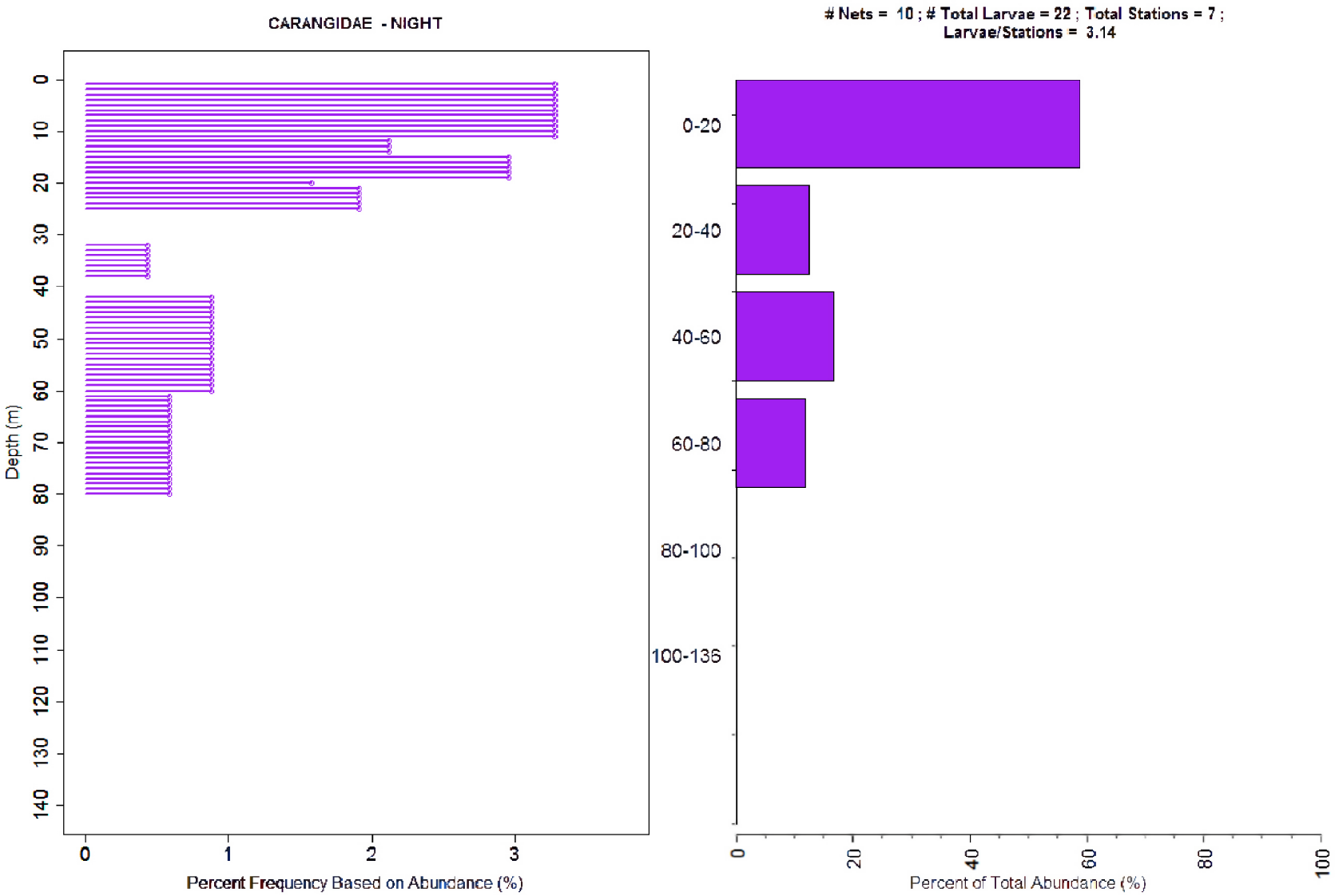
CALLIONYMIDAE, DAY



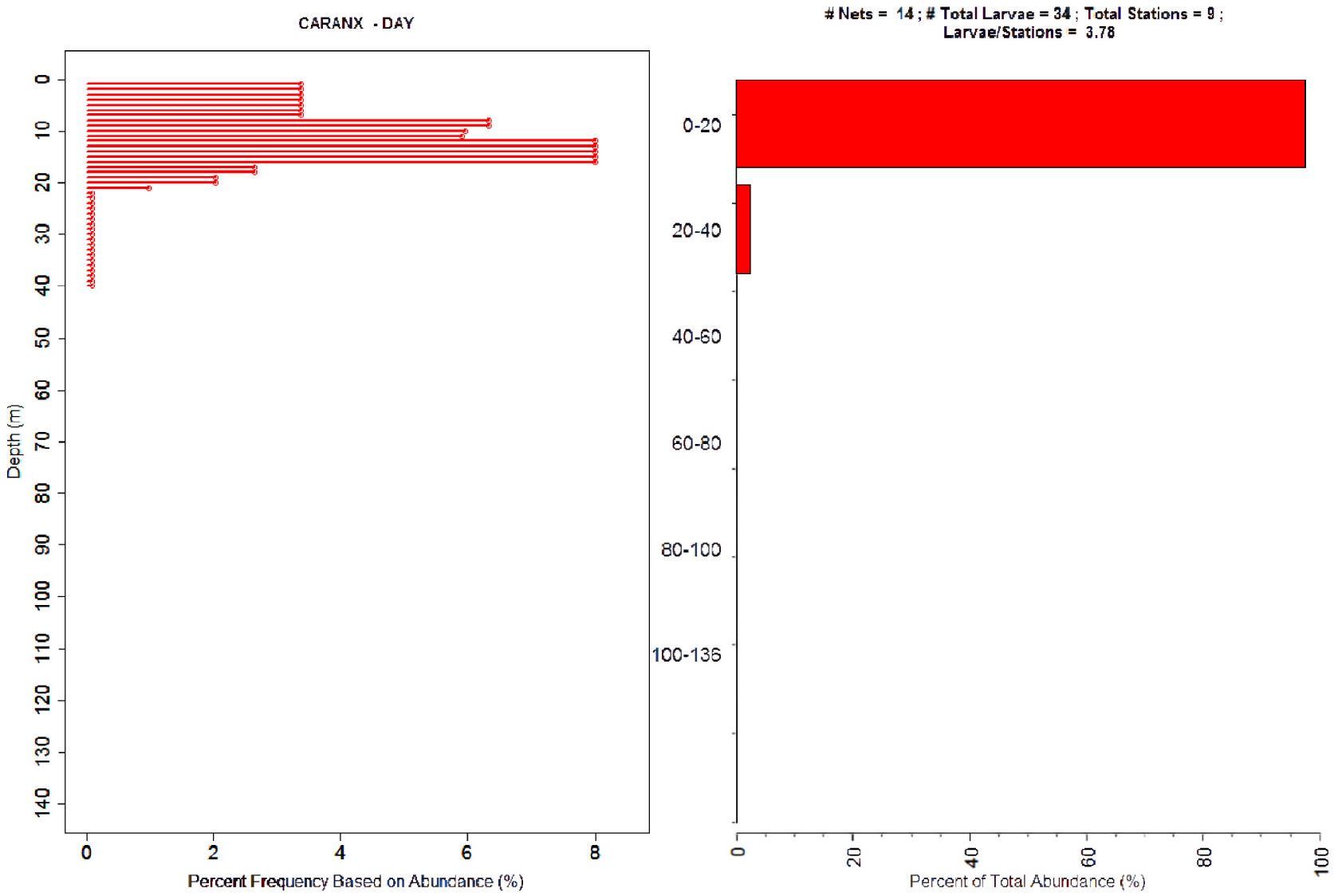
CALLIONYMIDAE, NIGHT



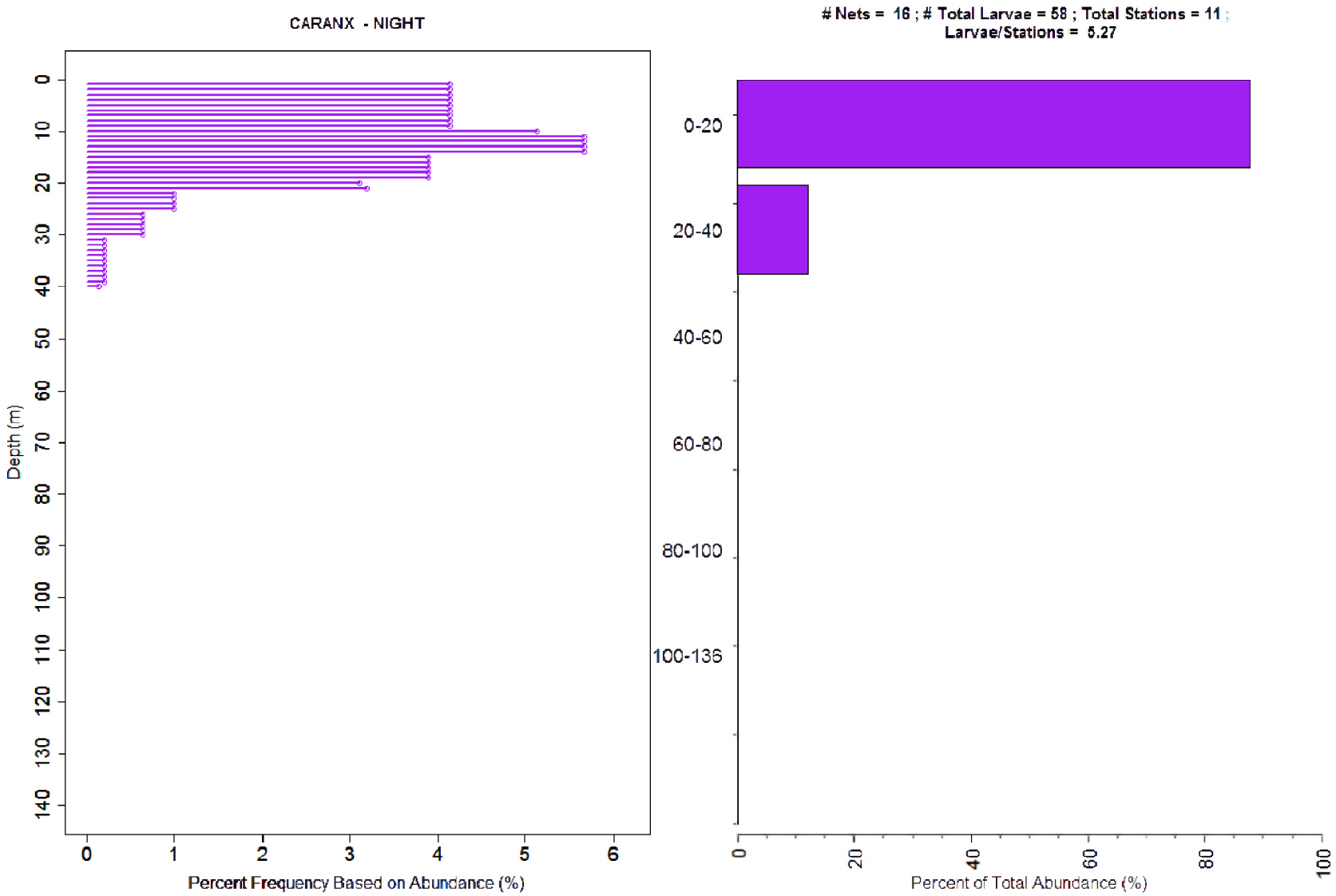
CARANGIDAE, DAY



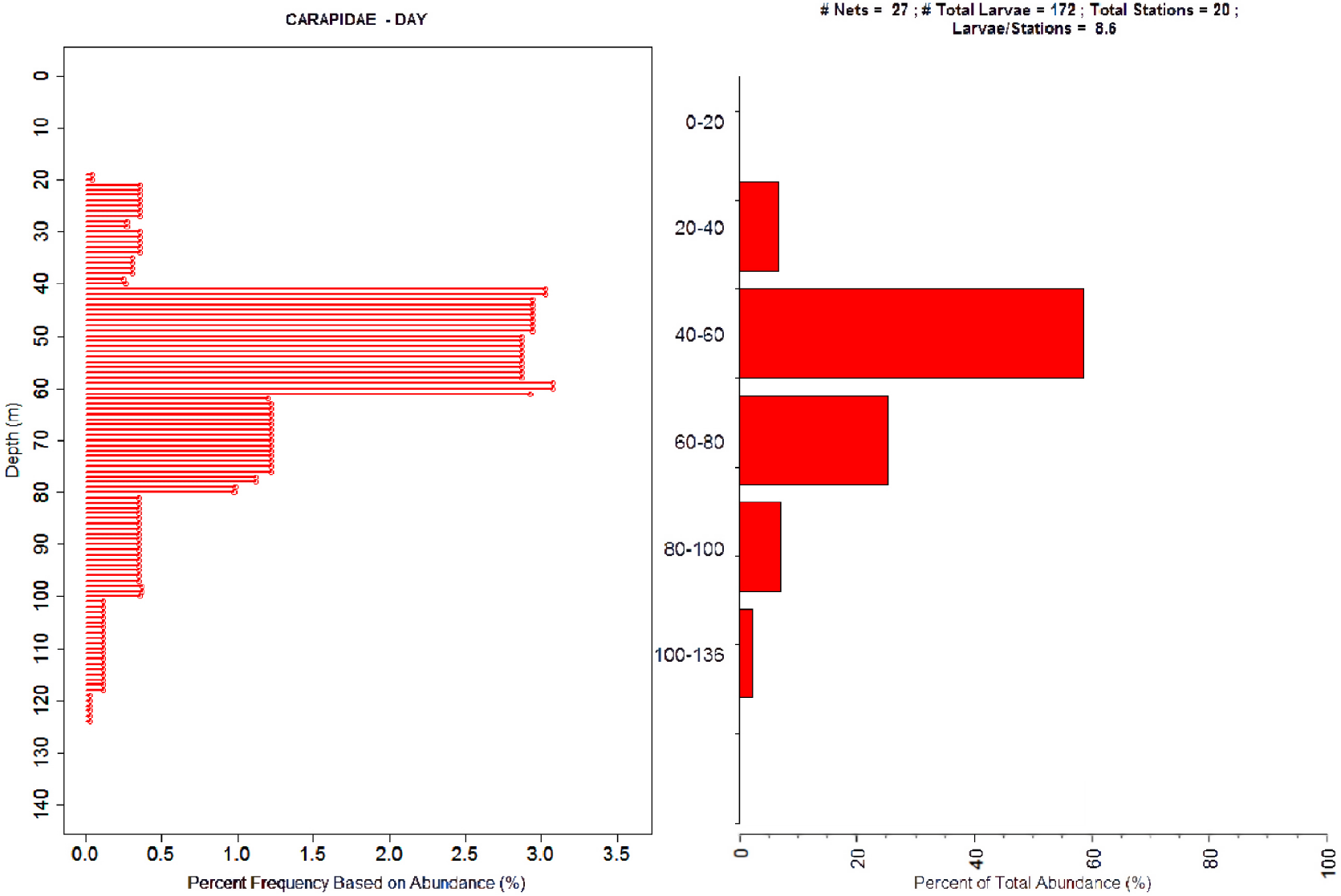
CARANGIDAE, NIGHT


CARANX - DAY
Nets = 14 ; # Total Larvae = 34 ; Total Stations = 9 ;
Larvae/Stations = 3.78
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
8
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

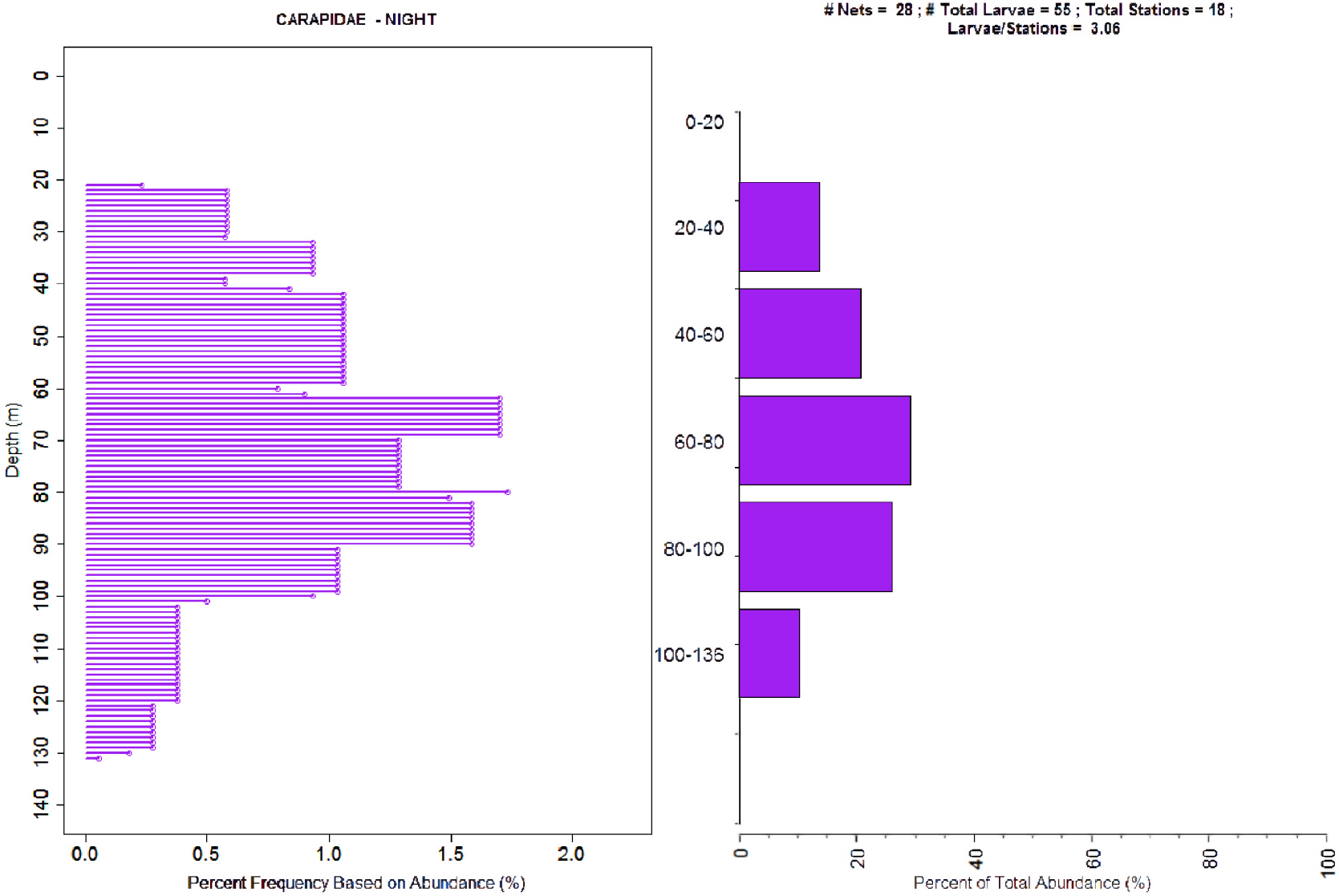
CARANX, DAY



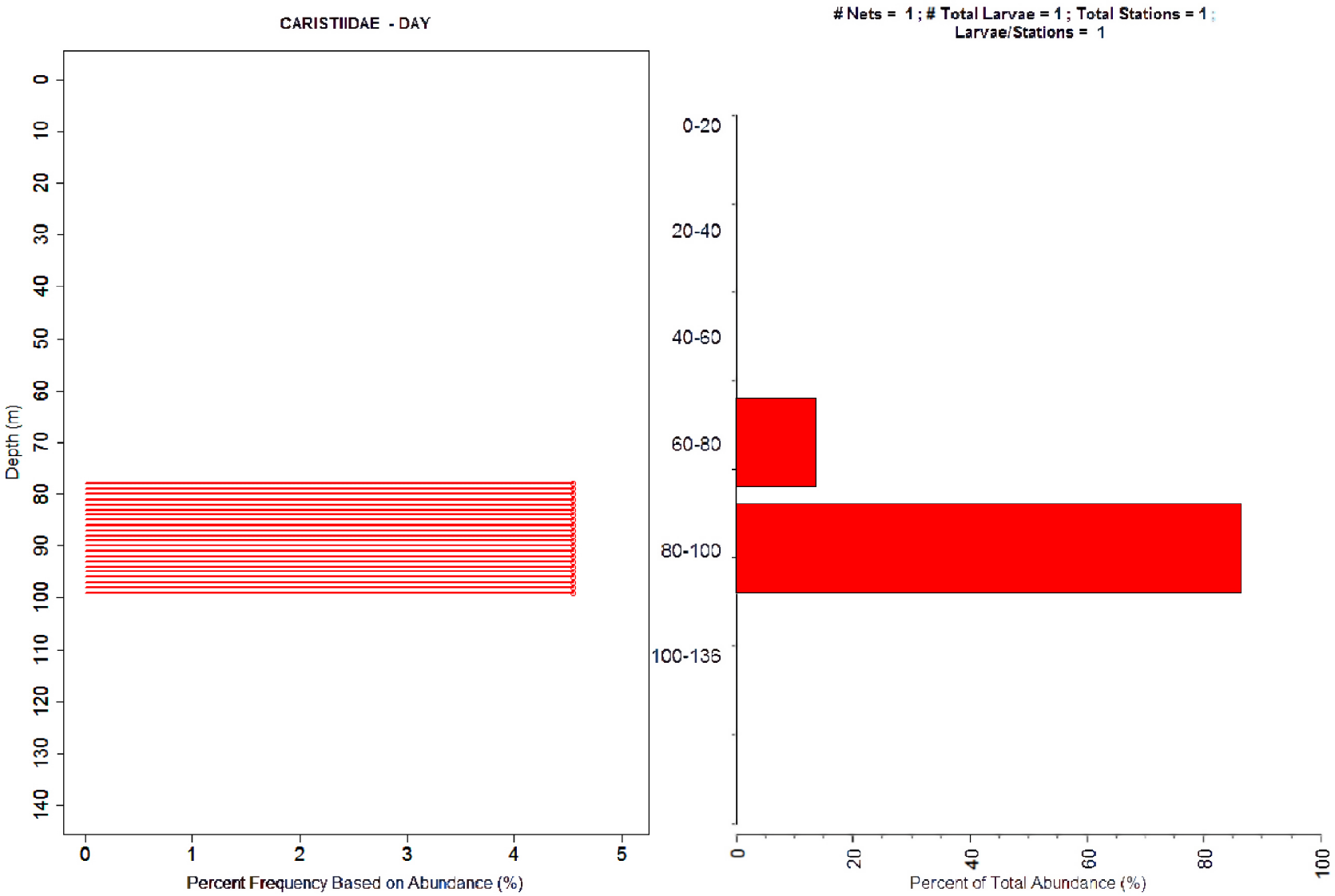
CARANX, NIGHT



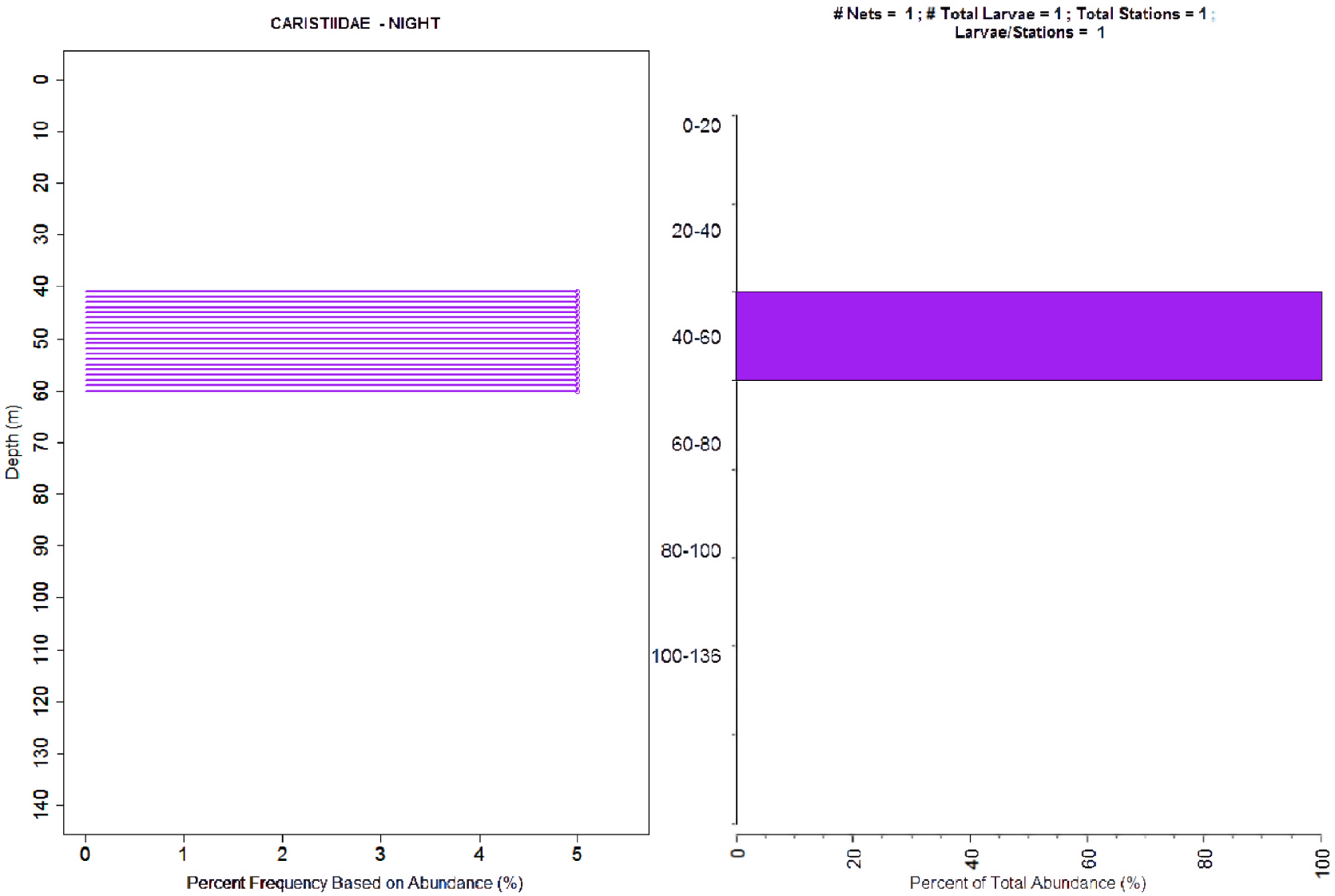
CARAPIDAE, DAY



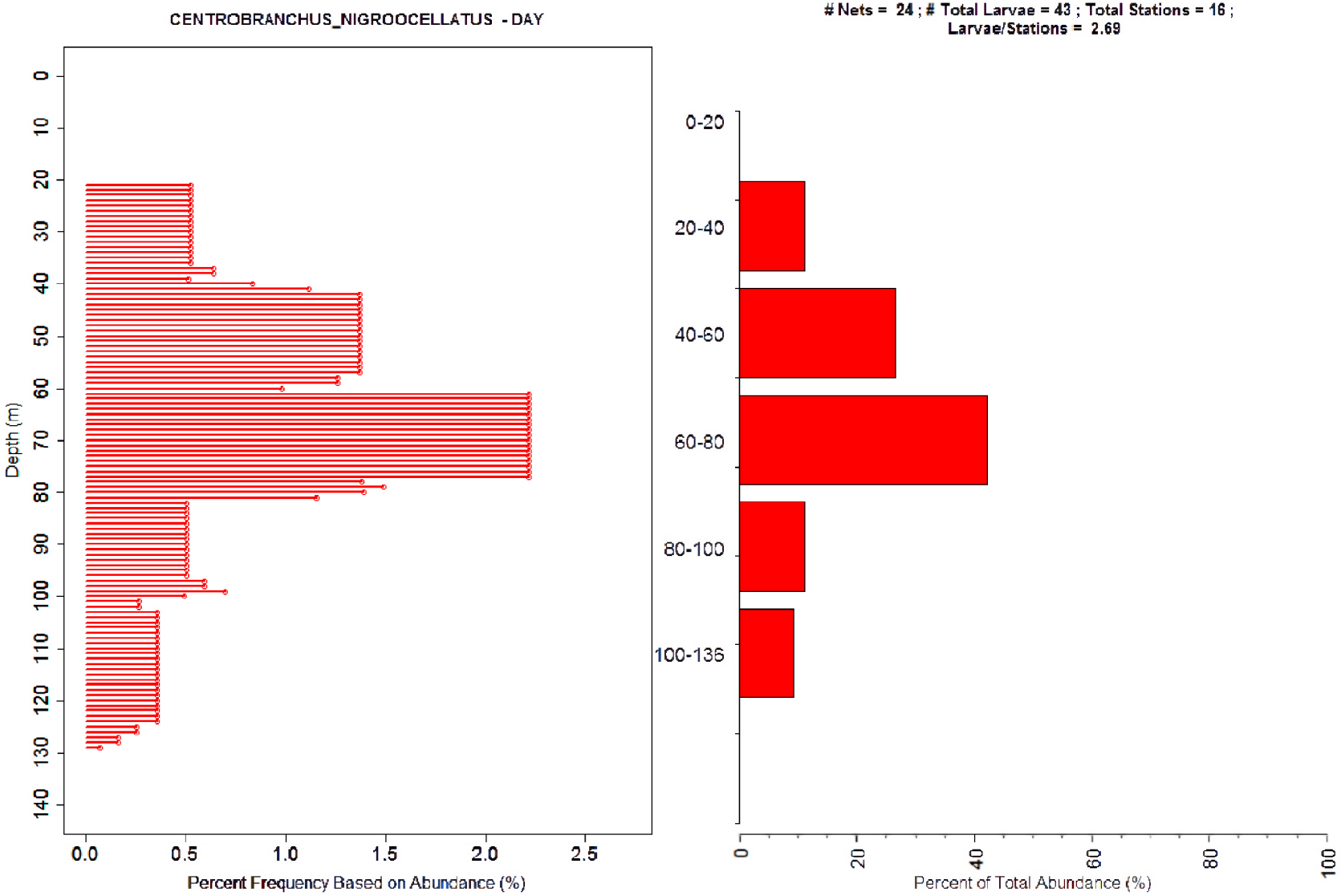
CARAPIDAE, NIGHT



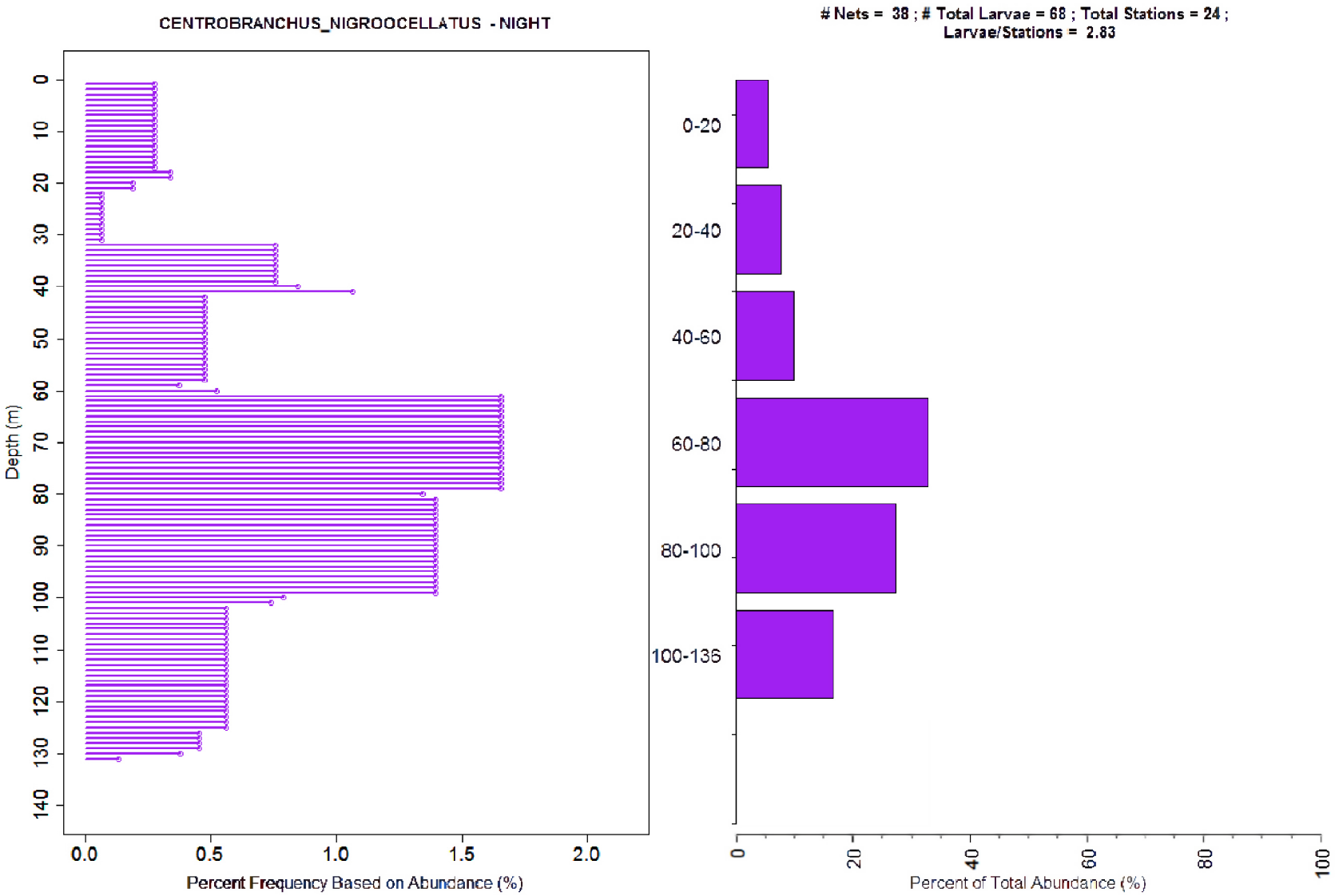
CARISTIIDAE, DAY



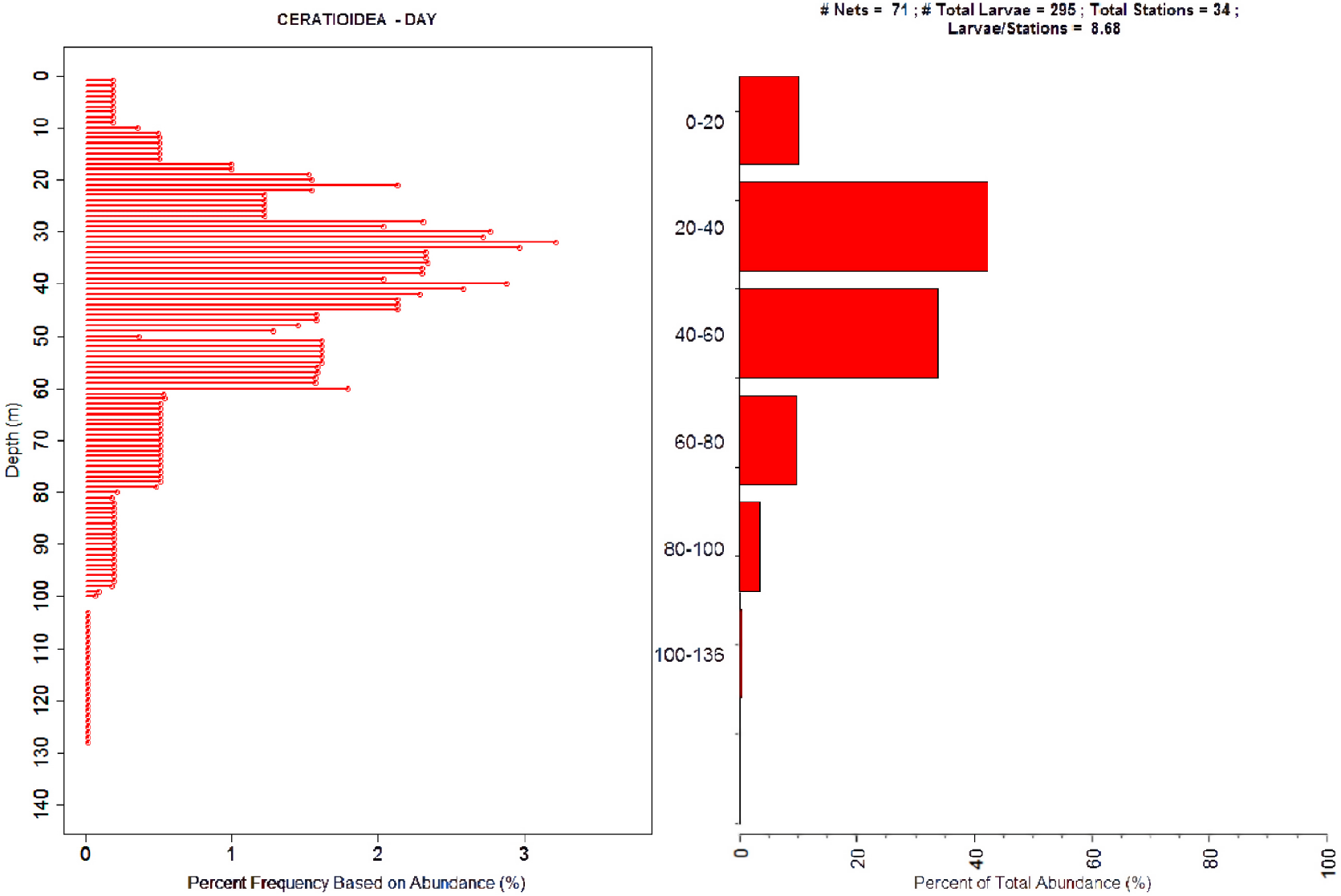
CARISTIIDAE, NIGHT



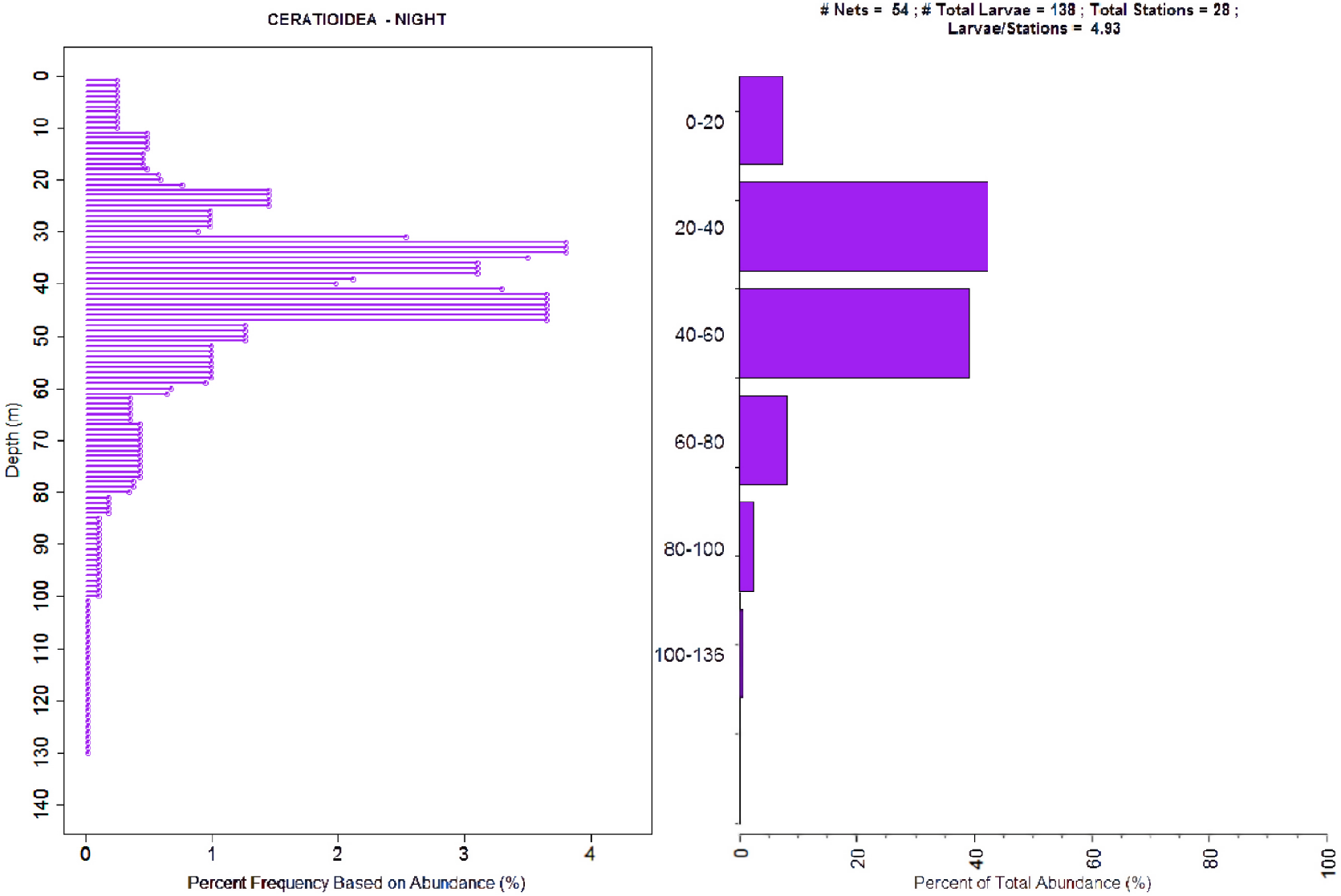
CENTROBRANCHUS_NIGROOCELLATUS, DAY



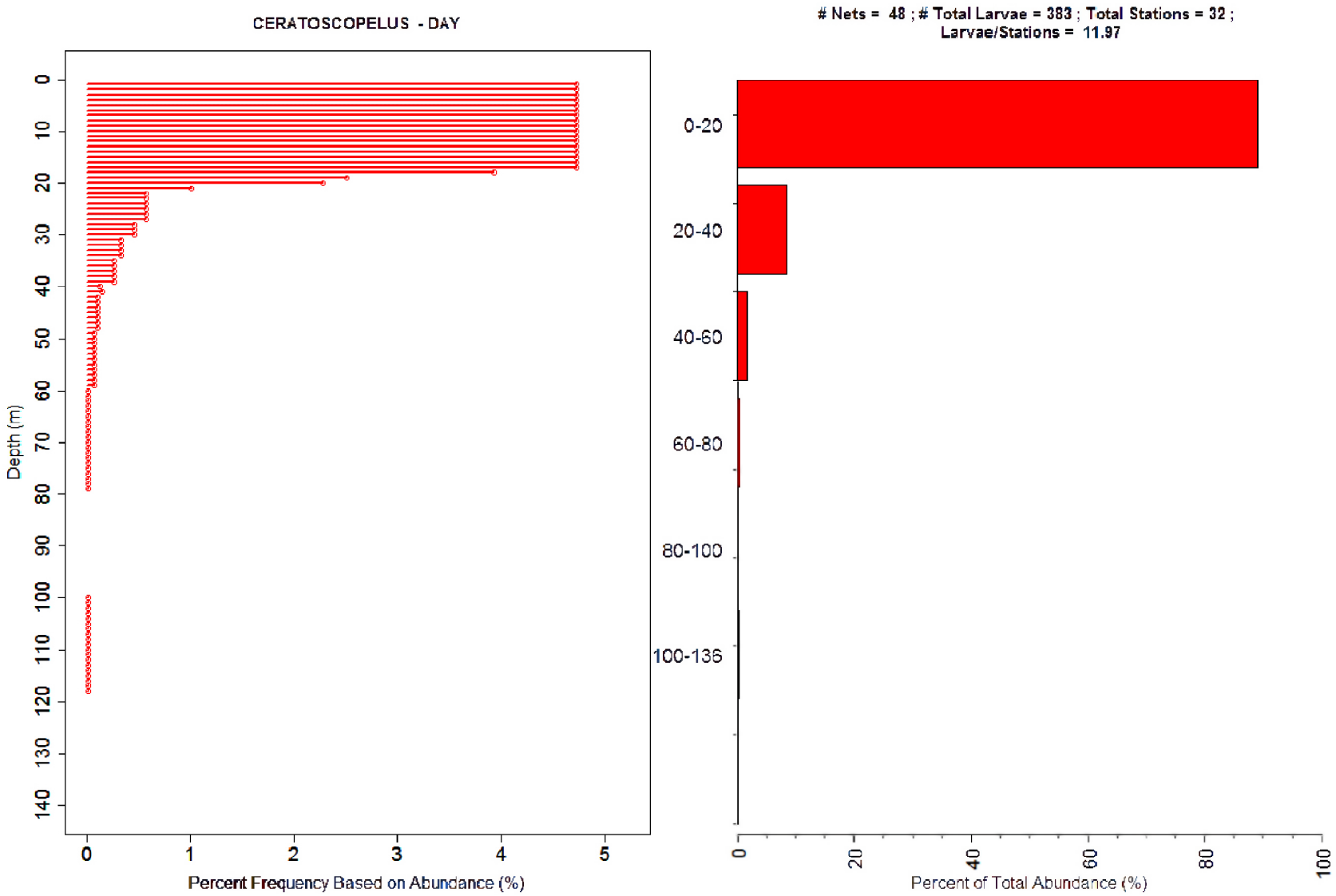
CENTROBRANCHUS_NIGROOCELLATUS, NIGHT



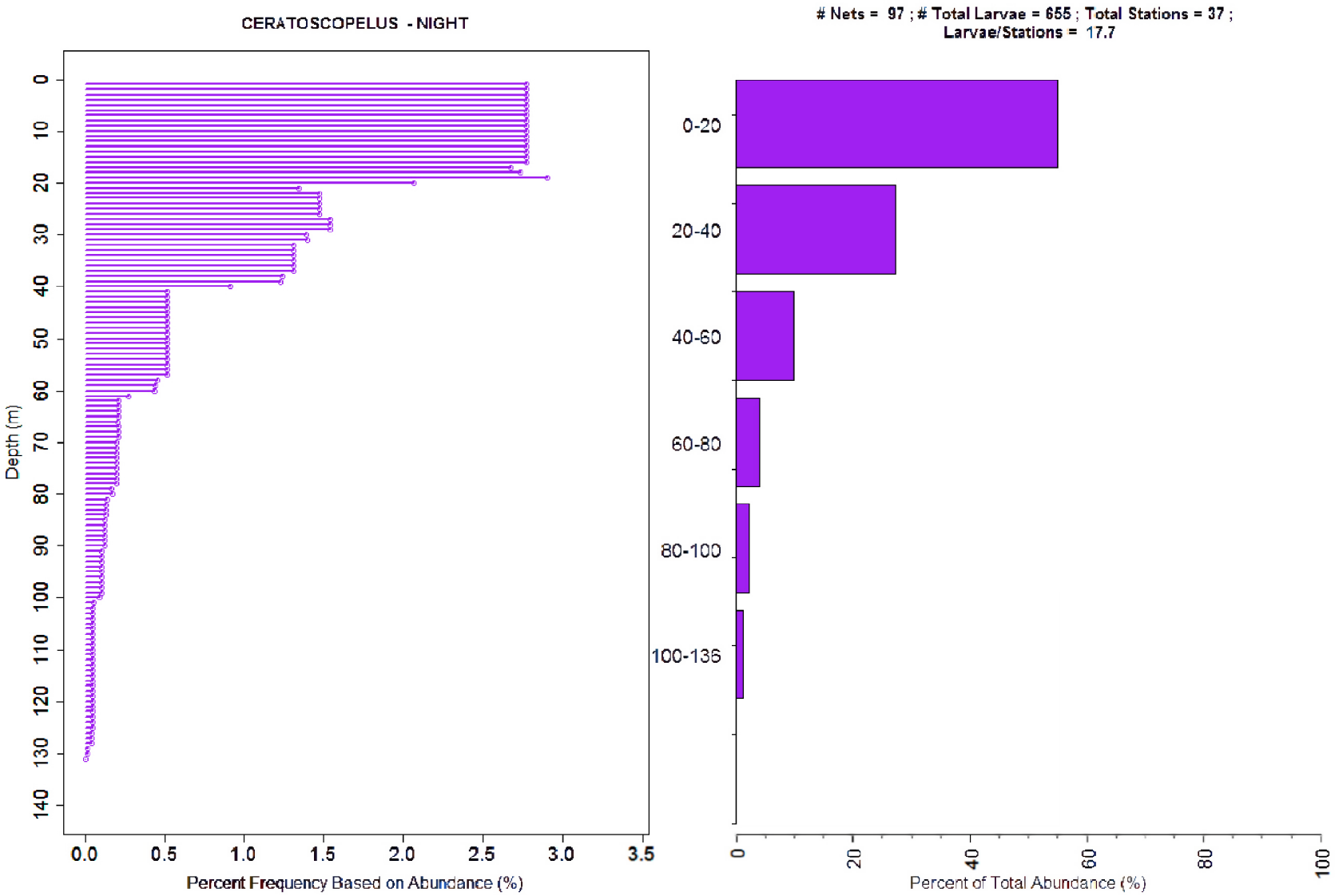
CERATIOIDEA, DAY



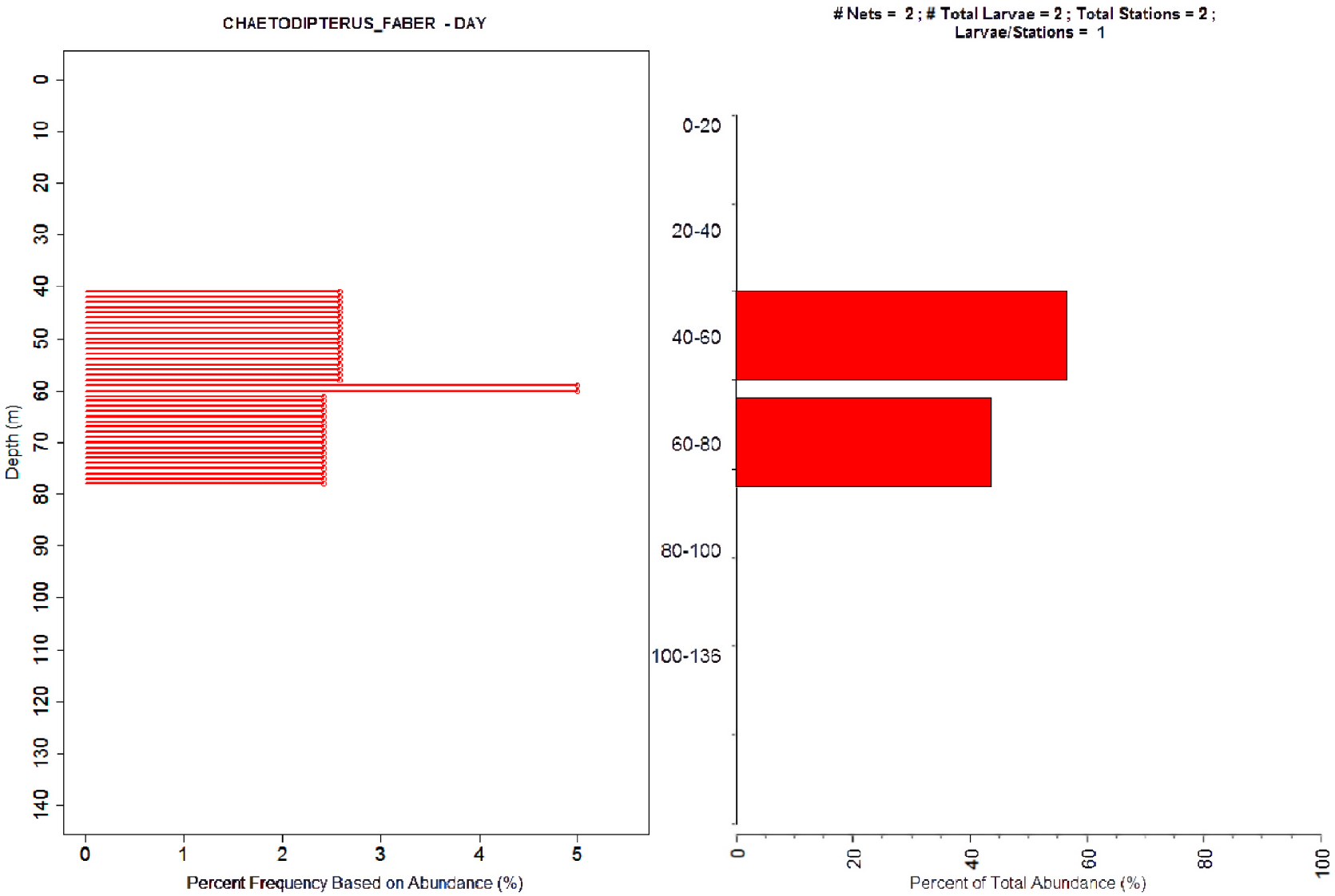
CERATIOIDEA, NIGHT



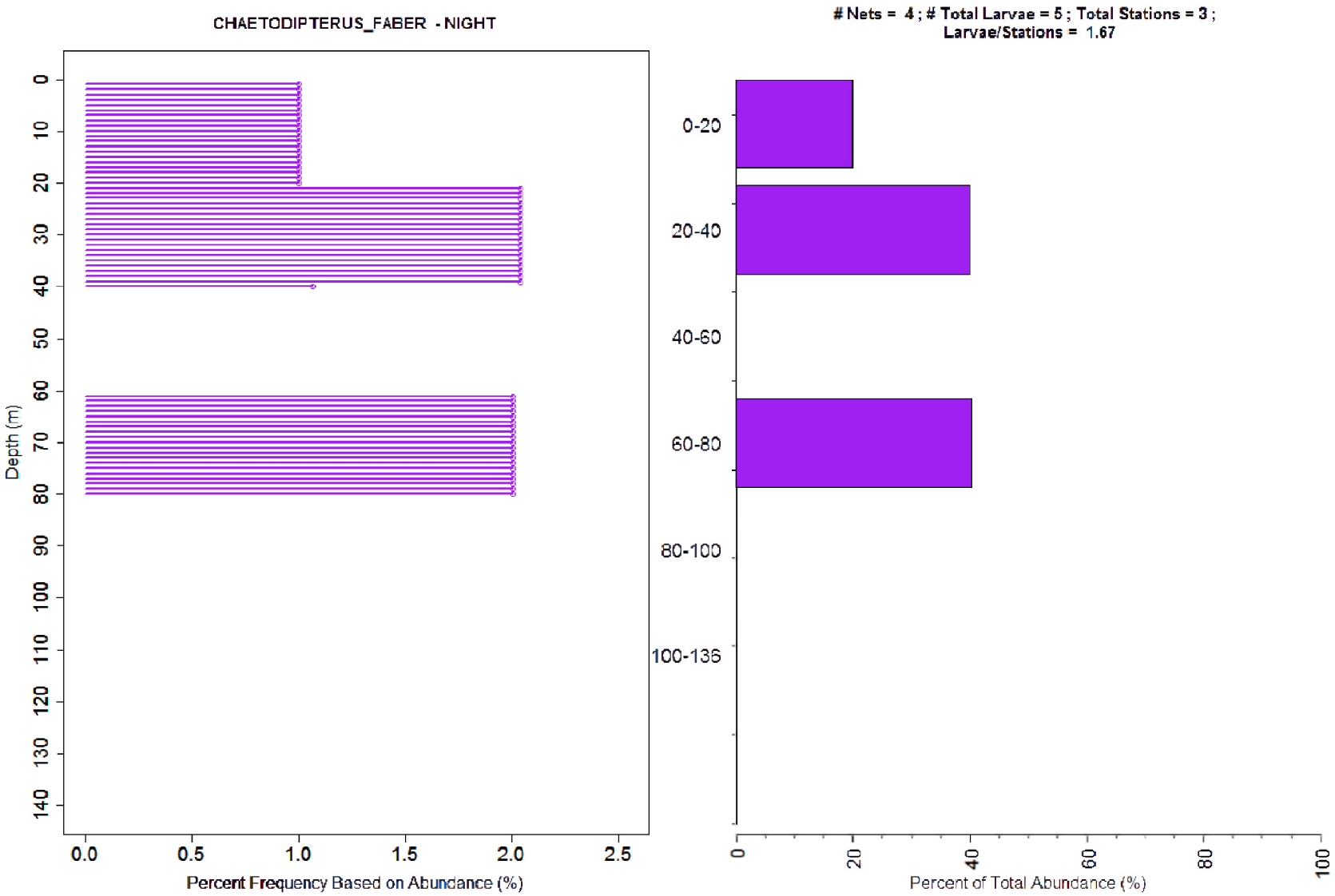
CERATOSCOPELUS, DAY



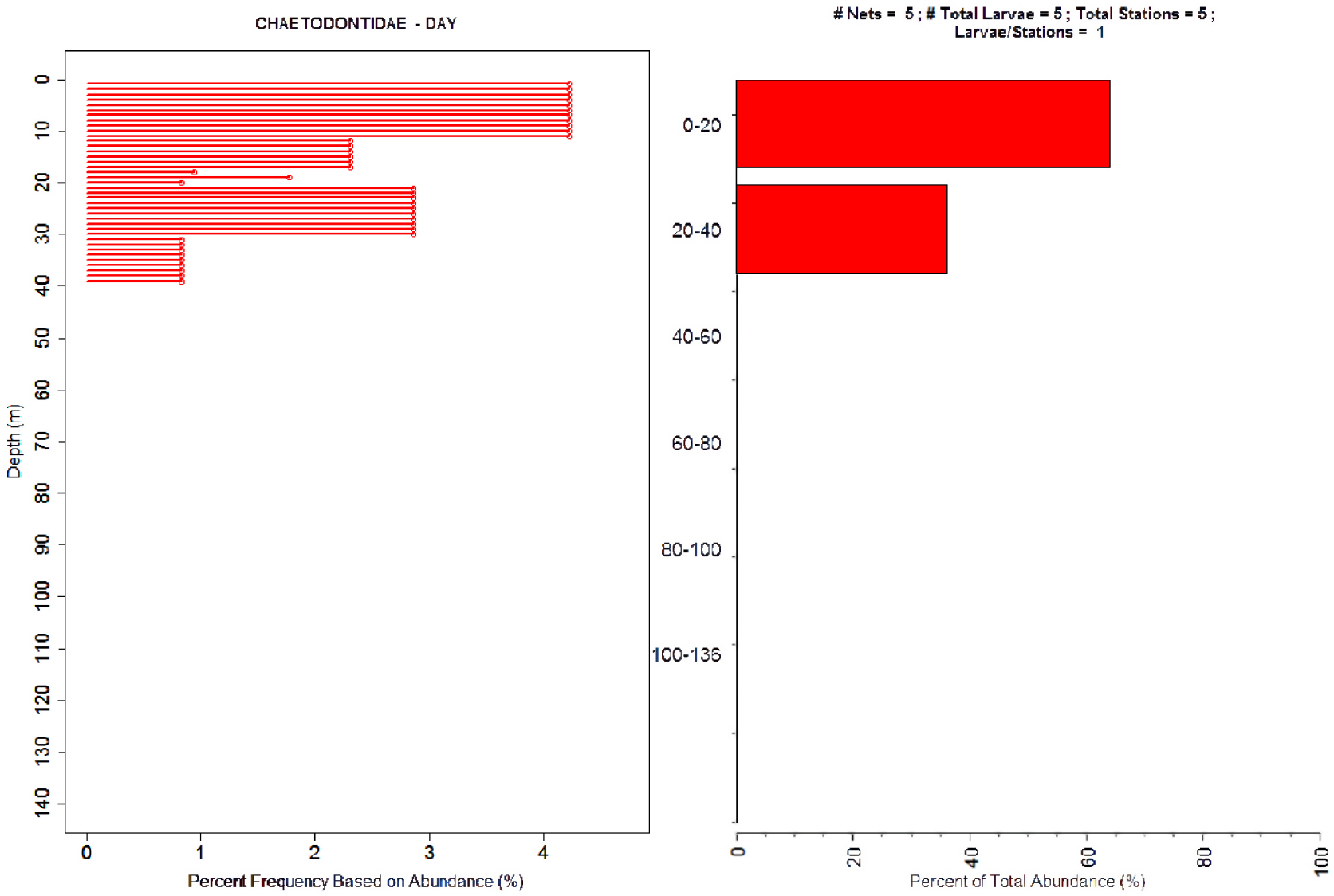
CERATOSCOPELUS, NIGHT



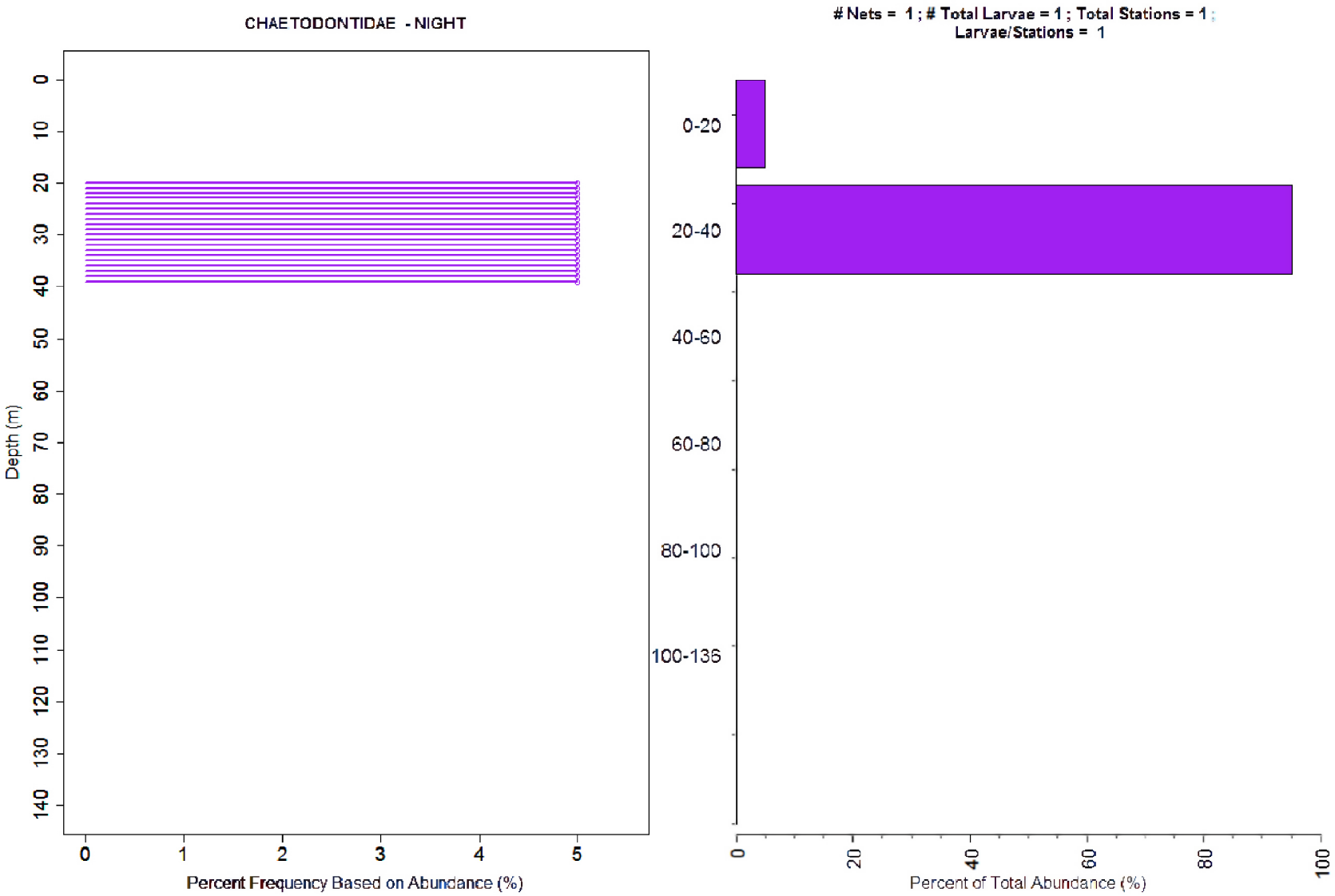
CHAETODIPTERUS_FABER, DAY



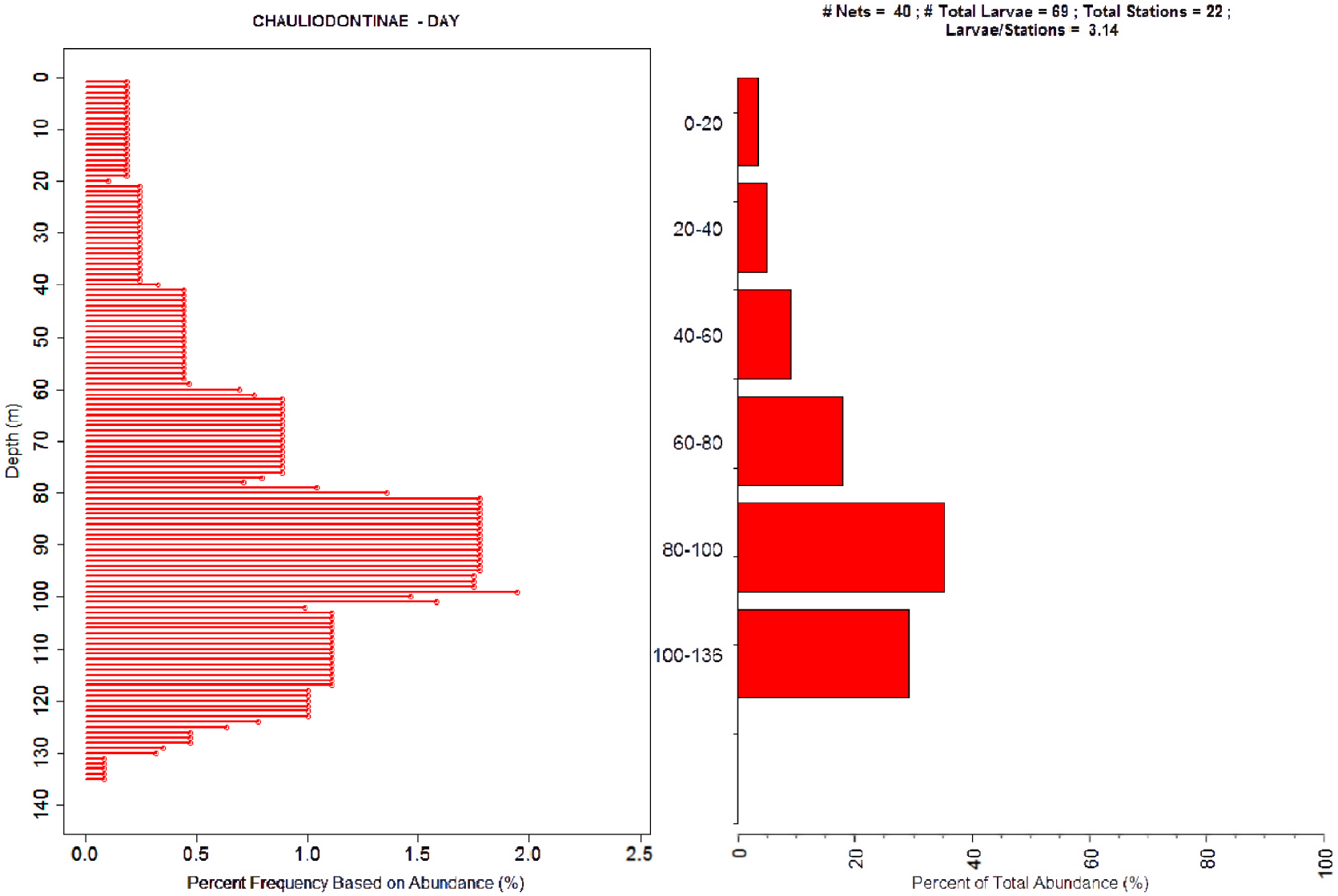
CHAETODIPTERUS_FABER, NIGHT



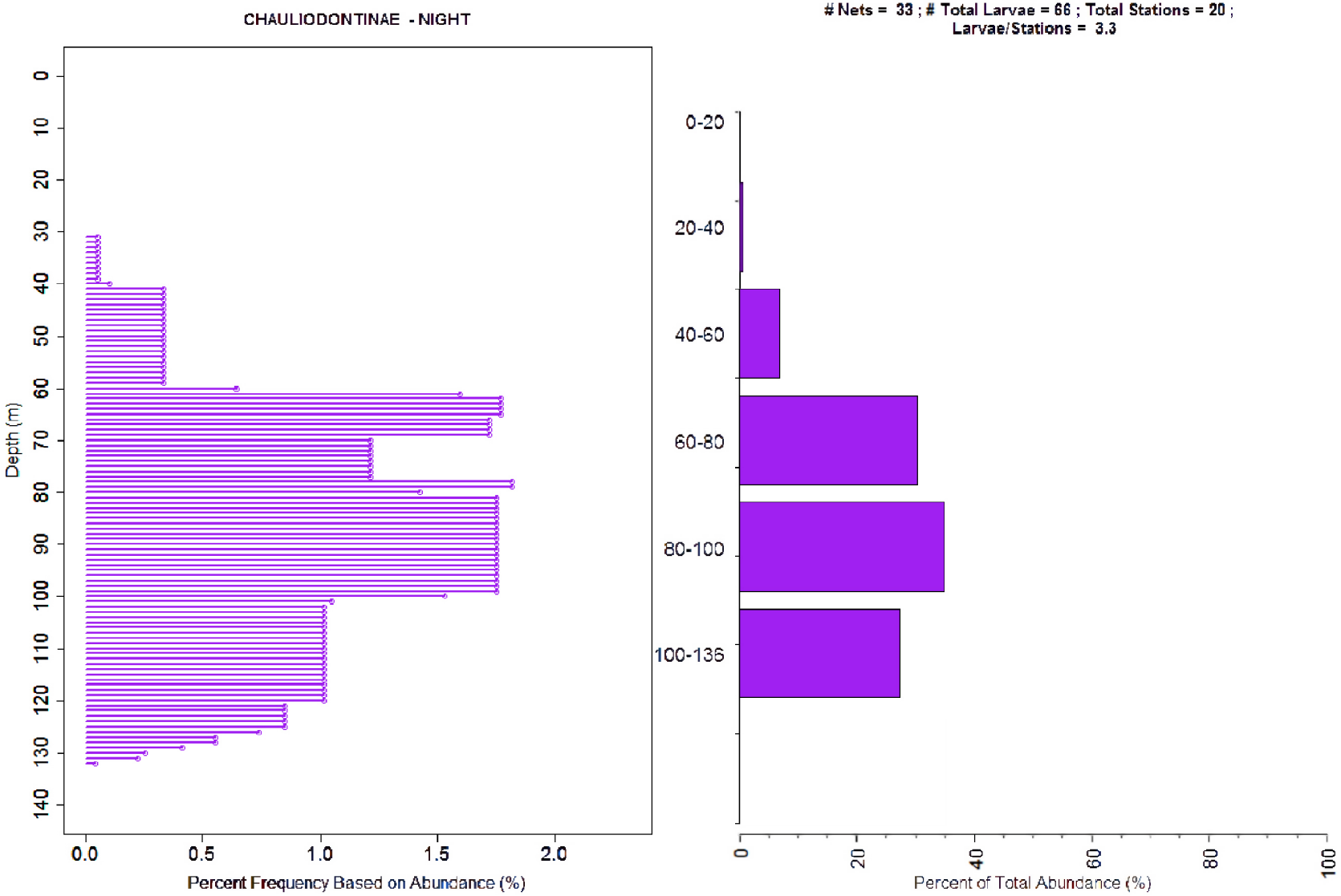
CHAETODONTIDAE, DAY



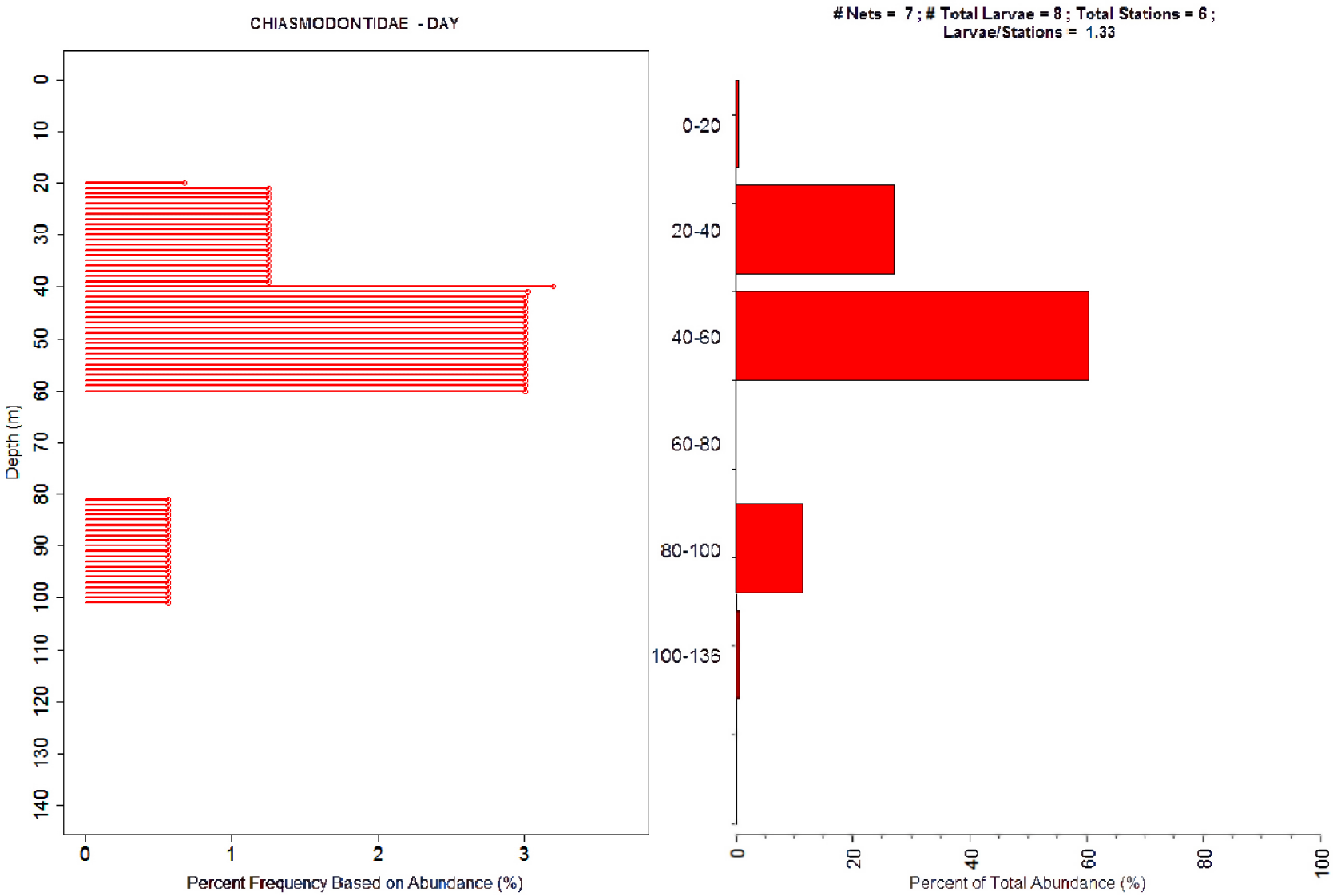
CHAETODONTIDAE, NIGHT



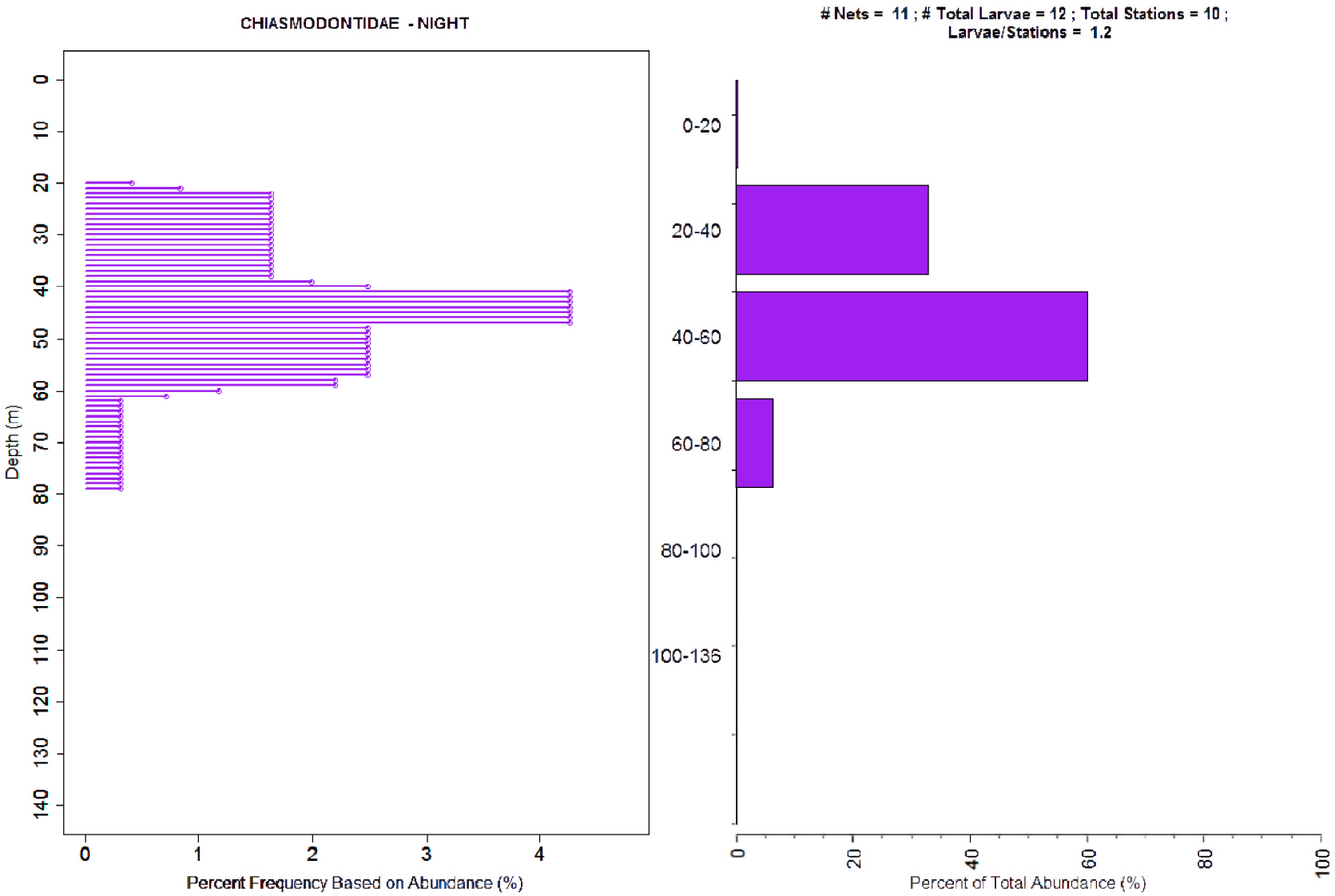
CHAULIODONTINAE, DAY



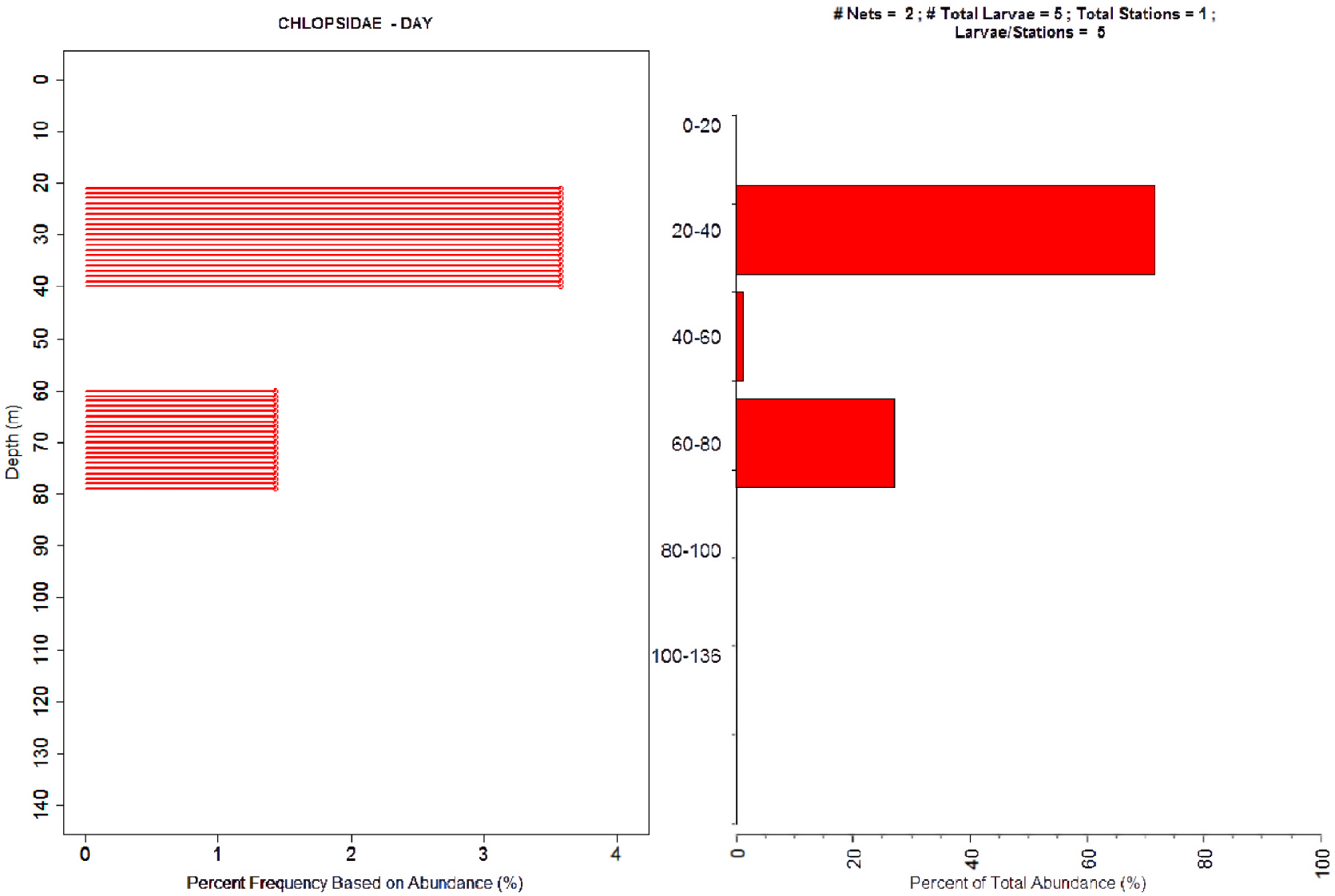
CHAULIODONTINAE, NIGHT



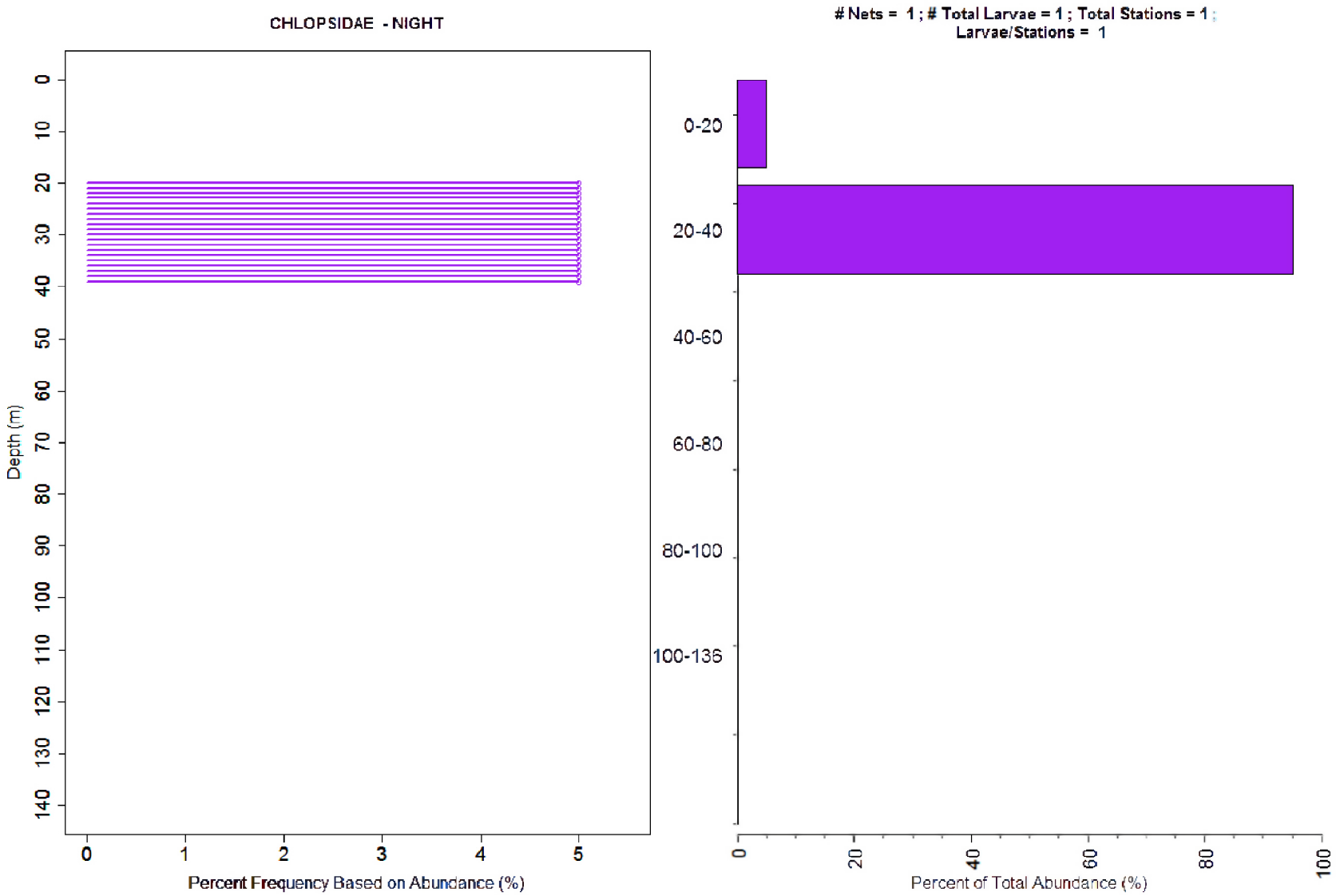
CHIASMODONTIDAE, DAY



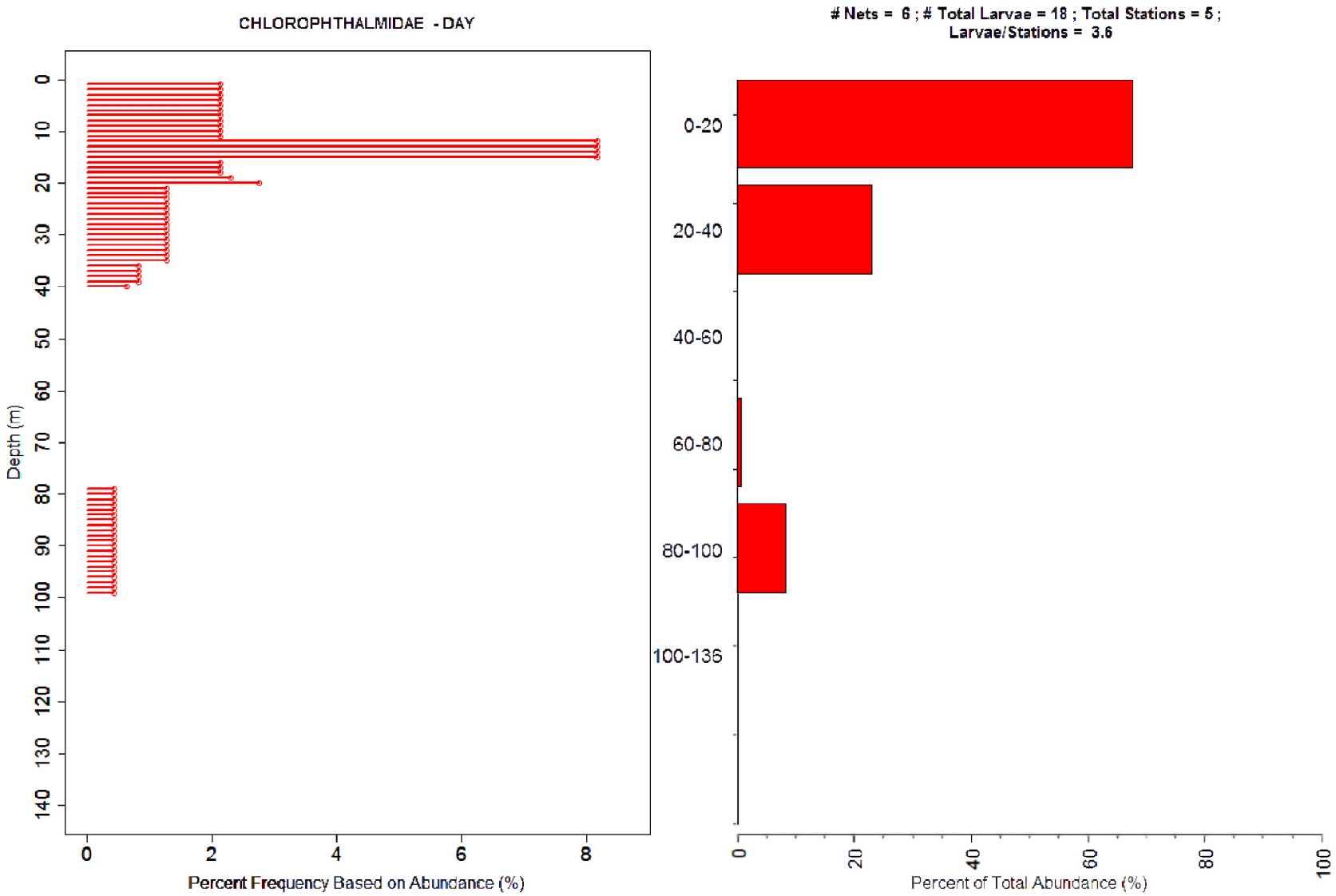
CHIASMODONTIDAE, NIGHT



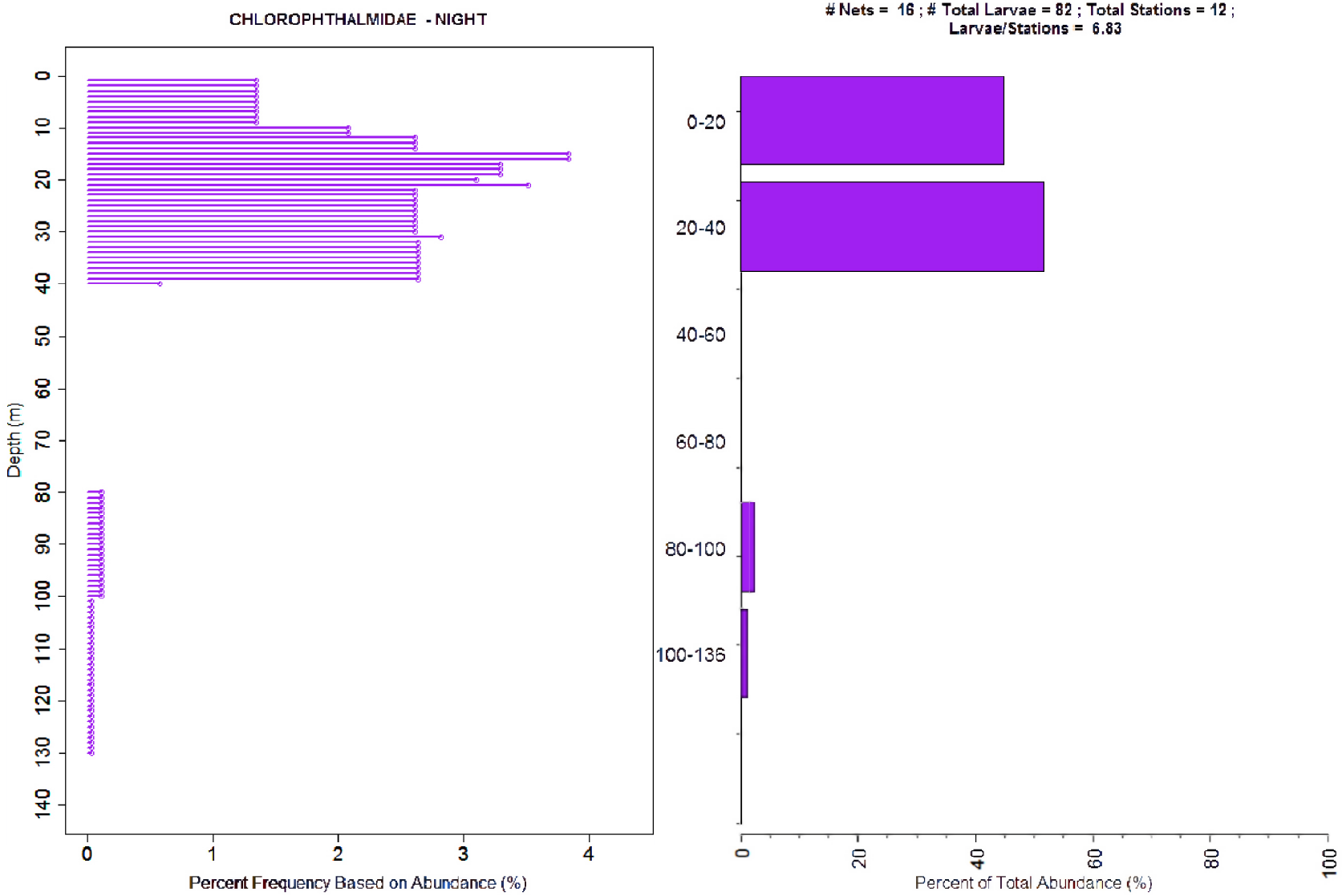
CHLOPSIDAE, DAY



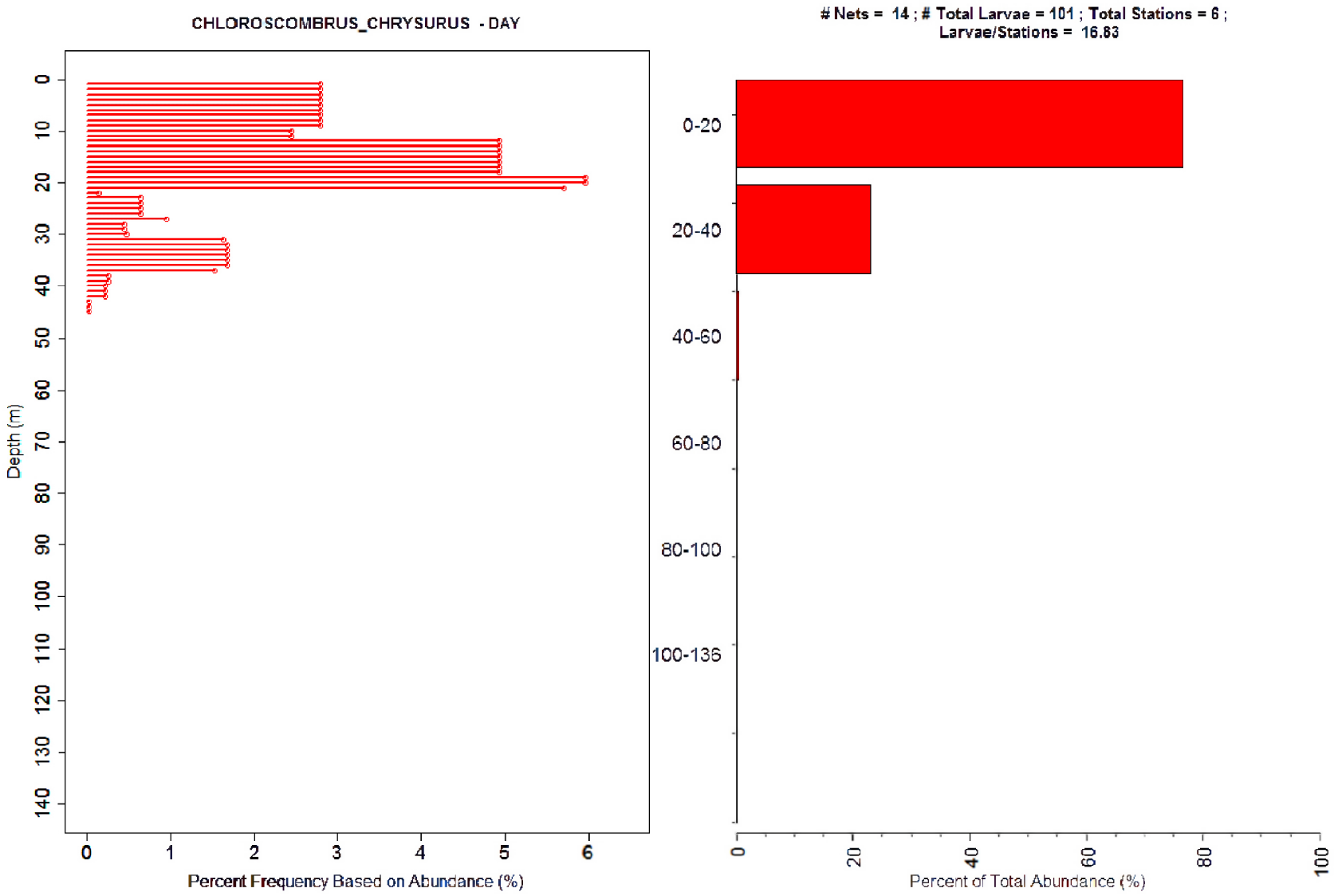
CHLOPSIDAE, NIGHT



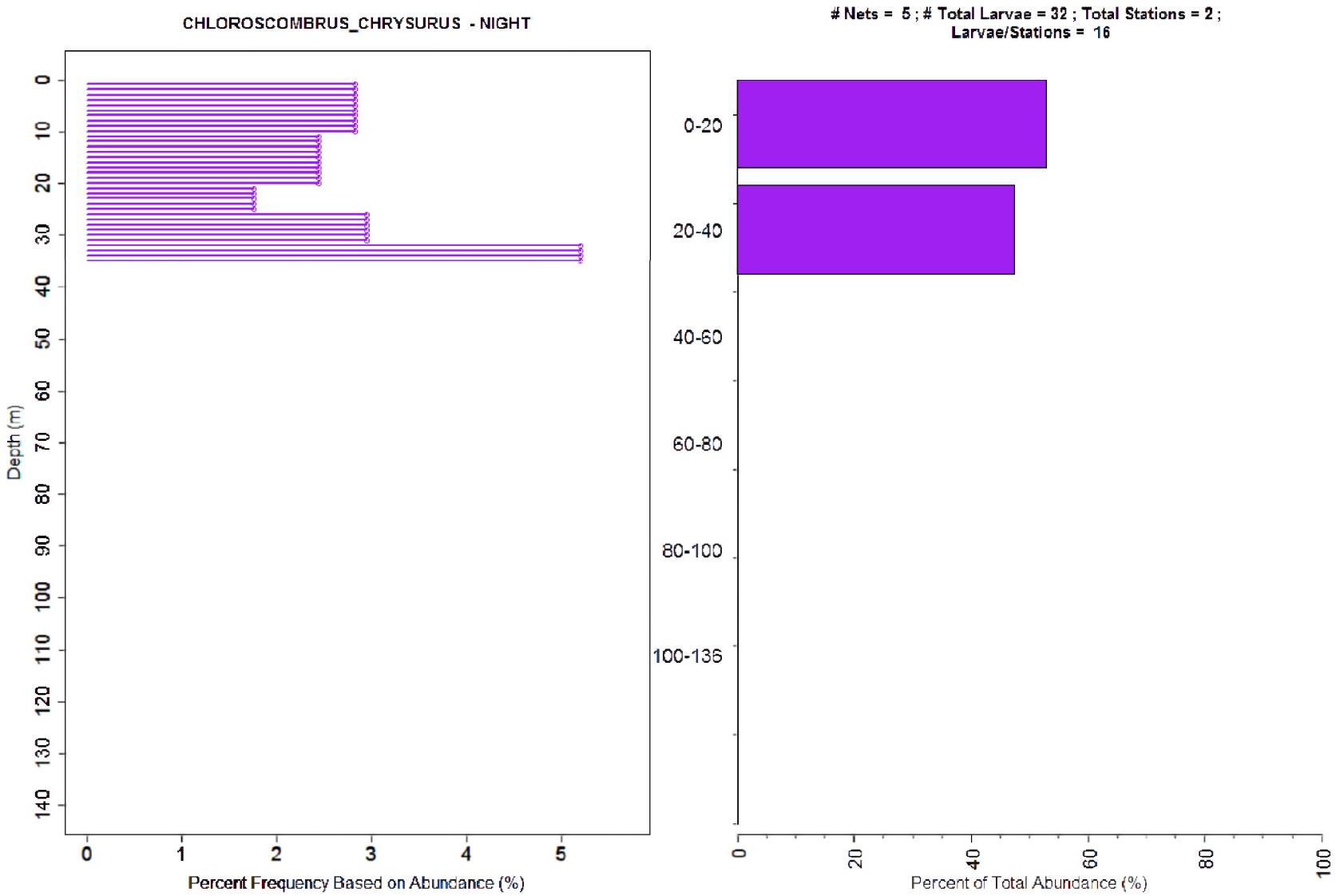
CHLOROPHTHALMIDAE, DAY



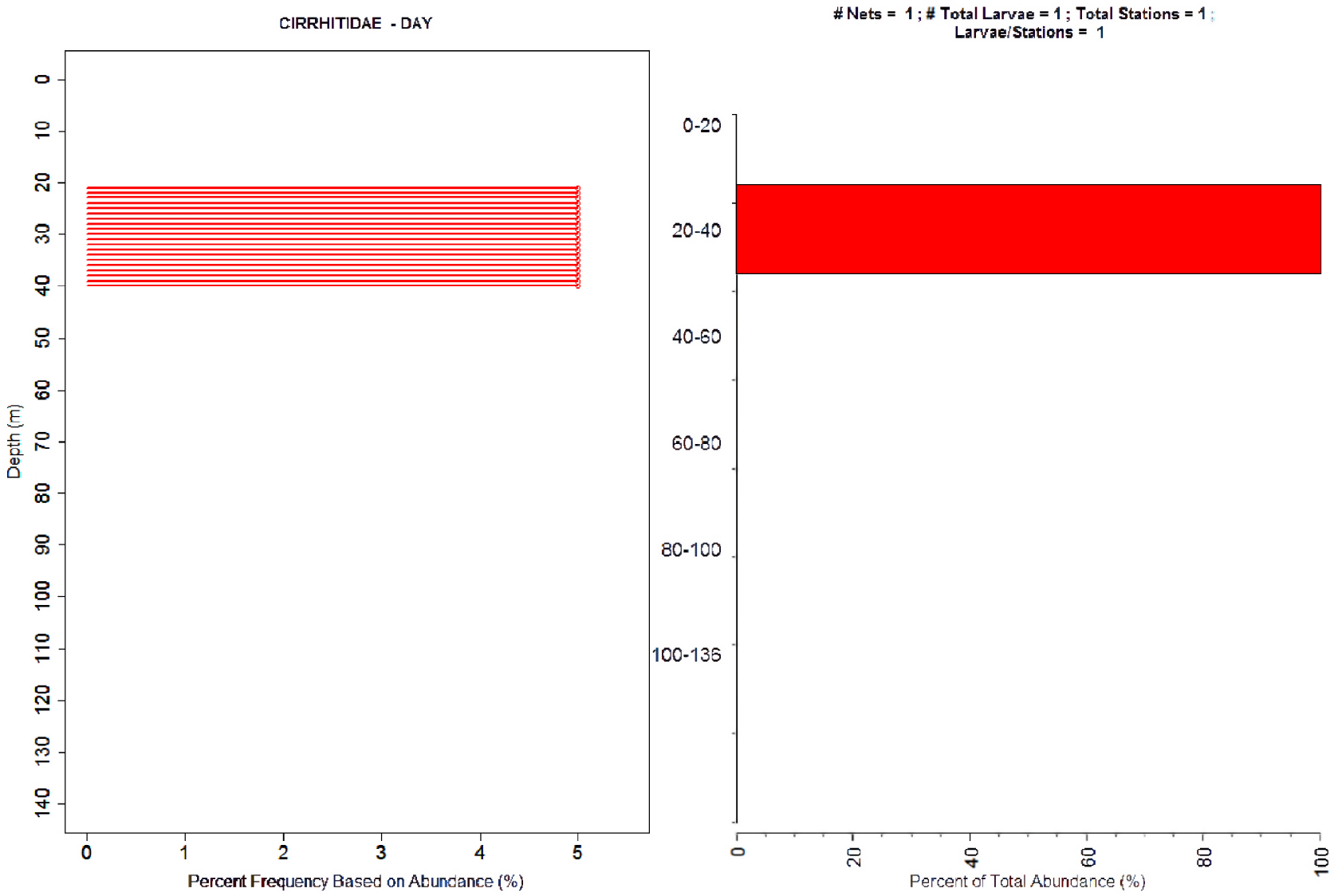
CHLOROPHTHALMIDAE, NIGHT



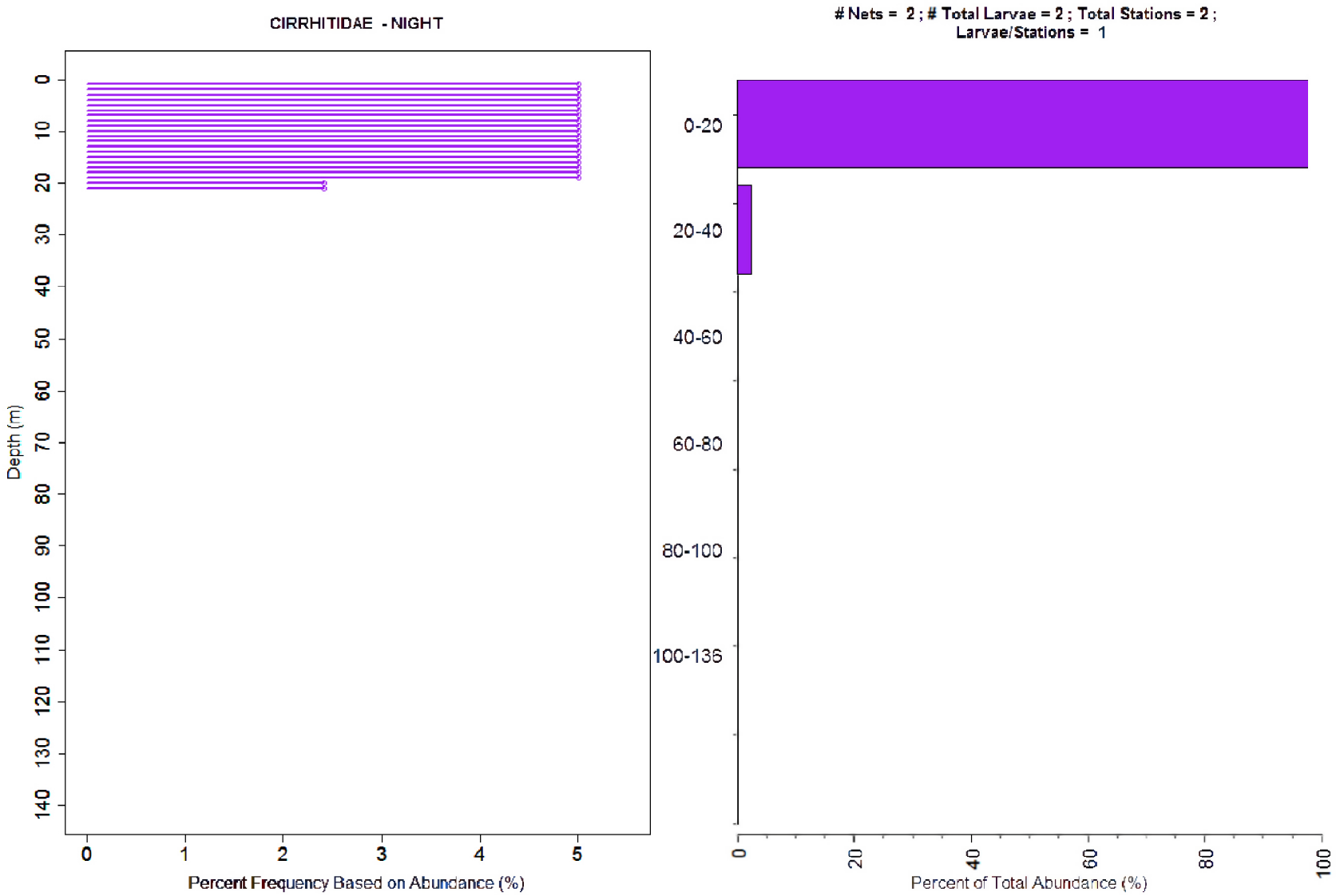
CHLOROSCOMBRUS_CHRYSURUS, DAY



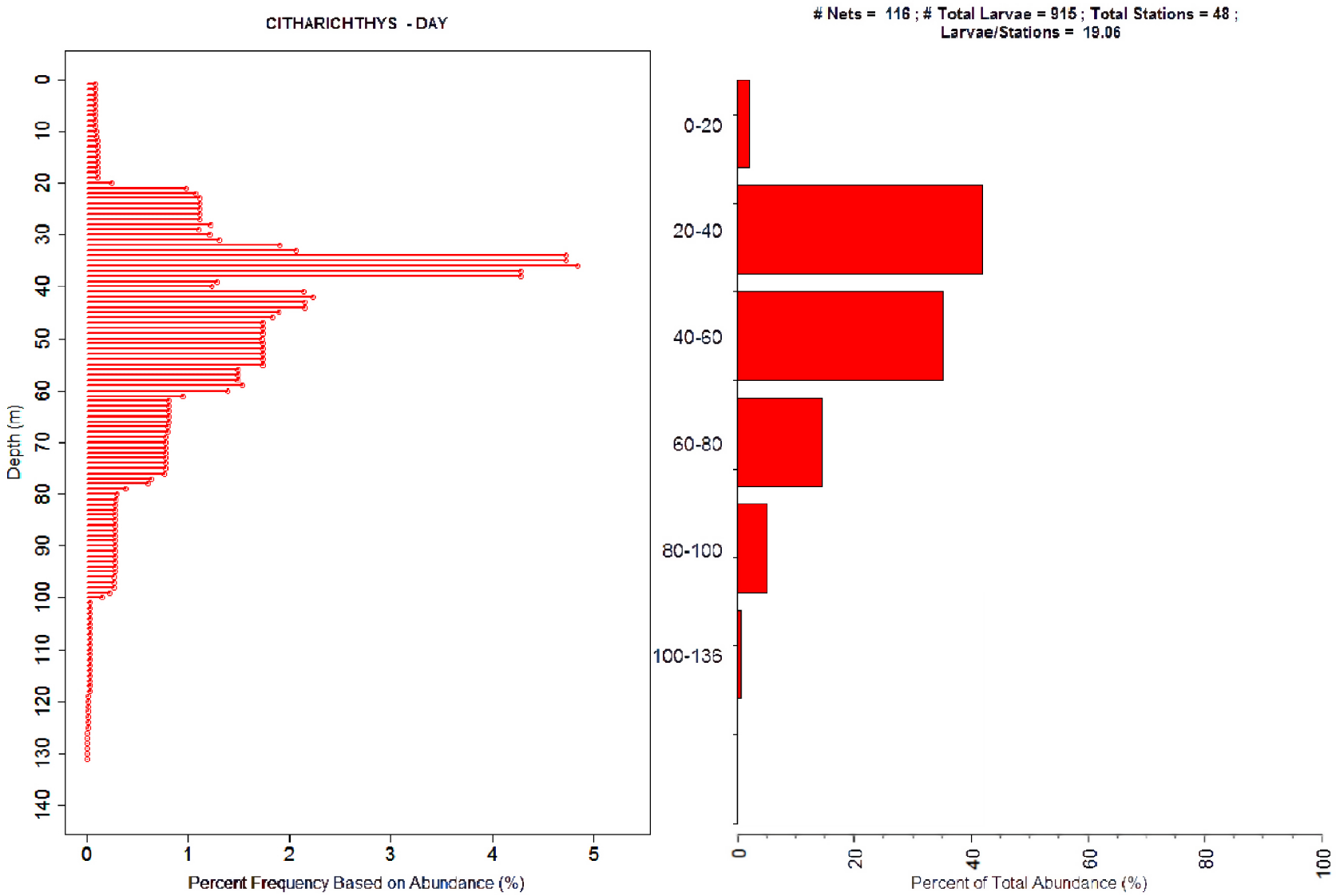
CHLOROSCOMBRUS_CHRYSURUS, NIGHT



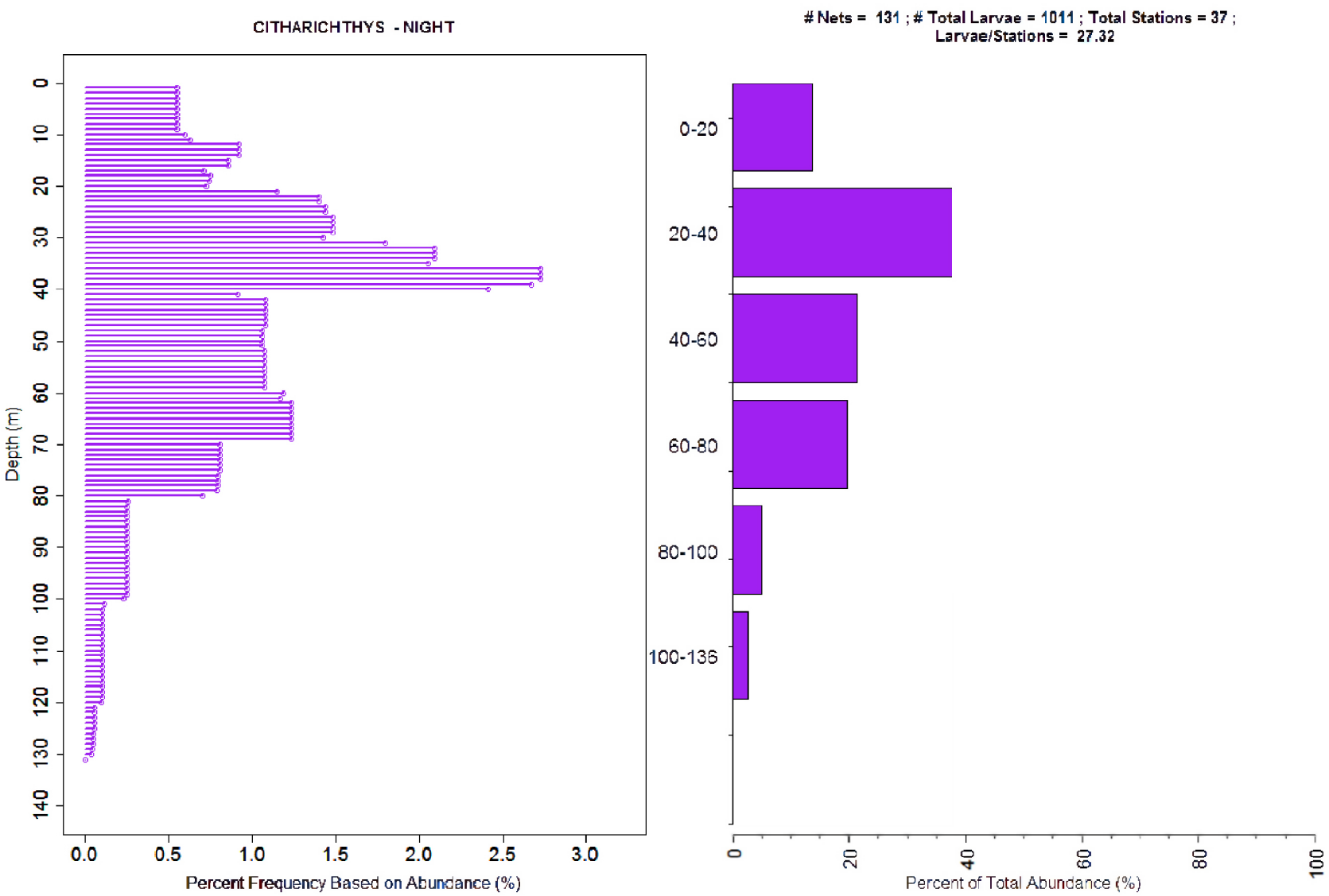
CIRRHITIDAE, DAY



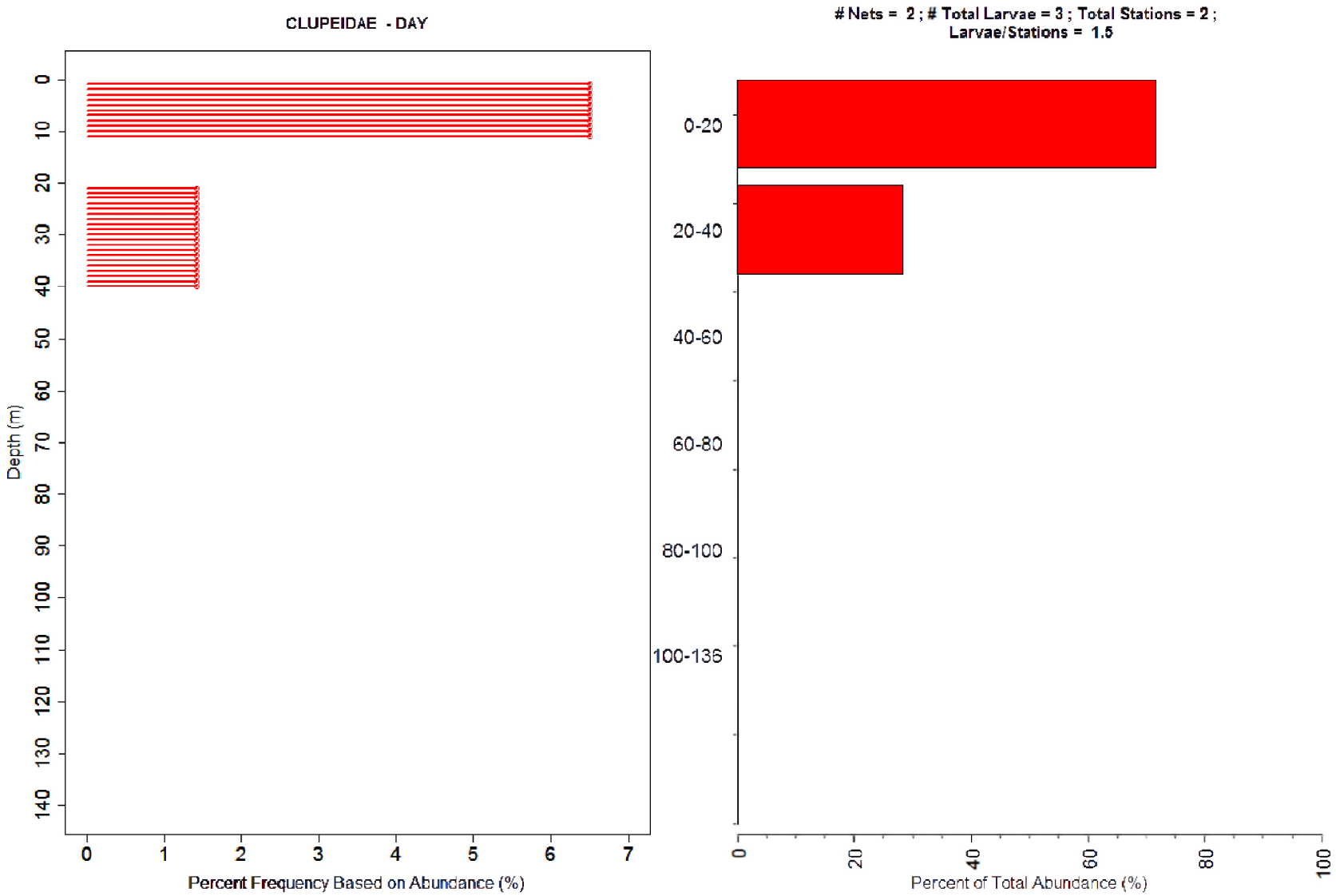
CIRRHITIDAE, NIGHT



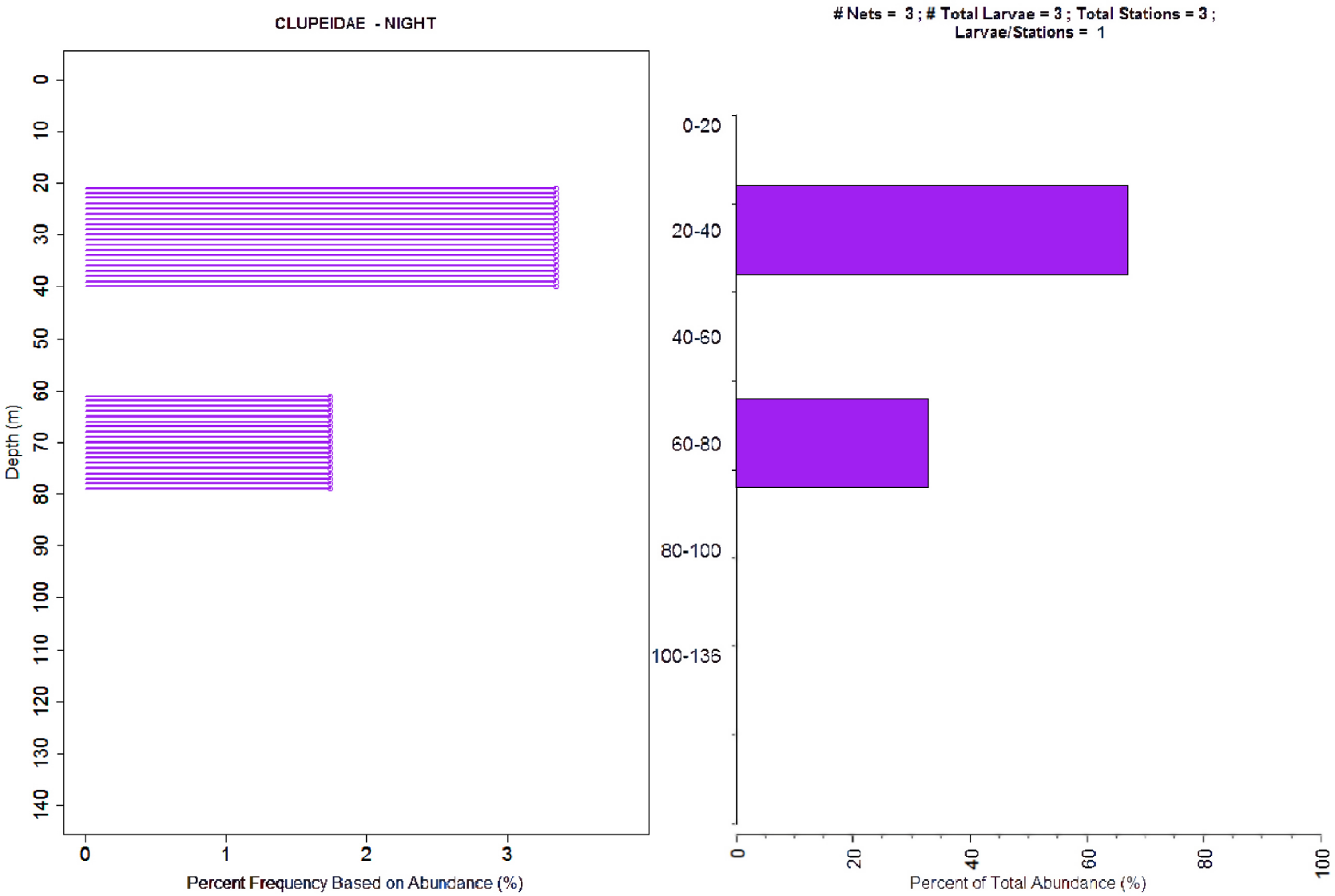
CITHARICHTHYS, DAY



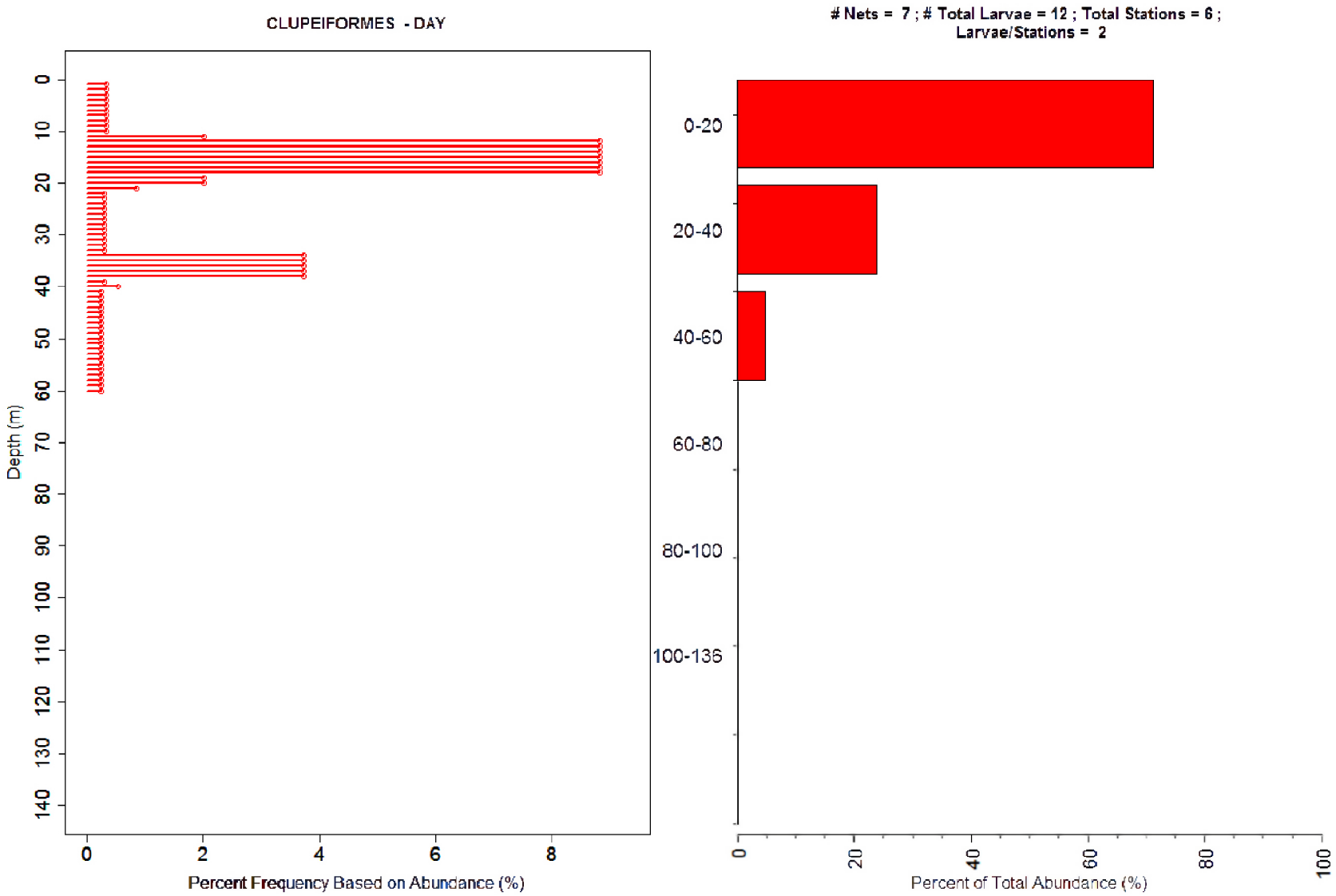
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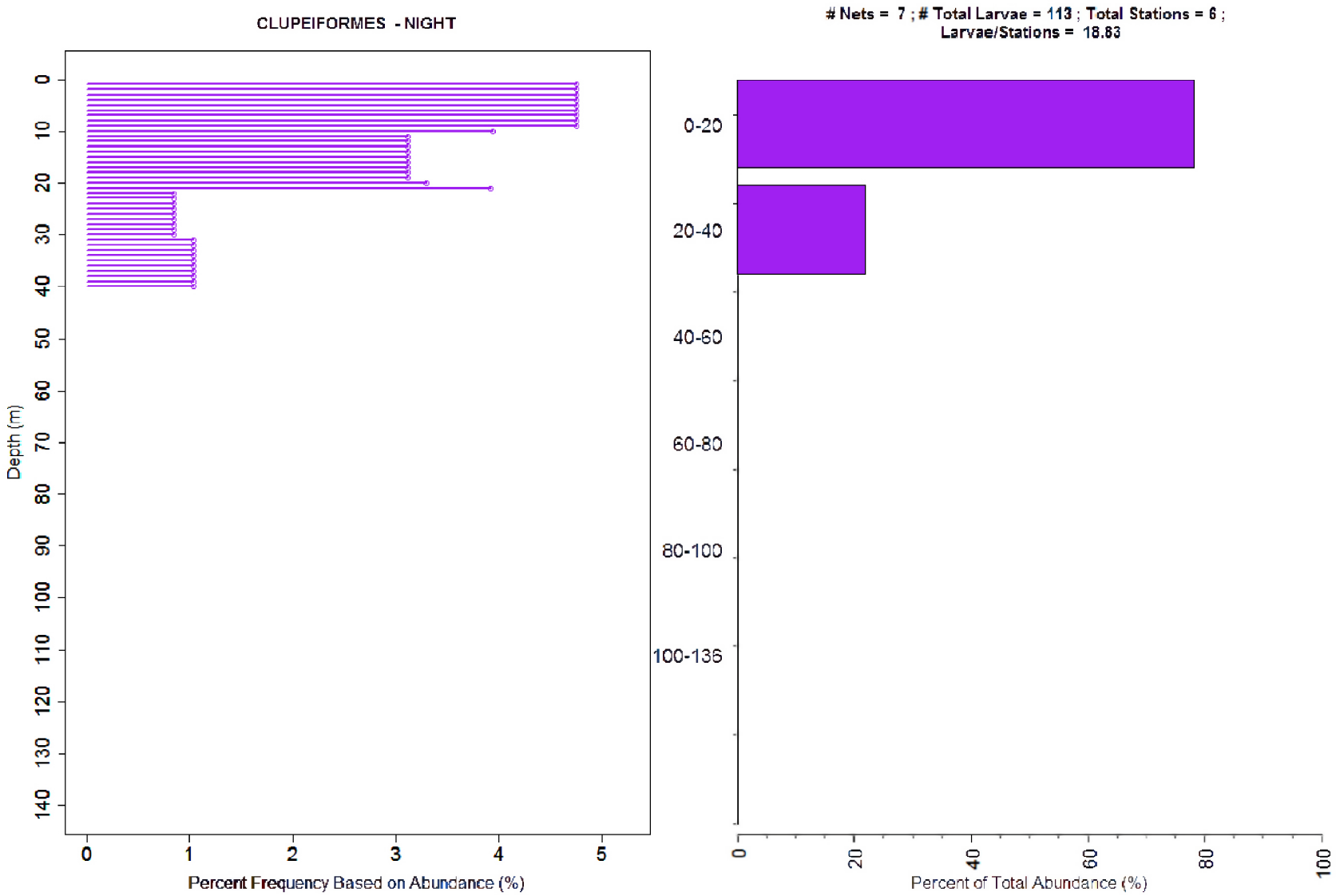
CLUPEIDAE, DAY



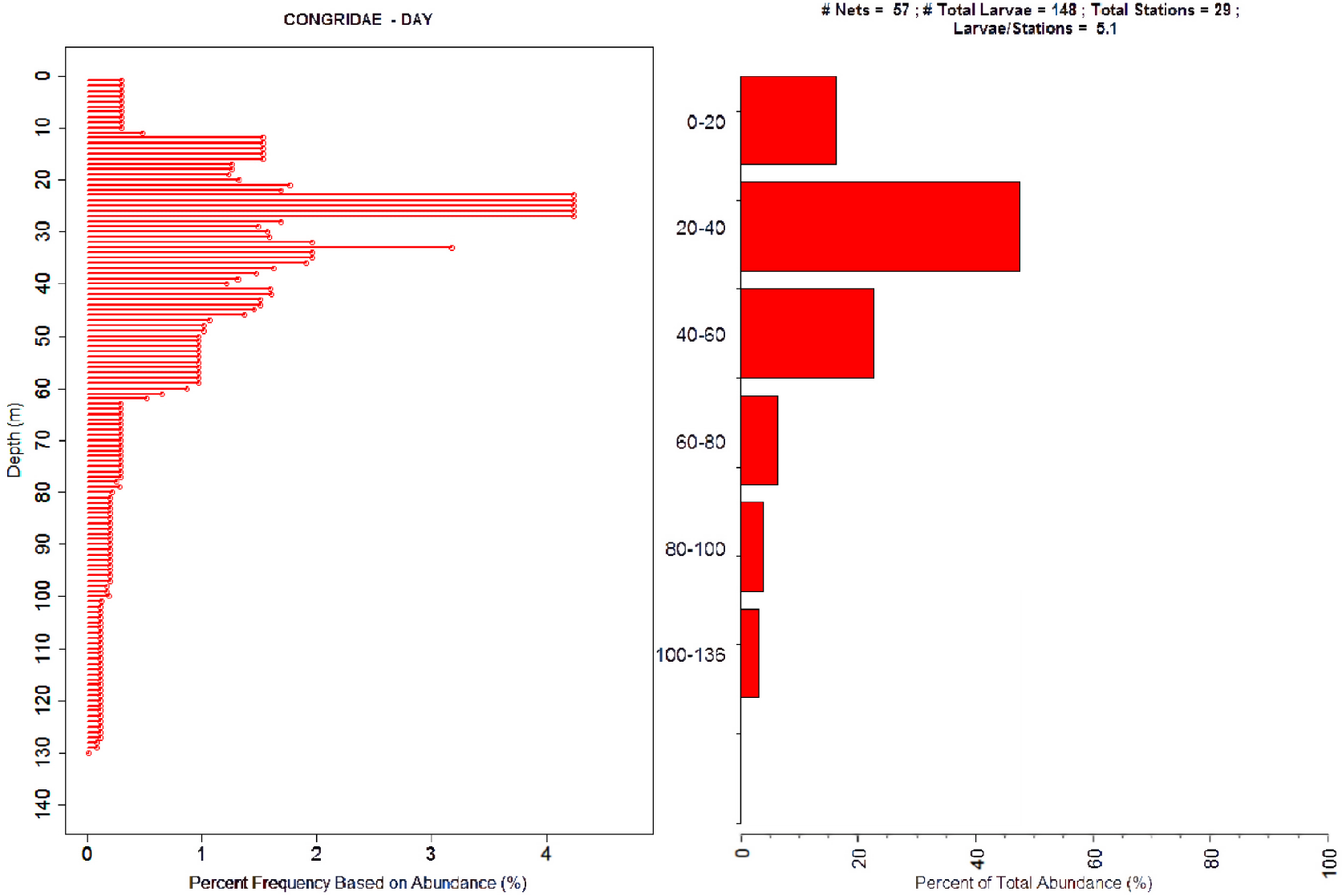
CLUPEIDAE, NIGHT



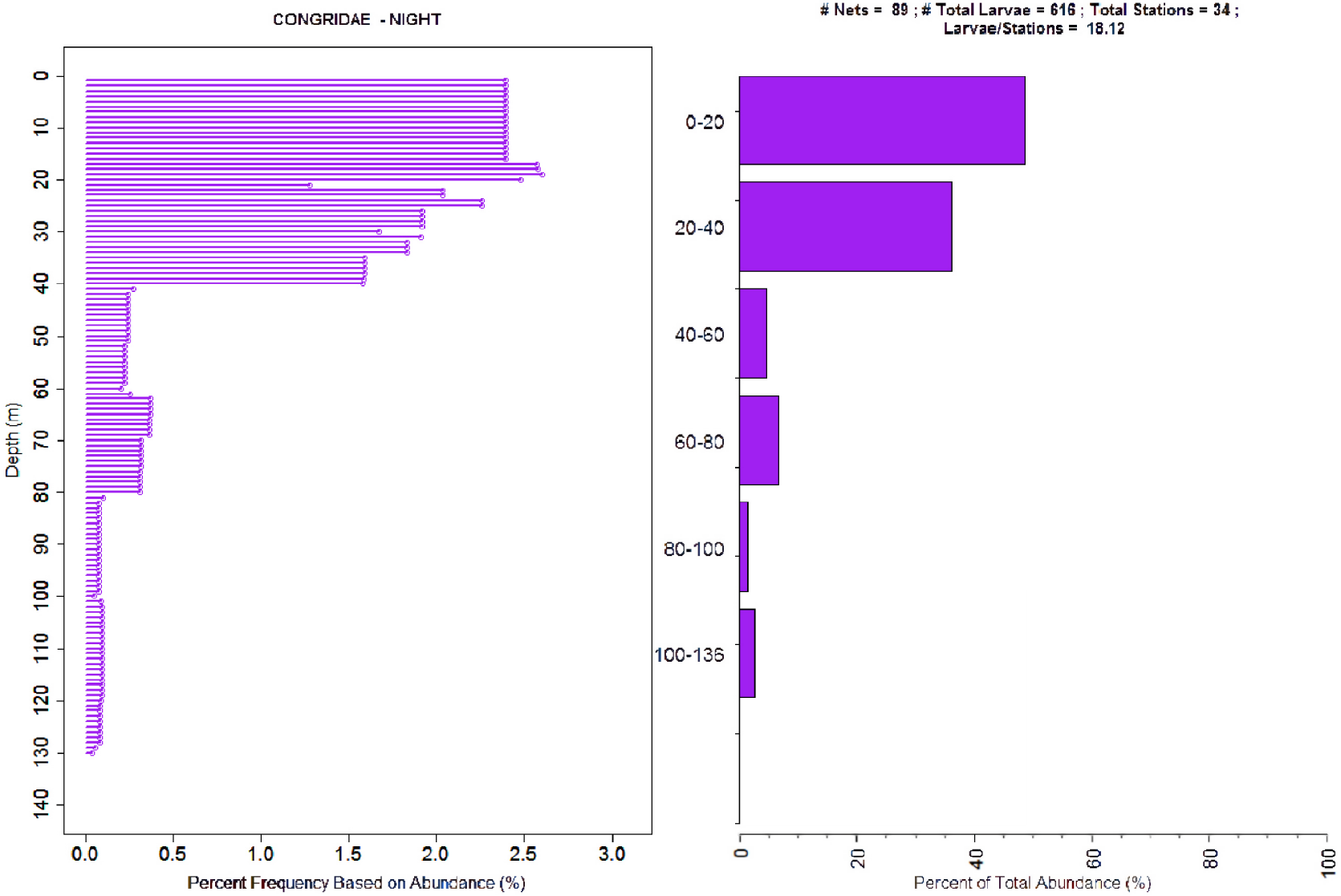
CLUPEIFORMES, DAY



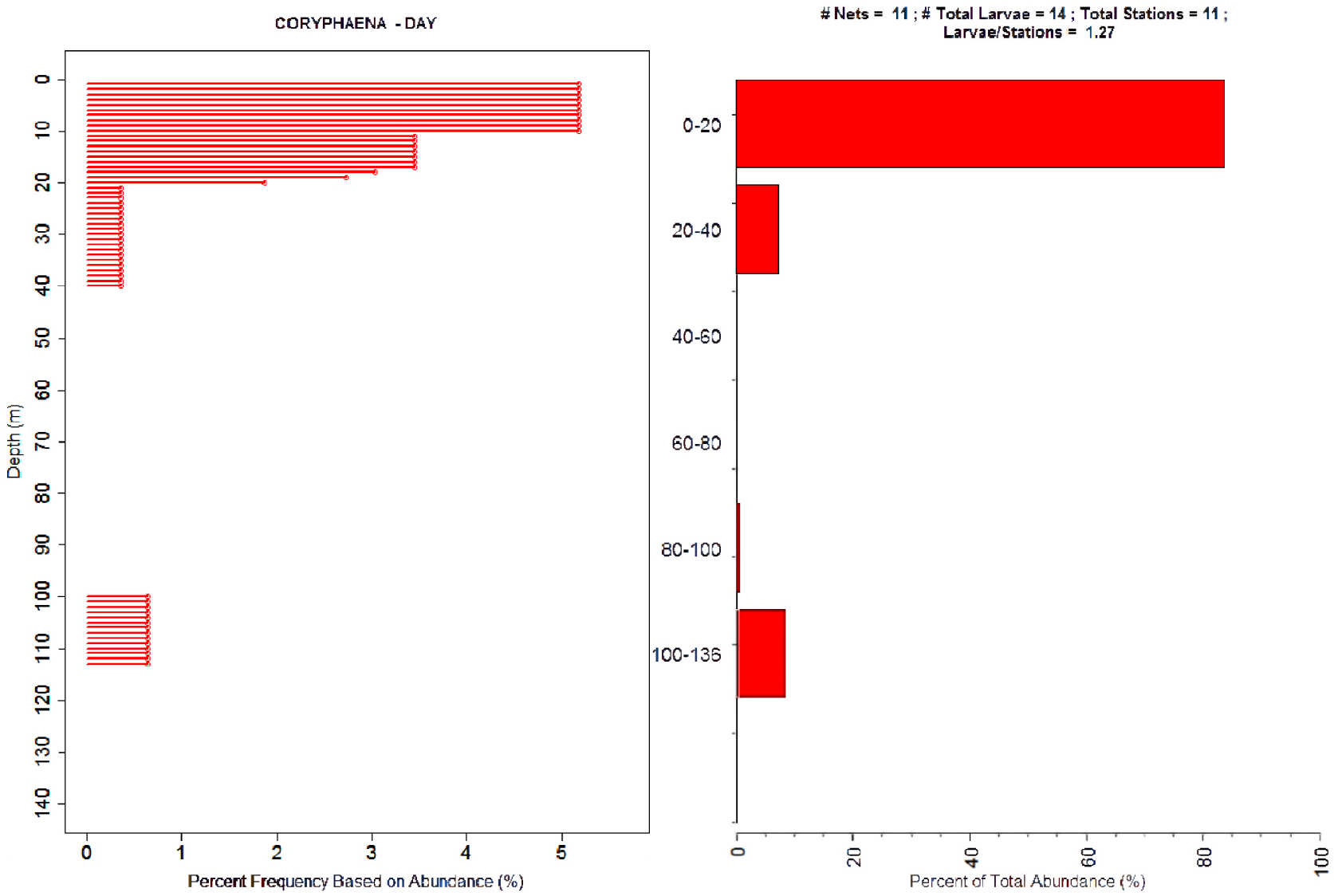
CLUPEIFORMES, NIGHT



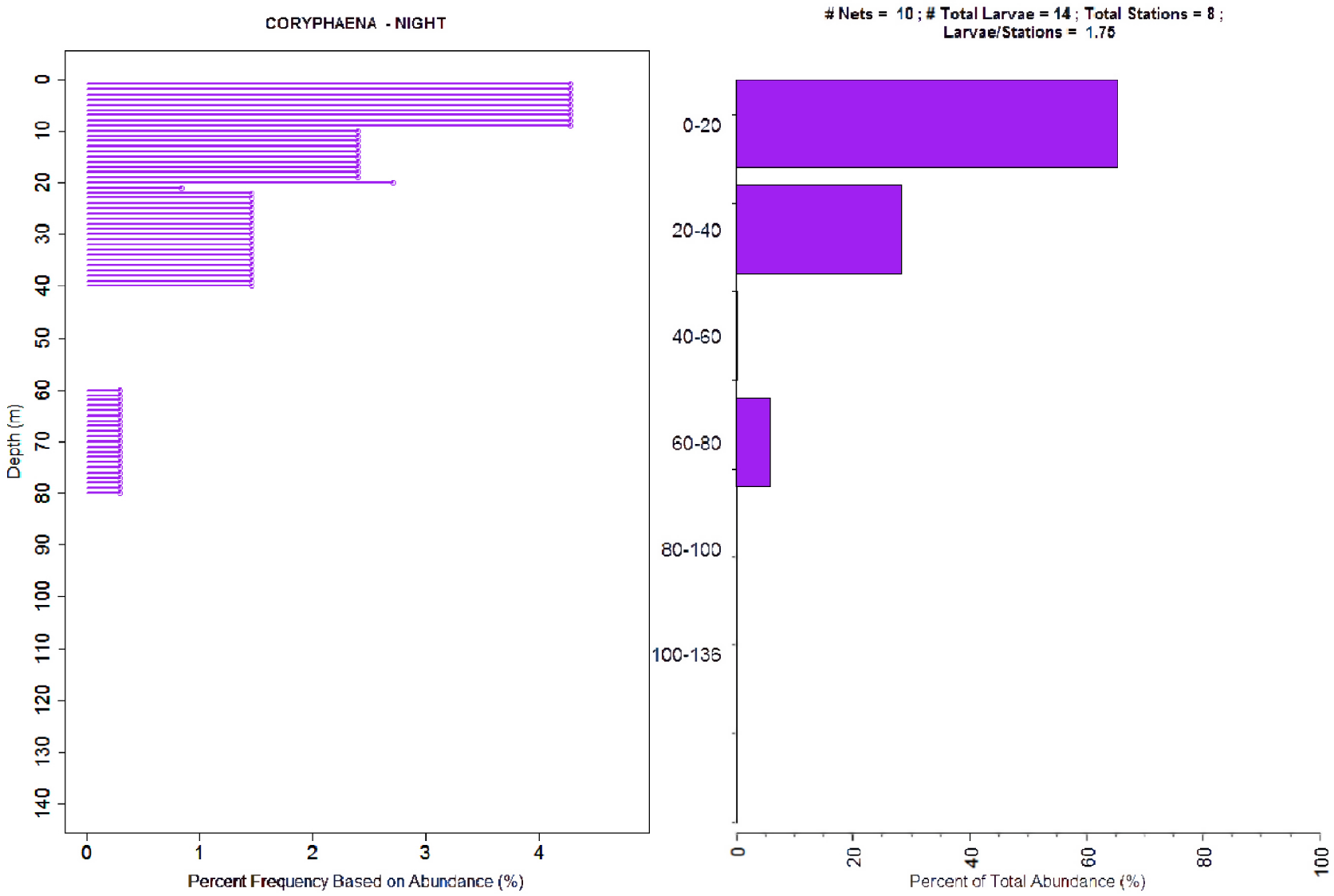
CONGRIDAE, DAY



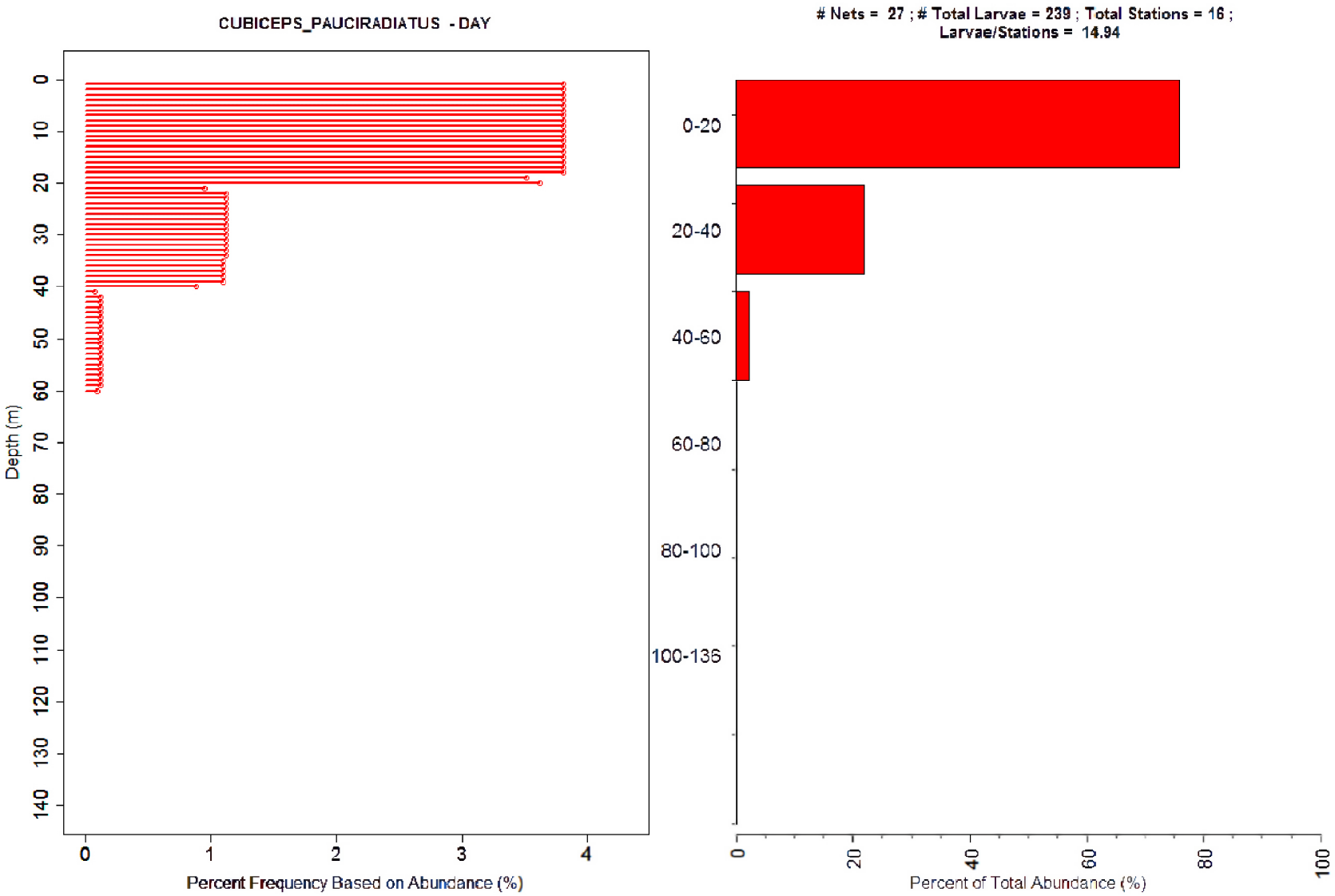
CONGRIDAE, NIGHT



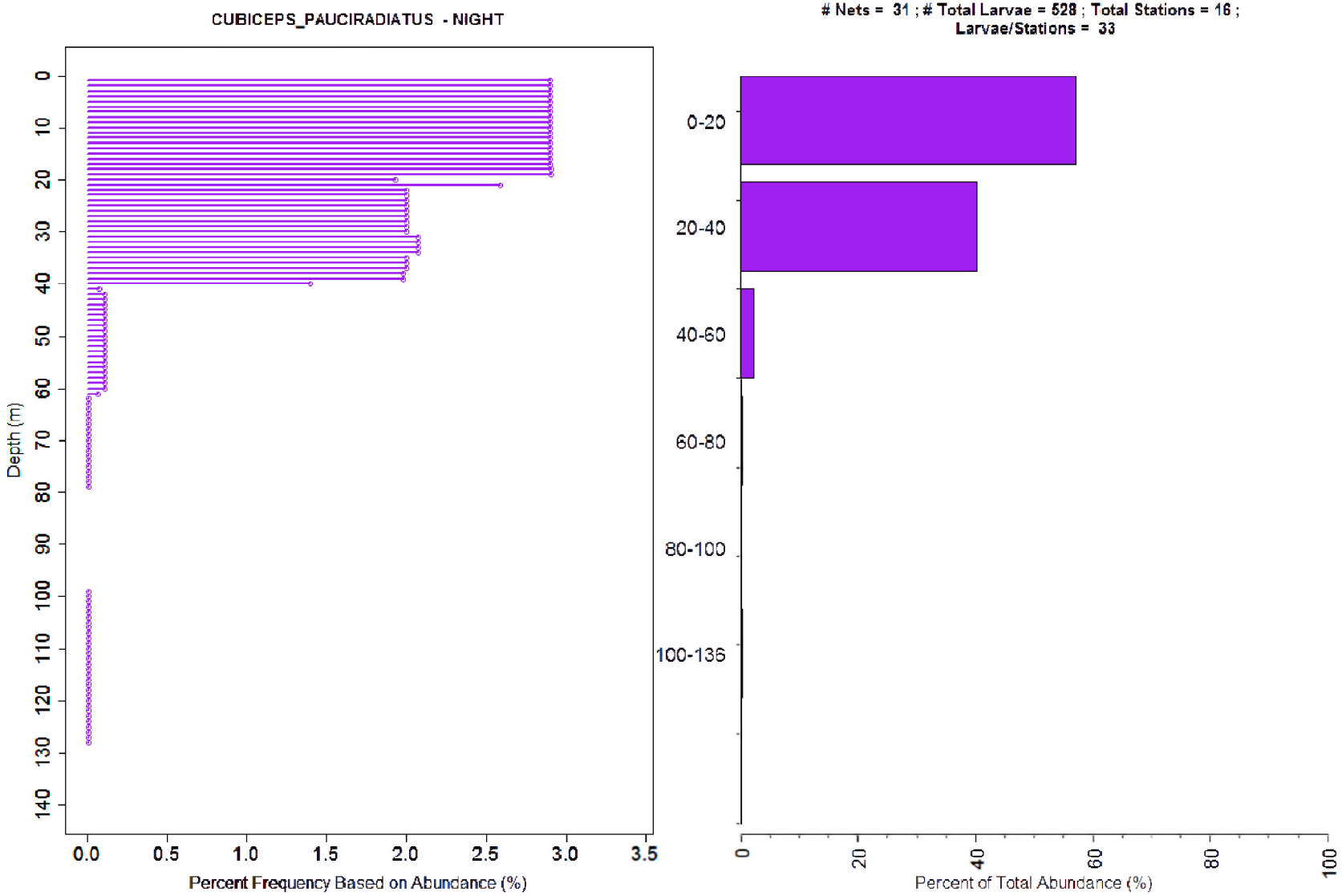
CORYPHAENA, DAY



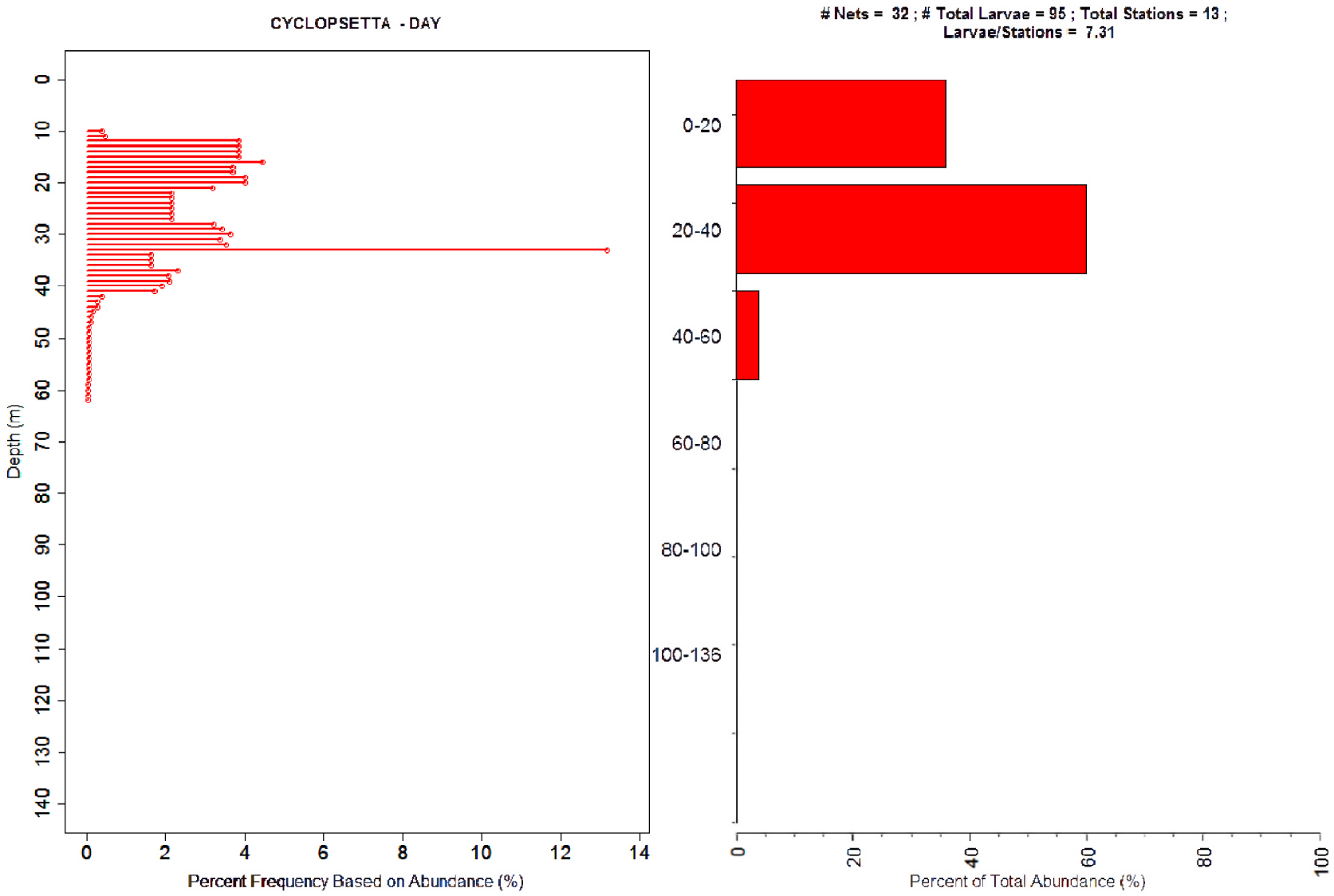
CORYPHAENA, NIGHT



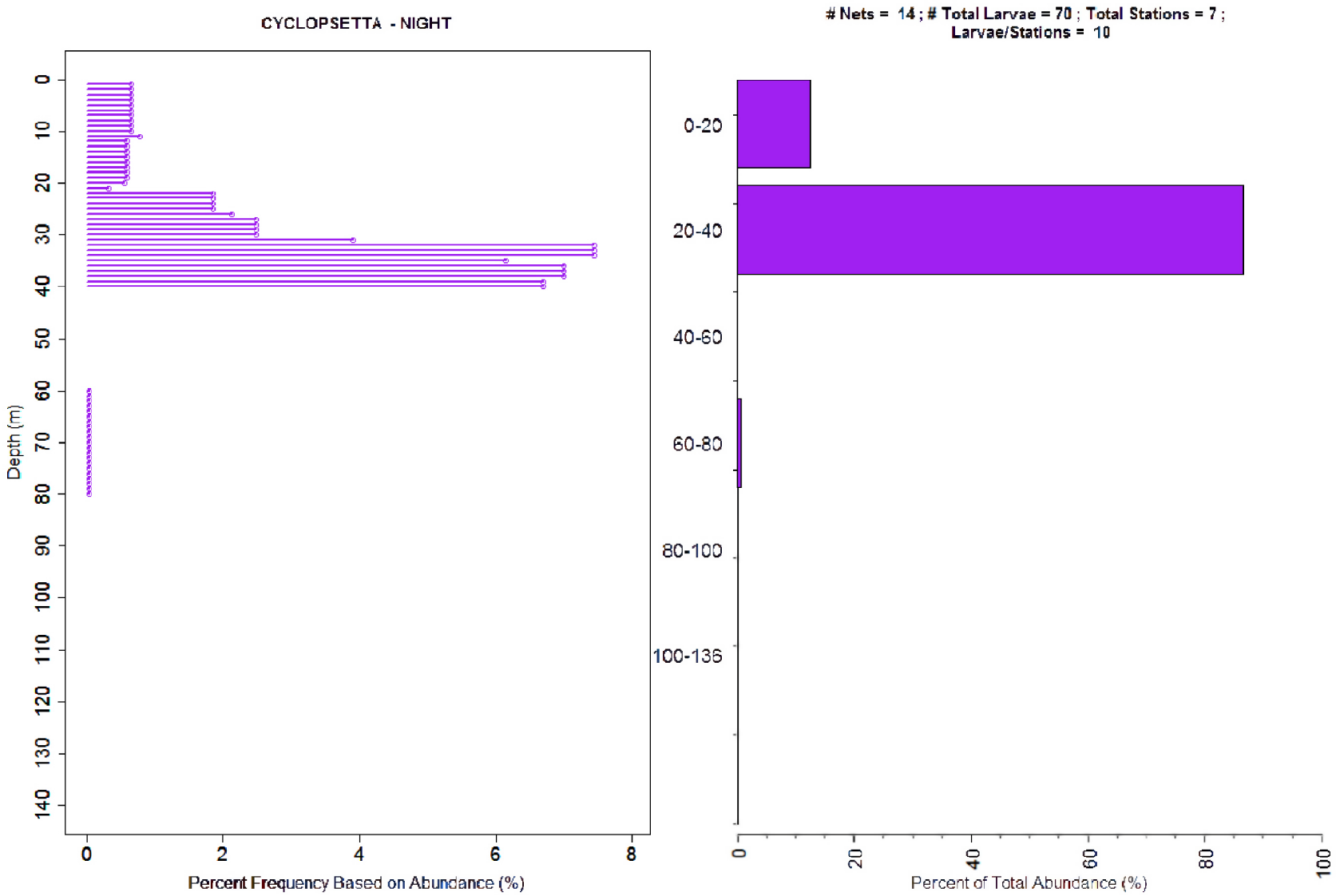
CUBICEPS_PAUCIRADIATUS, DAY



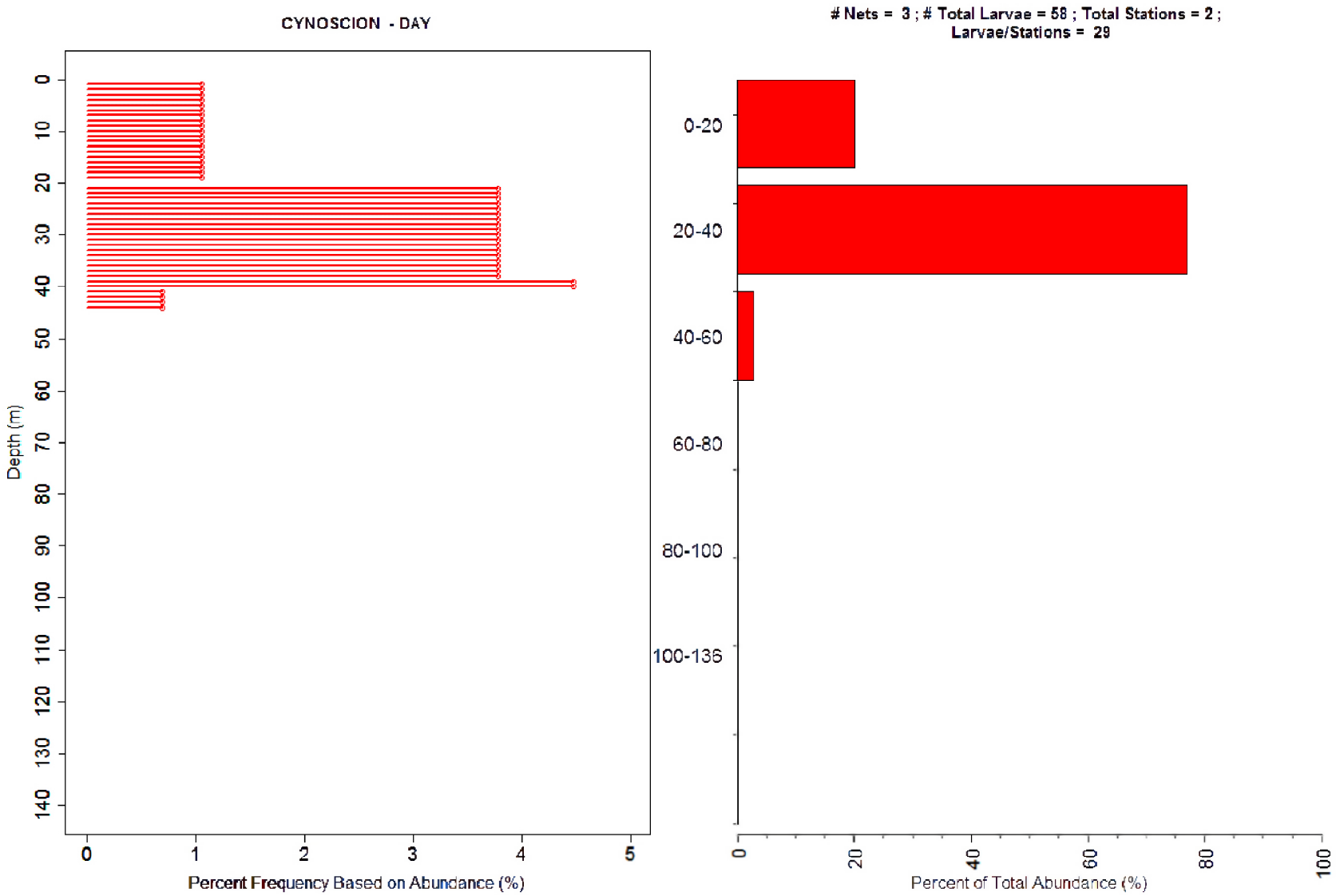
CUBICEPS_PAUCIRADIATUS, NIGHT



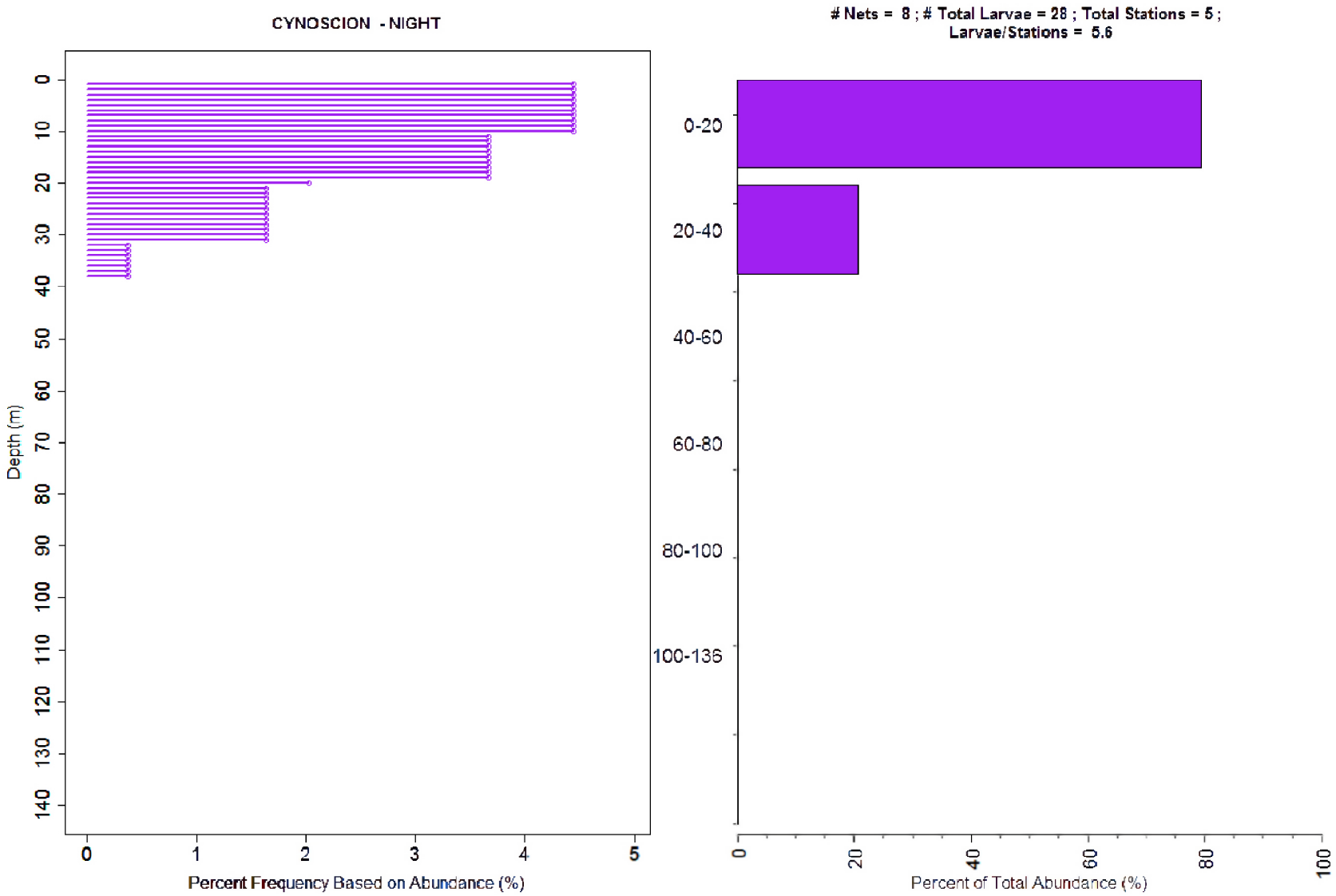
CYCLOPSETTA, DAY



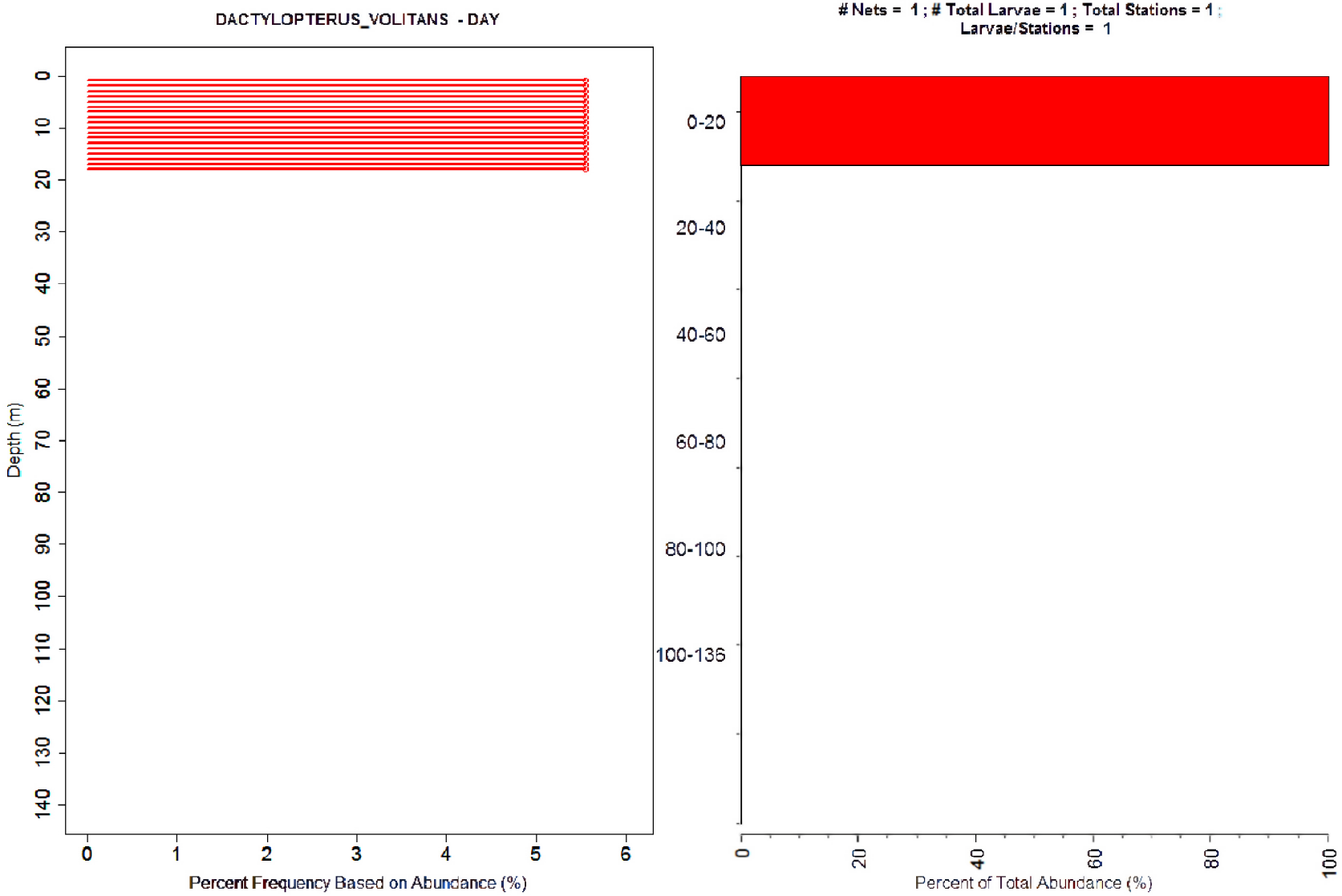
CYCLOPSETTA, NIGHT



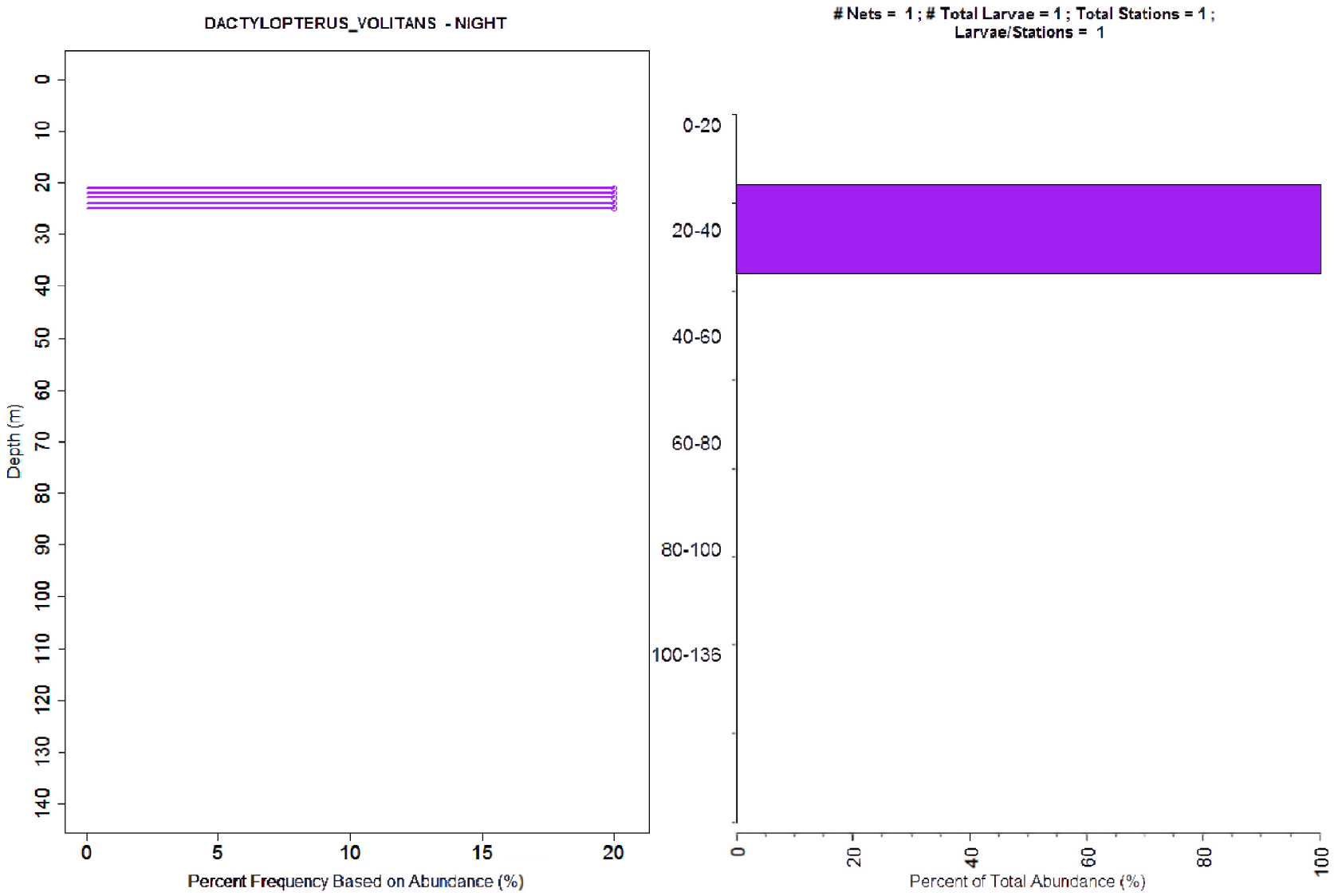
CYNOSCION, DAY



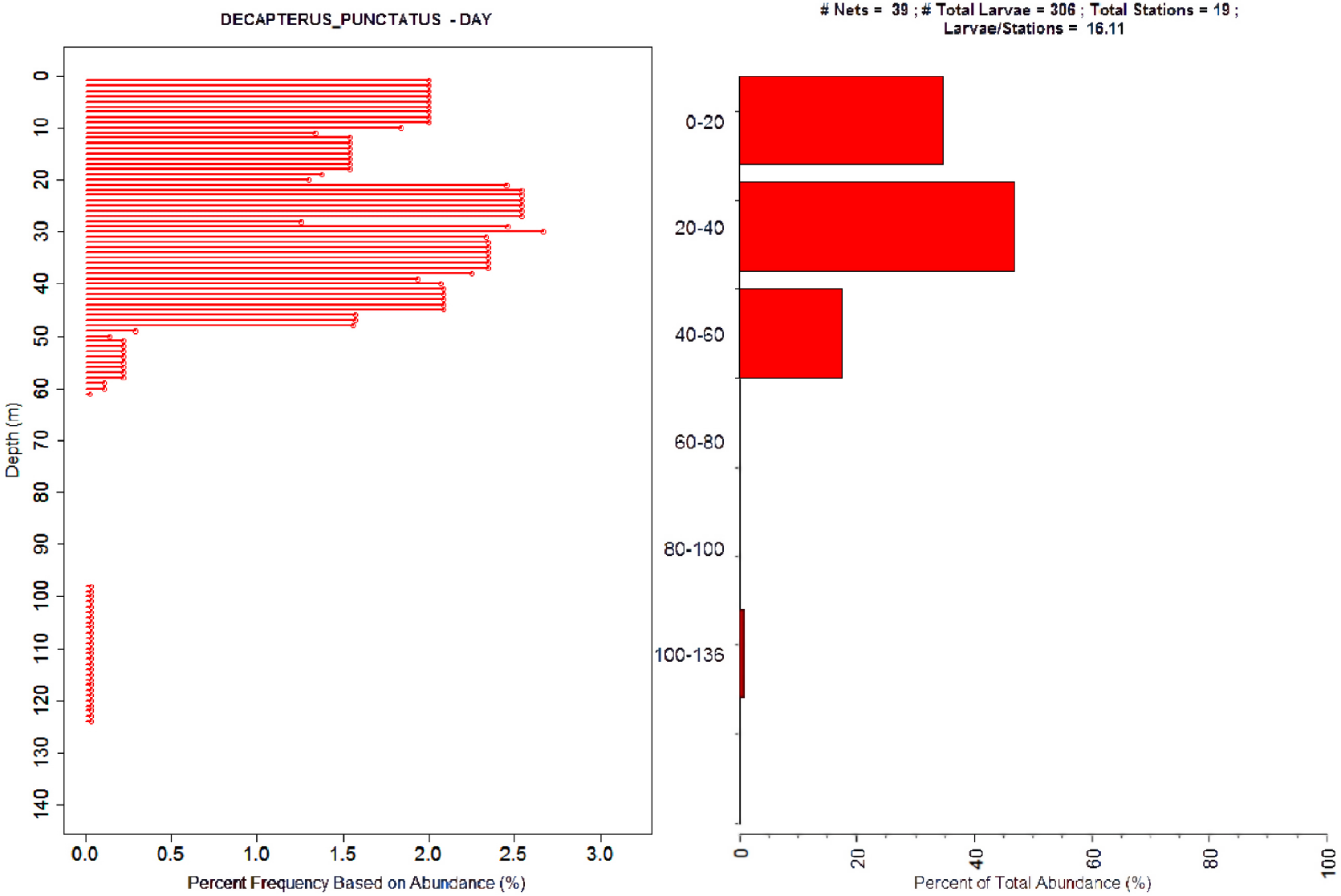
CYNOSCION, NIGHT



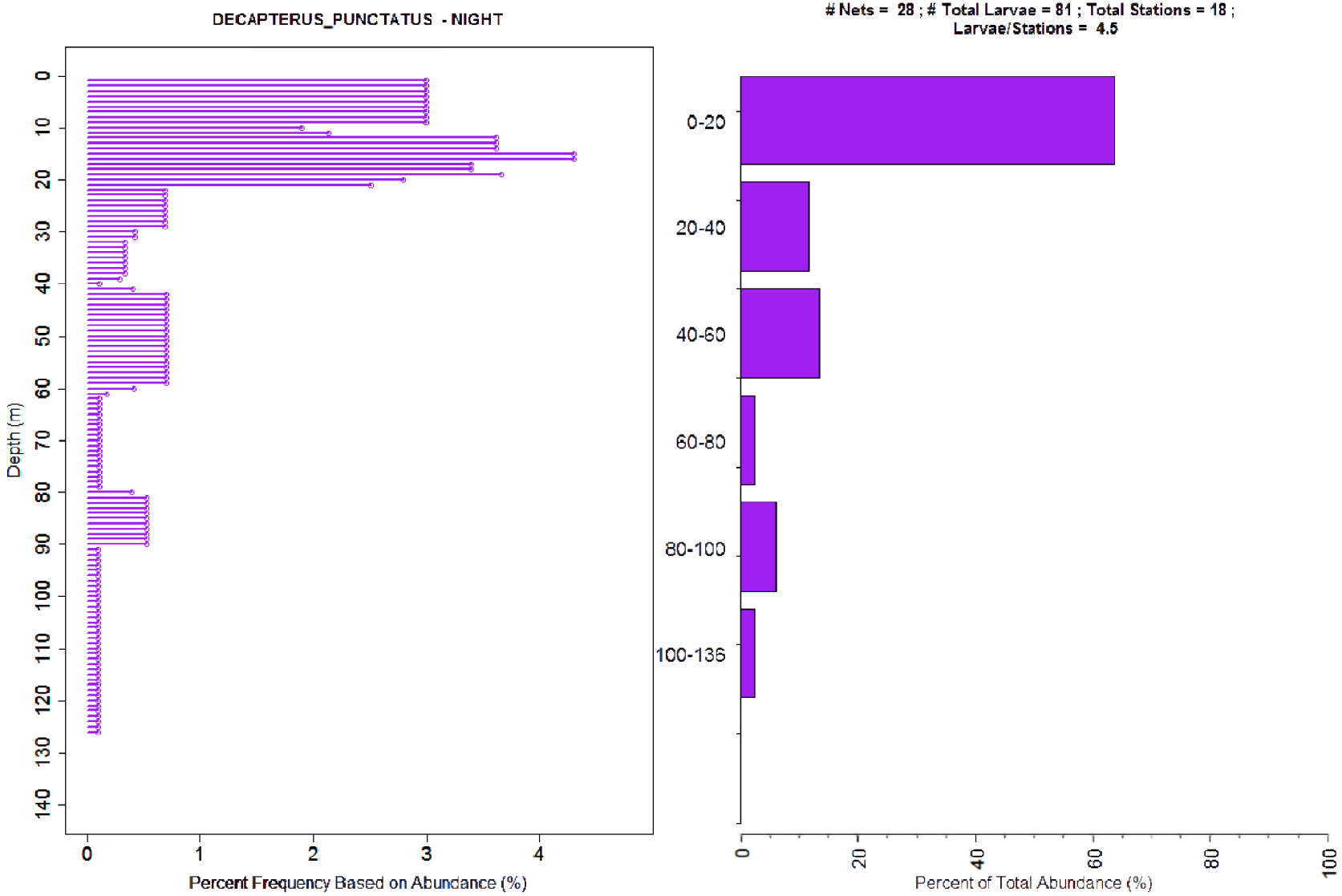
DACTYLOPTERUS_VOLITANS, DAY



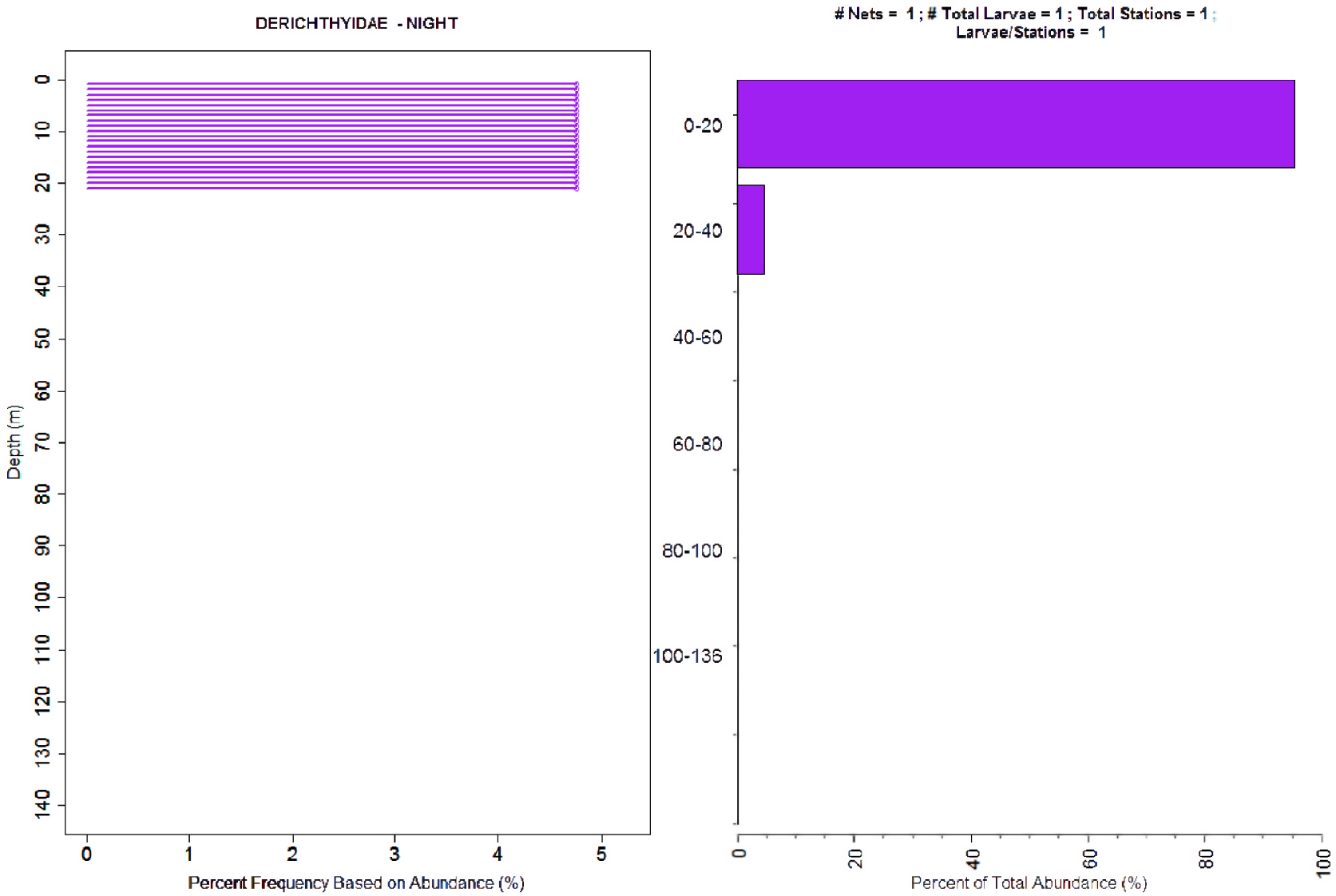
DACTYLOPTERUS_VOLITANS, NIGHT



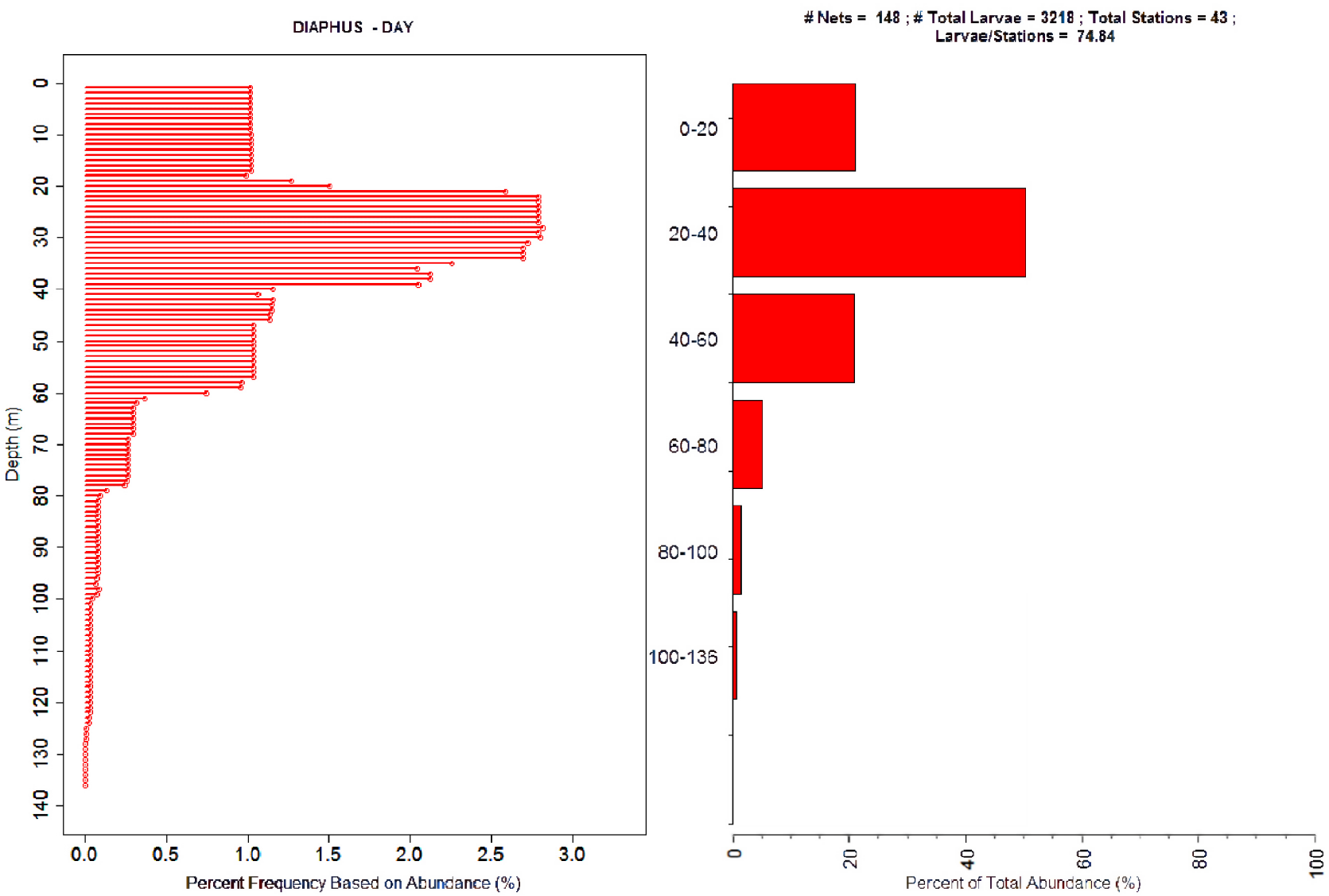
DECAPTERUS_PUNCTATUS, DAY



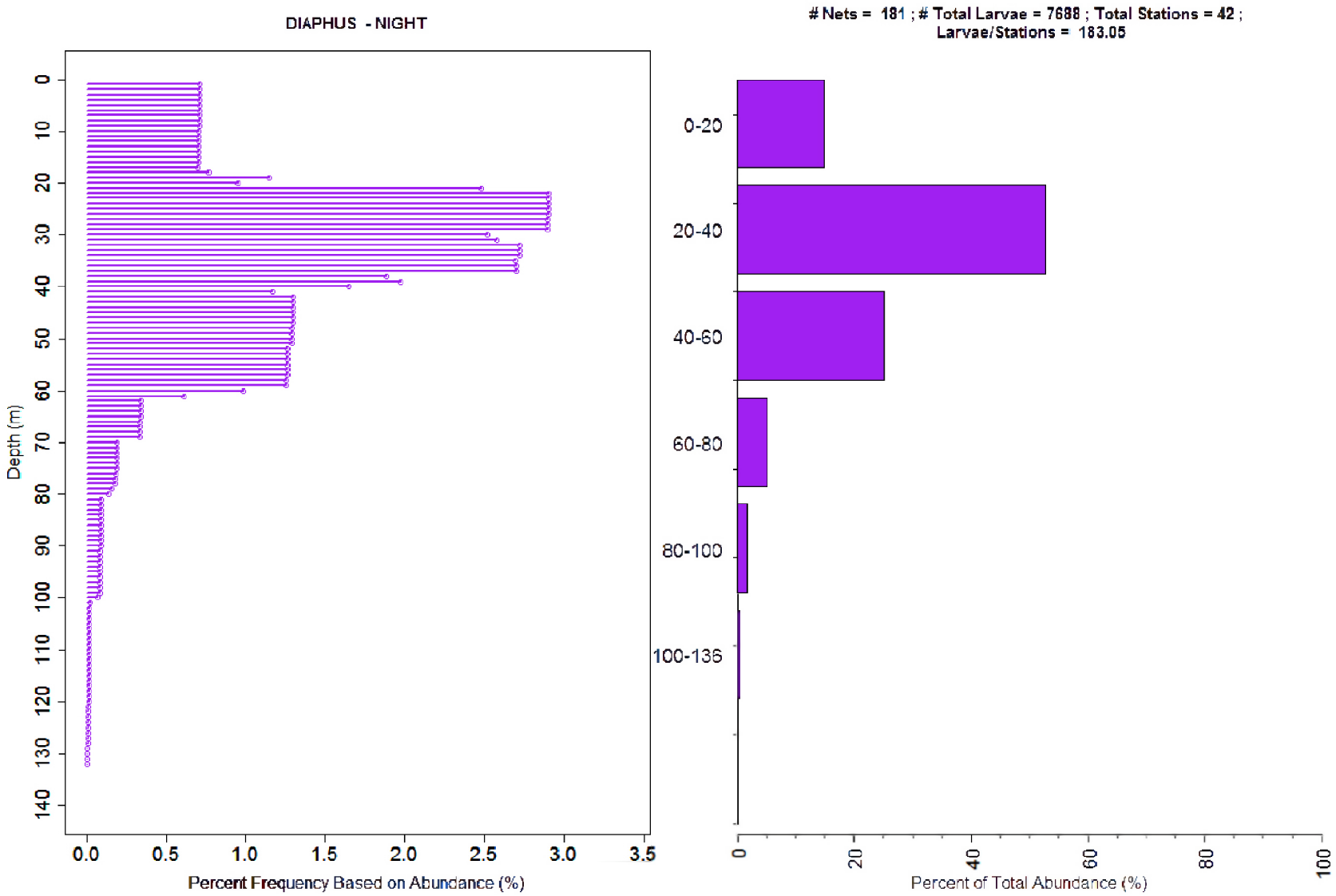
DECAPTERUS_PUNCTATUS, NIGHT



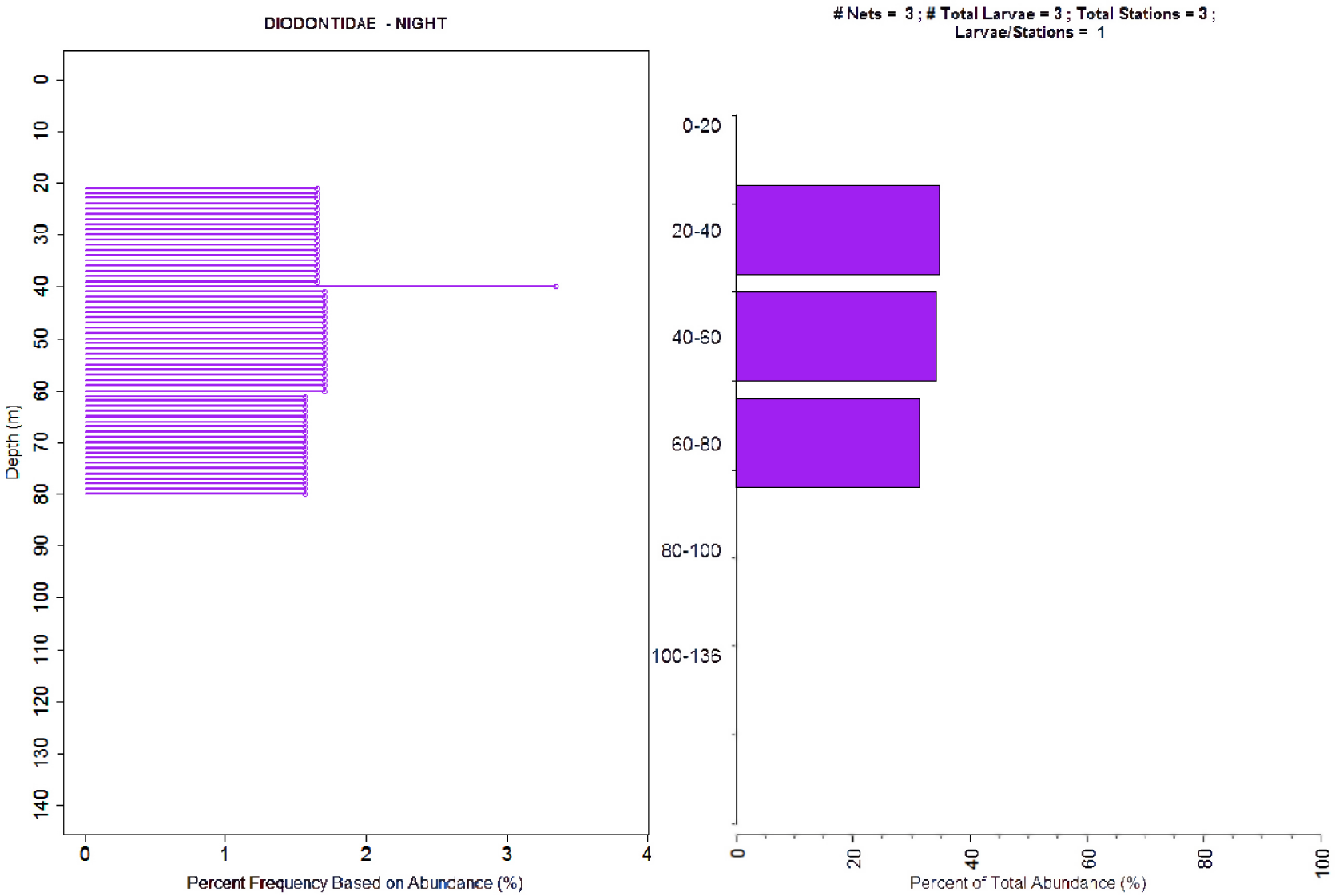
DERICHTHYIDAE, NIGHT


DIAPHUS - DAY
Nets = 148 ; # Total Larvae = 3218 ; Total Stations = 43 ;
Larvae/Stations = 74.84
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

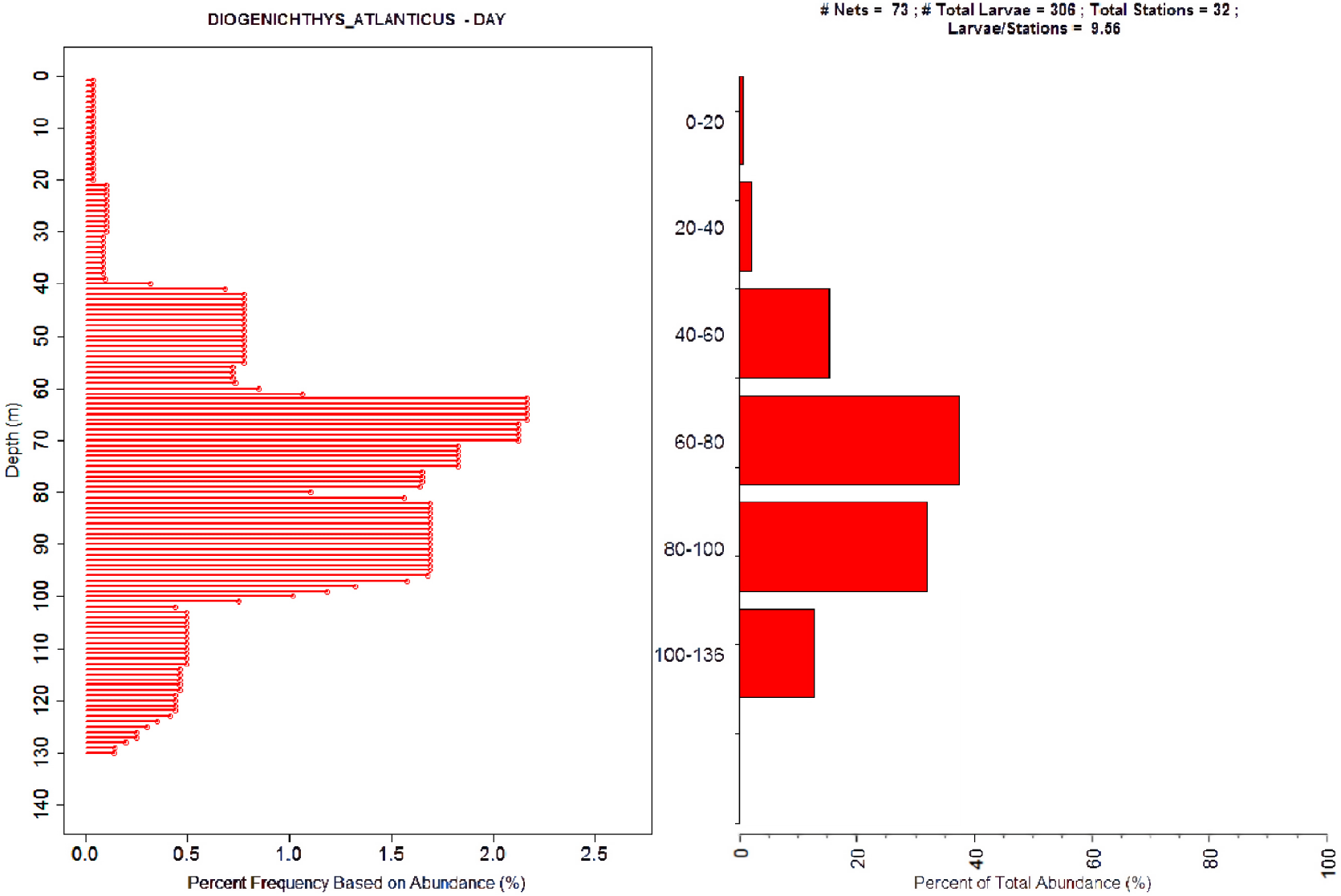
DIAPHUS, DAY



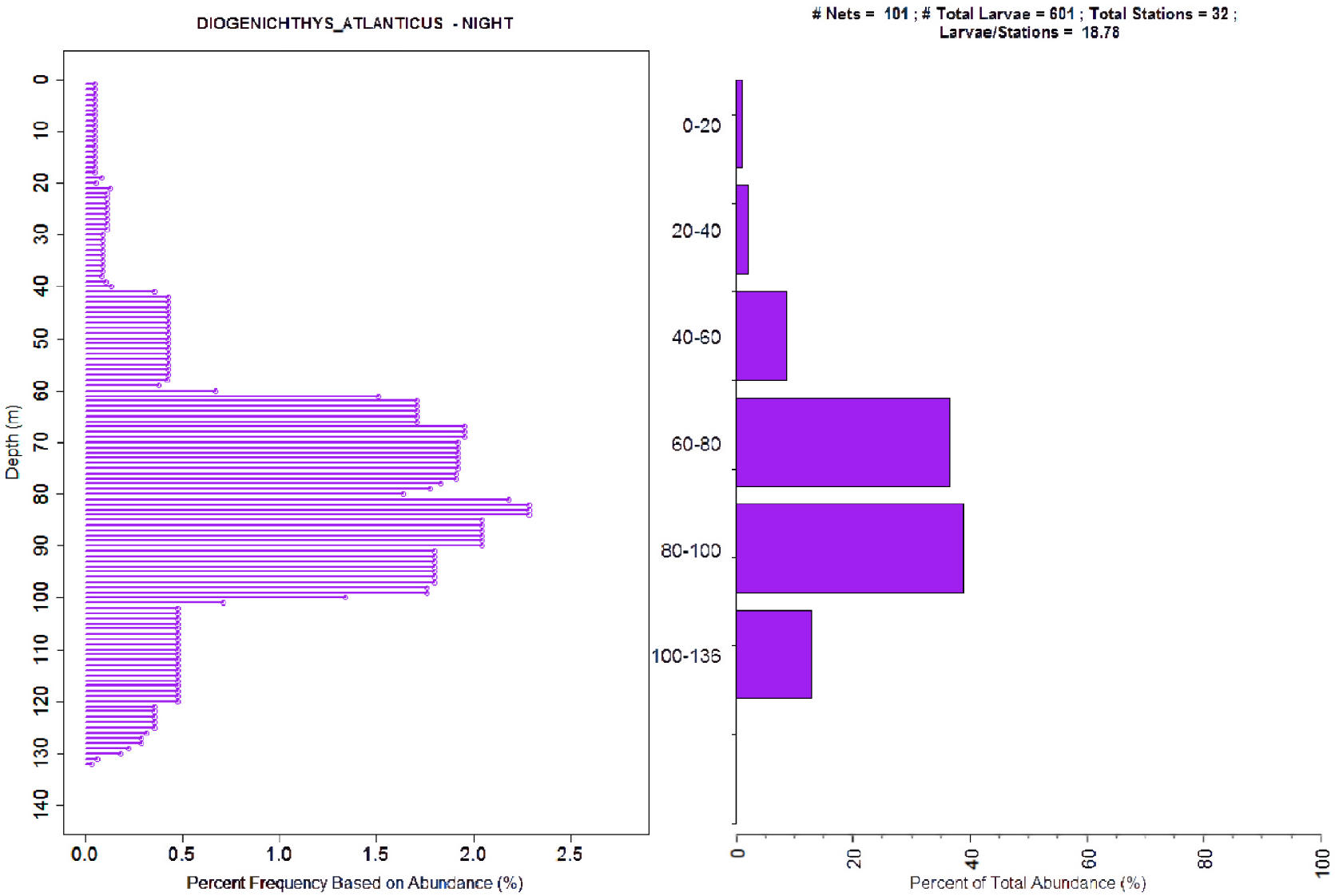
DIAPHUS, NIGHT



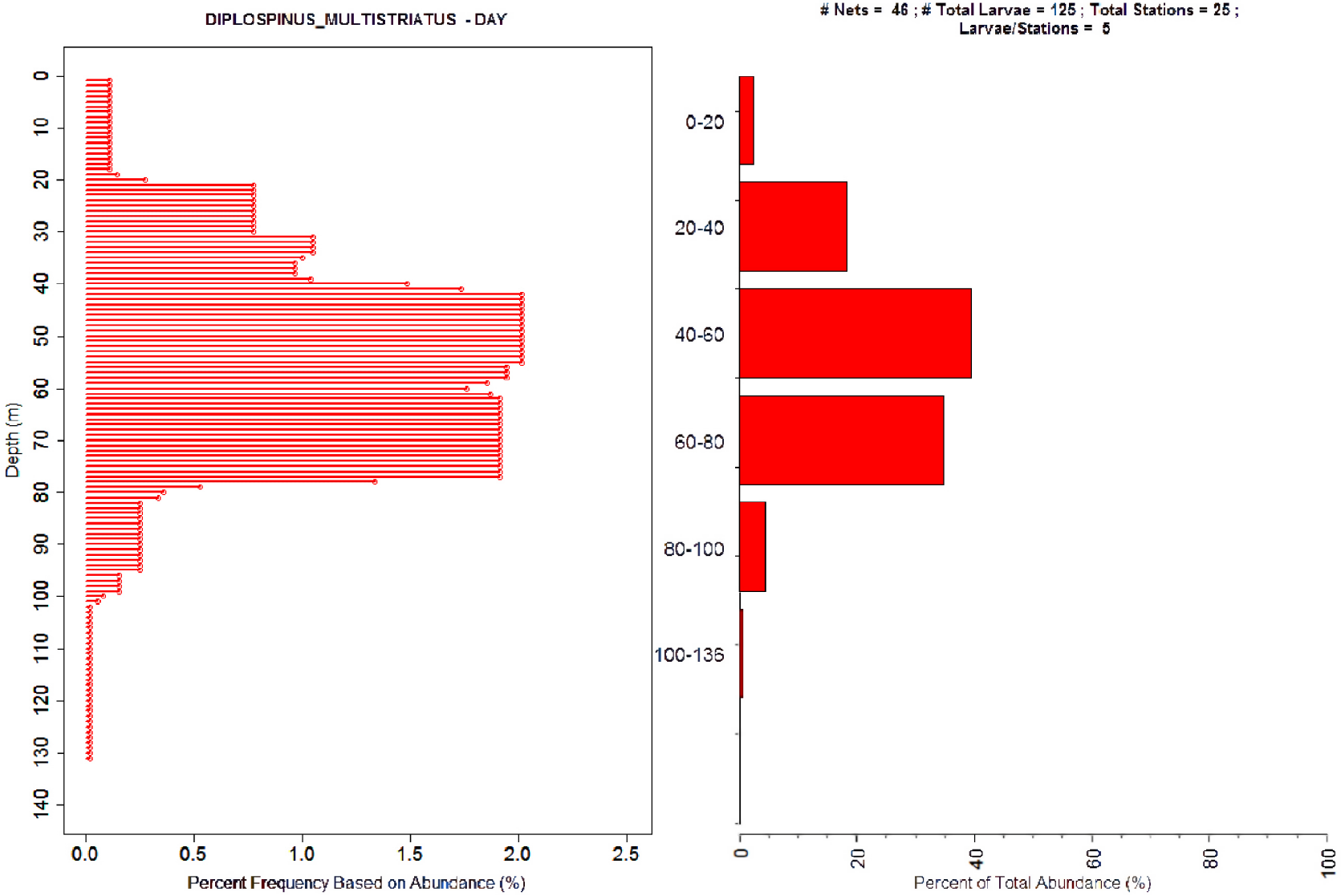
DIODONTIDAE, NIGHT



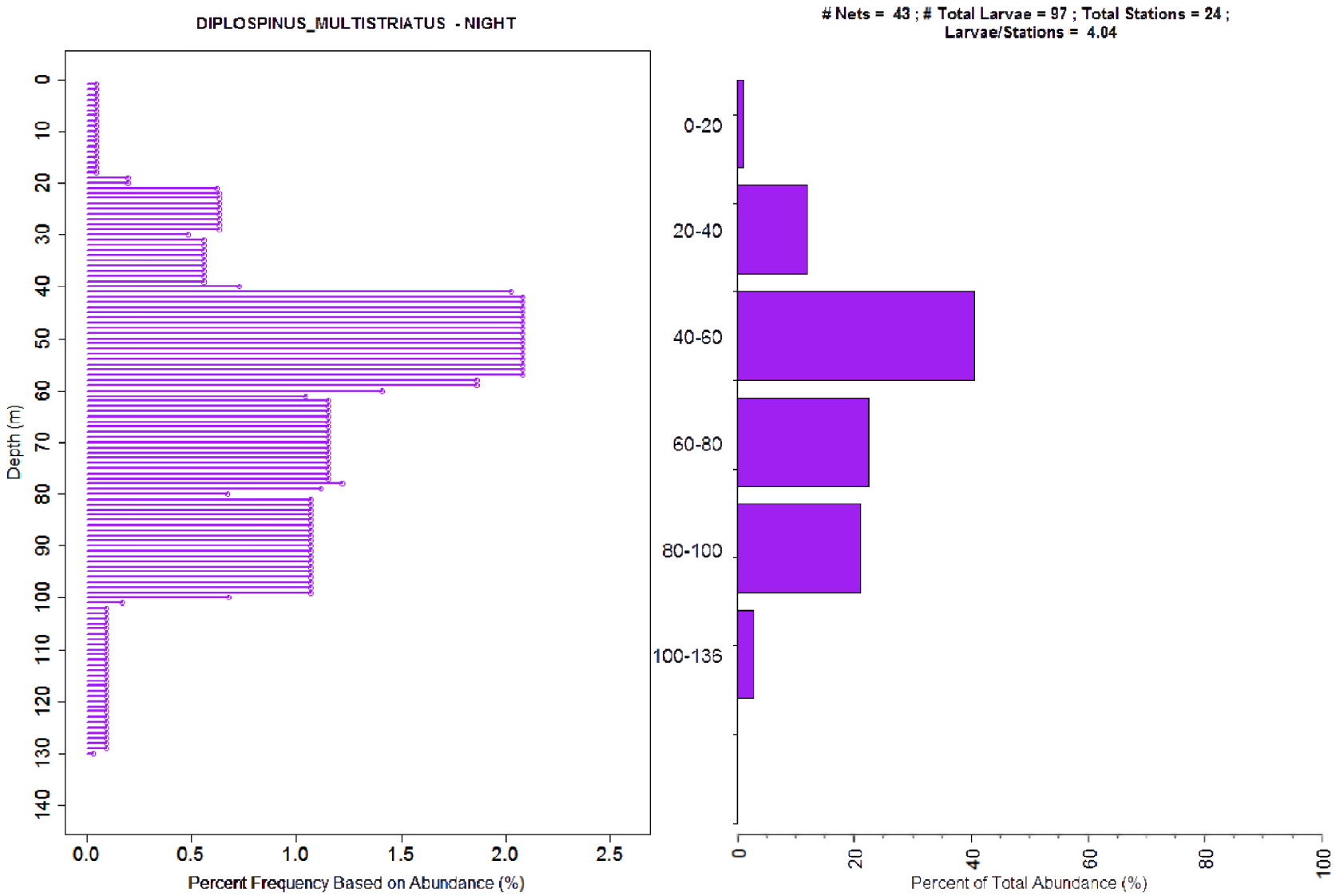
DIOGENICHTHYS_ATLANTICUS, DAY



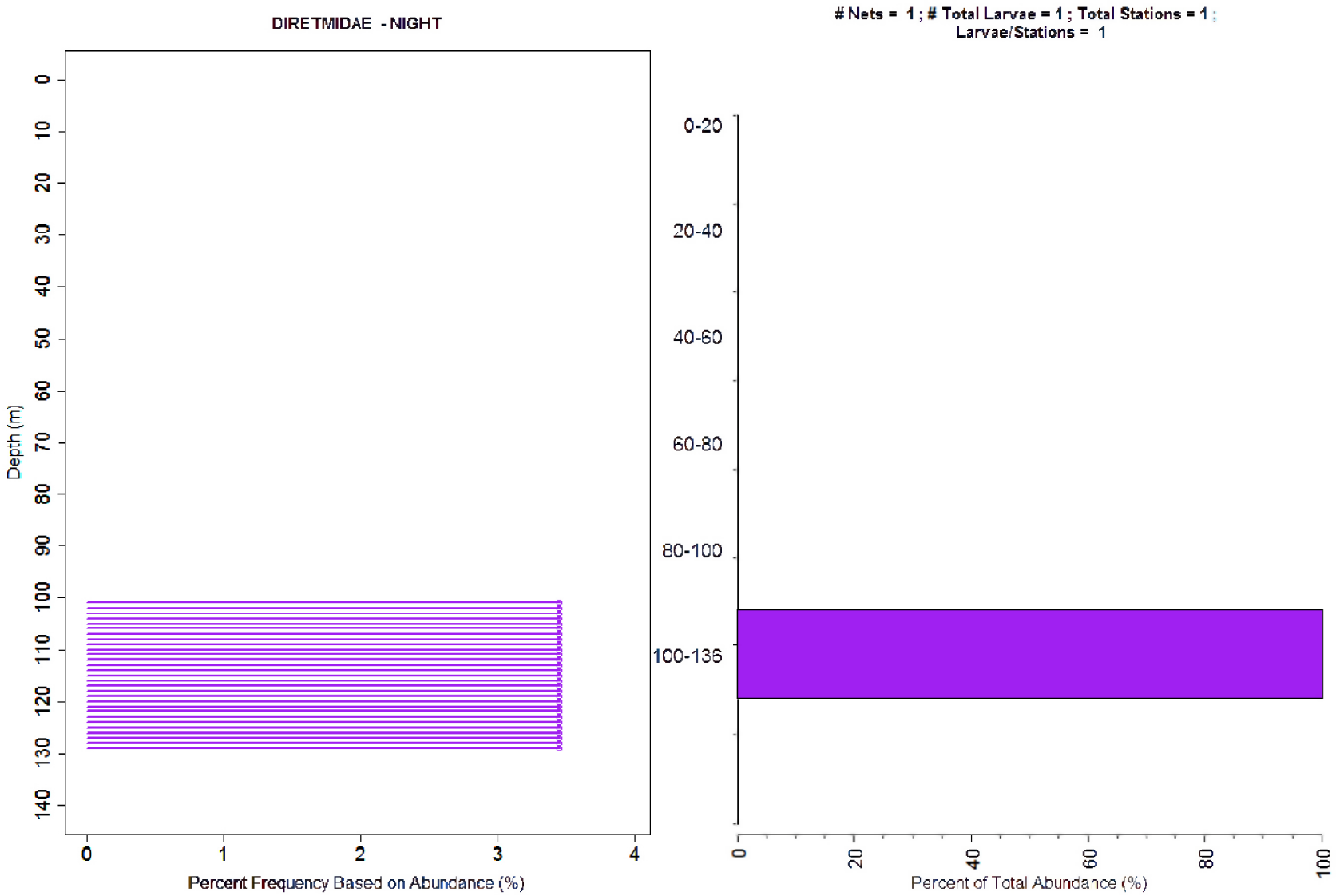
DIOGENICHTHYS_ATLANTICUS, NIGHT



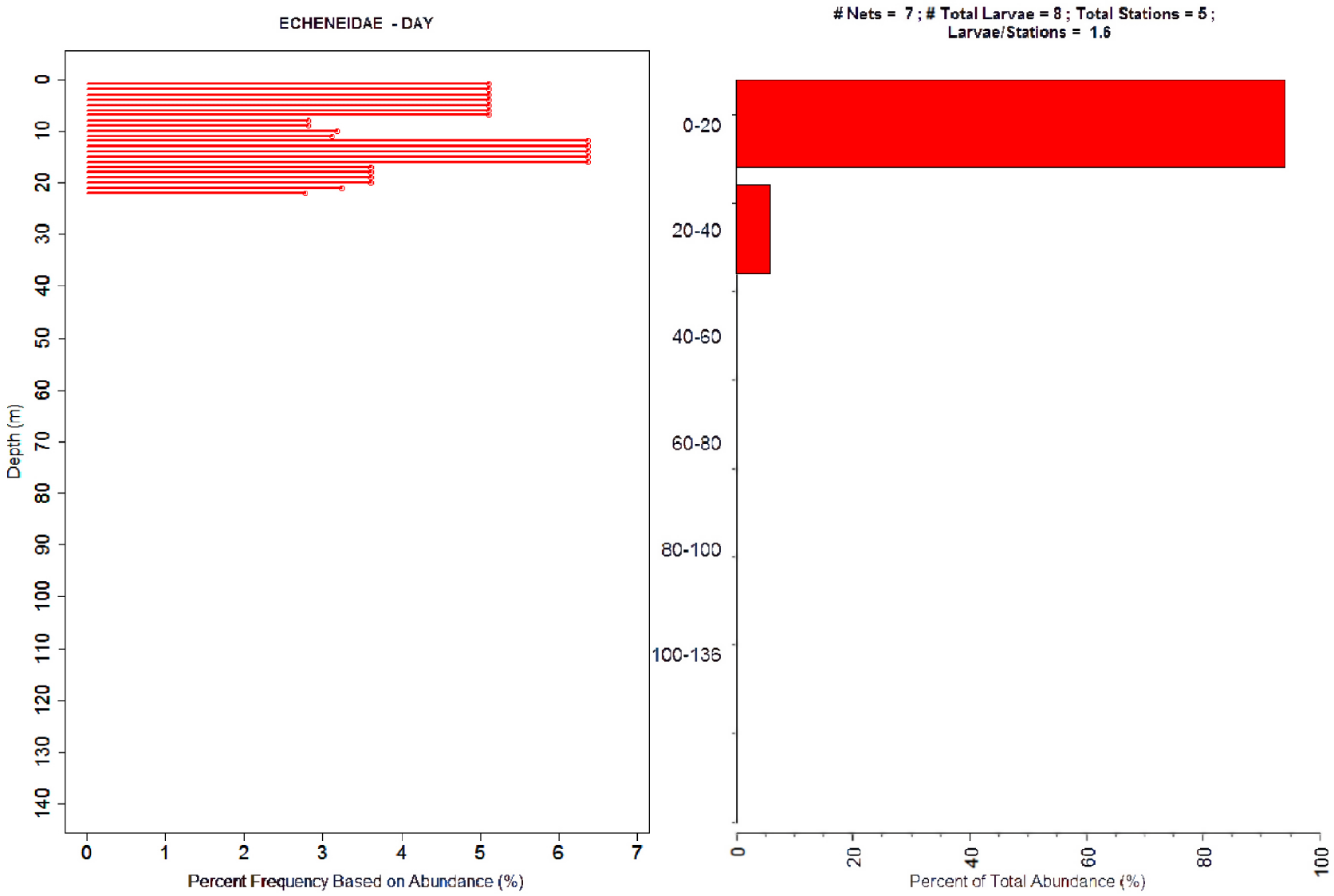
DIPLOSPINUS_MULTISTRIATUS, DAY



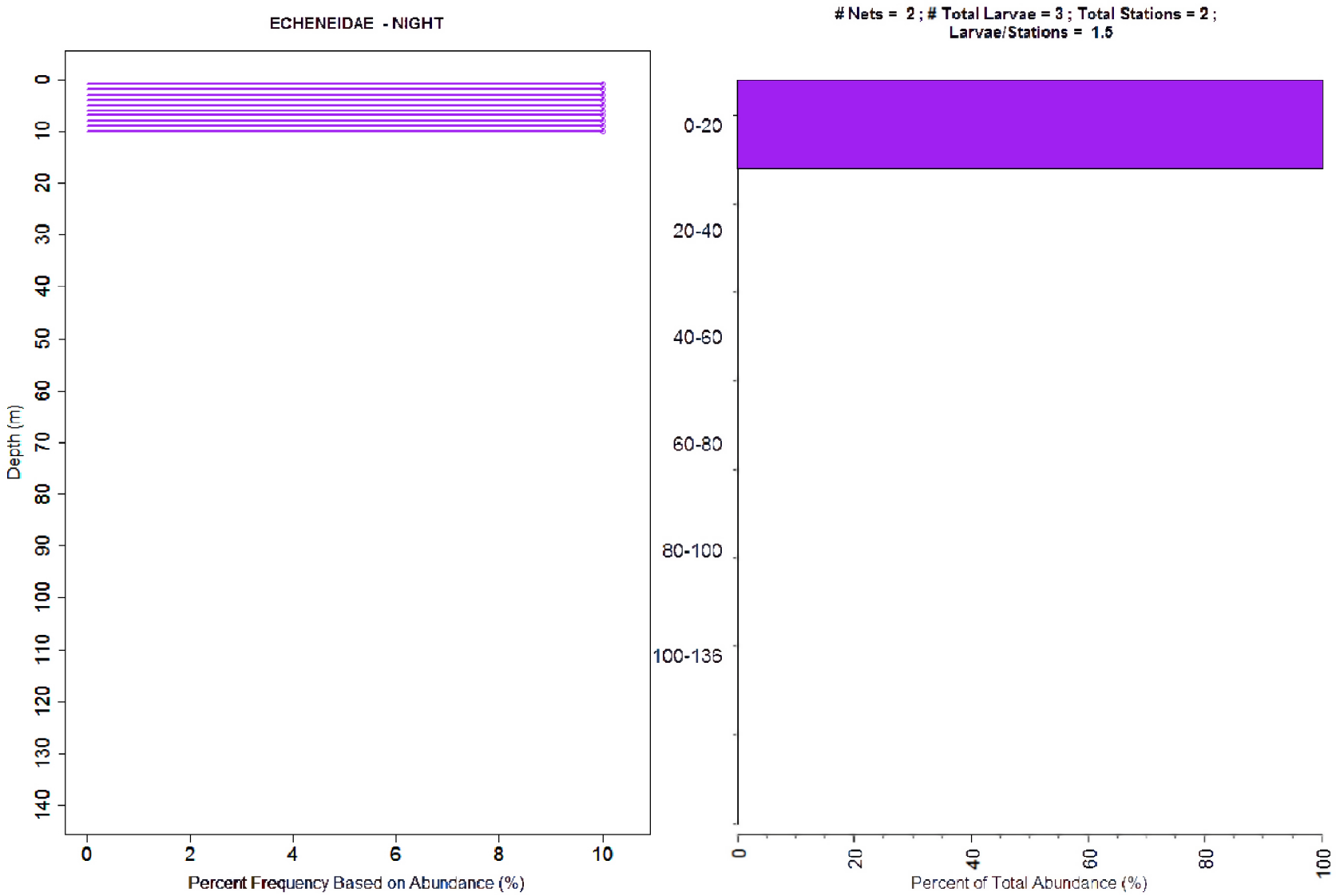
DIPLOSPINUS_MULTISTRIATUS, NIGHT



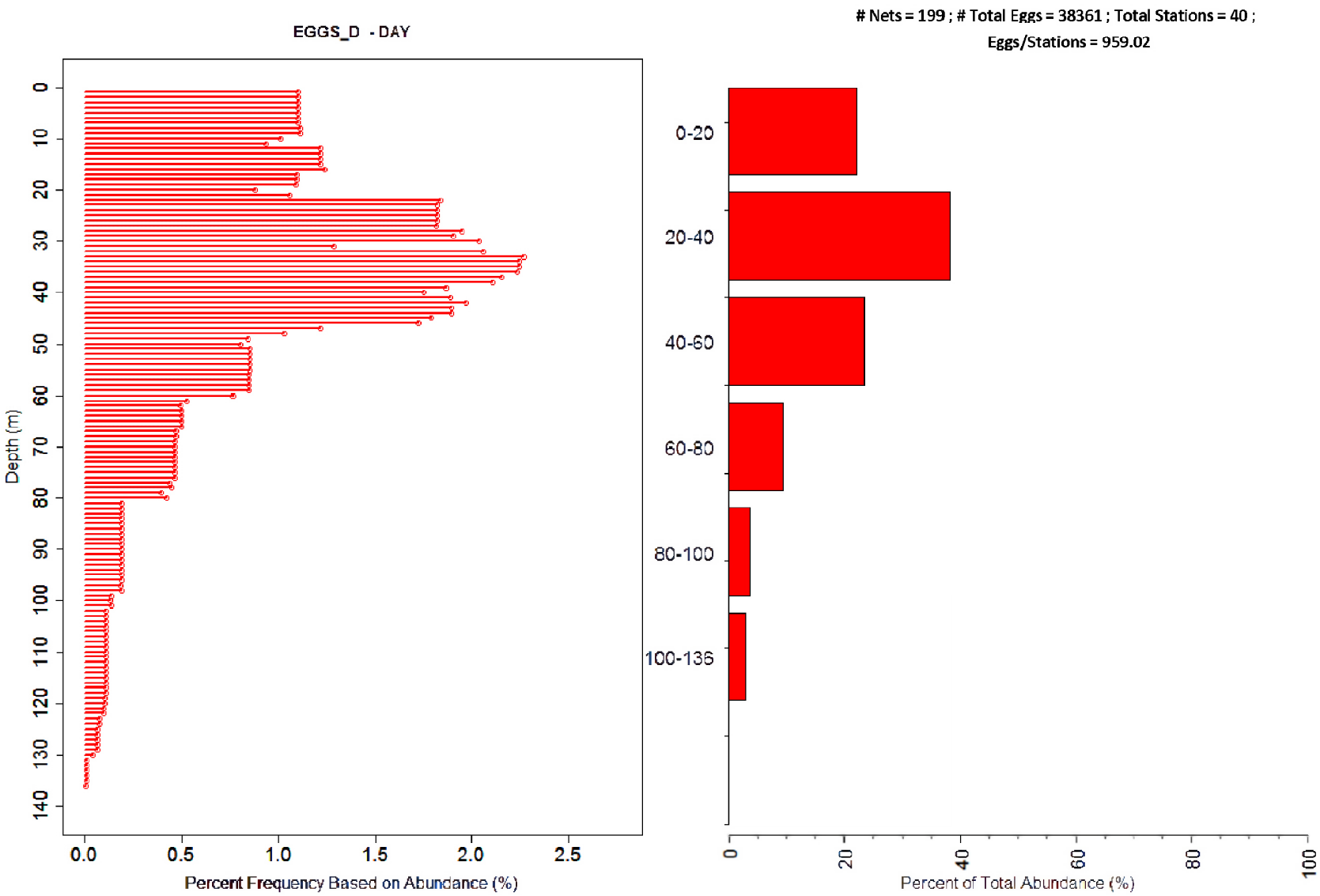
DIRETMIDAE, NIGHT



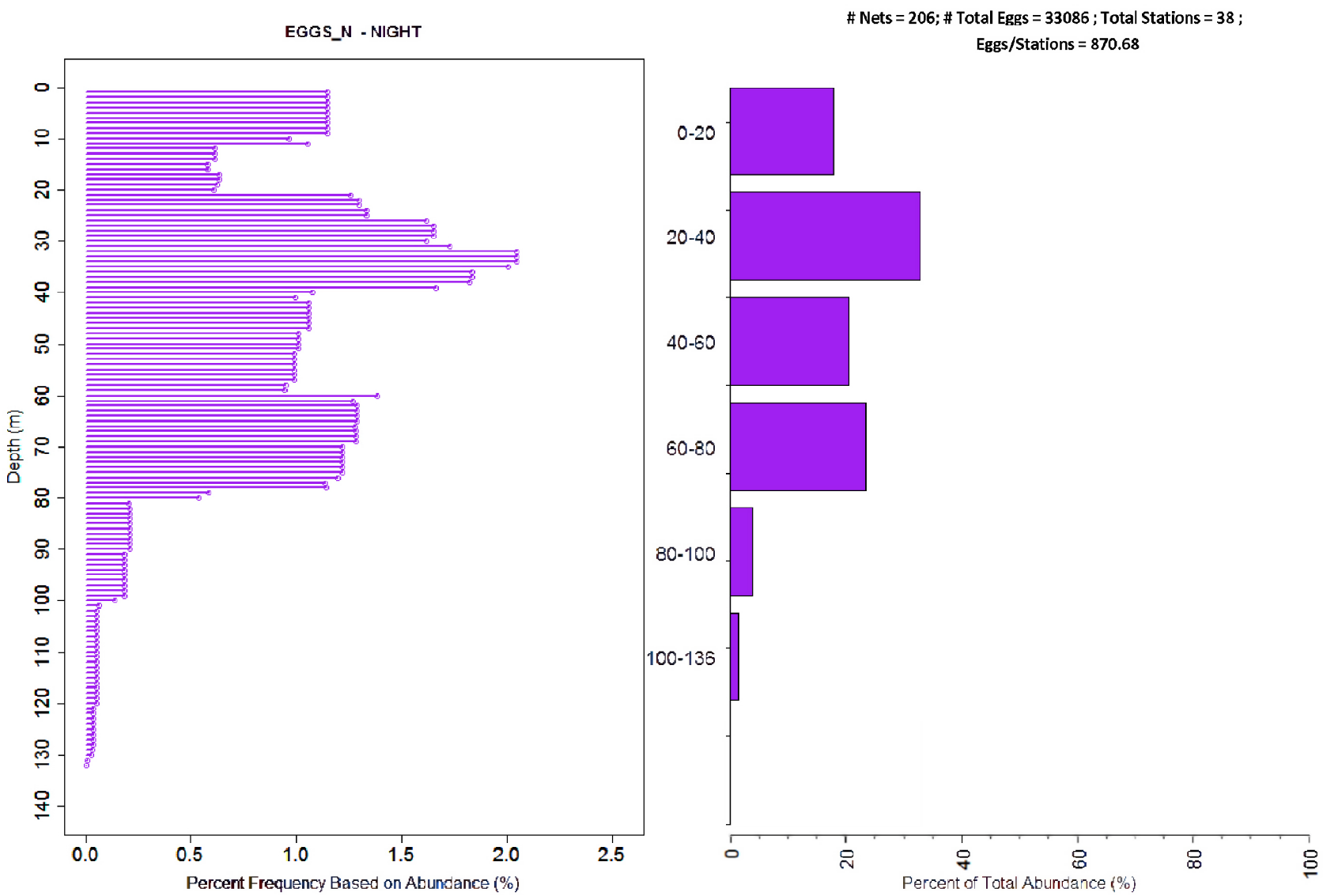
ECHENEIDAE, DAY



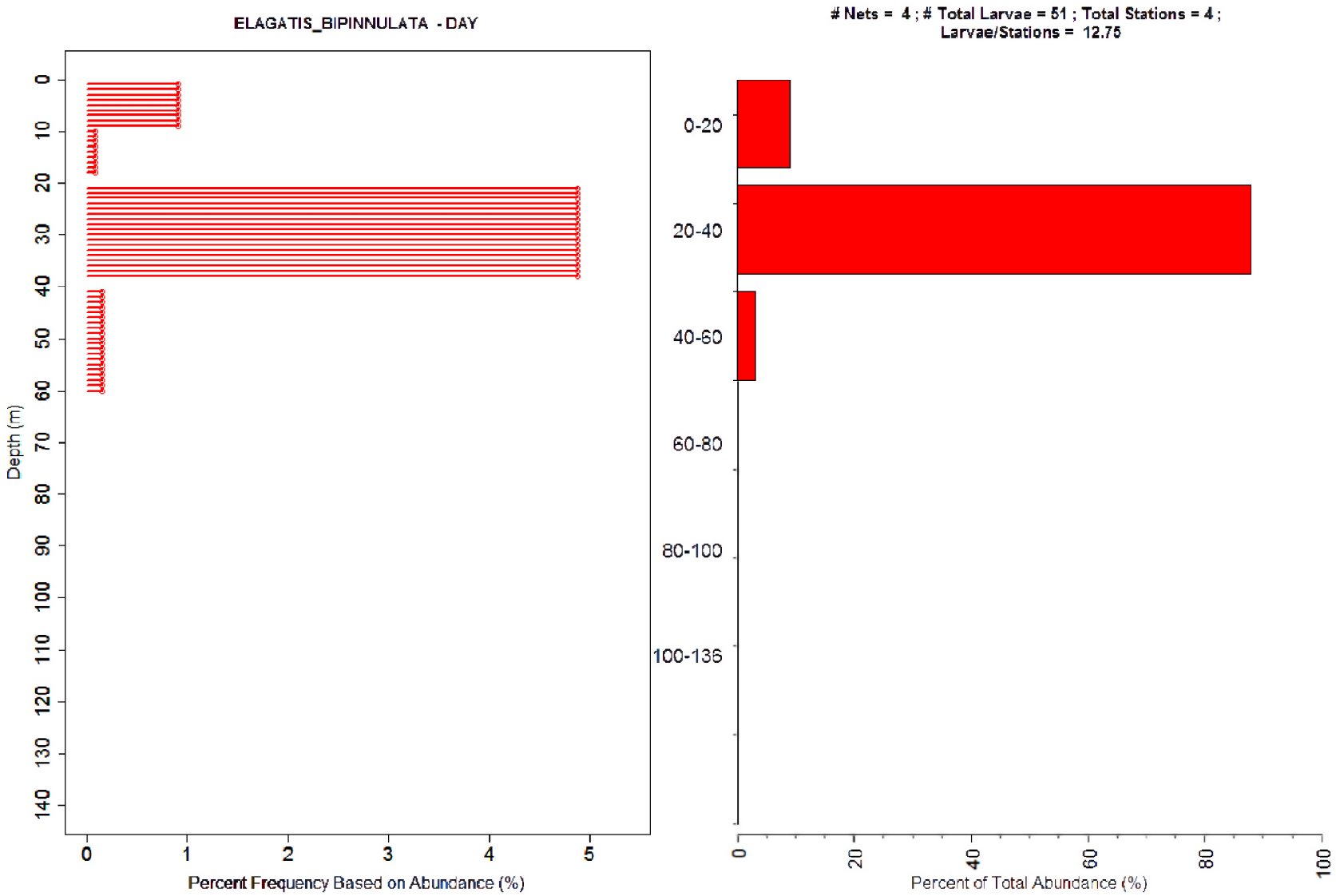
ECHENEIDAE, NIGHT


EGGS_D - DAY
Nets = 199 ; # Total Eggs = 38361 ; Total Stations = 40 ;
Eggs/Stations = 959.02
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

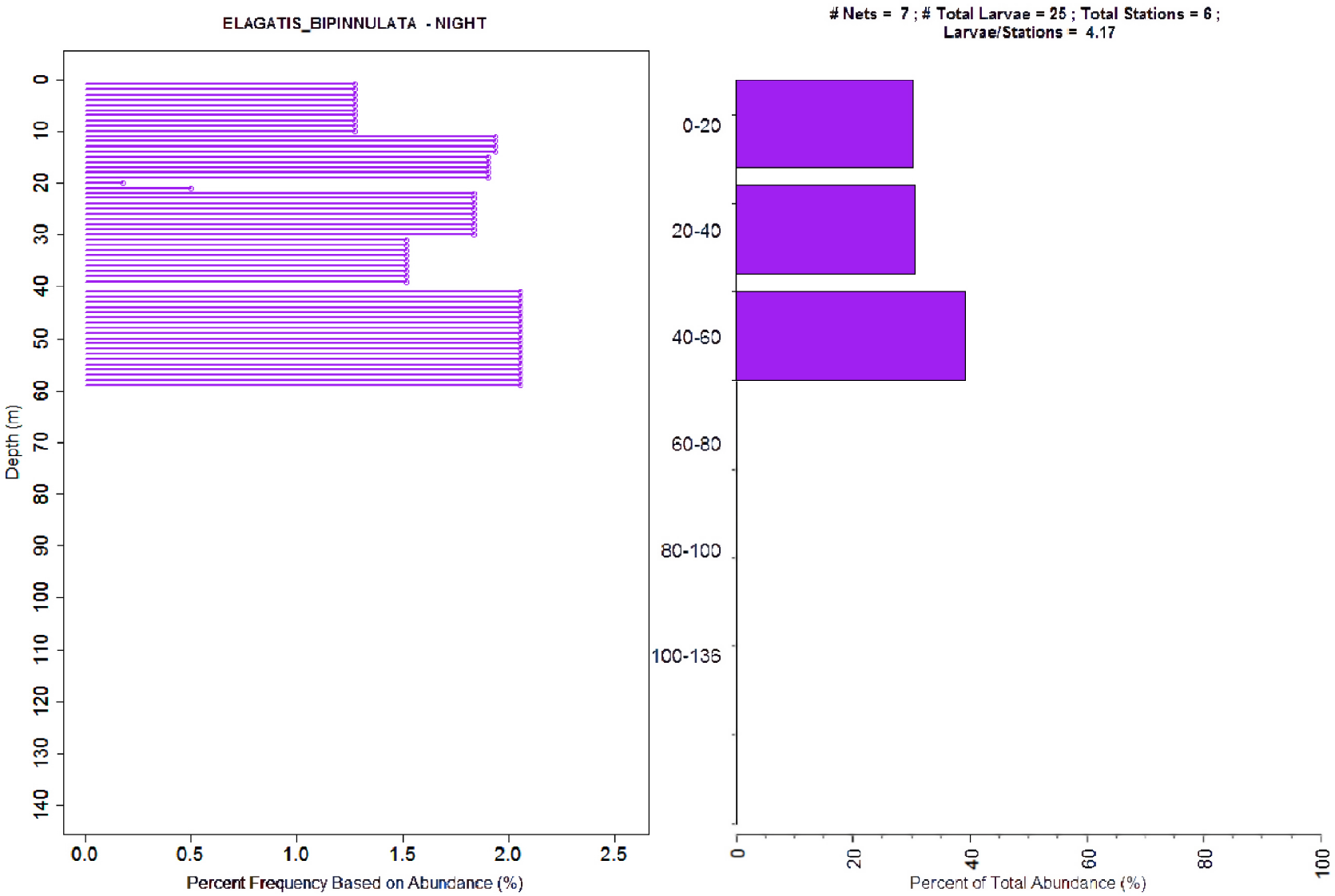
EGGS_D, DAY


EGGS_N - NIGHT
Nets = 206; # Total Eggs = 33086 ; Total Stations = 38 ;
Eggs/Stations = 870.68
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

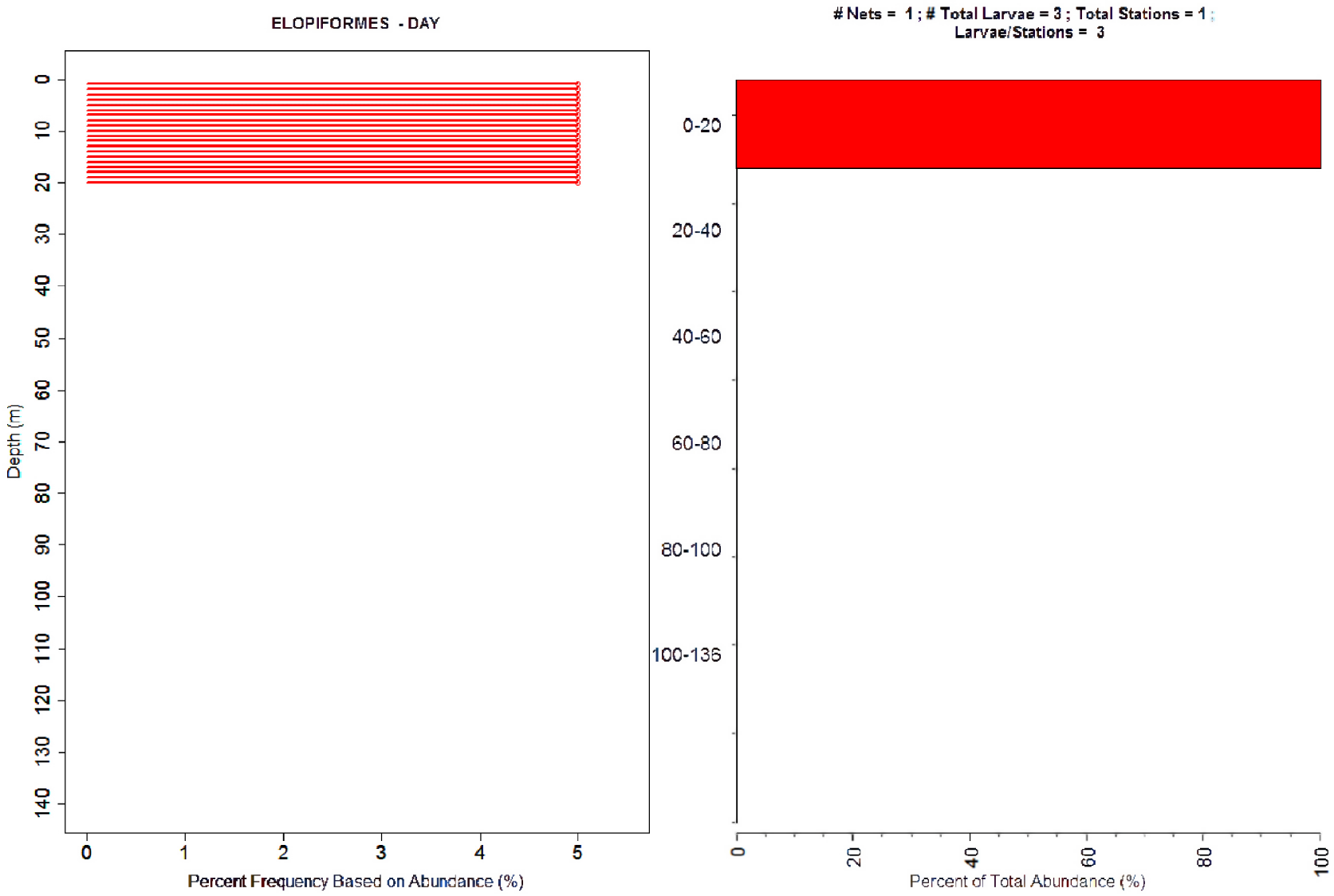
EGGS_N, NIGHT



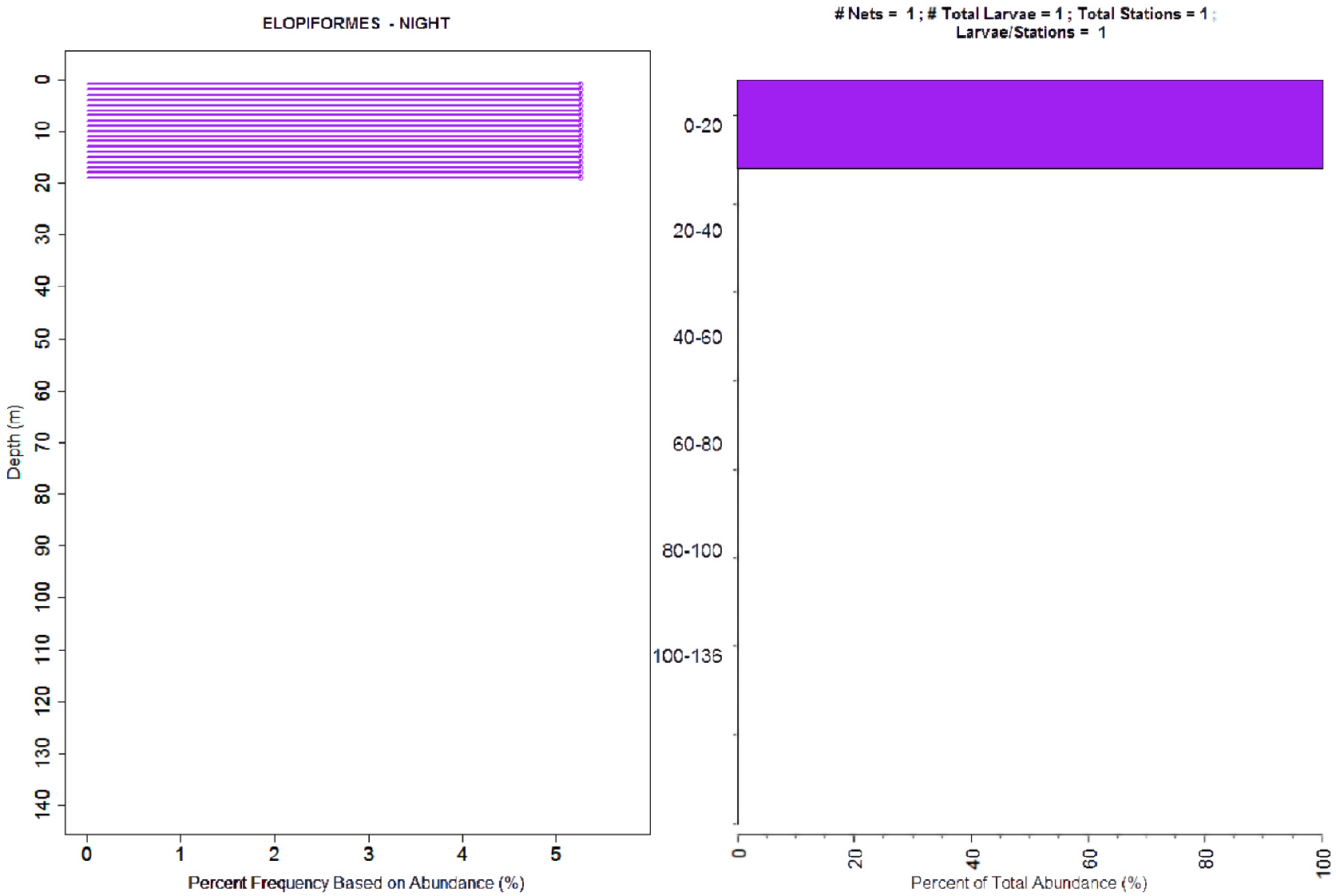
ELAGATIS_BIPINNULATA, DAY



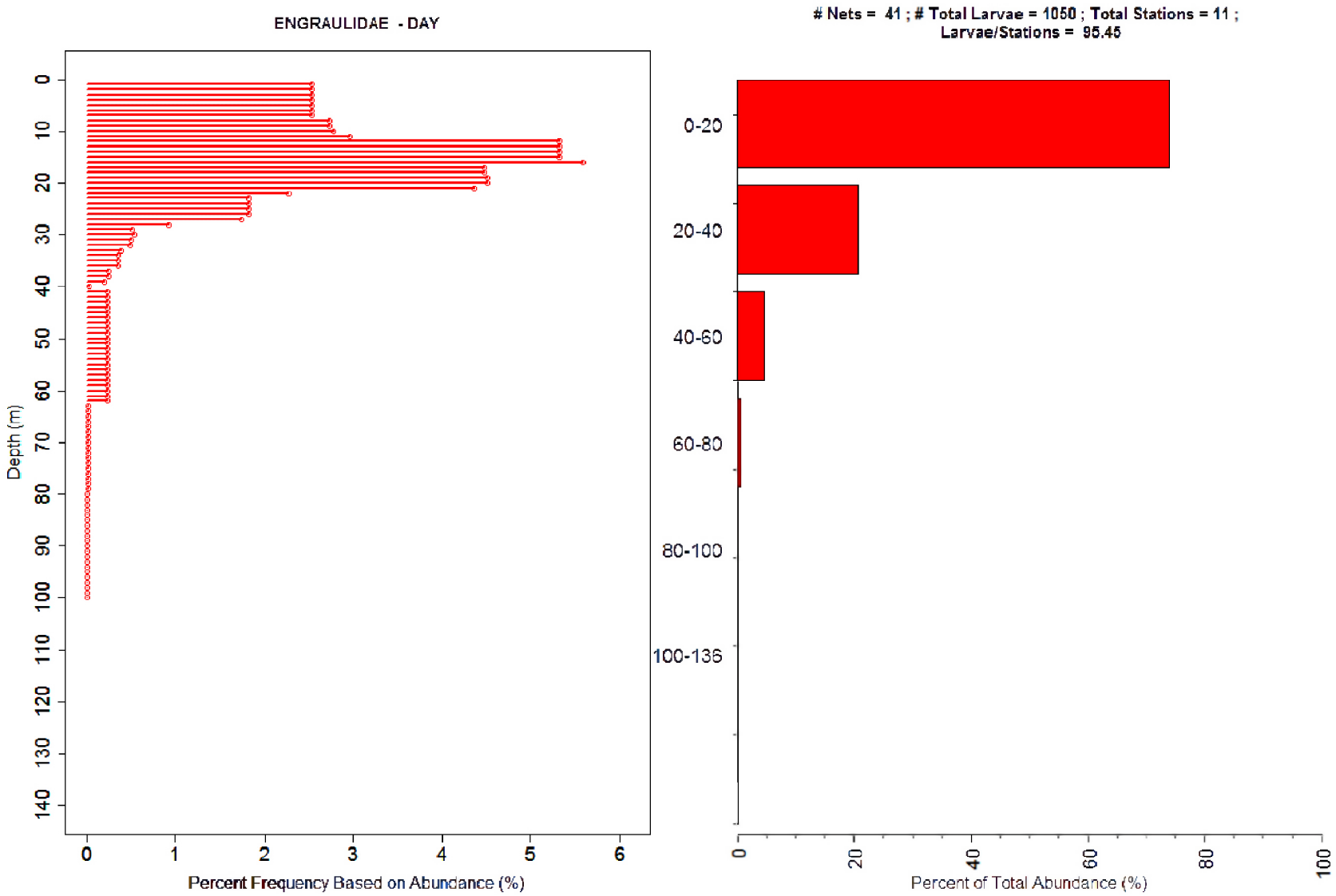
ELAGATIS_BIPINNULATA, NIGHT



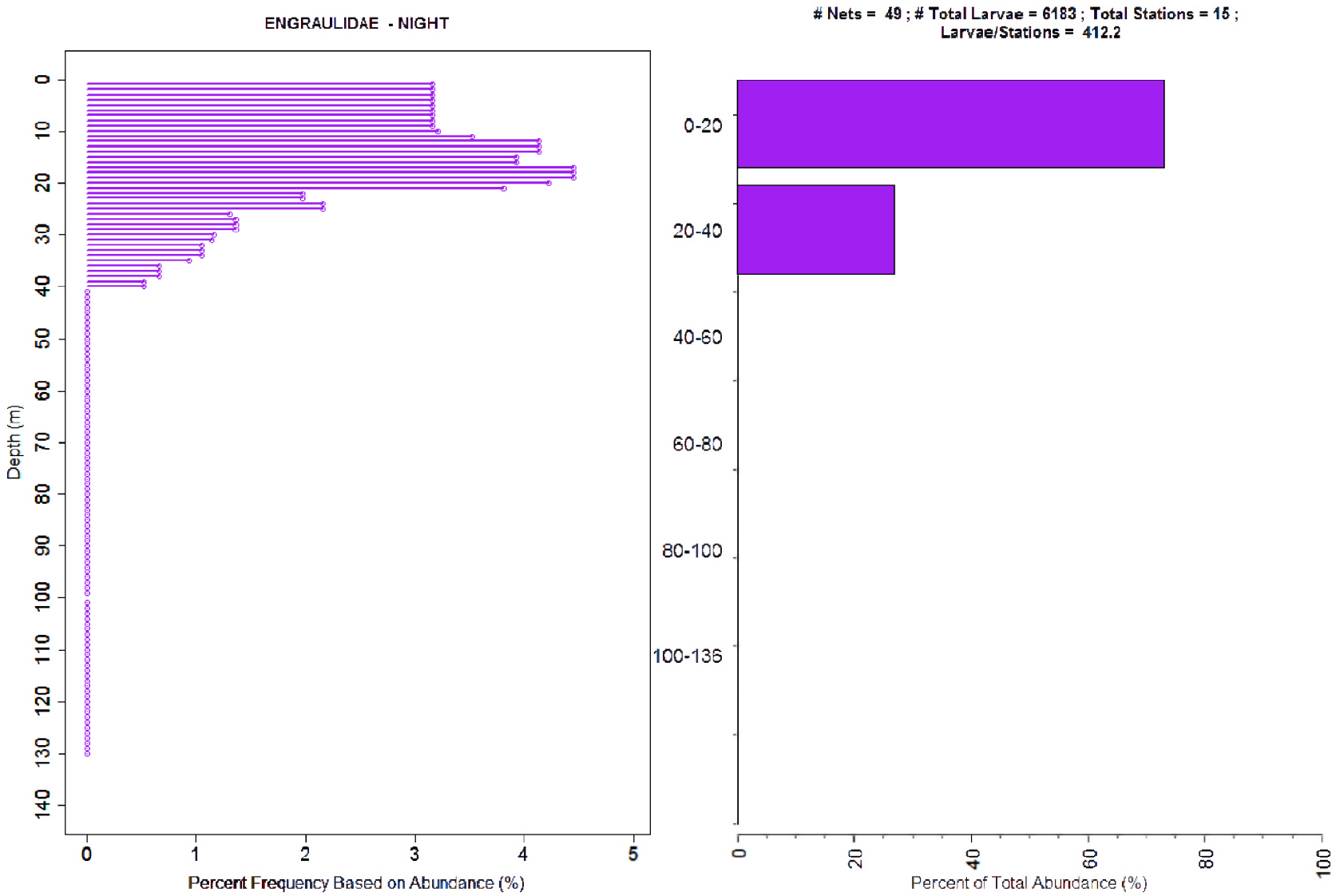
ELOPIFORMES, DAY



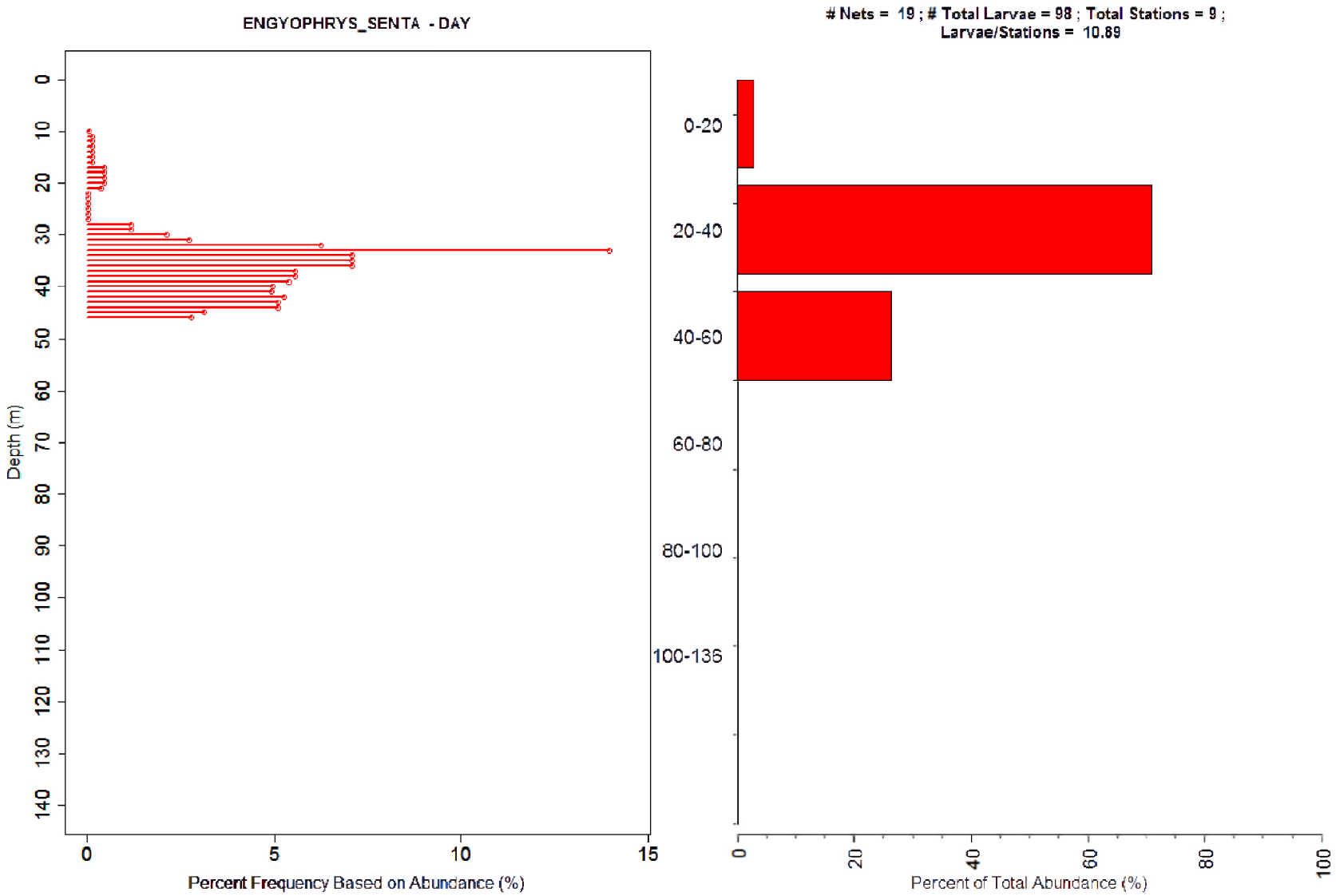
ELOPIFORMES, NIGHT



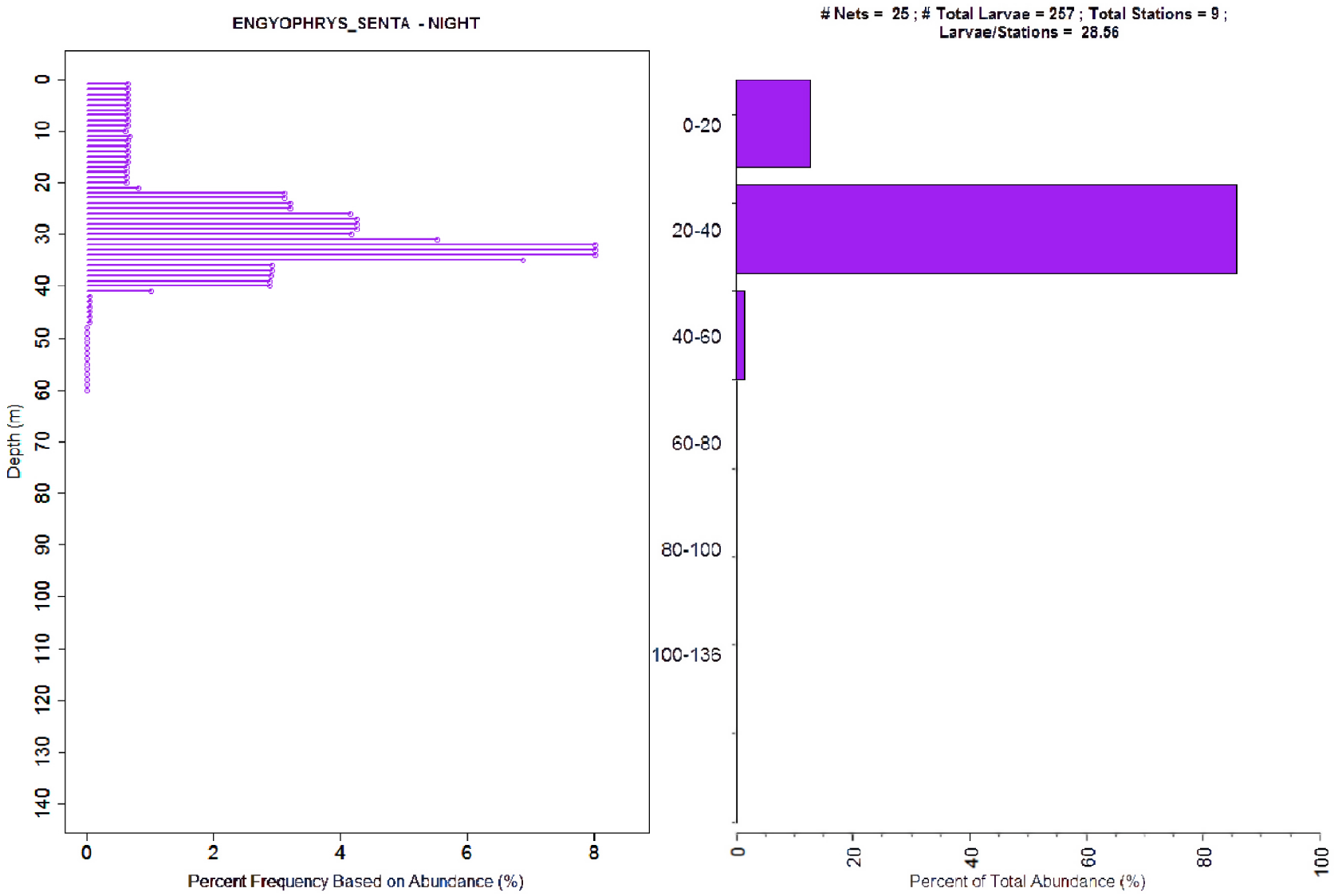
ENGRAULIDAE, DAY



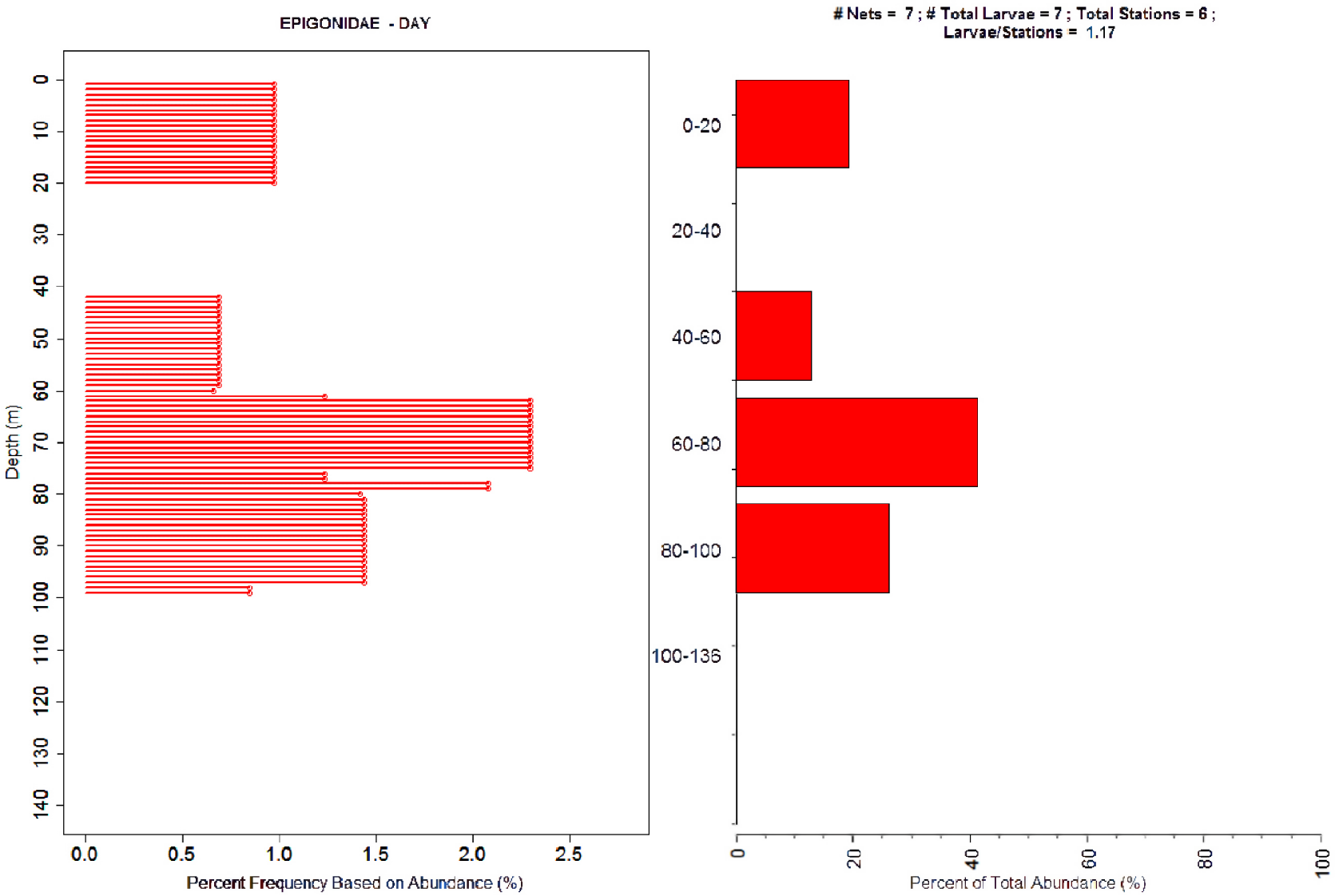
ENGRAULIDAE, NIGHT



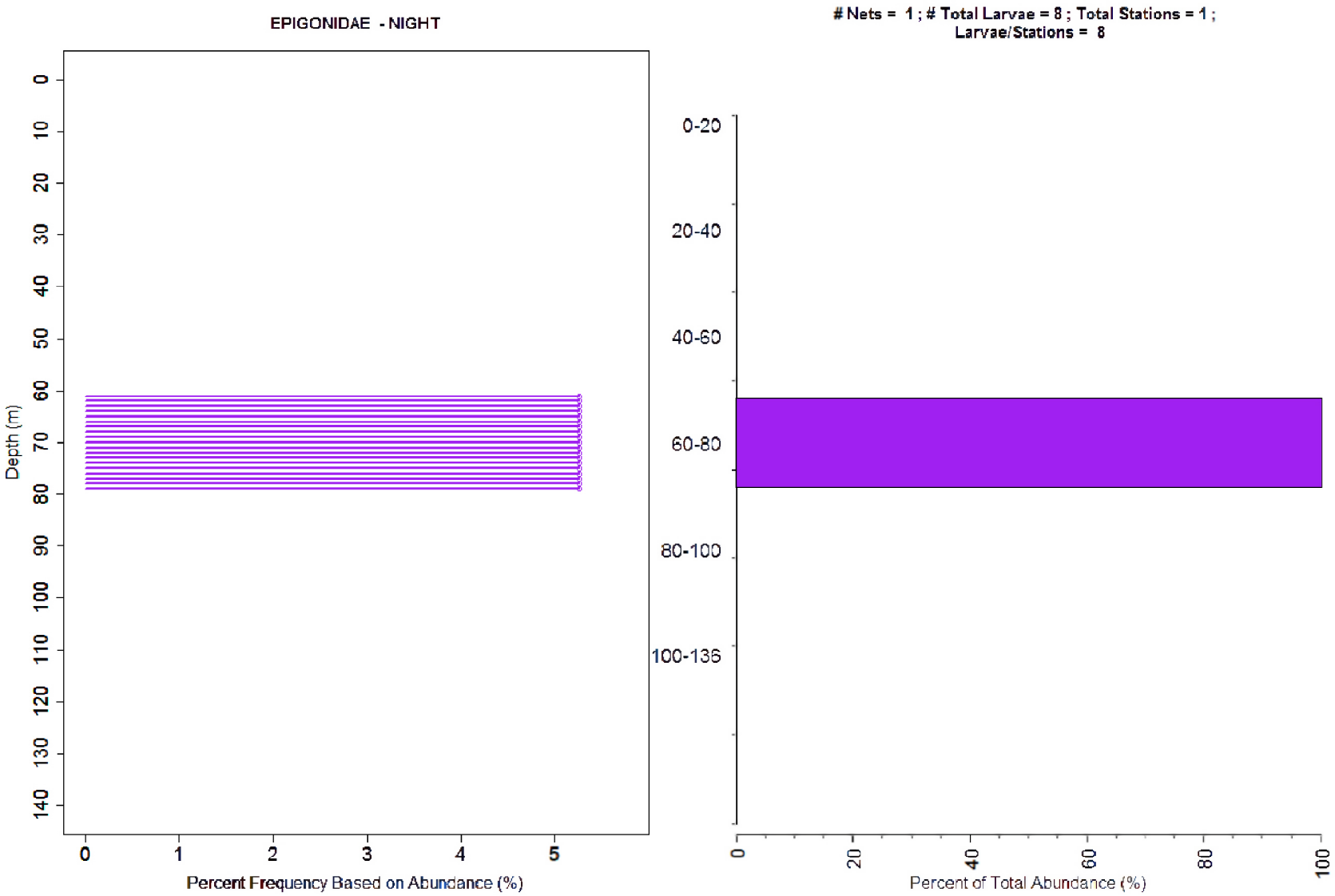
ENGYOPHRYS_SENTA, DAY



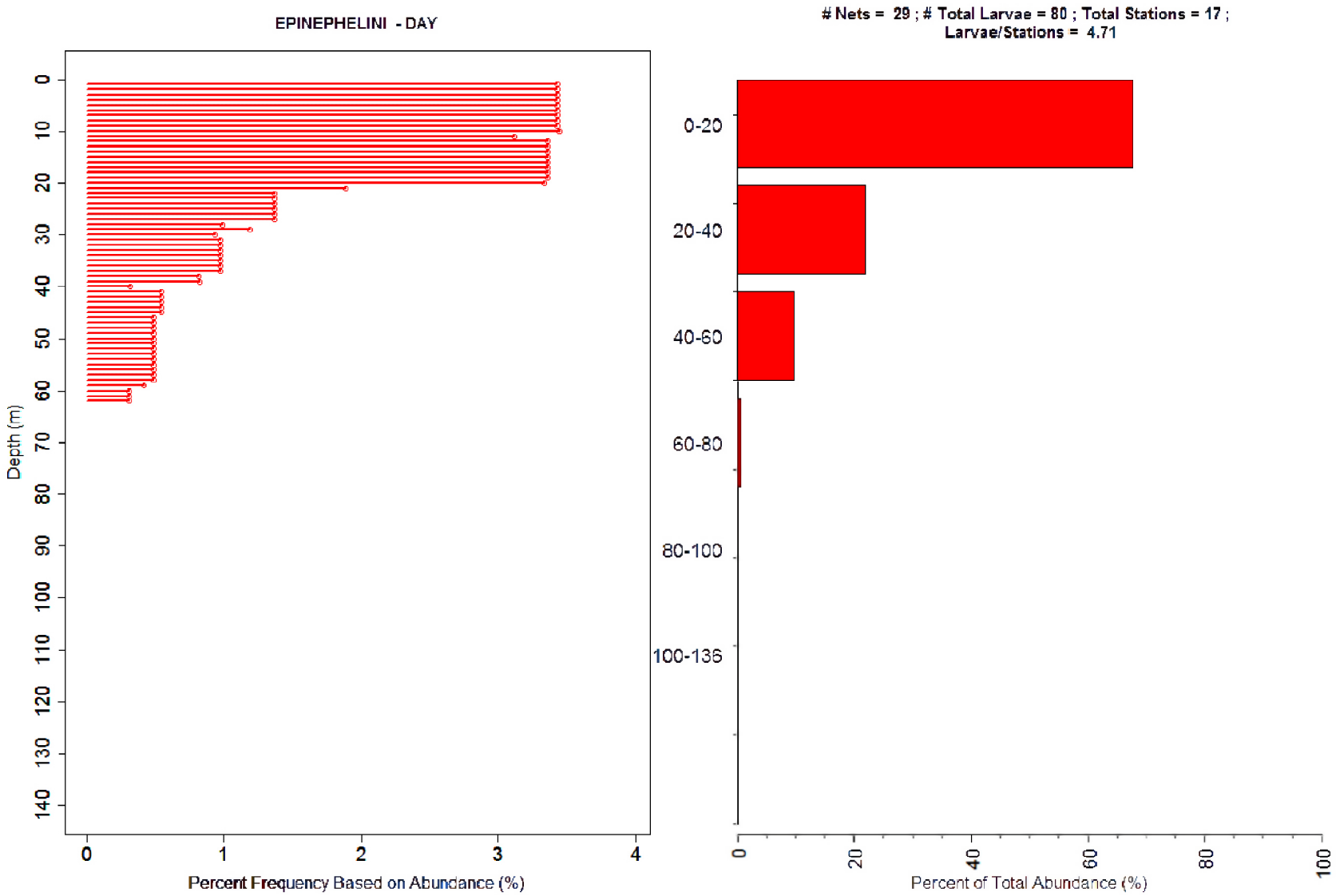
ENGYOPHRYS_SENTA, NIGHT



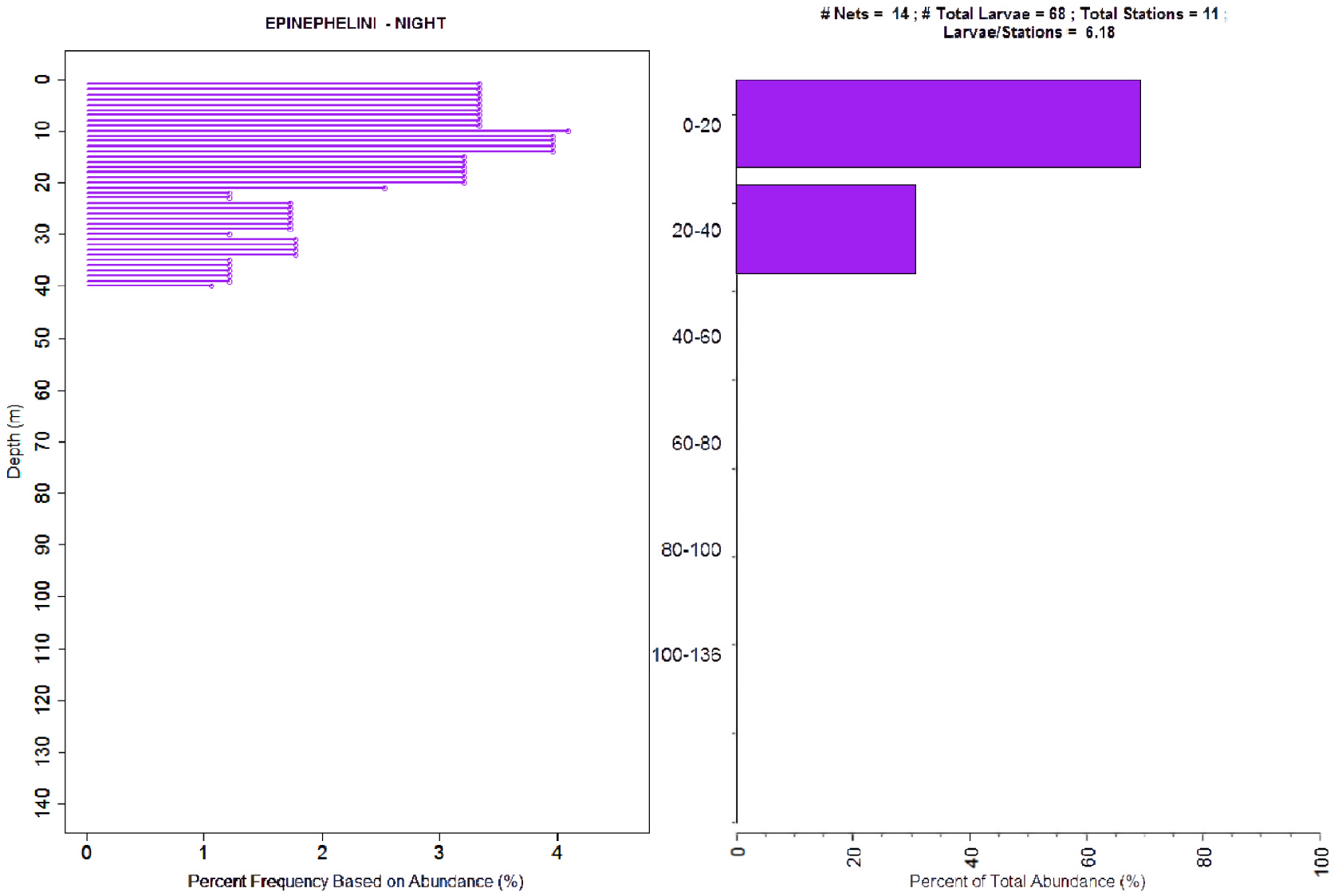
EPIGONIDAE, DAY



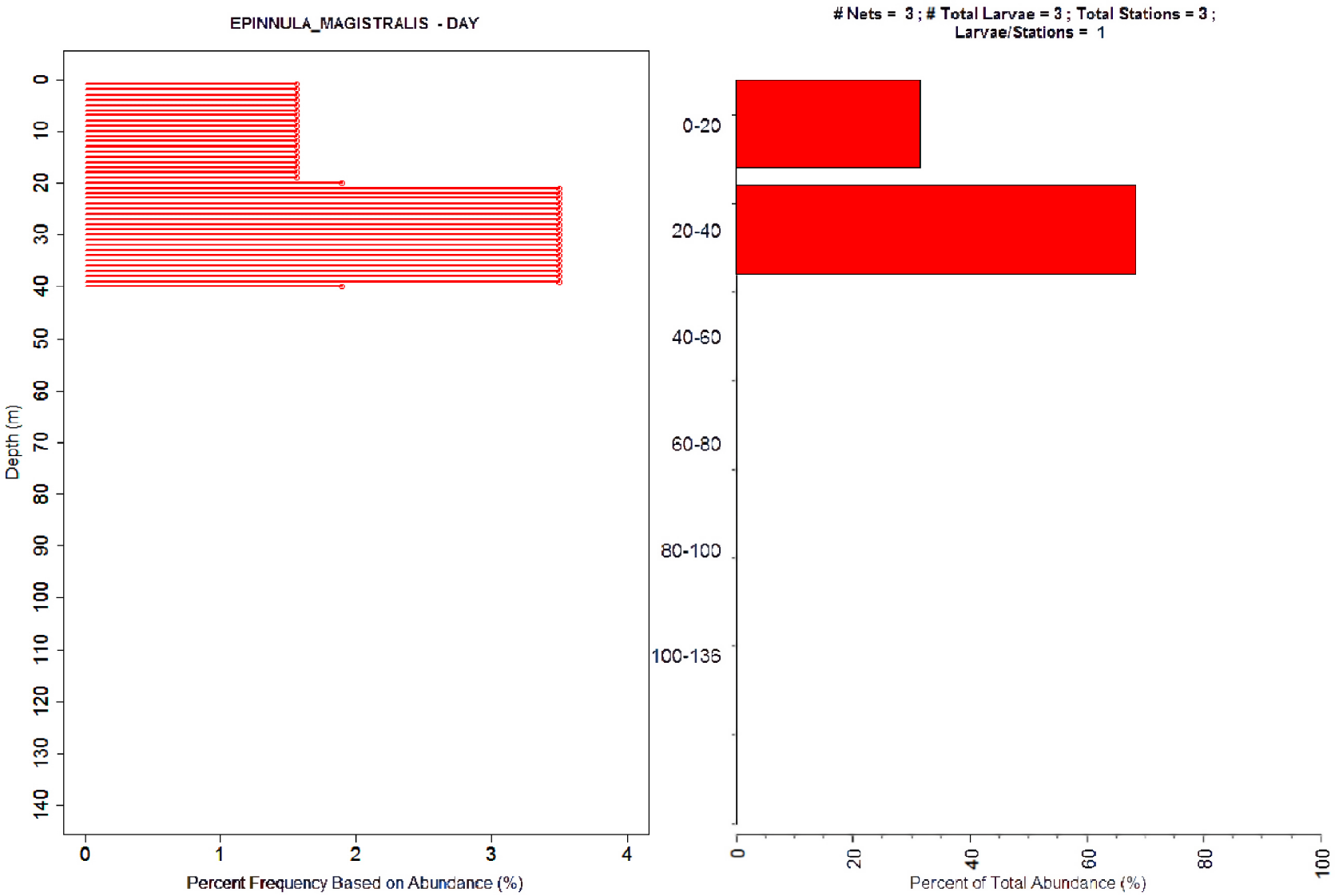
EPIGONIDAE, NIGHT



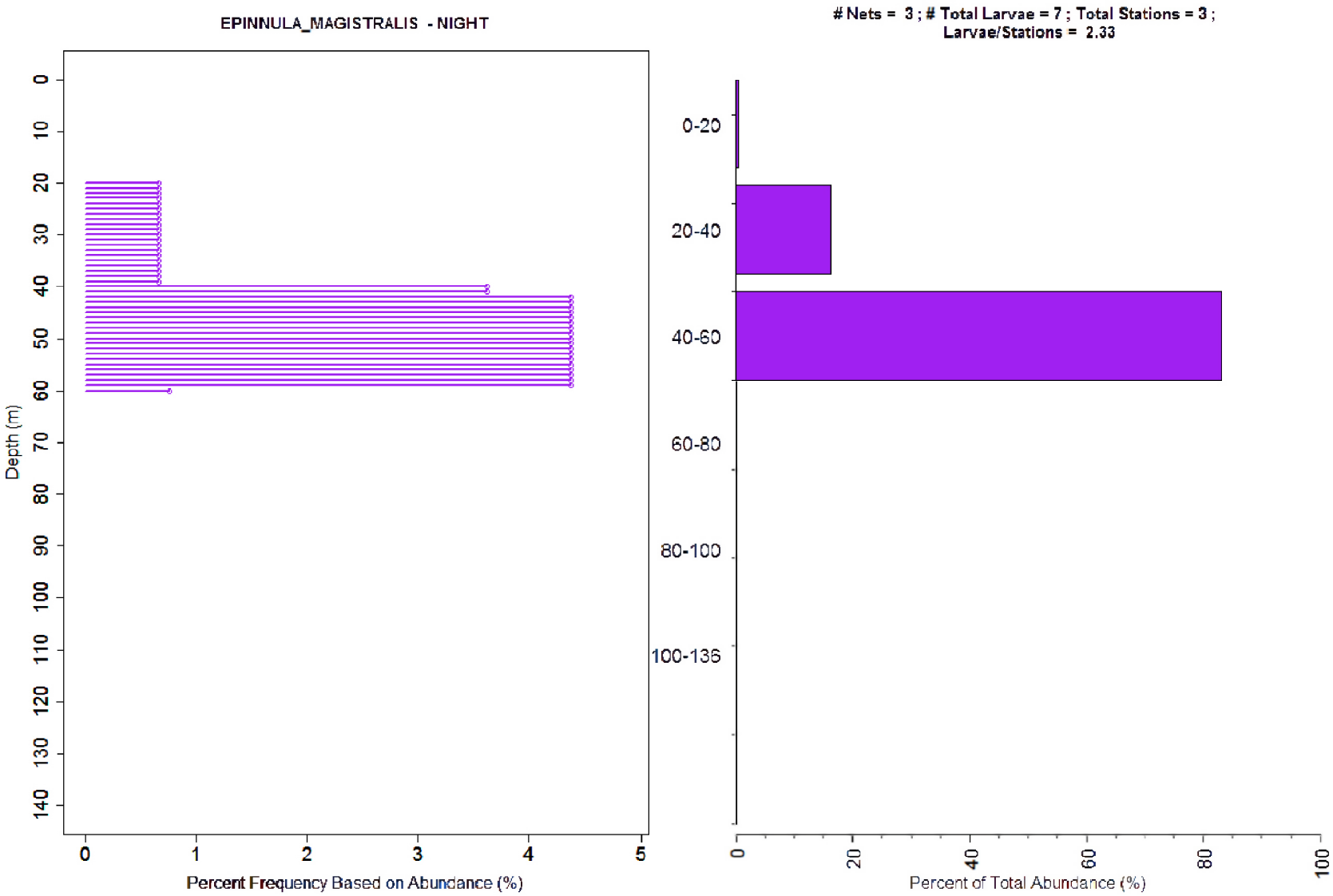
EPINEPHELINI, DAY



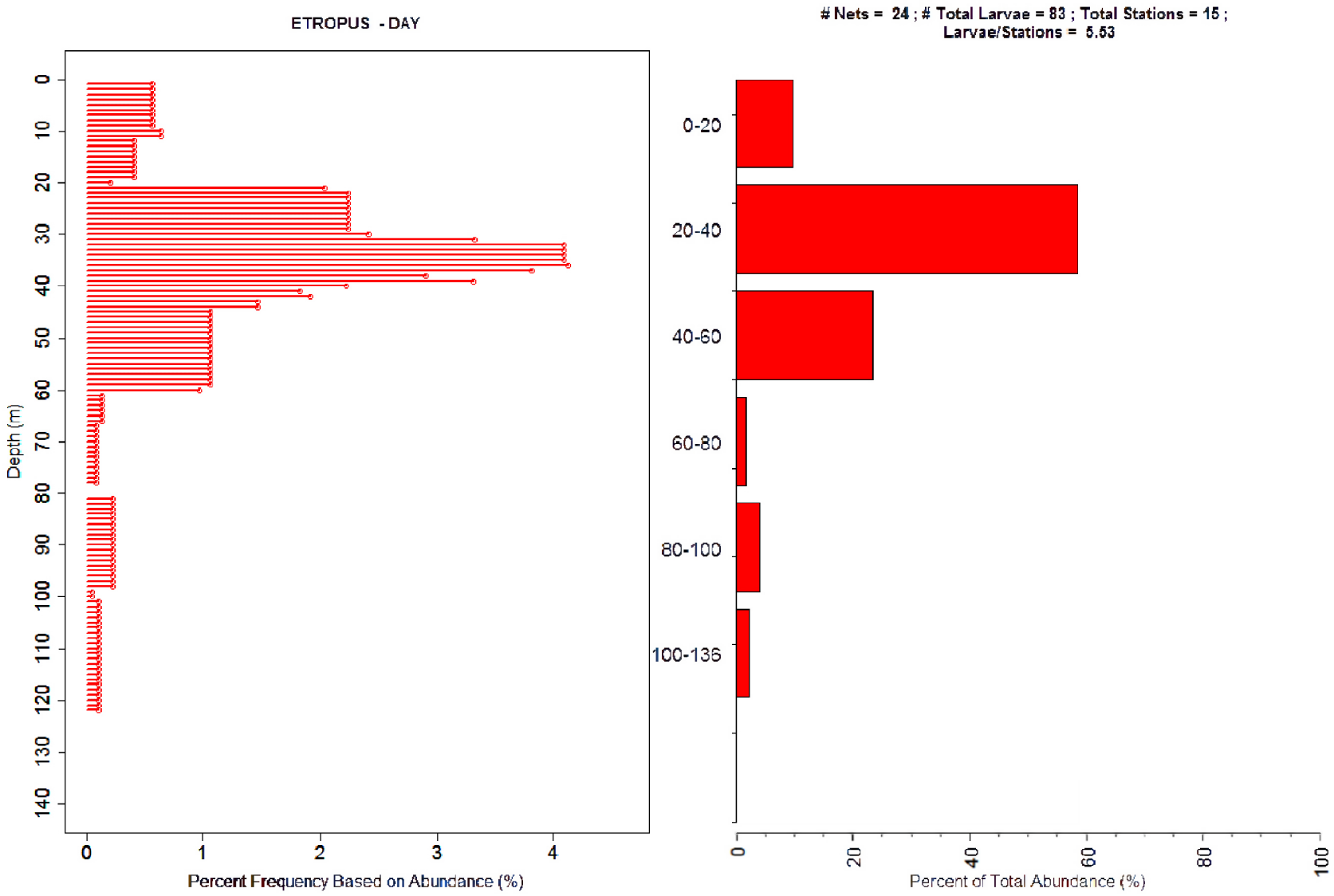
EPINEPHELINI, NIGHT



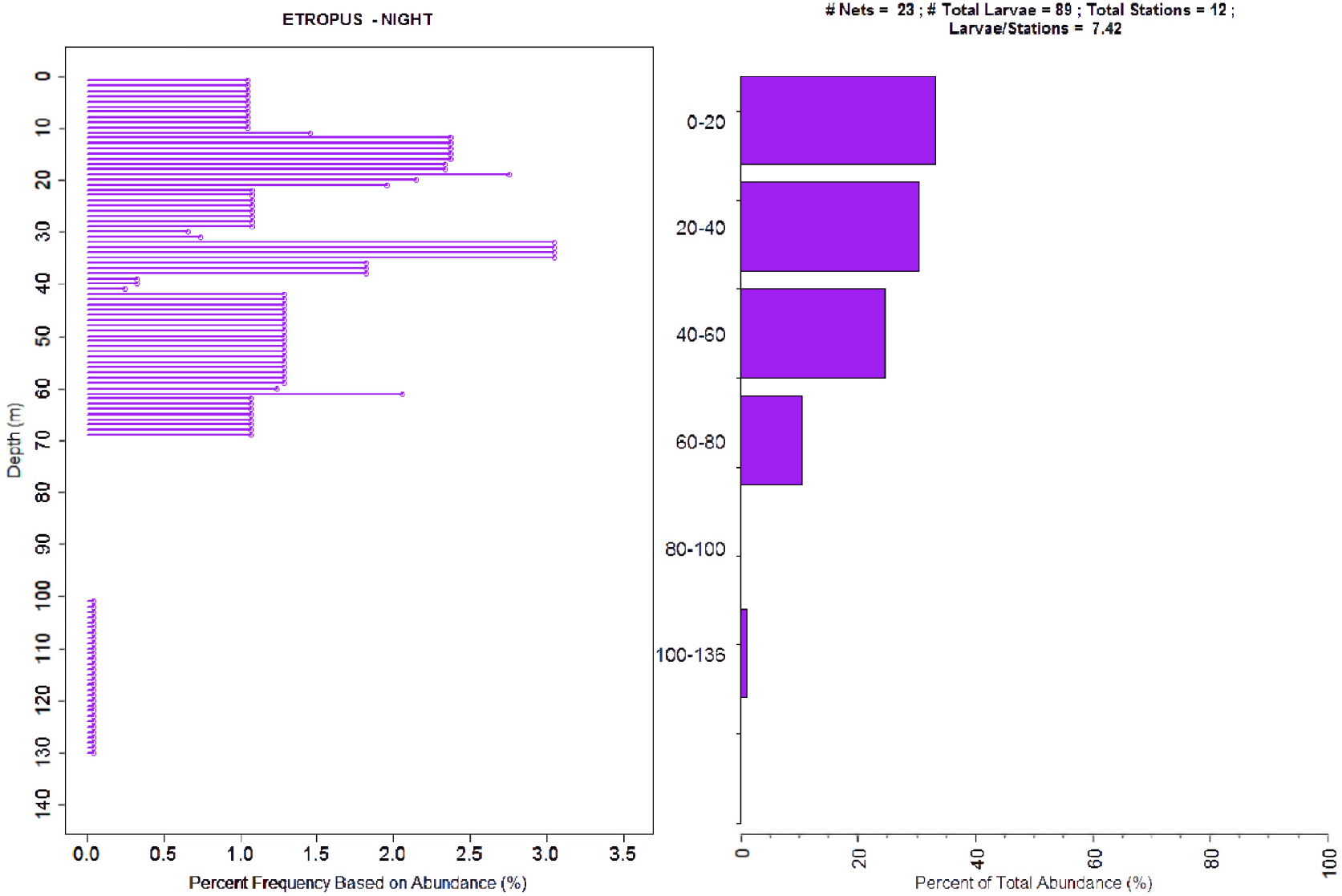
EPINNULA_MAGISTRALIS, DAY



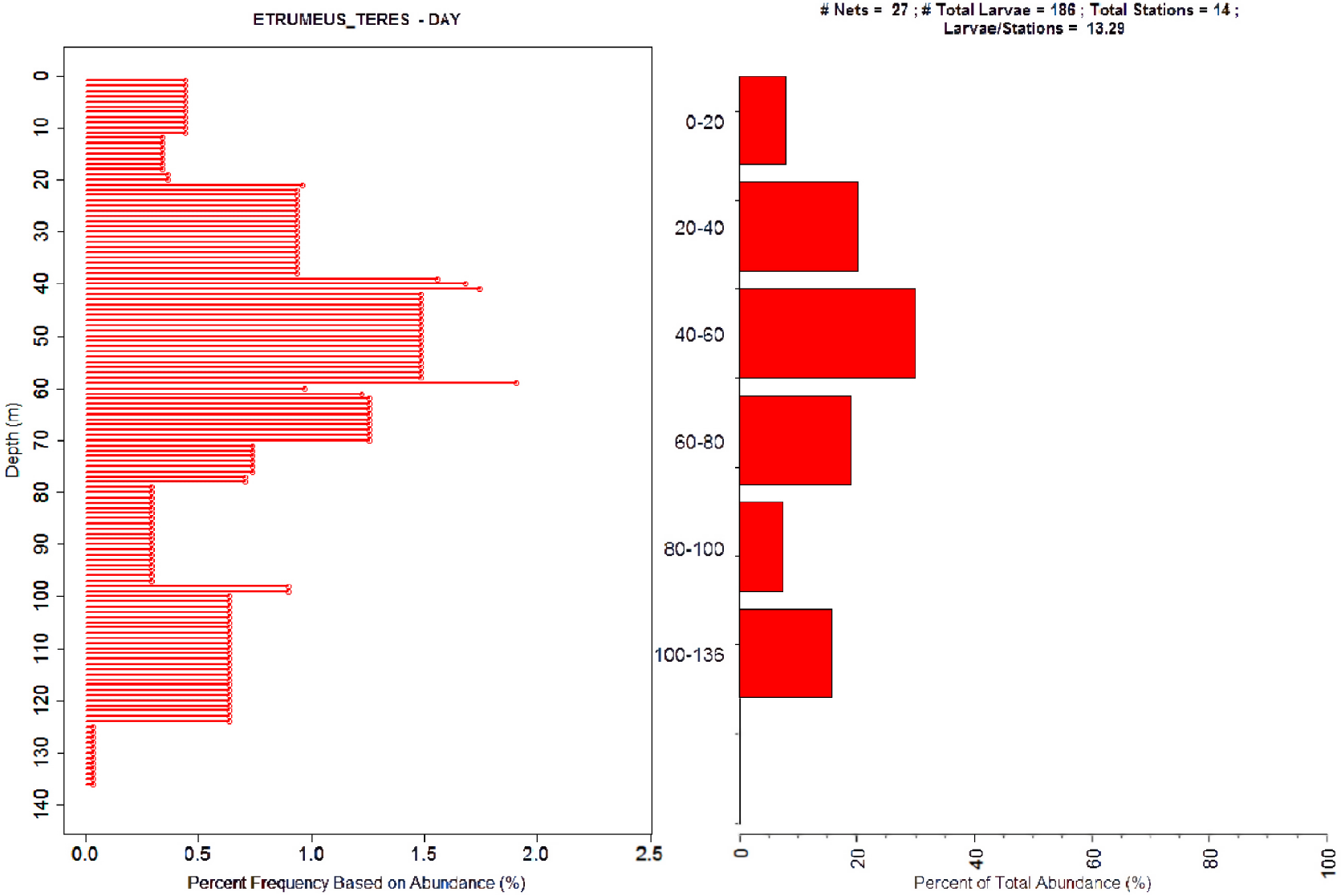
EPINNULA_MAGISTRALIS, NIGHT


ETROPUS - DAY
Nets = 24 ; # Total Larvae = 83 ; Total Stations = 15 ;
Larvae/Stations = 5.53
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

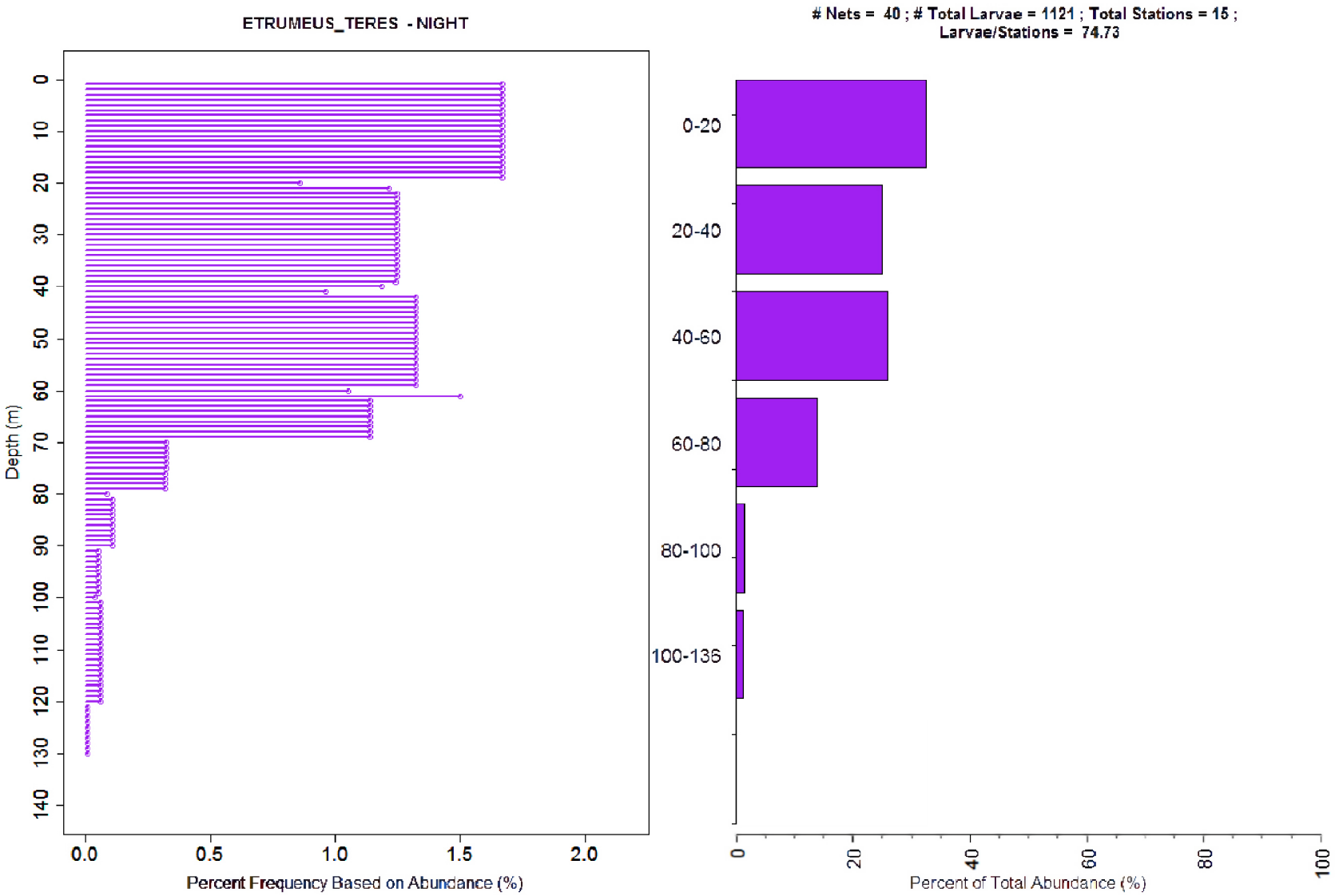
ETROPUS, DAY



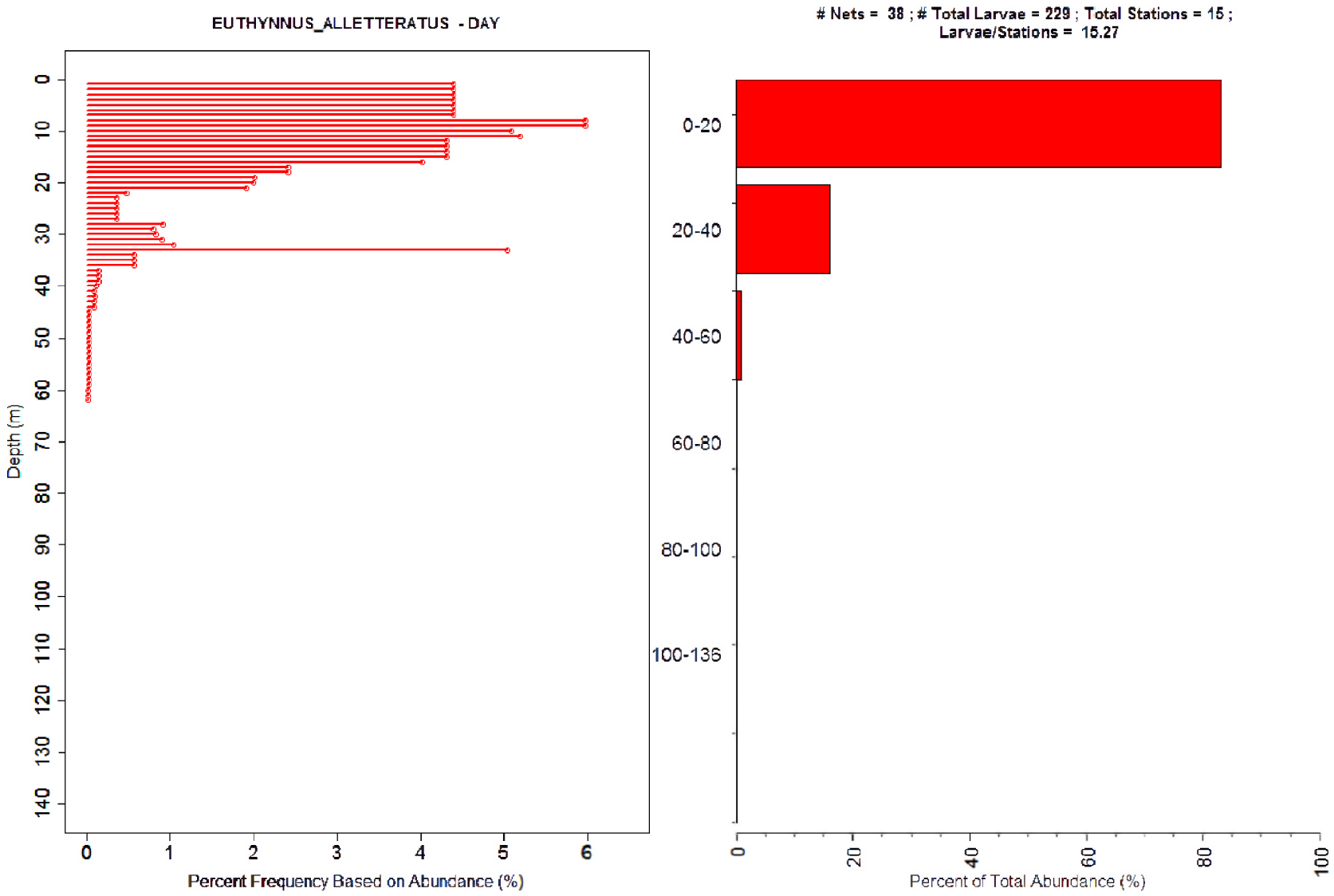
ETROPUS, NIGHT



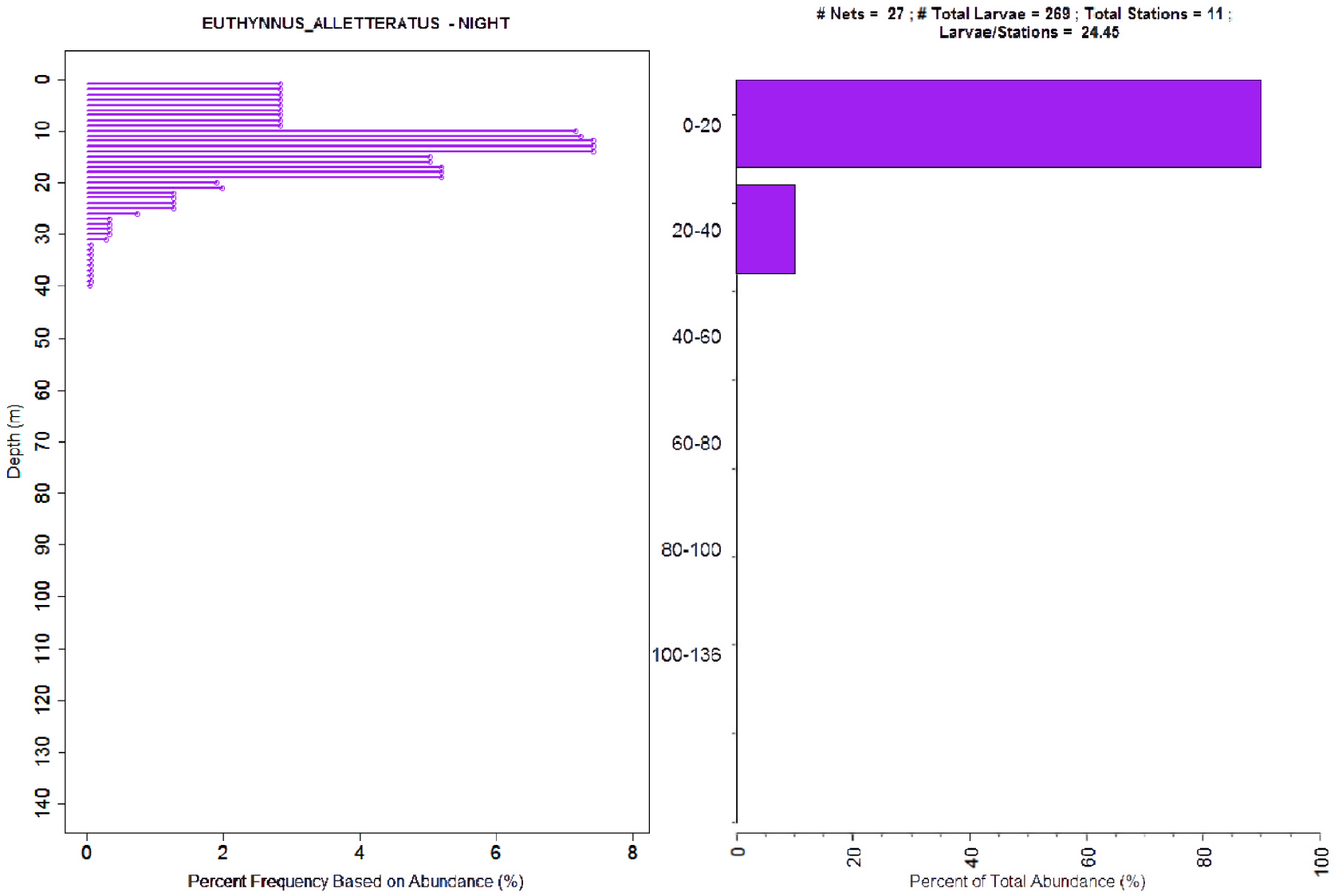
ETRUMEUS_TERES, DAY



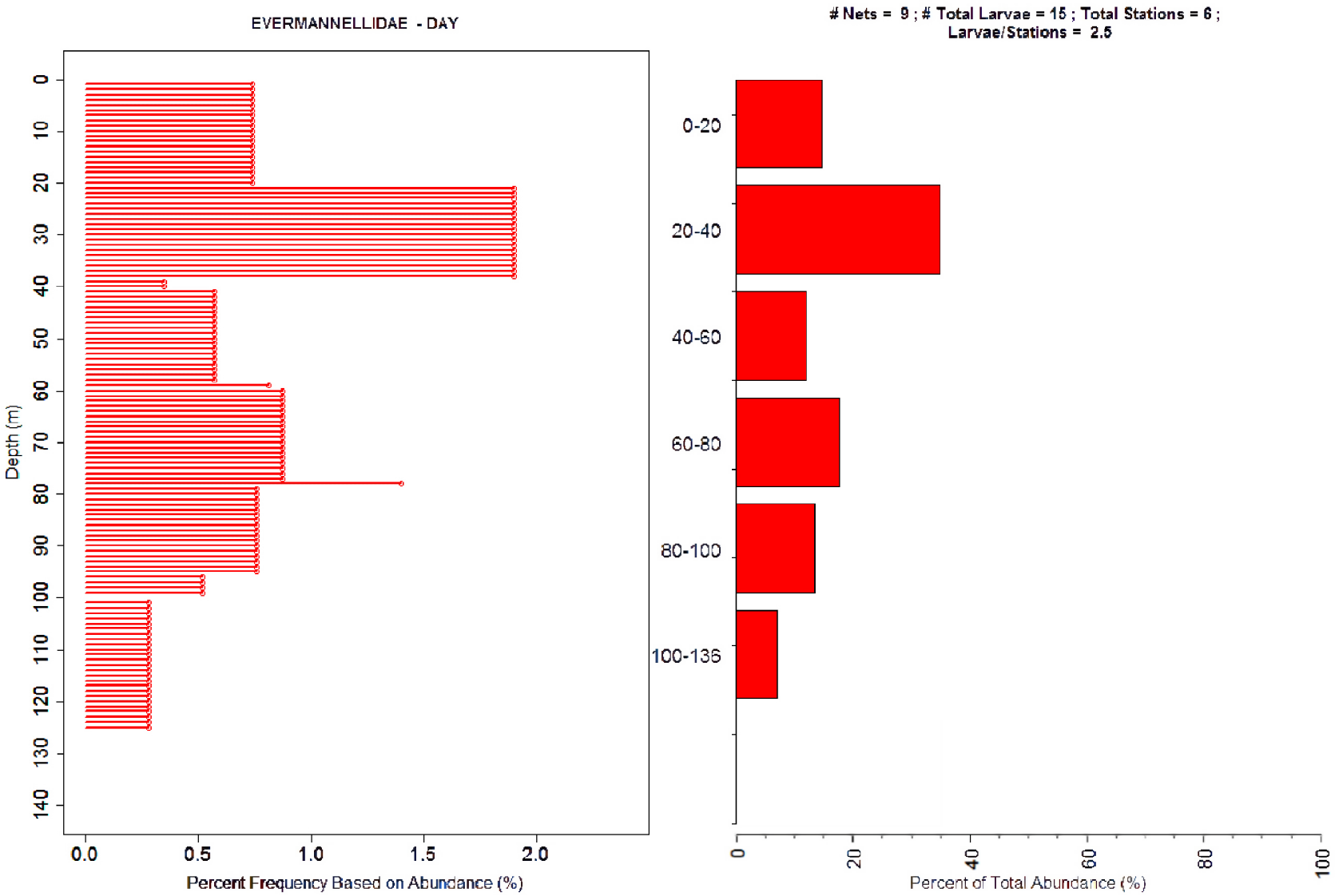
ETRUMEUS_TERES, NIGHT



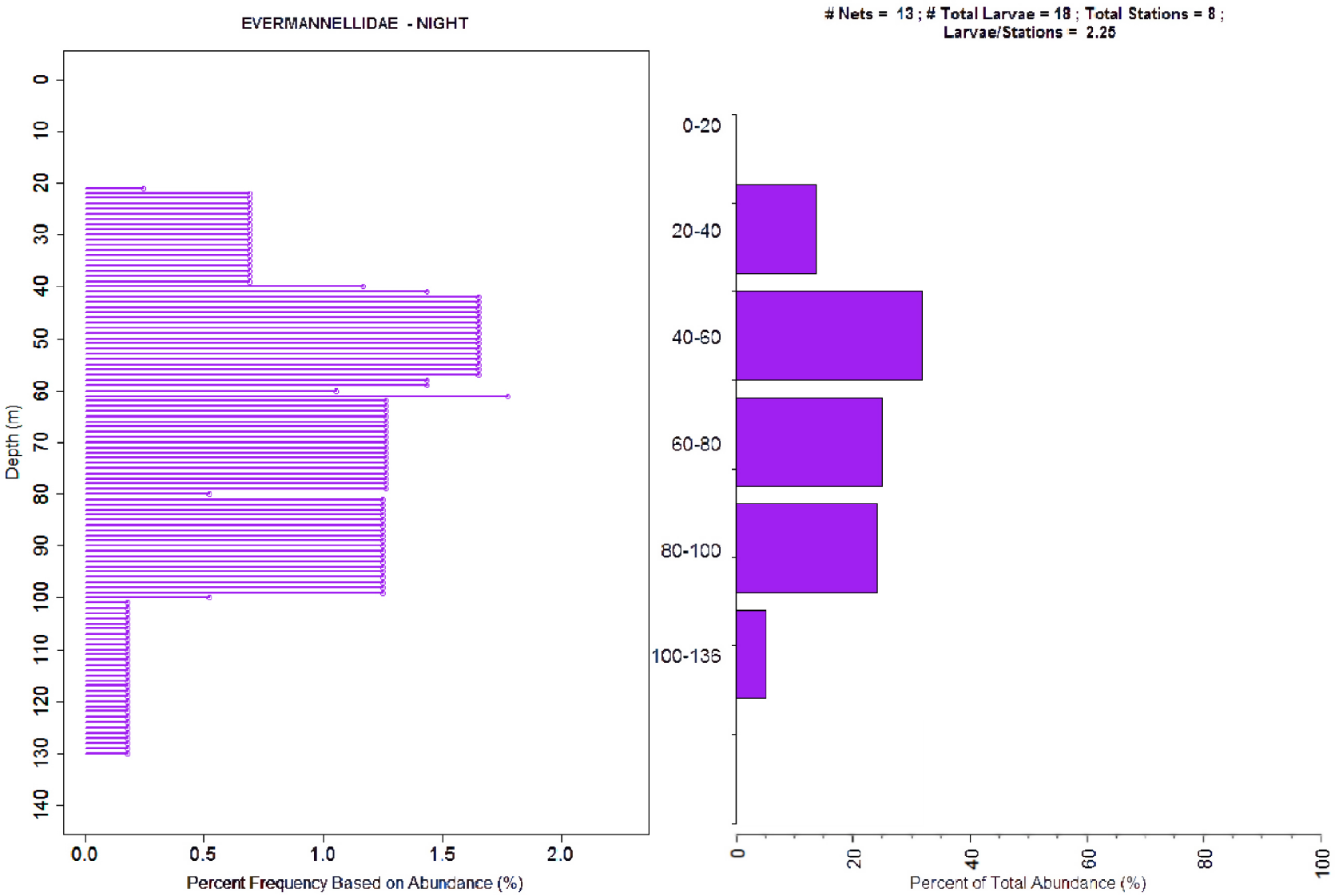
EUTHYNNUS_ALLETTERATUS, DAY



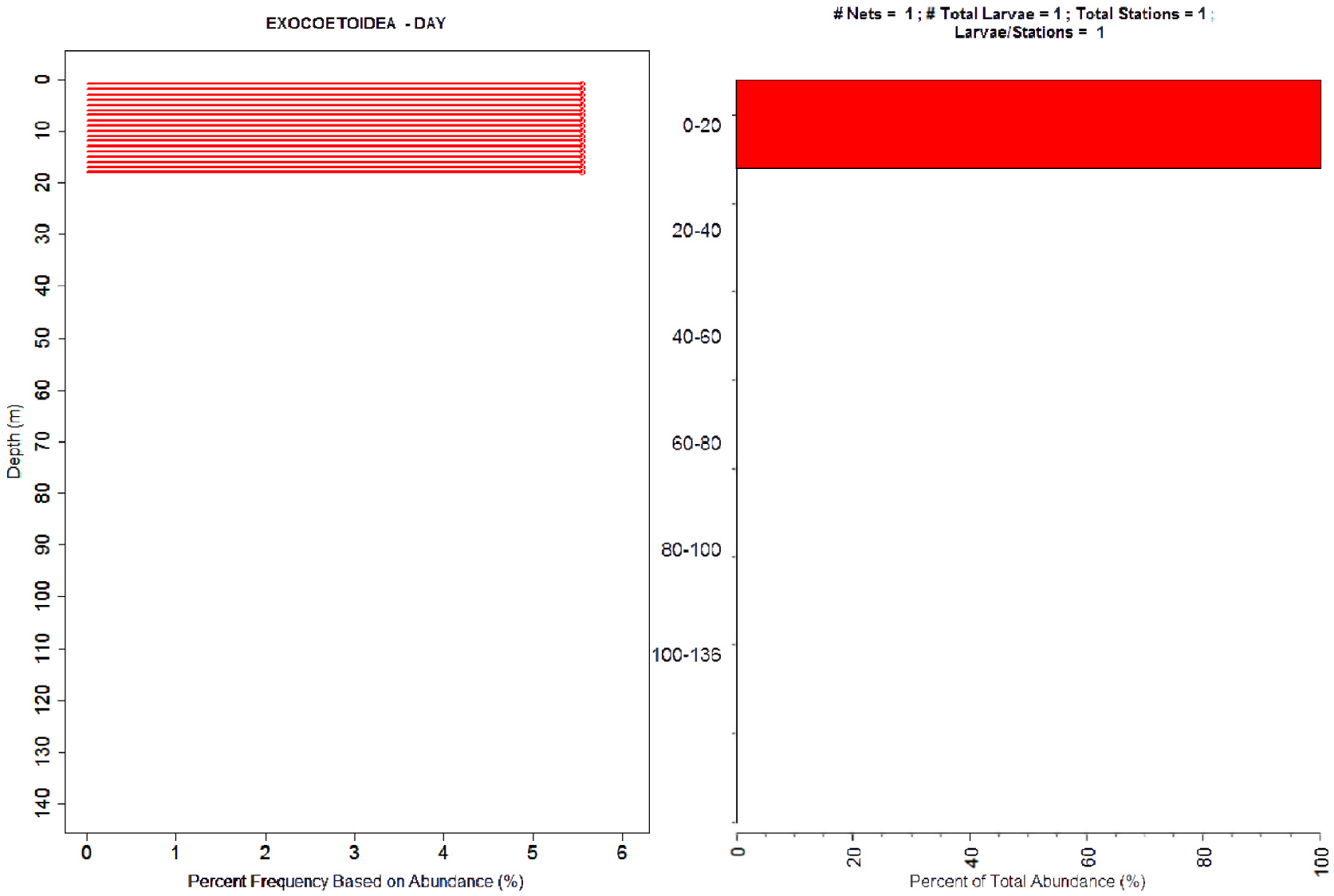
EUTHYNNUS_ALLETTERATUS, NIGHT



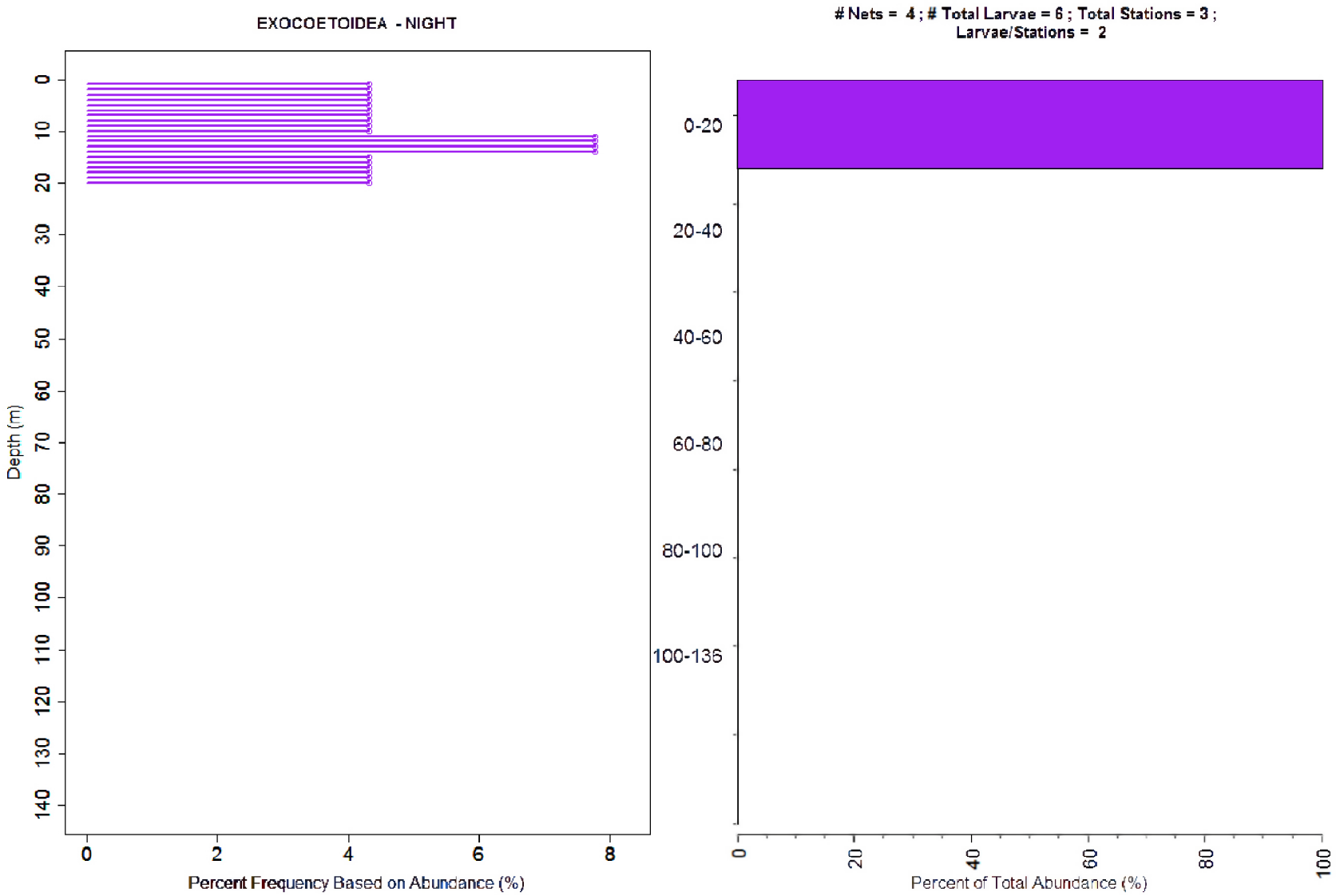
EVERMANNELLIDAE, DAY



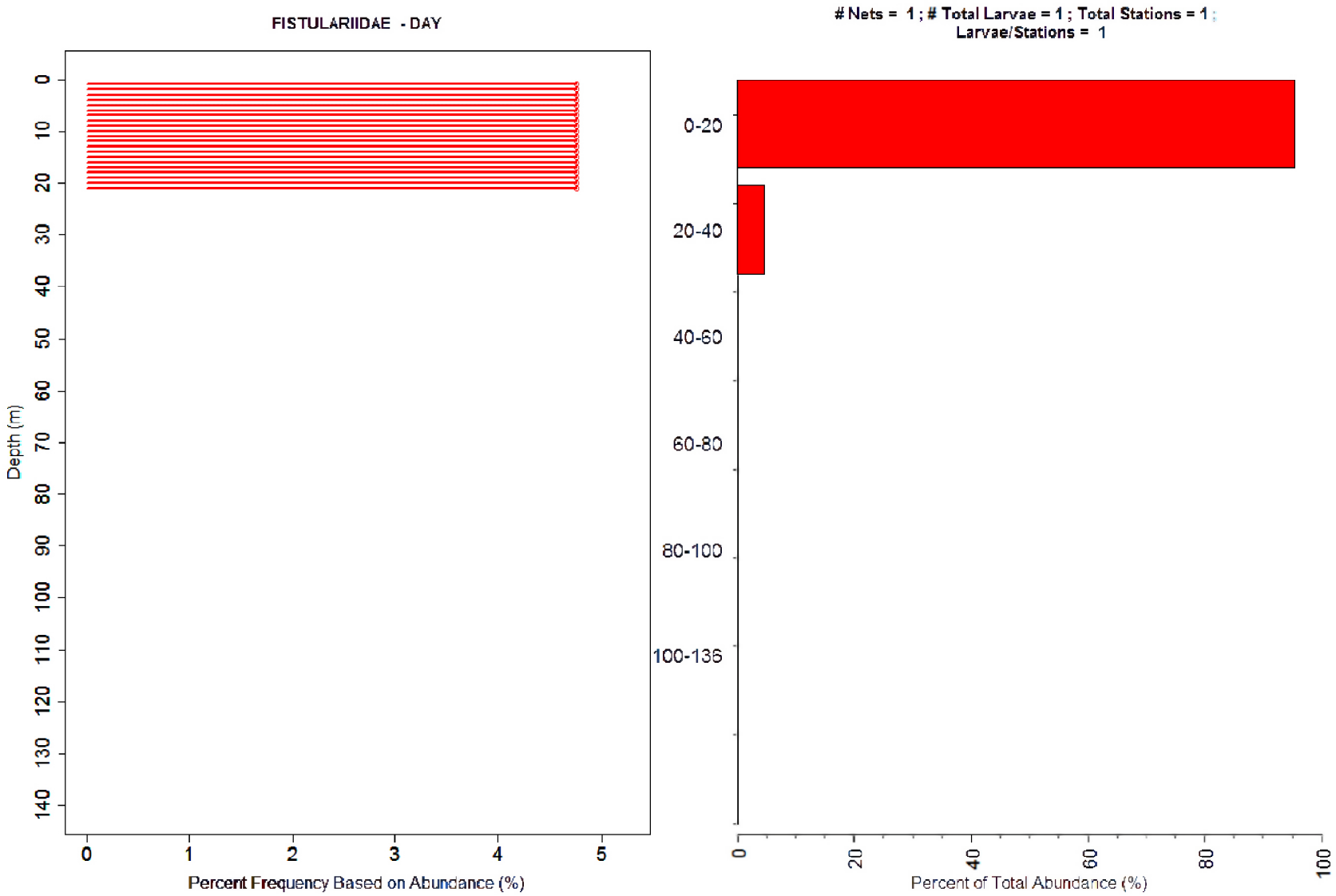
EVERMANNELLIDAE, NIGHT



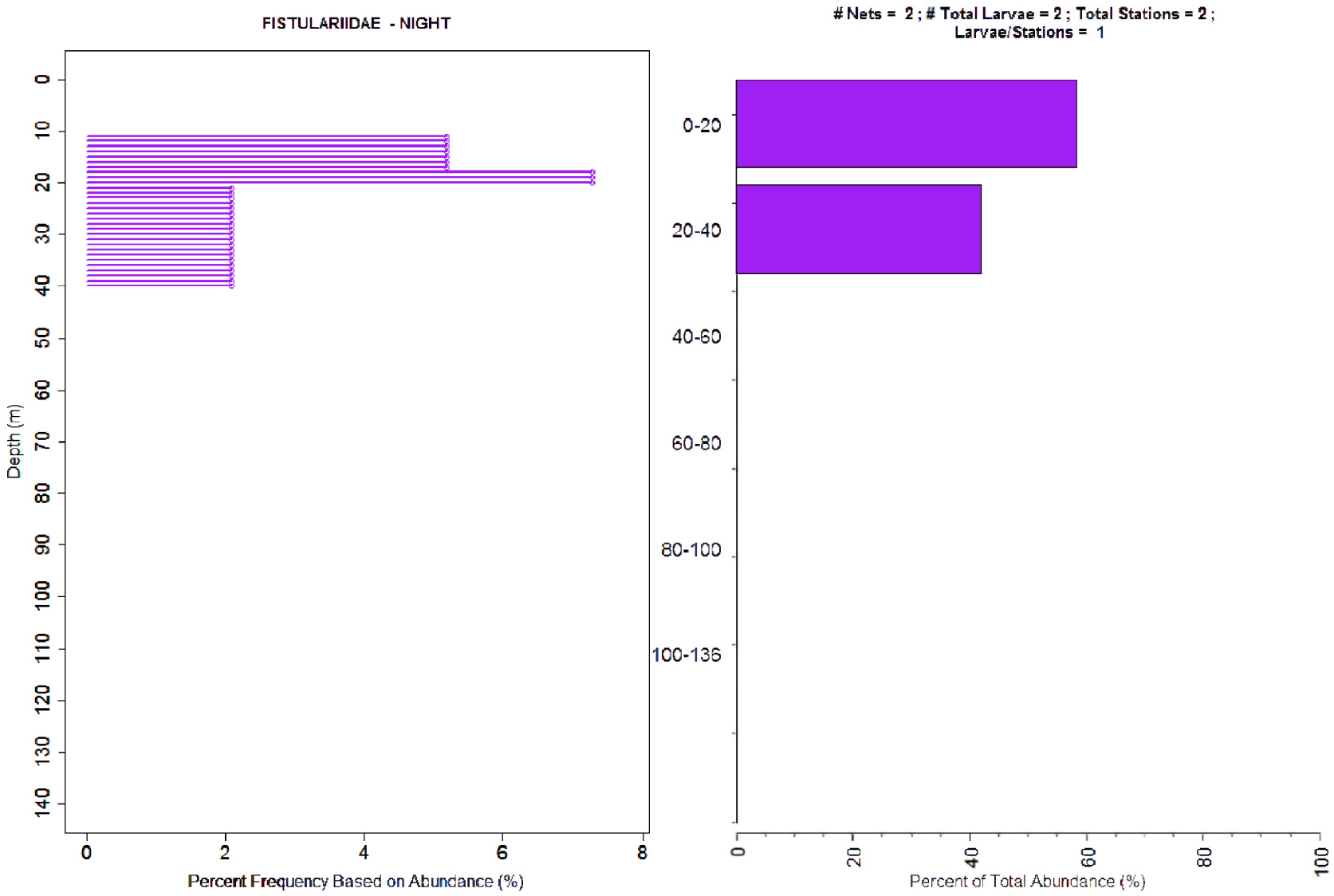
EXOCOETOIDEA, DAY



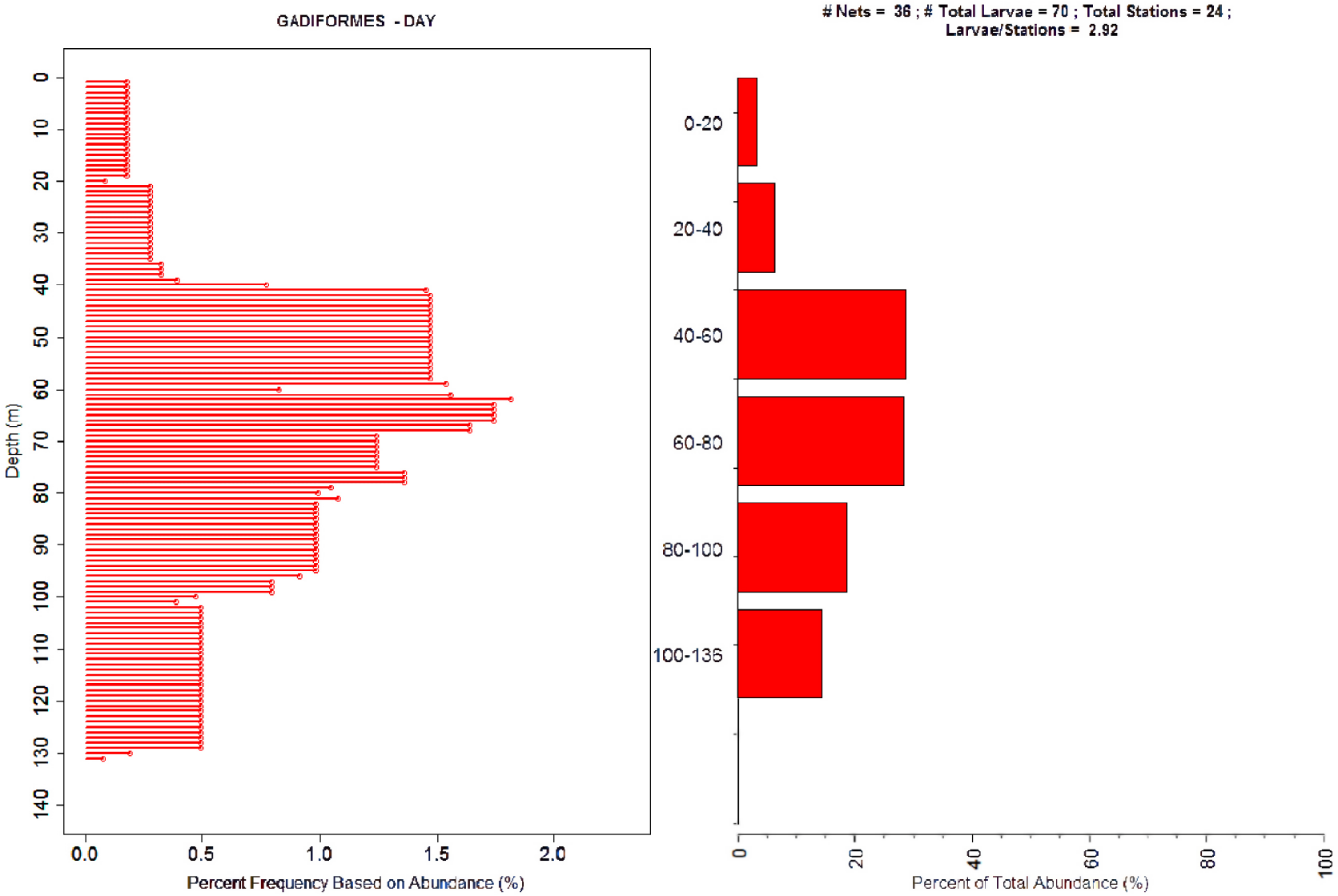
EXOCOETOIDEA, NIGHT



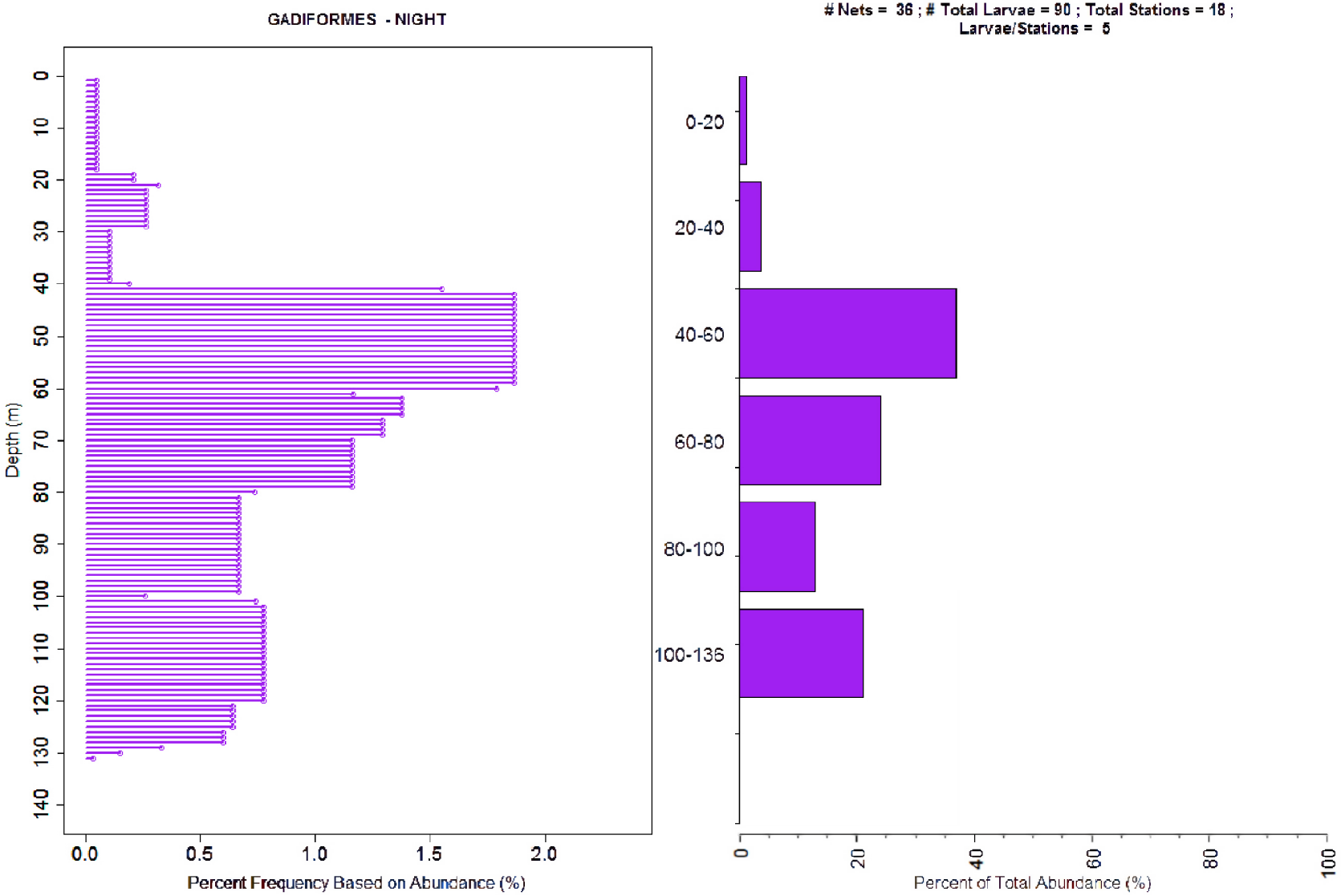
FISTULARIIDAE, DAY



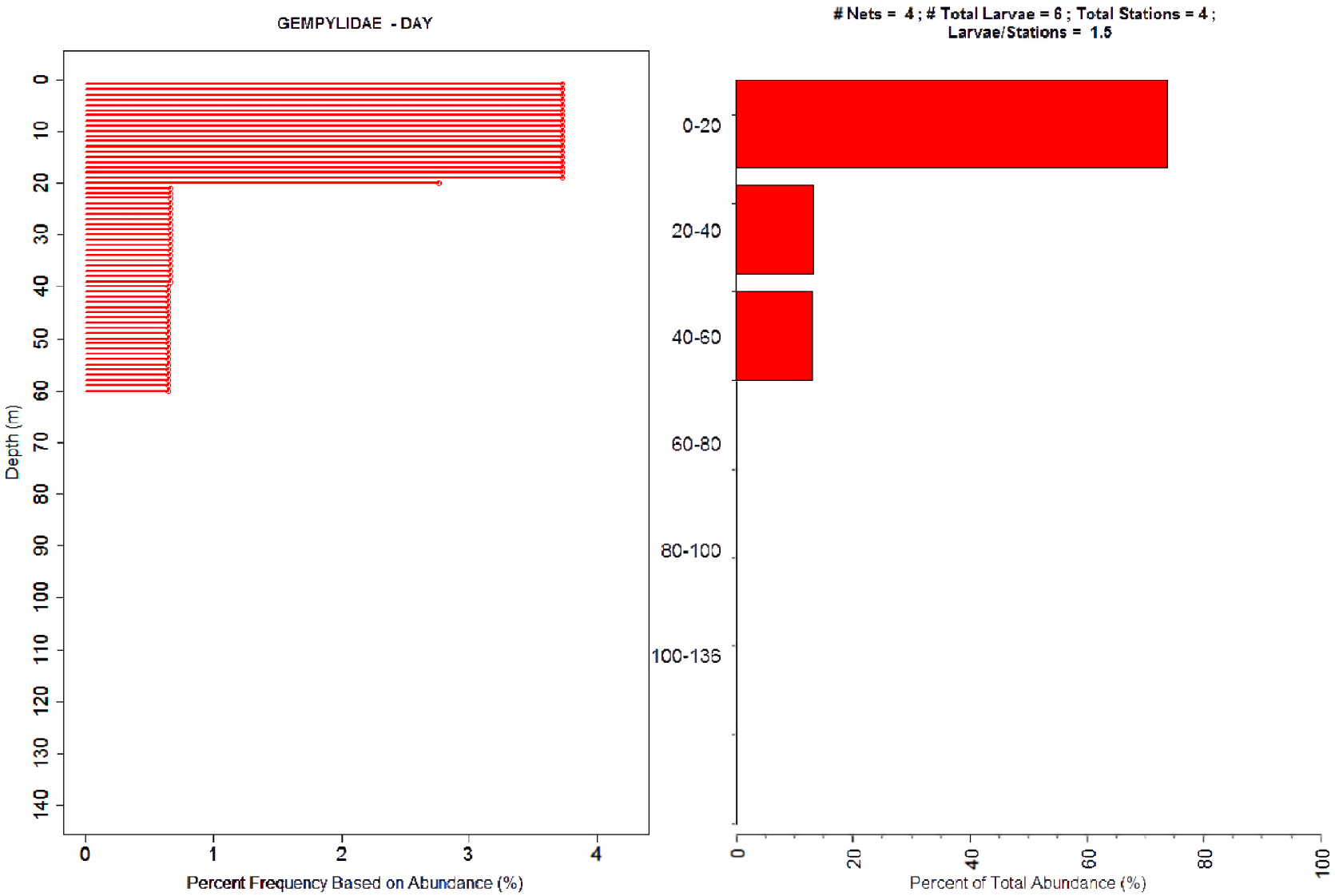
FISTULARIIDAE, NIGHT



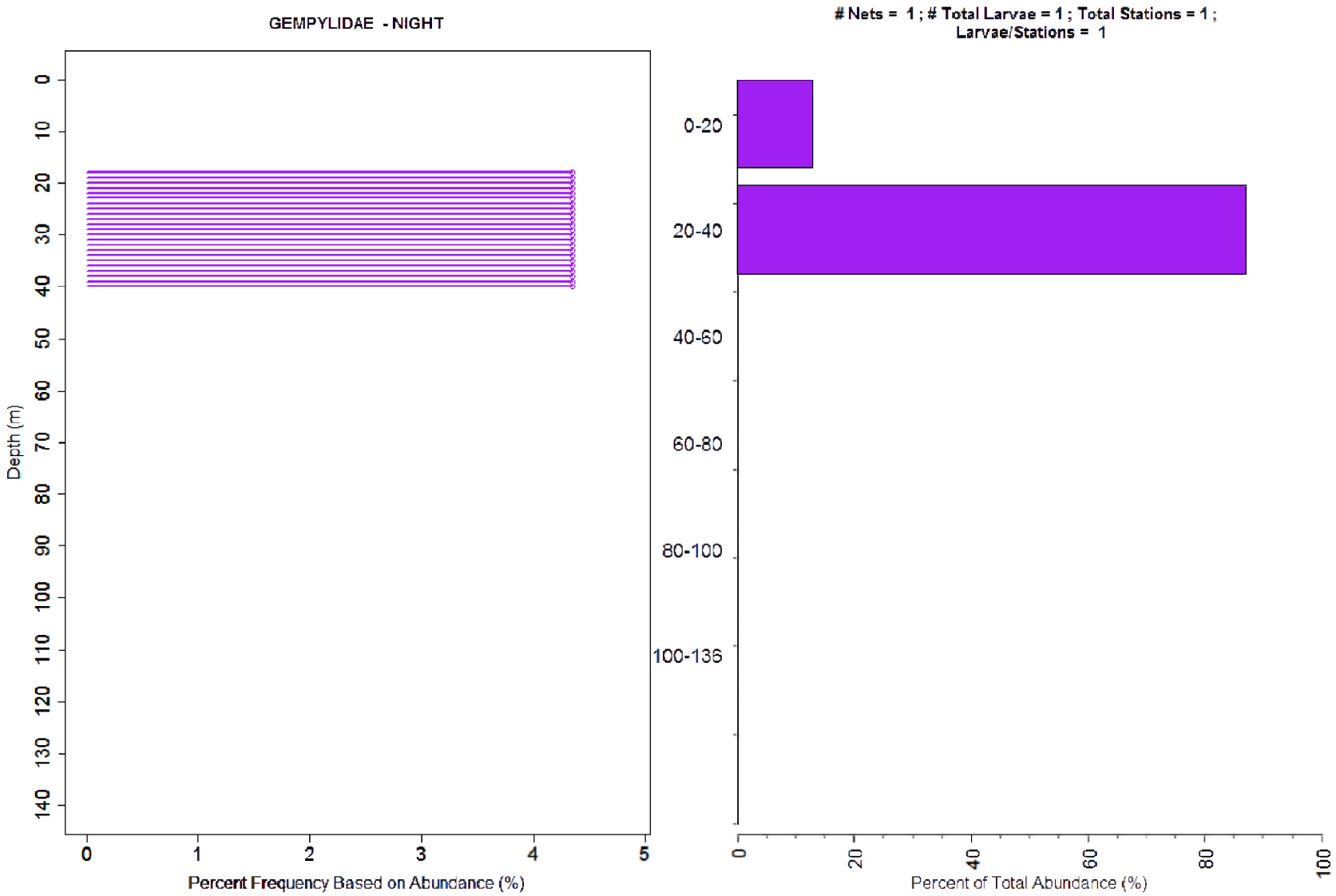
GADIFORMES, DAY



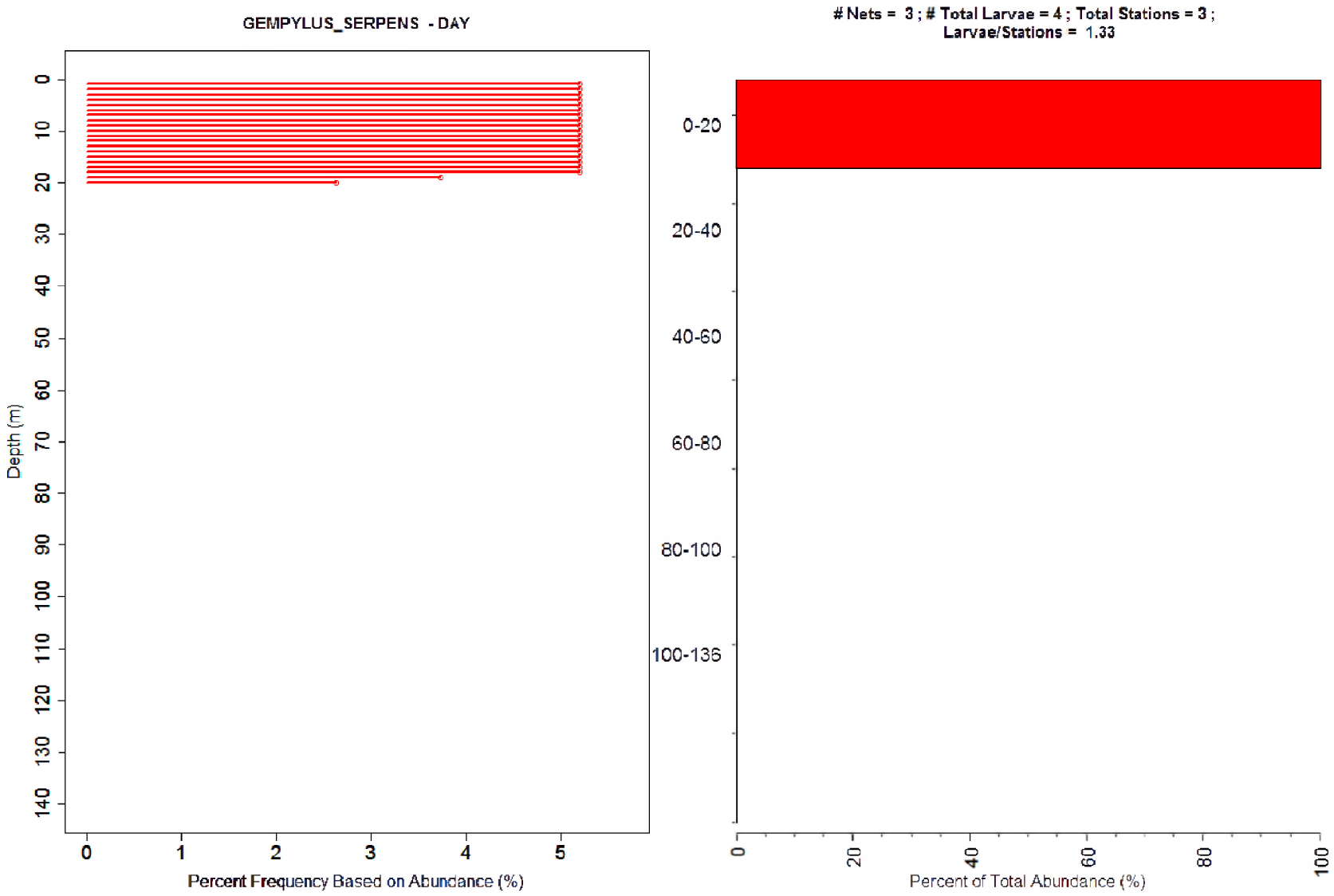
GADIFORMES, NIGHT



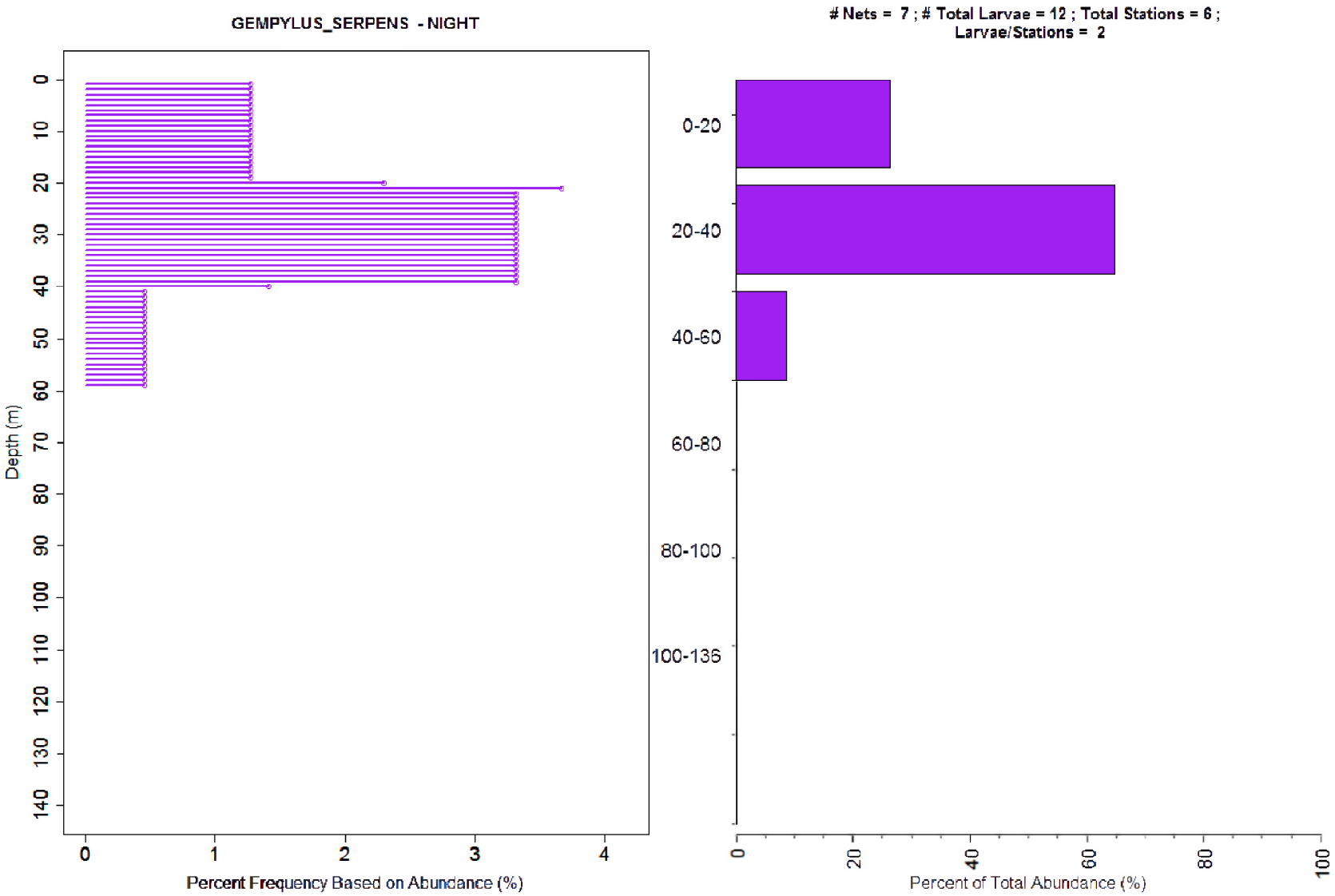
GEMPYLIDAE, DAY



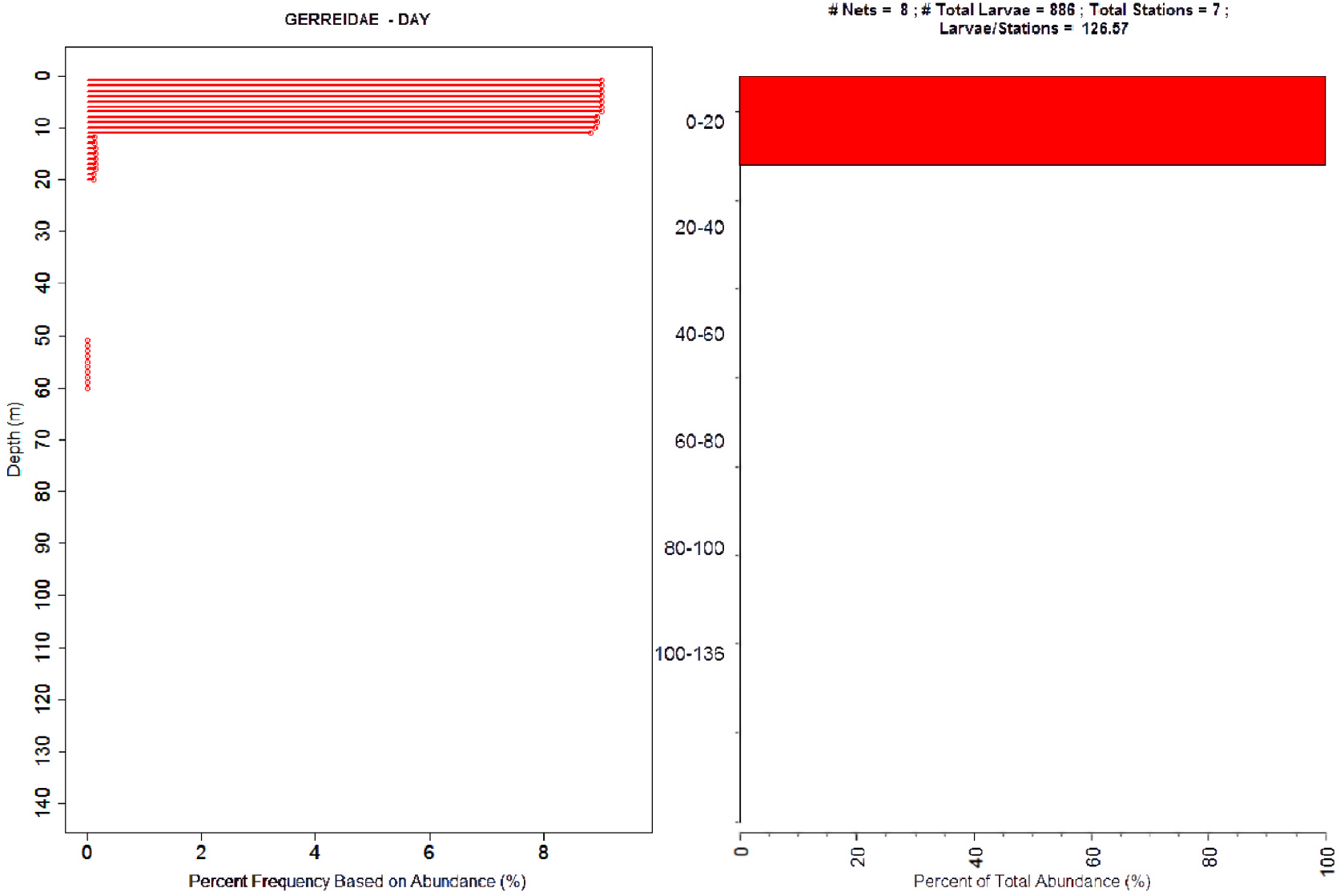
GEMPYLIDAE, NIGHT



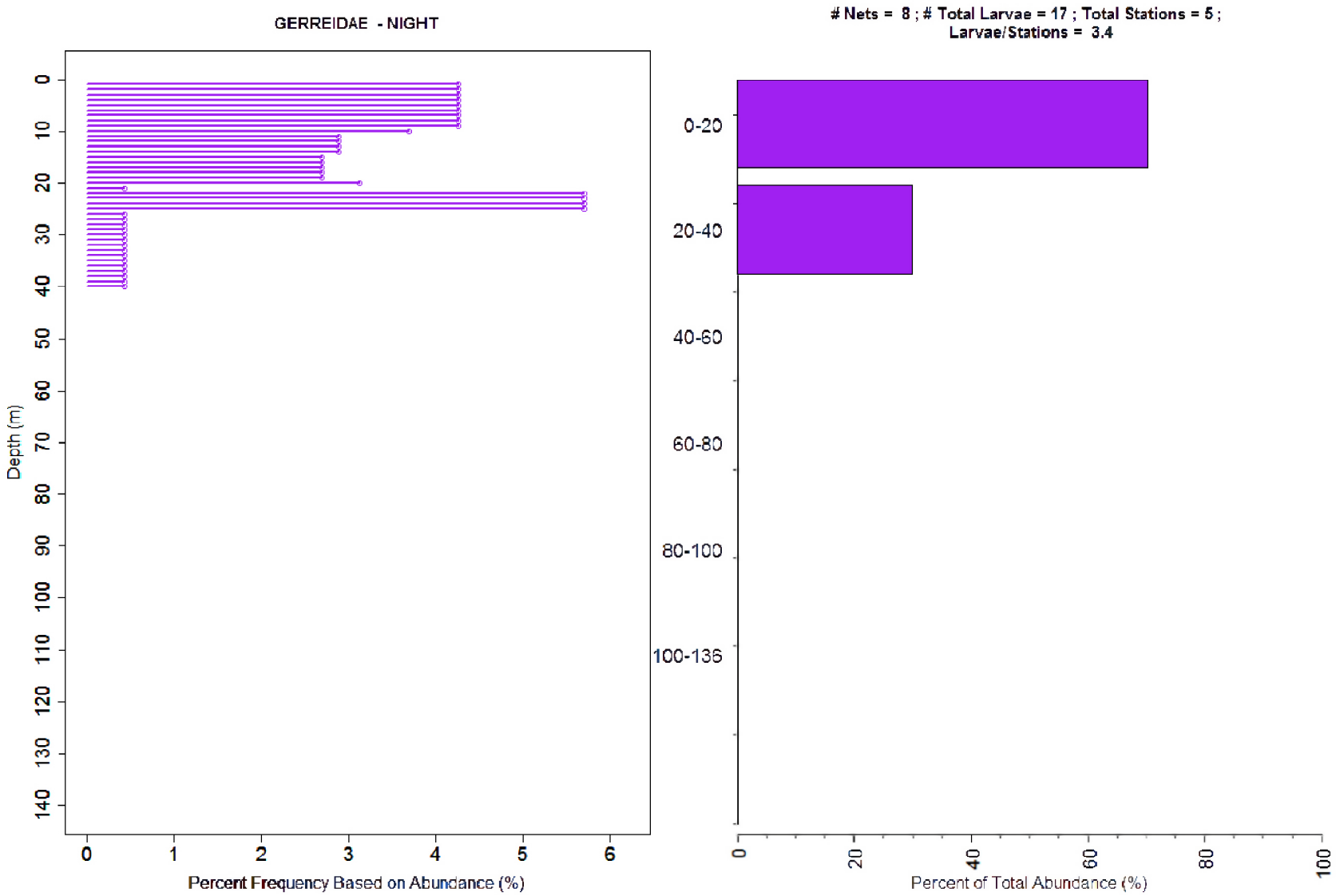
GEMPYLUS_SERPENS, DAY



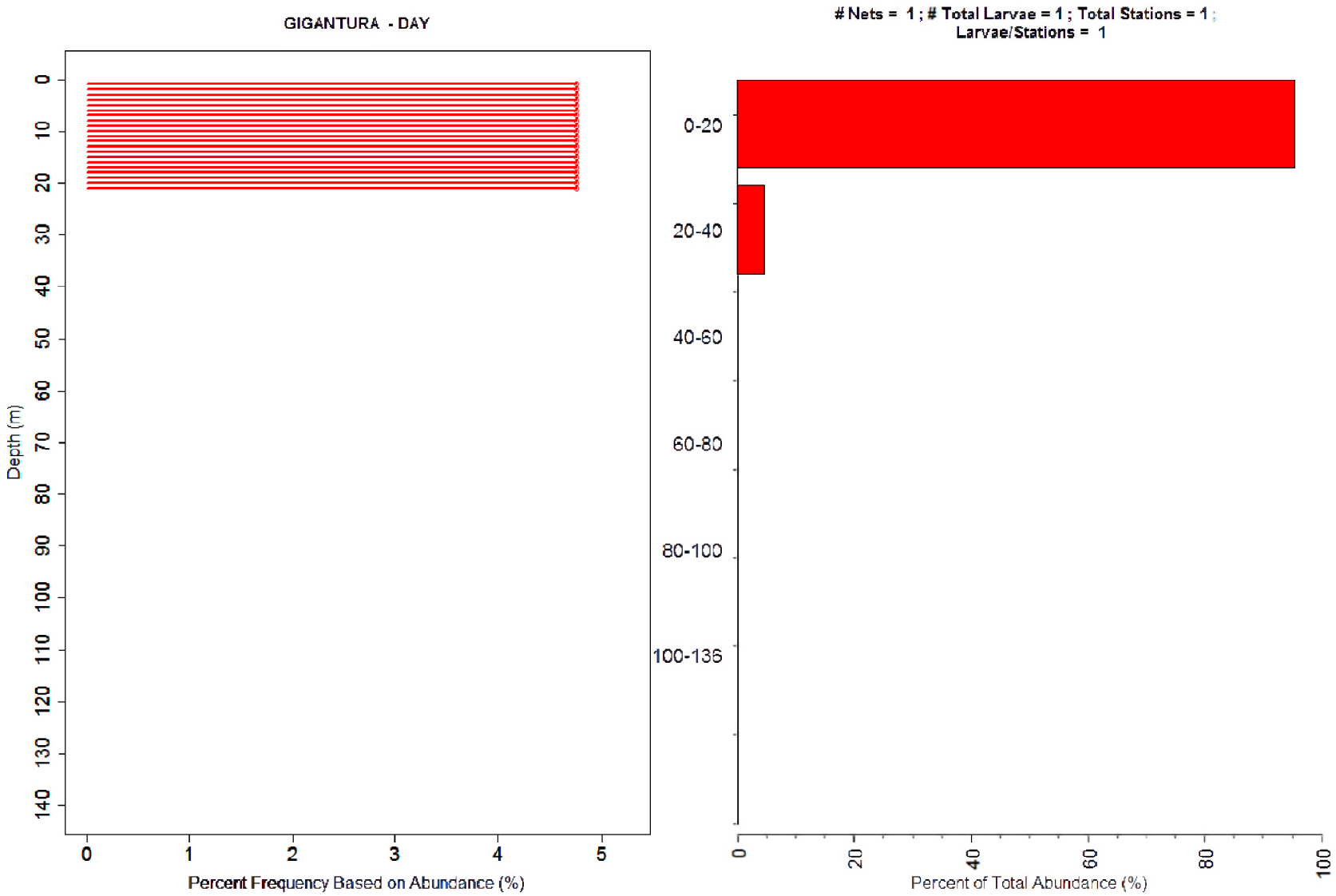
GEMPYLUS_SERPENS, NIGHT



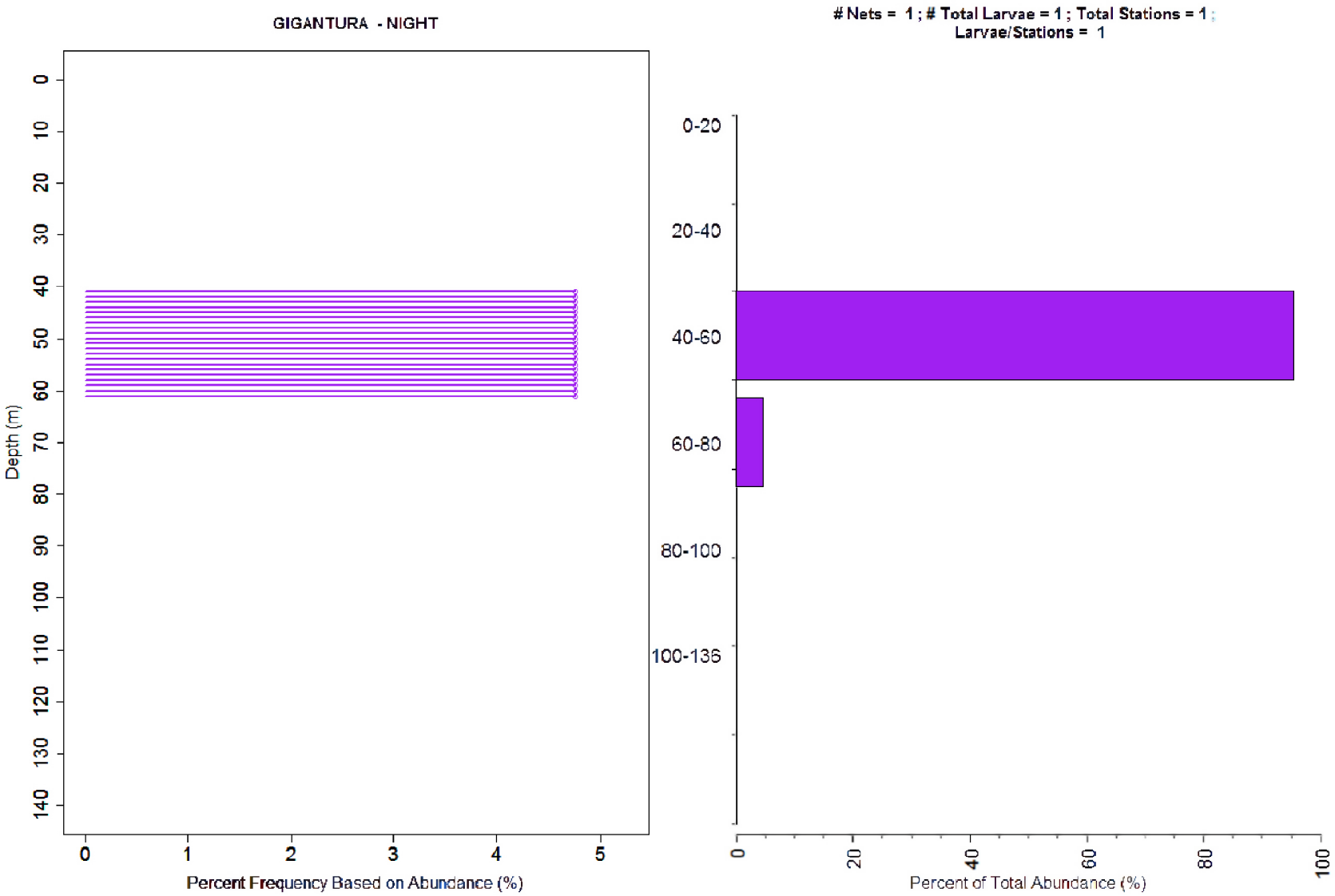
GERREIDAE, DAY



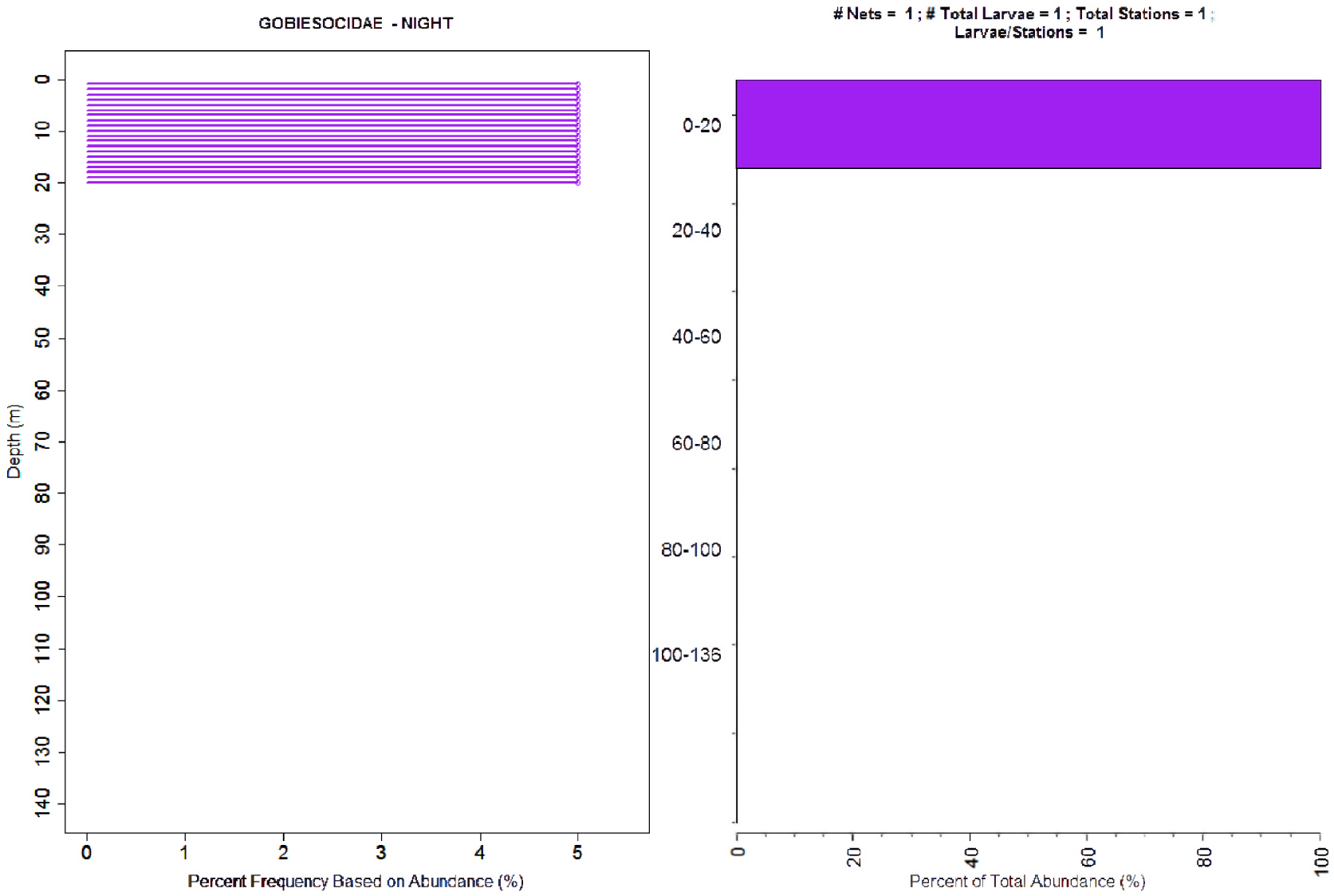
GERREIDAE, NIGHT



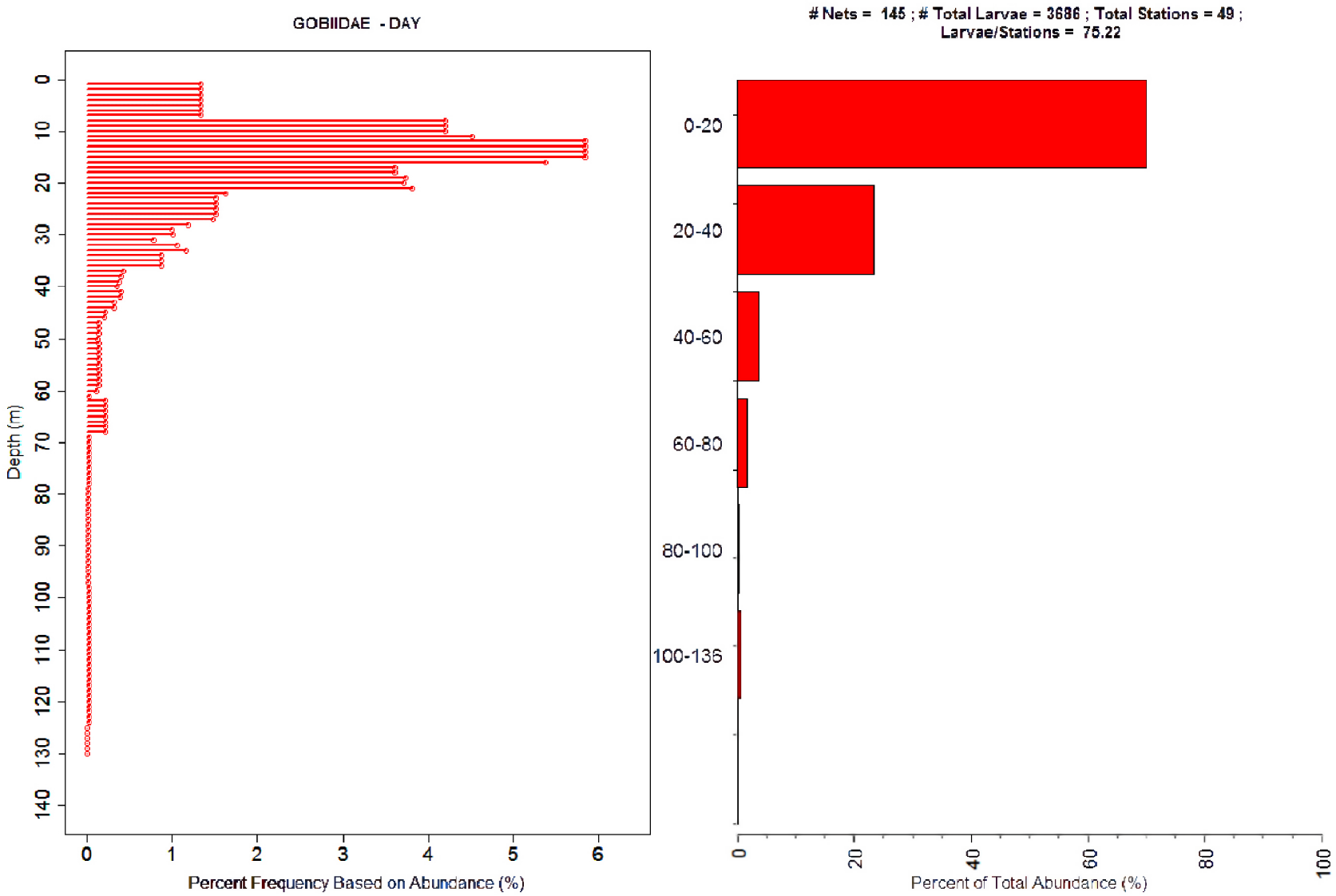
GIGANTURA, DAY



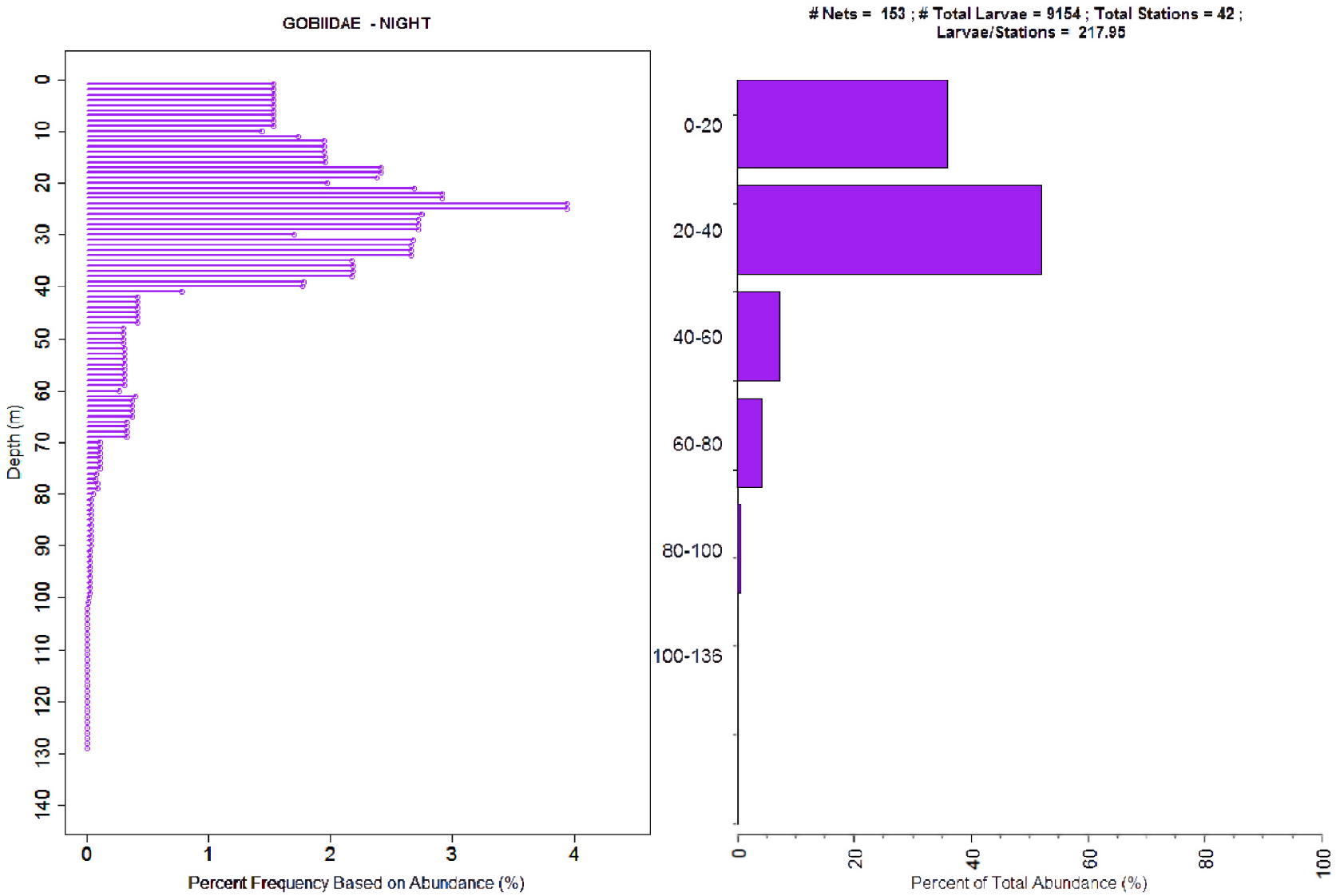
GIGANTURA, NIGHT



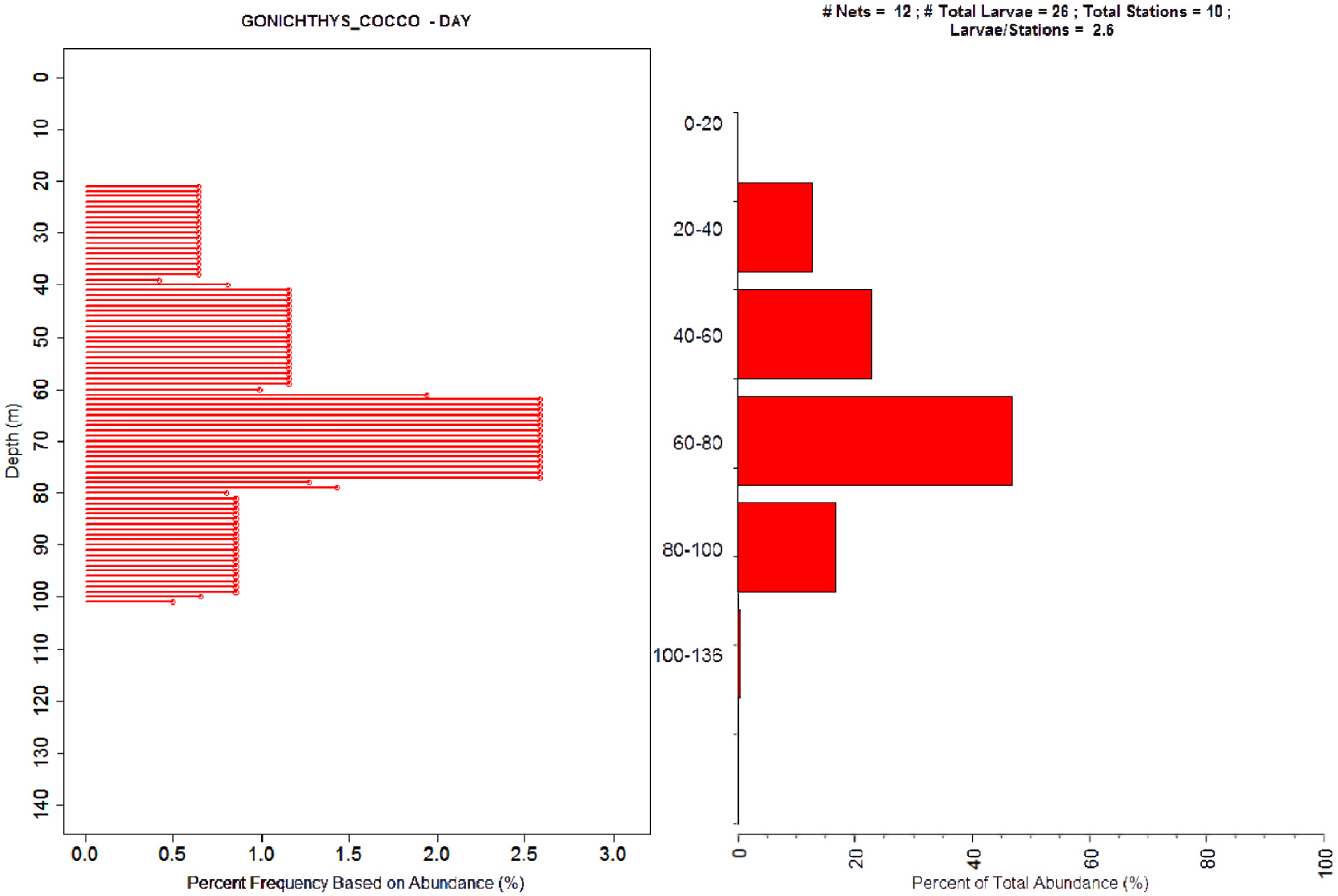
GOBIESOCIDAE, NIGHT



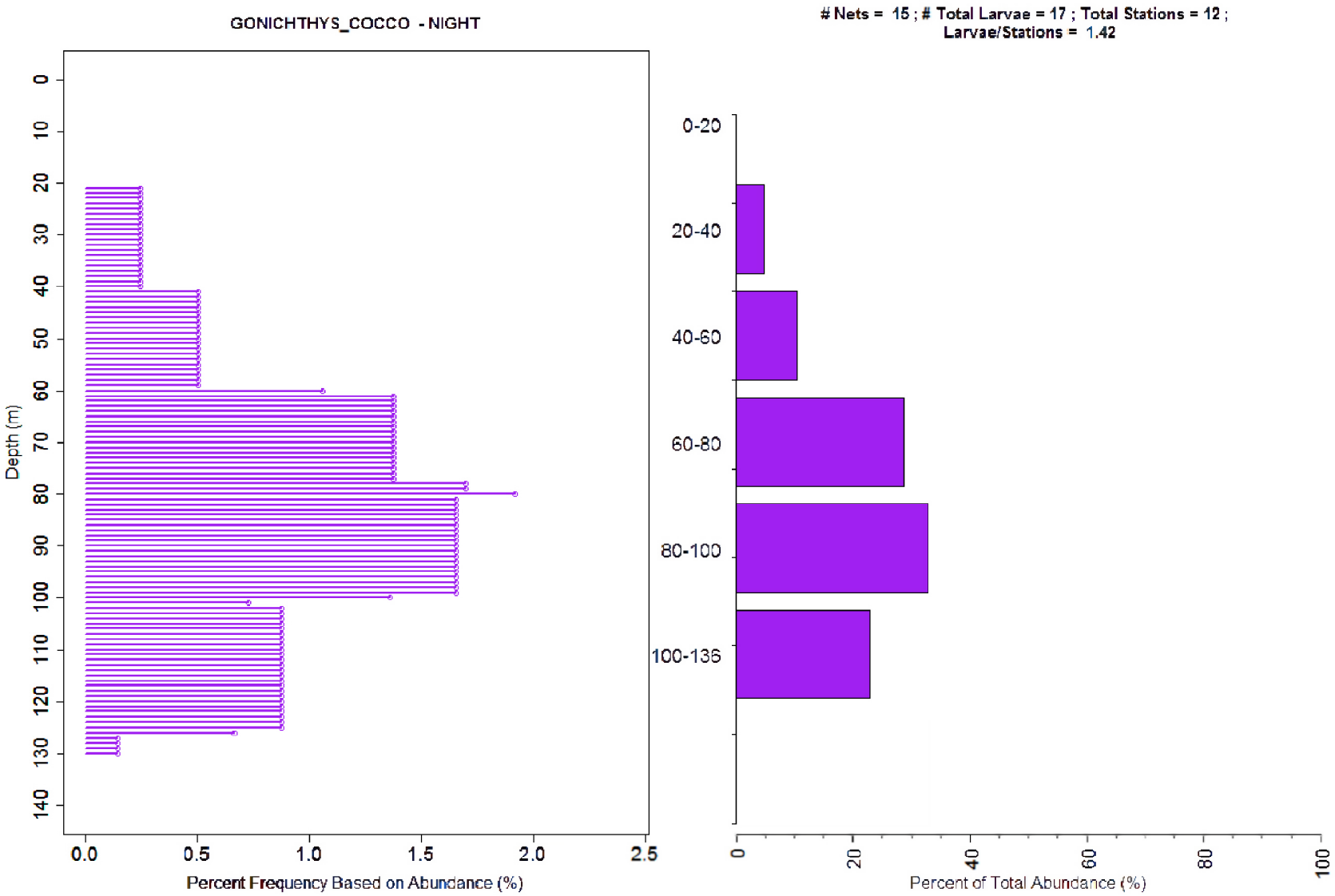
GOBIIDAE, DAY



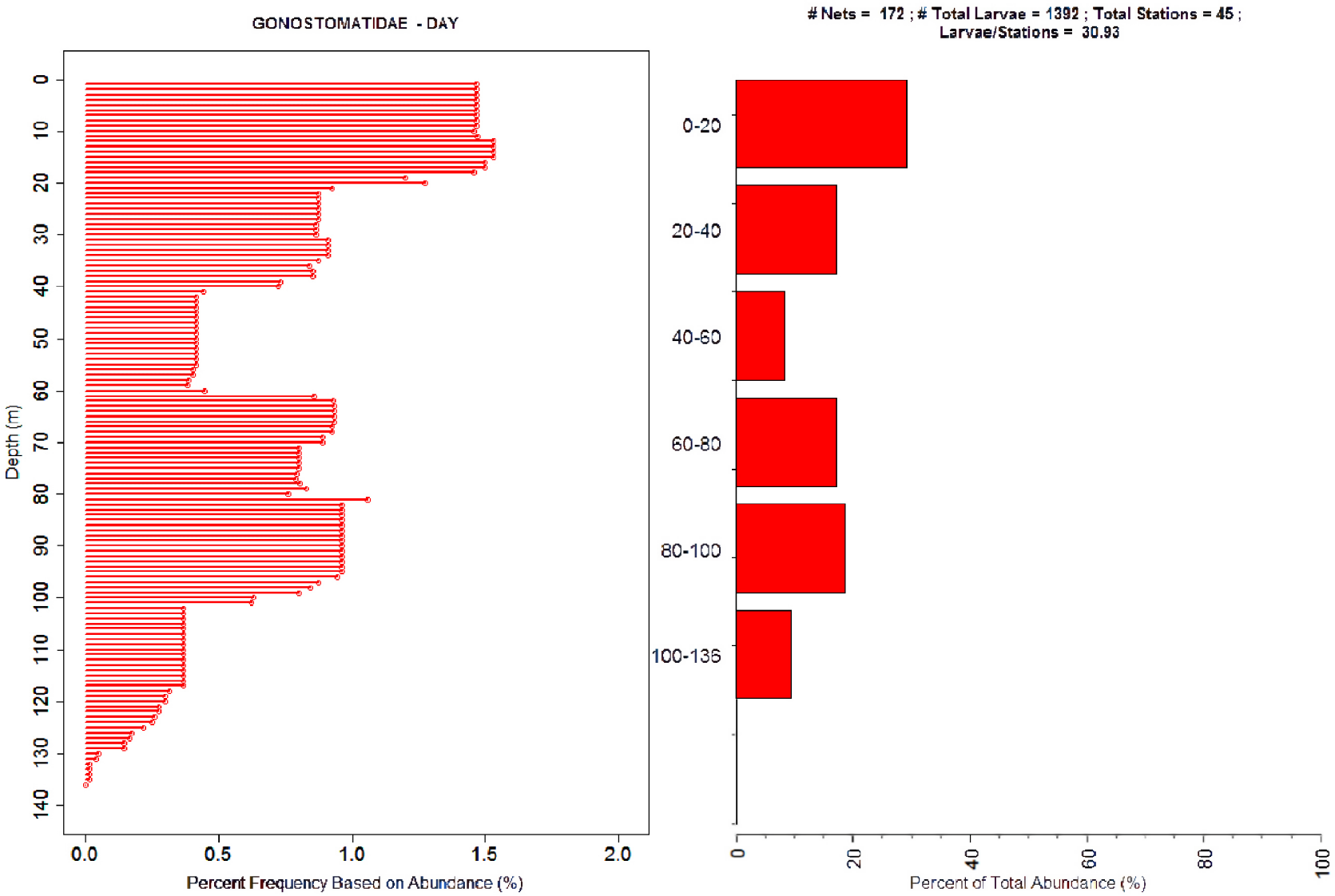
GOBIIDAE, NIGHT



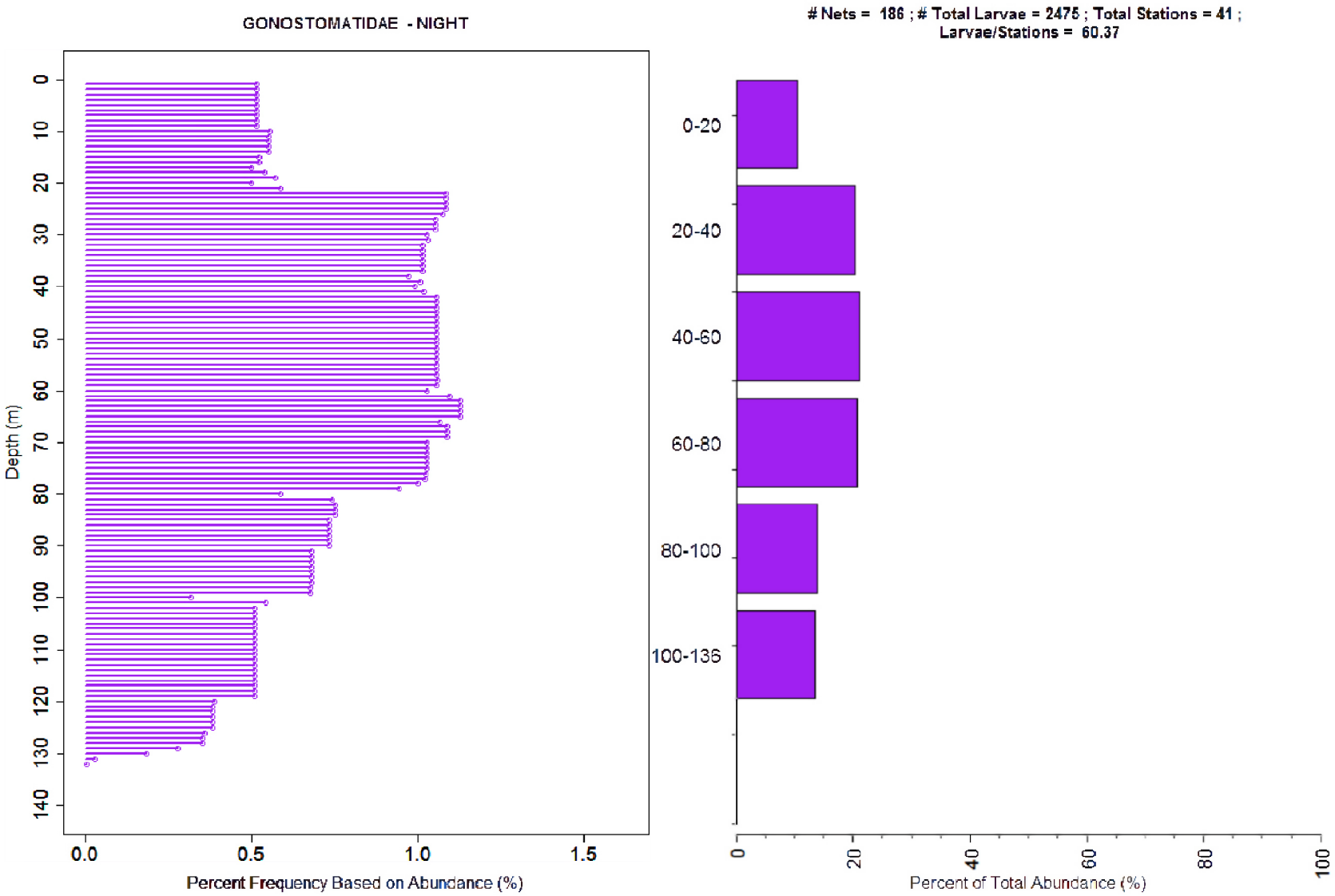
GONICHTHYS_COCCO, DAY



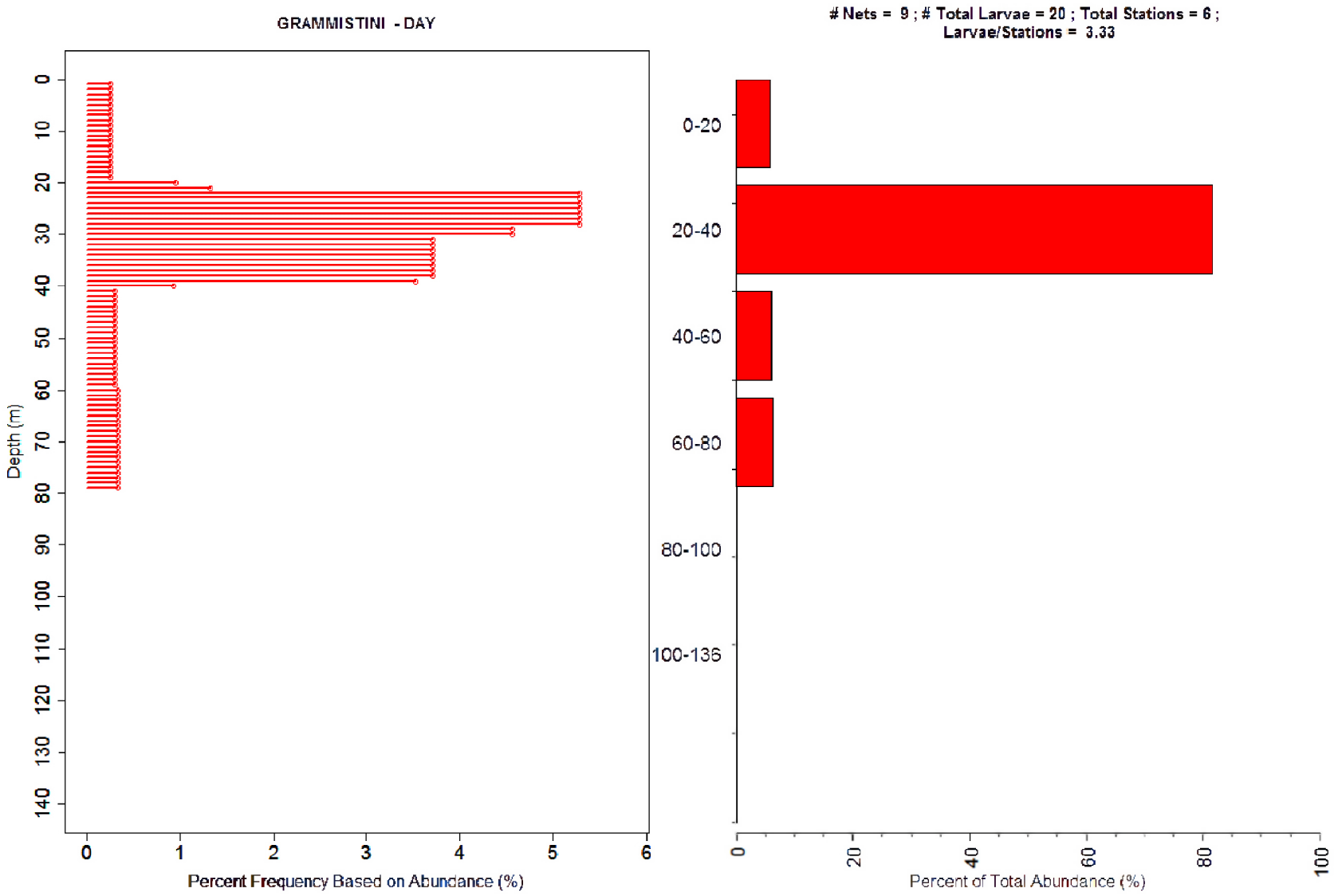
GONICHTHYS_COCCO, NIGHT



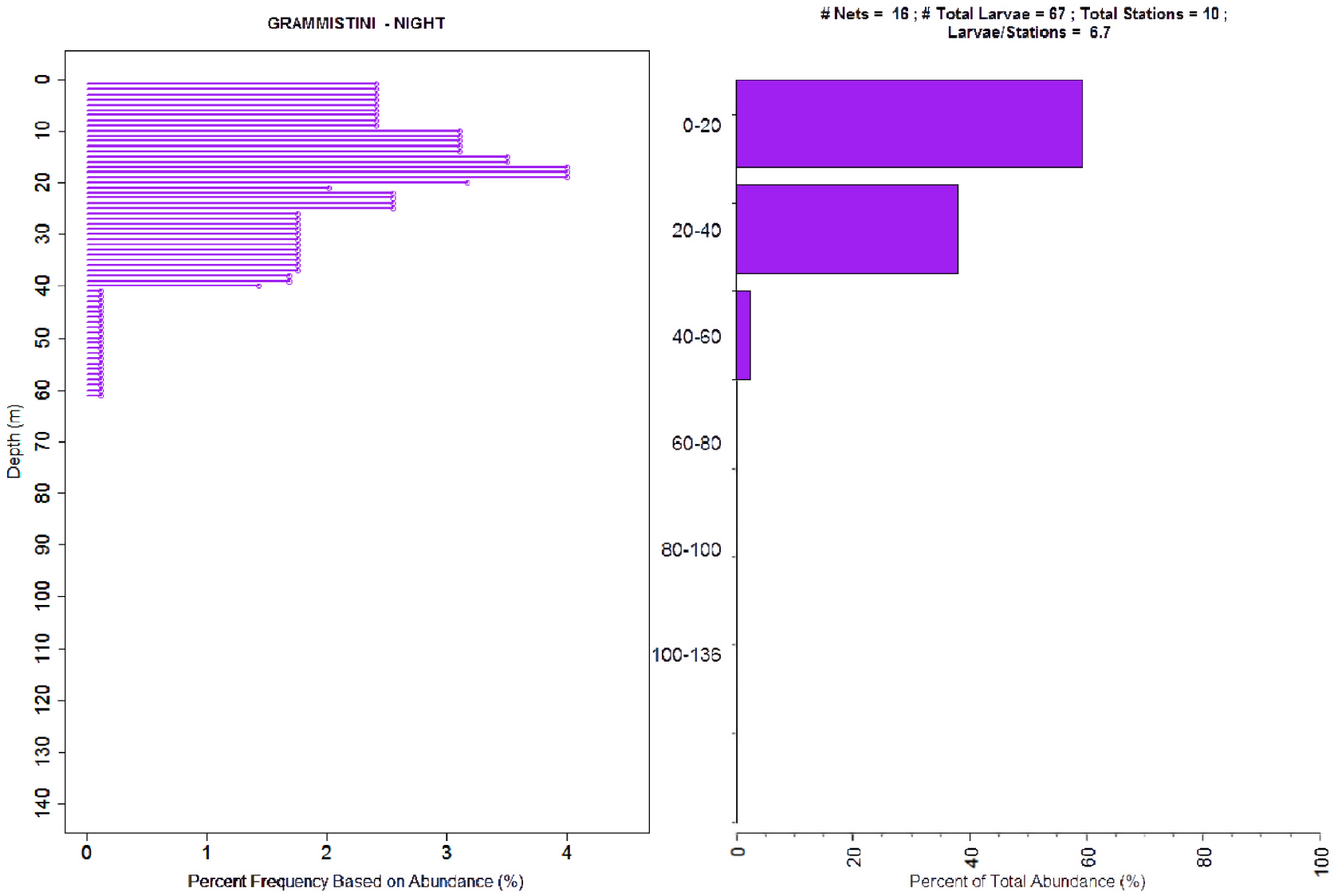
GONOSTOMATIDAE, DAY



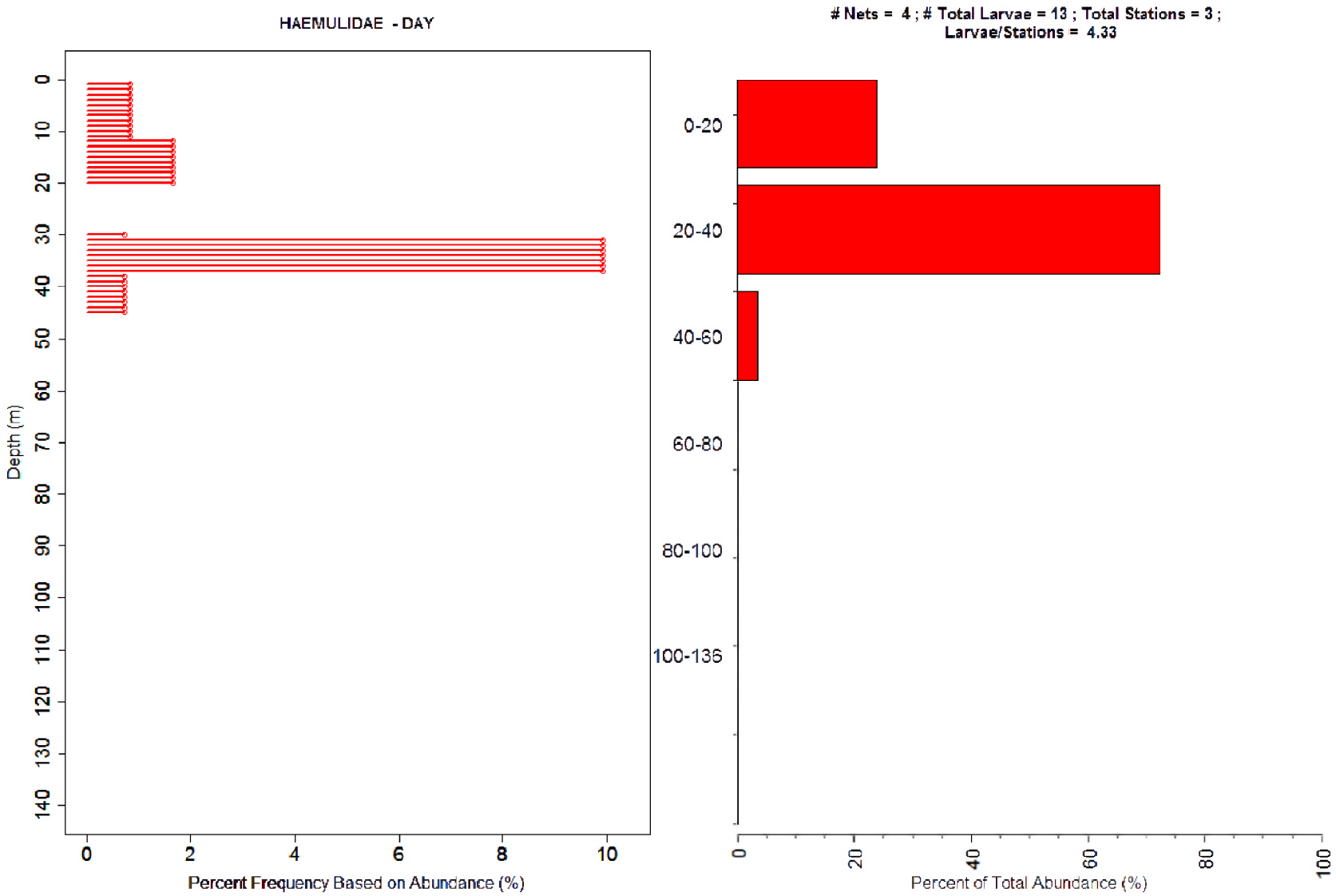
GONOSTOMATIDAE, NIGHT



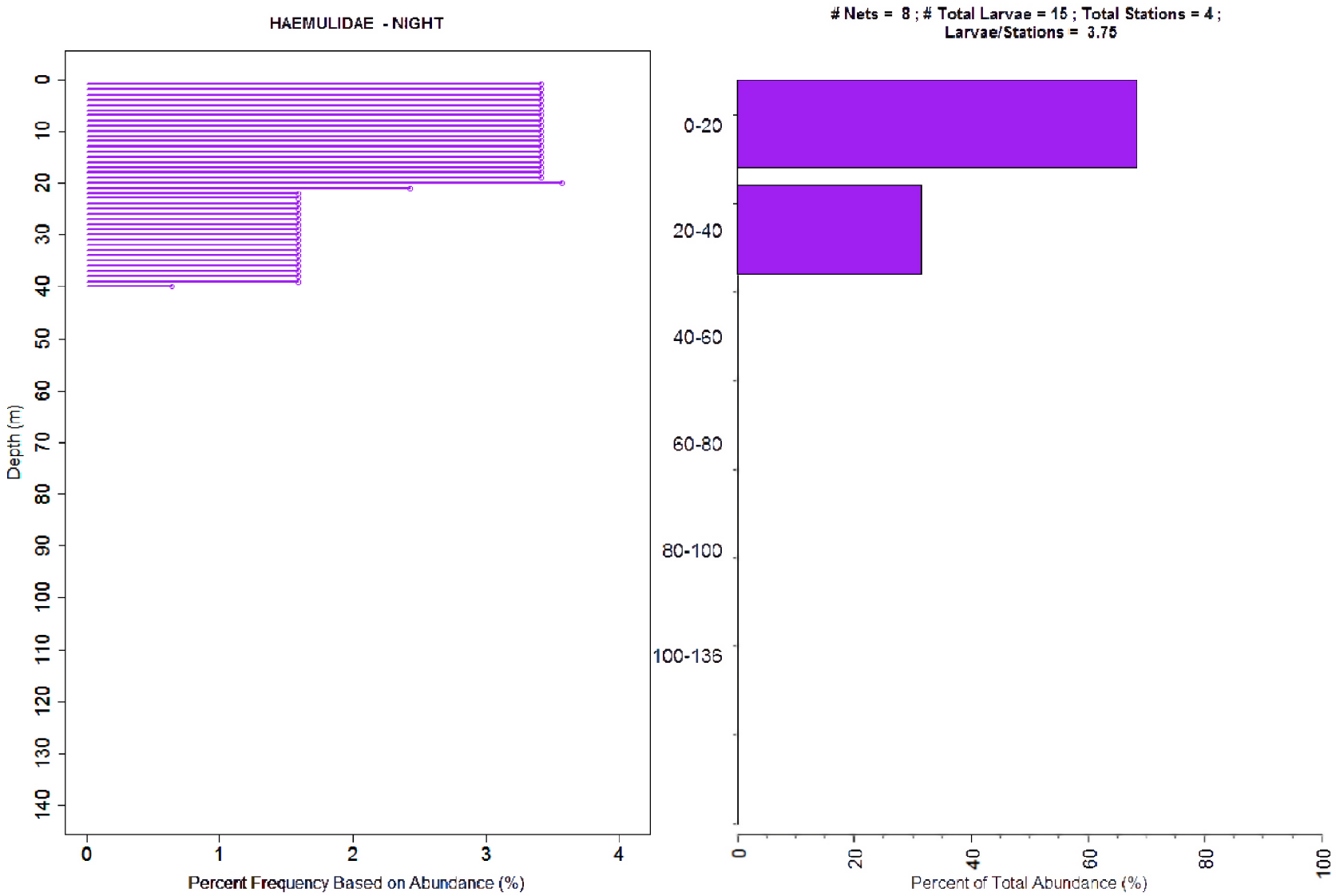
GRAMMISTINI, DAY



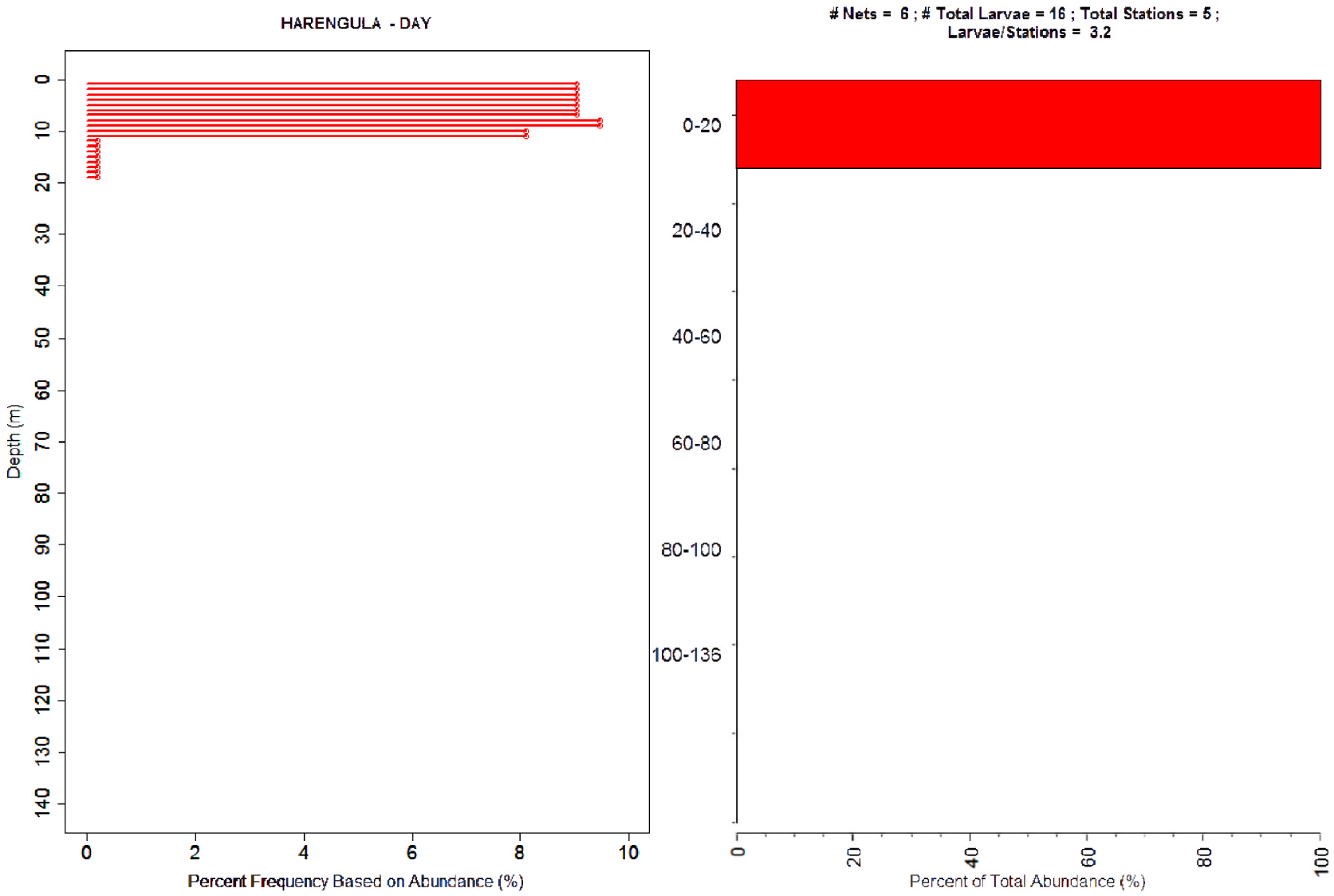
GRAMMISTINI, NIGHT



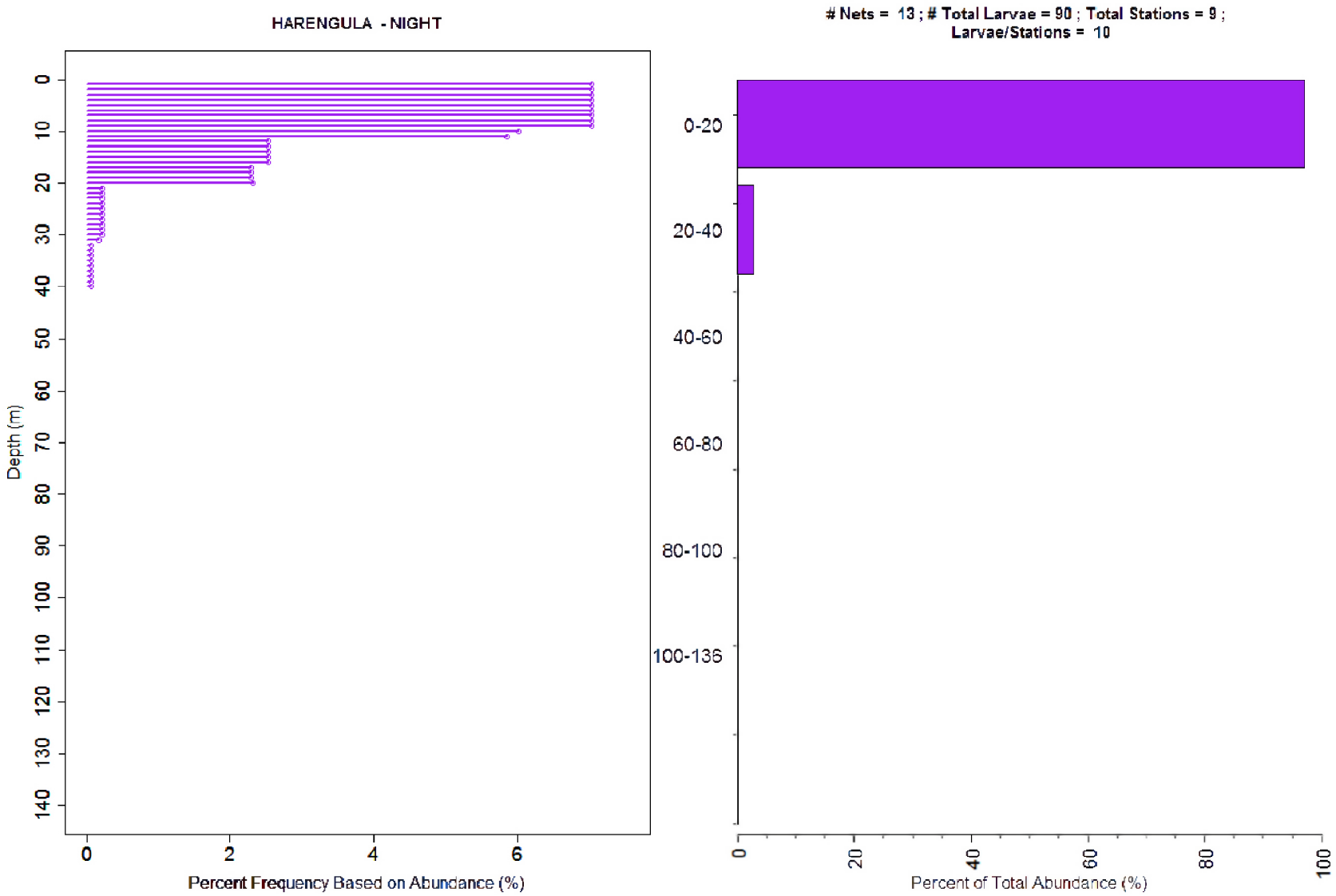
HAEMULIDAE, DAY



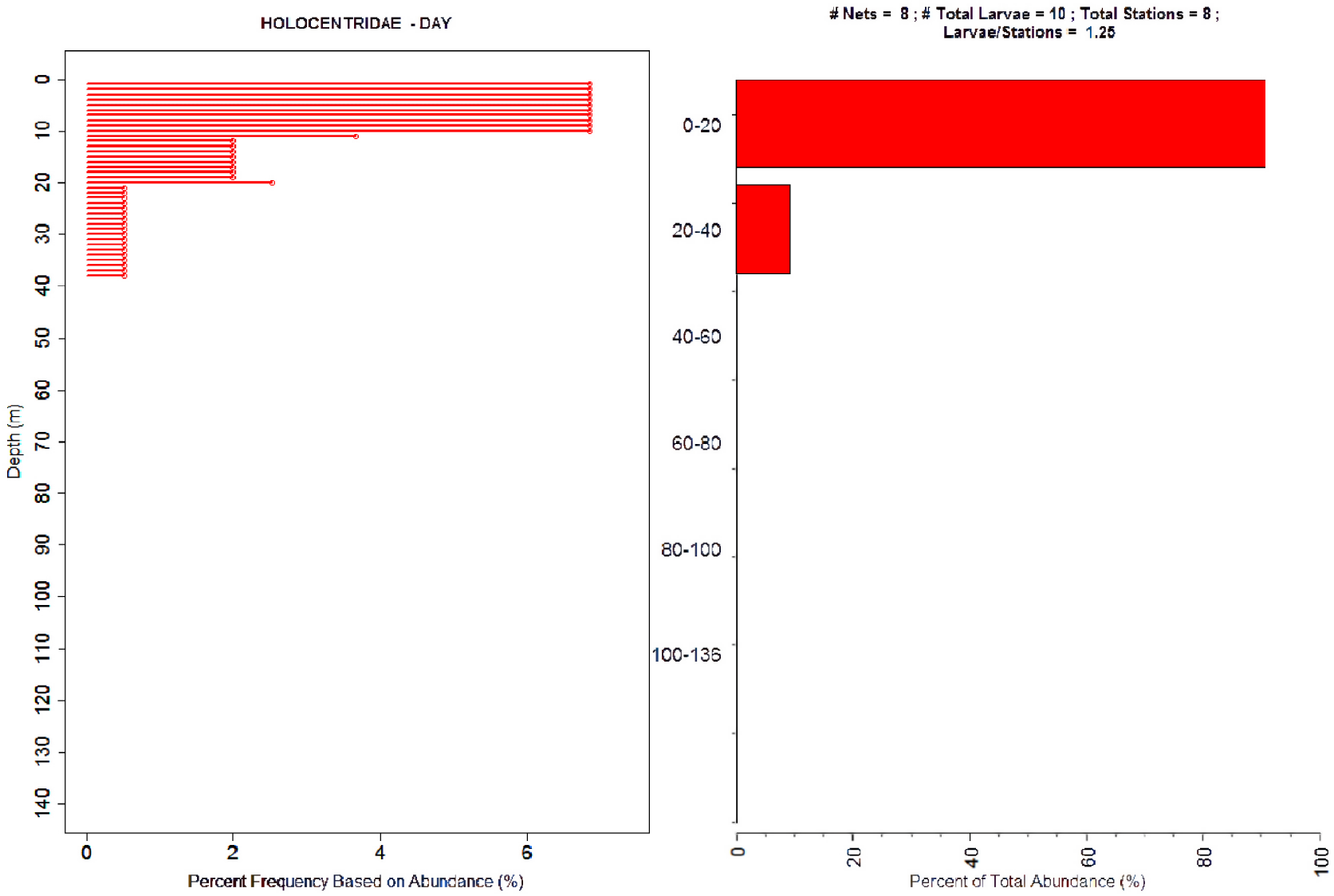
HAEMULIDAE, NIGHT



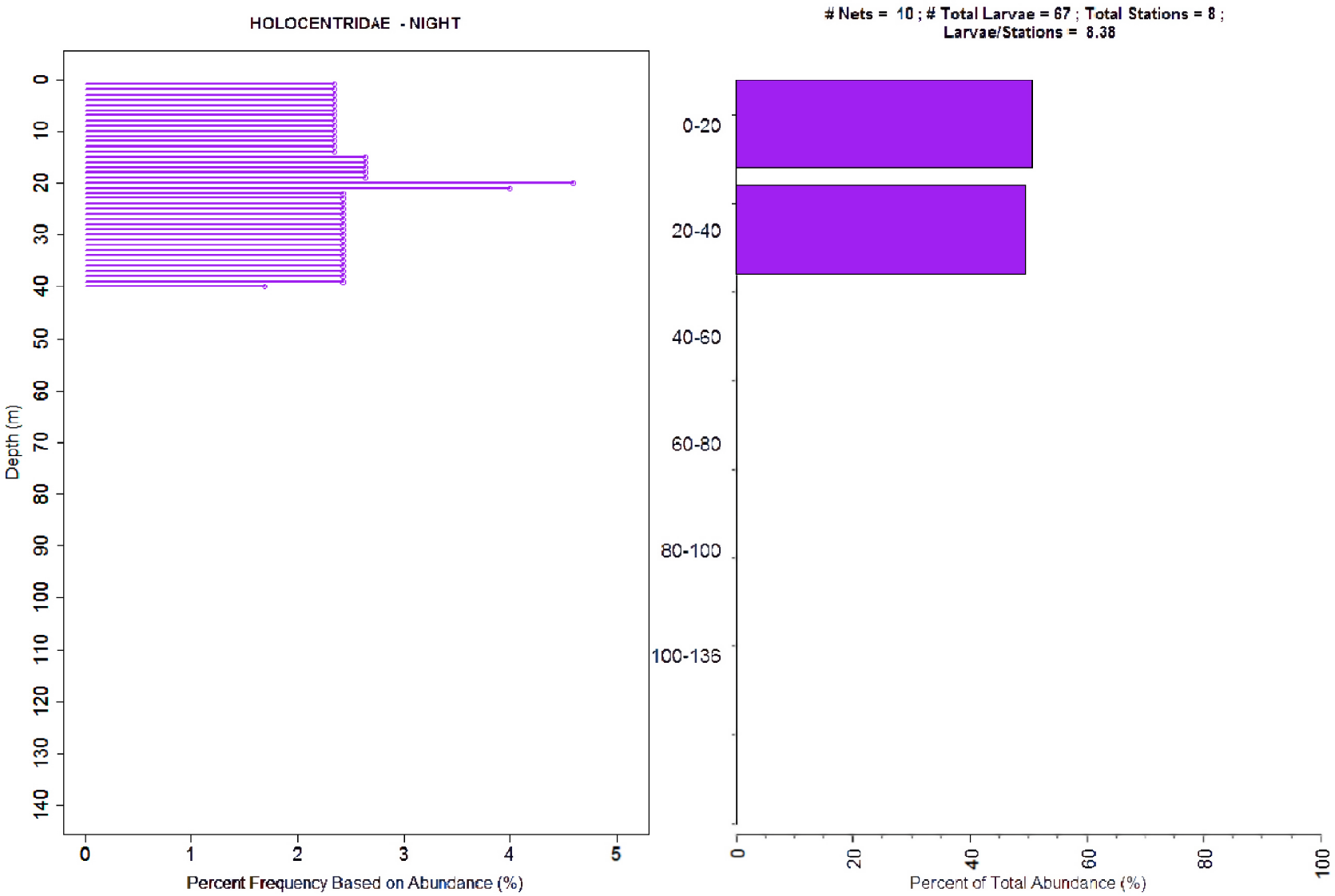
HARENGULA, DAY



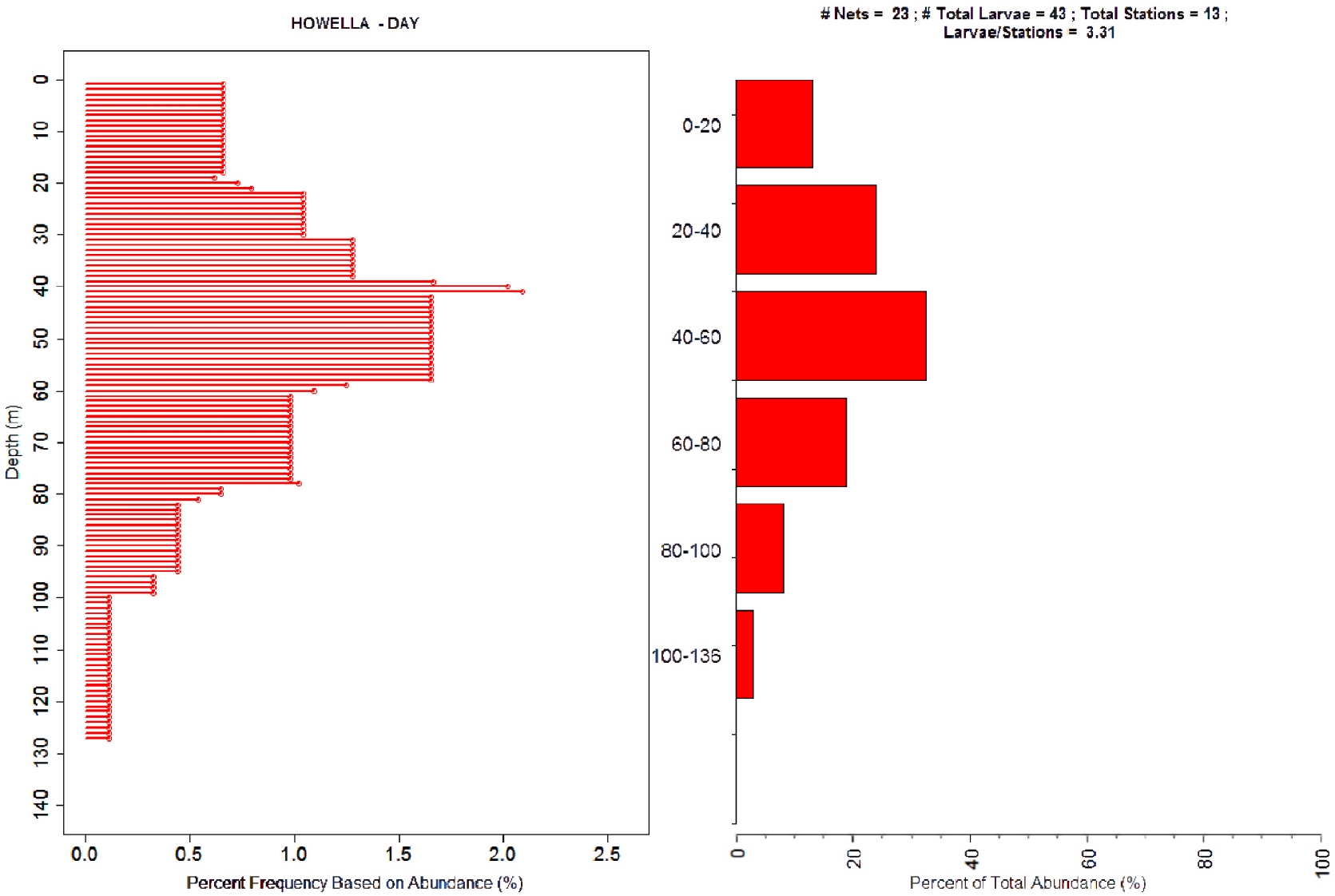
HARENGULA, NIGHT



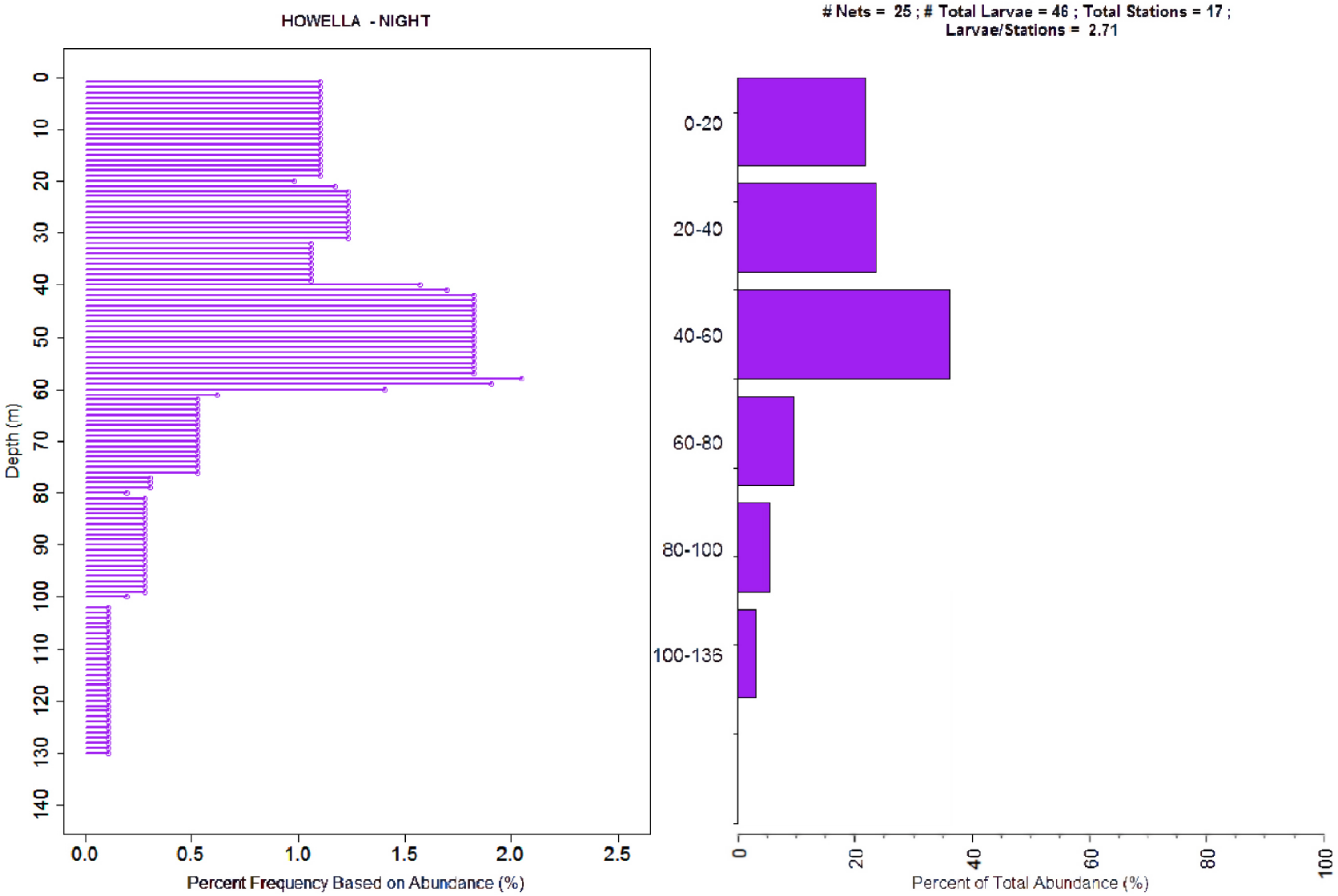
HOLOCENTRIDAE, DAY



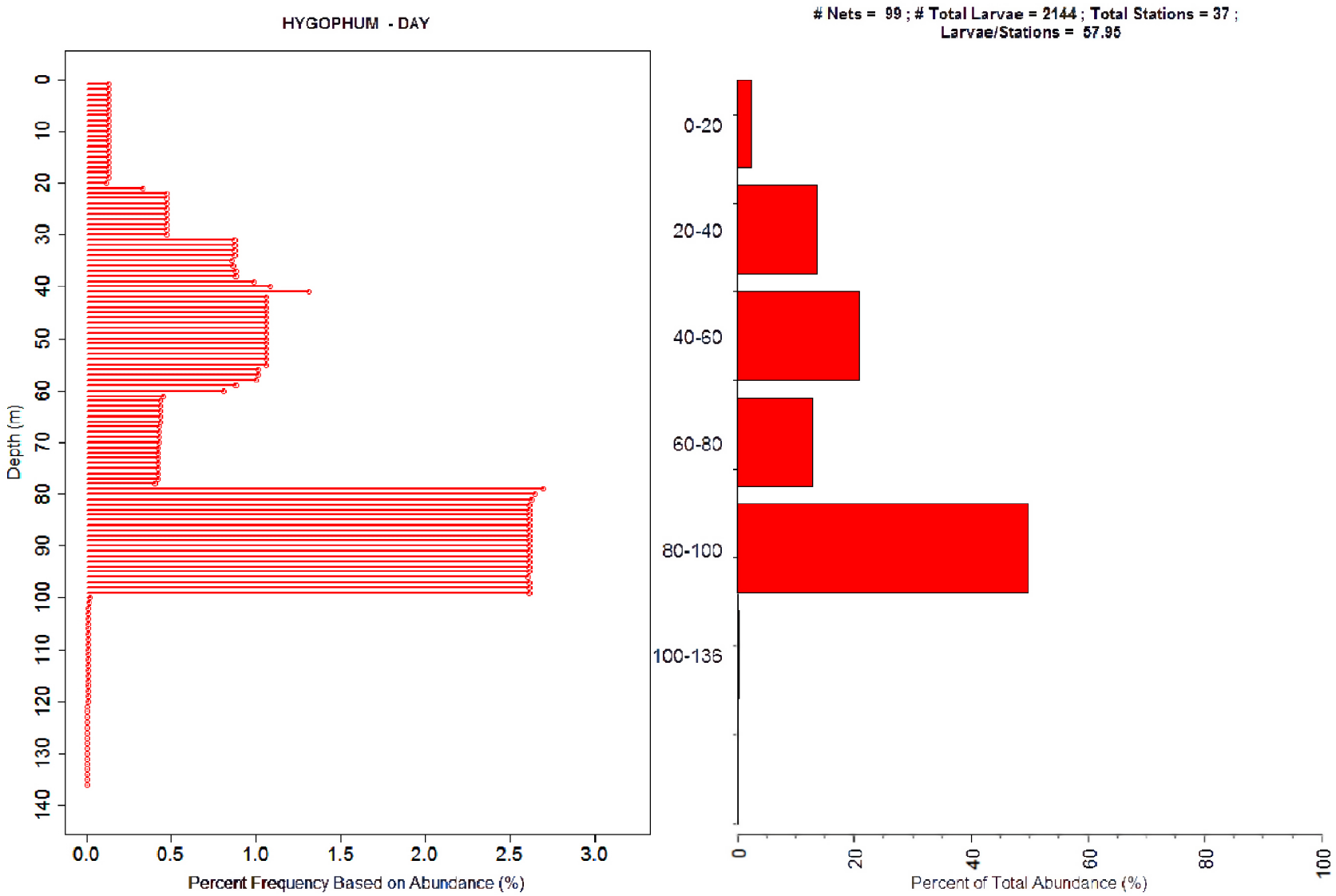
HOLOCENTRIDAE, NIGHT


HOWELLA - DAY
Nets = 23 ; # Total Larvae = 43 ; Total Stations = 13 ;
Larvae/Stations = 3.31
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

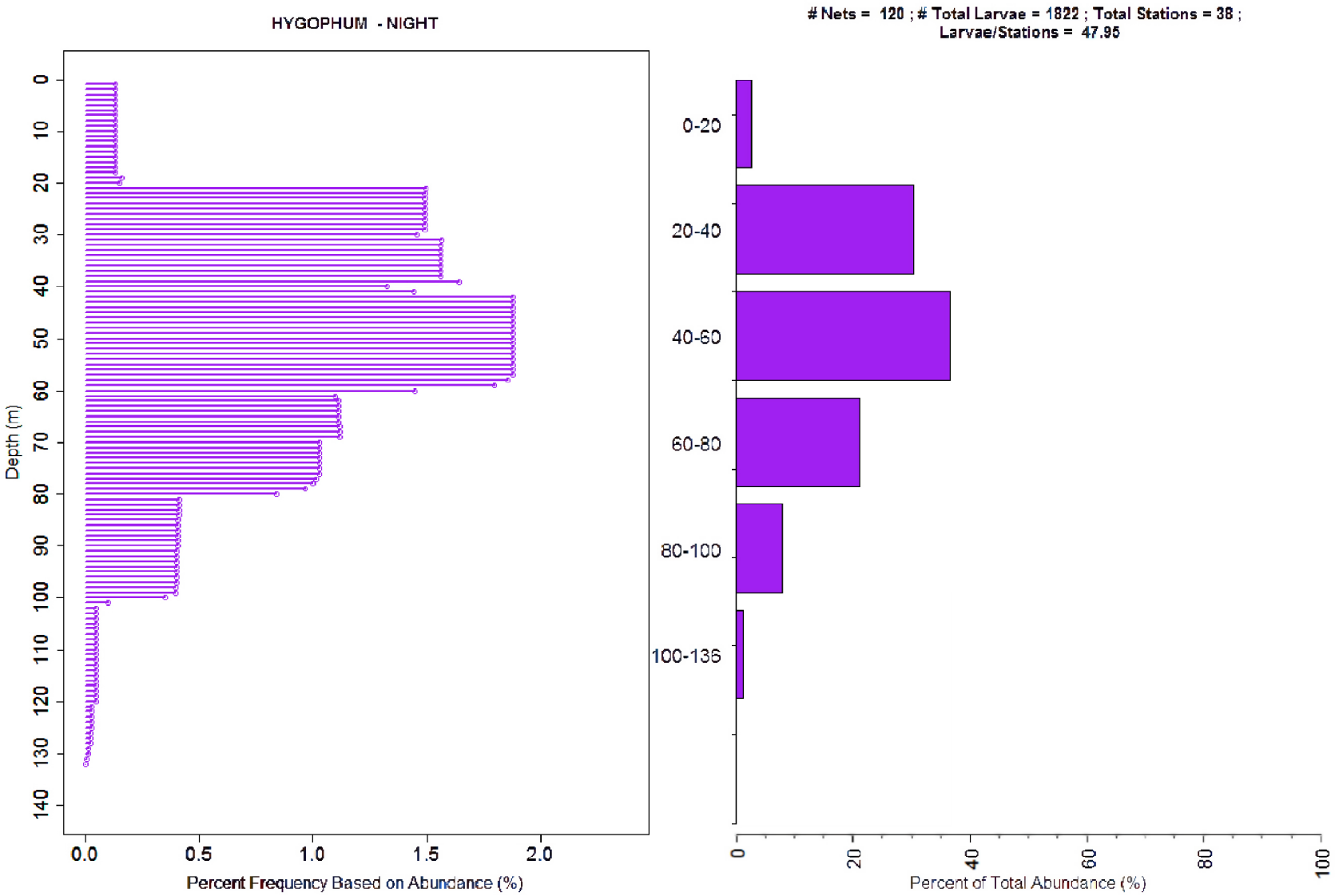
HOWELLA, DAY



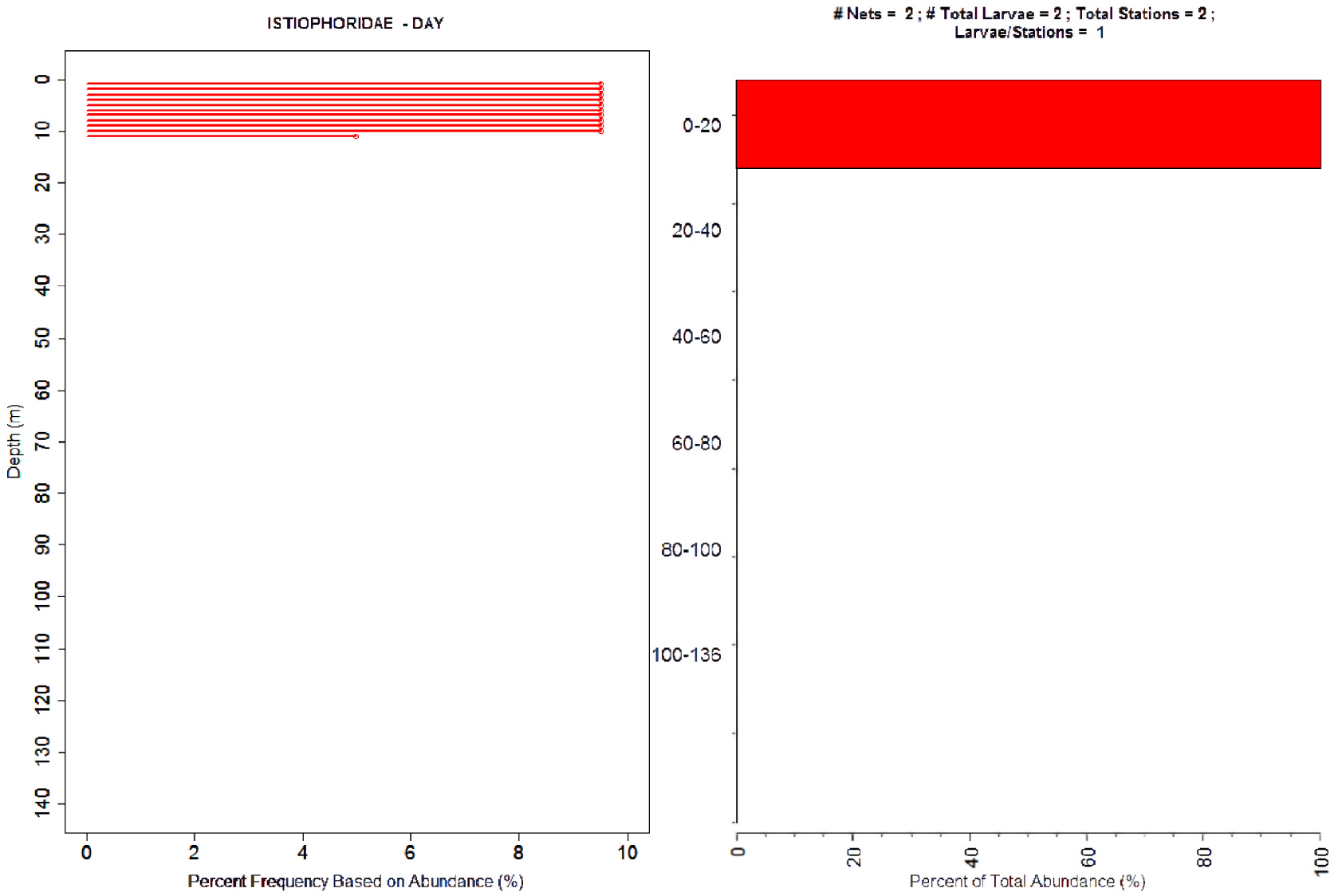
HOWELLA, NIGHT



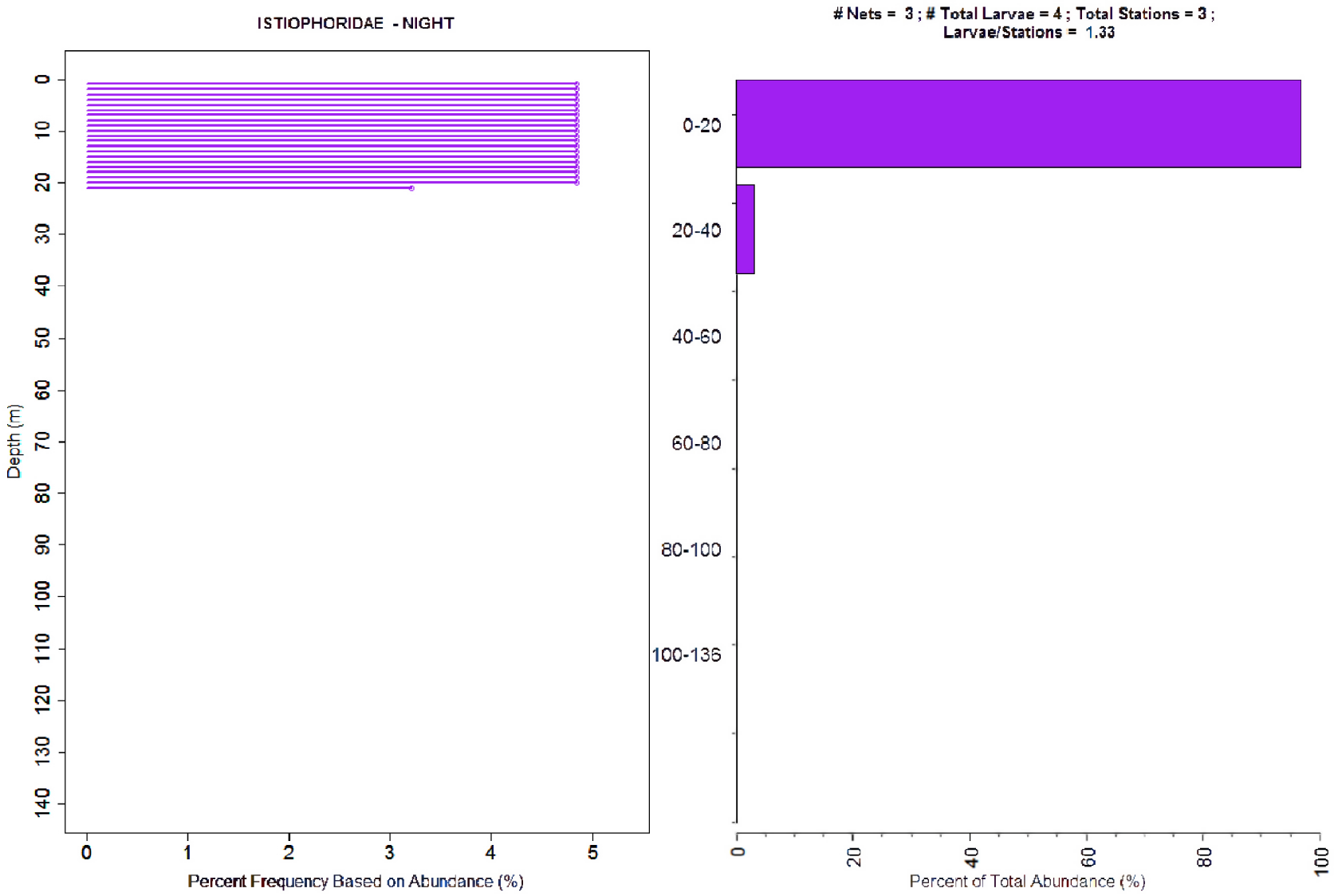
HYGOPHUM, DAY



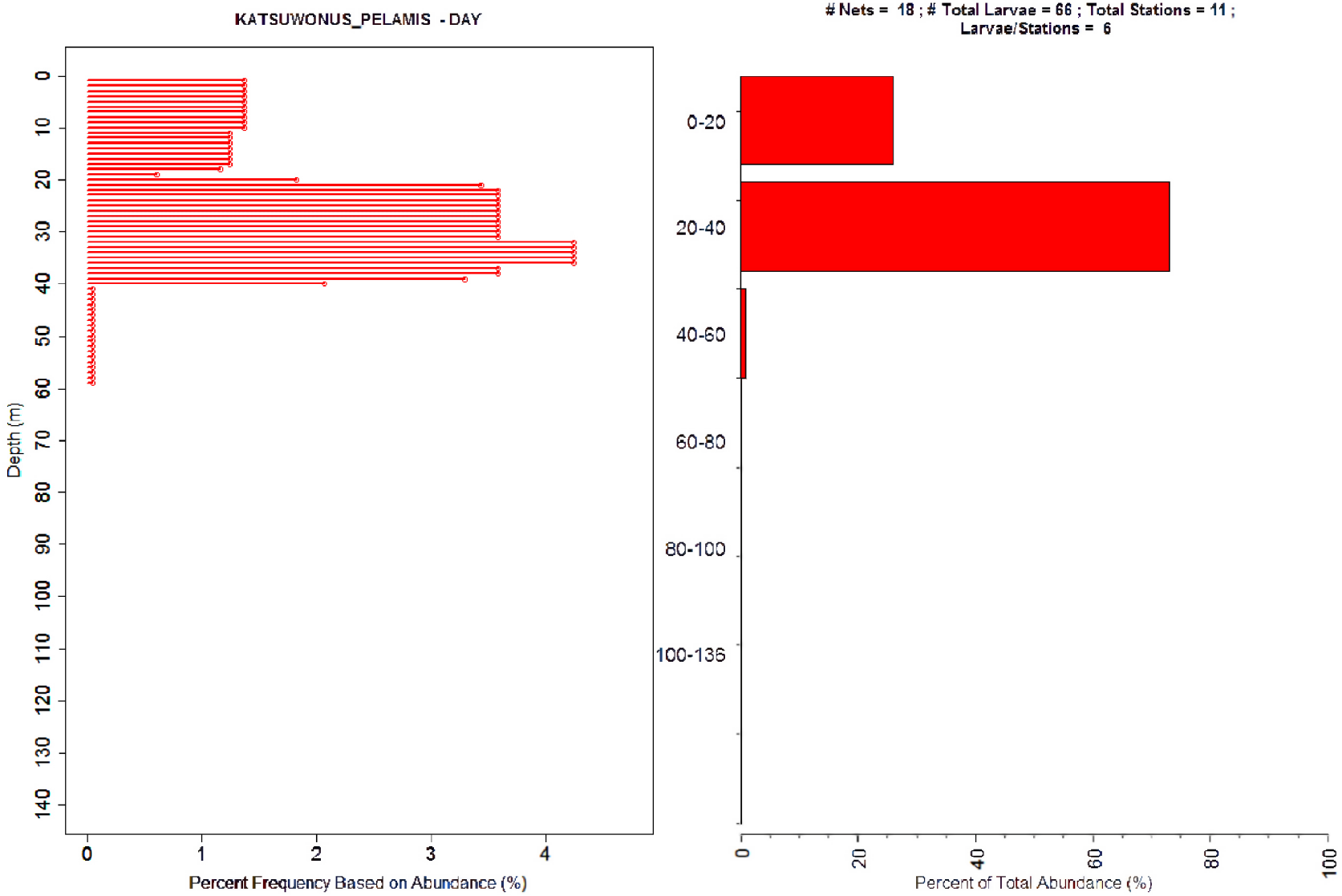
HYGOPHUM, NIGHT



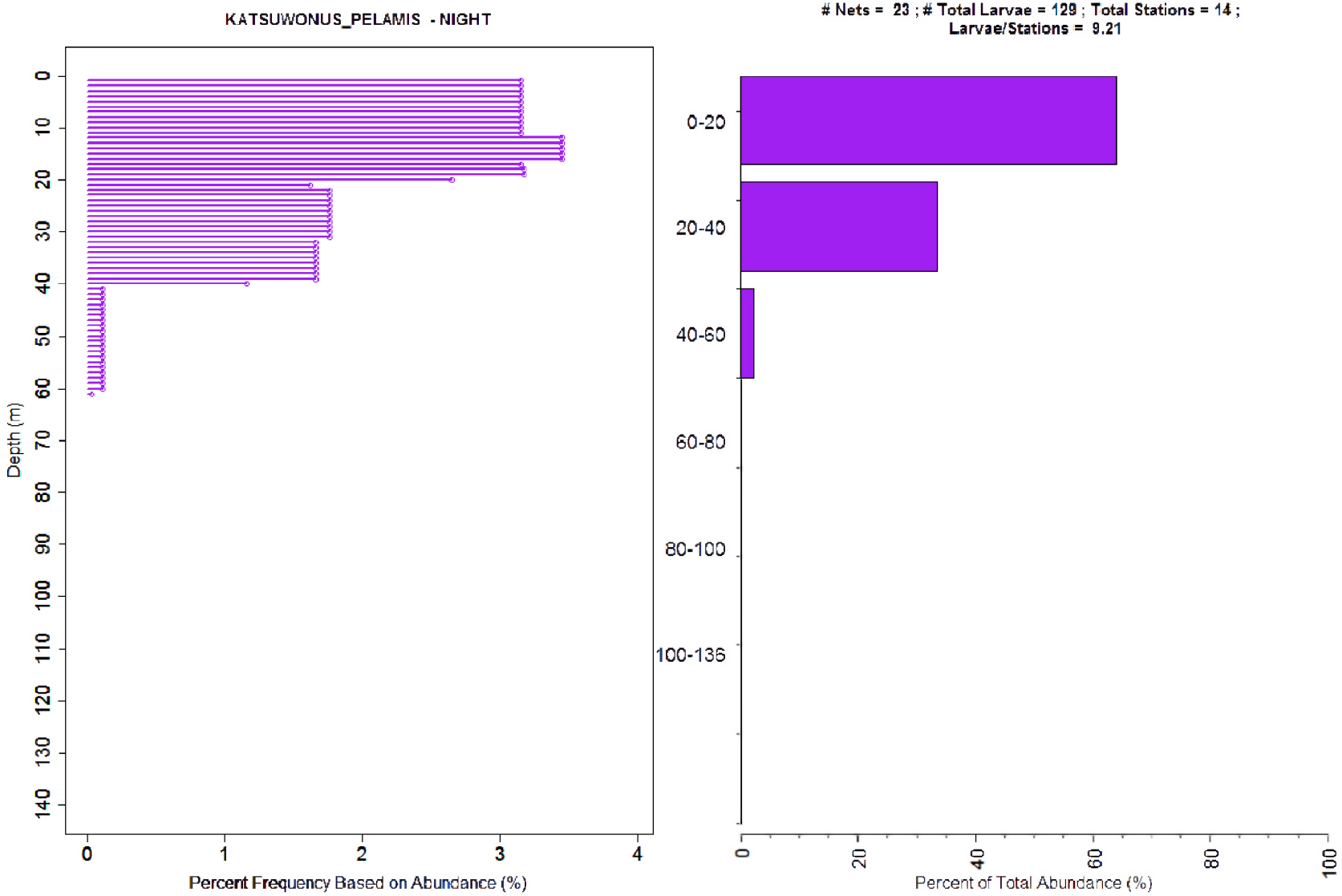
ISTIOPHORIDAE, DAY



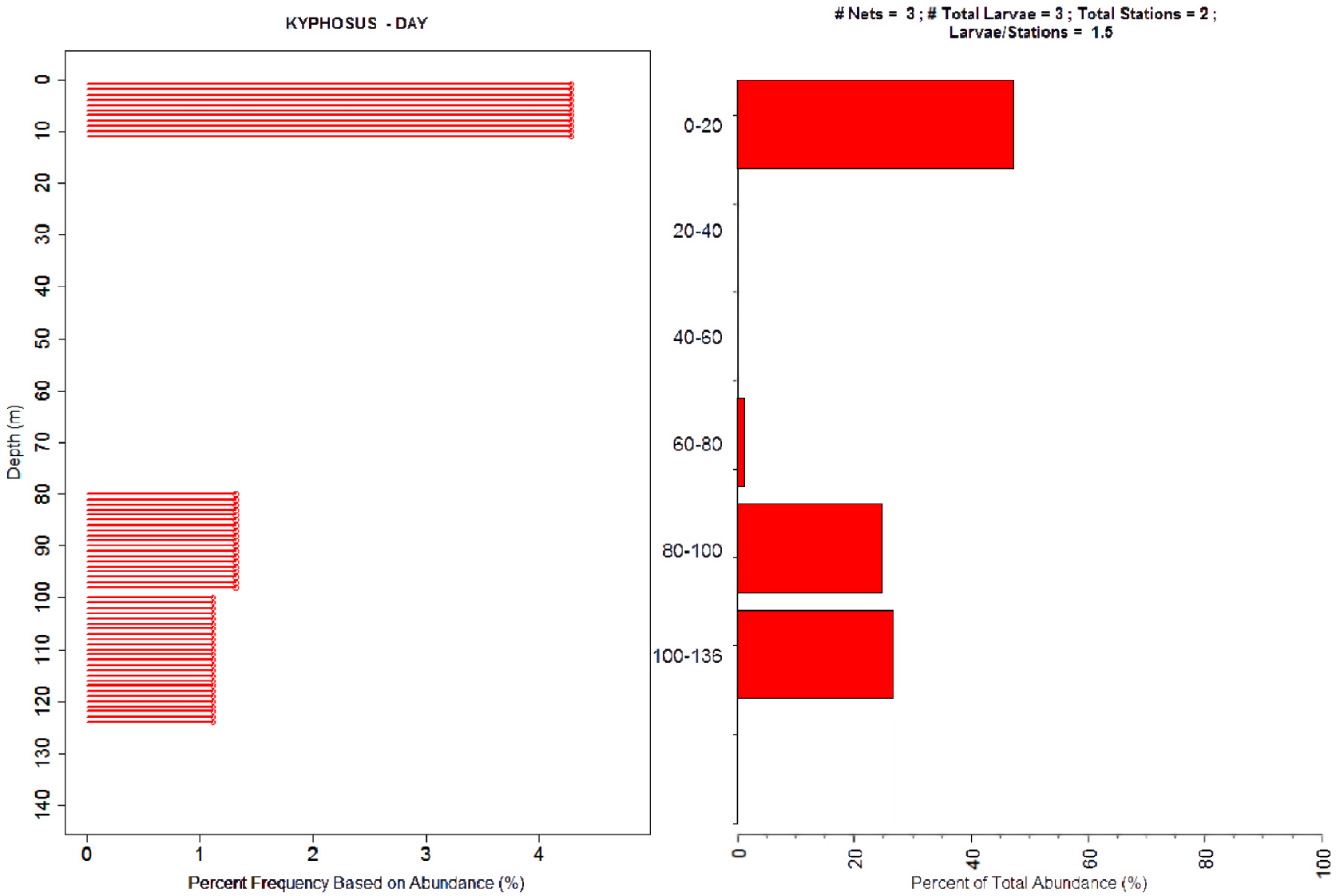
ISTIOPHORIDAE, NIGHT



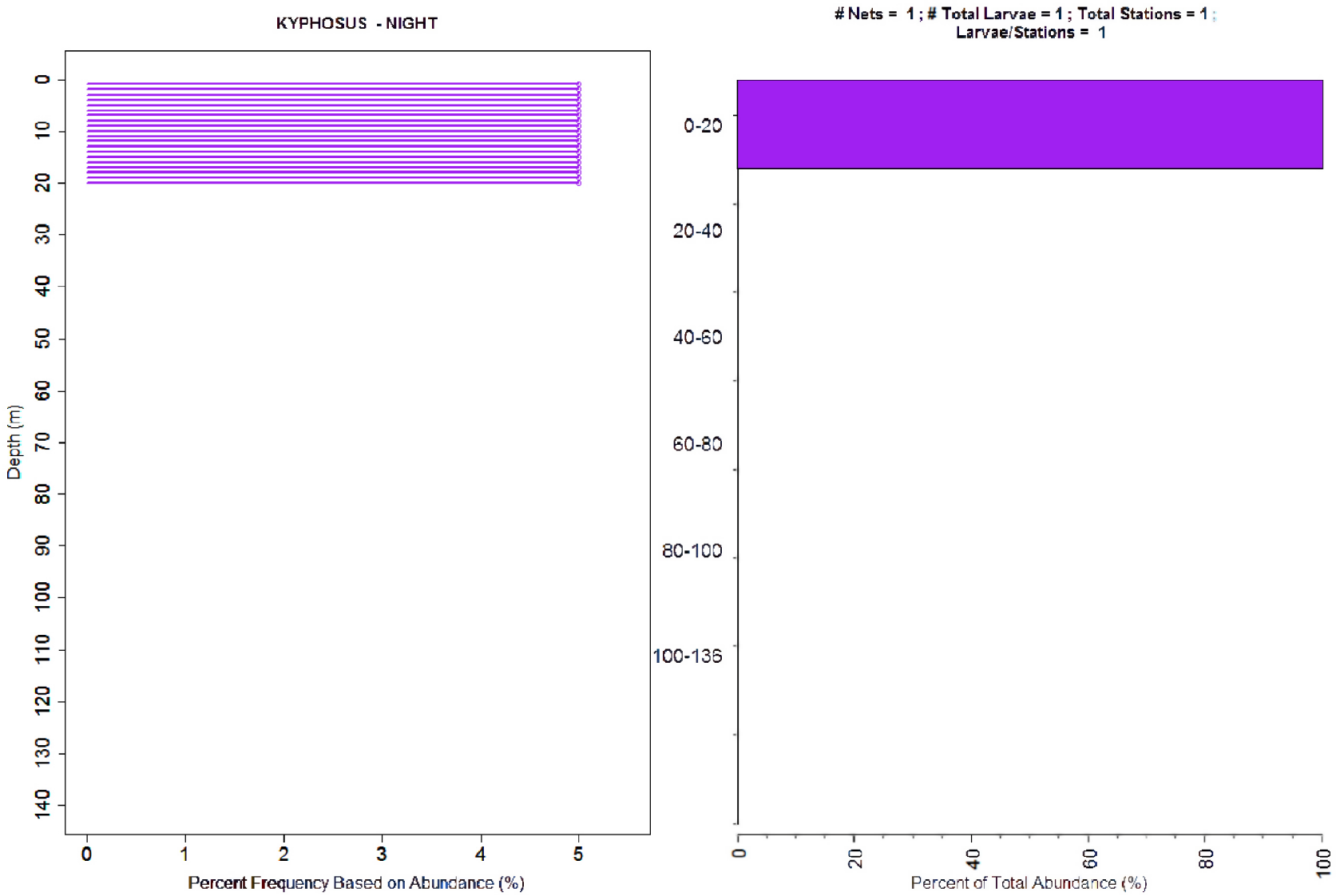
KATSUWONUS_PELAMIS, DAY



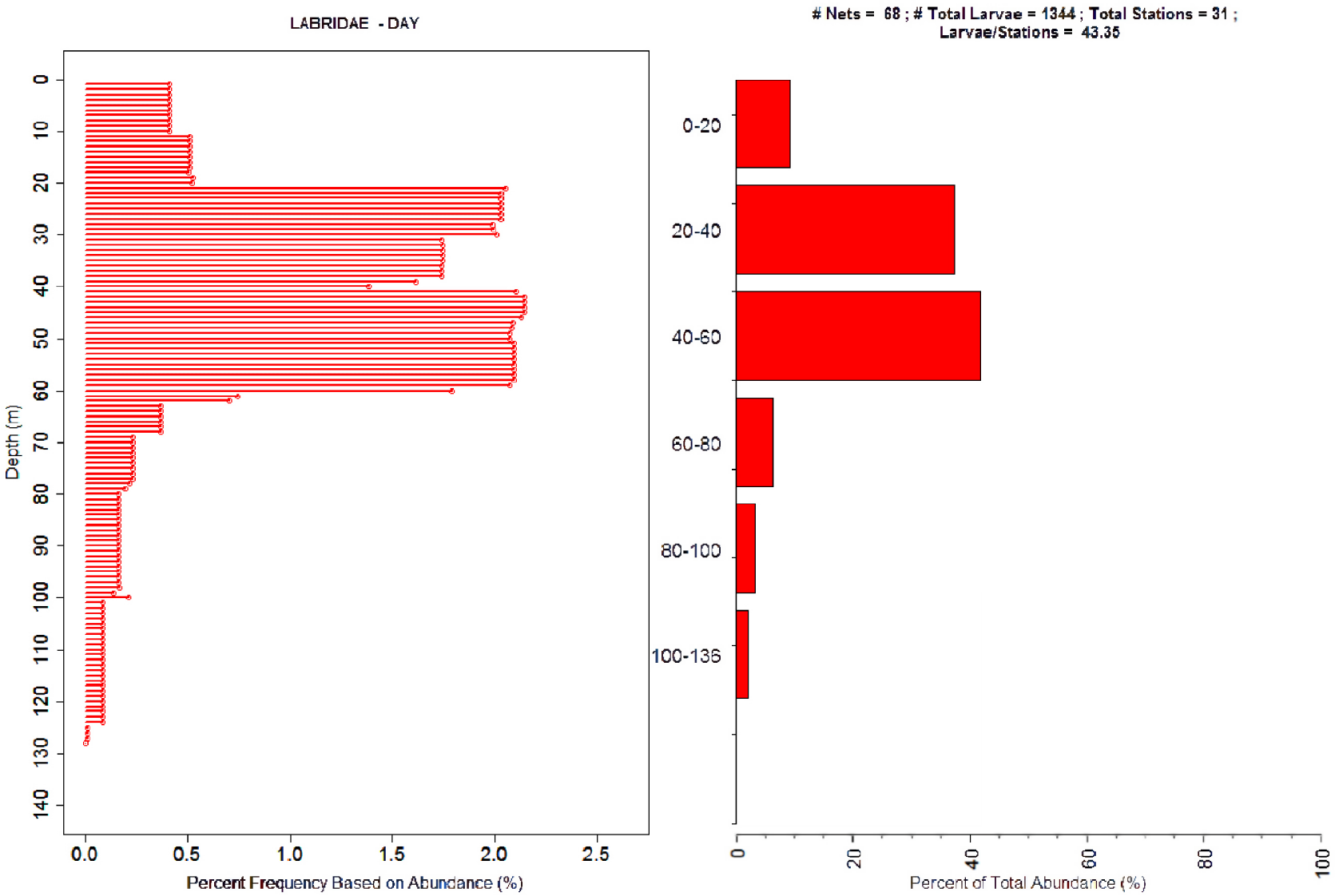
KATSUWONUS_PELAMIS, NIGHT



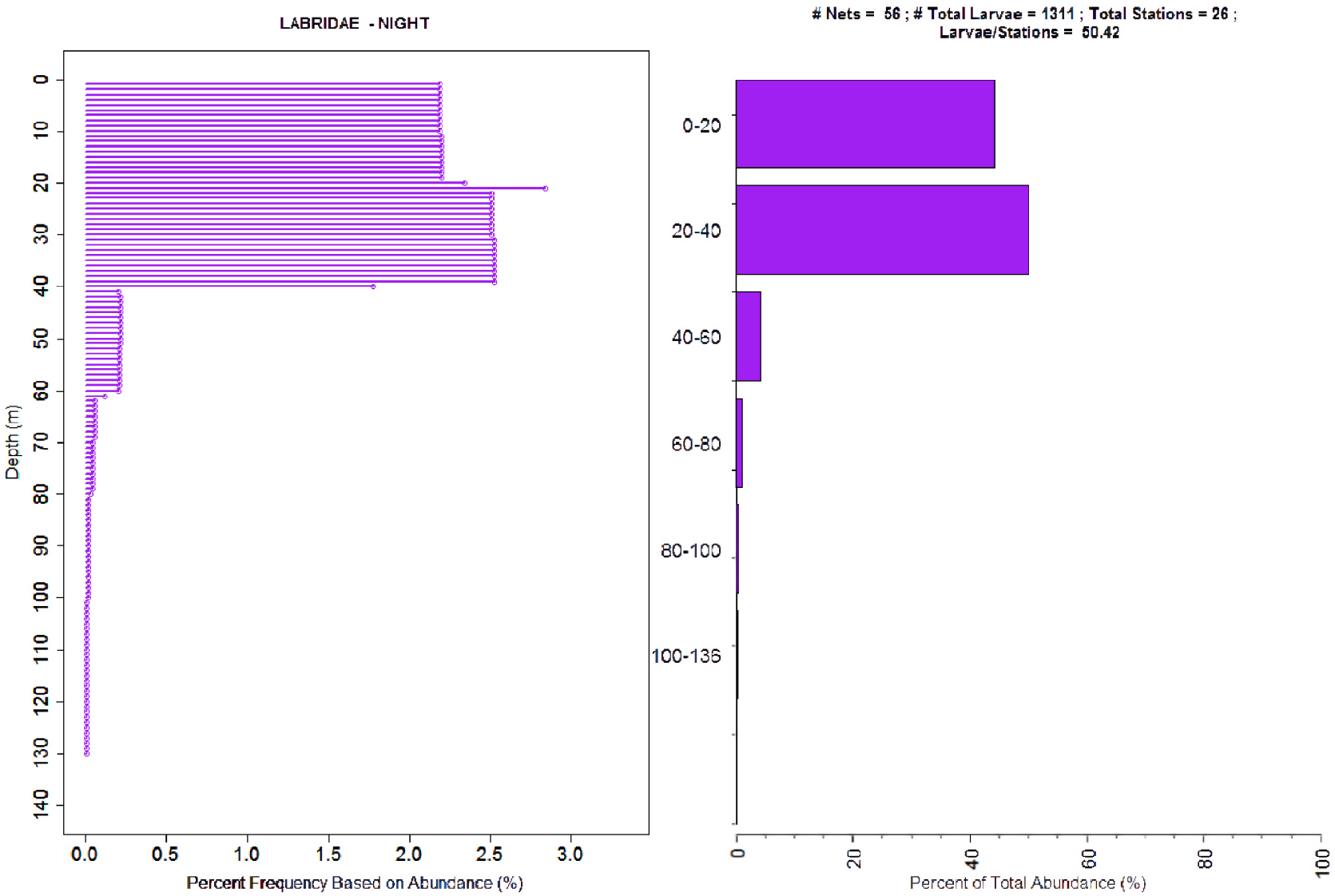
KYPHOSUS, DAY



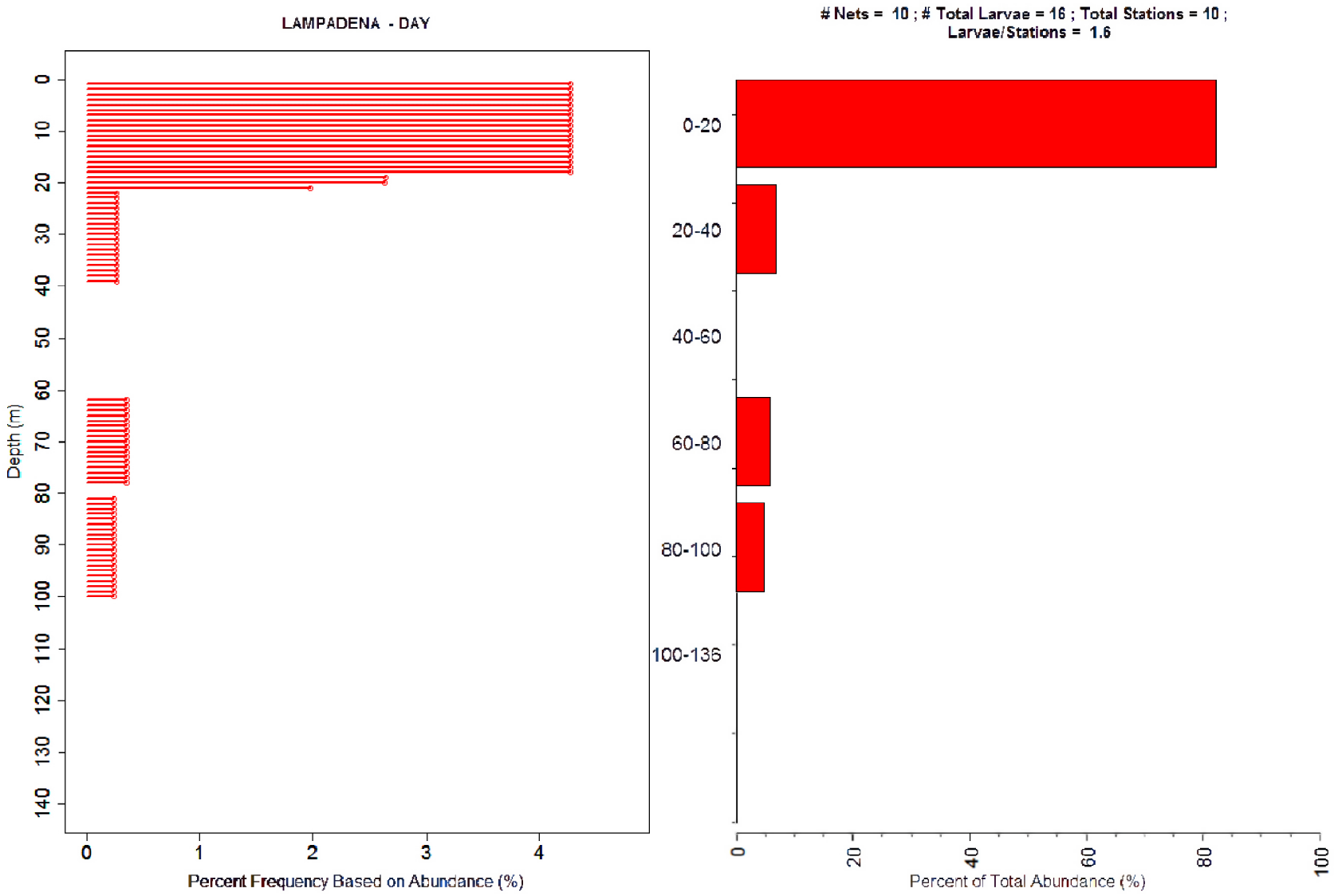
KYPHOSUS, NIGHT



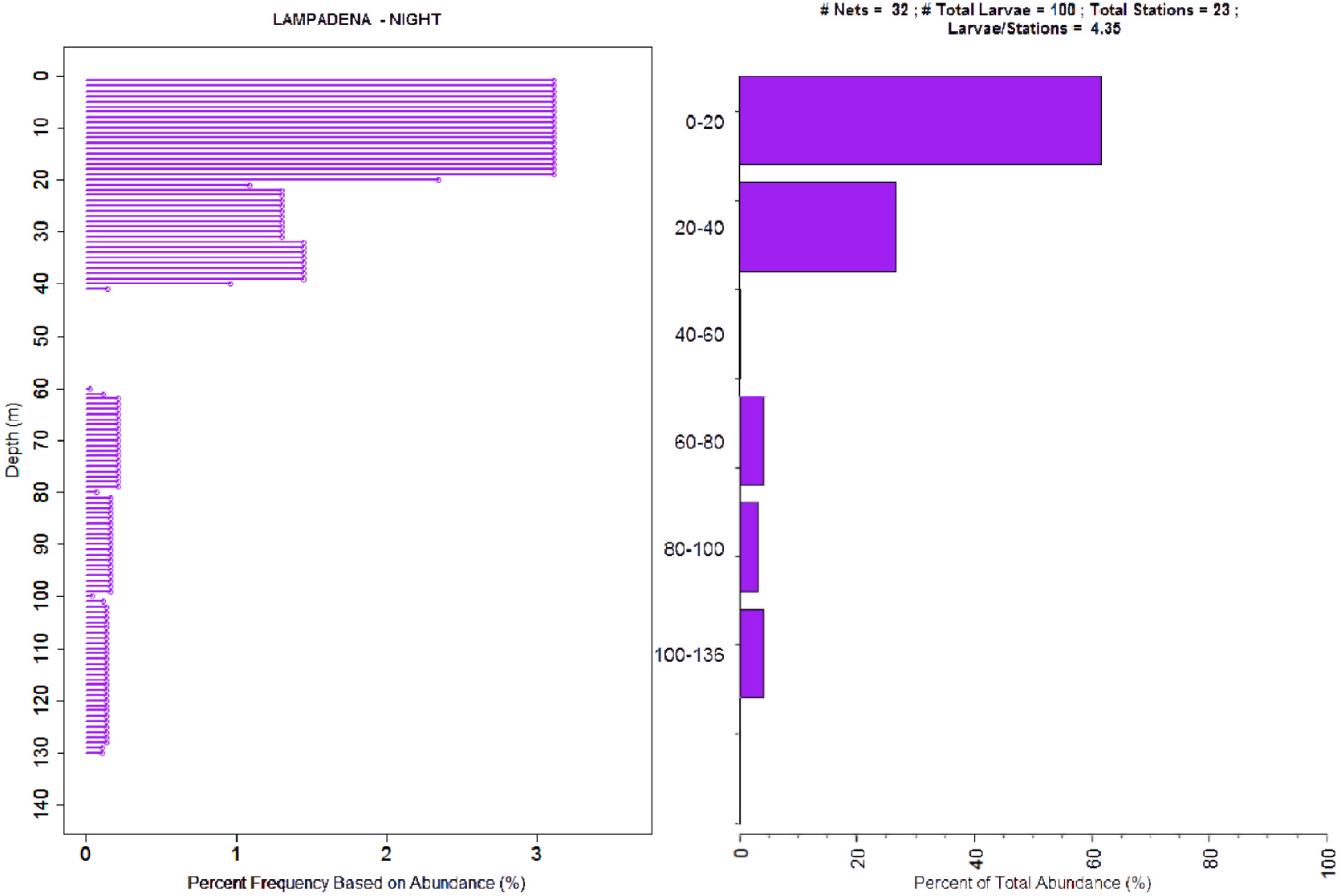
LABRIDAE, DAY



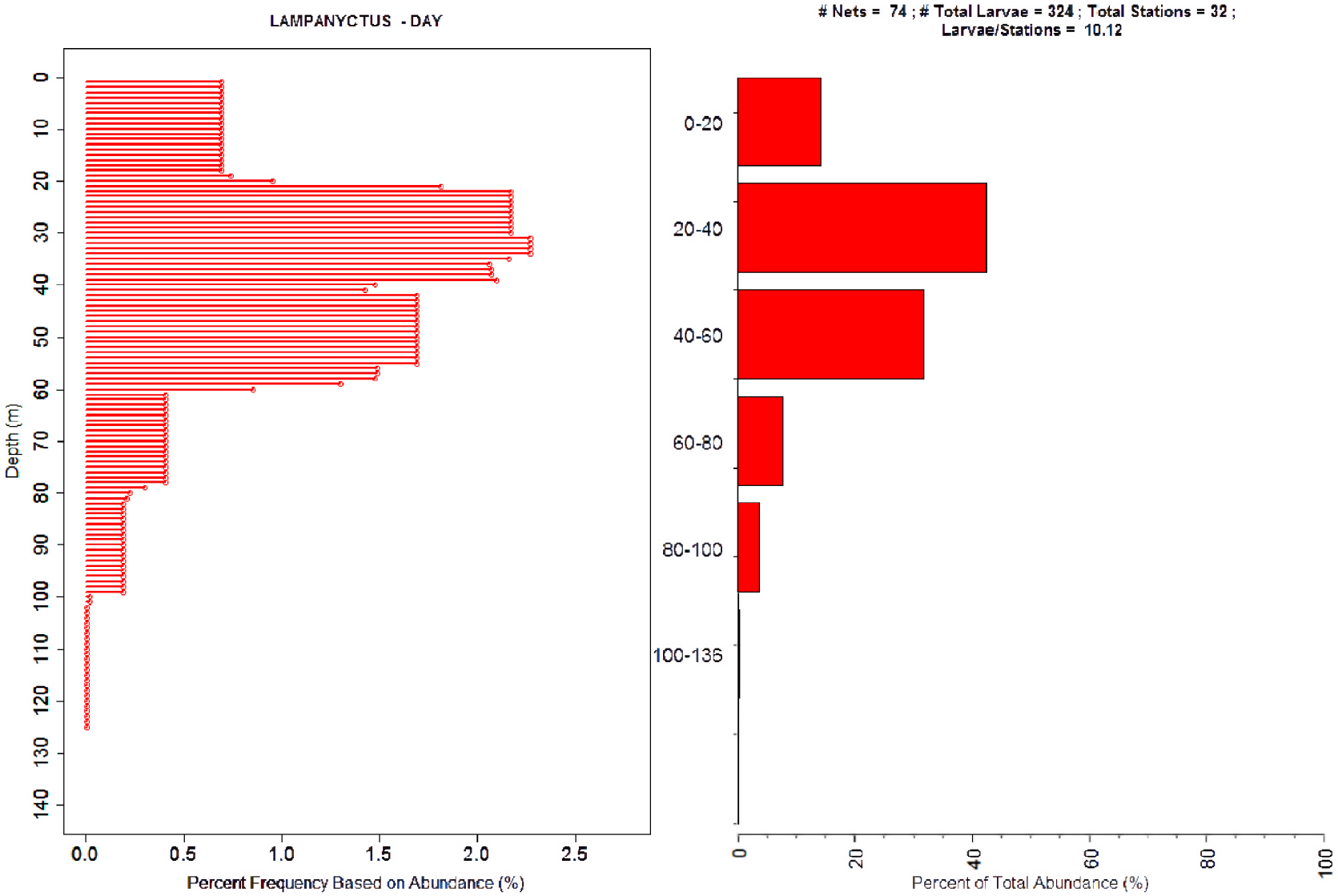
LABRIDAE, NIGHT



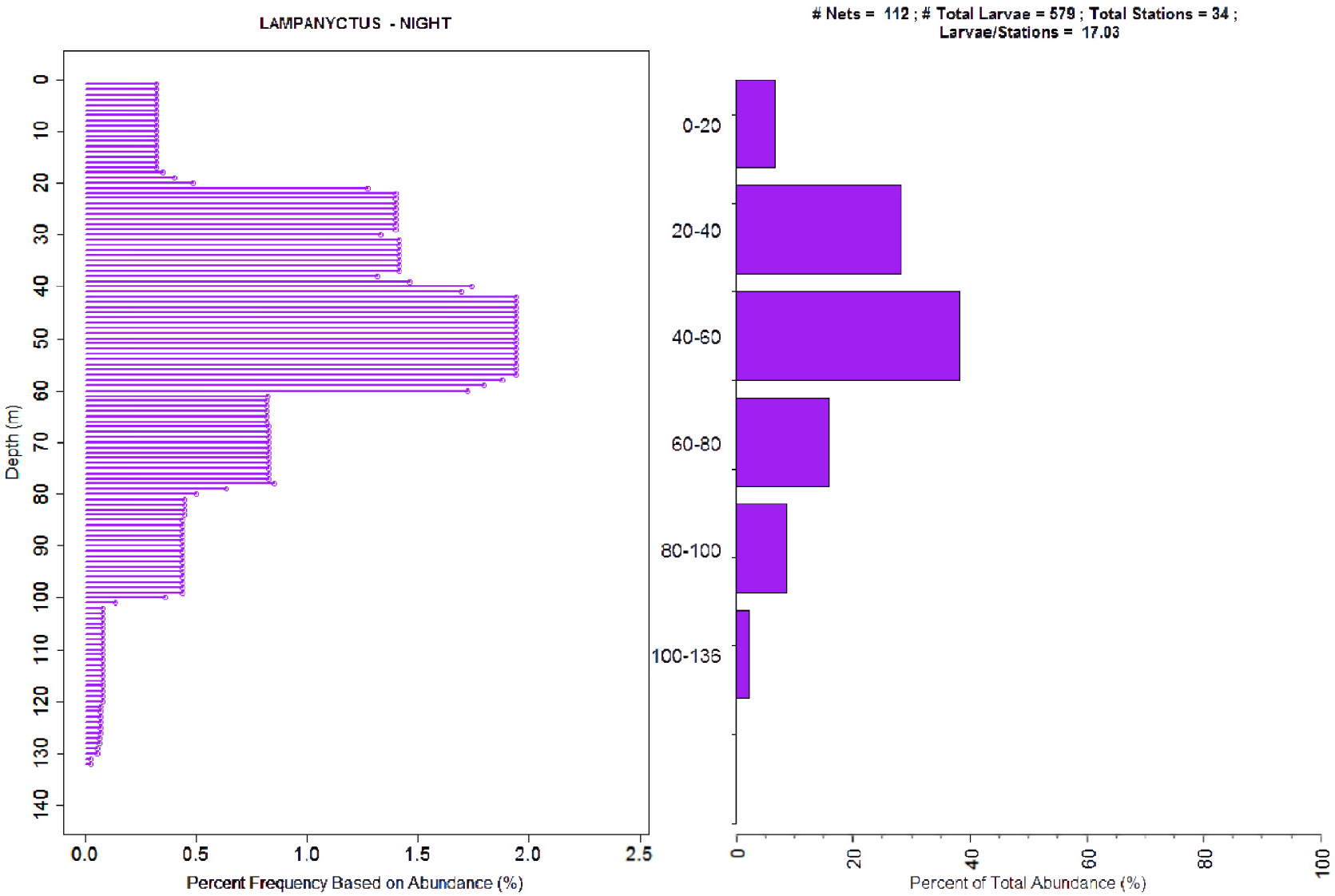
LAMPADENA, DAY



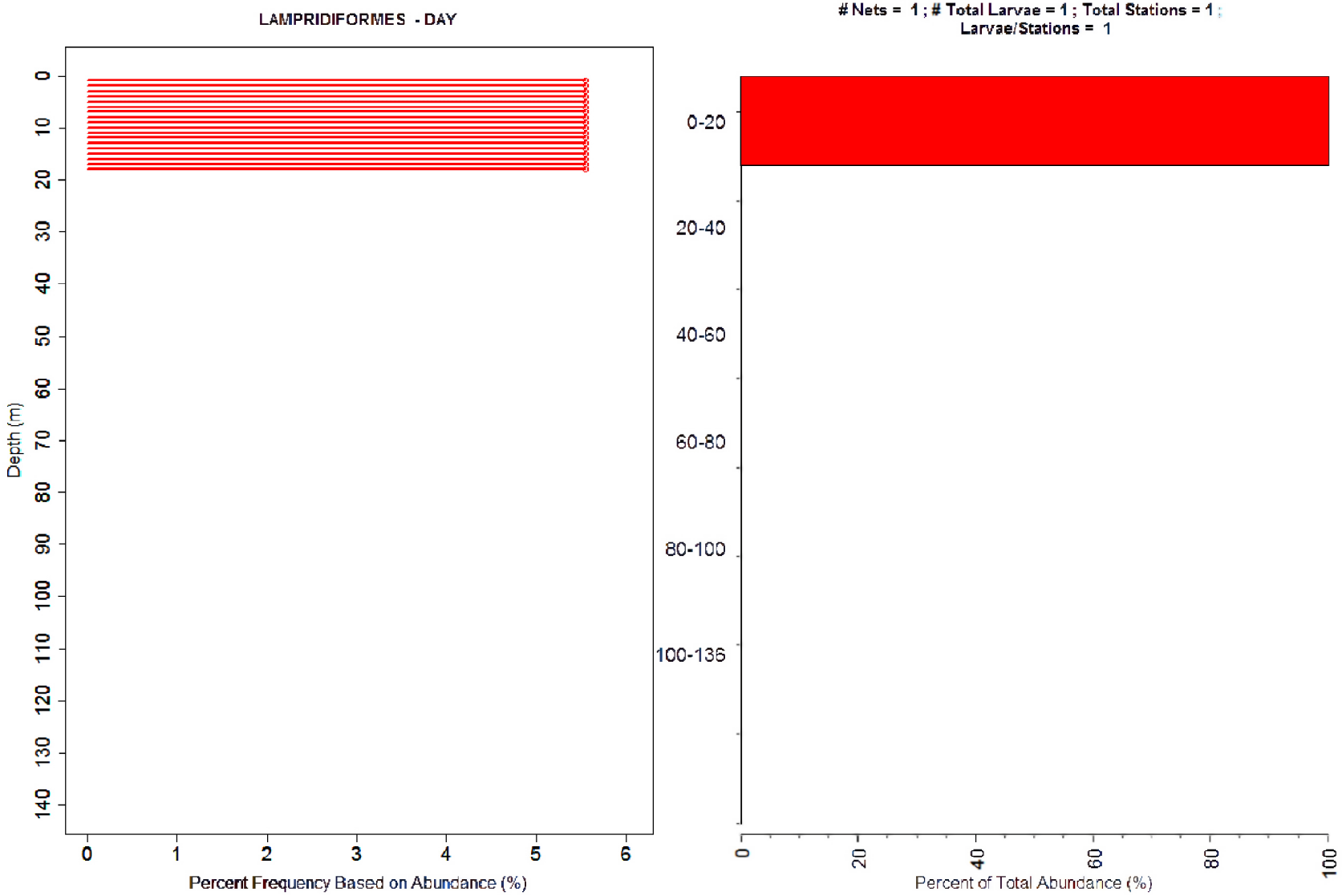
LAMPADENA, NIGHT



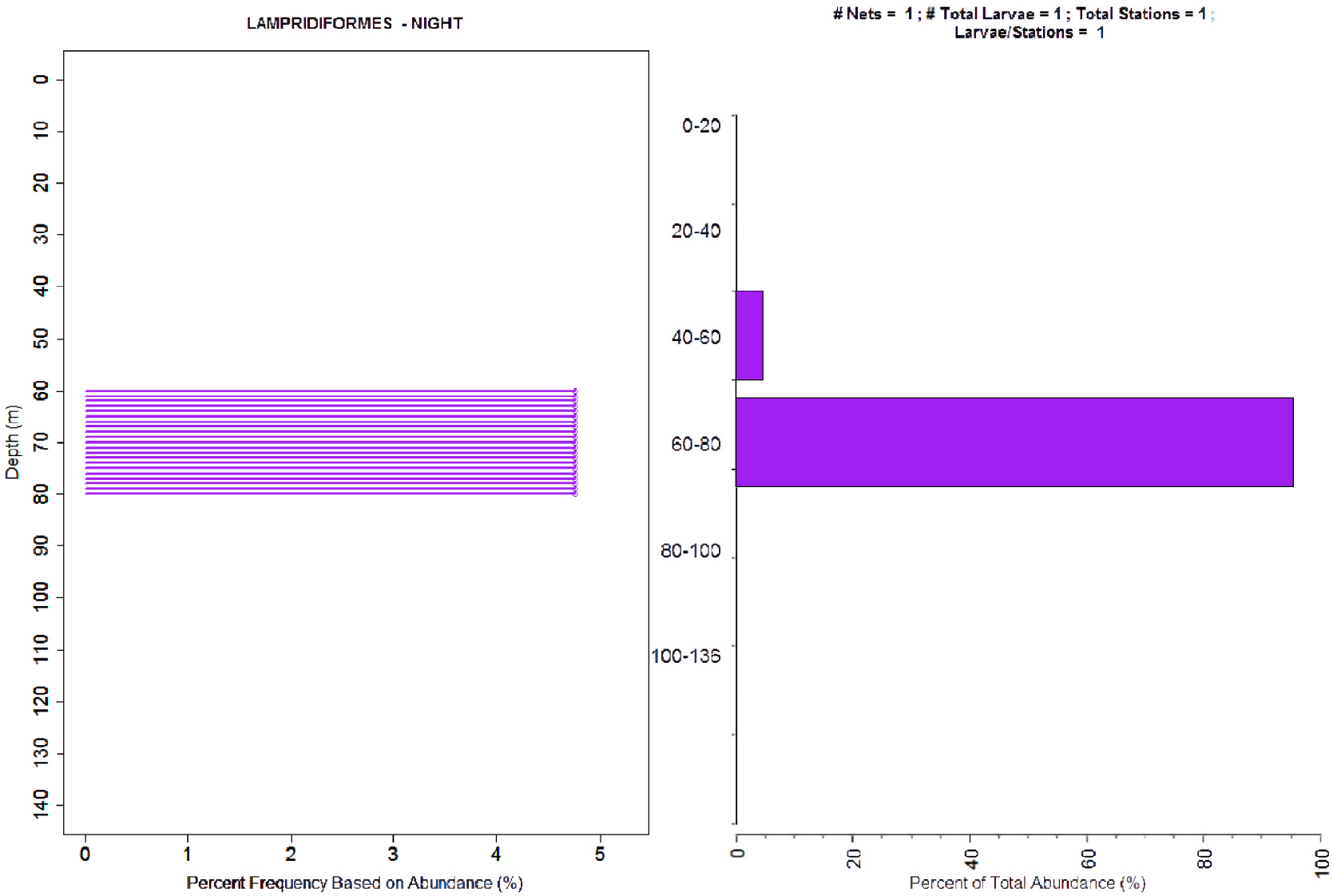
LAMPANYCTUS, DAY



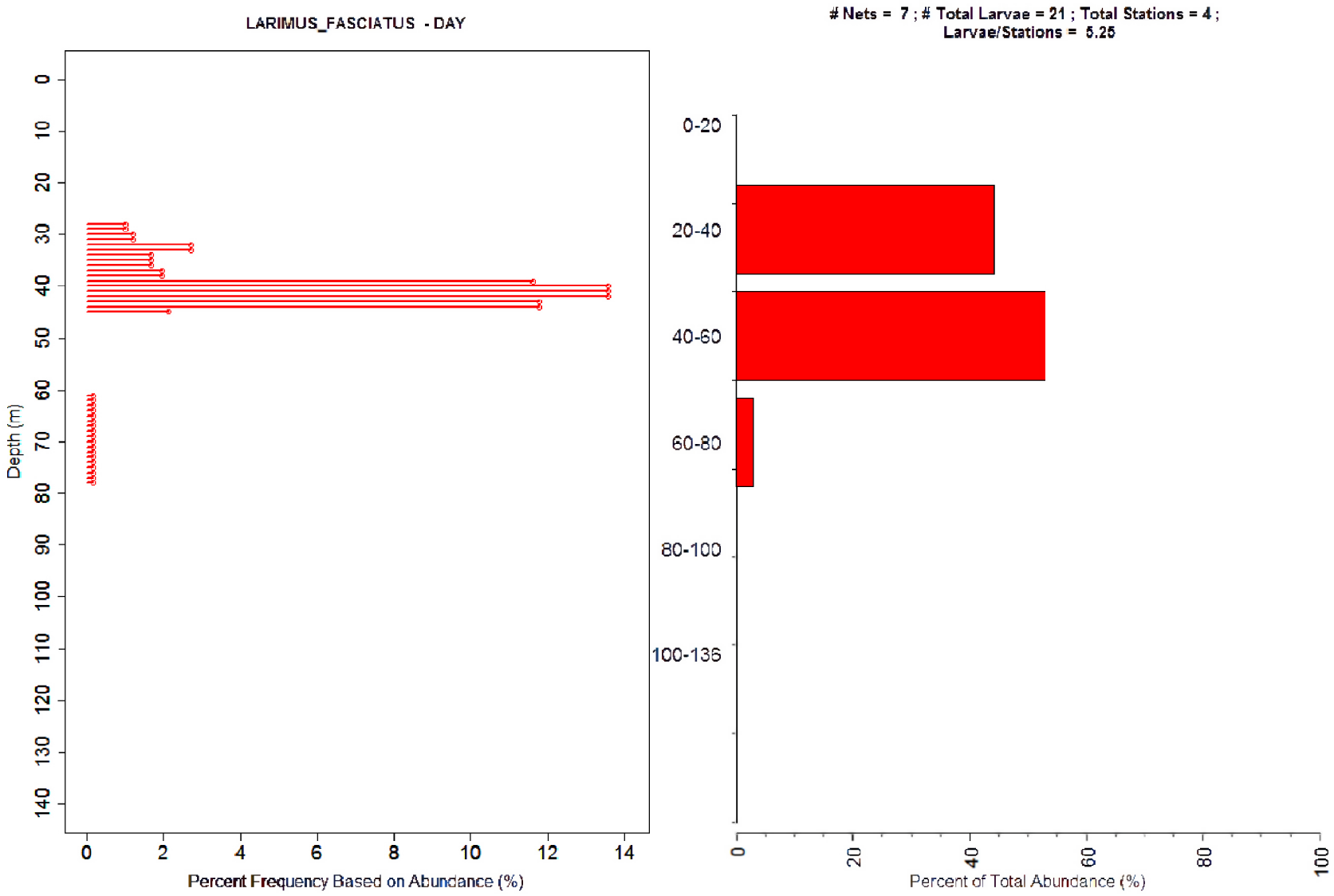
LAMPANYCTUS, NIGHT



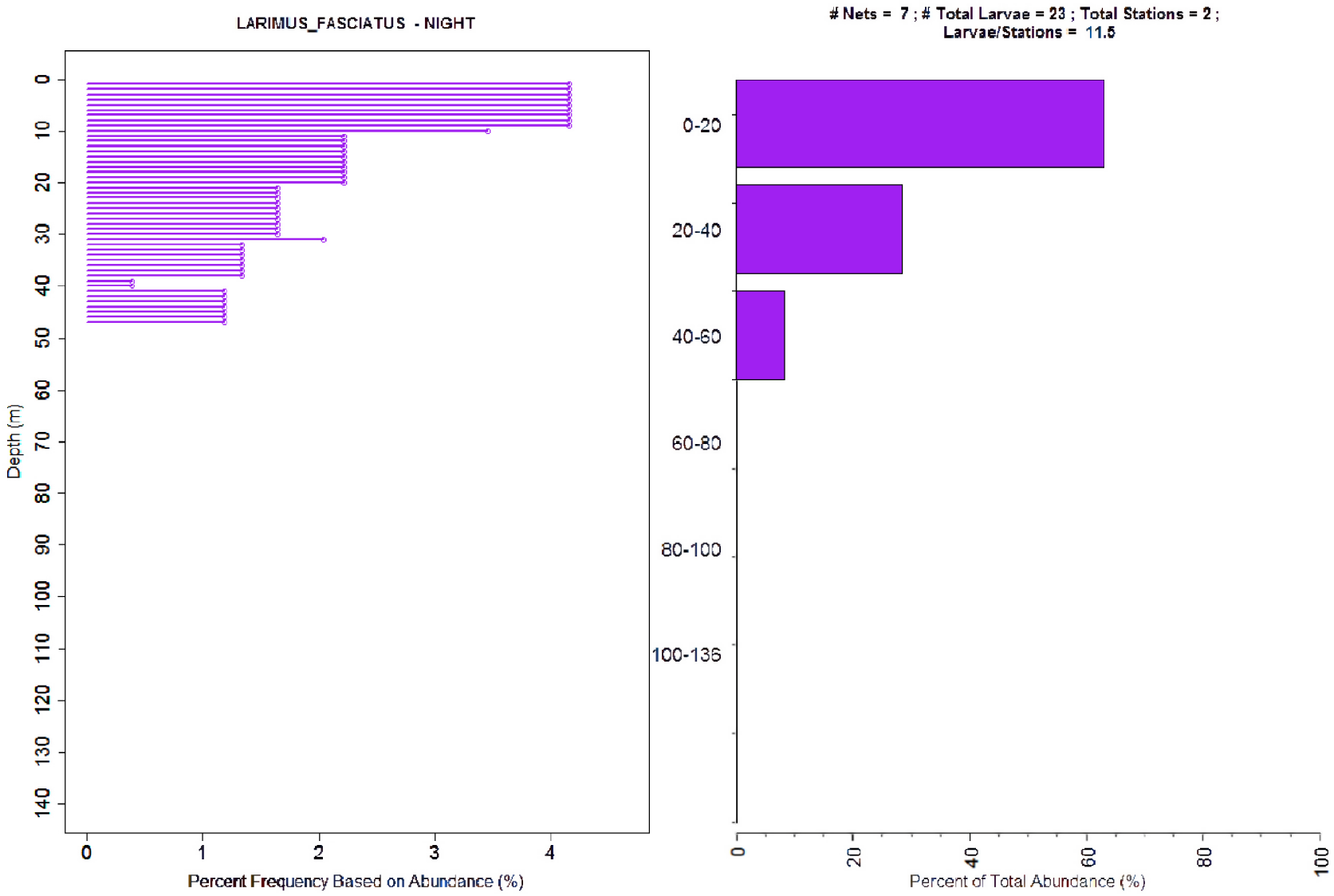
LAMPRIDIFORMES, DAY



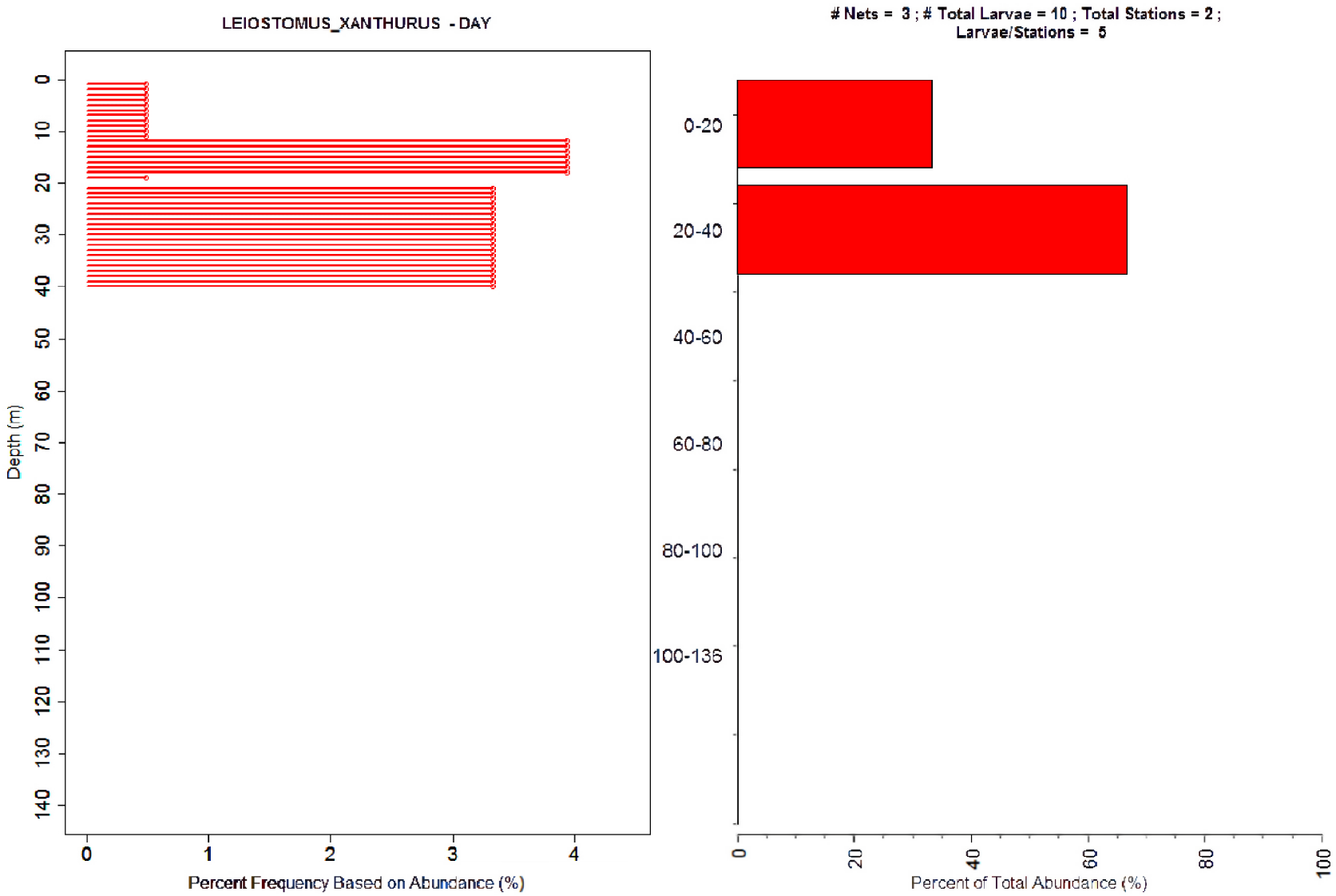
LAMPRIDIFORMES, NIGHT



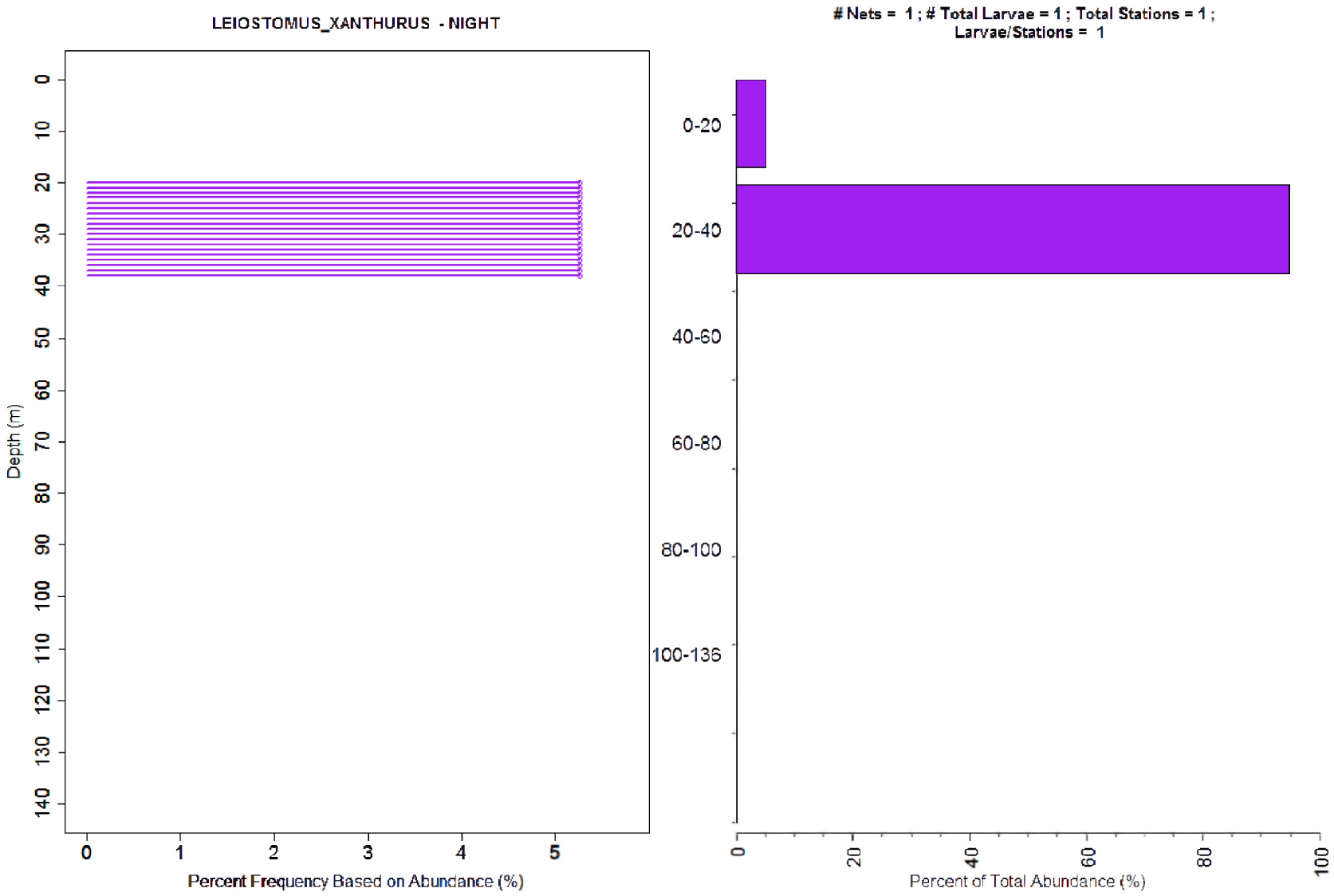
LARIMUS_FASCIATUS, DAY



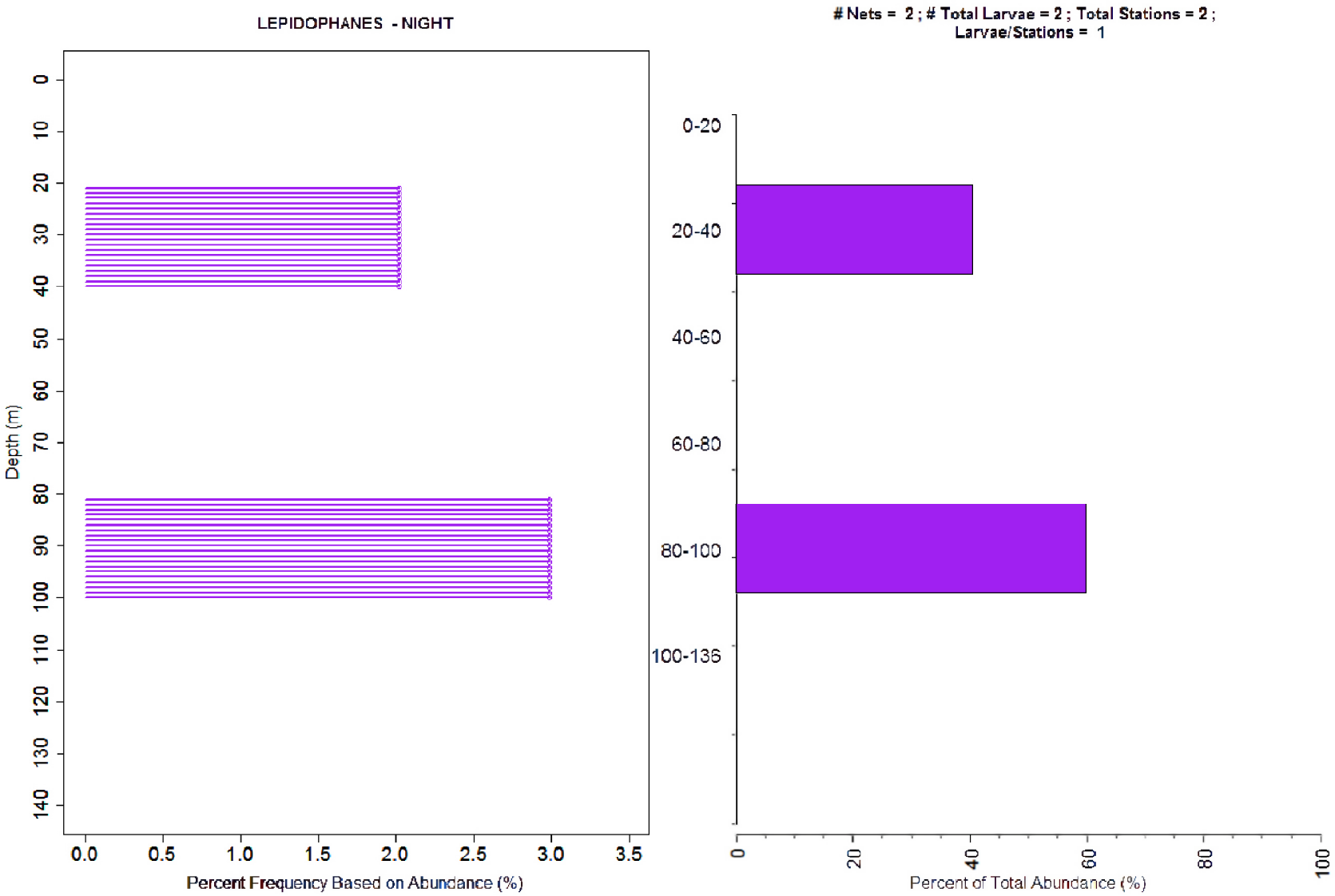
LARIMUS_FASCIATUS, NIGHT



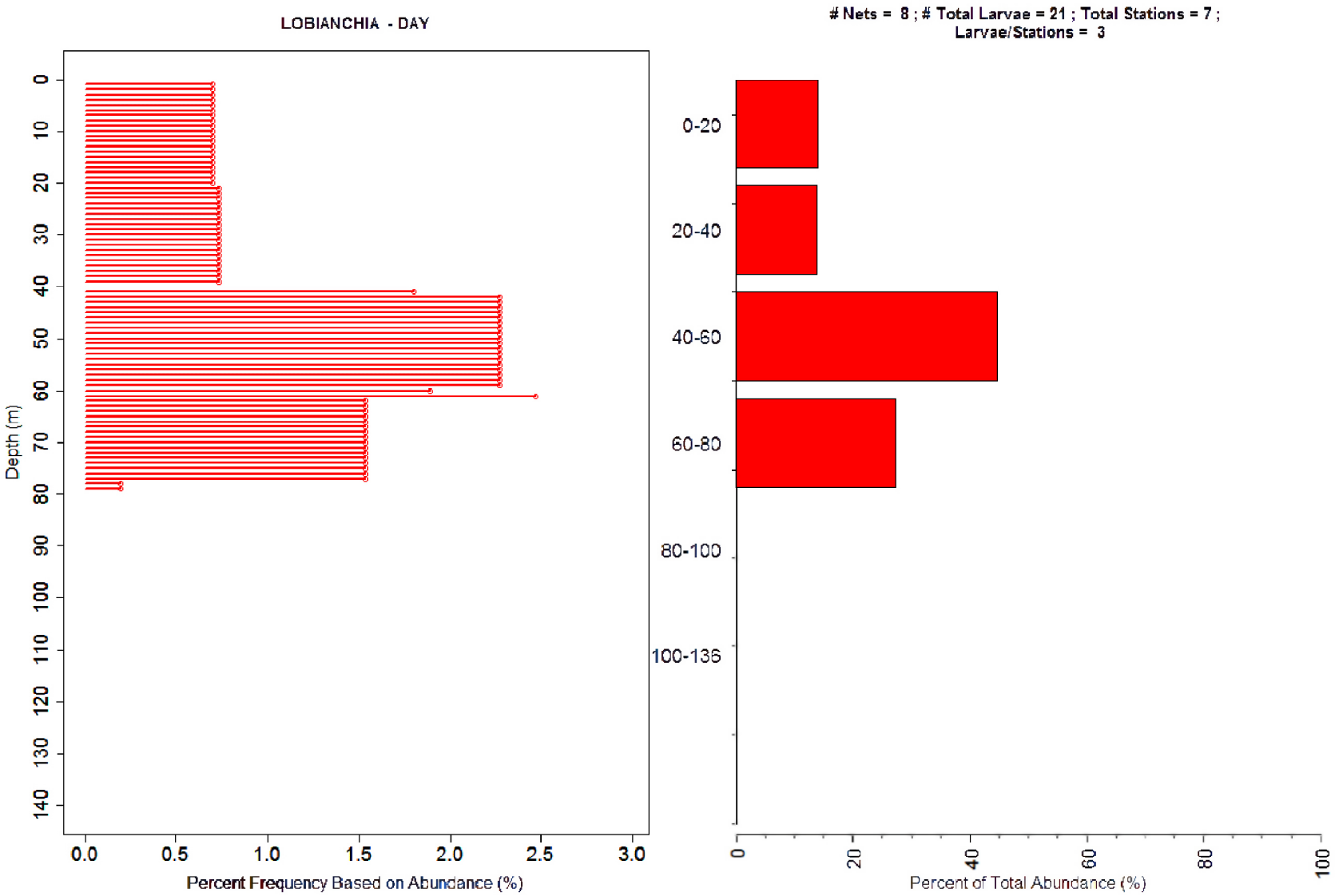
LEIOSTOMUS_XANTHURUS, DAY



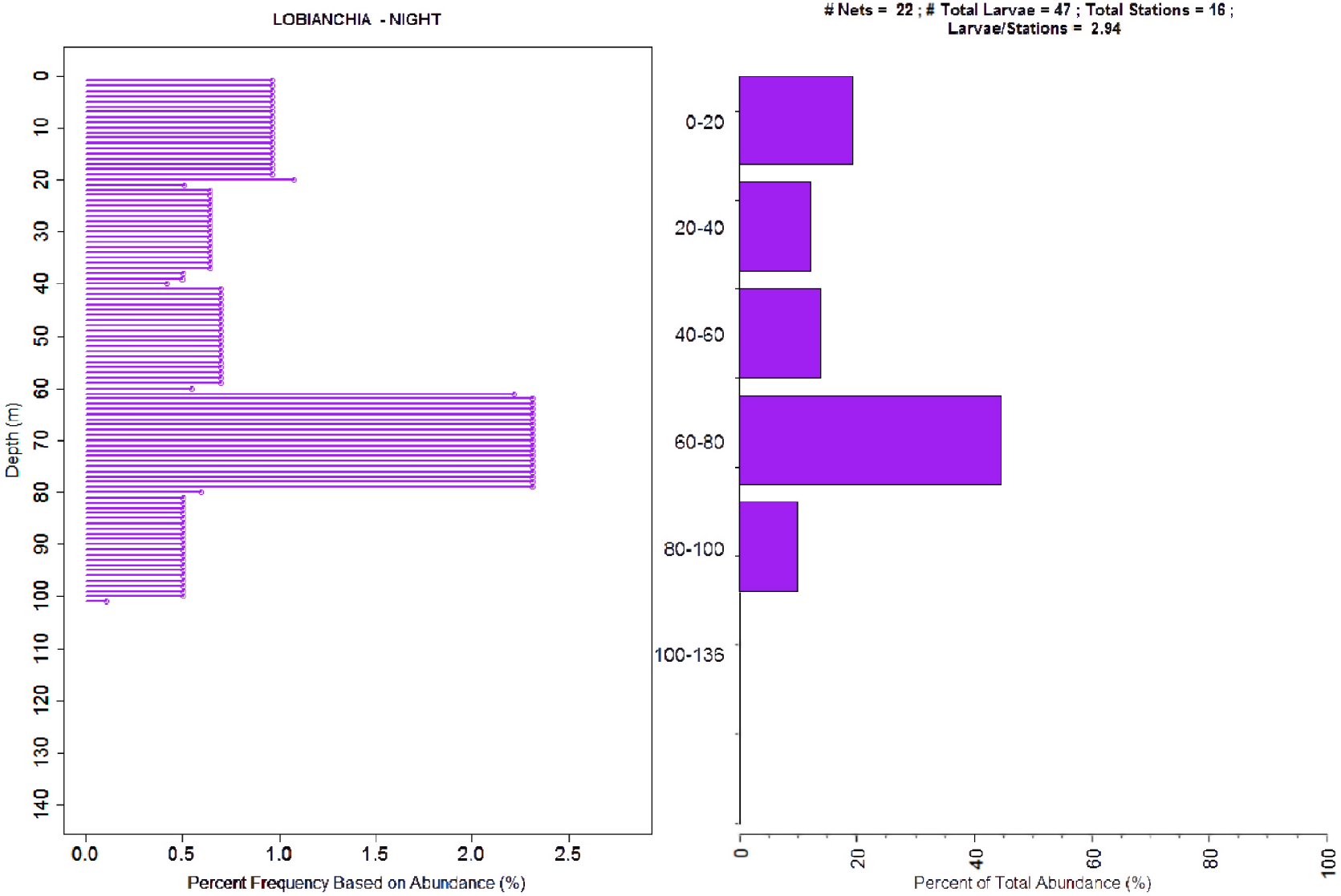
LEIOSTOMUS_XANTHURUS, NIGHT



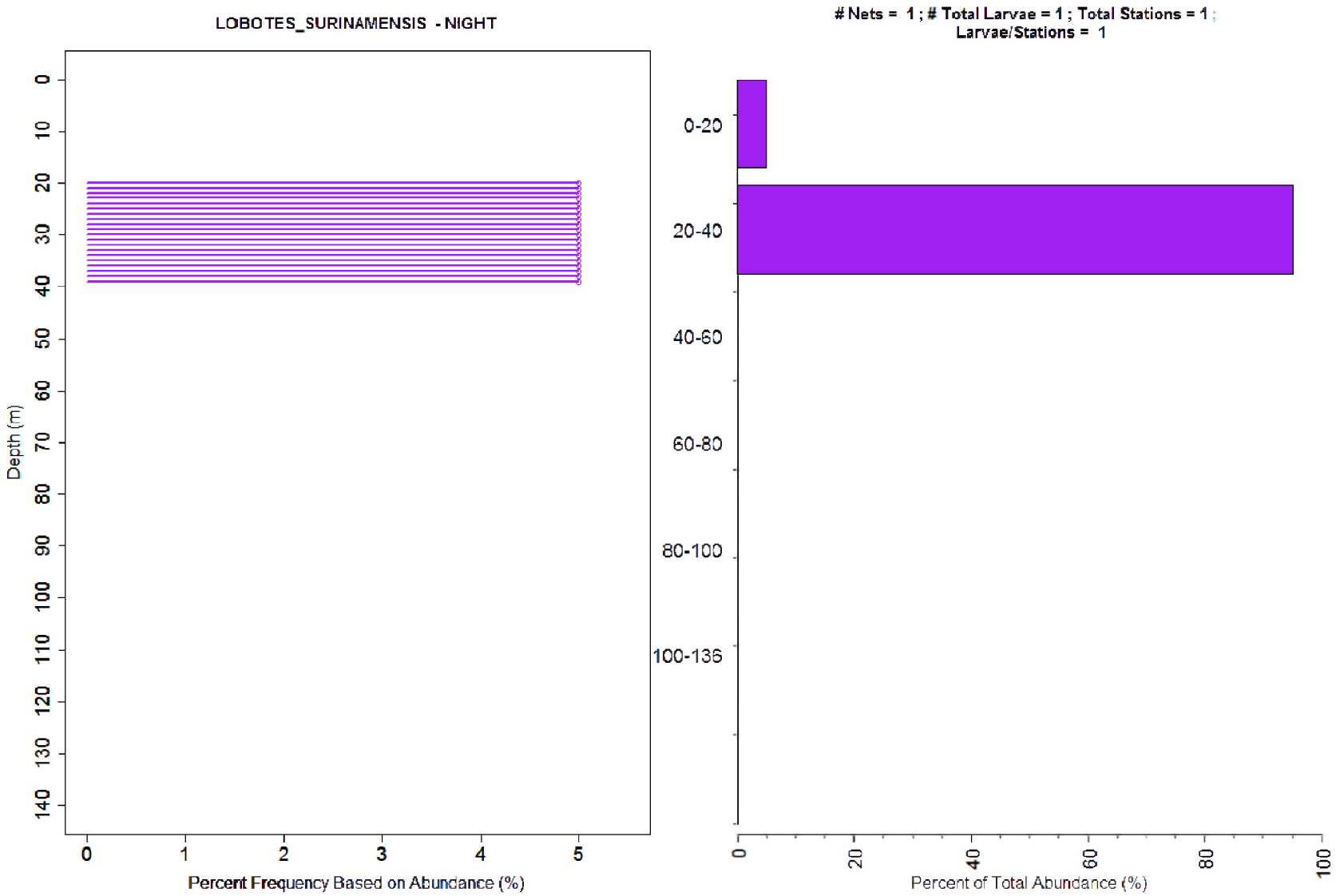
LEPIDOPHANES, NIGHT



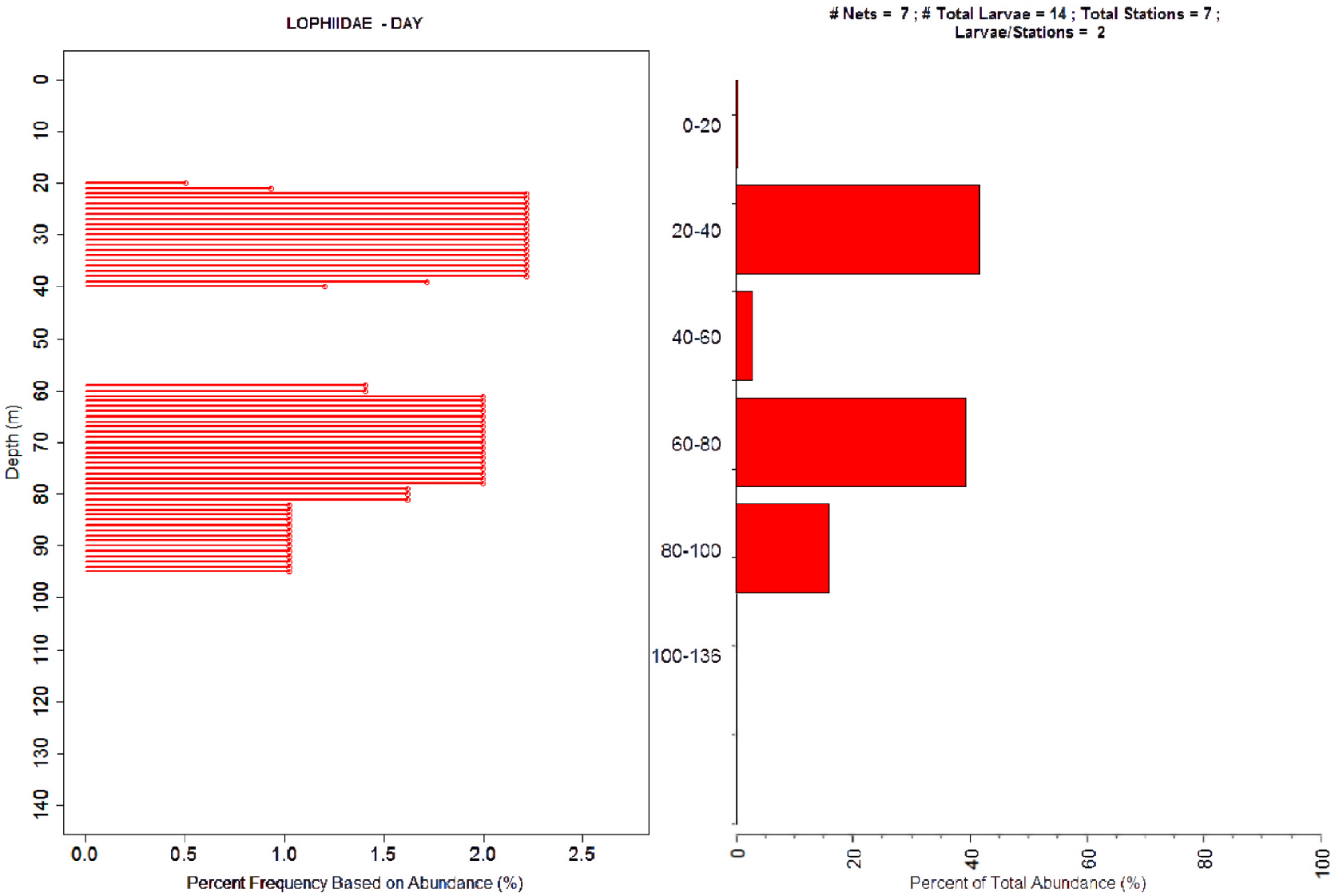
LOBIANCHIA, DAY



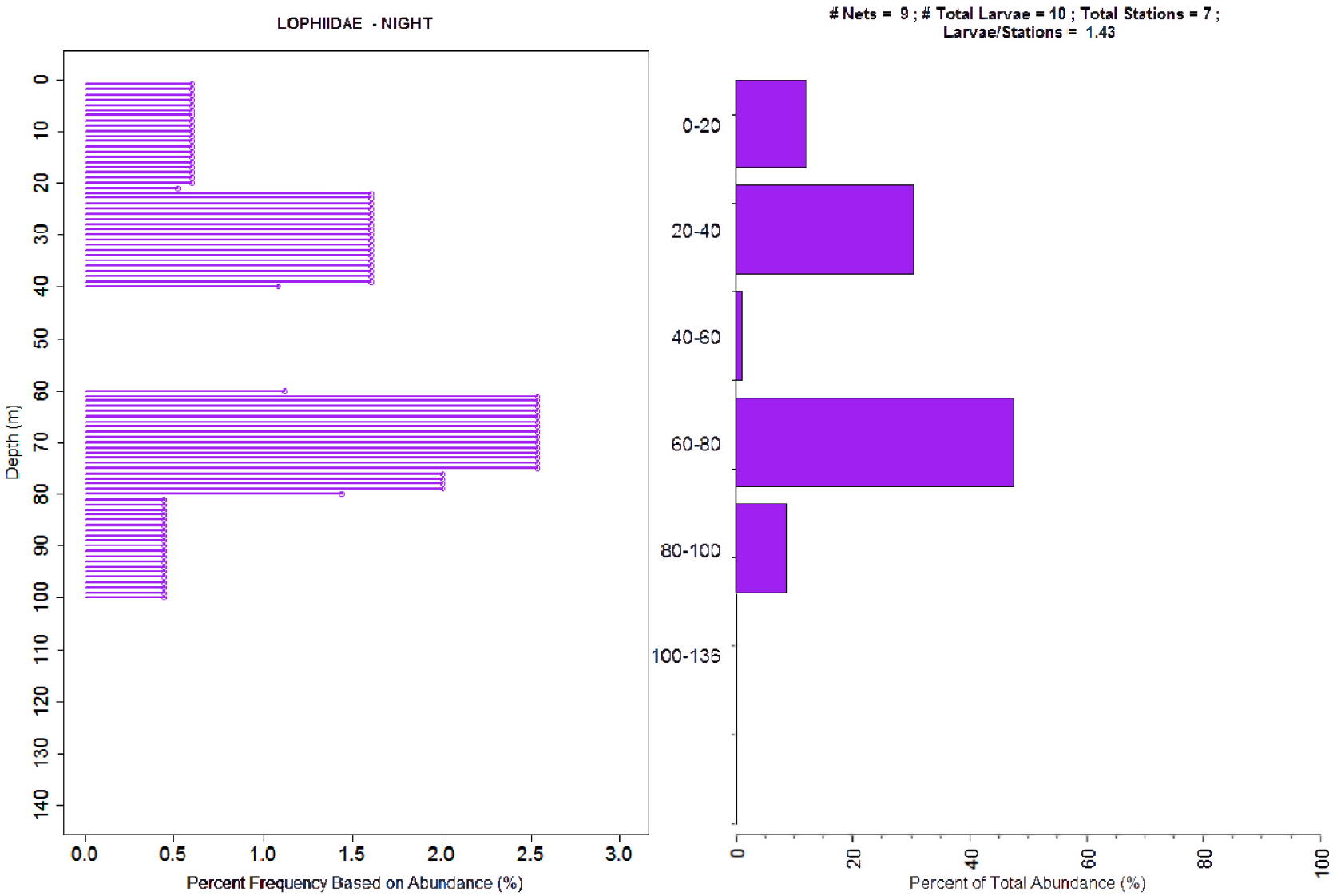
LOBIANCHIA, NIGHT



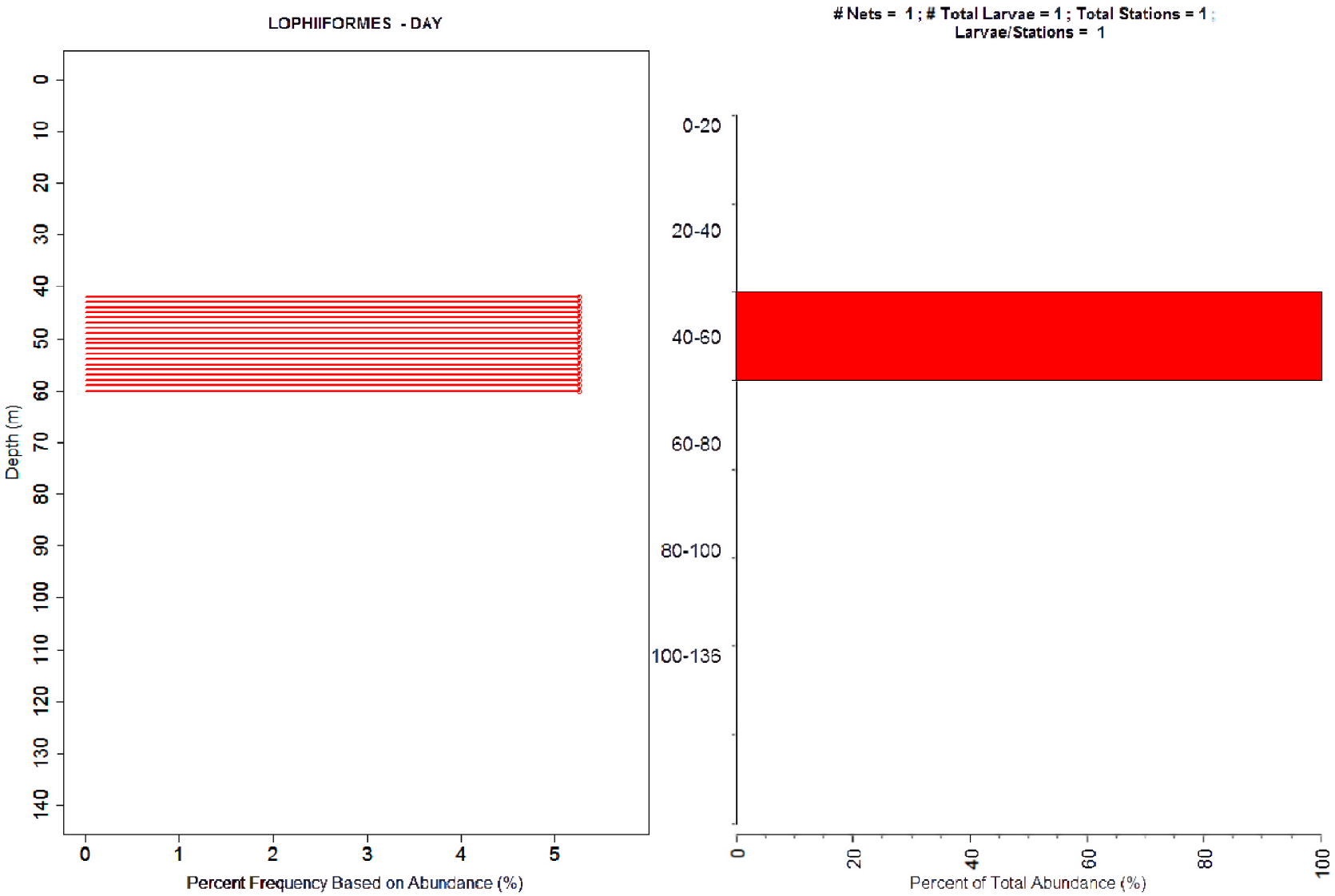
LOBOTES_SURINAMENSIS, NIGHT



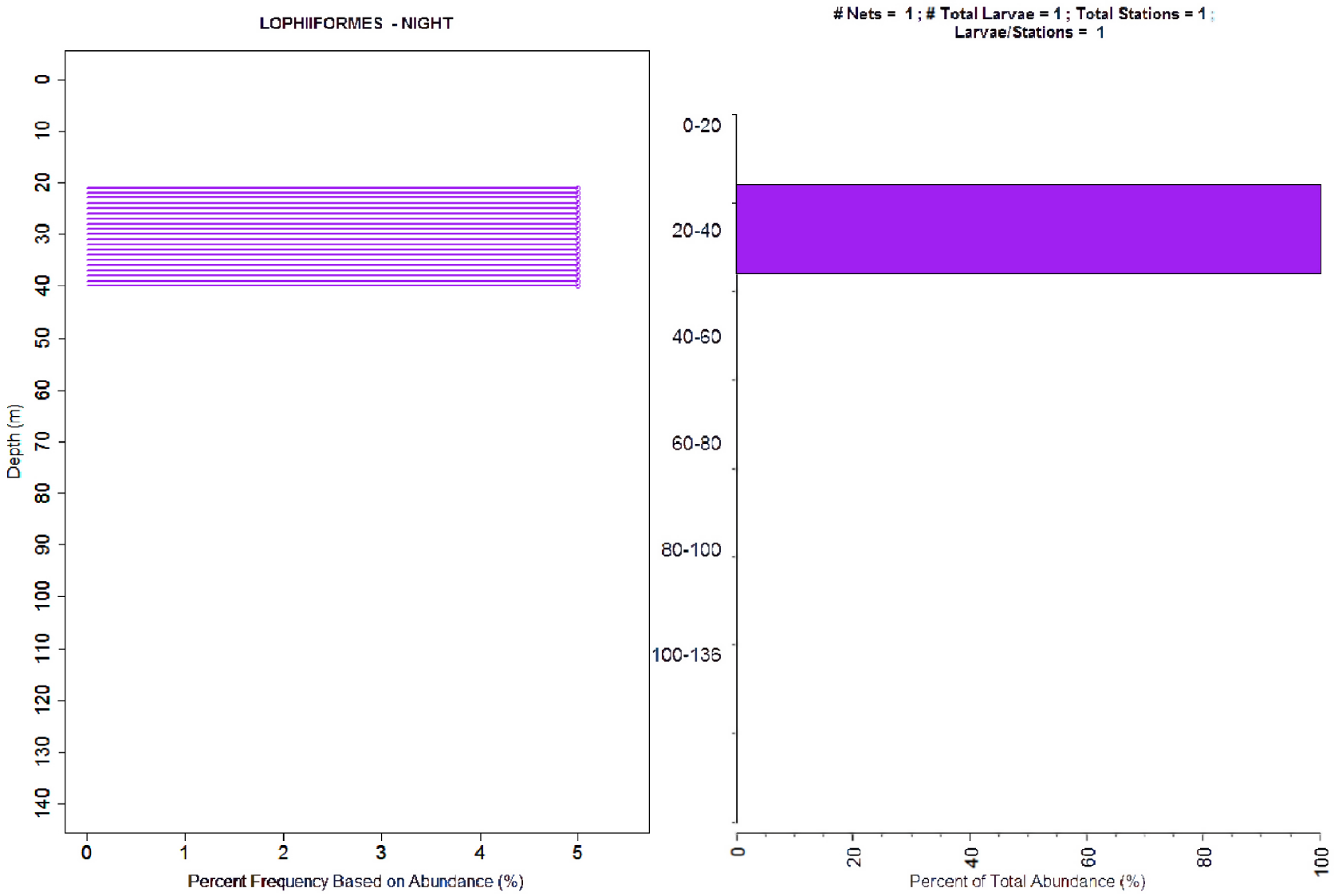
LOPHIIDAE, DAY



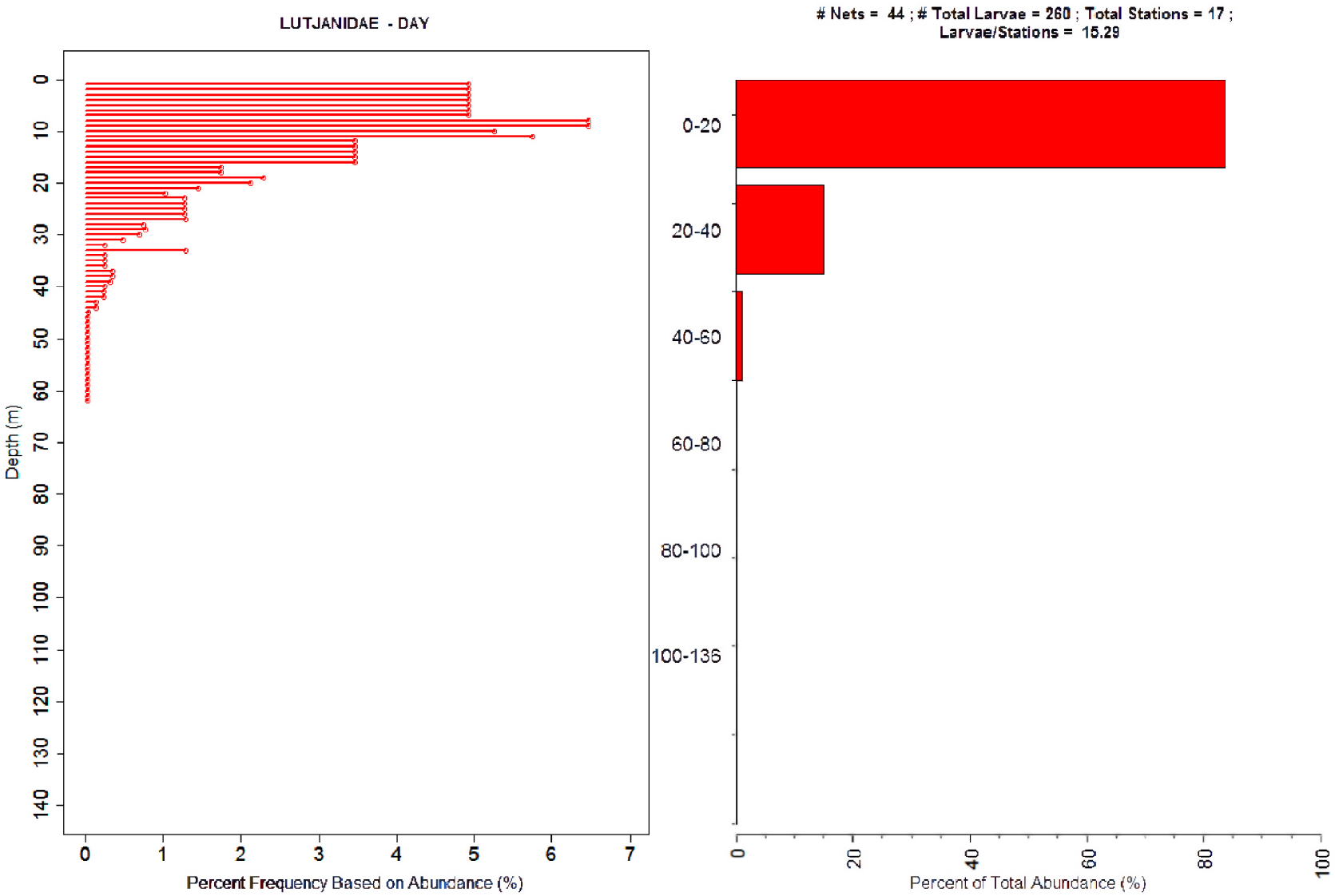
LOPHIIDAE, NIGHT



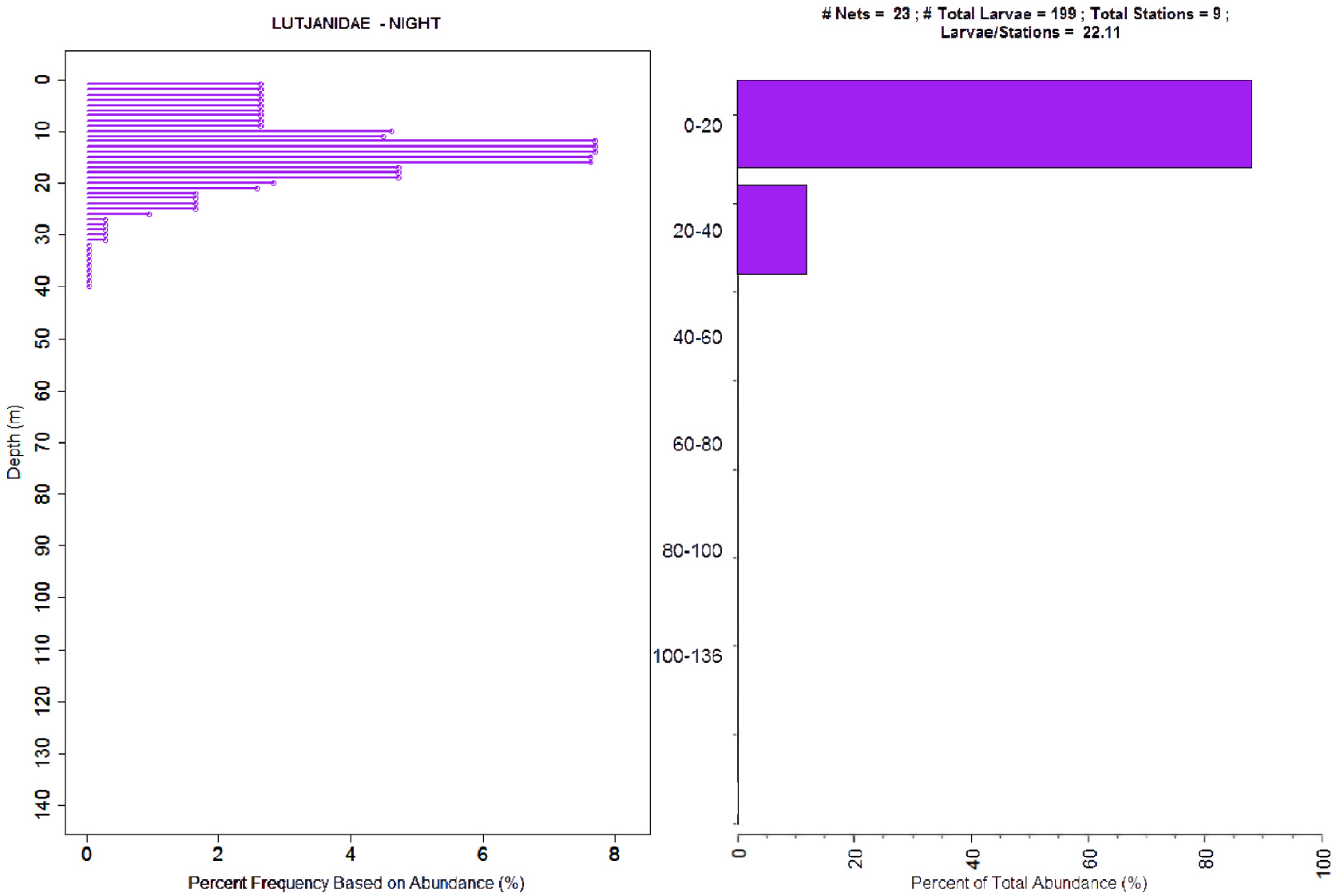
LOPHIIFORMES, DAY



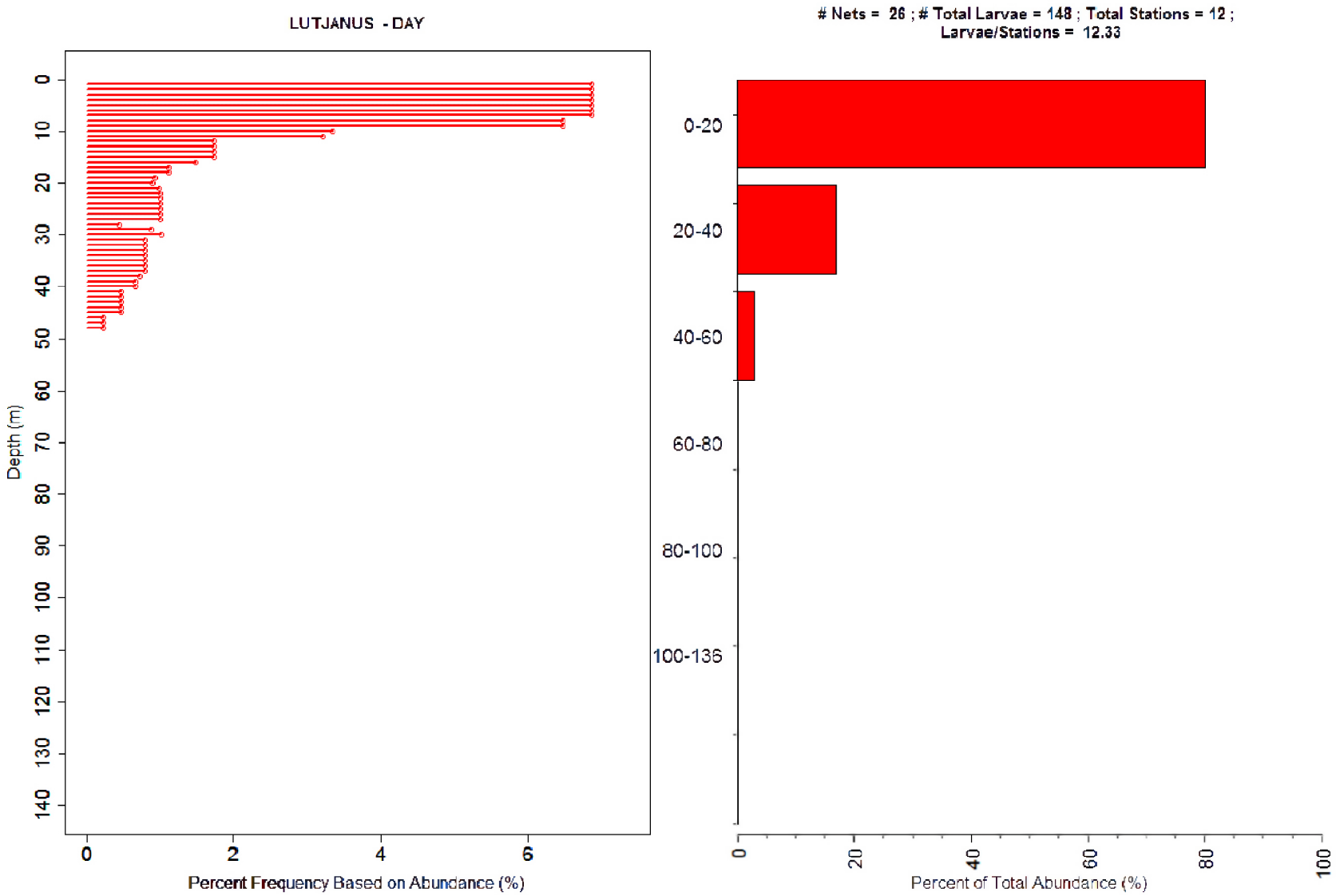
LOPHIIFORMES, NIGHT



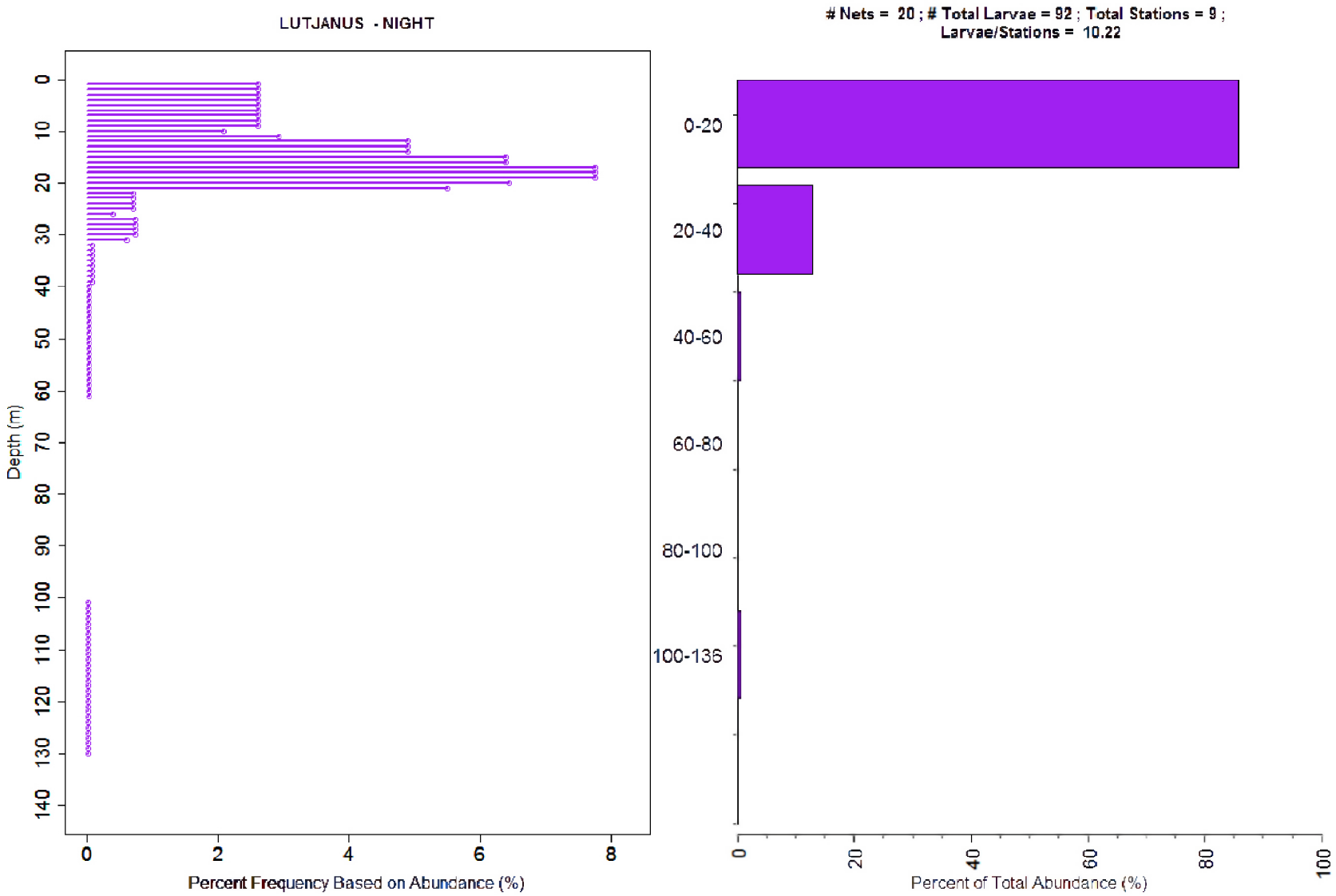
LUTJANIDAE, DAY



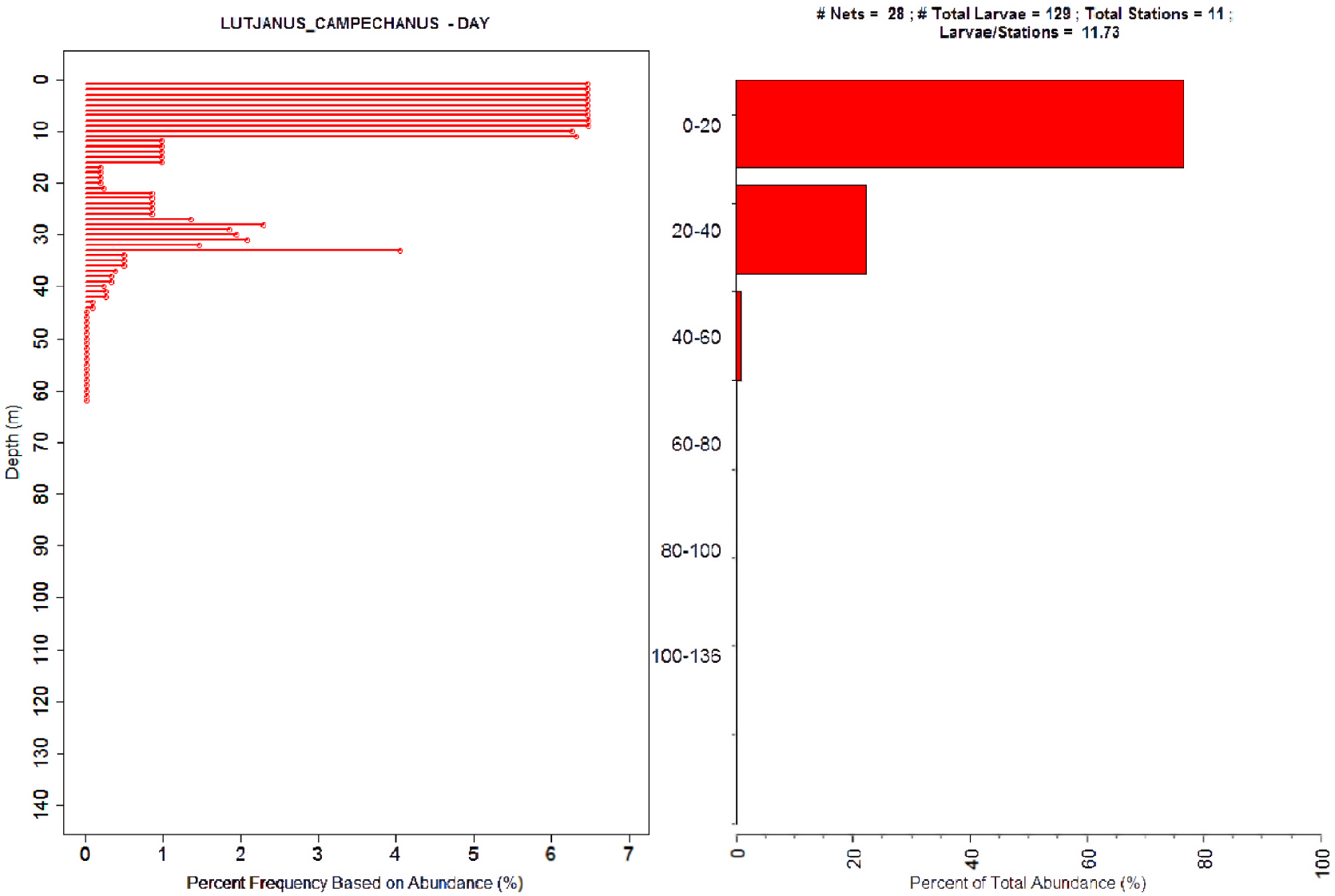
LUTJANIDAE, NIGHT



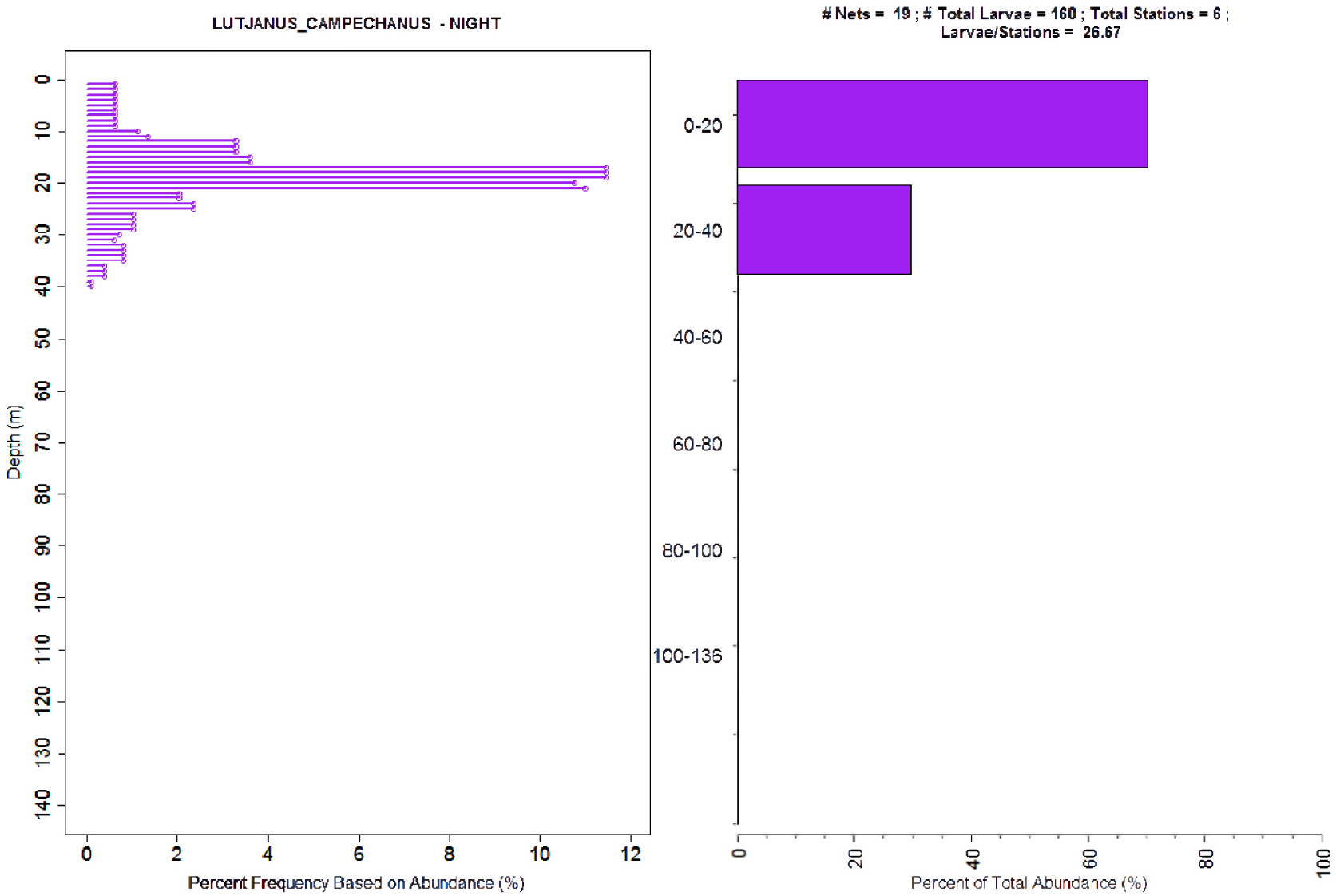
LUTJANUS, DAY



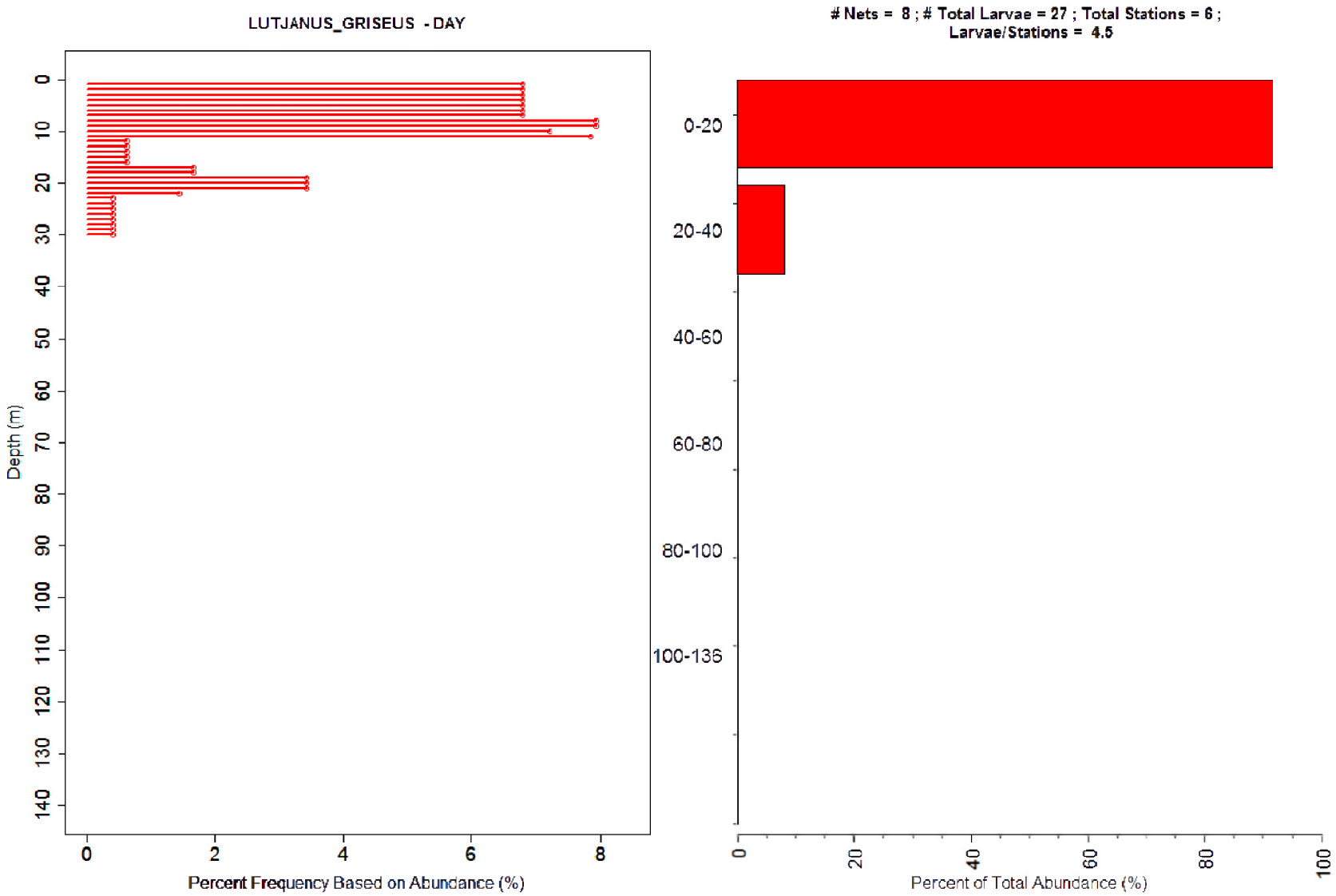
LUTJANUS, NIGHT



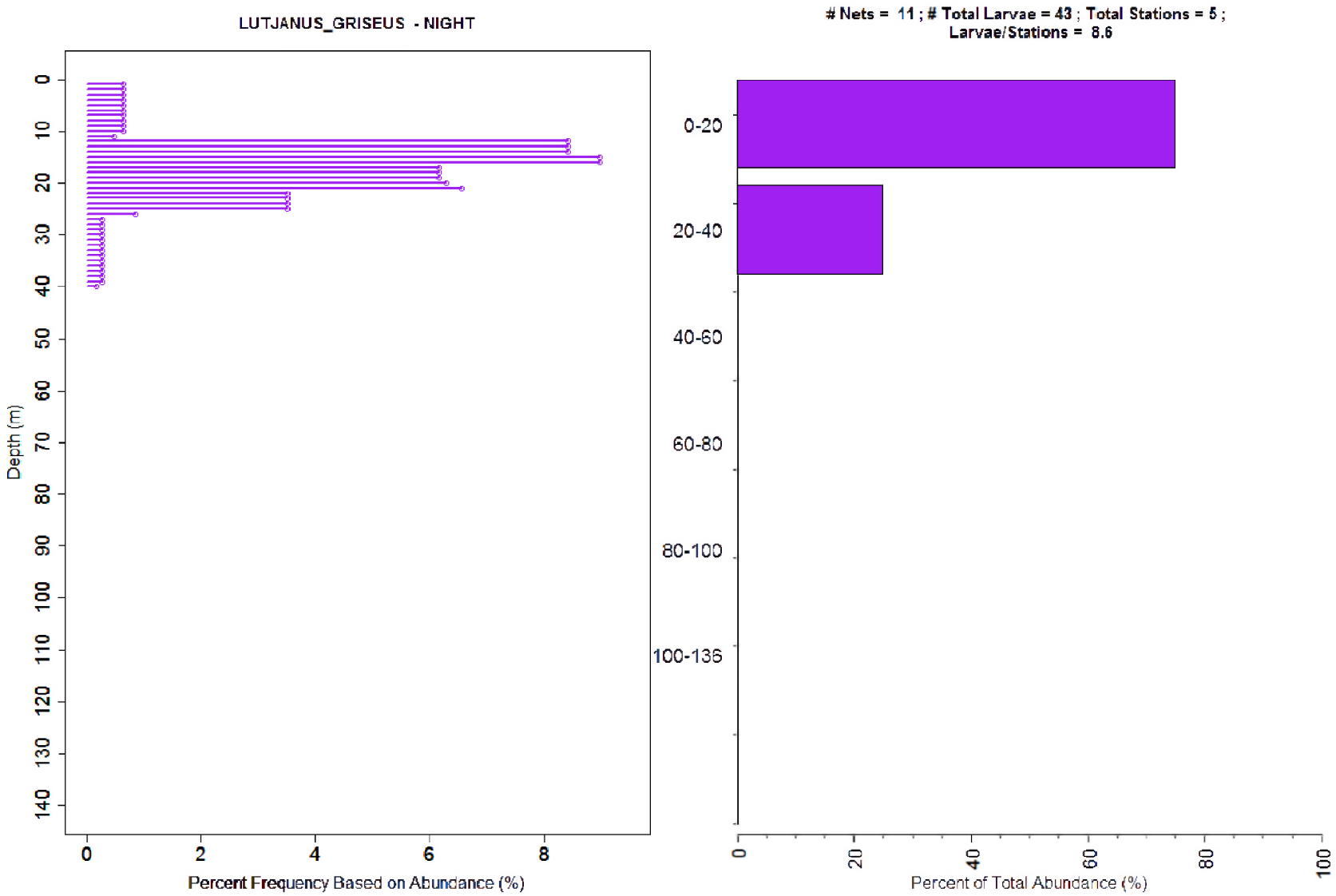
LUTJANUS_CAMPECHANUS, DAY



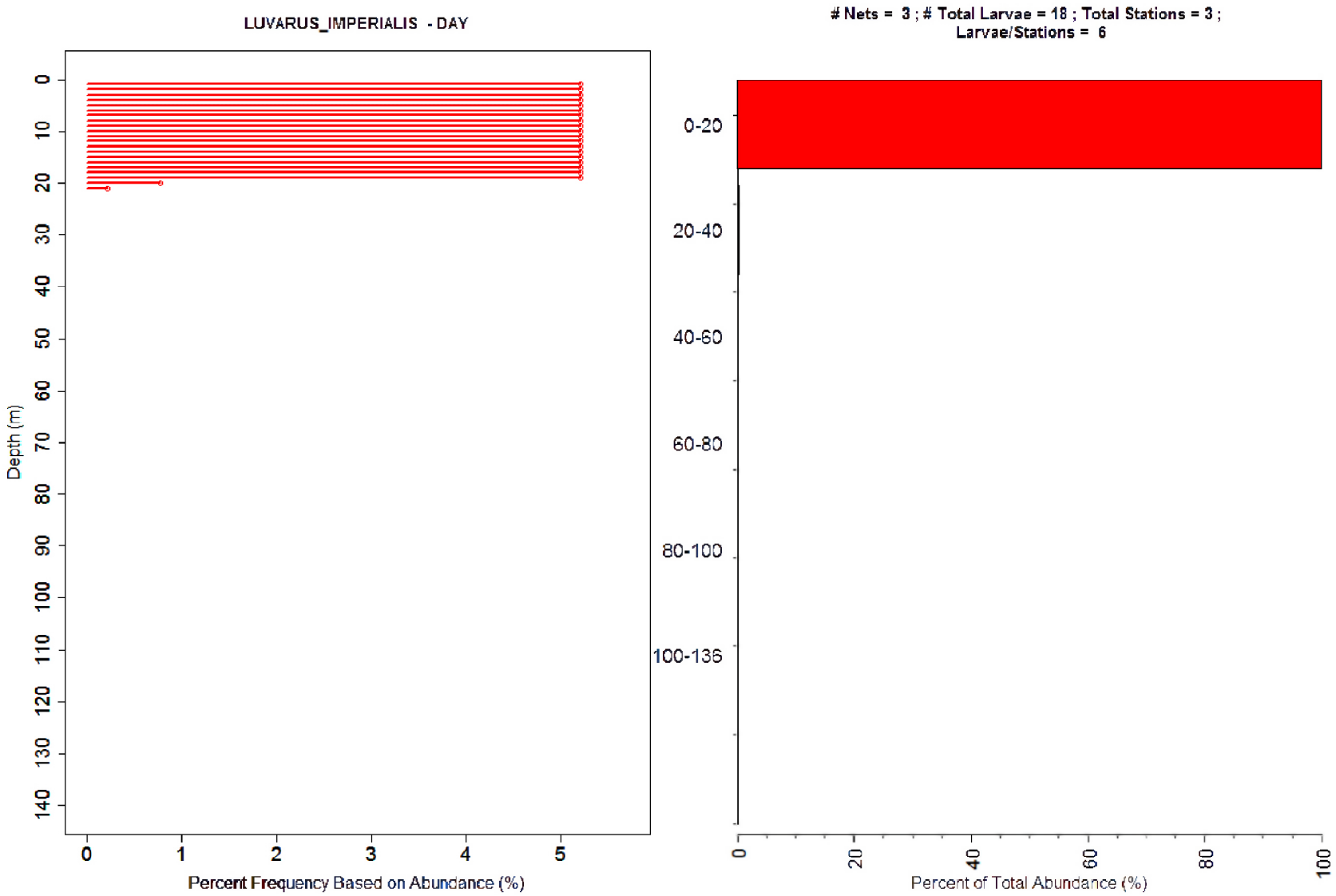
LUTJANUS_CAMPECHANUS, NIGHT



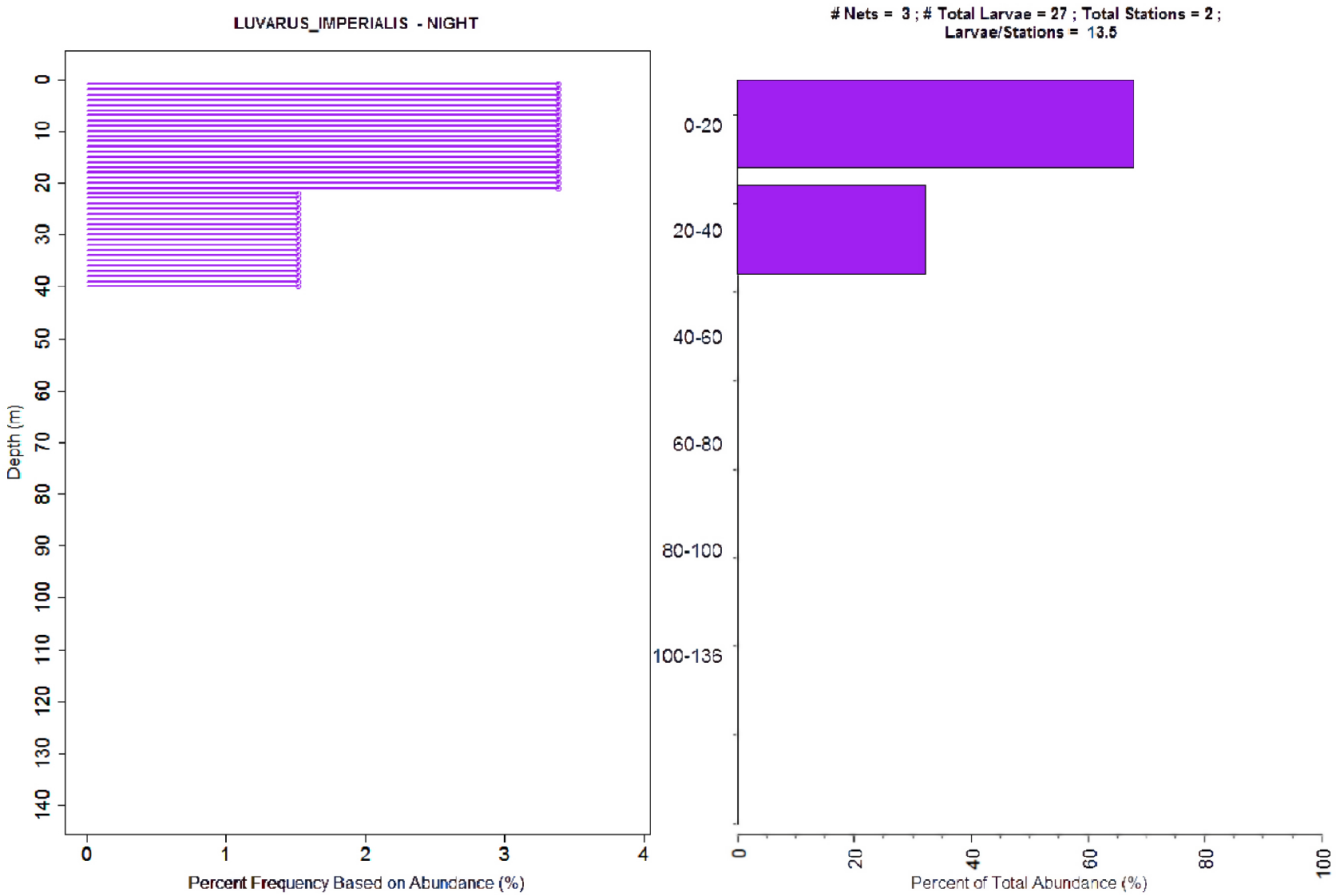
LUTJANUS_GRISEUS, DAY



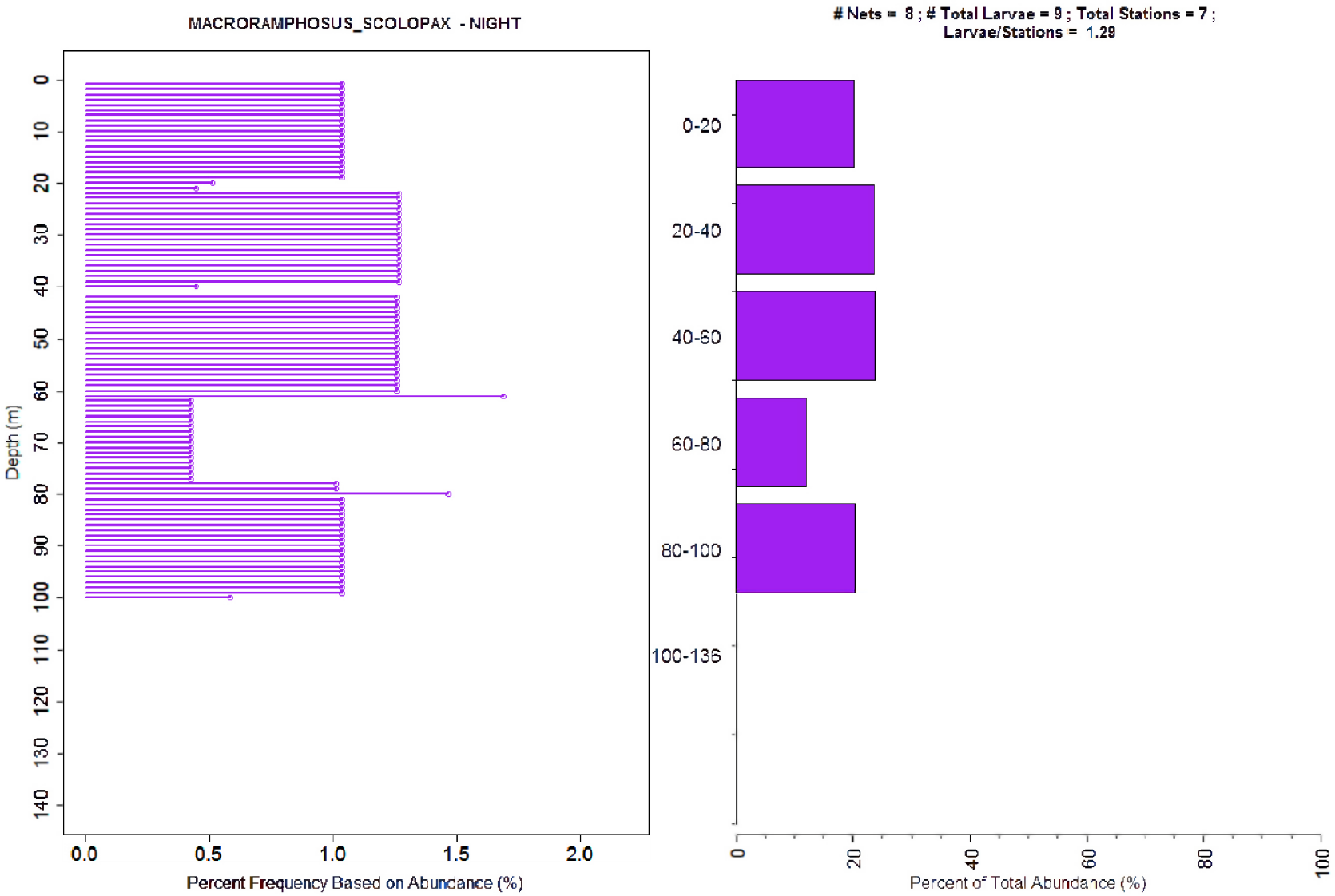
LUTJANUS_GRISEUS, NIGHT



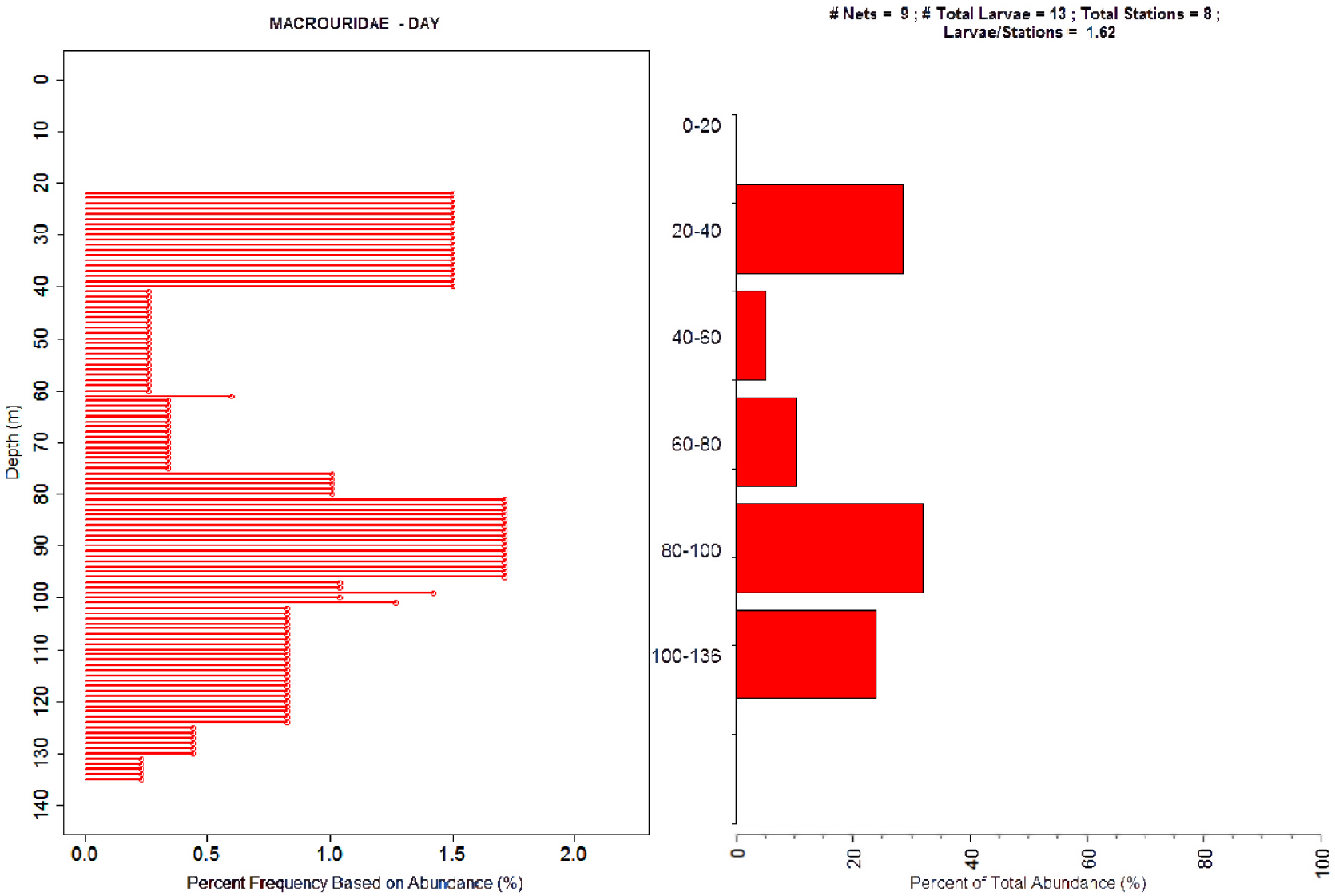
LUVARUS_IMPERIALIS, DAY



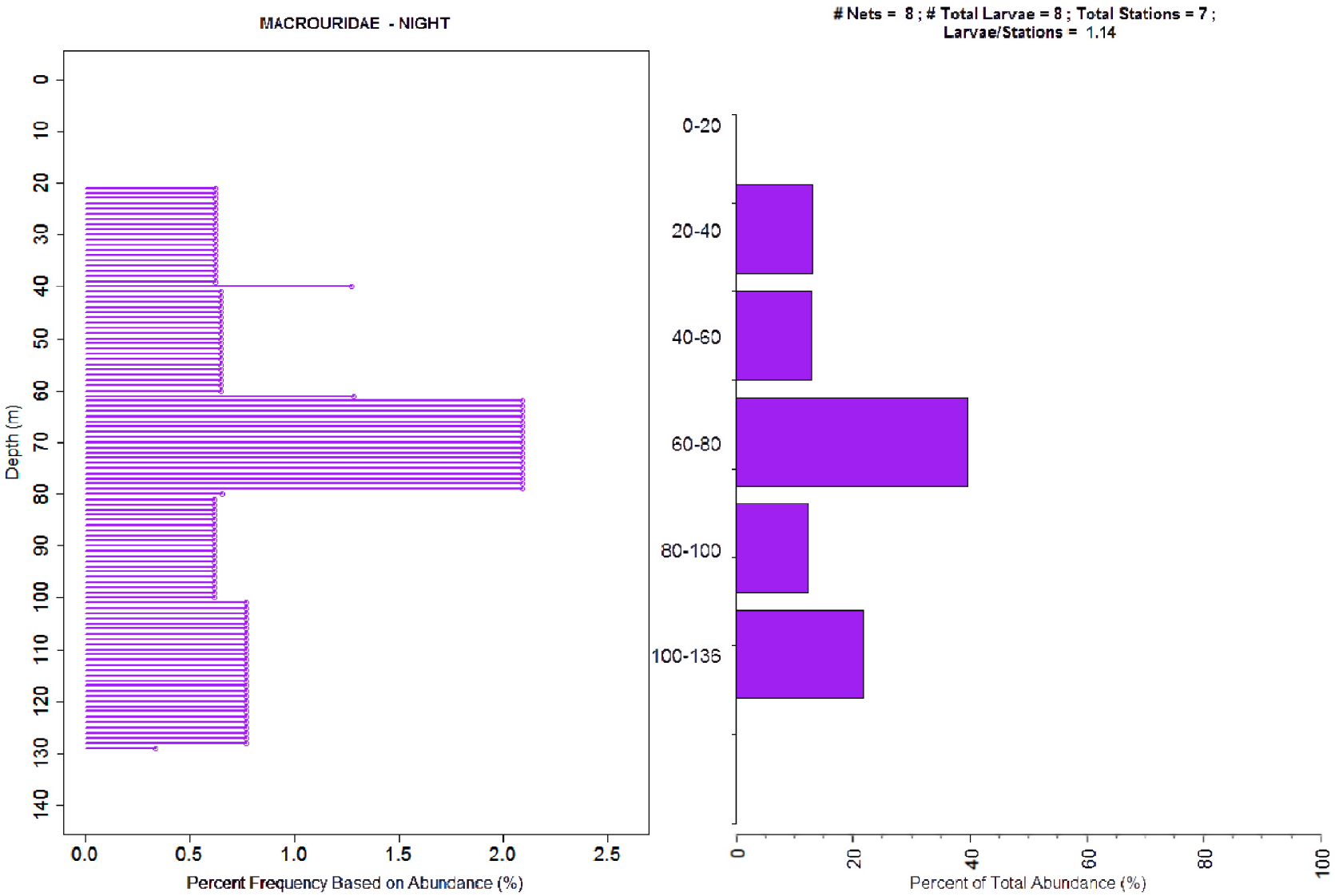
LUVARUS_IMPERIALIS, NIGHT



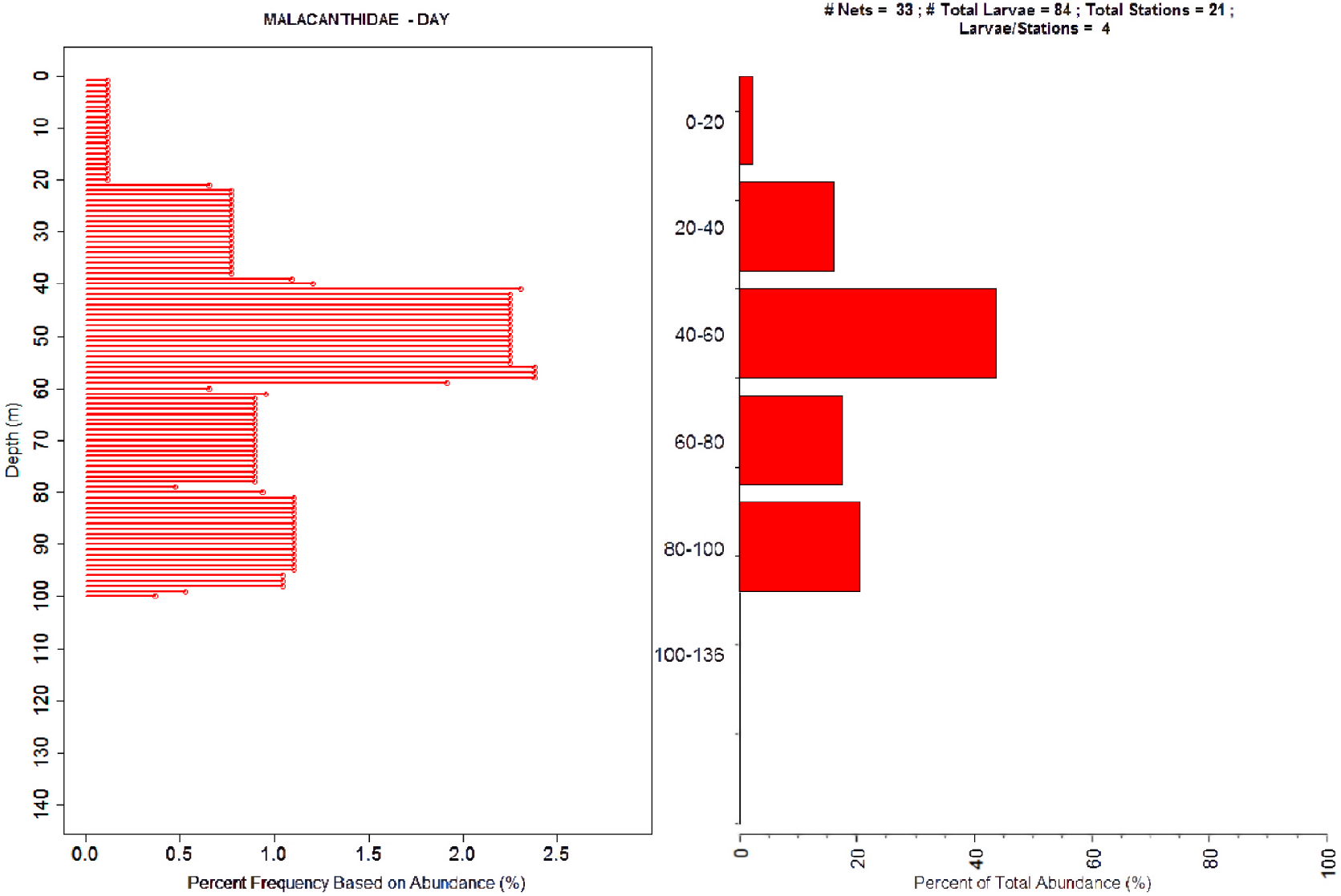
MACRORAMPHOSUS_SCOLOPAX, NIGHT



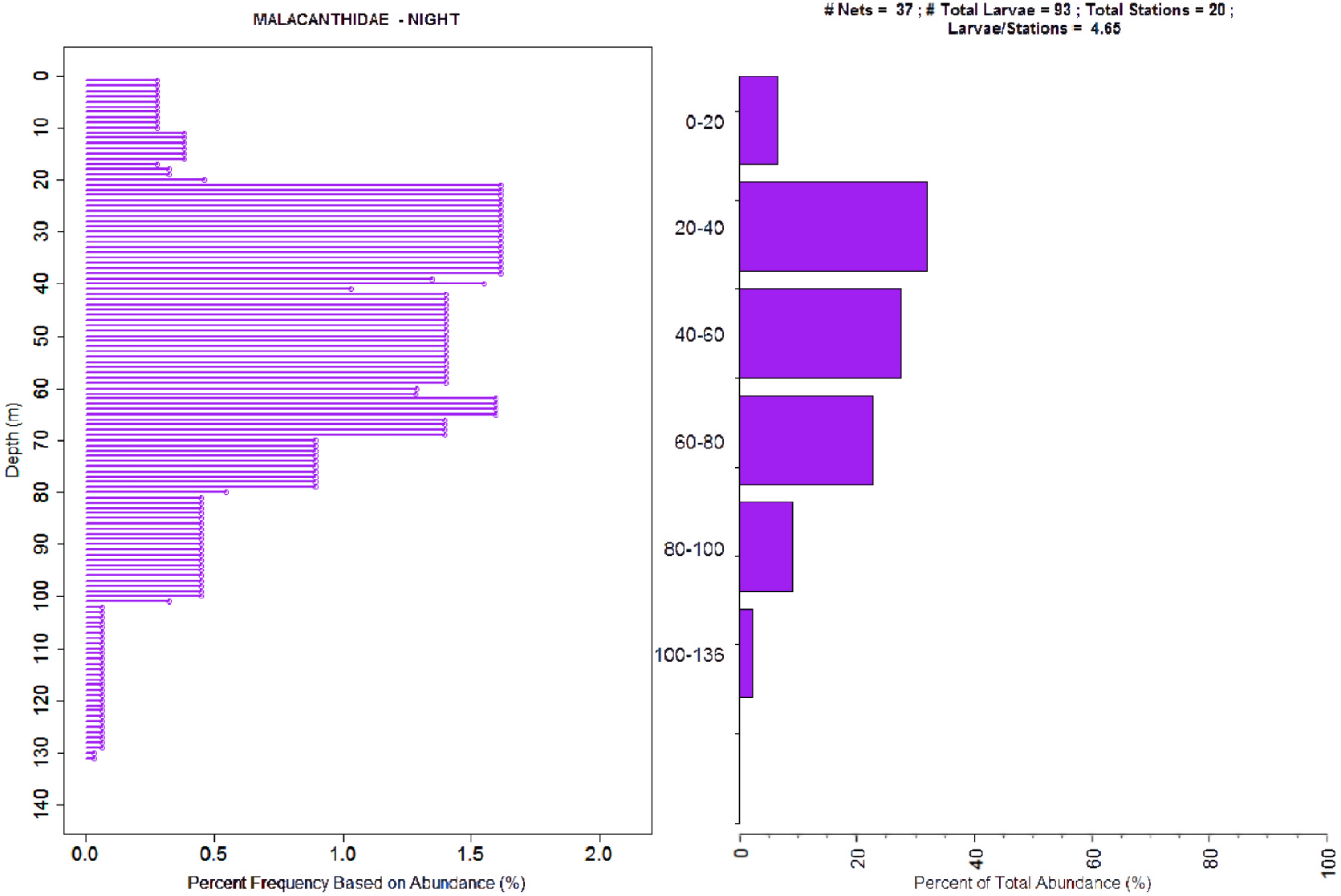
MACROURIDAE, DAY



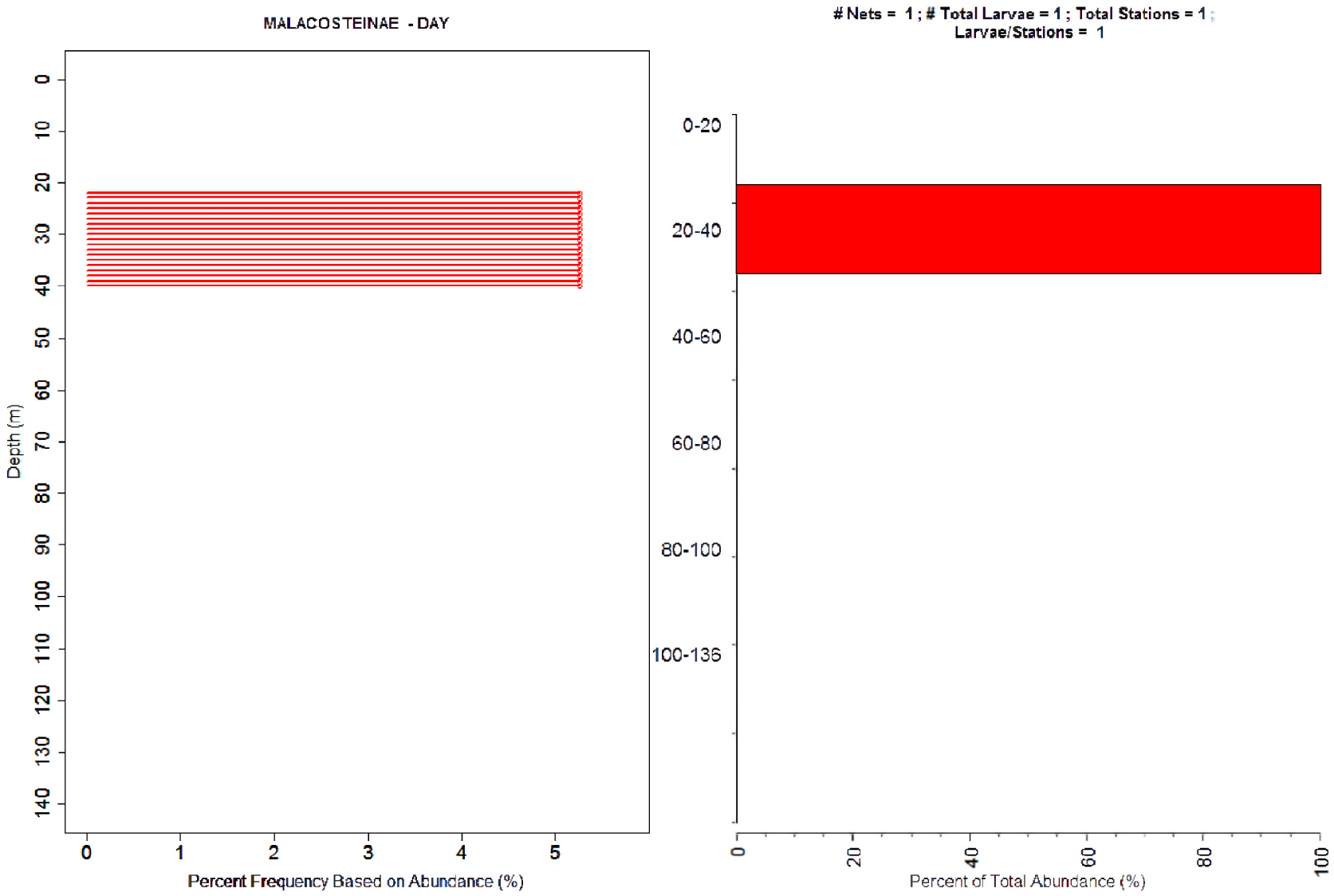
MACROURIDAE, NIGHT



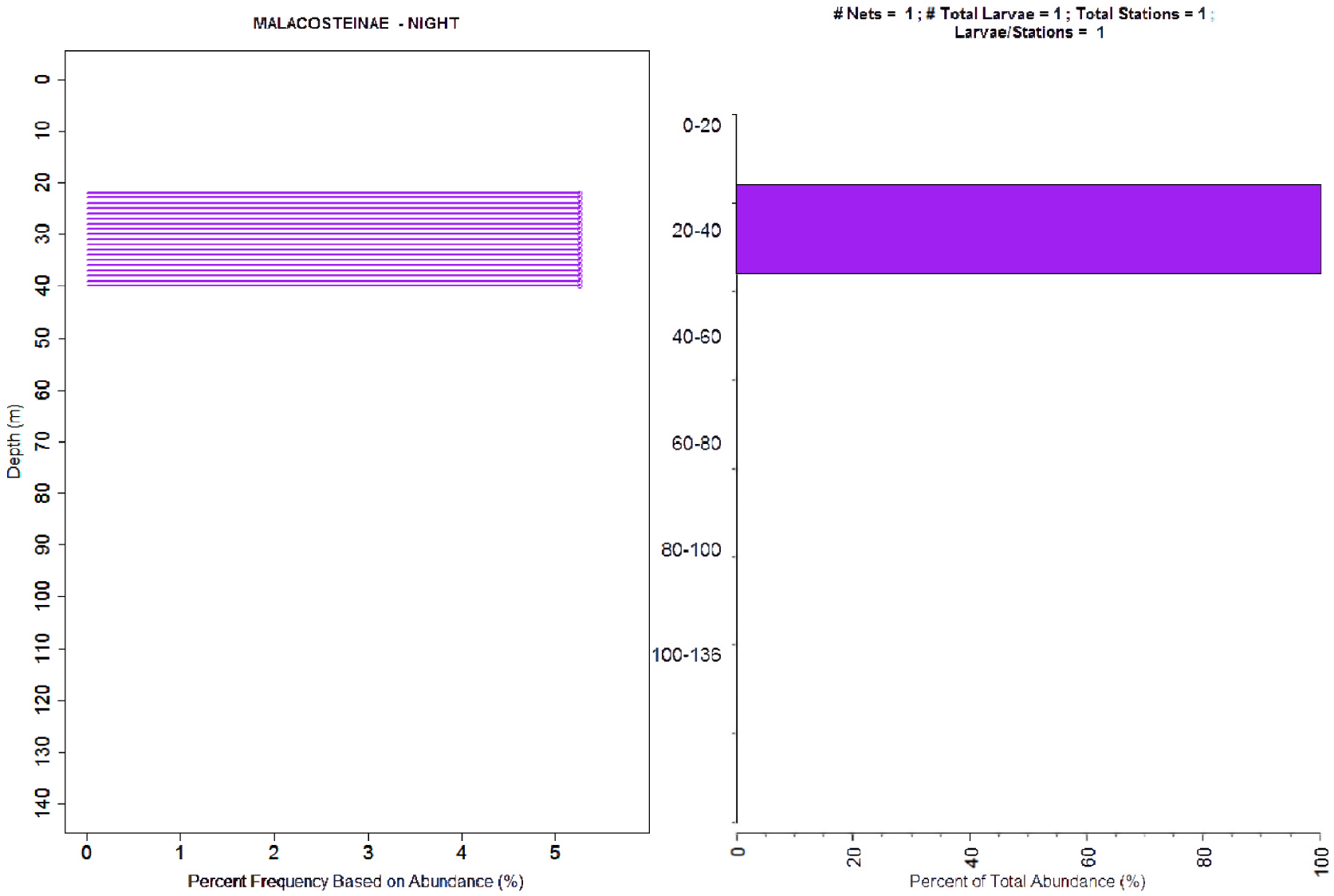
MALACANTHIDAE, DAY



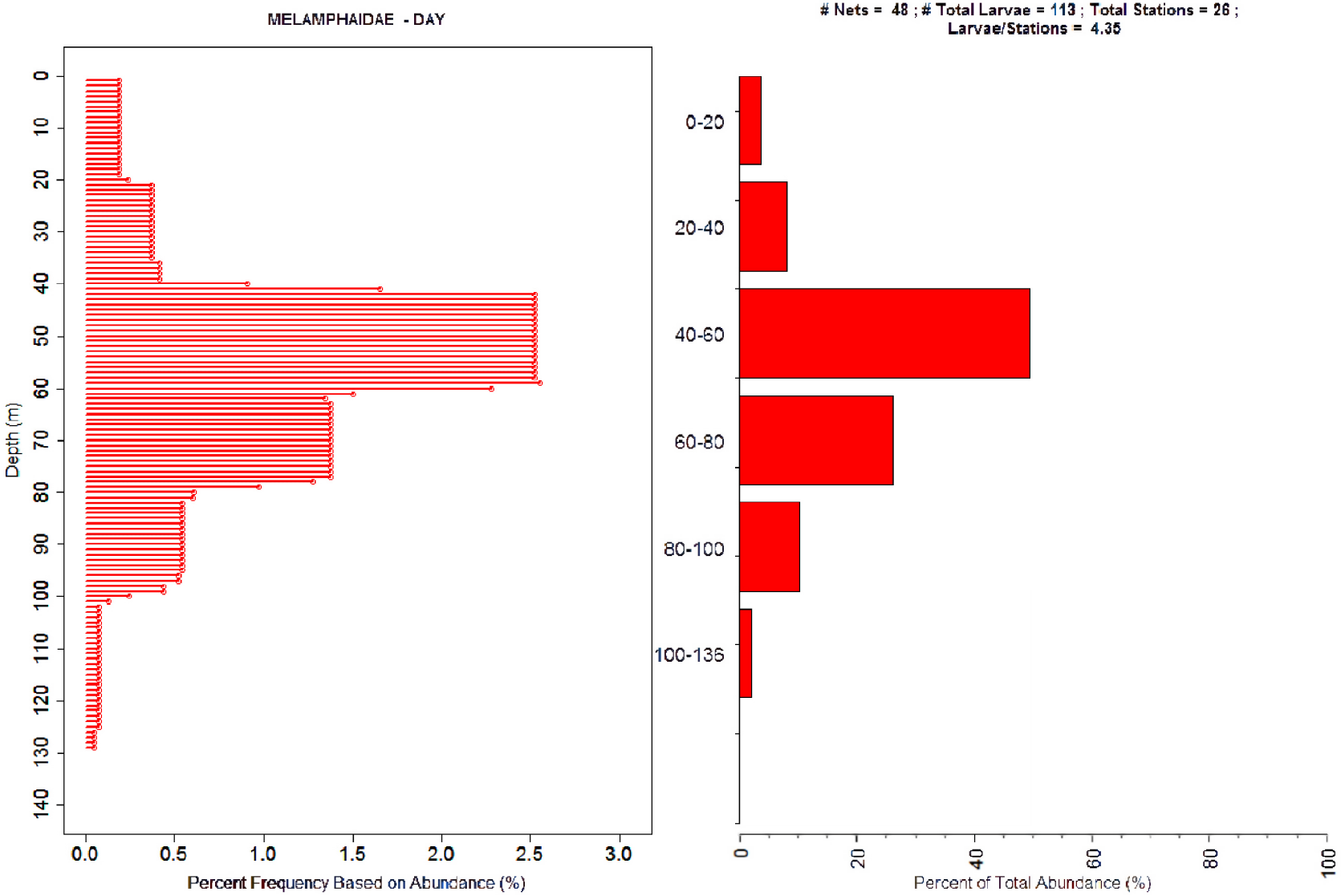
MALACANTHIDAE, NIGHT



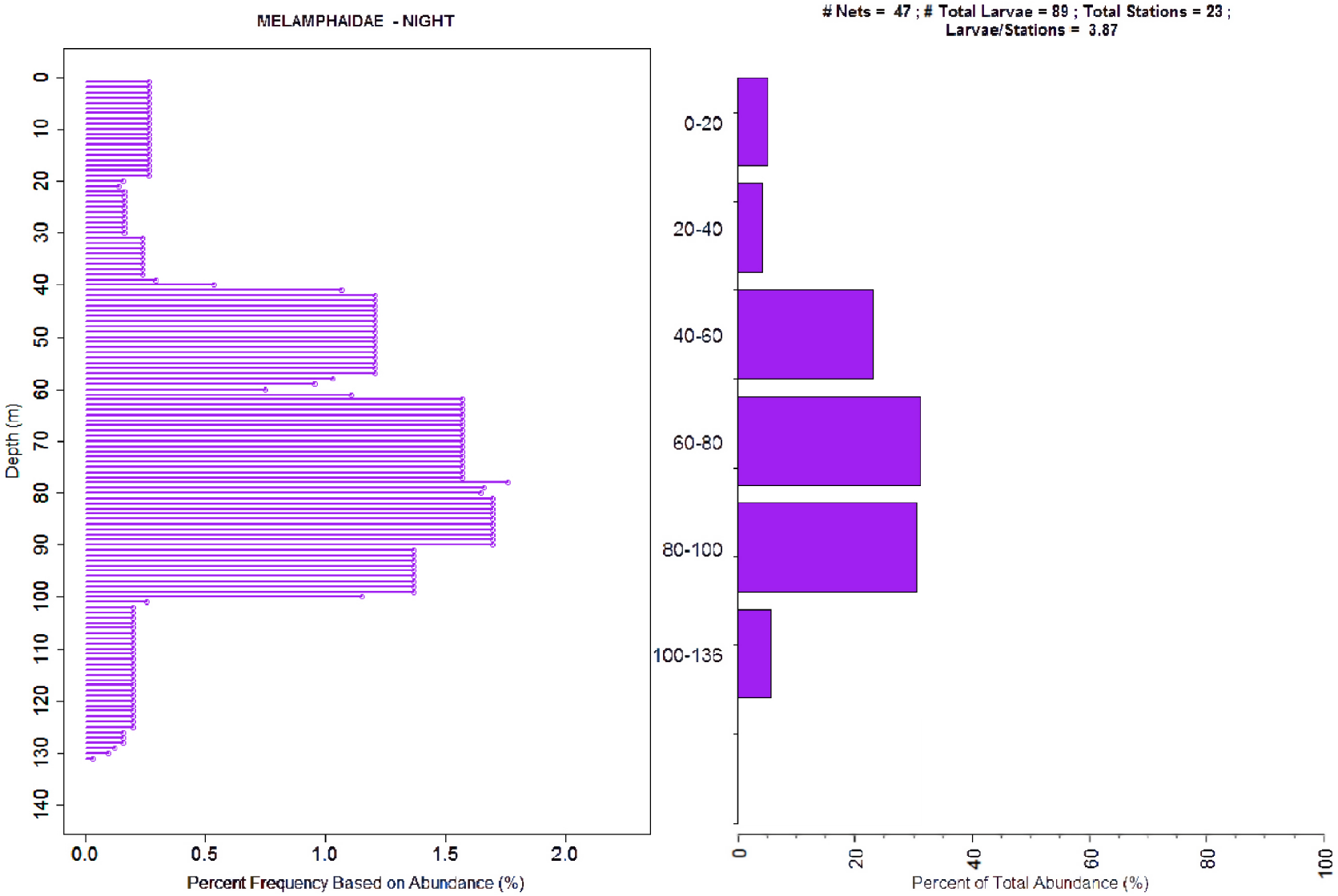
MALACOSTEINAE, DAY



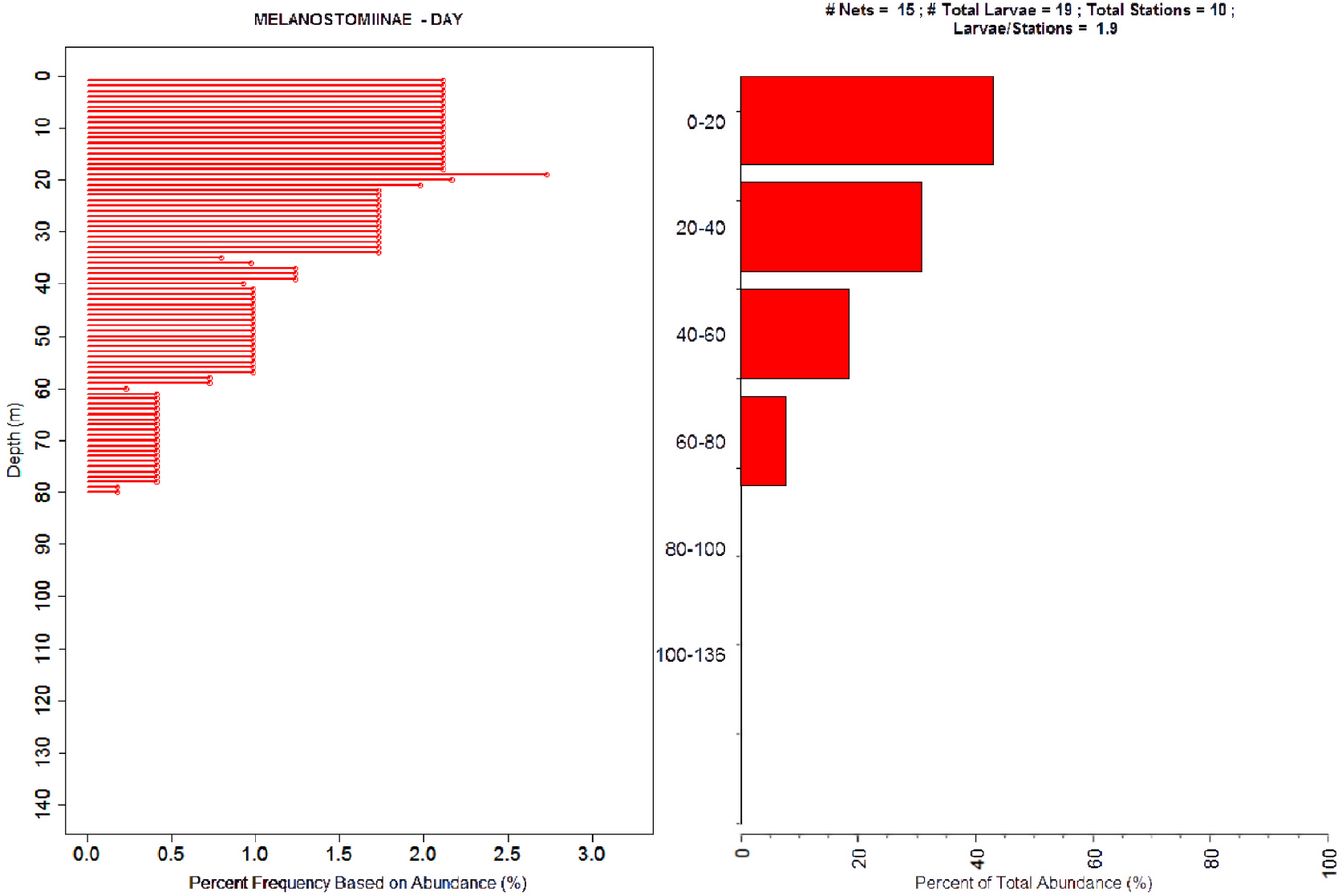
MALACOSTEINAE, NIGHT



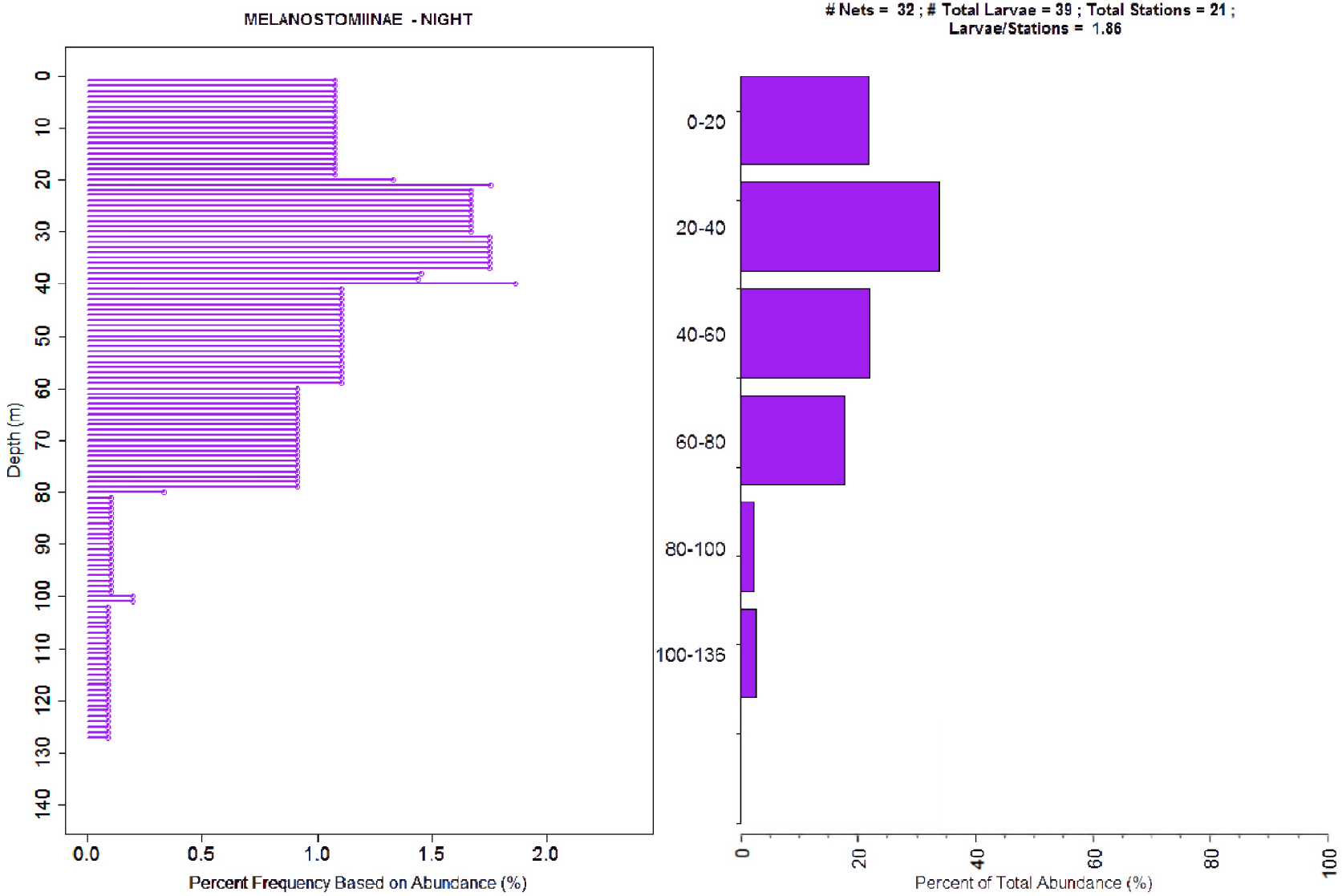
MELAMPHAIDAE, DAY



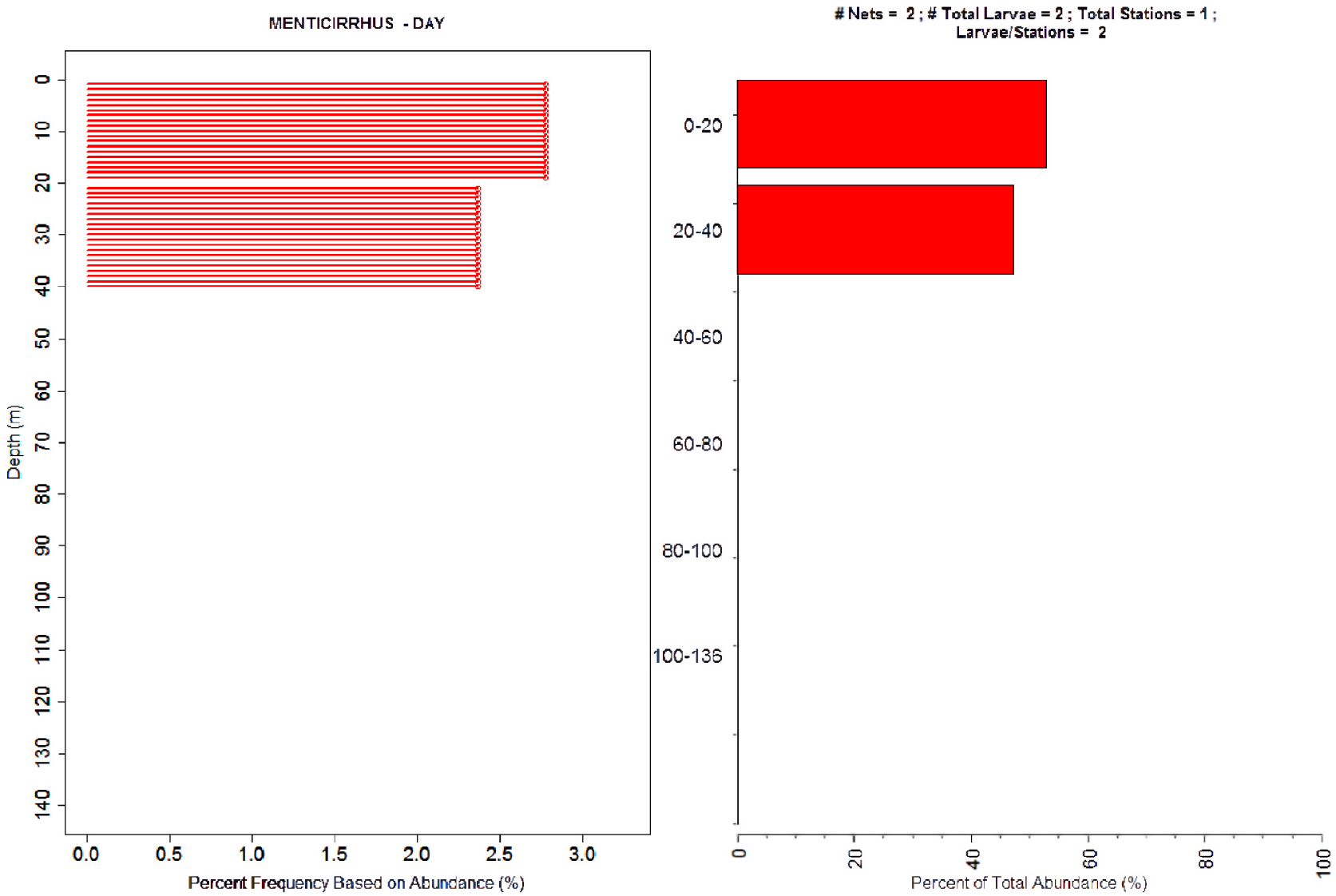
MELAMPHAIDAE, NIGHT



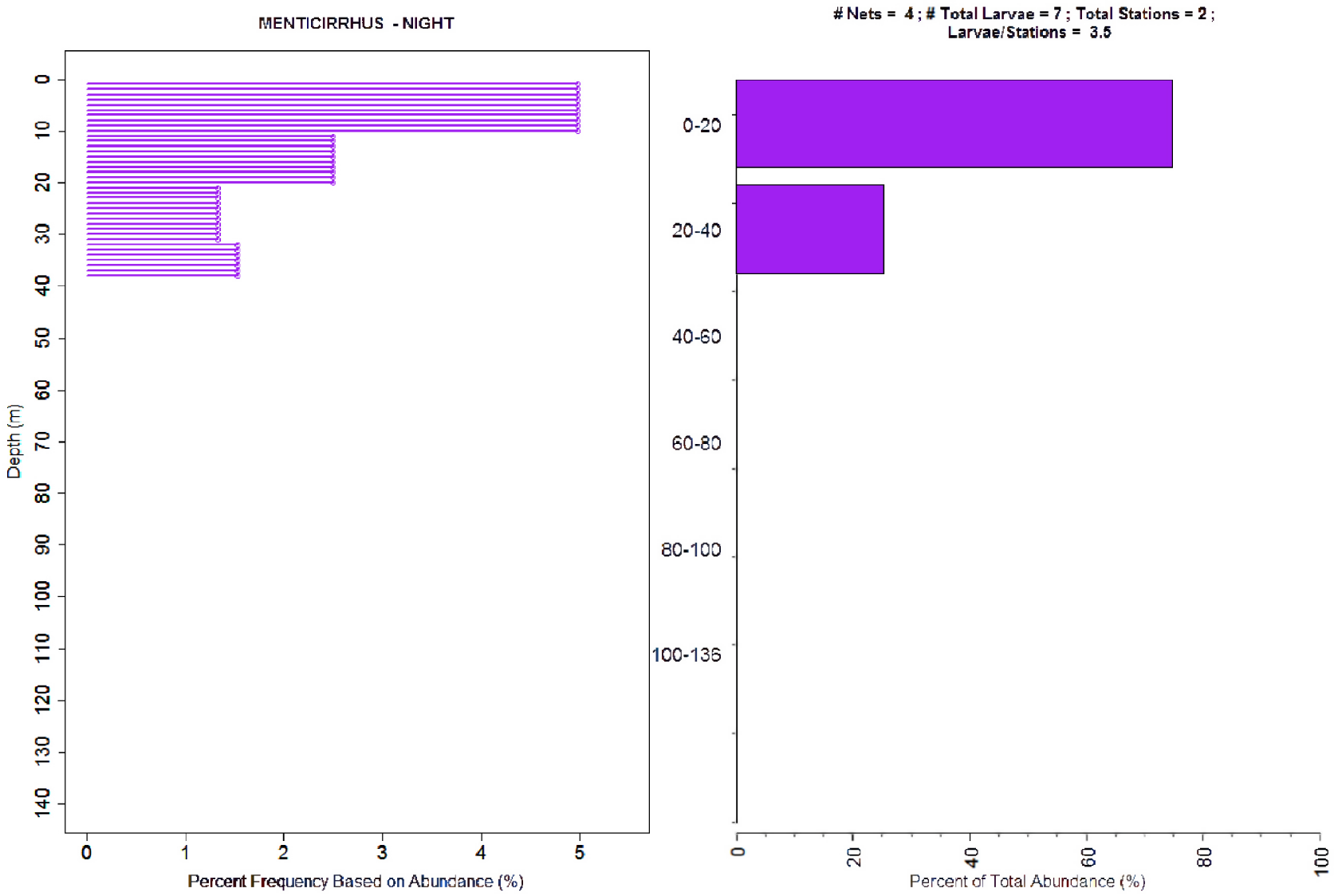
MELANOSTOMIINAE, DAY



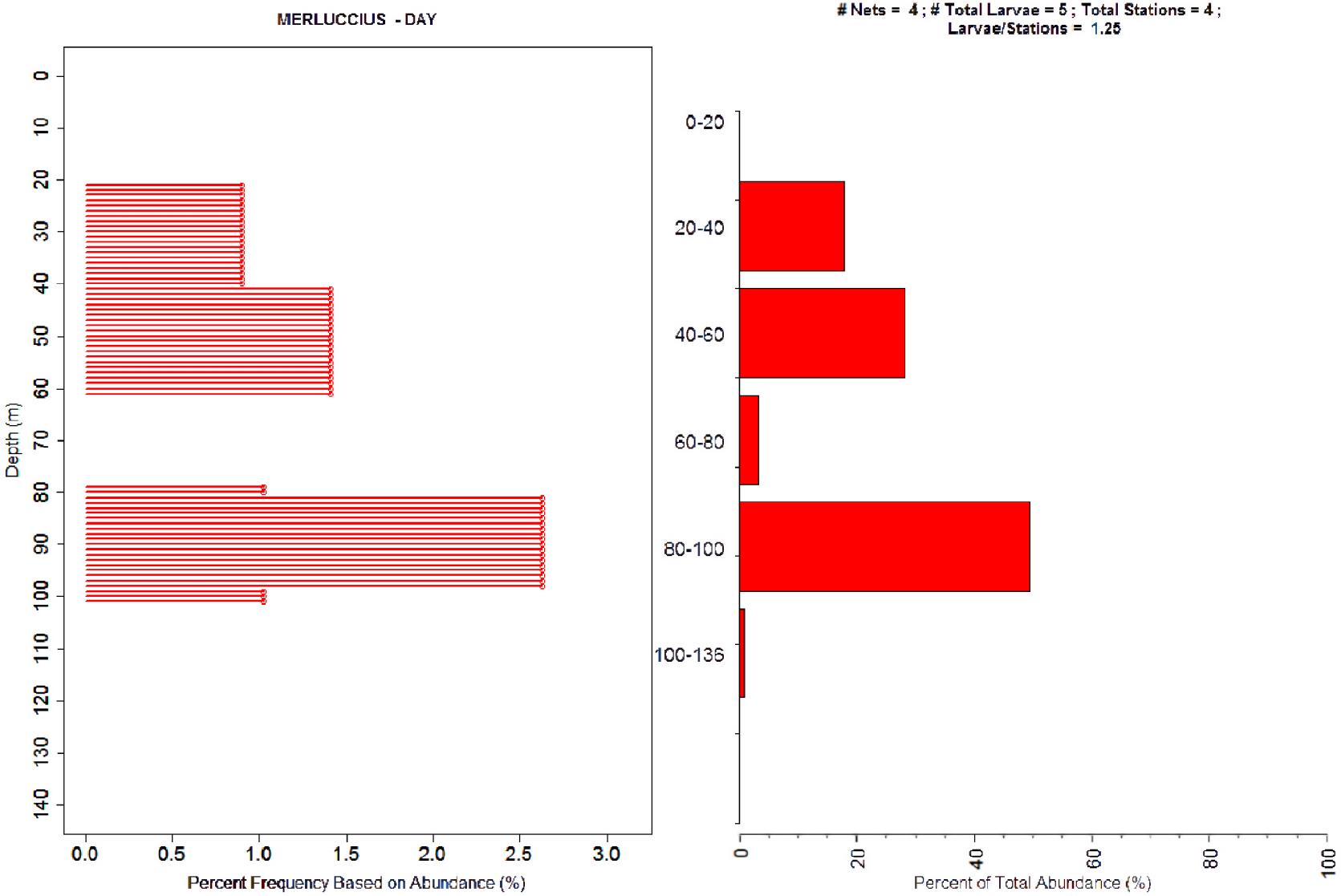
MELANOSTOMIINAE, NIGHT



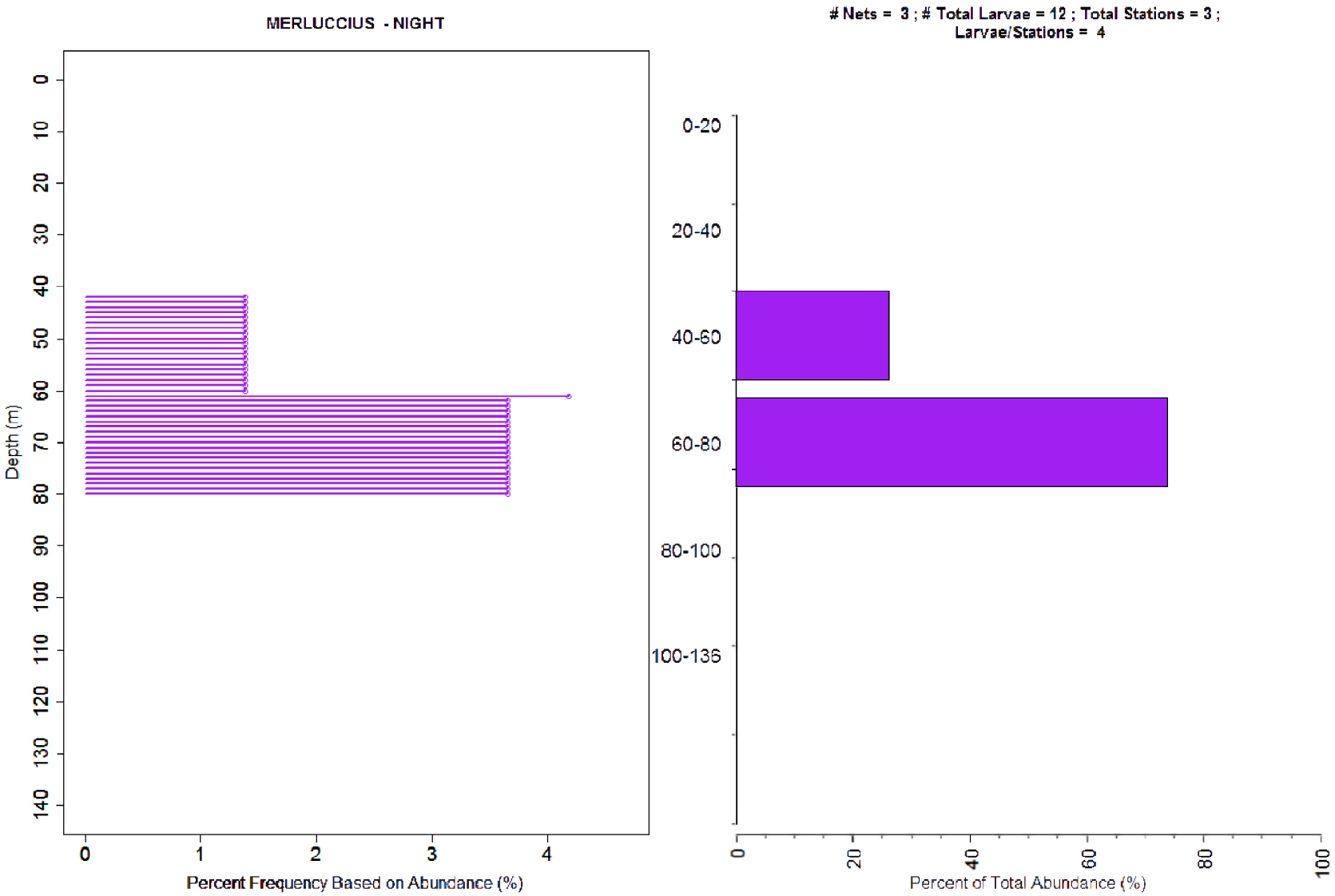
MENTICIRRHUS, DAY



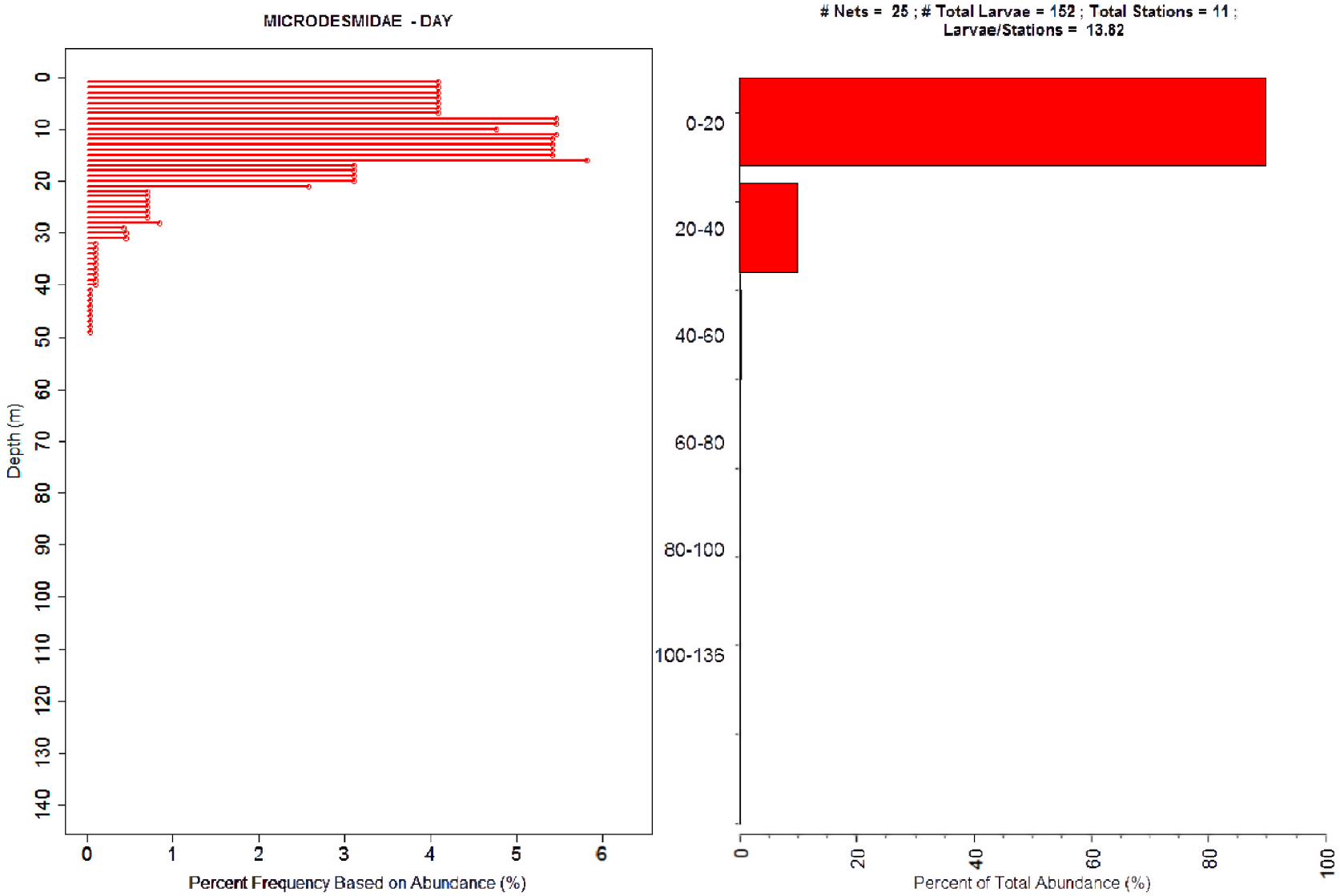
MENTICIRRHUS, NIGHT



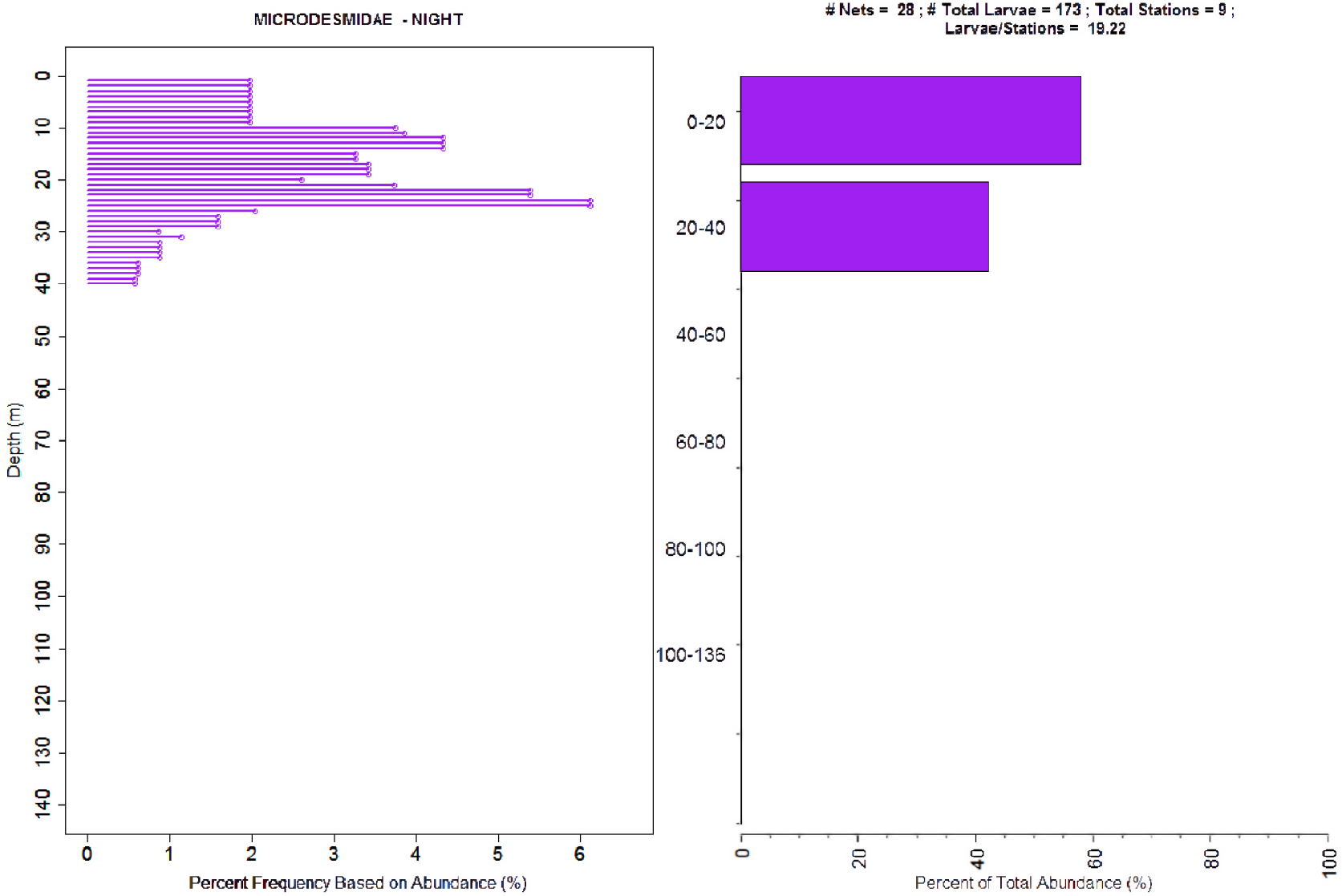
MERLUCCIUS, DAY



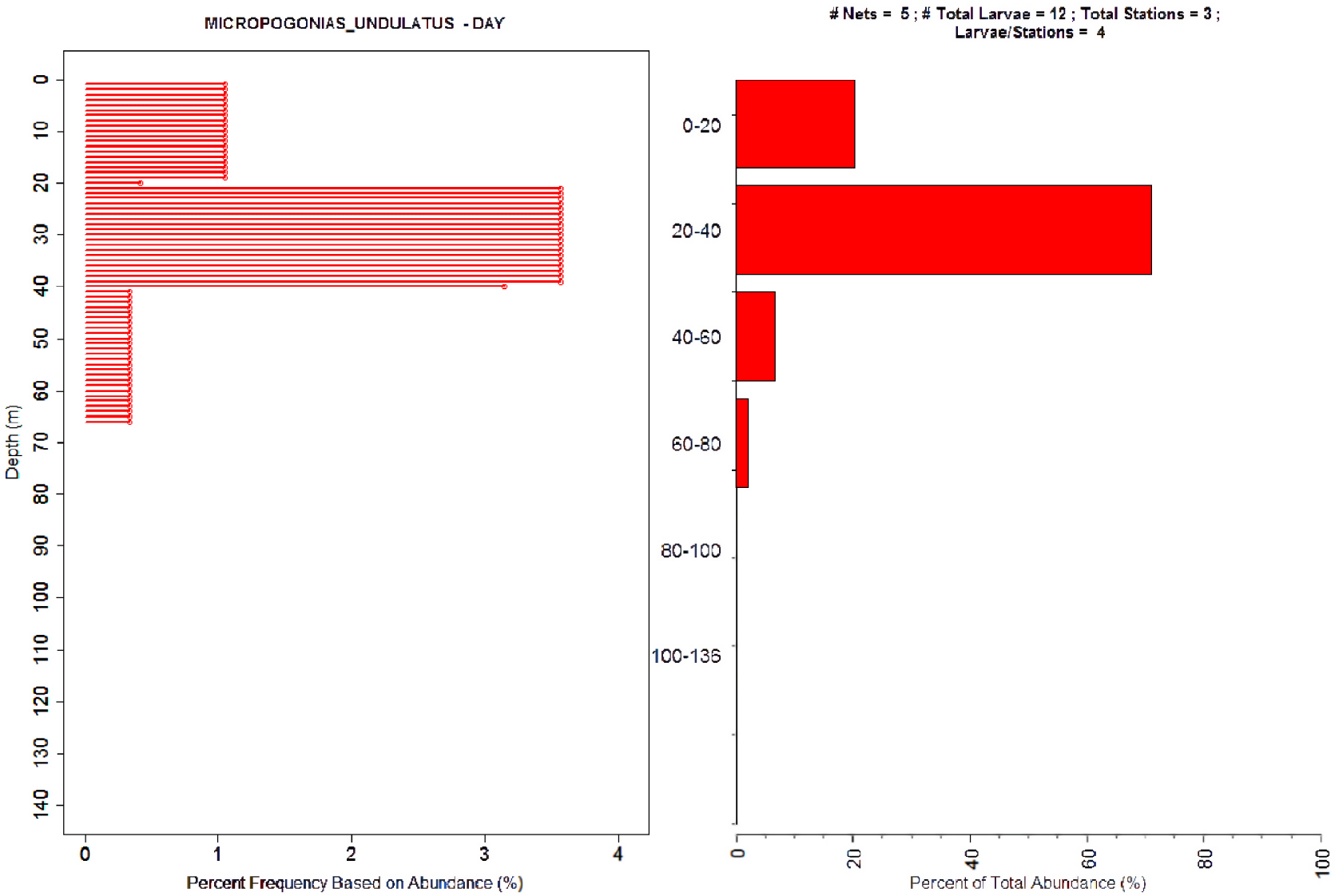
MERLUCCIUS, NIGHT



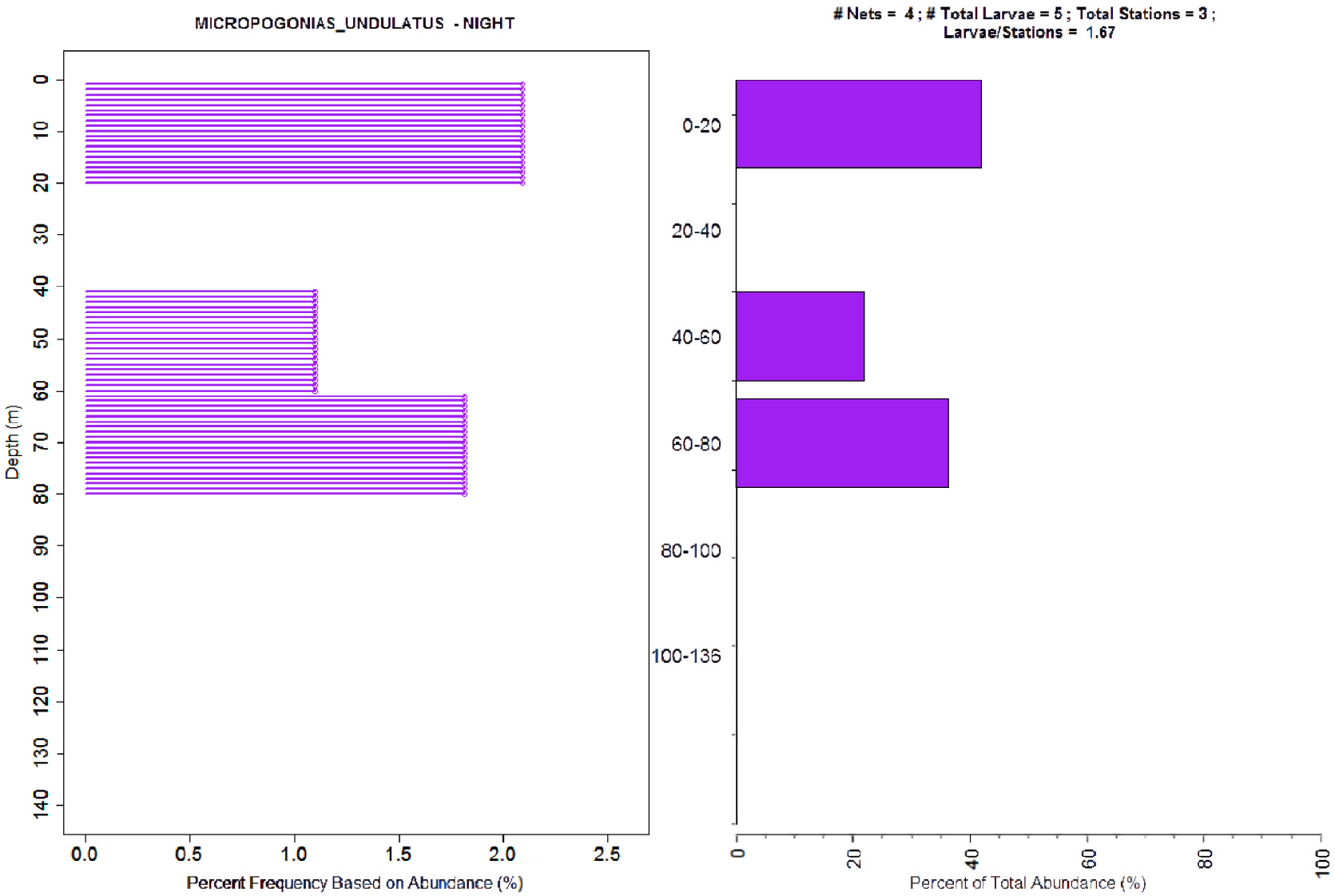
MICRODESMIDAE, DAY



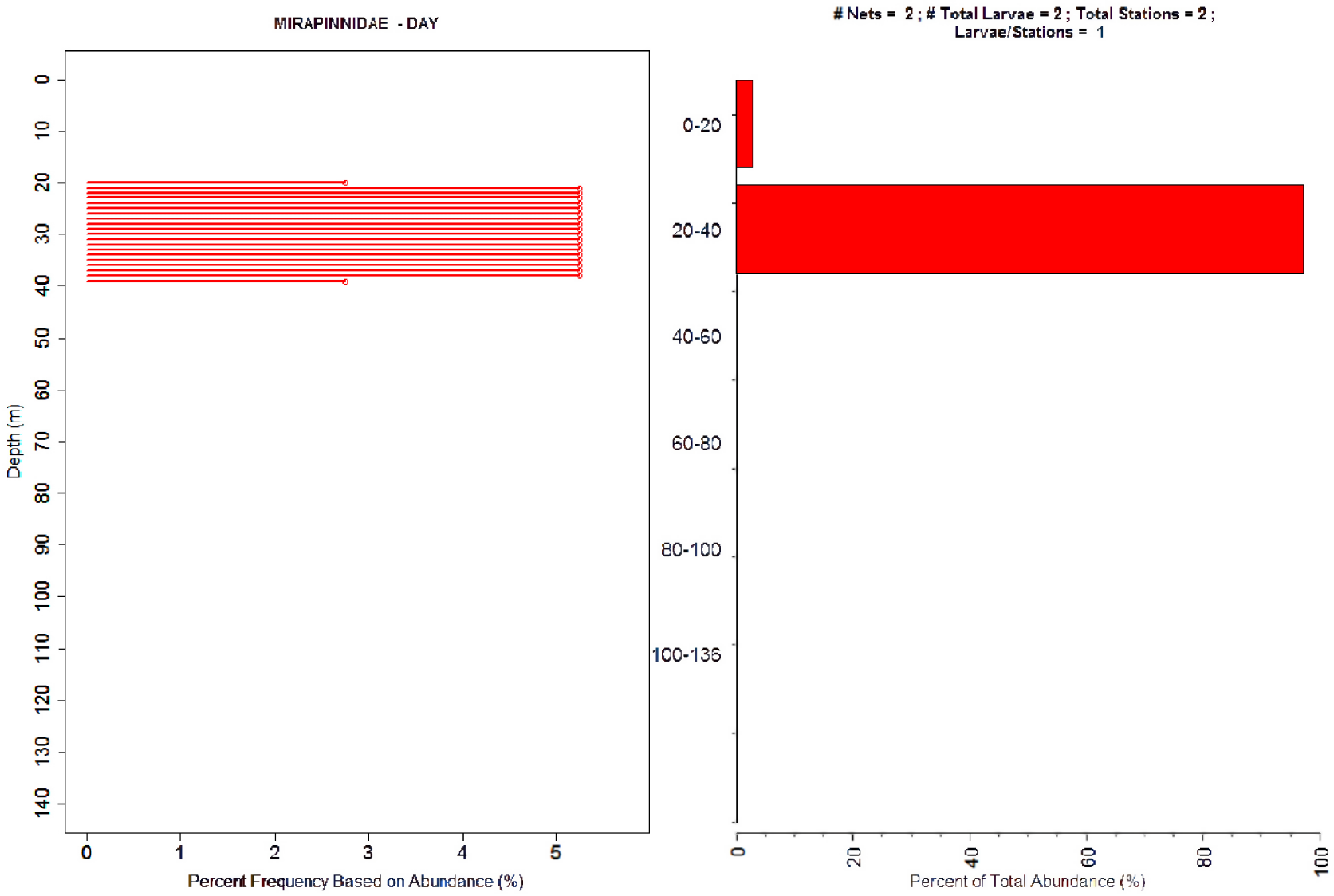
MICRODESMIDAE, NIGHT



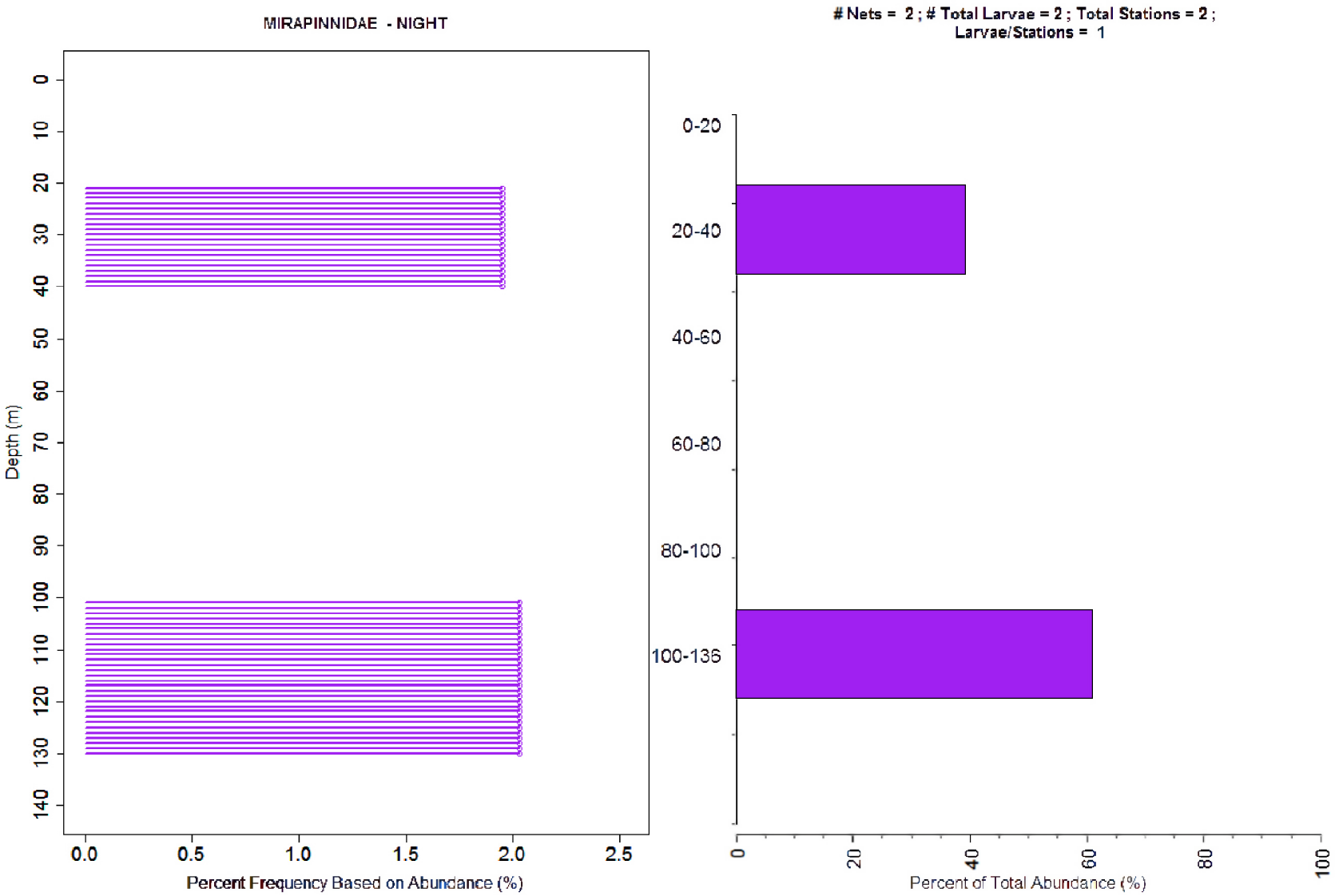
MICROPOGONIAS_UNDULATUS, DAY



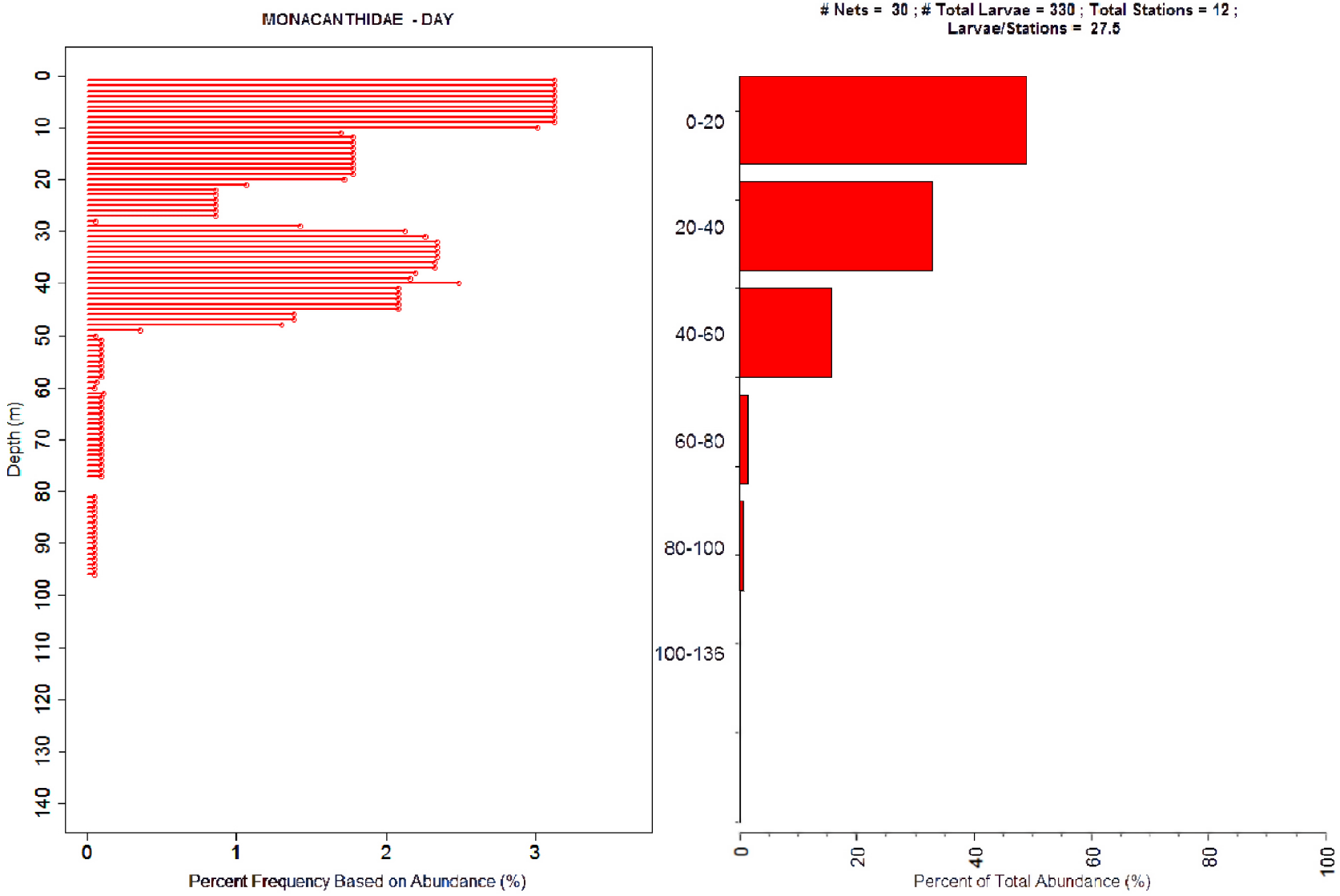
MICROPOGONIAS_UNDULATUS, NIGHT



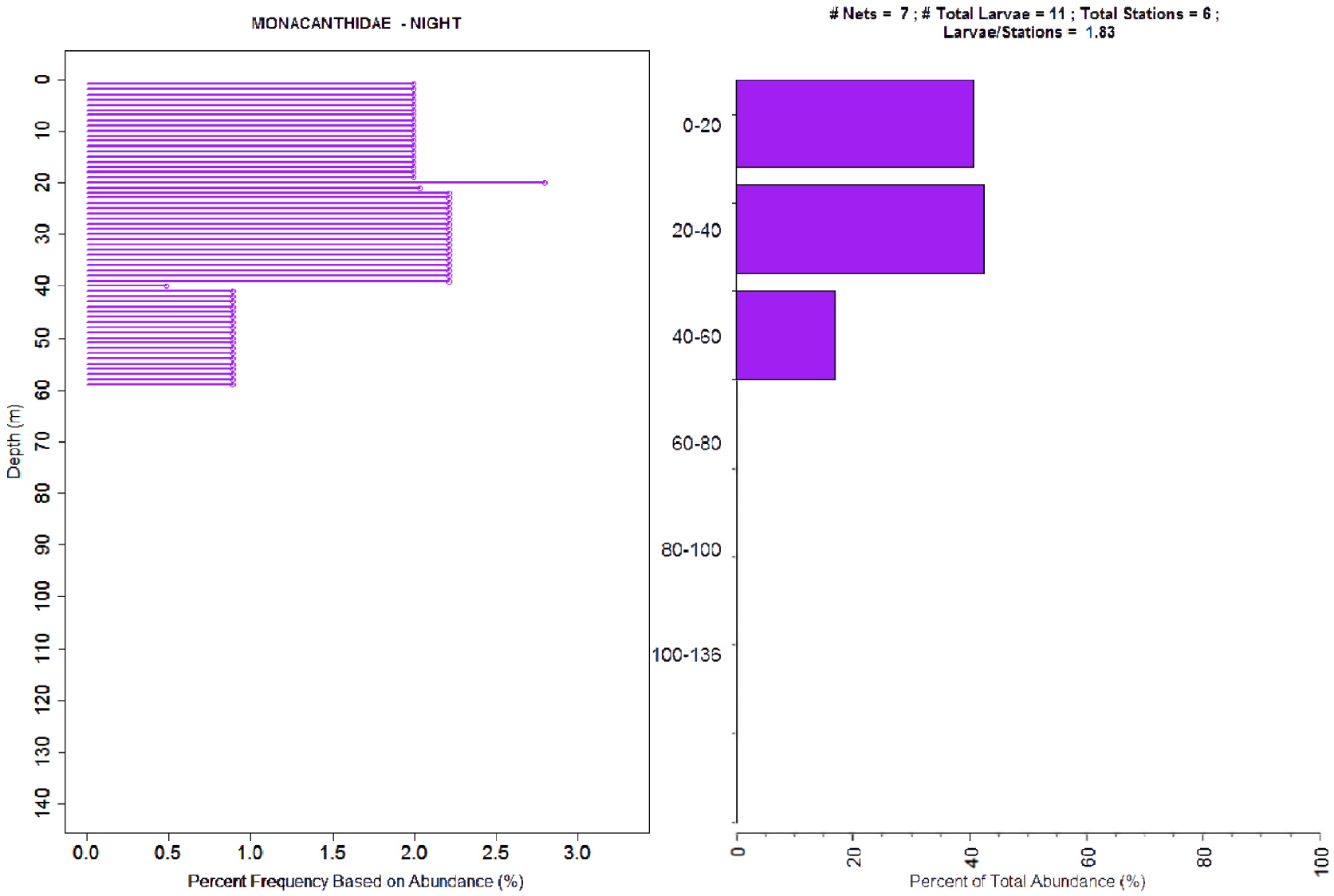
MIRAPINNIDAE, DAY



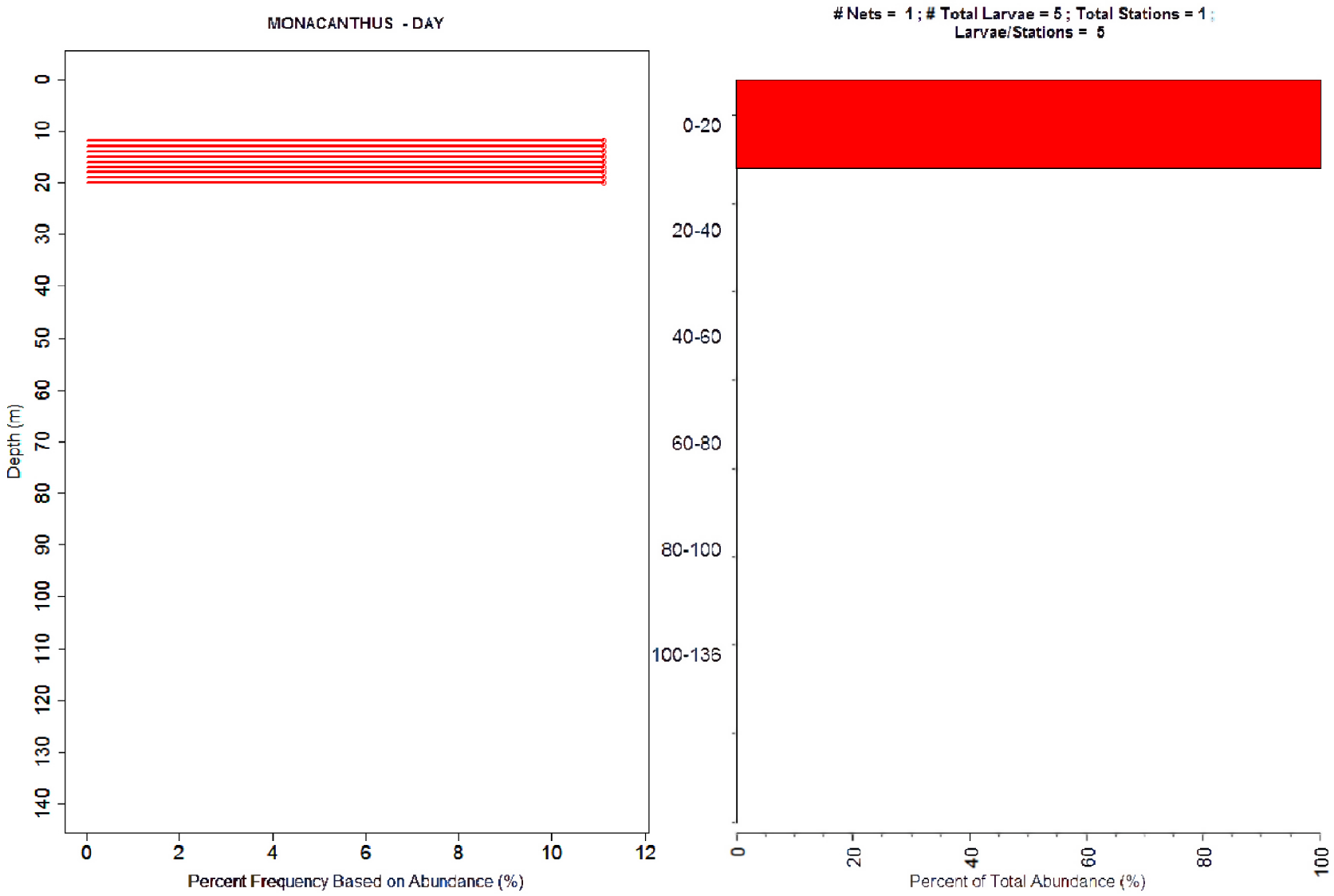
MIRAPINNIDAE, NIGHT



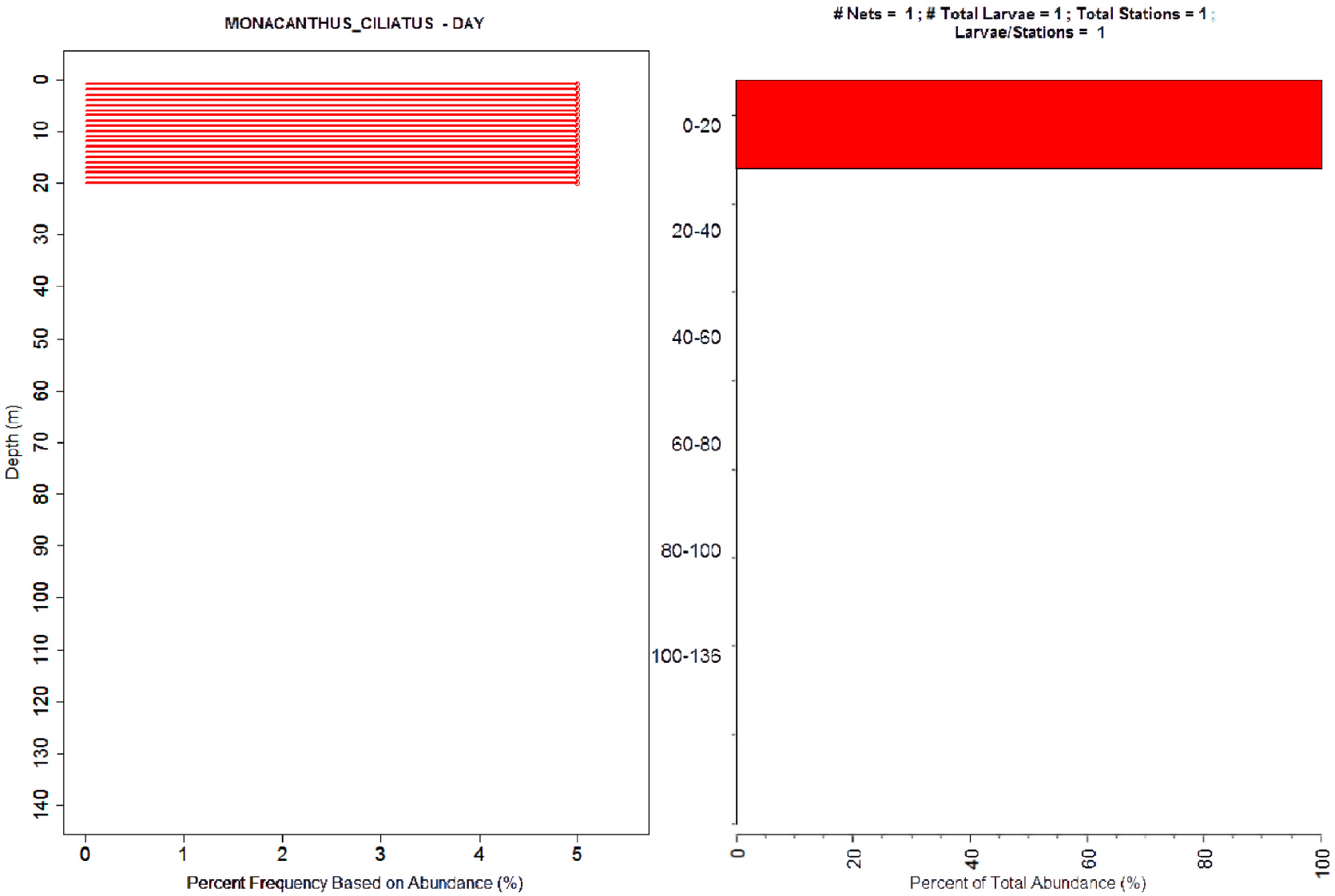
MONACANTHIDAE, DAY



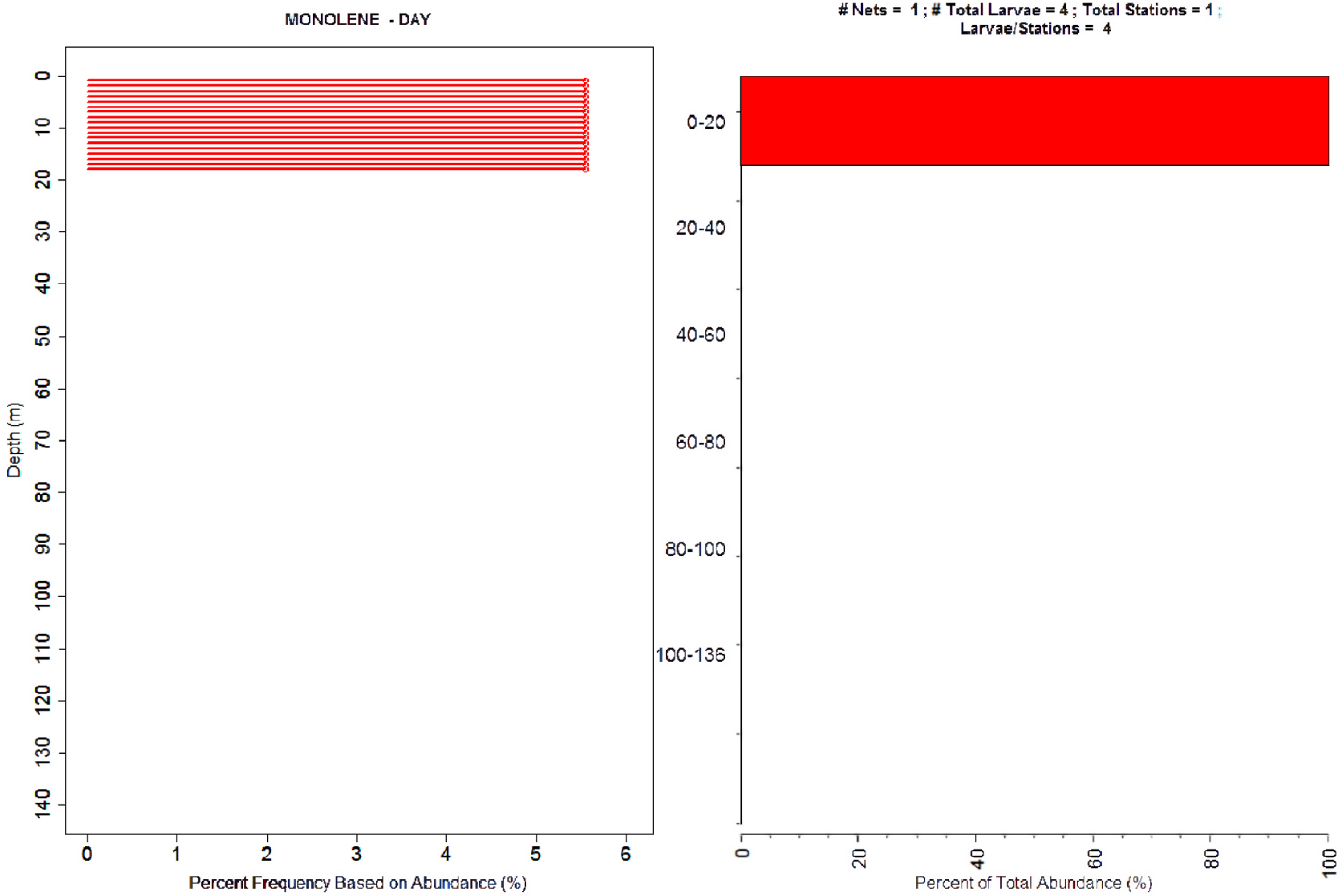
MONACANTHIDAE, NIGHT



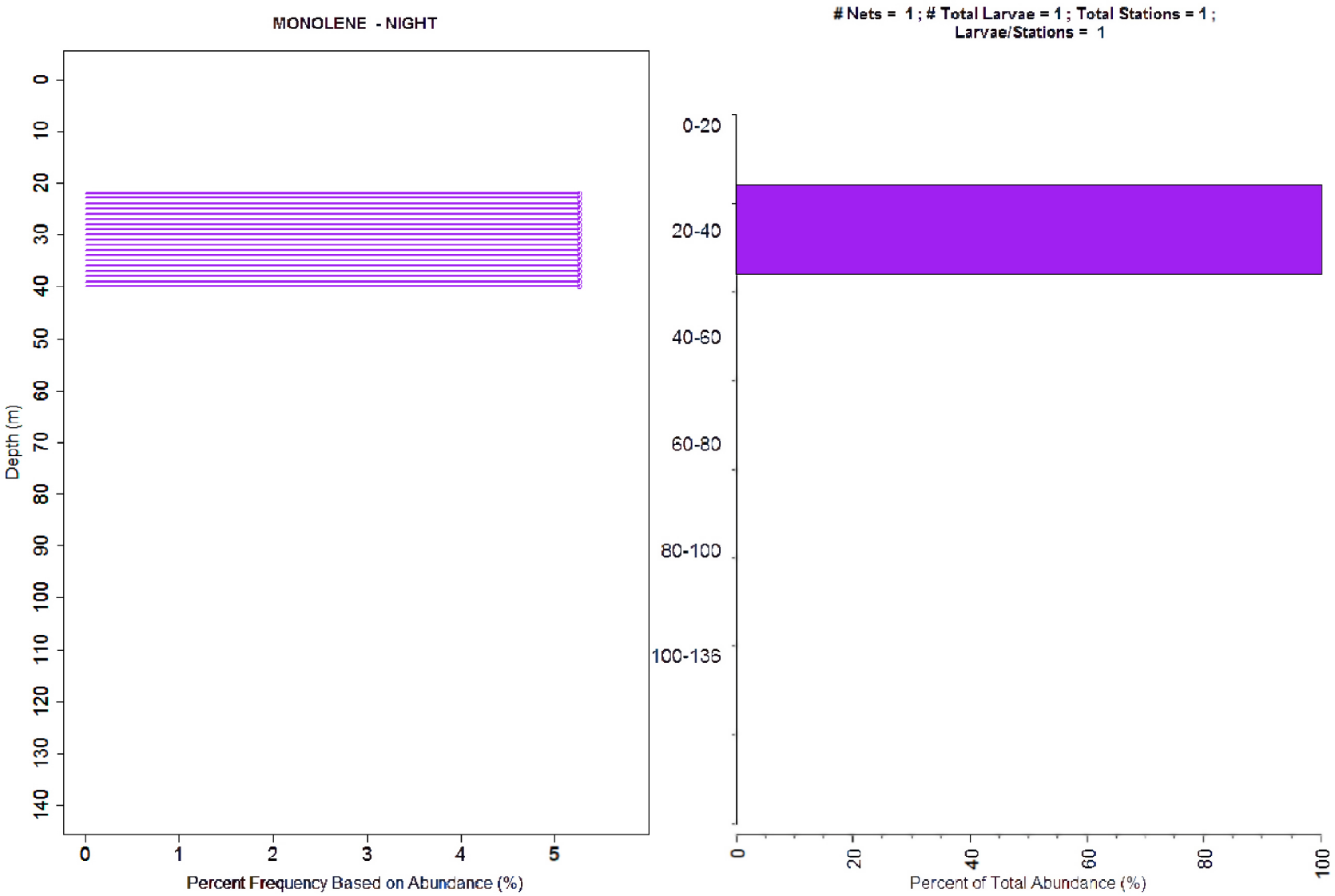
MONACANTHUS, DAY



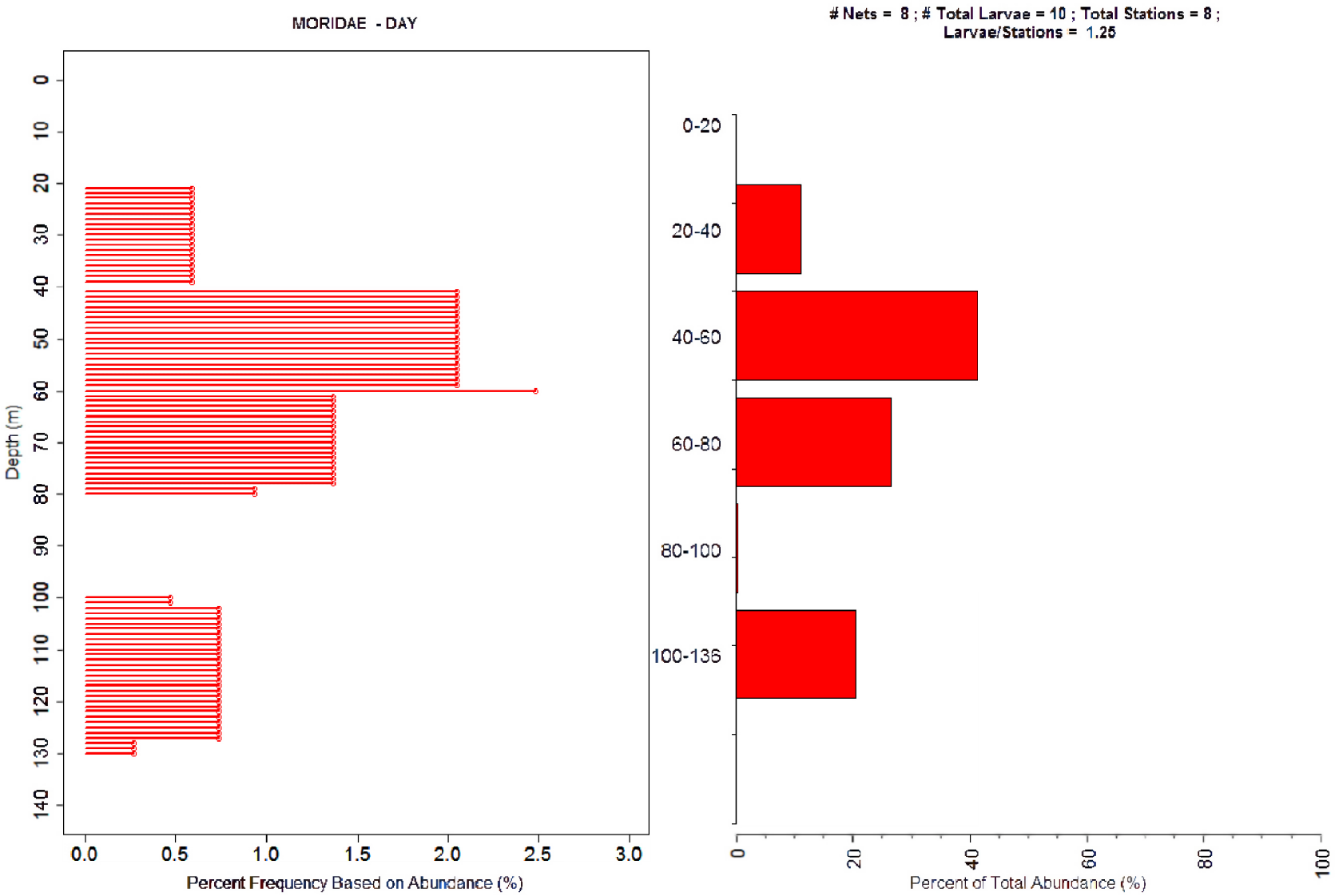
MONACANTHUS_CILIATUS, DAY



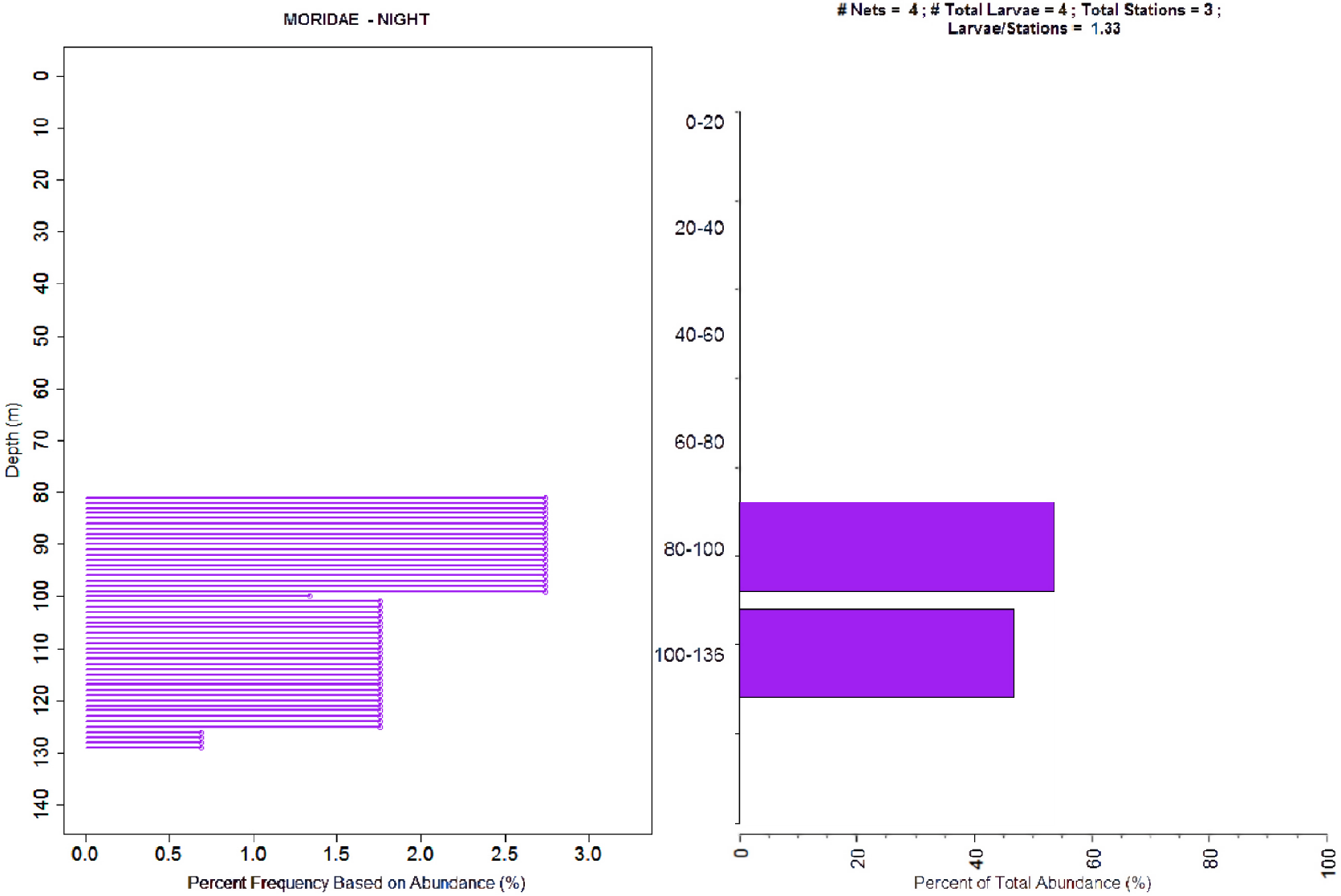
MONOLENE, DAY



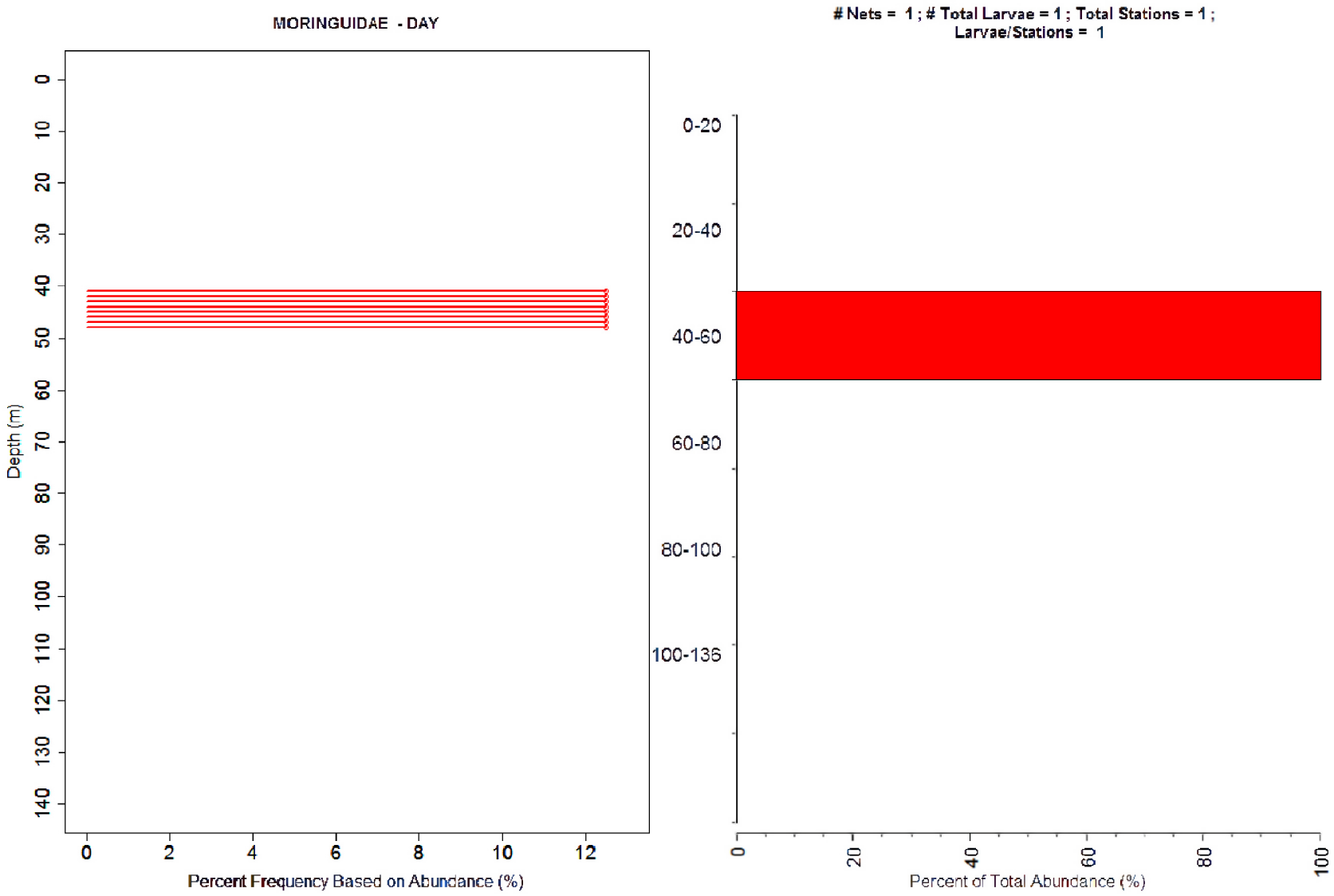
MONOLENE, NIGHT


MORIDAE - DAY
Nets = 8 ; # Total Larvae = 10 ; Total Stations = 8 ;
Larvae/Stations = 1.25
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

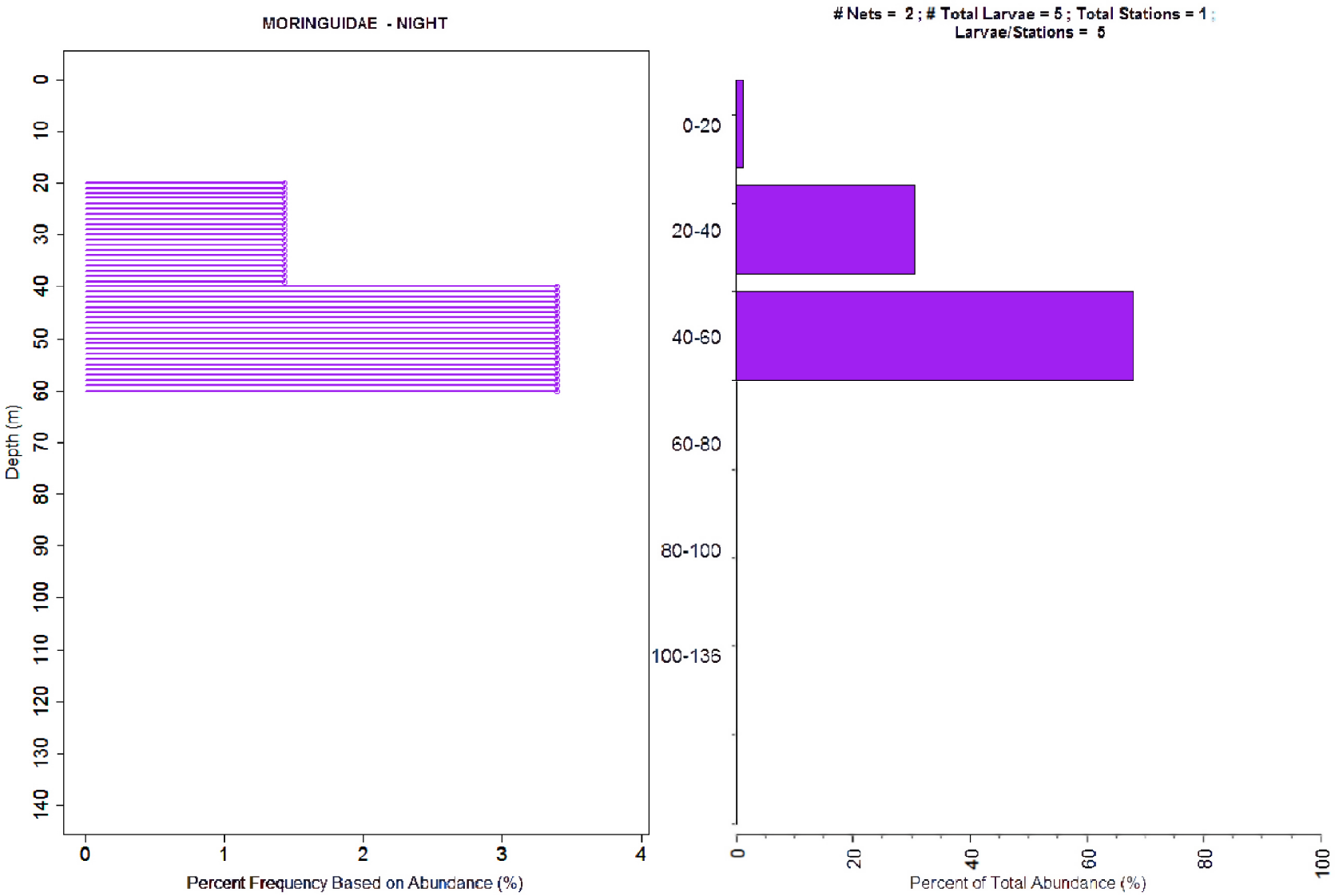
MORIDAE, DAY



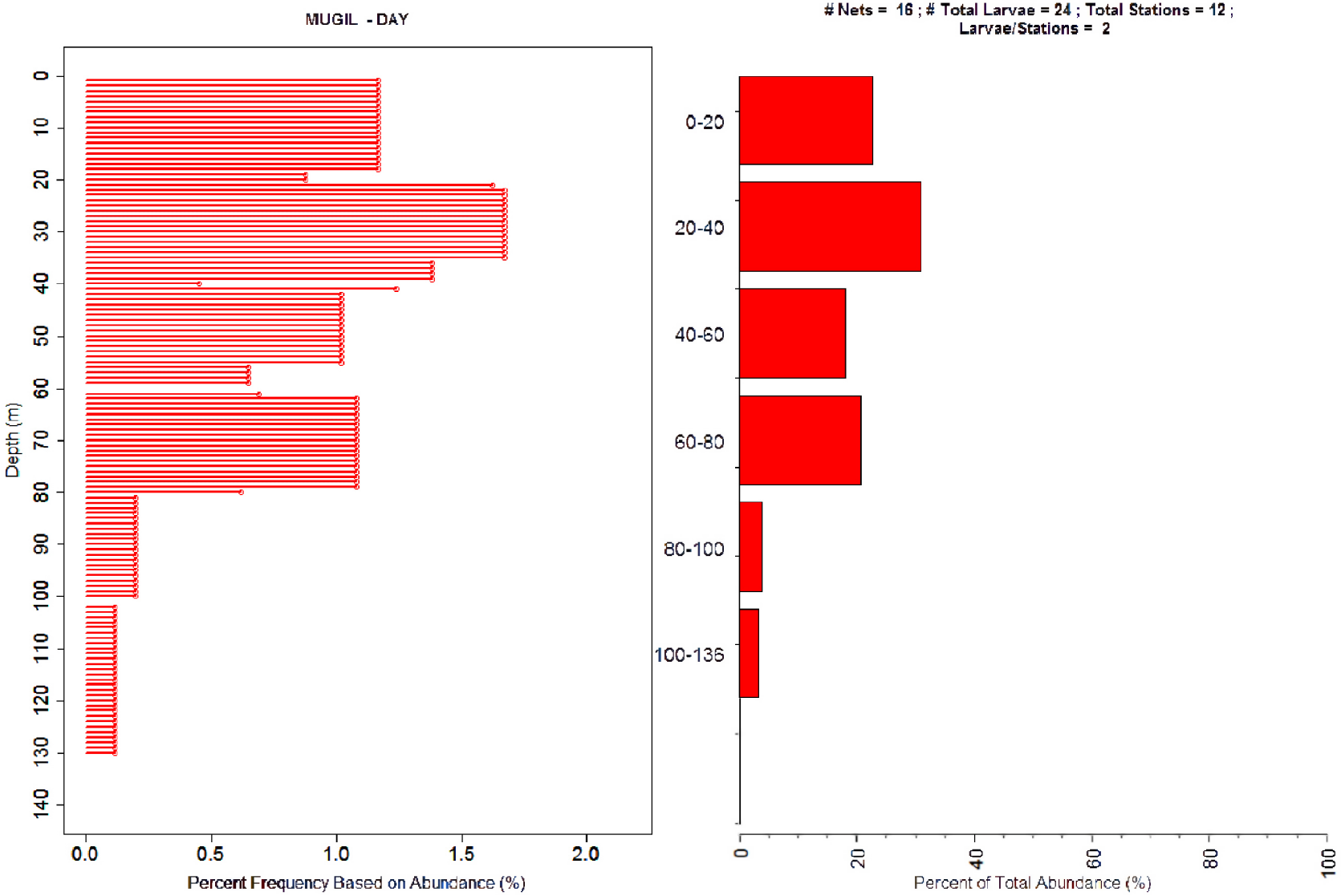
MORIDAE, NIGHT



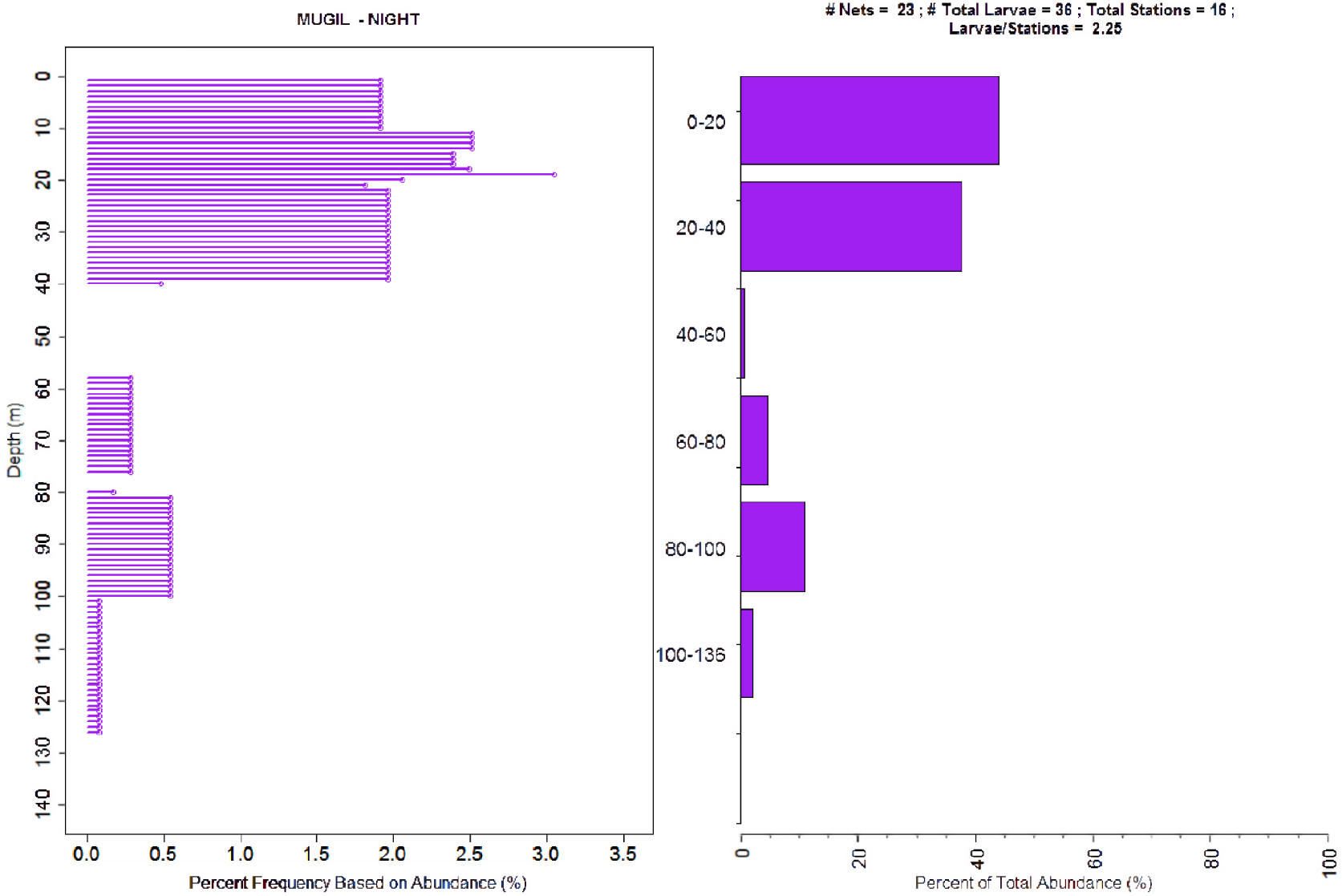
MORINGUIDAE, DAY



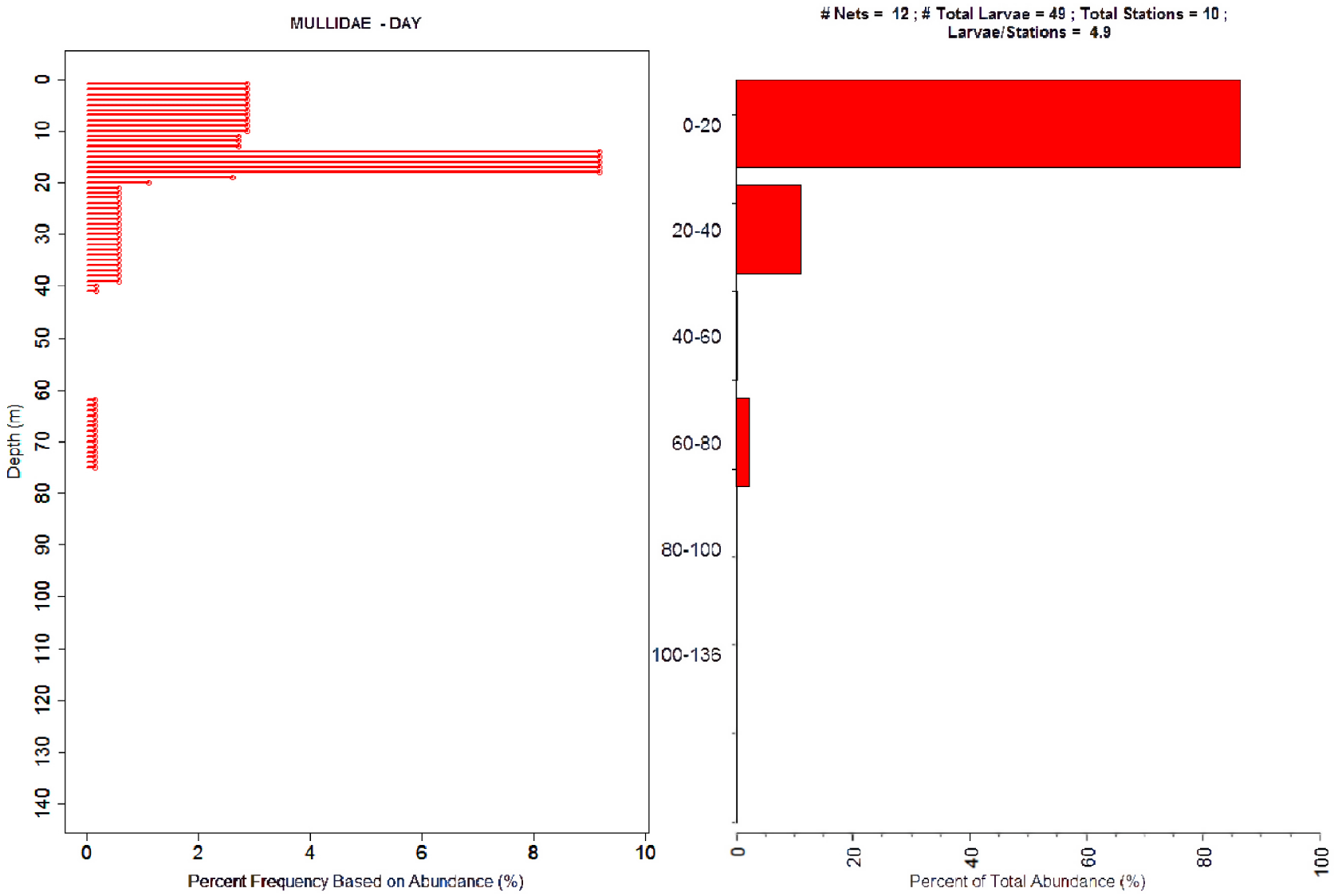
MORINGUIDAE, NIGHT


MUGIL - DAY
Nets = 16 ; # Total Larvae = 24 ; Total Stations = 12 ;
Larvae/Stations = 2
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

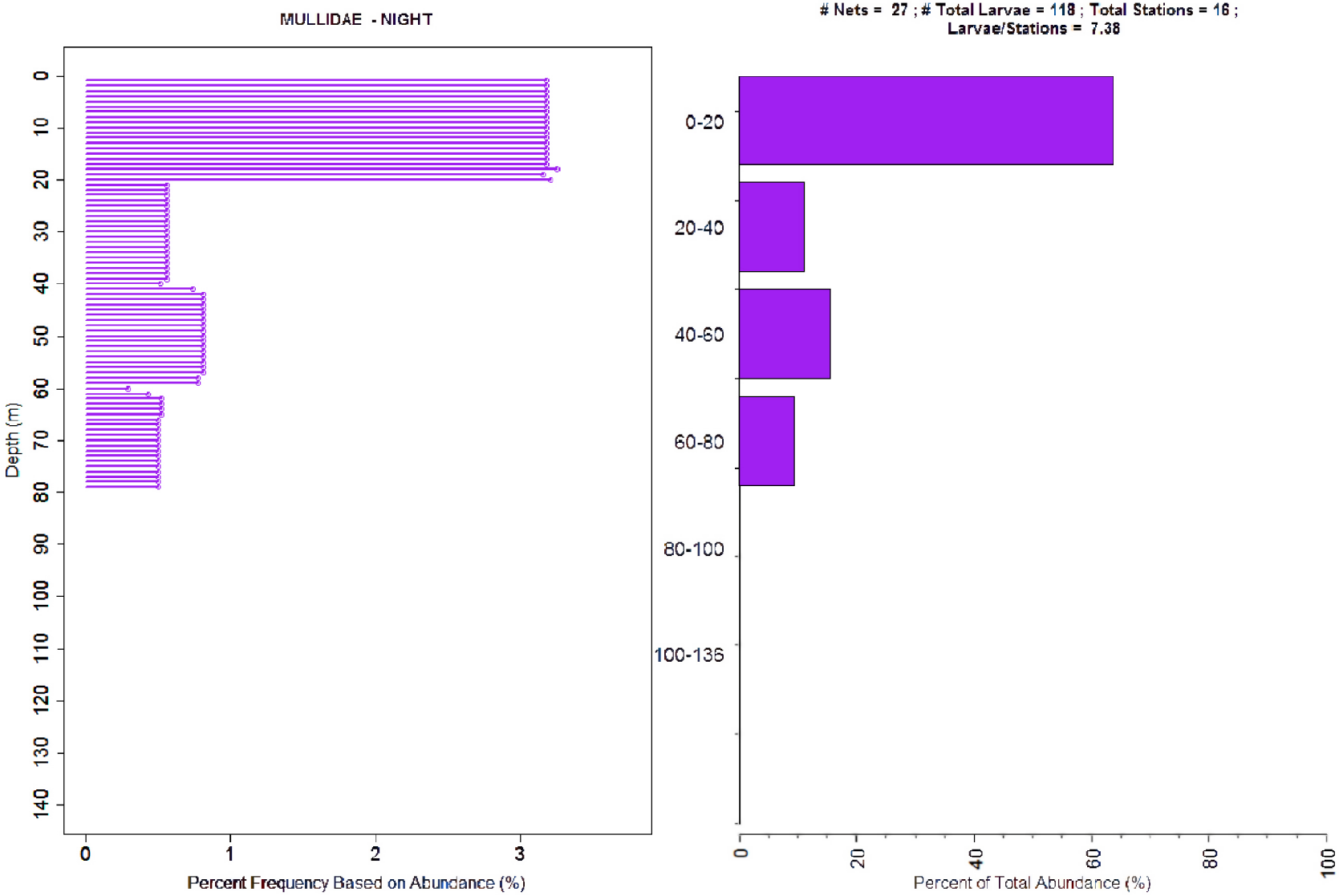
MUGIL, DAY


MUGIL - NIGHT
Nets = 23 ; # Total Larvae = 36 ; Total Stations = 16 ;
Larvae/Stations = 2.25
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

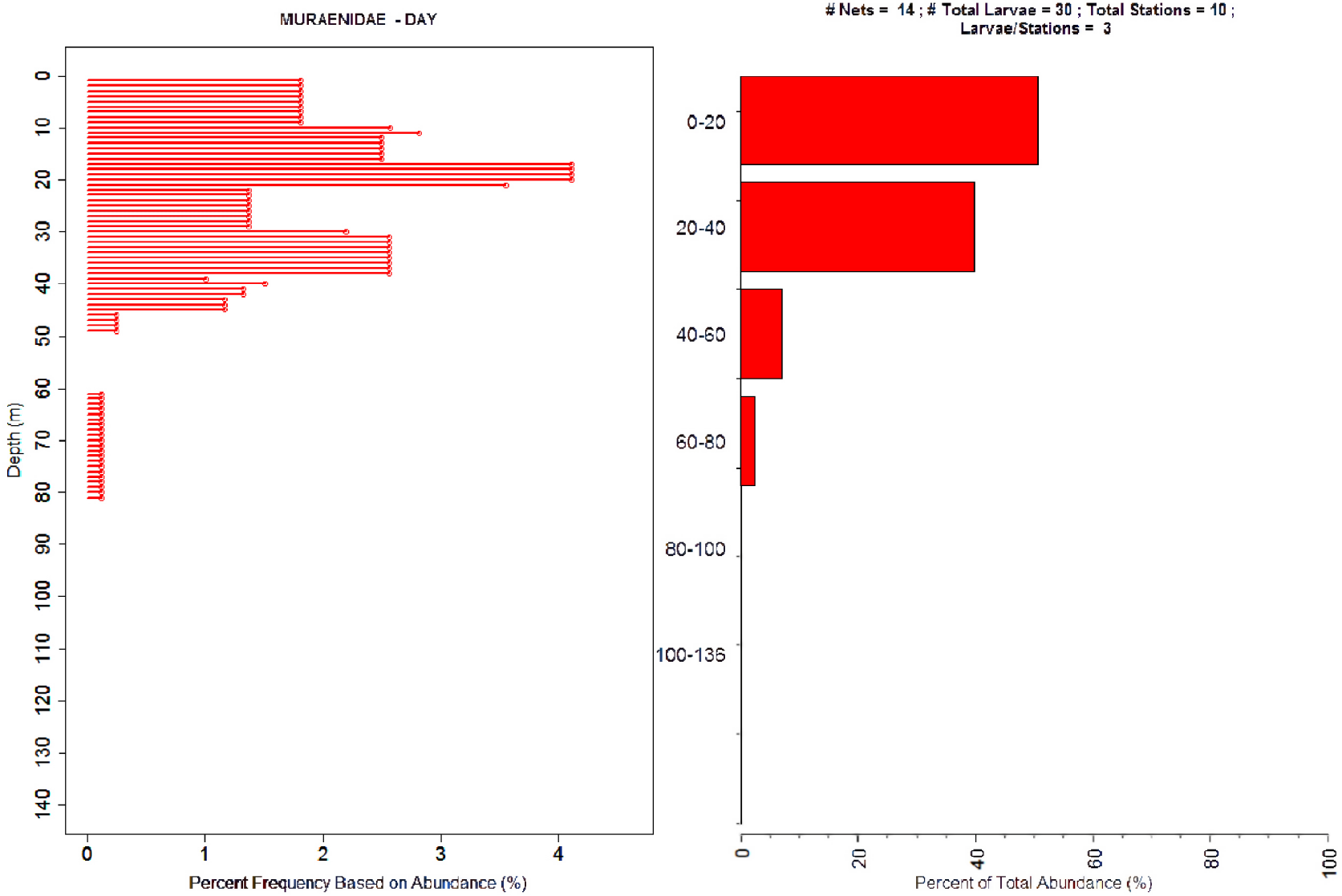
MUGIL, NIGHT



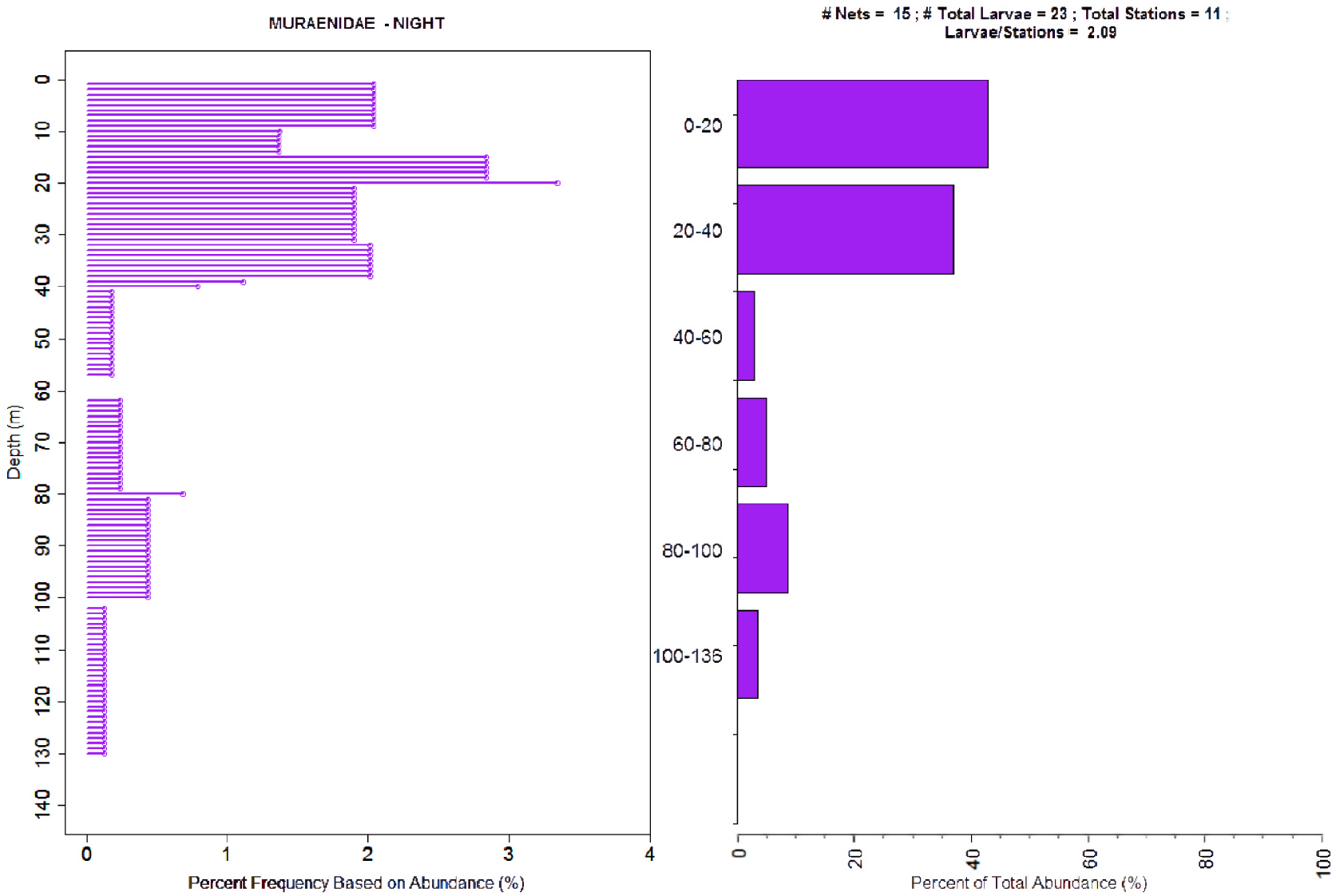
MULLIDAE, DAY



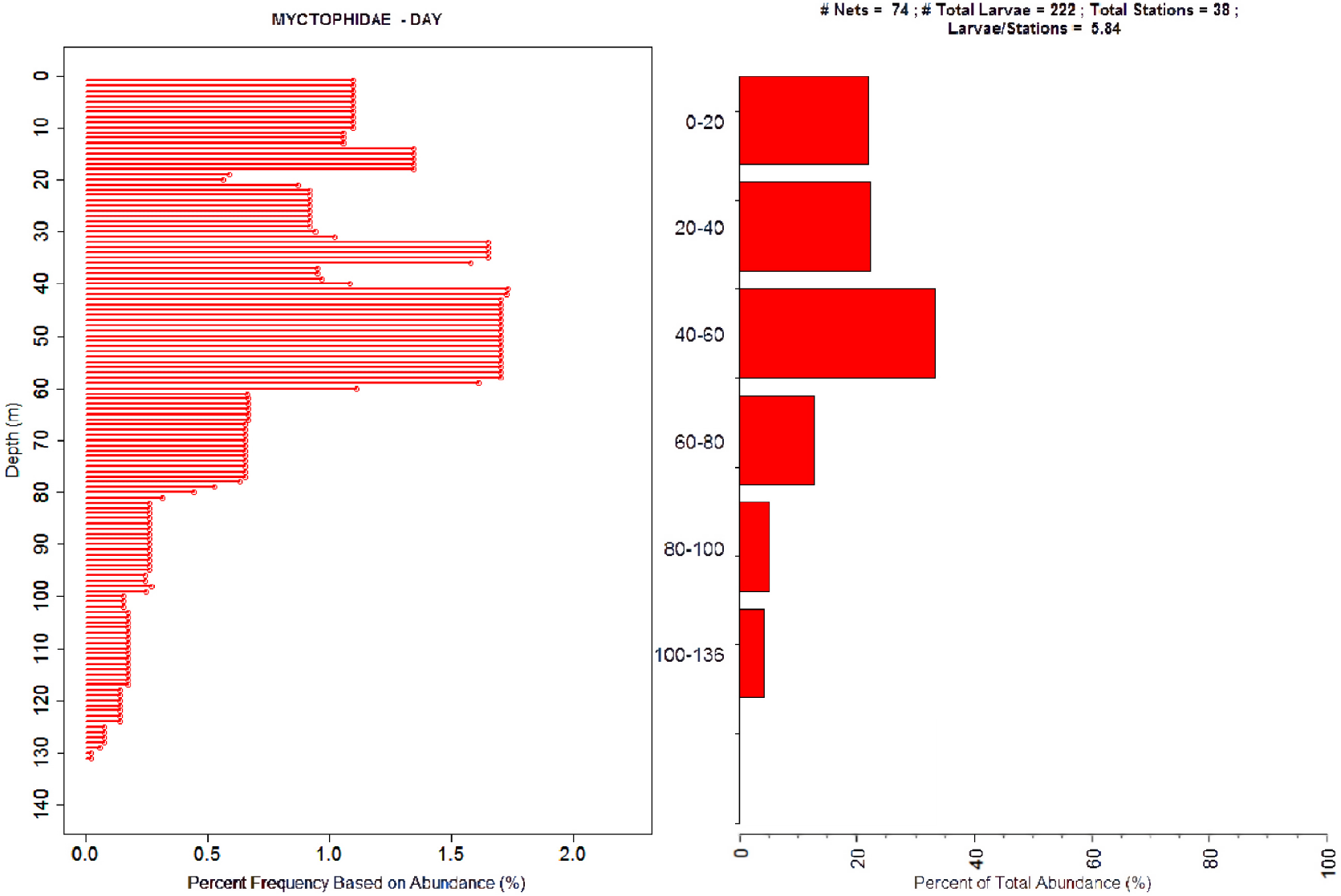
MULLIDAE, NIGHT



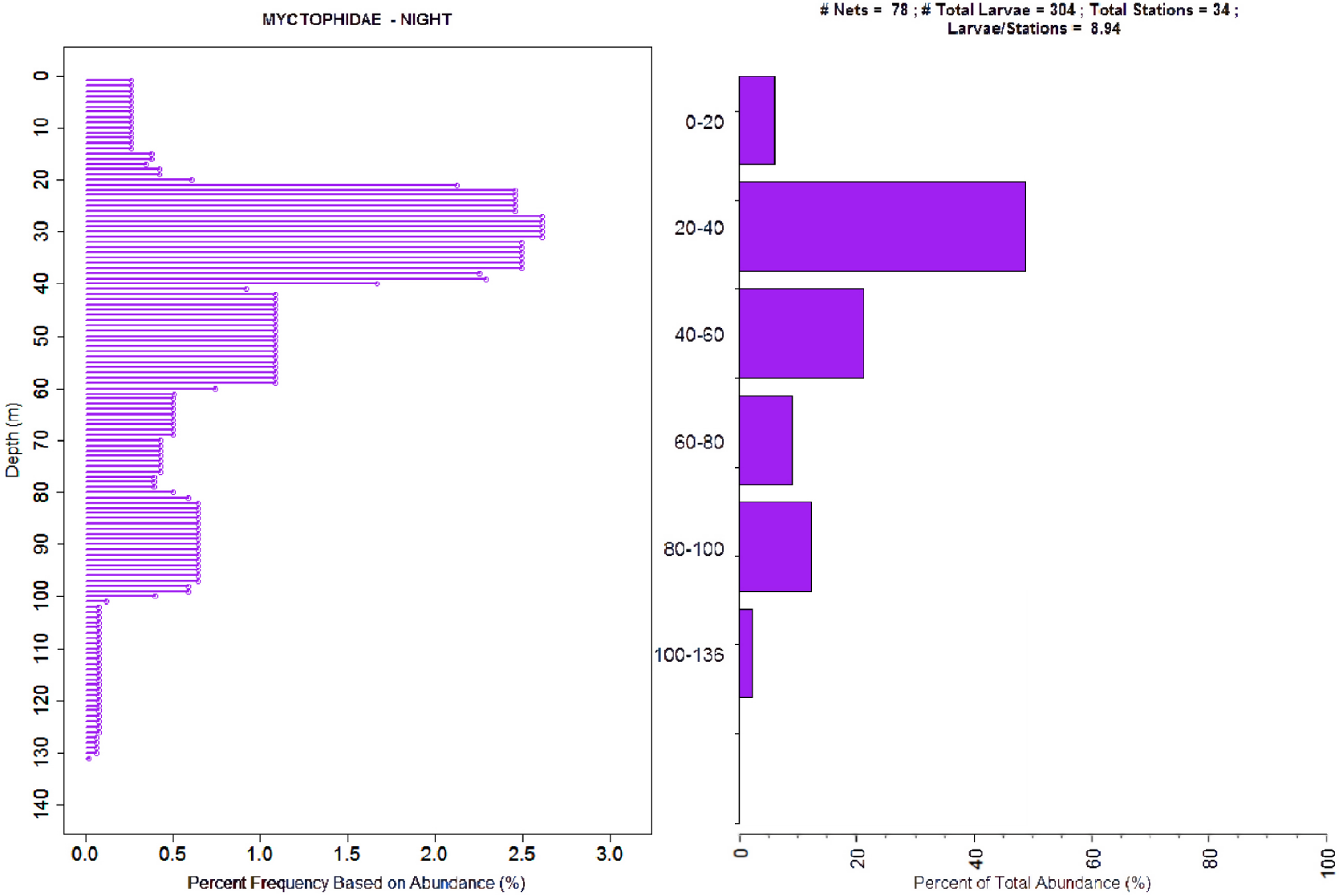
MURAENIDAE, DAY



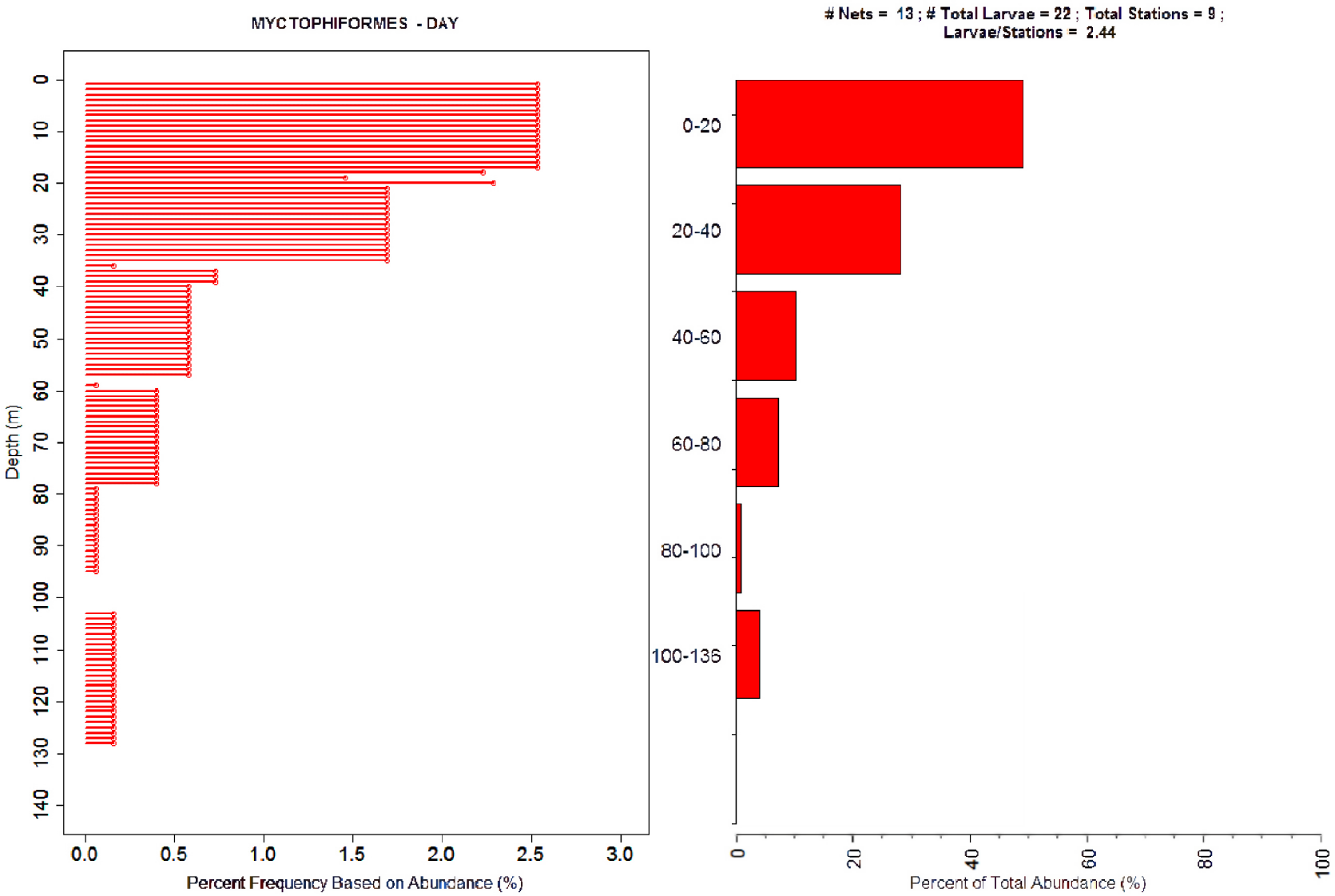
MURAENIDAE, NIGHT



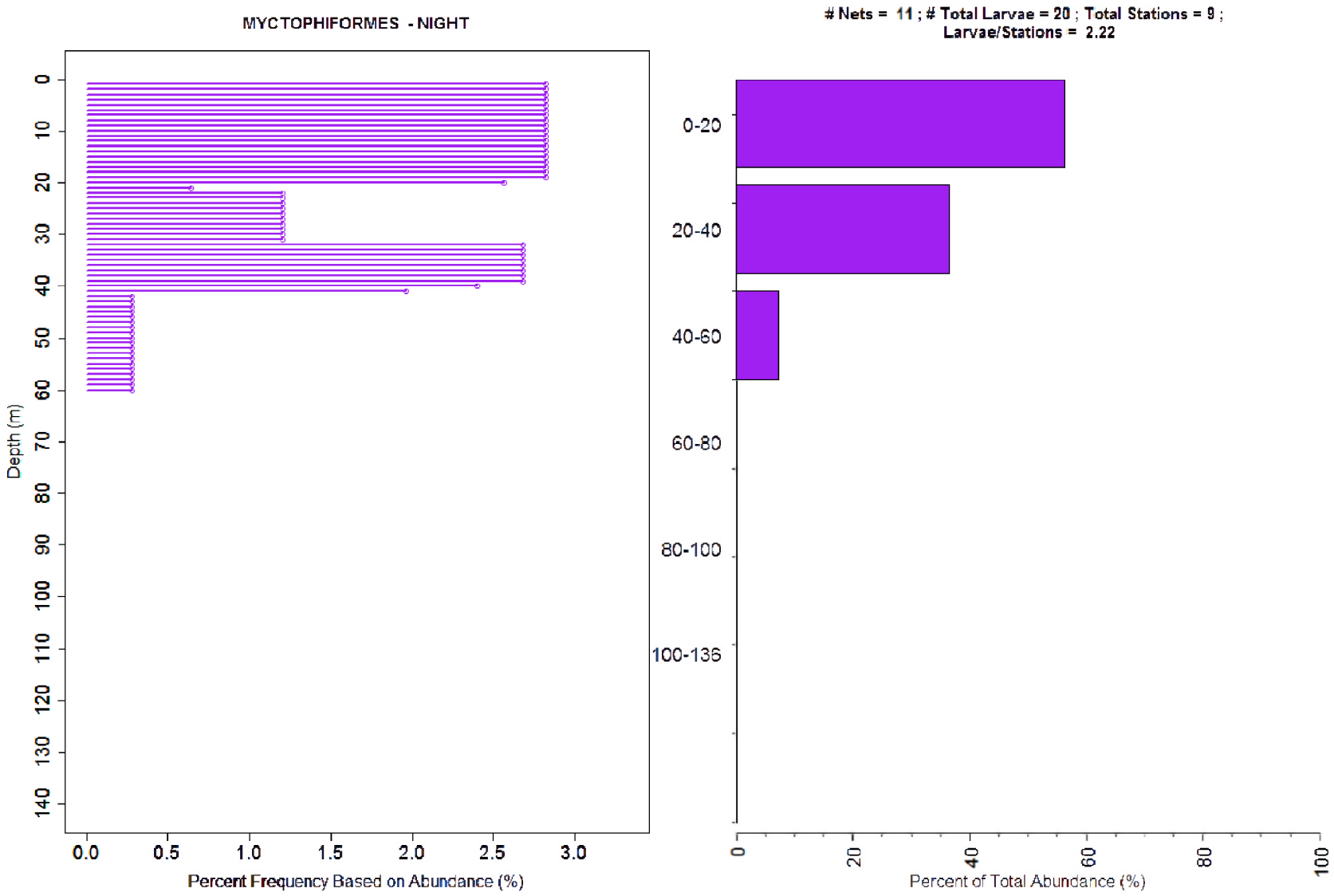
MYCTOPHIDAE, DAY



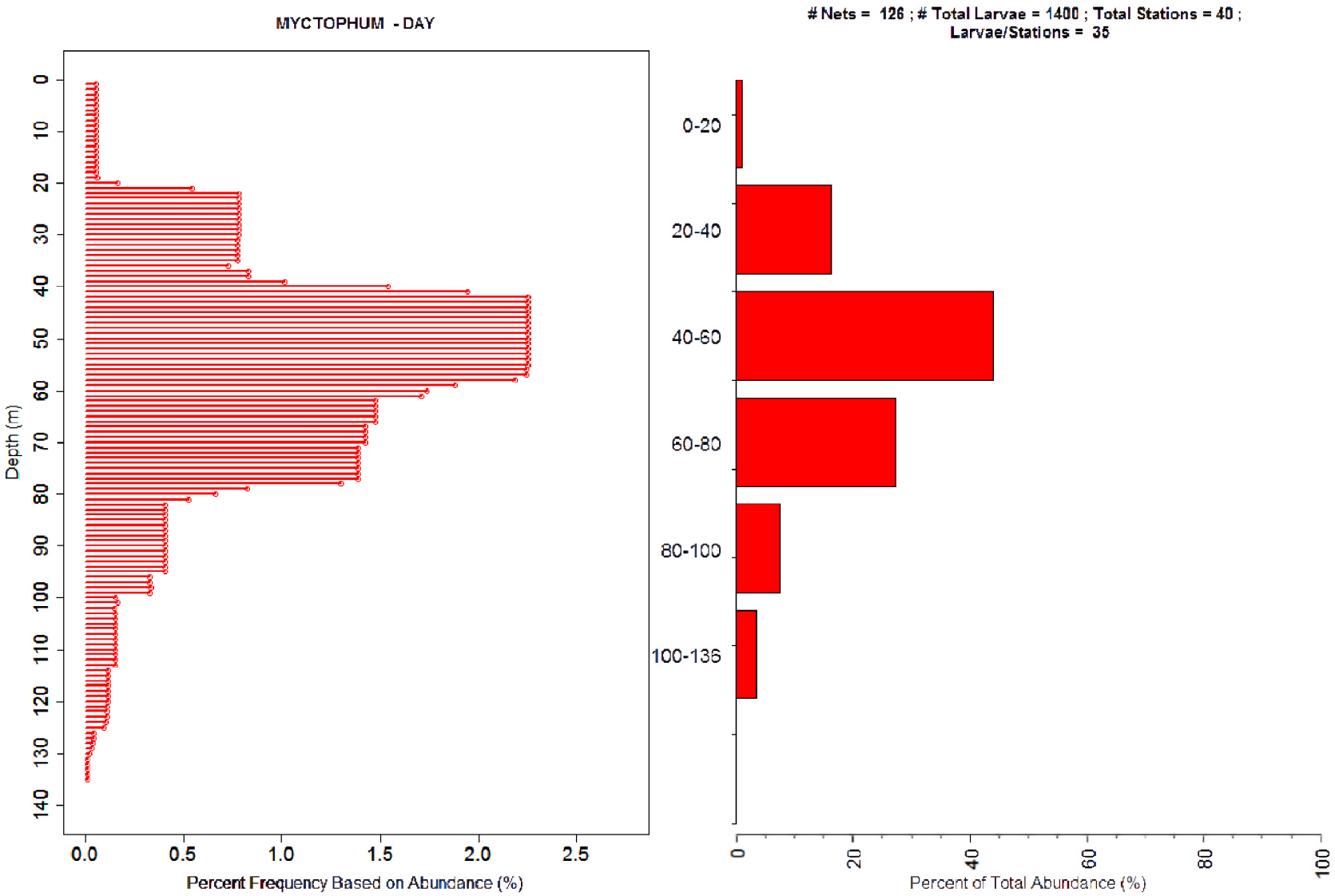
MYCTOPHIDAE, NIGHT



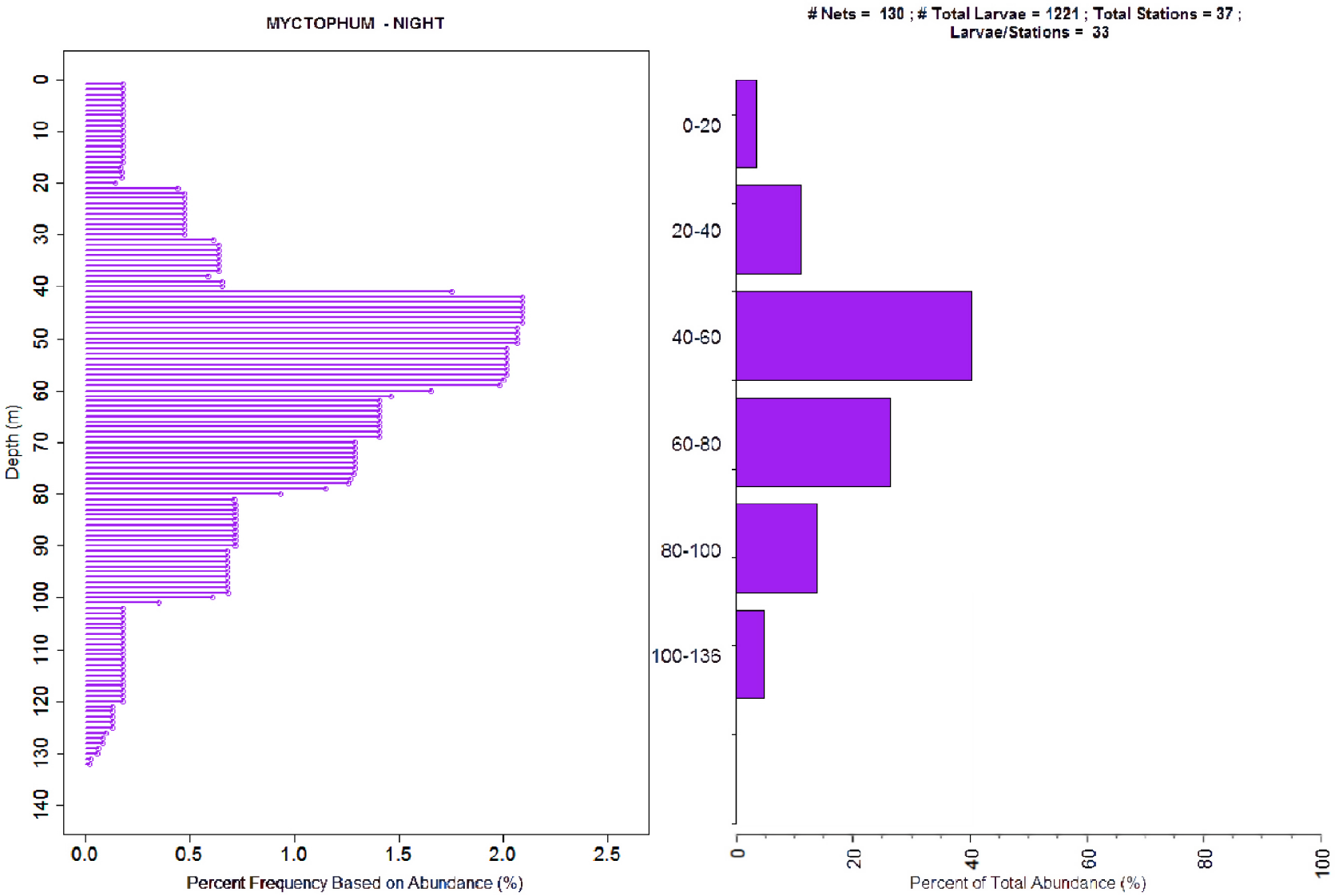
MYCTOPHIFORMES, DAY



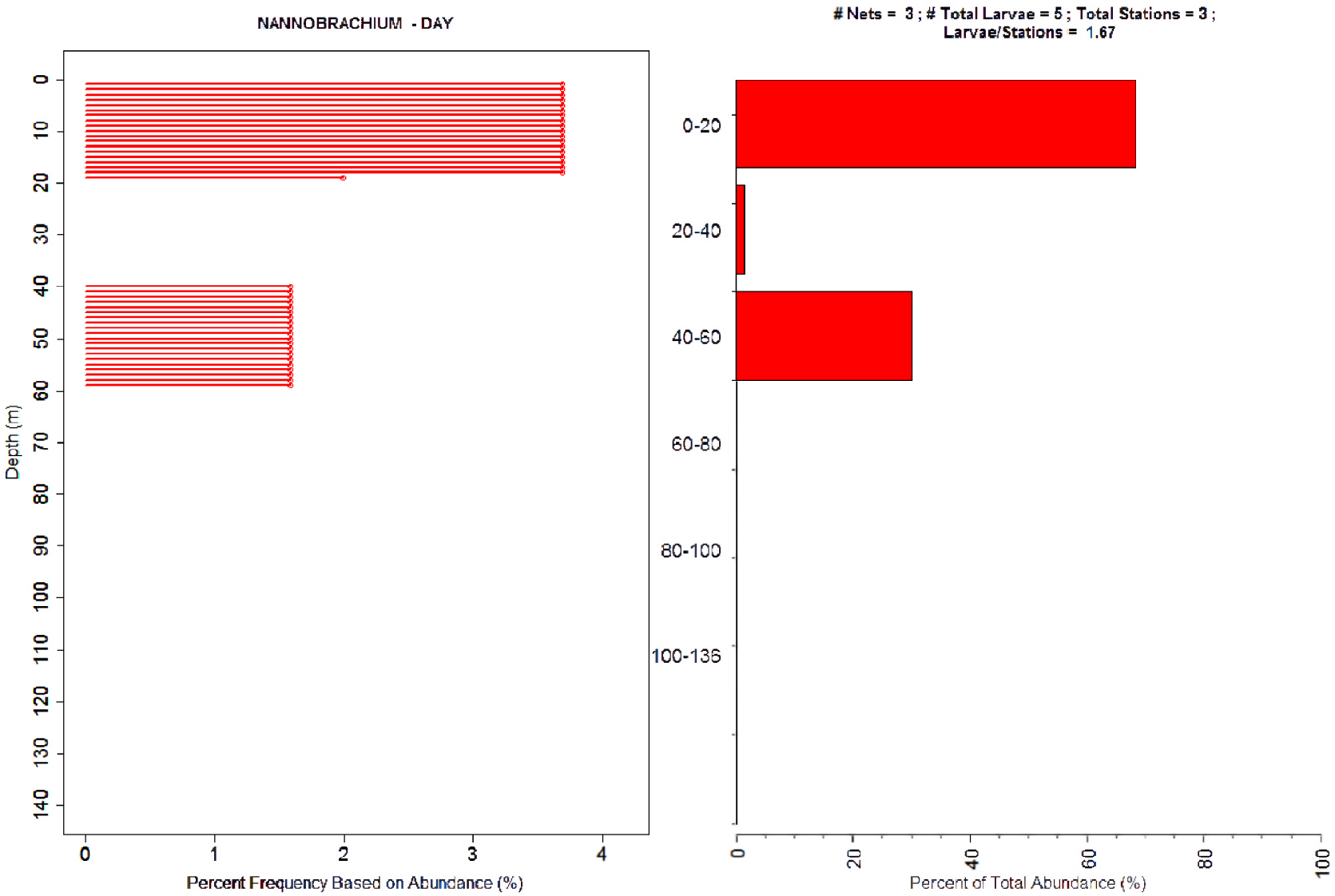
MYCTOPHIFORMES, NIGHT



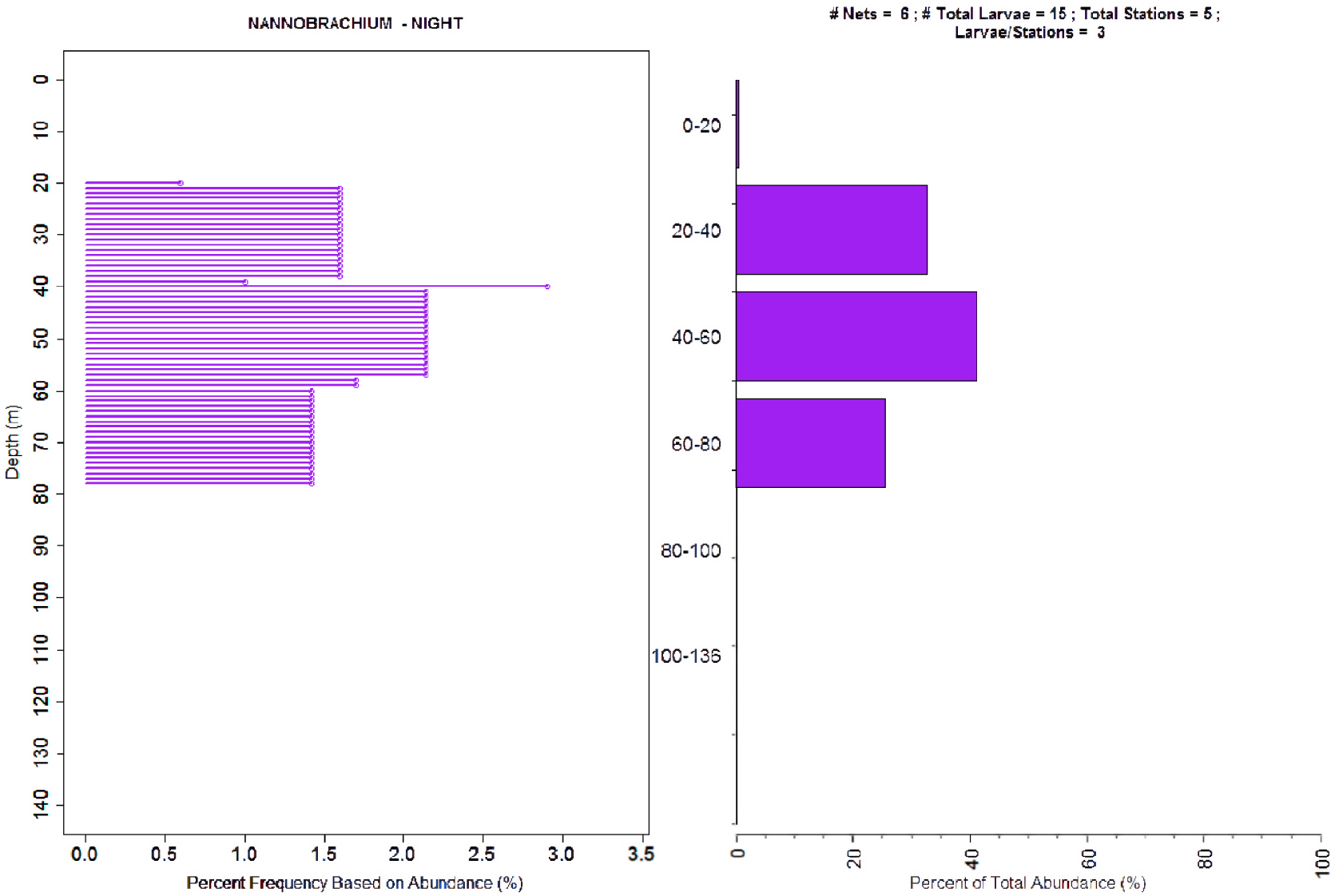
MYCTOPHUM, DAY



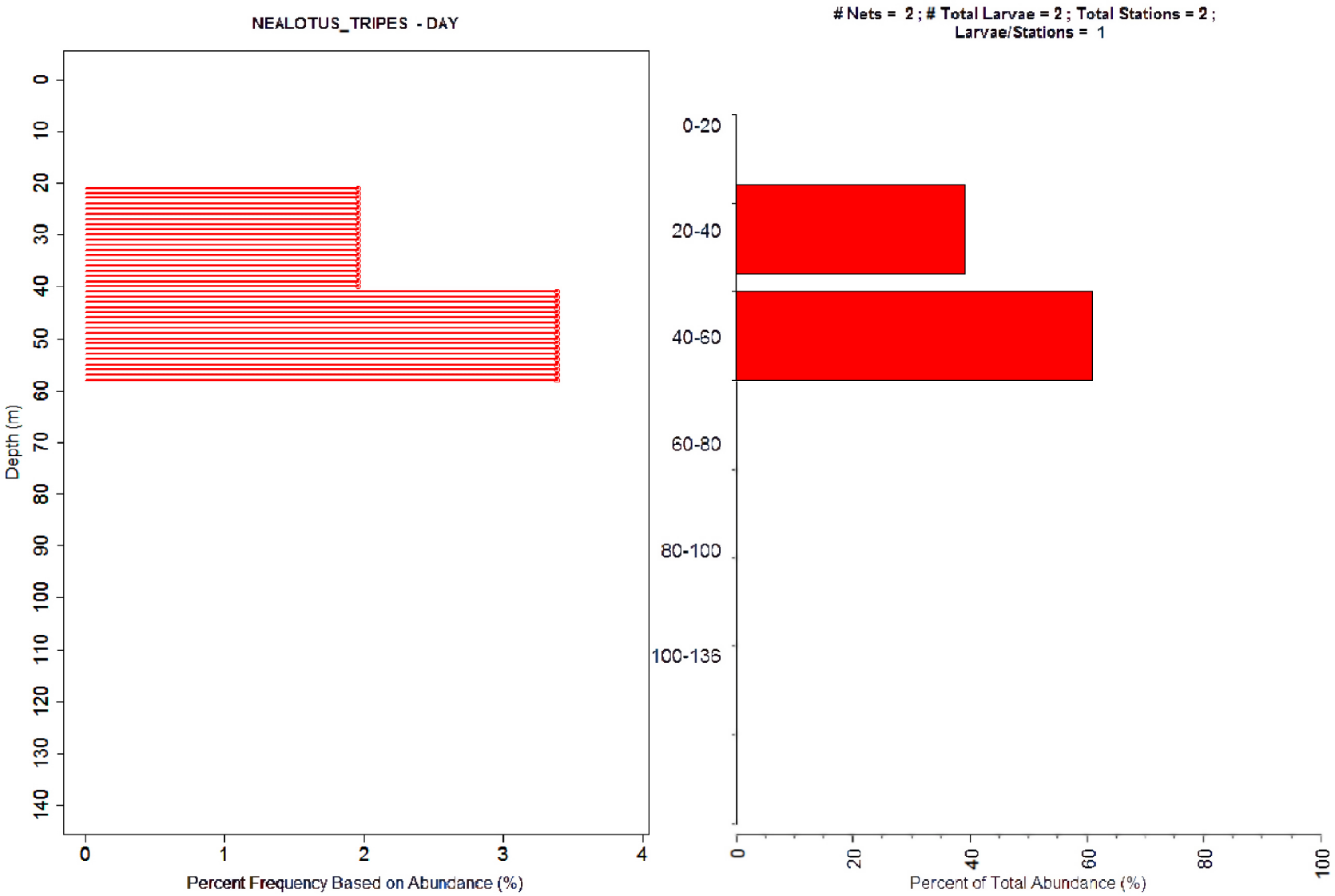
MYCTOPHUM, NIGHT



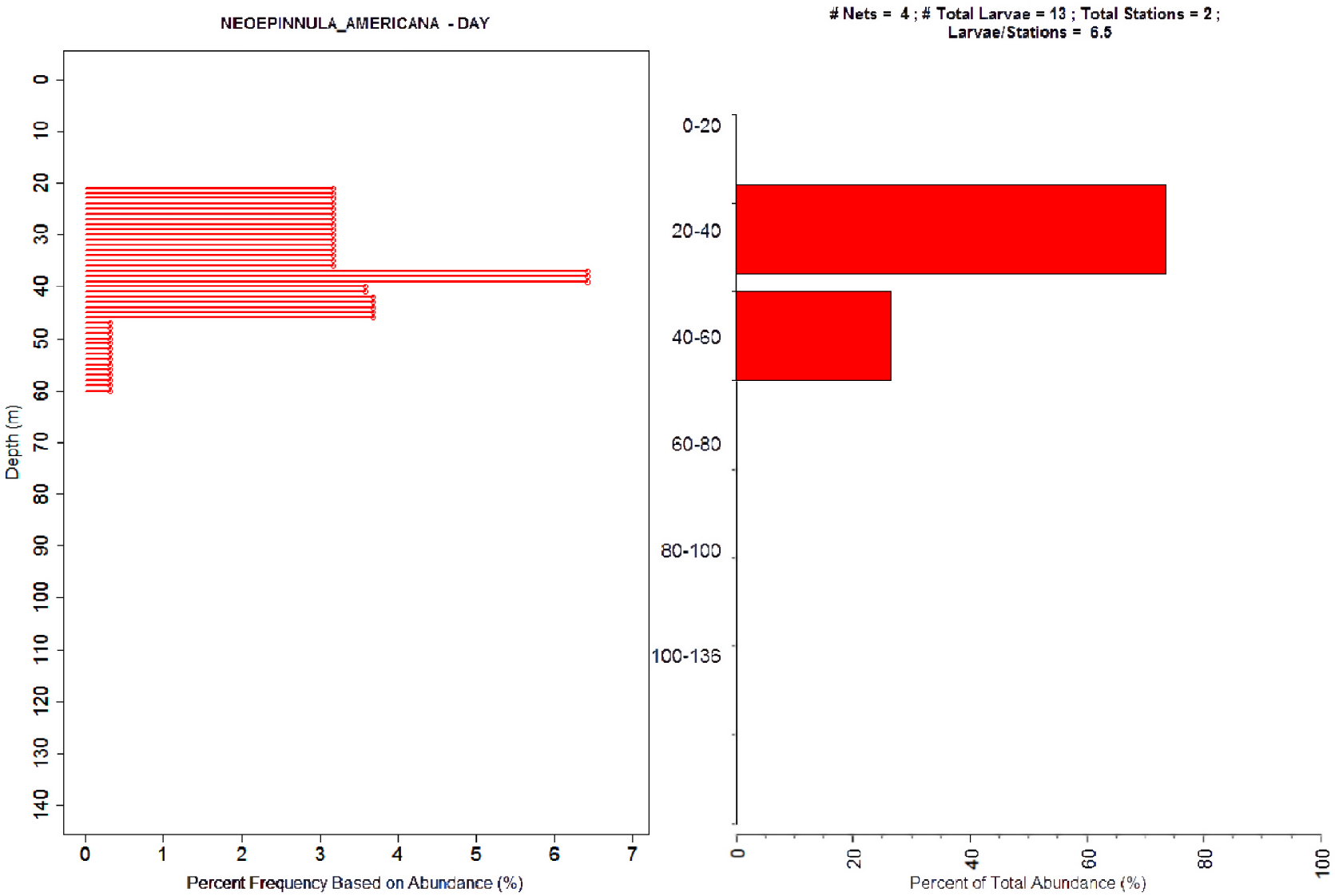
NANNOBRACHIUM, DAY



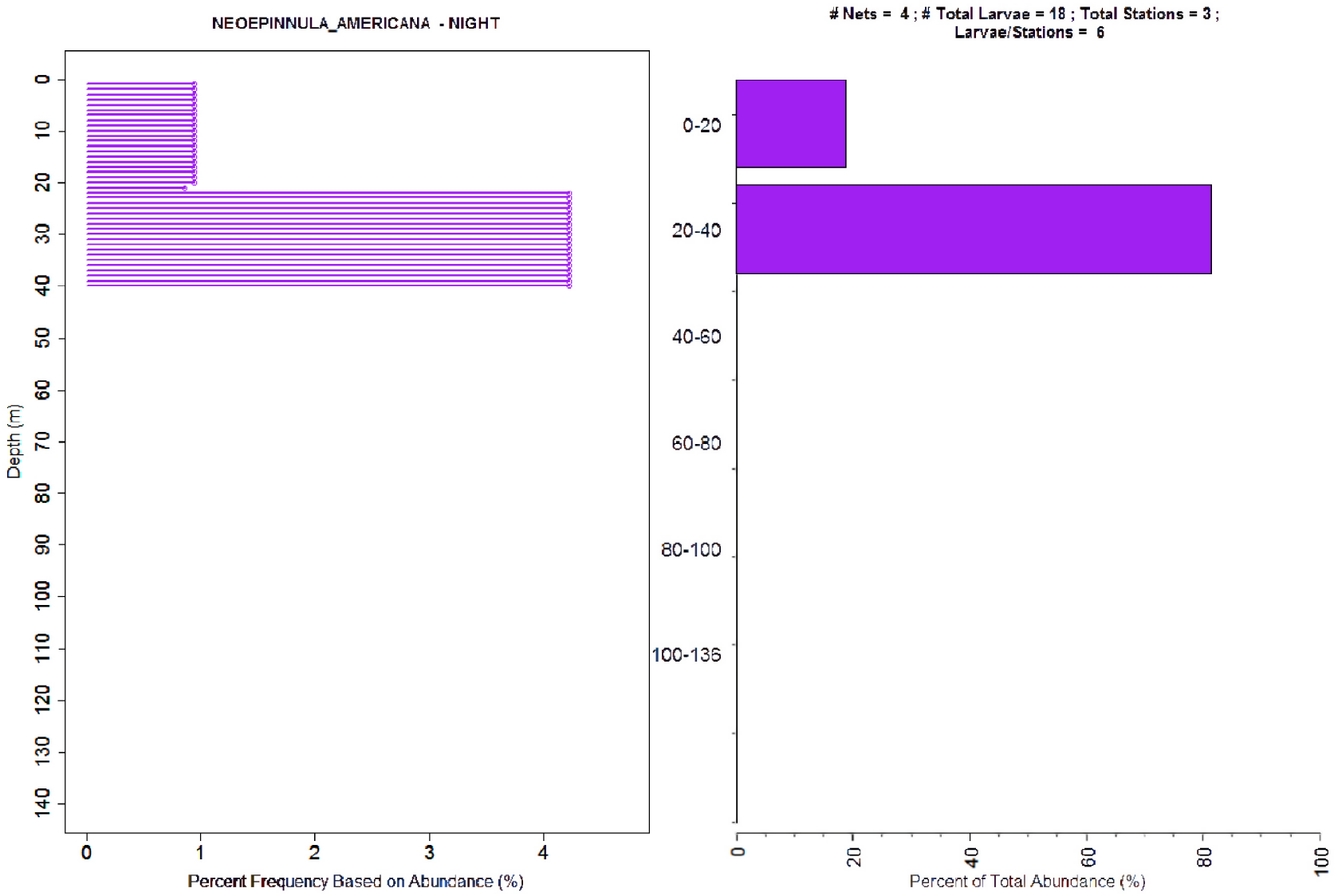
NANNOBRACHIUM, NIGHT



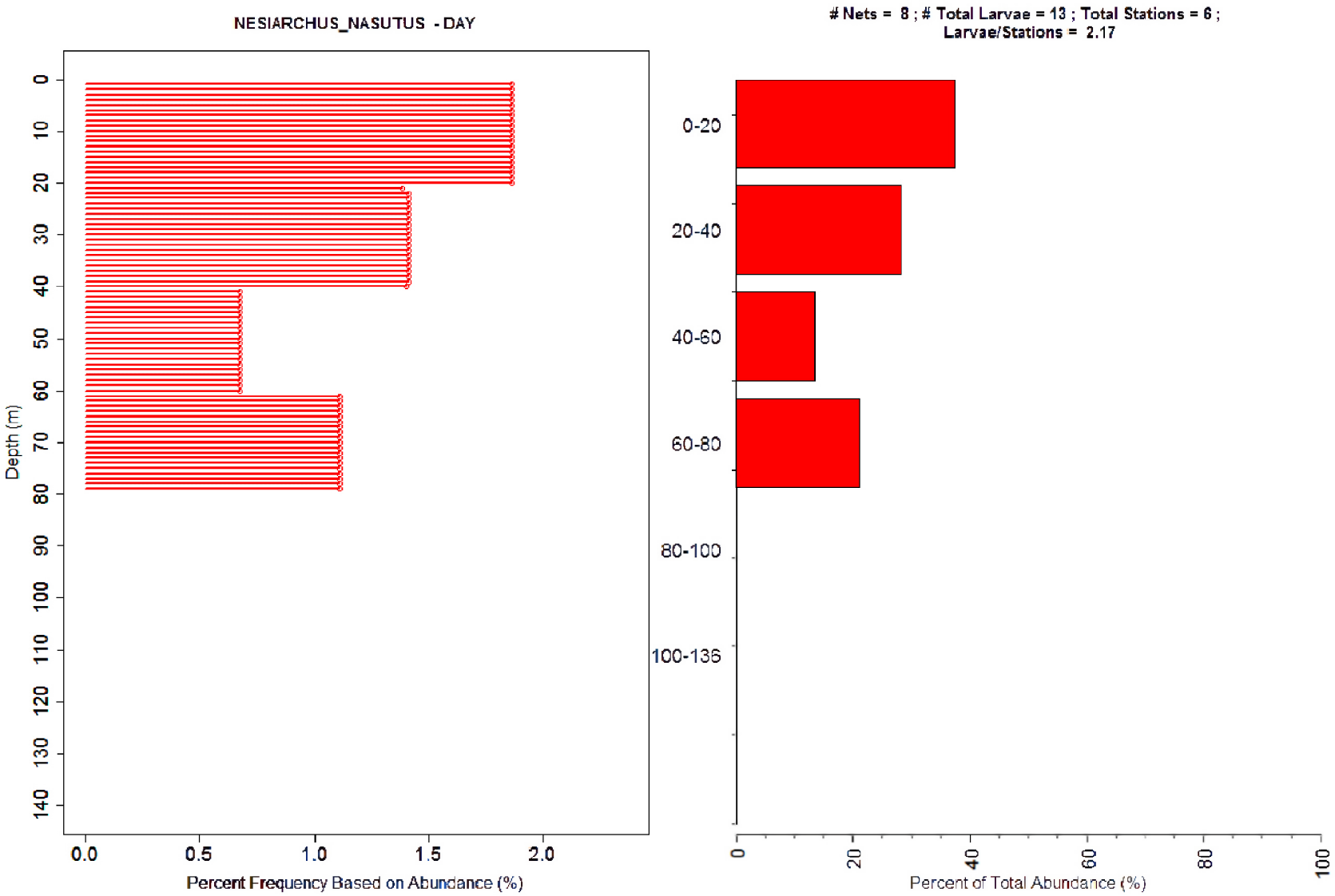
NEALOTUS_TRIPES, DAY



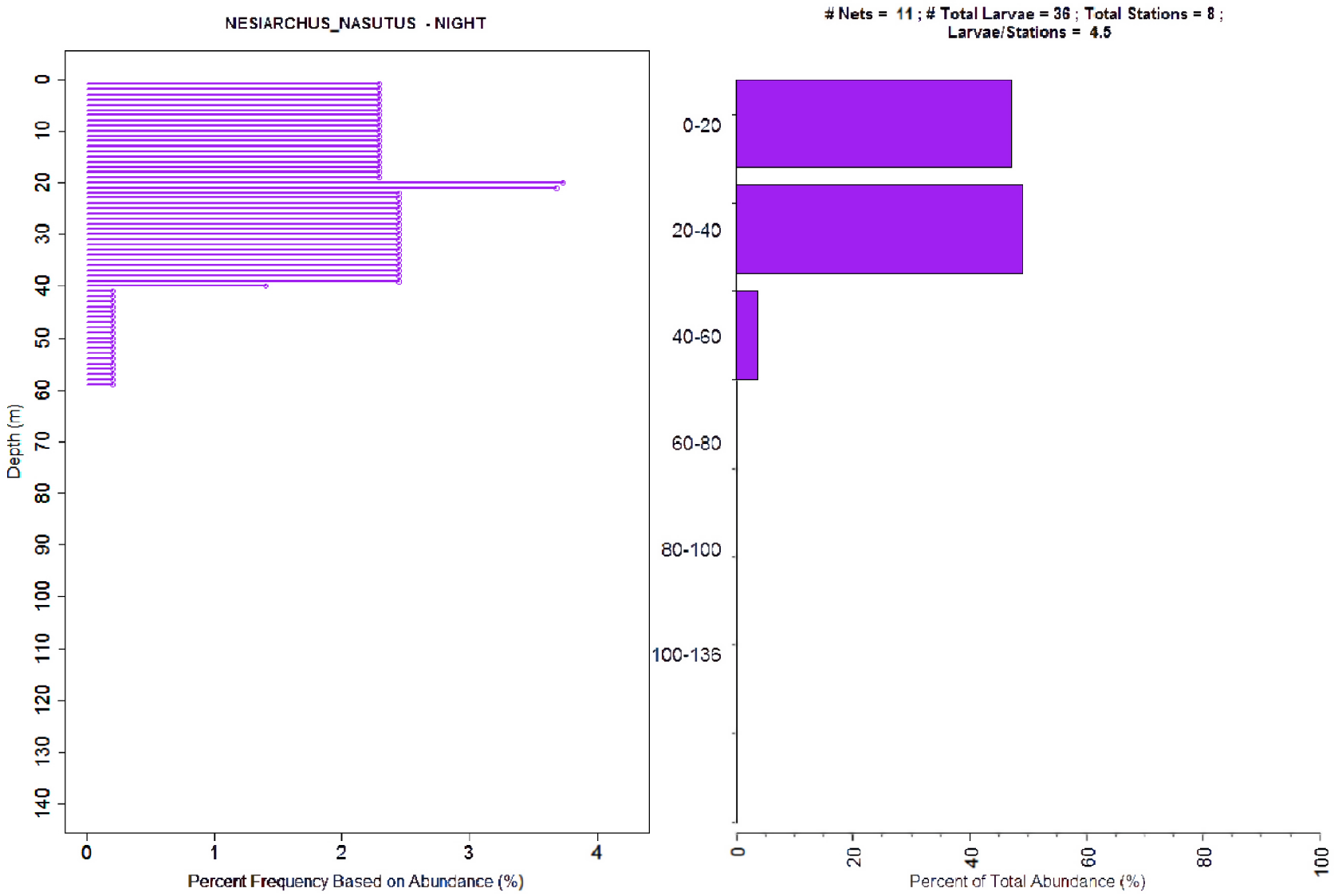
NEOEPINNULA_AMERICANA, DAY



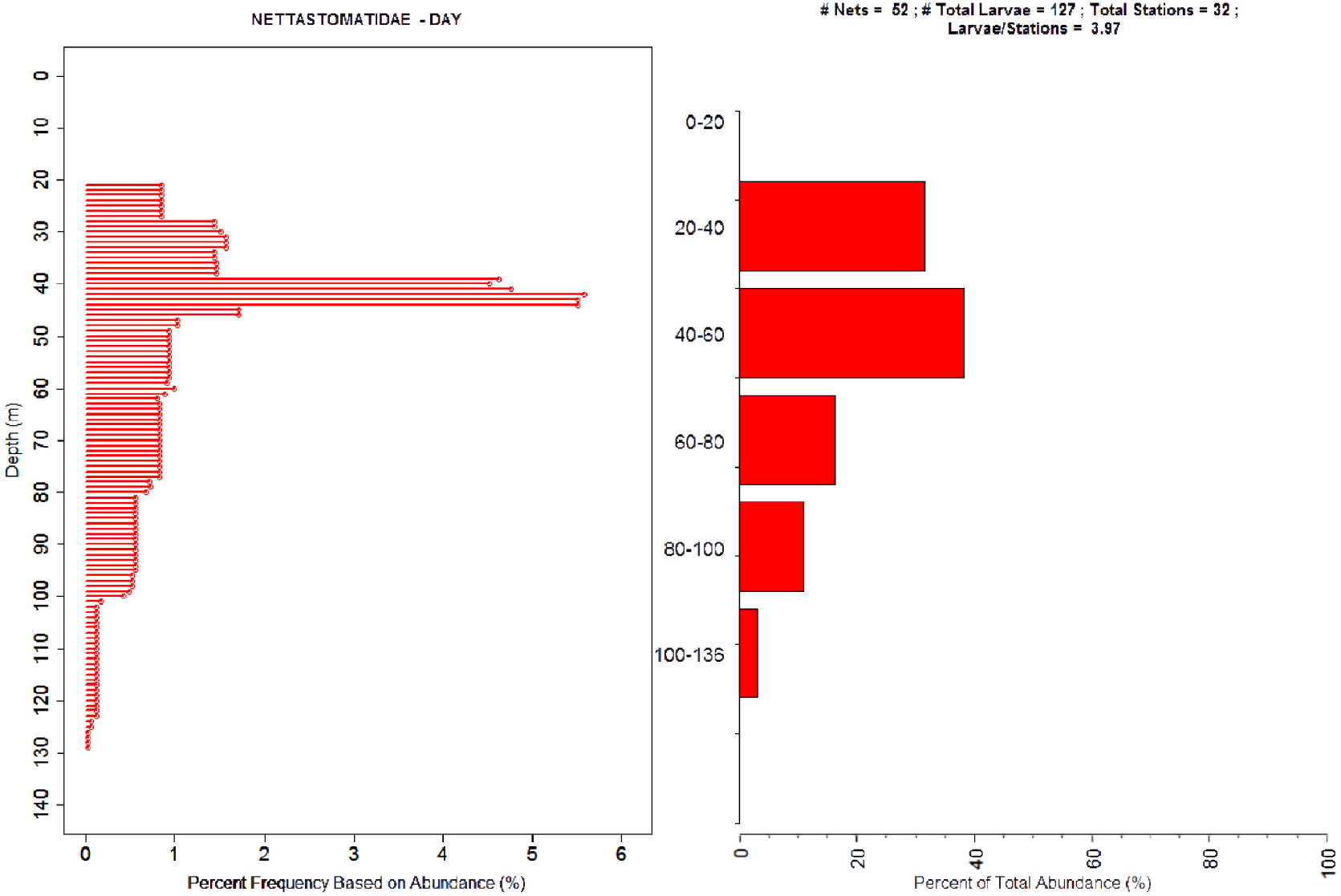
NEOEPINNULA_AMERICANA, NIGHT



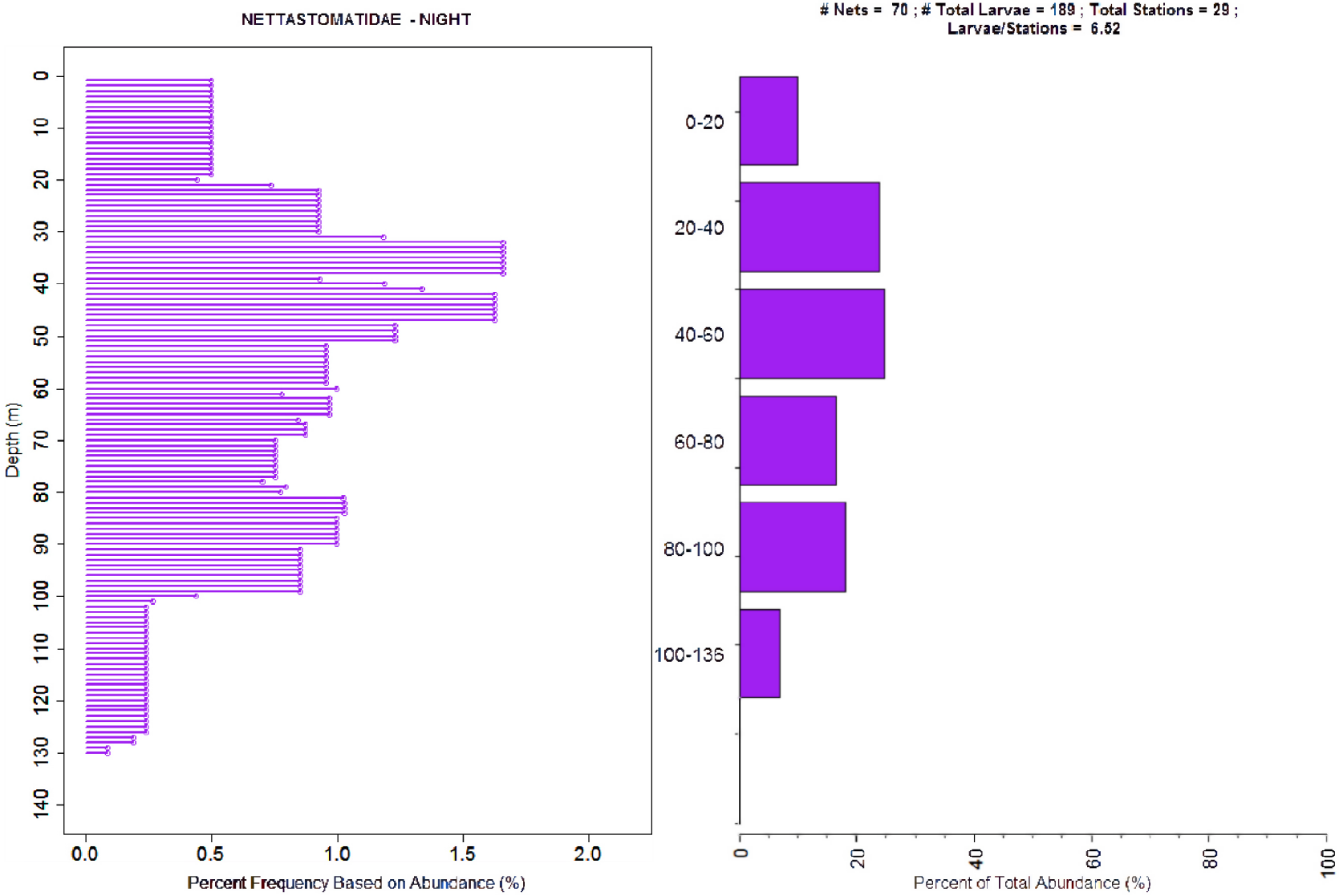
NESIARCHUS_NASUTUS, DAY



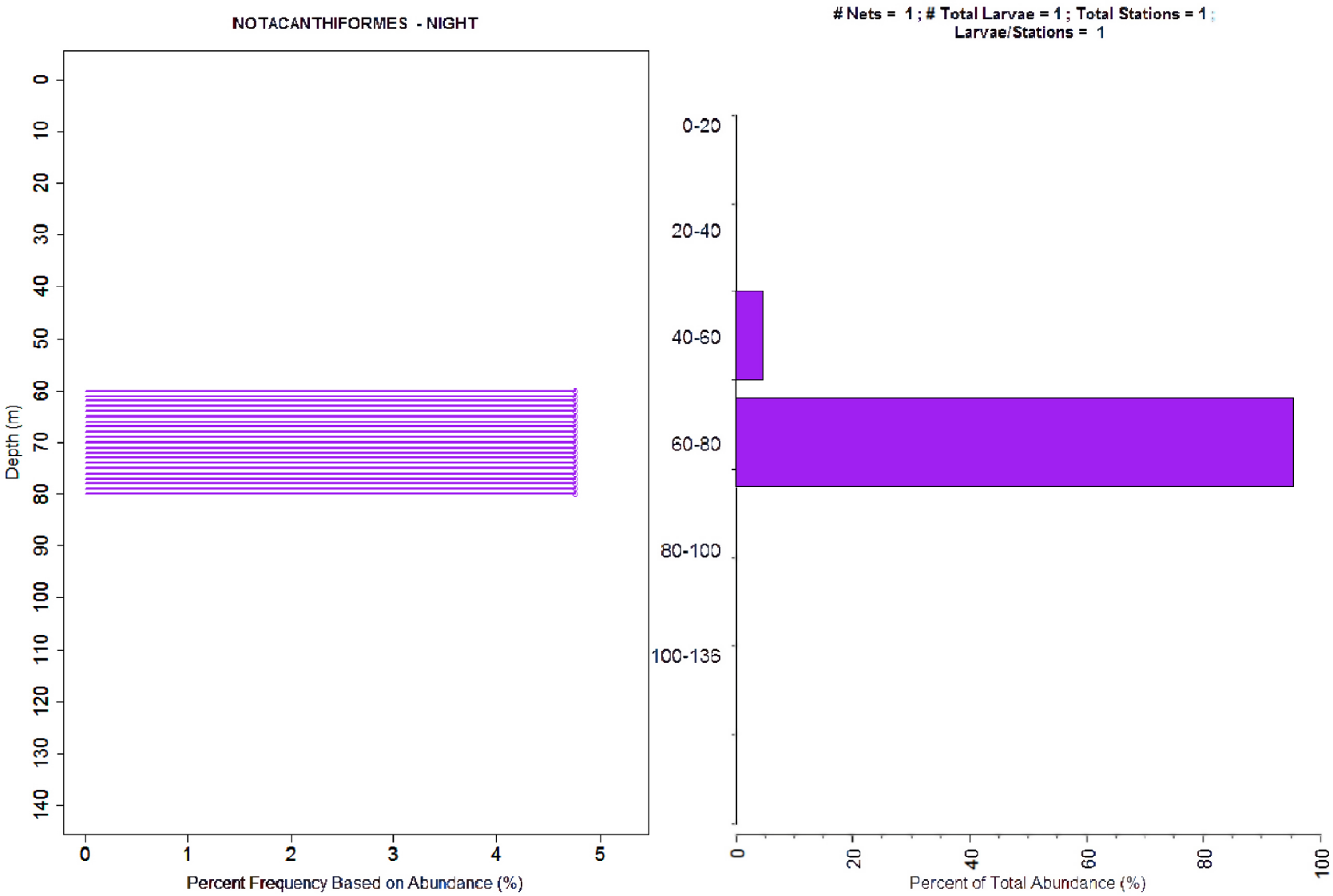
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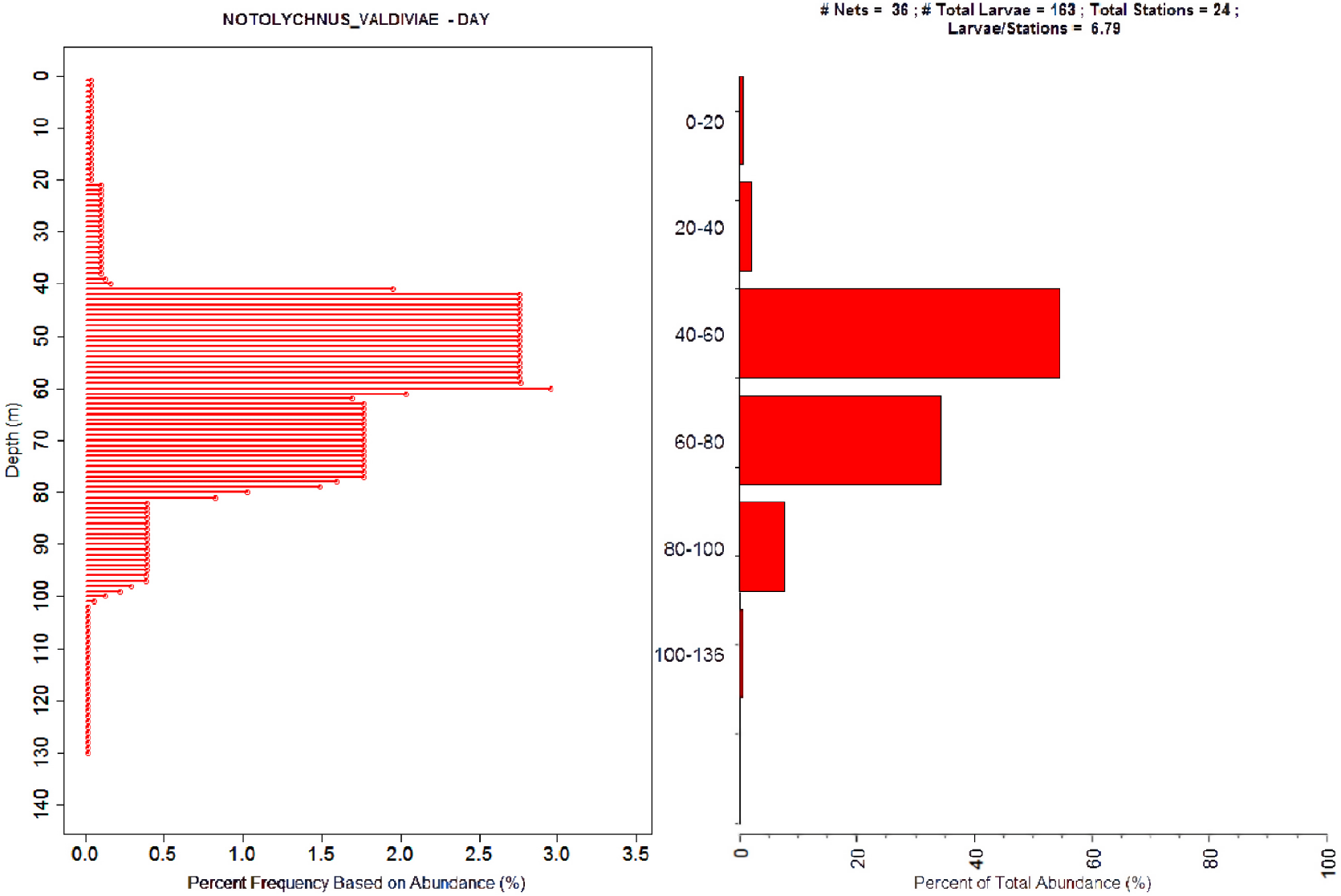
NETTASTOMATIDAE, DAY



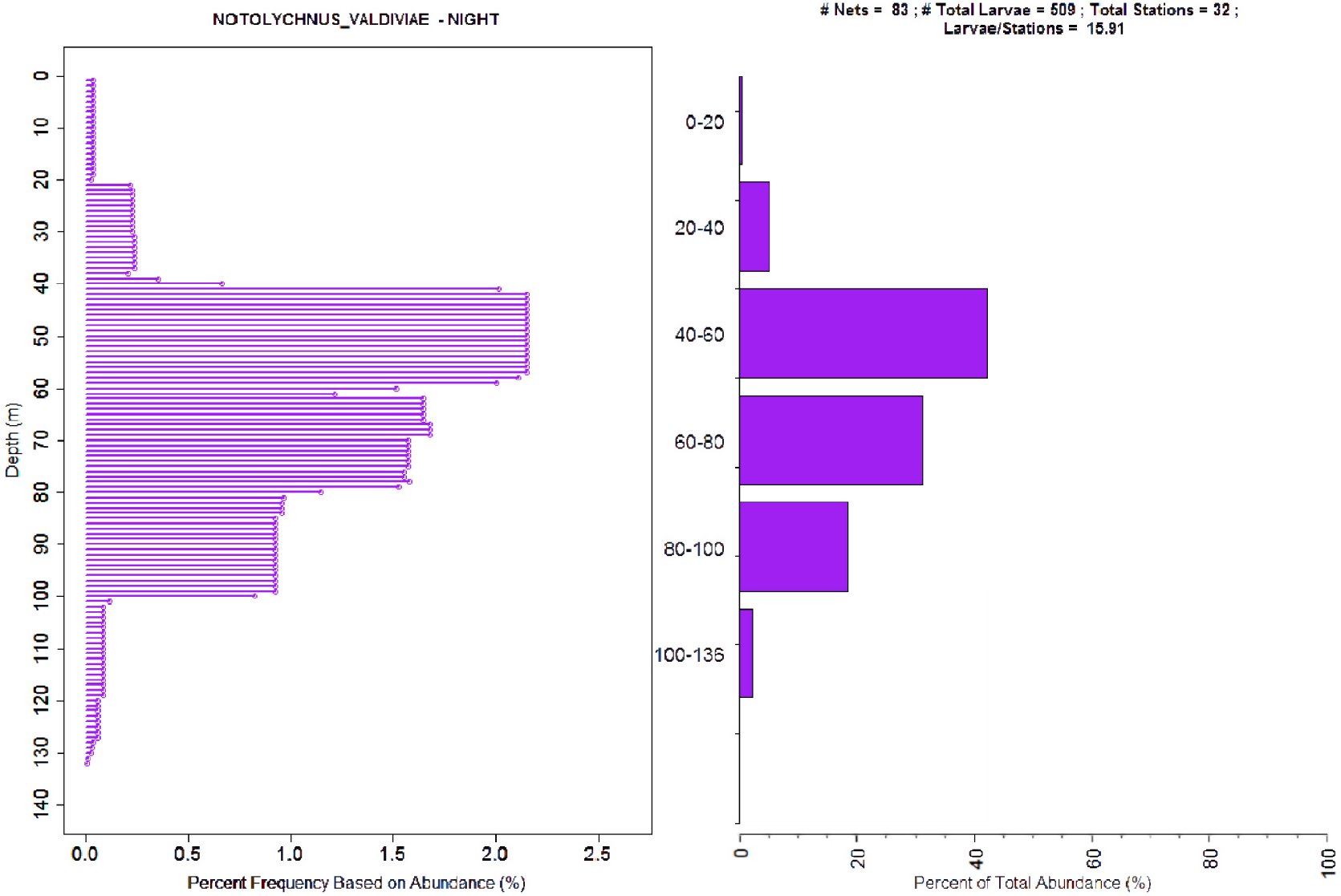
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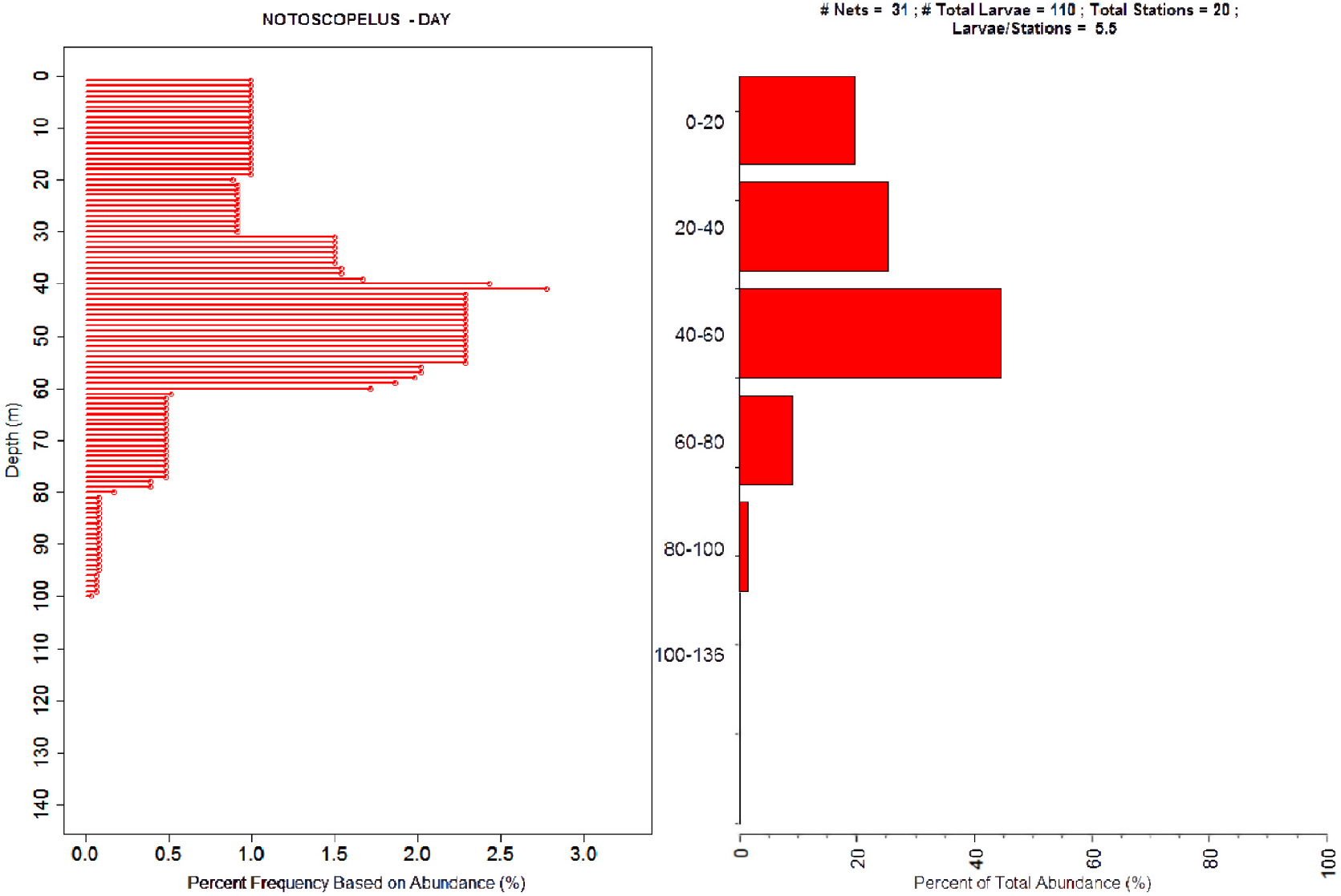
NOTACANTHIFORMES, NIGHT



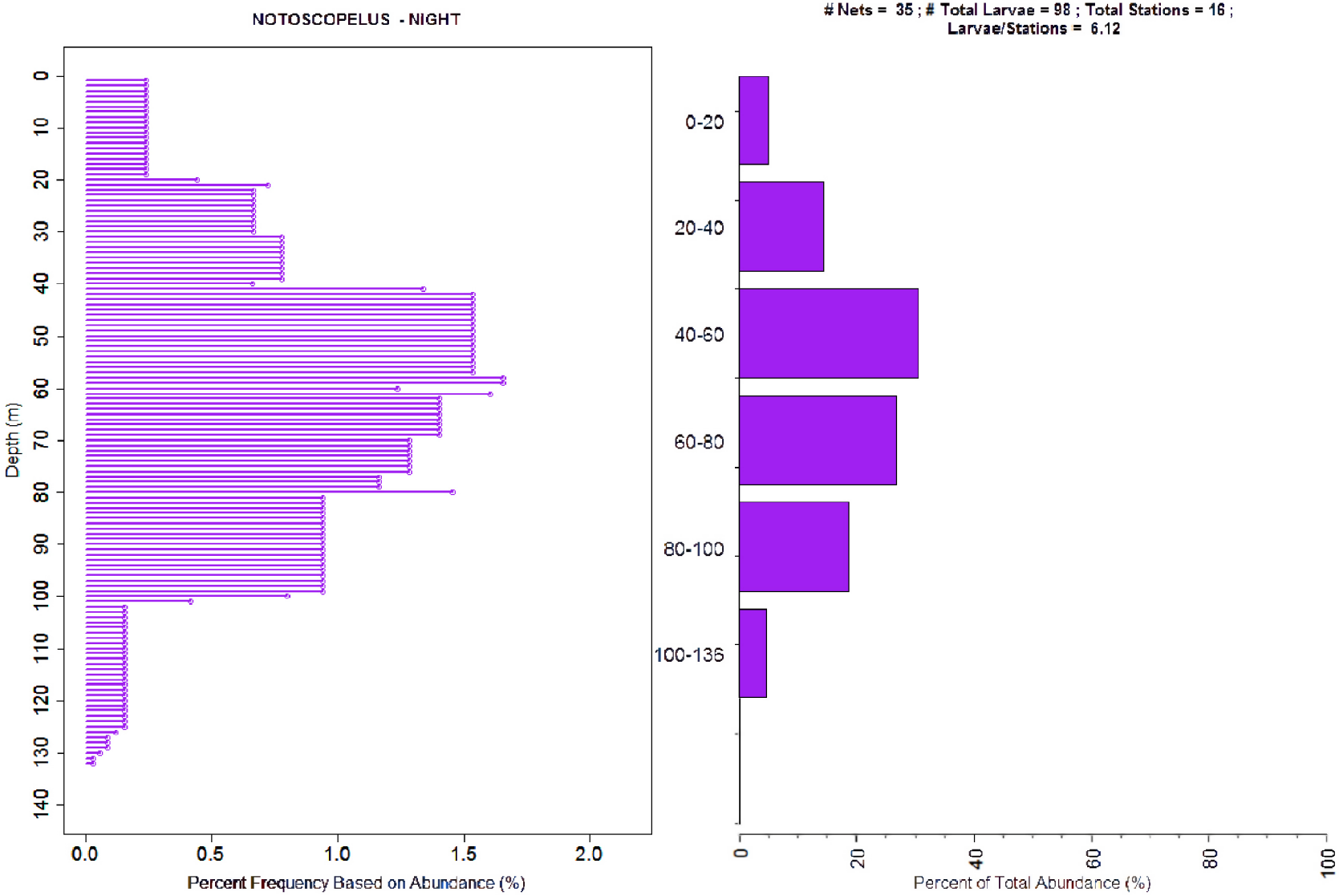
NOTOLYCHNUS_VALDIVIAE, DAY



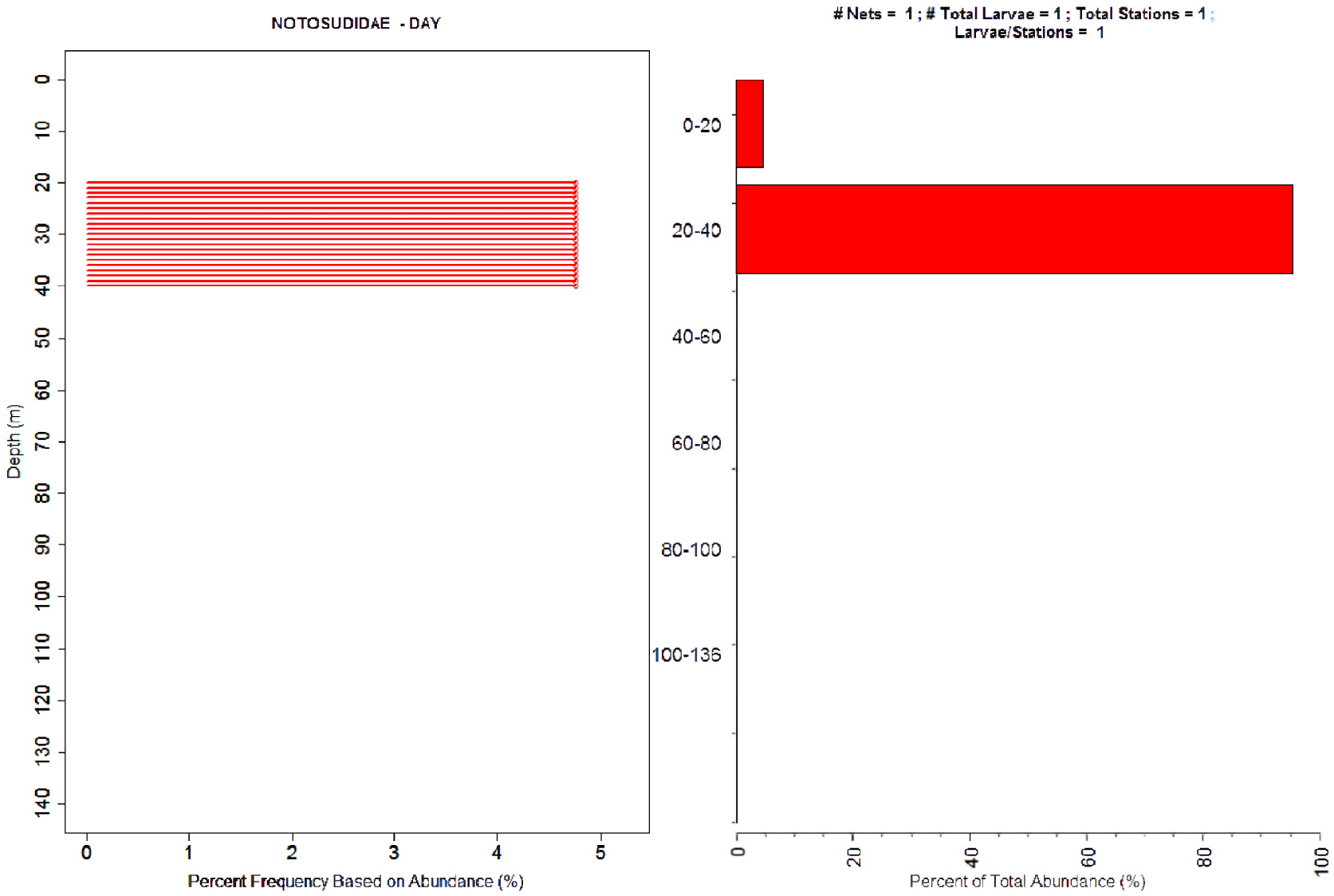
NOTOLYCHNUS_VALDIVIAE, NIGHT



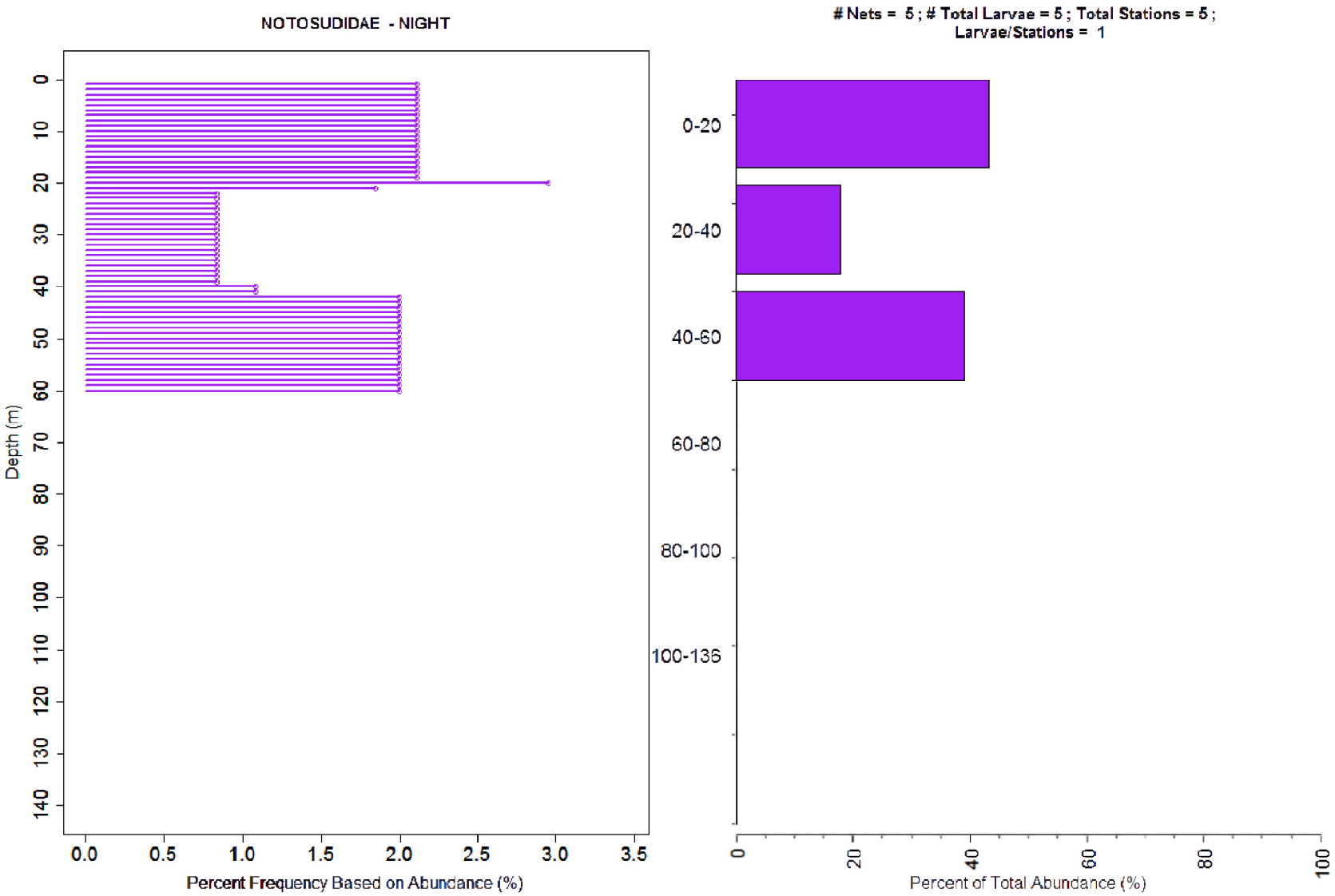
NOTOSCOPELUS, DAY



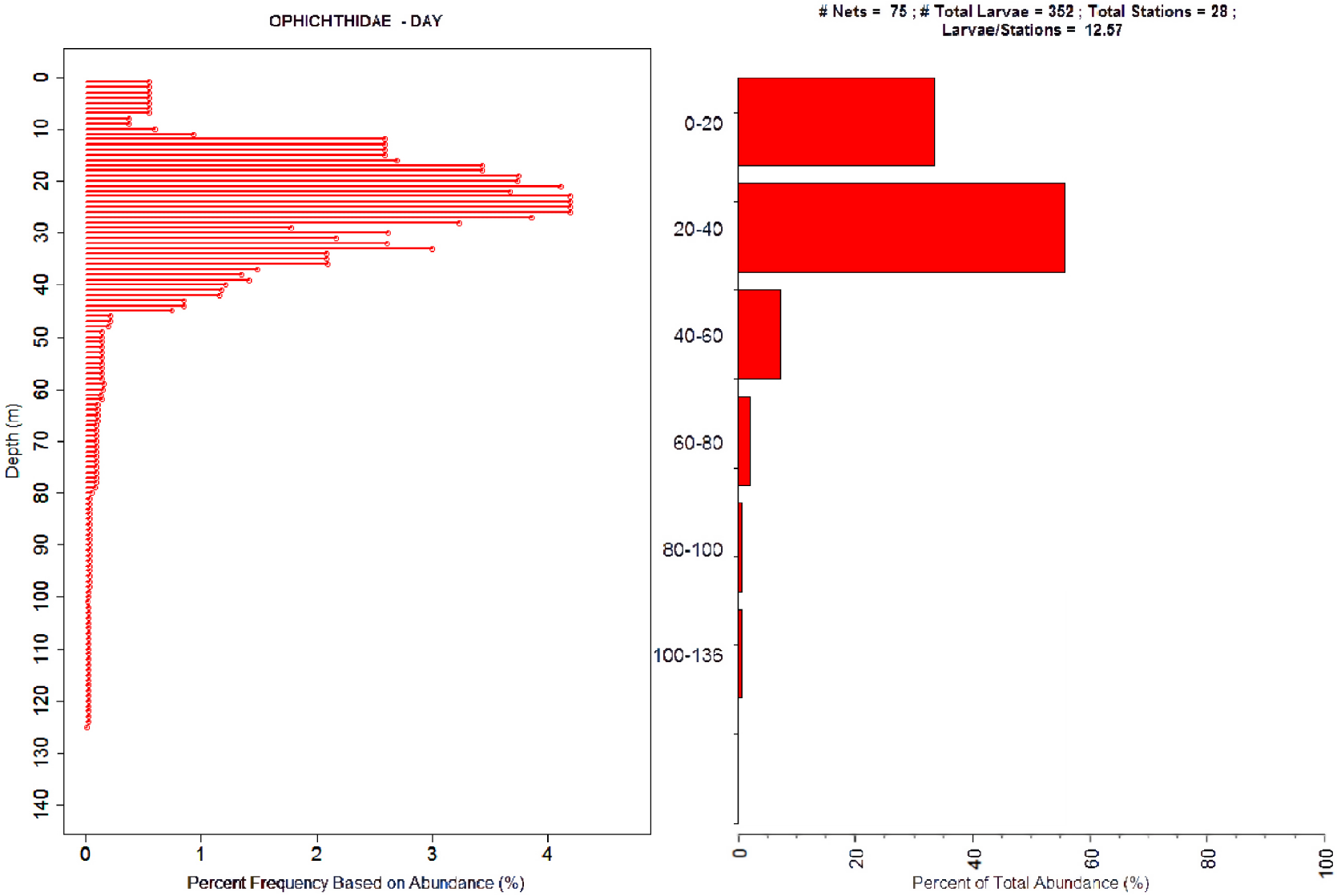
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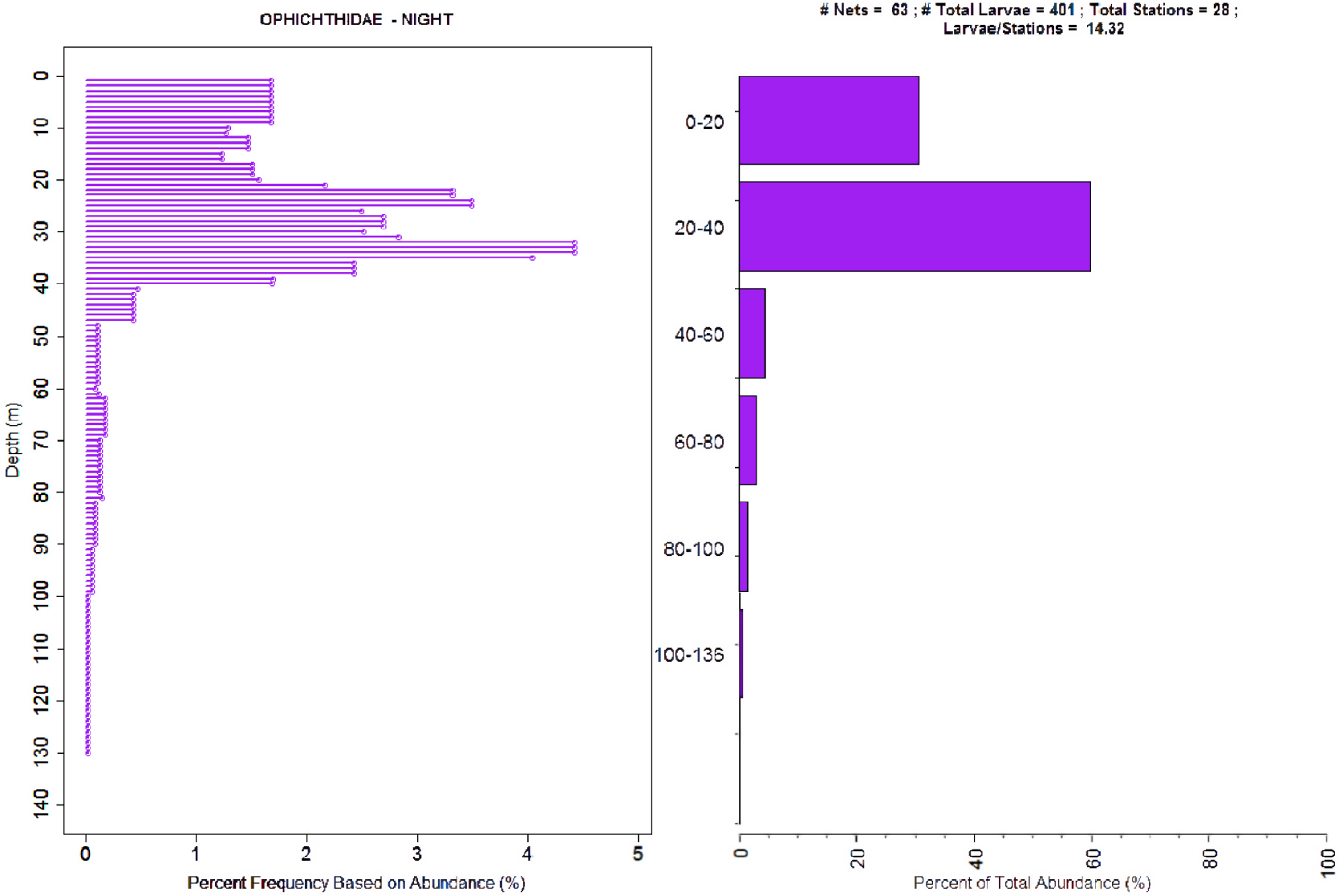
NOTOSUDIDAE, DAY



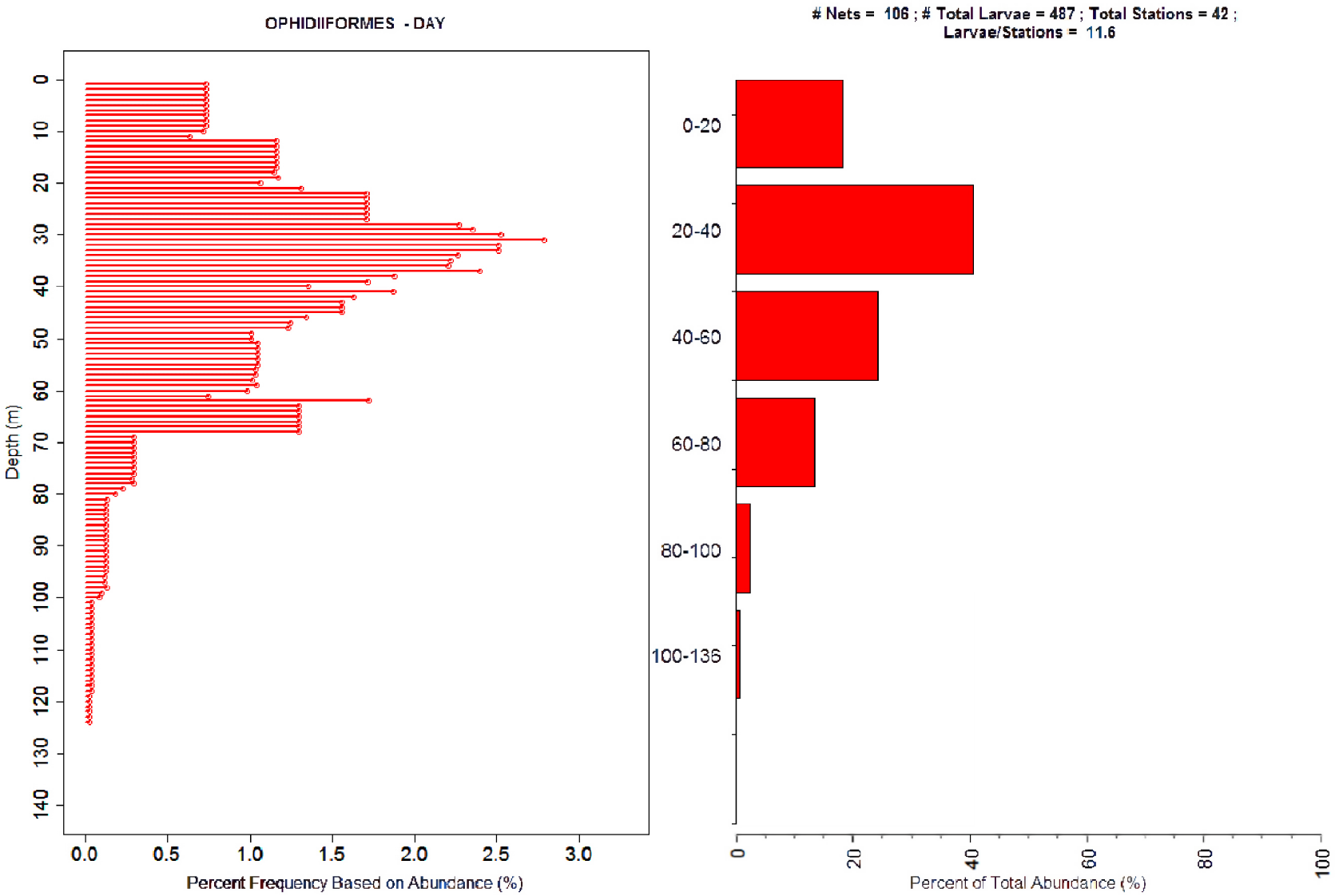
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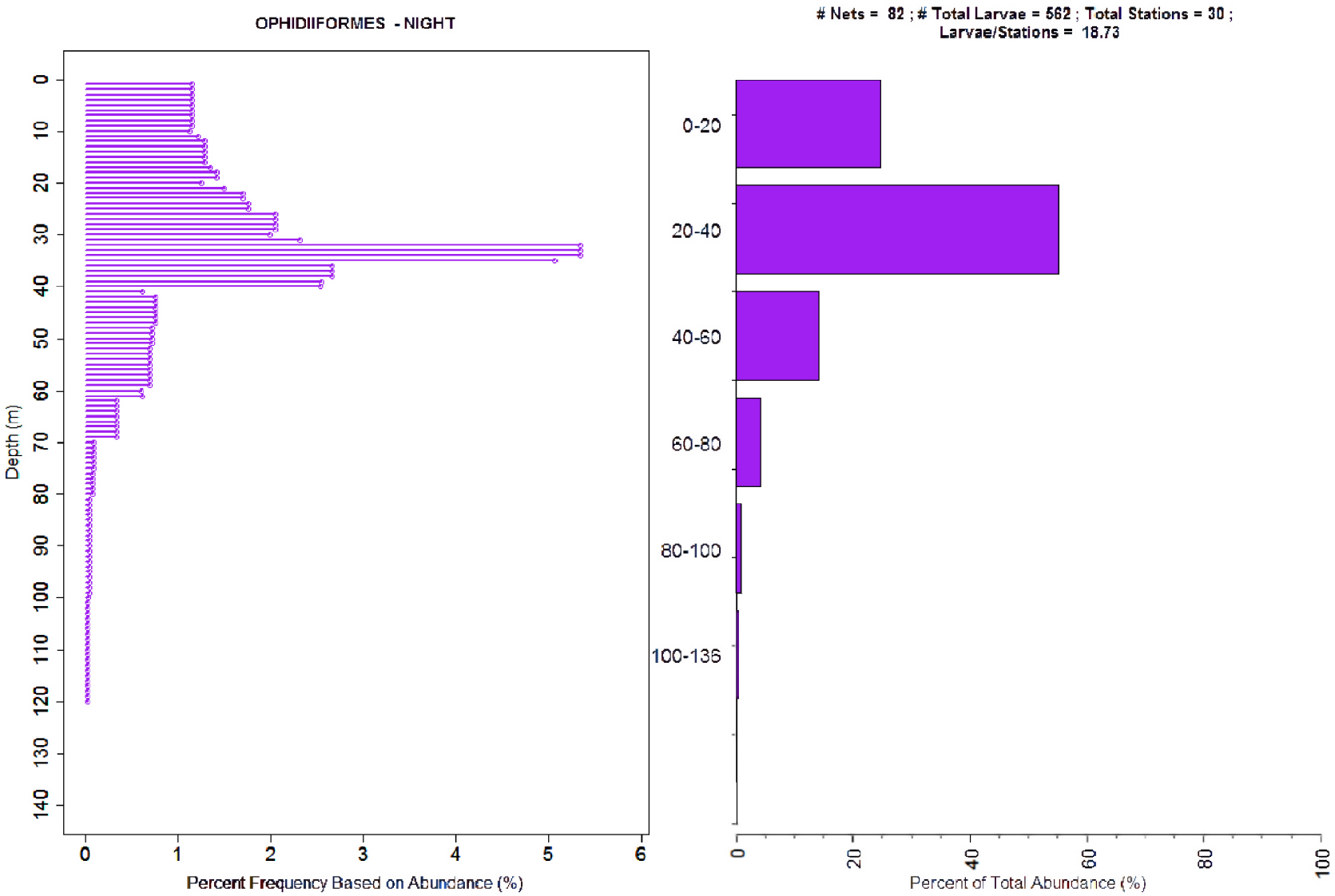
OPHICHTHIDAE, DAY



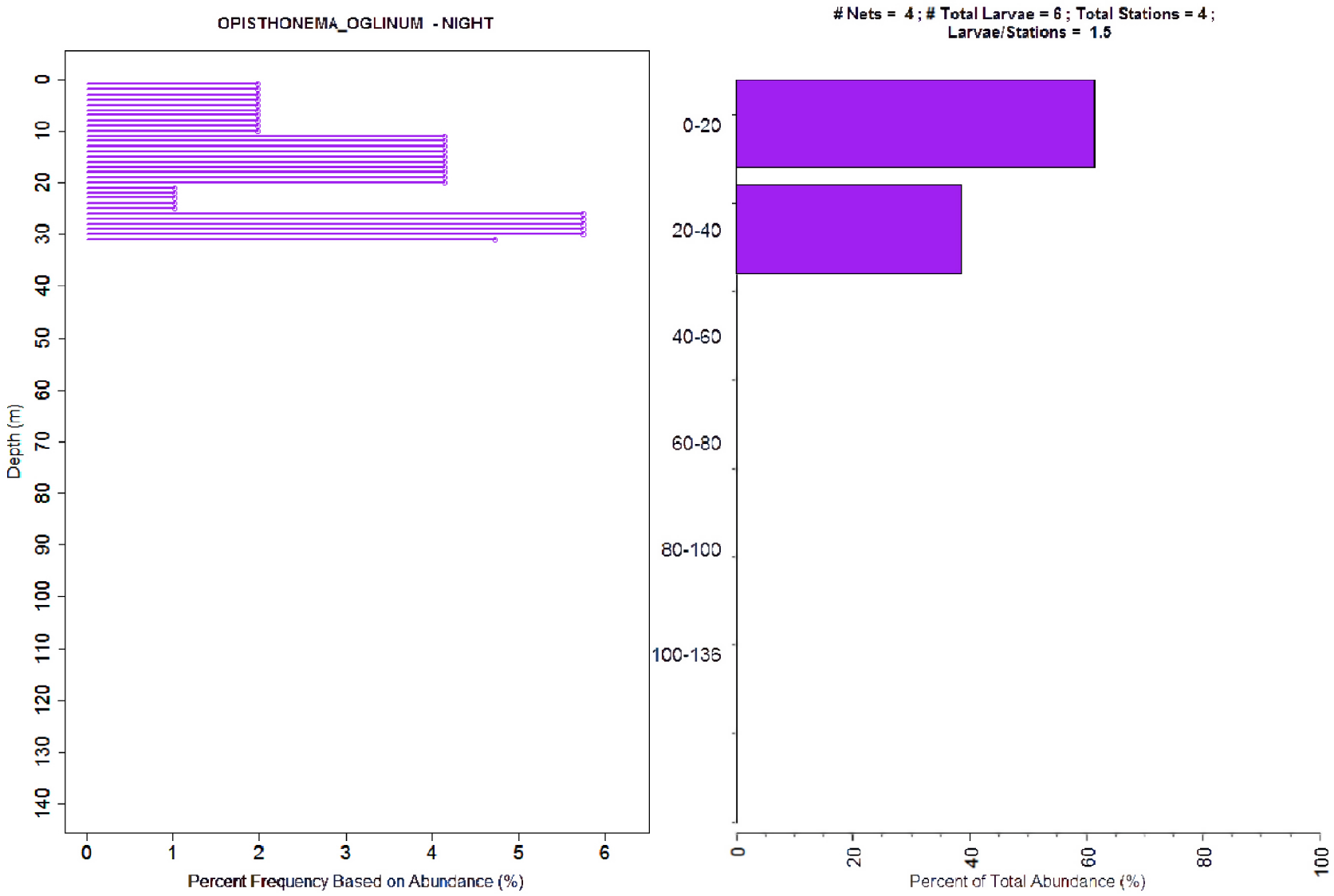
OPHICHTHIDAE, NIGHT



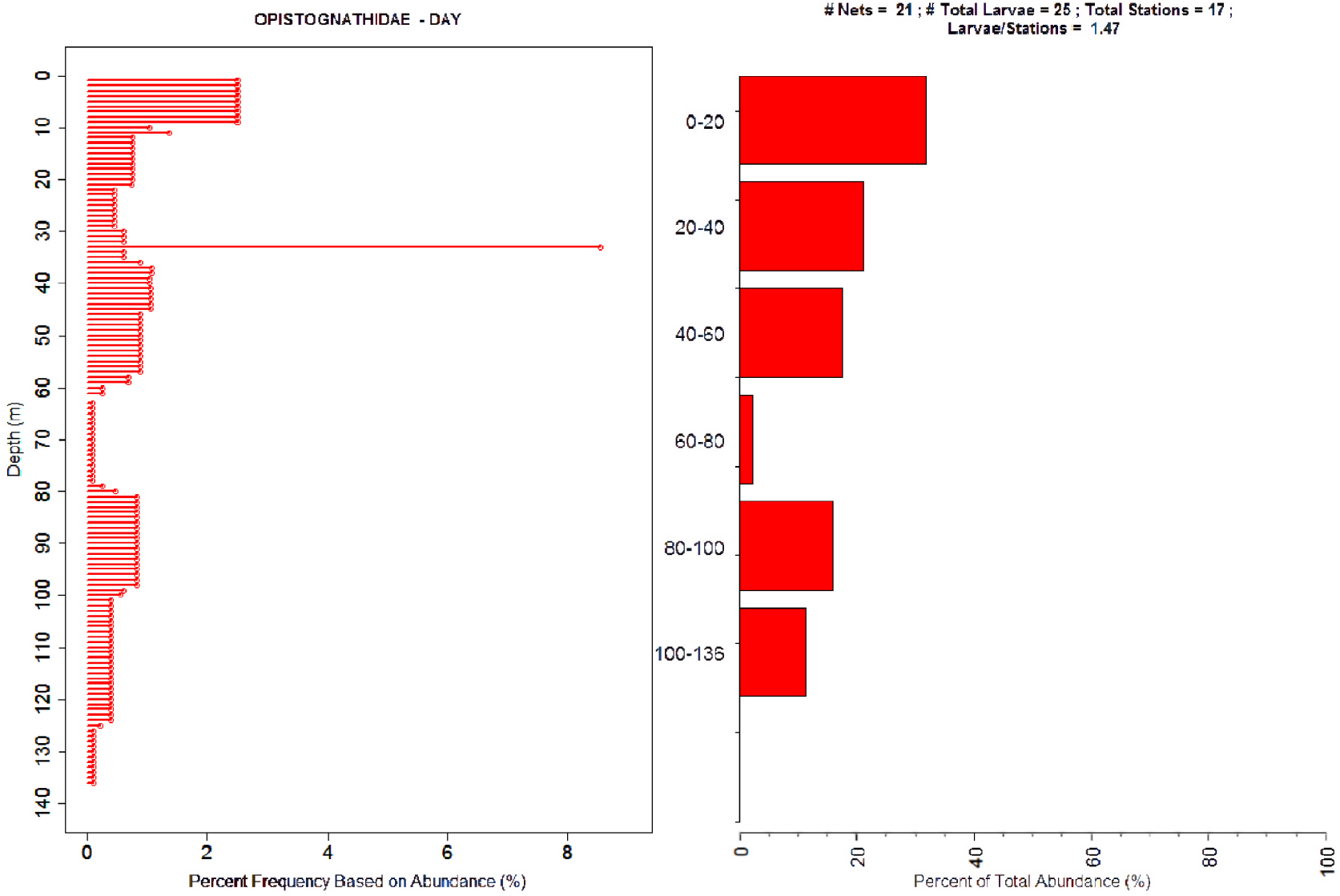
OPHIDIIFORMES, DAY



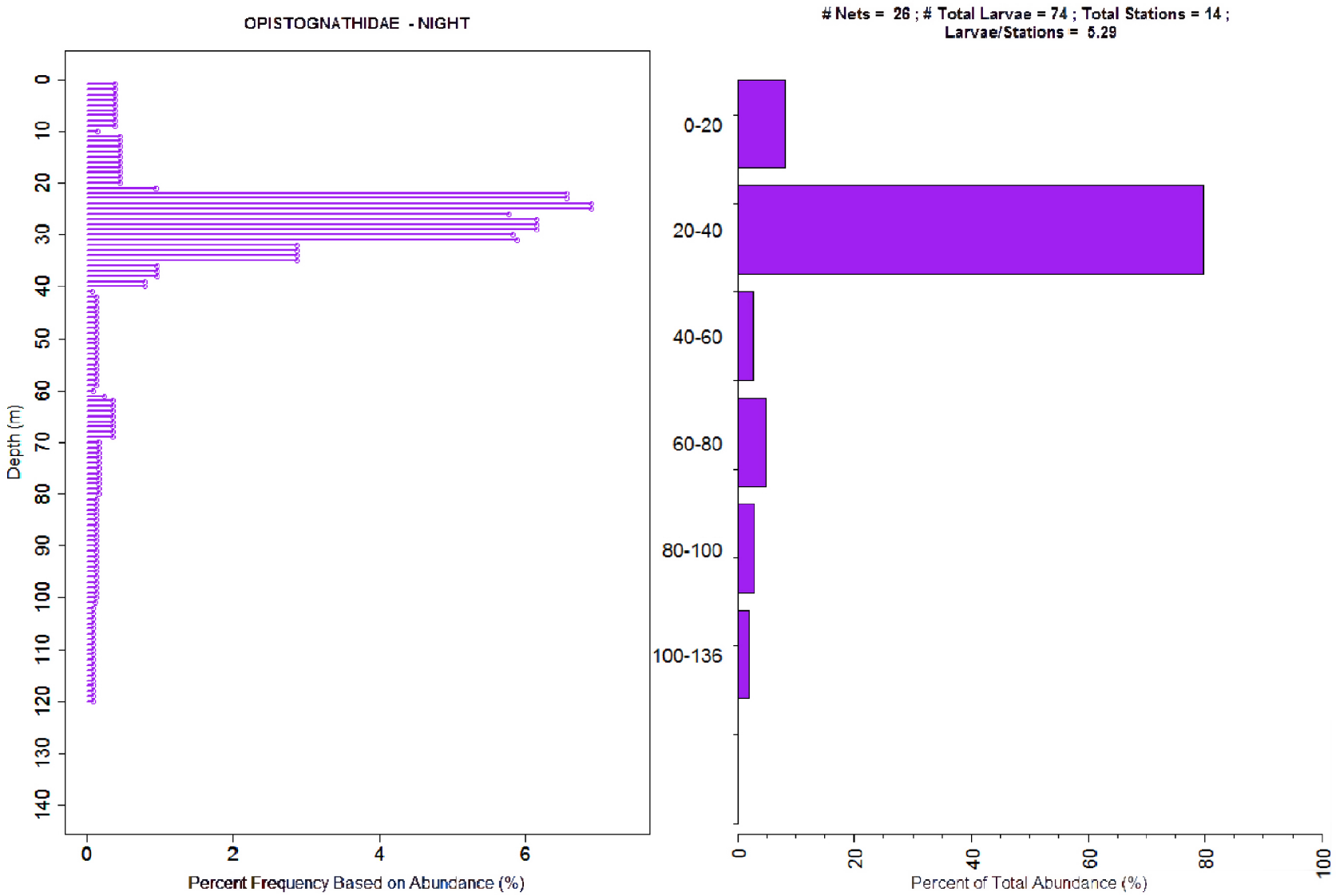
OPHIDIIFORMES, NIGHT



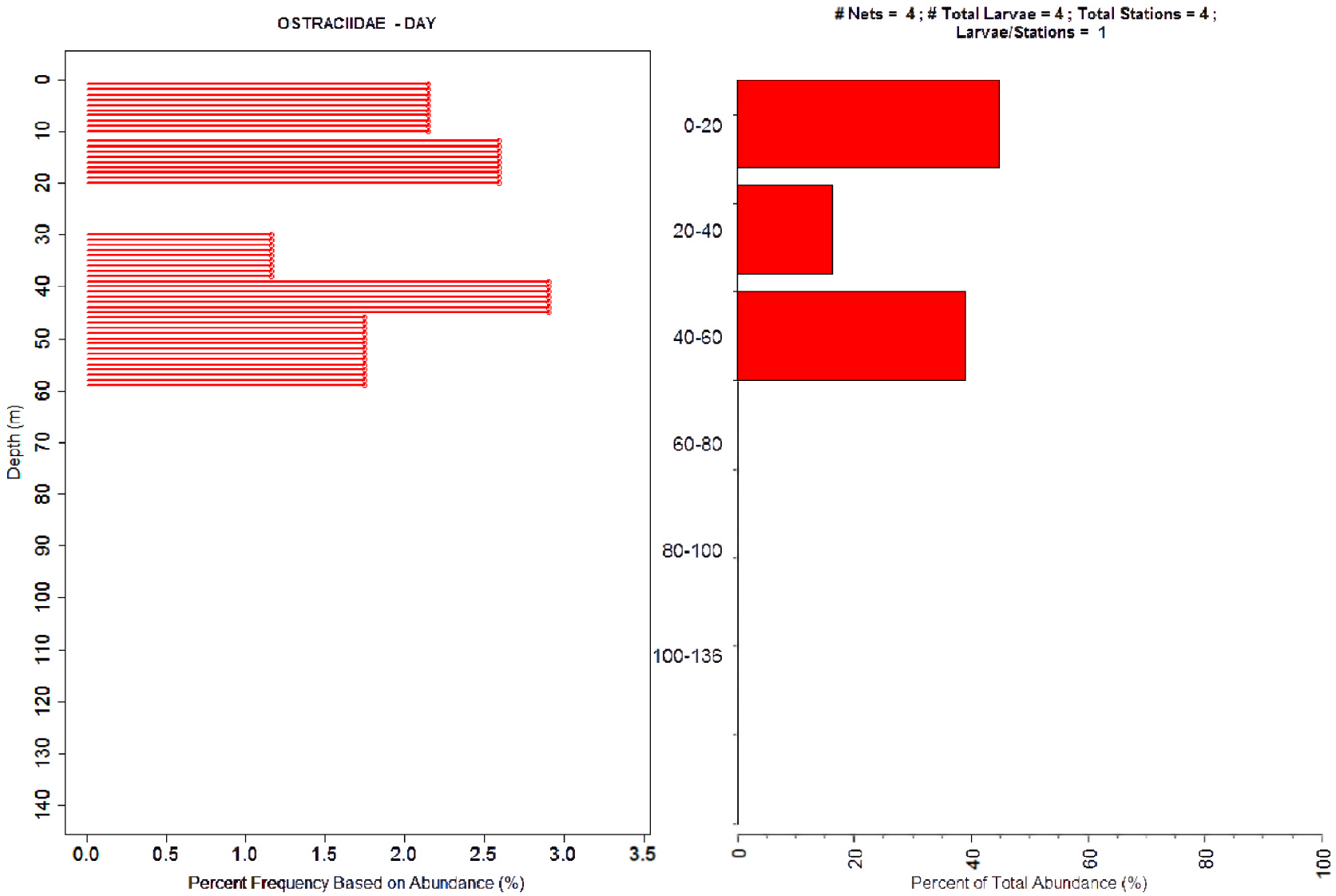
OPISTHONEMA_OGLINUM, NIGHT



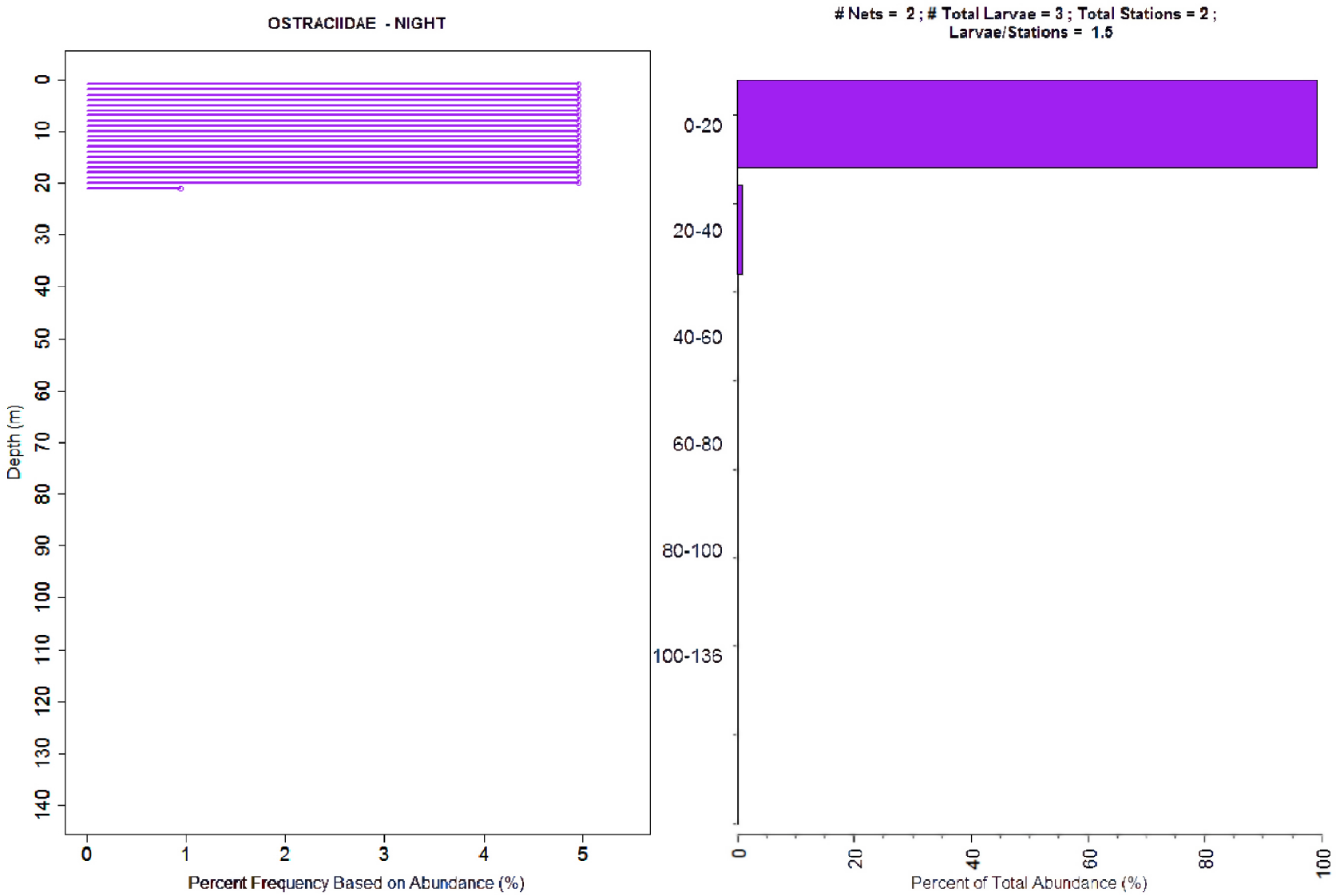
OPISTOGNATHIDAE, DAY



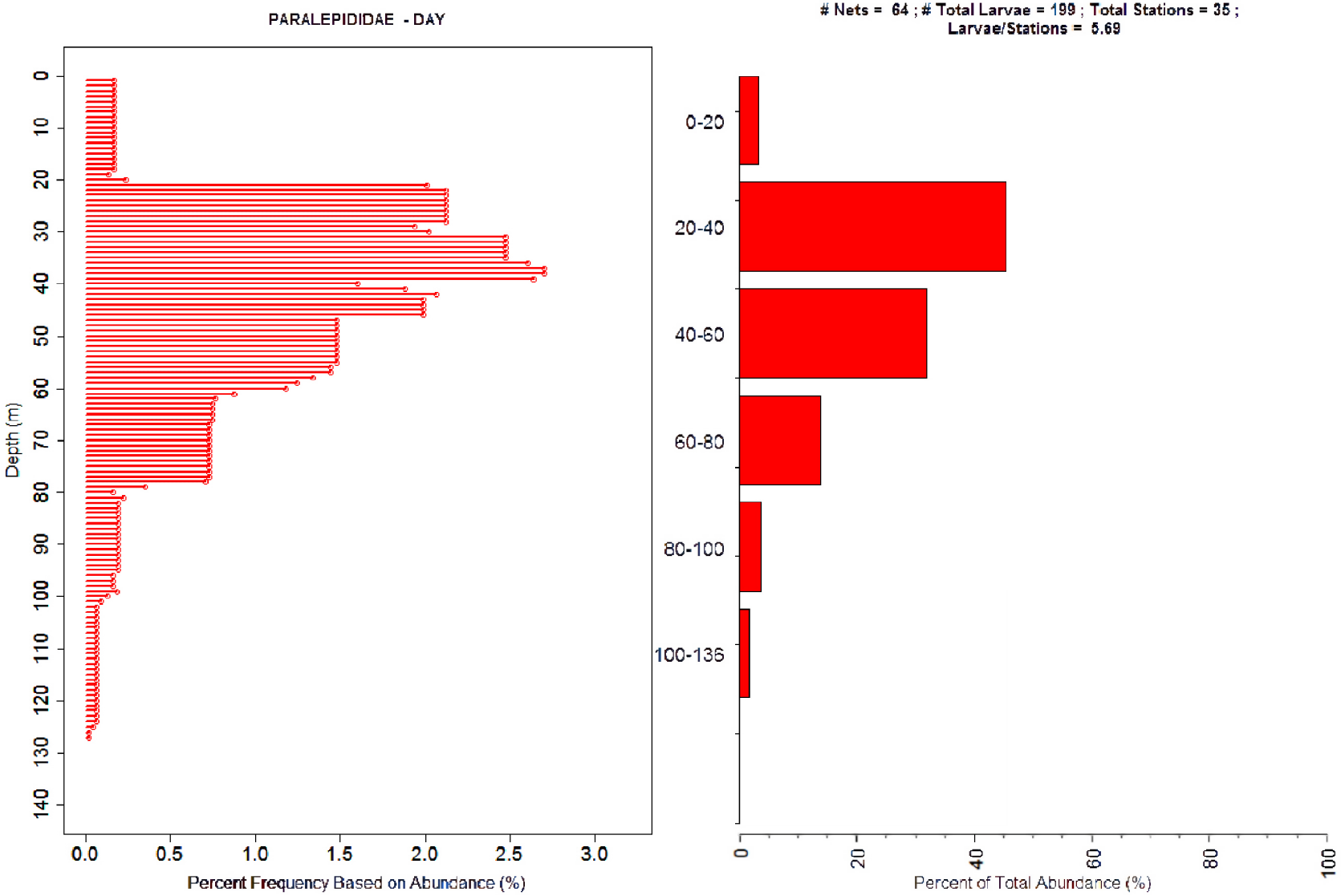
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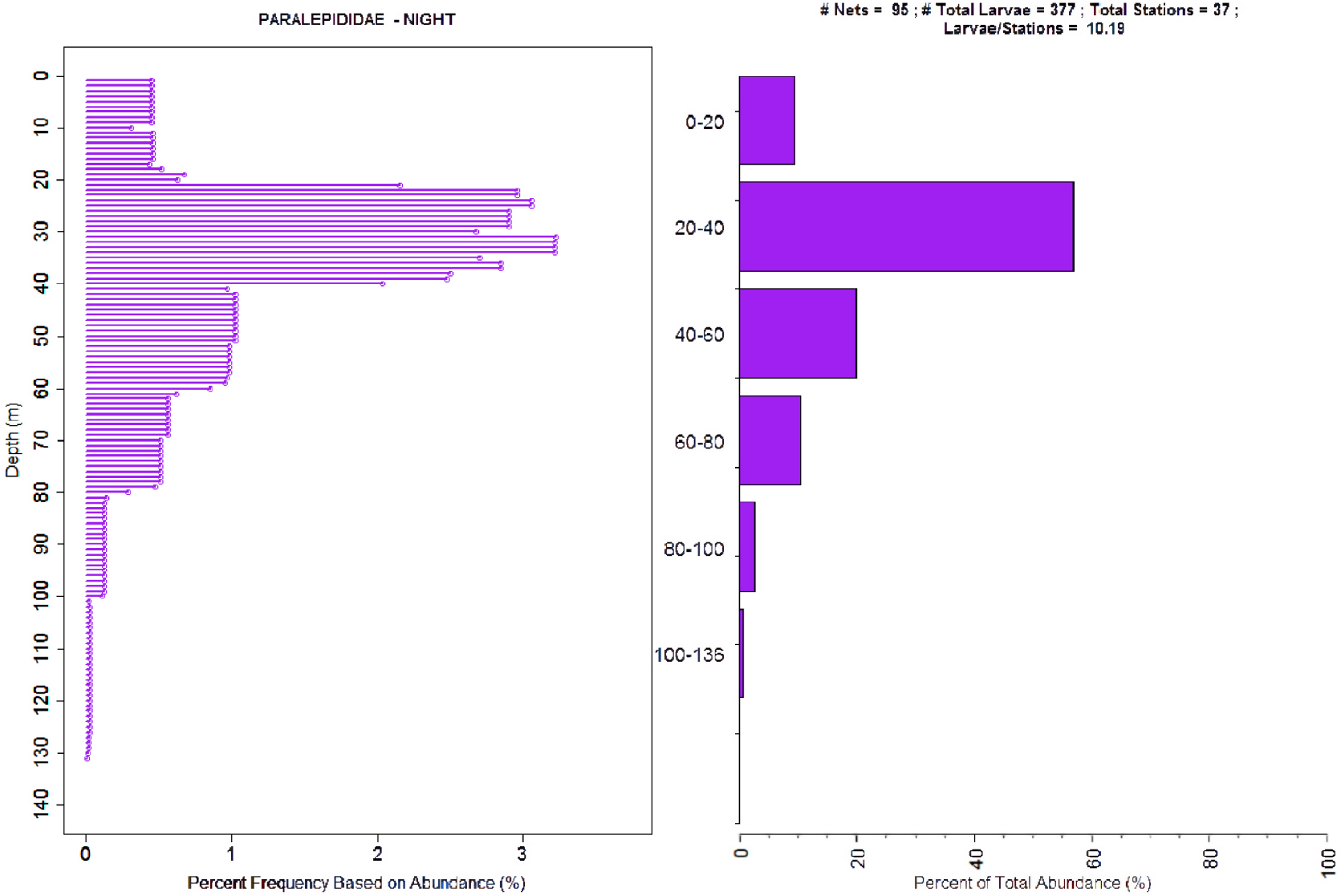
OSTRACIIDAE, DAY



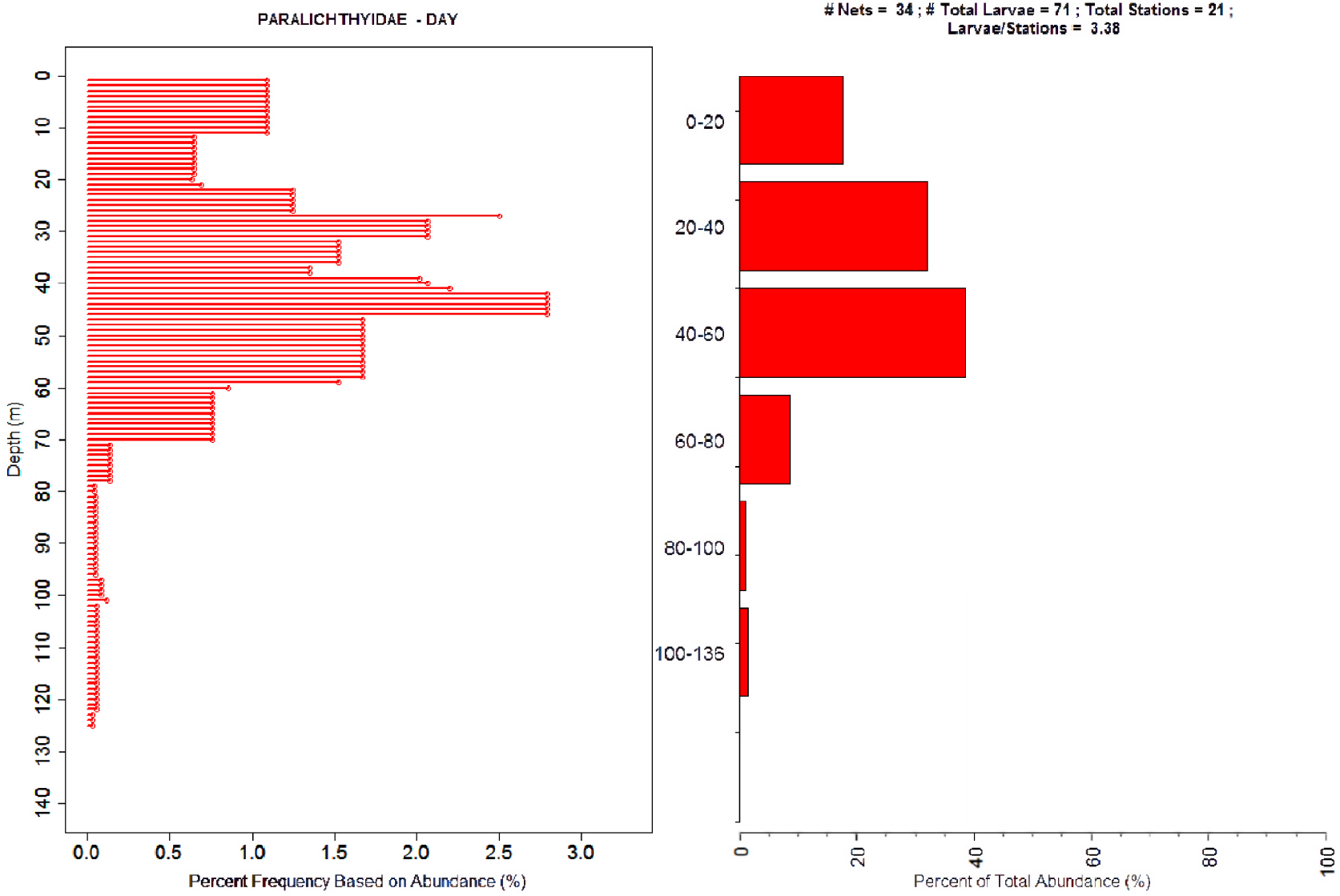
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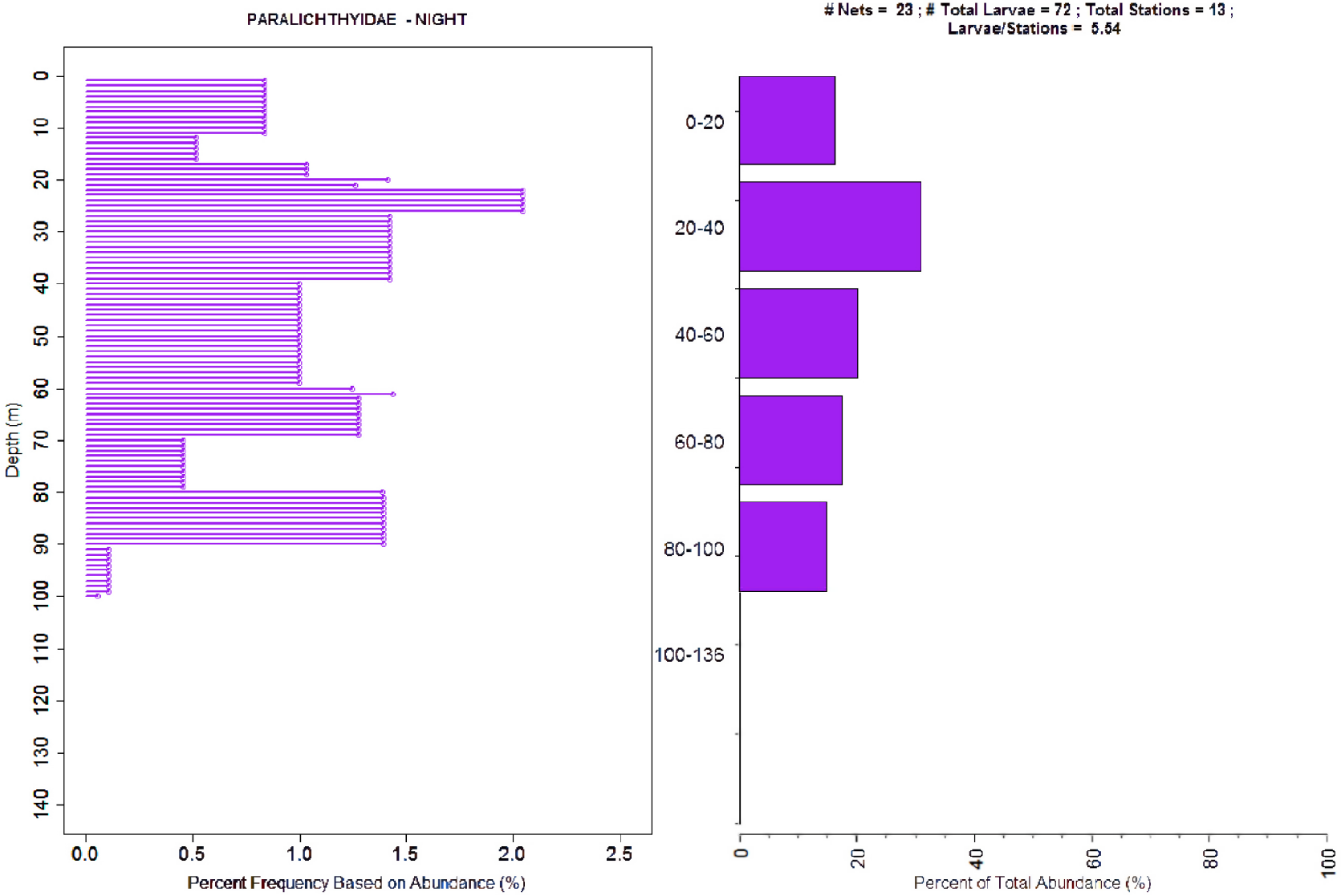
PARALEPIDIDAE, DAY



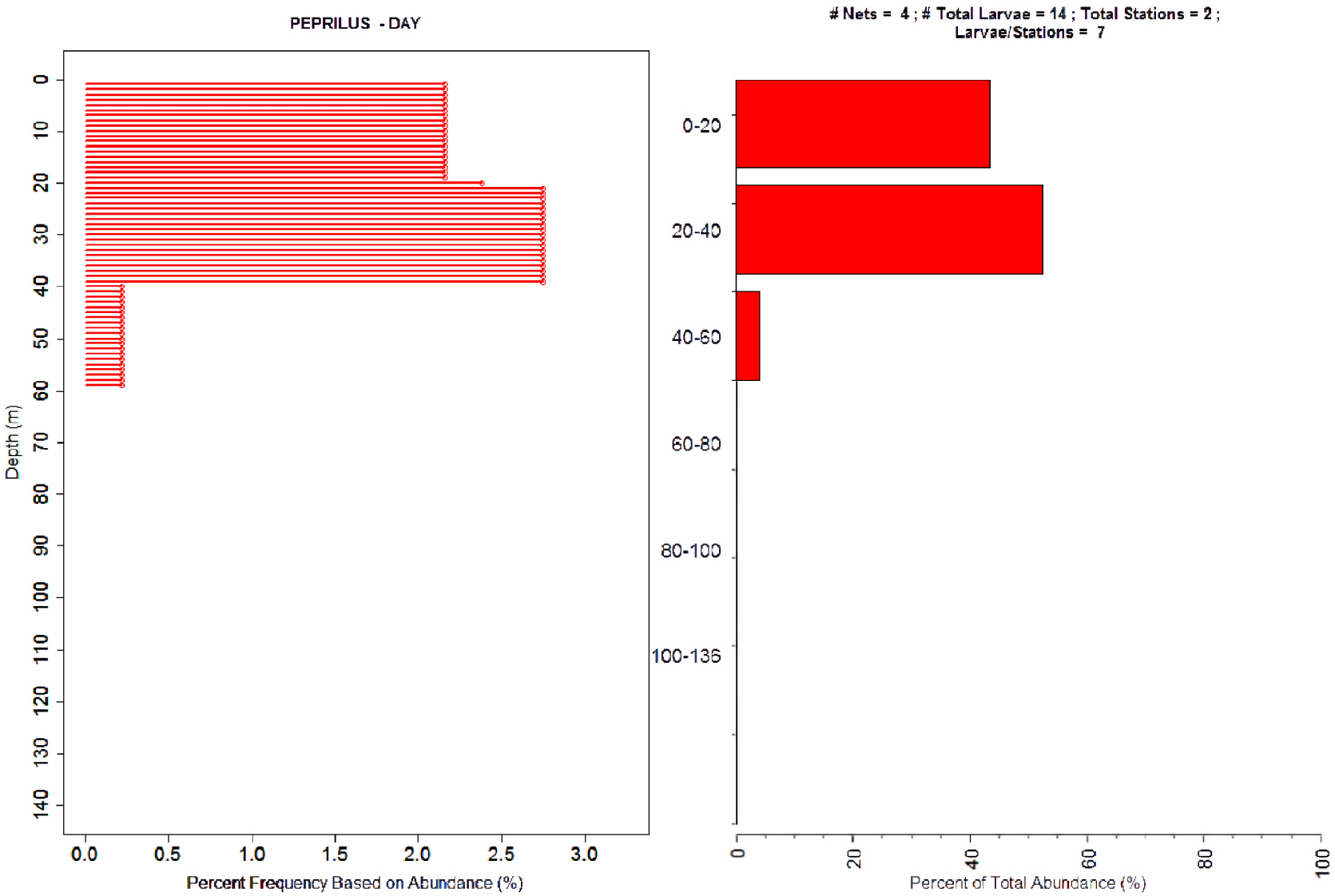
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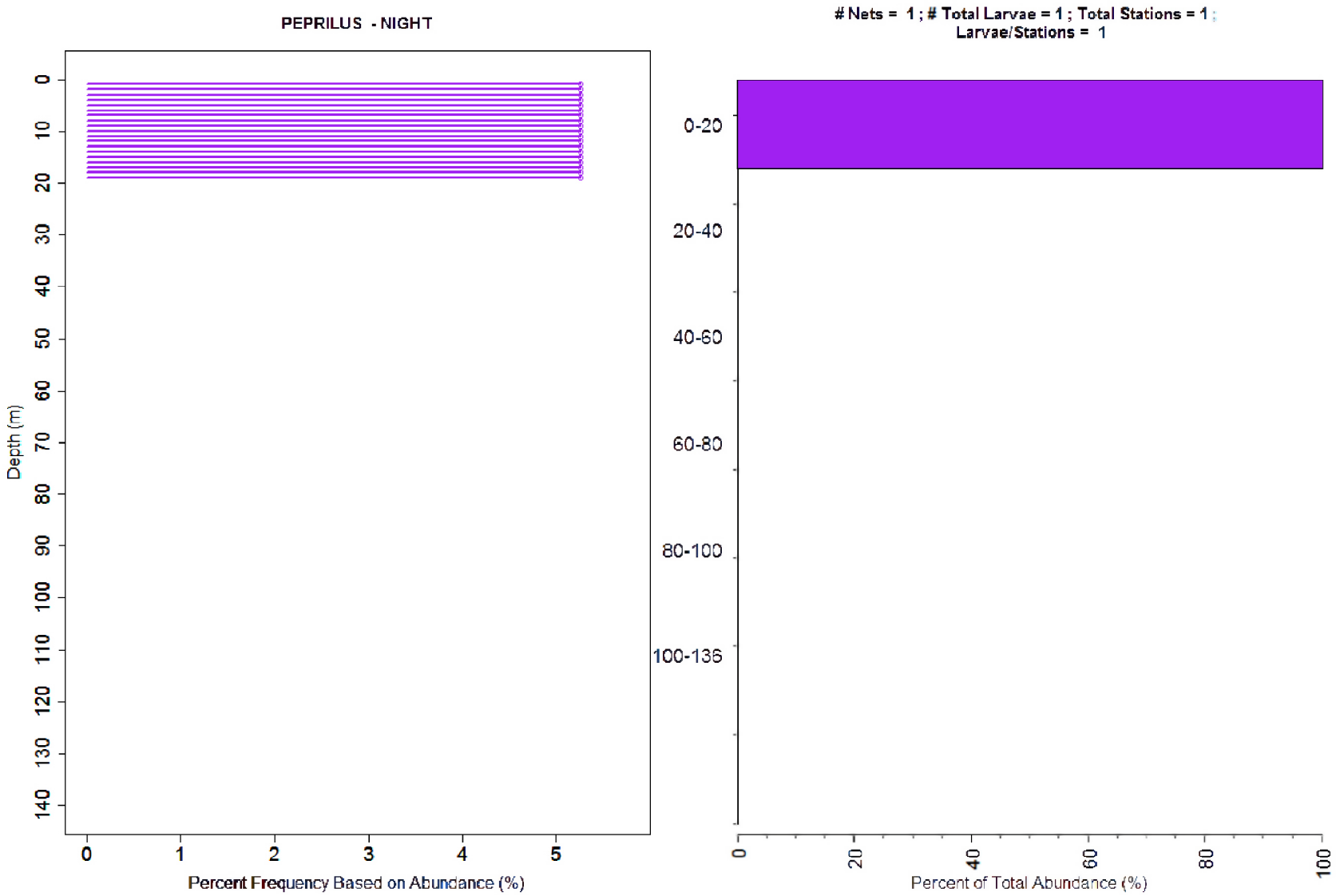
PARALICHTHYIDAE, DAY



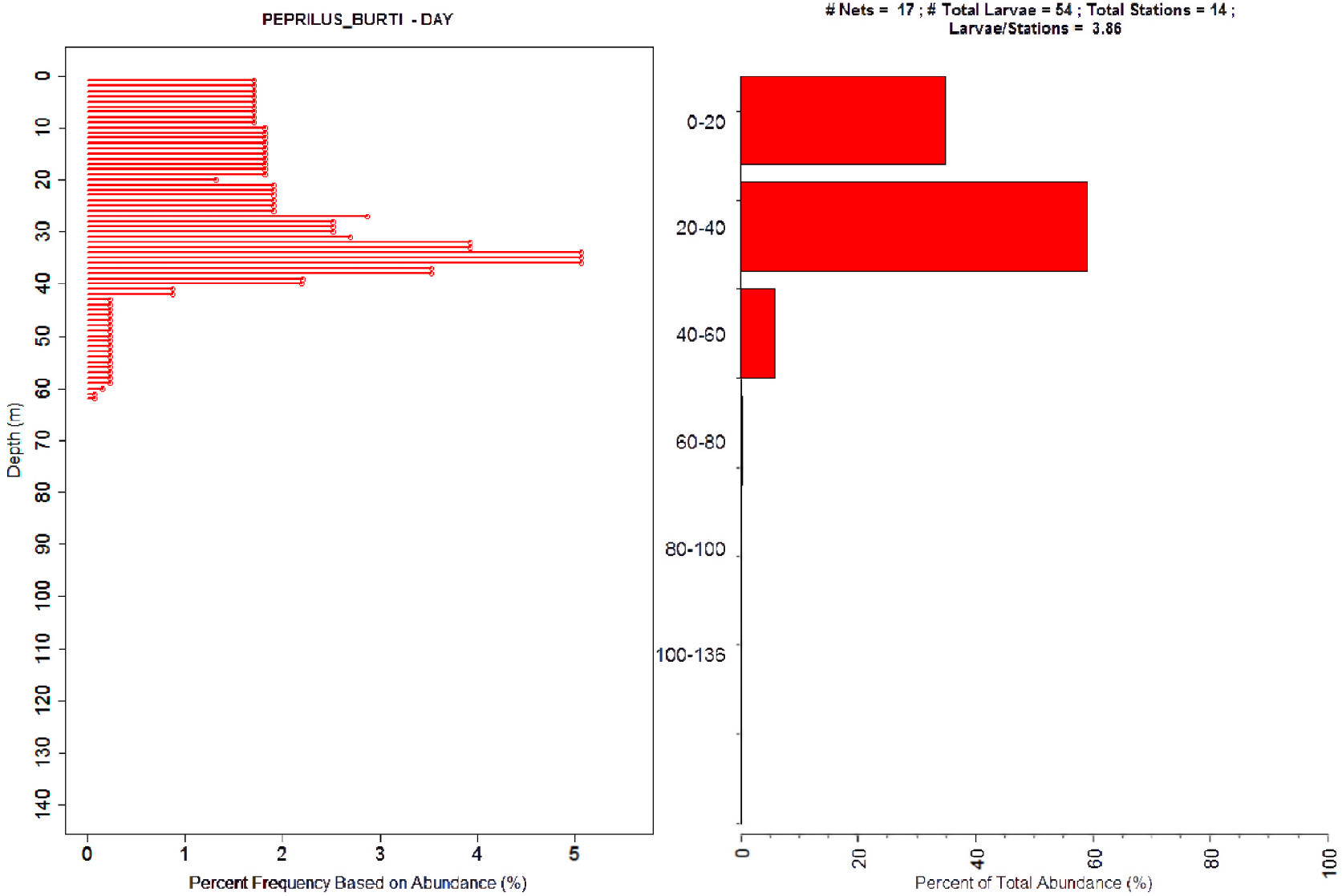
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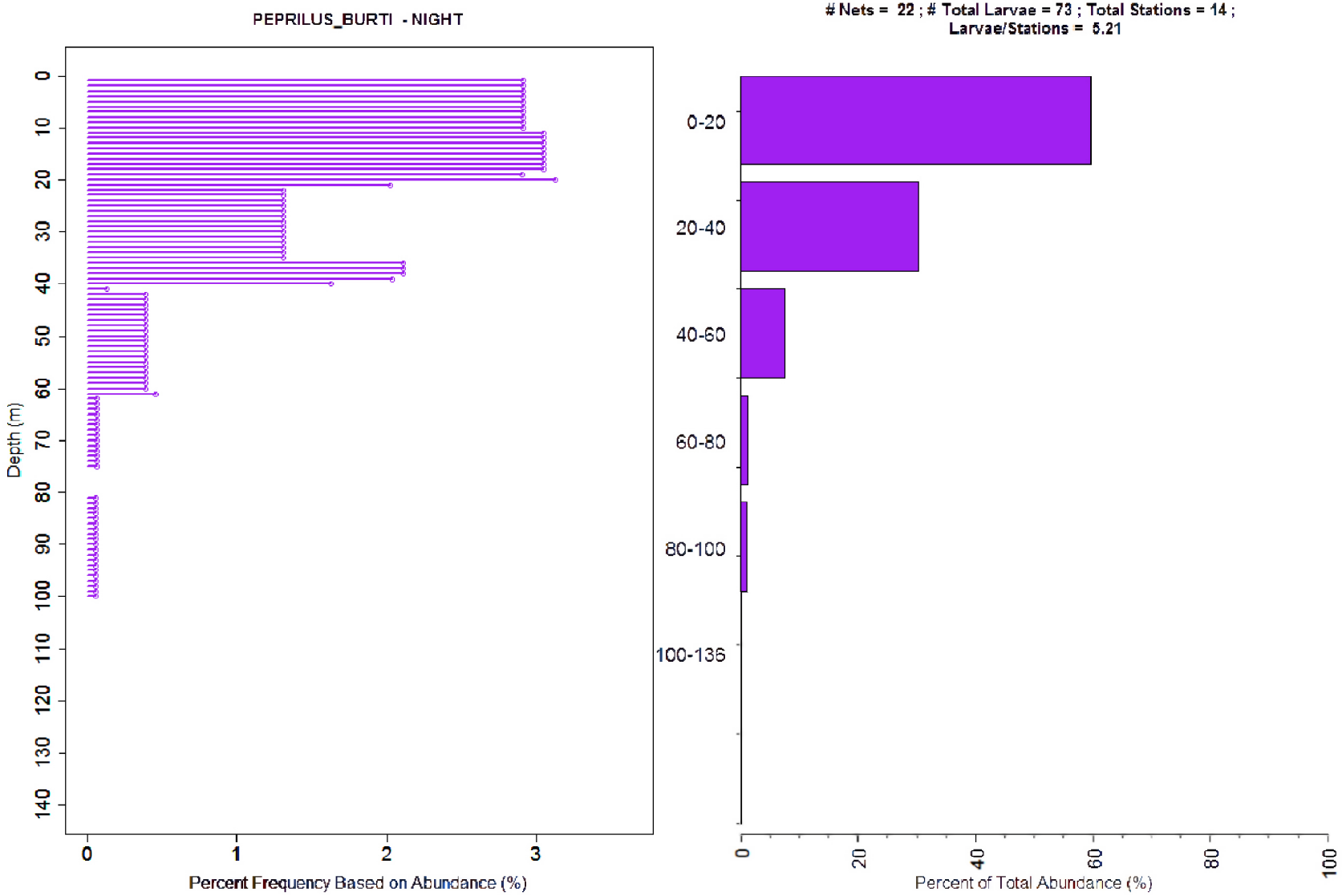
PEPRILUS, DAY



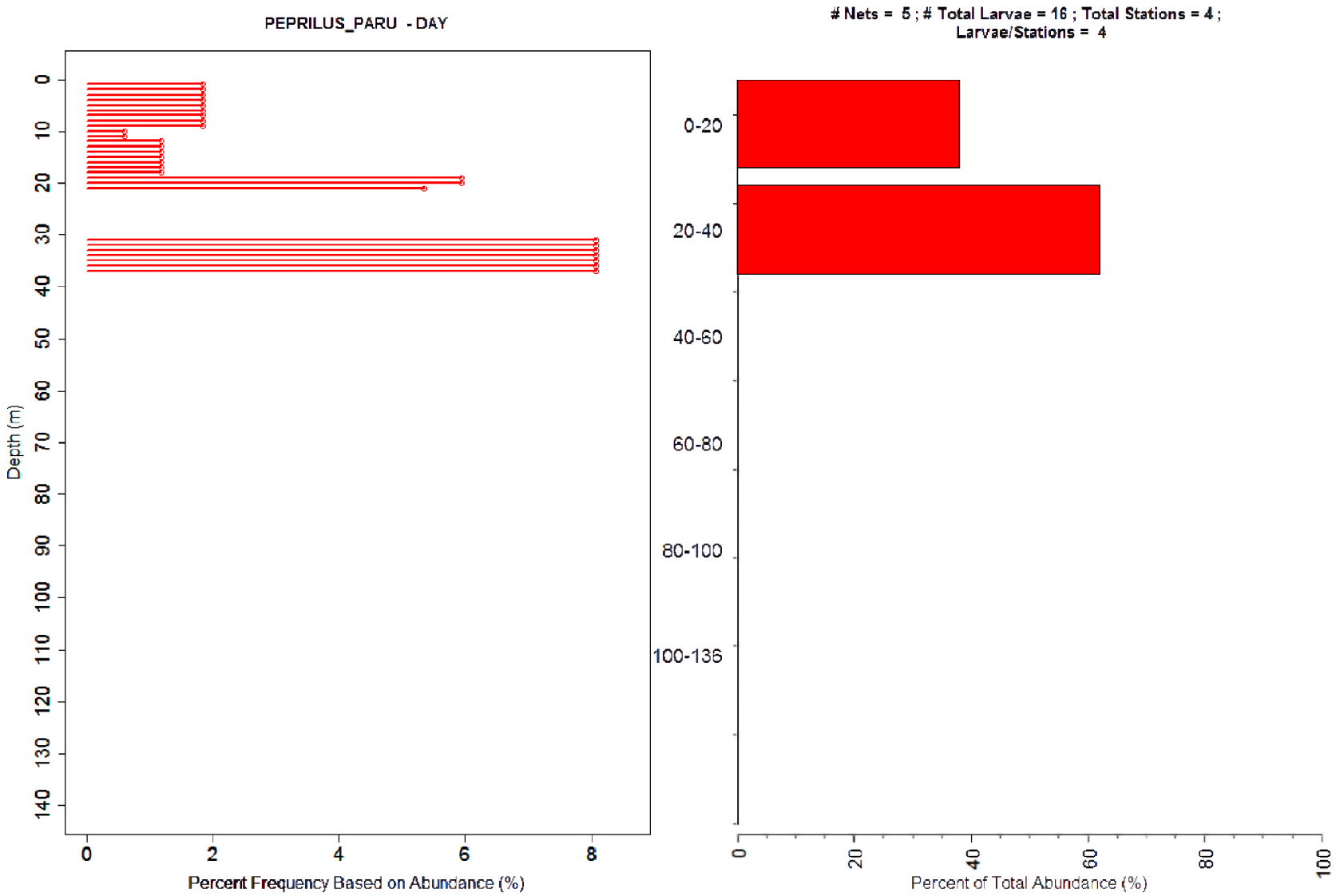
PEPRILUS, NIGHT



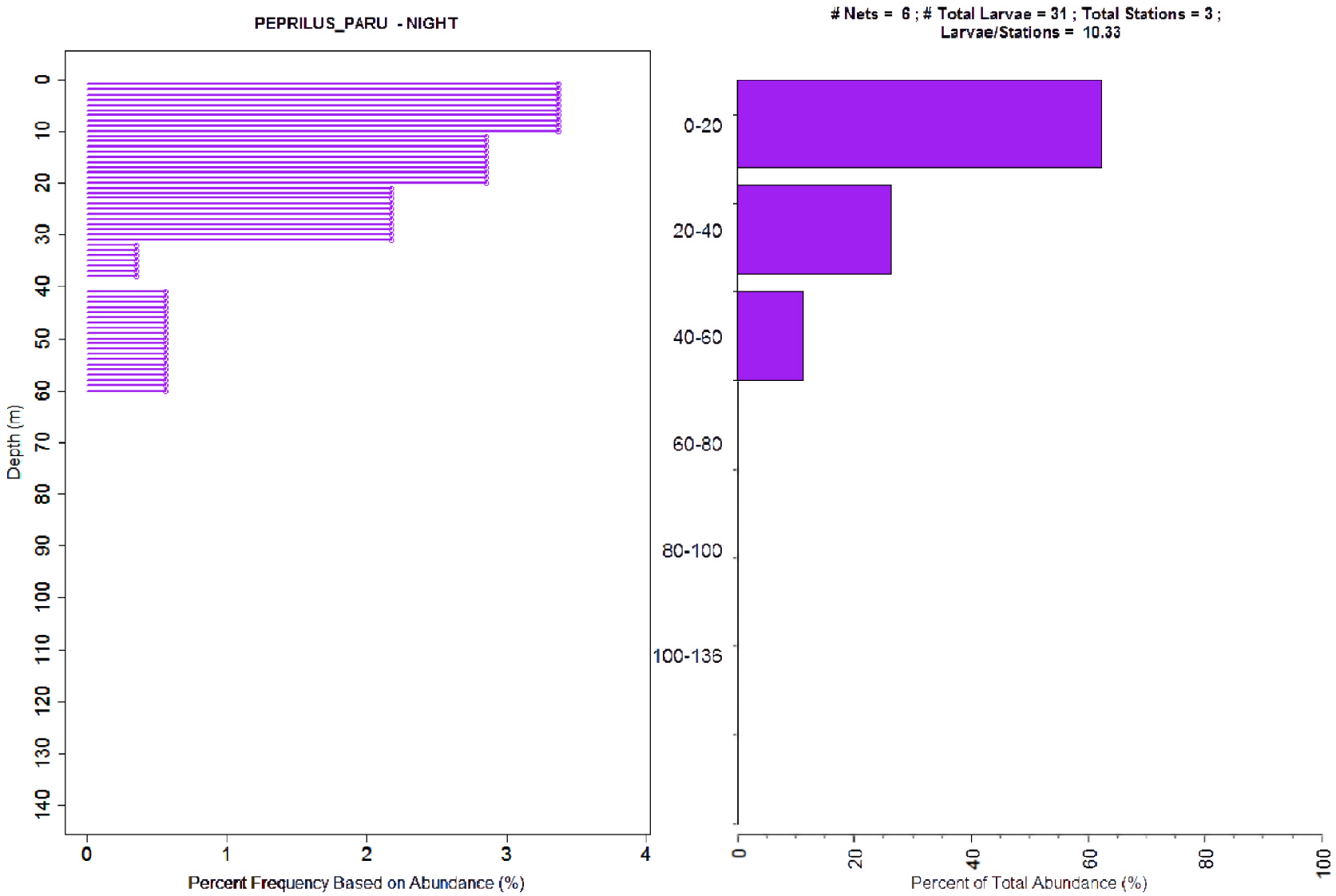
PEPRILUS_BURTI, DAY



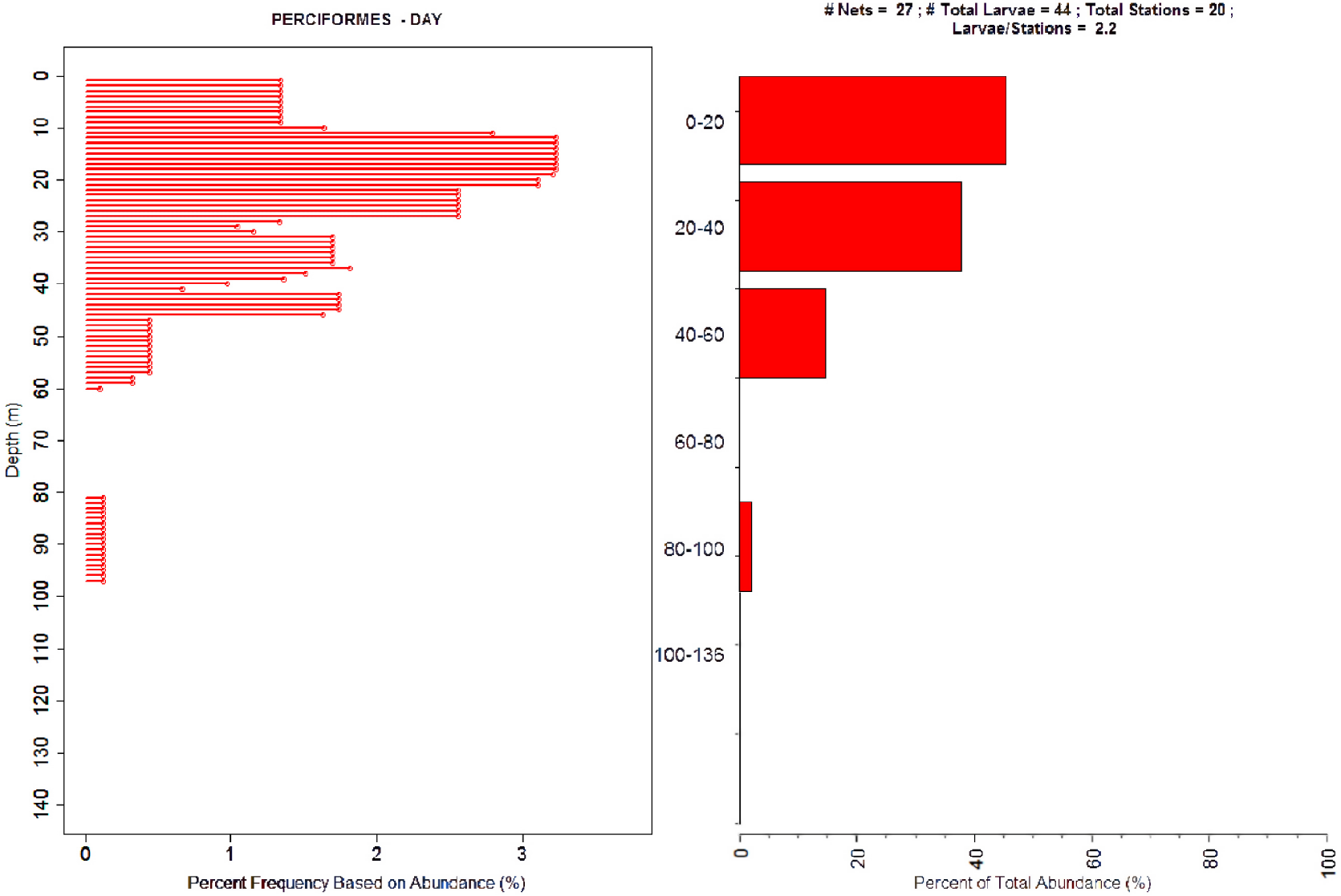
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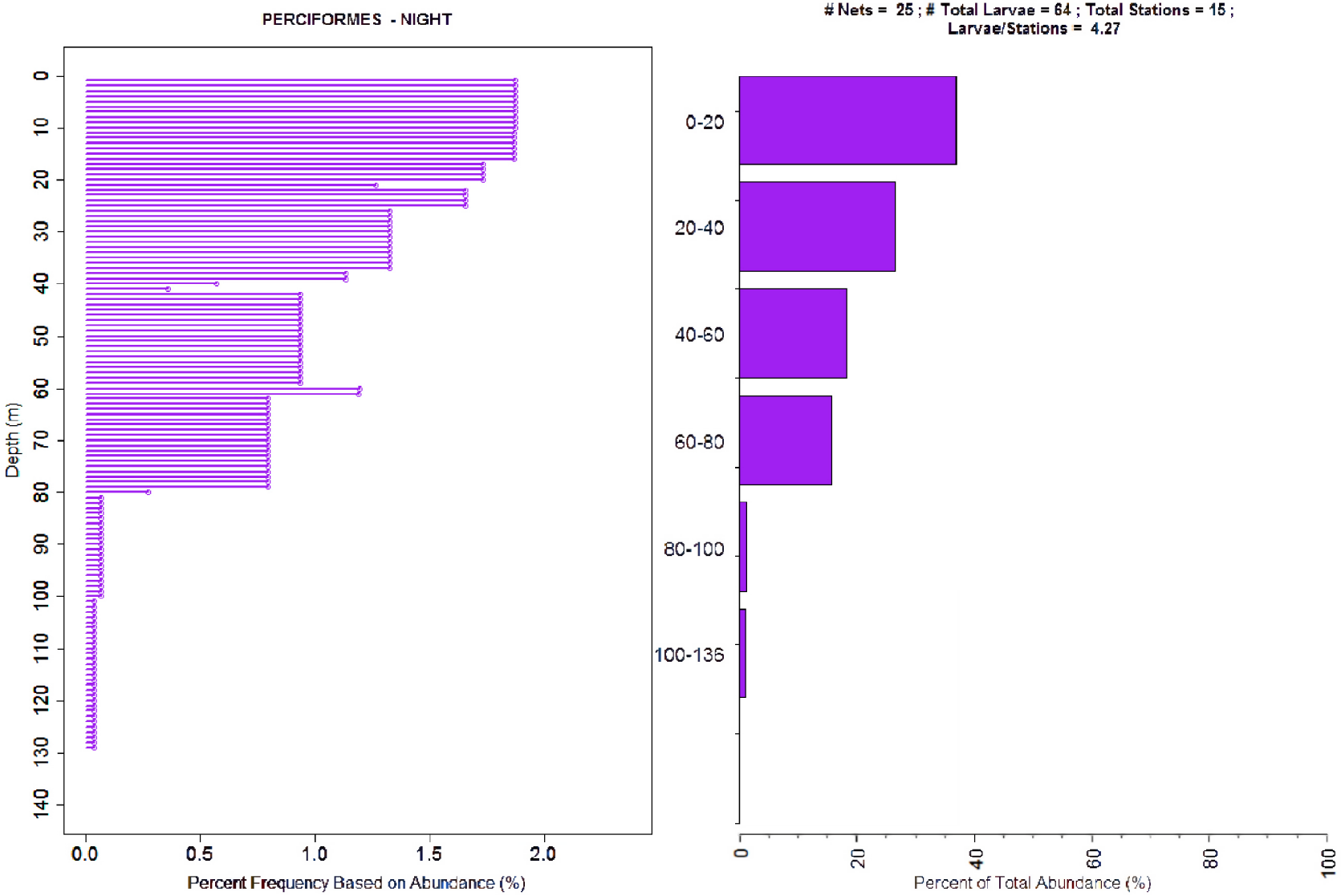
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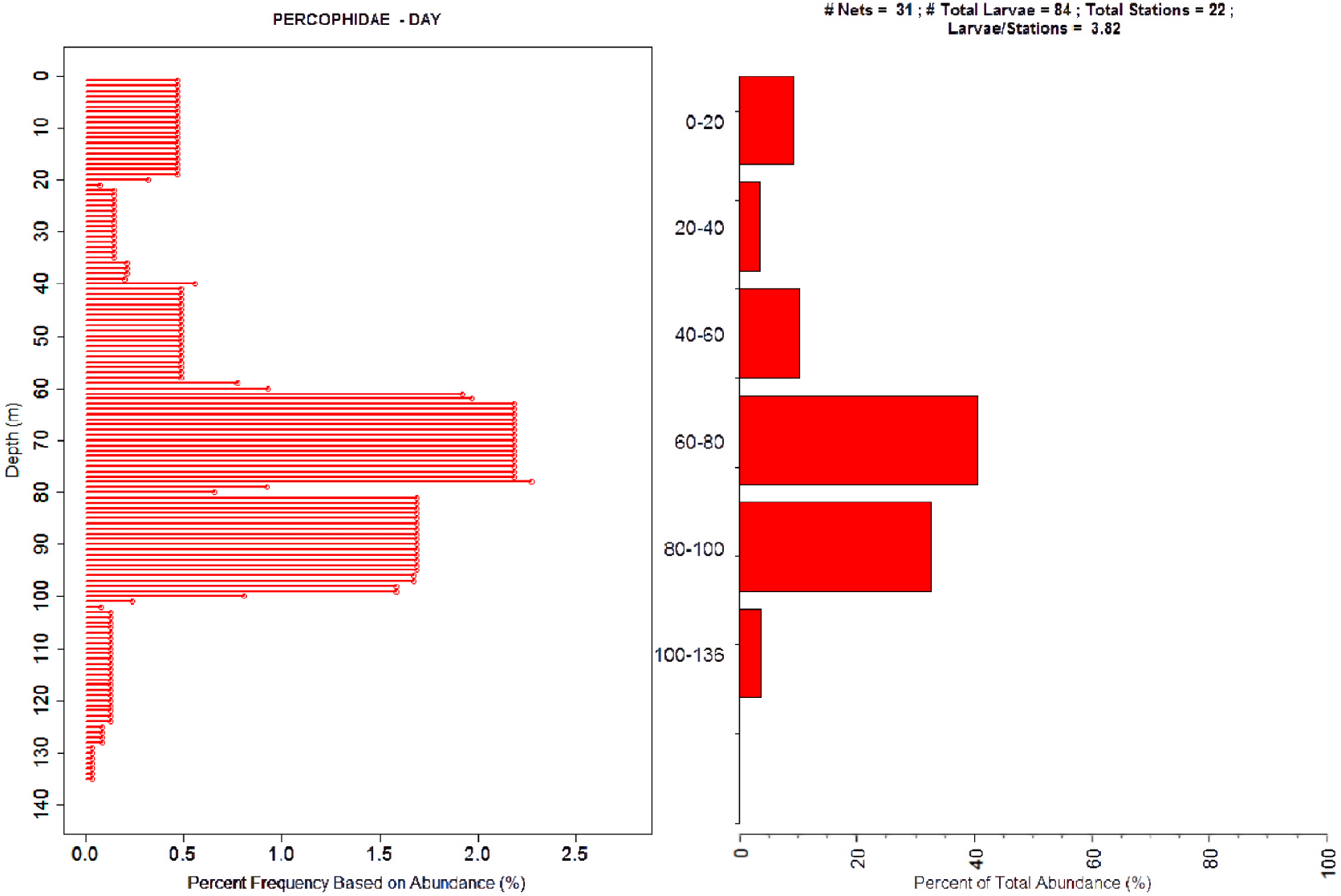
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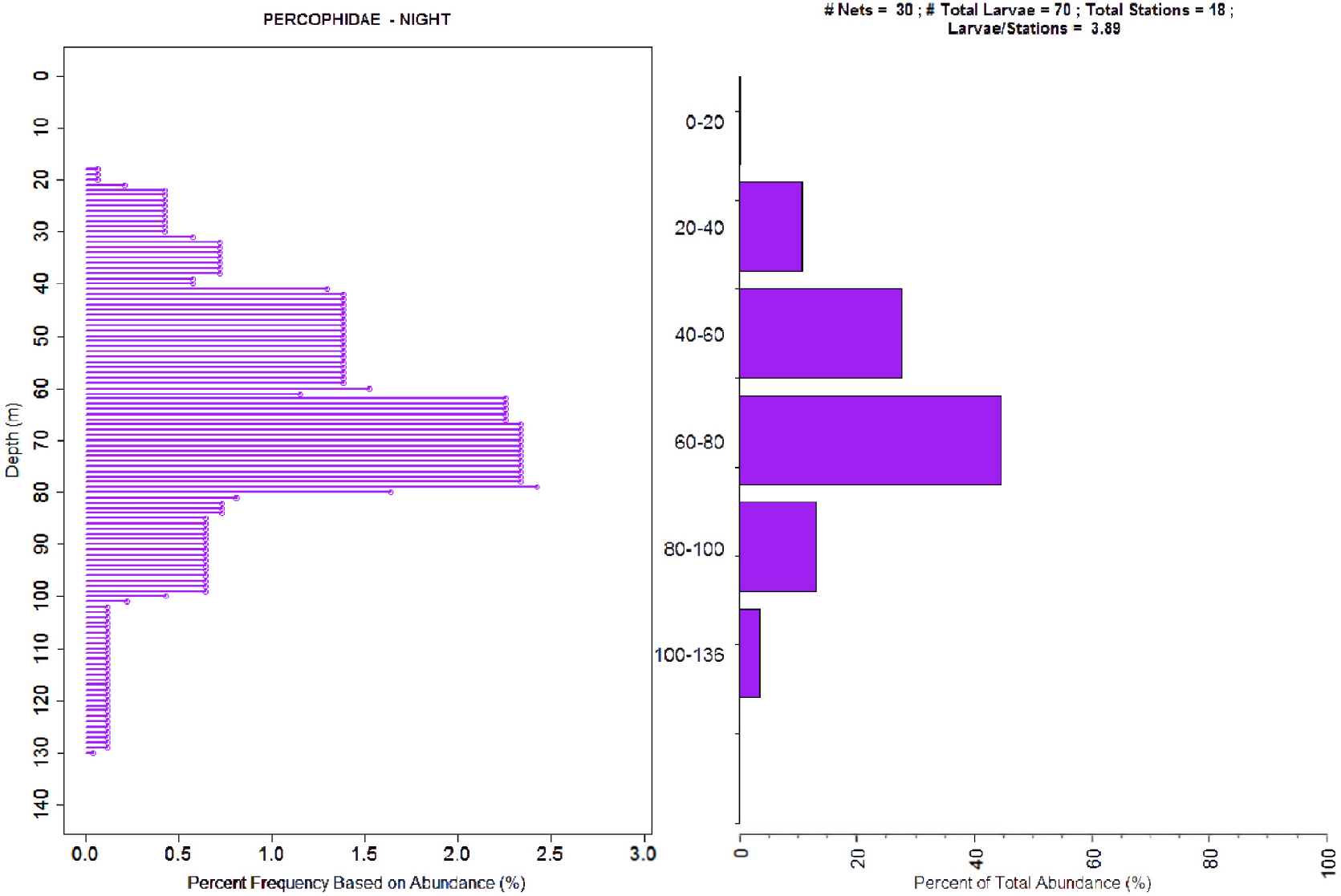
PERCIFORMES, DAY



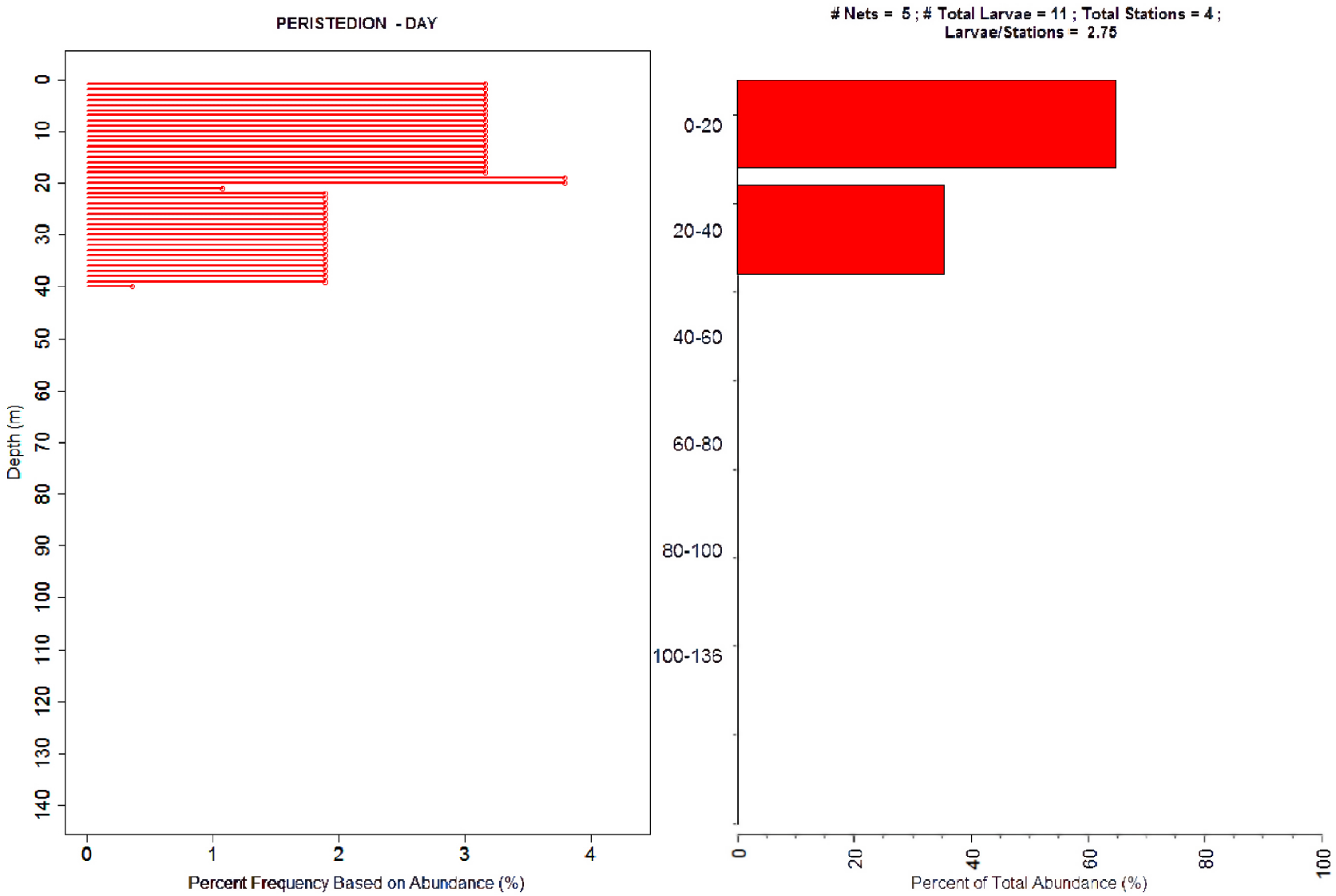
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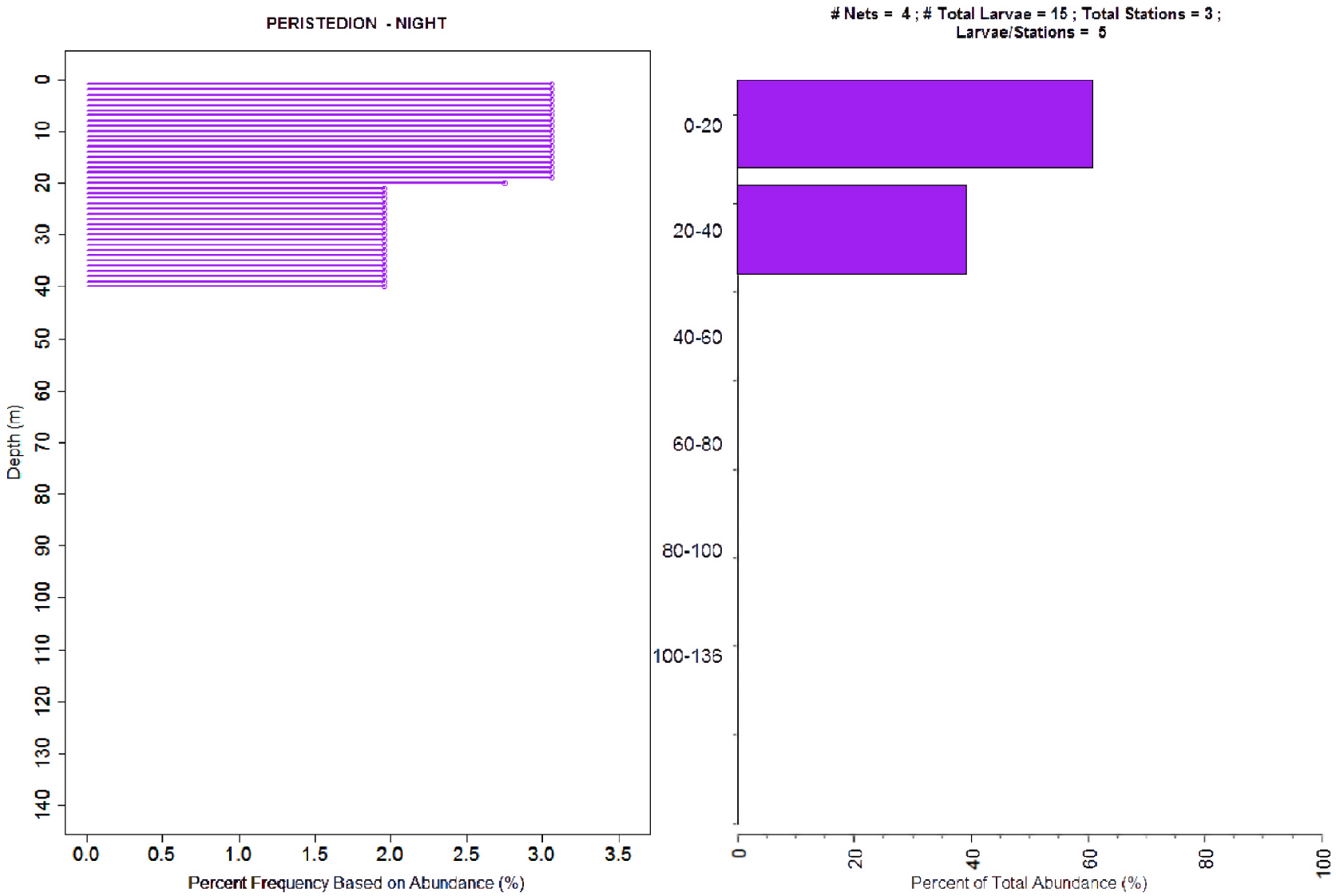
PERCOPHIDAE, DAY



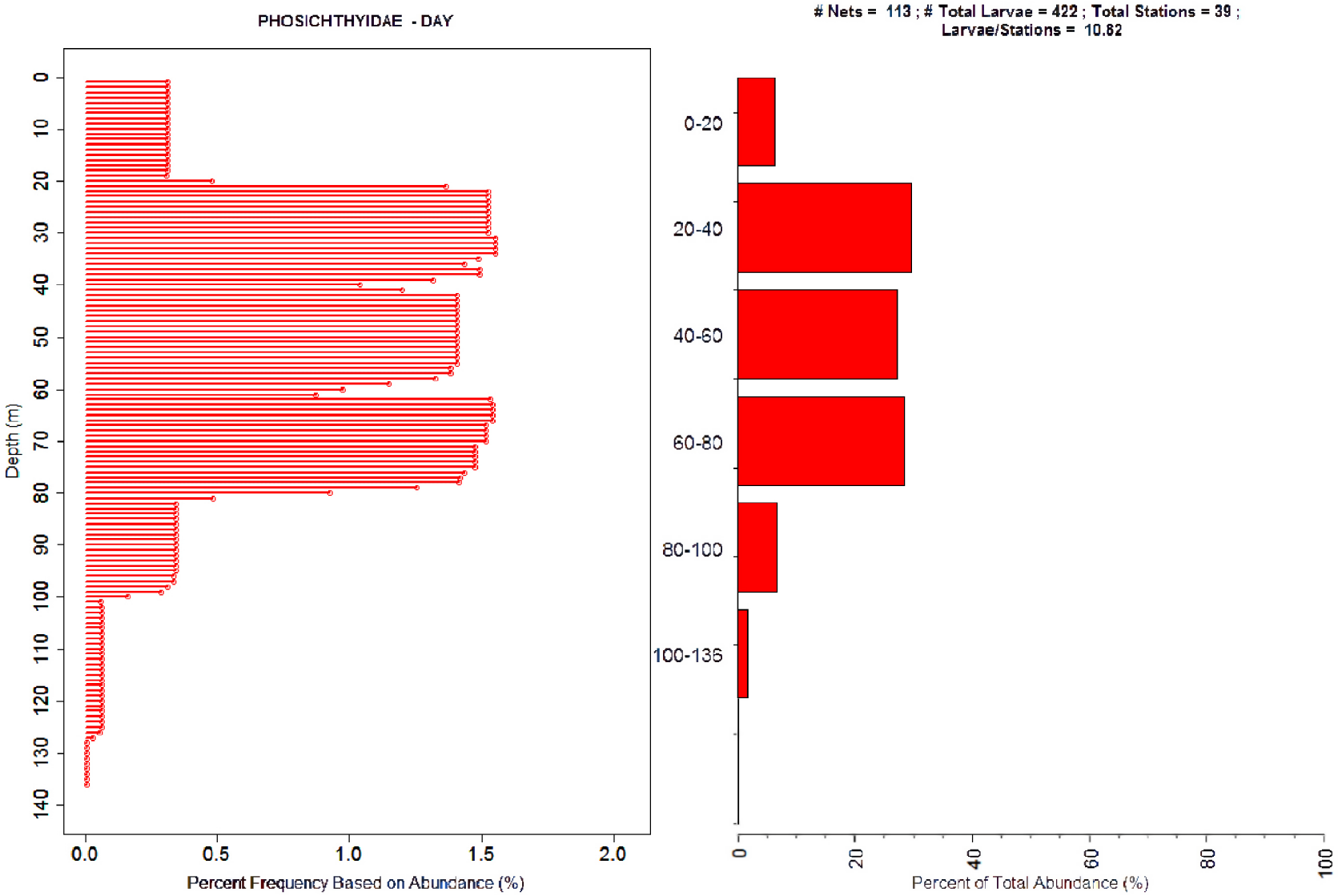
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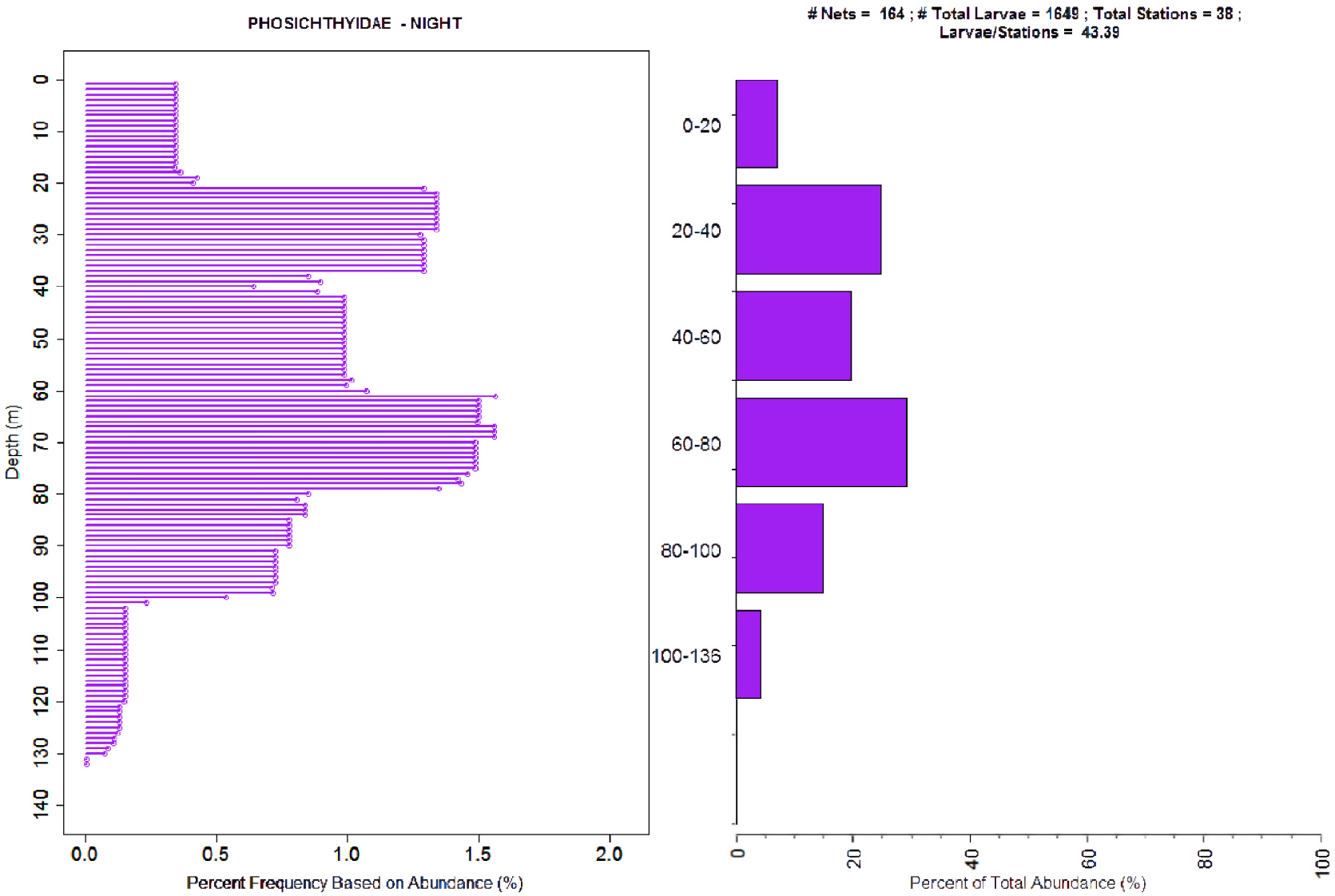
PERISTEDION, DAY



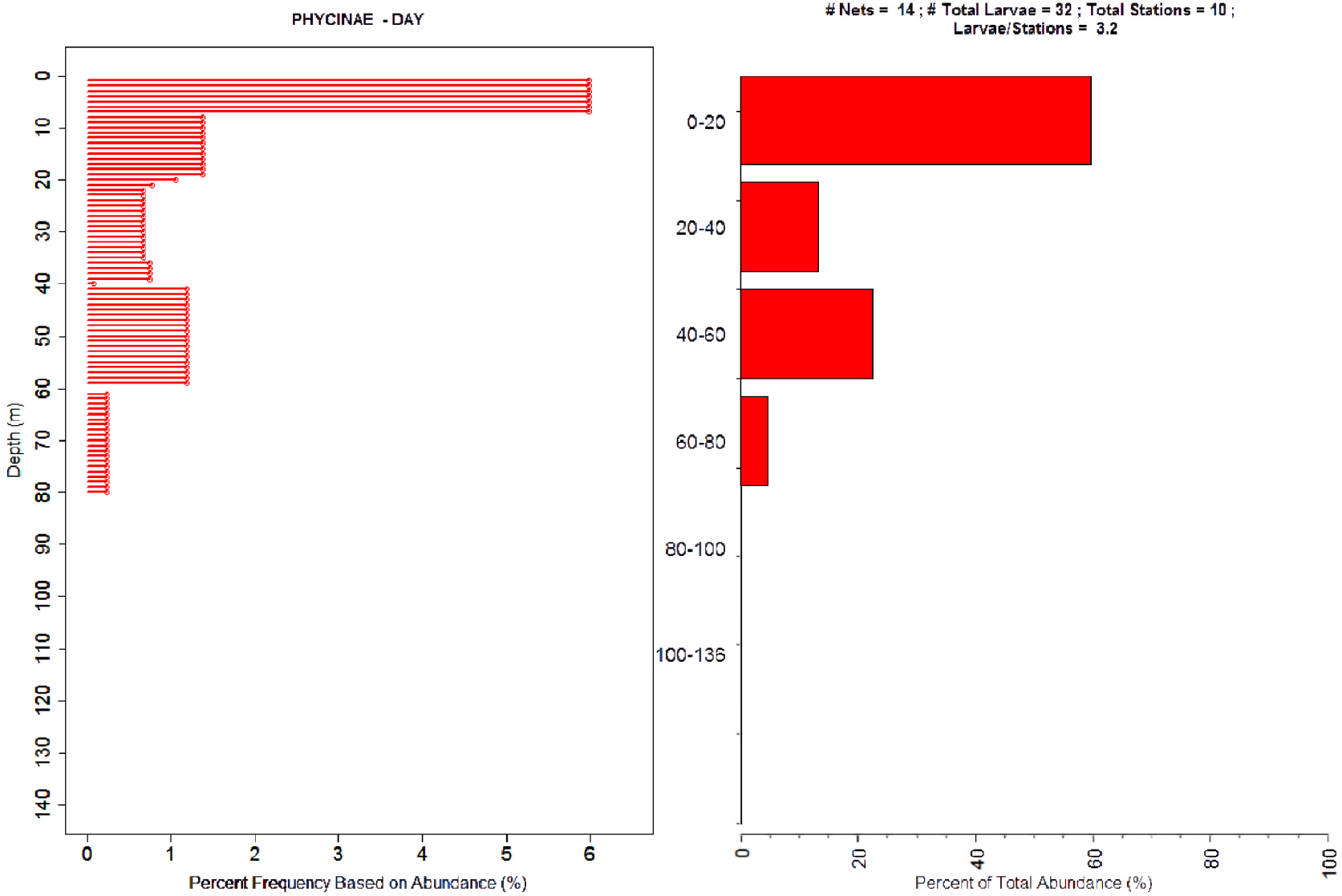
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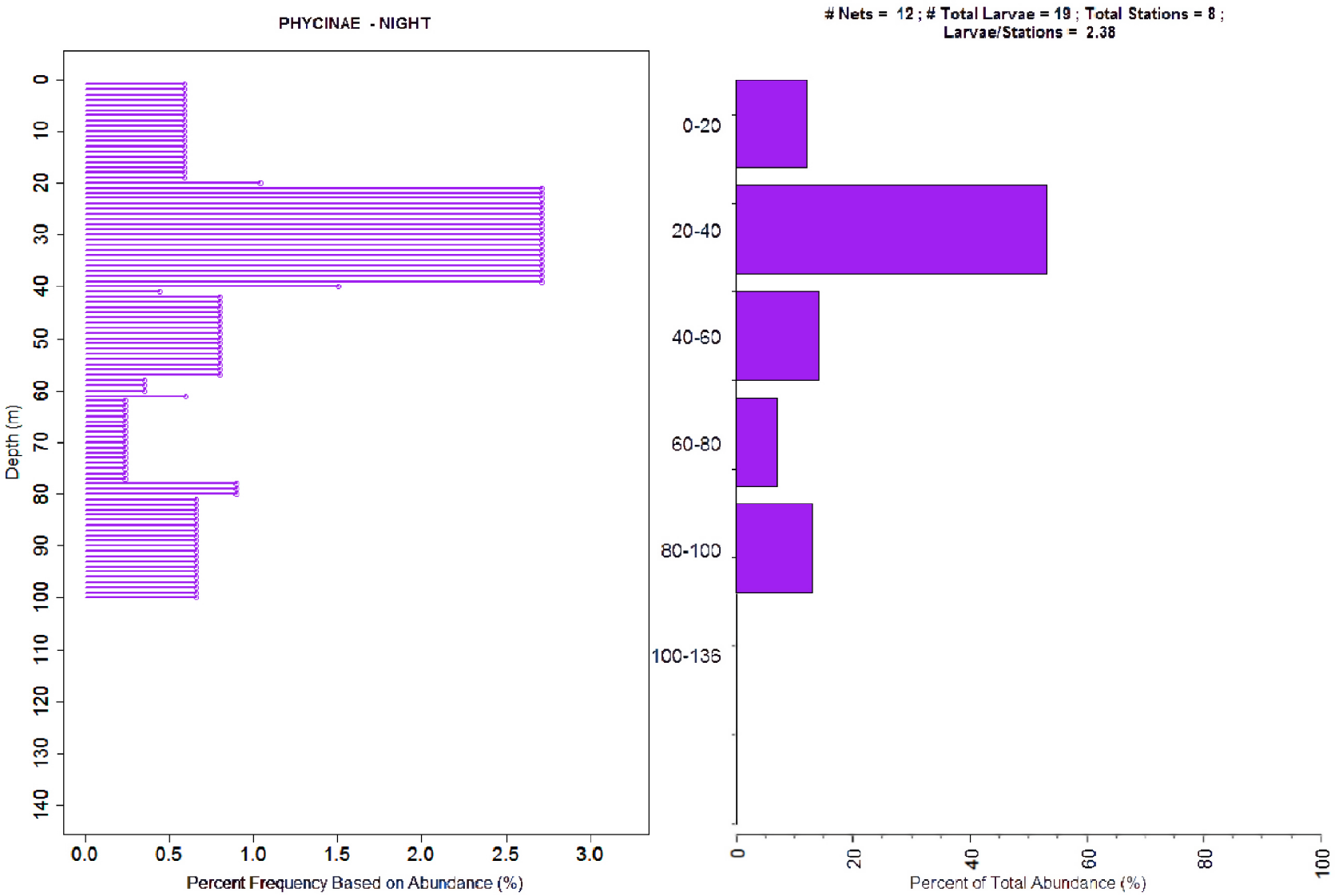
PHOSICHTHYIDAE, DAY



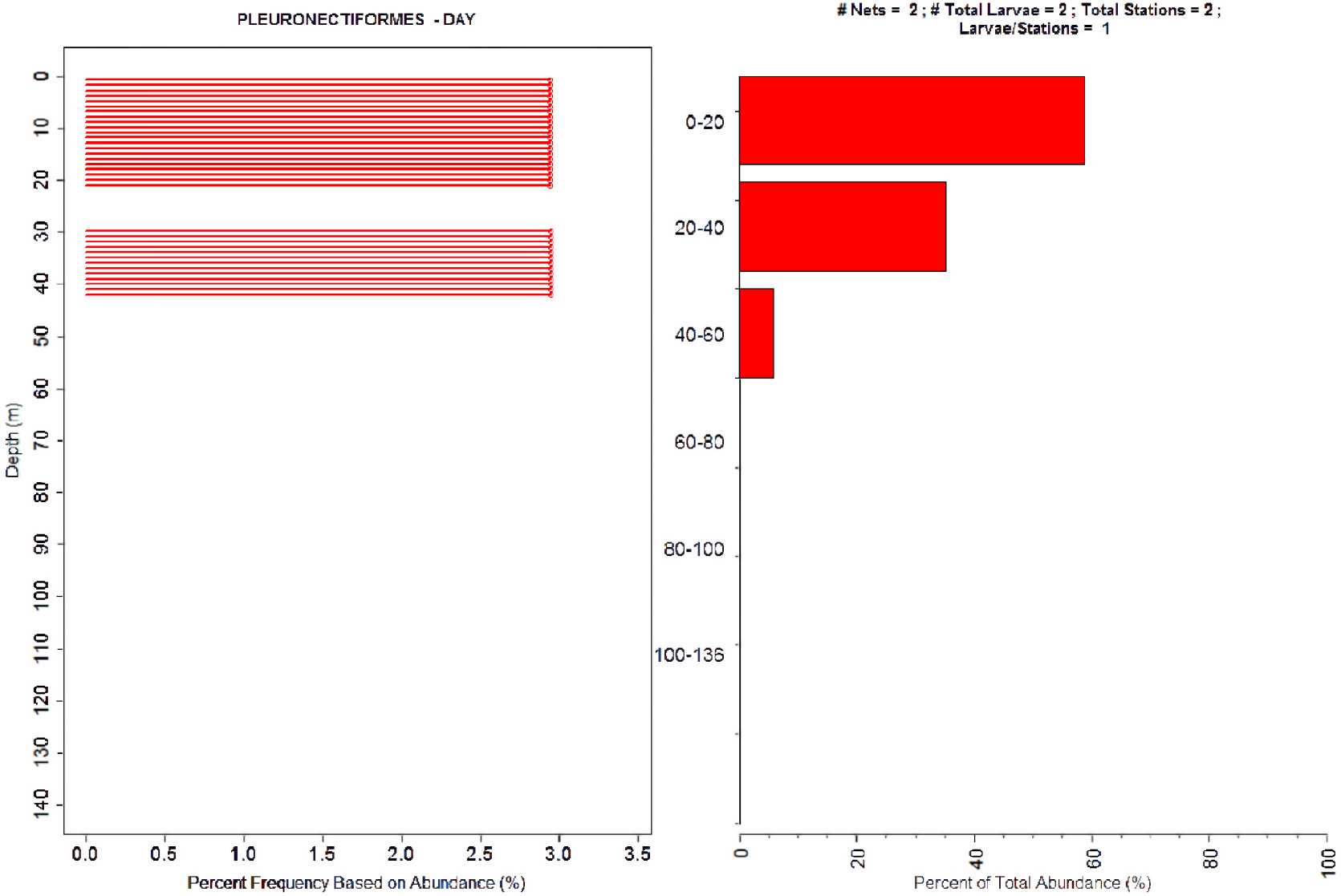
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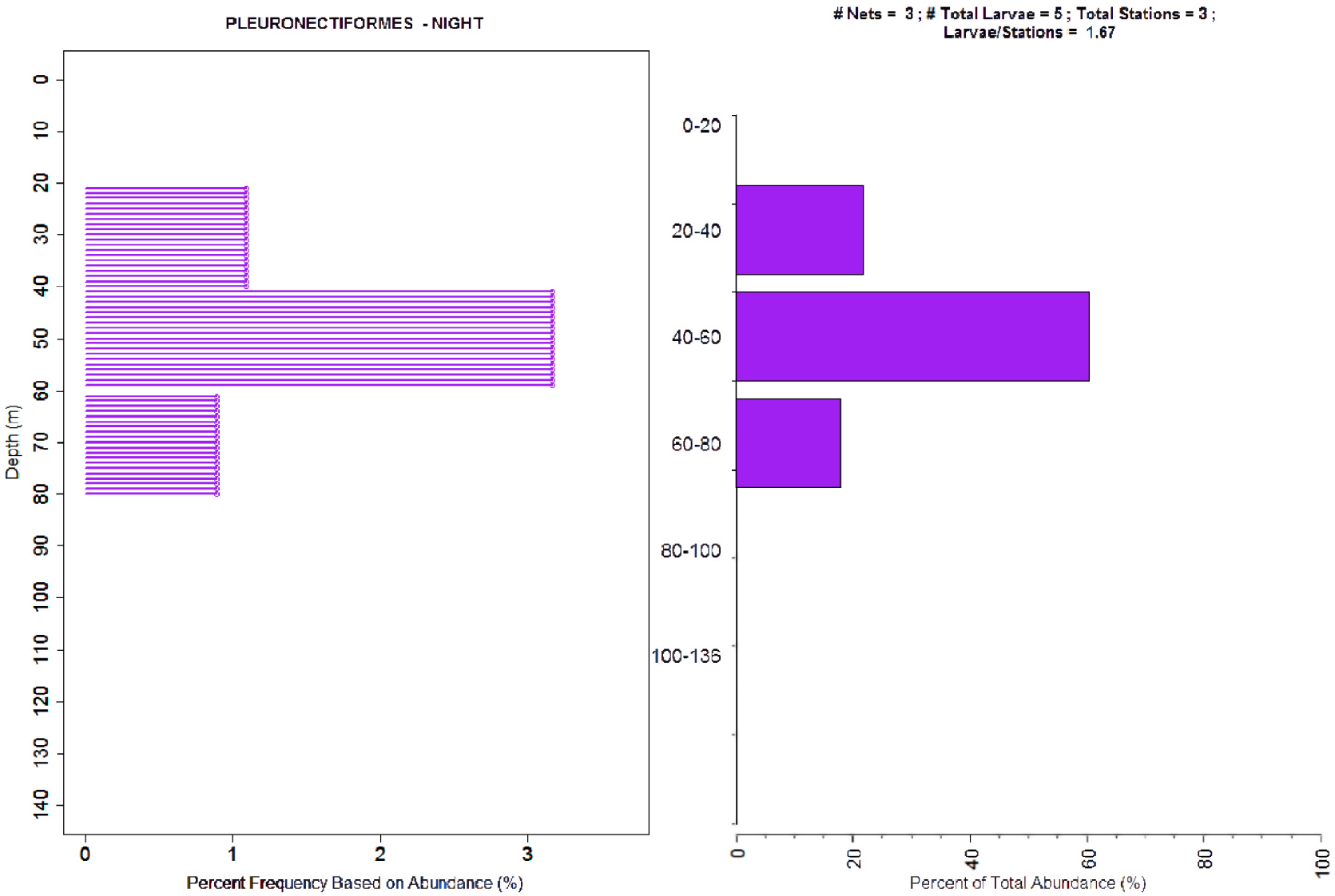
PHYCINAE, DAY



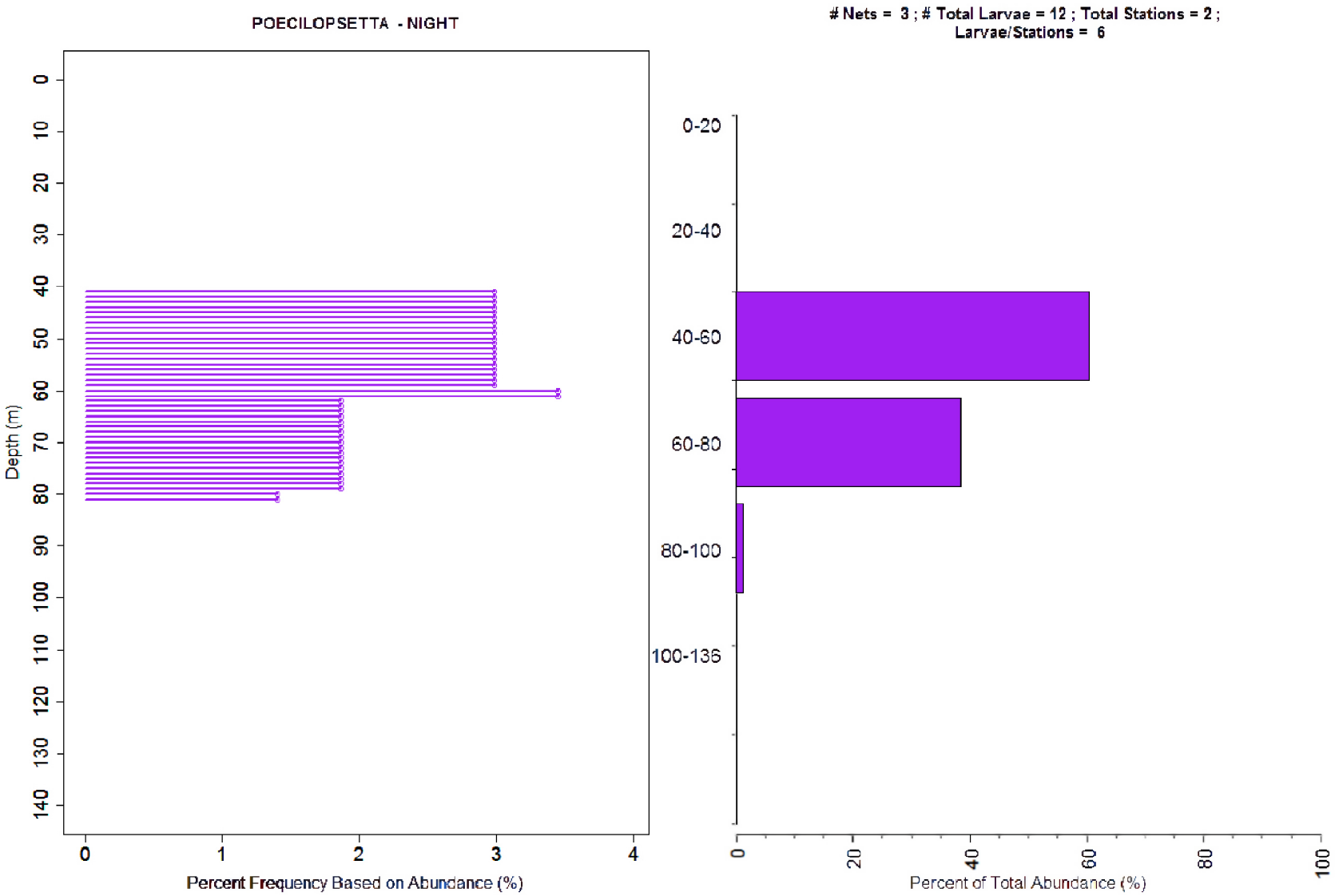
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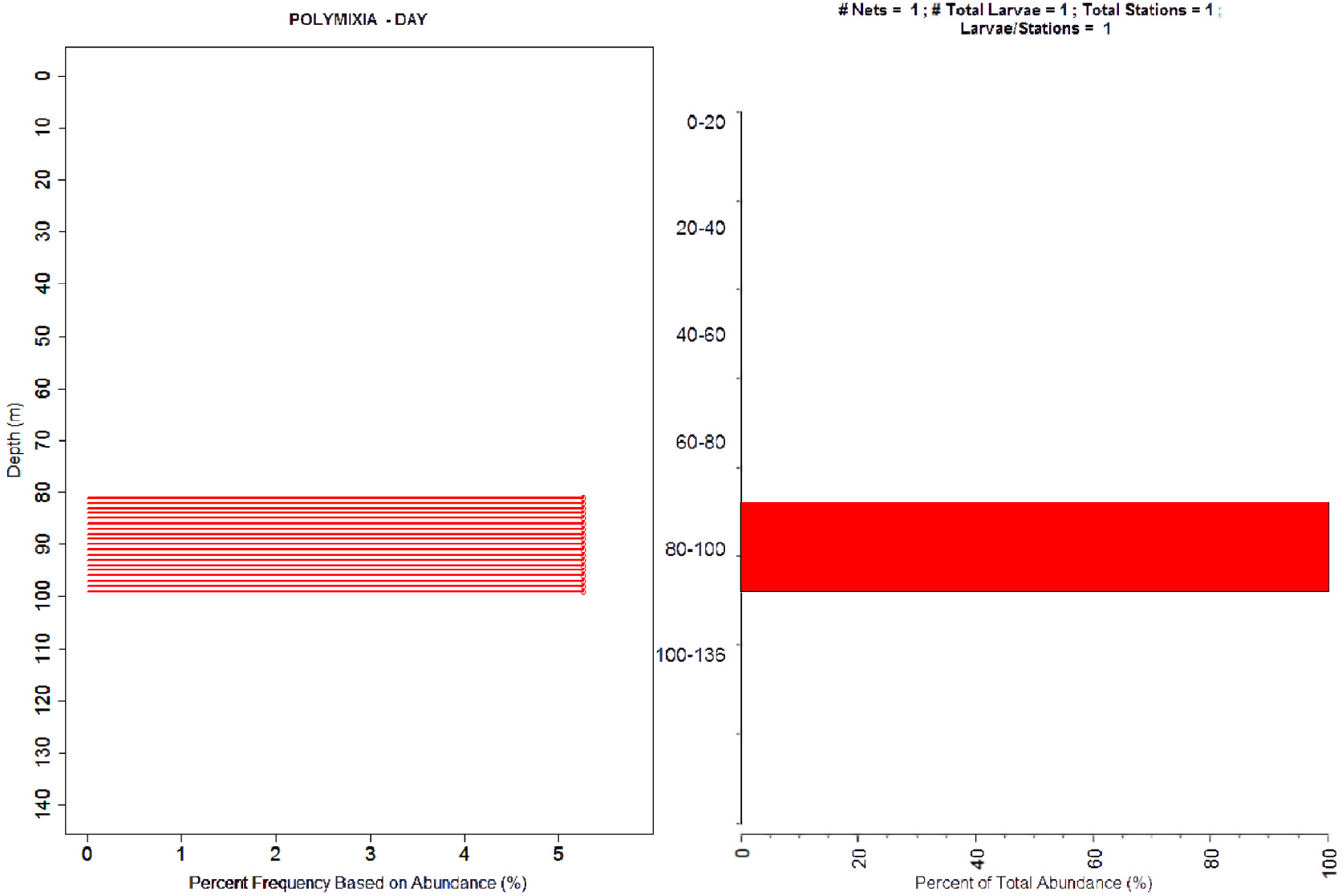
PLEURONECTIFORMES, DAY



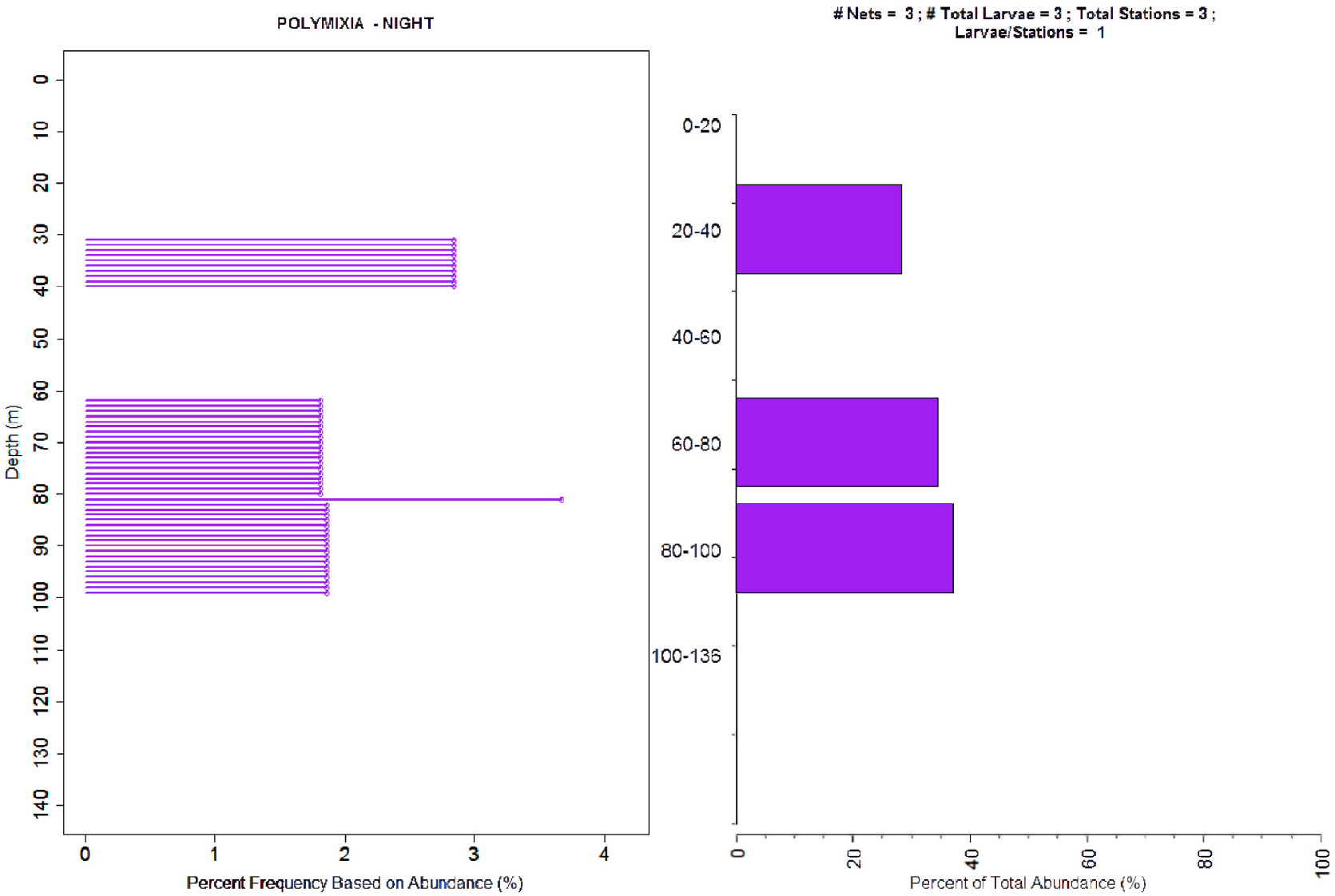
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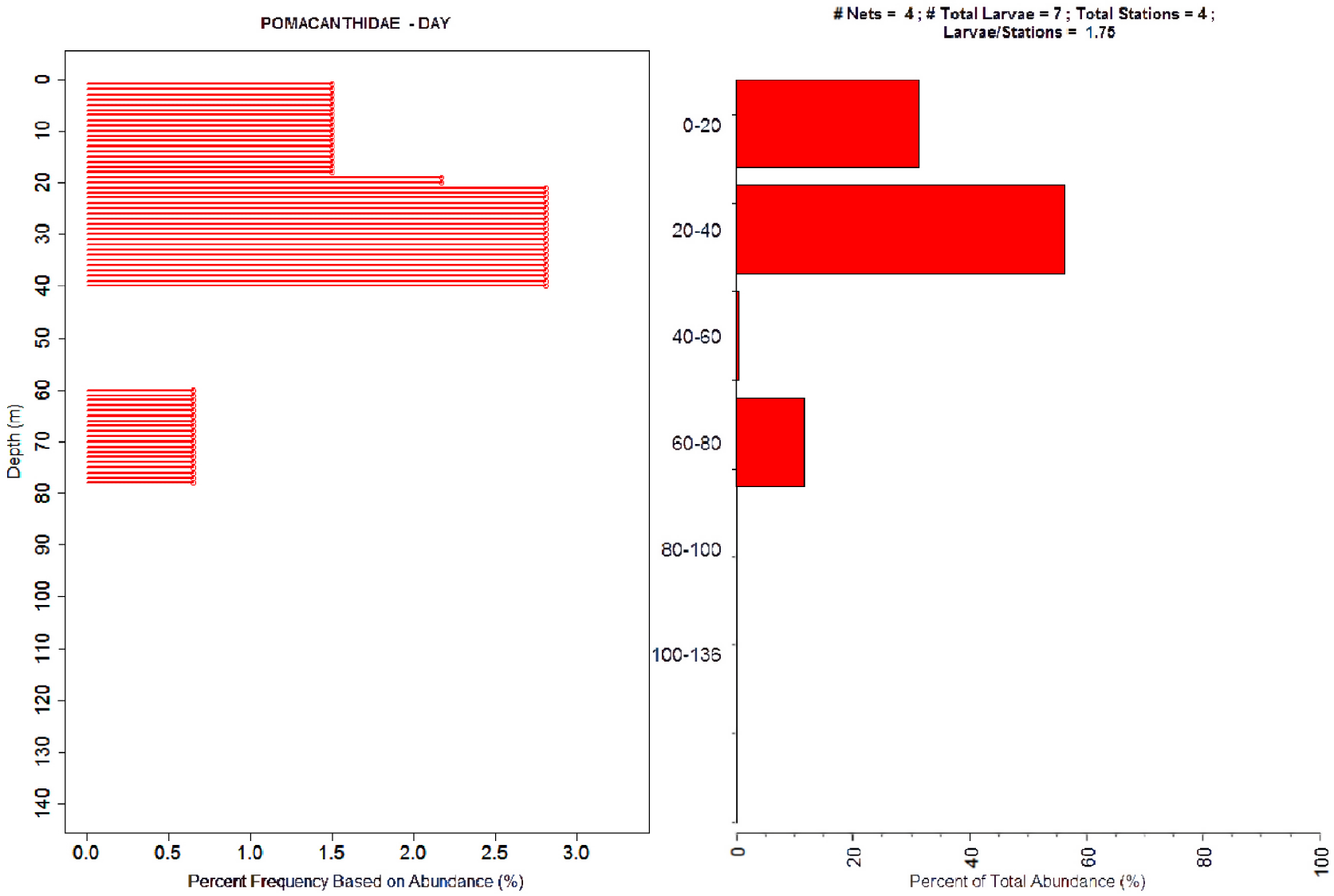
POECILOPSETTA, NIGHT



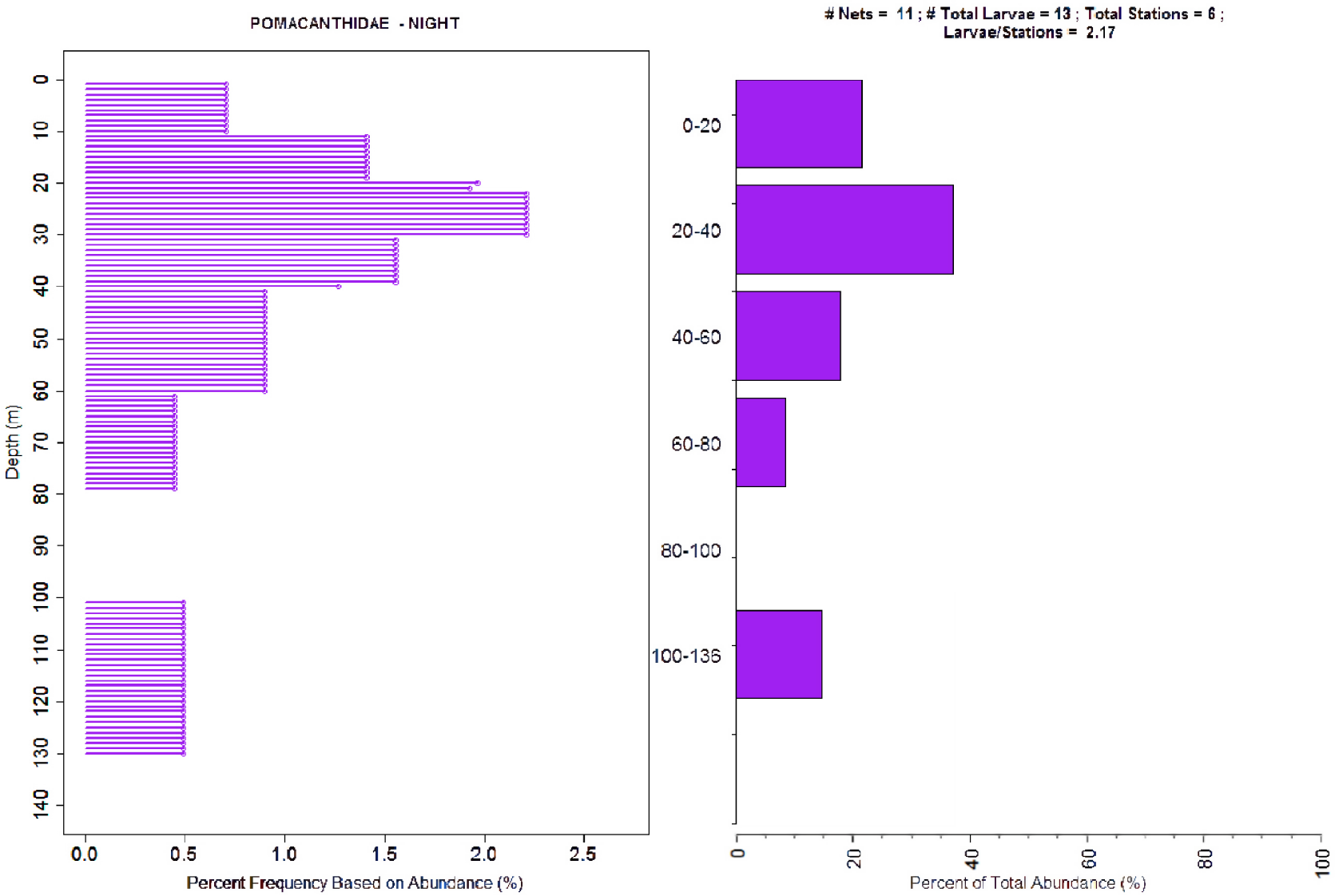
POLYMIXIA, DAY



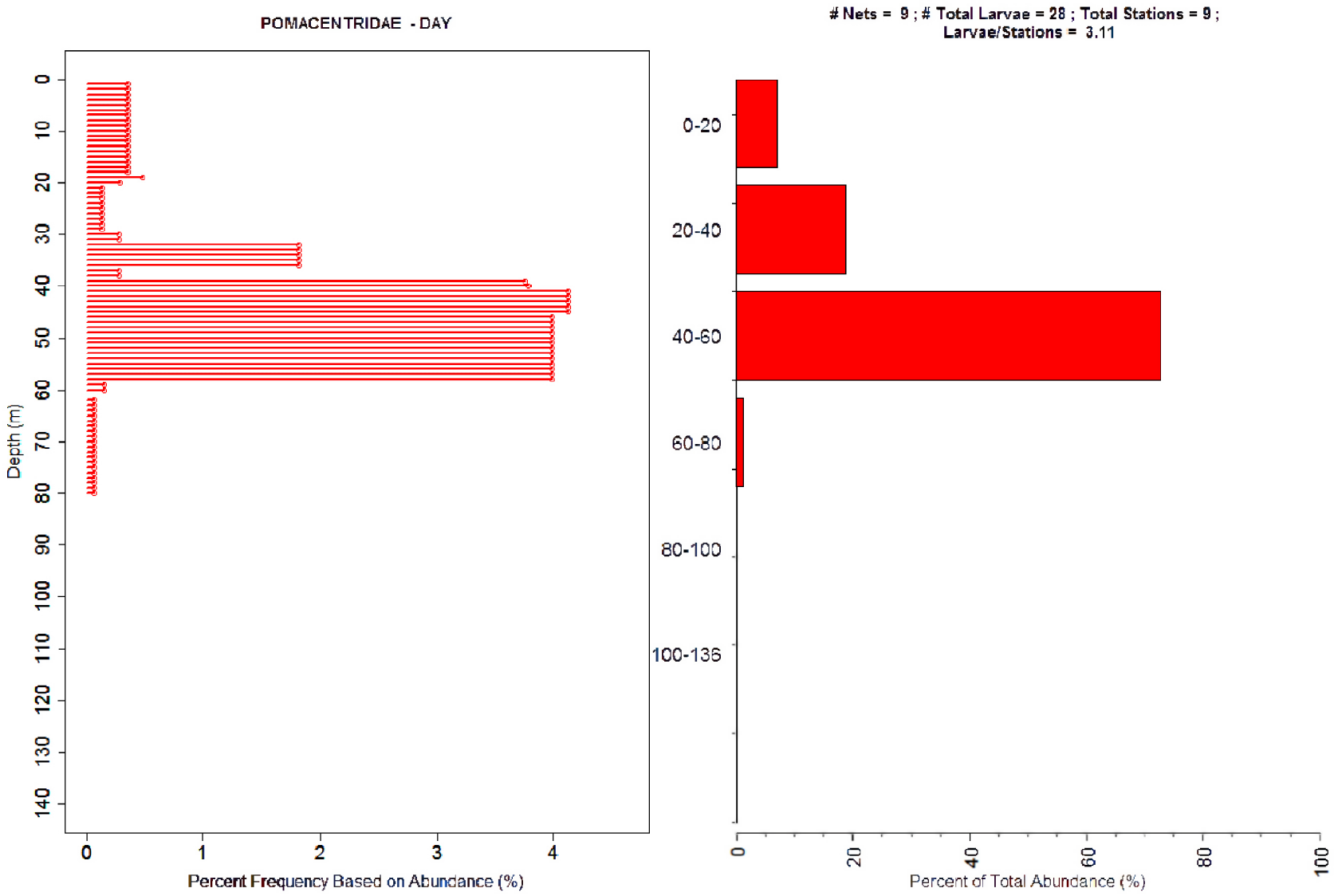
POLYMIXIA, NIGHT



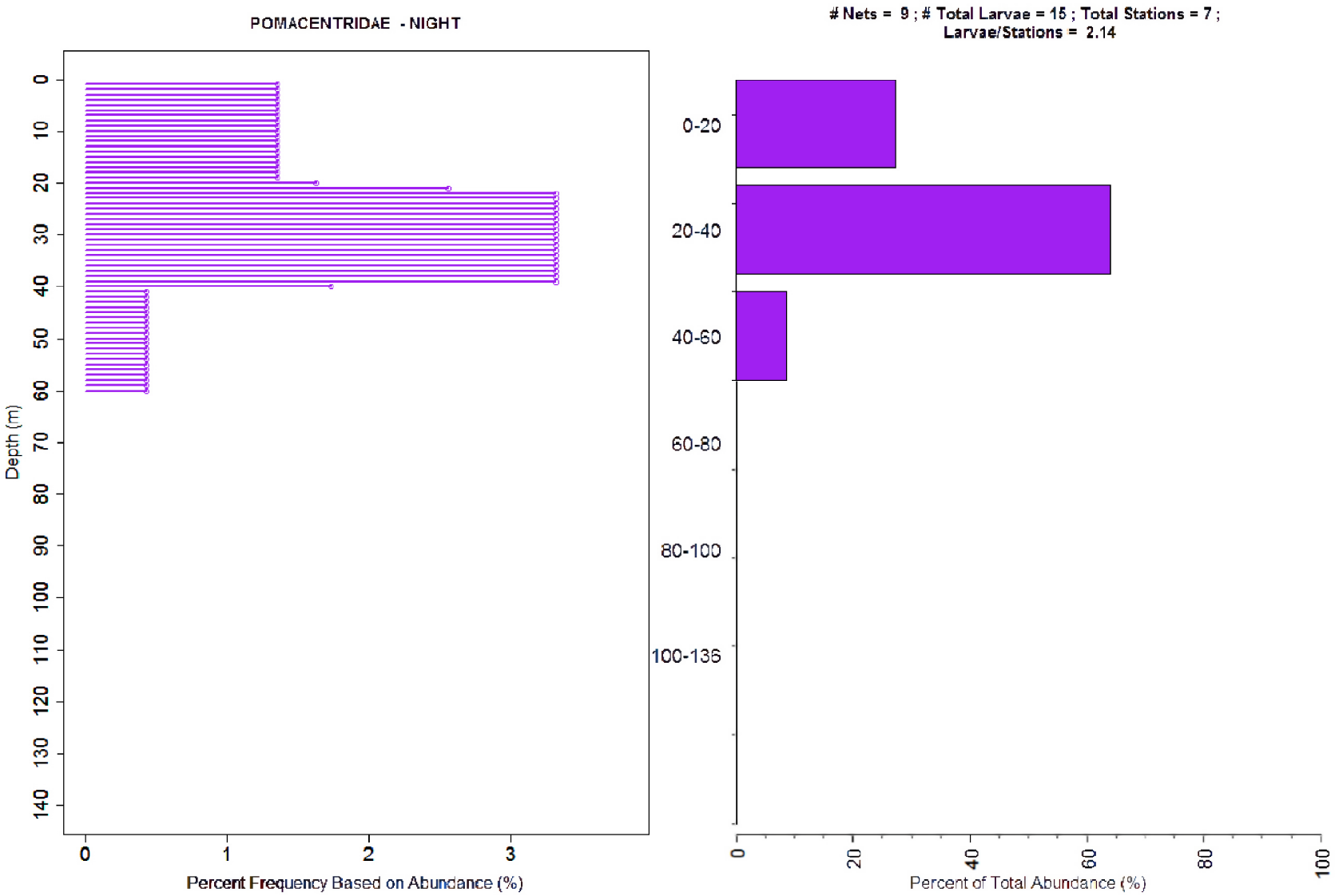
POMACANTHIDAE, DAY



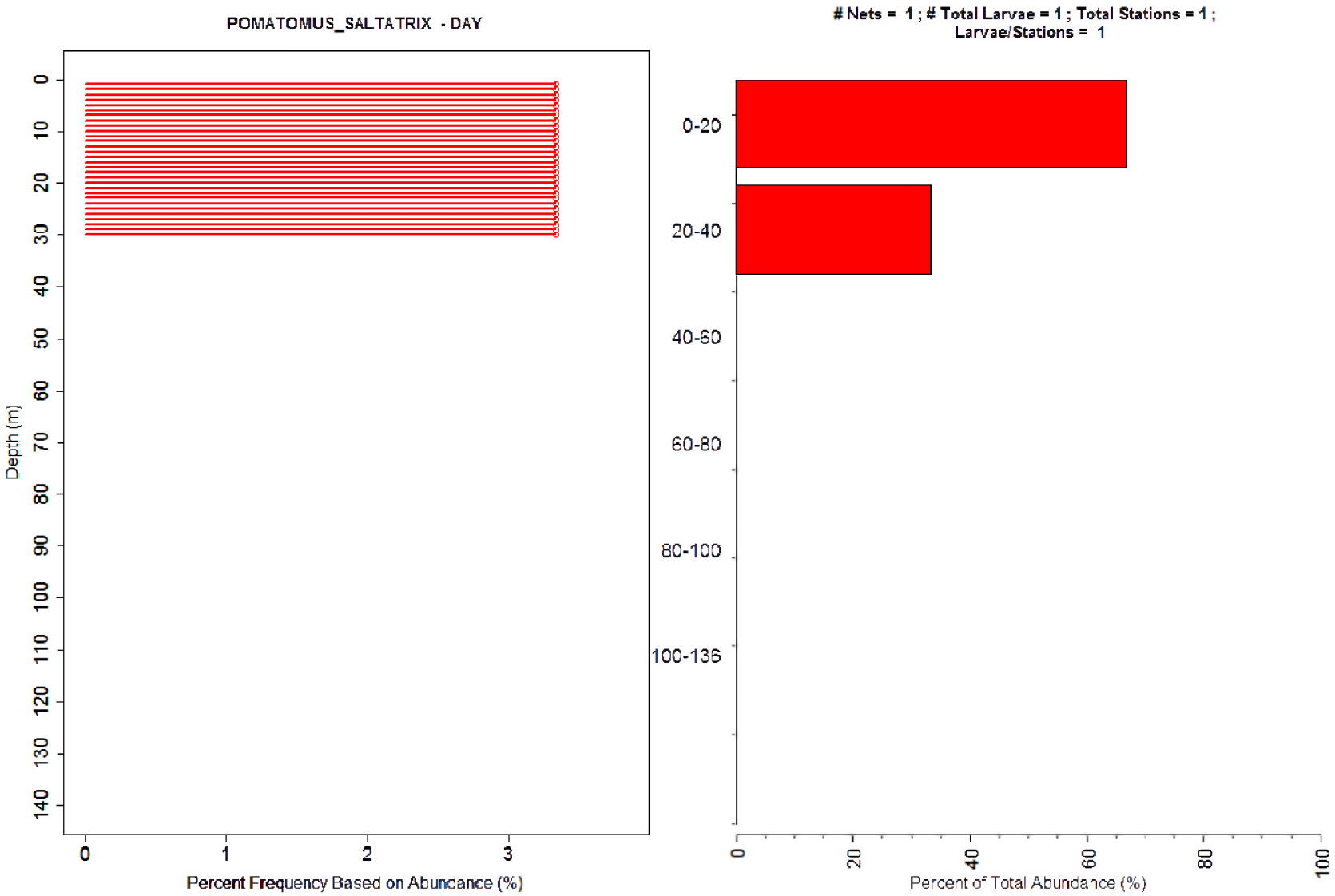
POMACANTHIDAE, NIGHT



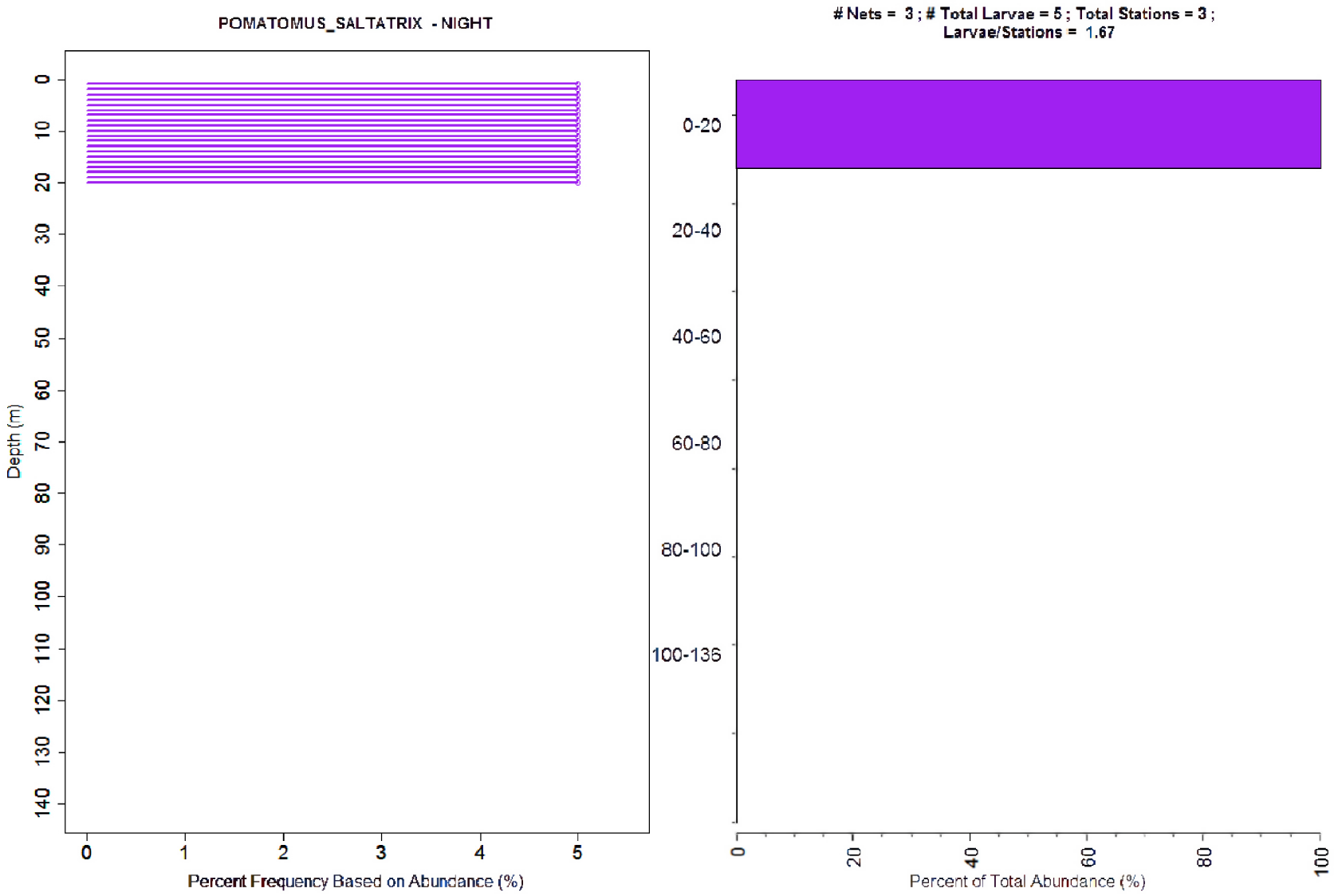
POMACENTRIDAE, DAY



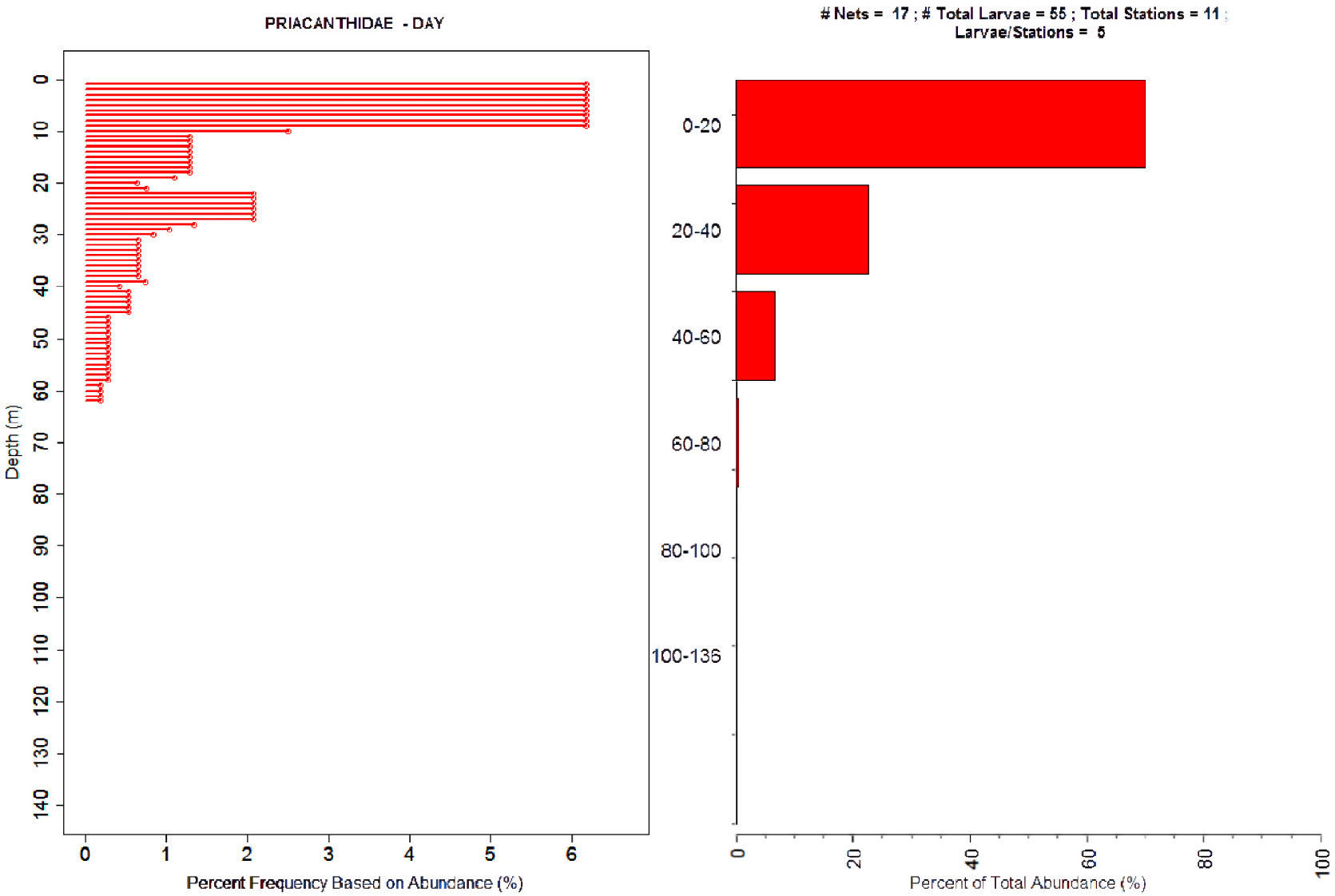
POMACENTRIDAE, NIGHT



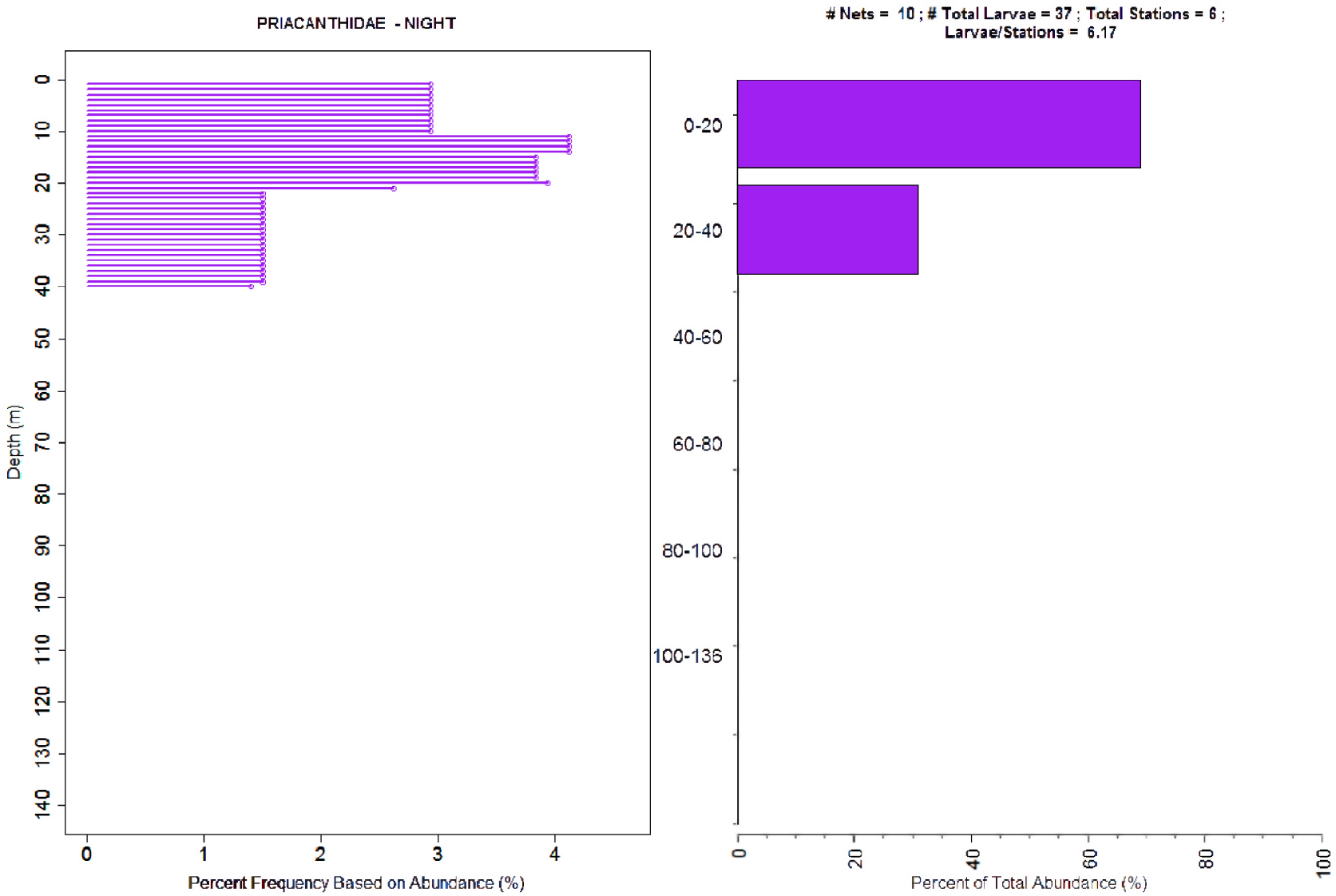
POMATOMUS_SALTATRIX, DAY



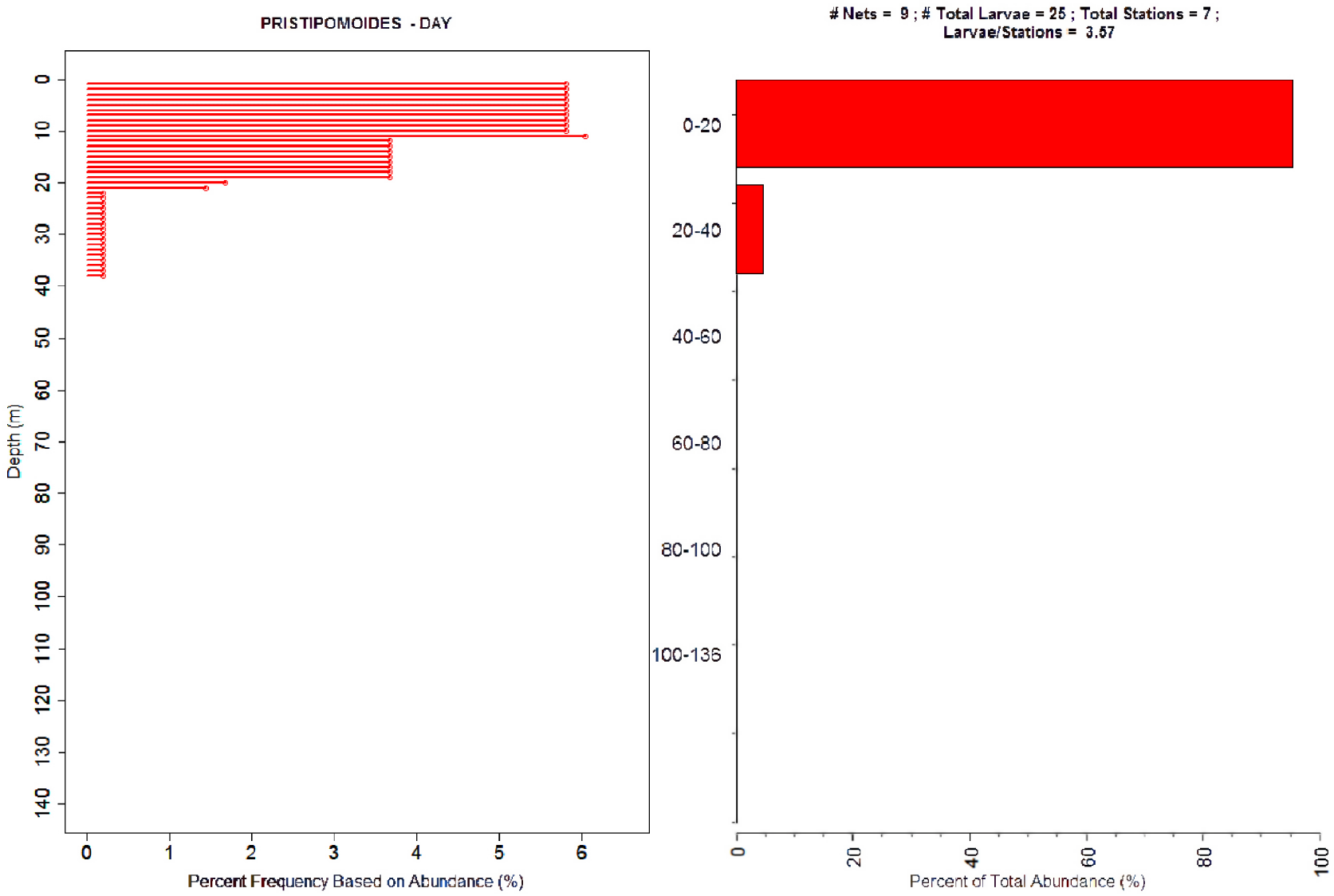
POMATOMUS_SALTATRIX, NIGHT



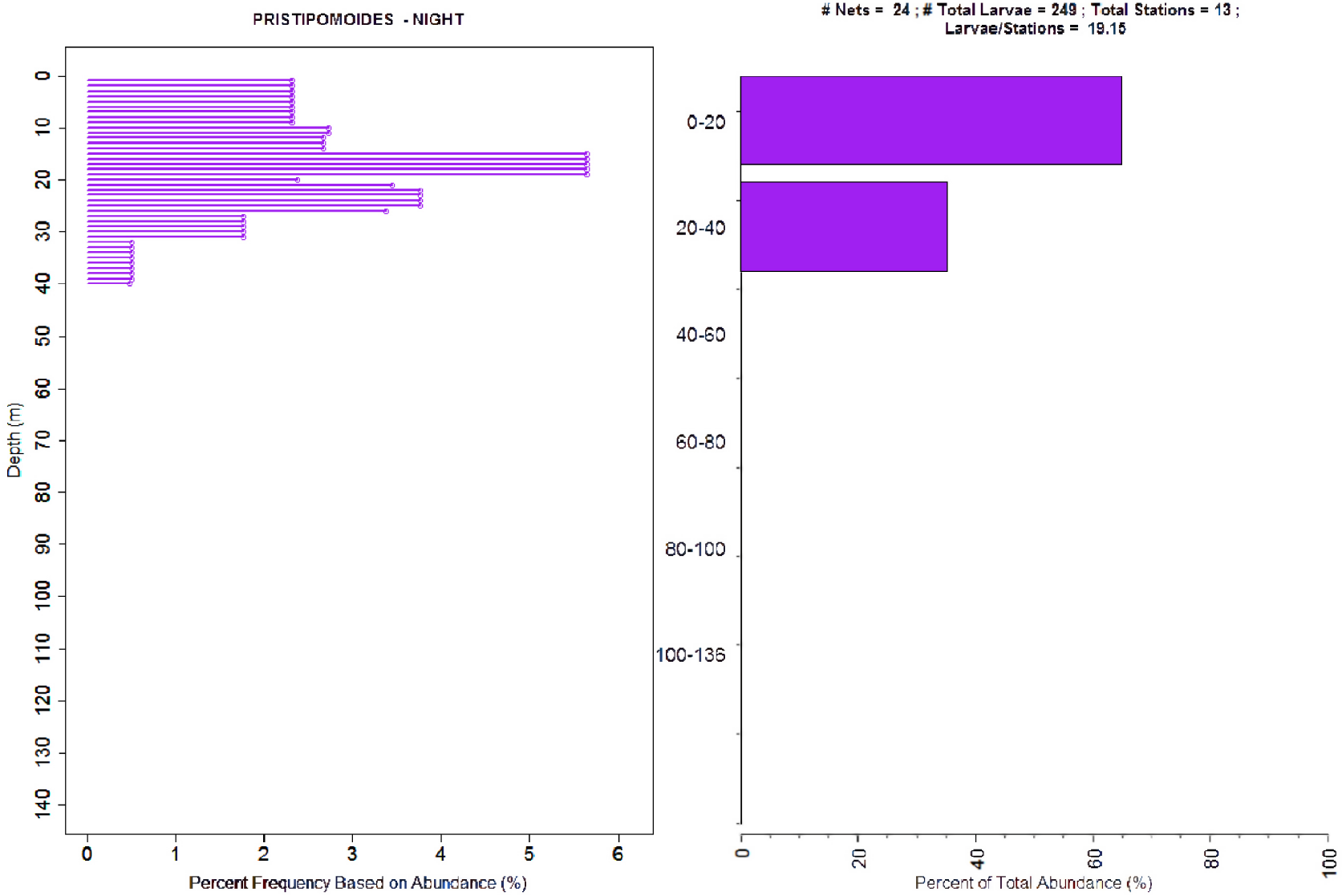
PRIACANTHIDAE, DAY



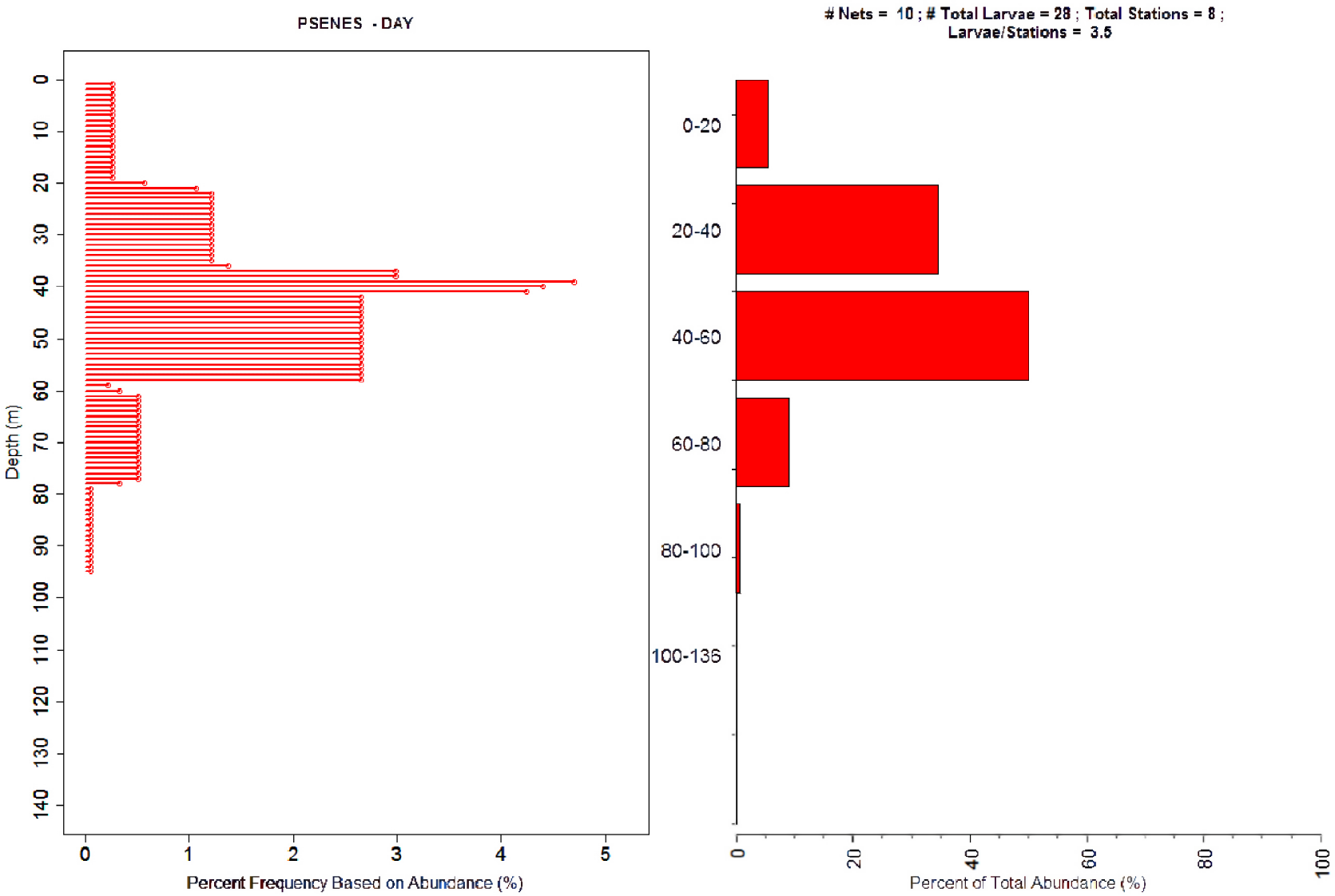
PRIACANTHIDAE, NIGHT



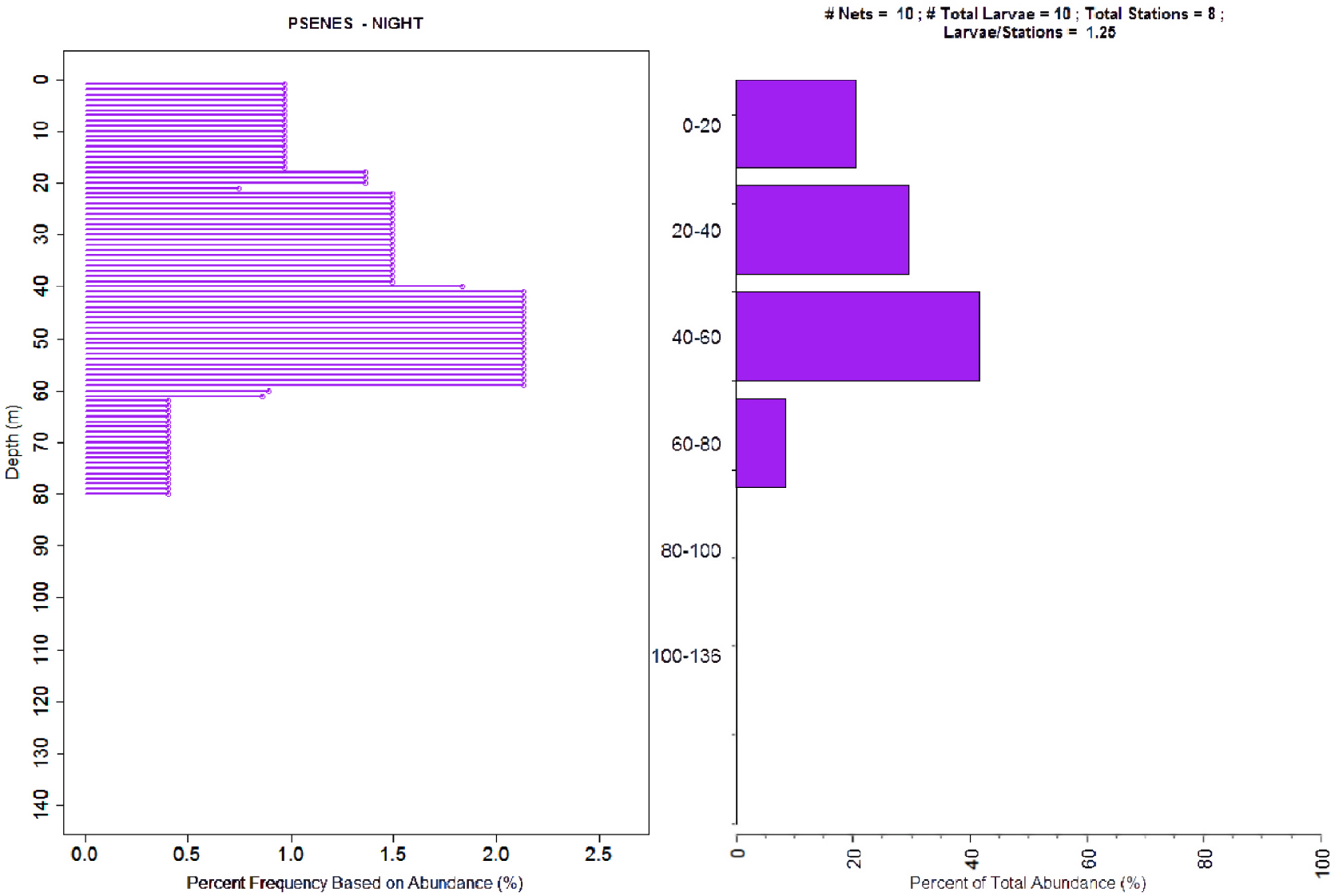
PRISTIPOMOIDES, DAY



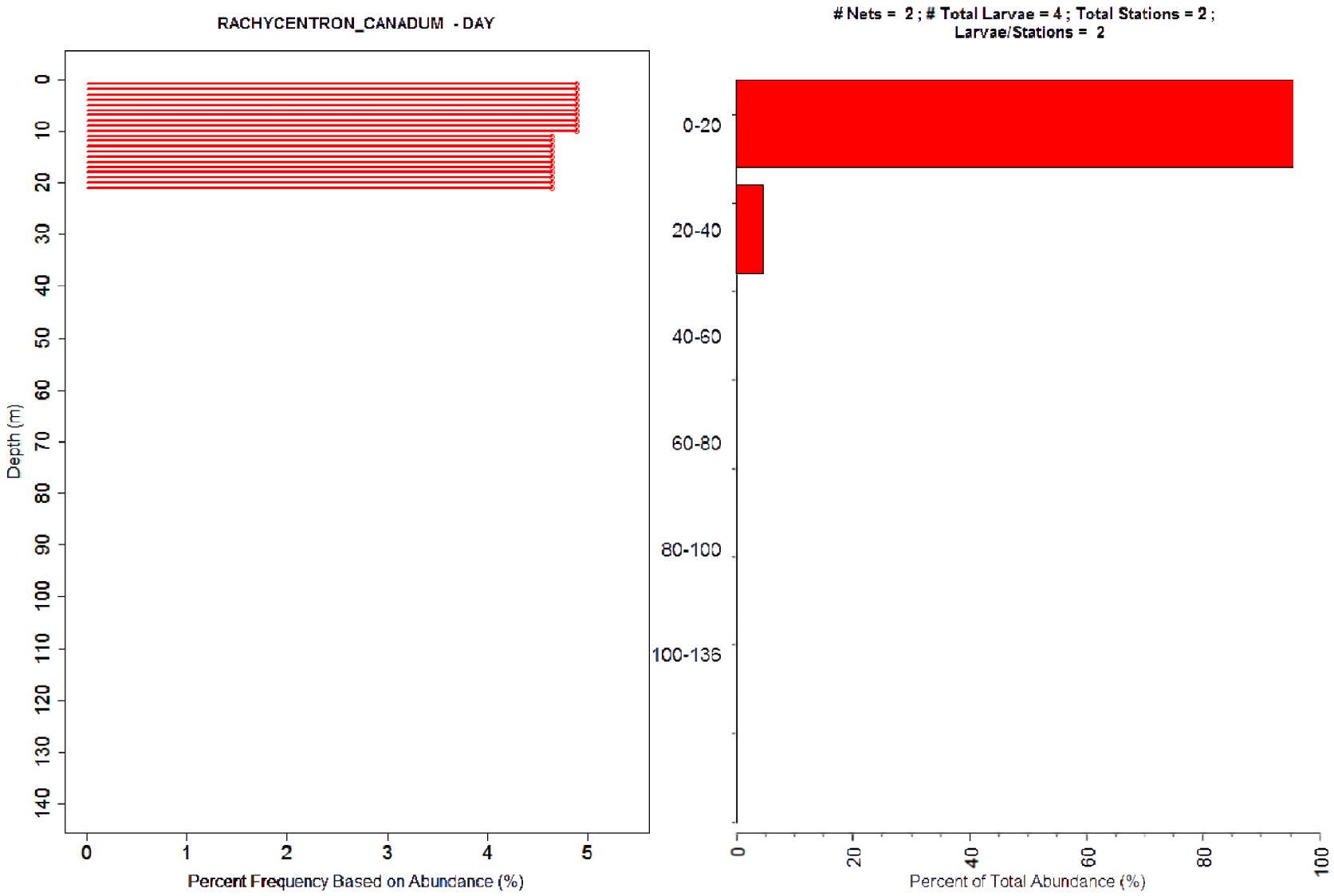
PRISTIPOMOIDES, NIGHT


PSENES - DAY
Nets = 10 ; # Total Larvae = 28 ; Total Stations = 8 ;
Larvae/Stations = 3.5
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

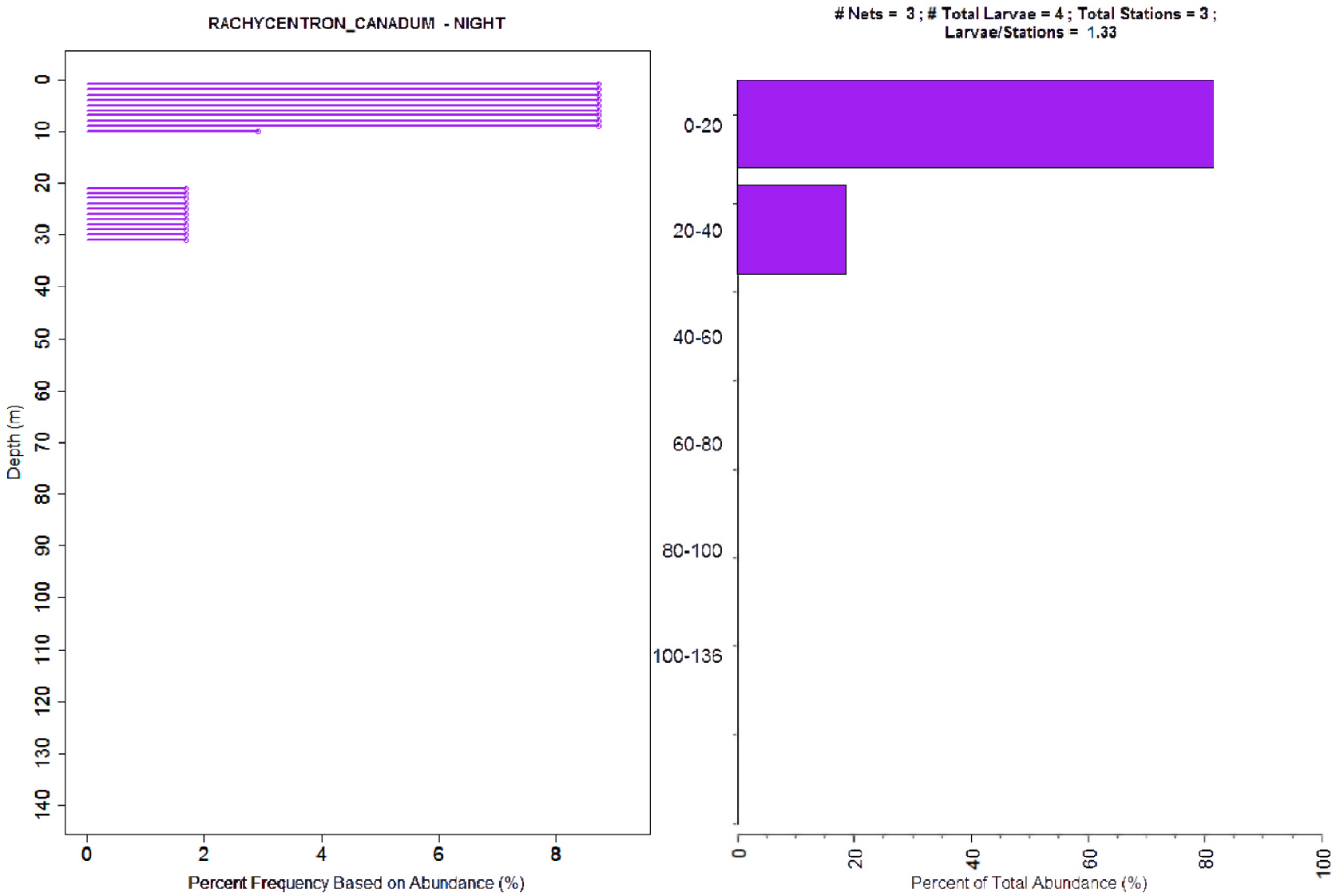
PSENES, DAY



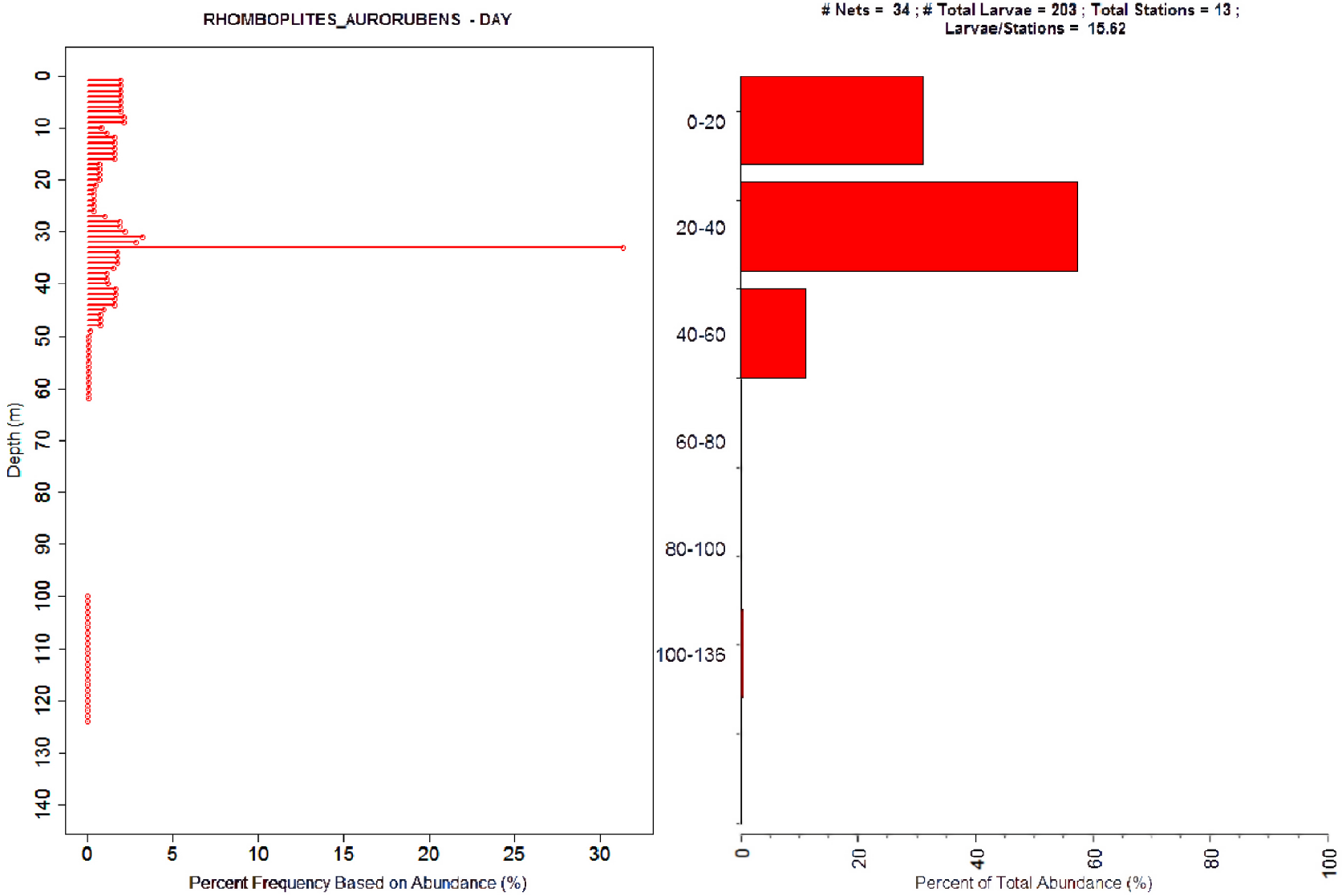
PSENES, NIGHT



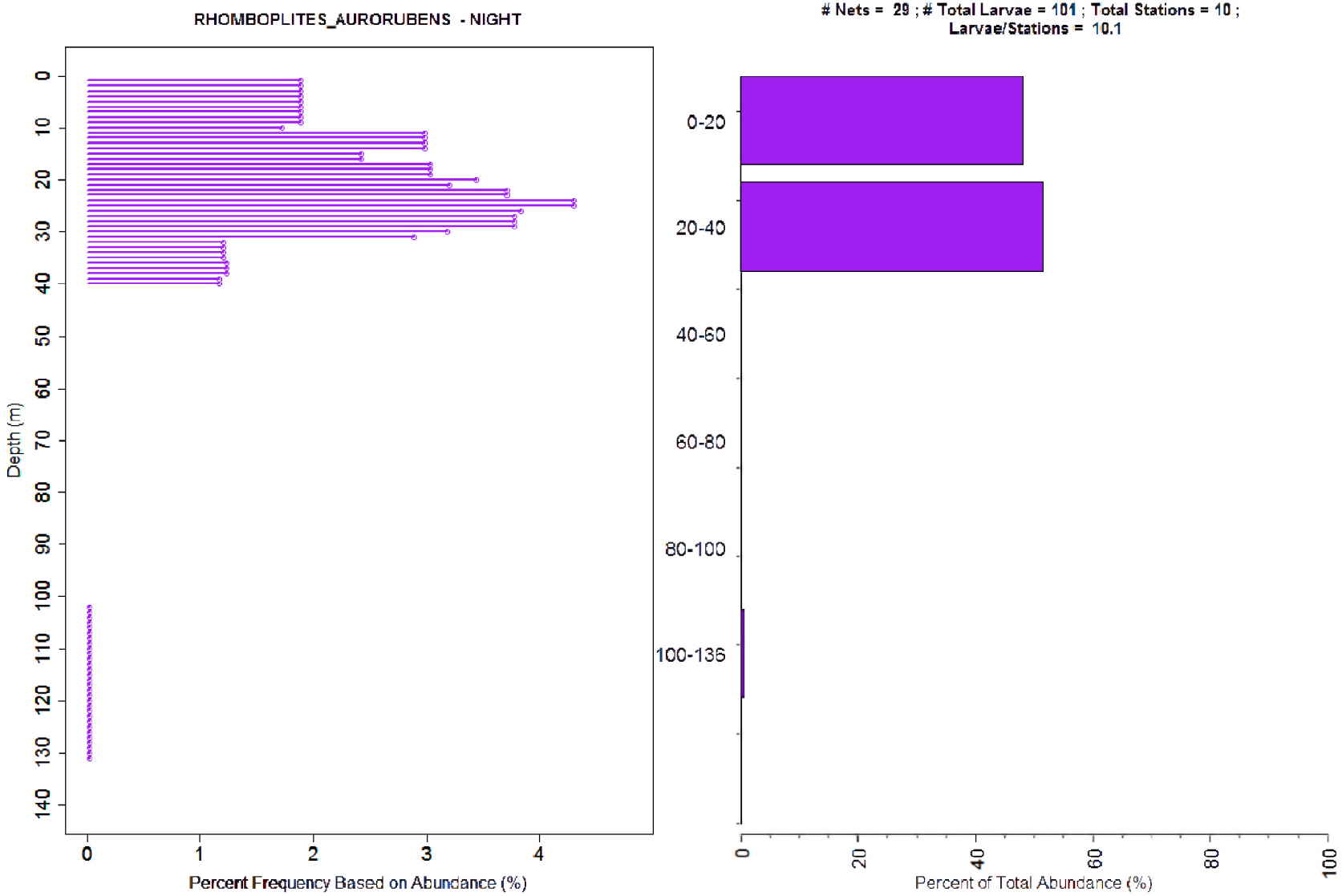
RACHYCENTRON_CANADUM, DAY



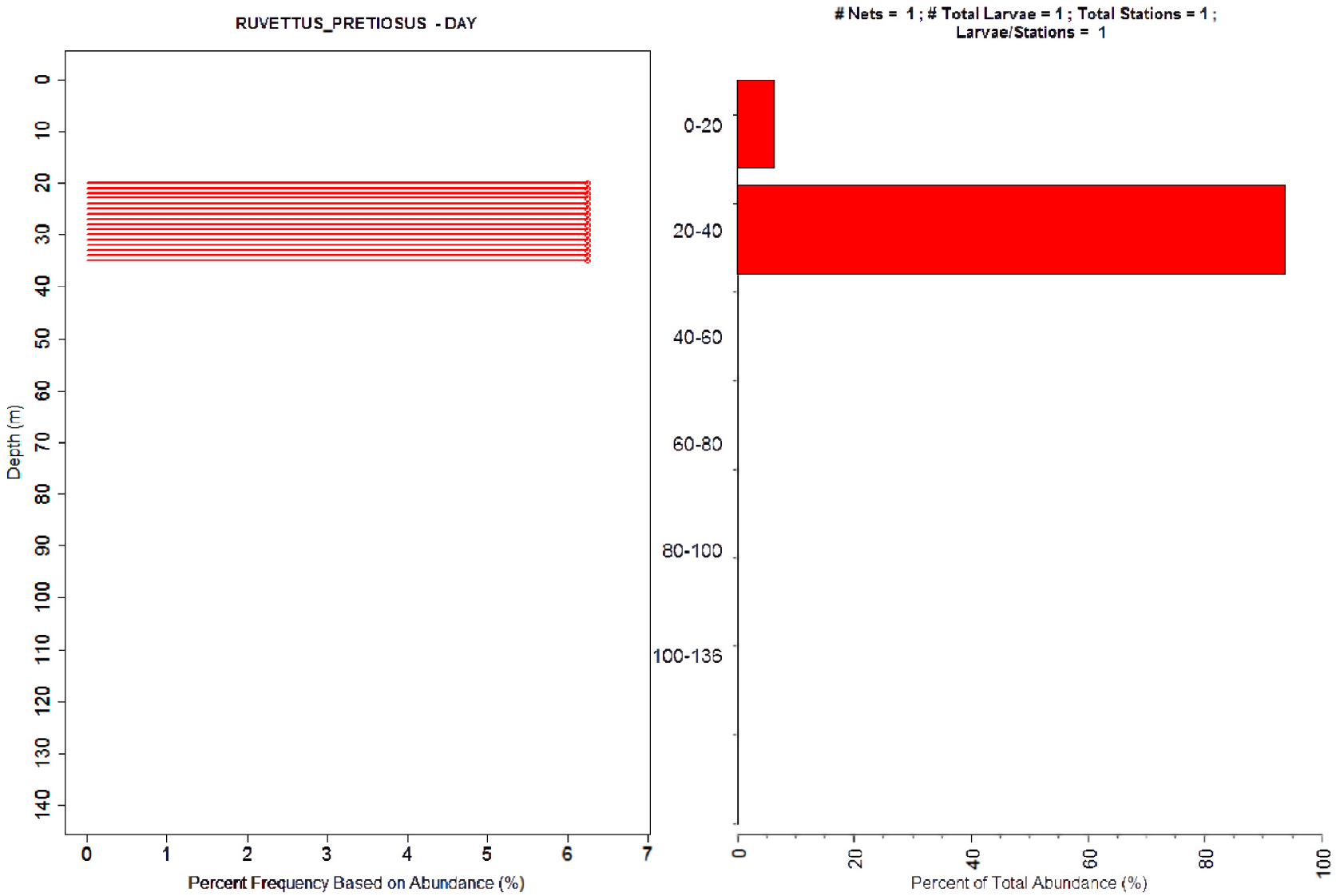
RACHYCENTRON_CANADUM, NIGHT



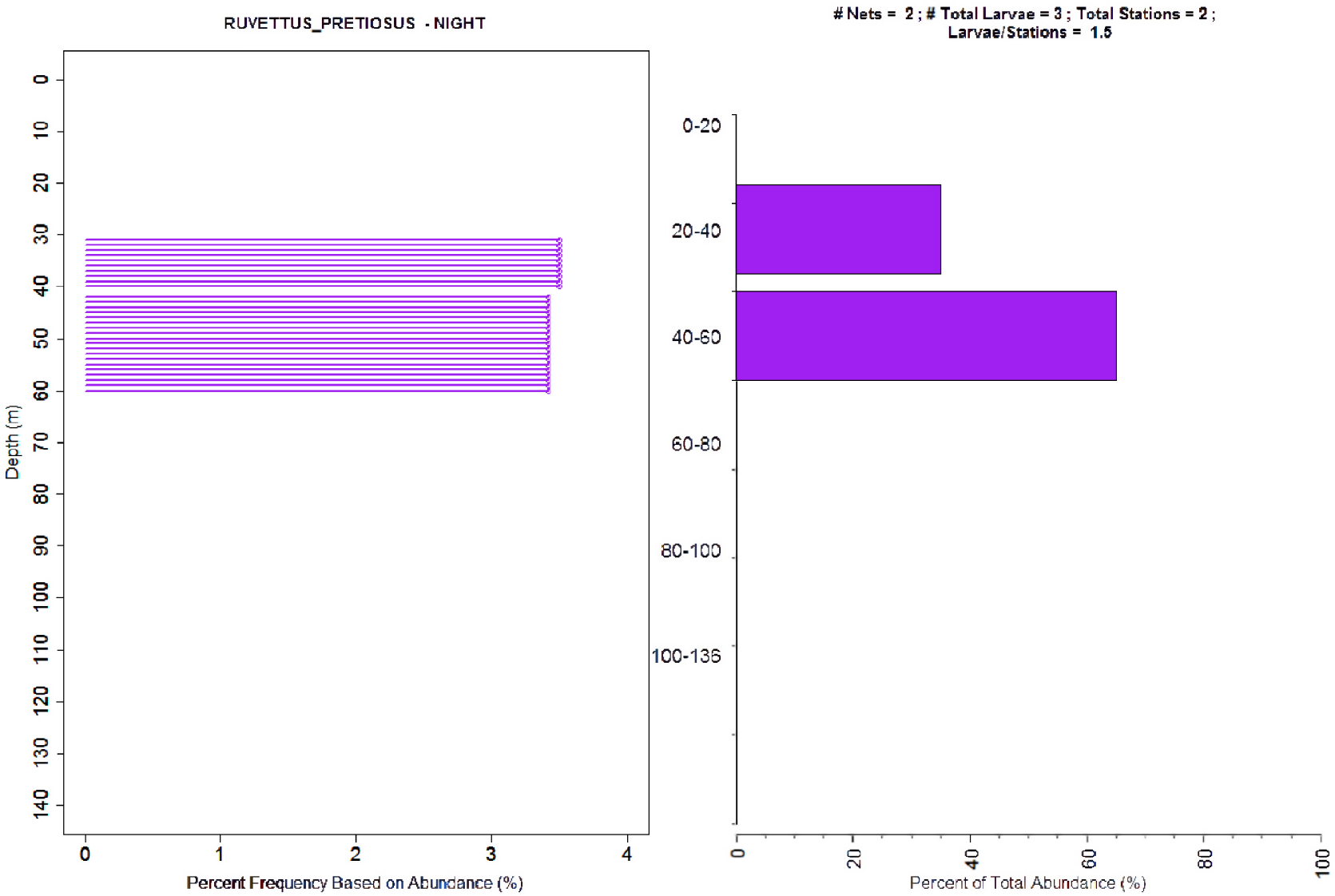
RHOMBOPLITES_AURORUBENS, DAY



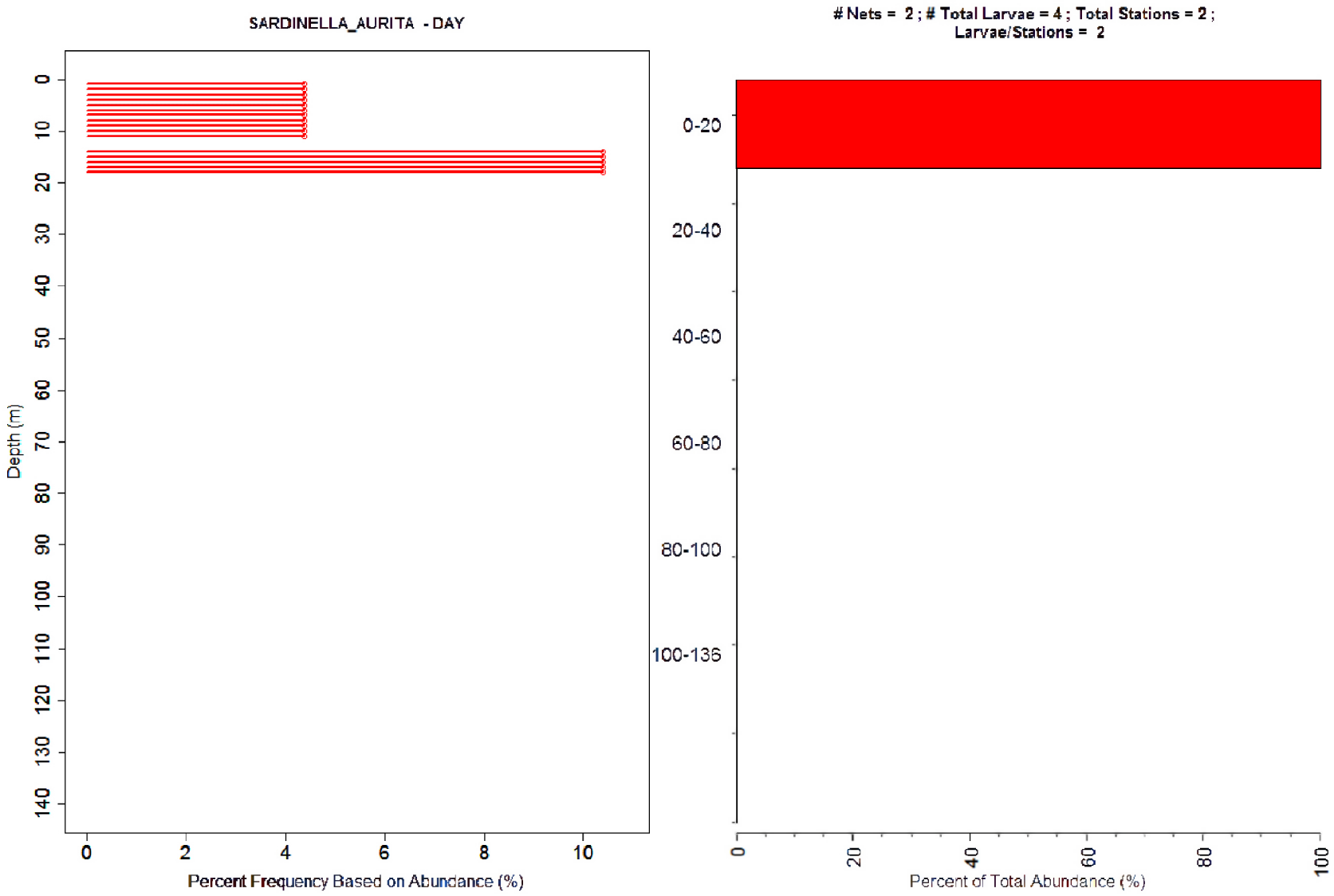
RHOMBOPLITES_AURORUBENS, NIGHT



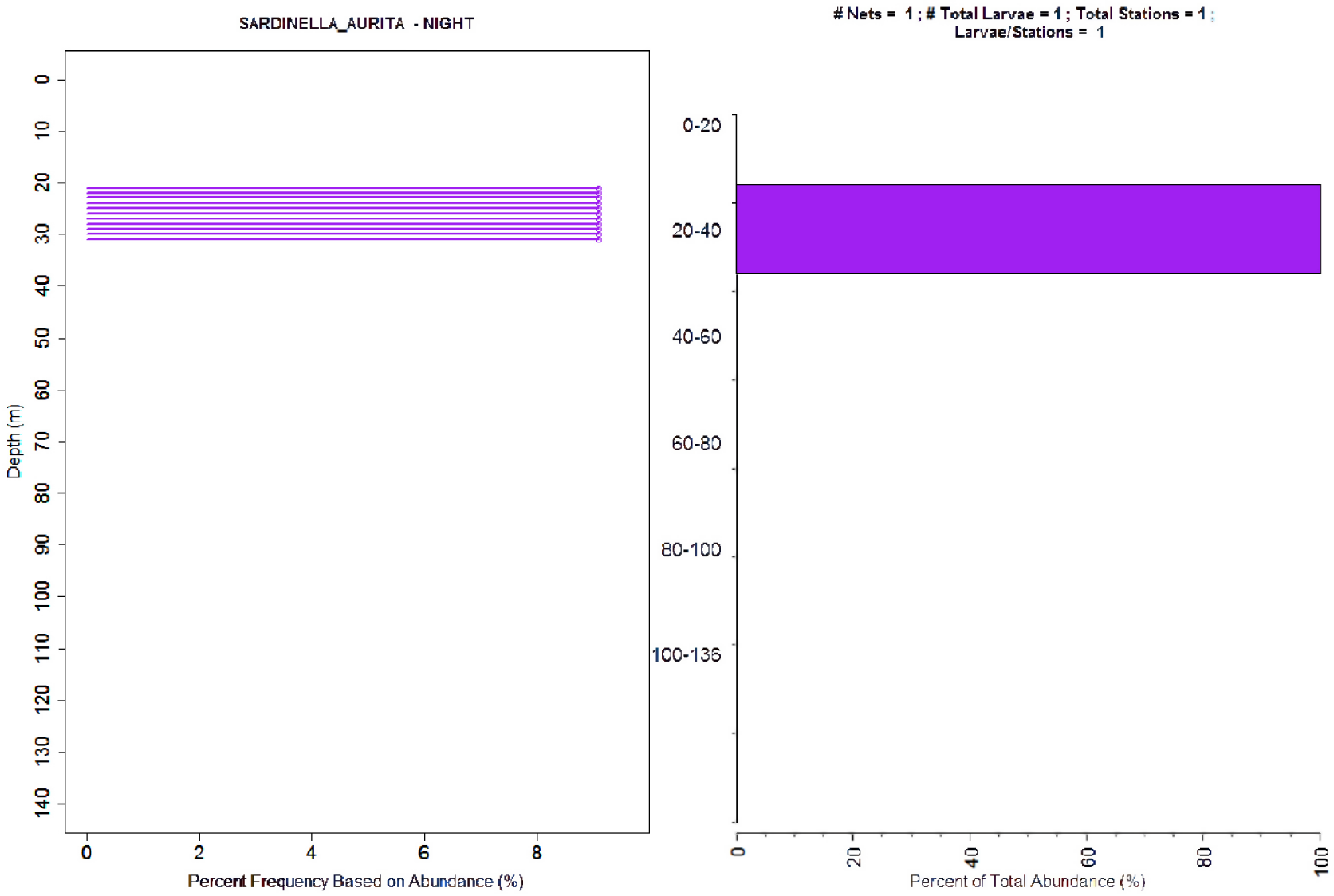
RUVETTUS_PRETIOSUS, DAY



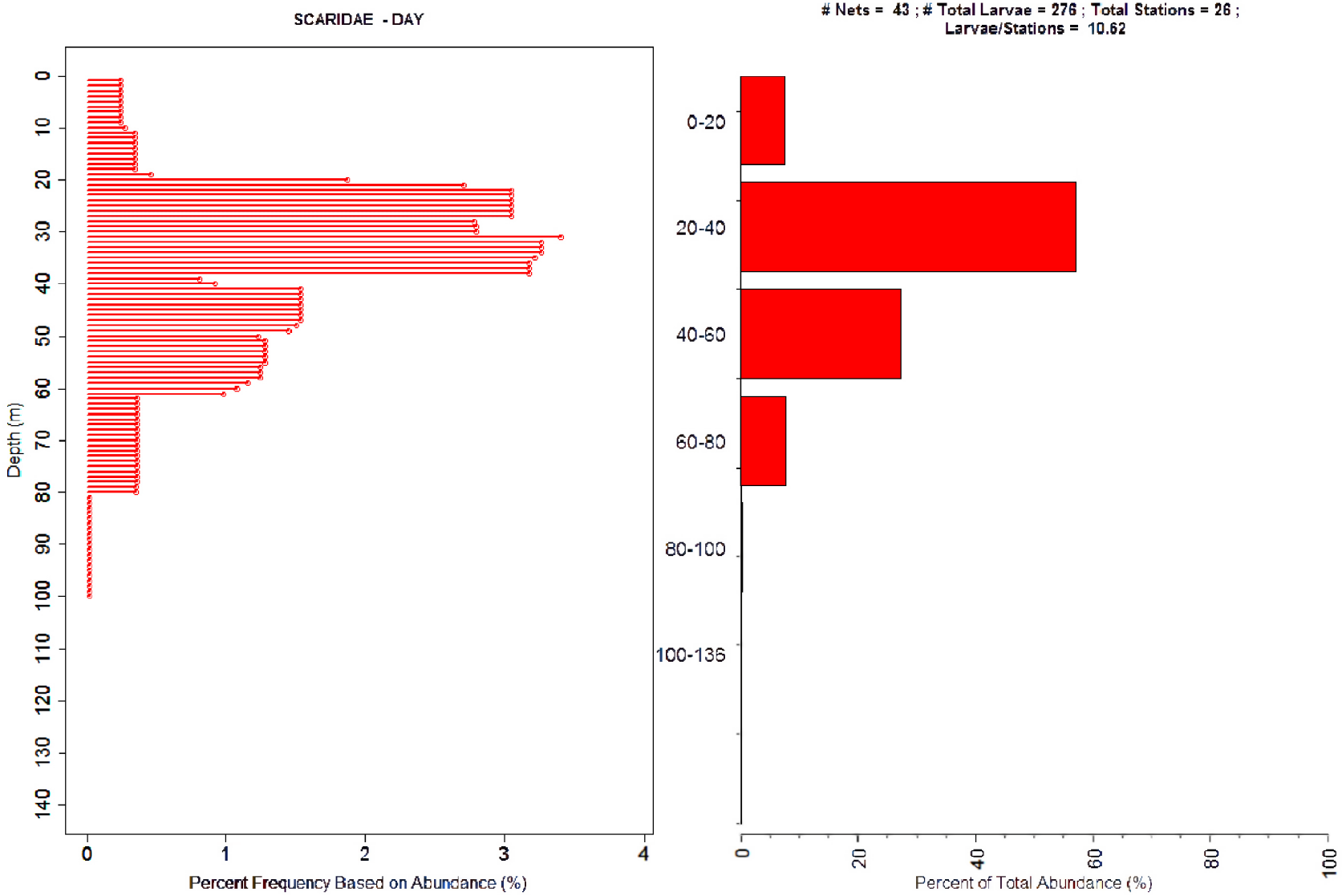
RUVETTUS_PRETIOSUS, NIGHT



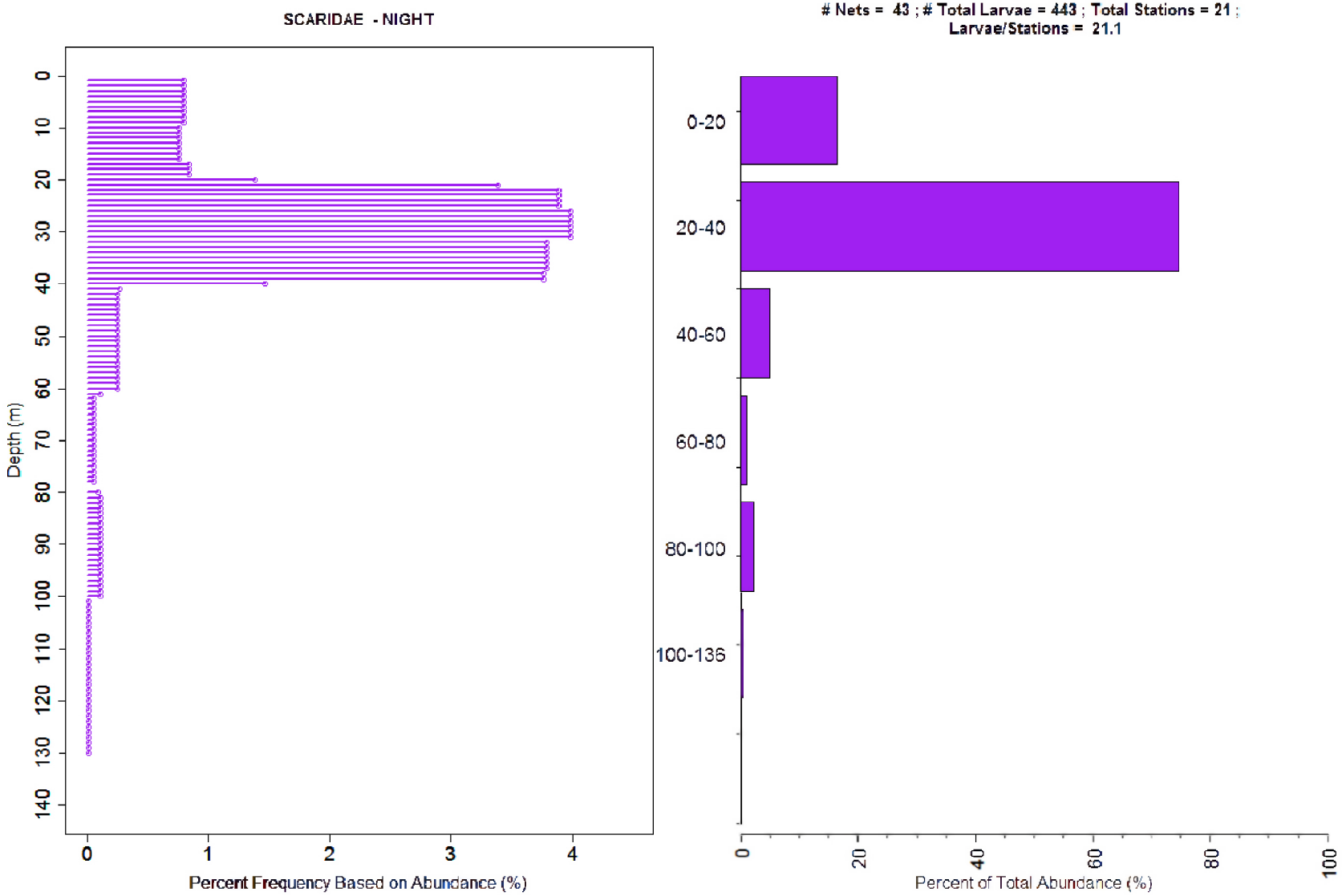
SARDINELLA_AURITA, DAY



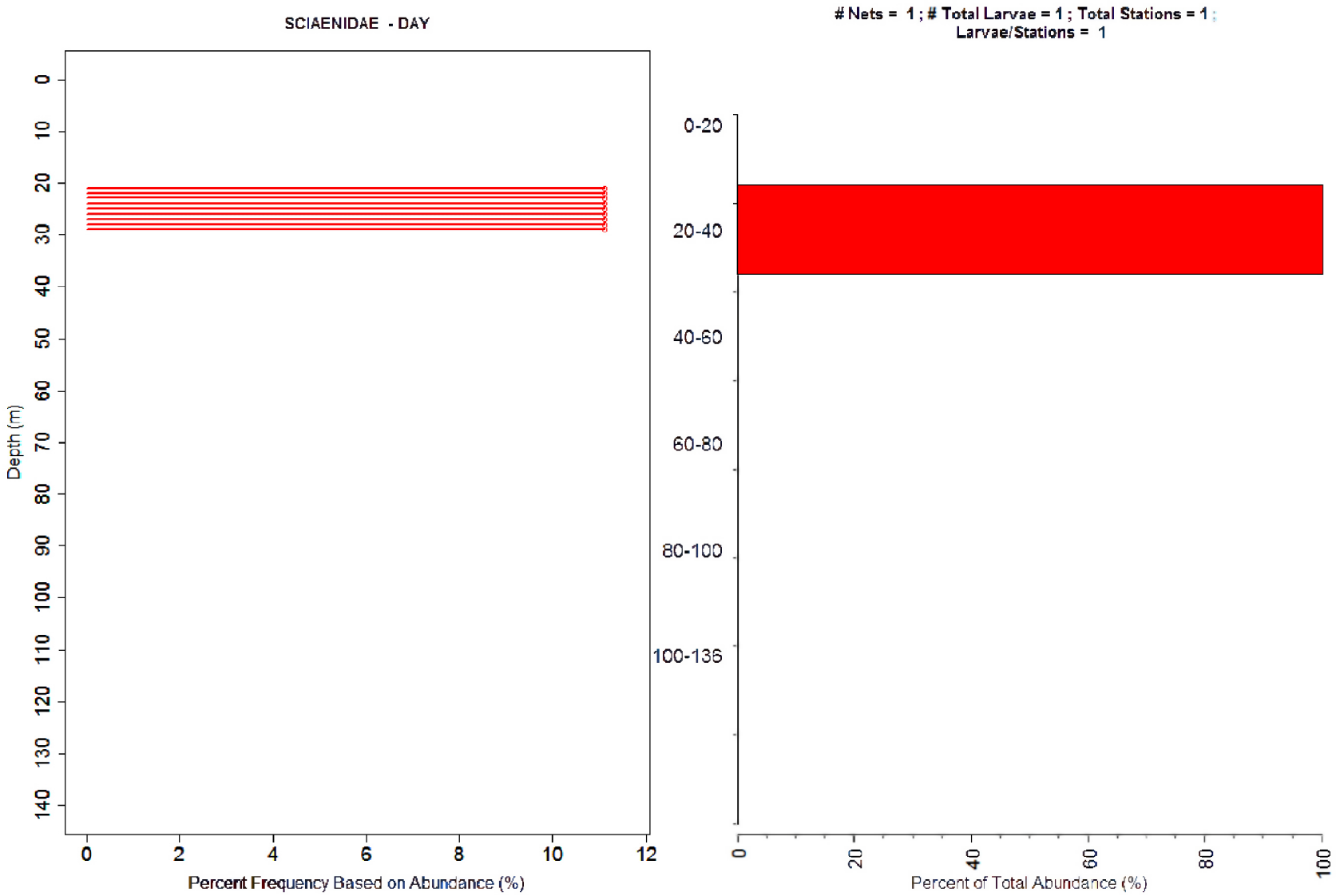
SARDINELLA_AURITA, NIGHT



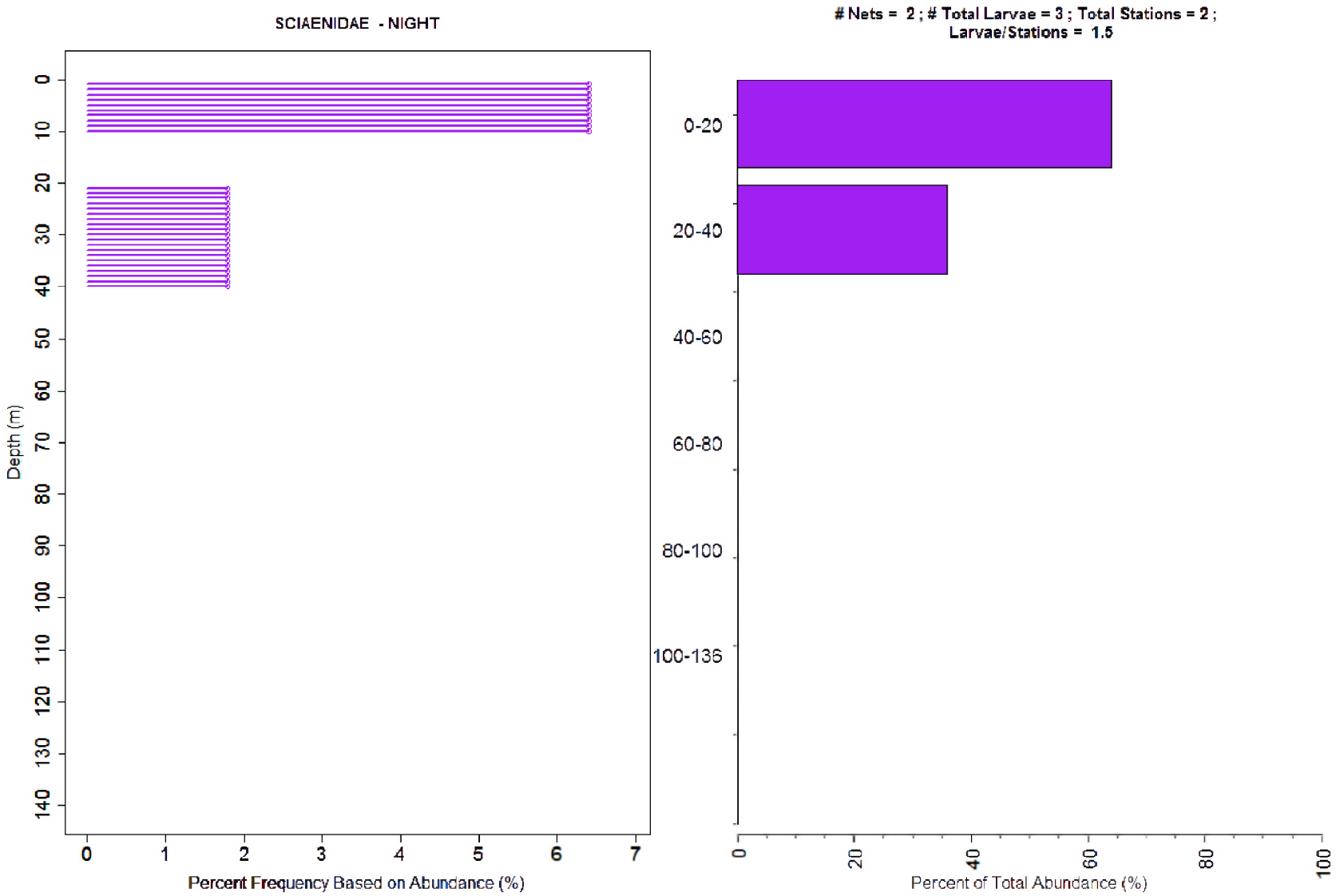
SCARIDAE, DAY



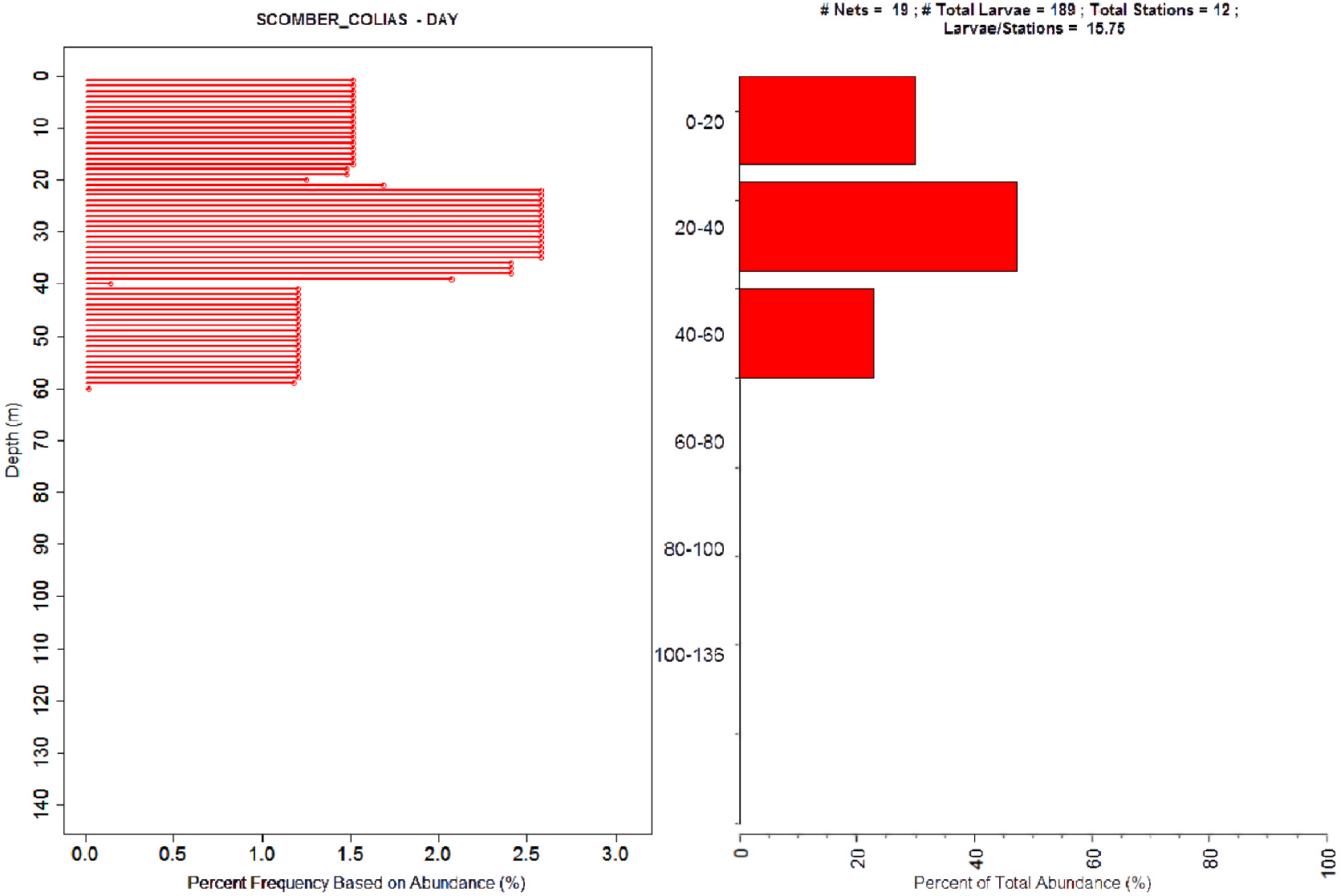
SCARIDAE, NIGHT



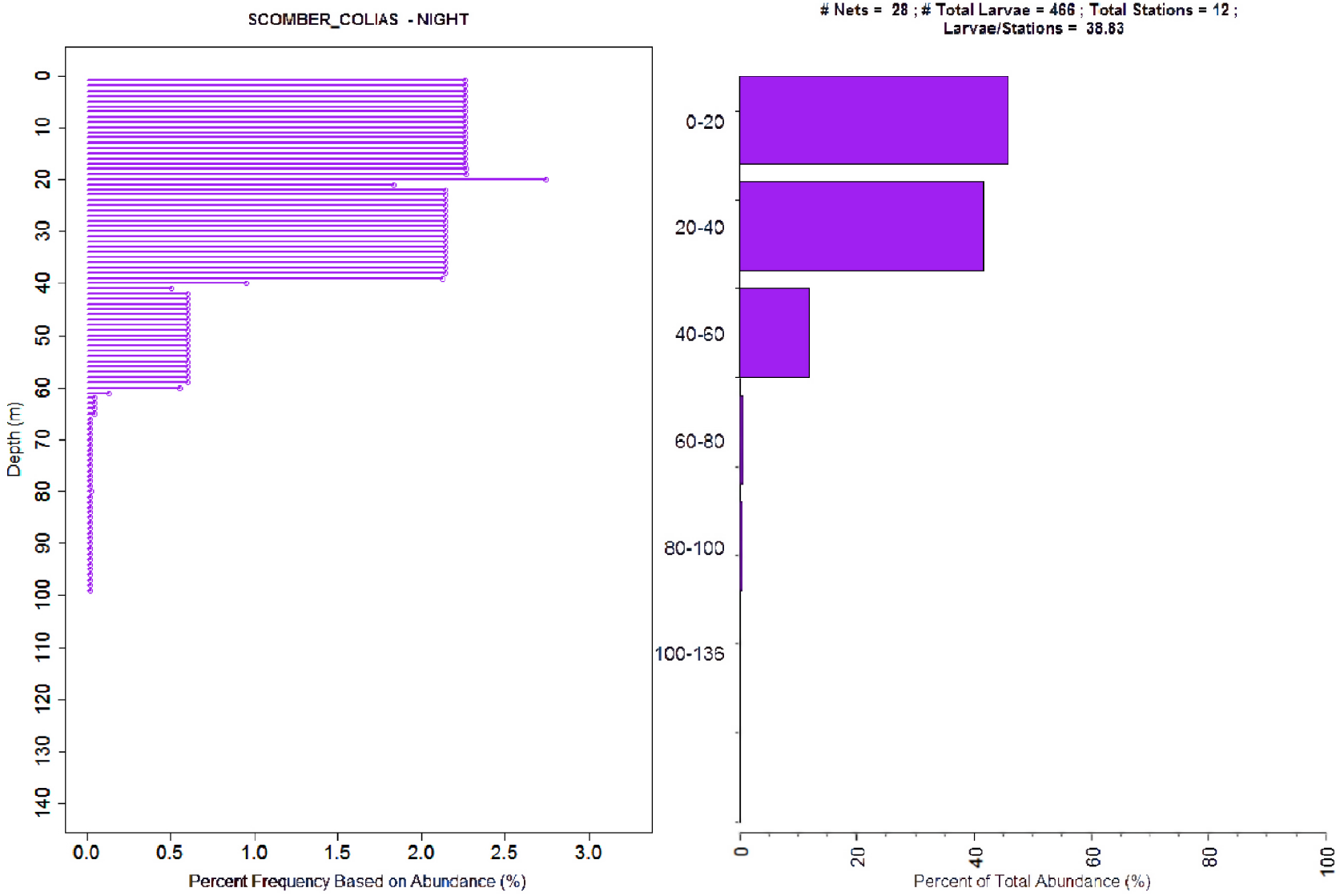
SCIAENIDAE, DAY



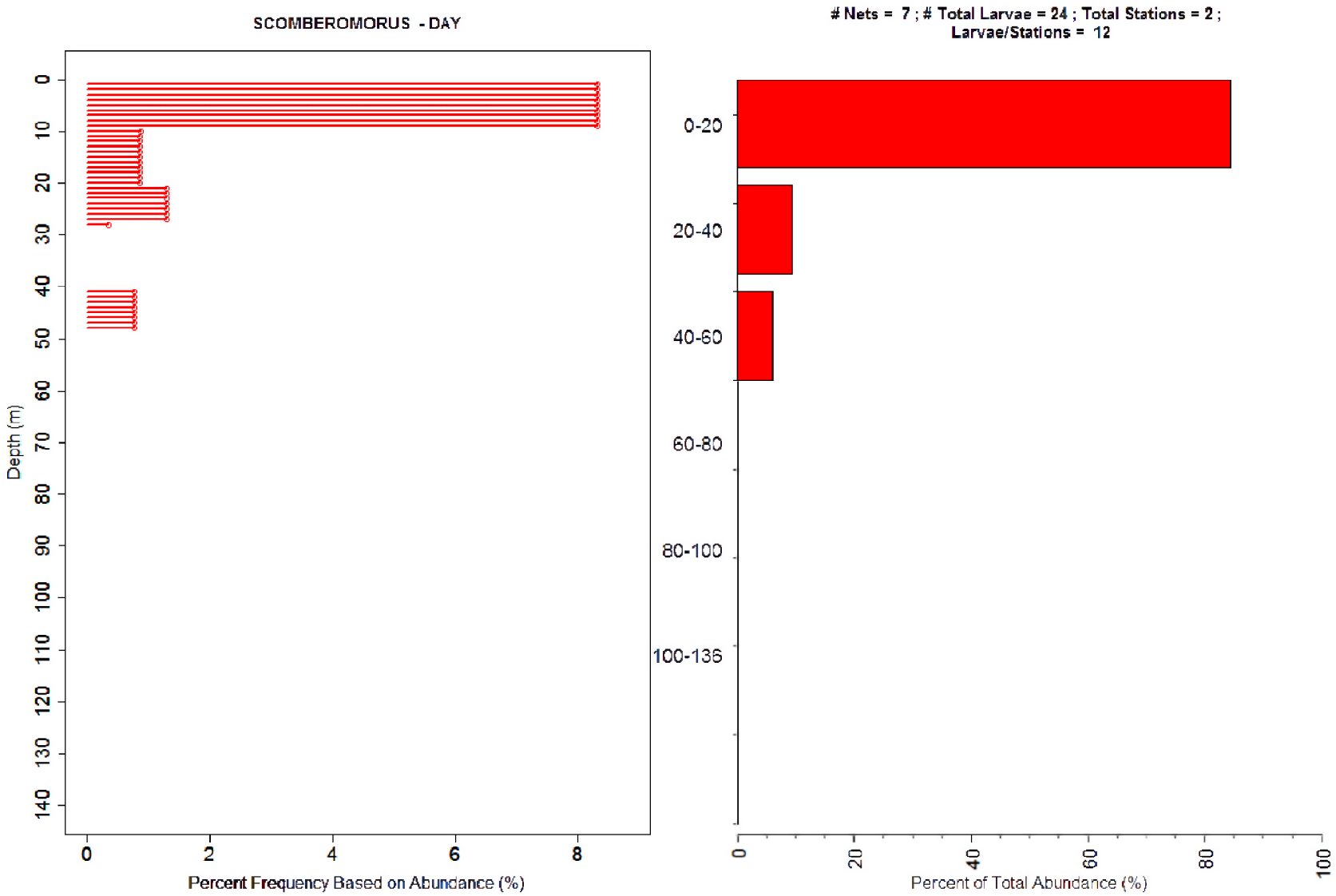
SCIAENIDAE, NIGHT



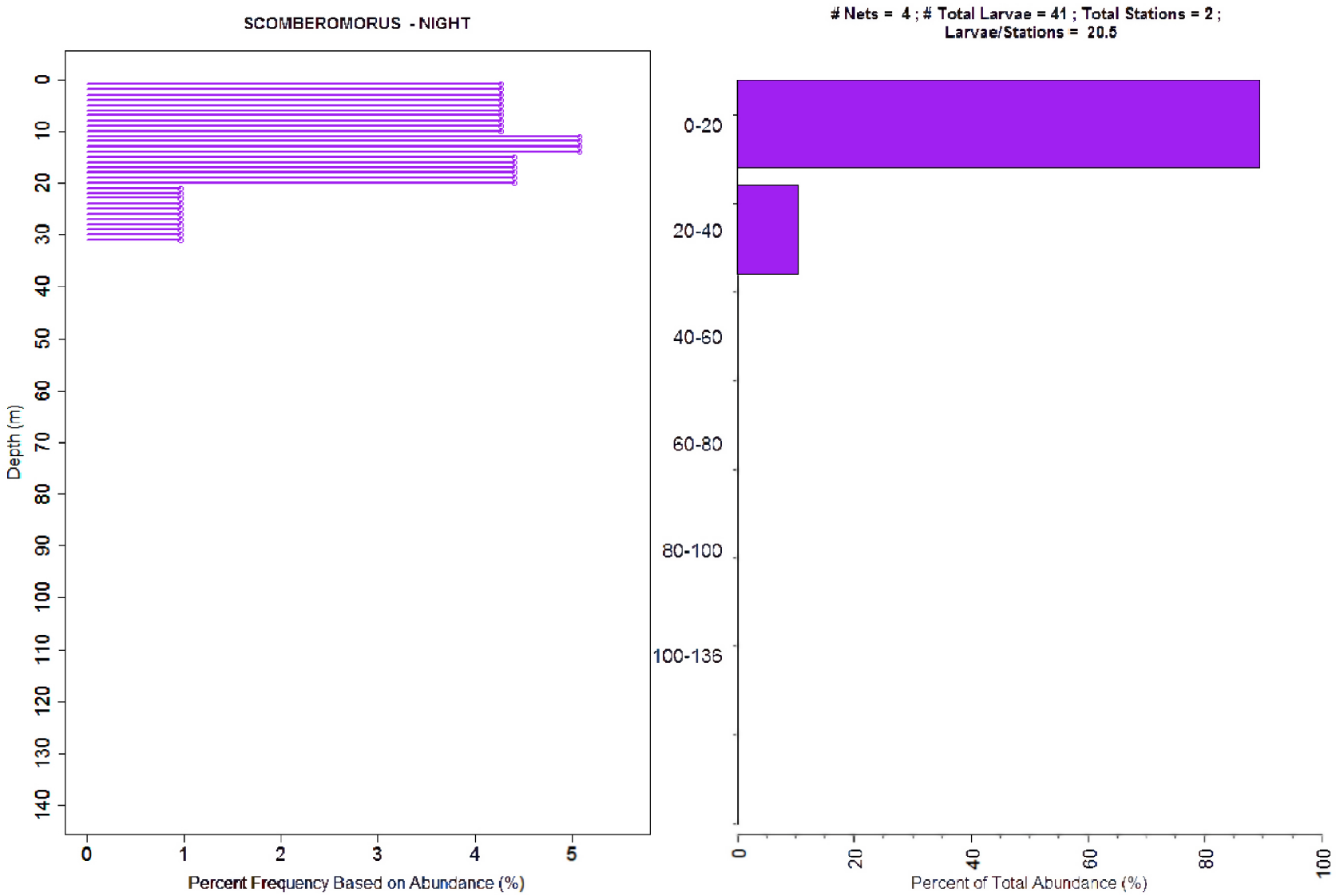
SCOMBER_COLIAS, DAY



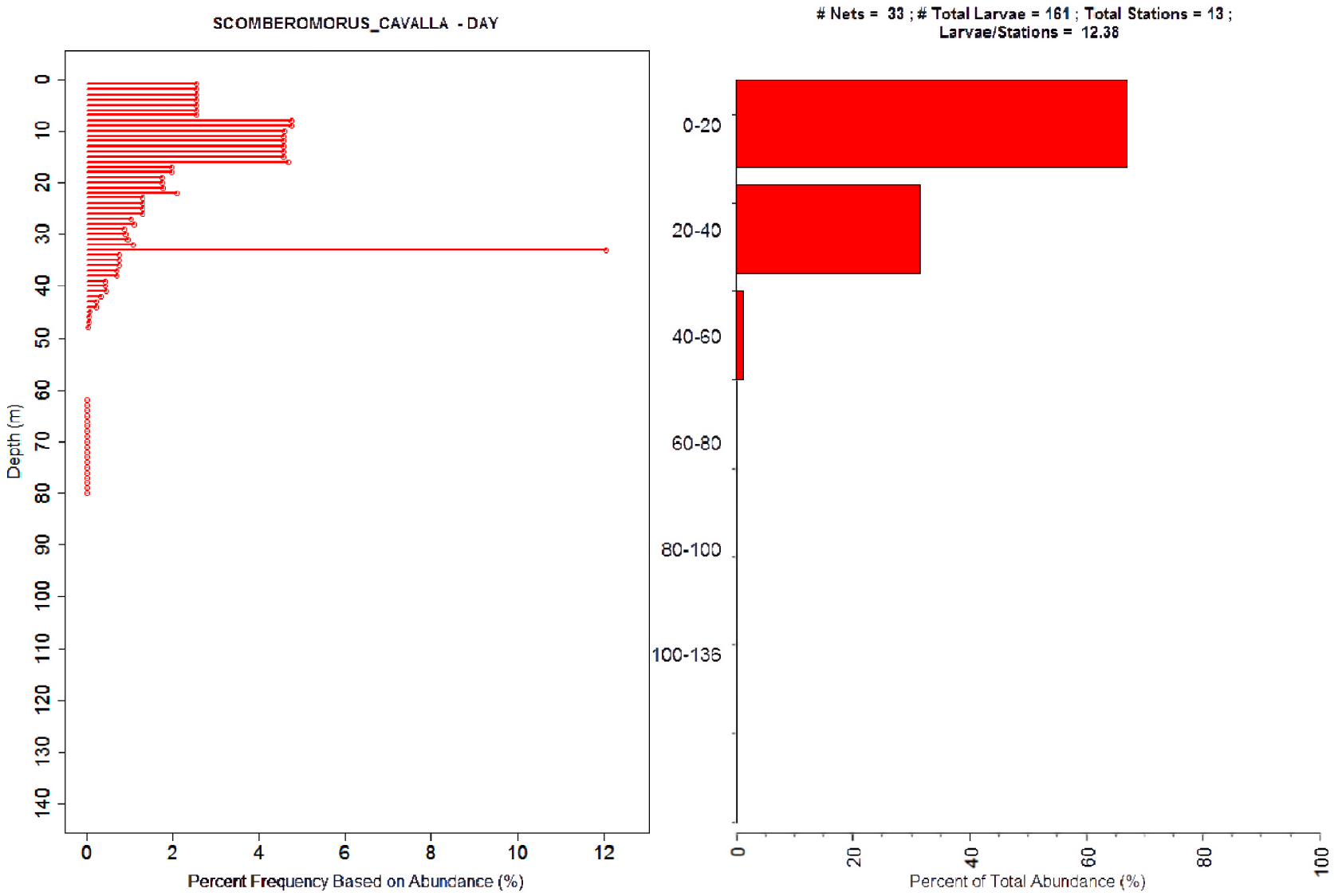
SCOMBER_COLIAS, NIGHT



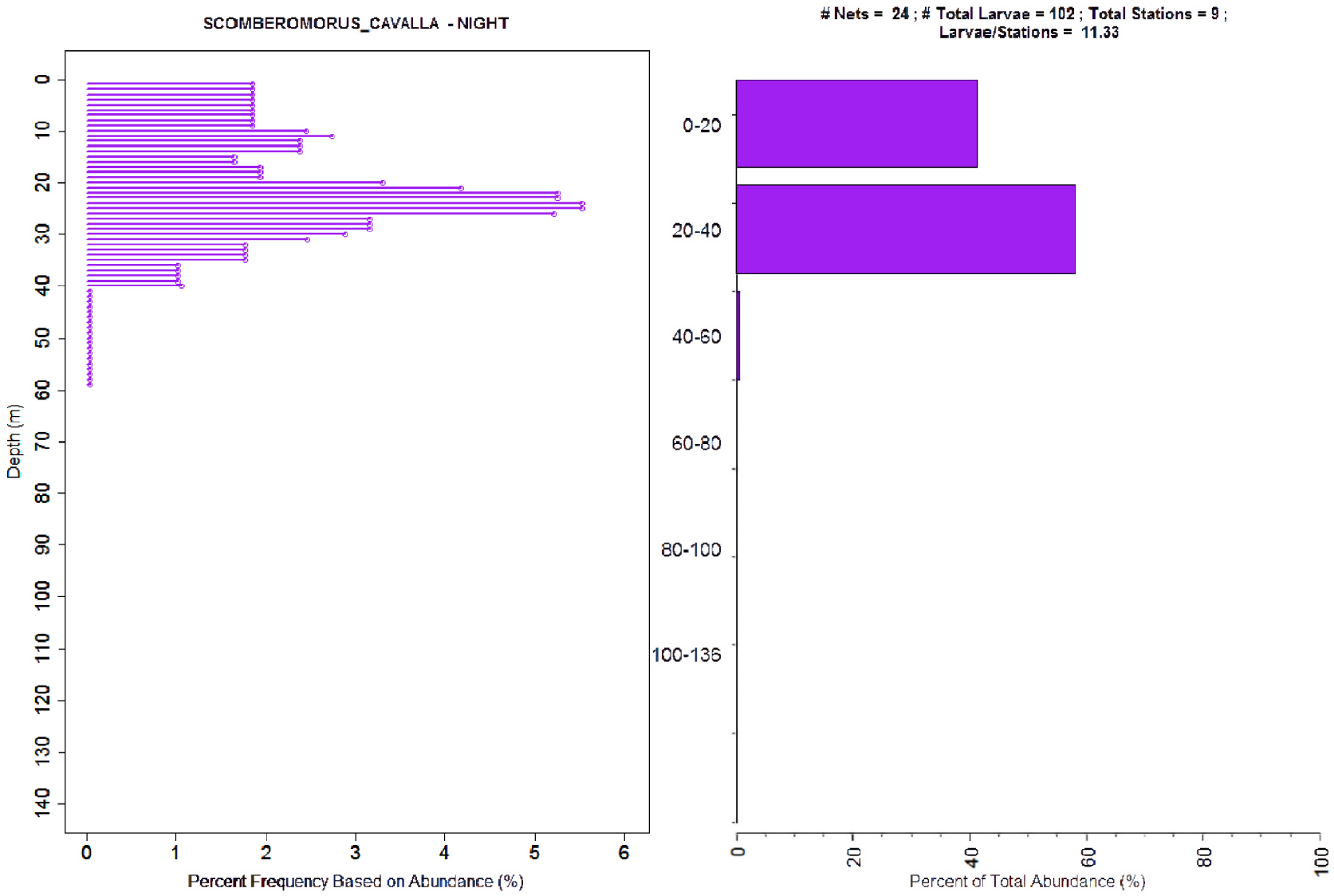
SCOMBEROMORUS, DAY



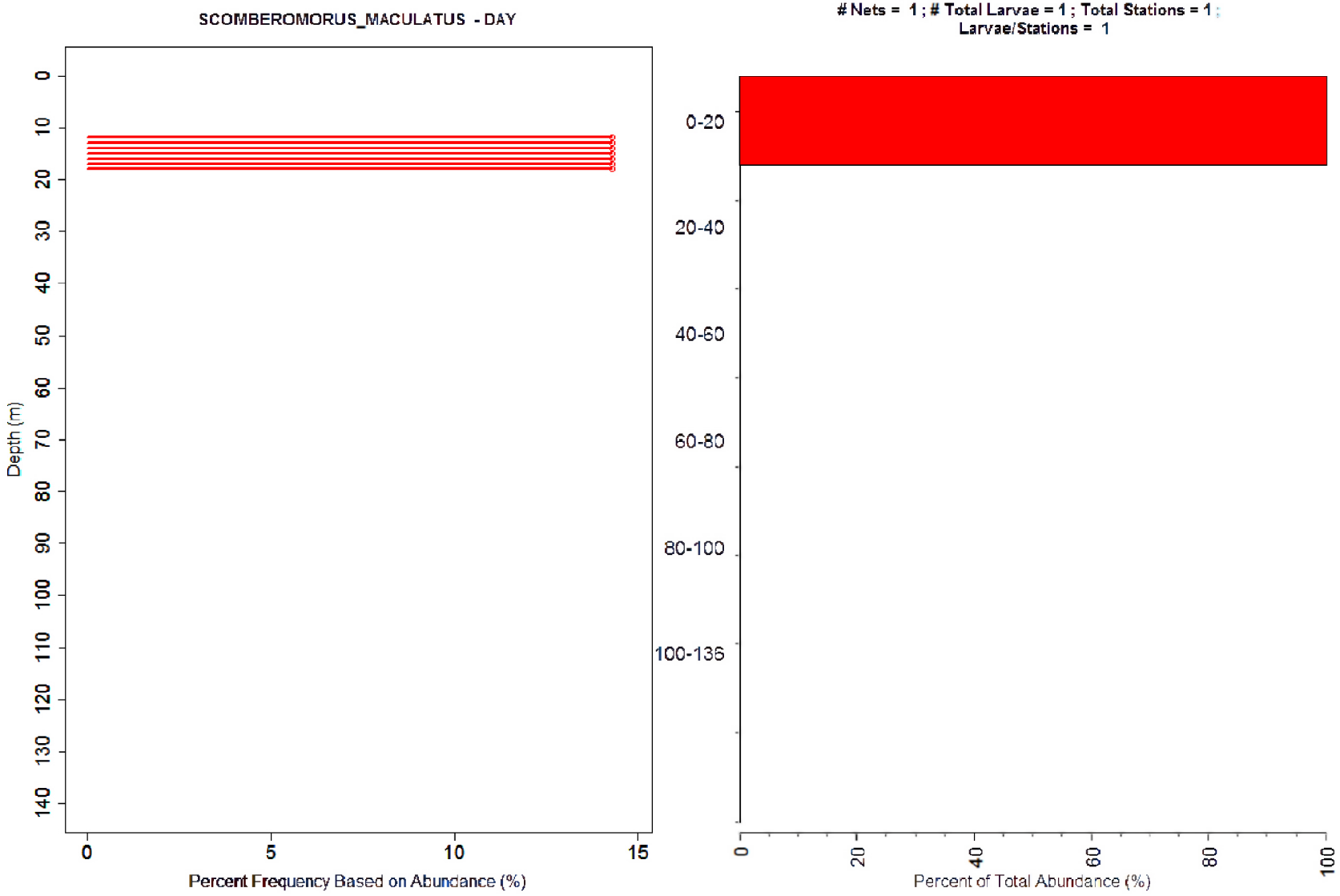
SCOMBEROMORUS, NIGHT



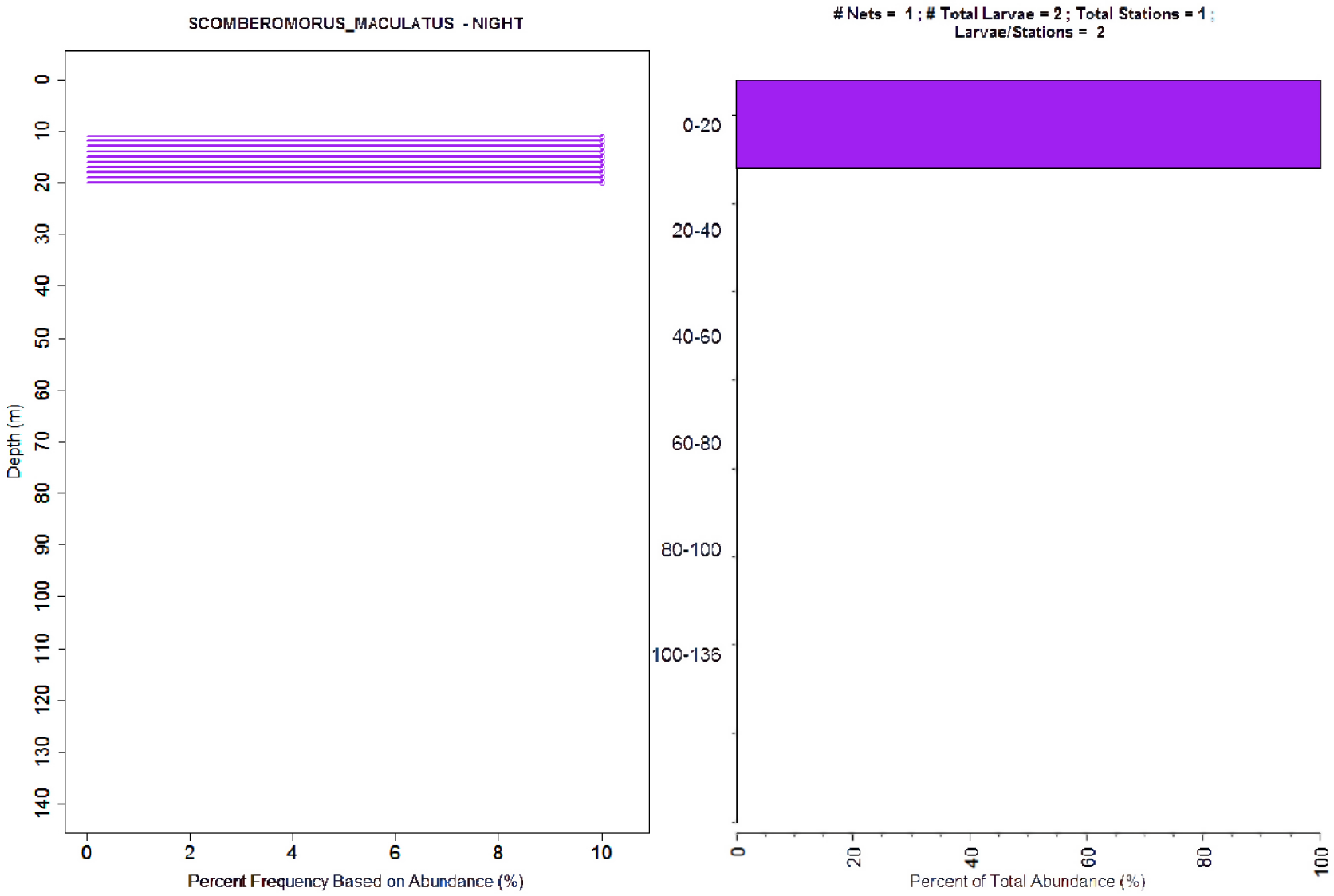
SCOMBEROMORUS_CAVALLA, DAY



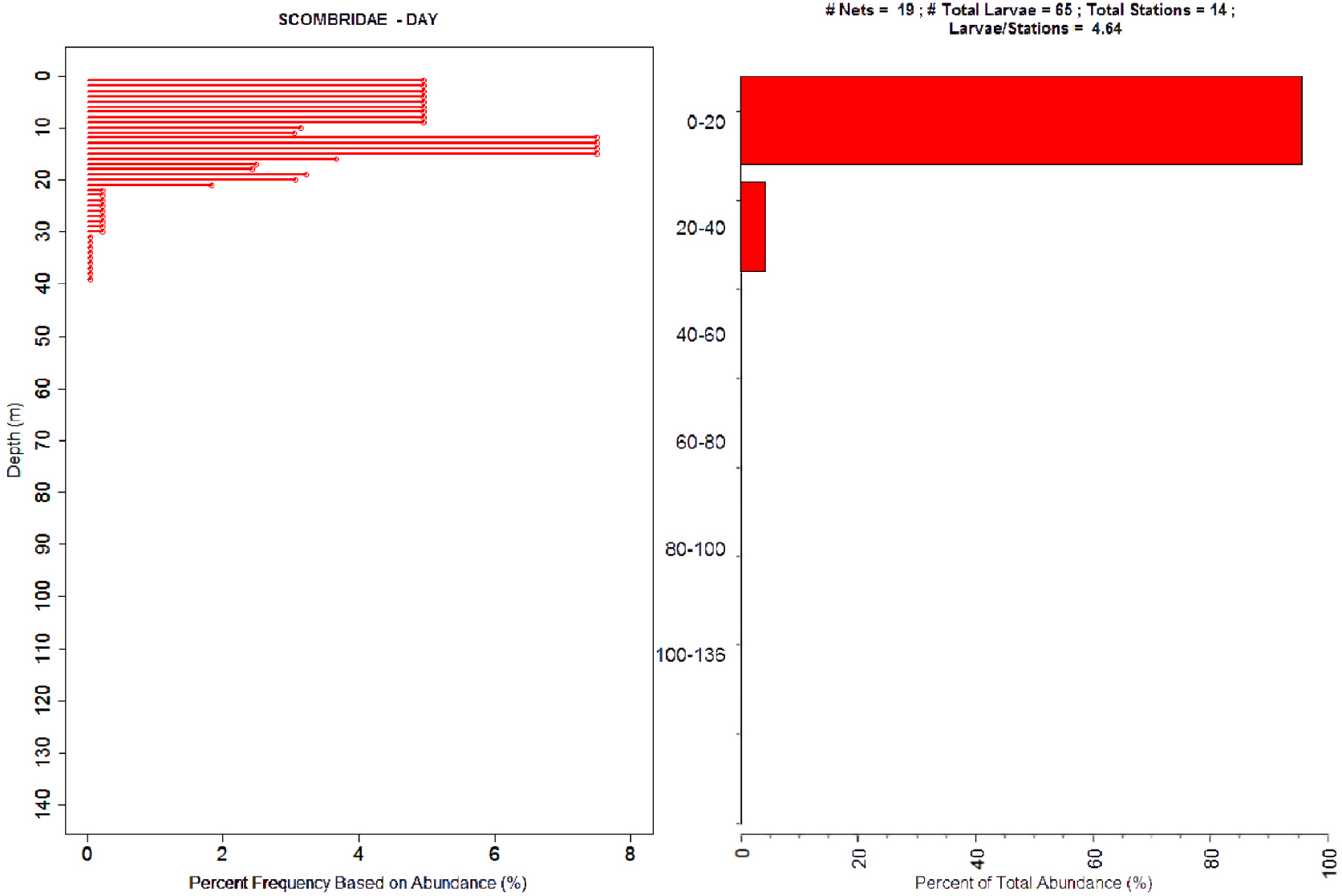
SCOMBEROMORUS_CAVALLA, NIGHT



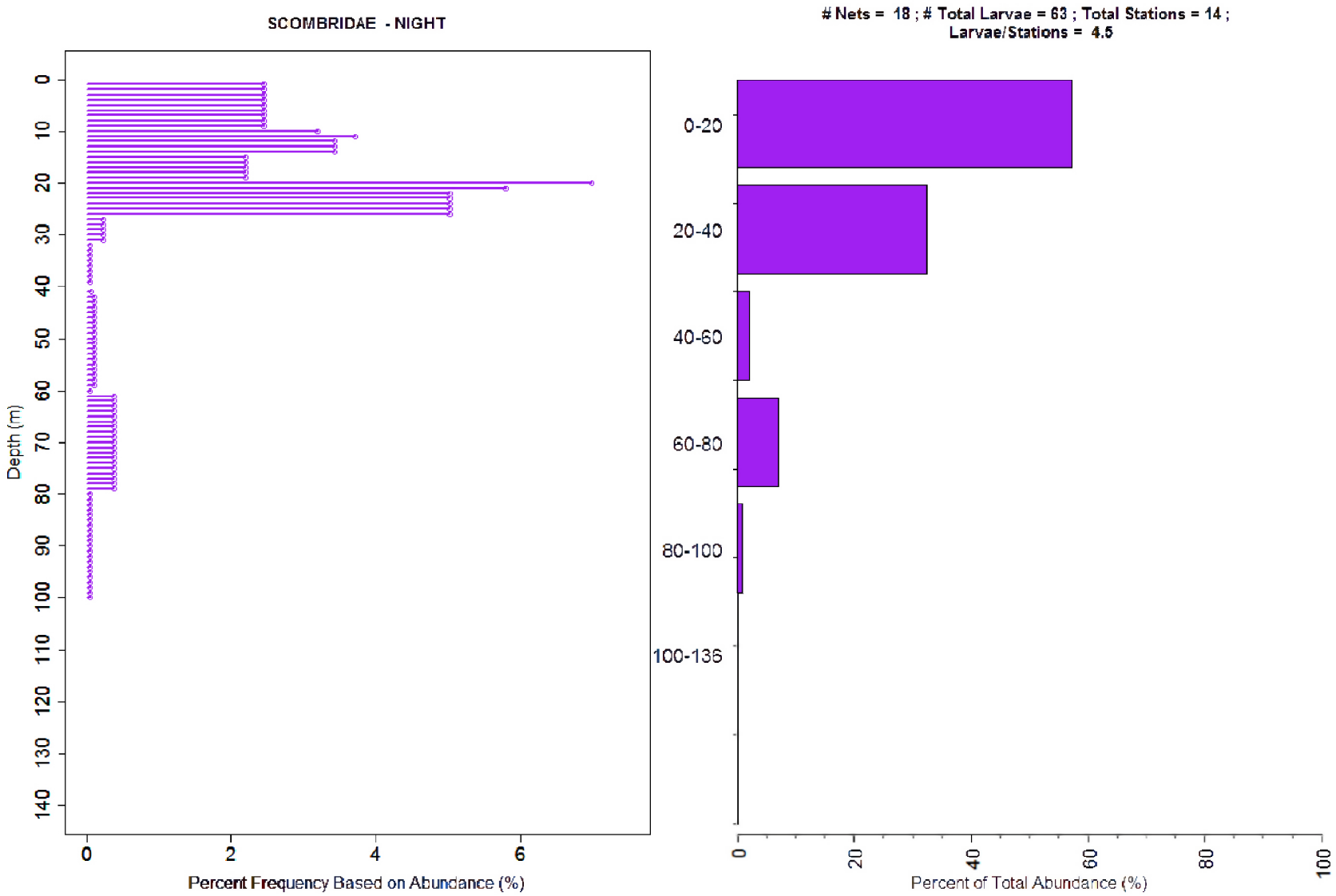
SCOMBEROMORUS_MACULATUS, DAY



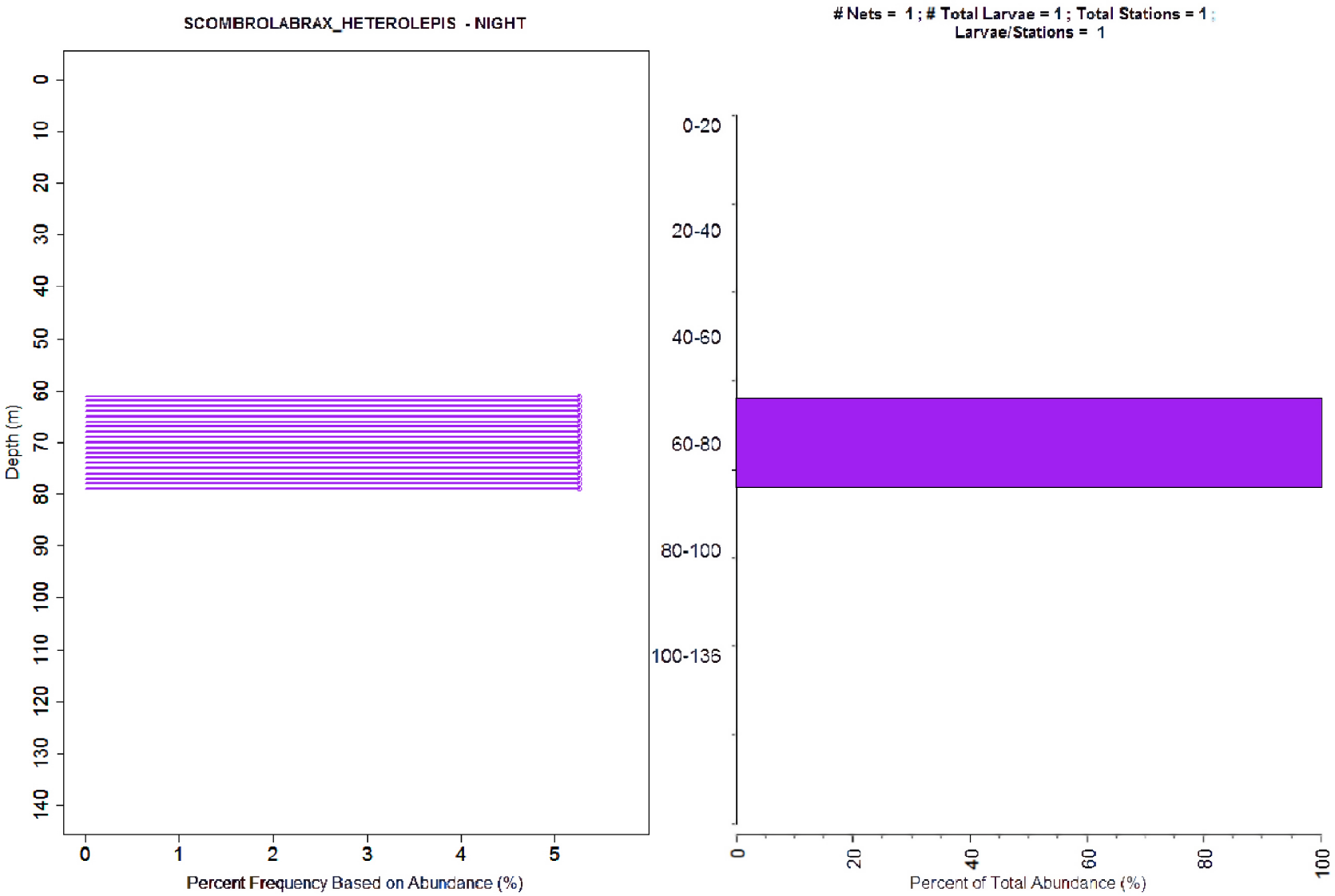
SCOMBEROMORUS_MACULATUS, NIGHT



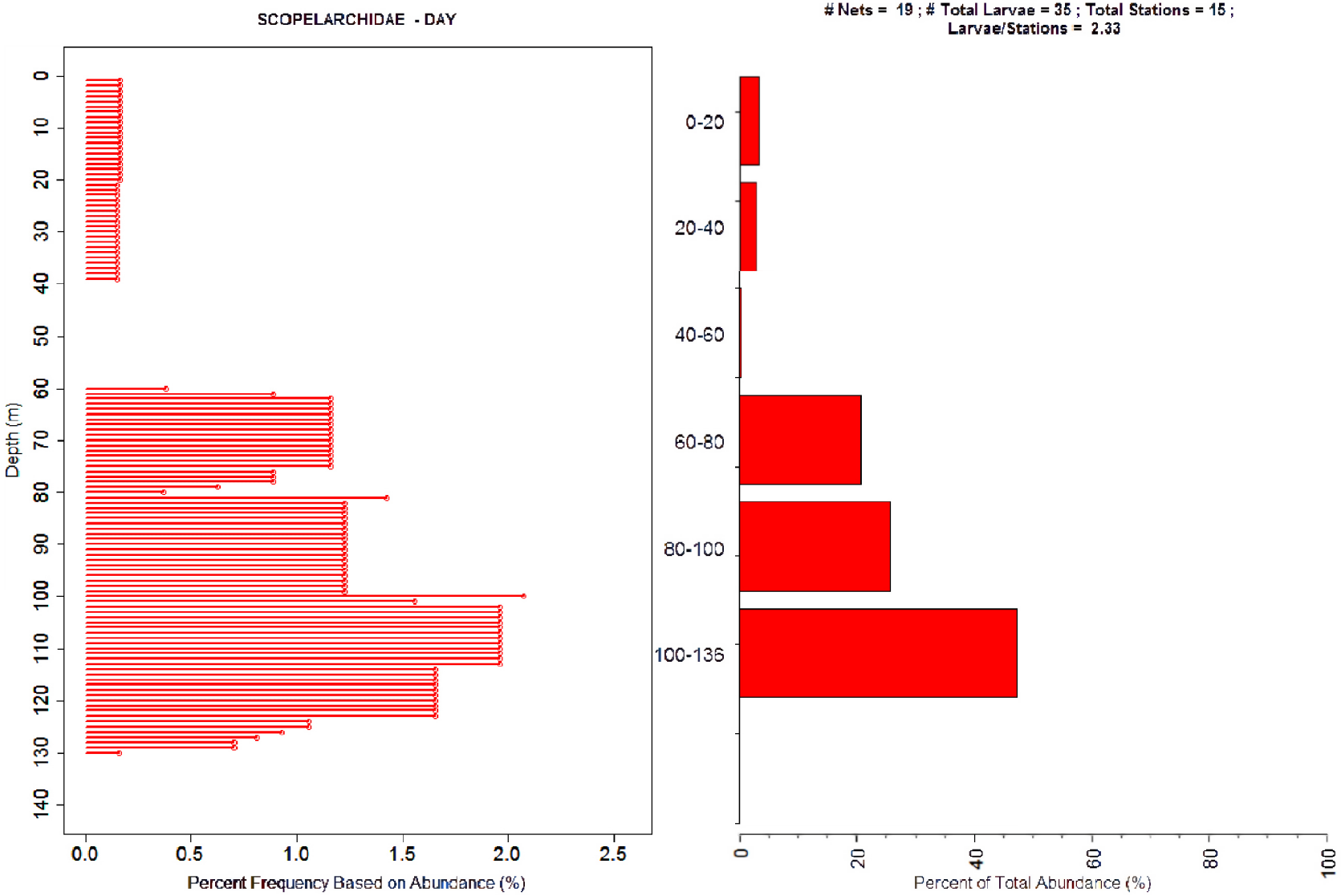
SCOMBRIDAE, DAY



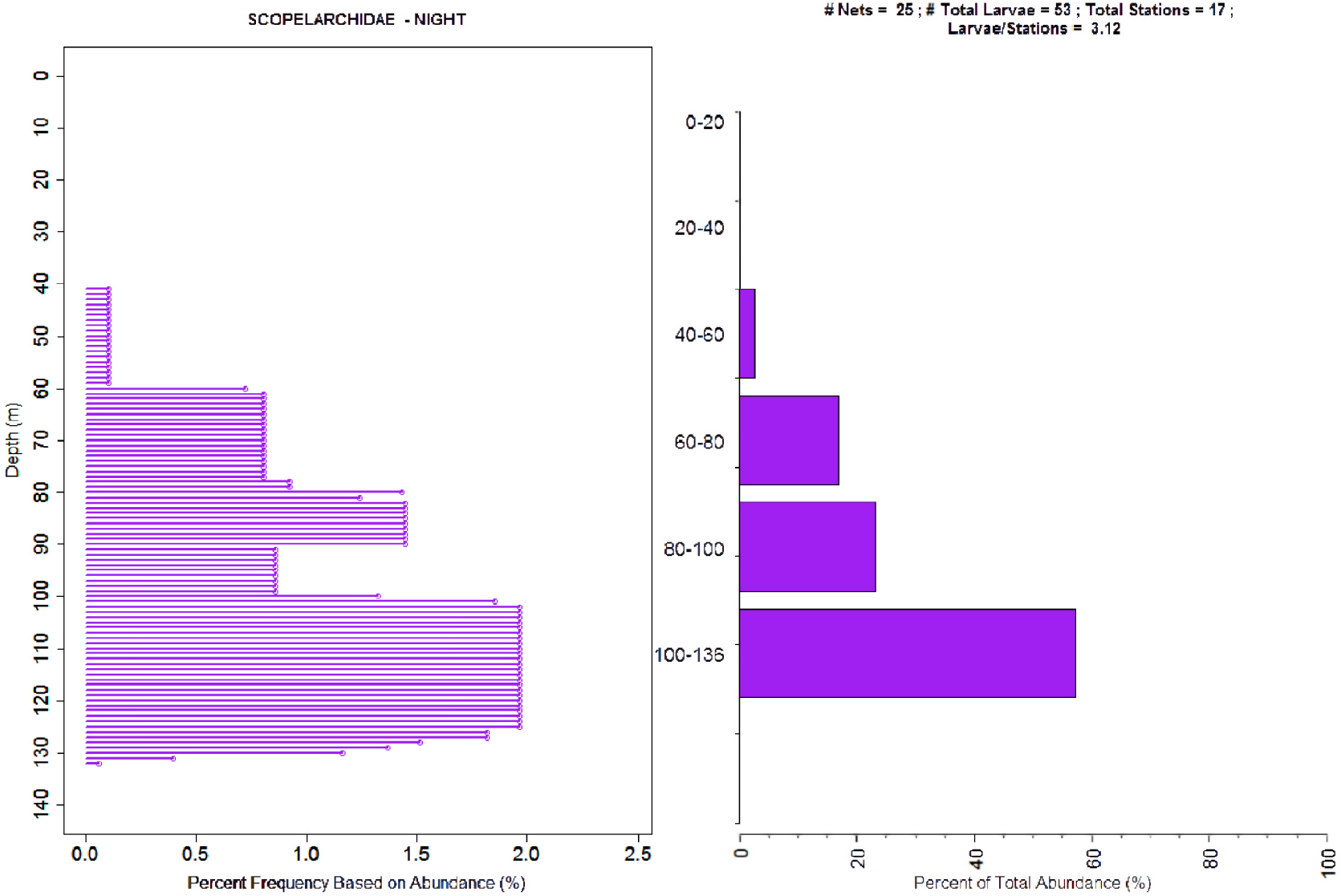
SCOMBRIDAE, NIGHT



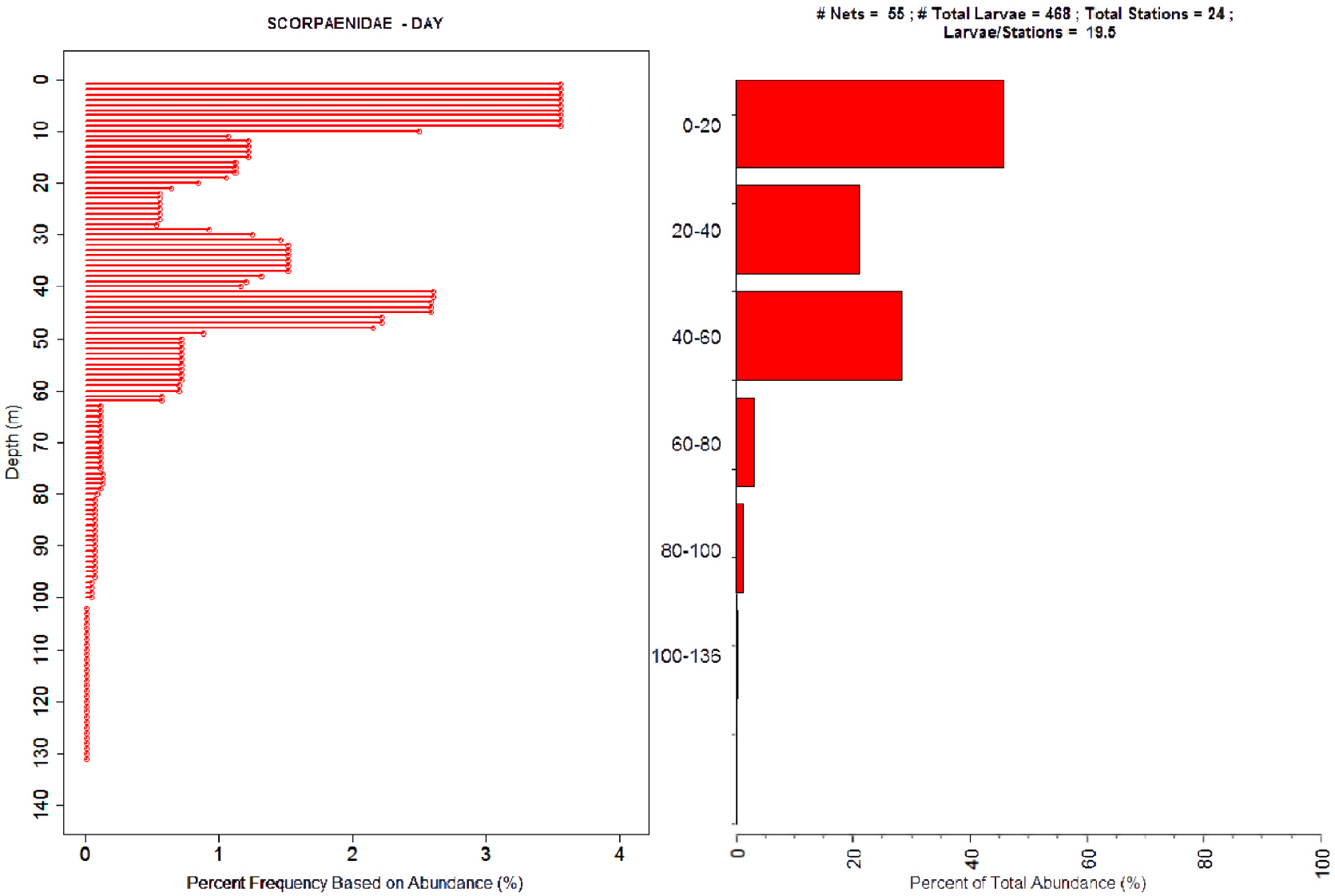
SCOMBROLABRAX_HETEROLEPIS, NIGHT



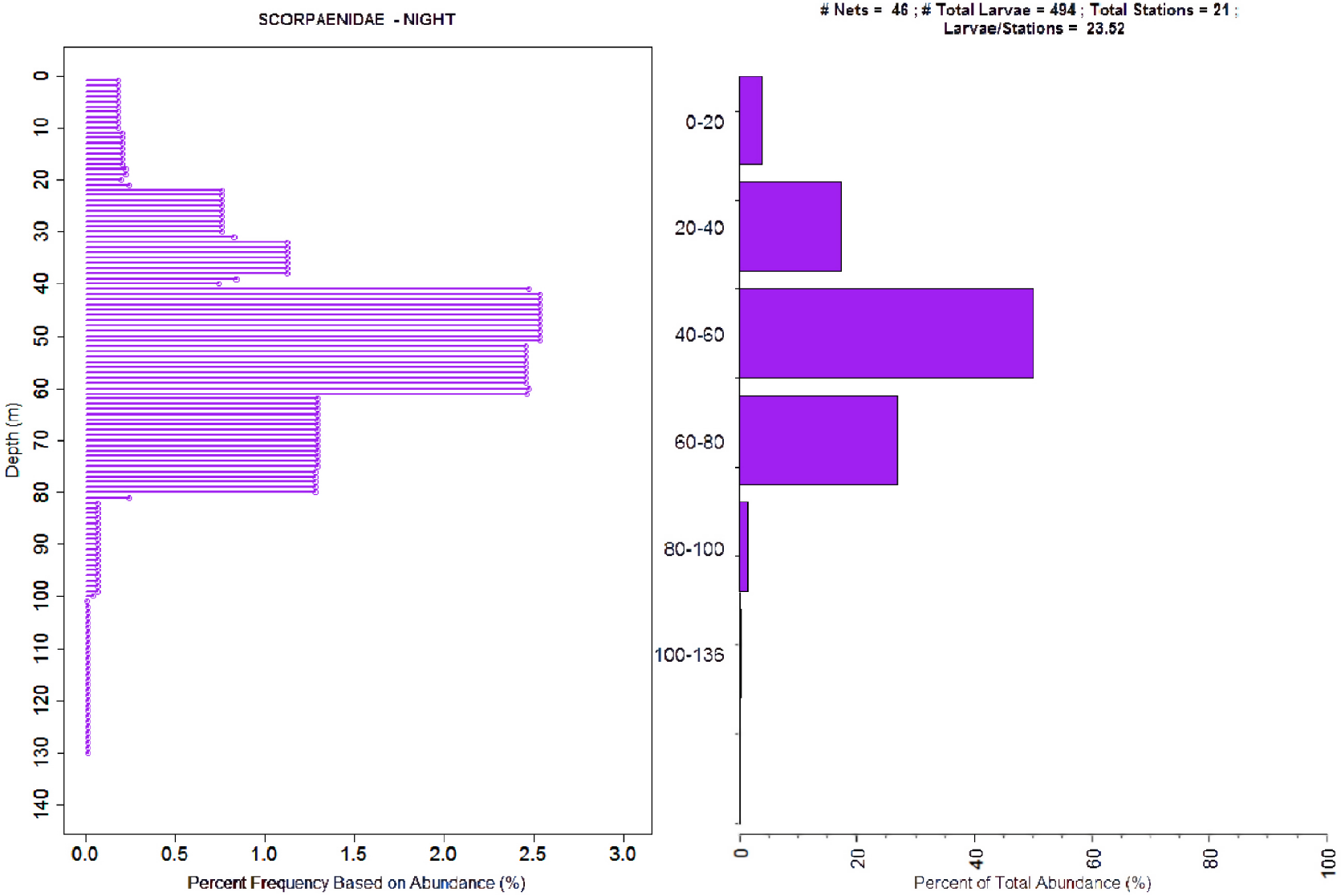
SCOPELARCHIDAE, DAY



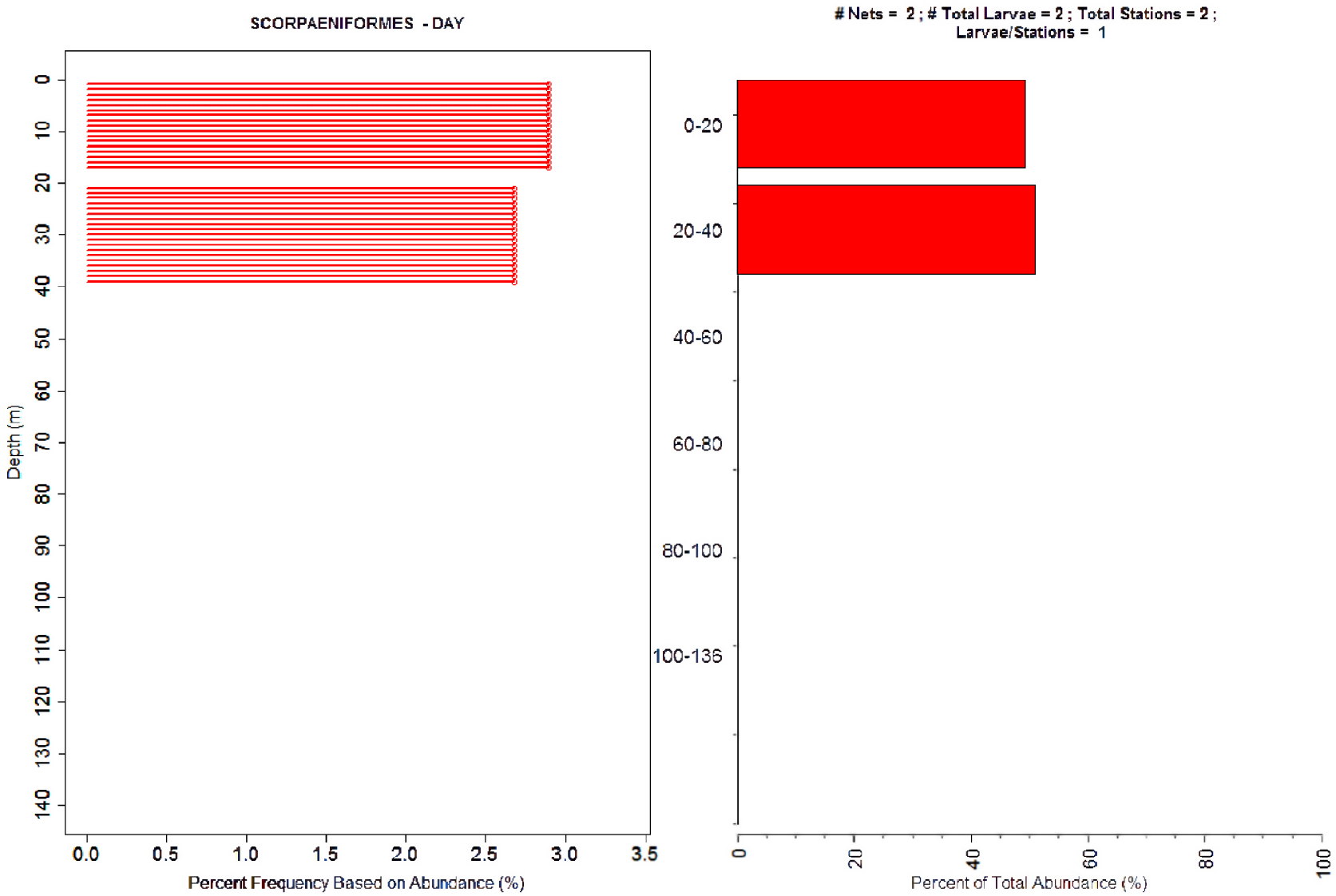
SCOPELARCHIDAE, NIGHT



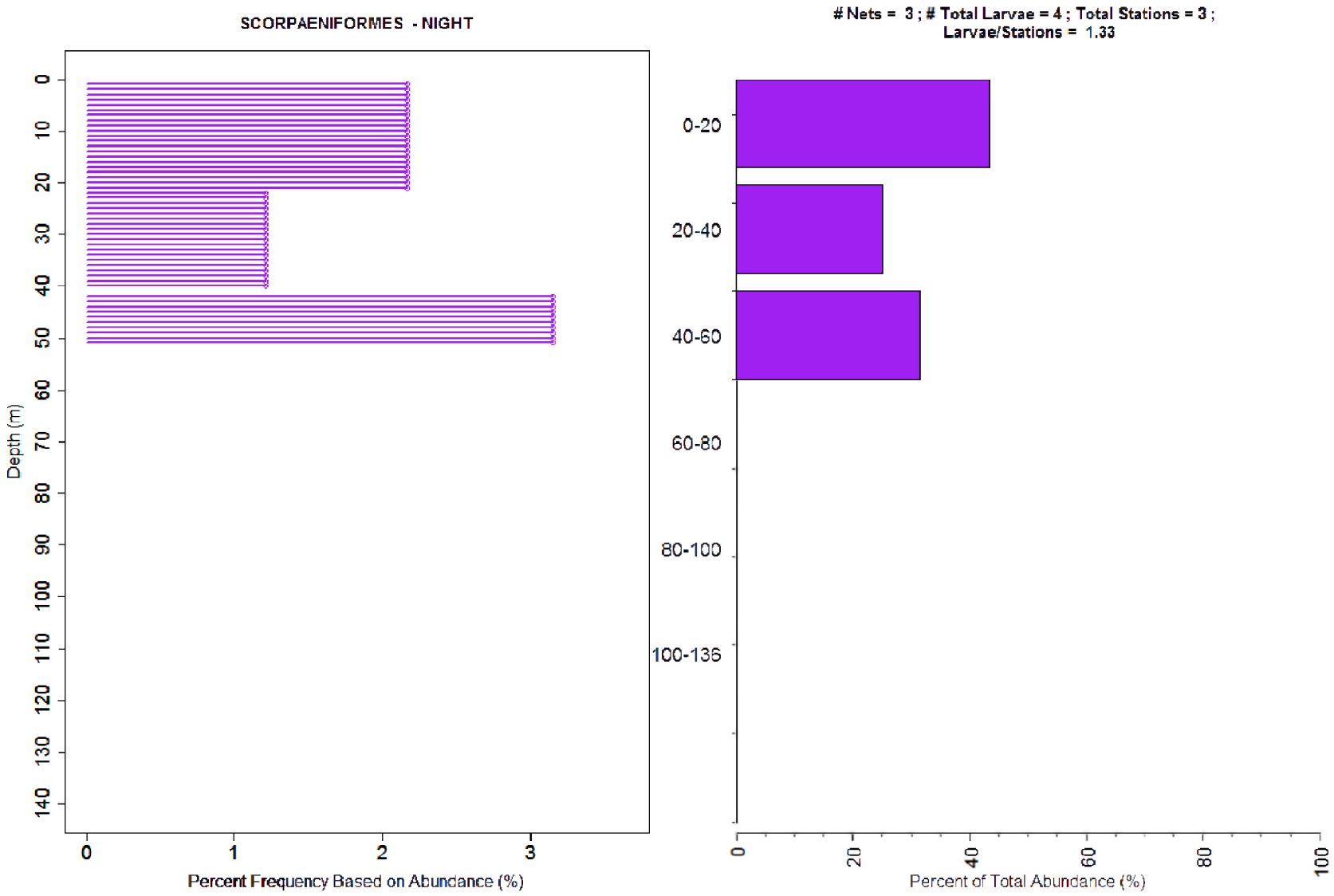
SCORPAENIDAE, DAY



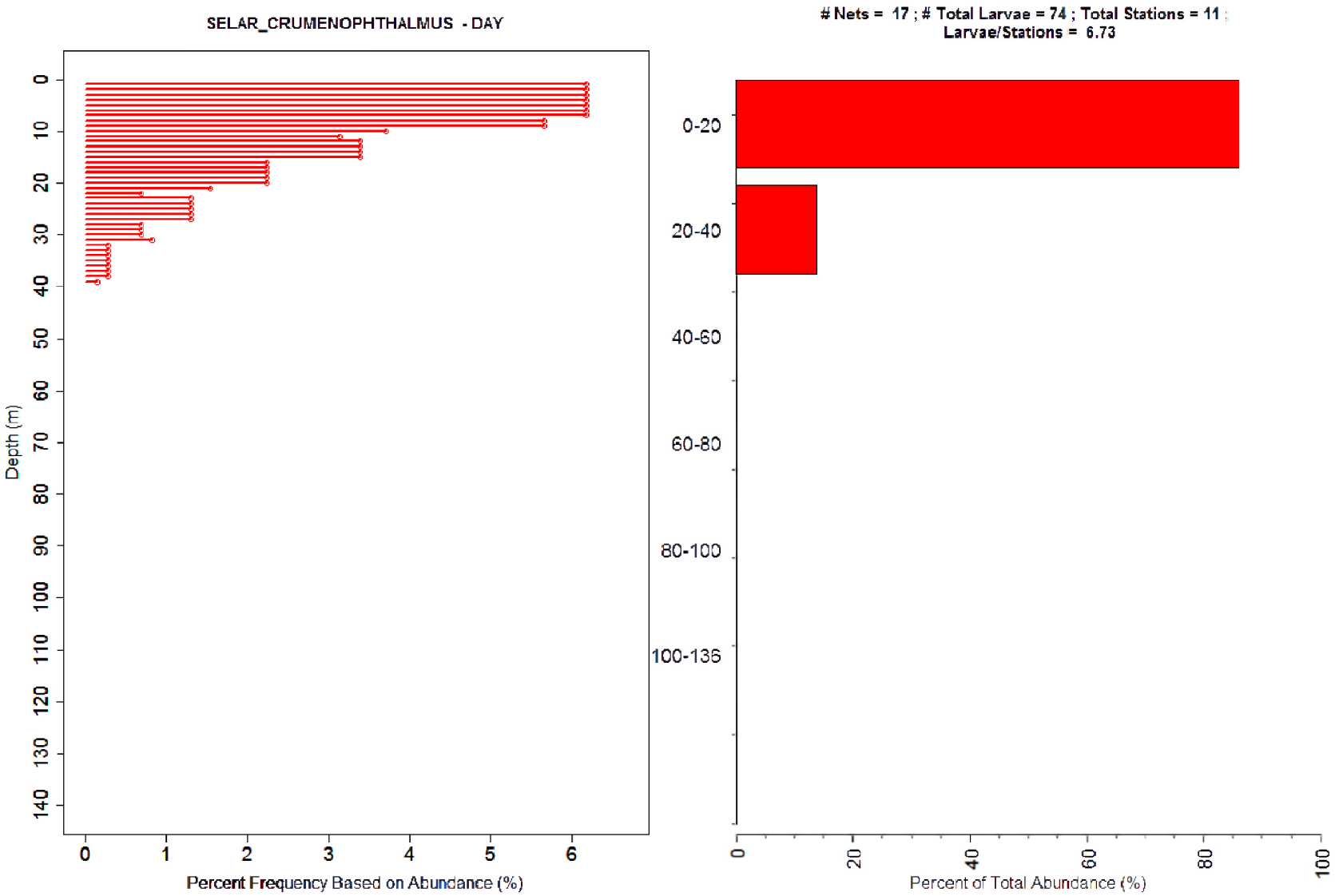
SCORPAENIDAE, NIGHT



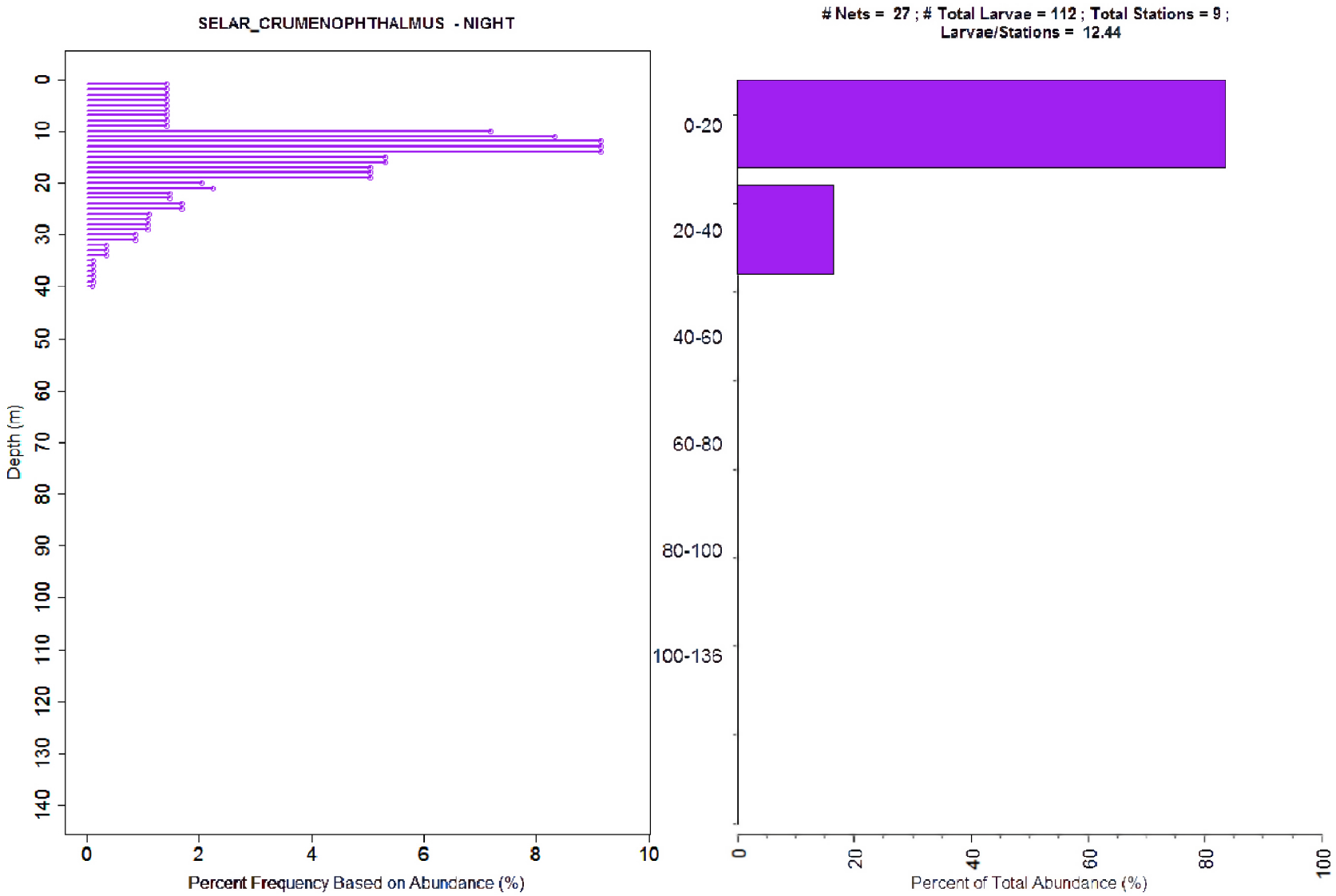
SCORPAENIFORMES, DAY



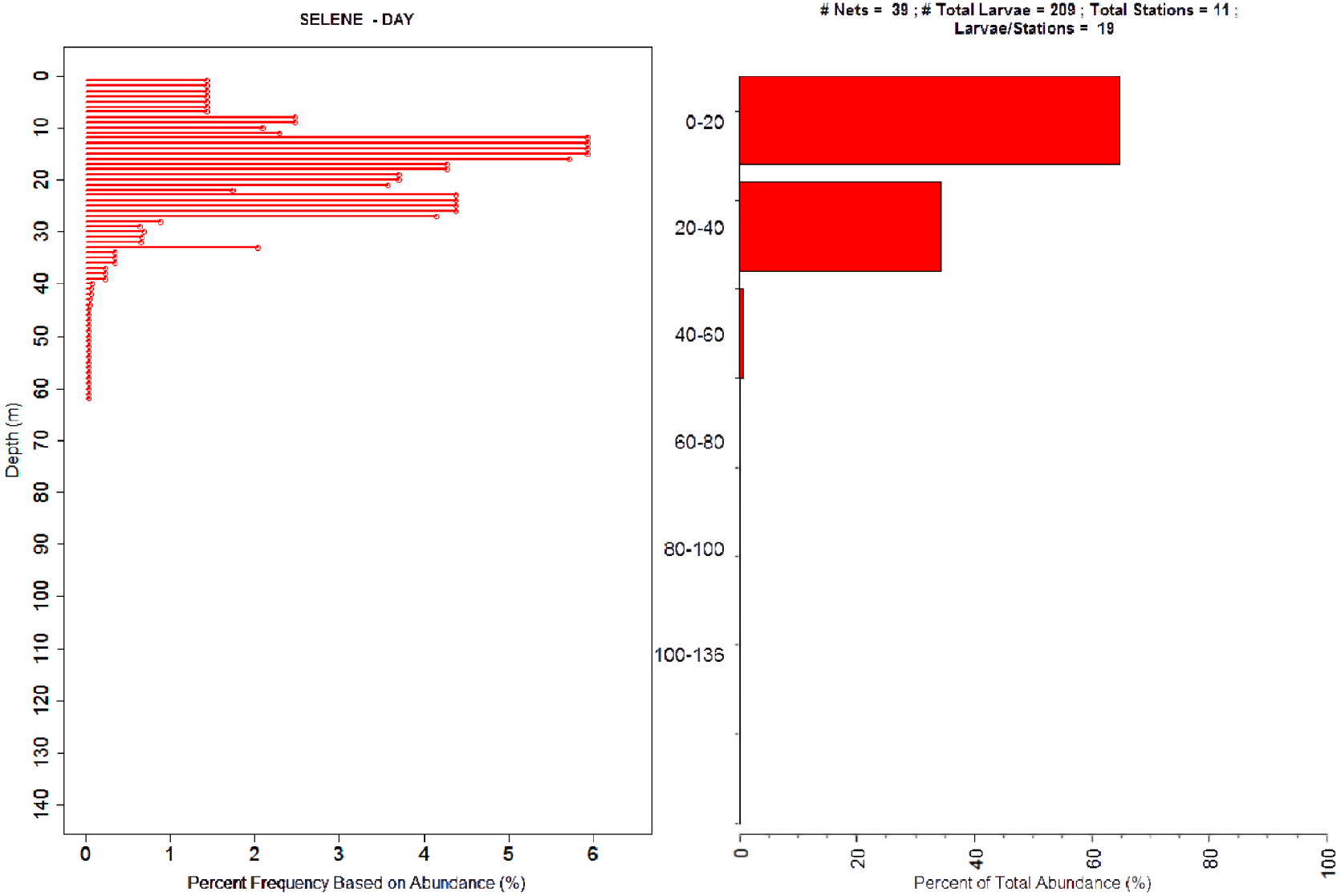
SCORPAENIFORMES, NIGHT



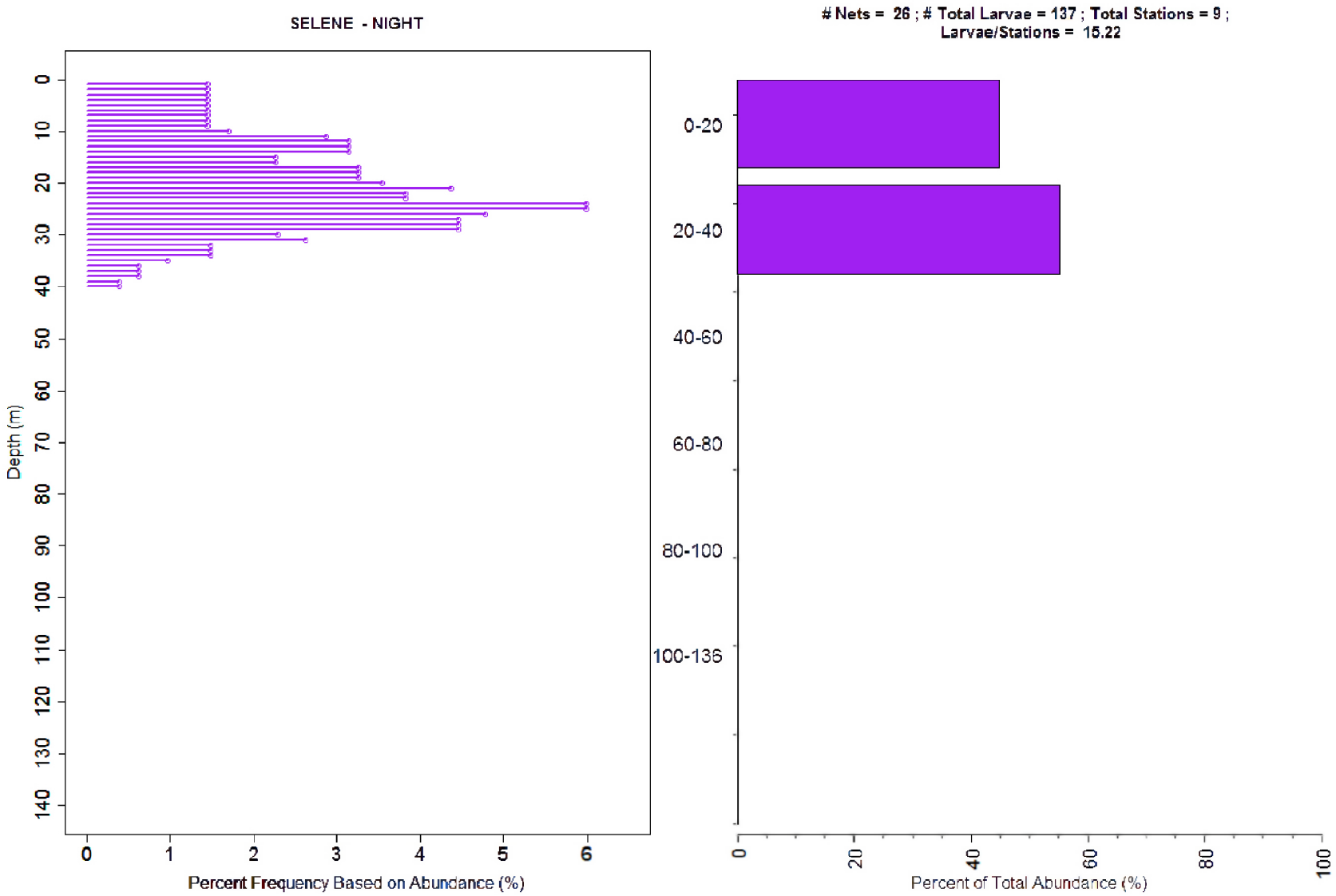
SELAR_CRUMENOPHTHALMUS, DAY



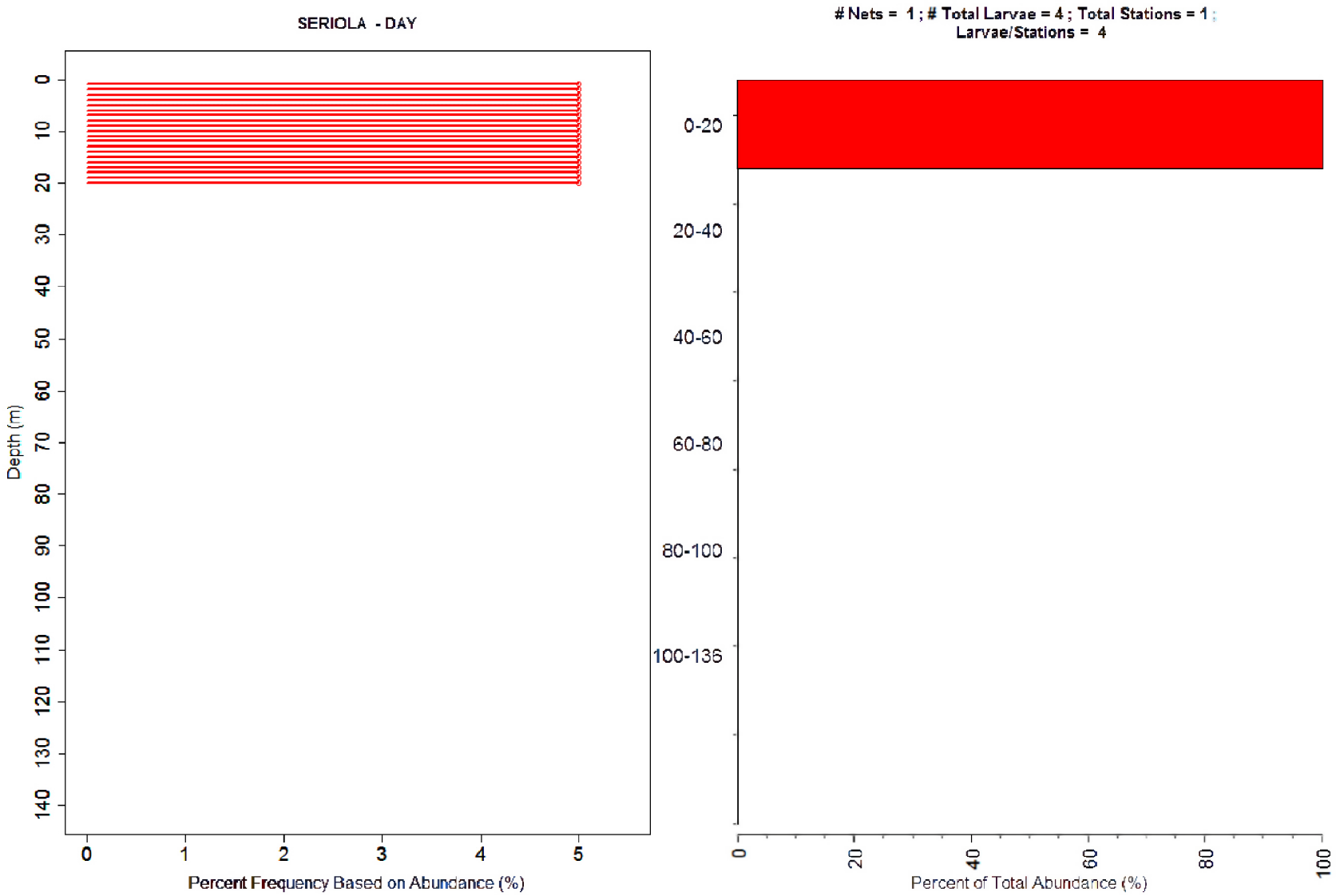
SELAR_CRUMENOPHTHALMUS, NIGHT


SELENE - DAY
Nets = 39 ; # Total Larvae = 209 ; Total Stations = 11 ;
Larvae/Stations = 19
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

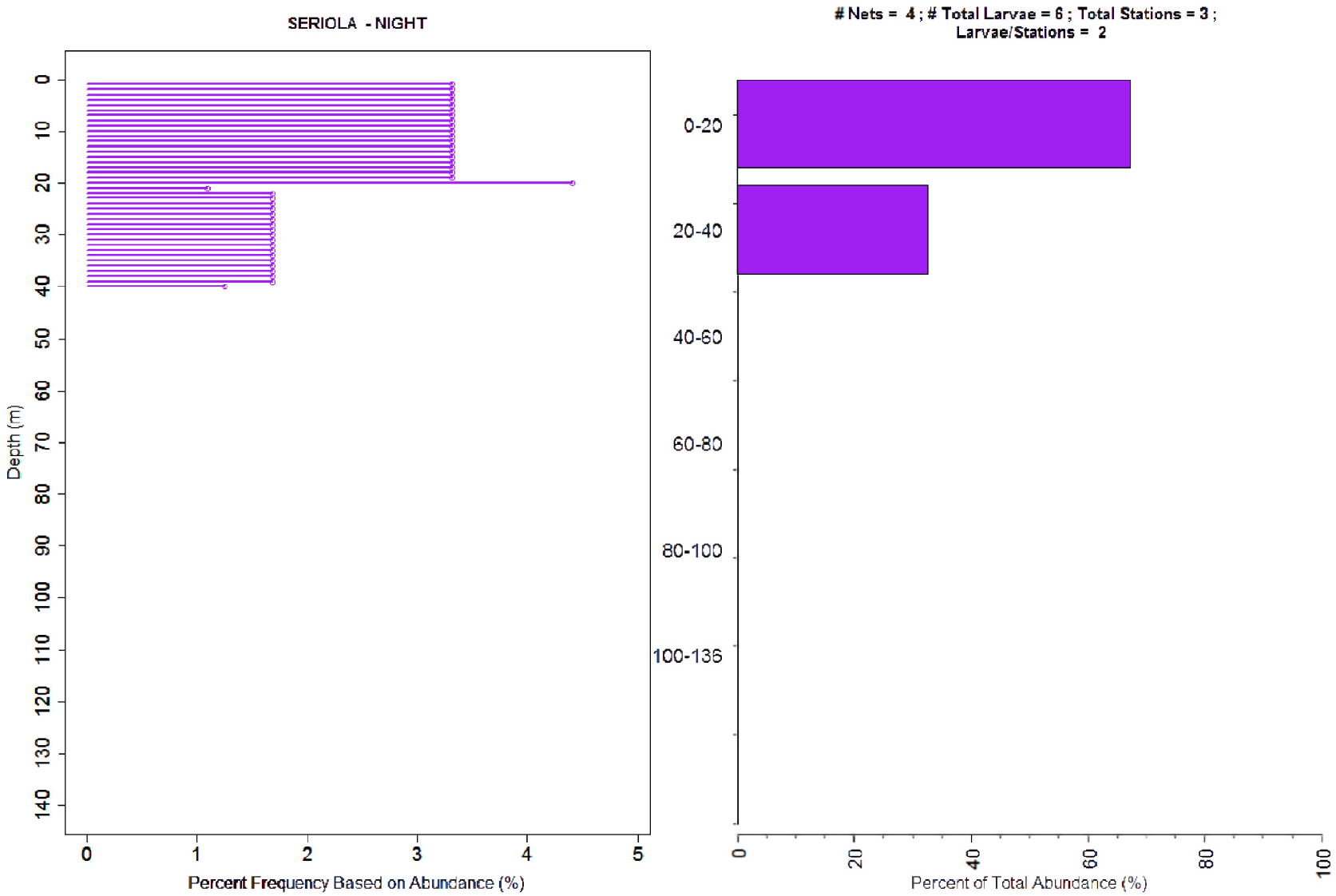
SELENE, DAY



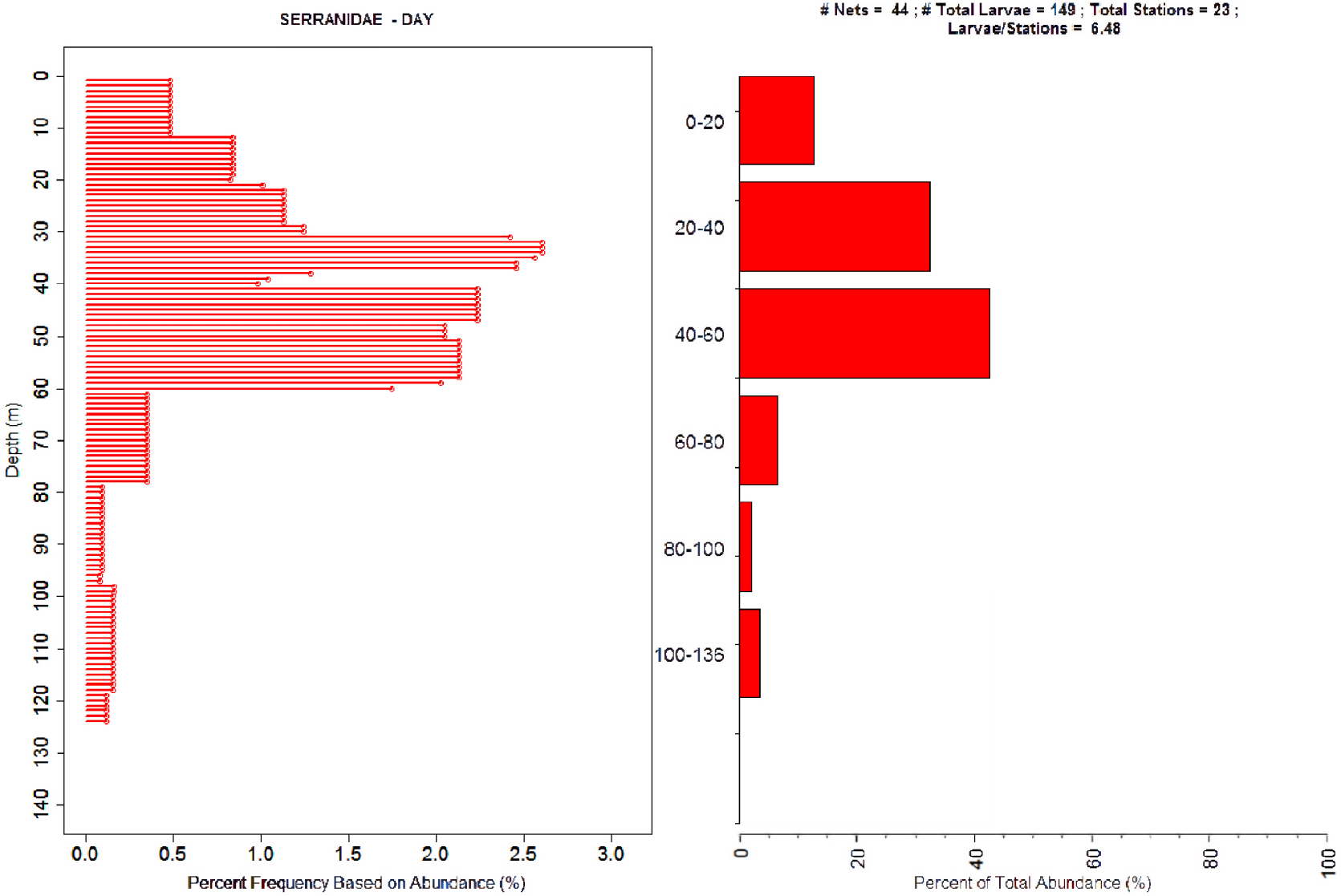
SELENE, NIGHT


SERIOLA - DAY
Nets = 1 ; # Total Larvae = 4 ; Total Stations = 1 ;
Larvae/Stations = 4
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

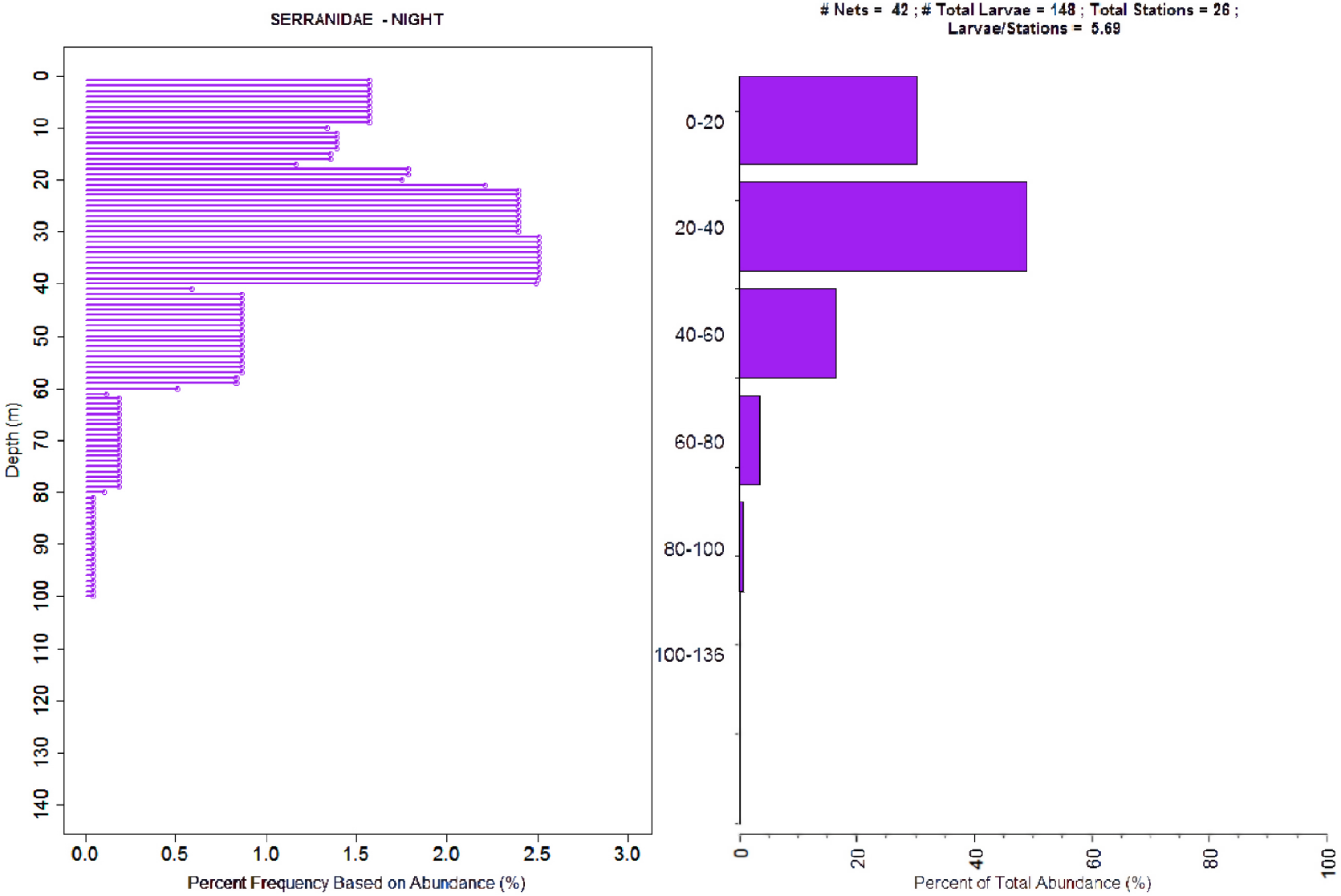
SERIOLA, DAY



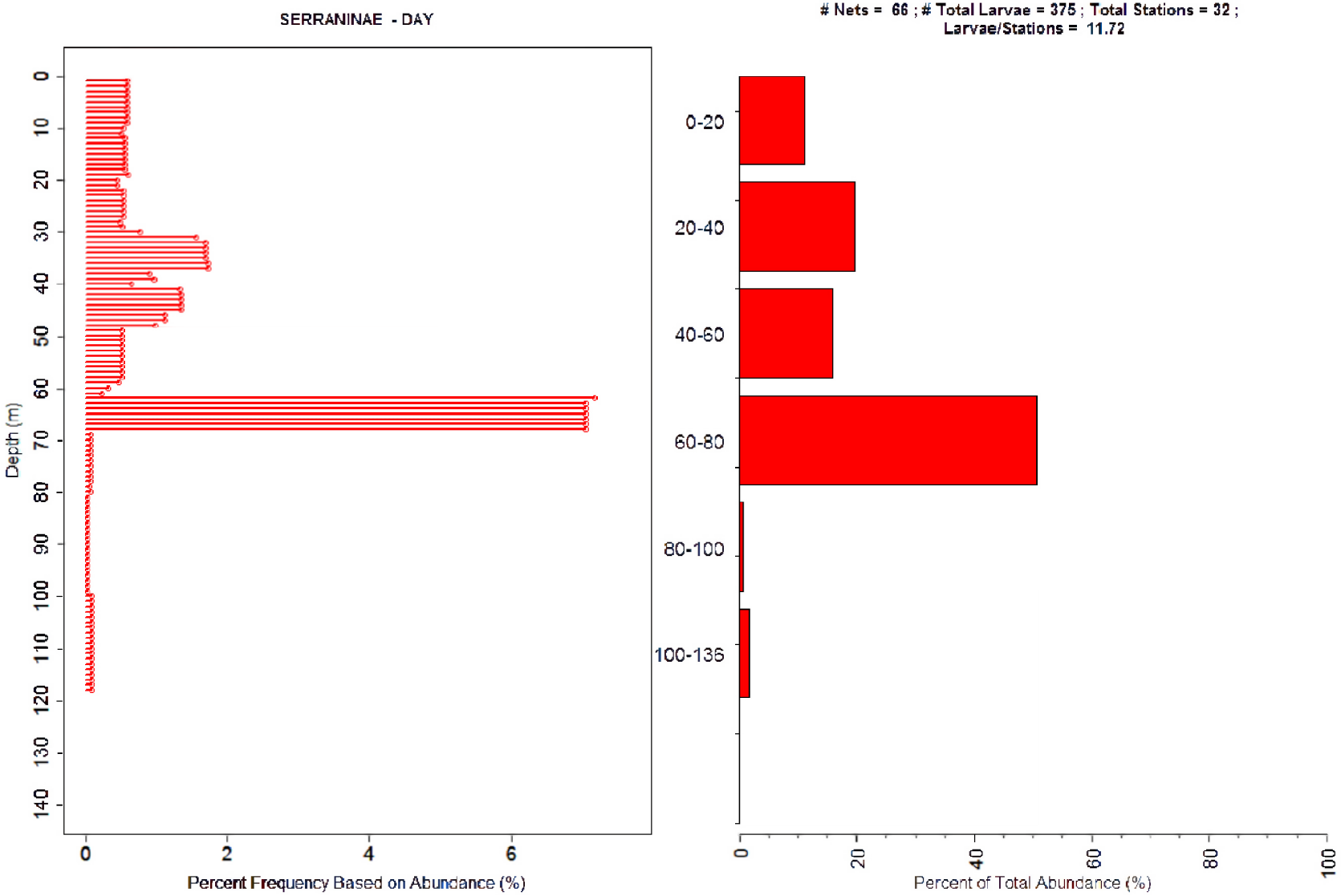
SERIOLA, NIGHT



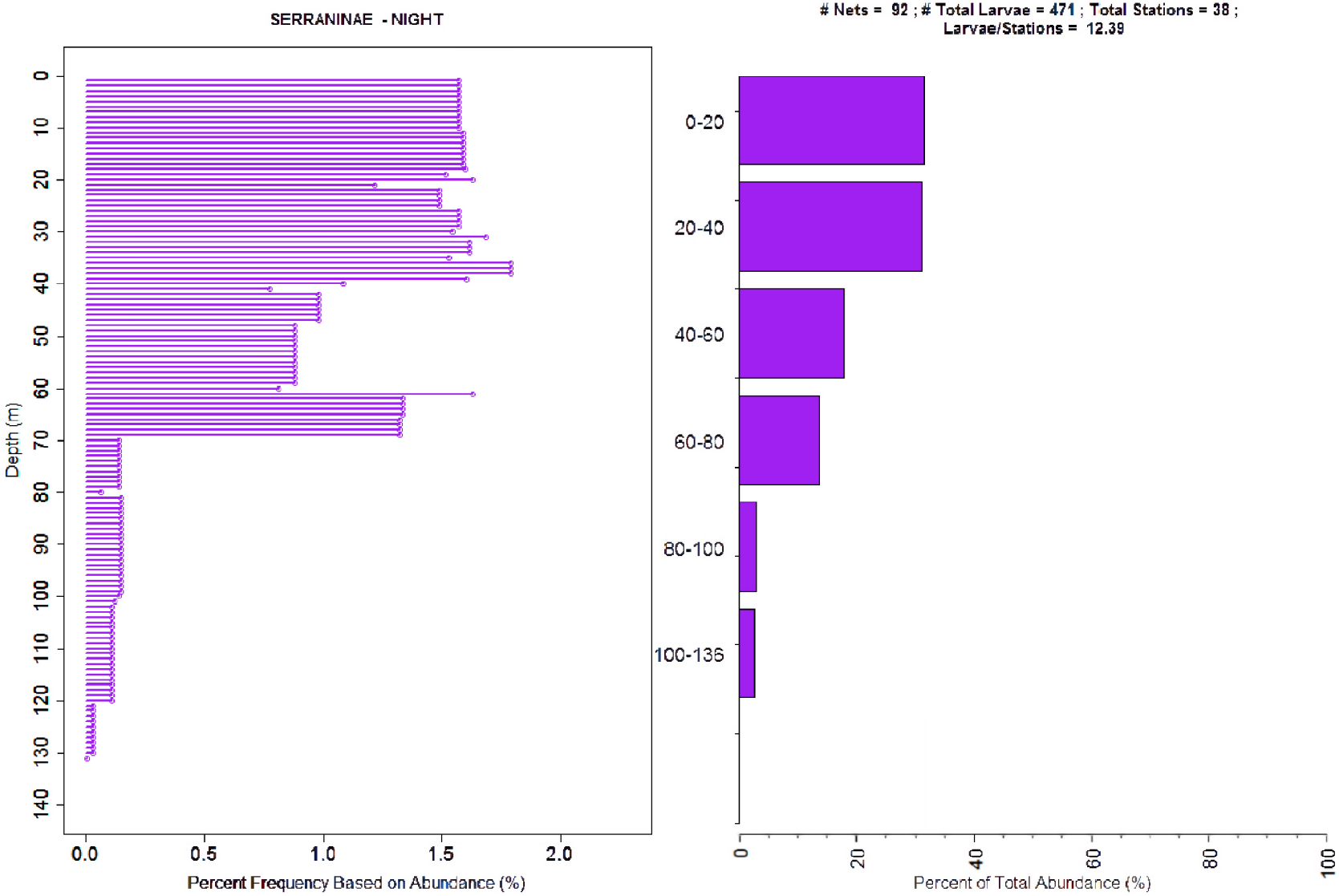
SERRANIDAE, DAY



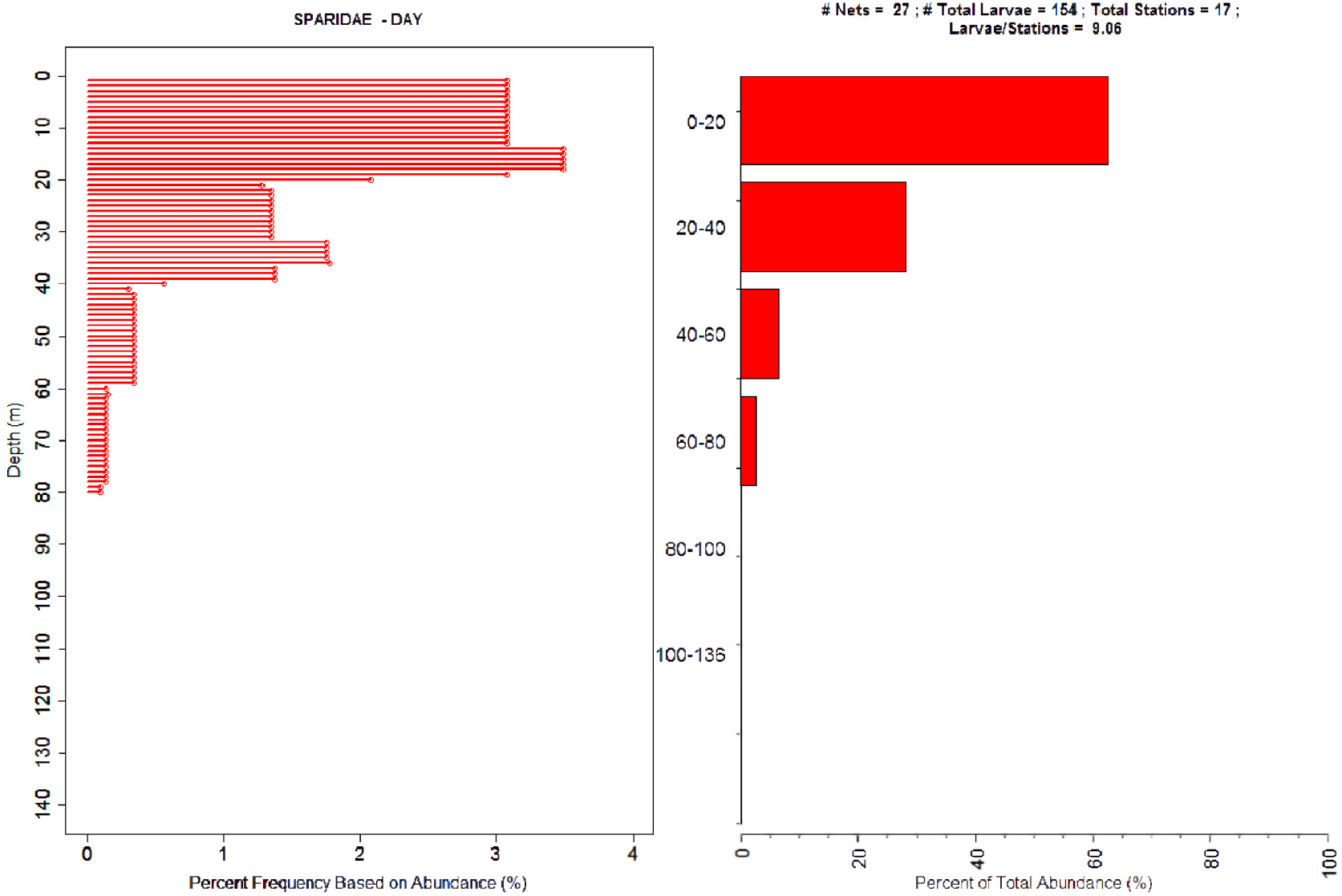
SERRANIDAE, NIGHT



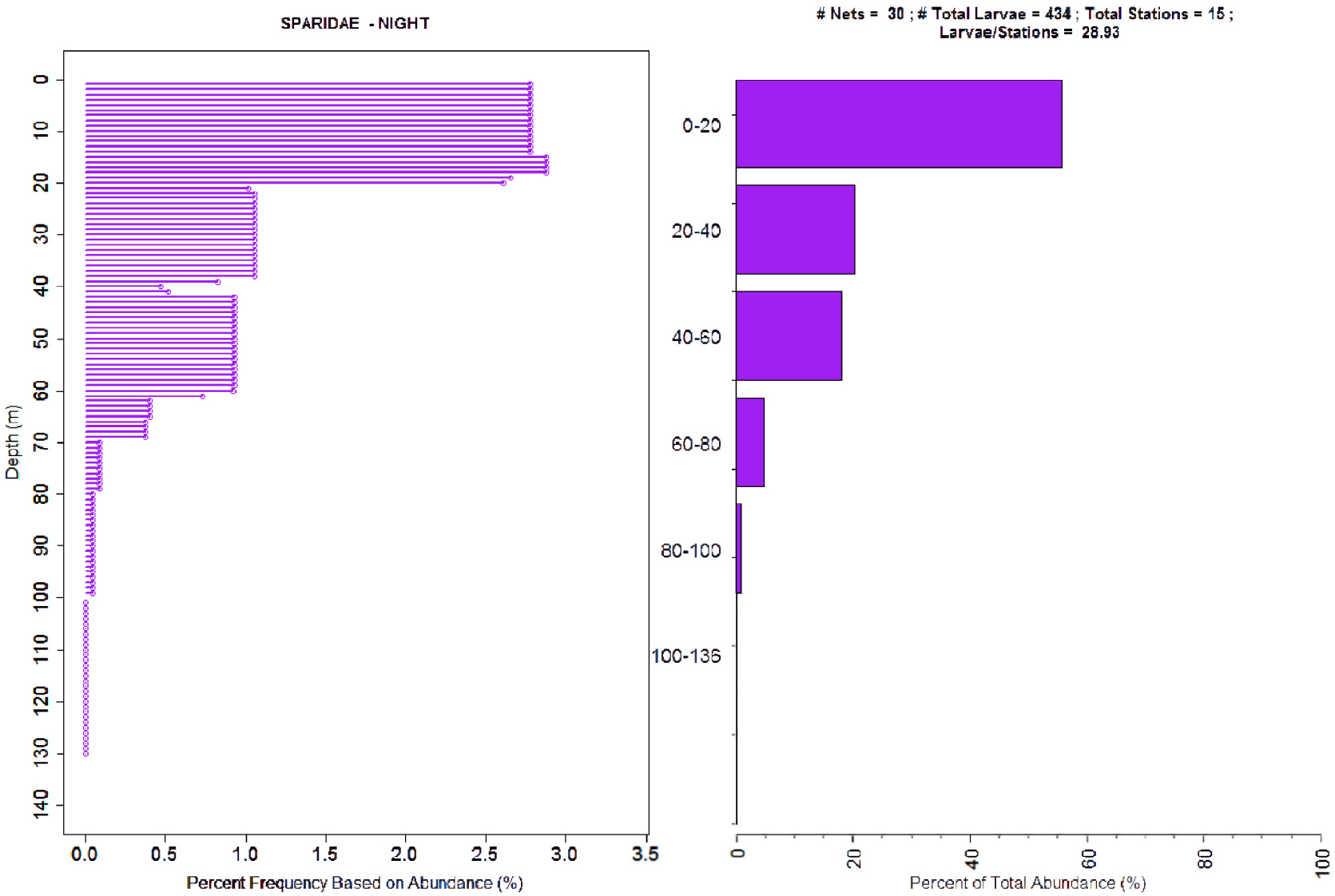
SERRANINAE, DAY



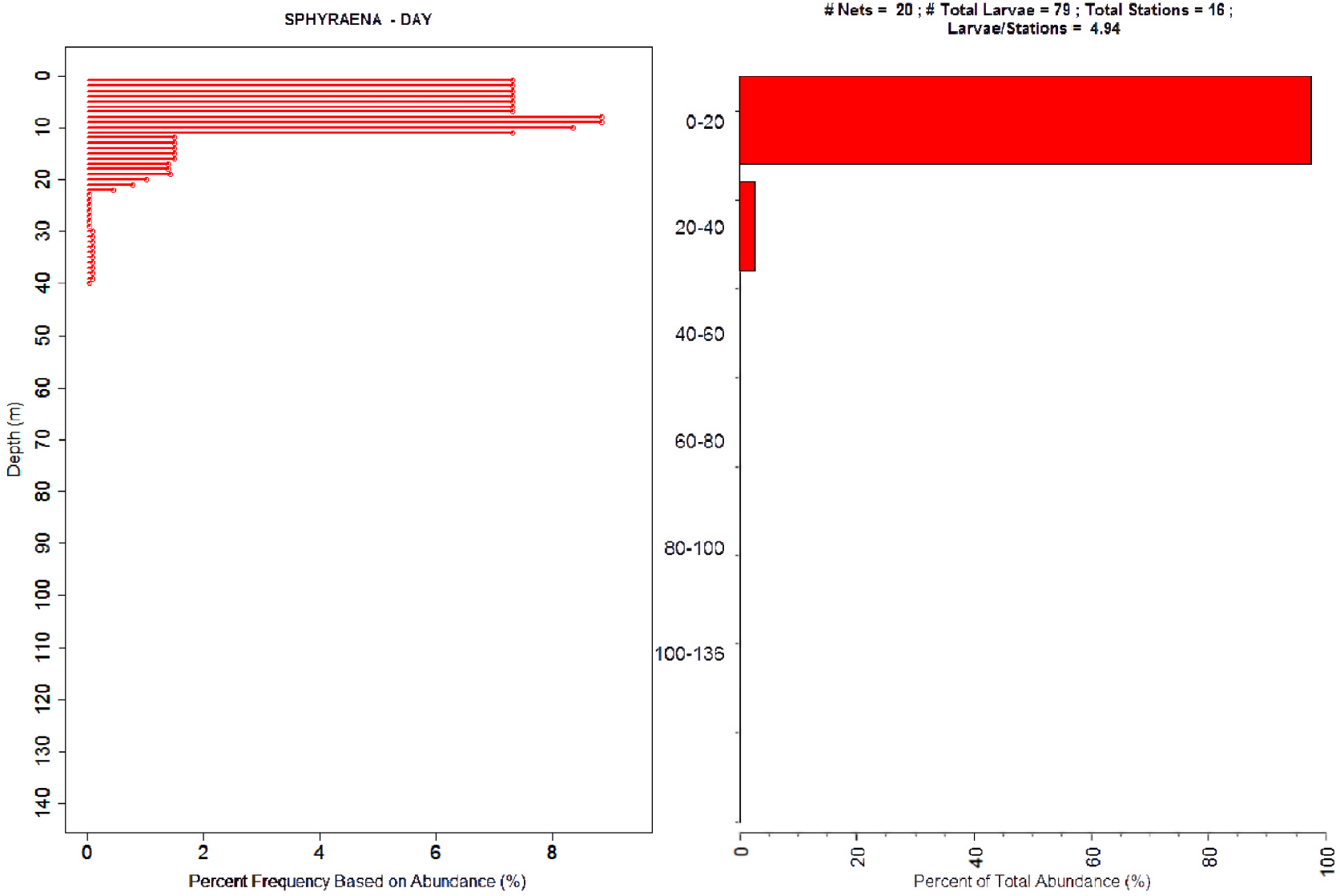
SERRANINAE, NIGHT



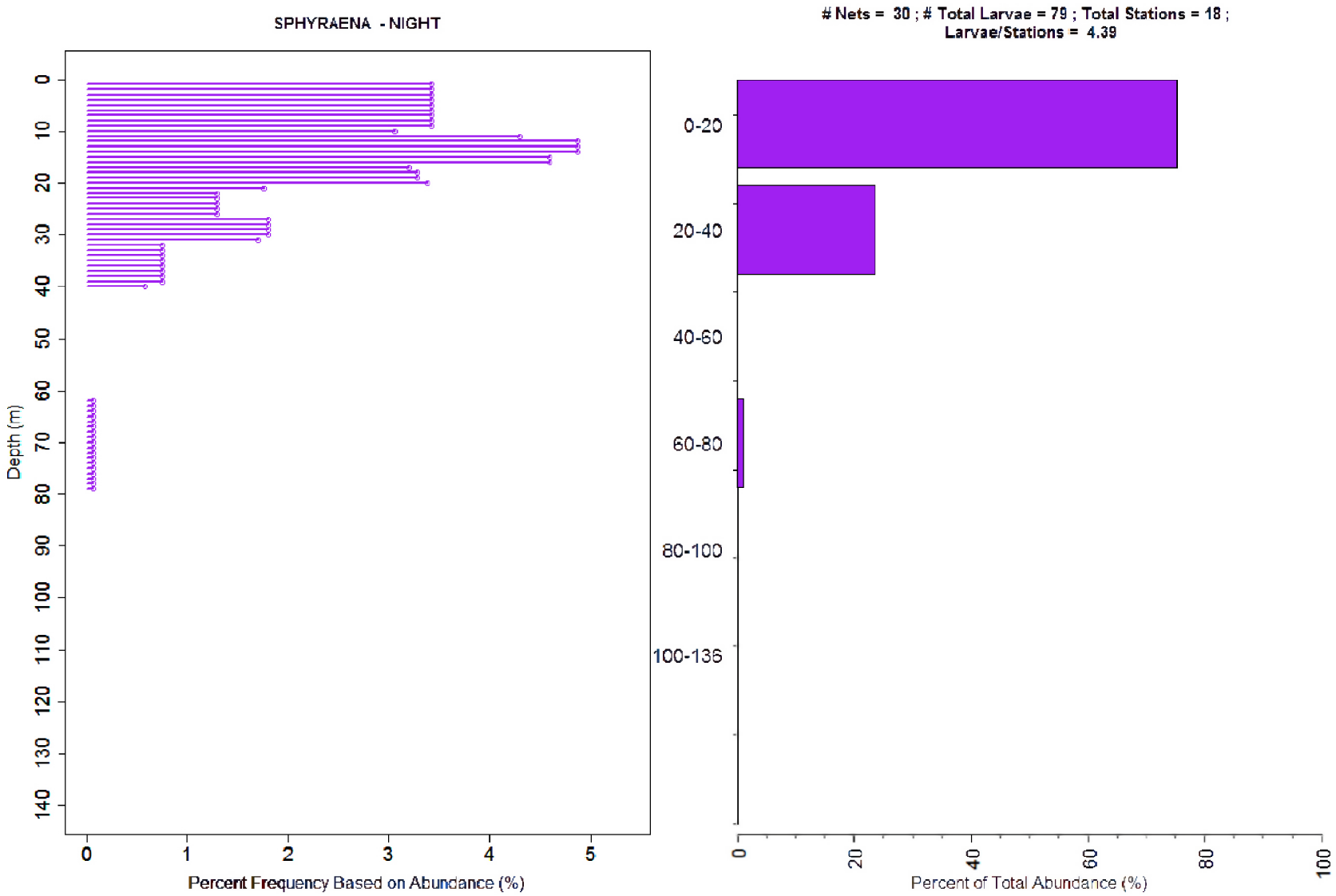
SPARIDAE, DAY



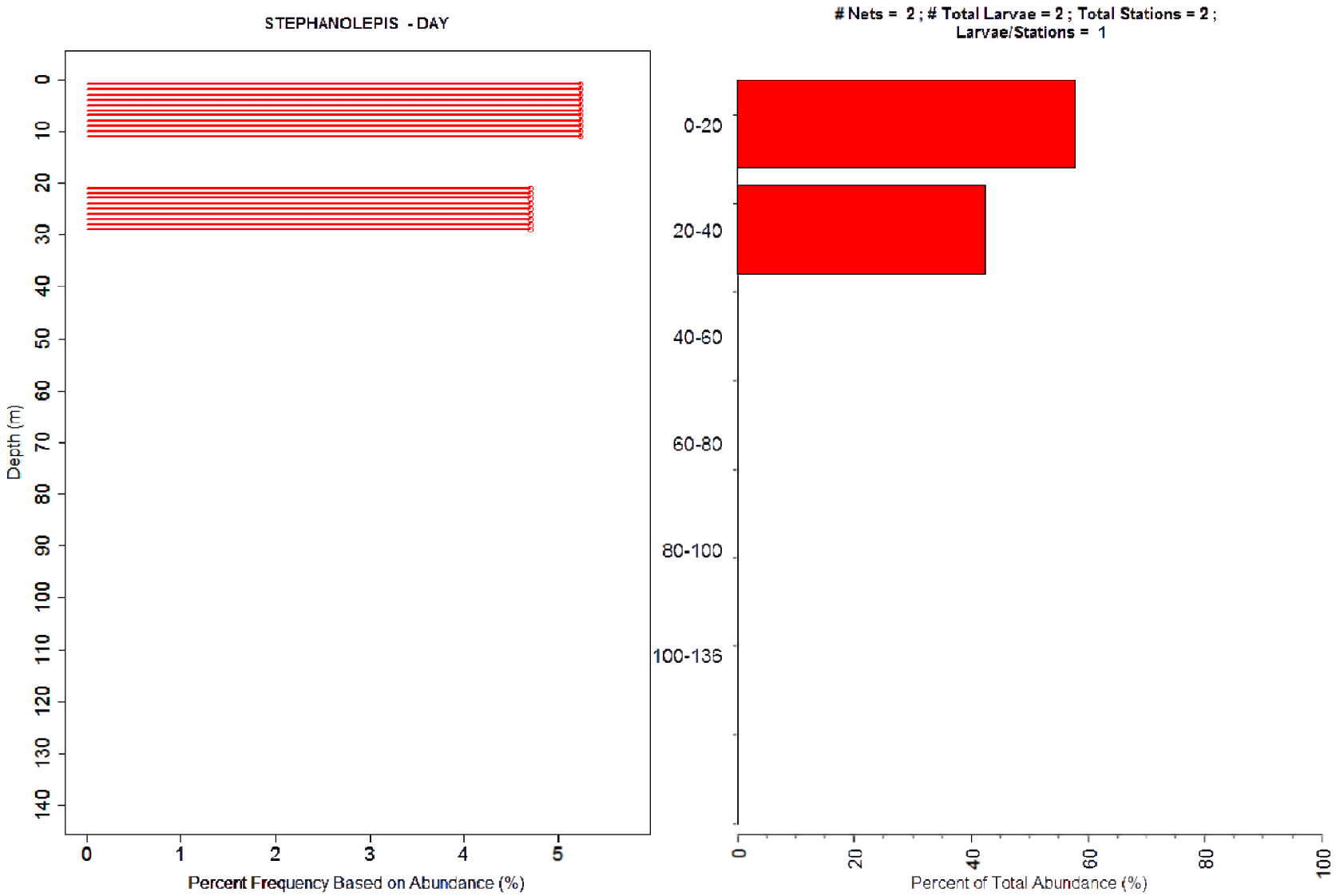
SPARIDAE, NIGHT



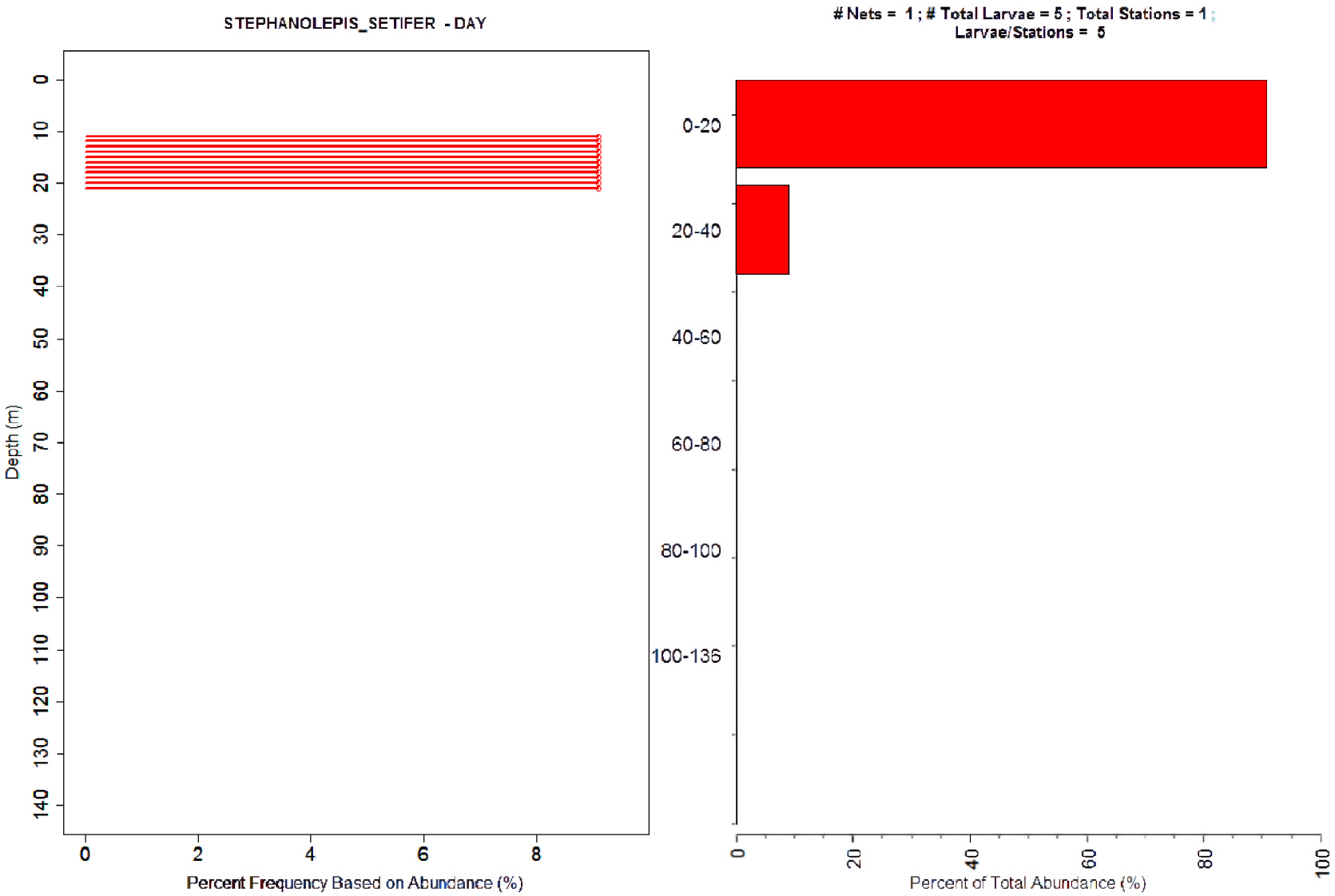
SPHYRAENA, DAY



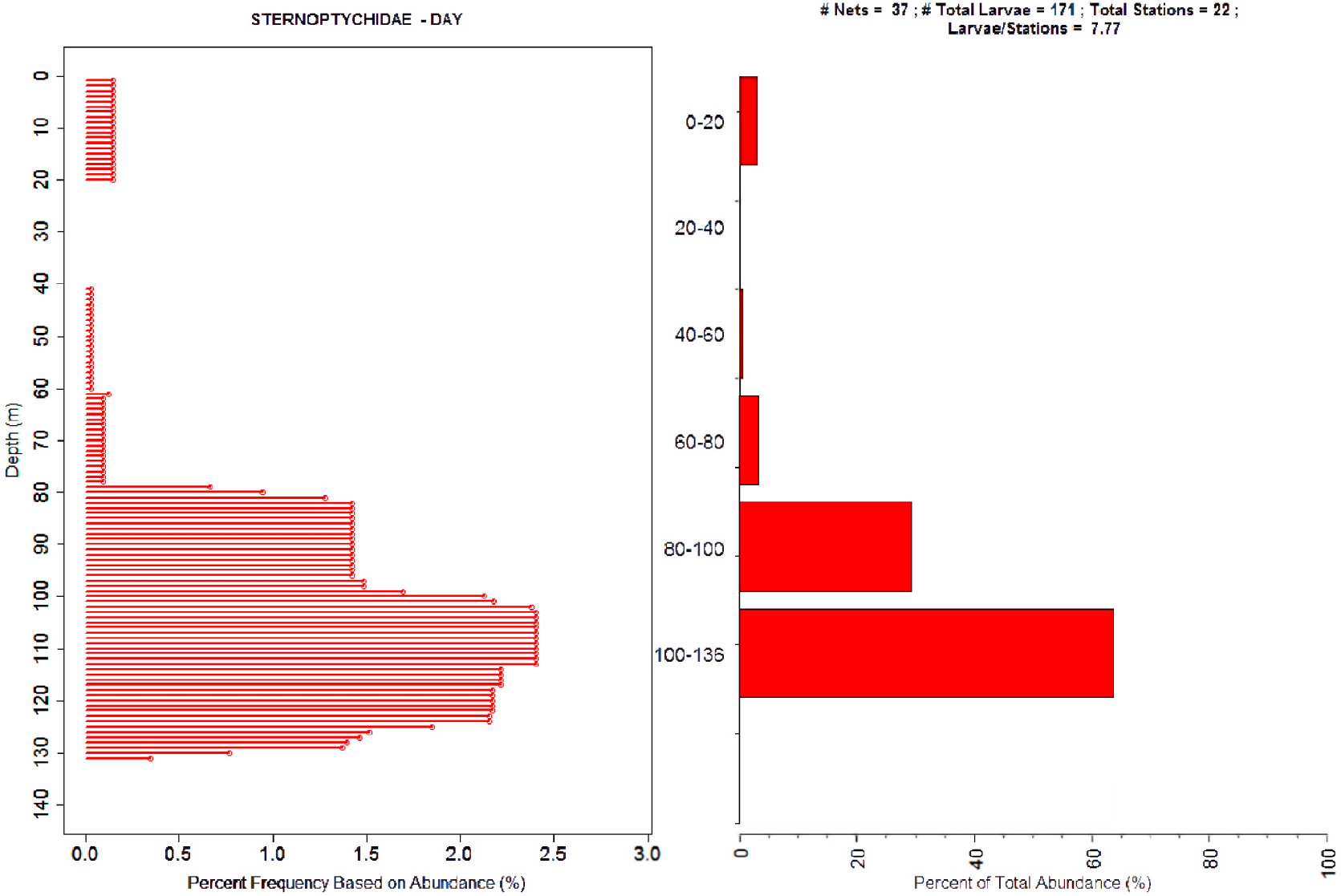
SPHYRAENA, NIGHT



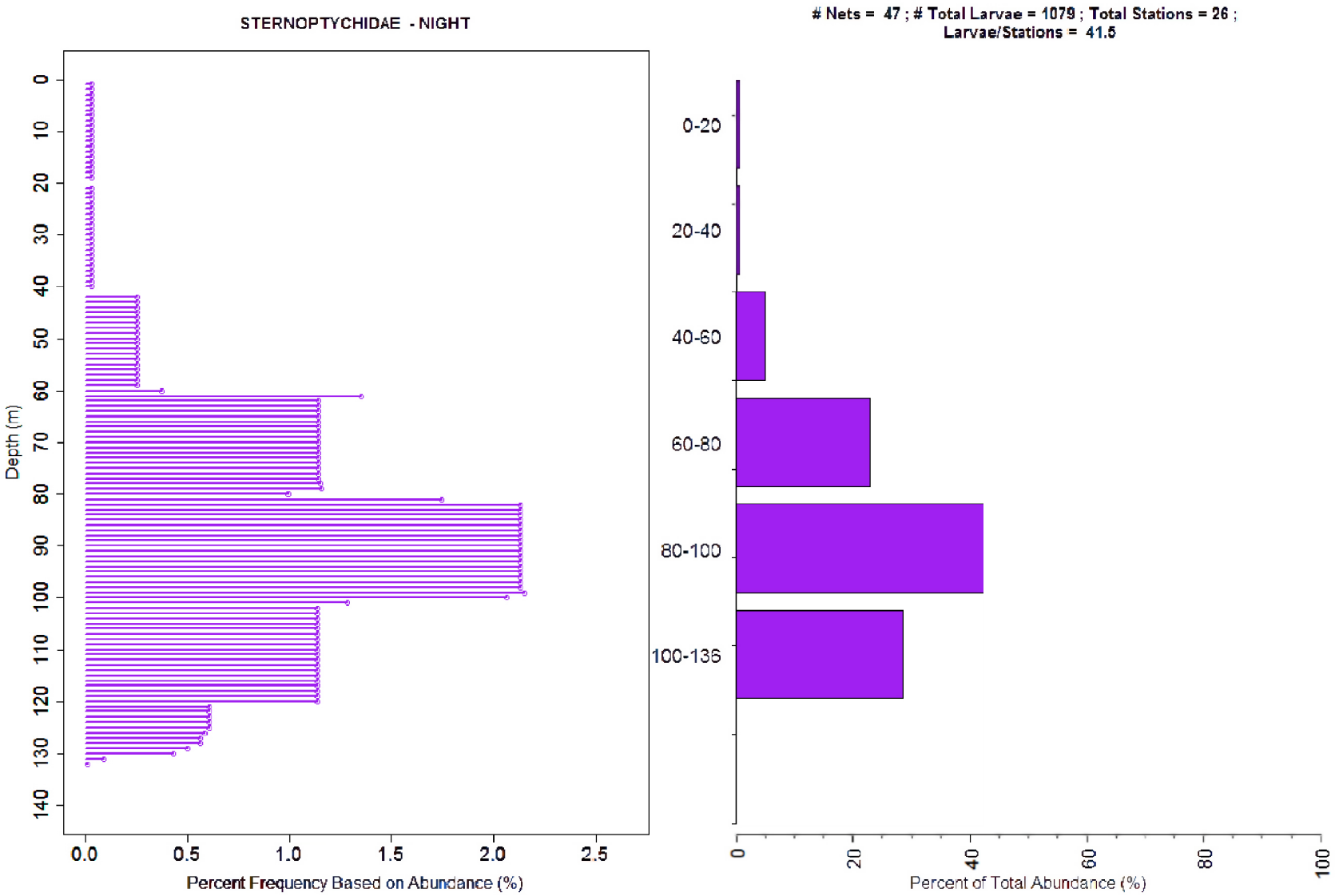
STEPHANOLEPIS, DAY



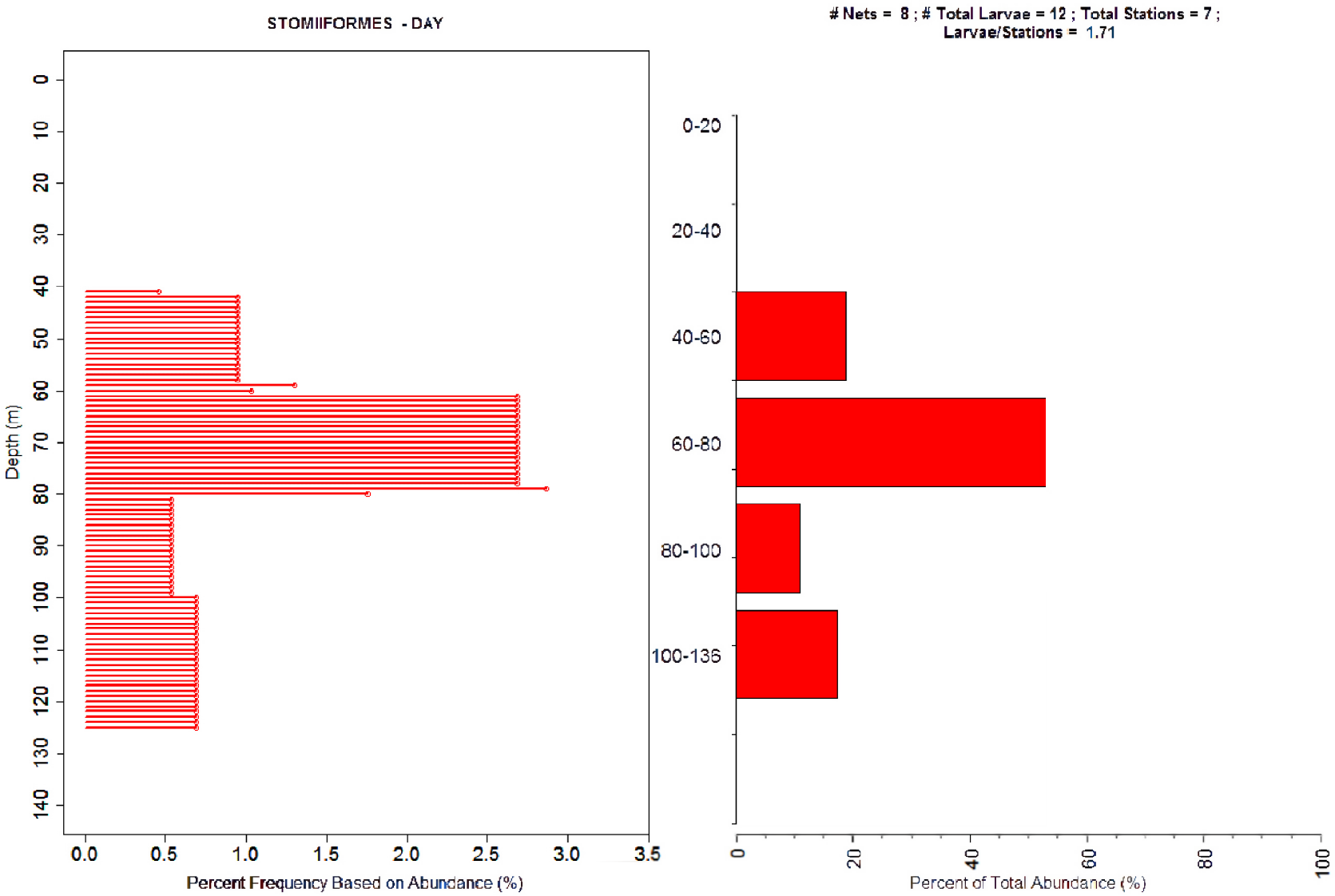
STEPHANOLEPIS_SETIFER, DAY



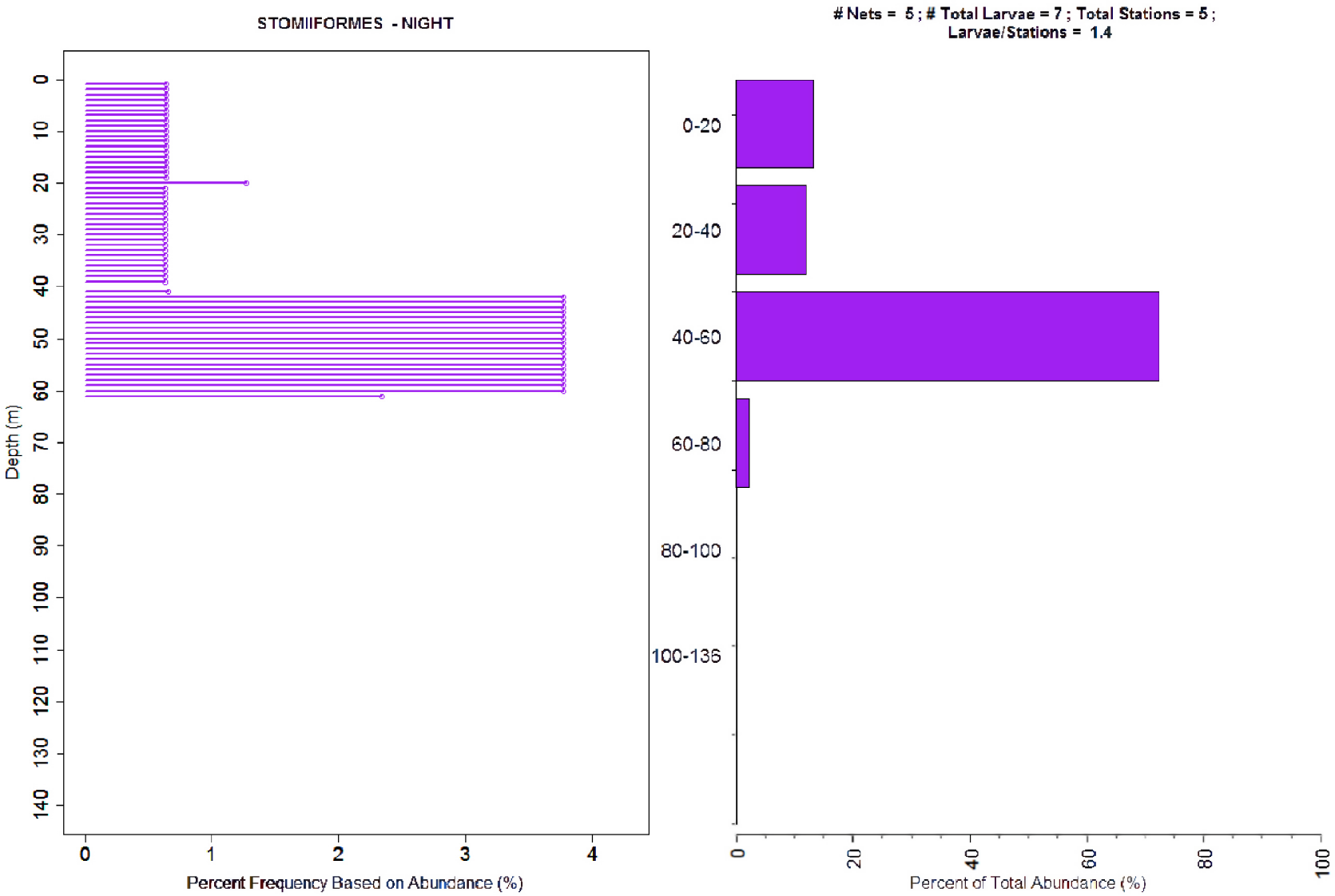
STERNOPTYCHIDAE, DAY



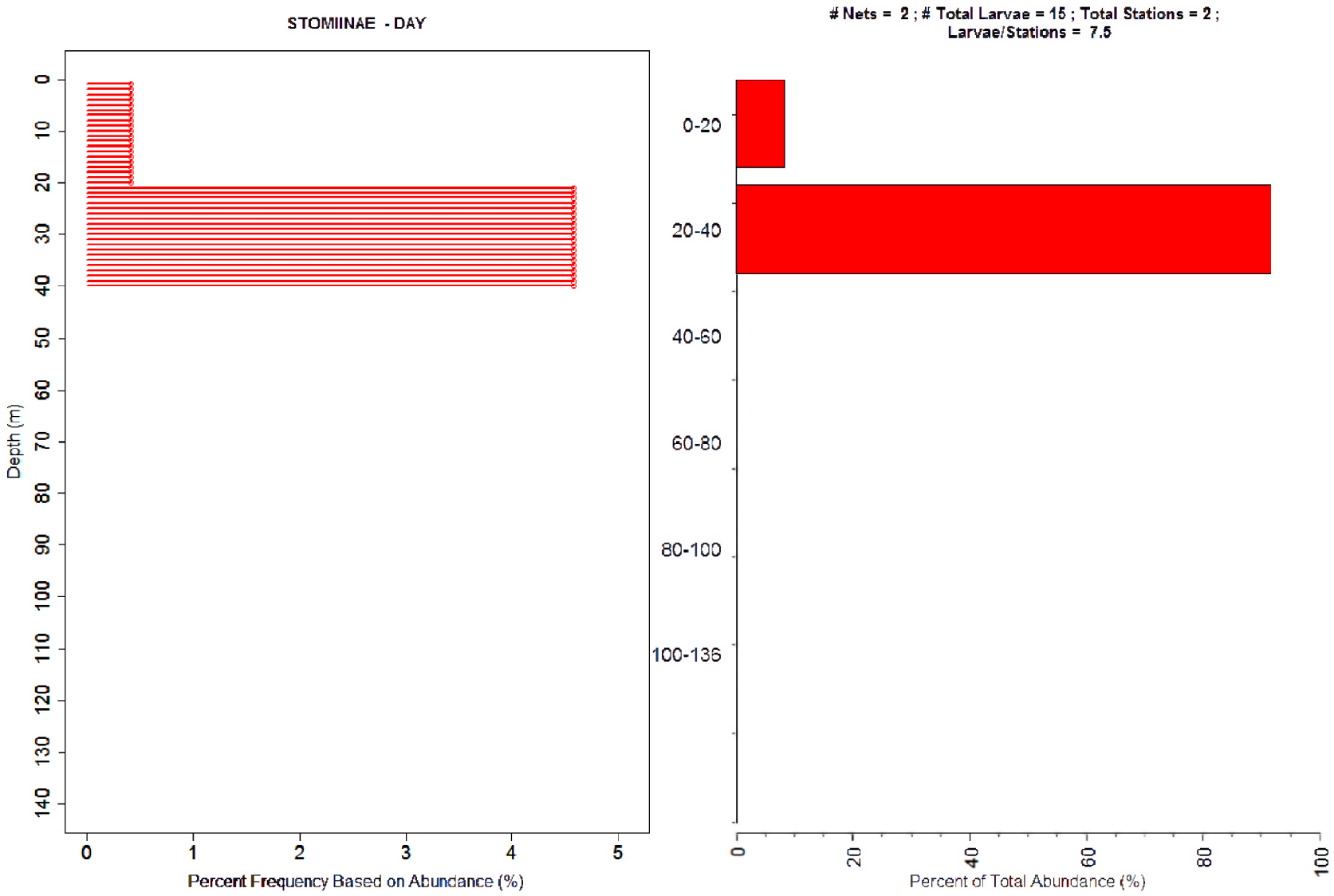
STERNOPTYCHIDAE, NIGHT



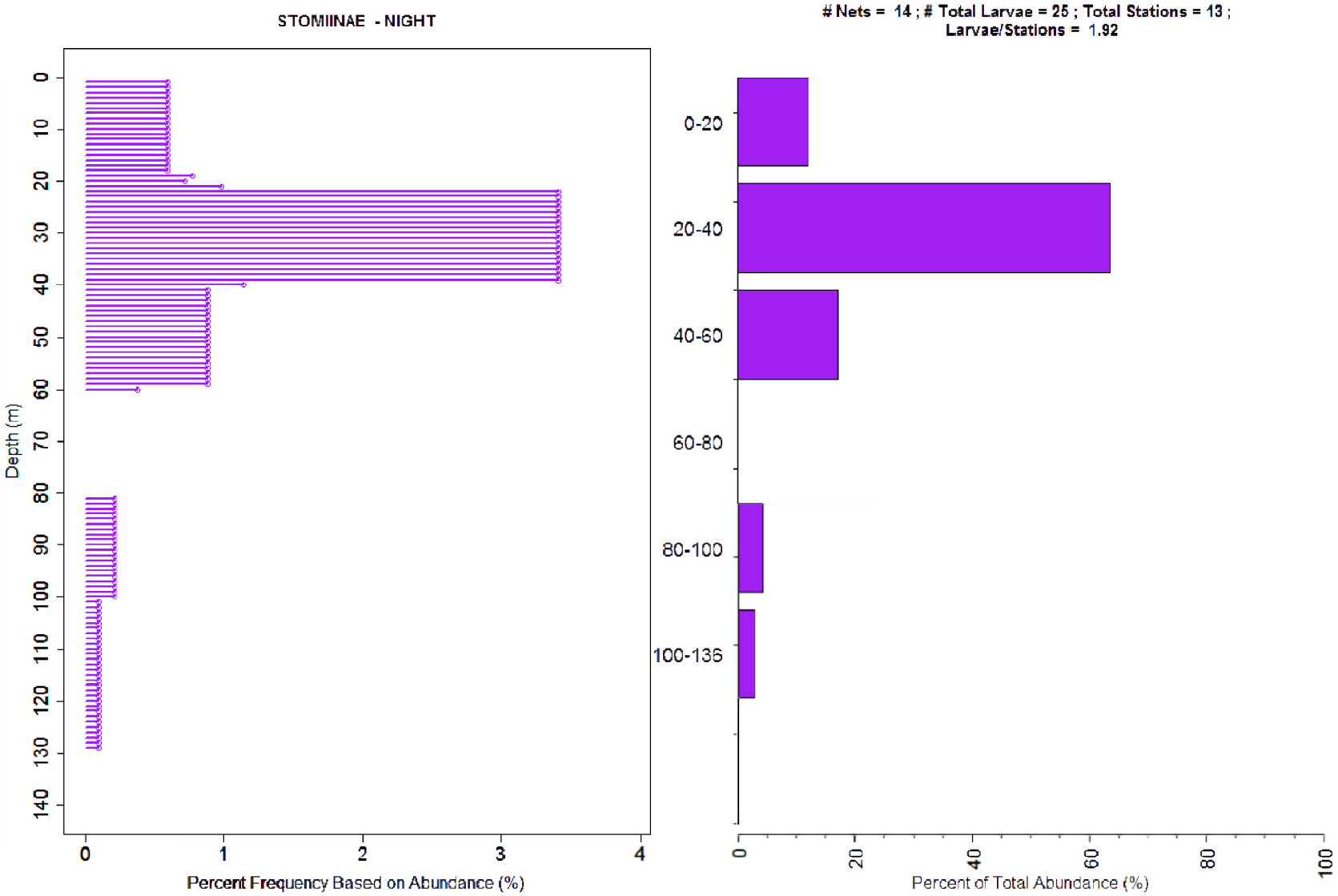
STOMIIFORMES, DAY



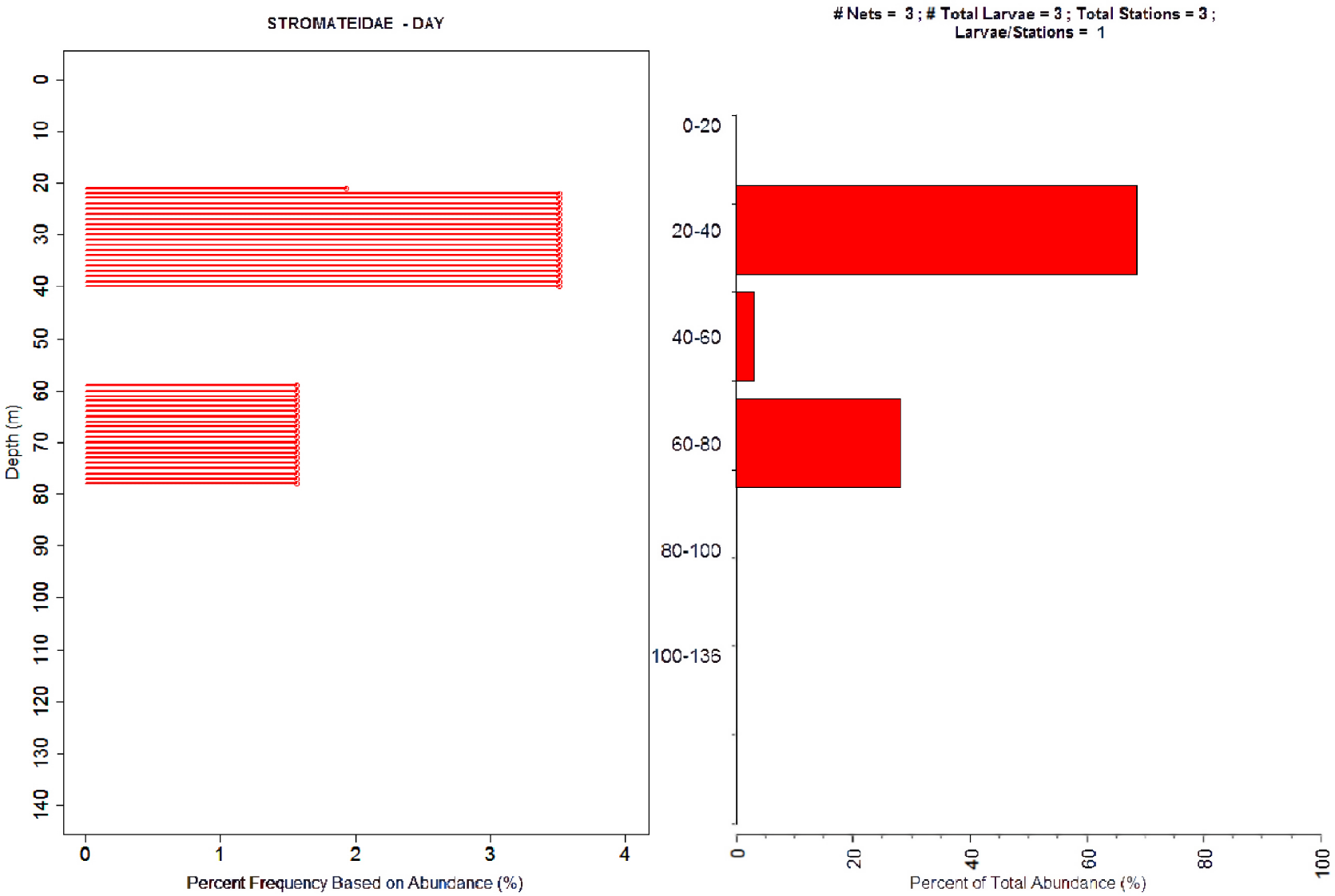
STOMIIFORMES, NIGHT



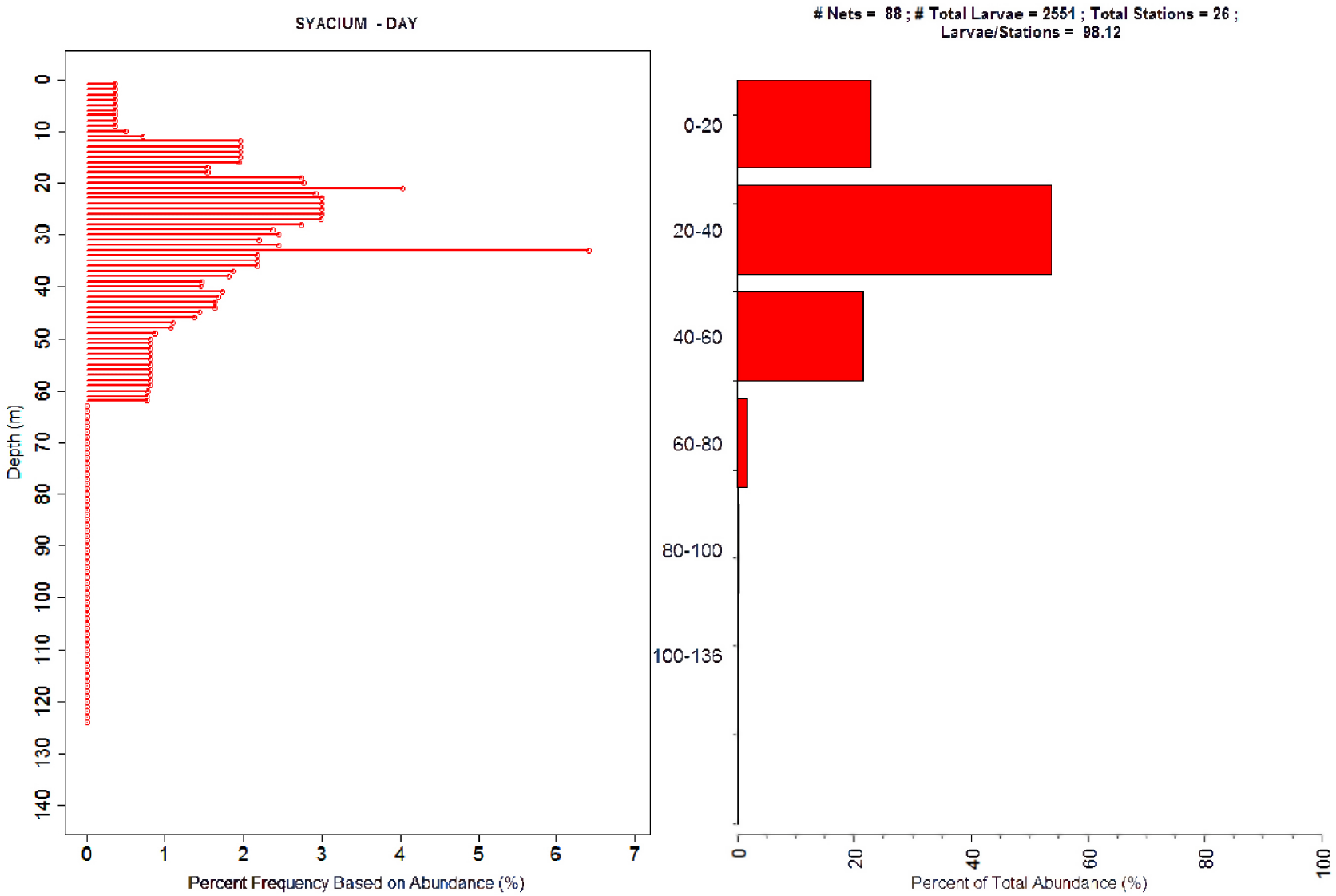
STOMIINAE, DAY



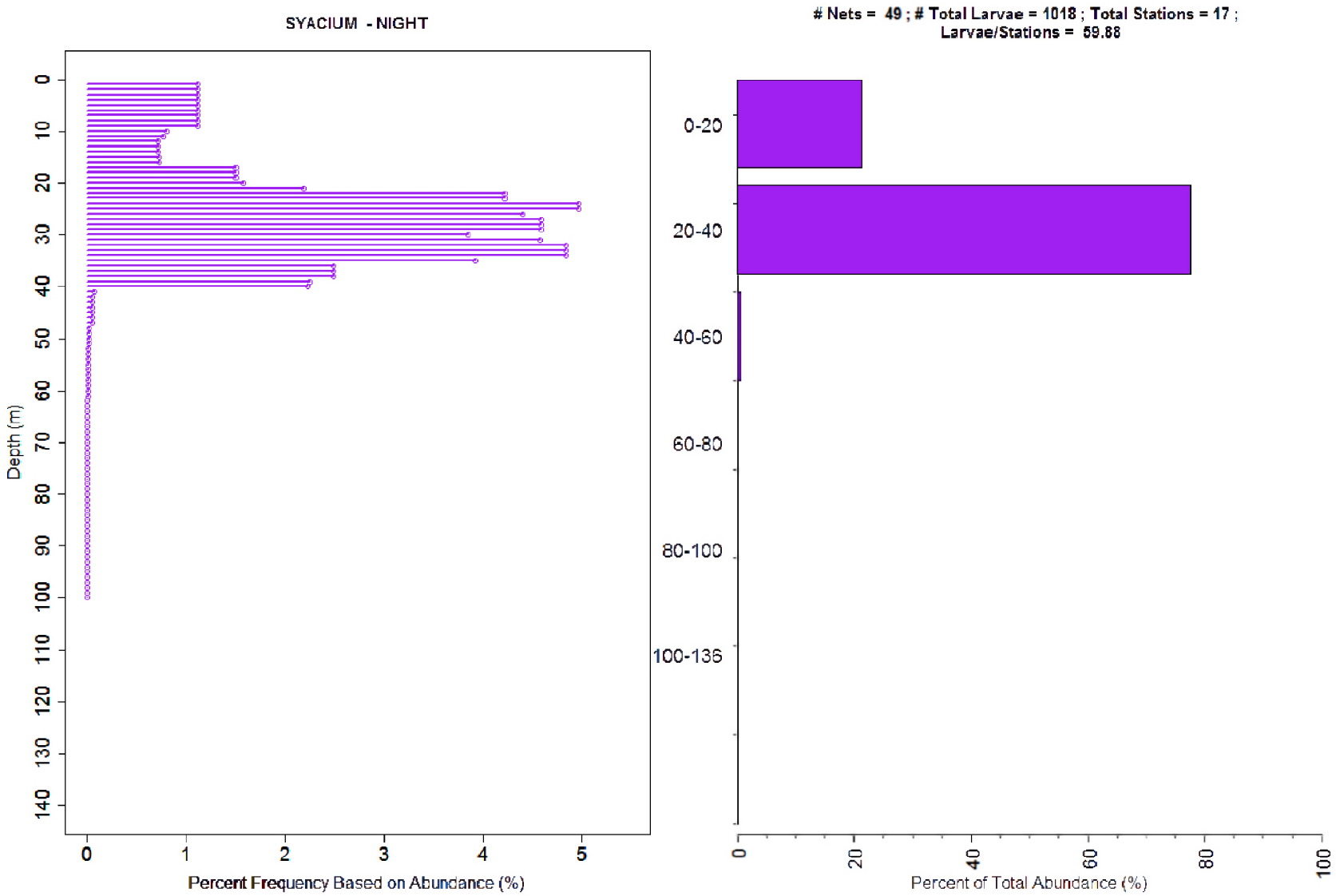
STOMIINAE, NIGHT



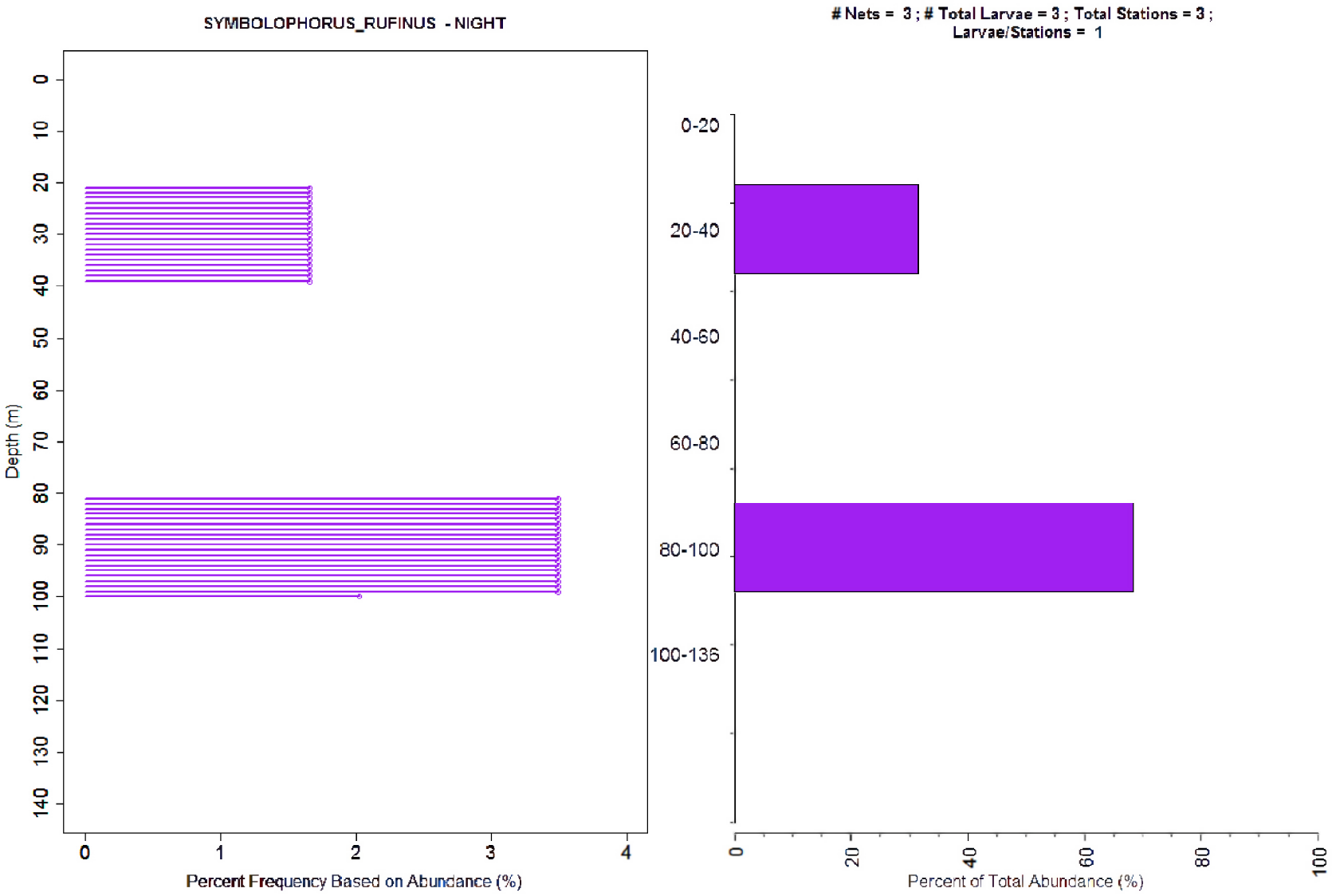
STROMATEIDAE, DAY


SYACIUM - DAY
Nets = 88 ; # Total Larvae = 2551 ; Total Stations = 26 ;
Larvae/Stations = 98.12
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
7
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

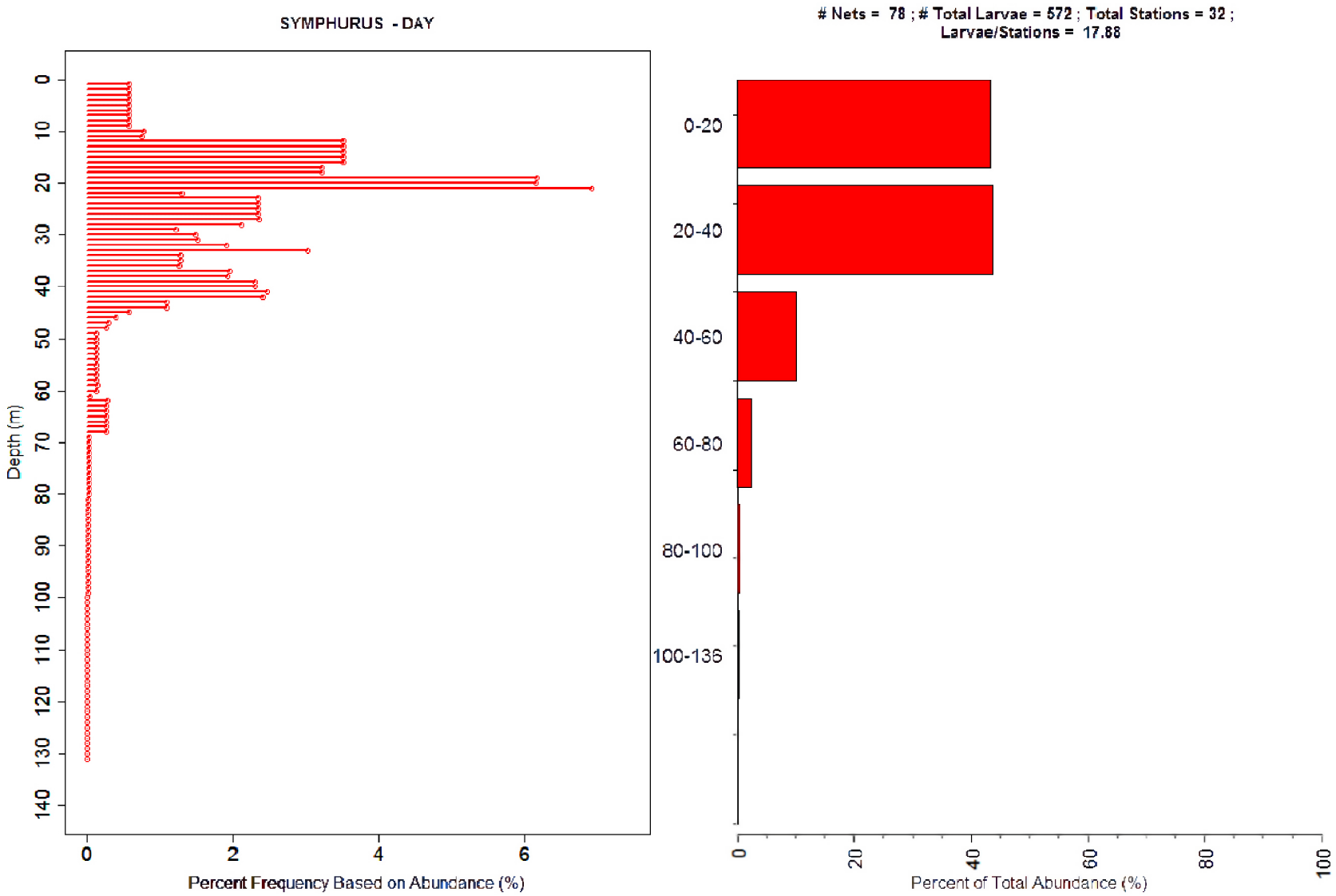
SYACIUM, DAY



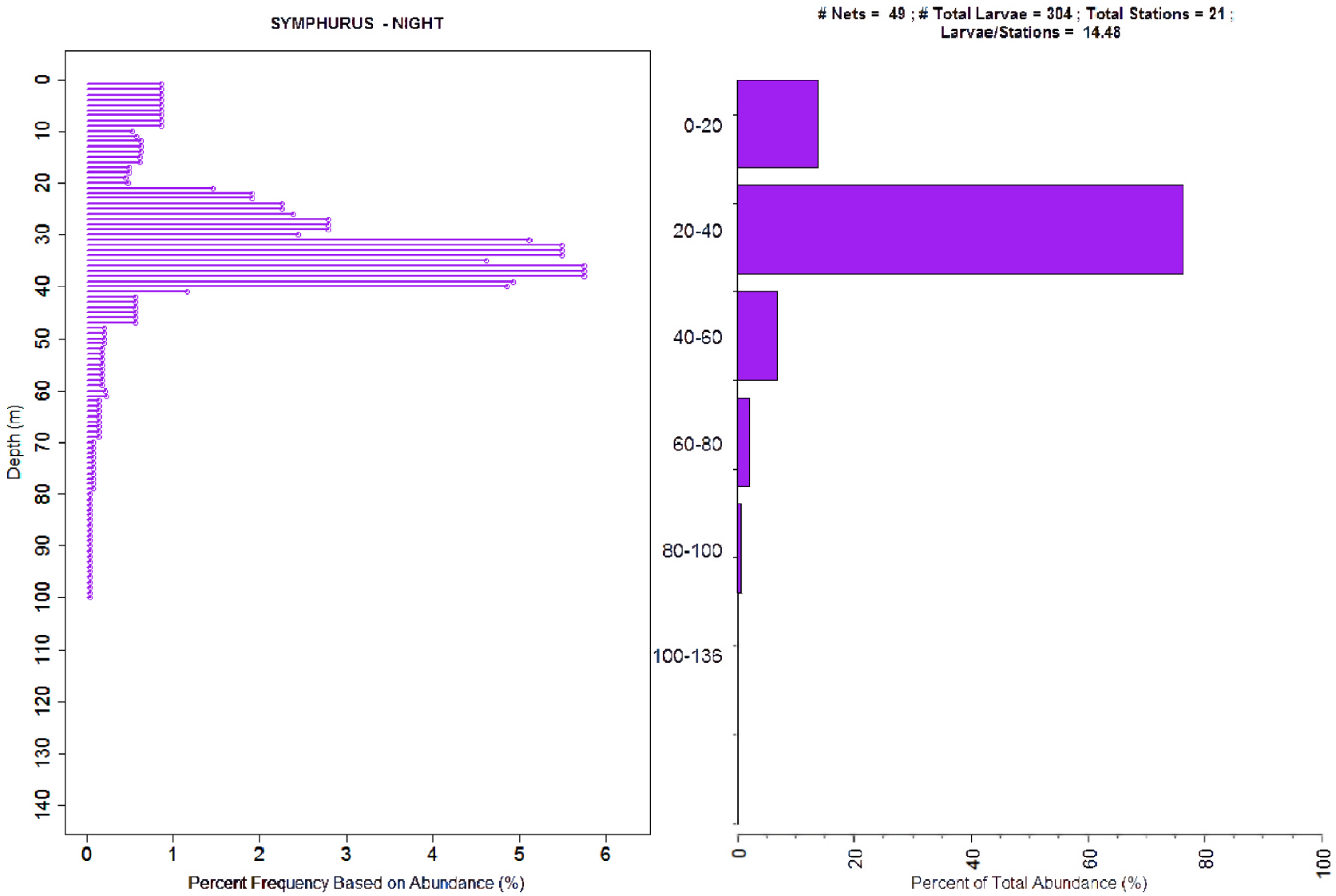
SYACIUM, NIGHT



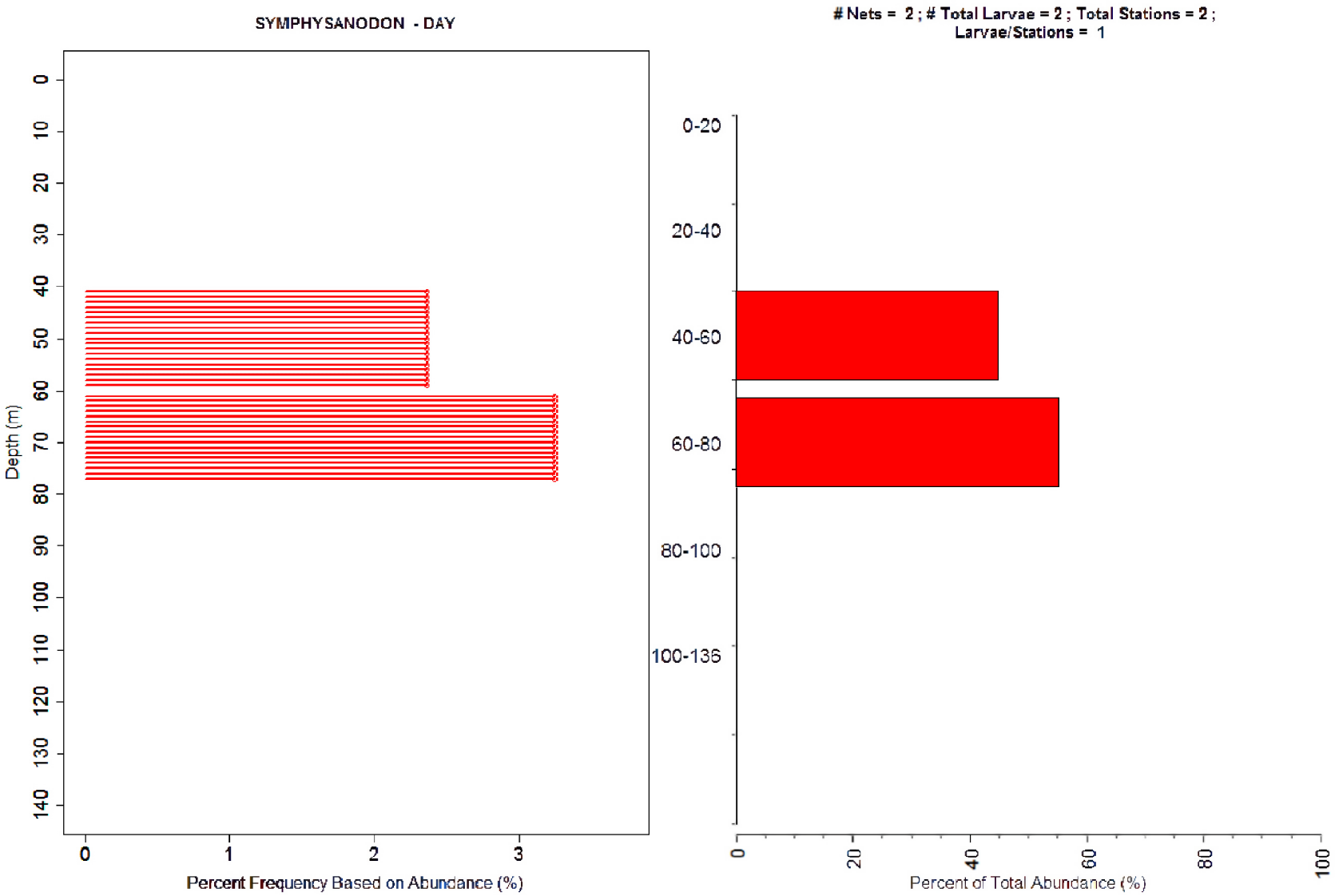
SYMBOLOPHORUS_RUFINUS, NIGHT



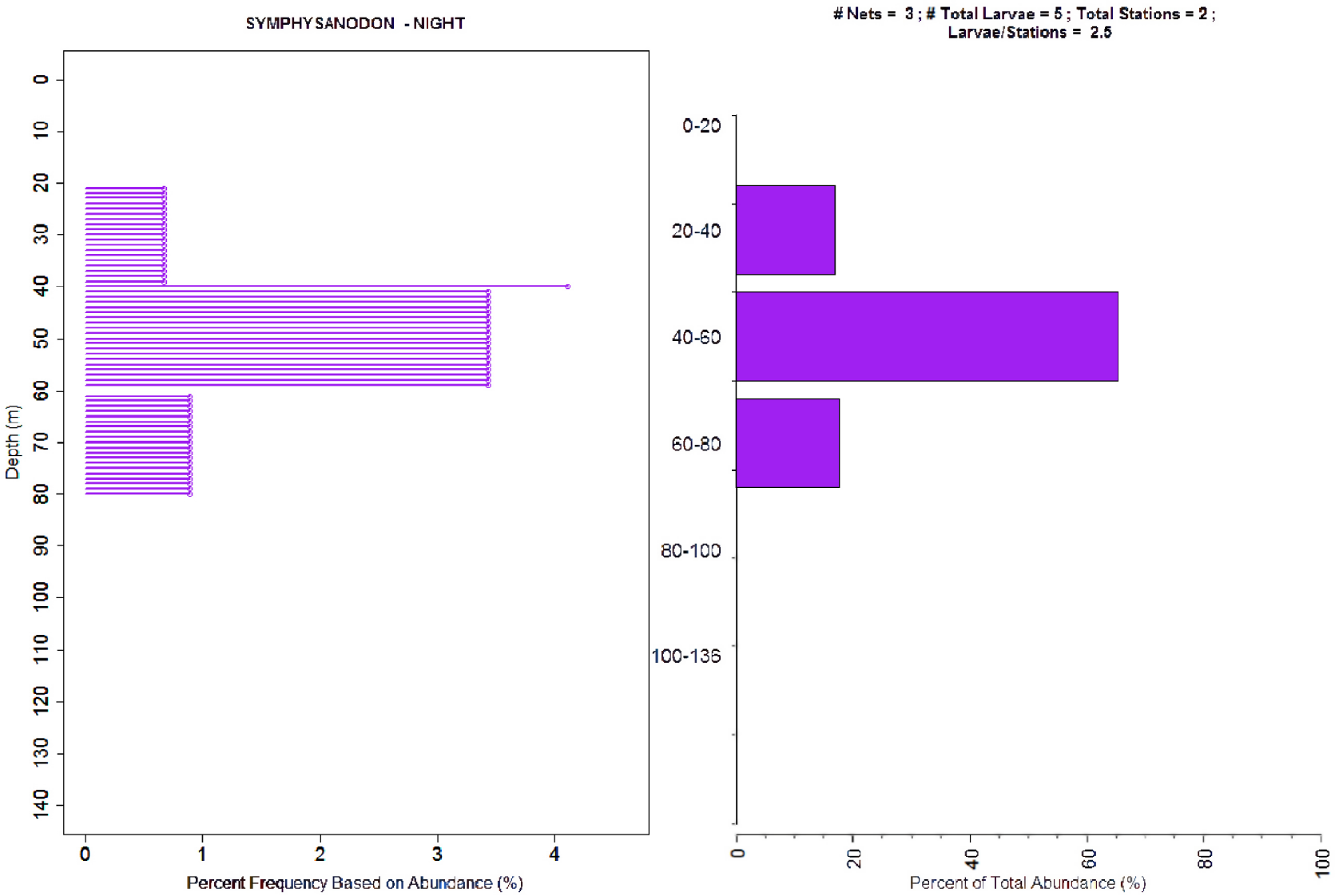
SYMPHURUS, DAY



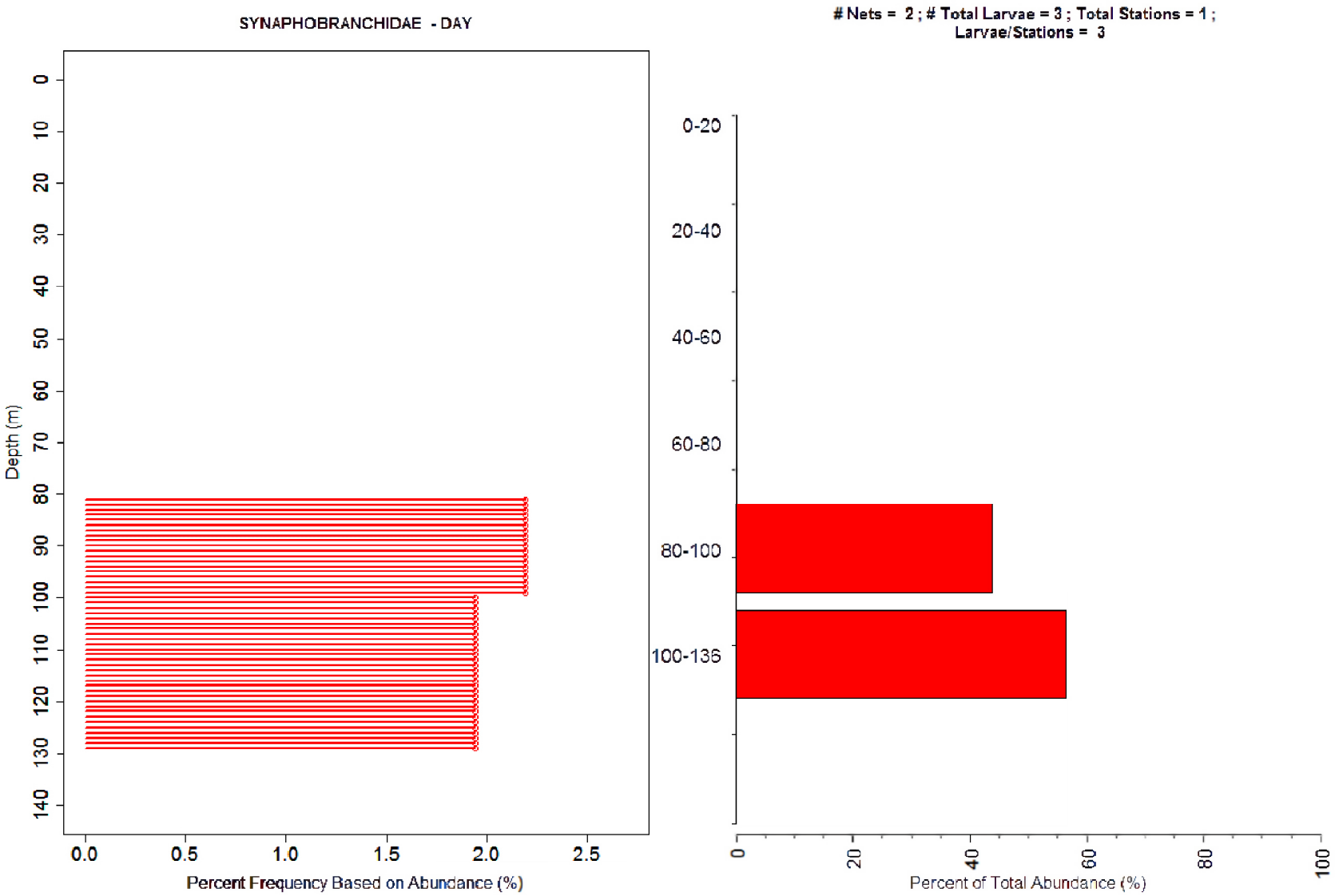
SYMPHURUS, NIGHT



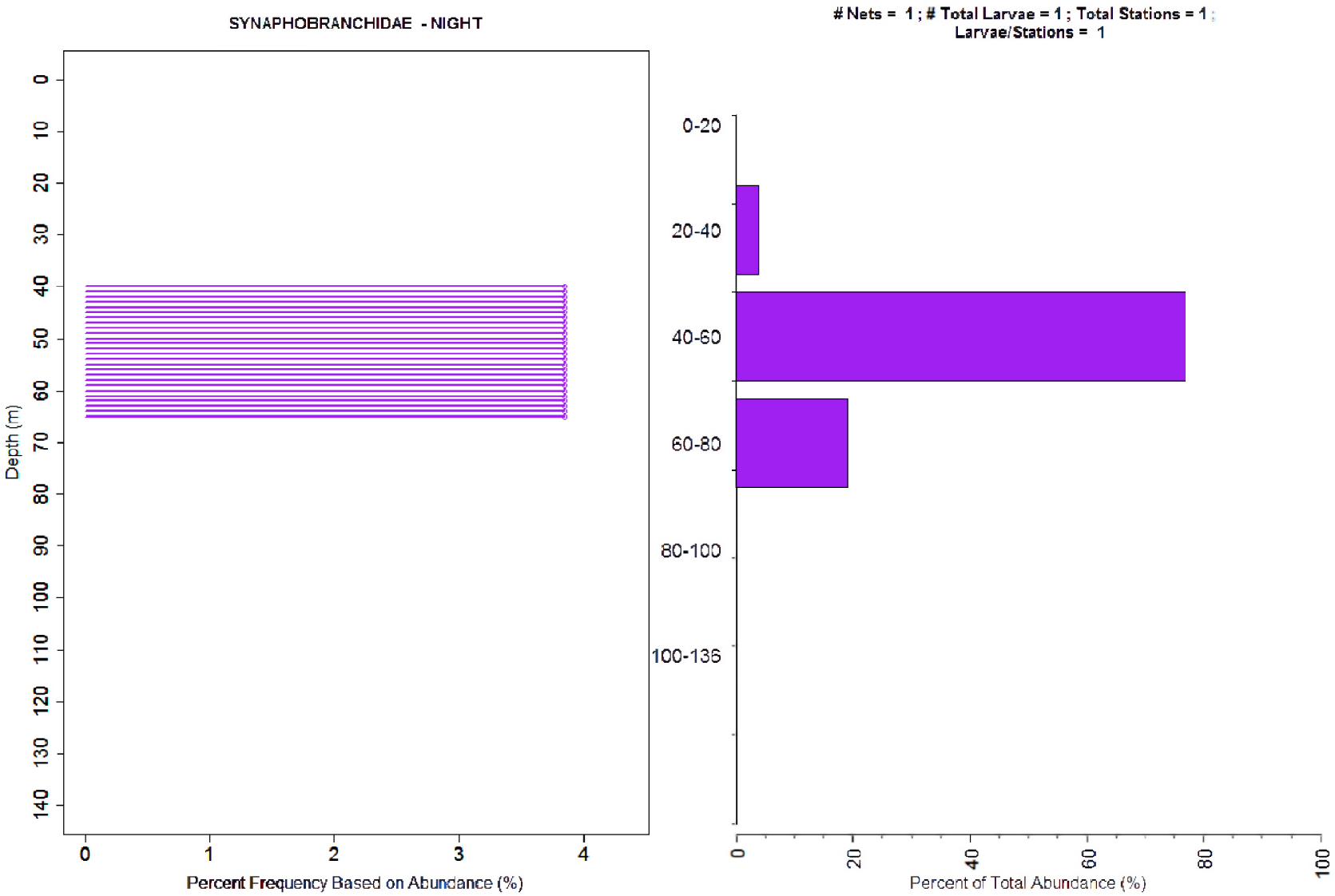
SYMPHYSANODON, DAY



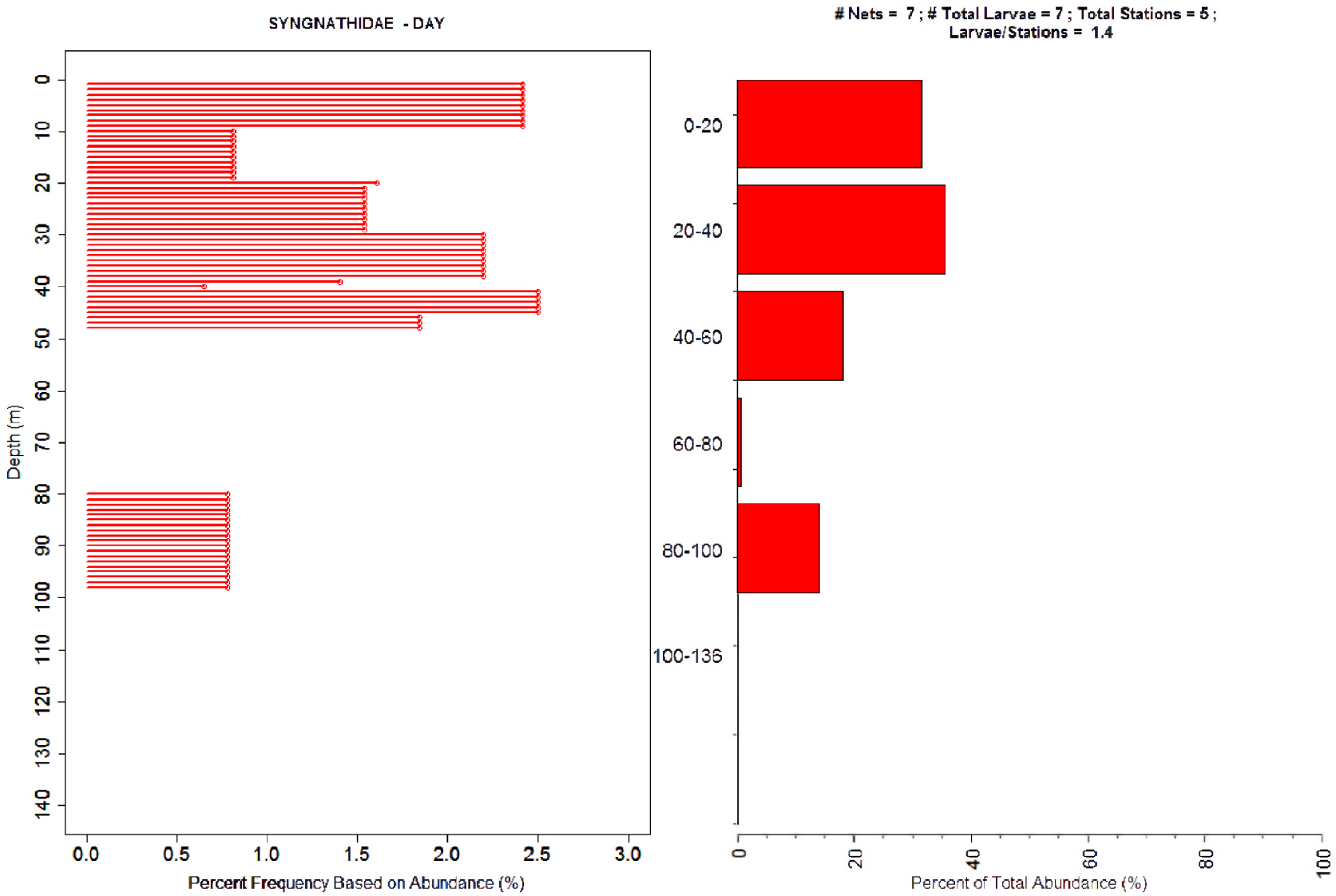
SYMPHYSANODON, NIGHT



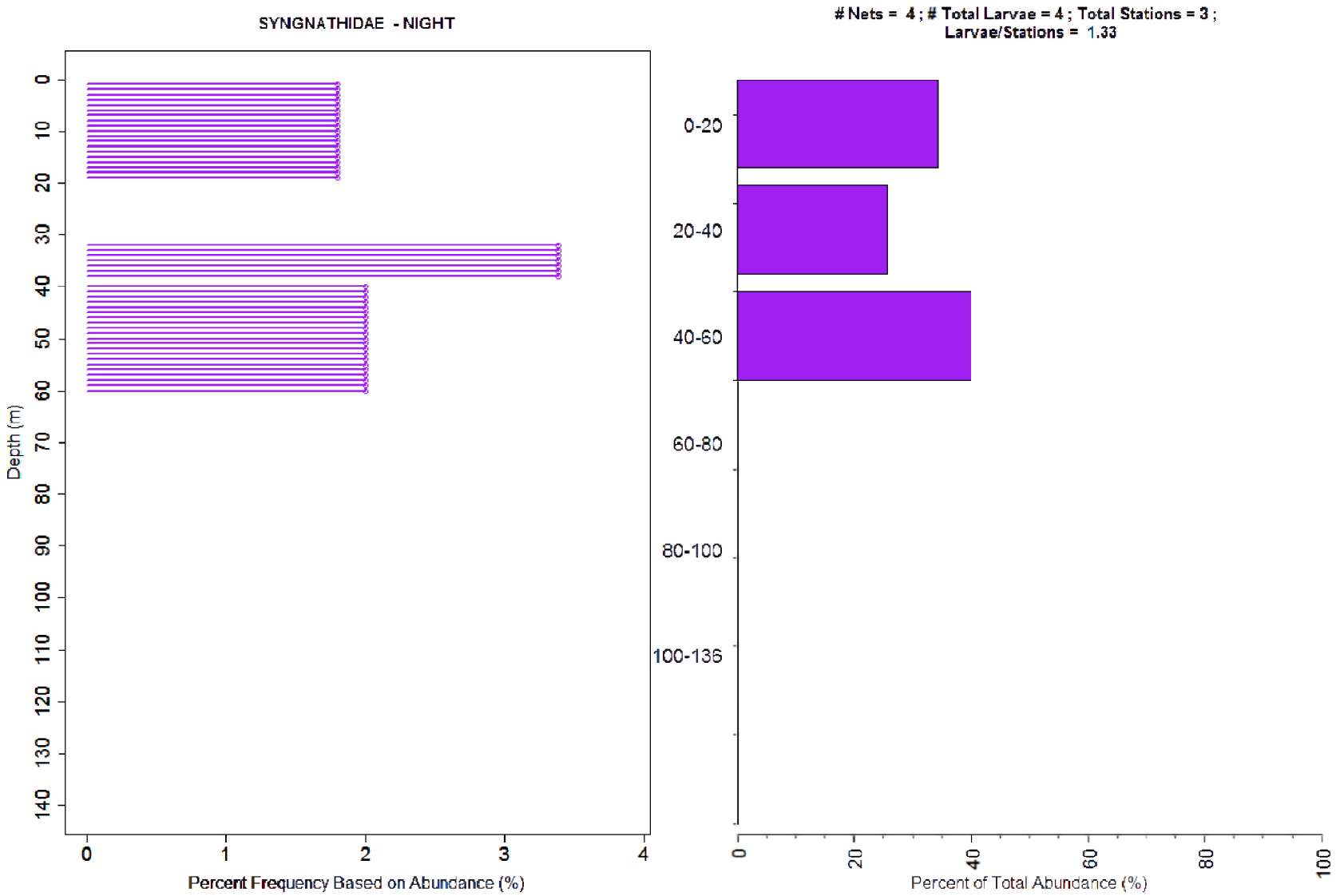
SYNAPHOBRANCHIDAE, DAY



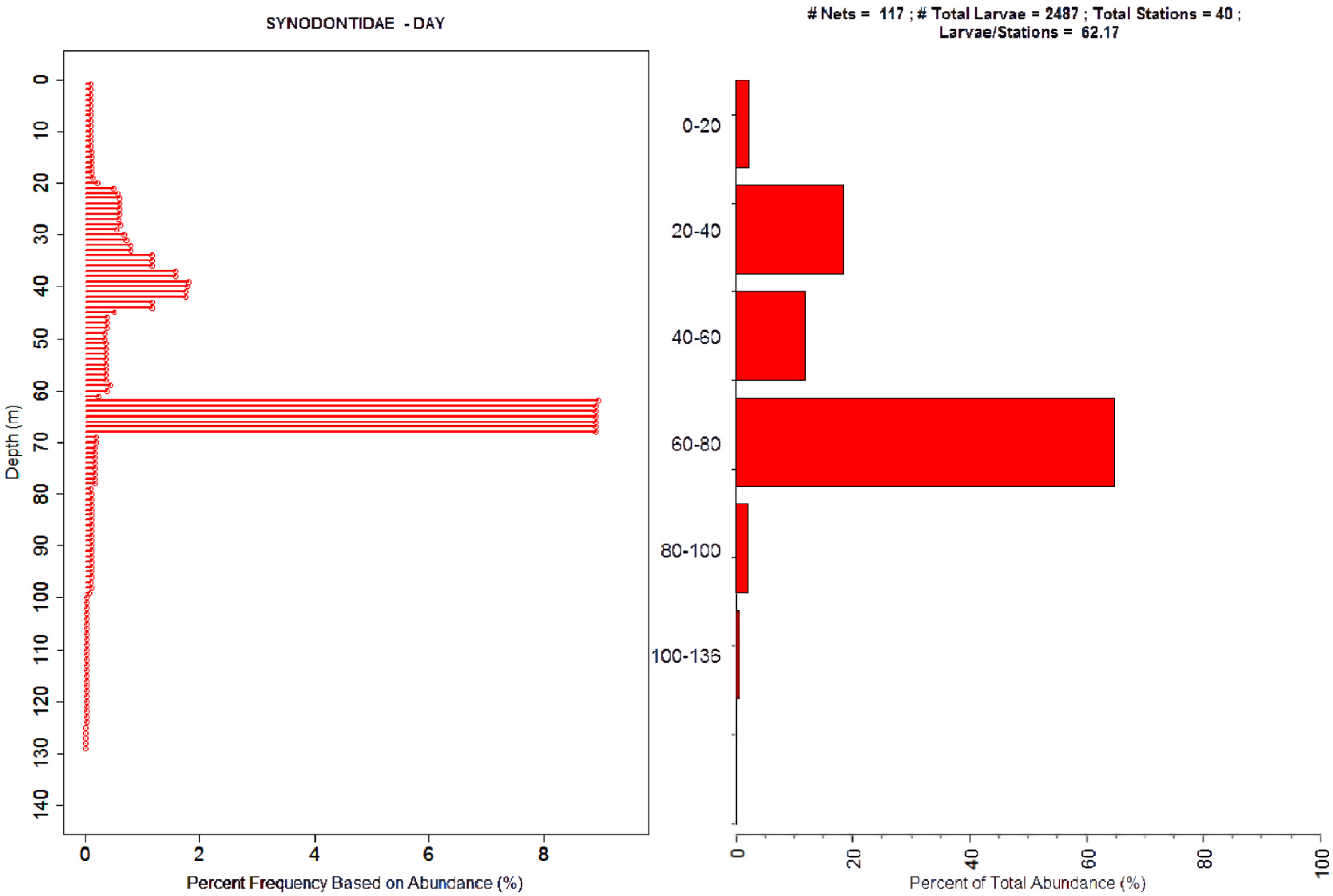
SYNAPHOBRANCHIDAE, NIGHT



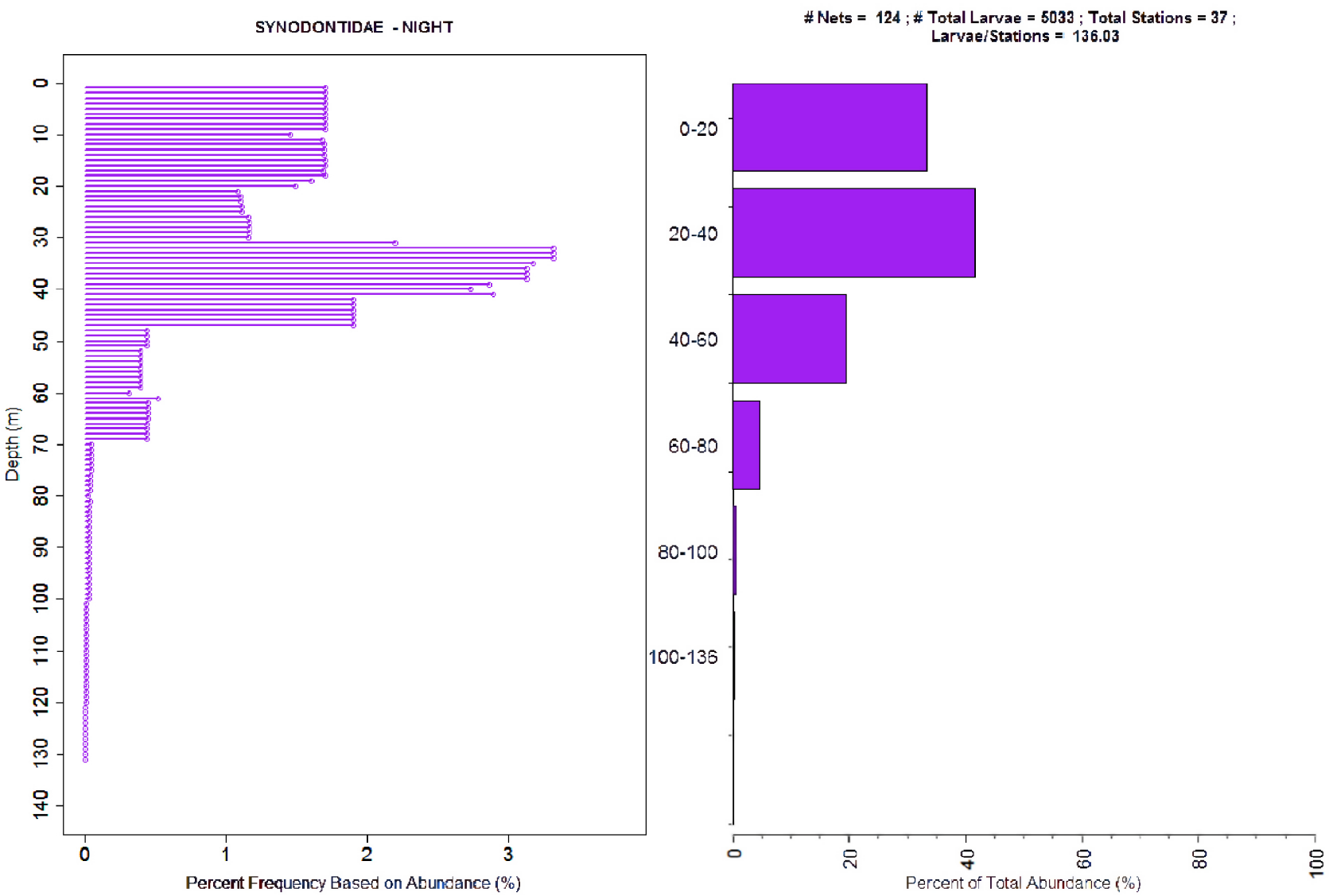
SYNGNATHIDAE, DAY



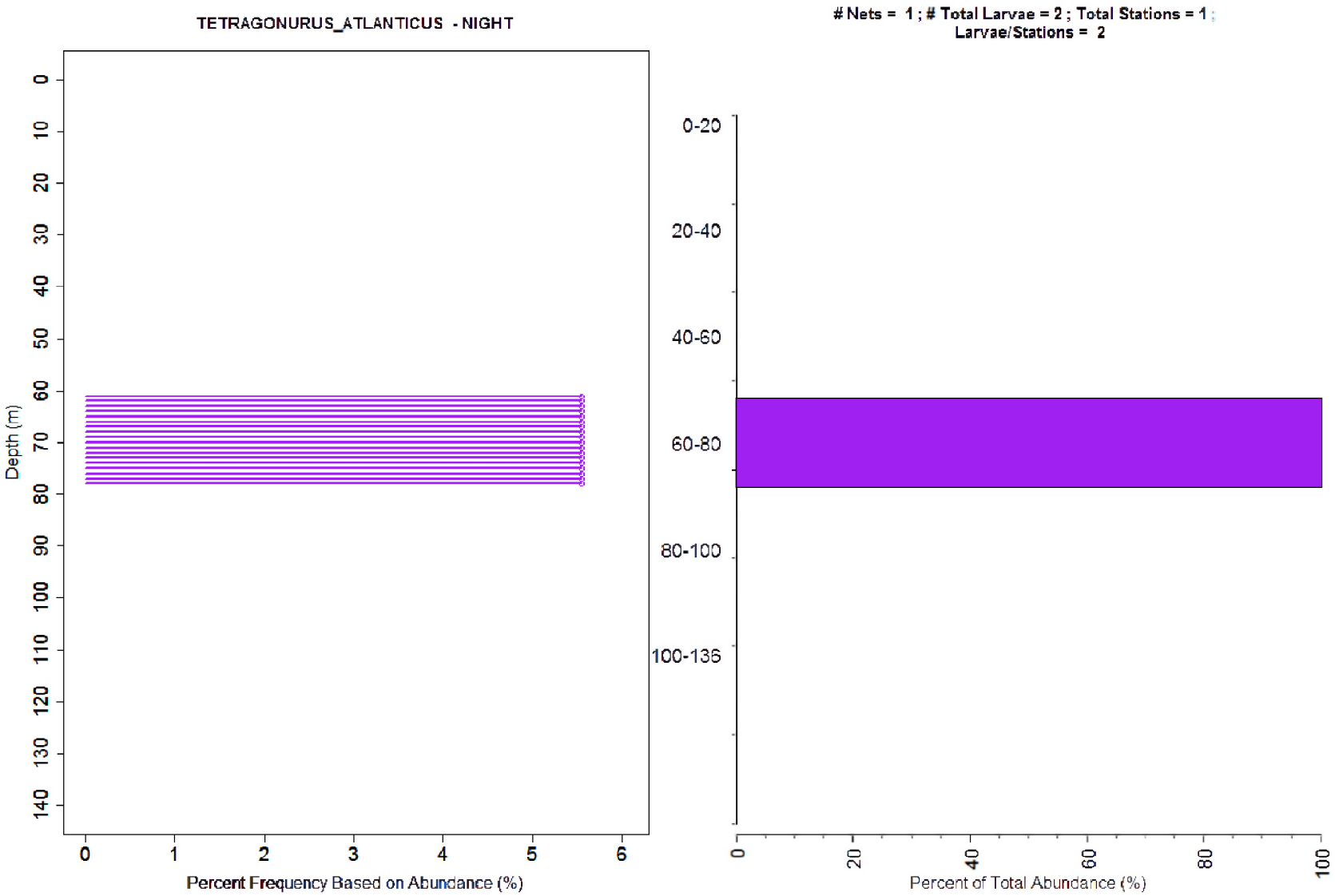
SYNGNATHIDAE, NIGHT



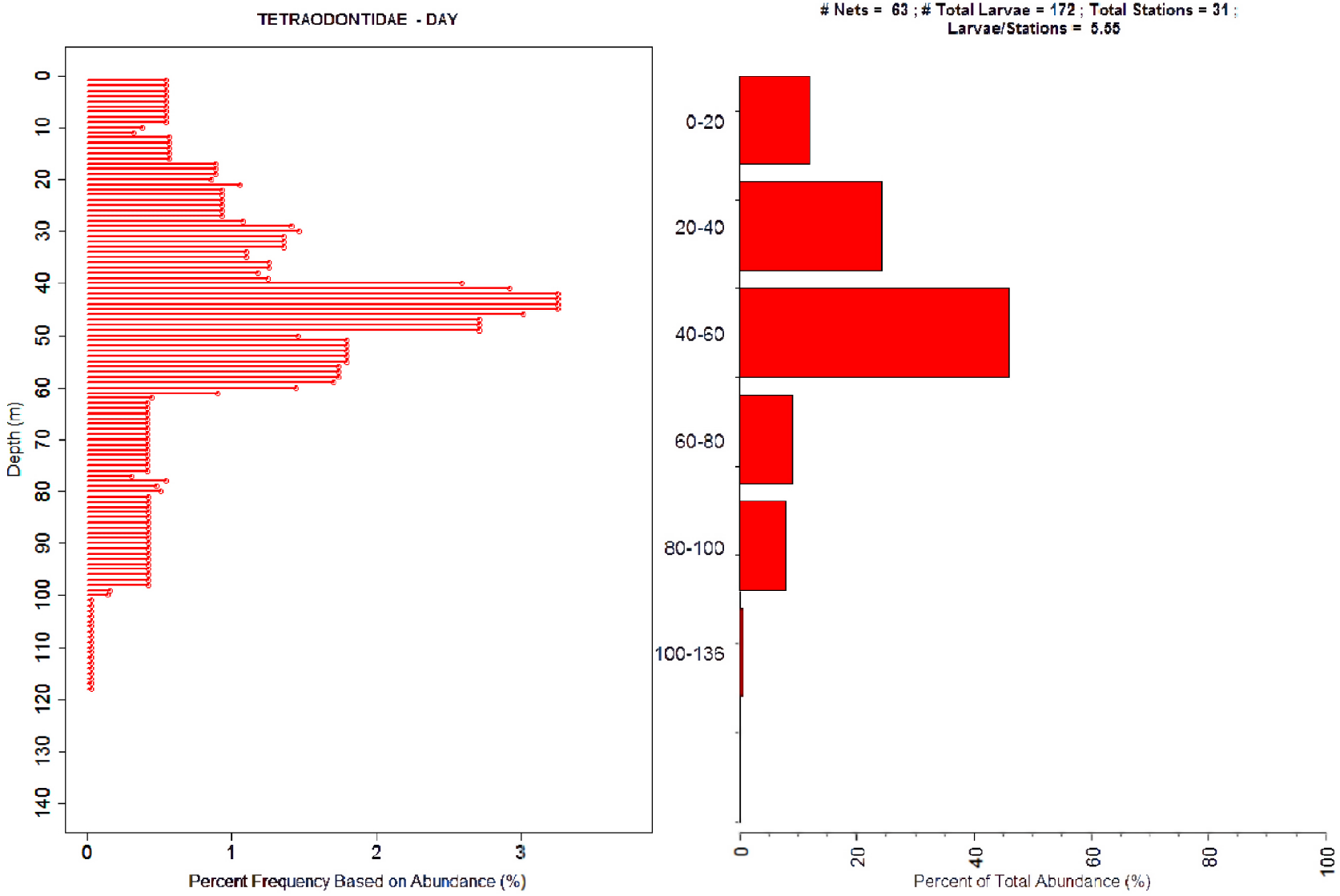
SYNODONTIDAE, DAY



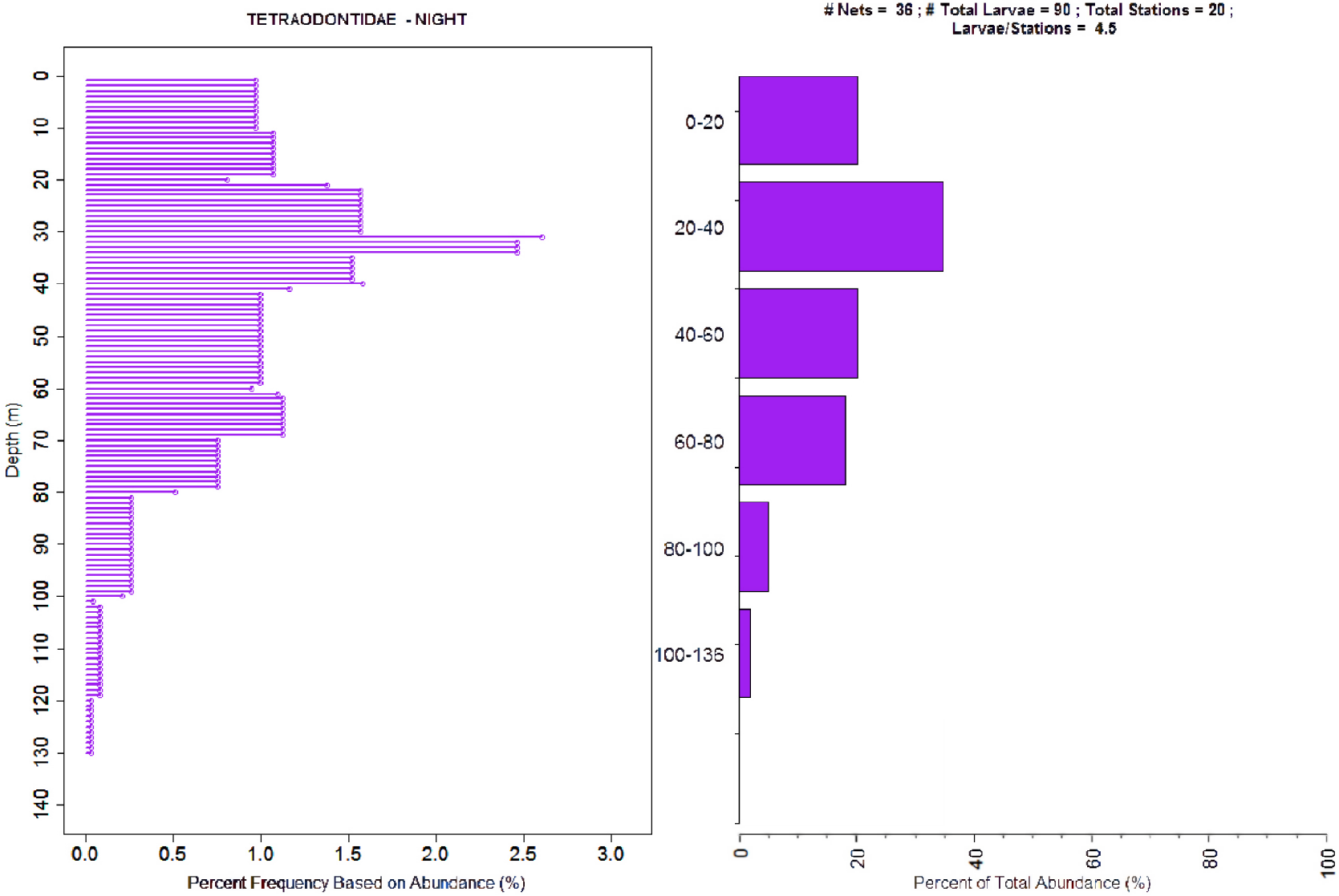
SYNODONTIDAE, NIGHT



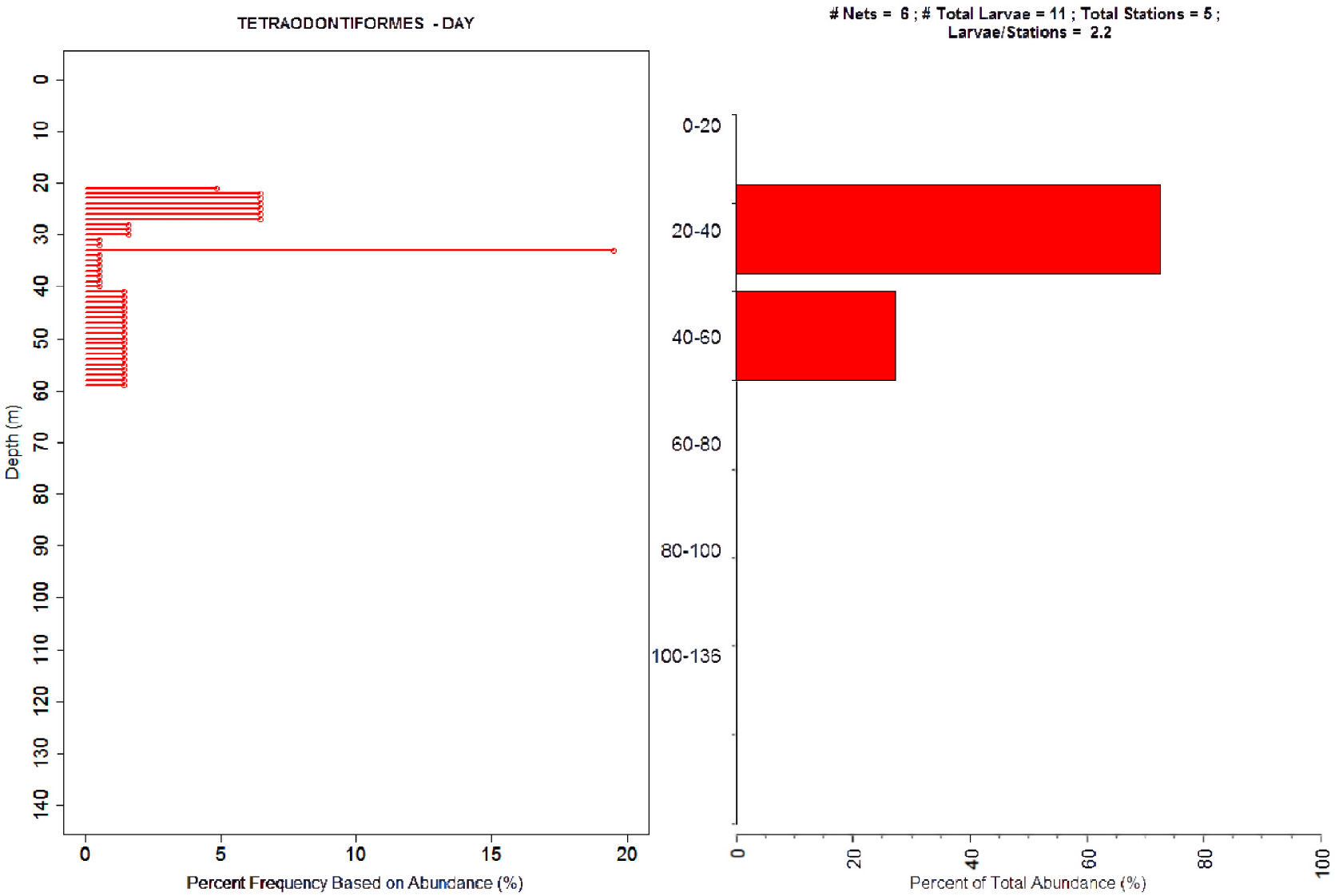
TETRAGONURUS_ATLANTICUS, NIGHT



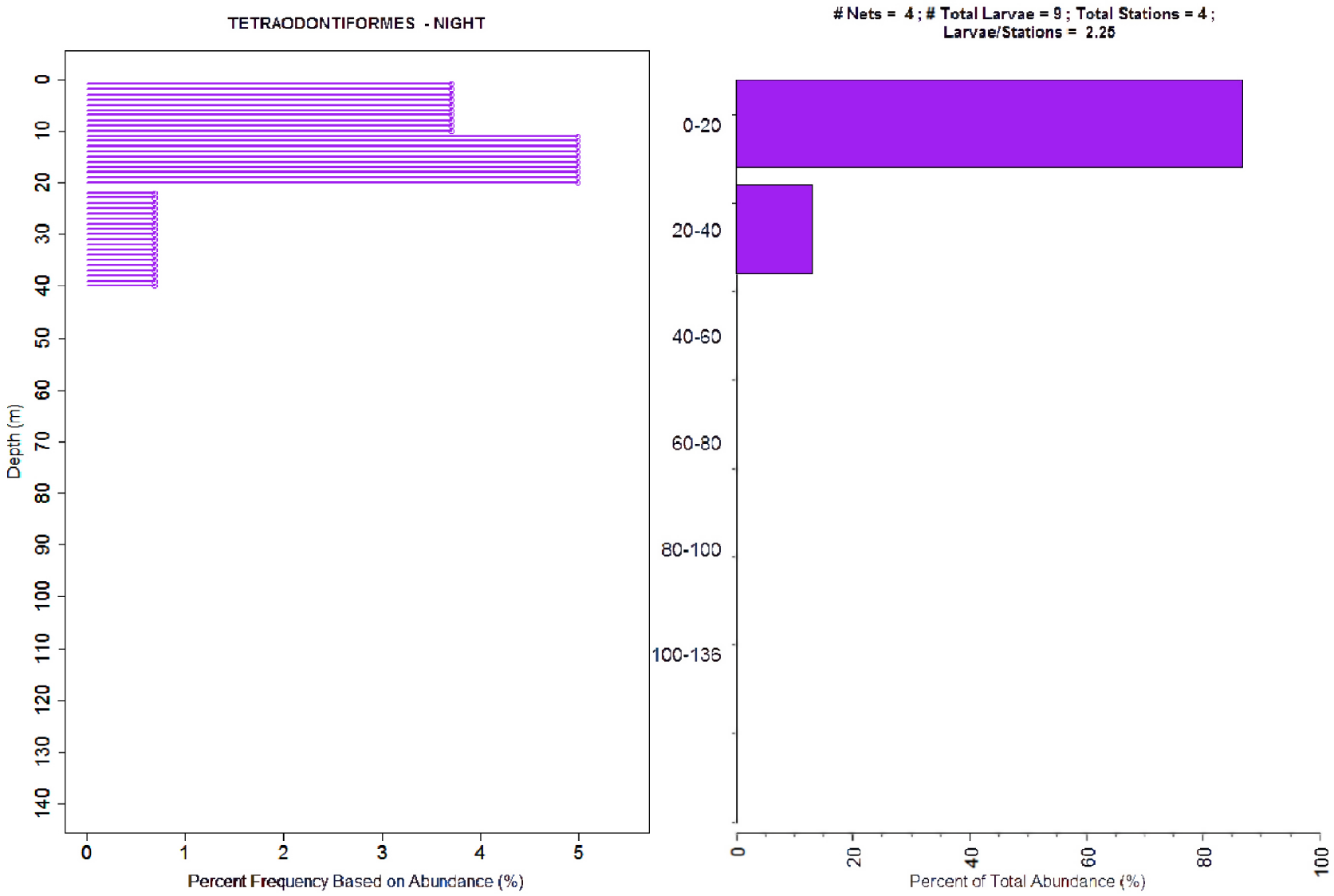
TETRAODONTIDAE, DAY



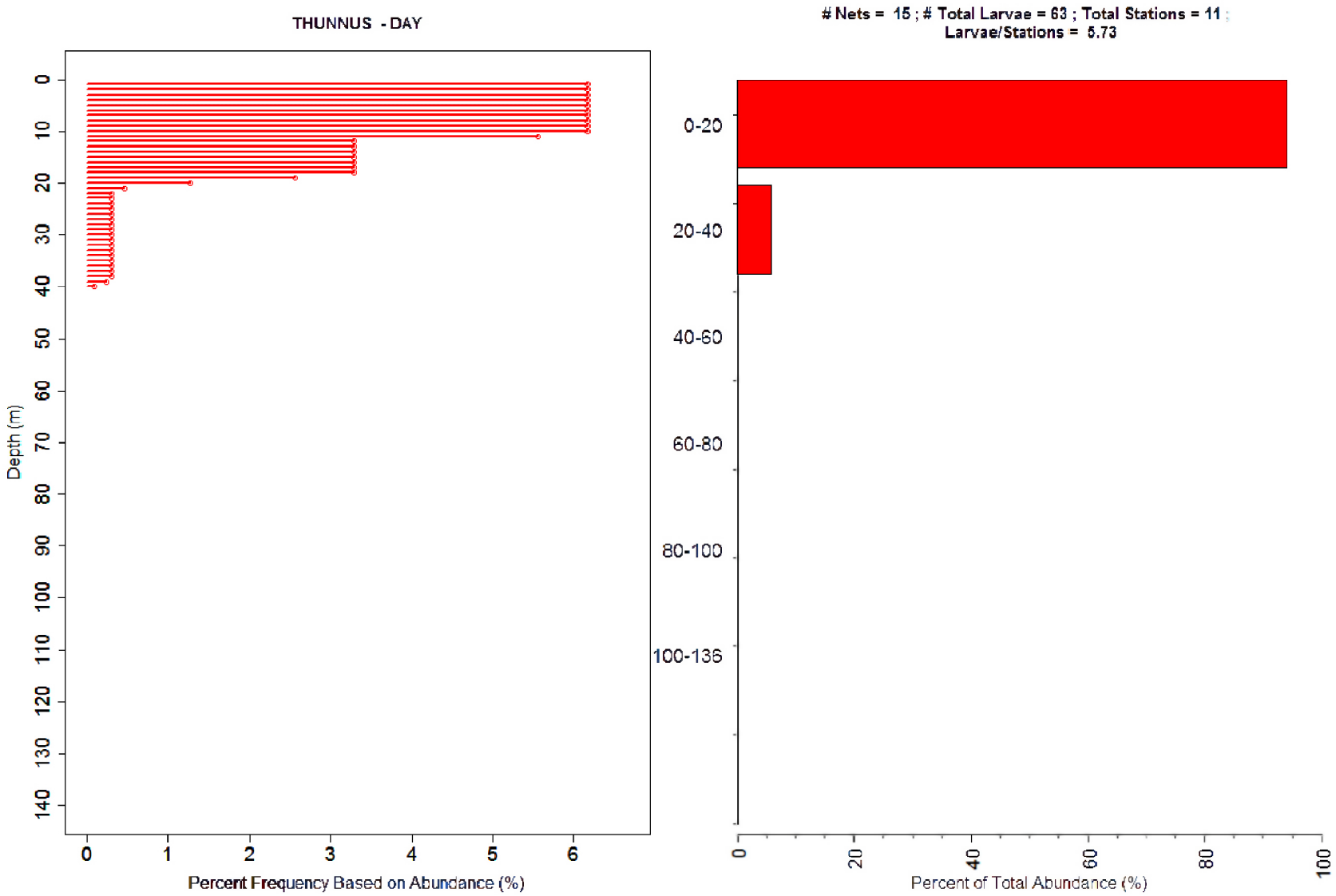
TETRAODONTIDAE, NIGHT



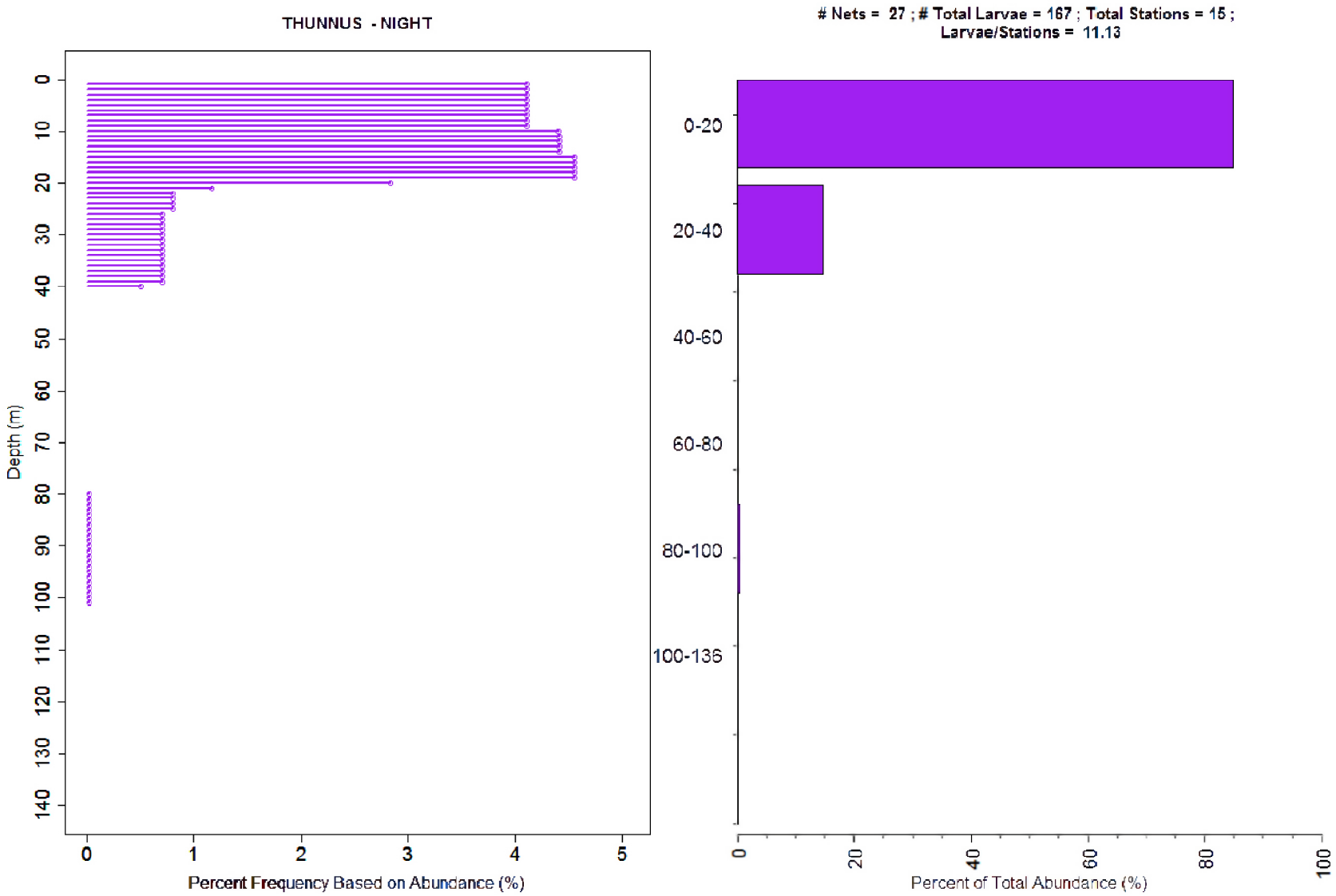
TETRAODONTIFORMES, DAY



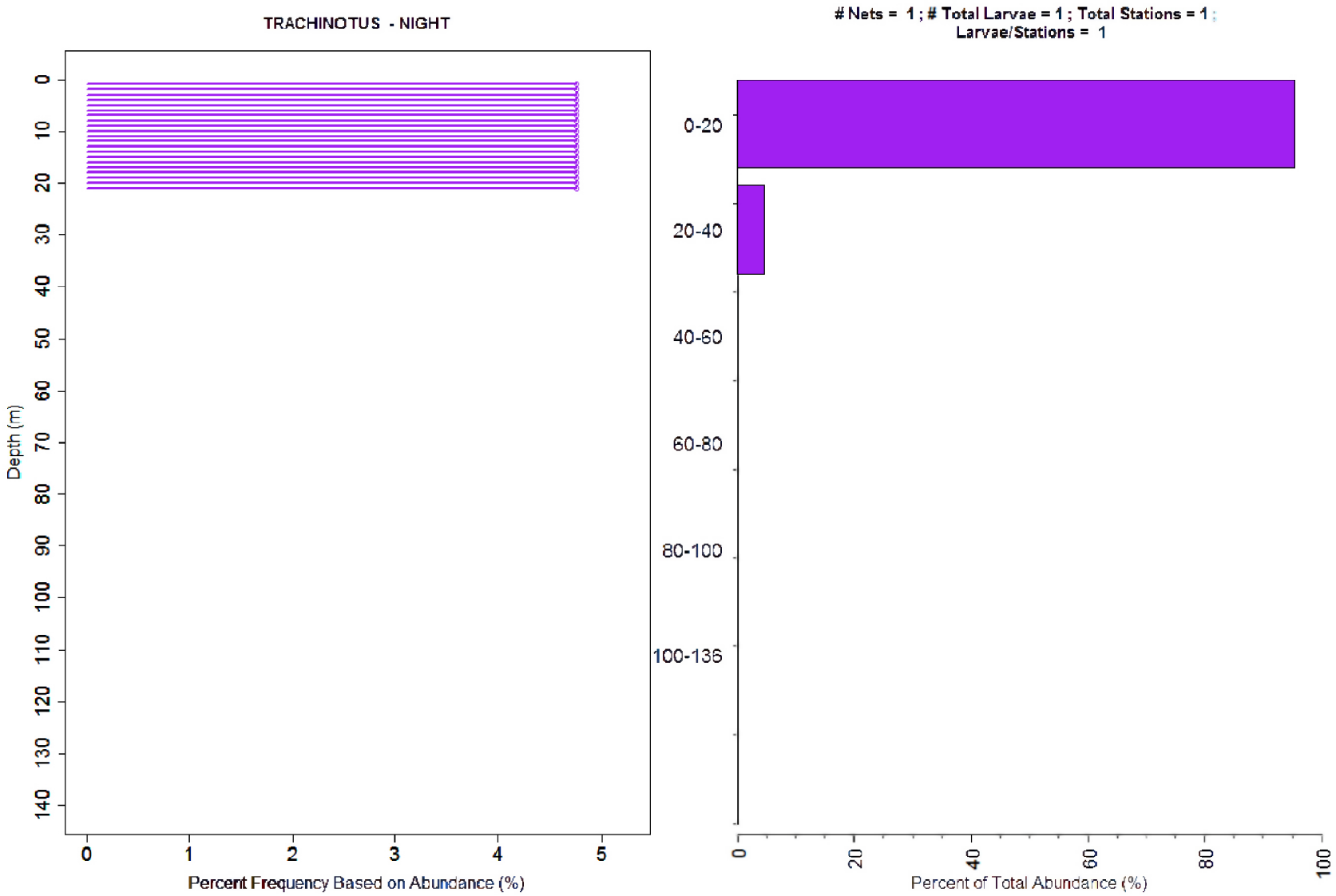
TETRAODONTIFORMES, NIGHT


THUNNUS - DAY
Nets = 15 ; # Total Larvae = 63 ; Total Stations = 11 ;
Larvae/Stations = 5.73
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

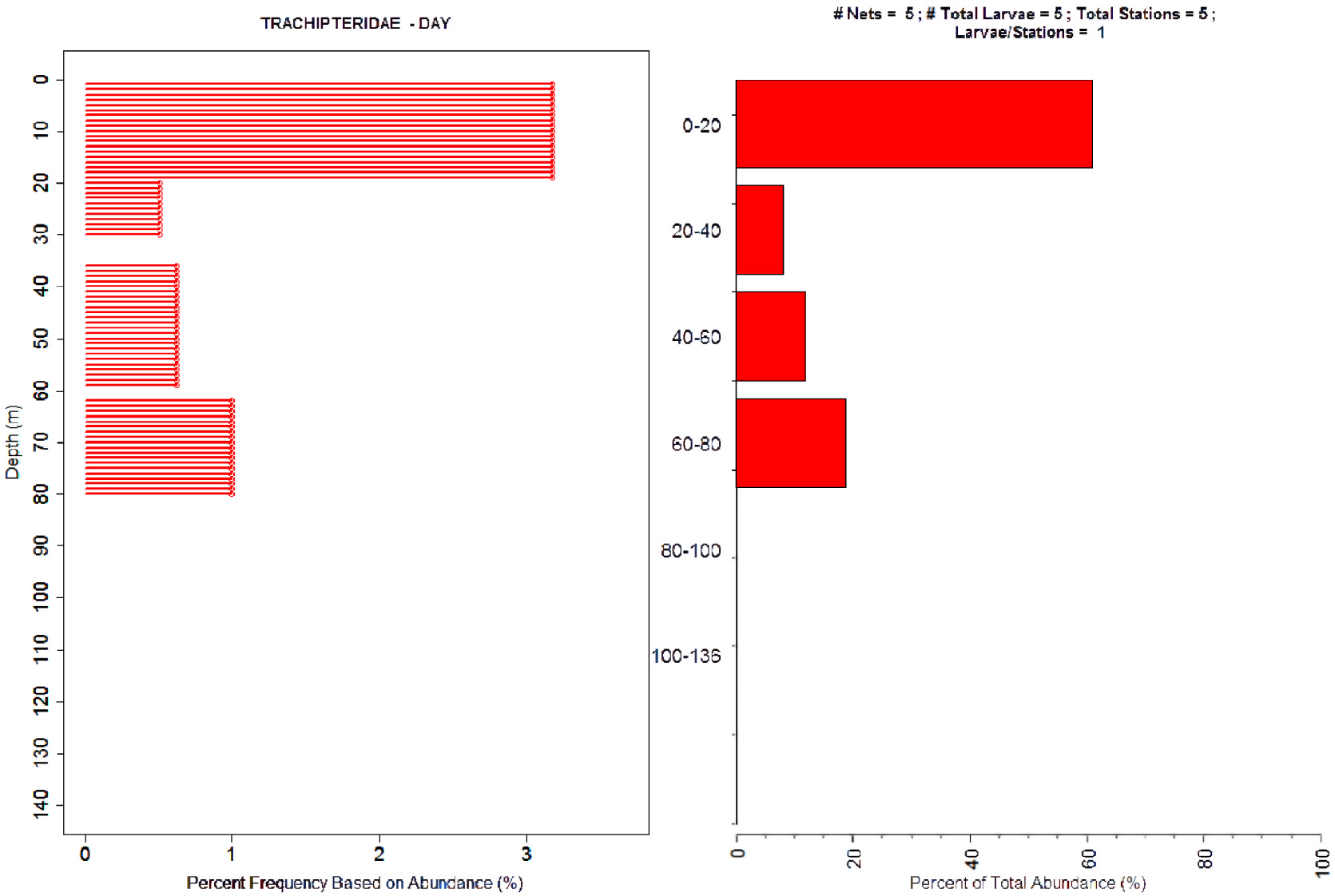
THUNNUS, DAY



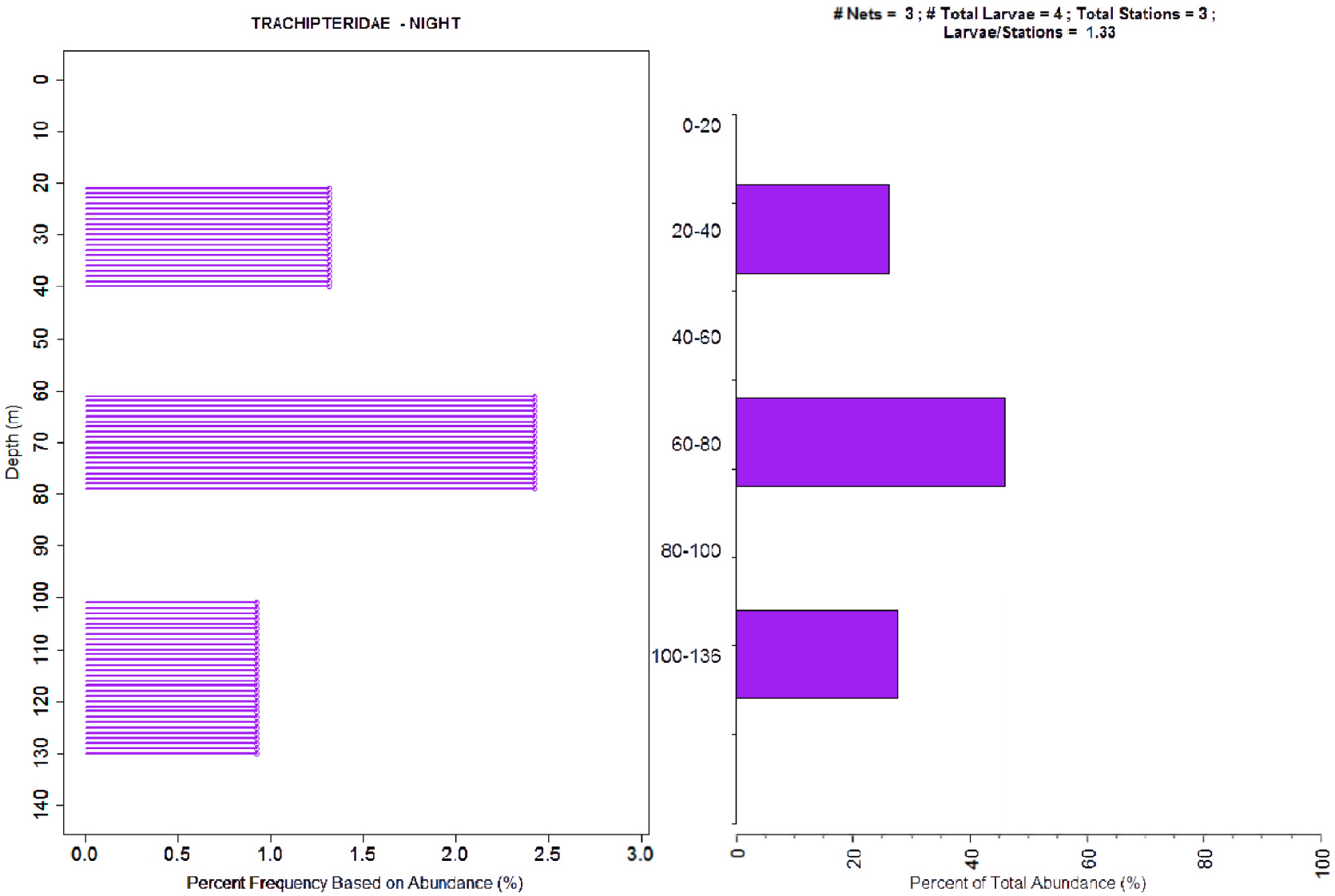
THUNNUS, NIGHT



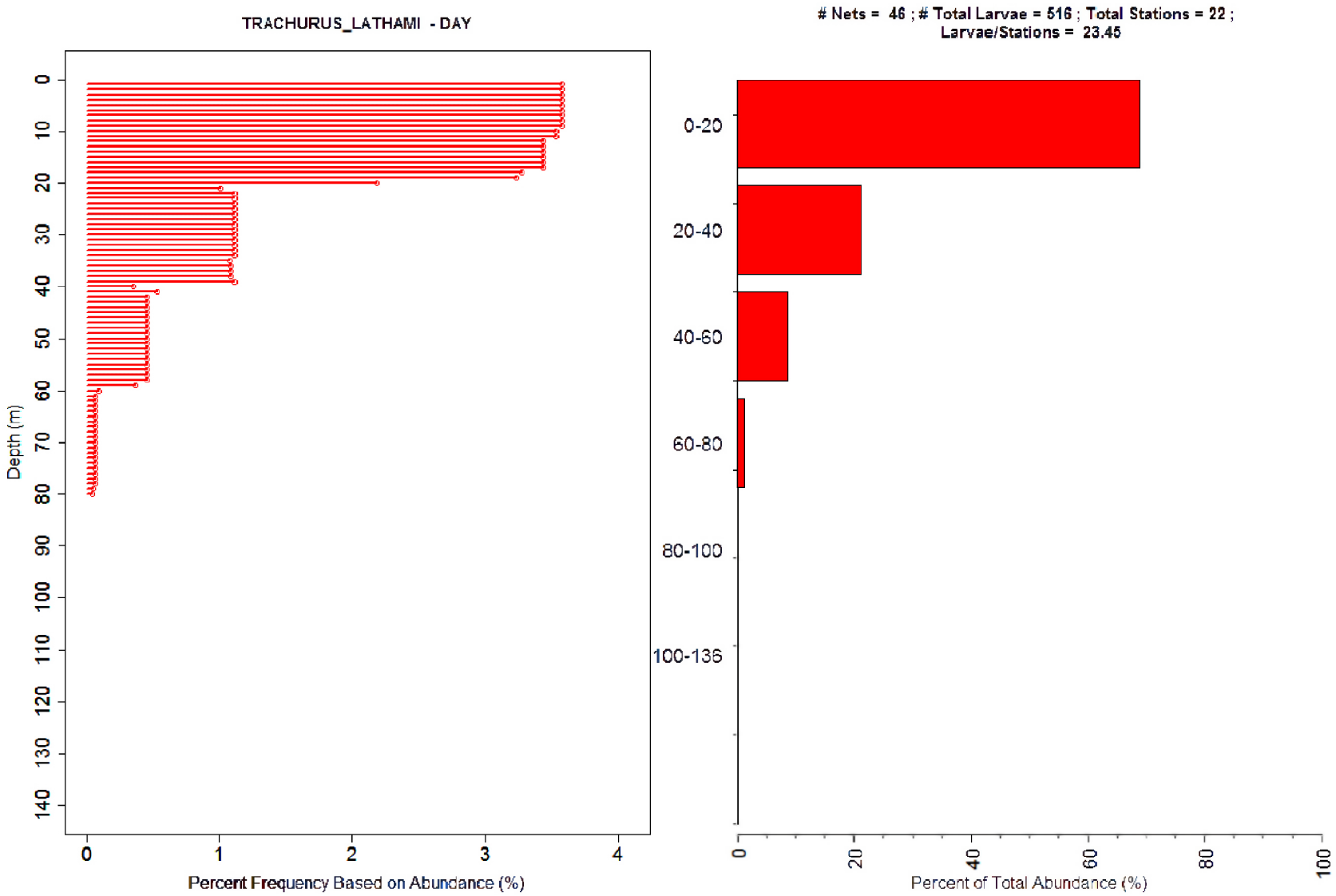
TRACHINOTUS, NIGHT



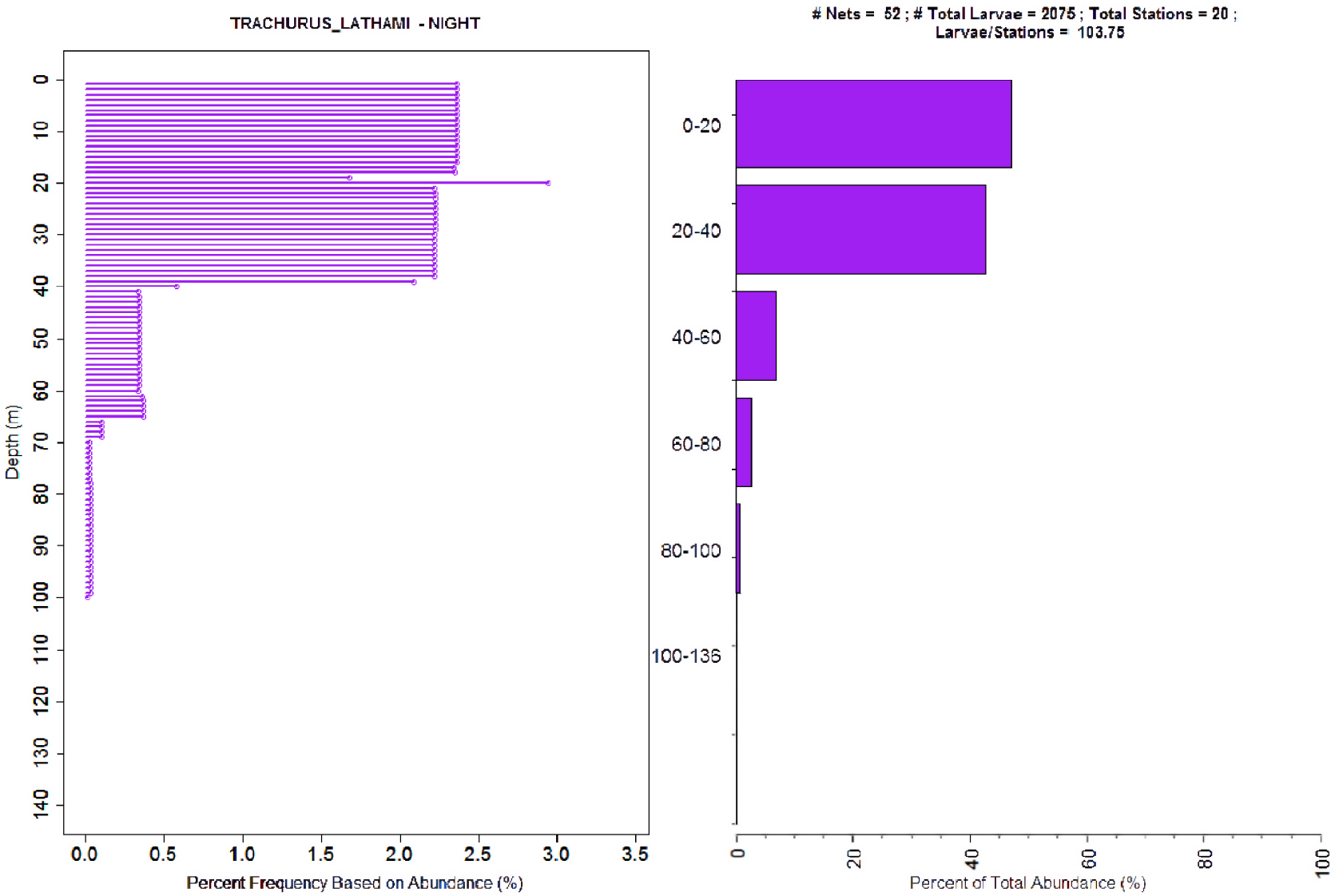
TRACHIPTERIDAE, DAY



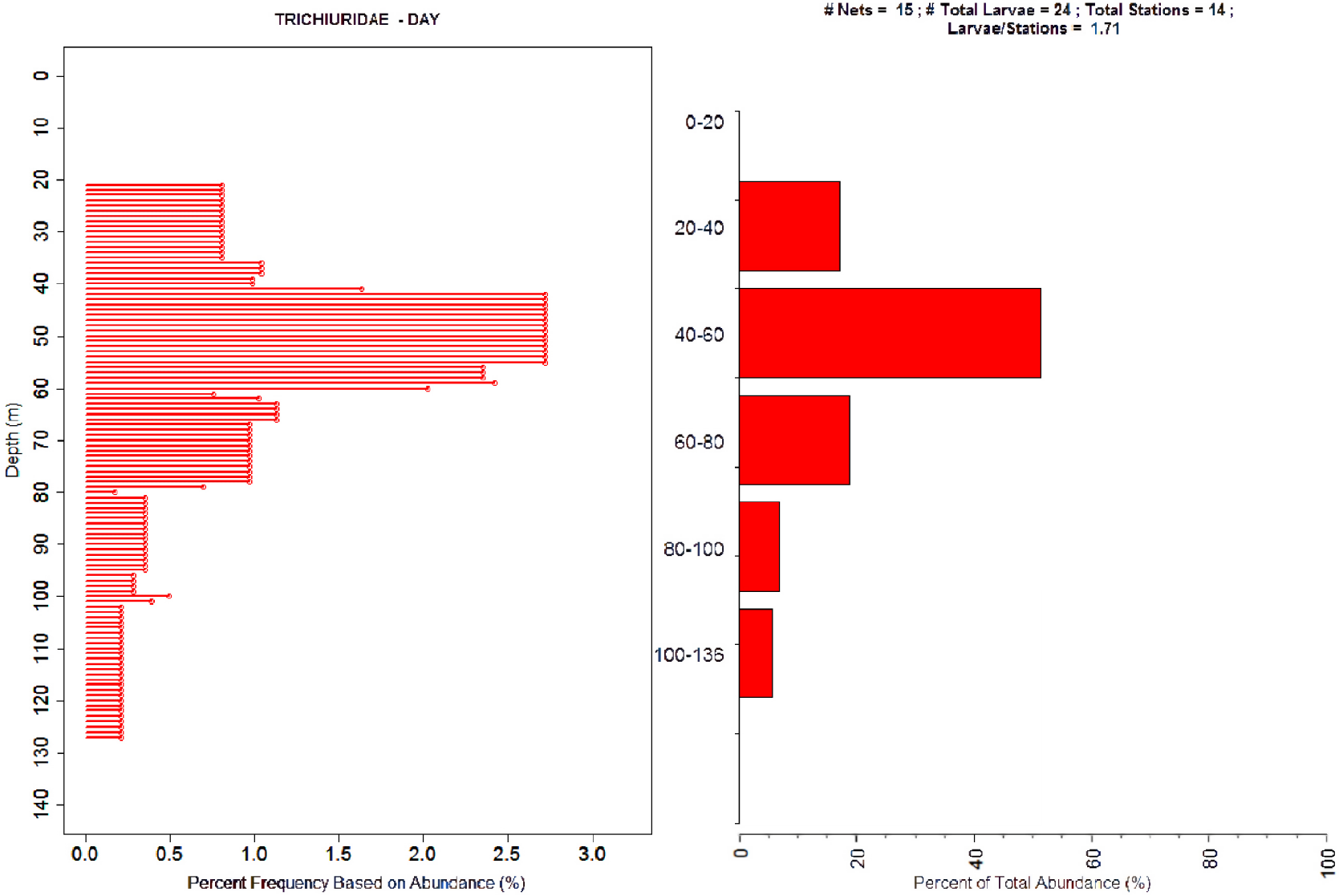
TRACHIPTERIDAE, NIGHT



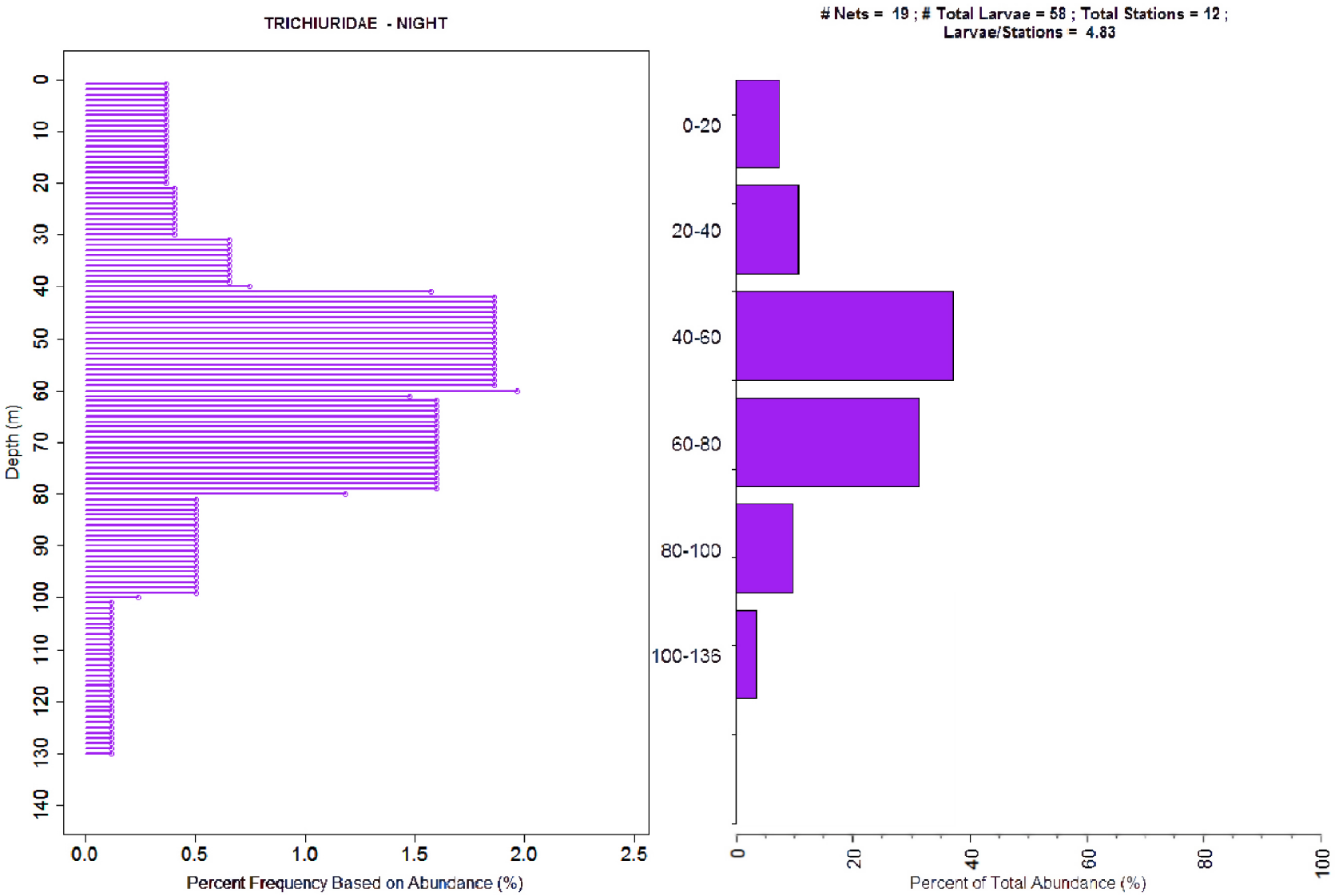
TRACHURUS_LATHAMI, DAY



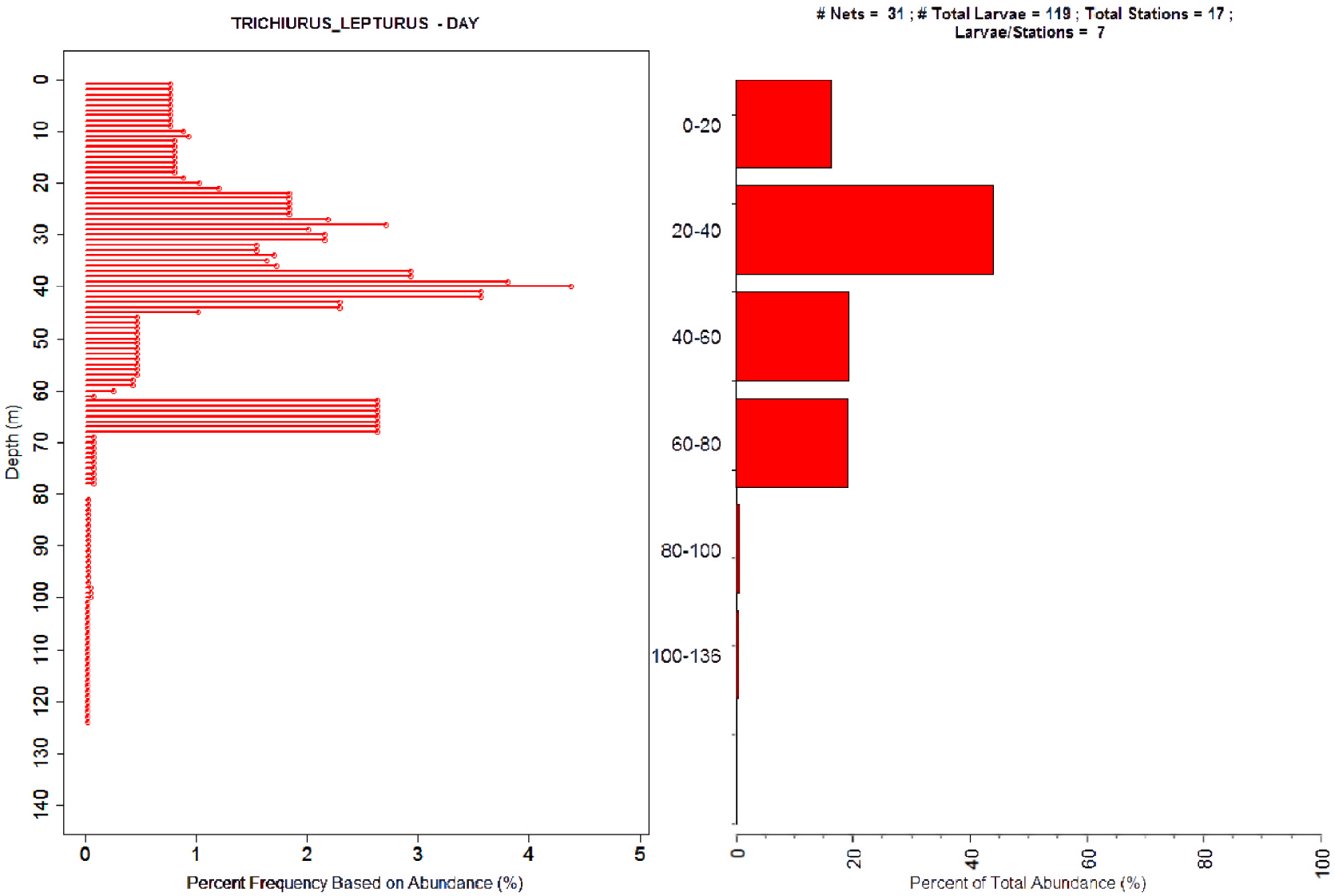
TRACHURUS_LATHAMI, NIGHT



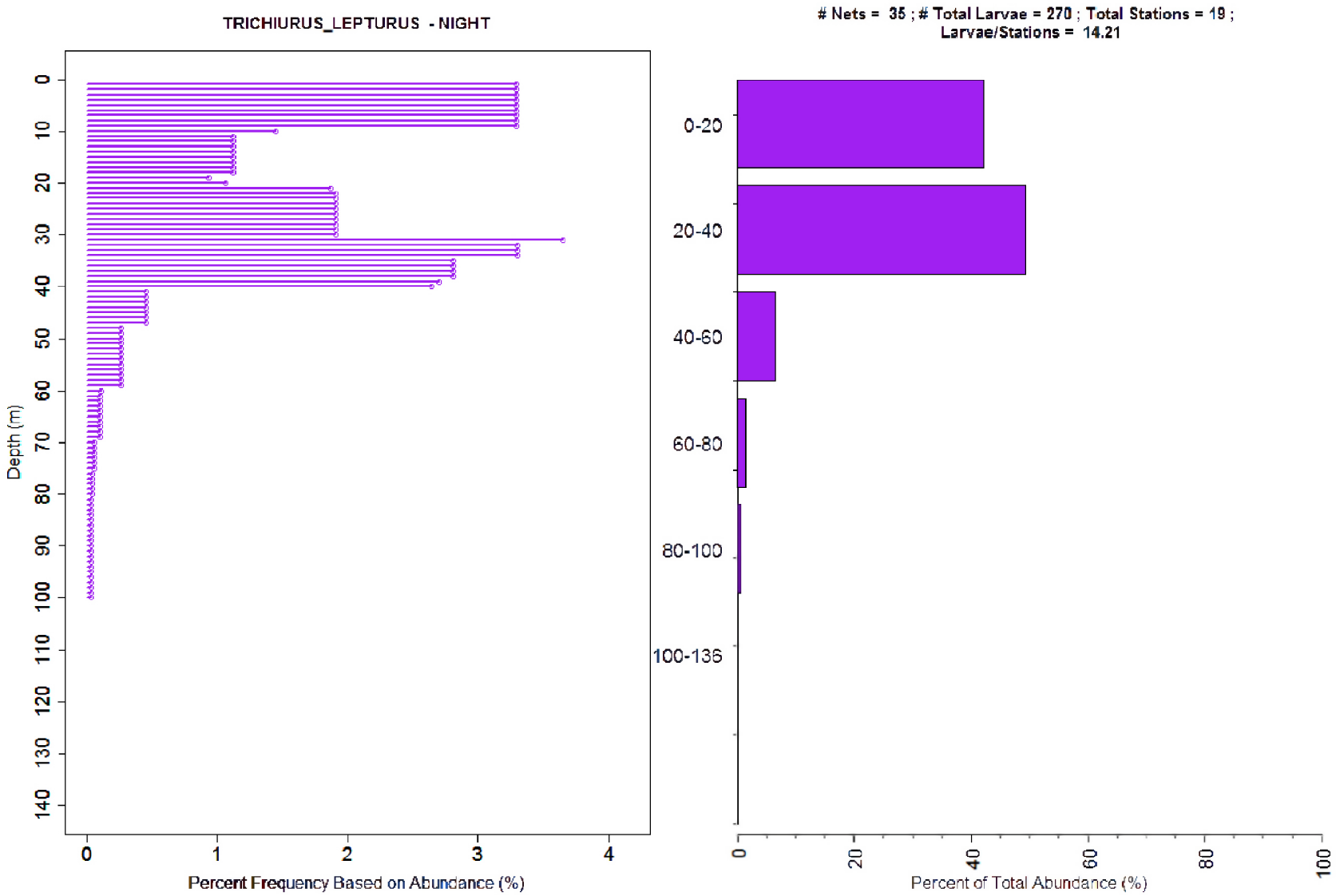
TRICHIURIDAE, DAY



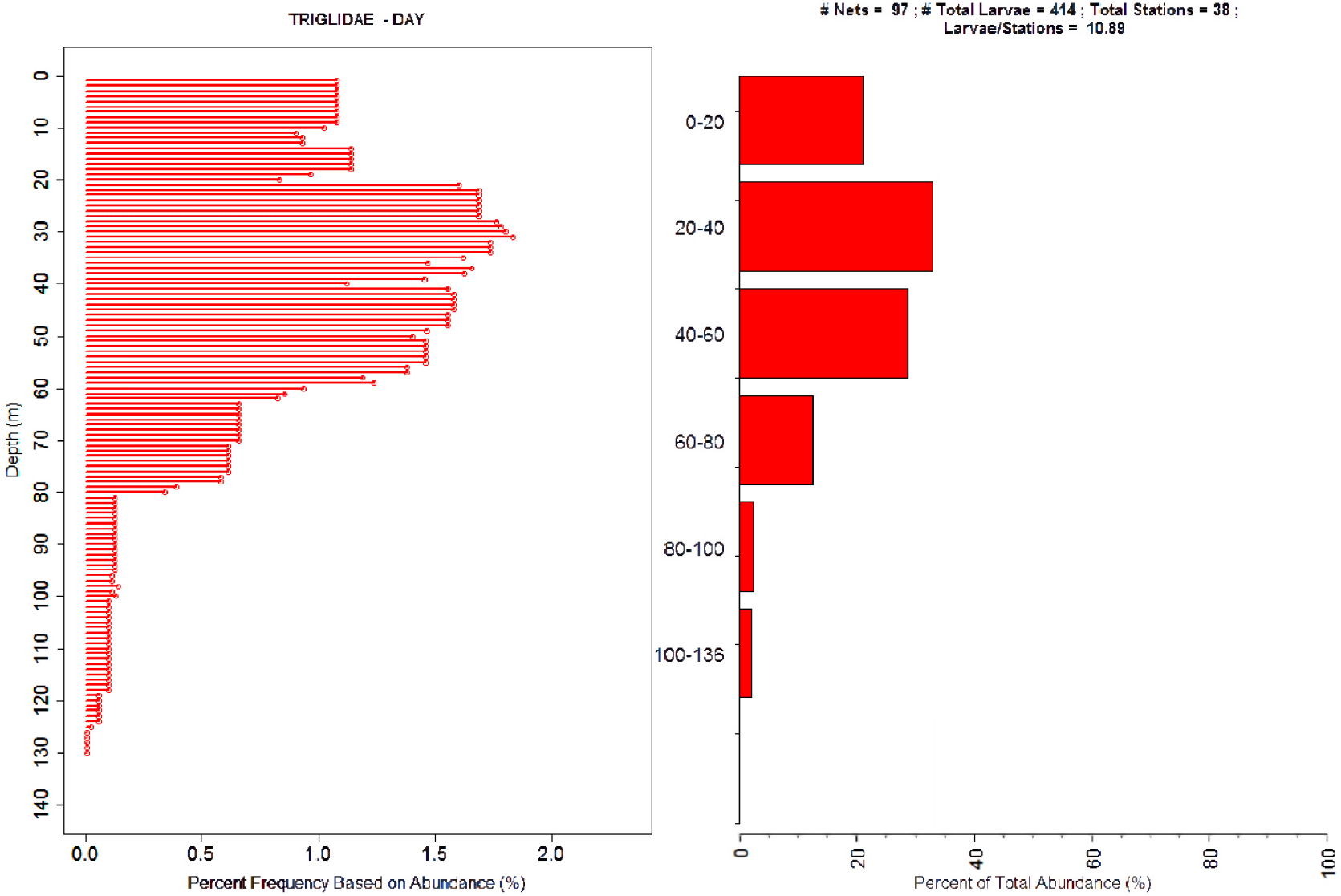
TRICHIURIDAE, NIGHT



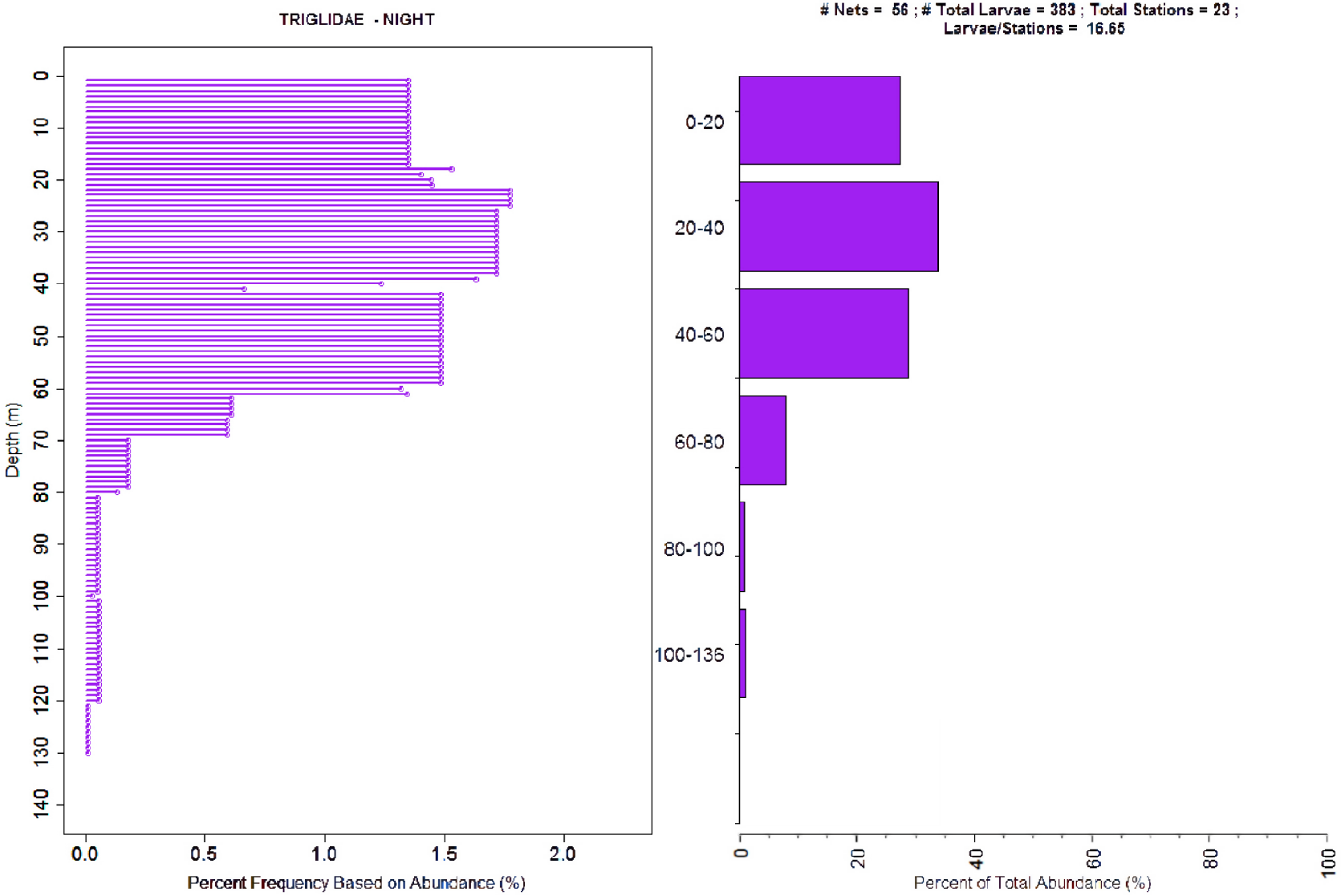
TRICHIURUS_LEPTURUS, DAY



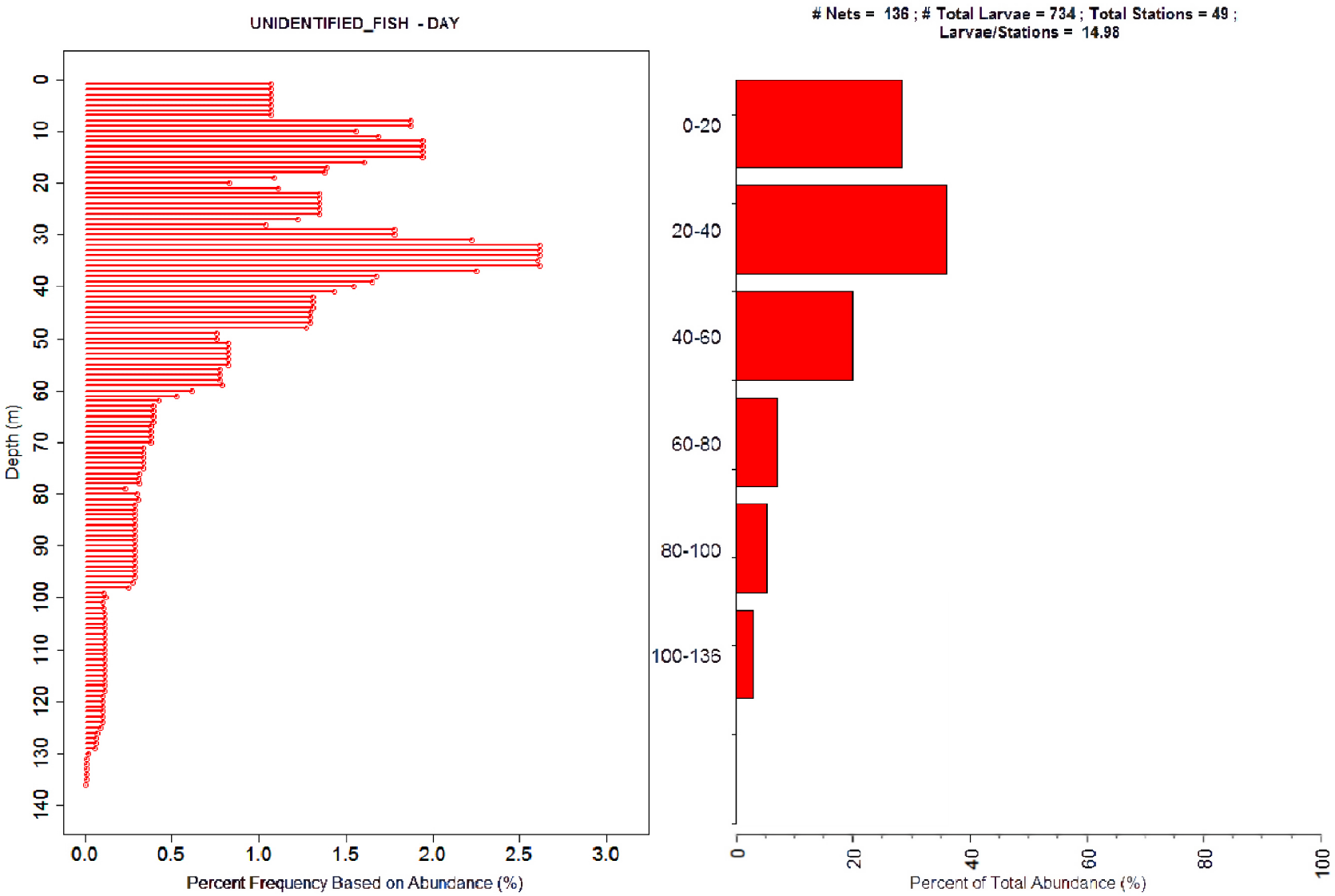
TRICHIURUS_LEPTURUS, NIGHT



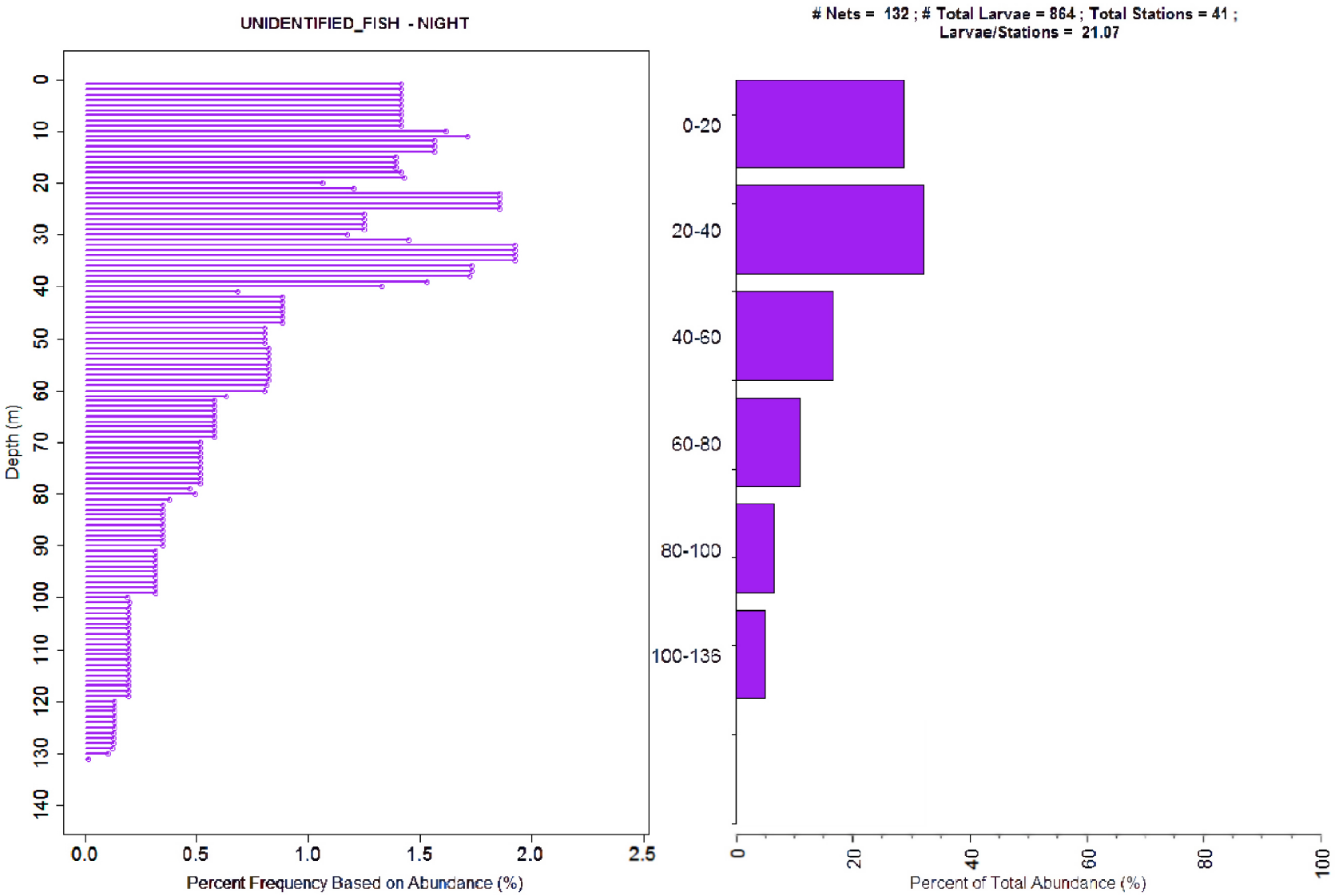
TRIGLIDAE, DAY



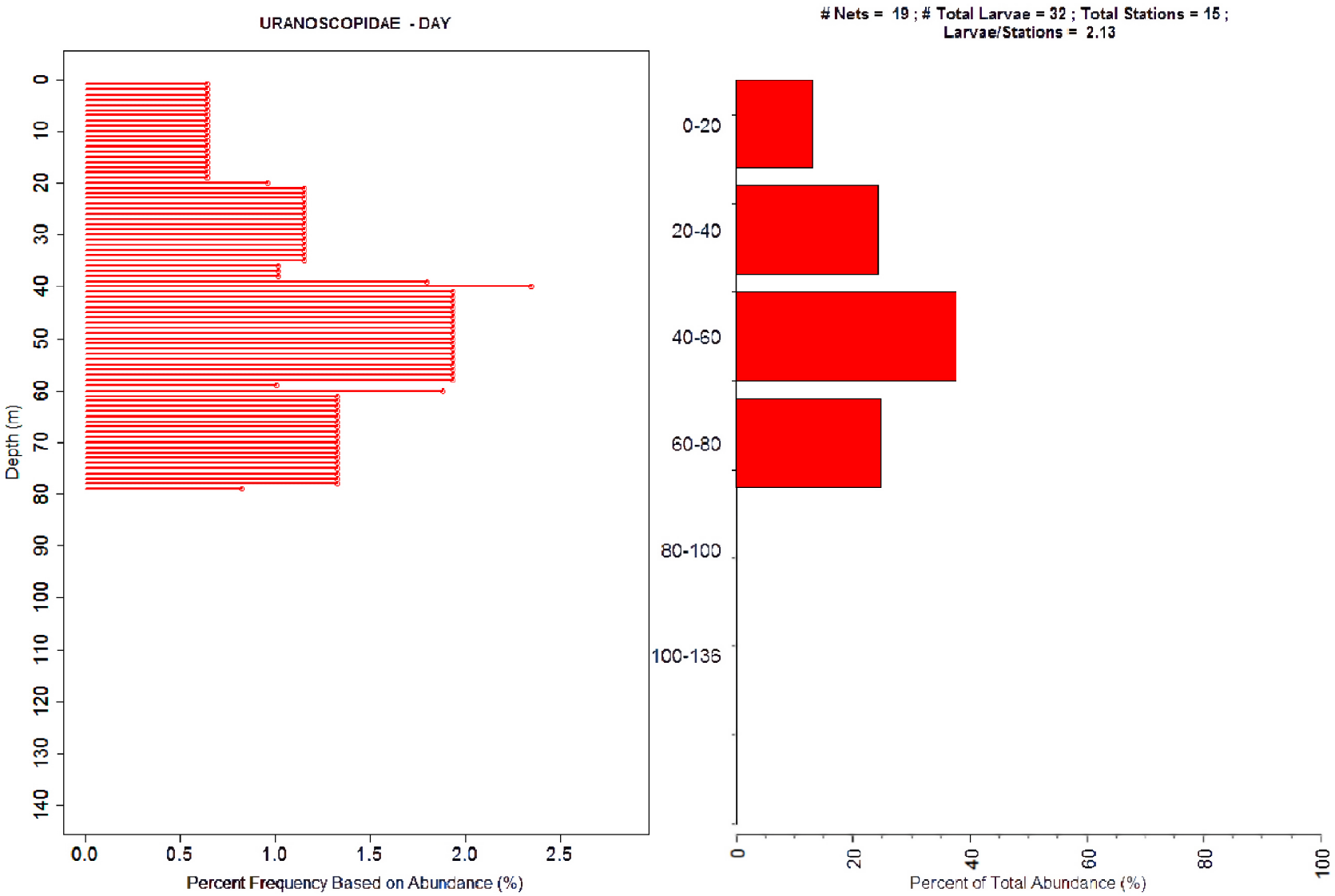
TRIGLIDAE, NIGHT



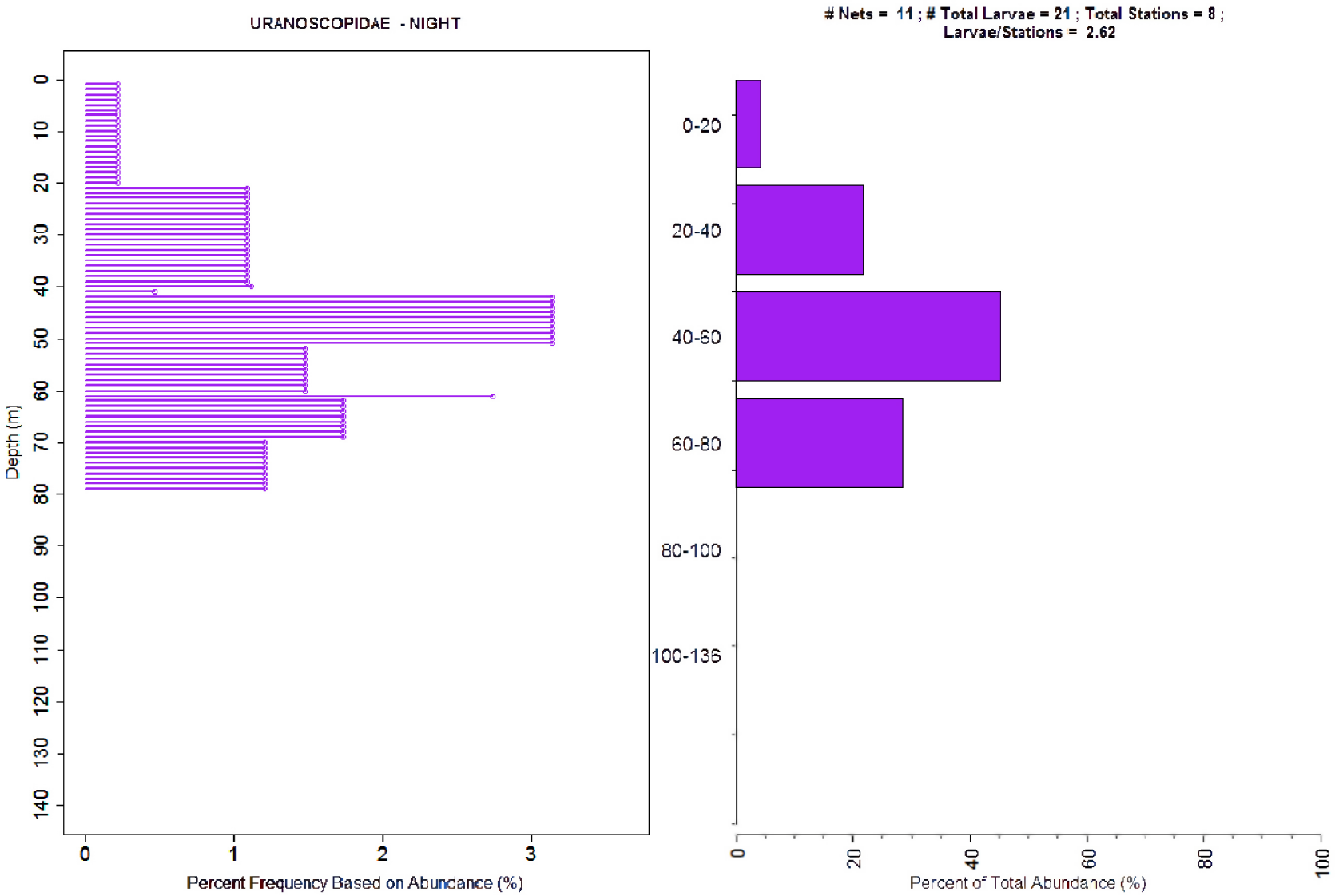
UNIDENTIFIED_FISH, DAY



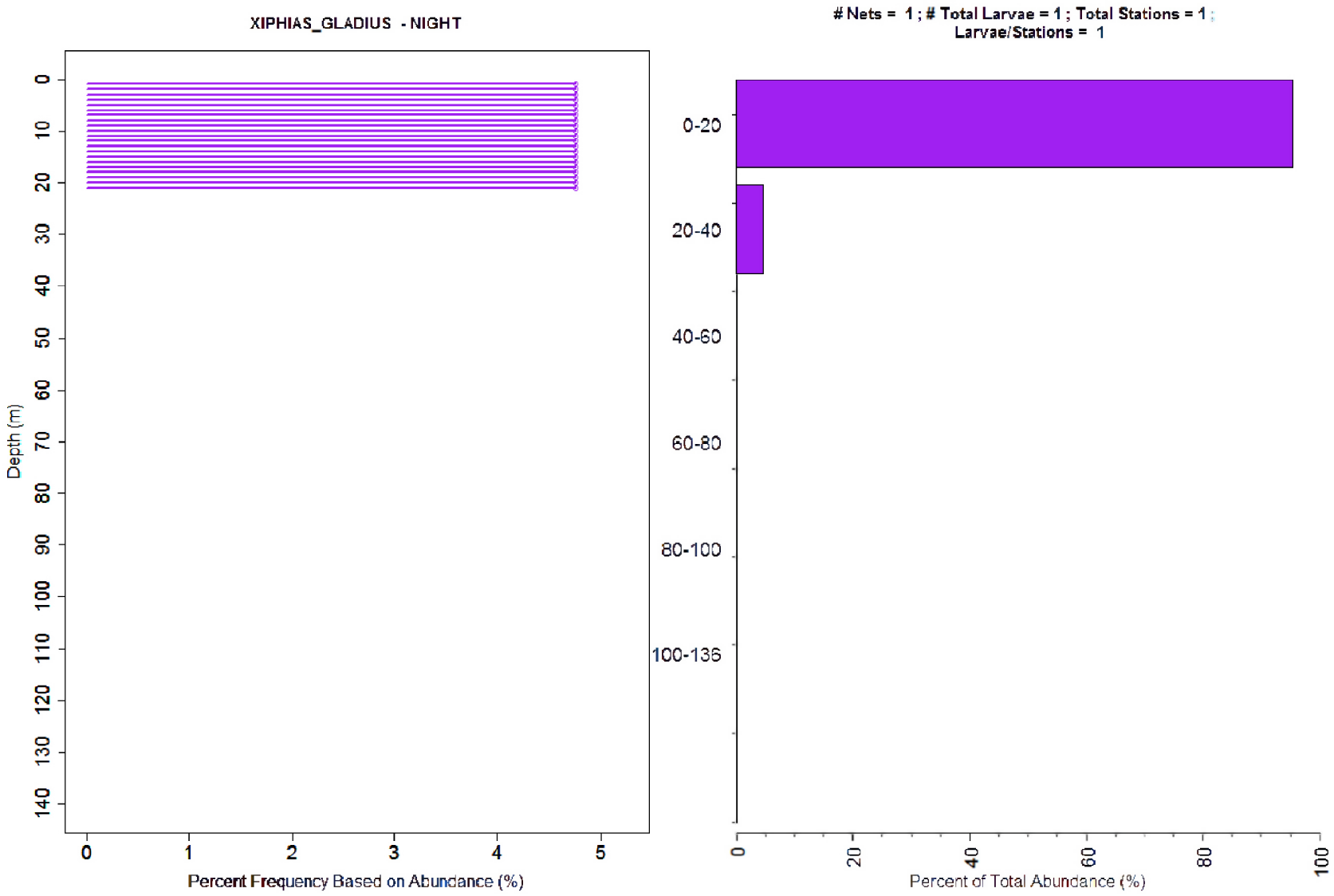
UNIDENTIFIED_FISH, NIGHT



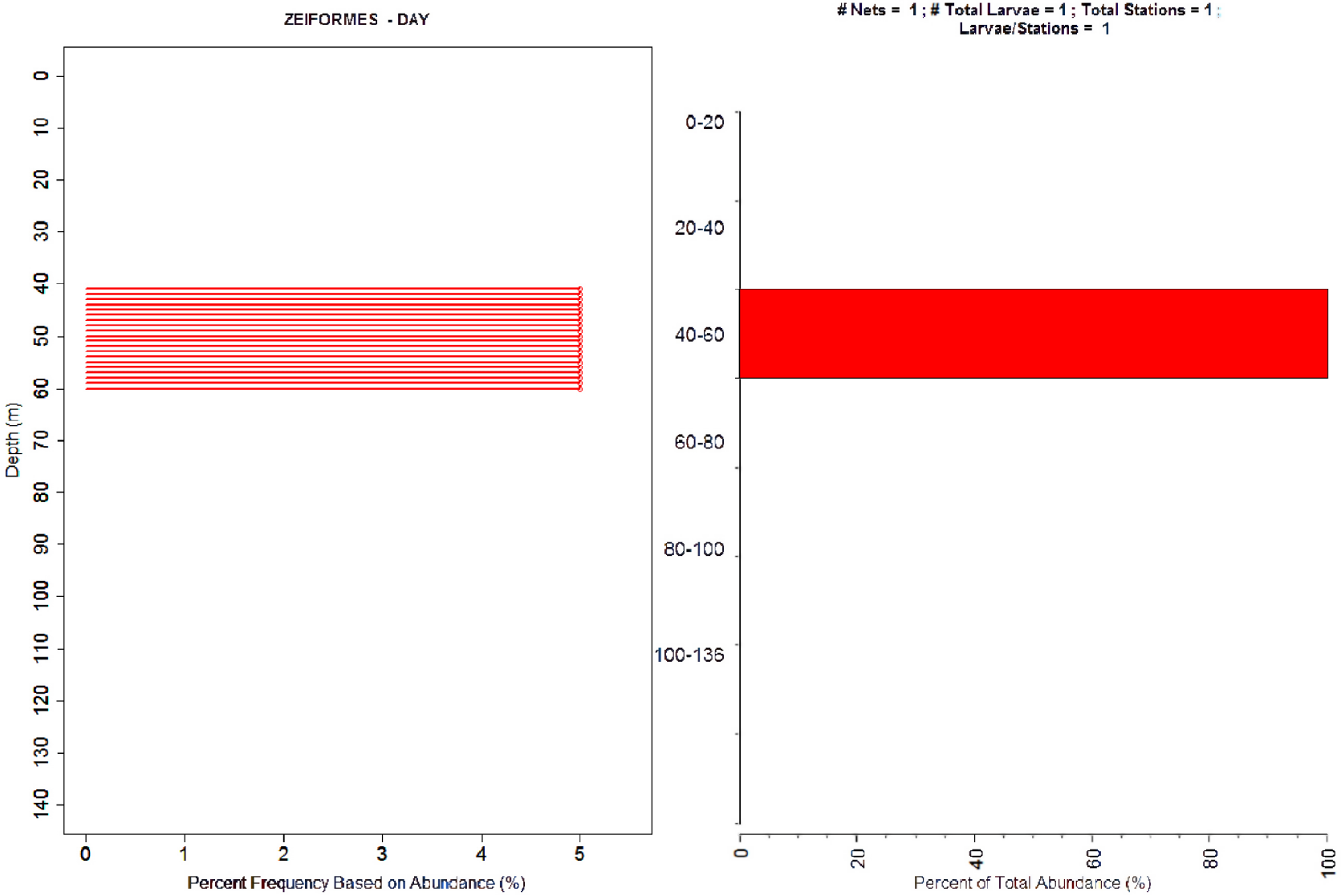
URANOSCOPIDAE, DAY



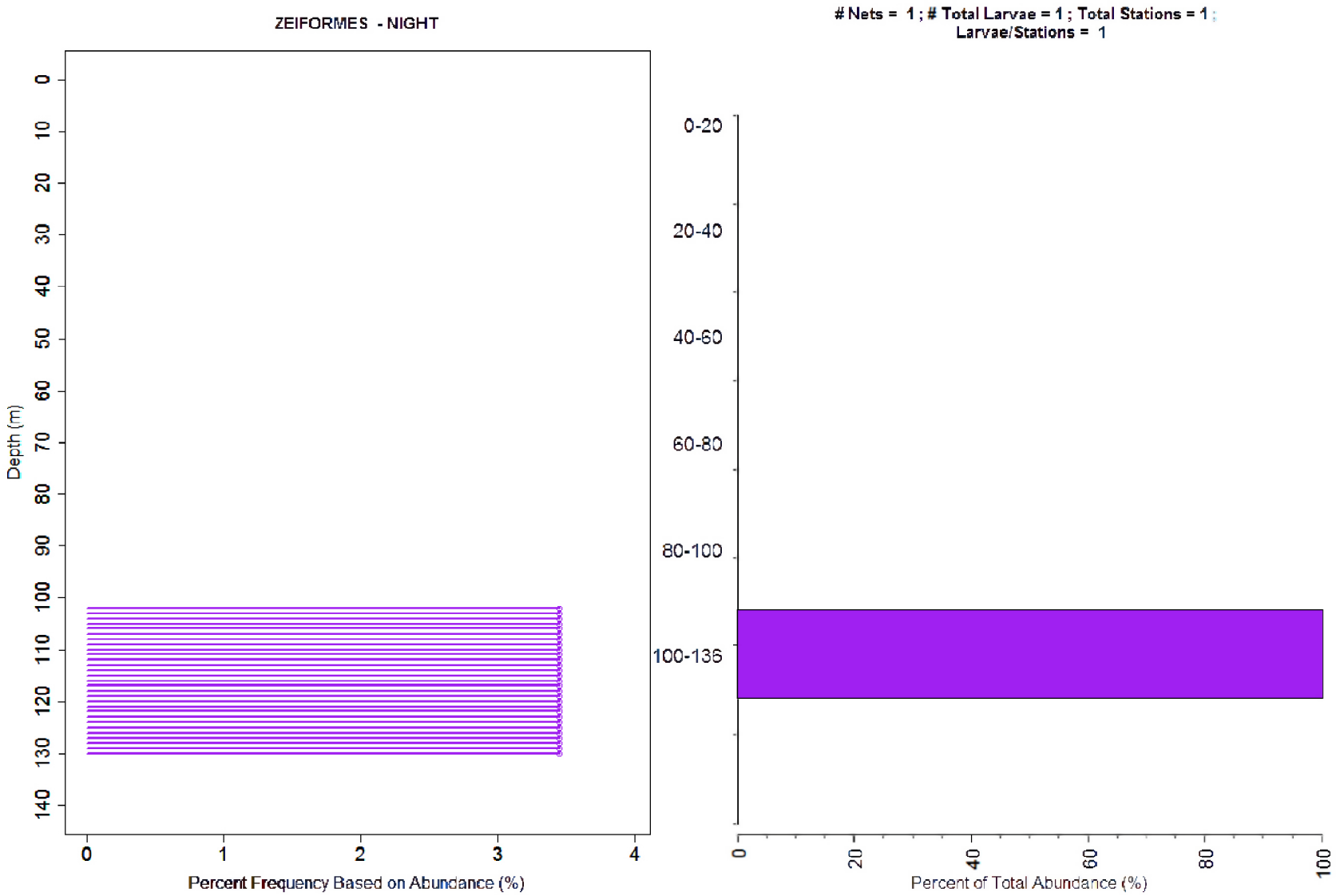
URANOSCOPIDAE, NIGHT



XIPHIAS_GLADIUS, NIGHT



ZEIFORMES, DAY



ZEIFORMES, NIGHT

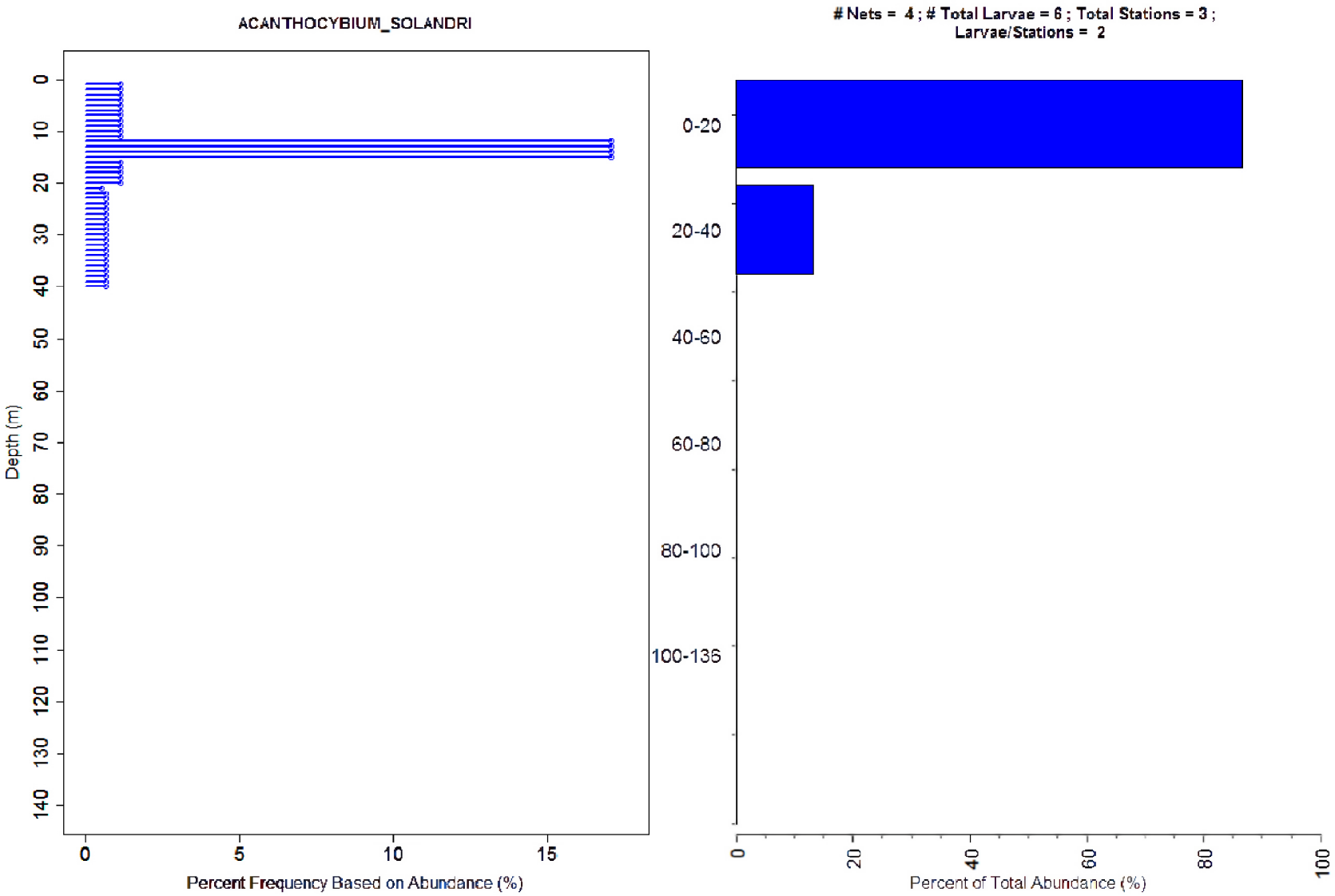
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

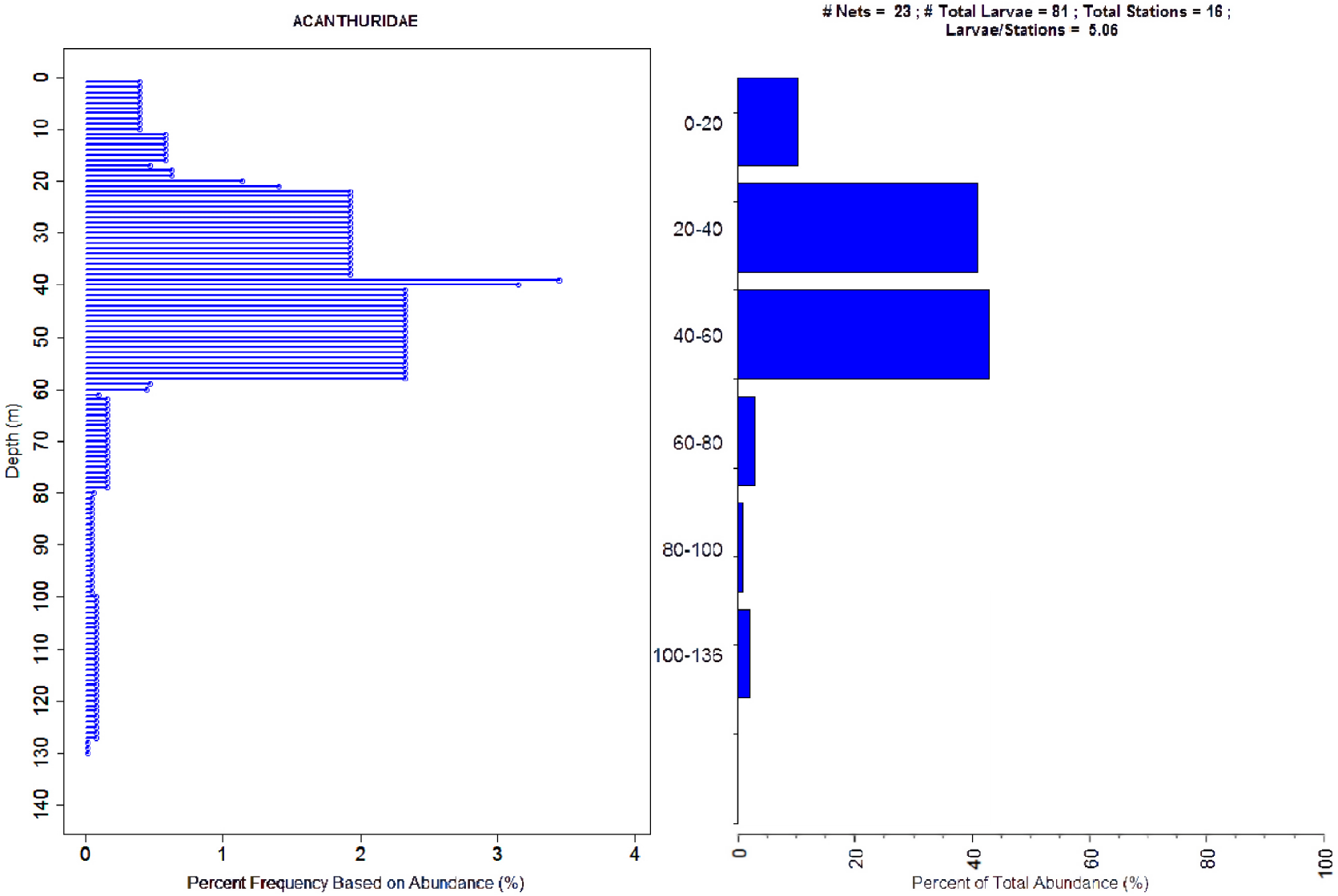
Appendix C2 – SEAMAP Historical MOC1 Plots Analysis Taxa Level, Pooled Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

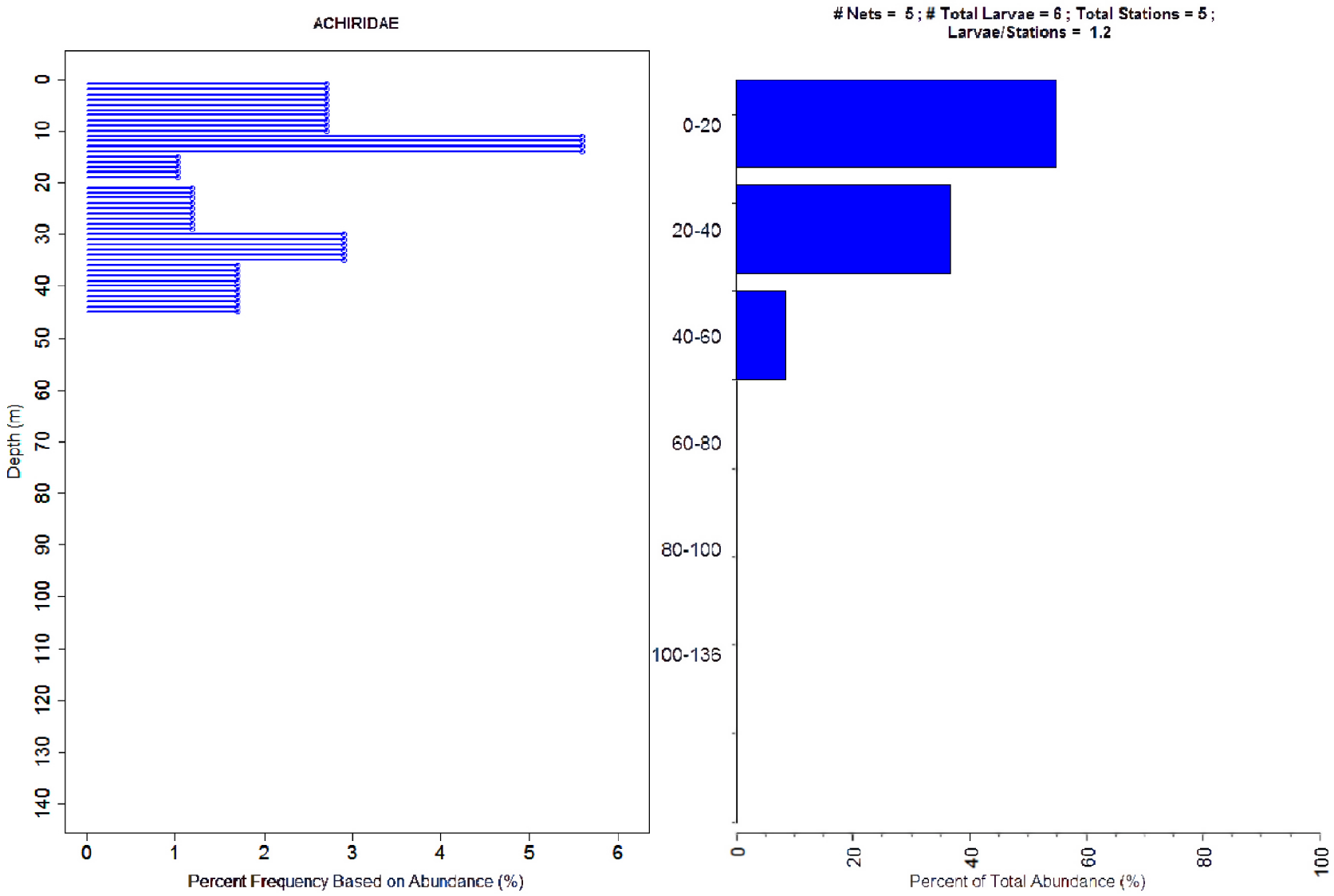
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



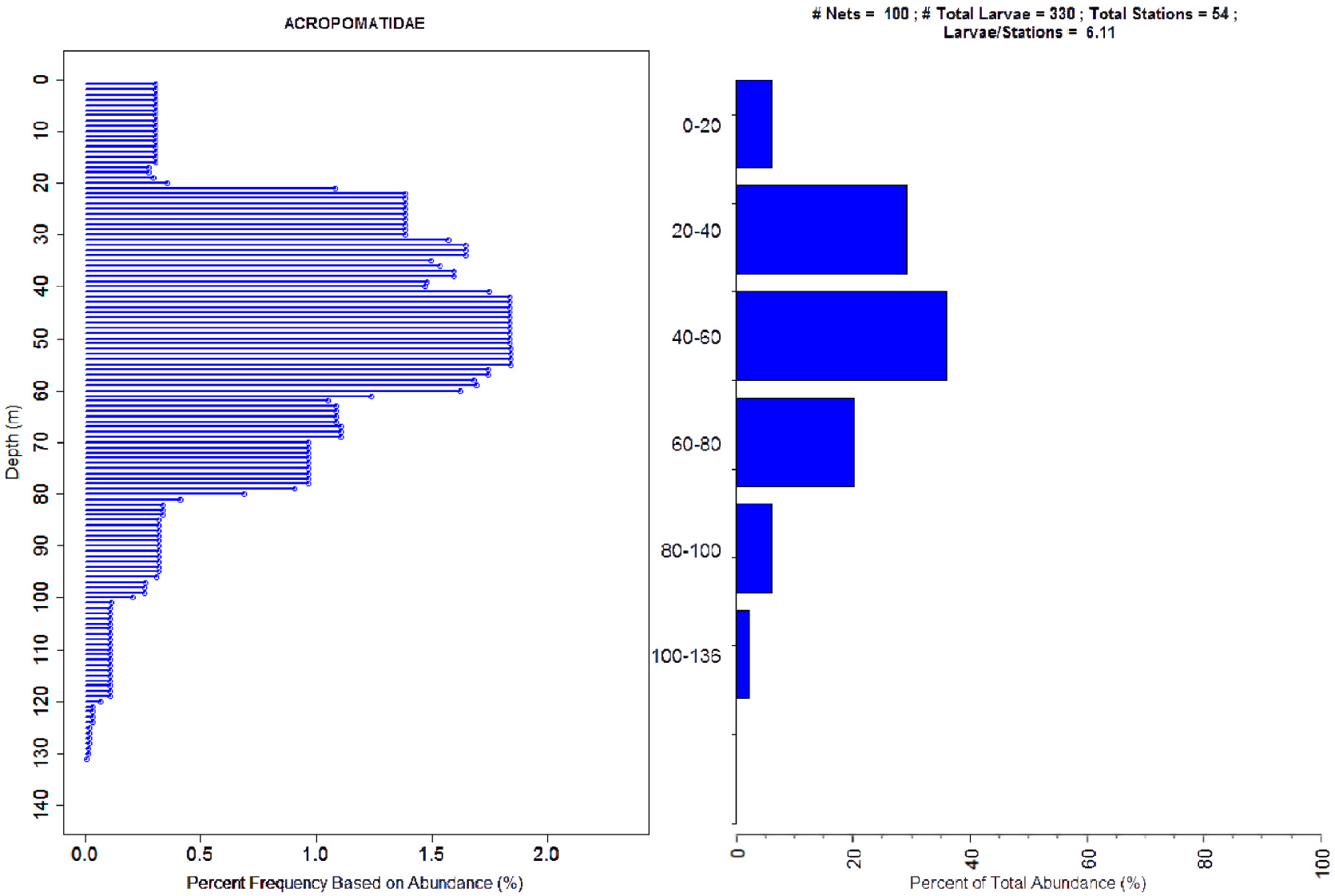
ACANTHOCYBIUM_SOLANDRI



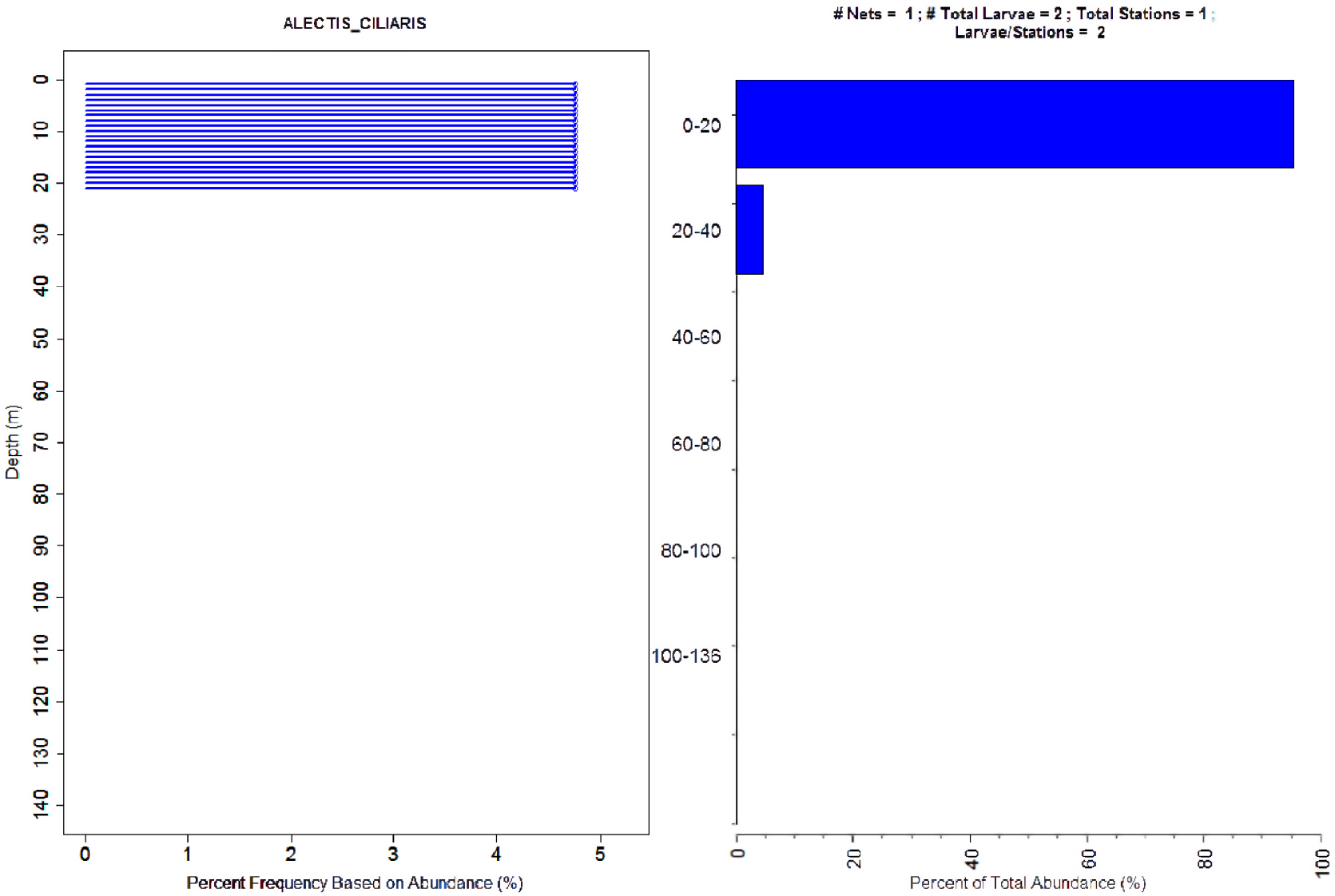
ACANTHURIDAE


ACHIRIDAE
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
Nets = 5 ; # Total Larvae = 6 ; Total Stations = 5 ;
Larvae/Stations = 1.2
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

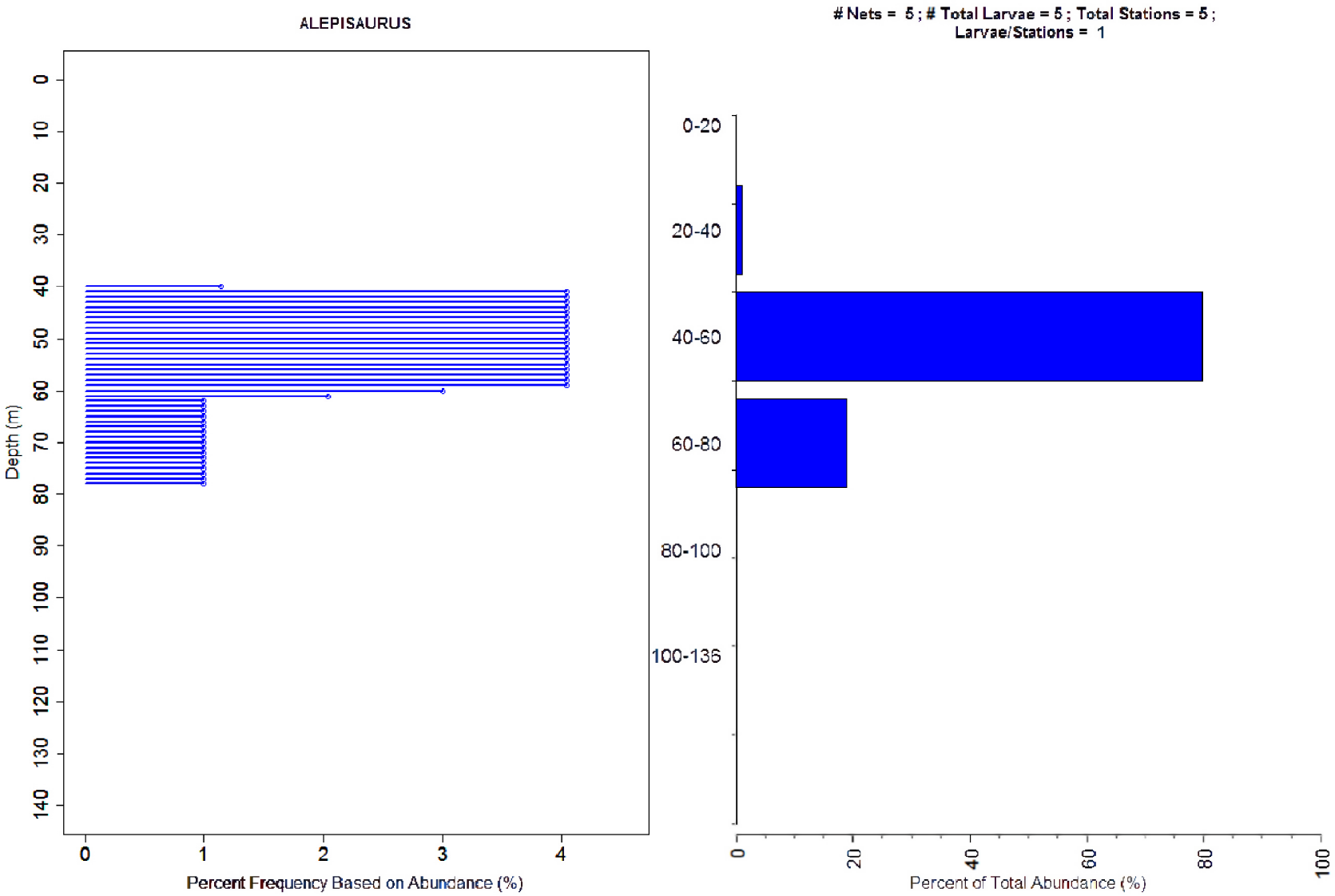
ACHIRIDAE



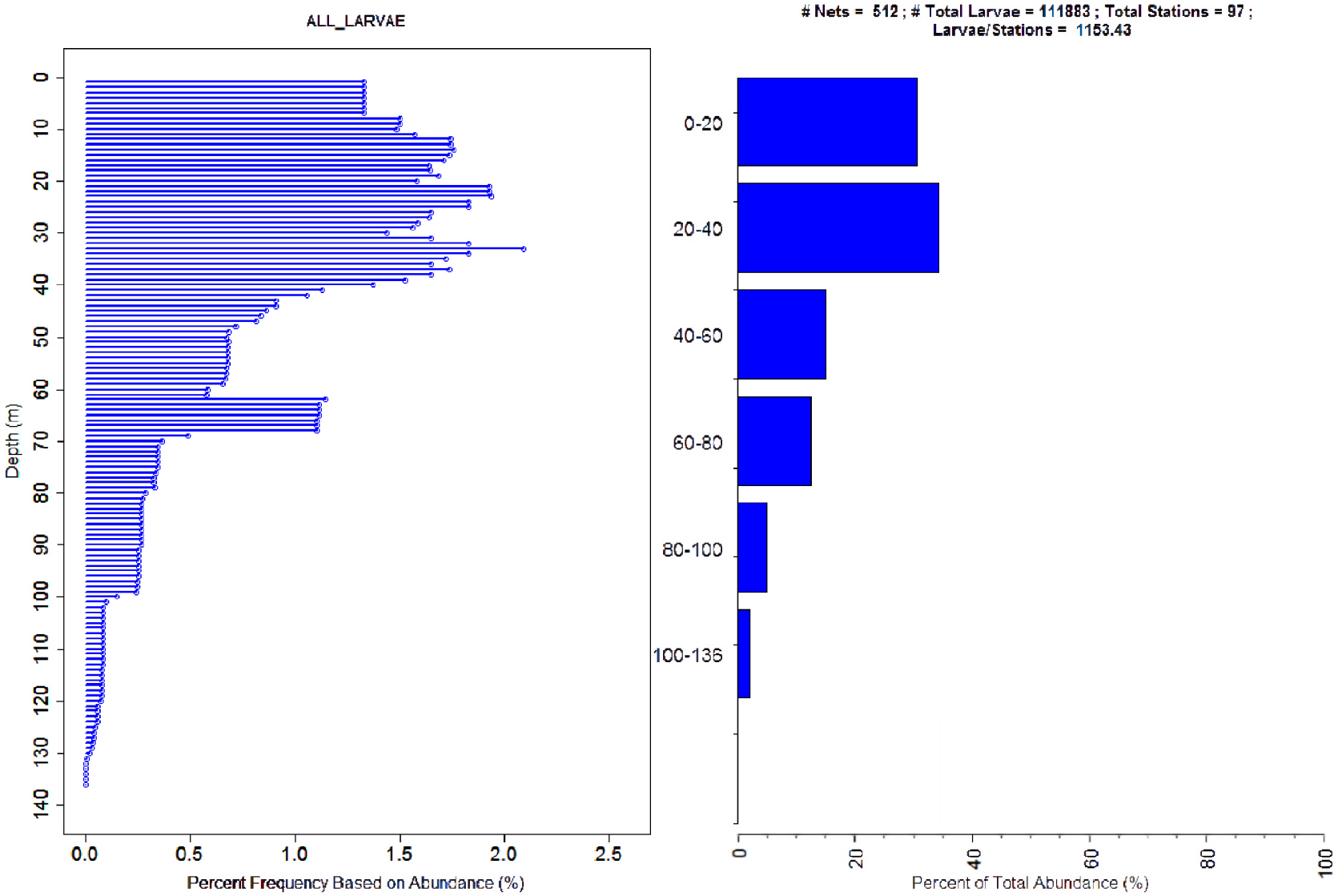
ACROPOMATIDAE



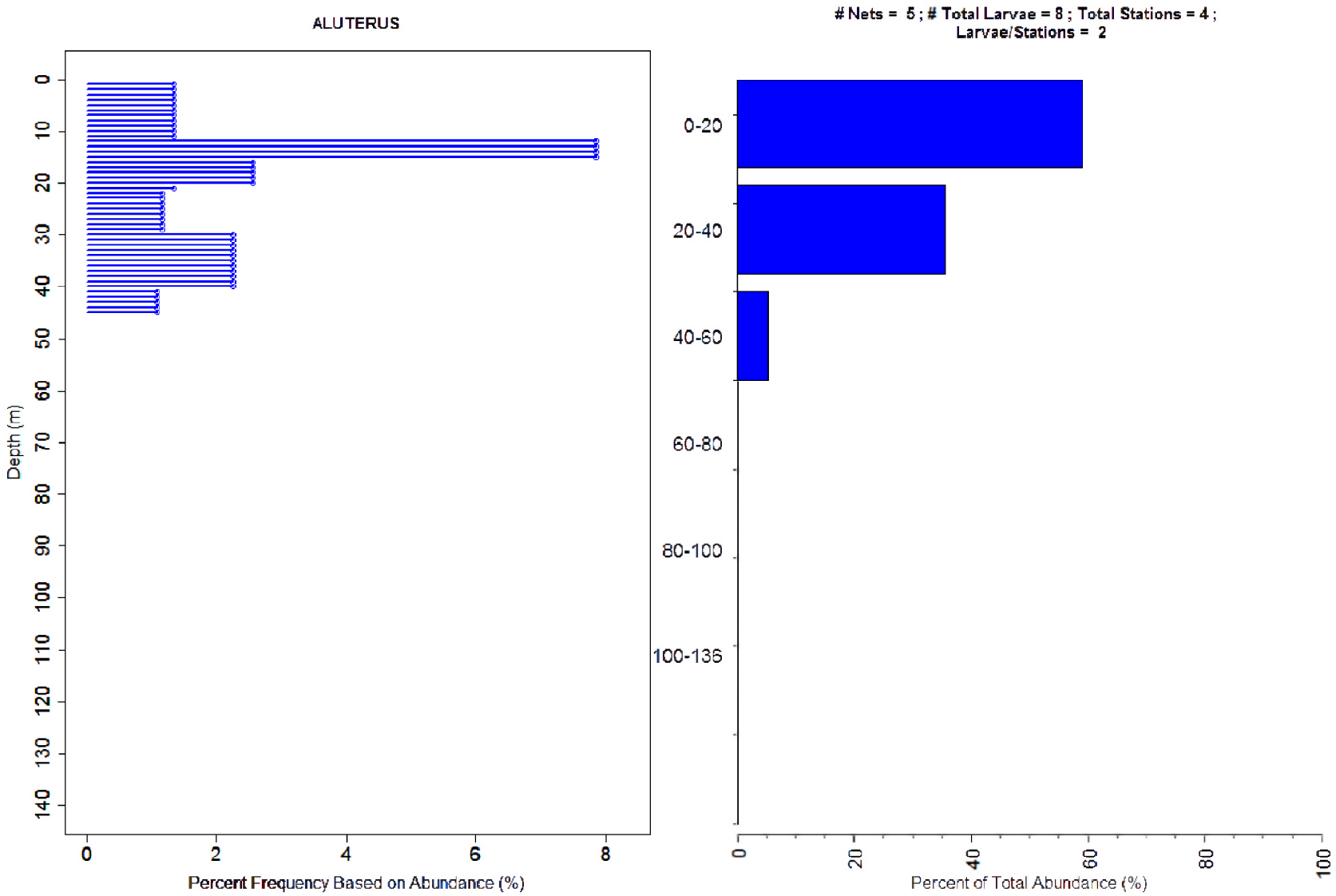
ALECTIS_CILIARIS



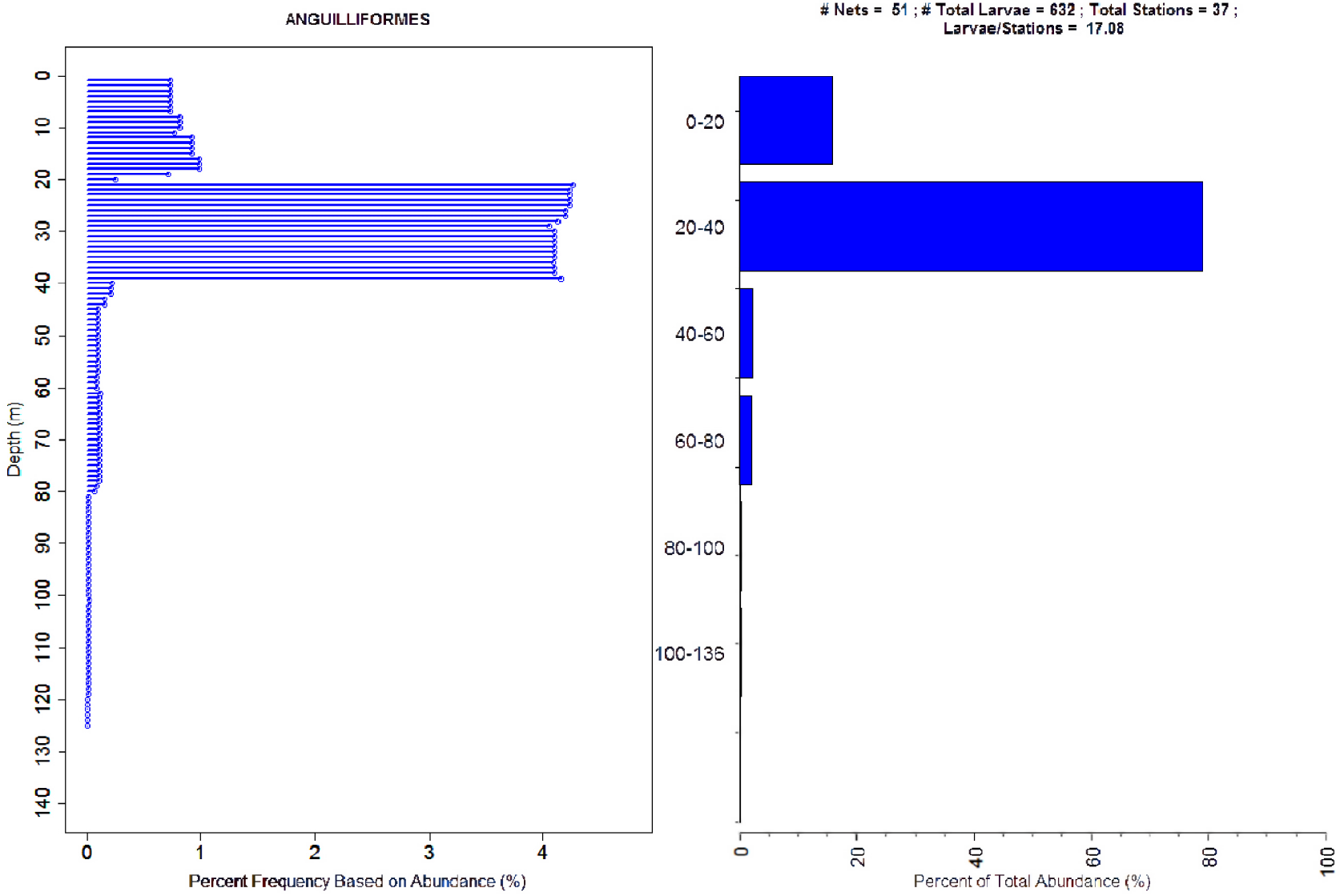
ALEPISAURUS


ALL_LARVAE
Nets = 512 ; # Total Larvae = 111883 ; Total Stations = 97 ;
Larvae/Stations = 1153.43
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

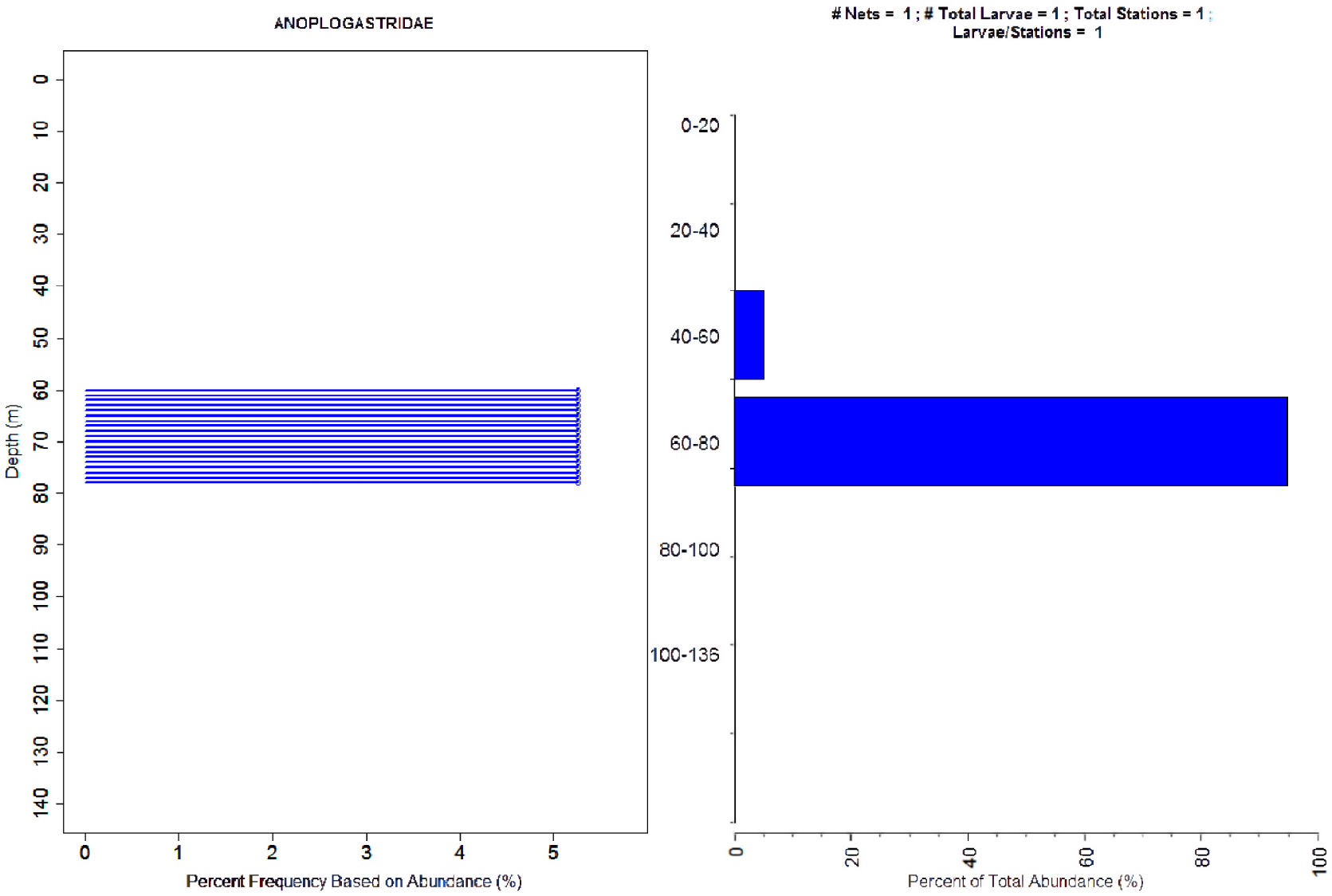
ALL_LARVAE


ALUTERUS
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
8
Percent Frequency Based on Abundance (%)
Nets = 5 ; # Total Larvae = 8 ; Total Stations = 4 ;
Larvae/Stations = 2
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

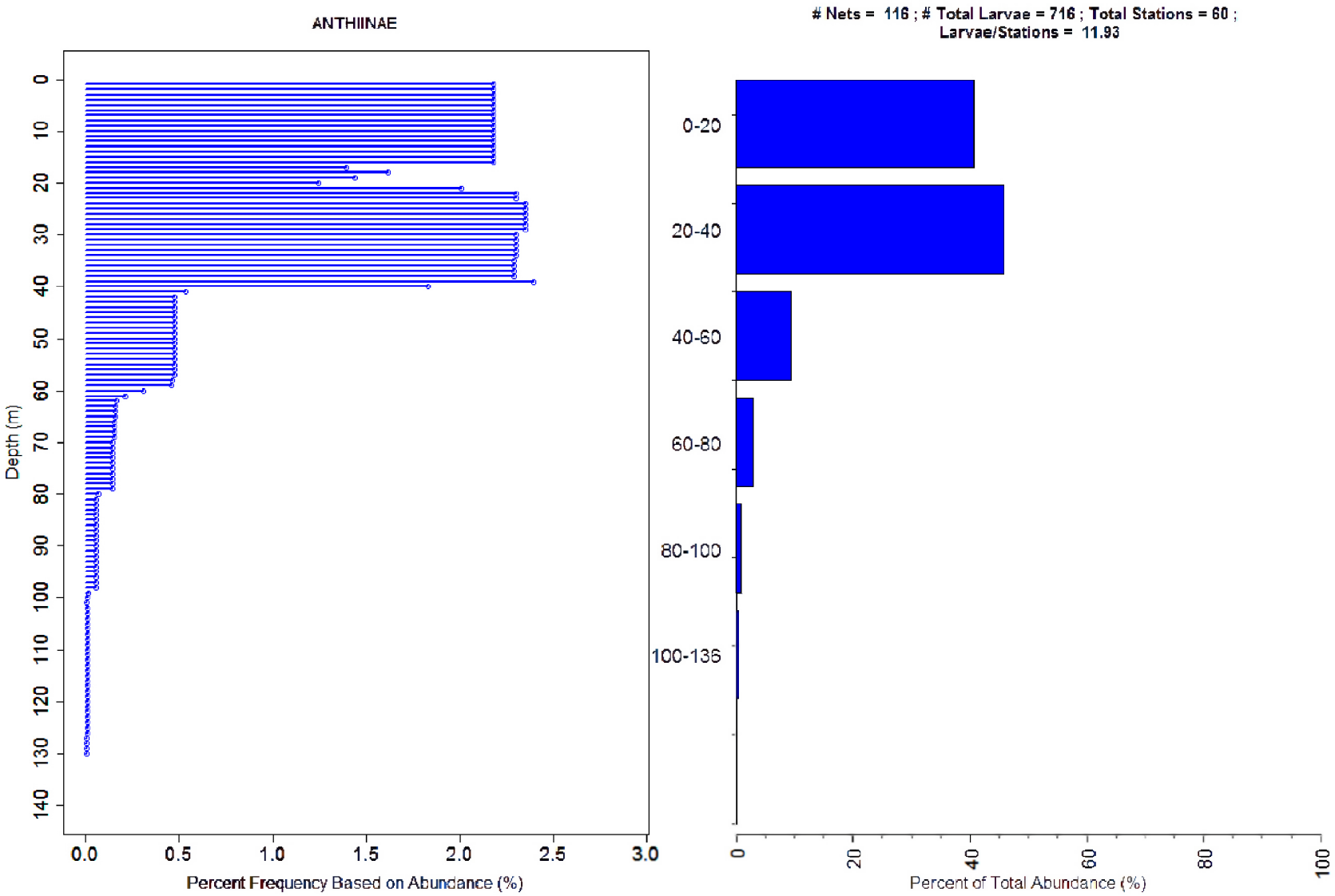
ALUTERUS



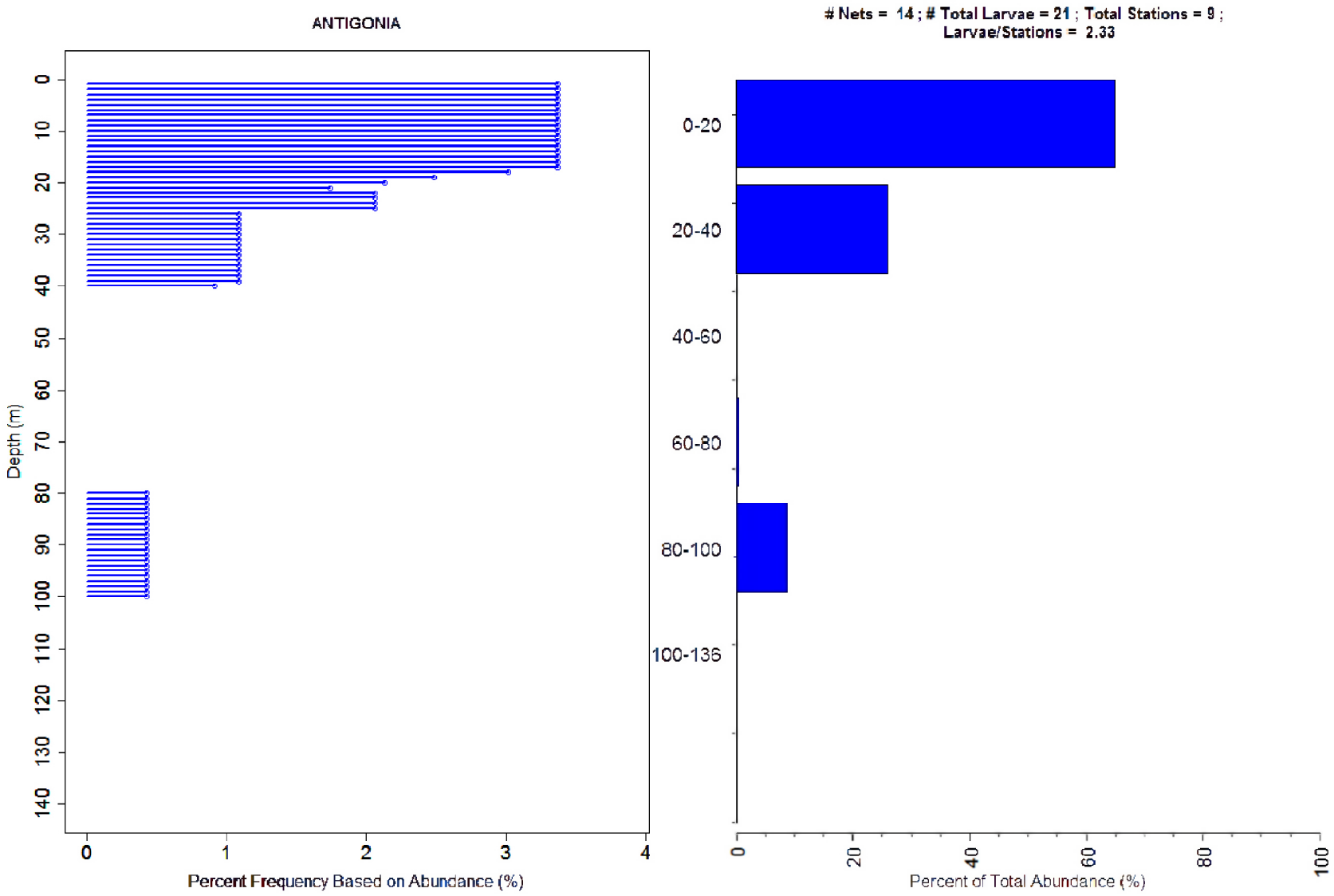
ANGUILLIFORMES



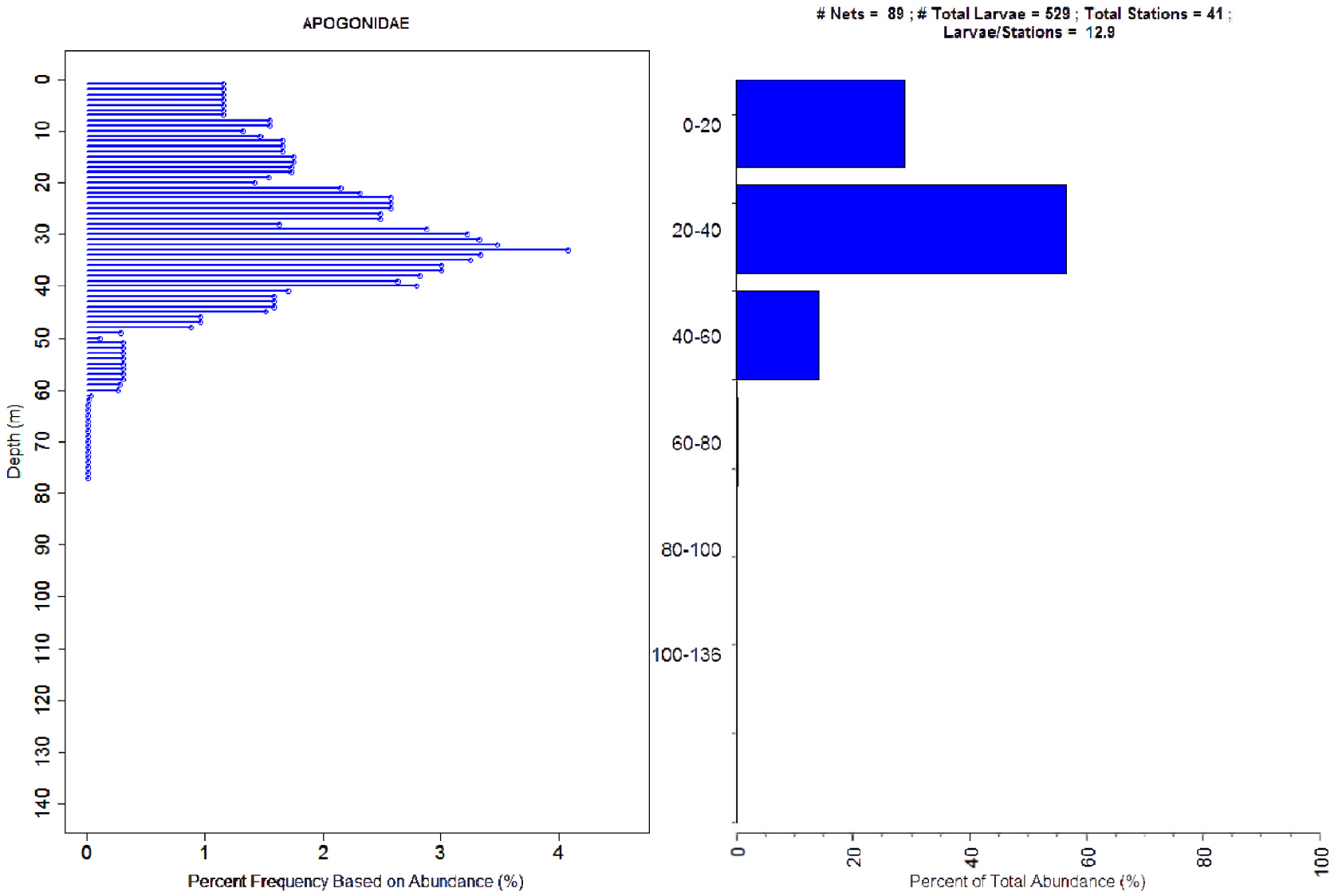
ANOPLOGASTRIDAE


ANTHIINAE
Nets = 116 ; # Total Larvae = 716 ; Total Stations = 60 ;
Larvae/Stations = 11.93
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

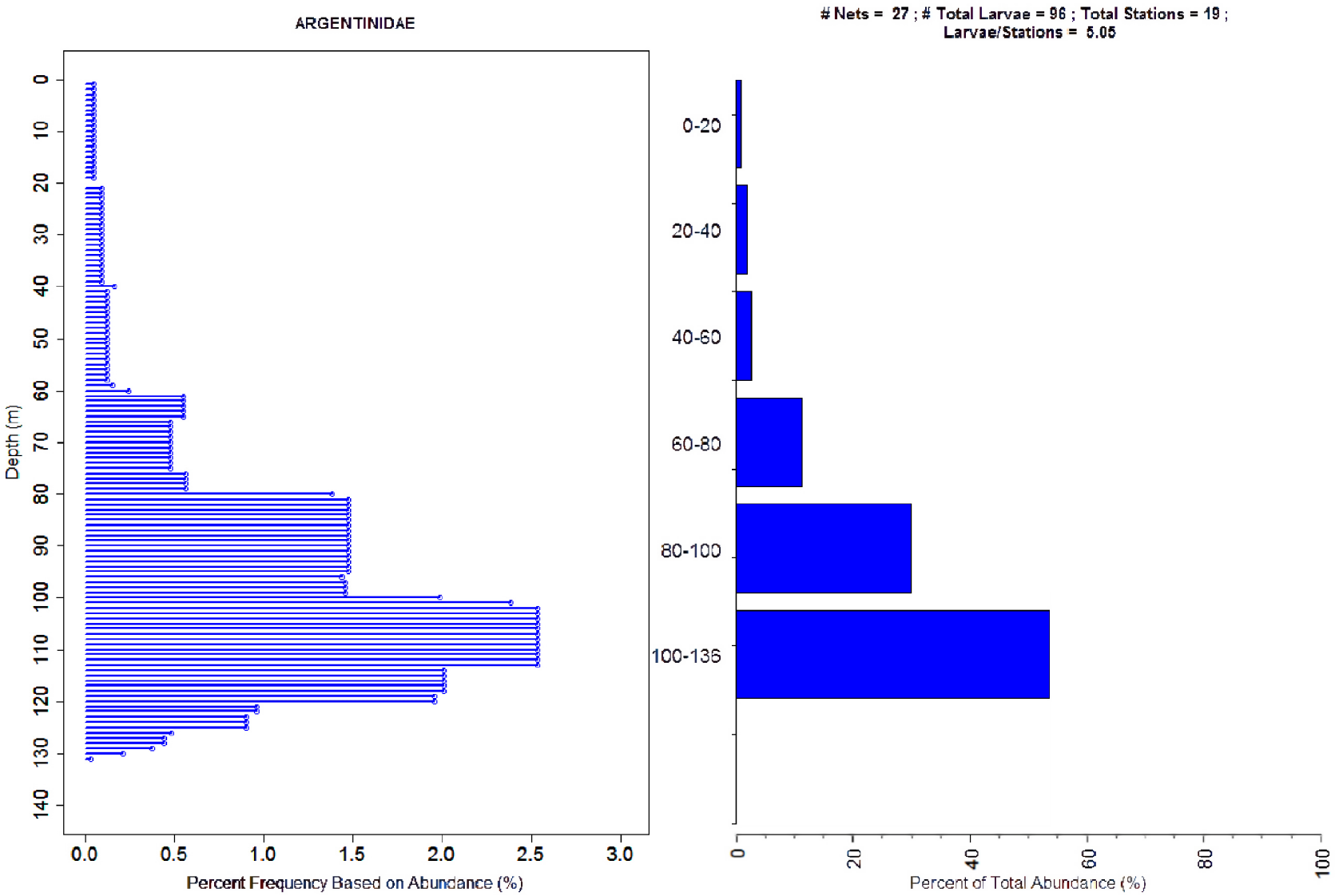
ANTHIINAE


ANTIGONIA
Nets = 14 ; # Total Larvae = 21 ; Total Stations = 9 ;
Larvae/Stations = 2.33
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

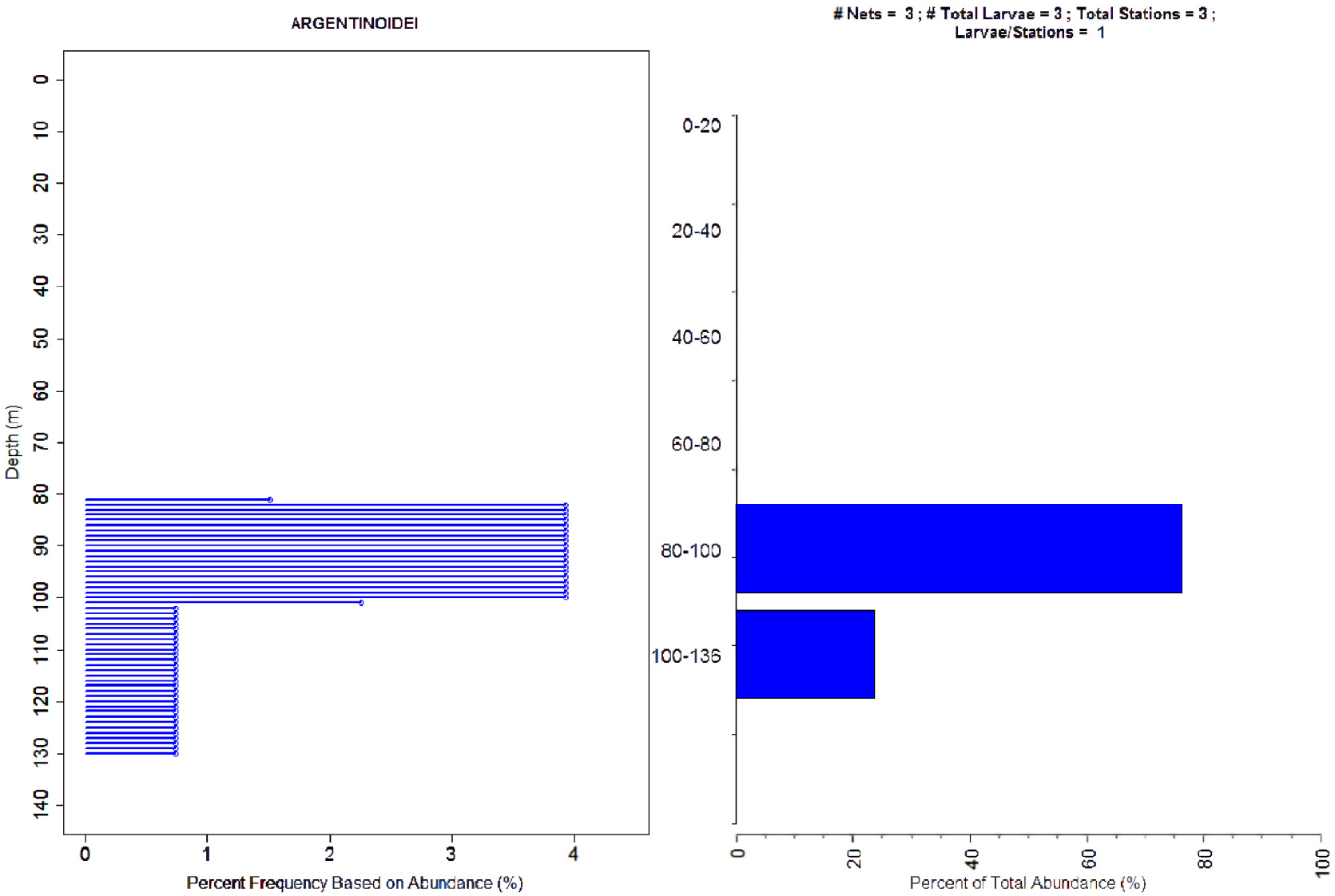
ANTIGONIA


APOGONIDAE
Nets = 89 ; # Total Larvae = 529 ; Total Stations = 41 ;
Larvae/Stations = 12.9
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

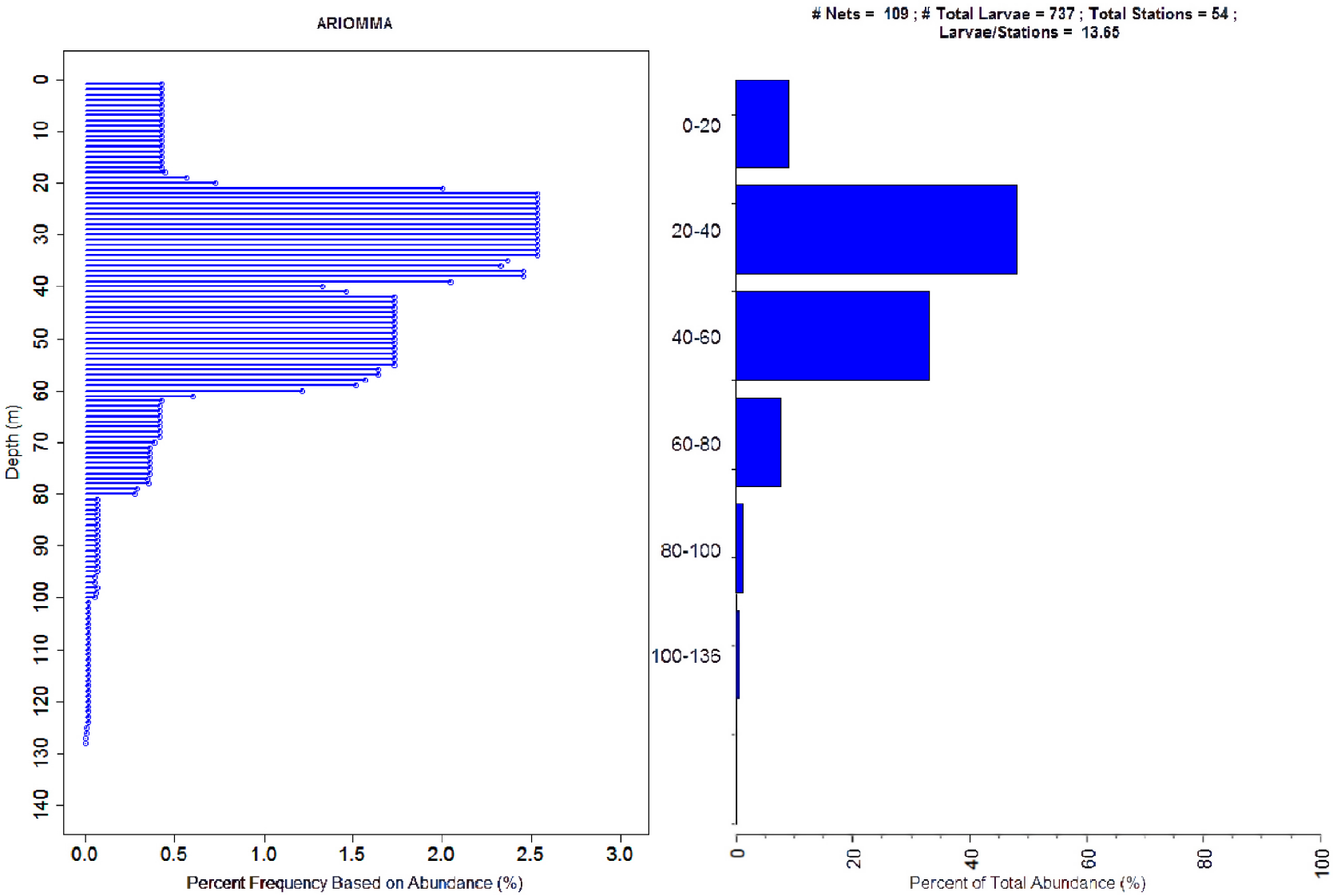
APOGONIDAE



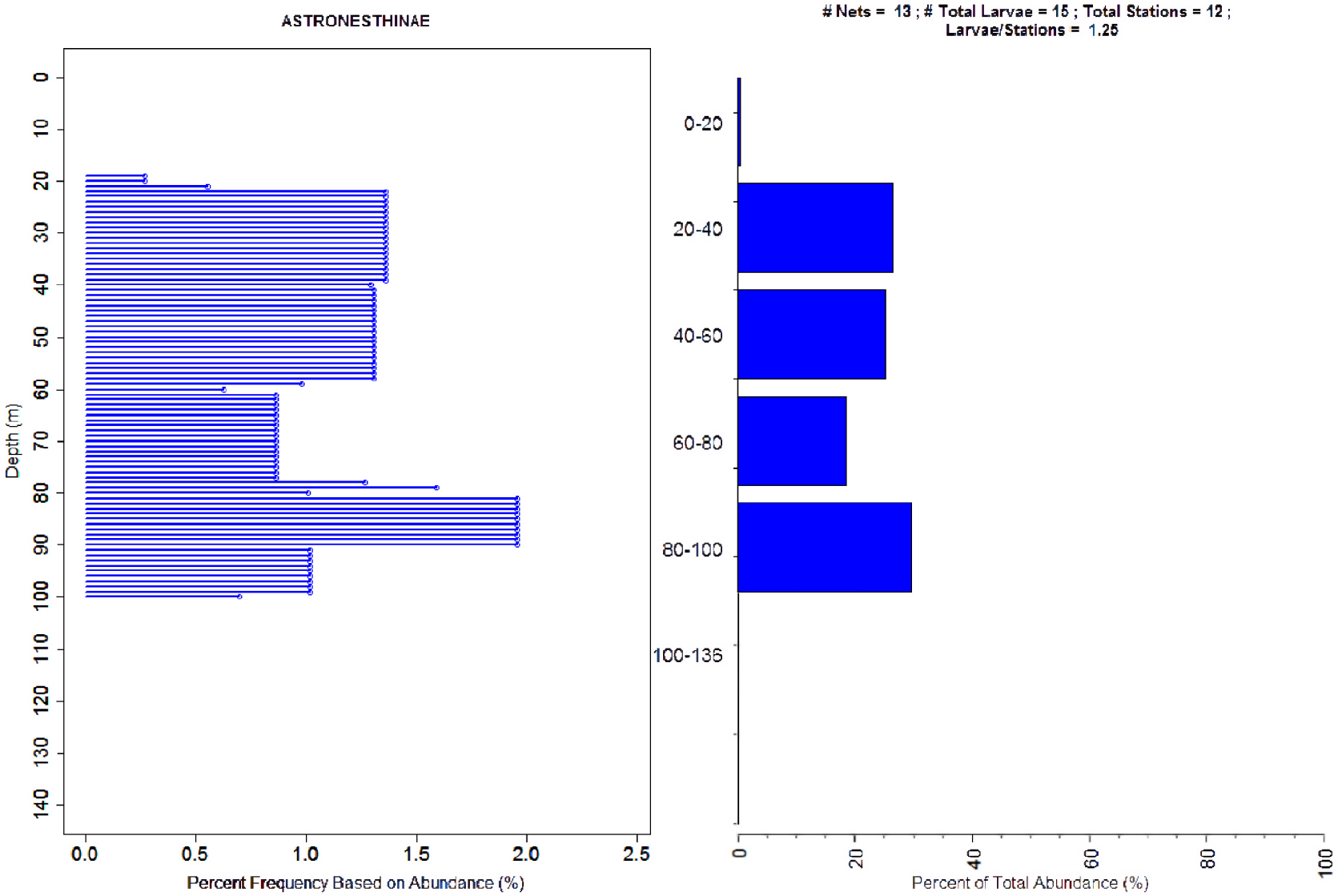
ARGENTINIDAE



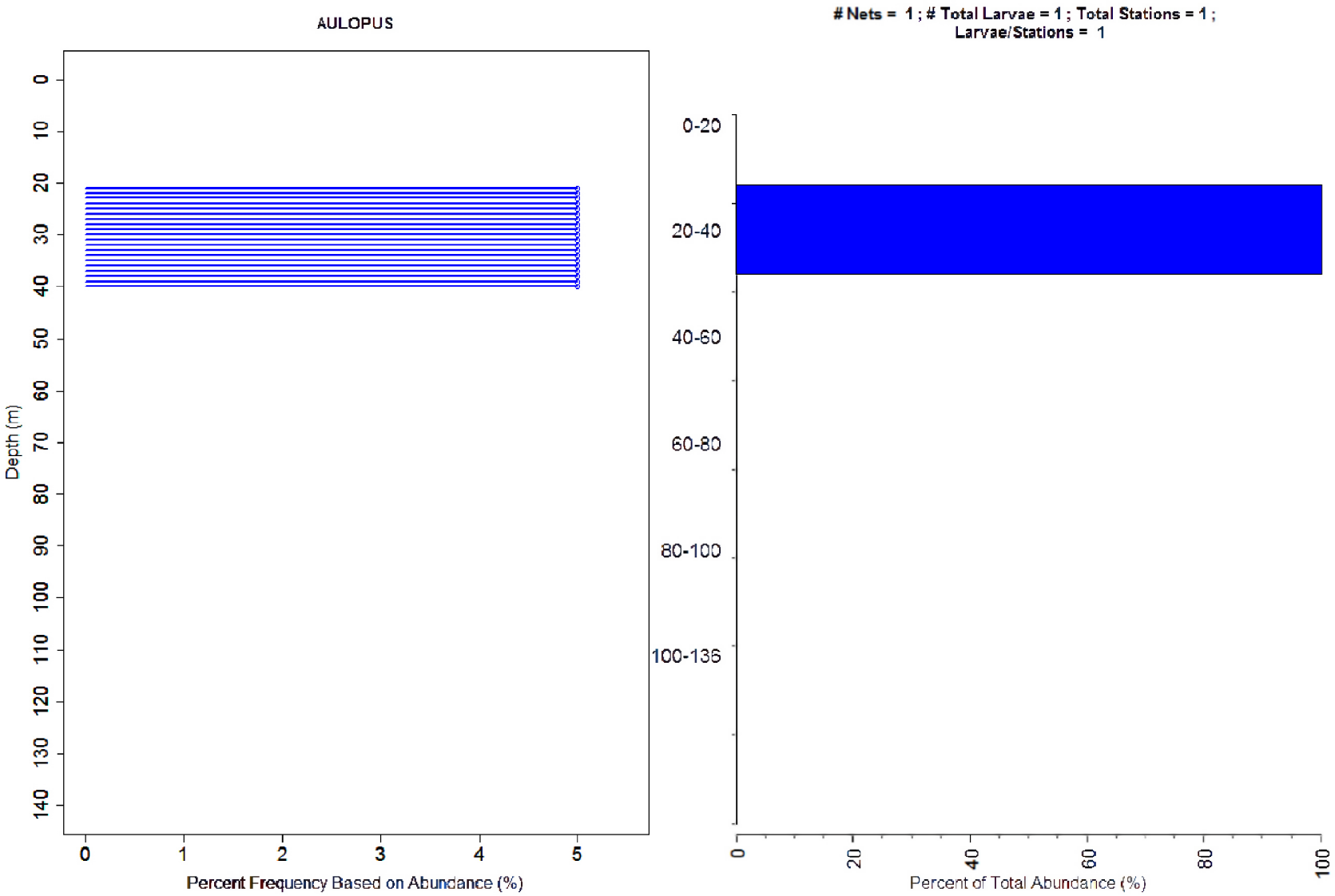
ARGENTINOIDEI


ARIOMMA
Nets = 109 ; # Total Larvae = 737 ; Total Stations = 54 ;
Larvae/Stations = 13.65
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

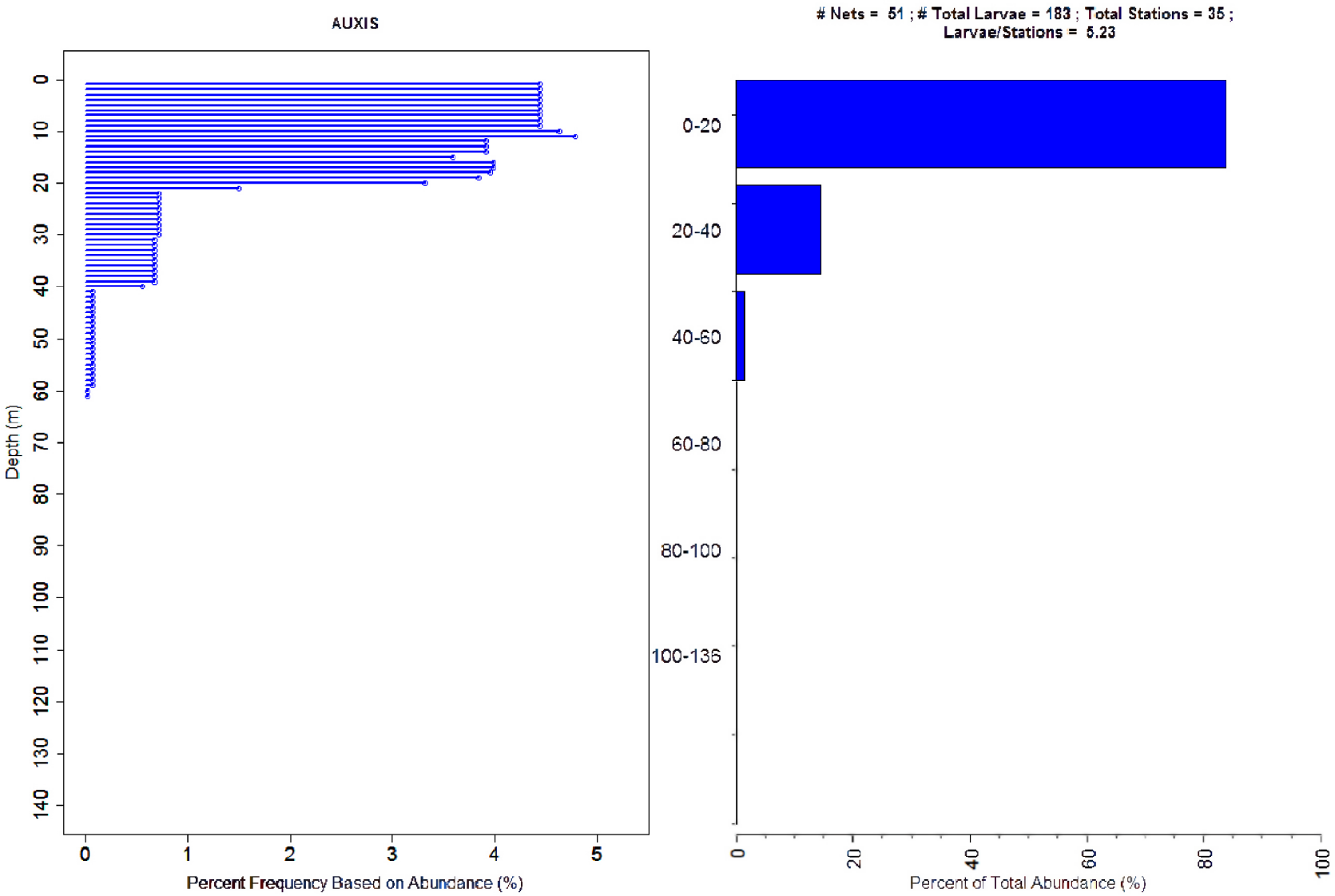
ARIOMMA



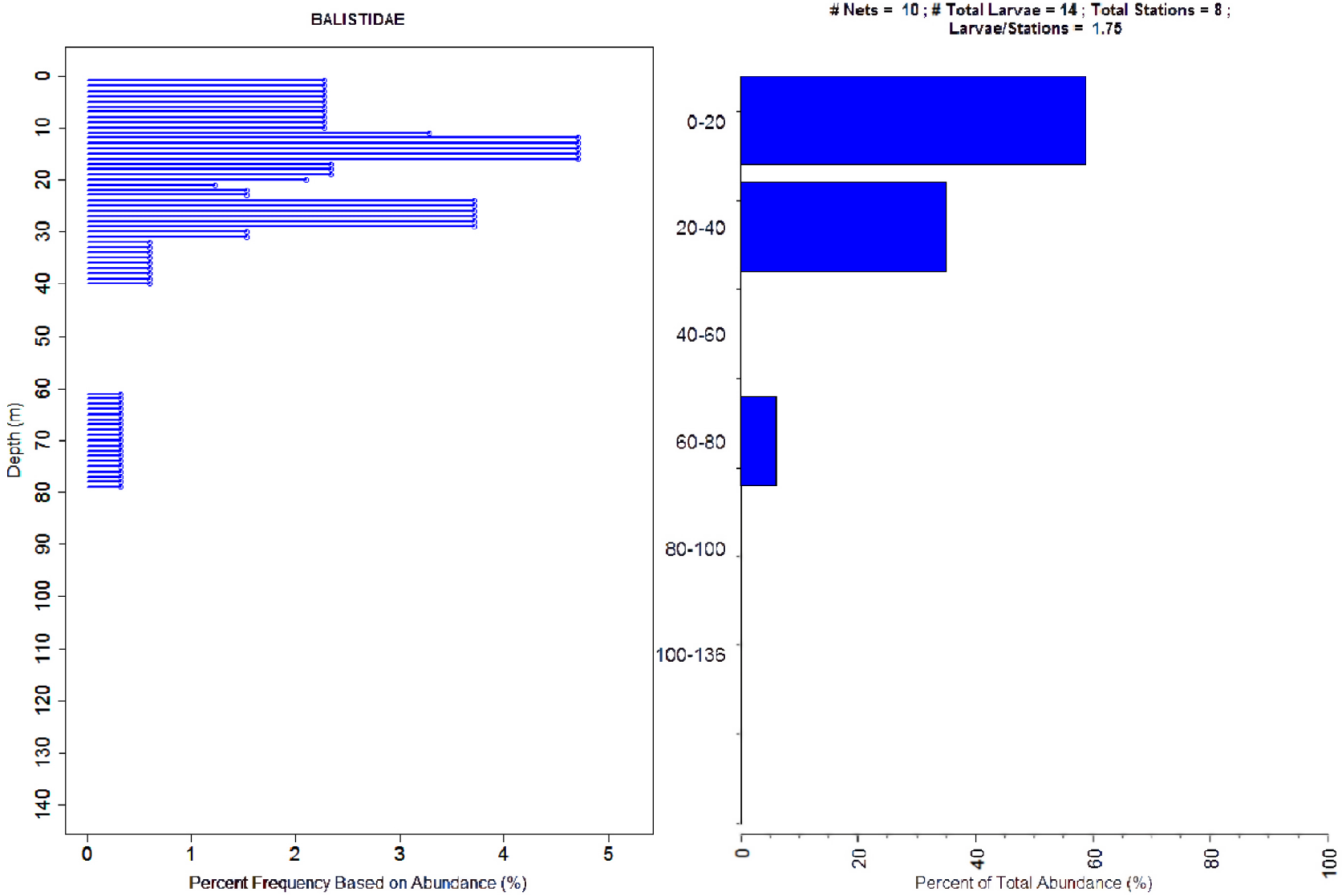
ASTRONESTHINAE


AULOPUS
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

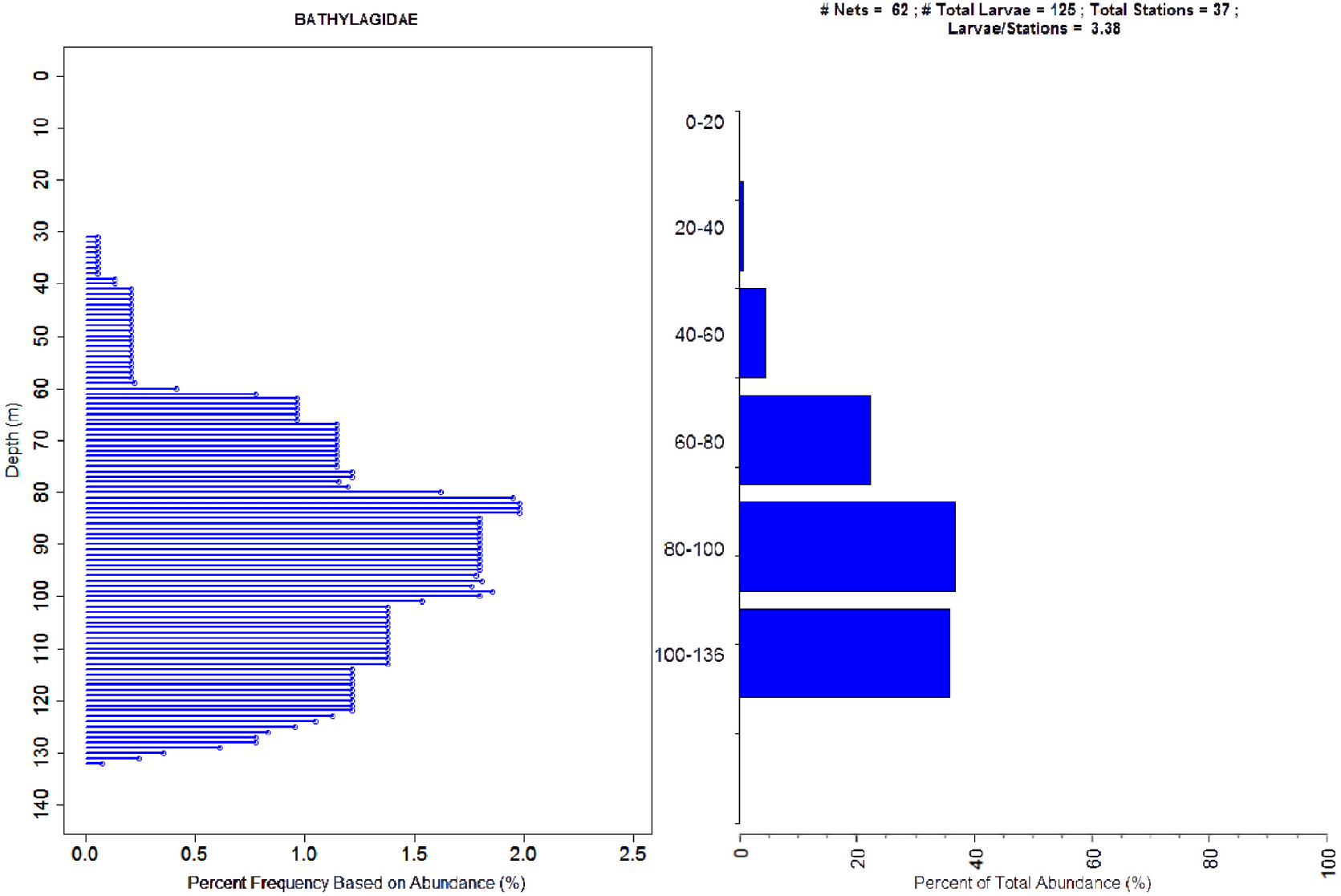
AULOPUS


AUXIS
Nets = 51 ; # Total Larvae = 183 ; Total Stations = 35 ;
Larvae/Stations = 5.23
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

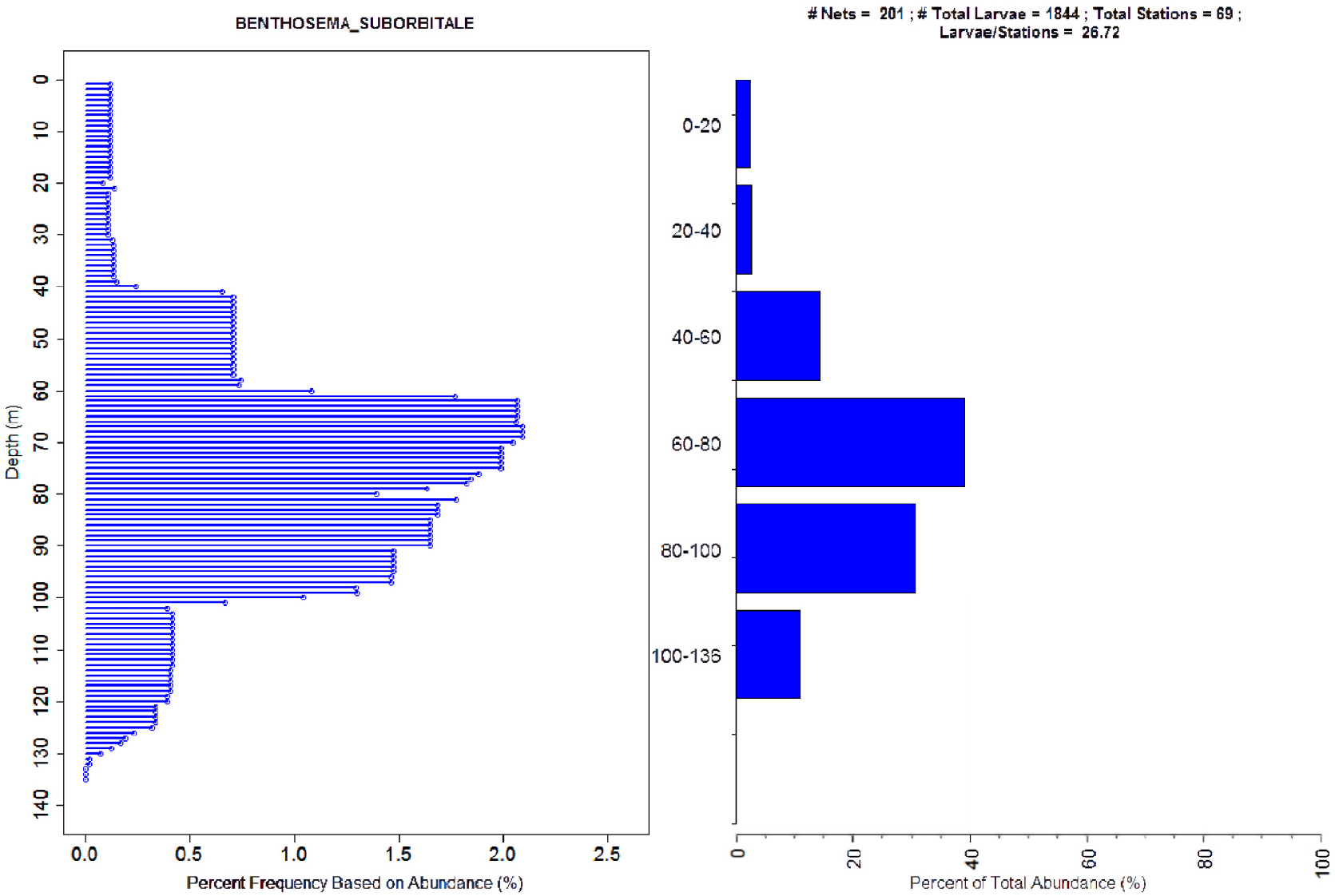
AUXIS


BALISTIDAE
Nets = 10 ; # Total Larvae = 14 ; Total Stations = 8 ;
Larvae/Stations = 1.75
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

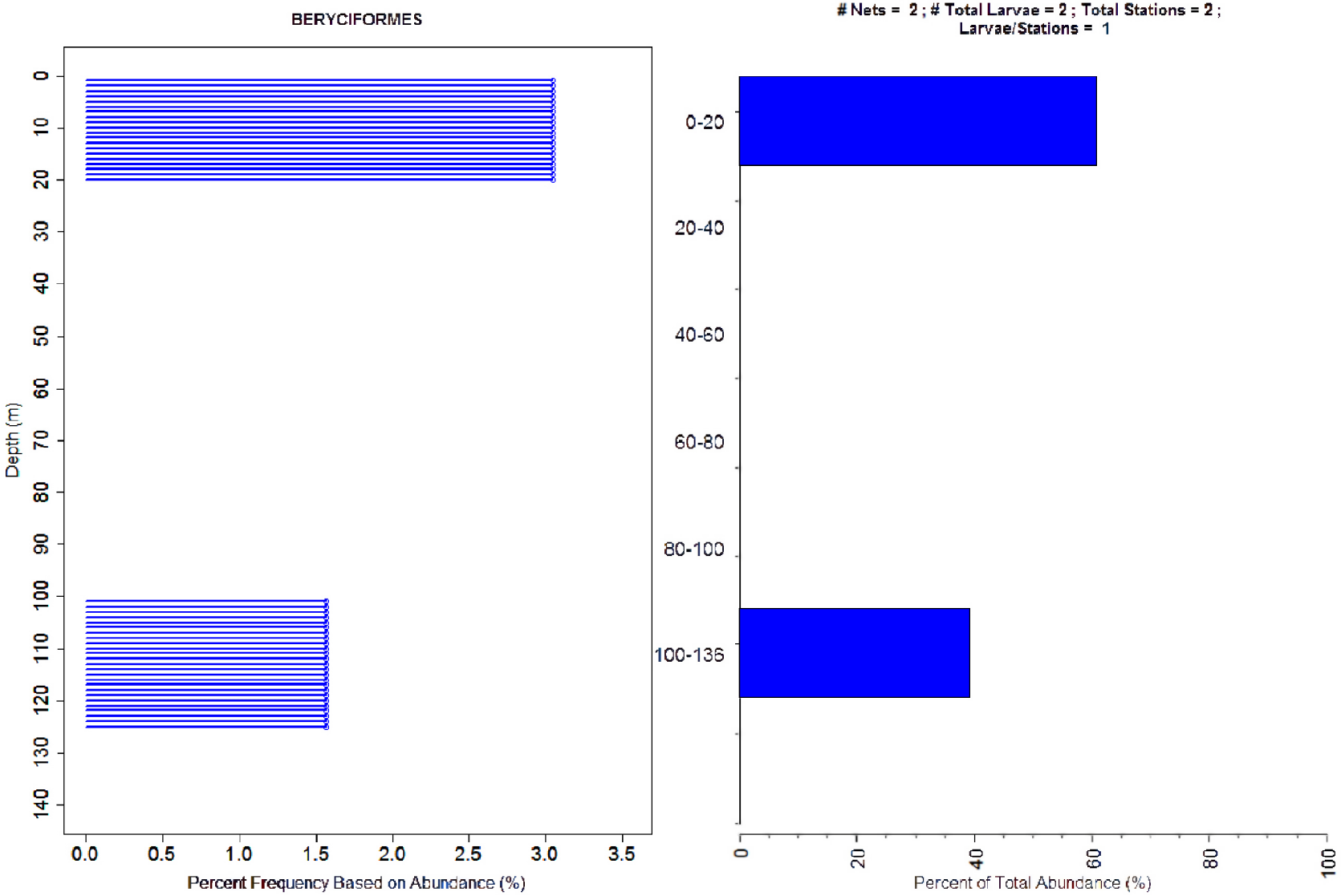
BALISTIDAE



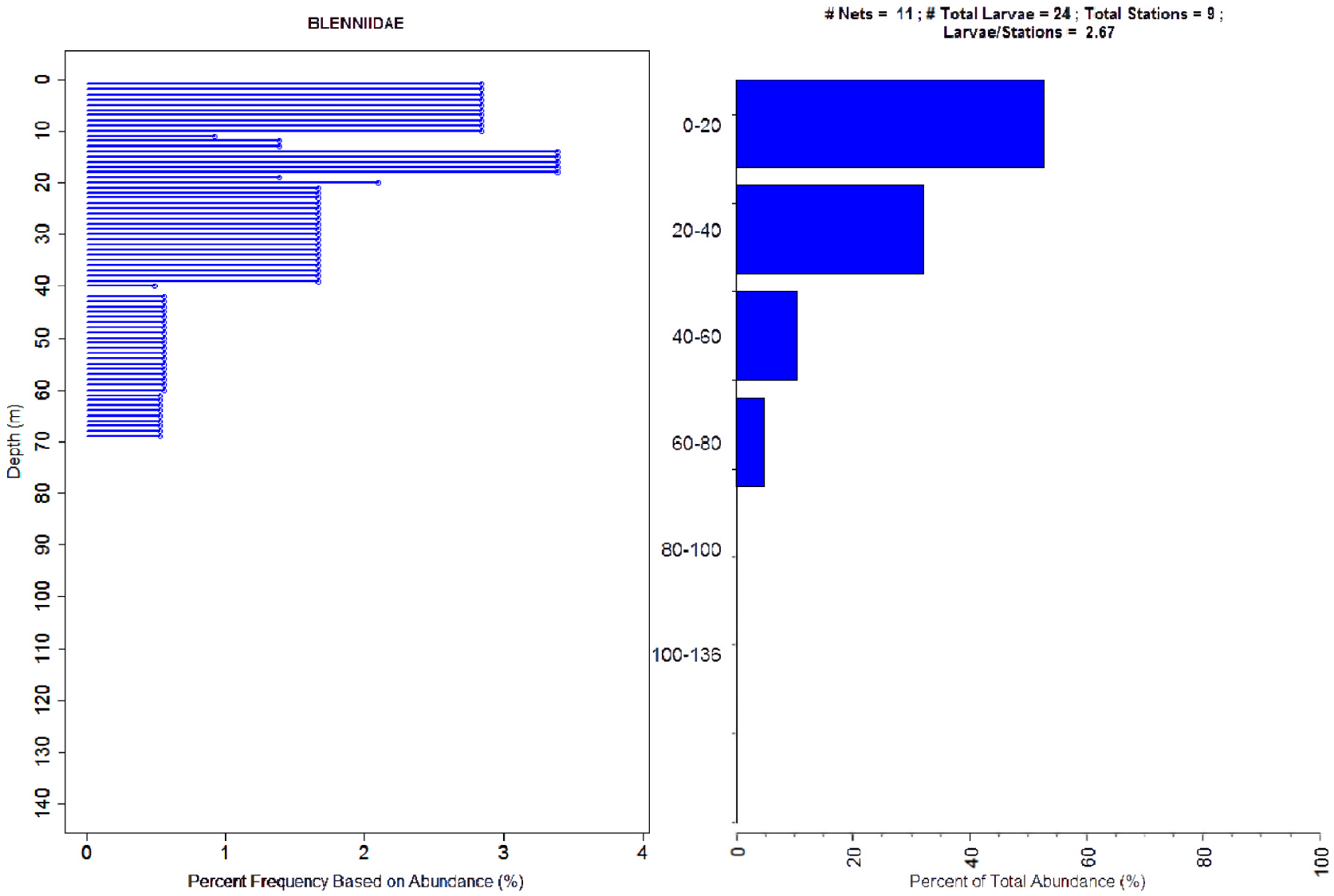
BATHYLAGIDAE



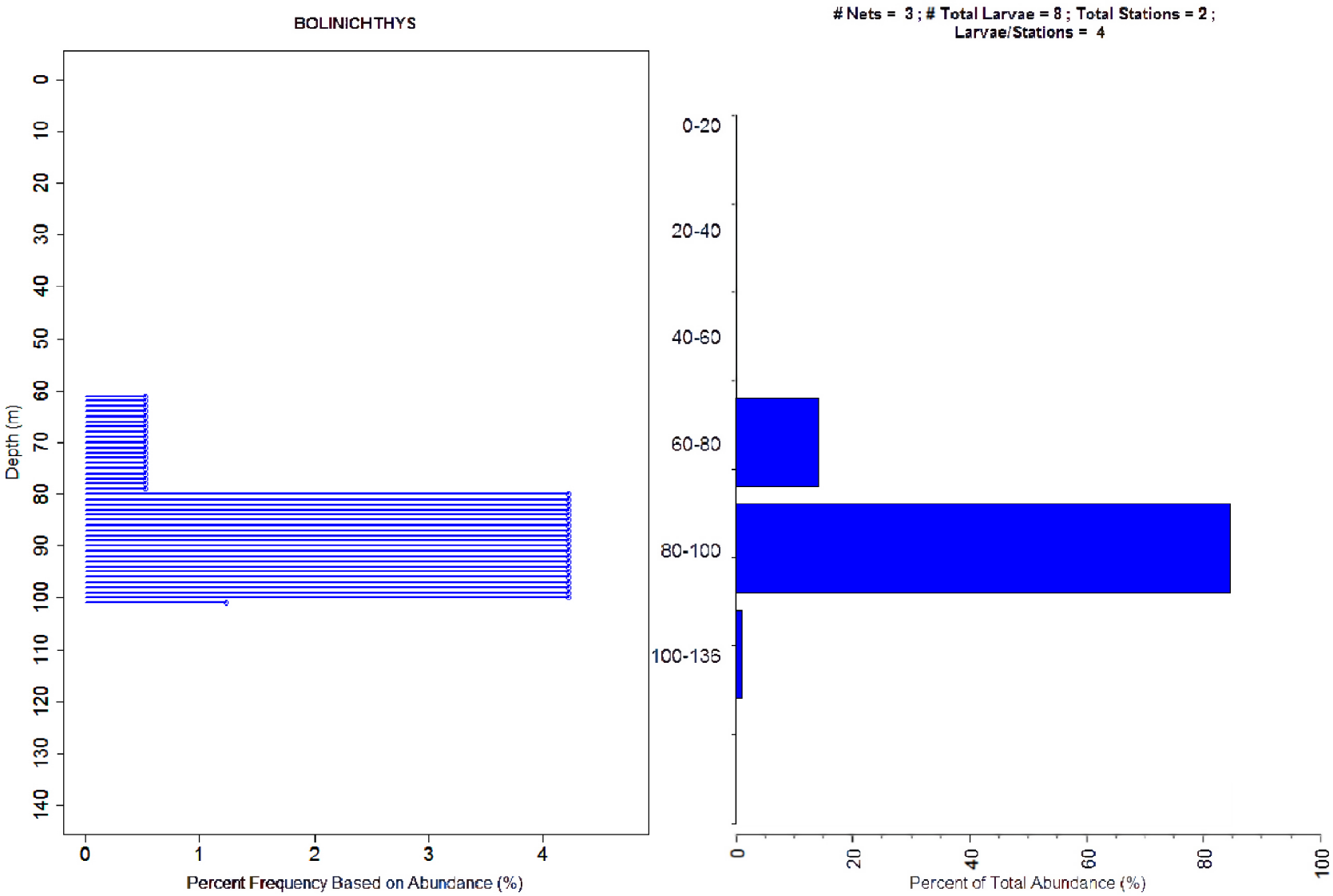
BENTHOSEMA_SUBORBITALE



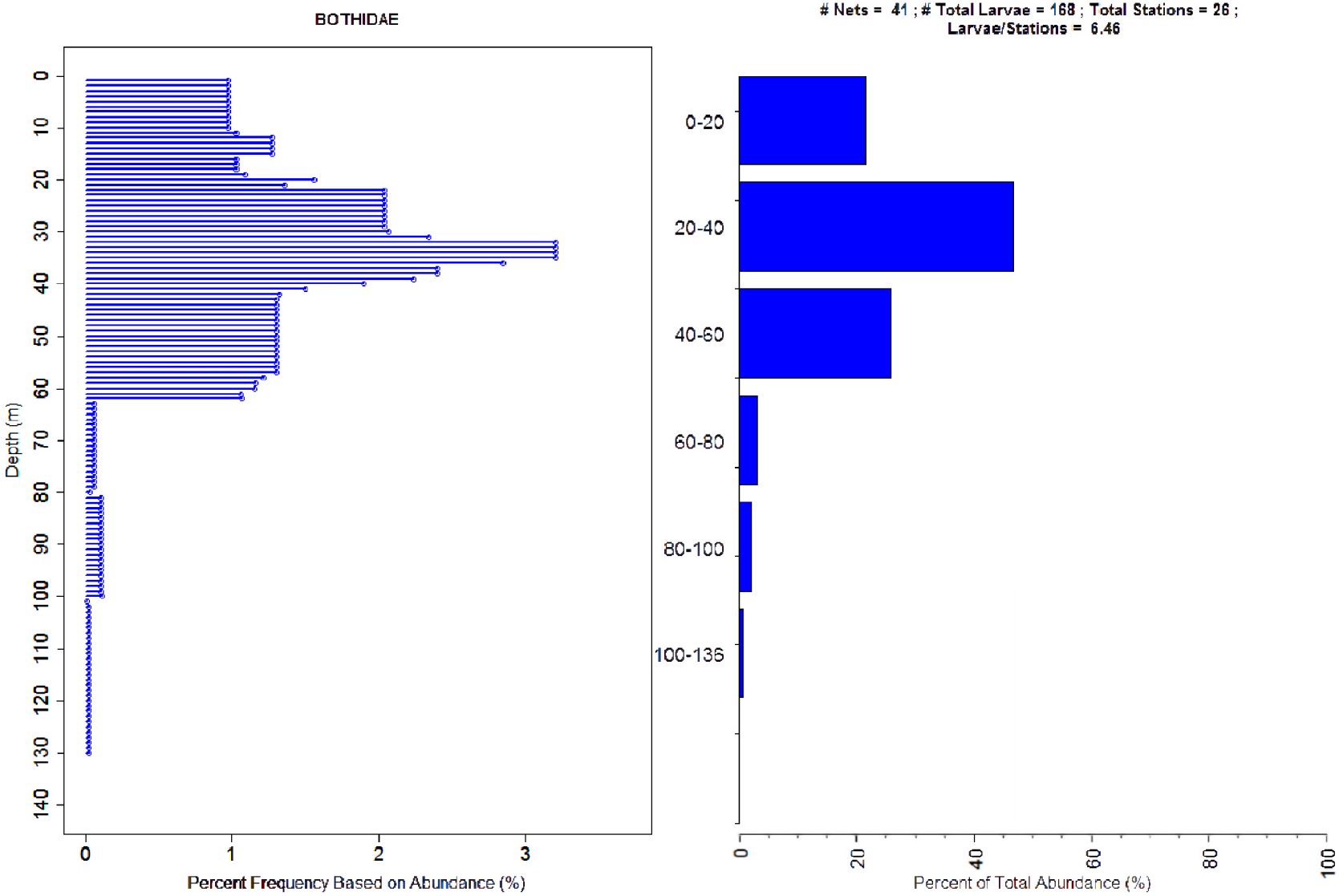
BERYCIFORMES


BLENNIIDAE
Nets = 11 ; # Total Larvae = 24 ; Total Stations = 9 ;
Larvae/Stations = 2.67
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

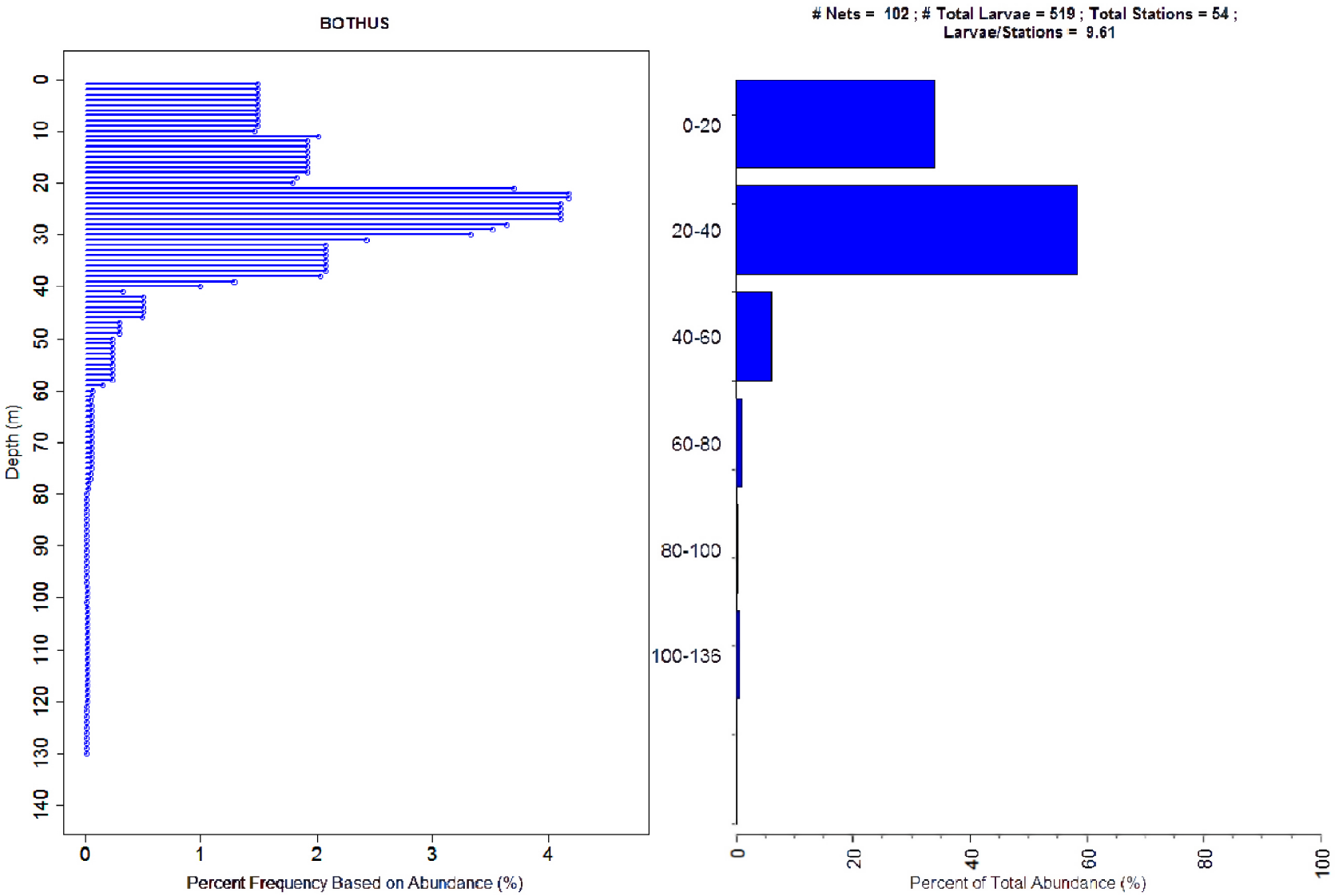
BLENNIIDAE



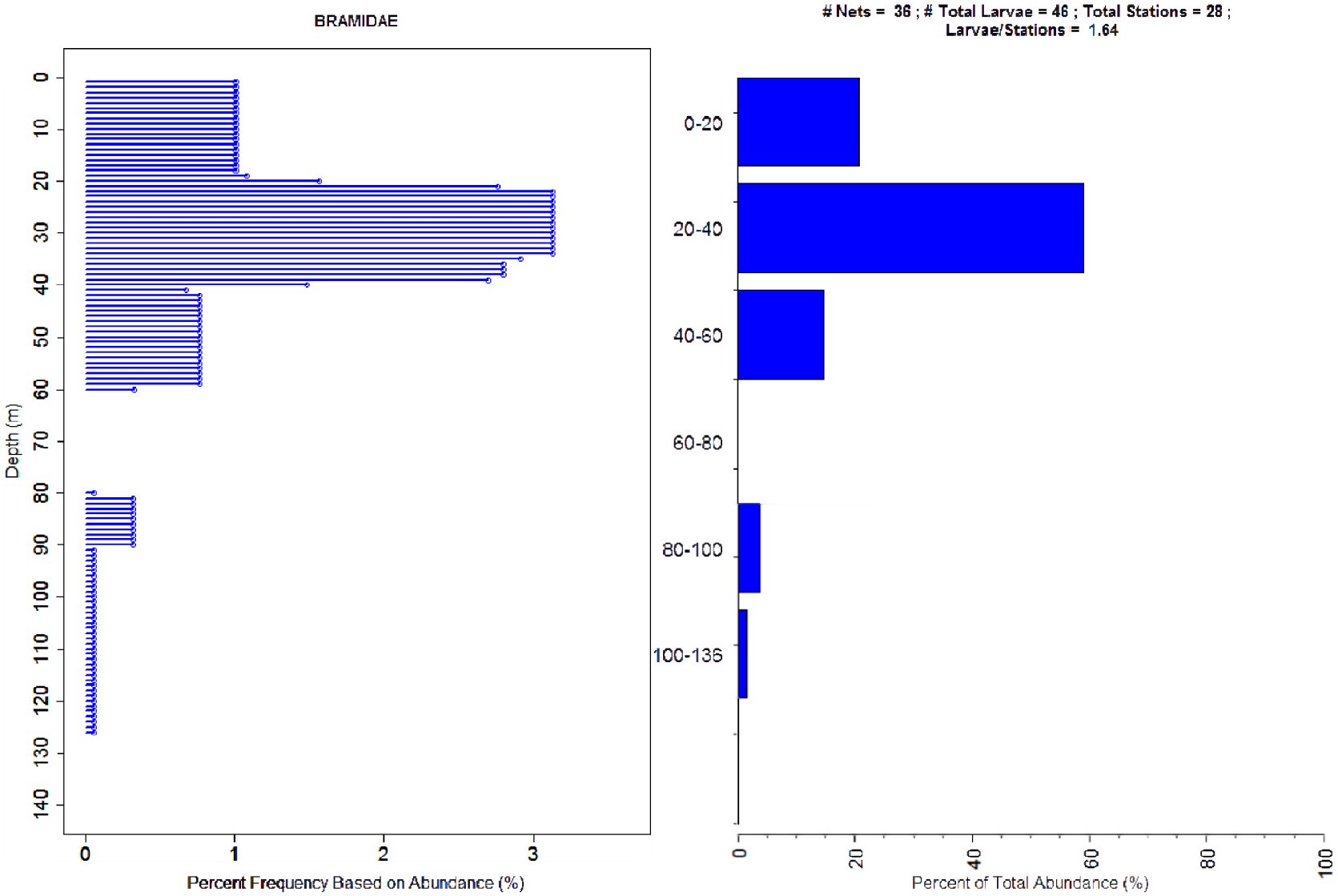
BOLINICHTHYS


BOTHIDAE
Nets = 41 ; # Total Larvae = 168 ; Total Stations = 26 ;
Larvae/Stations = 6.46
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

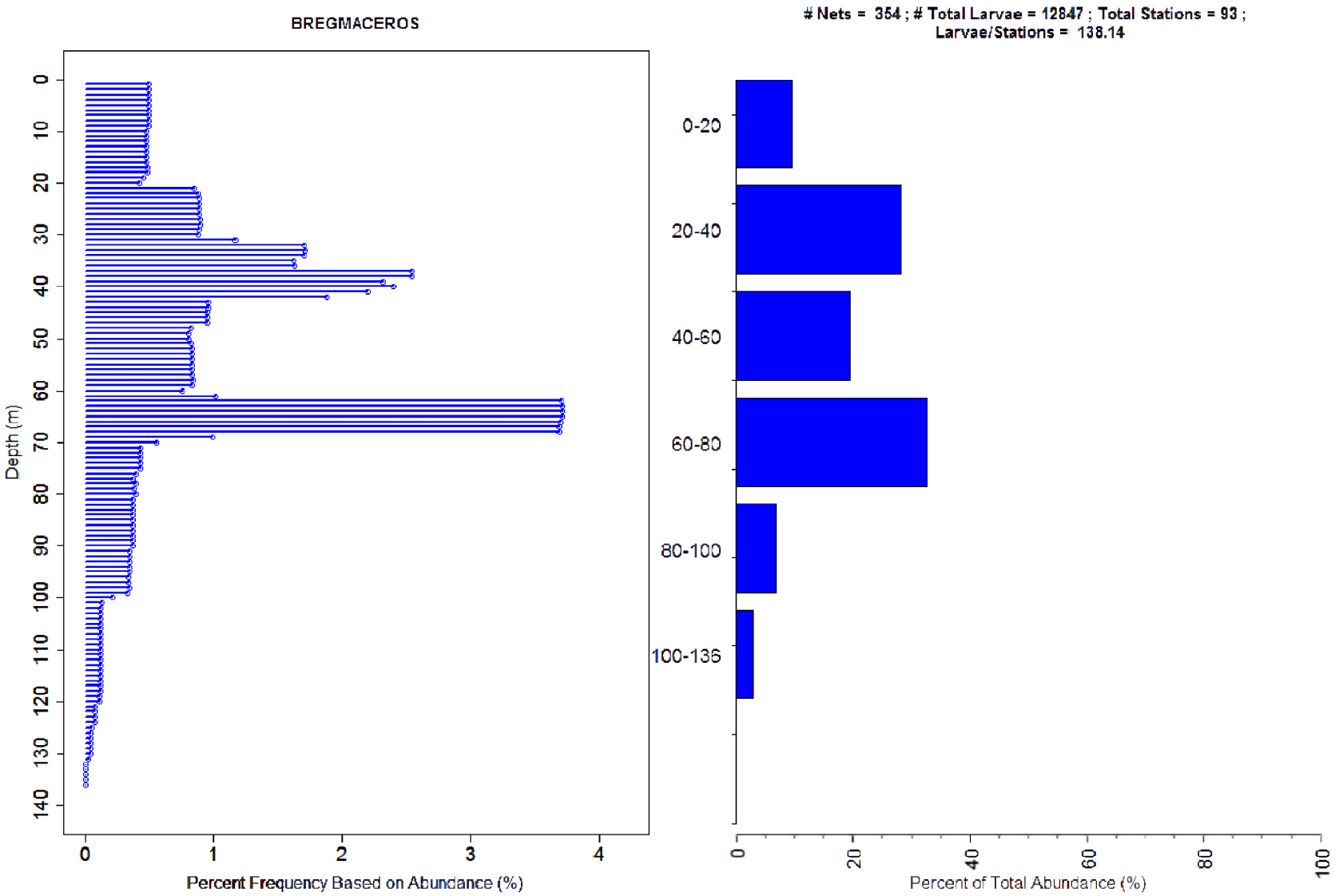
BOTHIDAE


BOTHUS
Nets = 102 ; # Total Larvae = 519 ; Total Stations = 54 ;
Larvae/Stations = 9.61
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

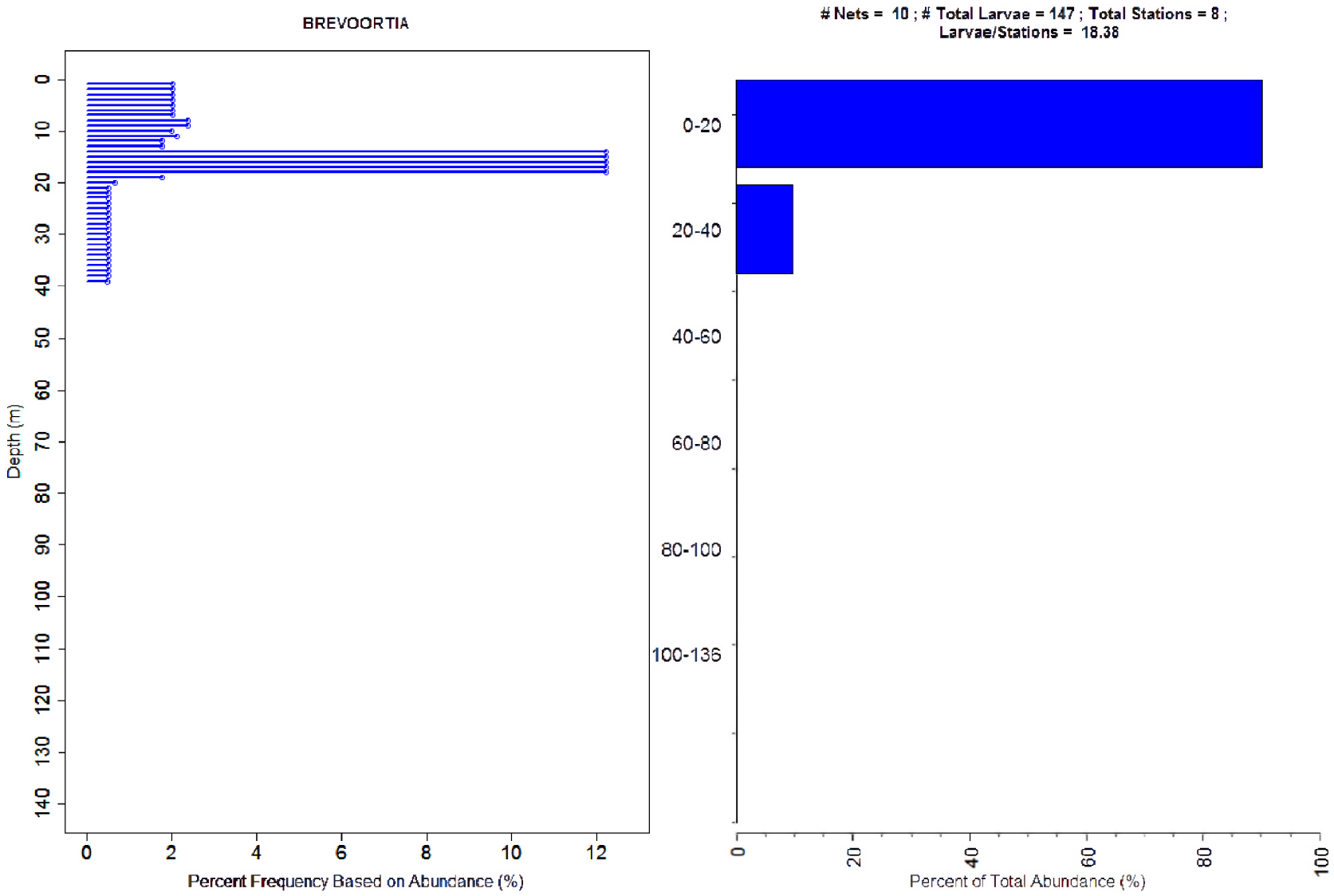
BOTHUS


BRAMIDAE
Nets = 36 ; # Total Larvae = 46 ; Total Stations = 28 ;
Larvae/Stations = 1.64
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

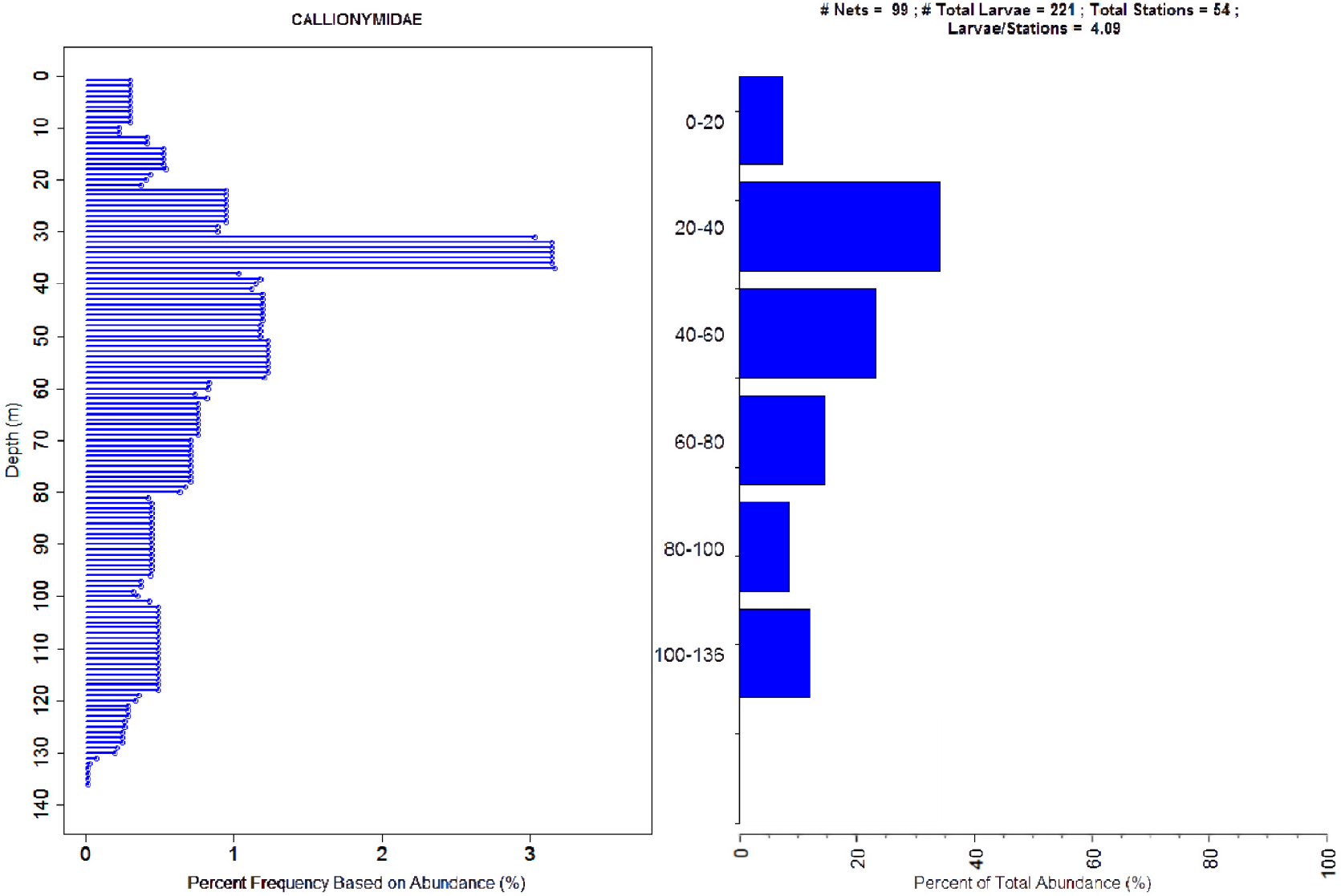
BRAMIDAE



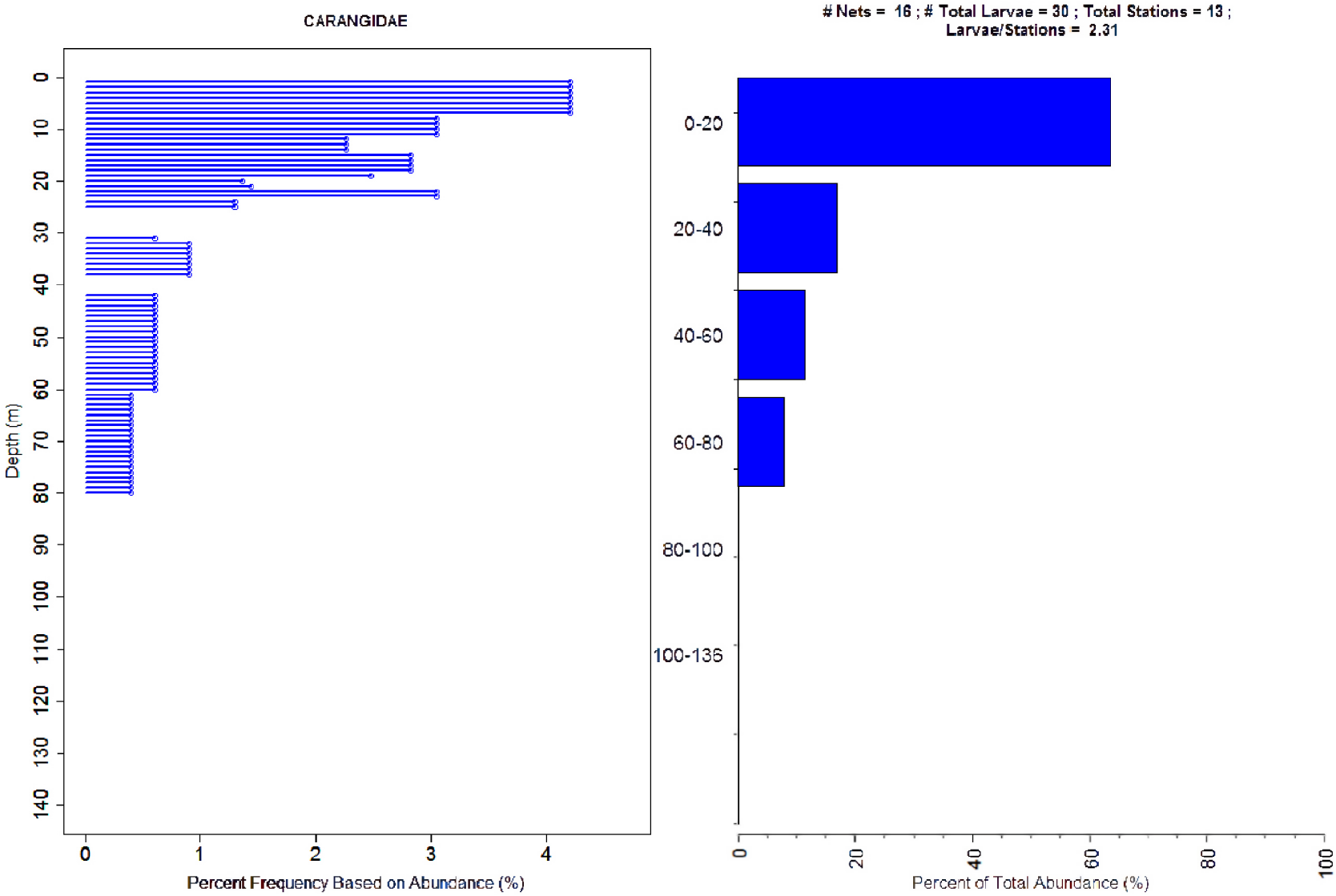
BREGMACEROS


BREVOORTIA
Nets = 10 ; # Total Larvae = 147 ; Total Stations = 8 ;
Larvae/Stations = 18.38
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
8
10
12
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

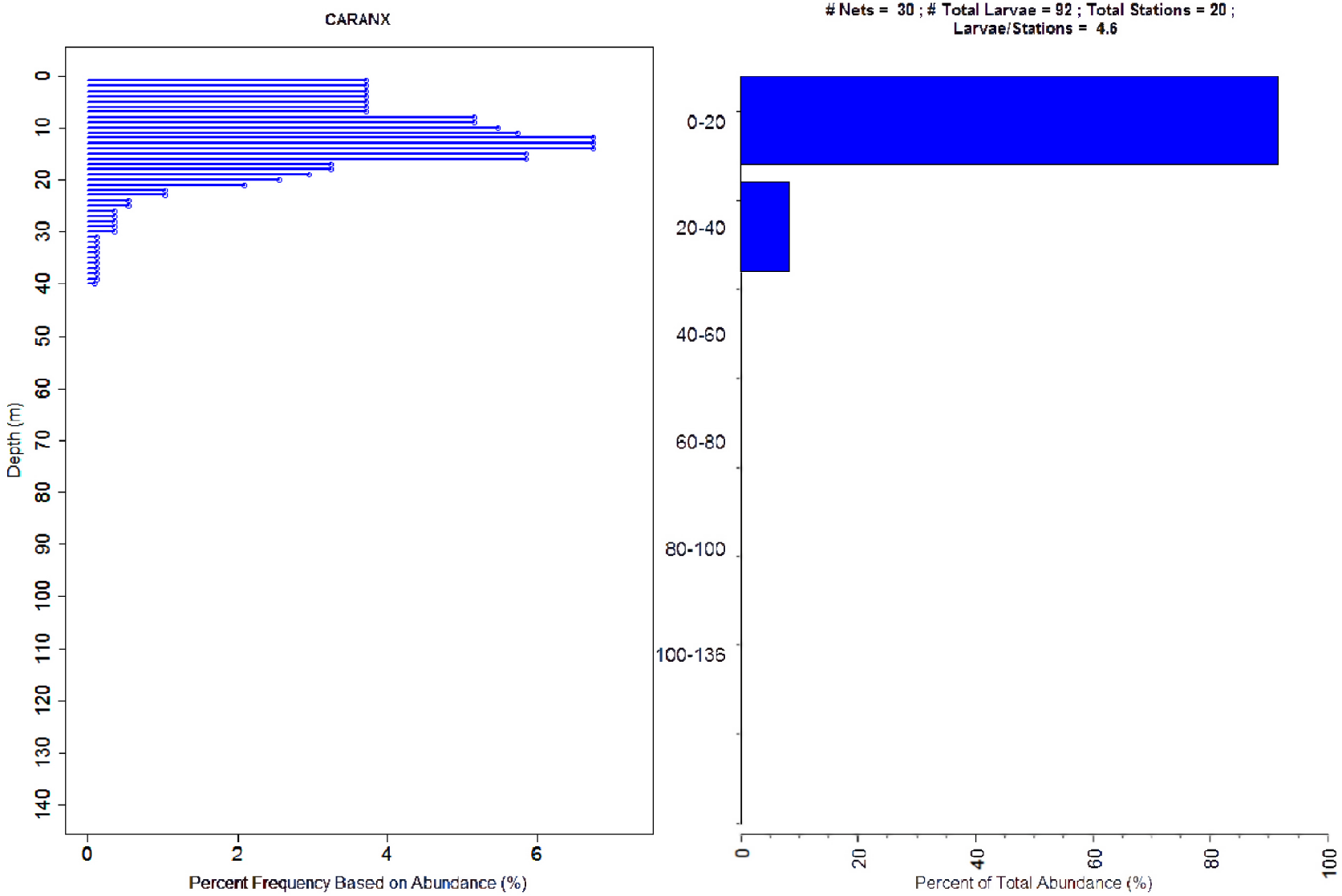
BREVOORTIA



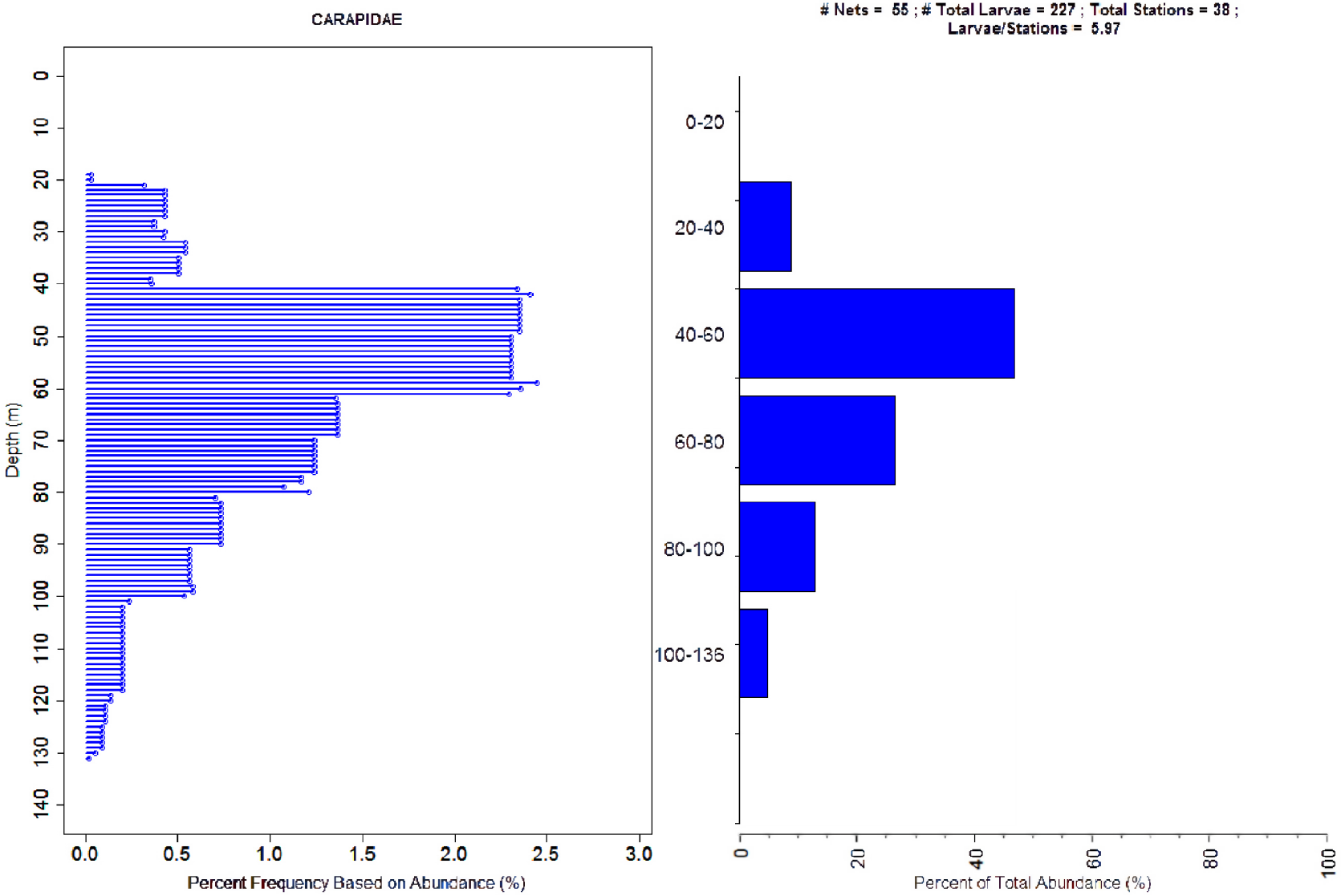
CALLIONYMIDAE


CARANGIDAE
Nets = 16 ; # Total Larvae = 30 ; Total Stations = 13 ;
Larvae/Stations = 2.31
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

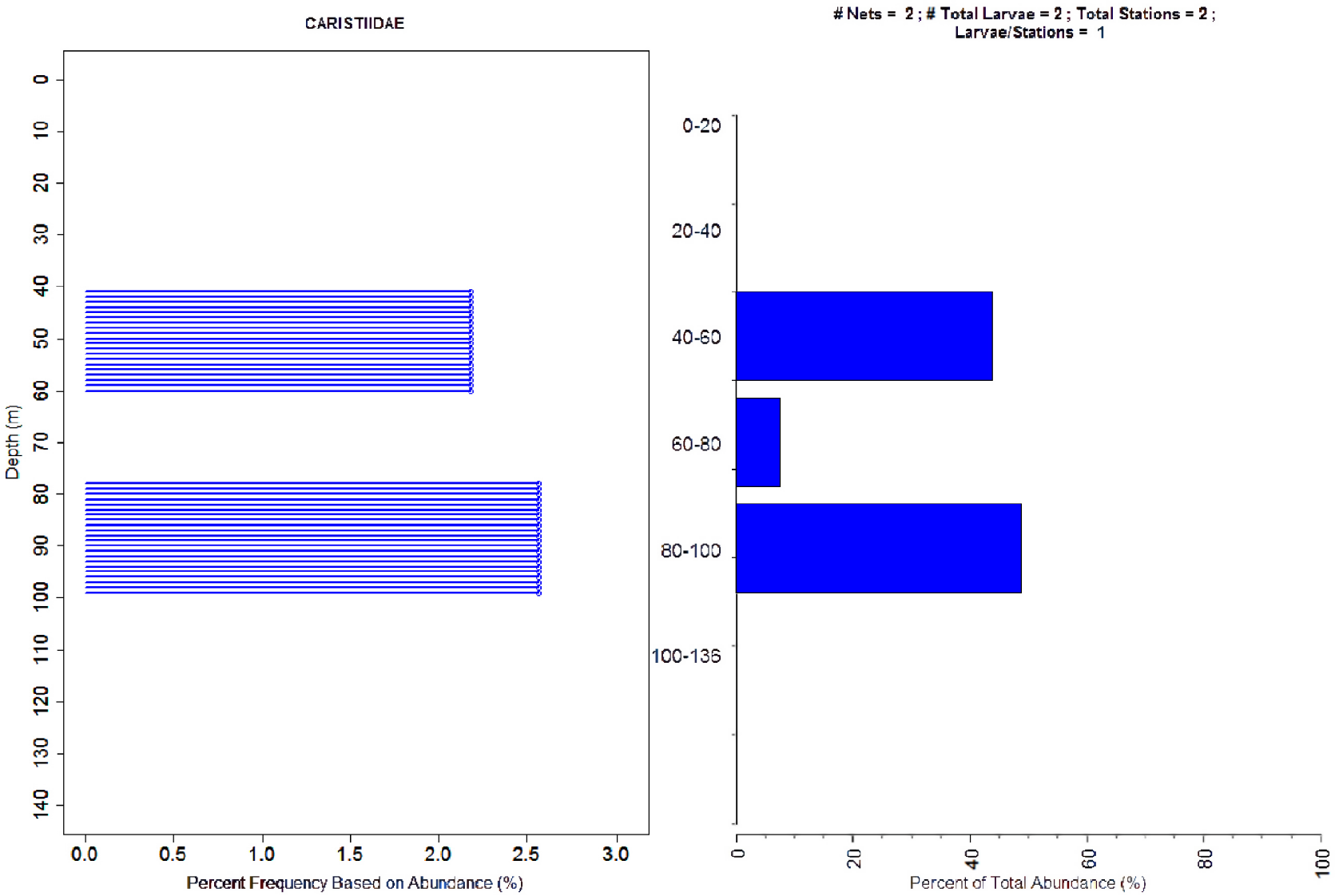
CARANGIDAE


CARANX
Nets = 30 ; # Total Larvae = 92 ; Total Stations = 20 ;
Larvae/Stations = 4.6
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

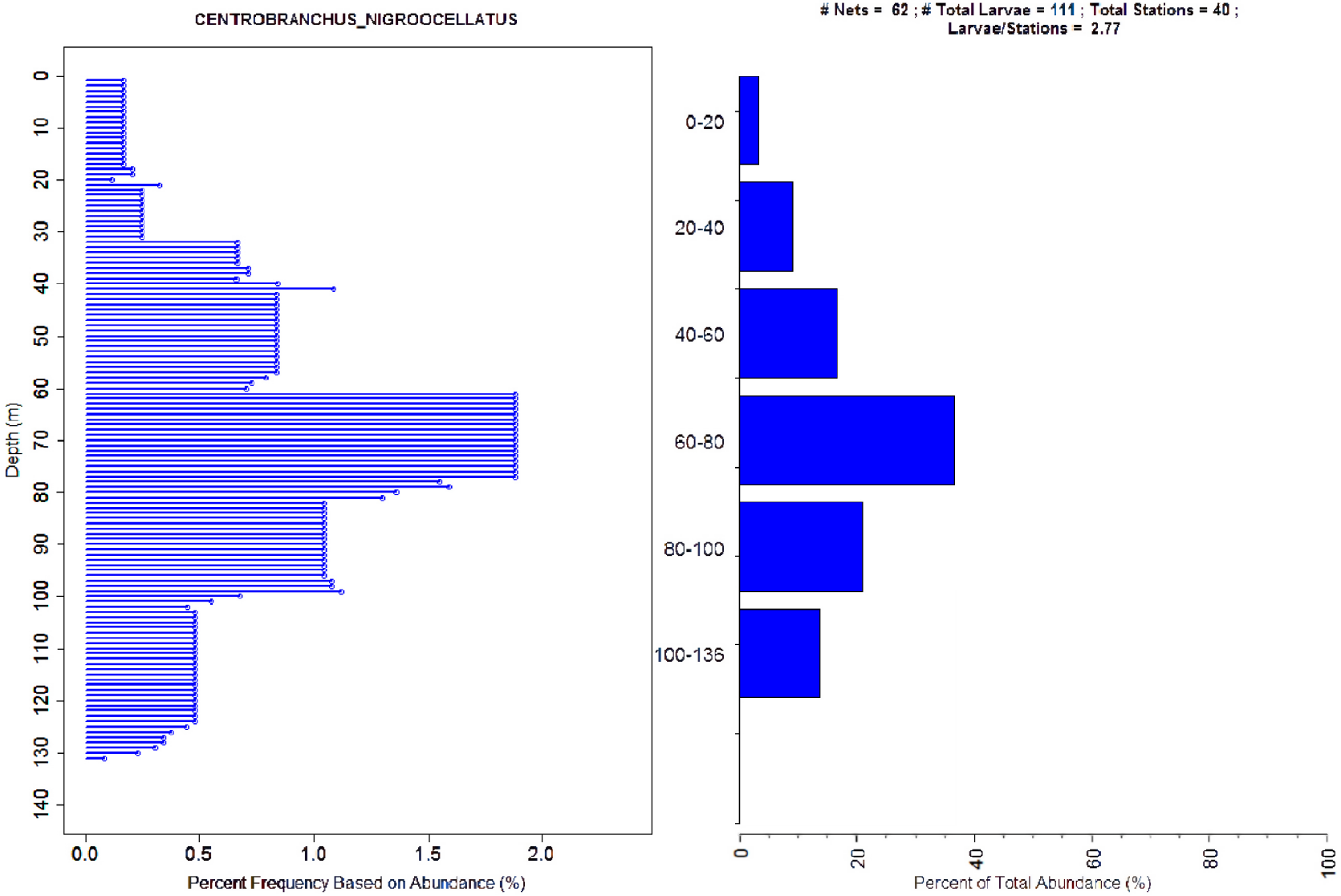
CARANX


CARAPIDAE
Nets = 55 ; # Total Larvae = 227 ; Total Stations = 38 ;
Larvae/Stations = 5.97
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

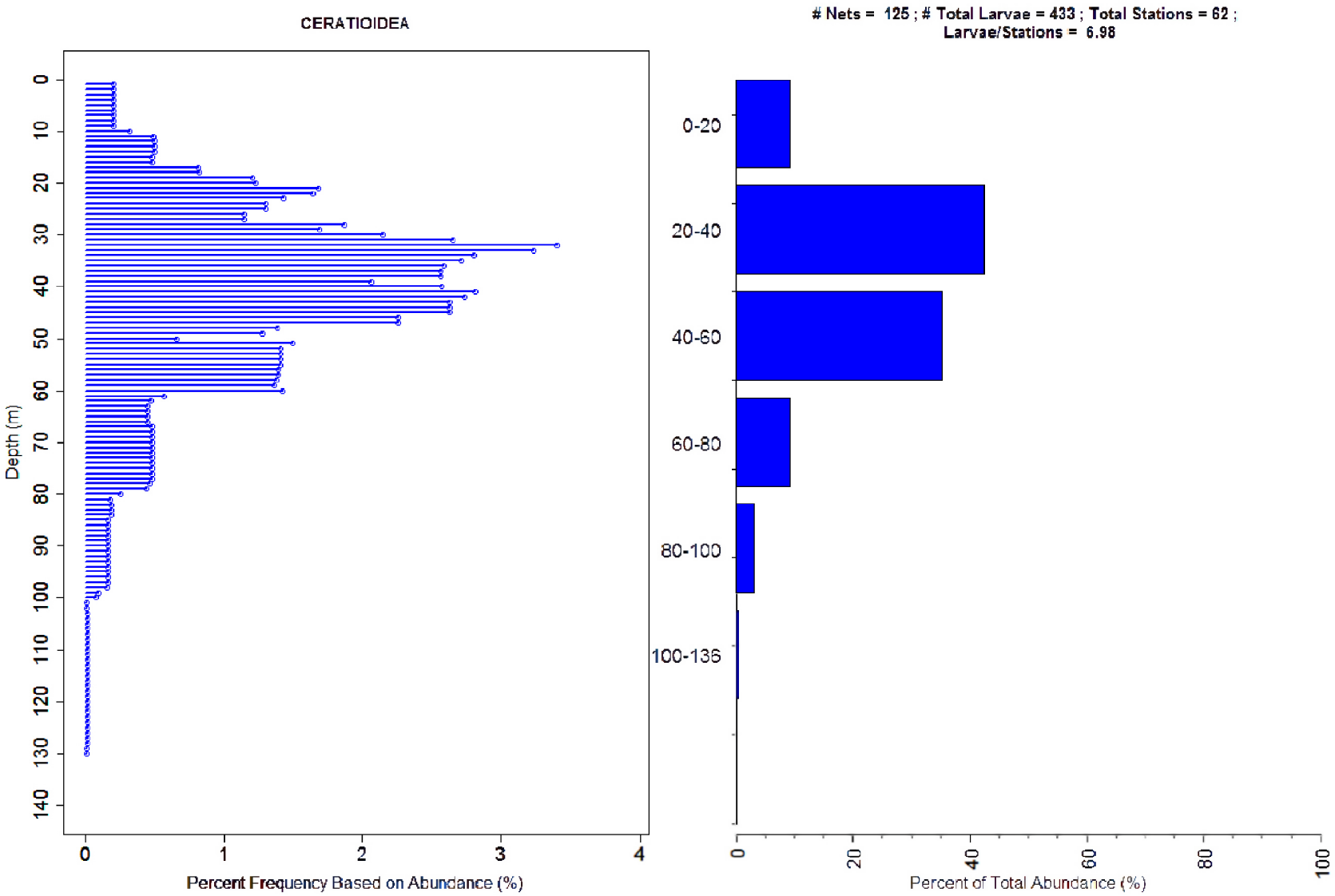
CARAPIDAE



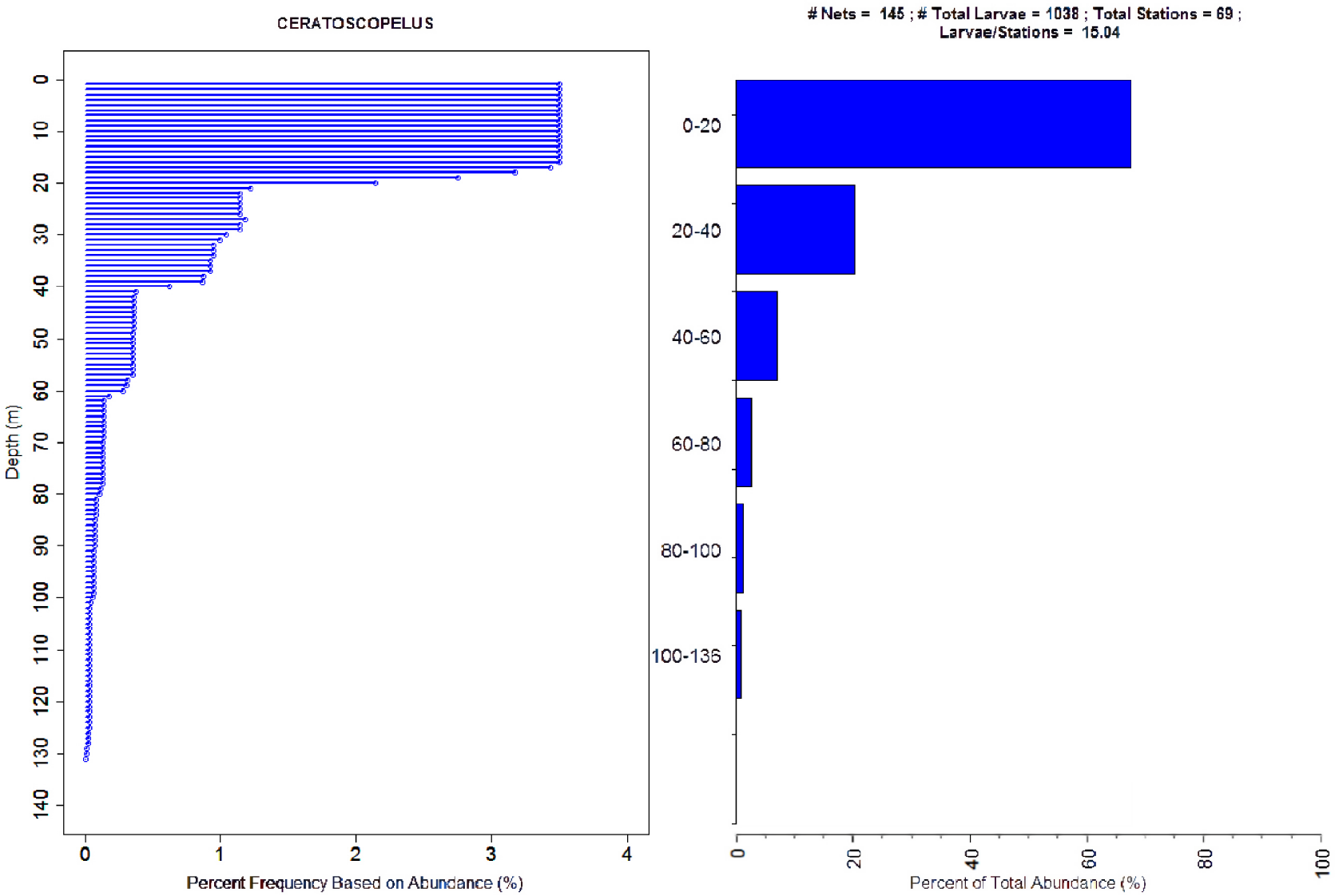
CARISTIIDAE



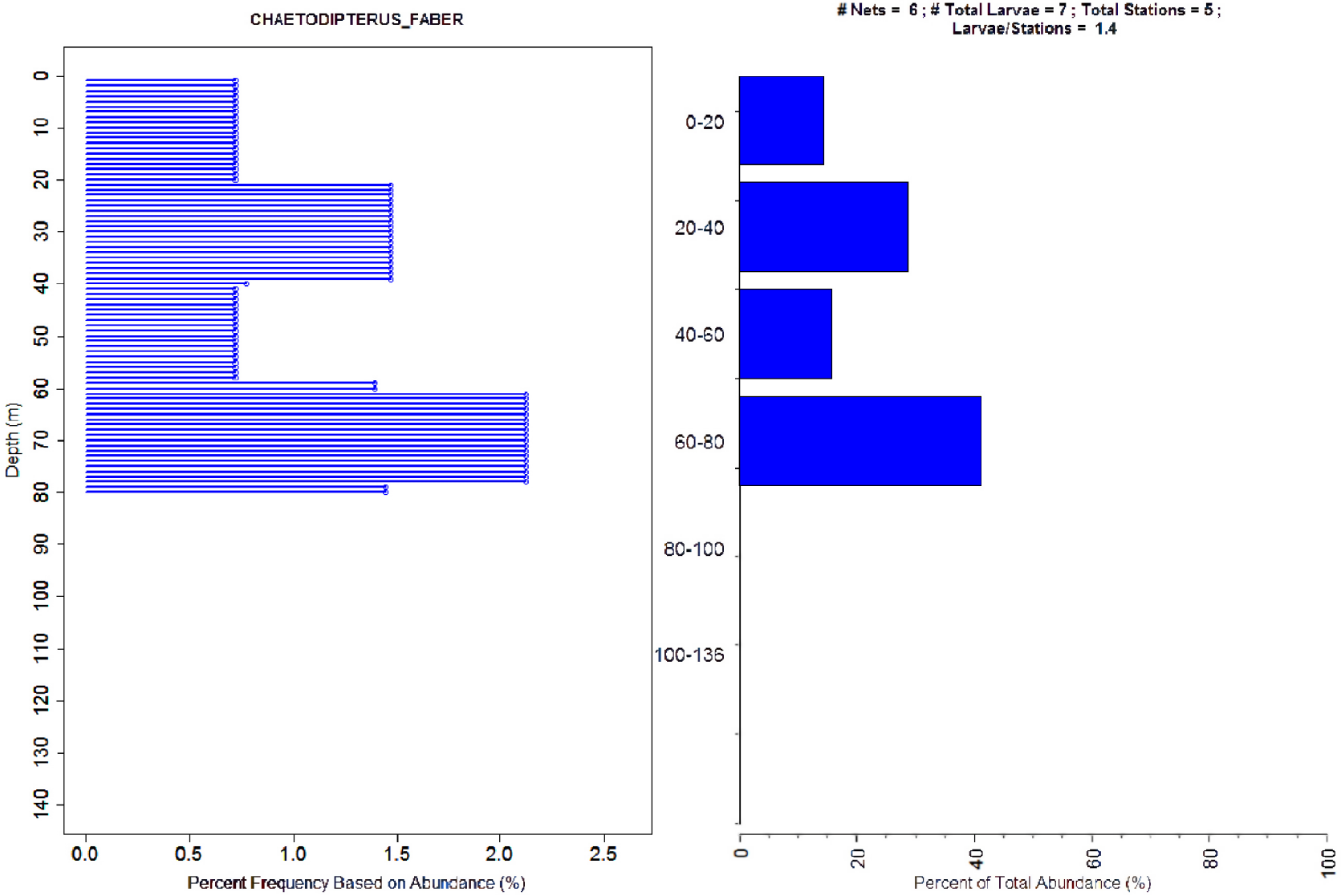
CENTROBRANCHUS_NIGROOCELLATUS



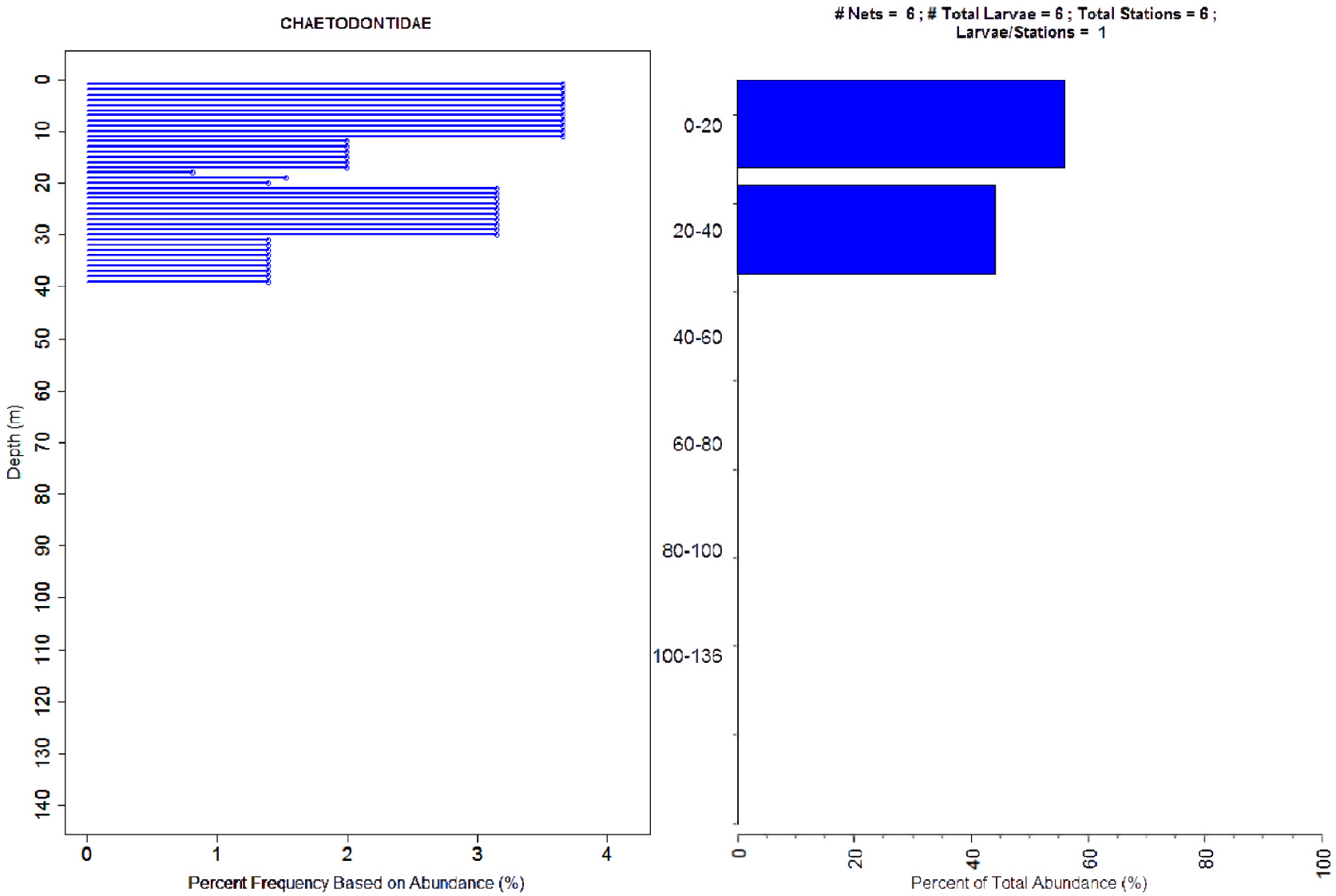
CERATIOIDEA



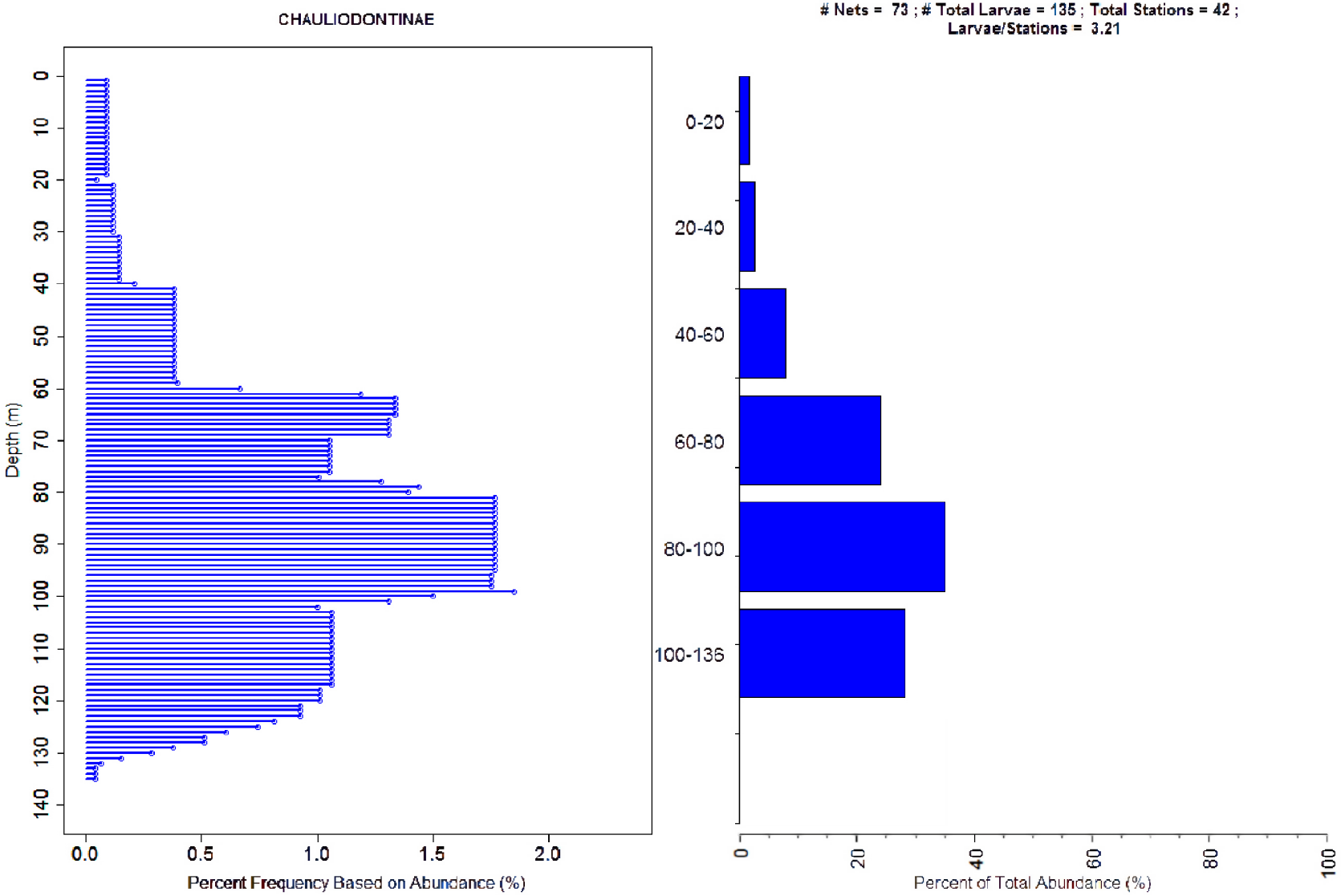
CERATOSCOPELUS



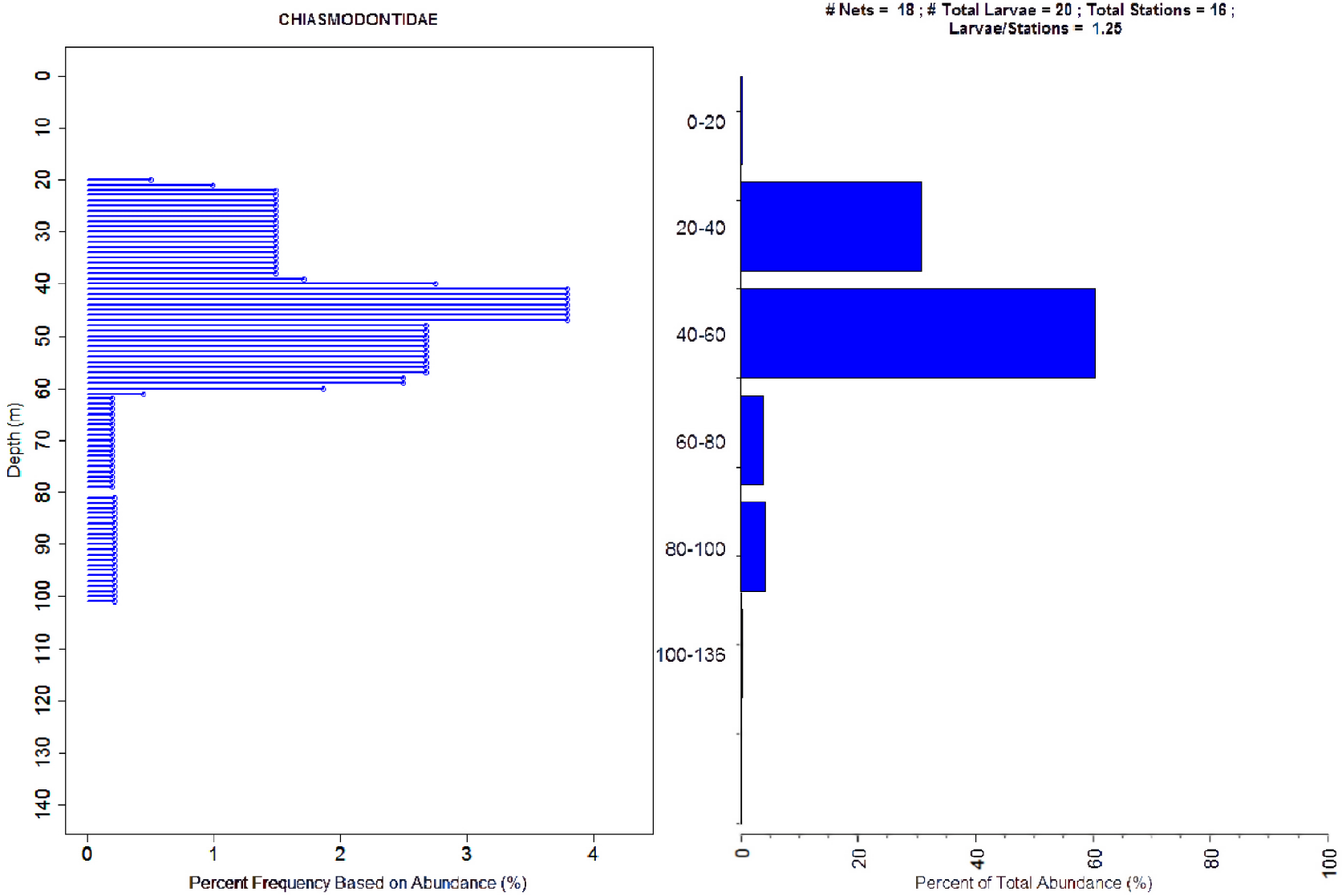
CHAETODIPTERUS_FABER



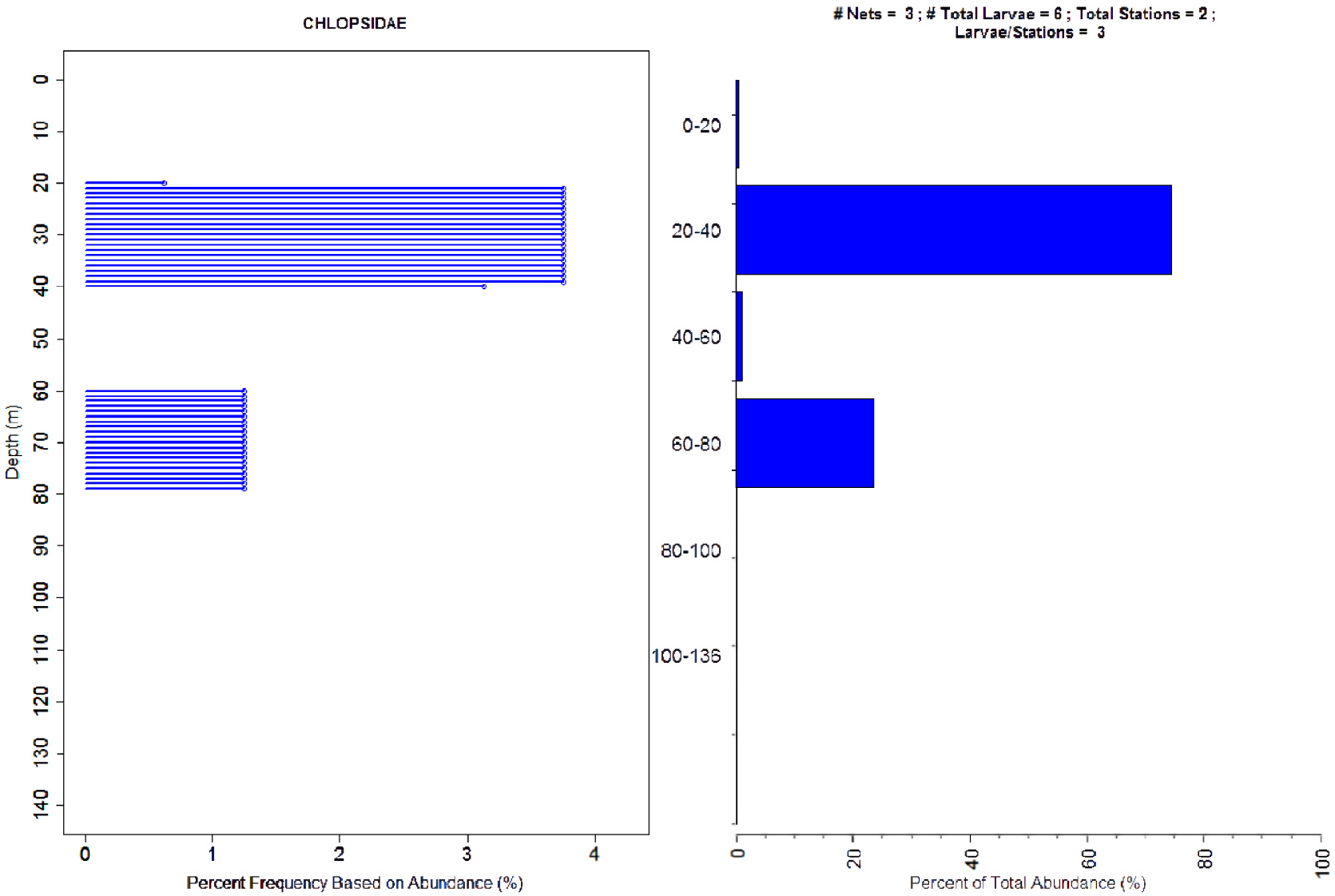
CHAETODONTIDAE



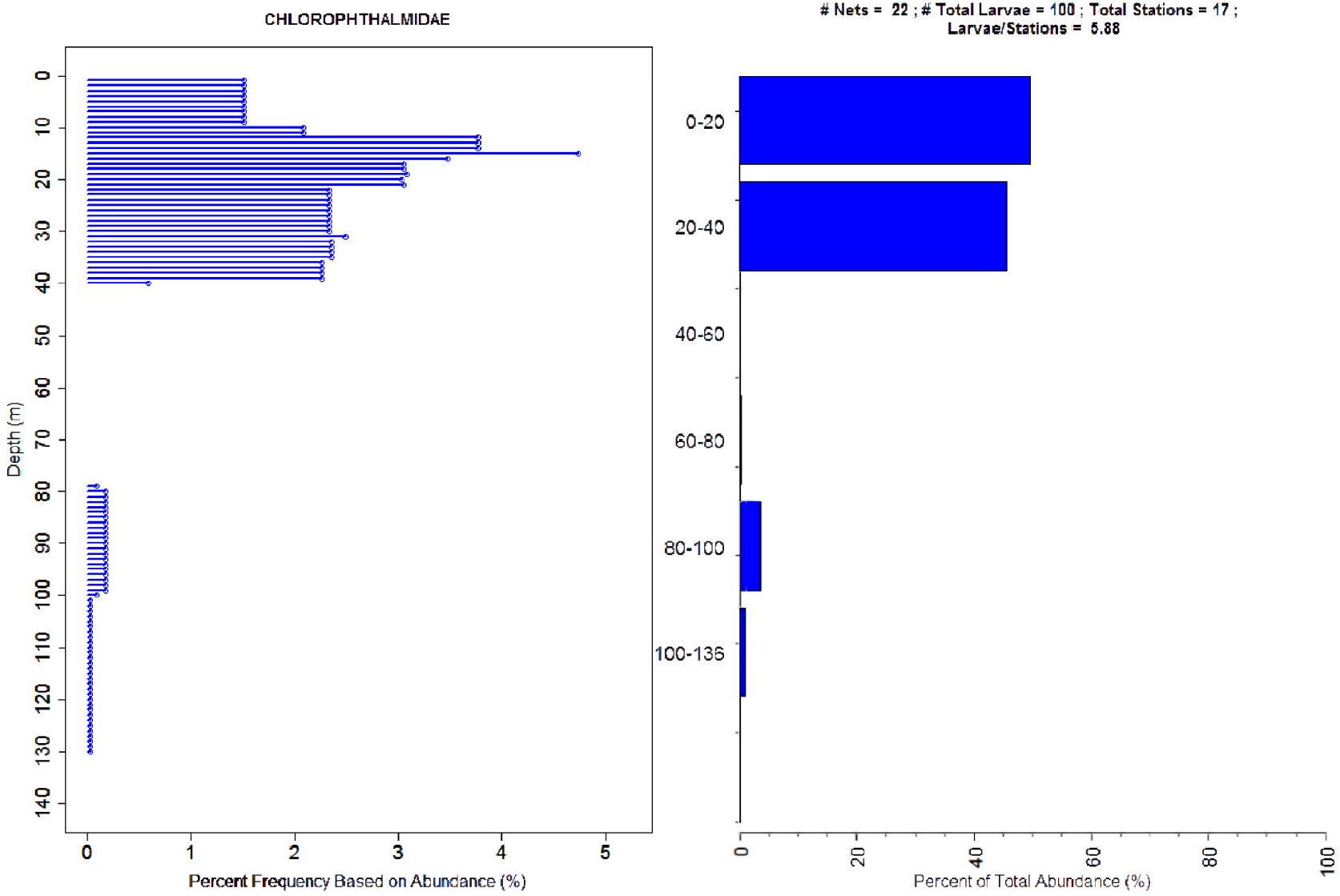
CHAULIODONTINAE



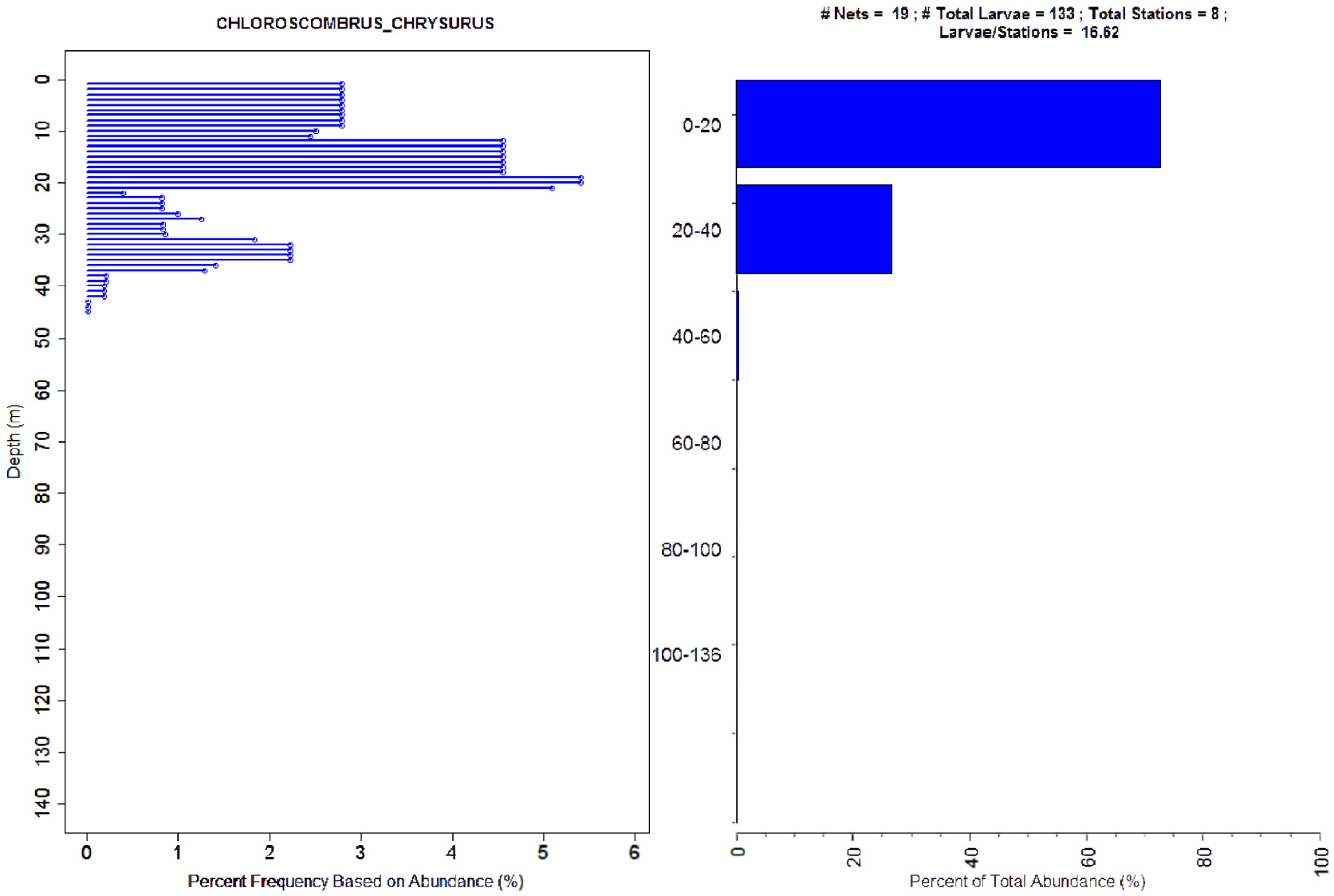
CHIASMODONTIDAE


CHLOPSIDAE
Nets = 3 ; # Total Larvae = 6 ; Total Stations = 2 ;
Larvae/Stations = 3
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

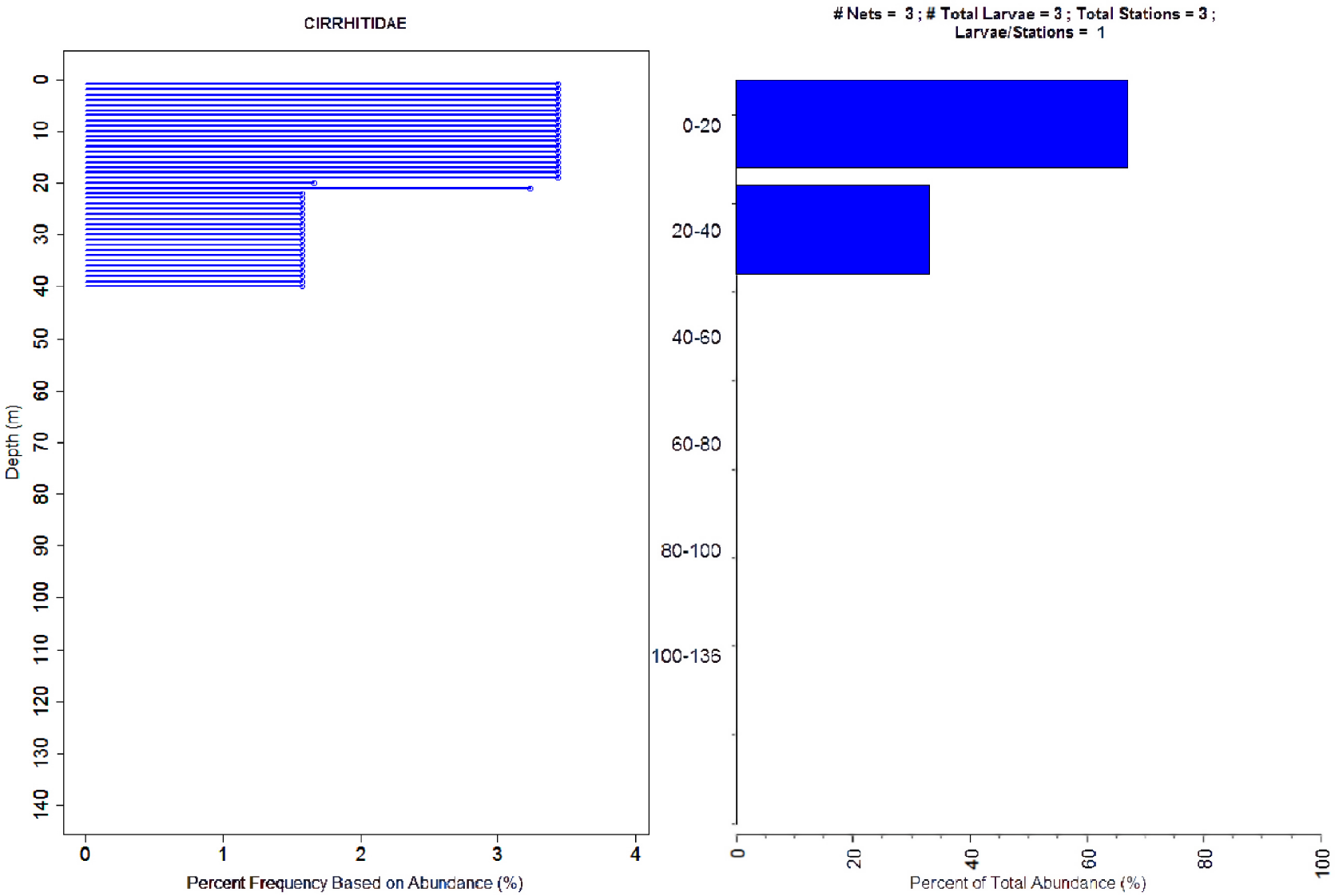
CHLOPSIDAE



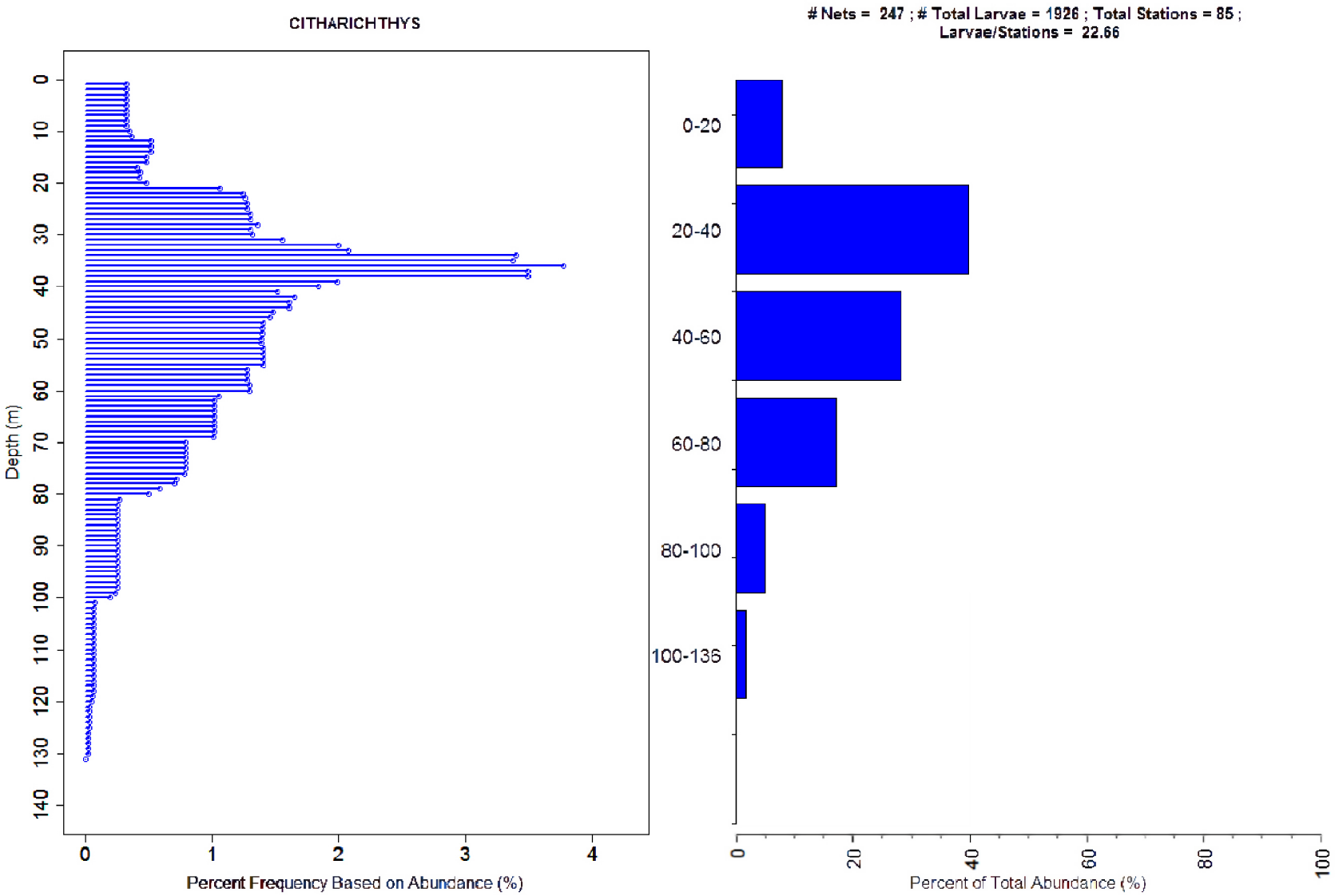
CHLOROPHTHALMIDAE



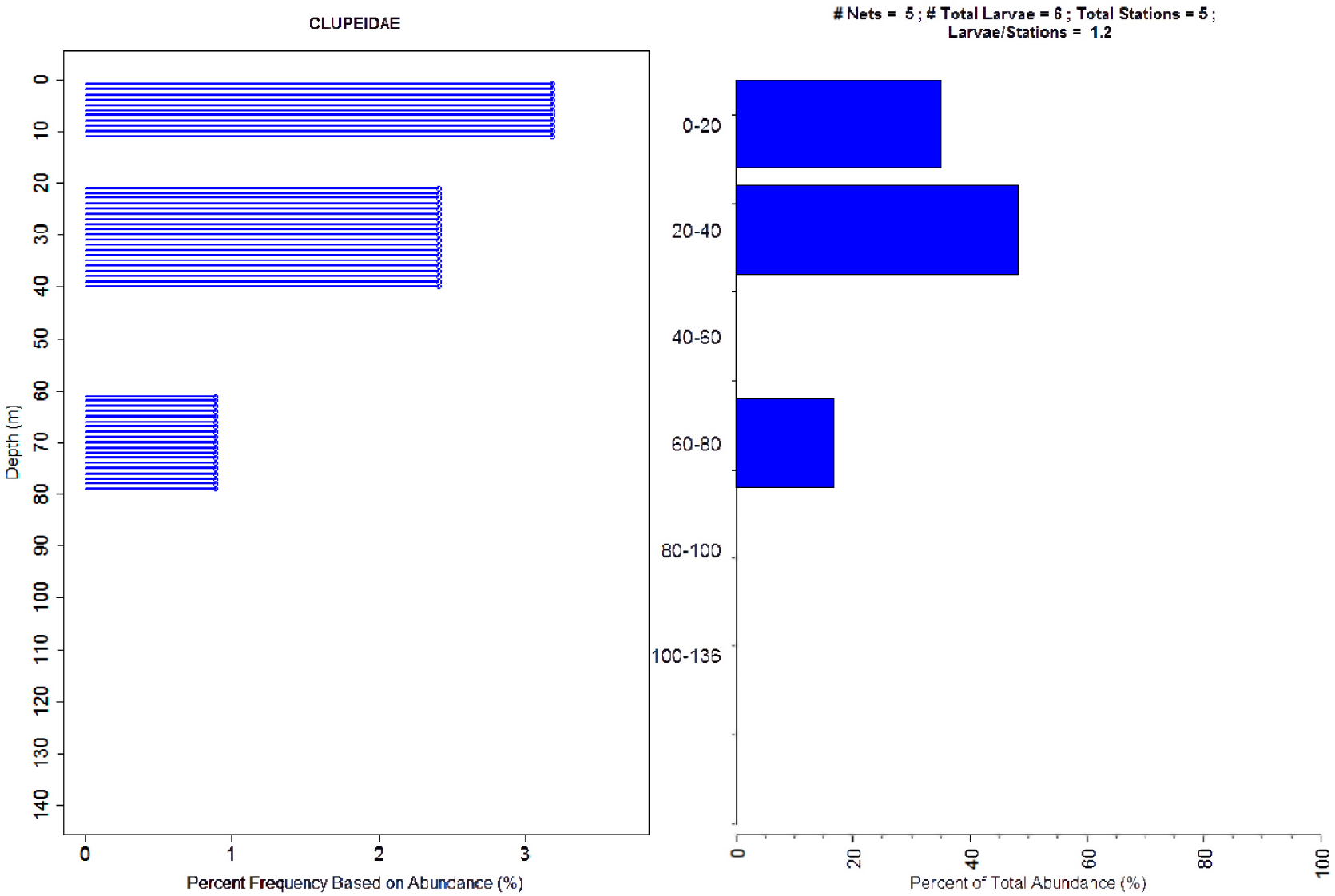
CHLOROSCOMBRUS_CHRYSURUS



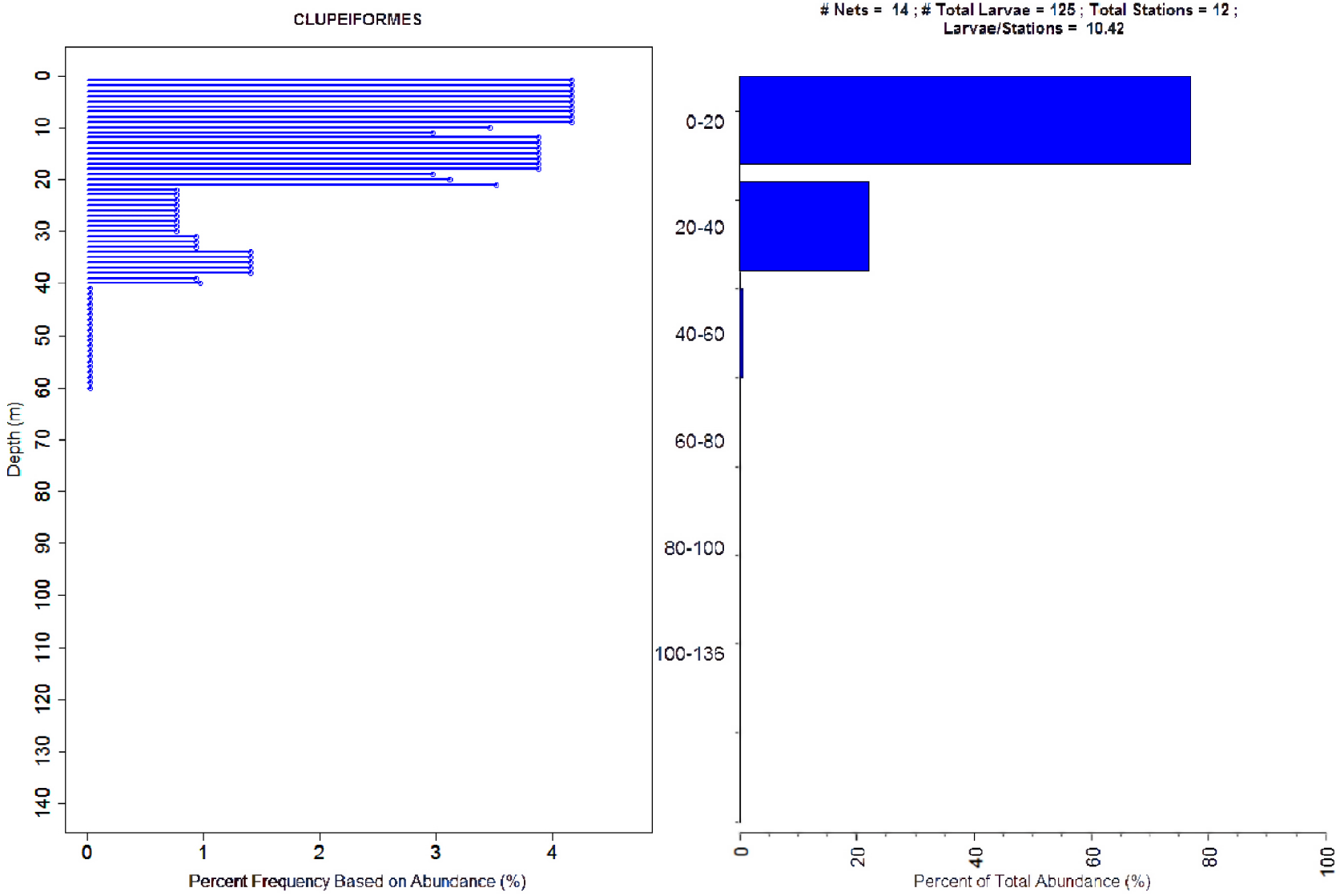
CIRRHITIDAE



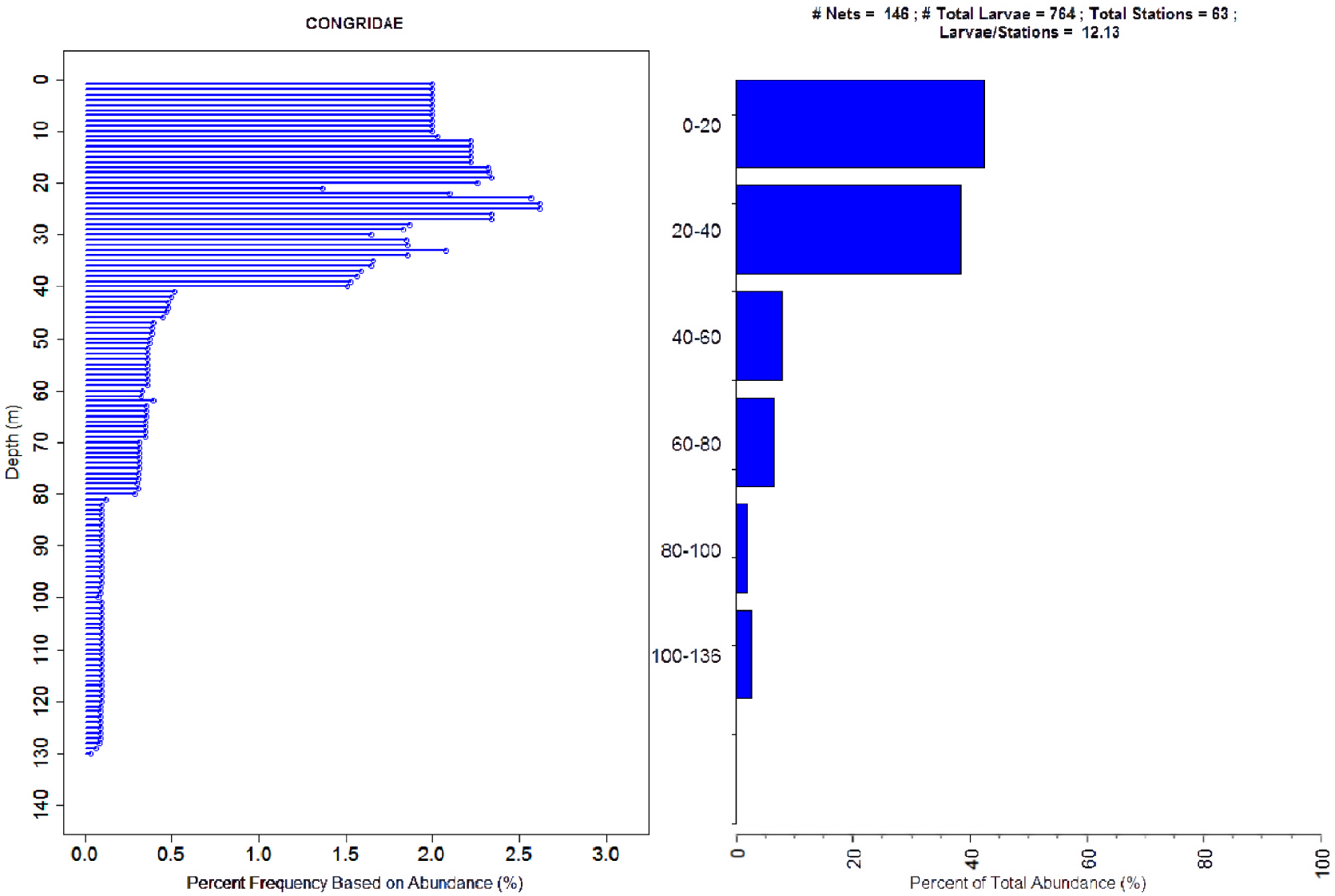
CITHARICHTHYS


CLUPEIDAE
Nets = 5 ; # Total Larvae = 6 ; Total Stations = 5 ;
Larvae/Stations = 1.2
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

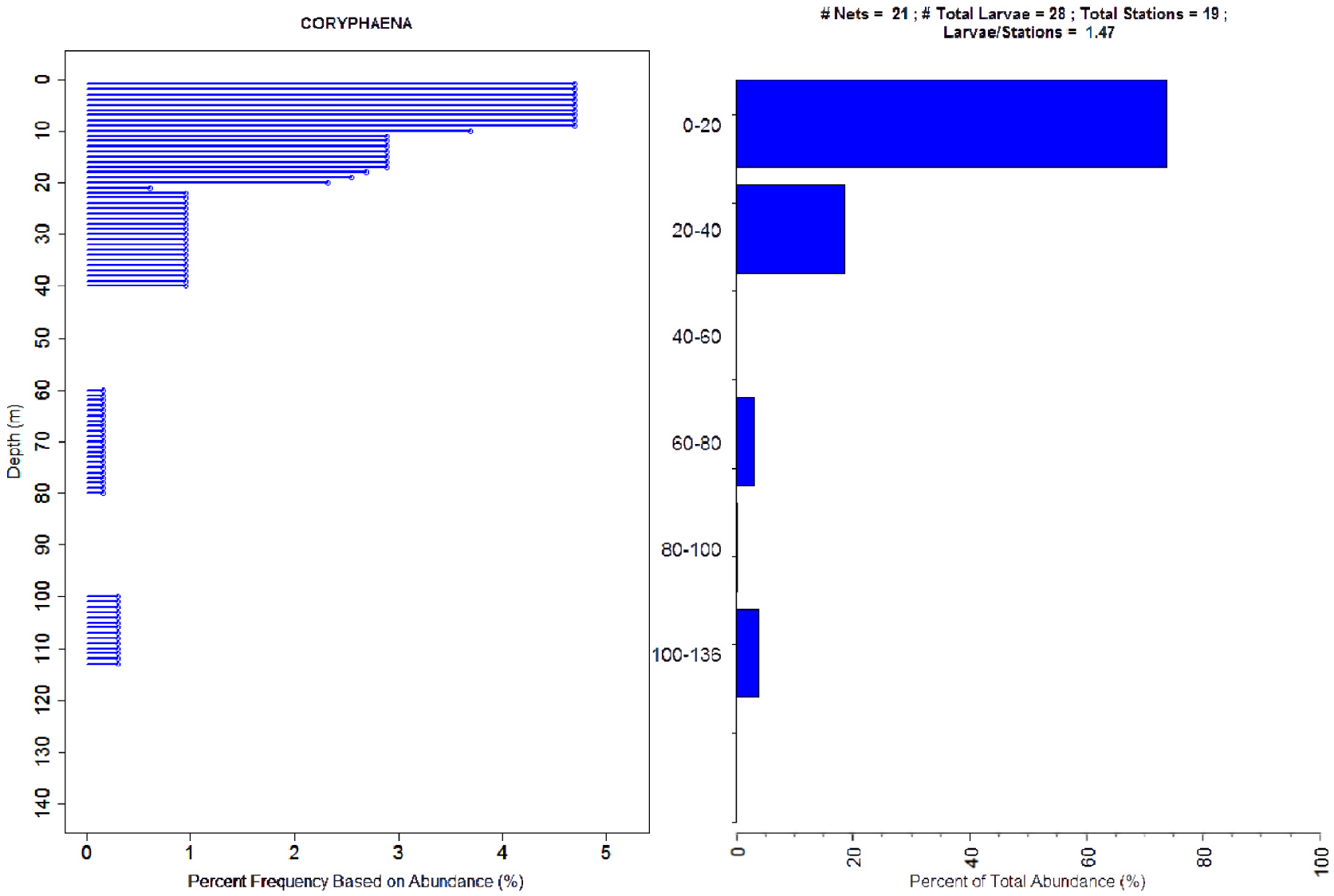
CLUPEIDAE



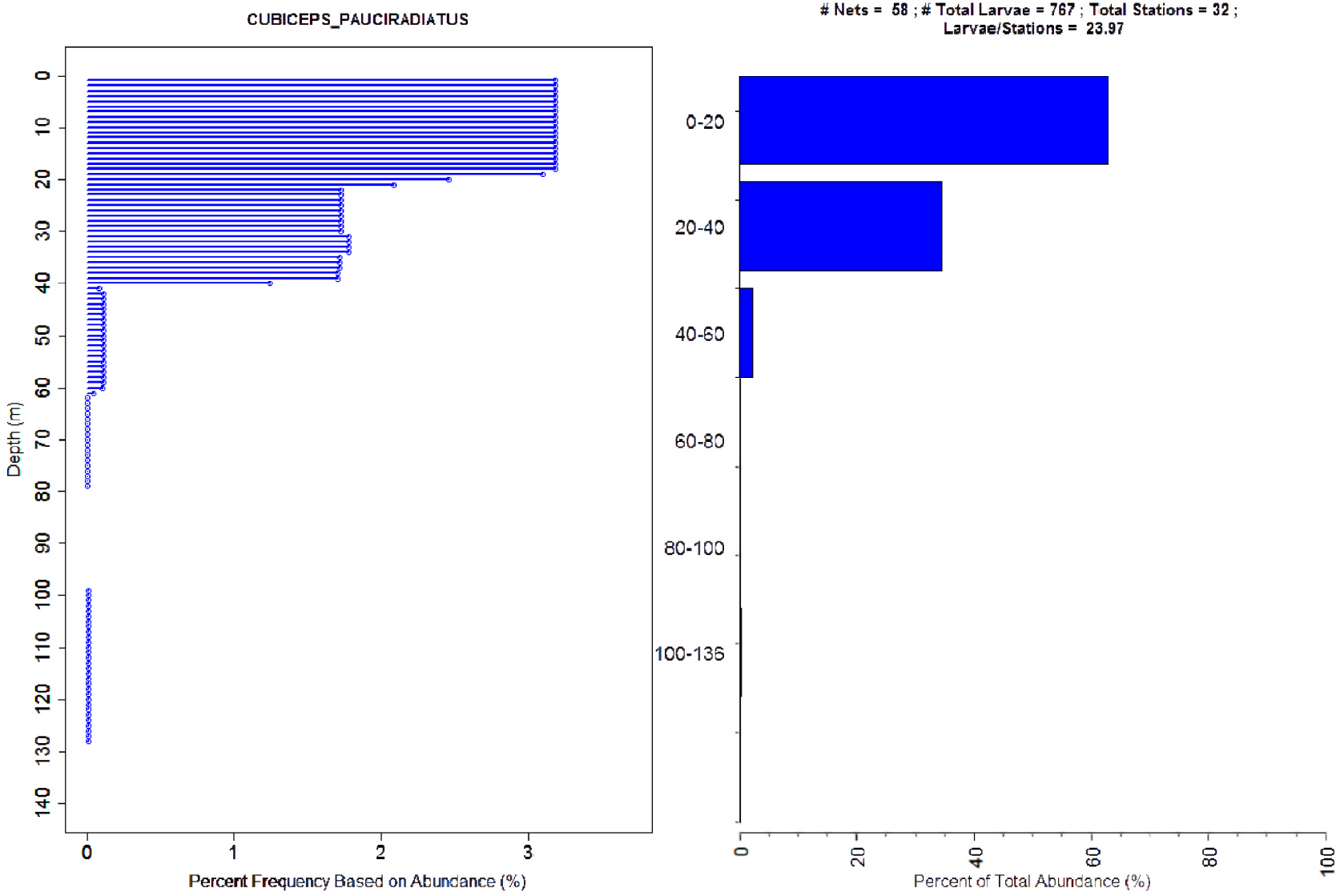
CLUPEIFORMES


CONGRIDAE
Nets = 146 ; # Total Larvae = 764 ; Total Stations = 63 ;
Larvae/Stations = 12.13
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

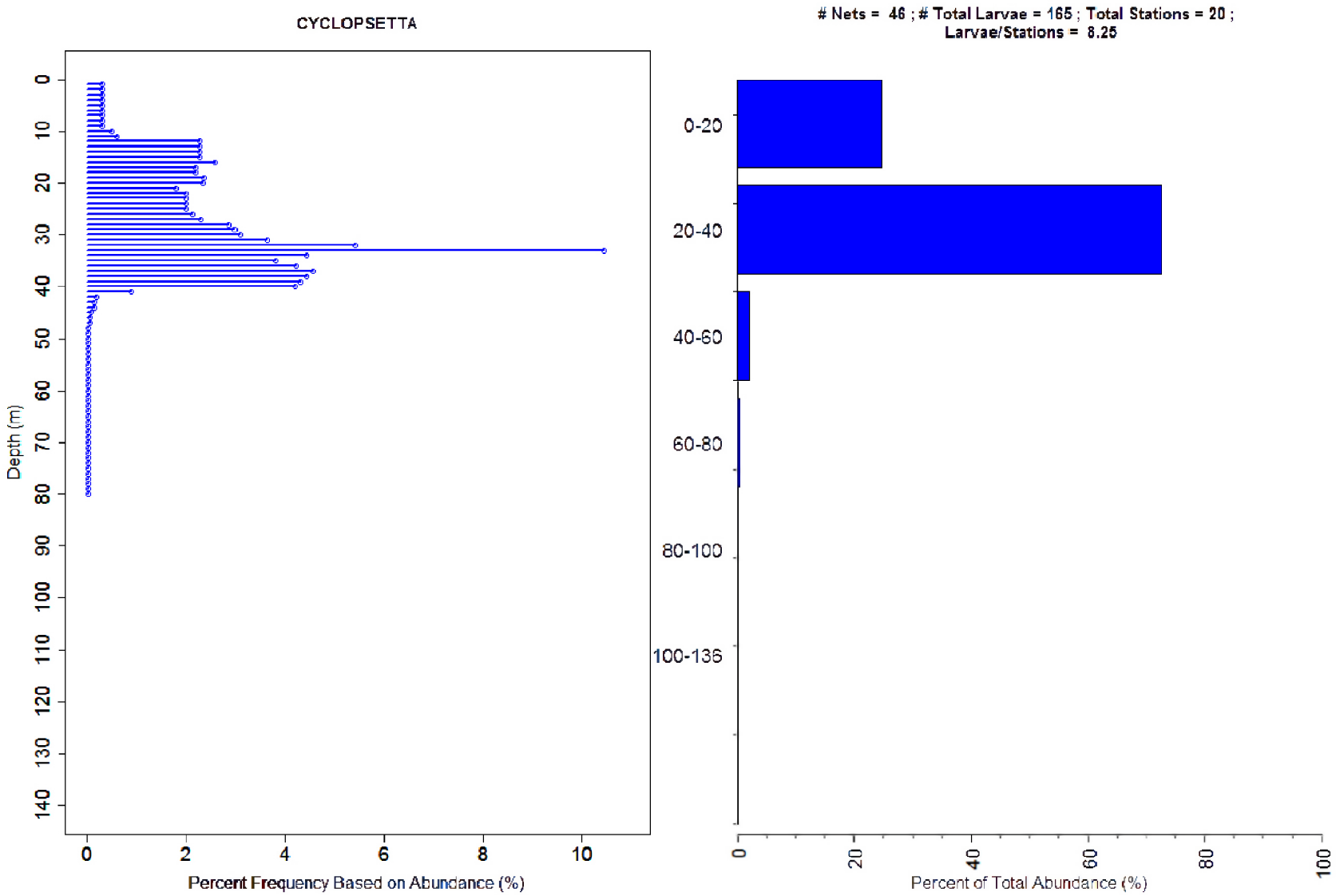
CONGRIDAE


CORYPHAENA
Nets = 21 ; # Total Larvae = 28 ; Total Stations = 19 ;
Larvae/Stations = 1.47
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

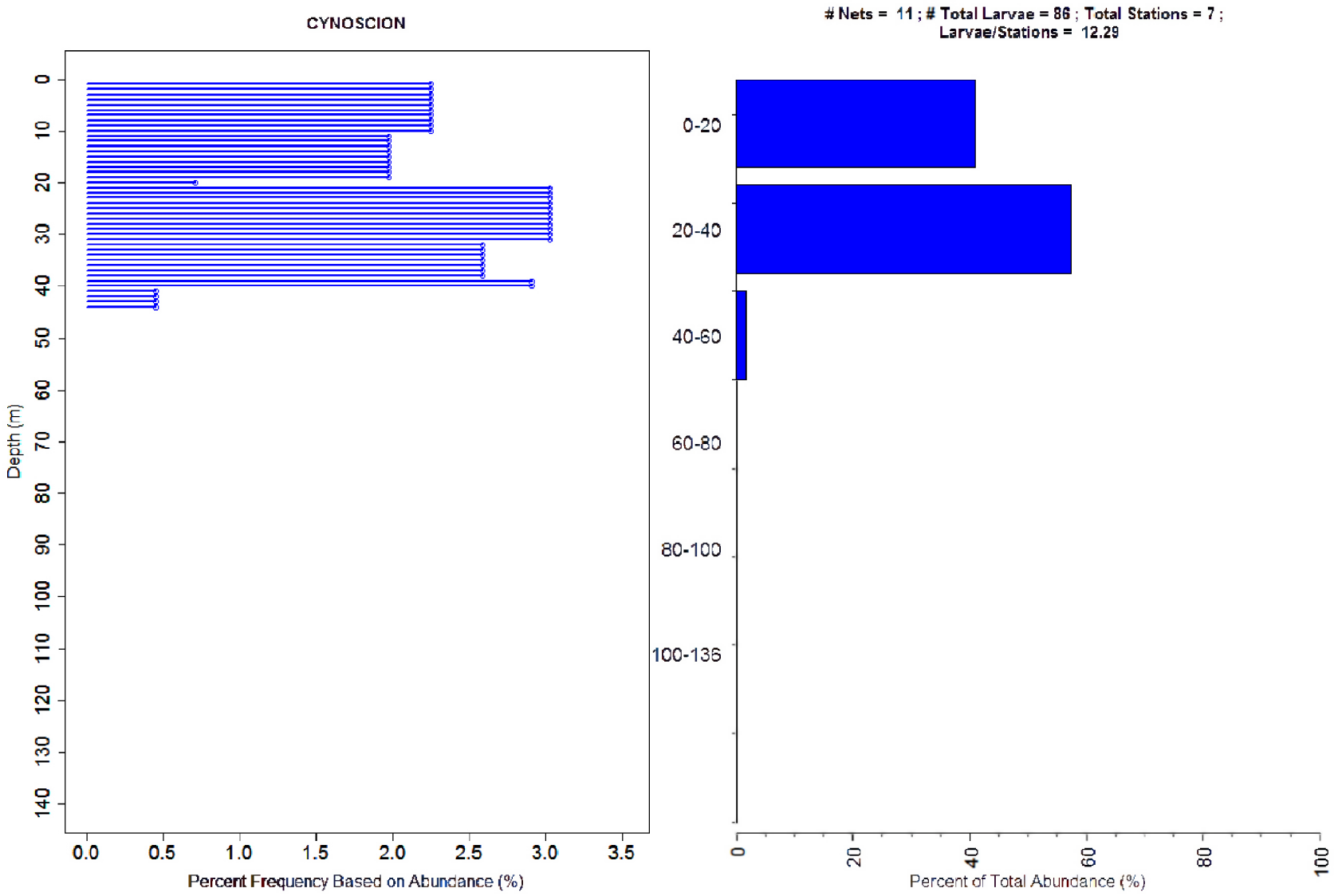
CORYPHAENA



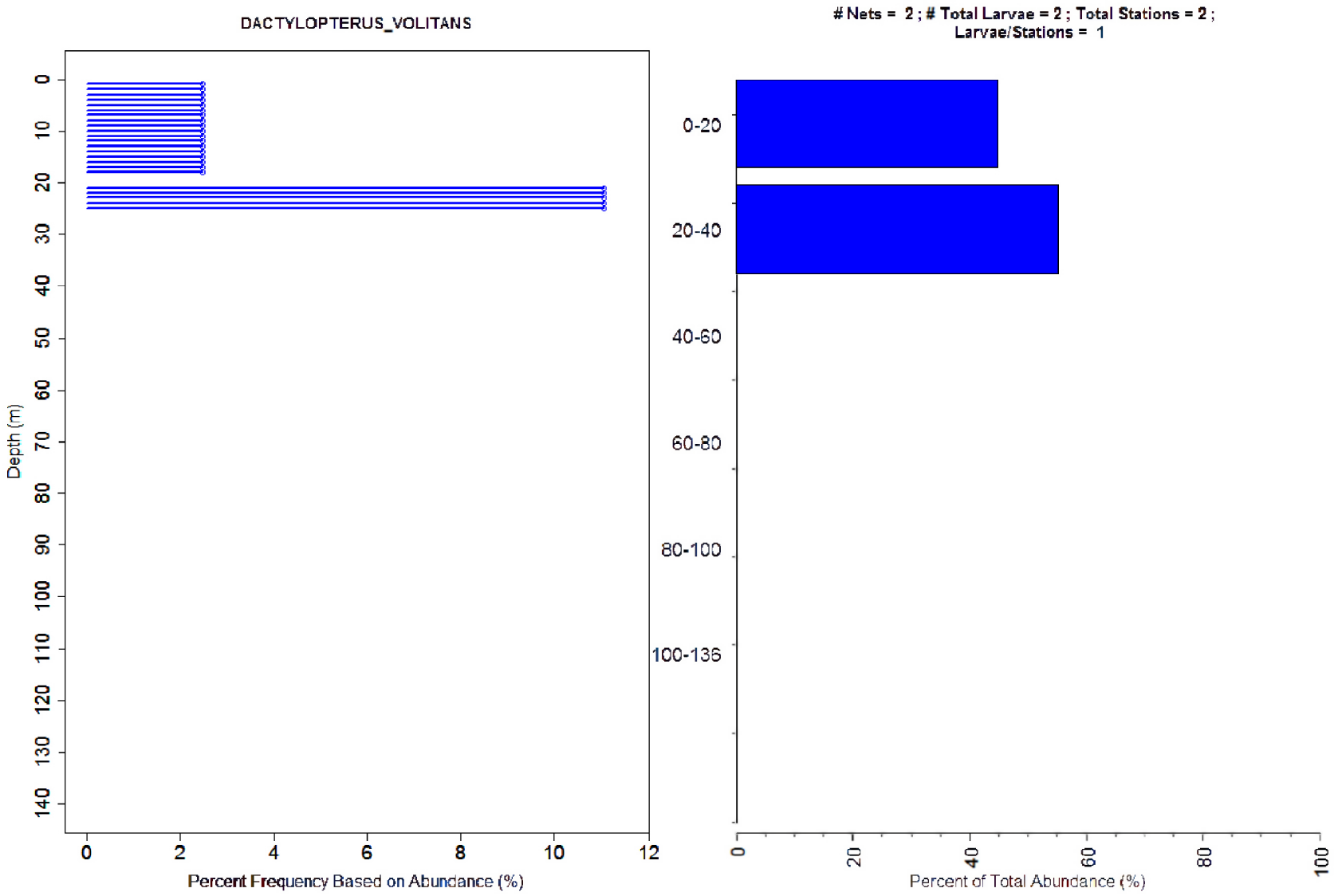
CUBICEPS_PAUCIRADIATUS



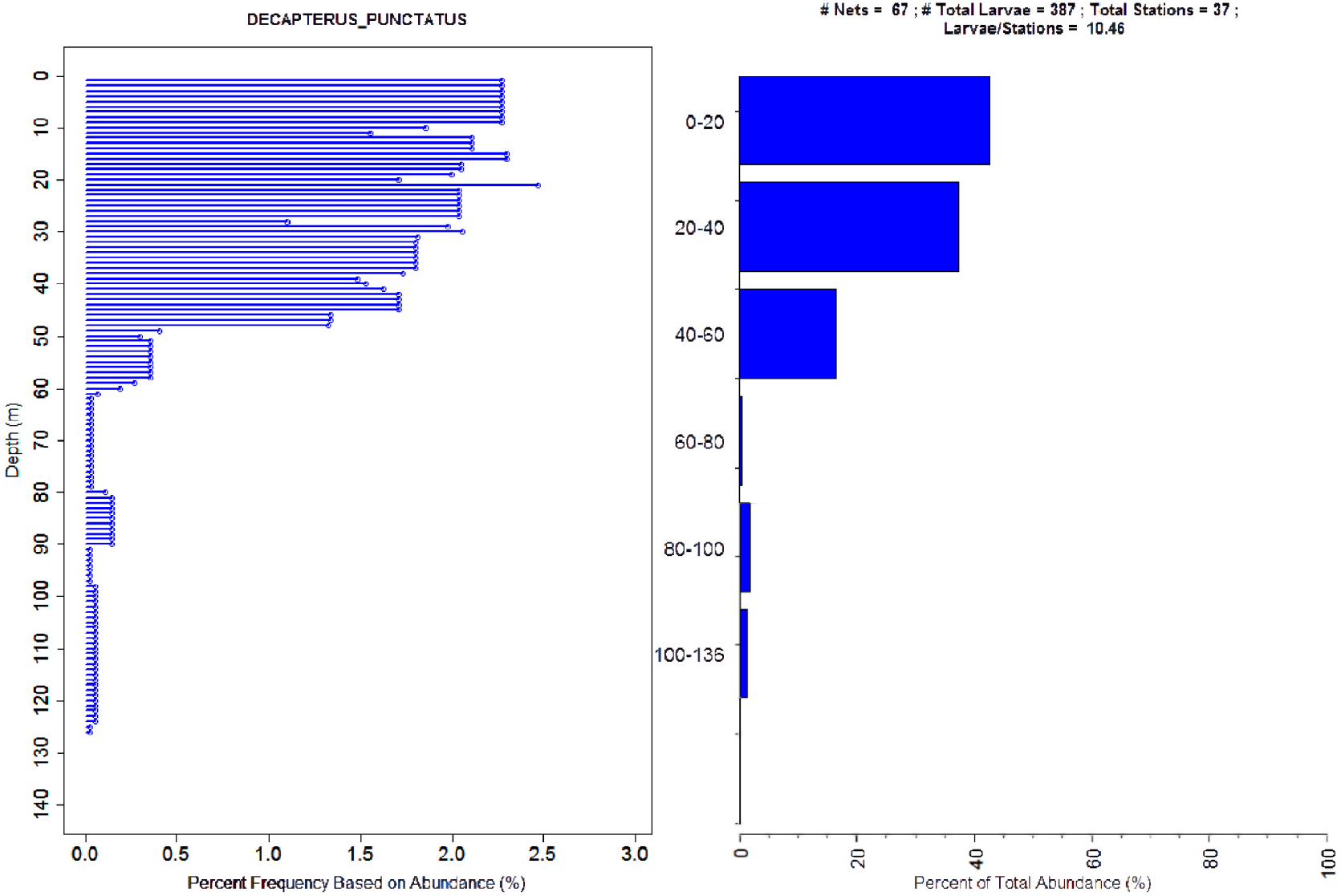
CYCLOPSETTA


CYNOSCION
Nets = 11 ; # Total Larvae = 86 ; Total Stations = 7 ;
Larvae/Stations = 12.29
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

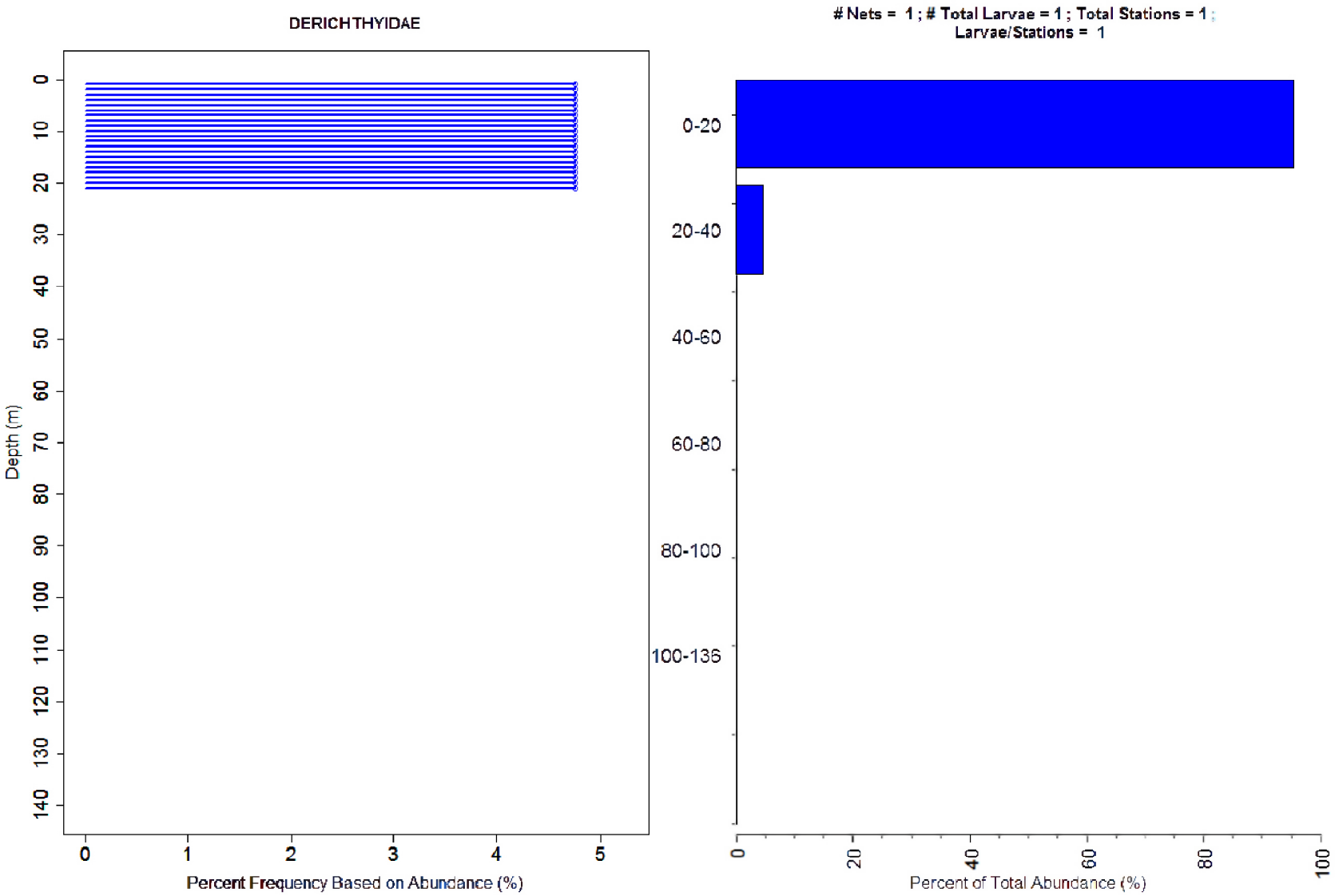
CYNOSCION



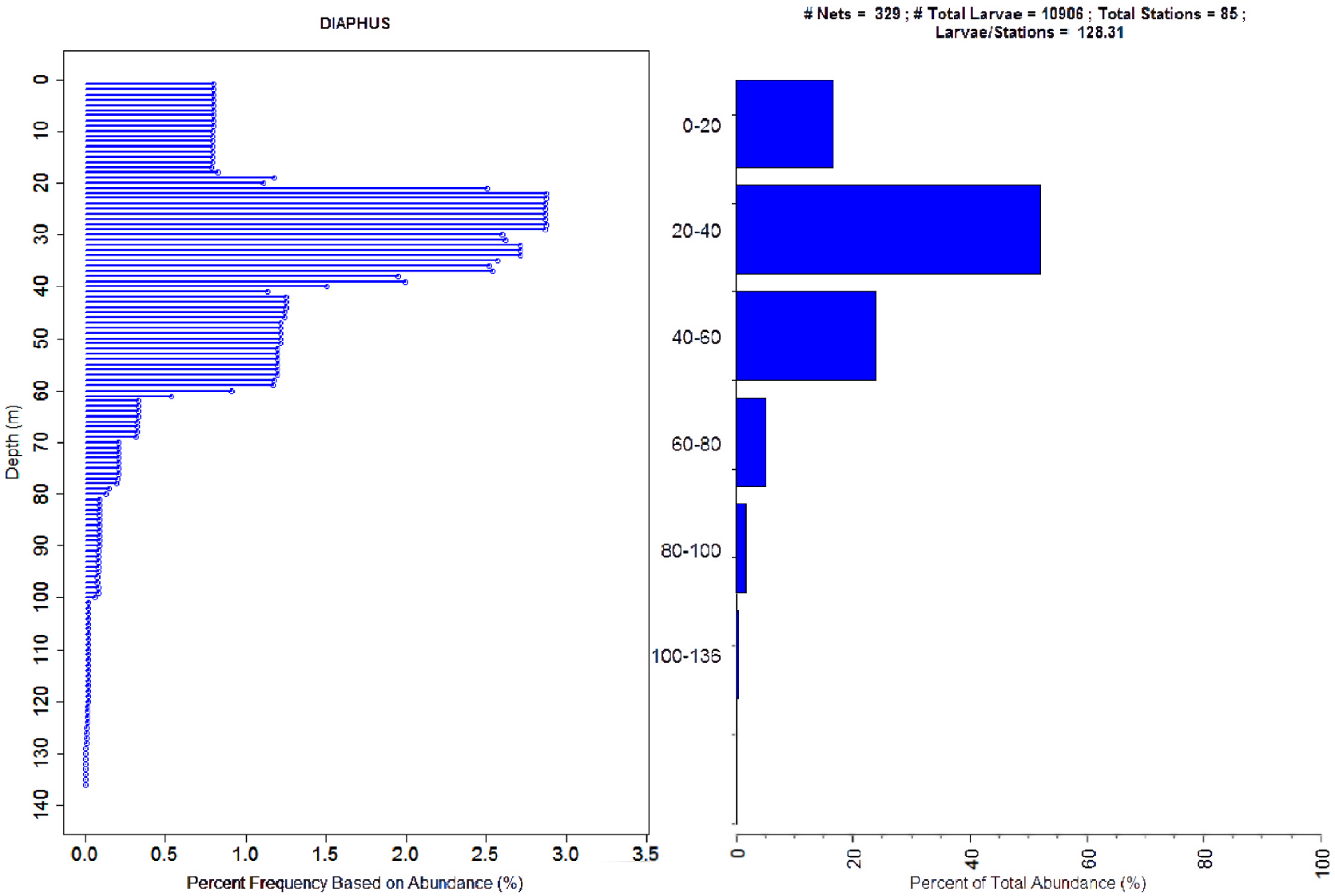
DACTYLOPTERUS_VOLITANS



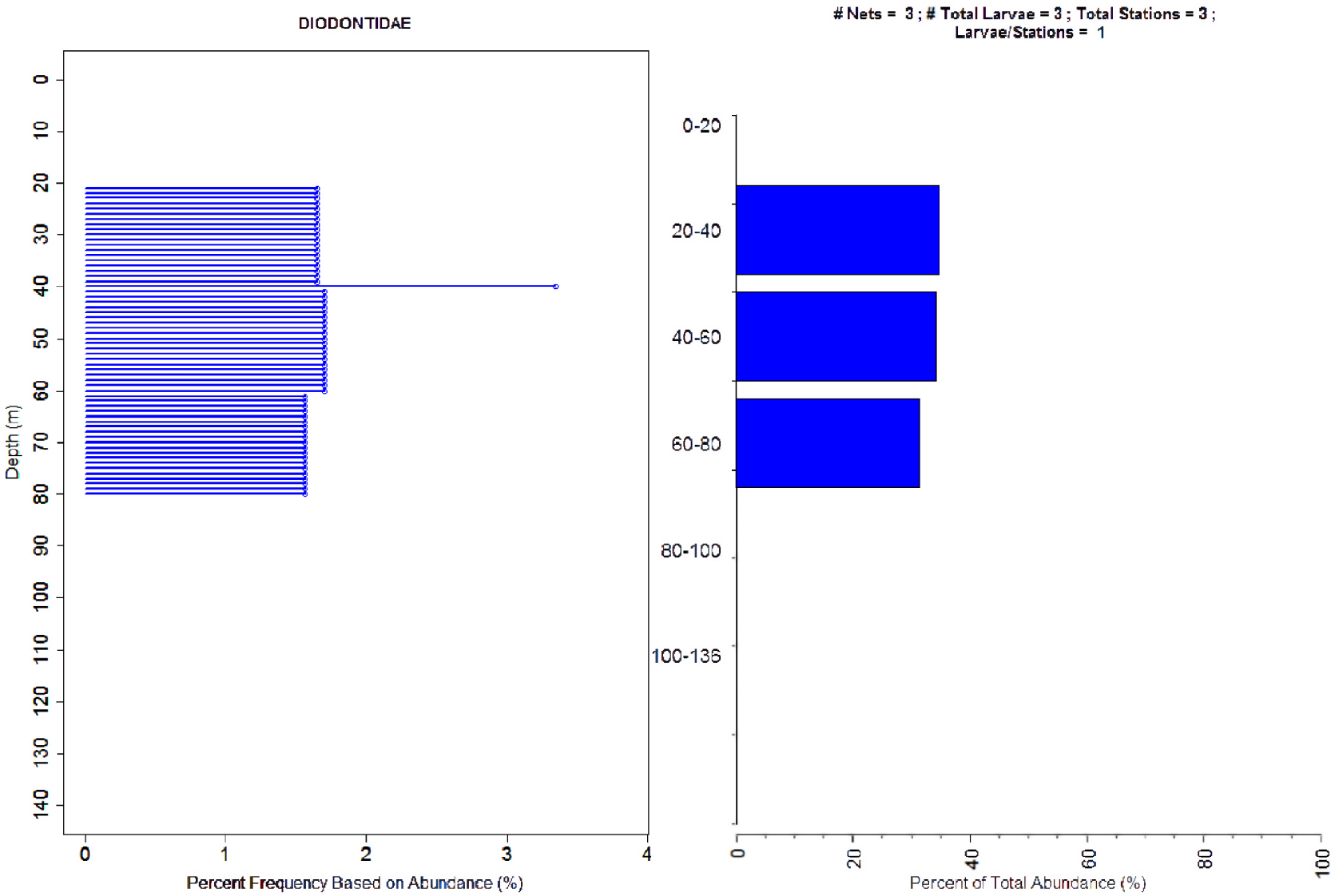
DECAPTERUS_PUNCTATUS



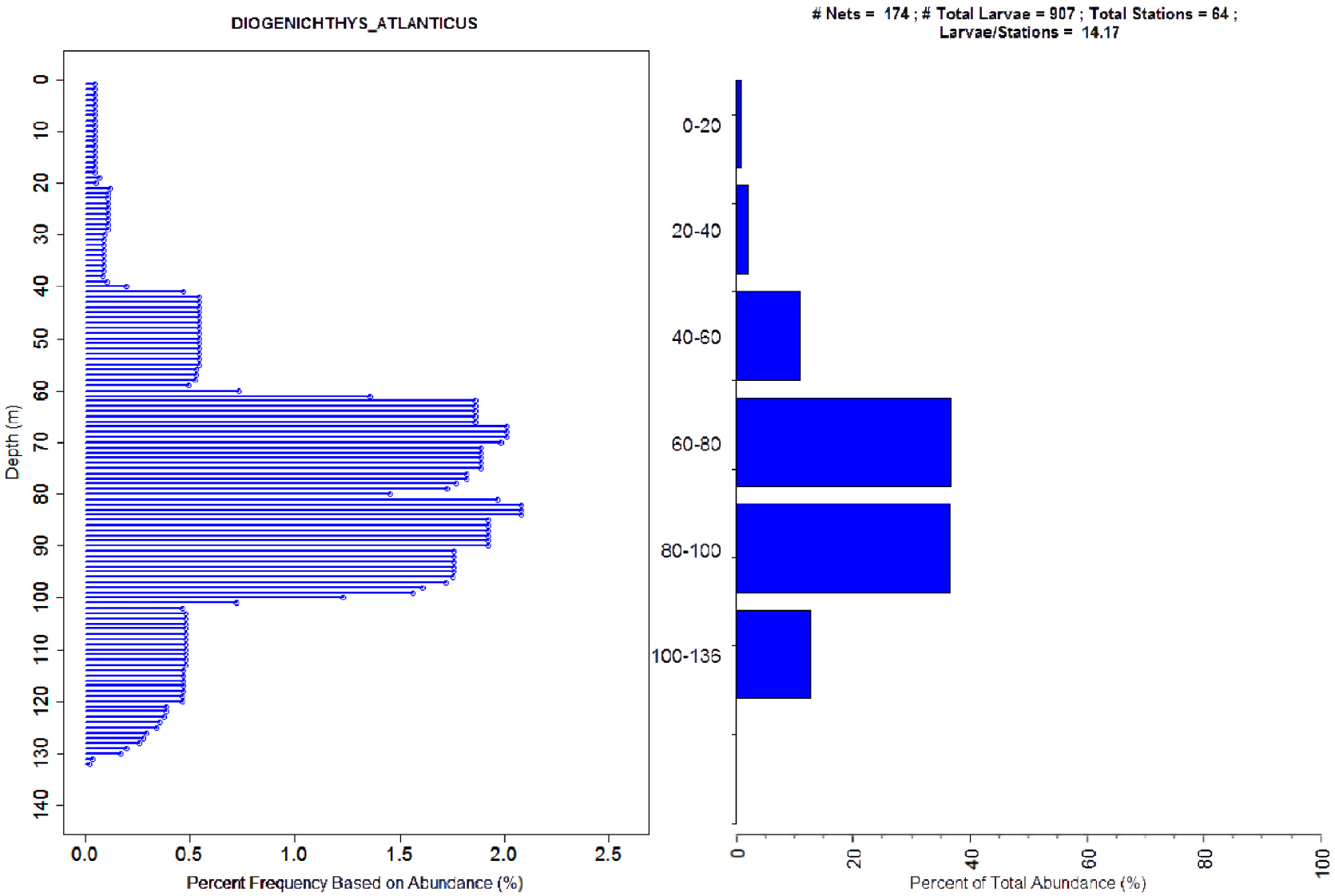
DERICHTHYIDAE


DIAPHUS
Nets = 329 ; # Total Larvae = 10906 ; Total Stations = 85 ;
Larvae/Stations = 128.31
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

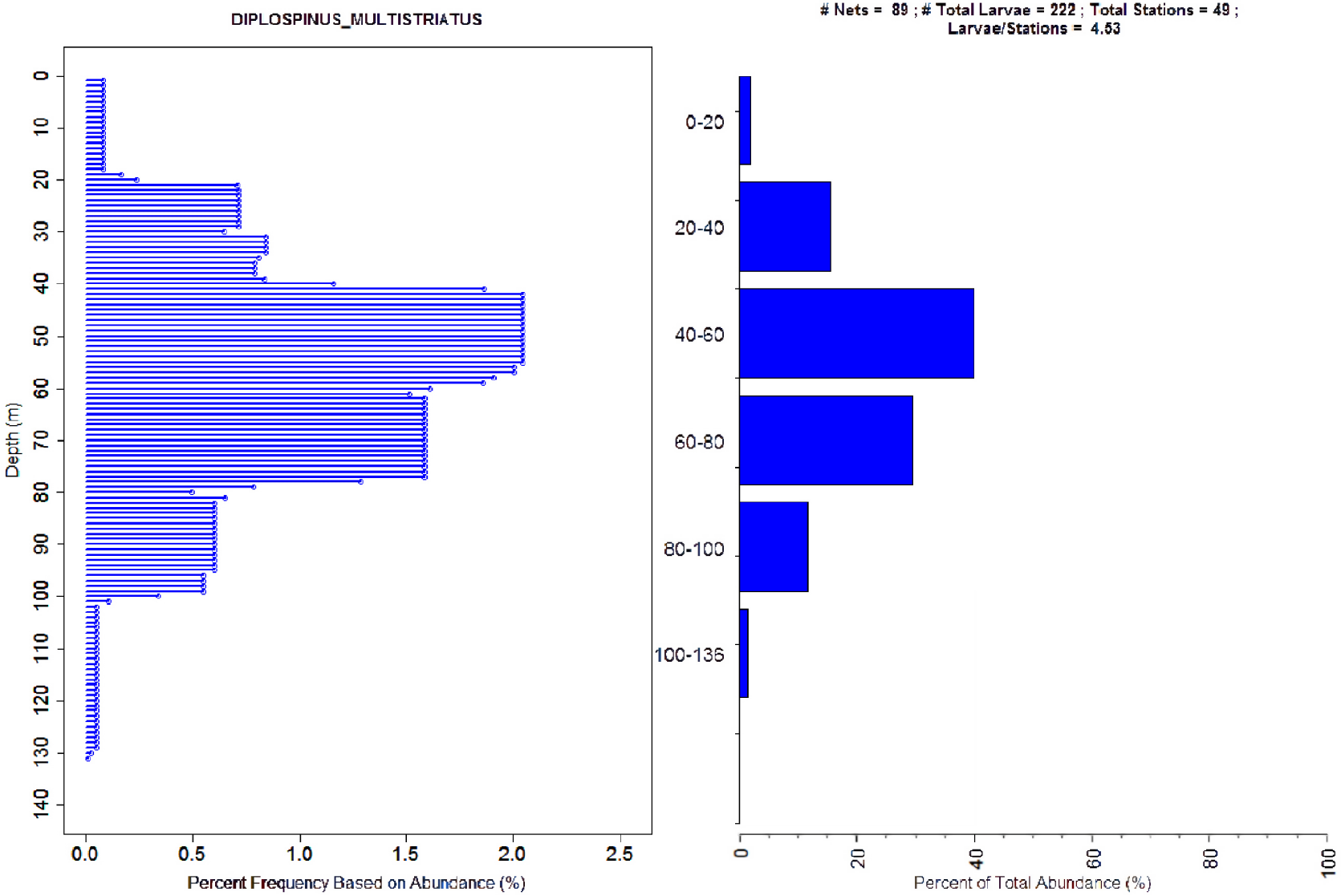
DIAPHUS



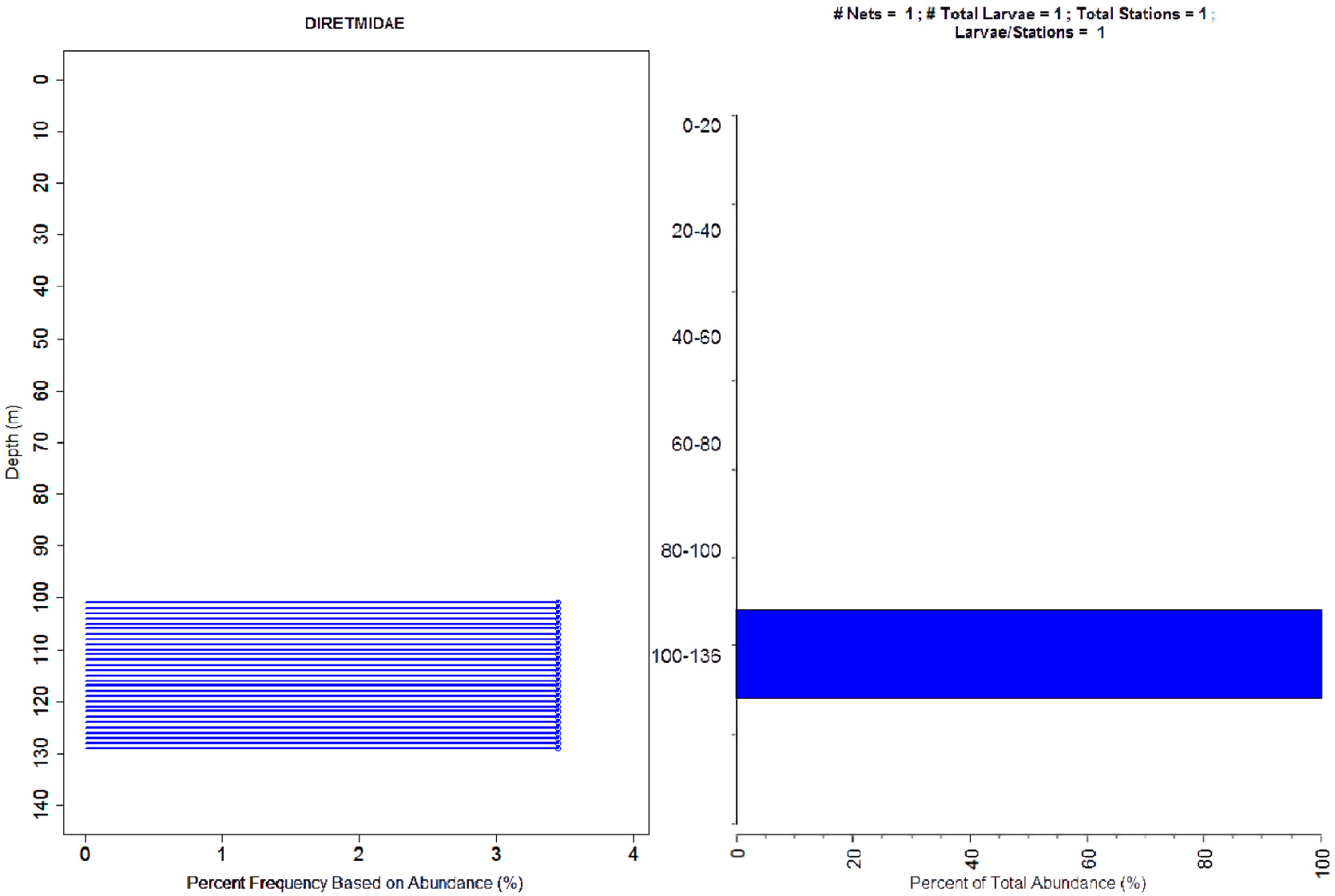
DIODONTIDAE



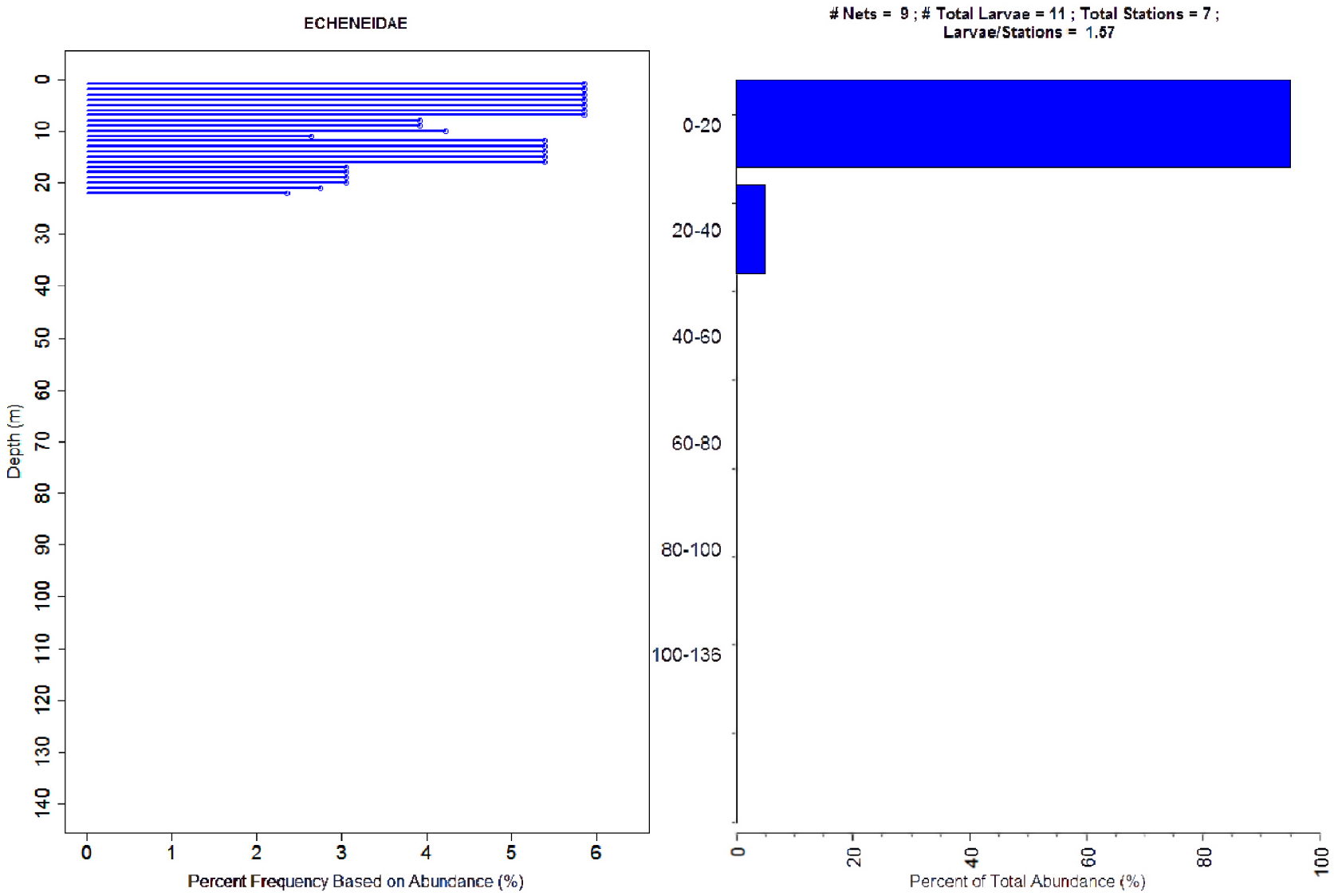
DIOGENICHTHYS_ATLANTICUS



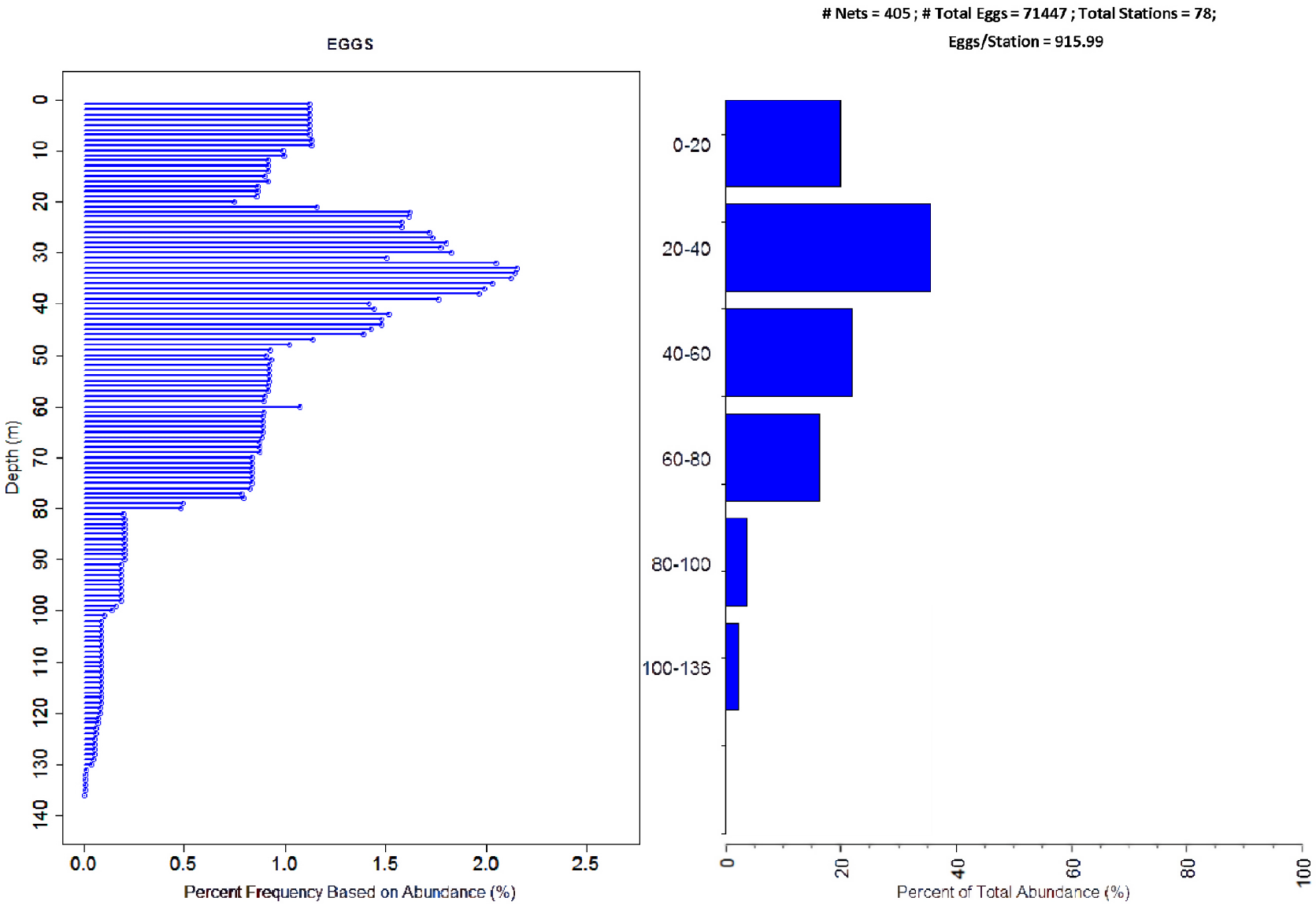
DIPLOSPINUS_MULTISTRIATUS


DIRETMIDAE
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

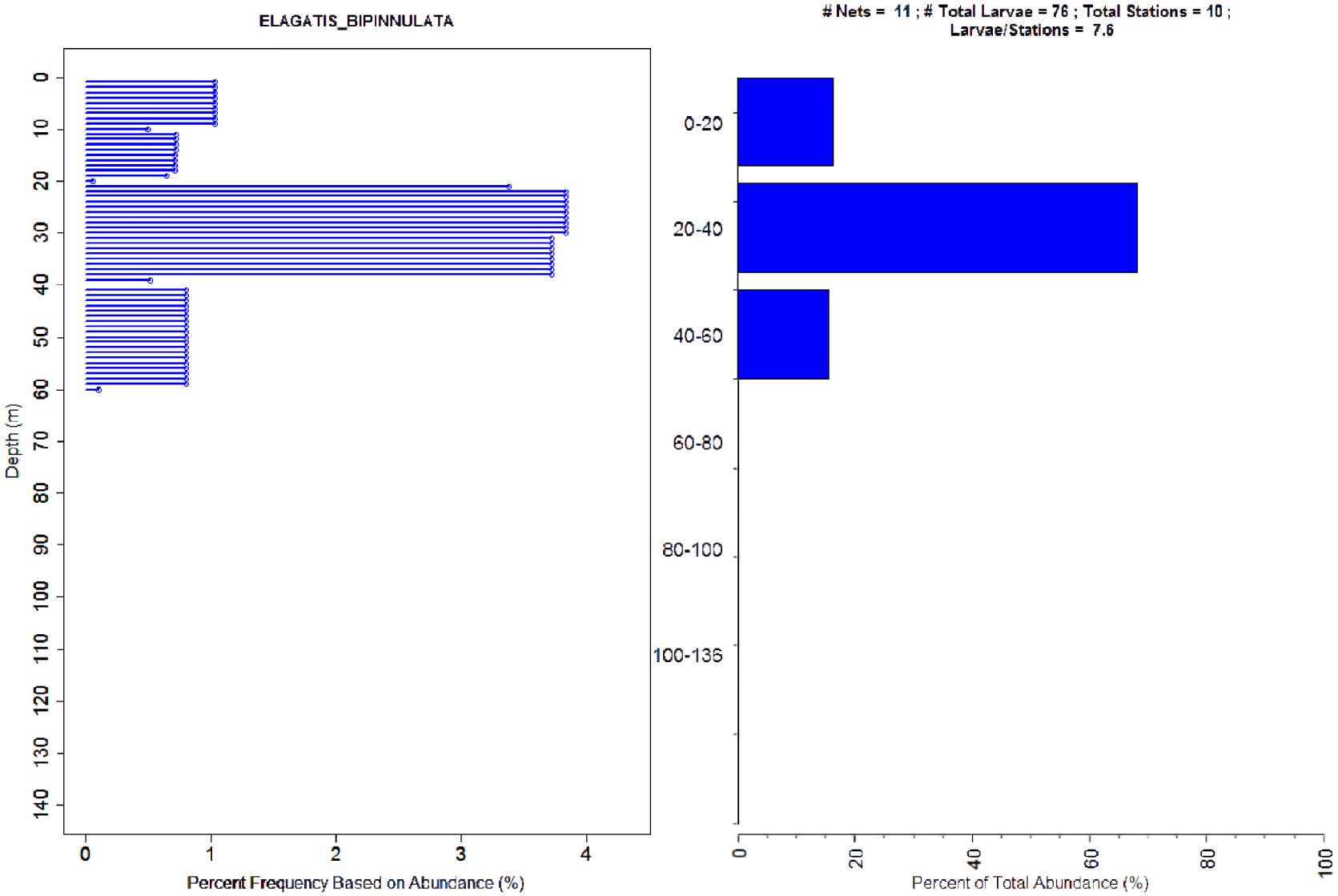
DIRETMIDAE


ECHENEIDAE
Nets = 9 ; # Total Larvae = 11 ; Total Stations = 7 ;
Larvae/Stations = 1.57
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

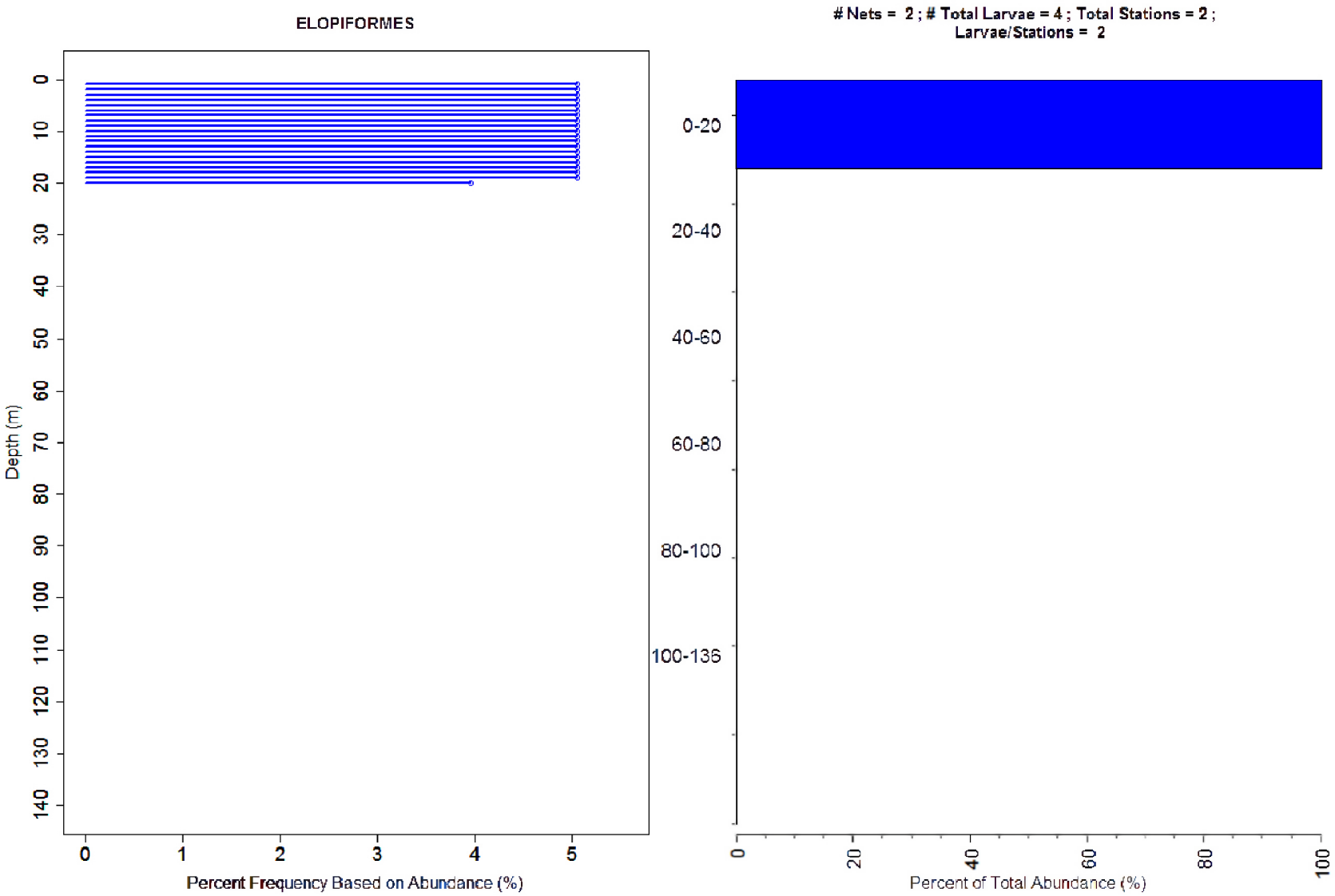
ECHENEIDAE


Nets = 405 ; # Total Eggs = 71447 ; Total Stations = 78;
Eggs/Station = 915.99
EGGS
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

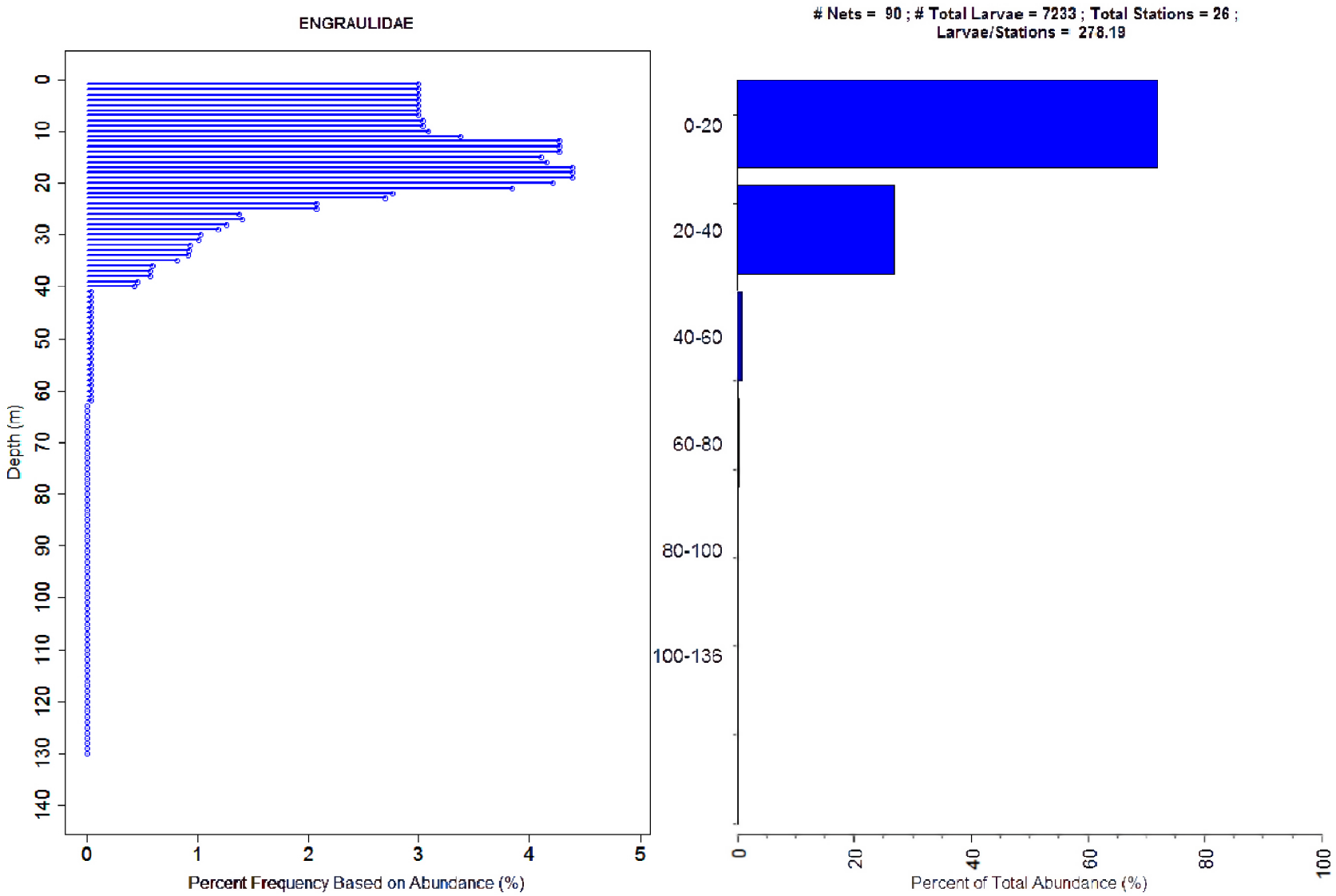
EGGS



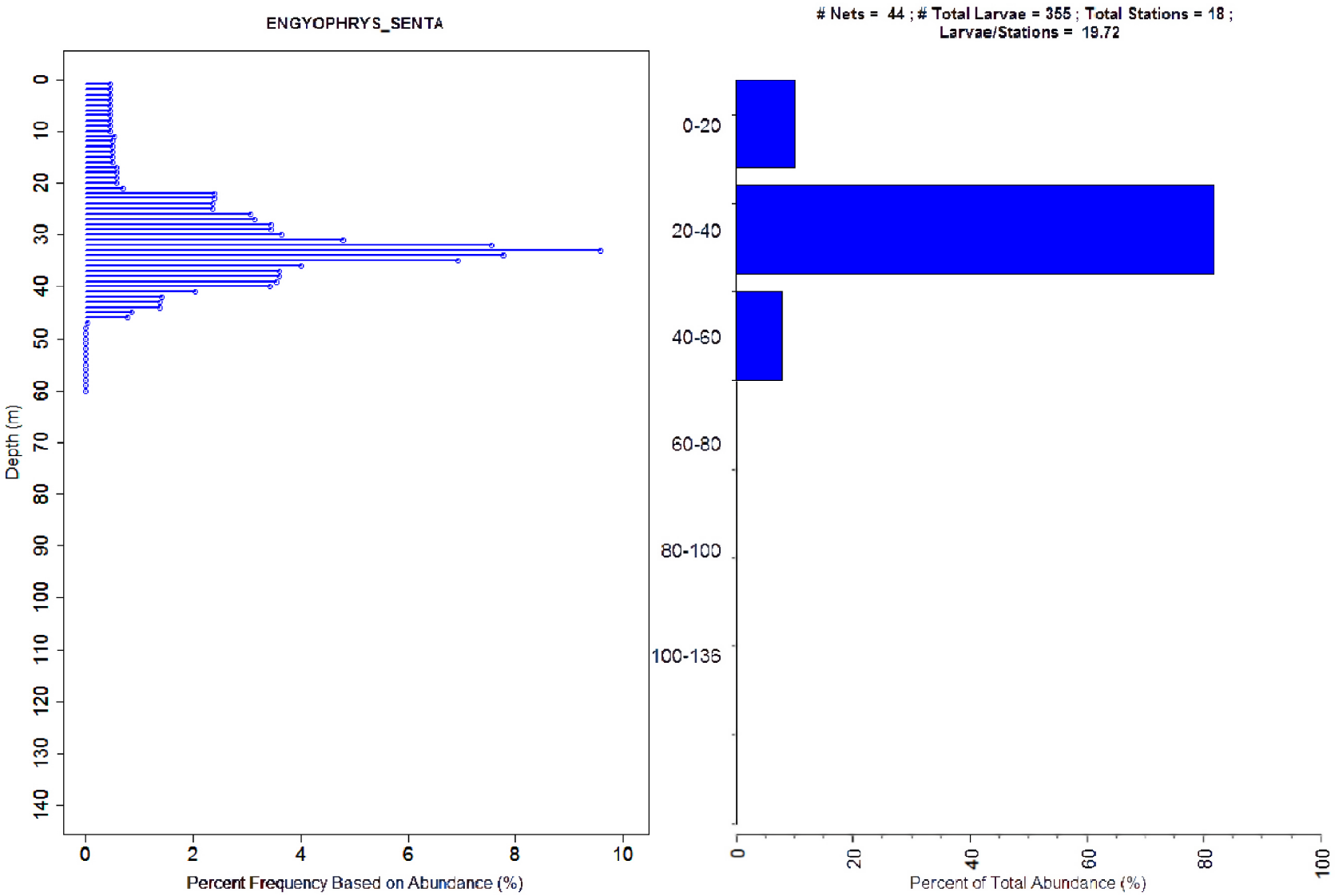
ELAGATIS_BIPINNULATA



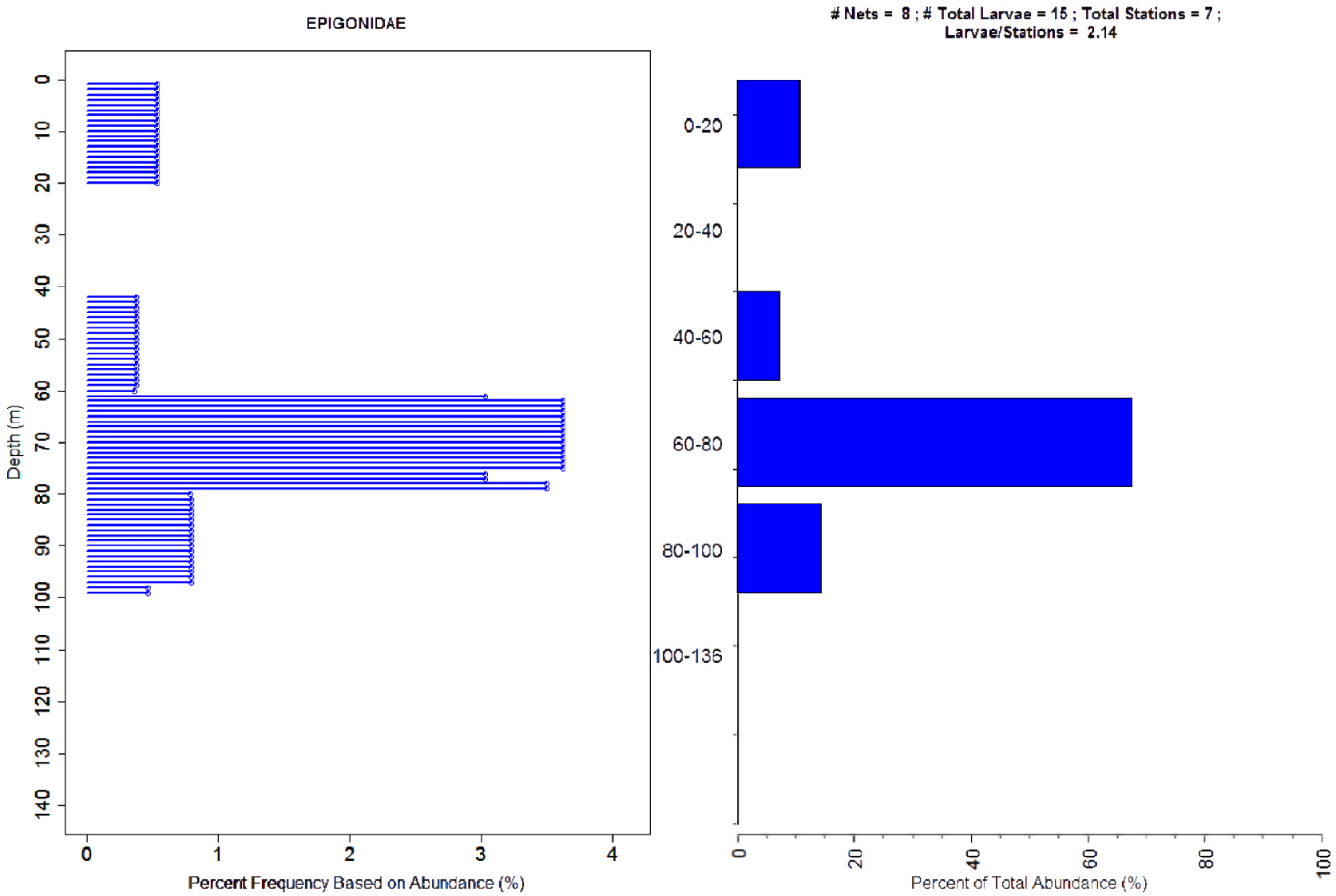
ELOPIFORMES



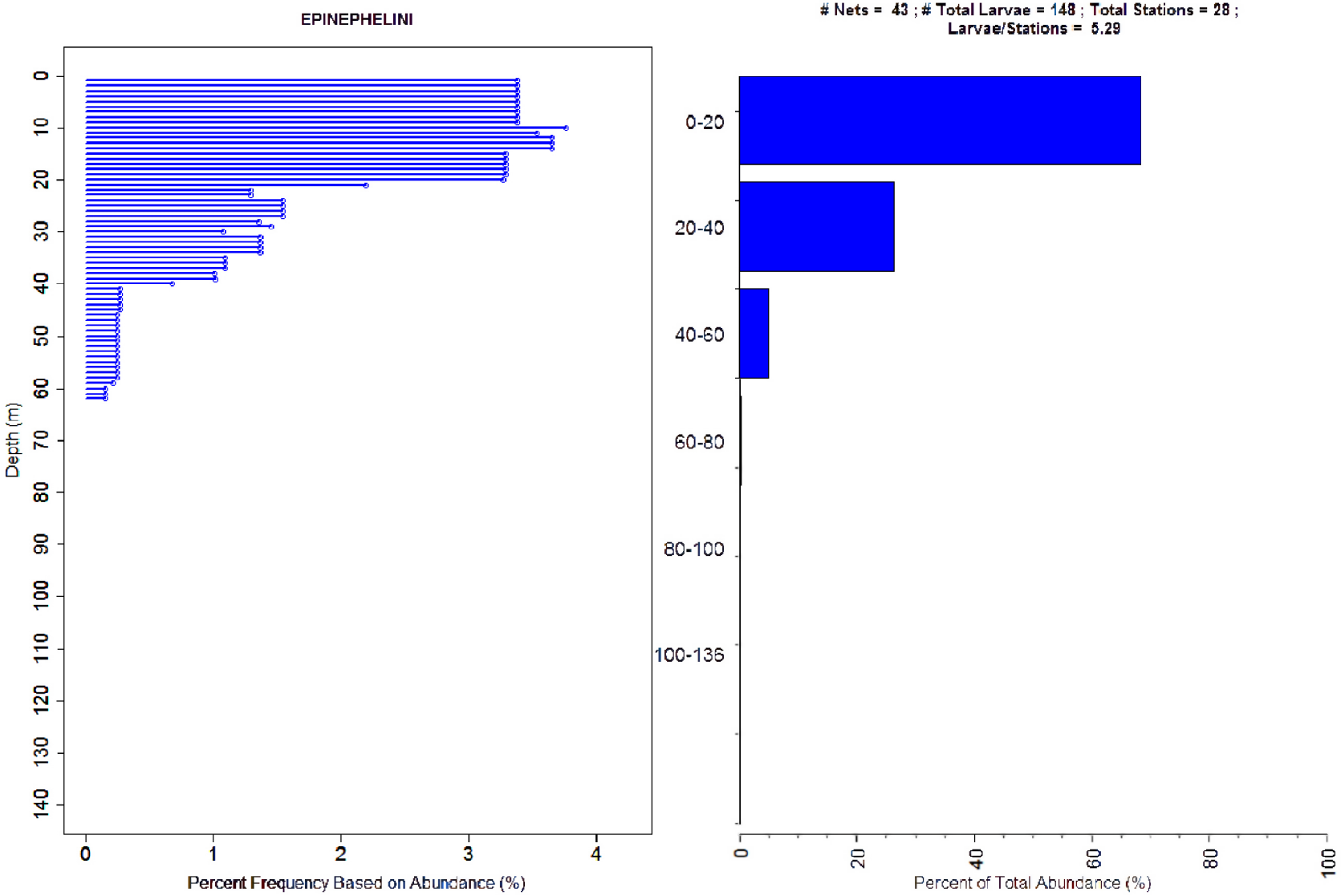
ENGRAULIDAE



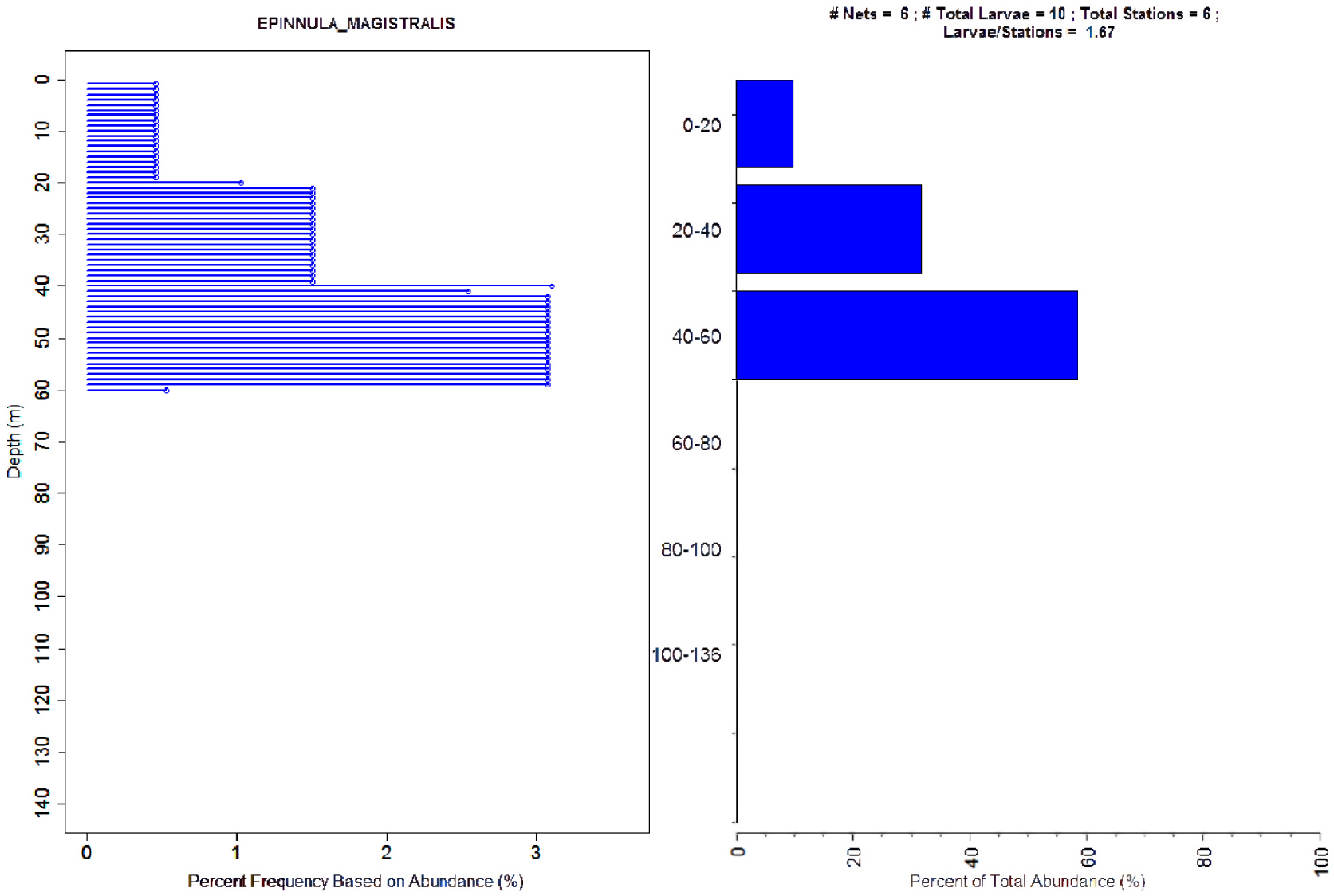
ENGYOPHRYS_SENTA


EPIGONIDAE
Nets = 8 ; # Total Larvae = 15 ; Total Stations = 7 ;
Larvae/Stations = 2.14
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

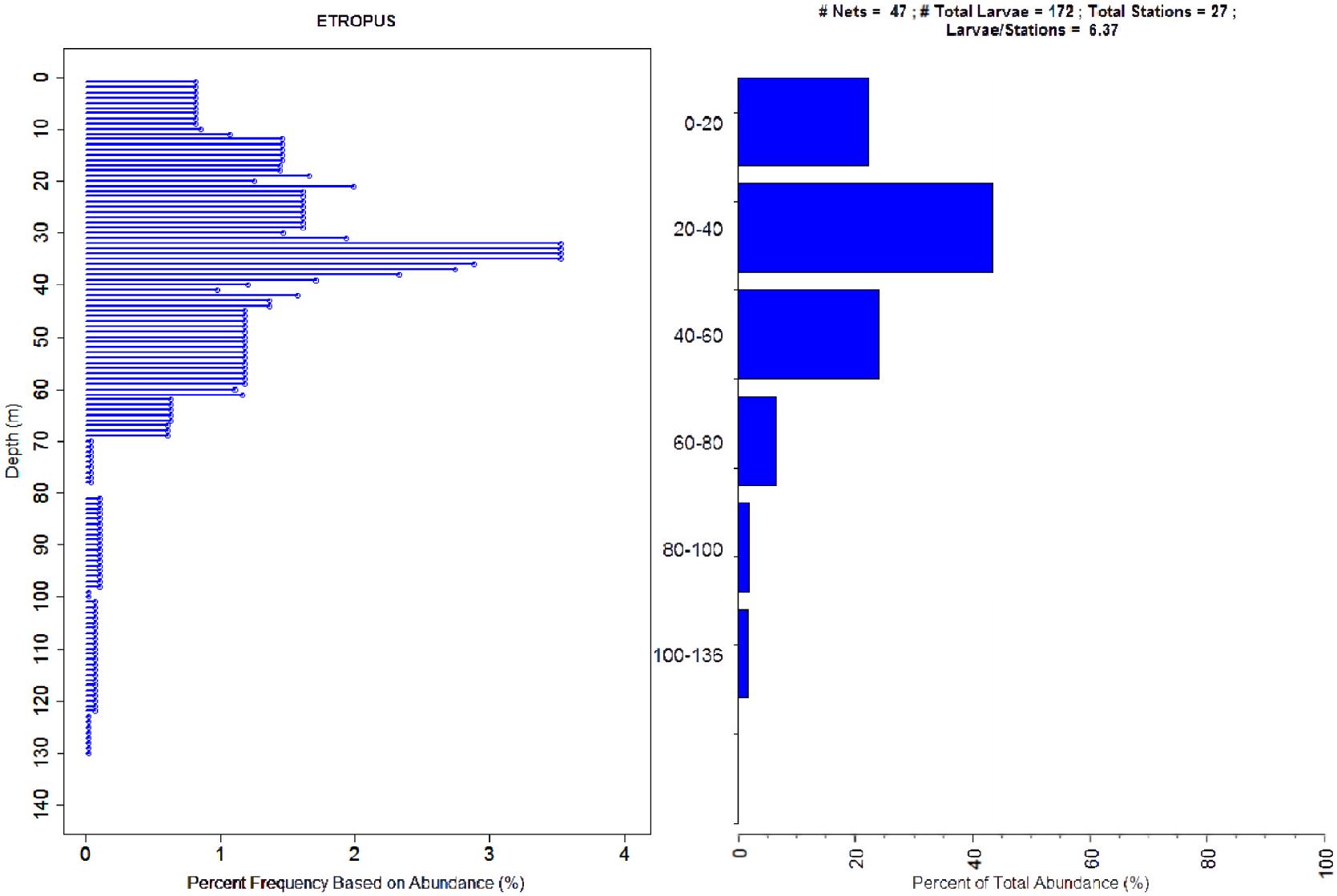
EPIGONIDAE



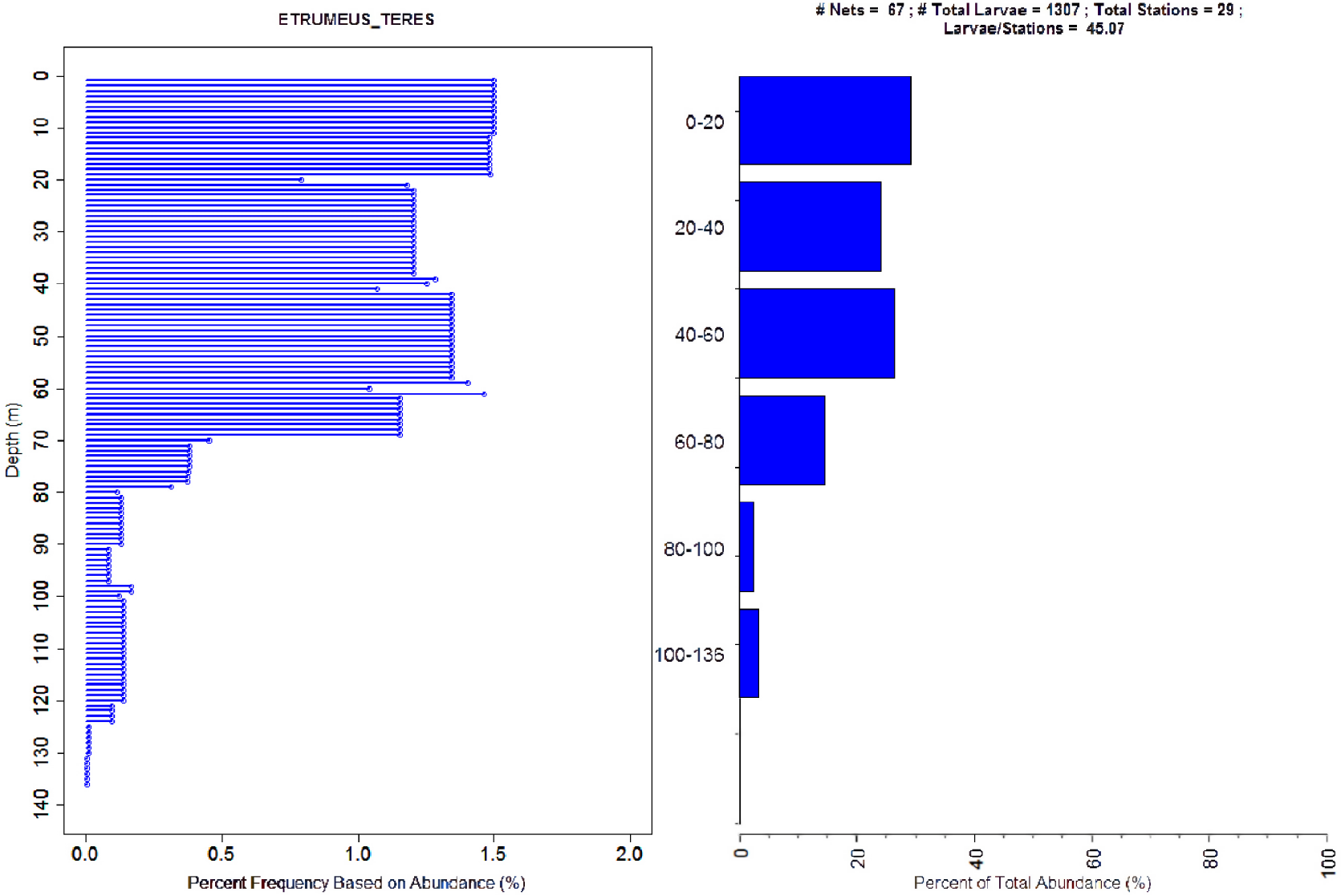
EPINEPHELINI



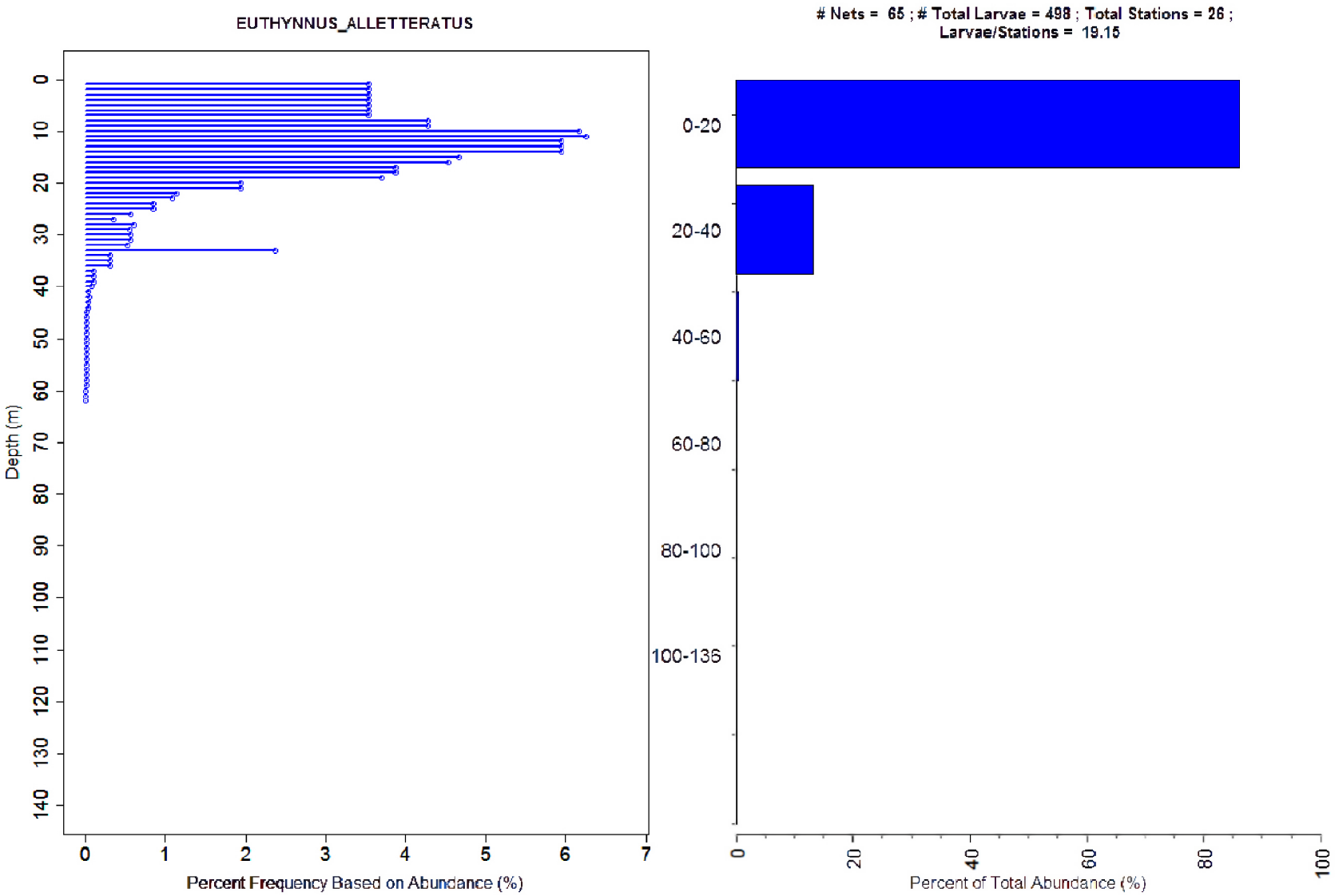
EPINNULA_MAGISTRALIS


ETROPUS
Nets = 47 ; # Total Larvae = 172 ; Total Stations = 27 ;
Larvae/Stations = 6.37
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

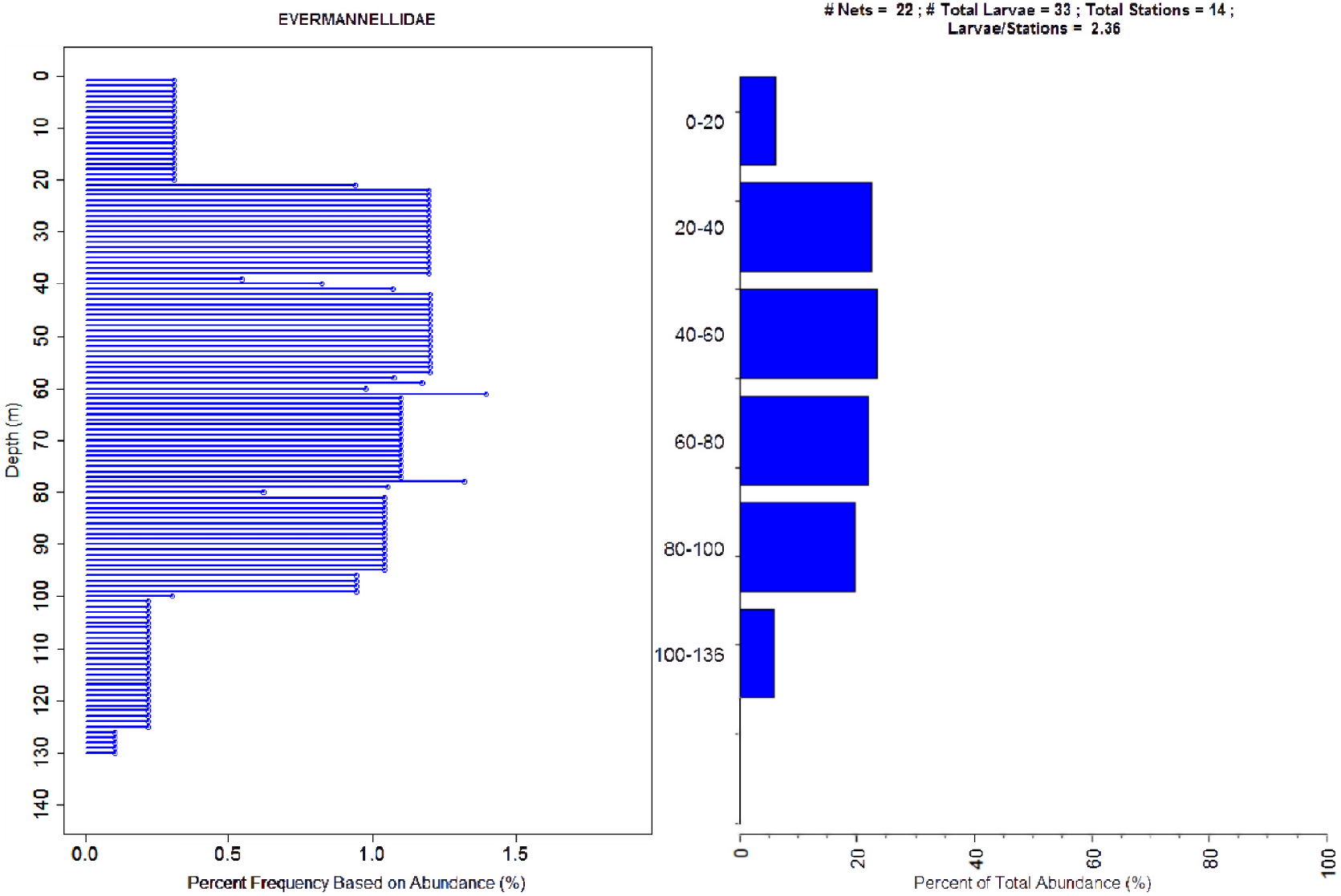
ETROPUS



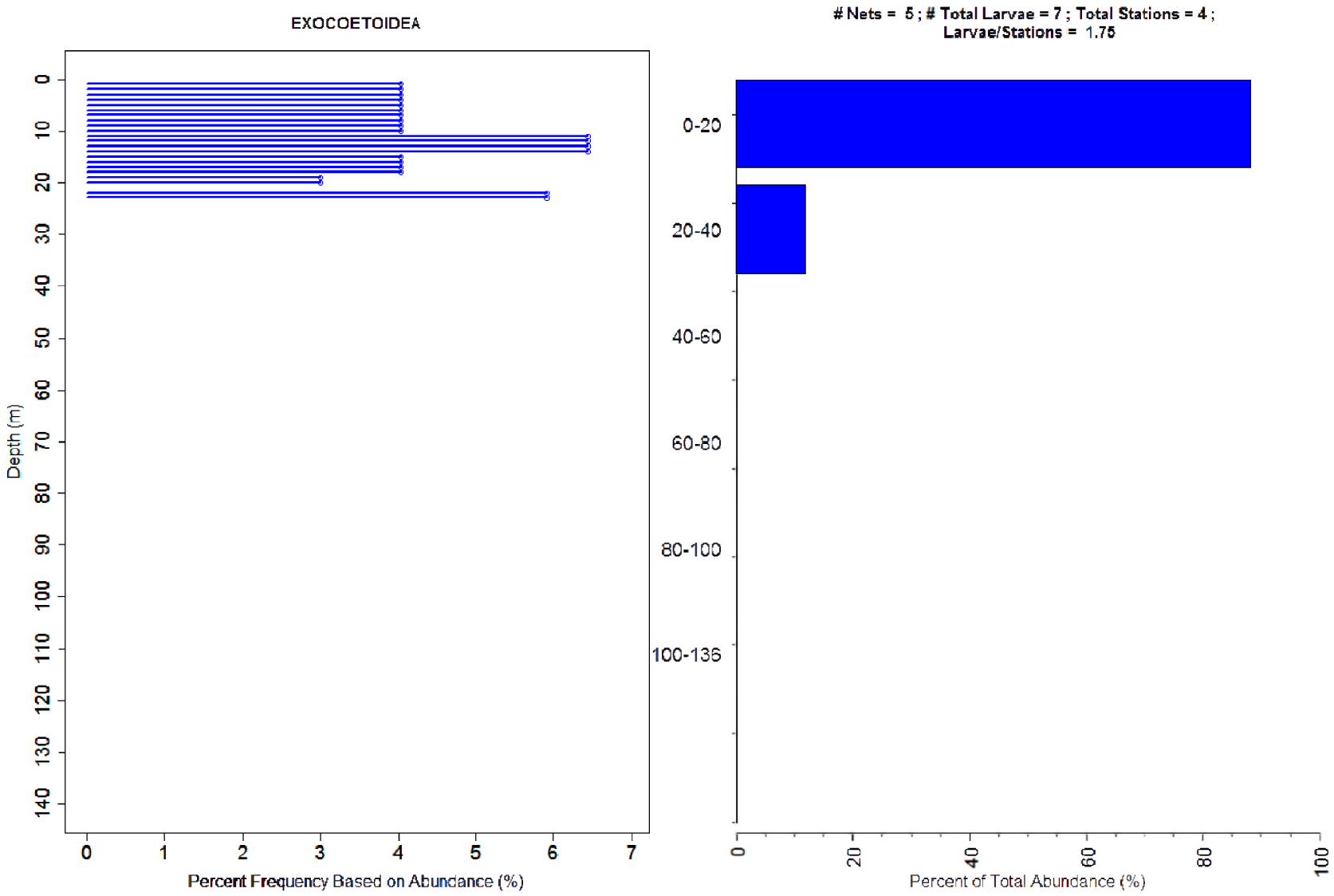
ETRUMEUS_TERES



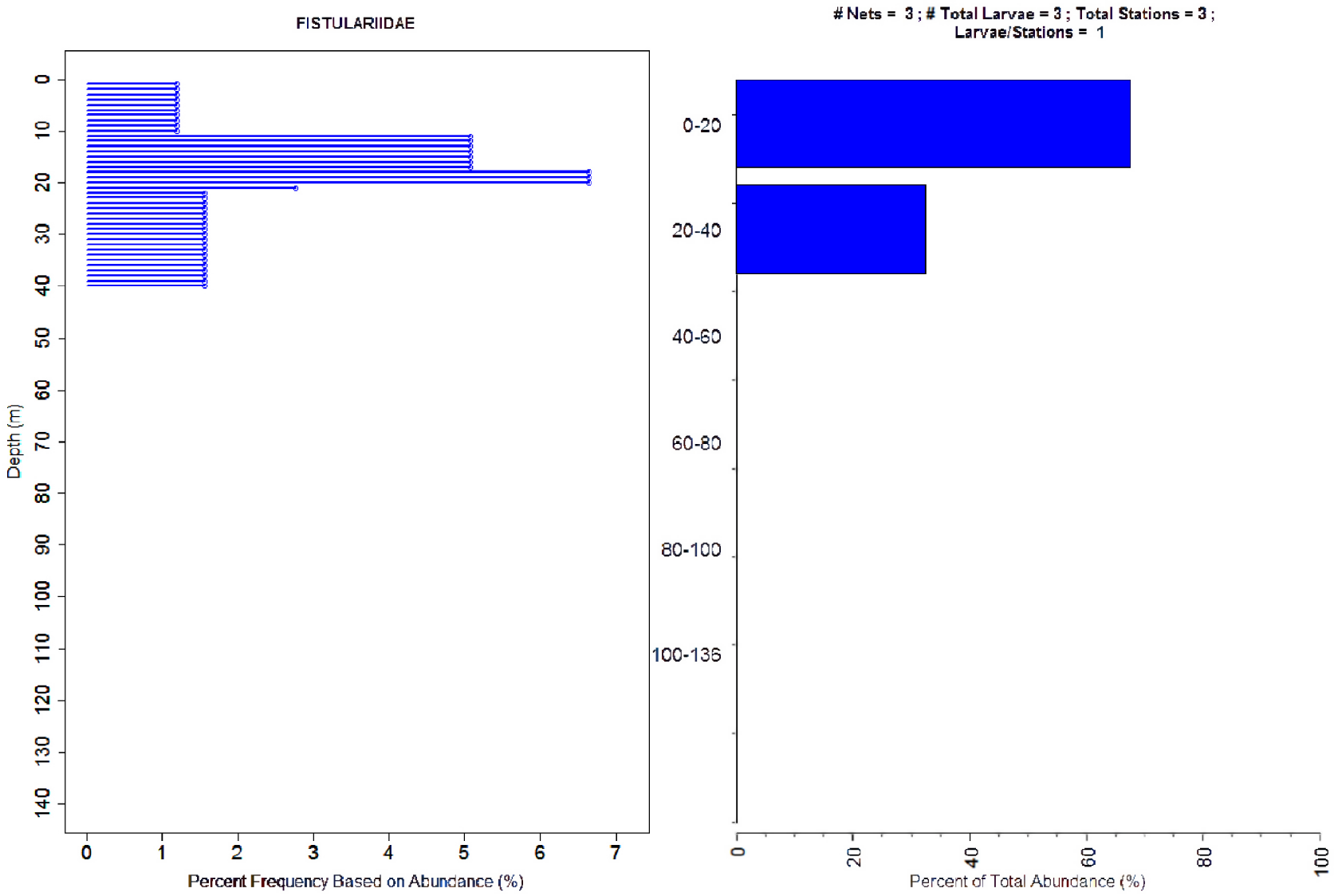
EUTHYNNUS_ALLETTERATUS



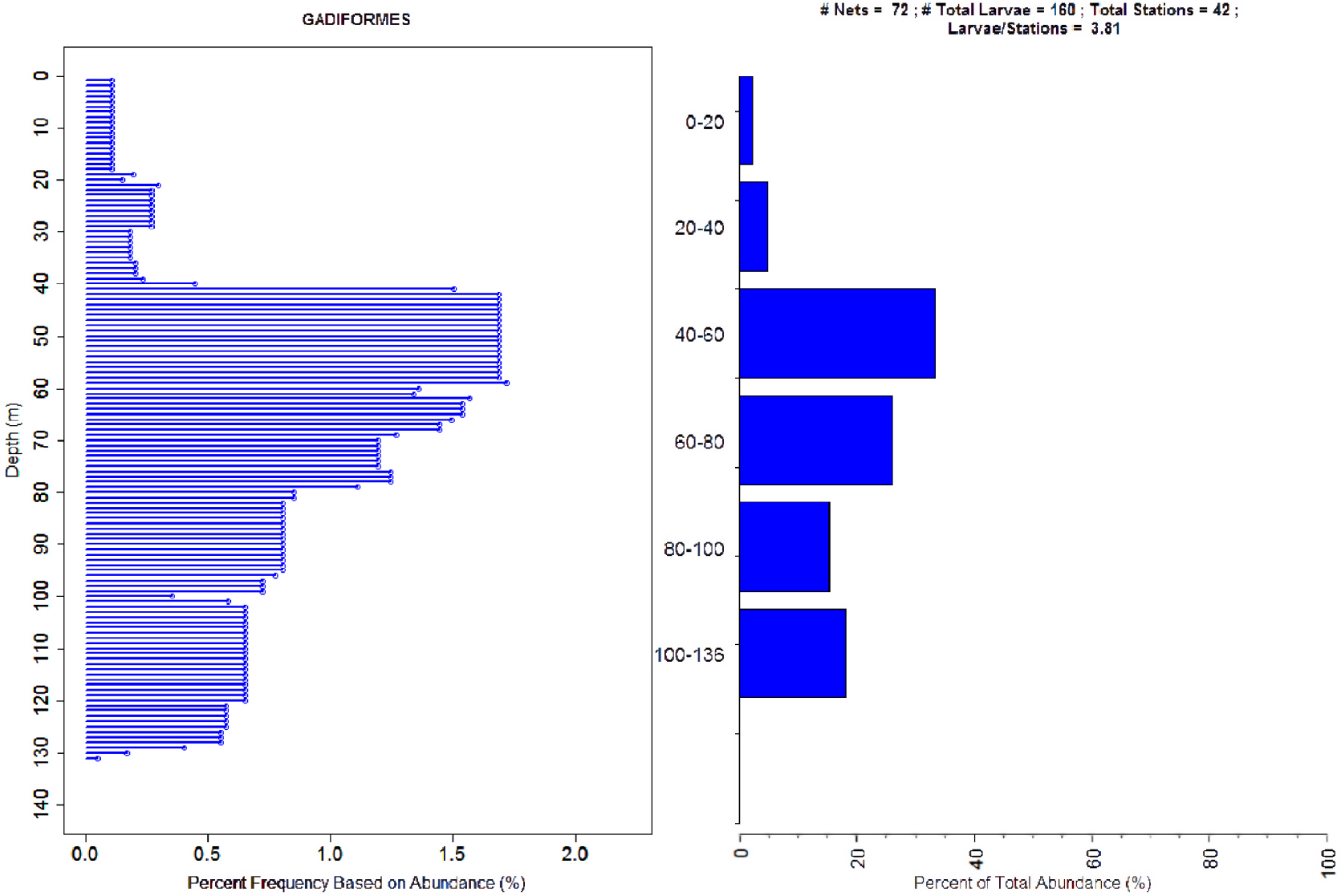
EVERMANNELLIDAE



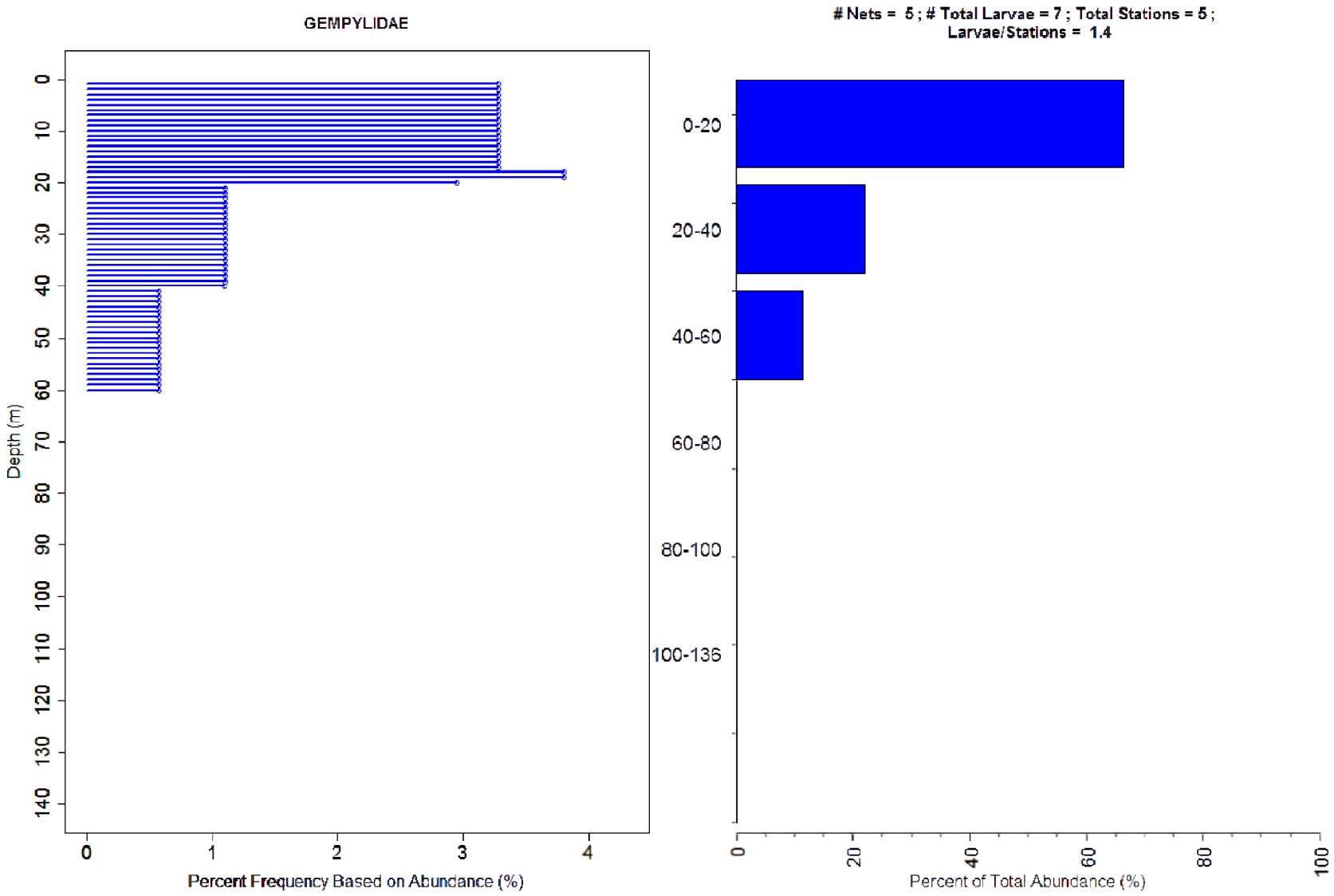
EXOCOETOIDEA



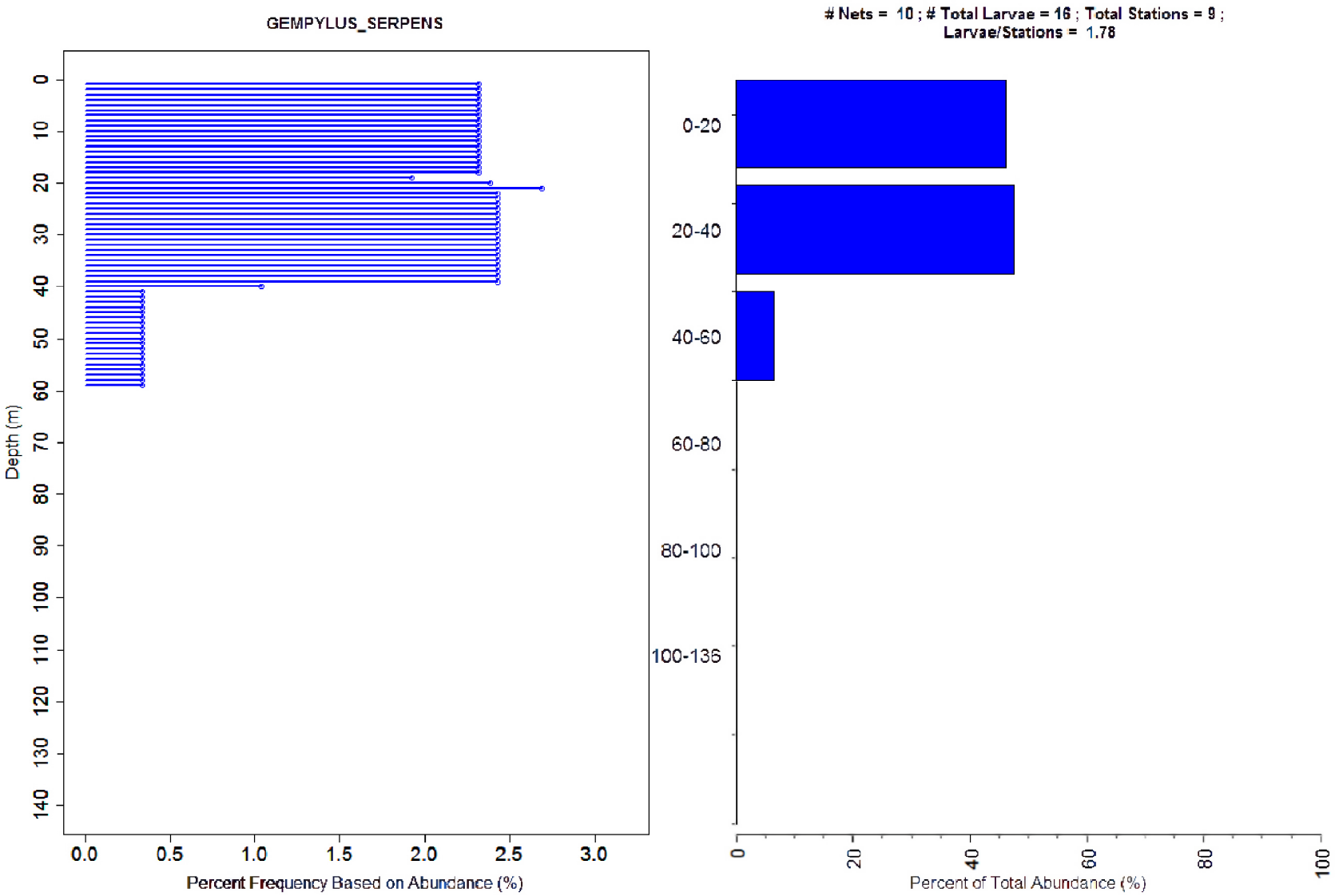
FISTULARIIDAE


GADIFORMES
Nets = 72 ; # Total Larvae = 160 ; Total Stations = 42 ;
Larvae/Stations = 3.81
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

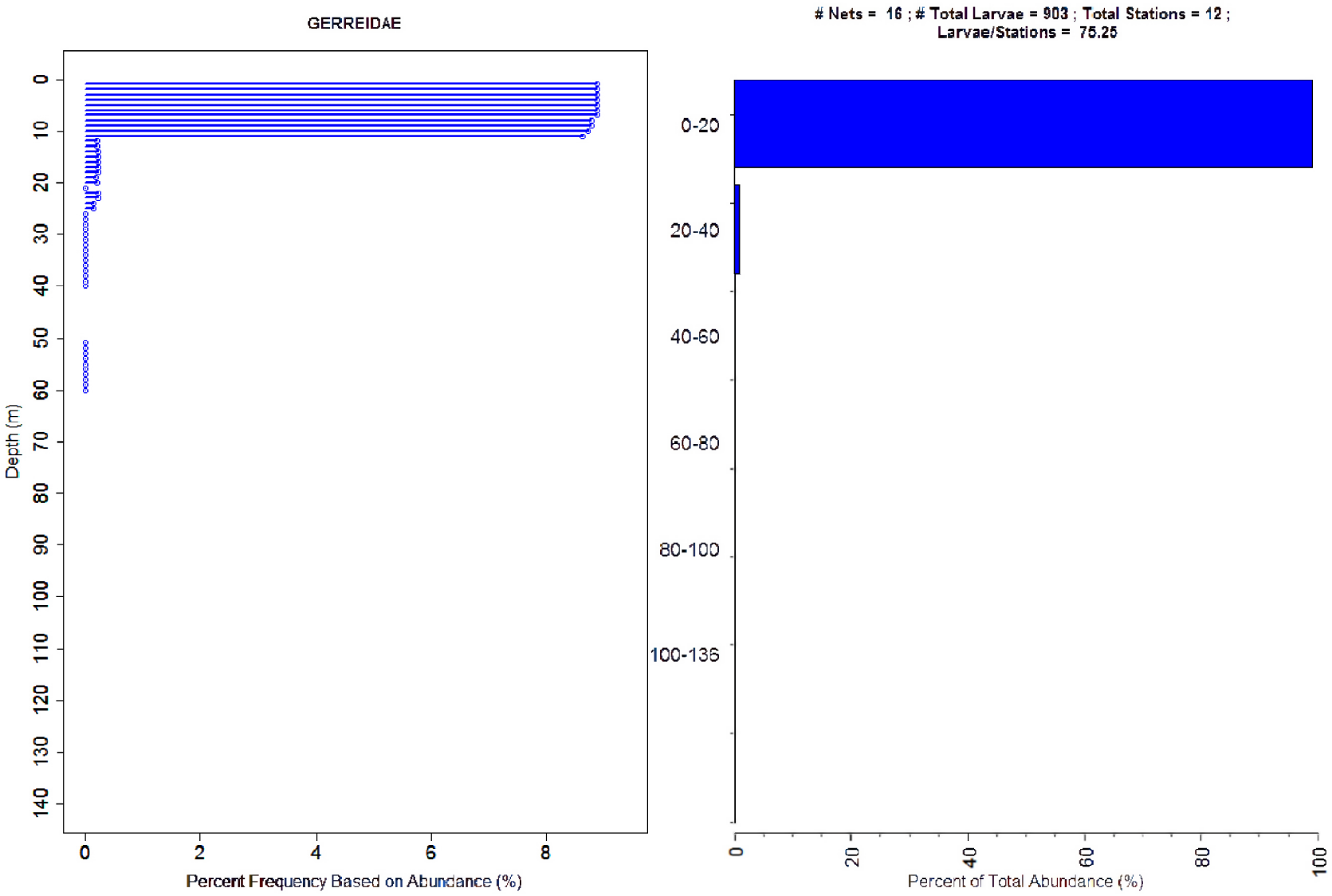
GADIFORMES


GEMPYLIDAE
Nets = 5 ; # Total Larvae = 7 ; Total Stations = 5 ;
Larvae/Stations = 1.4
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

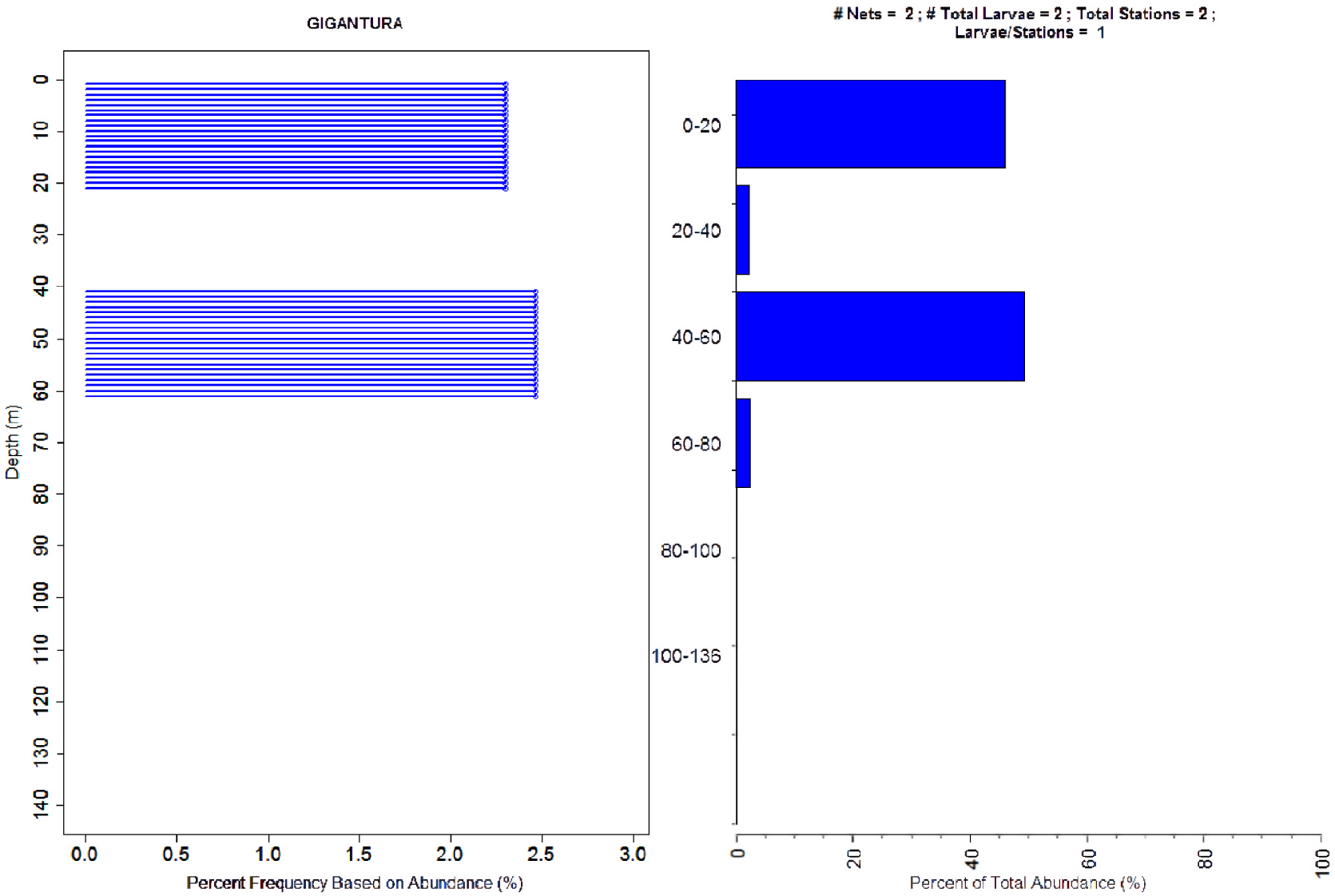
GEMPYLIDAE



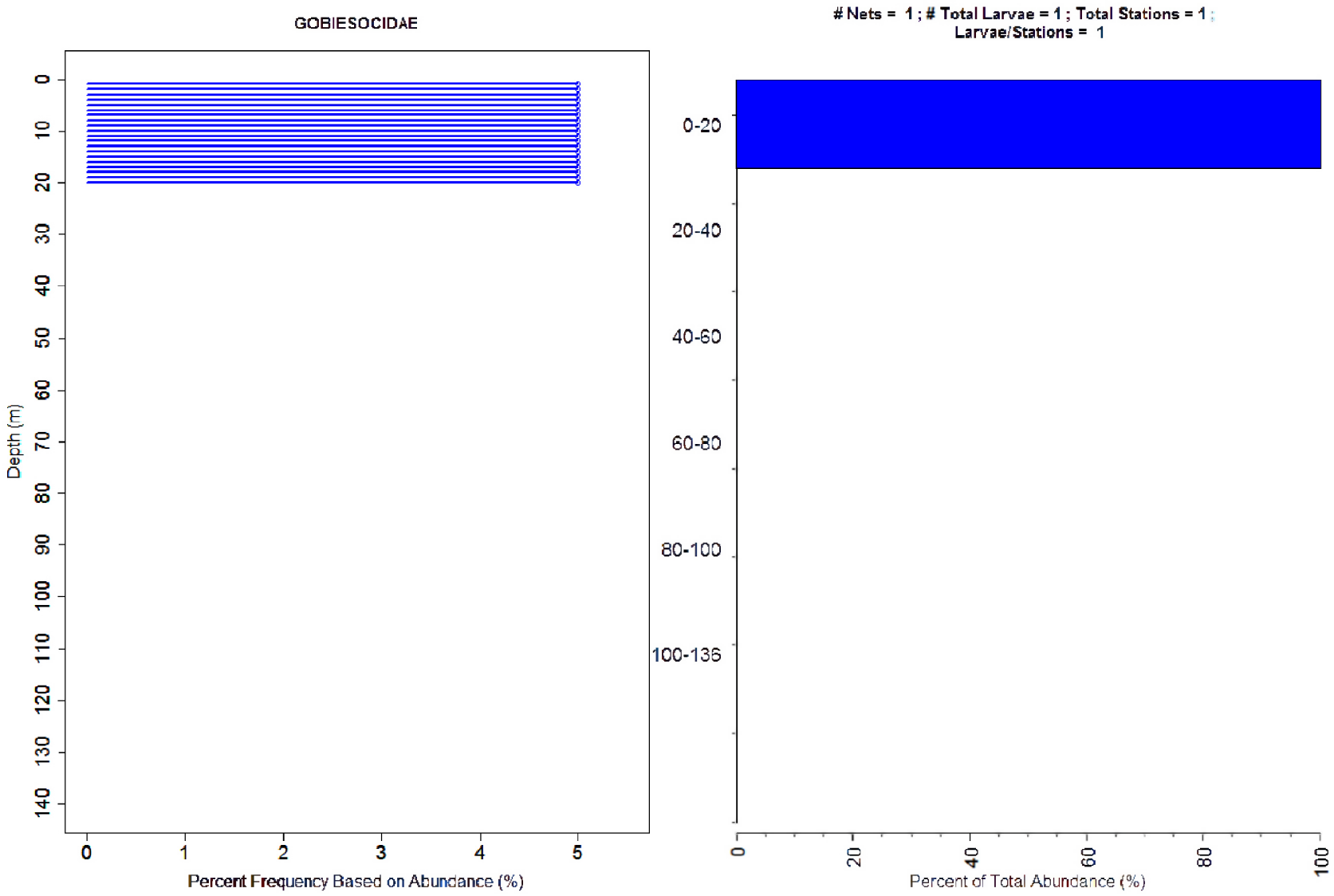
GEMPYLUS_SERPENS


GERREIDAE
Nets = 16 ; # Total Larvae = 903 ; Total Stations = 12 ;
Larvae/Stations = 75.25
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
8
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

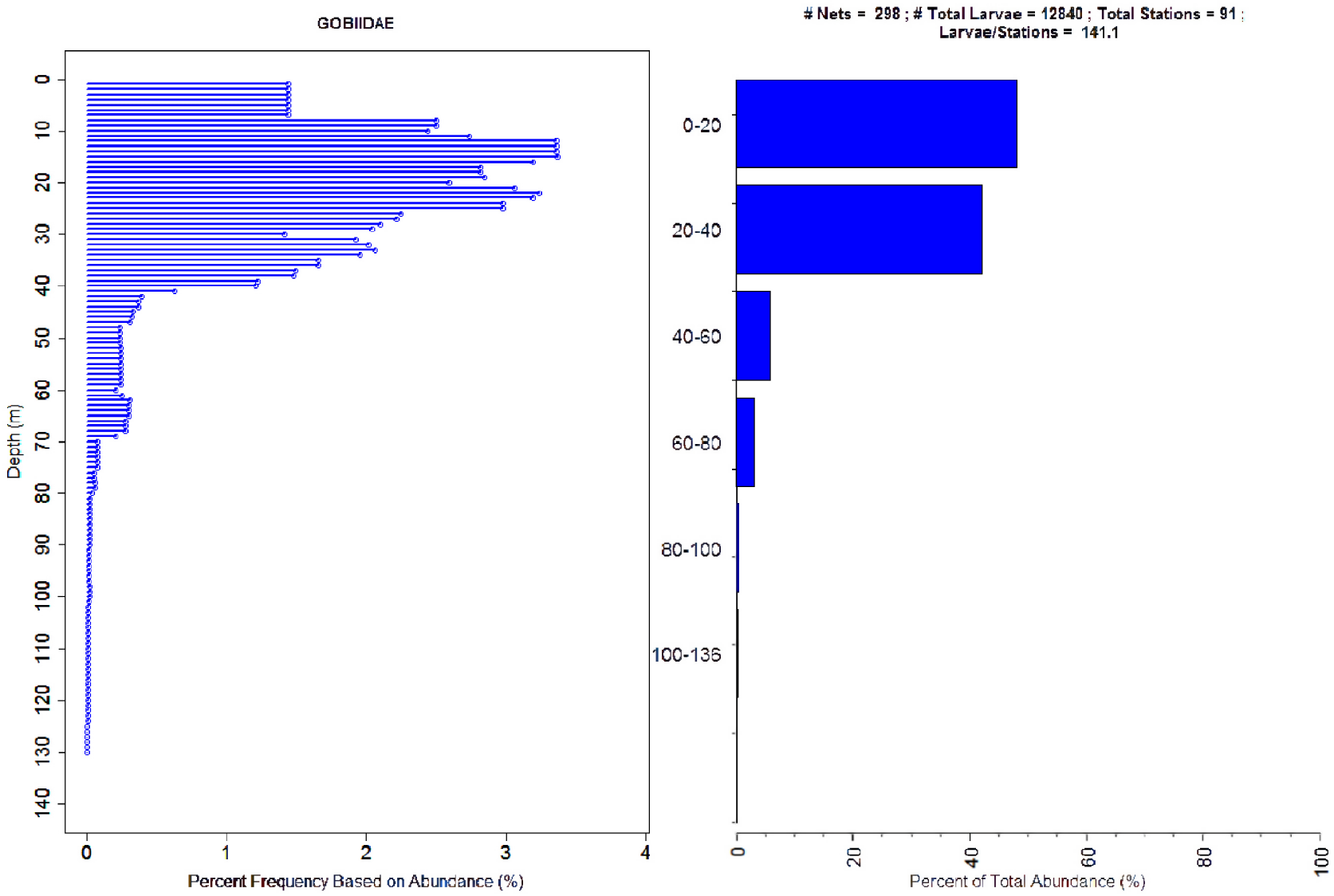
GERREIDAE


GIGANTURA
Nets = 2 ; # Total Larvae = 2 ; Total Stations = 2 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

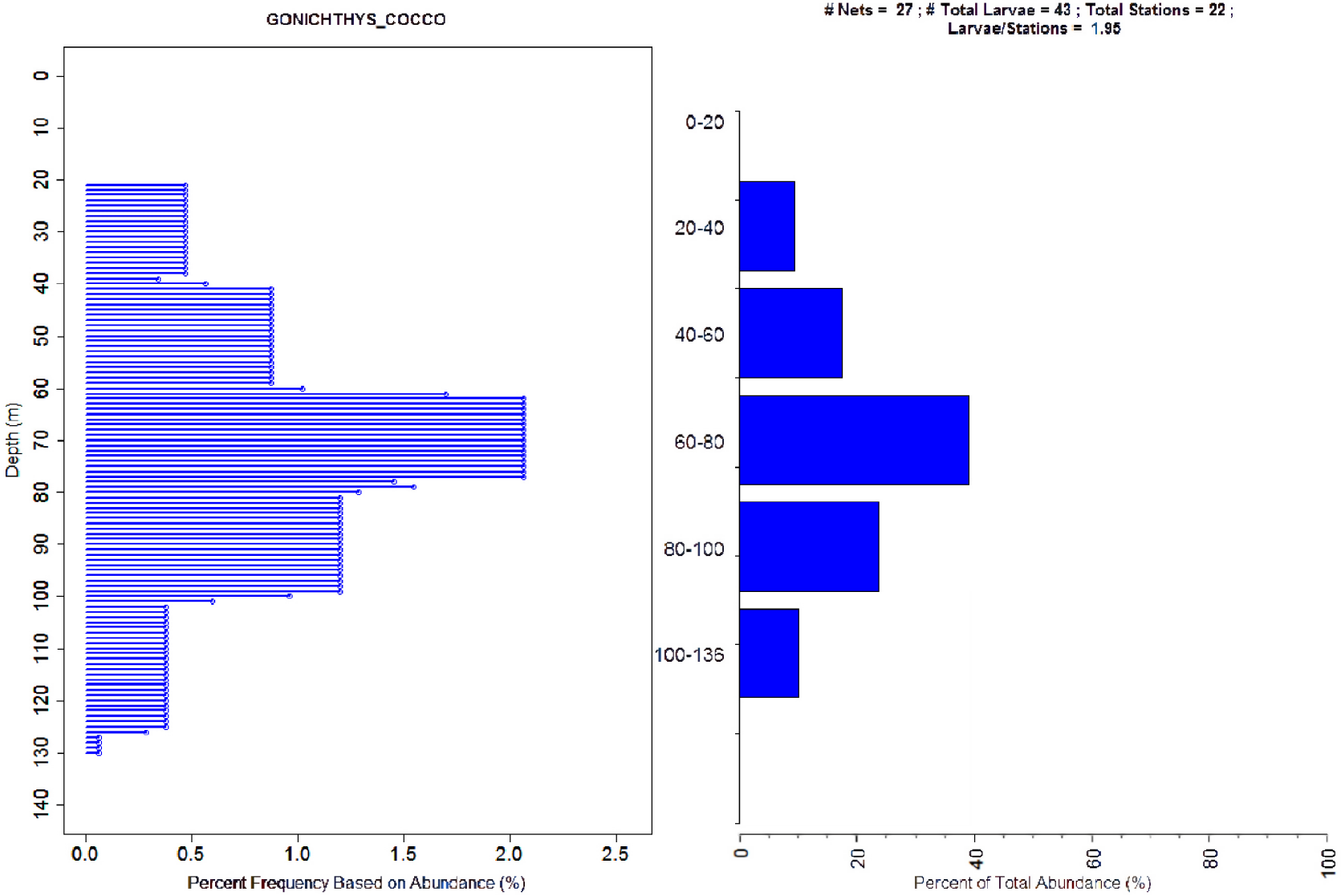
GIGANTURA



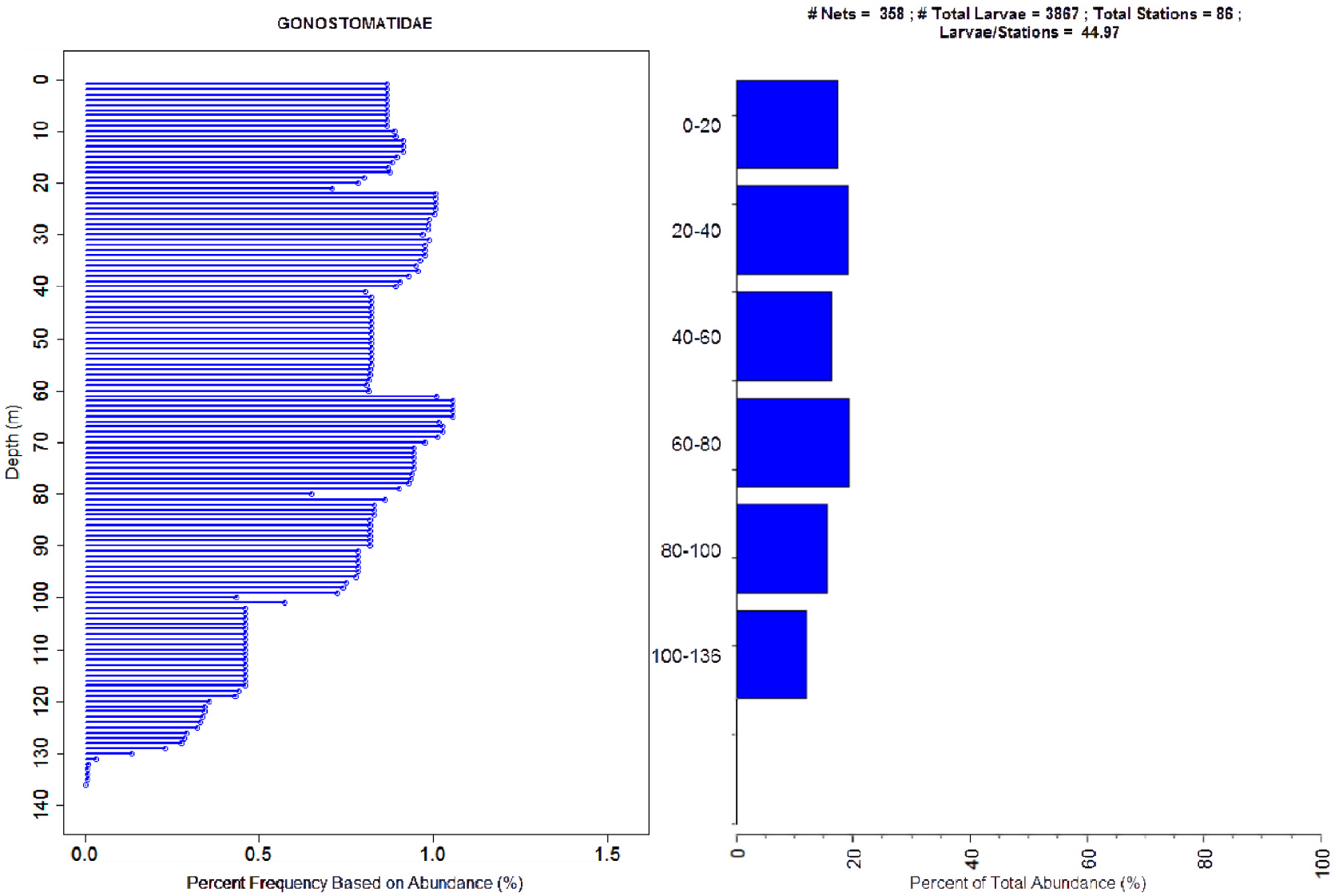
GOBIESOCIDAE


GOBIIDAE
Nets = 298 ; # Total Larvae = 12840 ; Total Stations = 91 ;
Larvae/Stations = 141.1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

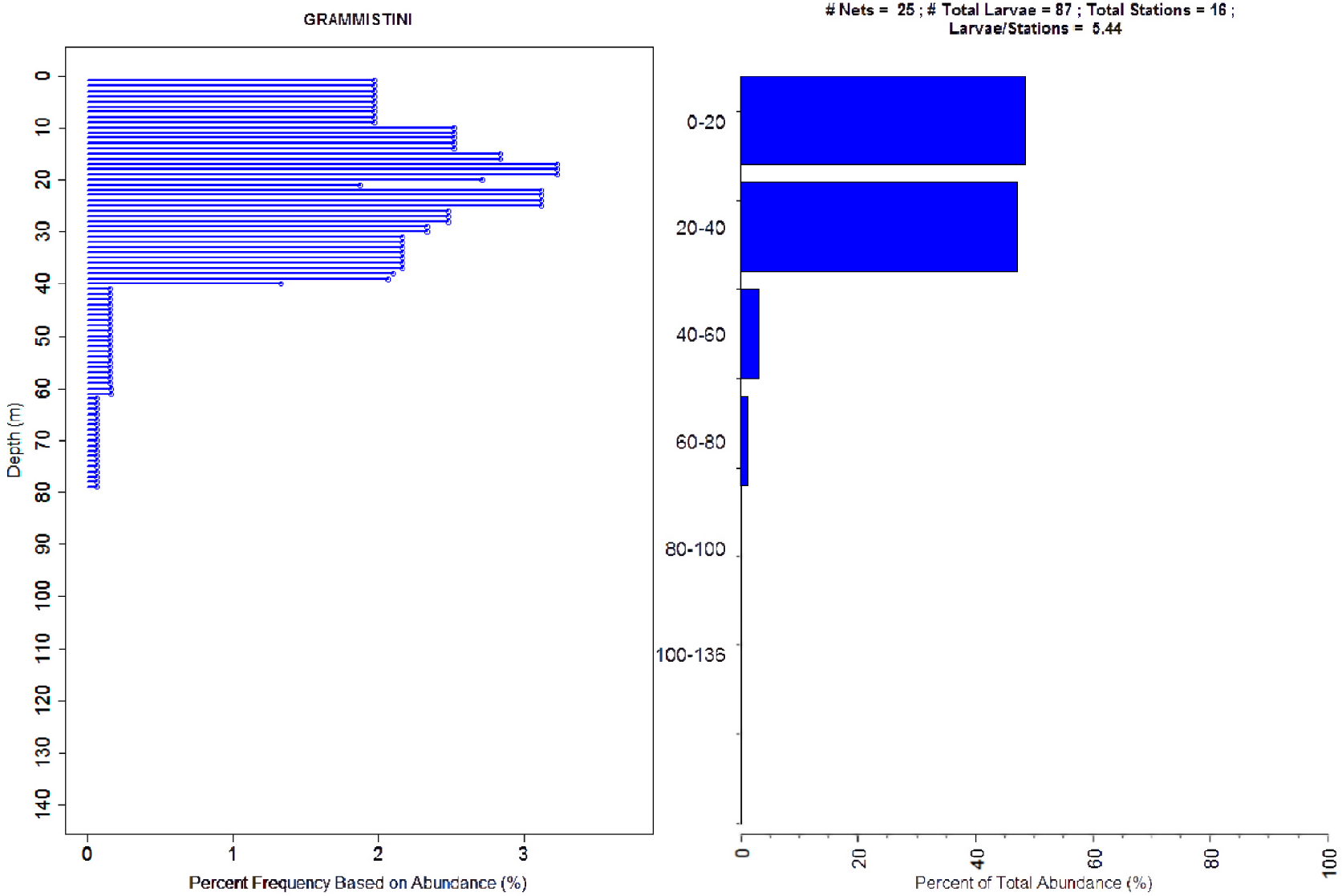
GOBIIDAE



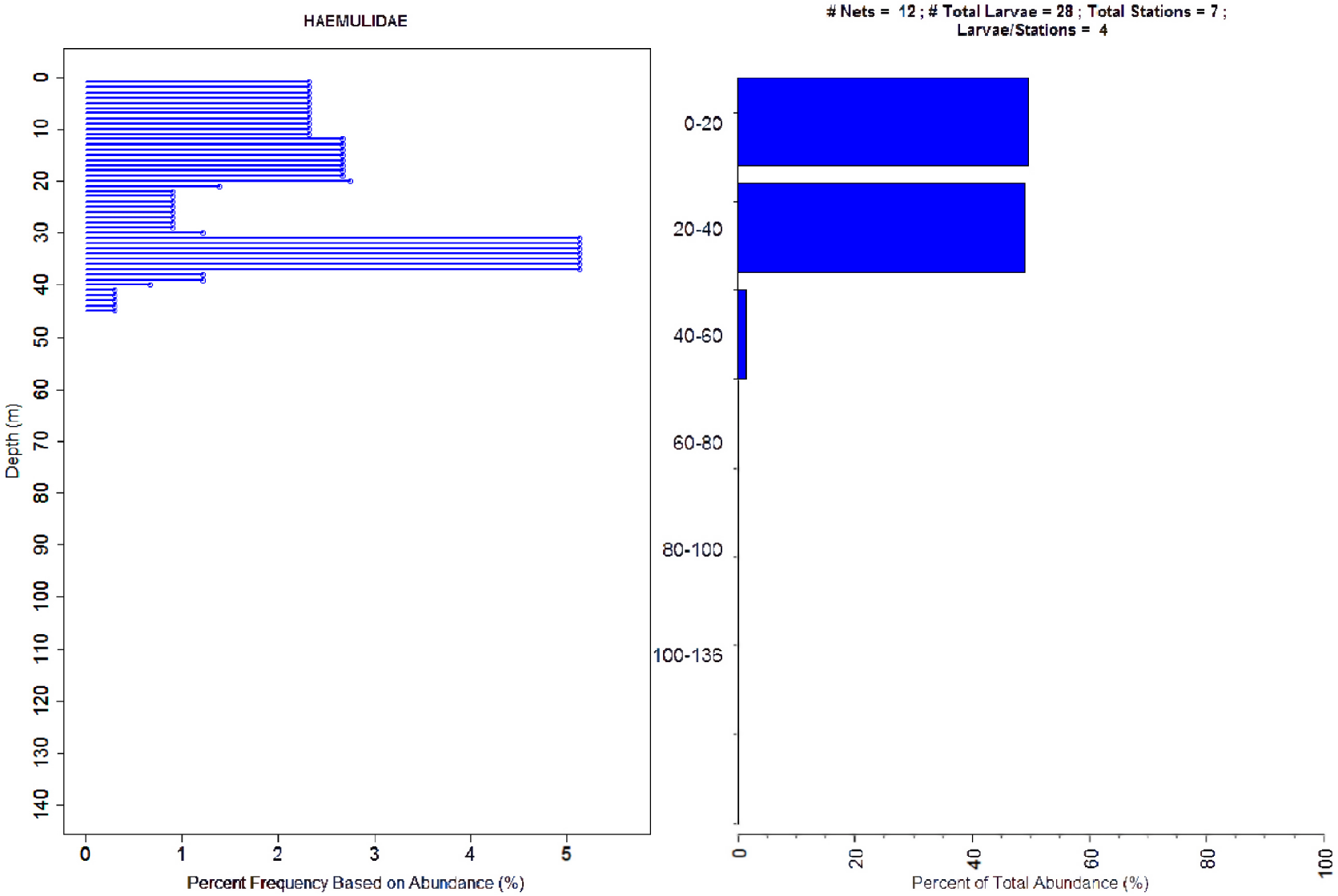
GONICHTHYS_COCCO



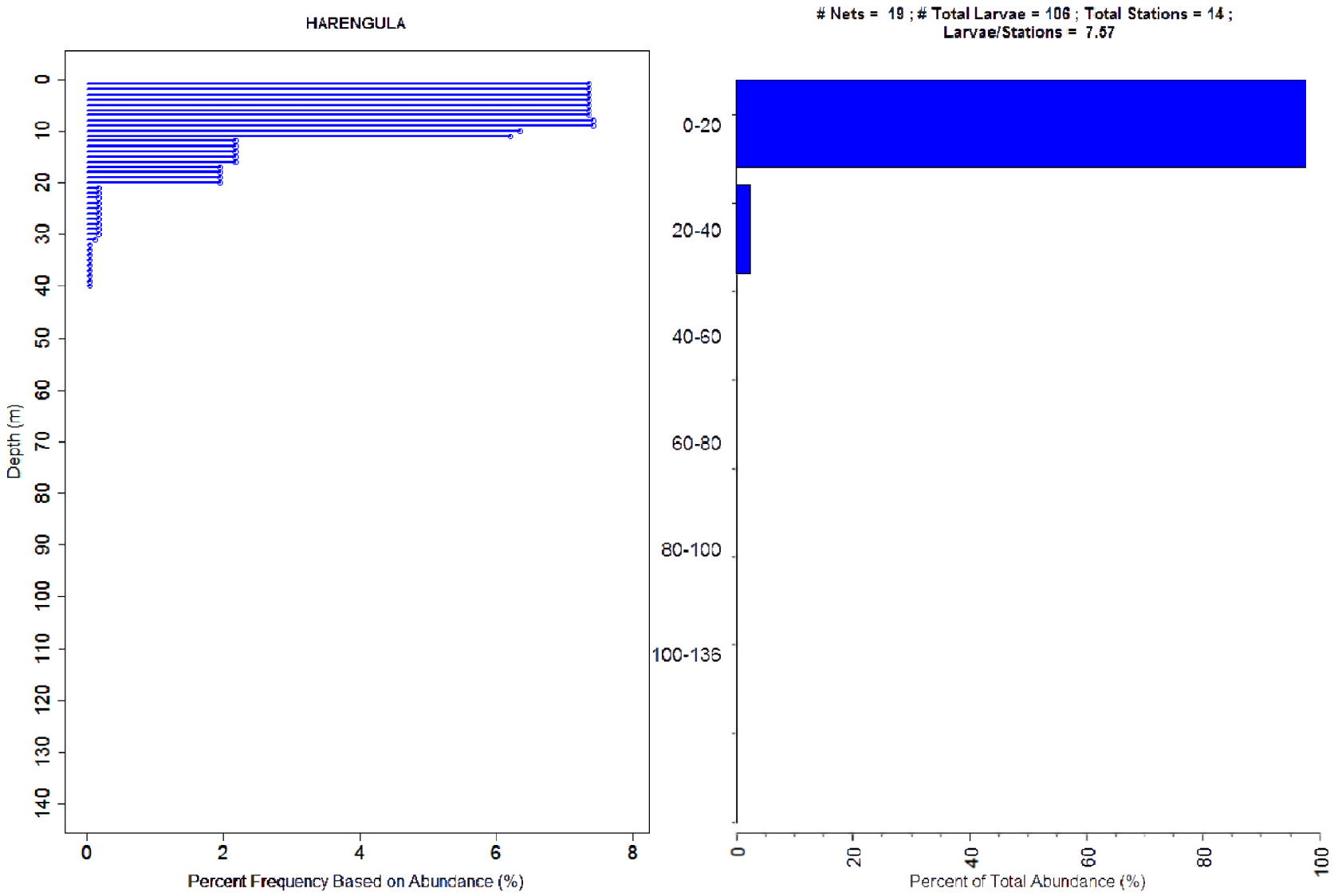
GONOSTOMATIDAE



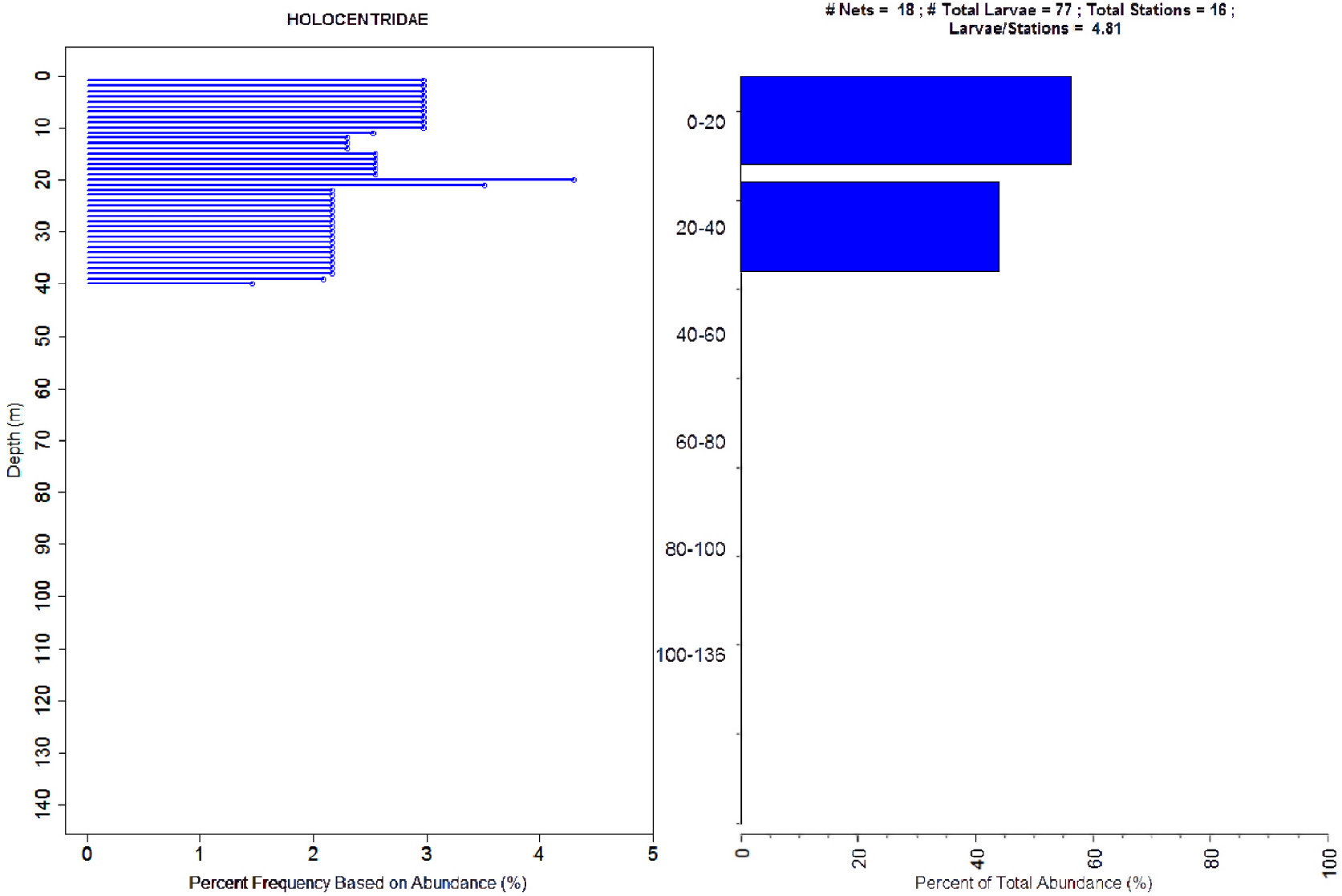
GRAMMISTINI


HAEMULIDAE
Nets = 12 ; # Total Larvae = 28 ; Total Stations = 7 ;
Larvae/Stations = 4
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

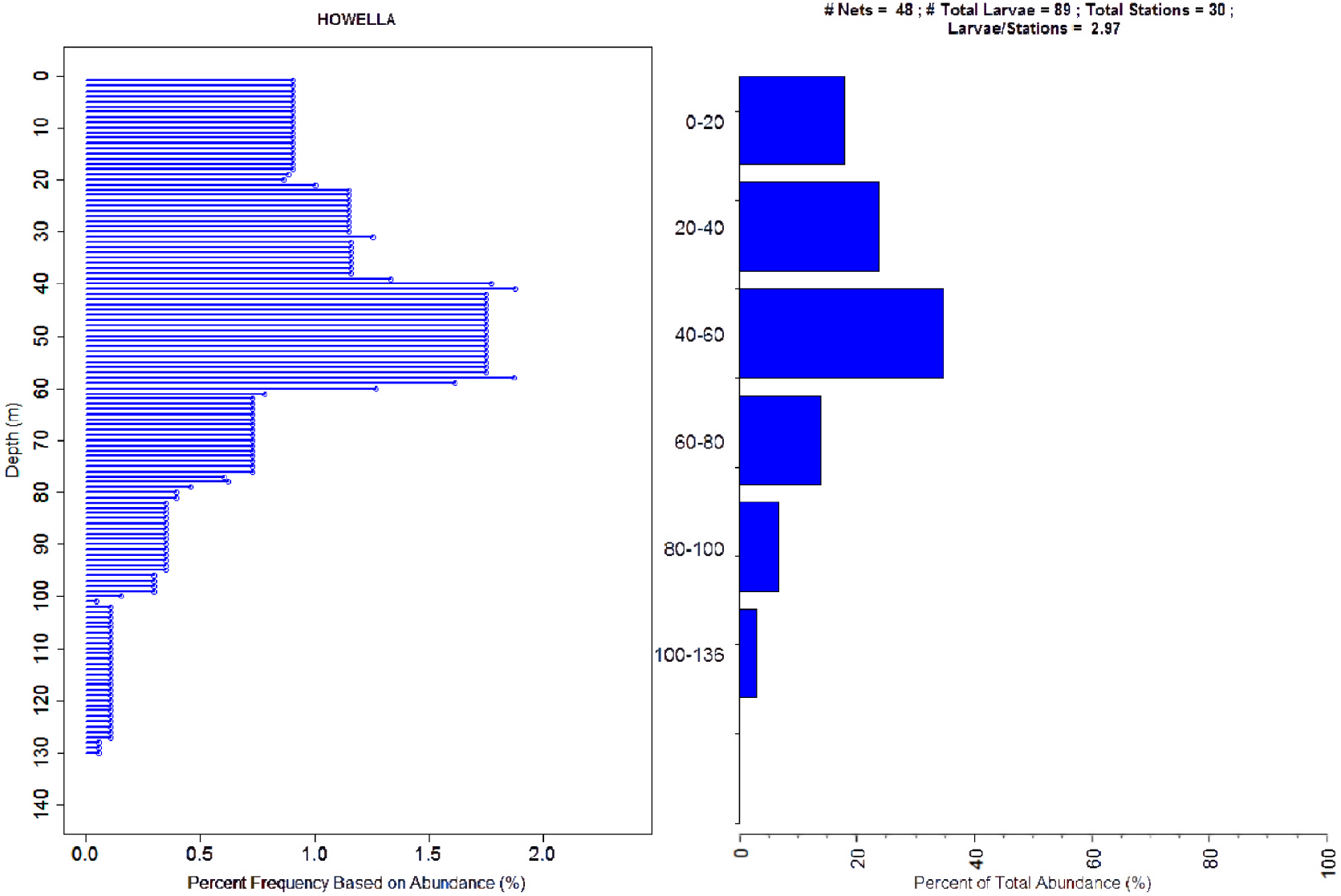
HAEMULIDAE


HARENGULA
Nets = 19 ; # Total Larvae = 106 ; Total Stations = 14 ;
Larvae/Stations = 7.57
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
8
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

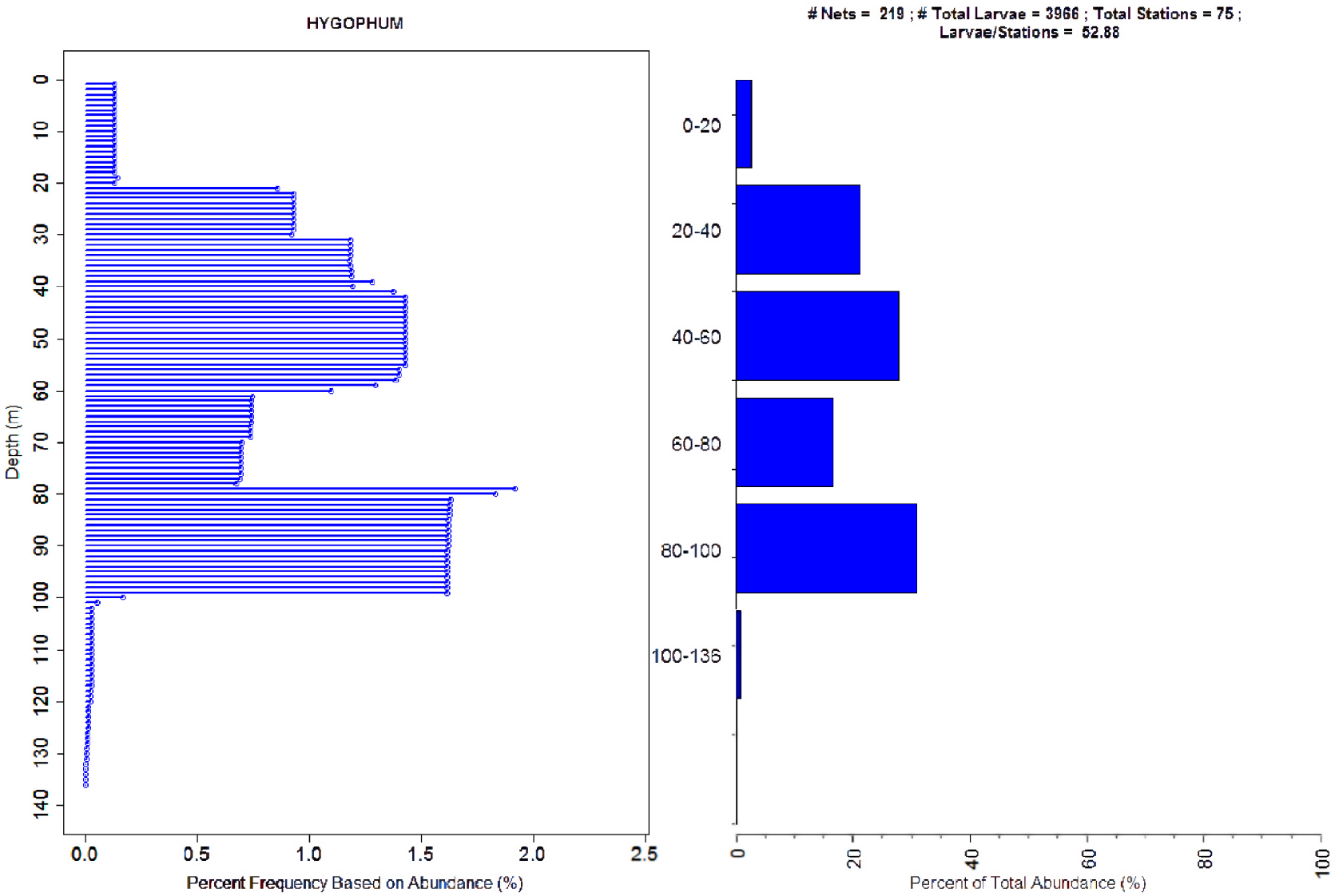
HARENGULA



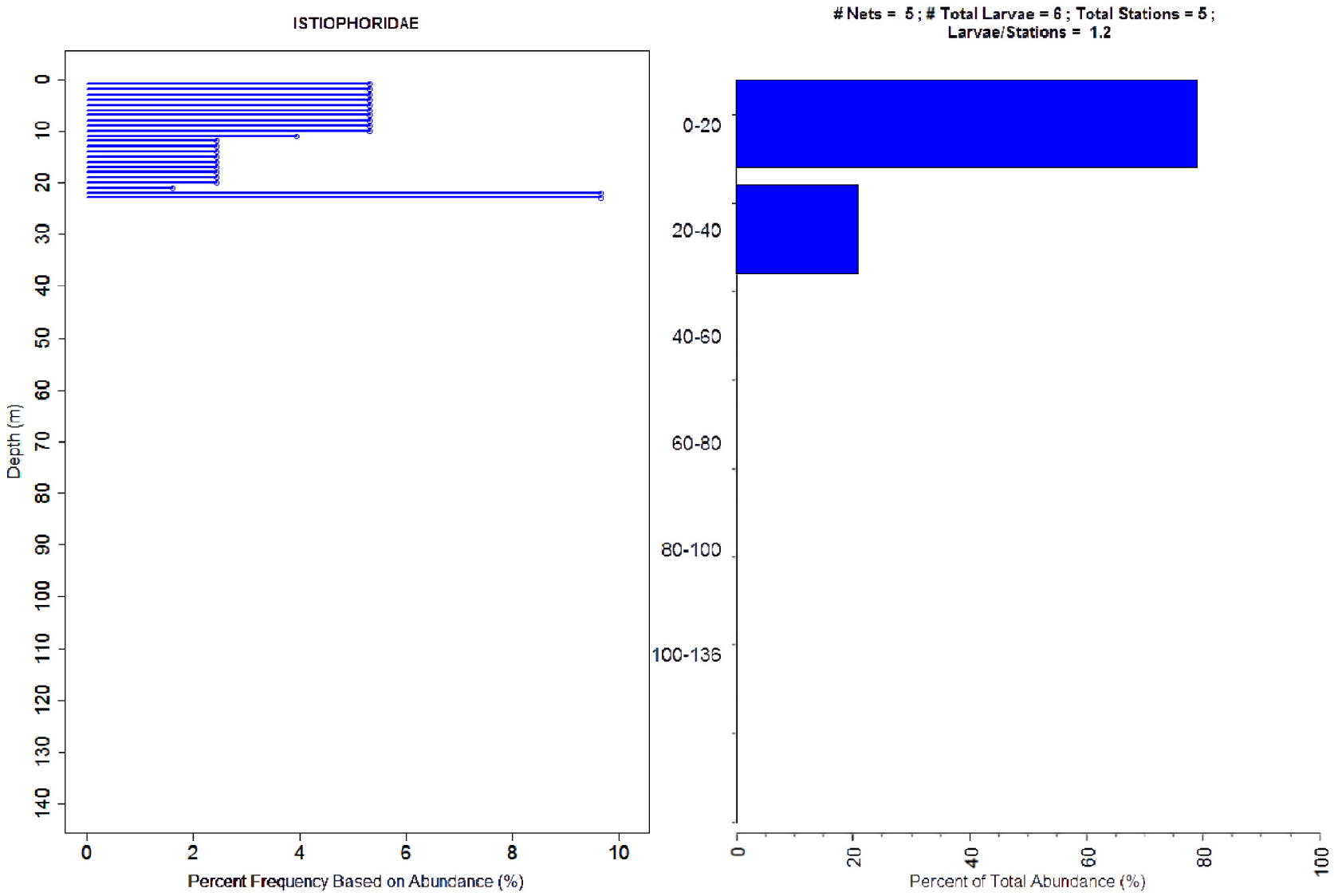
HOLOCENTRIDAE


HOWELLA
Nets = 48 ; # Total Larvae = 89 ; Total Stations = 30 ;
Larvae/Stations = 2.97
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

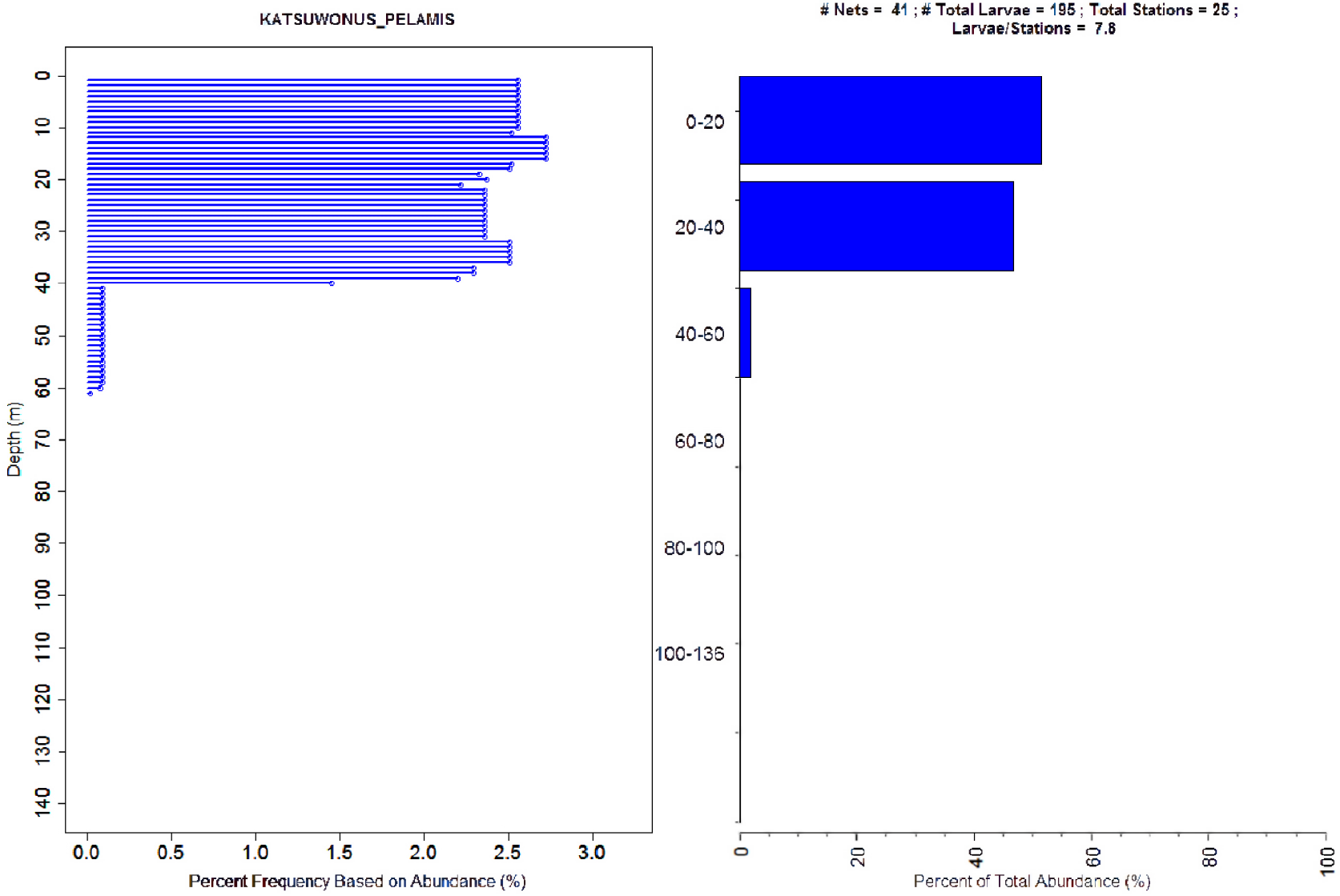
HOWELLA


HYGOPHUM
Nets = 219 ; # Total Larvae = 3966 ; Total Stations = 75 ;
Larvae/Stations = 52.88
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

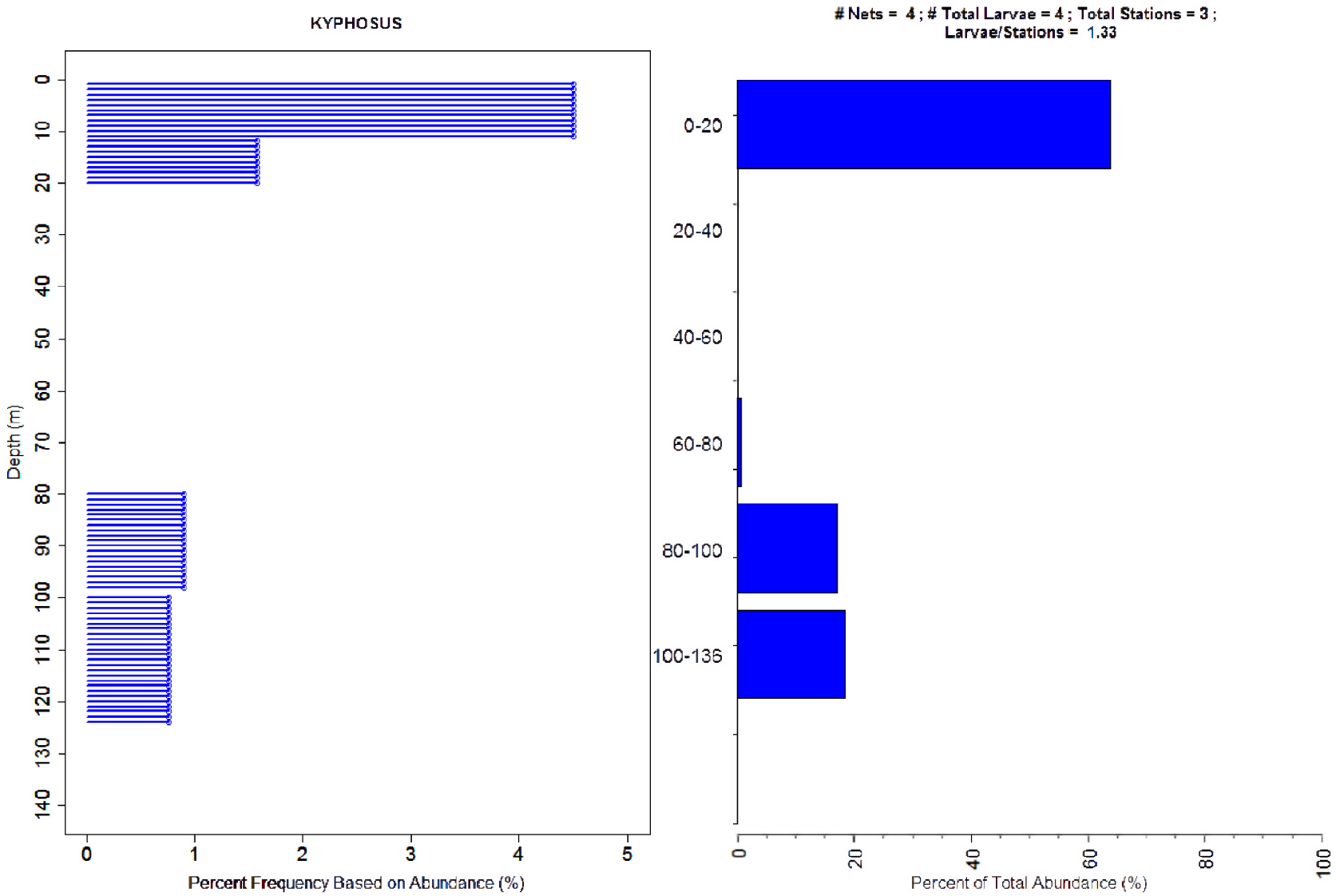
HYGOPHUM



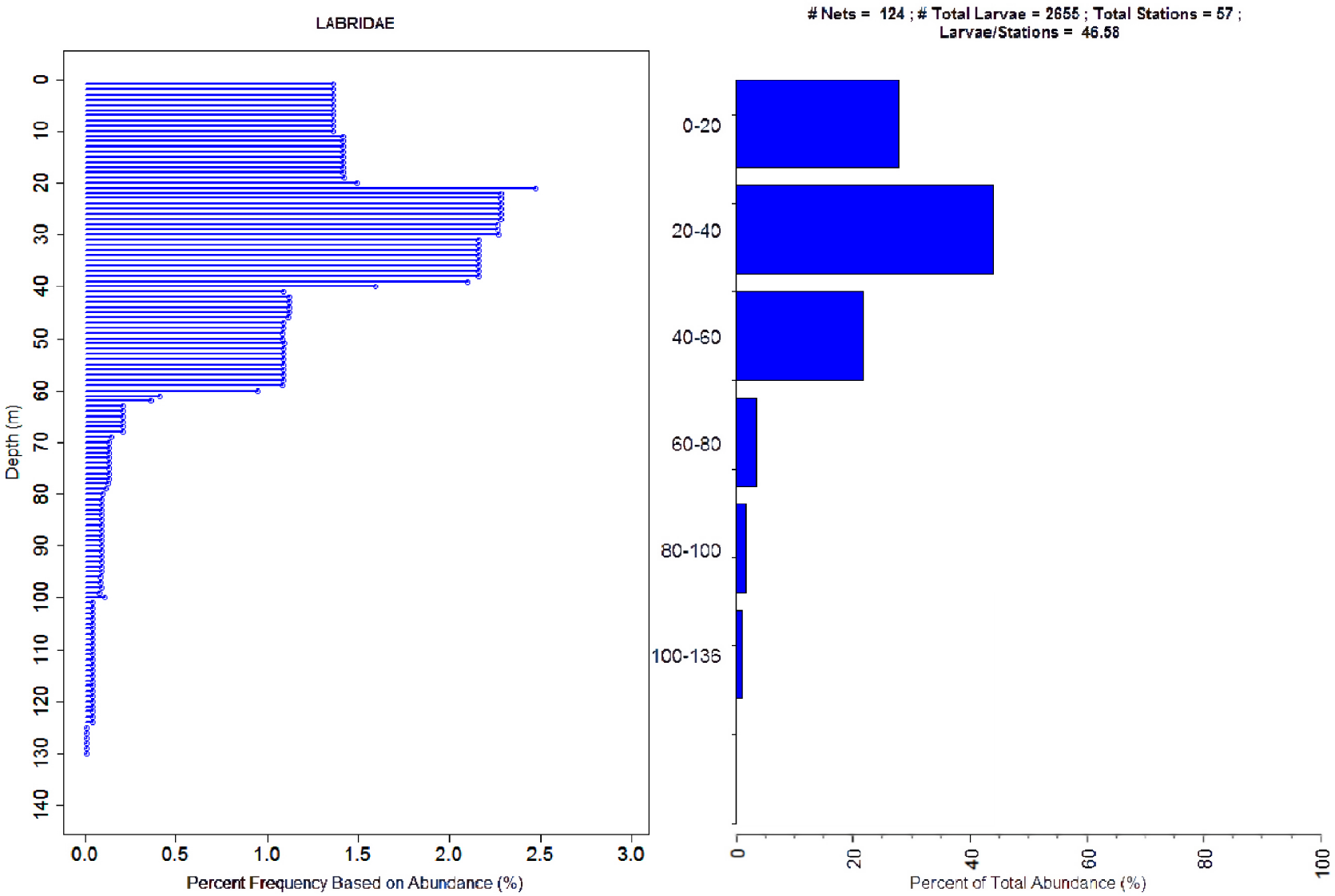
ISTIOPHORIDAE



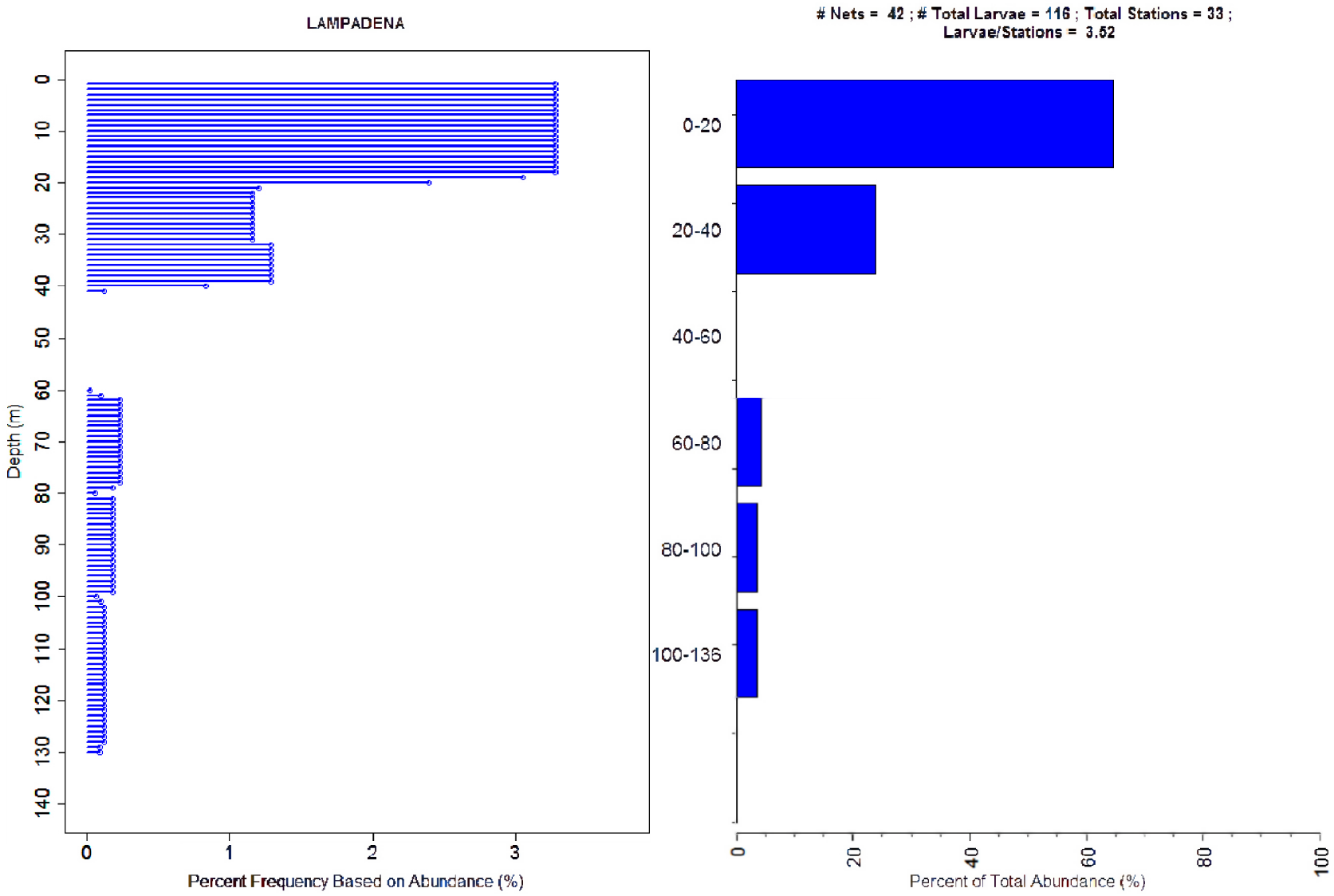
KATSUWONUS_PELAMIS


KYPHOSUS
Nets = 4 ; # Total Larvae = 4 ; Total Stations = 3 ;
Larvae/Stations = 1.33
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

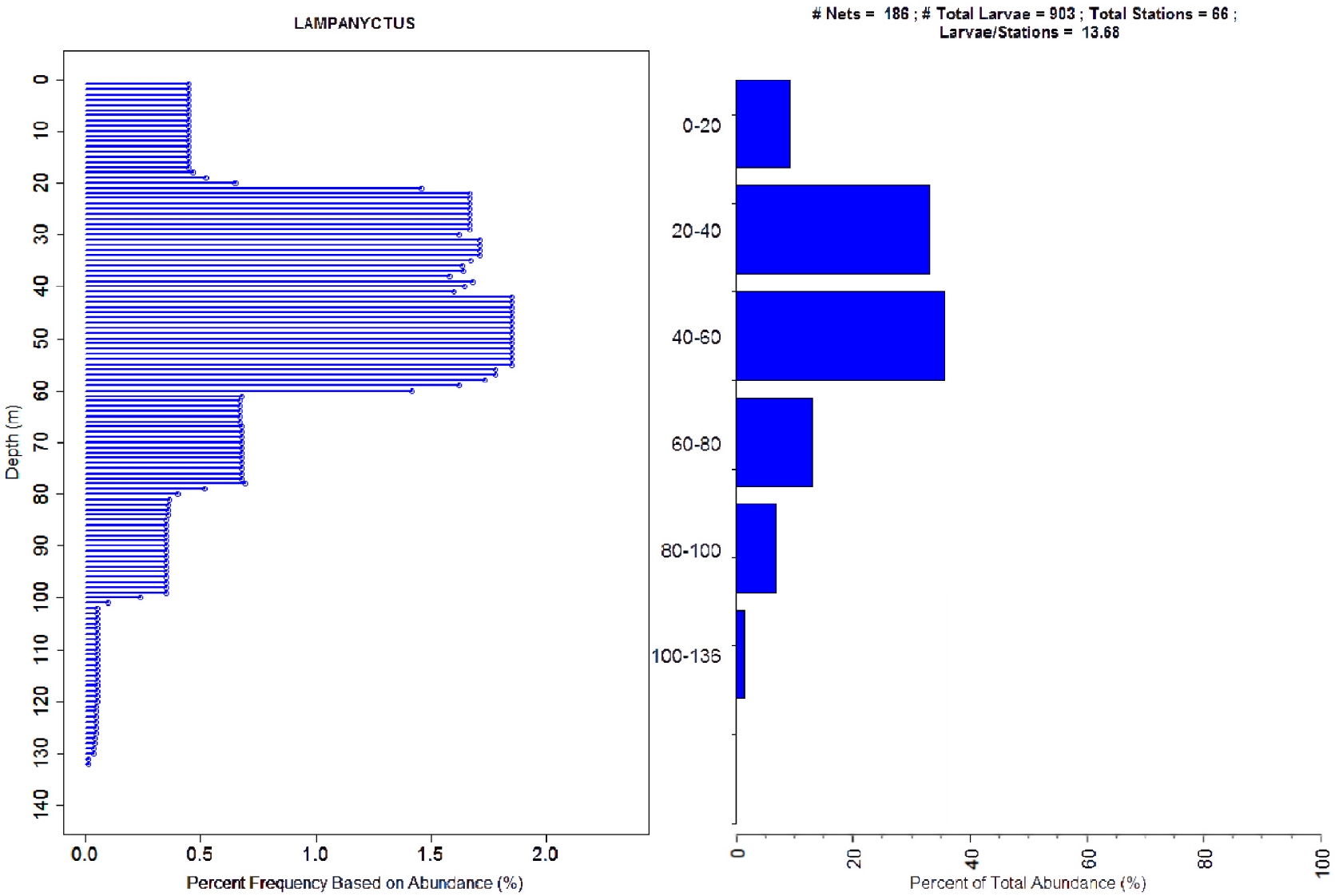
KYPHOSUS


LABRIDAE
Nets = 124 ; # Total Larvae = 2655 ; Total Stations = 57 ;
Larvae/Stations = 46.58
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

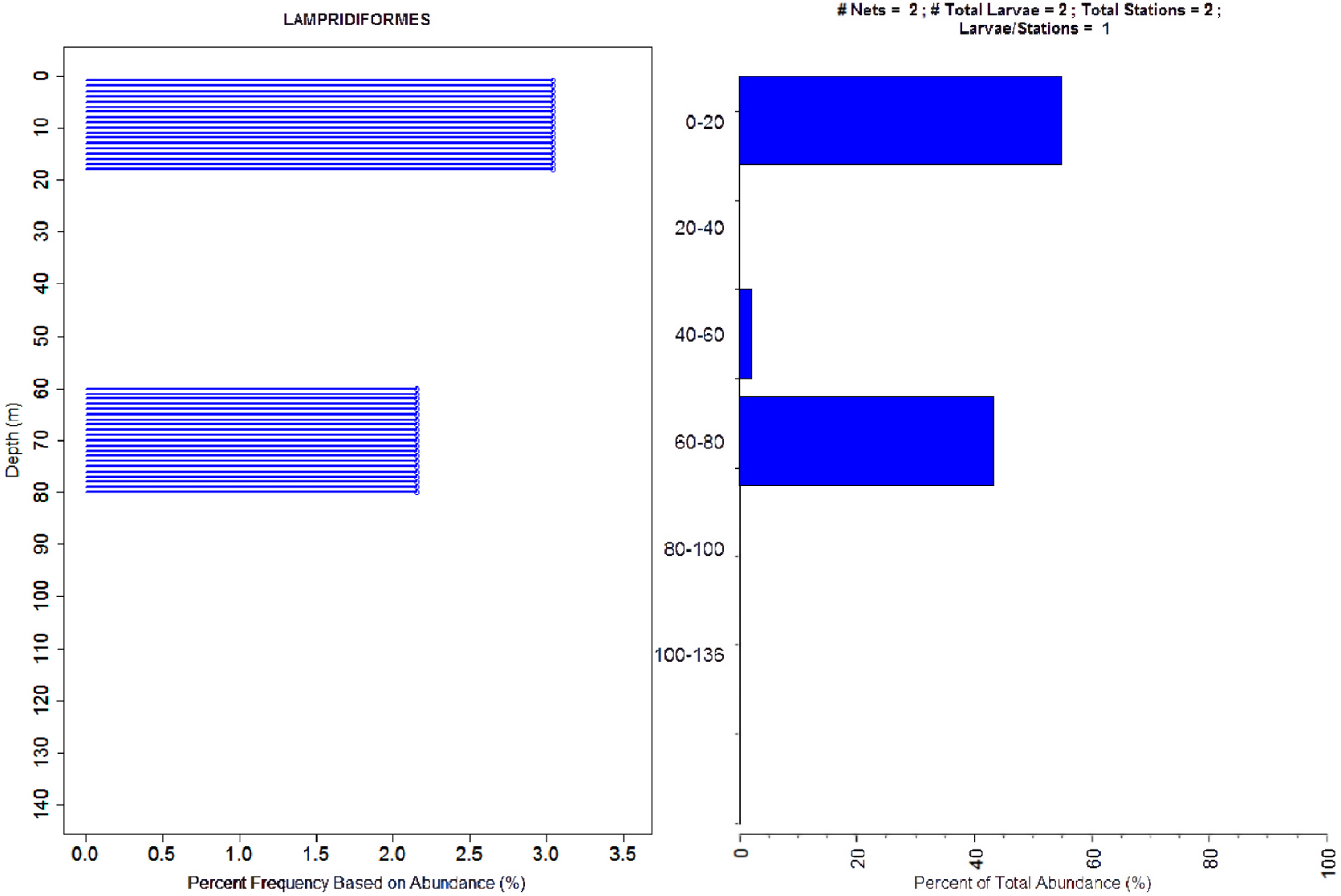
LABRIDAE


LAMPADENA
Nets = 42 ; # Total Larvae = 116 ; Total Stations = 33 ;
Larvae/Stations = 3.52
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

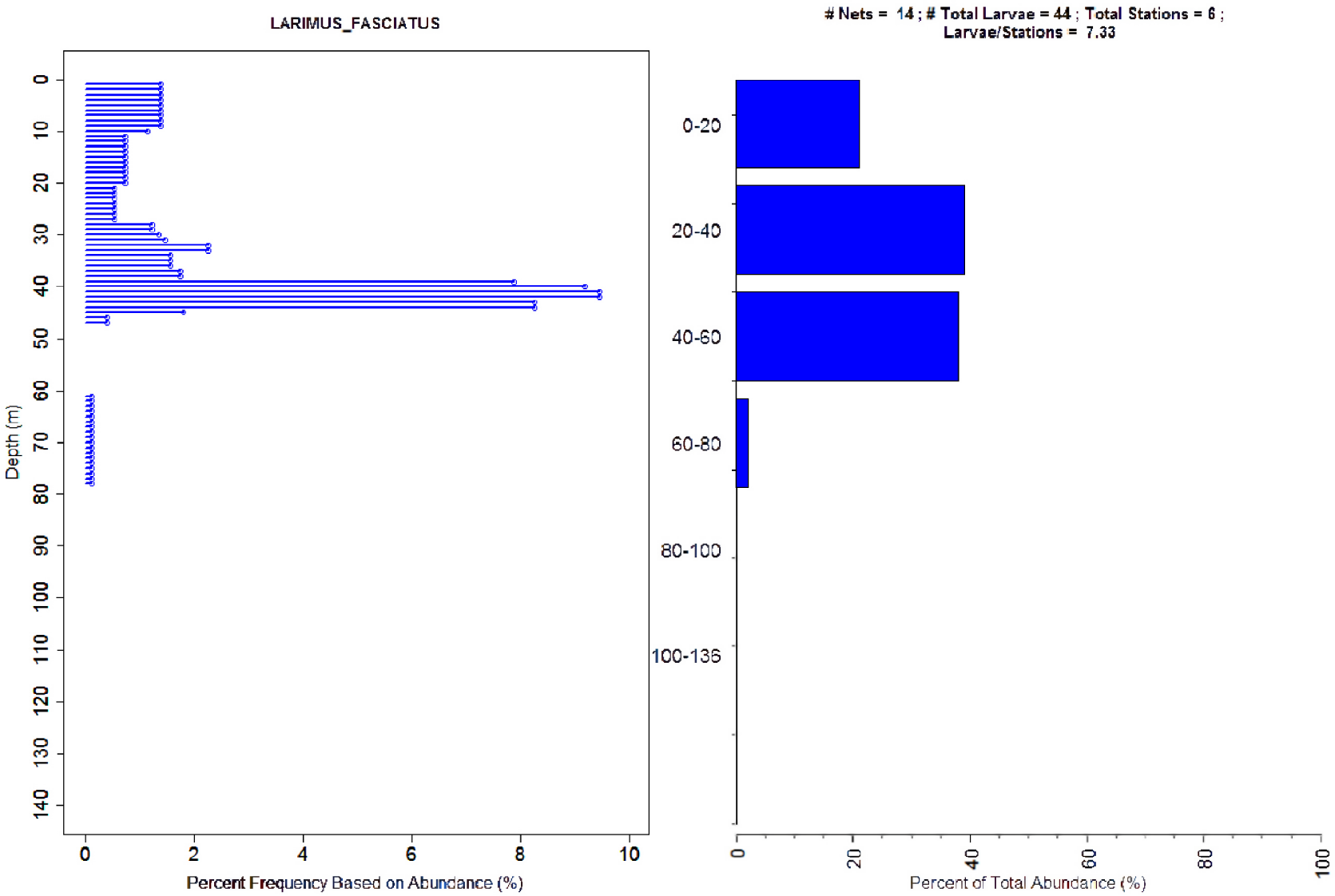
LAMPADENA



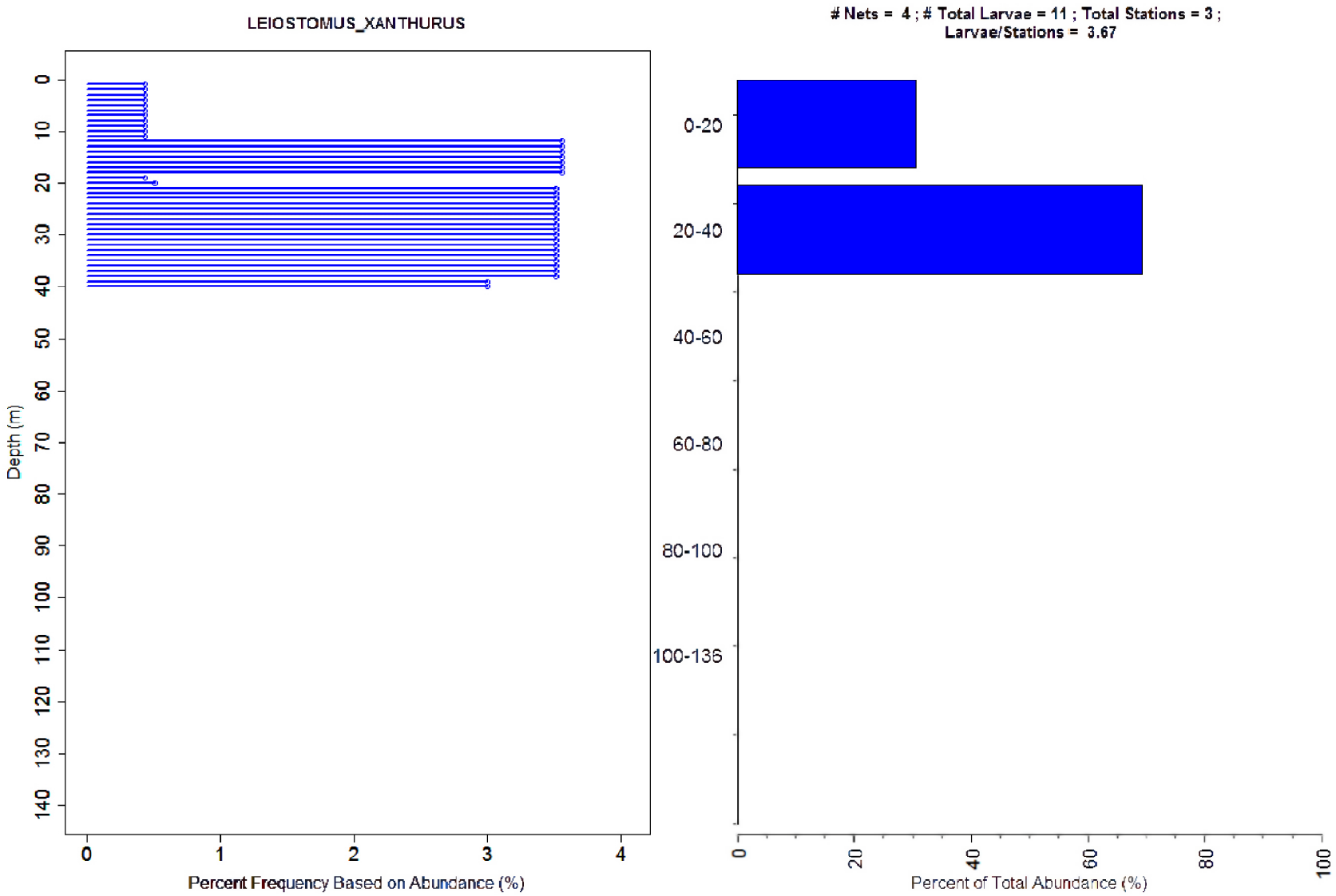
LAMPANYCTUS



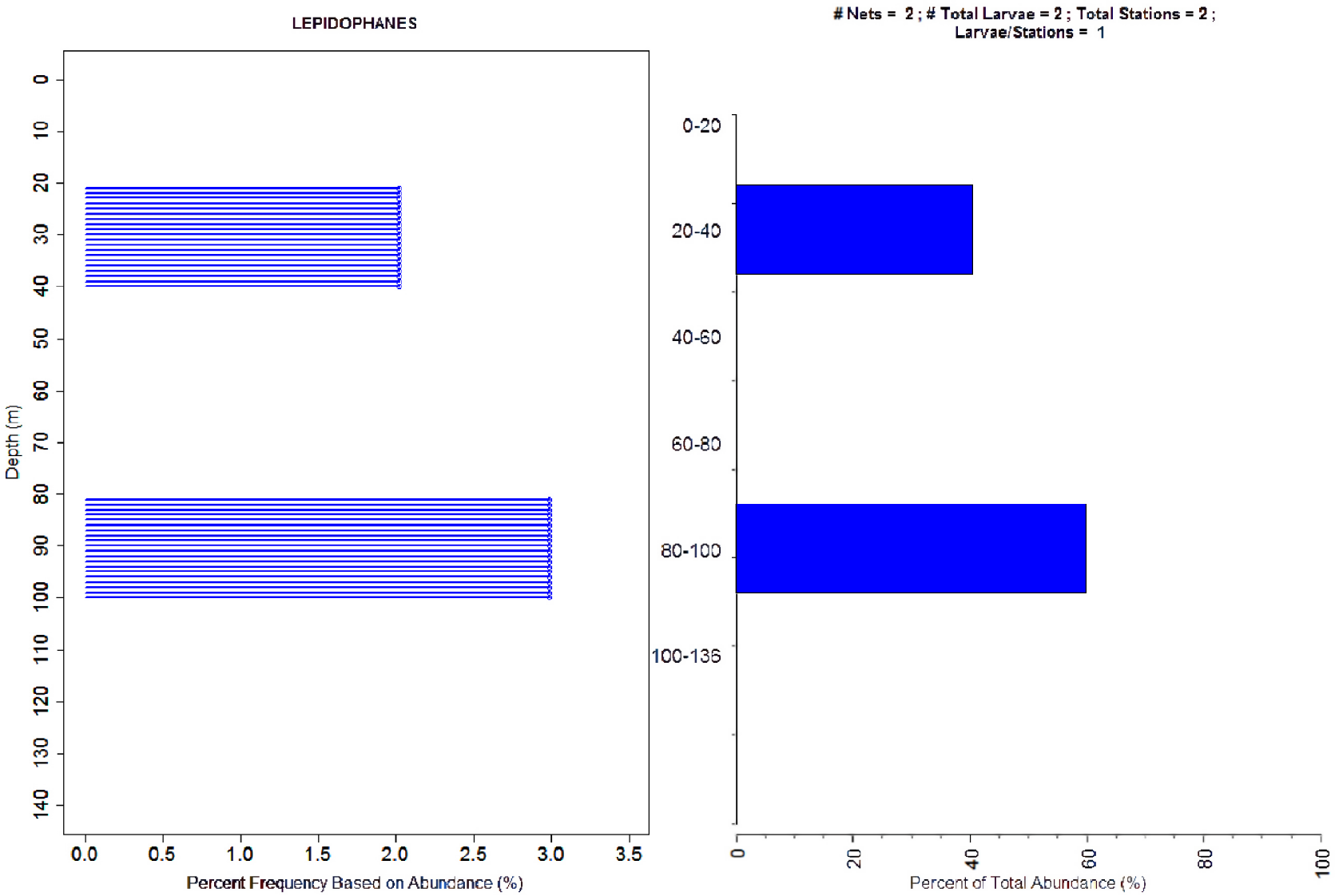
LAMPRIDIFORMES



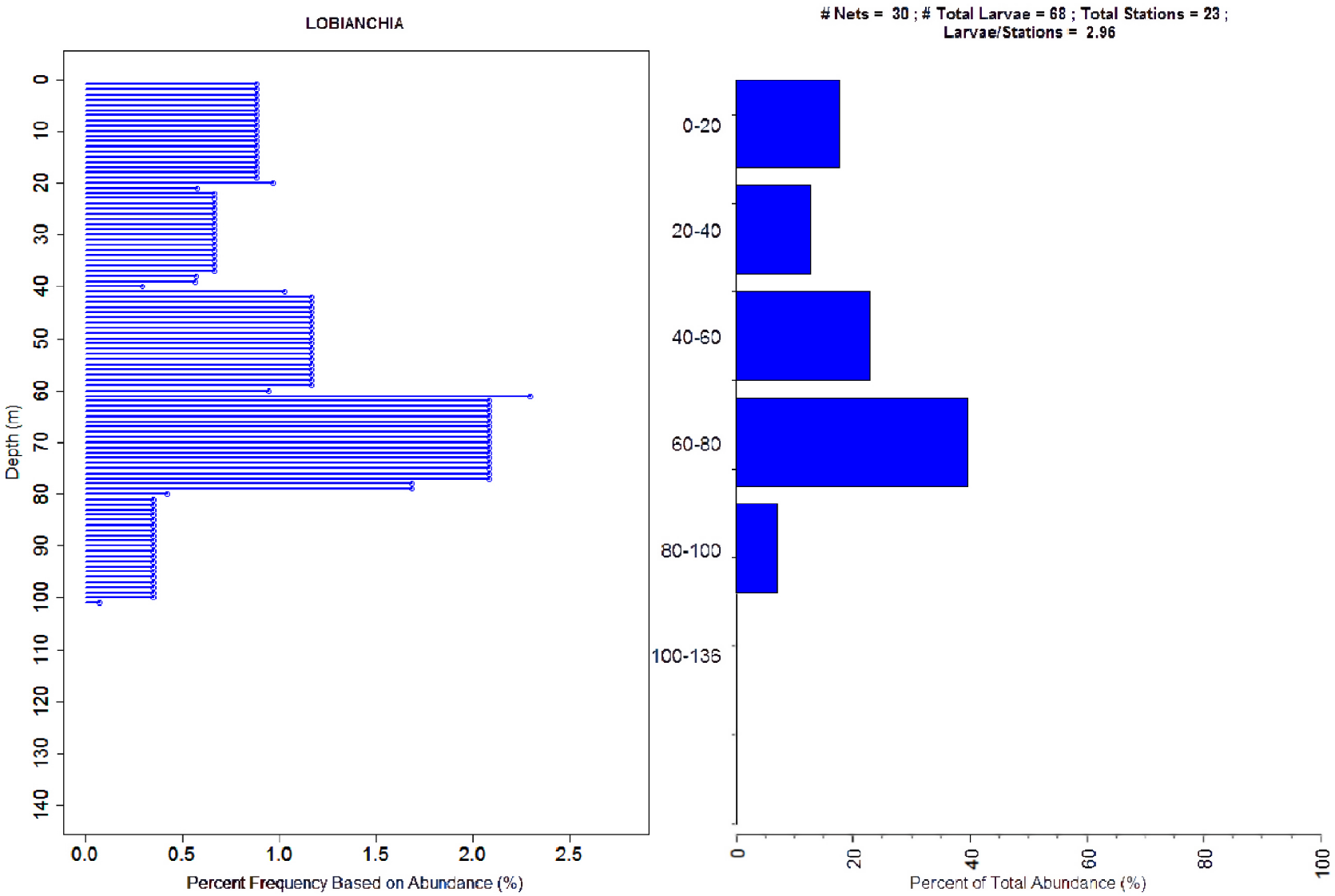
LARIMUS_FASCIATUS



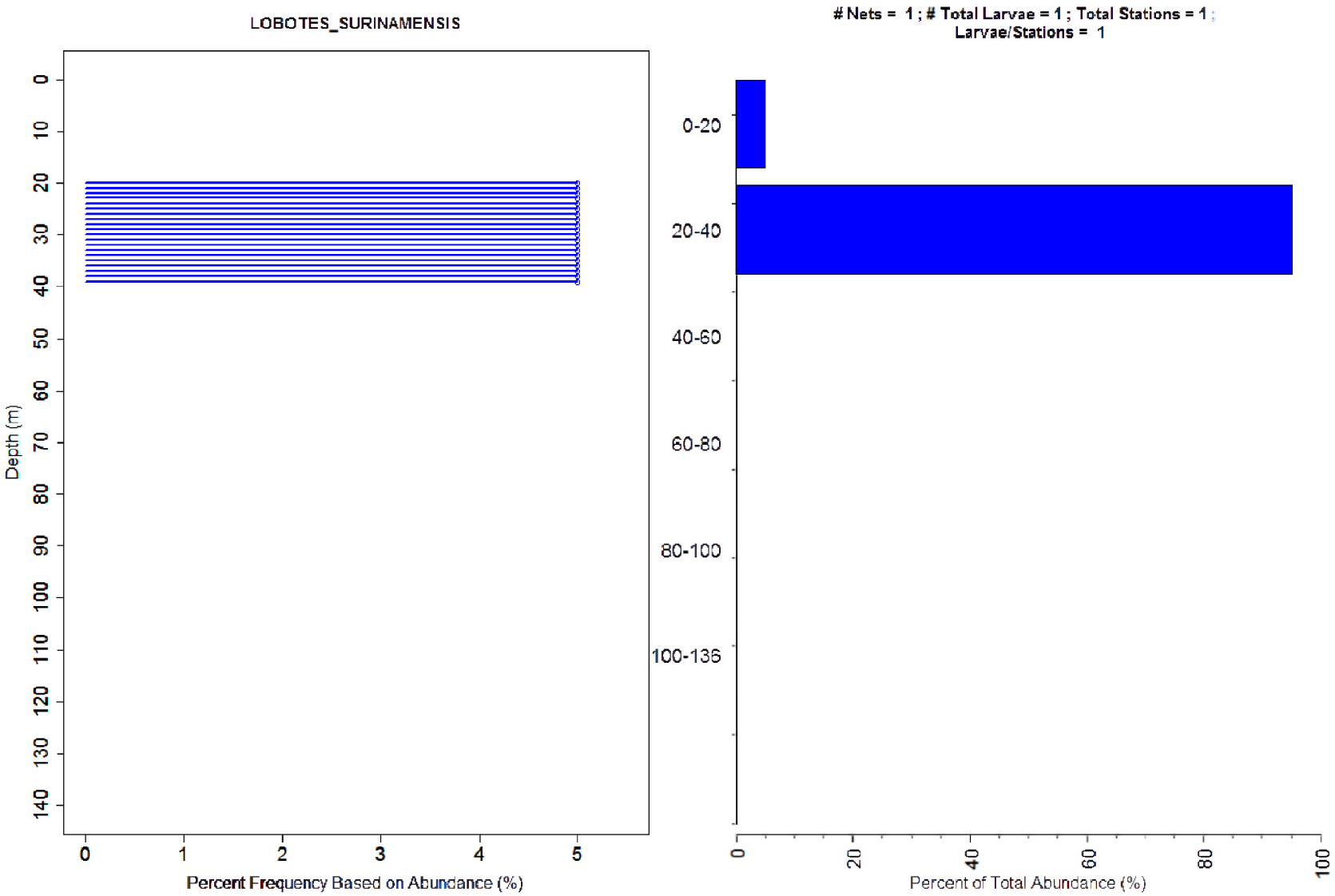
LEIOSTOMUS_XANTHURUS



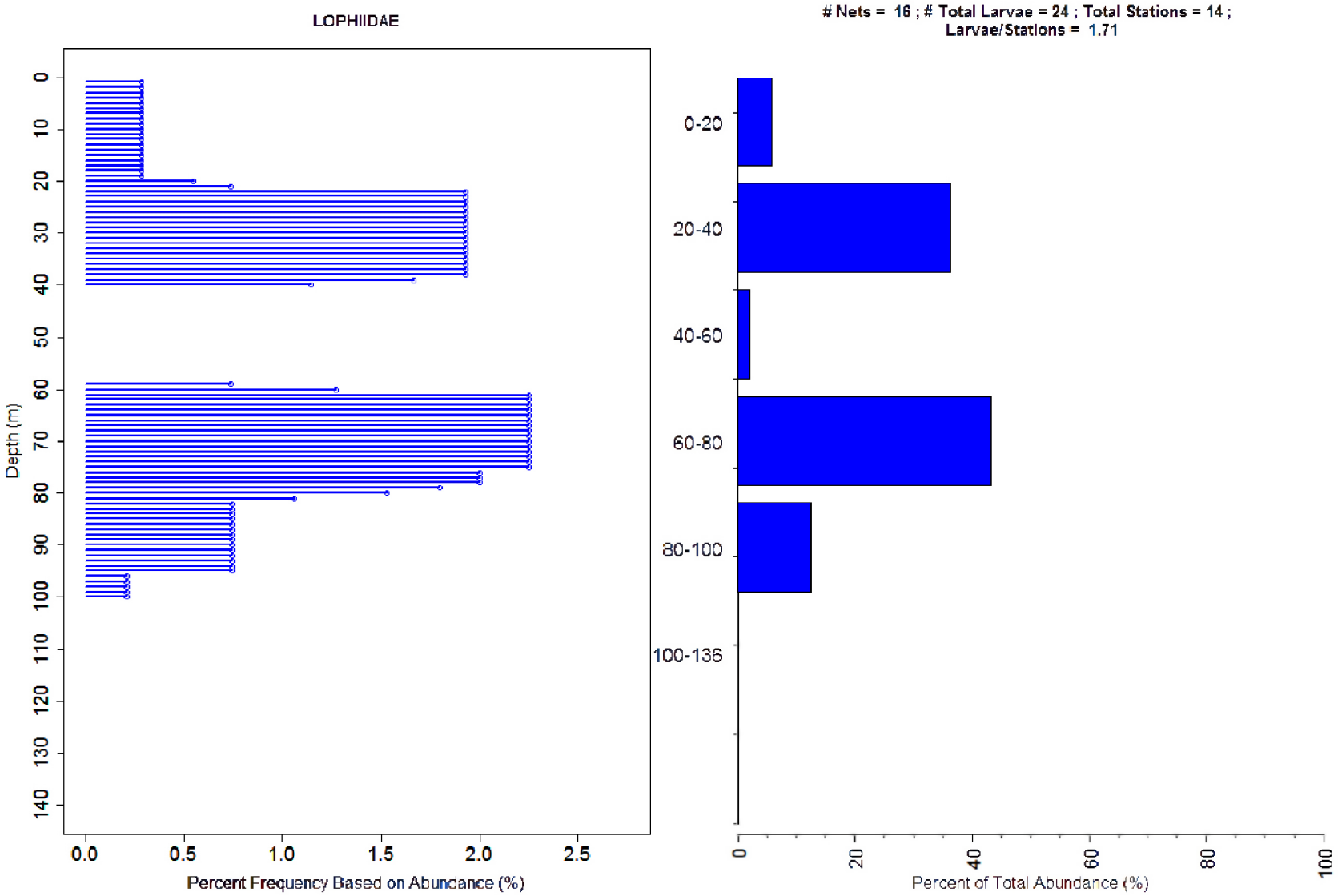
LEPIDOPHANES


LOBIANCHIA
Nets = 30 ; # Total Larvae = 68 ; Total Stations = 23 ;
Larvae/Stations = 2.96
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

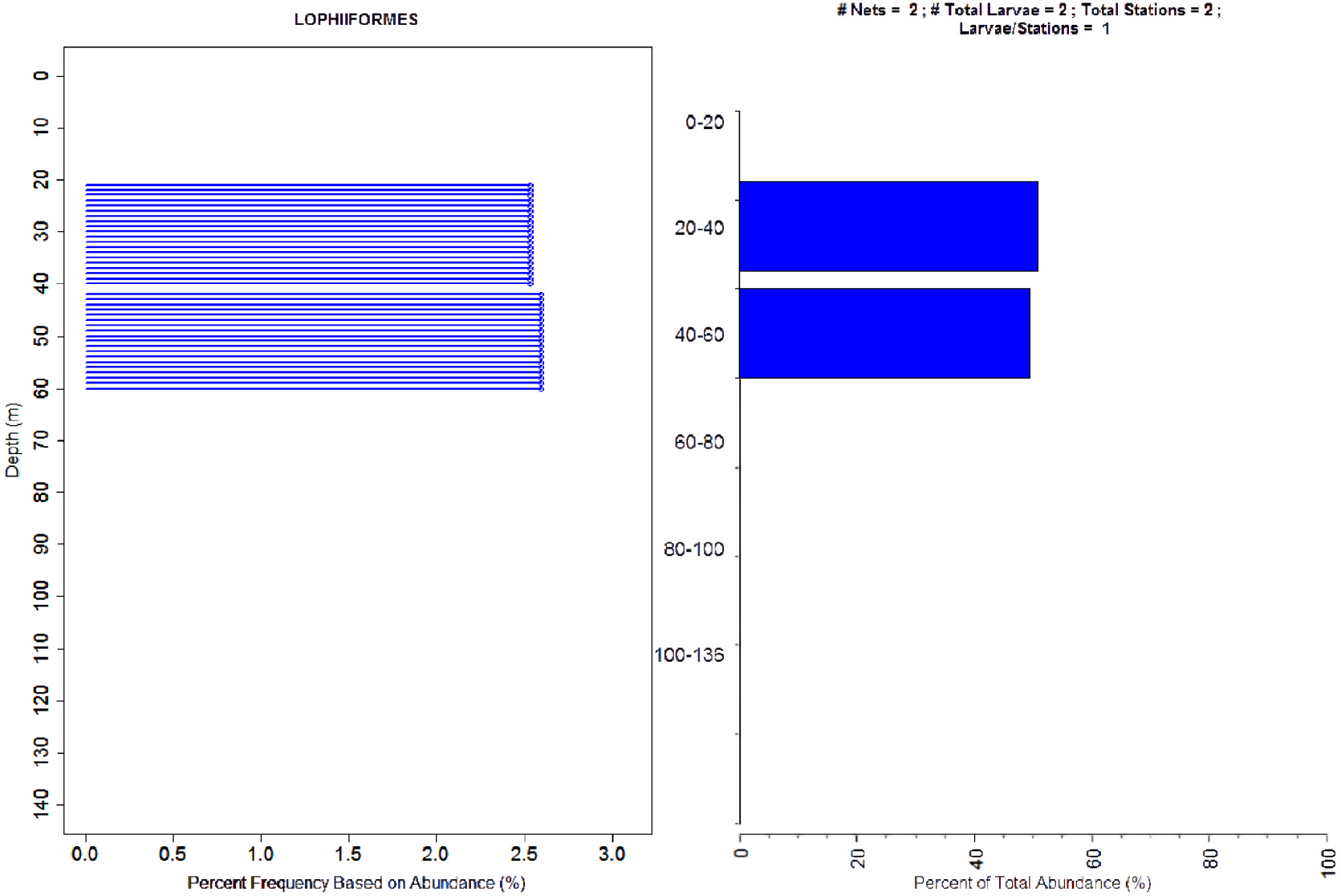
LOBIANCHIA



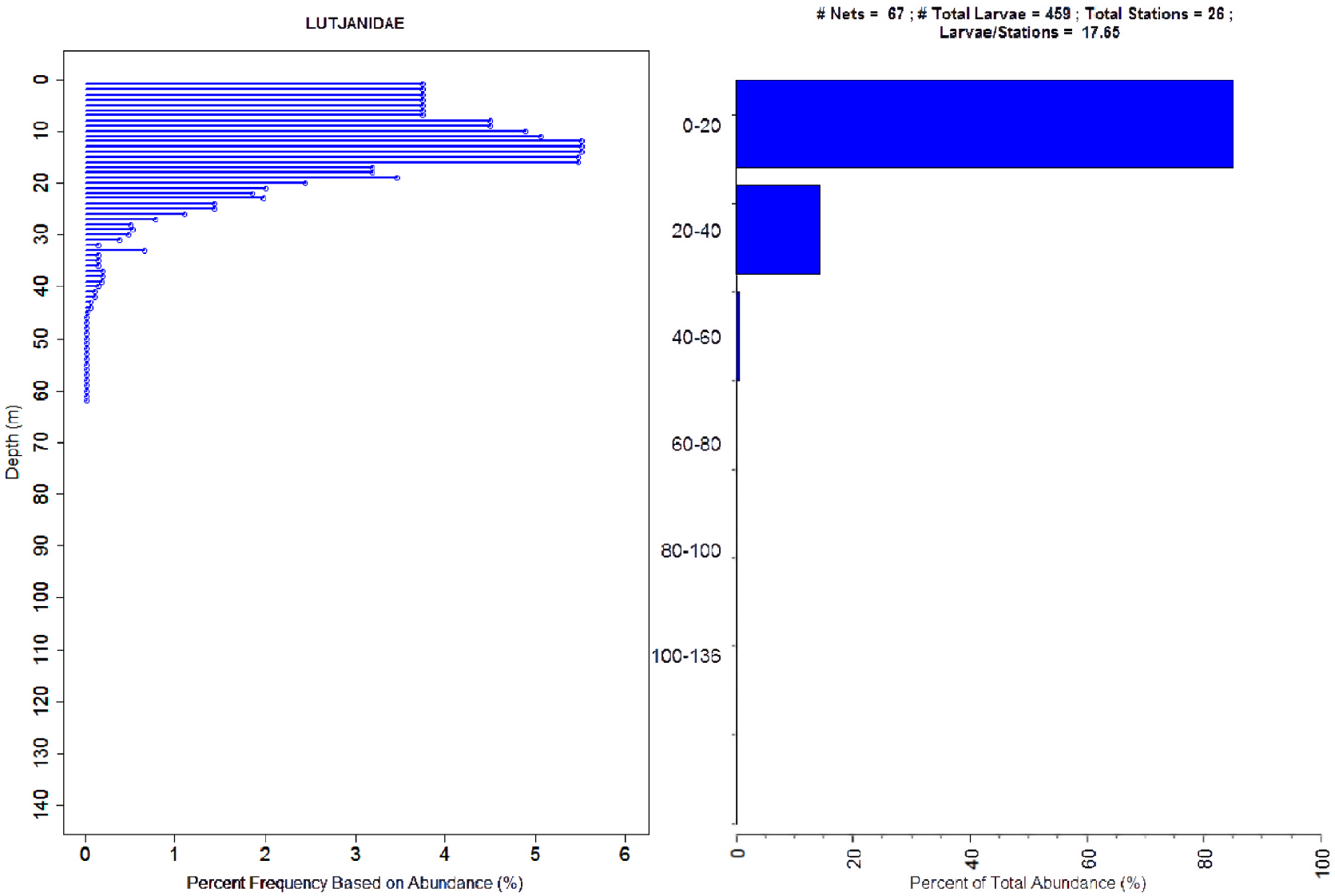
LOBOTES_SURINAMENSIS


LOPHIIDAE
Nets = 16 ; # Total Larvae = 24 ; Total Stations = 14 ;
Larvae/Stations = 1.71
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

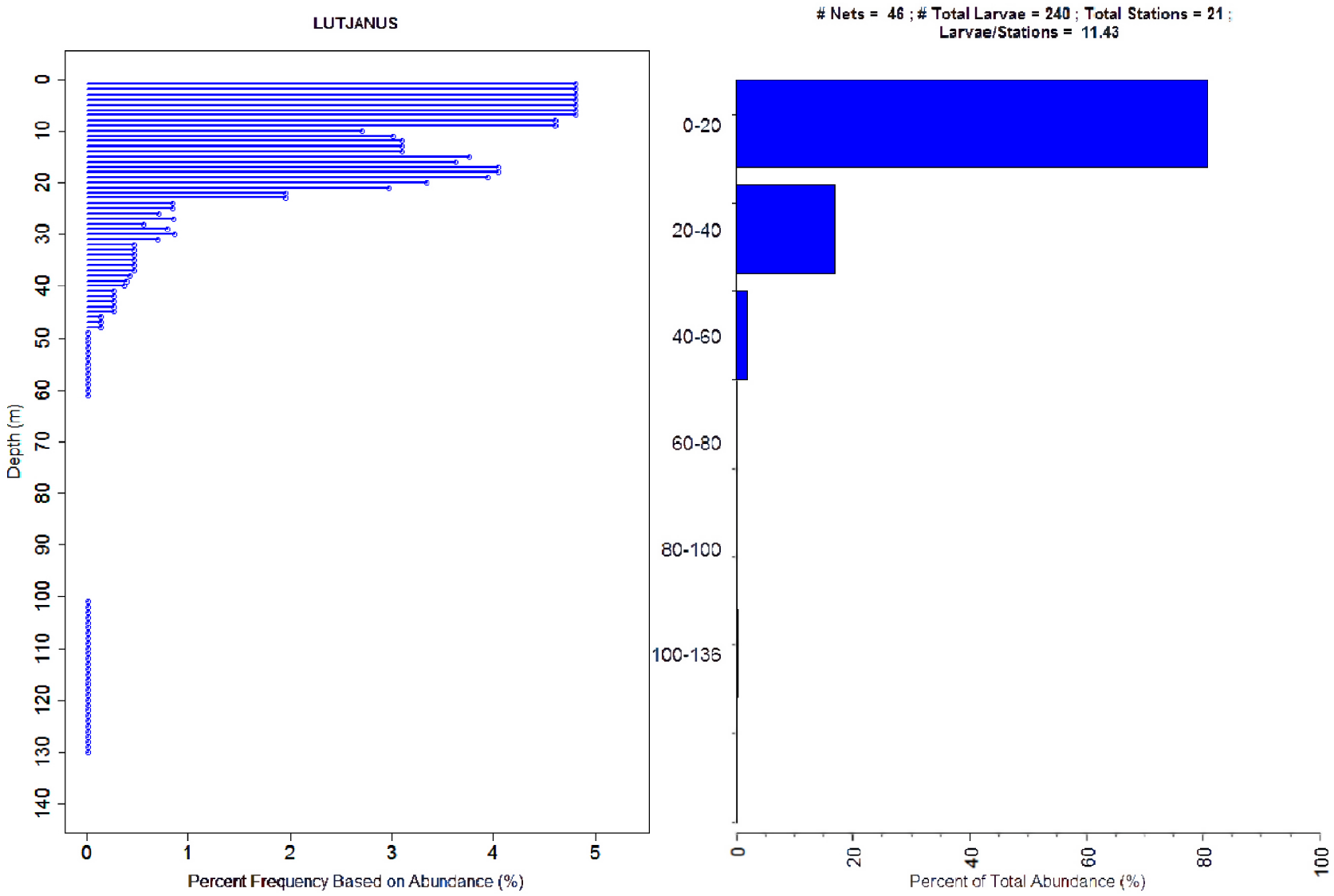
LOPHIIDAE



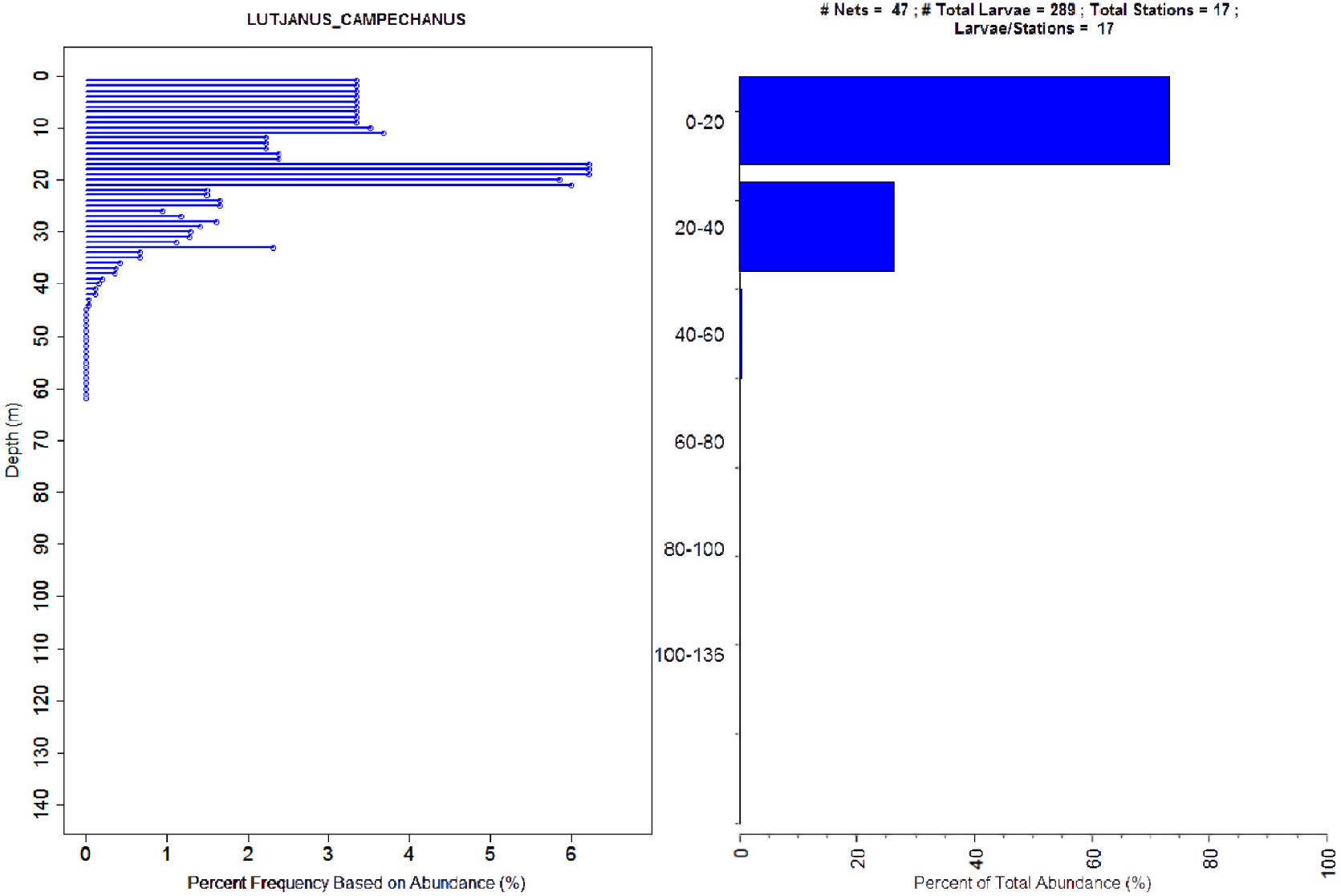
LOPHIIFORMES


LUTJANIDAE
Nets = 67 ; # Total Larvae = 459 ; Total Stations = 26 ;
Larvae/Stations = 17.65
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

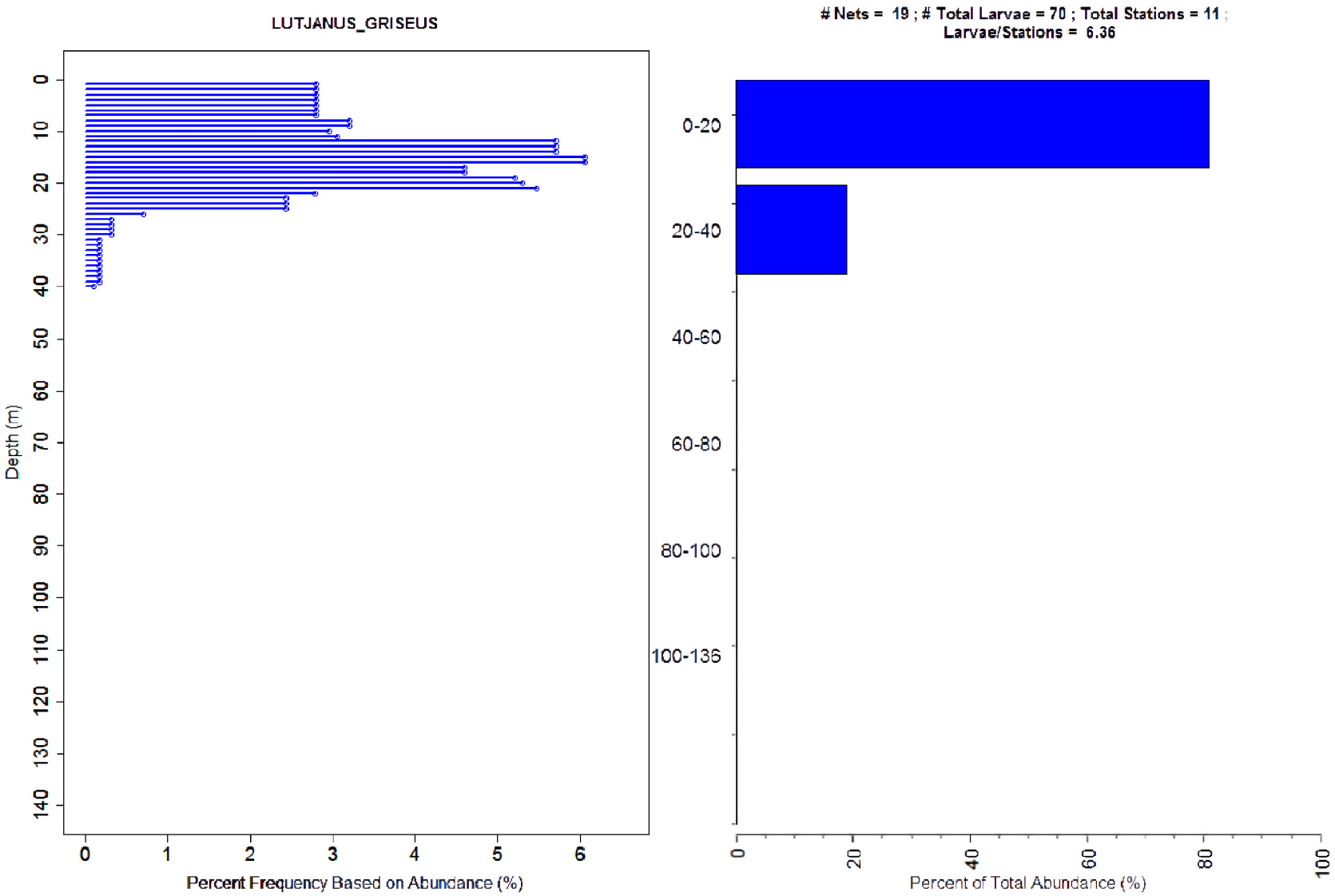
LUTJANIDAE


LUTJANUS
Nets = 46 ; # Total Larvae = 240 ; Total Stations = 21 ;
Larvae/Stations = 11.43
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

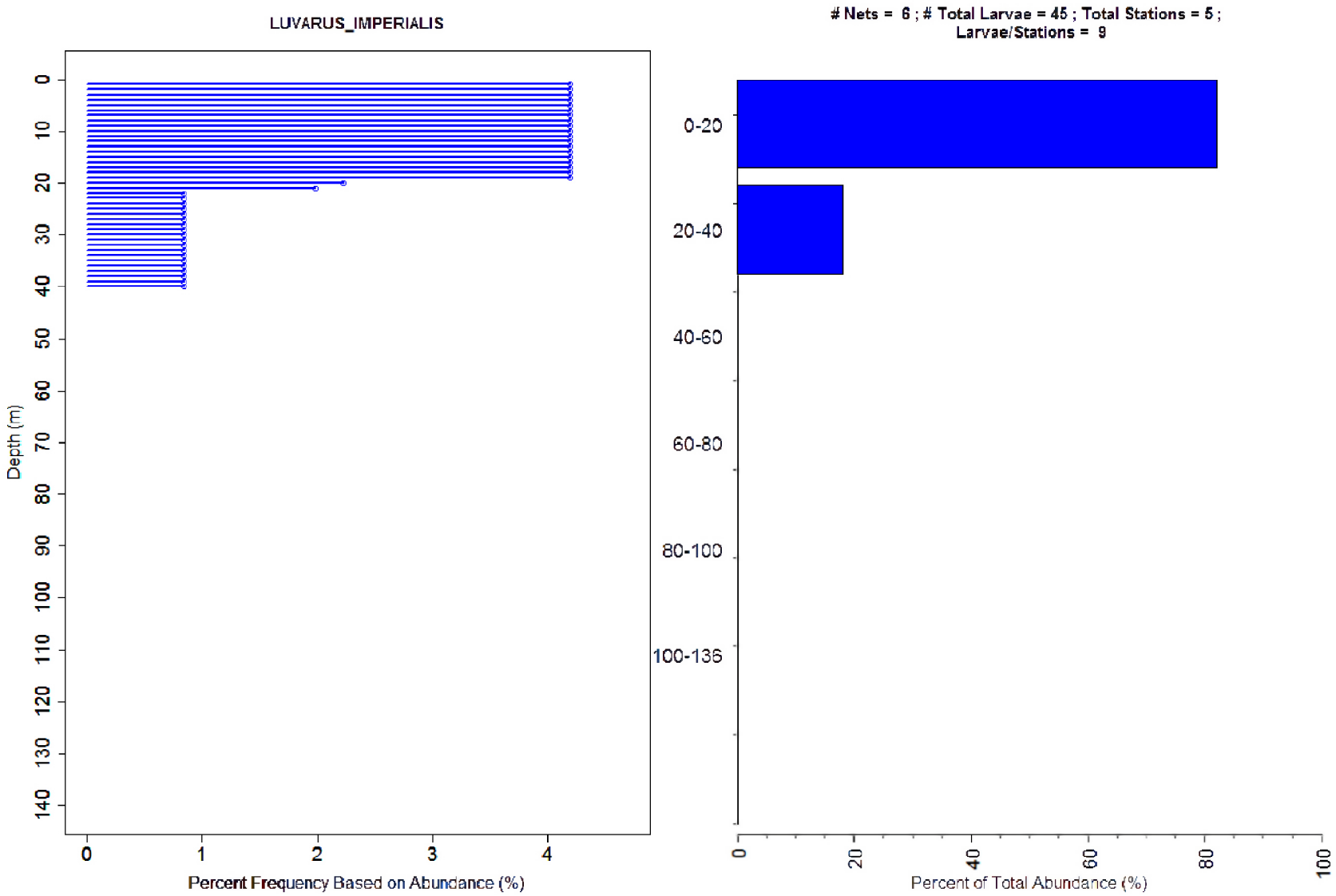
LUTJANUS



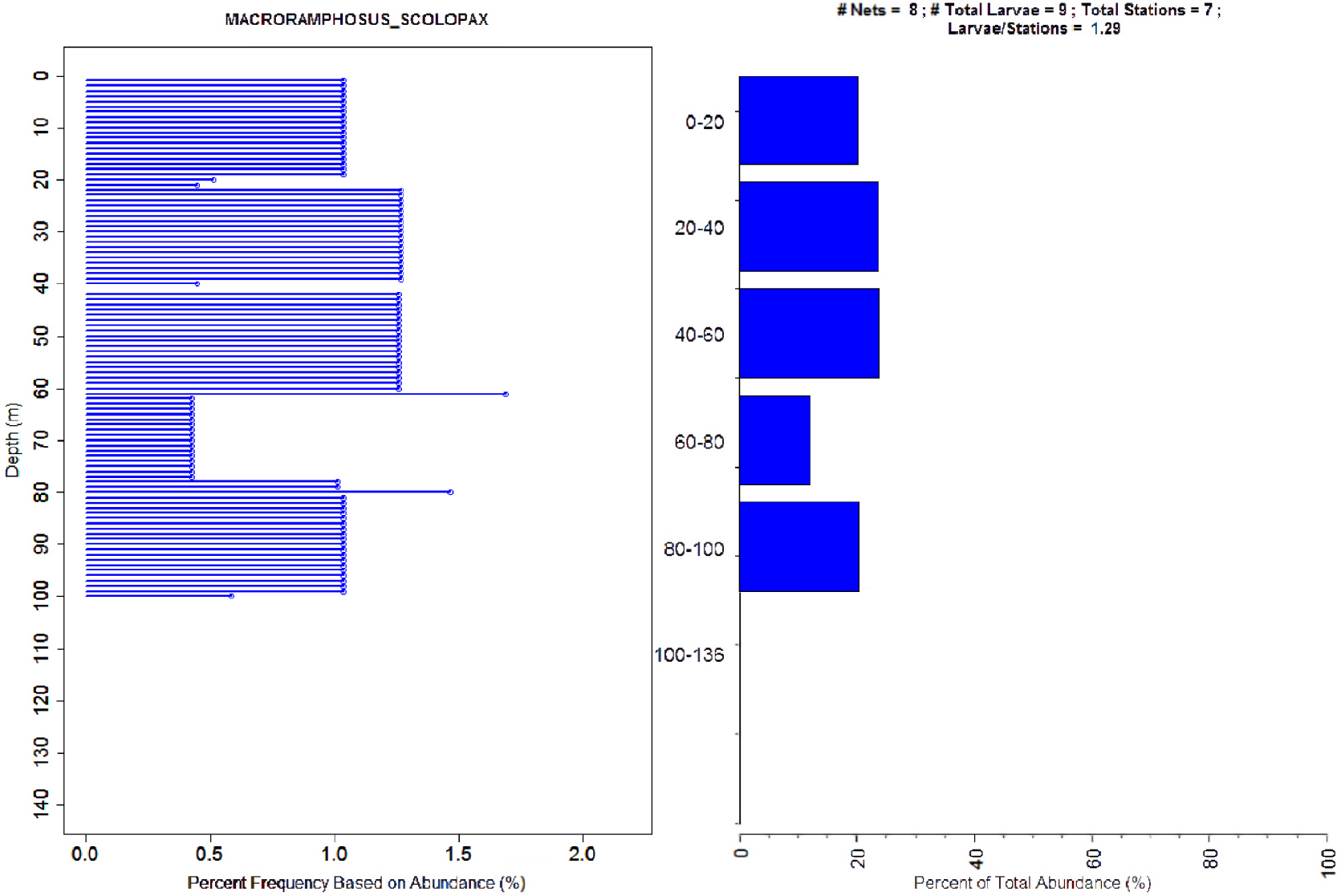
LUTJANUS_CAMPECHANUS



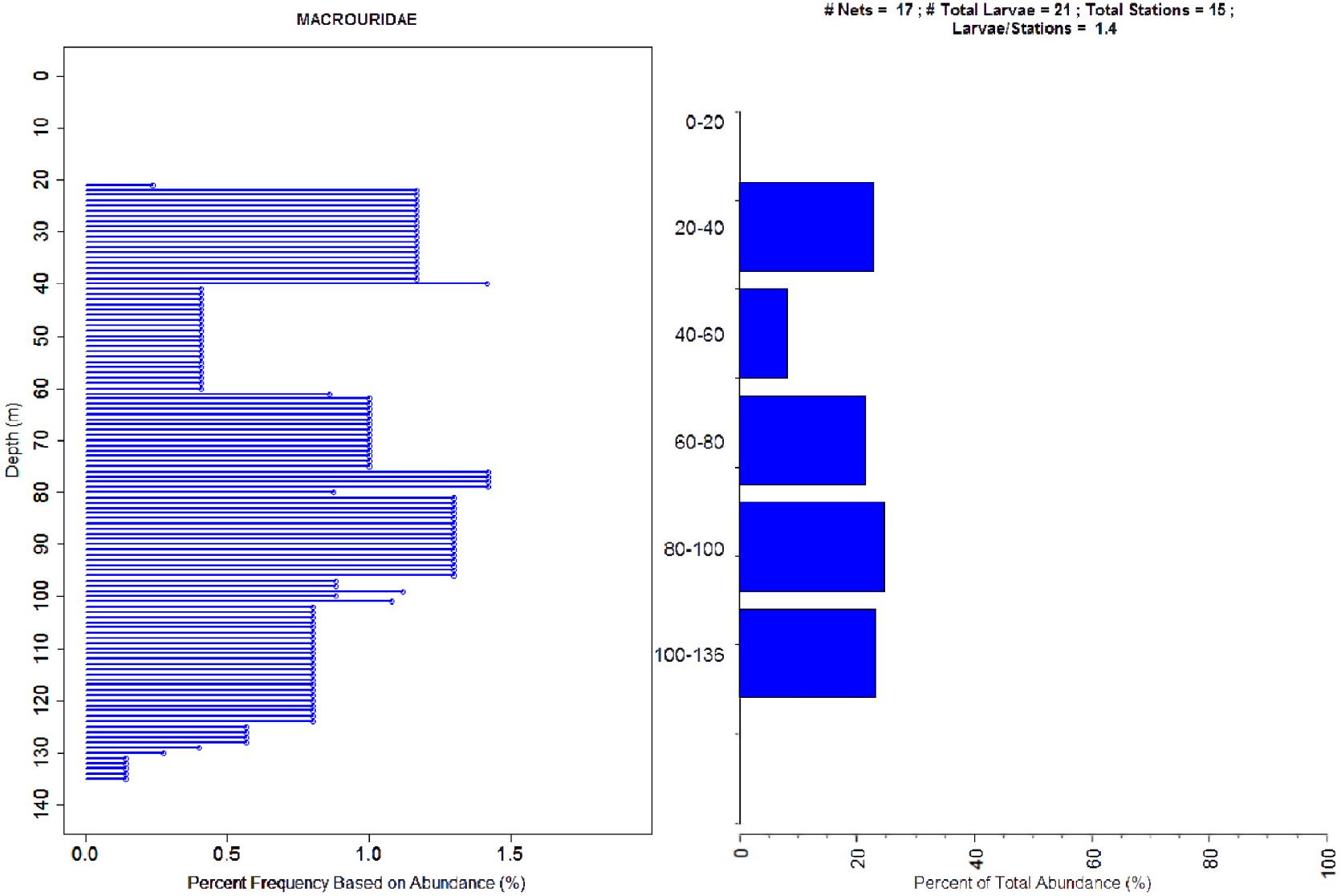
LUTJANUS_GRISEUS



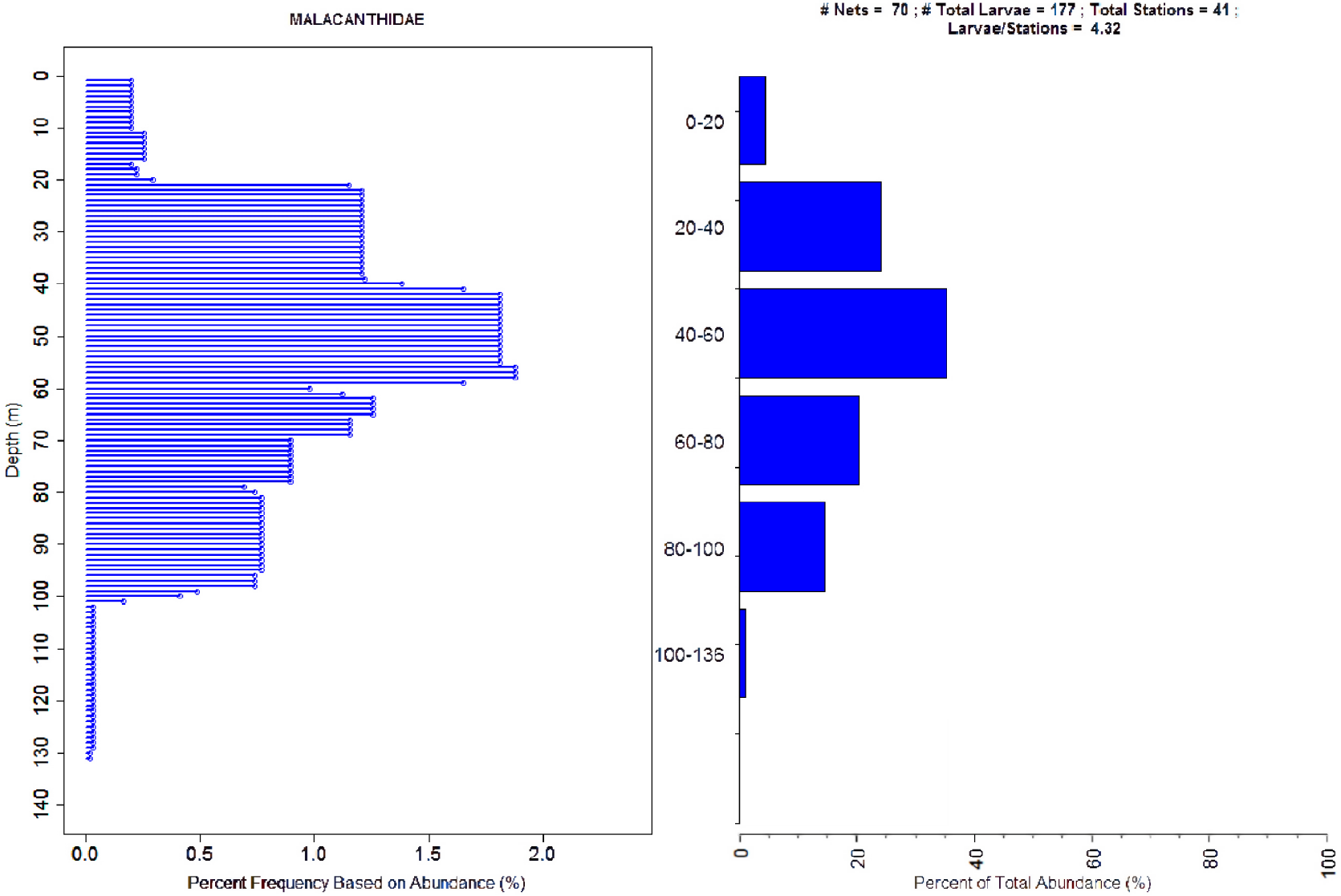
LUVARUS_IMPERIALIS



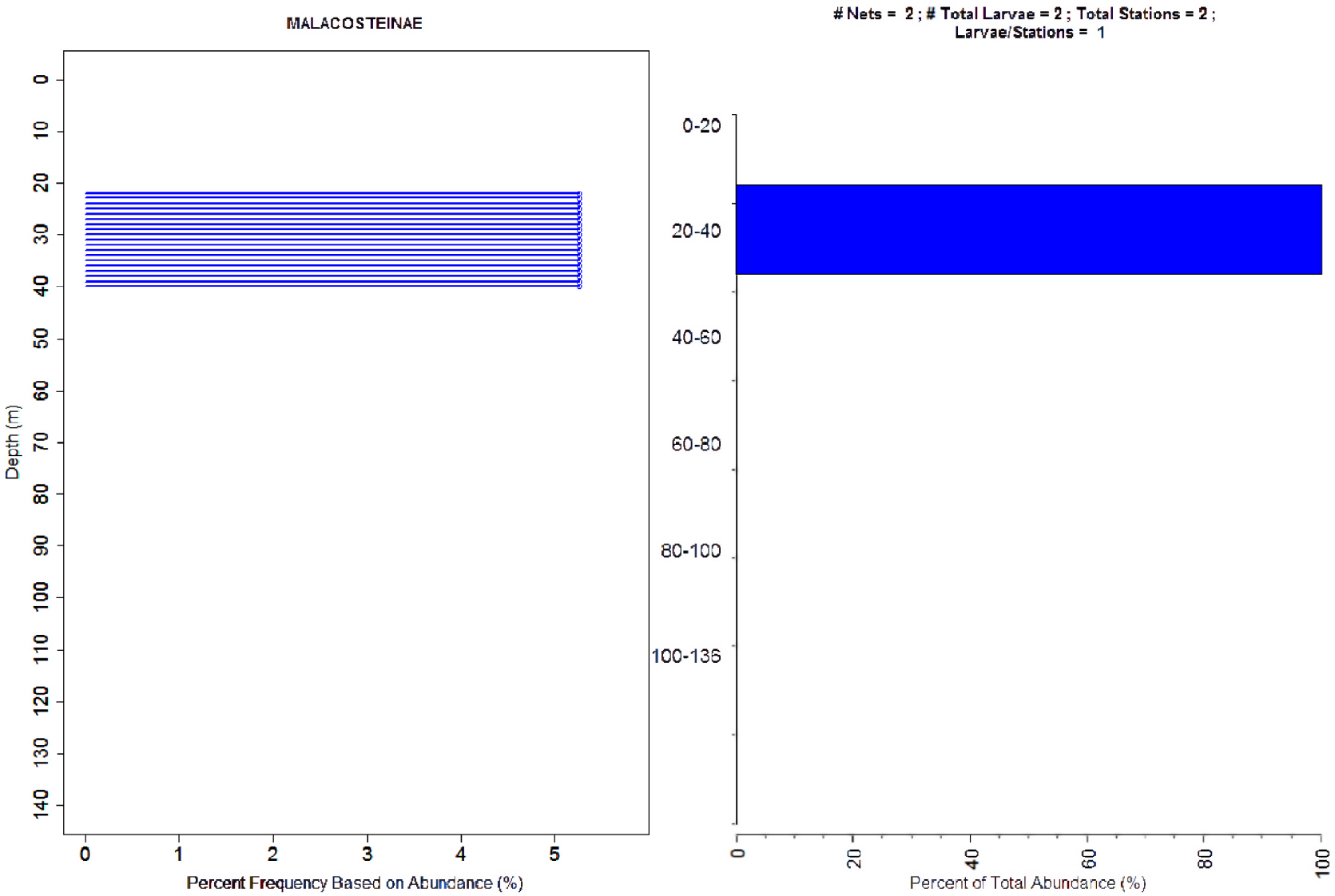
MACRORAMPHOSUS_SCOLOPAX



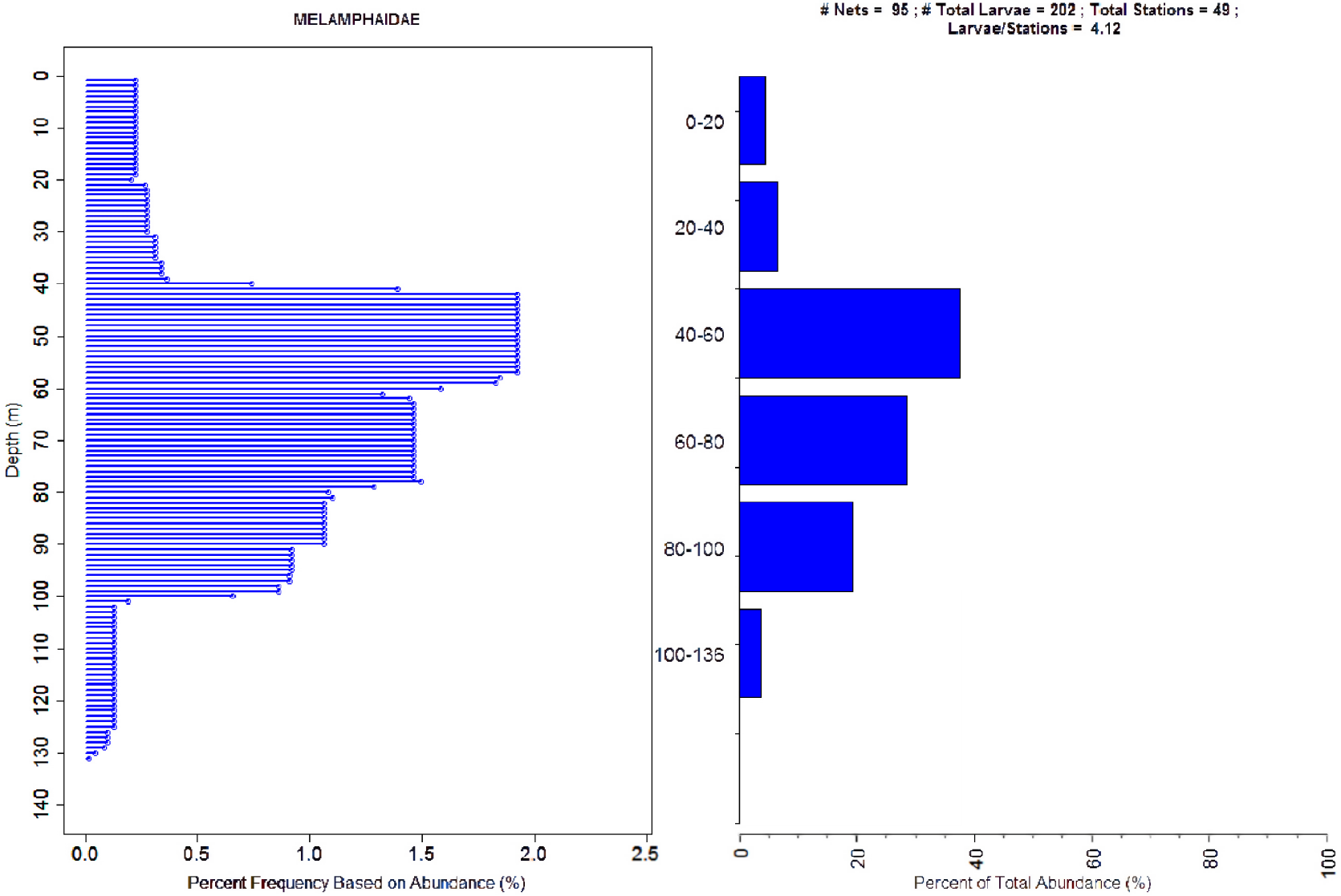
MACROURIDAE



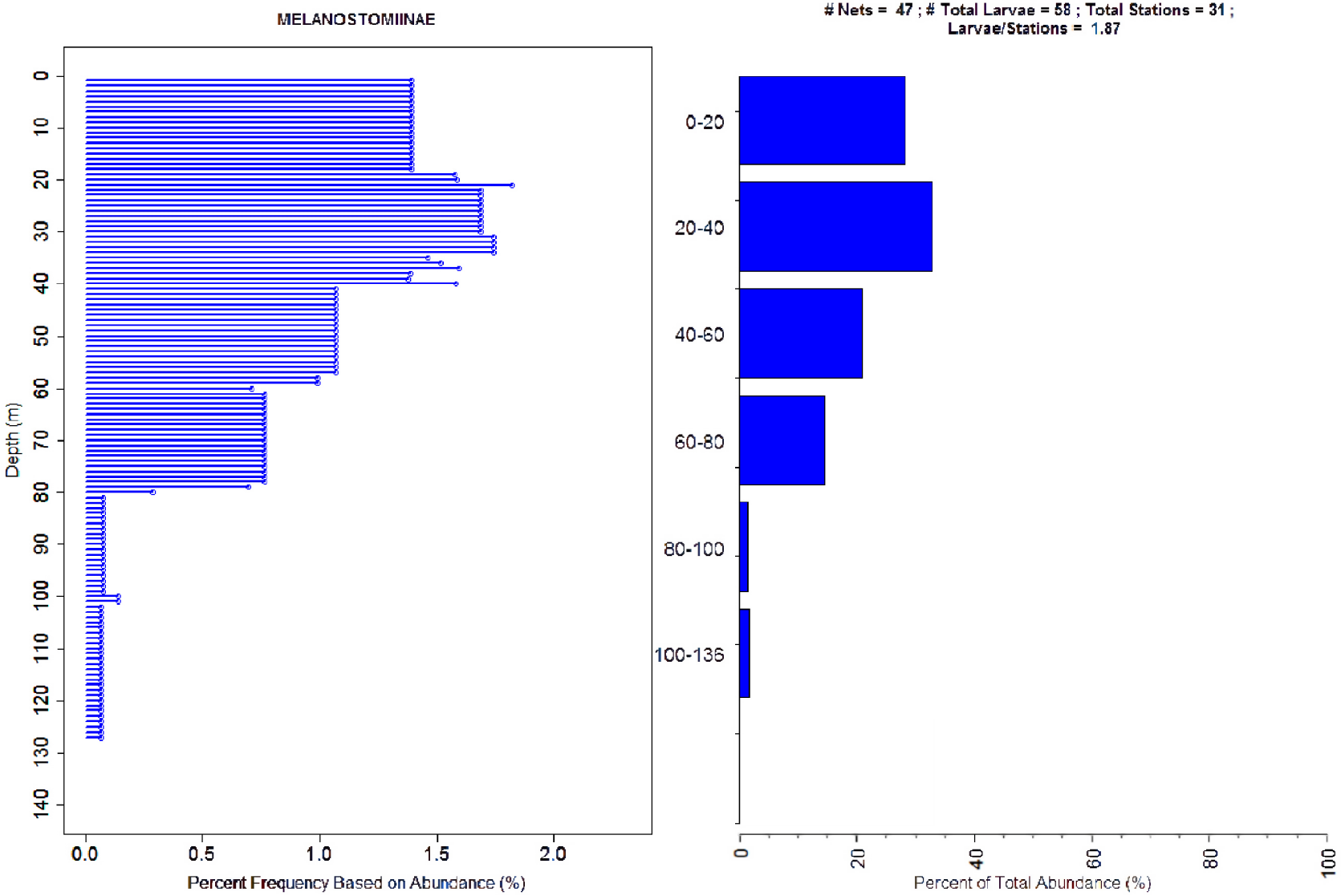
MALACANTHIDAE



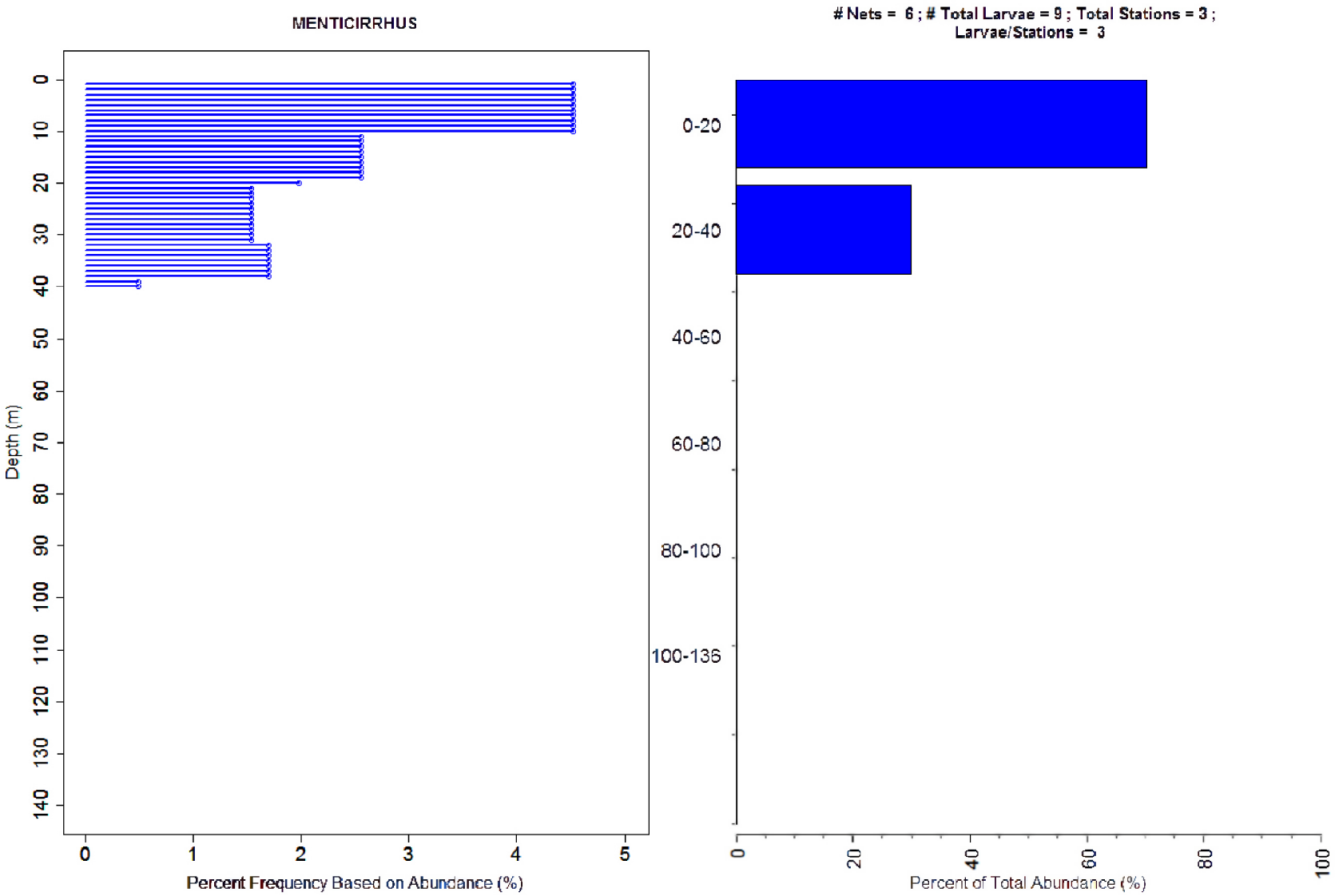
MALACOSTEINAE



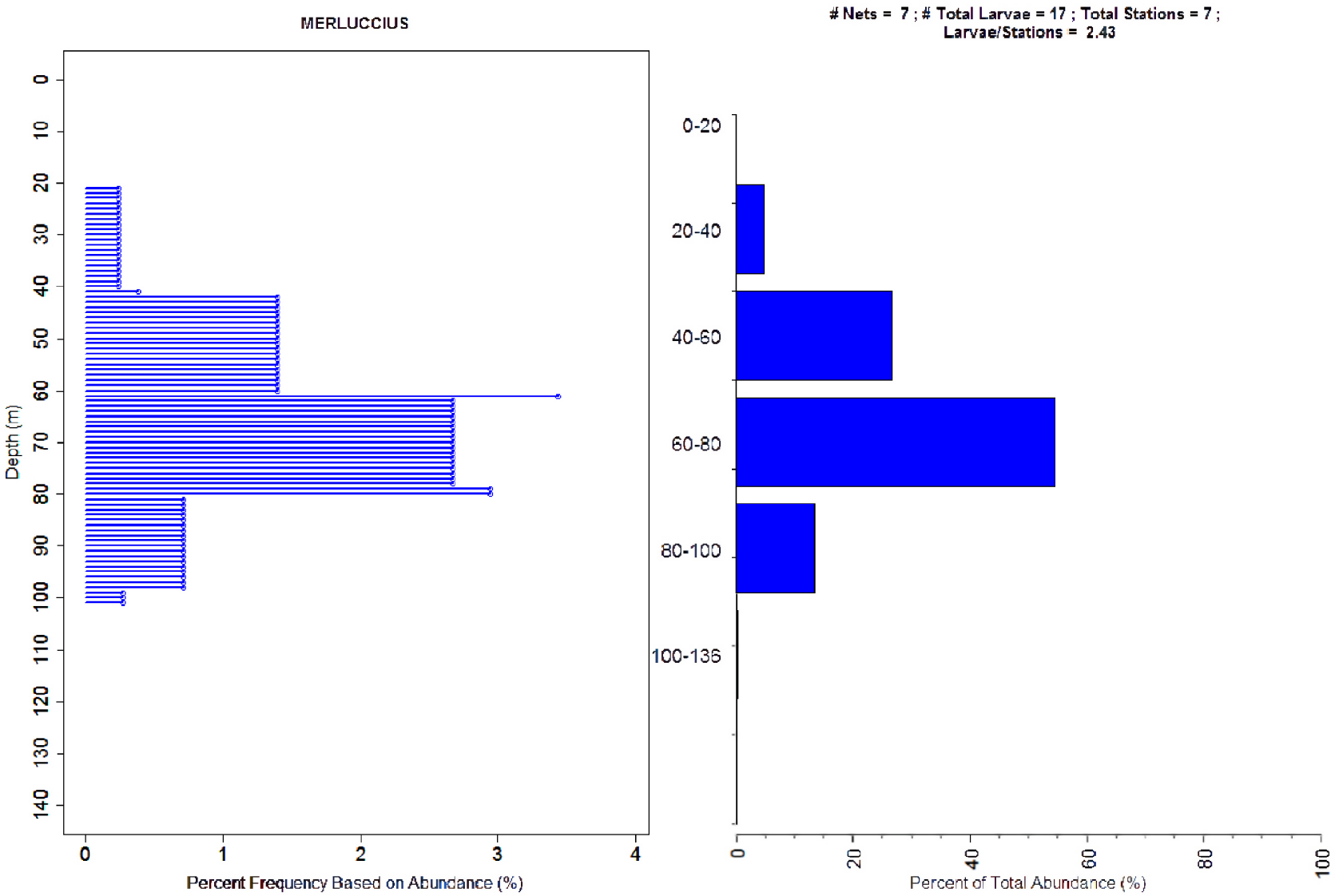
MELAMPHAIDAE



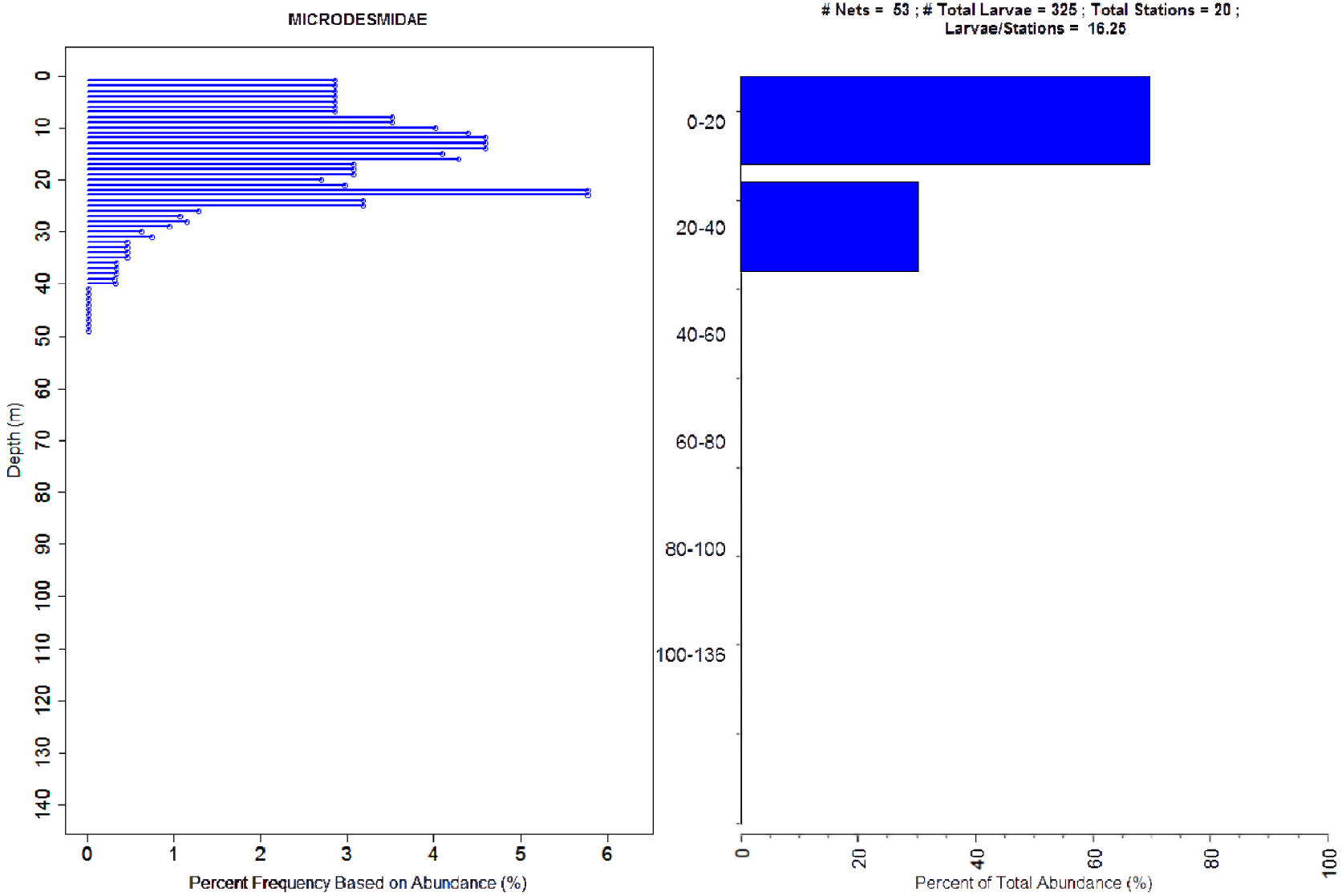
MELANOSTOMIINAE



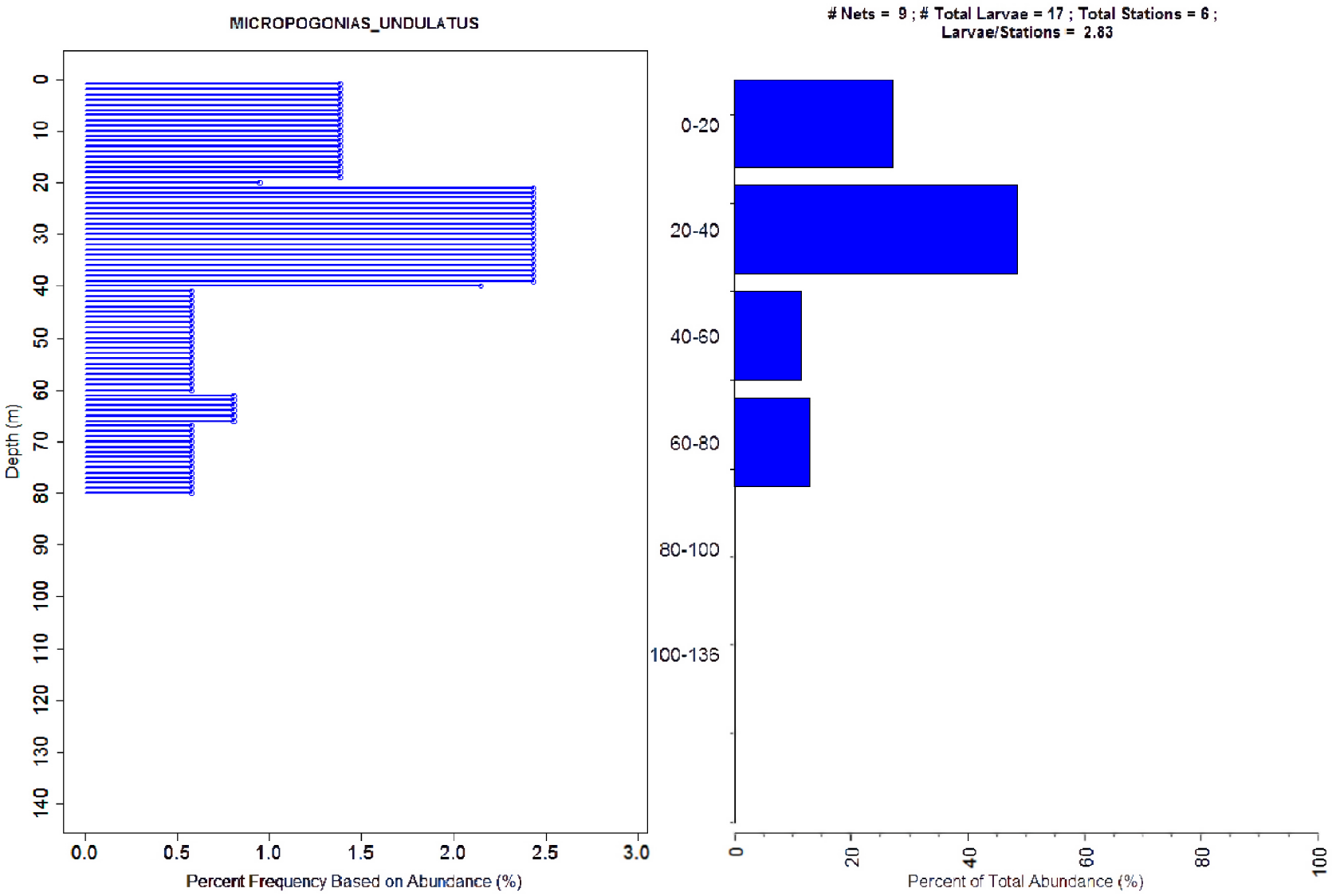
MENTICIRRHUS


MERLUCCIUS
Nets = 7 ; # Total Larvae = 17 ; Total Stations = 7 ;
Larvae/Stations = 2.43
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

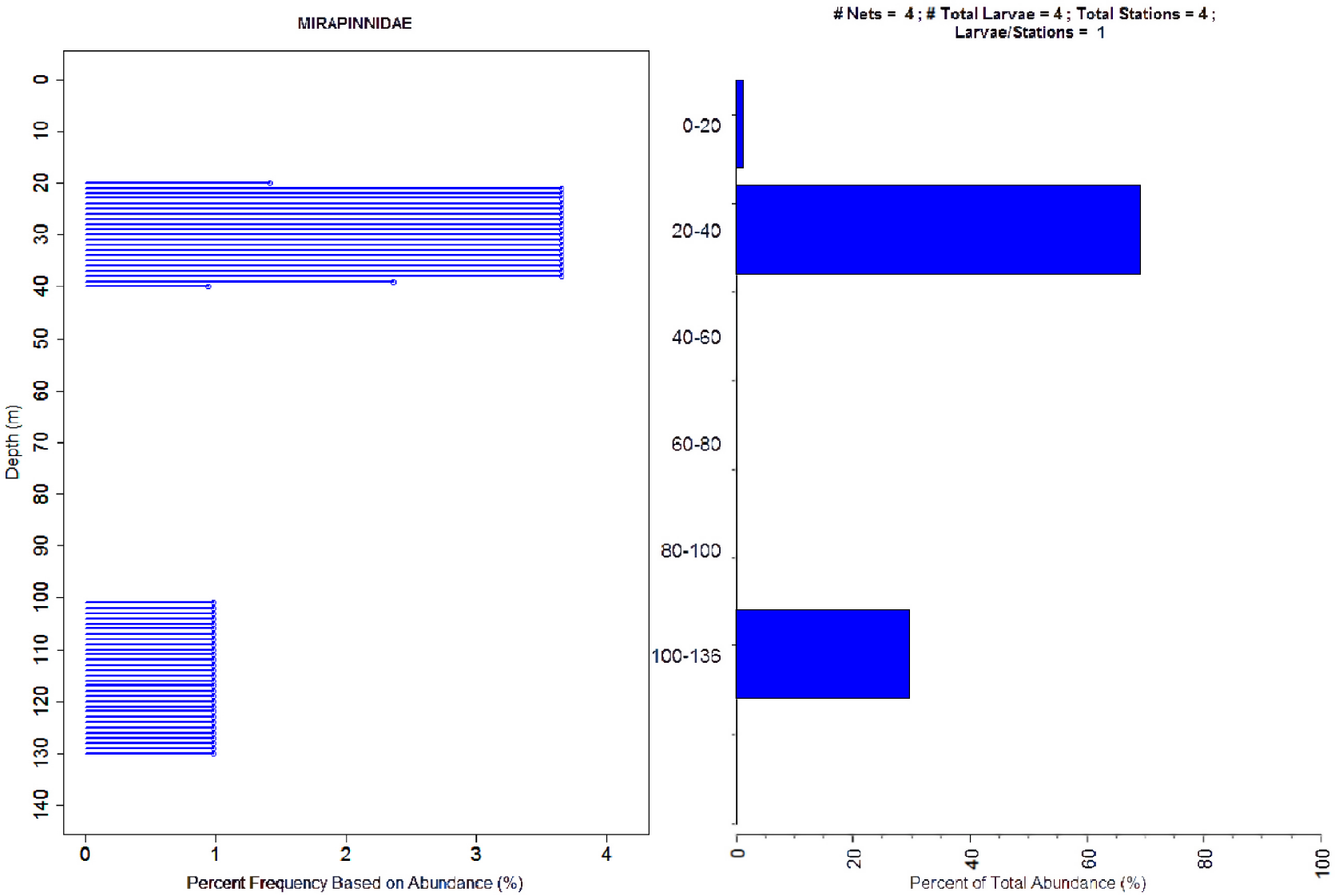
MERLUCCIUS



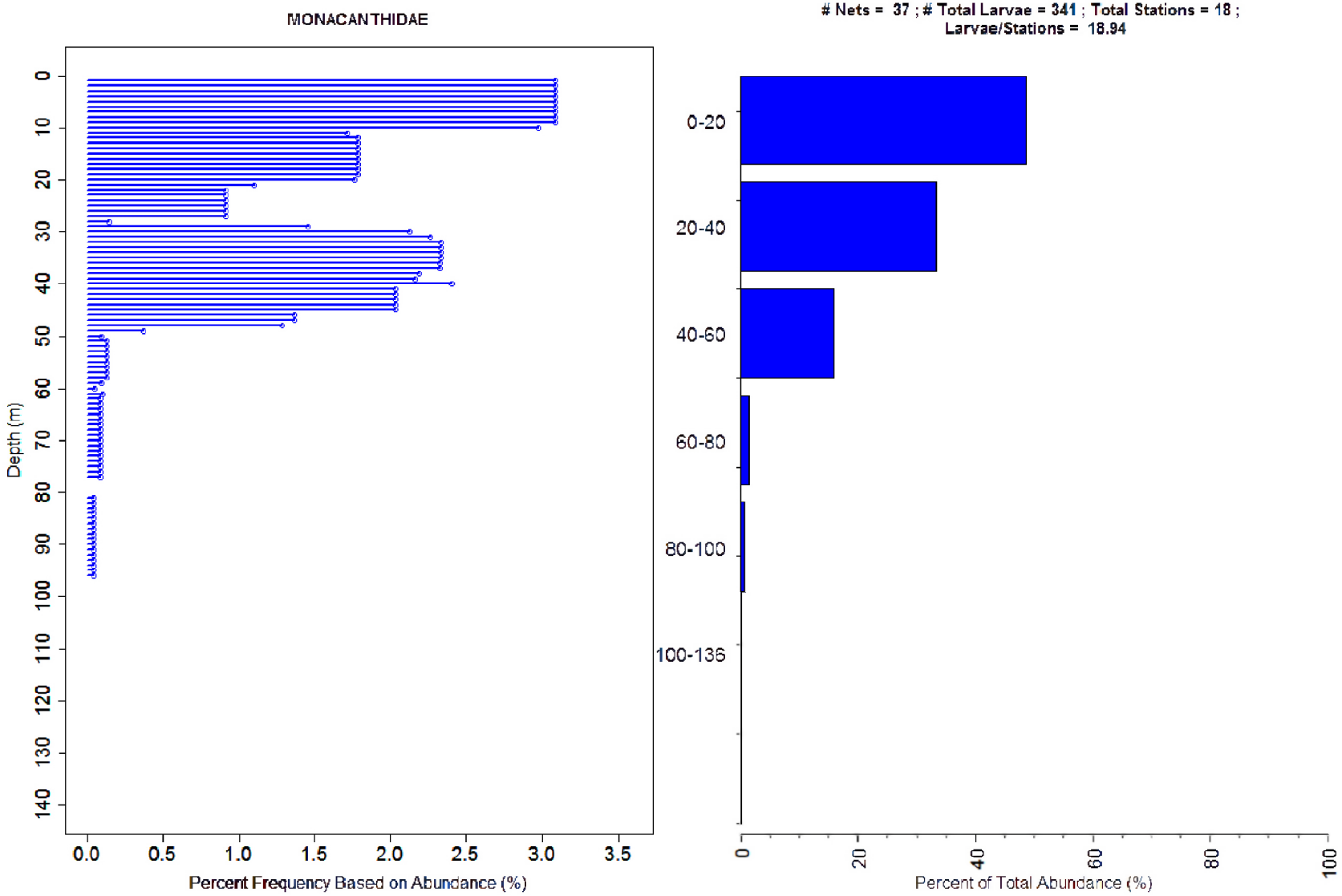
MICRODESMIDAE



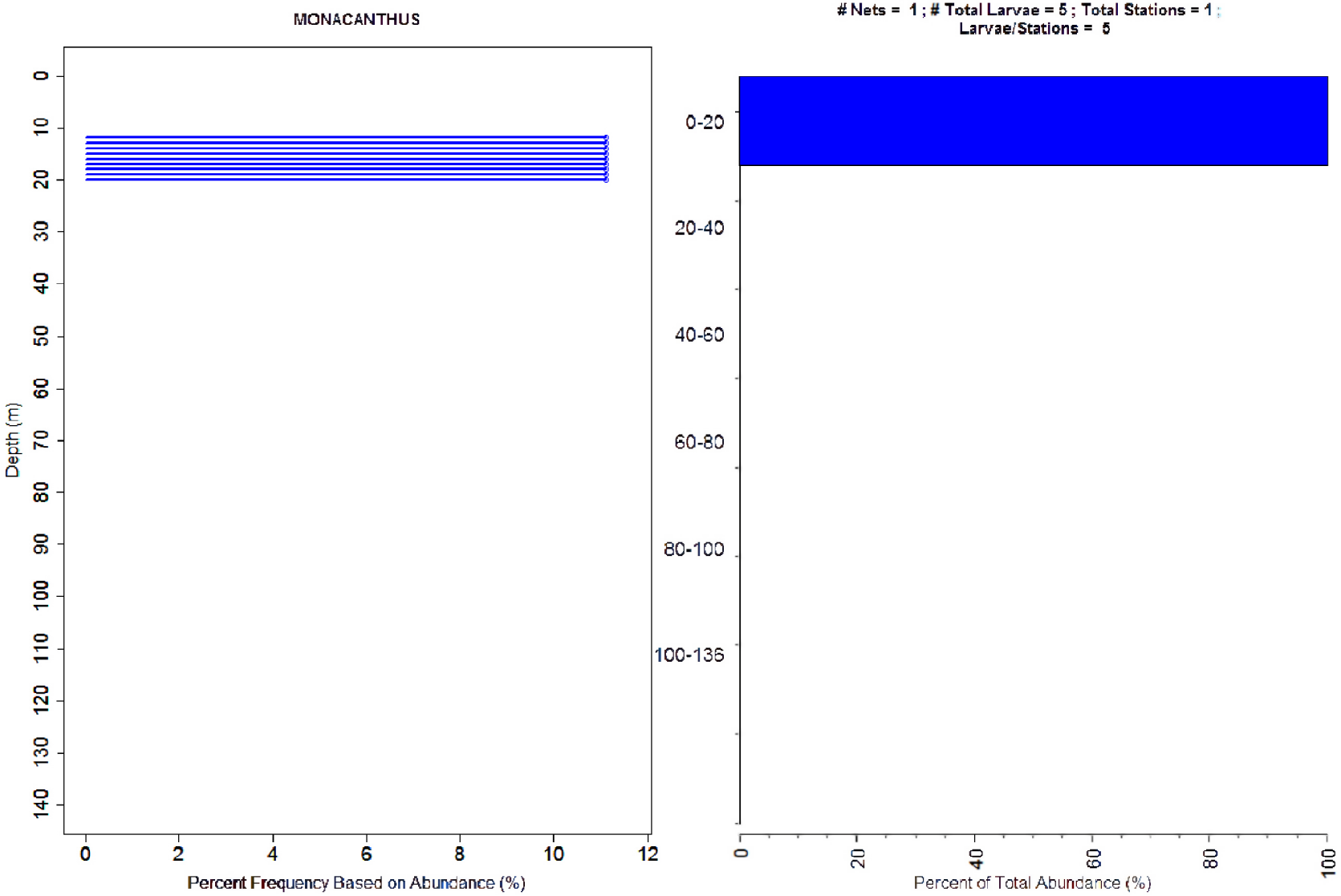
MICROPOGONIAS_UNDULATUS



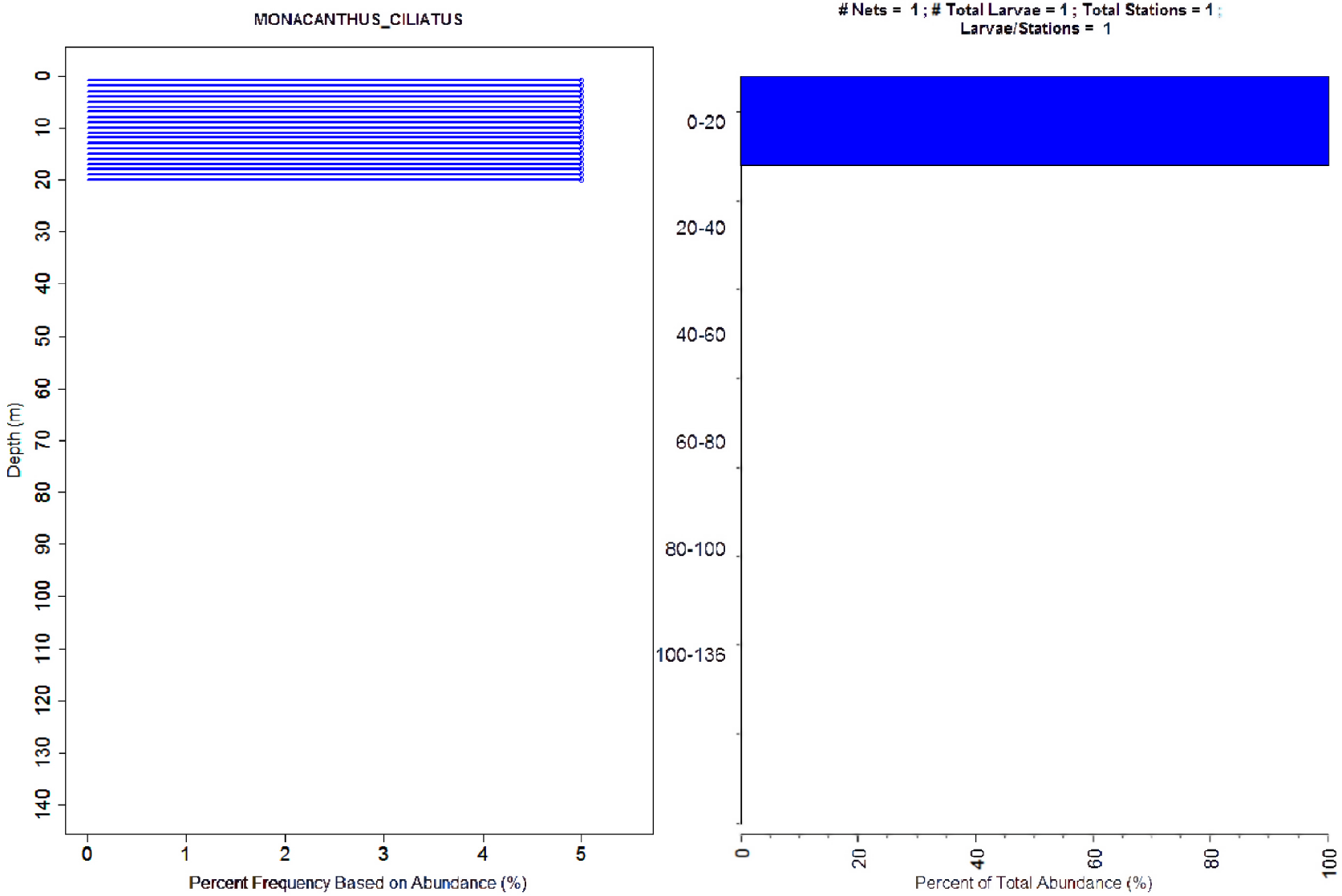
MIRAPINNIDAE



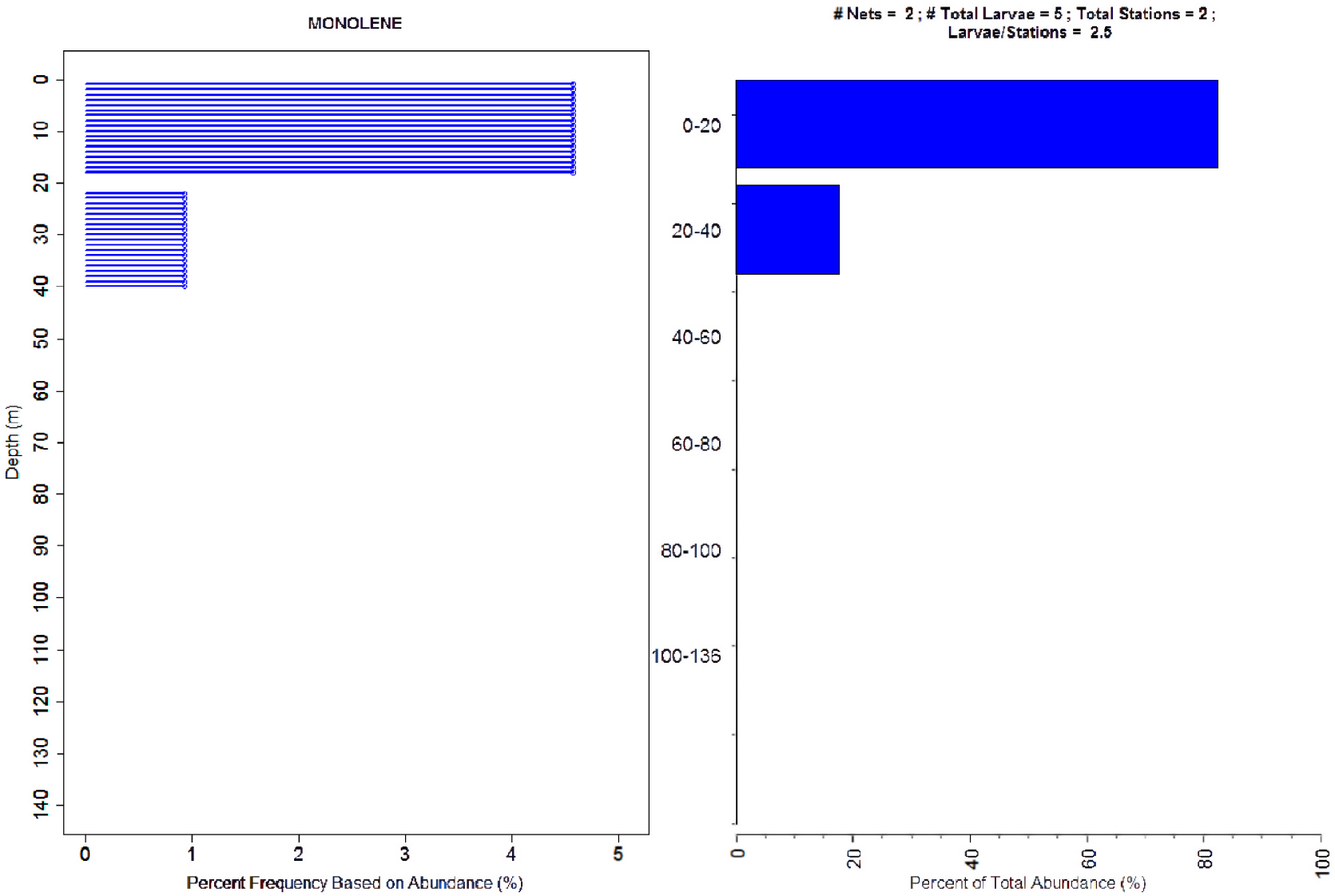
MONACANTHIDAE



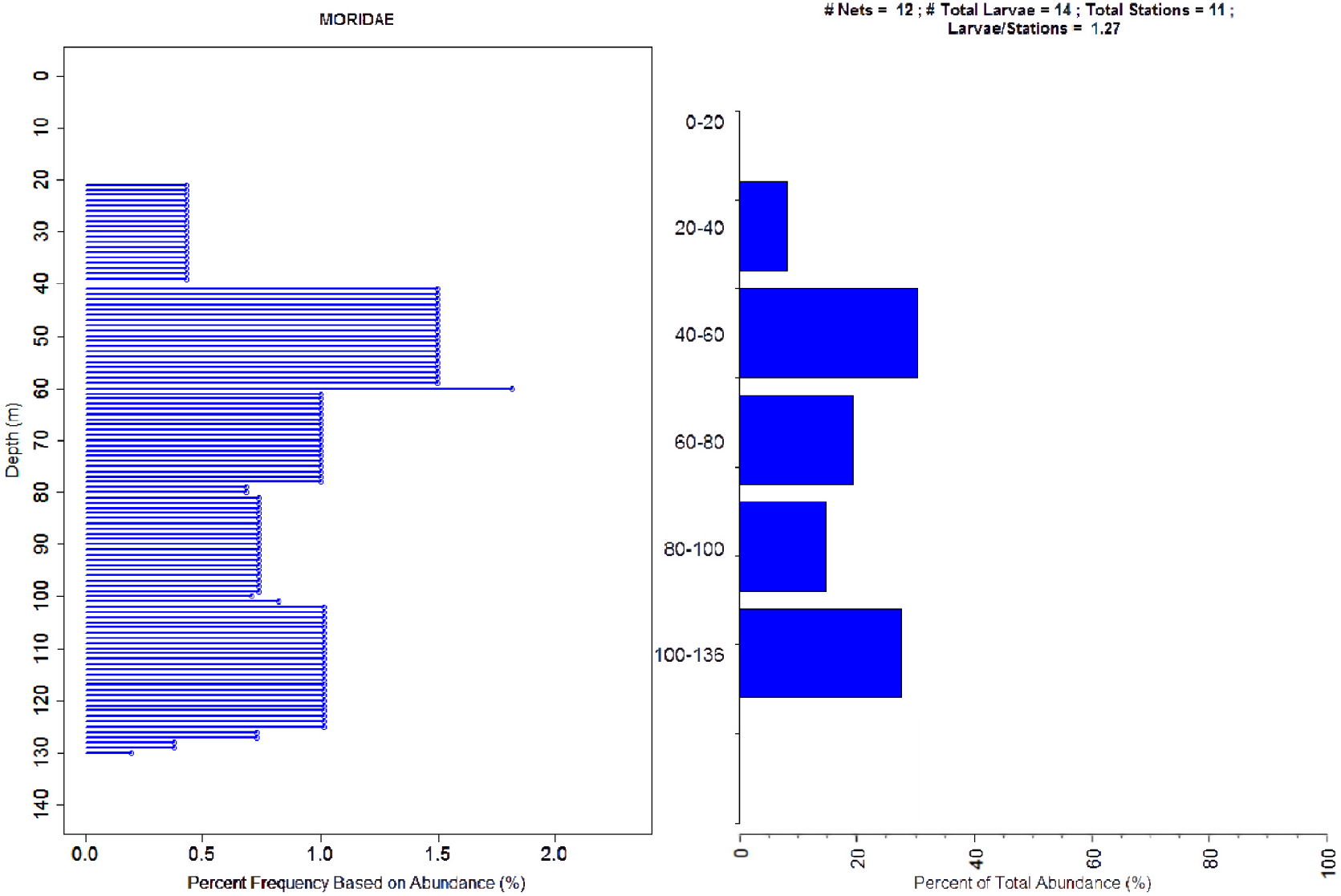
MONACANTHUS



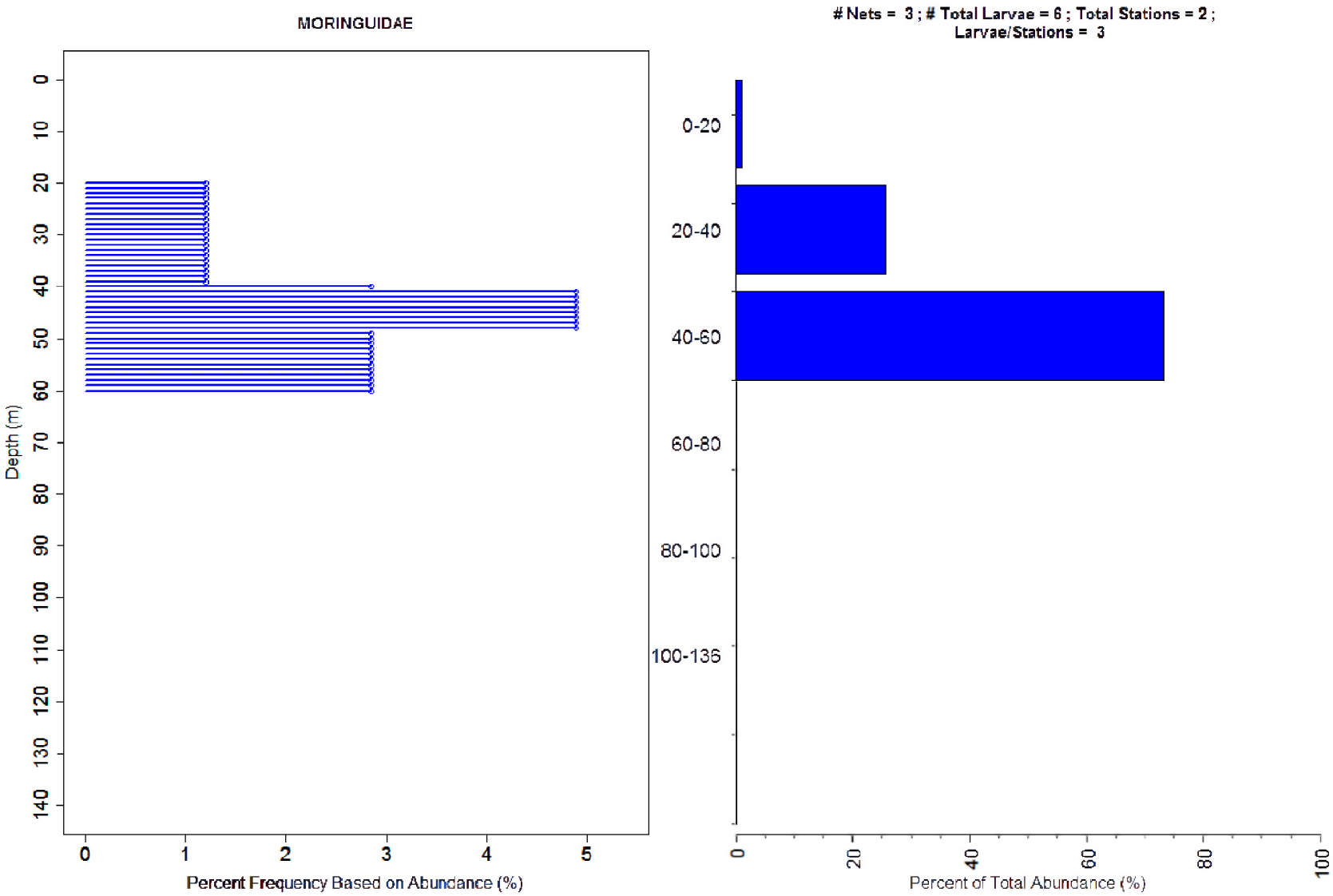
MONACANTHUS_CILIATUS


MONOLENE
Nets = 2 ; # Total Larvae = 5 ; Total Stations = 2 ;
Larvae/Stations = 2.5
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

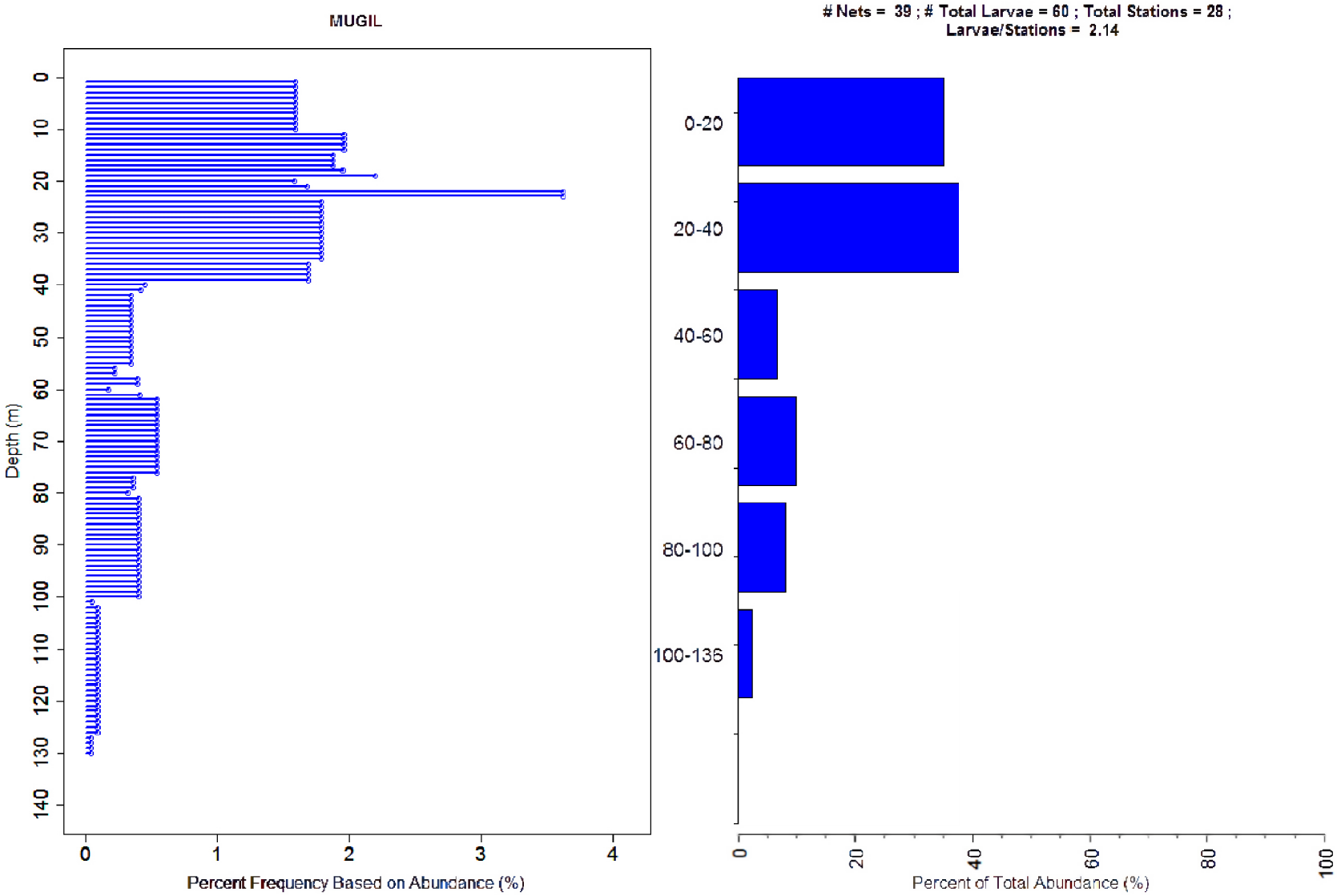
MONOLENE


MORIDAE
Nets = 12 ; # Total Larvae = 14 ; Total Stations = 11 ;
Larvae/Stations = 1.27
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

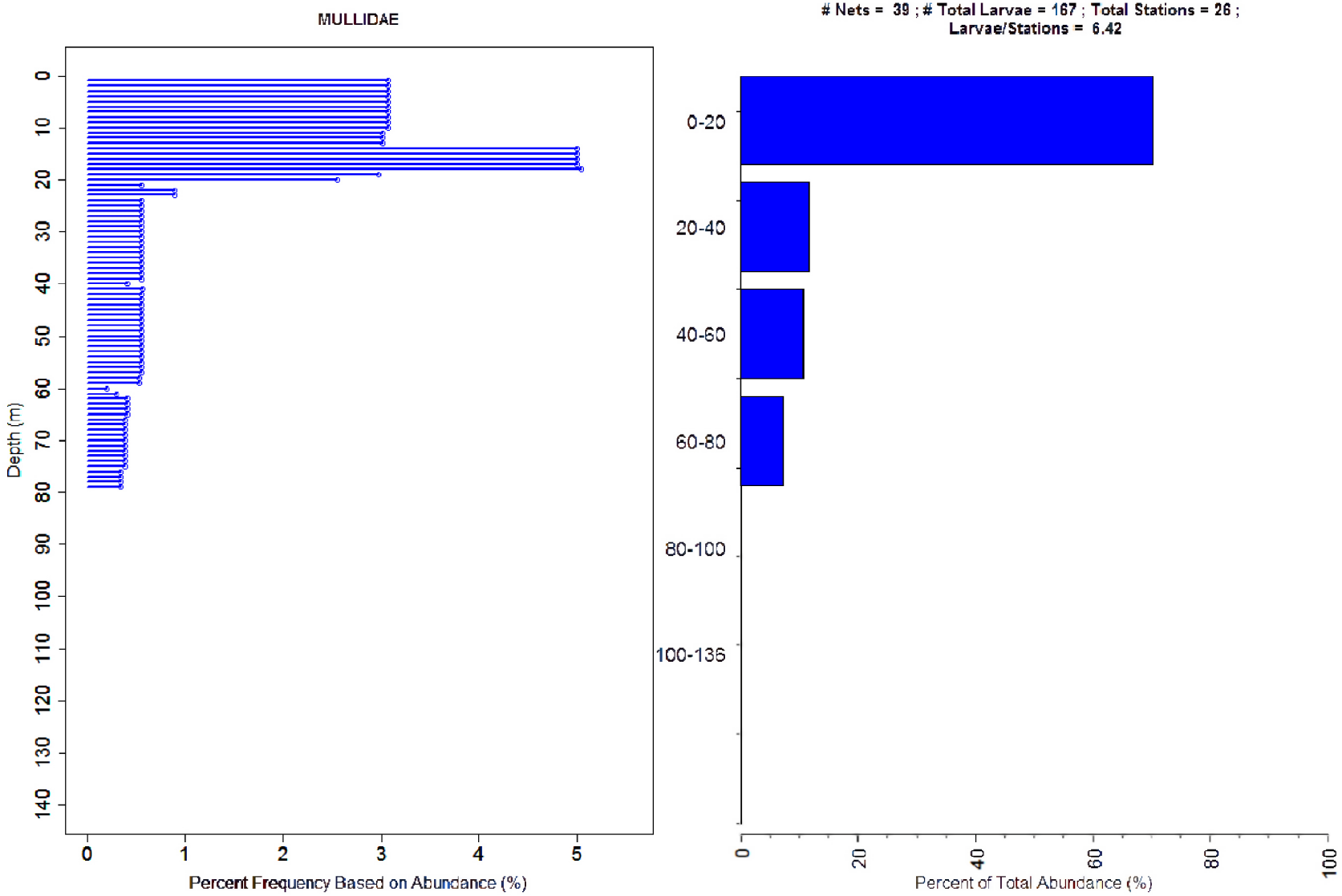
MORIDAE



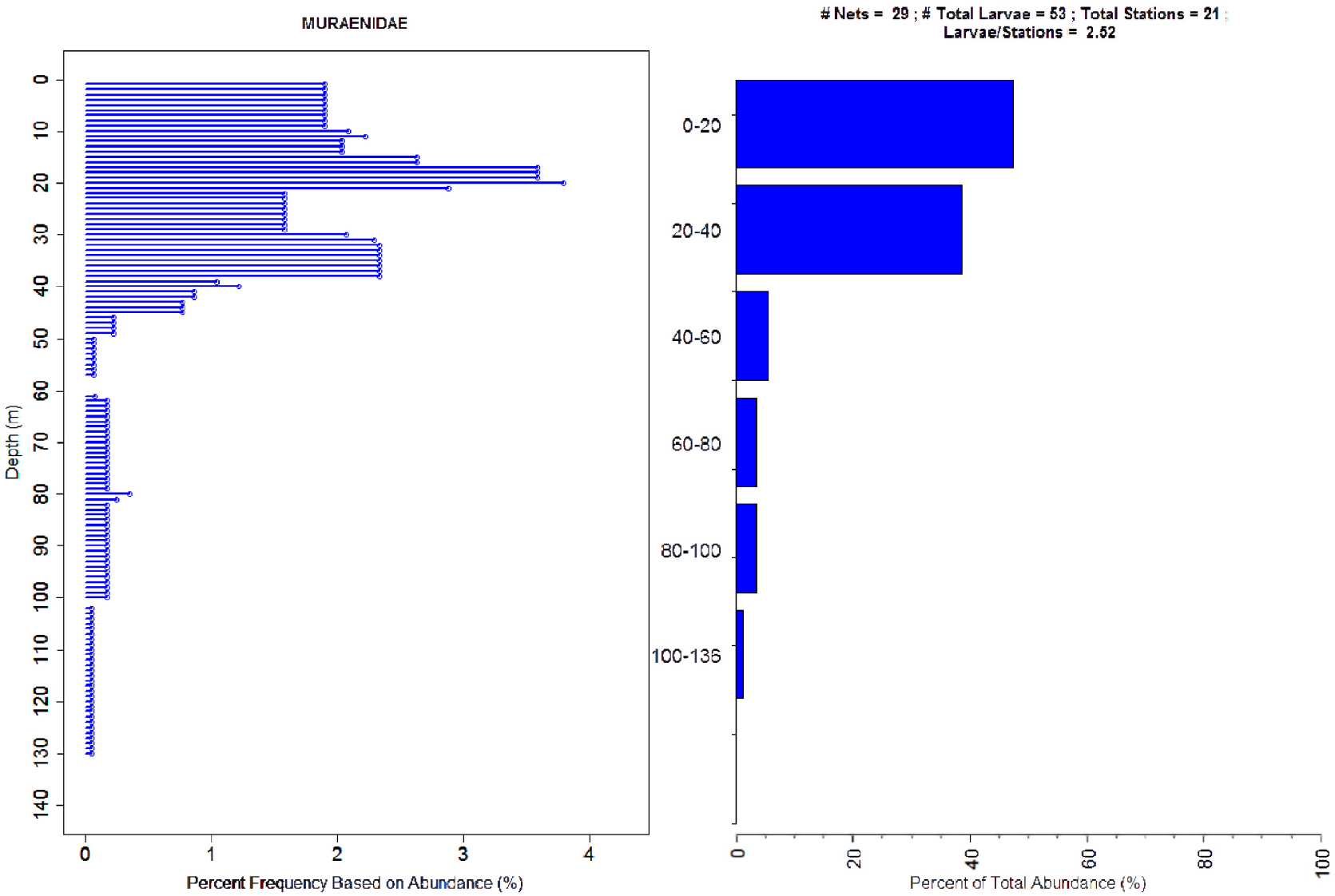
MORINGUIDAE


MUGIL
Nets = 39 ; # Total Larvae = 60 ; Total Stations = 28 ;
Larvae/Stations = 2.14
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

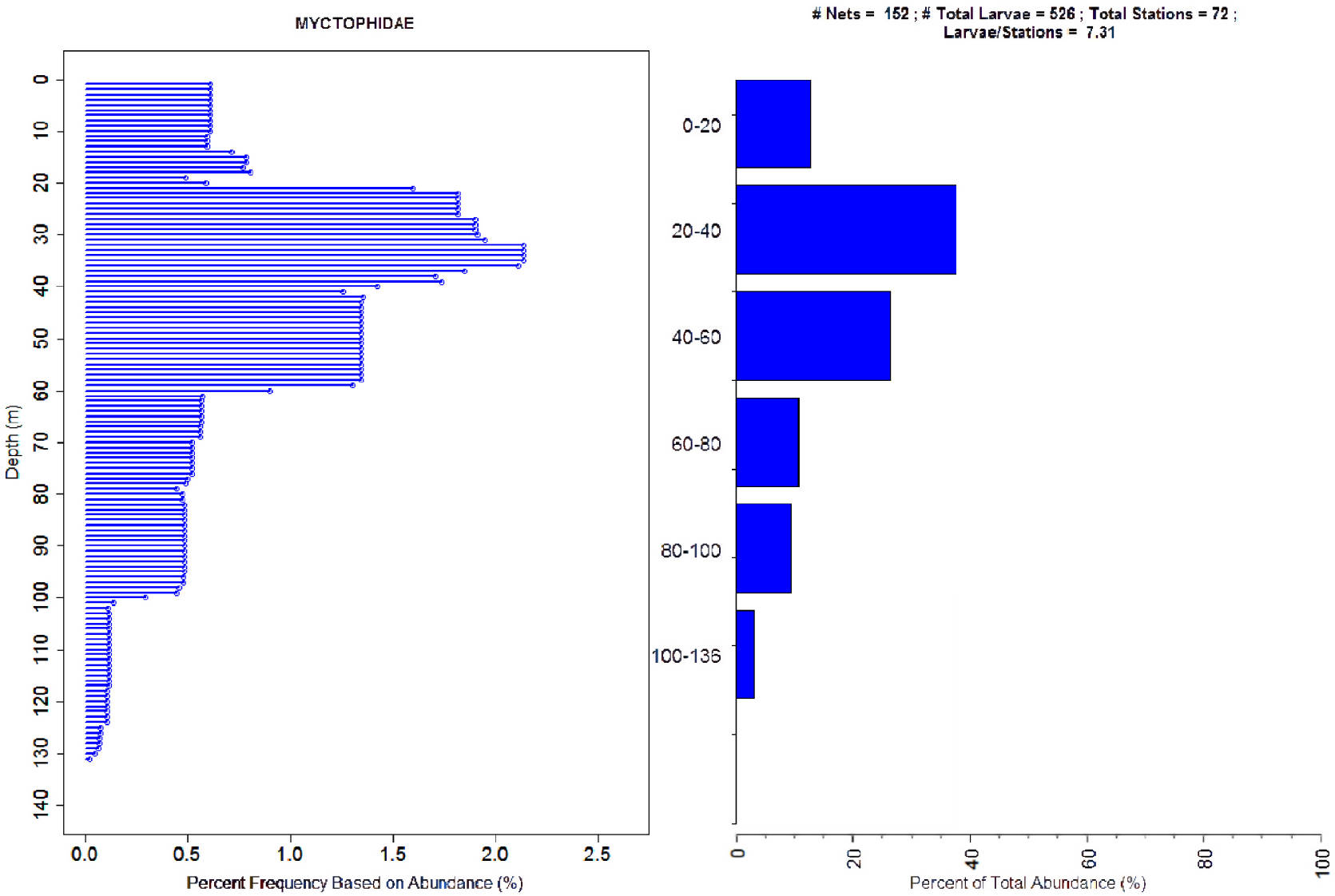
MUGIL


MULLIDAE
Nets = 39 ; # Total Larvae = 167 ; Total Stations = 26 ;
Larvae/Stations = 6.42
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

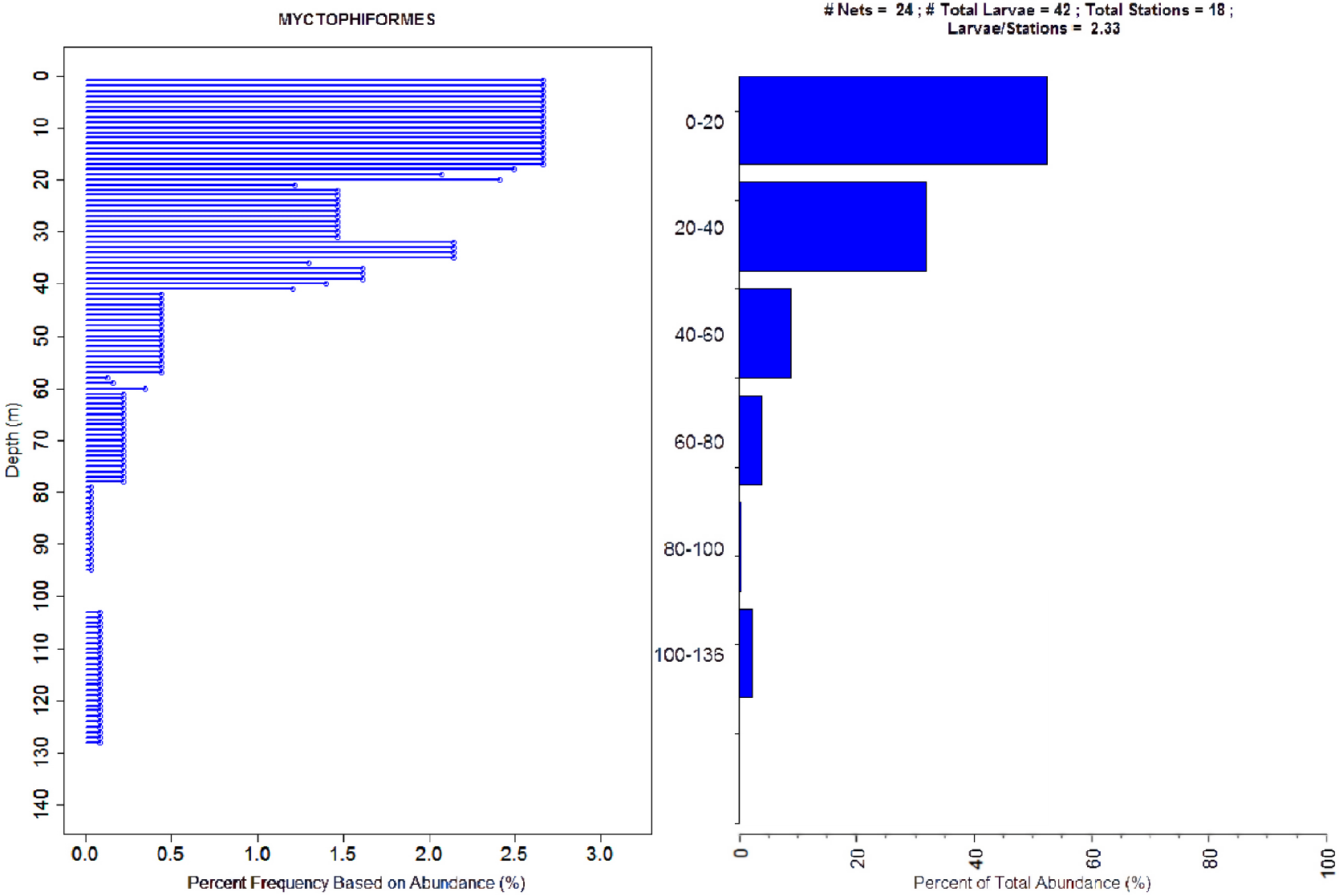
MULLIDAE


MURAENIDAE
Nets = 29 ; # Total Larvae = 53 ; Total Stations = 21 ;
Larvae/Stations = 2.52
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

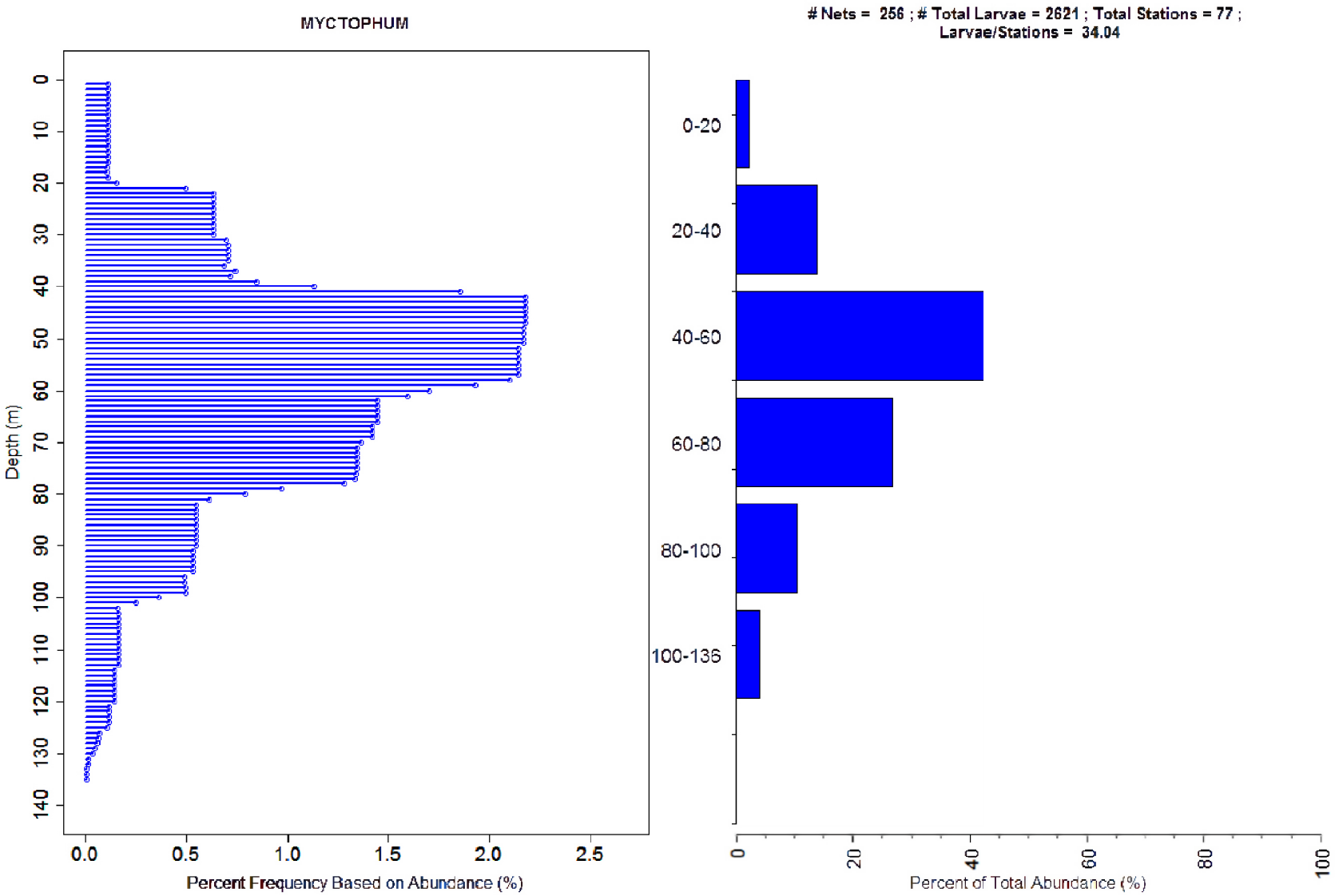
MURAENIDAE



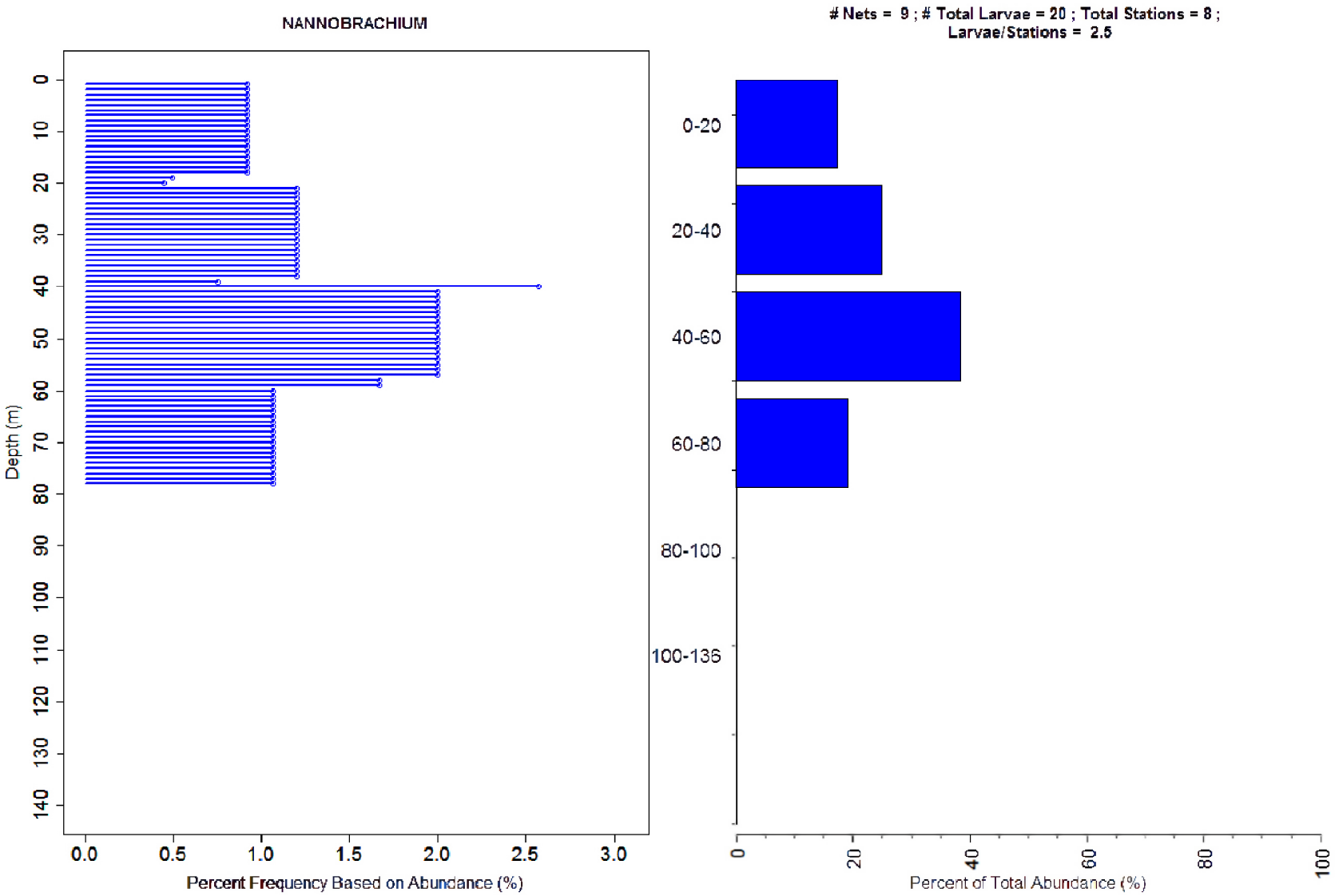
MYCTOPHIDAE



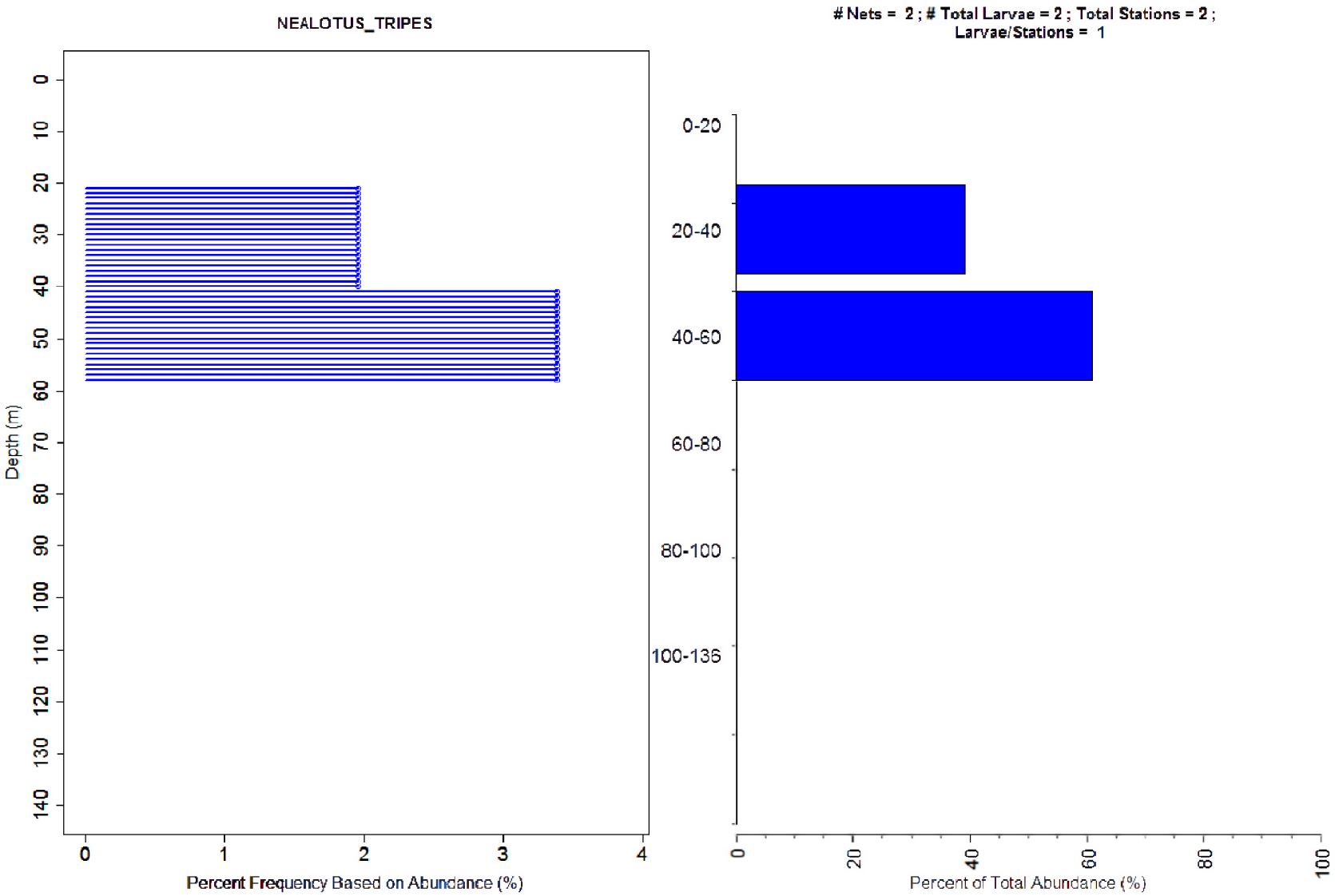
MYCTOPHIFORMES


MYCTOPHUM
Nets = 256 ; # Total Larvae = 2621 ; Total Stations = 77 ;
Larvae/Stations = 34.04
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

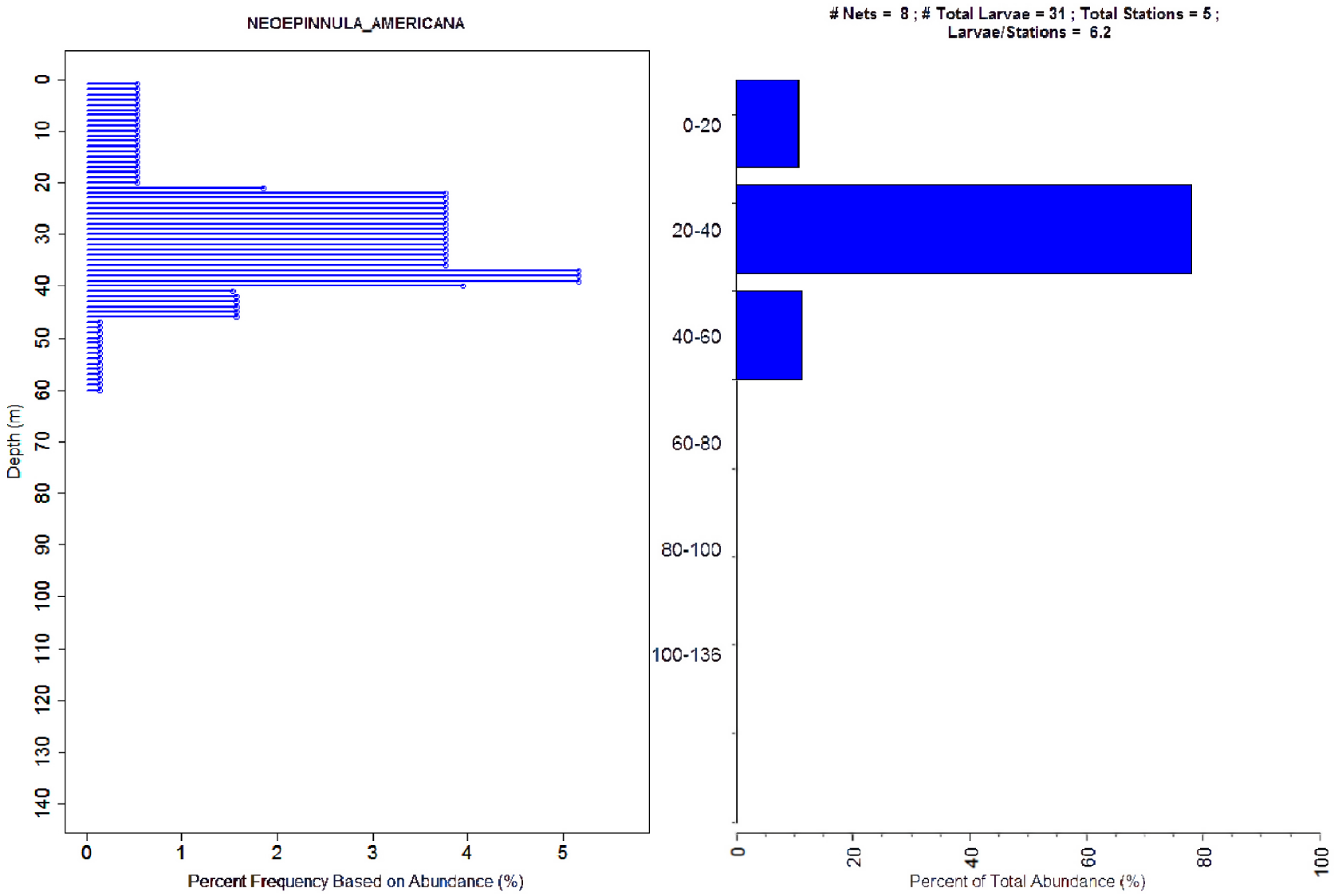
MYCTOPHUM



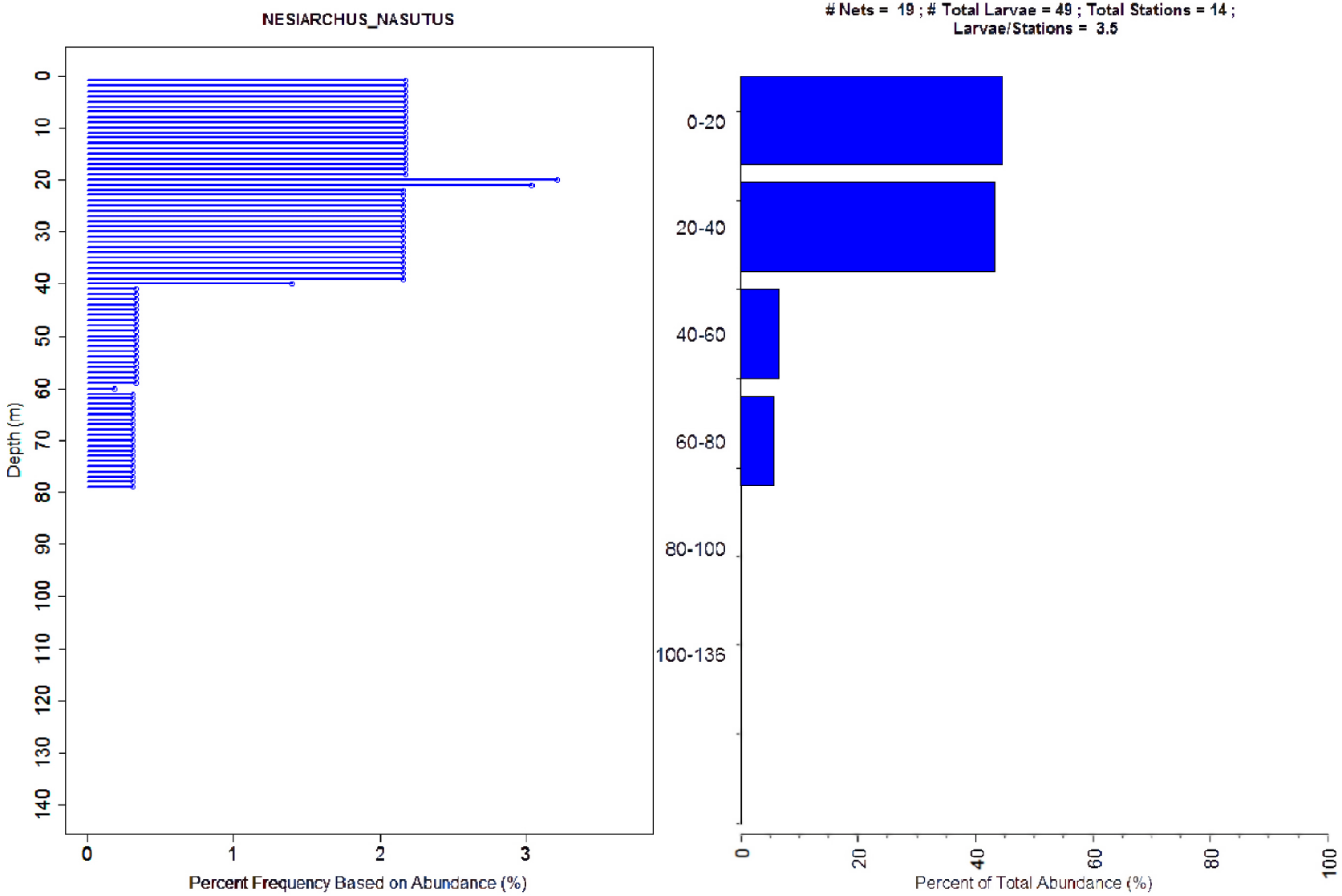
NANNOBRACHIUM



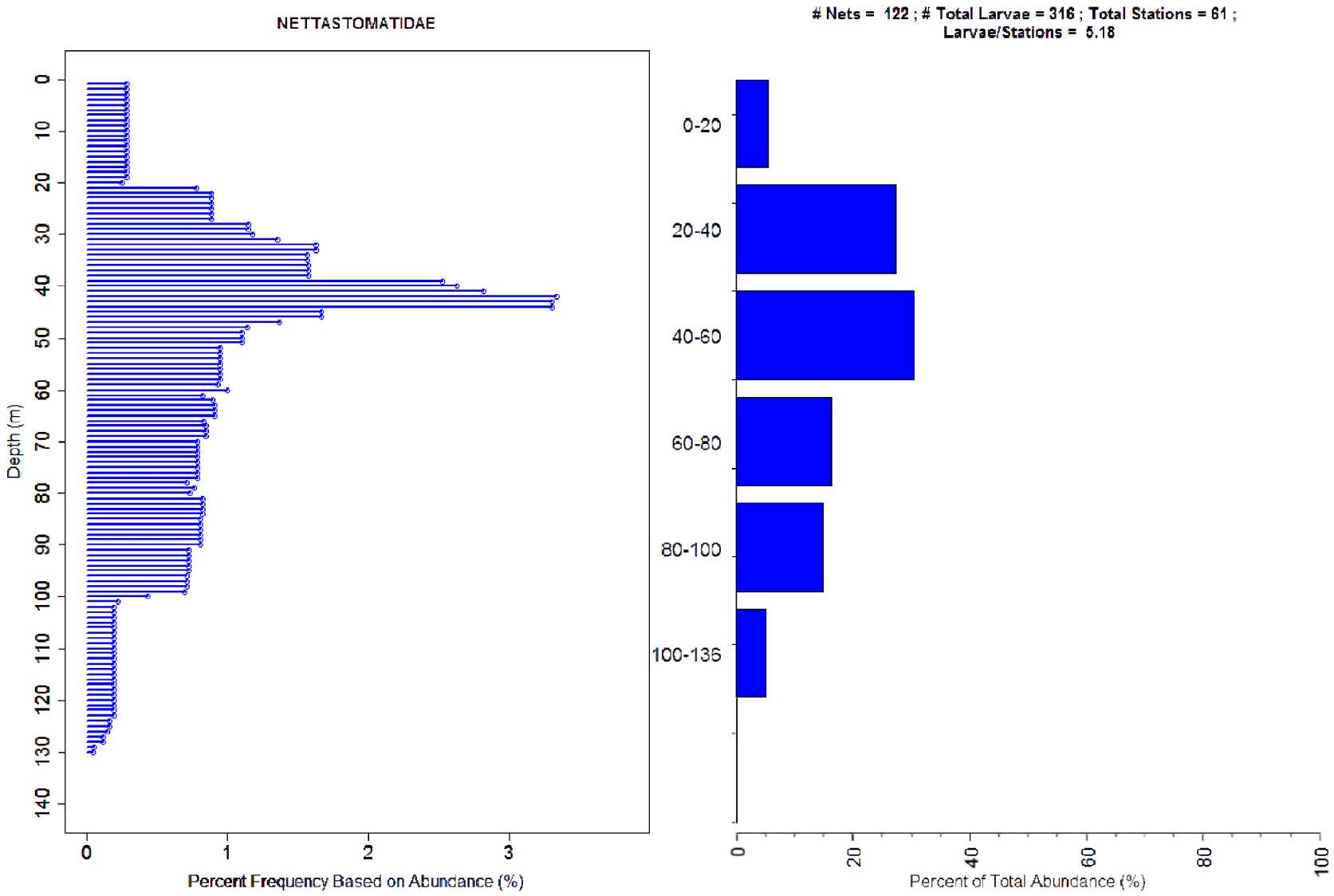
NEALOTUS_TRIPES



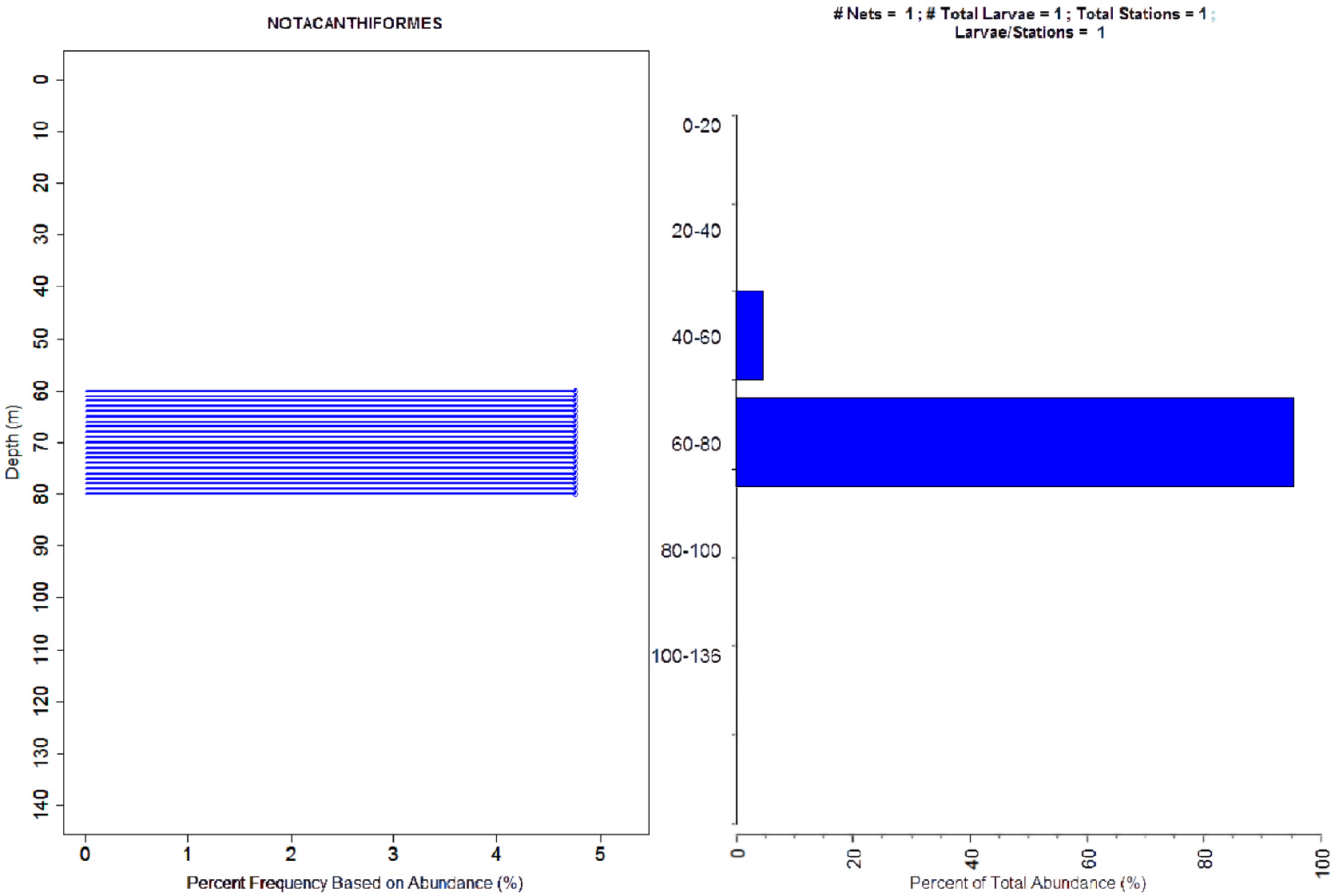
NEOEPINNULA_AMERICANA



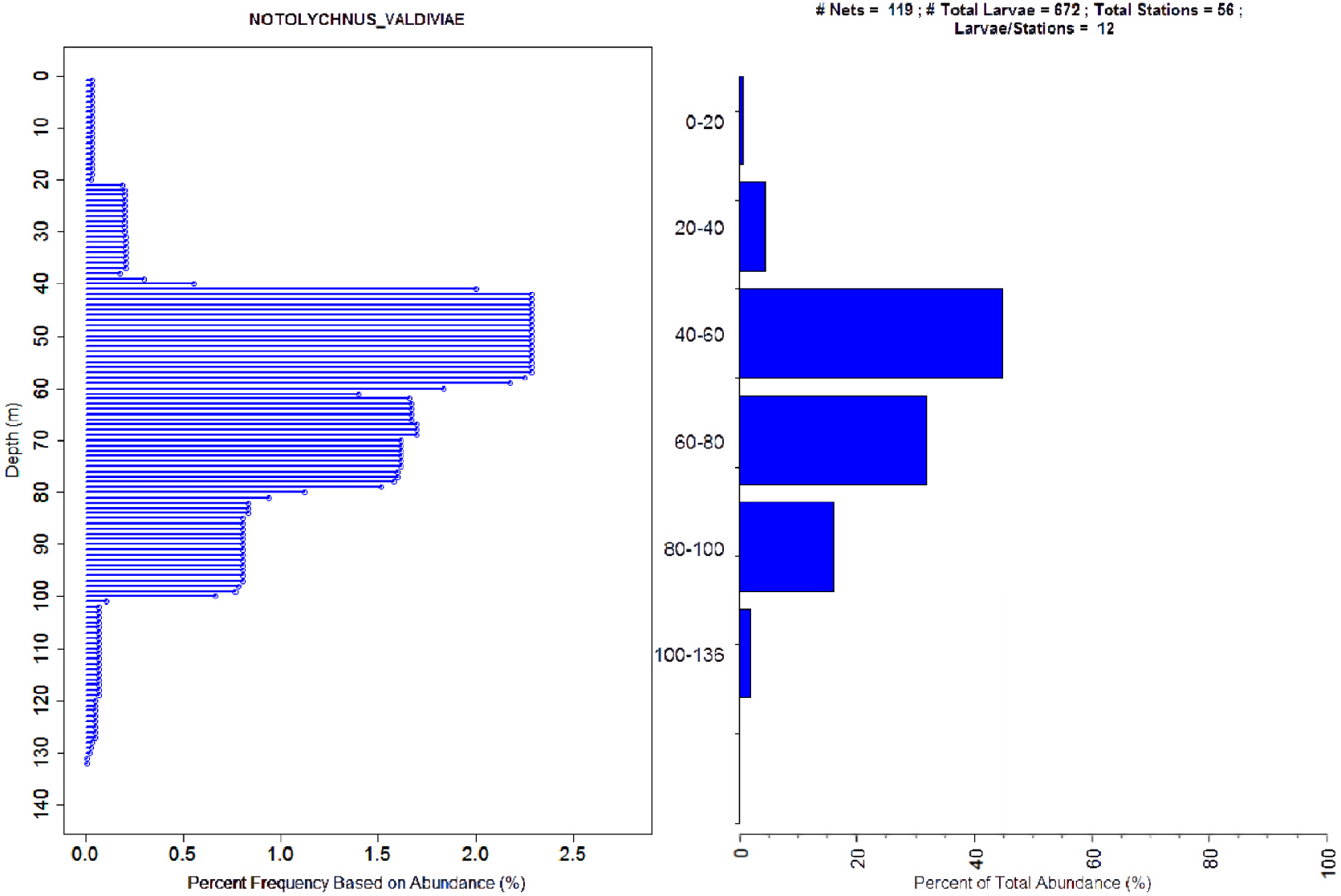
NESIARCHUS_NASUTUS



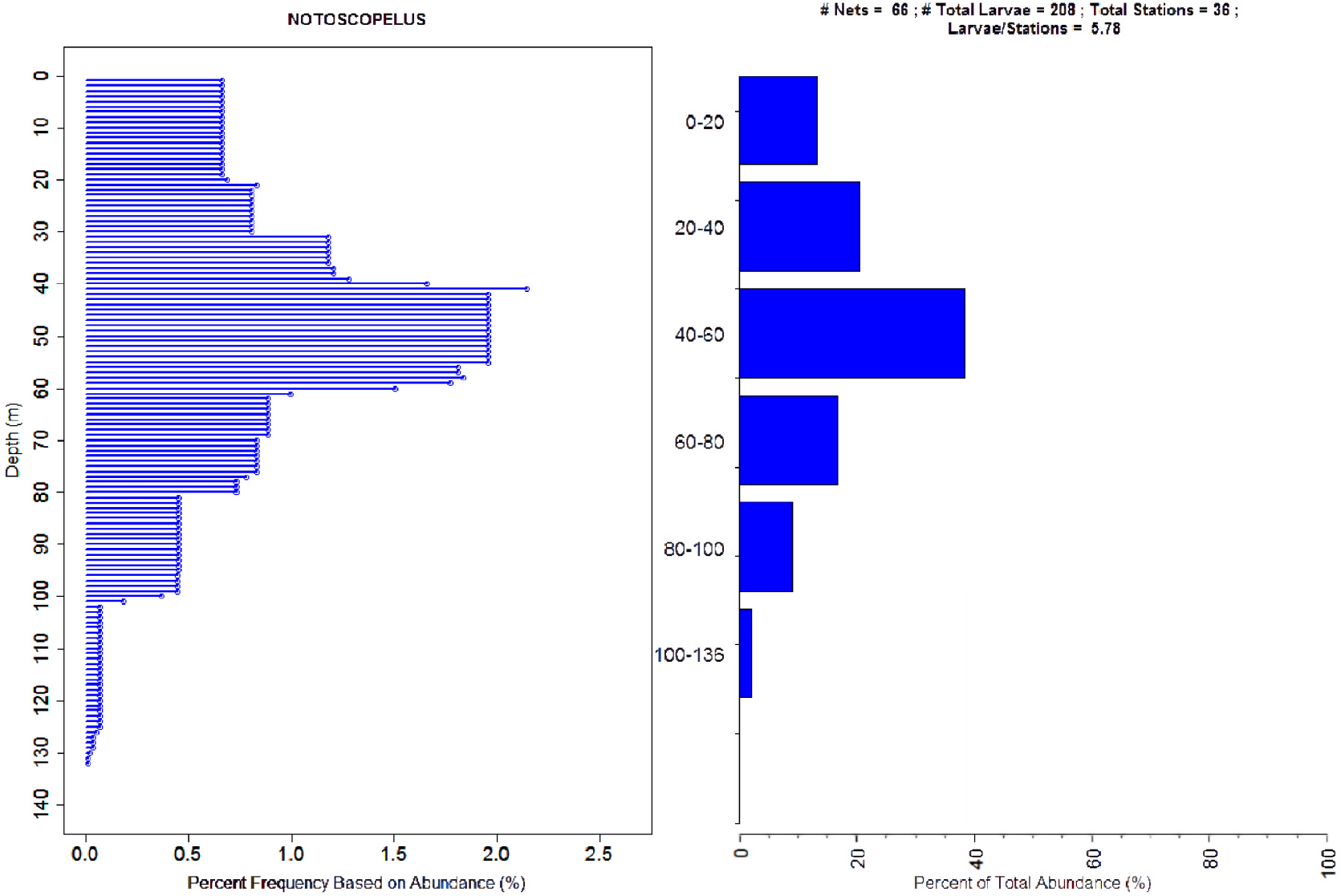
NETTASTOMATIDAE



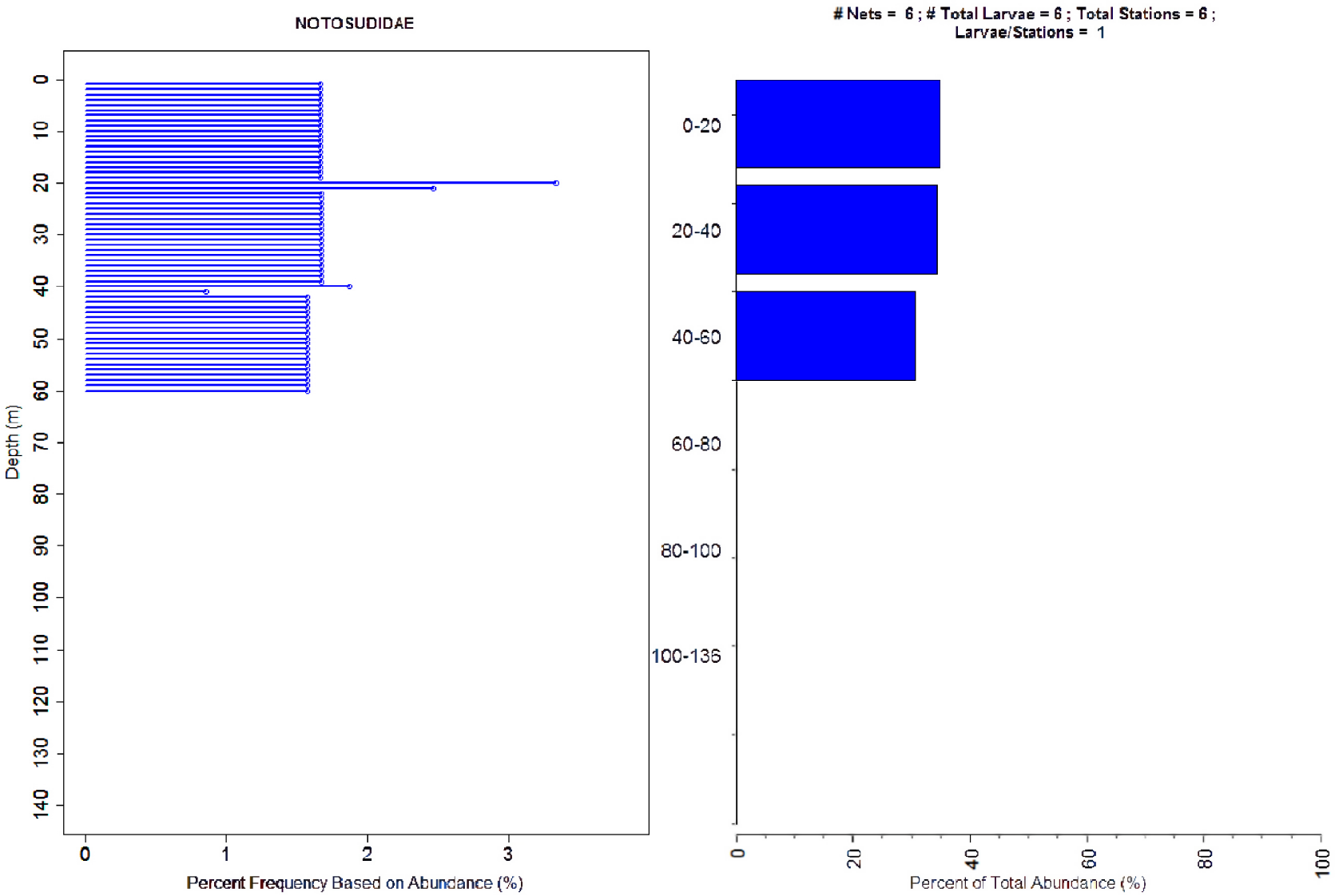
NOTACANTHIFORMES



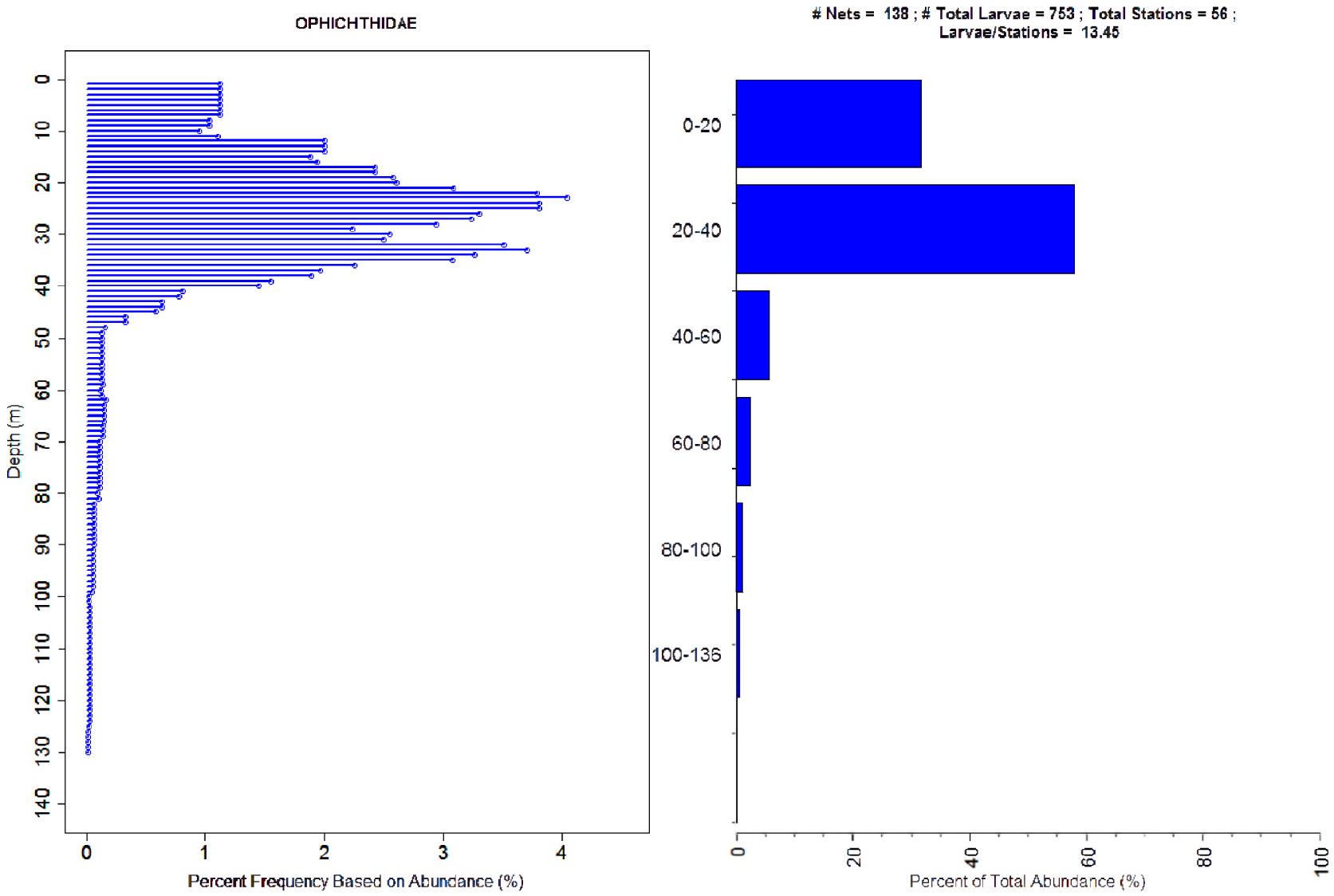
NOTOLYCHNUS_VALDIVIAE



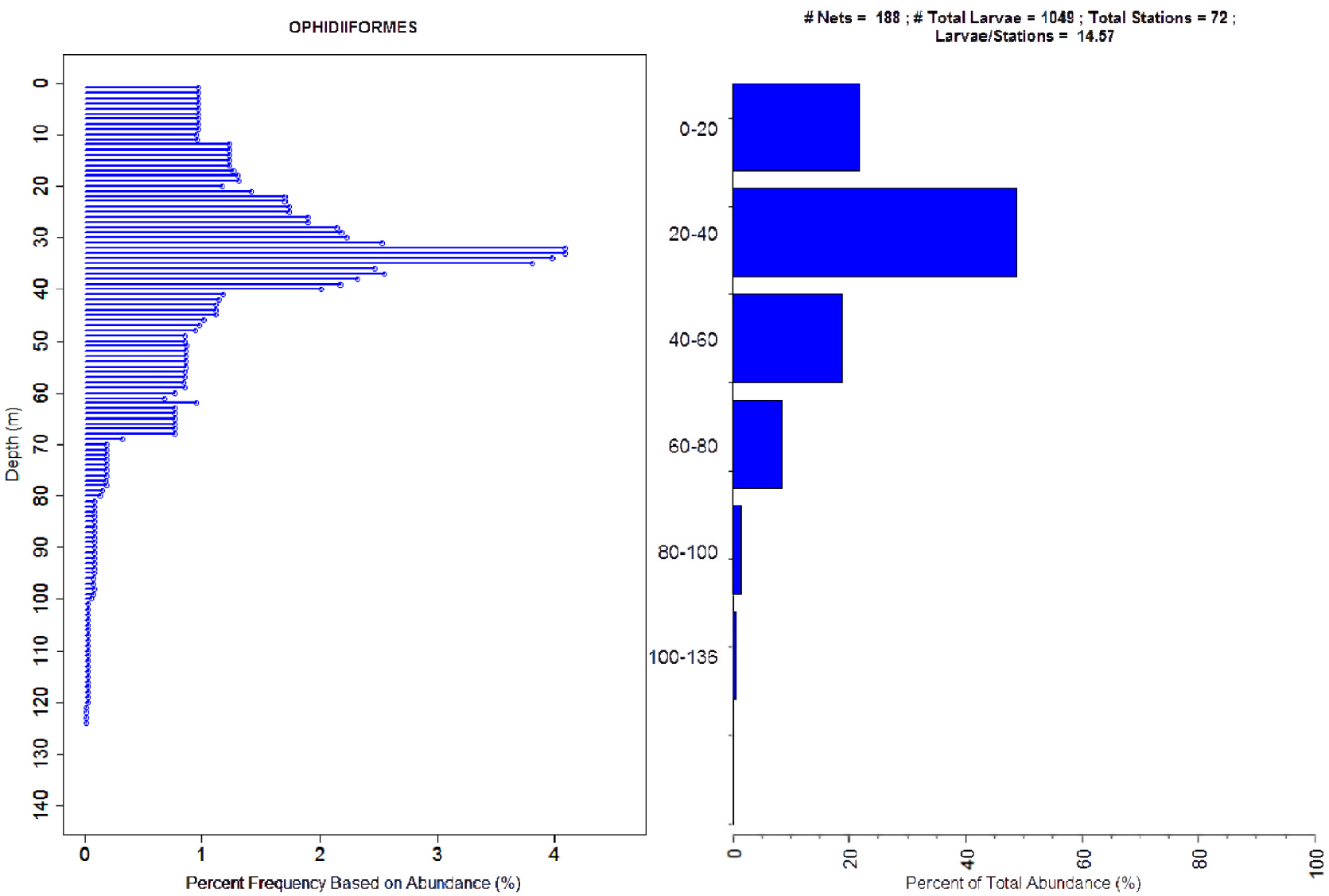
NOTOSCOPELUS



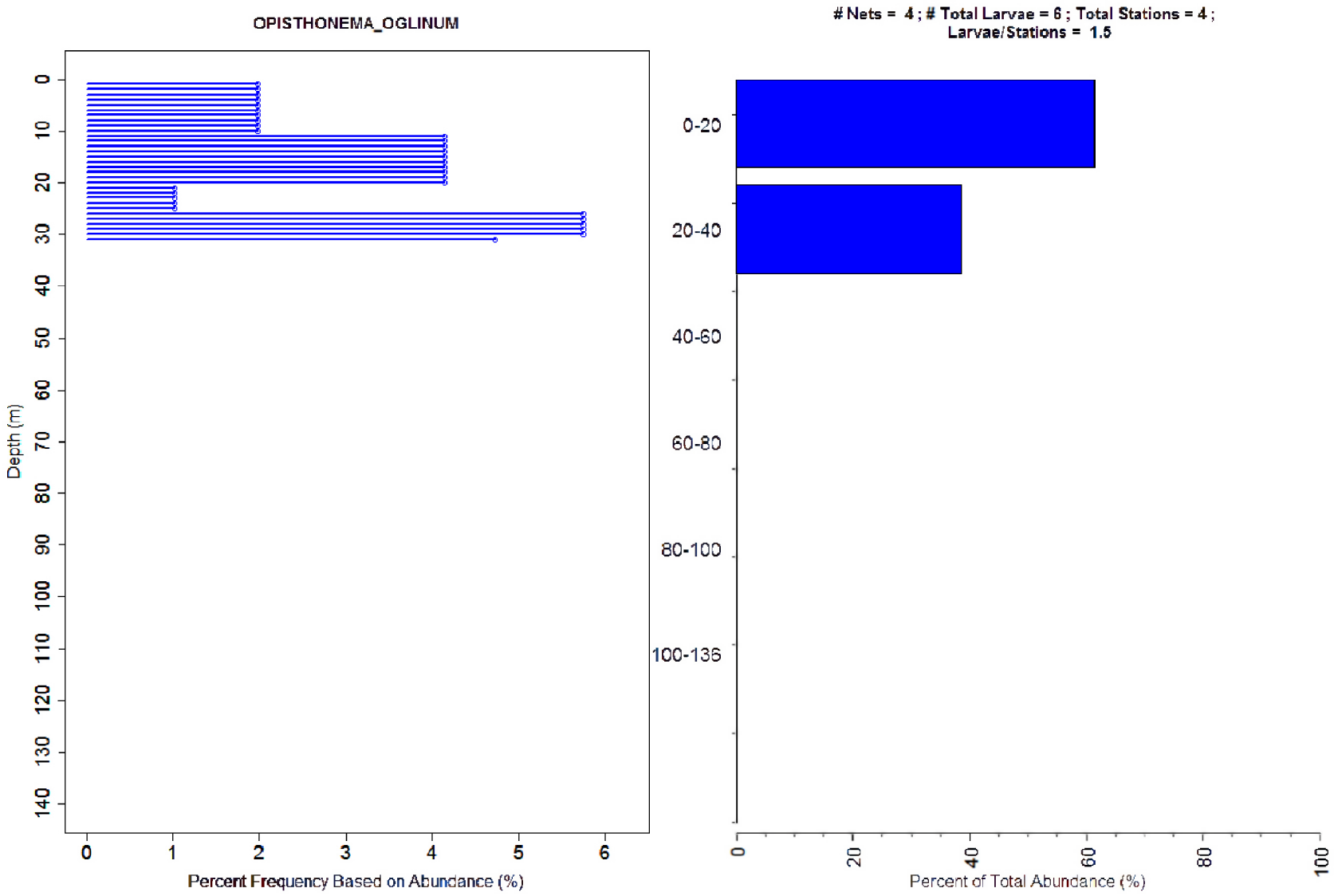
NOTOSUDIDAE



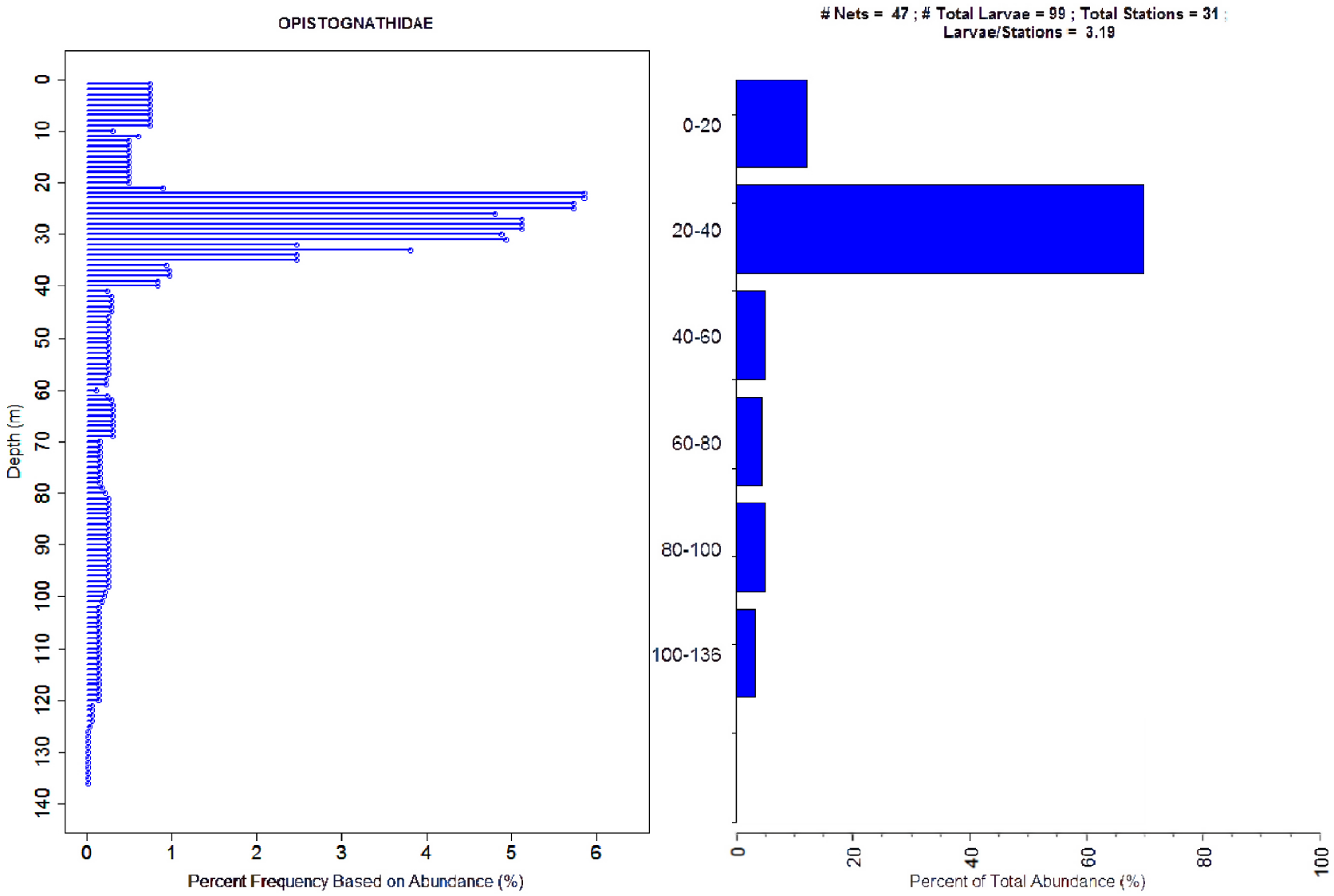
OPHICHTHIDAE



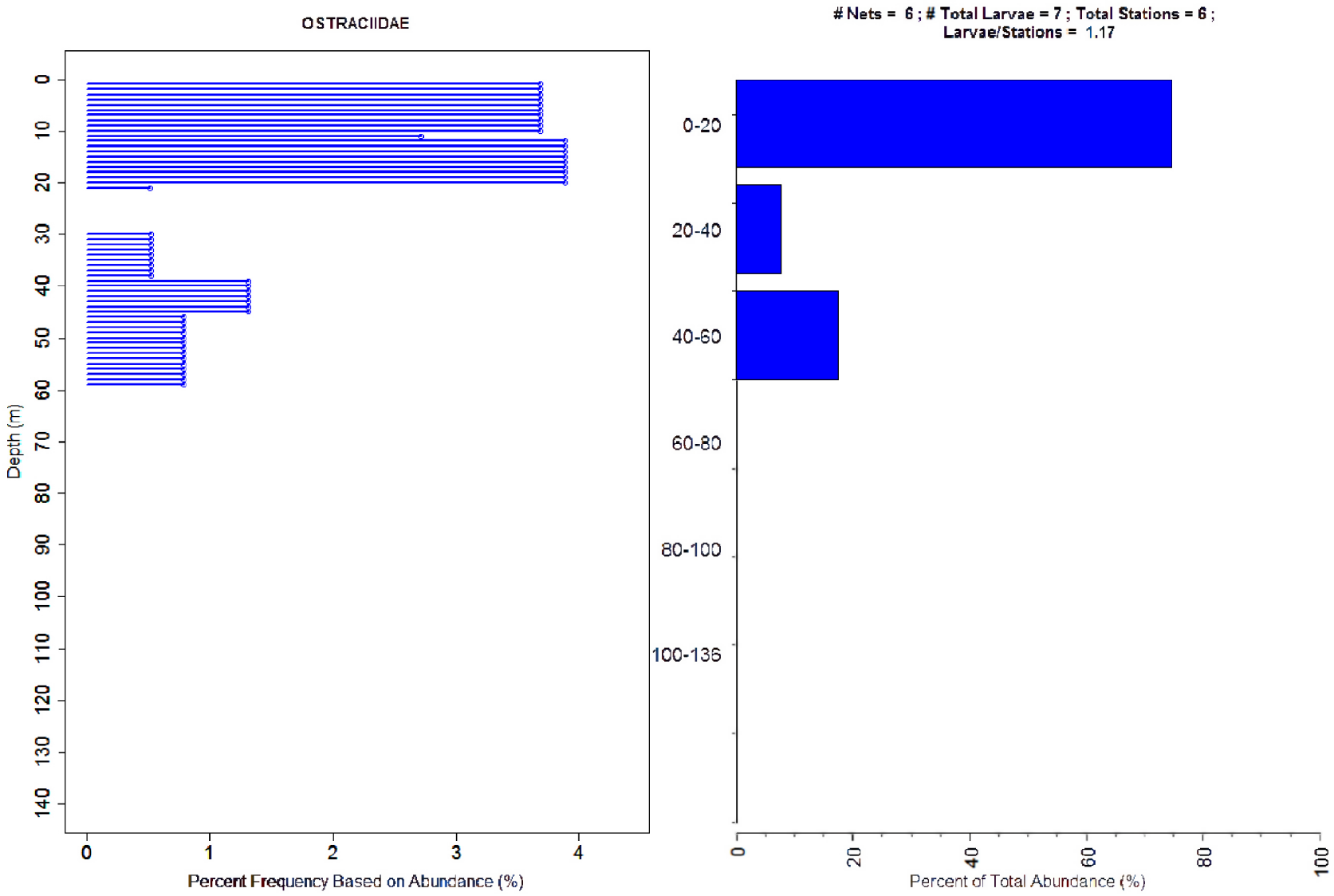
OPHIDIIFORMES



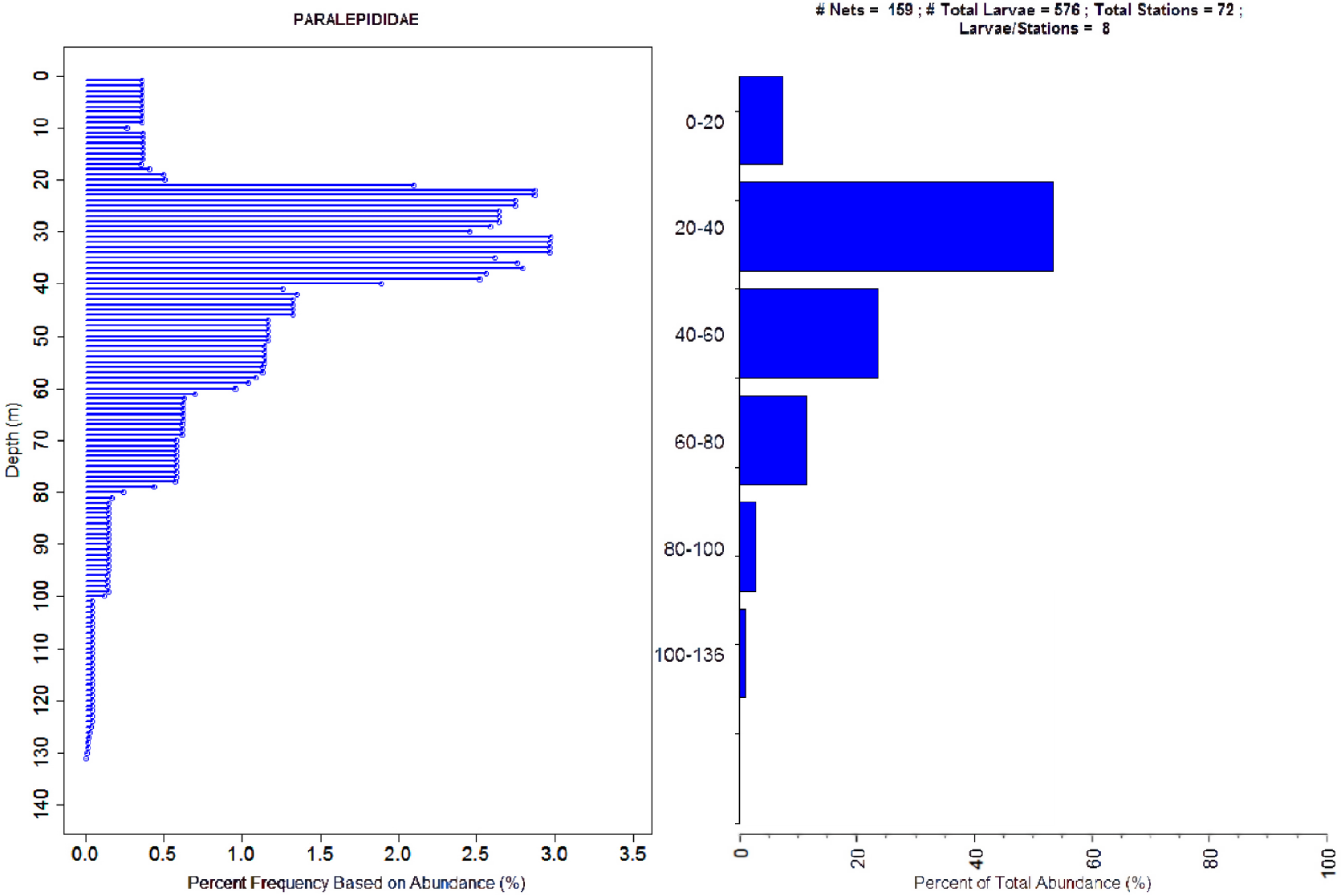
OPISTHONEMA_OGLINUM



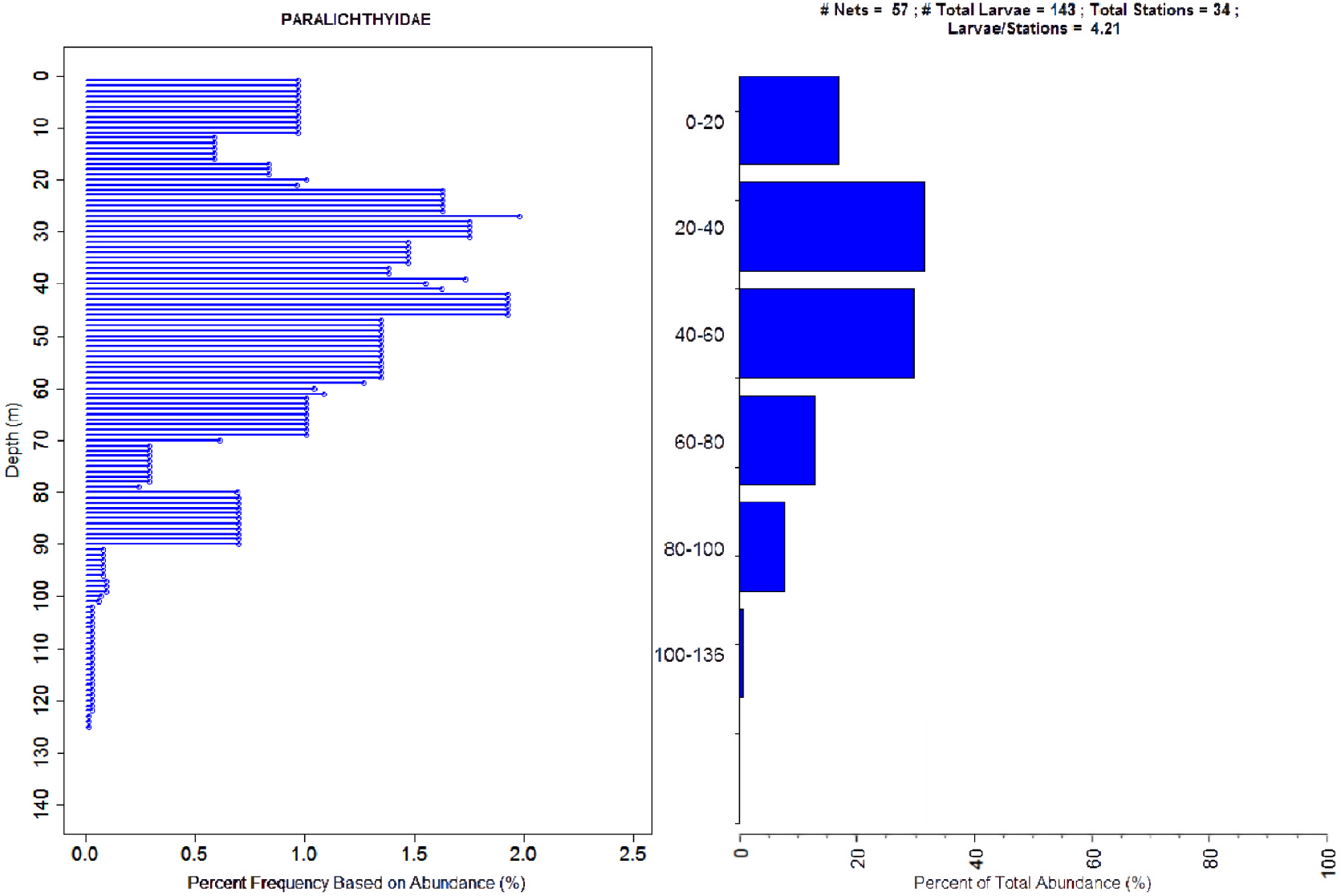
OPISTOGNATHIDAE



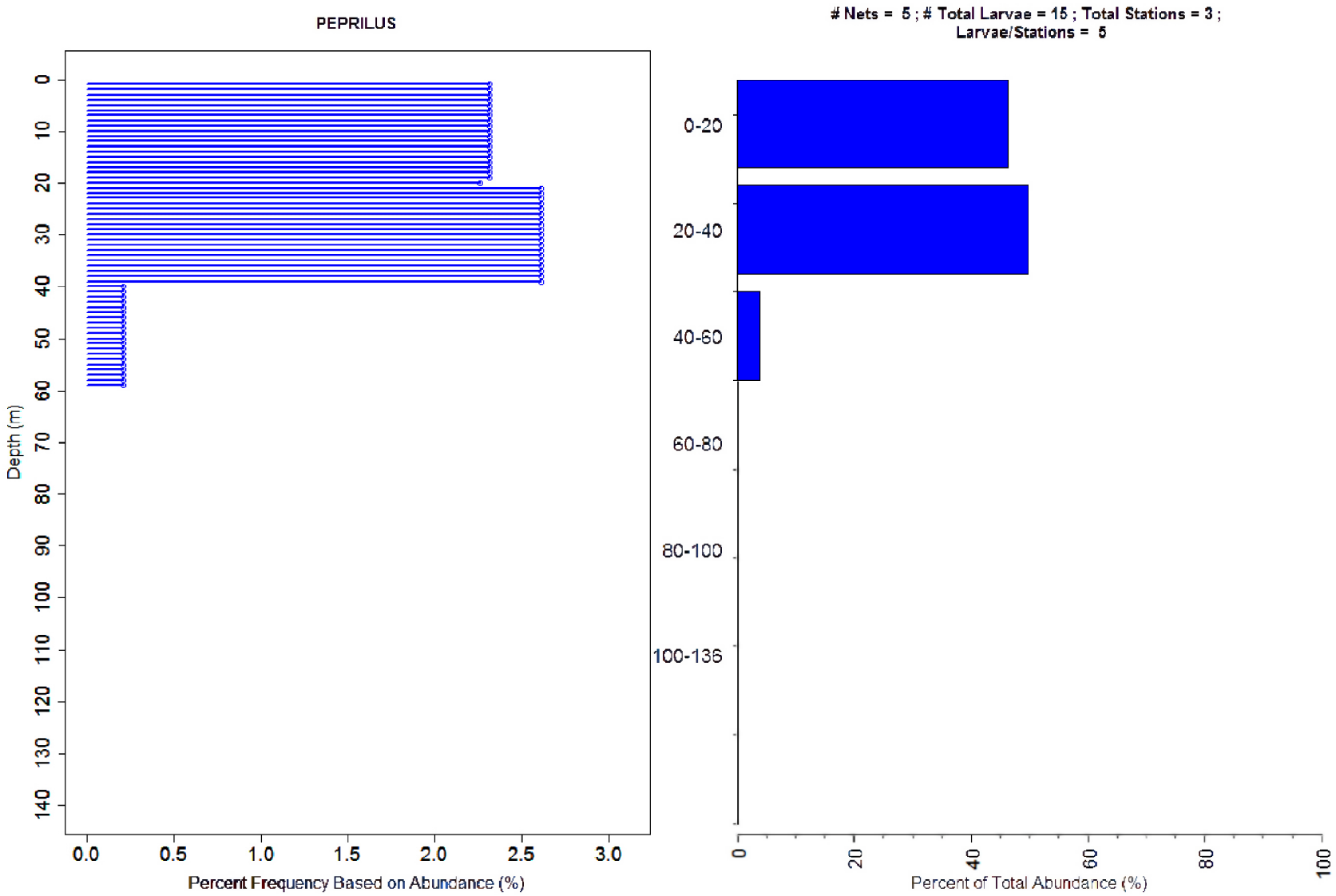
OSTRACIIDAE



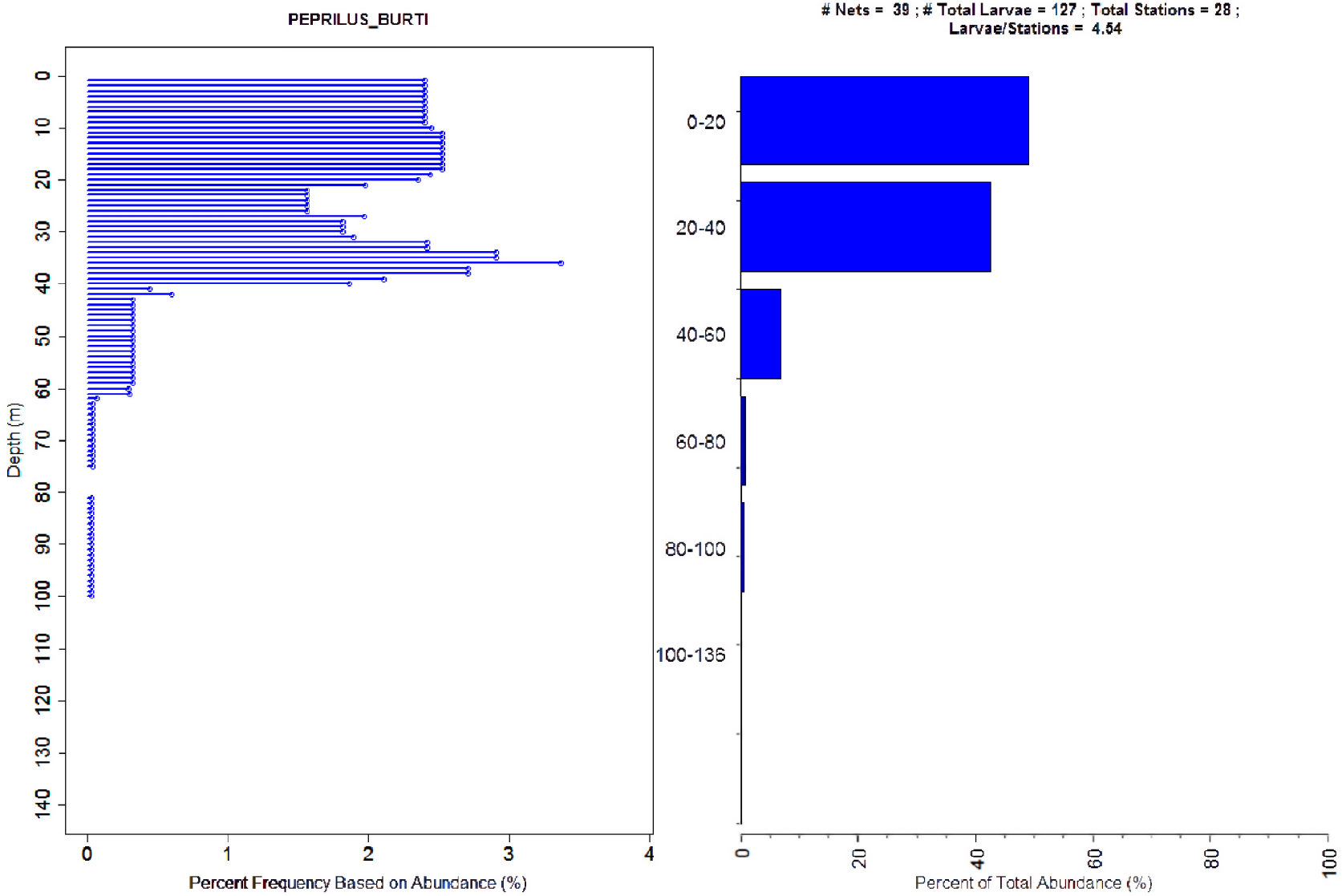
PARALEPIDIDAE



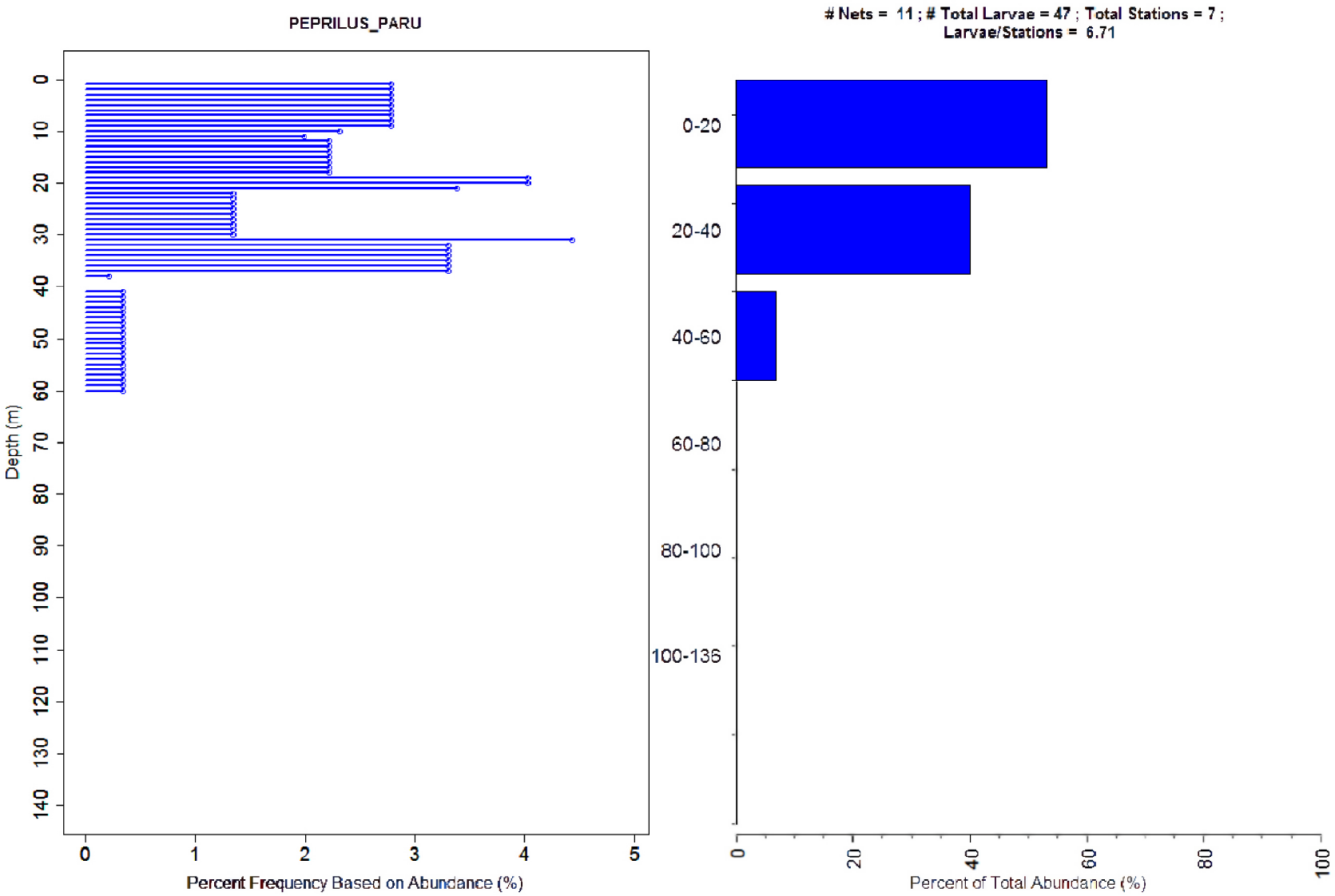
PARALICHTHYIDAE


PEPRILUS
Nets = 5 ; # Total Larvae = 15 ; Total Stations = 3 ;
Larvae/Stations = 5
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

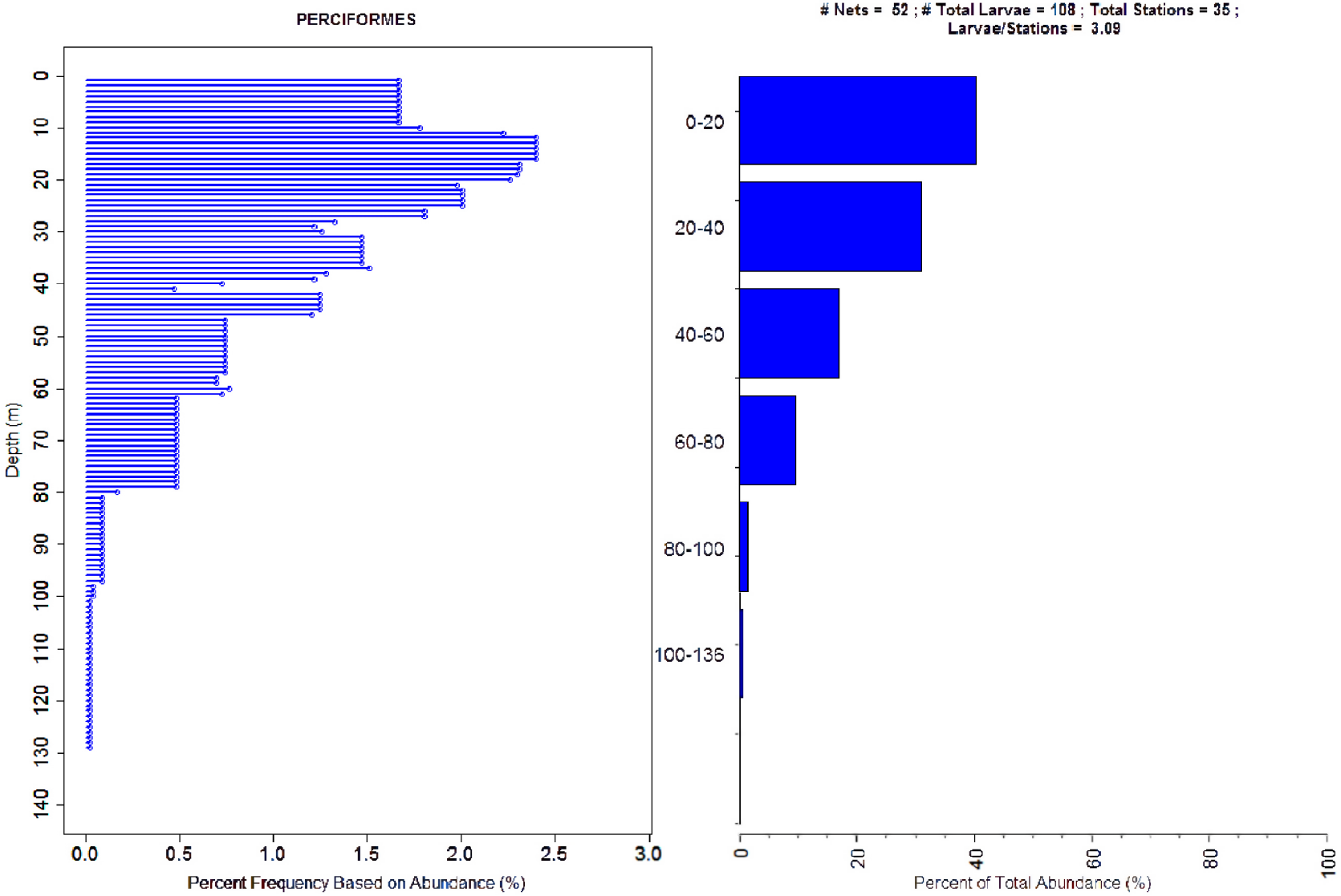
PEPRILUS



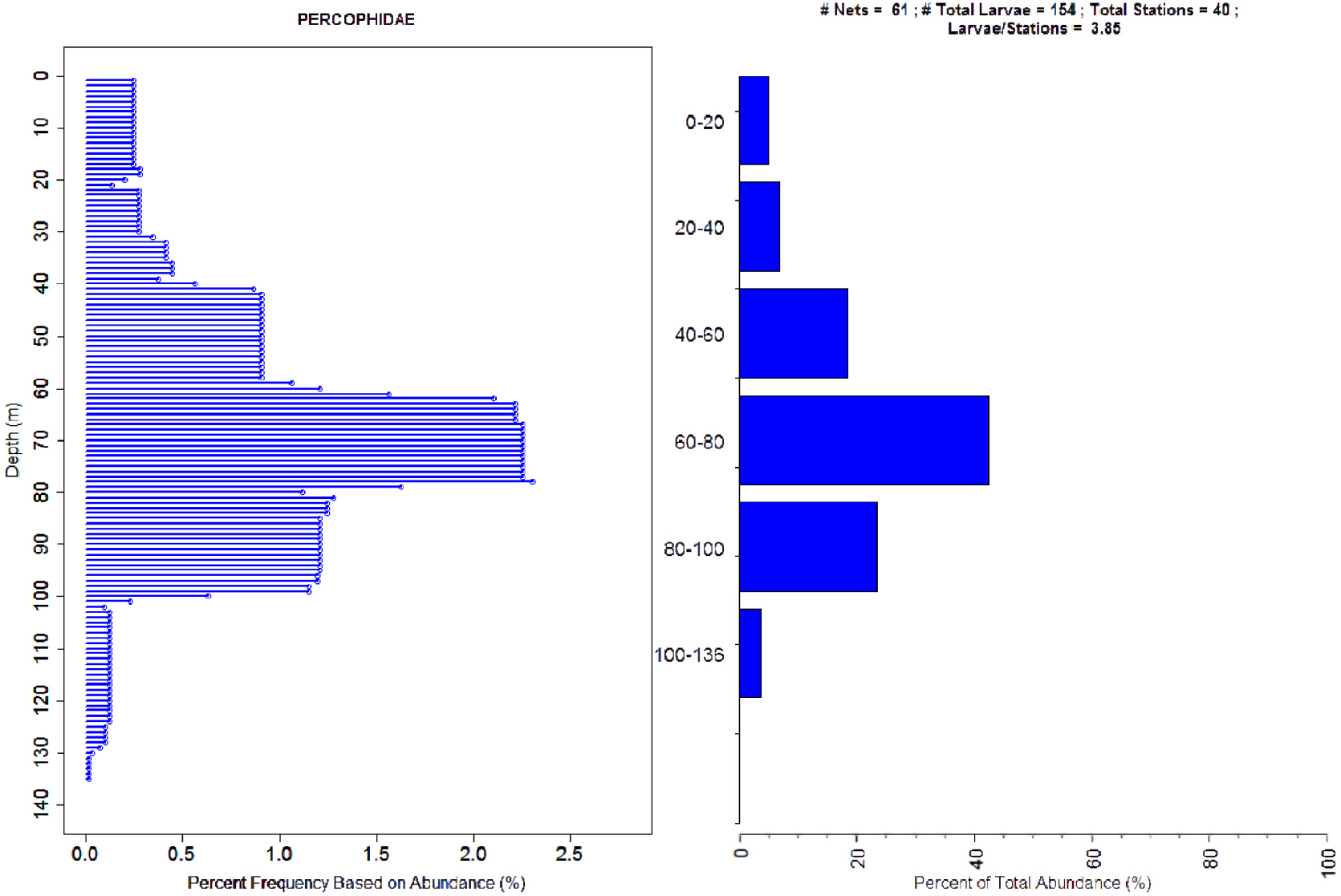
PEPRILUS_BURTI



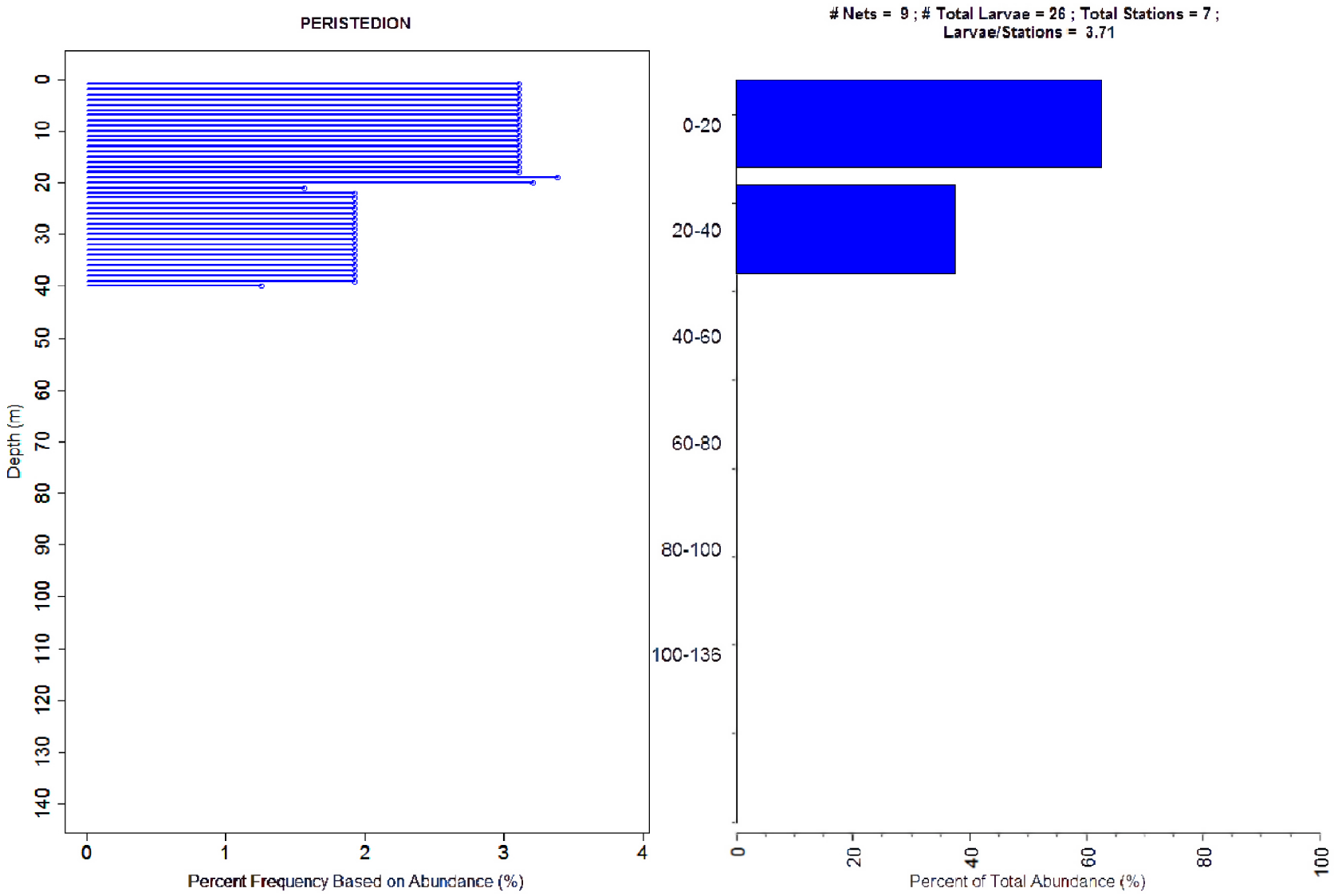
PEPRILUS_PARU



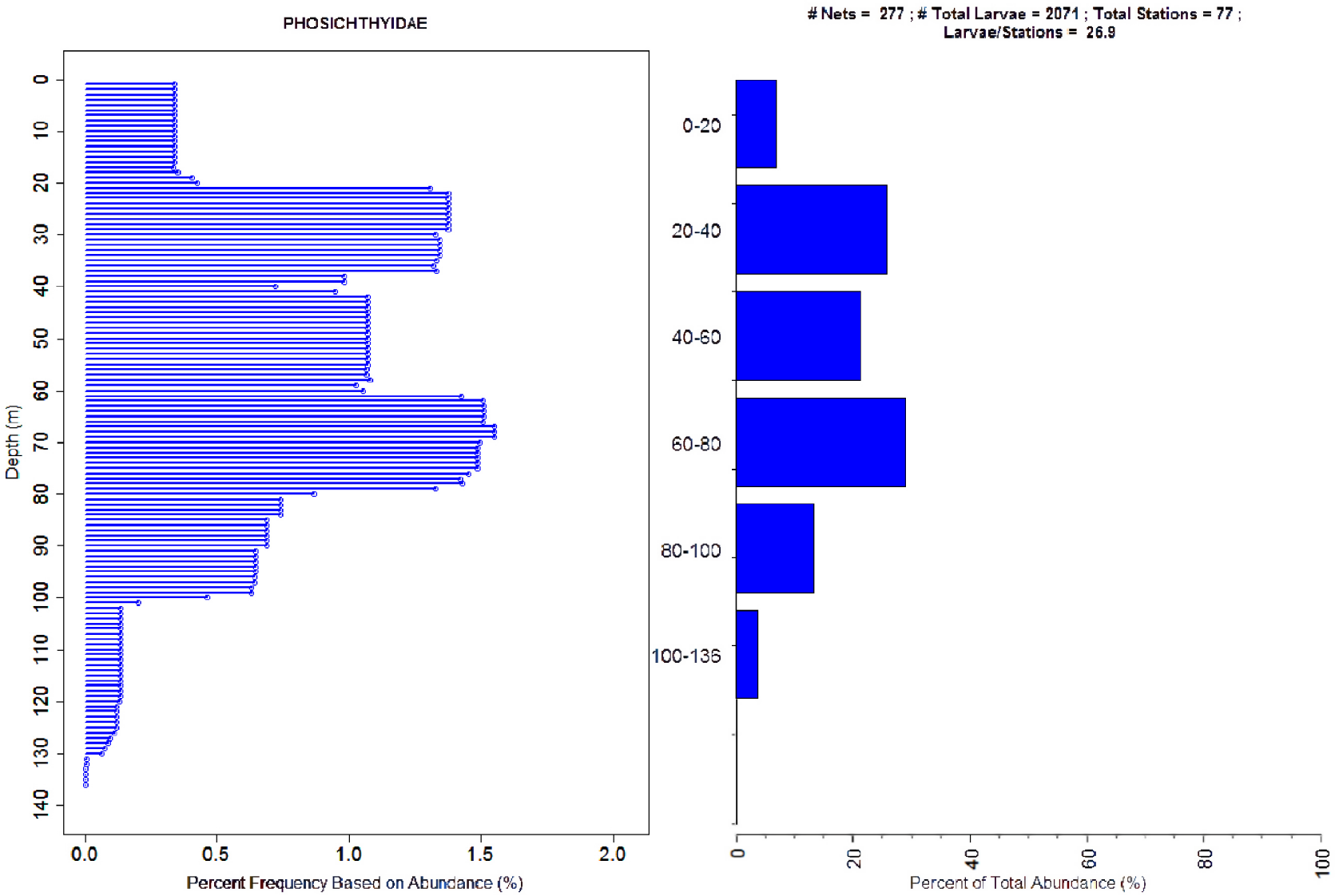
PERCIFORMES



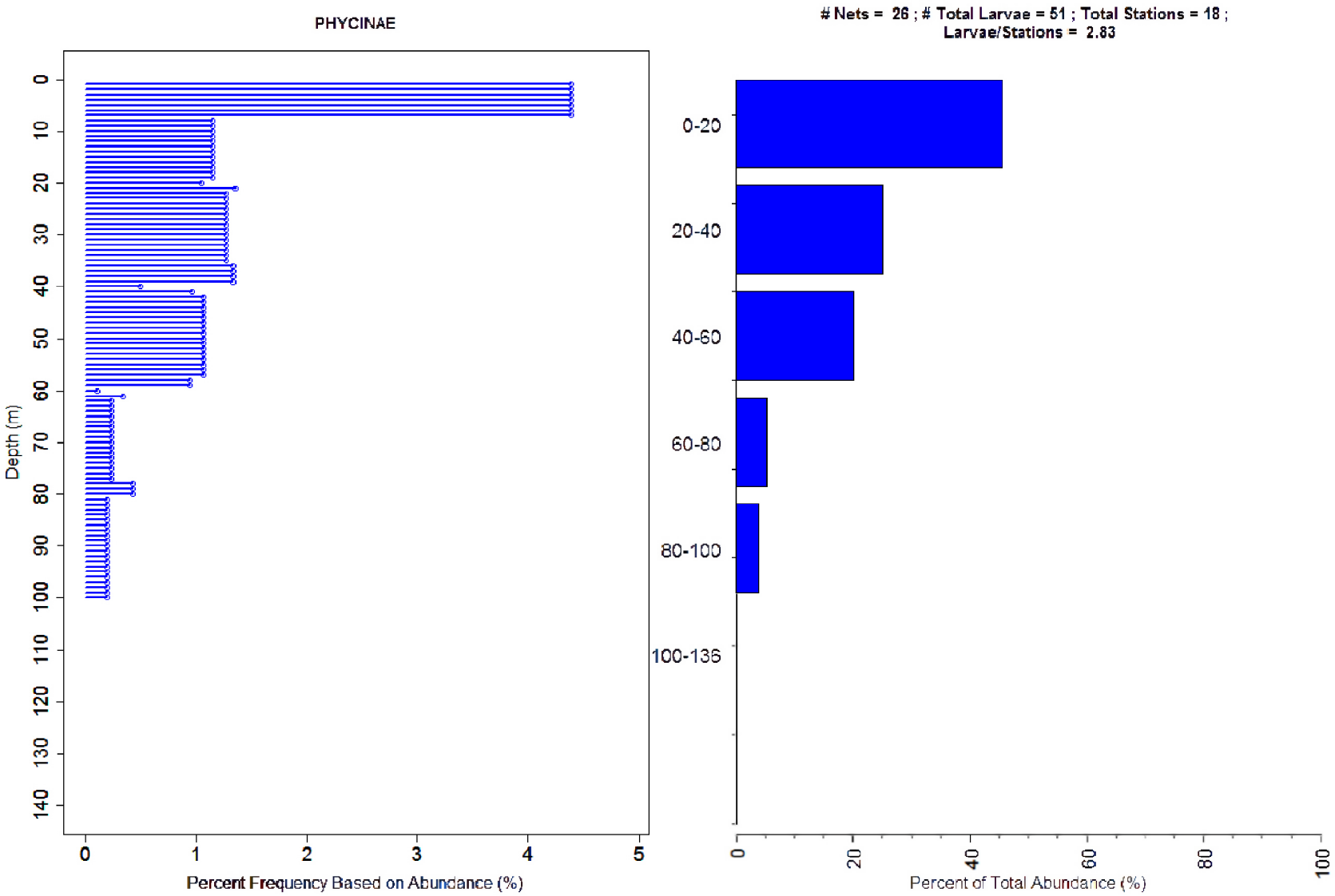
PERCOPHIDAE



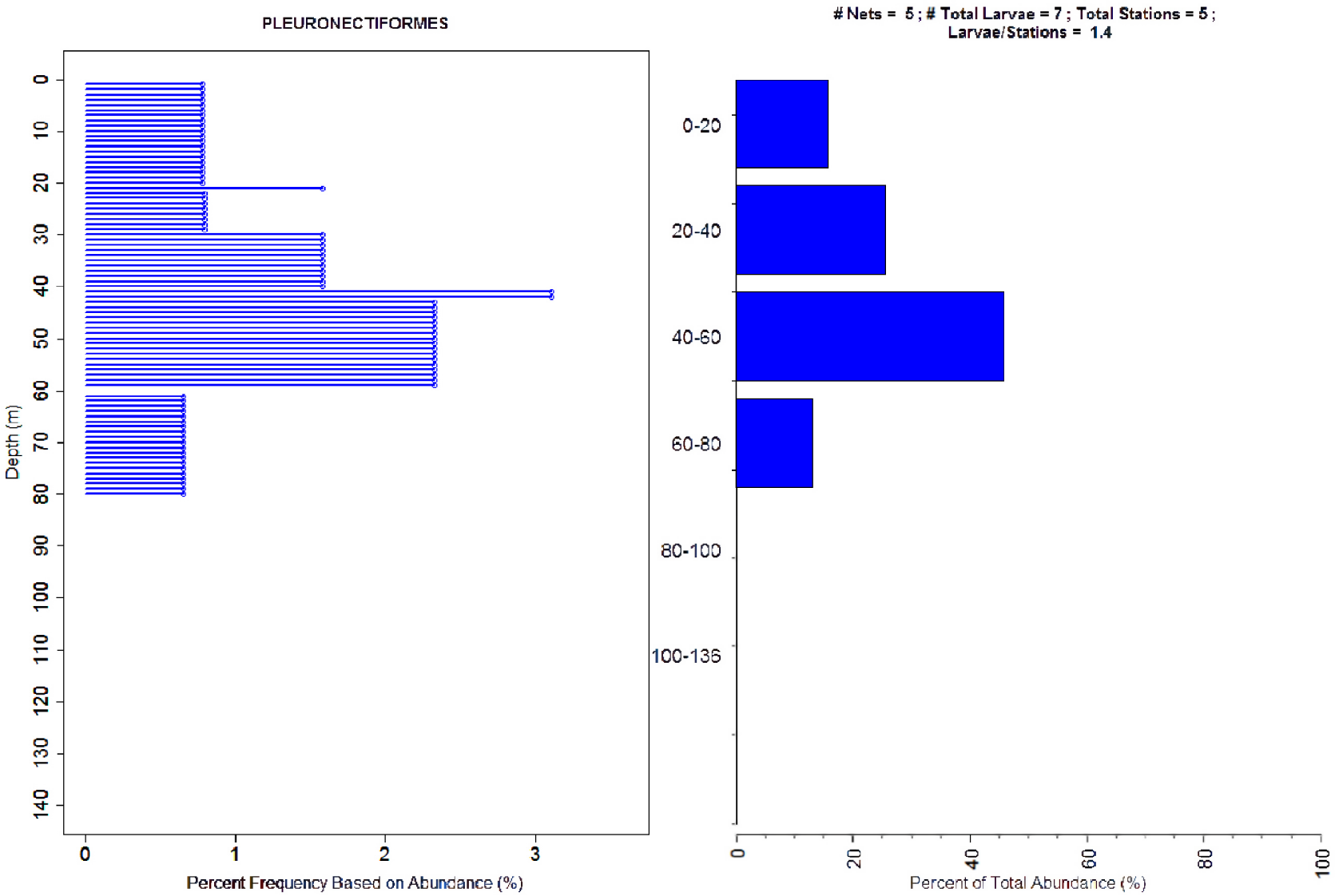
PERISTEDION



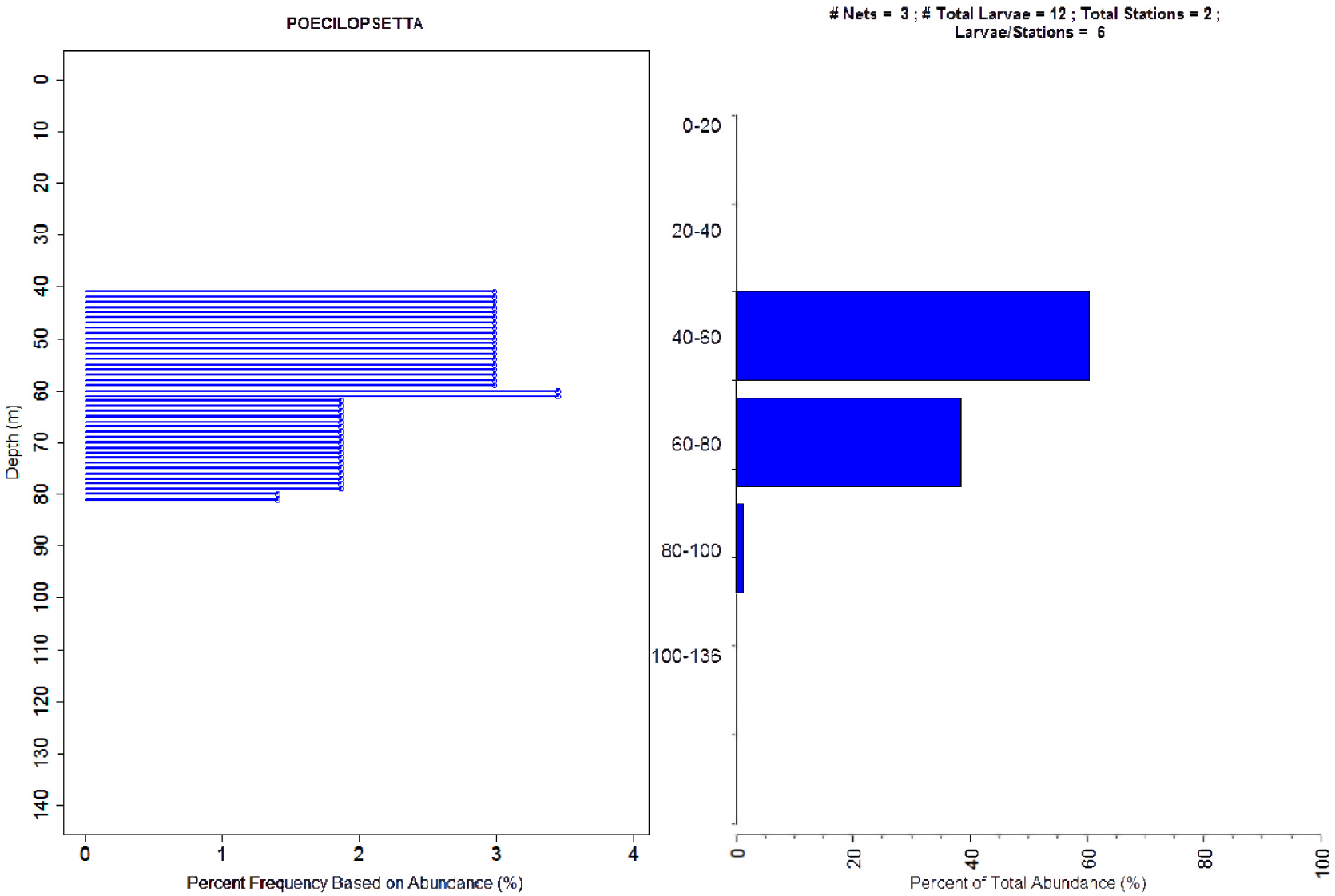
PHOSICHTHYIDAE


PHYCINAE
Nets = 26 ; # Total Larvae = 51 ; Total Stations = 18 ;
Larvae/Stations = 2.83
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

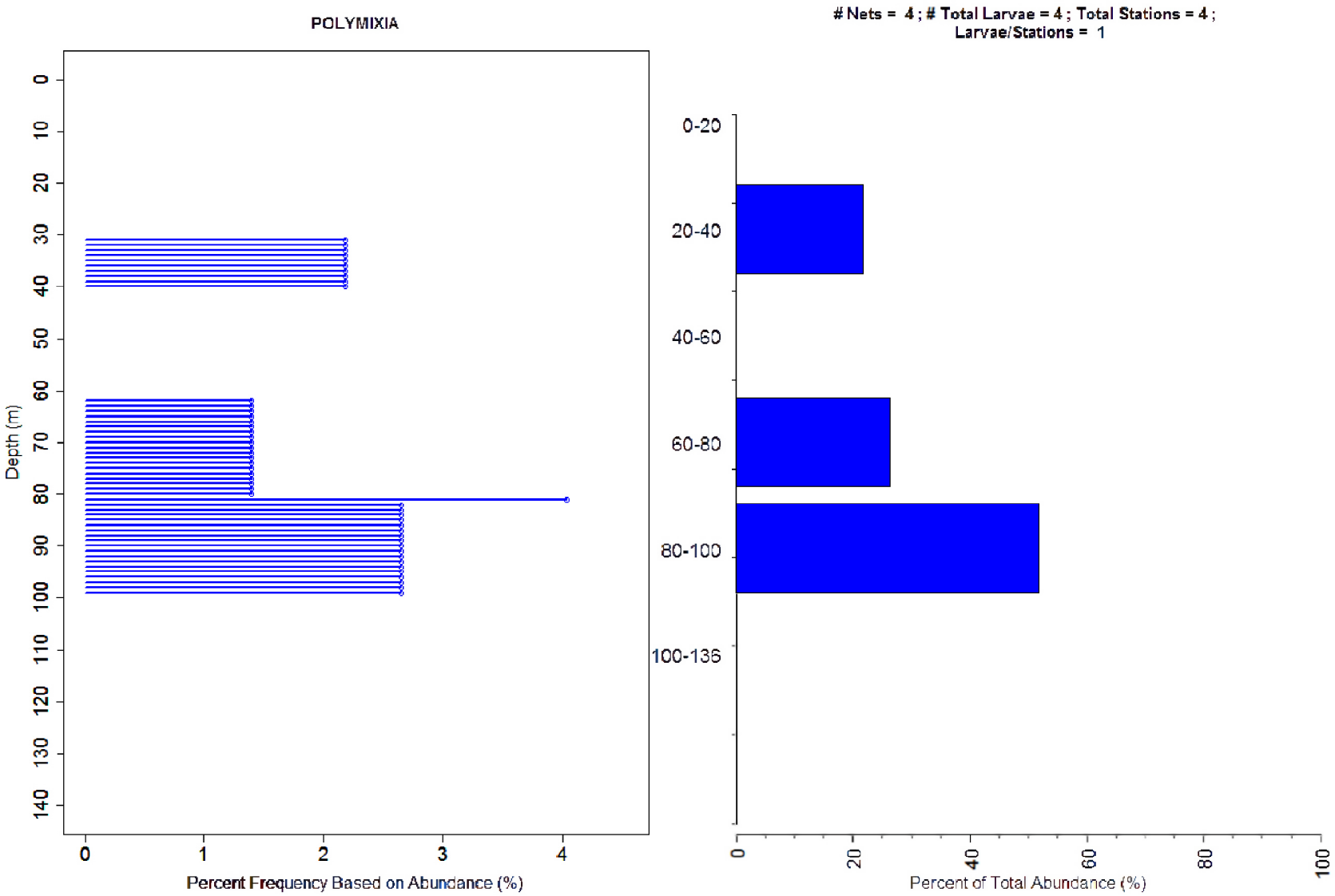
PHYCINAE



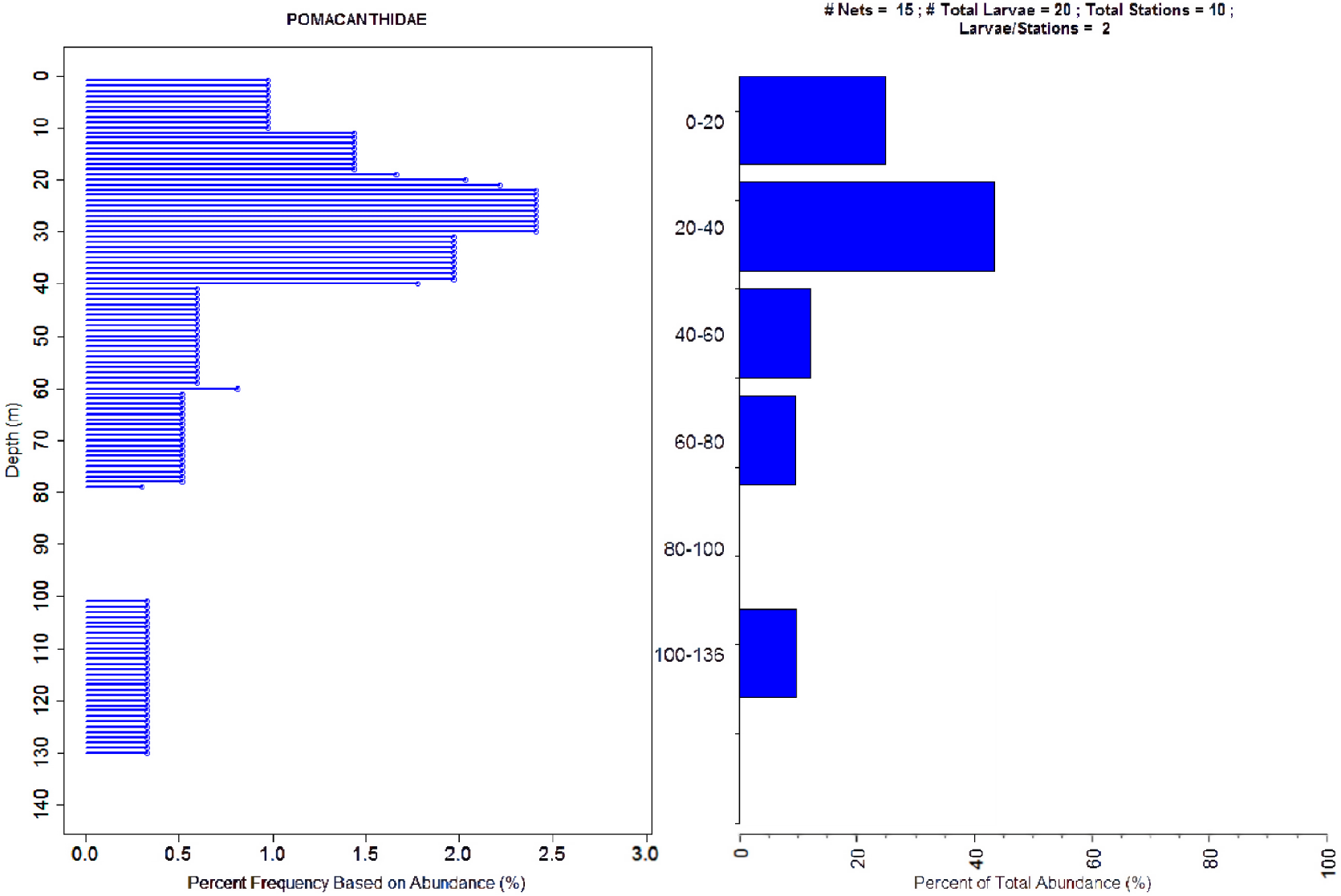
PLEURONECTIFORMES



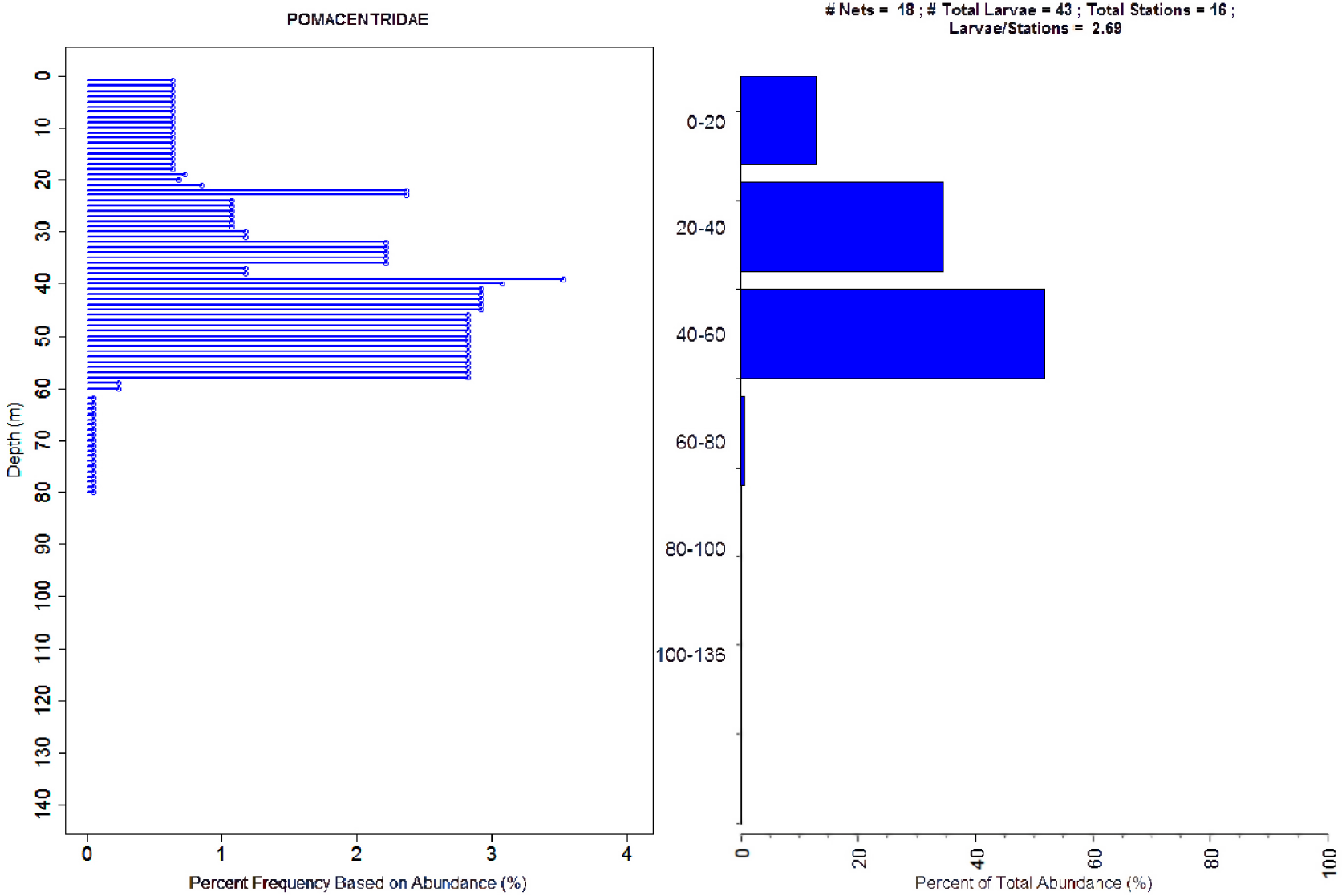
POECILOPSETTA


POLYMIXIA
Nets = 4 ; # Total Larvae = 4 ; Total Stations = 4 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

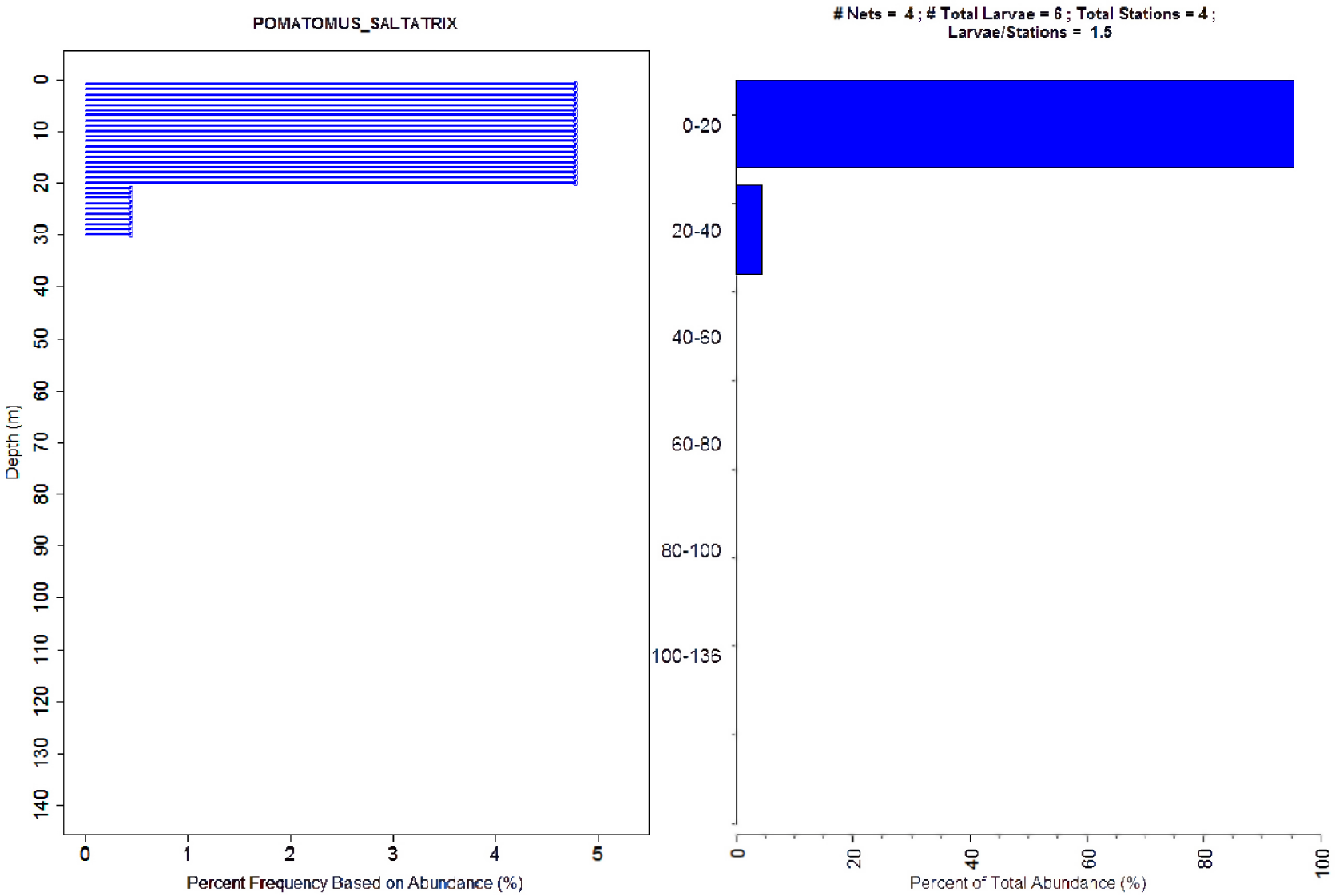
POLYMIXIA



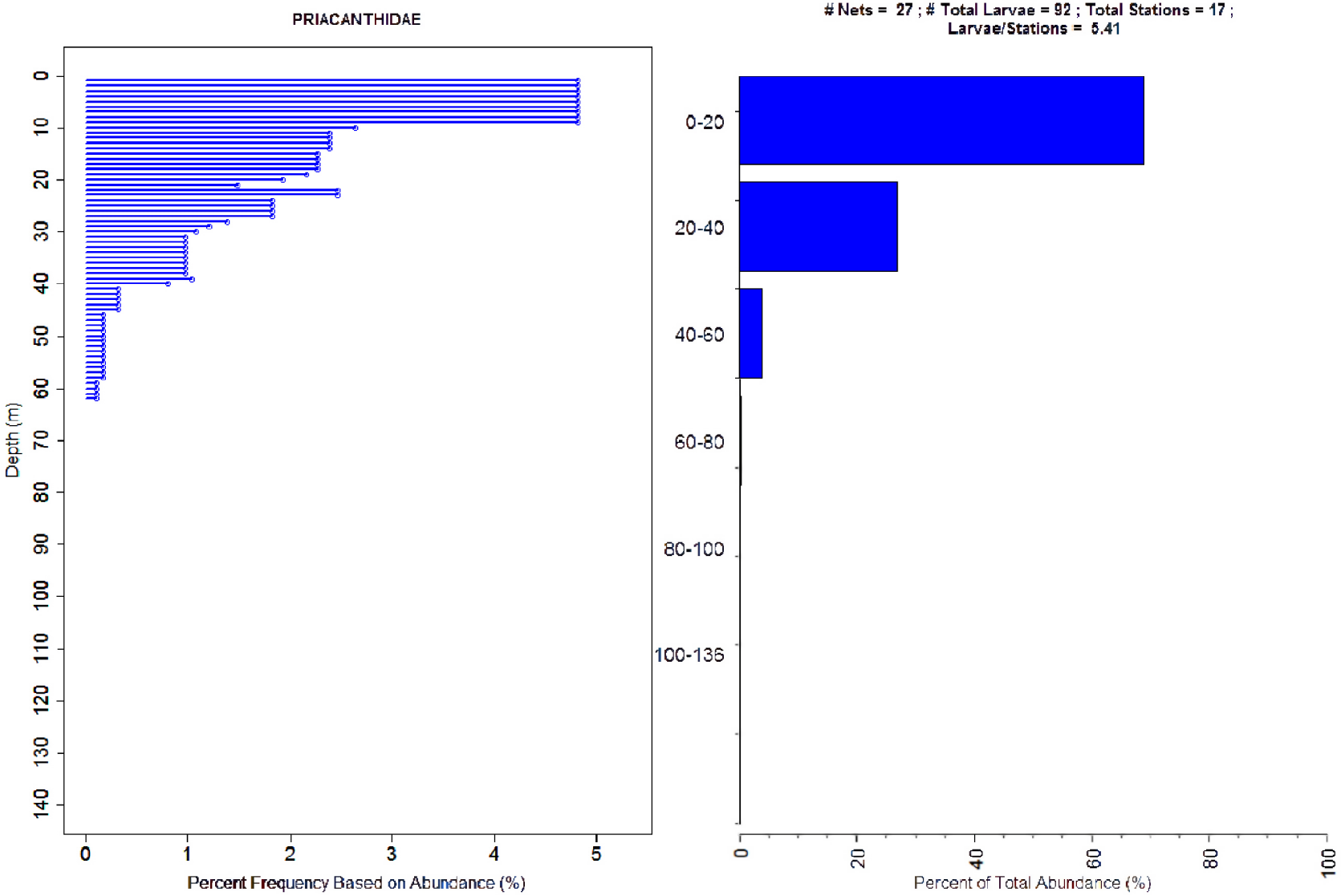
POMACANTHIDAE



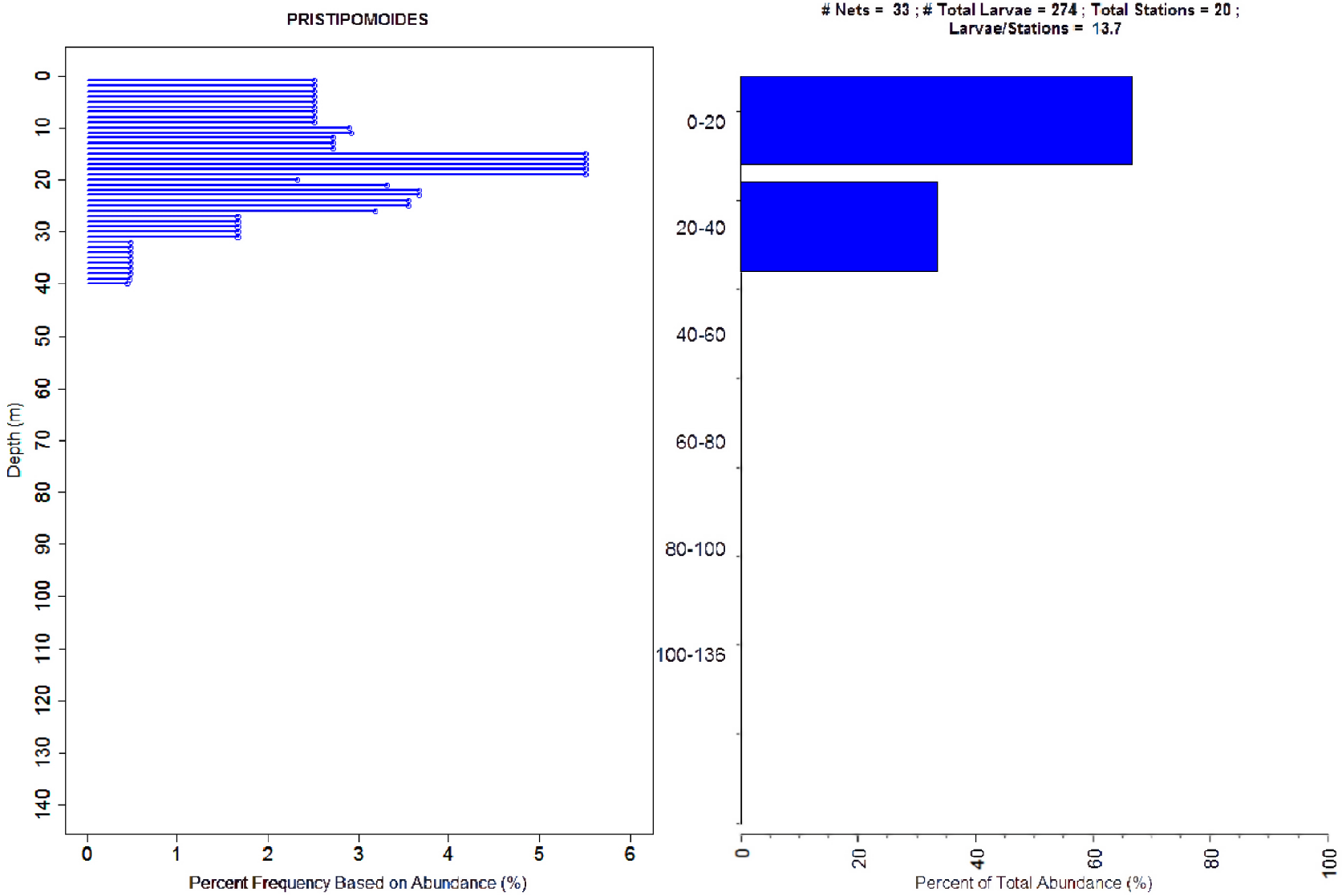
POMACENTRIDAE



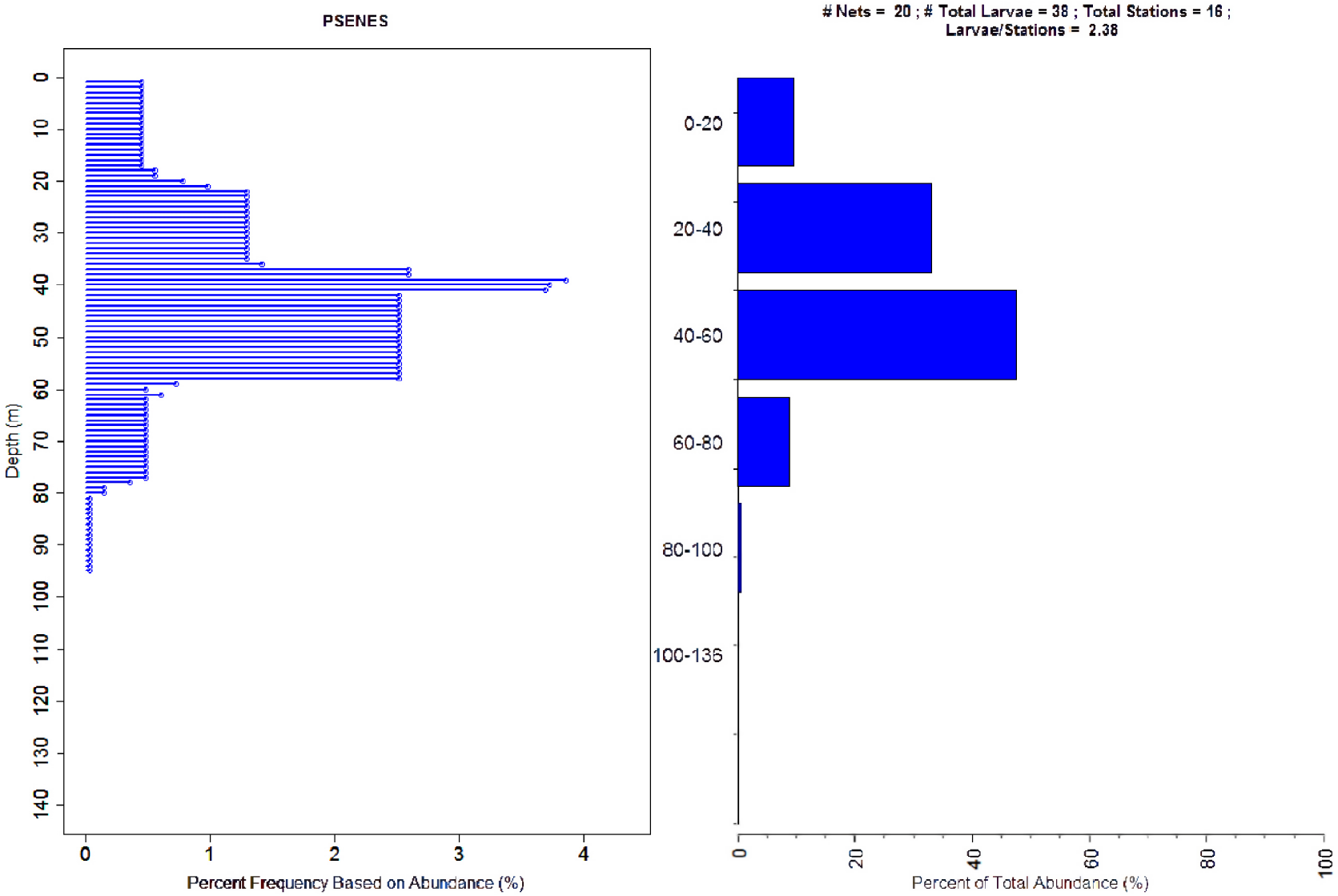
POMATOMUS_SALTATRIX



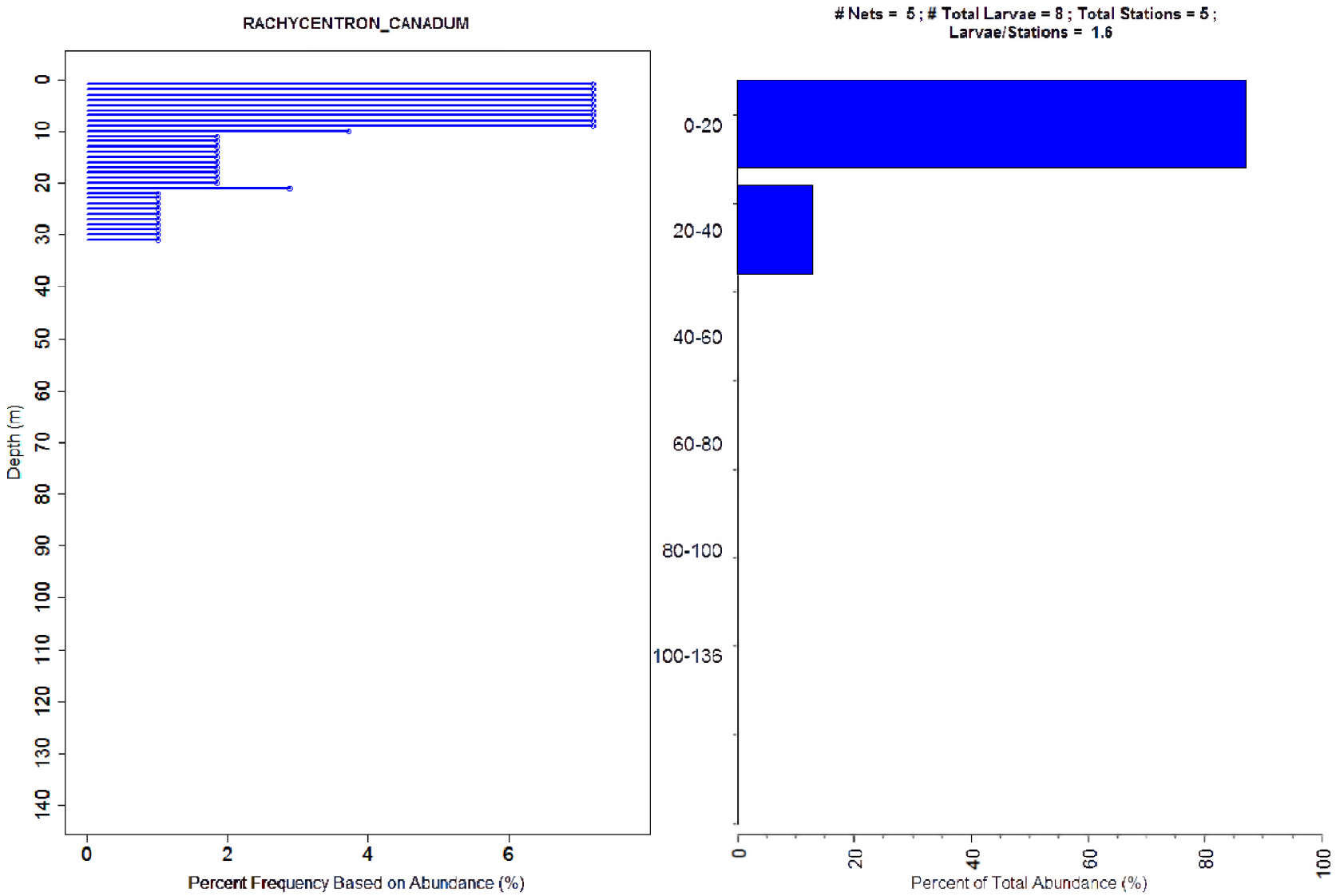
PRIACANTHIDAE



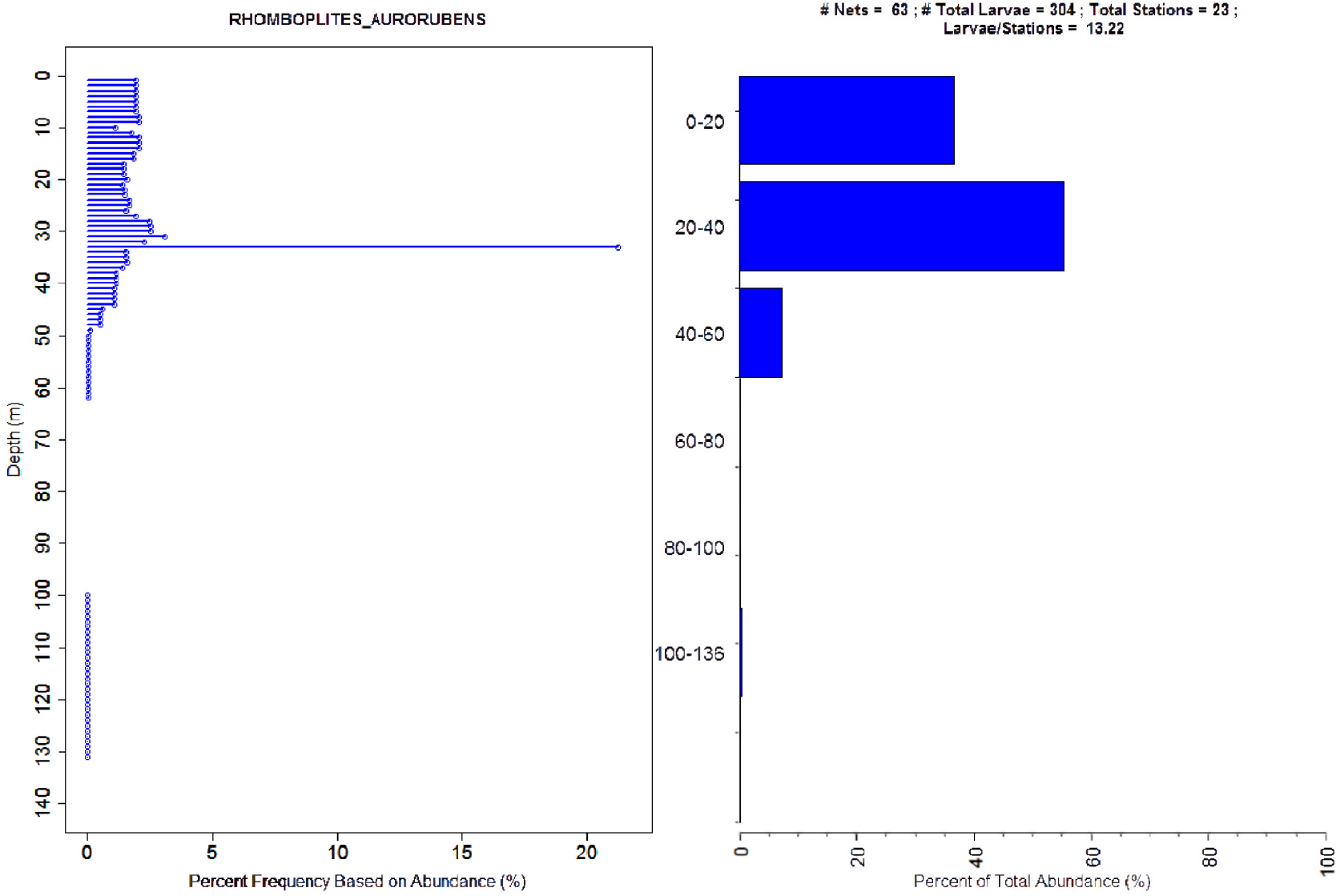
PRISTIPOMOIDES


PSENES
Nets = 20 ; # Total Larvae = 38 ; Total Stations = 16 ;
Larvae/Stations = 2.38
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

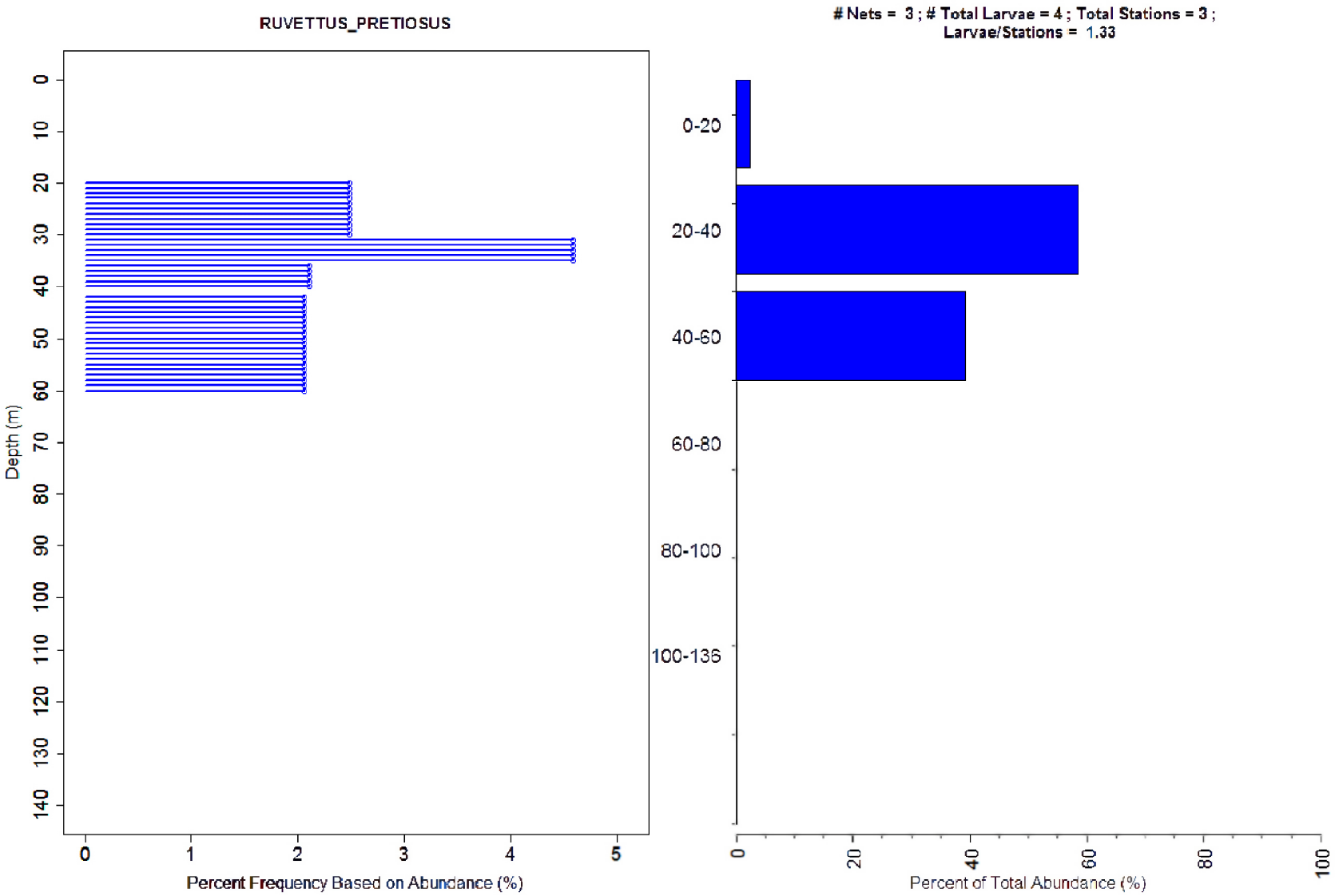
PSENES



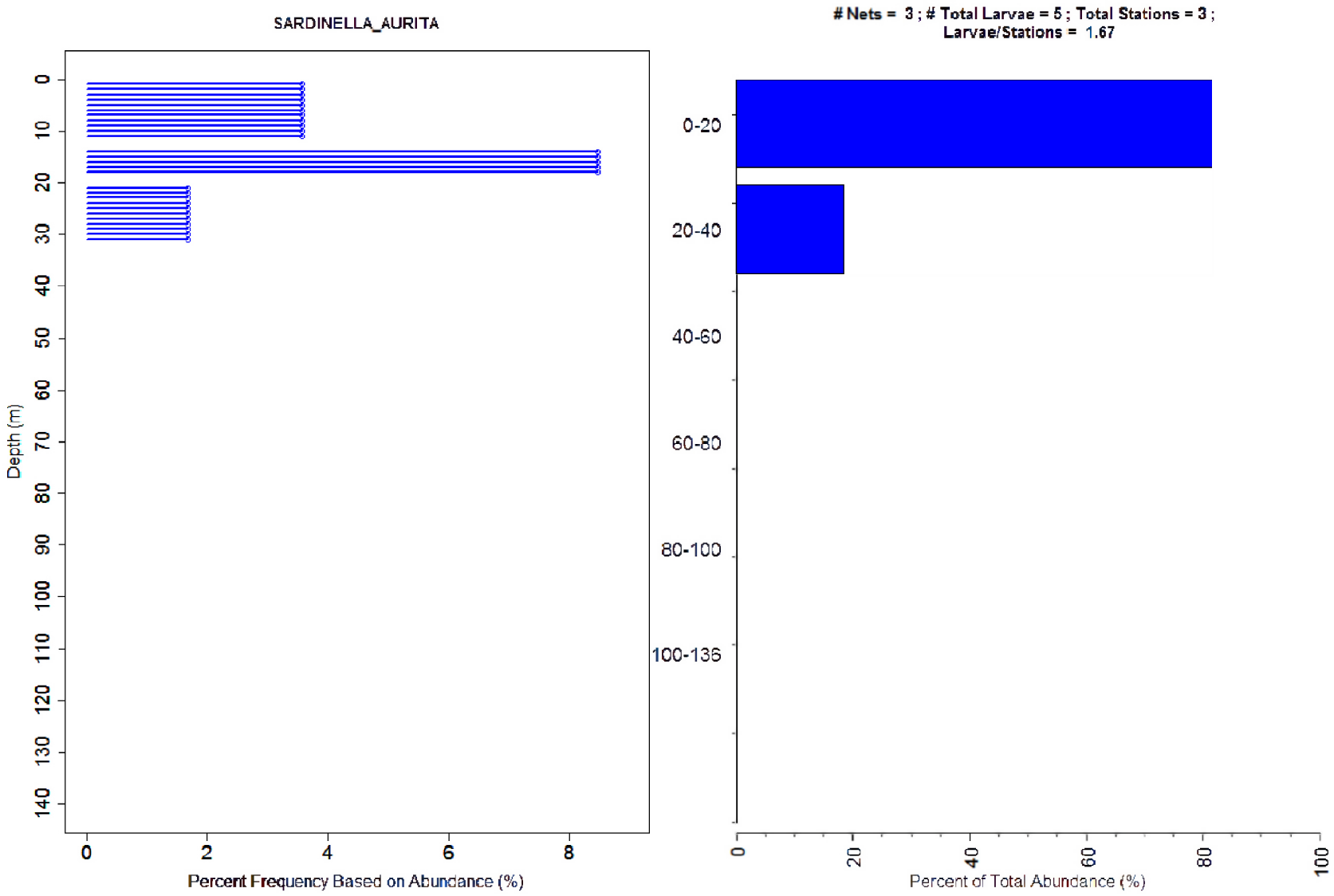
RACHYCENTRON_CANADUM



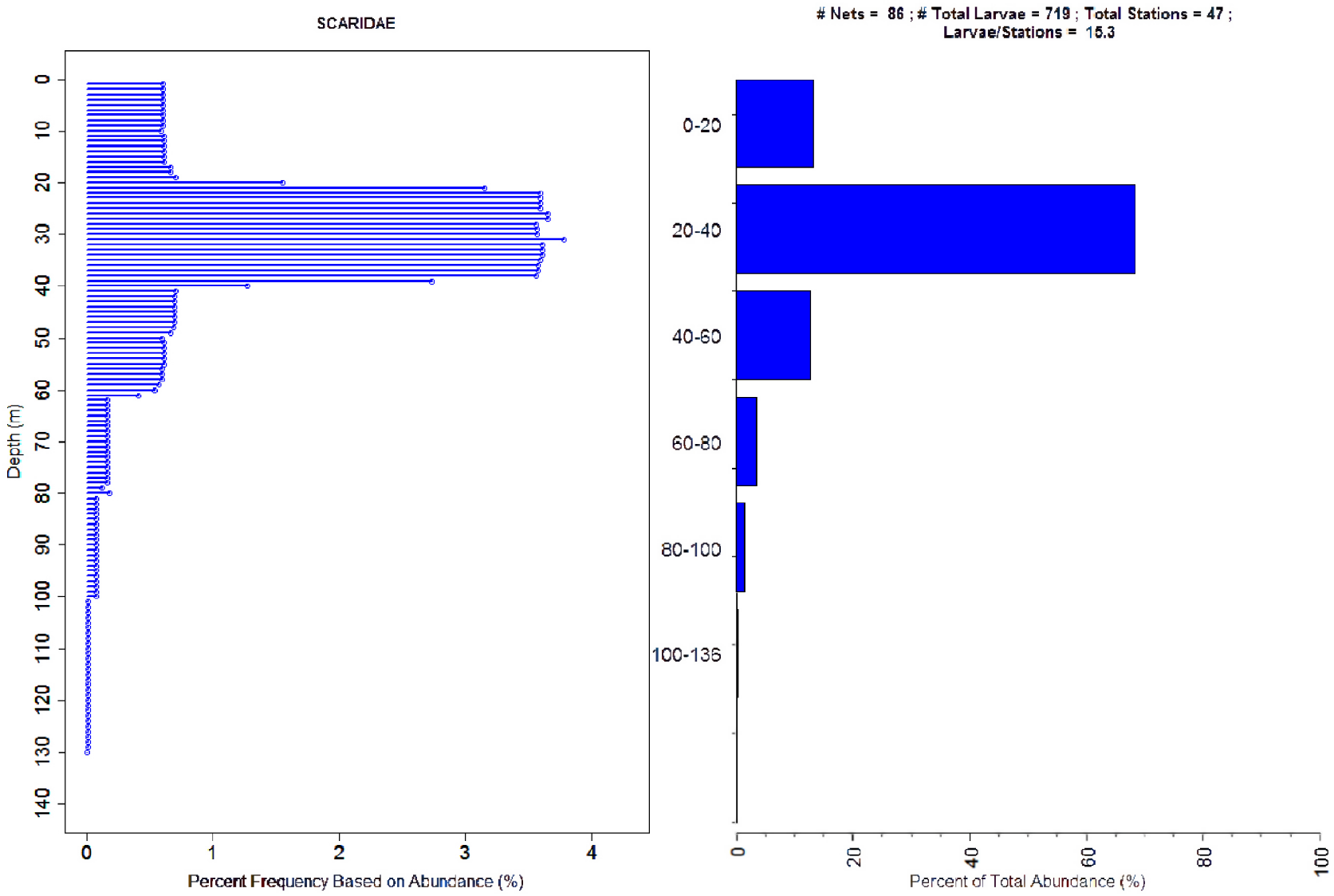
RHOMBOPLITES_AURORUBENS



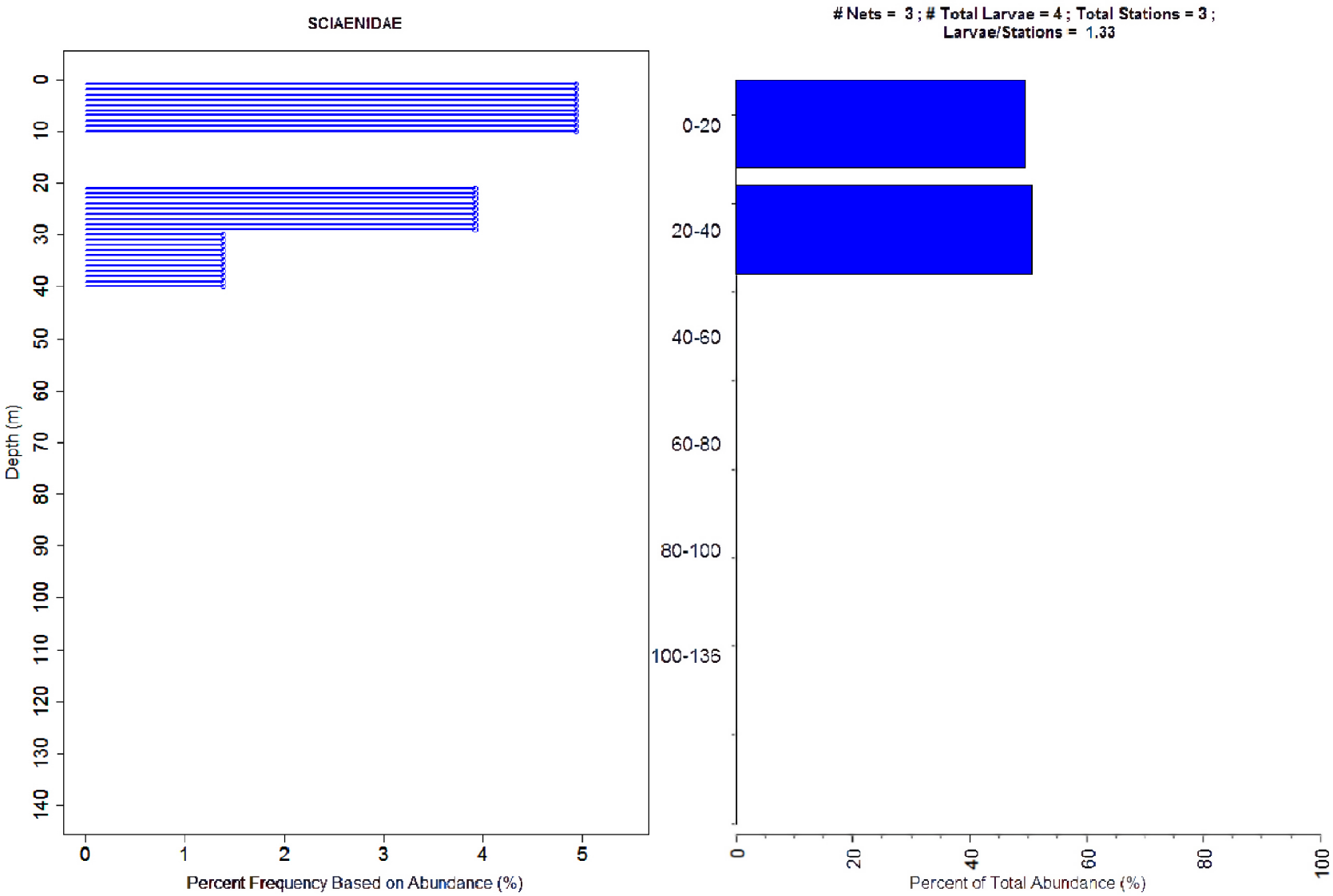
RUVETTUS_PRETIOSUS



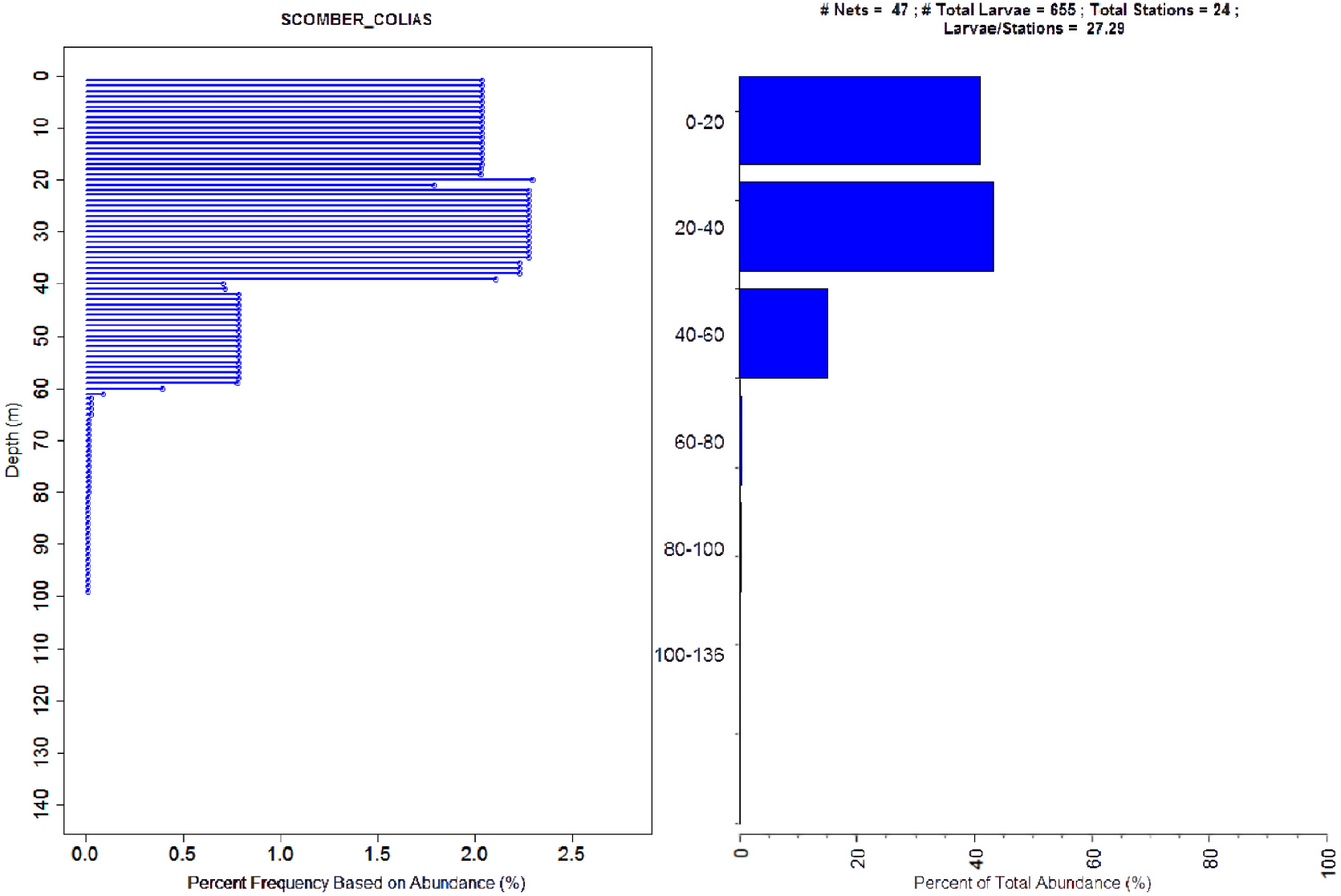
SARDINELLA_AURITA


SCARIDAE
Nets = 86 ; # Total Larvae = 719 ; Total Stations = 47 ;
Larvae/Stations = 15.3
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

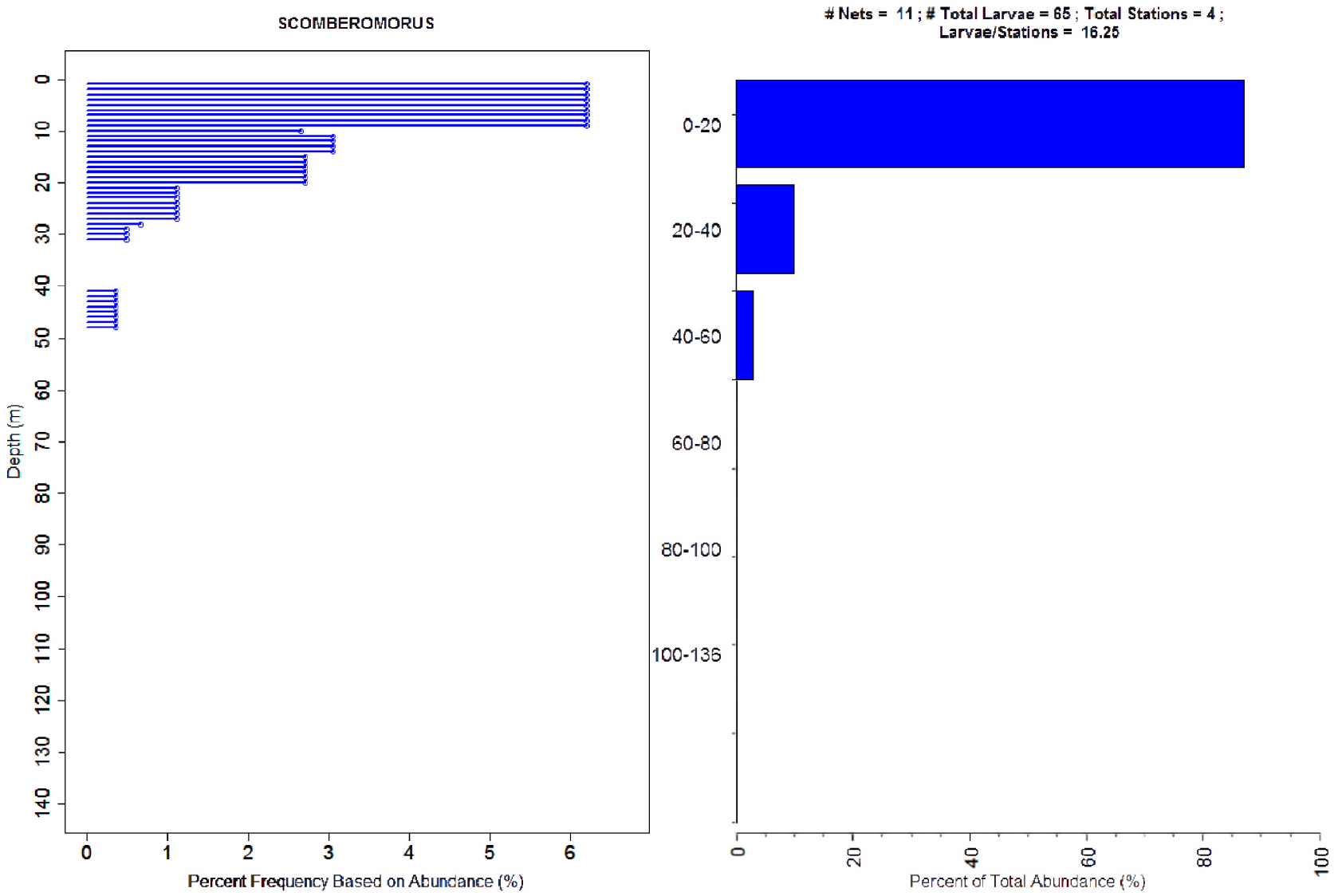
SCARIDAE


SCIAENIDAE
Nets = 3 ; # Total Larvae = 4 ; Total Stations = 3 ;
Larvae/Stations = 1.33
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

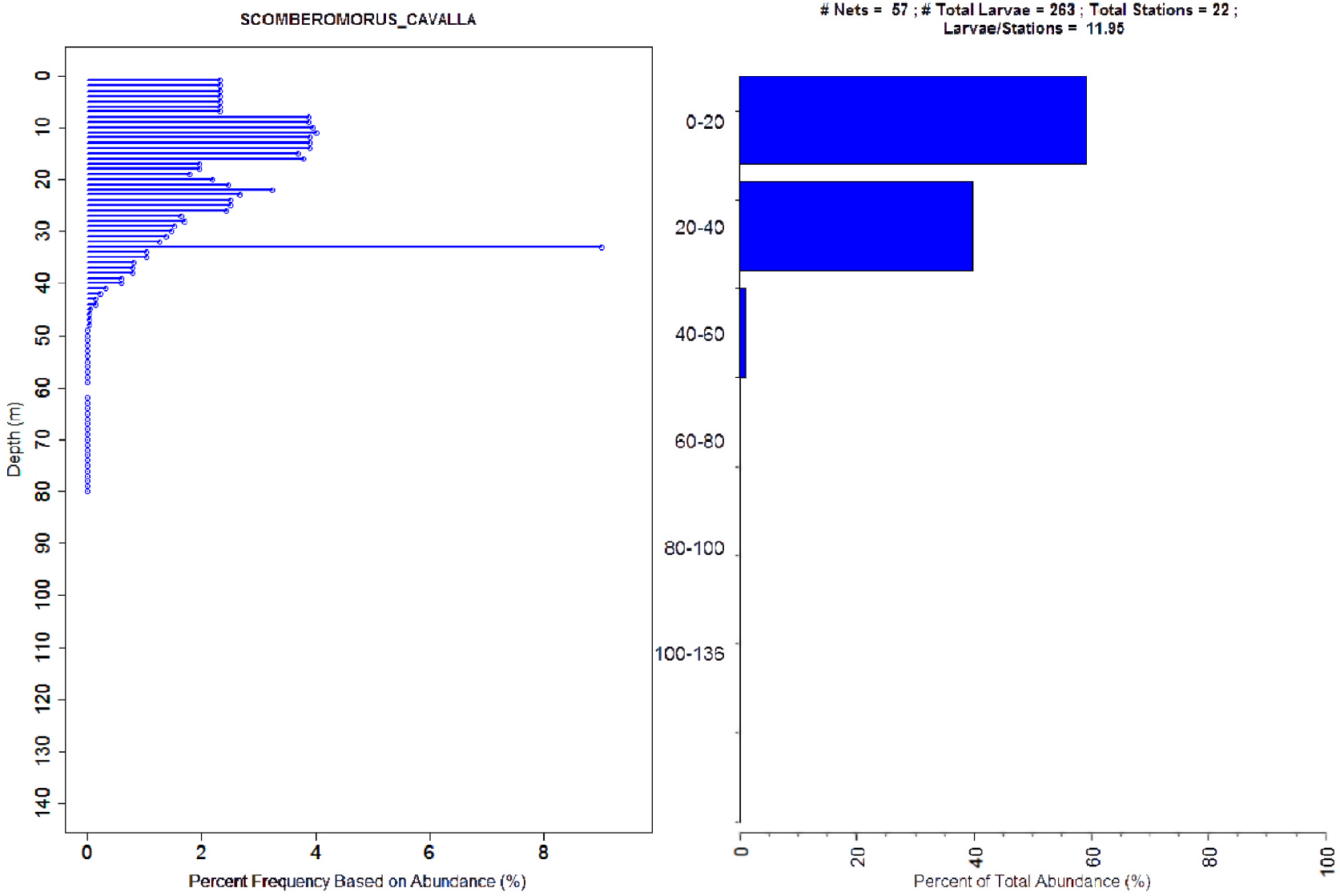
SCIAENIDAE



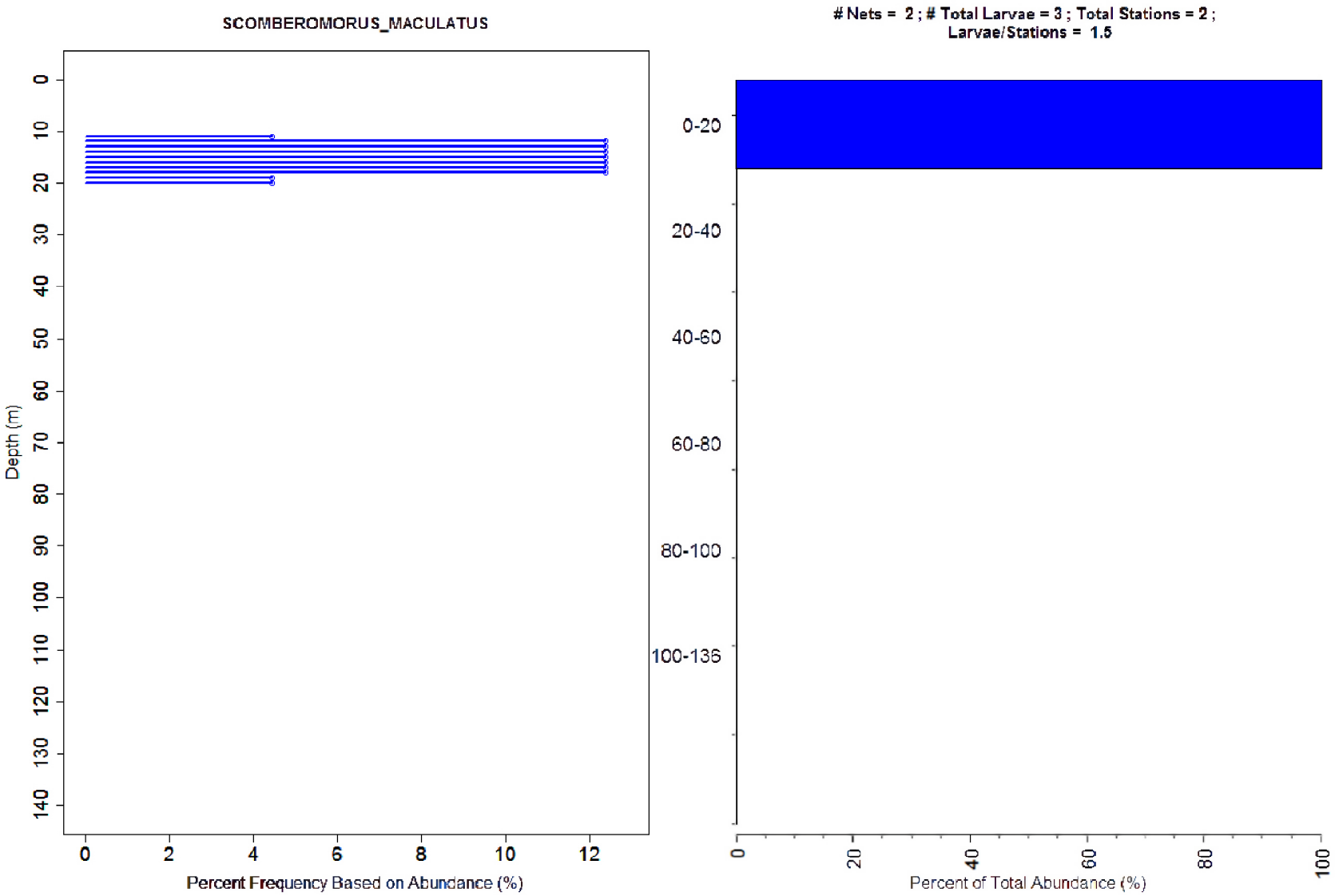
SCOMBER_COLIAS



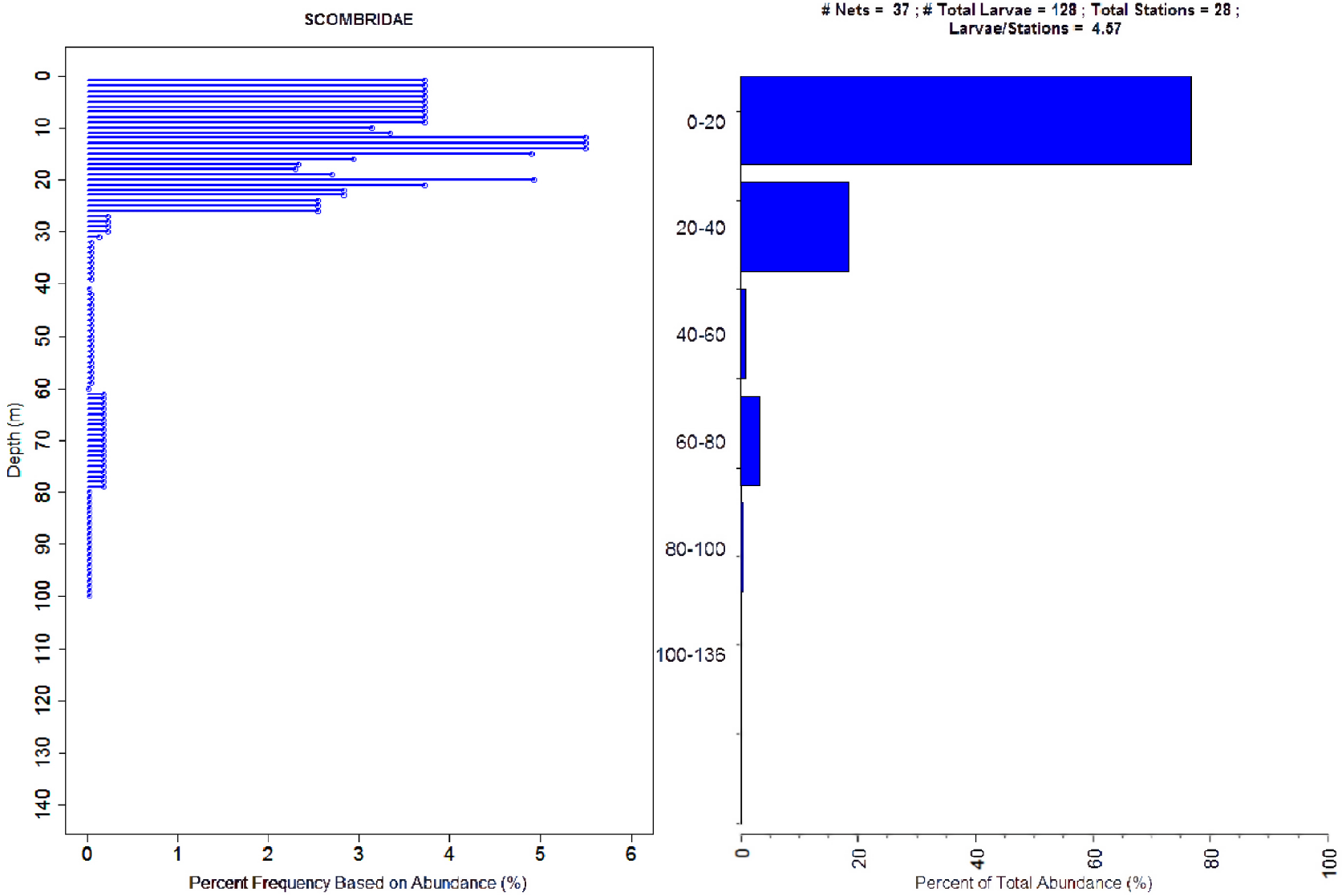
SCOMBEROMORUS



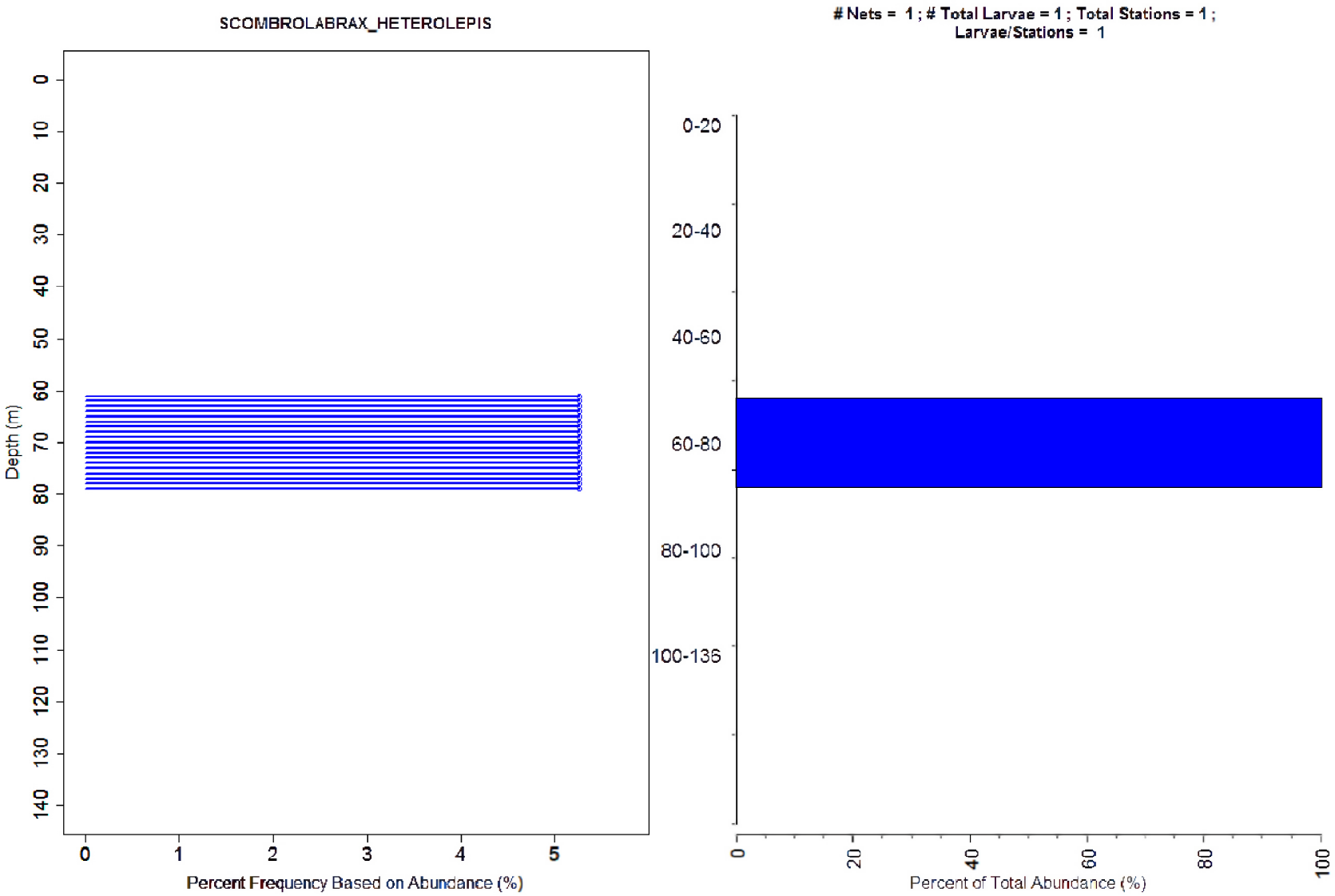
SCOMBEROMORUS_CAVALLA



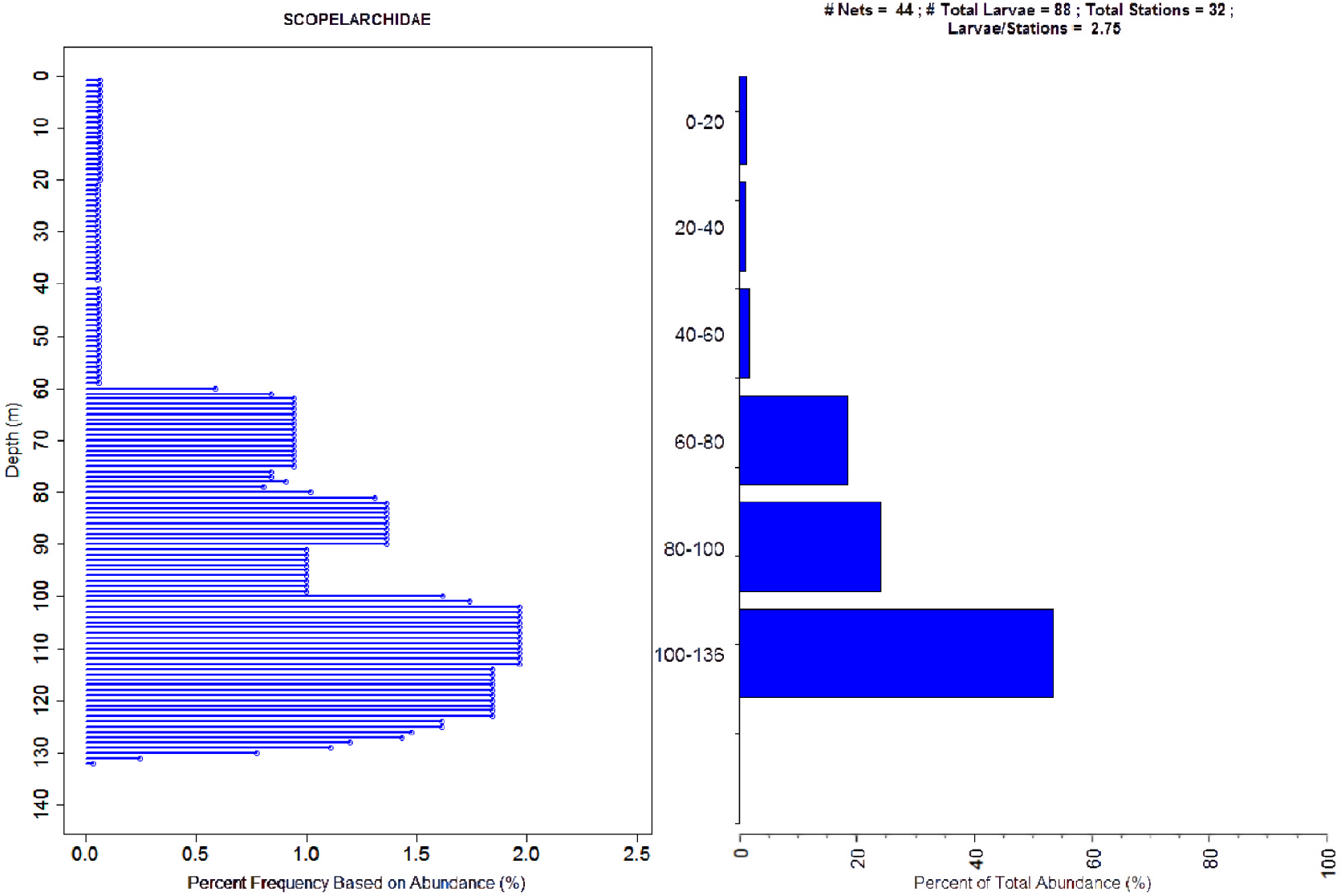
SCOMBEROMORUS_MACULATUS


SCOMBRIDAE
Nets = 37 ; # Total Larvae = 128 ; Total Stations = 28 ;
Larvae/Stations = 4.57
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

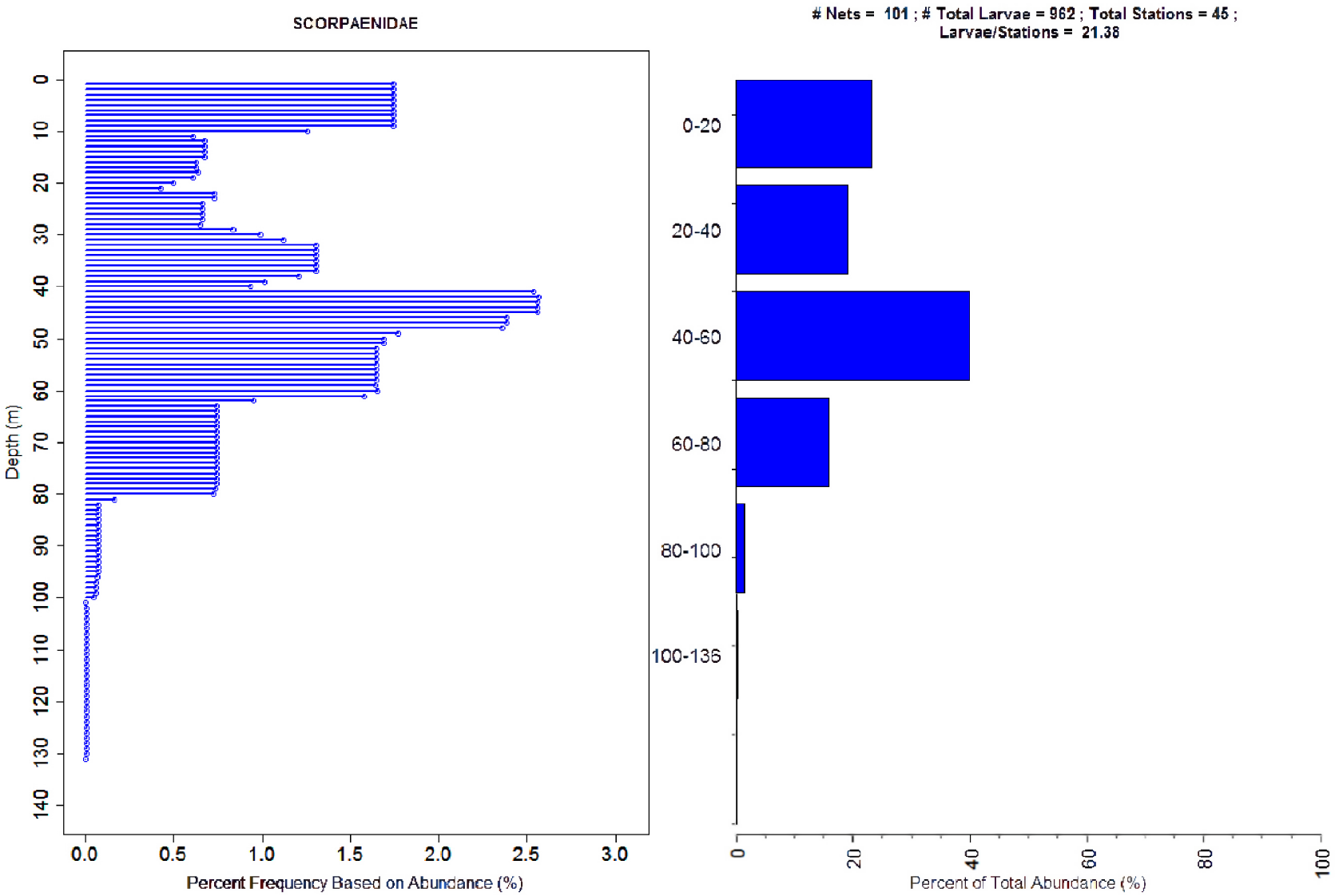
SCOMBRIDAE



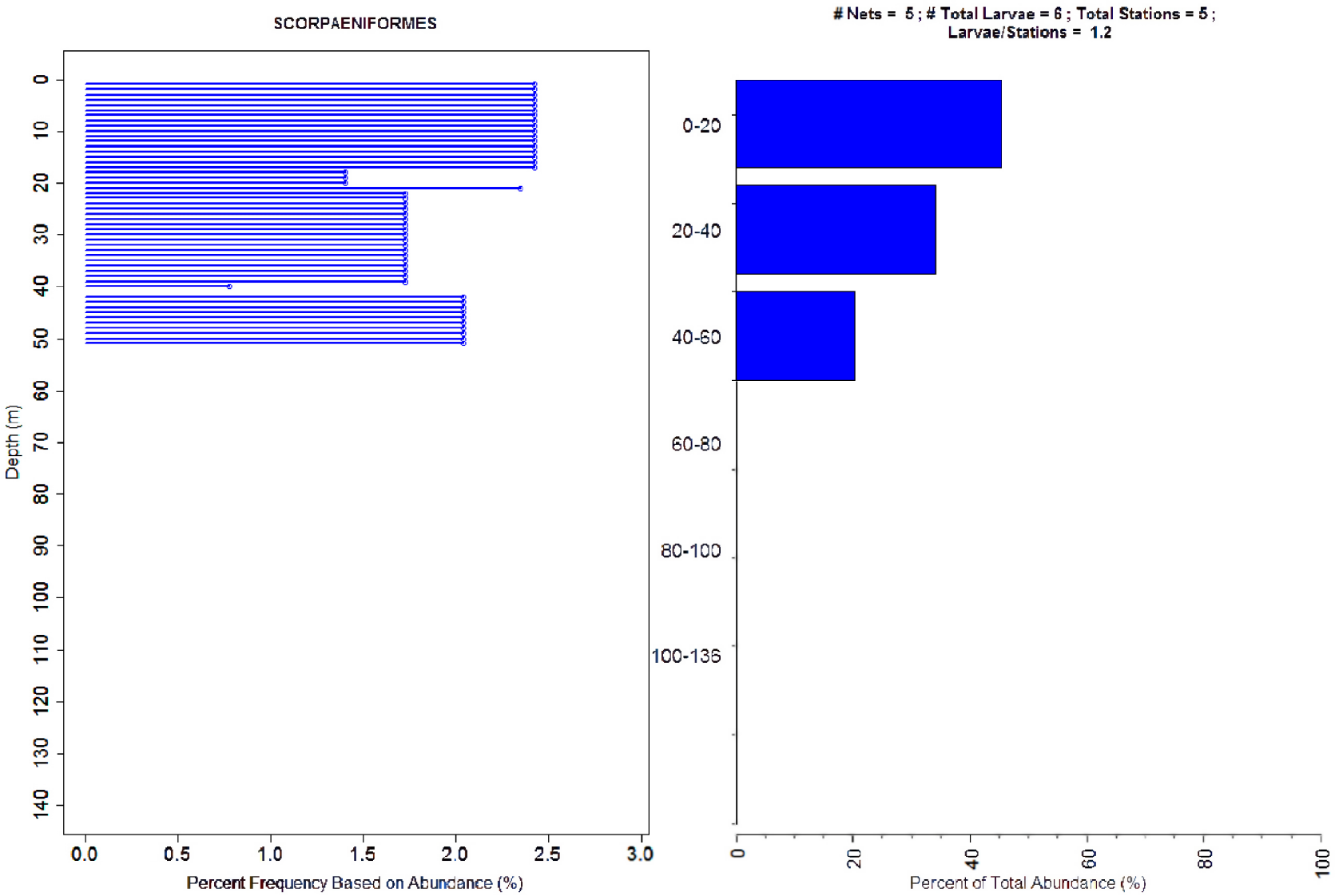
SCOMBROLABRAX_HETEROLEPIS



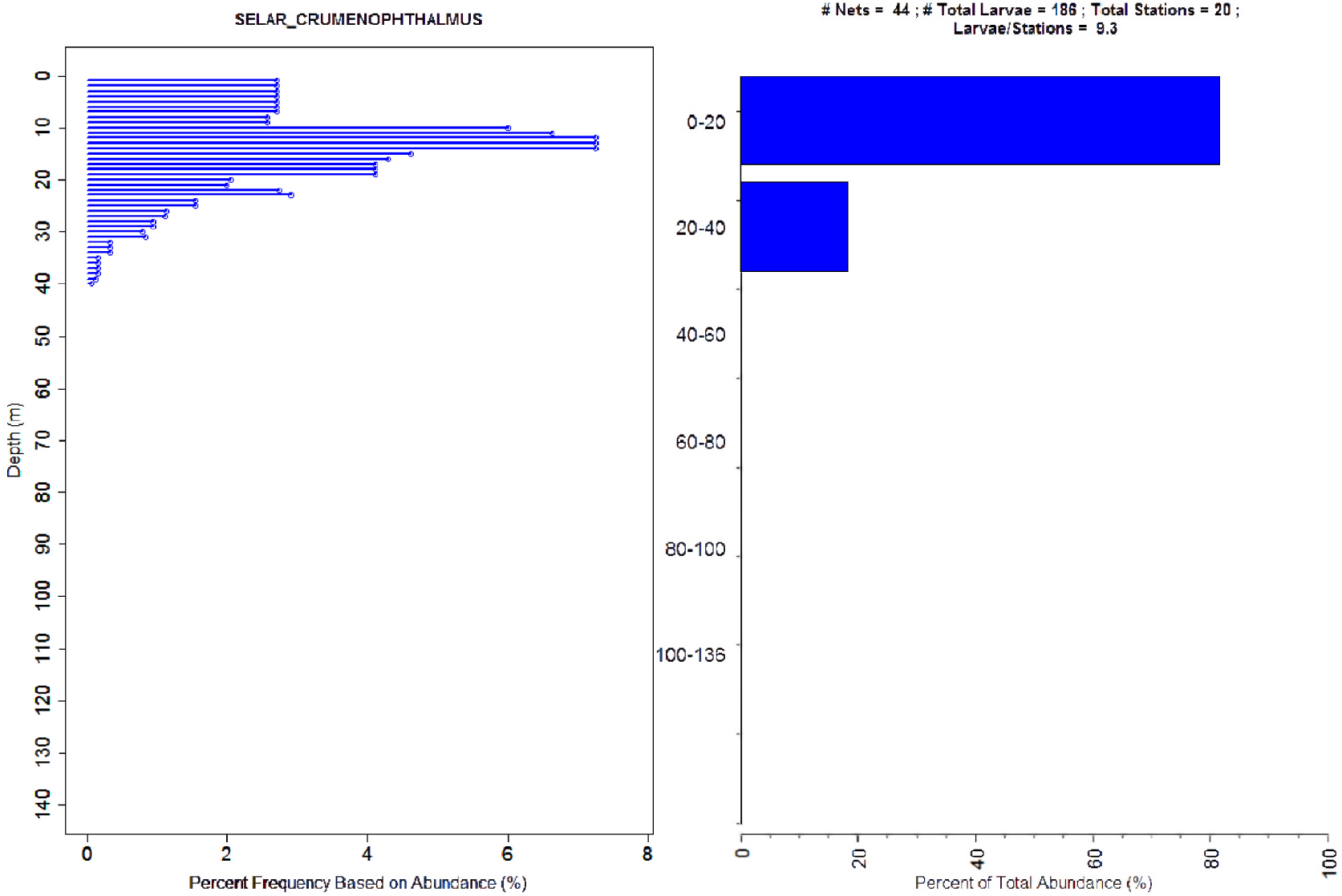
SCOPELARCHIDAE



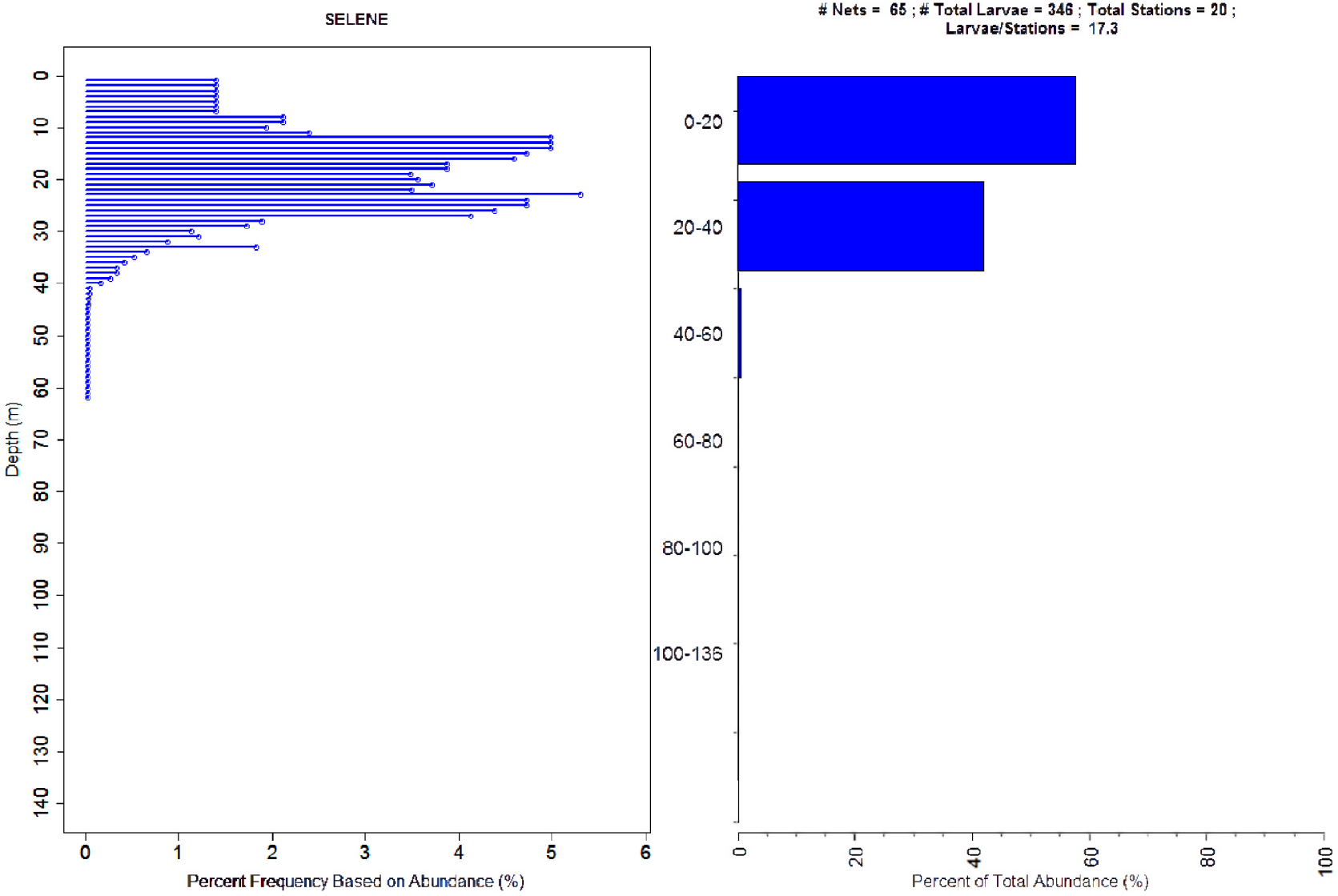
SCORPAENIDAE



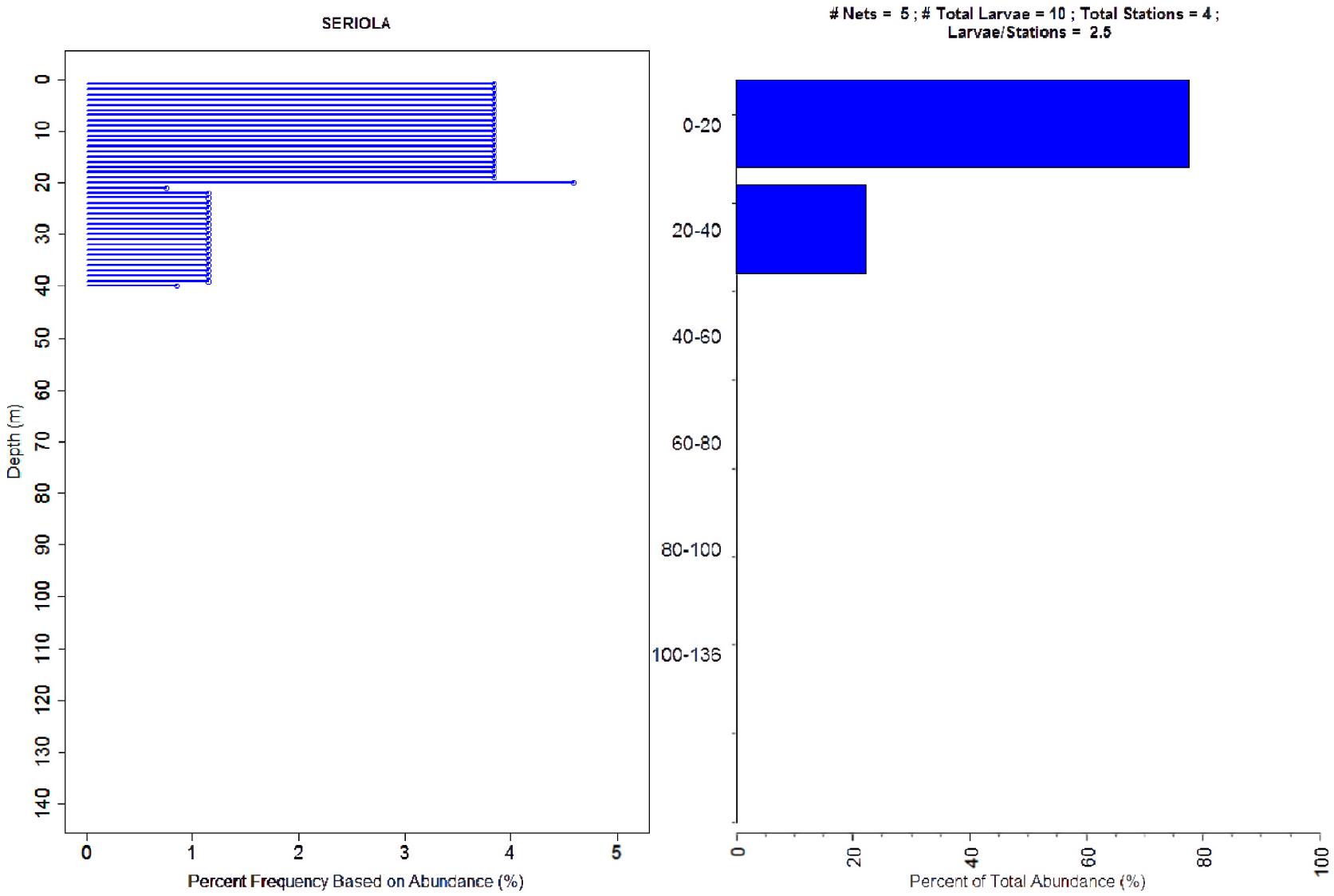
SCORPAENIFORMES



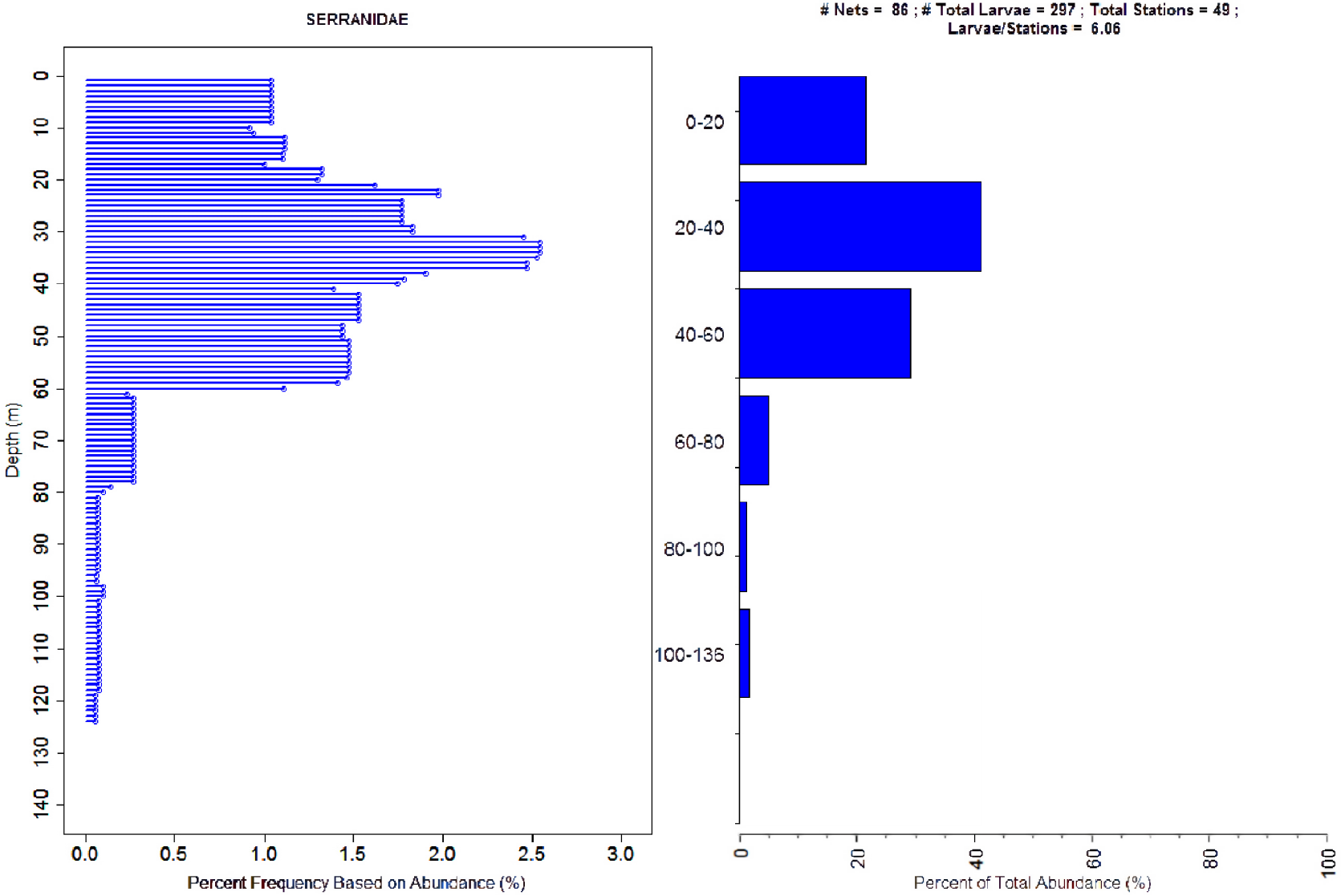
SELAR_CRUMENOPHTHALMUS


SELENE
Nets = 65 ; # Total Larvae = 346 ; Total Stations = 20 ;
Larvae/Stations = 17.3
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

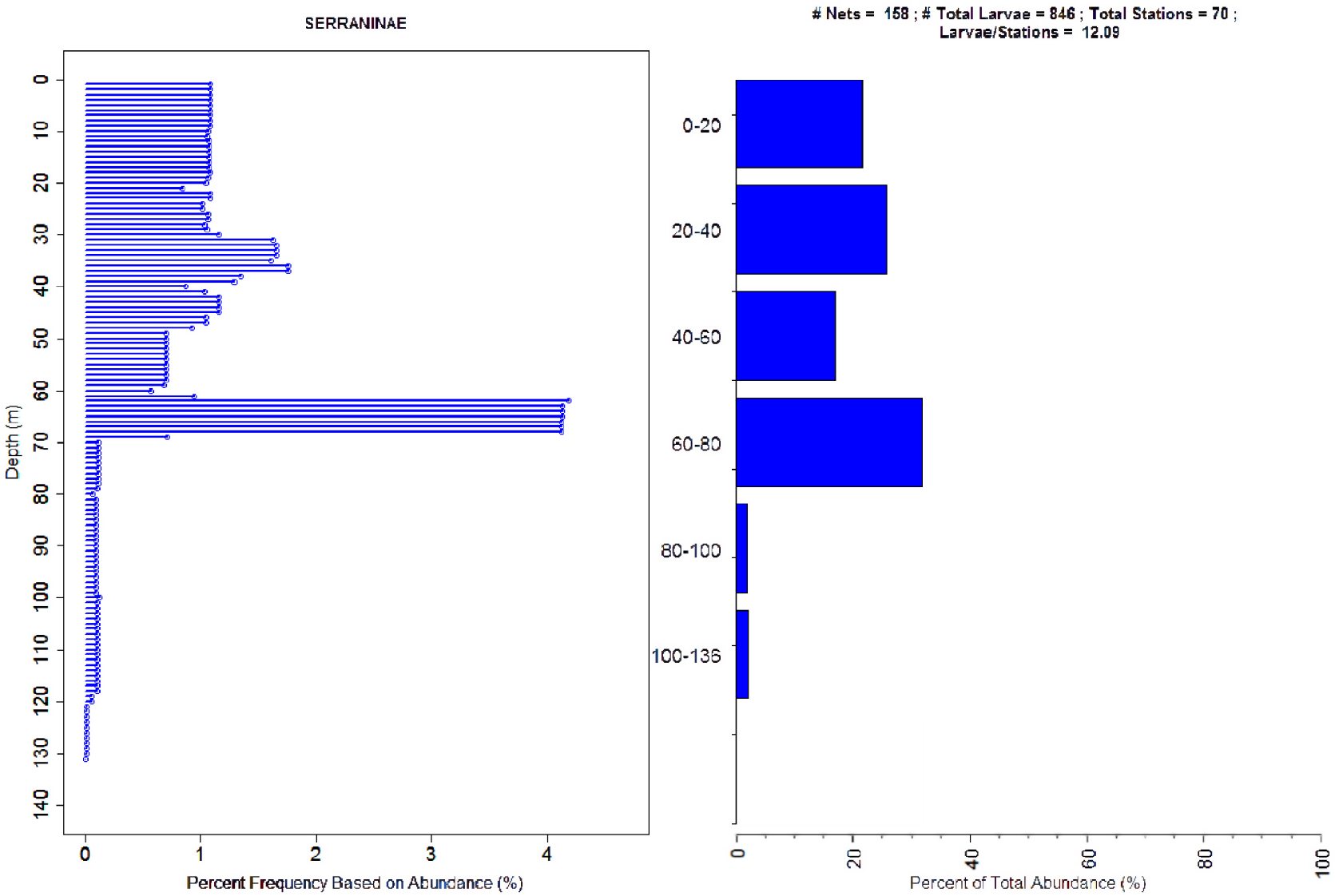
SELENE


SERIOLA
Nets = 5 ; # Total Larvae = 10 ; Total Stations = 4 ;
Larvae/Stations = 2.5
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

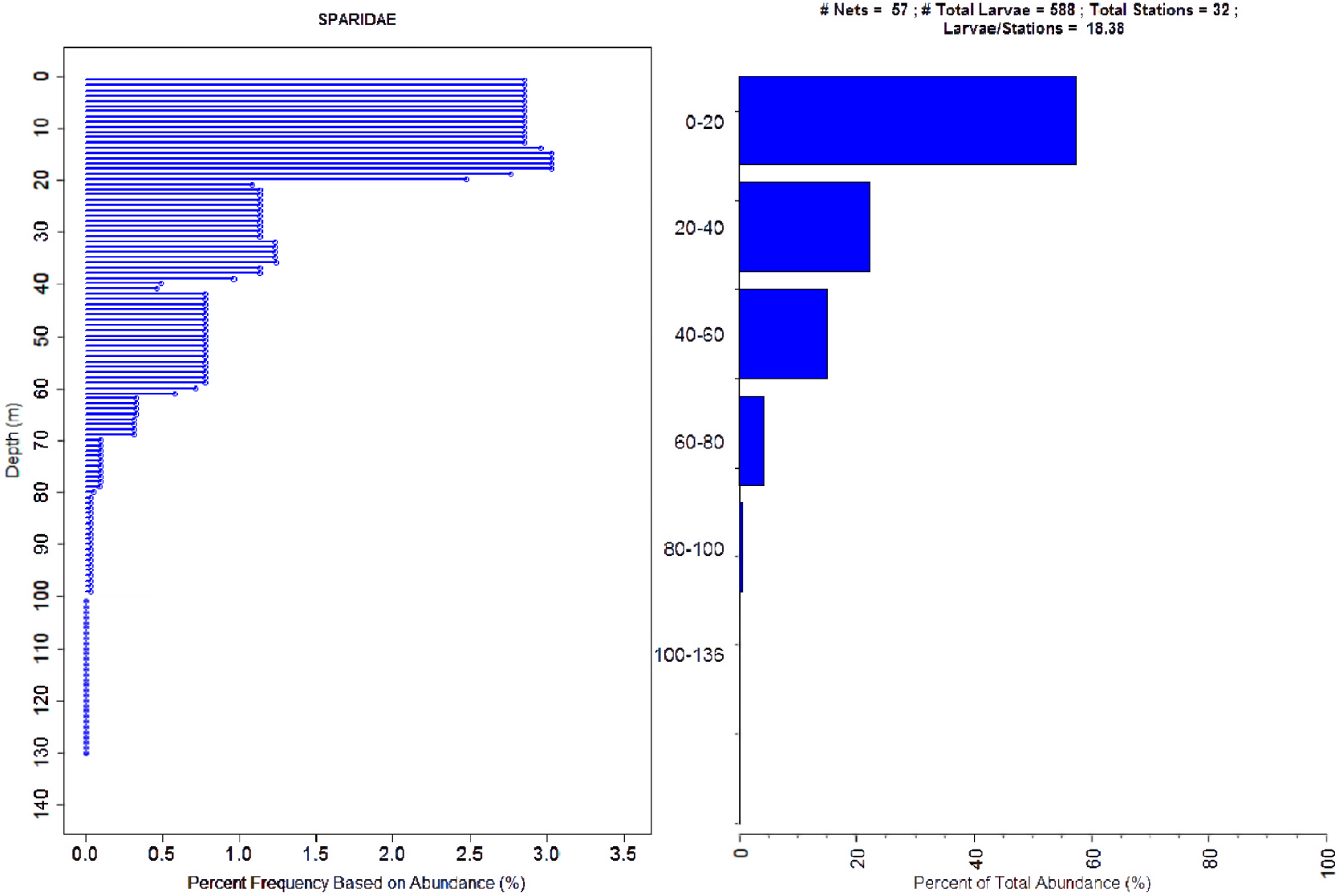
SERIOLA


SERRANIDAE
Nets = 86 ; # Total Larvae = 297 ; Total Stations = 49 ;
Larvae/Stations = 6.06
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

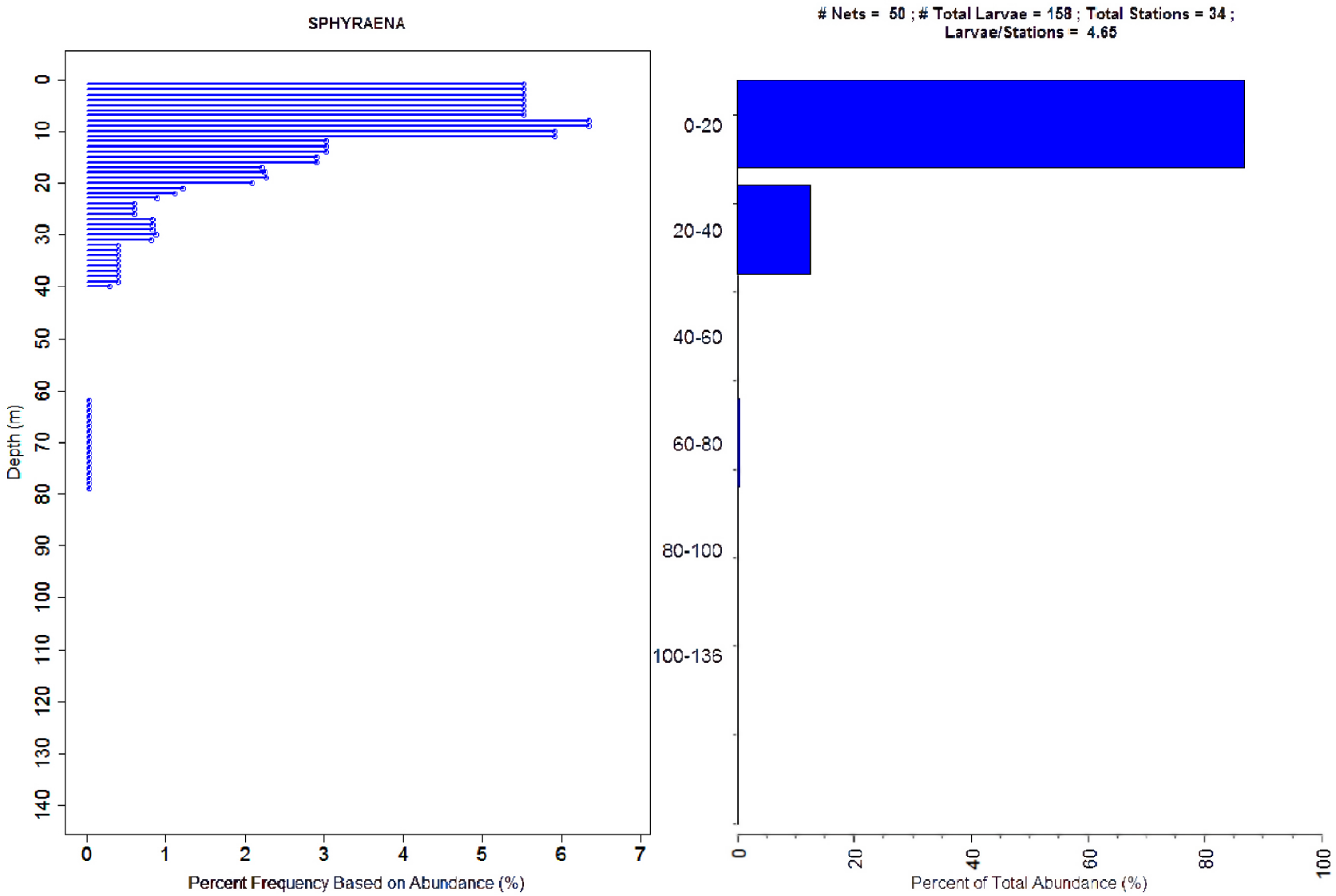
SERRANIDAE


SERRANINAE
Nets = 158 ; # Total Larvae = 846 ; Total Stations = 70 ;
Larvae/Stations = 12.09
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

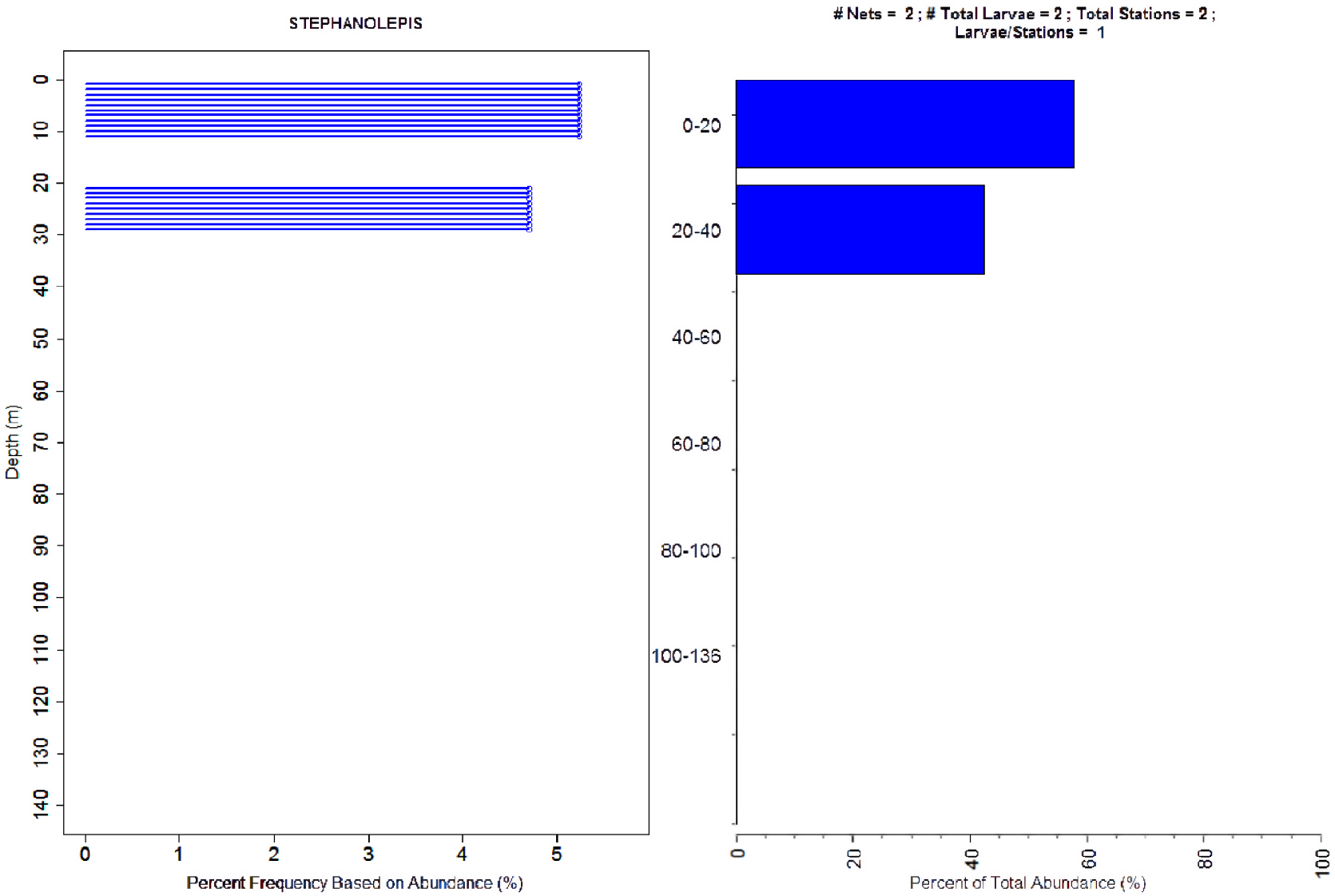
SERRANINAE


SPARIDAE
Nets = 57 ; # Total Larvae = 588 ; Total Stations = 32 ;
Larvae/Stations = 18.38
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

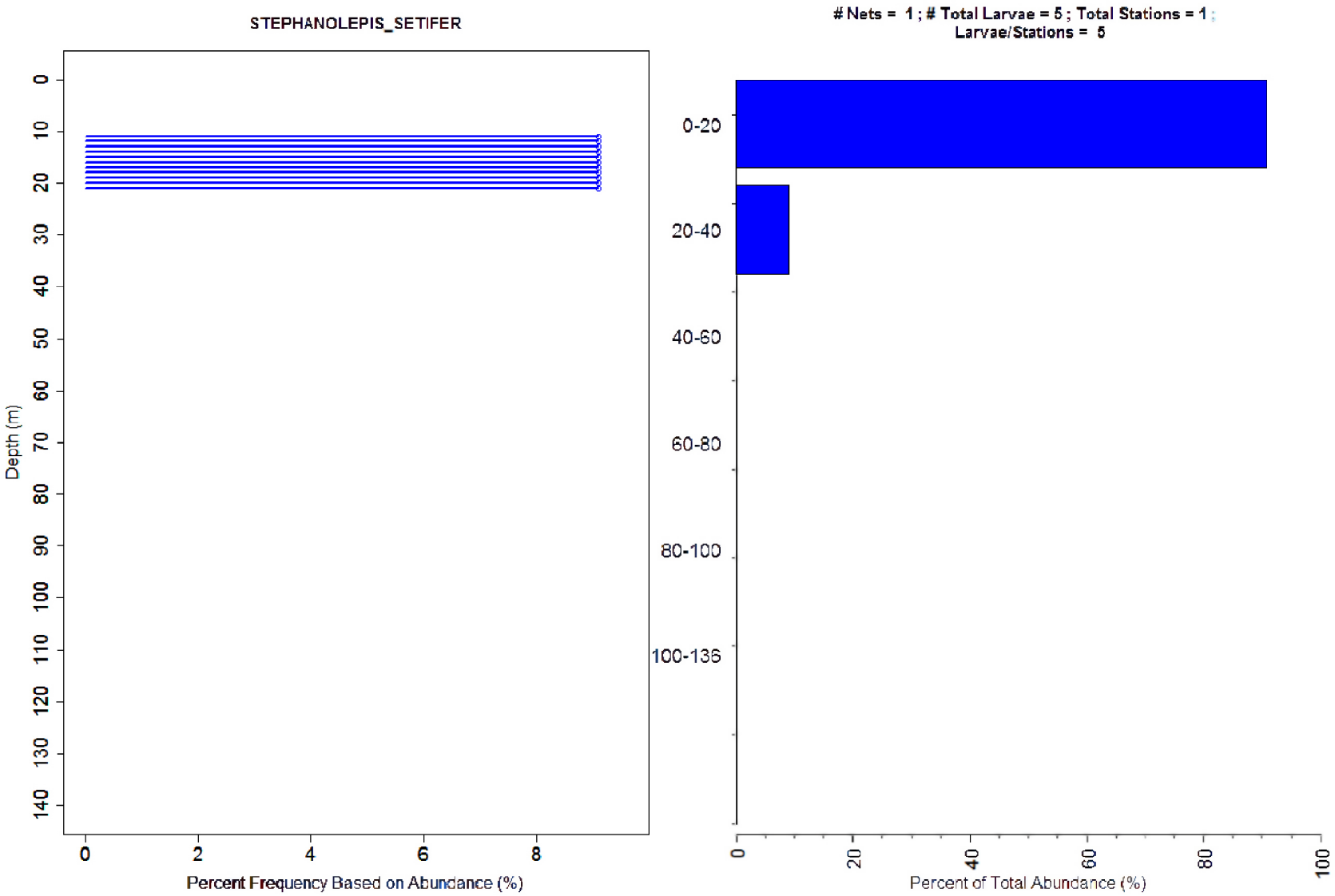
SPARIDAE


SPHYRAENA
Nets = 50 ; # Total Larvae = 158 ; Total Stations = 34 ;
Larvae/Stations = 4.65
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
7
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

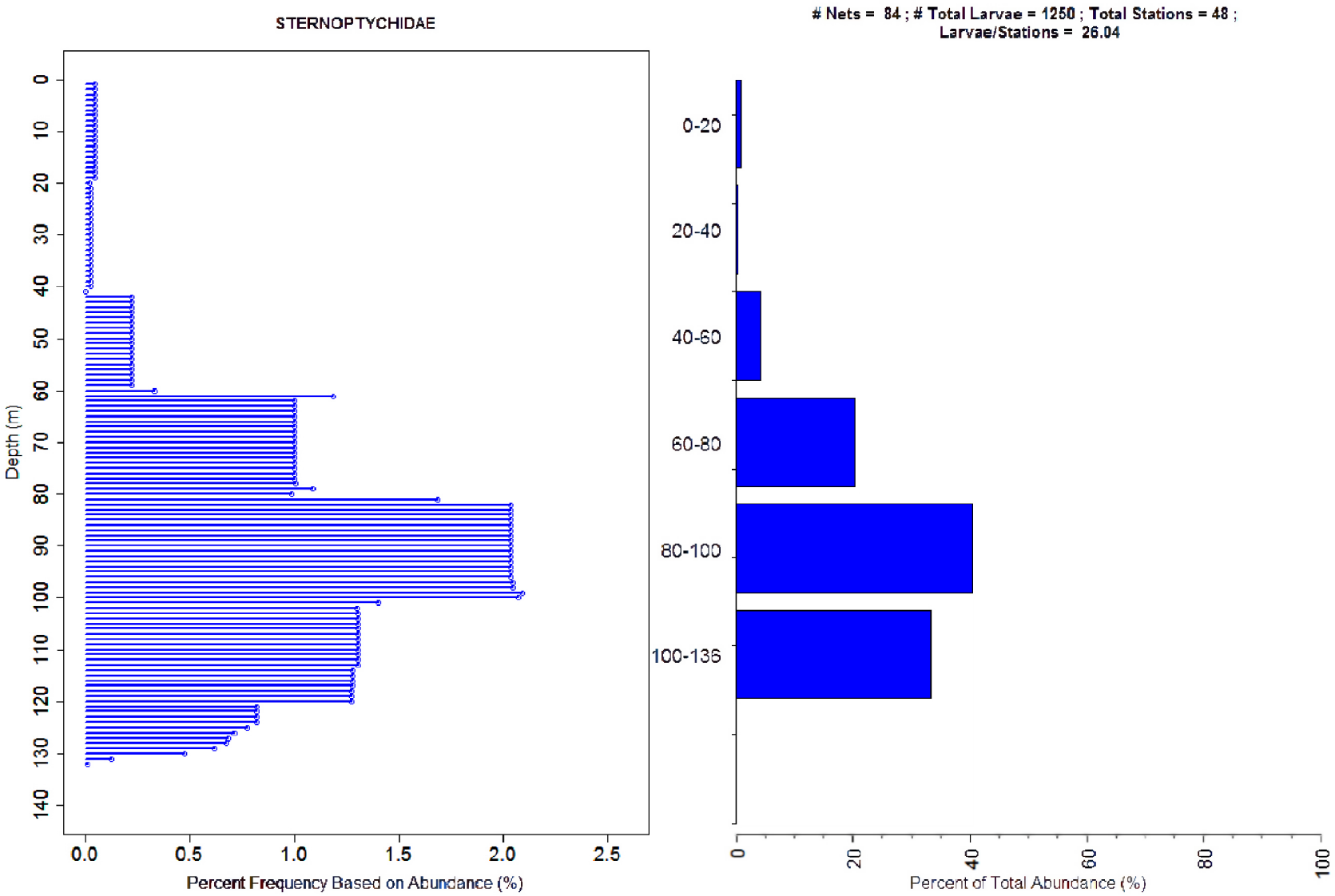
SPHYRAENA



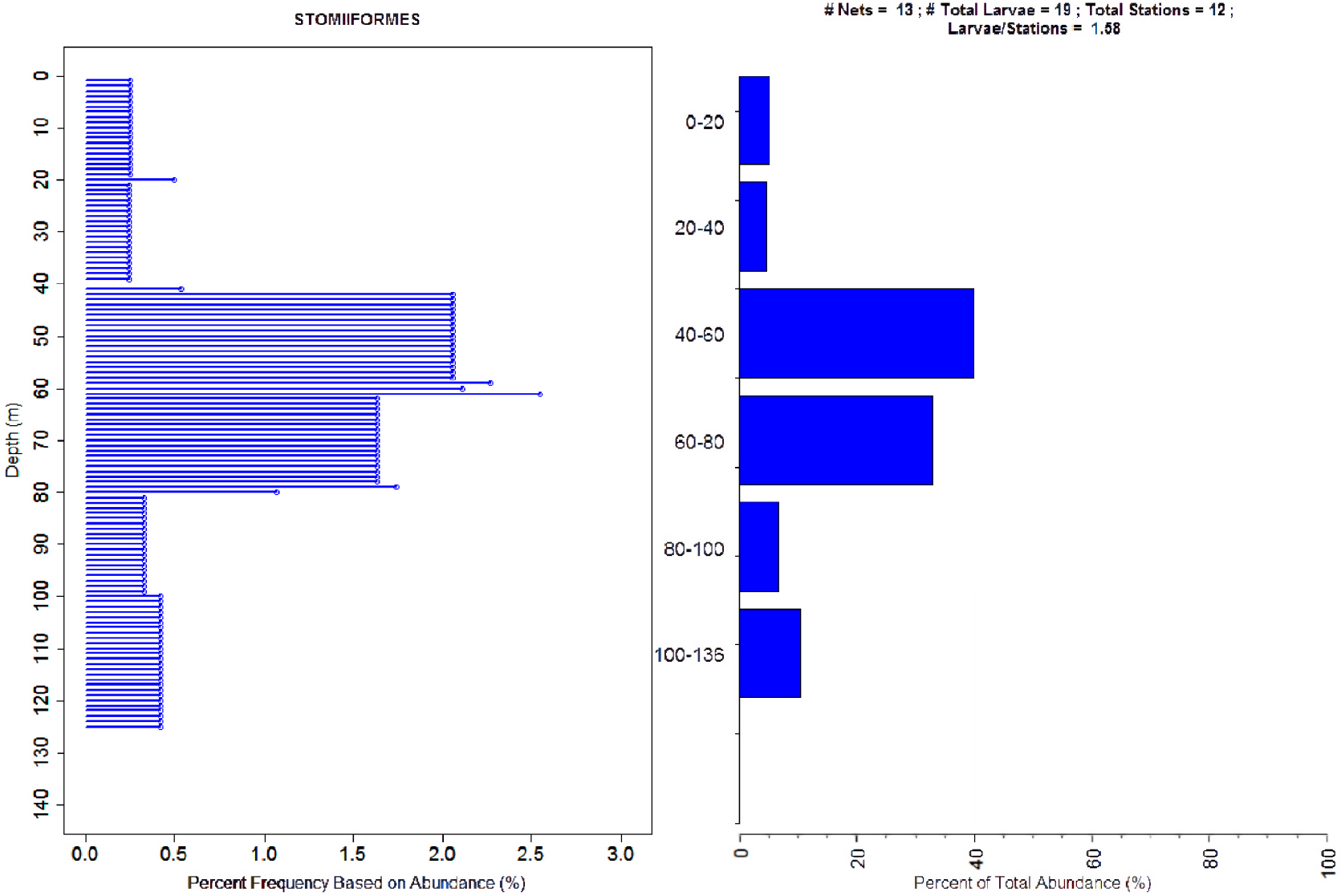
STEPHANOLEPIS



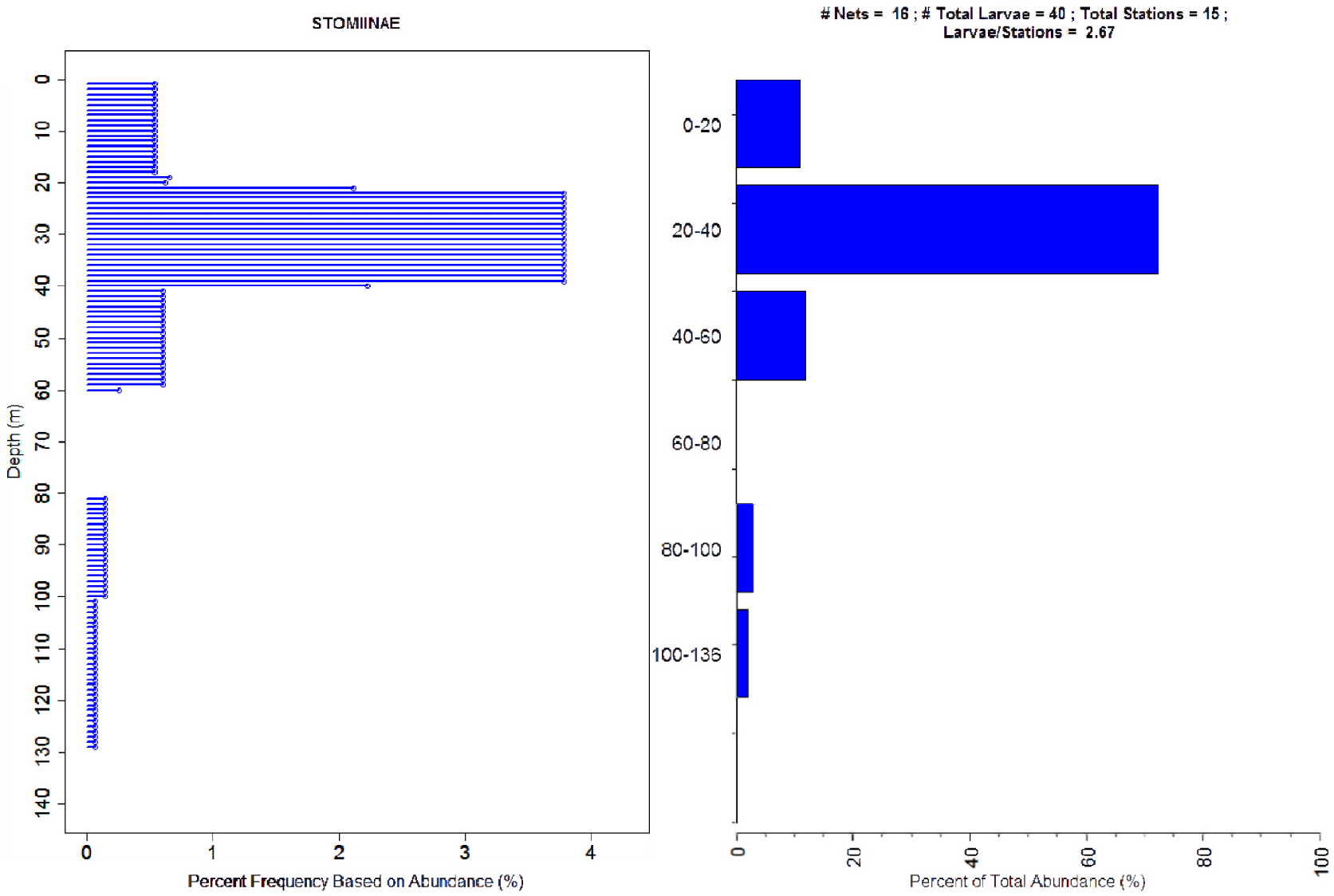
STEPHANOLEPIS_SETIFER



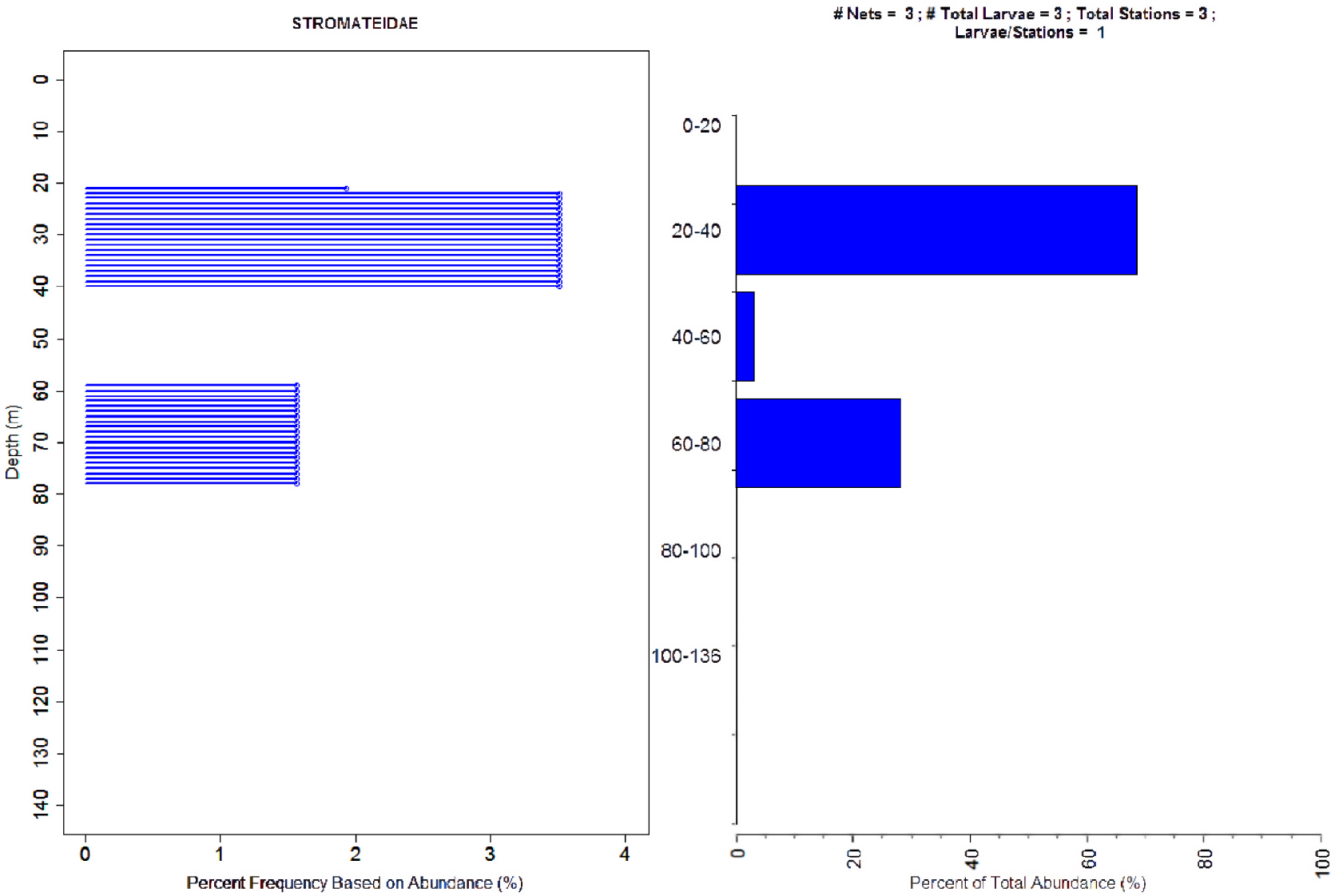
STERNOPTYCHIDAE



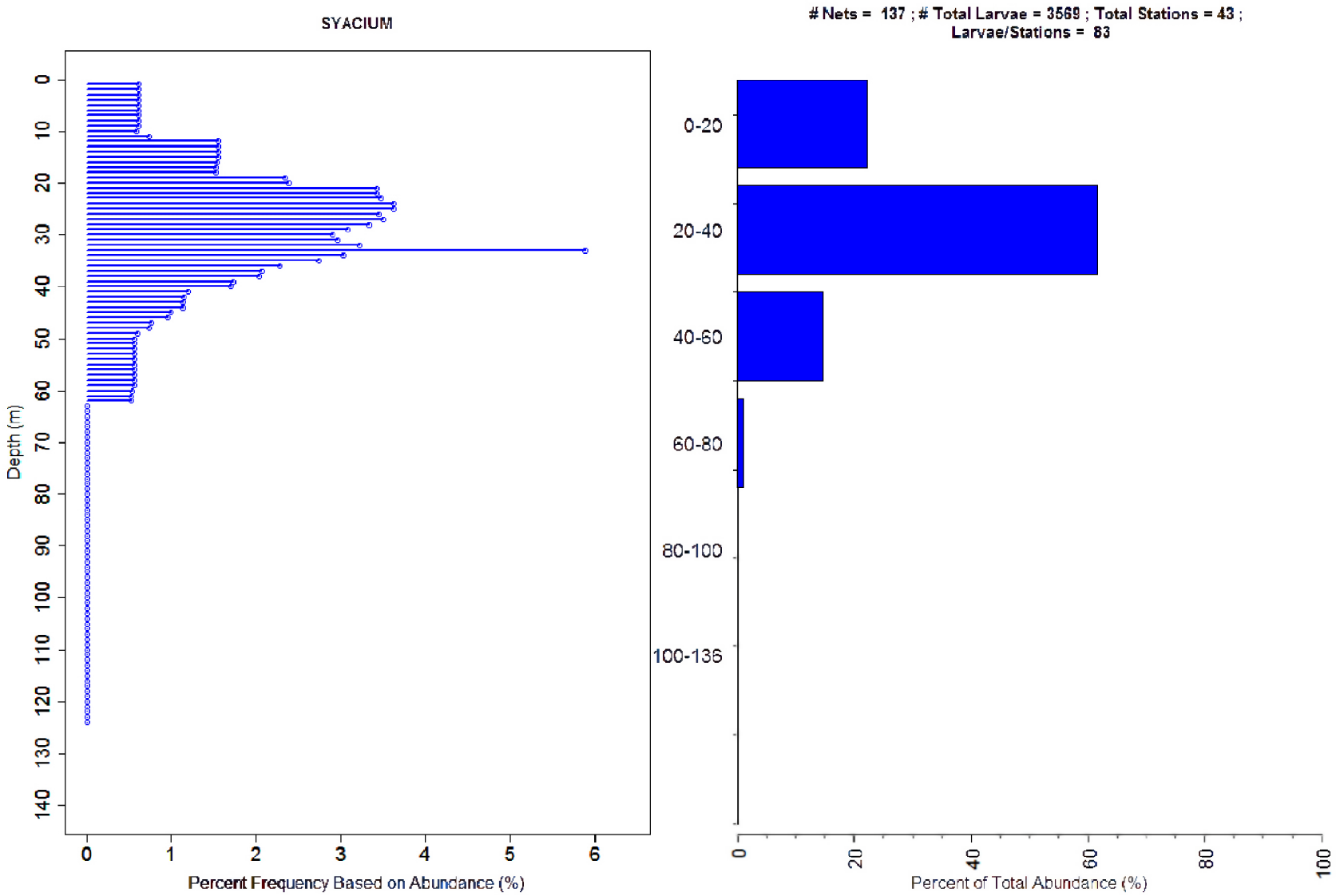
STOMIIFORMES


STOMIINAE
Nets = 16 ; # Total Larvae = 40 ; Total Stations = 15 ;
Larvae/Stations = 2.67
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

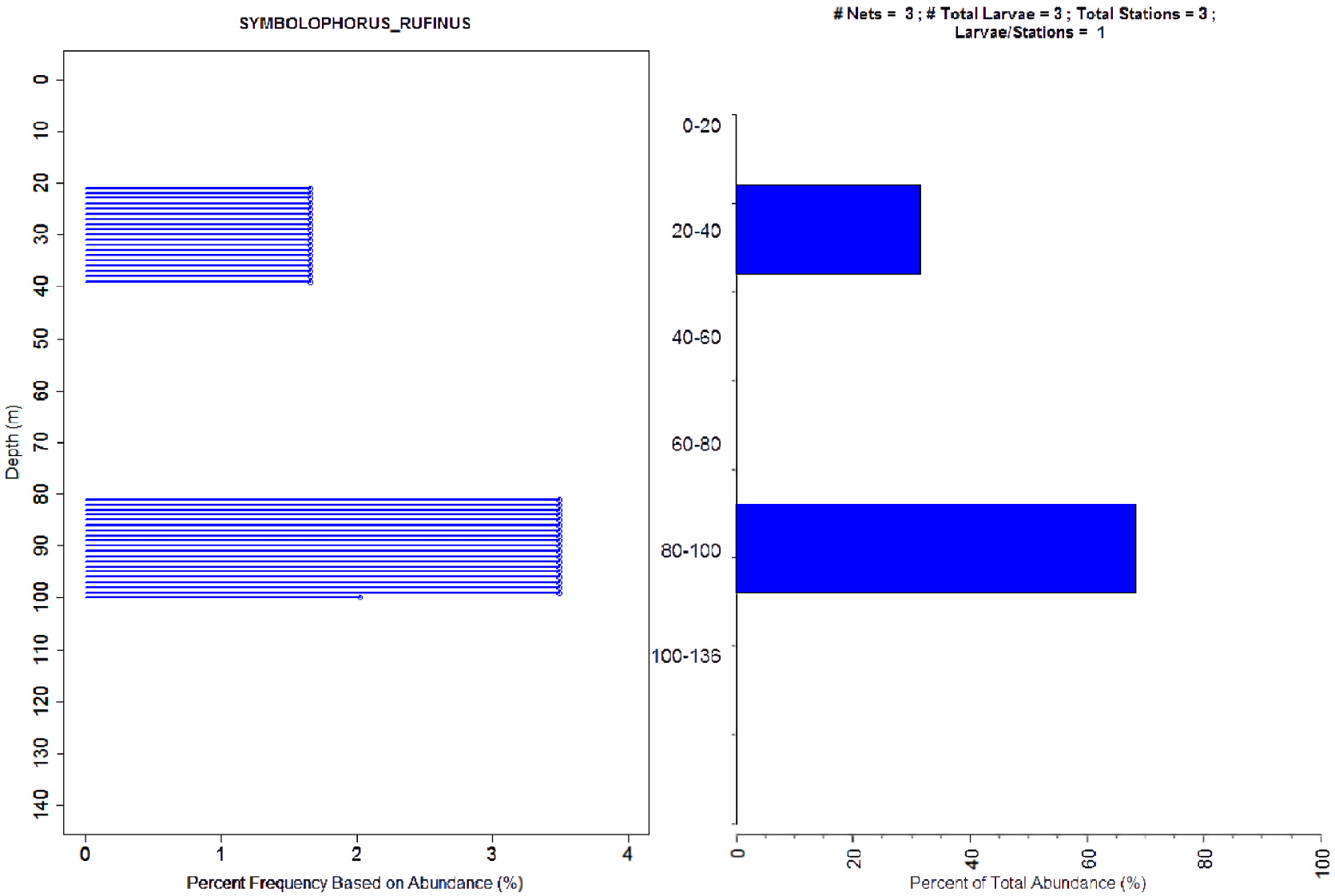
STOMIINAE



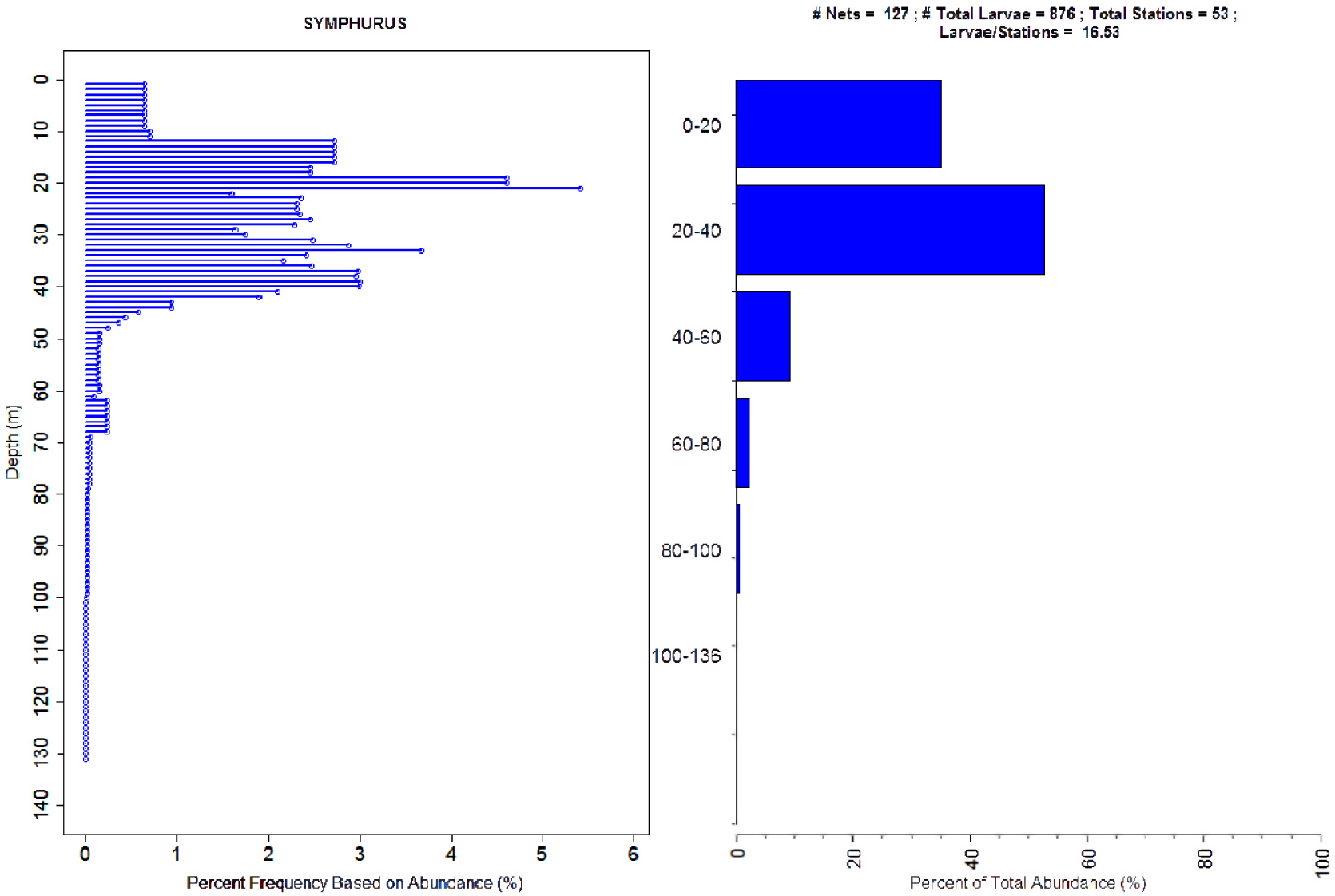
STROMATEIDAE


SYACIUM
Nets = 137 ; # Total Larvae = 3569 ; Total Stations = 43 ;
Larvae/Stations = 83
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

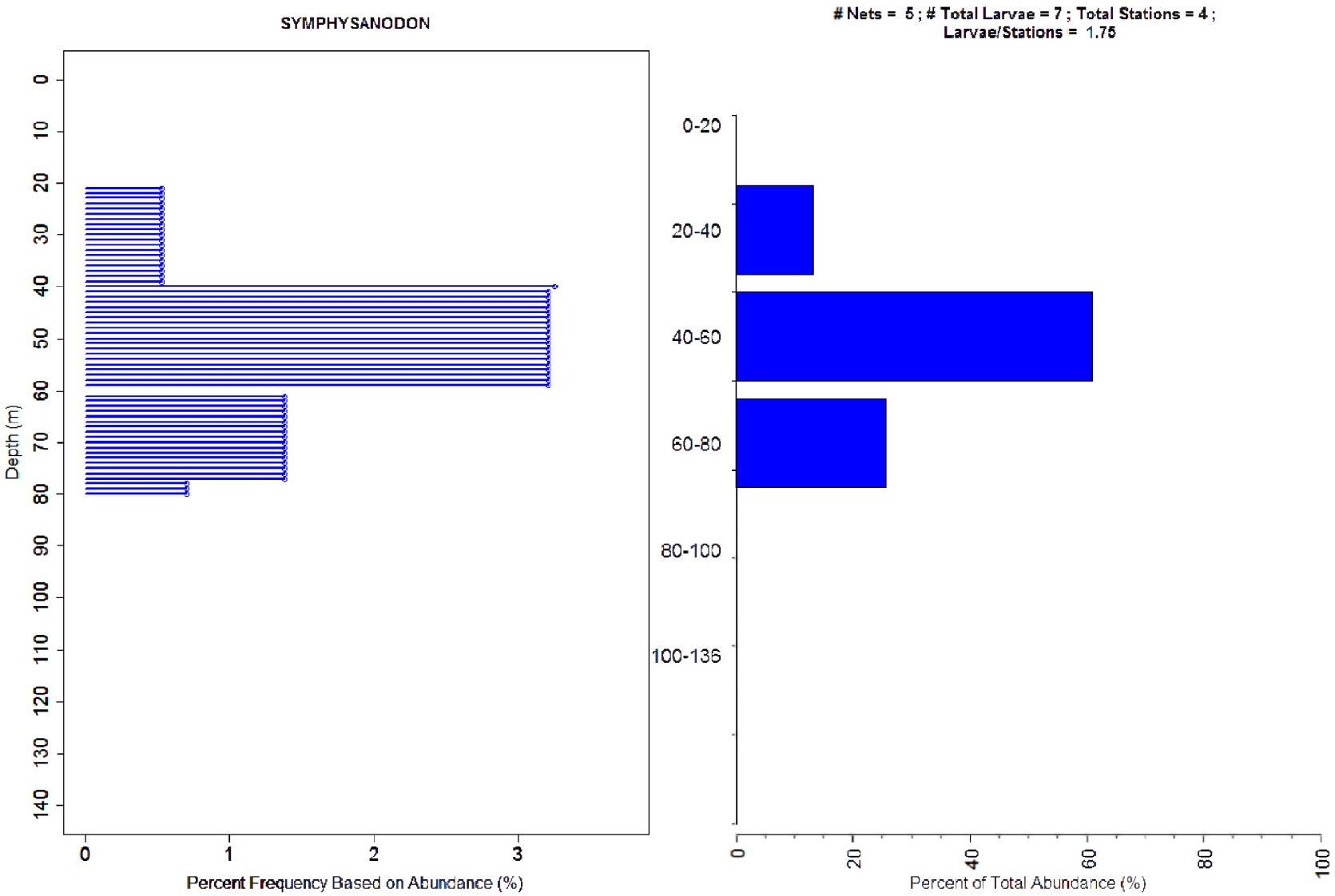
SYACIUM



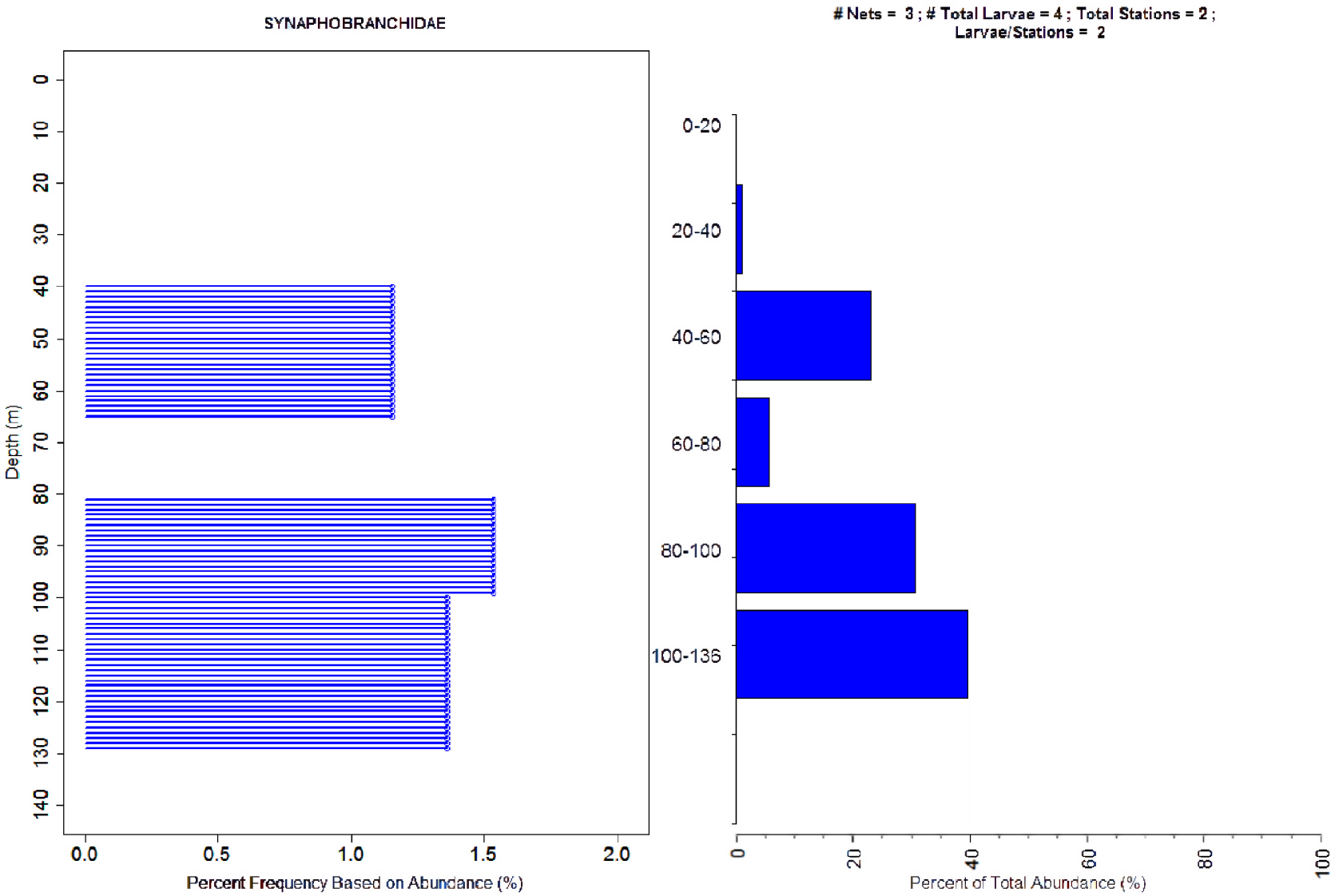
SYMBOLOPHORUS_RUFINUS


SYMPHURUS
Nets = 127 ; # Total Larvae = 876 ; Total Stations = 53 ;
Larvae/Stations = 16.53
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

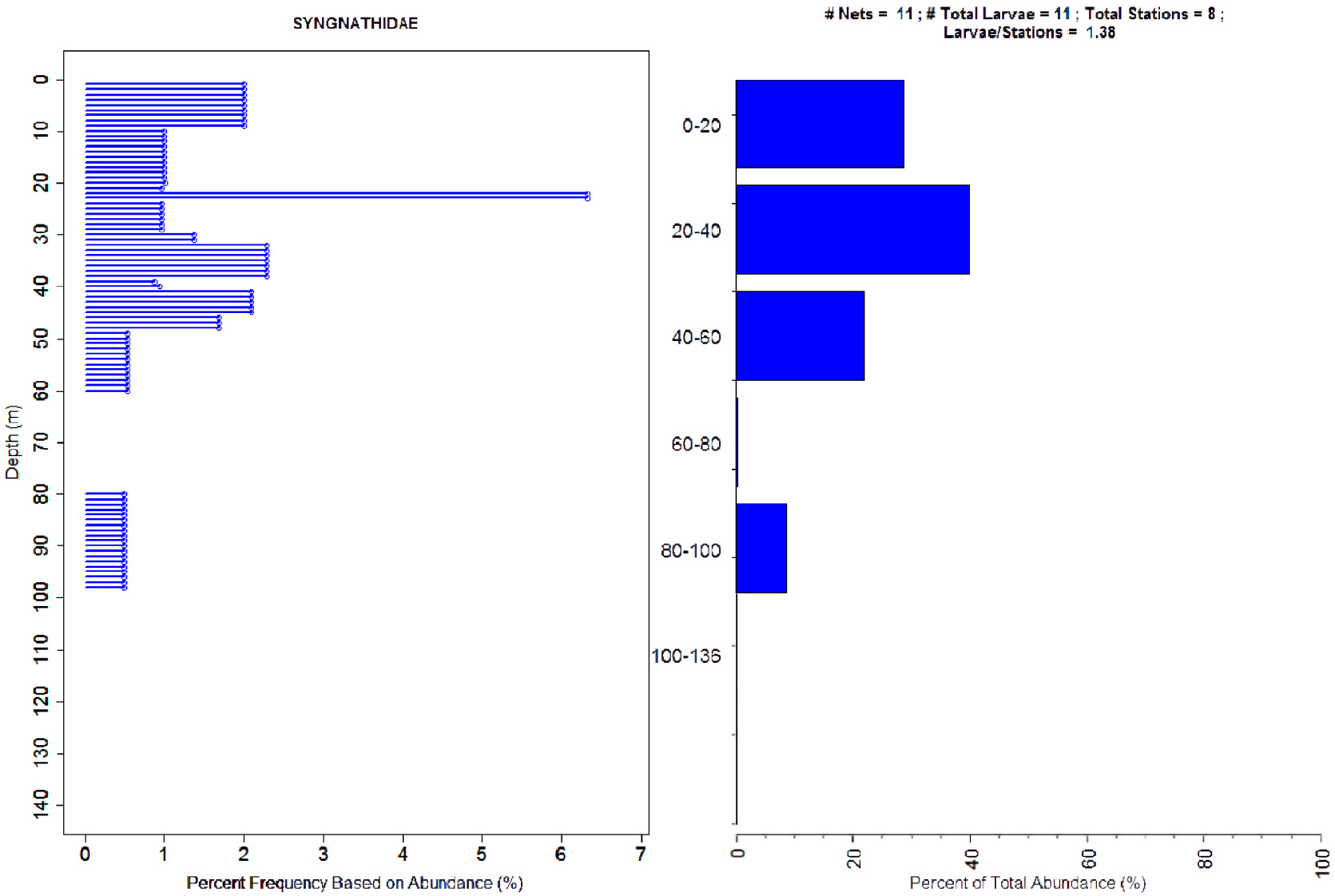
SYMPHURUS



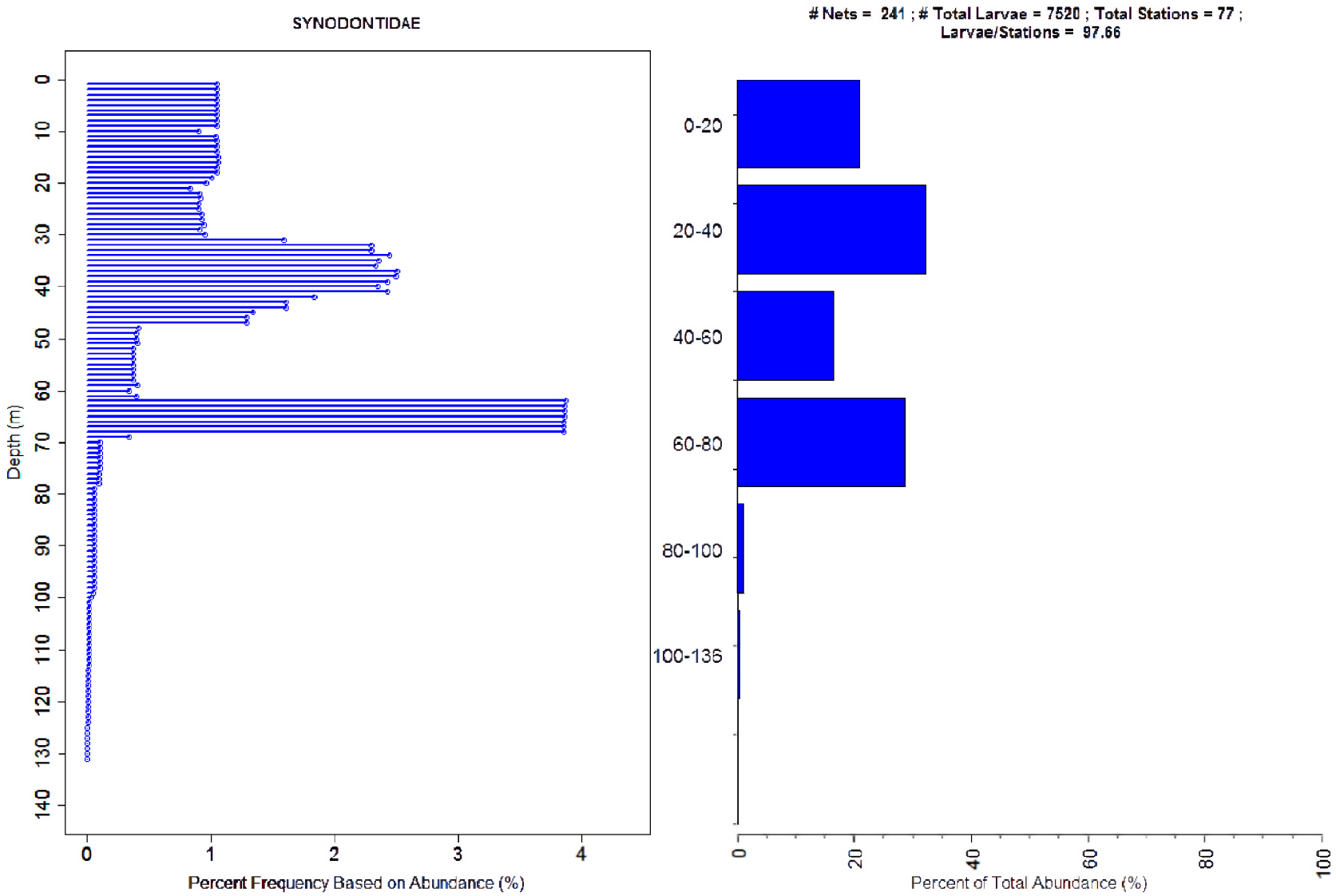
SYMPHYSANODON



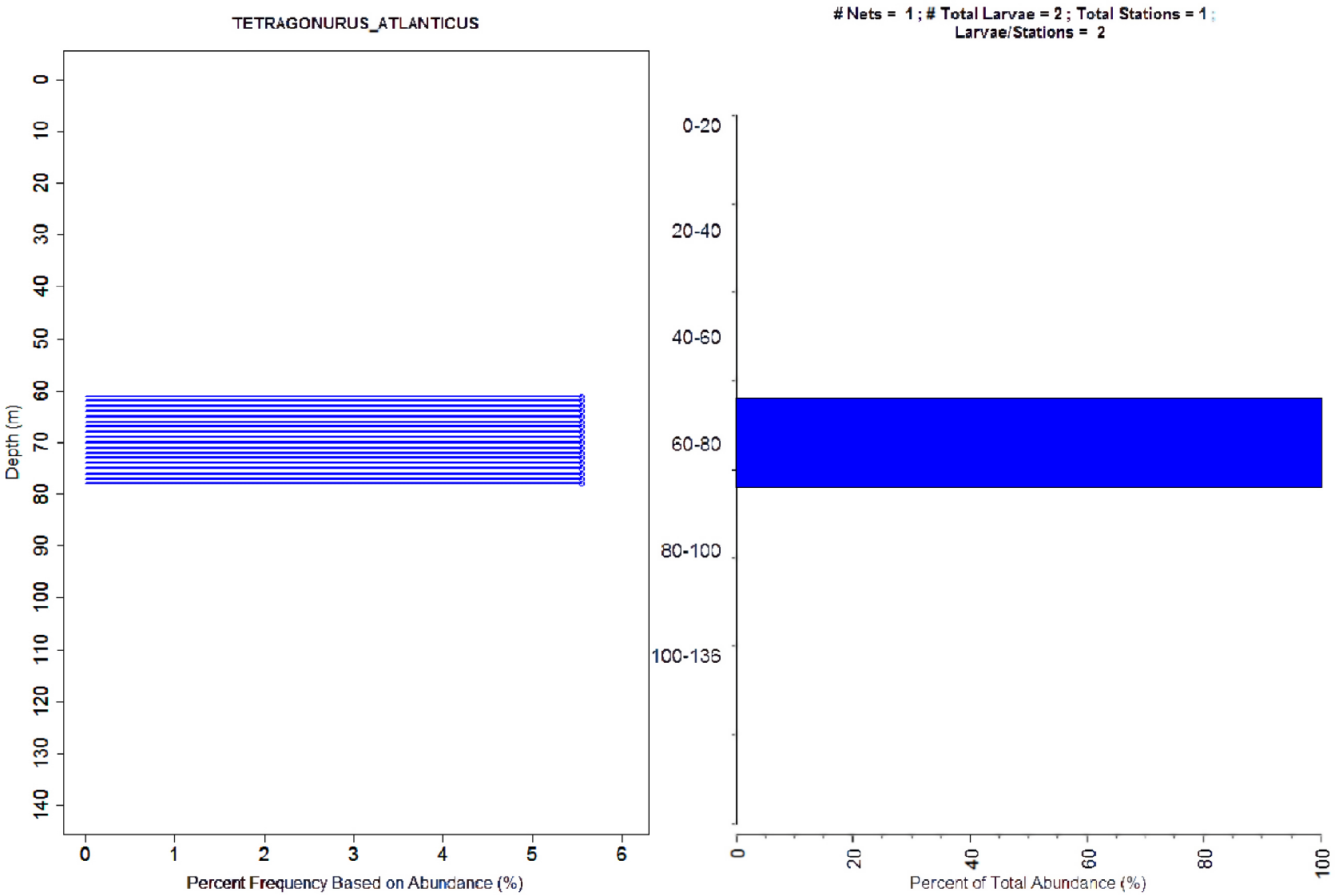
SYNAPHOBRANCHIDAE



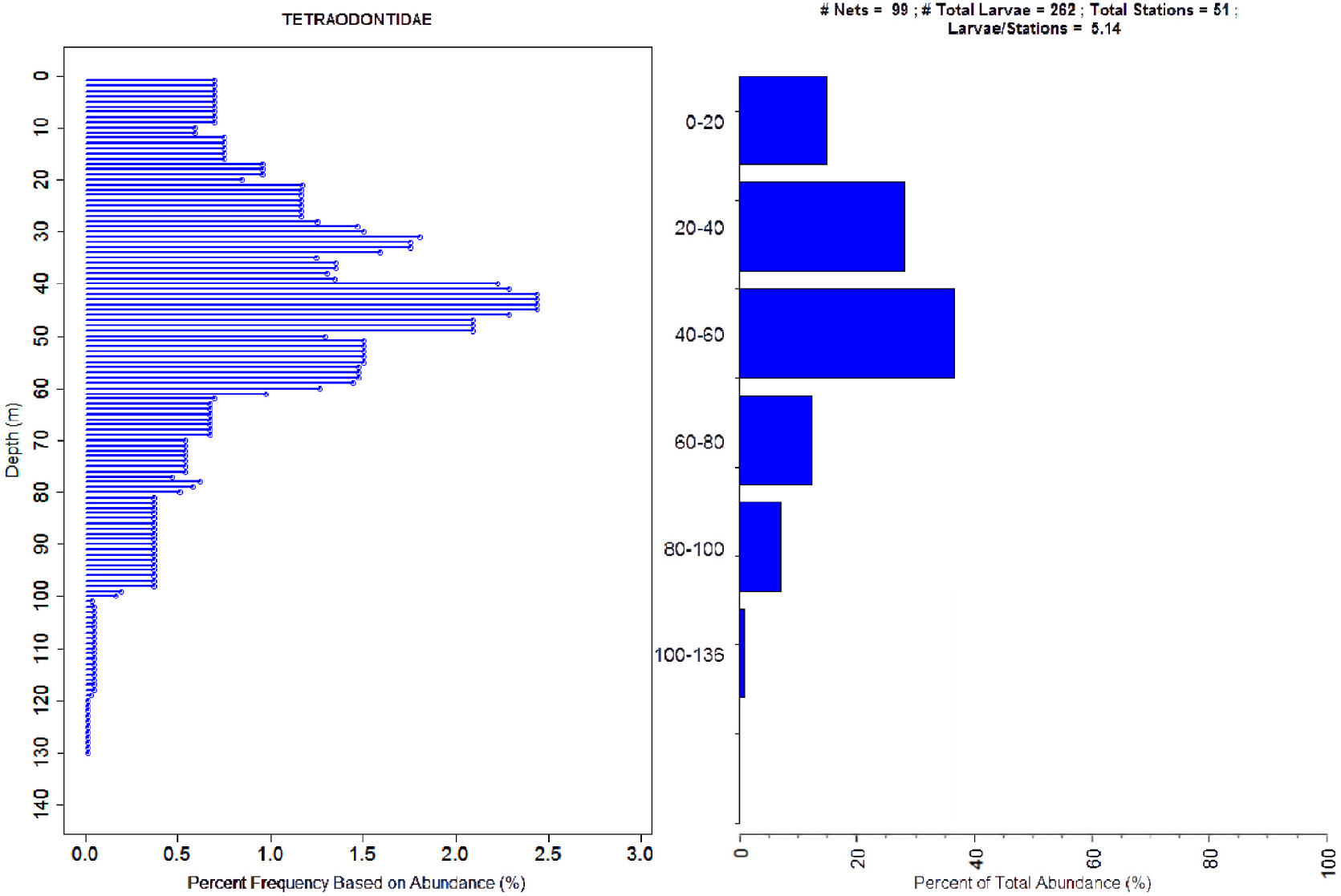
SYNGNATHIDAE



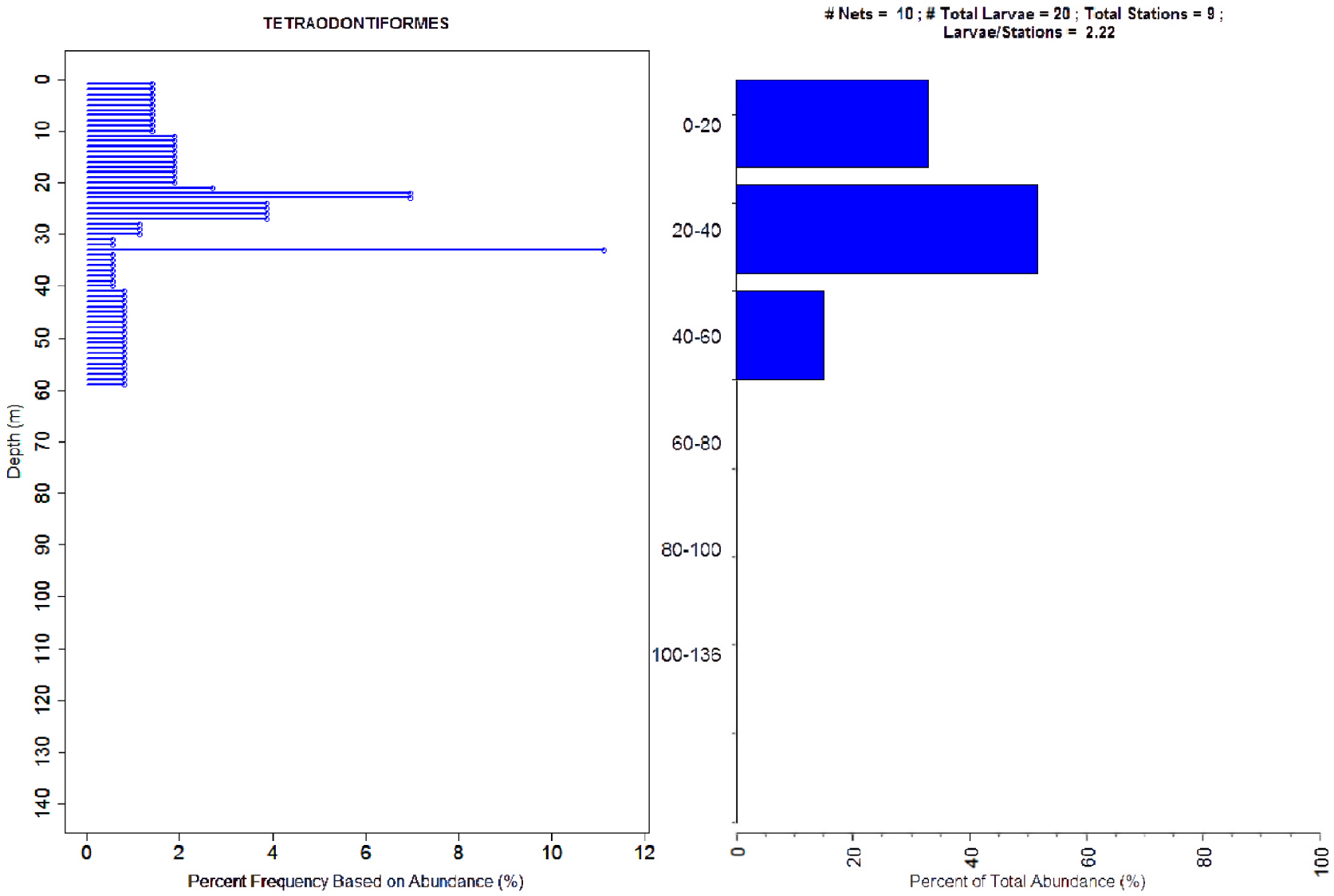
SYNODONTIDAE



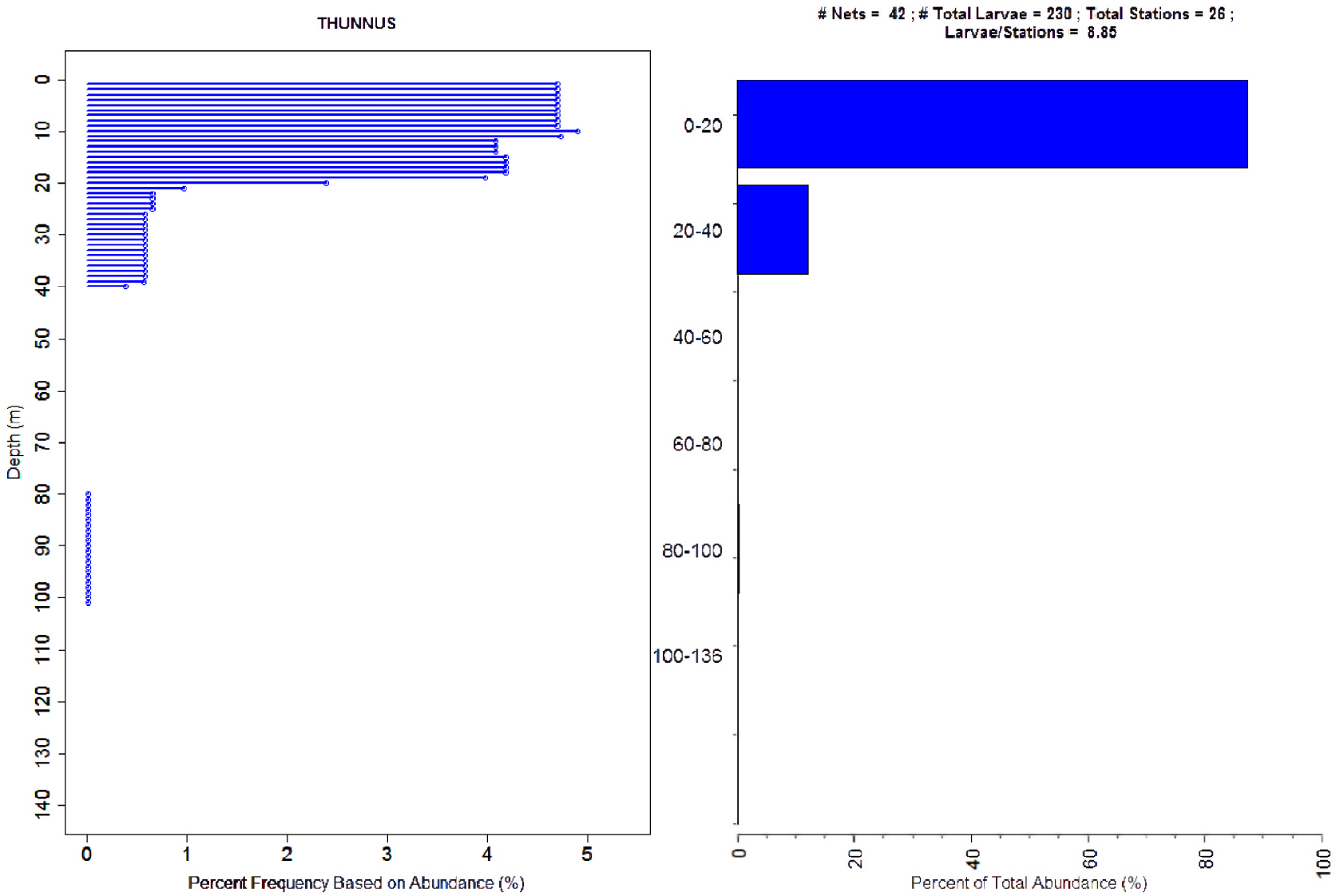
TETRAGONURUS_ATLANTICUS



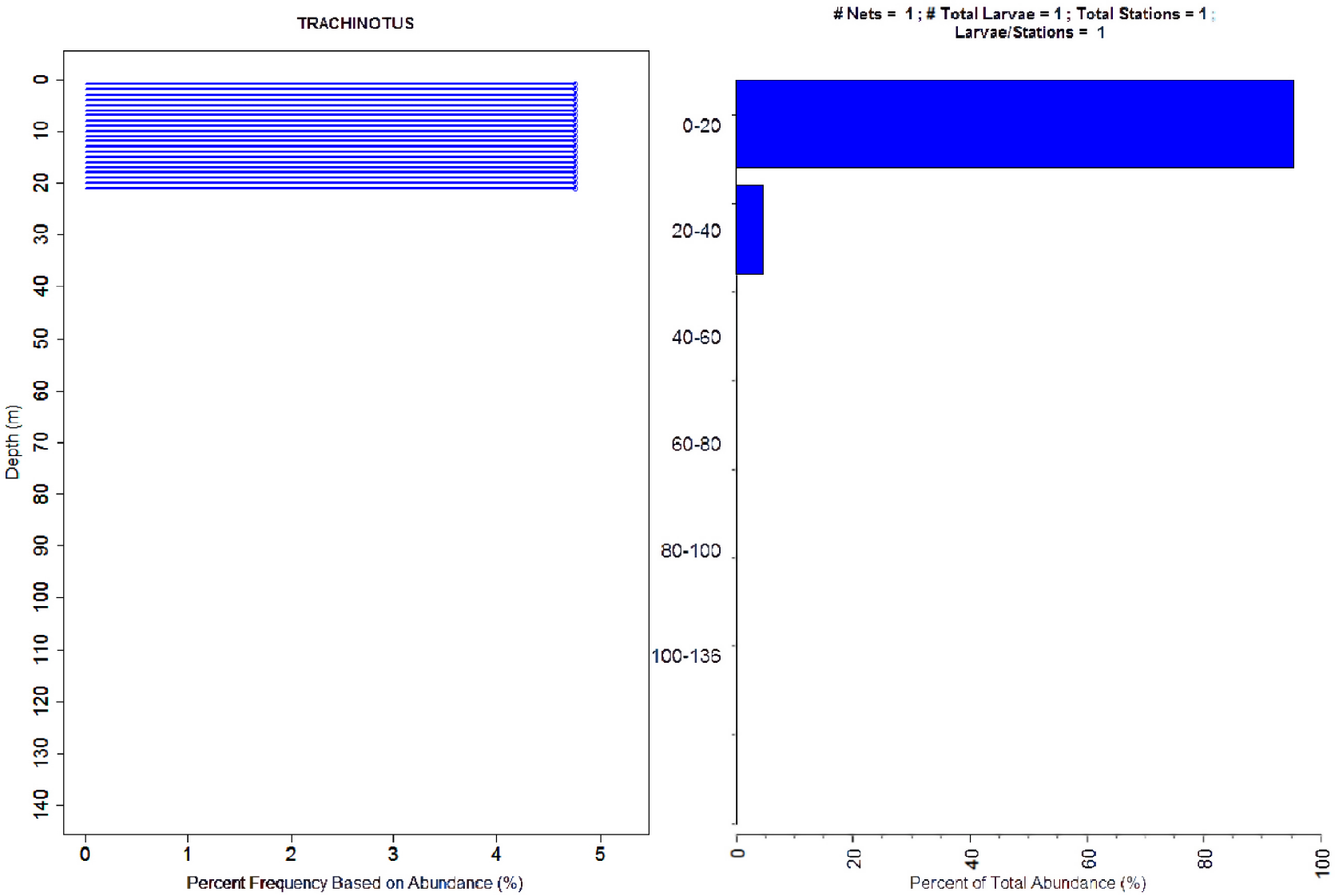
TETRAODONTIDAE



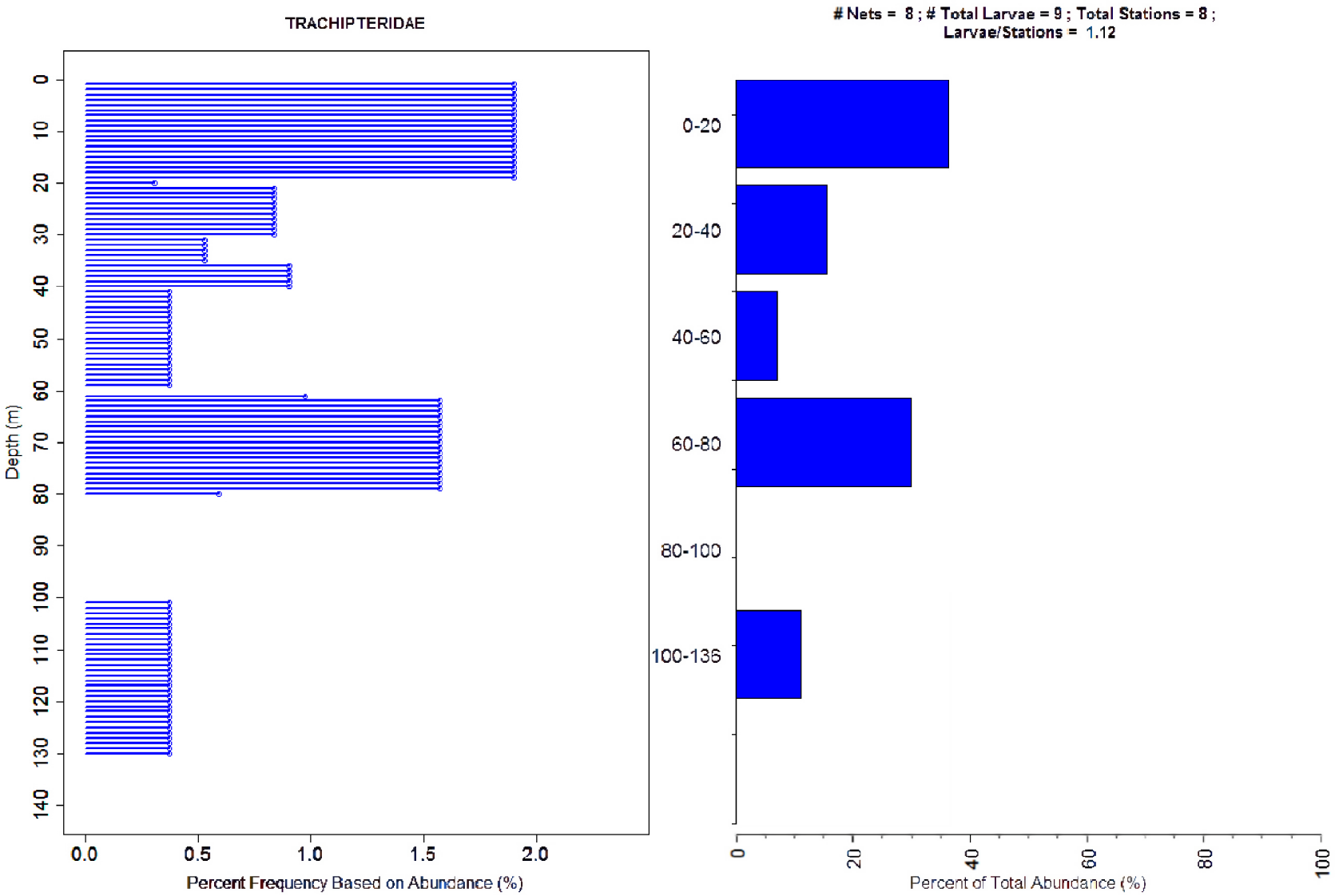
TETRAODONTIFORMES


THUNNUS
Nets = 42 ; # Total Larvae = 230 ; Total Stations = 26 ;
Larvae/Stations = 8.85
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

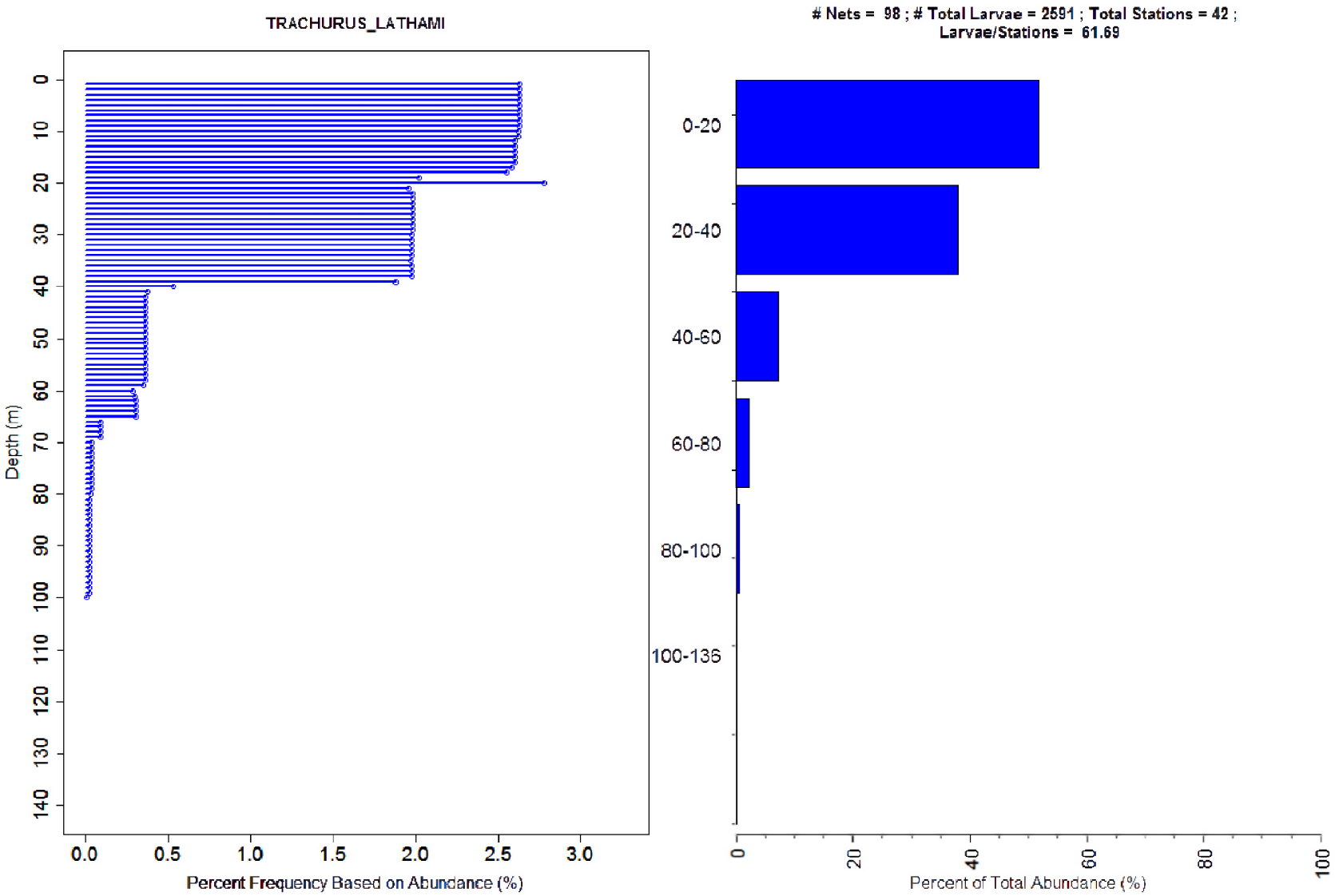
THUNNUS



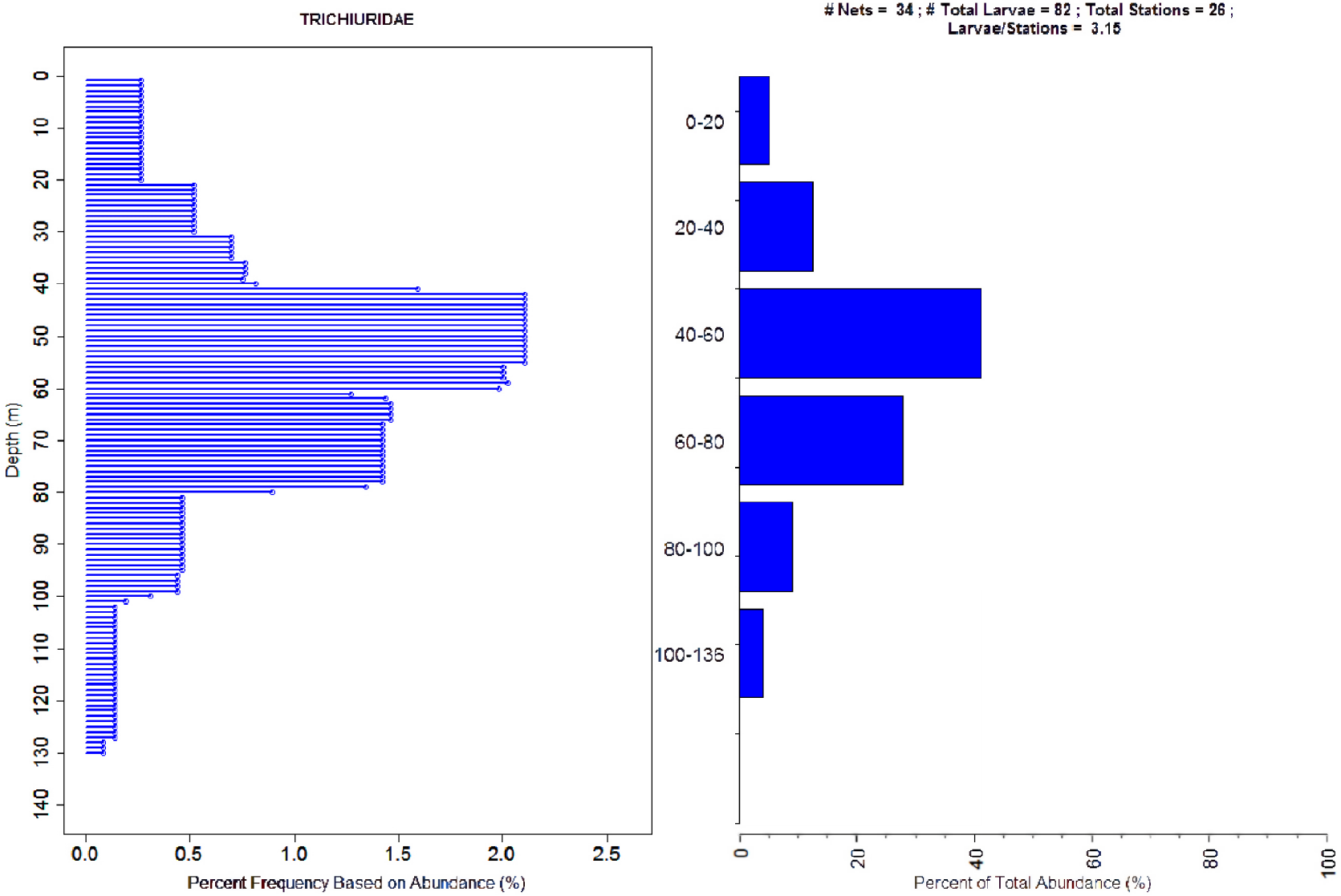
TRACHINOTUS



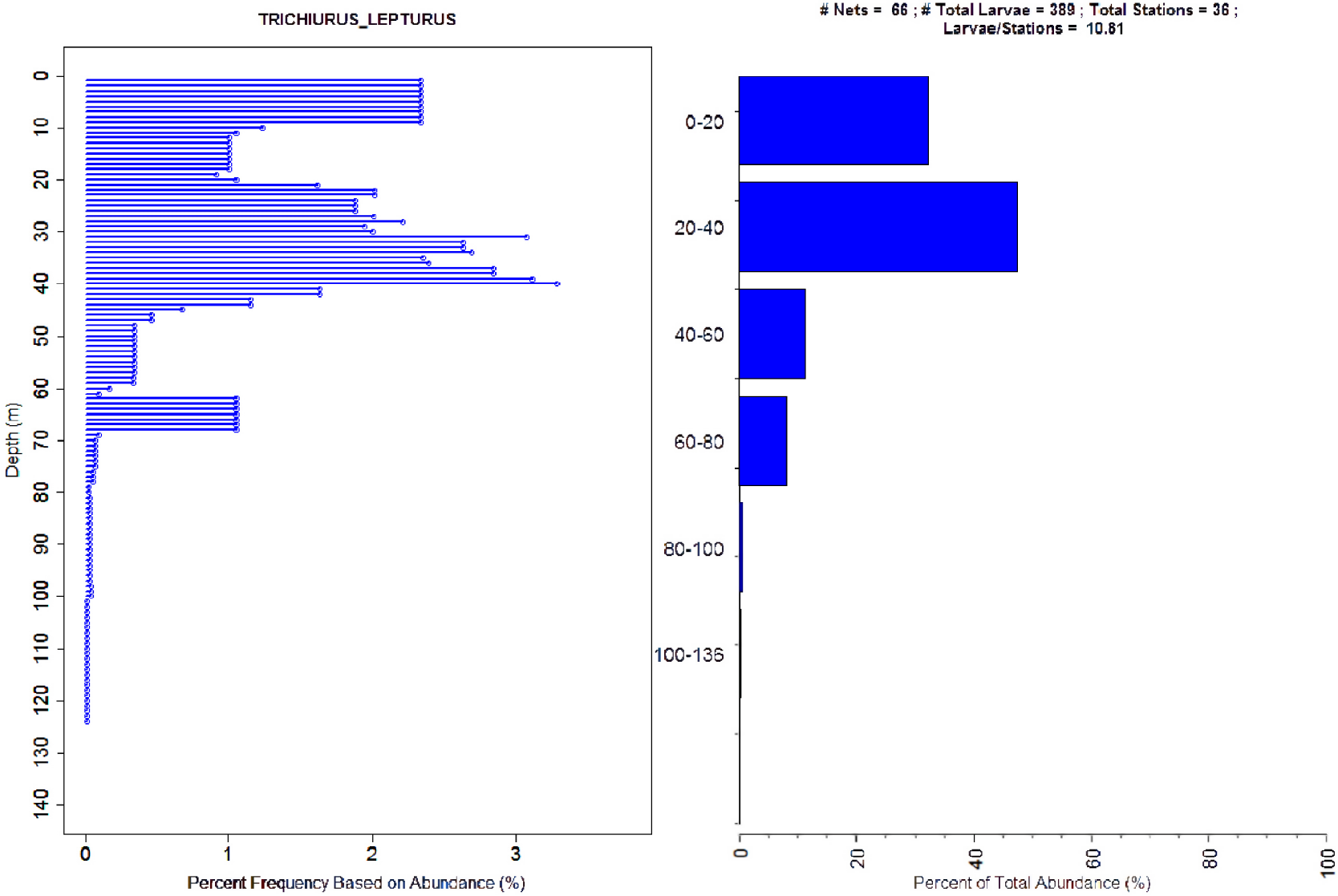
TRACHIPTERIDAE



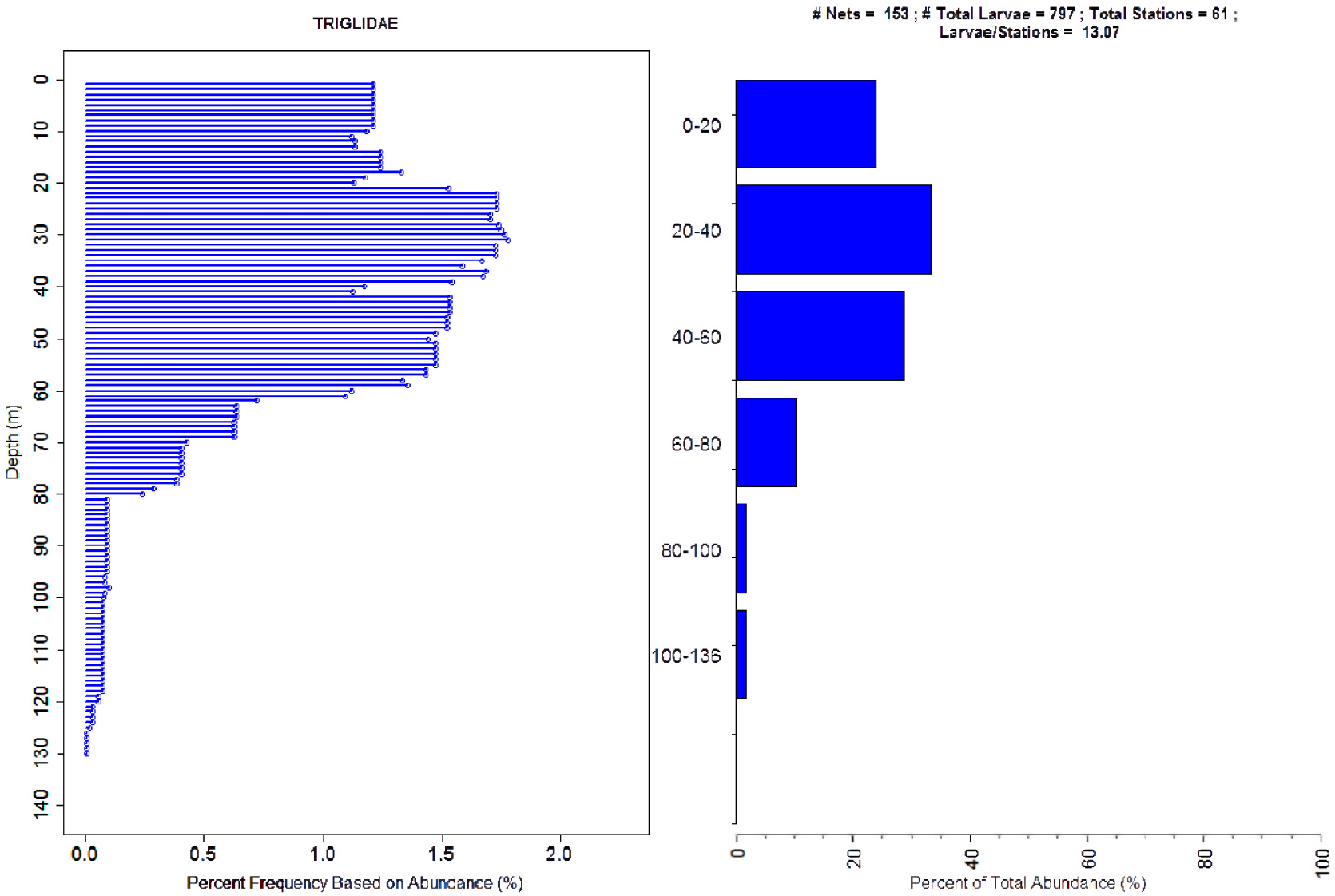
TRACHURUS_LATHAMI



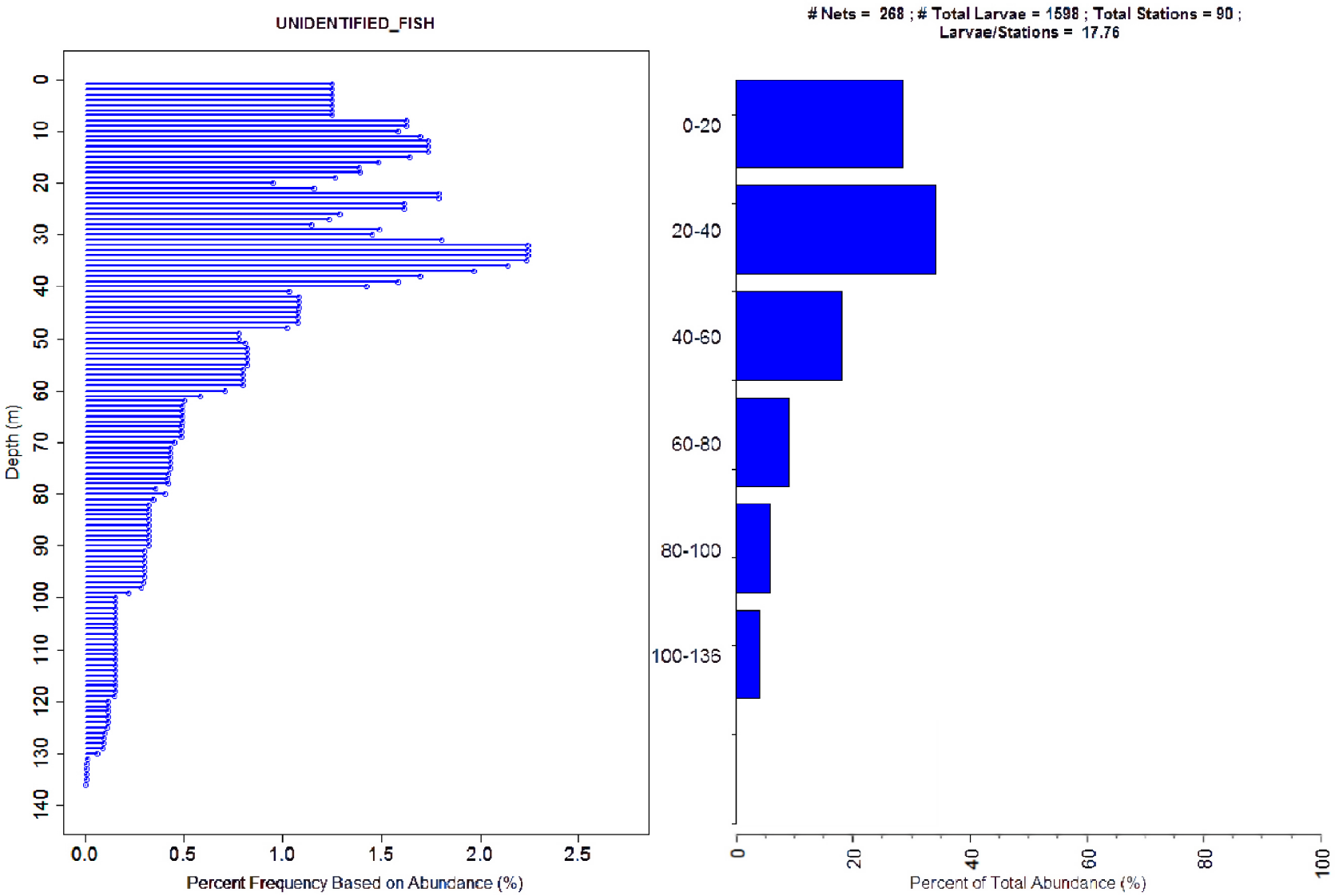
TRICHIURIDAE



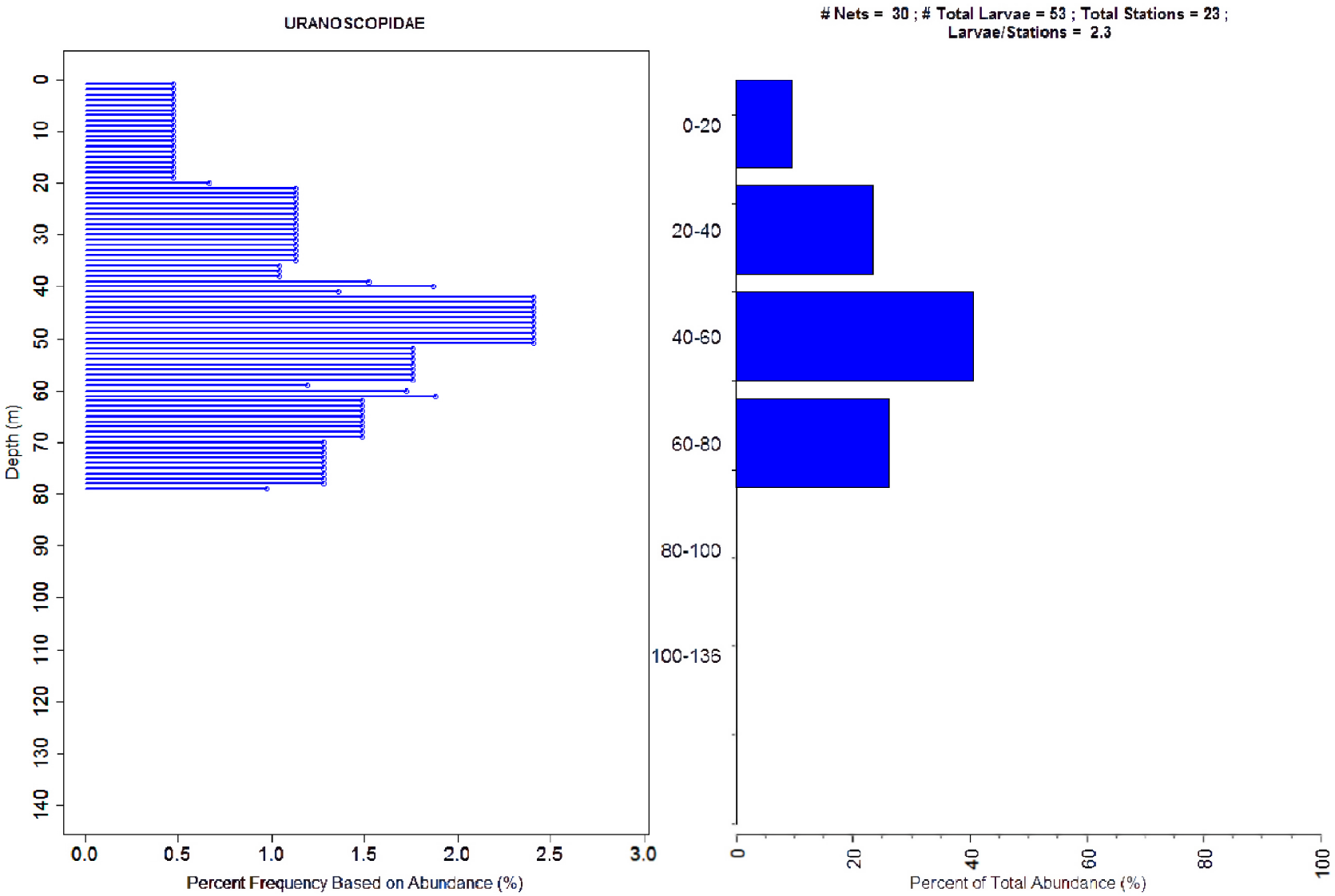
TRICHIURUS_LEPTURUS


TRIGLIDAE
Nets = 153 ; # Total Larvae = 797 ; Total Stations = 61 ;
Larvae/Stations = 13.07
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

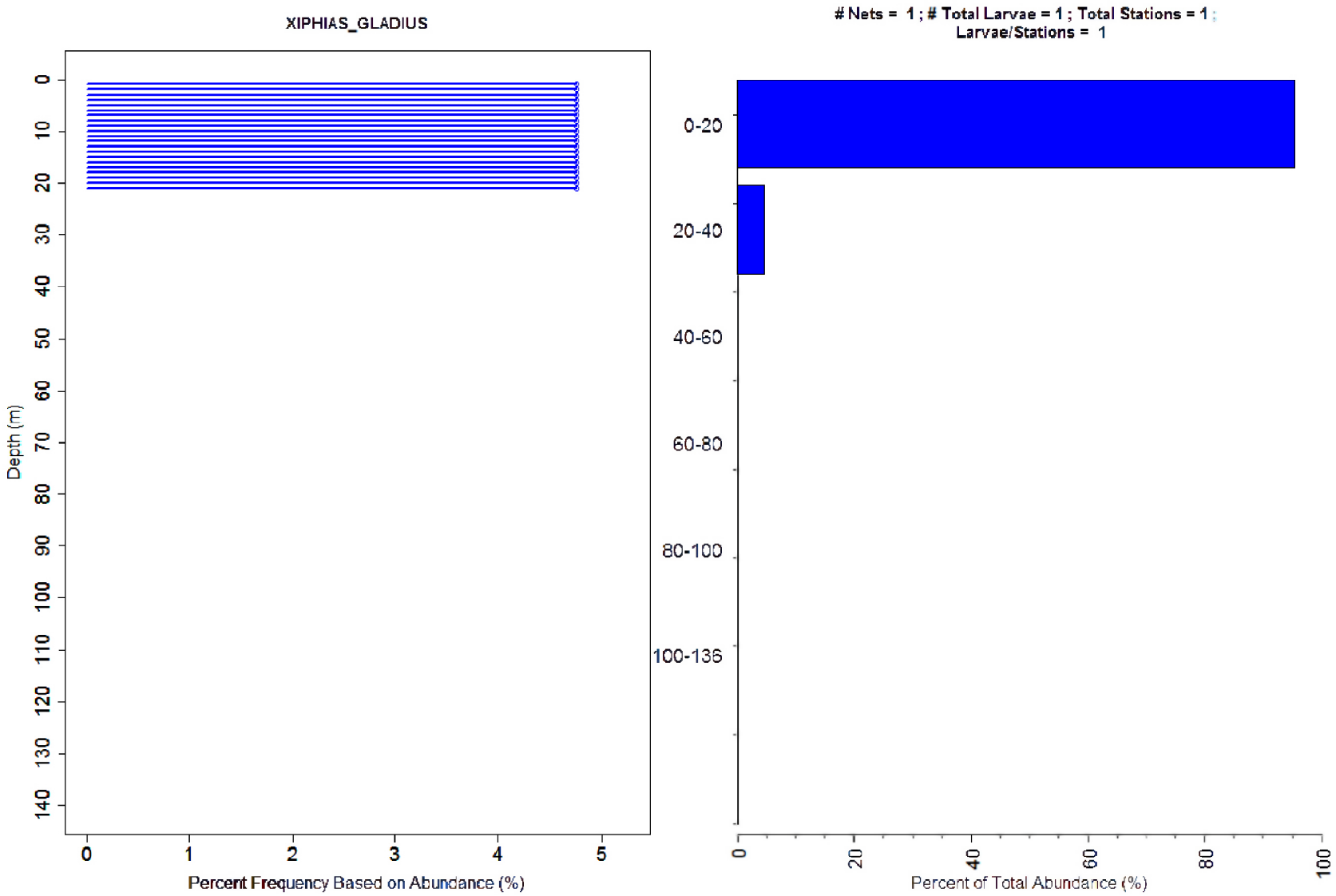
TRIGLIDAE



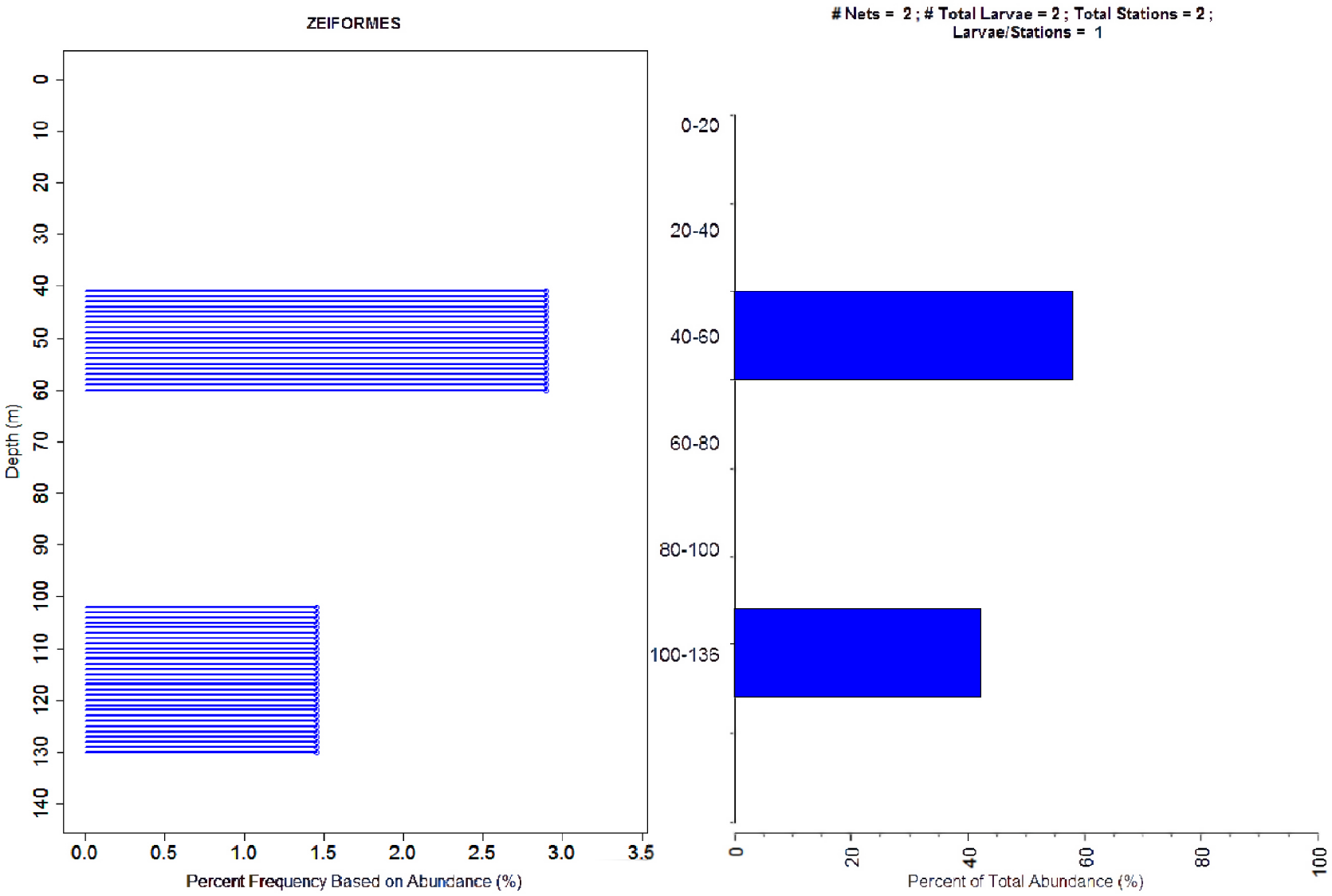
UNIDENTIFIED_FISH



URANOSCOPIDAE



XIPHIAS_GLADIUS


ZEIFORMES
Nets = 2 ; # Total Larvae = 2 ; Total Stations = 2 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

ZEIFORMES

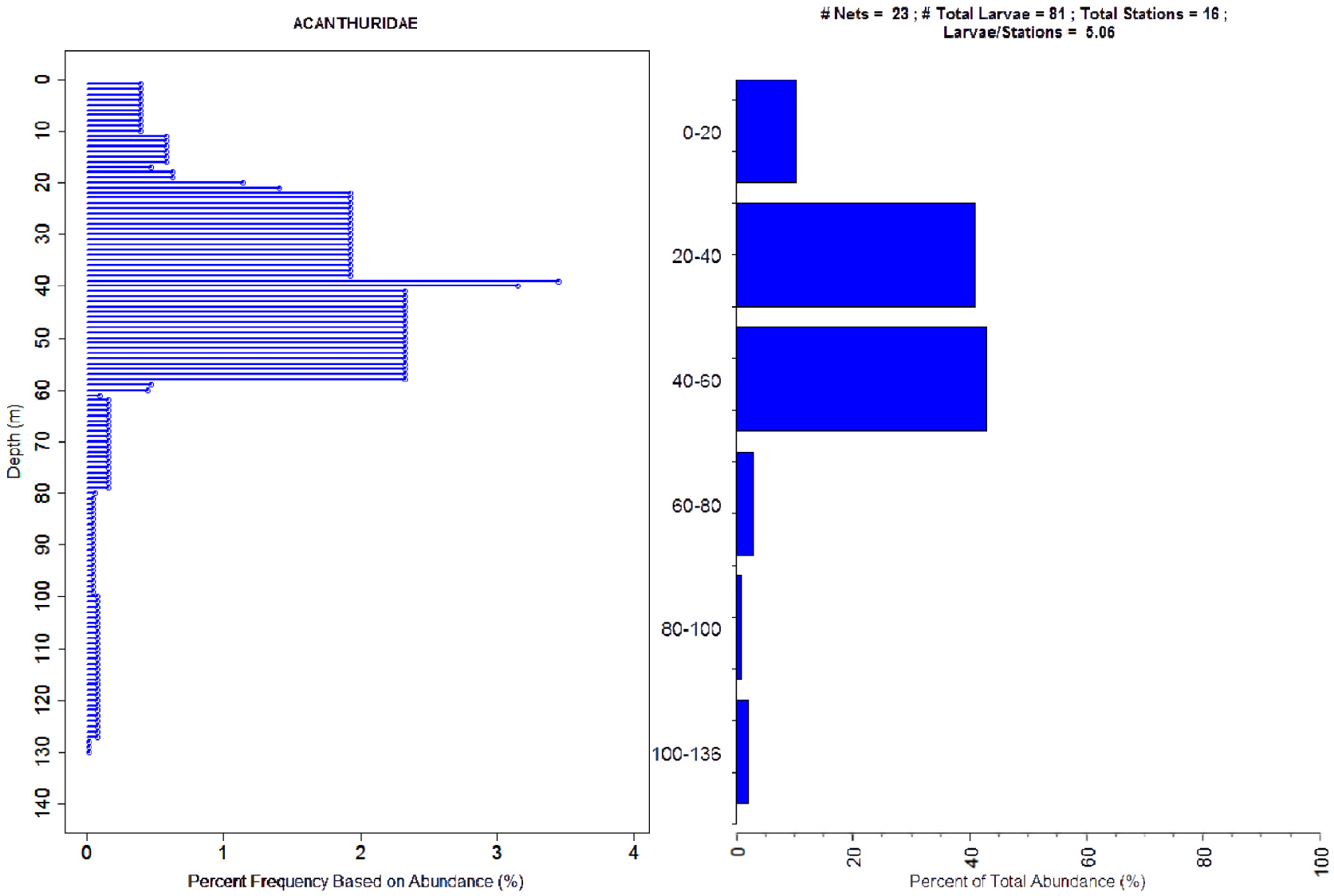
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

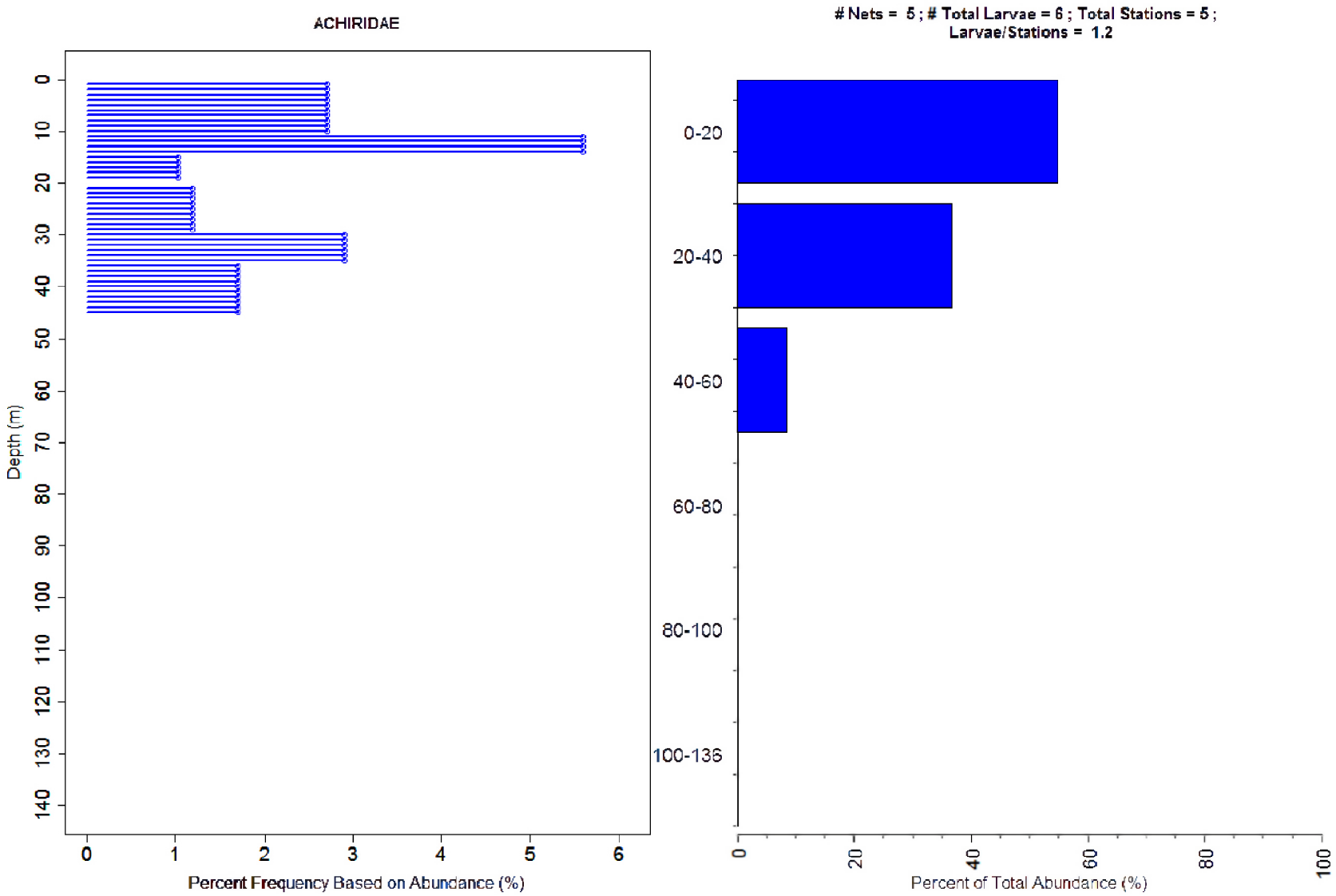
Appendix C3 – SEAMAP Historical MOC1 Plots Family Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

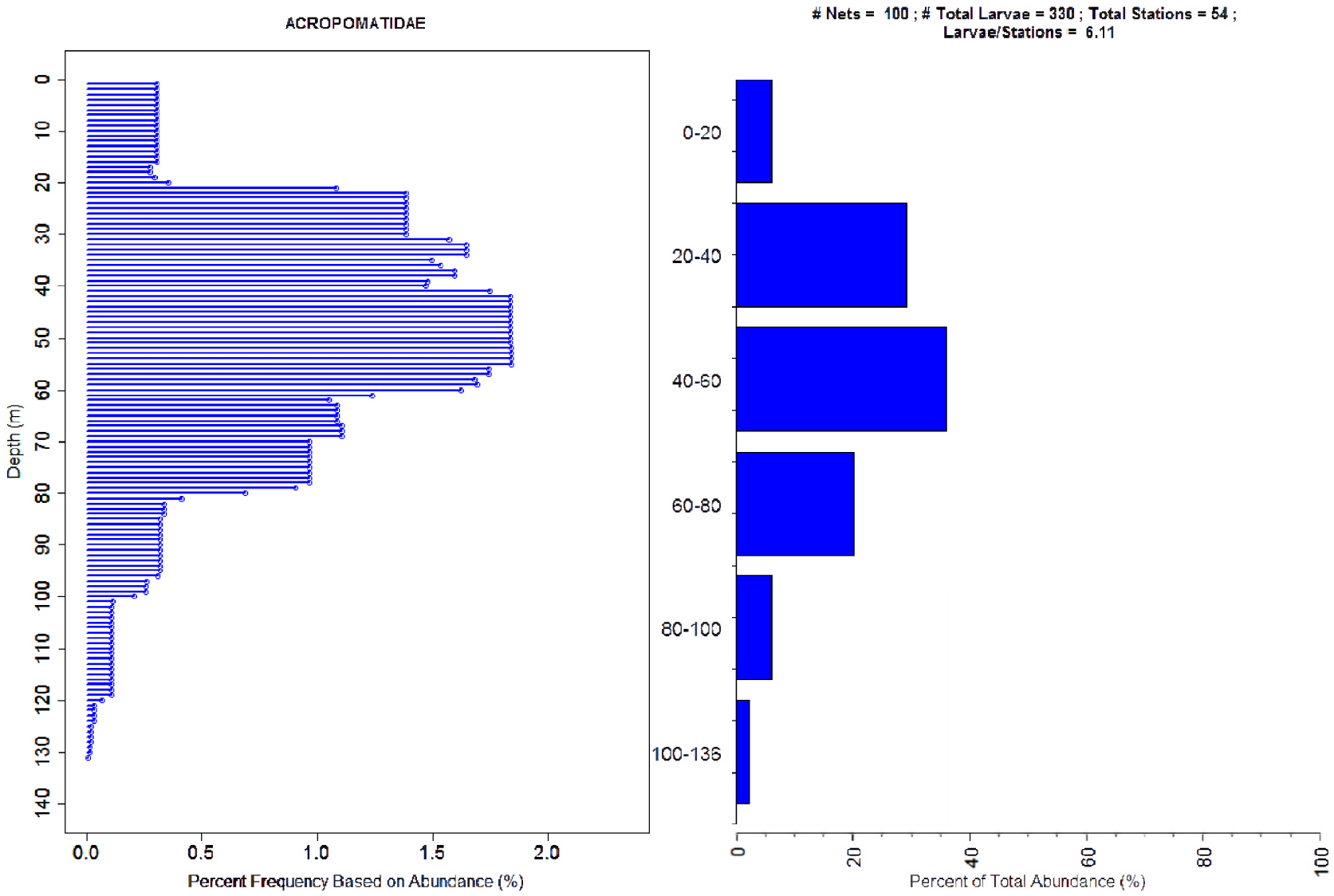
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



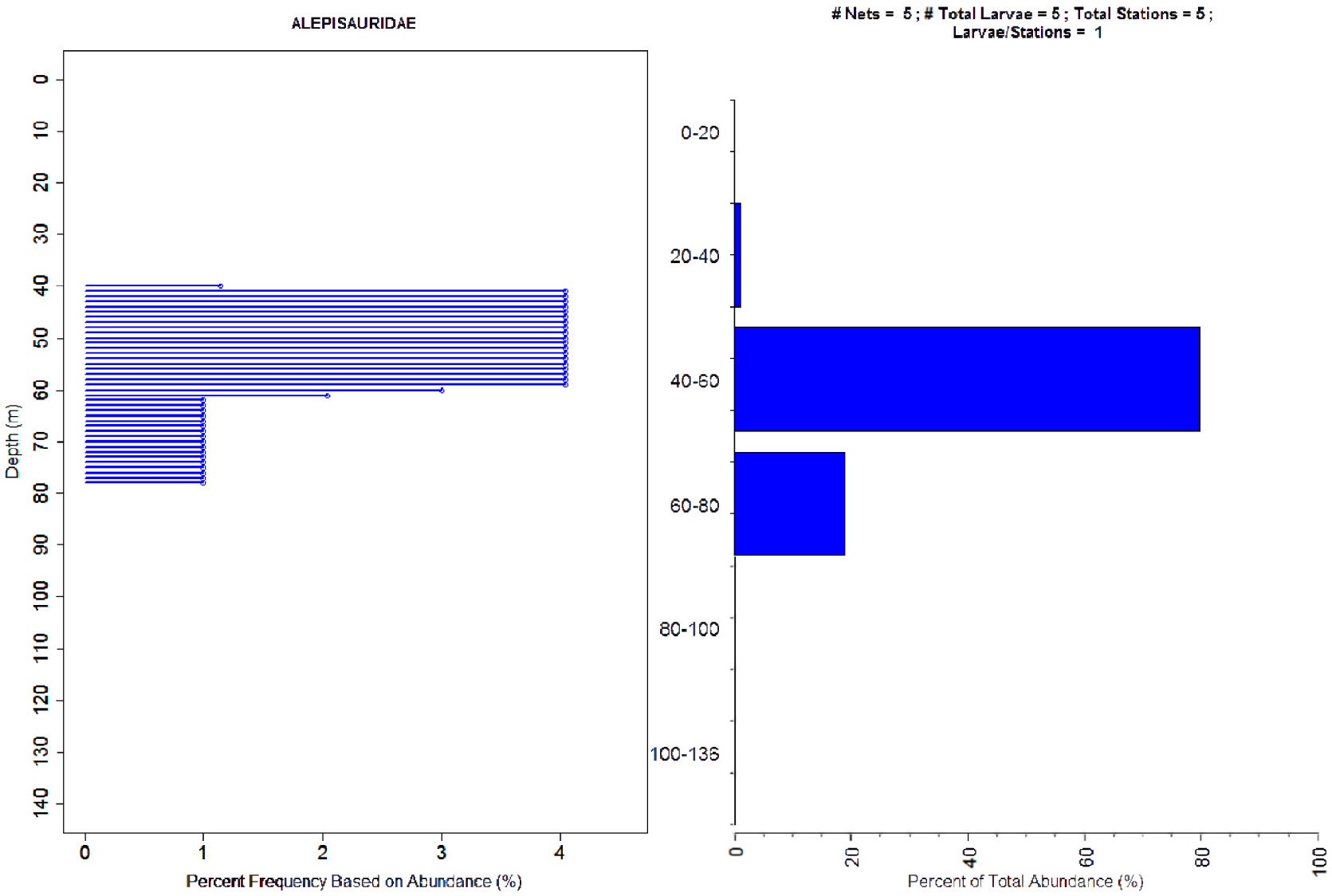
ACANTHURIDAE


ACHIRIDAE
Nets = 5 ; # Total Larvae = 6 ; Total Stations = 5 ;
Larvae/Stations = 1.2
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

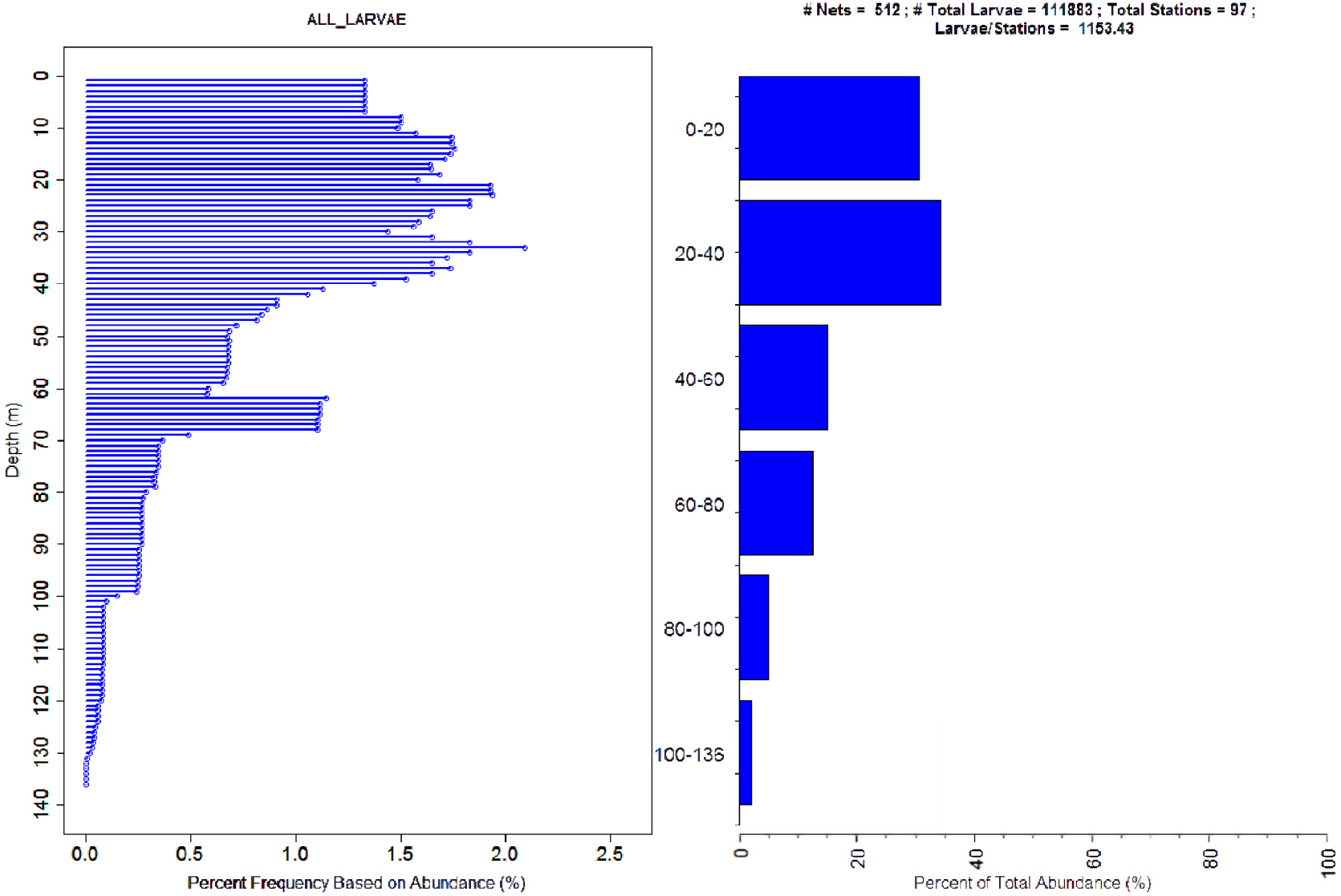
ACHIRIDAE



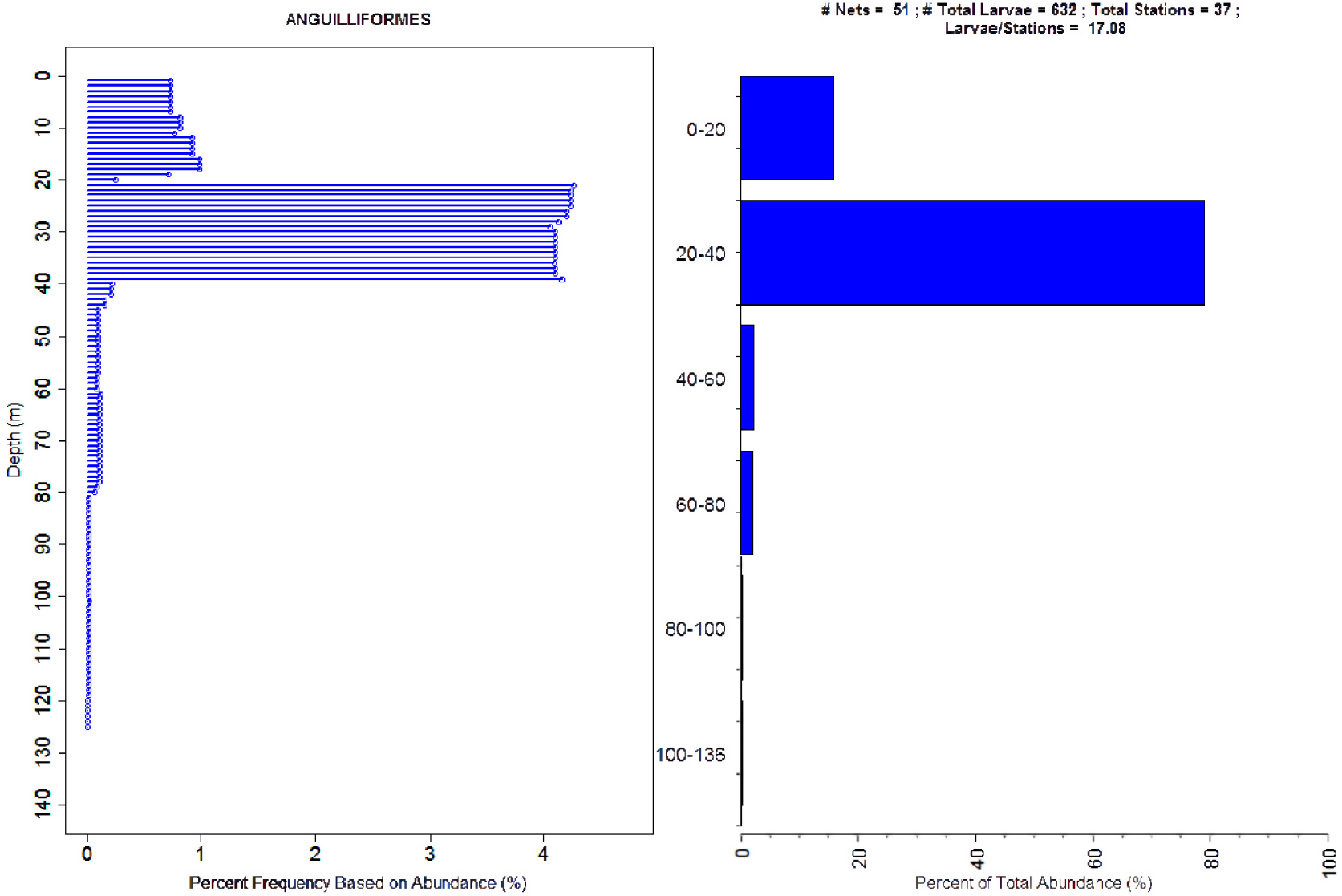
ACROPOMATIDAE



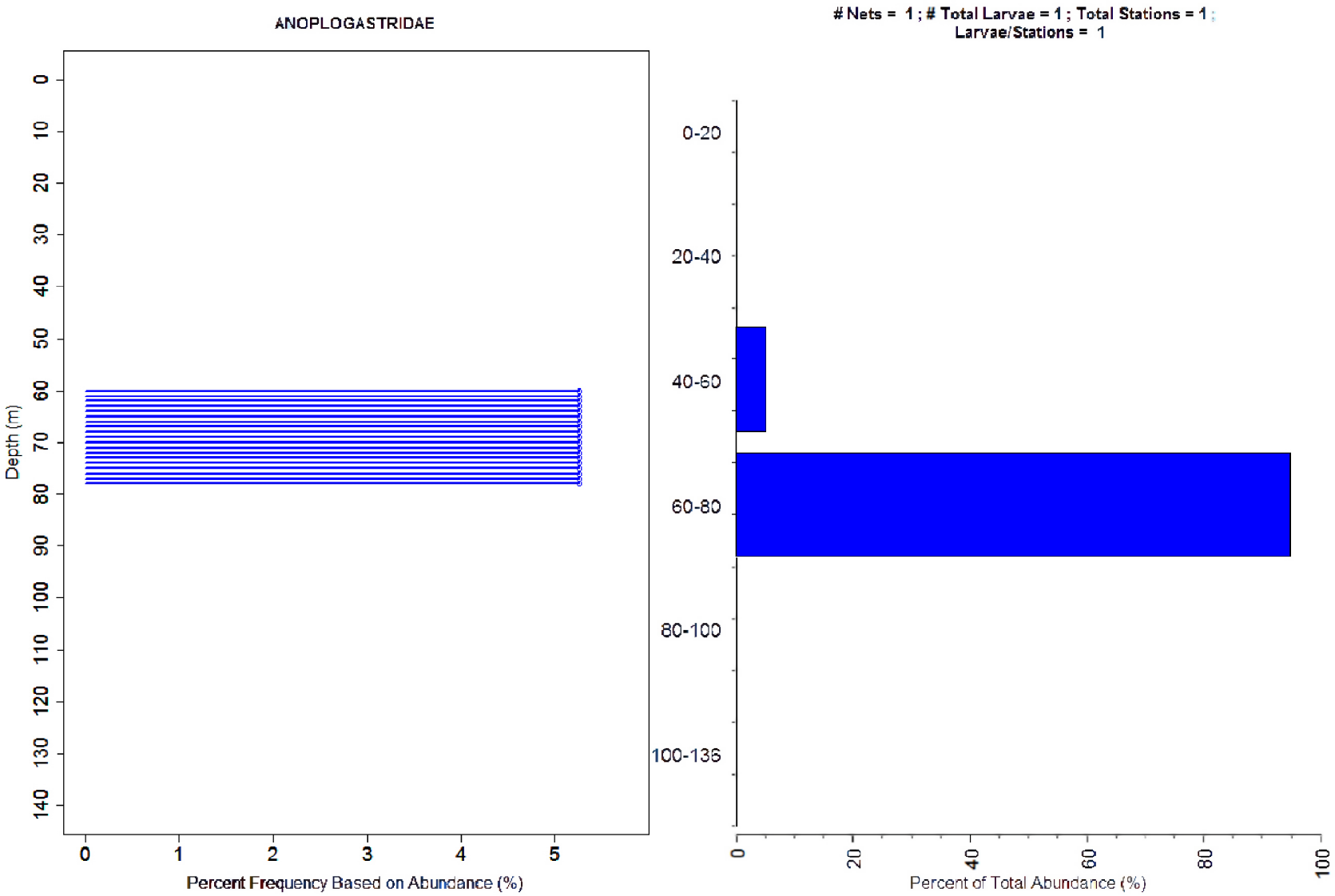
ALEPISAURIDAE


ALL_LARVAE
Nets = 512 ; # Total Larvae = 111883 ; Total Stations = 97 ;
Larvae/Stations = 1153.43
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

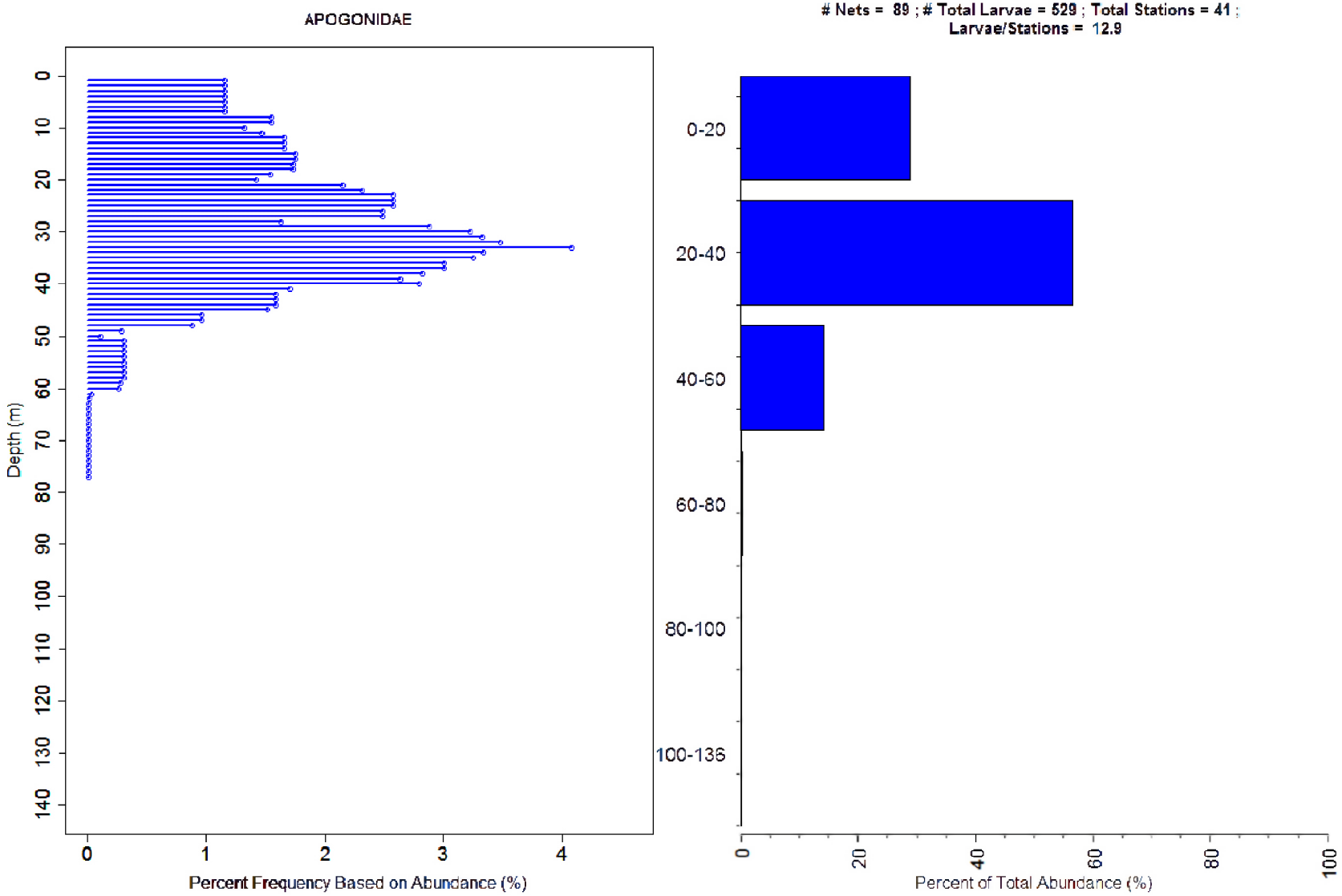
ALL_LARVAE



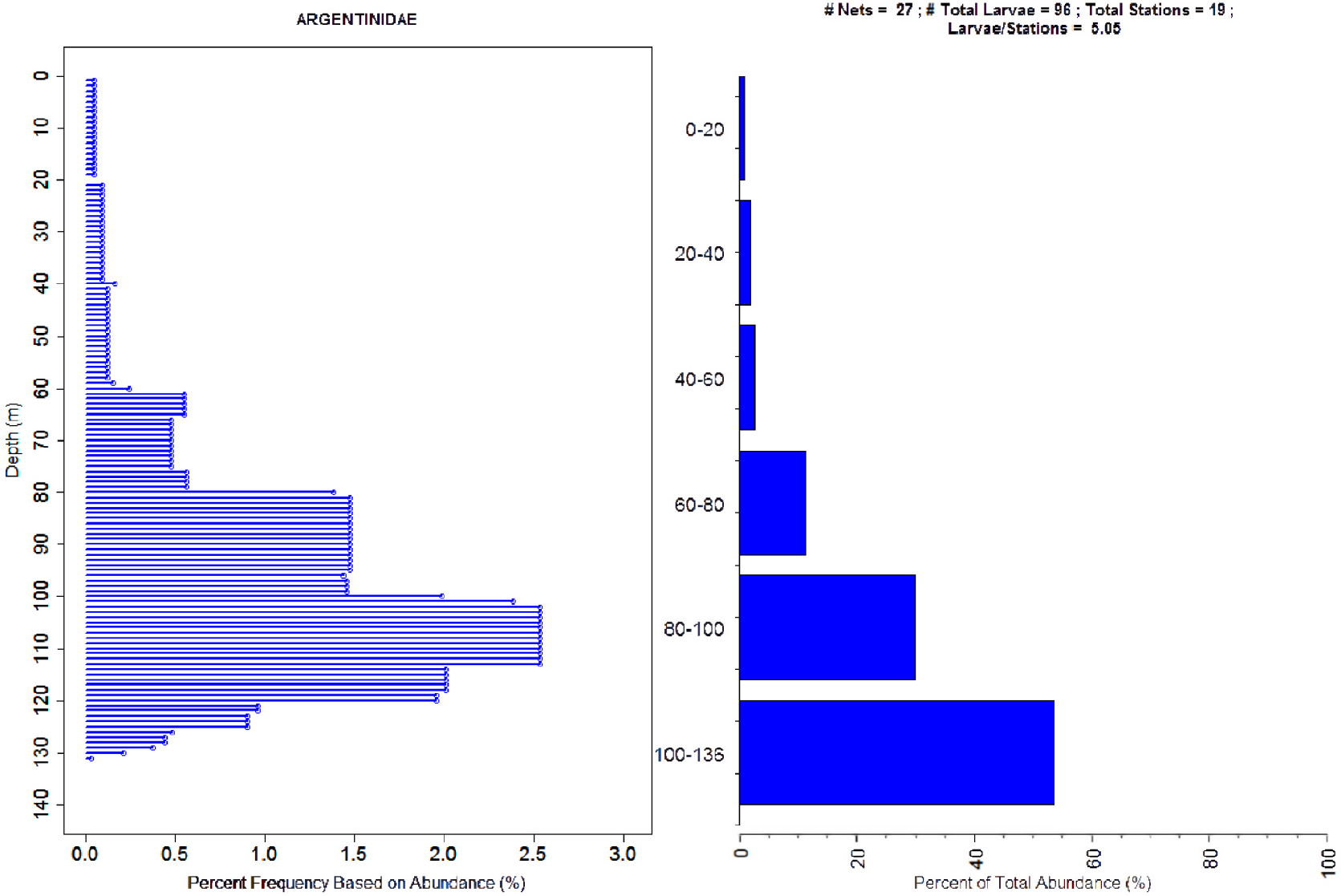
ANGUILLIFORMES



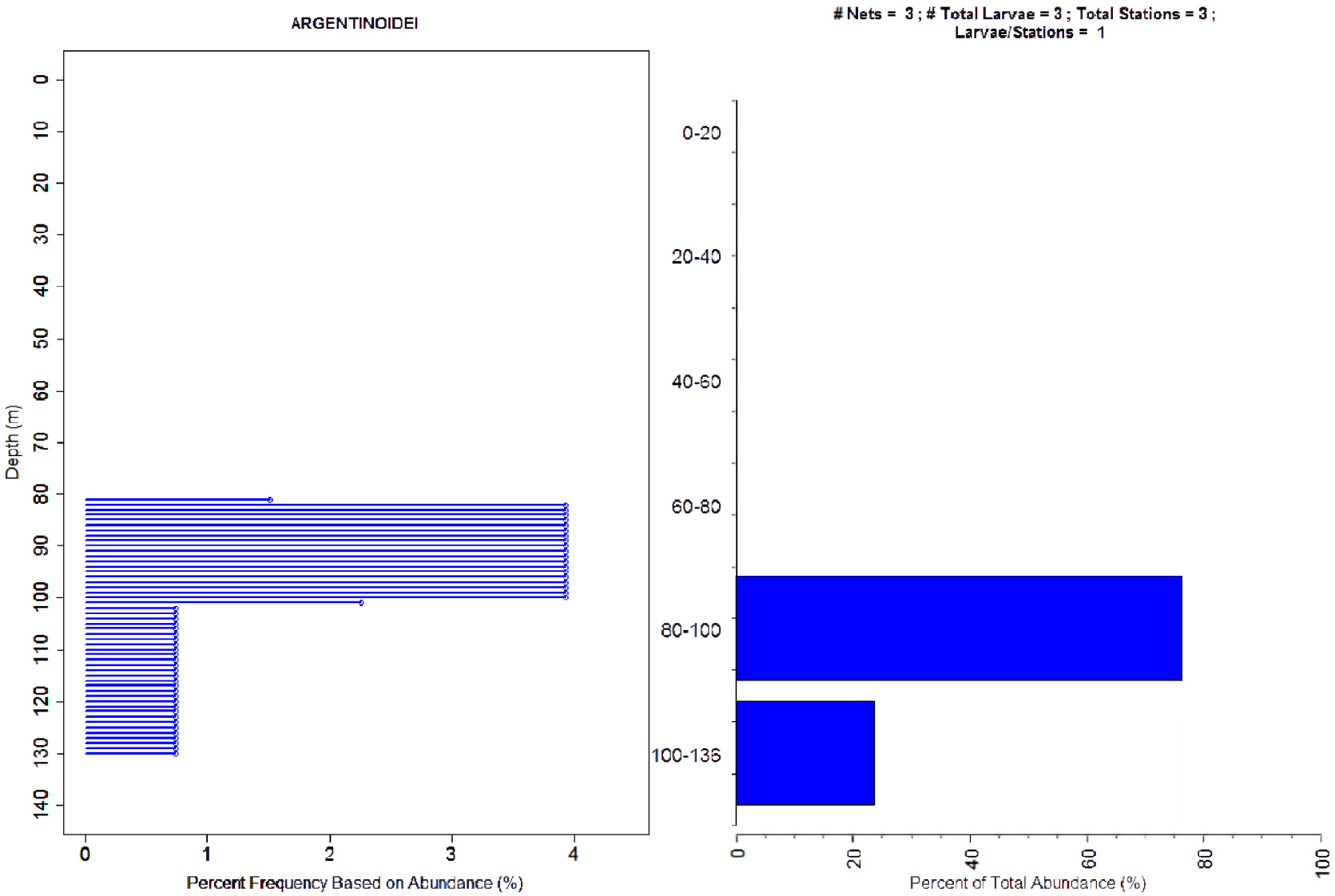
ANOPLOGASTRIDAE


APOGONIDAE
Nets = 89 ; # Total Larvae = 529 ; Total Stations = 41 ;
Larvae/Stations = 12.9
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

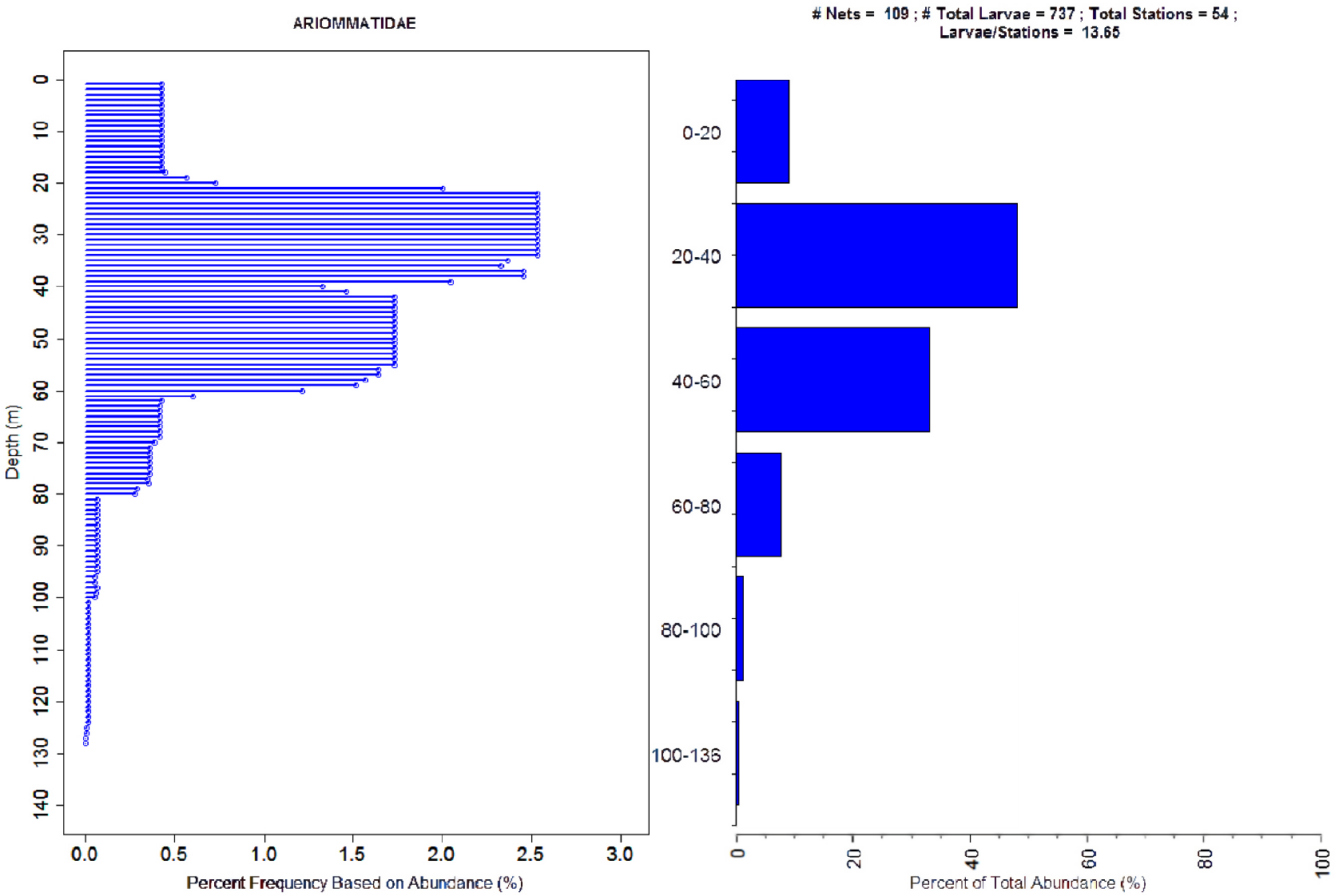
APOGONIDAE



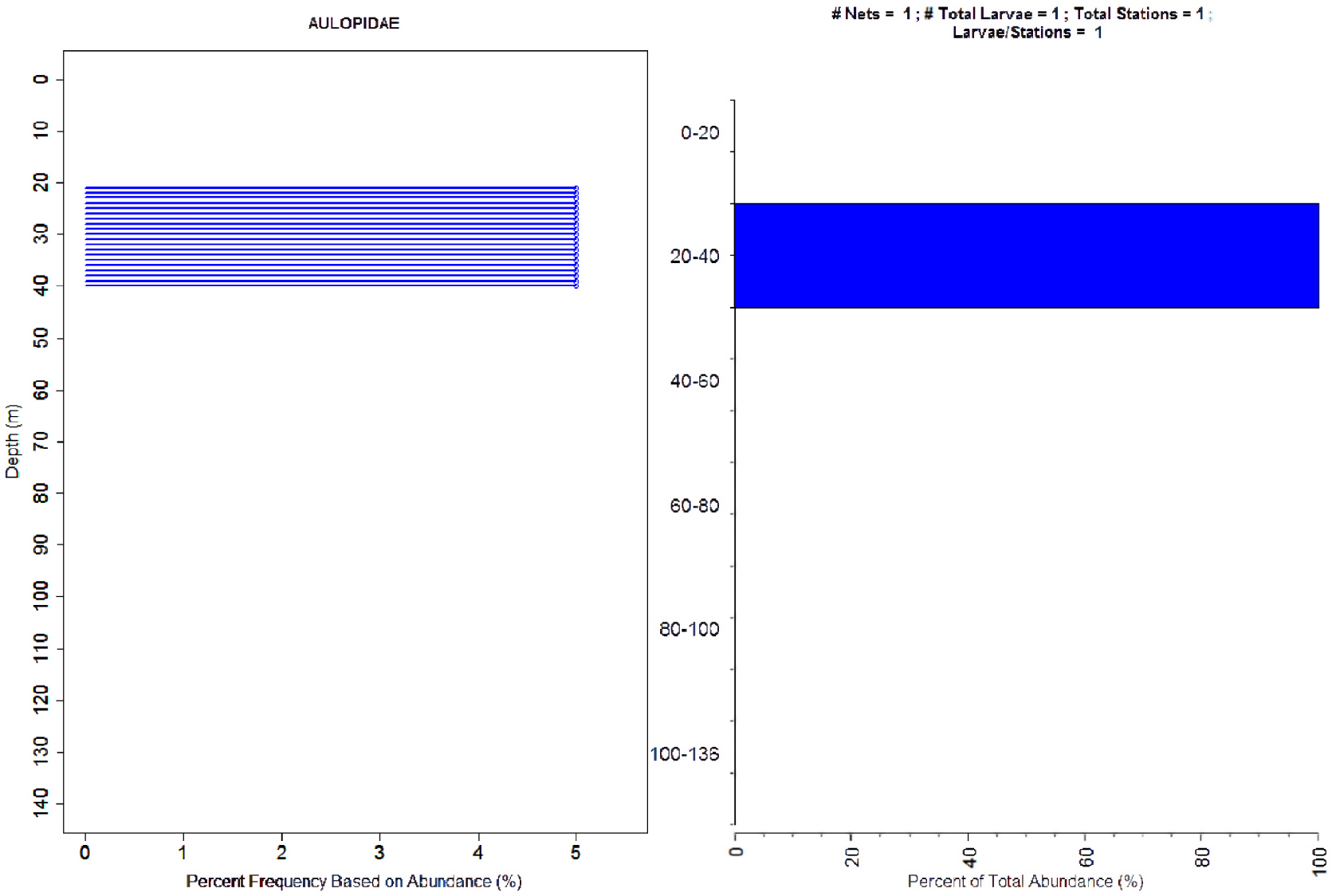
ARGENTINIDAE



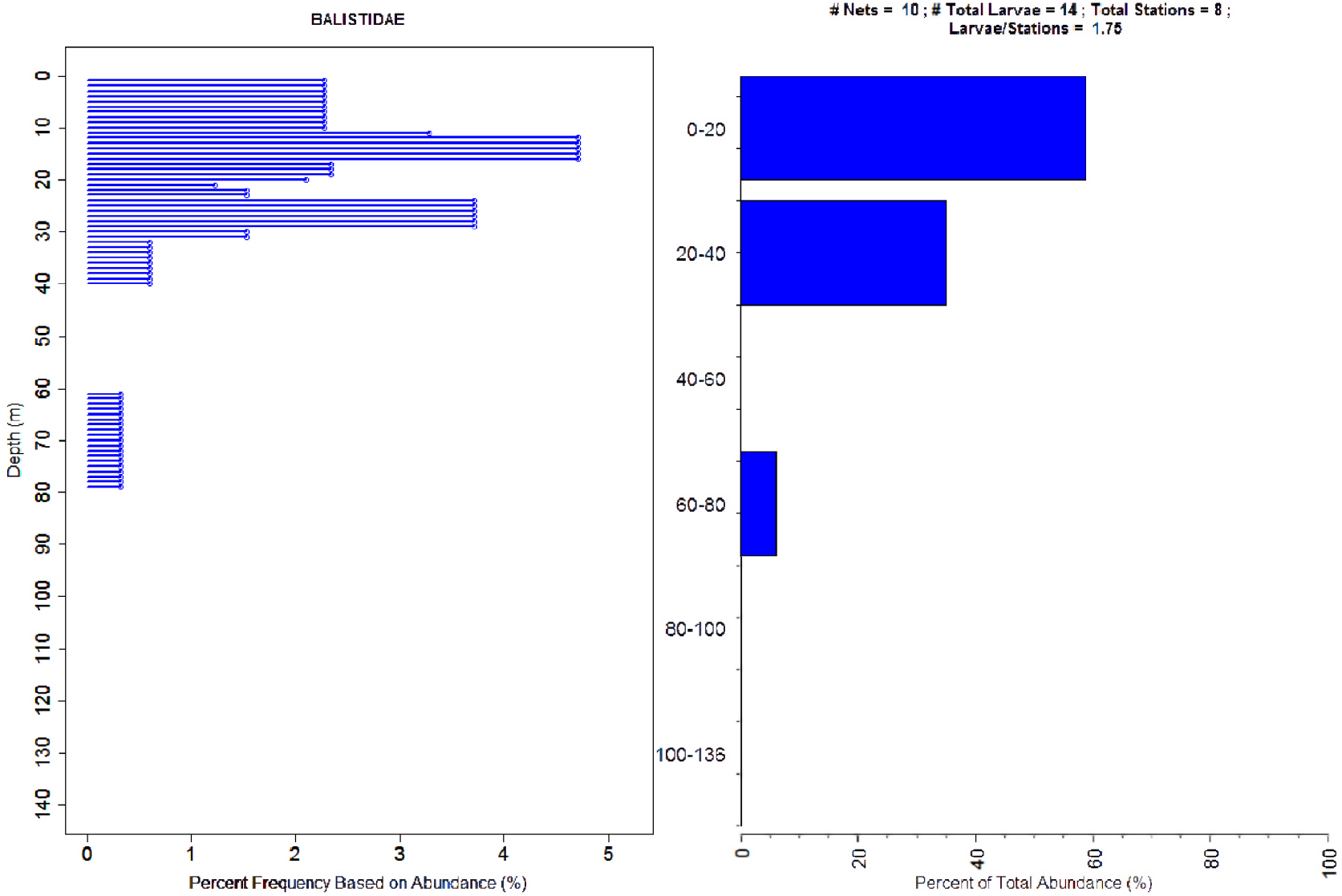
ARGENTINOIDEI



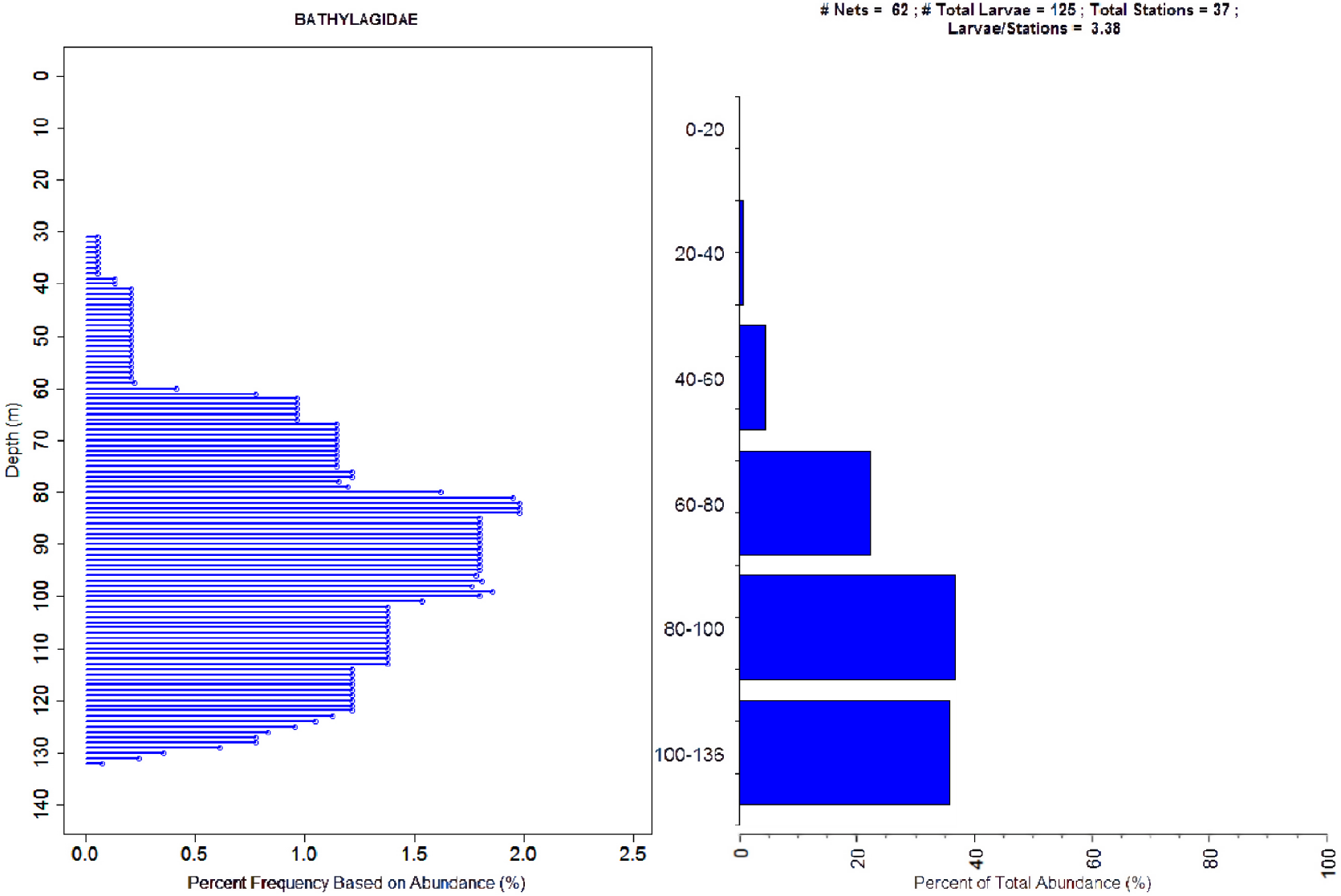
ARIOMMATIDAE


AULOPIDAE
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

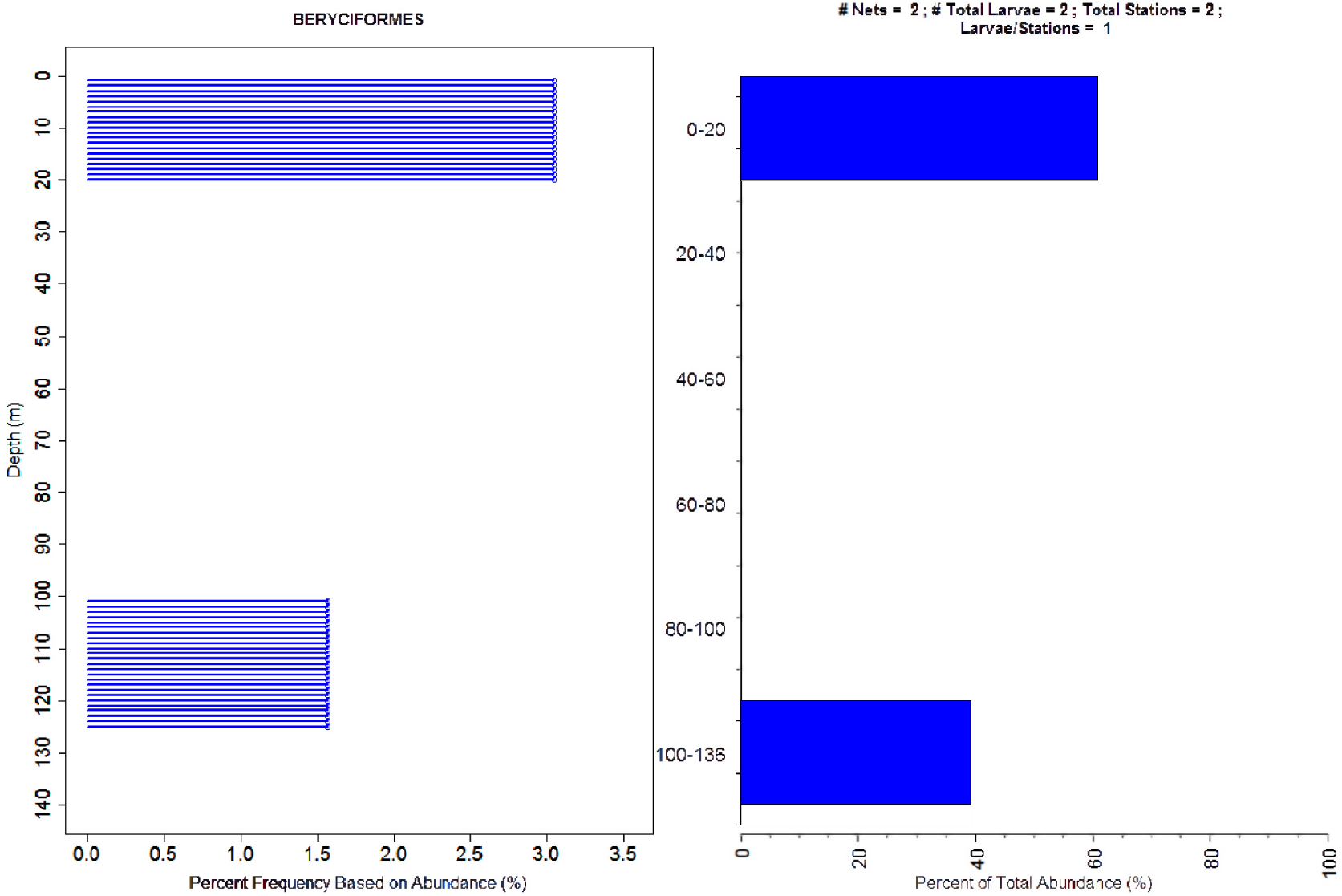
AULOPIDAE


BALISTIDAE
Nets = 10 ; # Total Larvae = 14 ; Total Stations = 8 ;
Larvae/Stations = 1.75
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

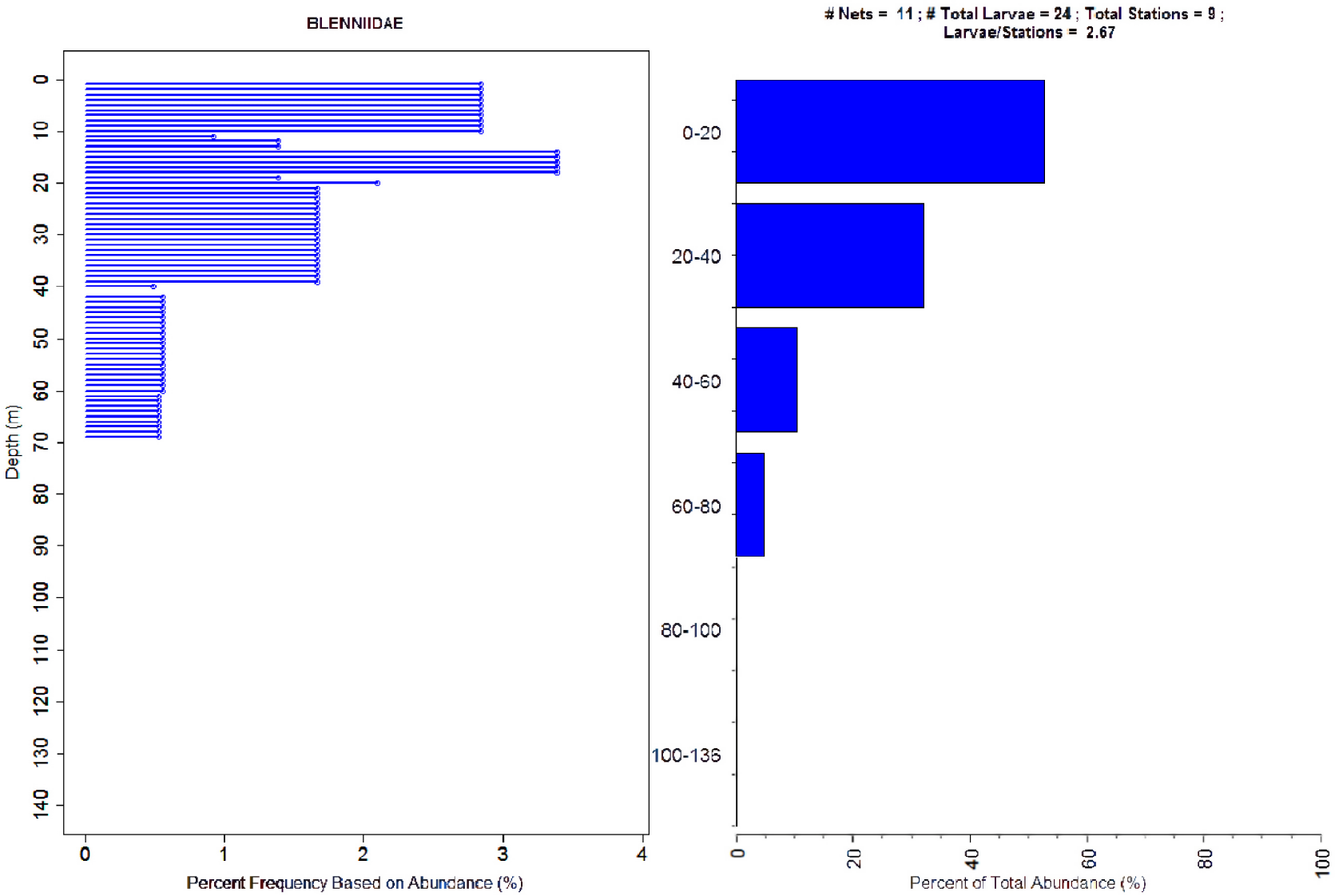
BALISTIDAE



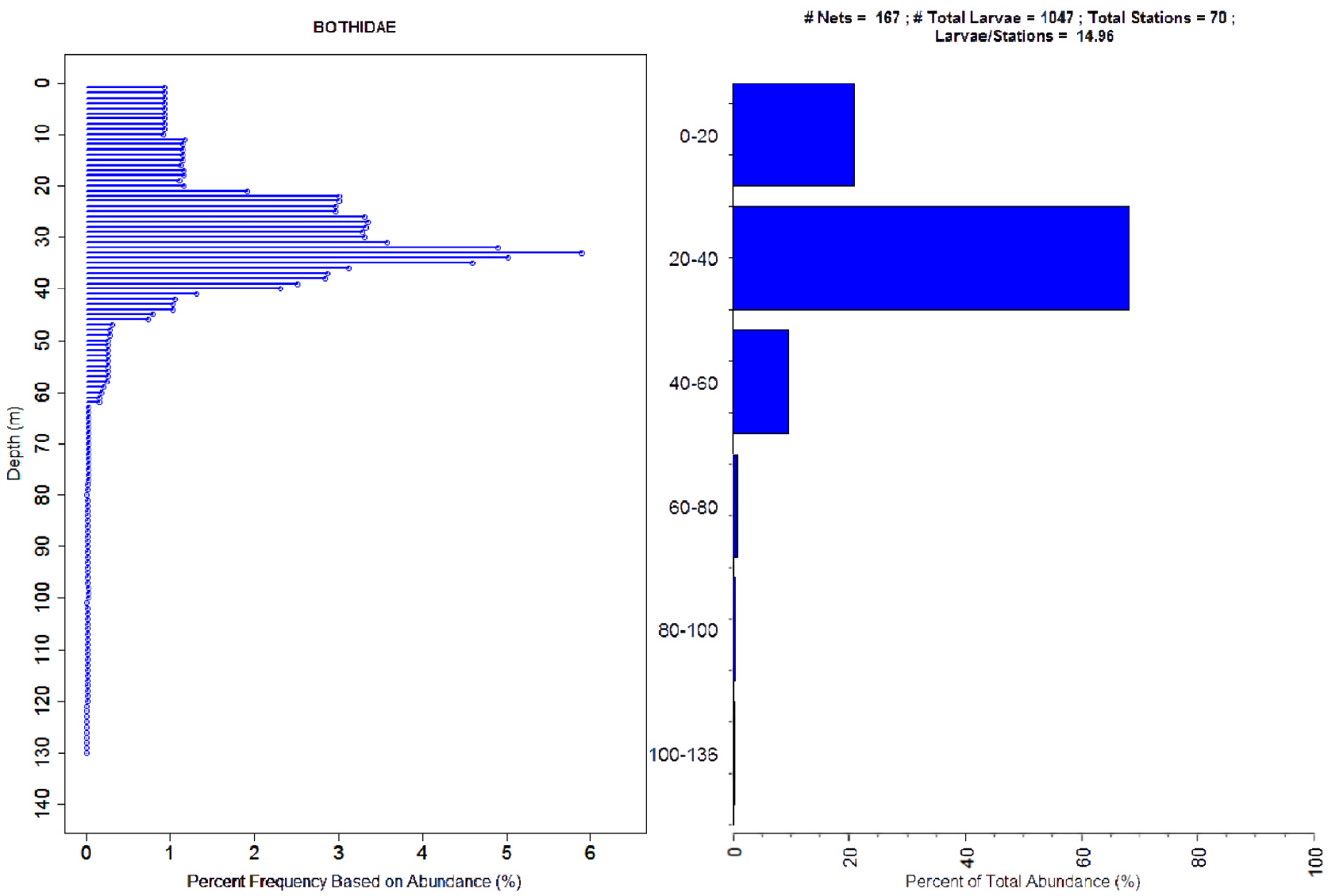
BATHYLAGIDAE



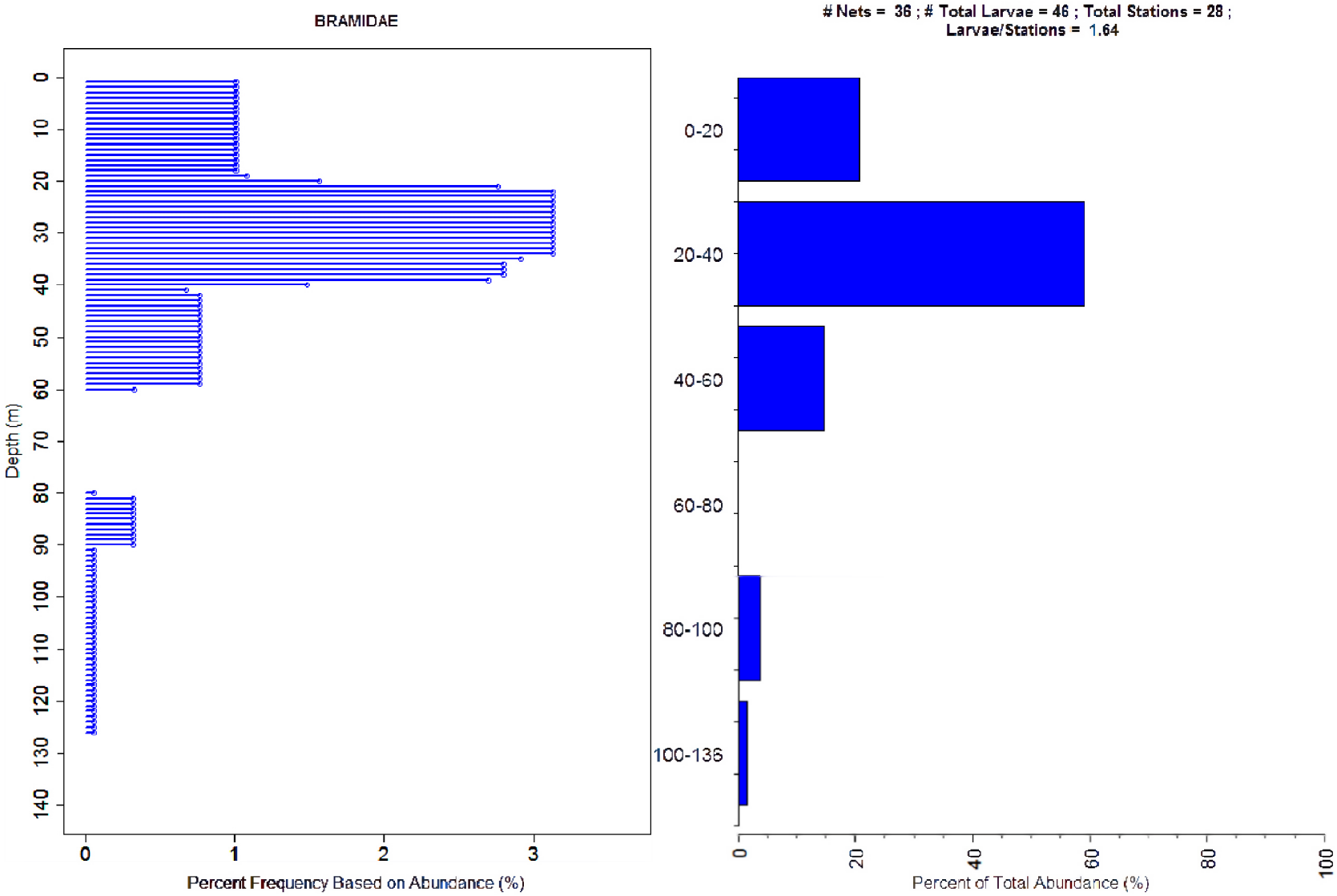
BERYCIFORMES


BLENNIIDAE
Nets = 11 ; # Total Larvae = 24 ; Total Stations = 9 ;
Larvae/Stations = 2.67
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

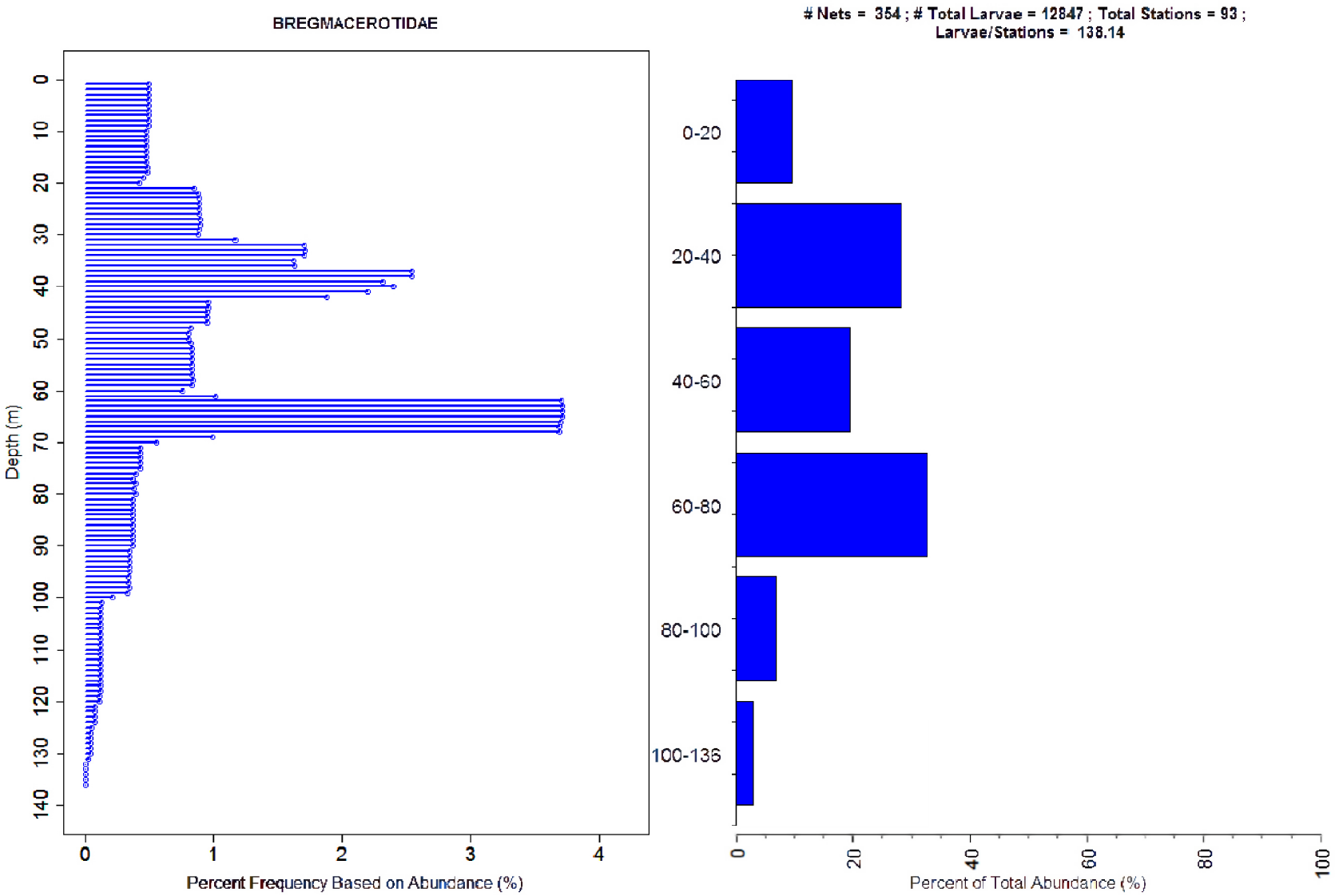
BLENNIIDAE


BOTHIDAE
Nets = 167 ; # Total Larvae = 1047 ; Total Stations = 70 ;
Larvae/Stations = 14.96
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

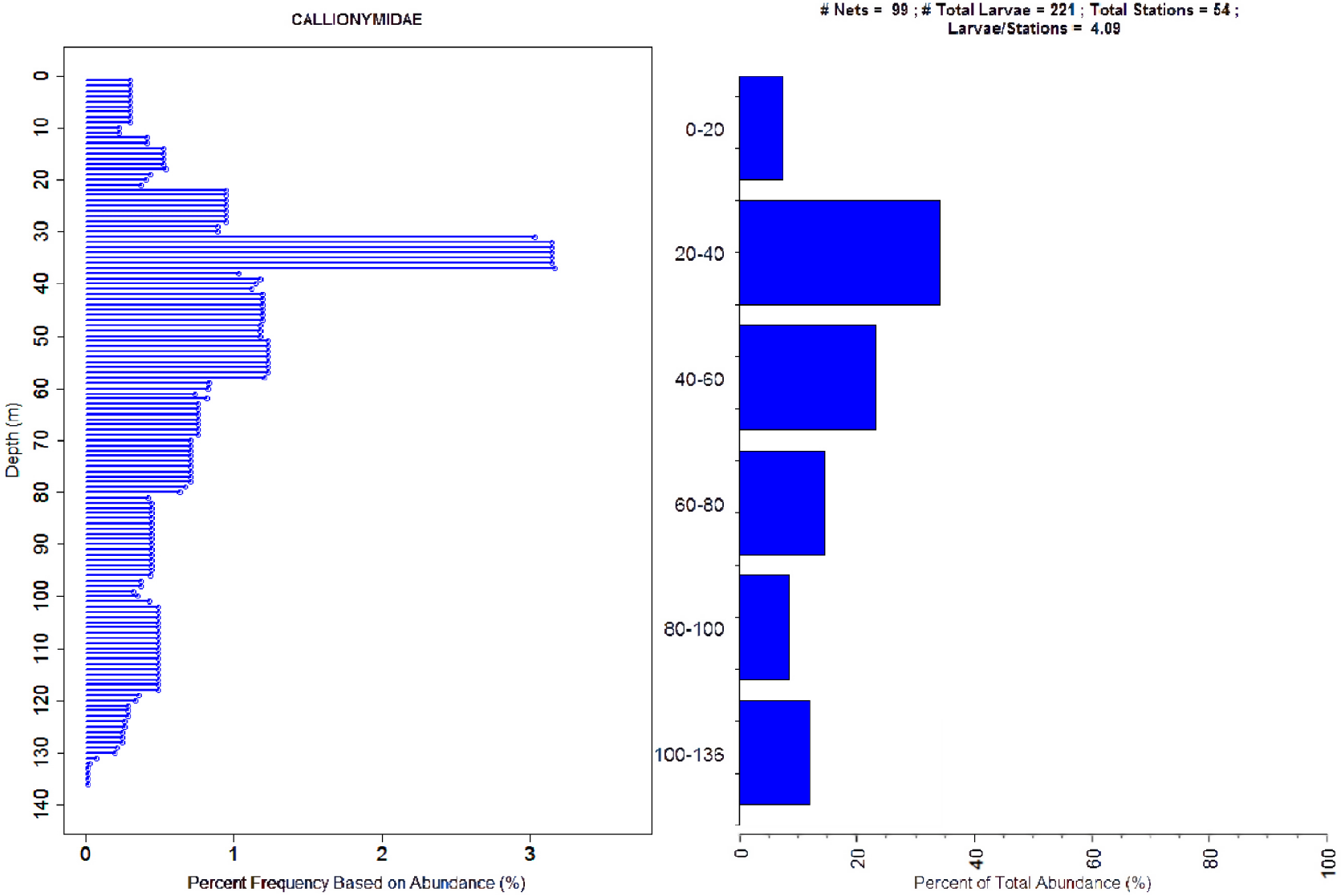
BOTHIDAE


BRAMIDAE
Nets = 36 ; # Total Larvae = 46 ; Total Stations = 28 ;
Larvae/Stations = 1.64
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

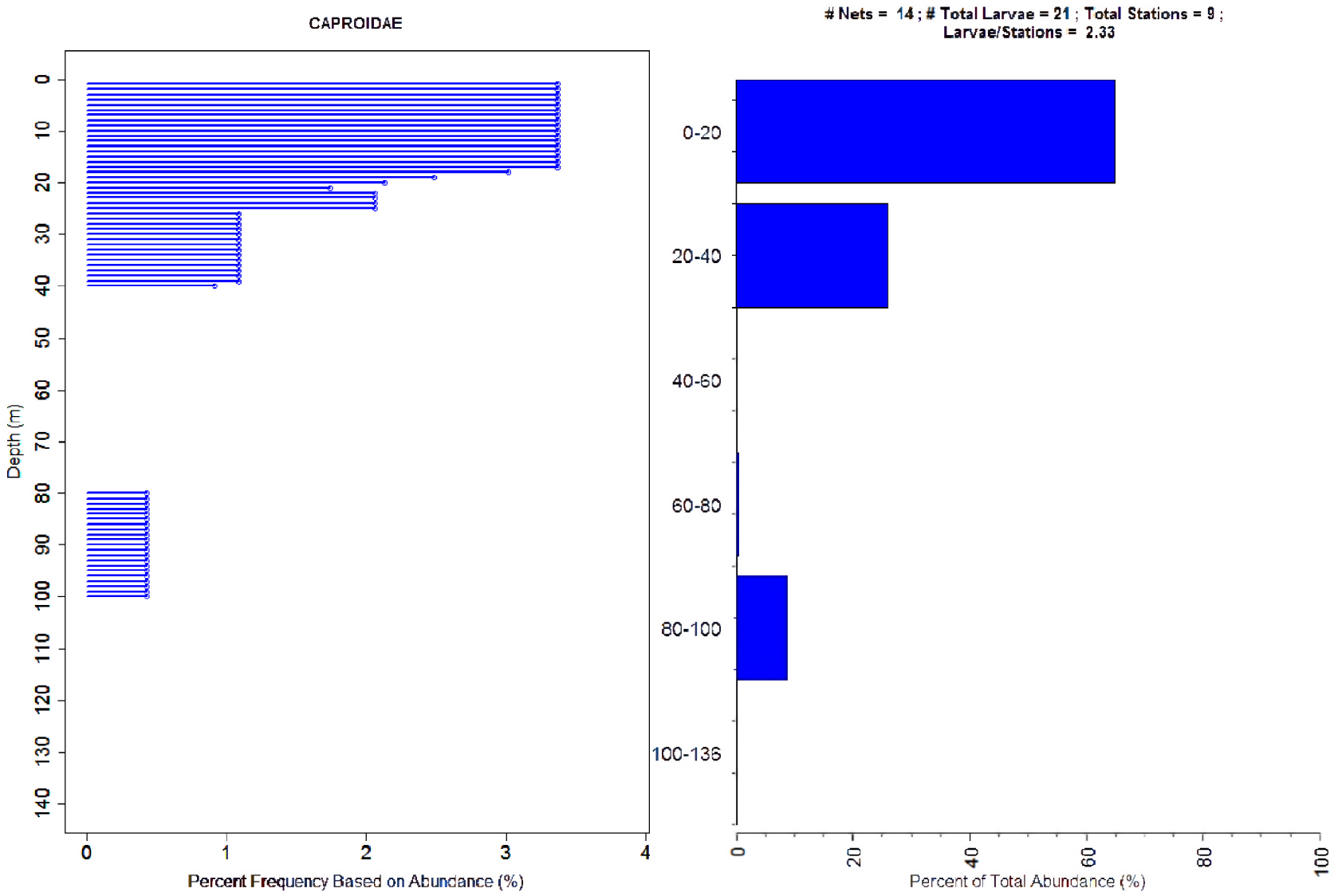
BRAMIDAE



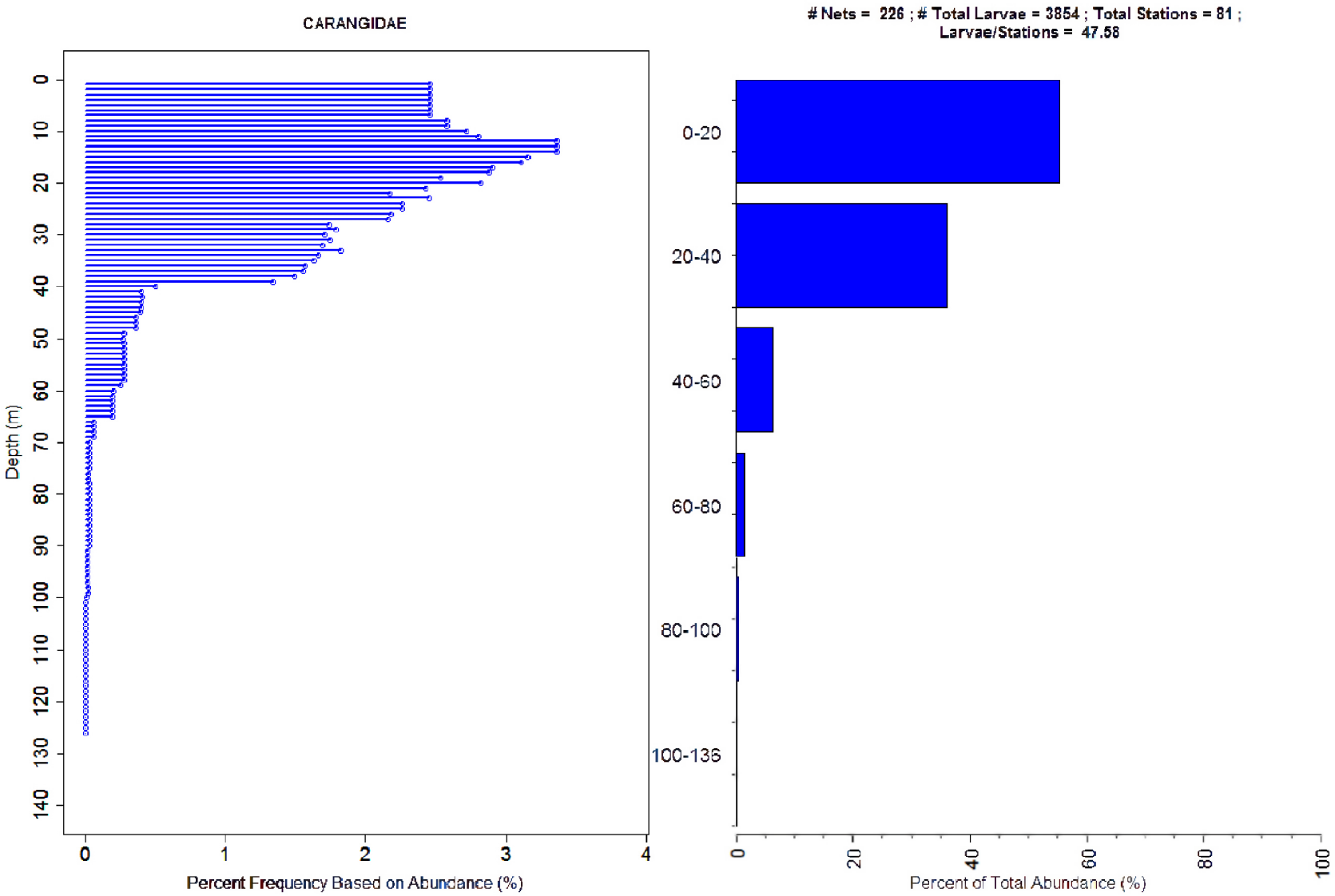
BREGMACEROTIDAE



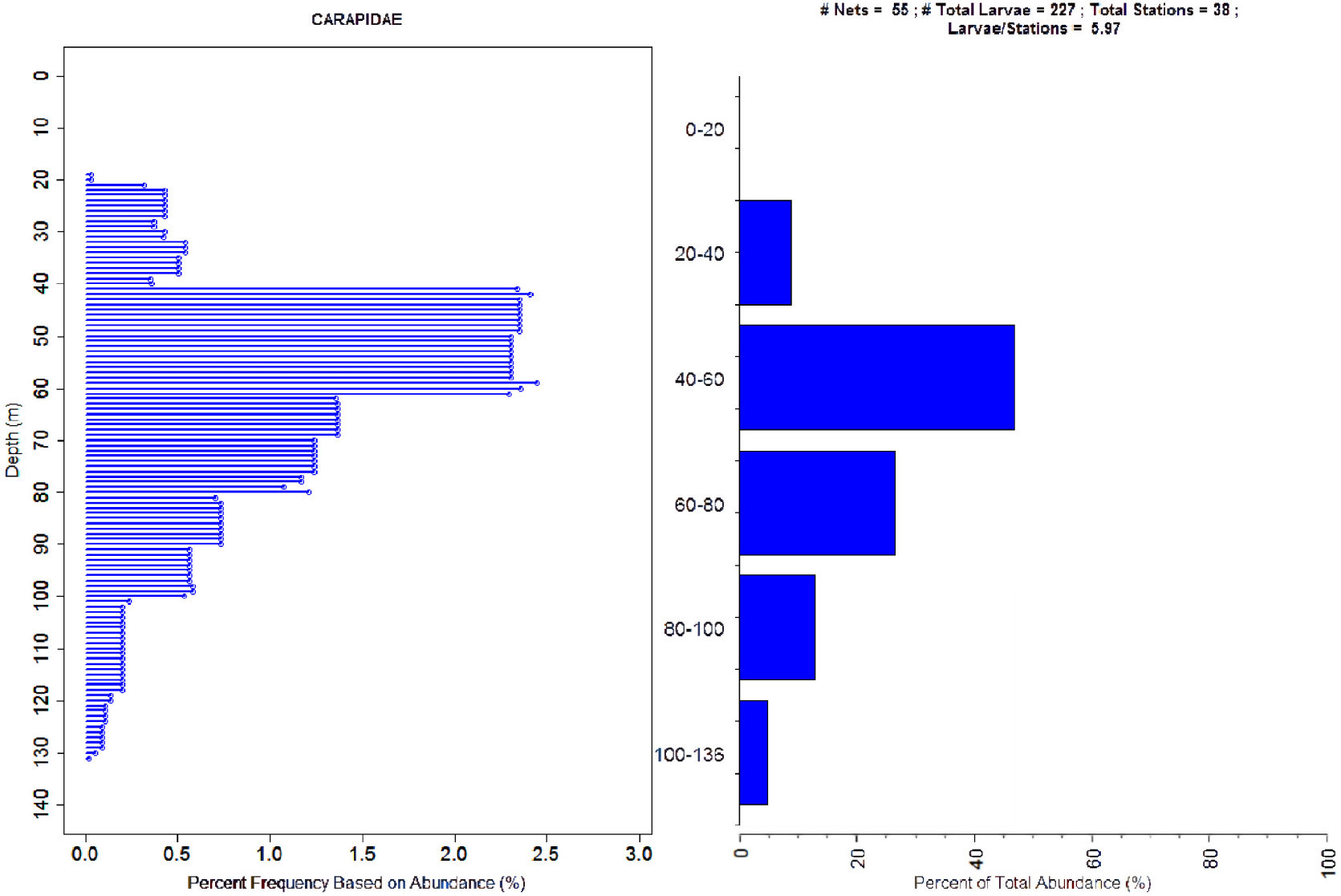
CALLIONYMIDAE


CAPROIDAE
Nets = 14 ; # Total Larvae = 21 ; Total Stations = 9 ;
Larvae/Stations = 2.33
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

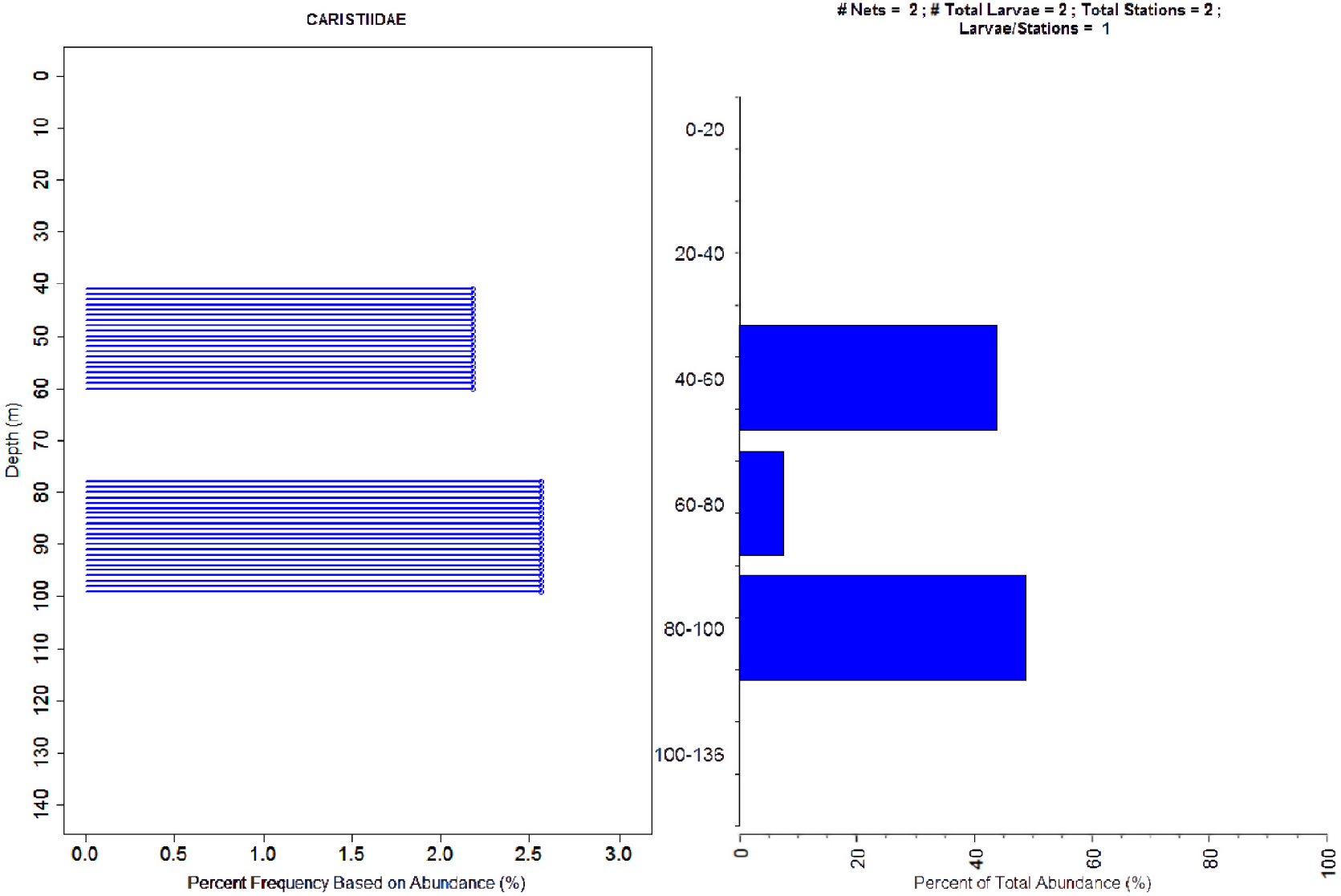
CAPROIDAE


CARANGIDAE
Nets = 226 ; # Total Larvae = 3854 ; Total Stations = 81 ;
Larvae/Stations = 47.58
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

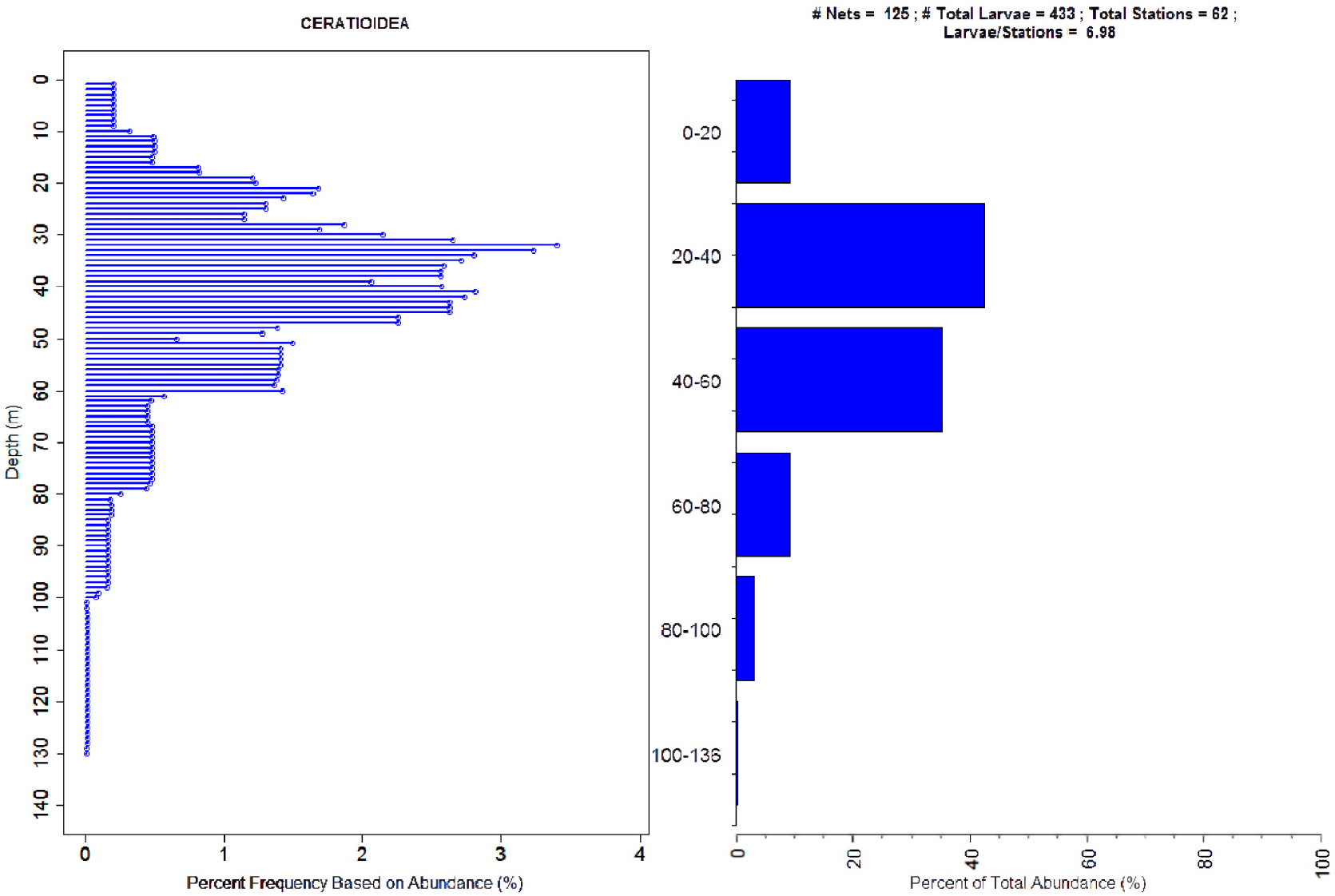
CARANGIDAE


CARAPIDAE
Nets = 55 ; # Total Larvae = 227 ; Total Stations = 38 ;
Larvae/Stations = 5.97
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

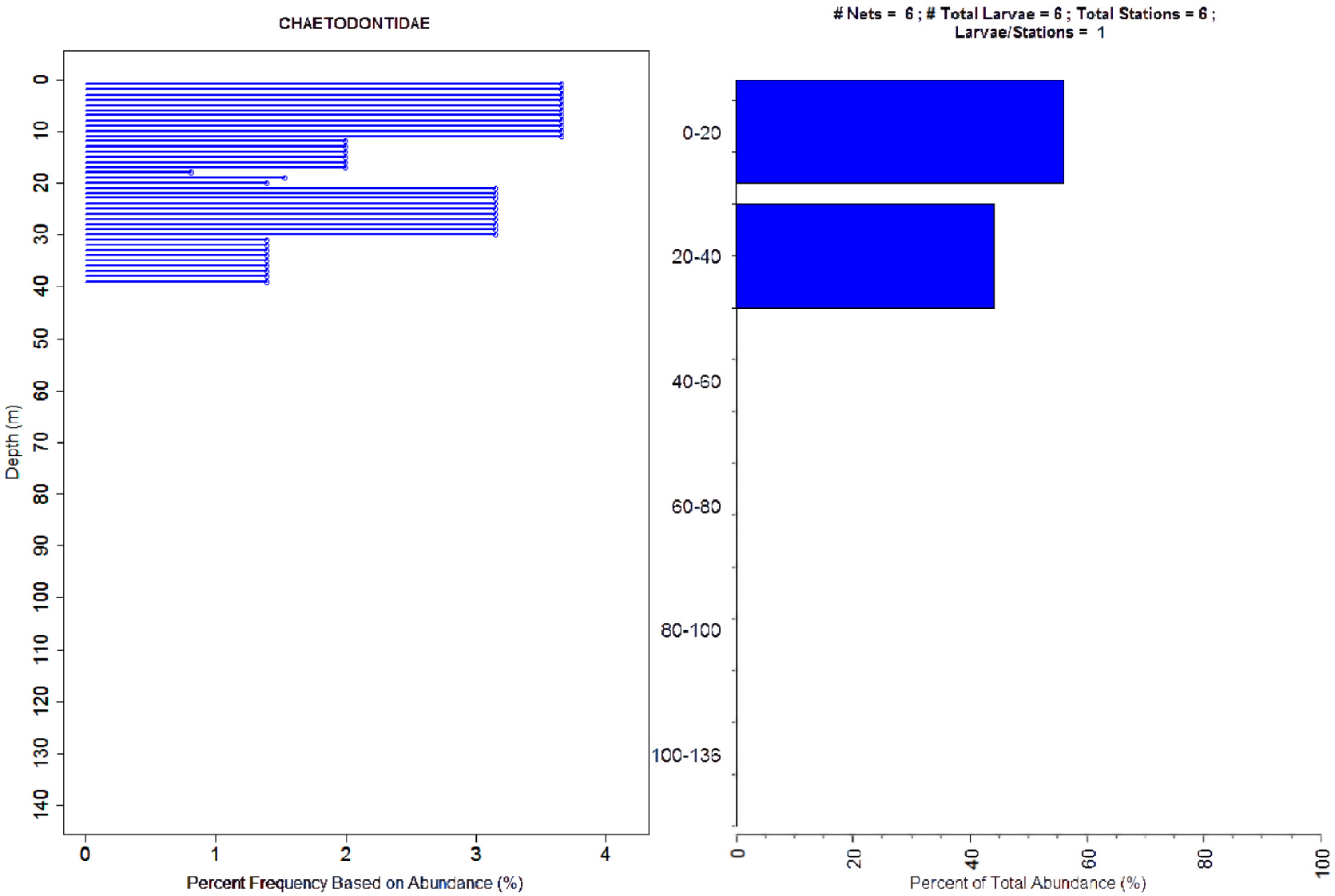
CARAPIDAE



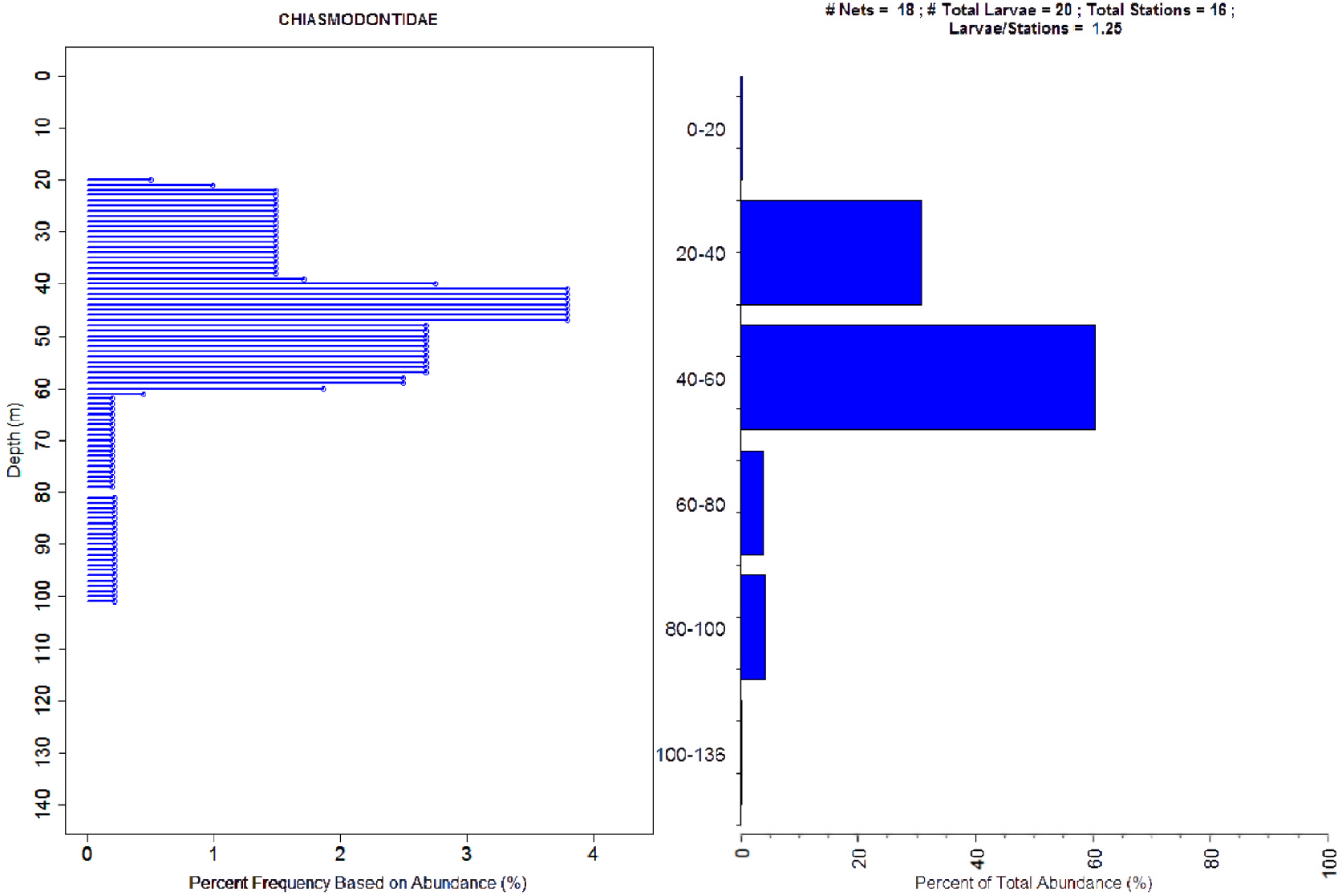
CARISTIIDAE



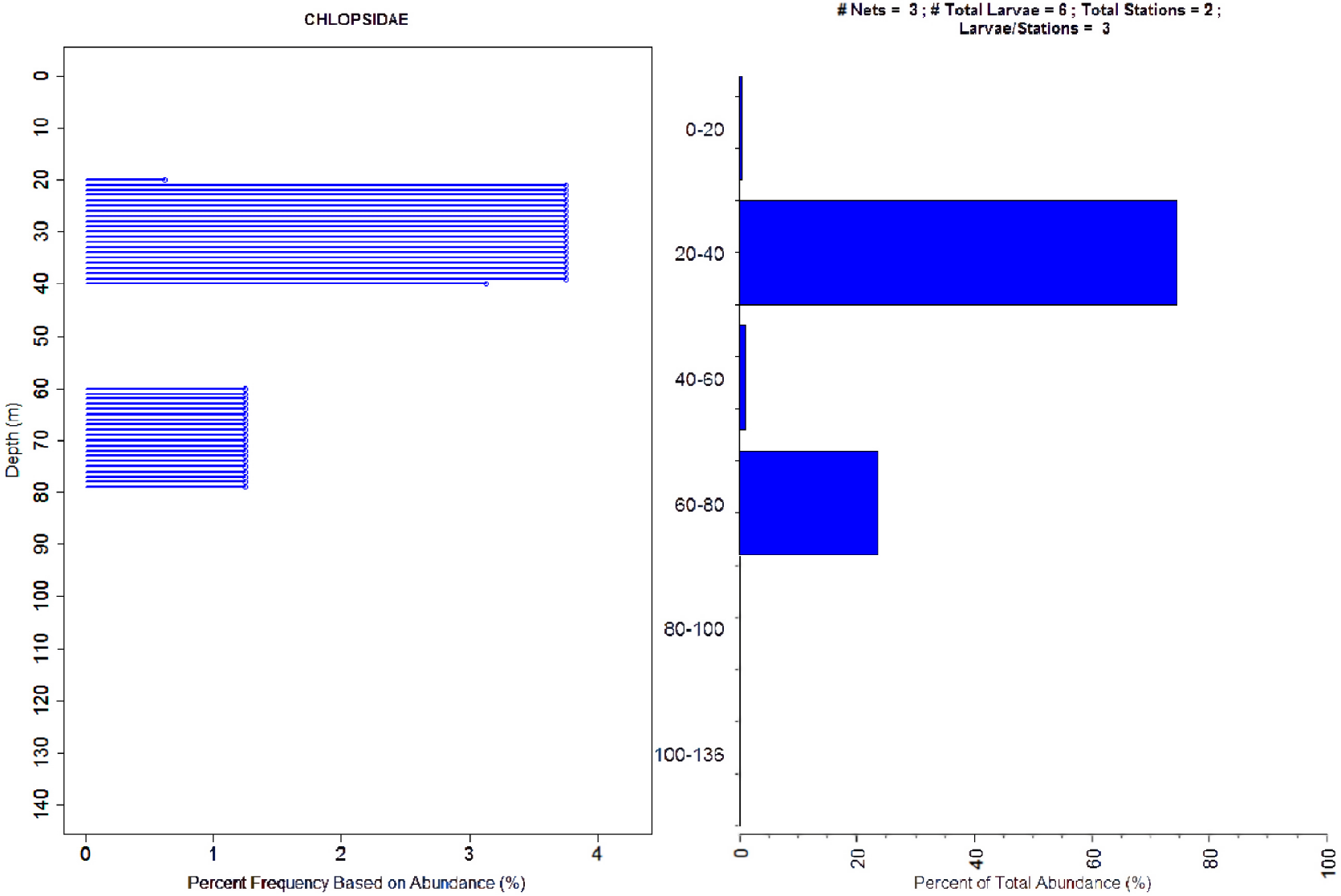
CERATIOIDEA



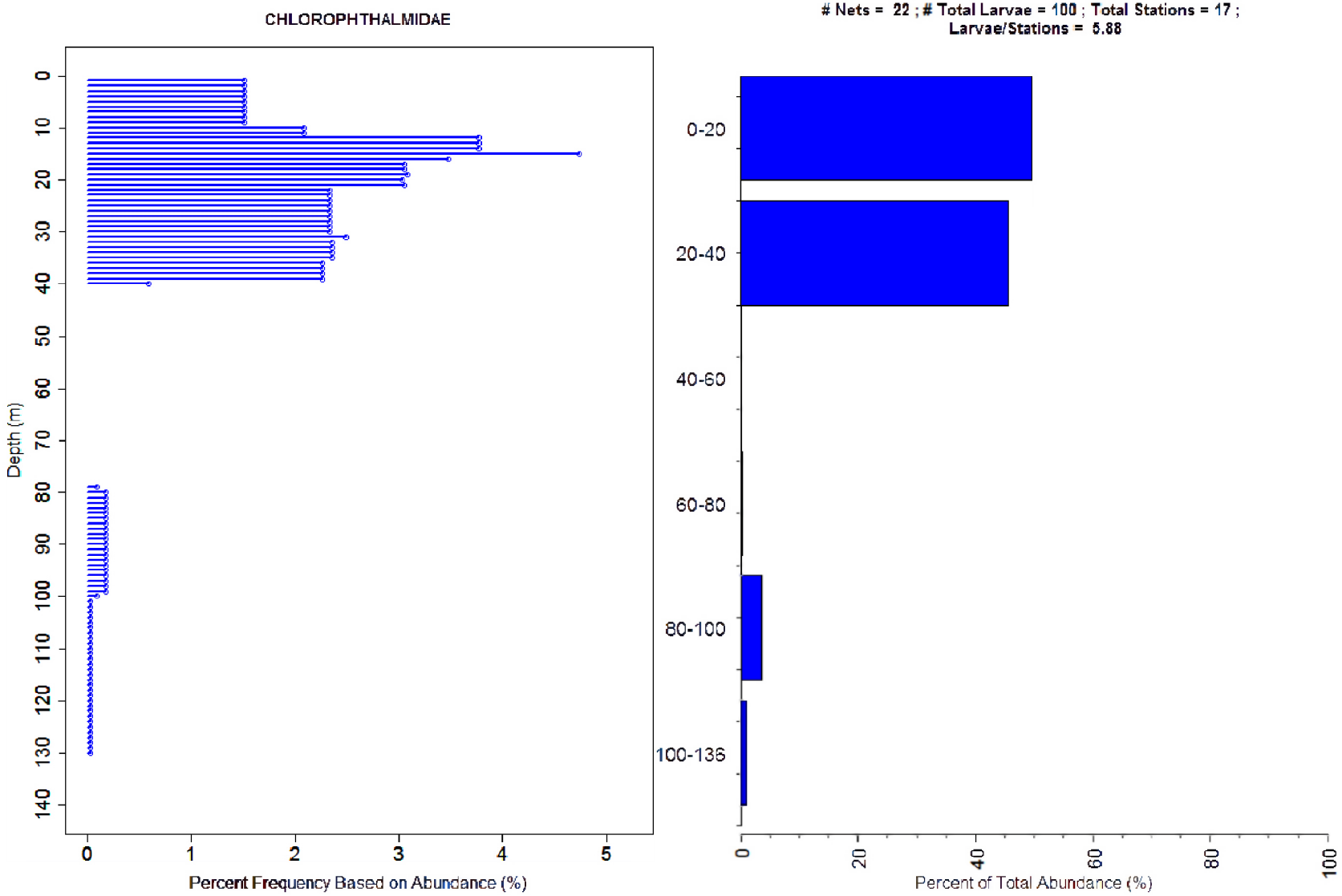
CHAETODONTIDAE



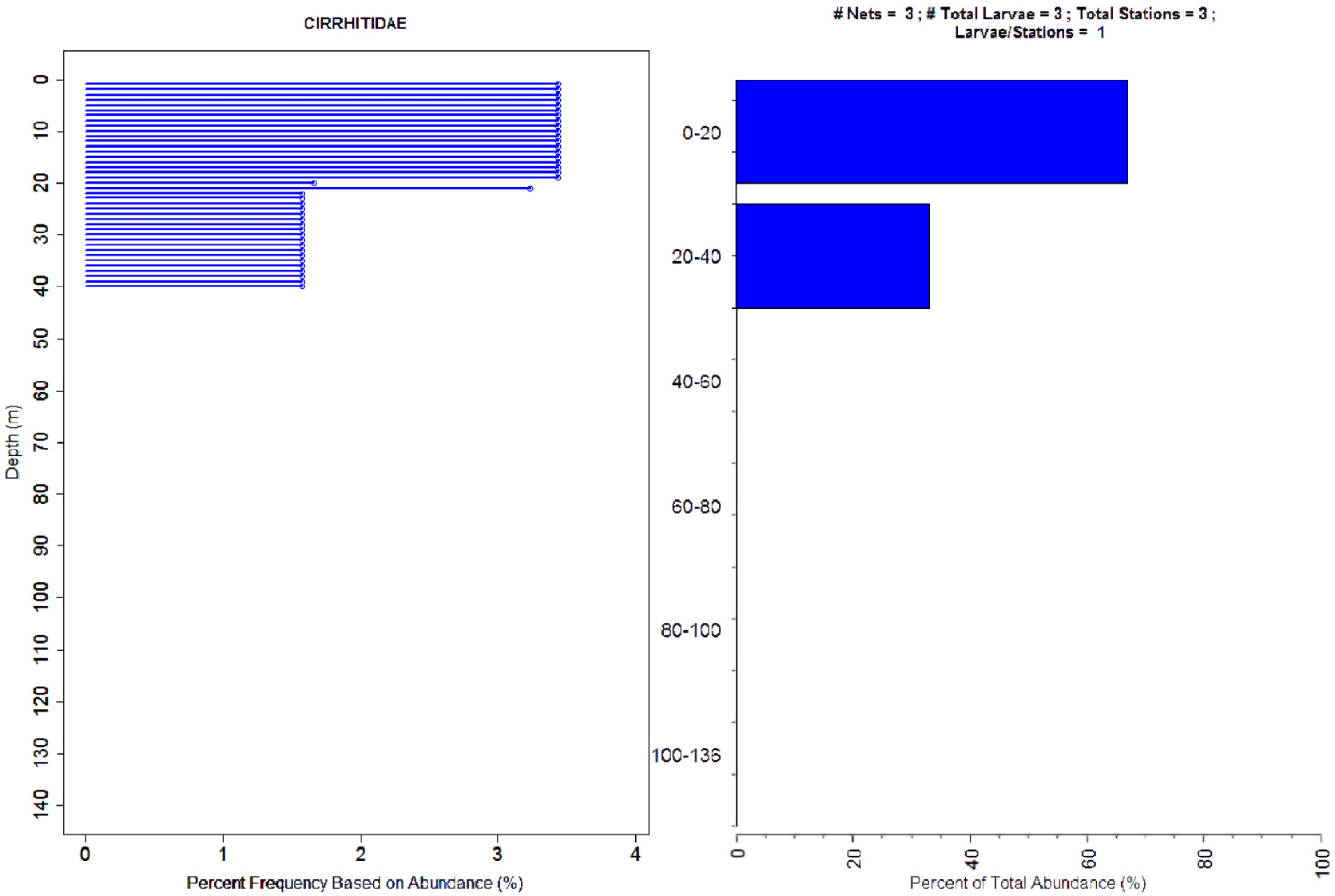
CHIASMODONTIDAE


CHLOPSIDAE
Nets = 3 ; # Total Larvae = 6 ; Total Stations = 2 ;
Larvae/Stations = 3
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

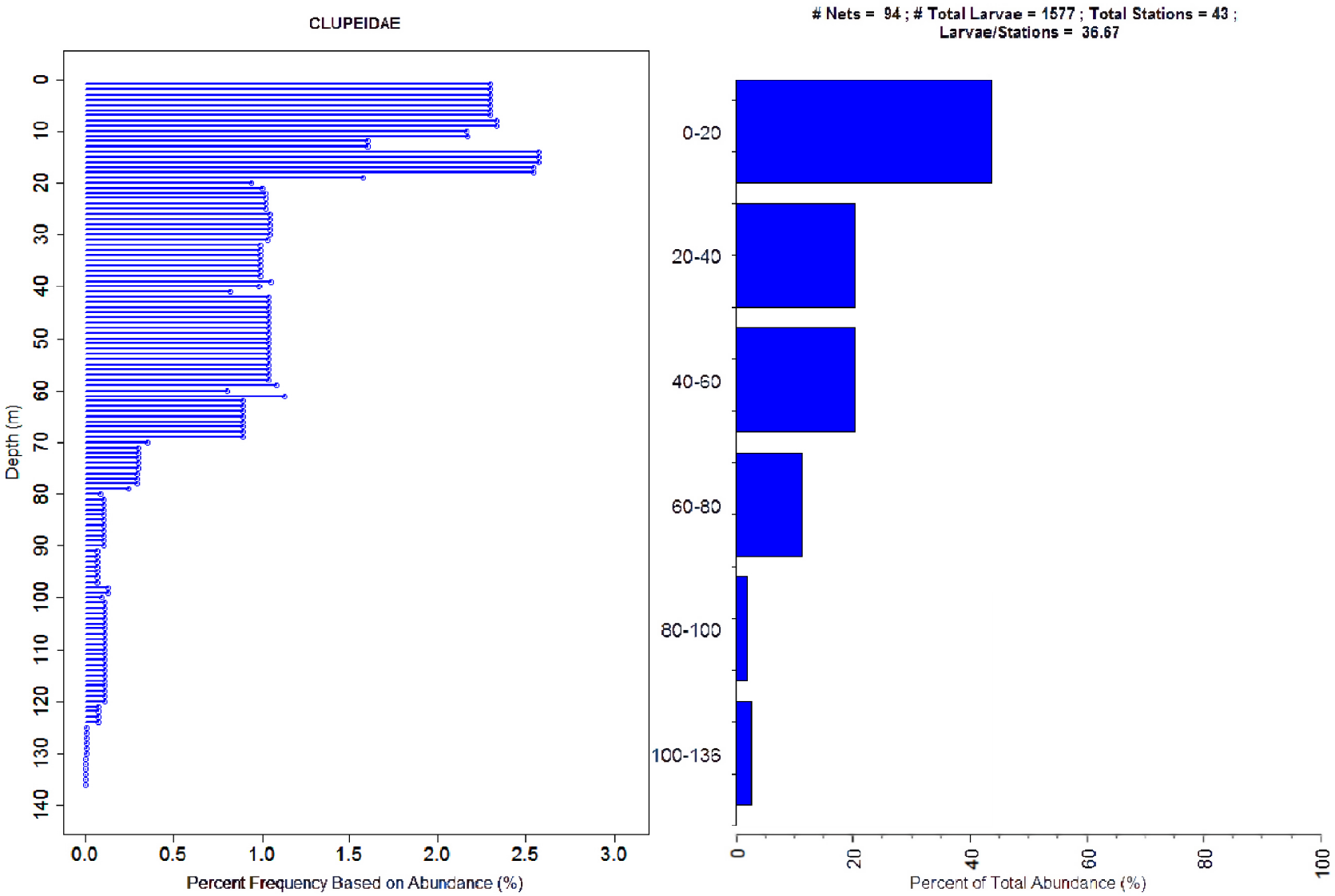
CHLOPSIDAE



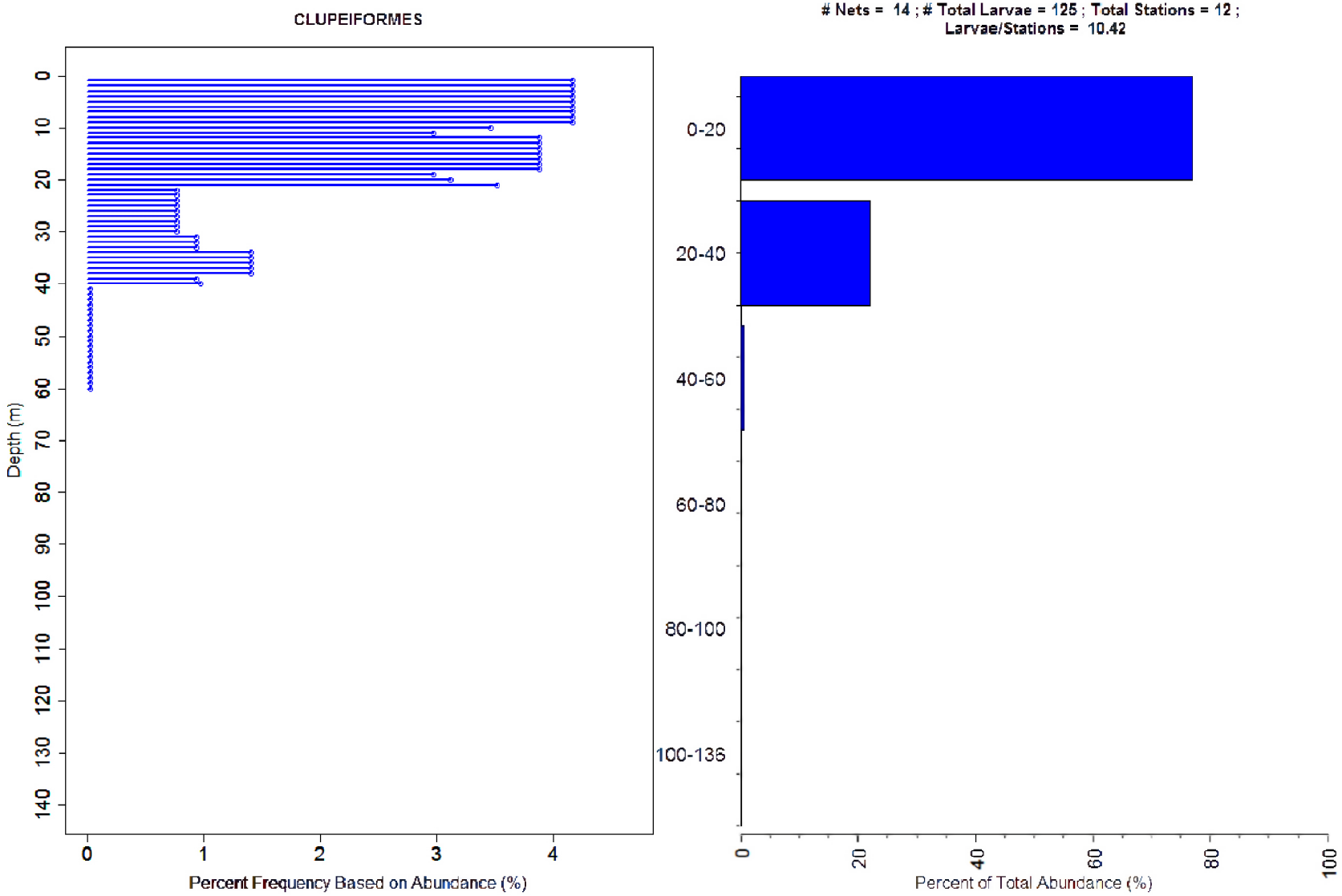
CHLOROPHTHALMIDAE



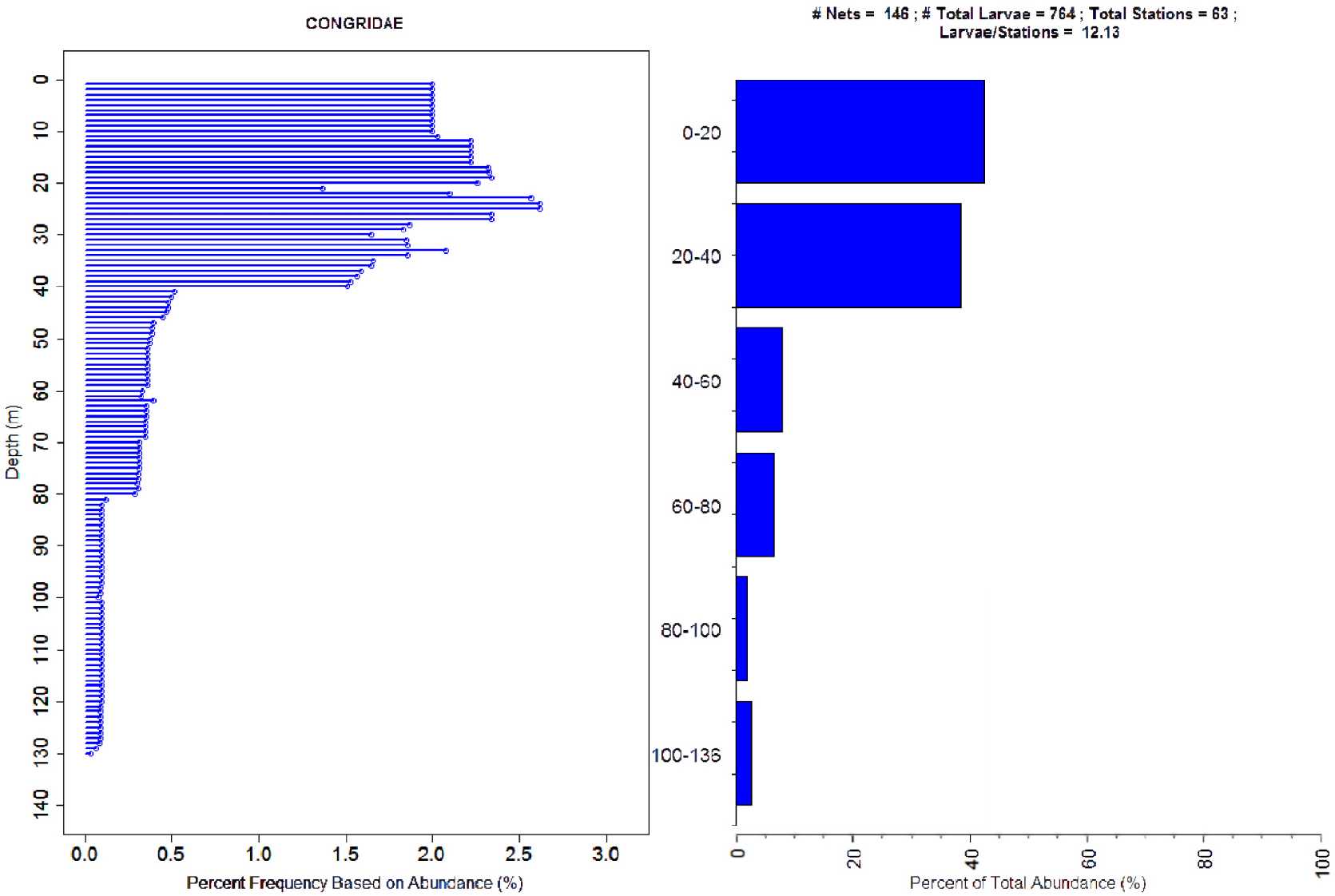
CIRRHITIDAE


CLUPEIDAE
Nets = 94 ; # Total Larvae = 1577 ; Total Stations = 43 ;
Larvae/Stations = 36.67
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

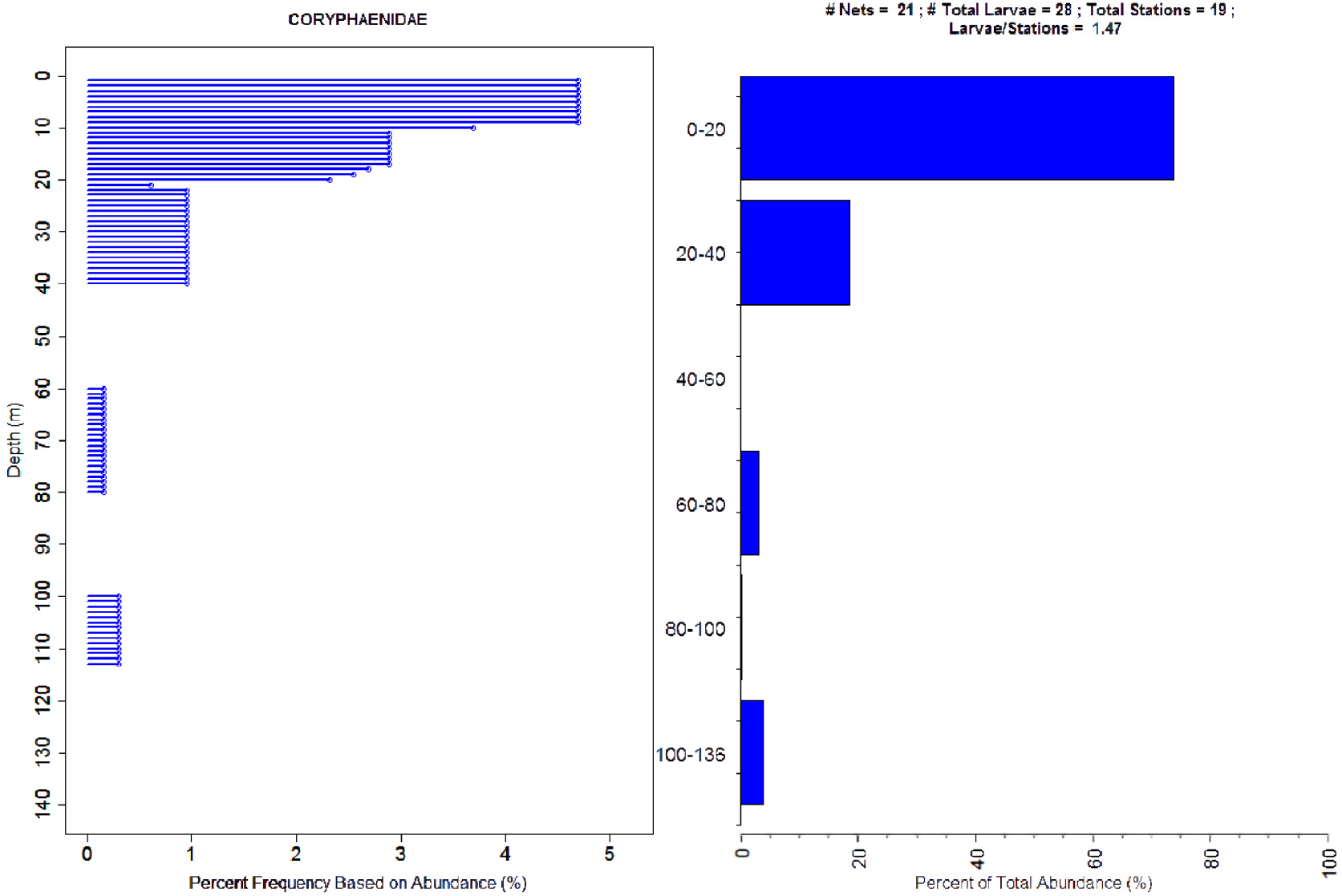
CLUPEIDAE



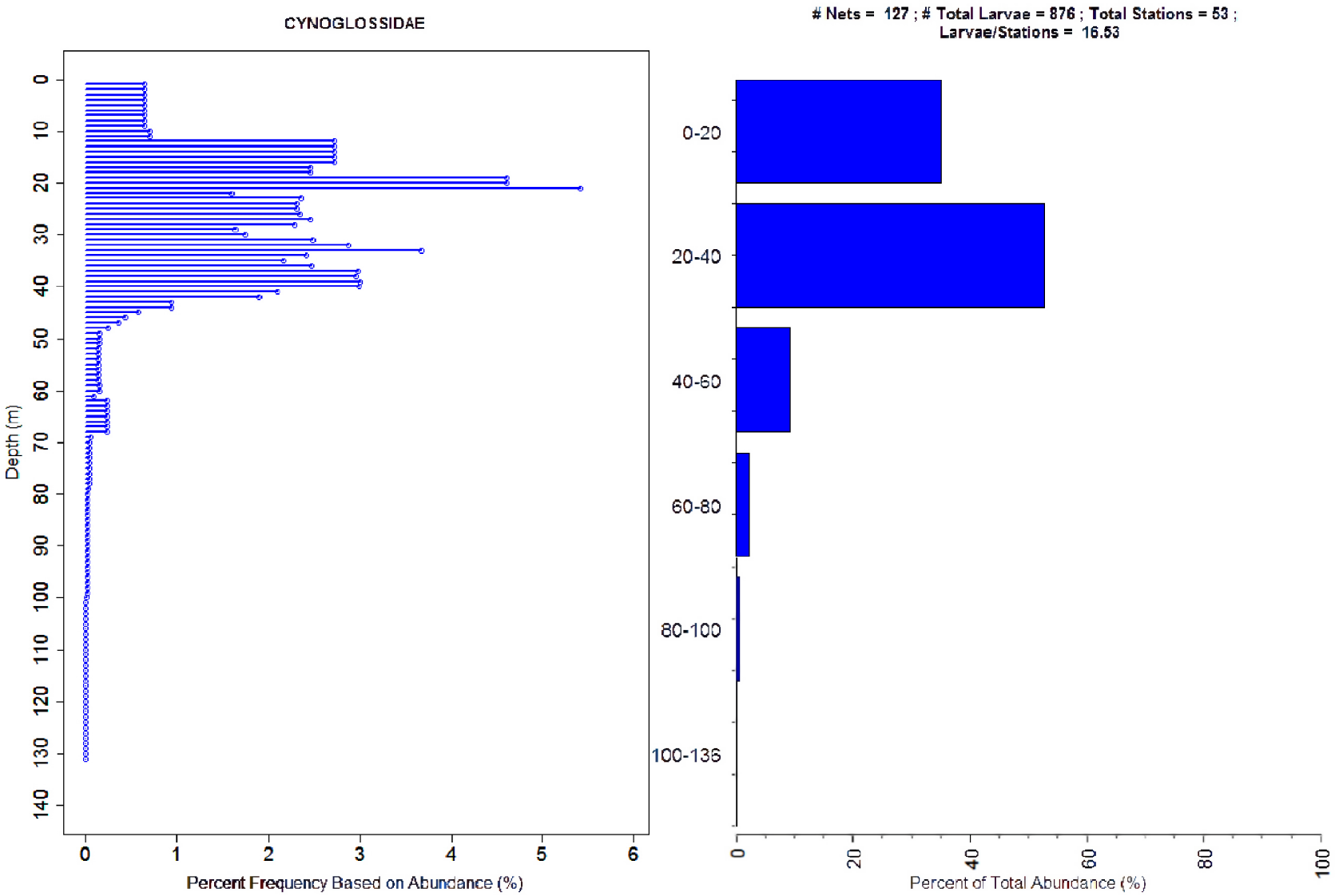
CLUPEIFORMES


CONGRIDAE
Nets = 146 ; # Total Larvae = 764 ; Total Stations = 63 ;
Larvae/Stations = 12.13
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

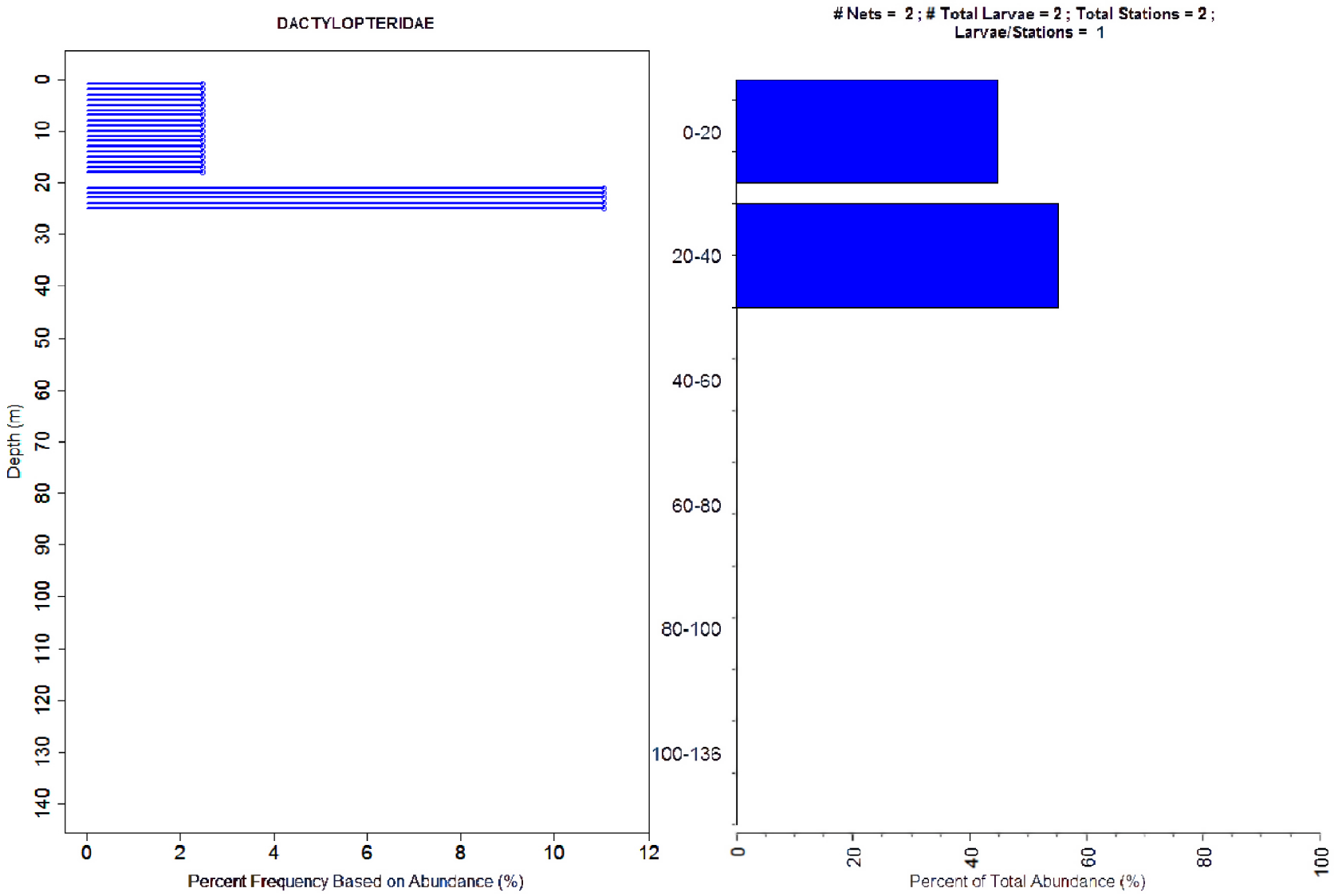
CONGRIDAE



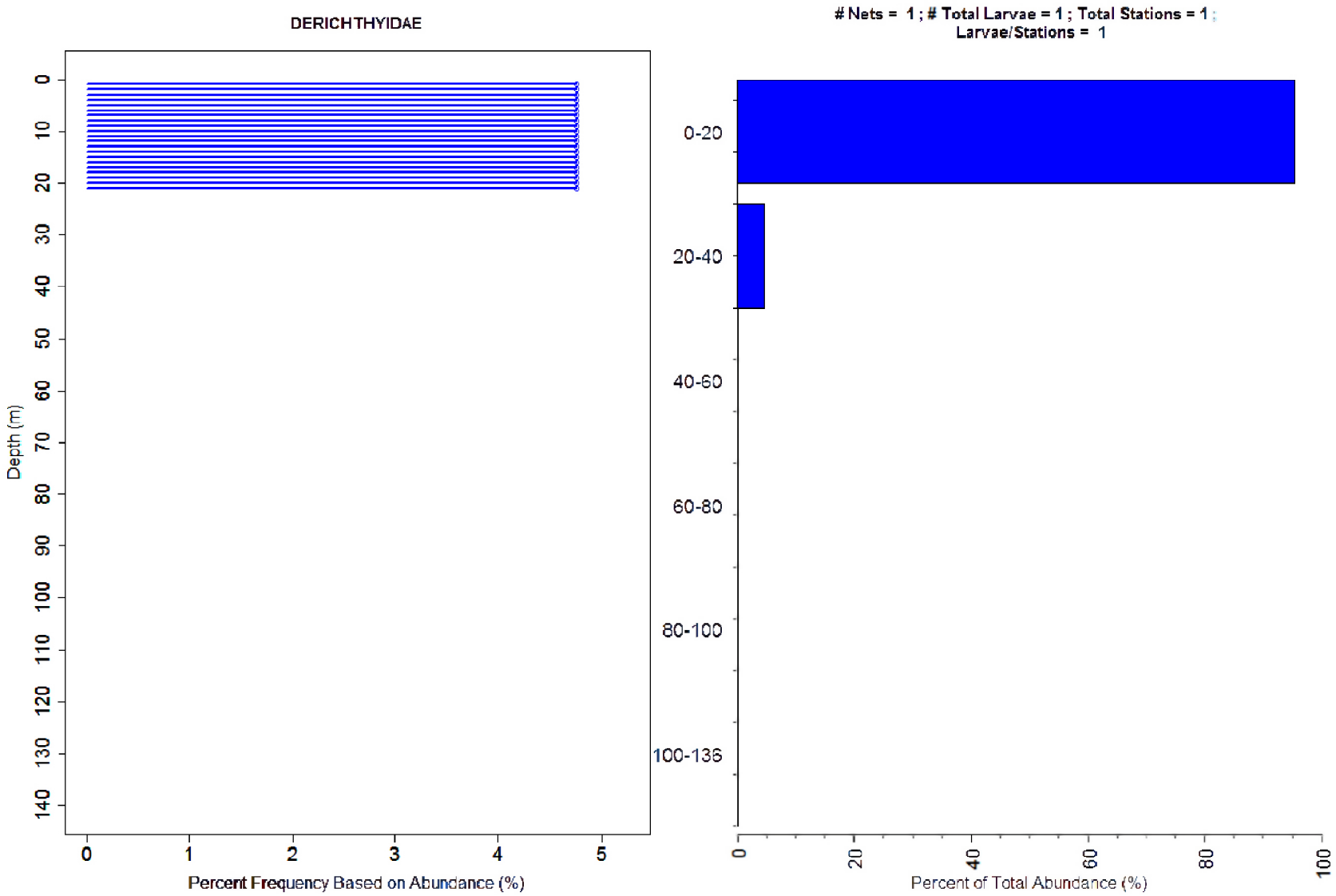
CORYPHAENIDAE



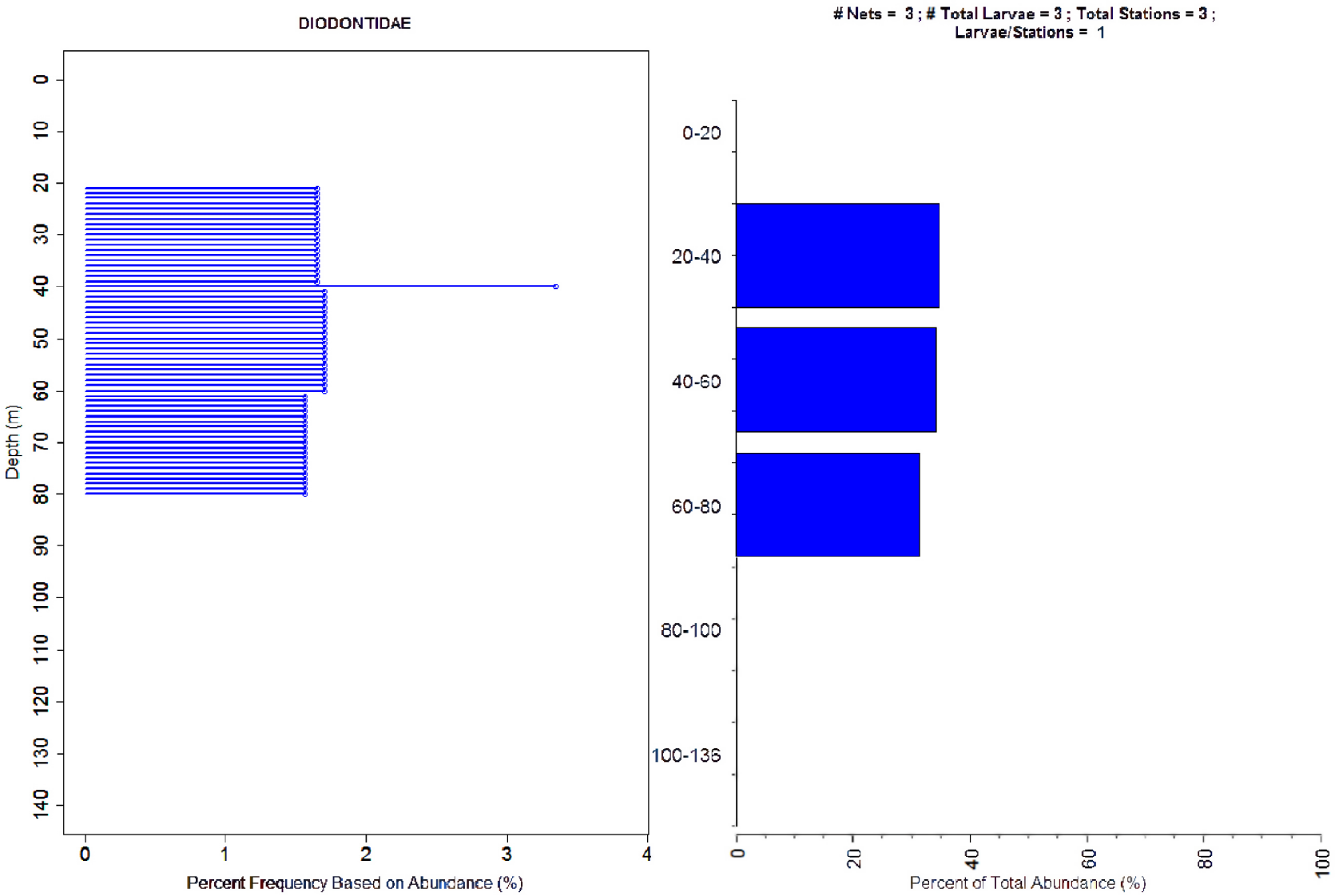
CYNOGLOSSIDAE



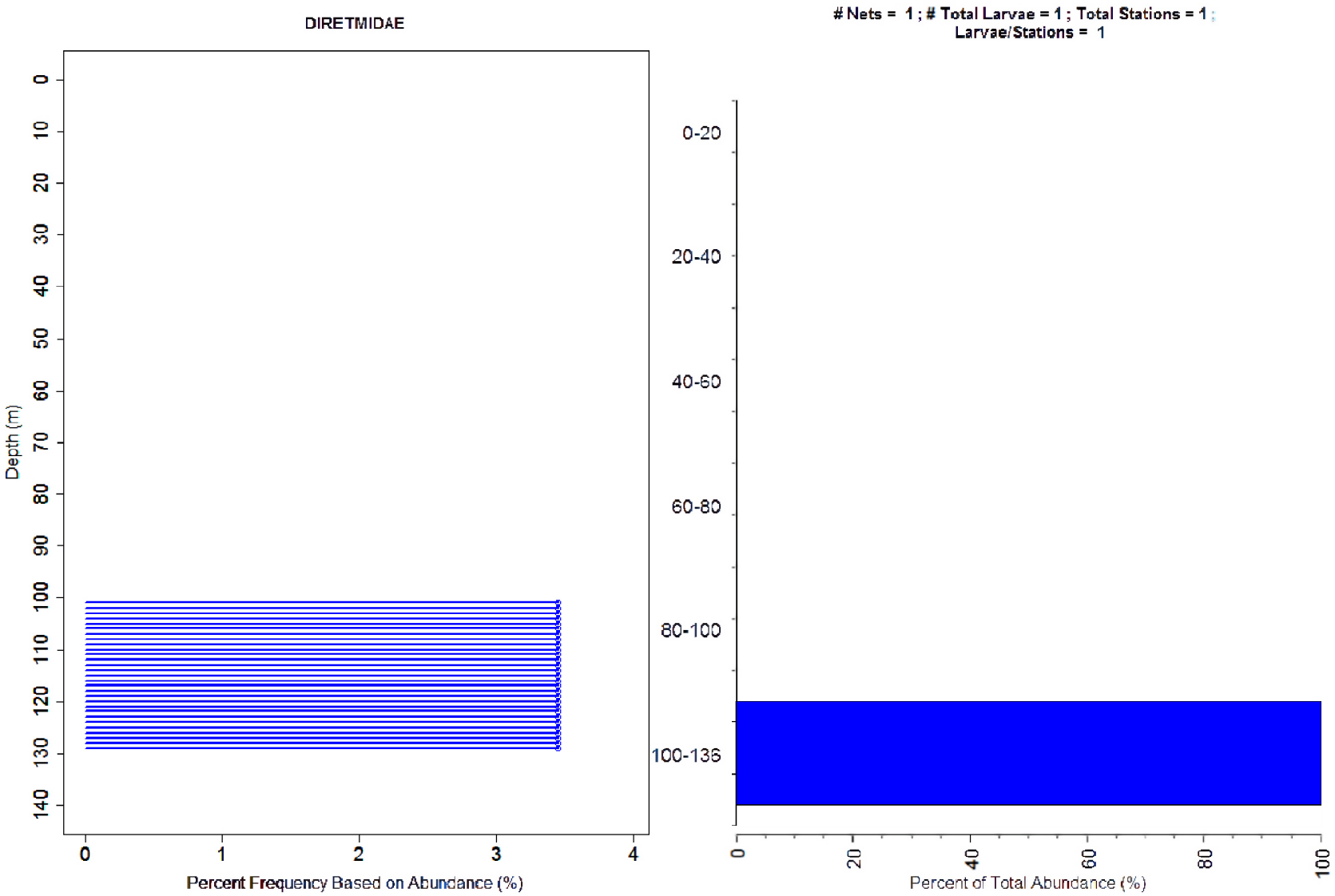
DACTYLOPTERIDAE



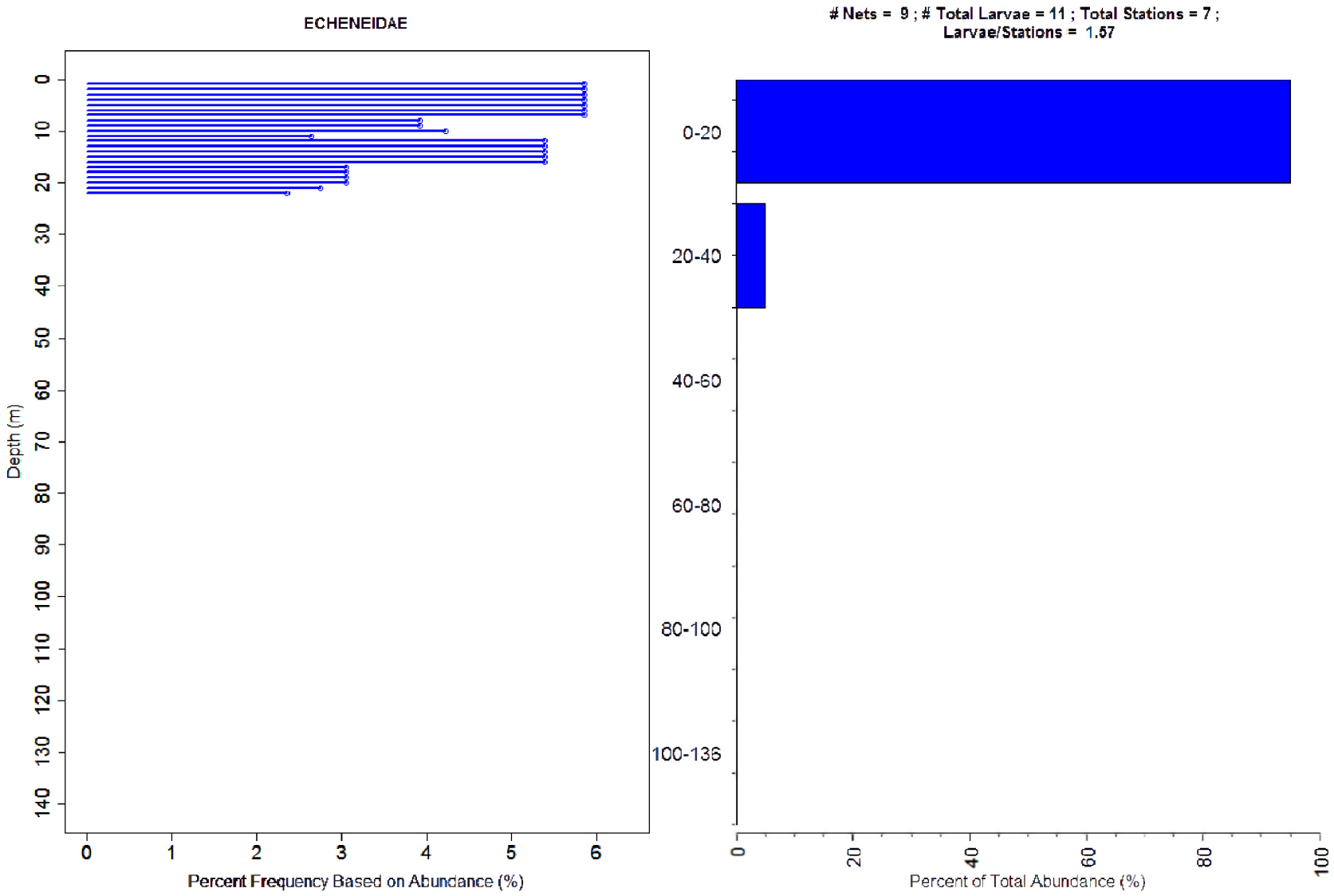
DERICHTHYIDAE



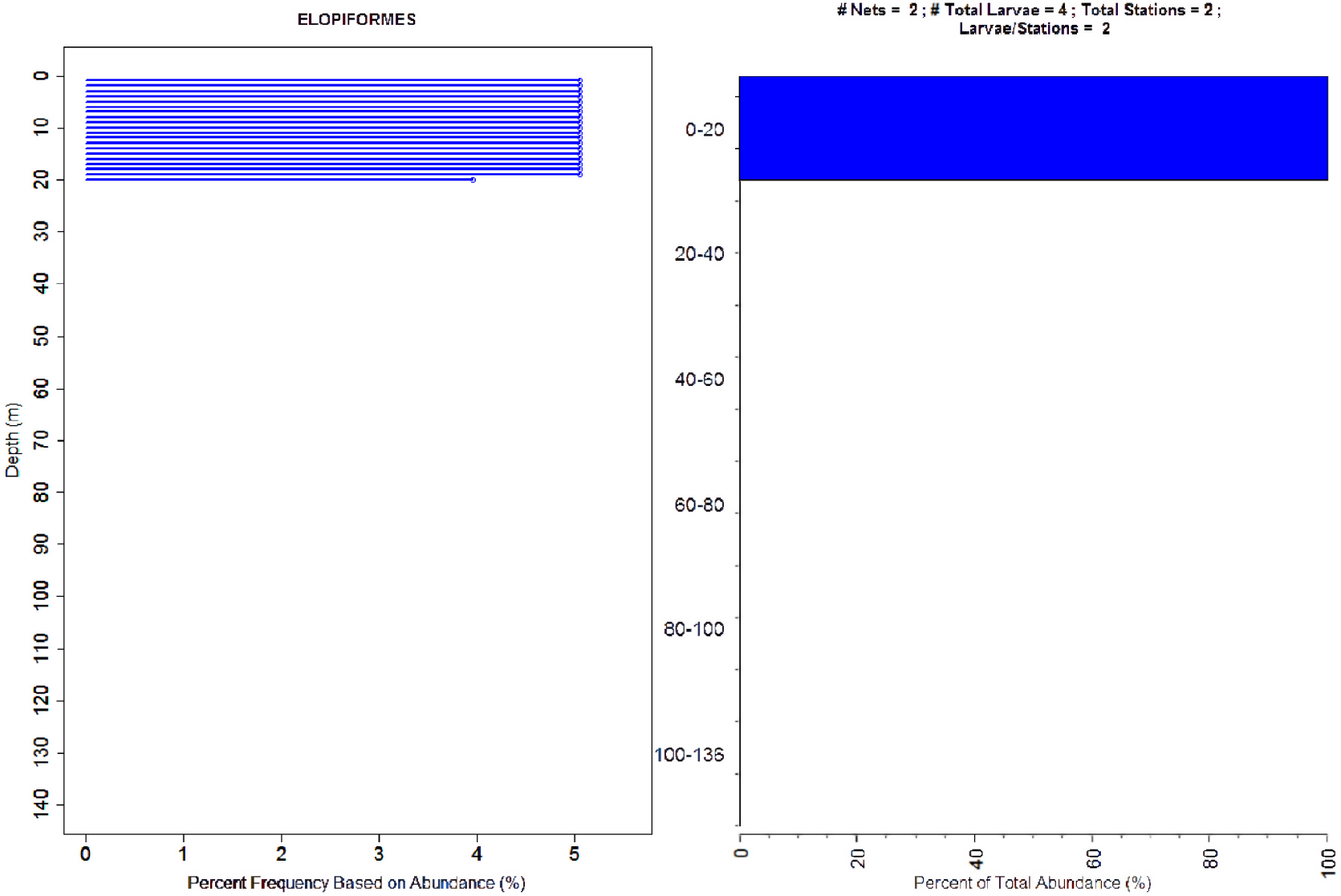
DIODONTIDAE


DIRETMIDAE
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

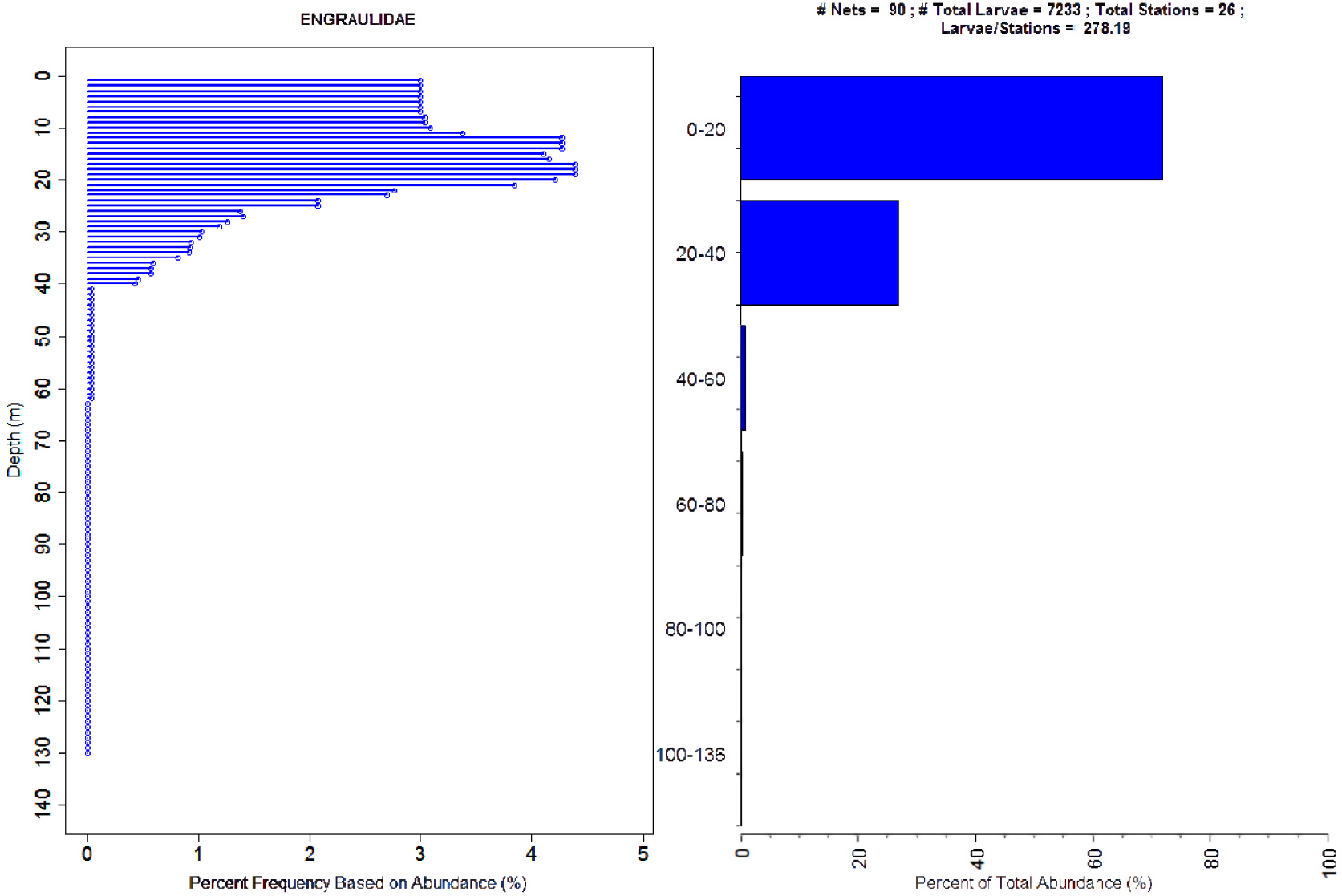
DIRETMIDAE


ECHENEIDAE
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
6
Percent Frequency Based on Abundance (%)
Nets = 9 ; # Total Larvae = 11 ; Total Stations = 7 ;
Larvae/Stations = 1.57
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

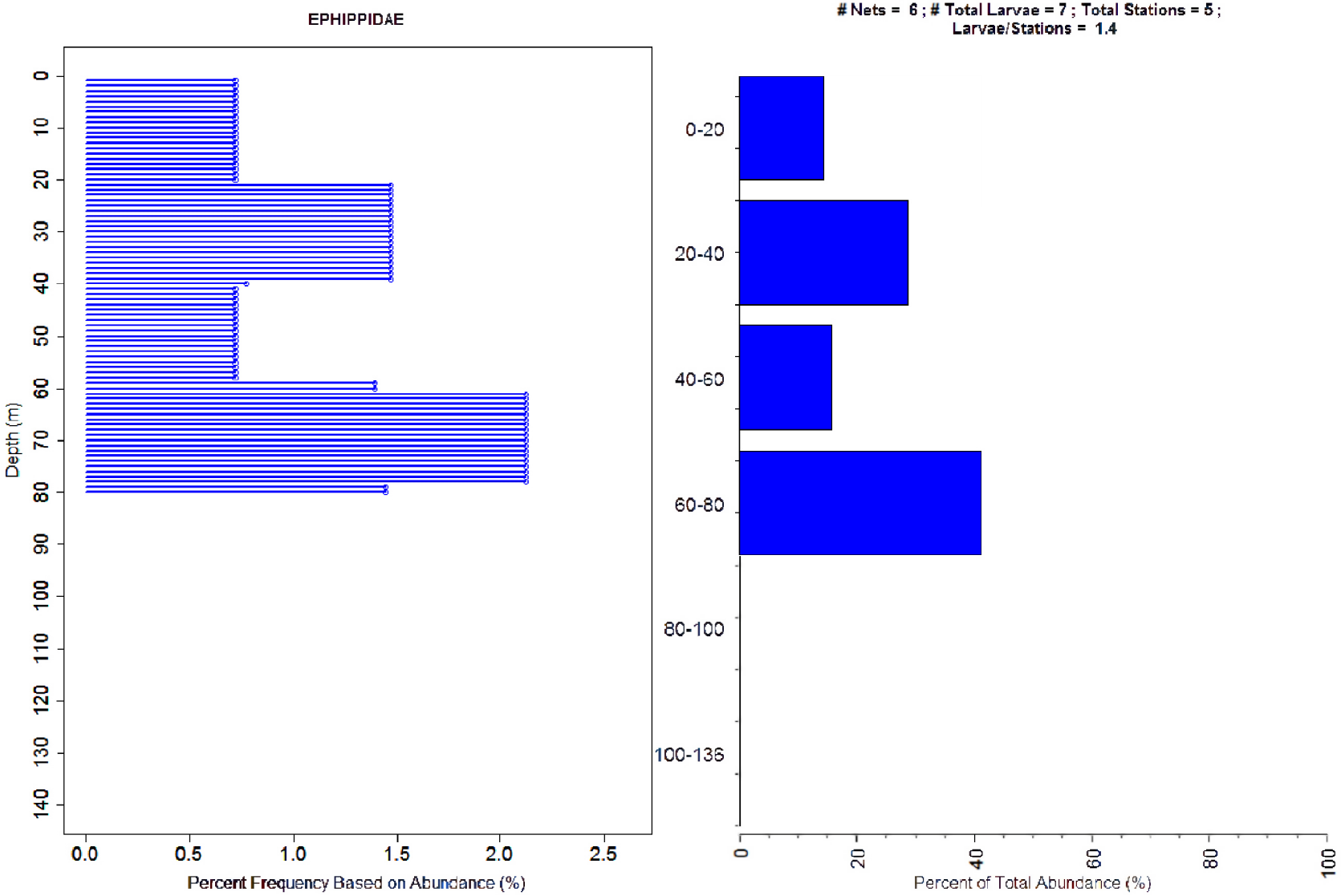
ECHENEIDAE



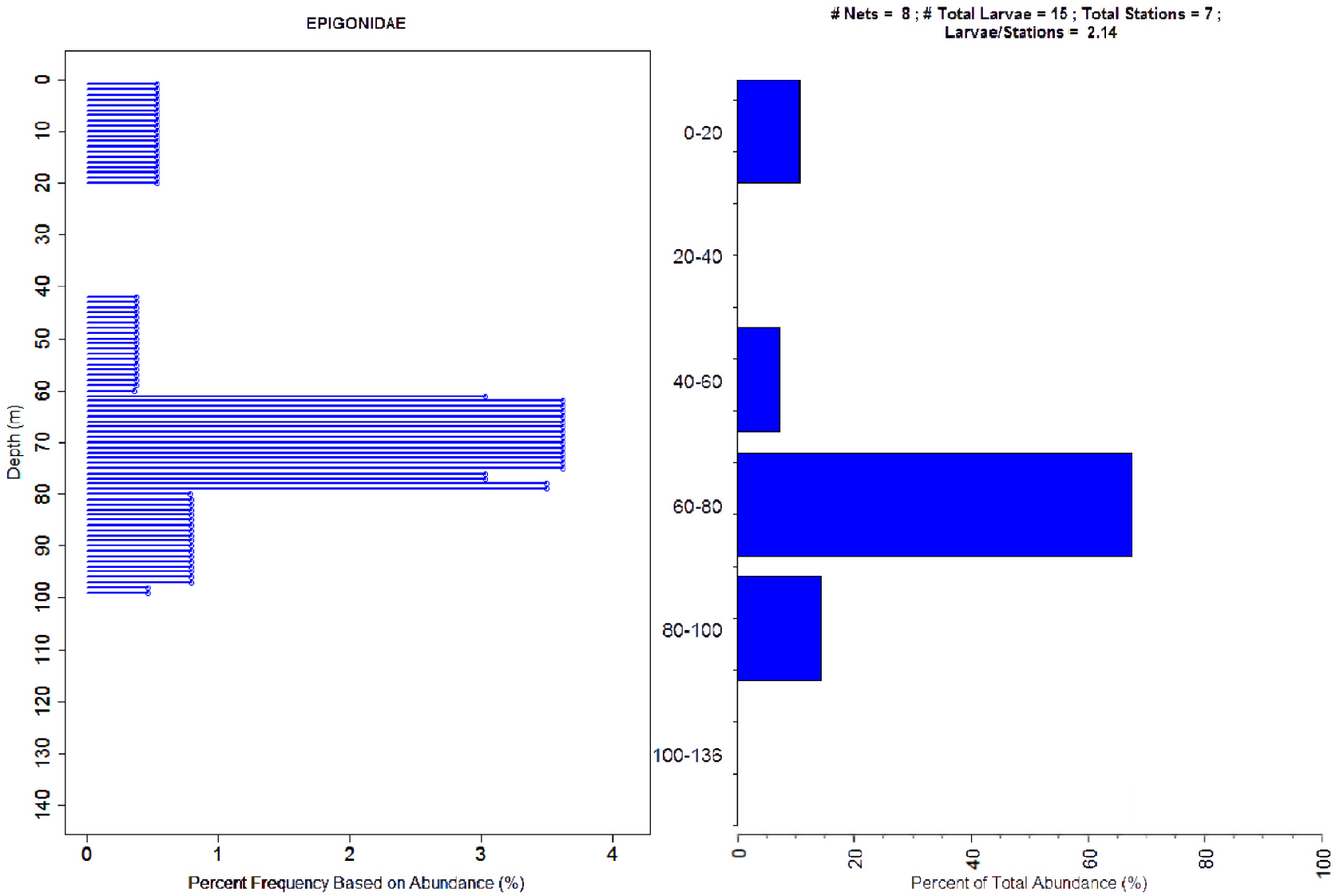
ELOPIFORMES



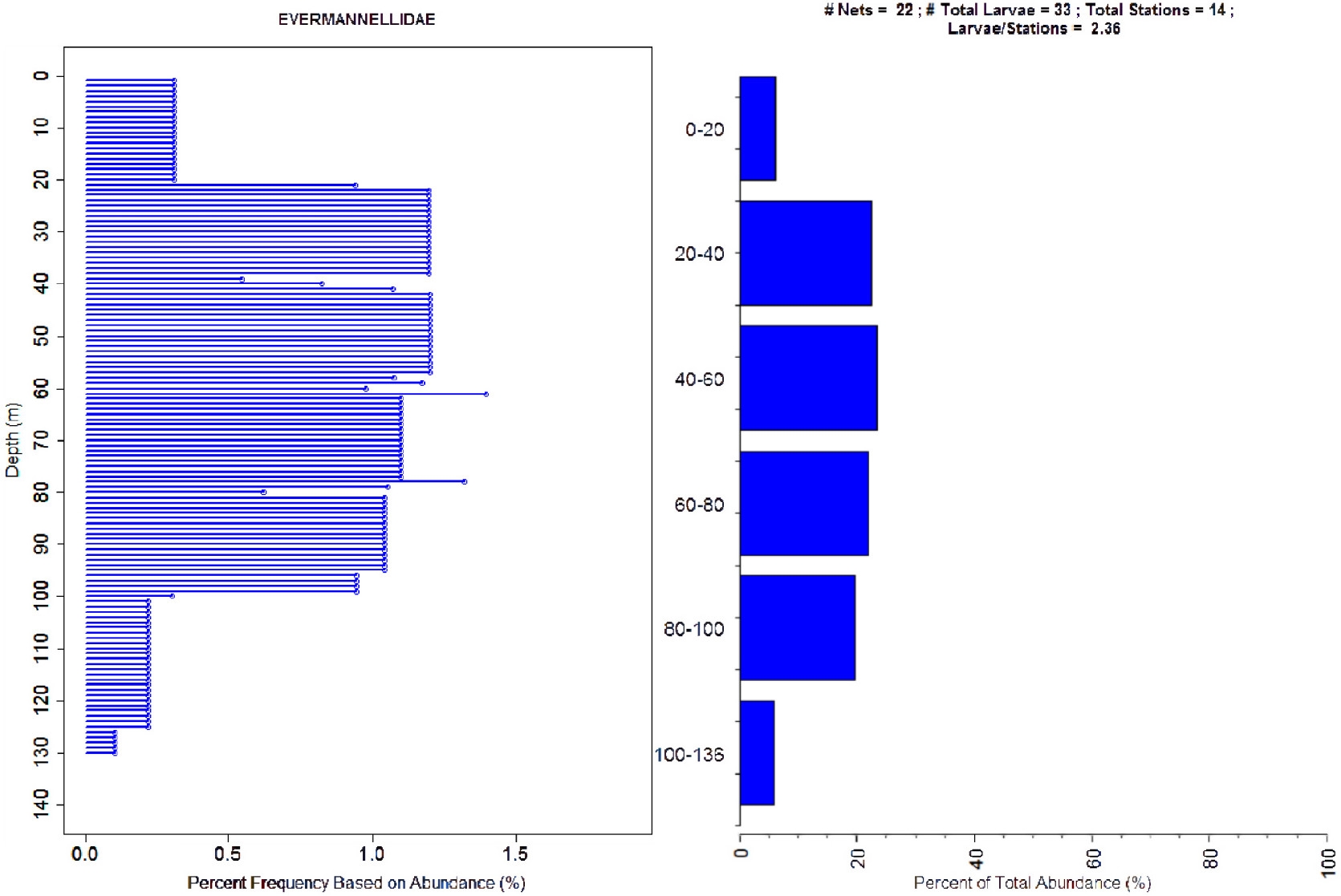
ENGRAULIDAE


EPHIPPIDAE
Nets = 6 ; # Total Larvae = 7 ; Total Stations = 5 ;
Larvae/Stations = 1.4
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

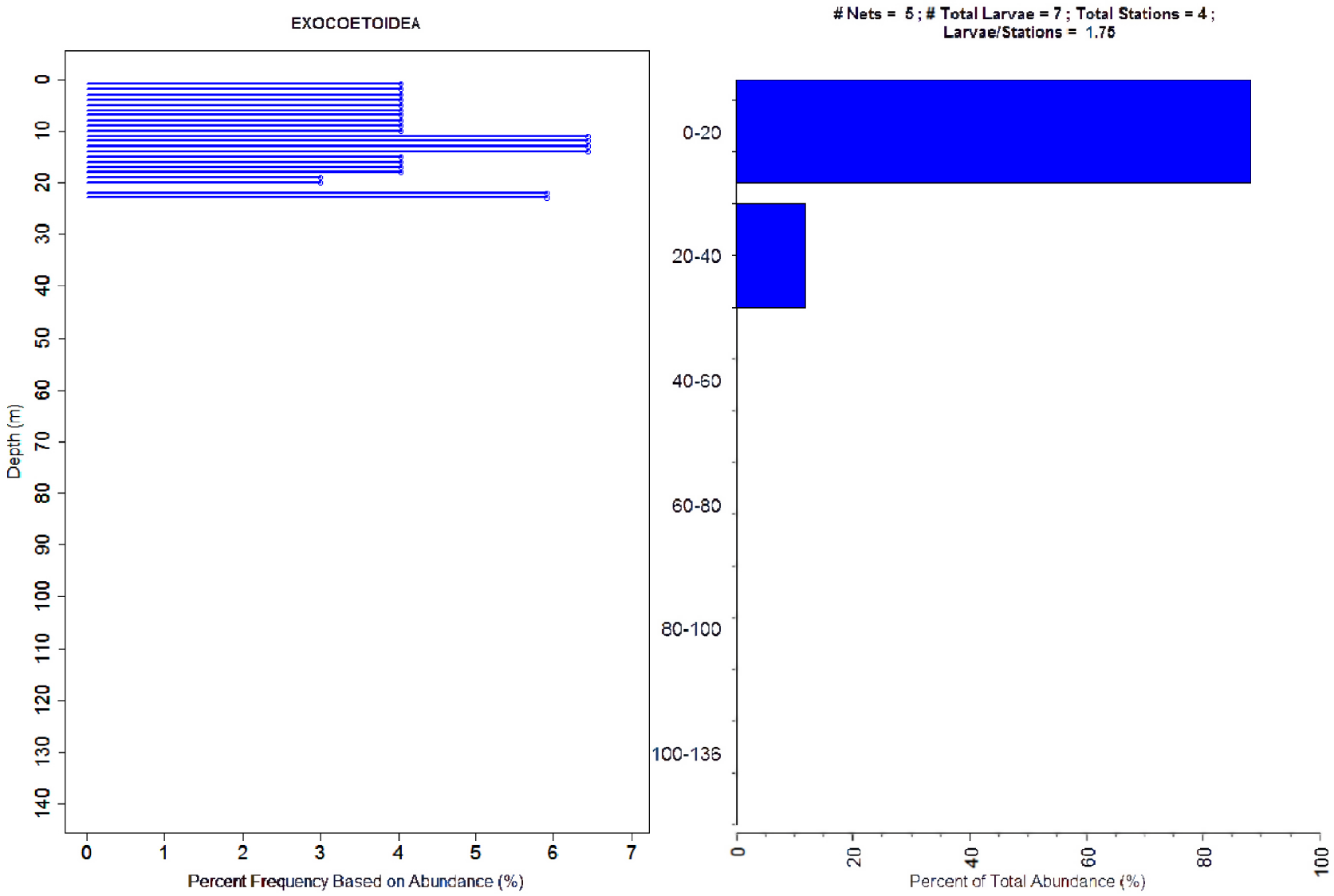
EPHIPPIDAE


EPIGONIDAE
Nets = 8 ; # Total Larvae = 15 ; Total Stations = 7 ;
Larvae/Stations = 2.14
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

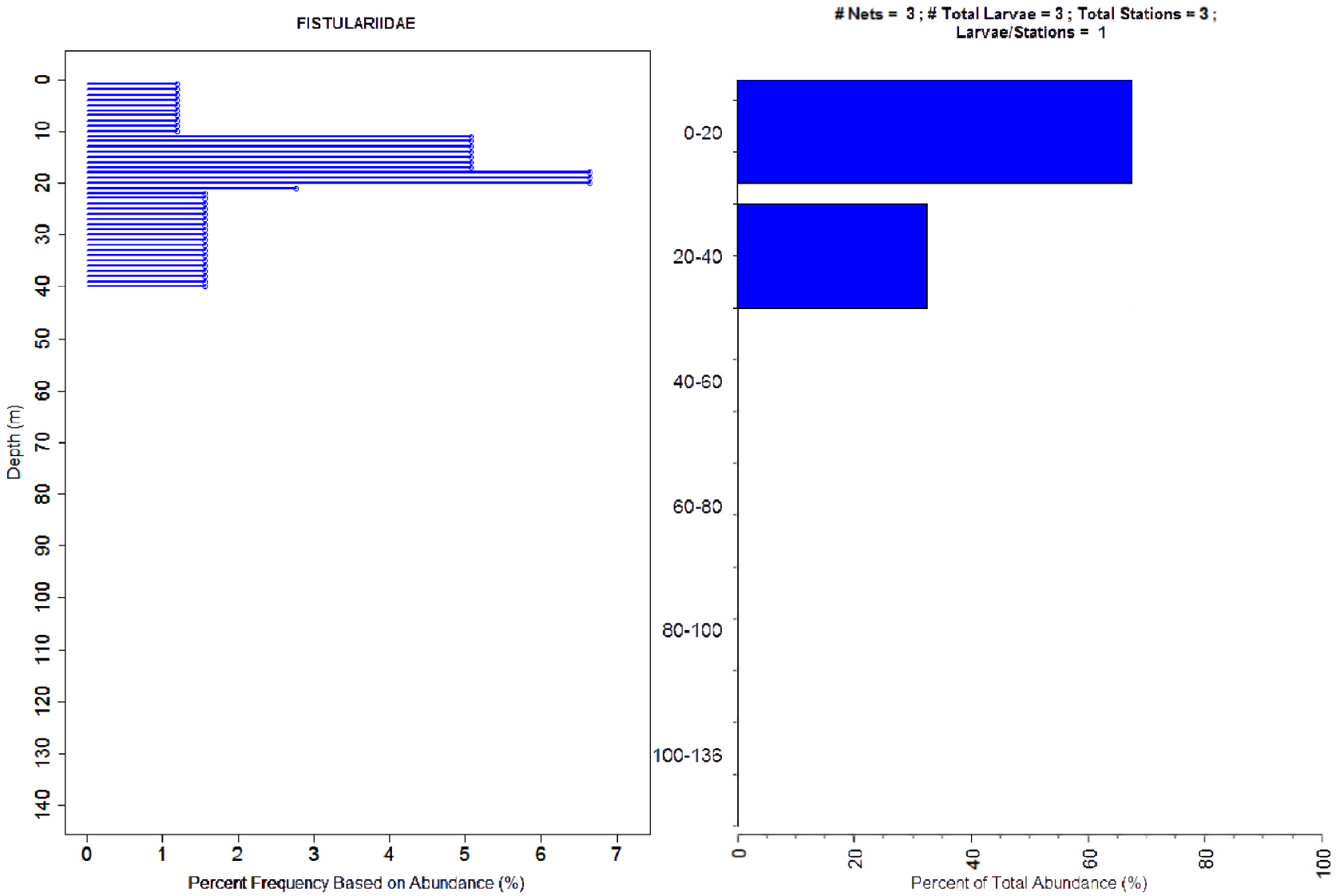
EPIGONIDAE



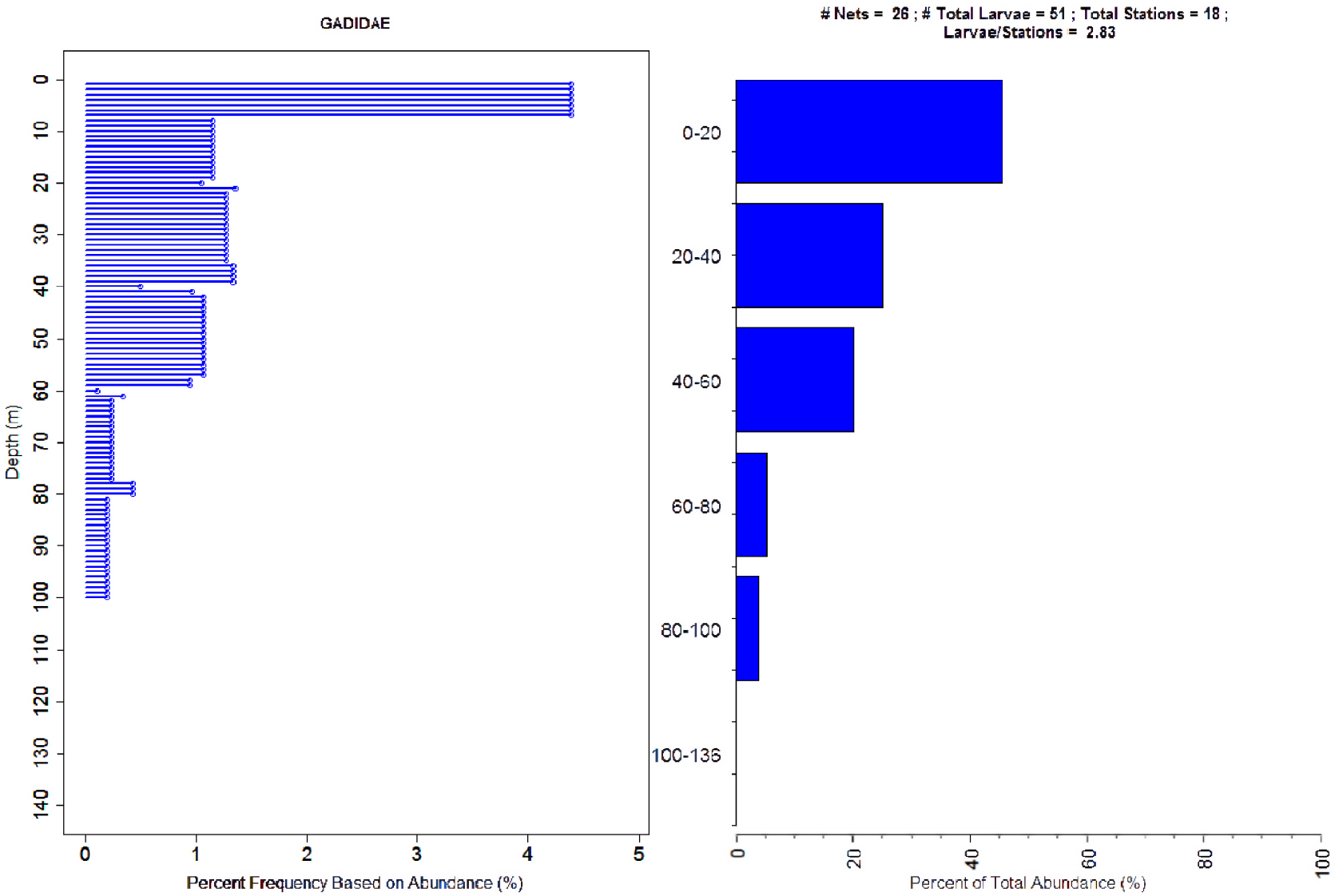
EVERMANNELLIDAE



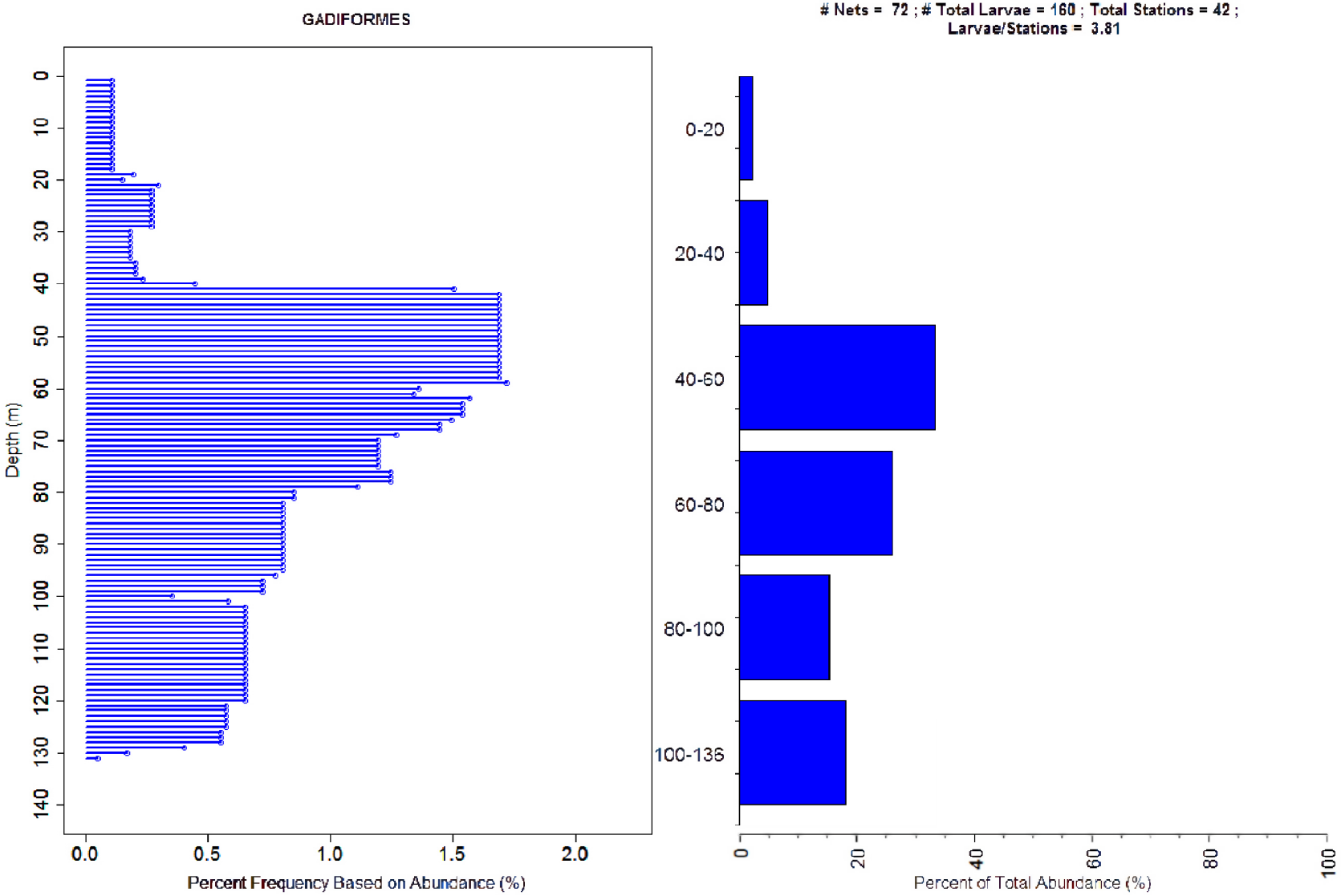
EXOCOETOIDEA



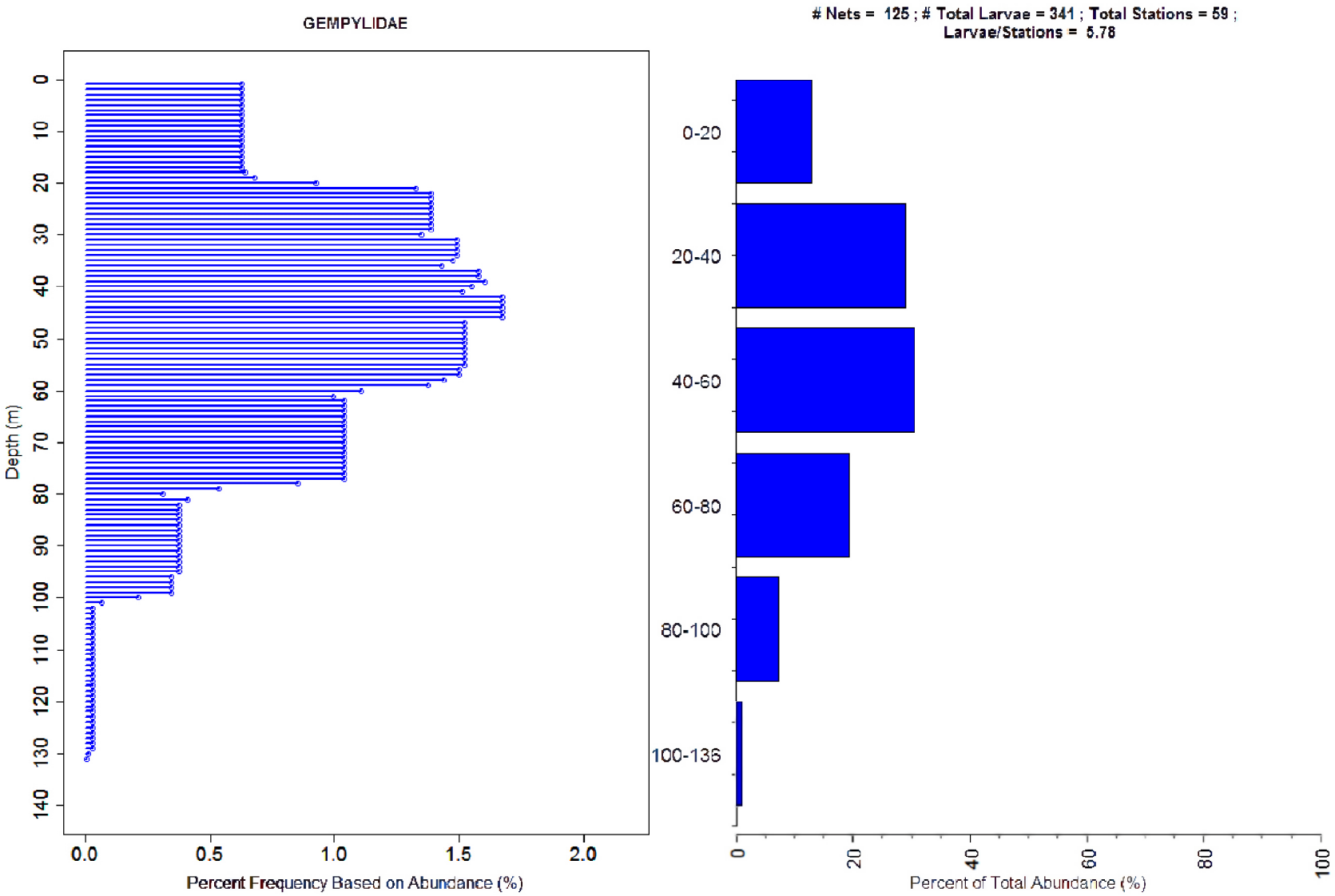
FISTULARIIDAE


GADIDAE
Nets = 26 ; # Total Larvae = 51 ; Total Stations = 18 ;
Larvae/Stations = 2.83
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

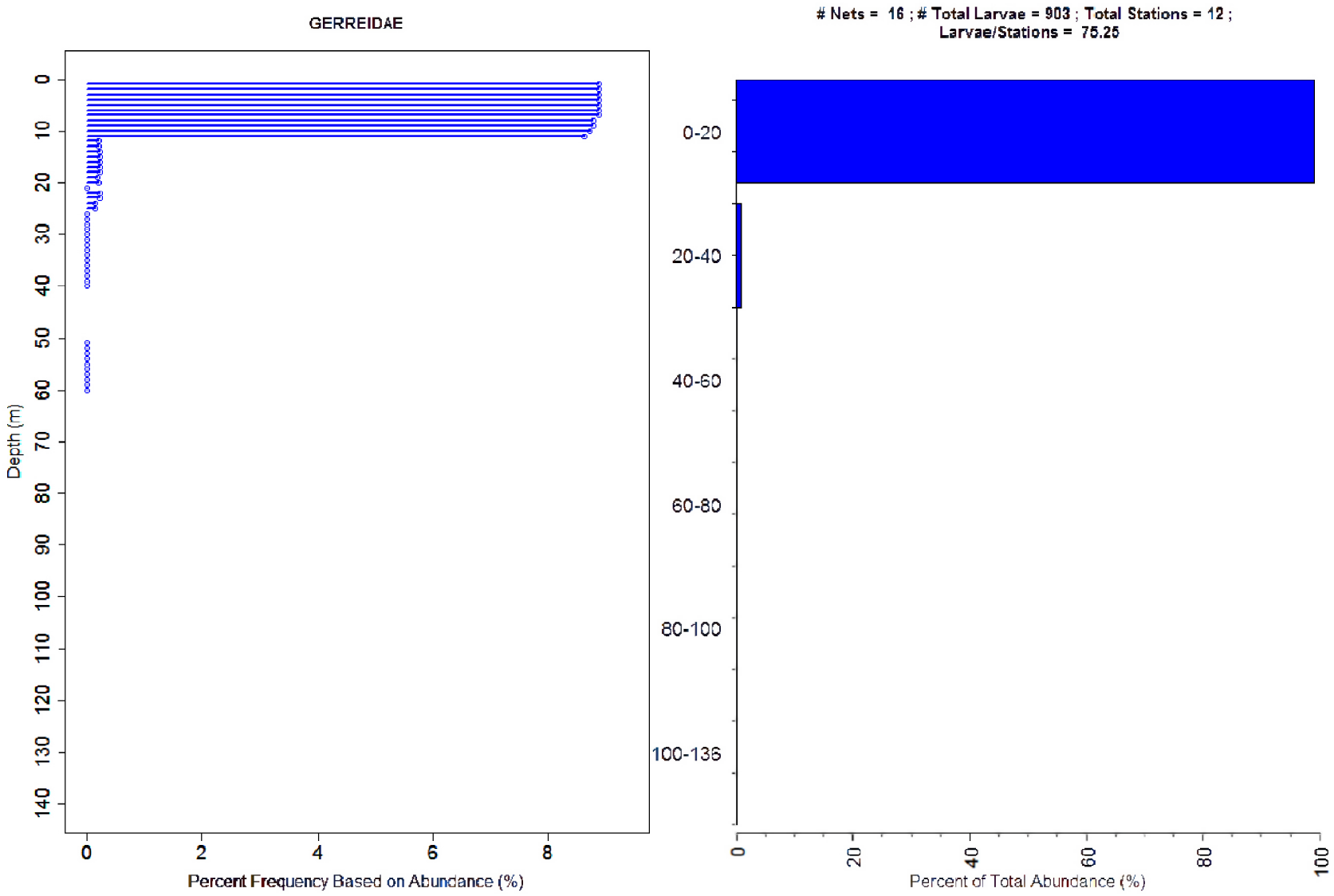
GADIDAE


GADIFORMES
Nets = 72 ; # Total Larvae = 160 ; Total Stations = 42 ;
Larvae/Stations = 3.81
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

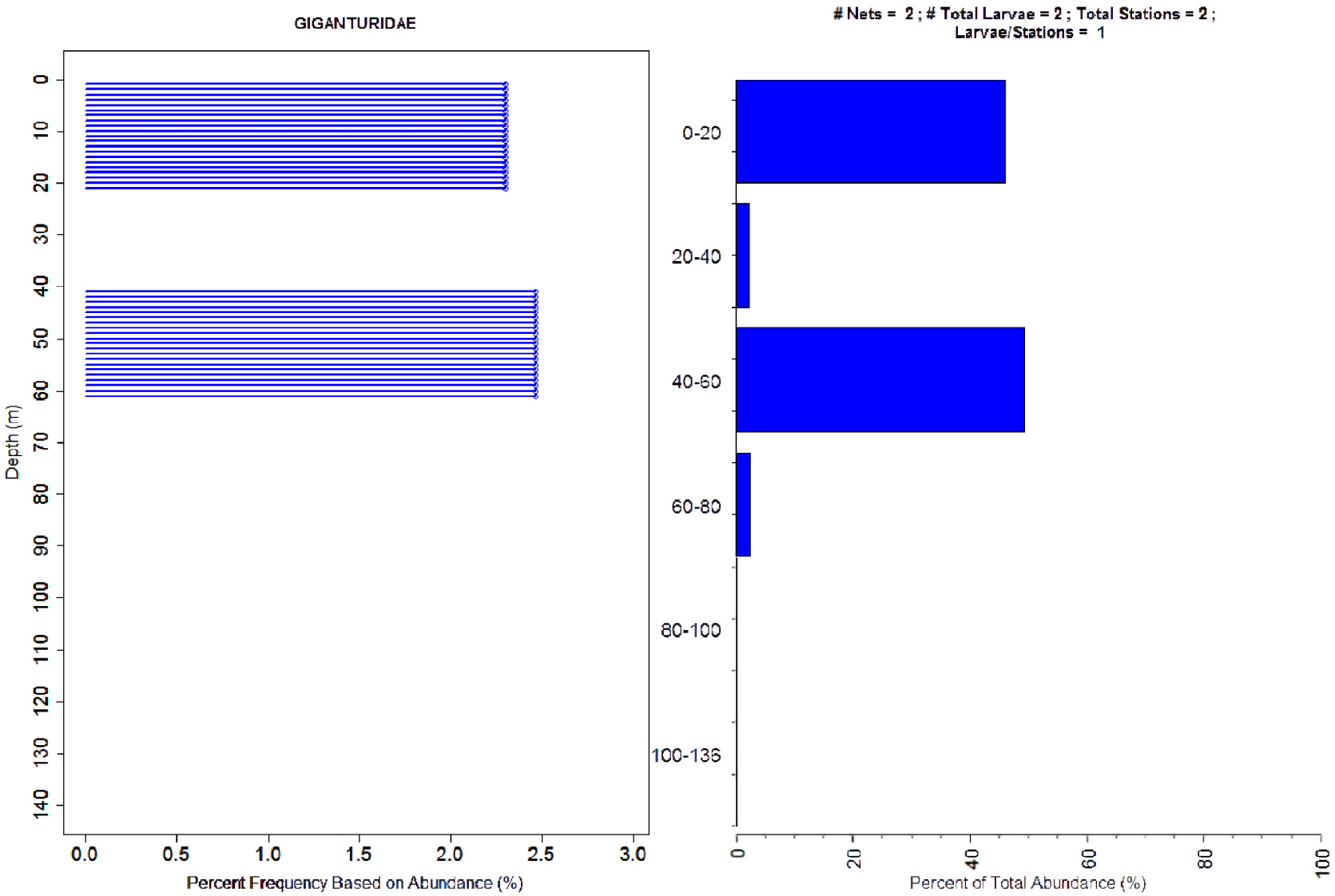
GADIFORMES


GEMPYLIDAE
Nets = 125 ; # Total Larvae = 341 ; Total Stations = 59 ;
Larvae/Stations = 5.78
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

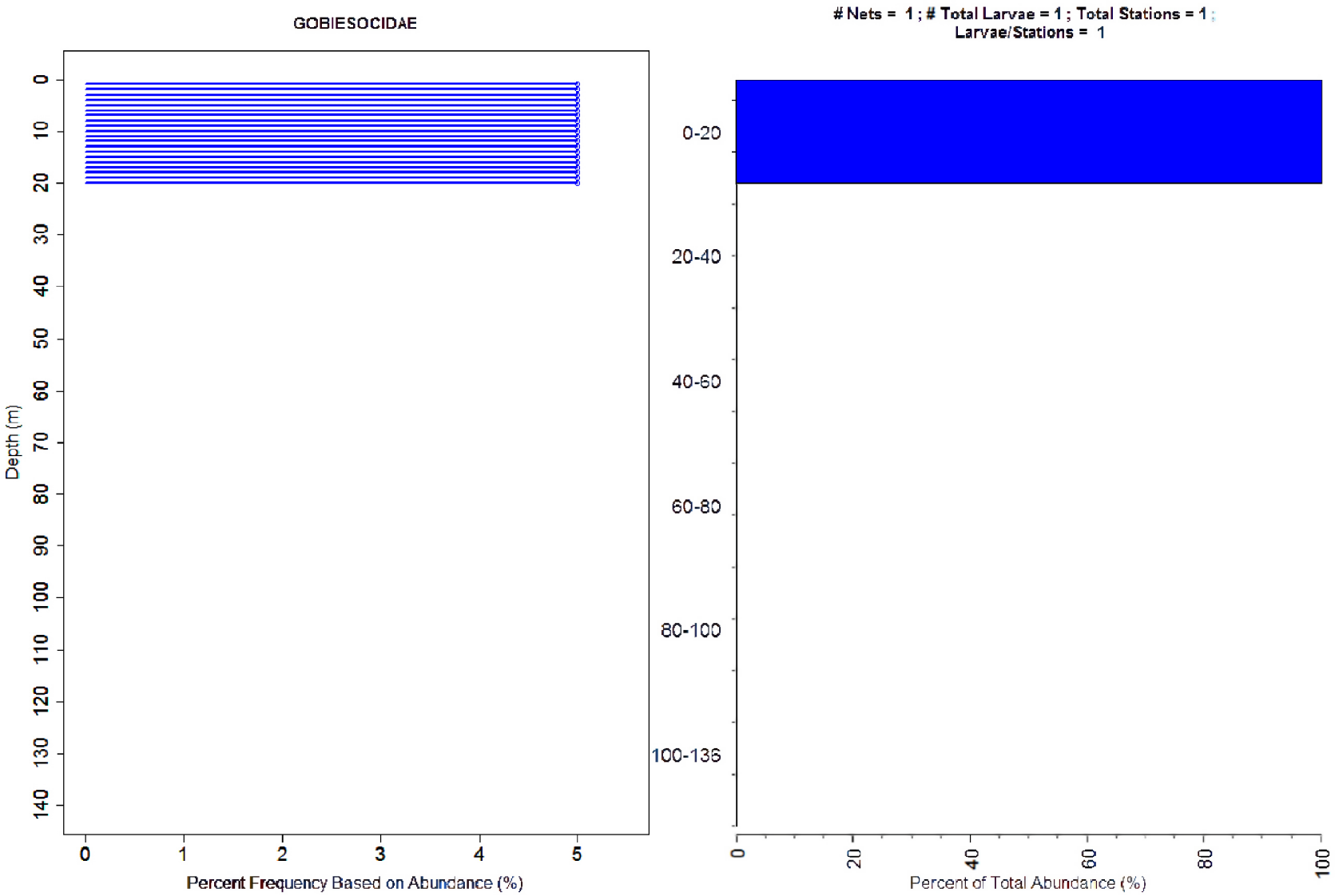
GEMPYLIDAE


GERREIDAE
Nets = 16 ; # Total Larvae = 903 ; Total Stations = 12 ;
Larvae/Stations = 75.25
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
2
4
6
8
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

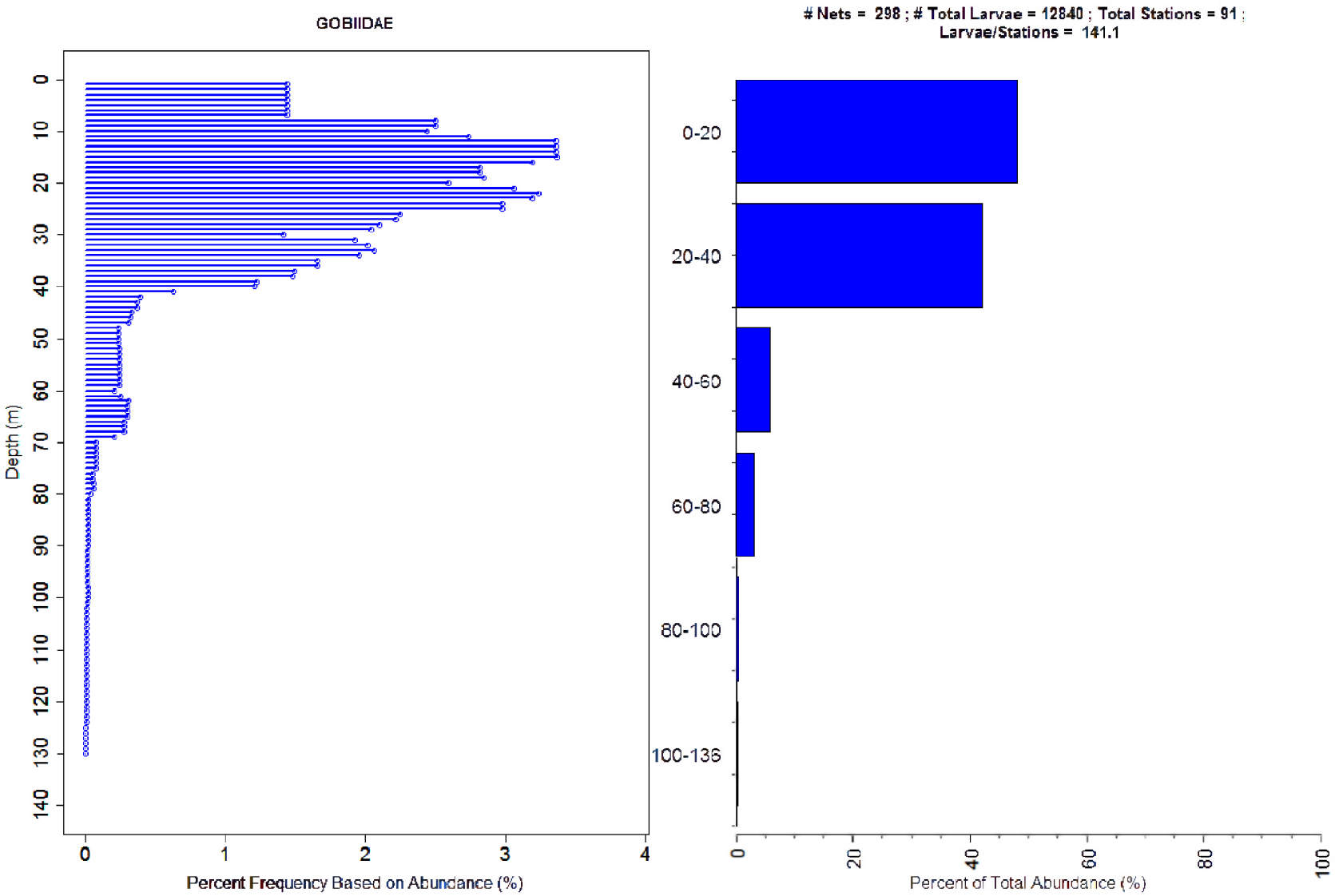
GERREIDAE



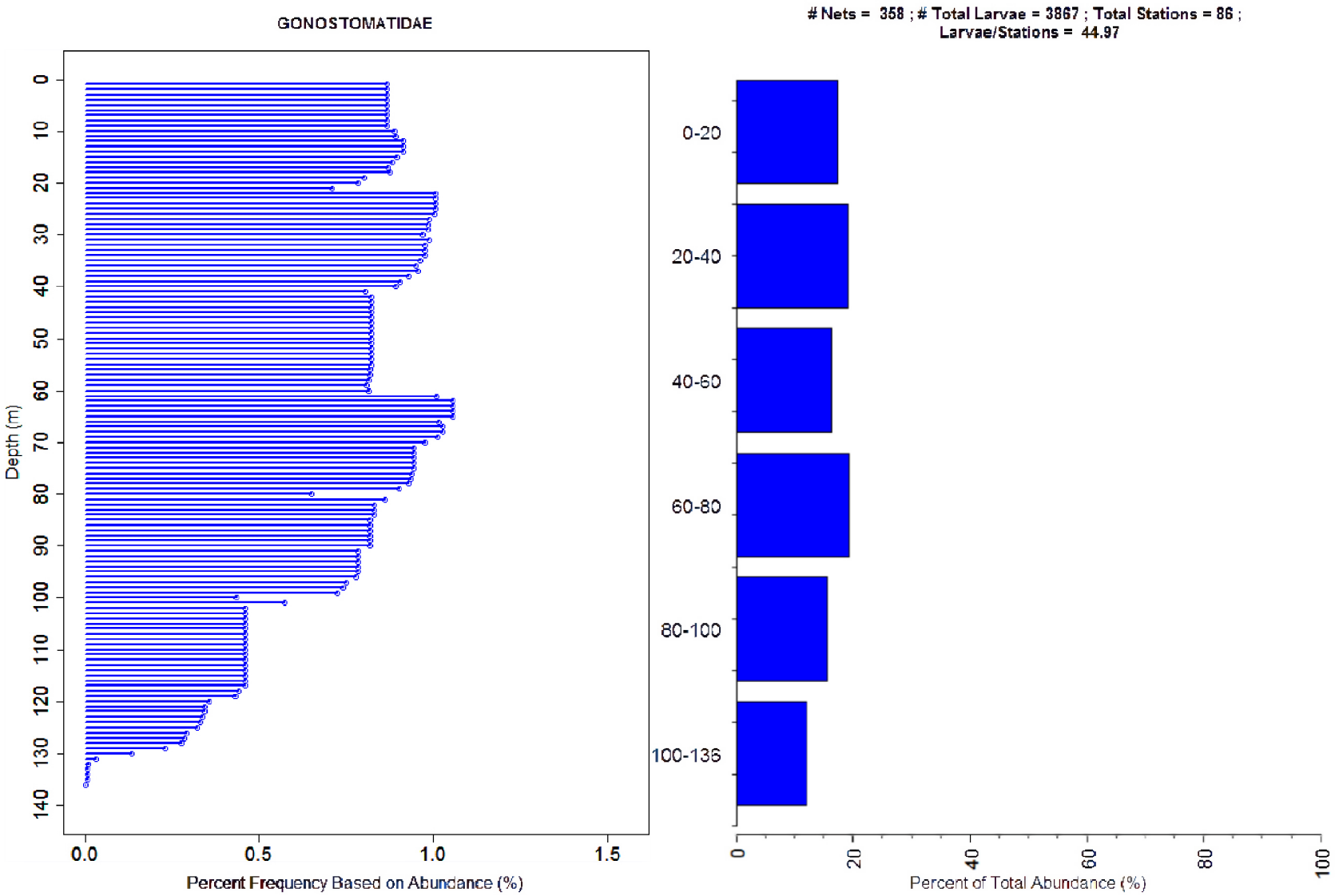
GIGANTURIDAE



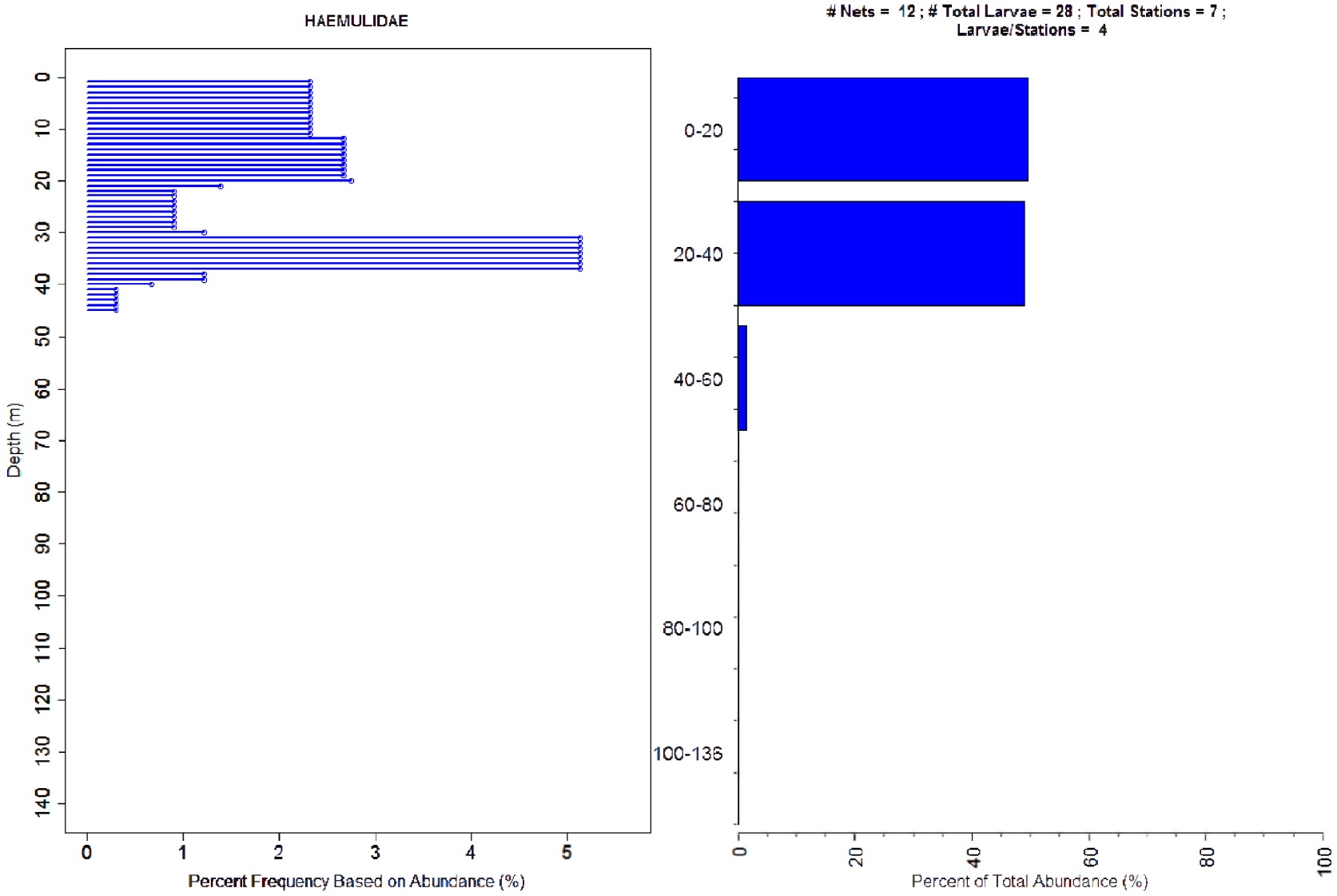
GOBIESOCIDAE


GOBIIDAE
Nets = 298 ; # Total Larvae = 12840 ; Total Stations = 91 ;
Larvae/Stations = 141.1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

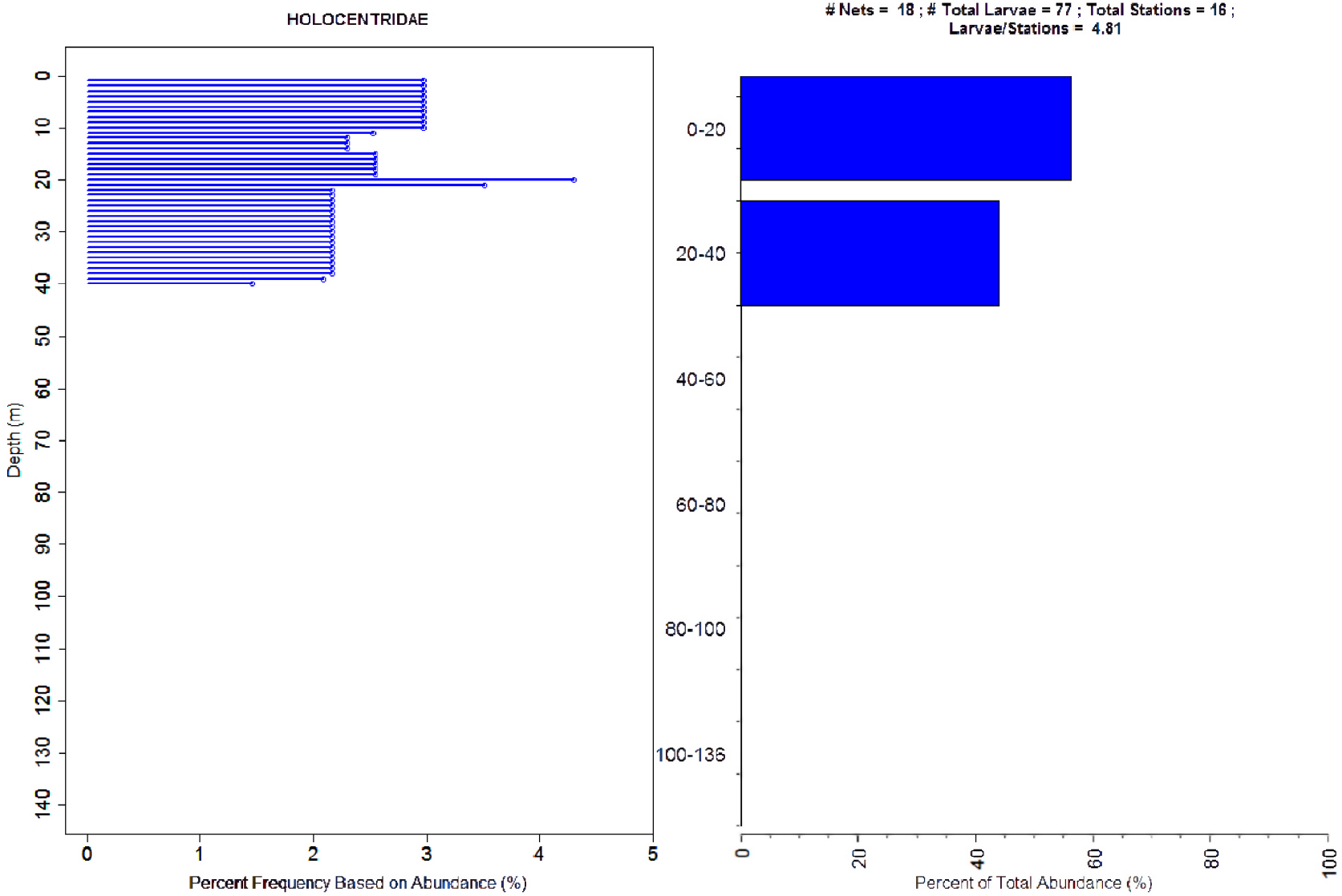
GOBIIDAE



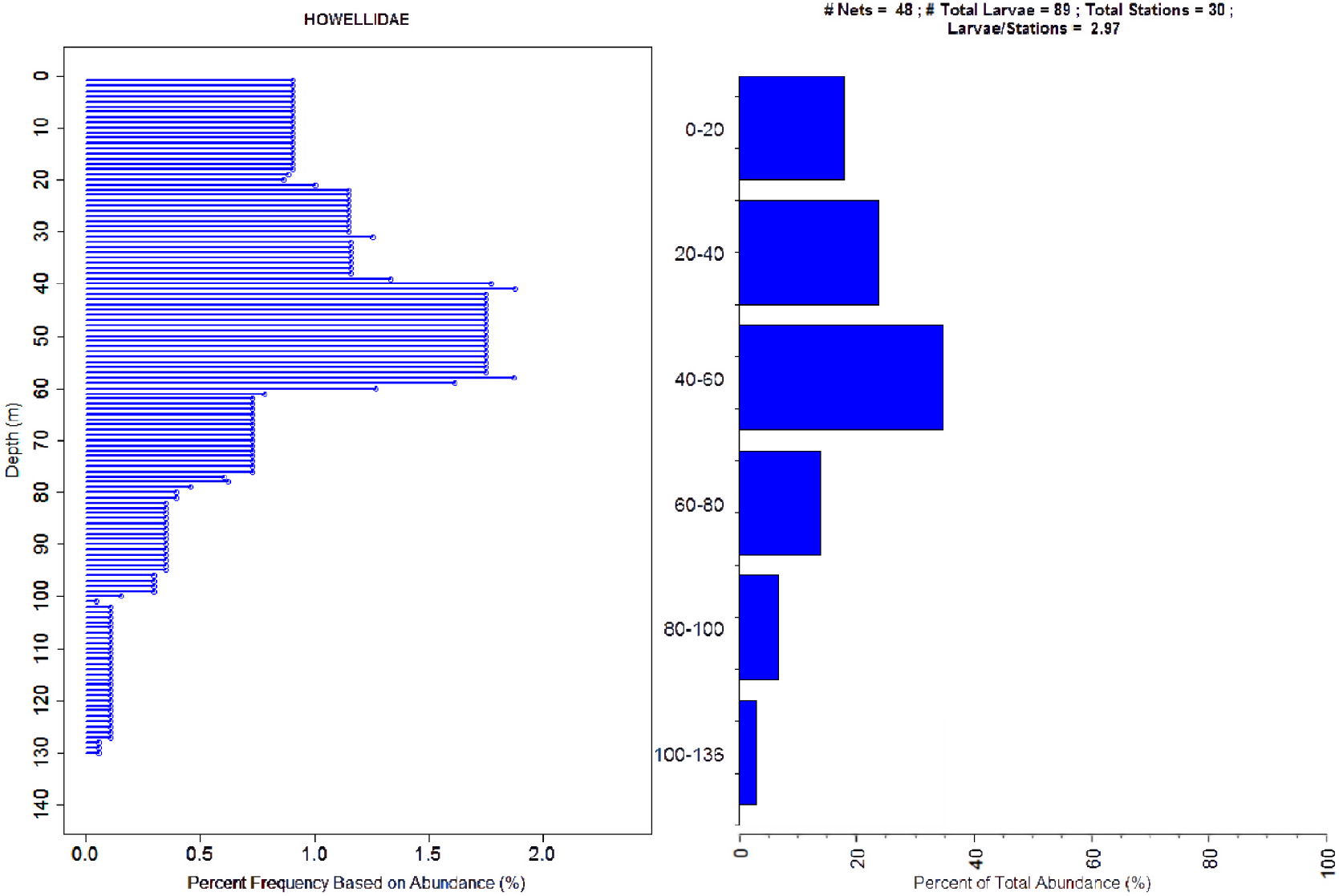
GONOSTOMATIDAE


HAEMULIDAE
Nets = 12 ; # Total Larvae = 28 ; Total Stations = 7 ;
Larvae/Stations = 4
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

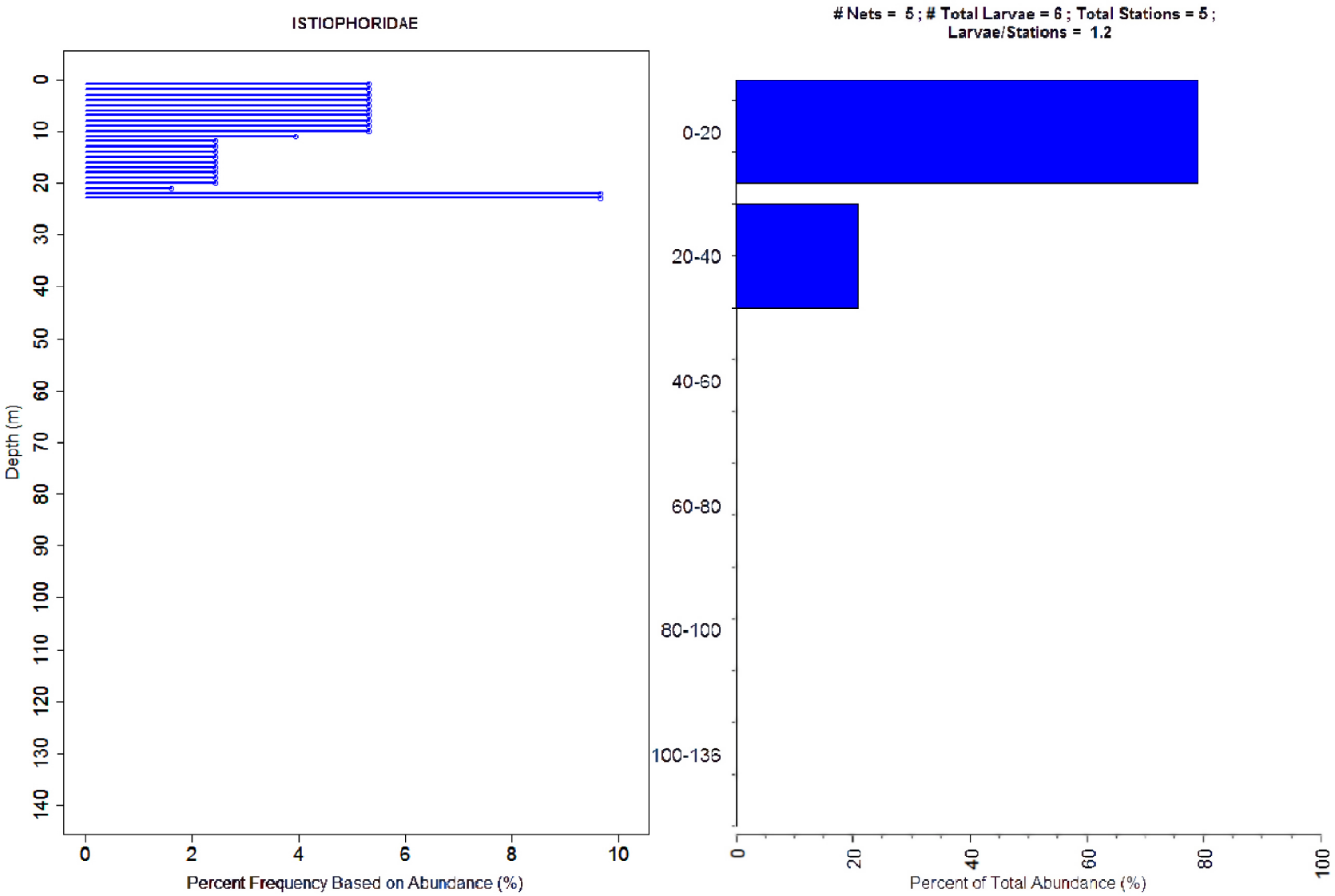
HAEMULIDAE



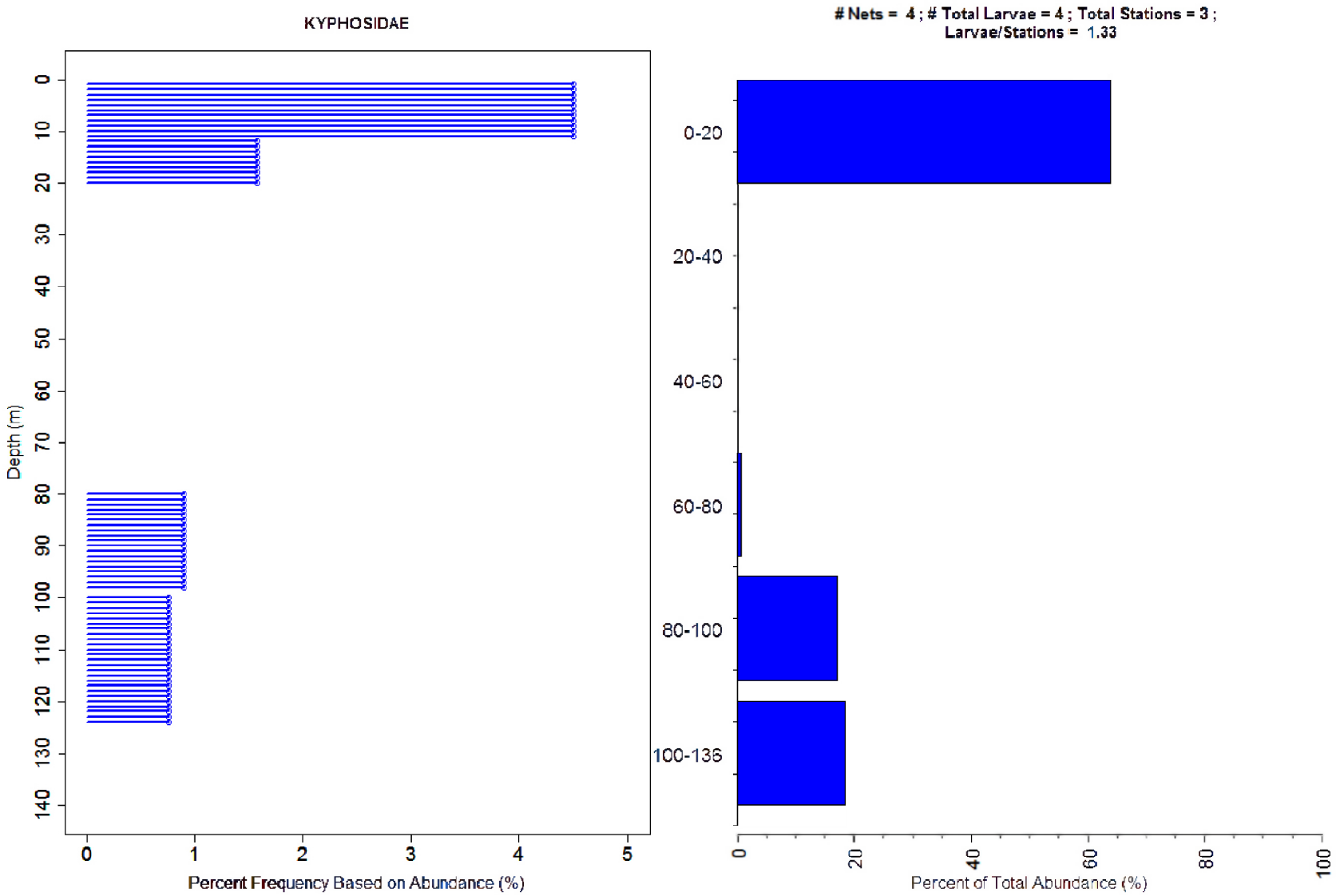
HOLOCENTRIDAE


HOWELLIDAE
Nets = 48 ; # Total Larvae = 89 ; Total Stations = 30 ;
Larvae/Stations = 2.97
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

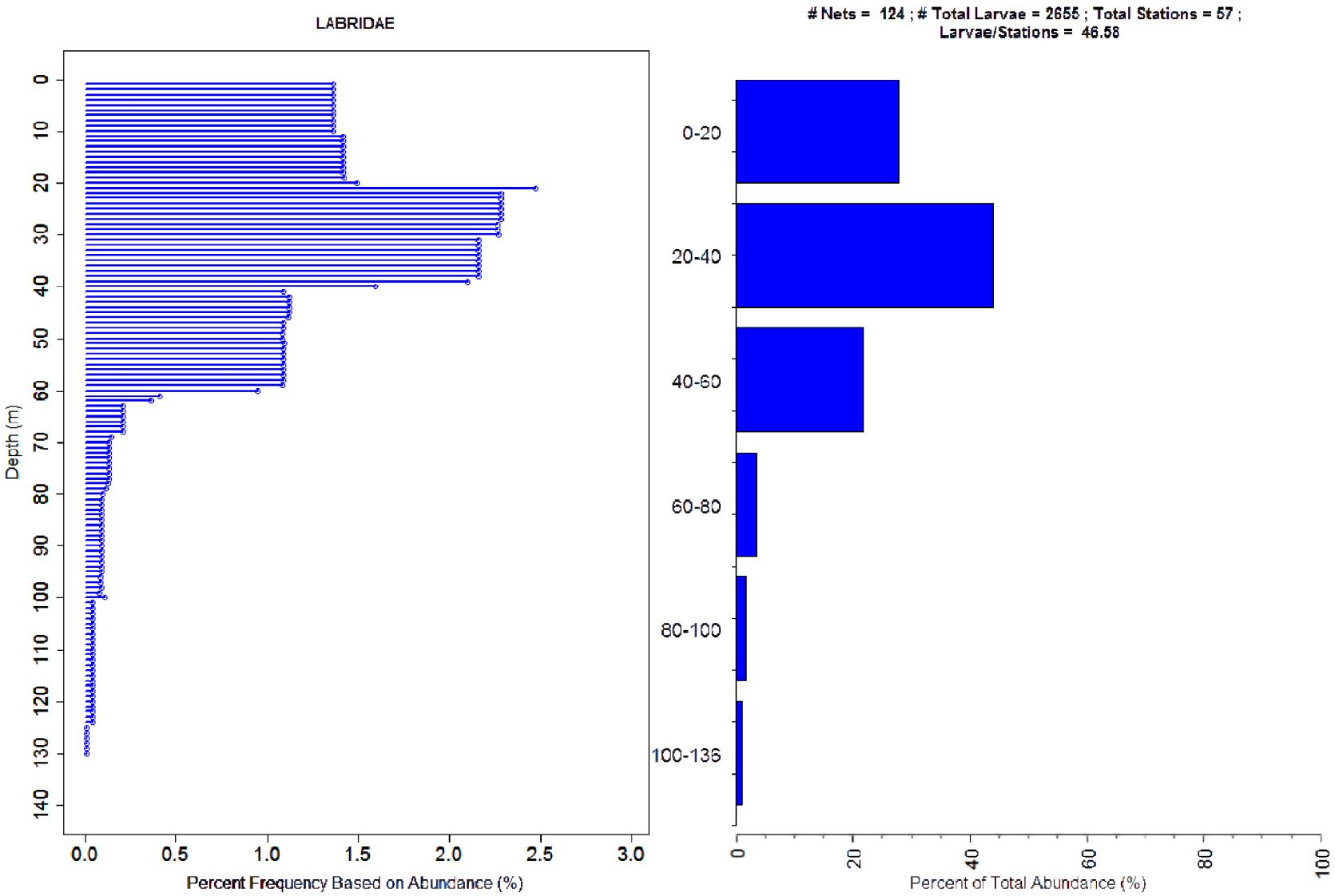
HOWELLIDAE



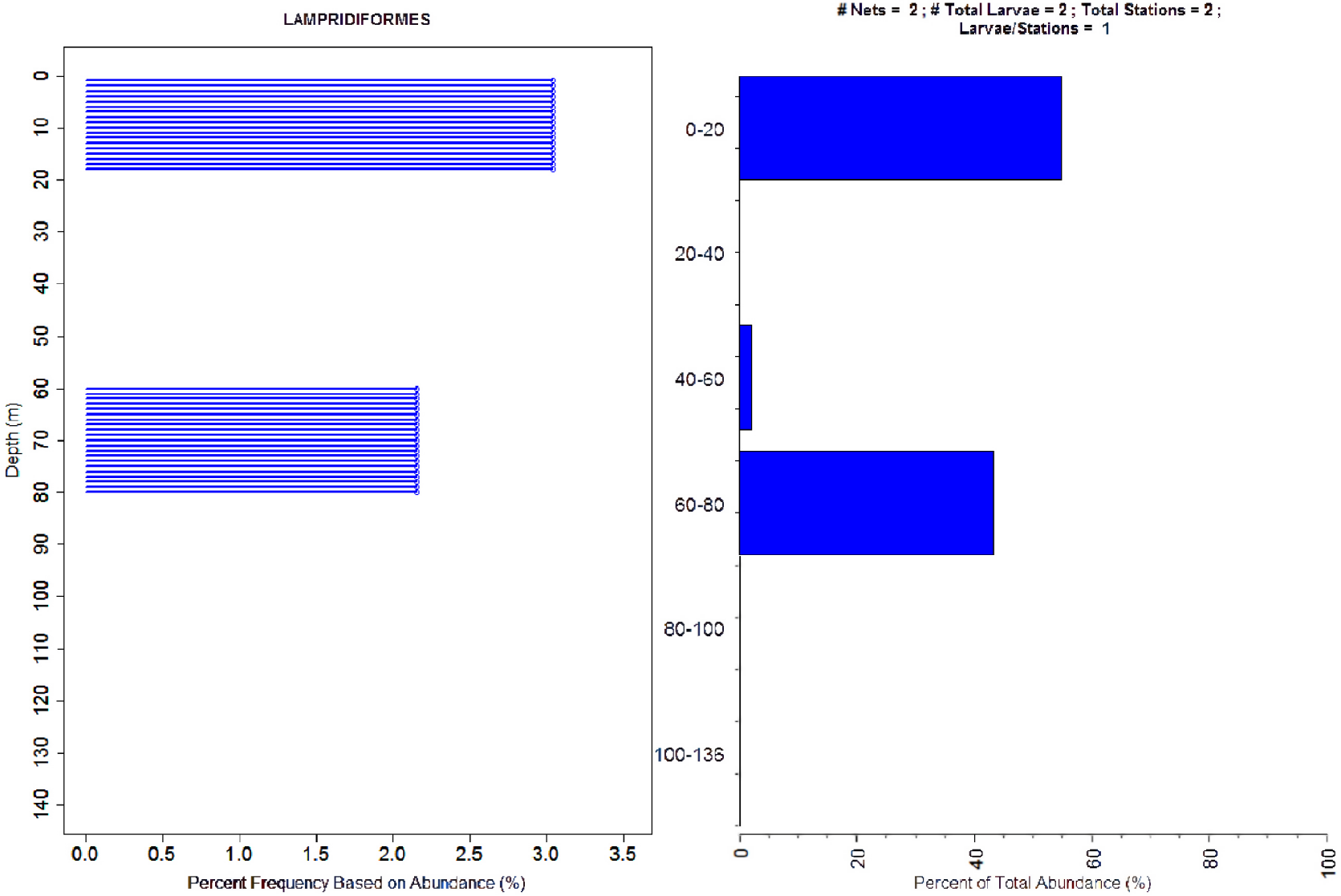
ISTIOPHORIDAE


KYPHOSIDAE
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
Nets = 4 ; # Total Larvae = 4 ; Total Stations = 3 ;
Larvae/Stations = 1.33
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

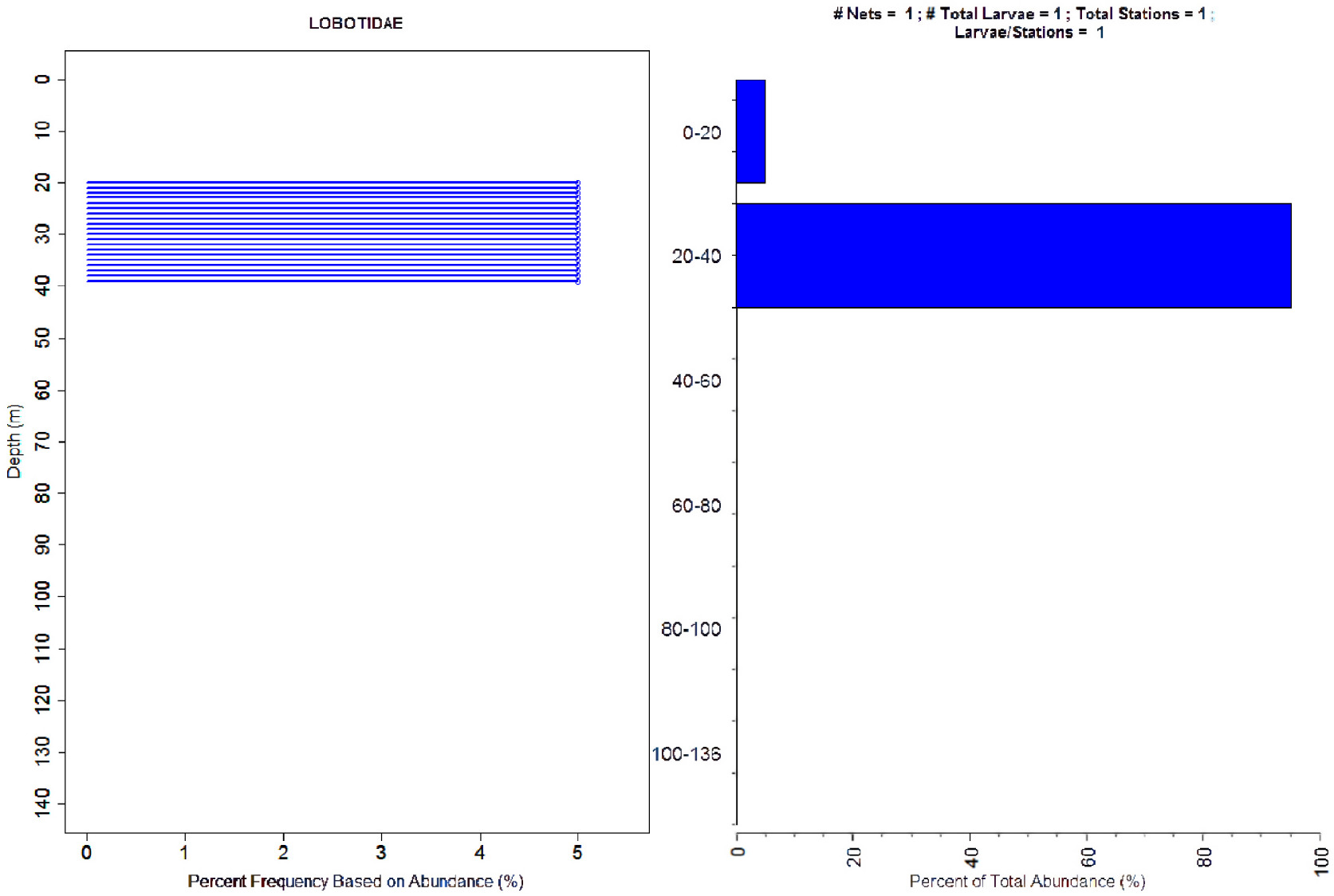
KYPHOSIDAE


LABRIDAE
Nets = 124 ; # Total Larvae = 2655 ; Total Stations = 57 ;
Larvae/Stations = 46.58
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

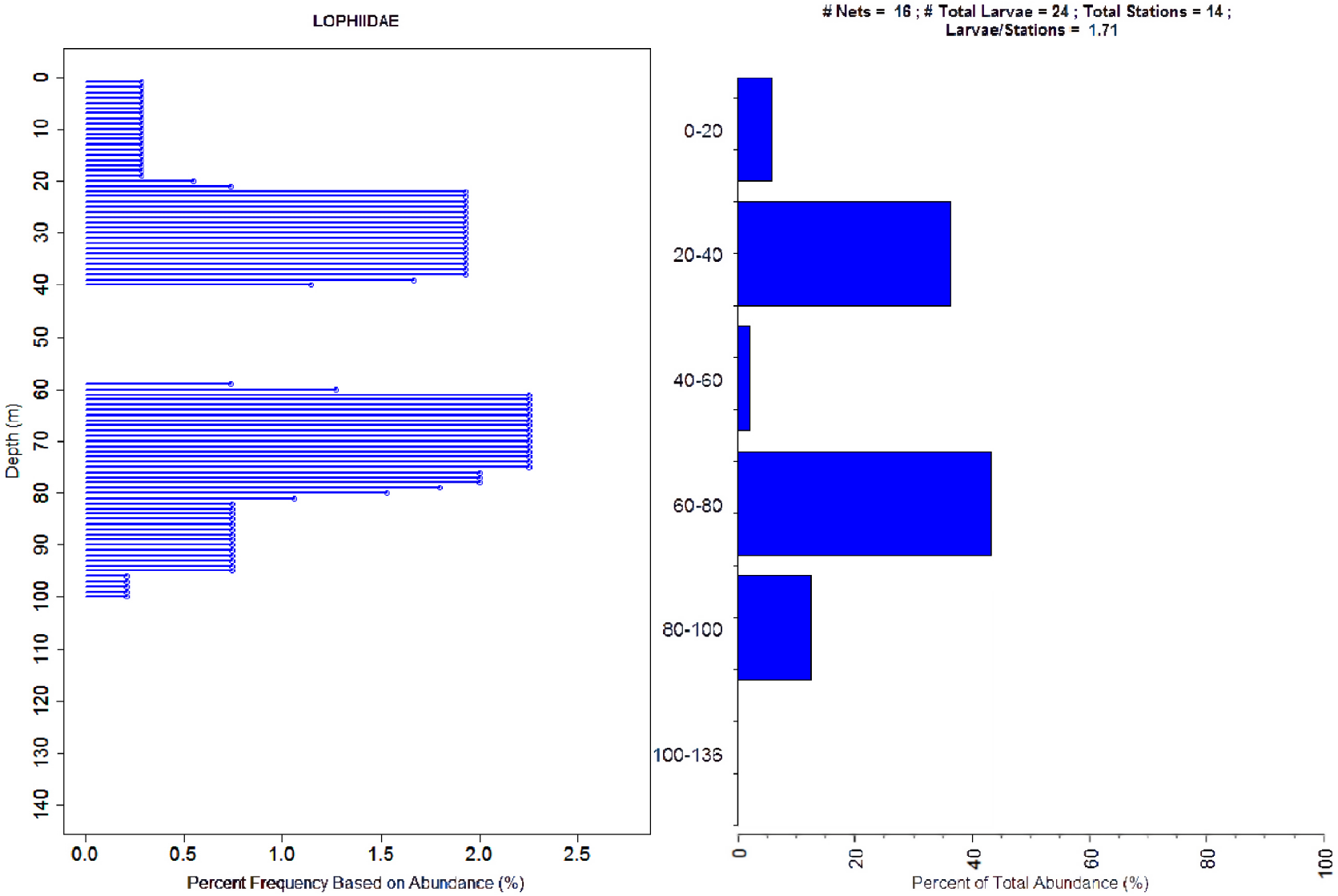
LABRIDAE



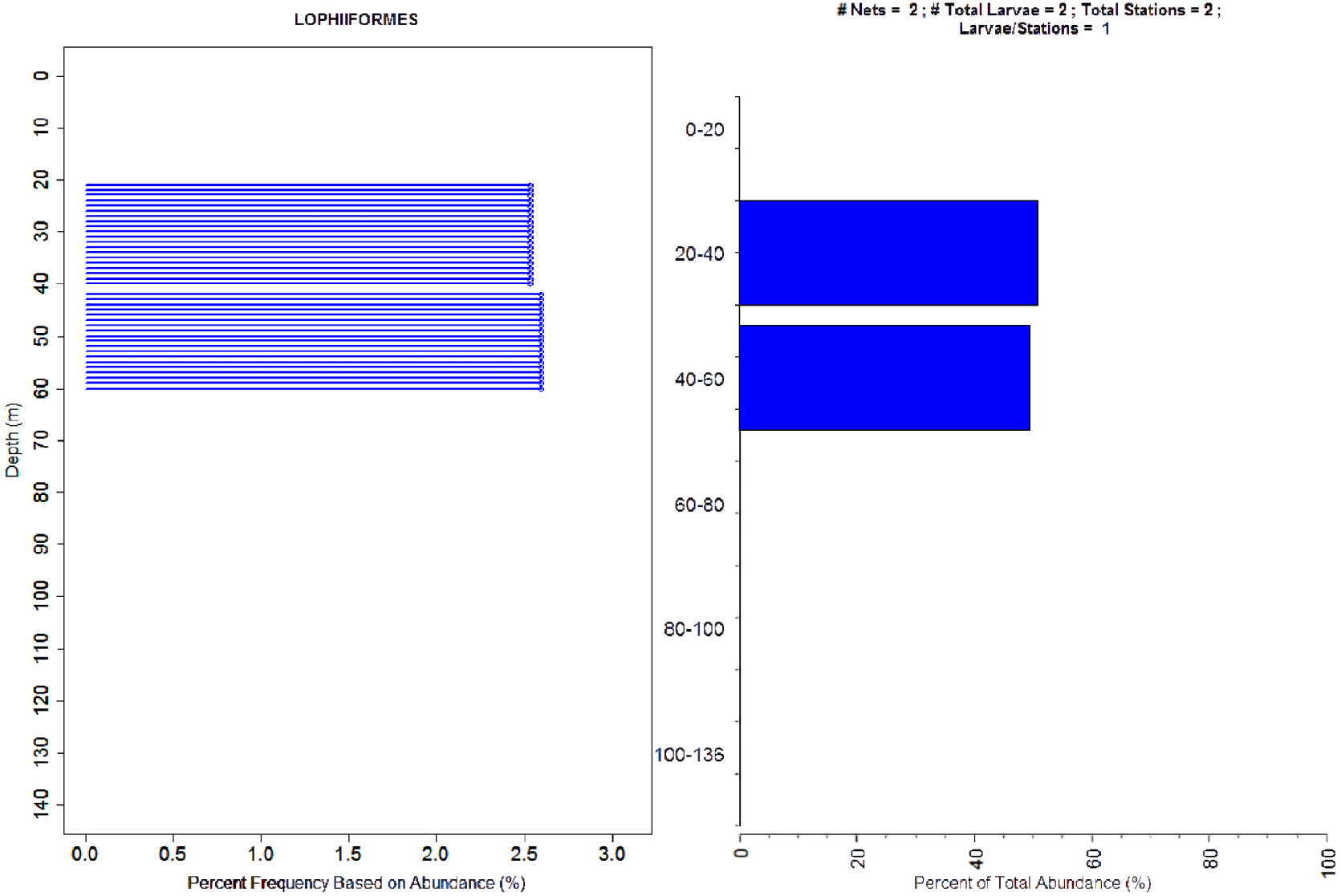
LAMPRIDIFORMES


LOBOTIDAE
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

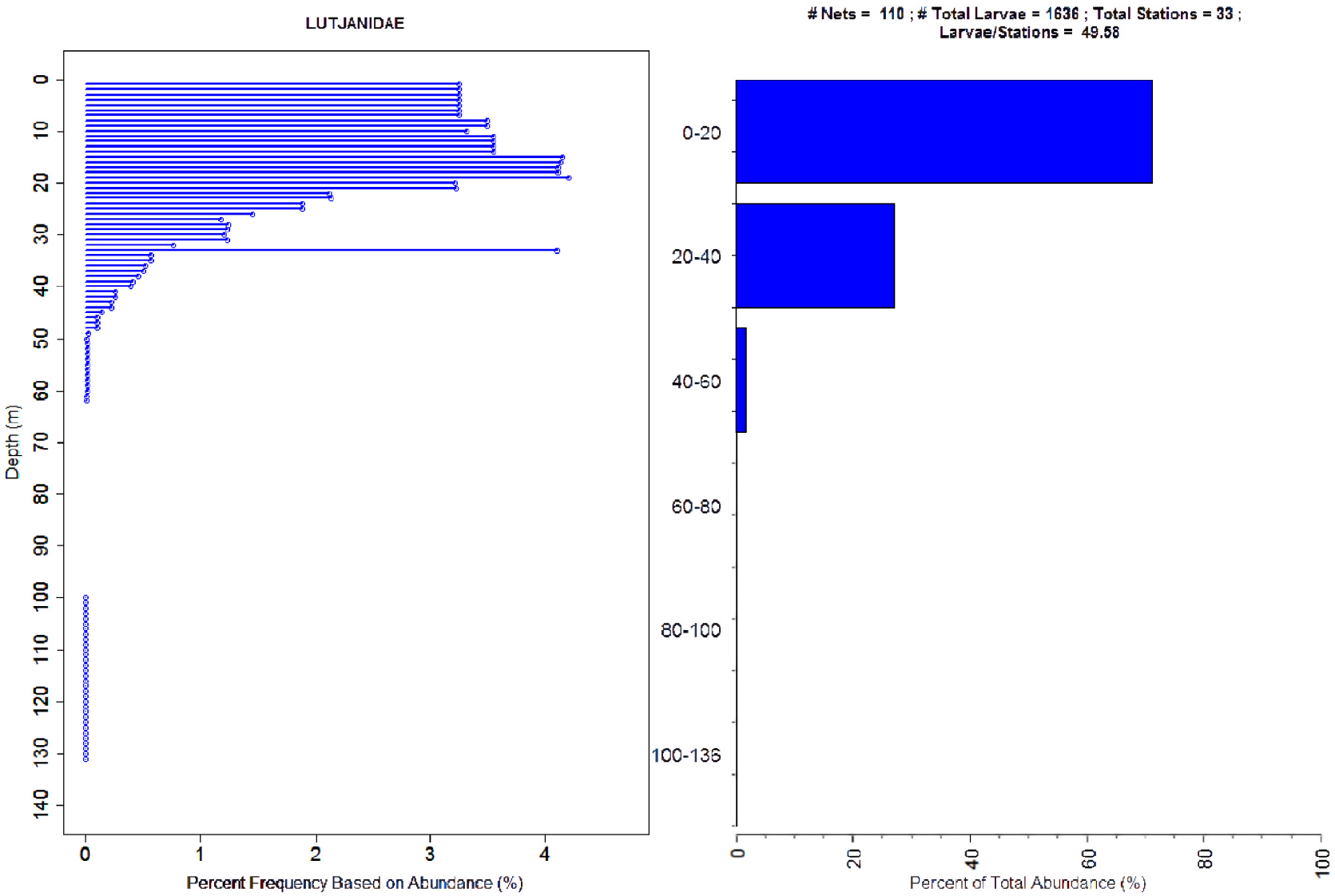
LOBOTIDAE


LOPHIIDAE
Nets = 16 ; # Total Larvae = 24 ; Total Stations = 14 ;
Larvae/Stations = 1.71
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

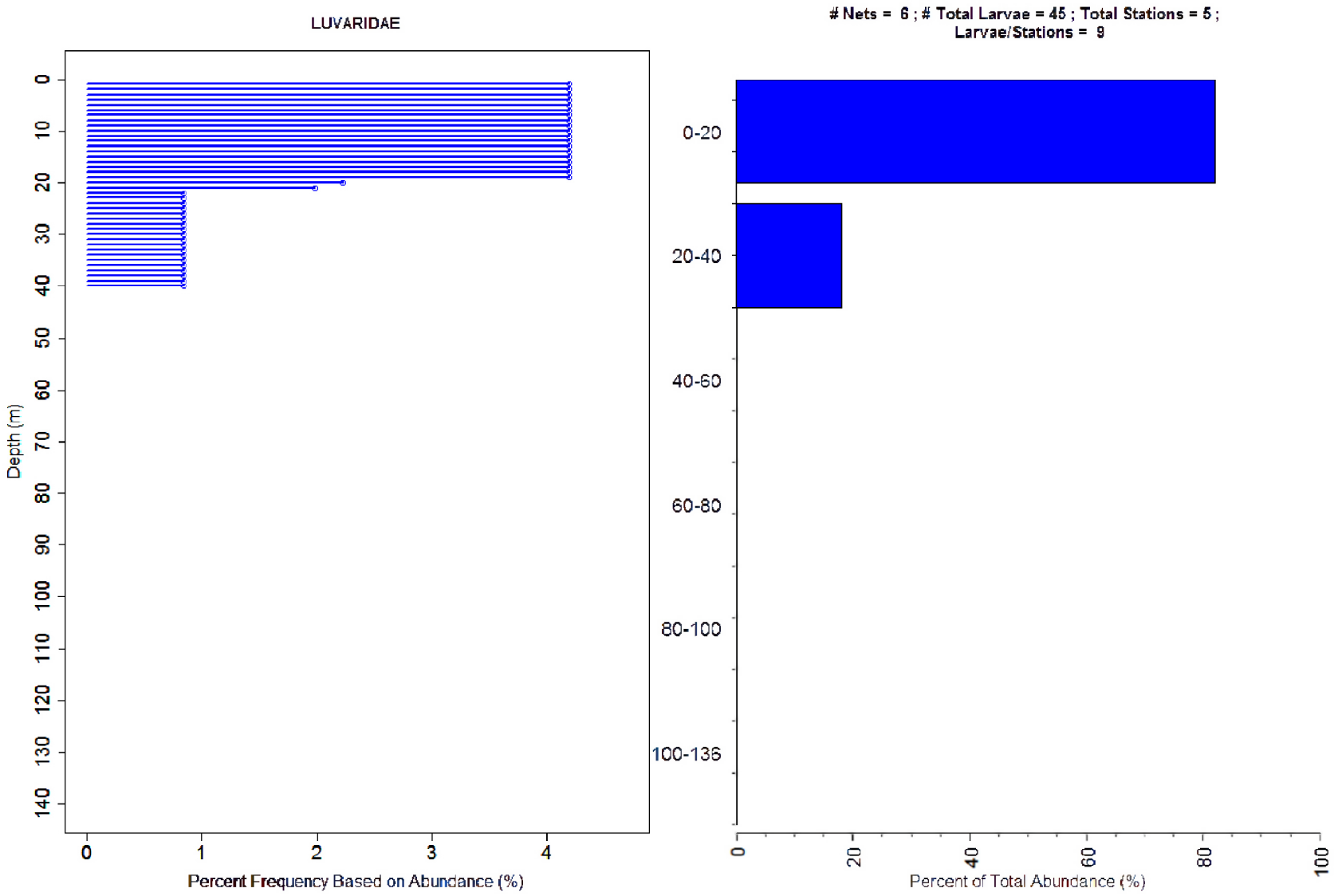
LOPHIIDAE



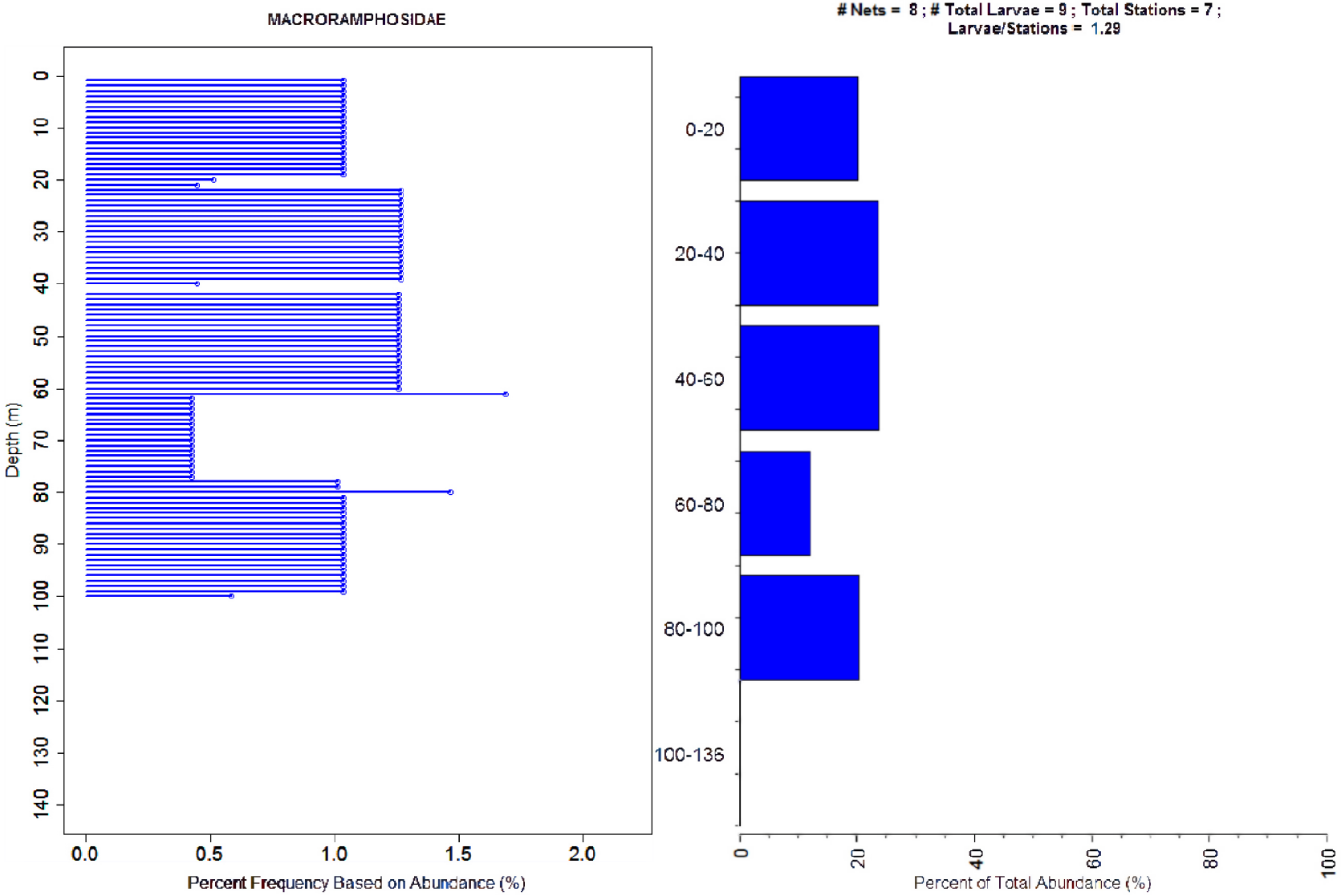
LOPHIIFORMES


LUTJANIDAE
Nets = 110 ; # Total Larvae = 1636 ; Total Stations = 33 ;
Larvae/Stations = 49.58
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

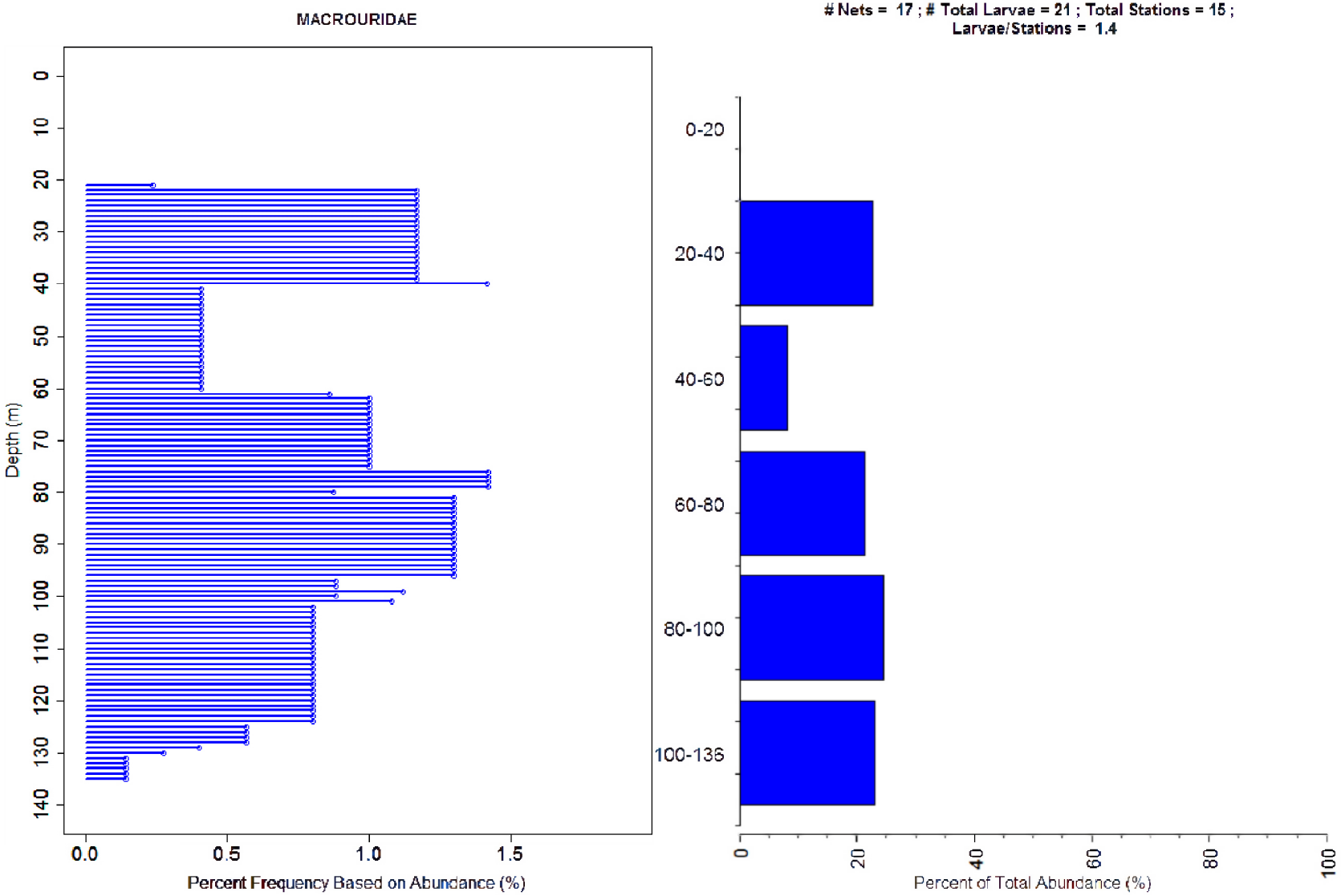
LUTJANIDAE


LUVARIDAE
Nets = 6 ; # Total Larvae = 45 ; Total Stations = 5 ;
Larvae/Stations = 9
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

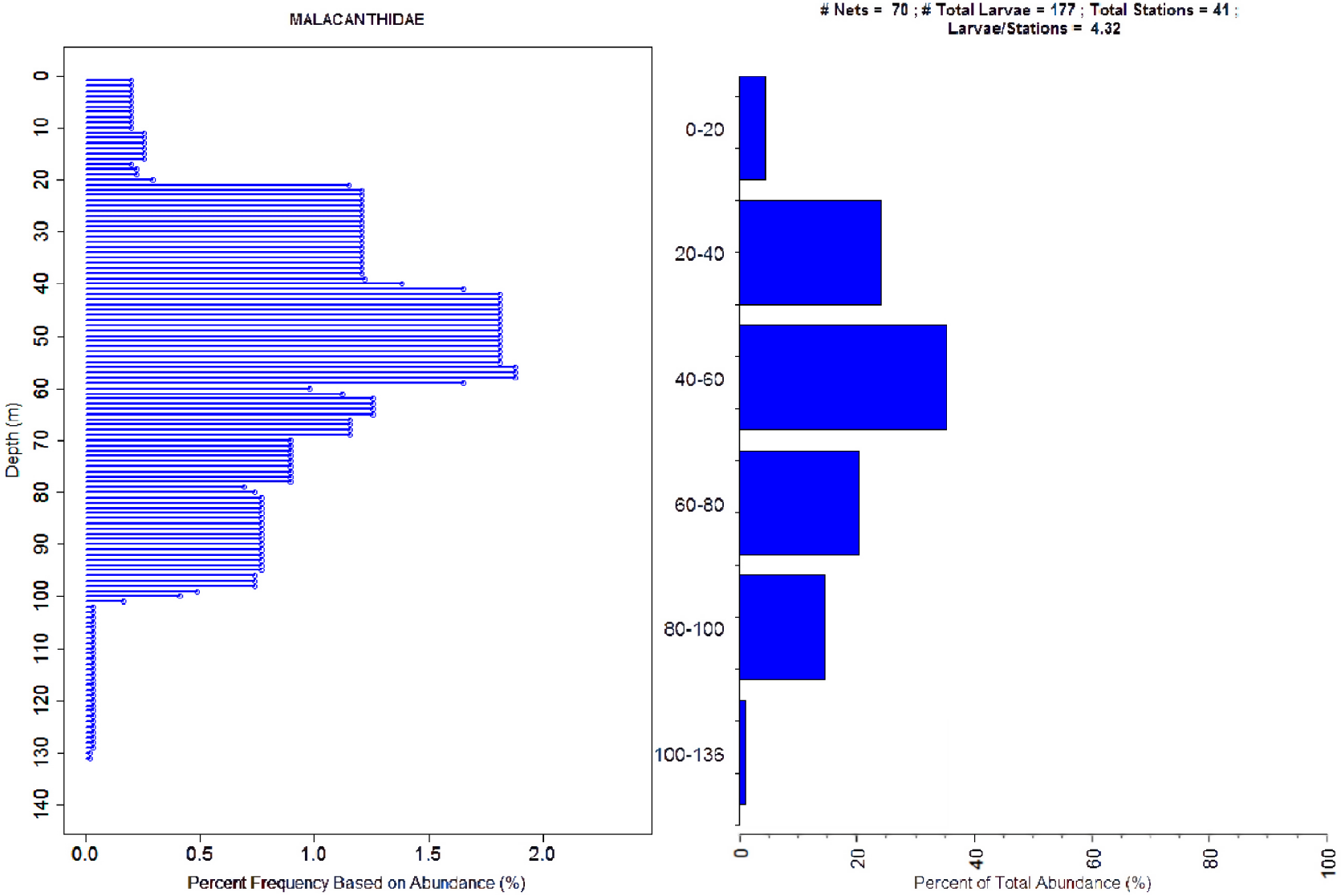
LUVARIDAE



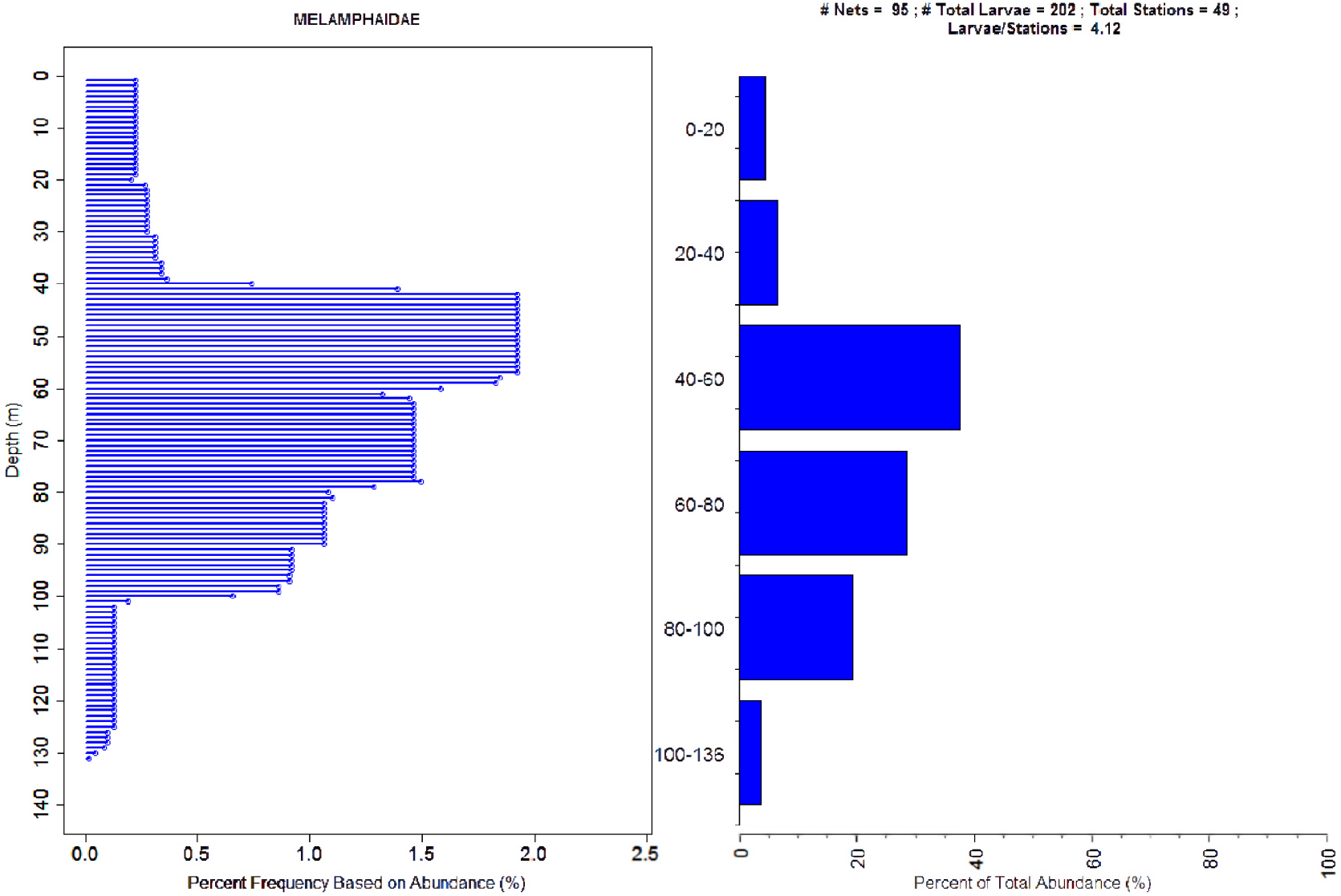
MACRORAMPHOSIDAE



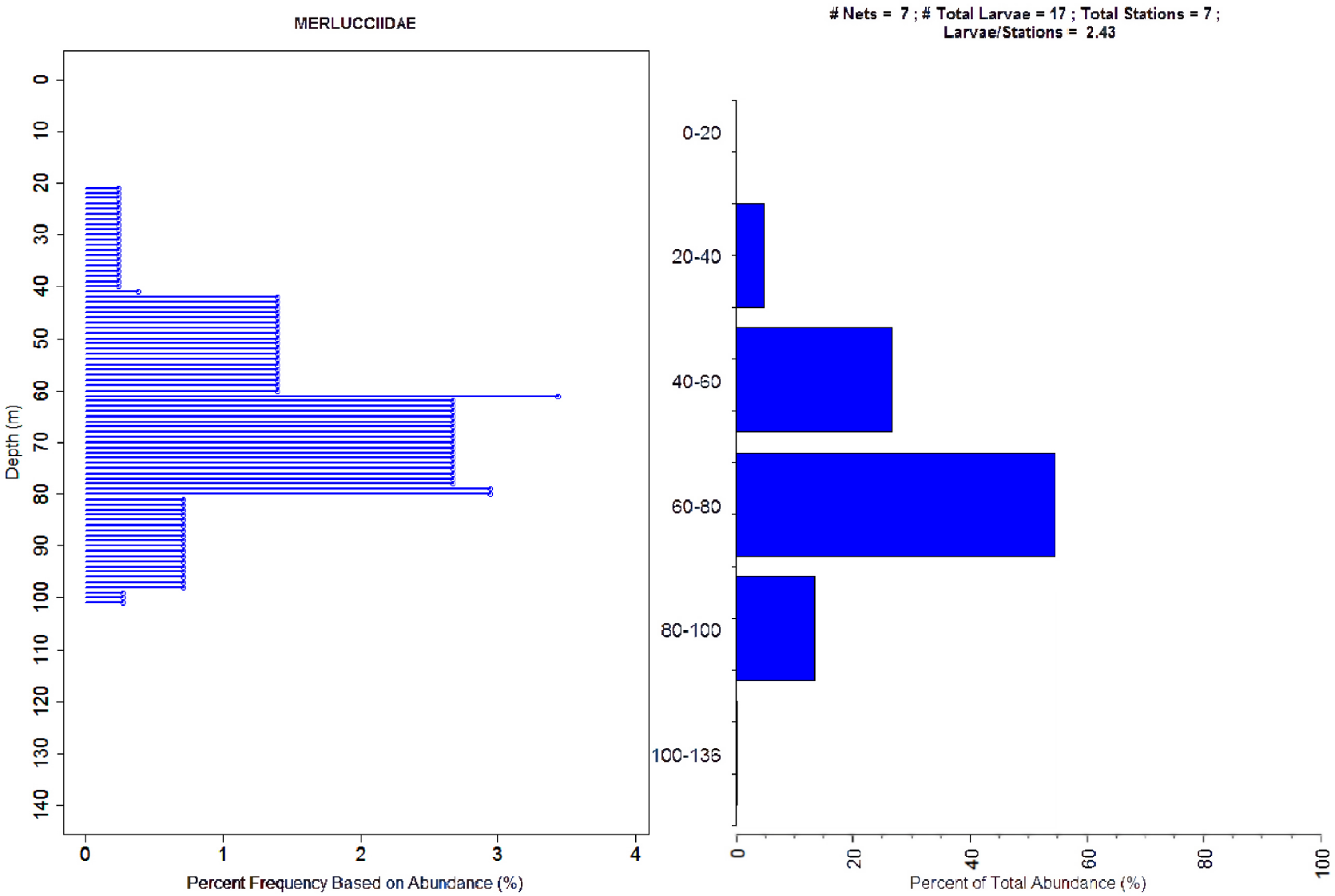
MACROURIDAE



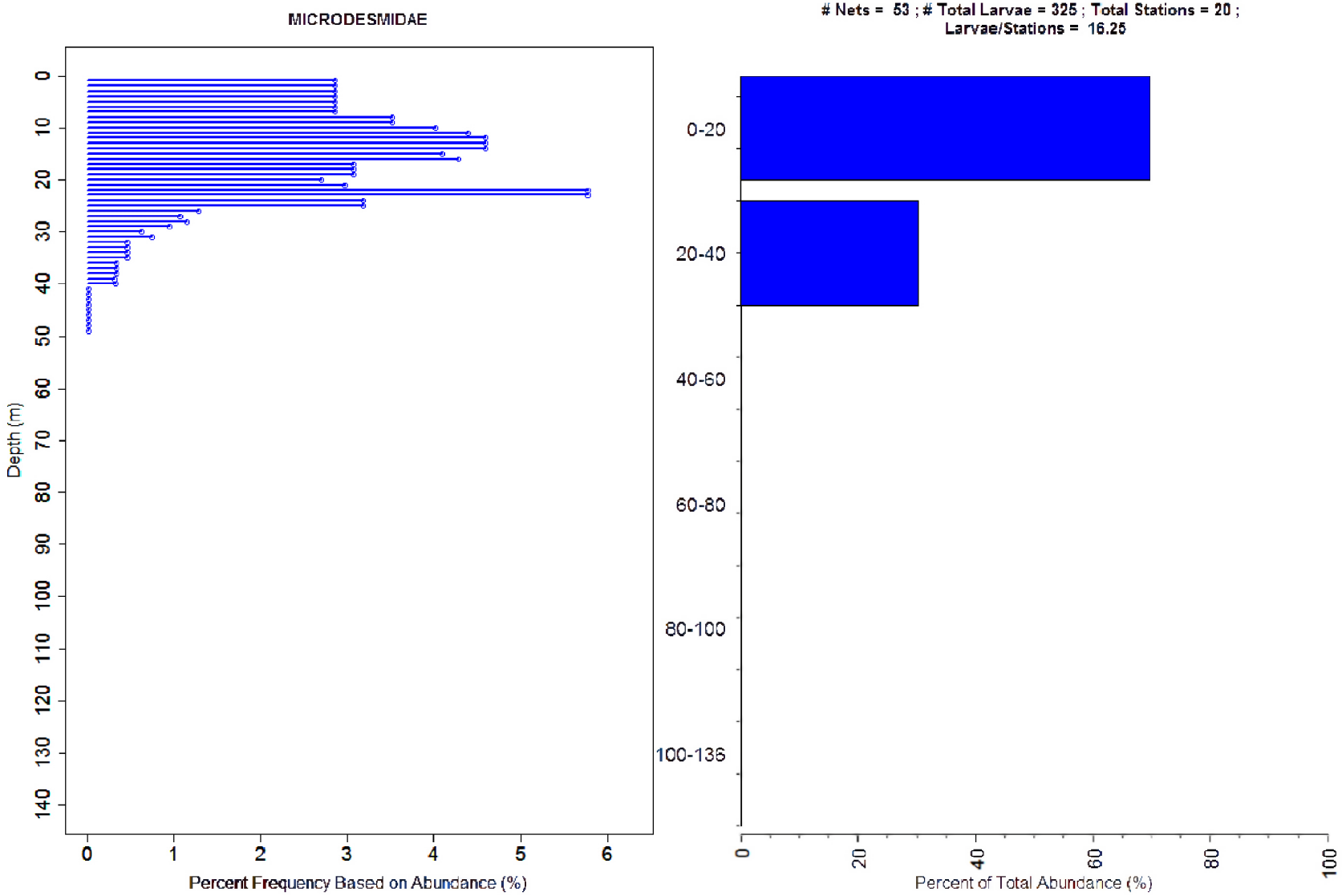
MALACANTHIDAE



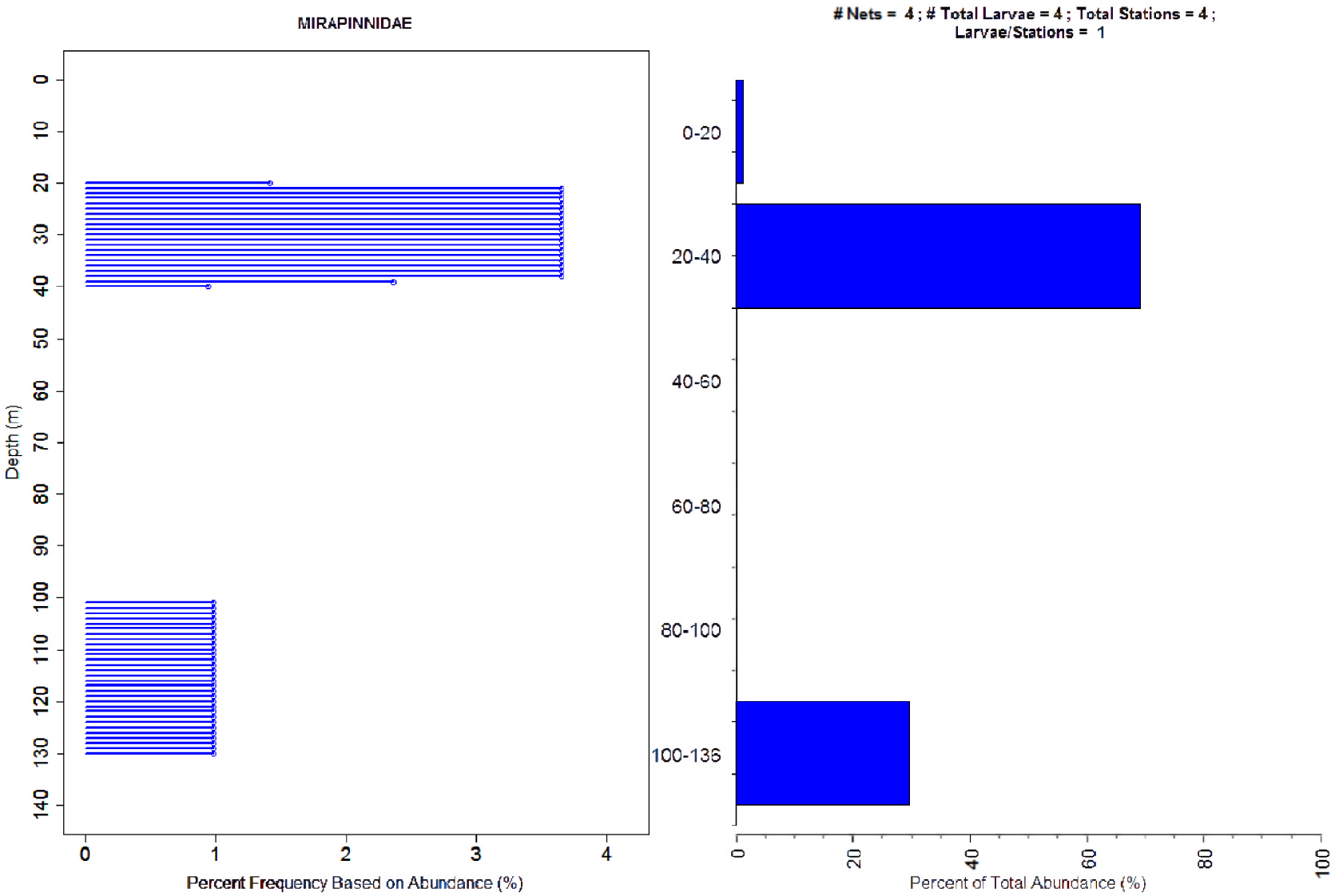
MELAMPHAIDAE



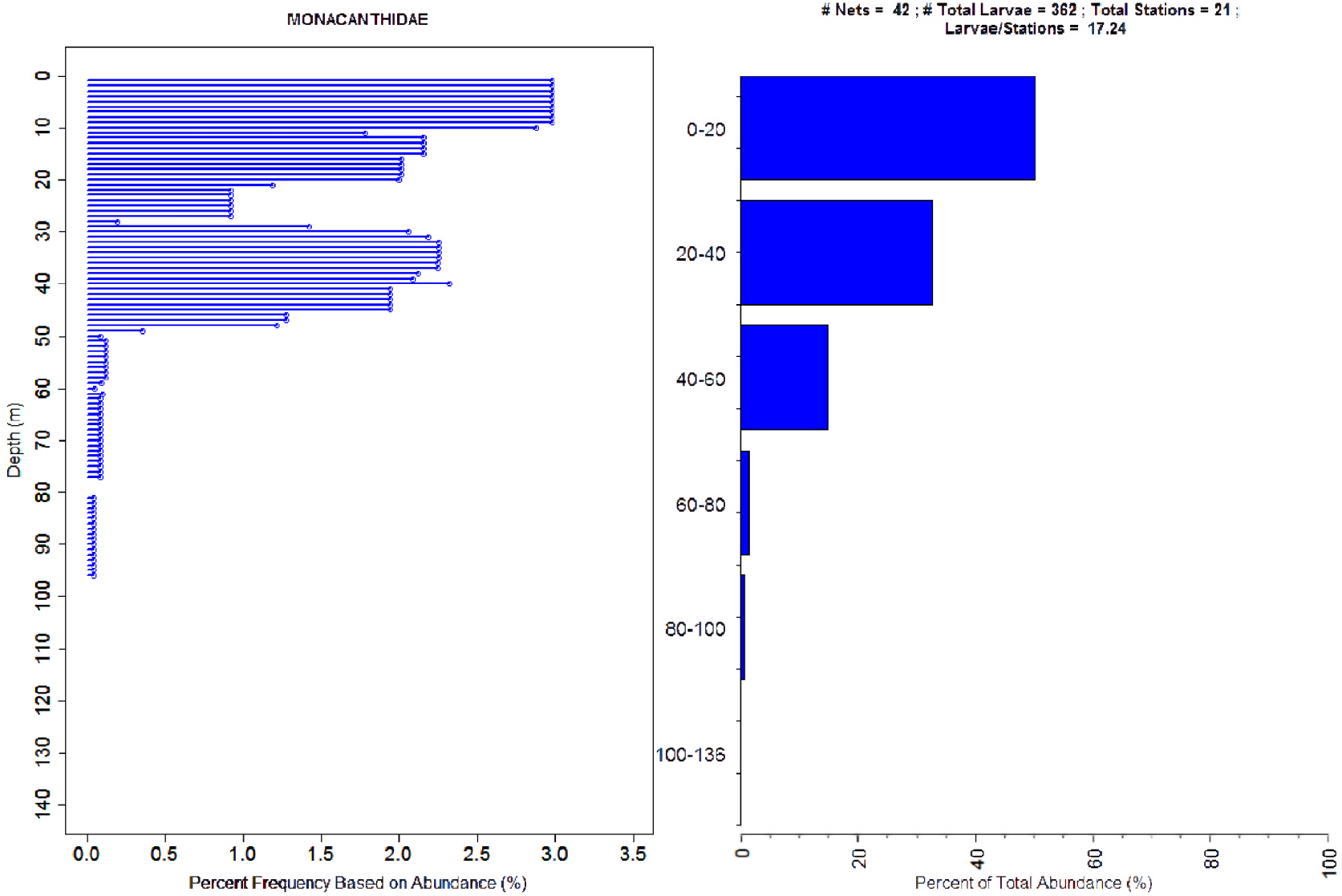
MERLUCCIIDAE



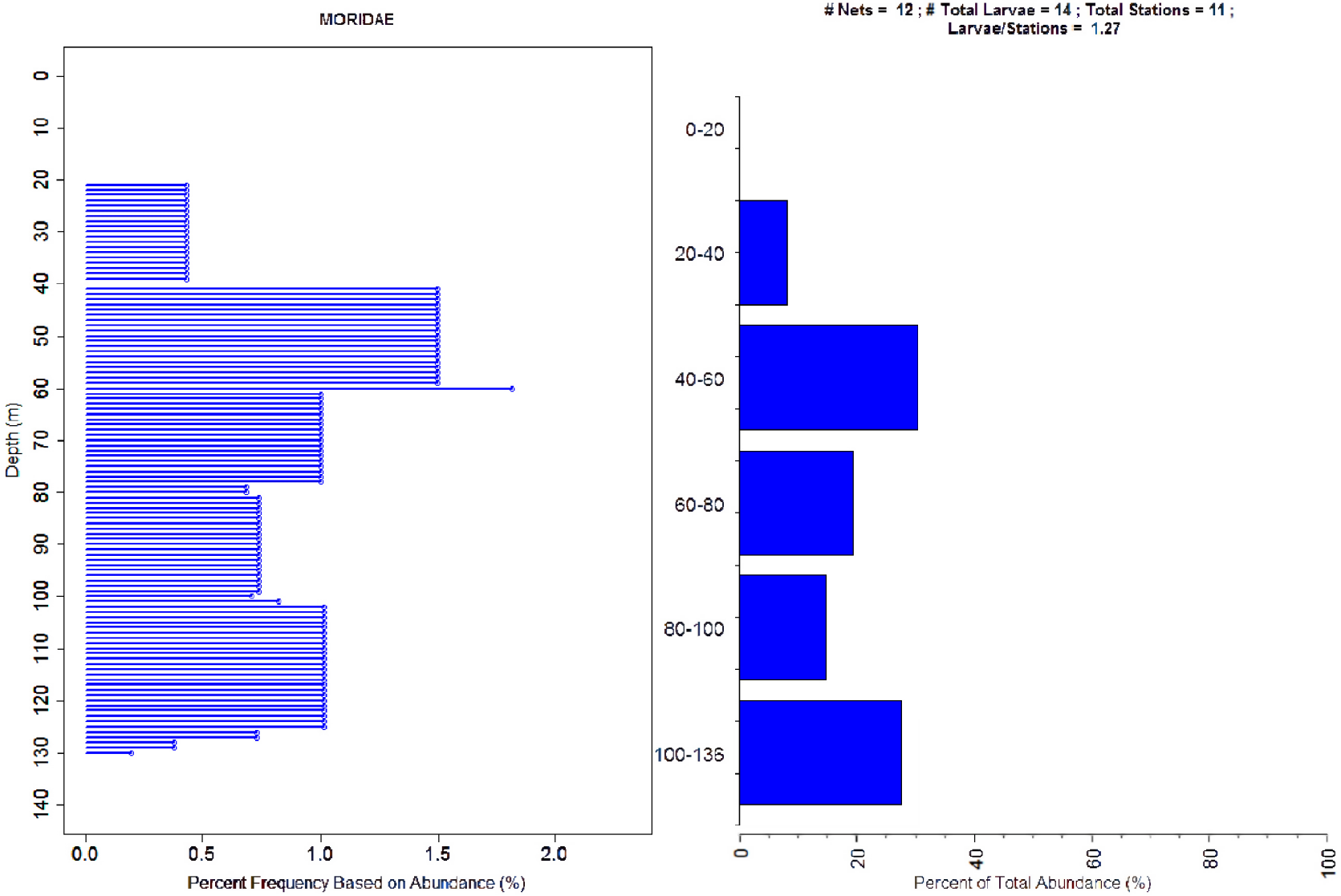
MICRODESMIDAE



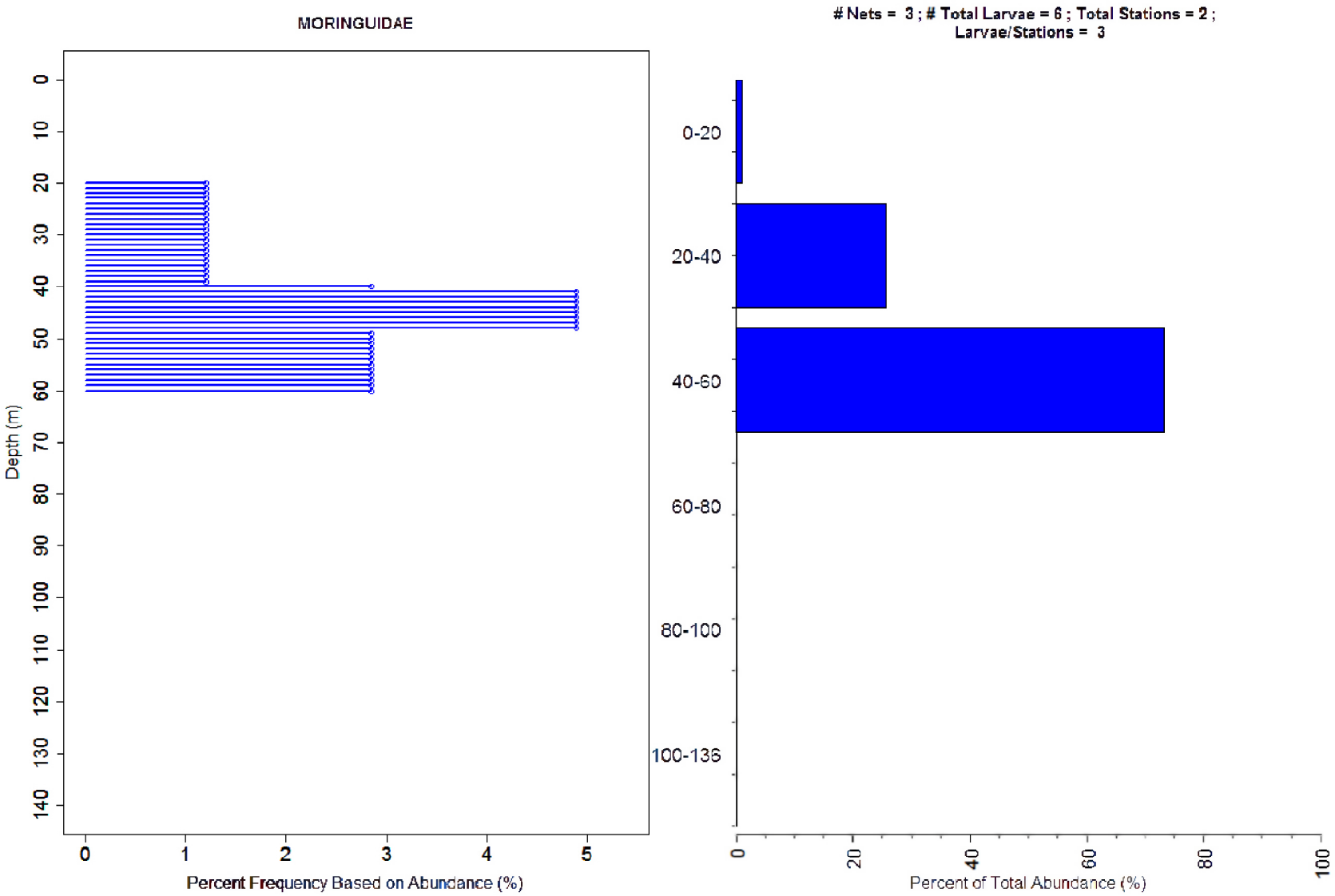
MIRAPINNIDAE



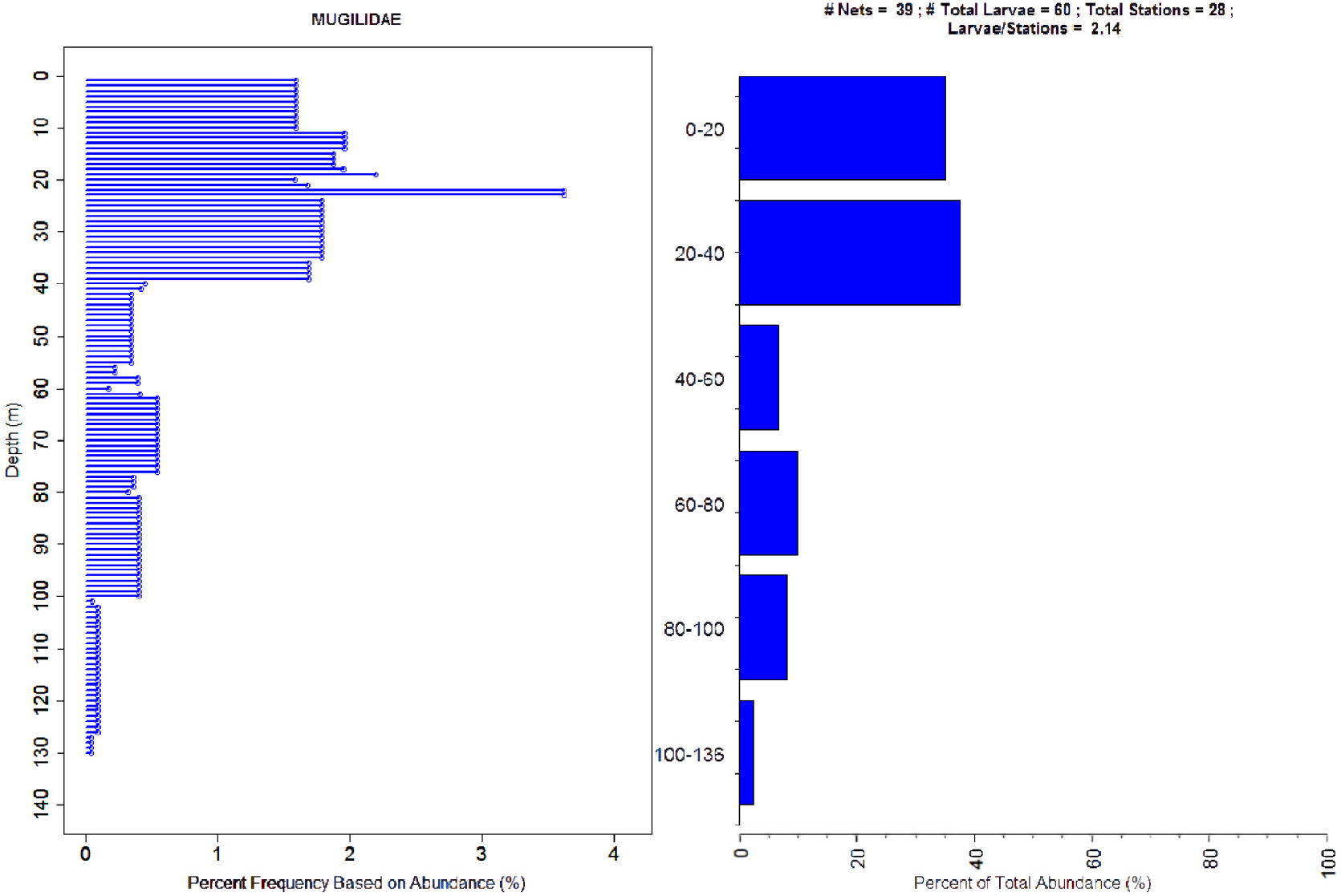
MONACANTHIDAE


MORIDAE
Nets = 12 ; # Total Larvae = 14 ; Total Stations = 11 ;
Larvae/Stations = 1.27
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

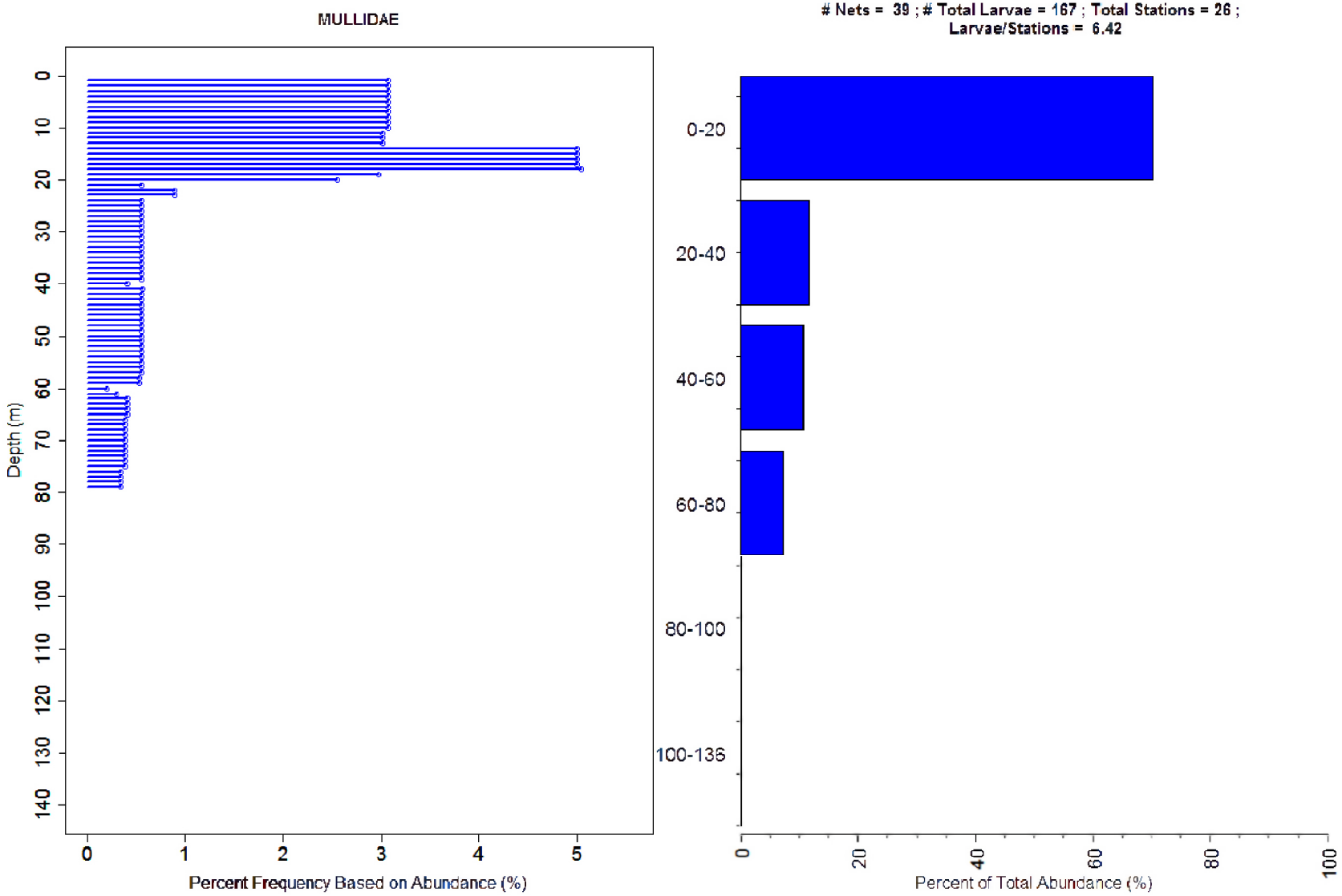
MORIDAE



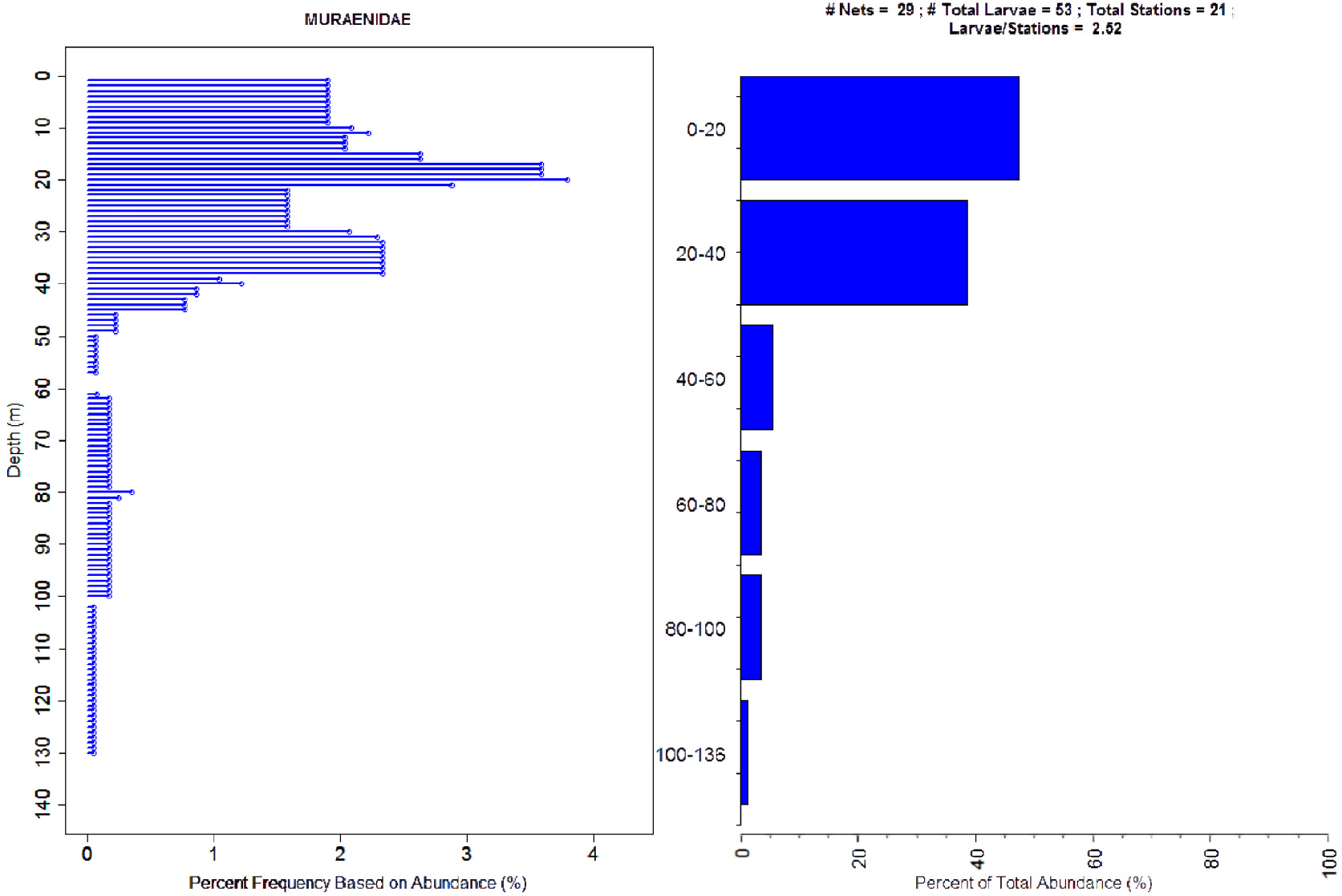
MORINGUIDAE


MUGILIDAE
Nets = 39 ; # Total Larvae = 60 ; Total Stations = 28 ;
Larvae/Stations = 2.14
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

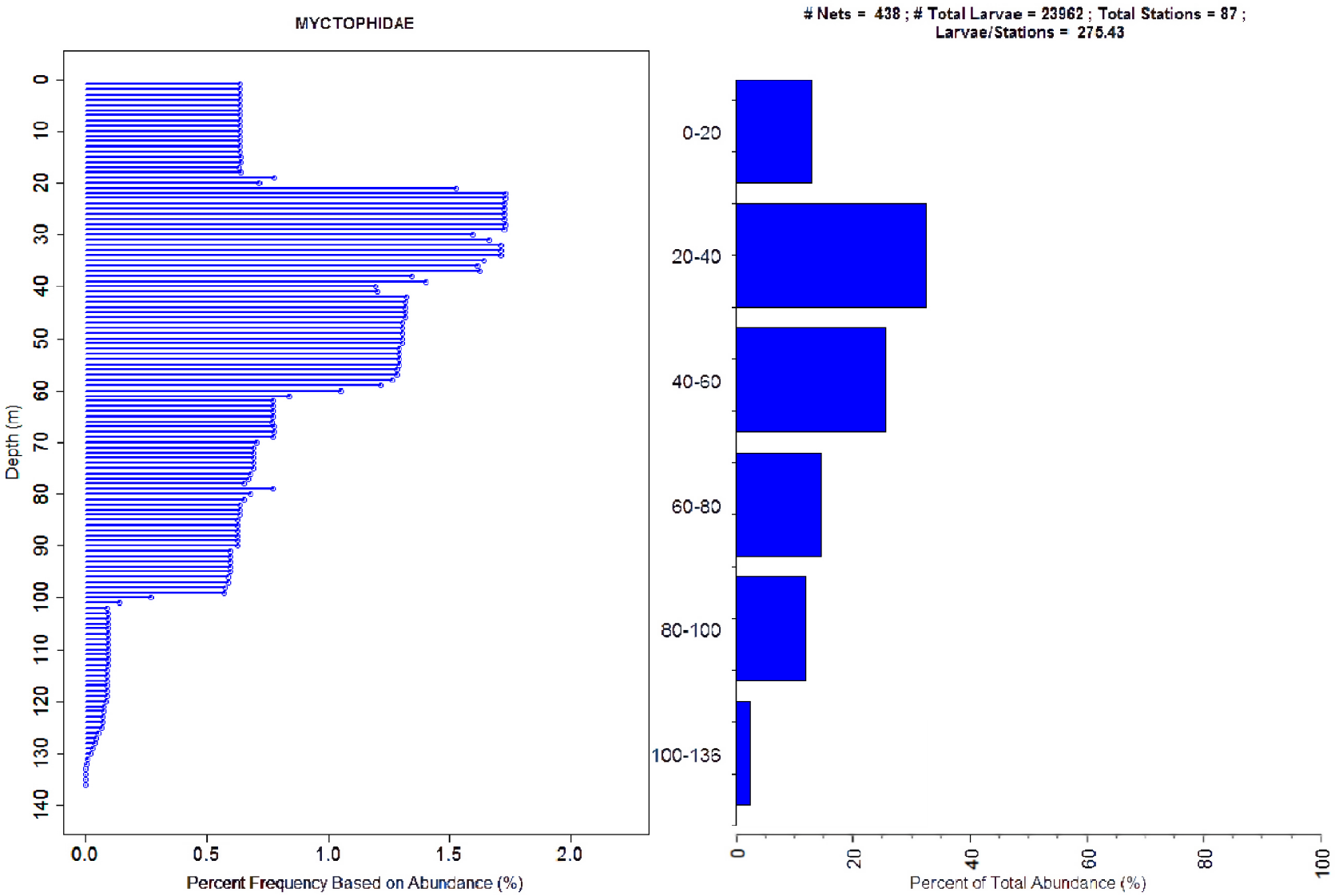
MUGILIDAE


MULLIDAE
Nets = 39 ; # Total Larvae = 167 ; Total Stations = 26 ;
Larvae/Stations = 6.42
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

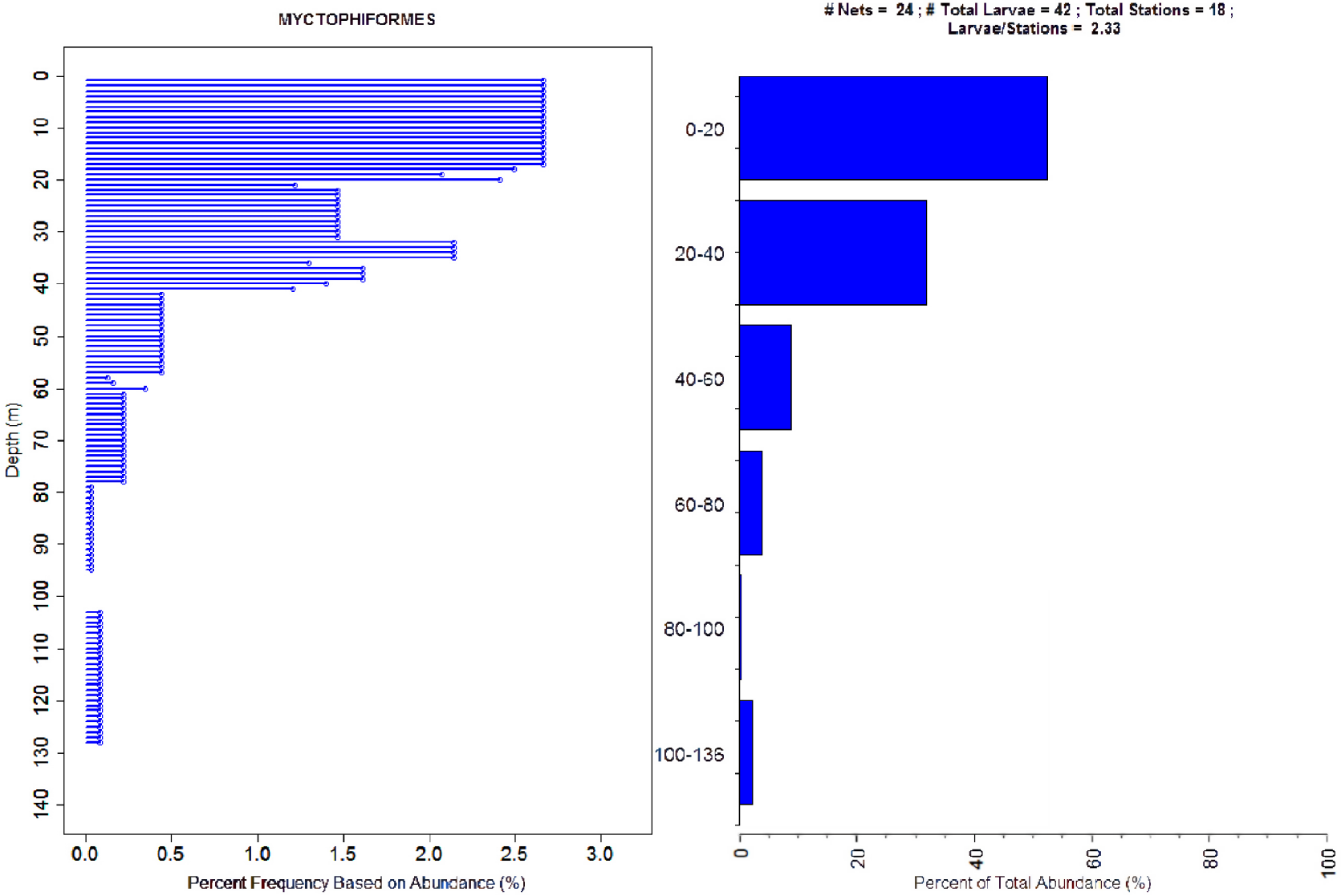
MULLIDAE


MURAENIDAE
Nets = 29 ; # Total Larvae = 53 ; Total Stations = 21 ;
Larvae/Stations = 2.52
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

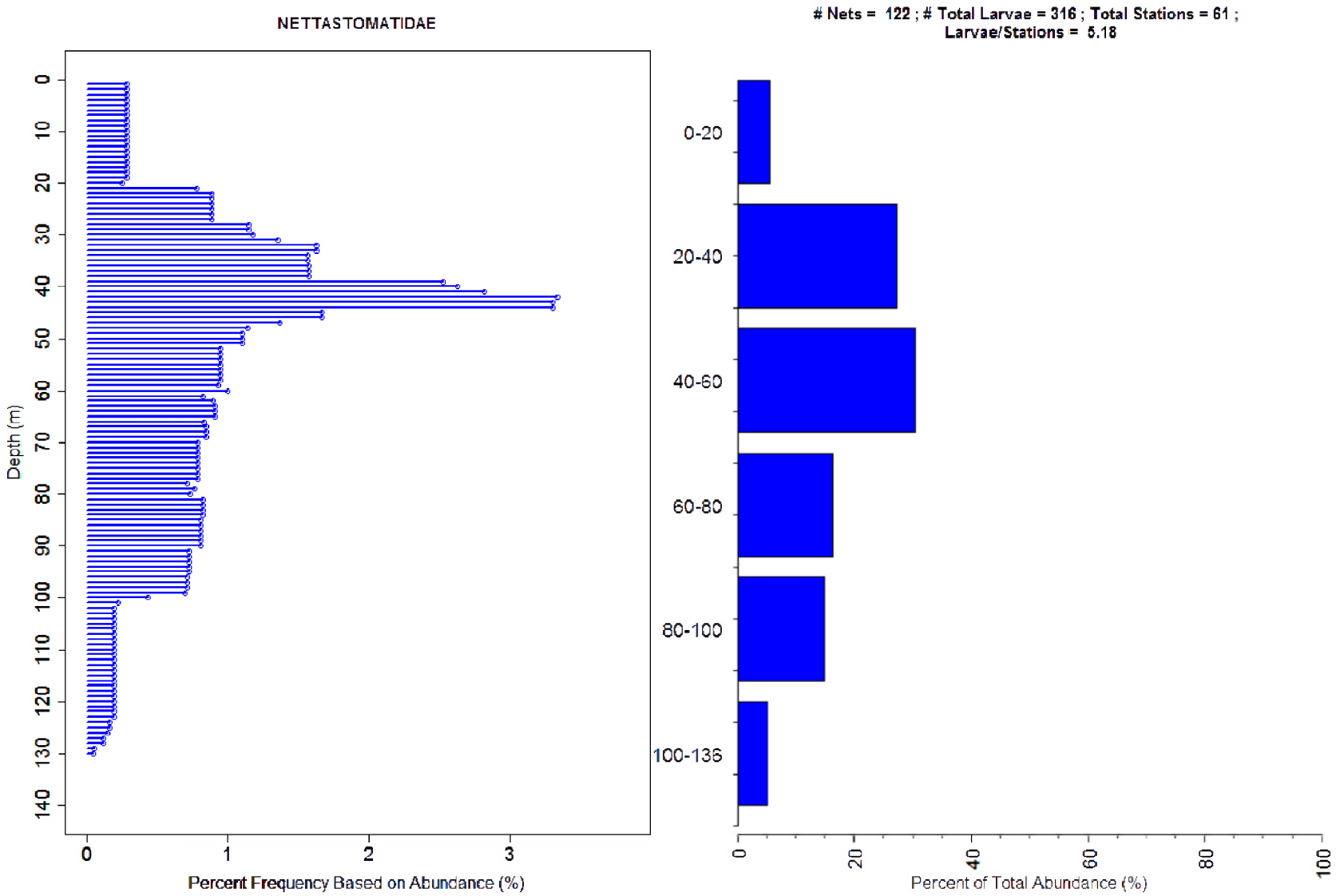
MURAENIDAE



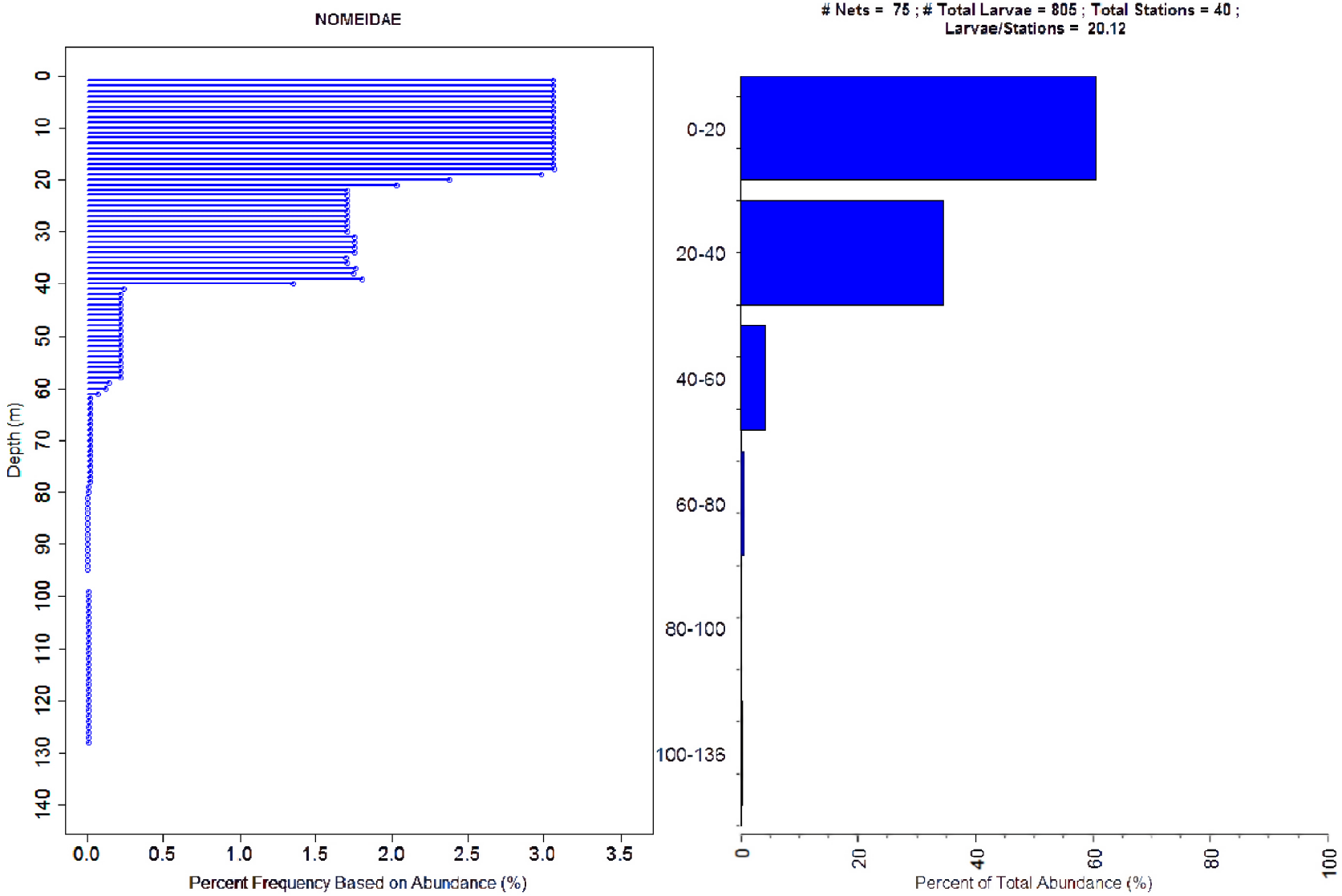
MYCTOPHIDAE



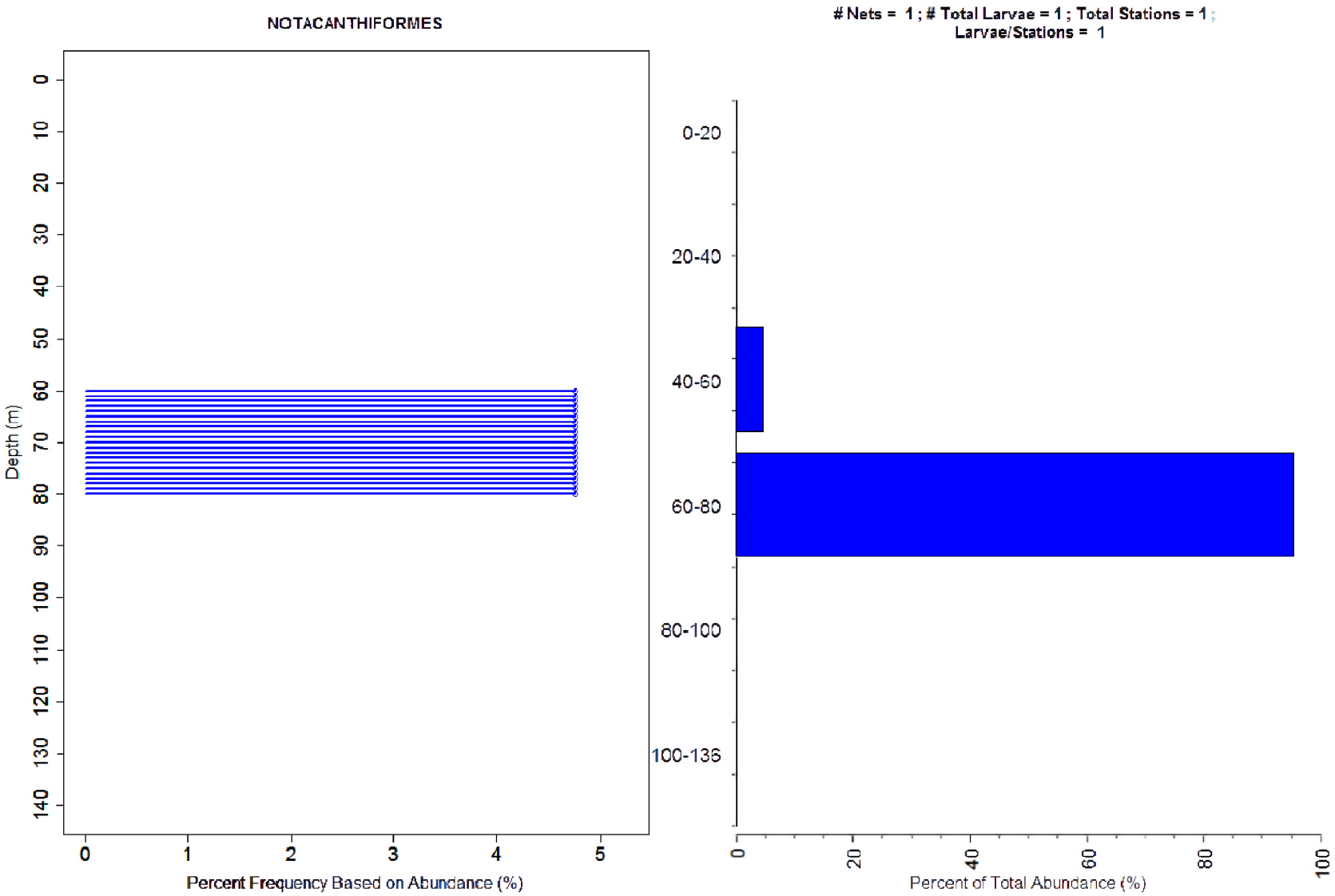
MYCTOPHIFORMES



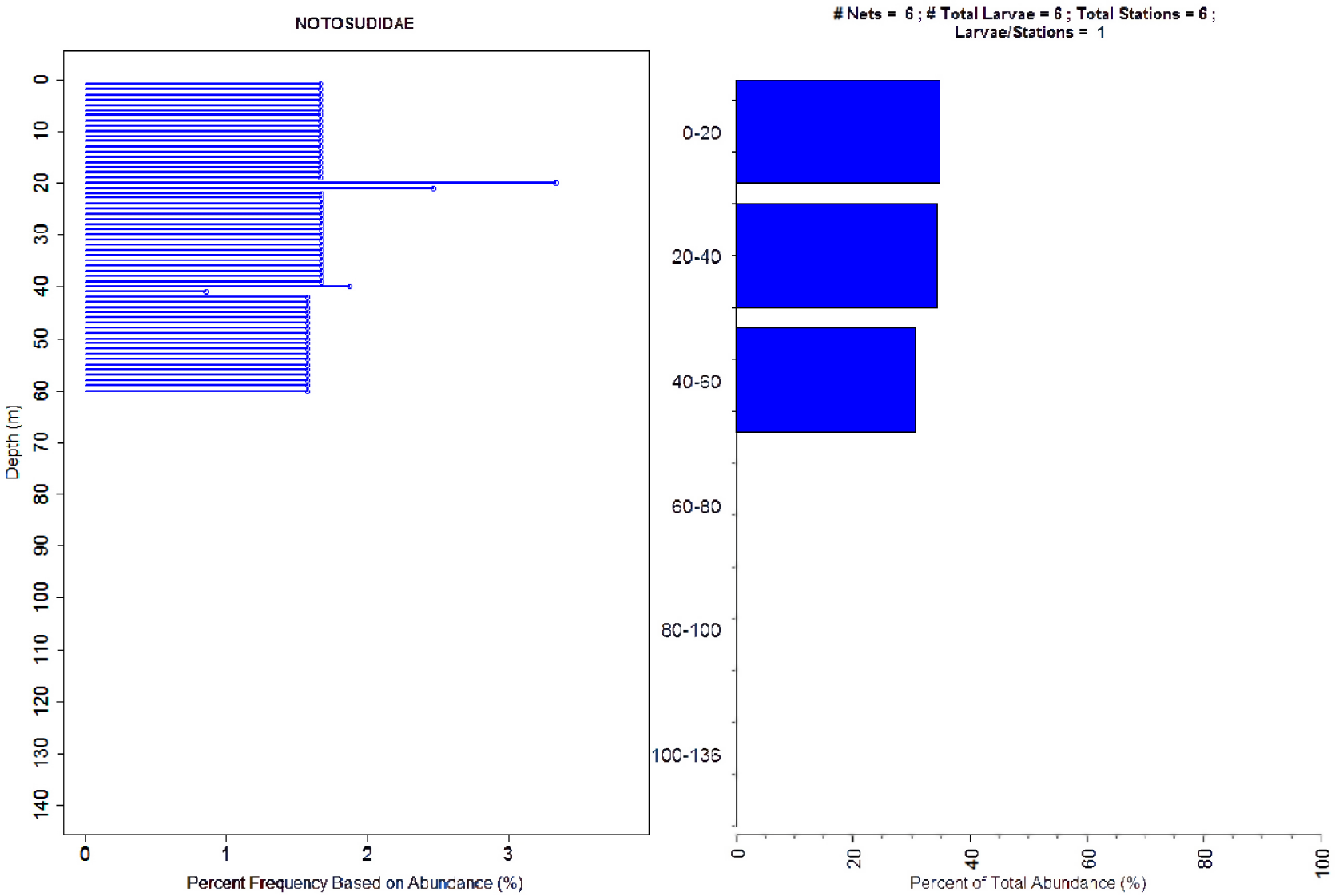
NETTASTOMATIDAE


NOMEIDAE
Nets = 75 ; # Total Larvae = 805 ; Total Stations = 40 ;
Larvae/Stations = 20.12
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

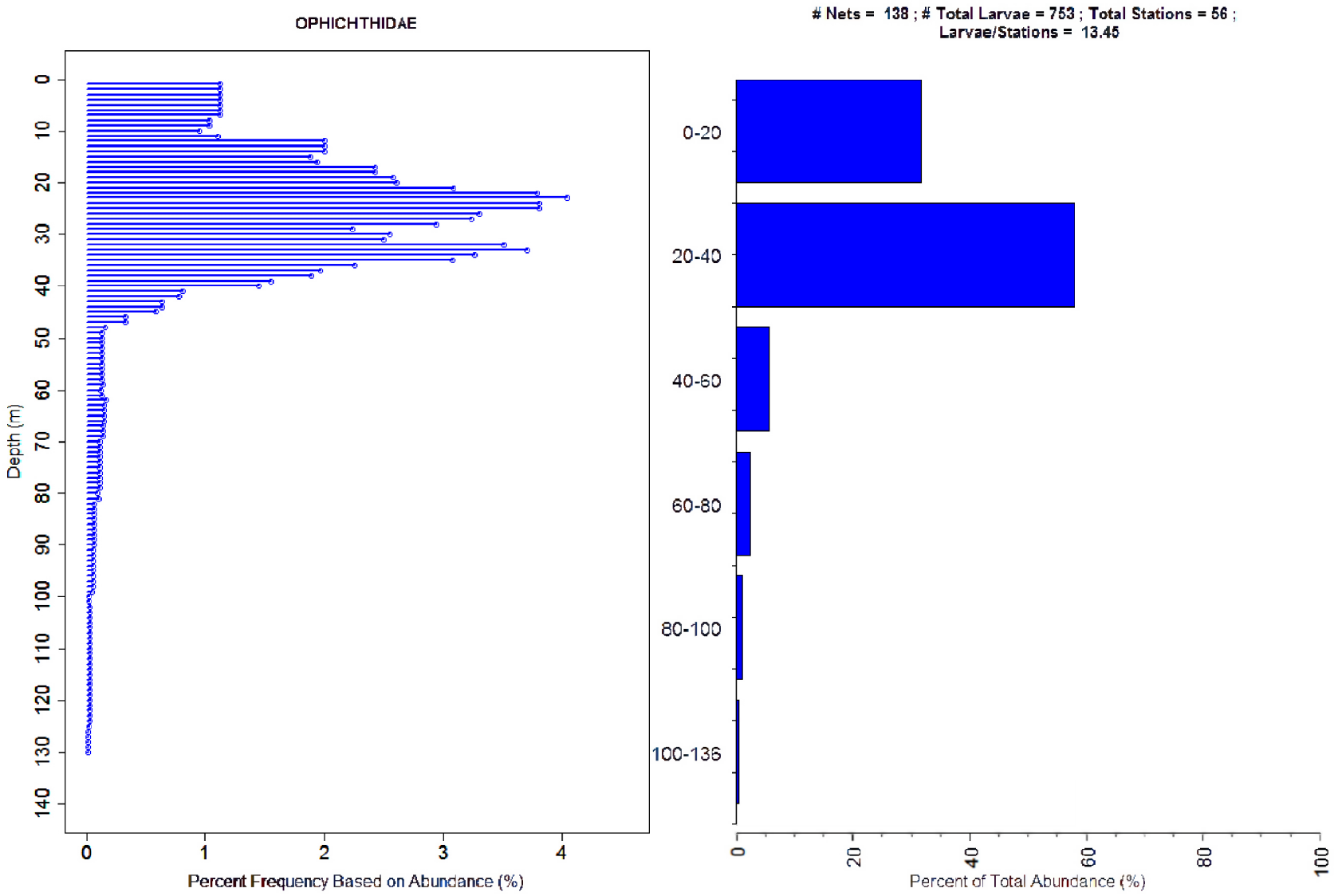
NOMEIDAE



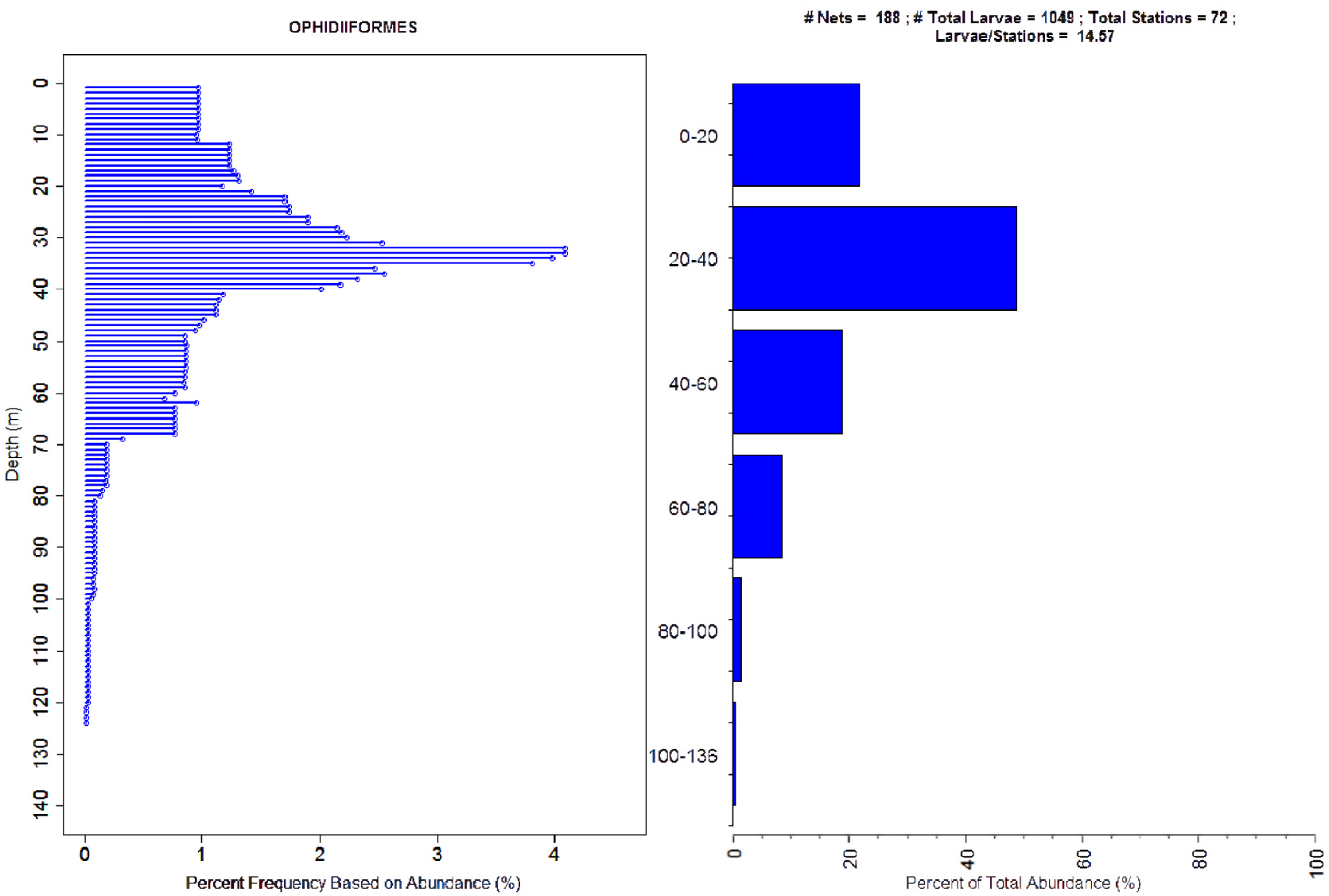
NOTACANTHIFORMES



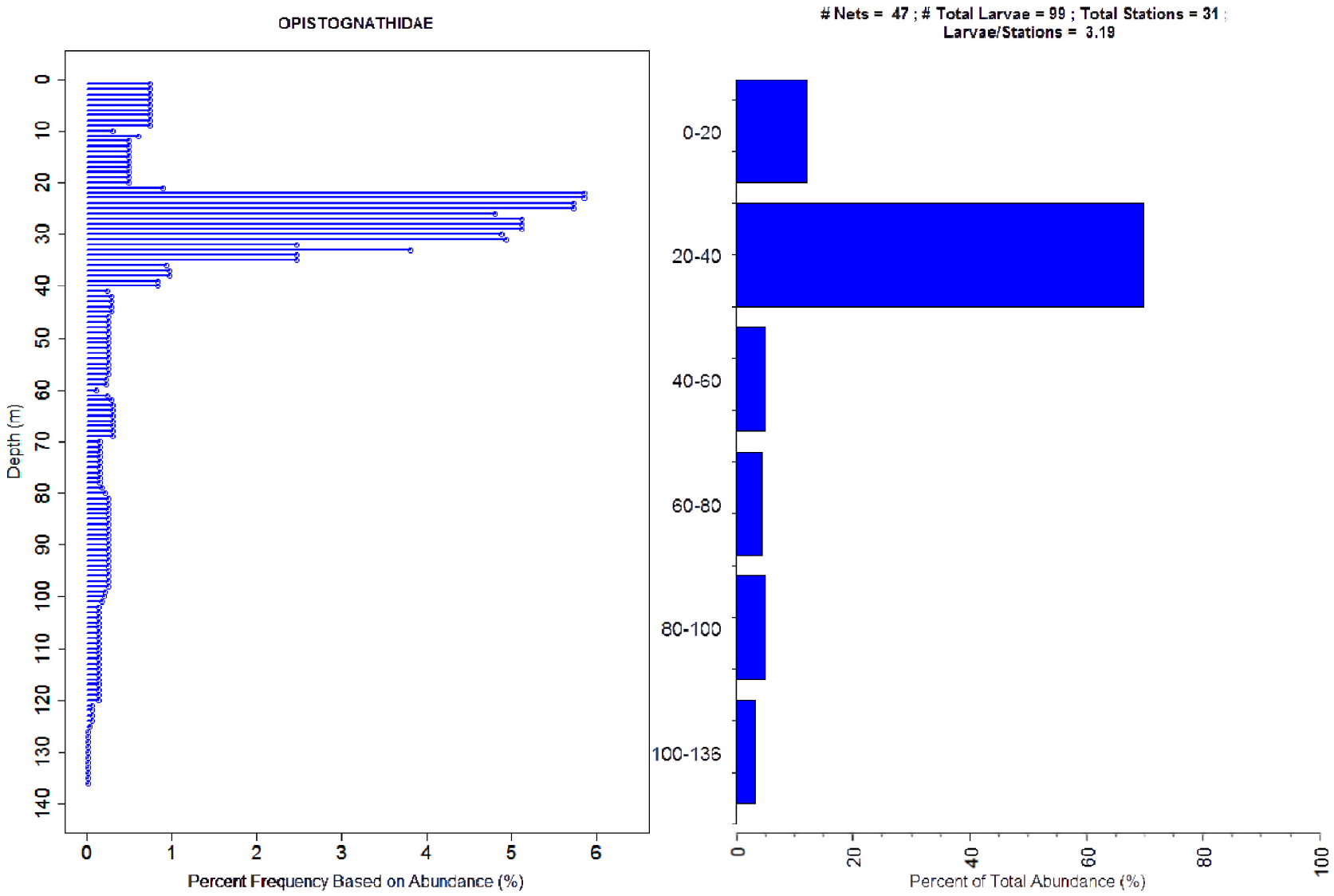
NOTOSUDIDAE



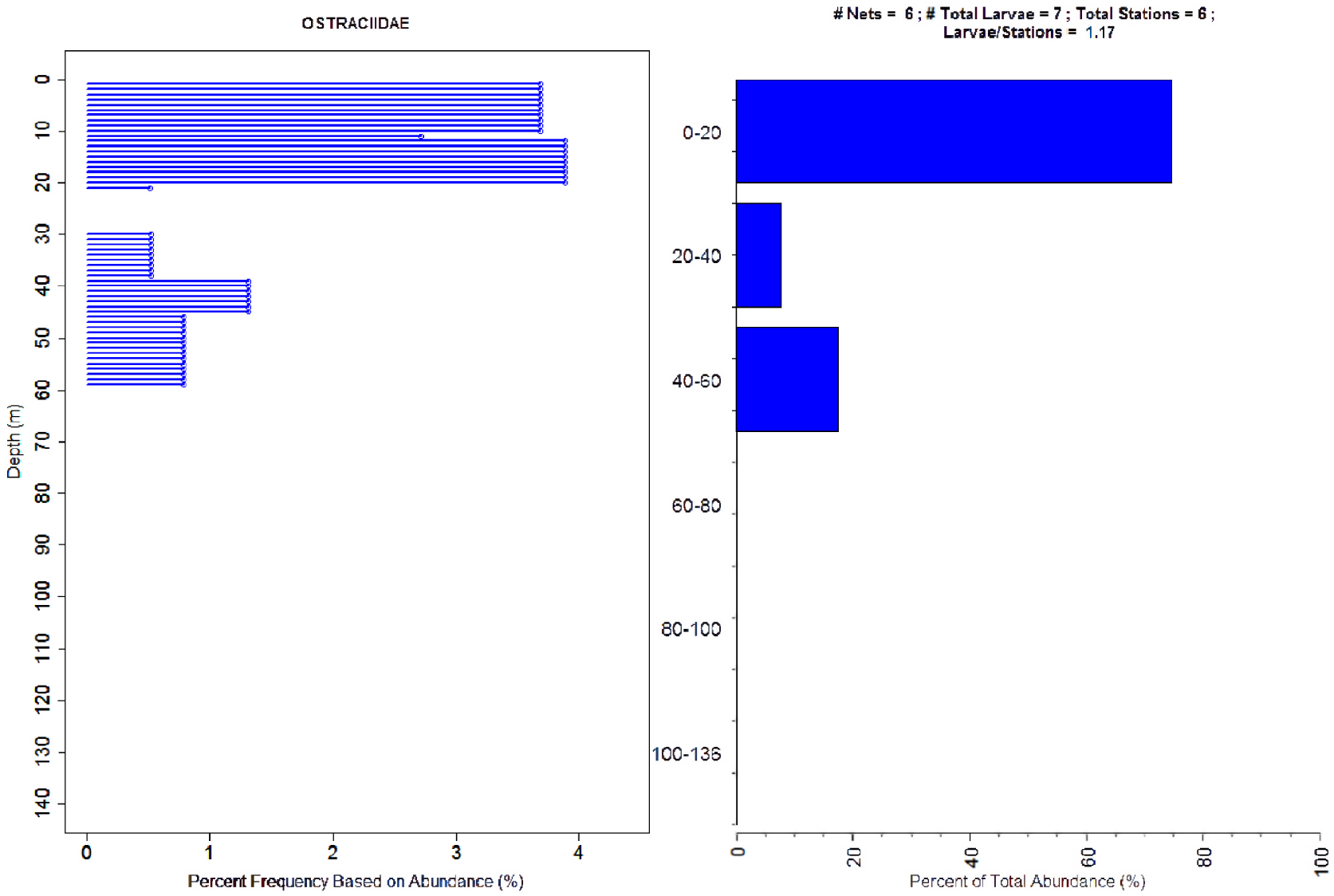
OPHICHTHIDAE



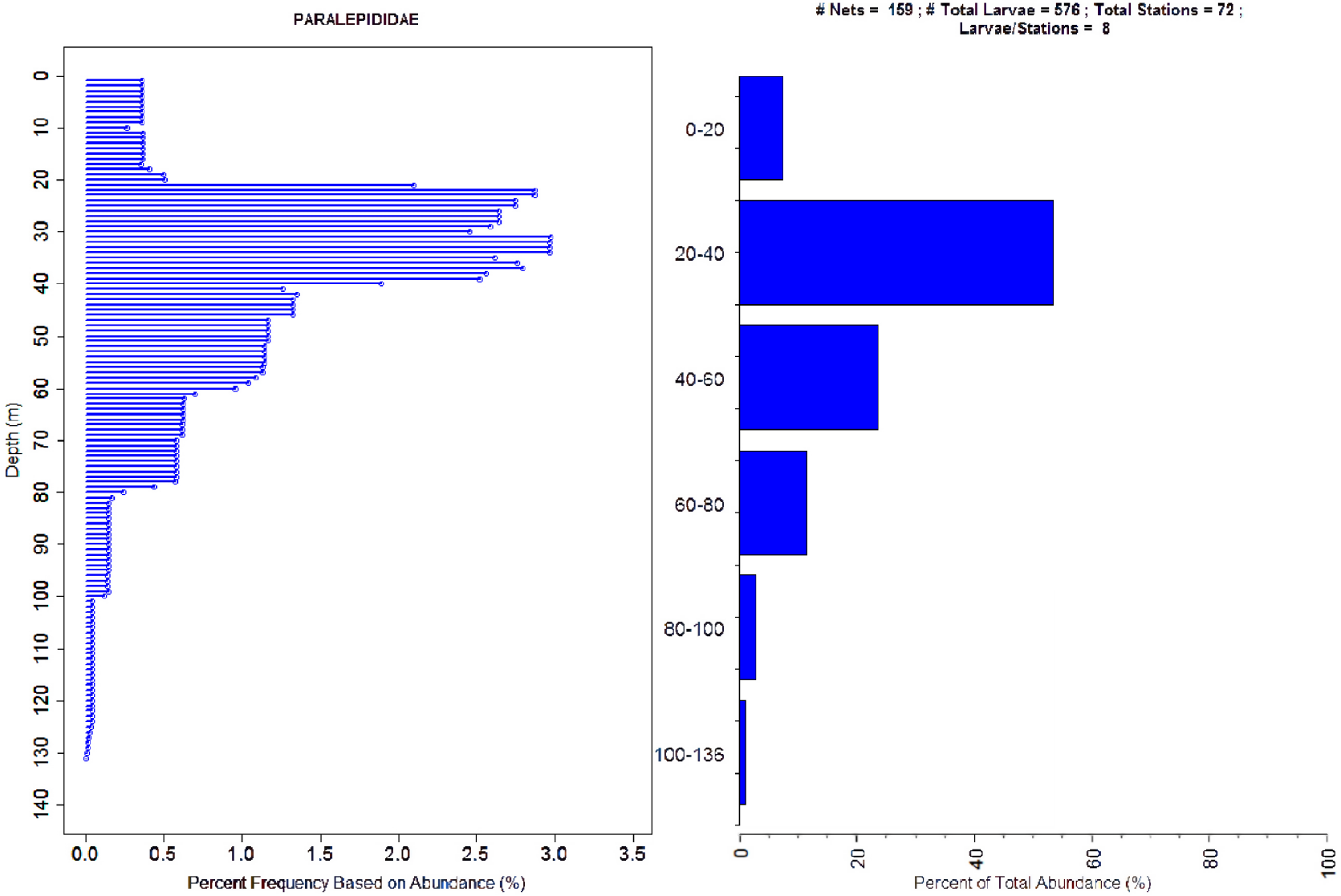
OPHIDIIFORMES



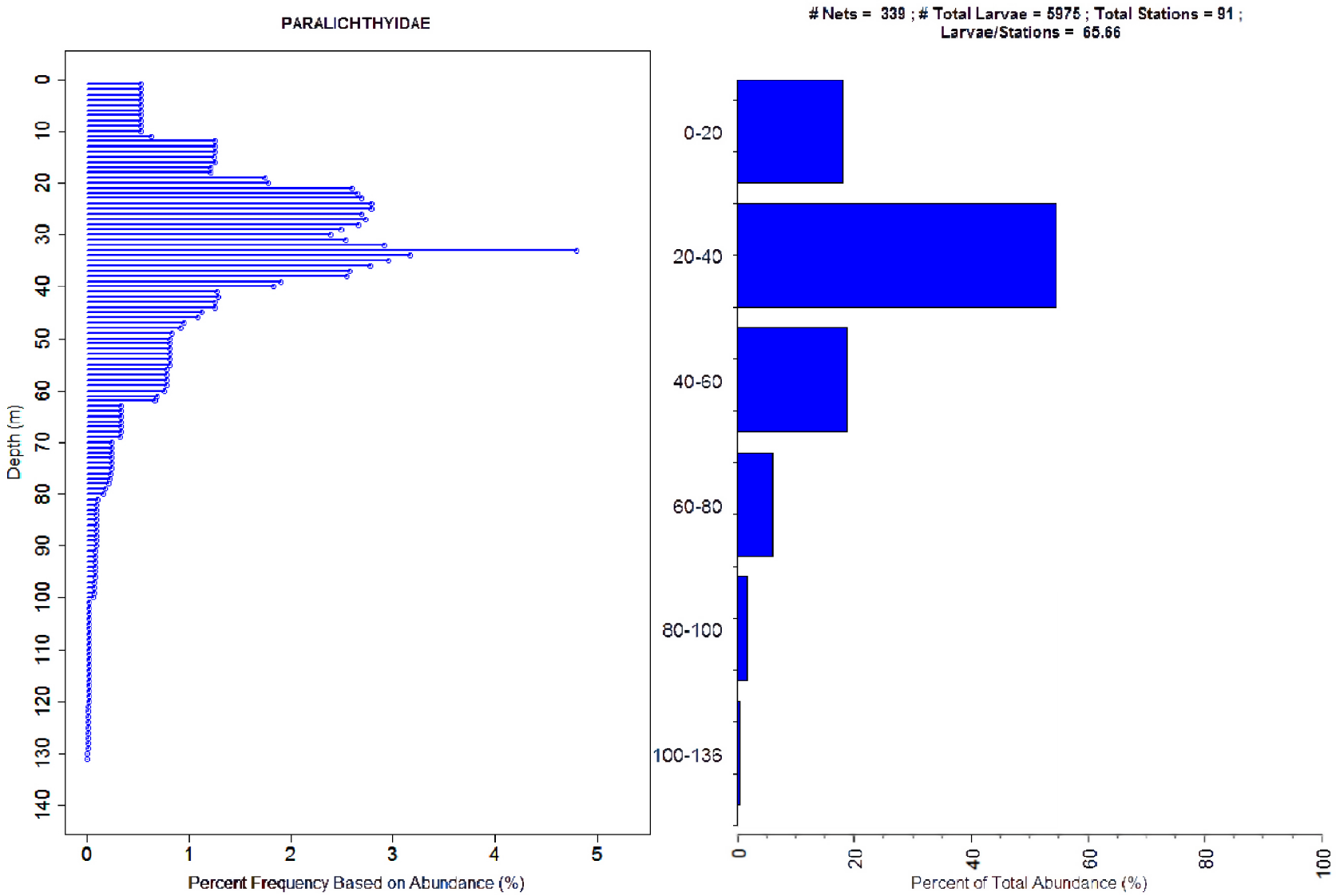
OPISTOGNATHIDAE



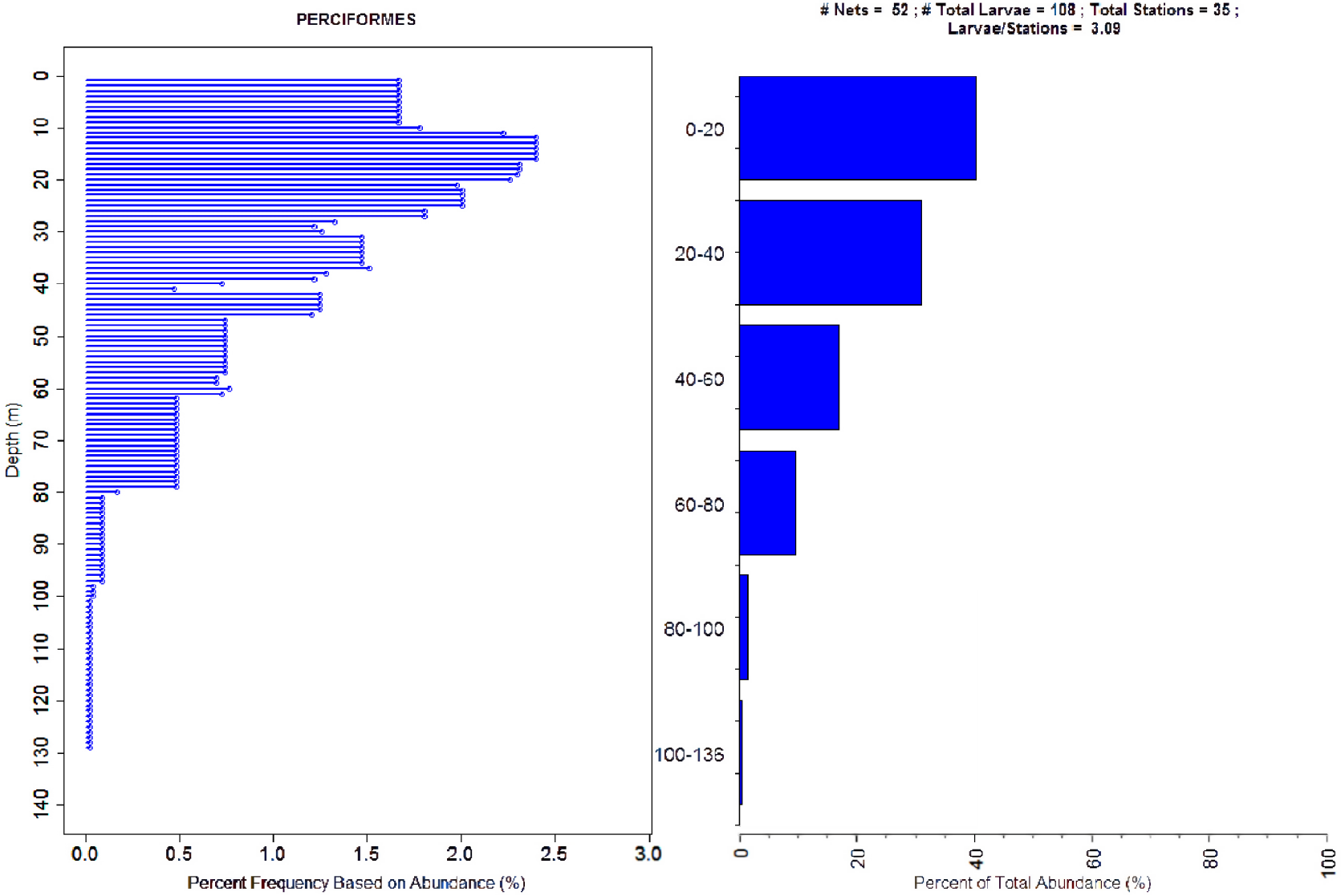
OSTRACIIDAE



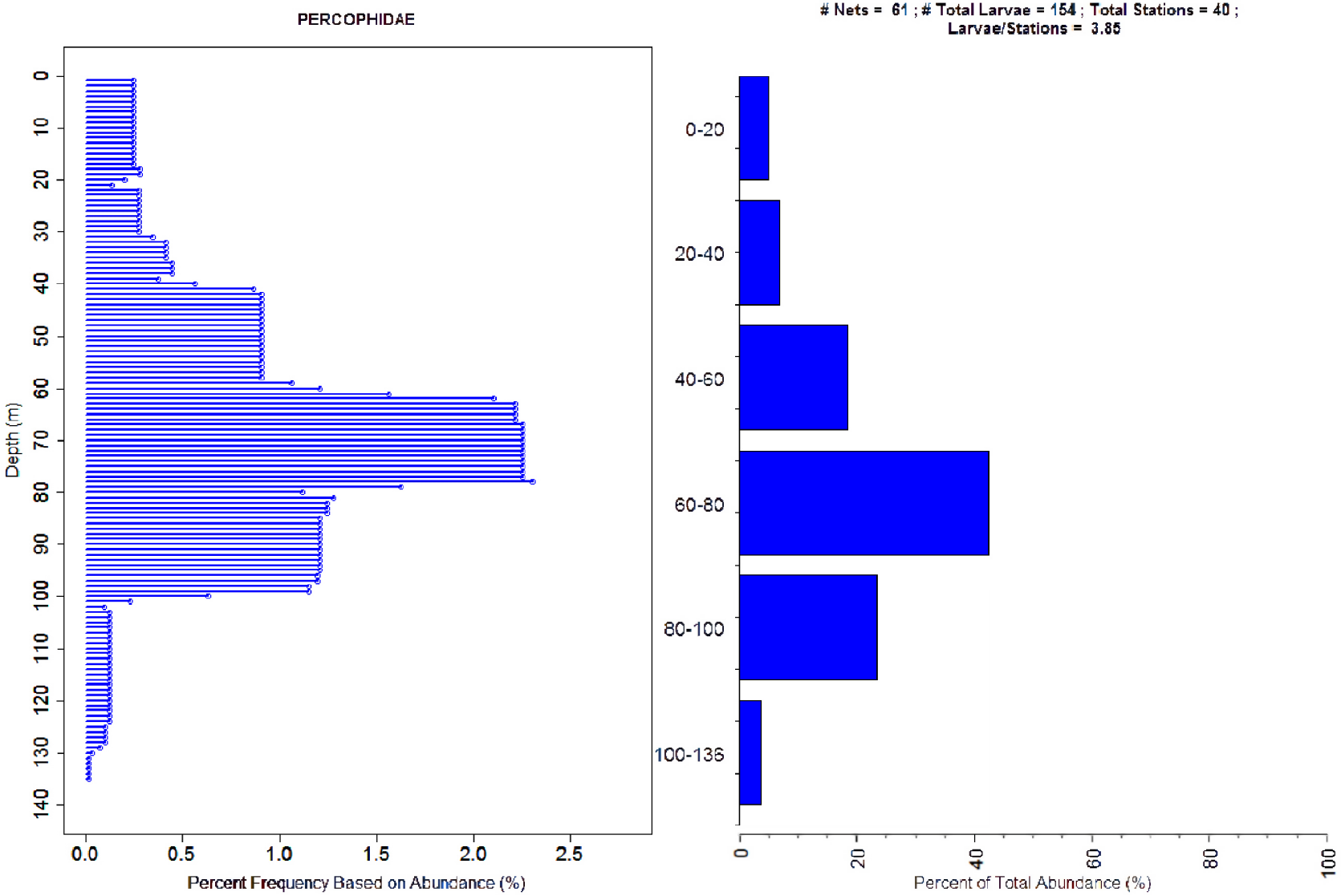
PARALEPIDIDAE



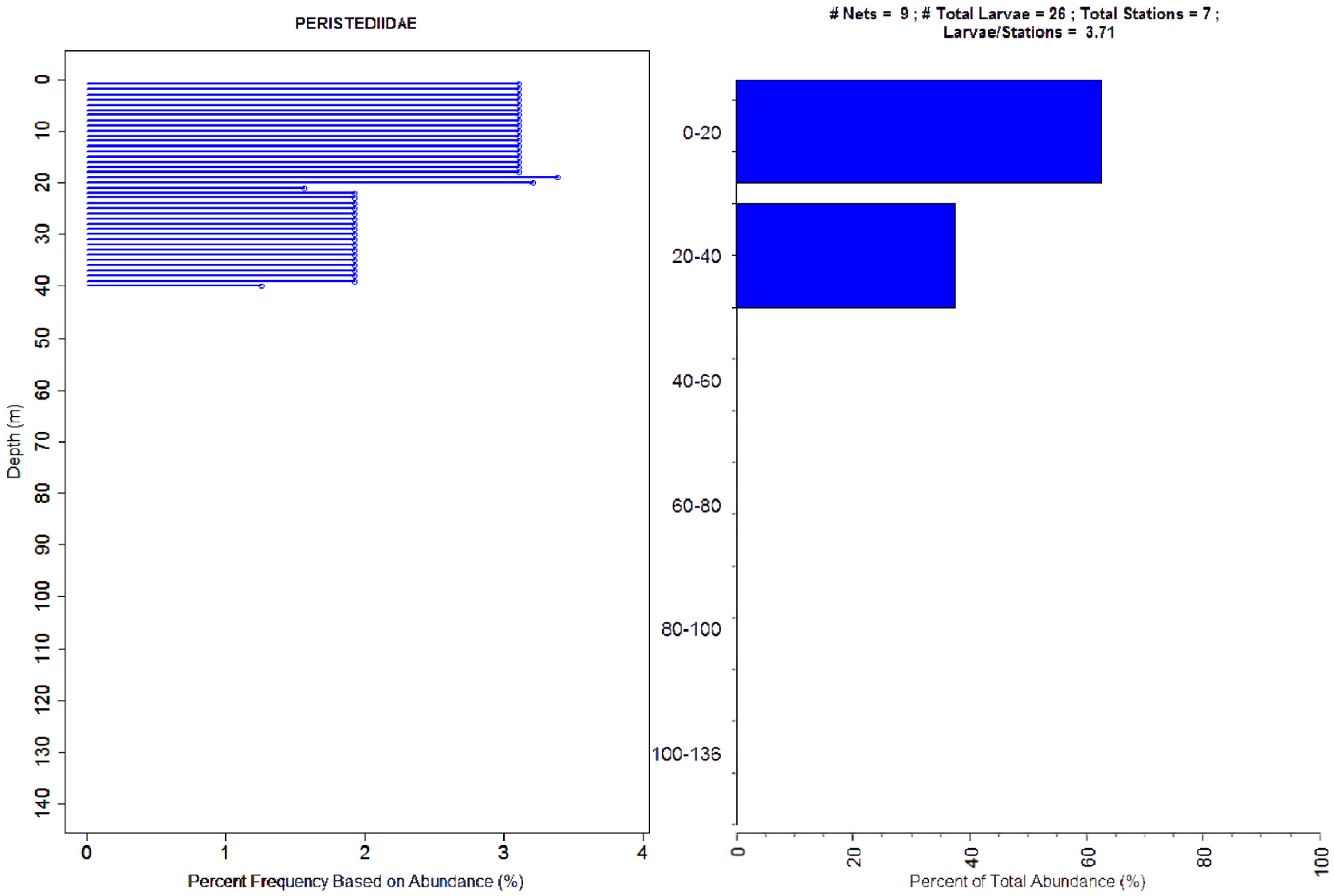
PARALICHTHYIDAE



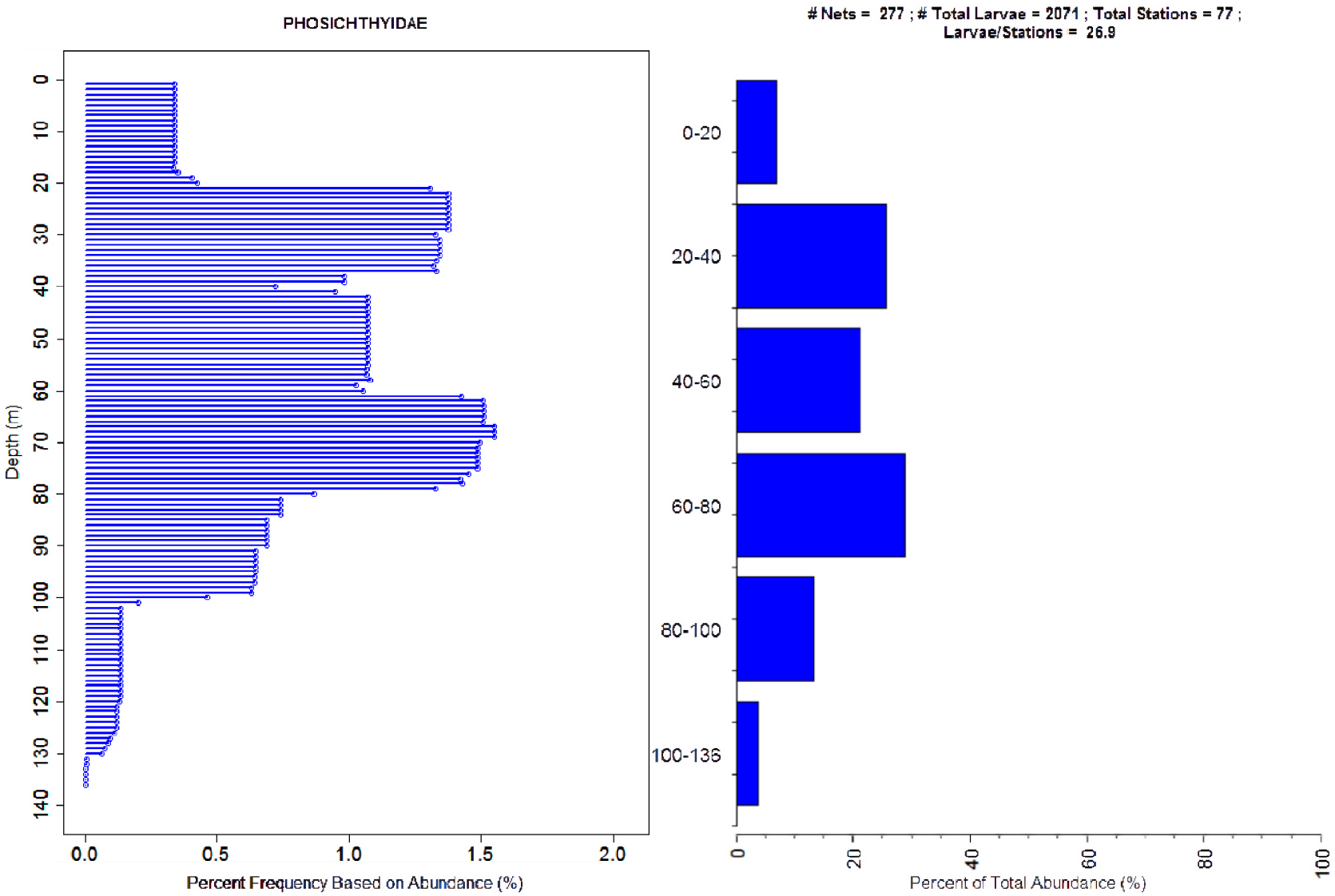
PERCIFORMES



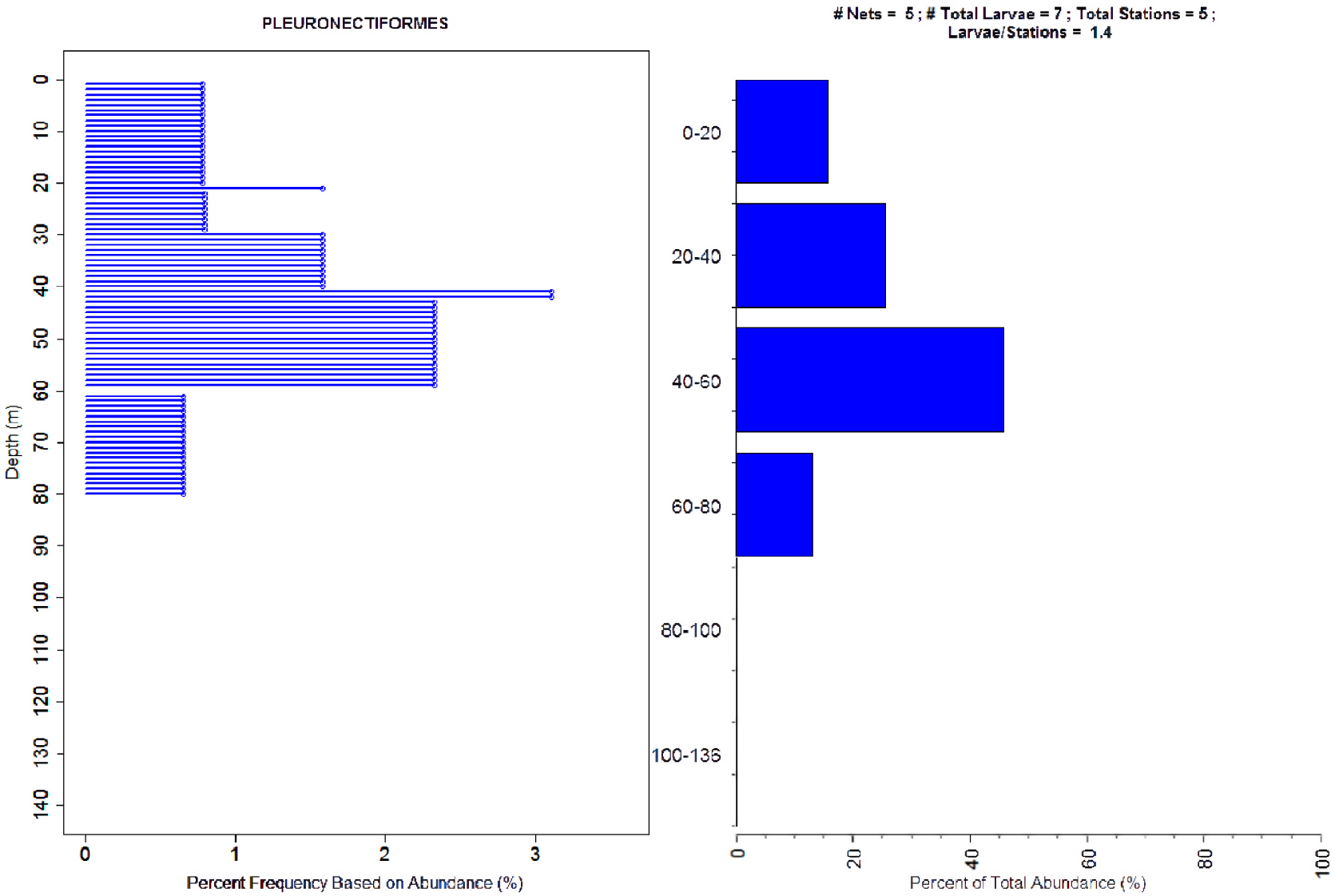
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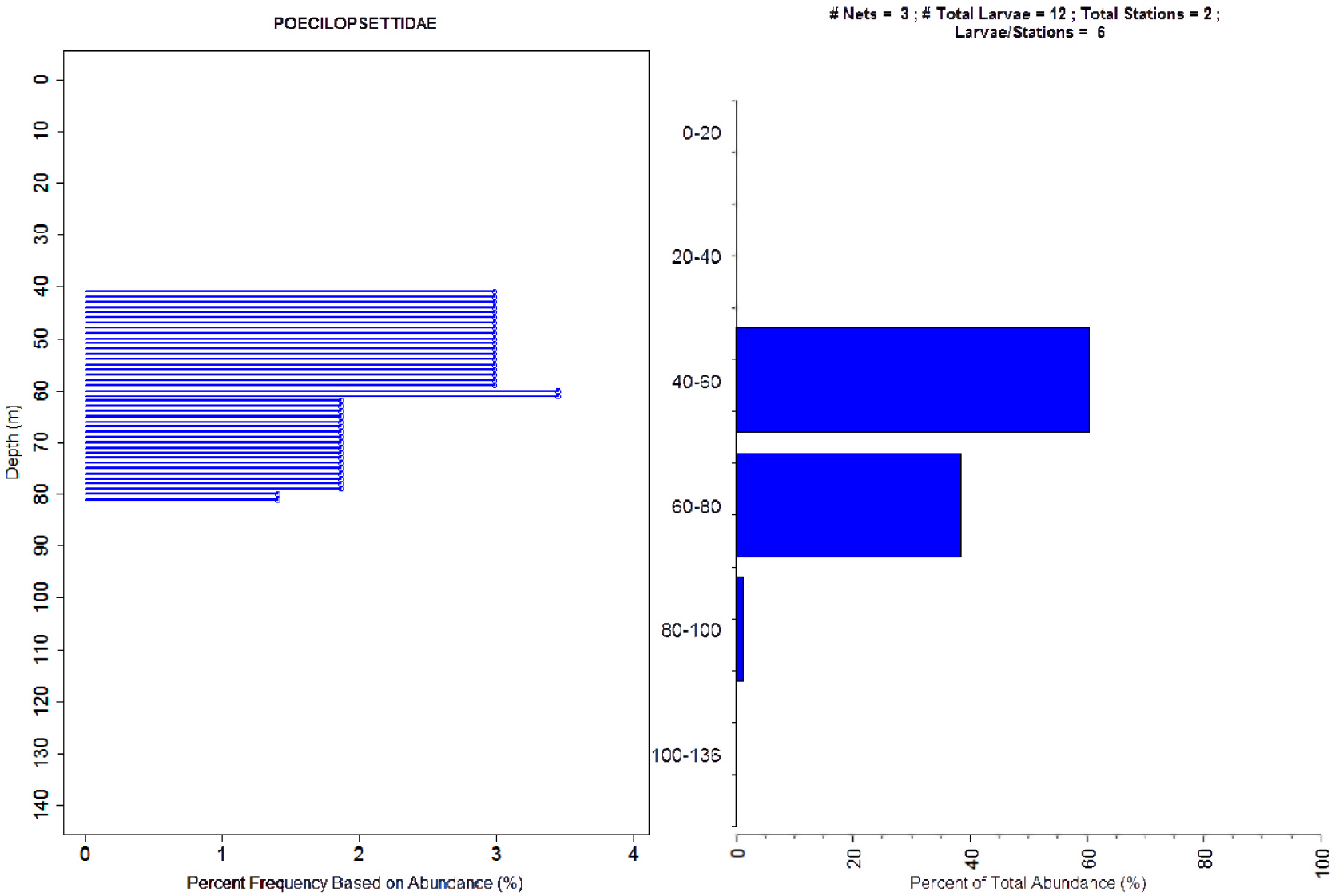
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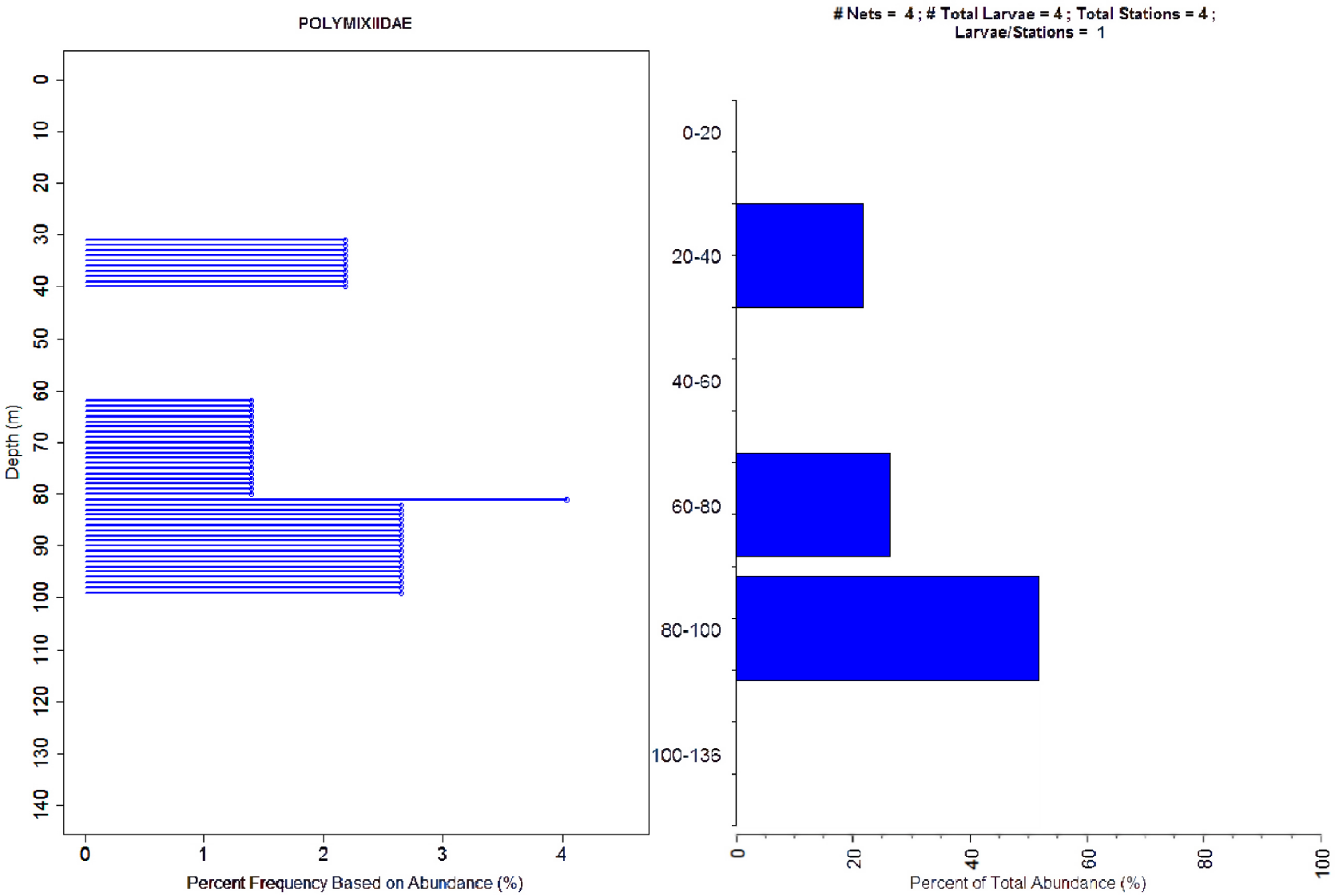
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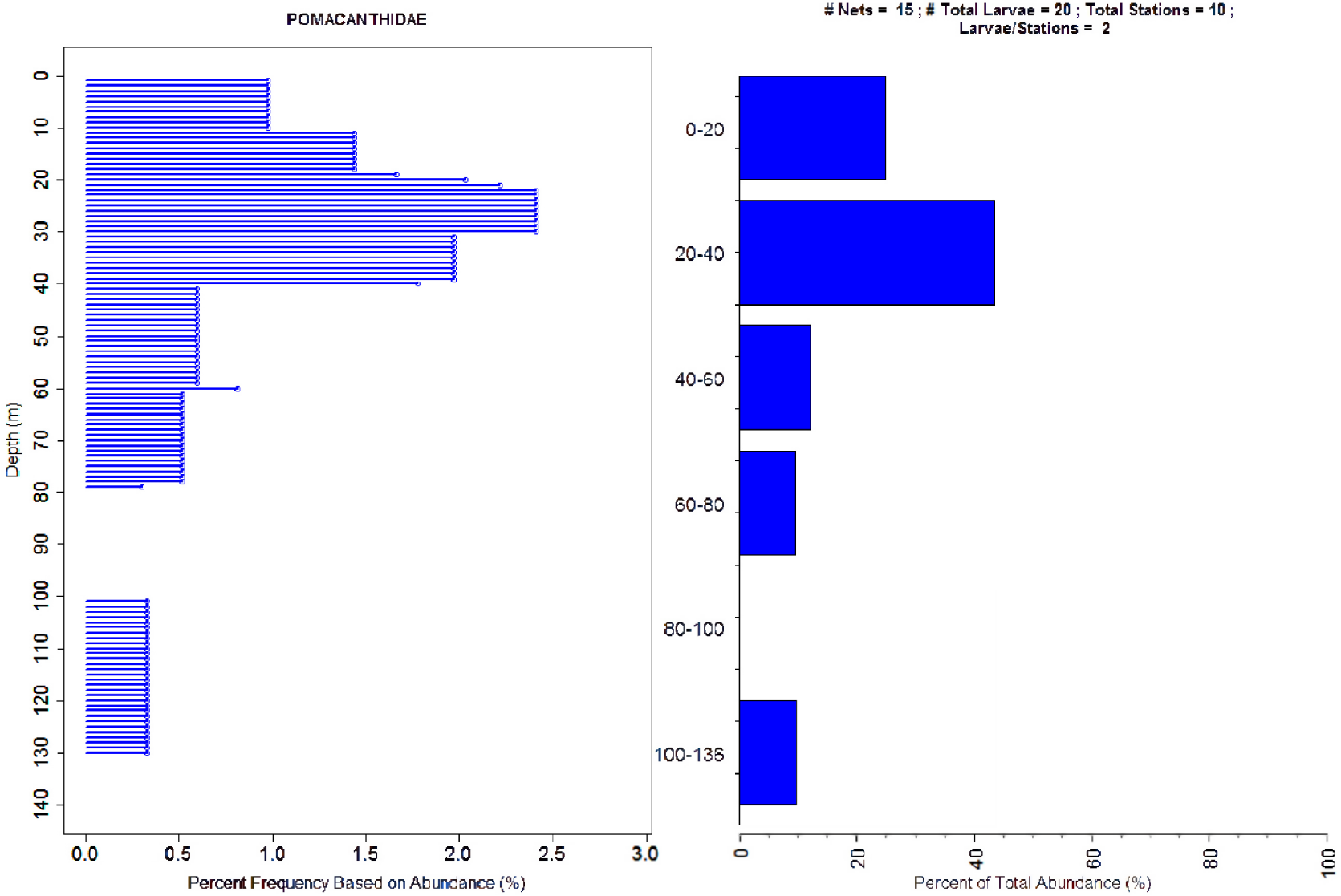
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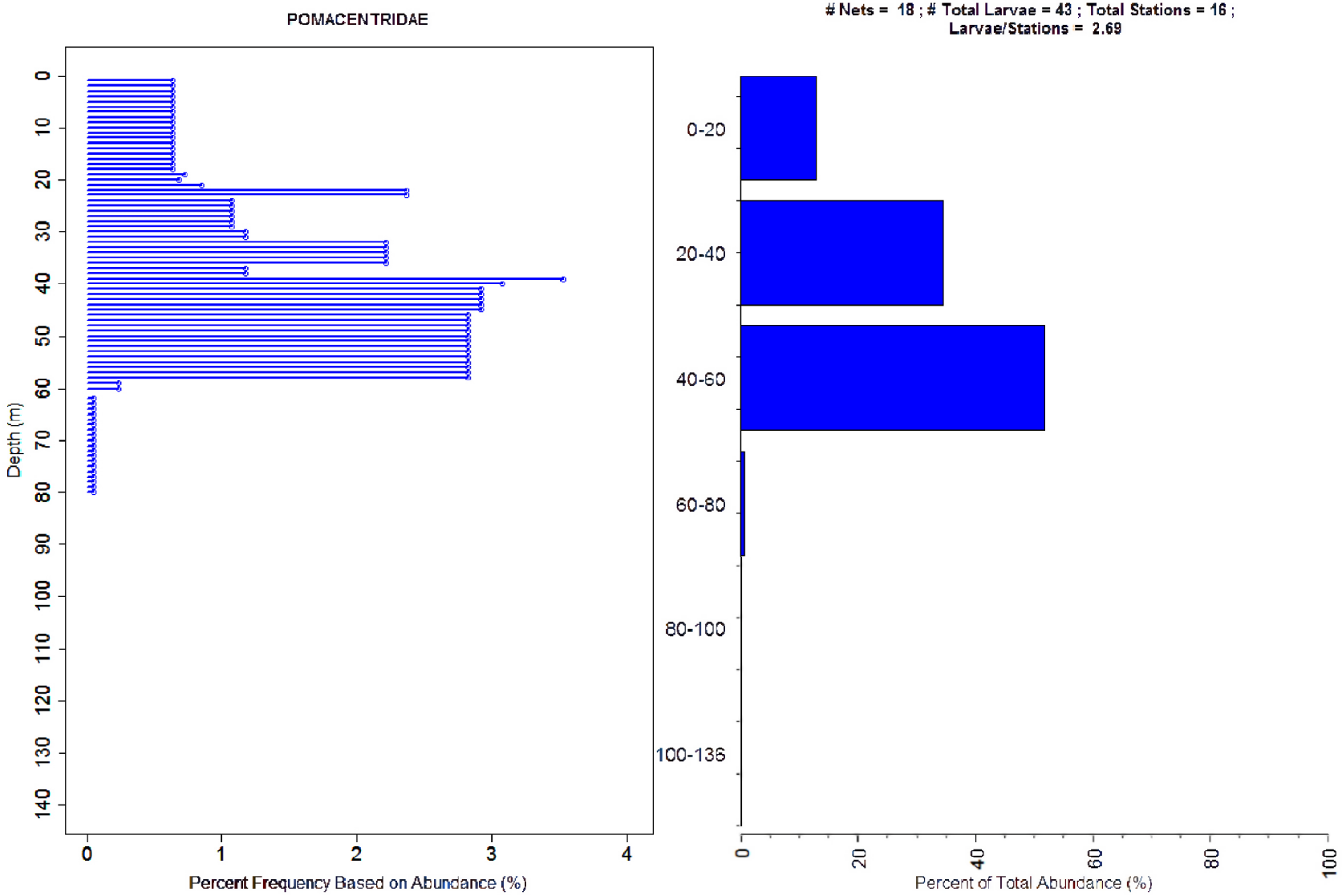
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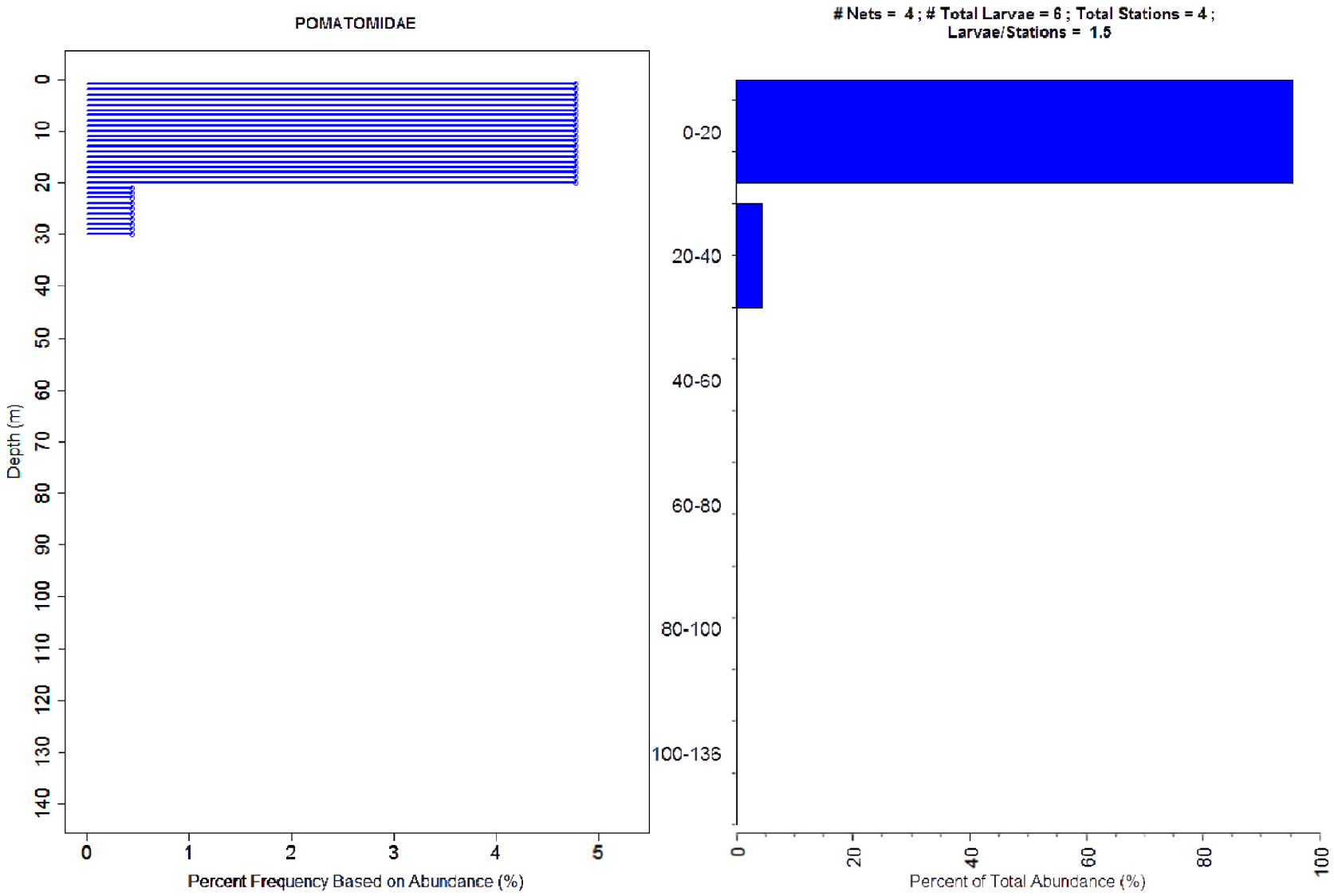
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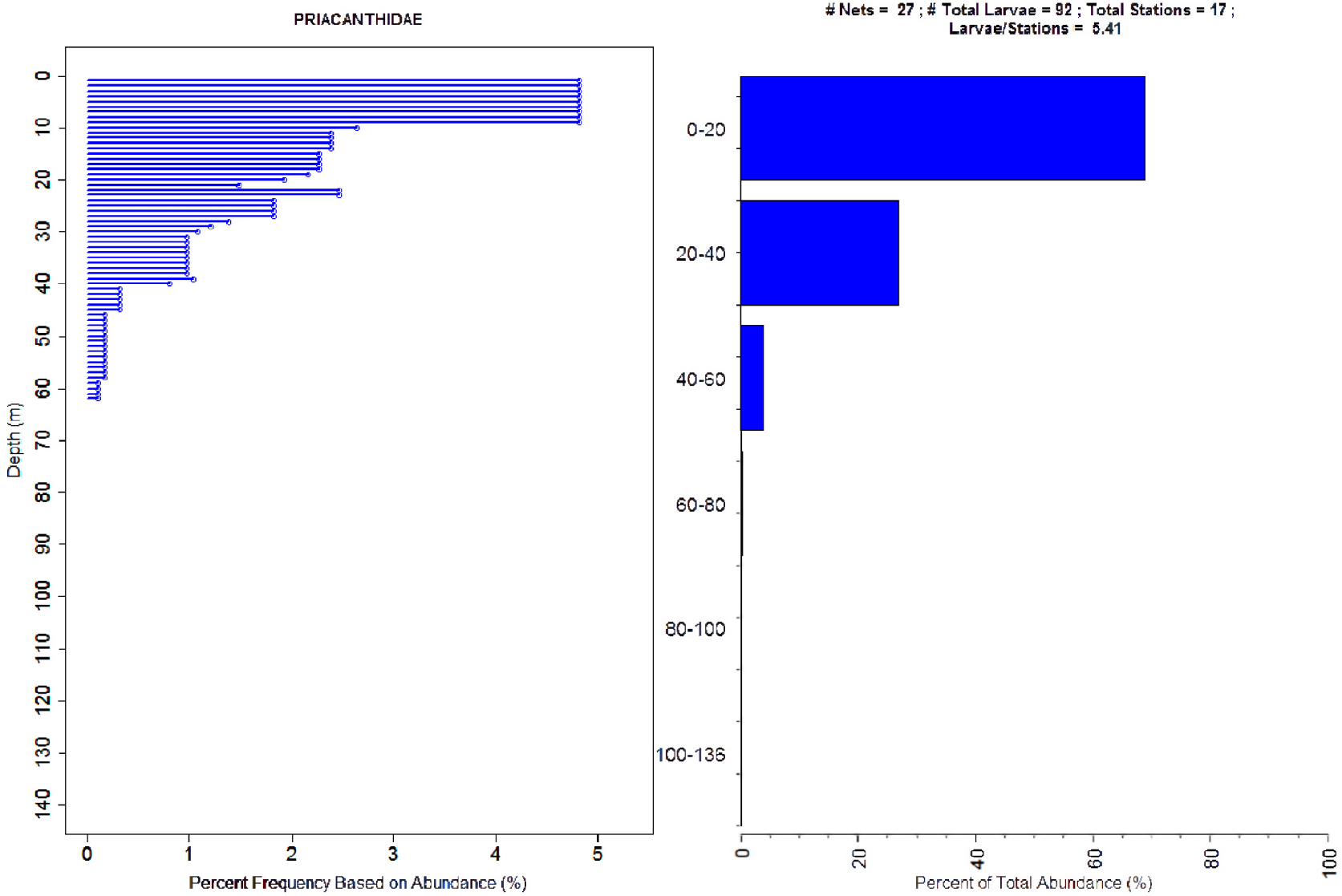
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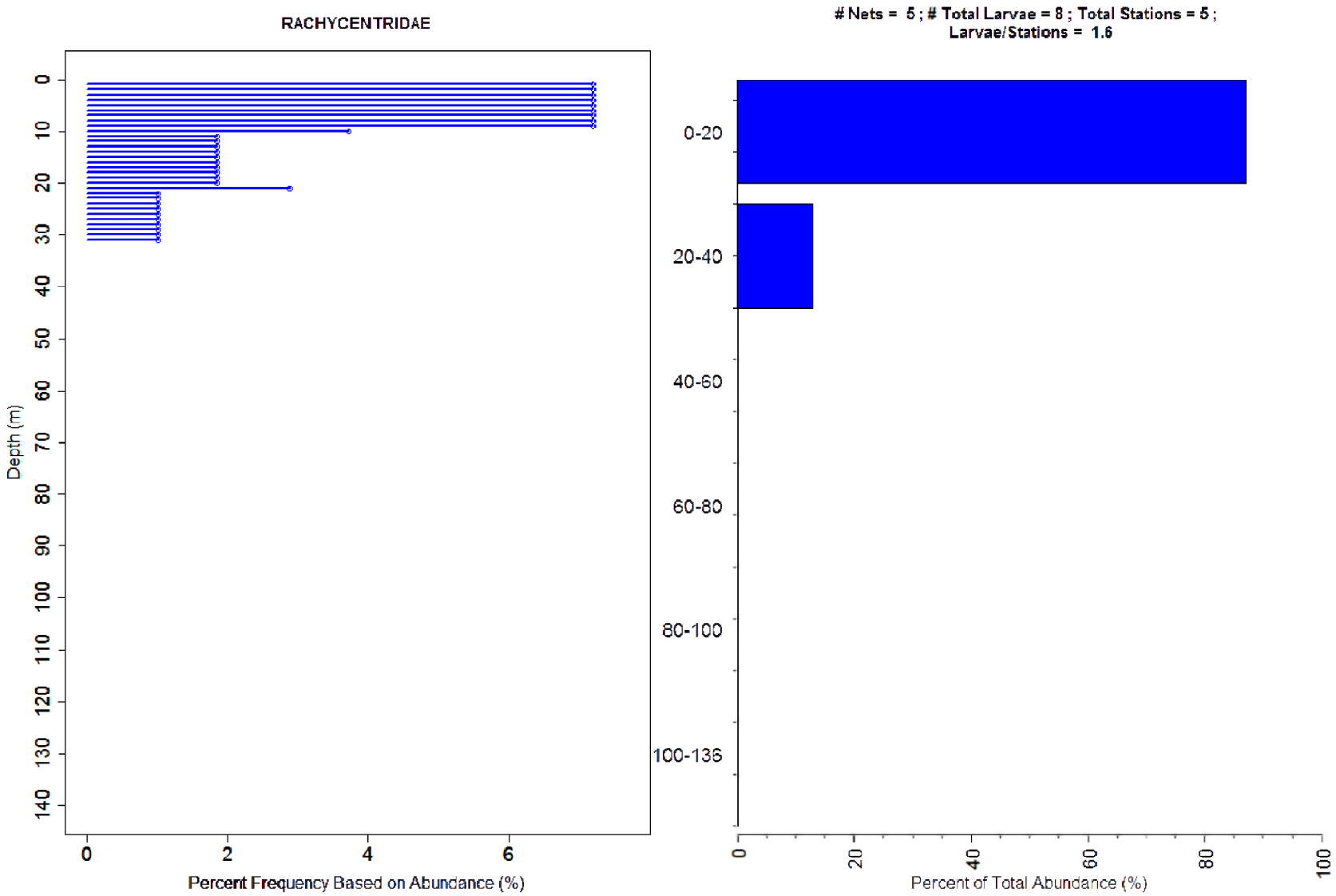
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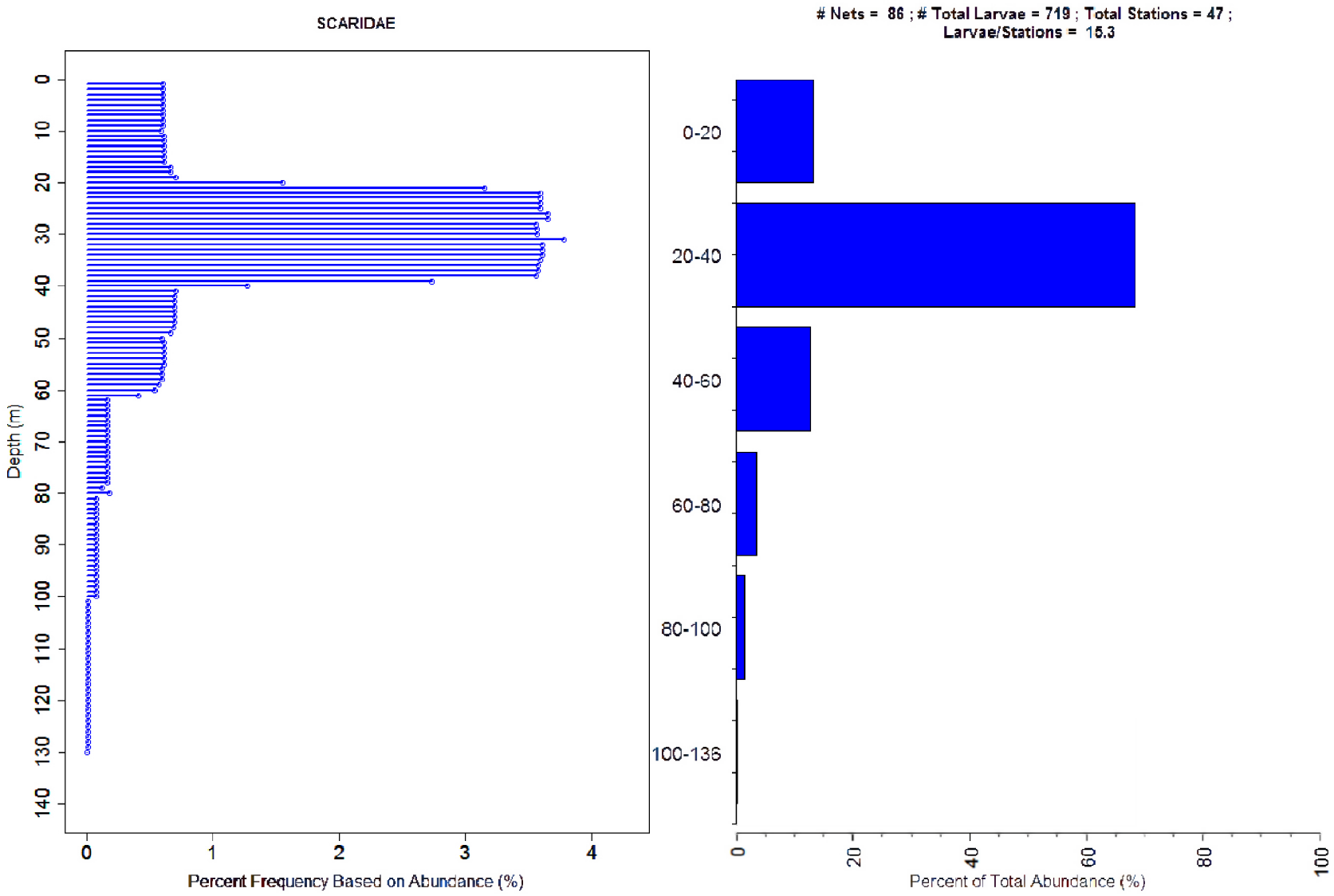
POMATOMIDAE



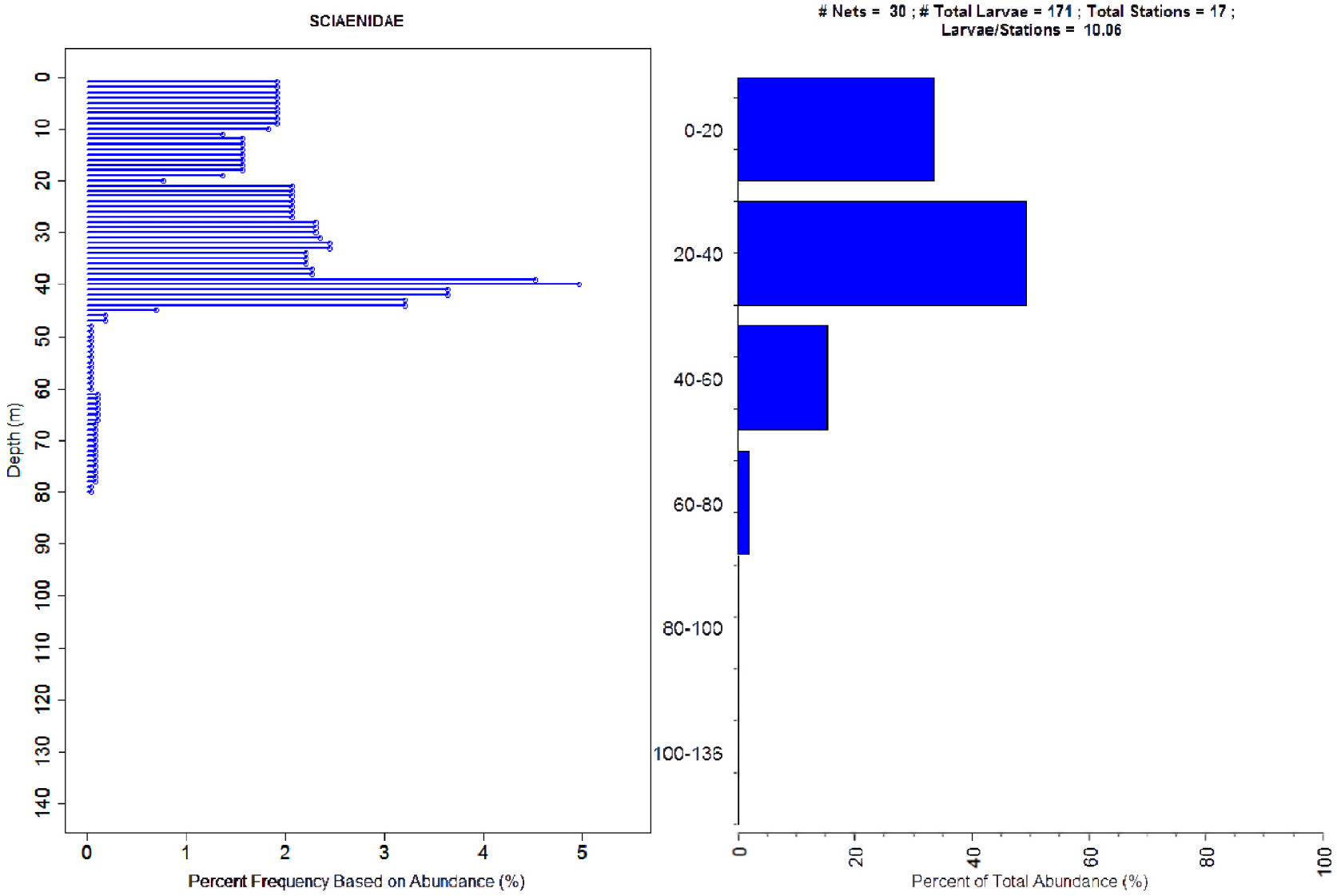
PRIACANTHIDAE



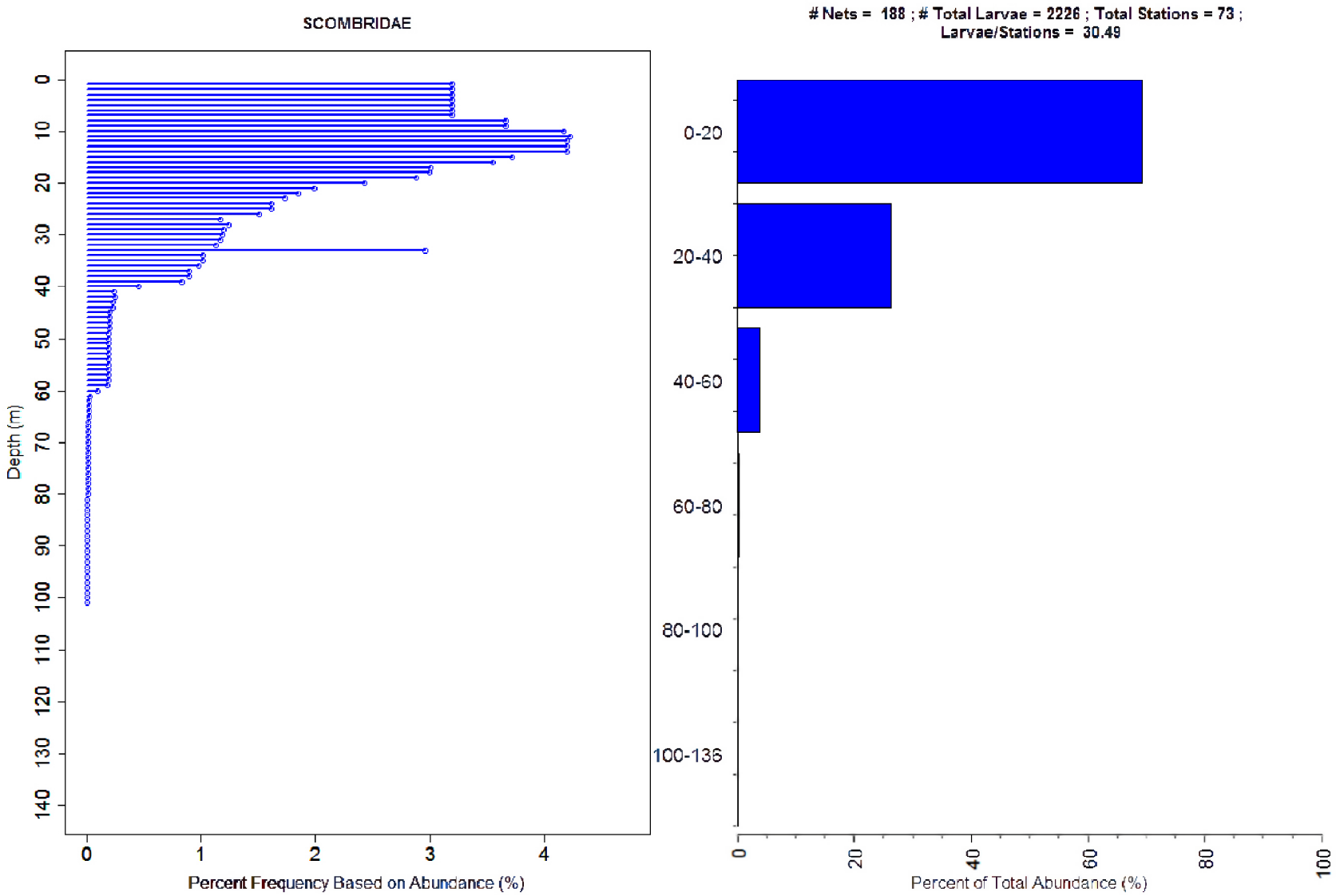
RACHYCENTRIDAE


SCARIDAE
Nets = 86 ; # Total Larvae = 719 ; Total Stations = 47 ;
Larvae/Stations = 15.3
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

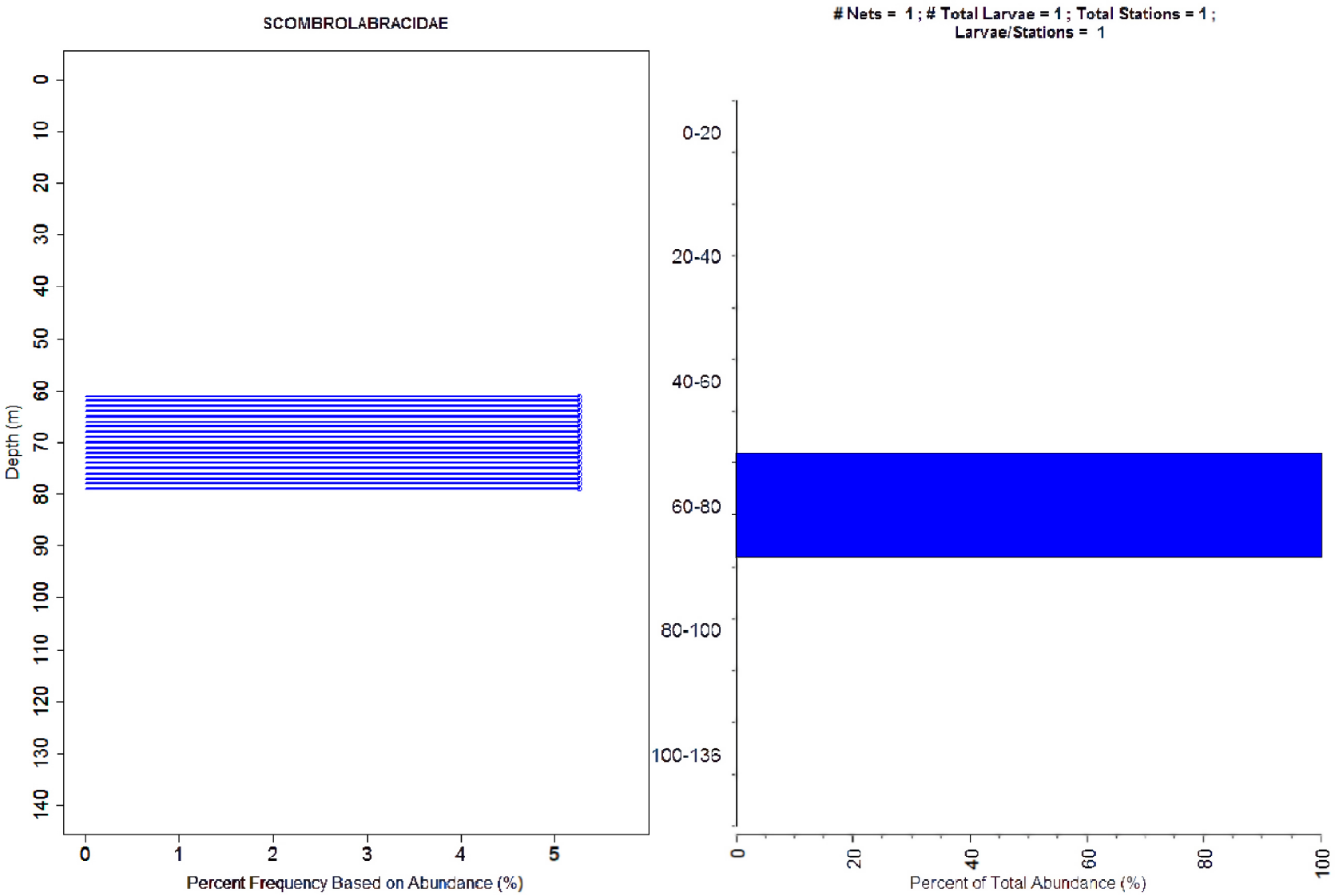
SCARIDAE


SCIAENIDAE
Nets = 30 ; # Total Larvae = 171 ; Total Stations = 17 ;
Larvae/Stations = 10.06
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

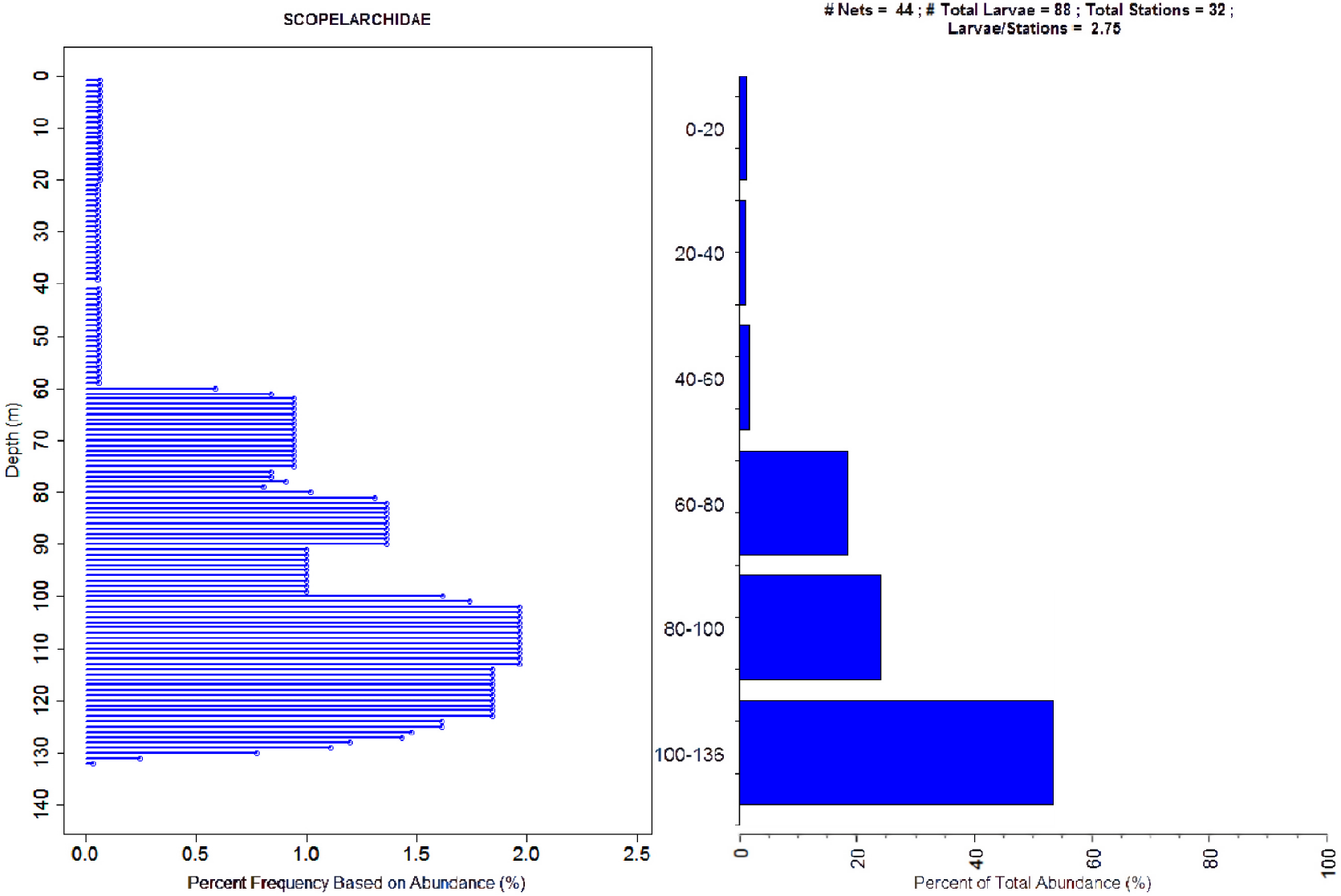
SCIAENIDAE


SCOMBRIDAE
Nets = 188 ; # Total Larvae = 2226 ; Total Stations = 73 ;
Larvae/Stations = 30.49
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

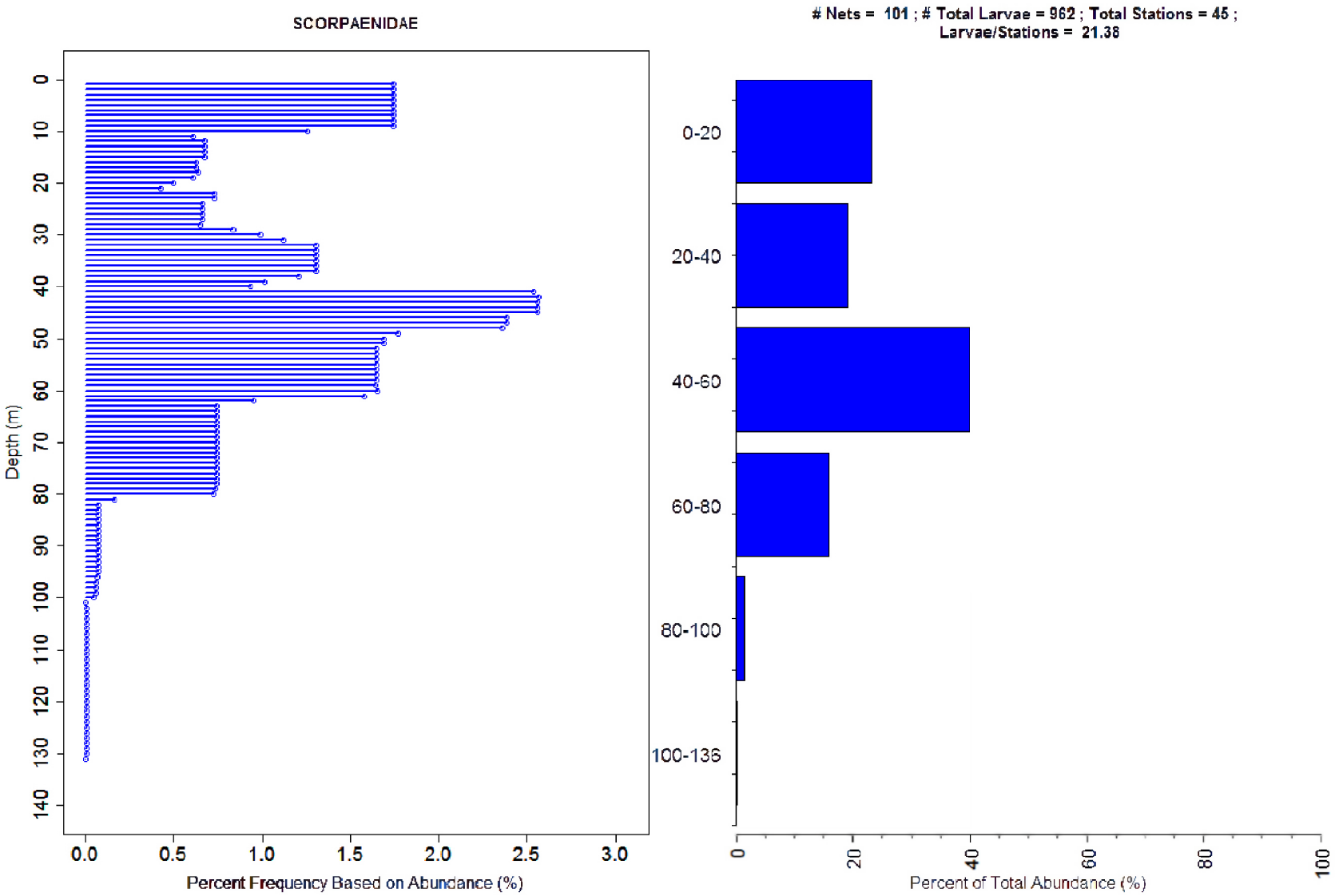
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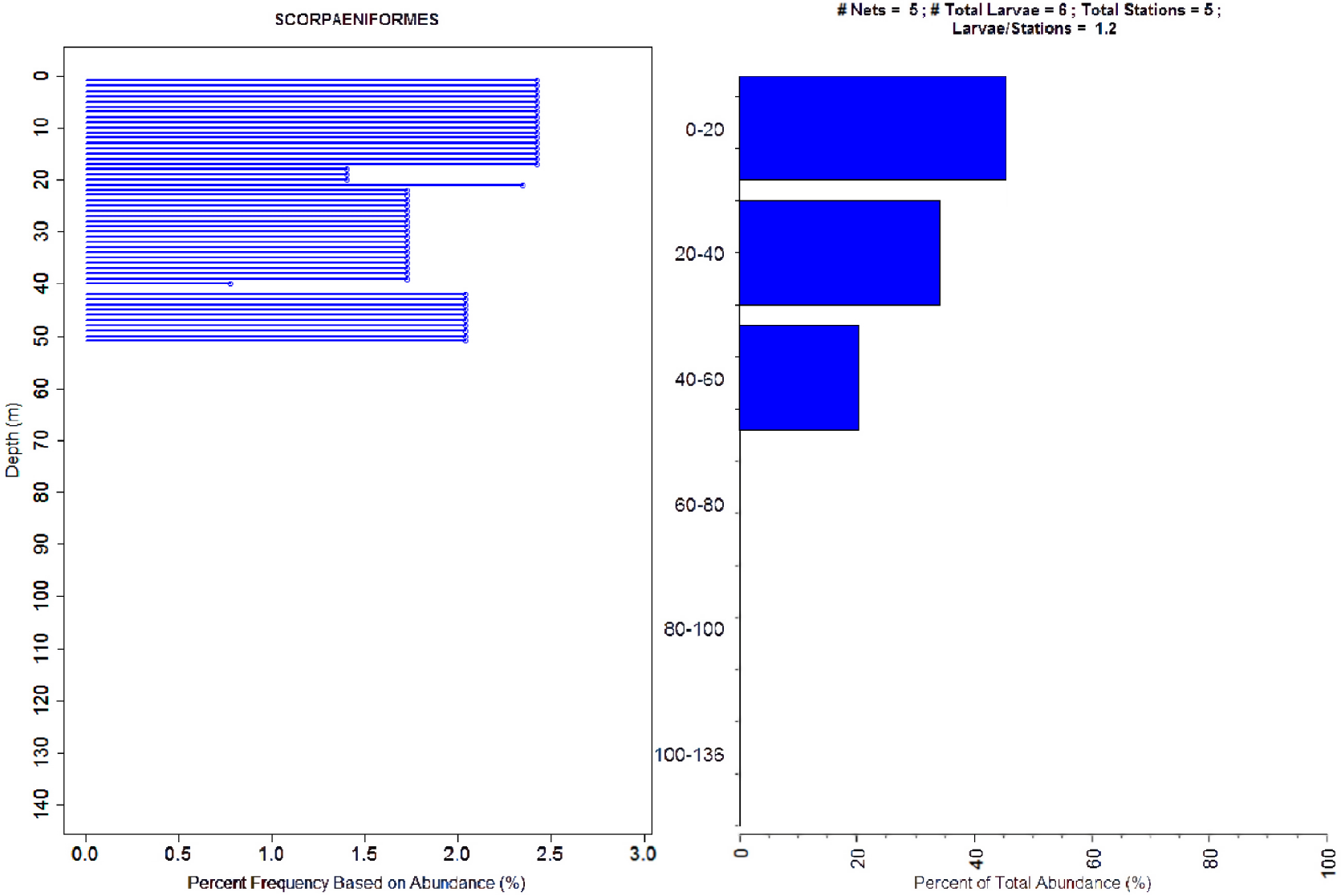
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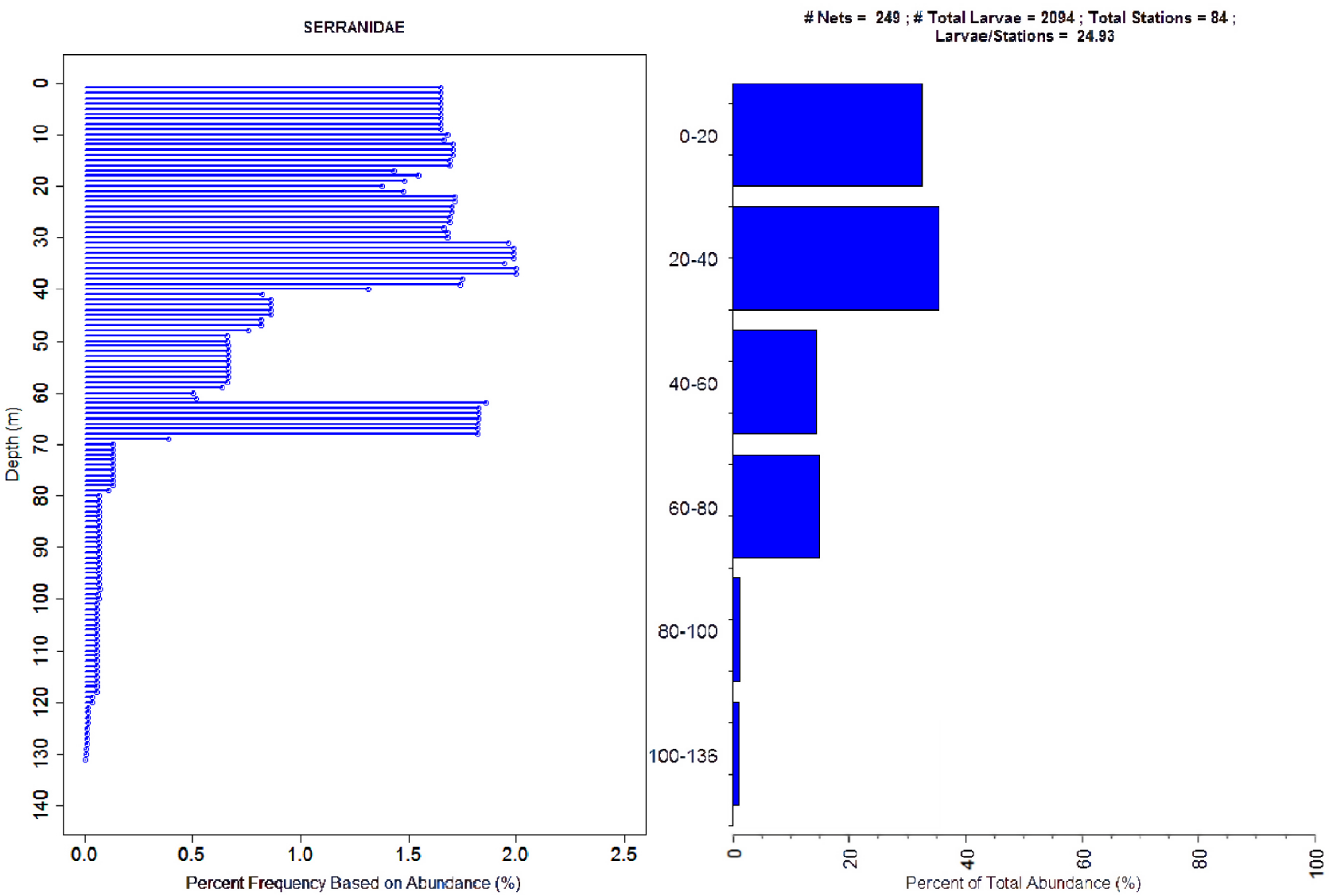
SCOPELARCHIDAE



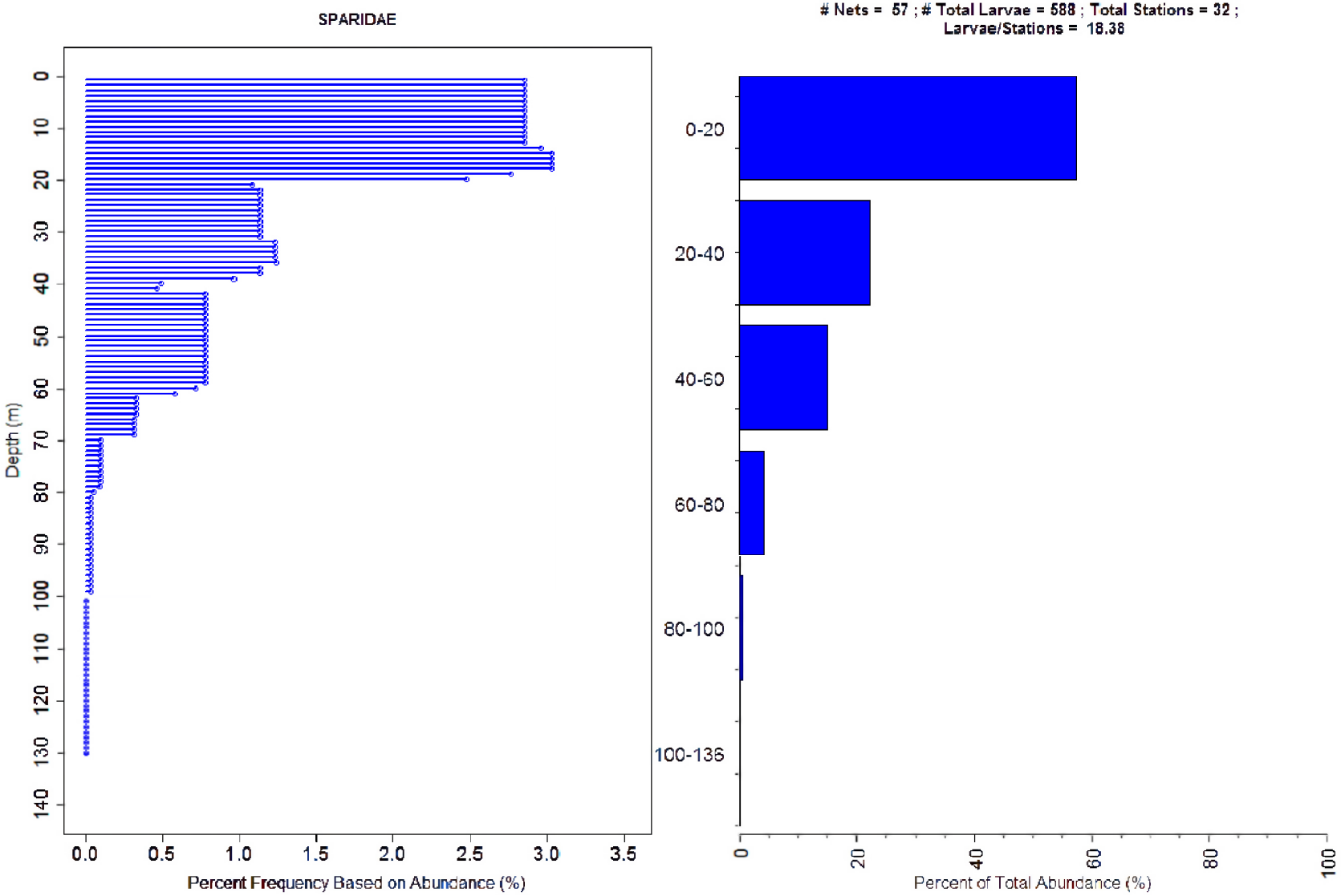
SCORPAENIDAE



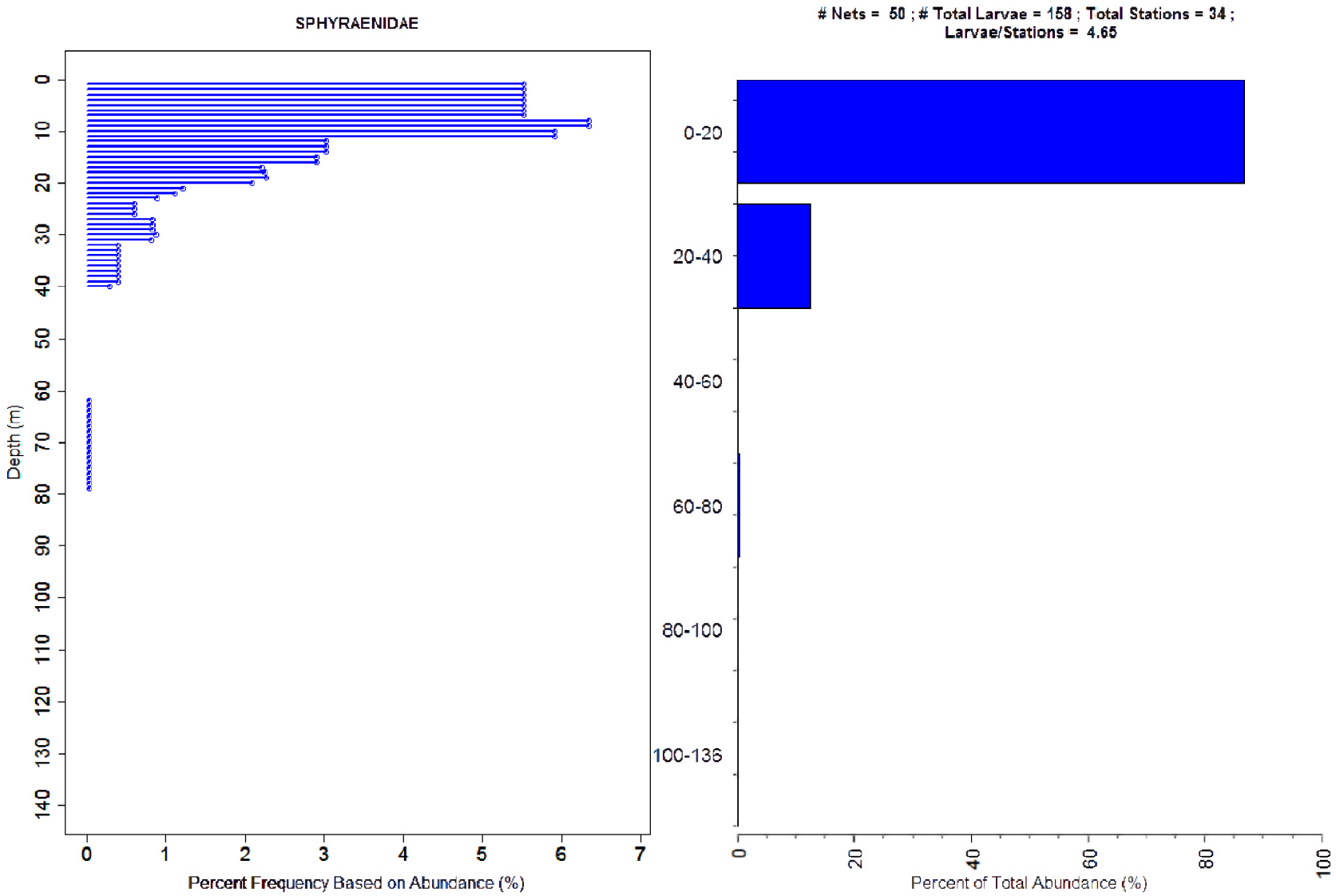
SCORPAENIFORMES


SERRANIDAE
Nets = 249 ; # Total Larvae = 2094 ; Total Stations = 84 ;
Larvae/Stations = 24.93
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

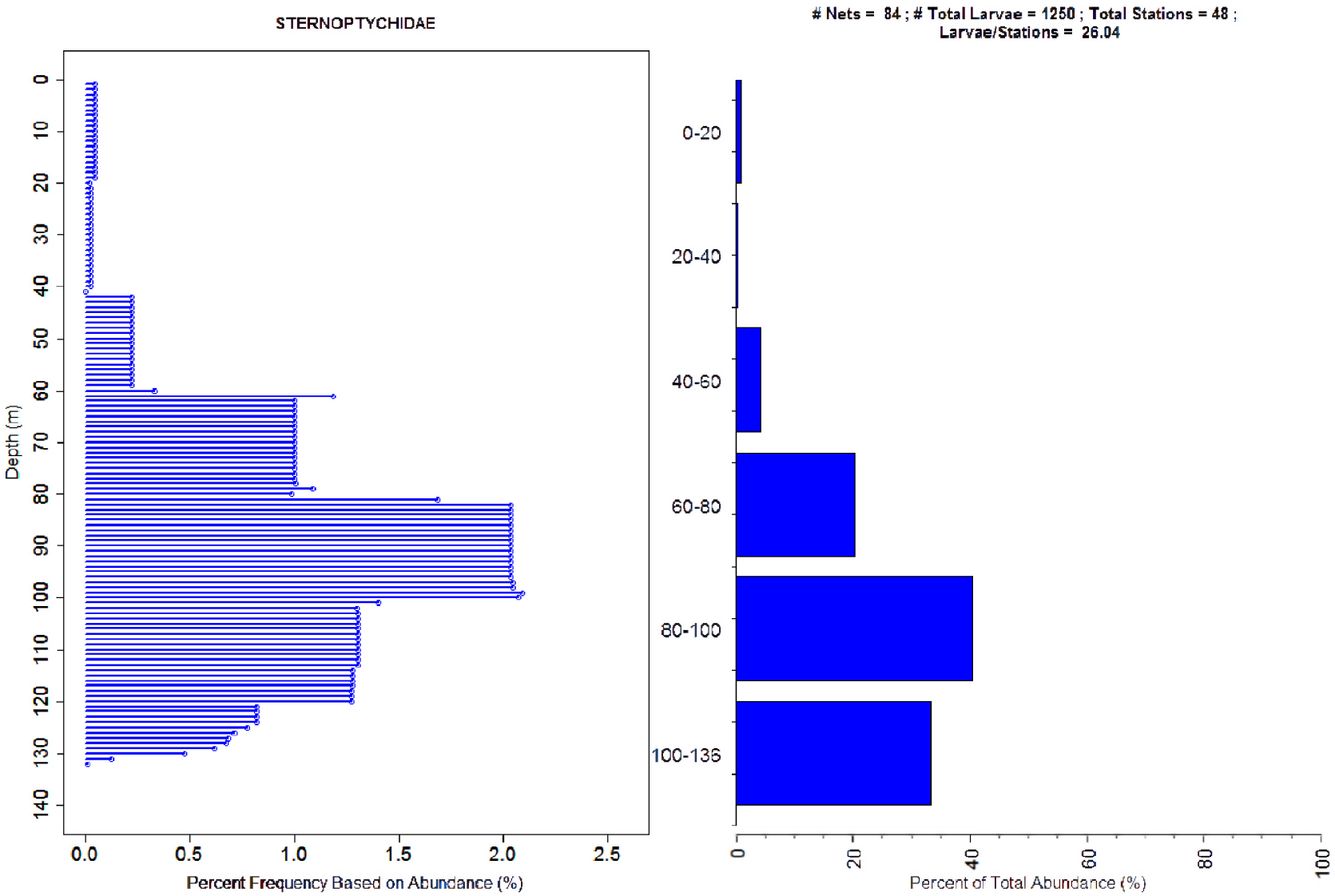
SERRANIDAE


SPARIDAE
Nets = 57 ; # Total Larvae = 588 ; Total Stations = 32 ;
Larvae/Stations = 18.38
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

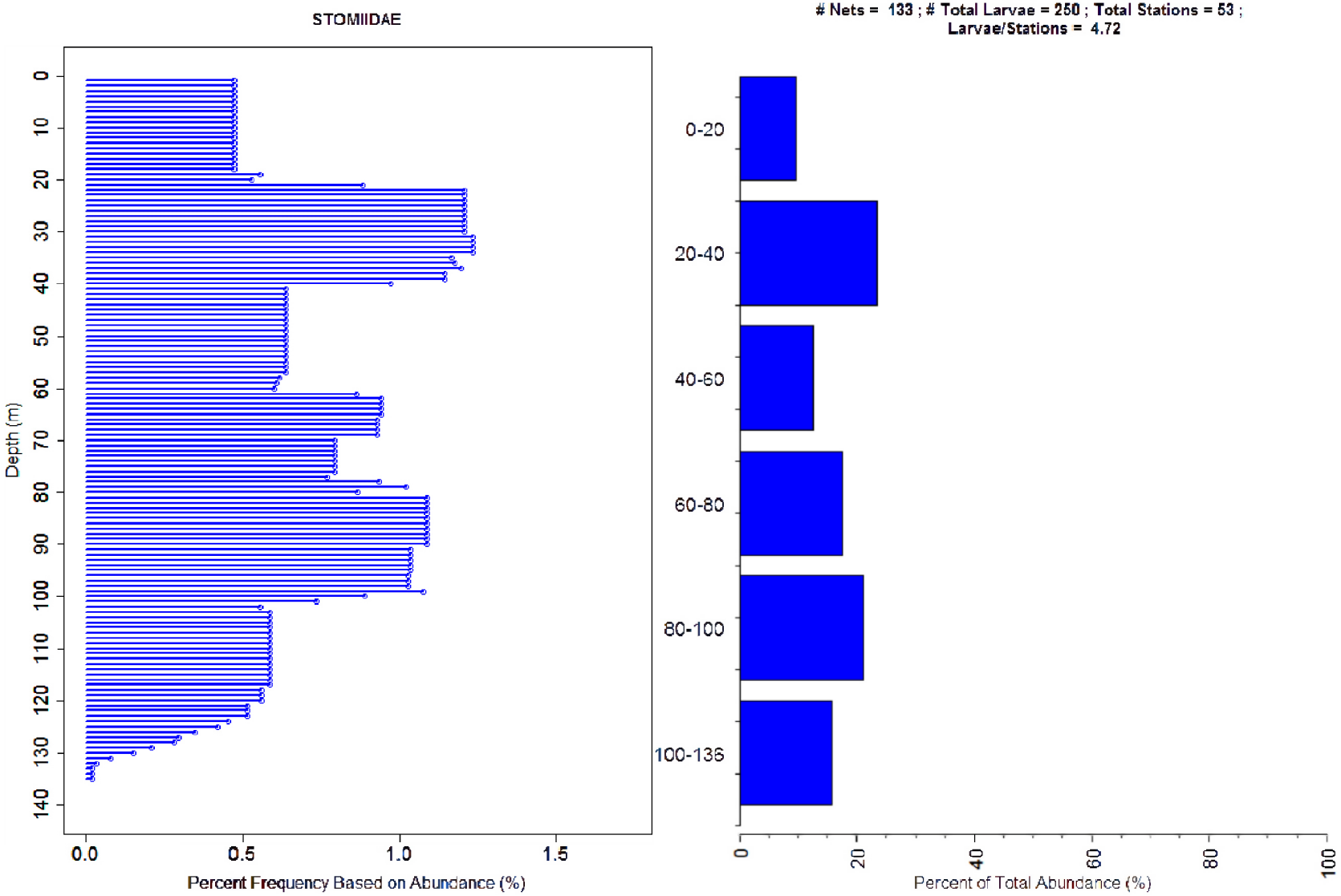
SPARIDAE



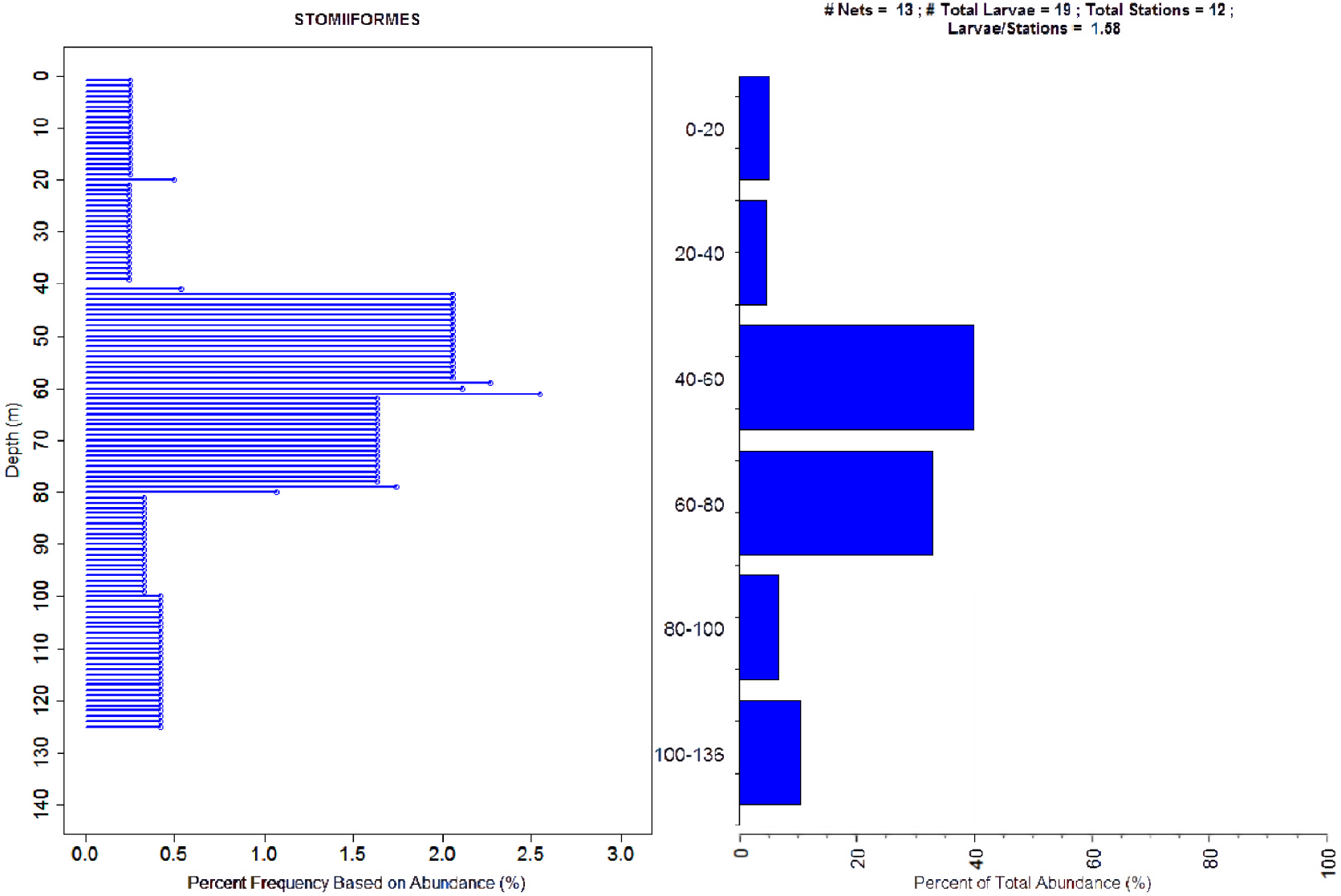
SPHYRAENIDAE



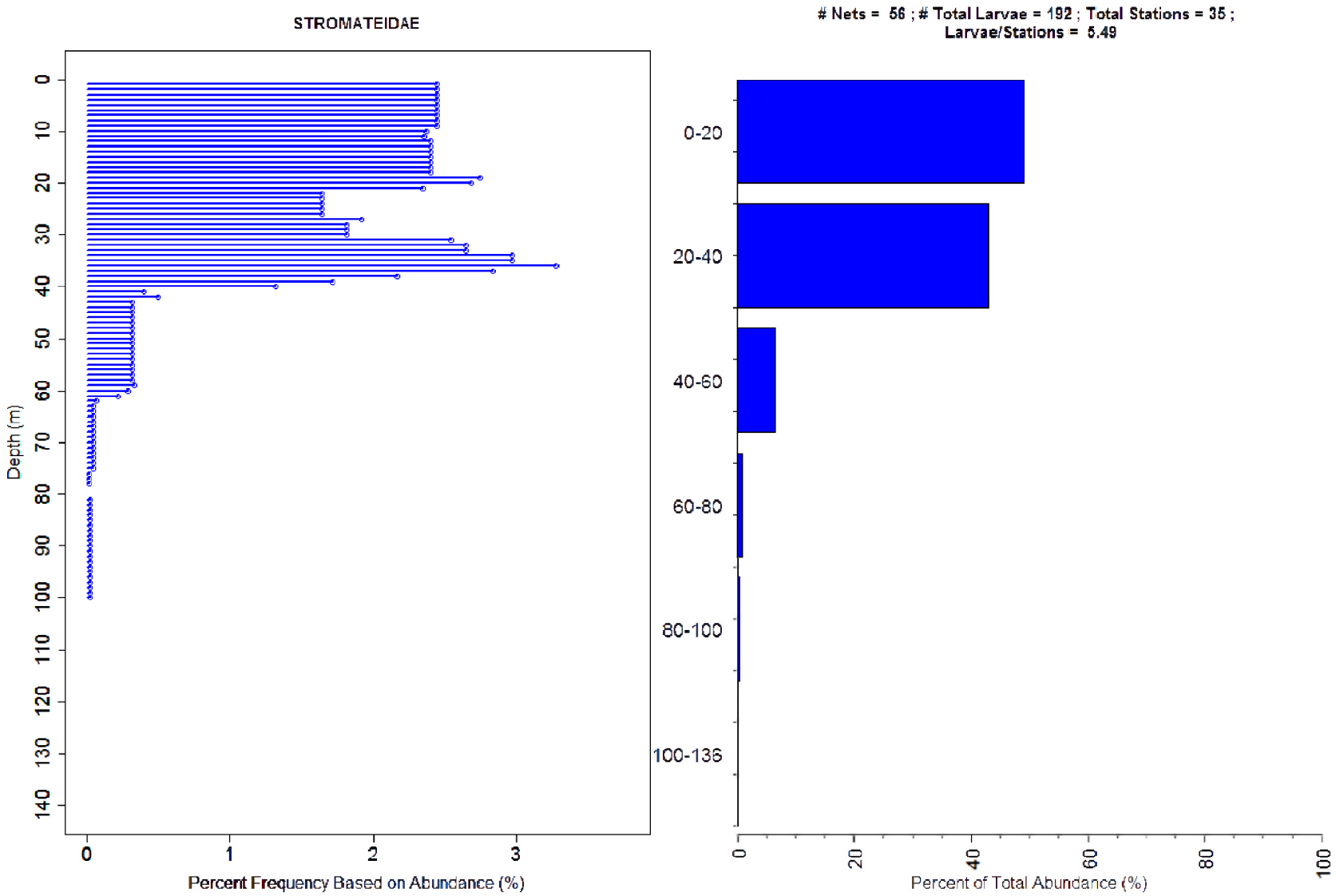
STERNOPTYCHIDAE


STOMIIDAE
Nets = 133 ; # Total Larvae = 250 ; Total Stations = 53 ;
Larvae/Stations = 4.72
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

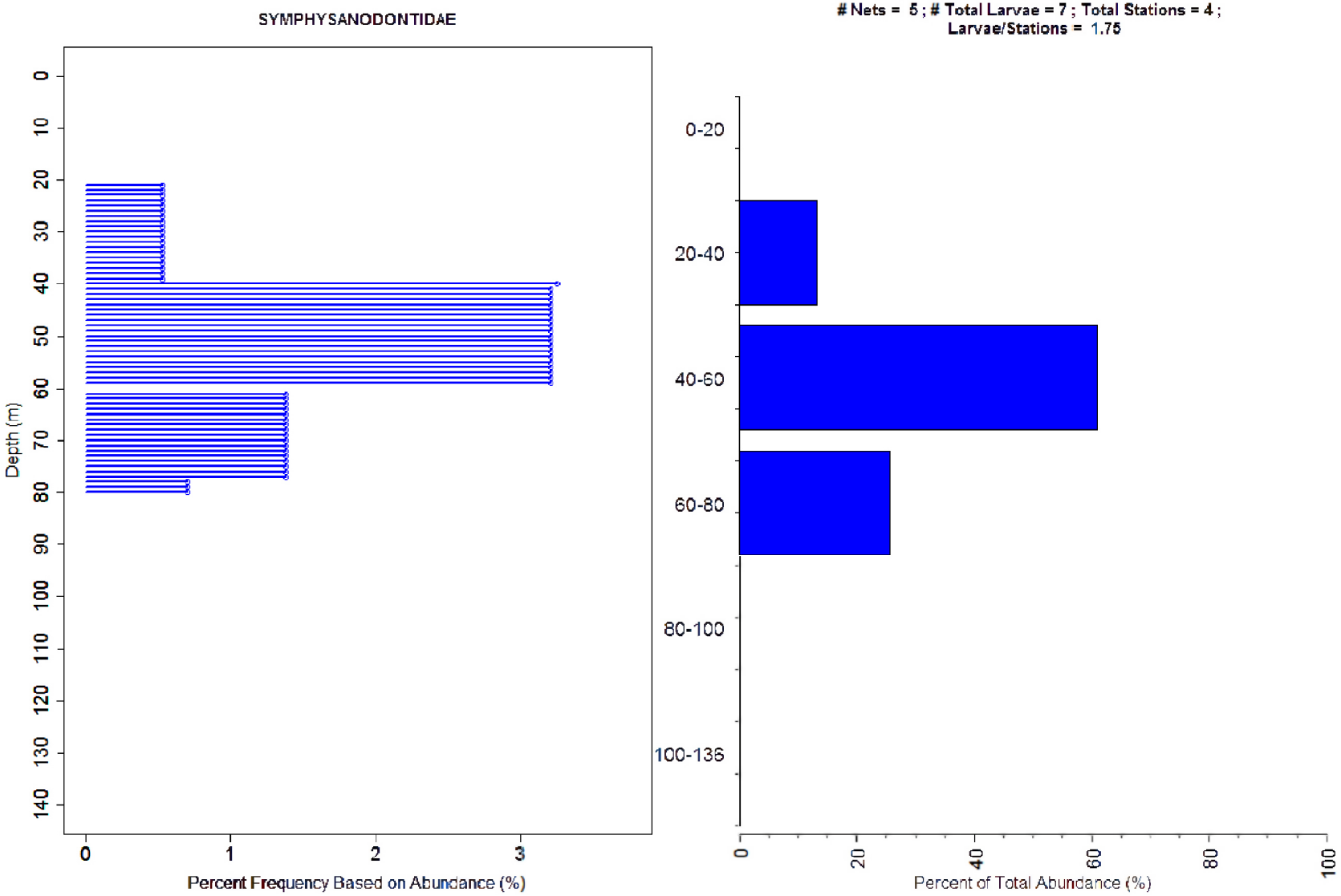
STOMIIDAE



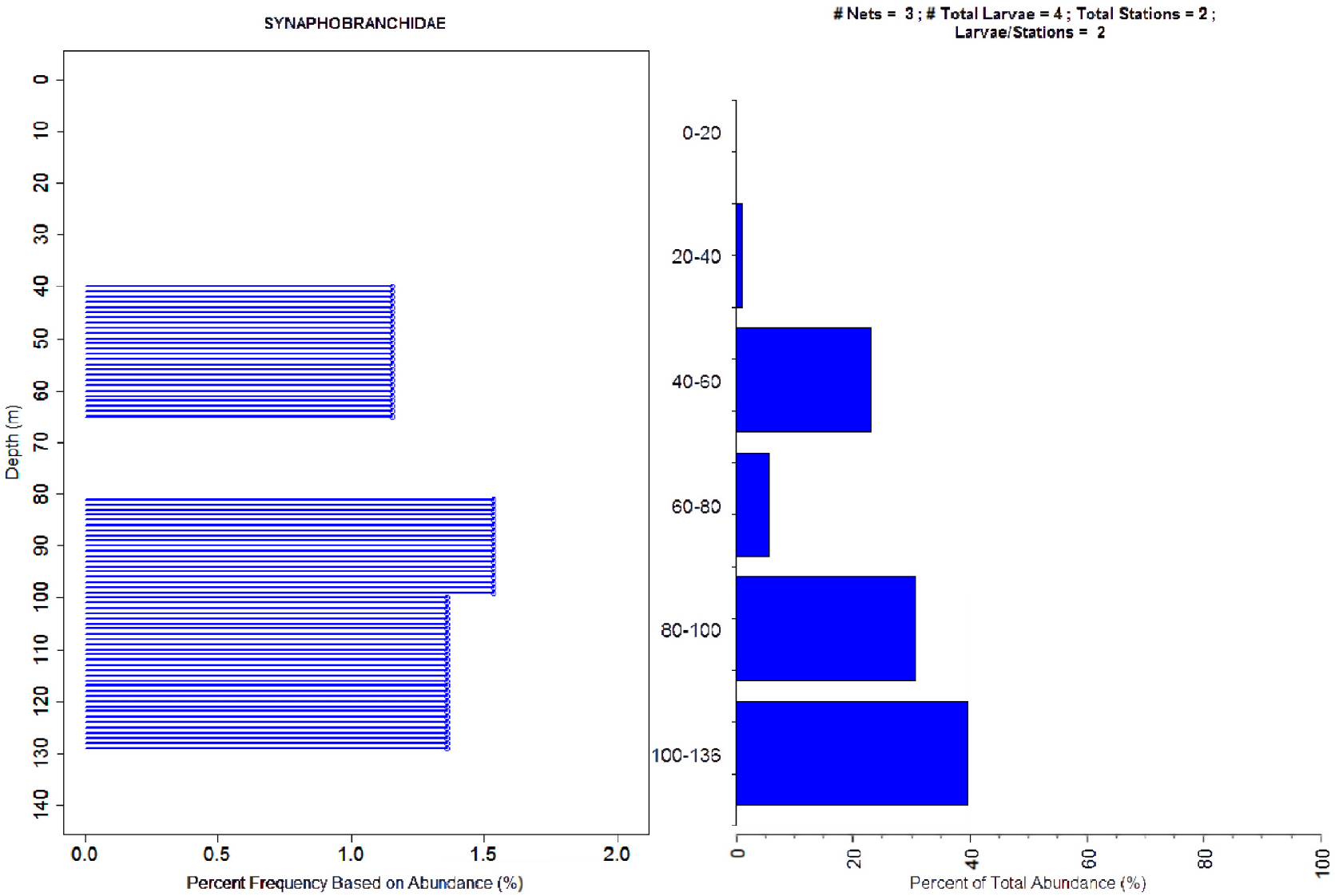
STOMIIFORMES



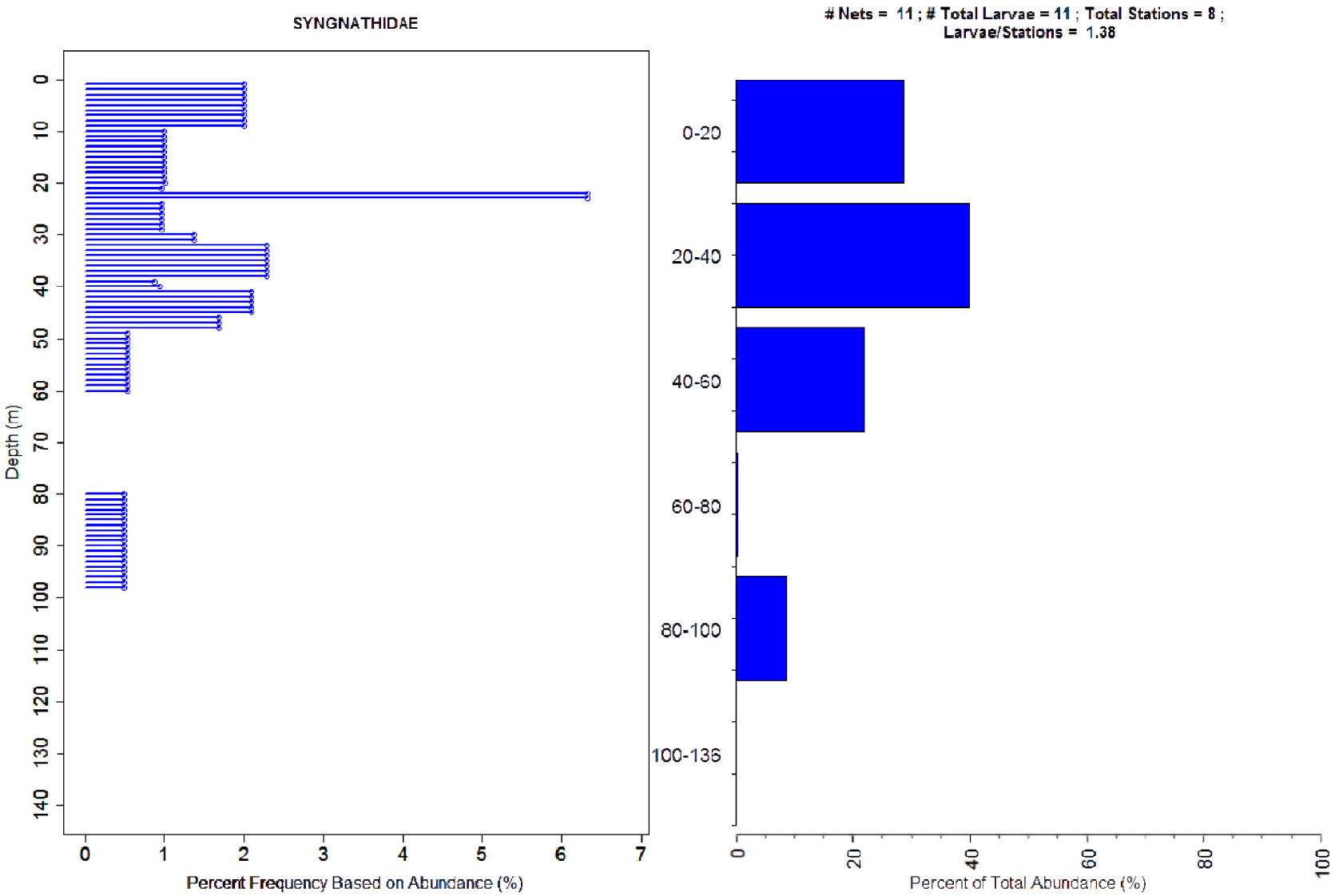
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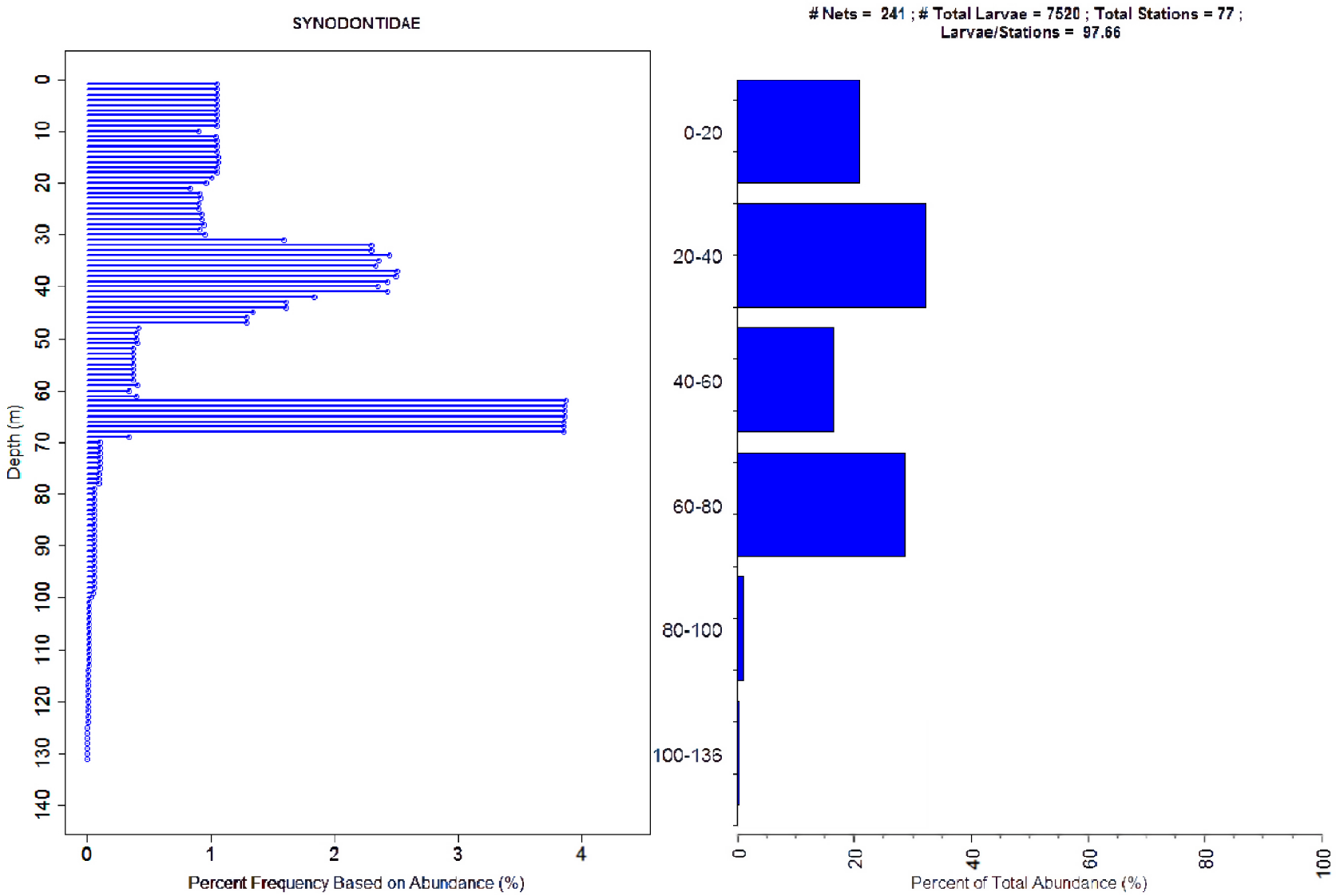
SYMPHYSANODONTIDAE



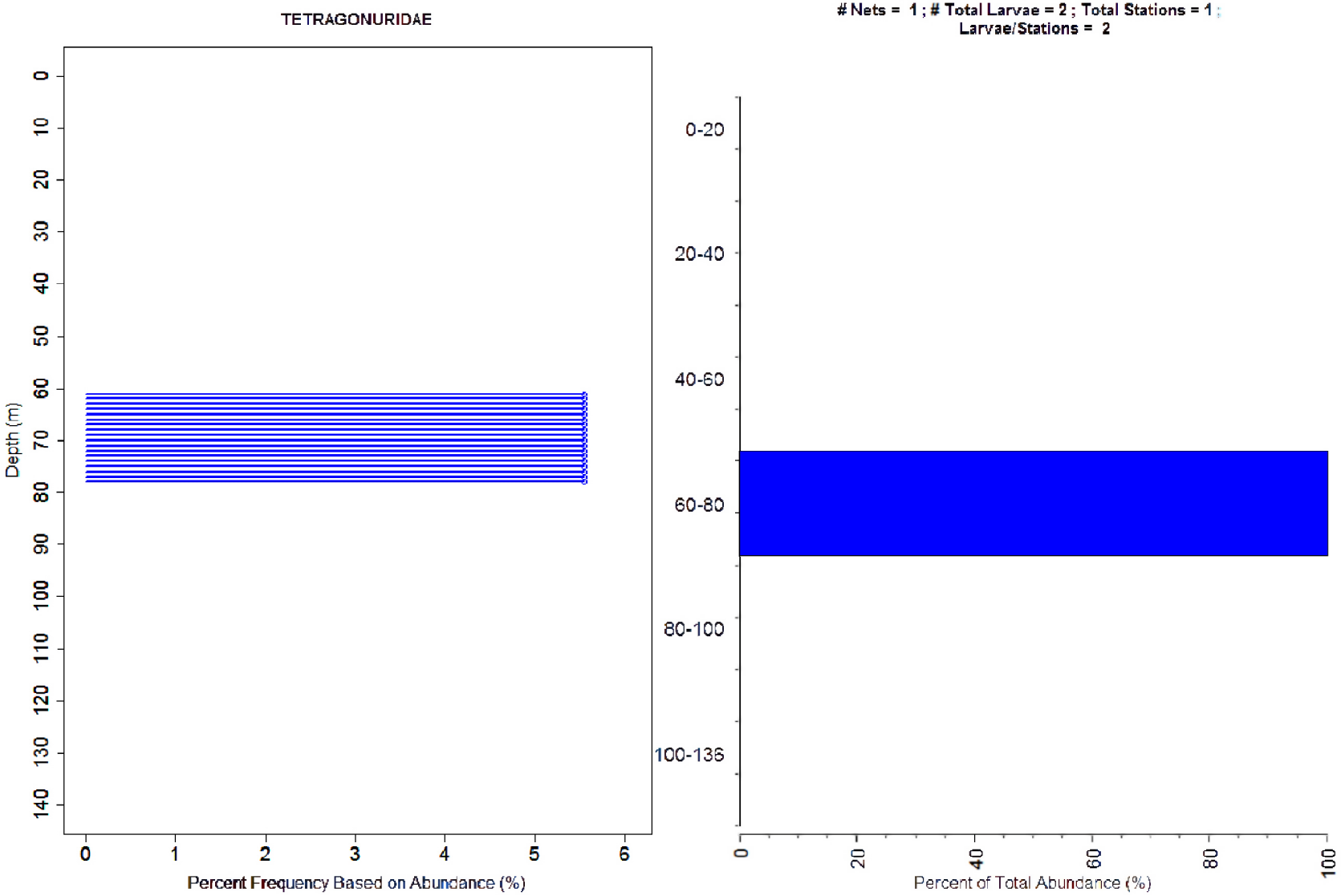
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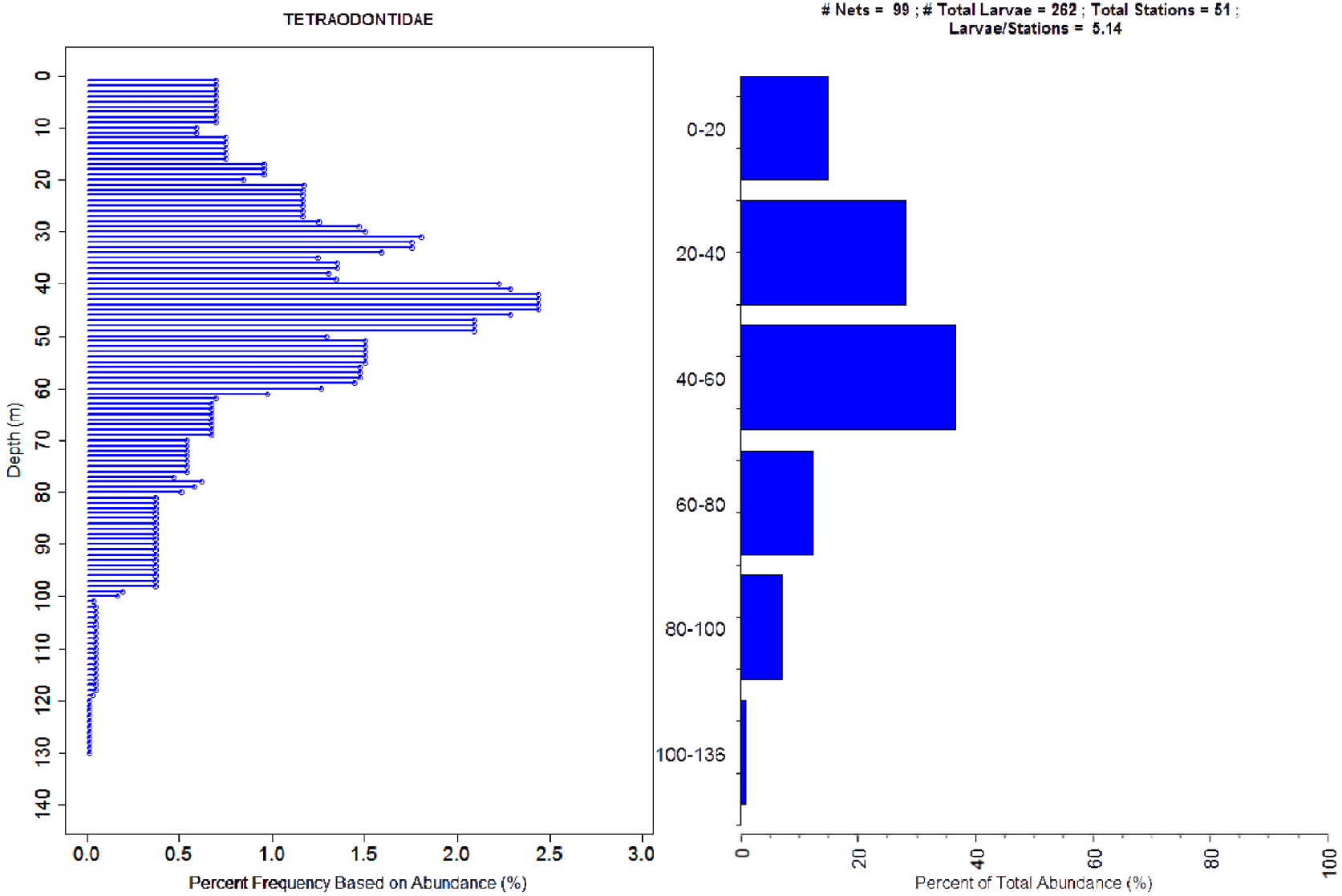
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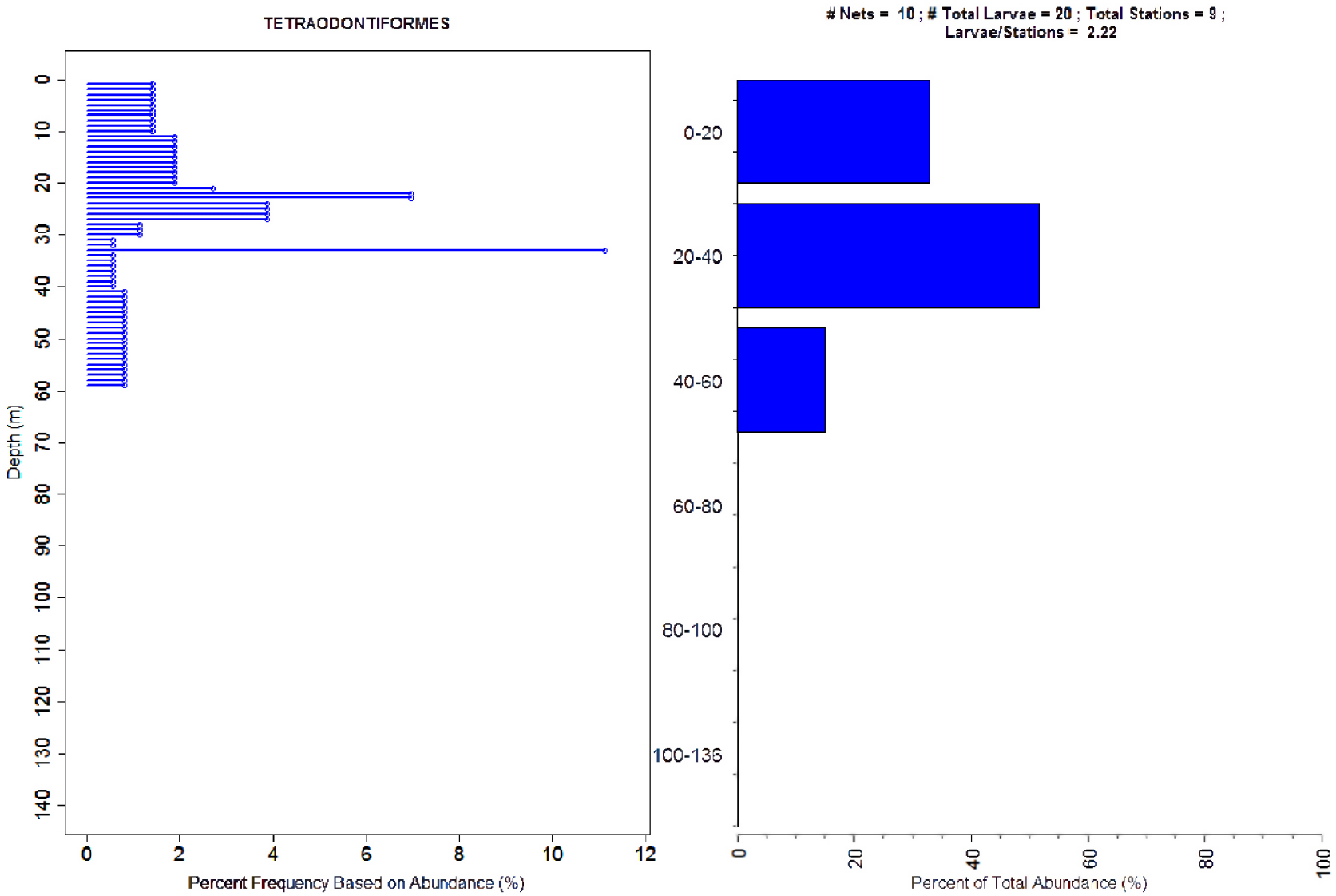
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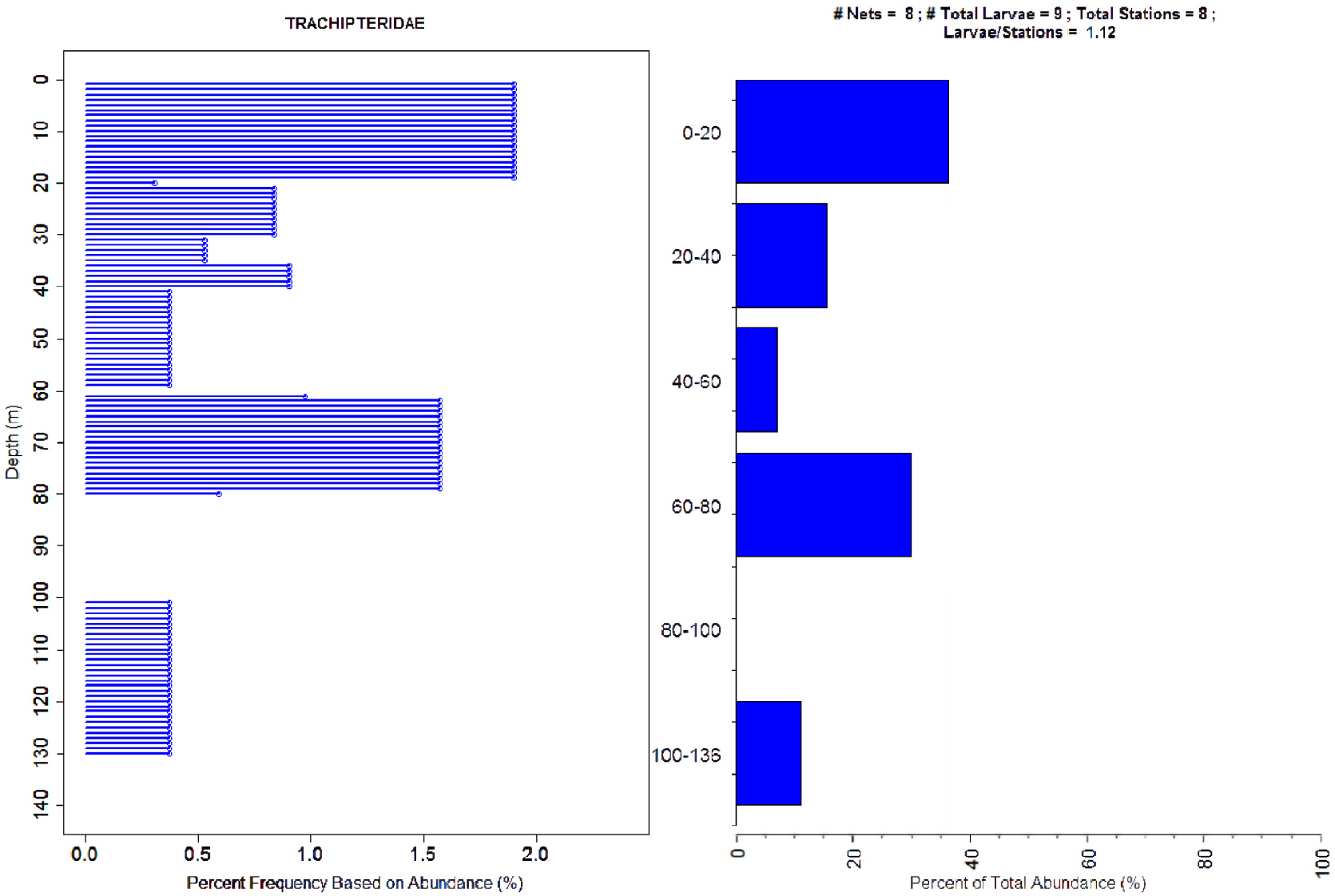
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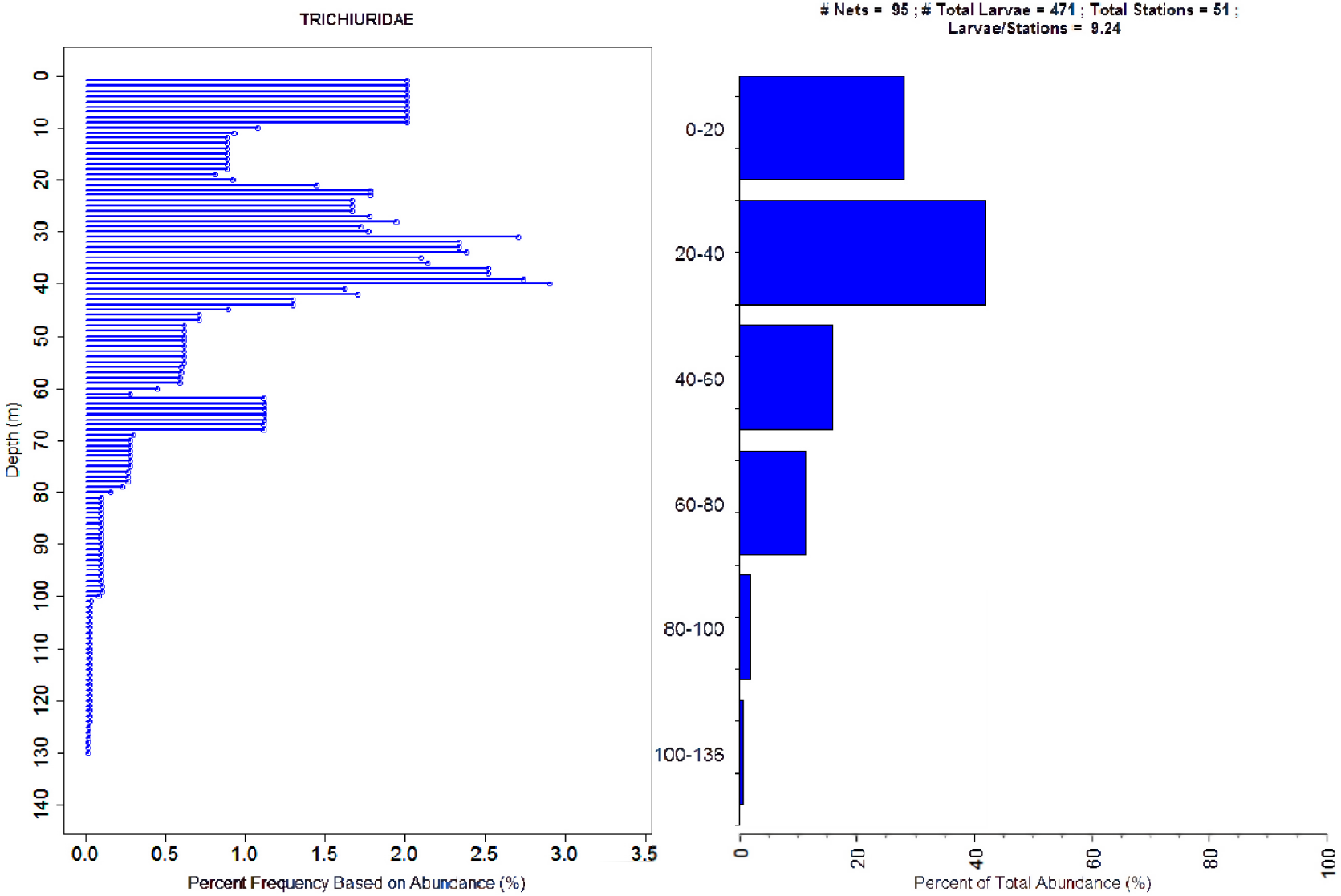
TETRAODONTIDAE



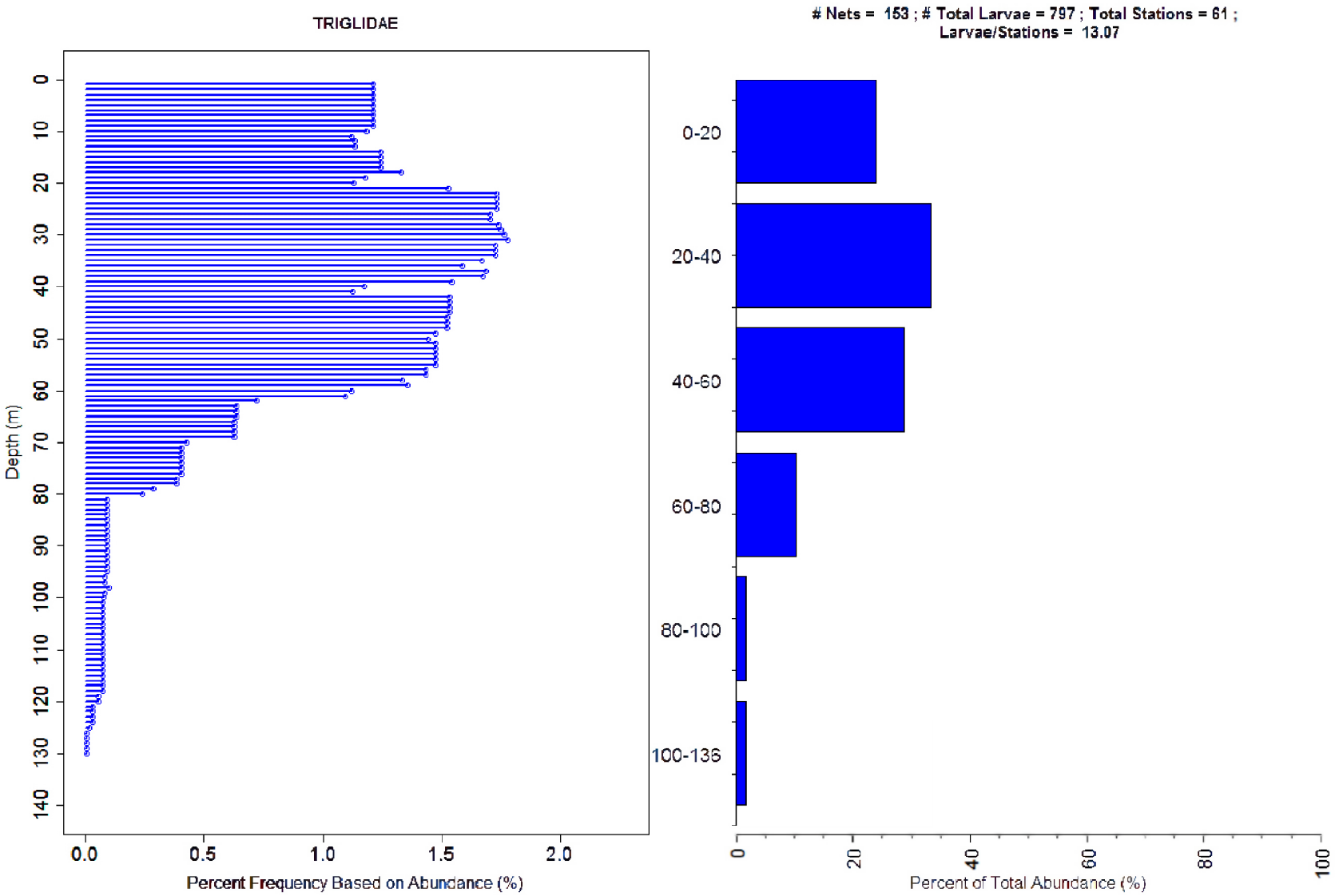
TETRAODONTIFORMES



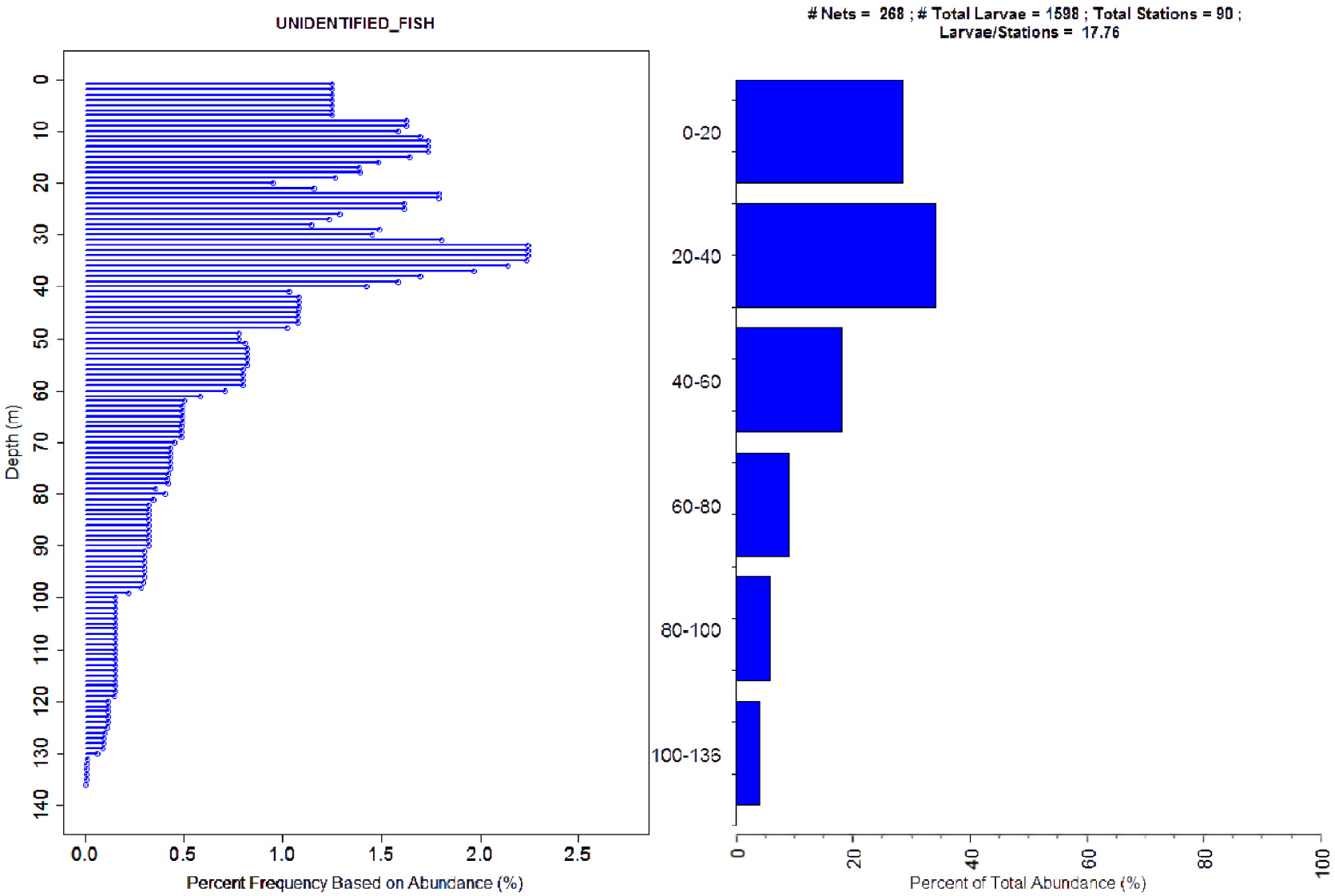
TRACHIPTERIDAE



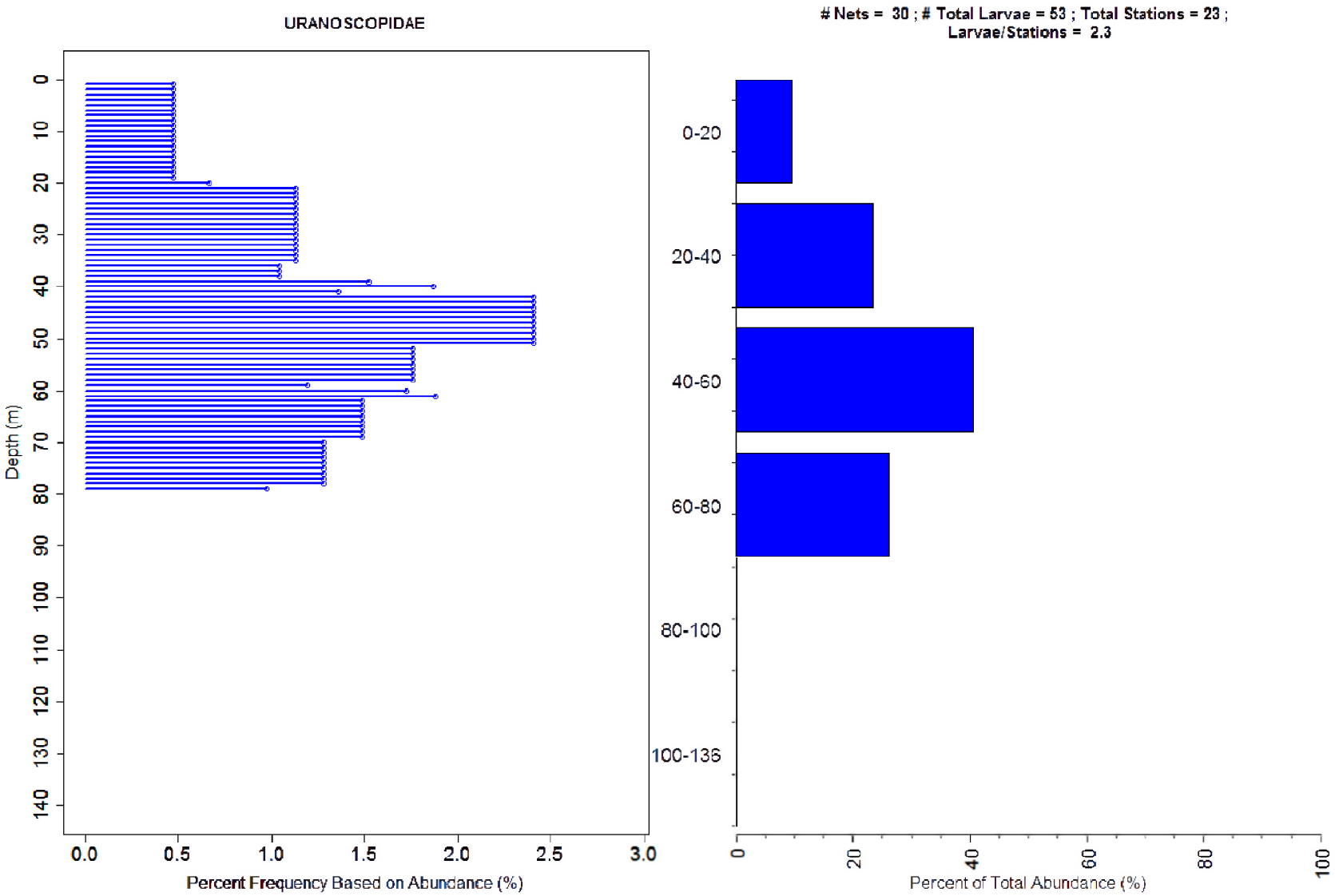
TRICHIURIDAE


TRIGLIDAE
Nets = 153 ; # Total Larvae = 797 ; Total Stations = 61 ;
Larvae/Stations = 13.07
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

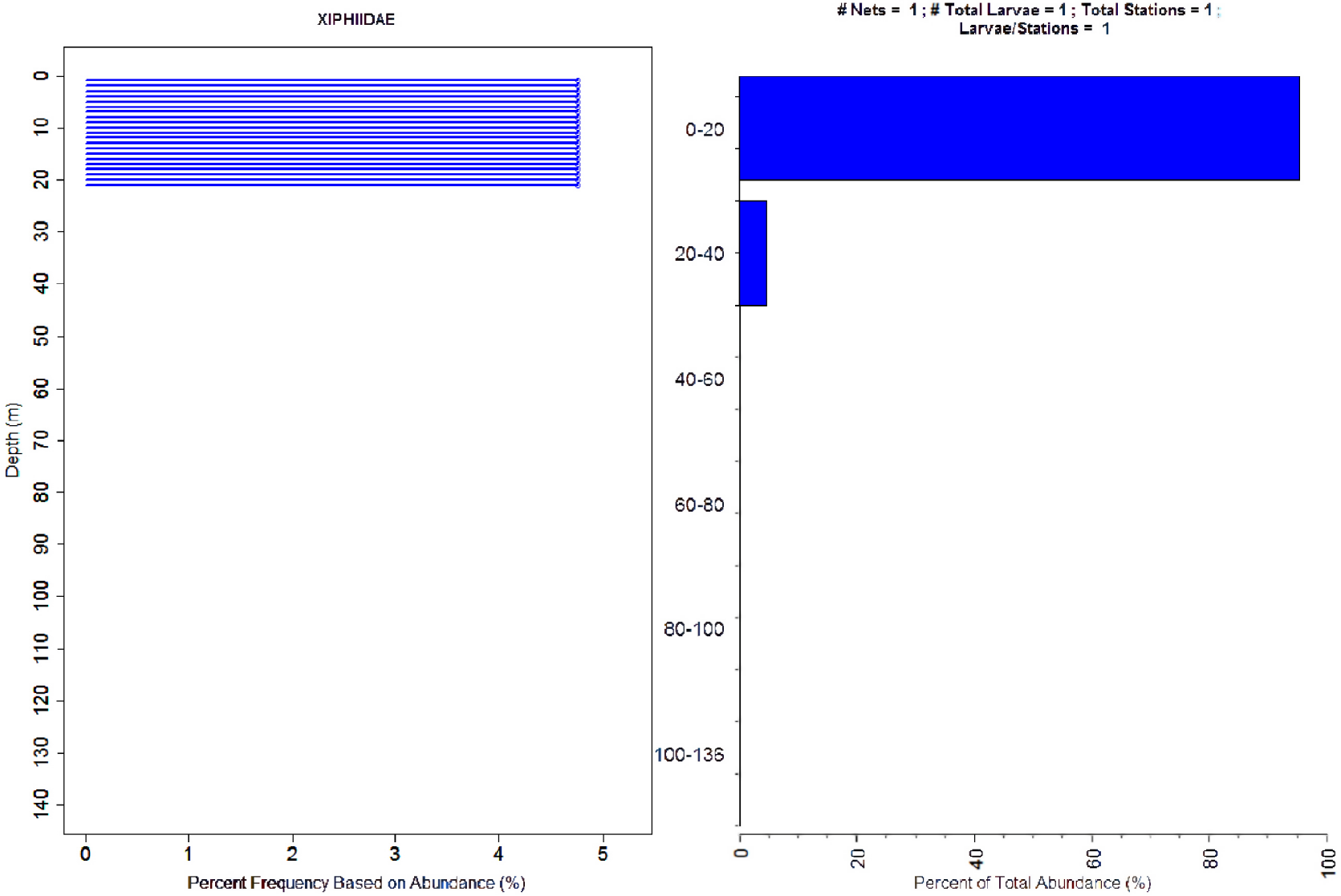
TRIGLIDAE



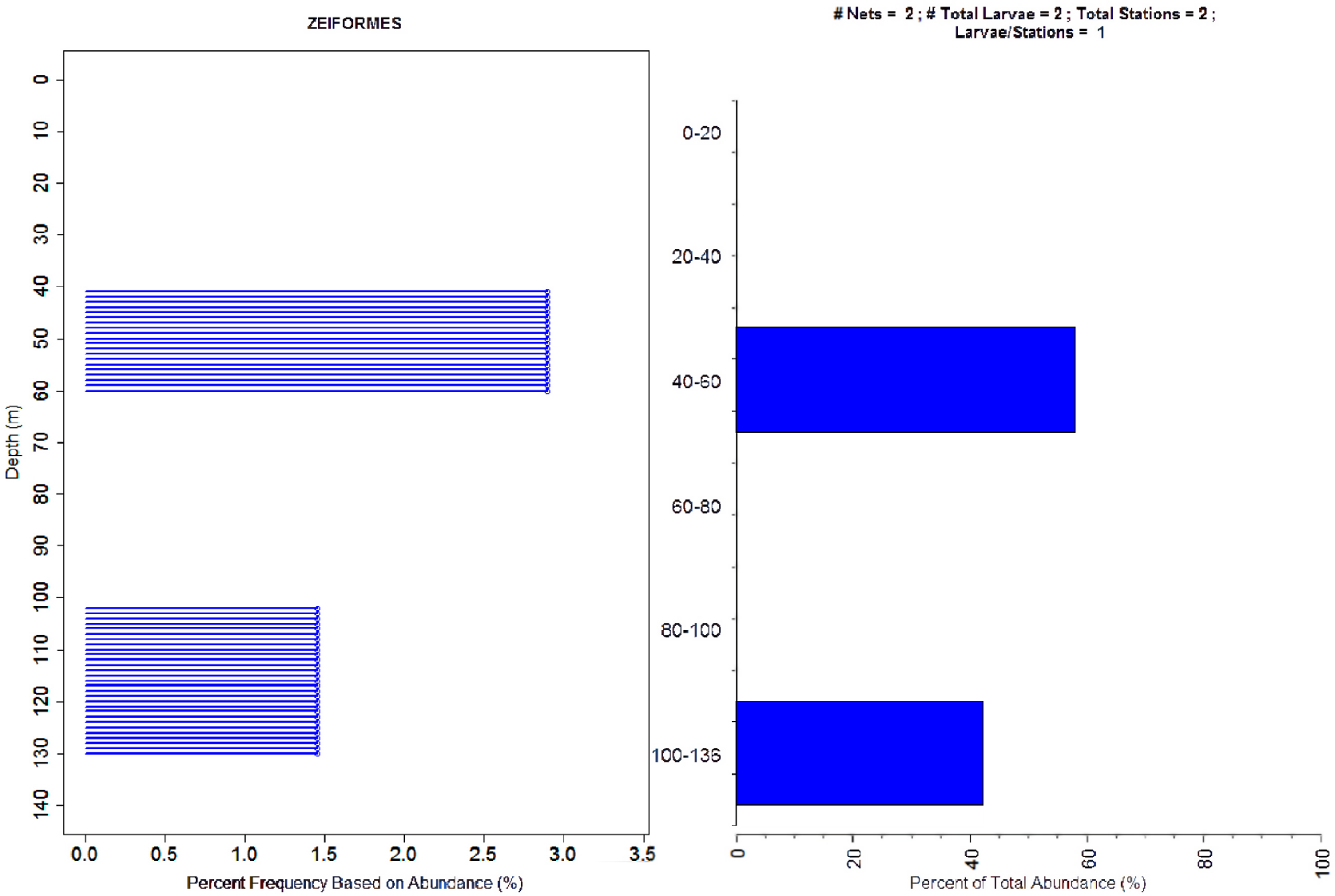
UNIDENTIFIED_FISH



URANOSCOPIDAE


XIPHIIDAE
Nets = 1 ; # Total Larvae = 1 ; Total Stations = 1 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

XIPHIIDAE


ZEIFORMES
Nets = 2 ; # Total Larvae = 2 ; Total Stations = 2 ;
Larvae/Stations = 1
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

ZEIFORMES

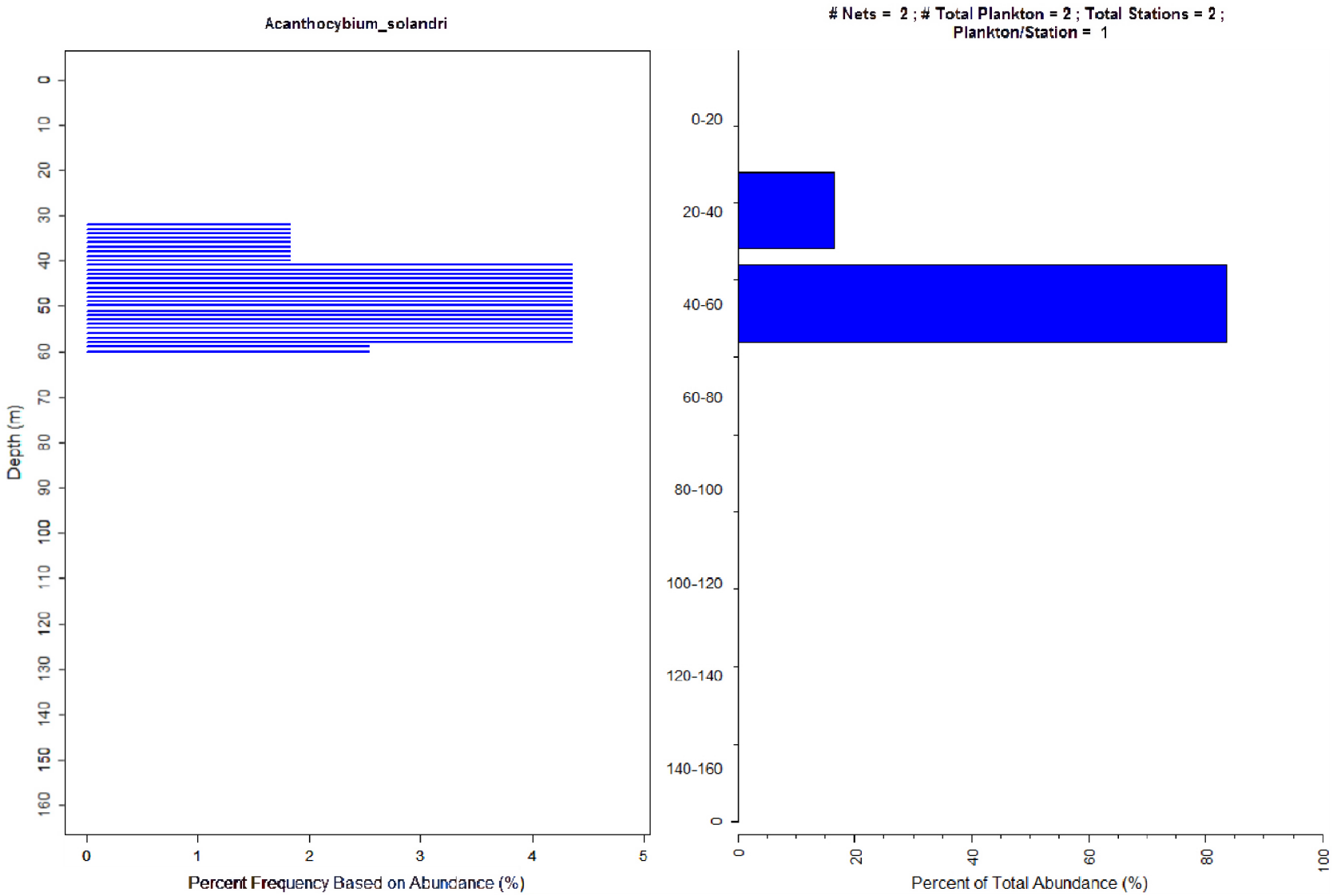
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

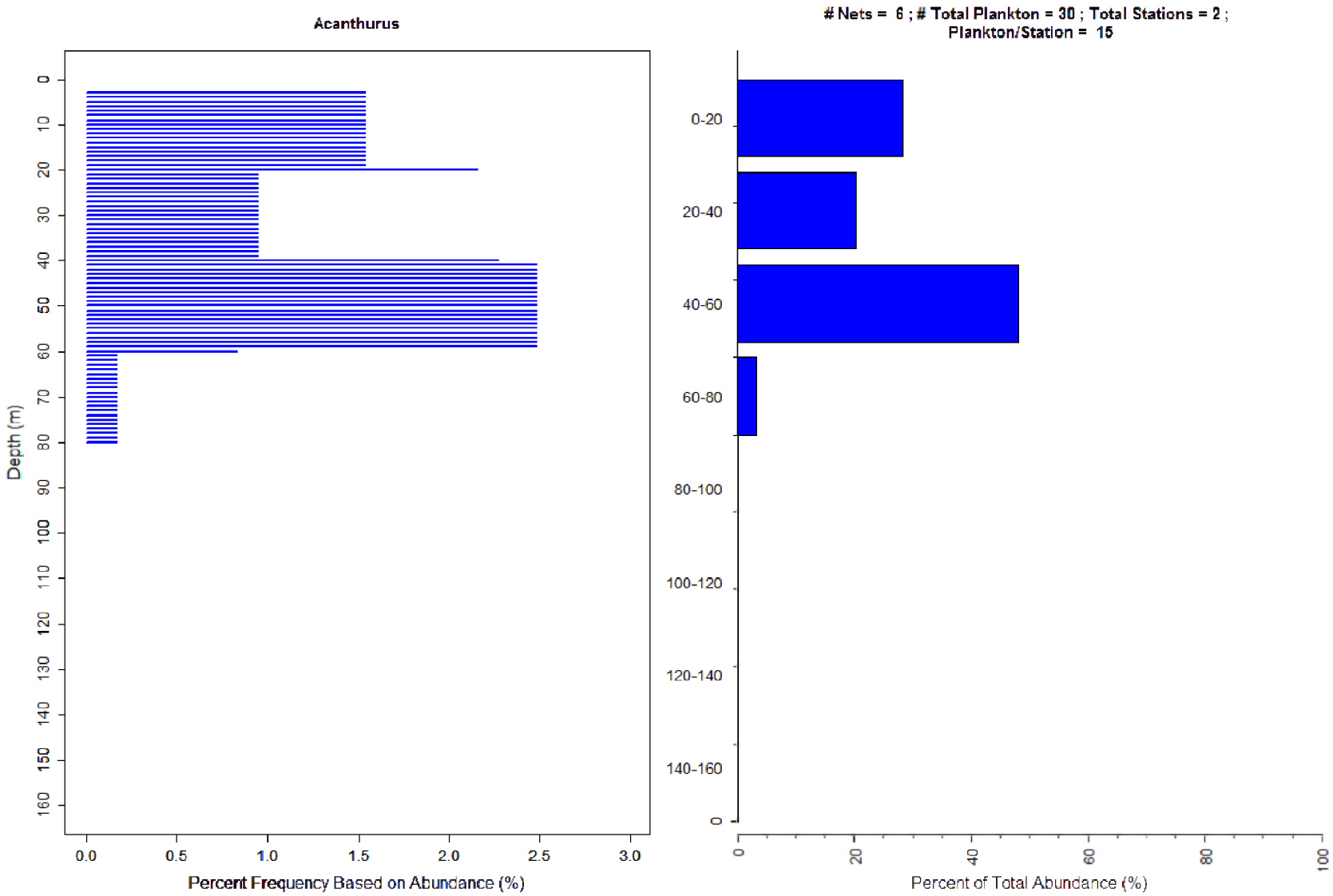
Appendix D1 – NRDA Tier1A Shallow MOC1 Plots Analysis Taxa Level, Pooled Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

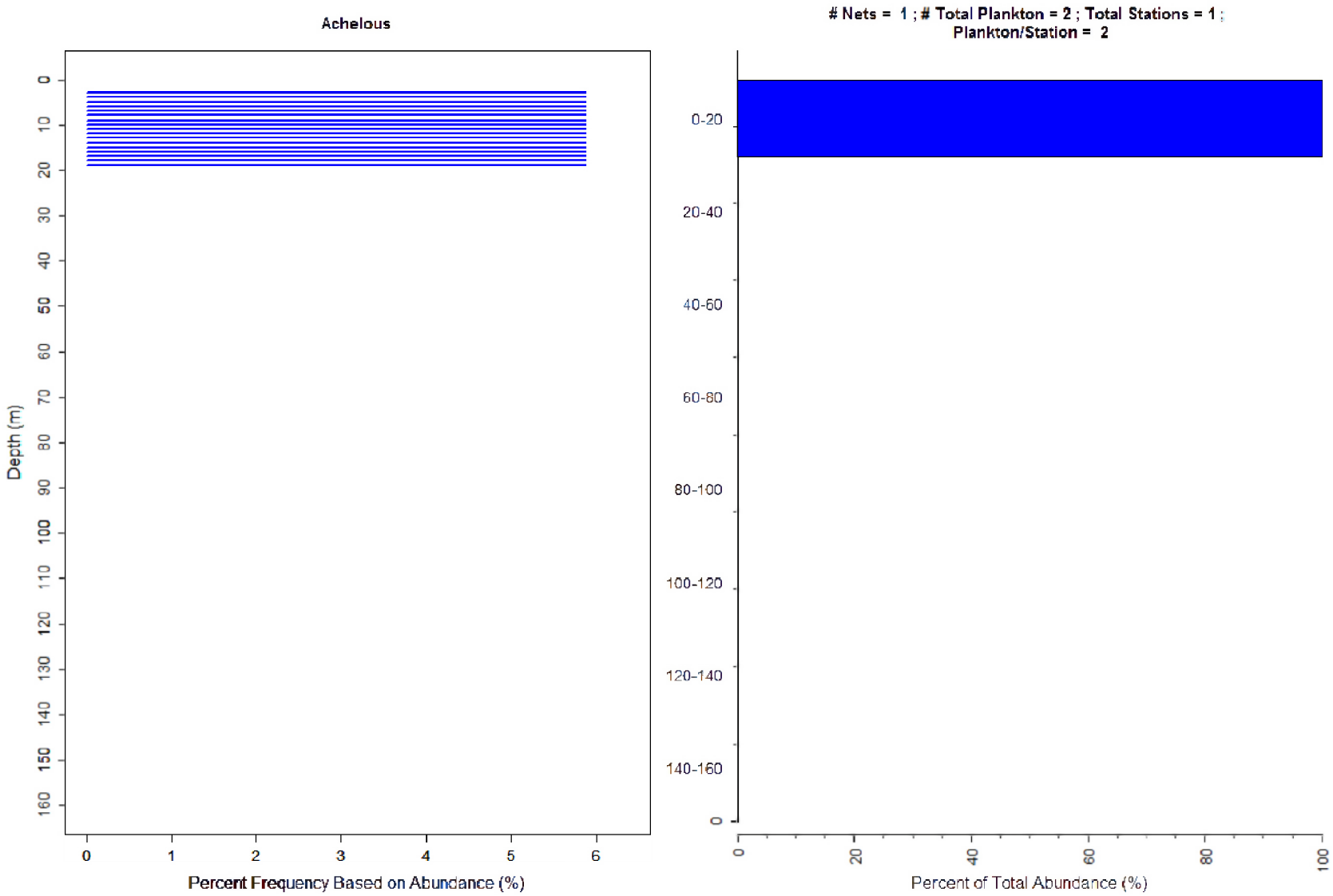
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



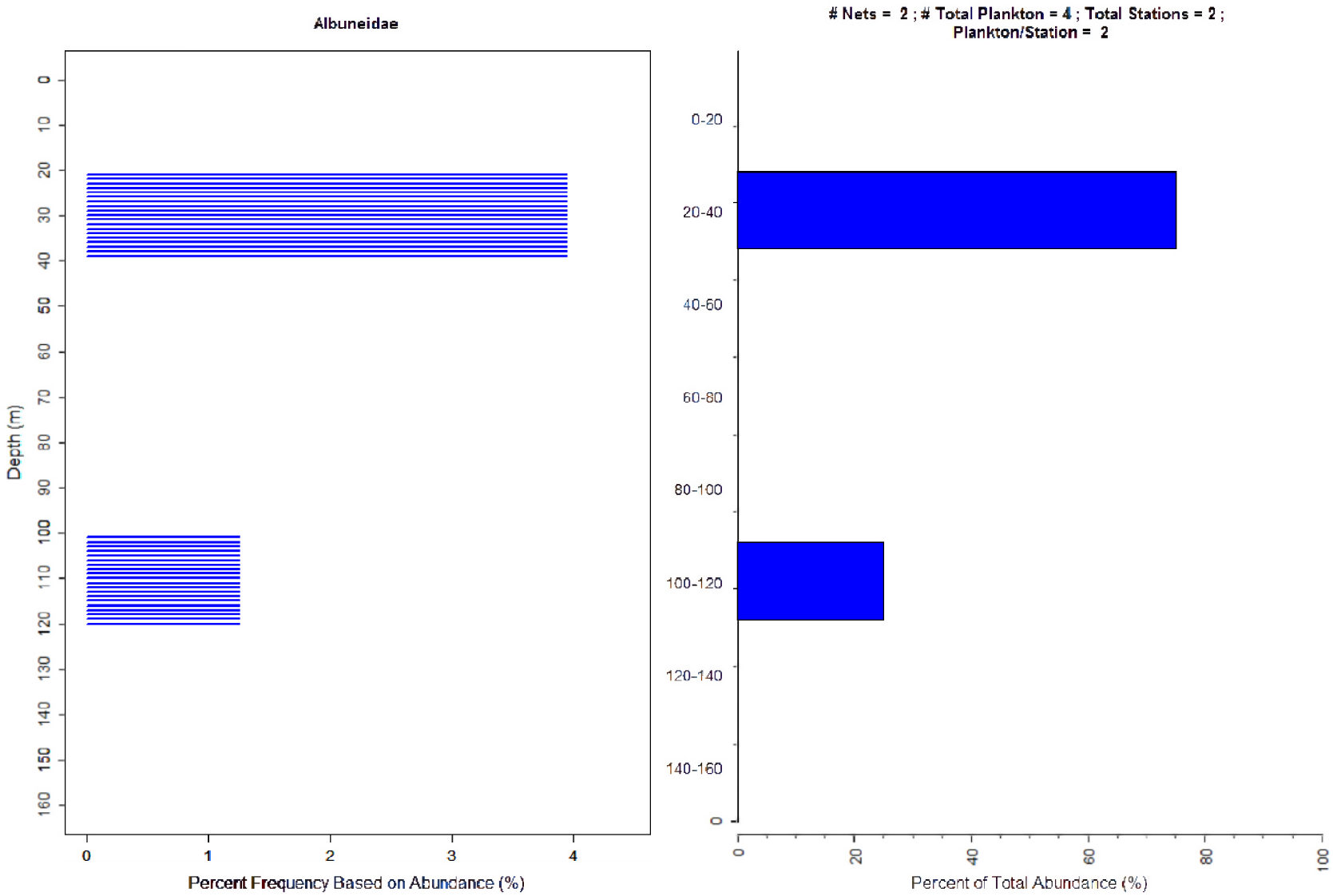
Acanthocybium_solandri - Shallow



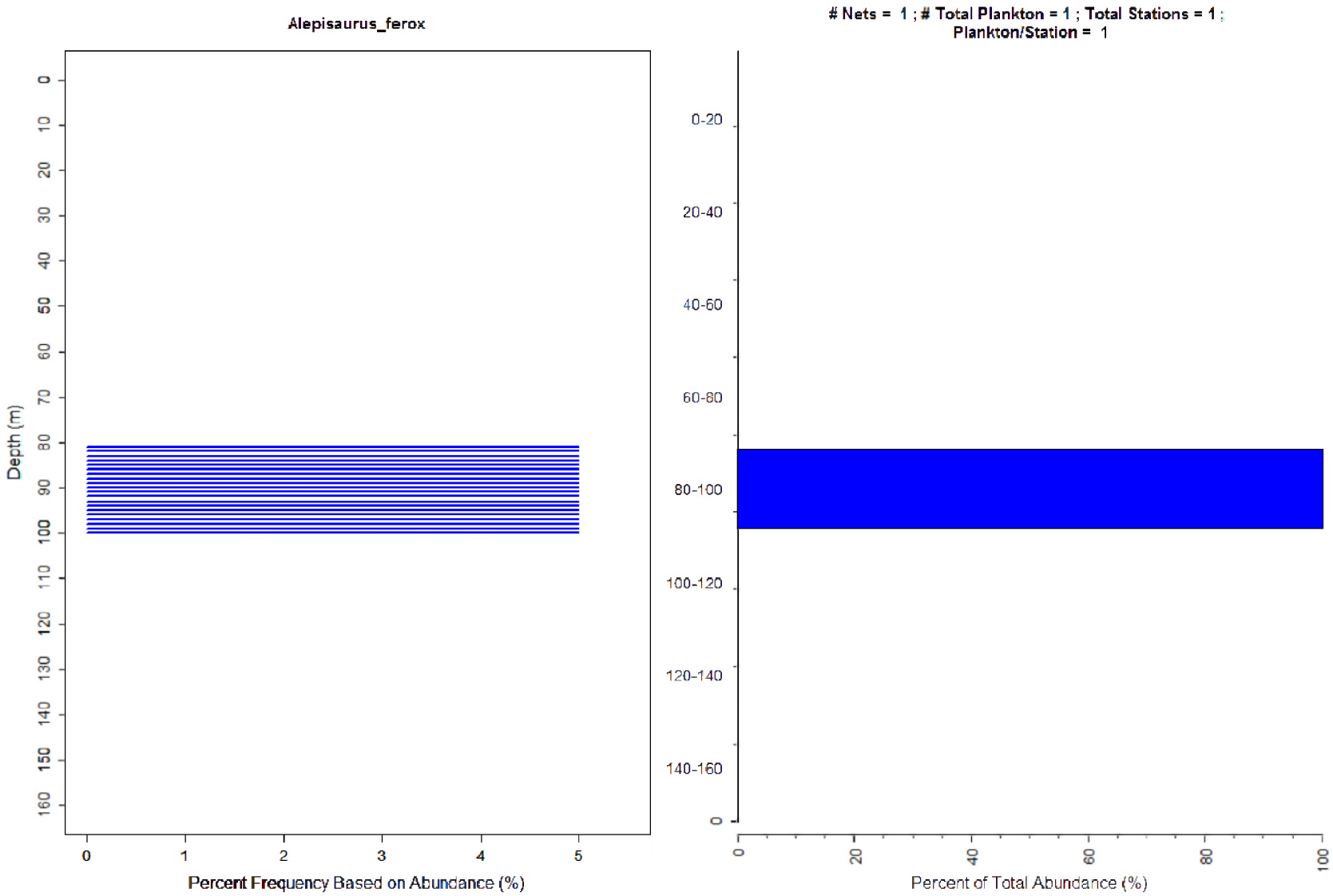
Acanthurus - Shallow



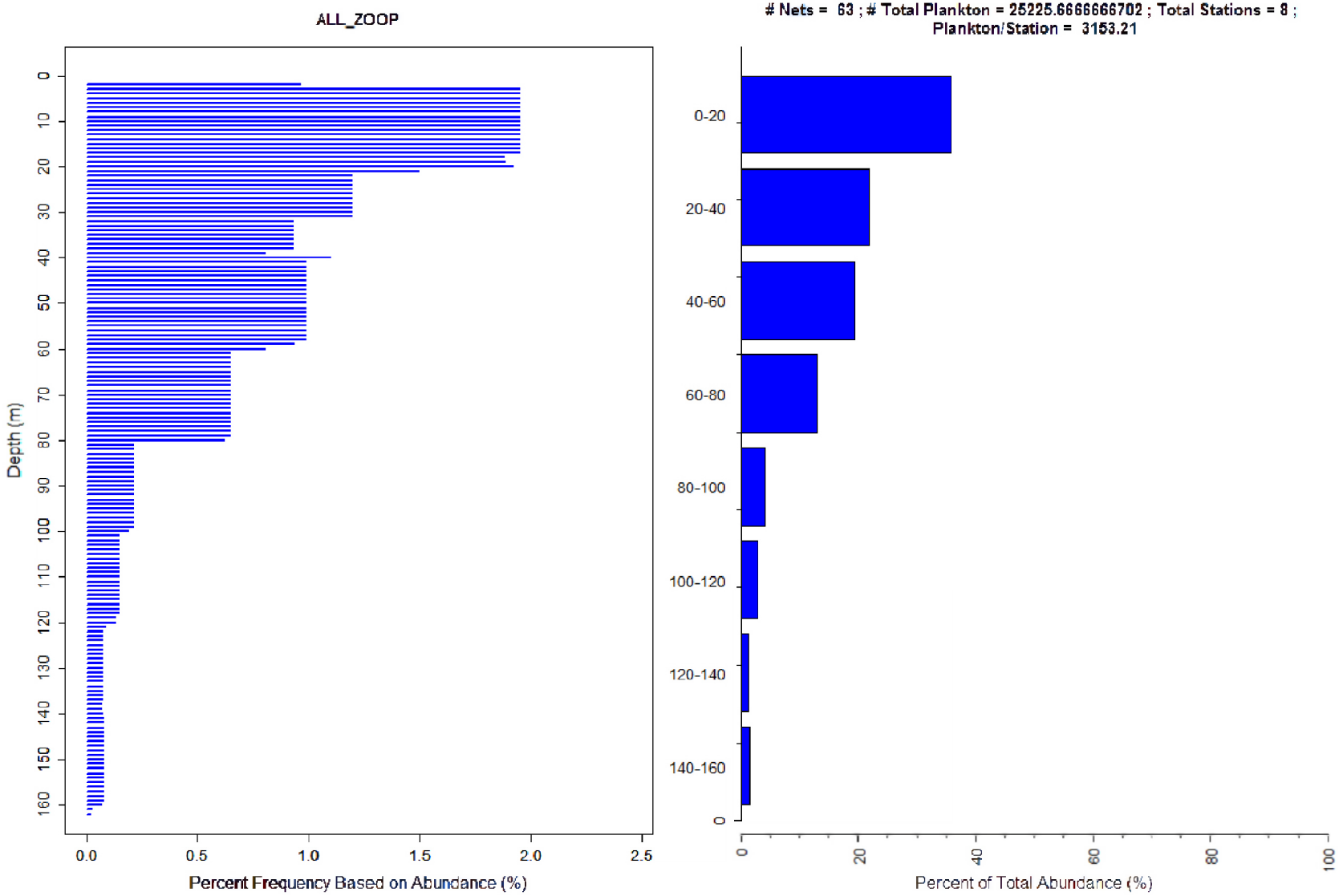
Achelous - Shallow



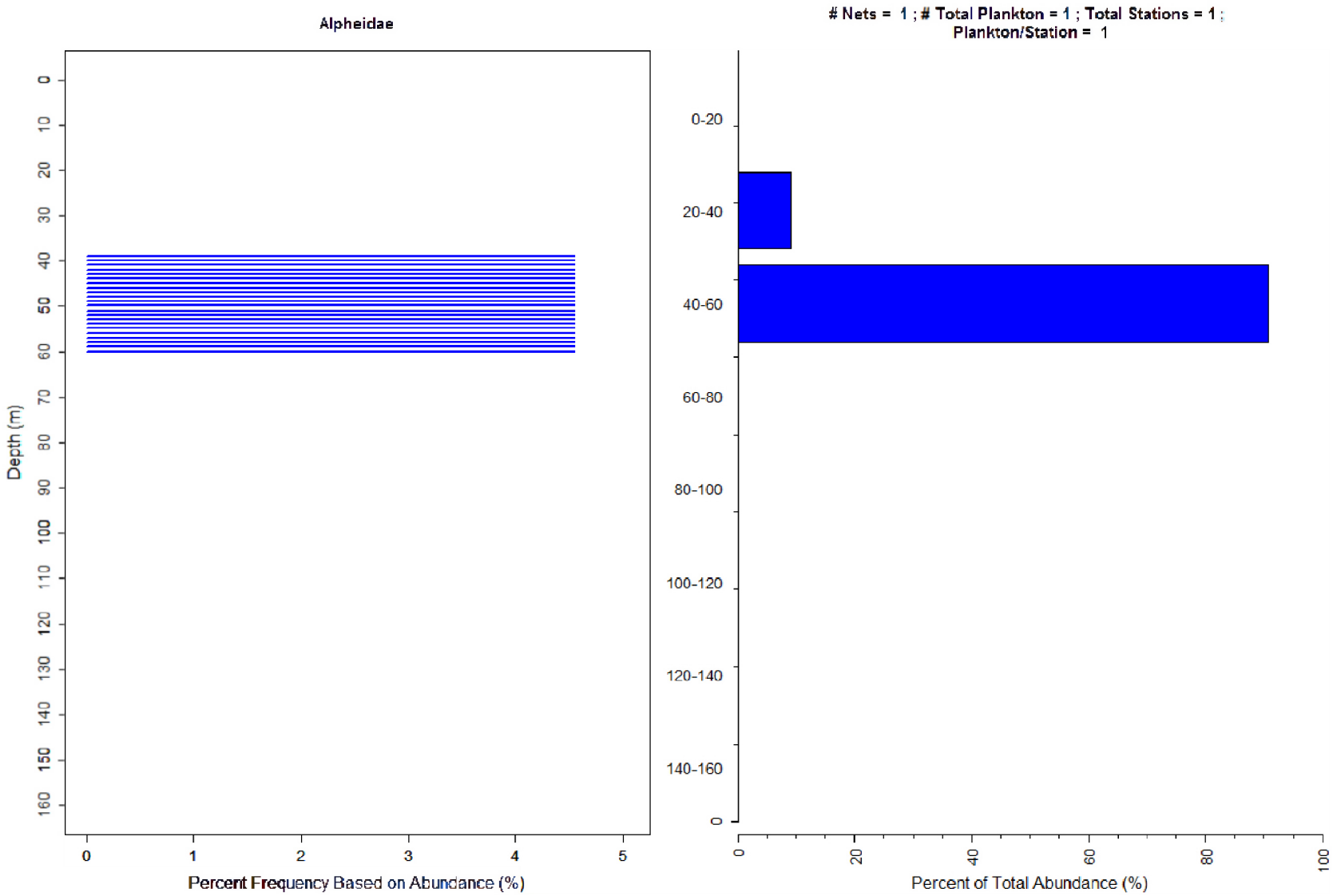
Albuneidae - Shallow



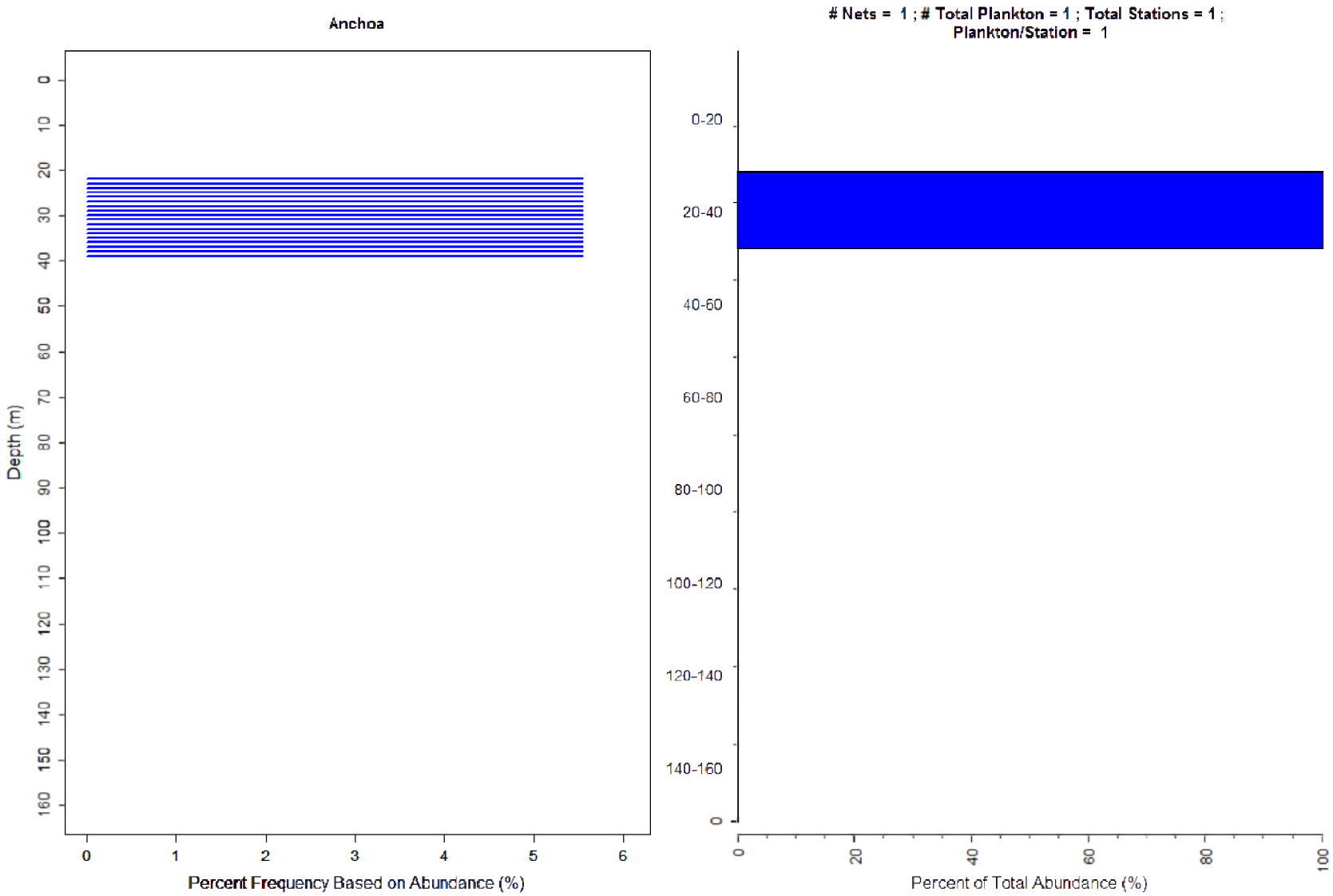
Alepisaurus_ferox - Shallow



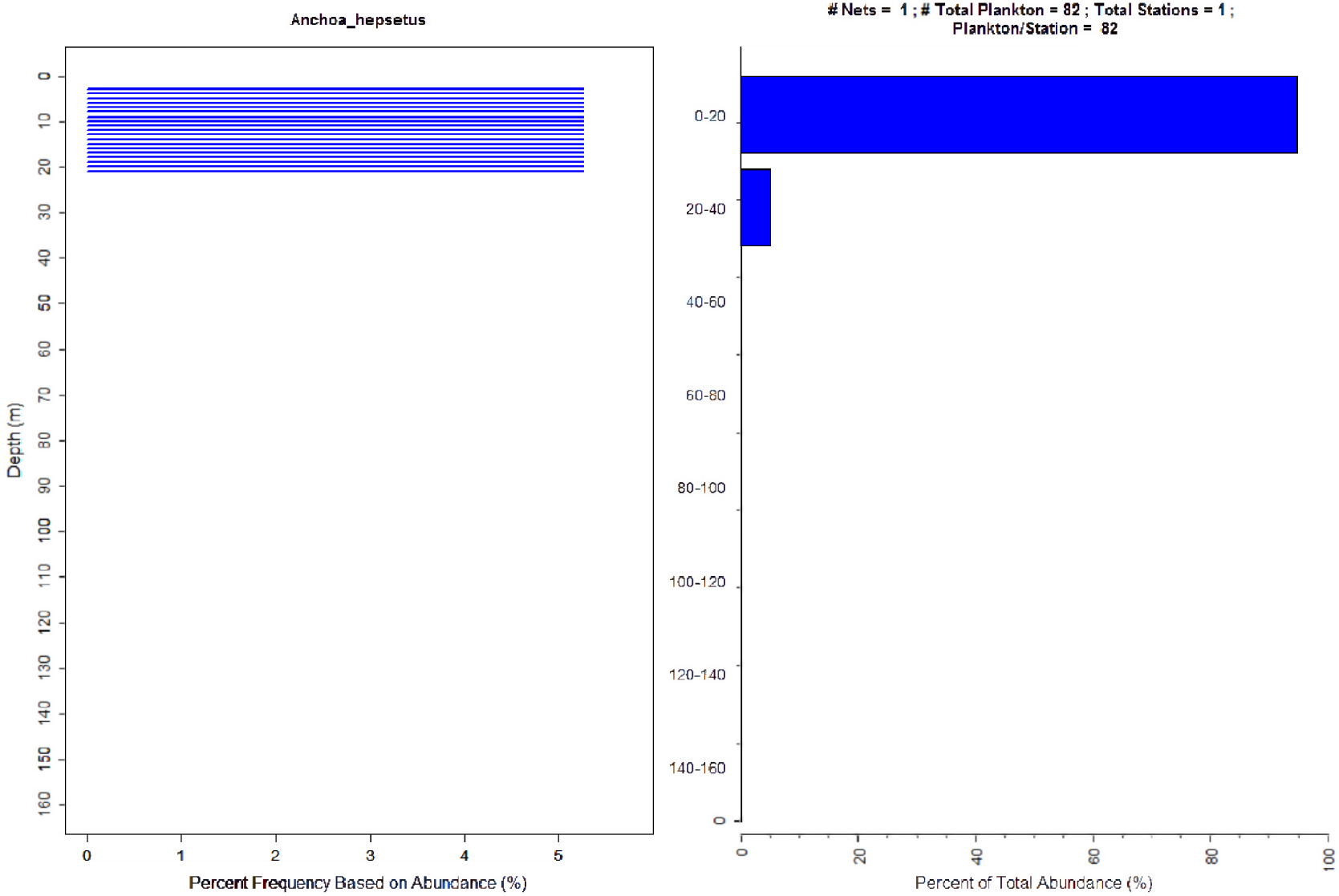
ALL_ZOOP - Shallow



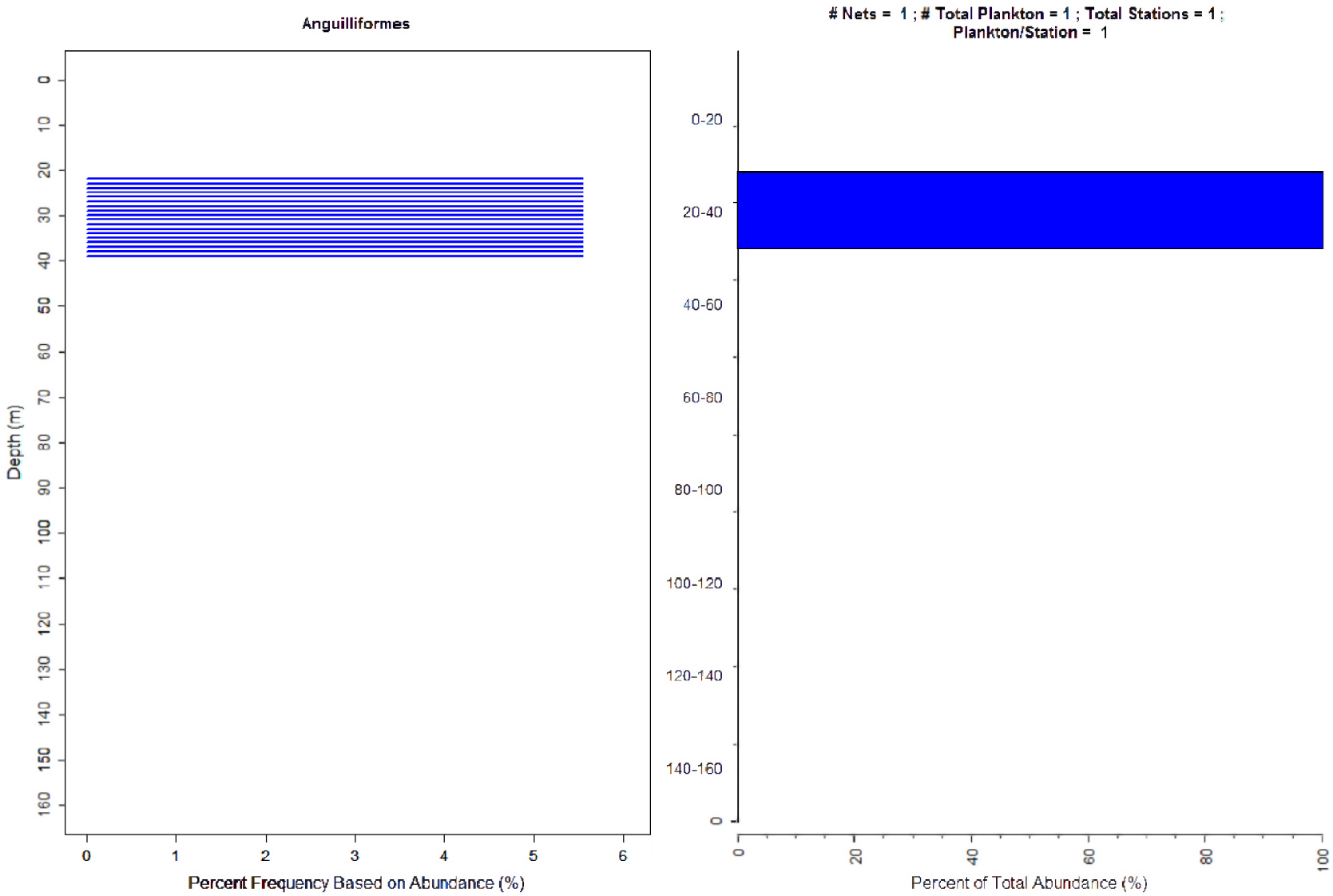
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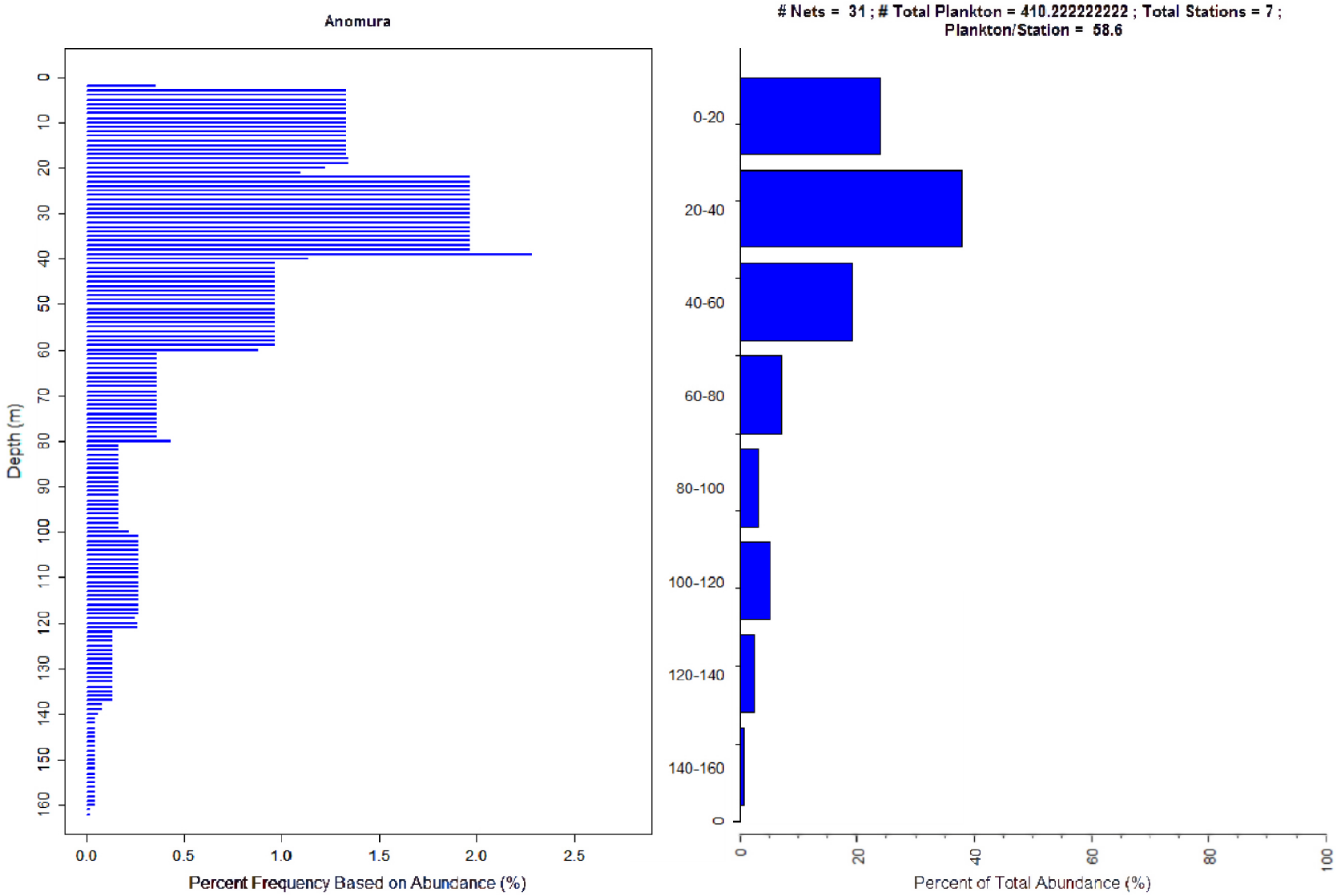
Anchoa - Shallow



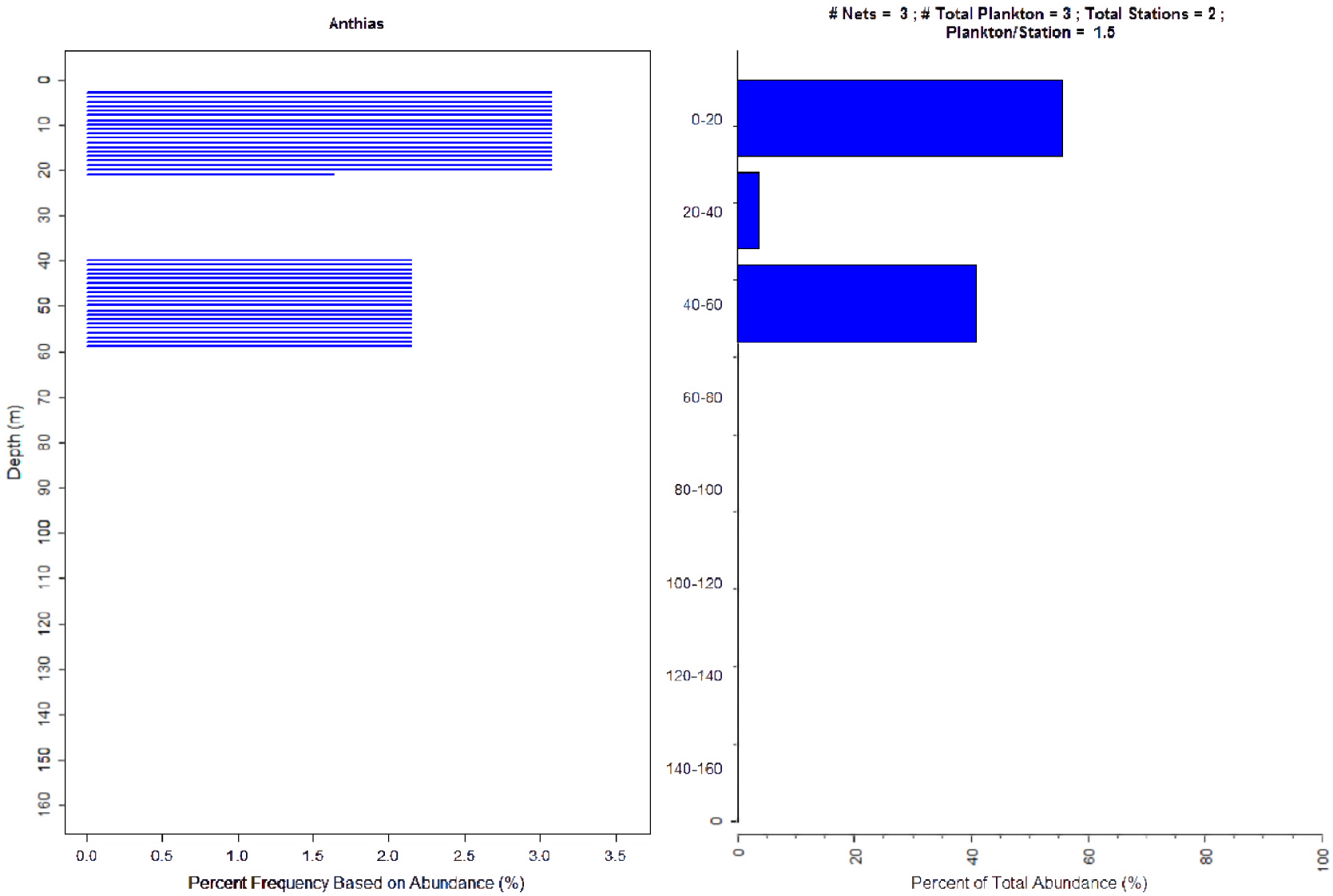
Anchoa_hepsetus - Shallow



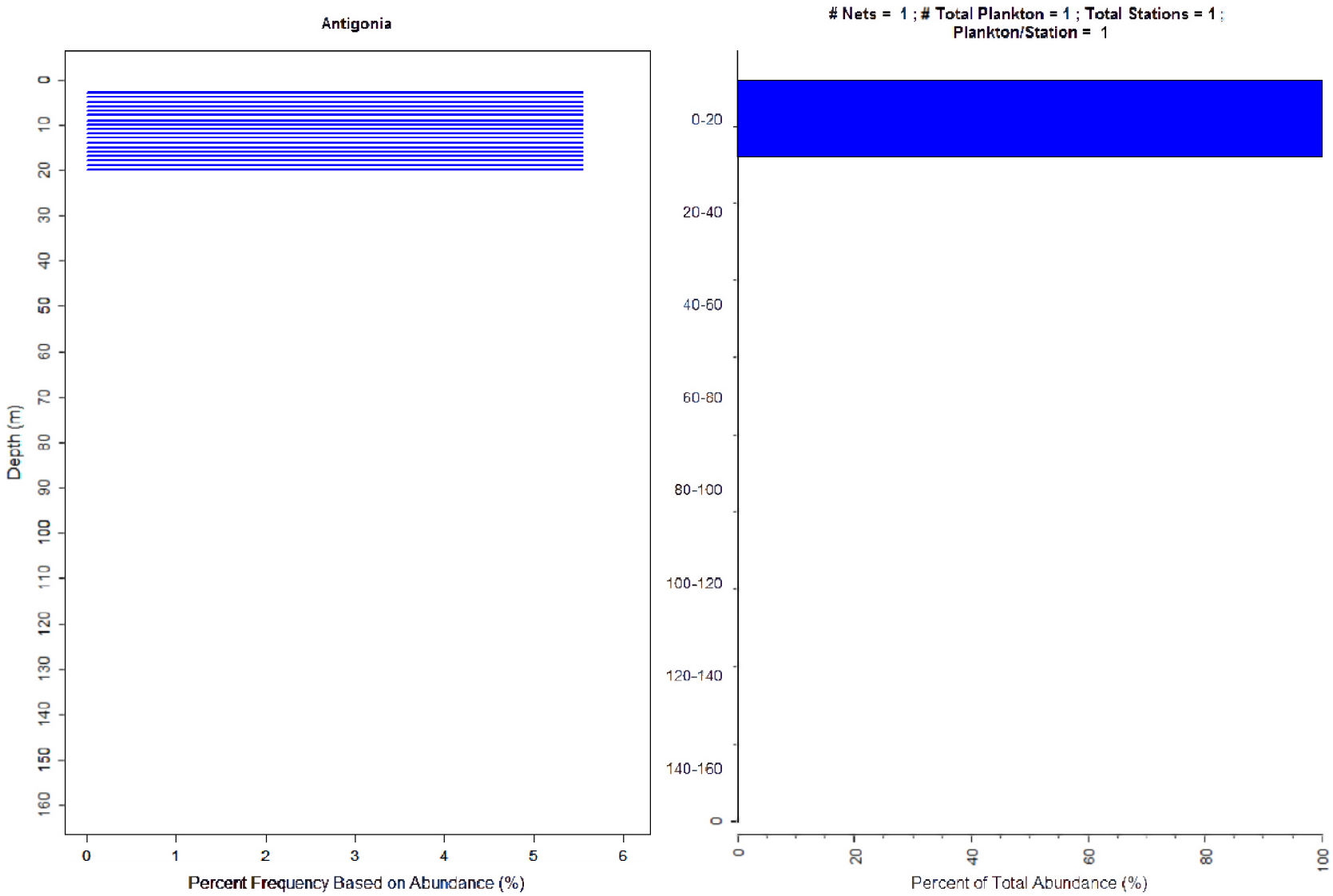
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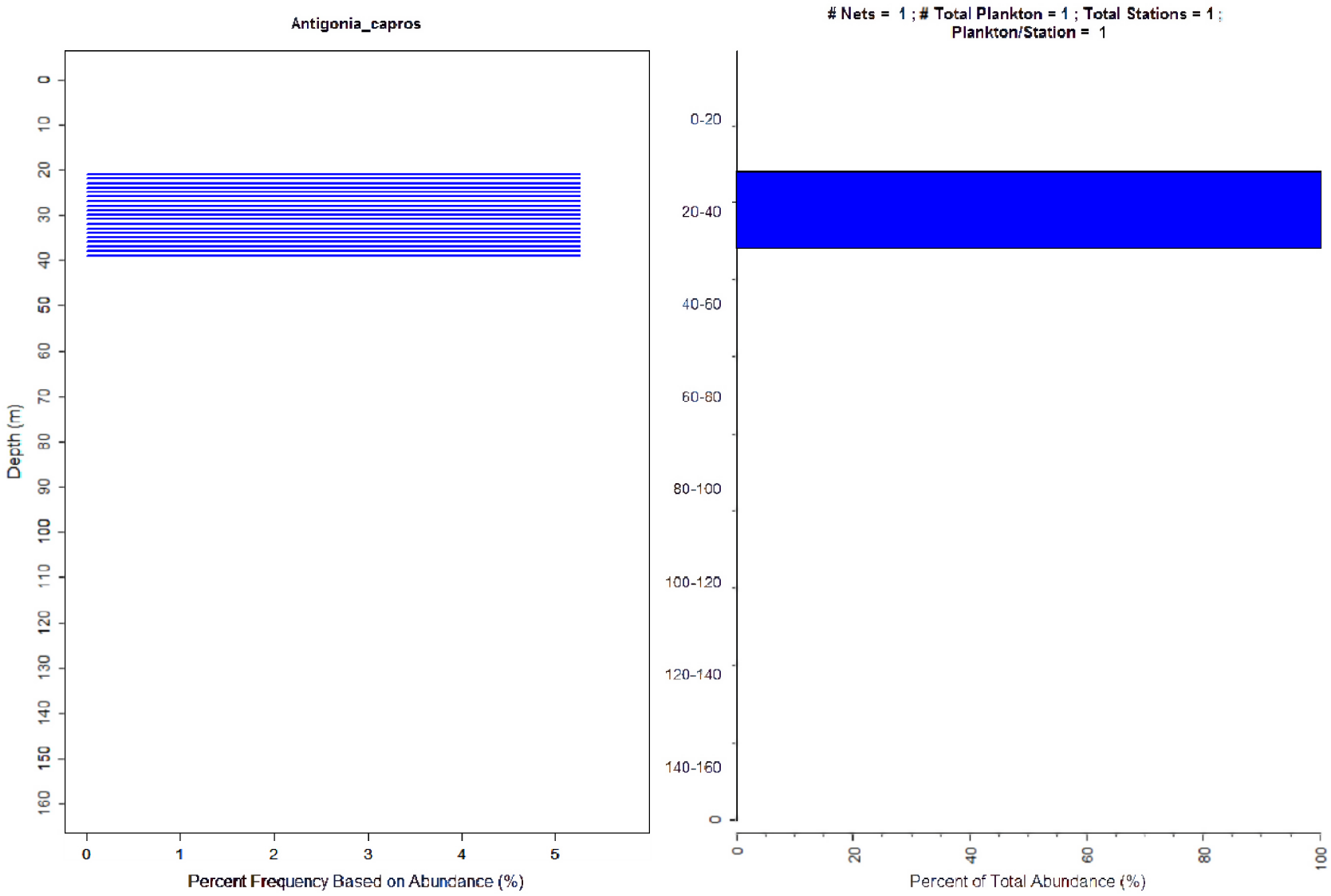
Anomura - Shallow



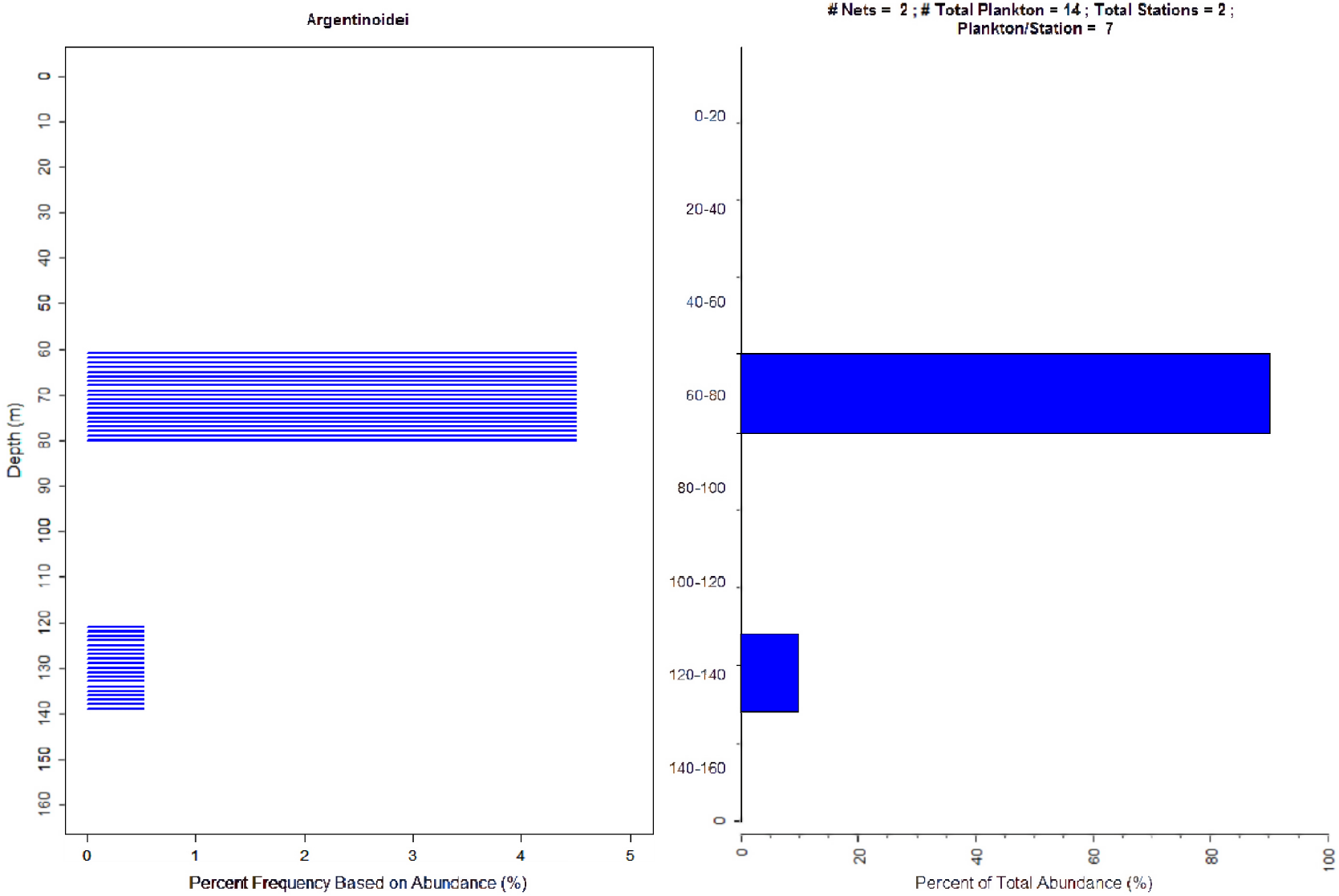
Anthias - Shallow



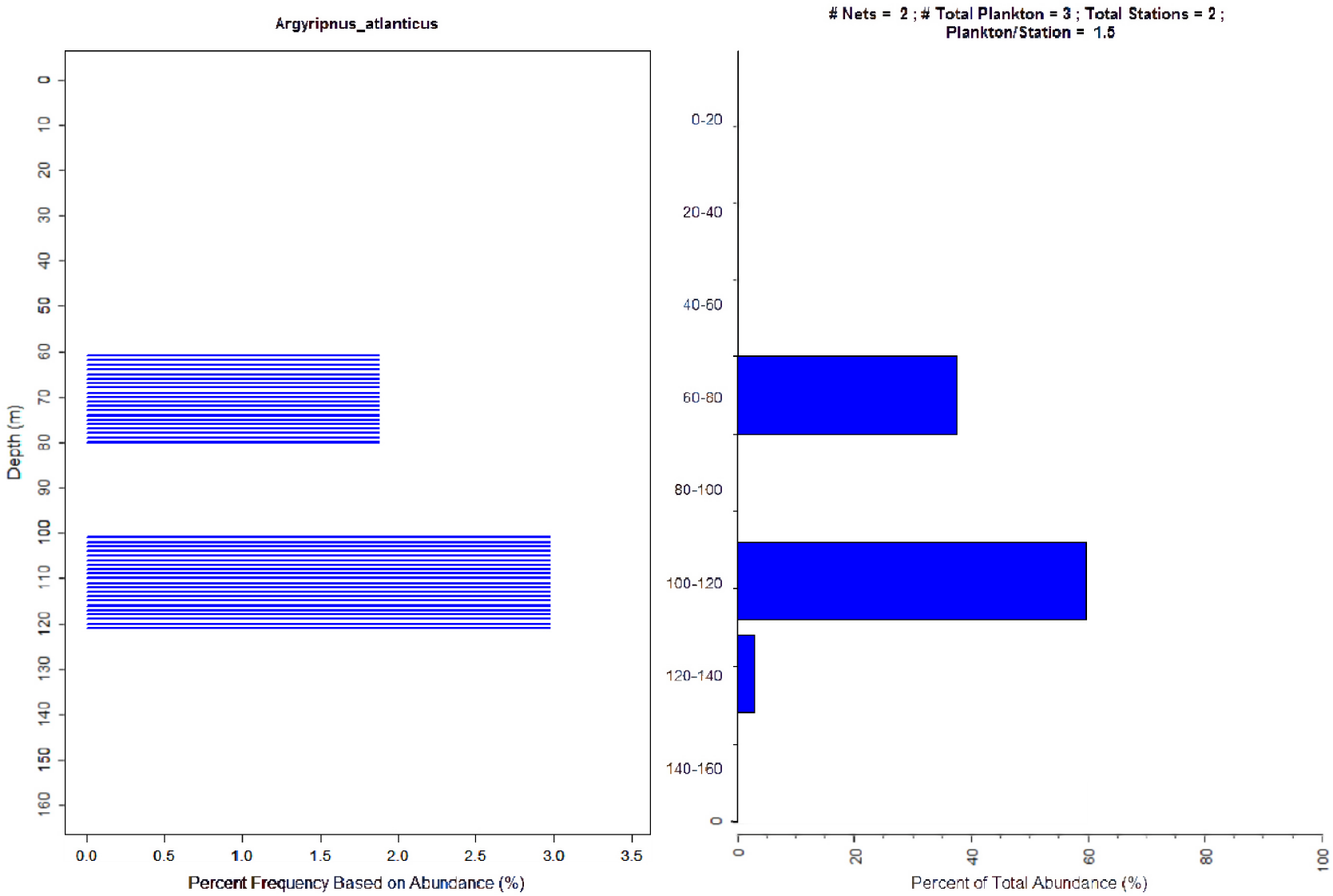
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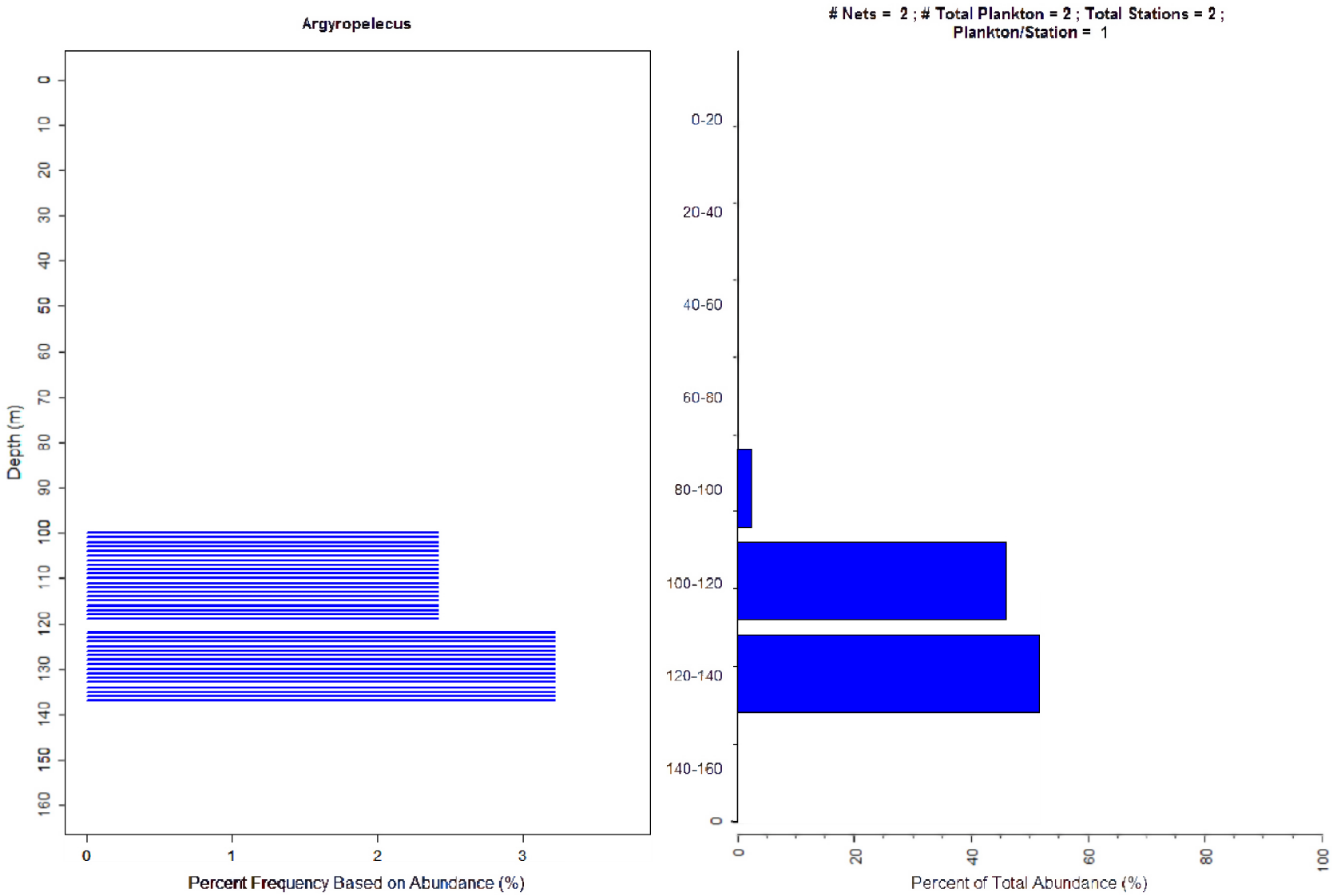
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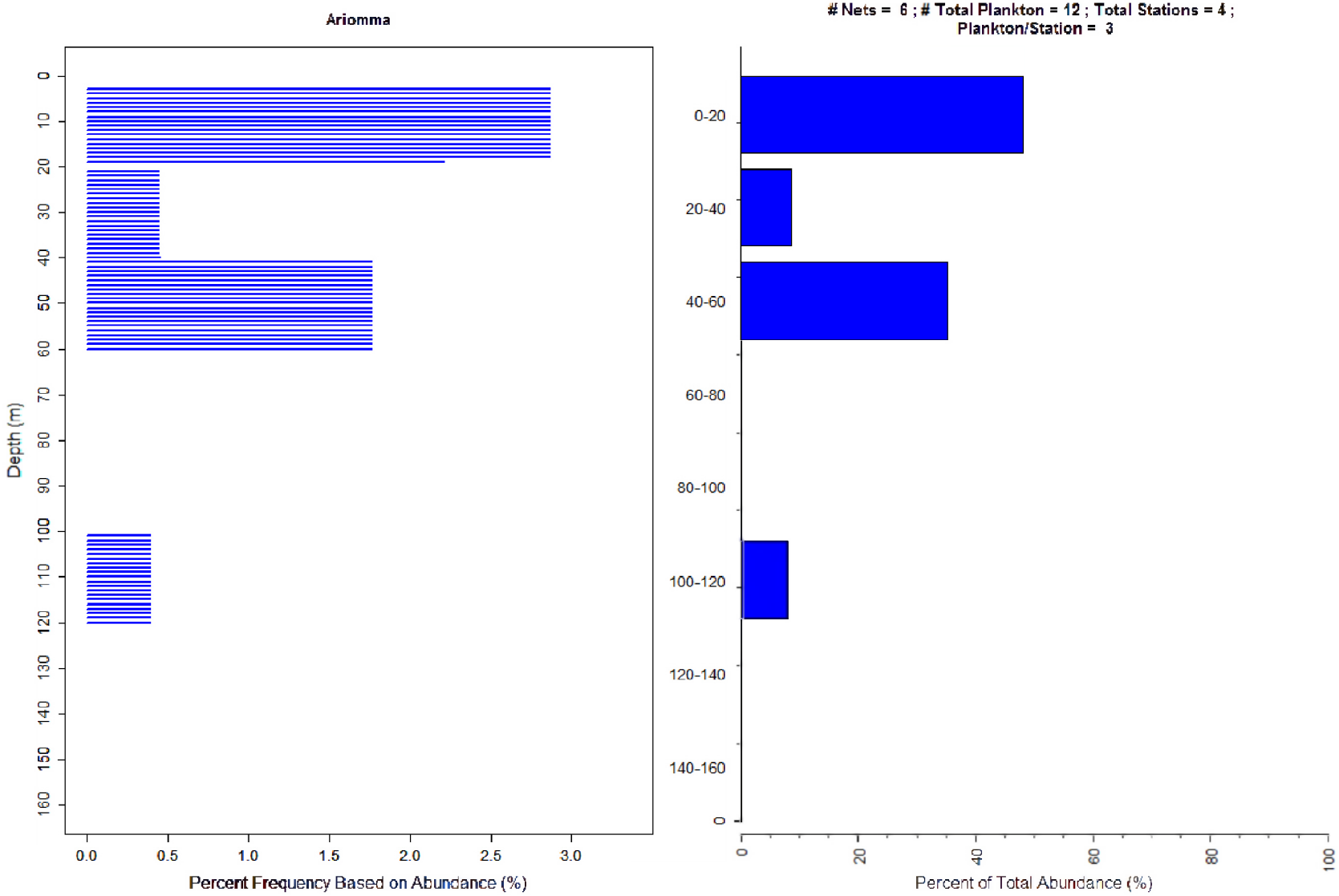
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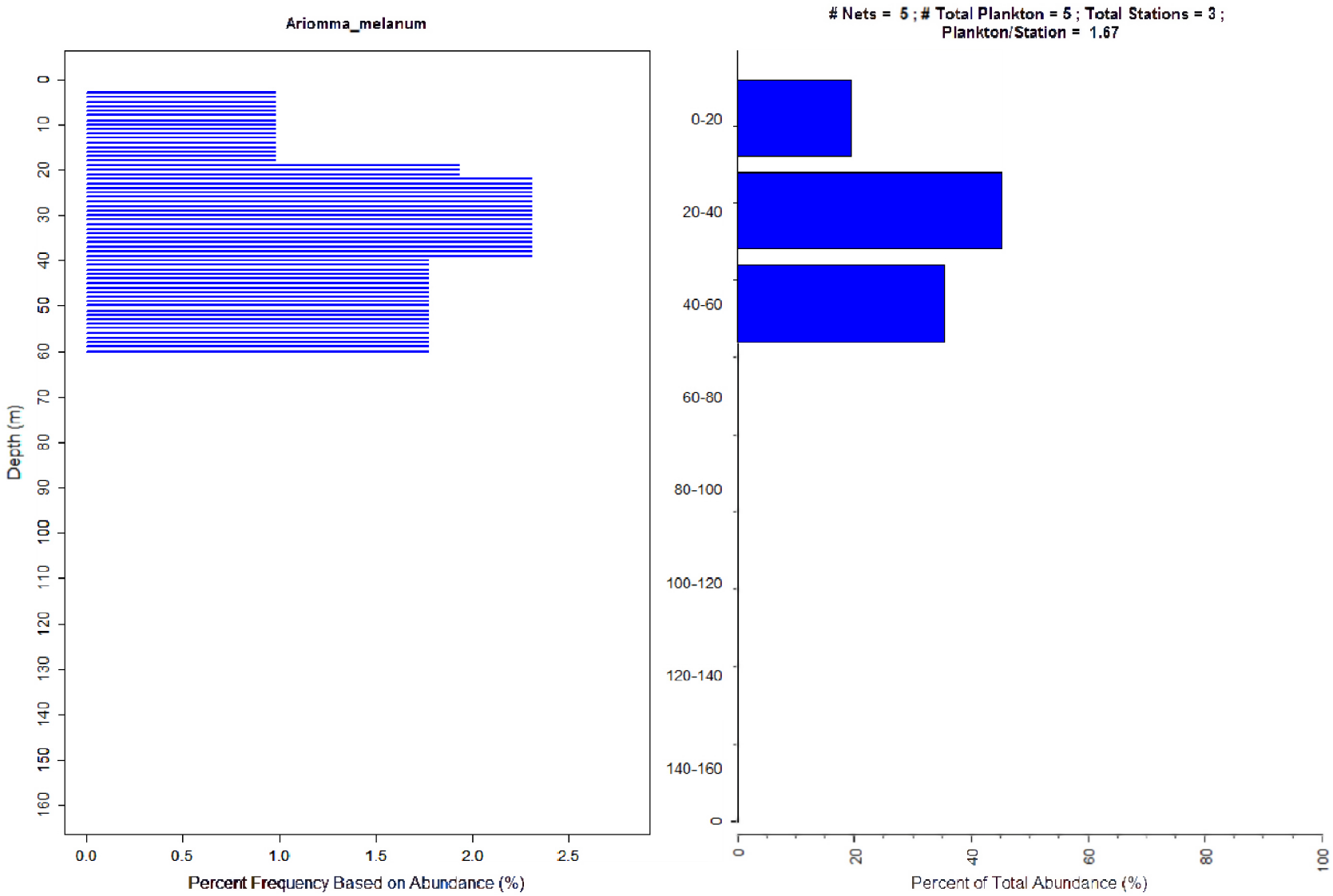
Argyripnus_atlanticus - Shallow



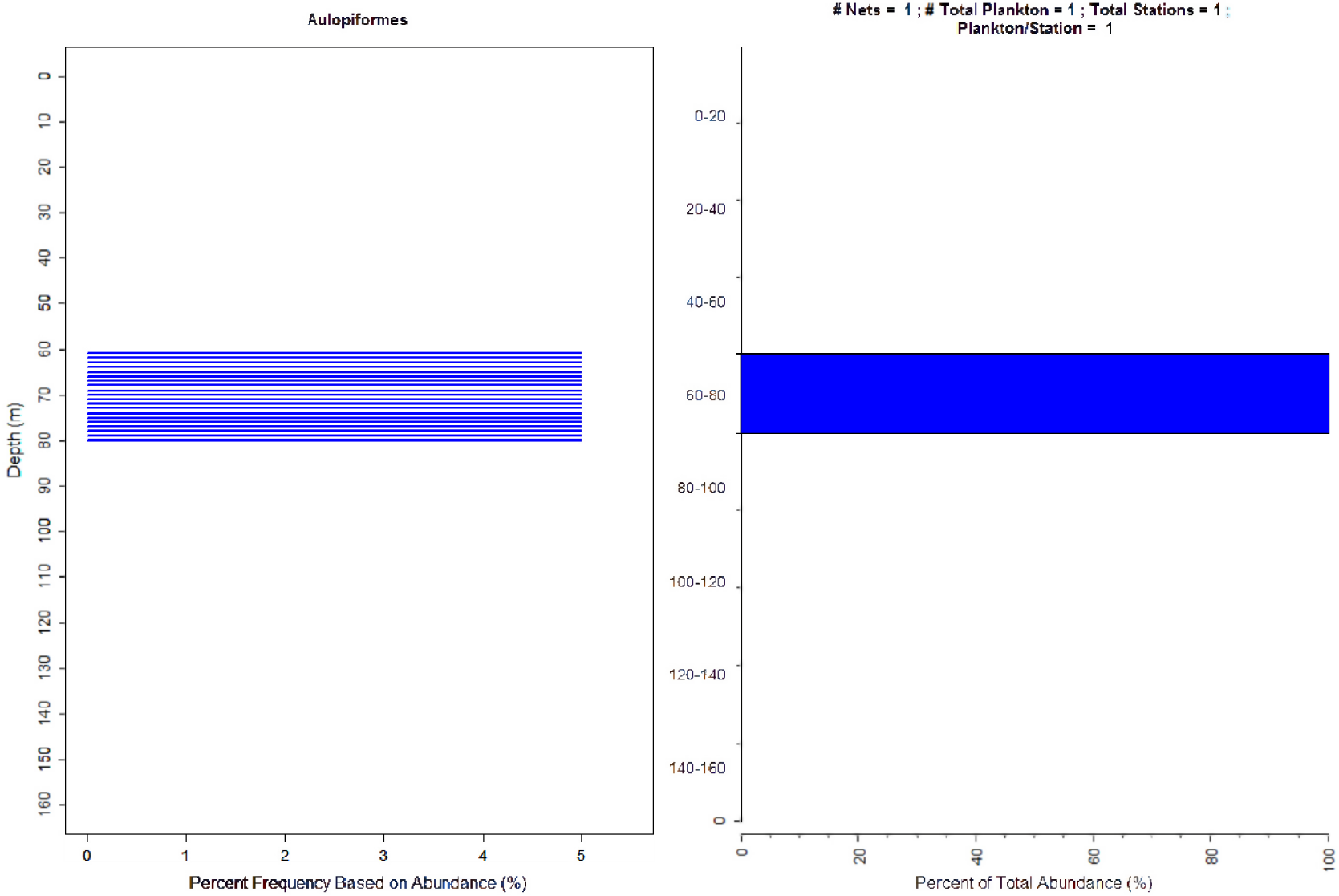
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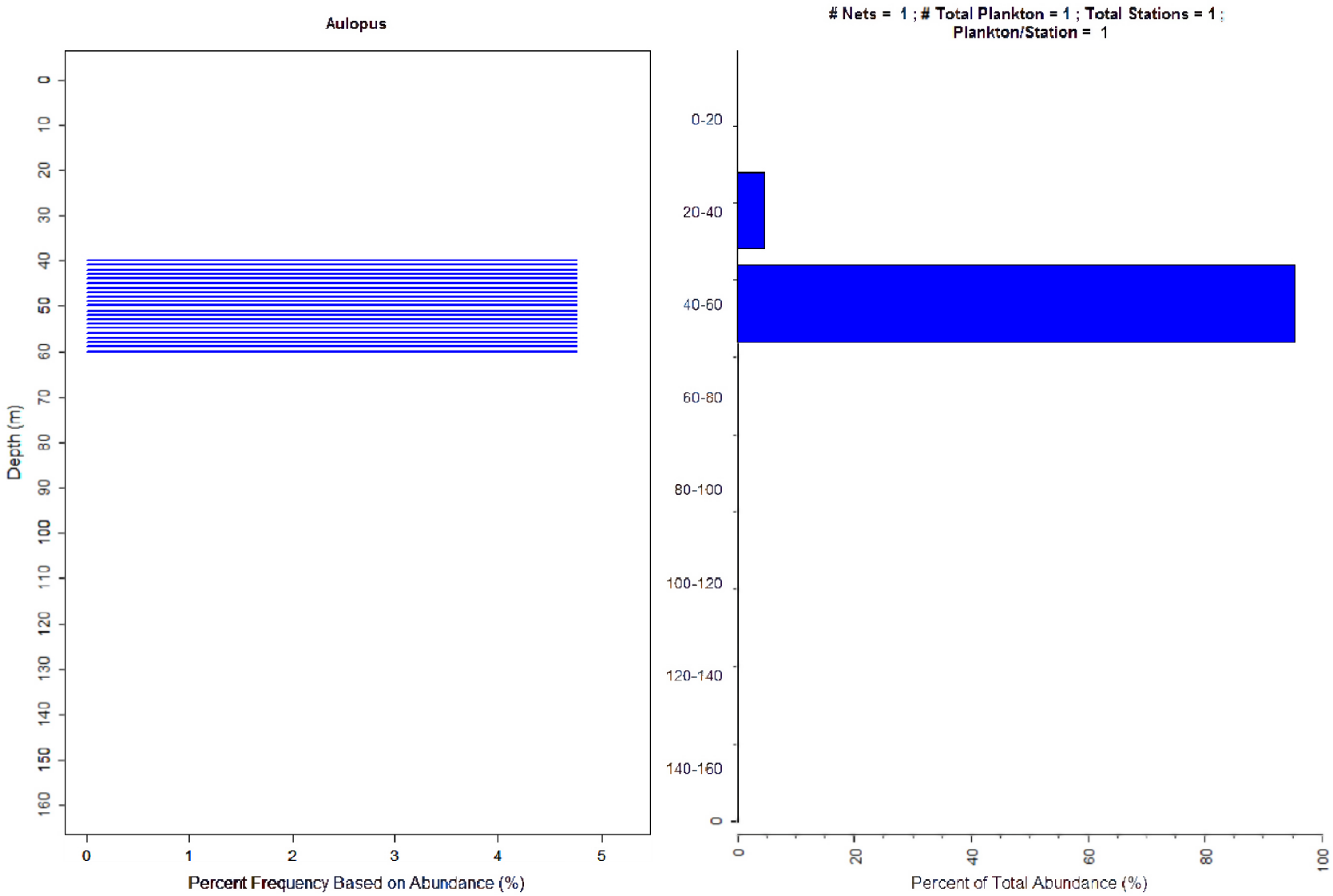
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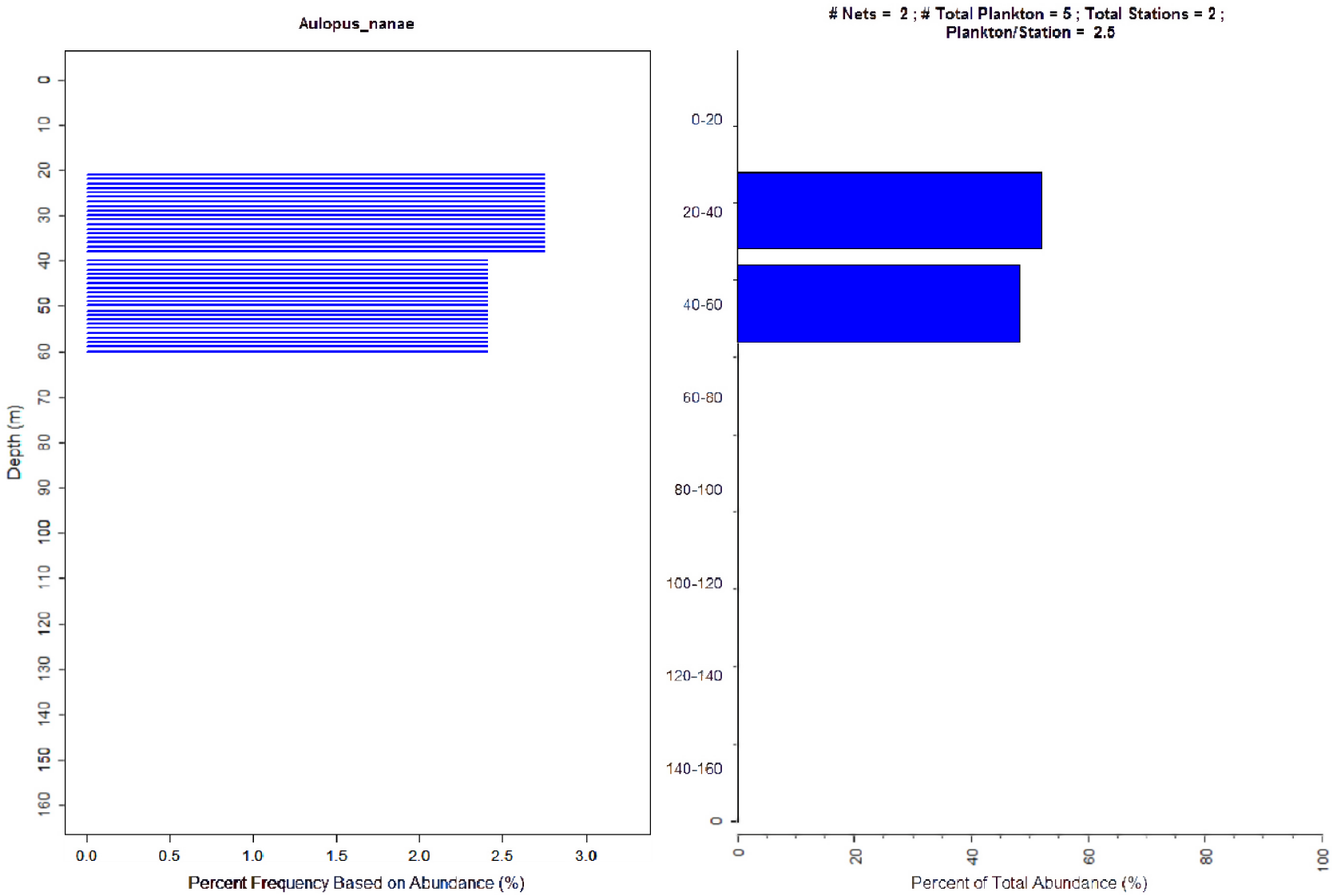
Ariomma_melanum - Shallow



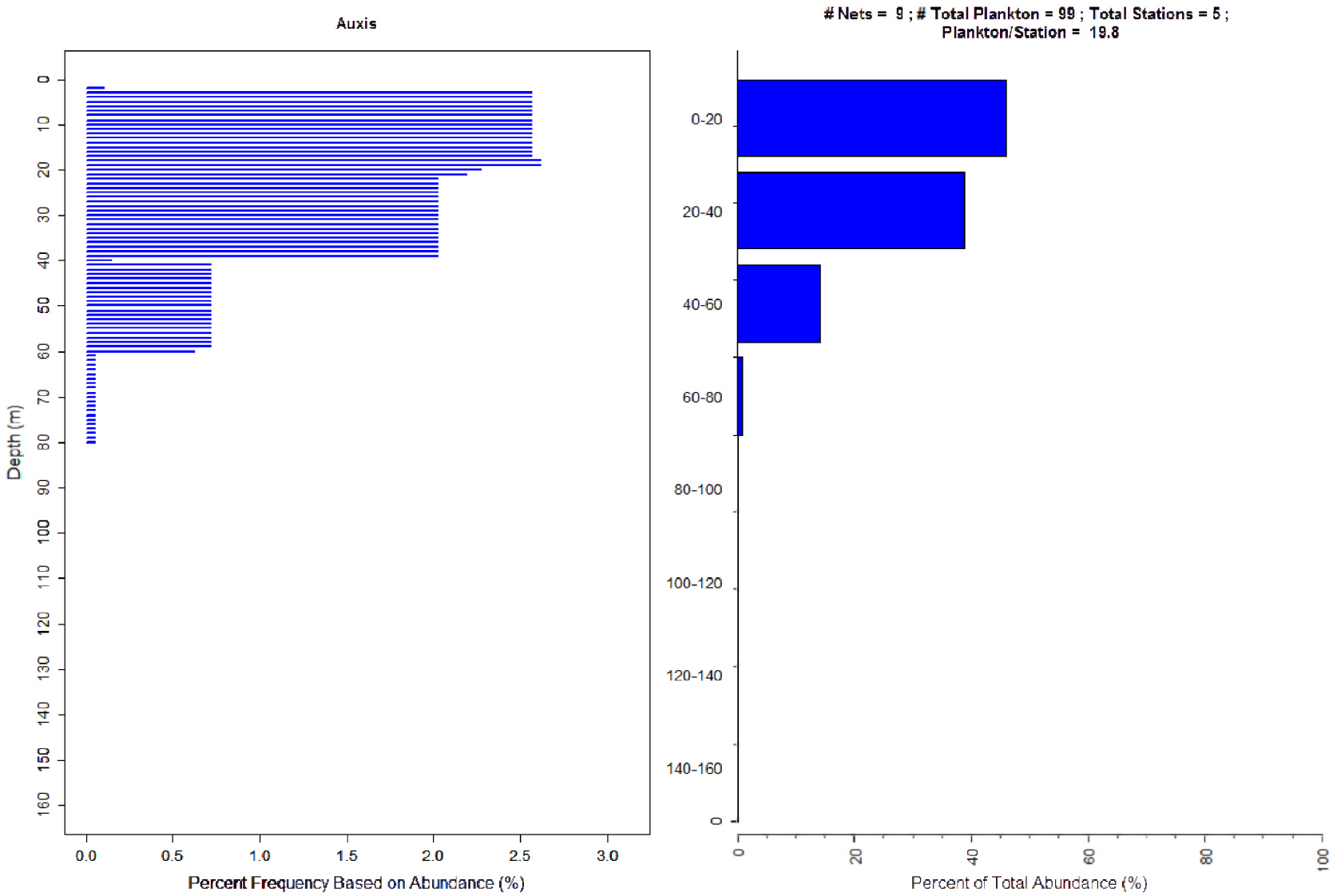
Aulopiformes - Shallow



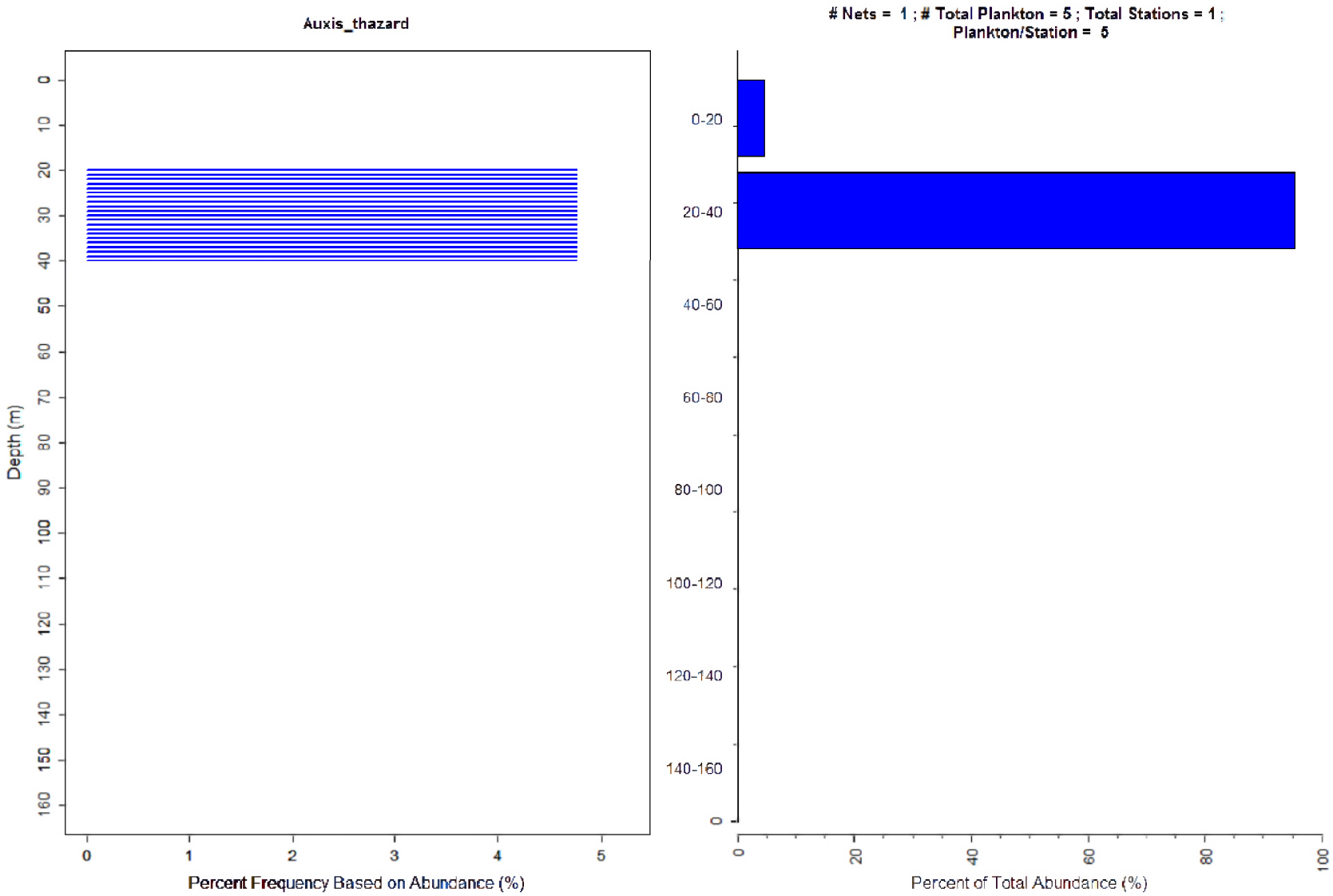
Aulopus - Shallow



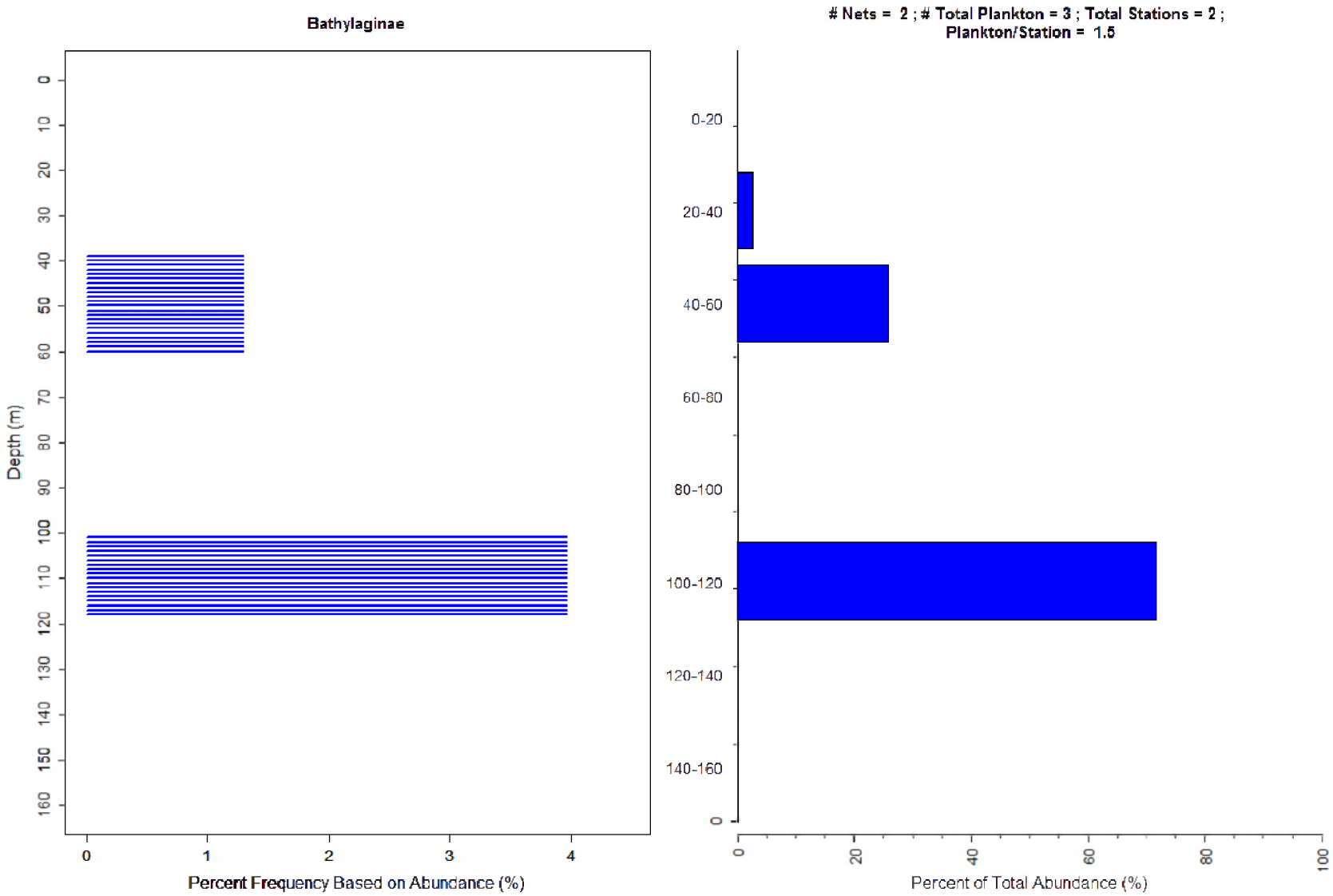
Aulopus_nanae - Shallow



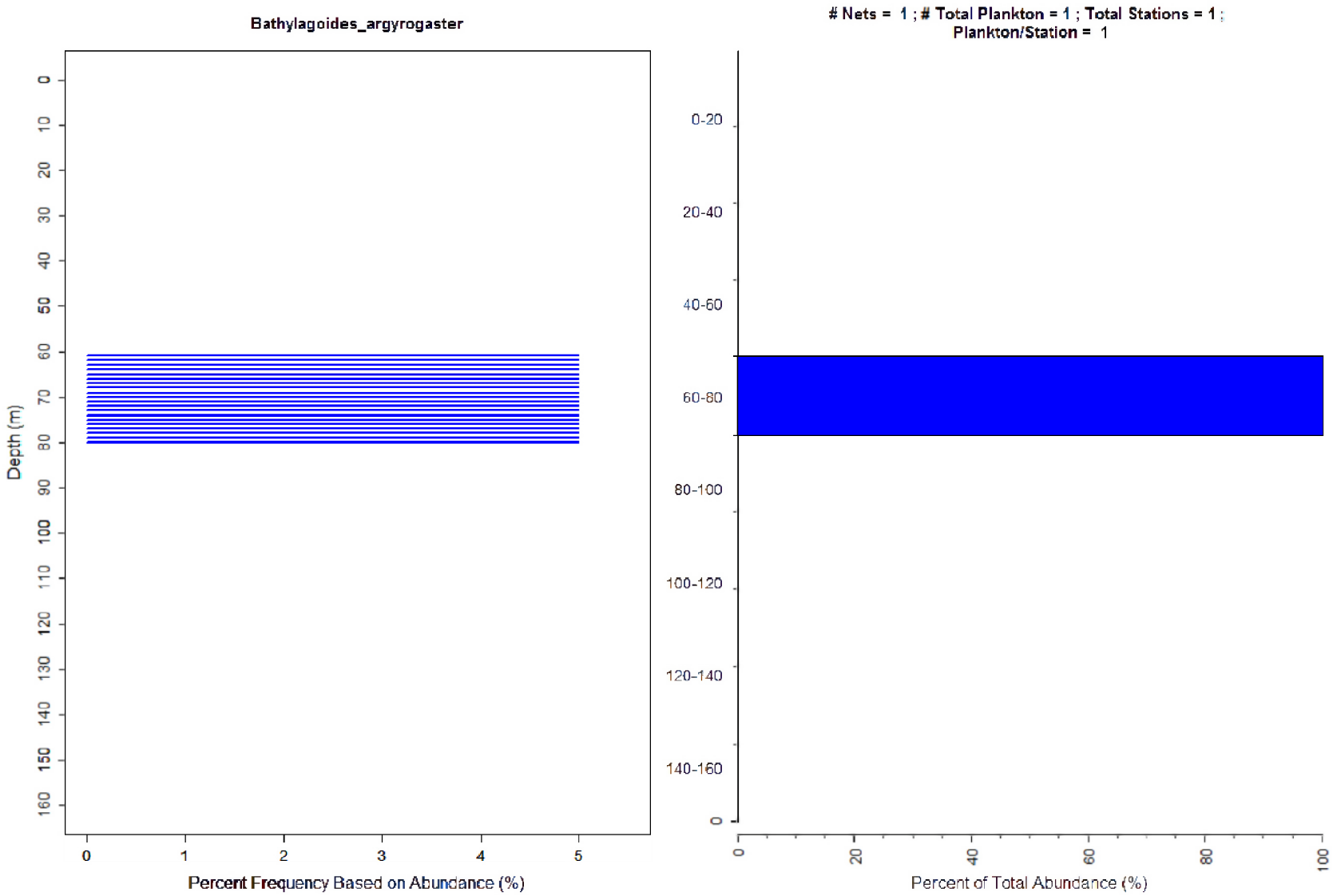
Auxis - Shallow



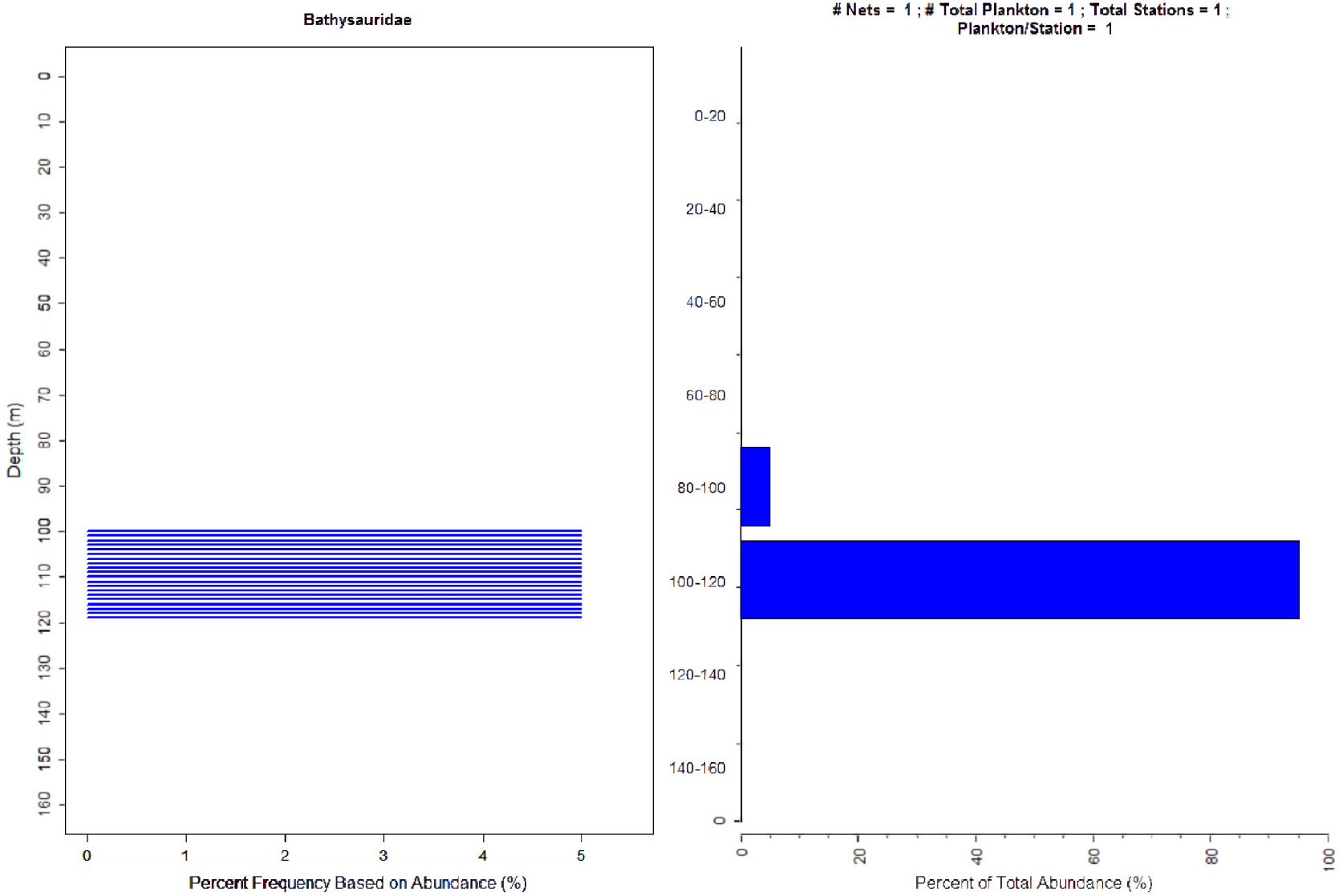
Auxis_thazard - Shallow



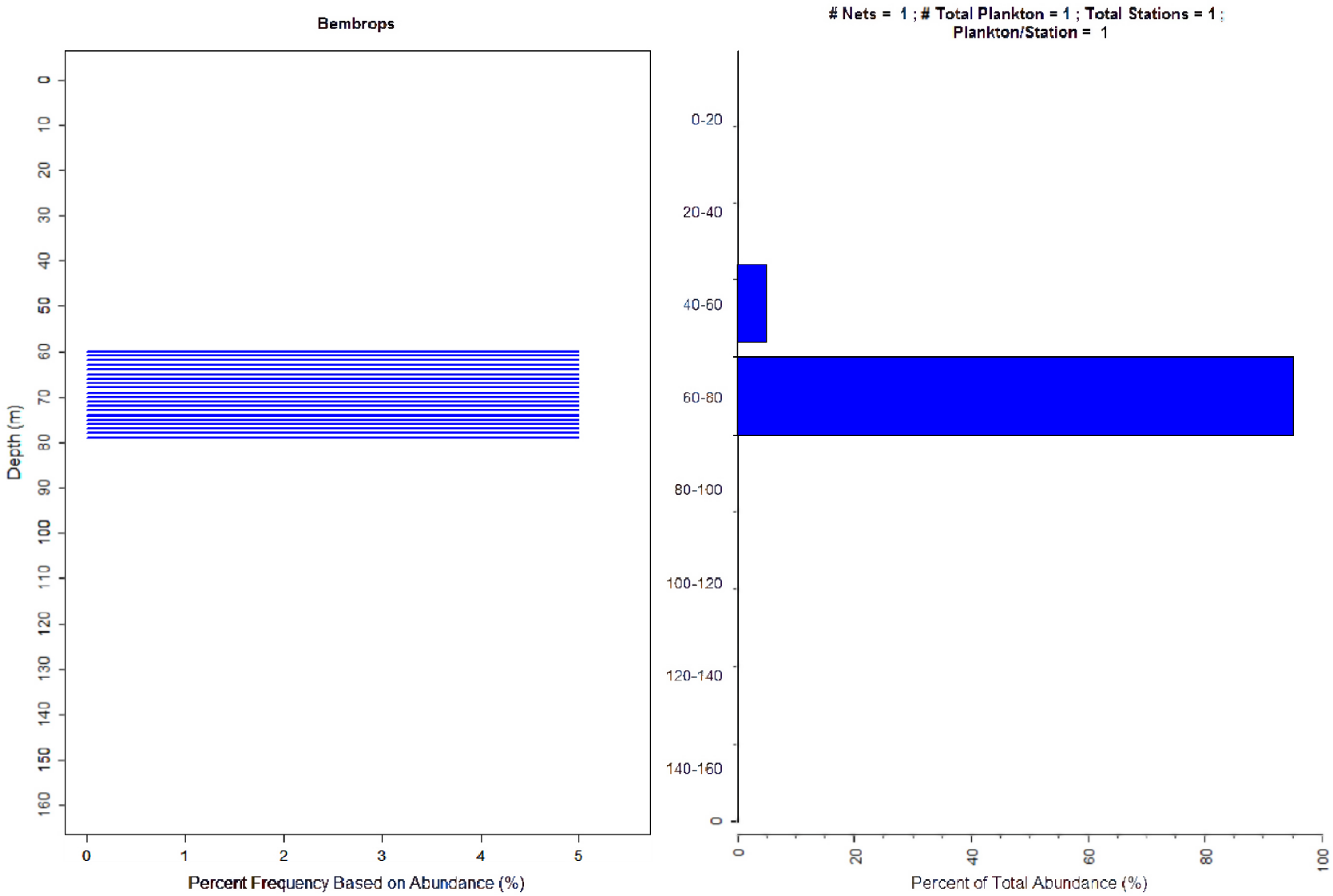
Bathylaginae - Shallow



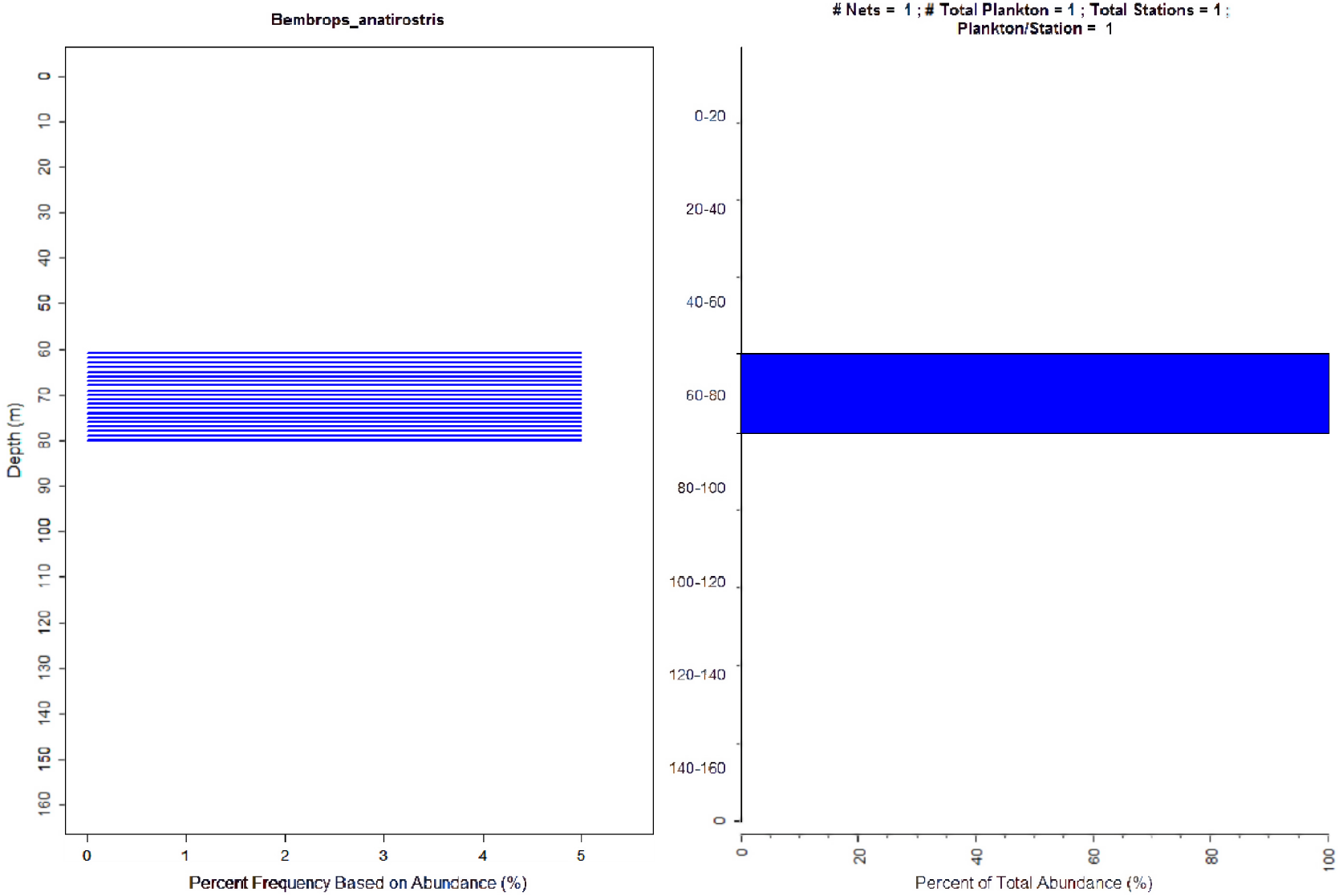
Bathylagoides_argyrogaster - Shallow



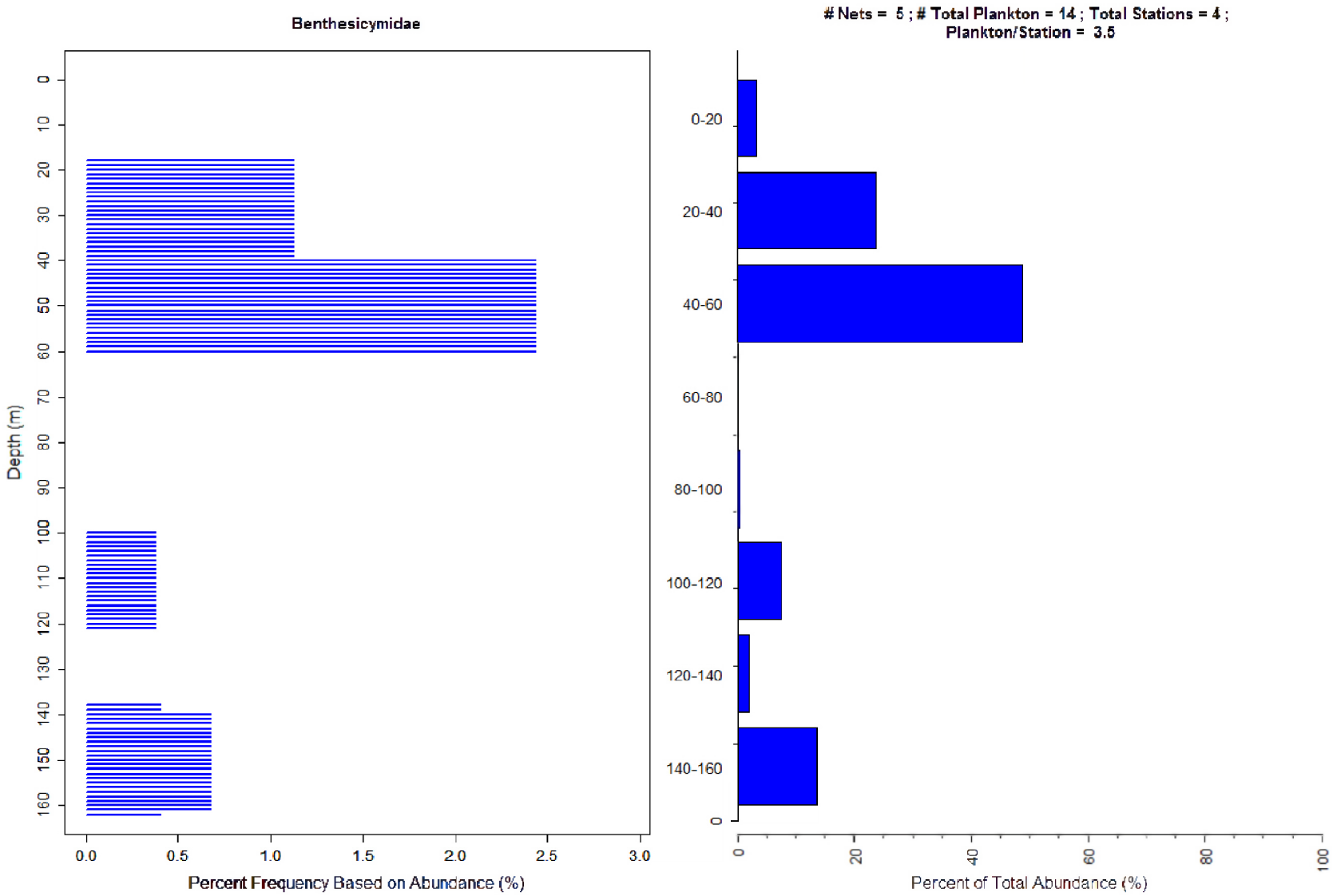
Bathysauridae - Shallow



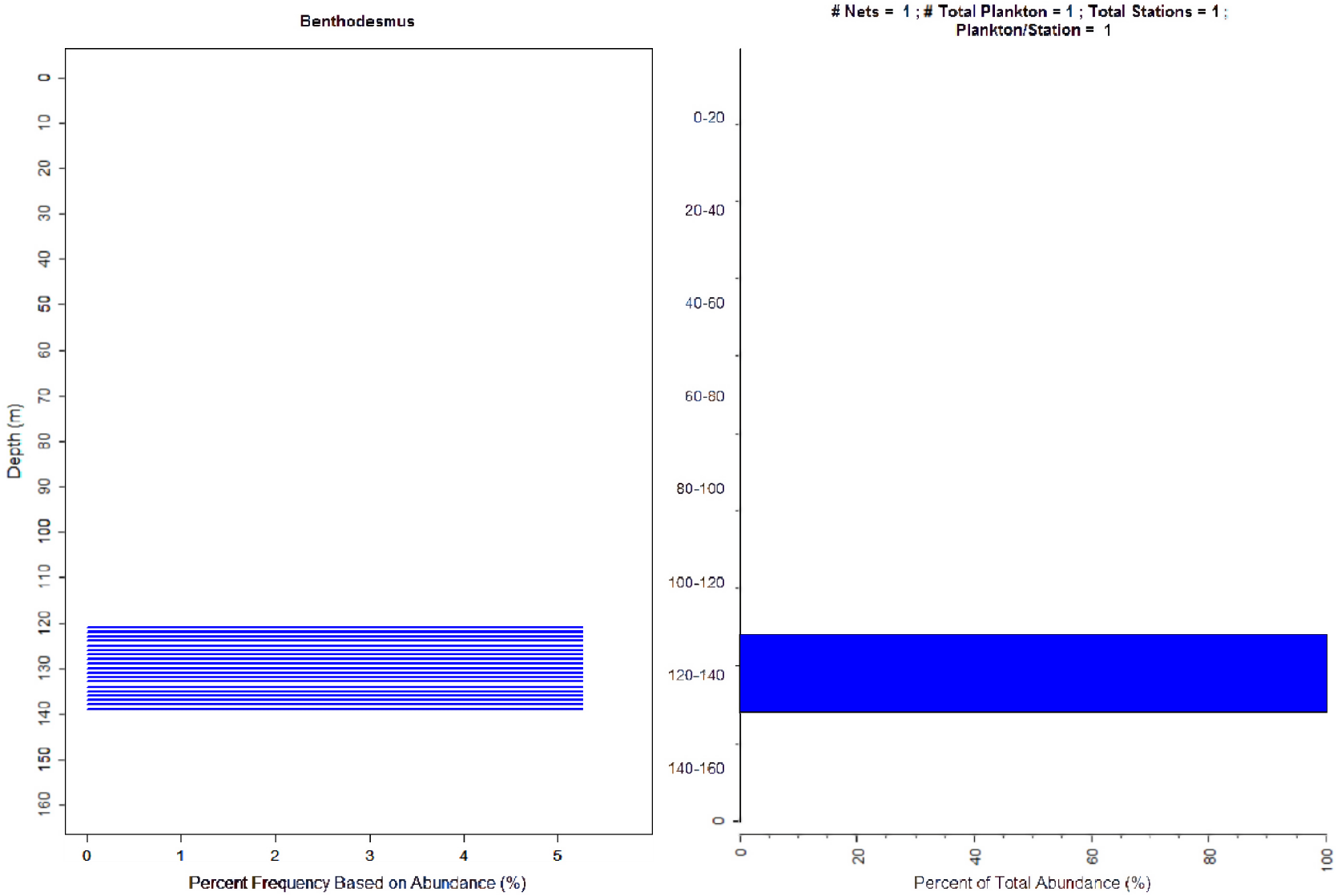
Bembrops - Shallow



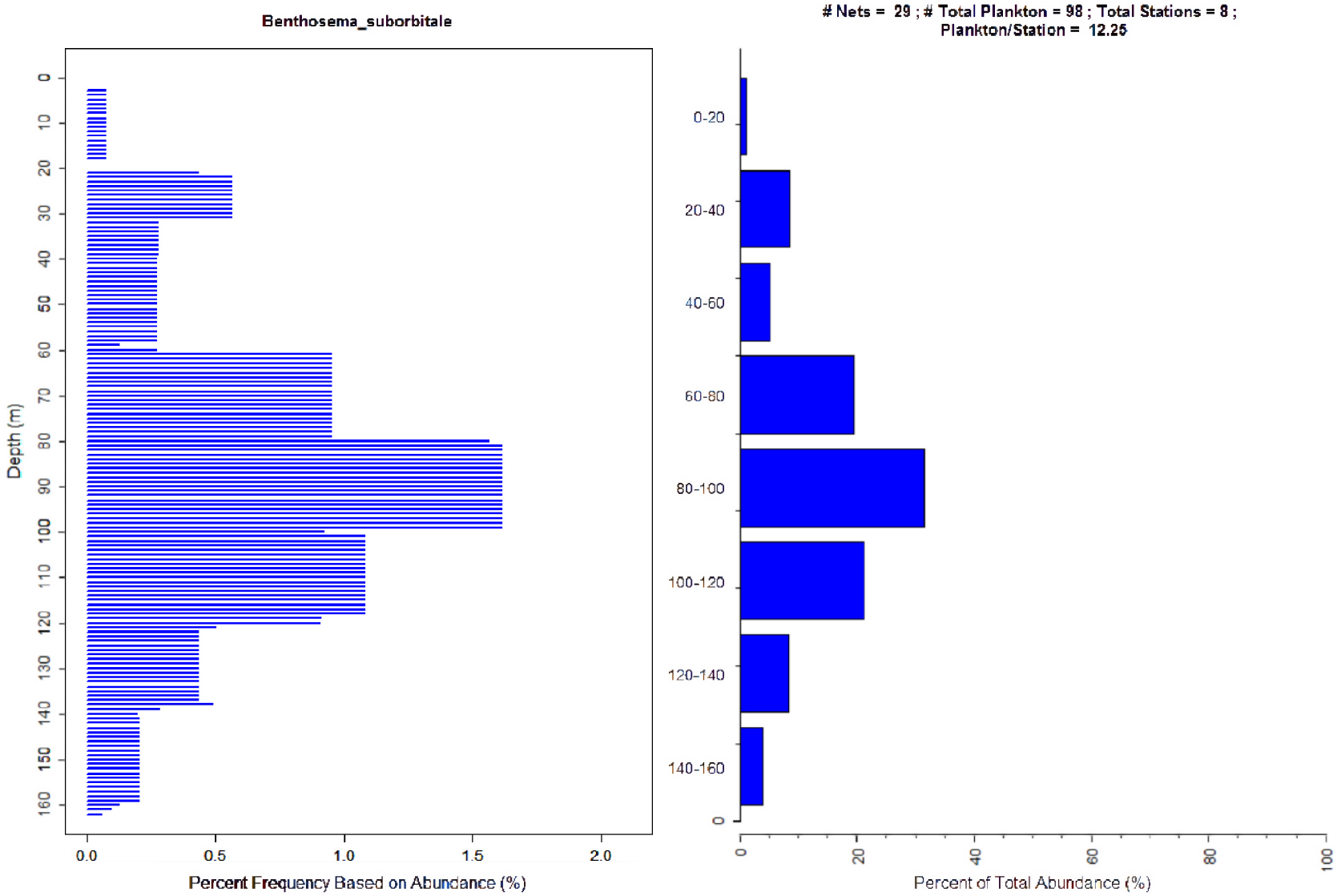
Bembrops_anatirostris - Shallow



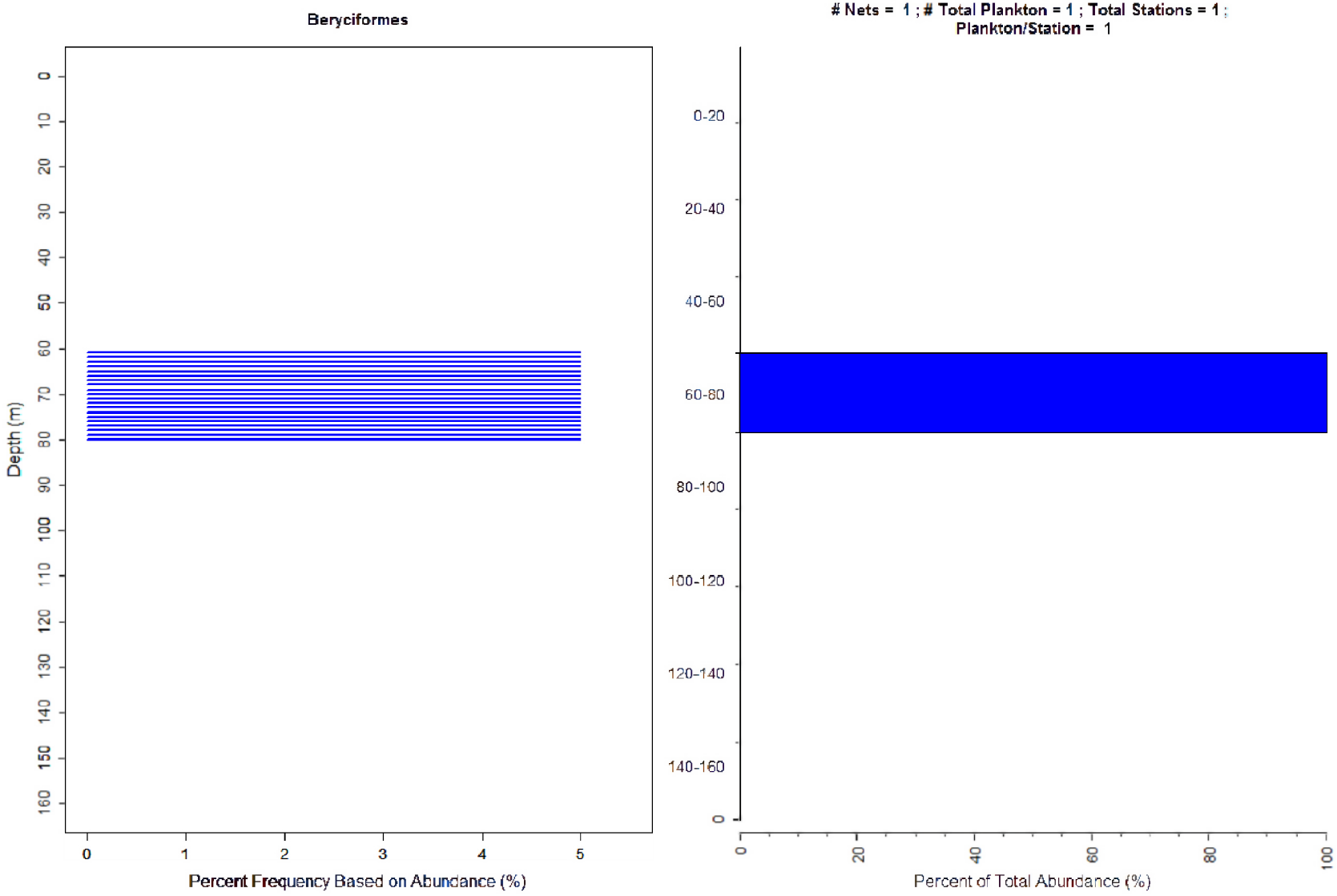
Benthesicymidae - Shallow



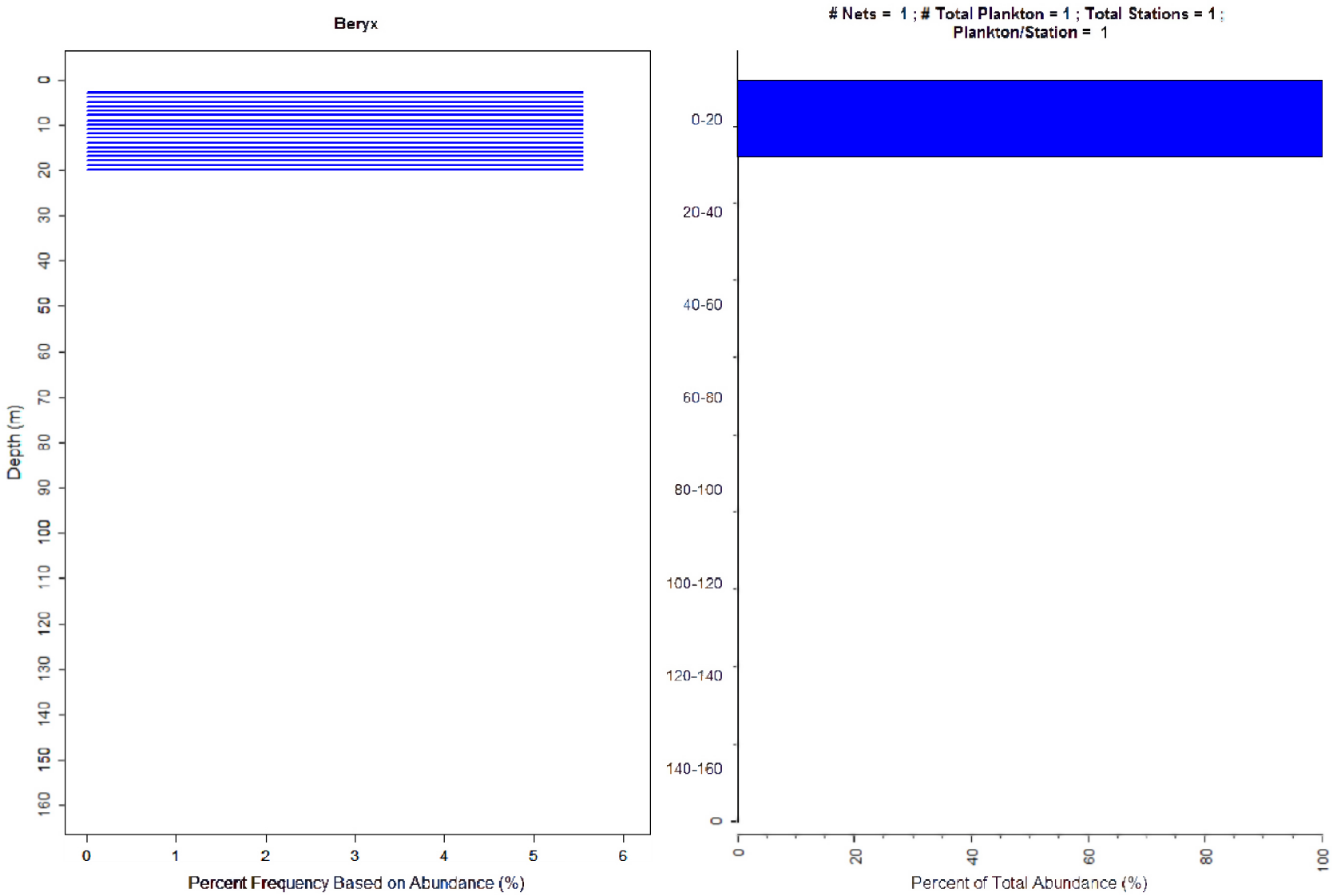
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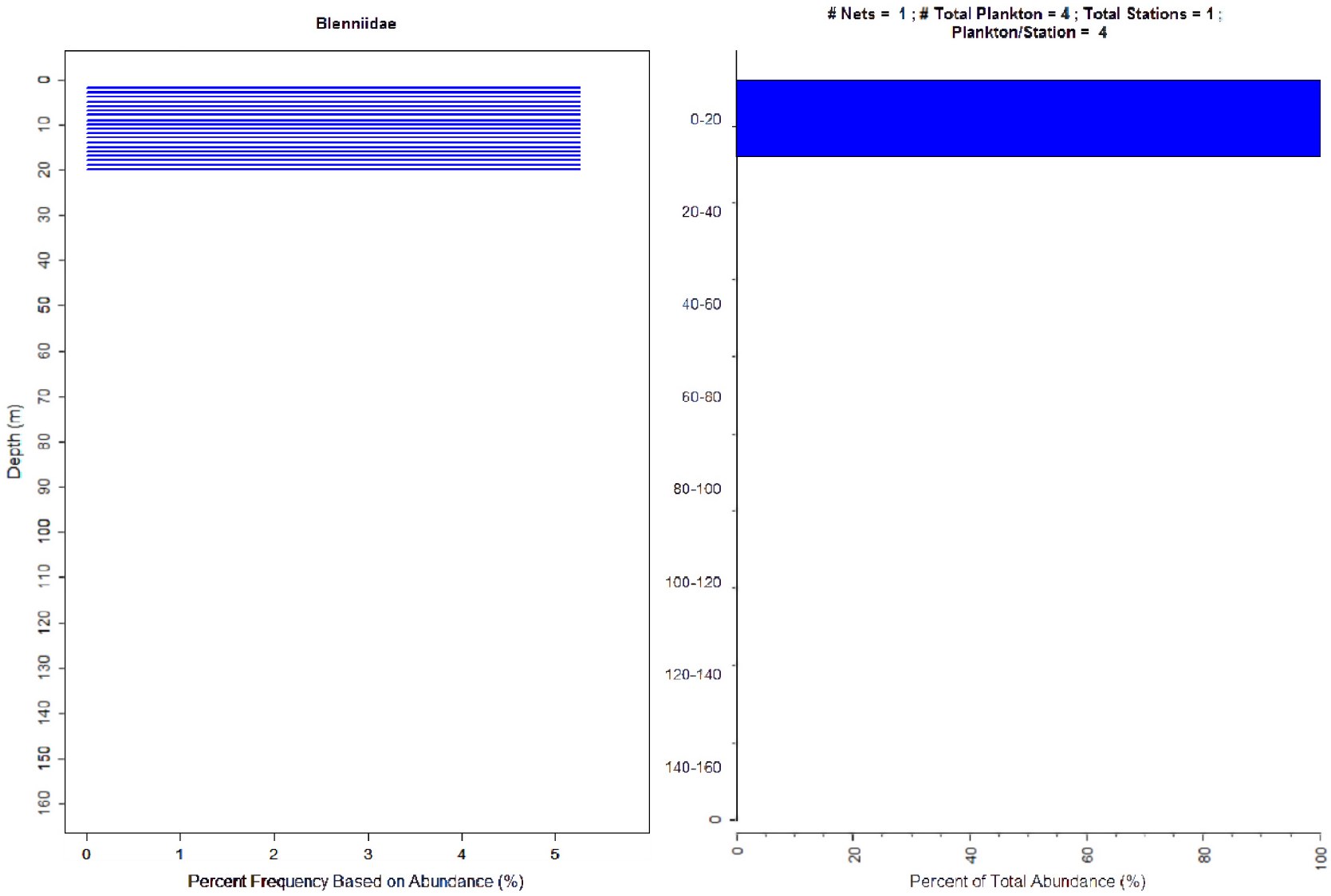
Benthosema_suborbitale - Shallow



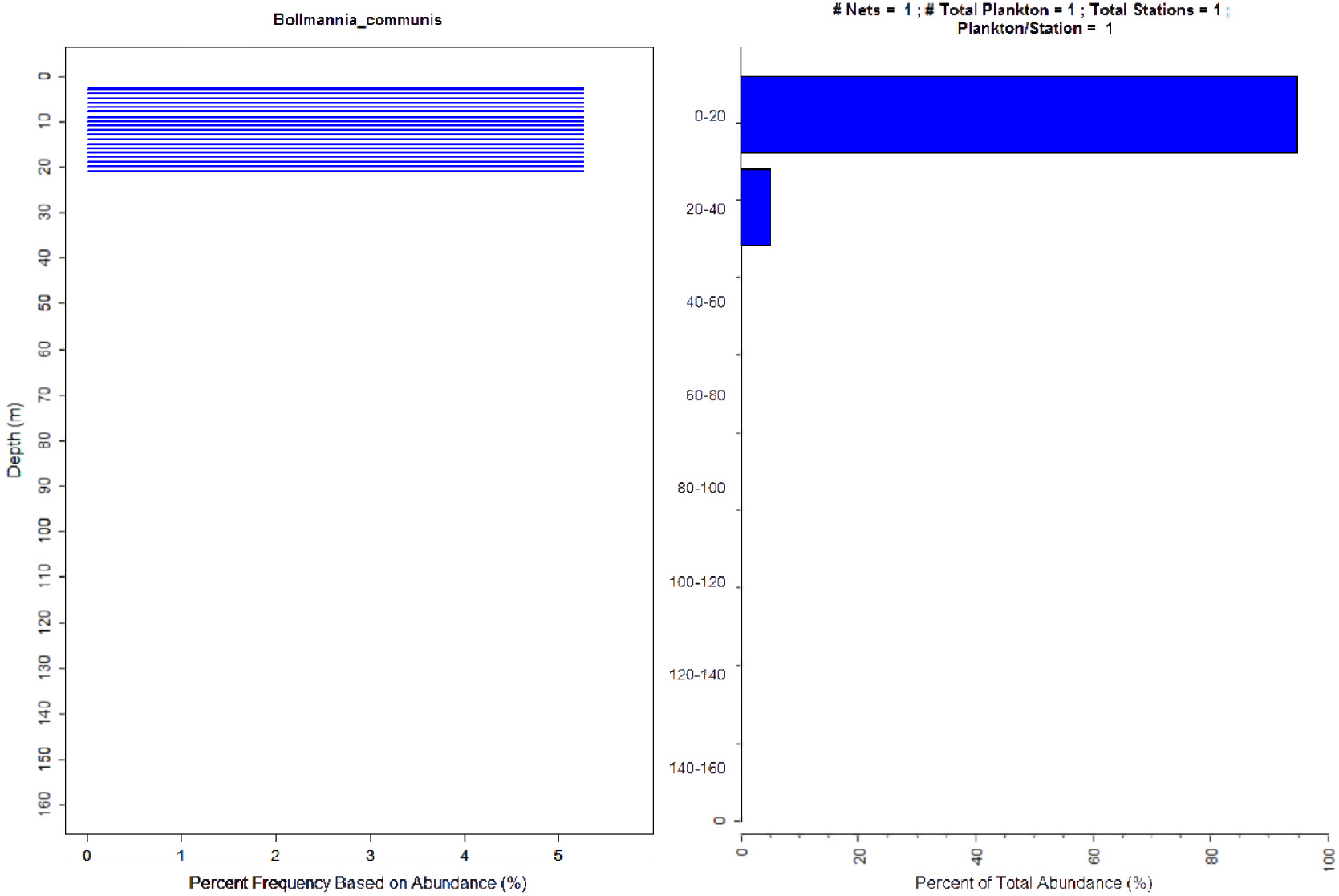
Beryciformes - Shallow



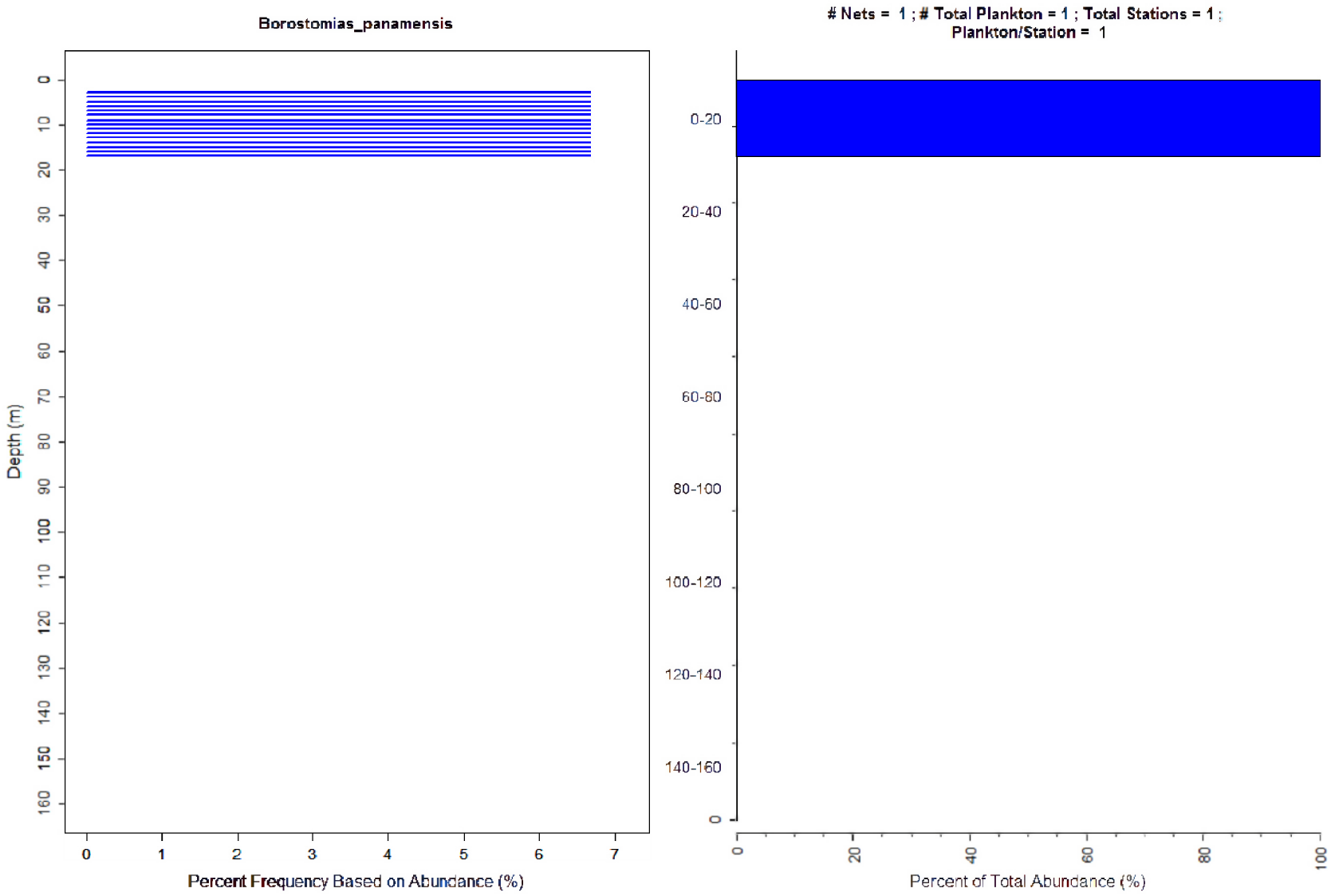
Beryx - Shallow



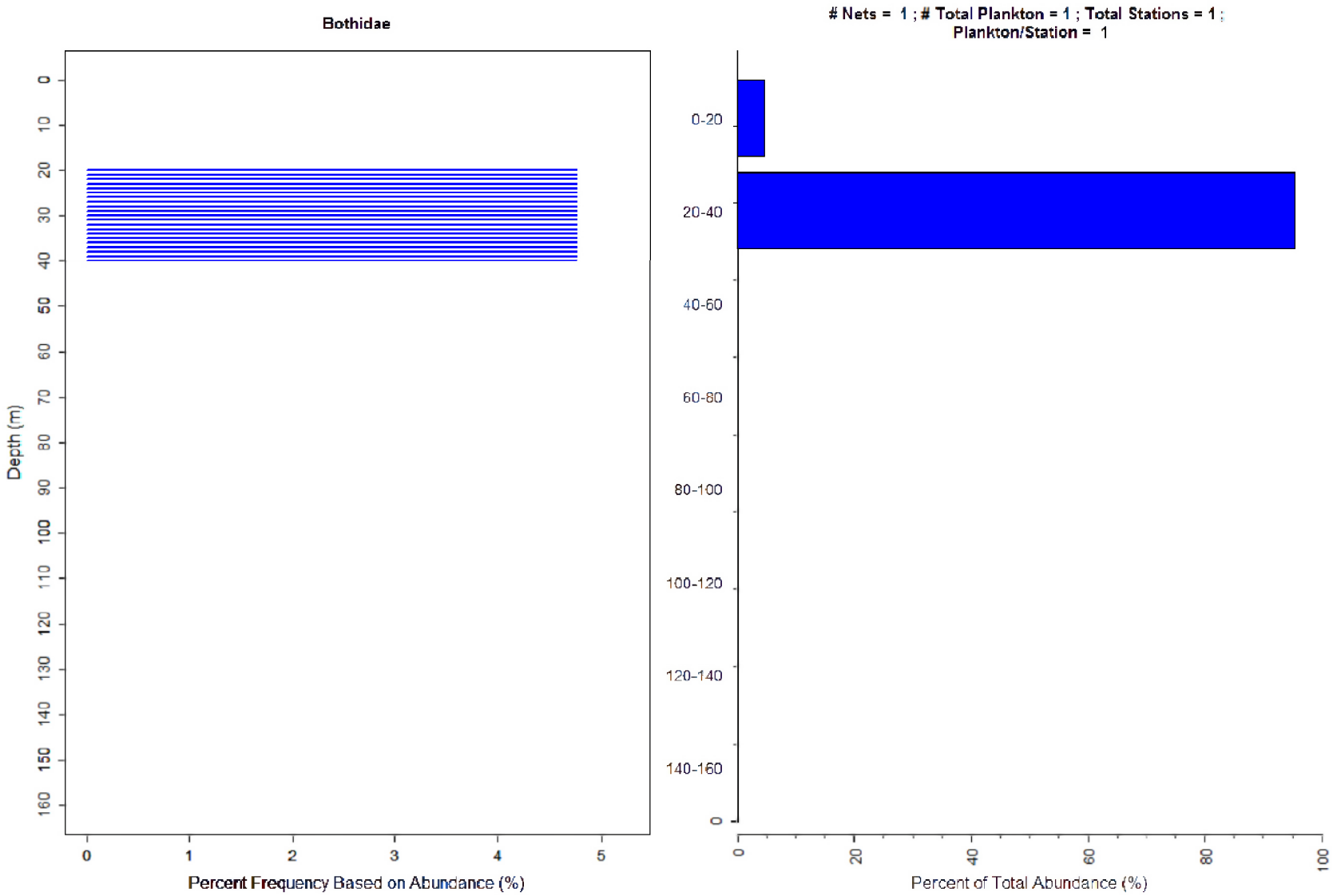
Blenniidae - Shallow



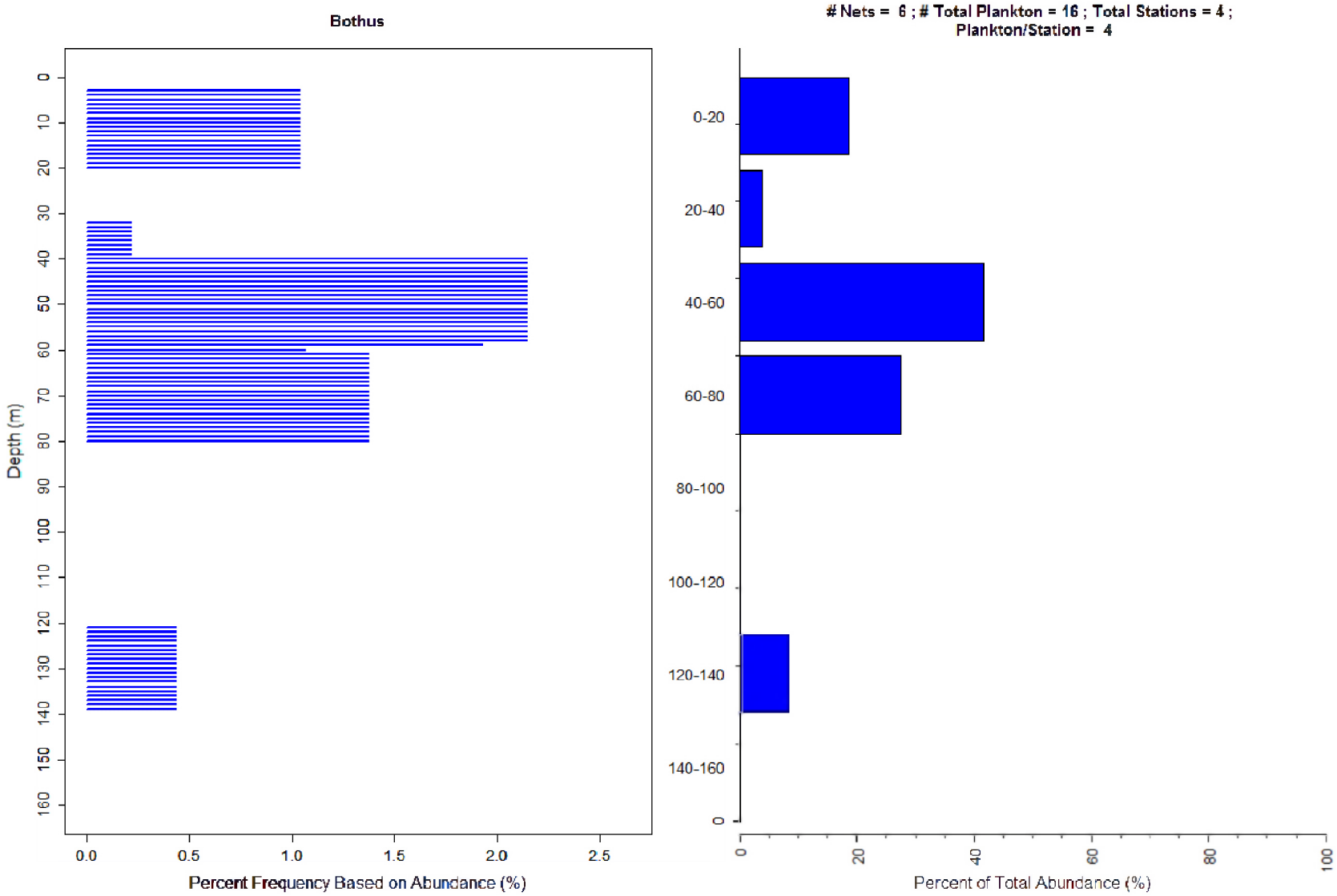
Bollmannia_communis - Shallow



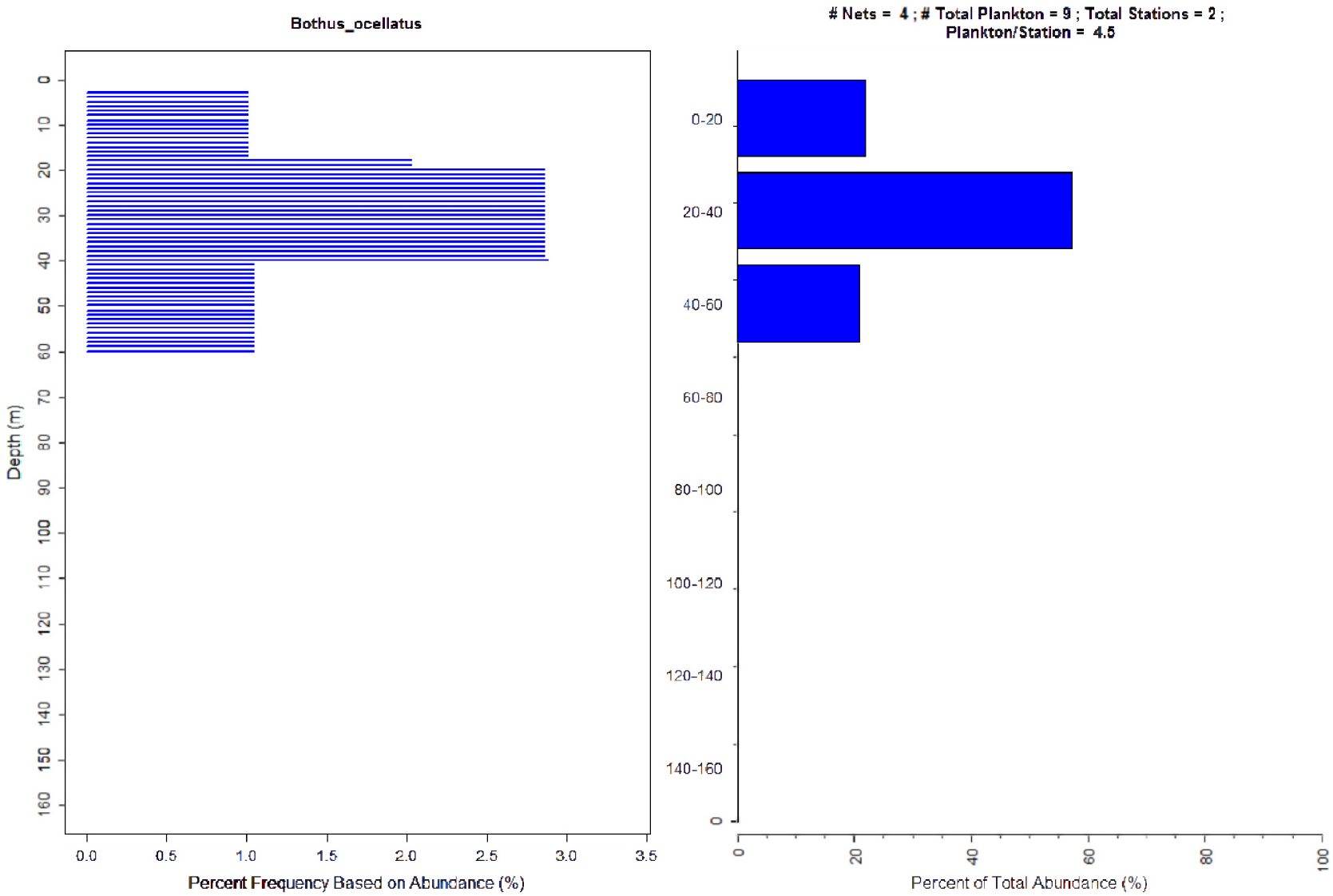
Borostomias_panamensis - Shallow



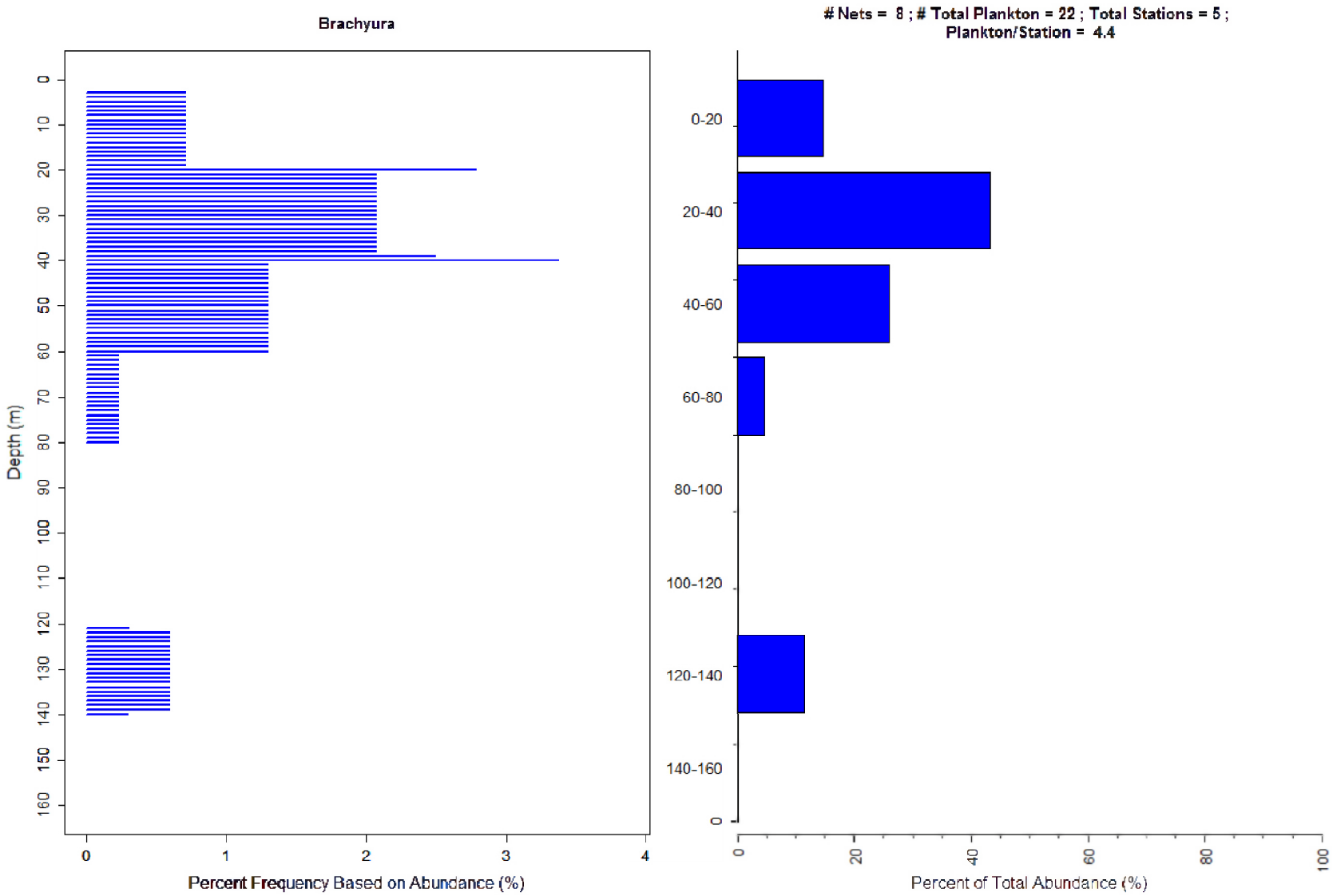
Bothidae - Shallow



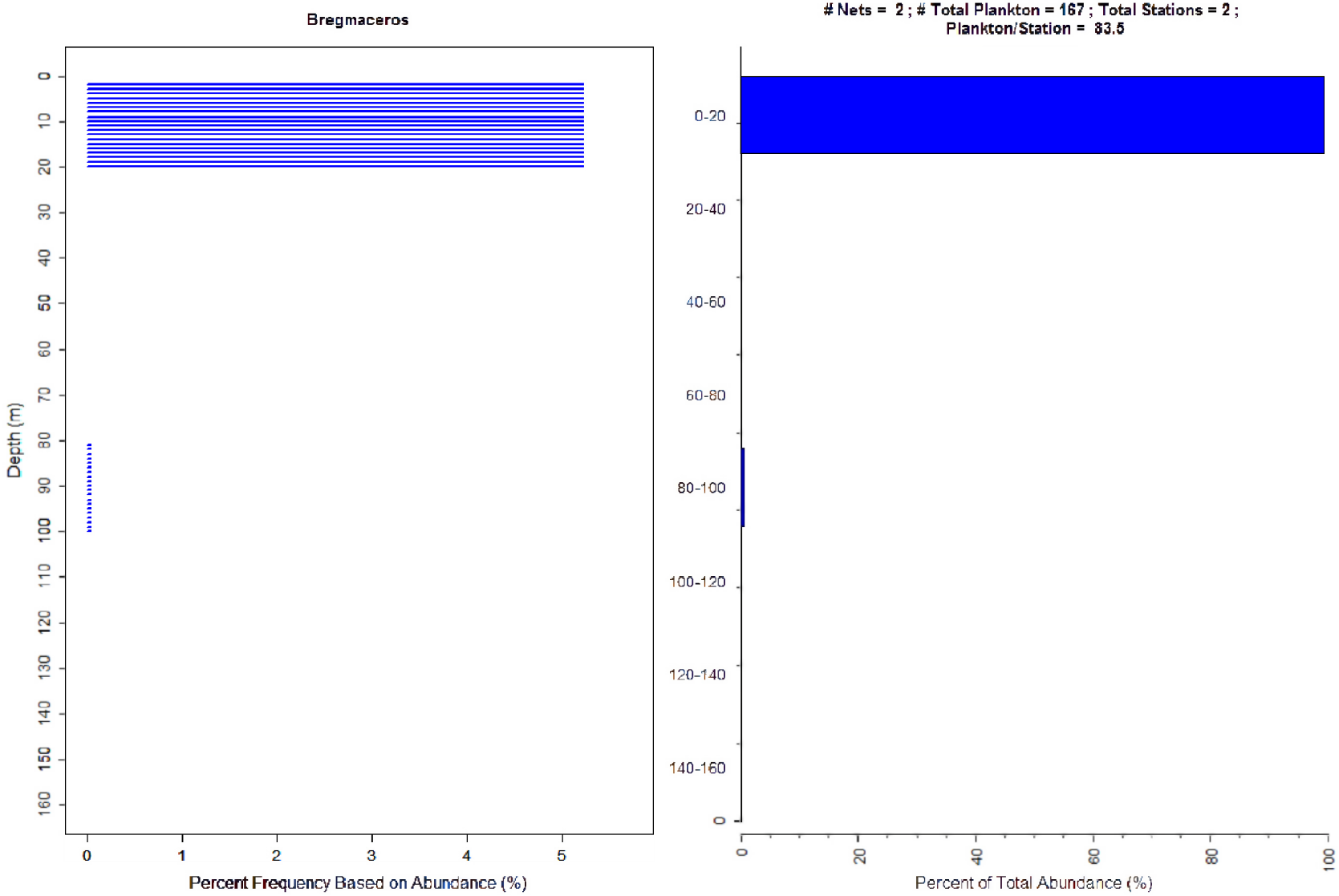
Bothus - Shallow



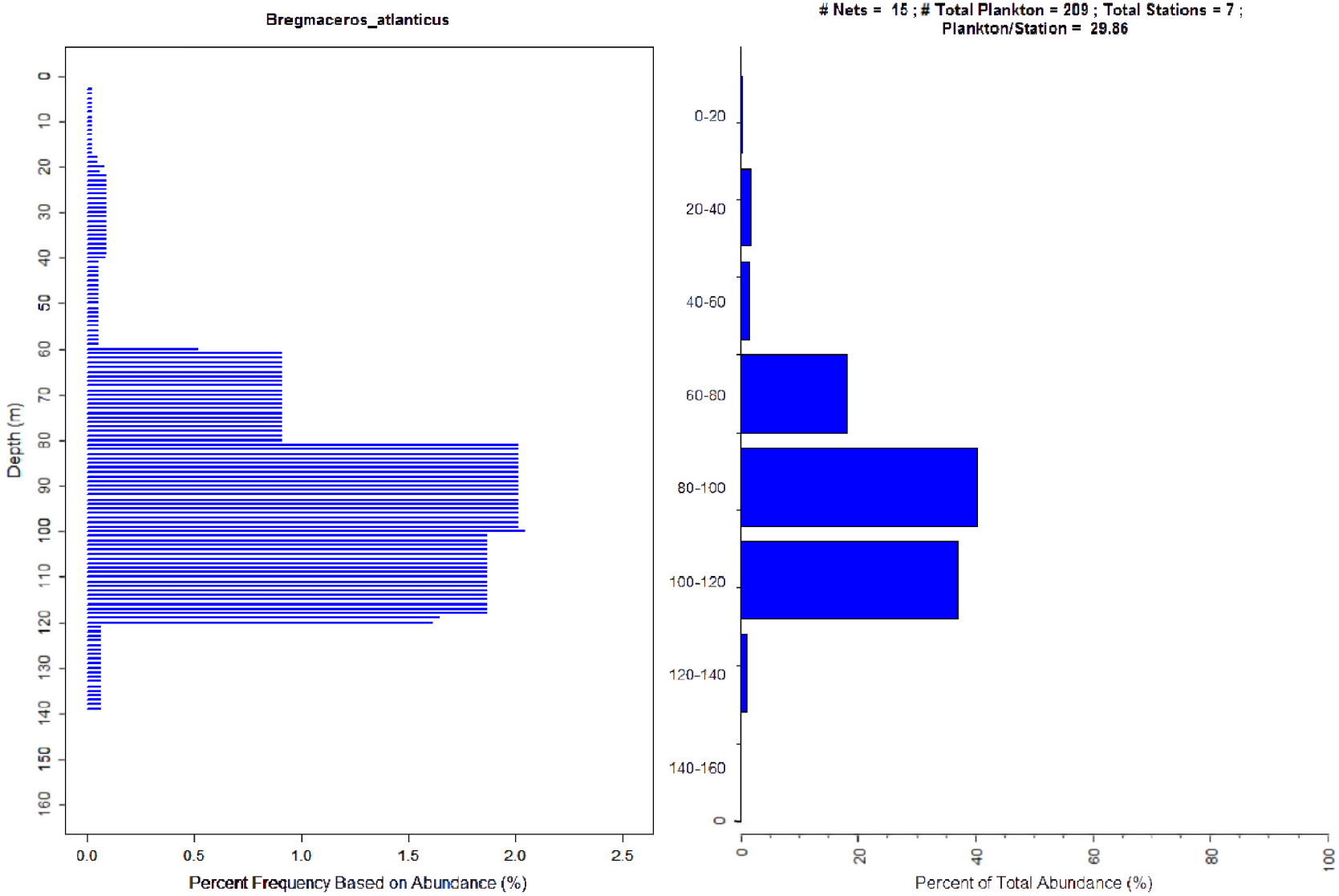
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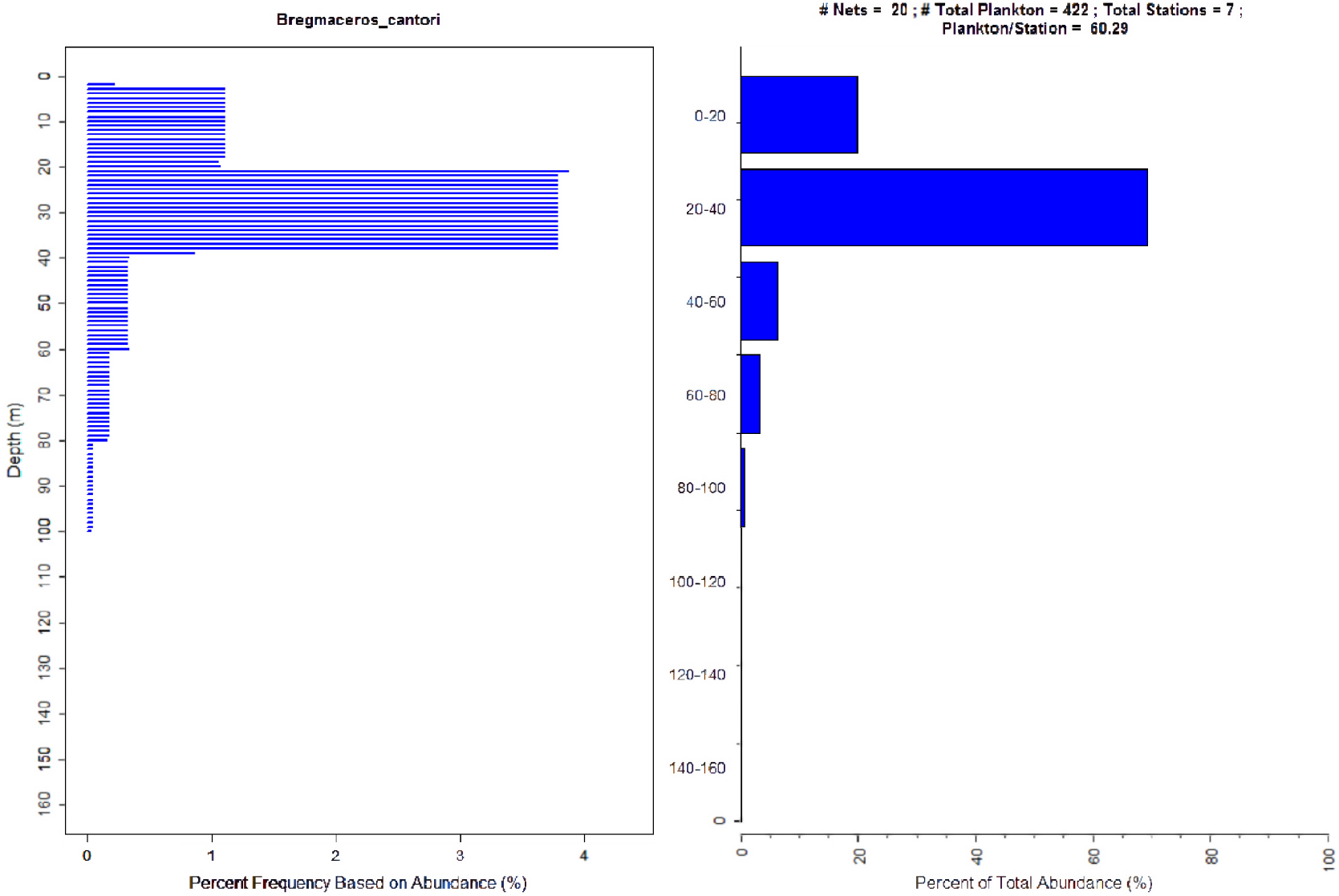
Brachyura - Shallow



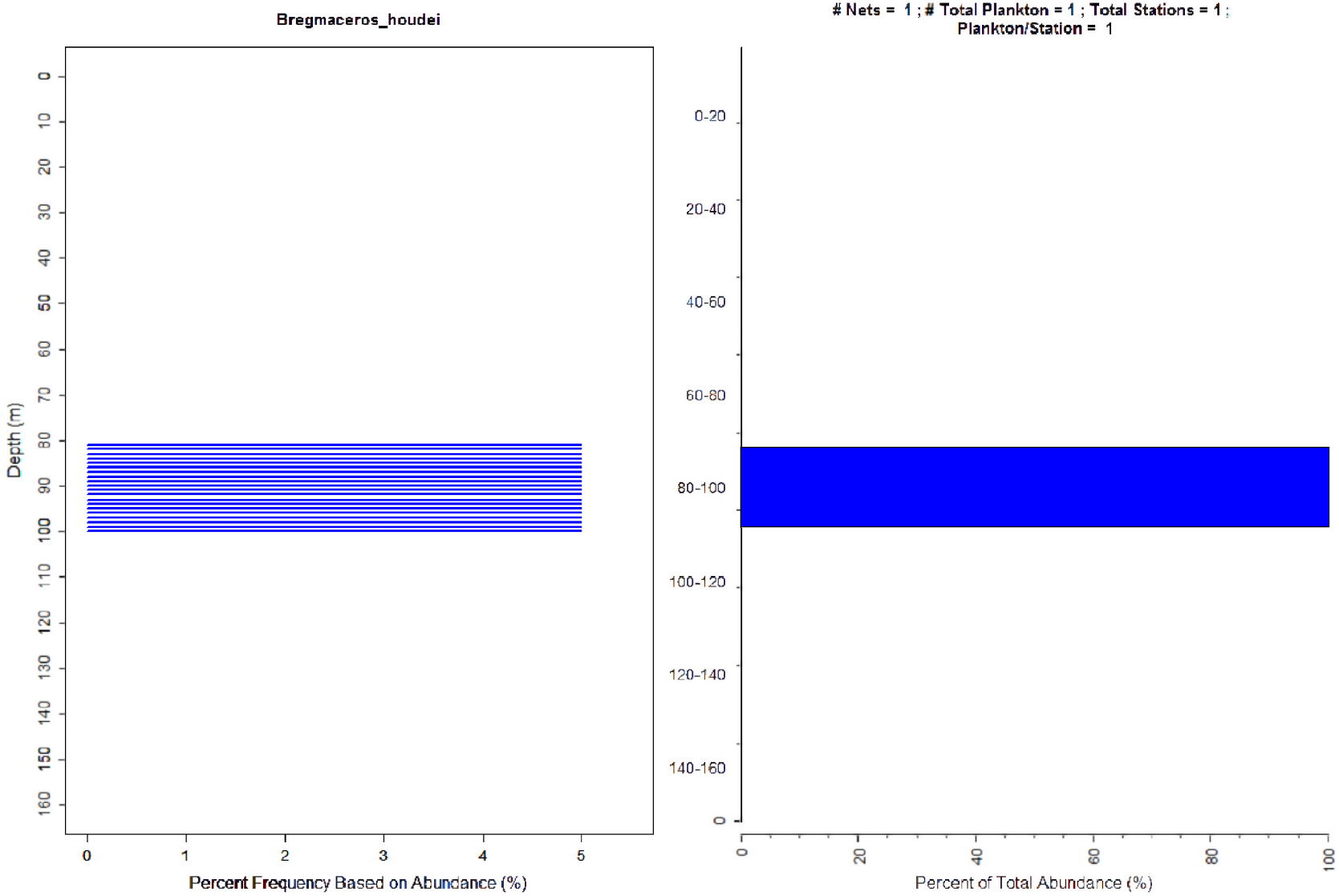
Bregmaceros - Shallow



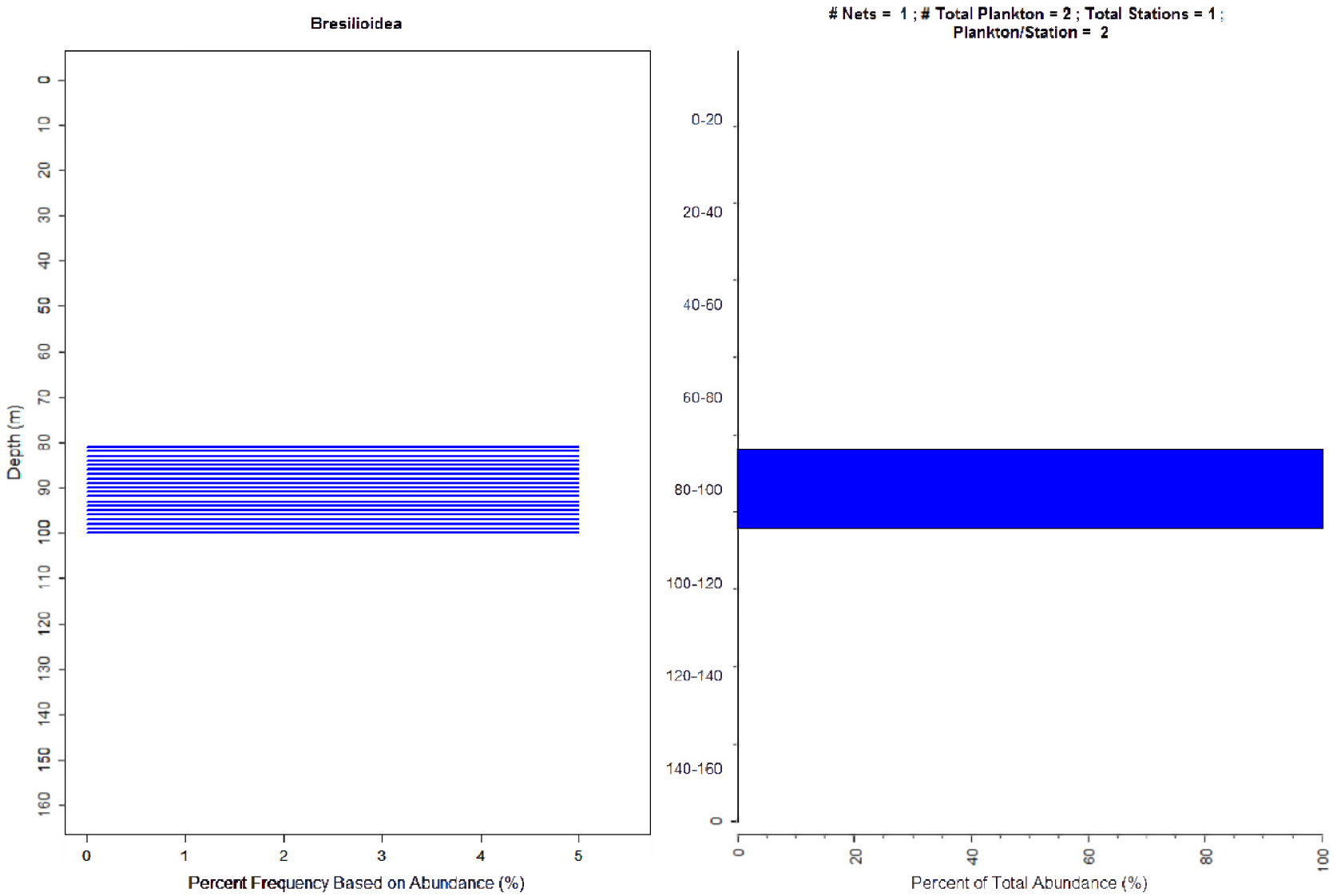
Bregmaceros_atlanticus - Shallow



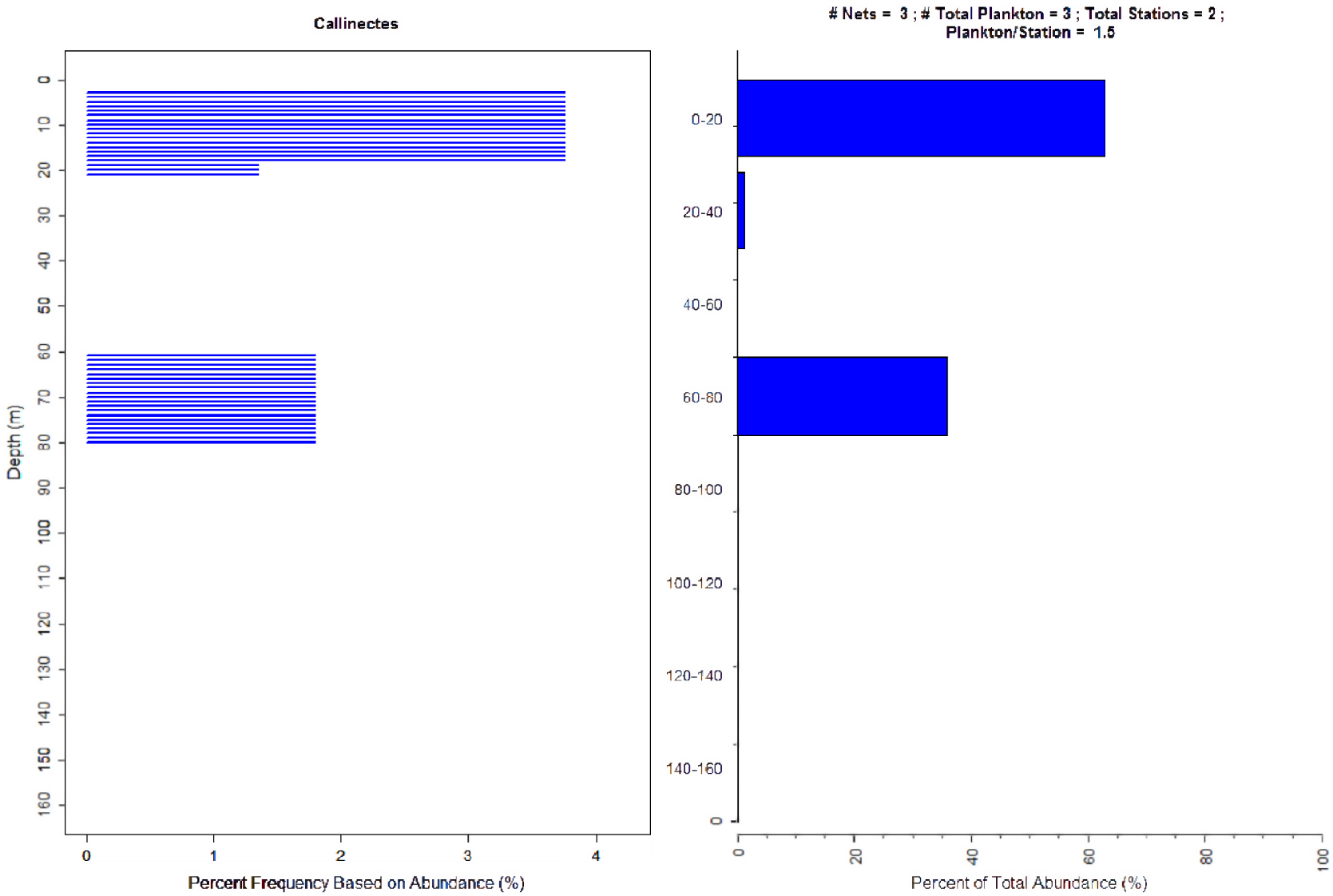
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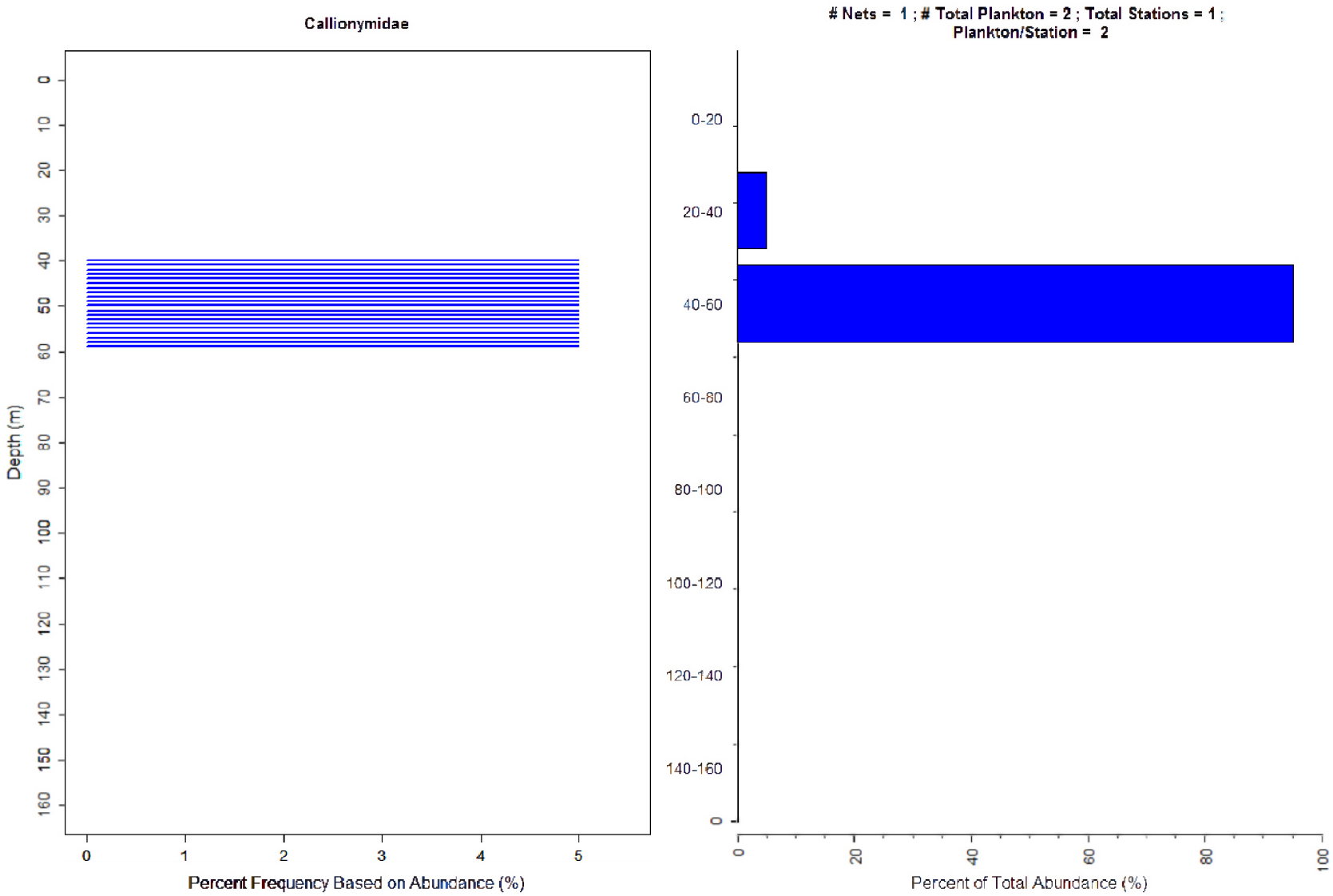
Bregmaceros_houdei - Shallow



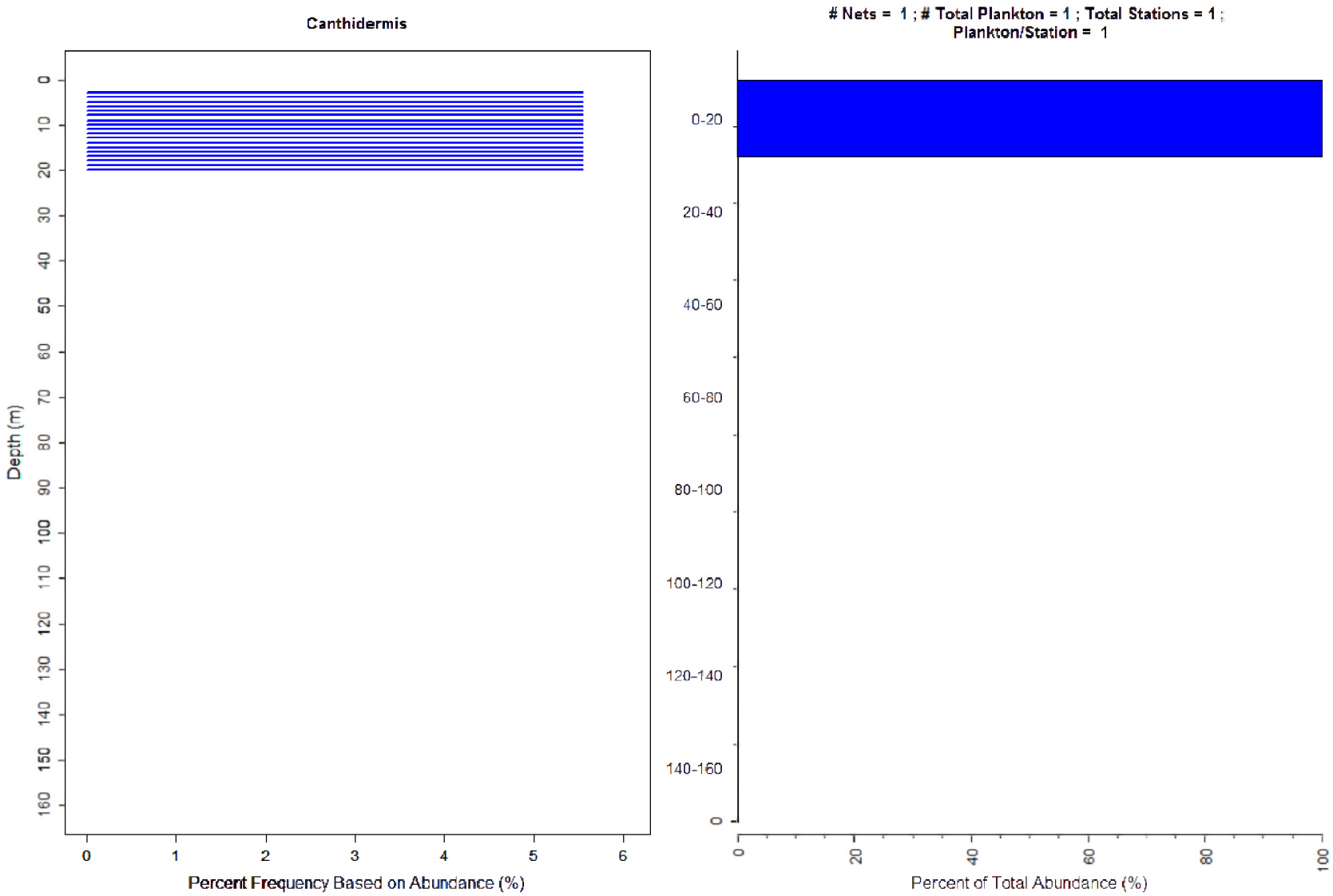
Bresilioidea - Shallow



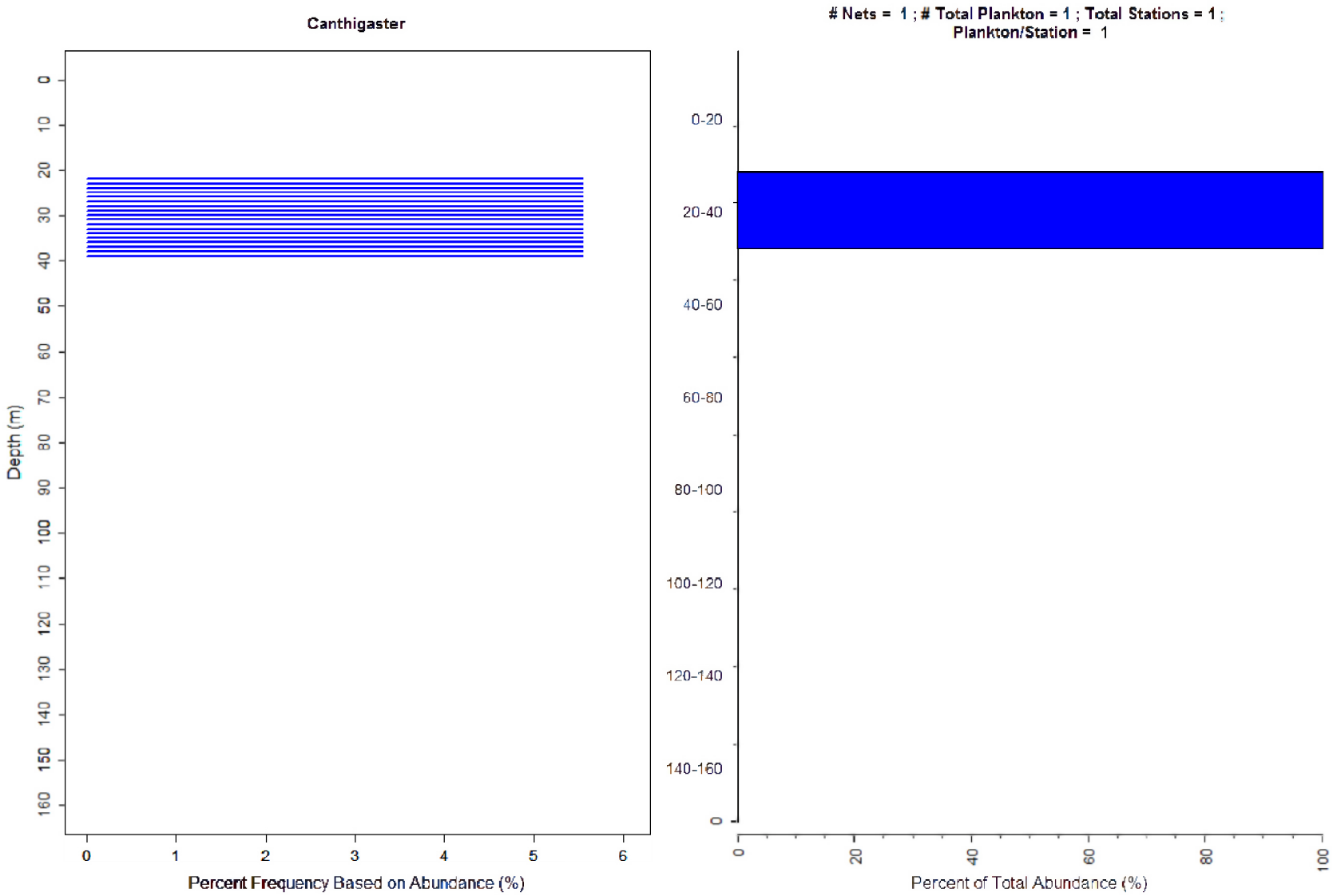
Callinectes - Shallow



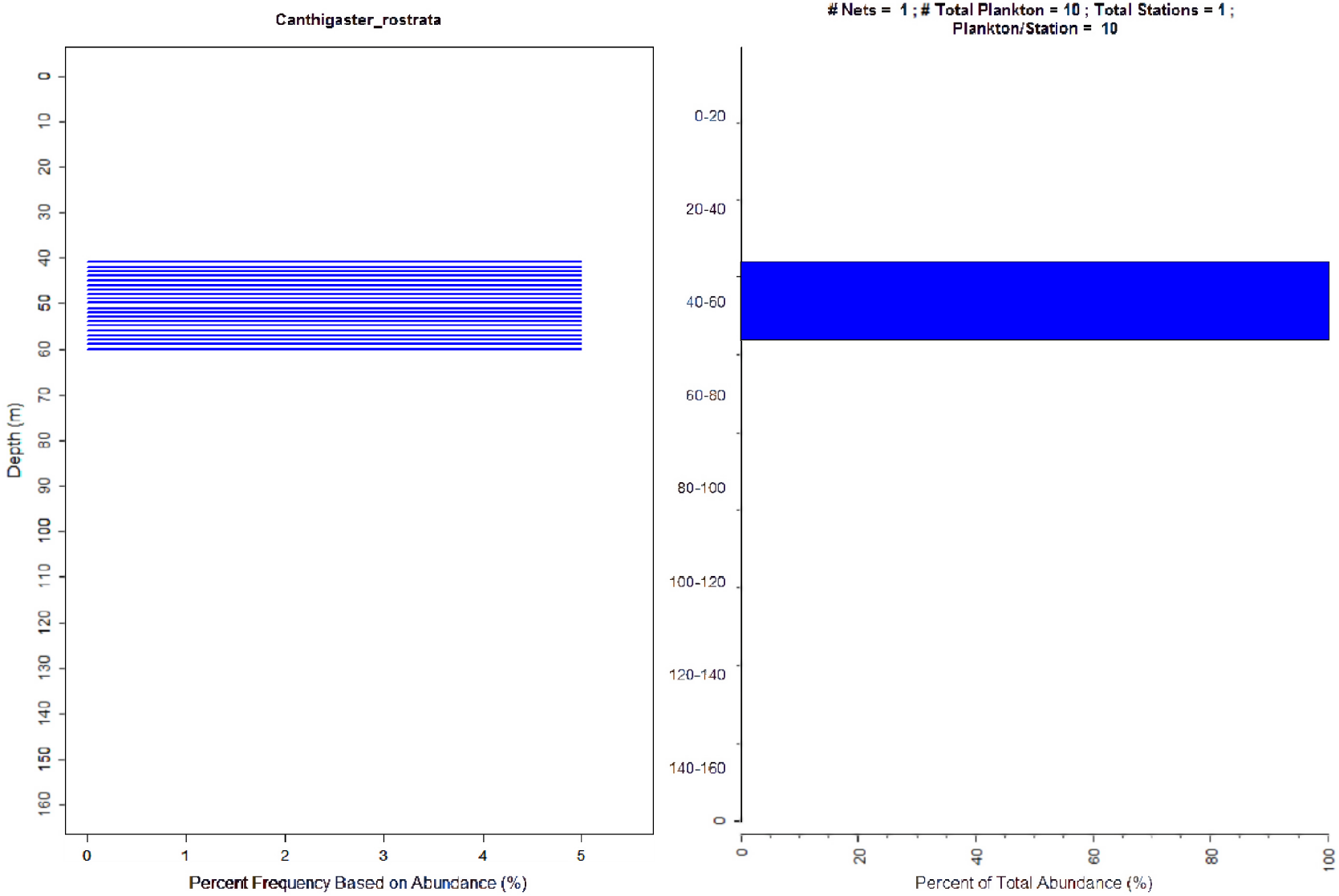
Callionymidae - Shallow



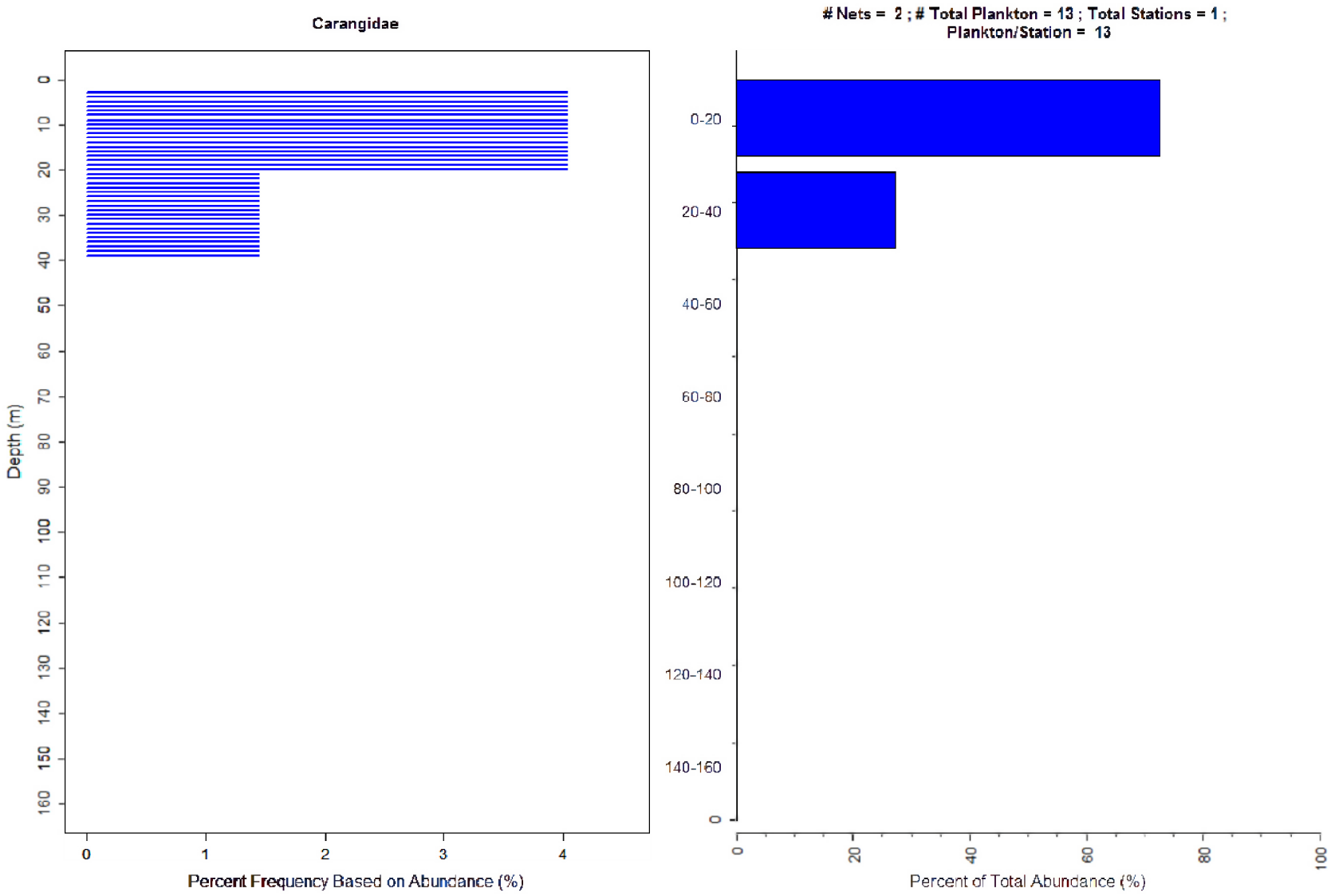
Canthidermis - Shallow



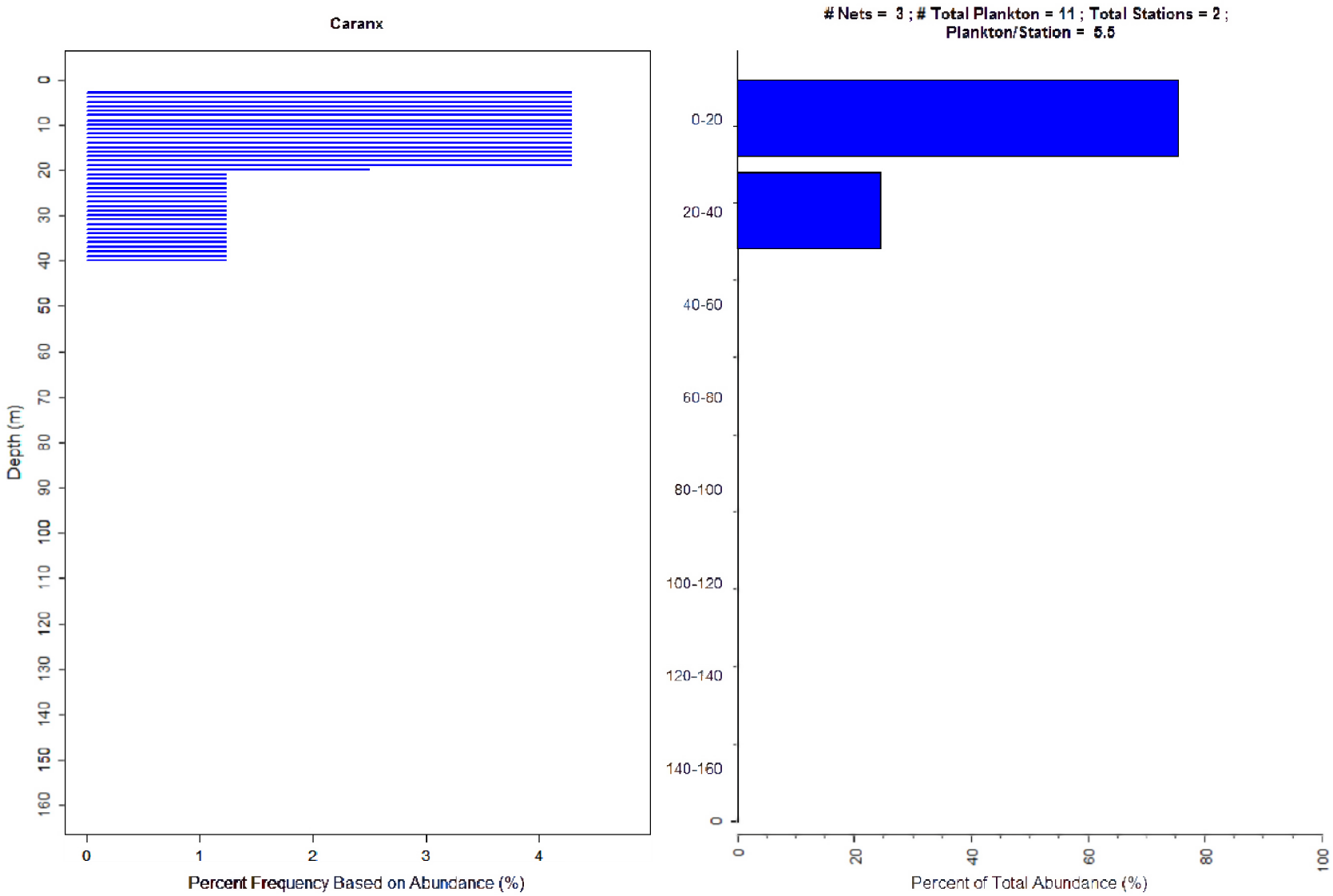
Canthigaster - Shallow



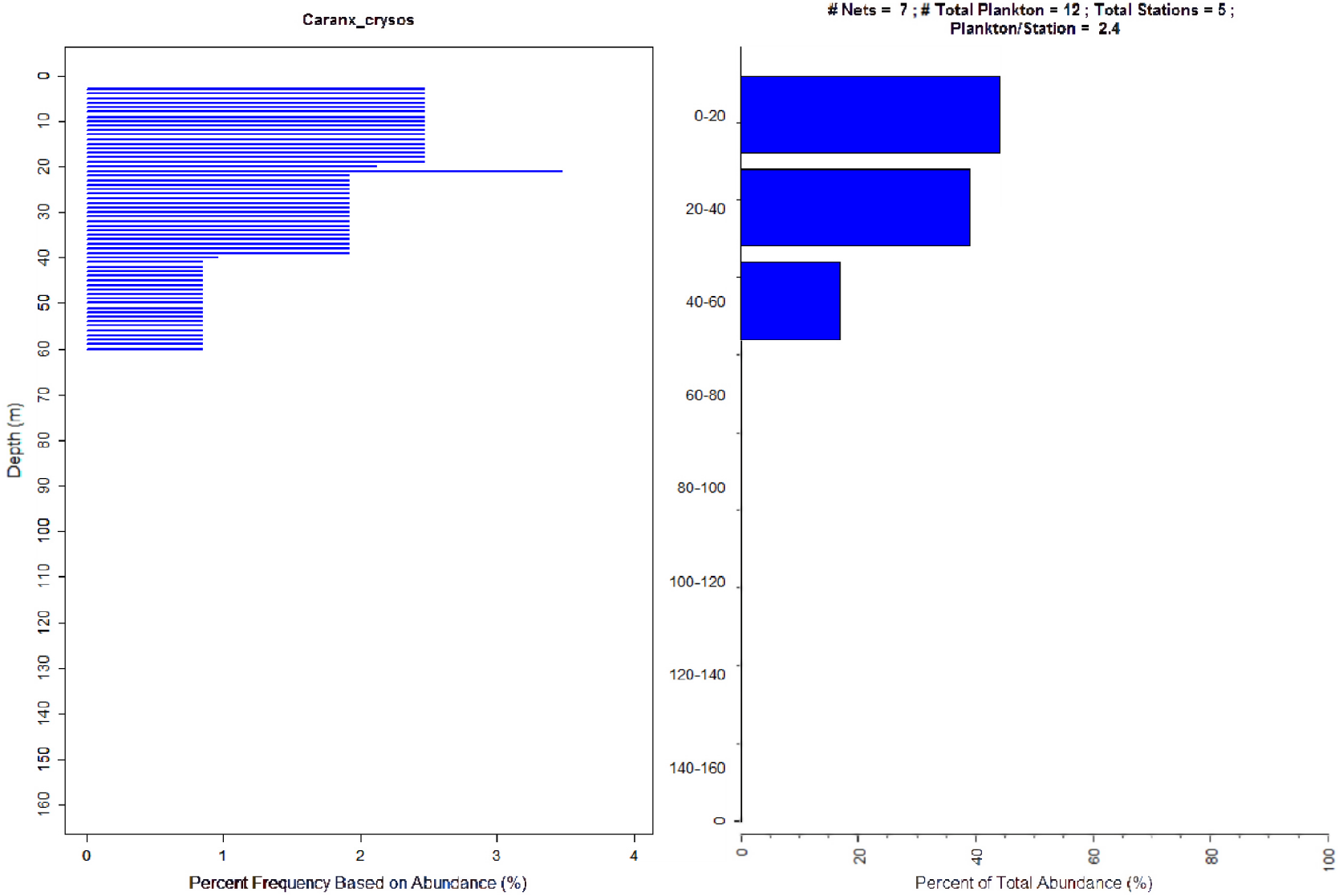
Canthigaster_rostrata - Shallow



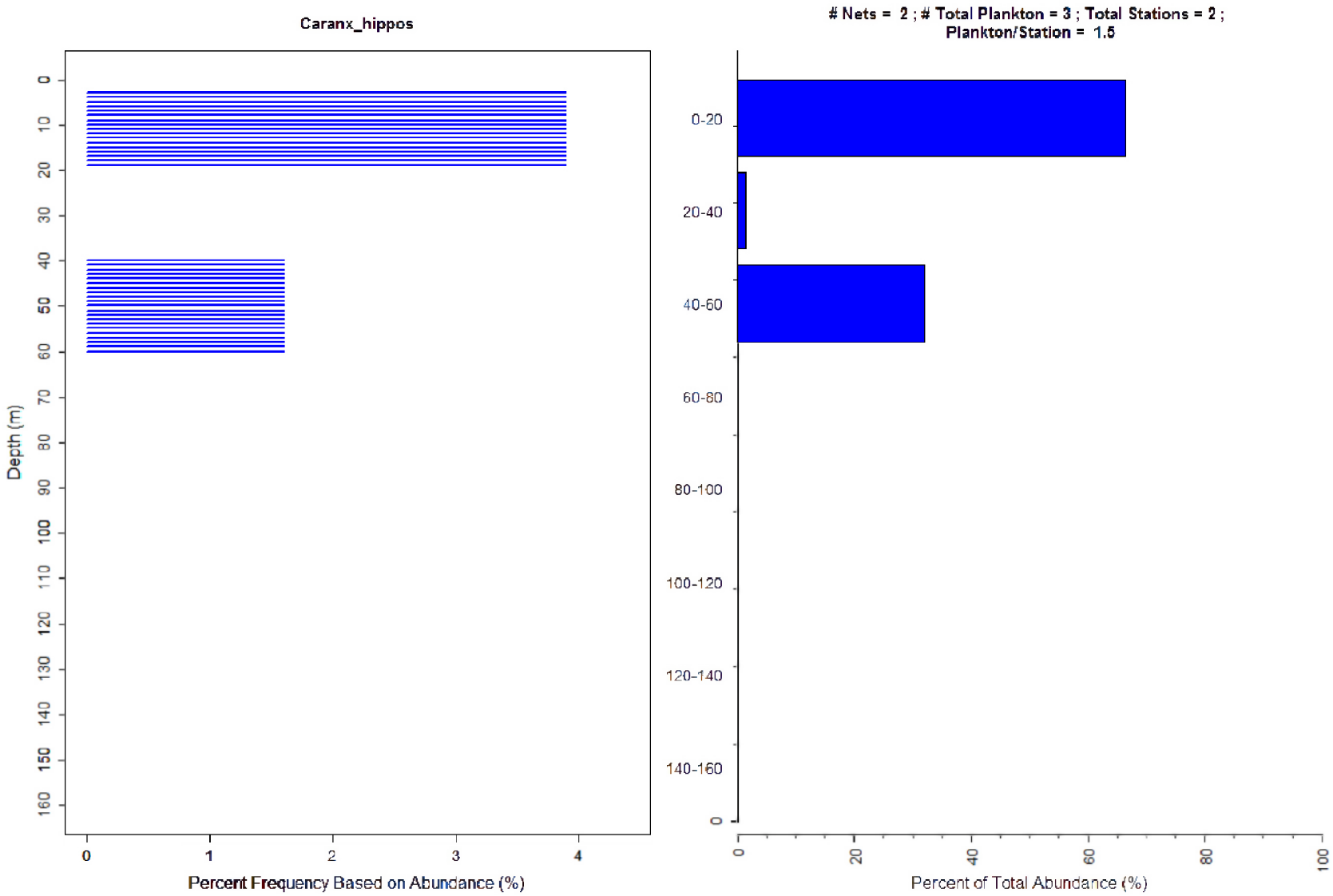
Carangidae - Shallow



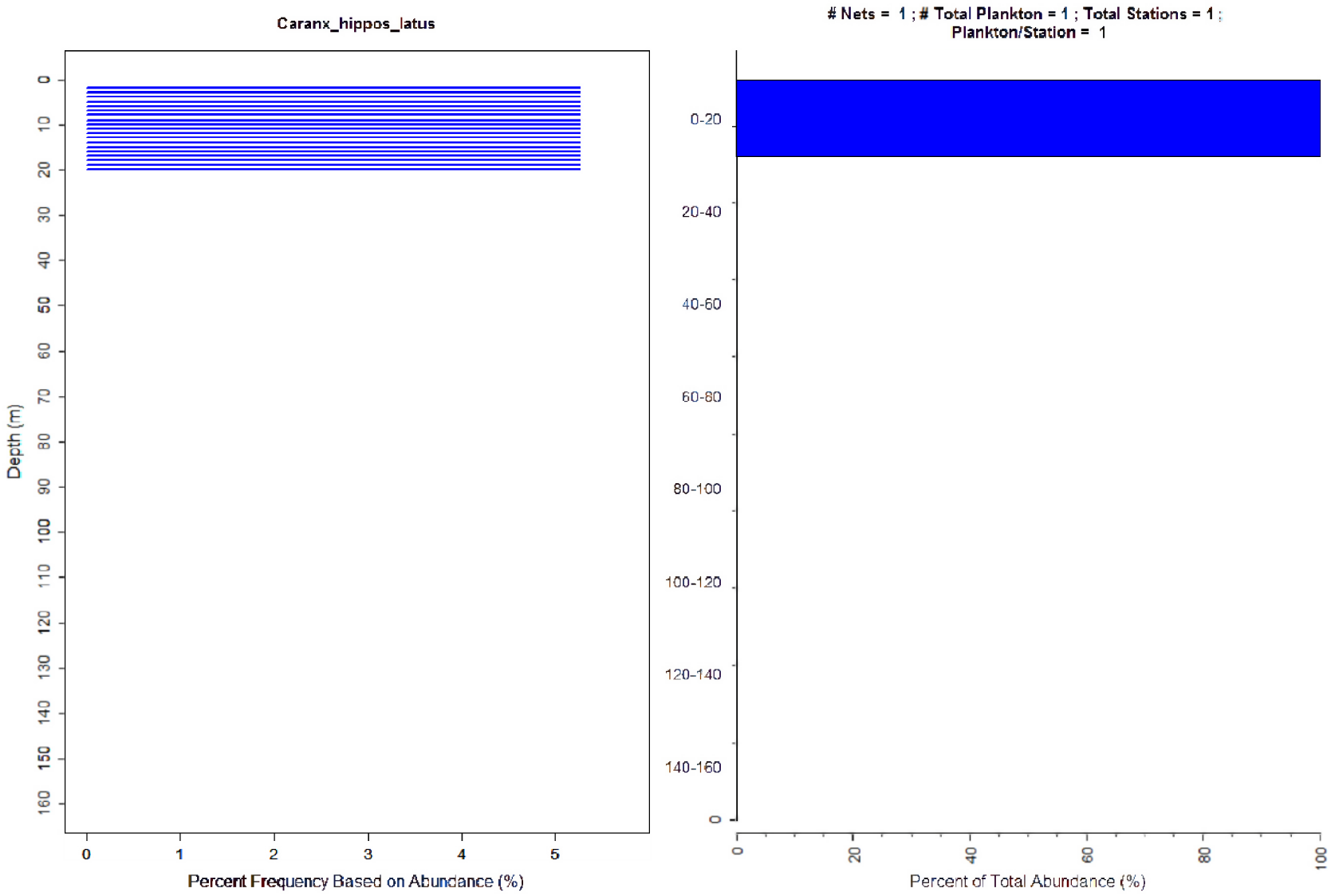
Caranx - Shallow



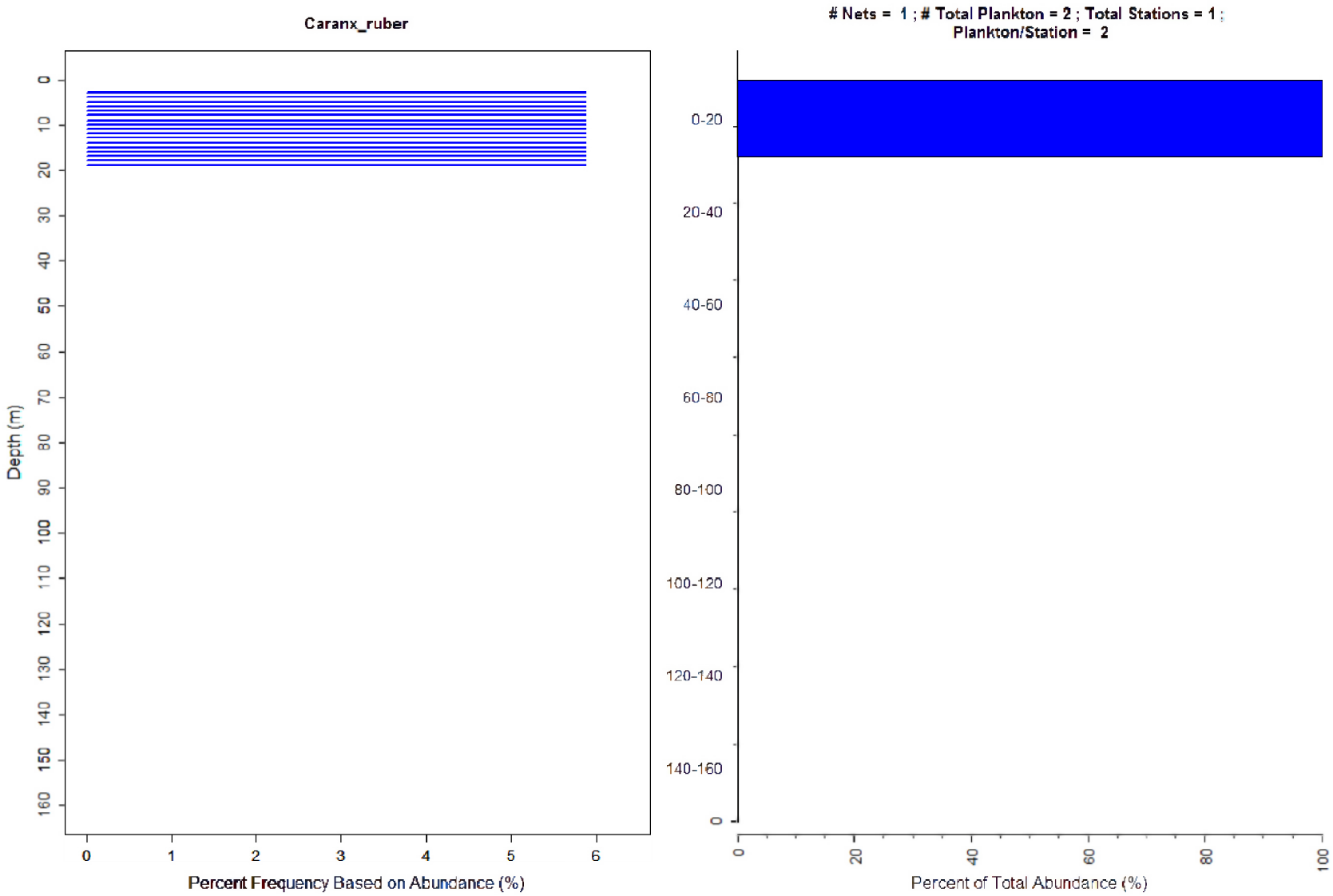
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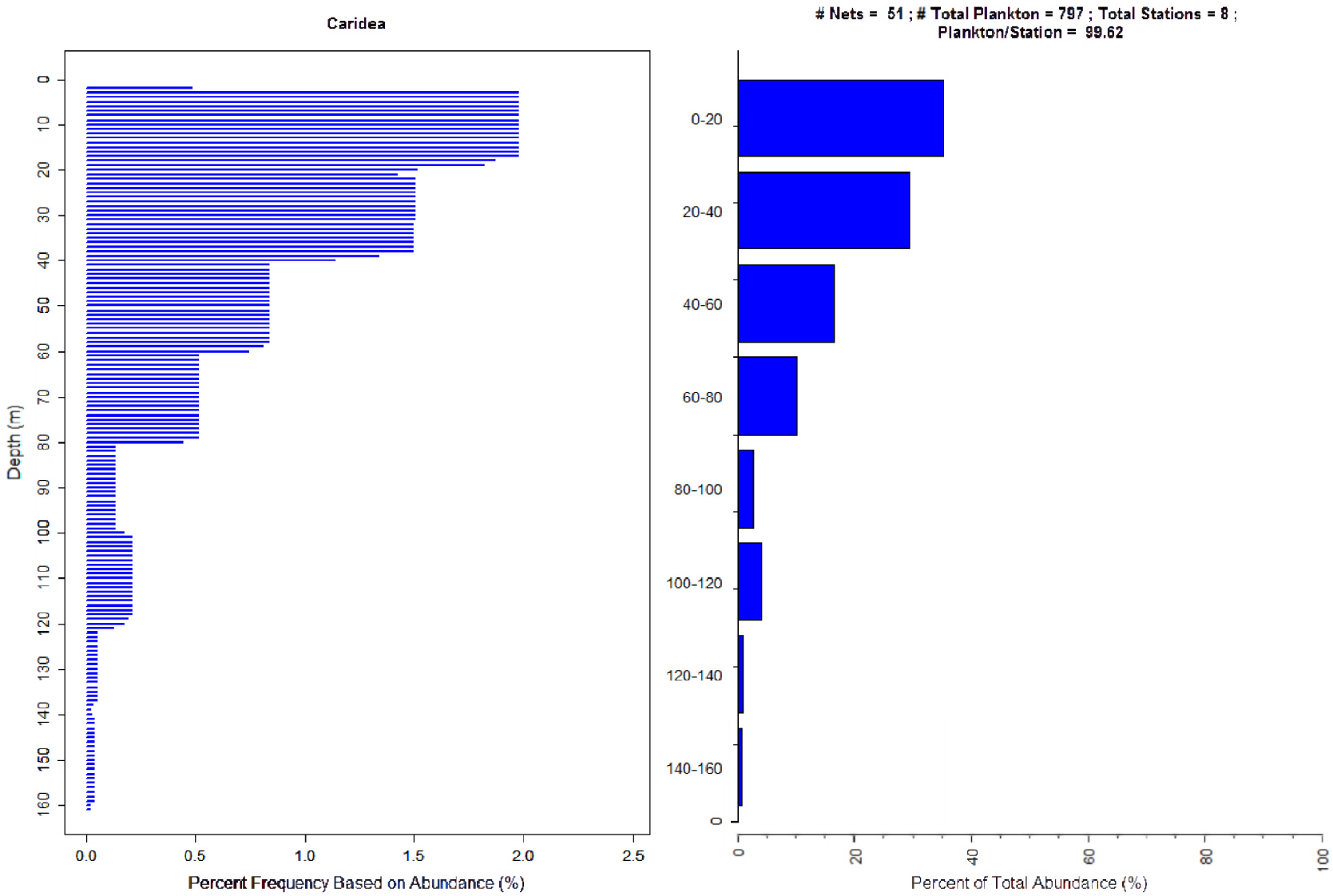
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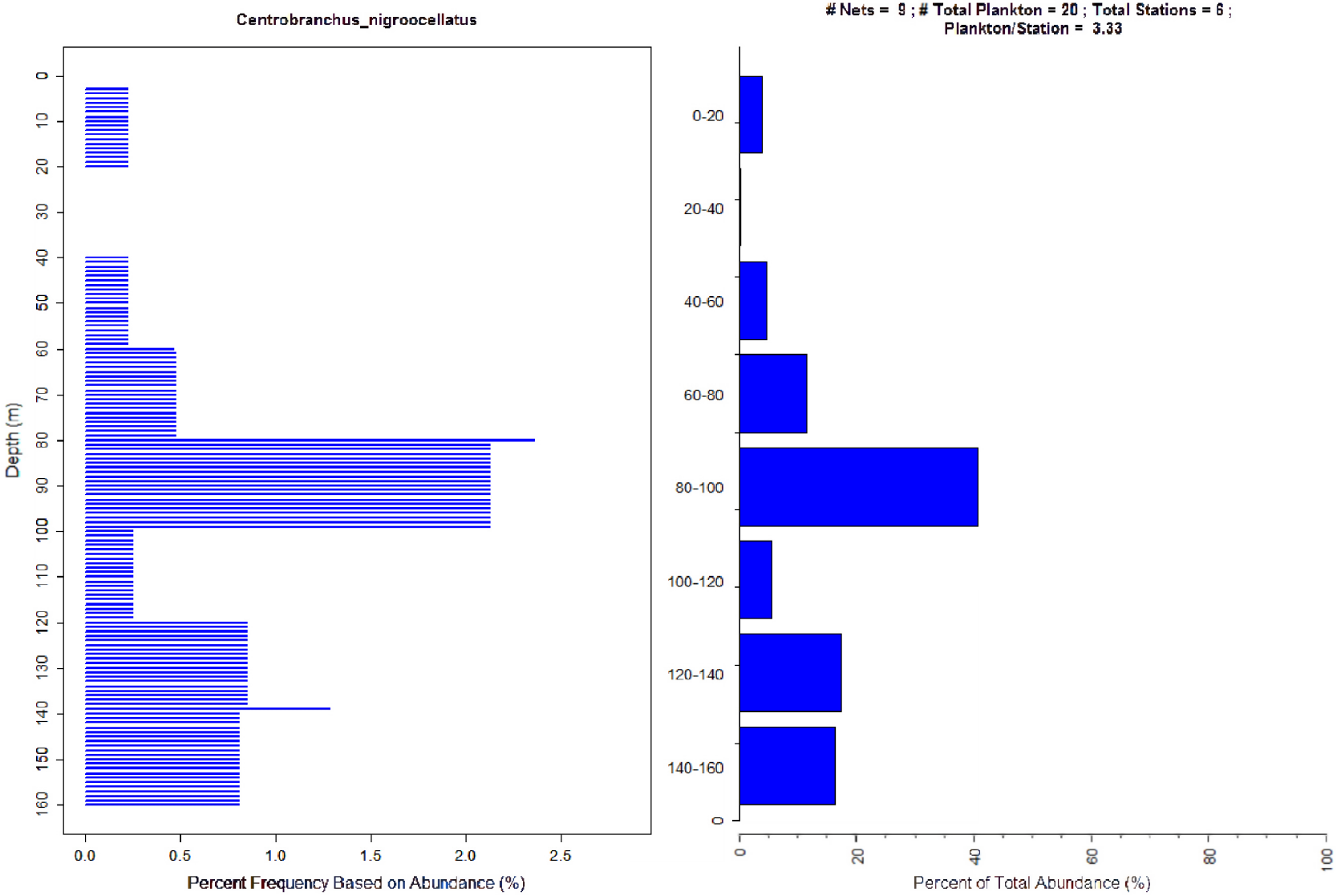
Caranx_hippos_latus - Shallow



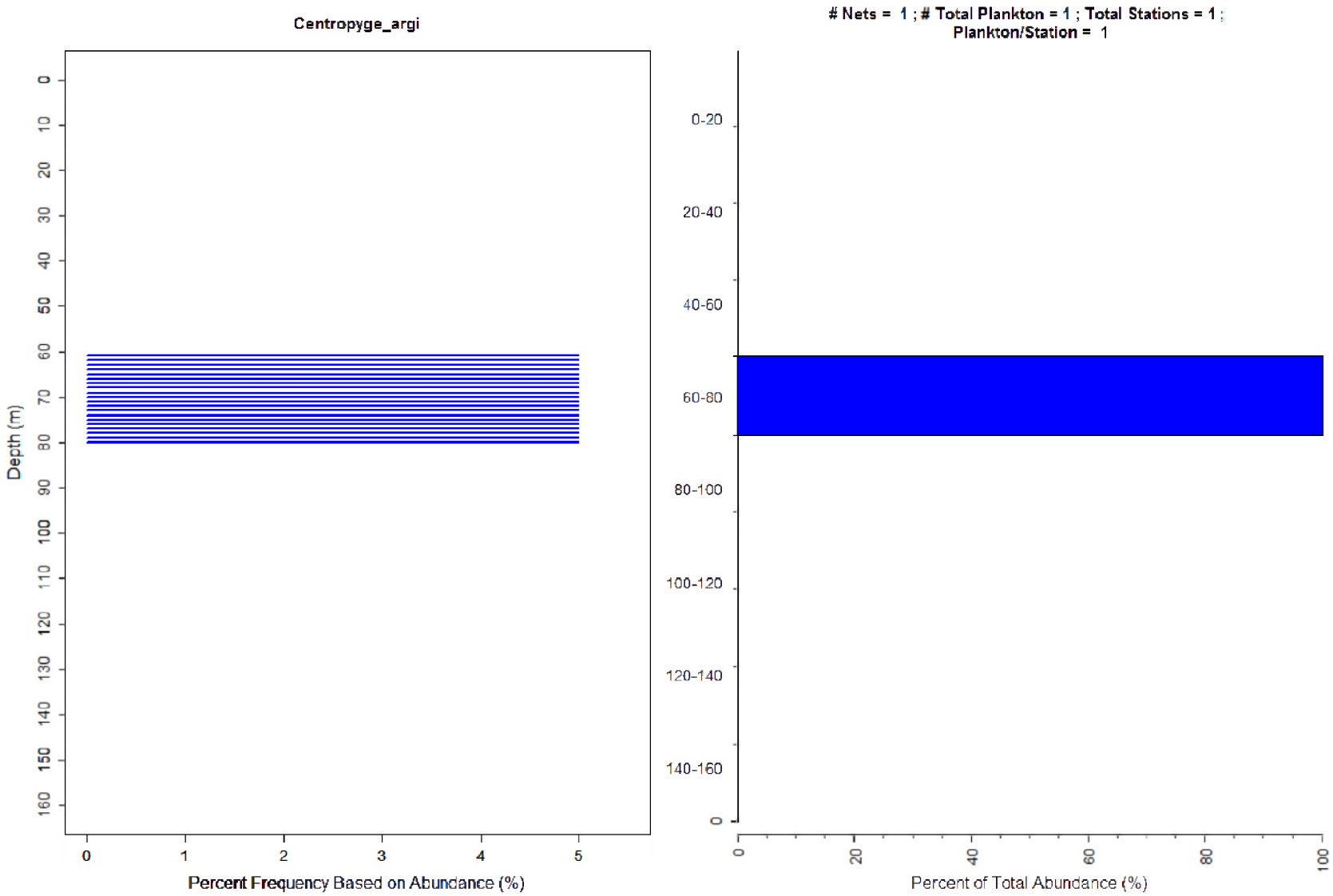
Caranx_ruber - Shallow



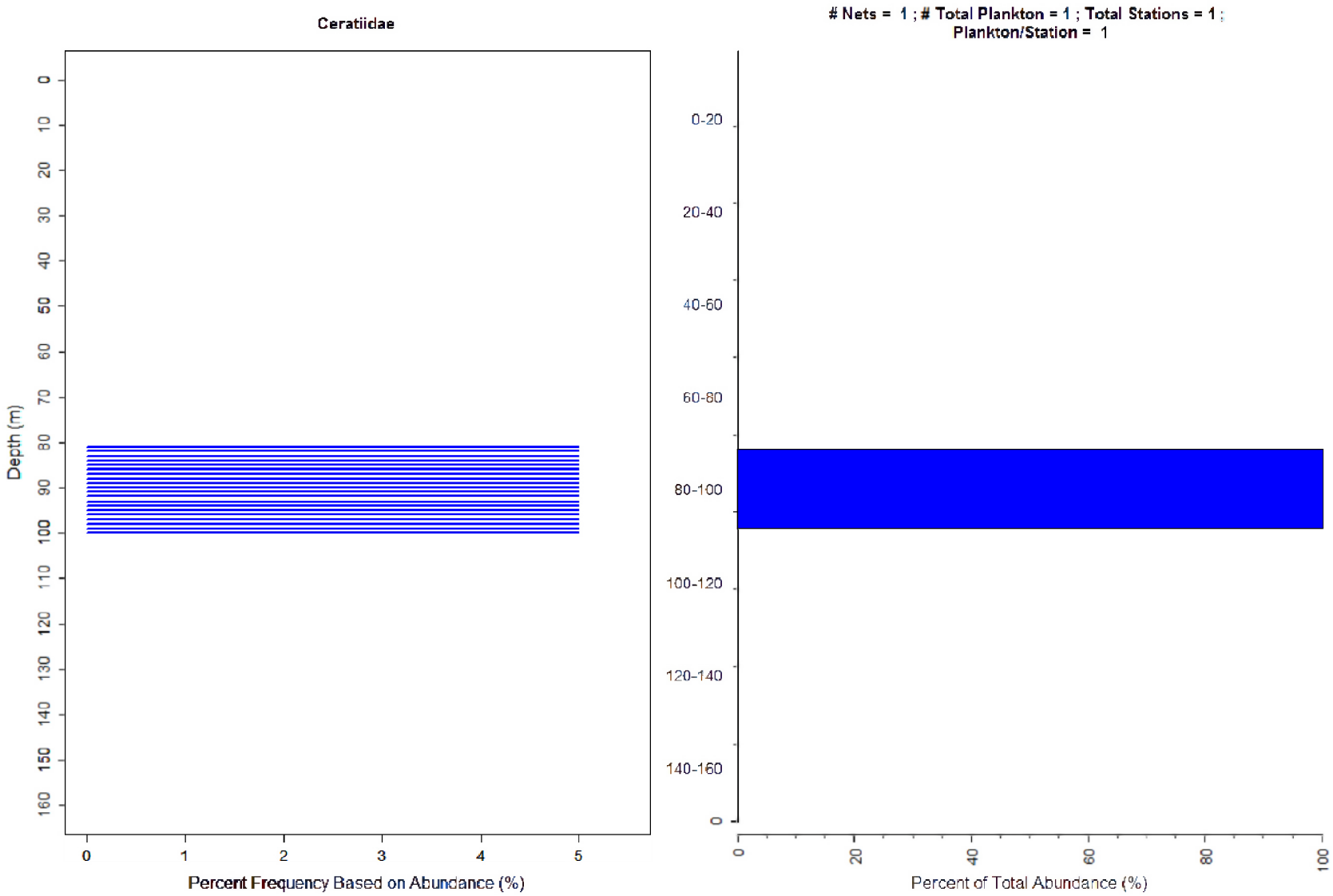
Caridea - Shallow



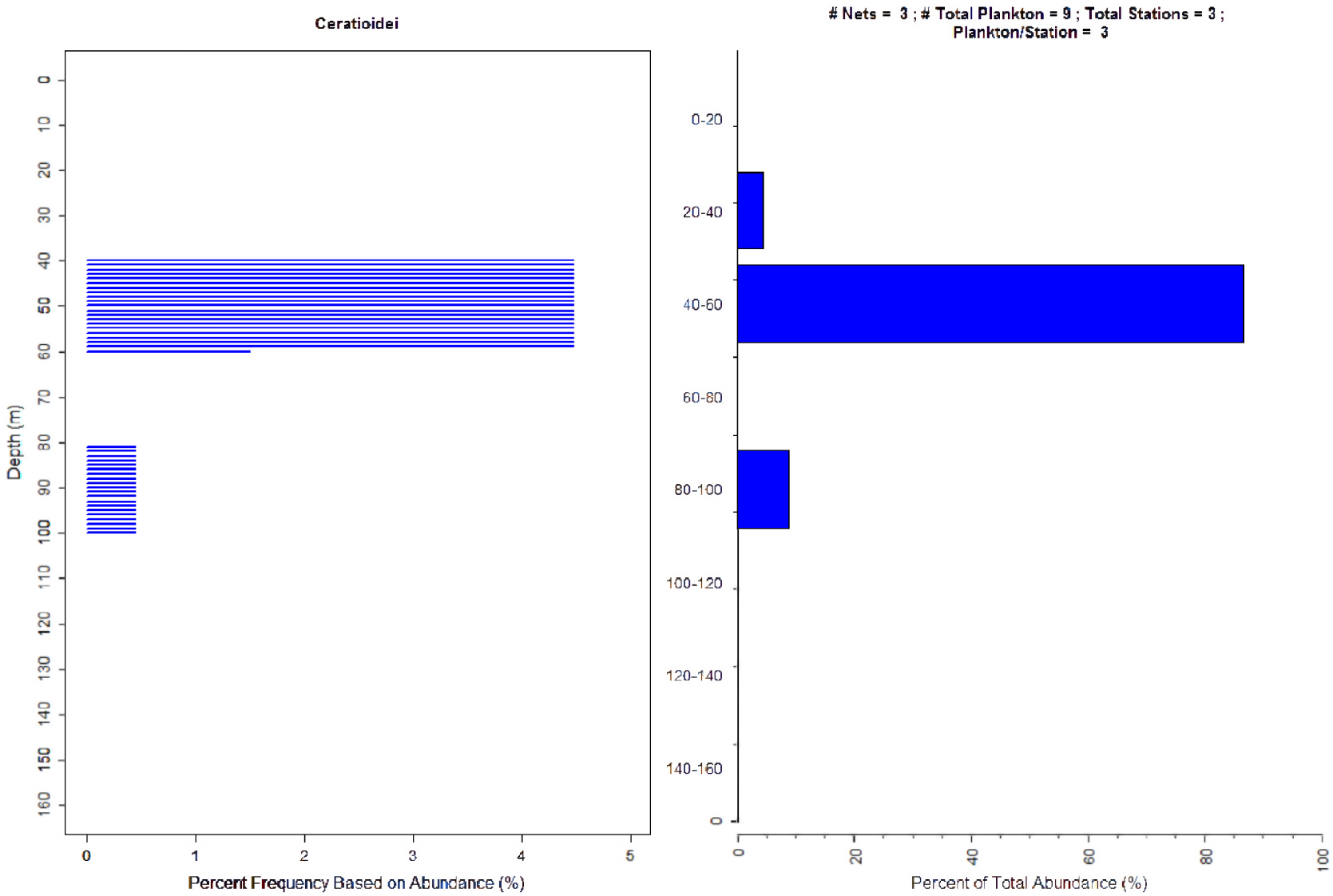
Centrobranchus_nigroocellatus - Shallow



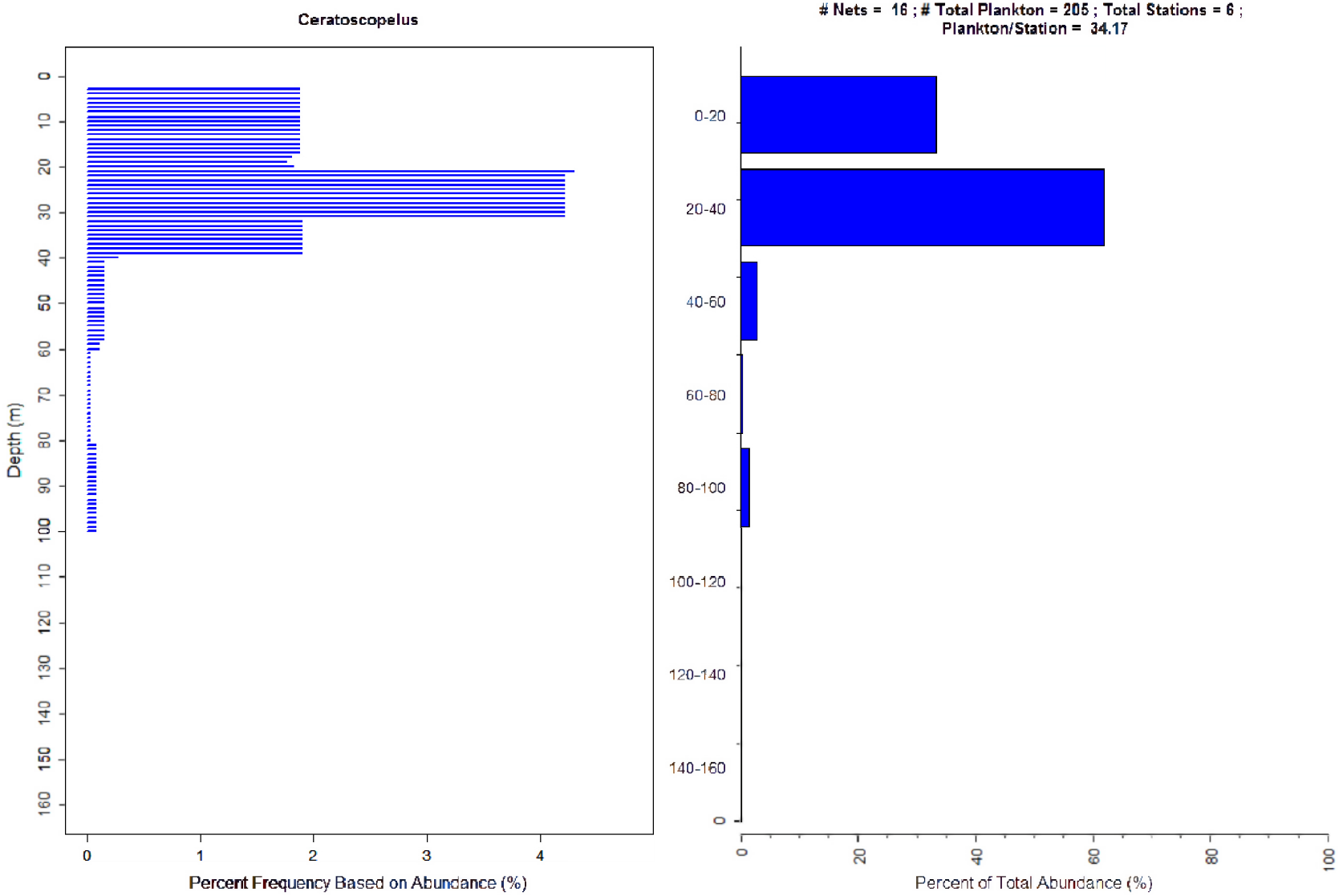
Centropyge_argi - Shallow



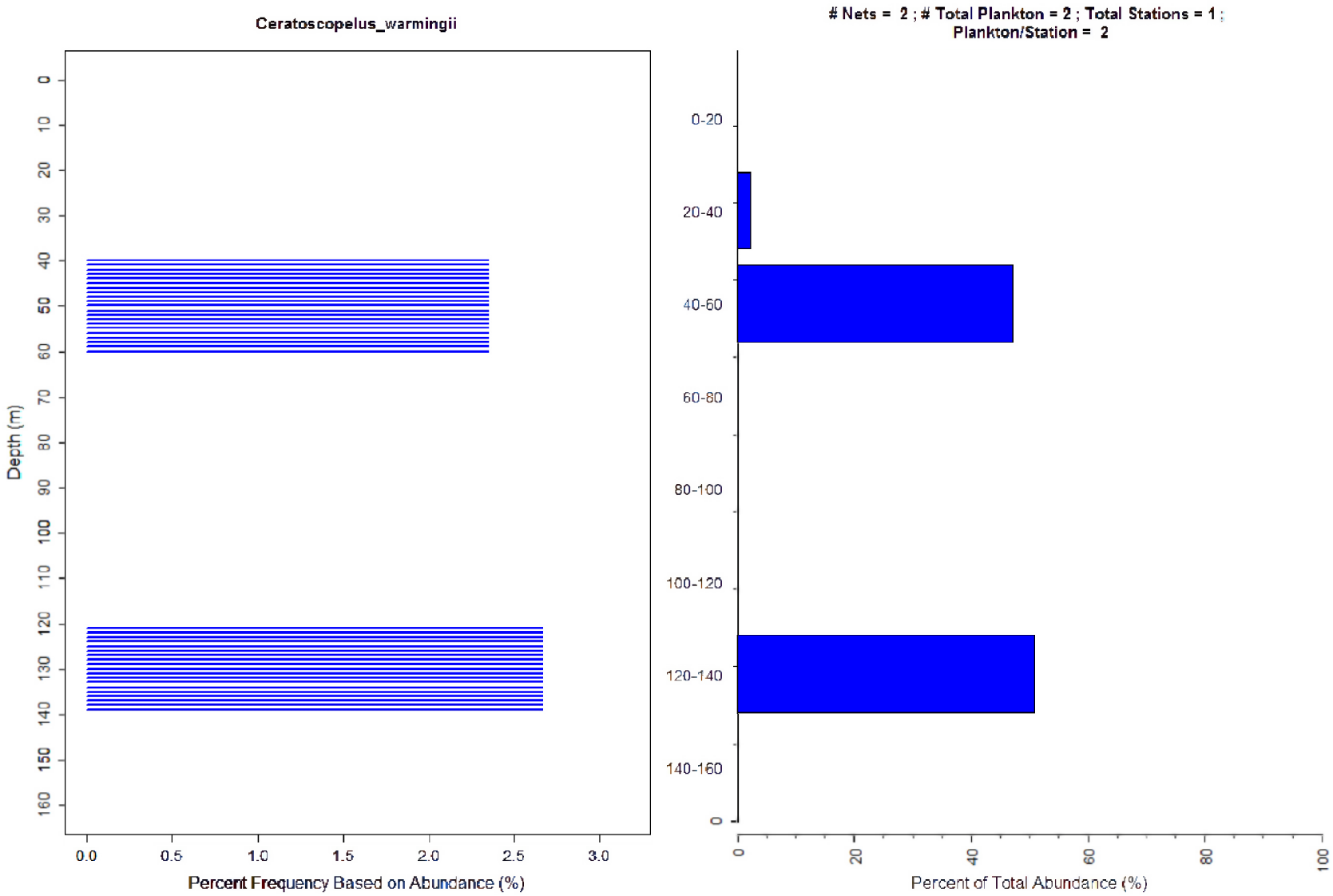
Ceratiidae - Shallow



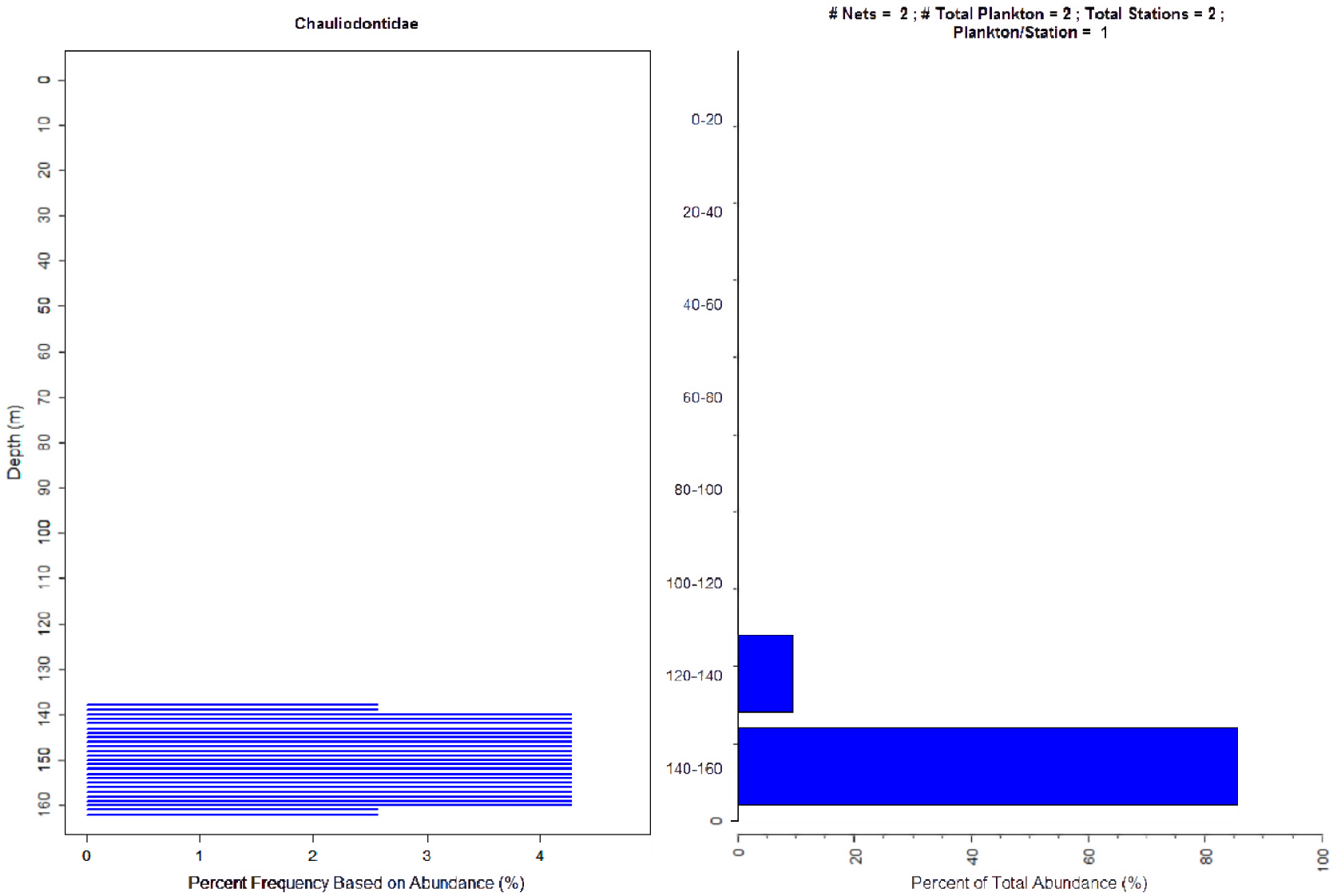
Ceratioidei - Shallow



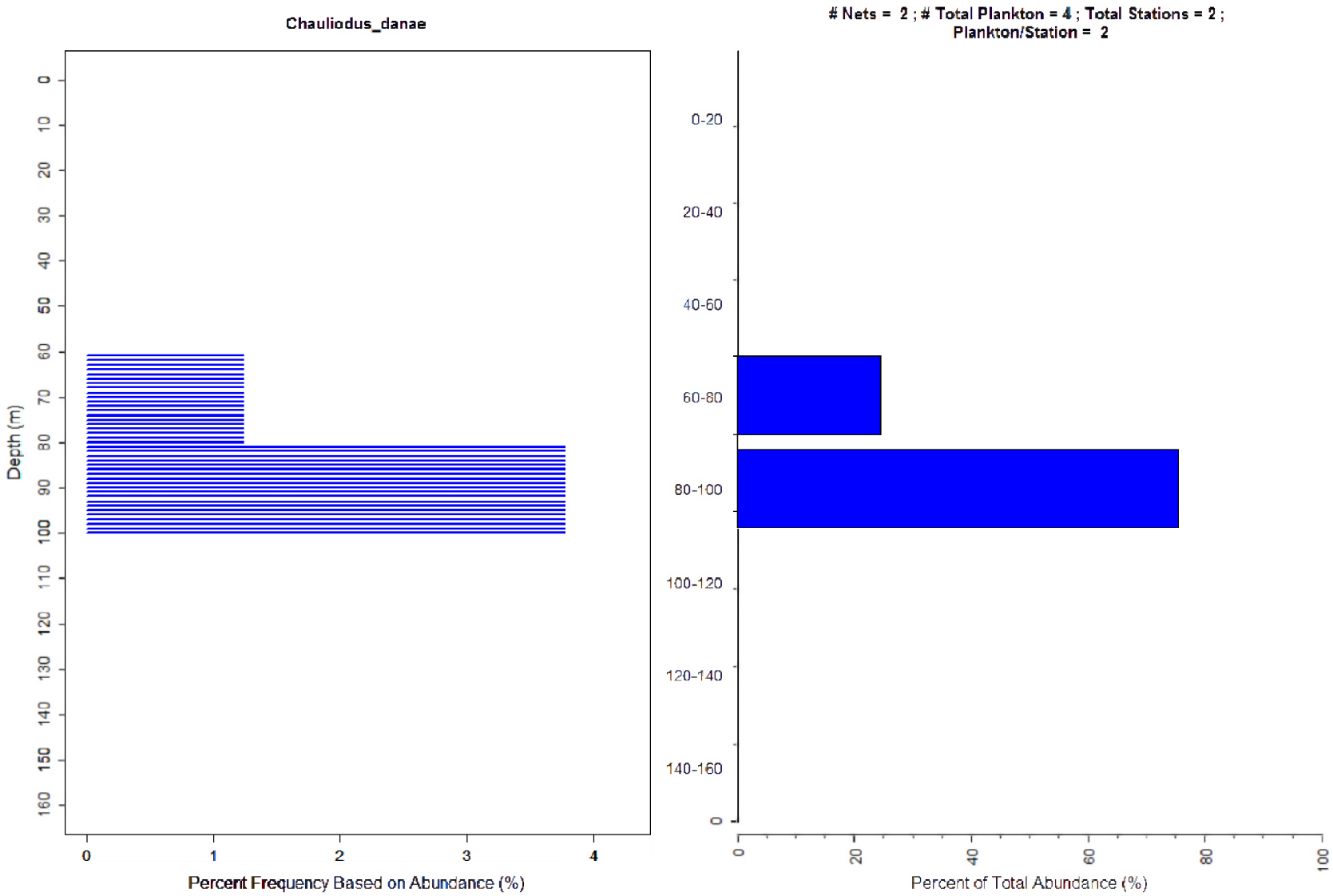
Ceratoscopelus - Shallow



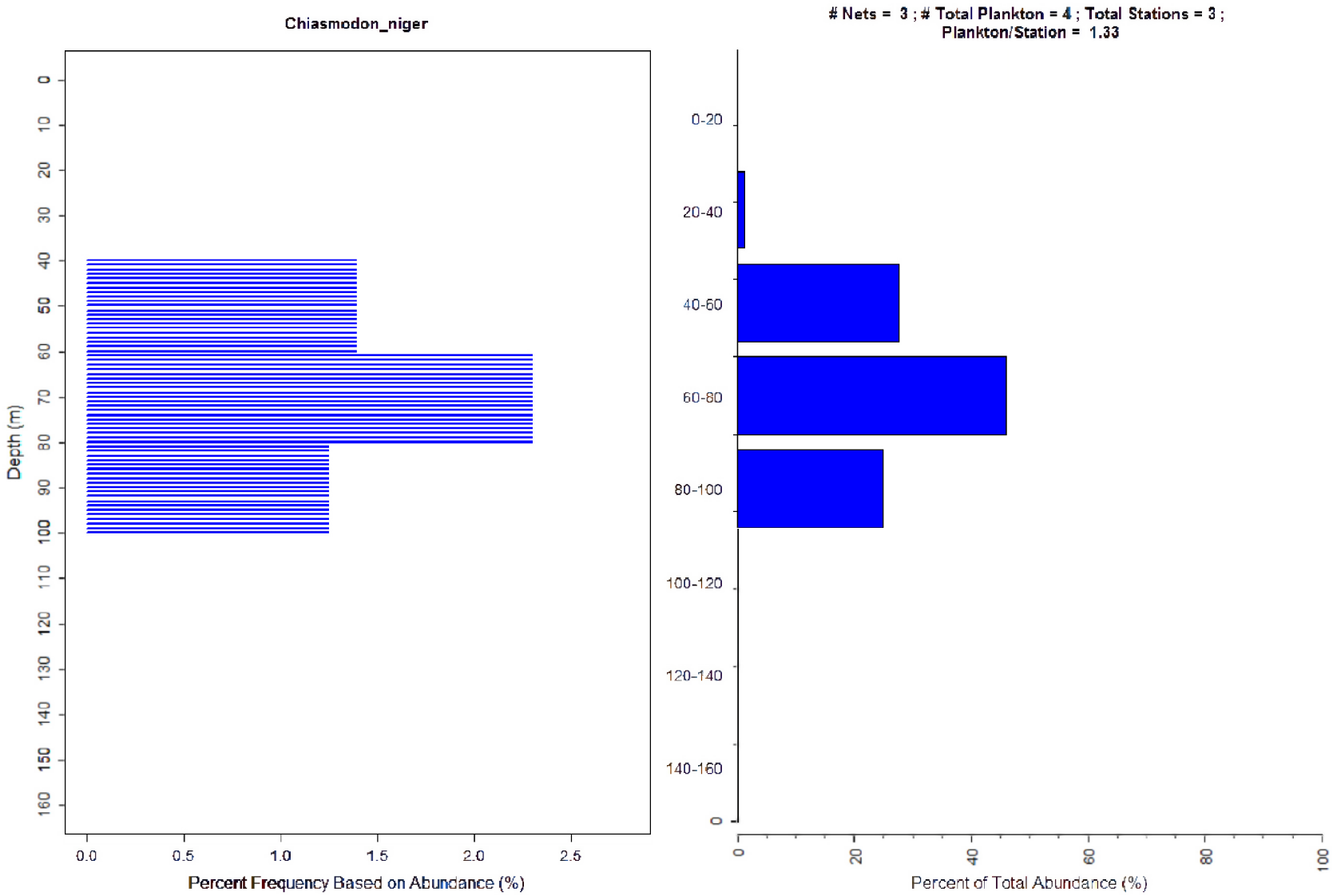
Ceratoscopelus_warmingii - Shallow



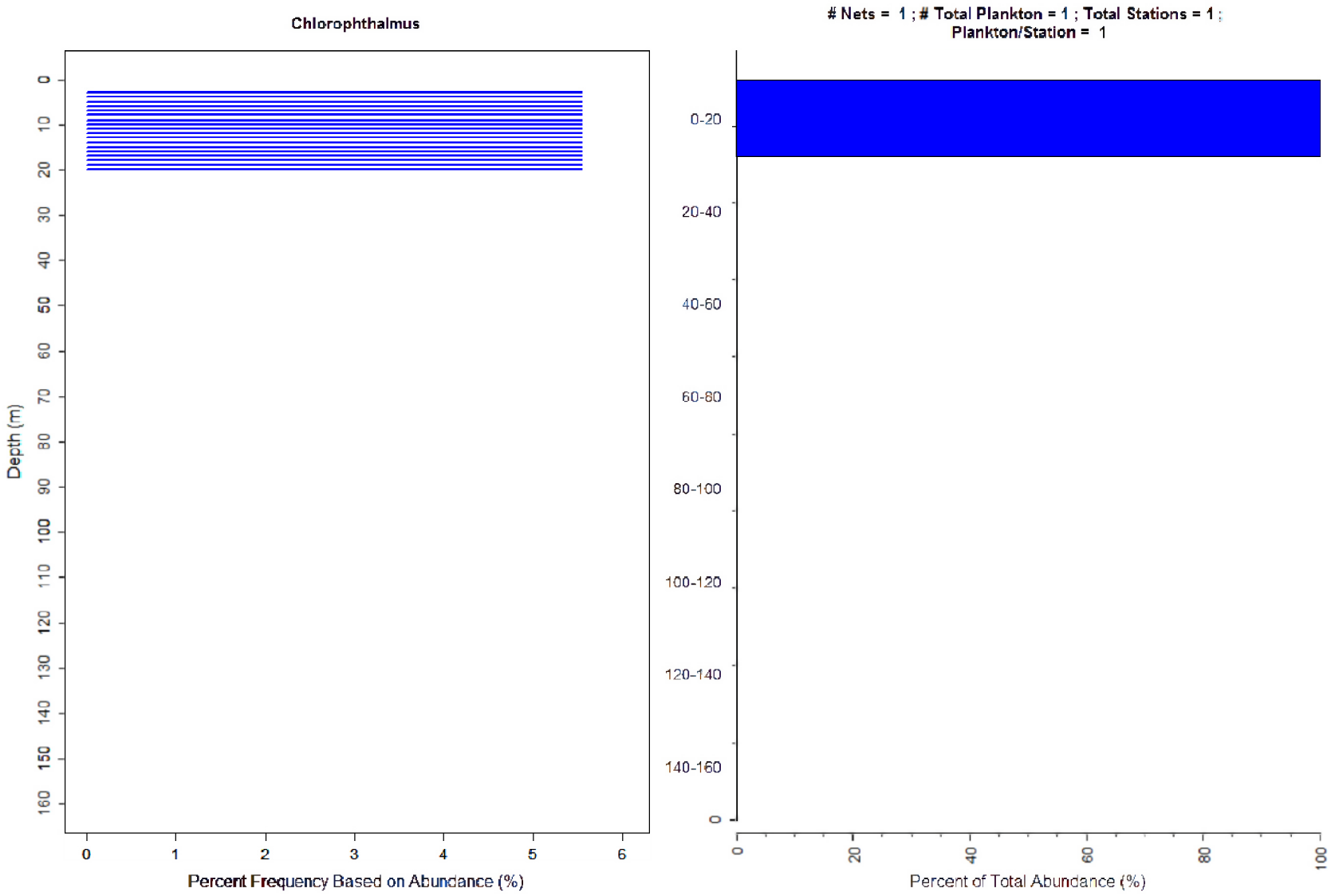
Chauliodontidae - Shallow



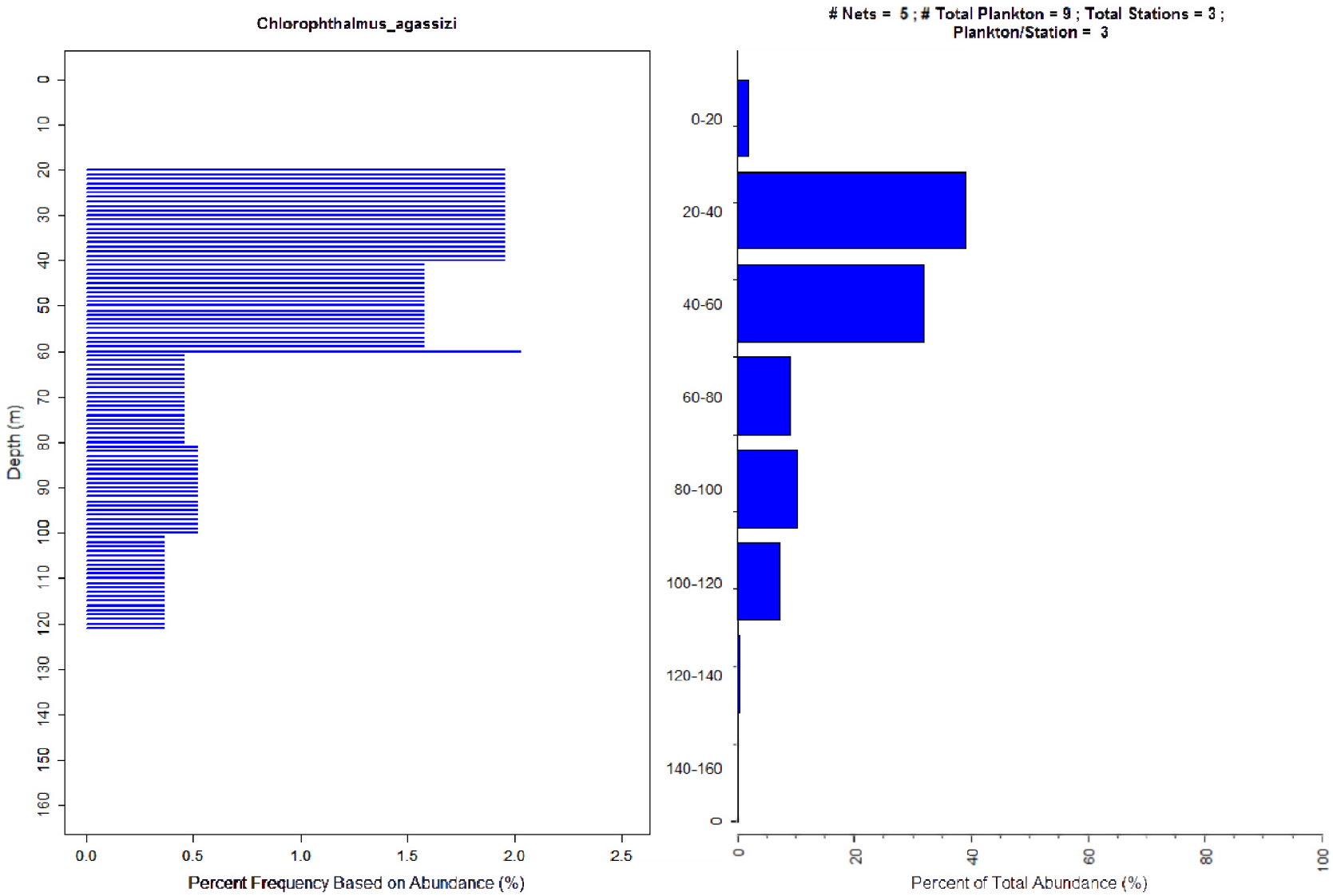
Chauliodus_danae - Shallow



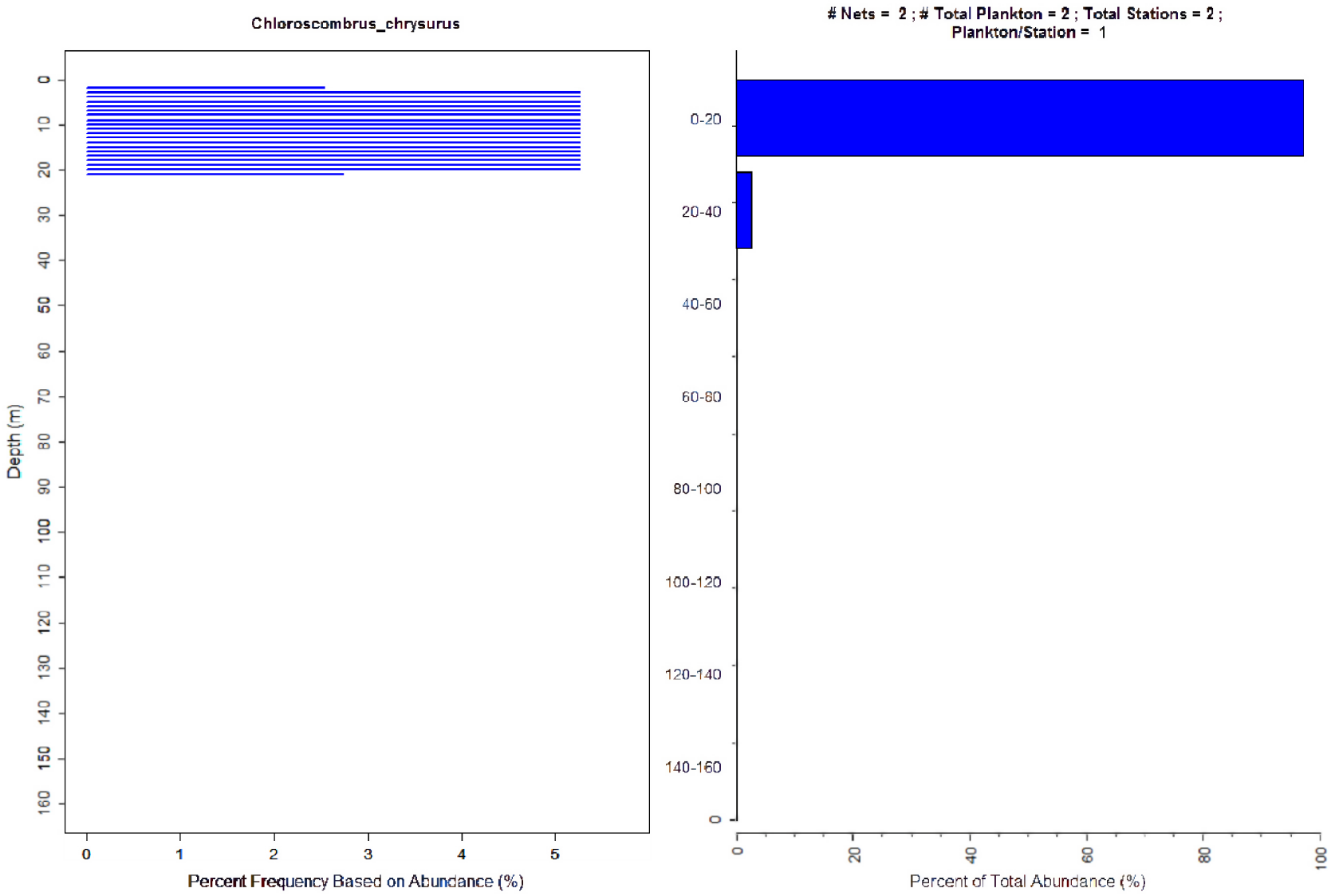
Chiasmodon_niger - Shallow



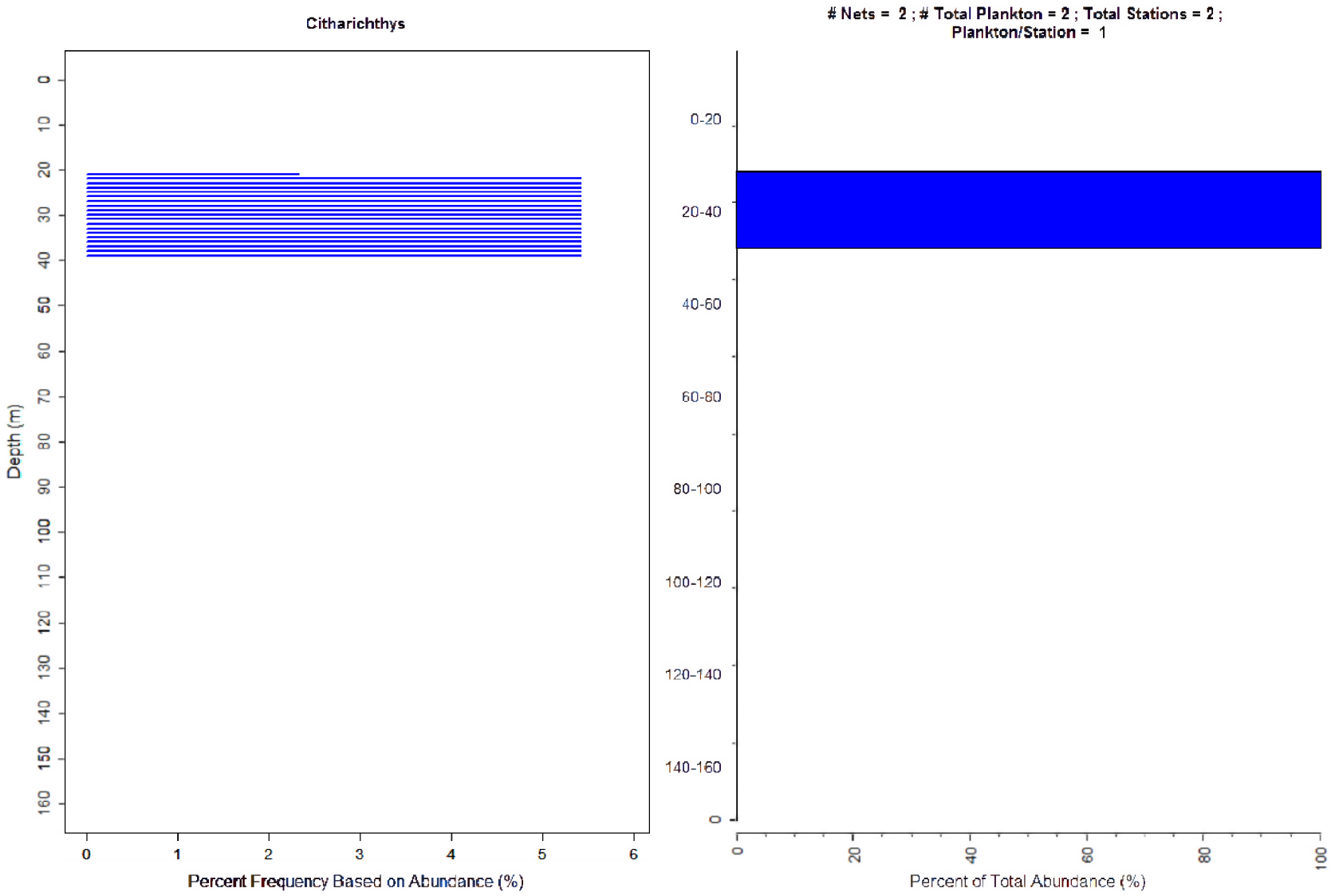
Chlorophthalmus - Shallow



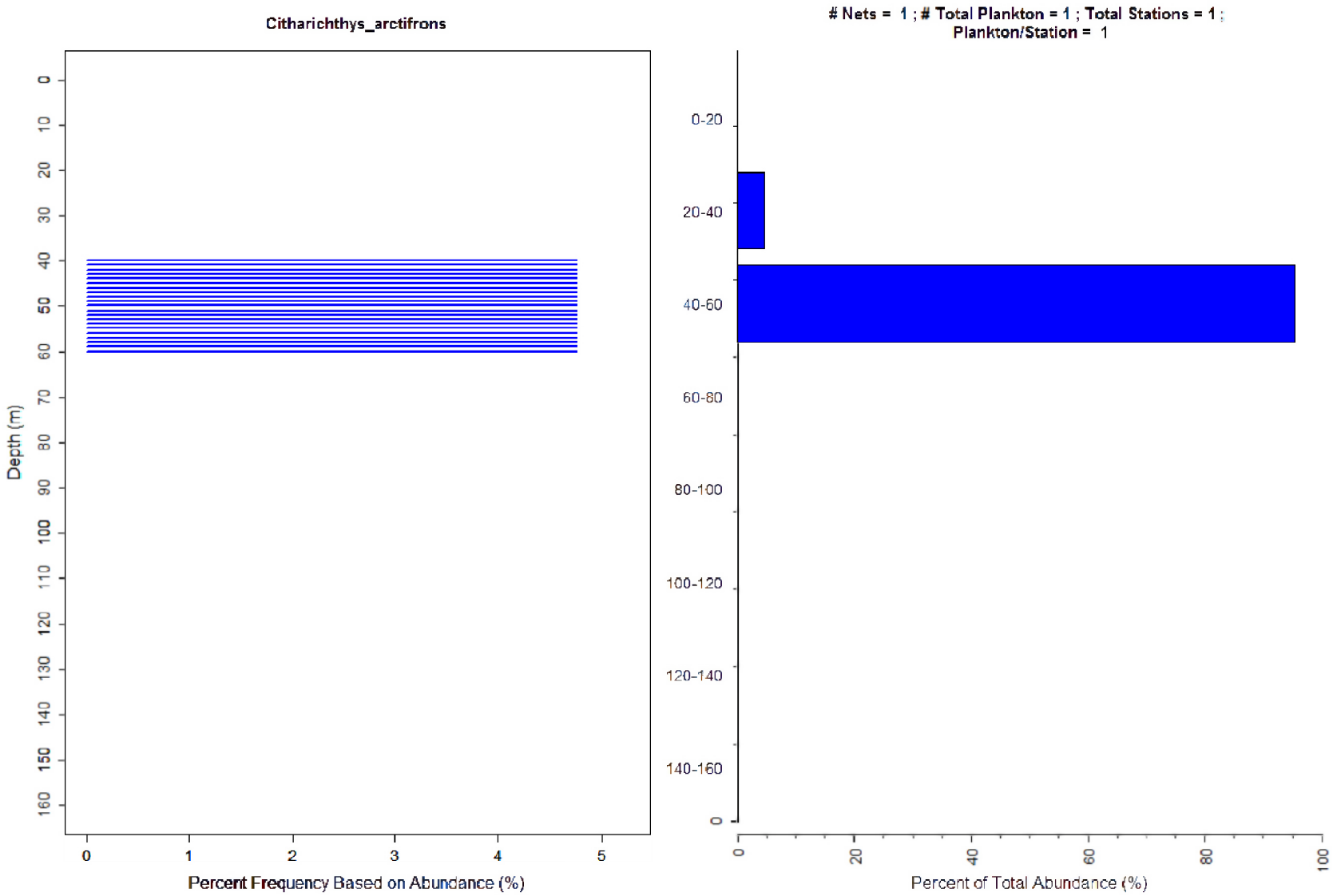
Chlorophthalmus_agassizi - Shallow



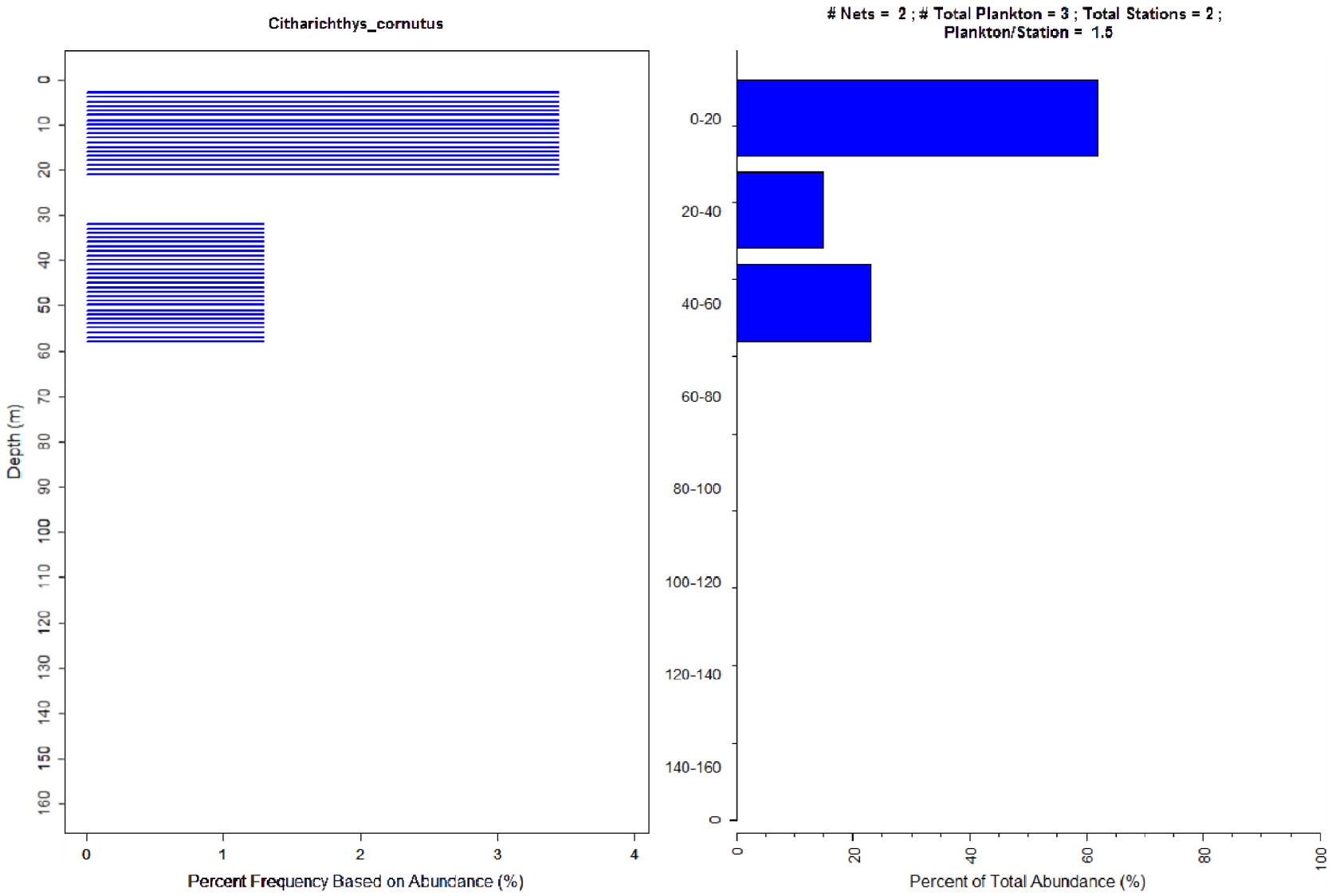
Chloroscombrus_chrysurus - Shallow



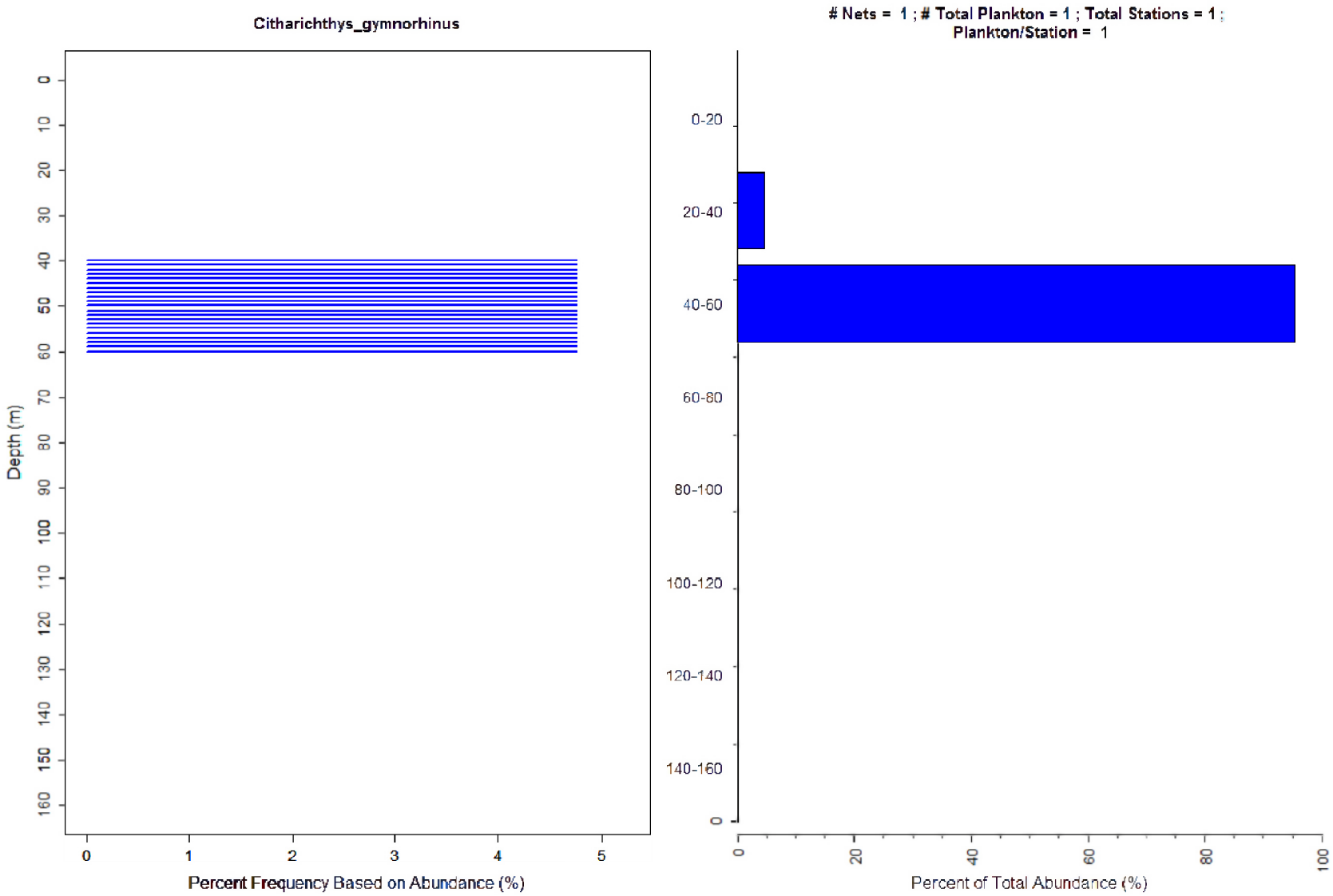
Citharichthys - Shallow



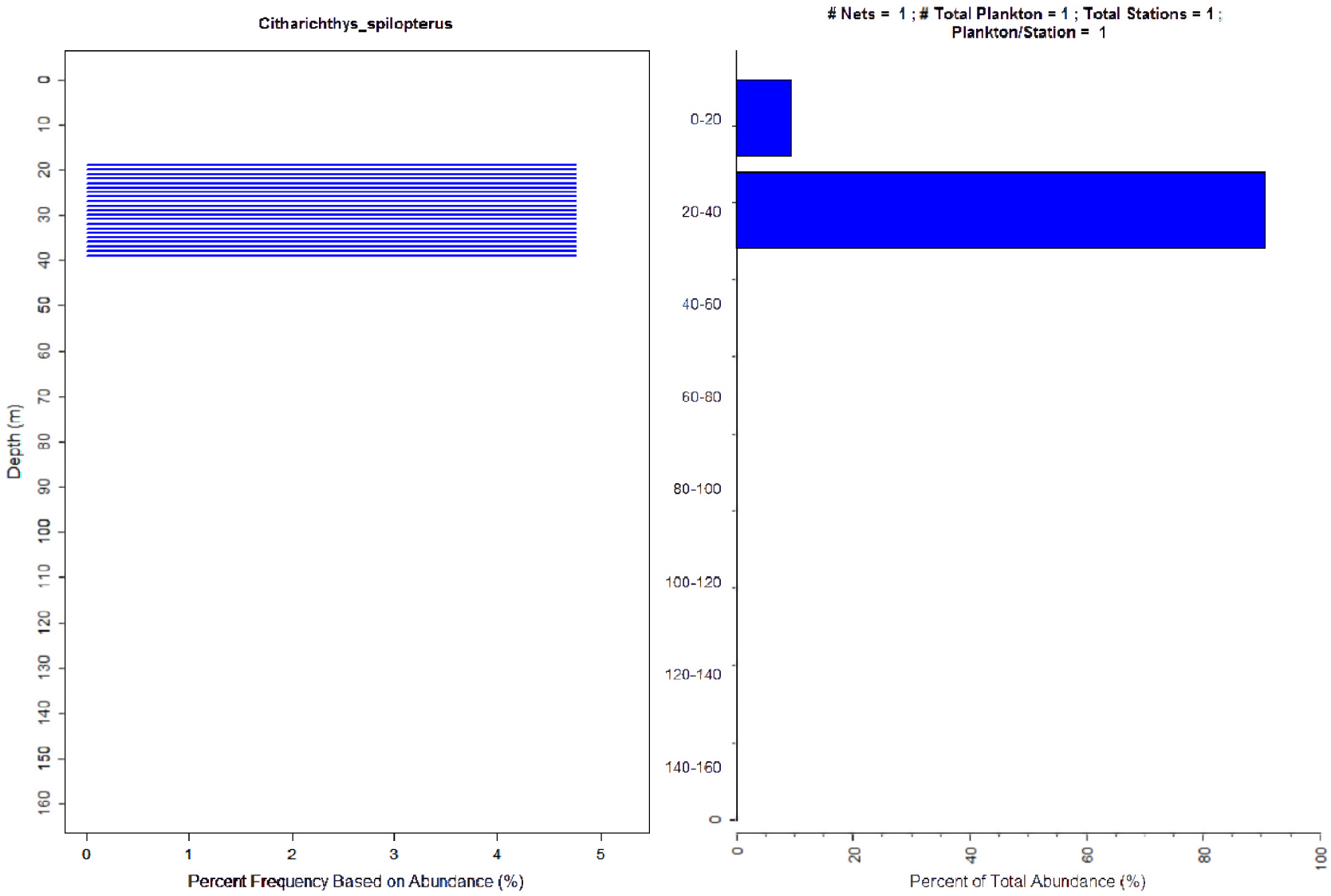
Citharichthys_arctifrons - Shallow



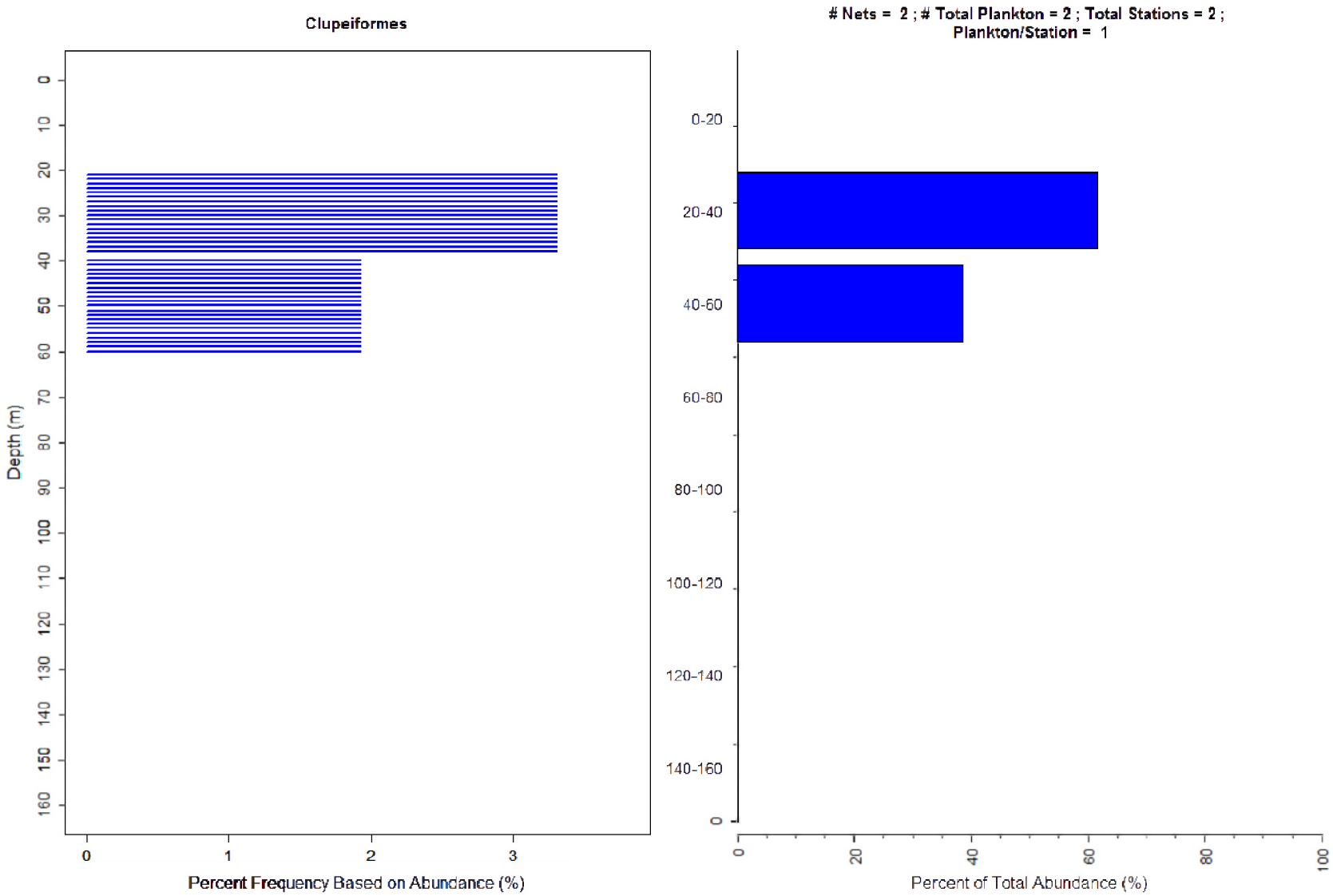
Citharichthys_cornutus - Shallow



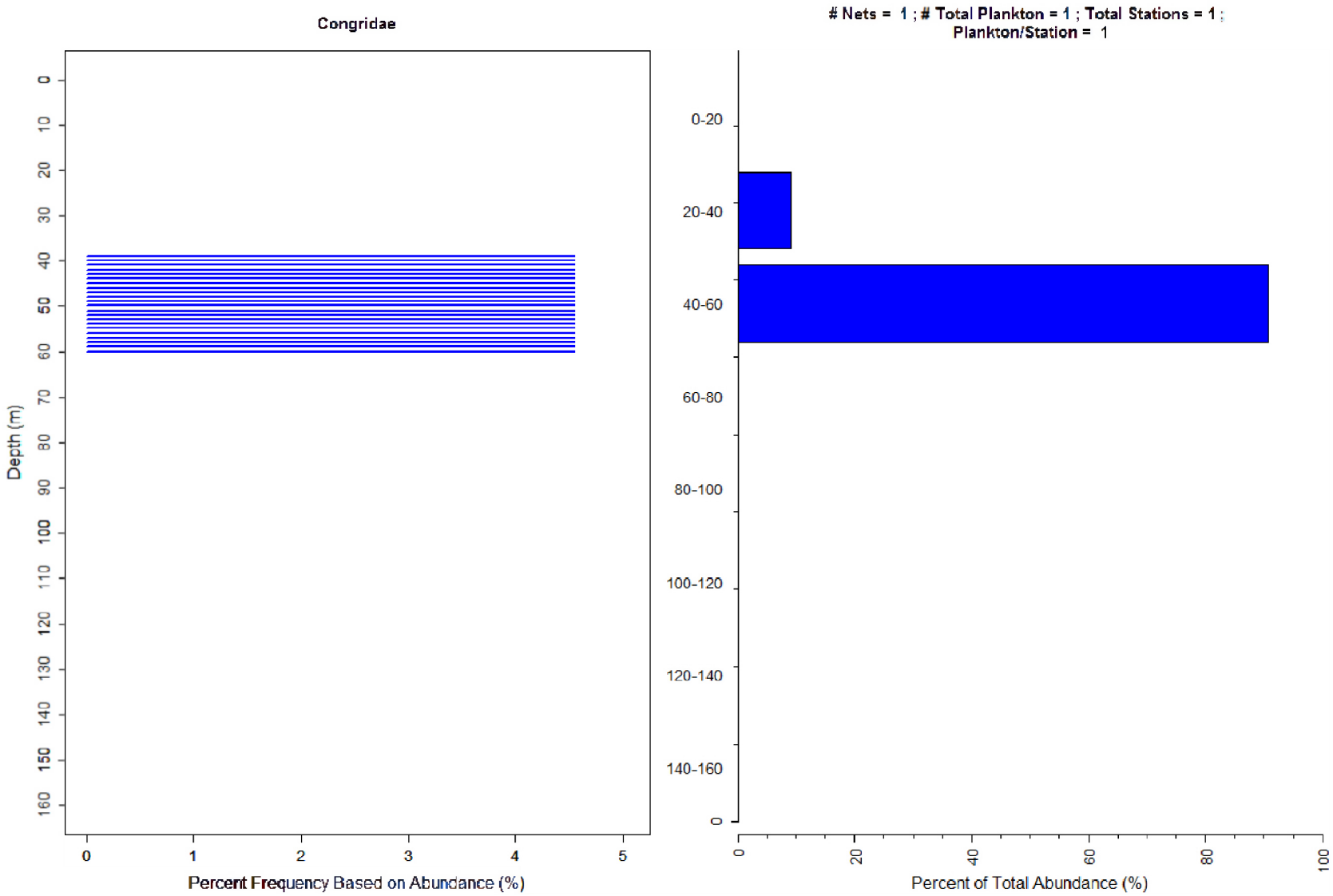
Citharichthys_gymnorhinus - Shallow



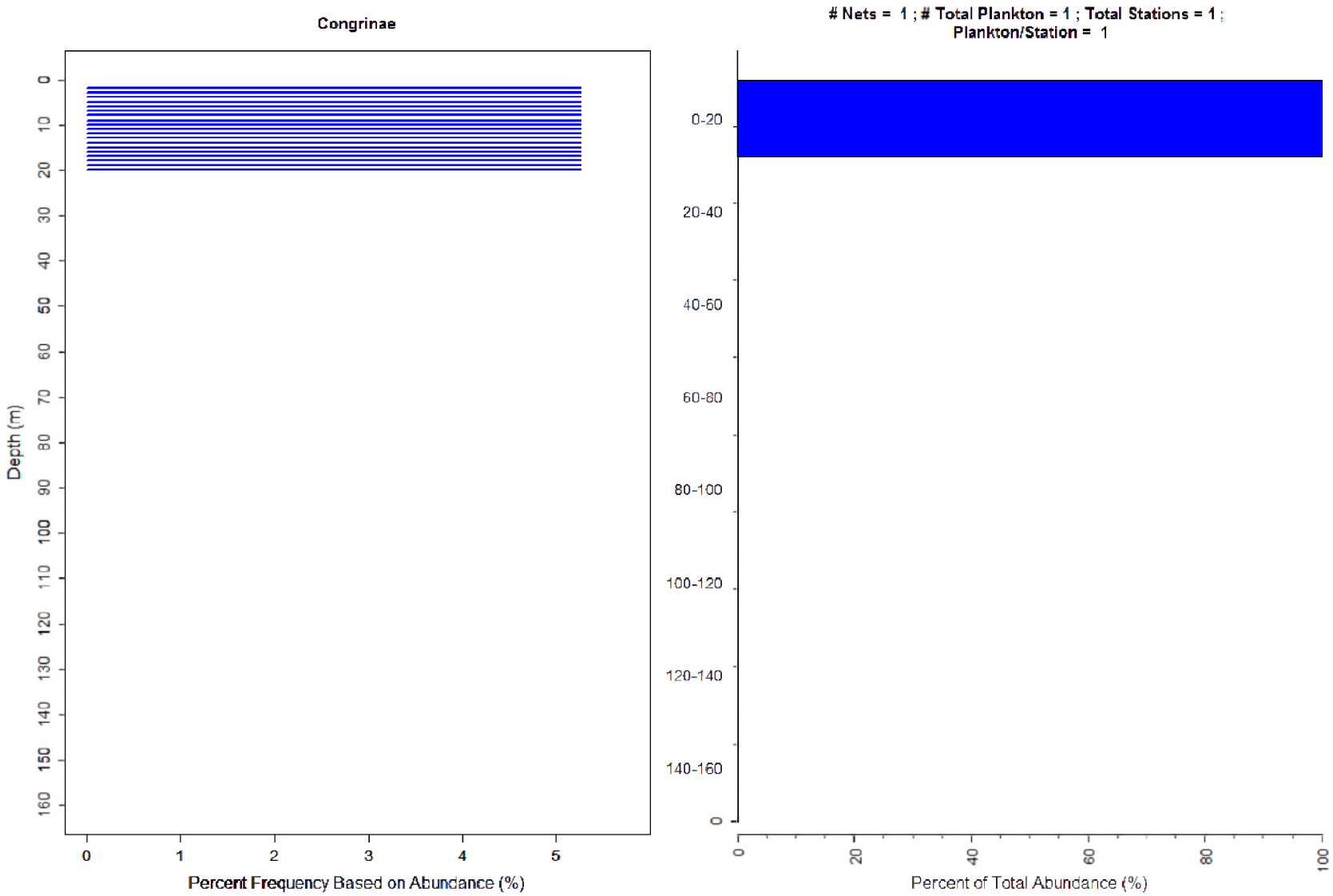
Citharichthys_spilopterus - Shallow



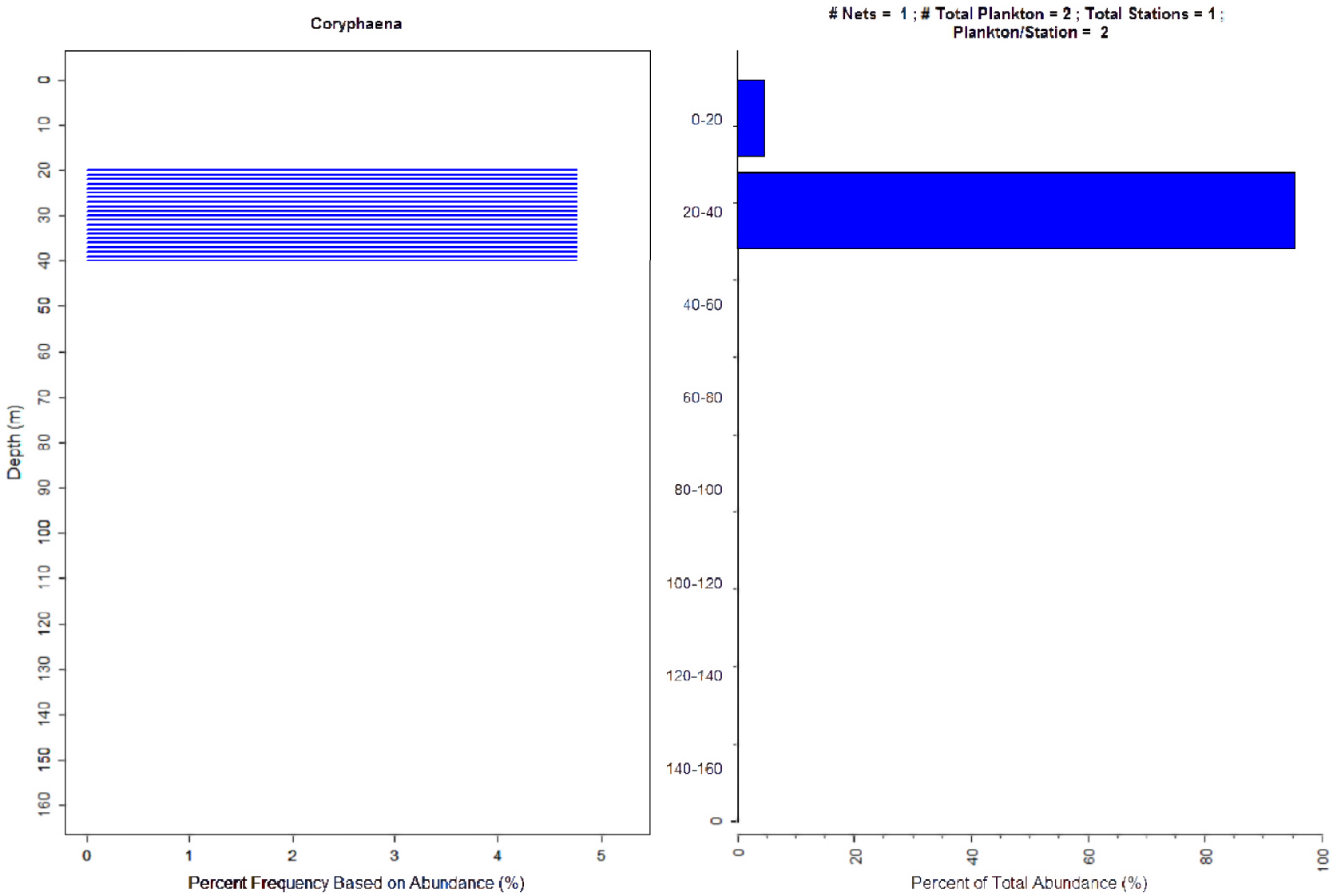
Clupeiformes - Shallow



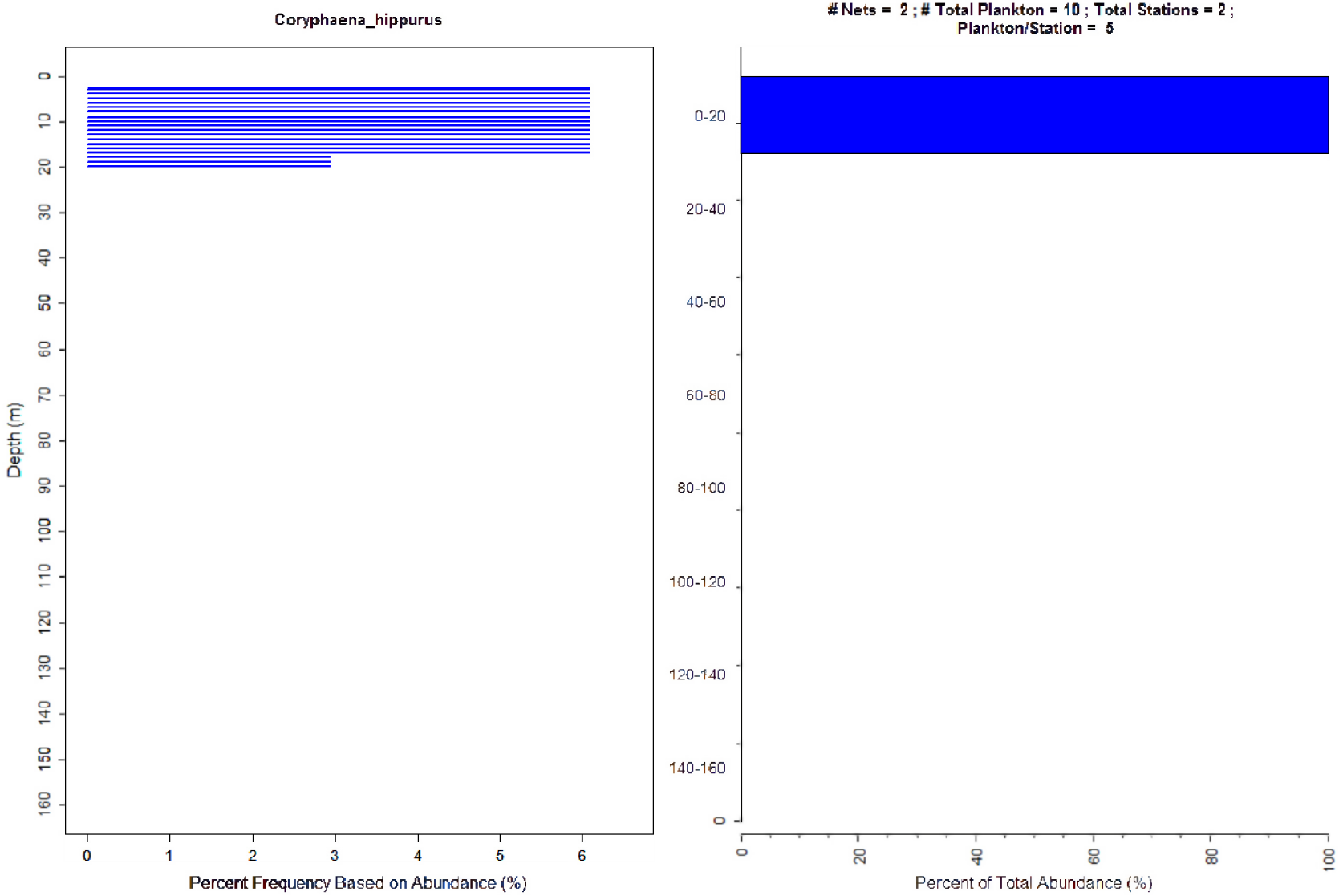
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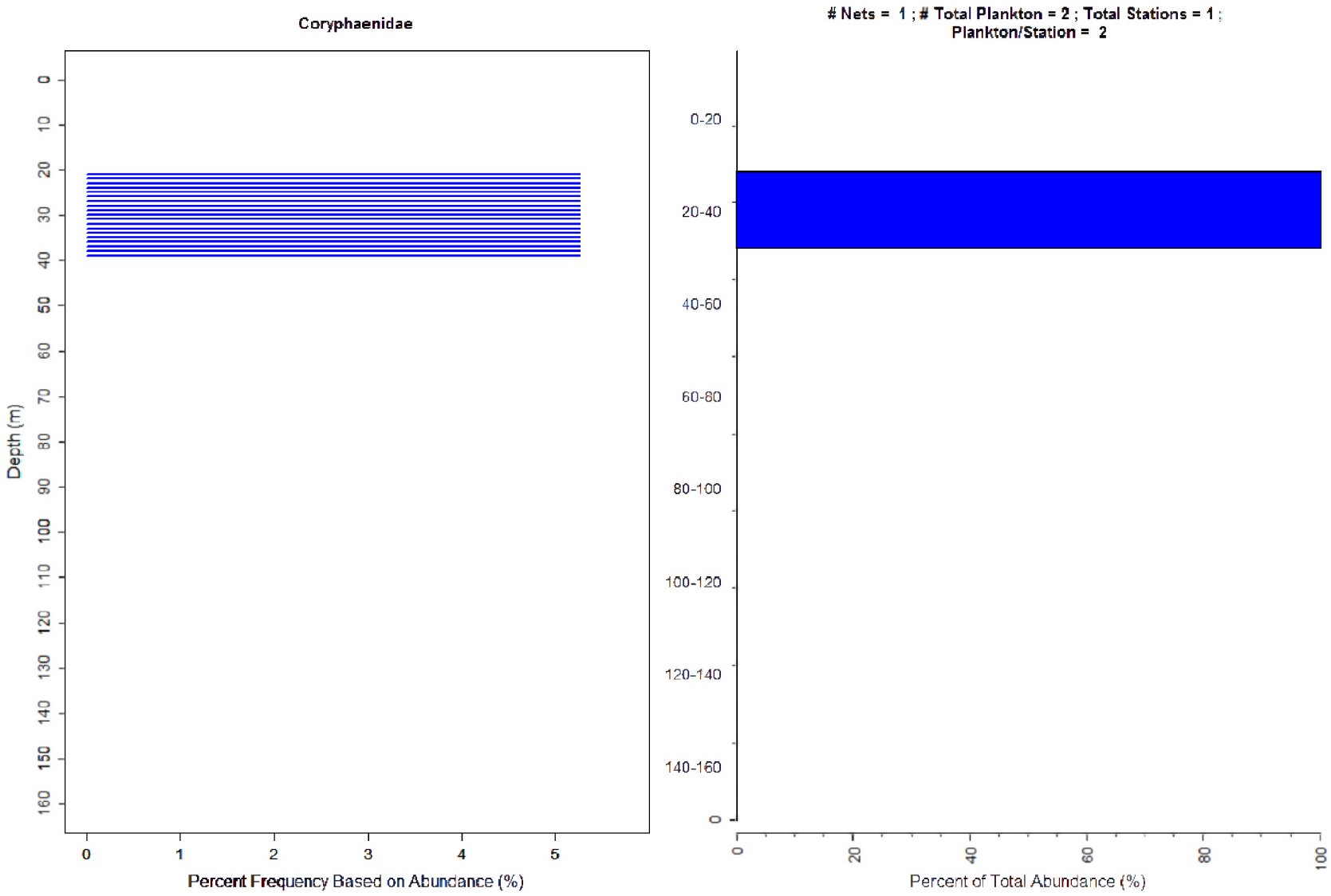
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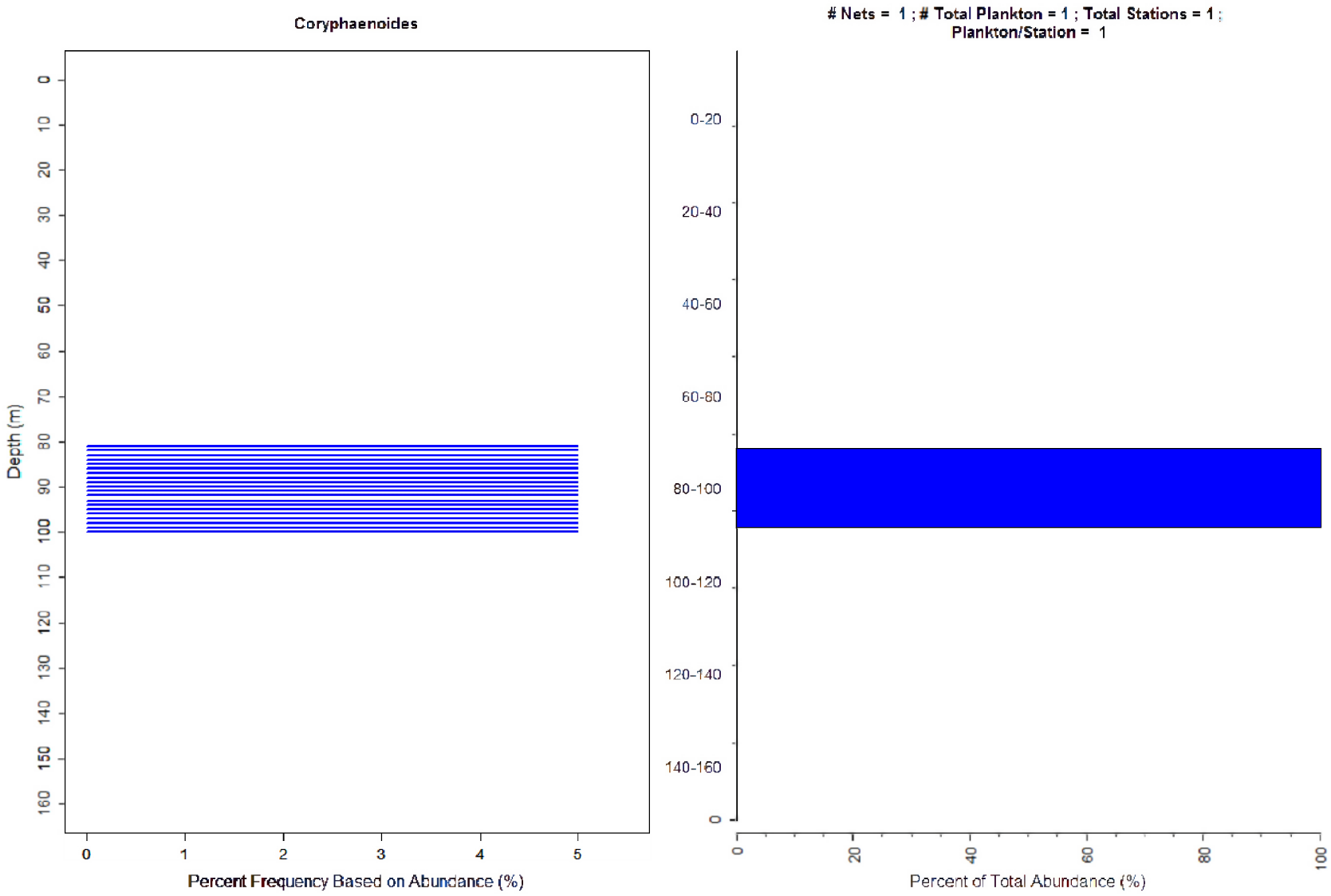
Coryphaena - Shallow



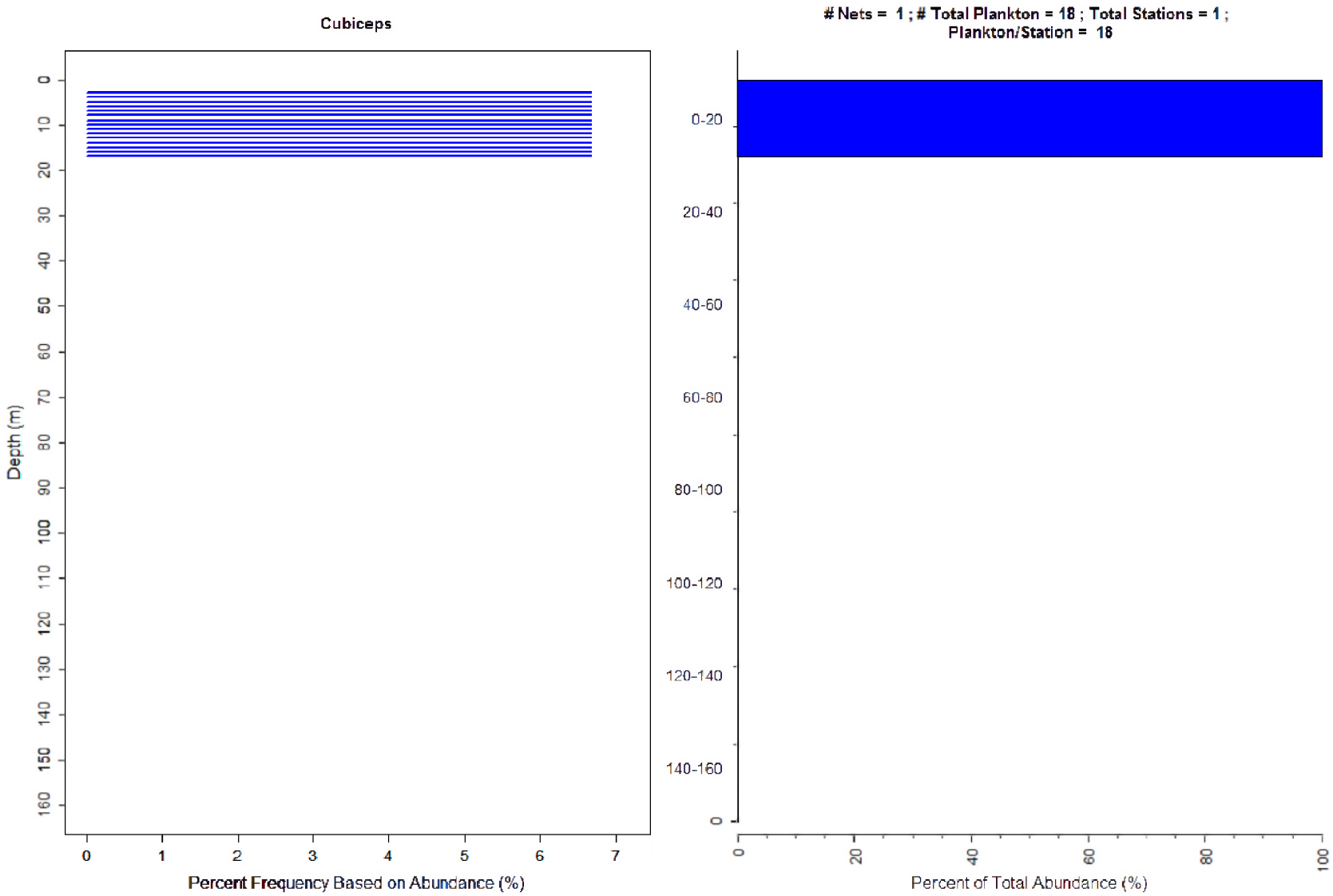
Coryphaena_hippurus - Shallow



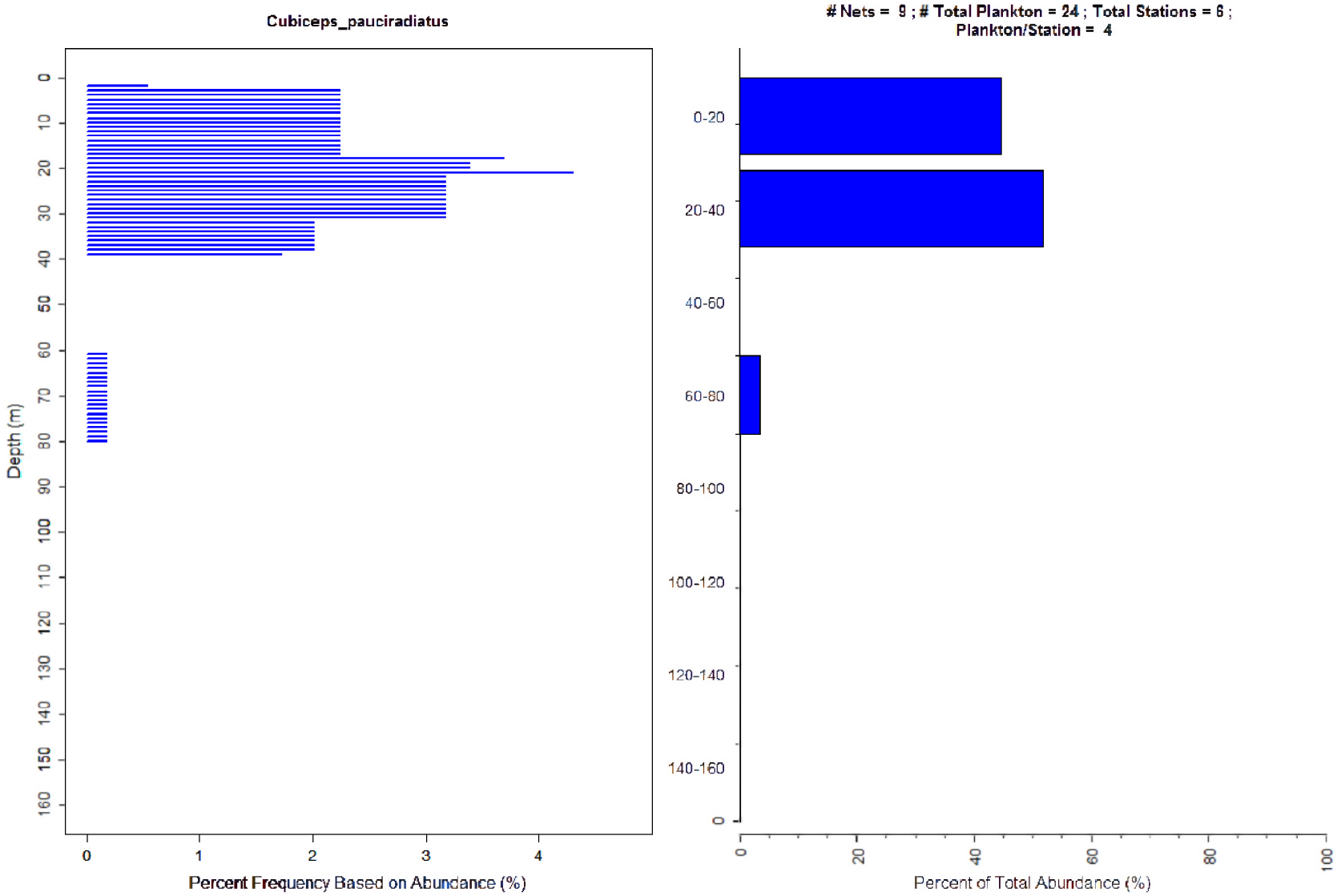
Coryphaenidae - Shallow



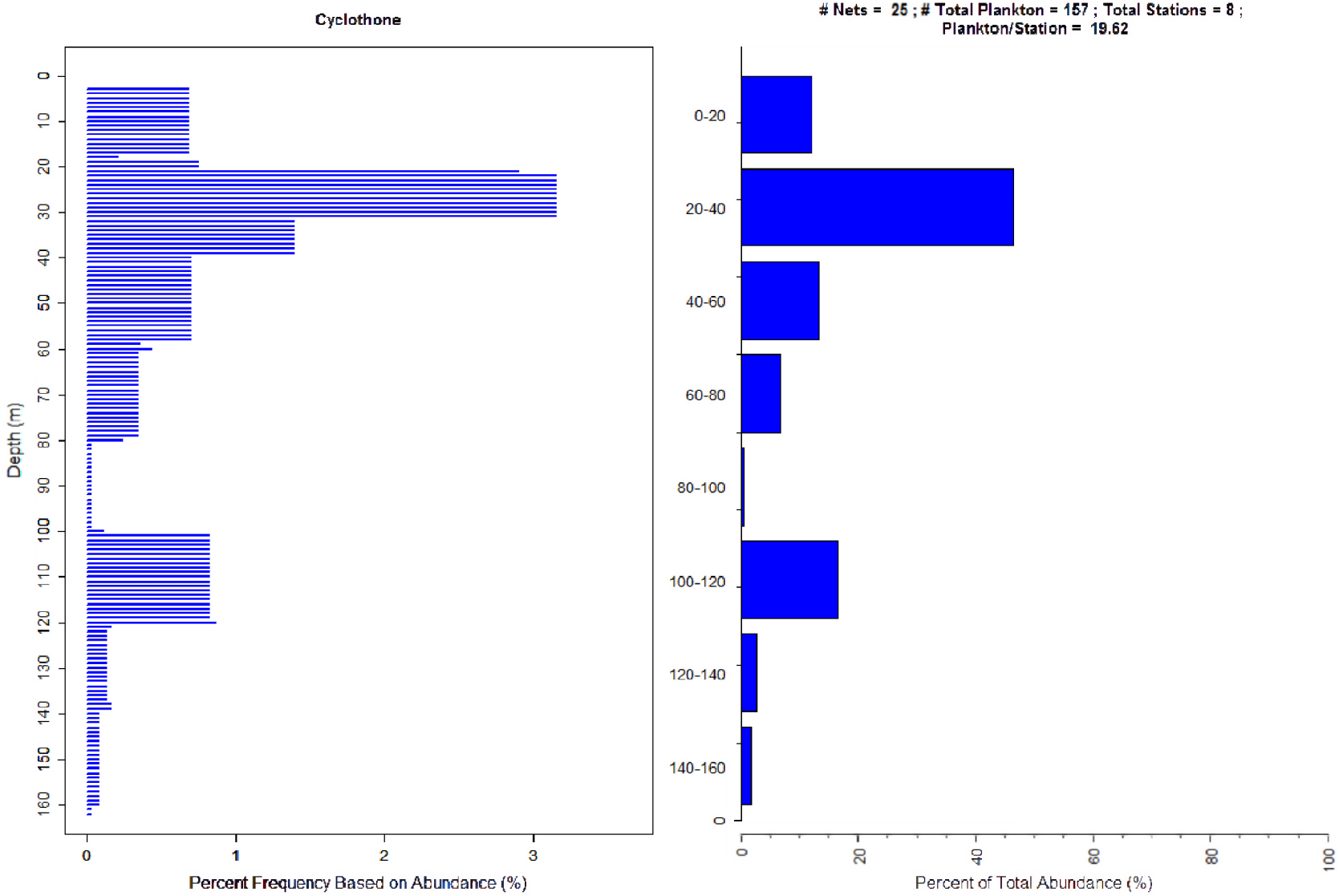
Coryphaenoides - Shallow



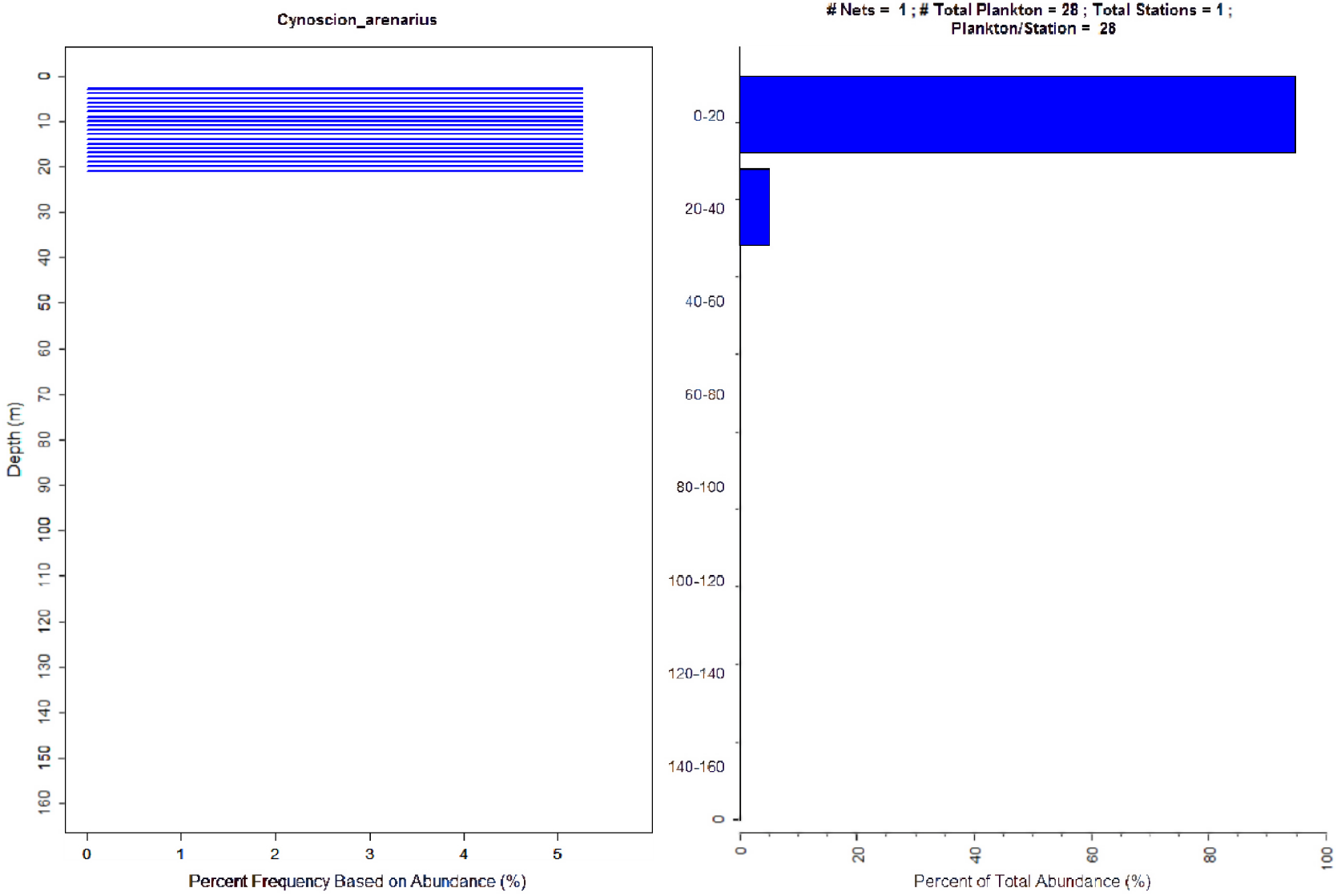
Cubiceps - Shallow



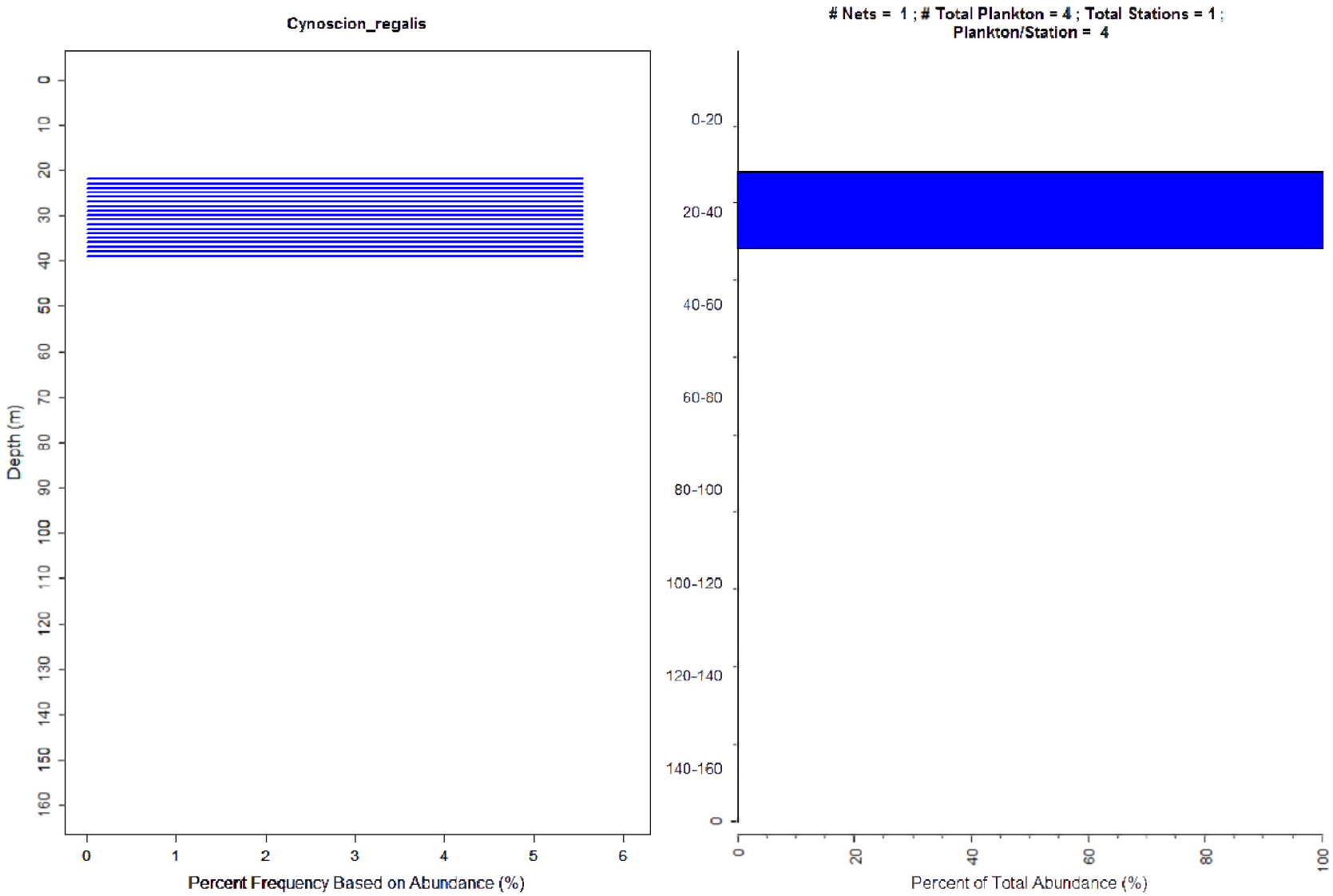
Cubiceps_pauciradiatus - Shallow



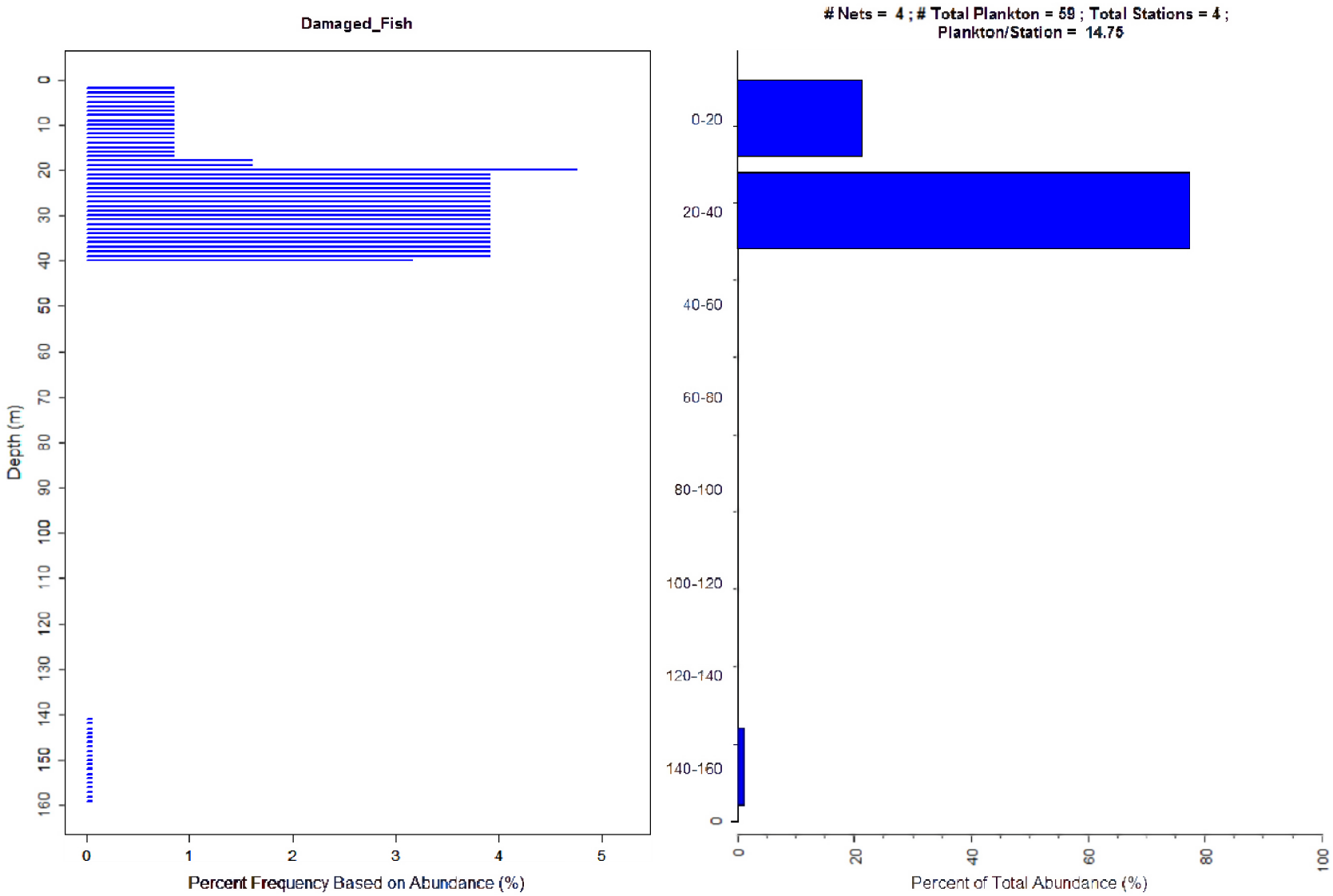
Cyclothone - Shallow



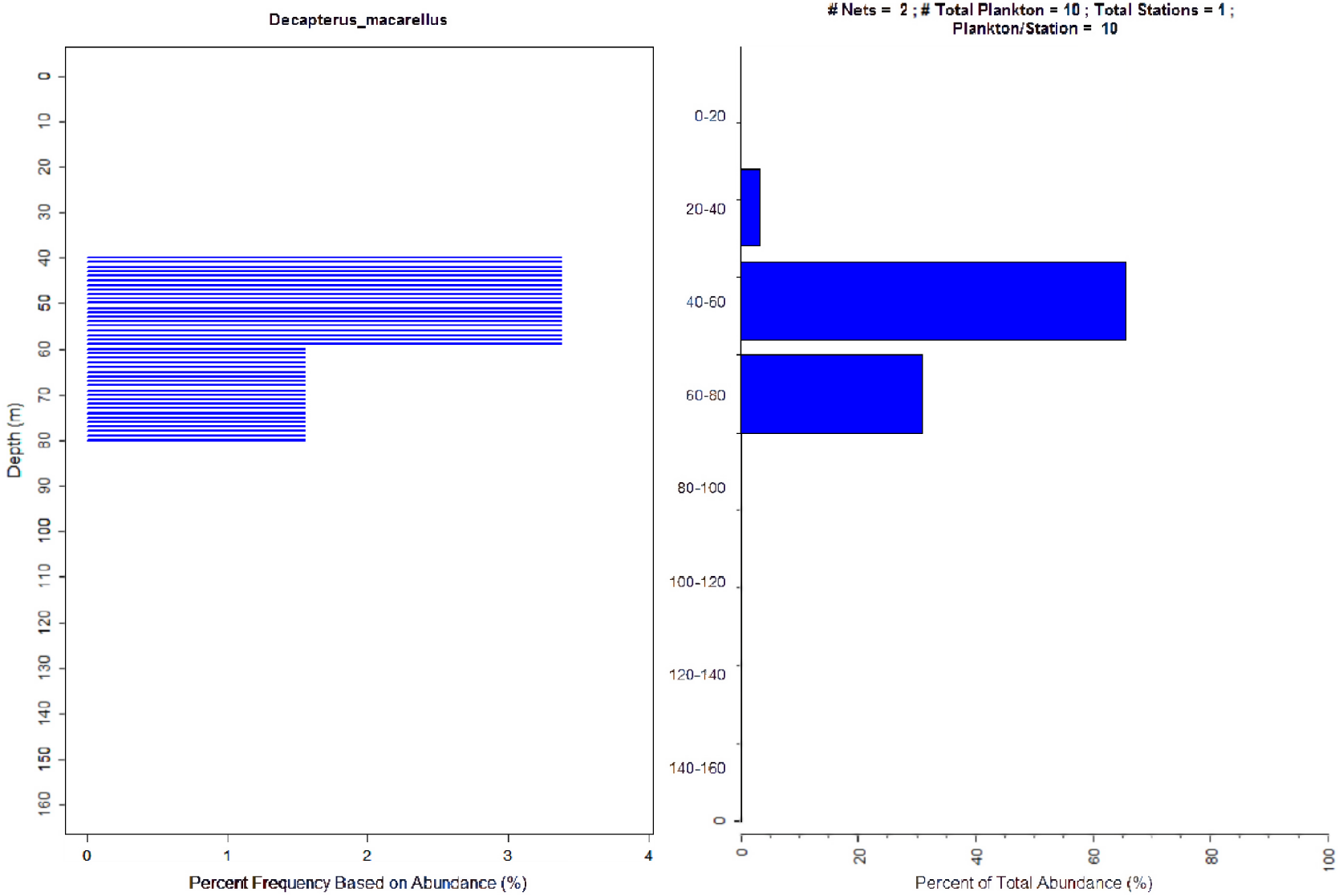
Cynoscion_arenarius - Shallow



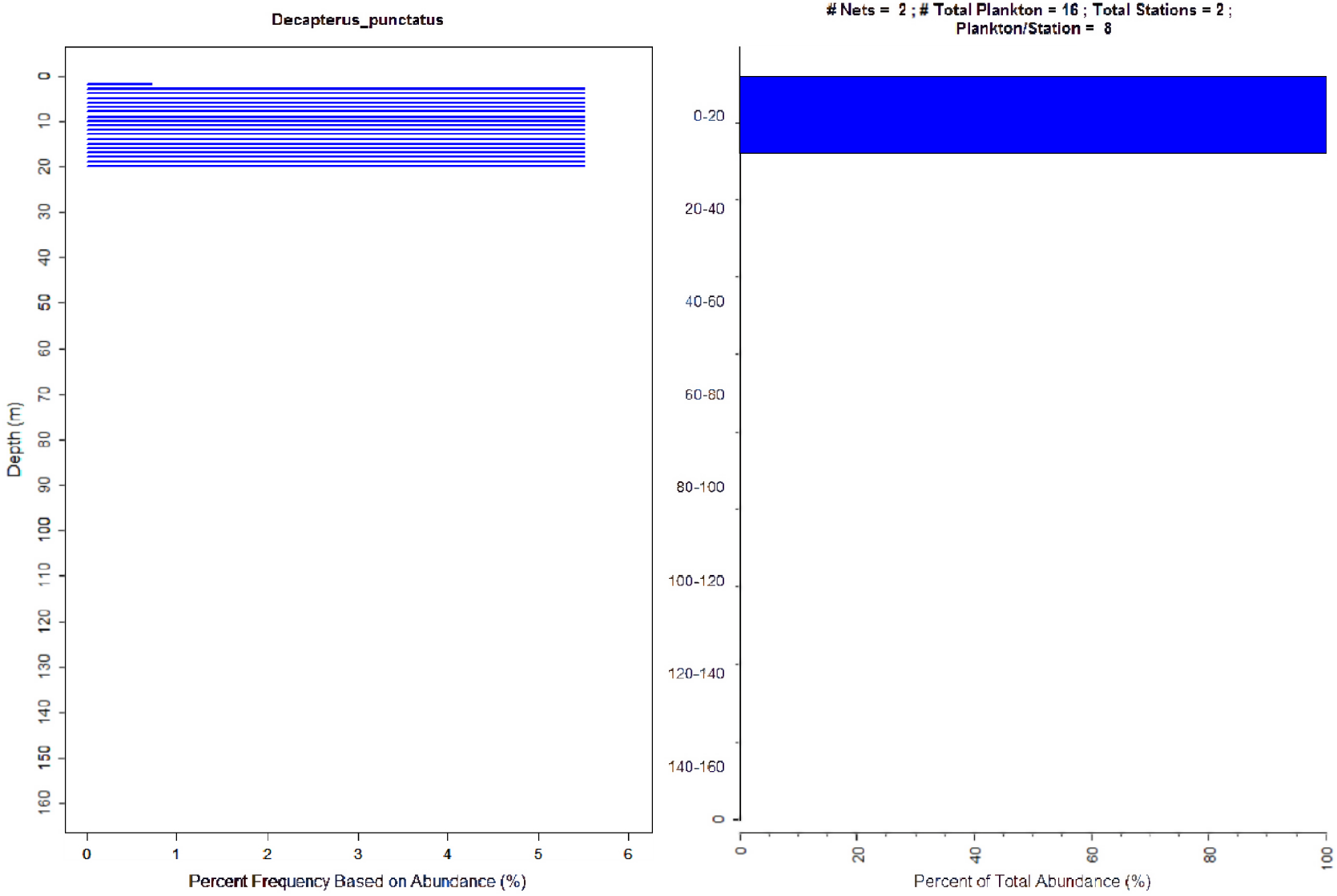
Cynoscion_regalis - Shallow



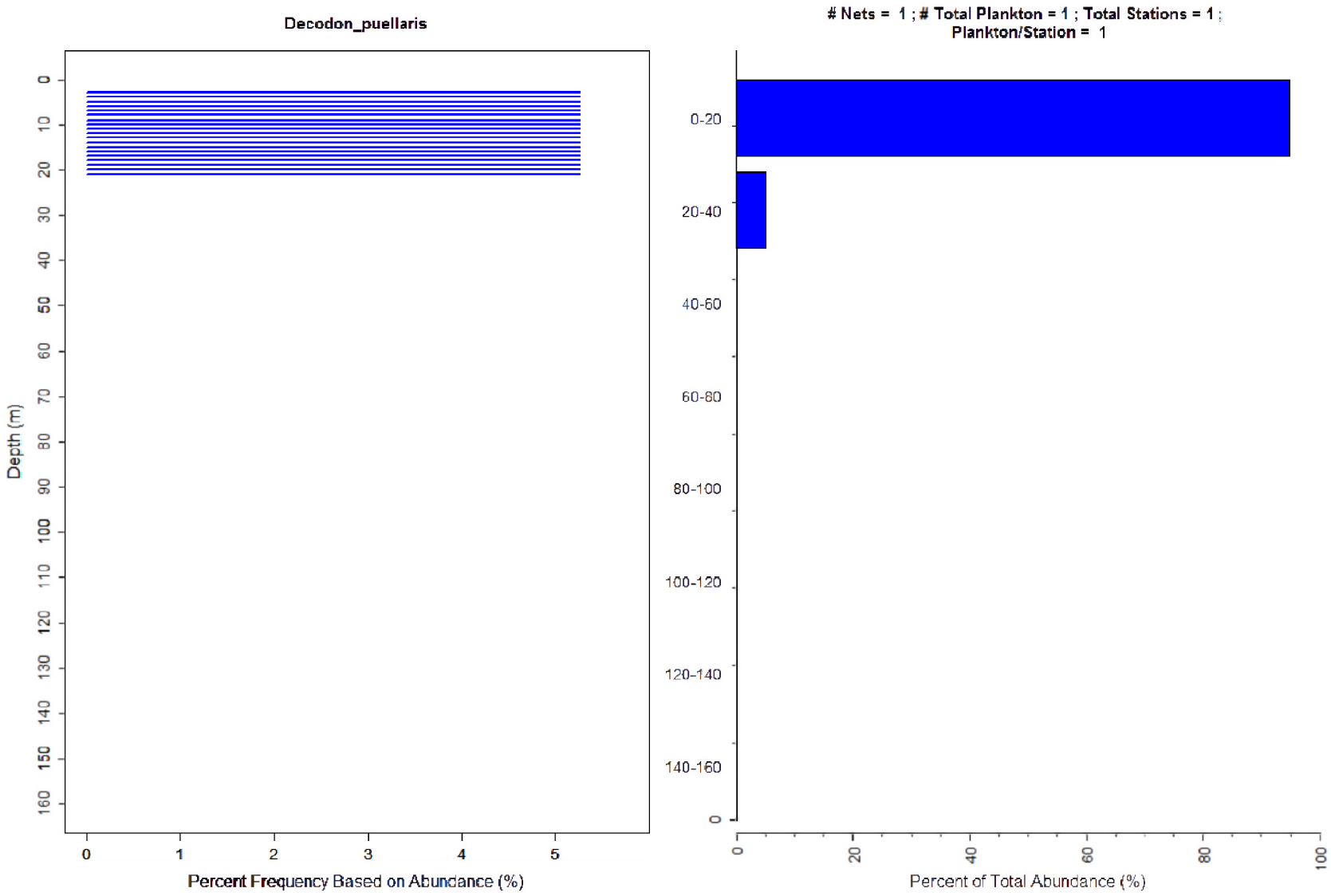
Damaged_Fish - Shallow



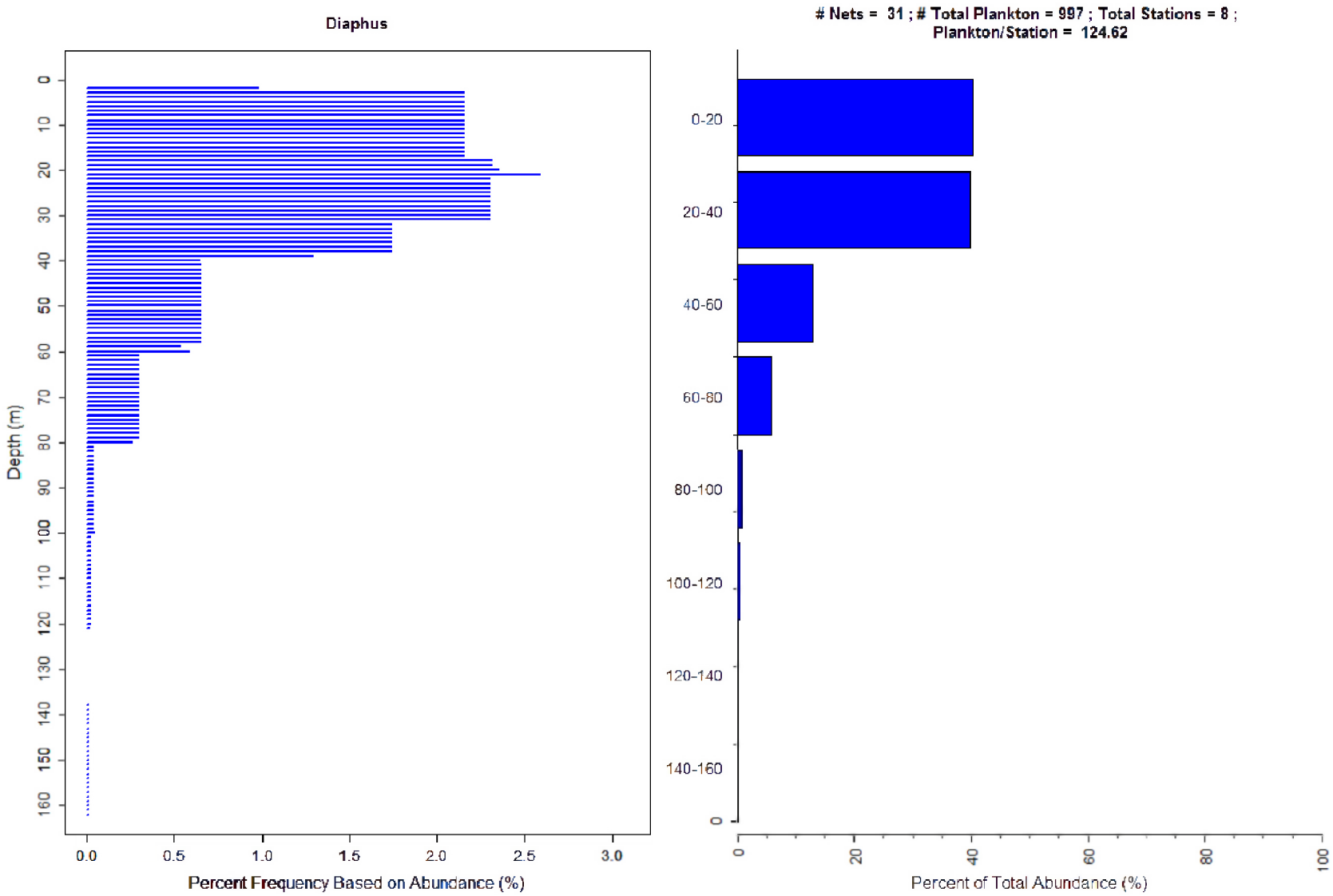
Decapterus_macarellus - Shallow



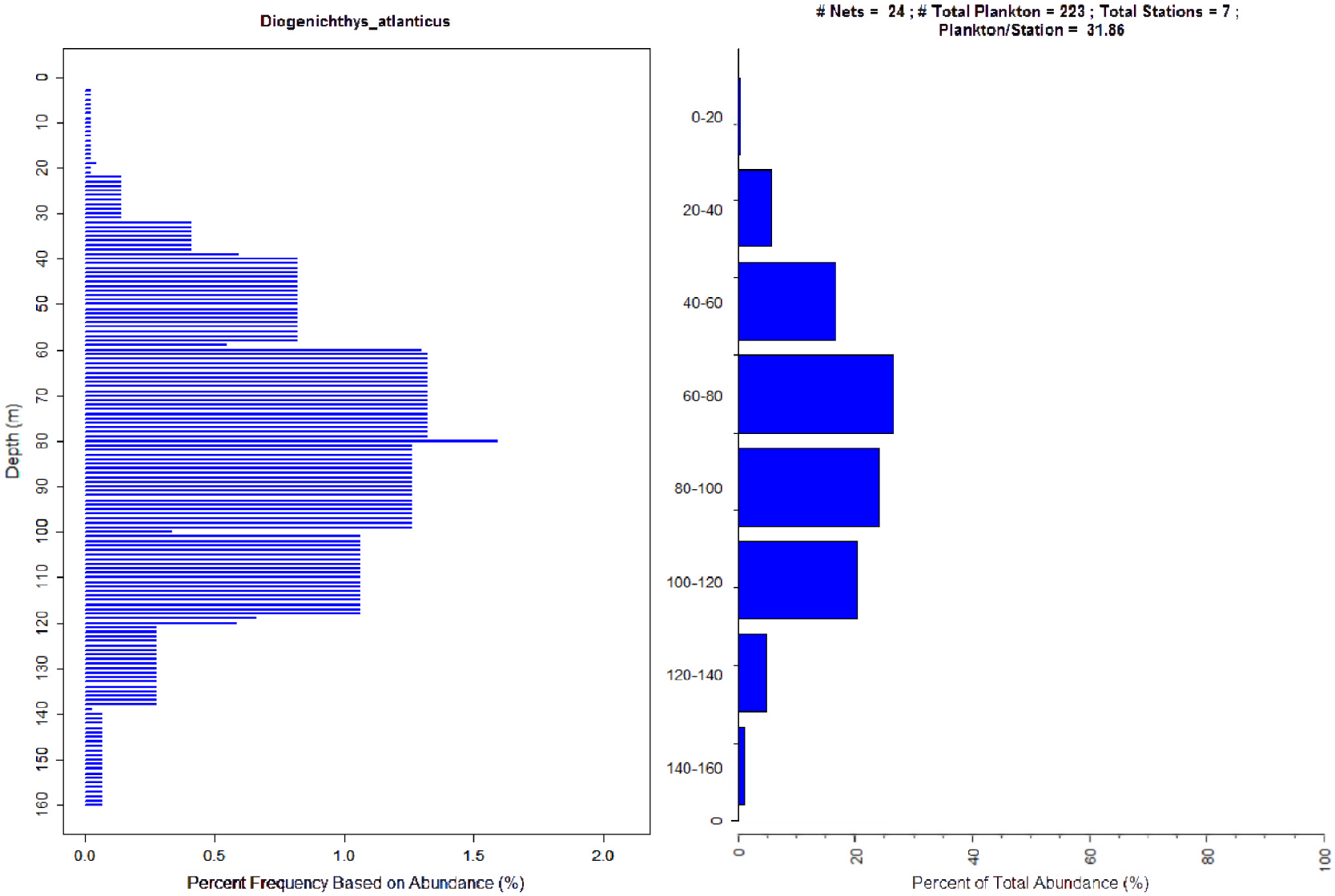
Decapterus_punctatus - Shallow



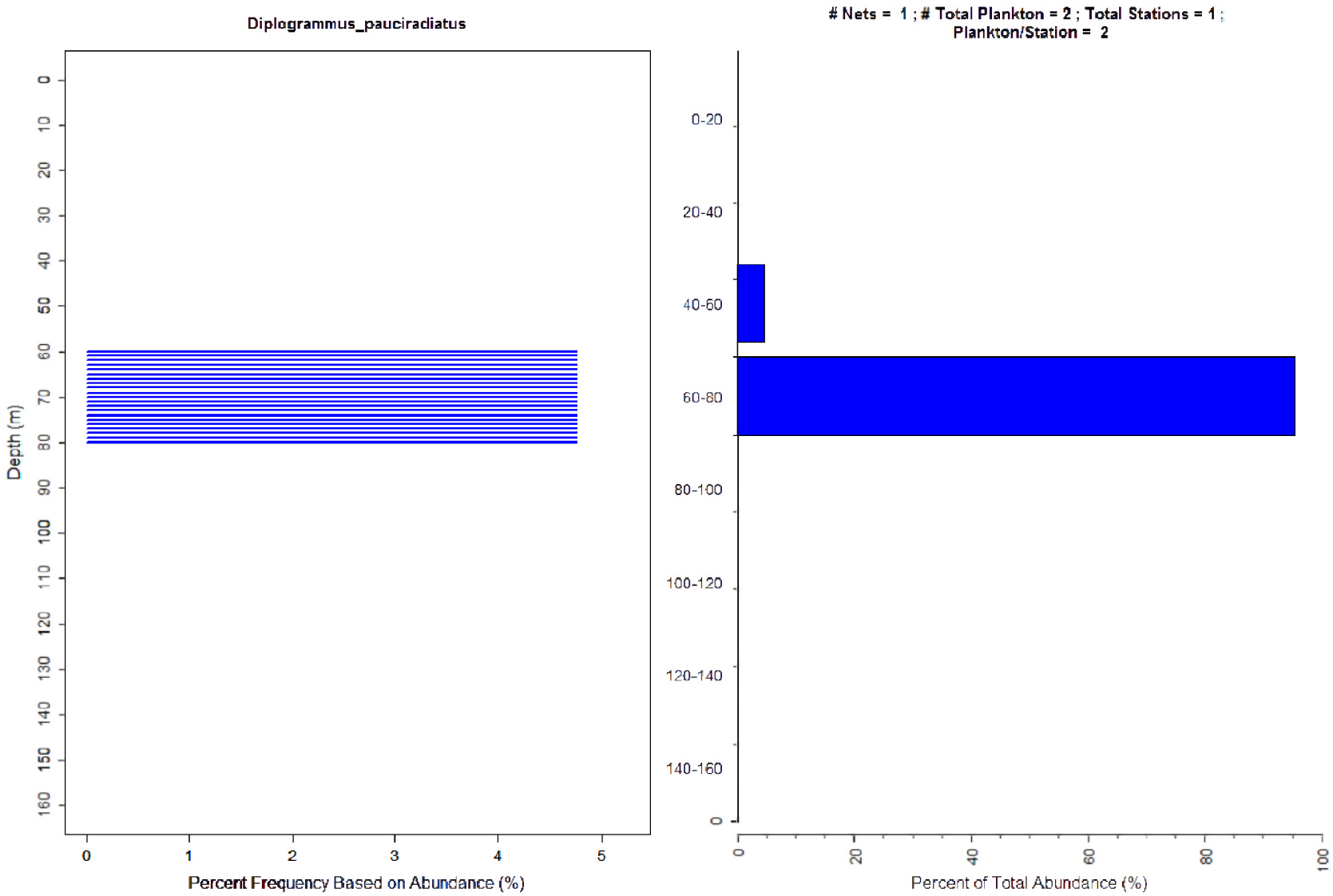
Decodon_puellaris - Shallow



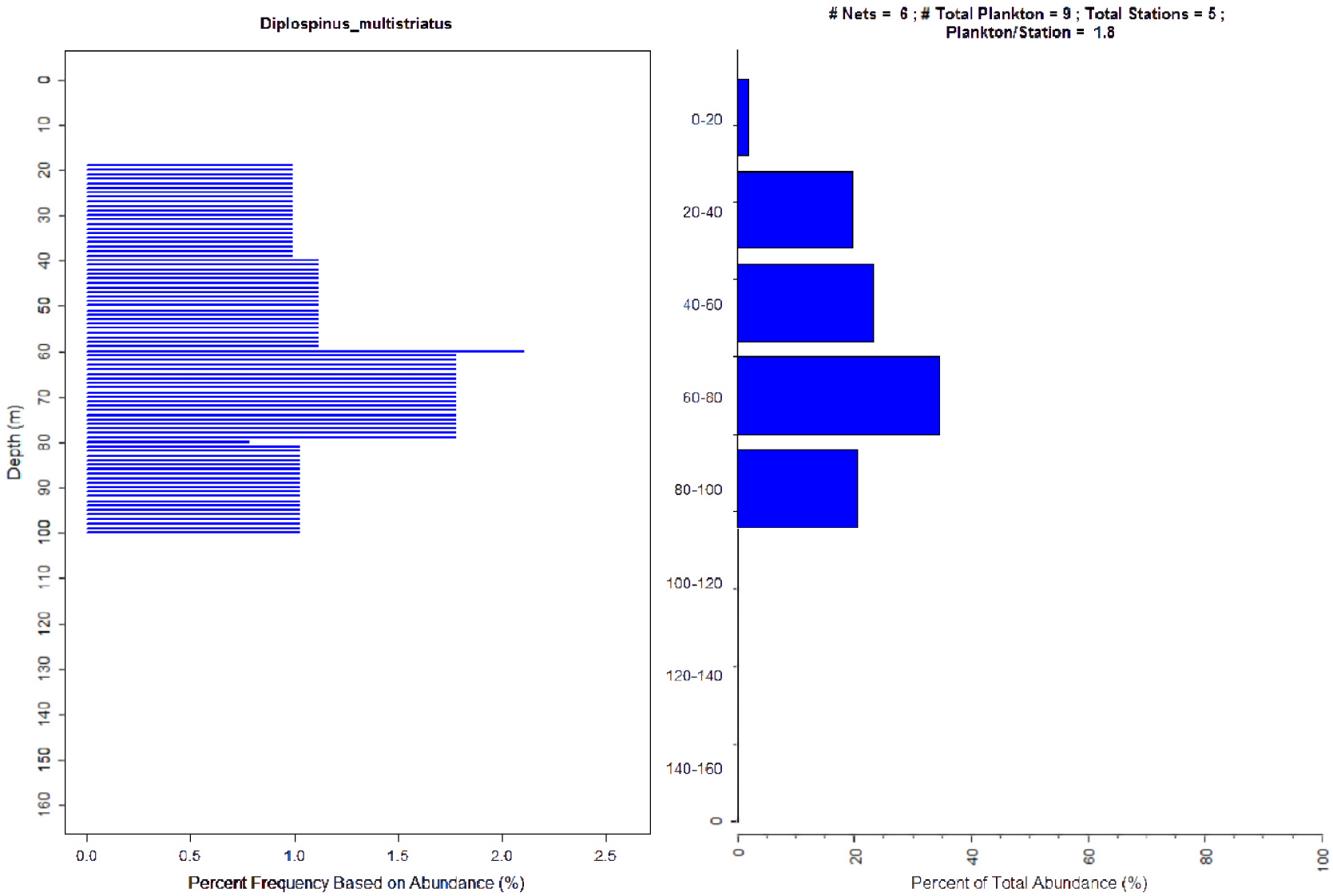
Diaphus - Shallow



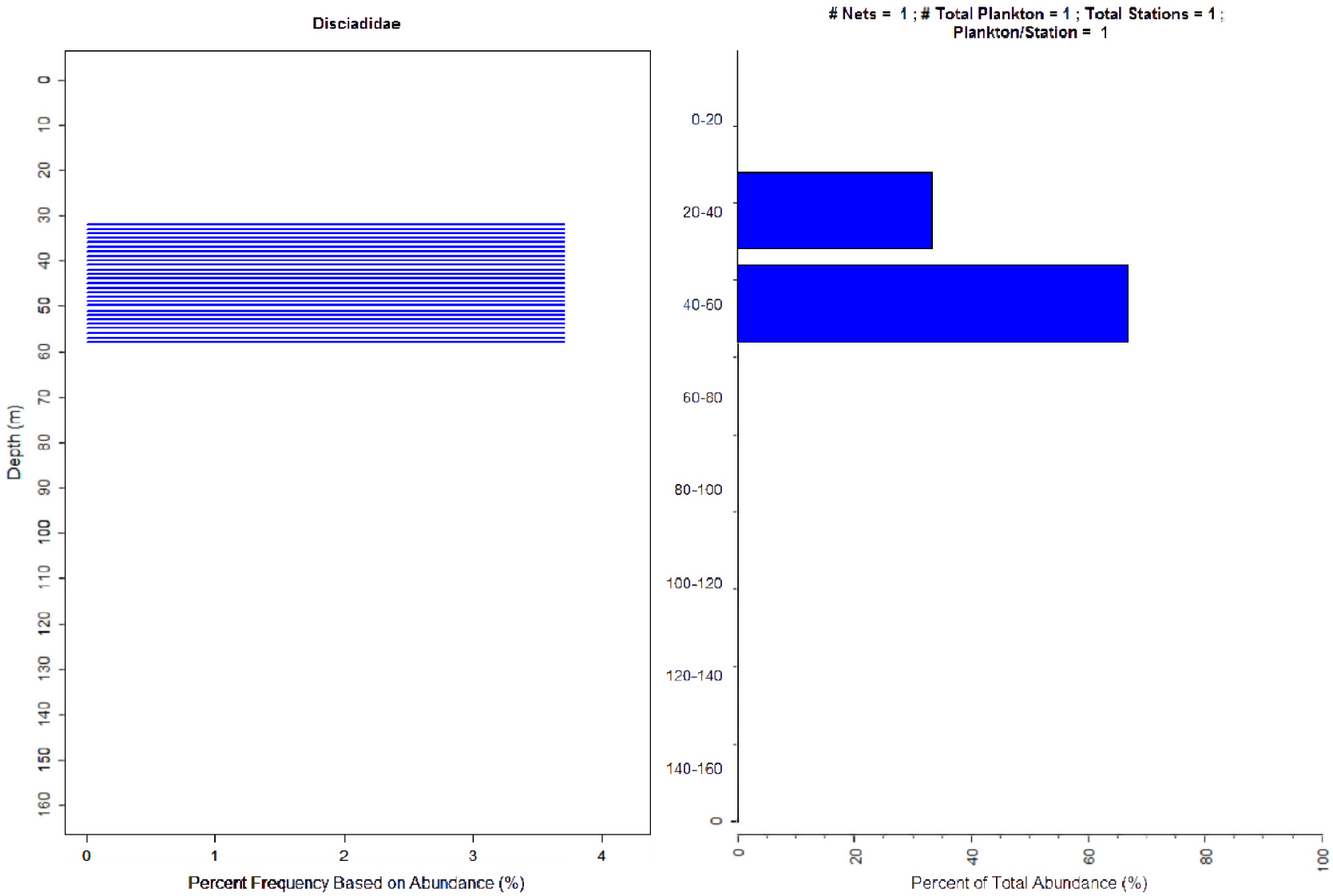
Diogenichthys_atlanticus - Shallow



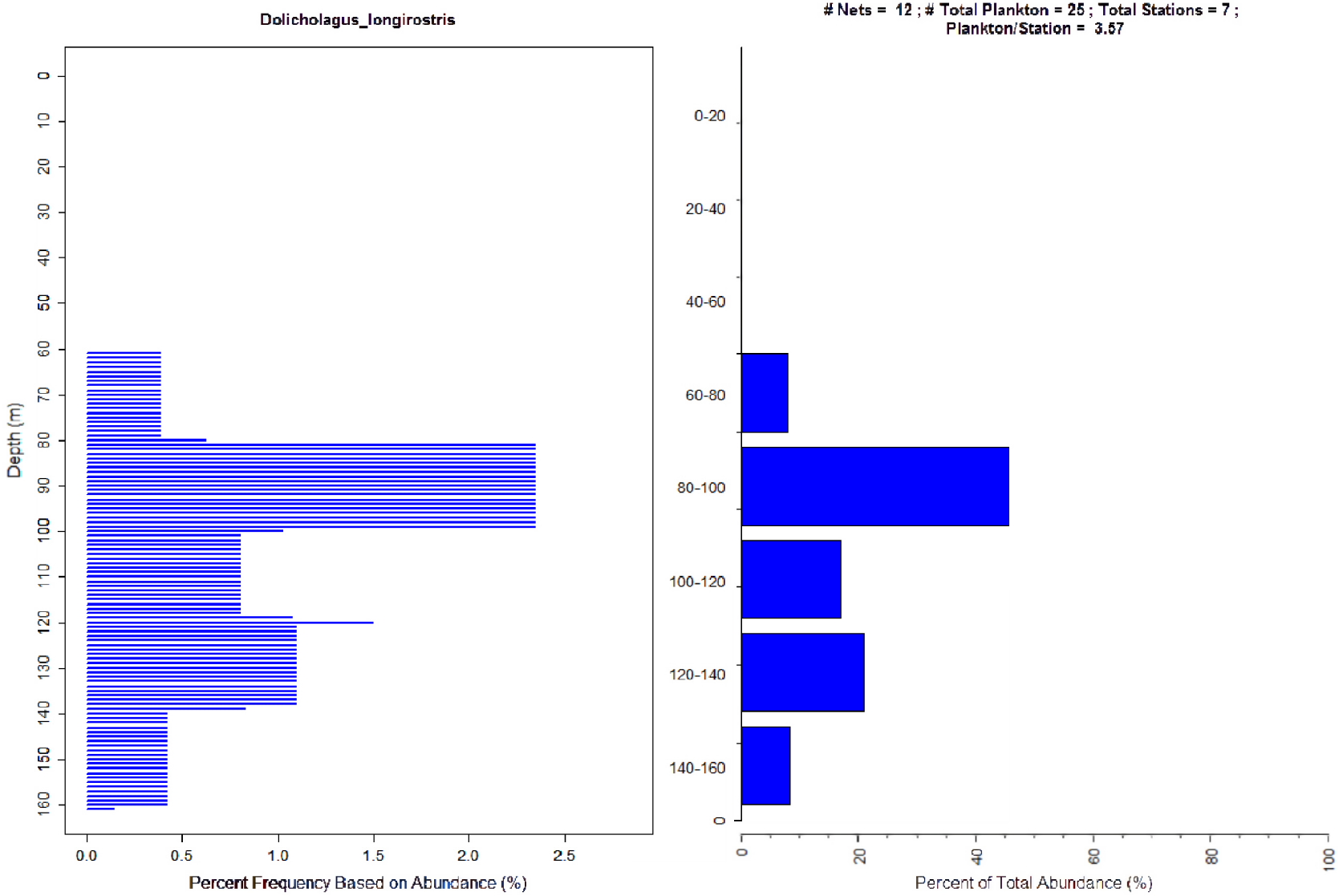
Diplogrammus_pauciradiatus - Shallow



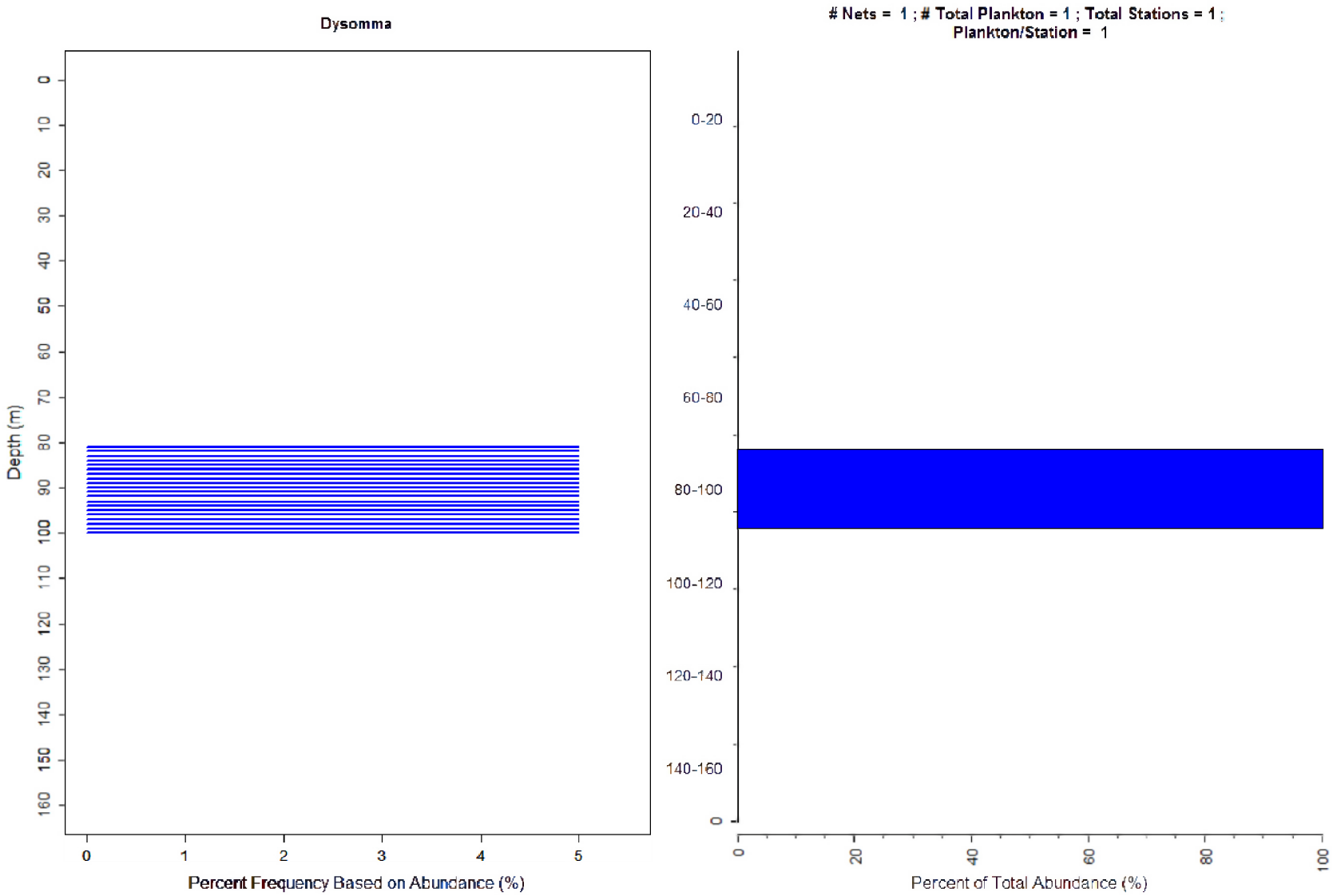
Diplospinus_multistriatus - Shallow



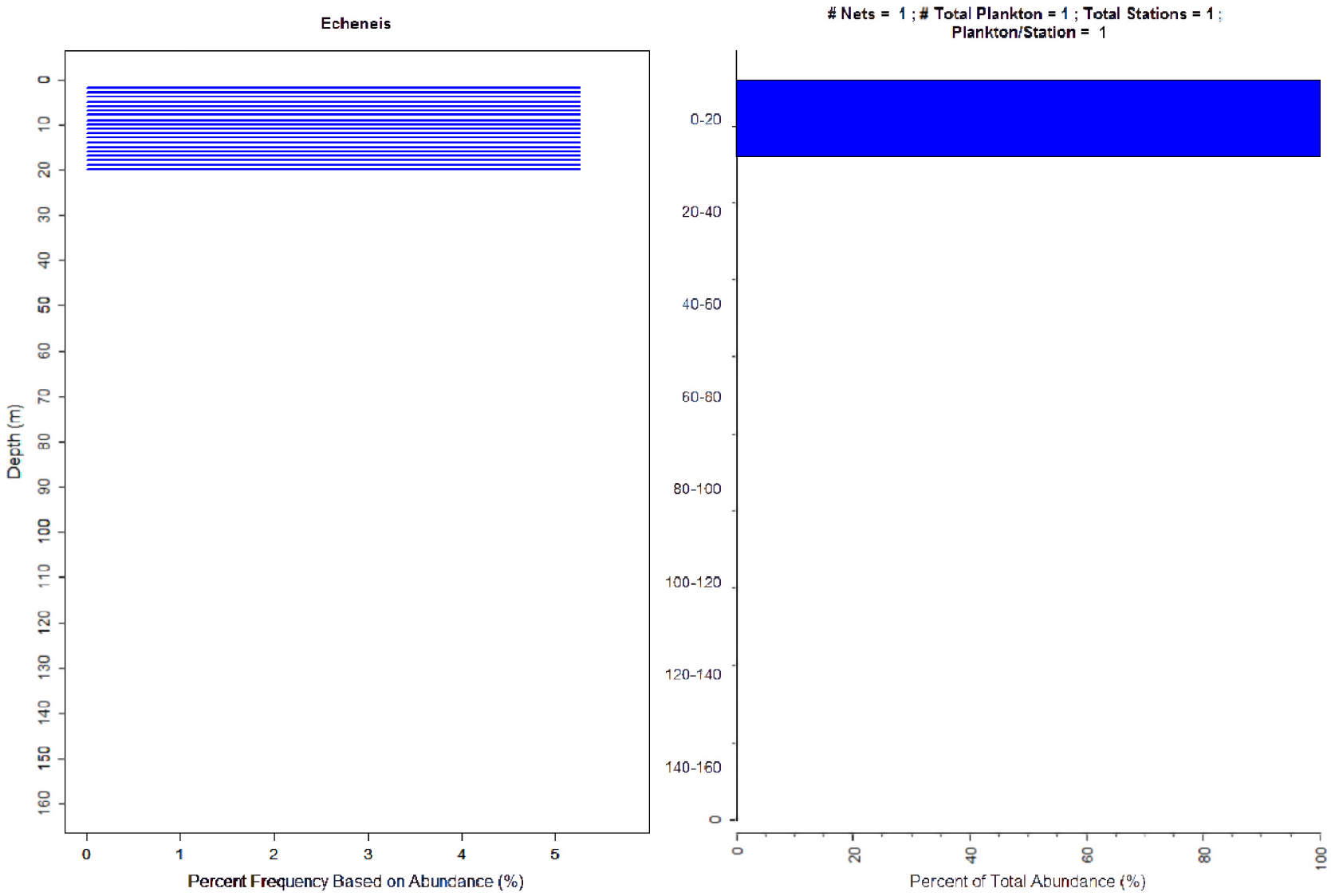
Disciadidae - Shallow



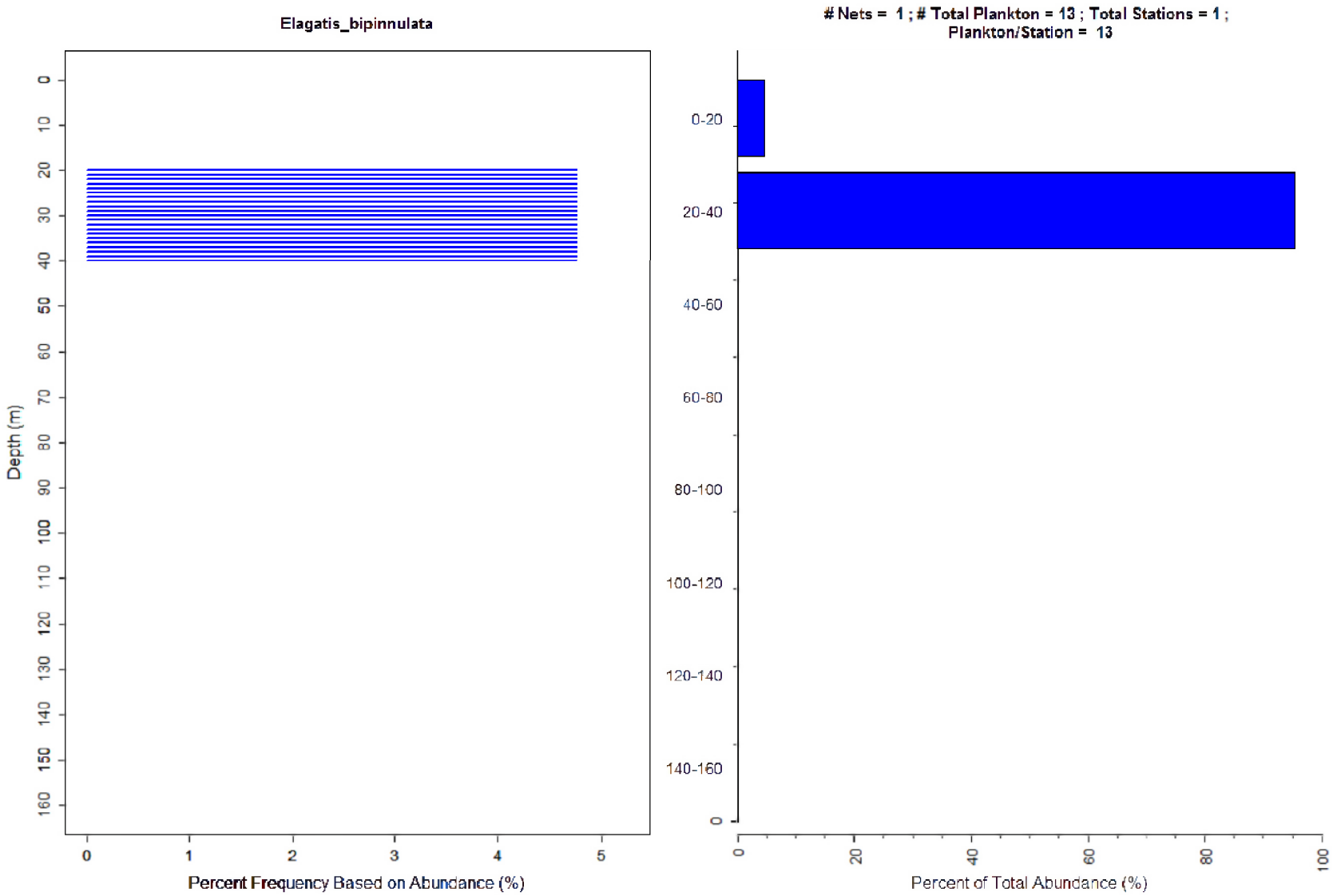
Dolicholagus_longirostris - Shallow



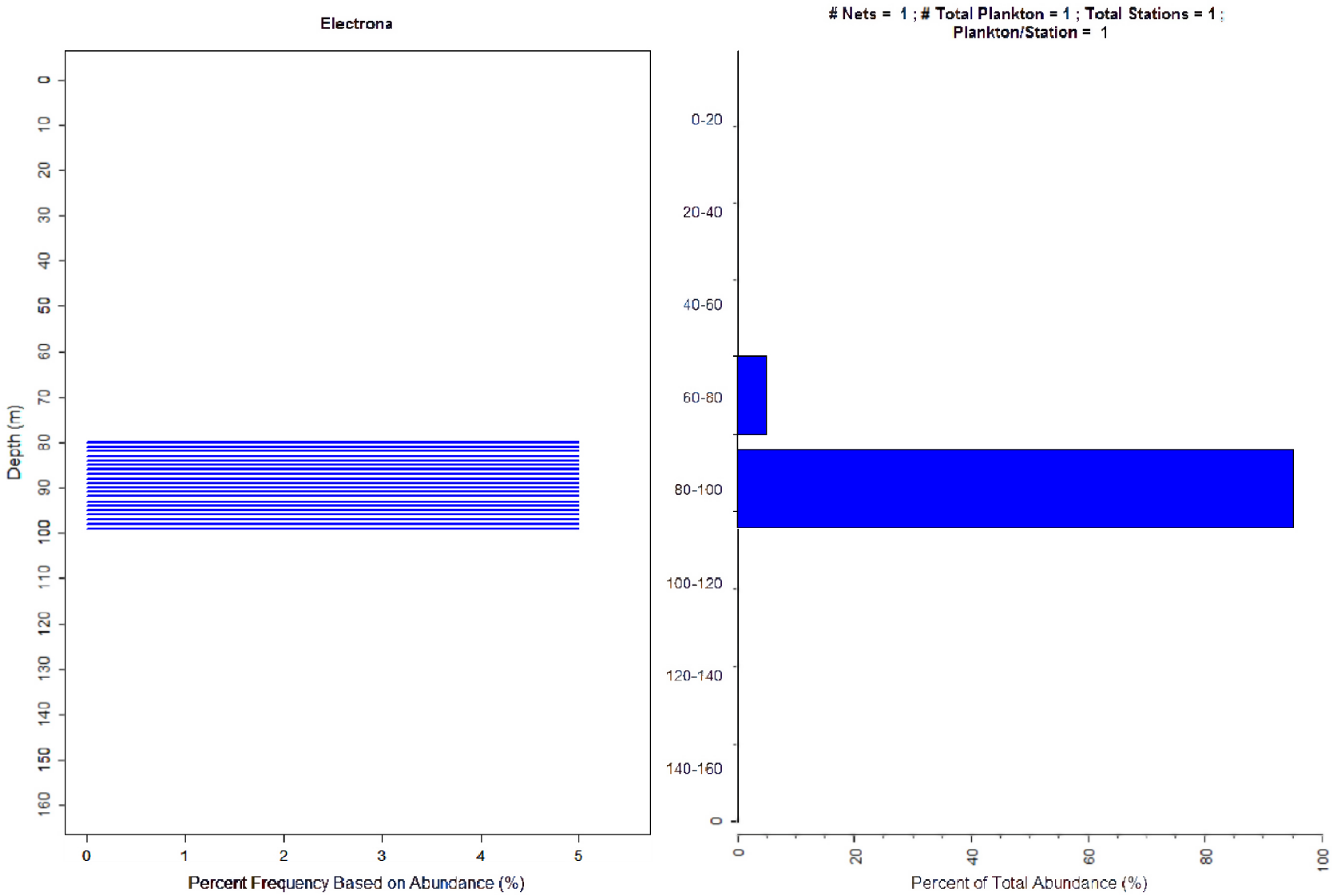
Dysomma - Shallow



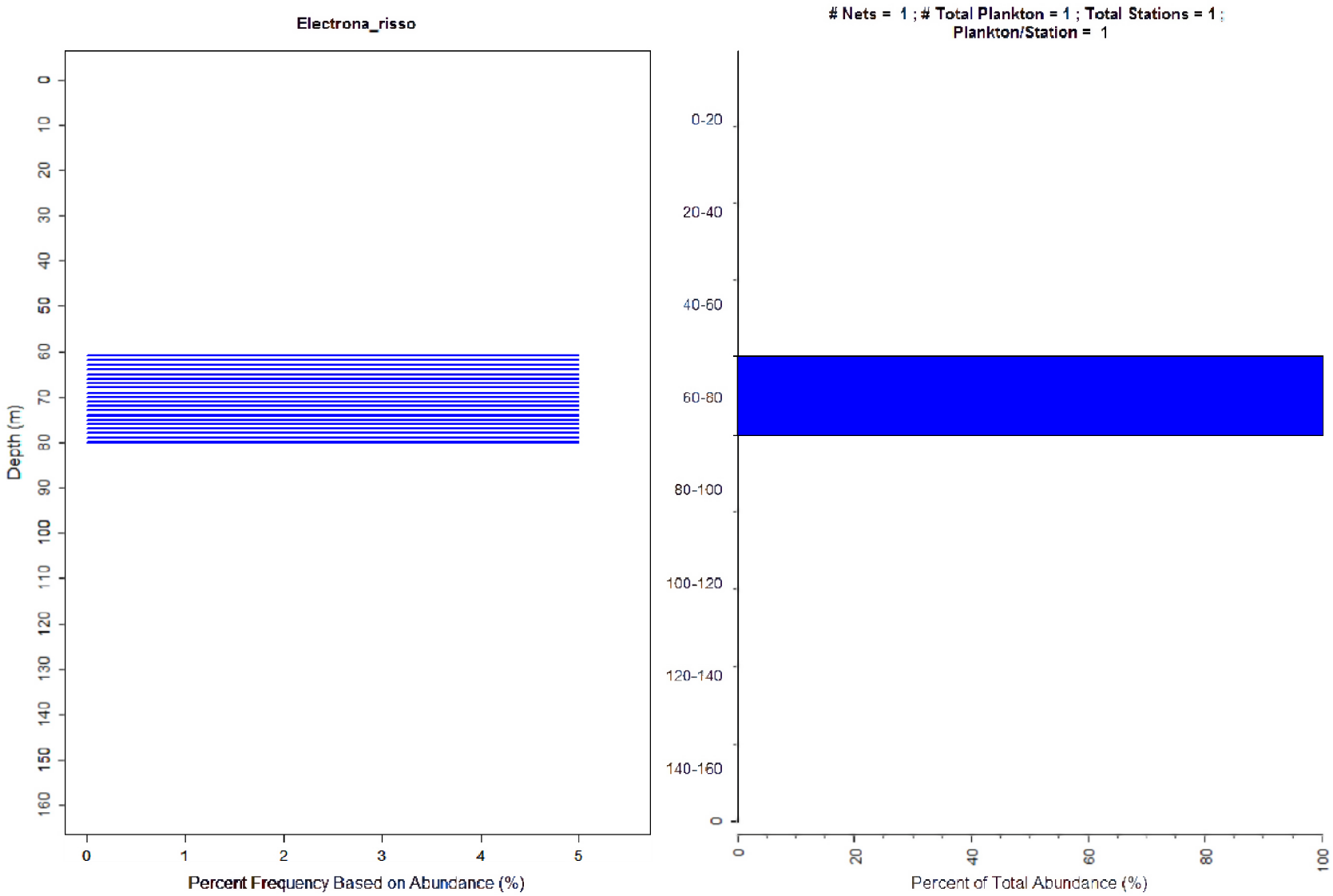
Echeneis - Shallow



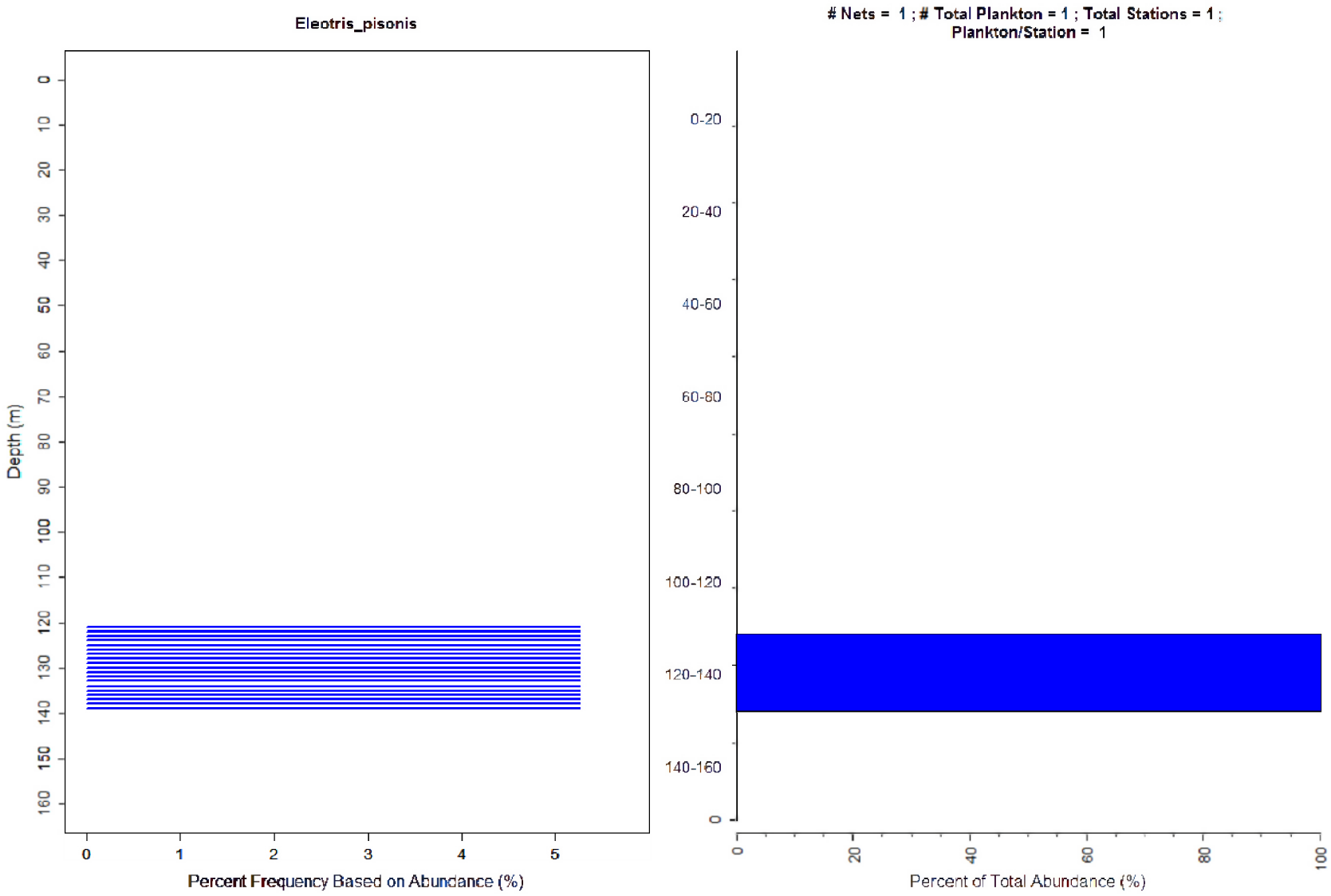
Elagatis_bipinnulata - Shallow



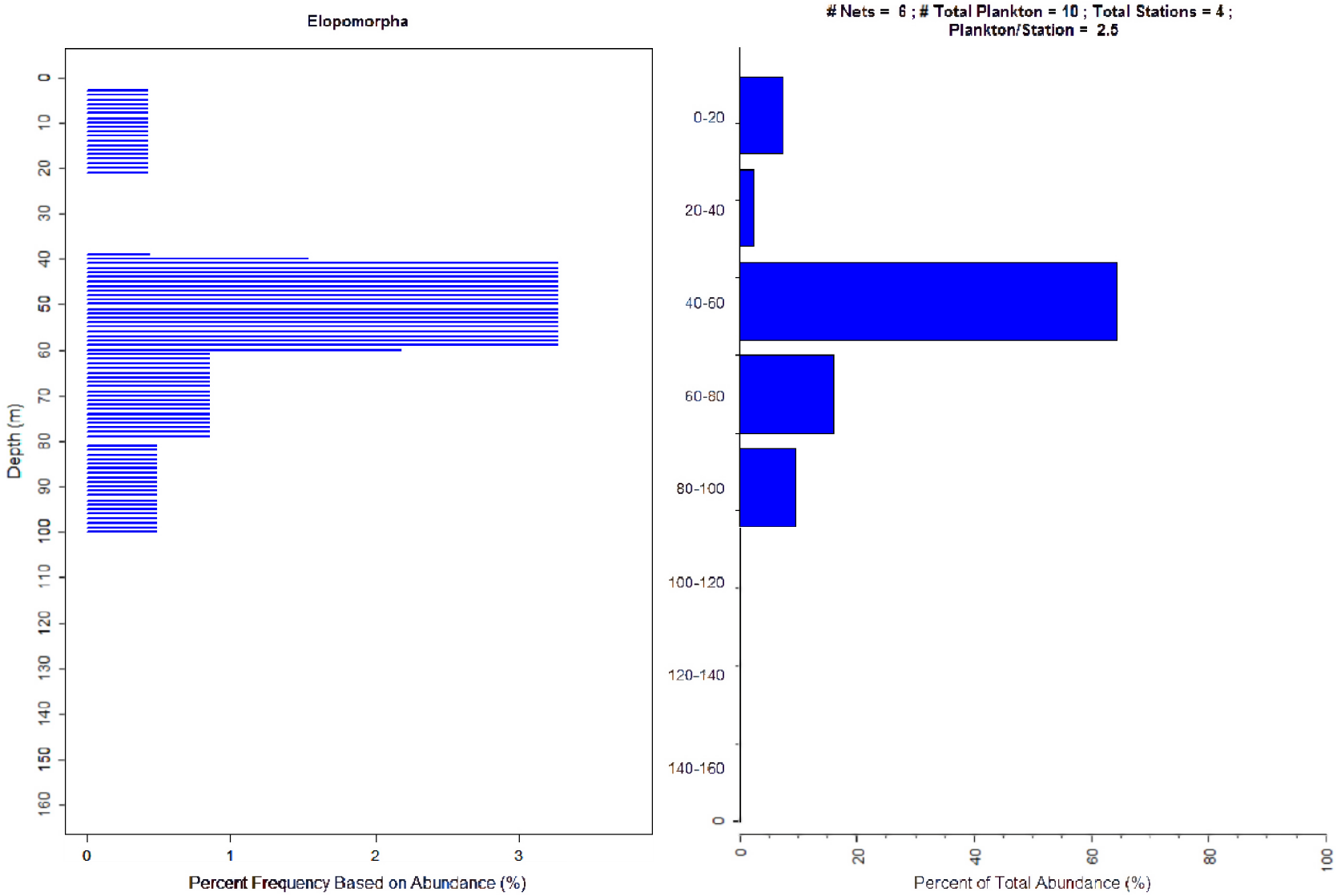
Electrona - Shallow



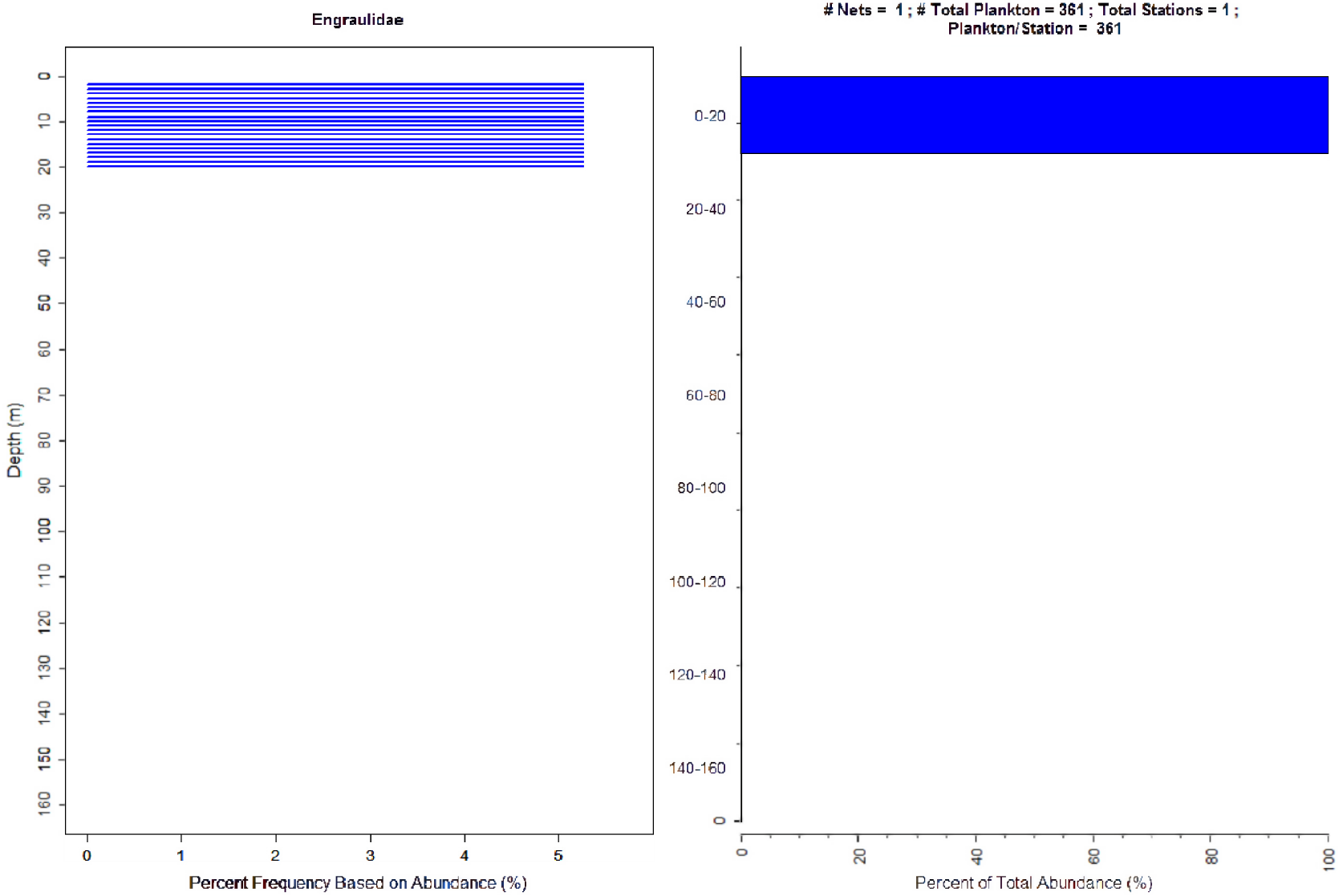
Electrona_risso - Shallow



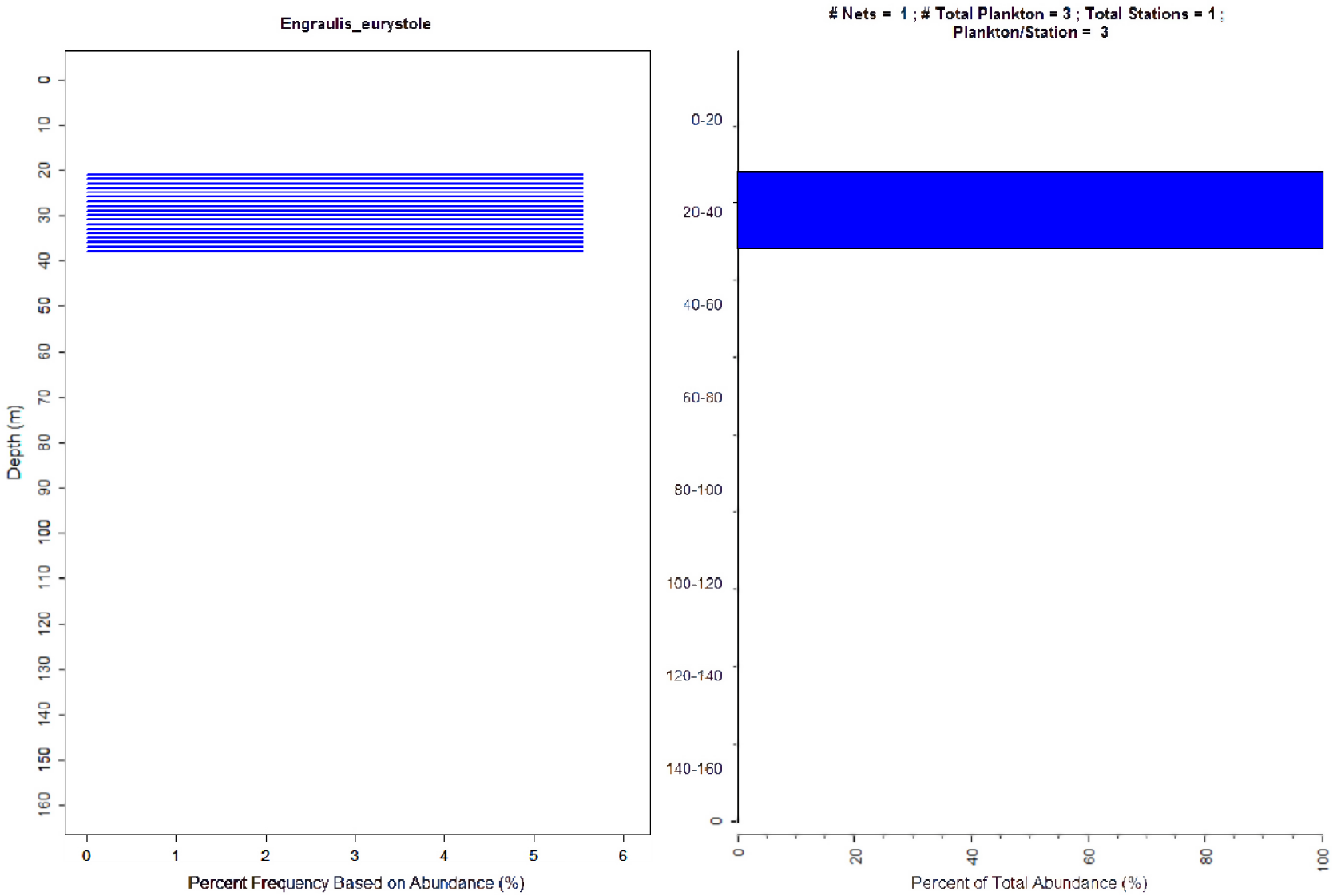
Eleotris_pisonis - Shallow



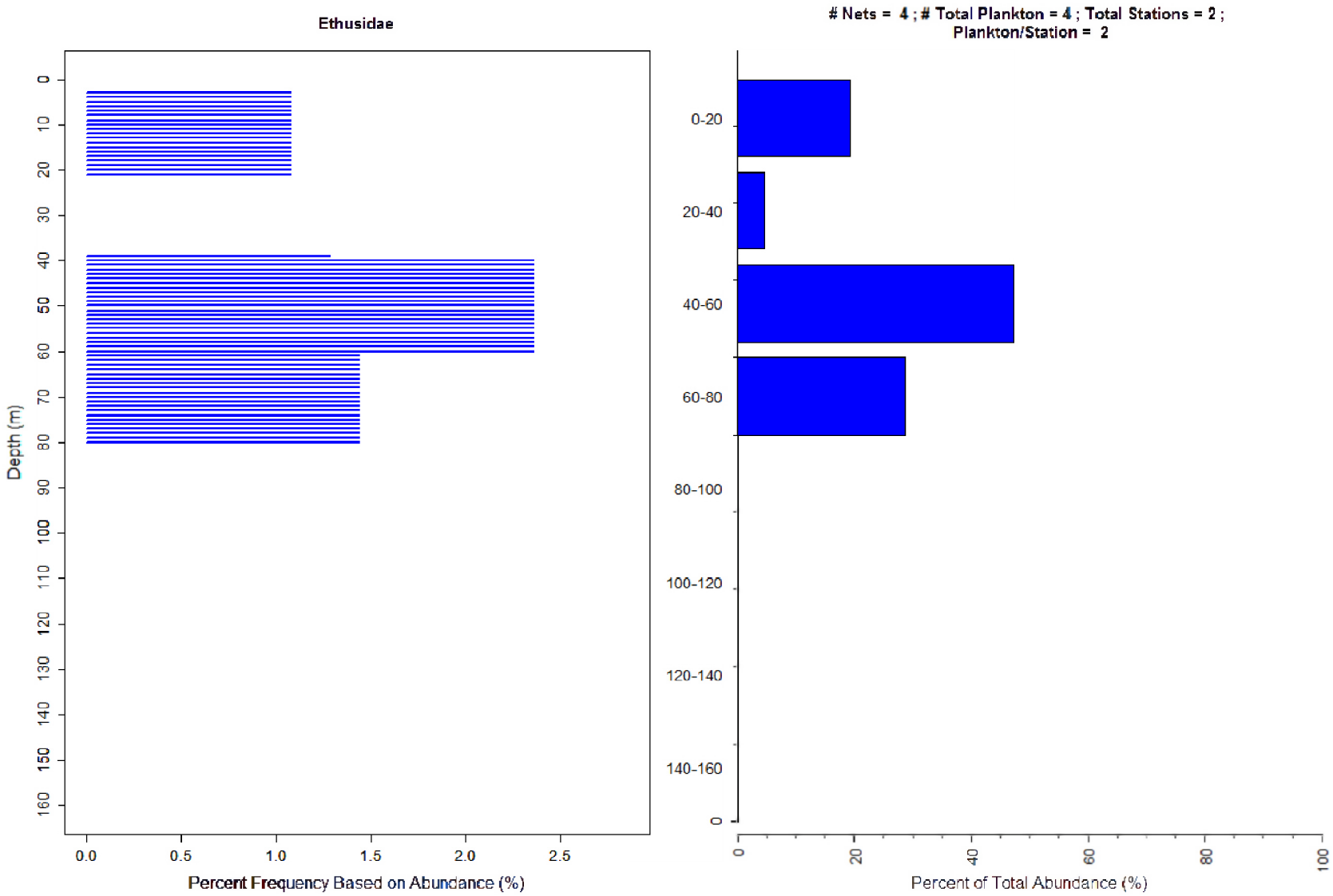
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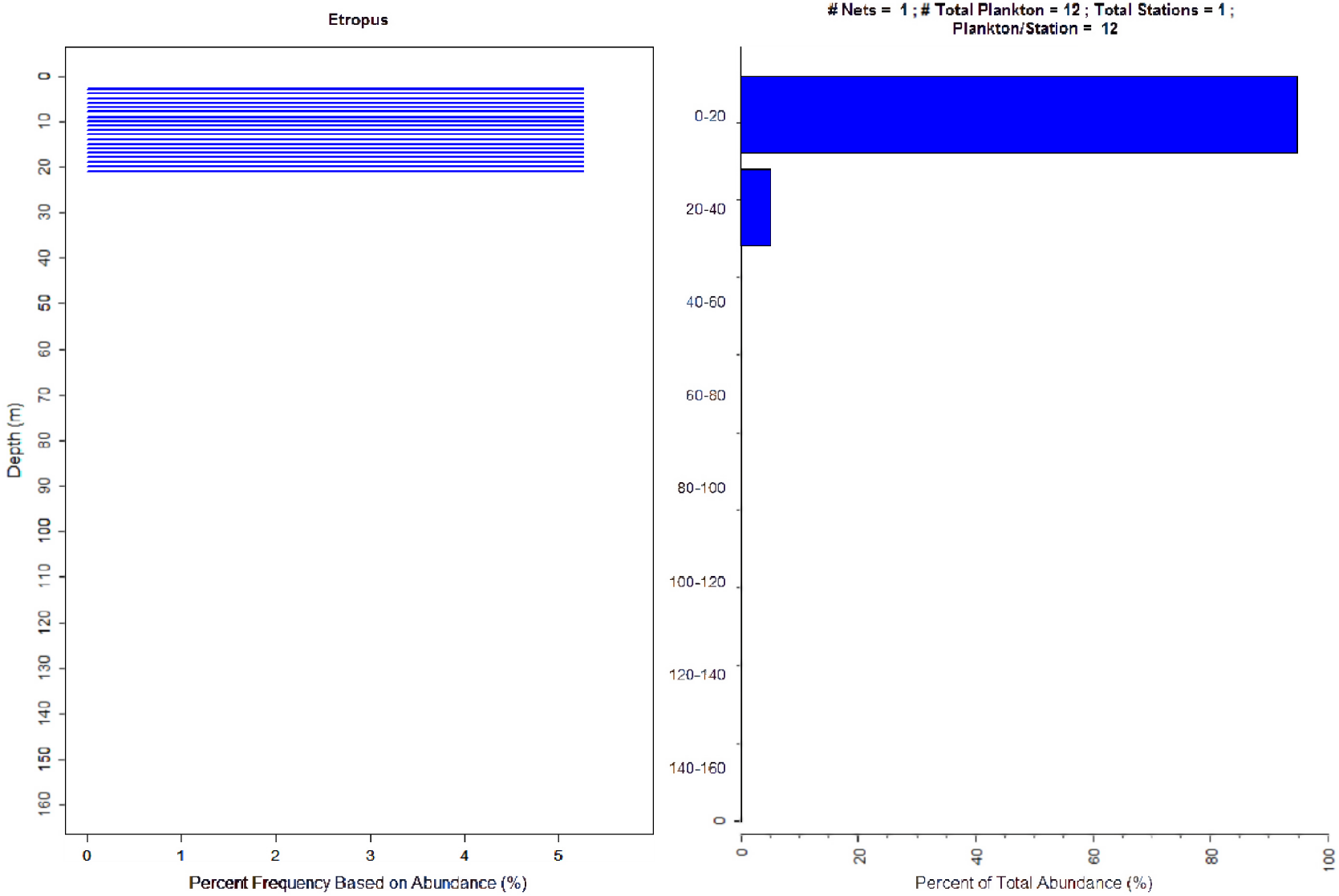
Engraulidae - Shallow



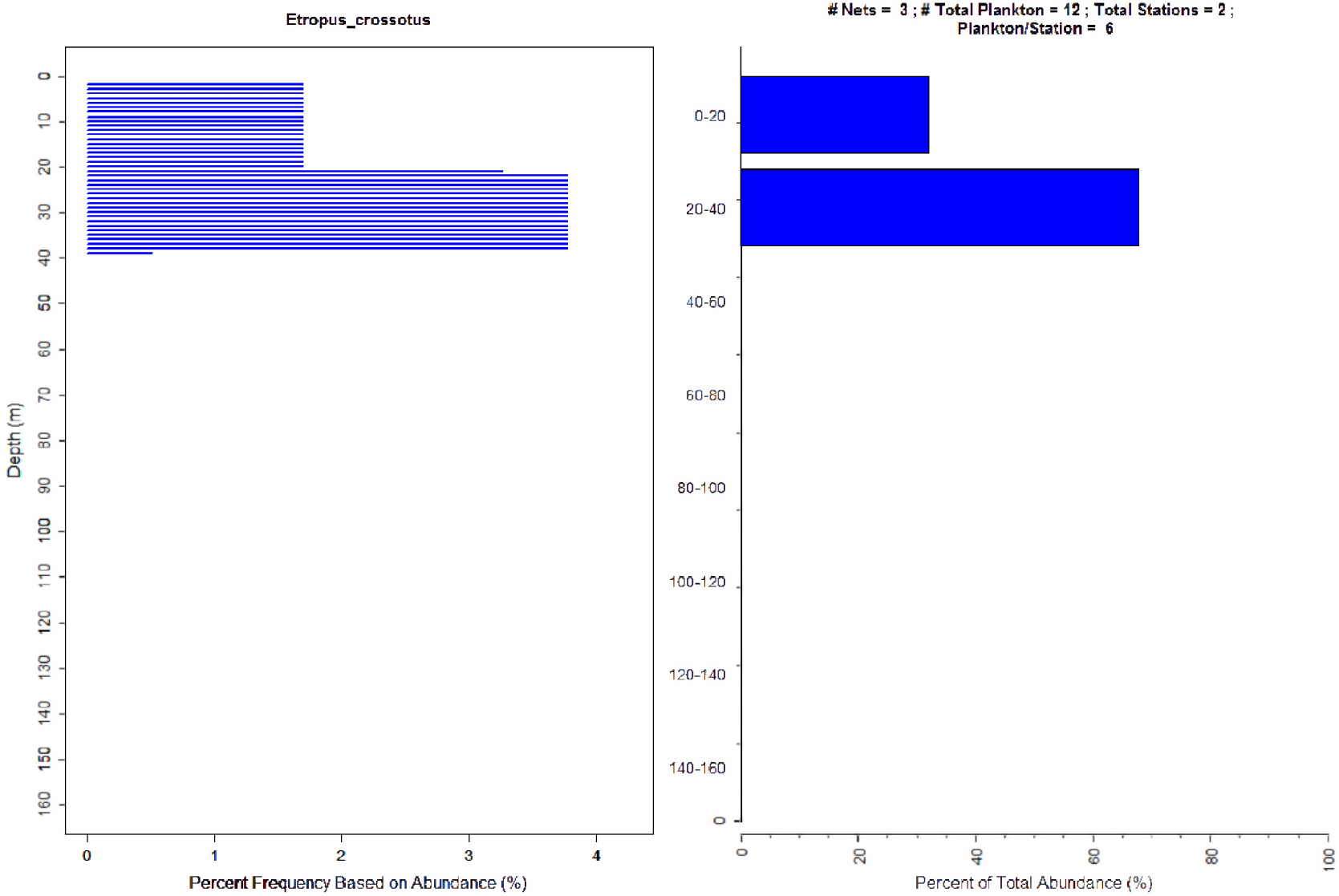
Engraulis_eurystole - Shallow



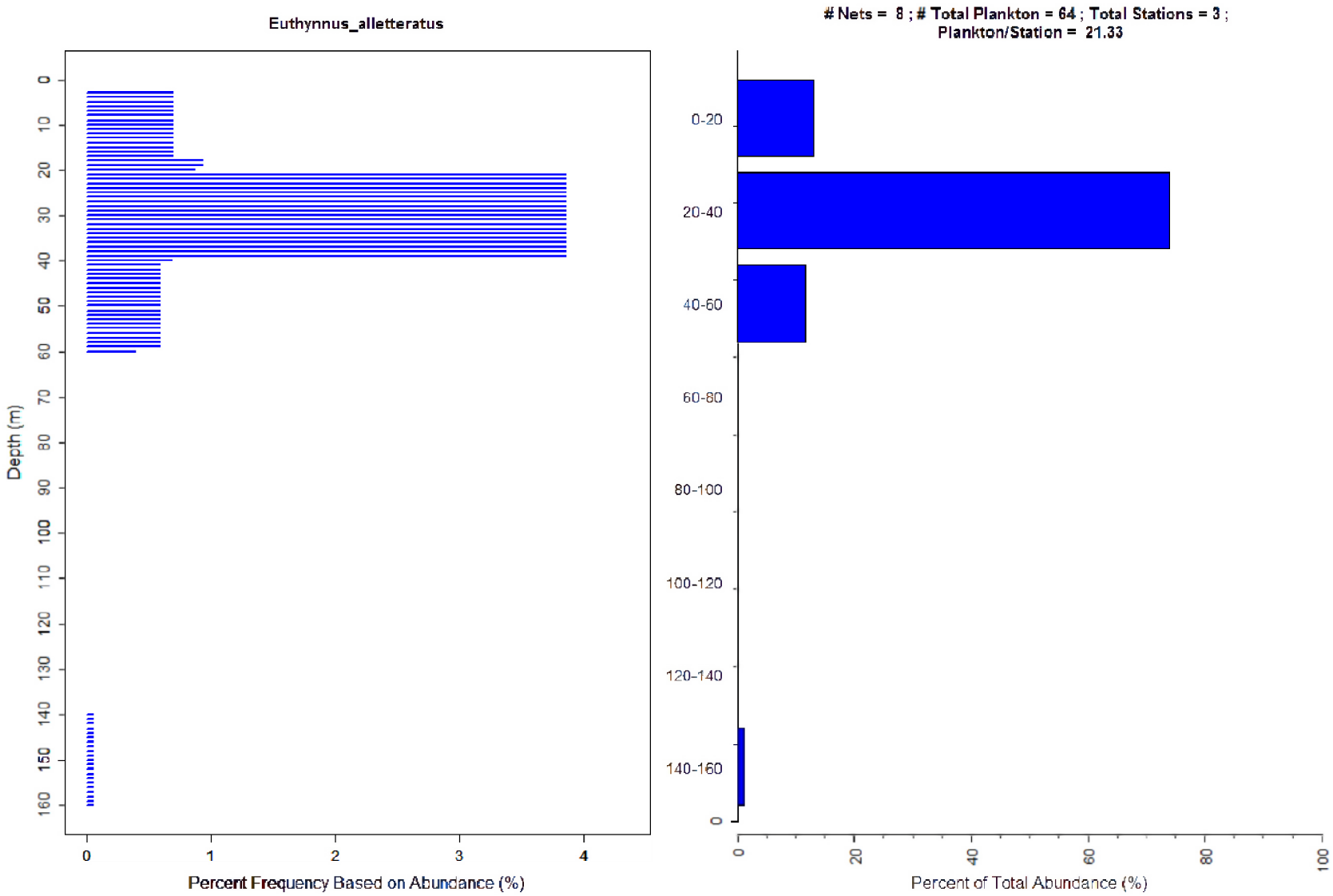
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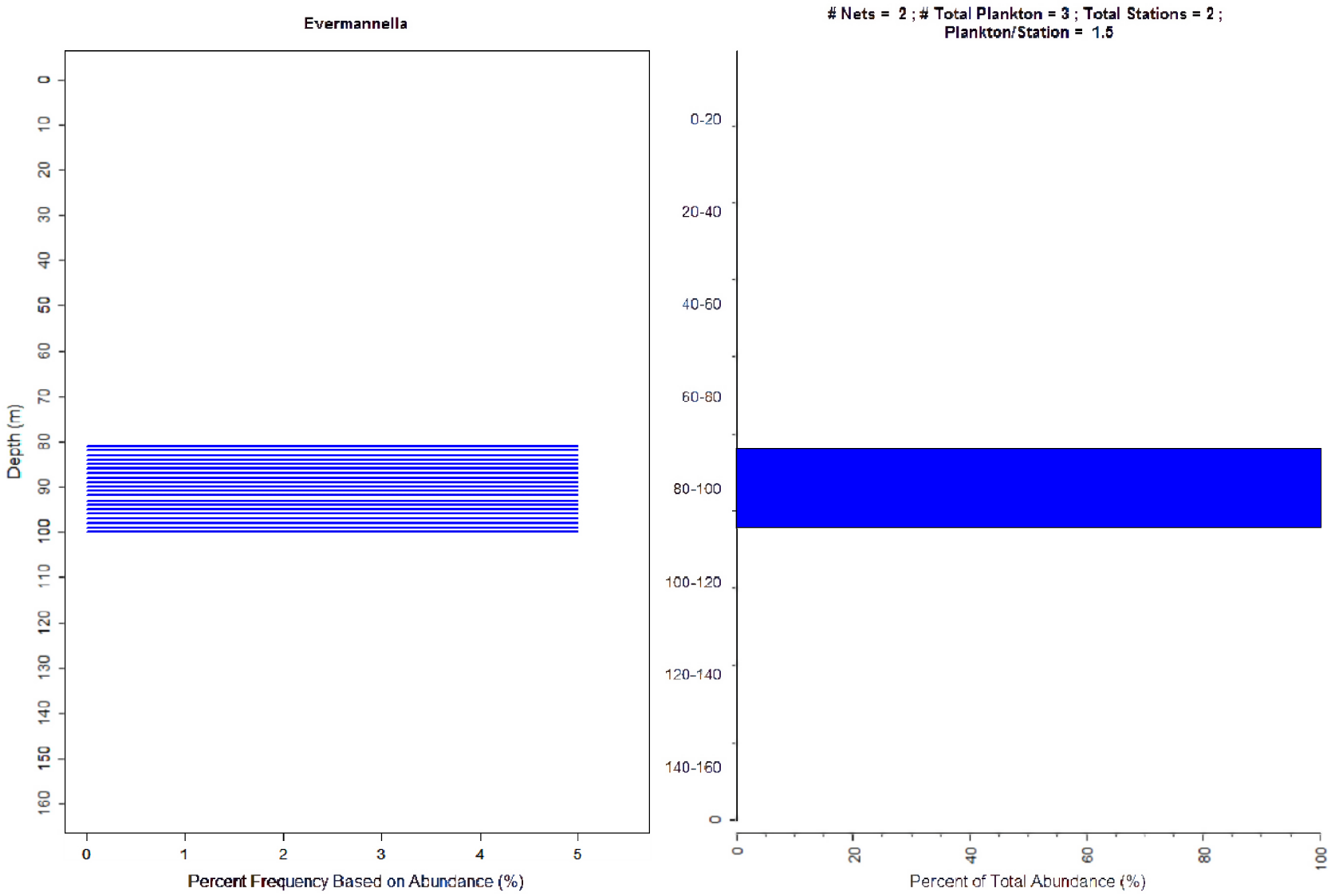
Etropus - Shallow



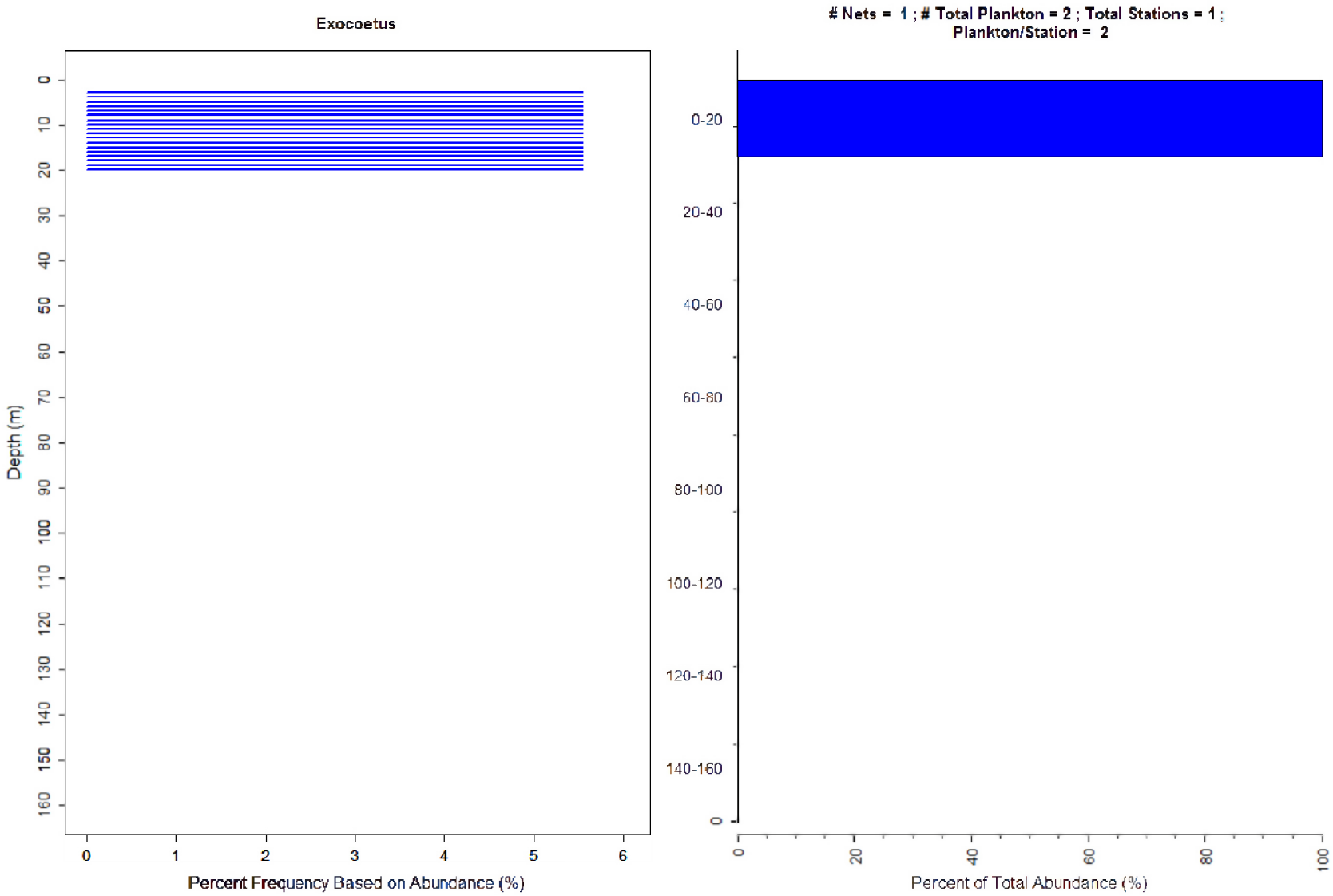
Etropus_crossotus - Shallow



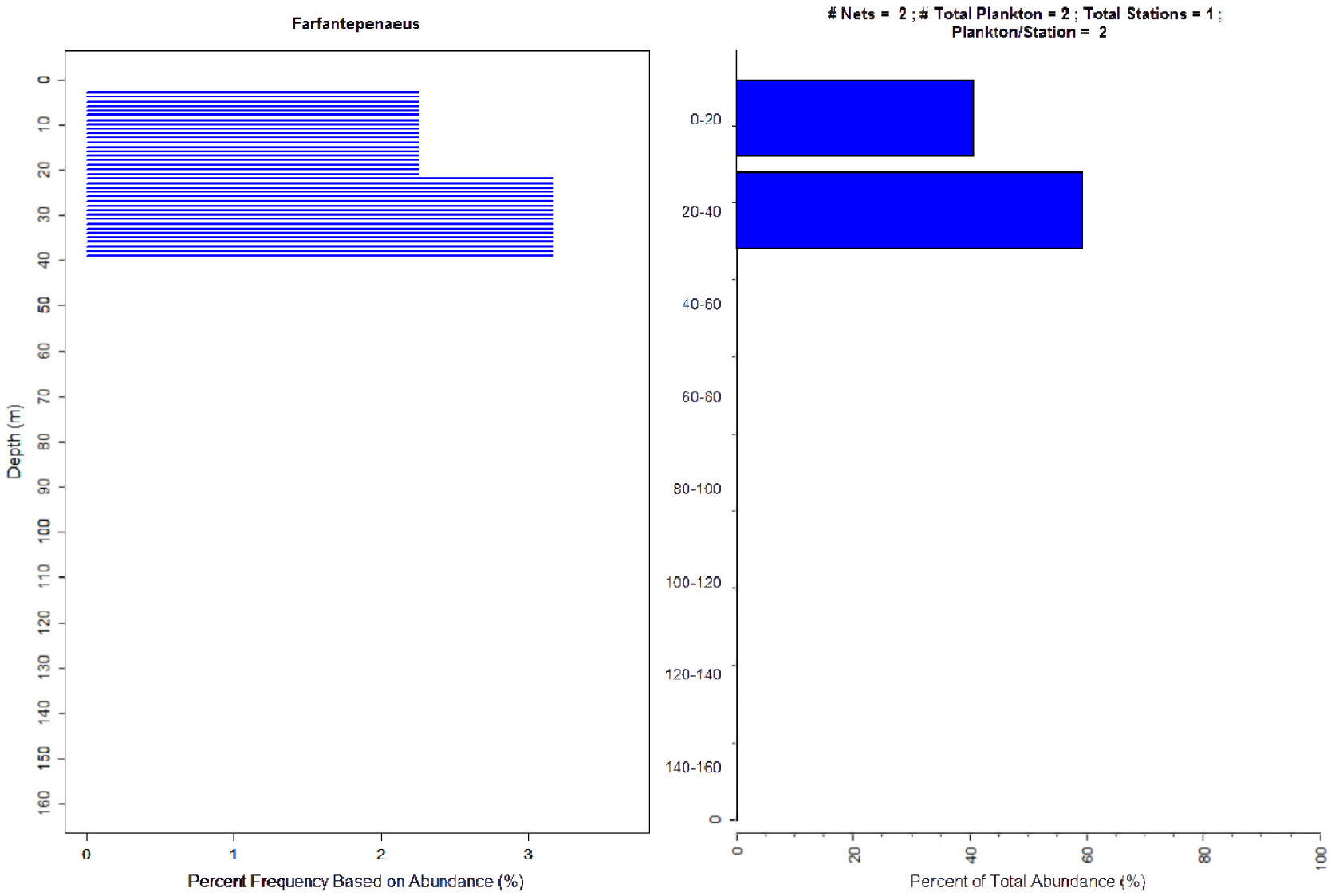
Euthynnus_alletteratus - Shallow



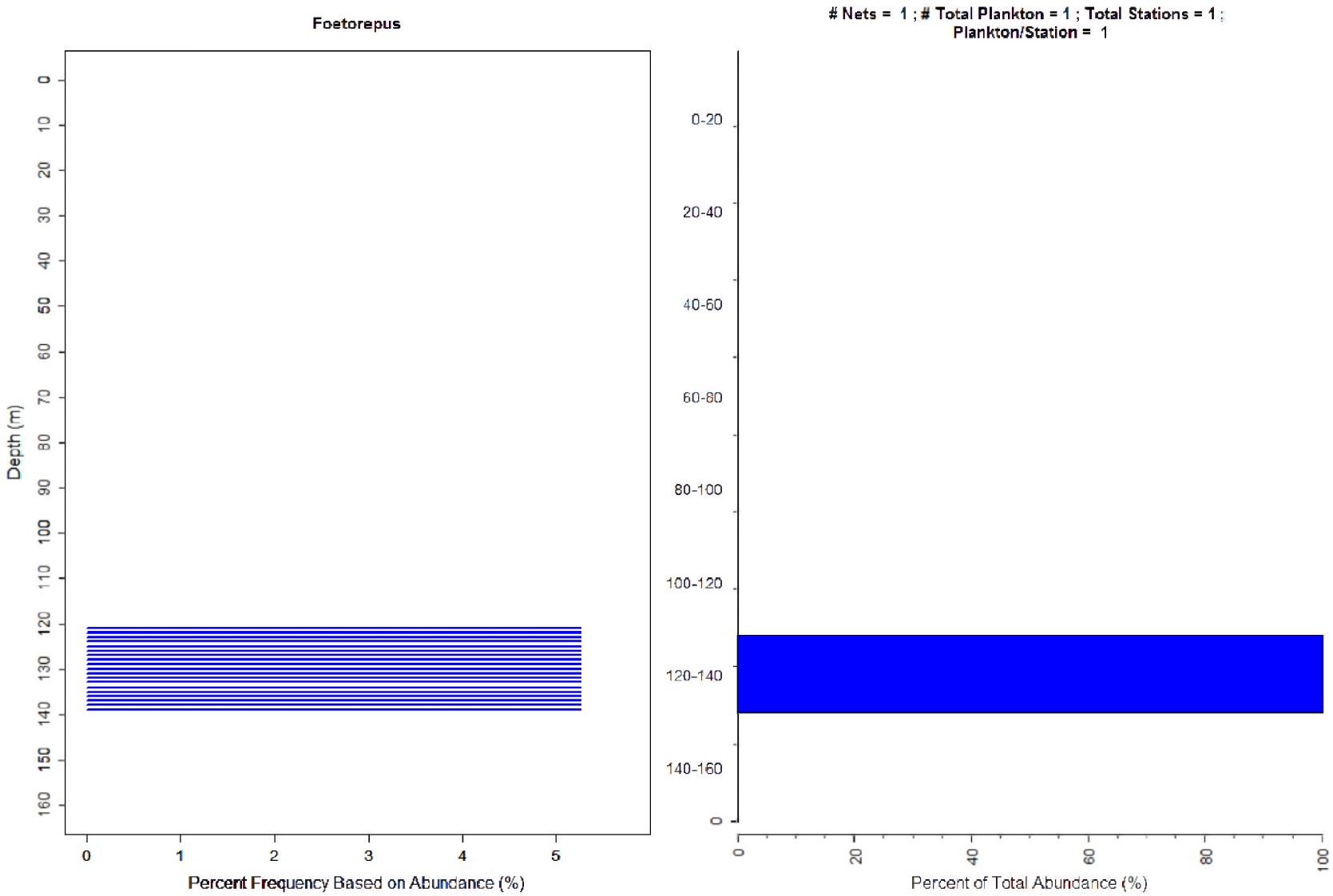
Evermannella - Shallow



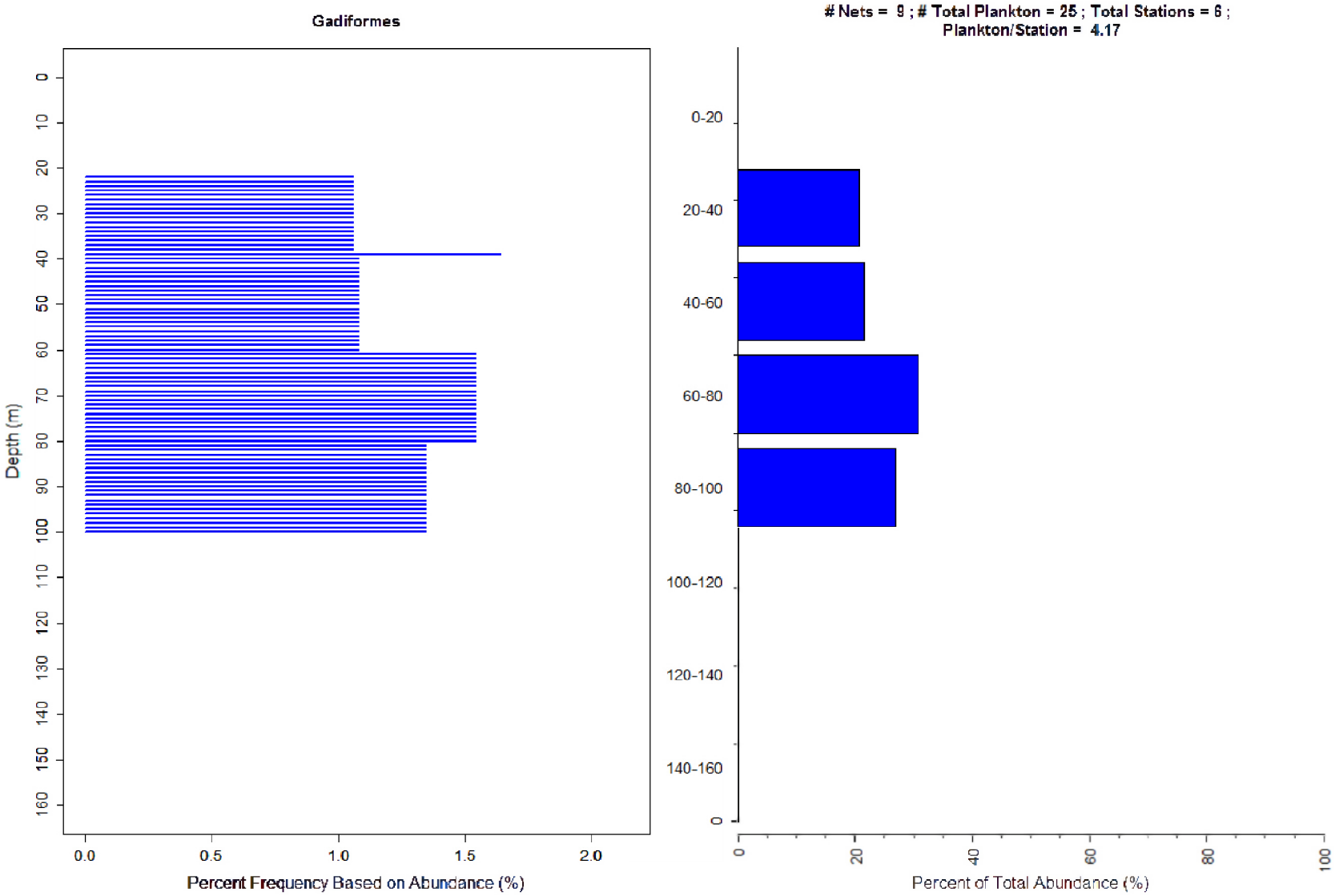
Exocoetus - Shallow



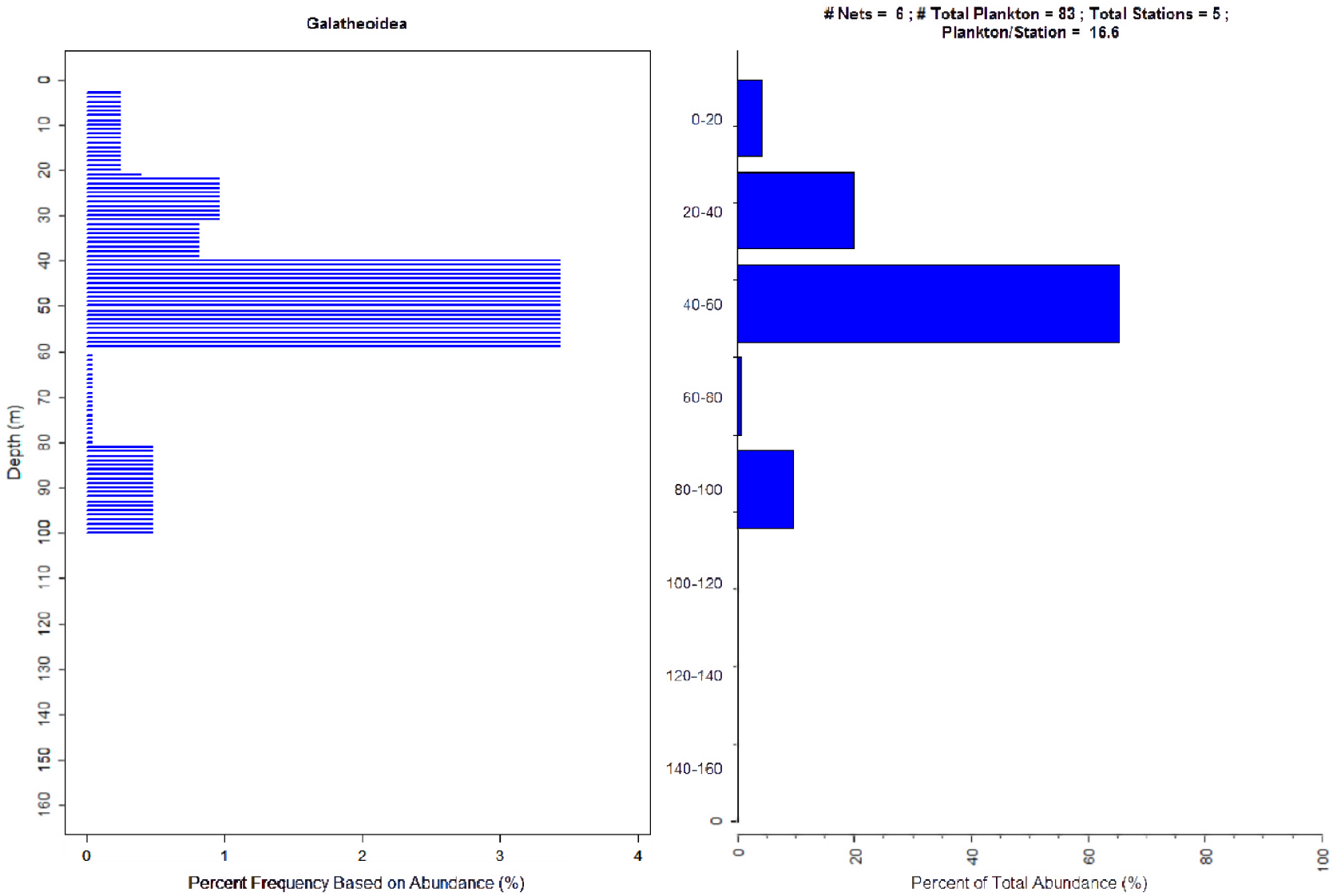
Farfantepenaeus - Shallow



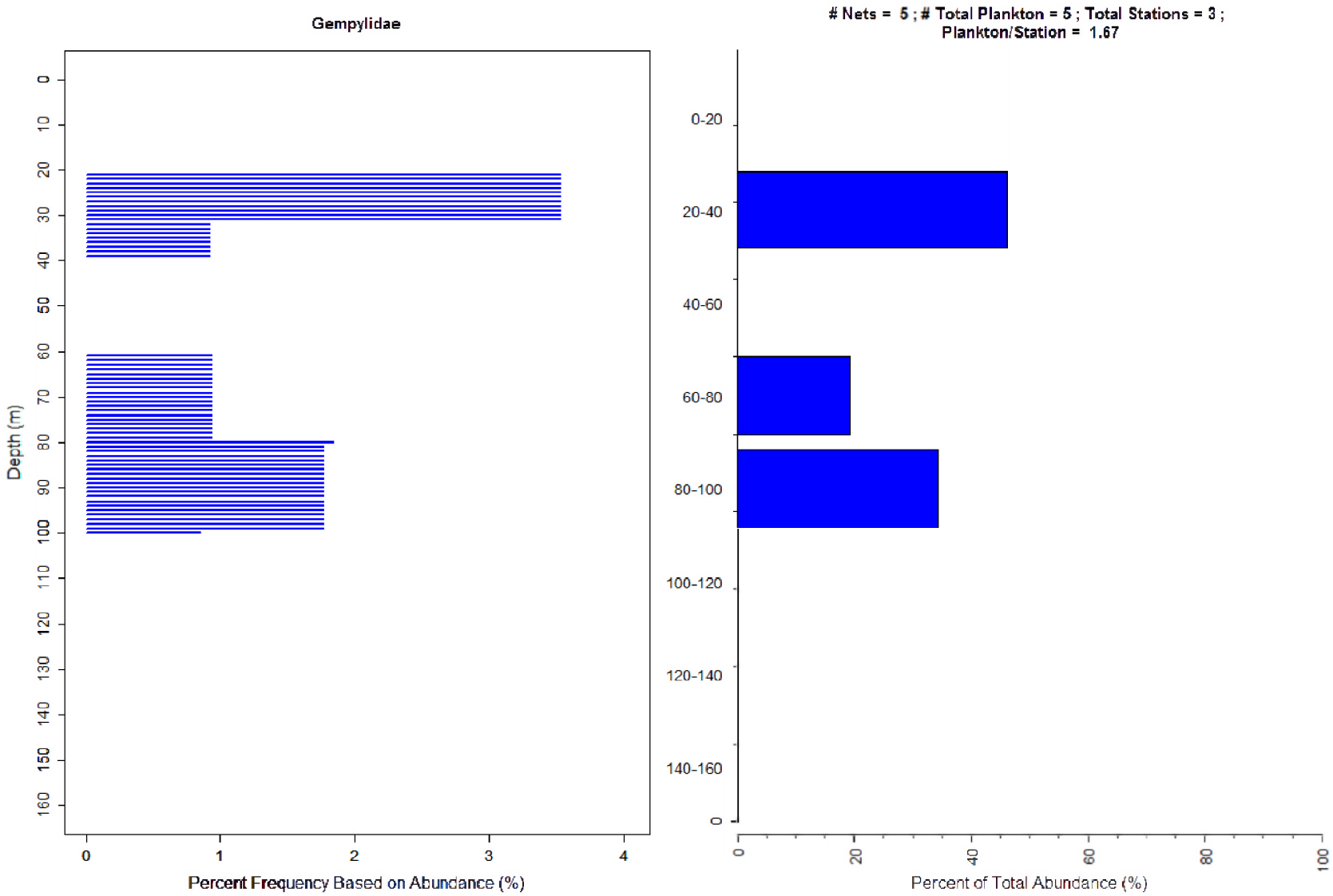
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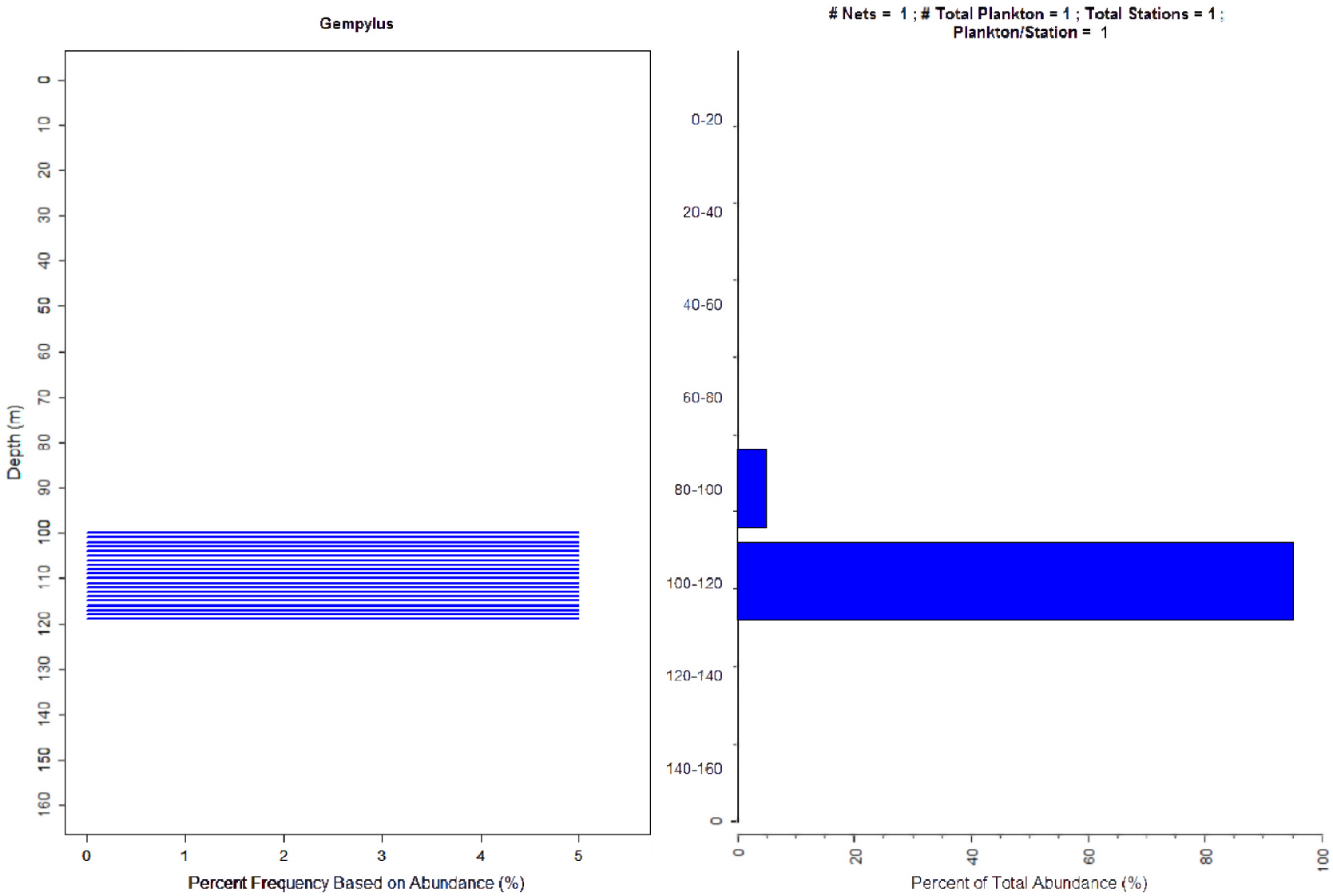
Gadiformes - Shallow



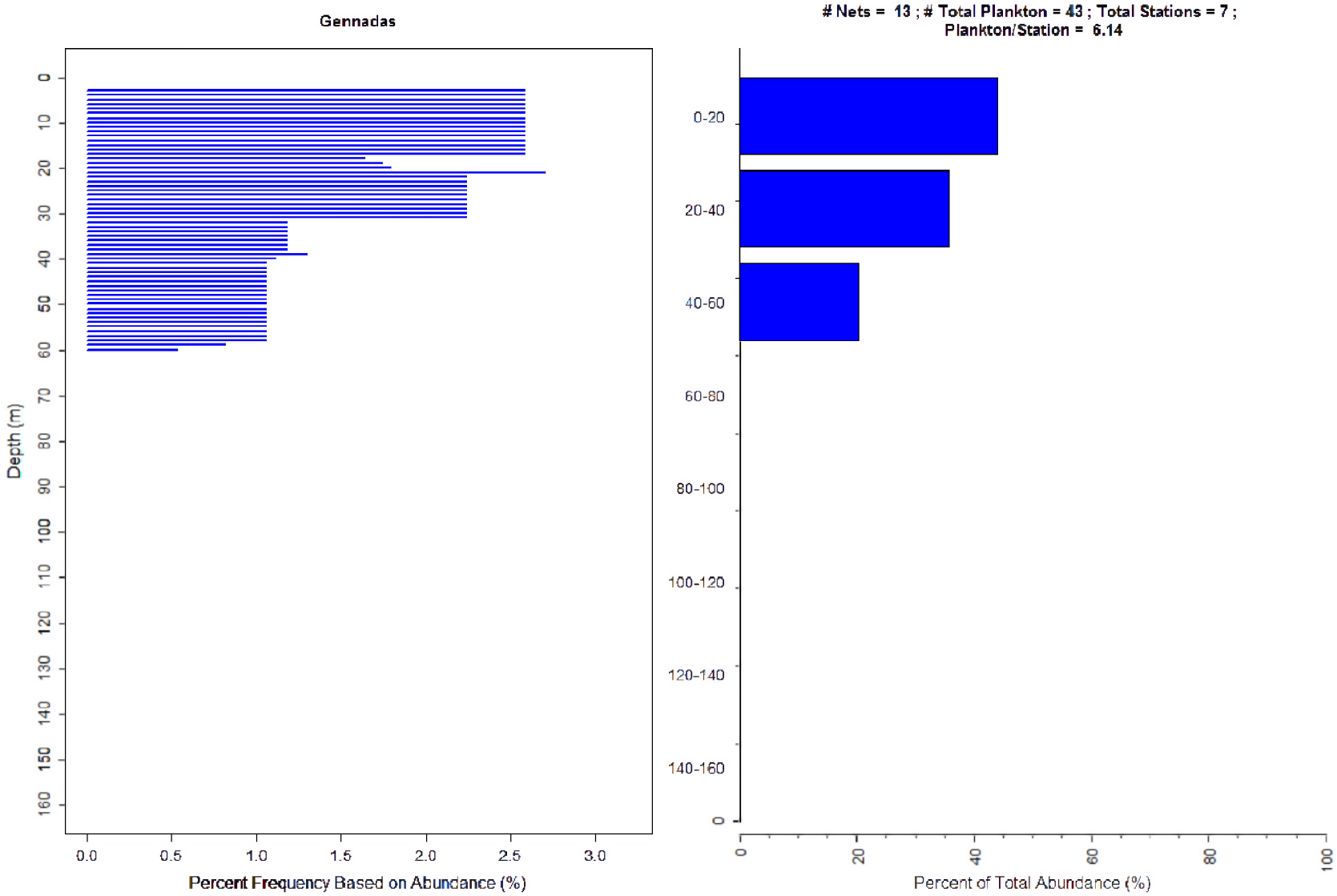
Galatheoidea - Shallow



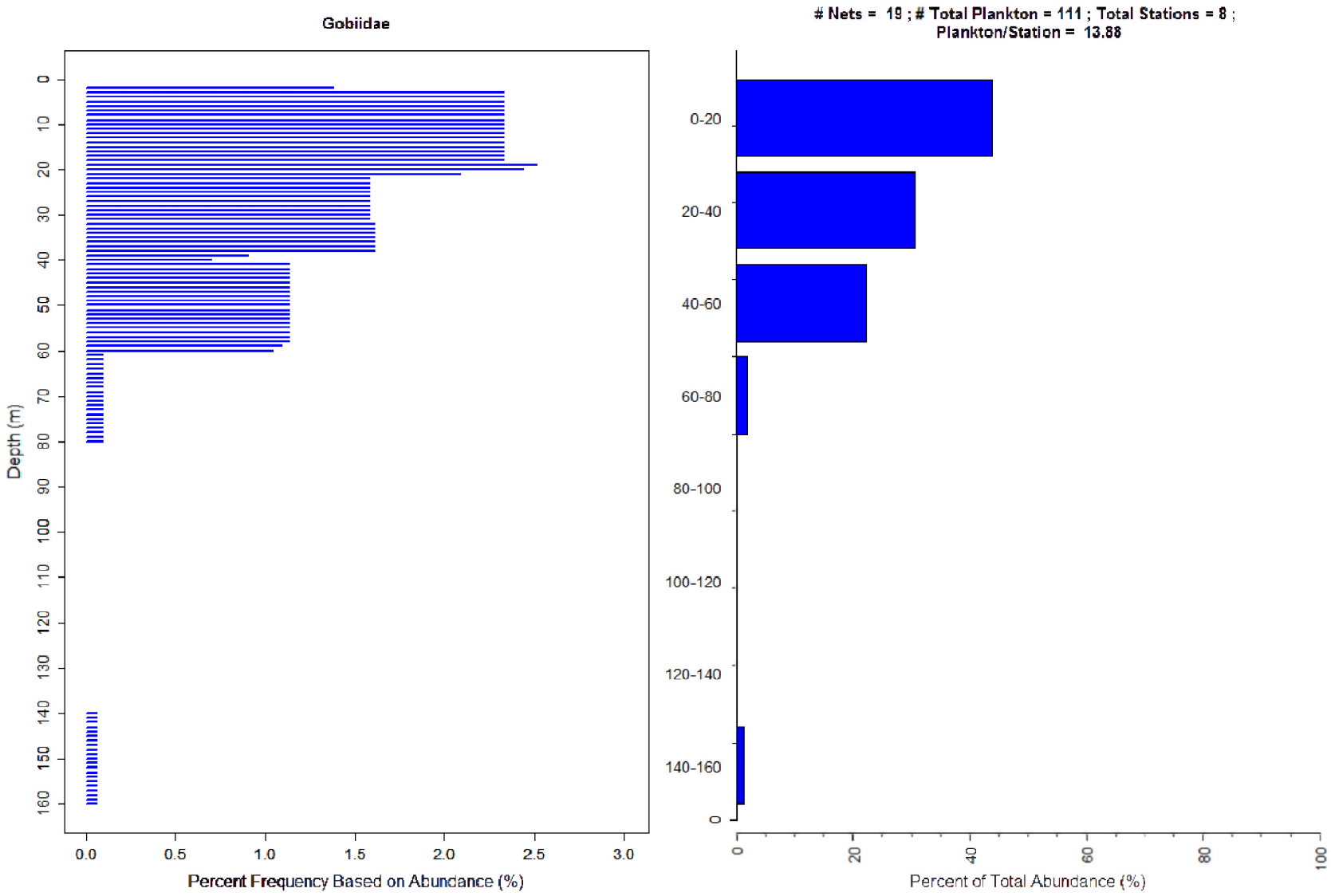
Gempylidae - Shallow



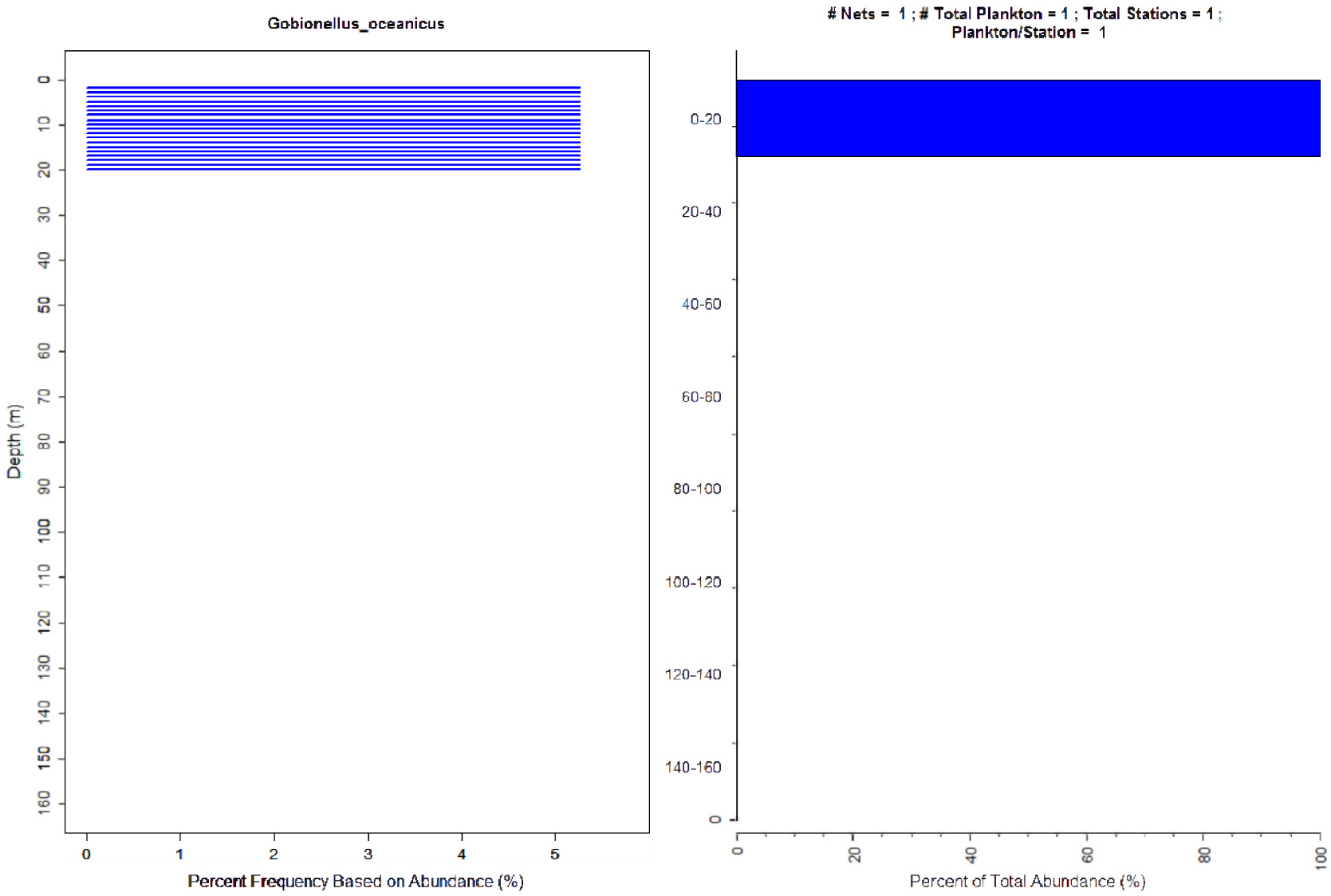
Gempylus - Shallow



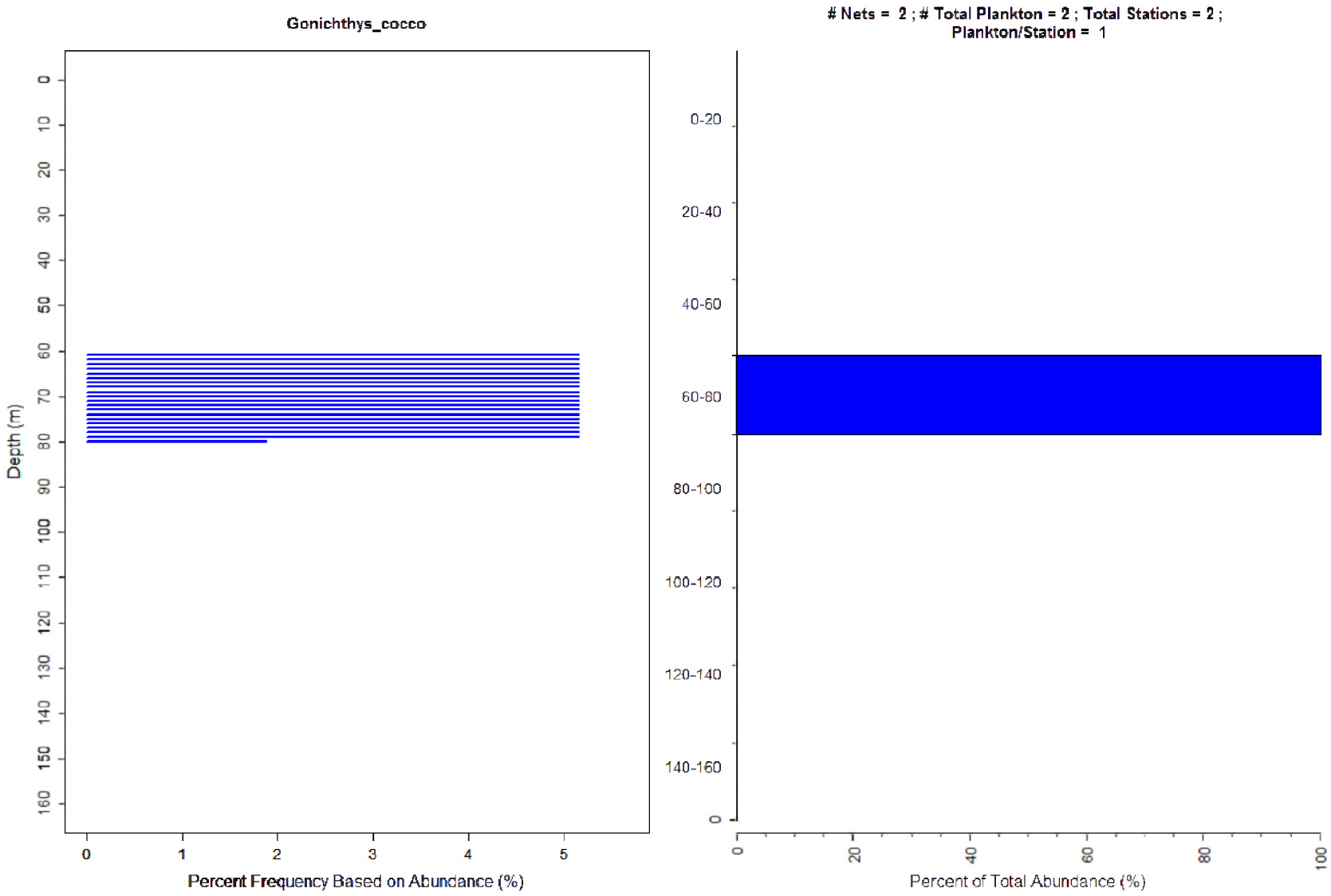
Gennadas - Shallow



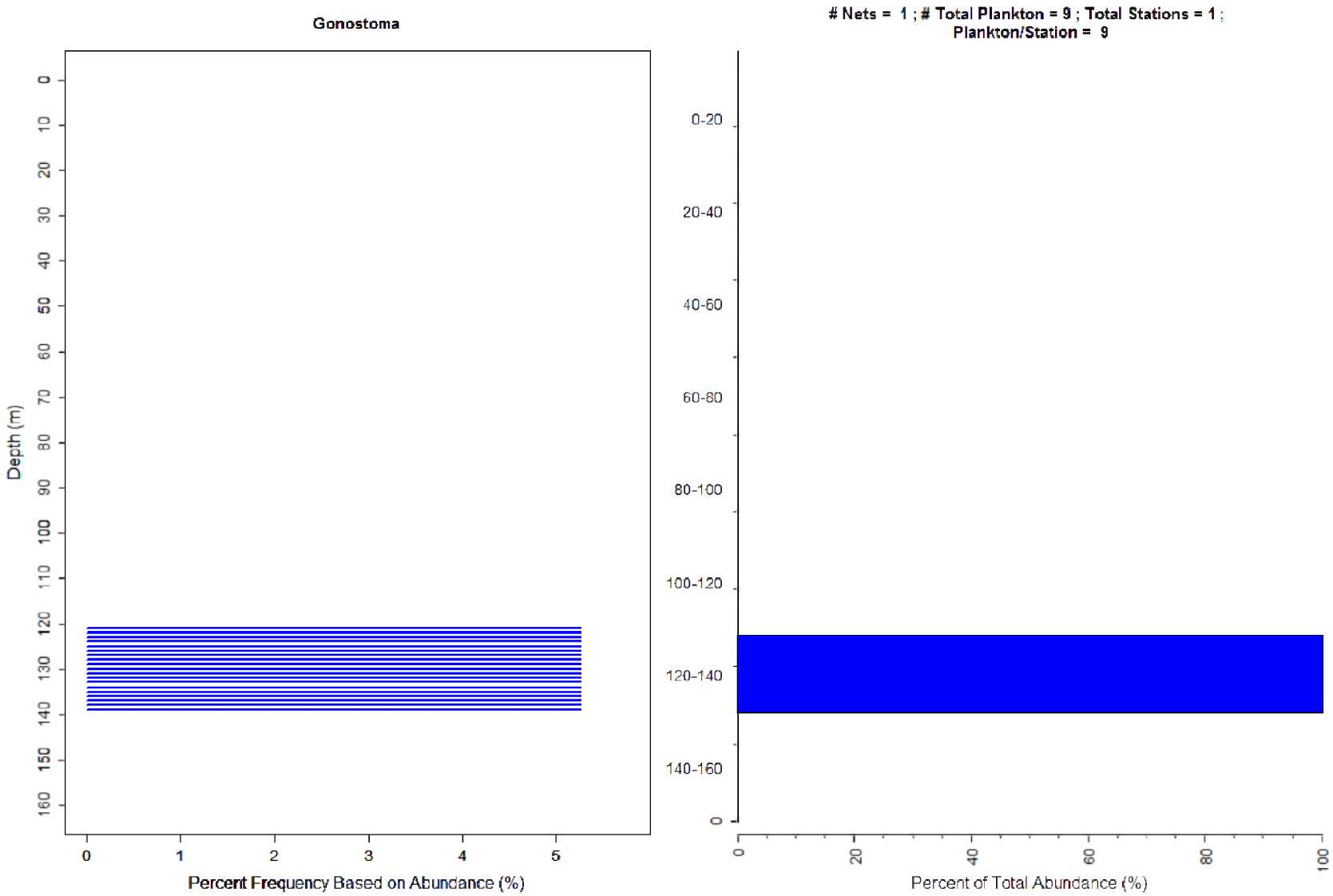
Gobiidae - Shallow



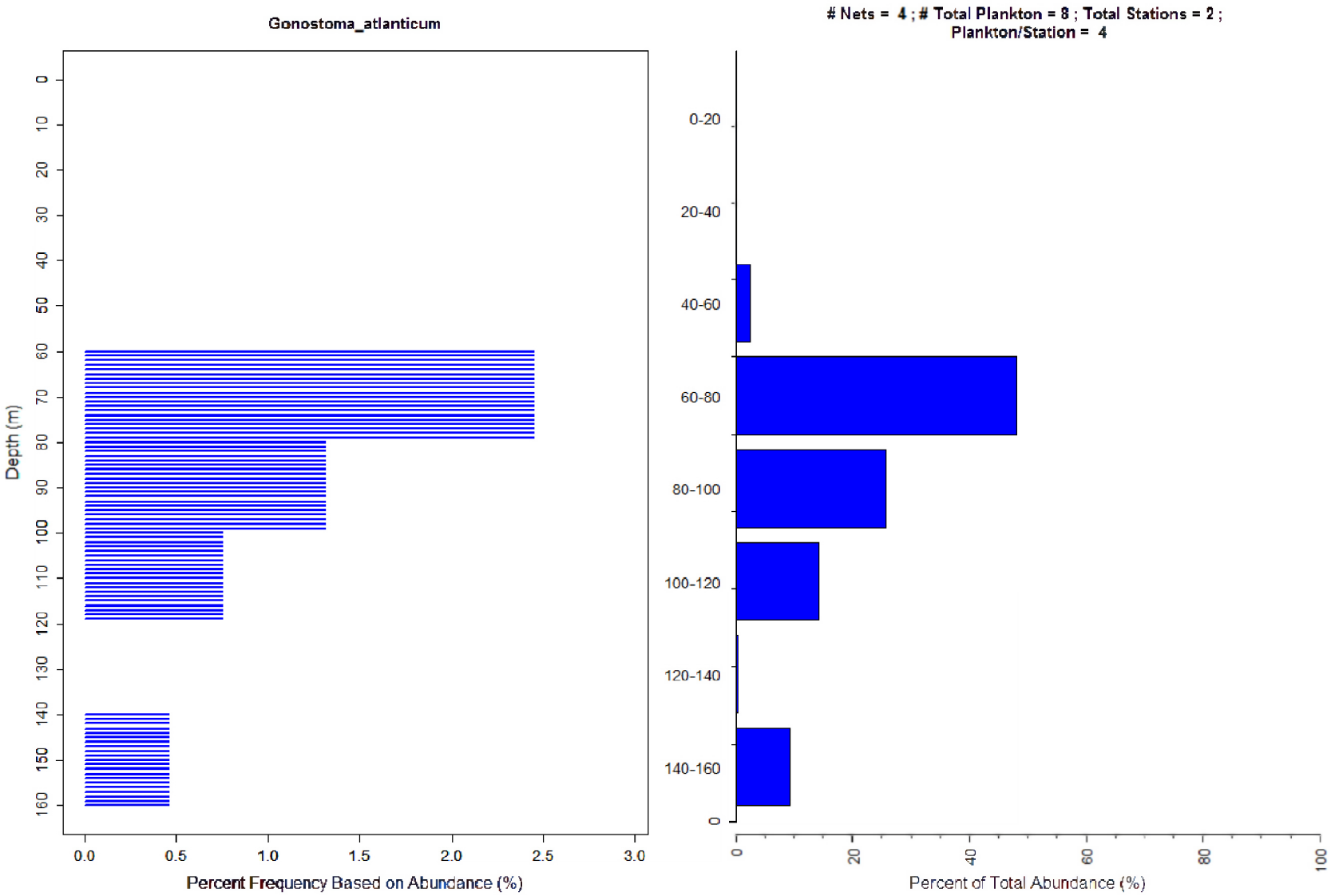
Gobionellus_oceanicus - Shallow



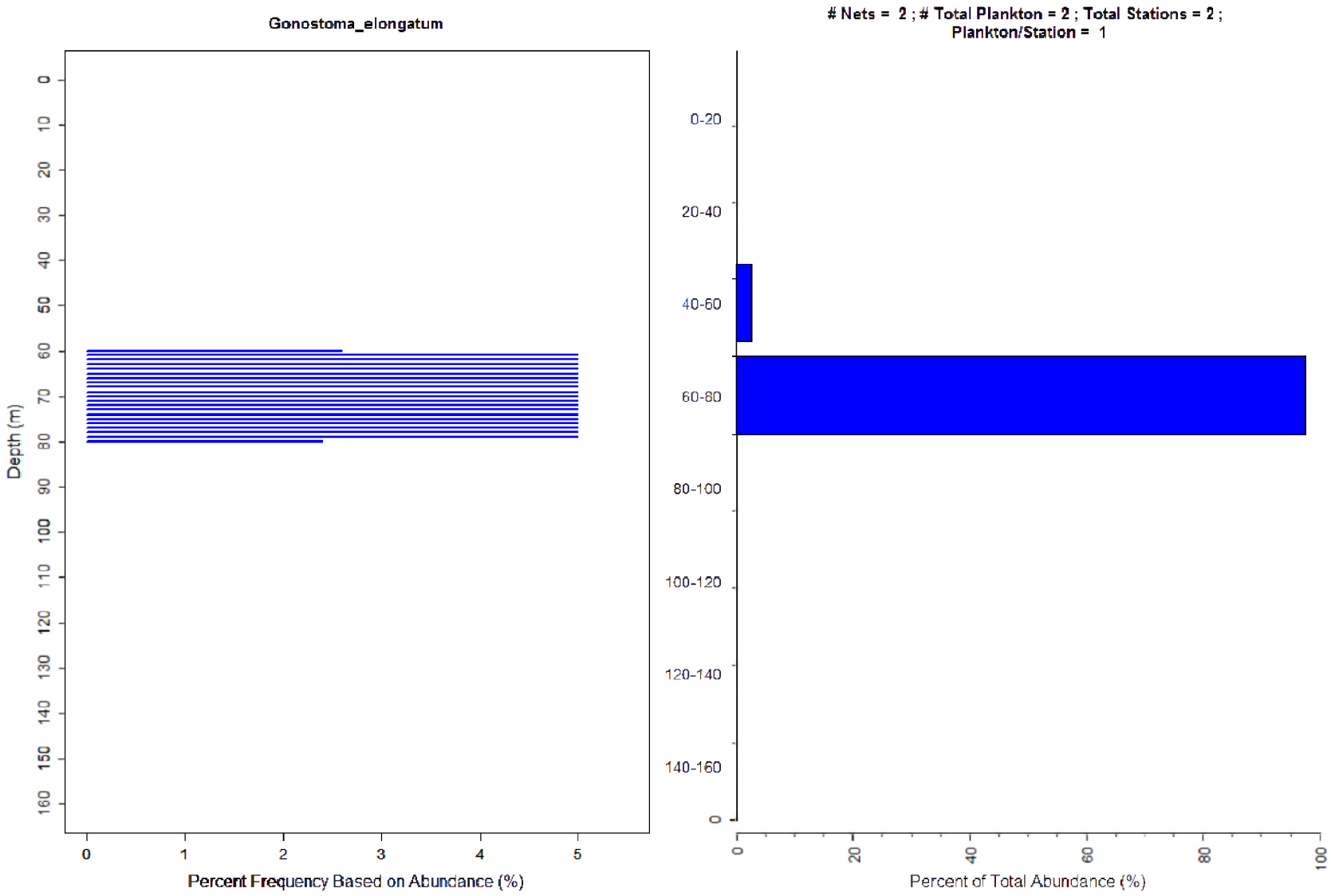
Gonichthys_cocco - Shallow



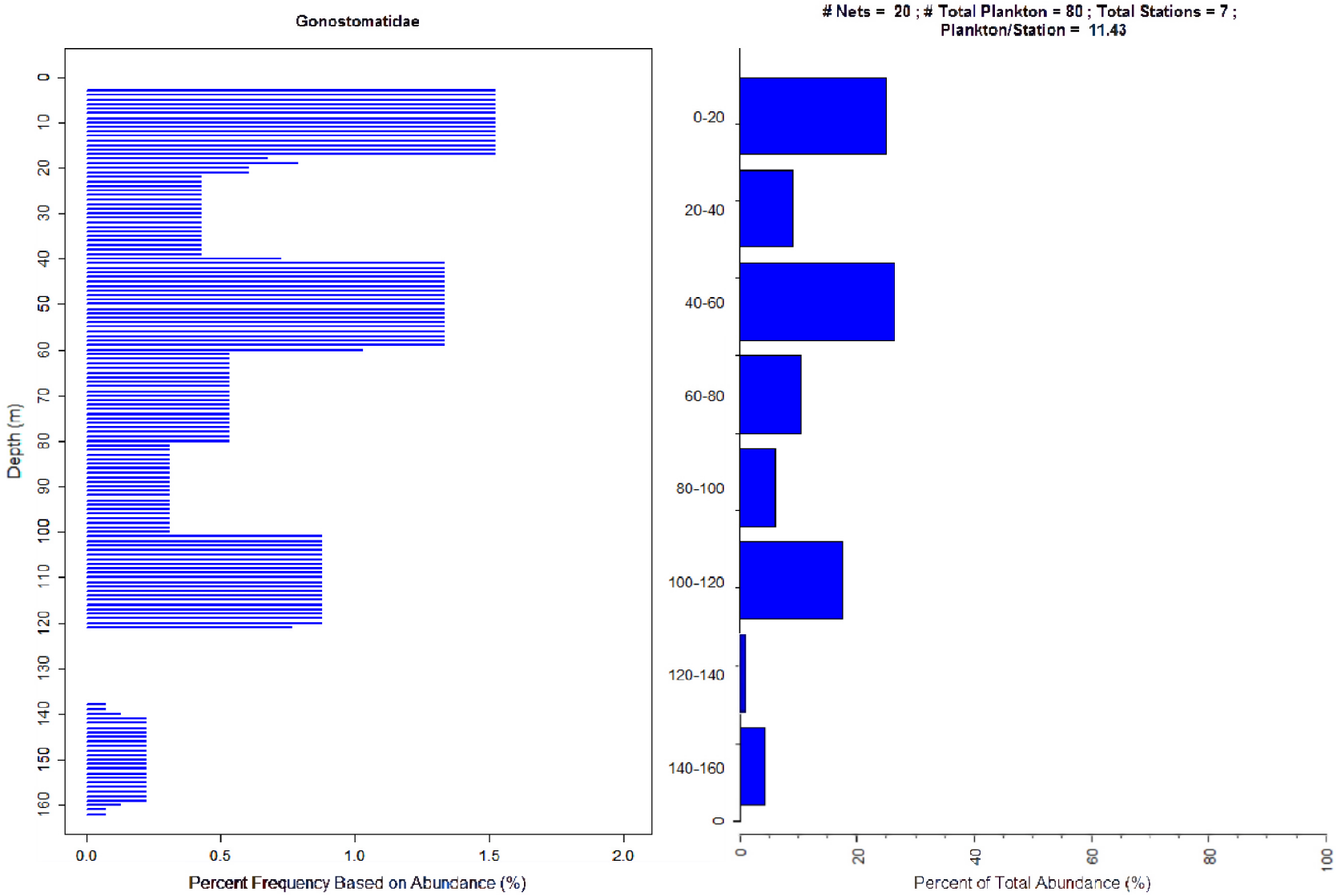
Gonostoma - Shallow



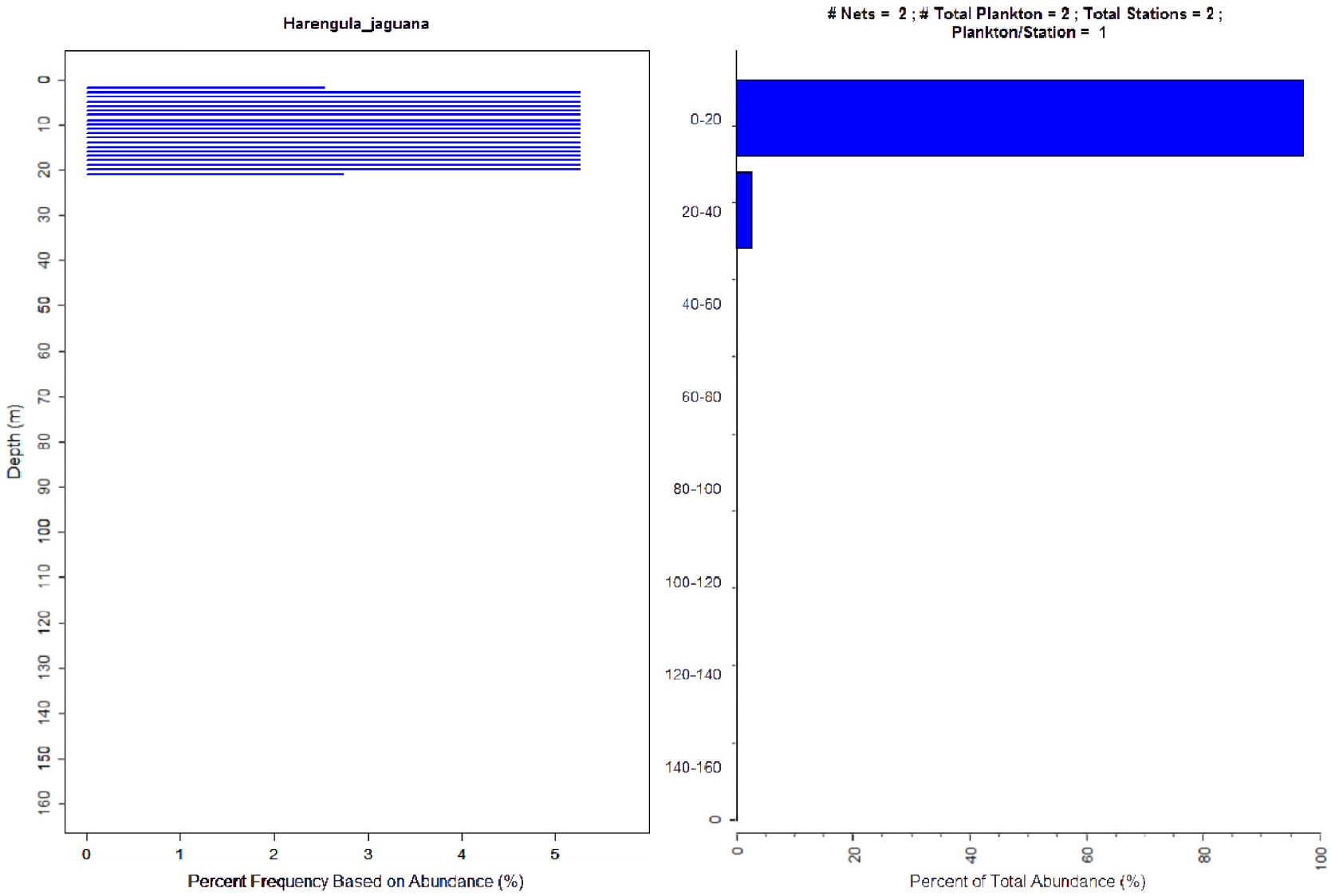
Gonostoma_atlanticum - Shallow



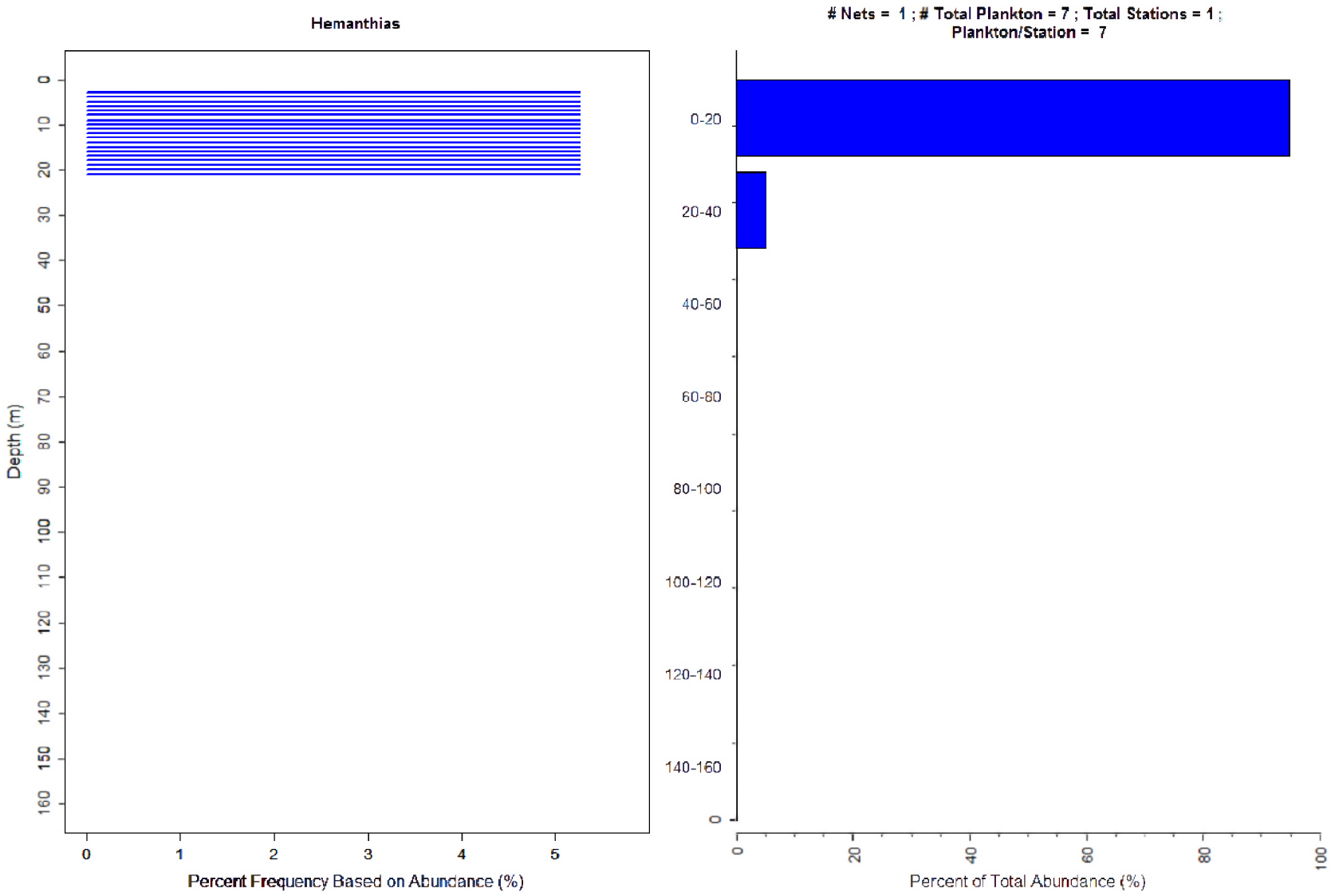
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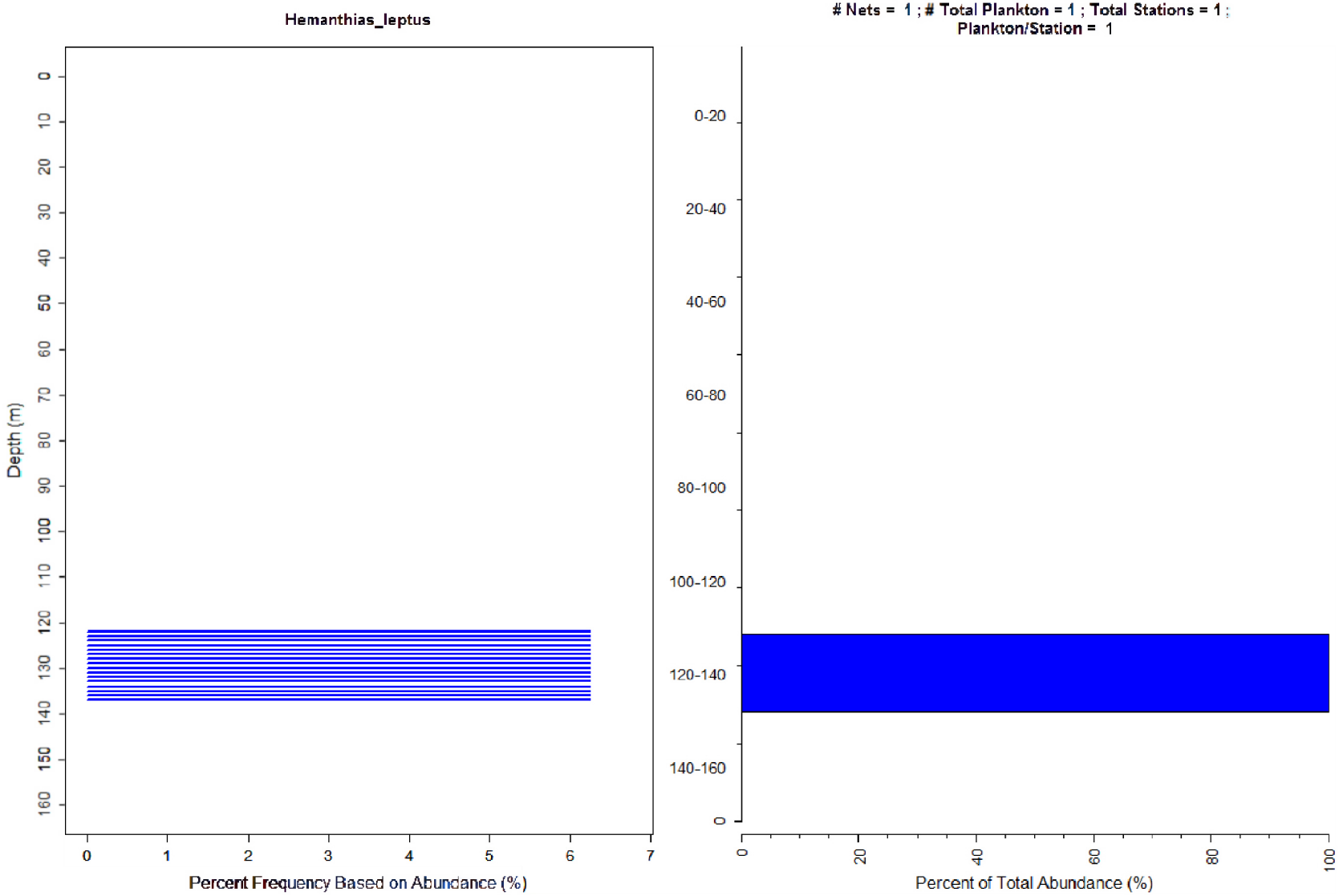
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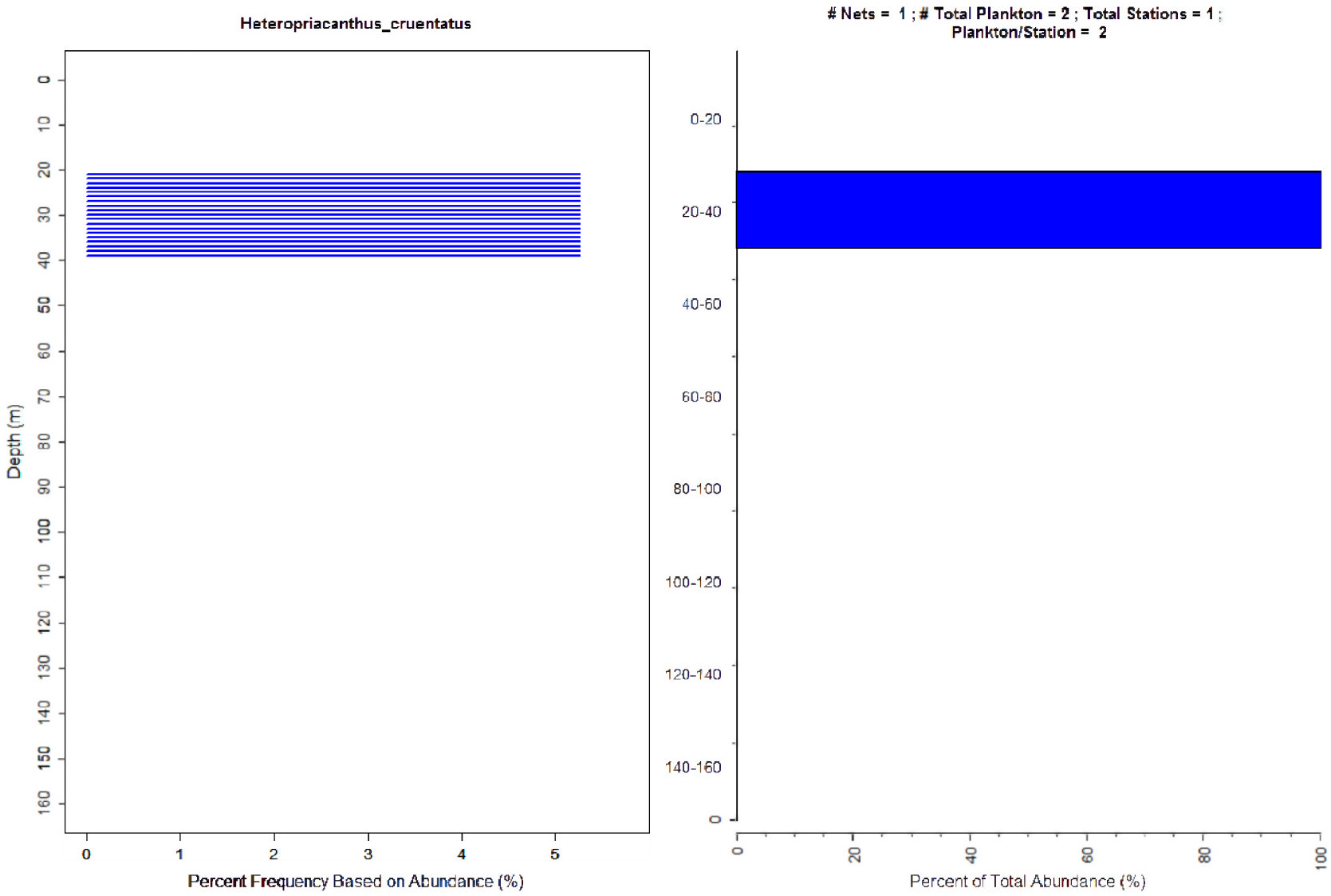
Harengula_jaguana - Shallow



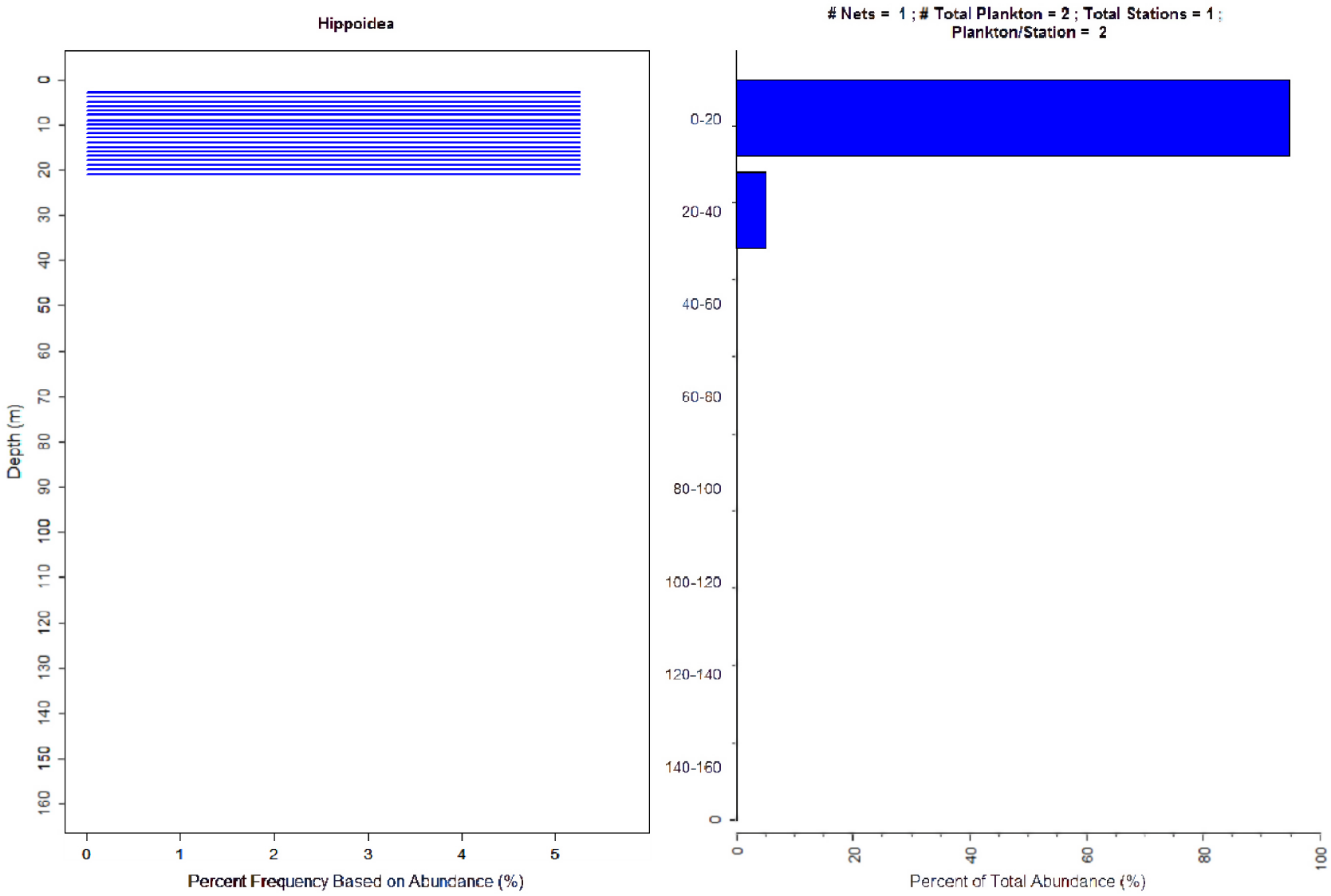
Hemanthias - Shallow



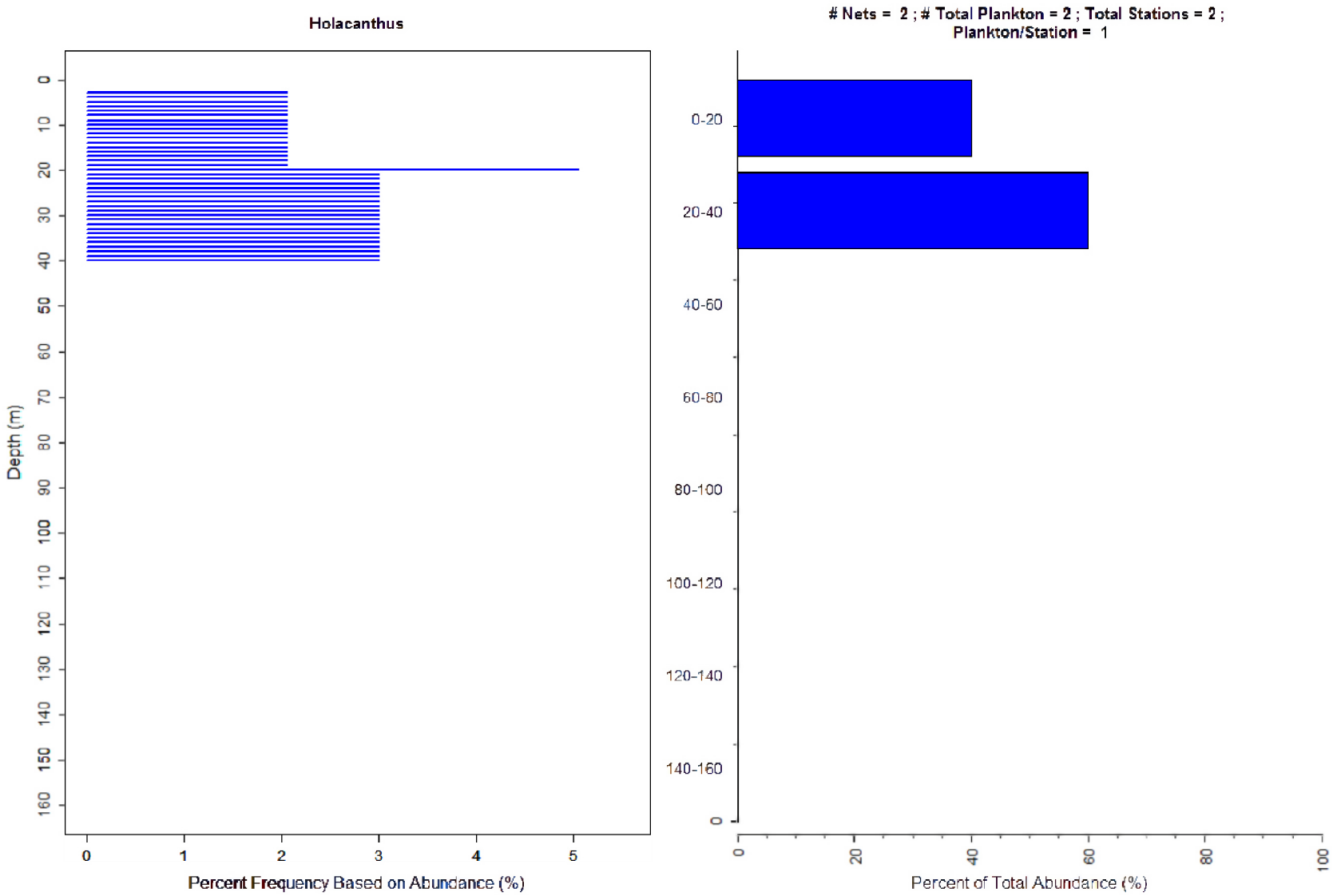
Hemanthias_leptus - Shallow



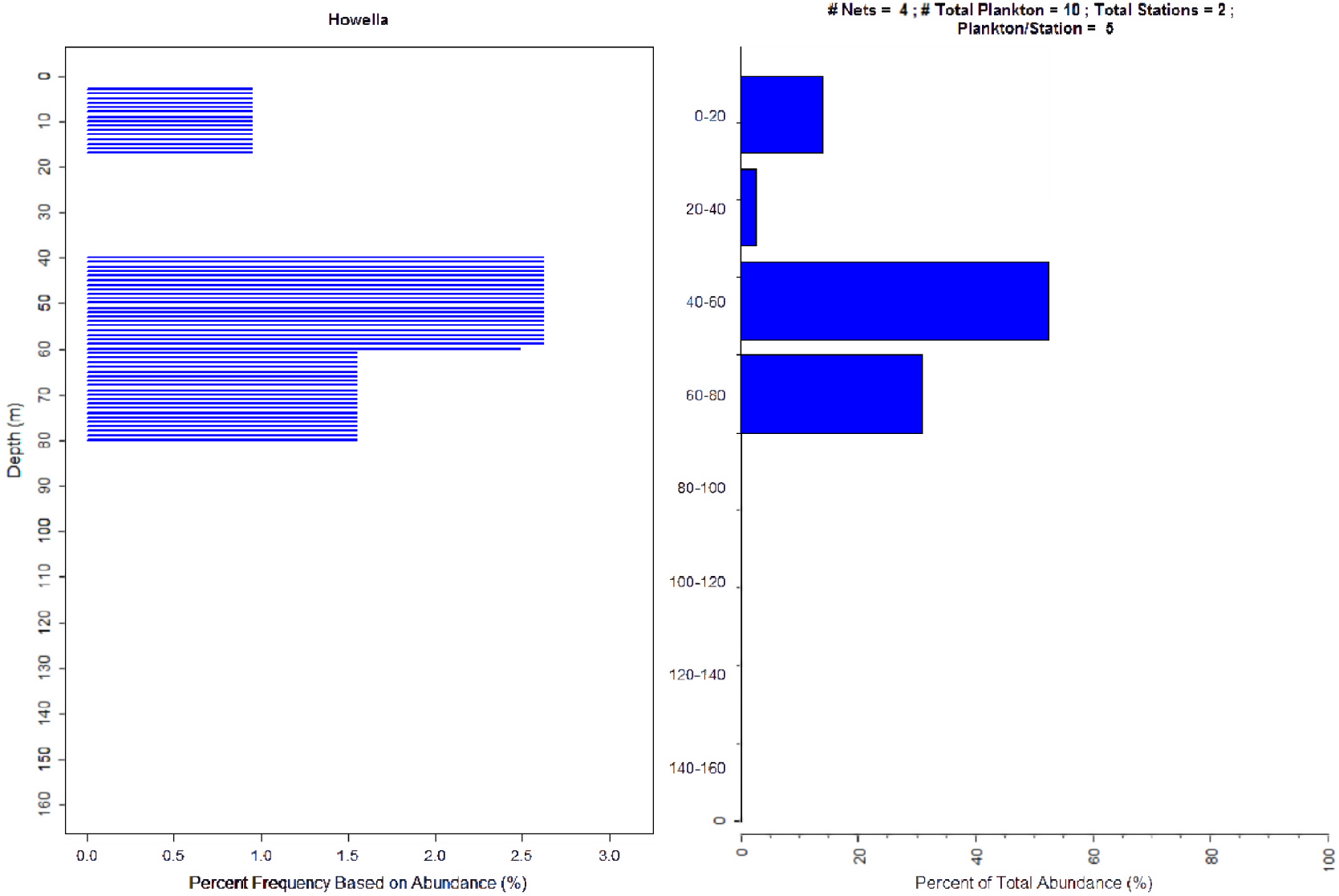
Heteropriacanthus_cruentatus - Shallow



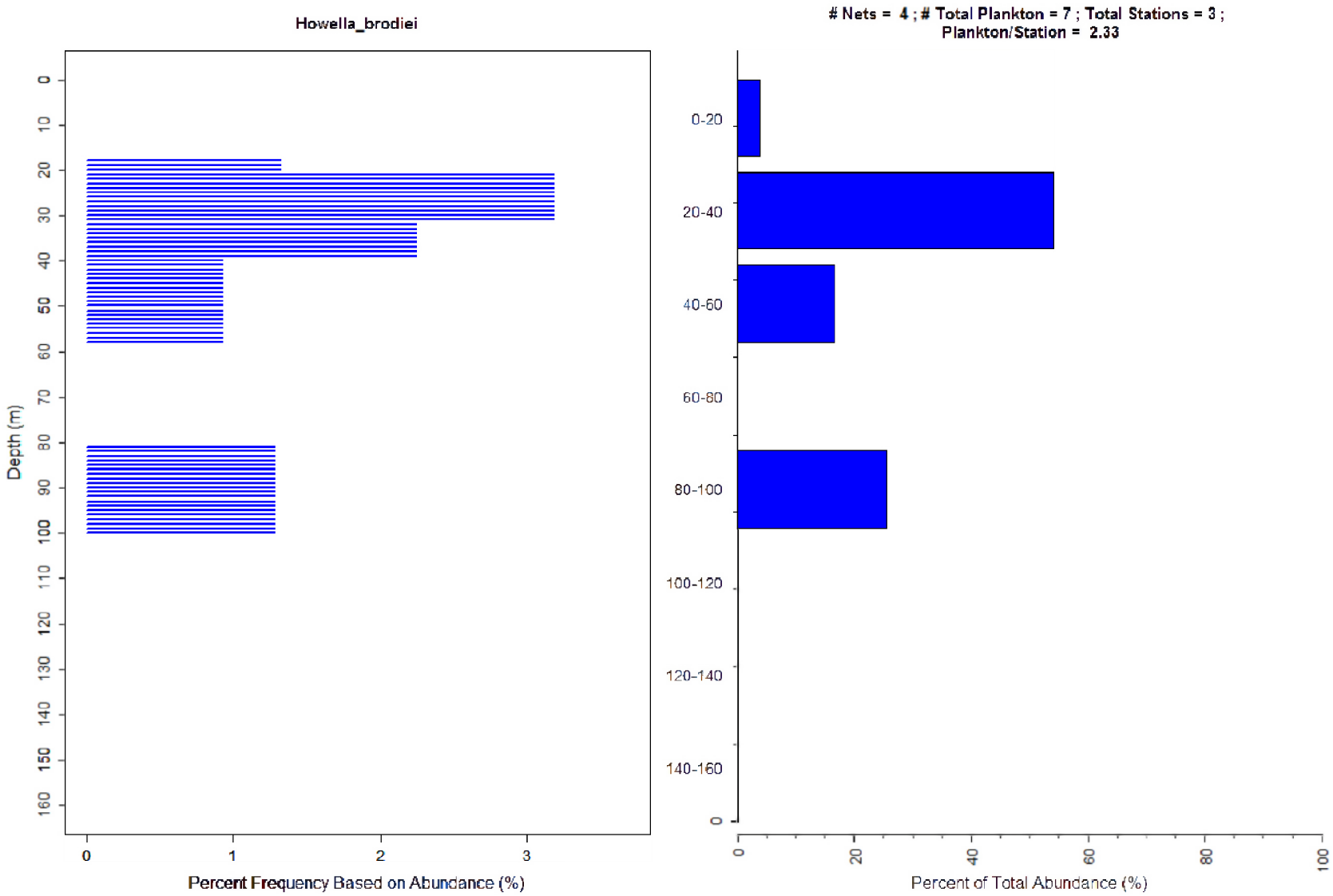
Hippoidea - Shallow



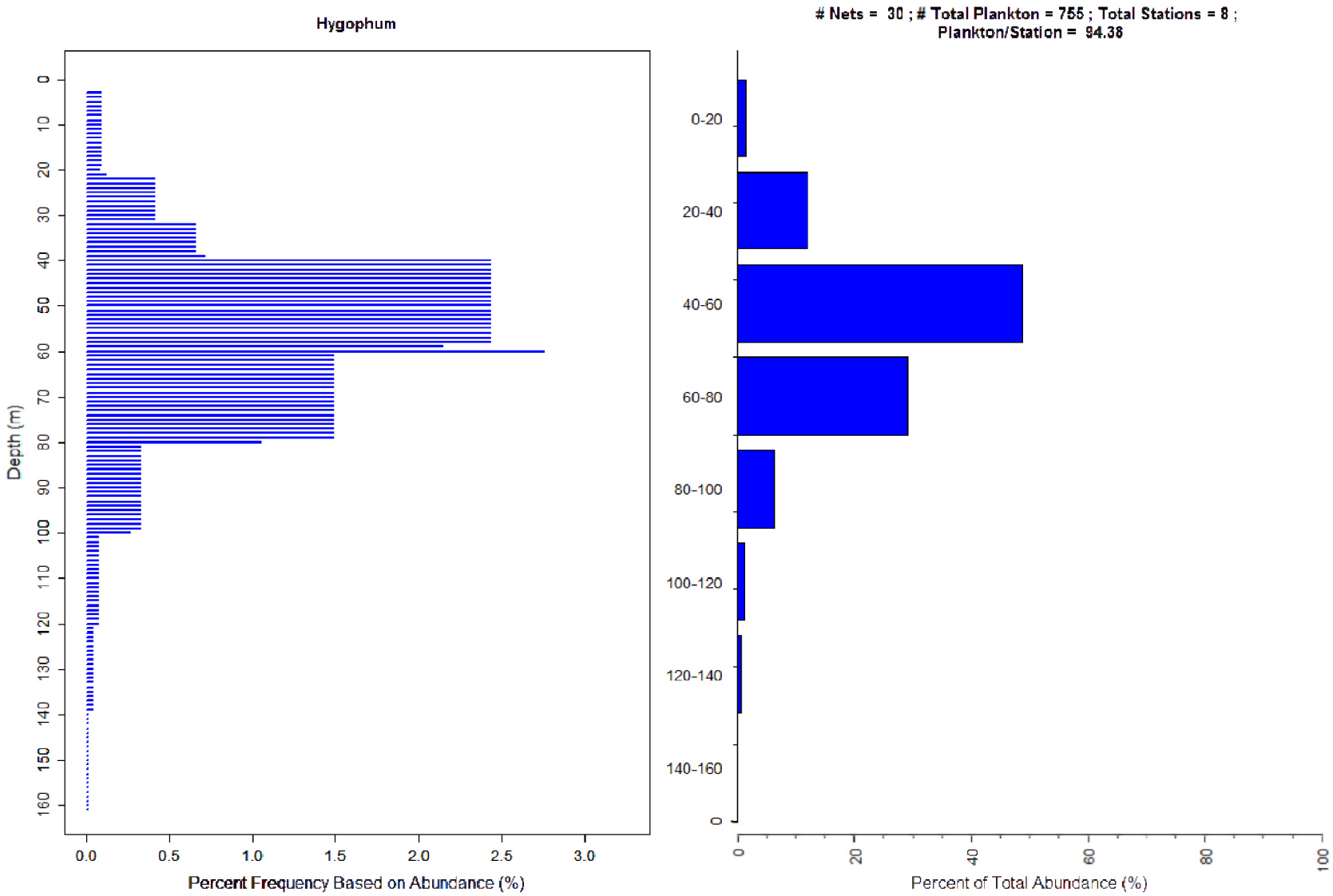
Holacanthus - Shallow



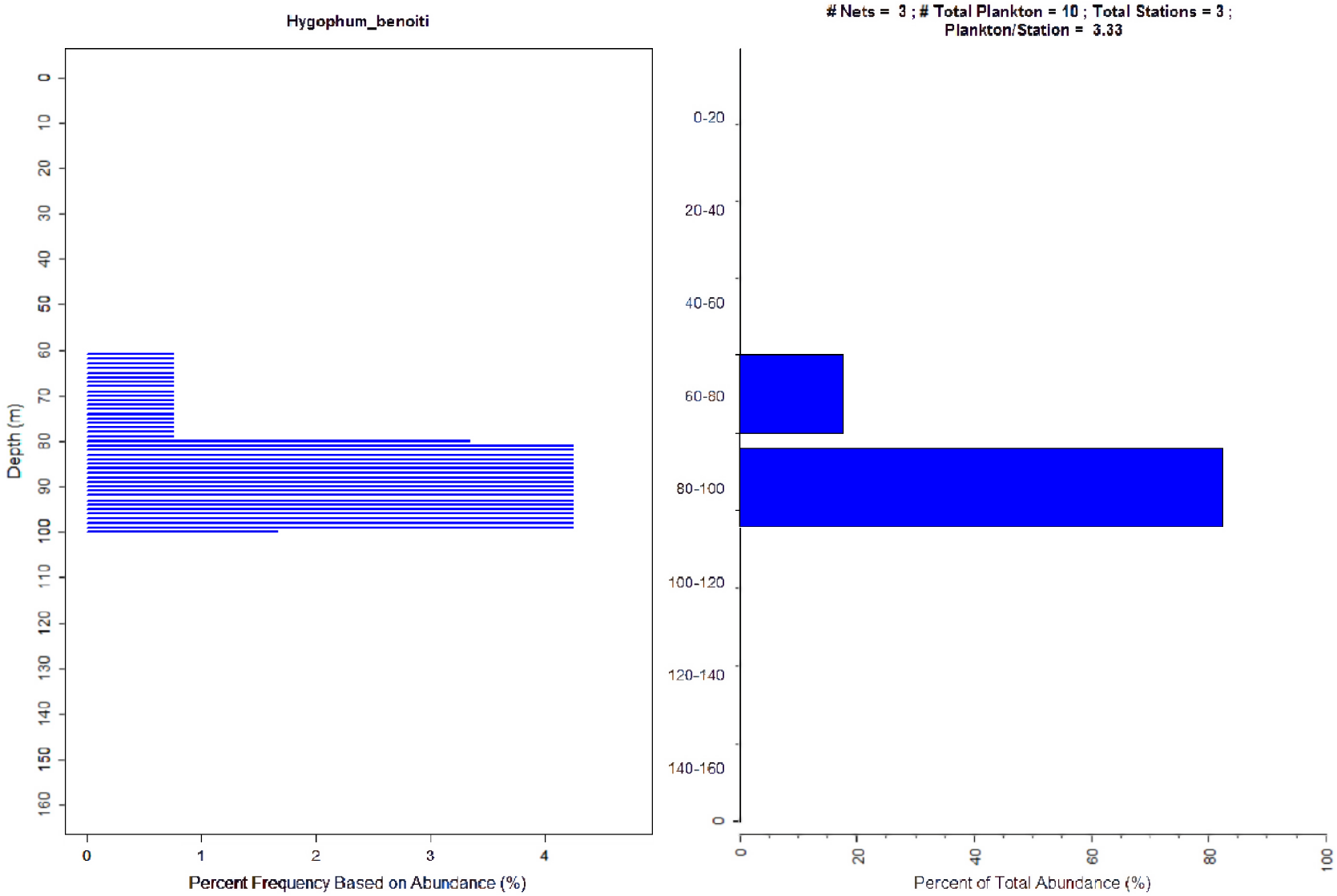
Howella - Shallow



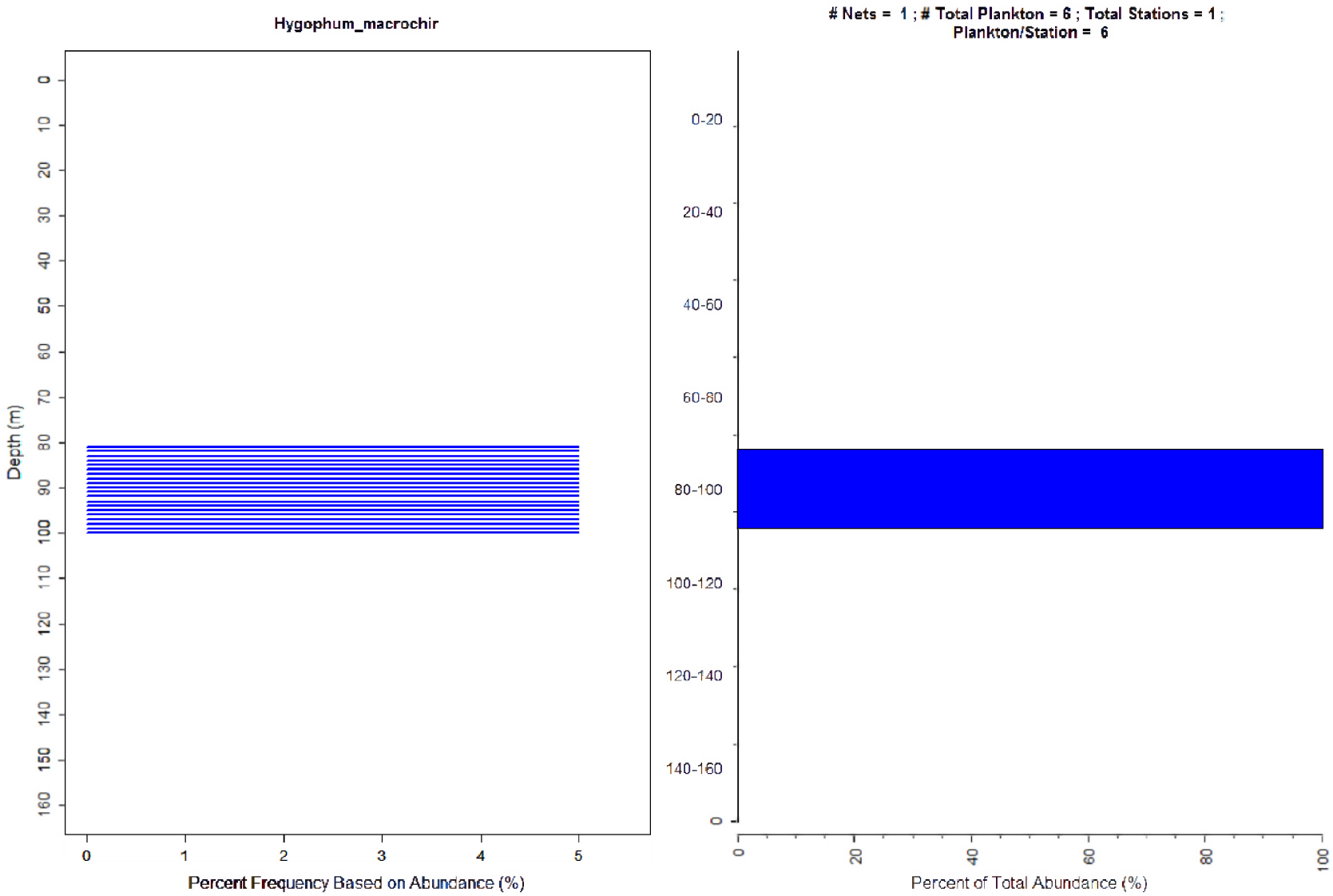
Howella_brodiei - Shallow



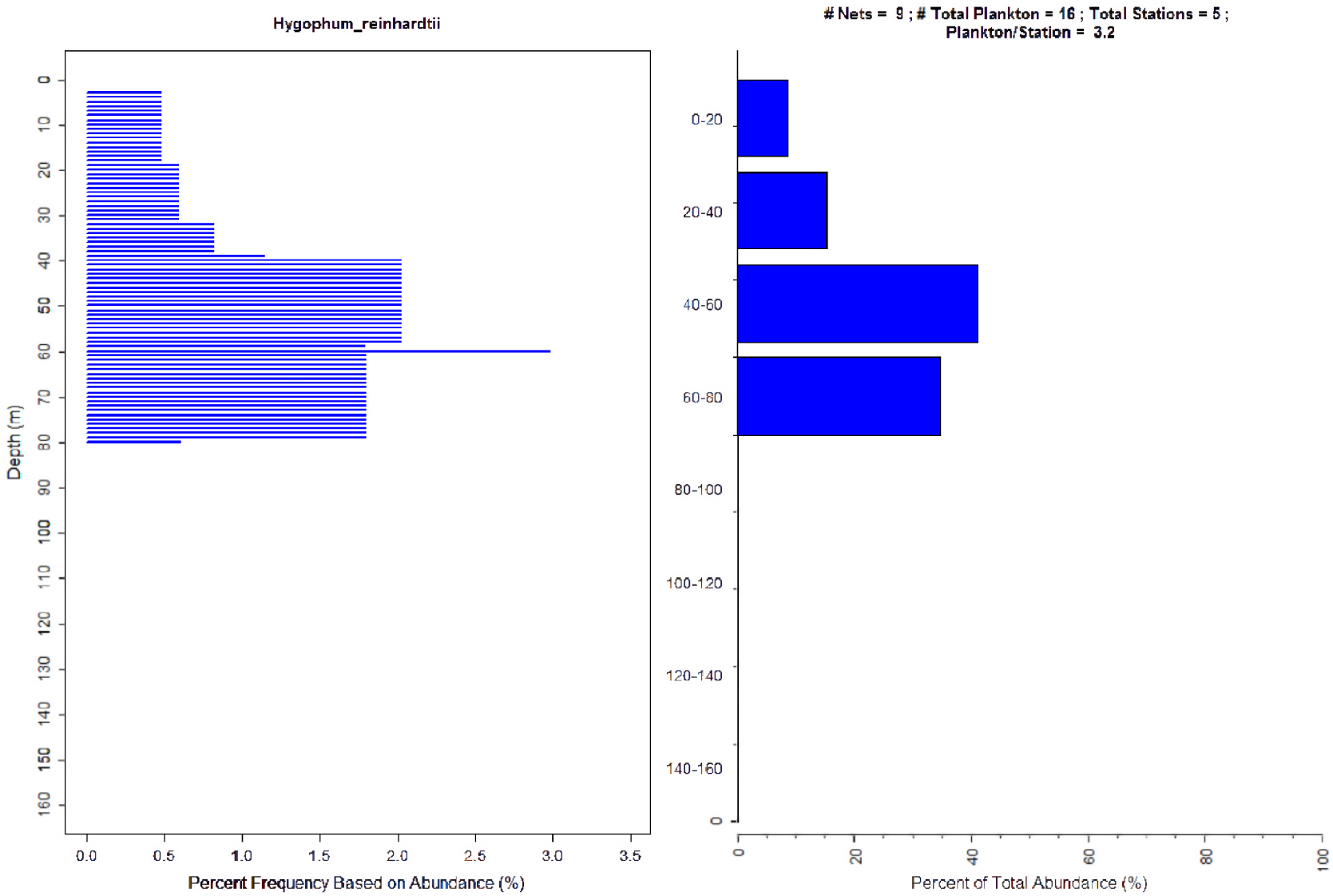
Hygophum - Shallow



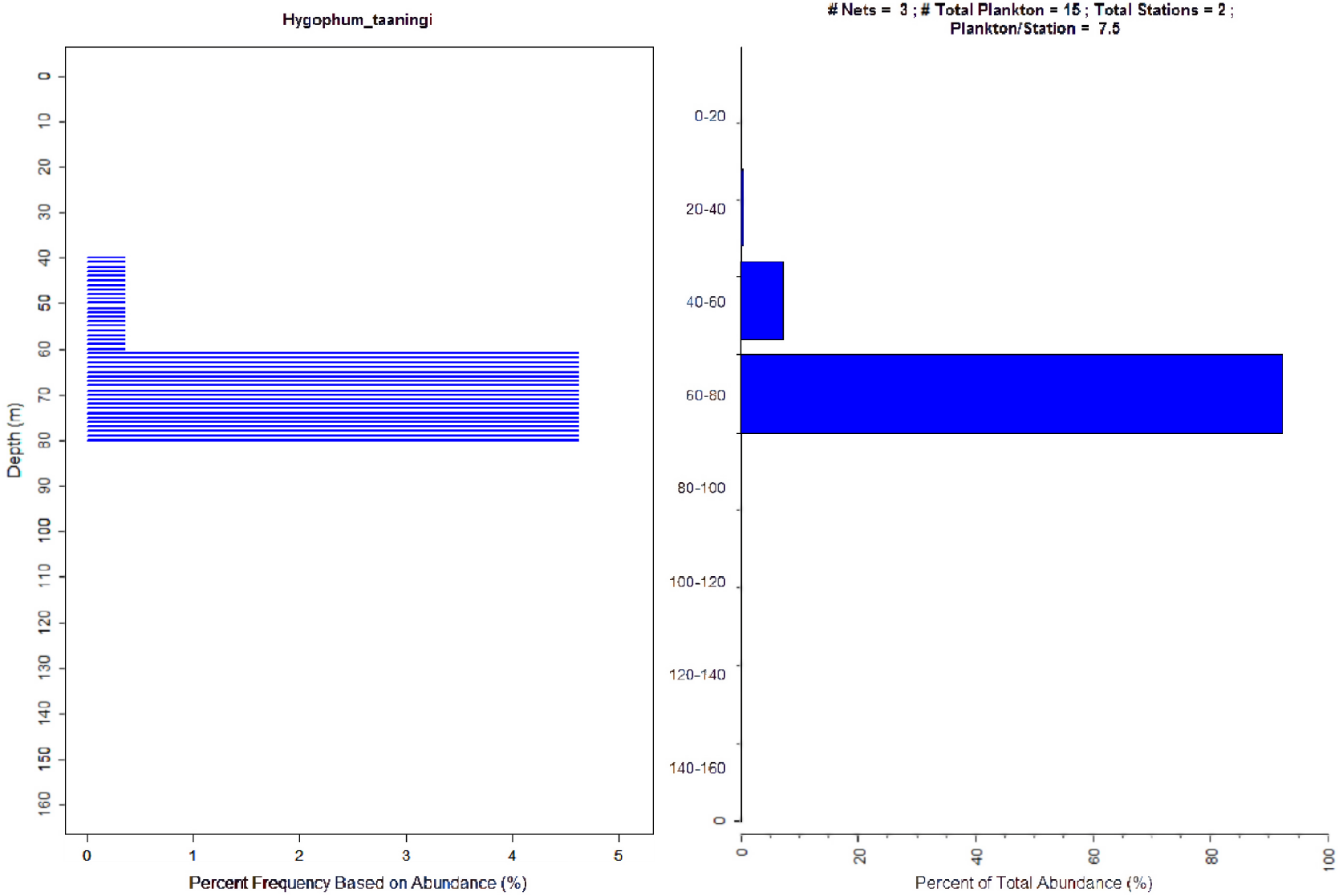
Hygophum_benoiti - Shallow



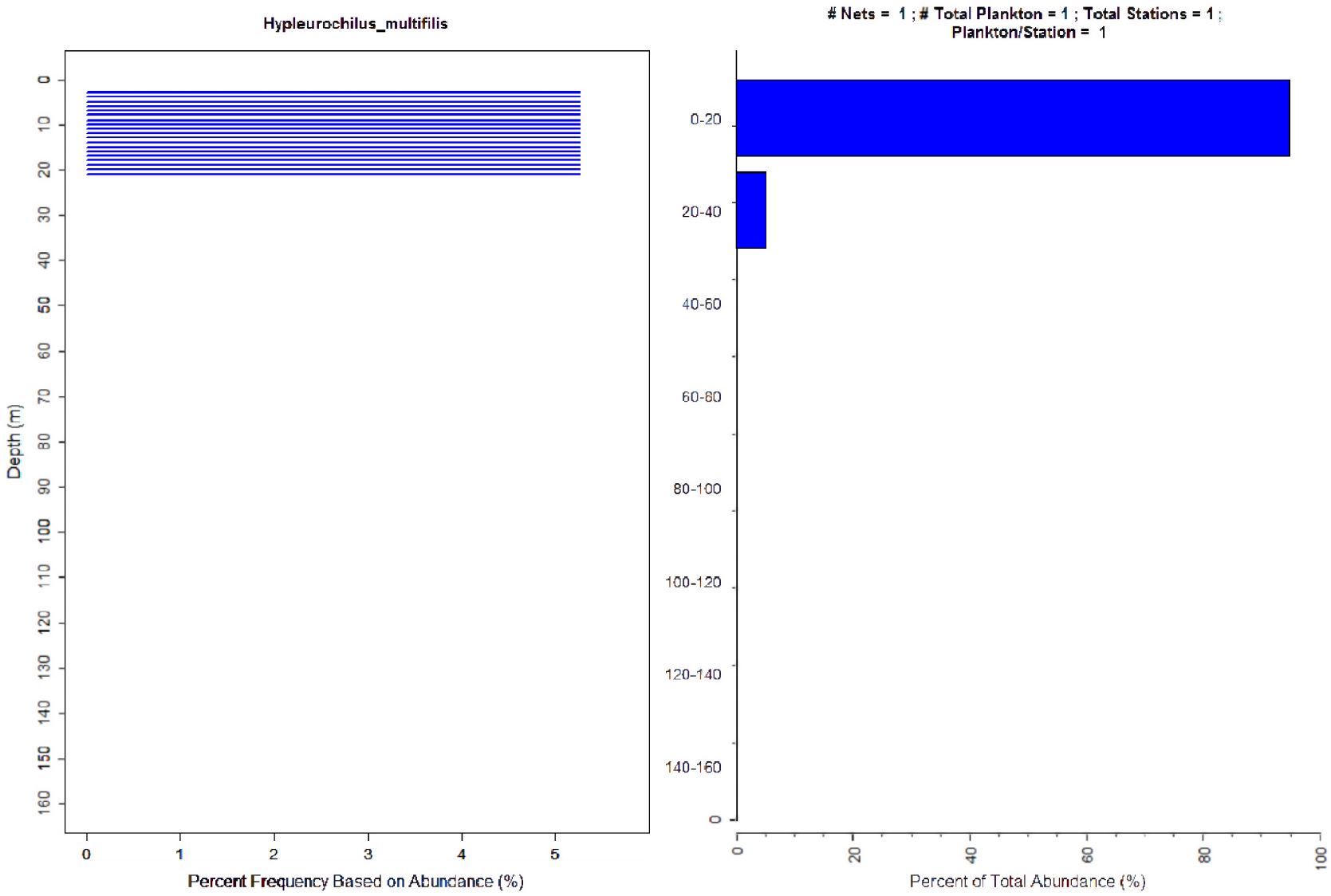
Hygophum_macrochir - Shallow



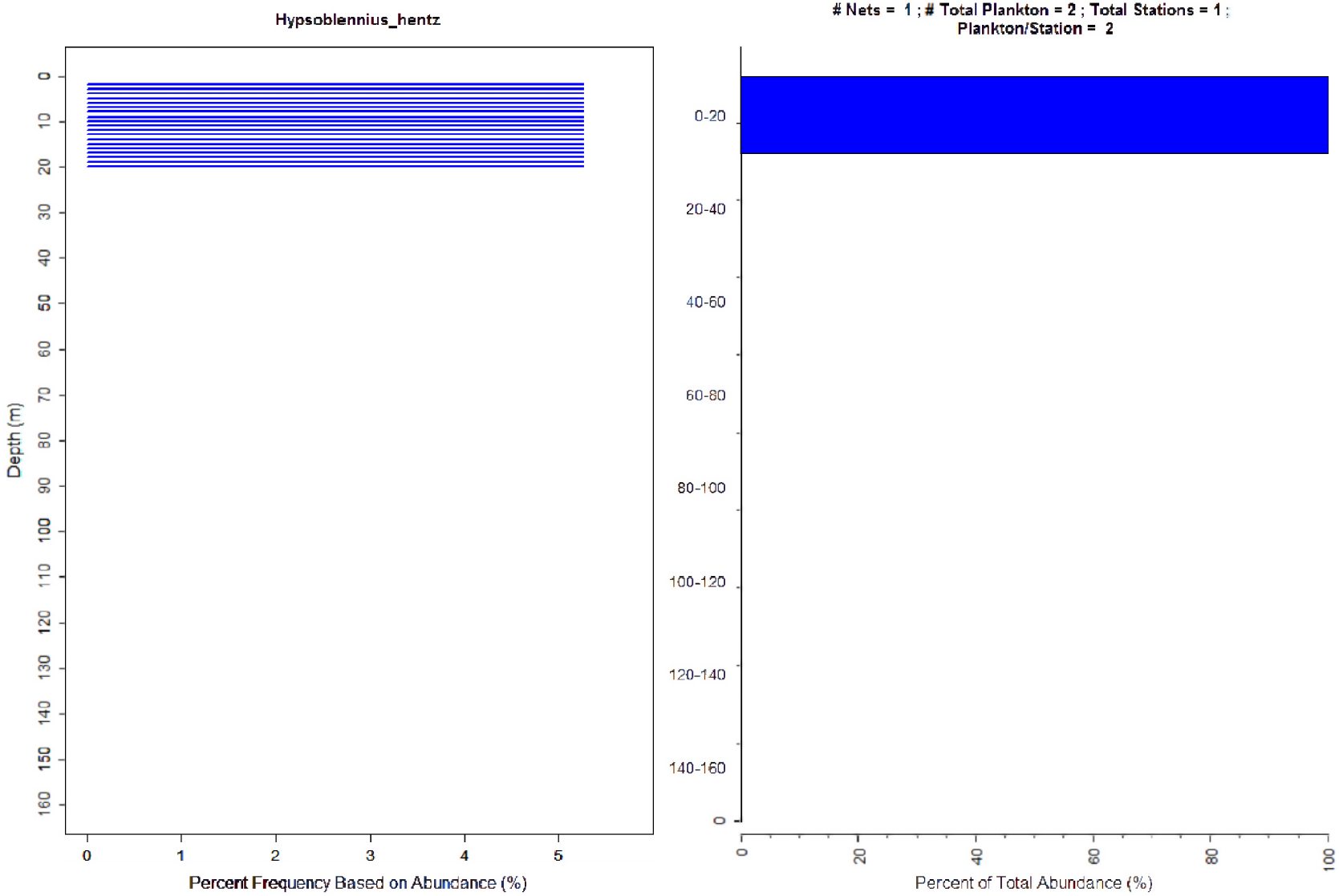
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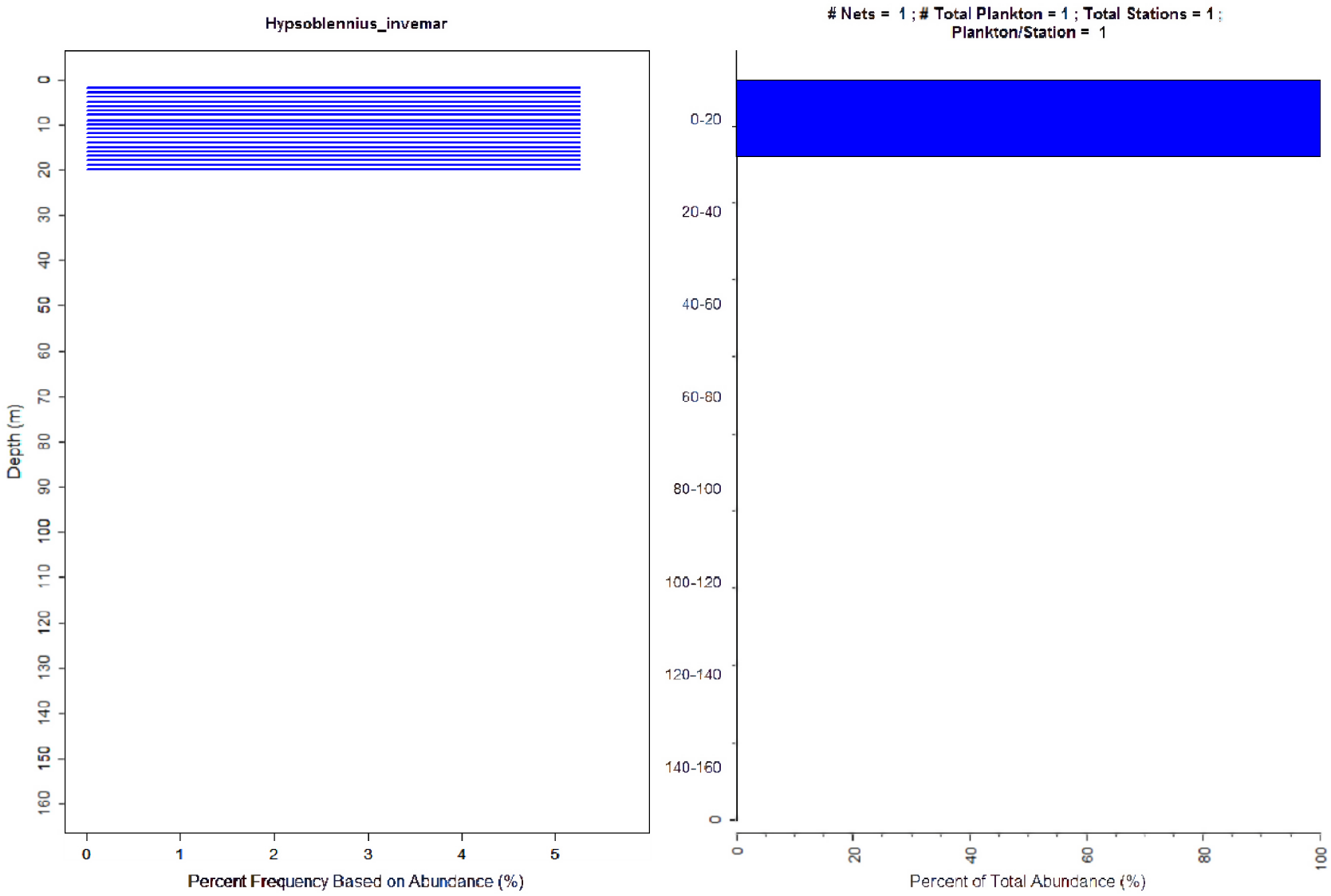
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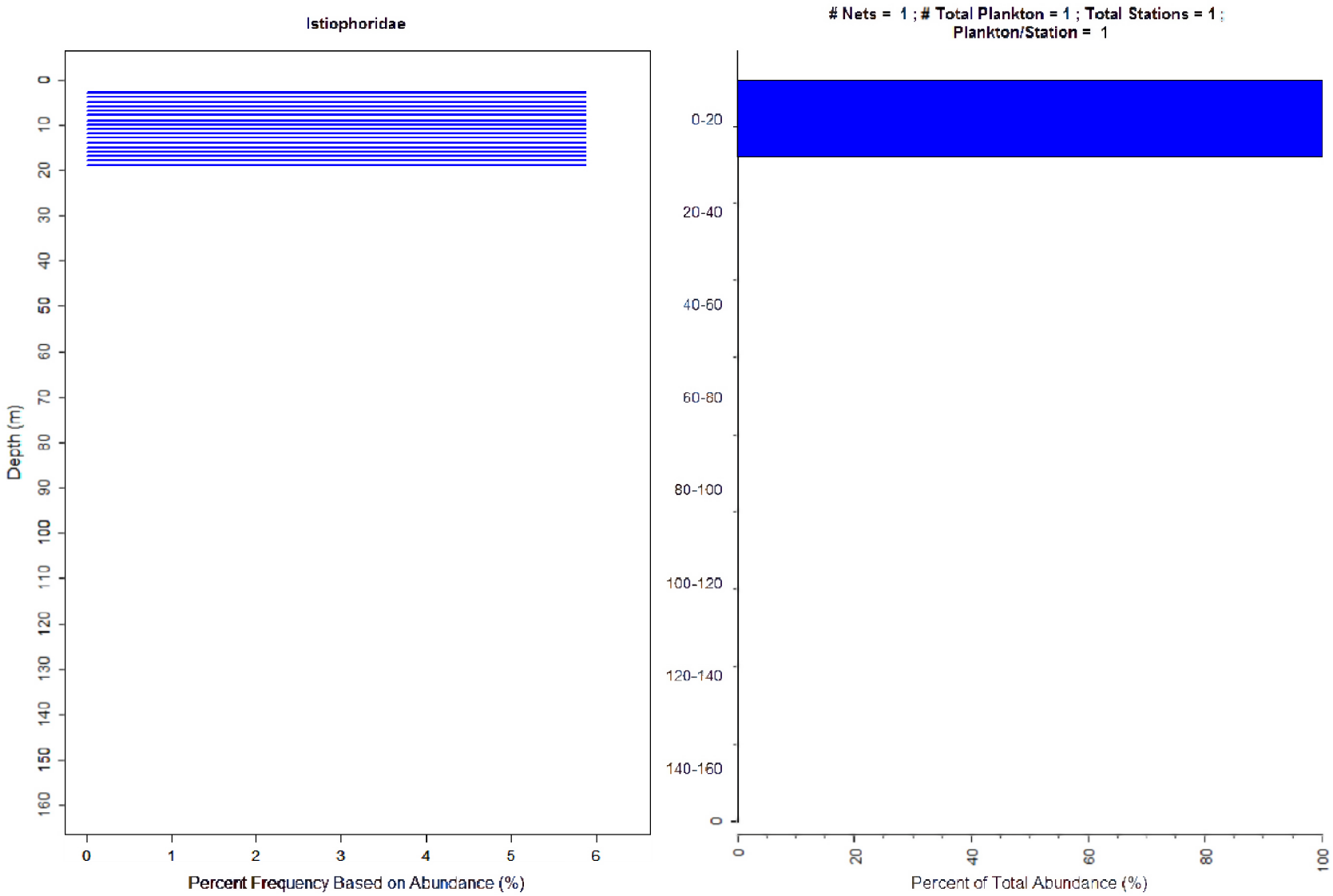
Hypleurochilus_multifilis - Shallow



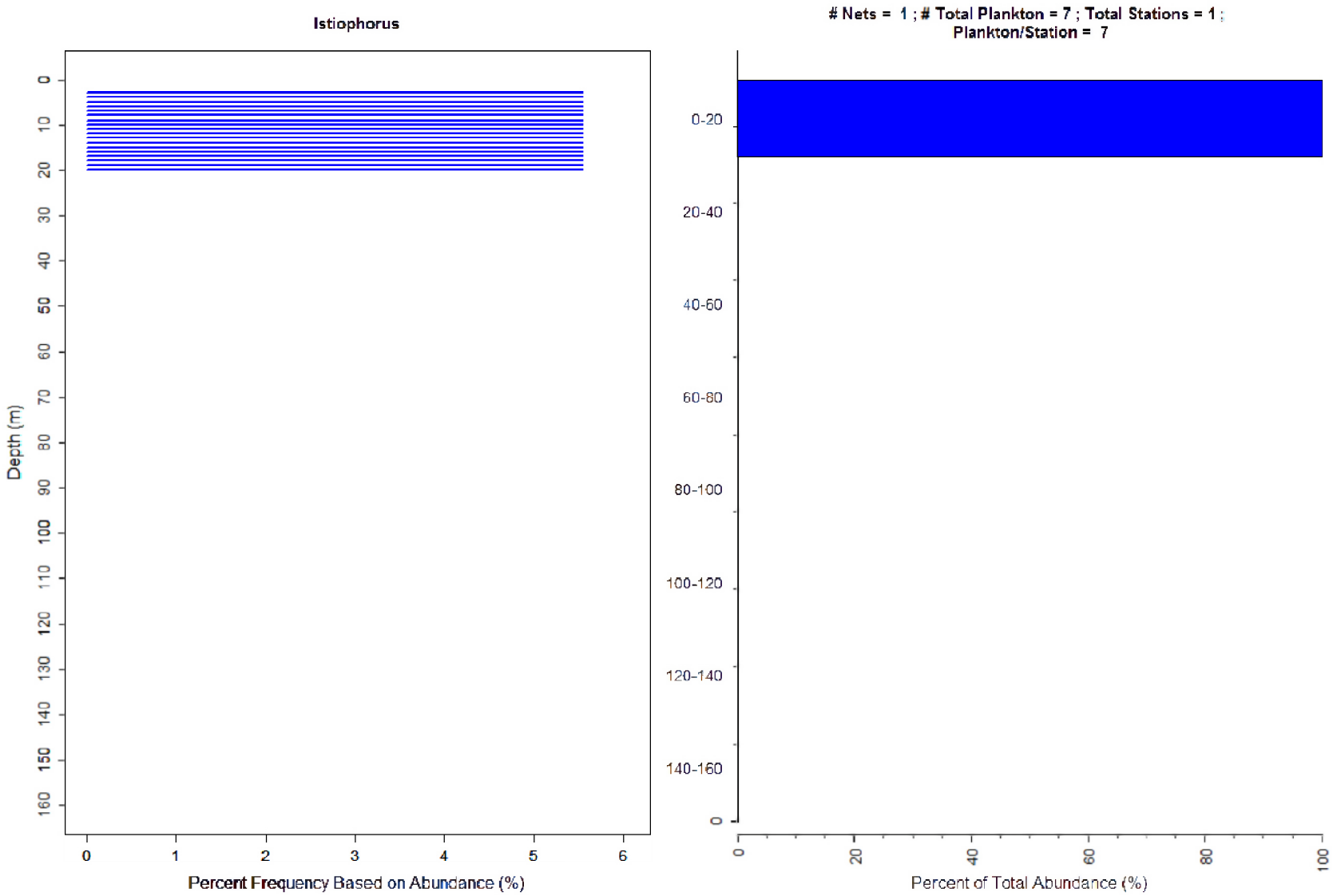
Hypsoblennius_hentz - Shallow



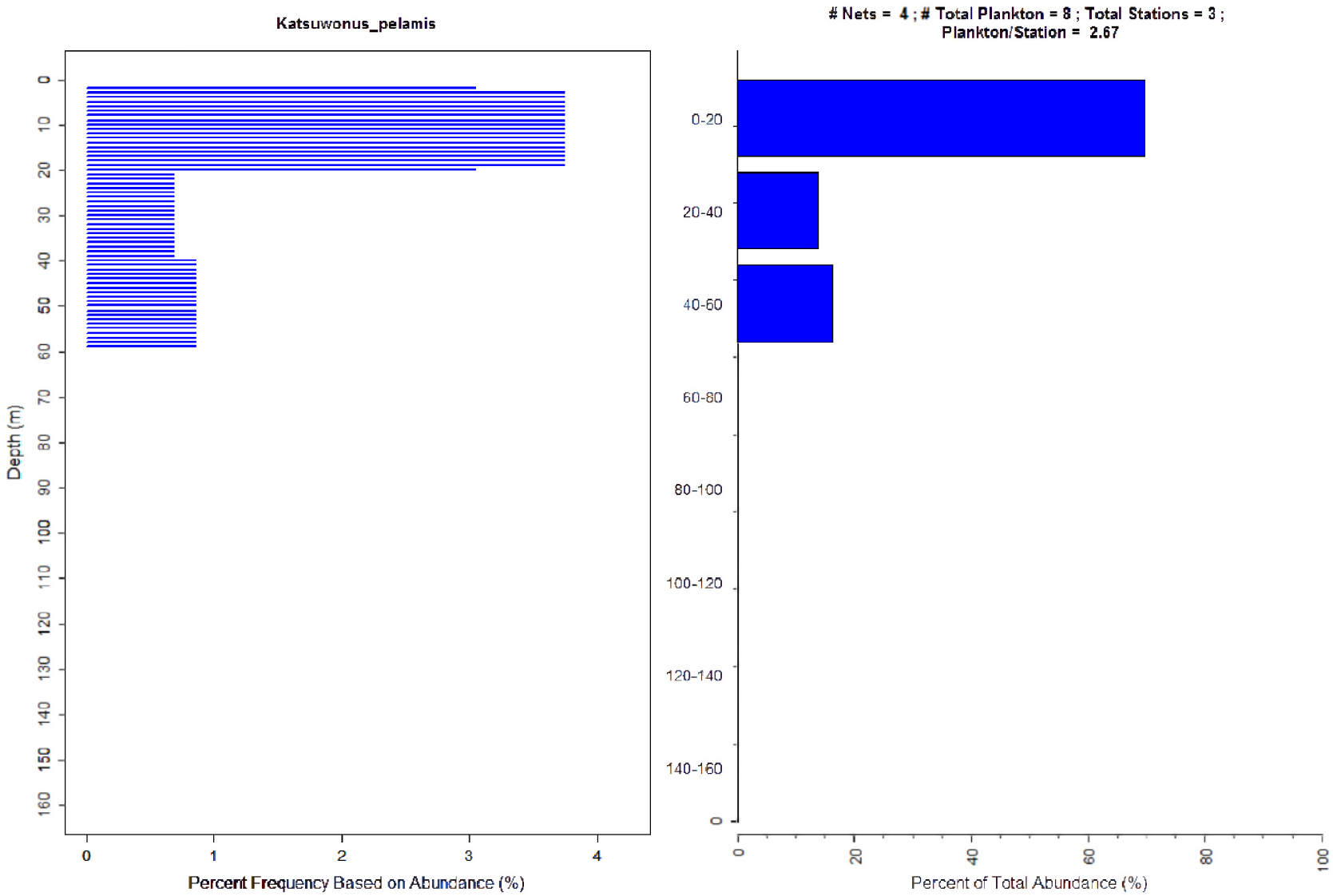
Hypsoblennius_invemar - Shallow



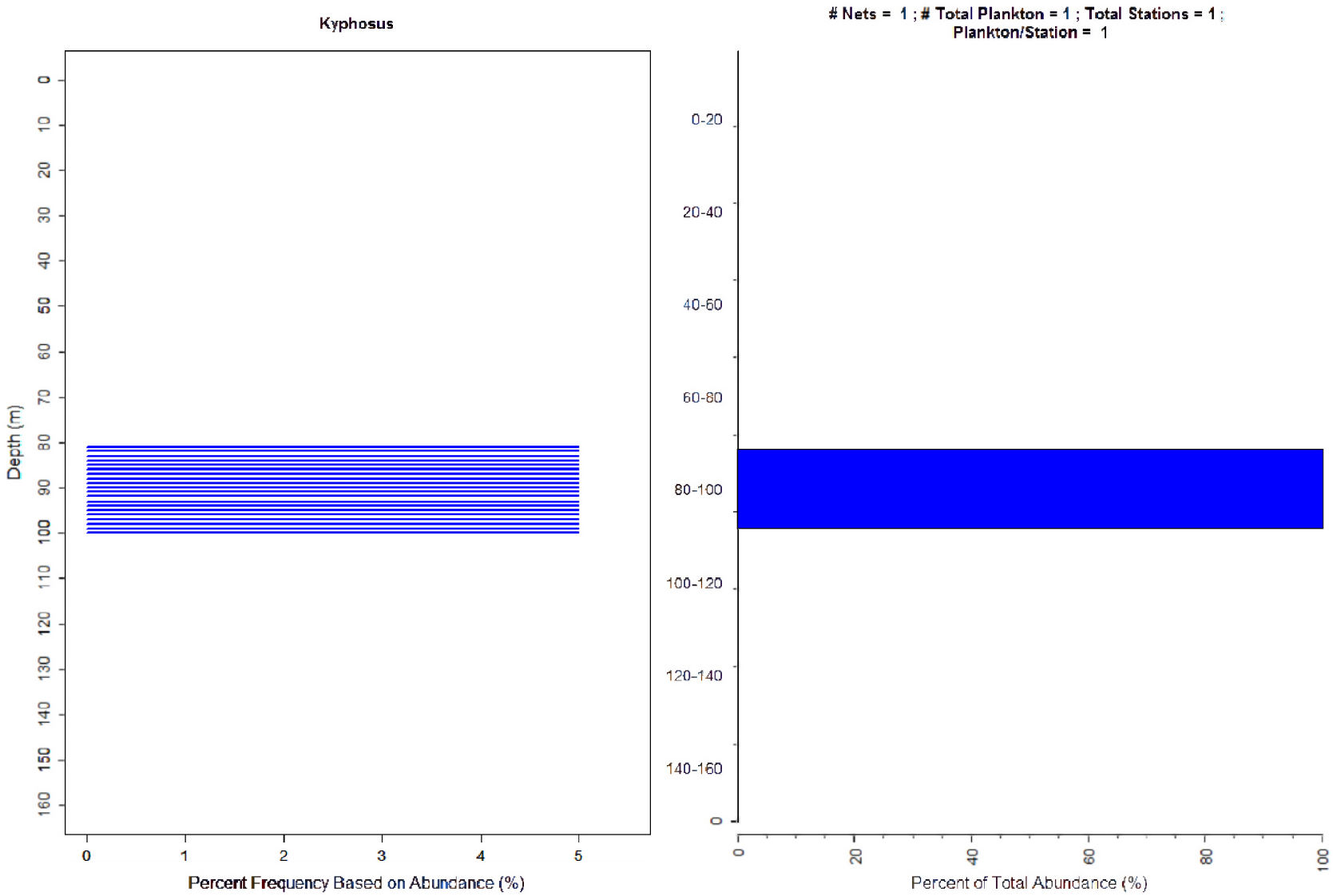
Istiophoridae - Shallow



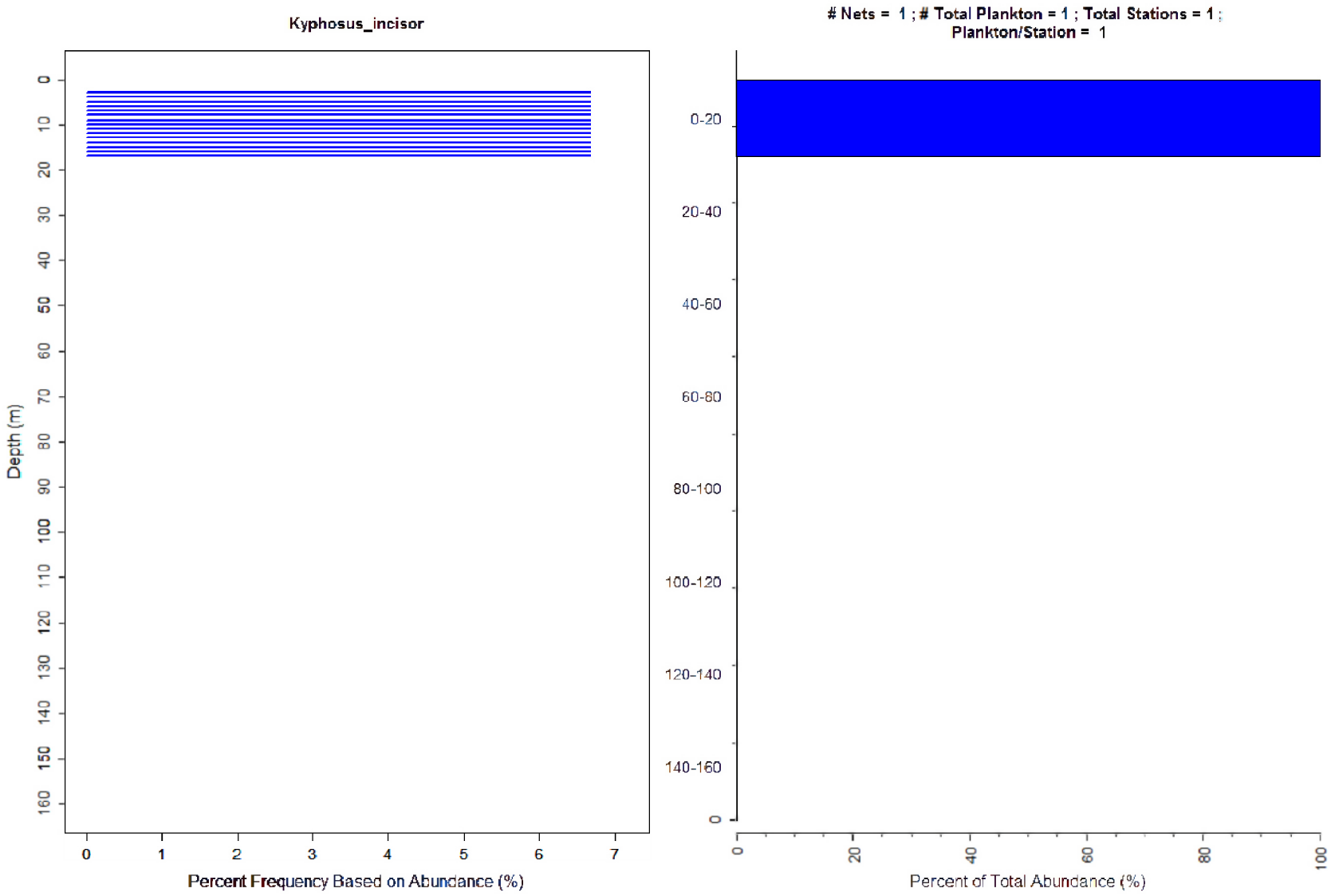
Istiophorus - Shallow



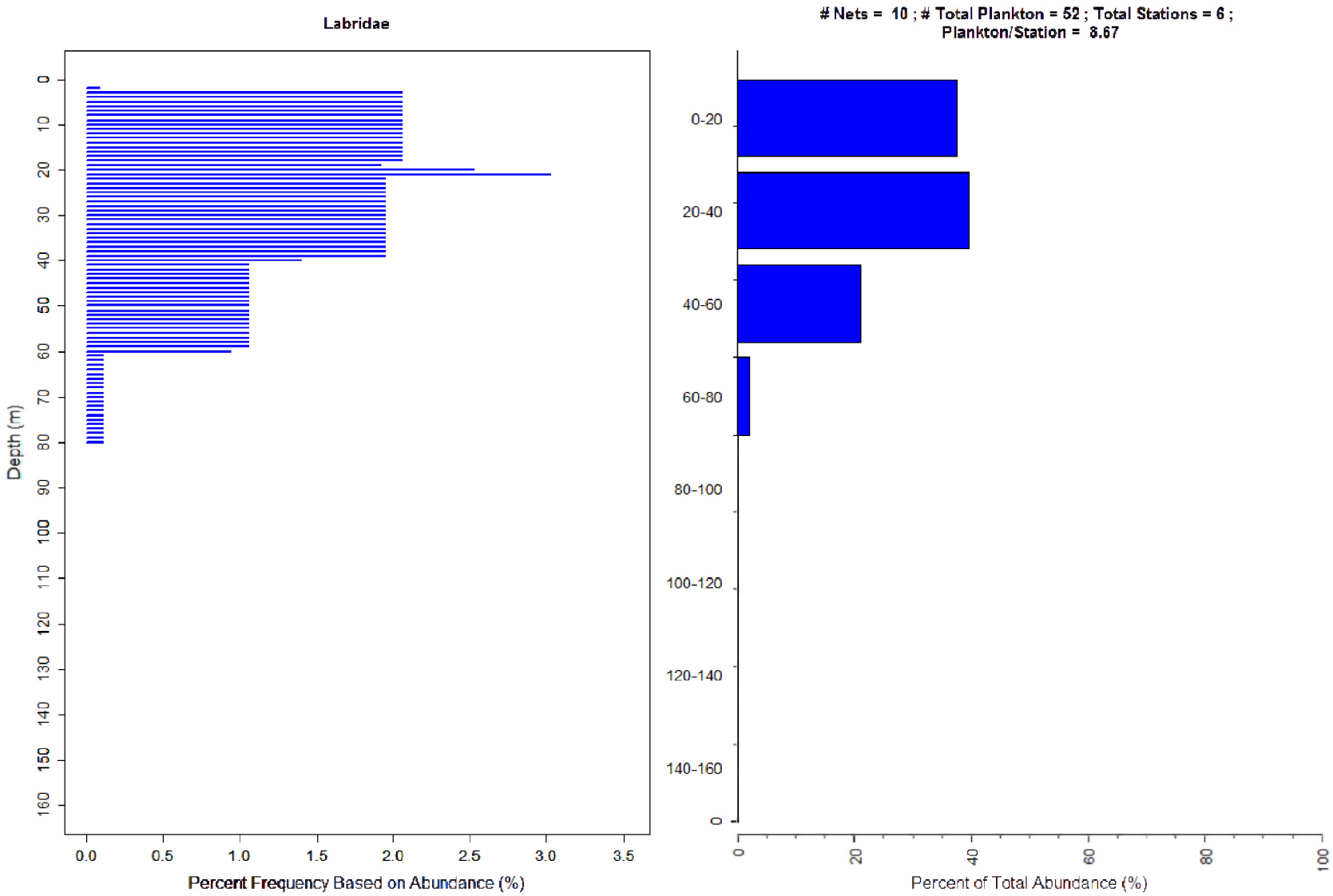
Katsuwonus_pelamis - Shallow



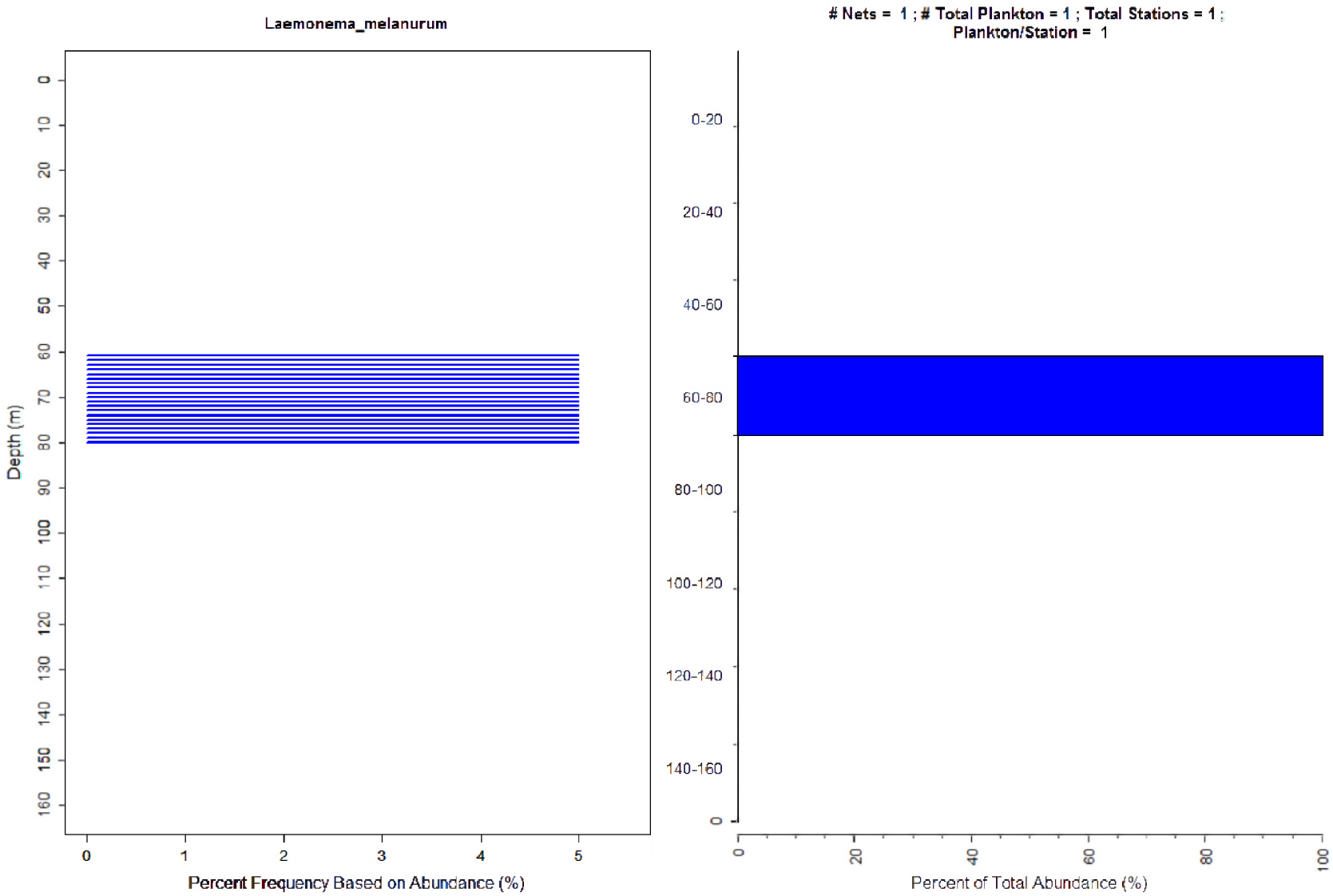
Kyphosus - Shallow



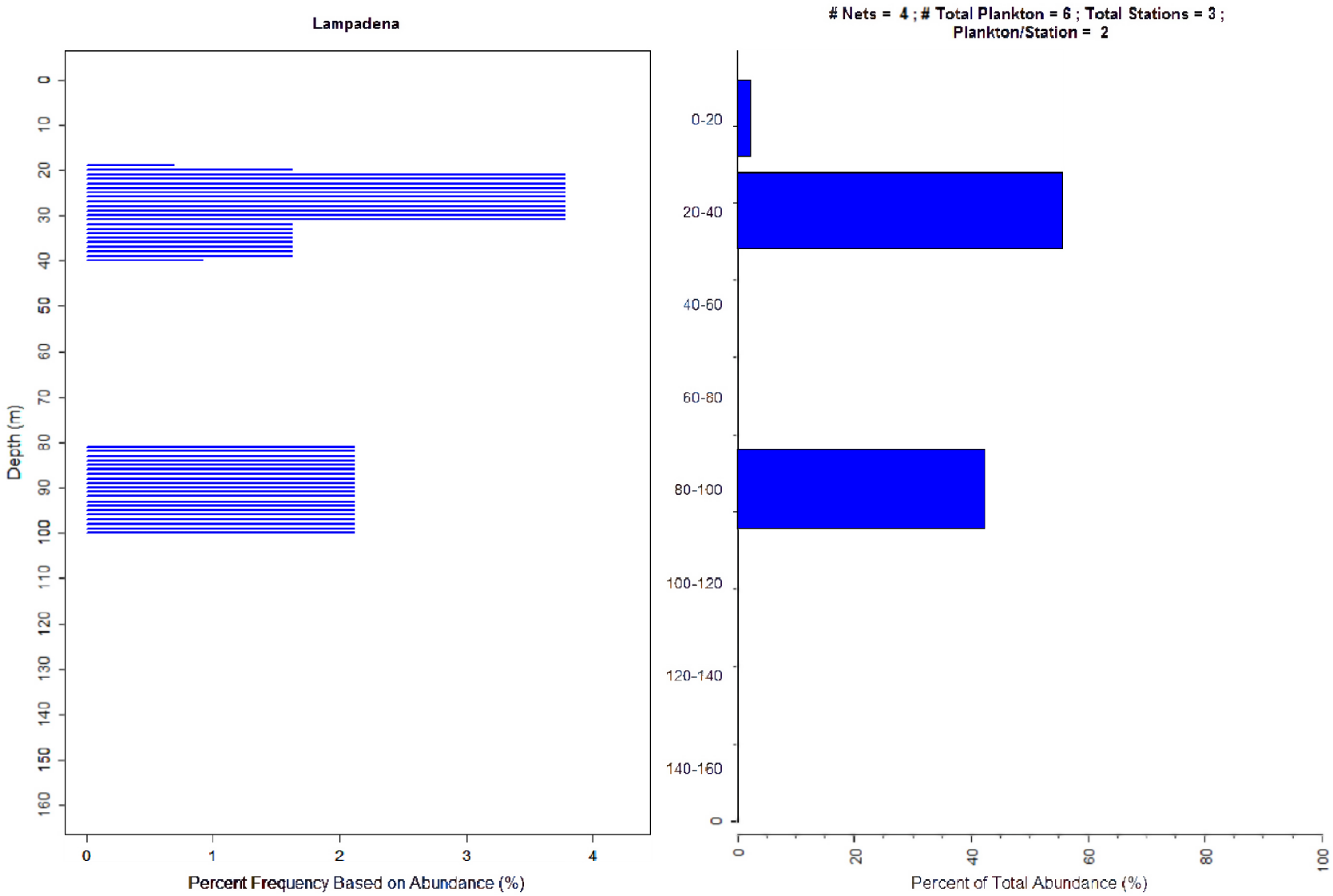
Kyphosus_incisor - Shallow



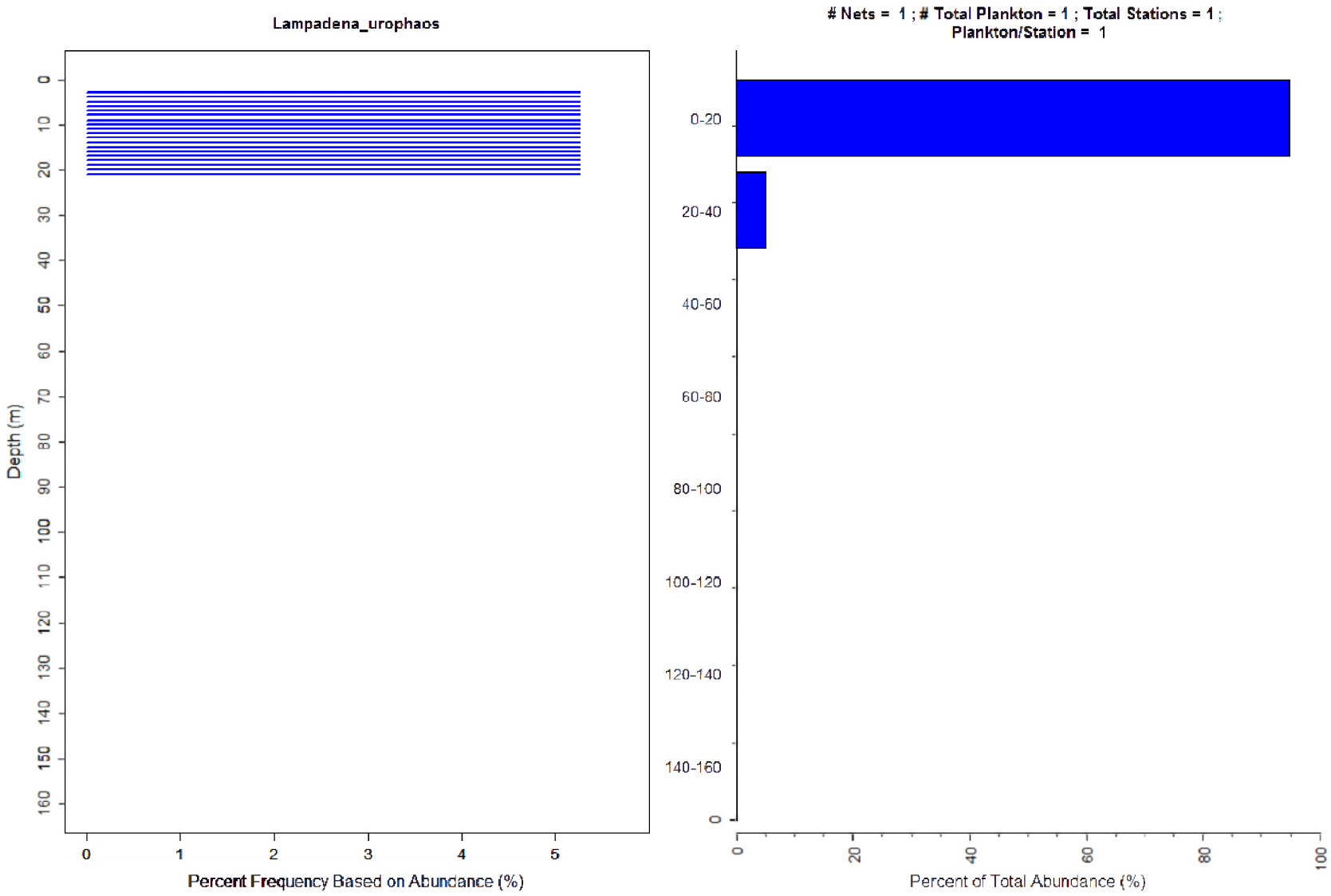
Labridae - Shallow



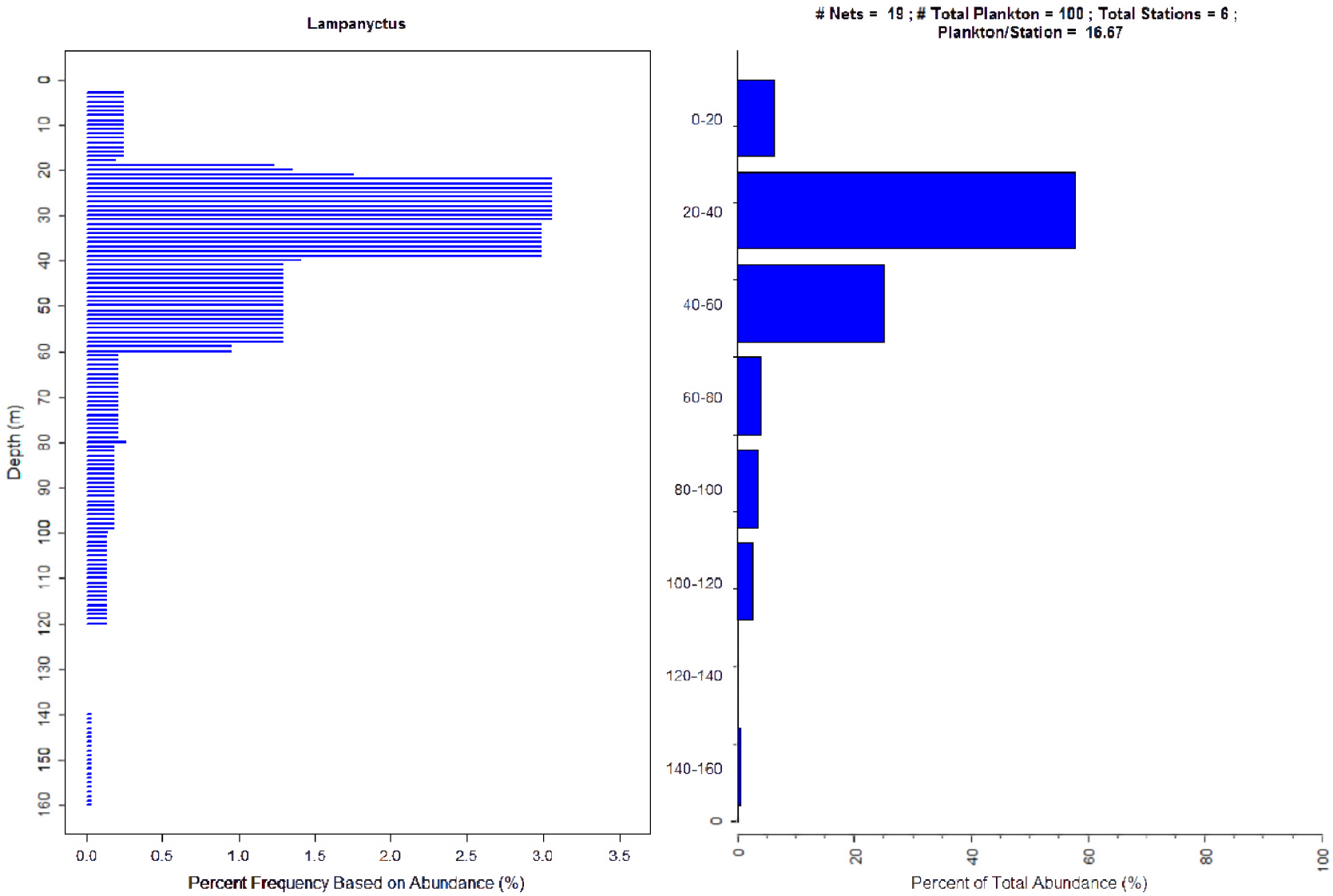
Laemonema_melanurum - Shallow



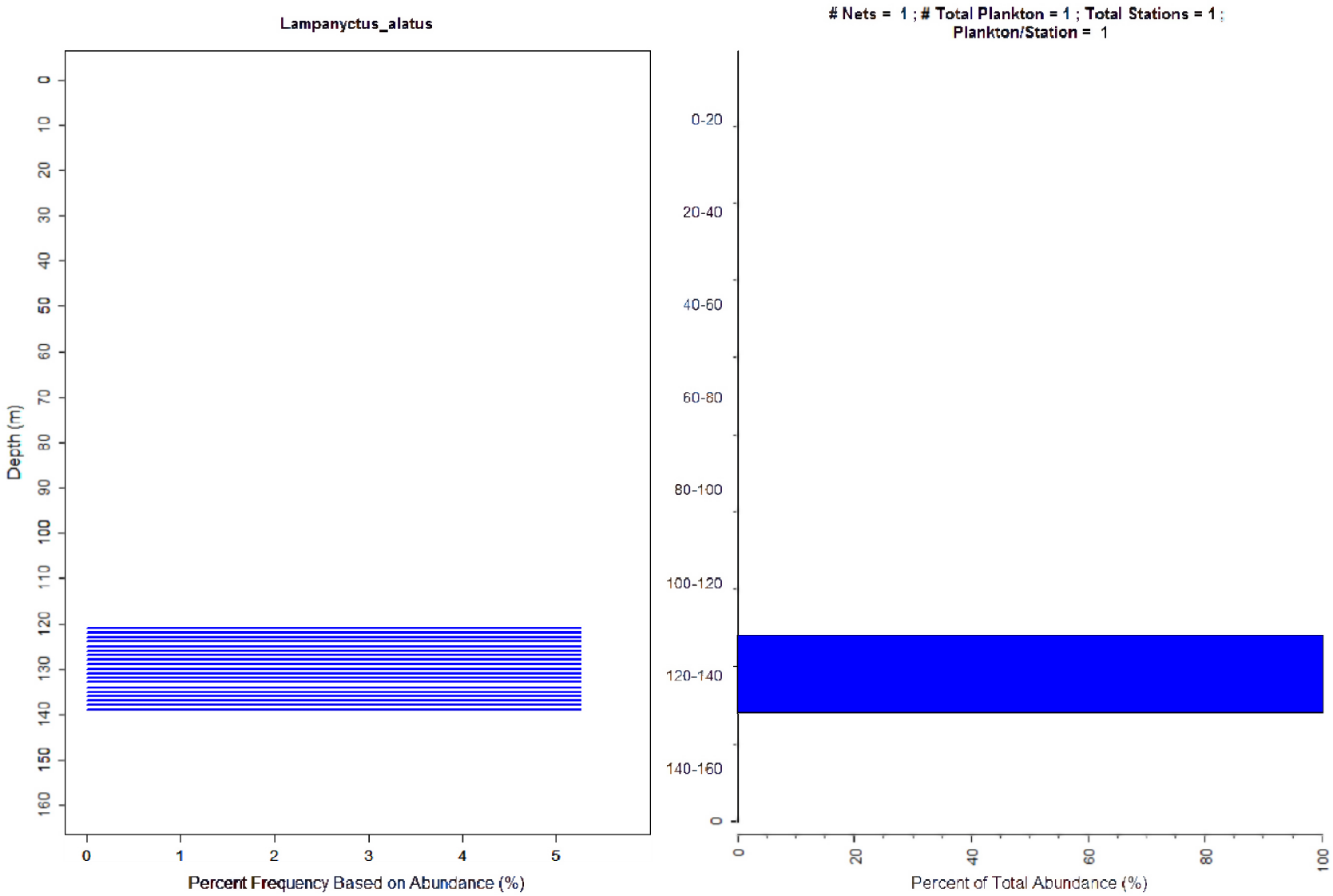
Lampadena - Shallow



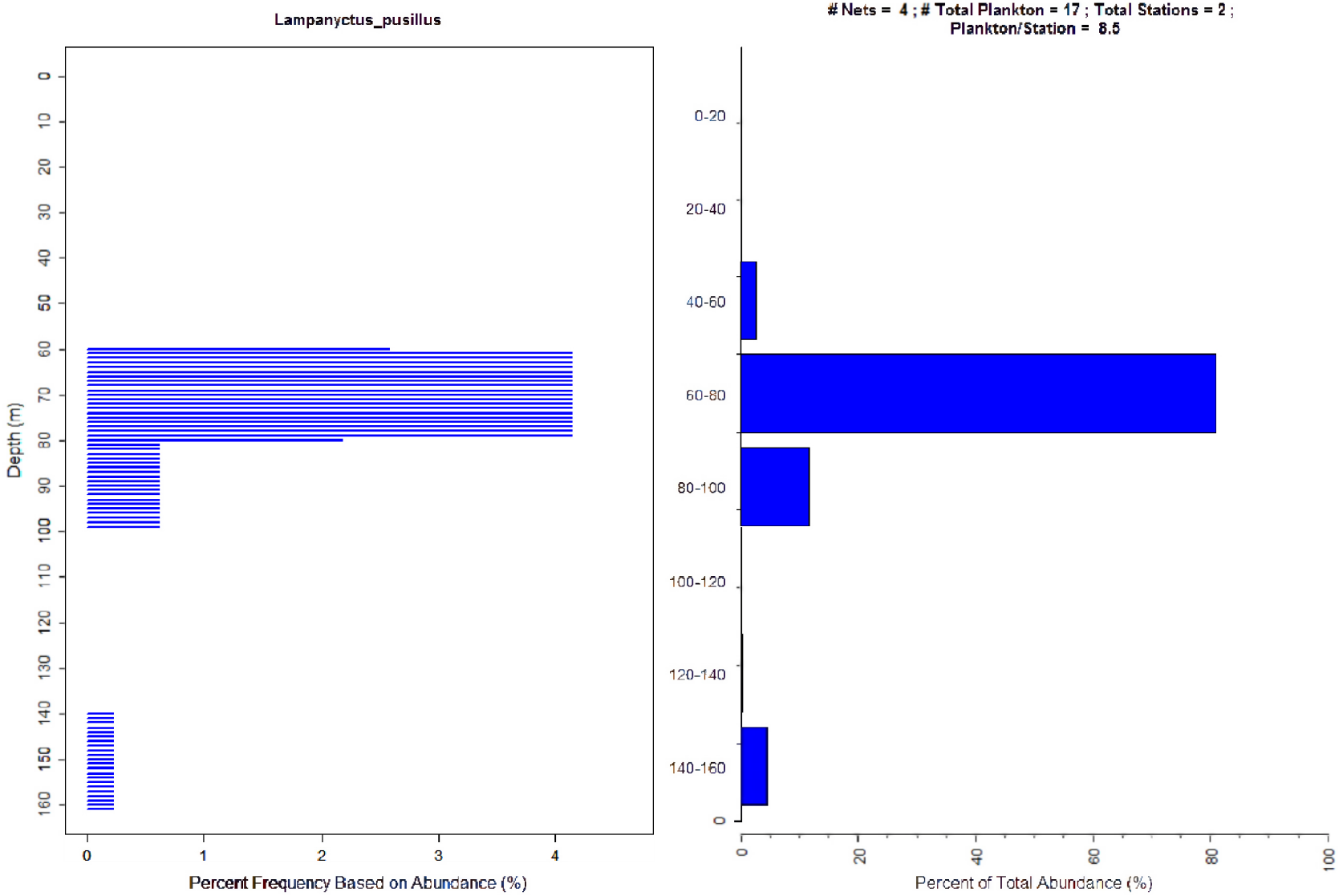
Lampadena_urophaos - Shallow



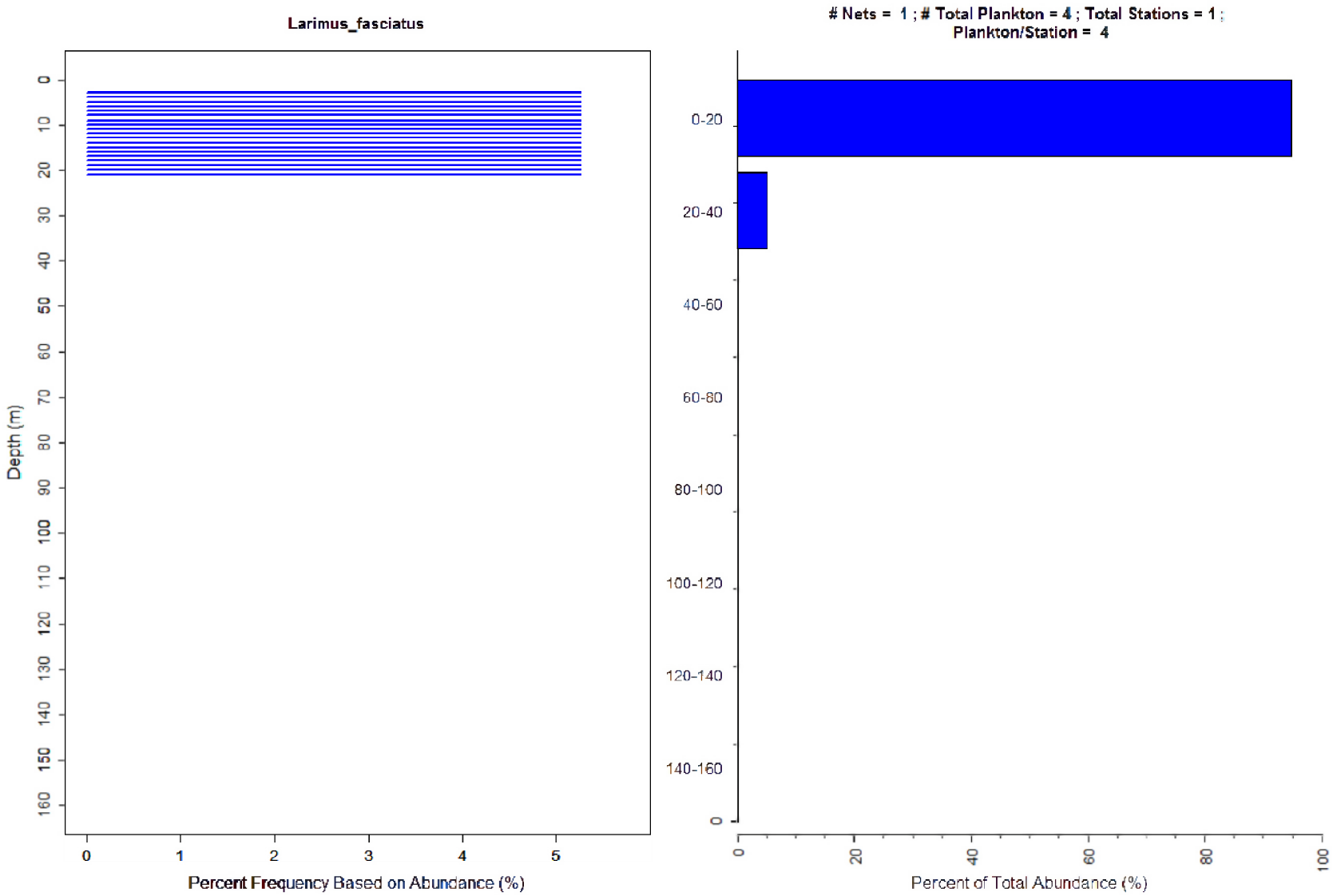
Lampanyctus - Shallow



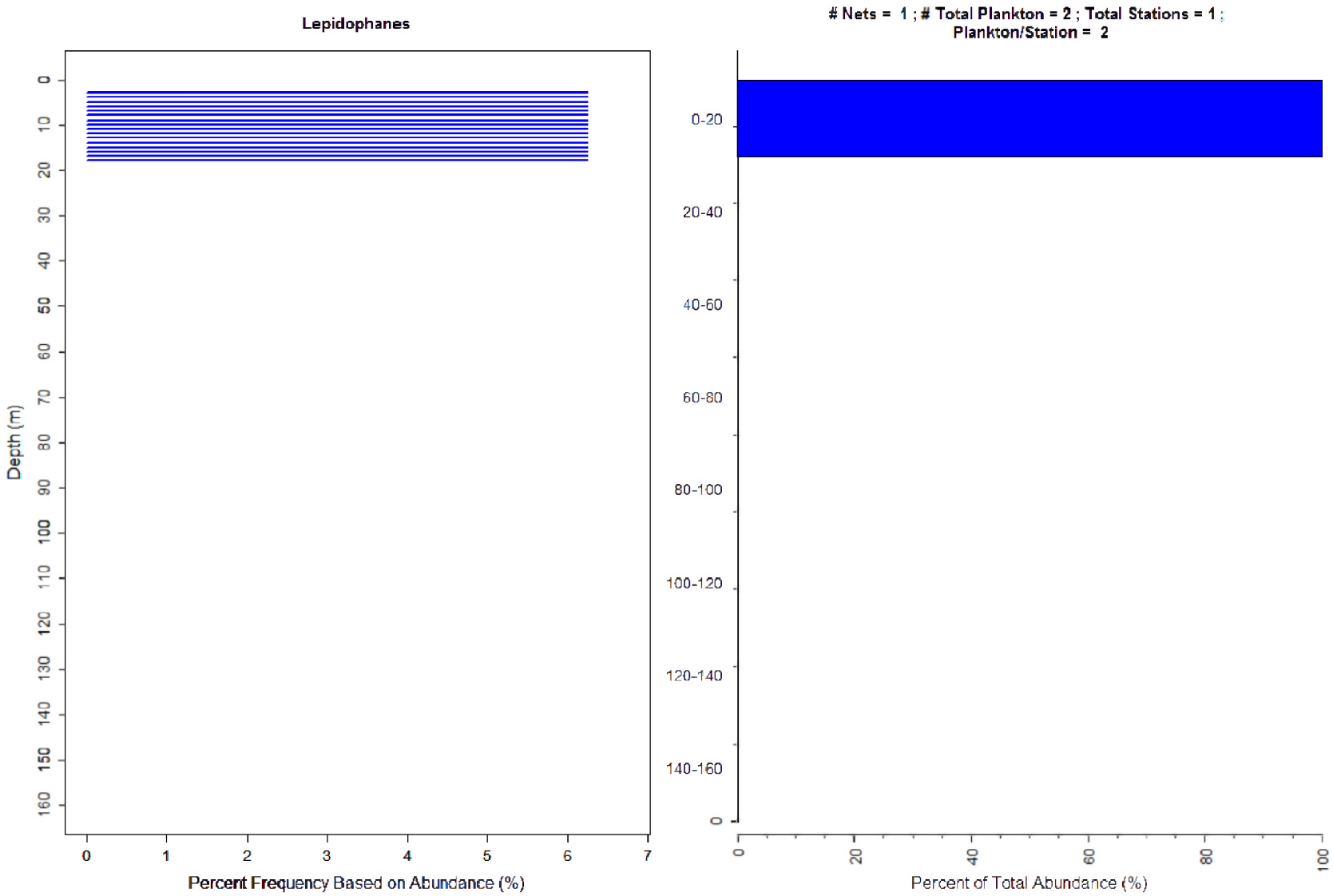
Lampanyctus_alatus - Shallow



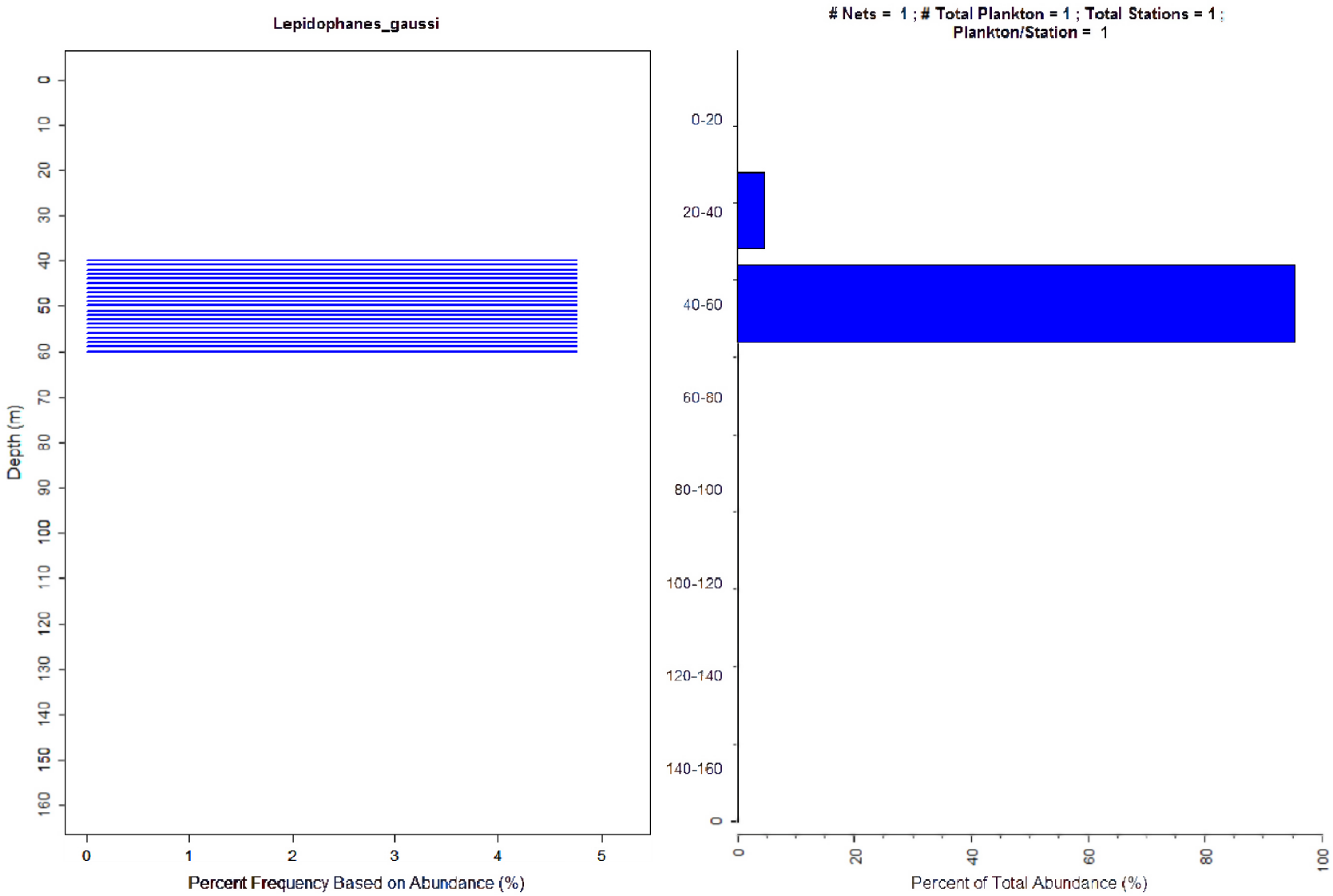
Lampanyctus_pusillus - Shallow



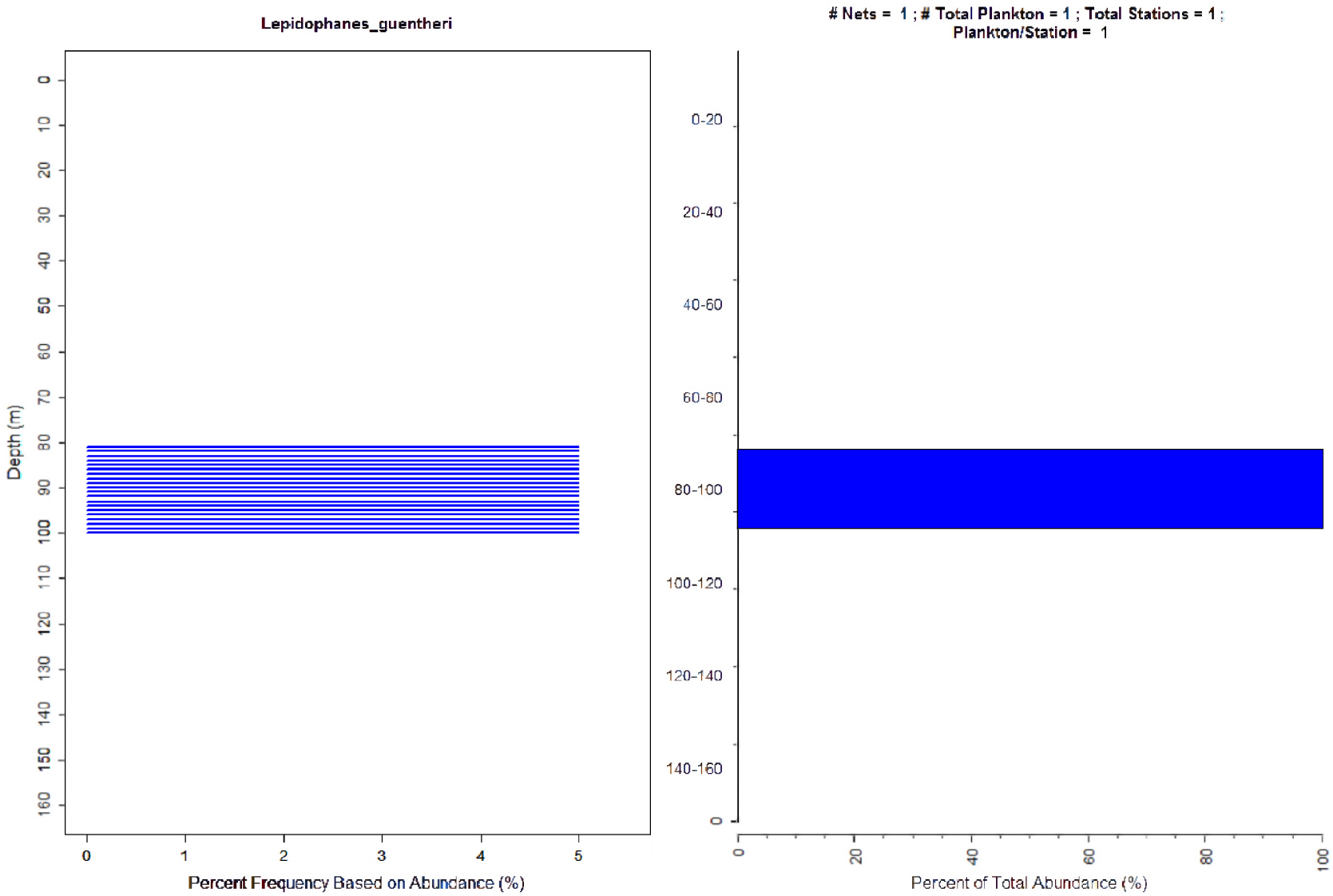
Larimus_fasciatus - Shallow



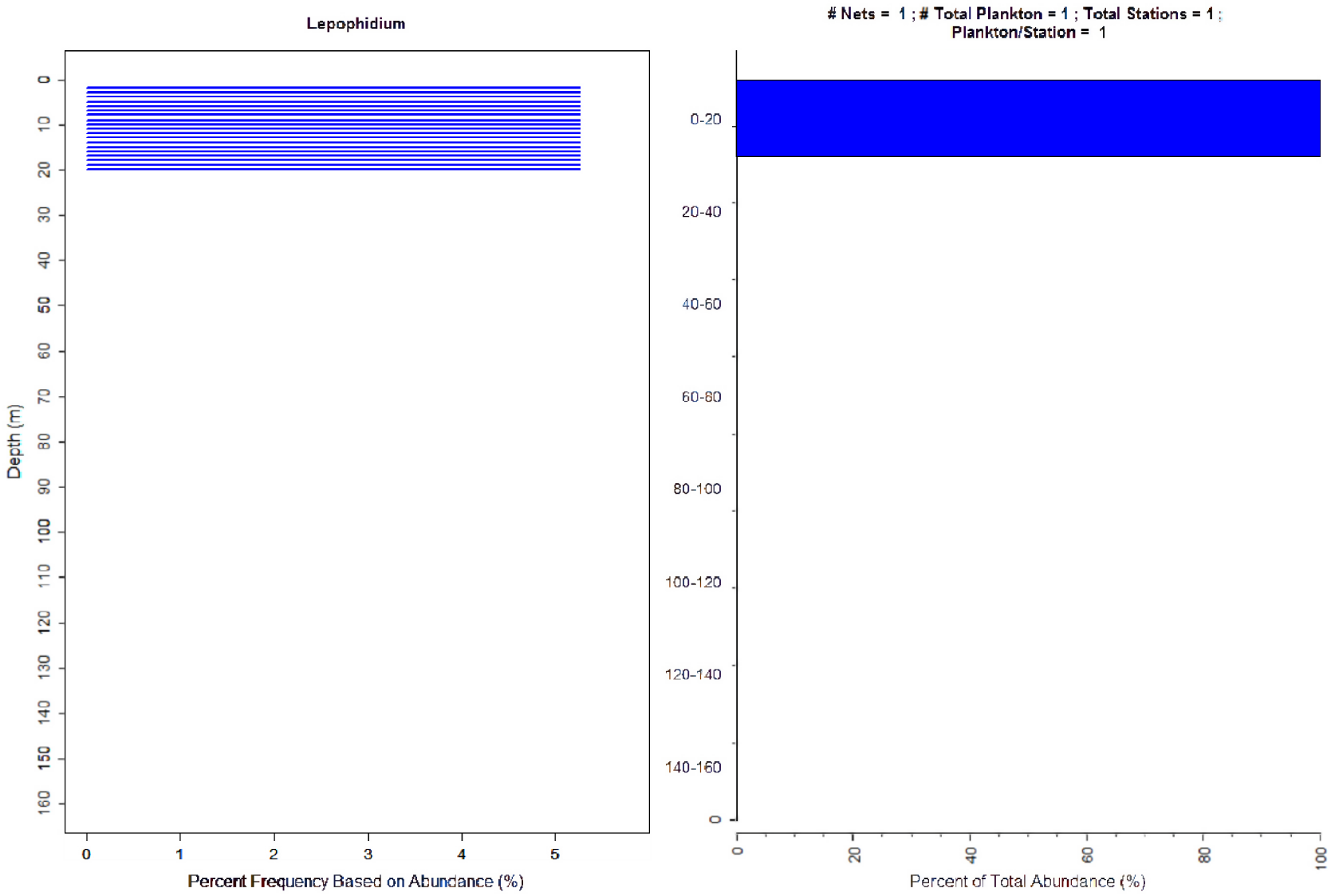
Lepidophanes - Shallow



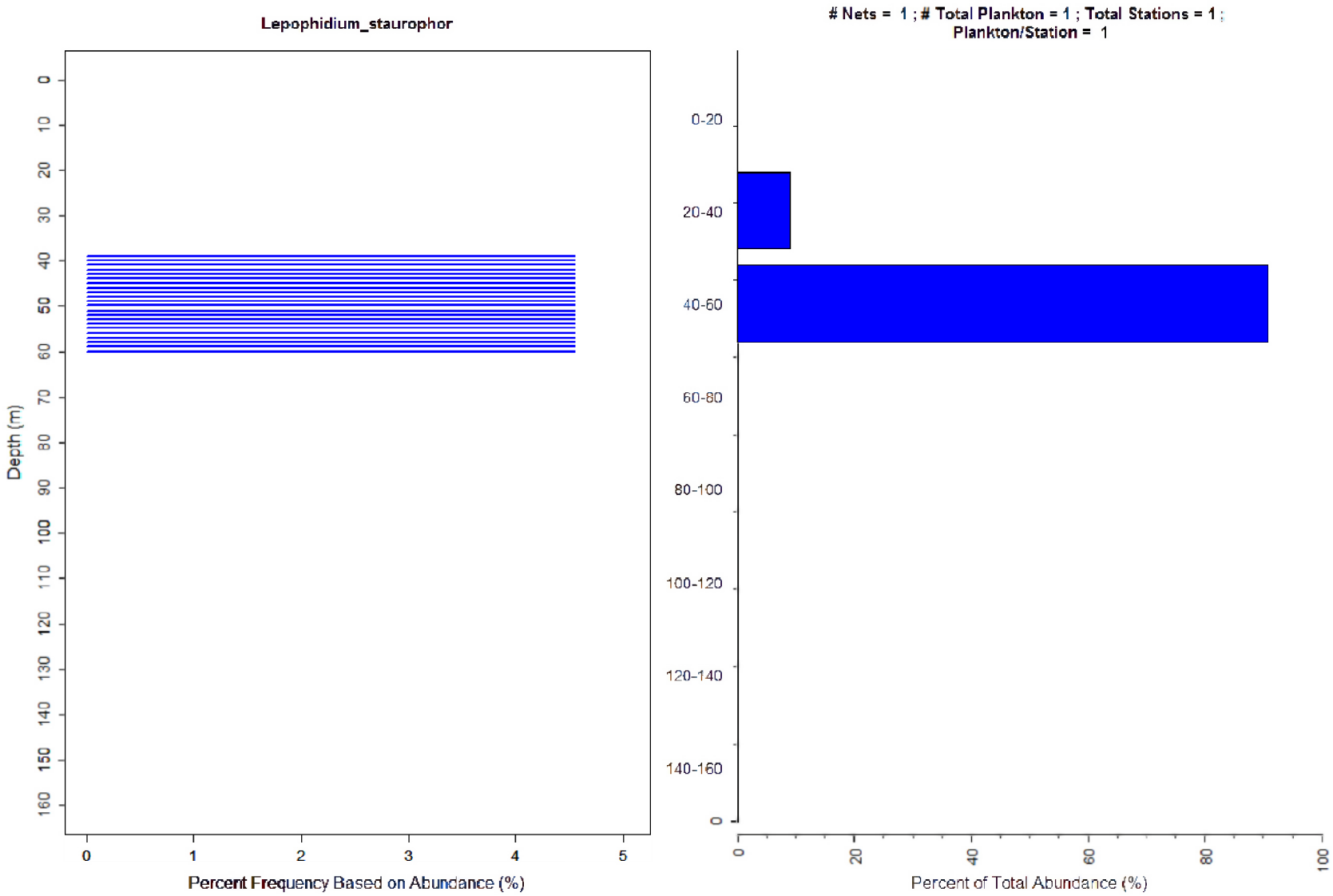
Lepidophanes_gaussi - Shallow



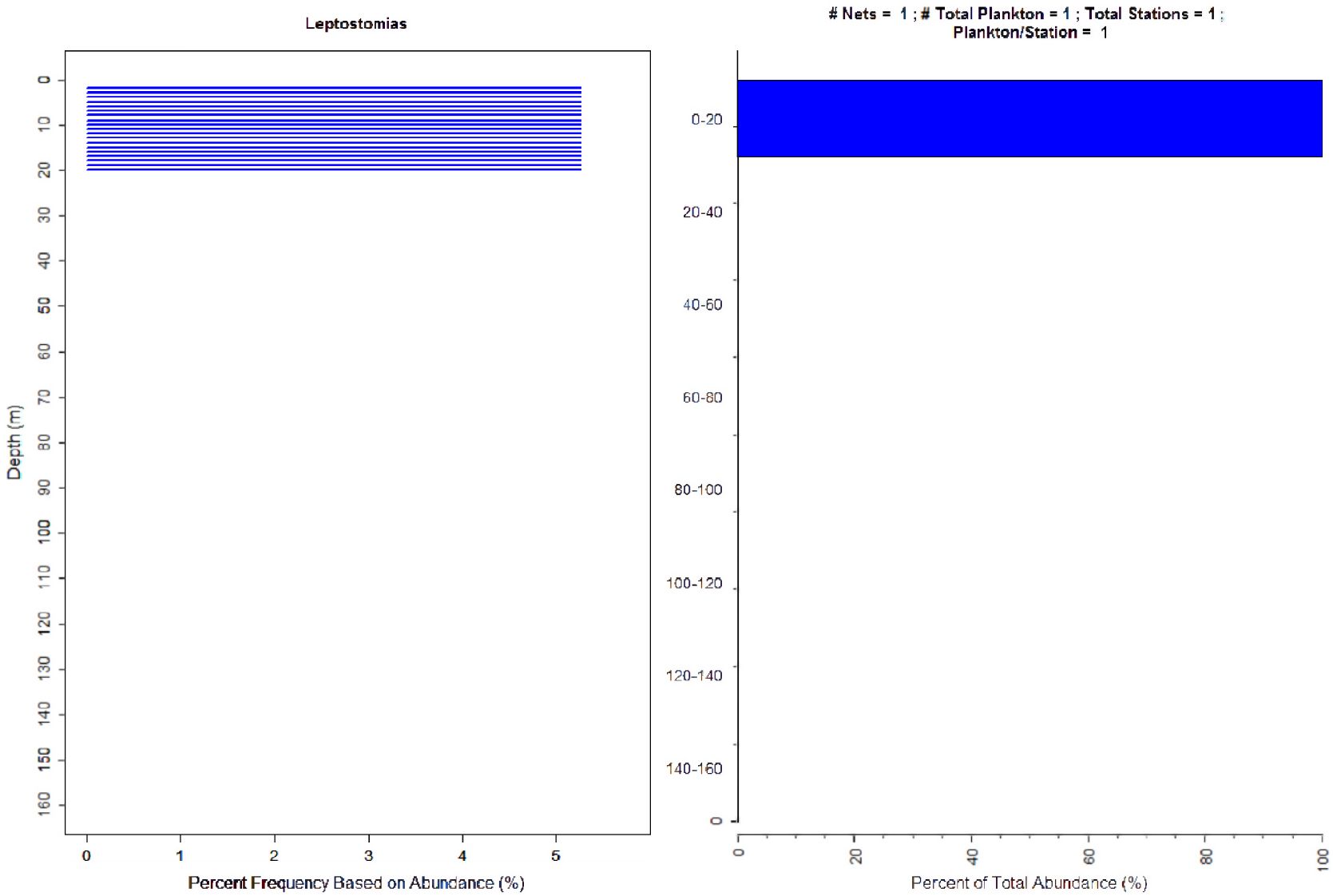
Lepidophanes_guentheri - Shallow



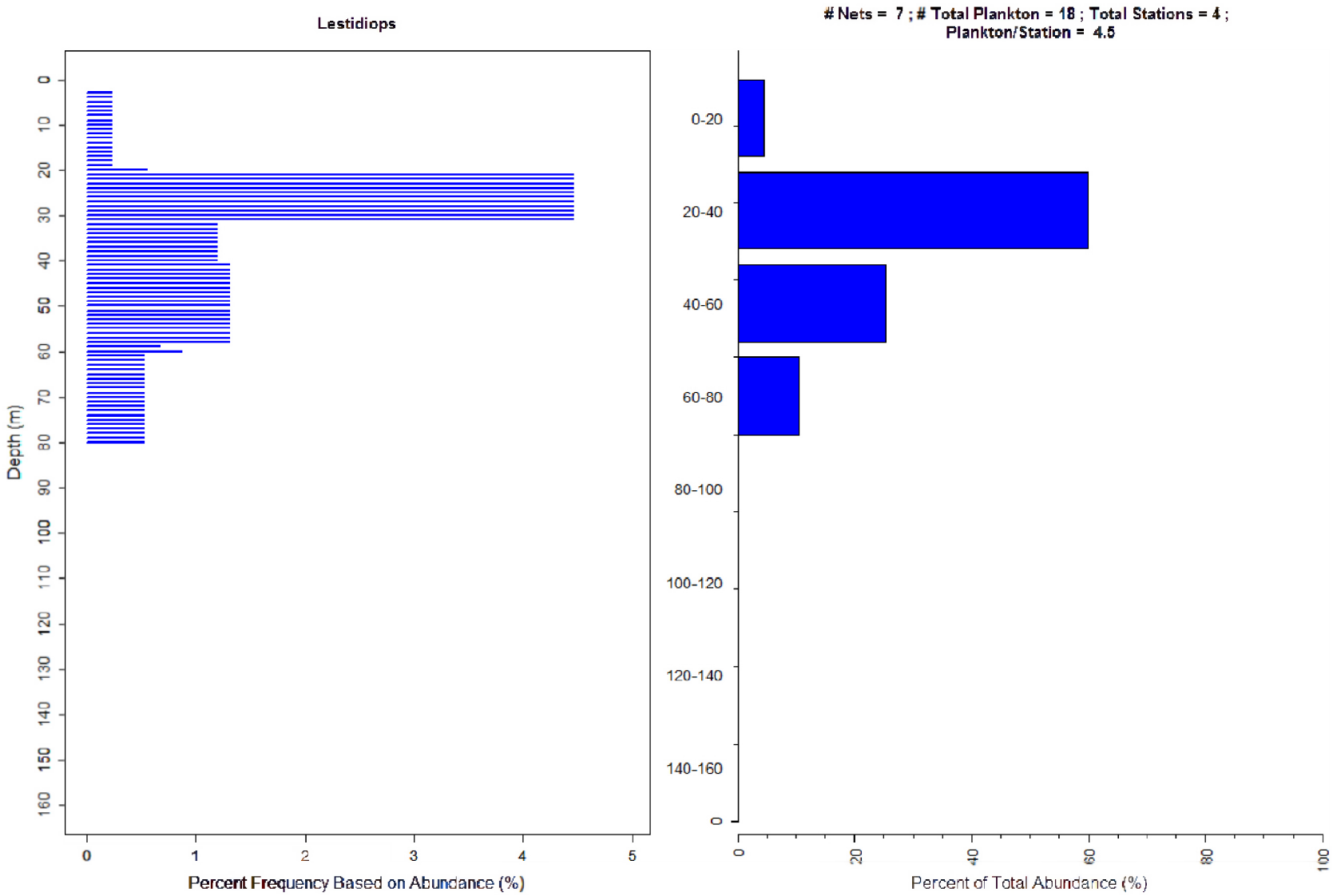
Lepophidium - Shallow



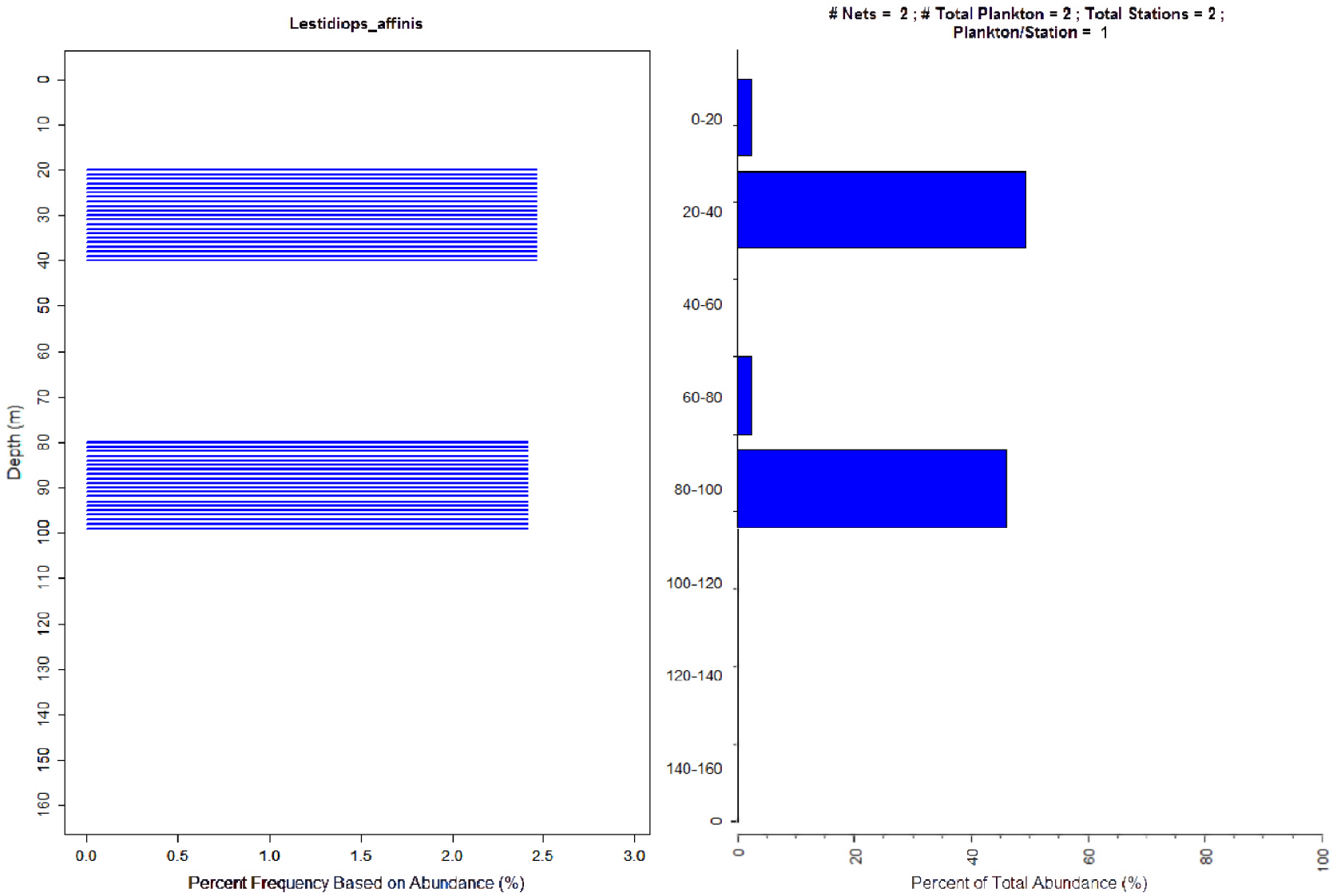
Lepophidium_staurophor - Shallow



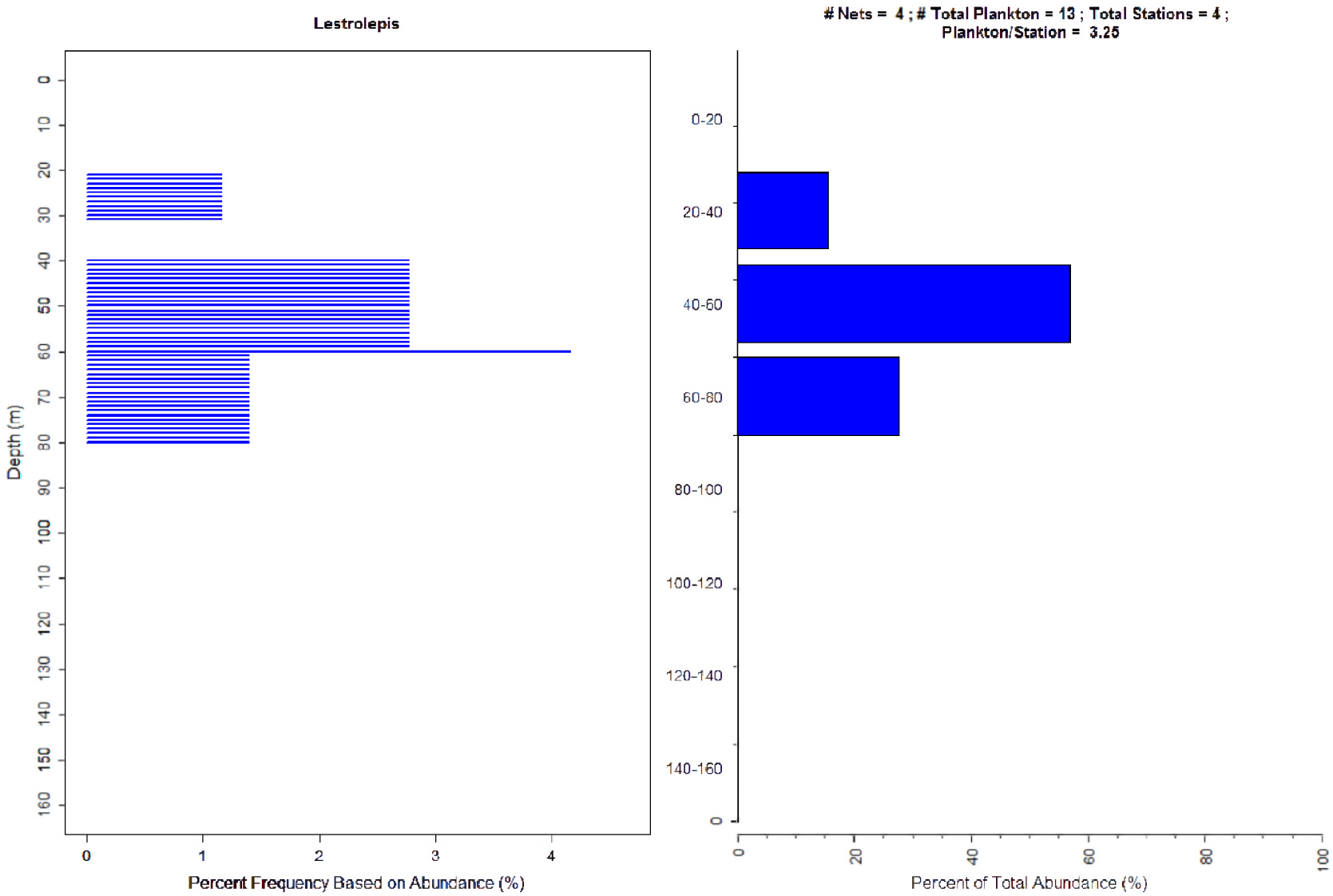
Leptostomias - Shallow



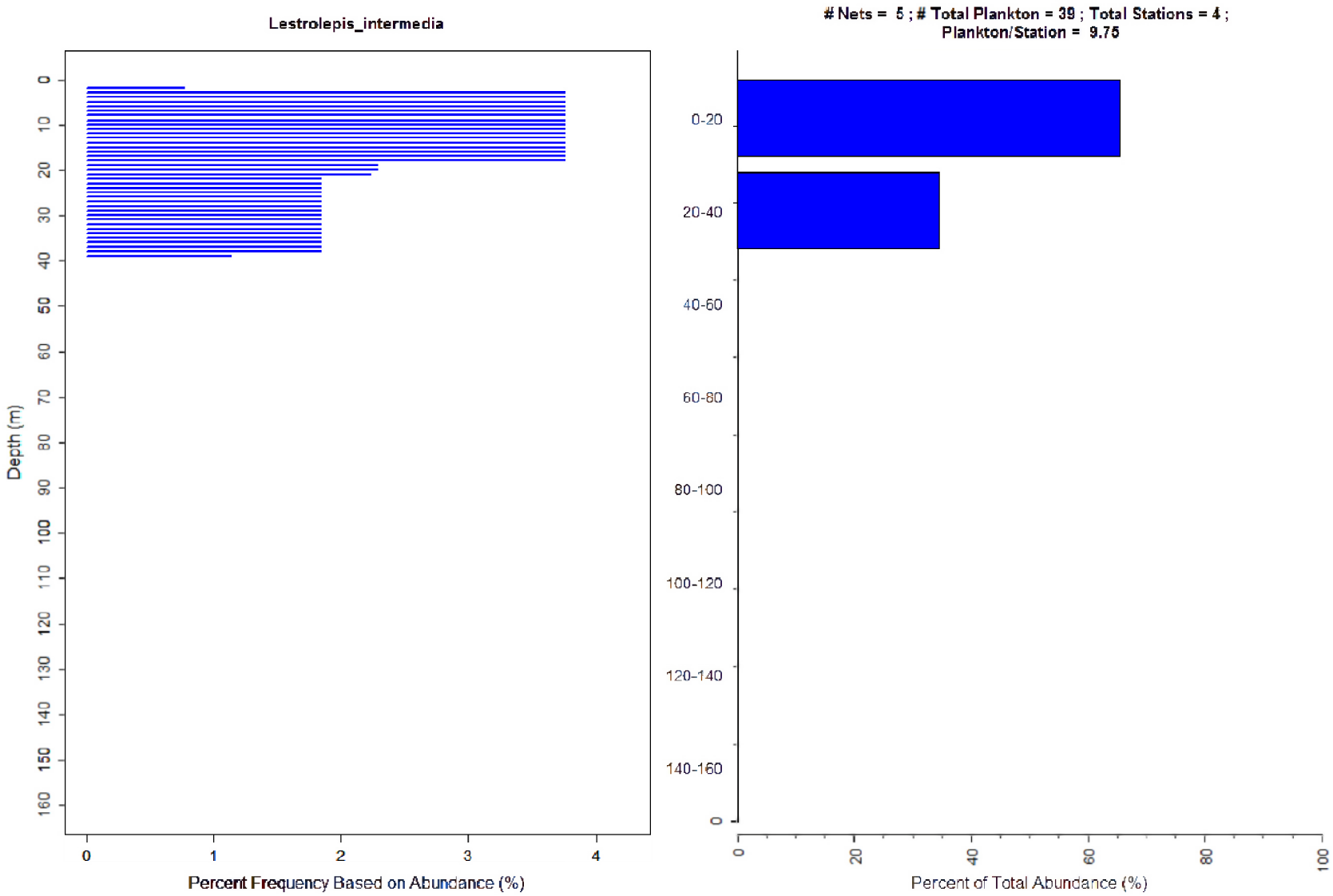
Lestidiops - Shallow



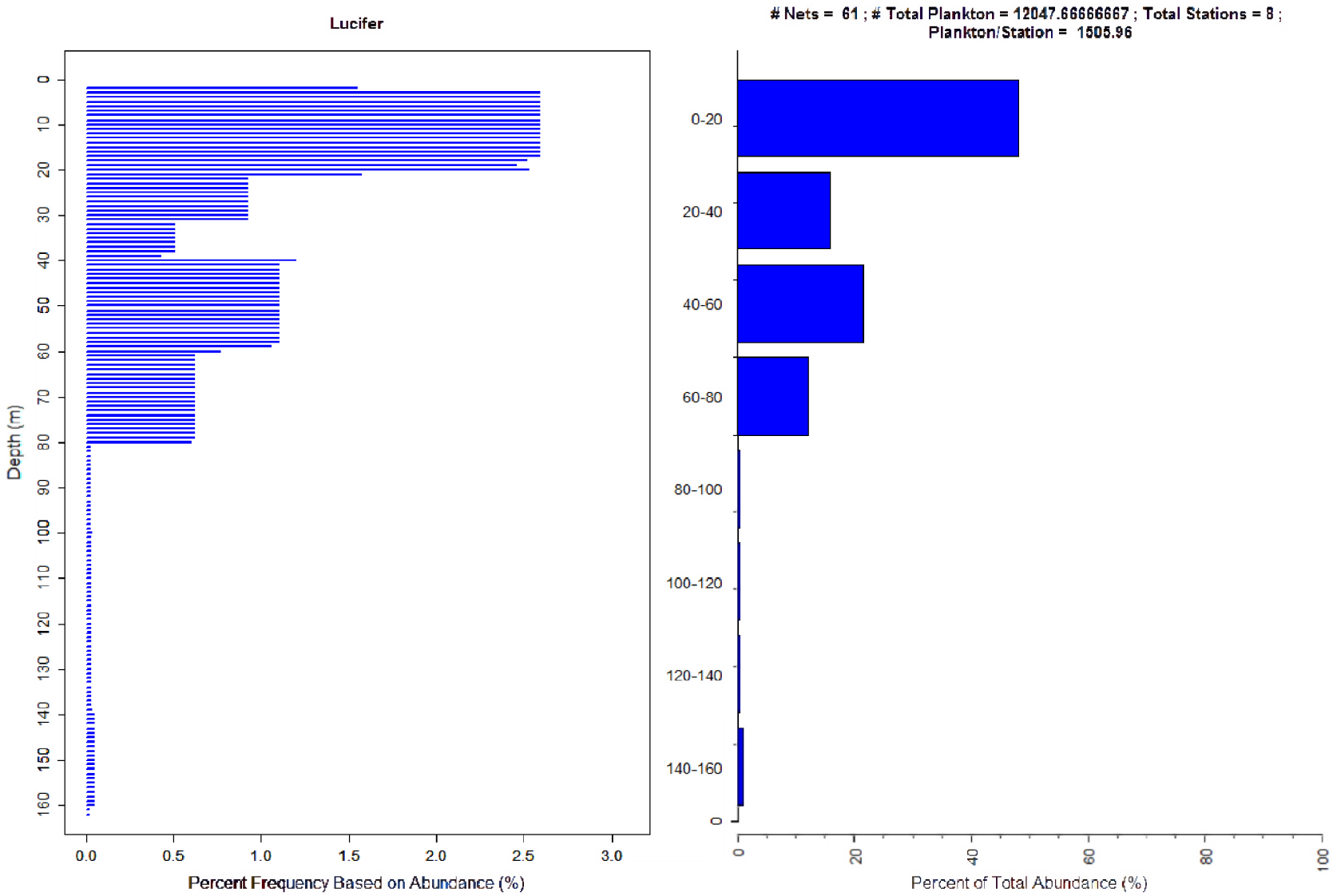
Lestidiops_affinis - Shallow



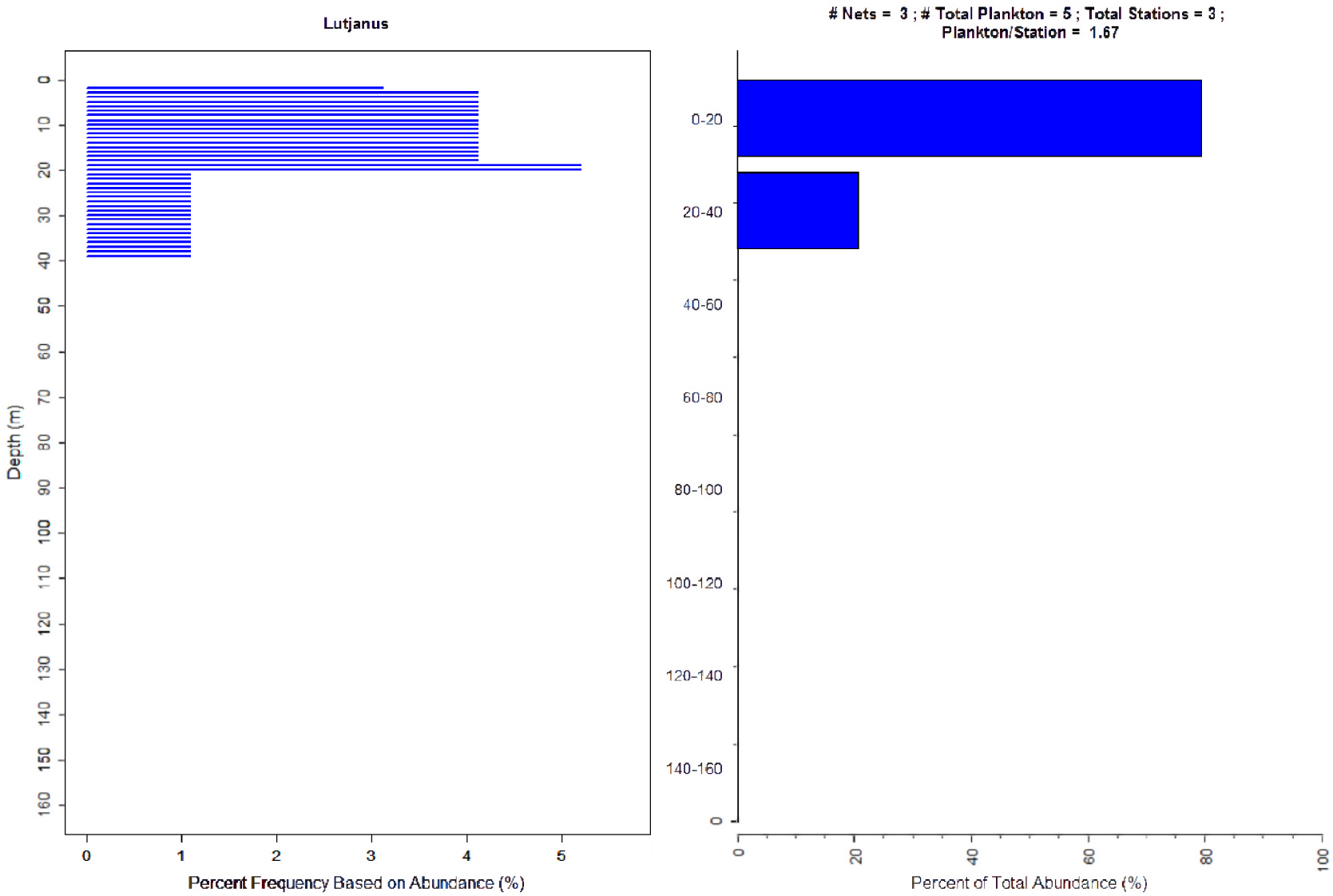
Lestrolepis - Shallow



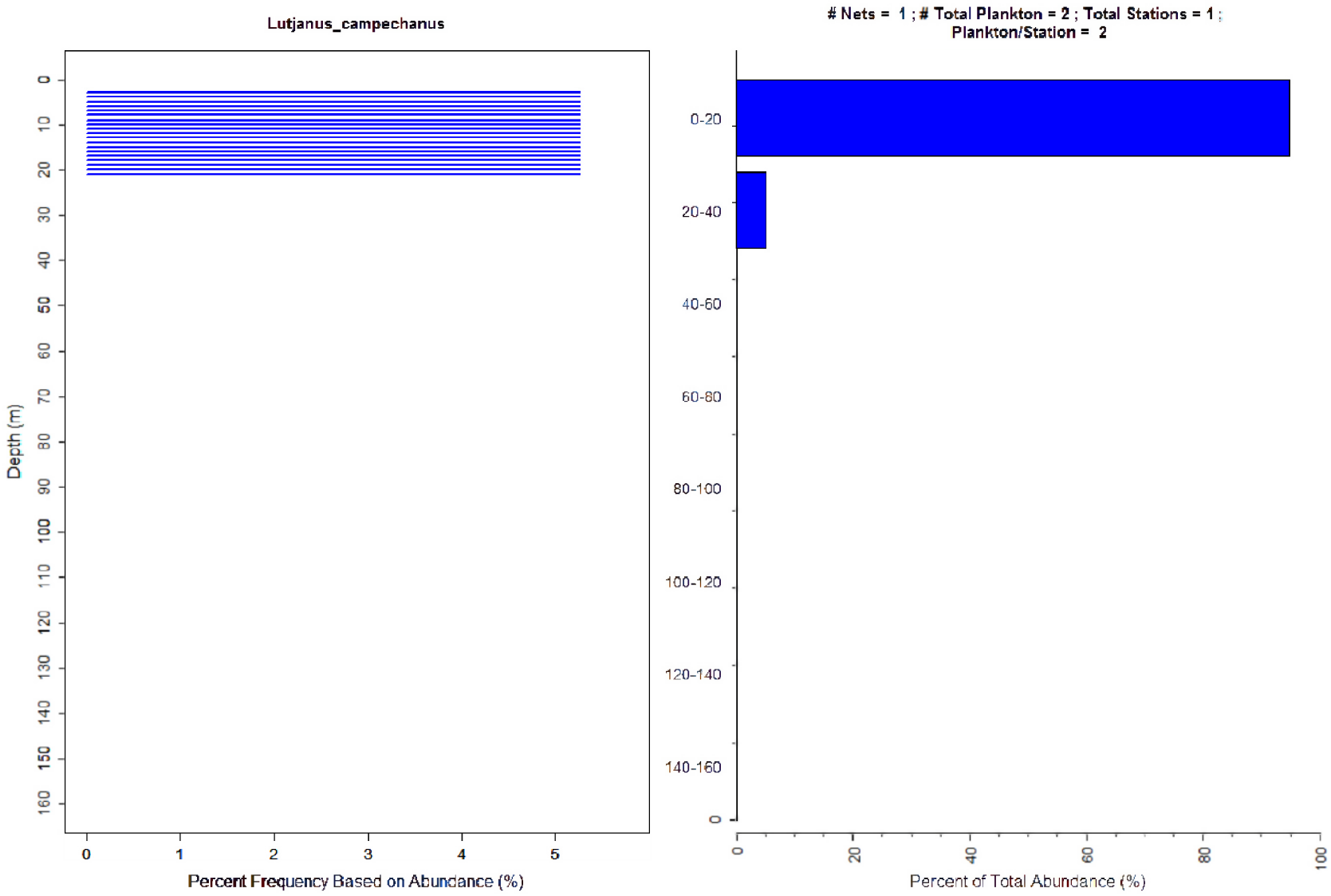
Lestrolepis_intermedia - Shallow



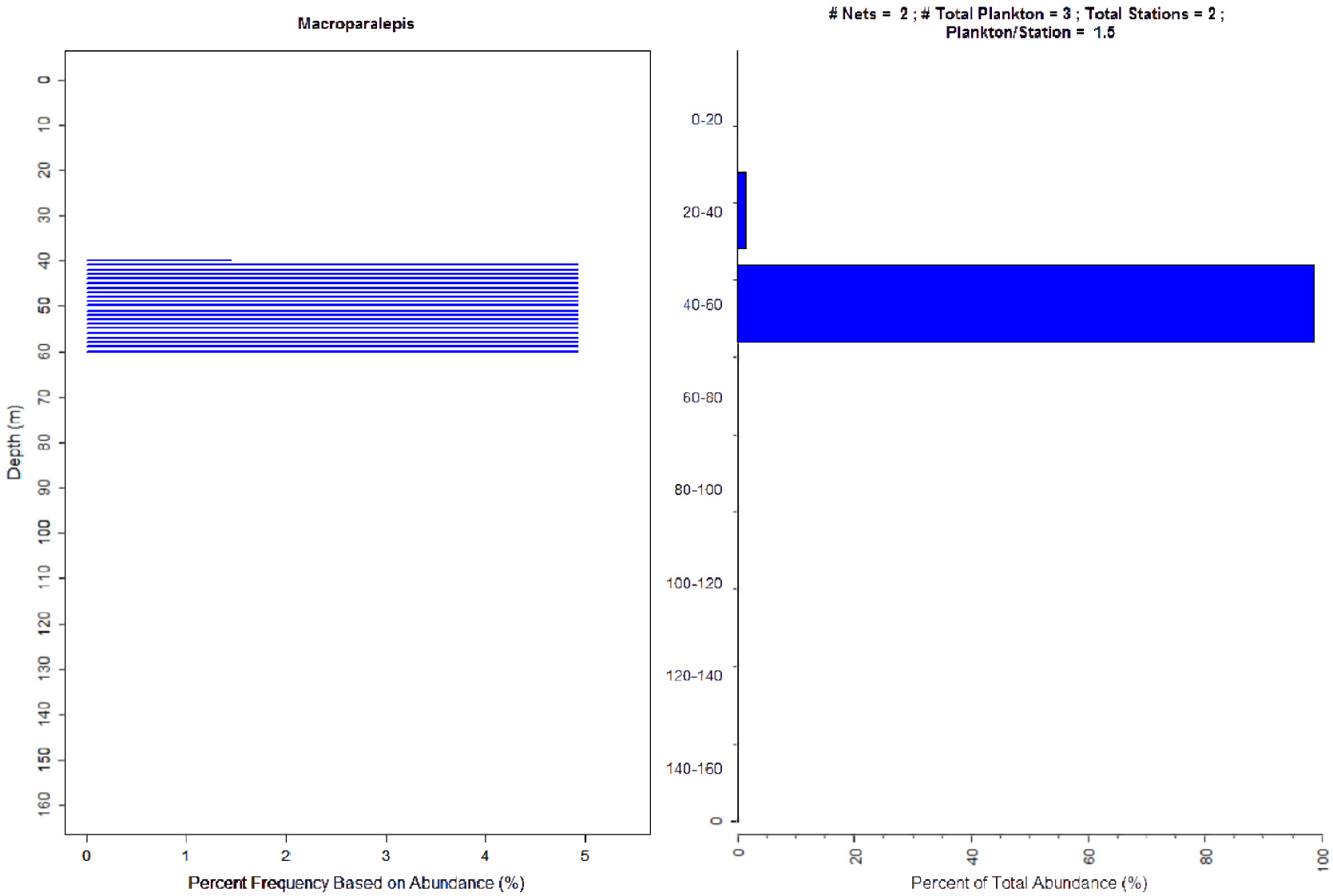
Lucifer - Shallow



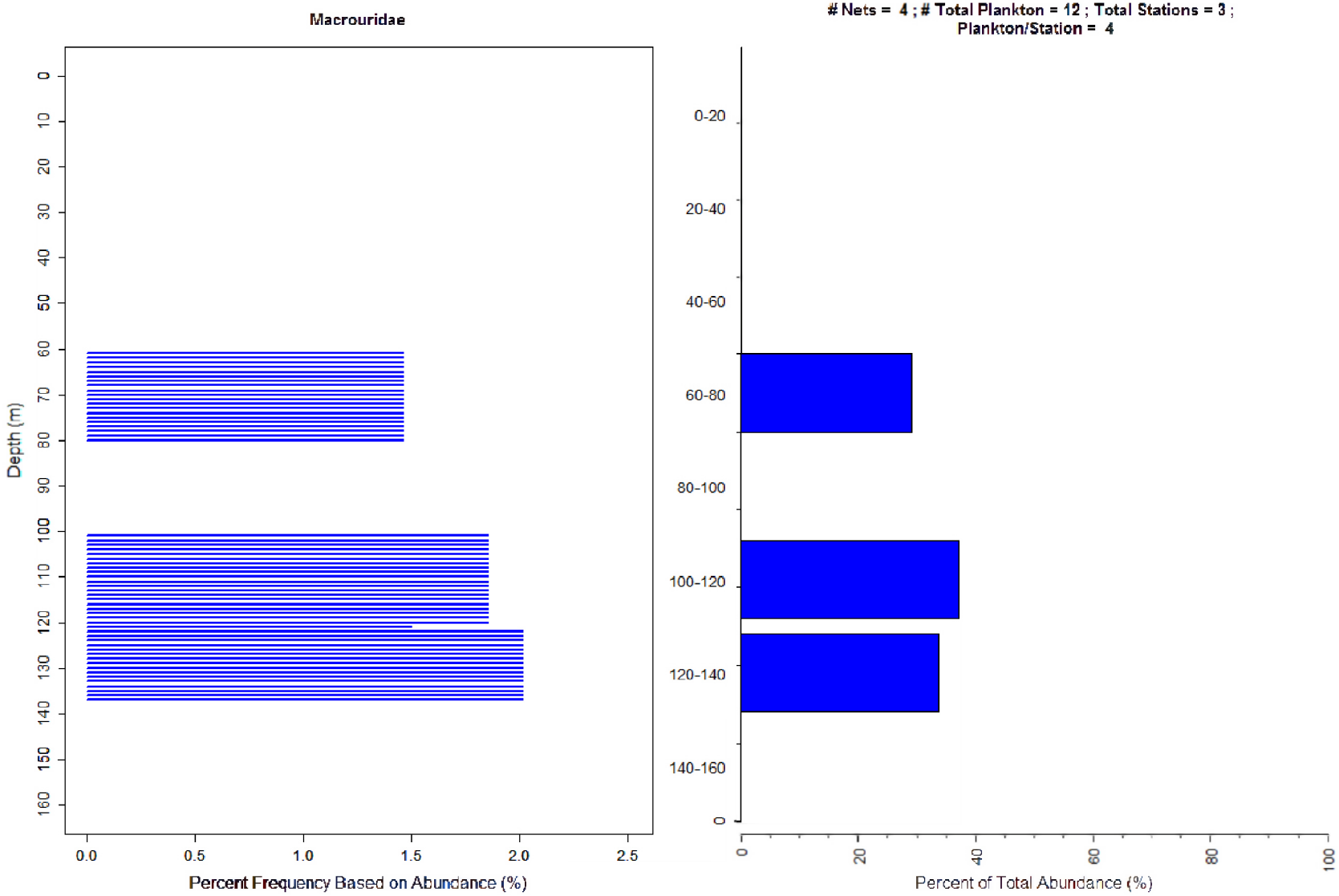
Lutjanus - Shallow



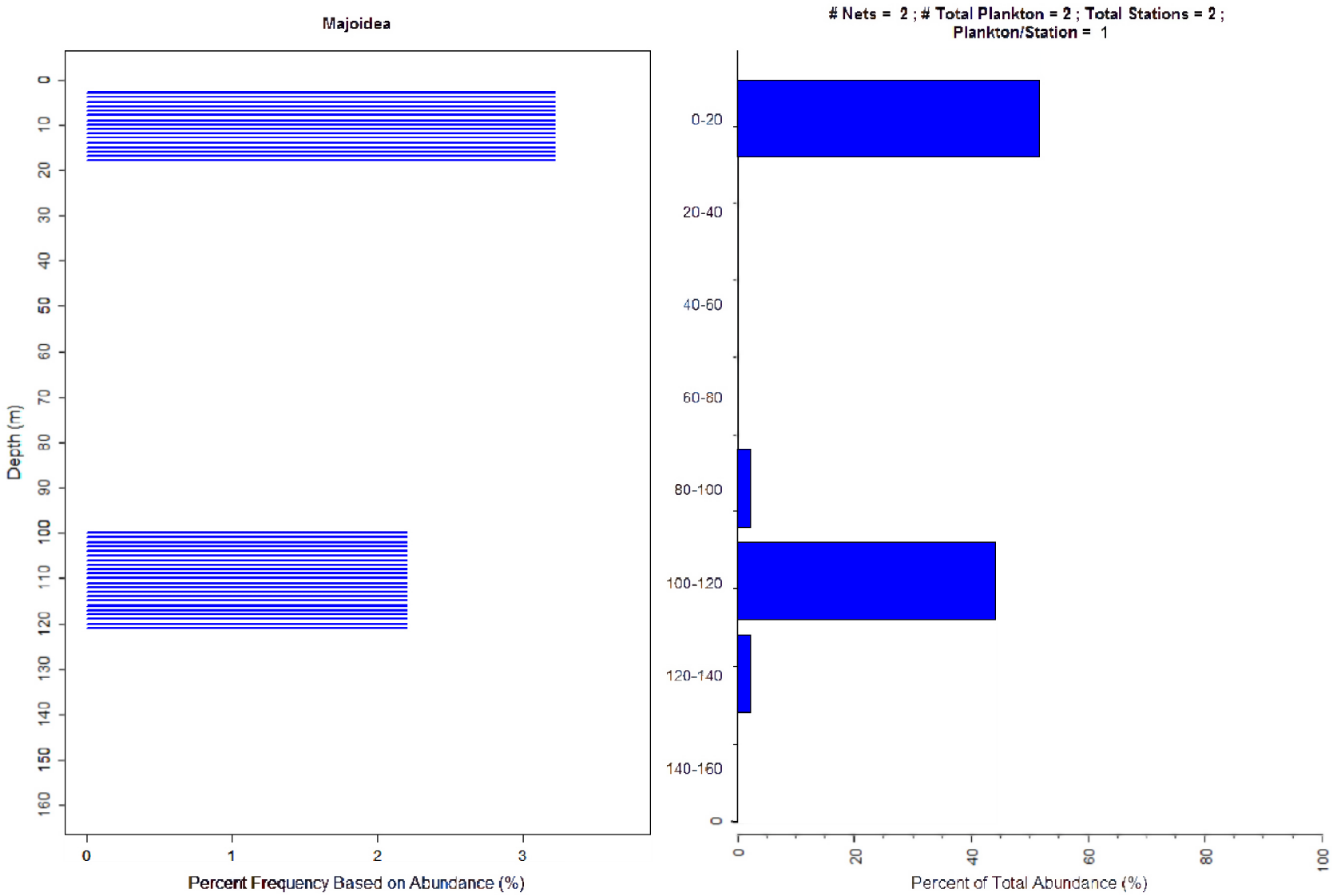
Lutjanus_campechanus - Shallow



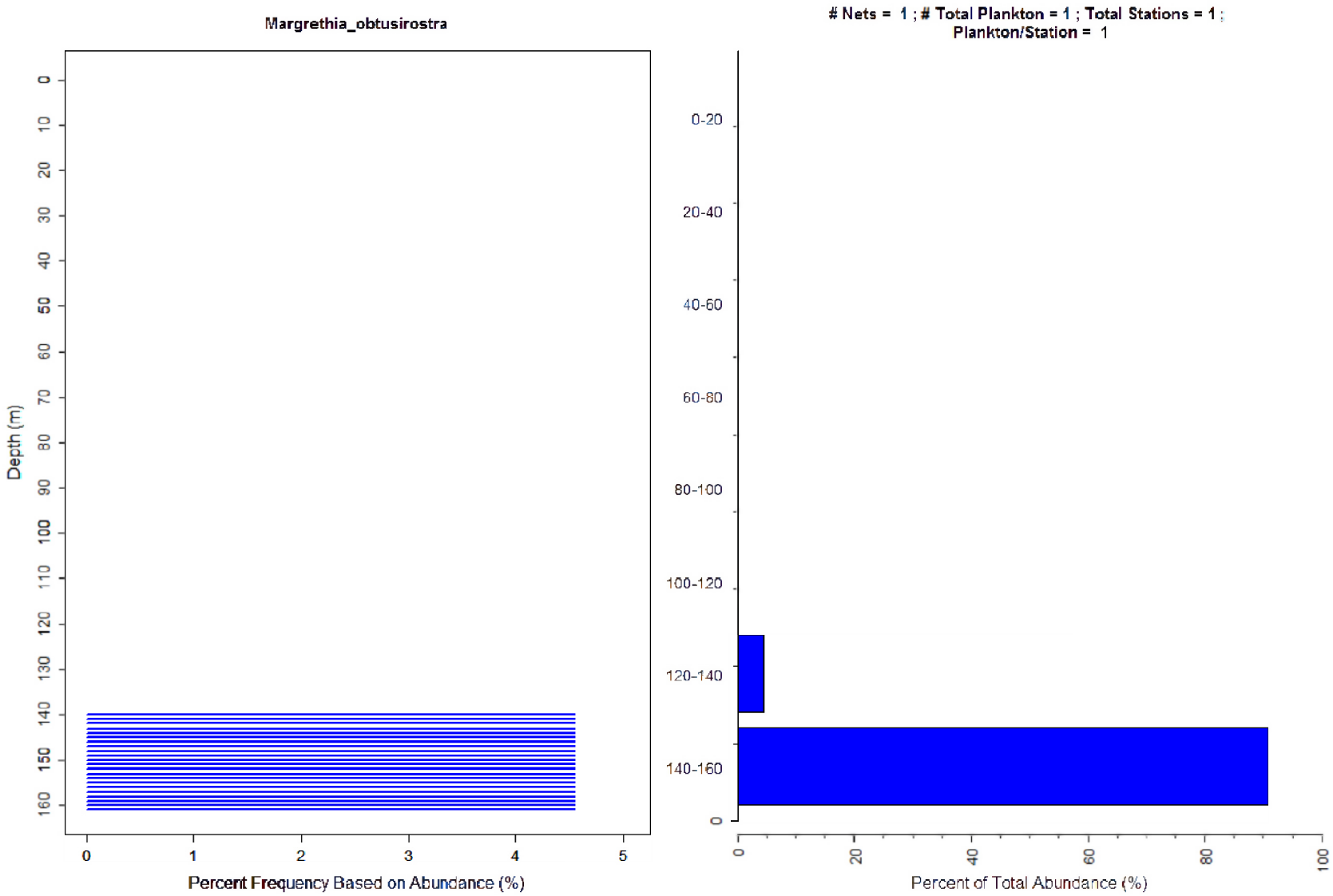
Macroparalepis - Shallow



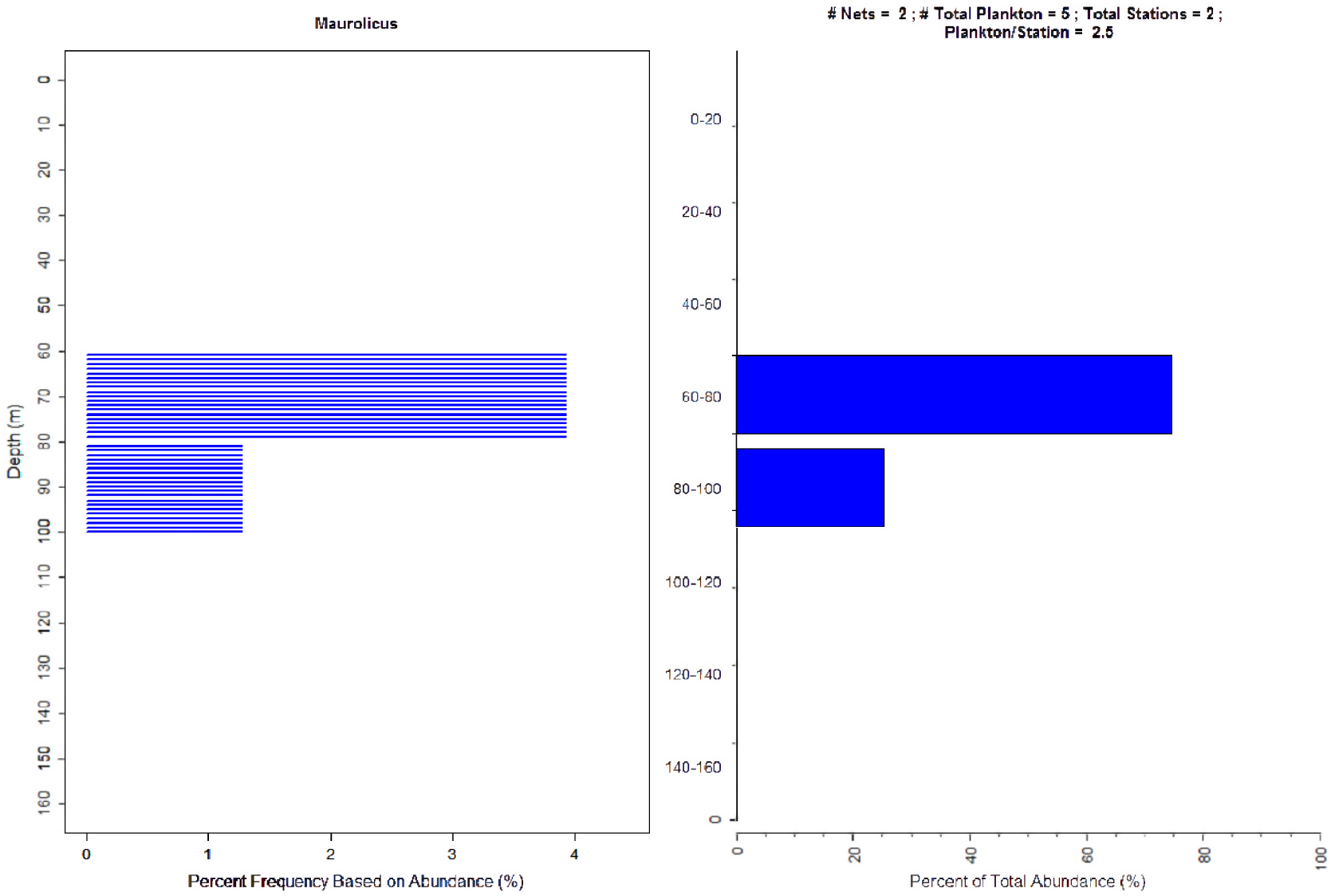
Macrouridae - Shallow



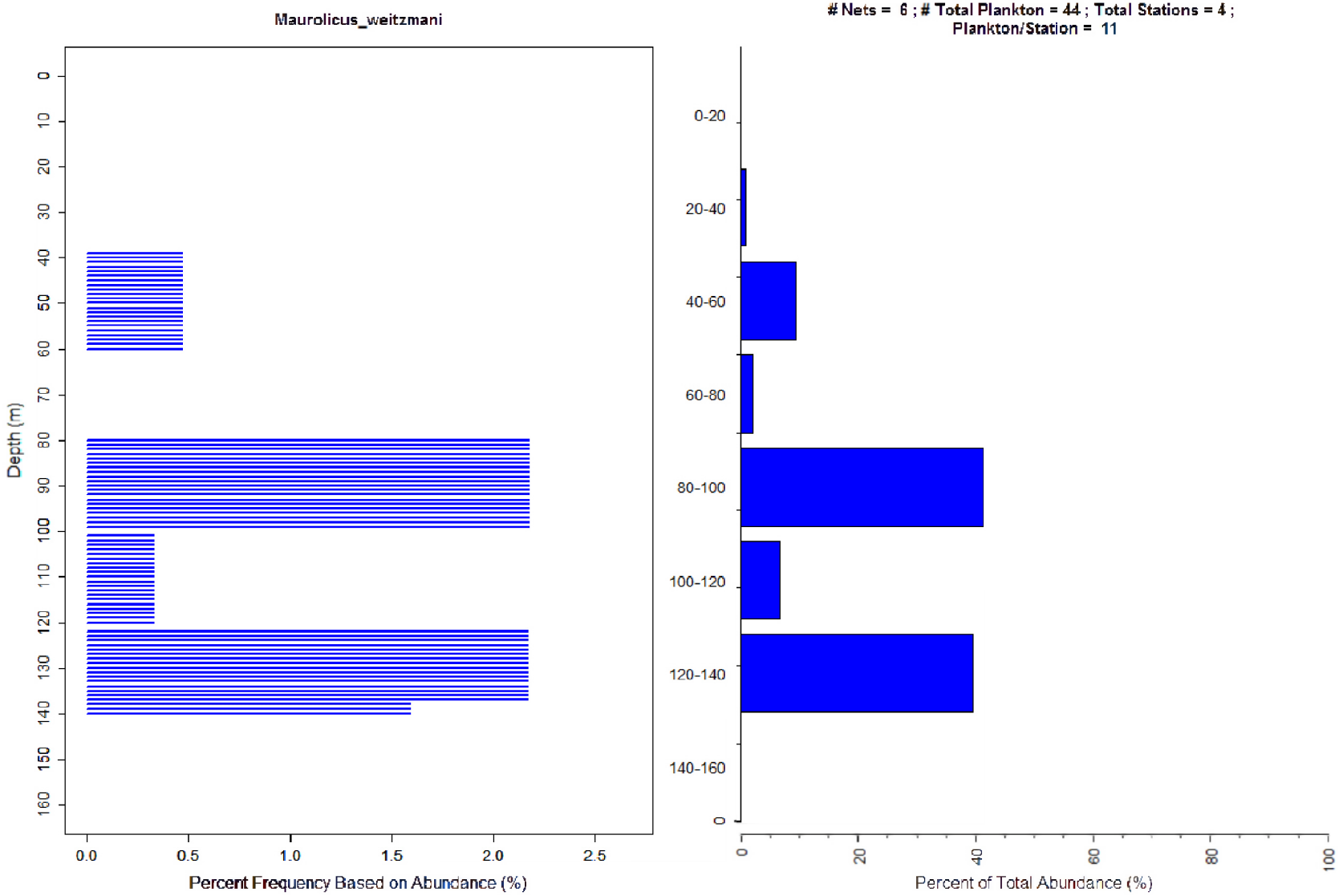
Majoidea - Shallow



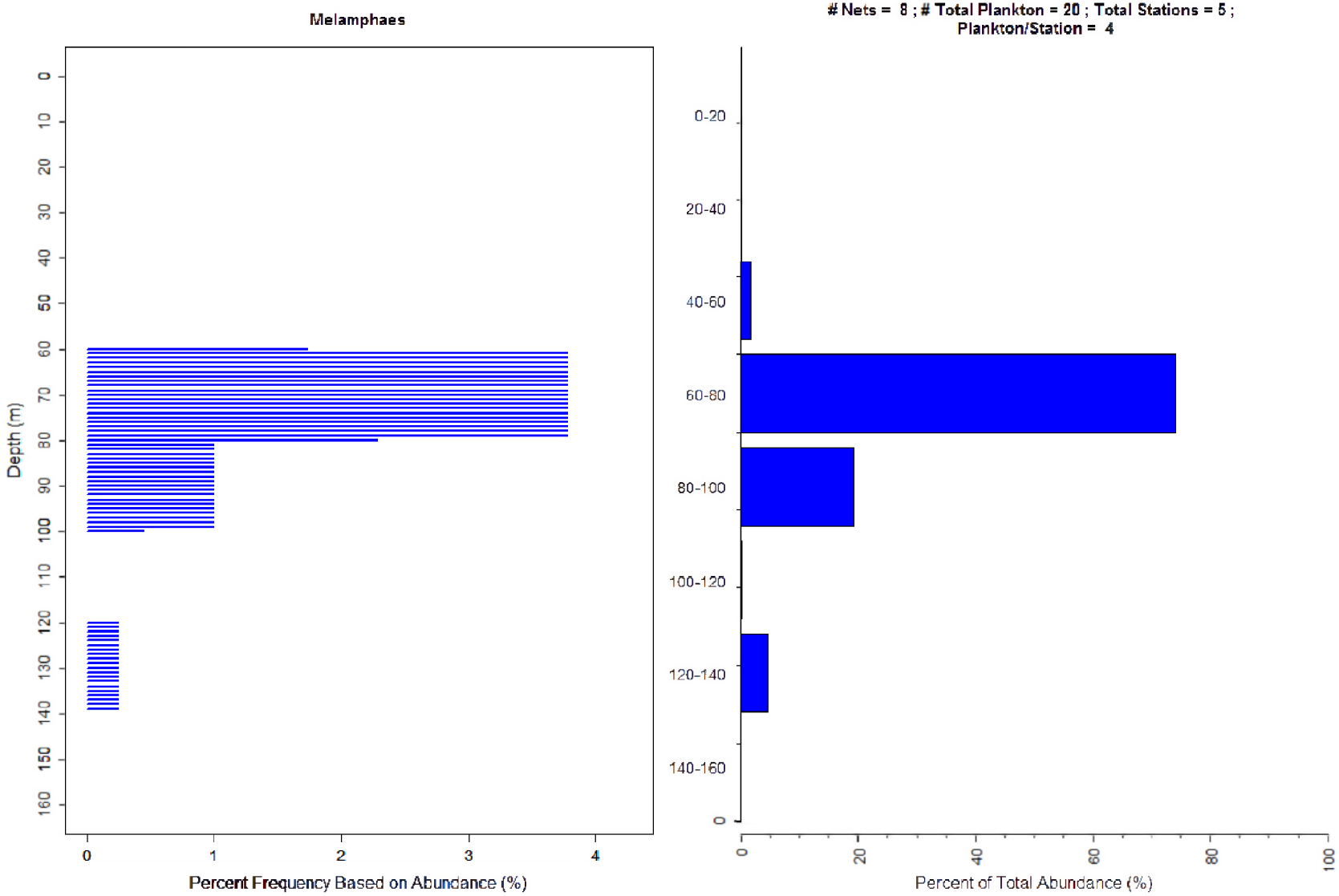
Margrethia_obtusirostra - Shallow



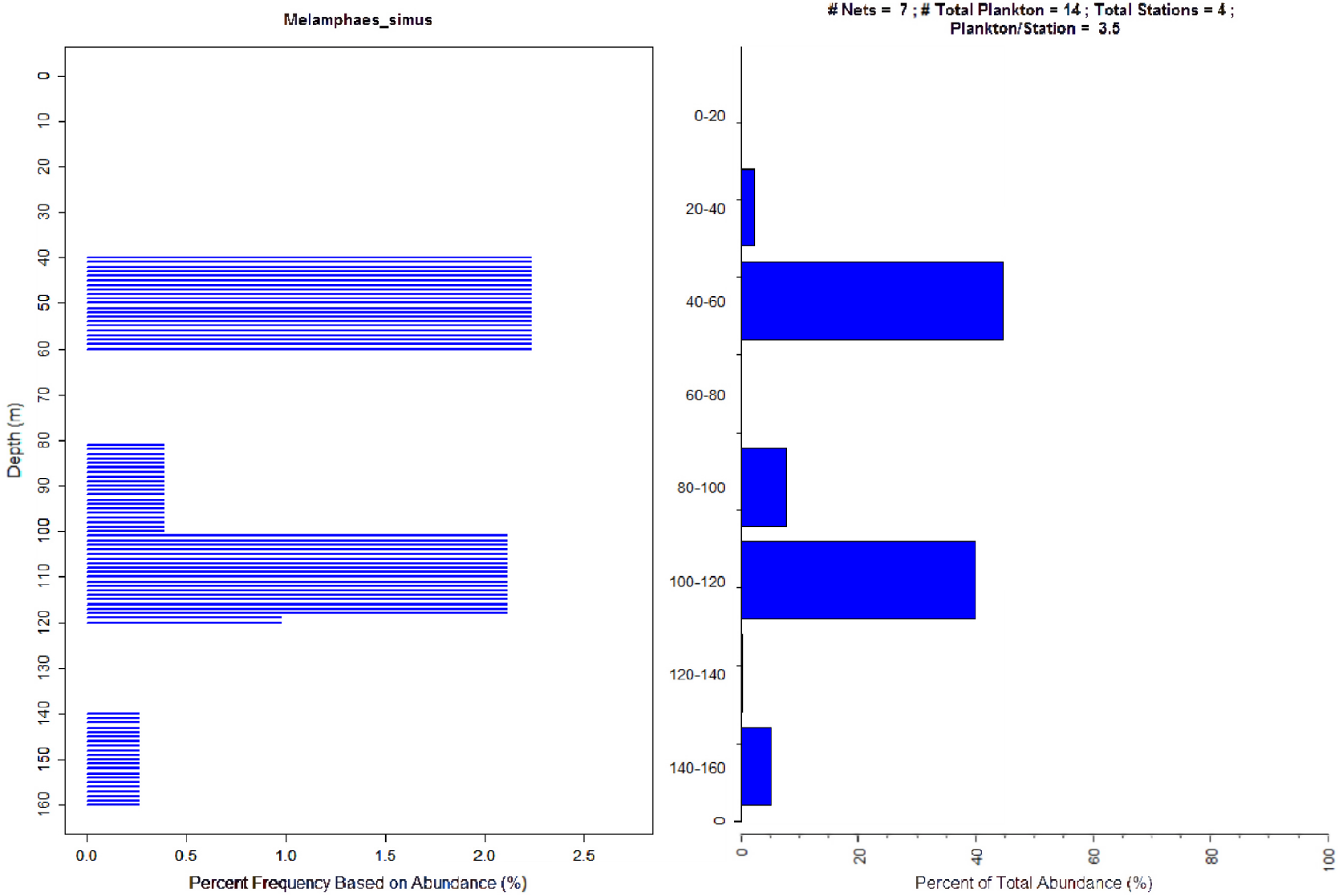
Maurolicus - Shallow



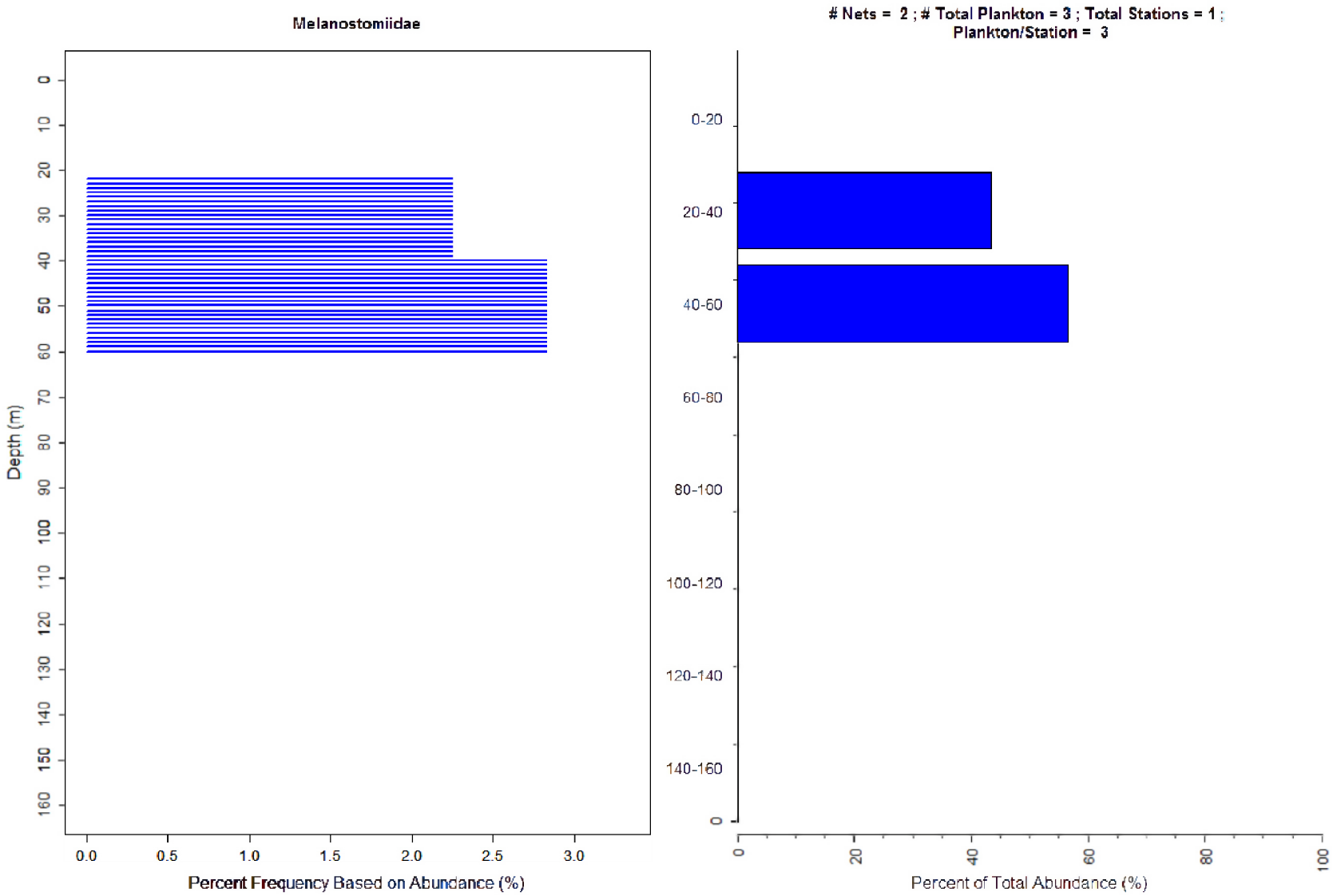
Maurolicus_weitzmani - Shallow



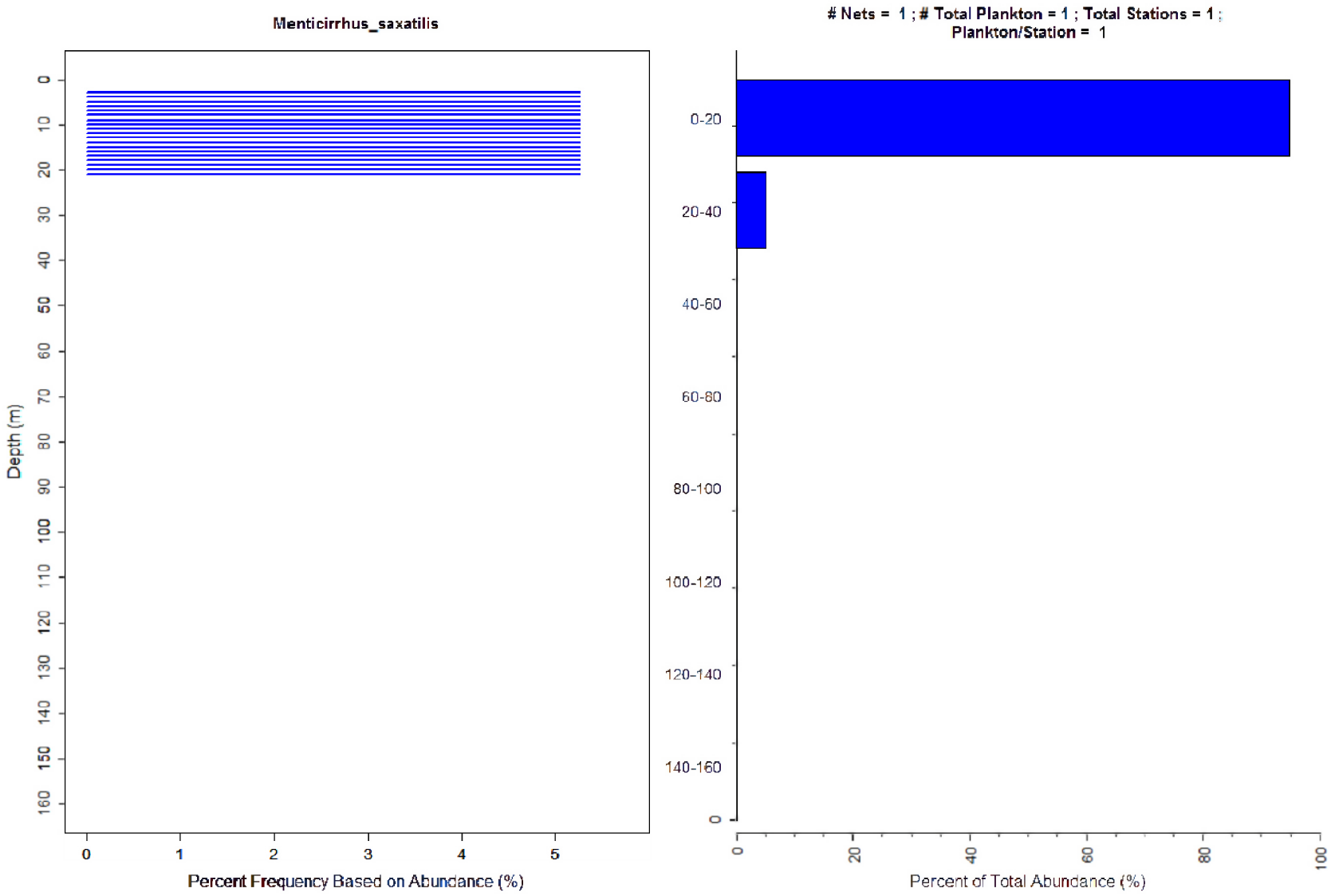
Melamphaes - Shallow



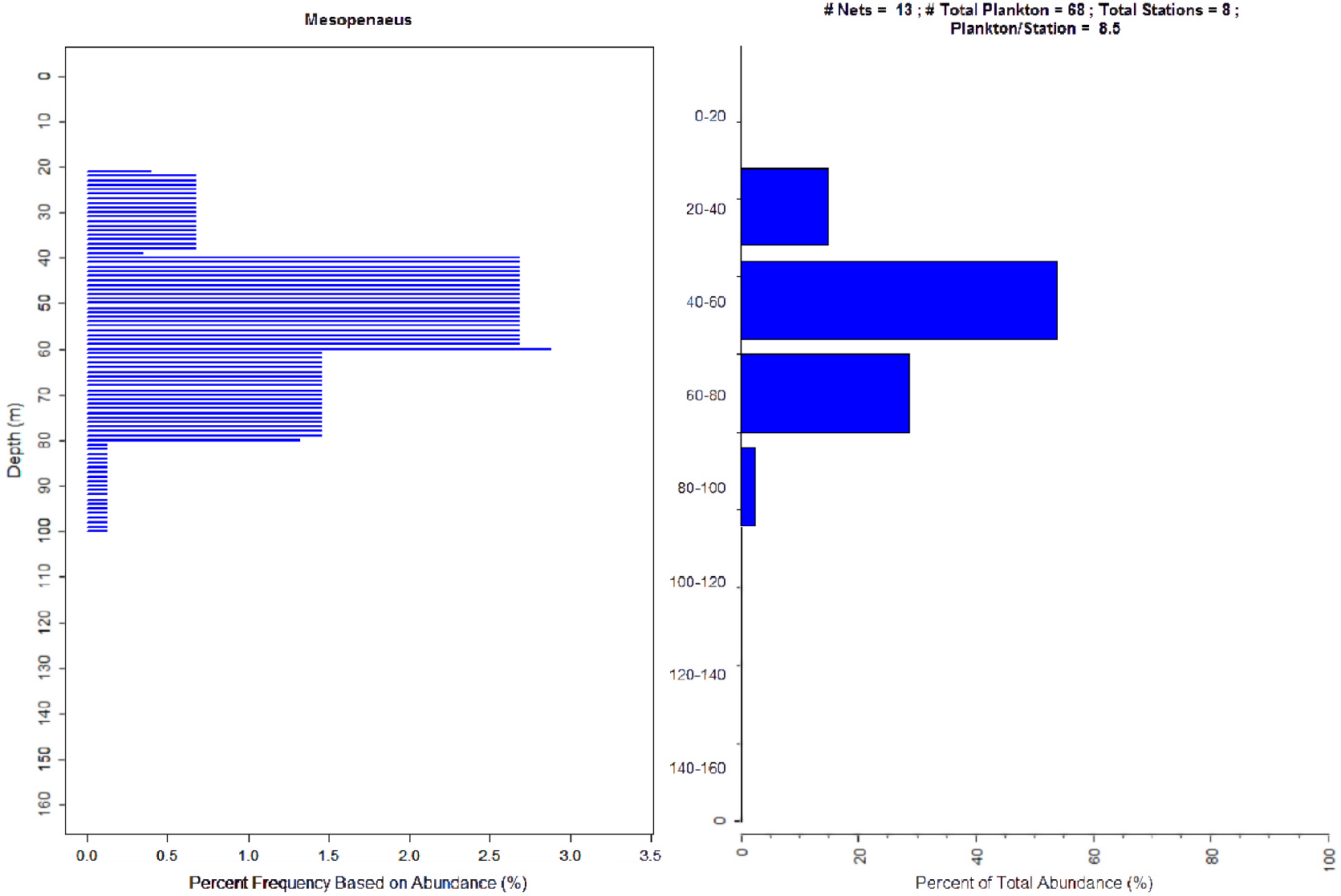
Melamphaes_simus - Shallow



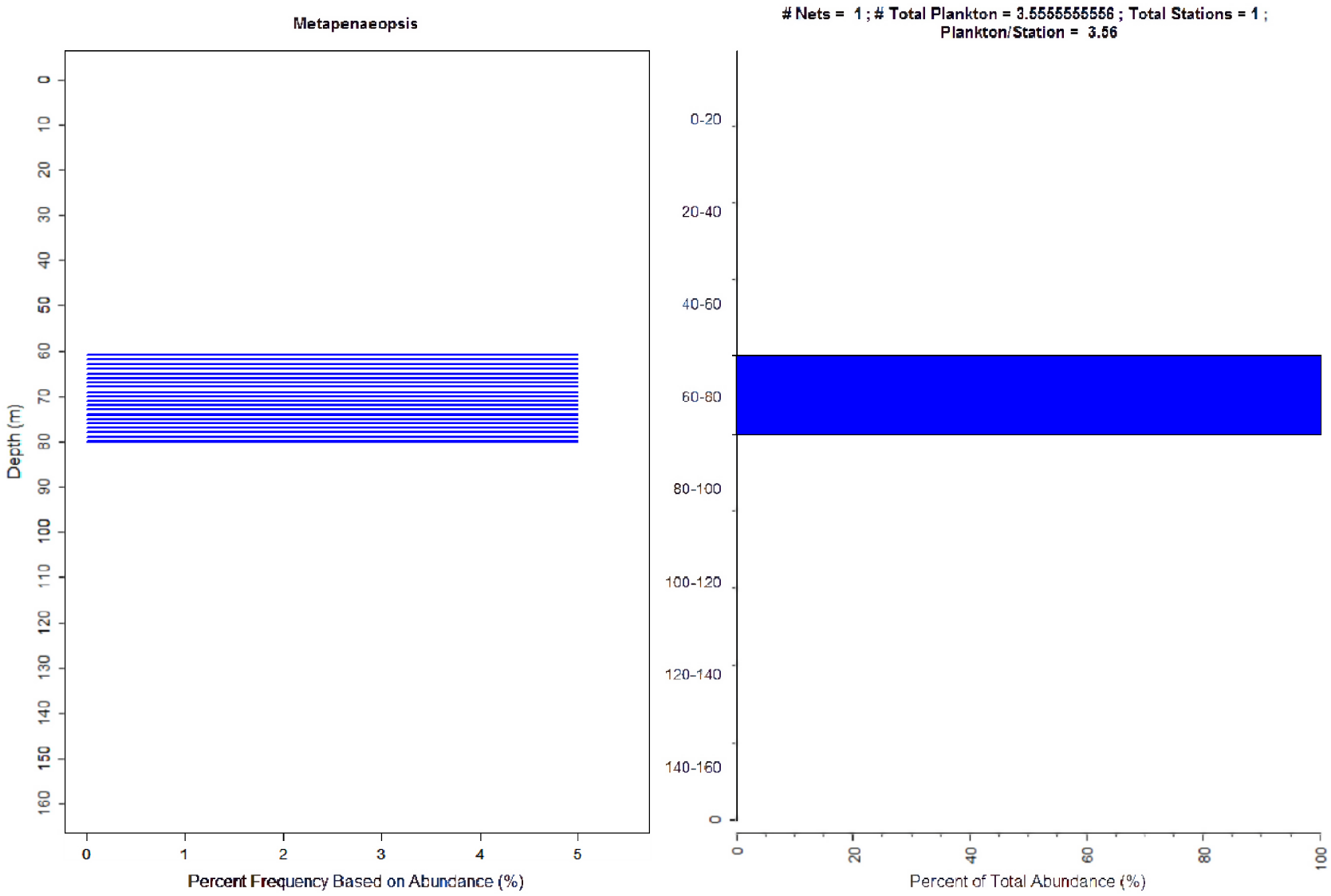
Melanostomiidae - Shallow



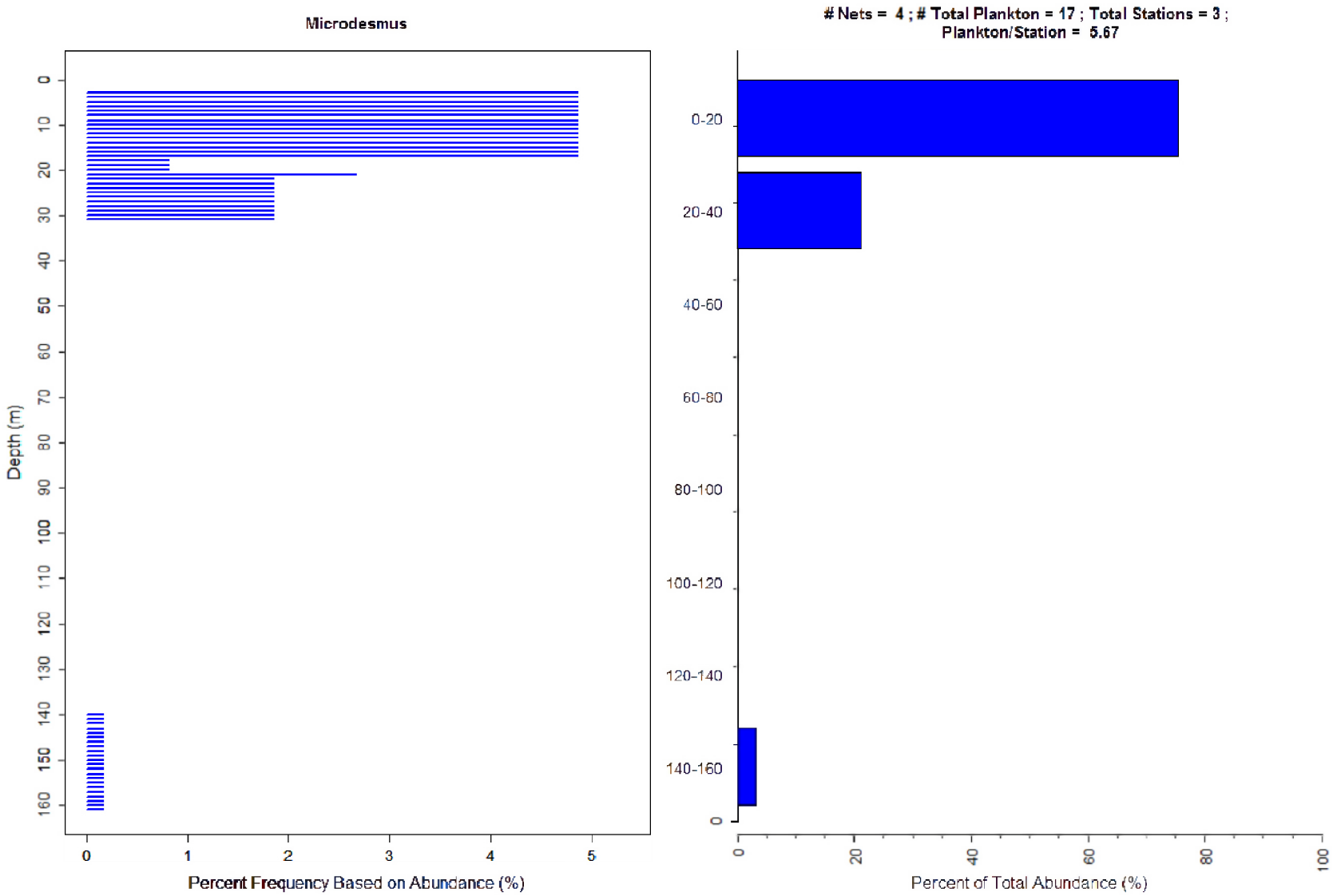
Menticirrhus_saxatilis - Shallow



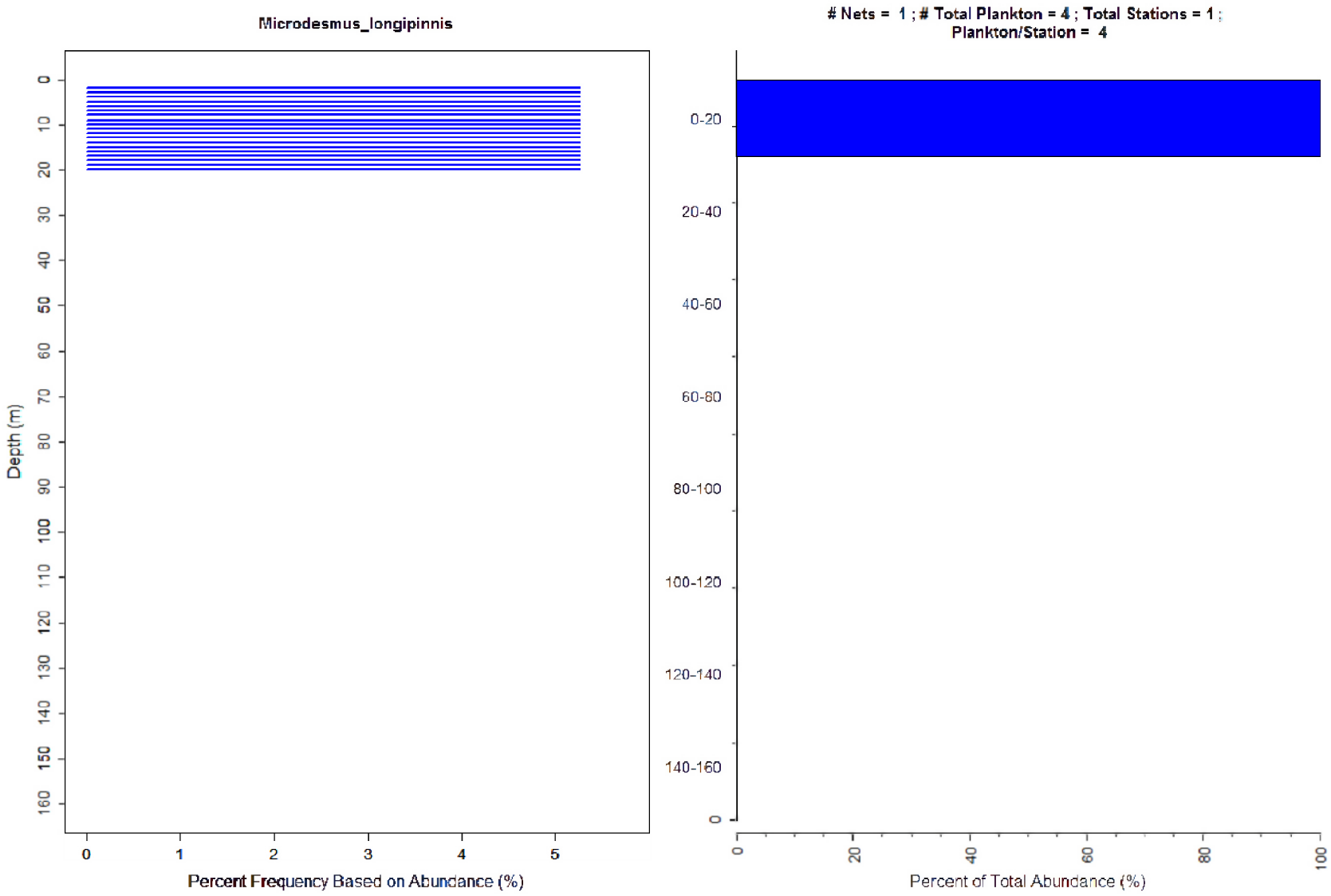
Mesopenaeus - Shallow



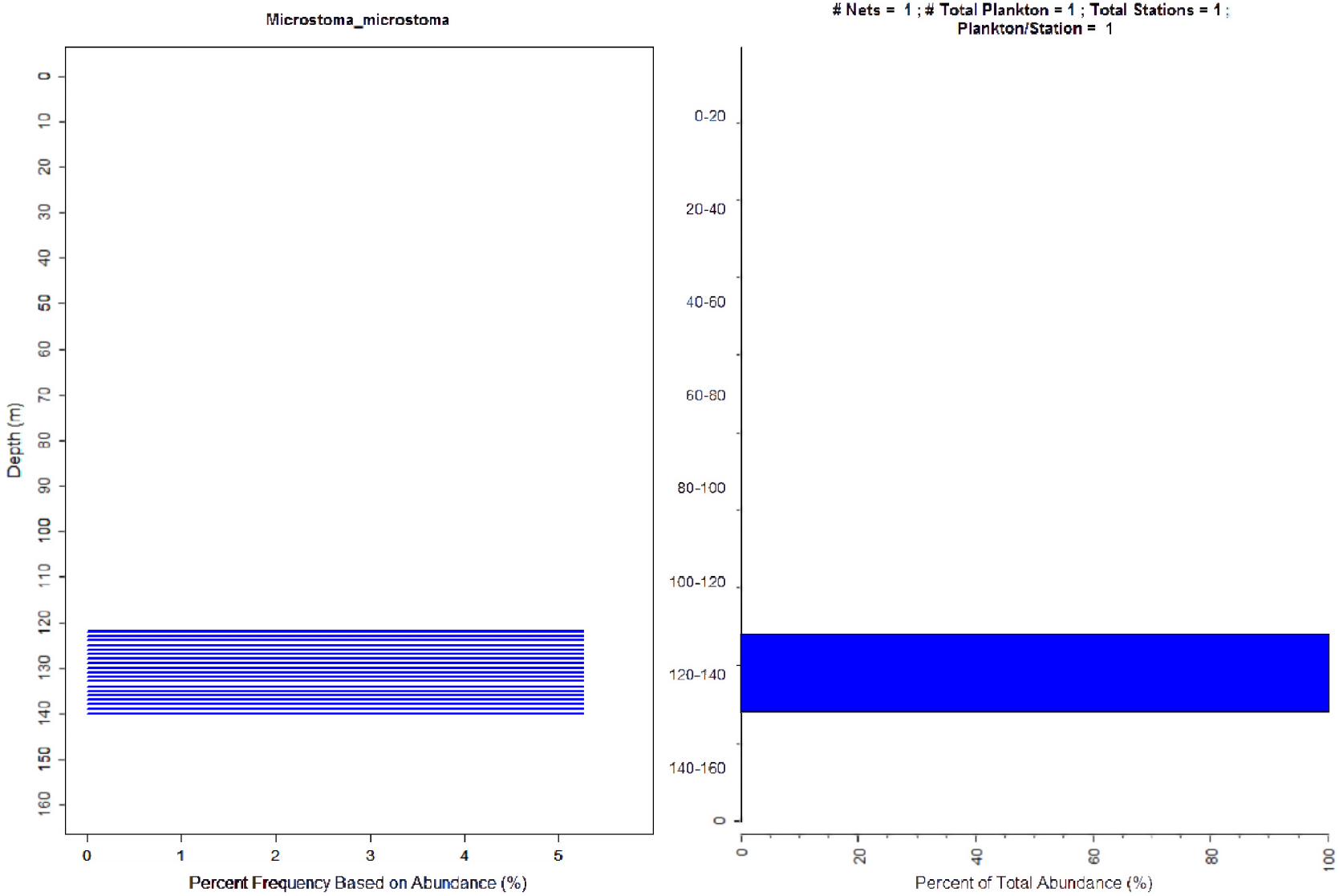
Metapenaeopsis - Shallow



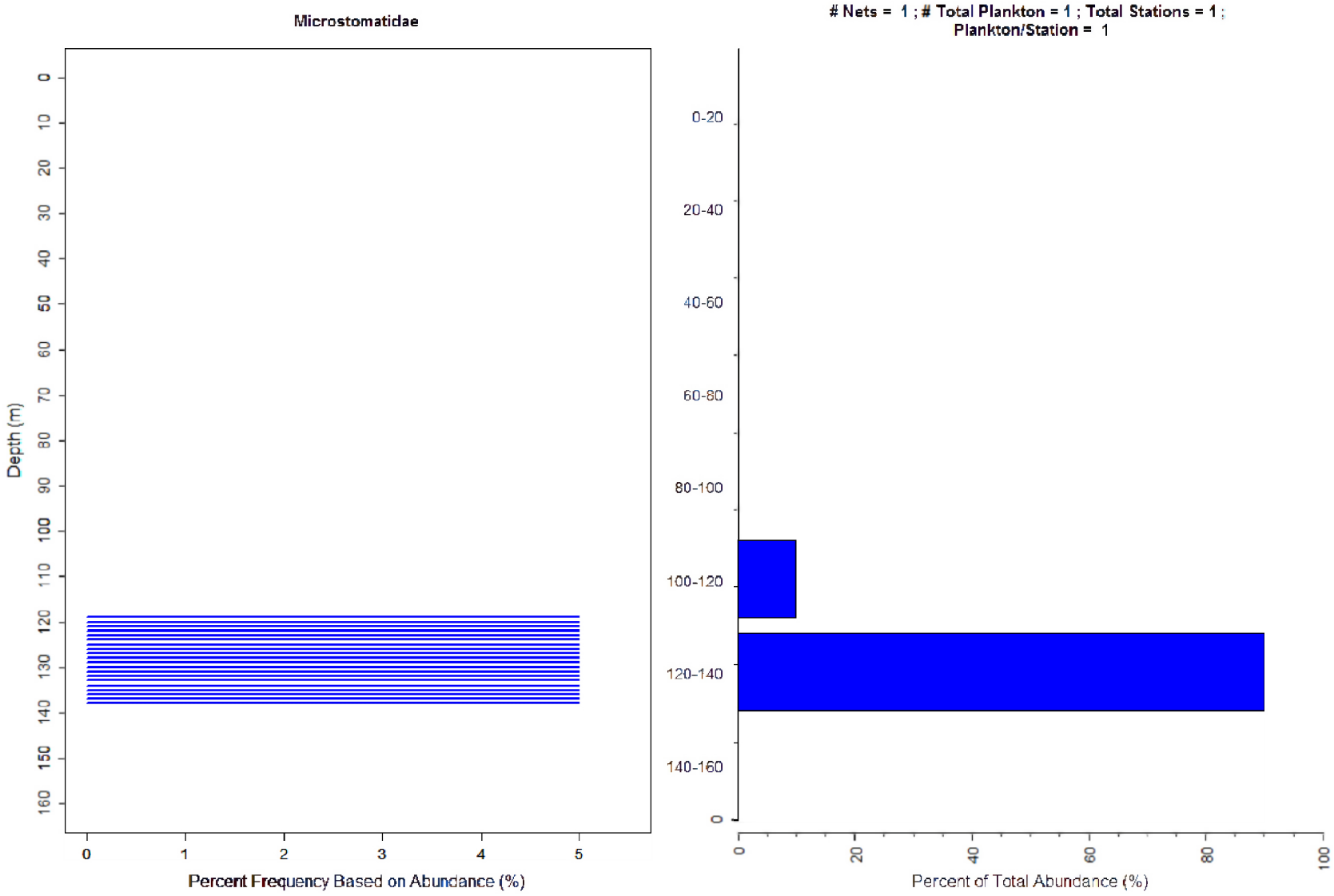
Microdesmus - Shallow



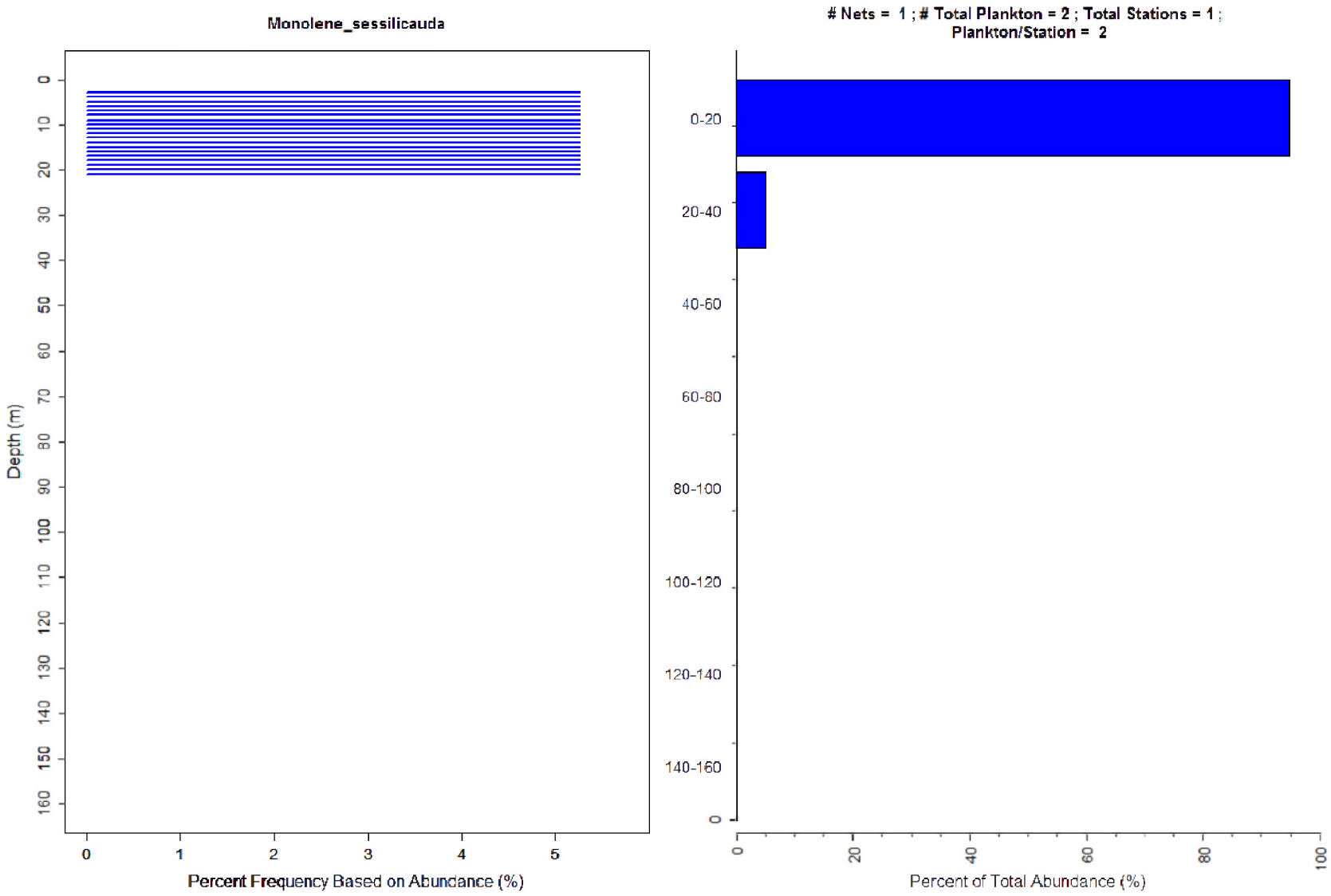
Microdesmus_longipinnis - Shallow



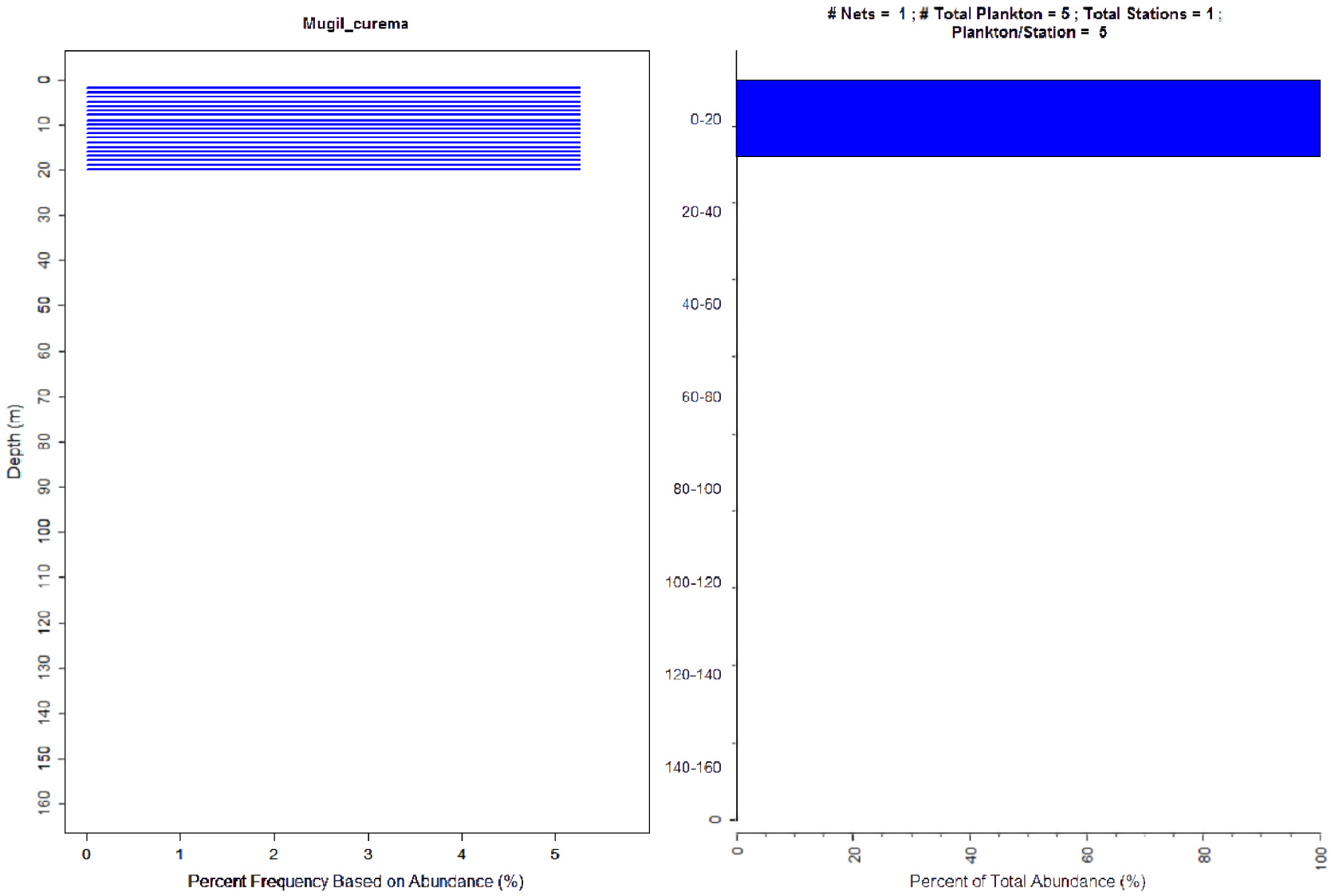
Microstoma_microstoma - Shallow



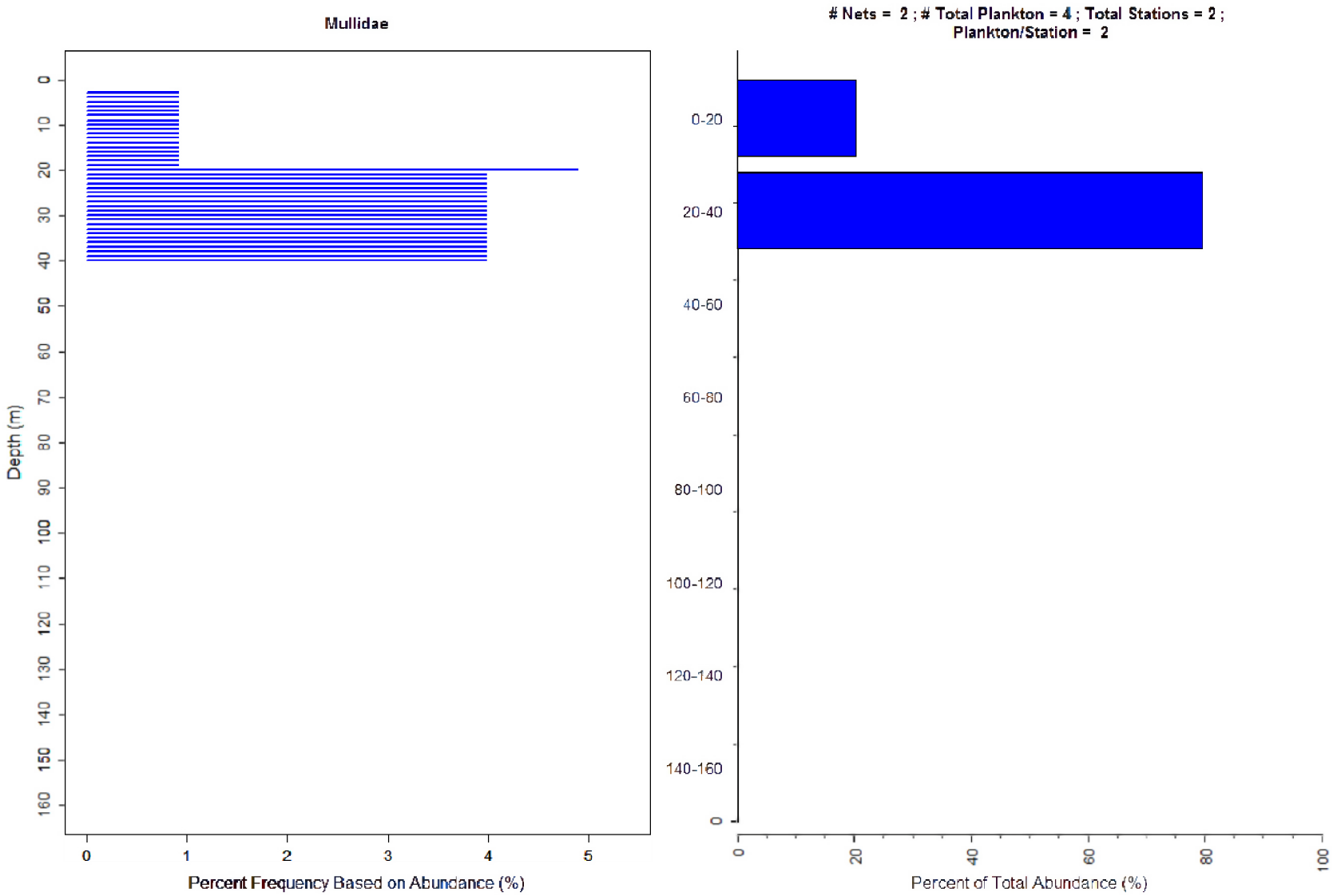
Microstomatidae - Shallow



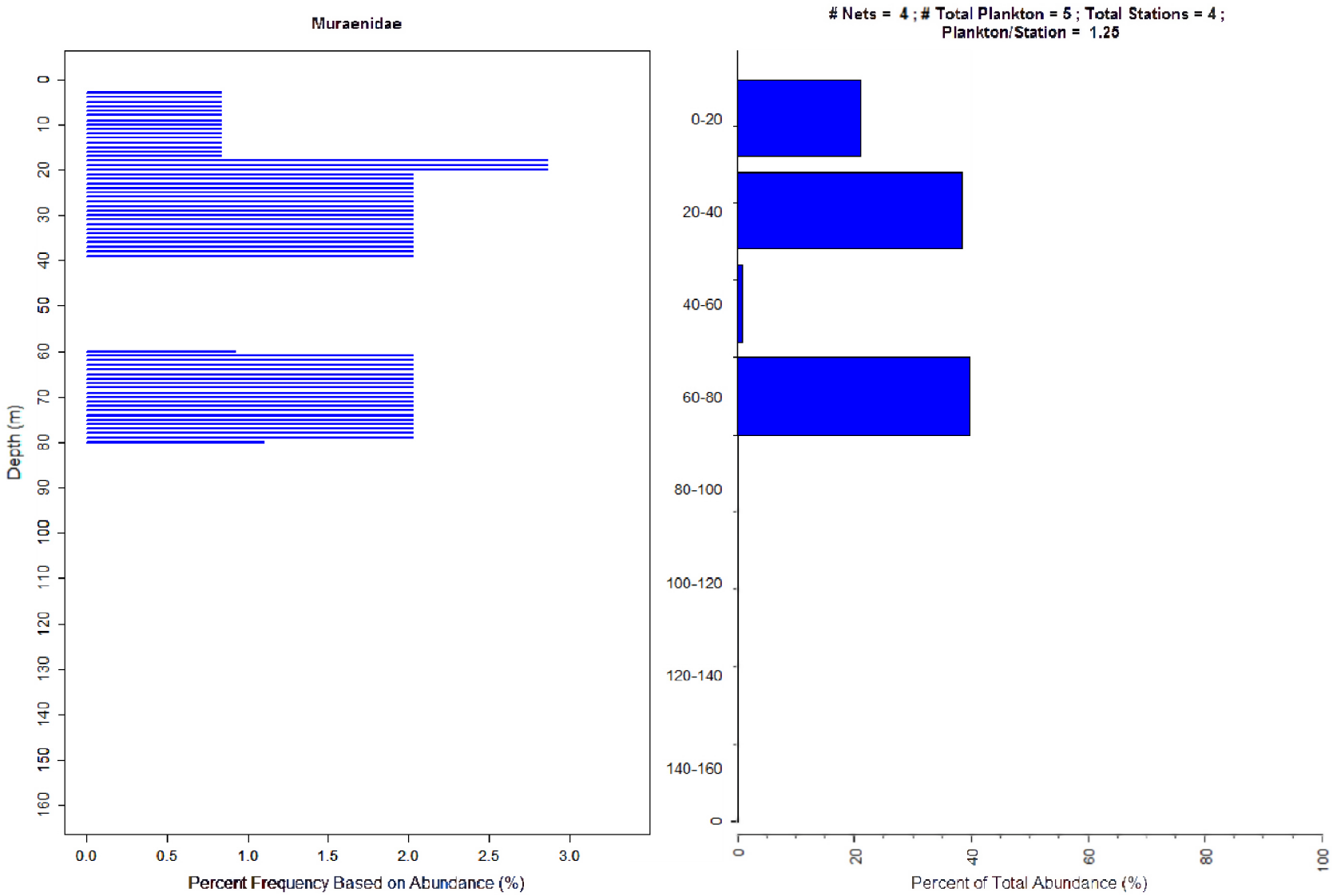
Monolene_sessilicauda - Shallow



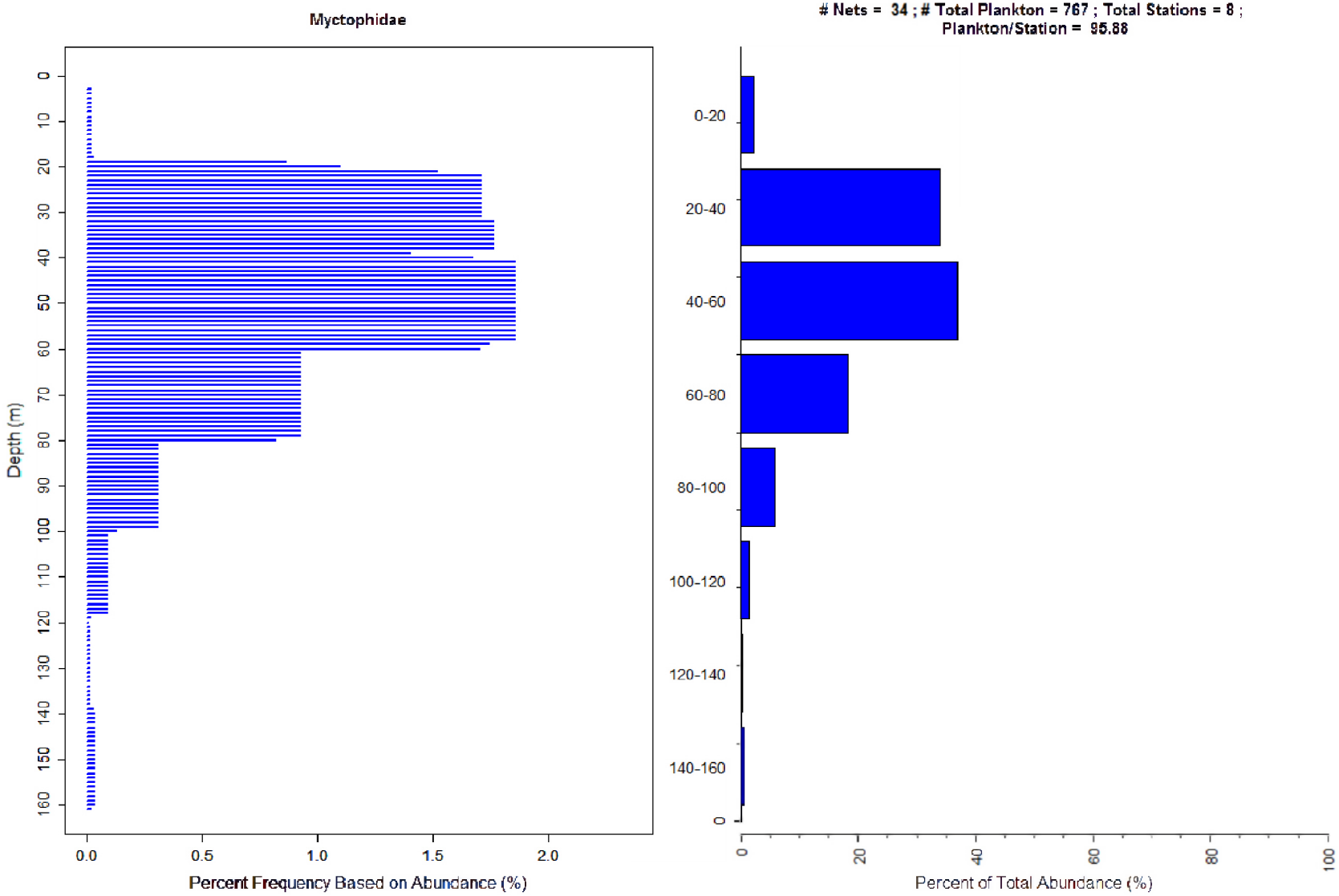
Mugil_curema - Shallow



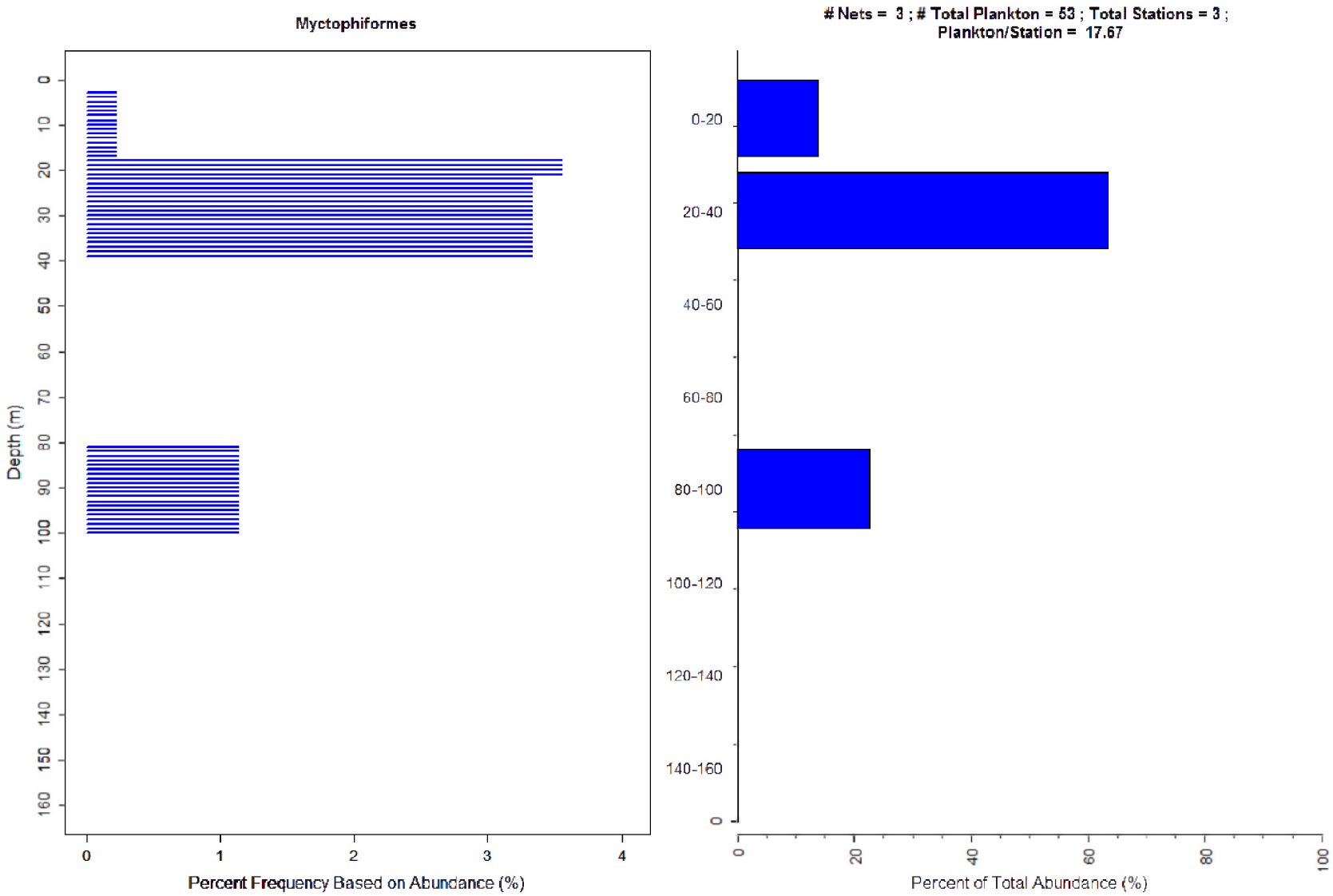
Mullidae - Shallow



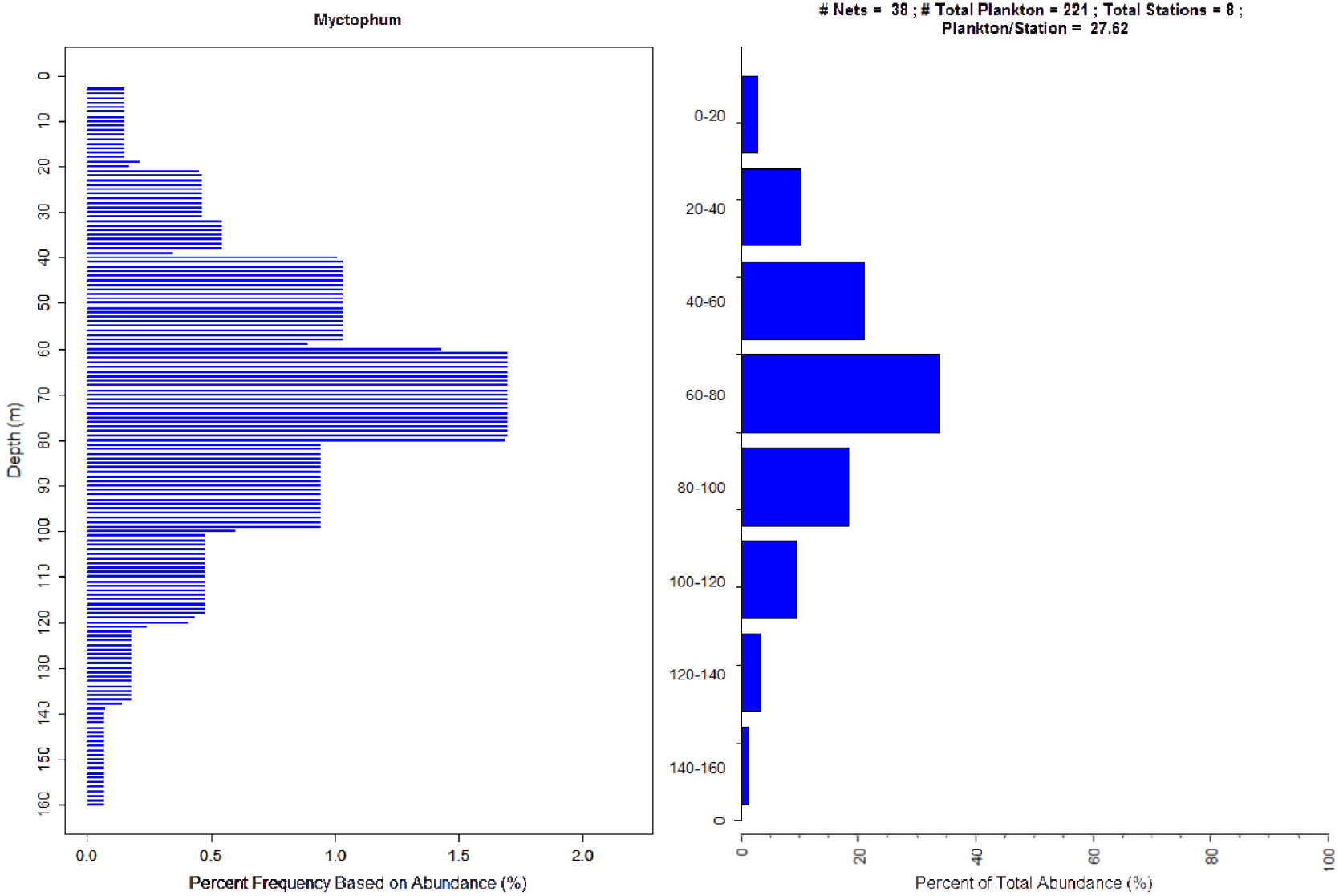
Muraenidae - Shallow



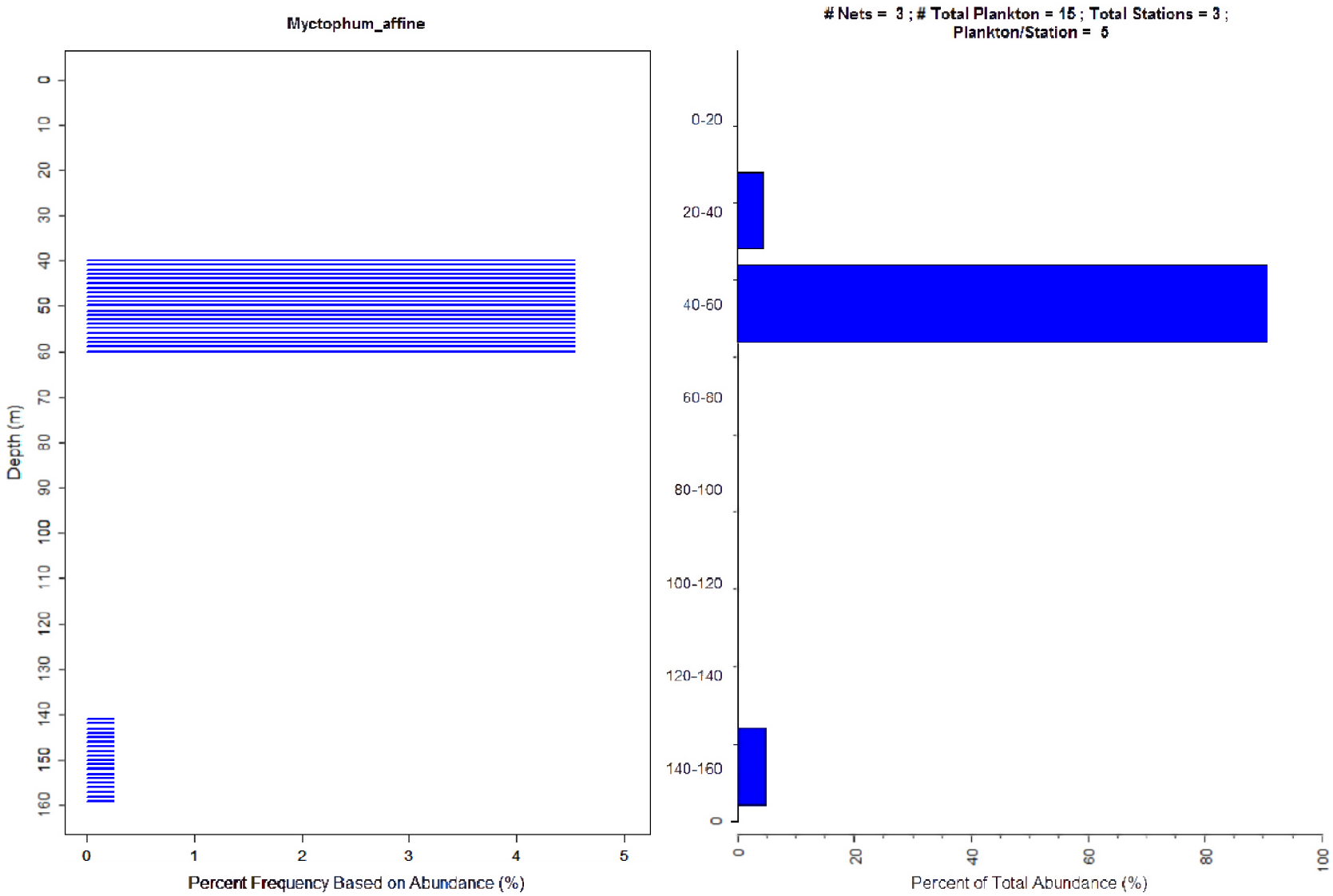
Myctophidae - Shallow



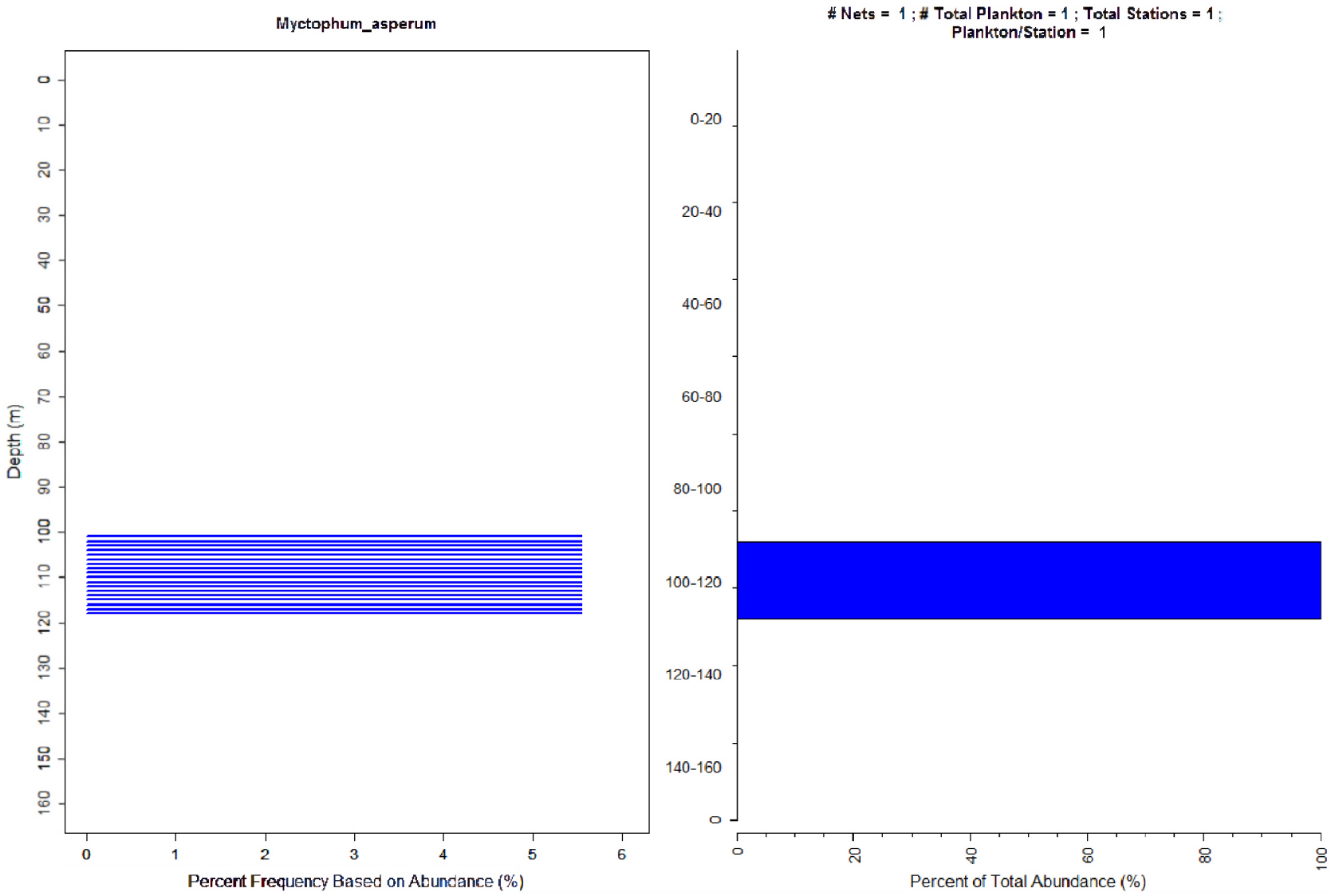
Myctophiformes - Shallow



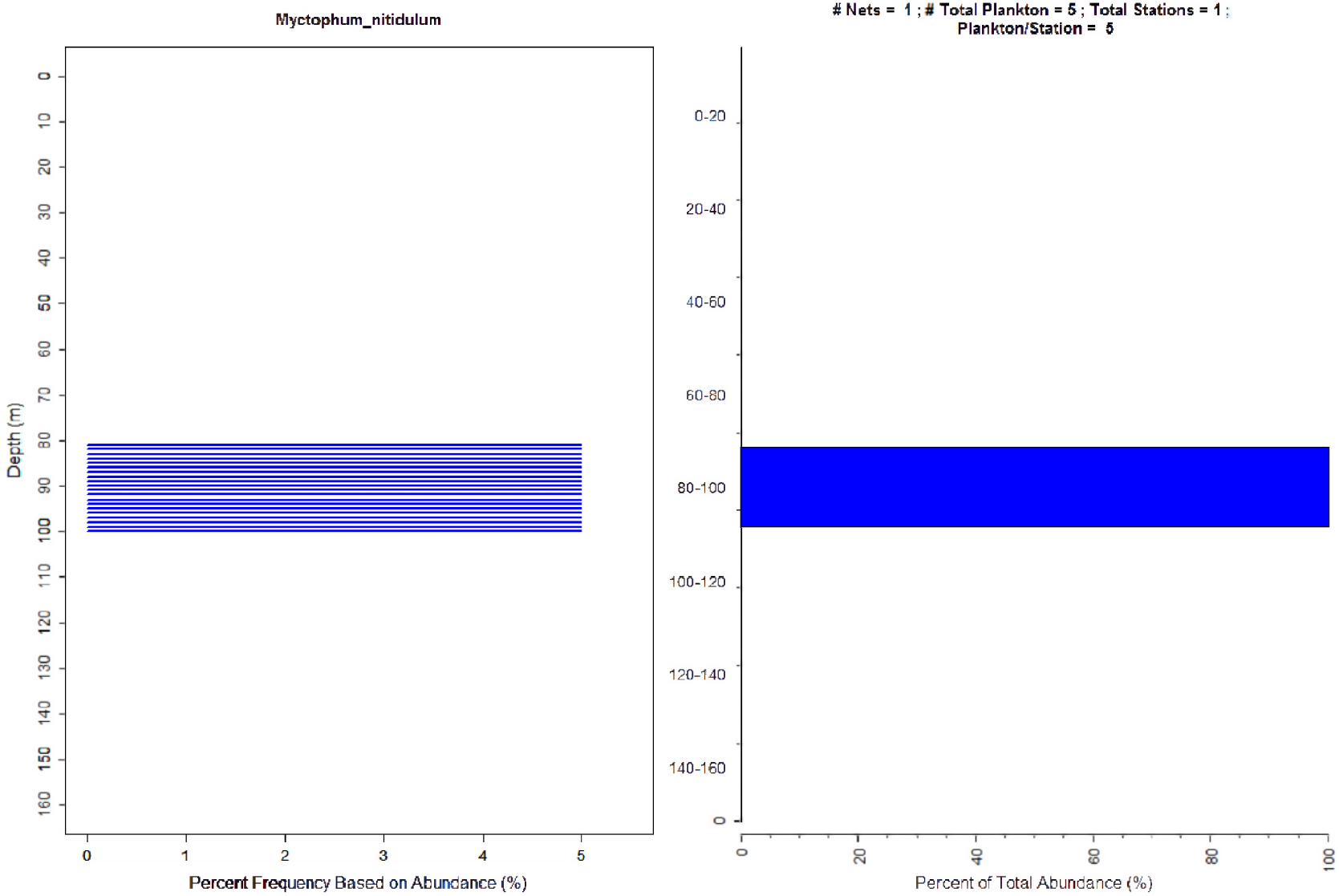
Myctophum - Shallow



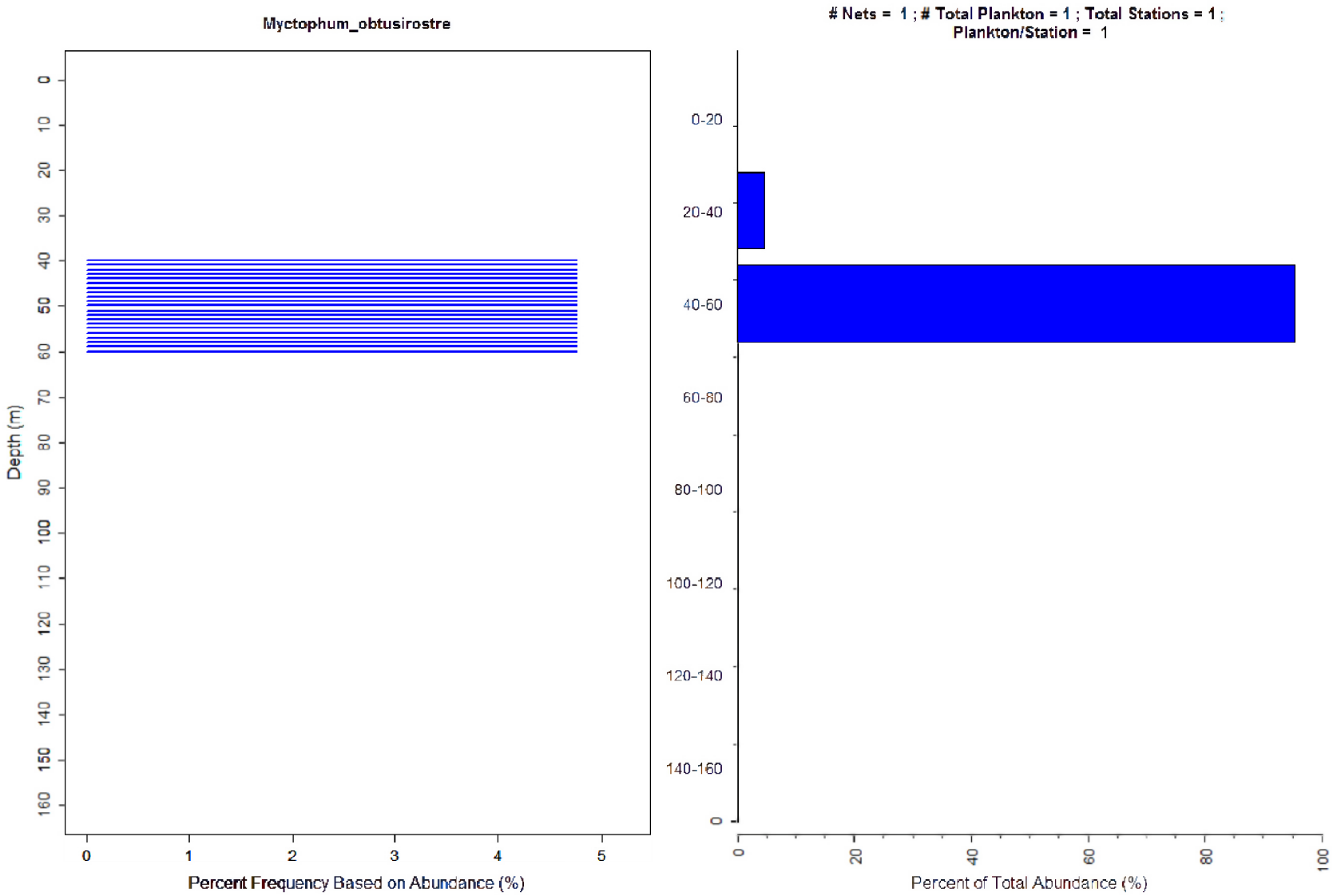
Myctophum_affine - Shallow



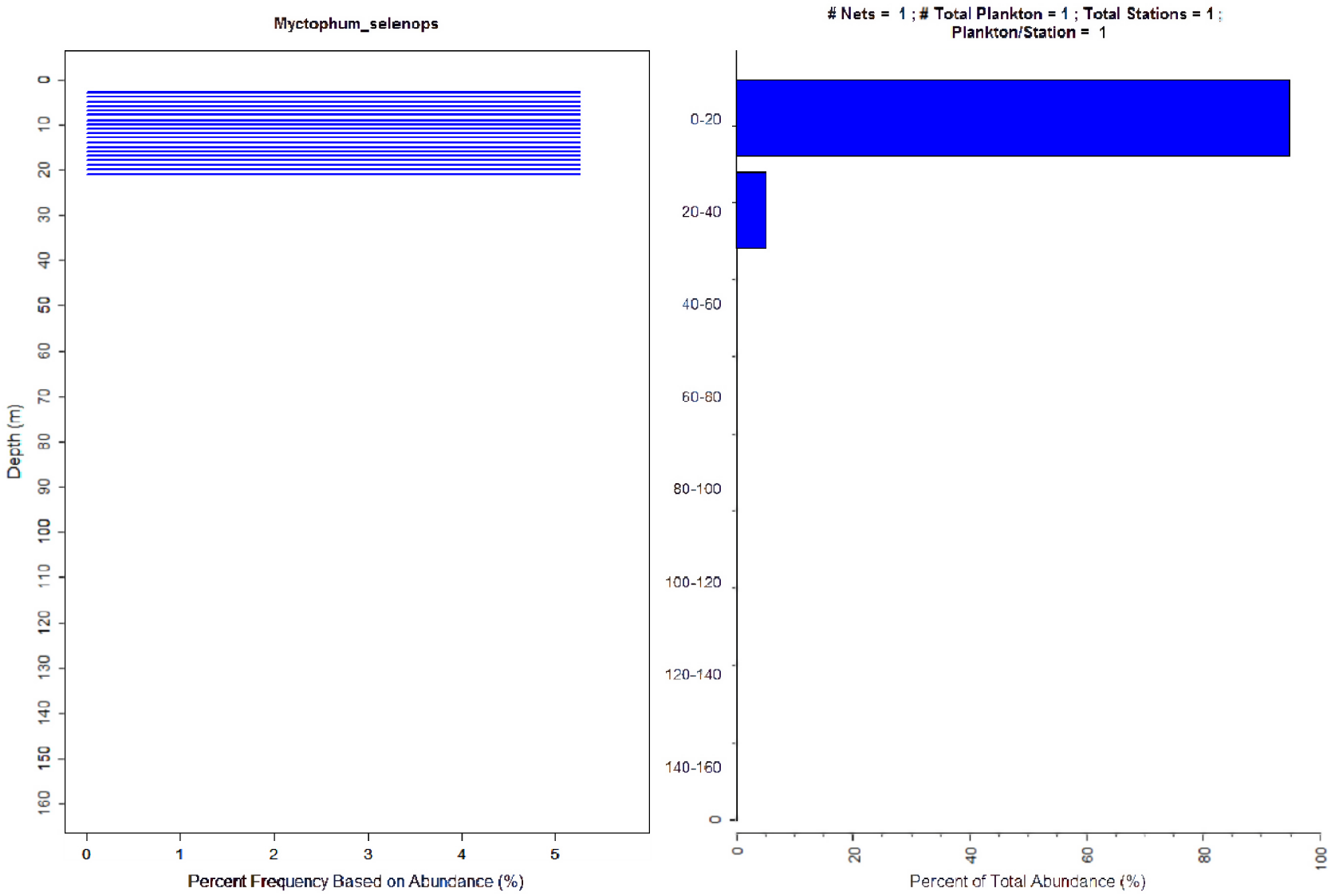
Myctophum_asperum - Shallow



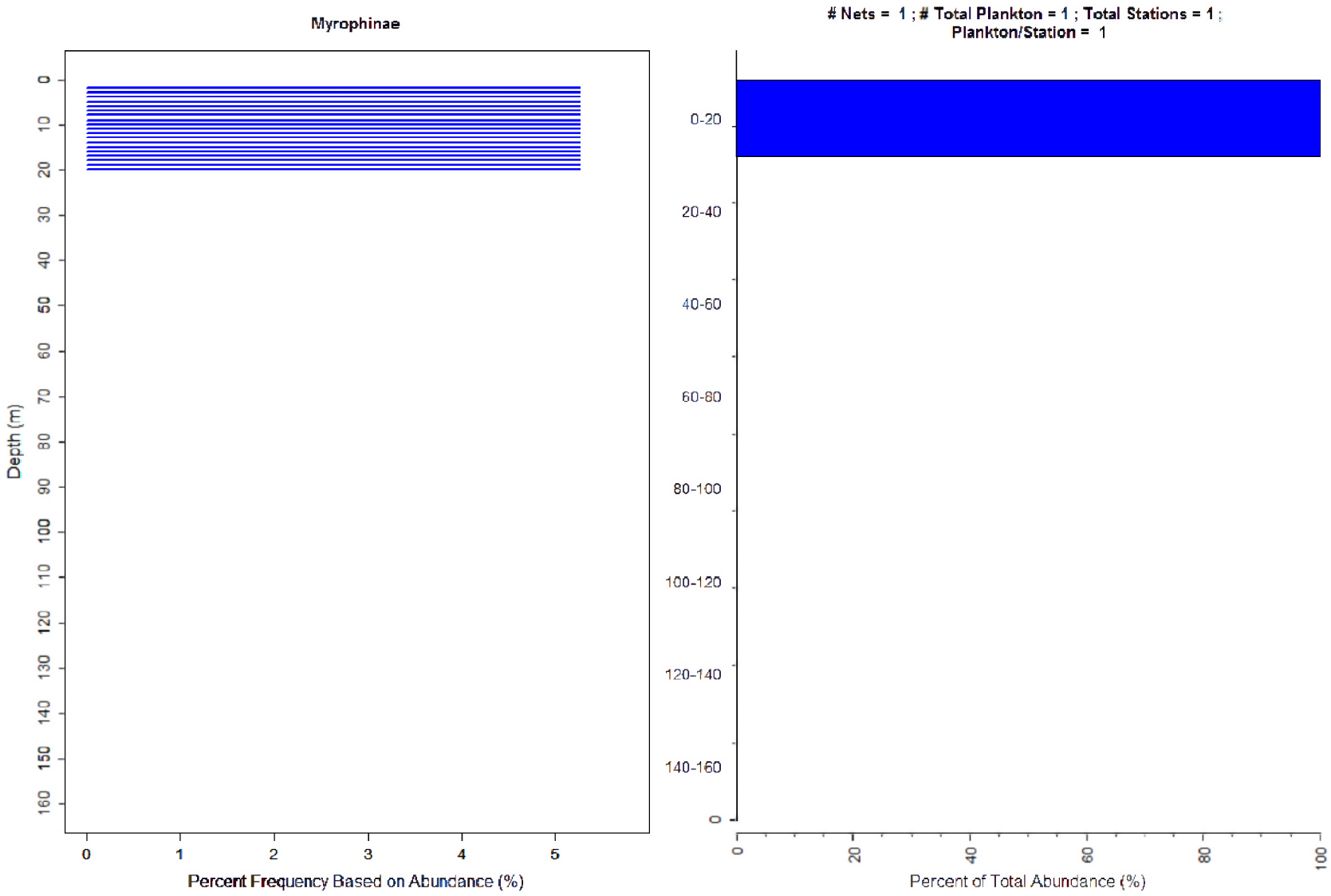
Myctophum_nitidulum - Shallow



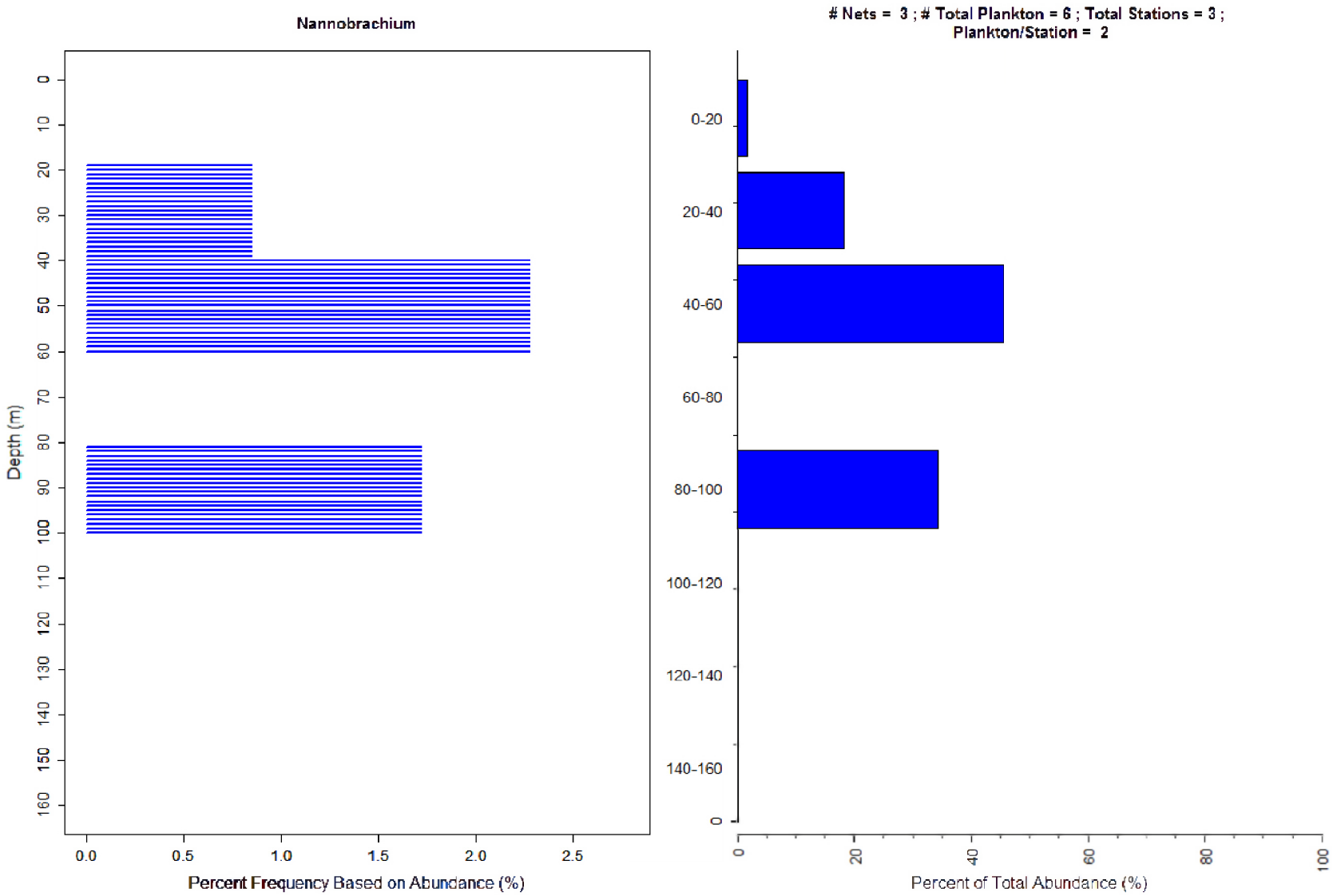
Myctophum_obtusirostre - Shallow



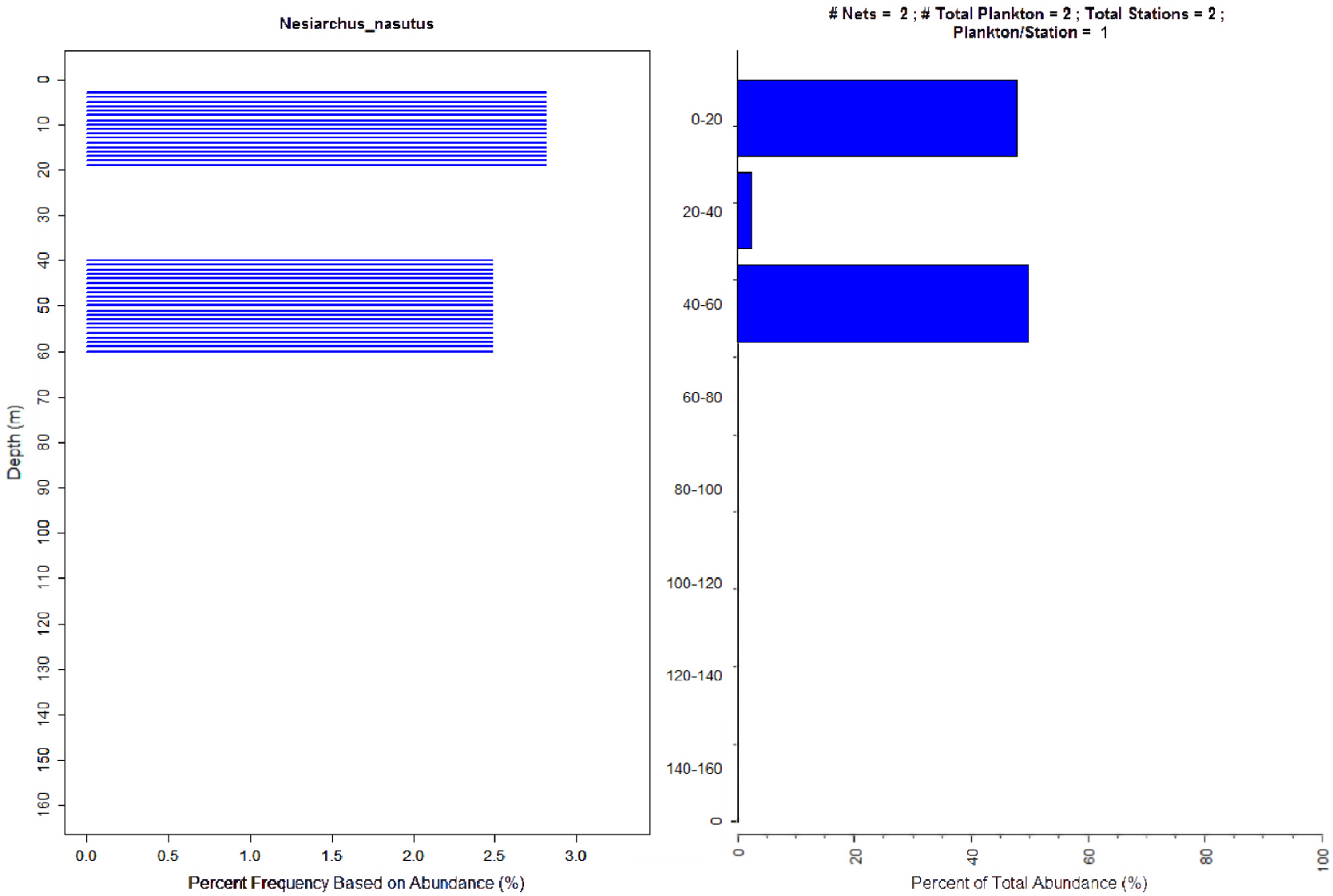
Myctophum_selenops - Shallow



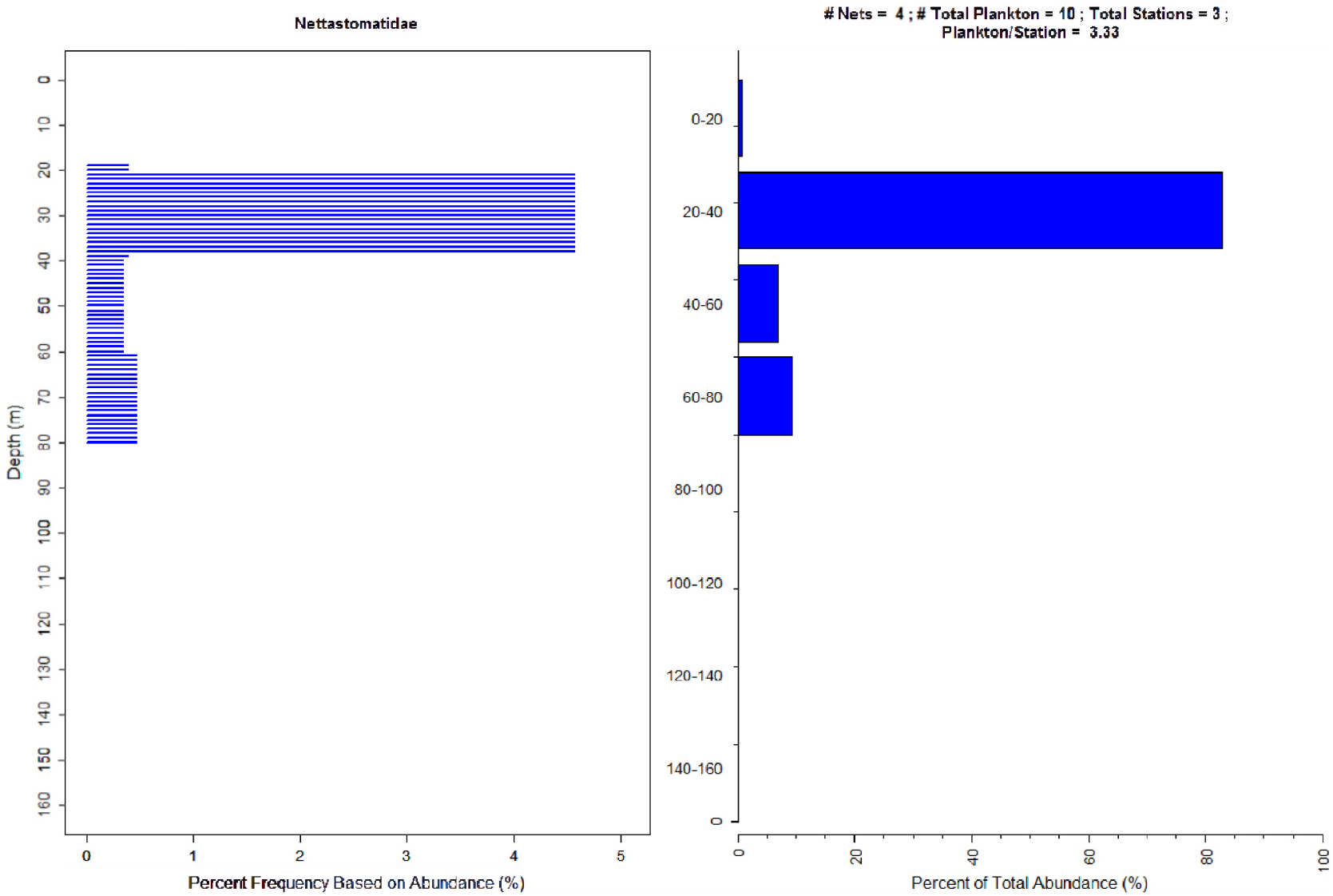
Myrophinae - Shallow



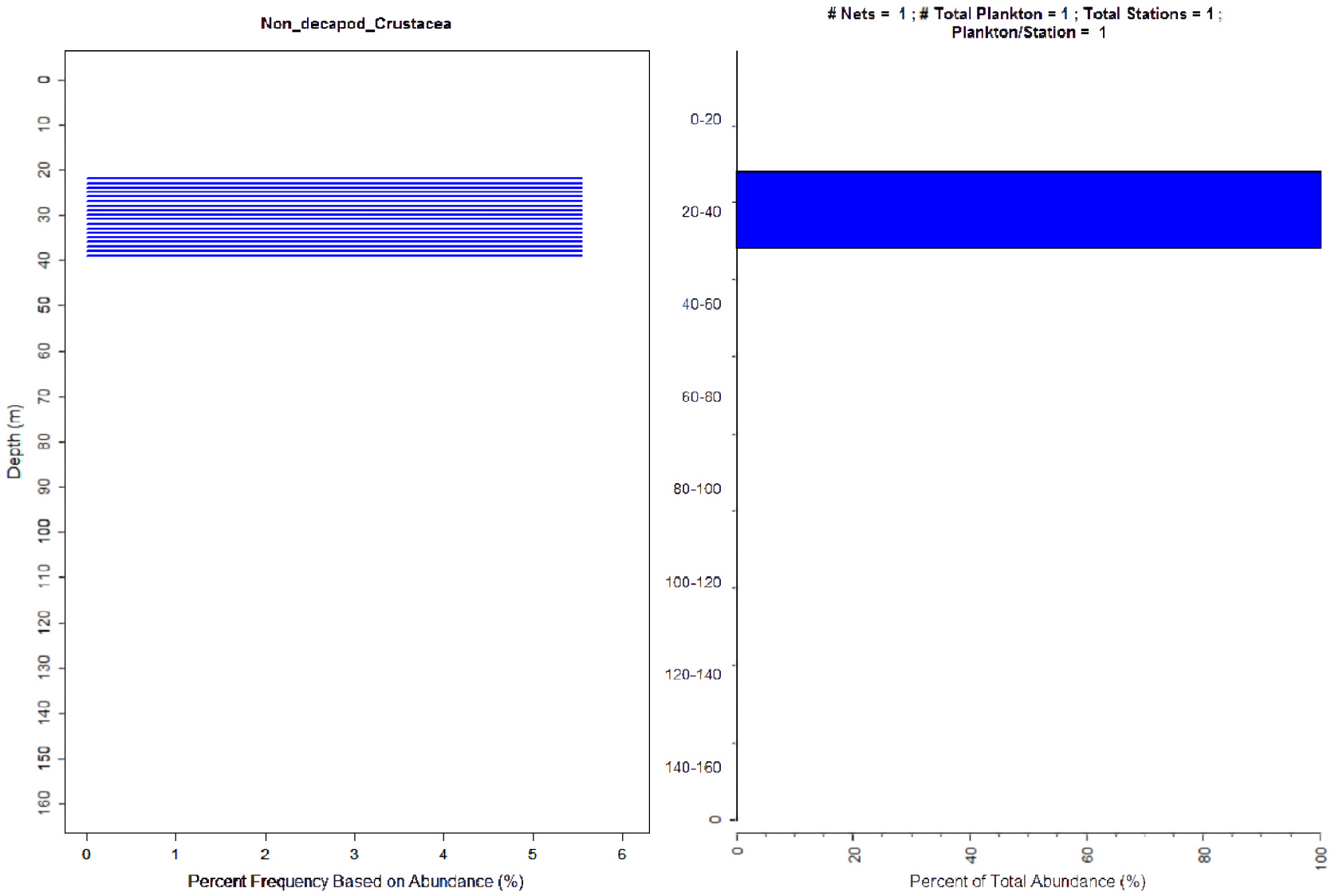
Nannobrachium - Shallow



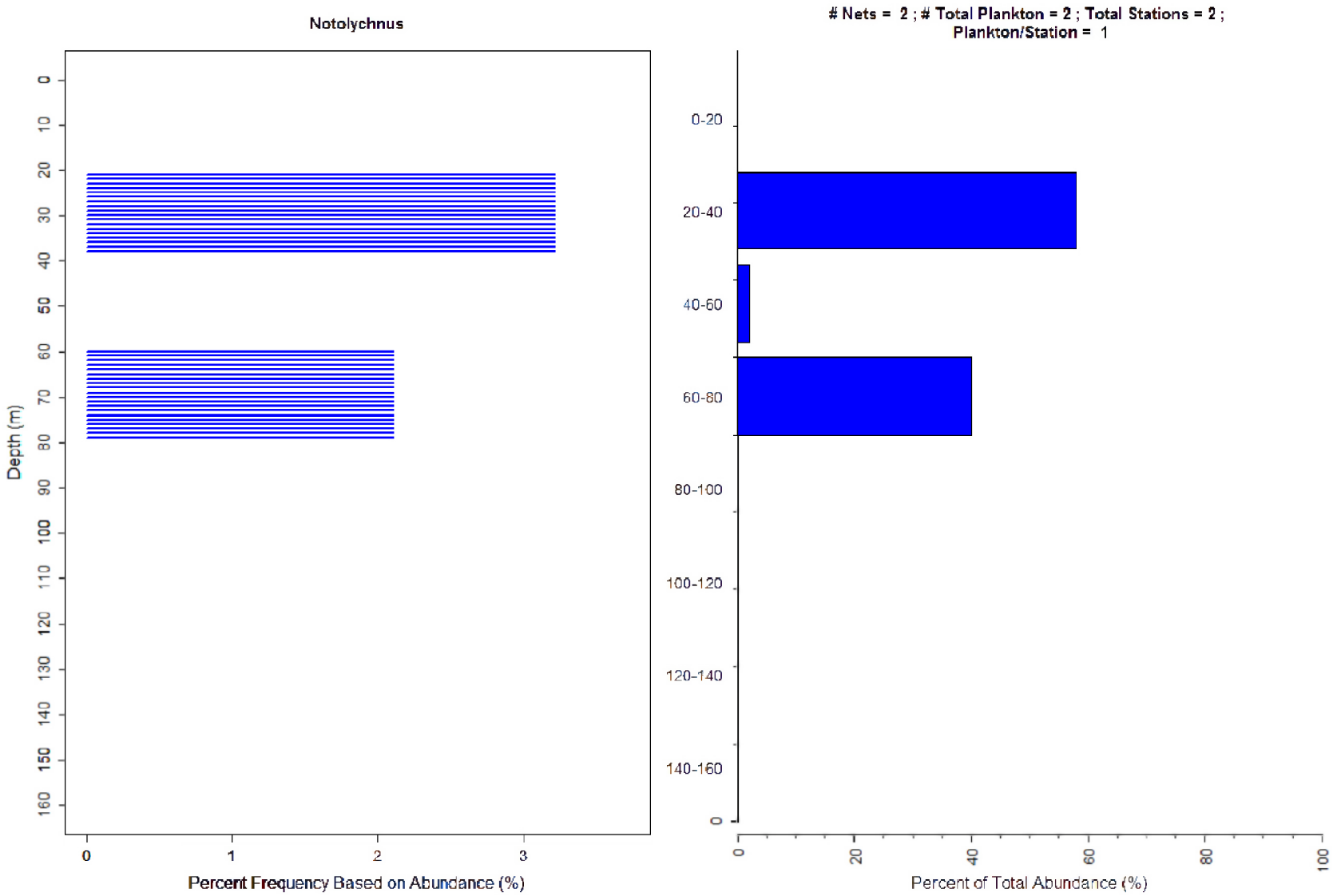
Nesiarchus_nasutus - Shallow



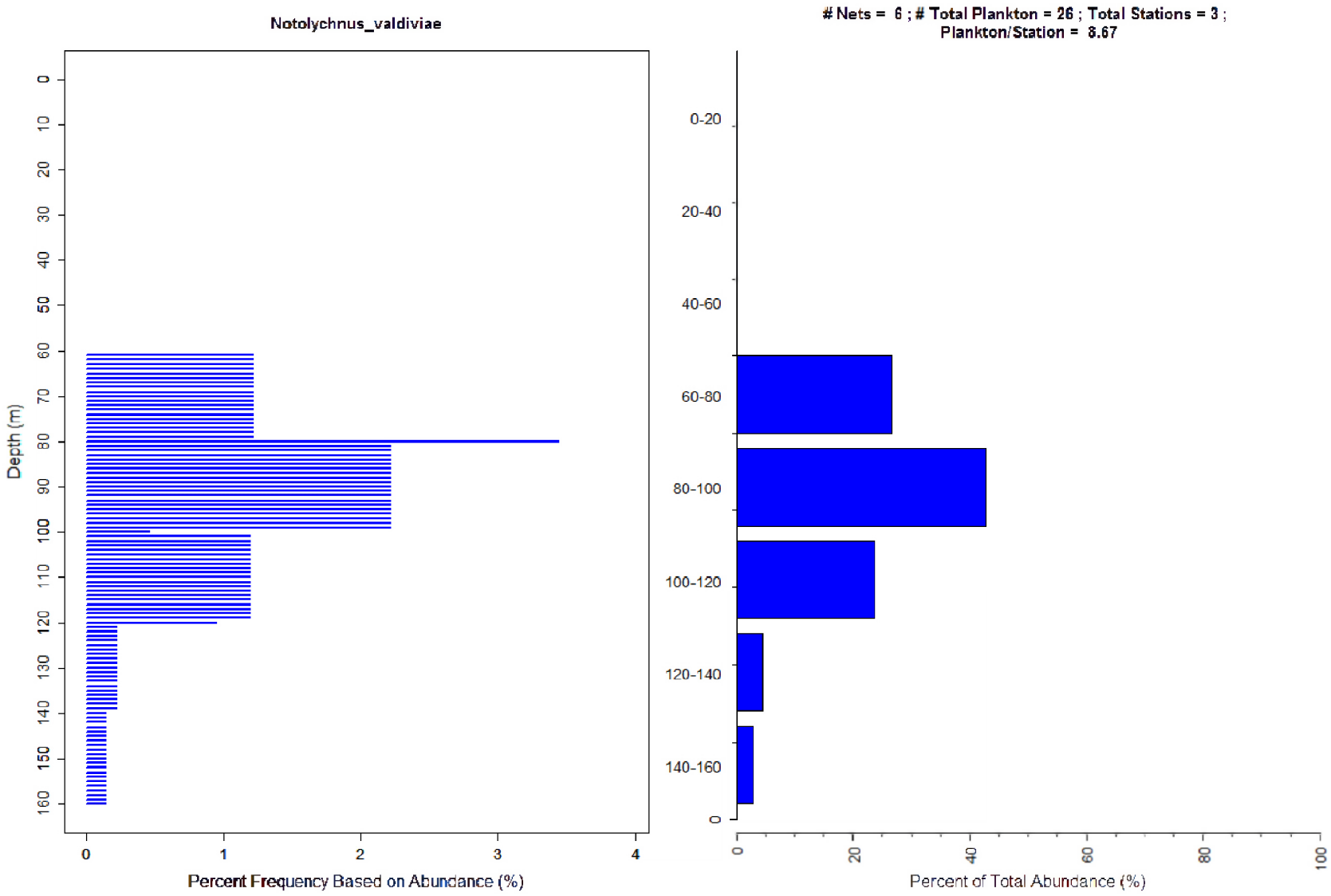
Nettastomatidae - Shallow



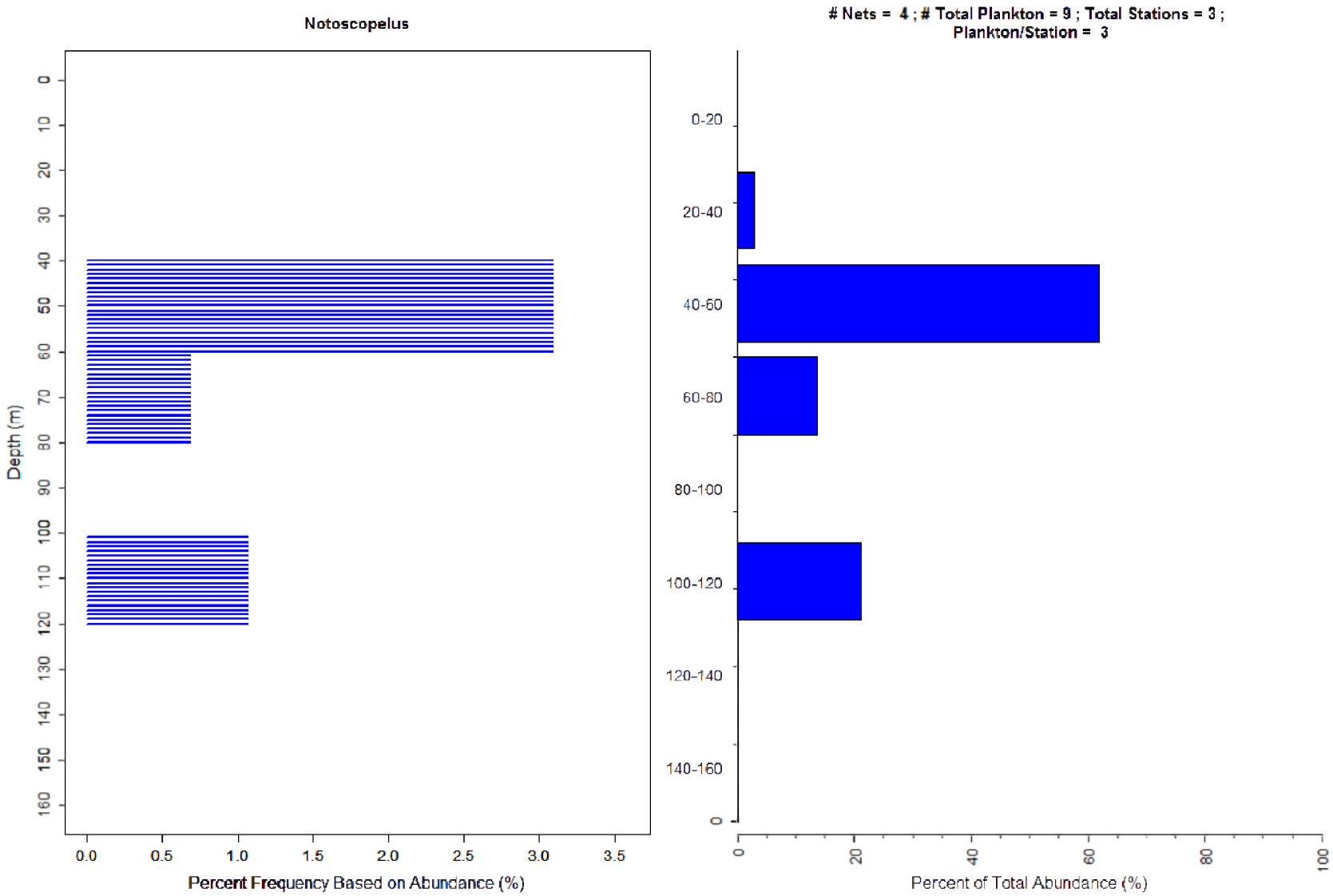
Non_decapod_Crustacea - Shallow



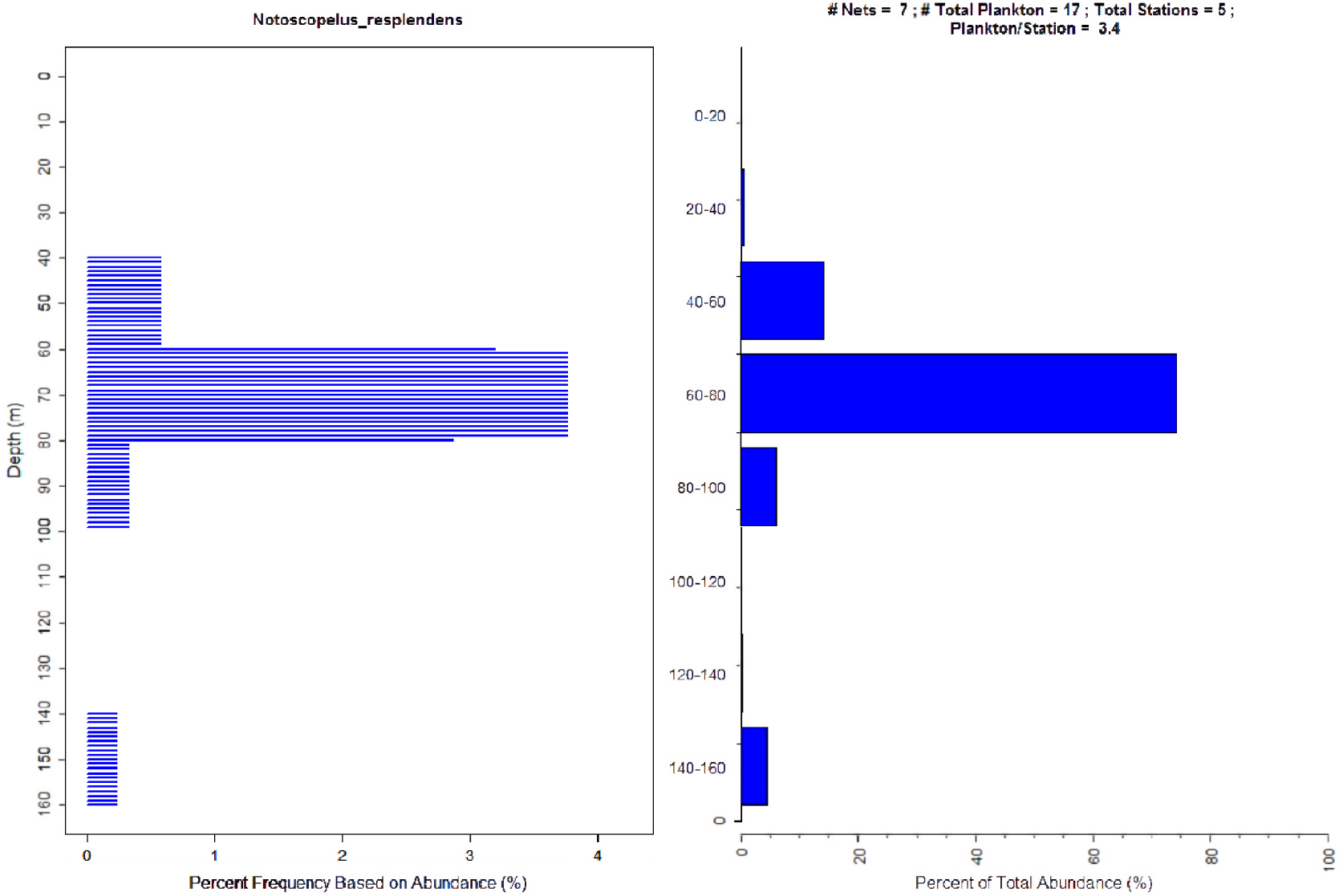
Notolychnus - Shallow



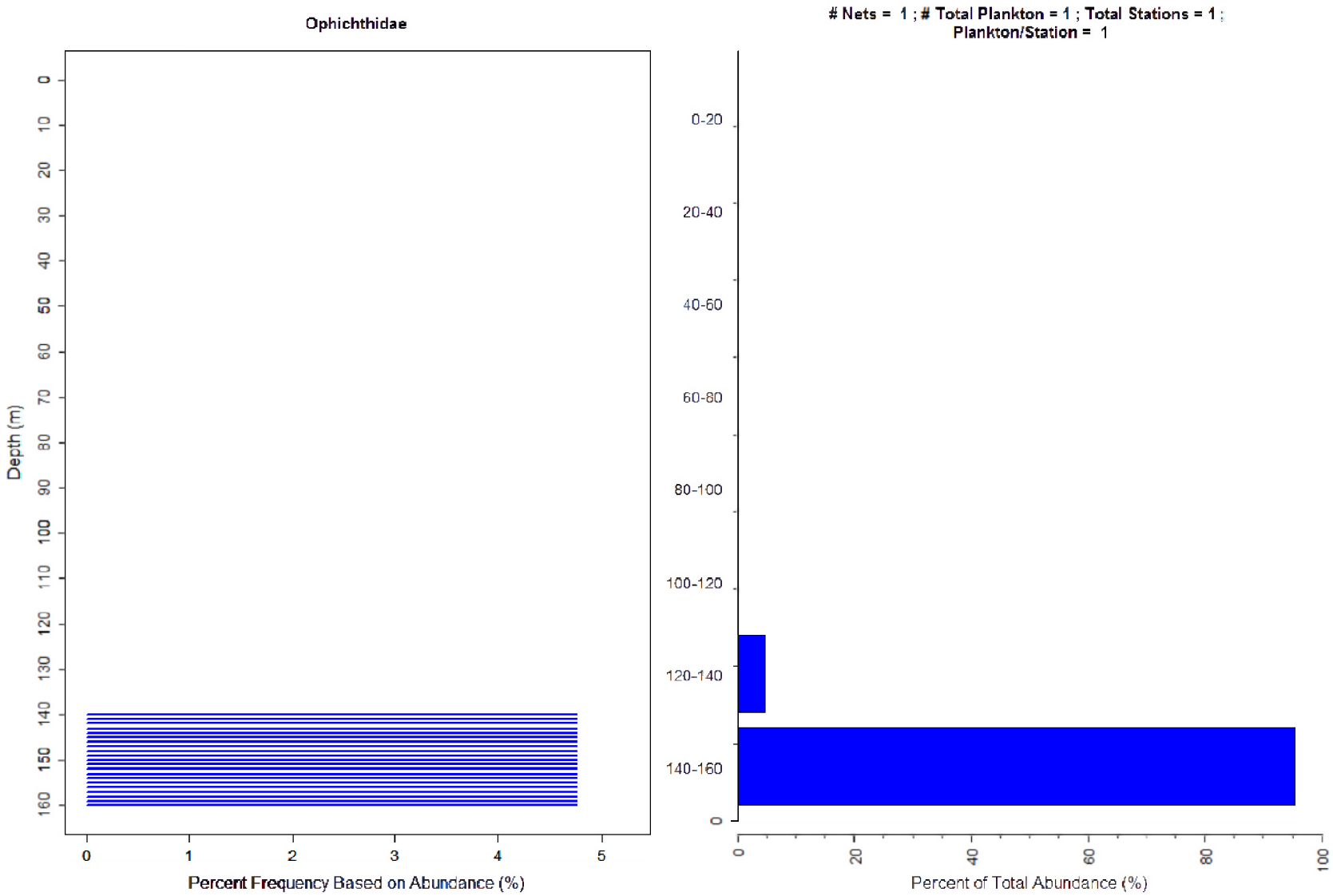
Notolychnus_valdiviae - Shallow



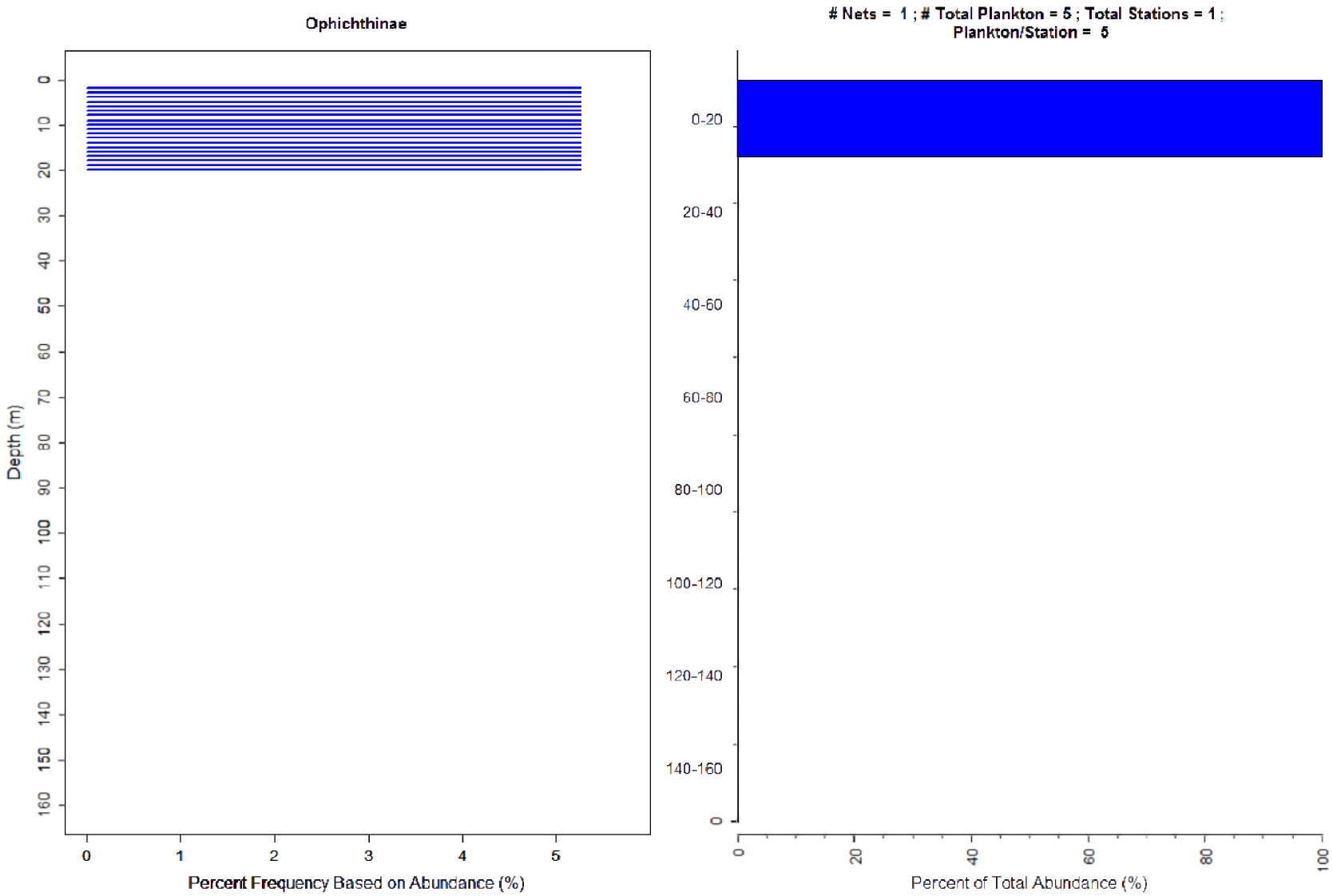
Notoscopelus - Shallow



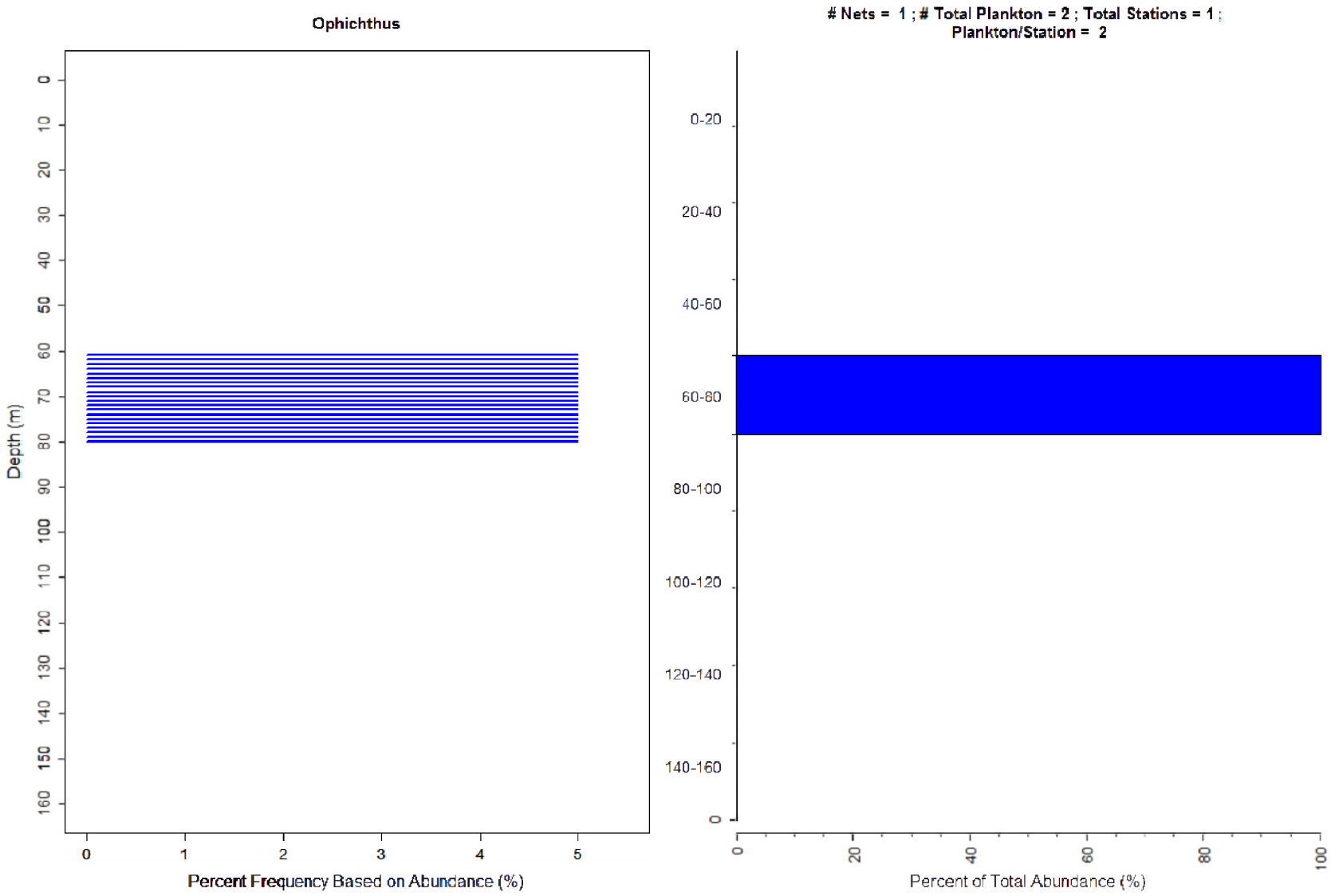
Notoscopelus_resplendens - Shallow



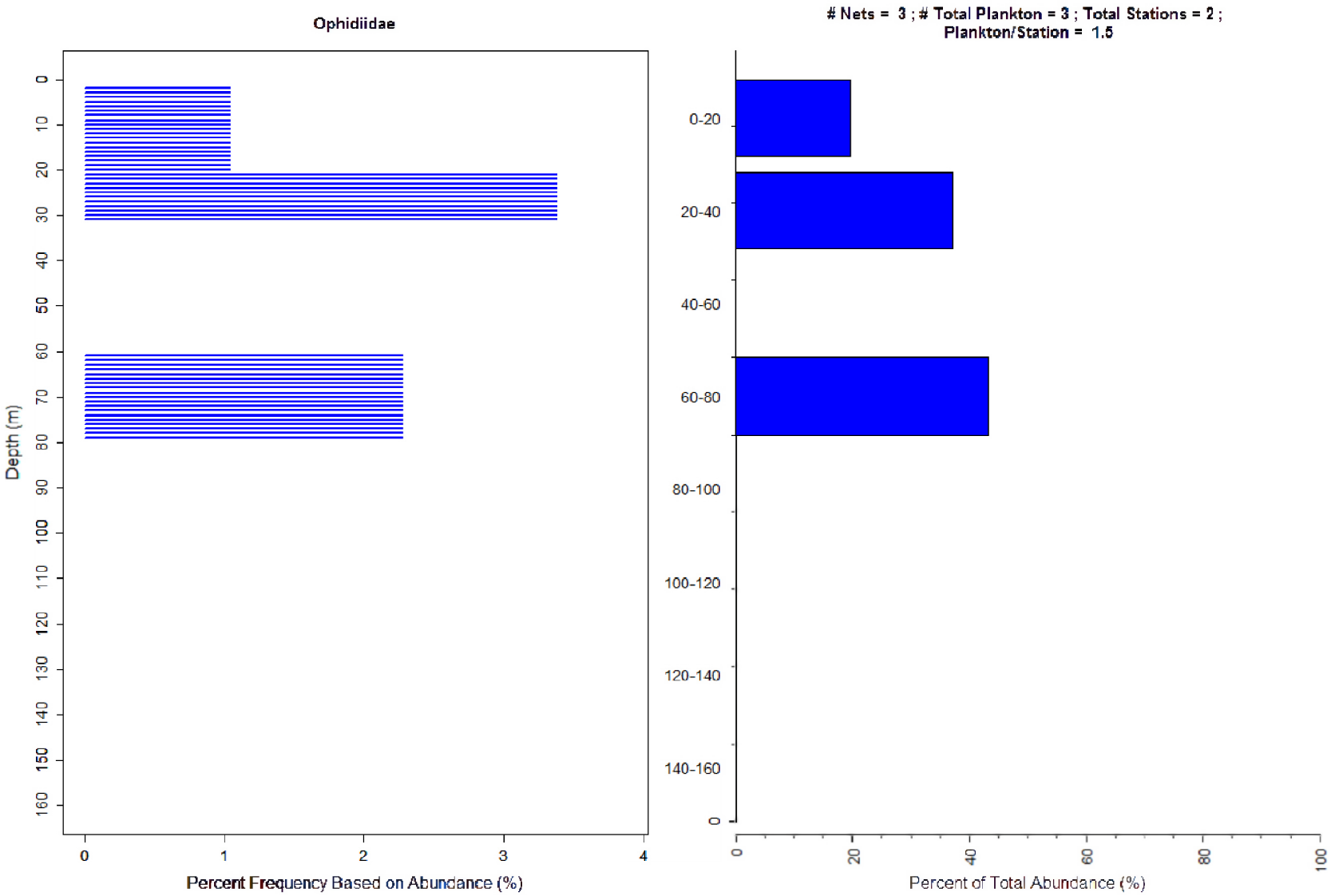
Ophichthidae - Shallow



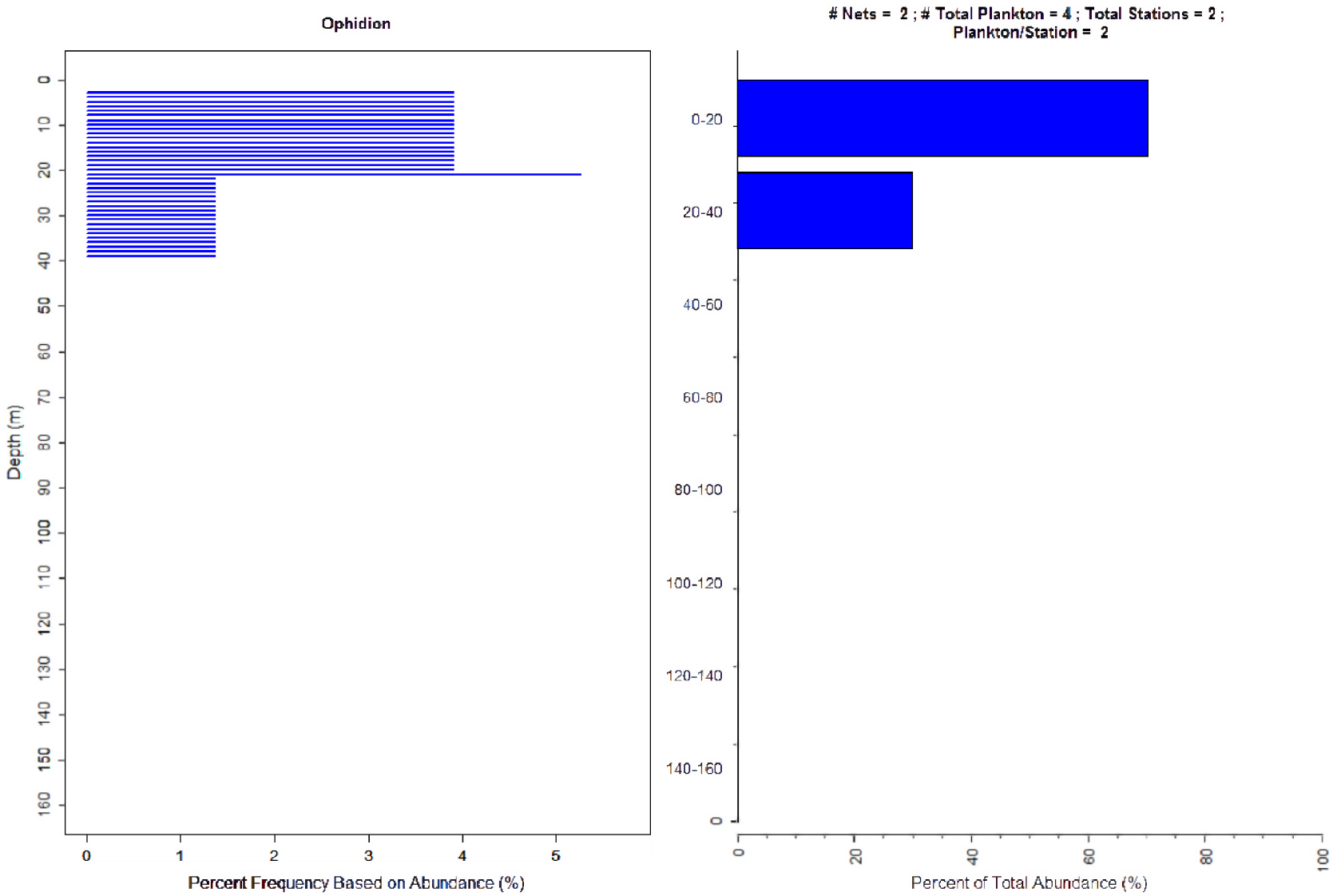
Ophichthinae - Shallow



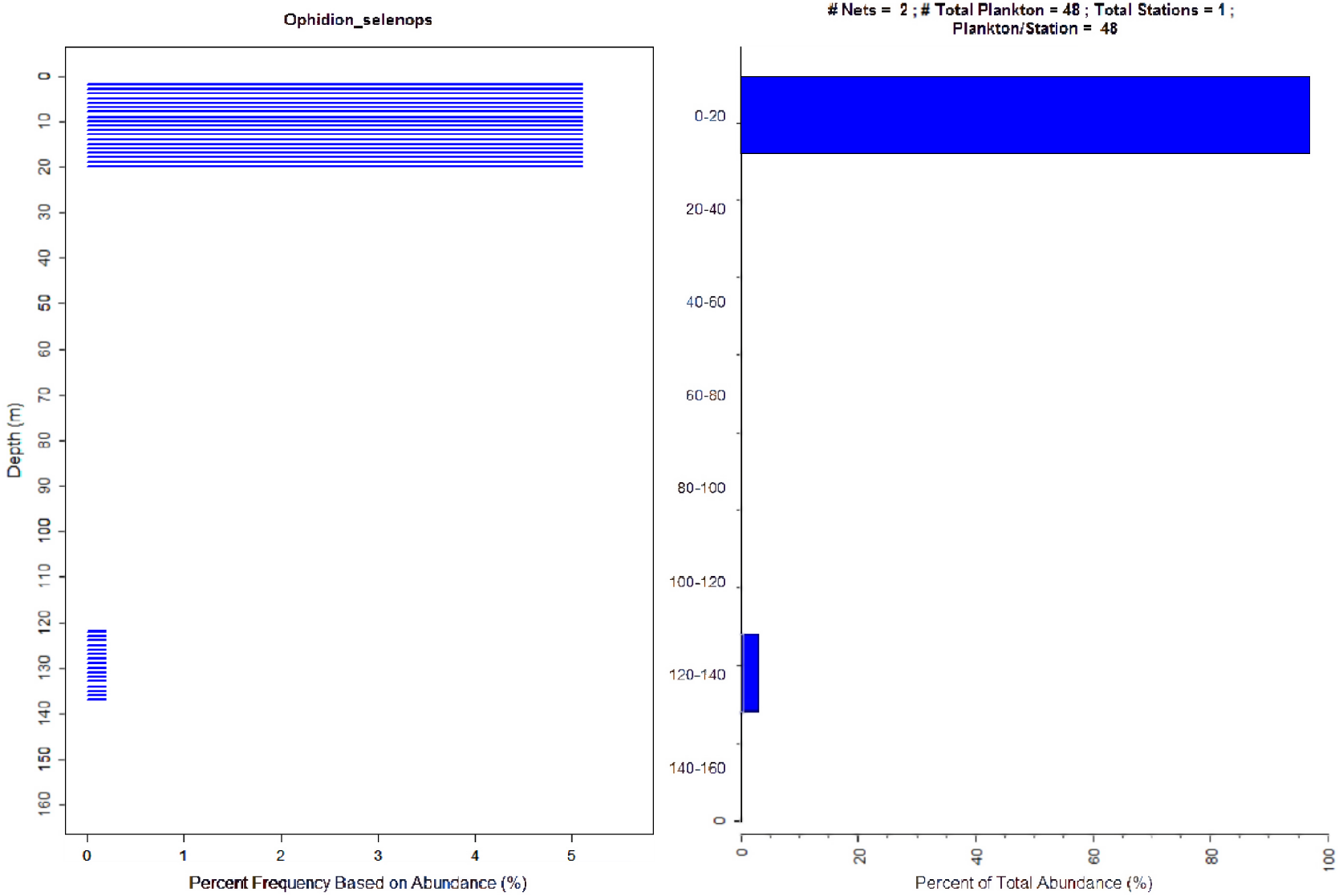
Ophichthus - Shallow



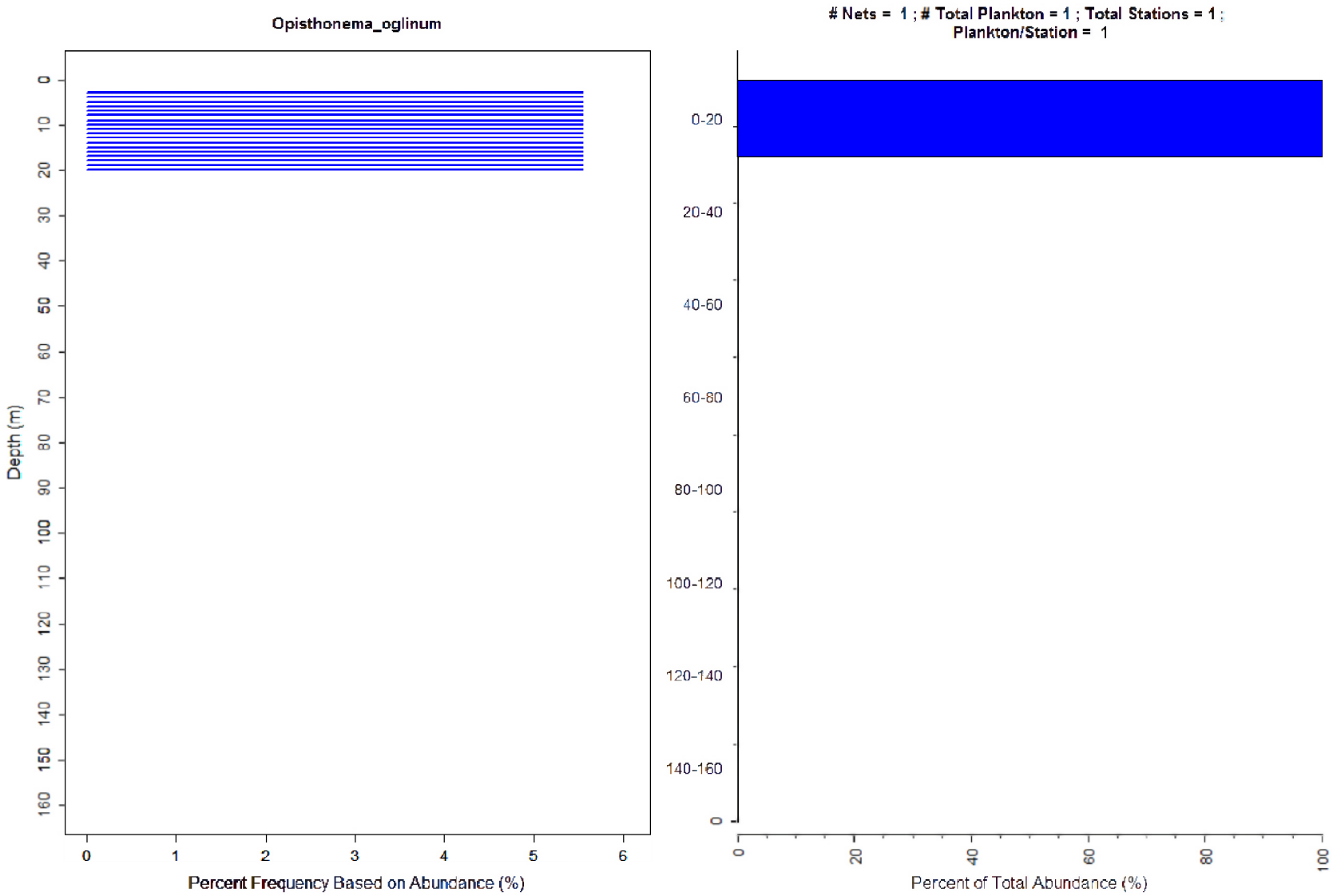
Ophidiidae - Shallow



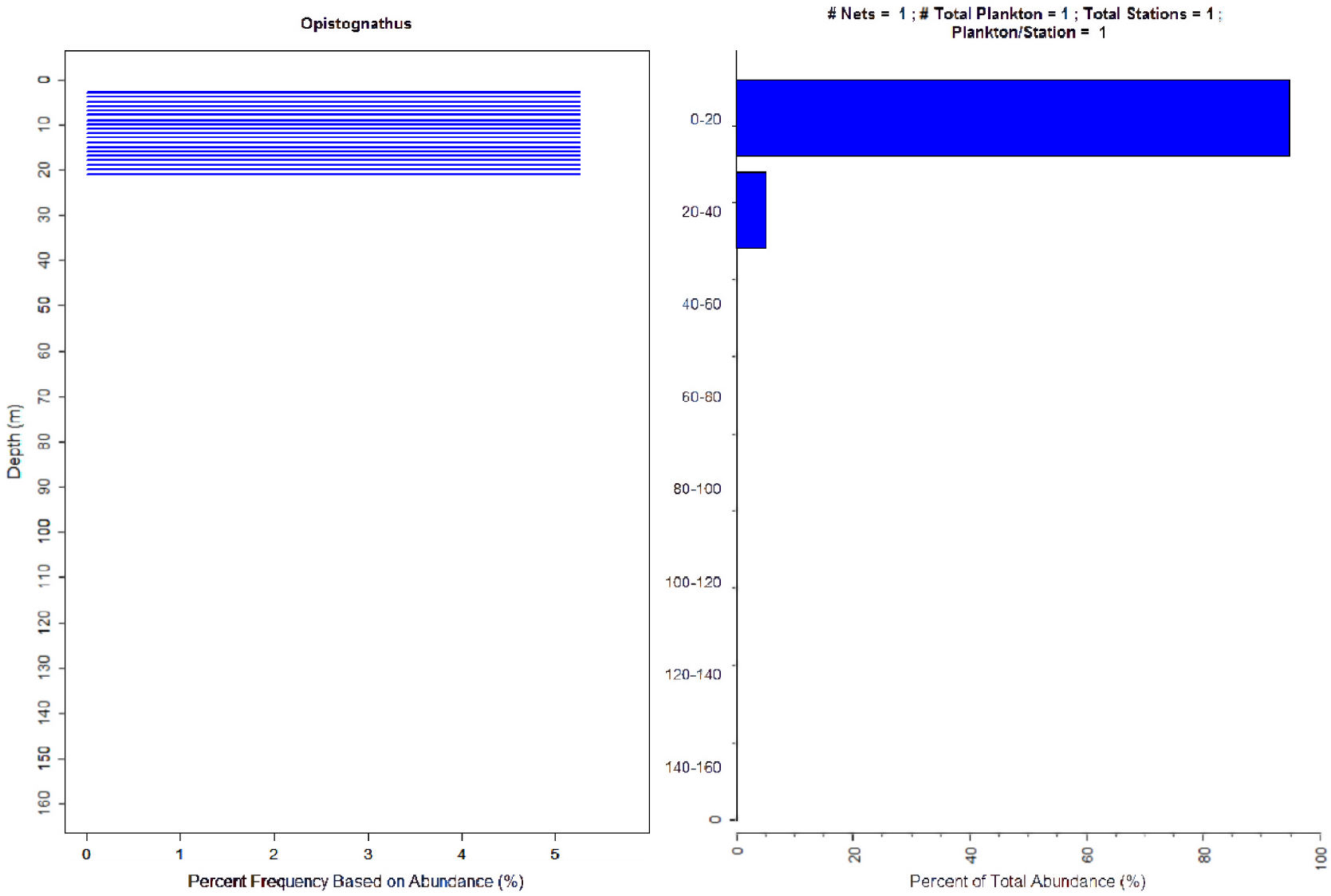
Ophidion - Shallow



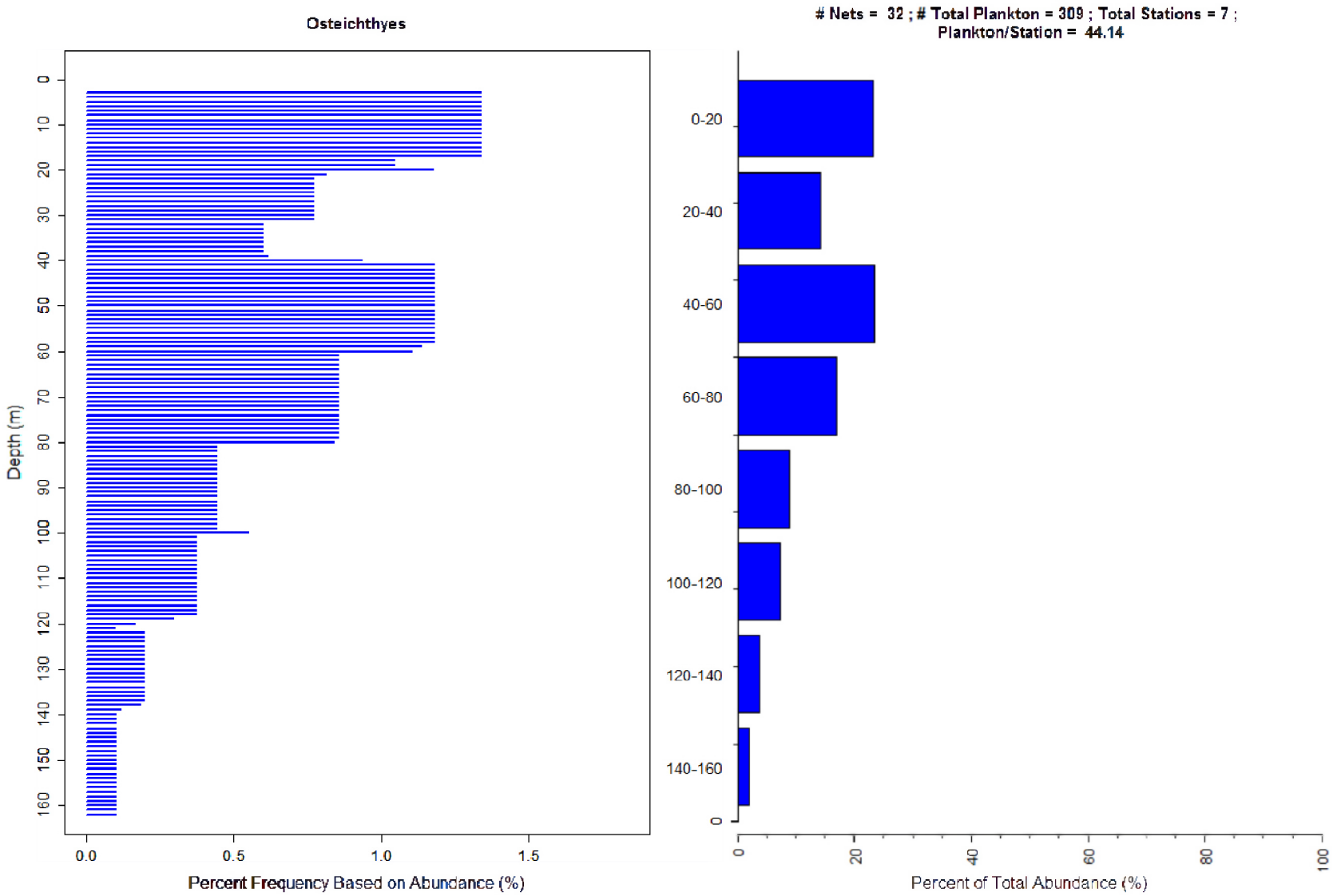
Ophidion_selenops - Shallow



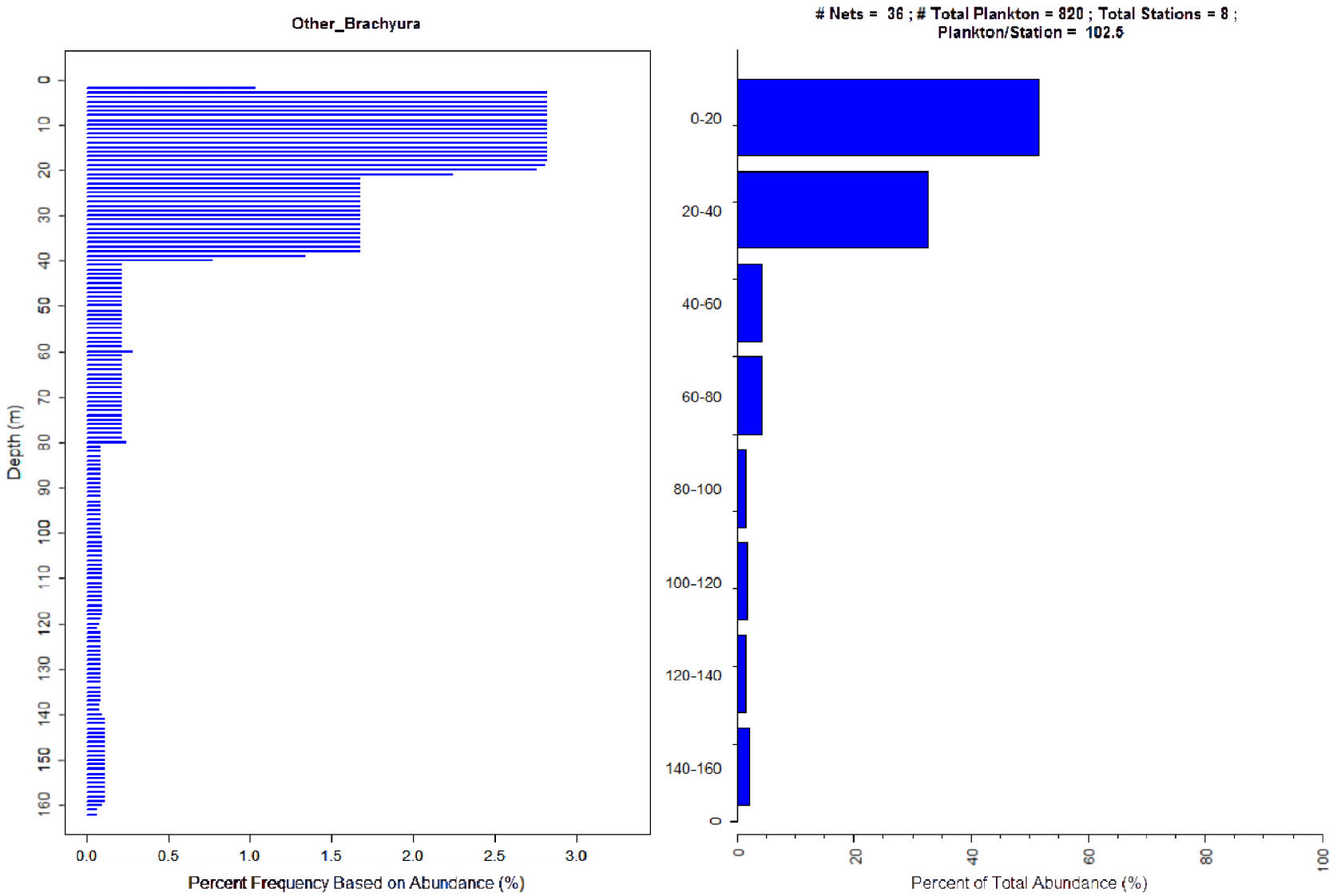
Opisthonema_oglinum - Shallow



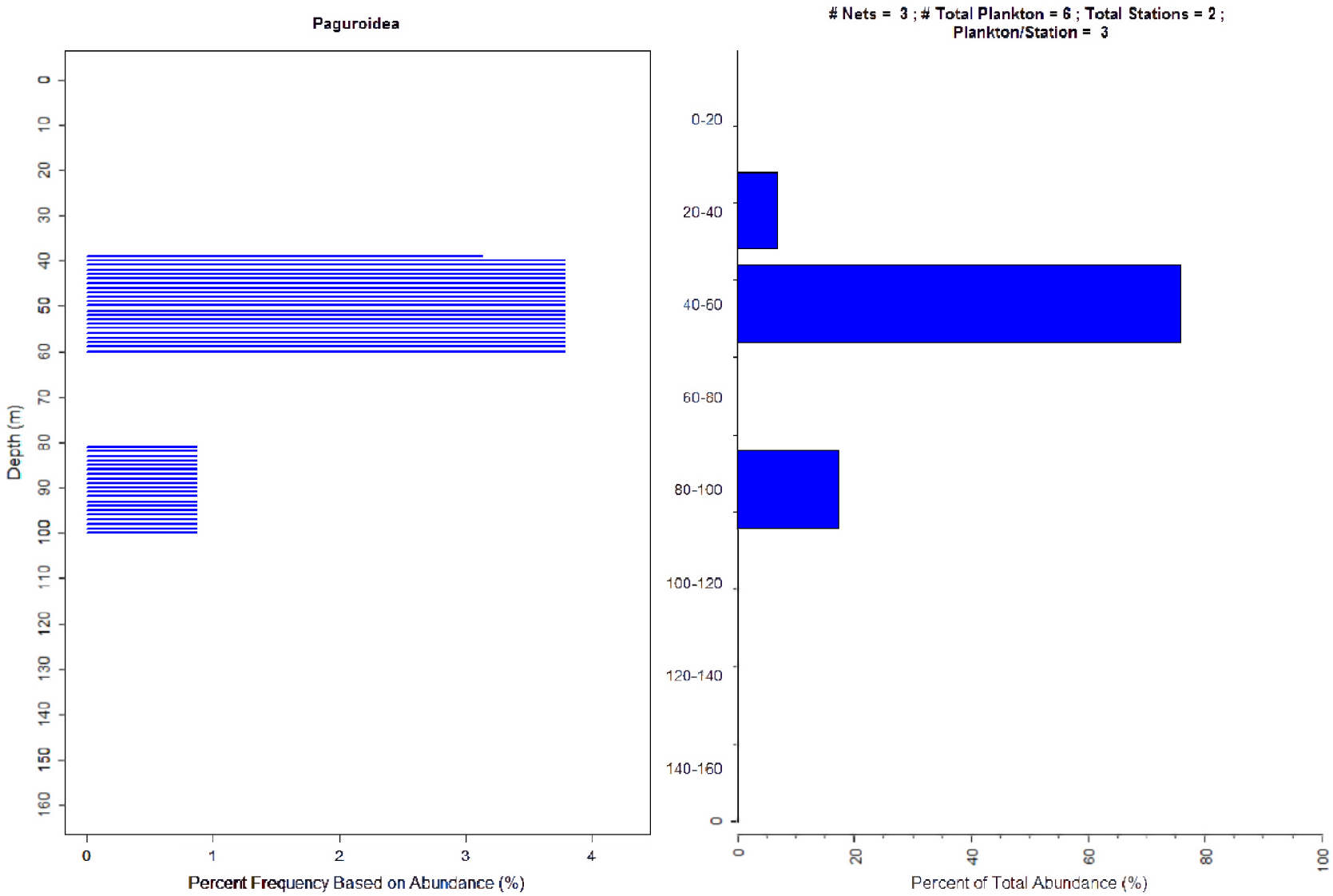
Opistognathus - Shallow



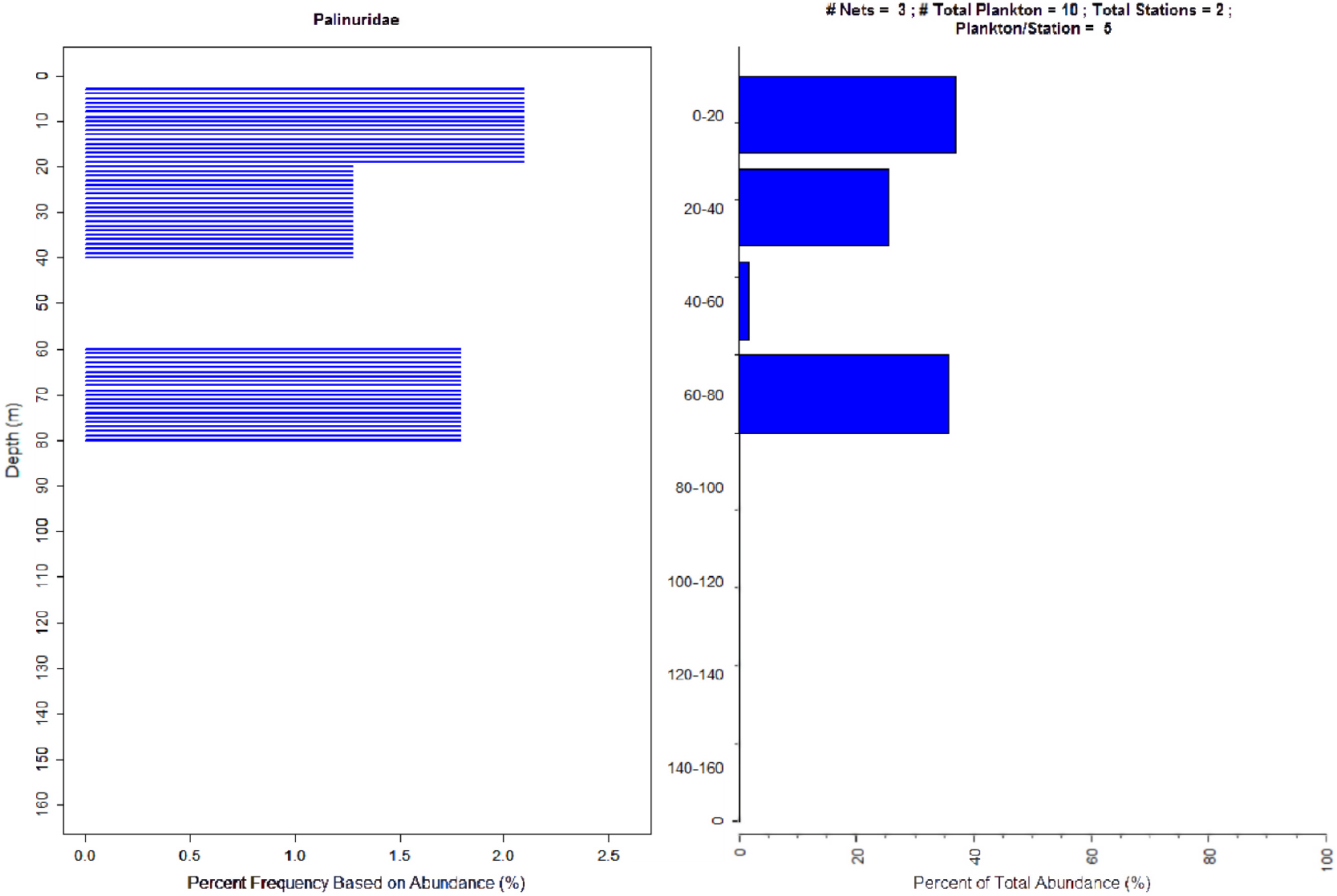
Osteichthyes - Shallow



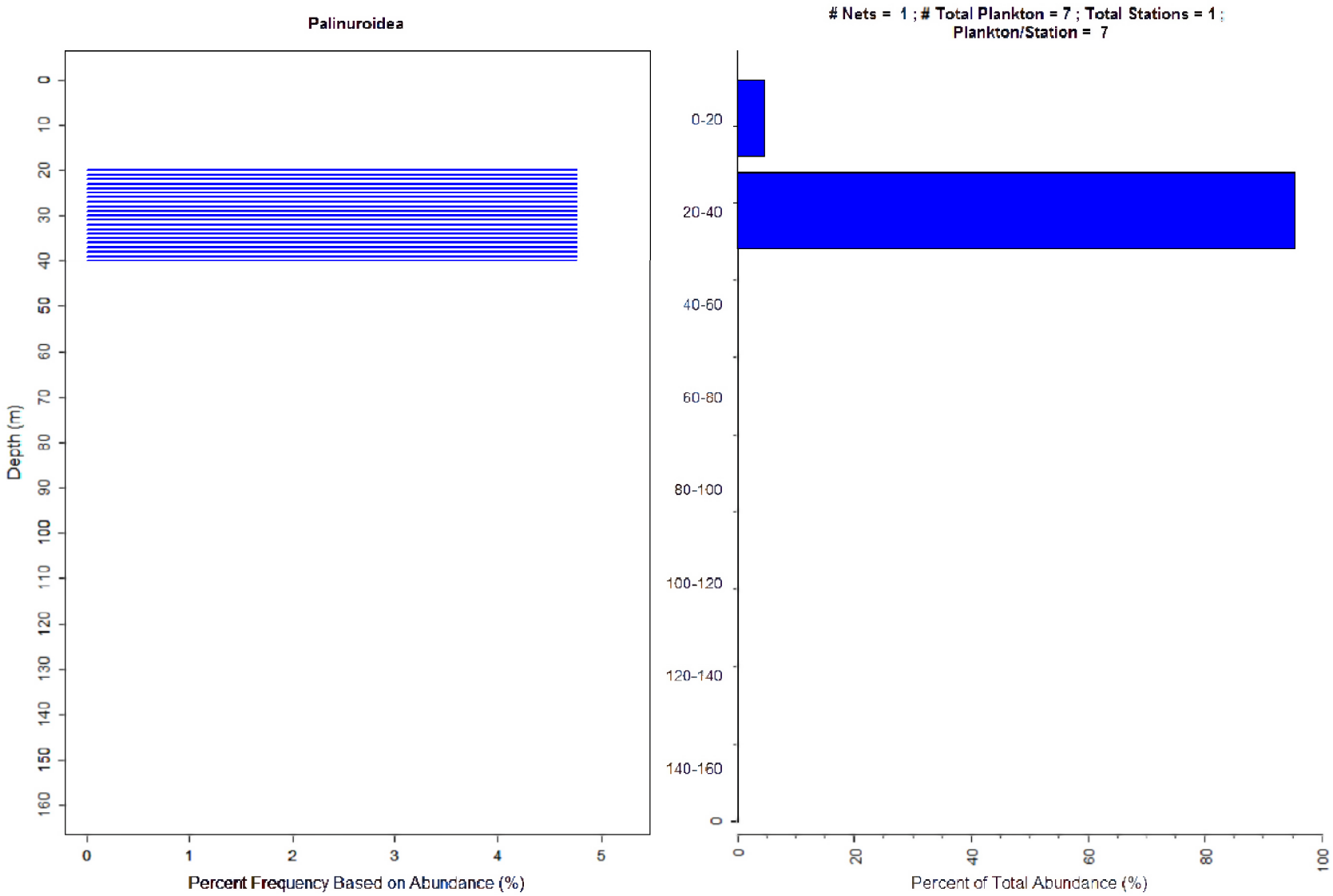
Other_Brachyura - Shallow



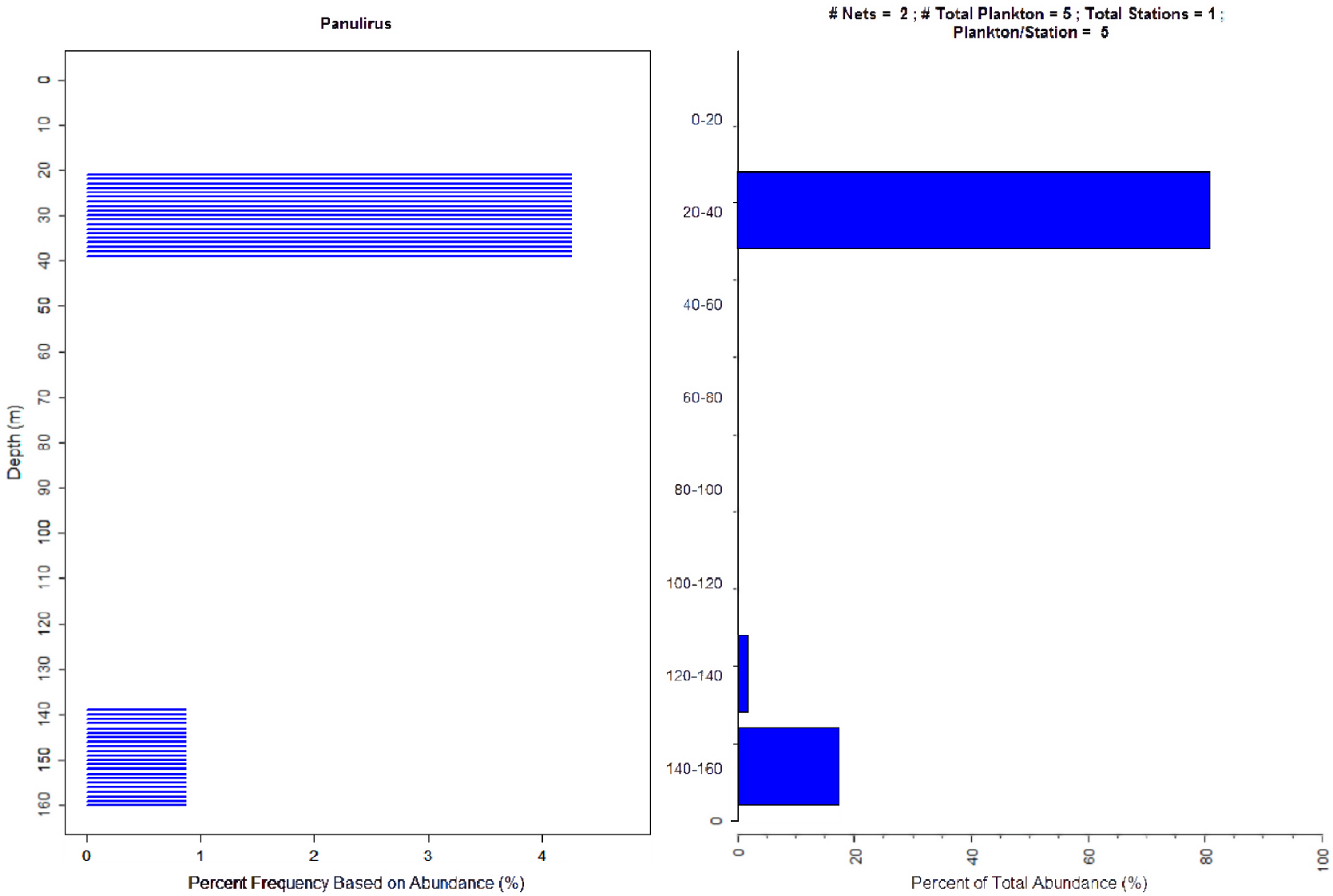
Paguroidea - Shallow



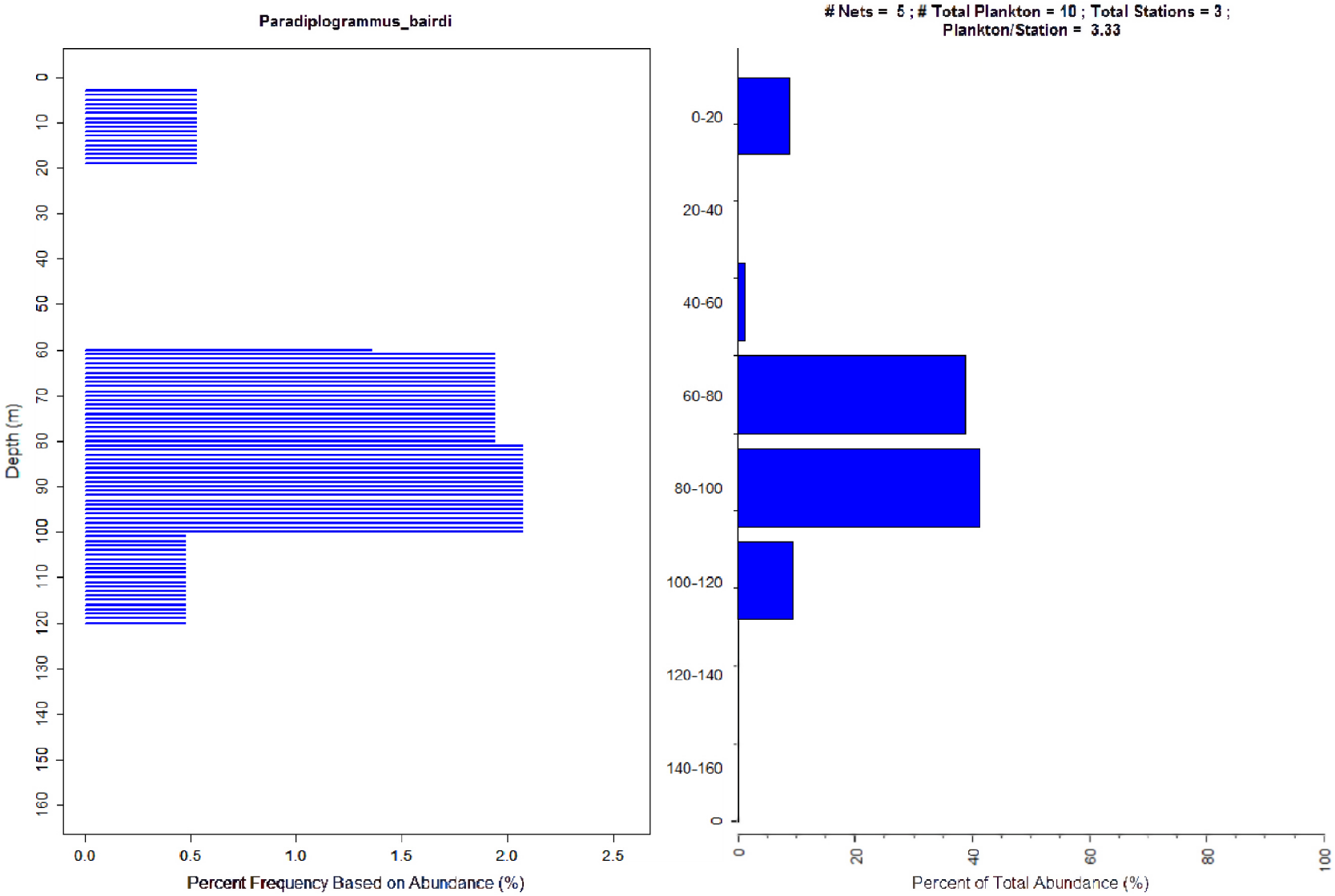
Palinuridae - Shallow



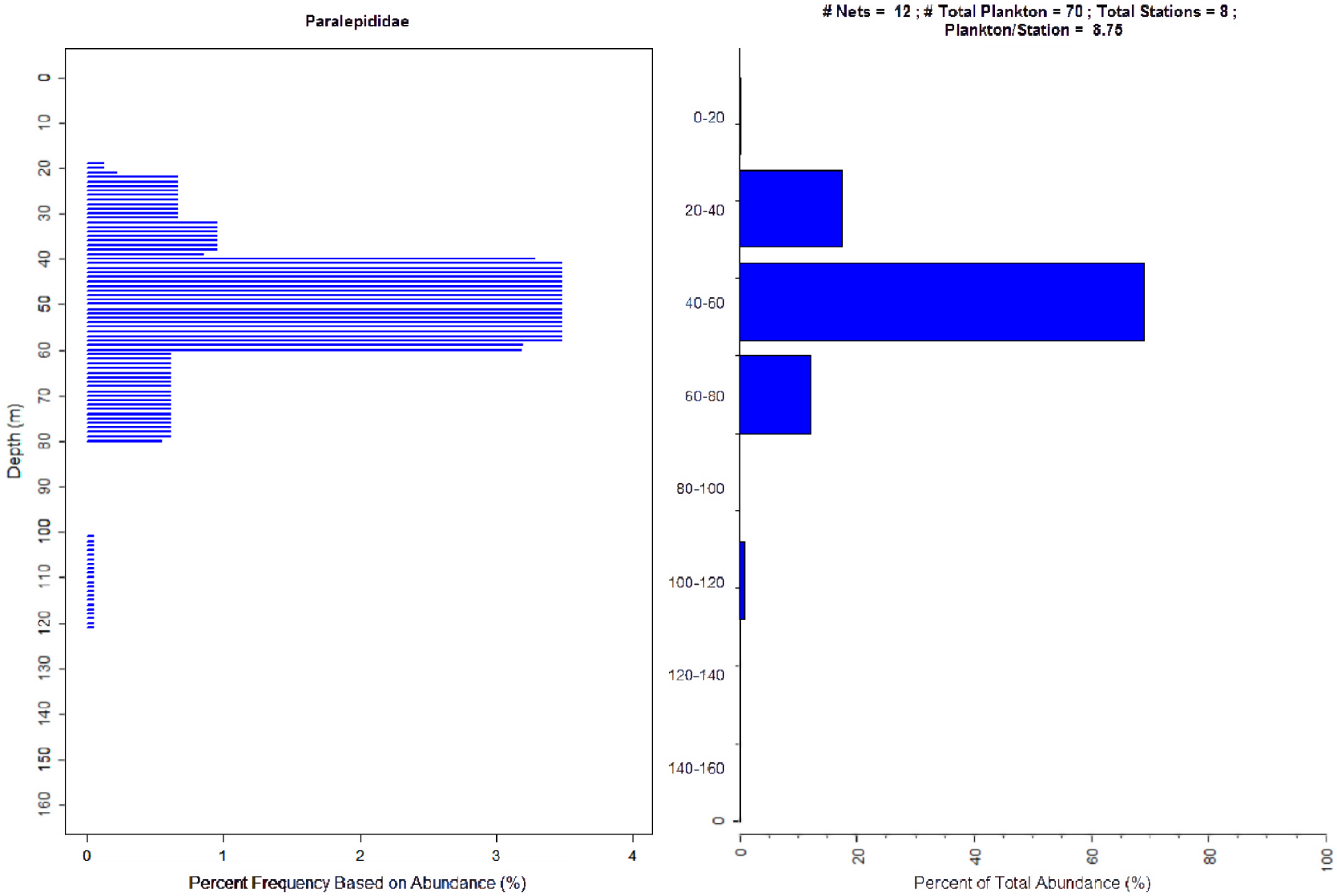
Palinuroidea - Shallow



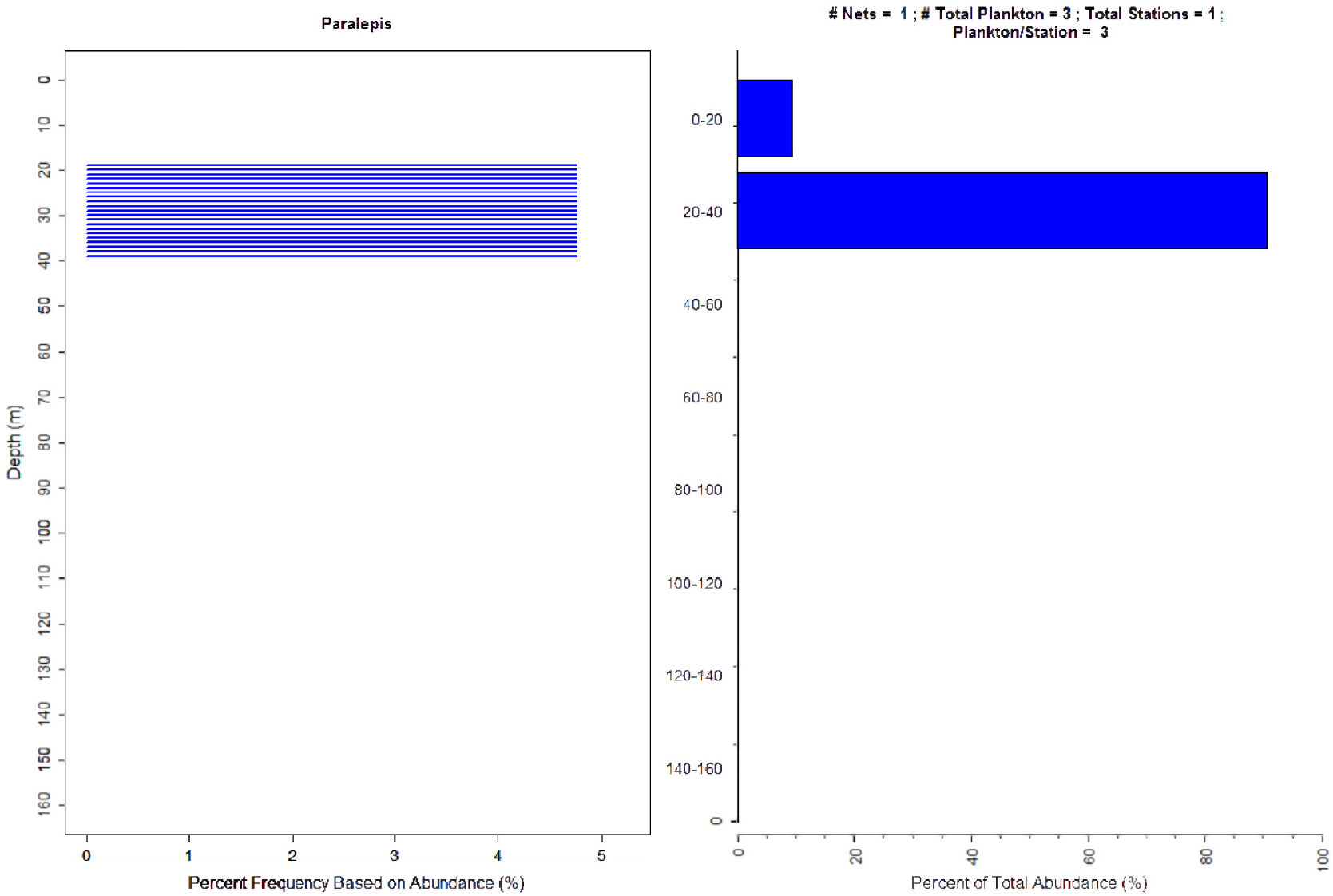
Panulirus - Shallow



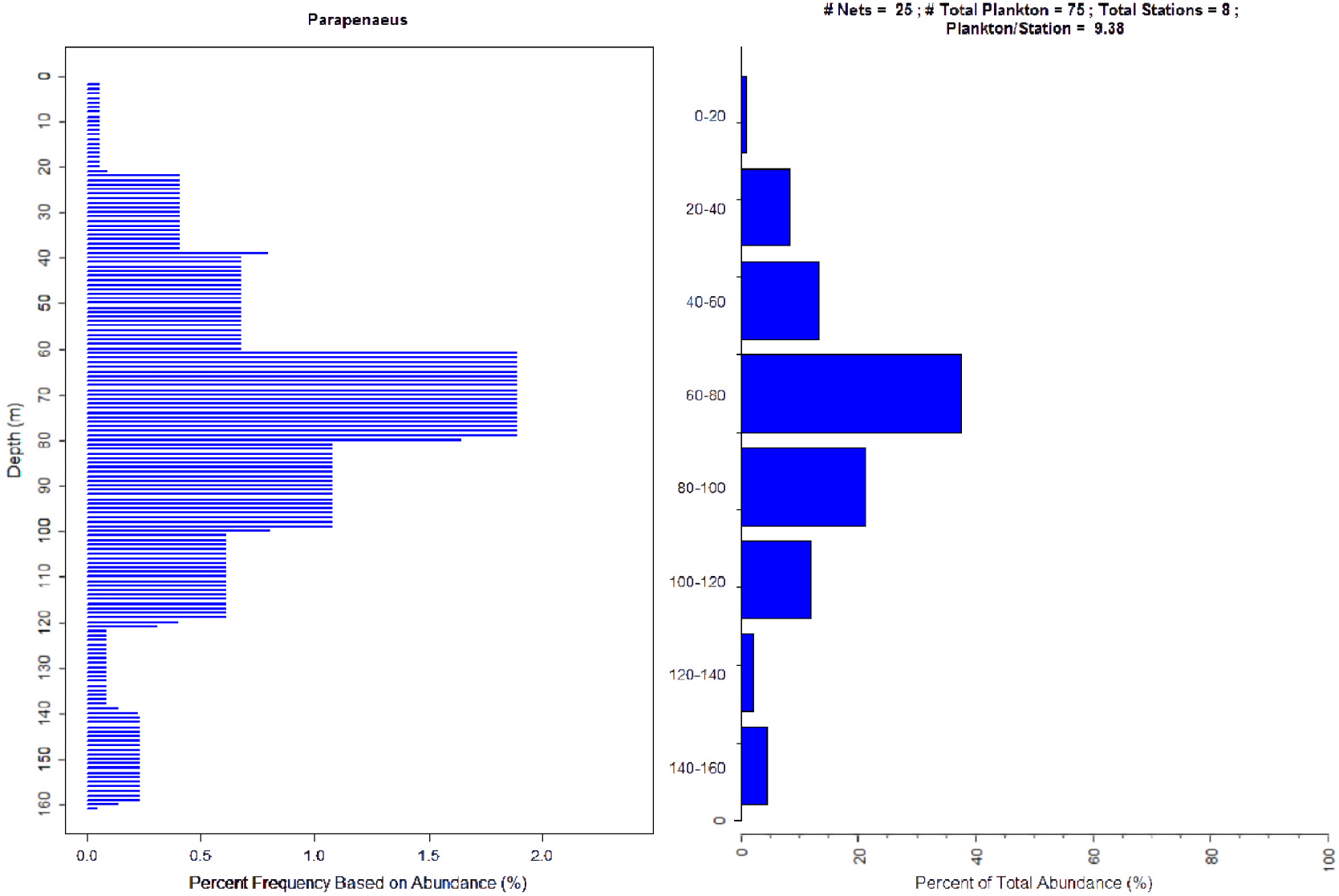
Paradiplogrammus_bairdi - Shallow



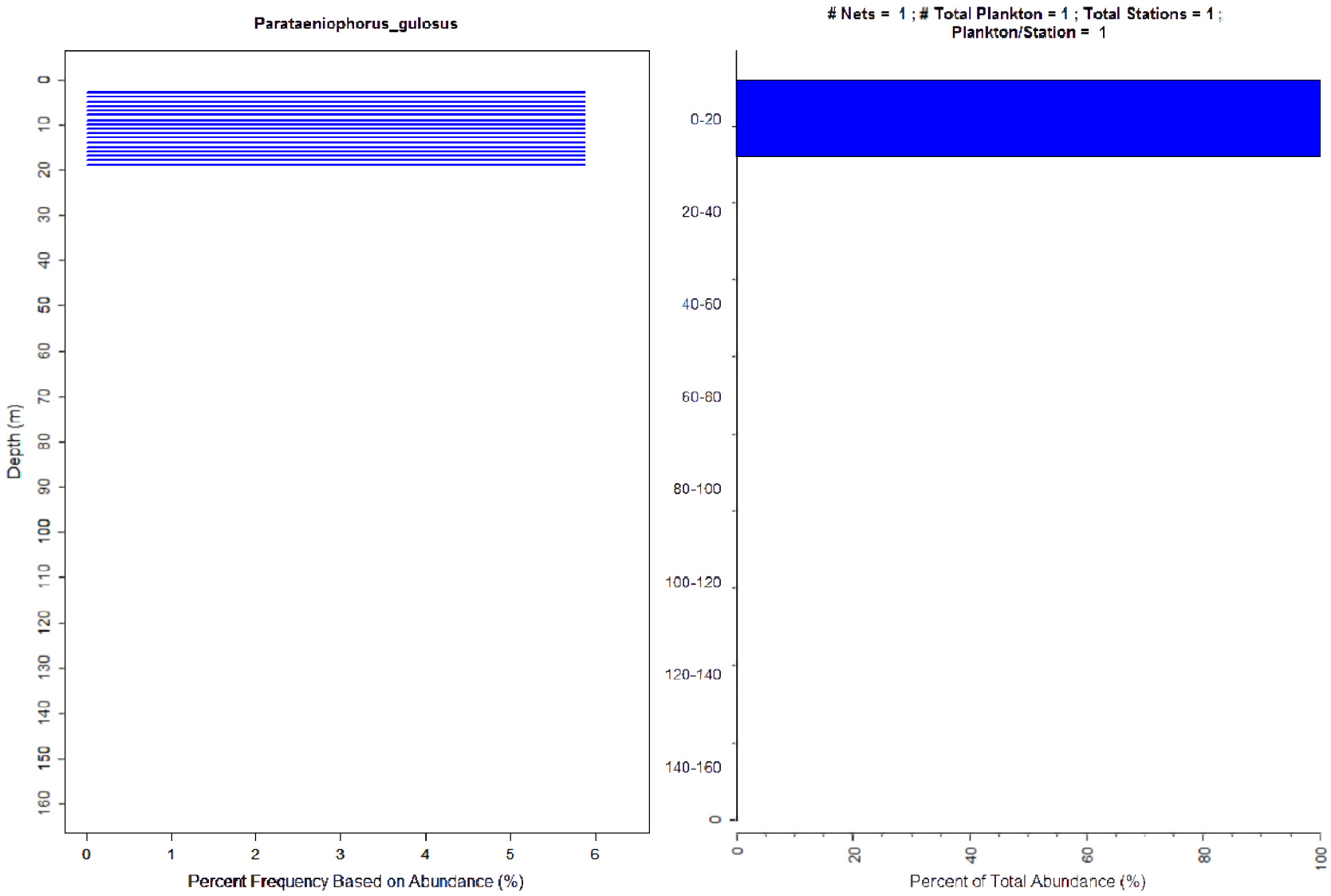
Paralepididae - Shallow



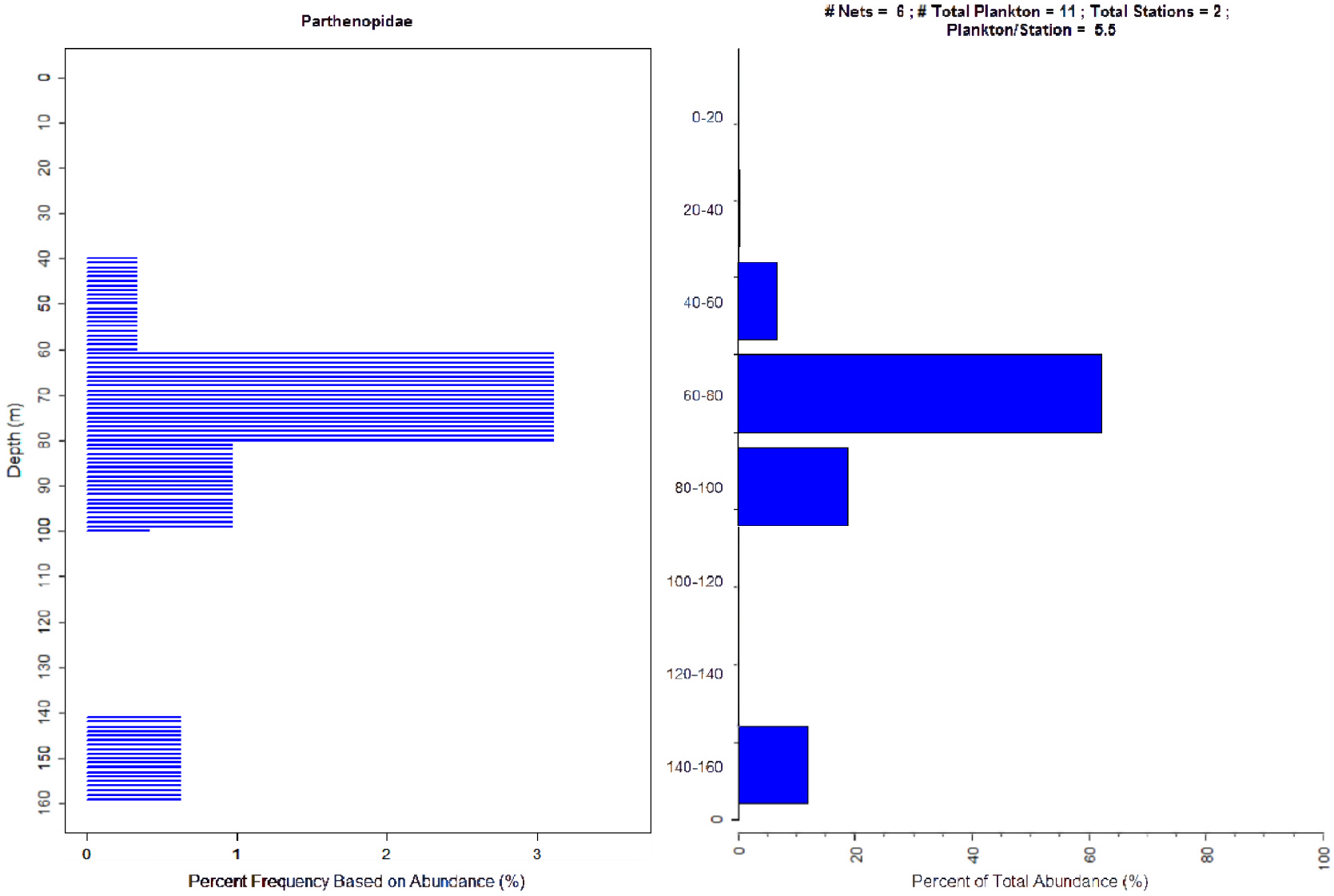
Paralepis - Shallow



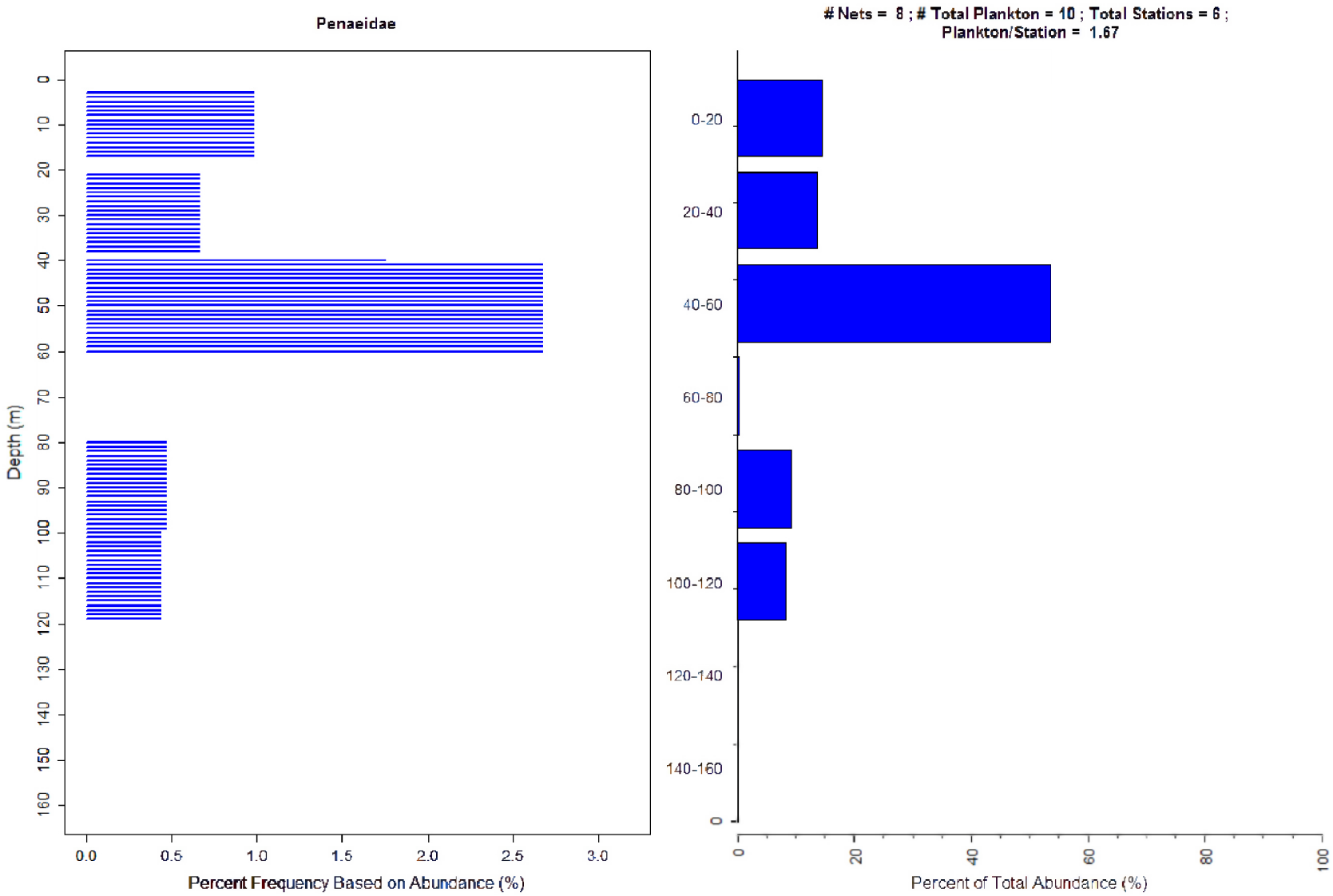
Parapenaeus - Shallow



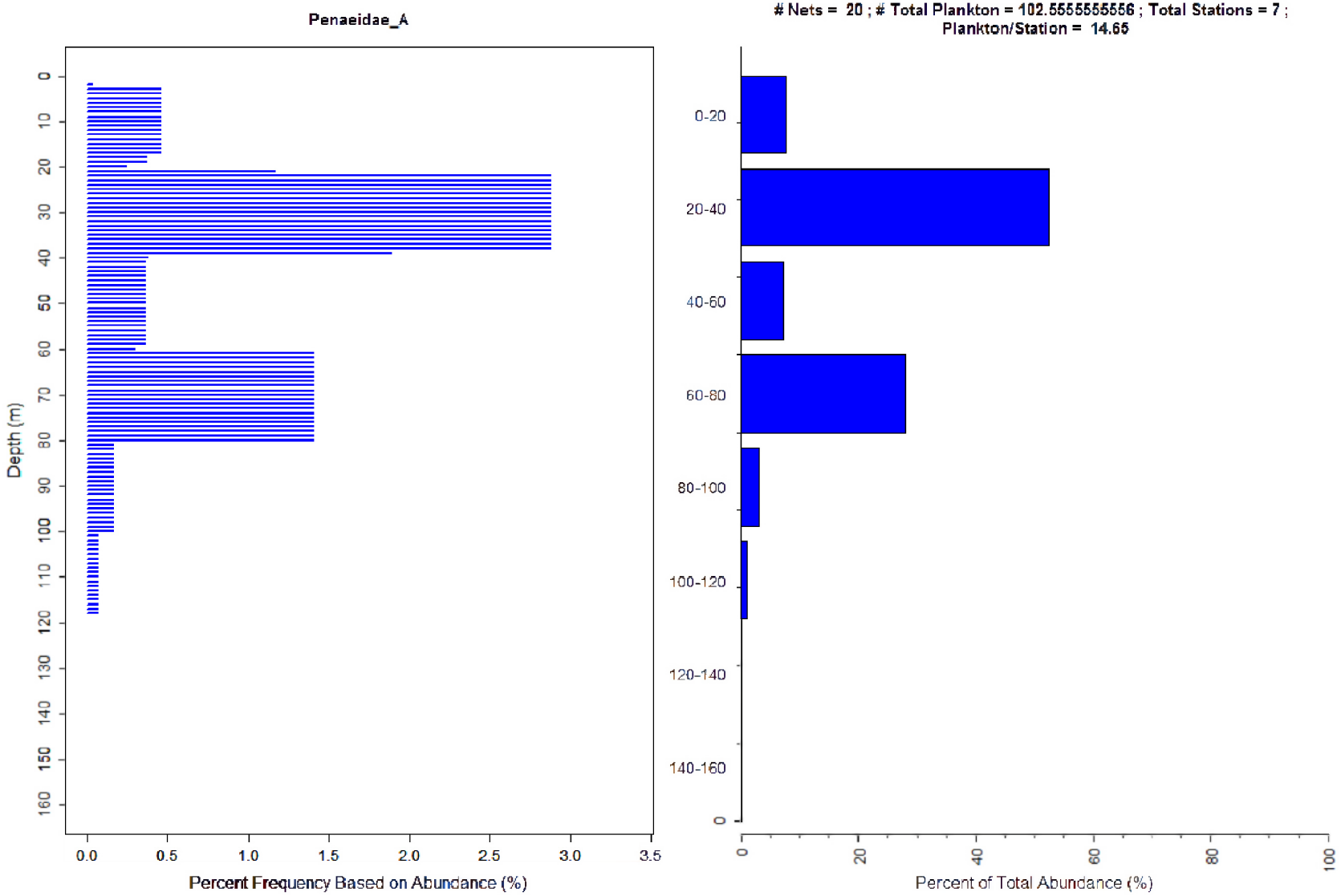
Parataeniophorus_gulosus - Shallow



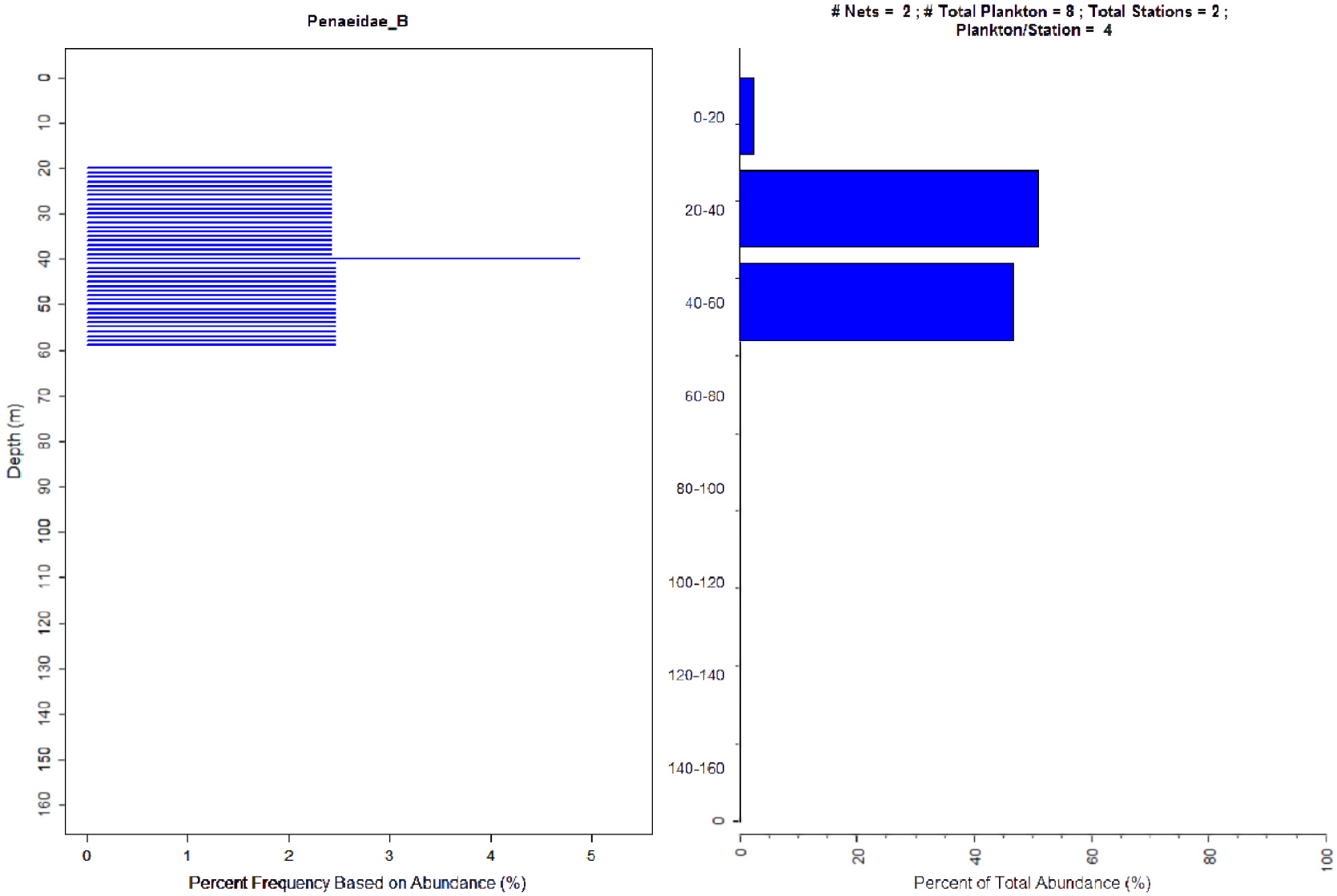
Parthenopidae - Shallow



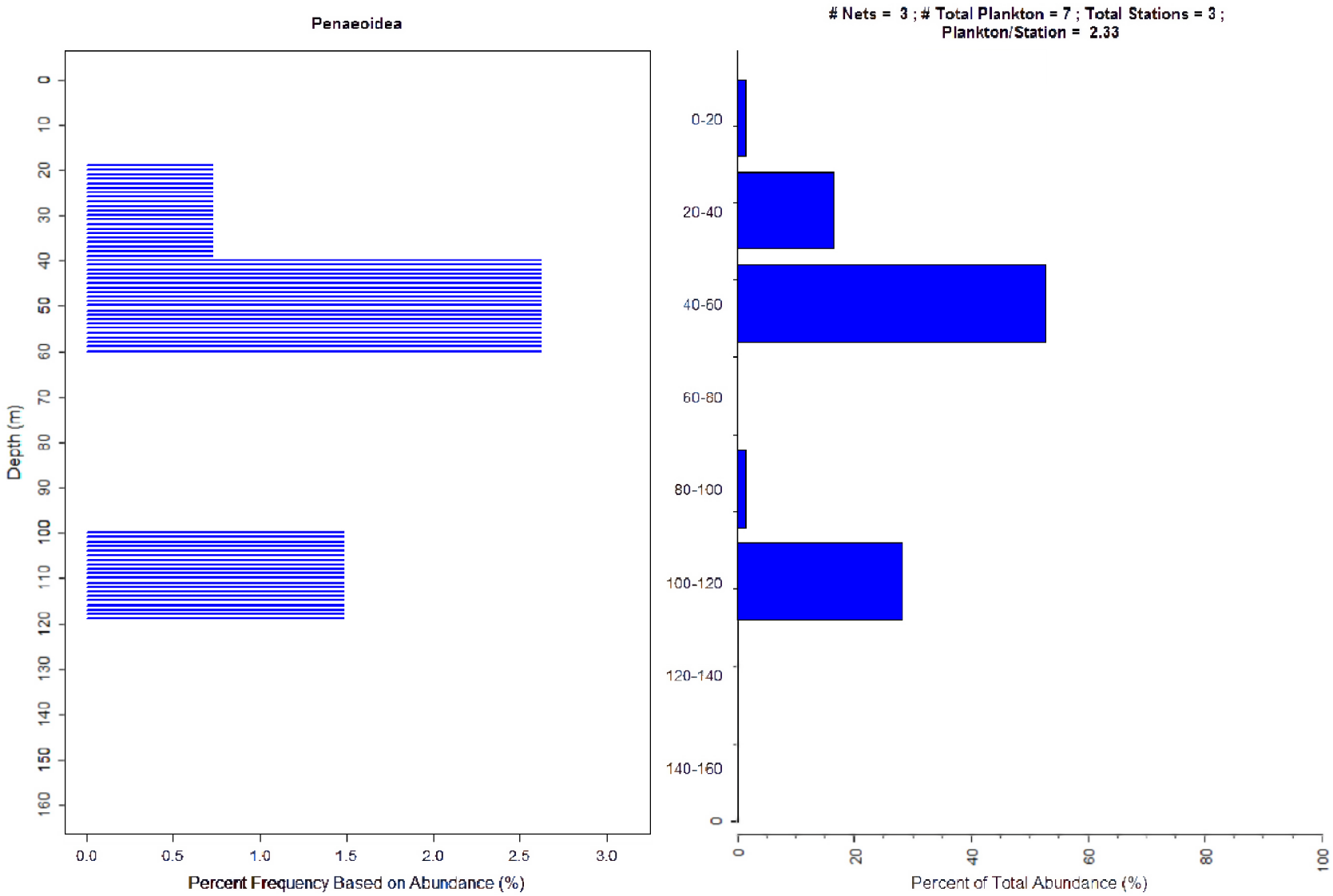
Penaeidae - Shallow



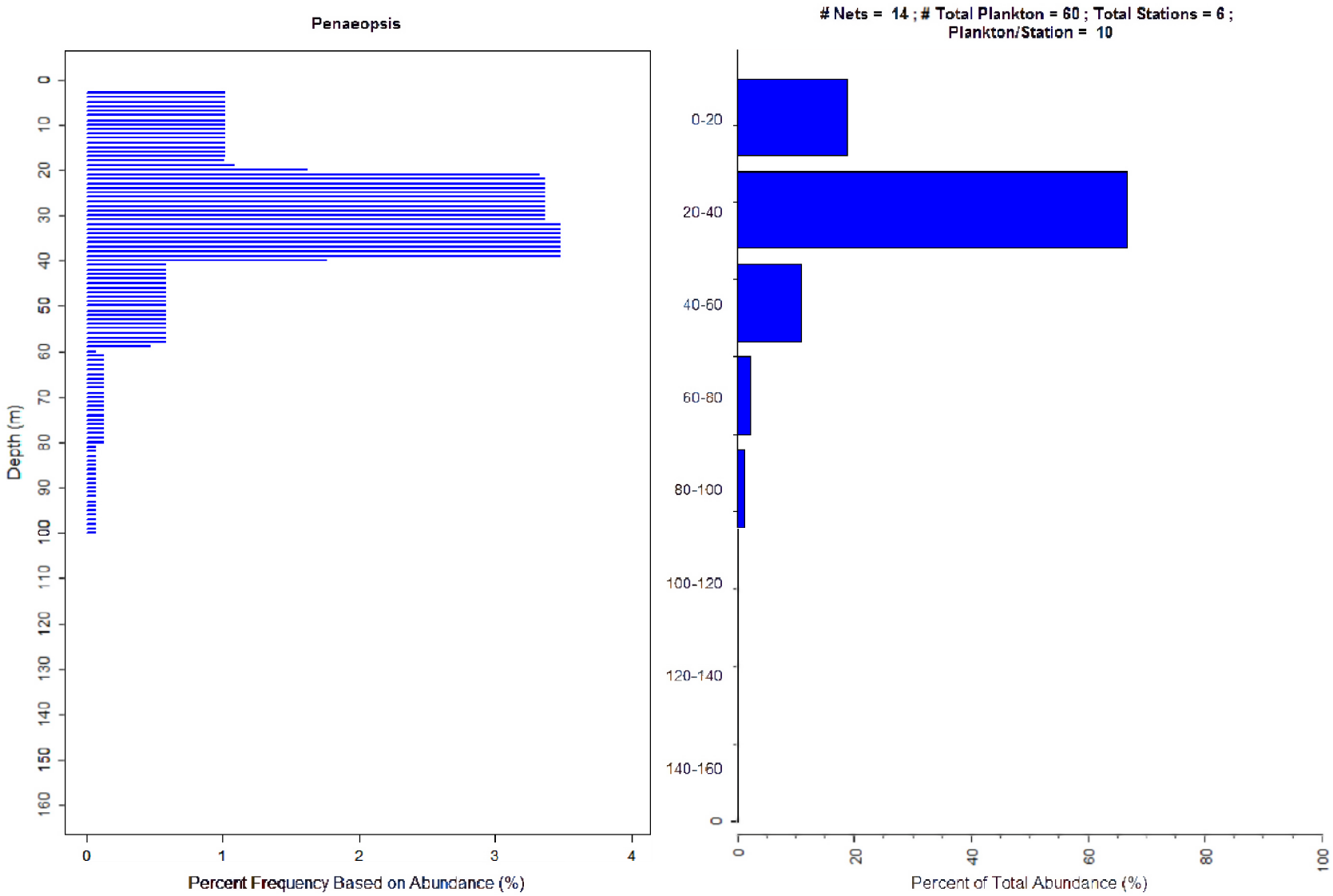
Penaeidae_A - Shallow



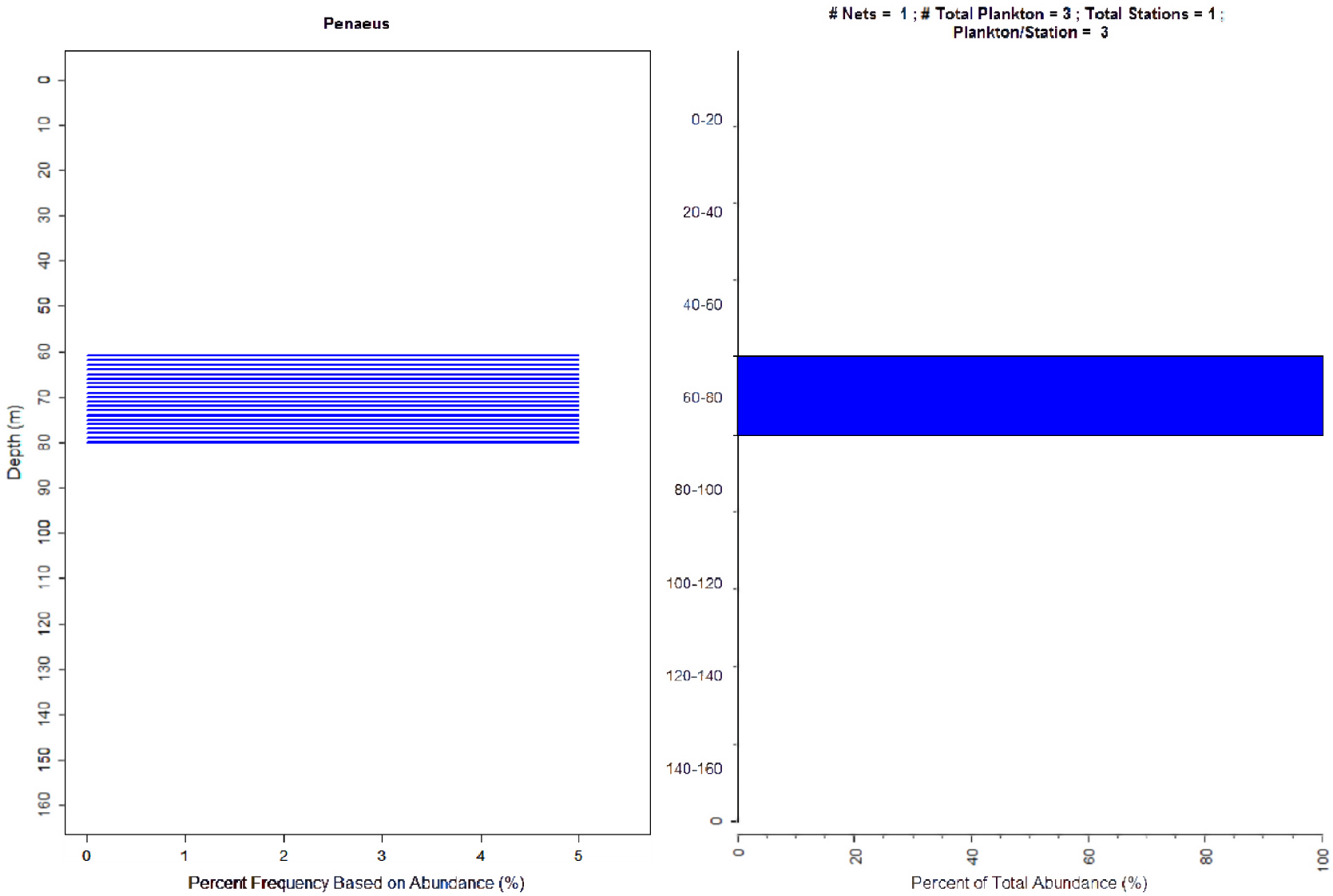
Penaeidae_B - Shallow



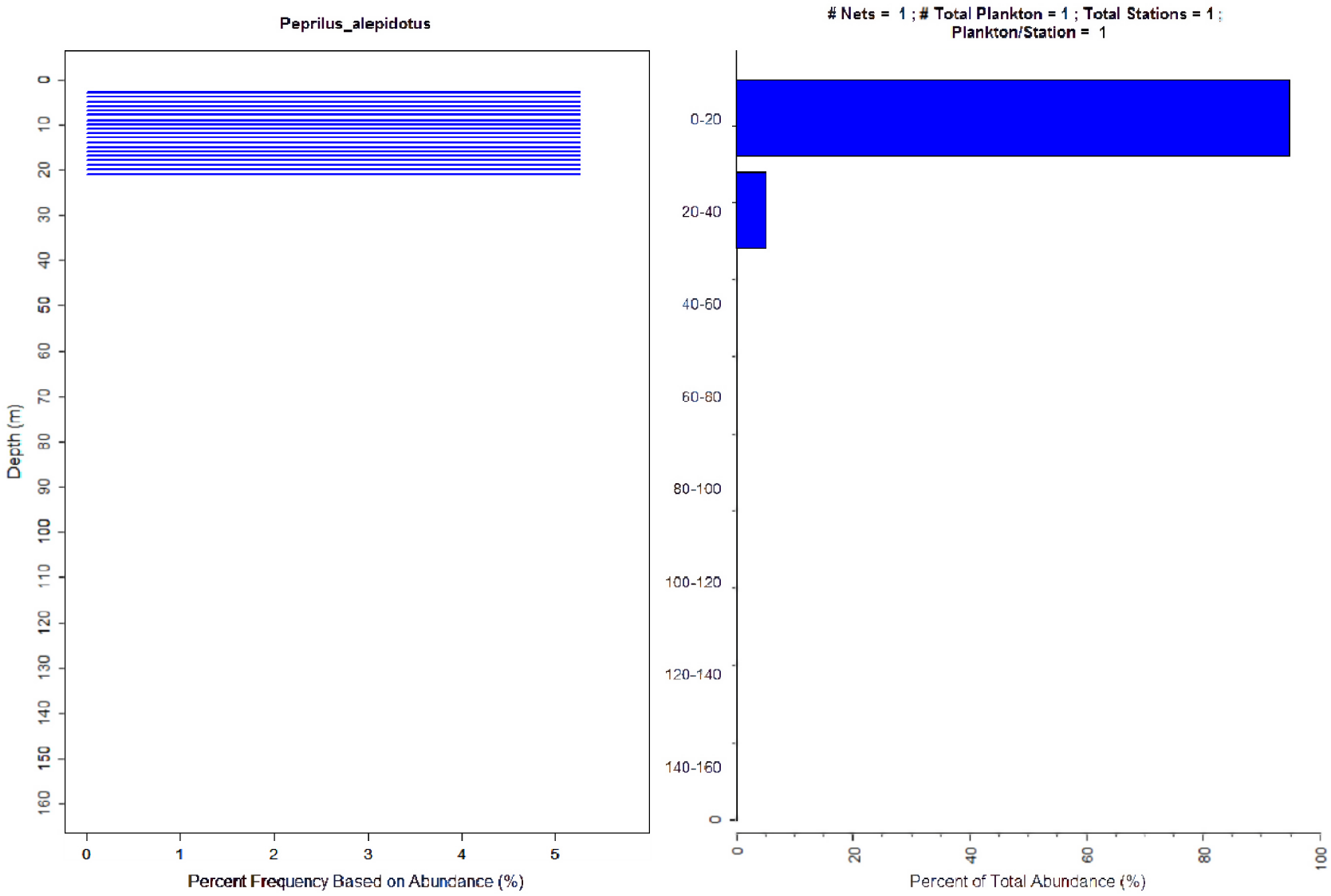
Penaeoidea - Shallow



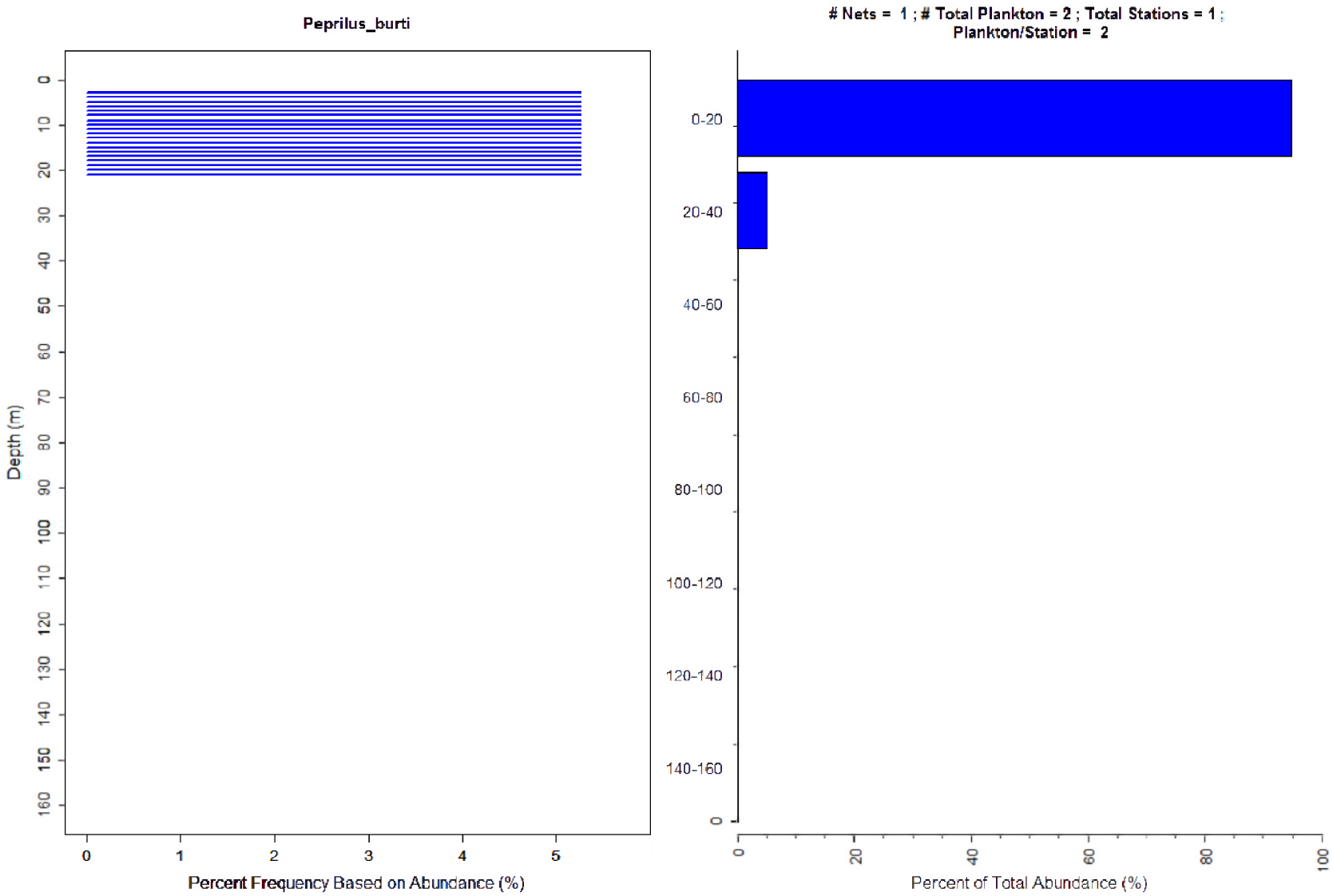
Penaeopsis - Shallow



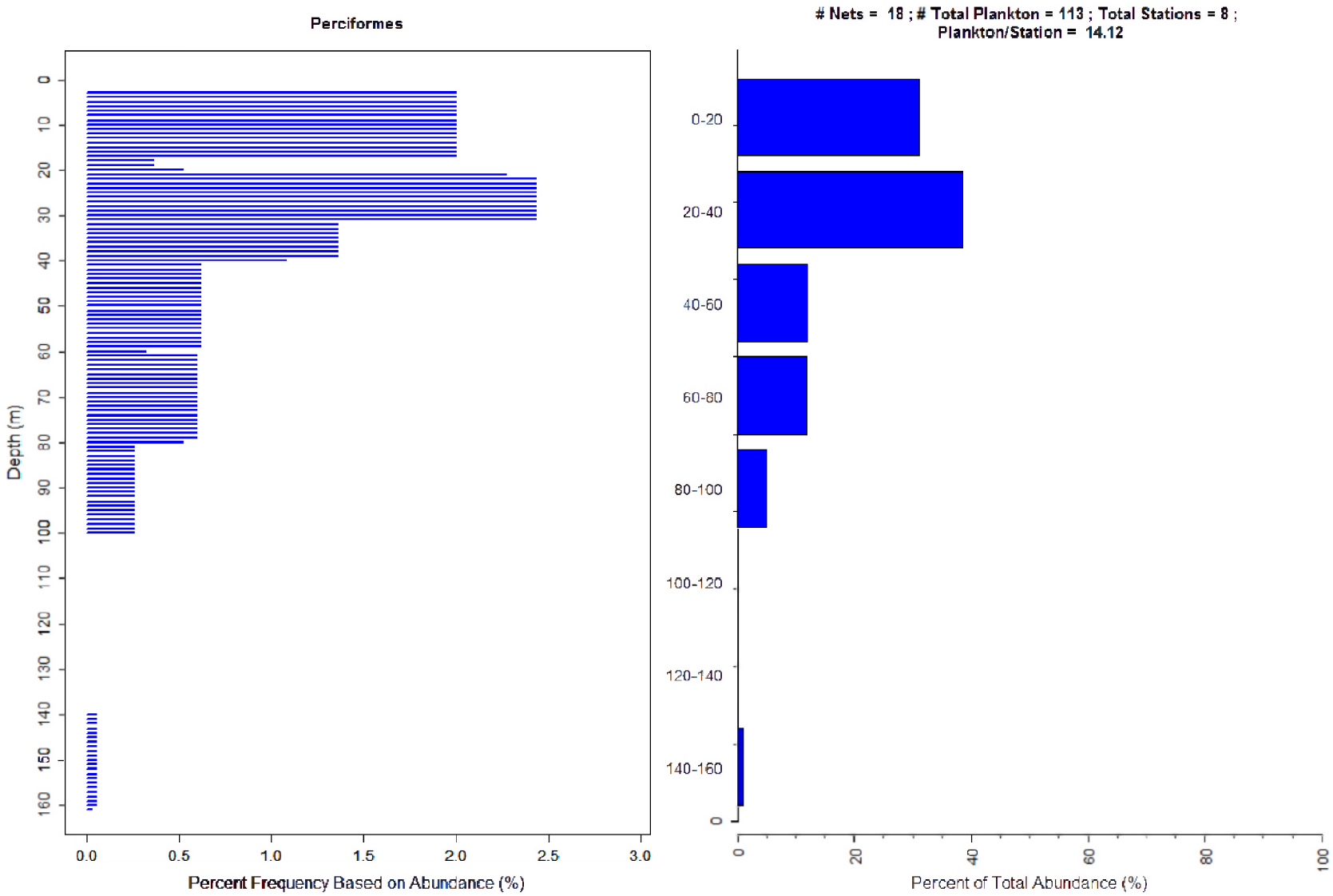
Penaeus - Shallow



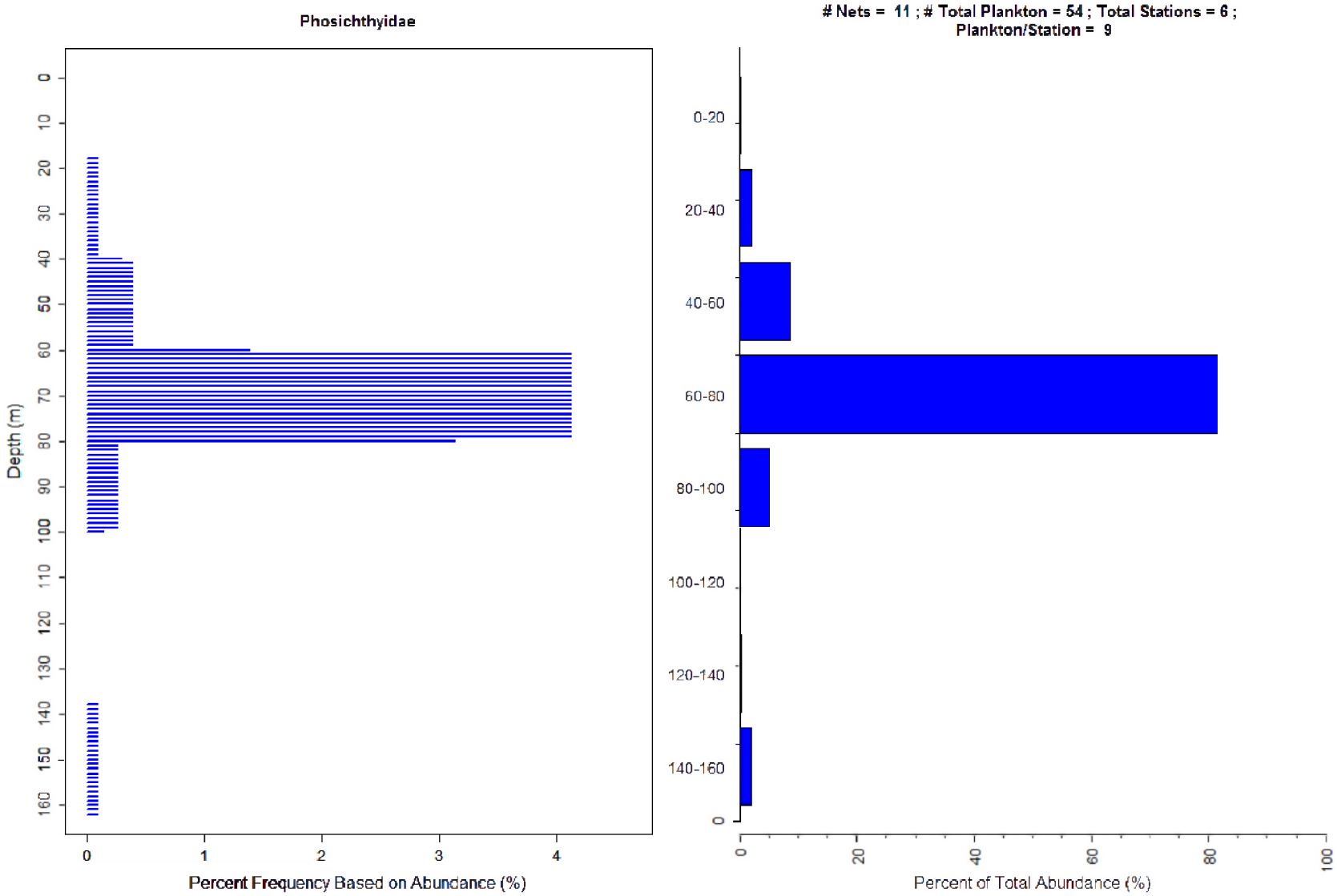
Peprilus_alepidotus - Shallow



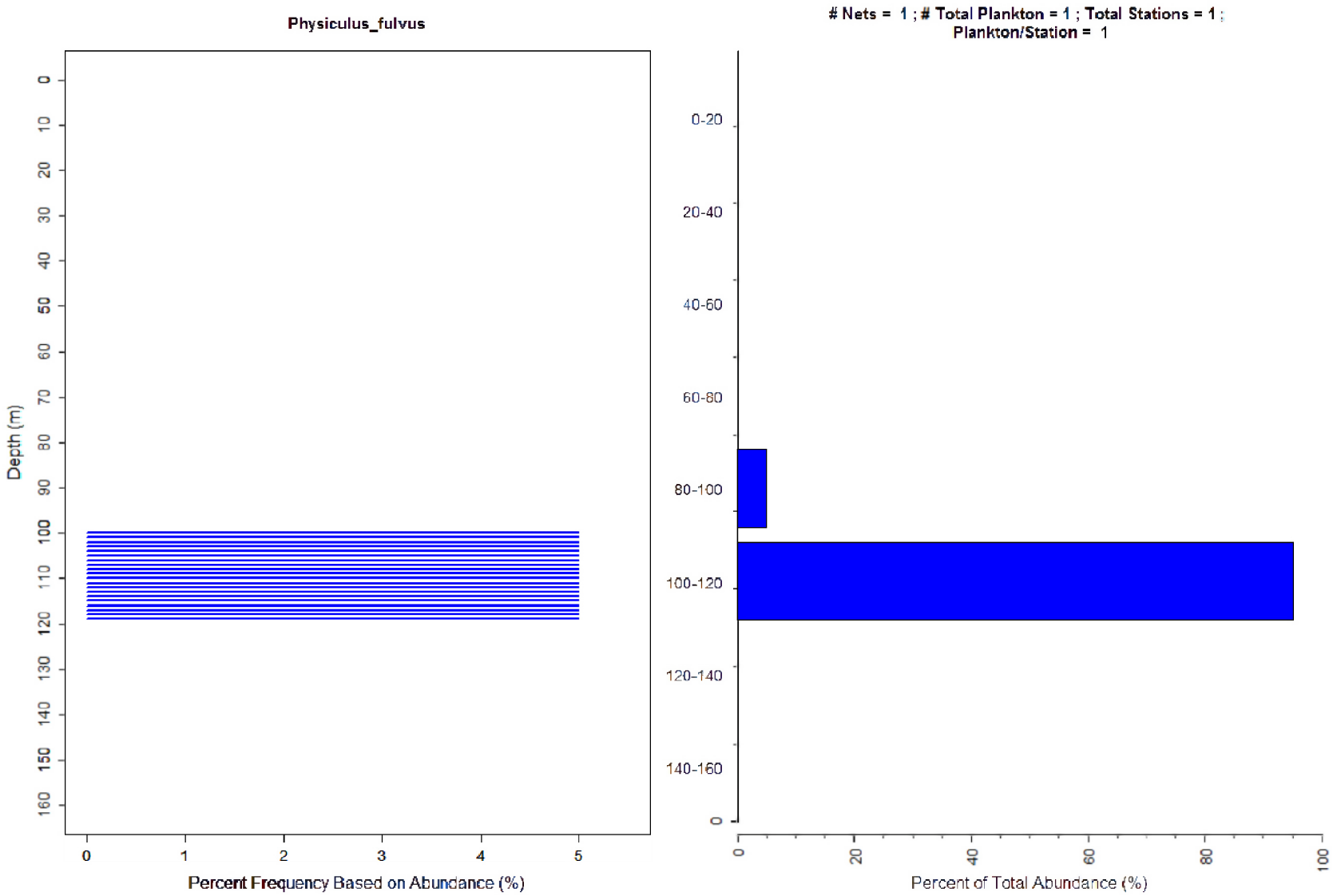
Peprilus_burti - Shallow



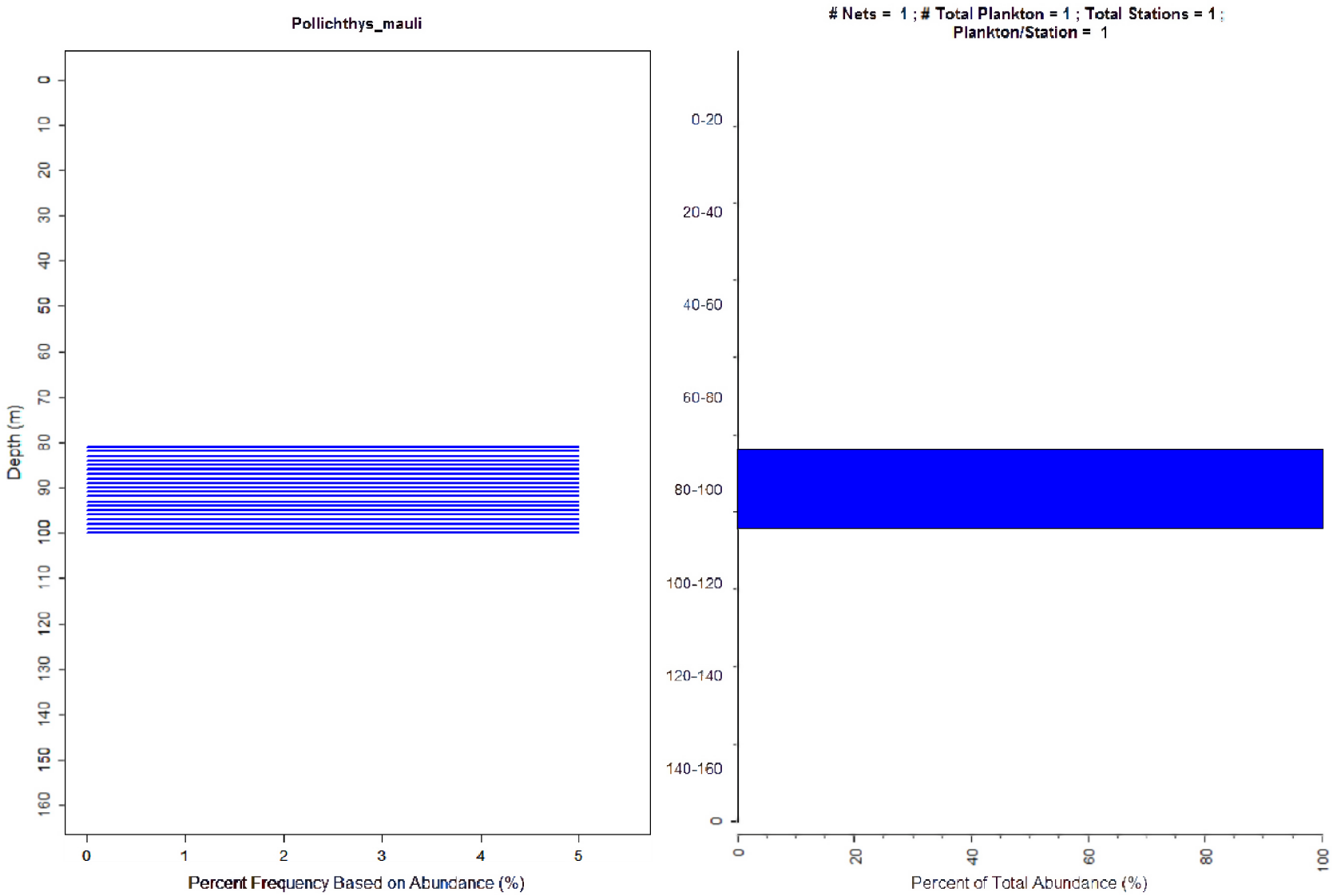
Perciformes - Shallow



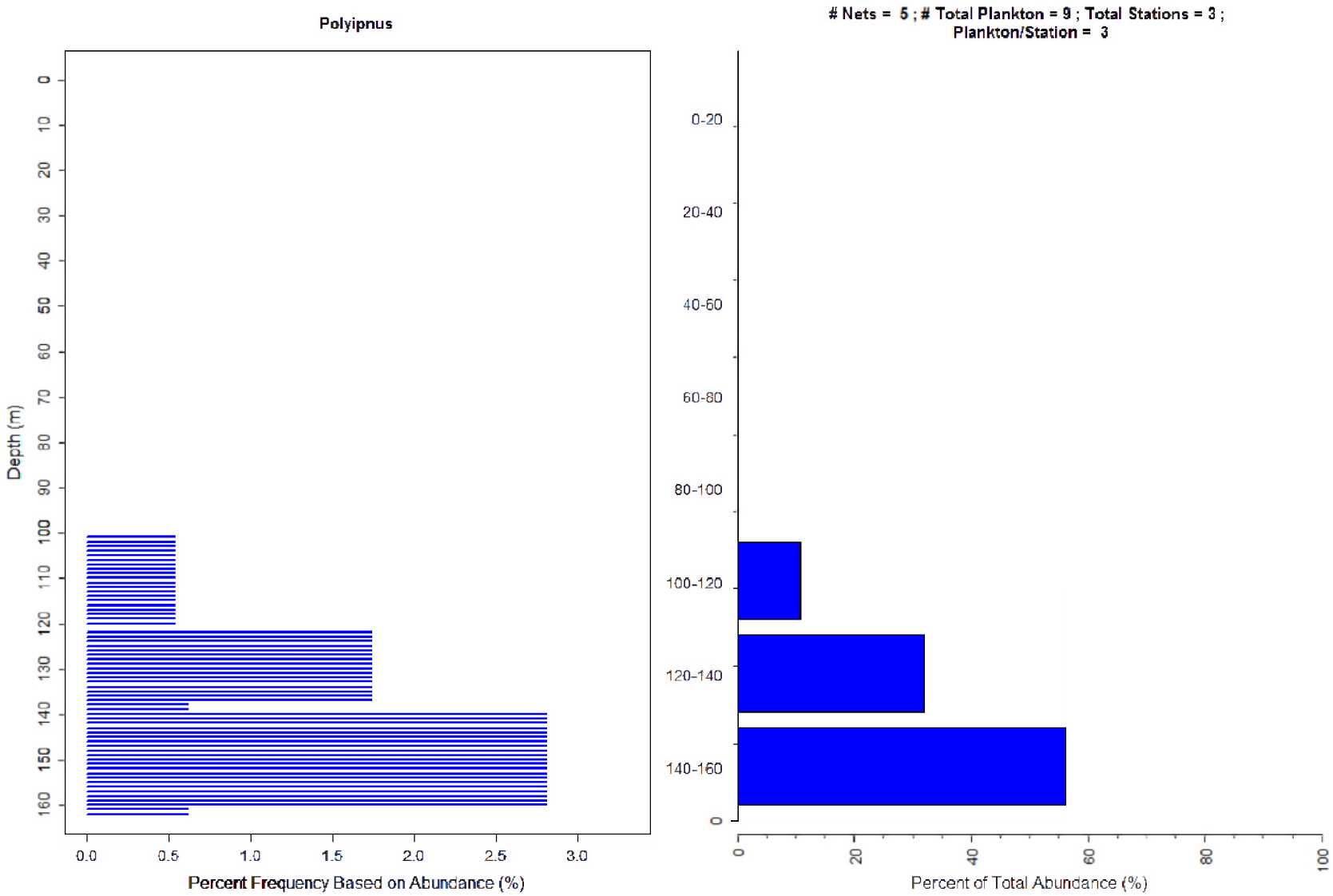
Phosichthyidae - Shallow



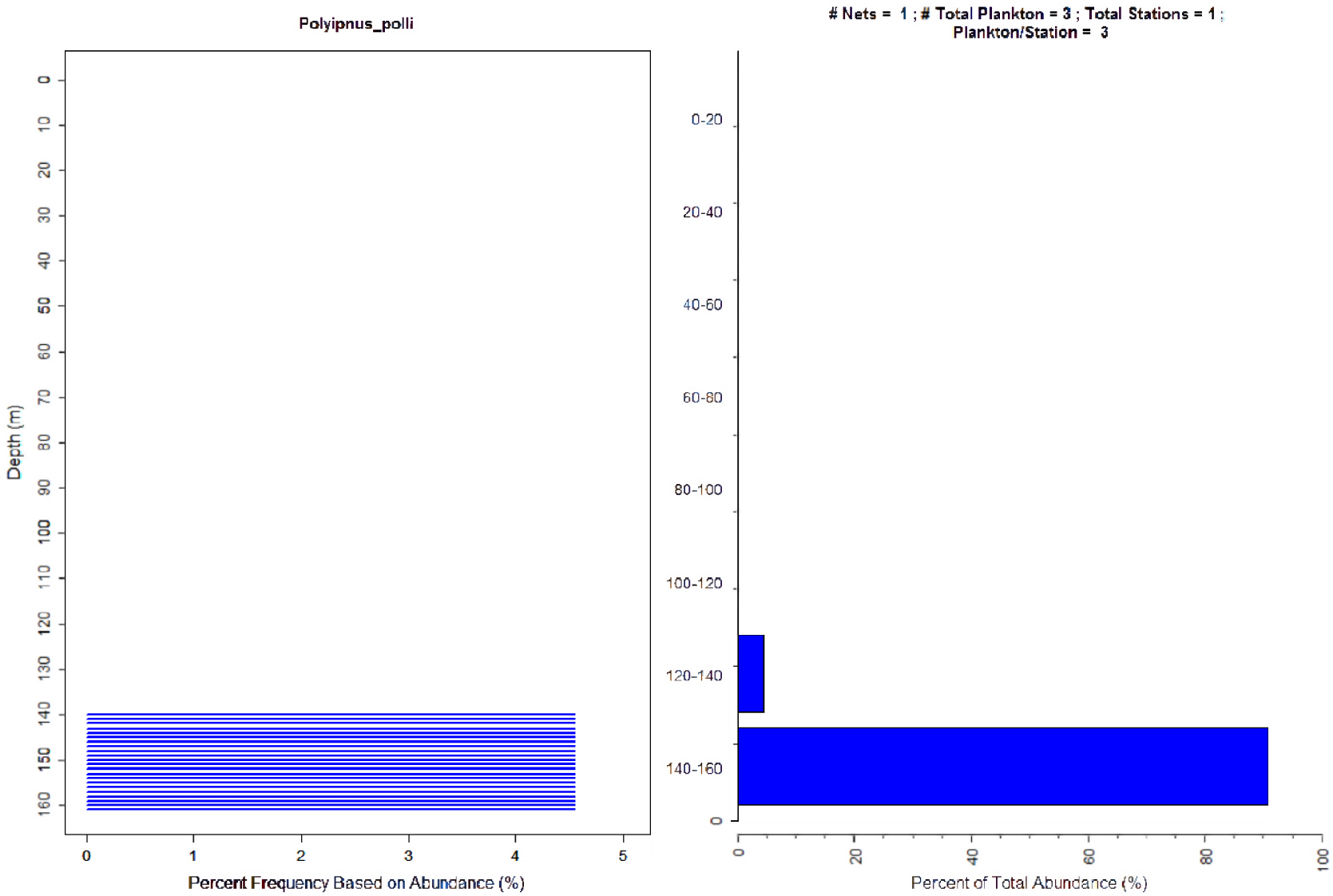
Physiculus_fulvus - Shallow



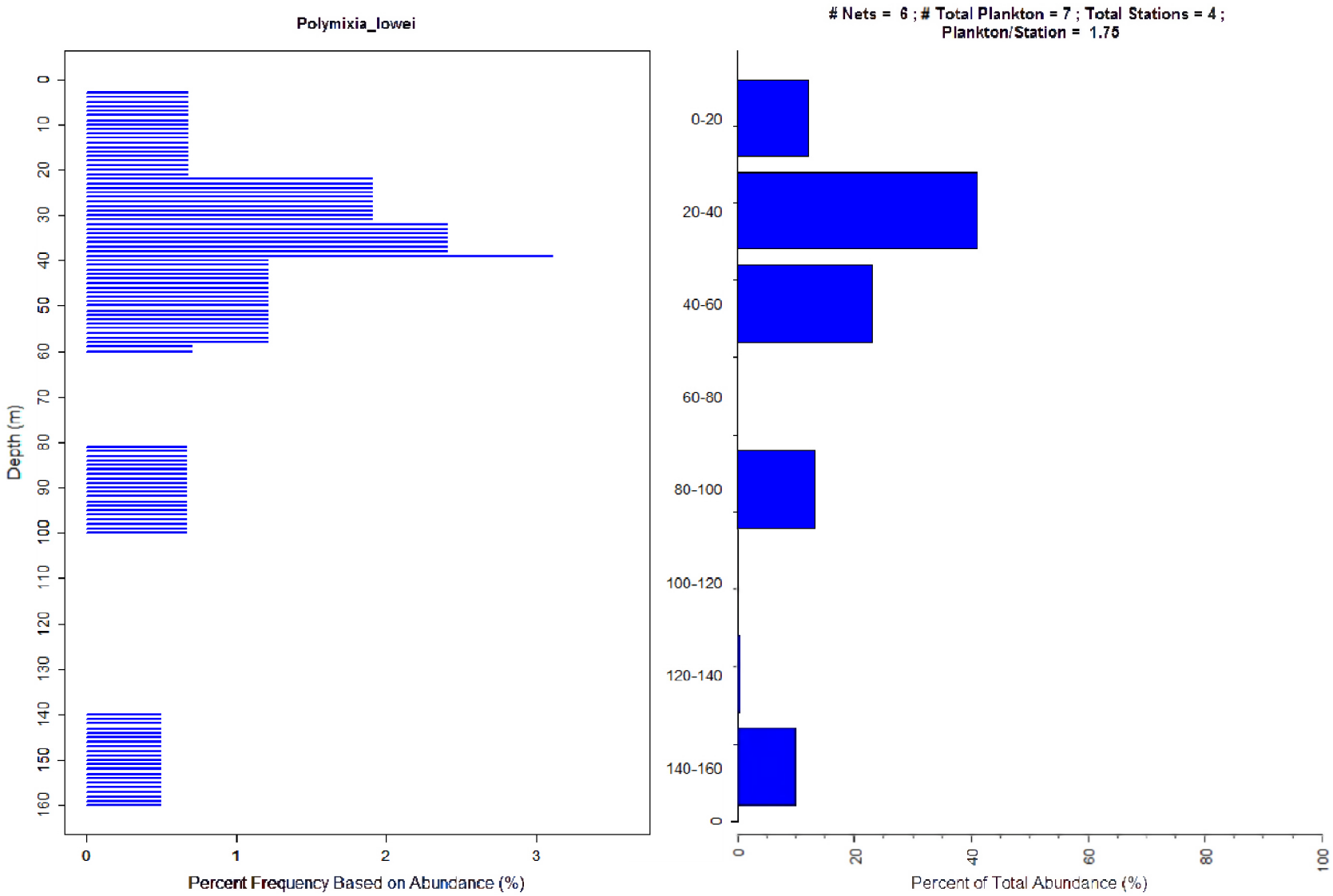
Pollichthys_mauli - Shallow



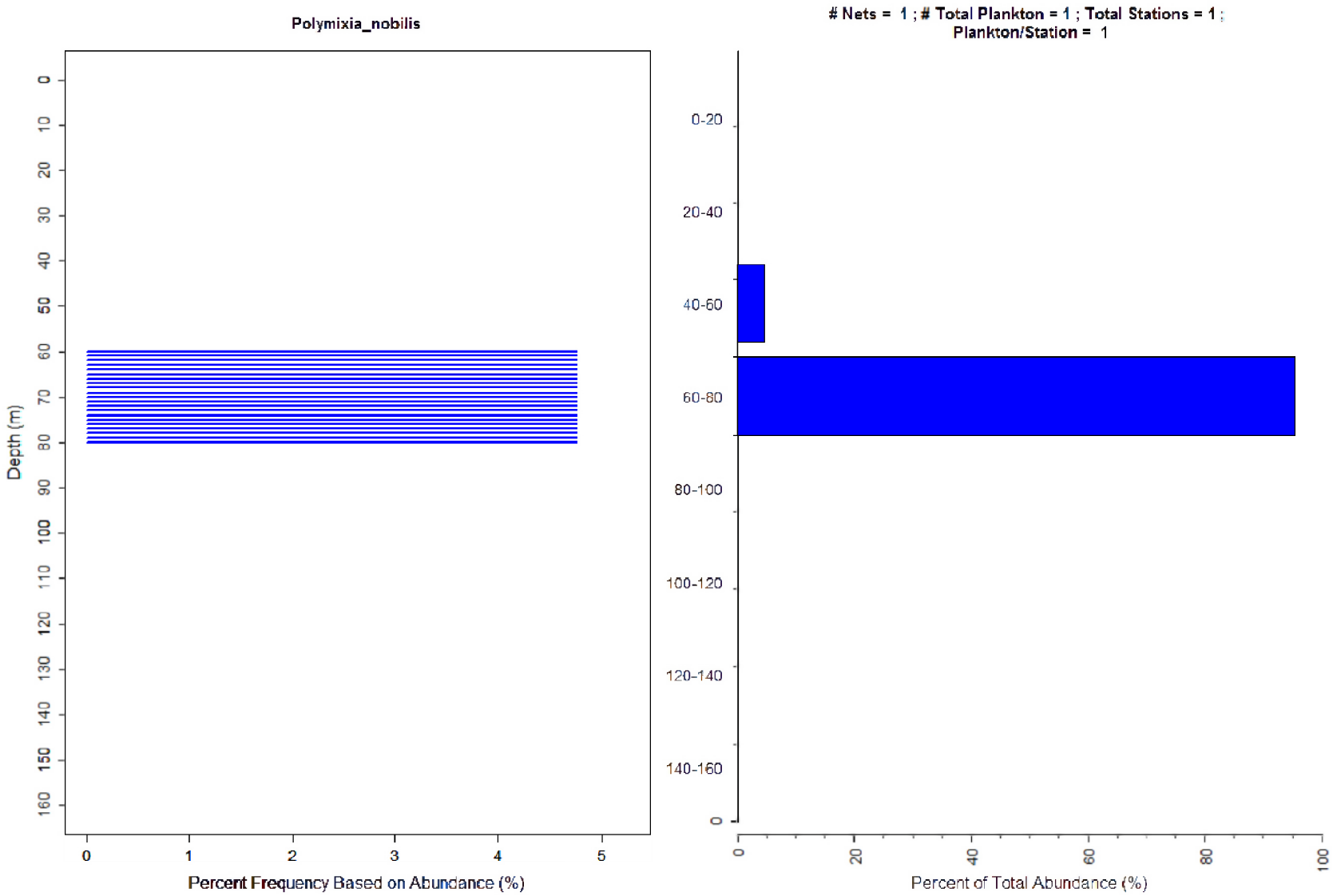
Polyipnus - Shallow



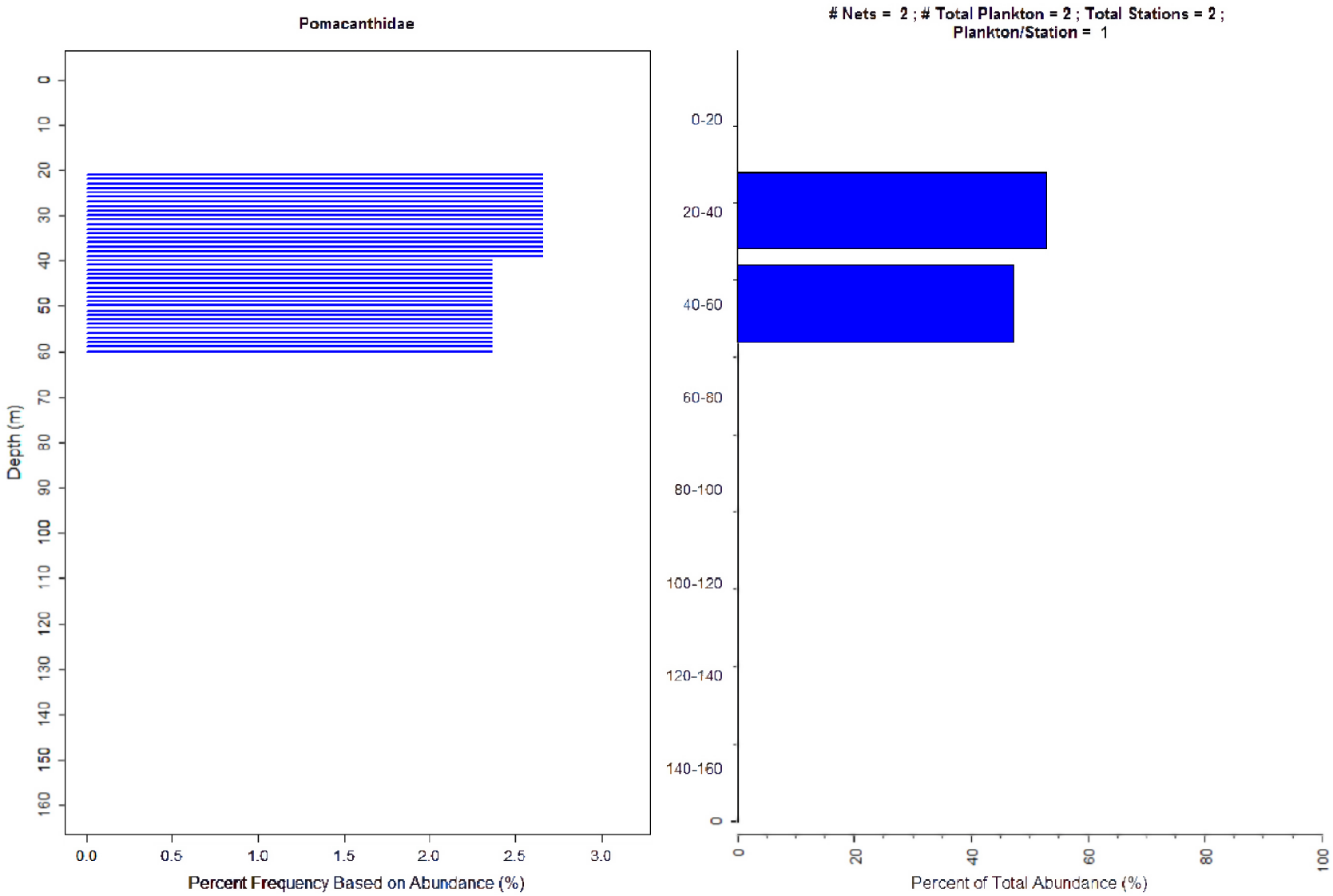
Polyipnus_polli - Shallow



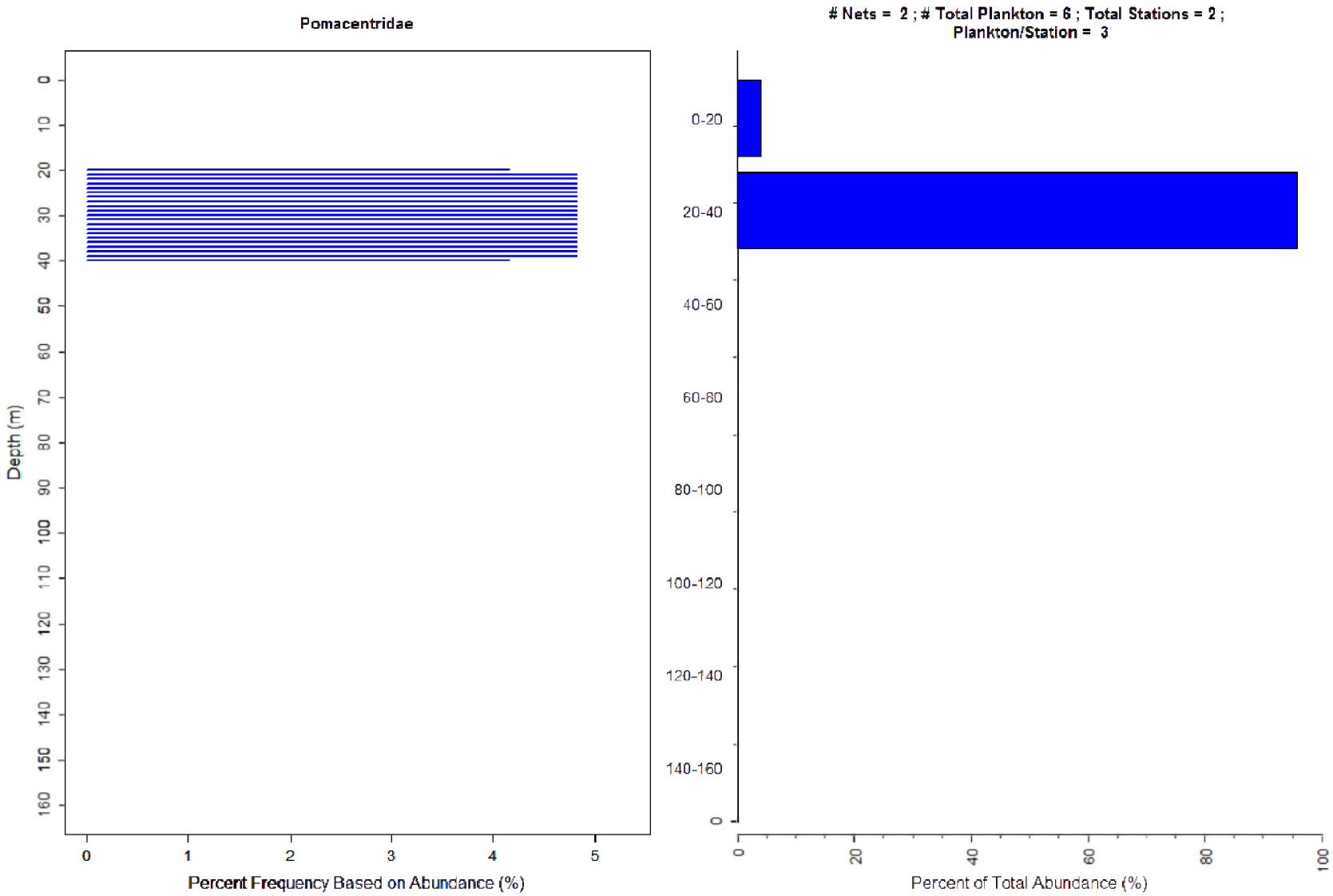
Polymixia_lowei - Shallow



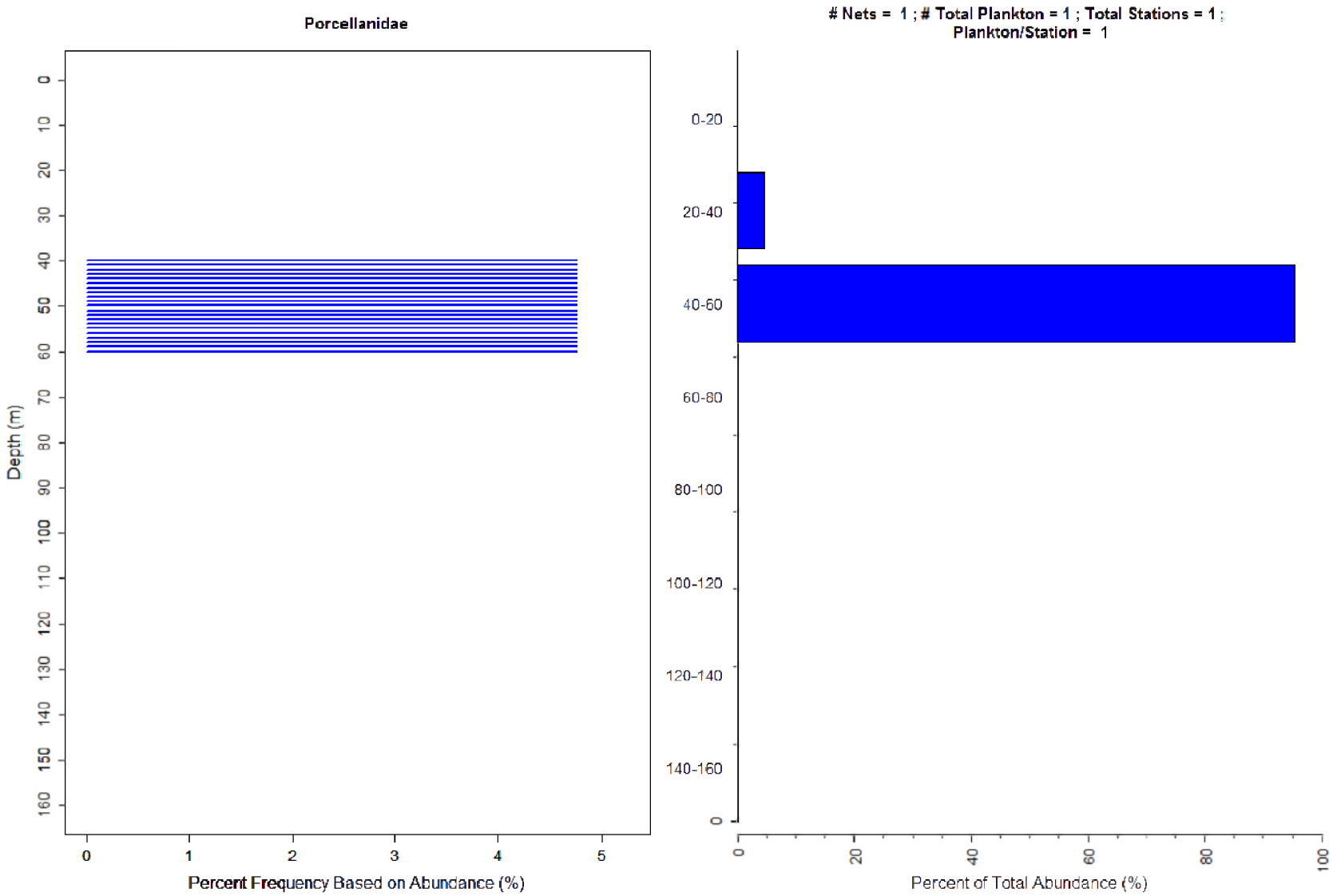
Polymixia_nobilis - Shallow



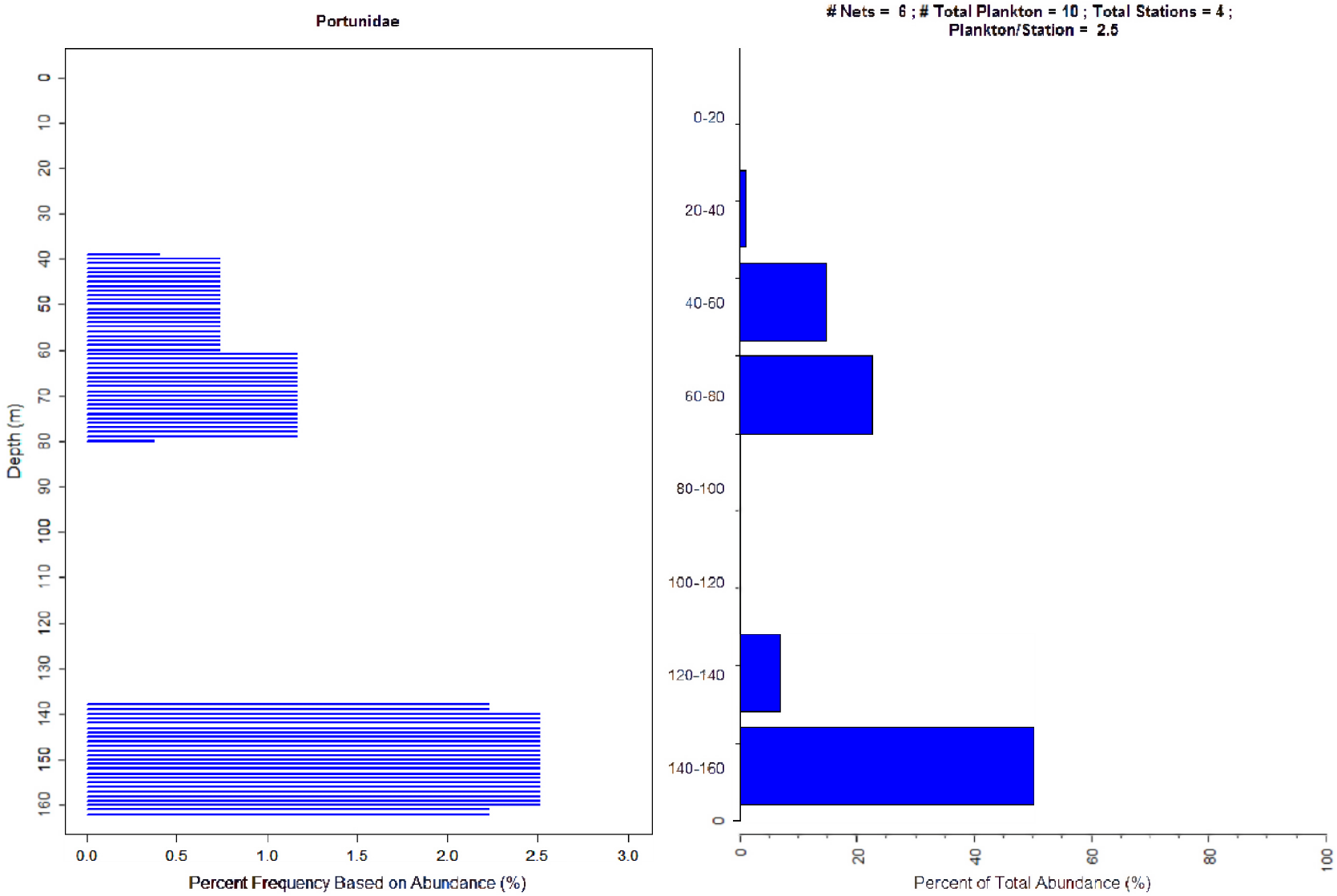
Pomacanthidae - Shallow



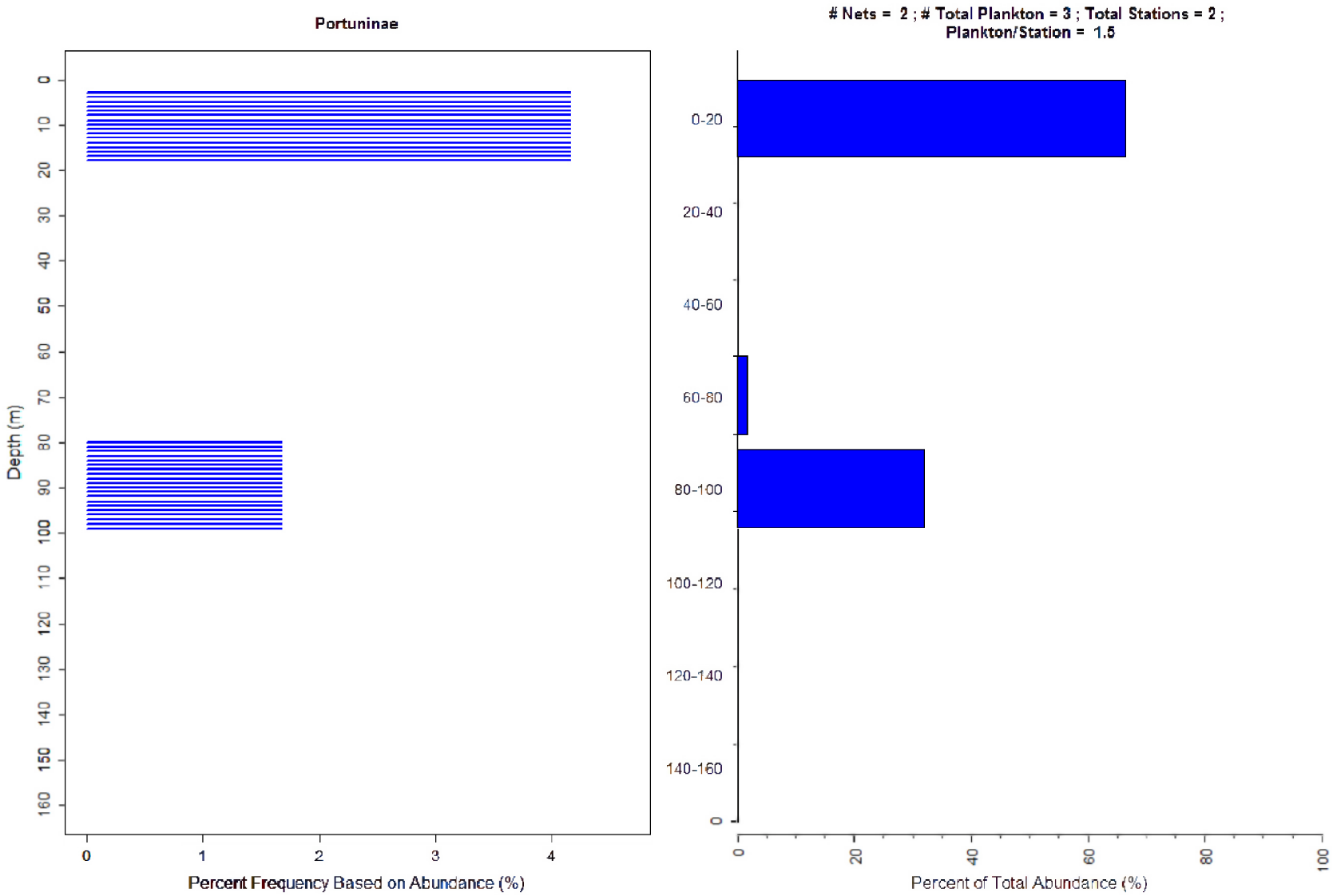
Pomacentridae - Shallow



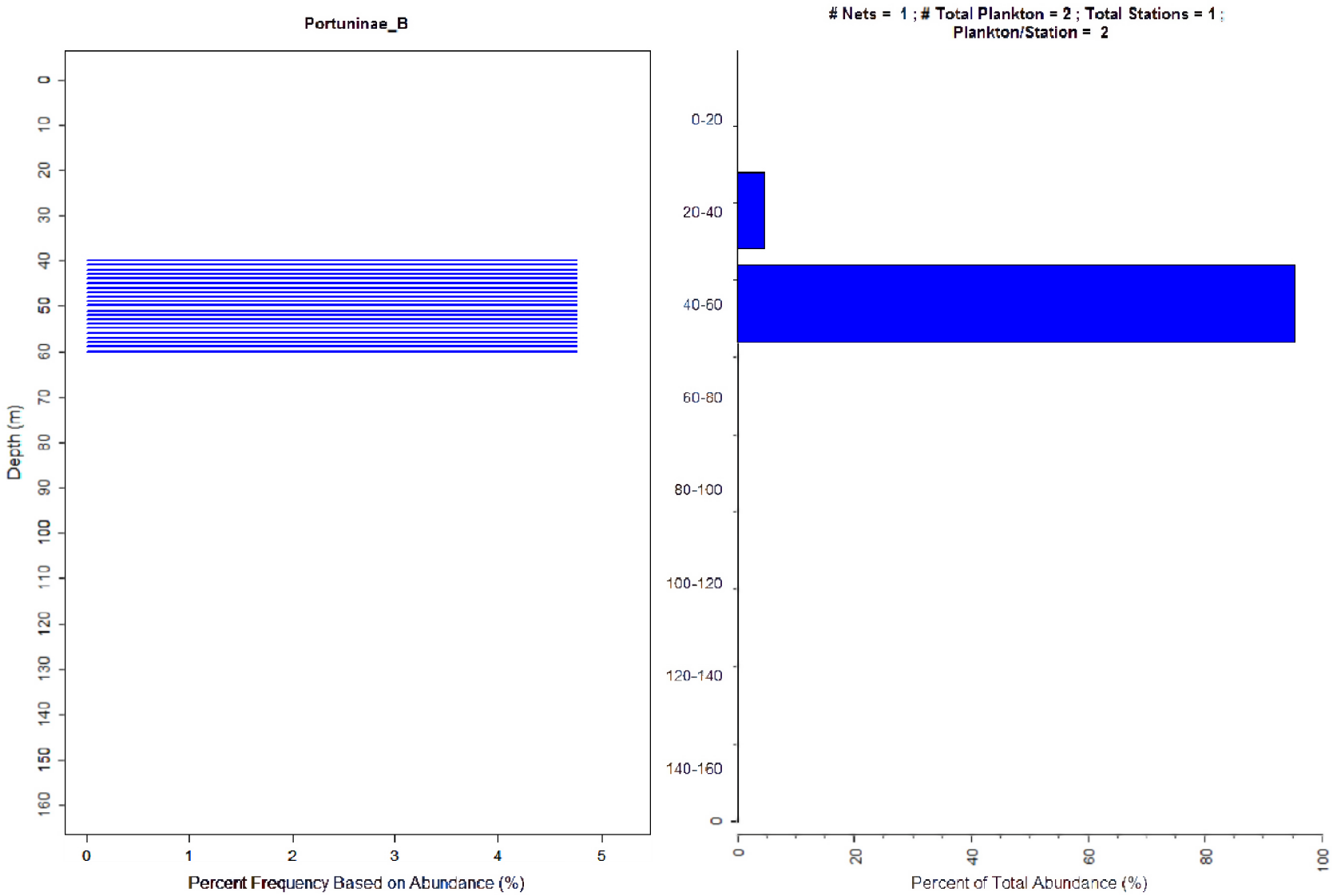
Porcellanidae - Shallow



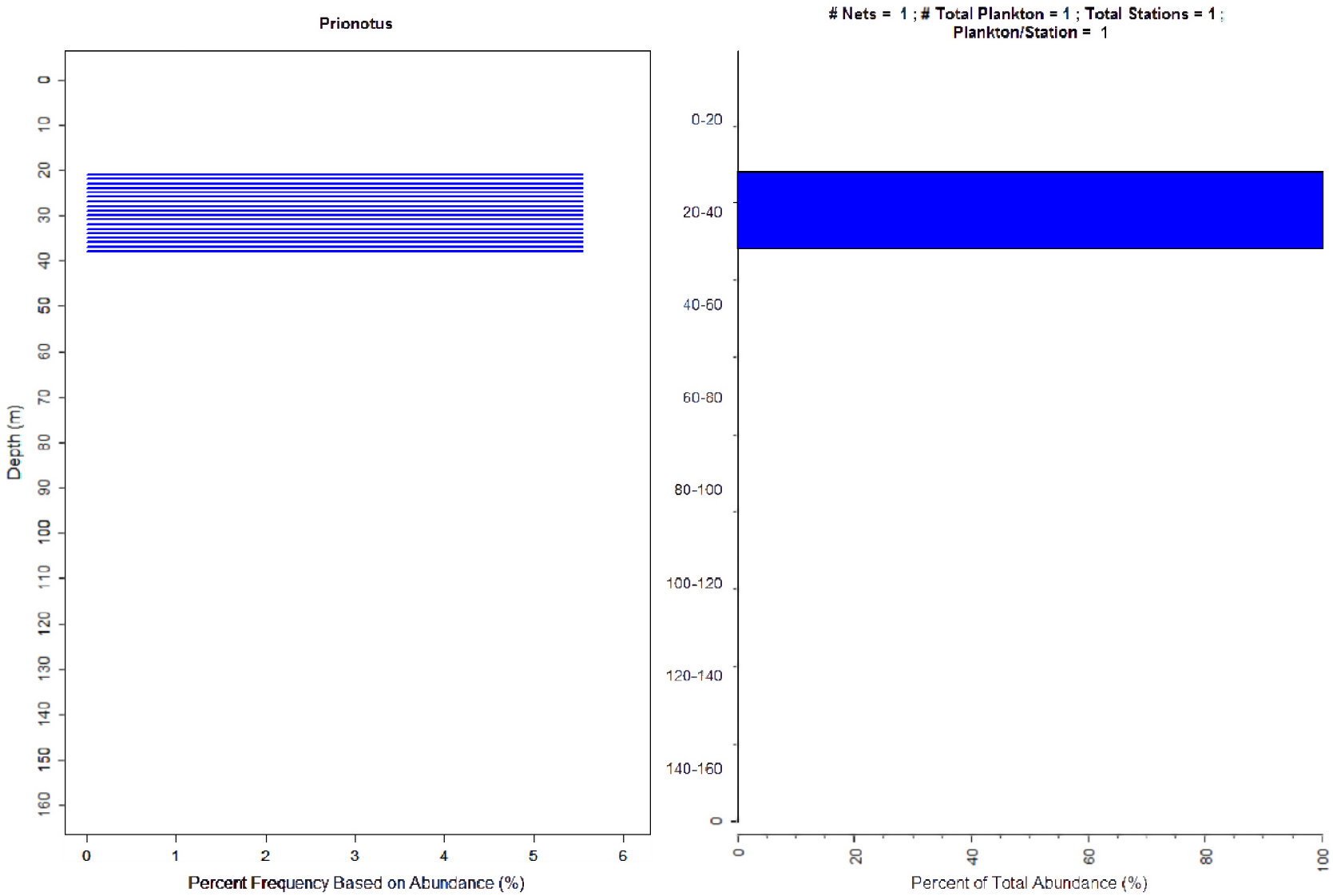
Portunidae - Shallow



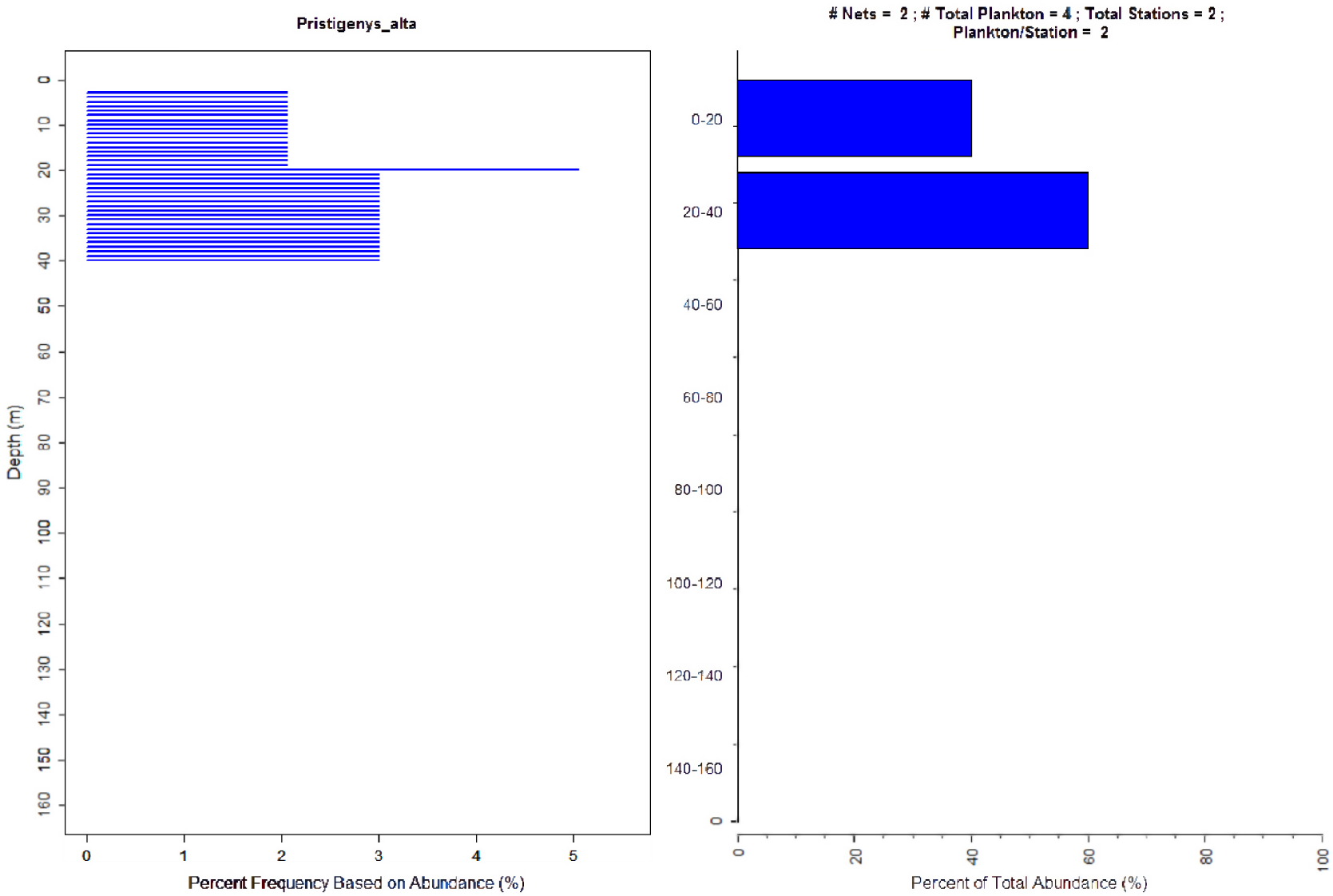
Portuninae - Shallow



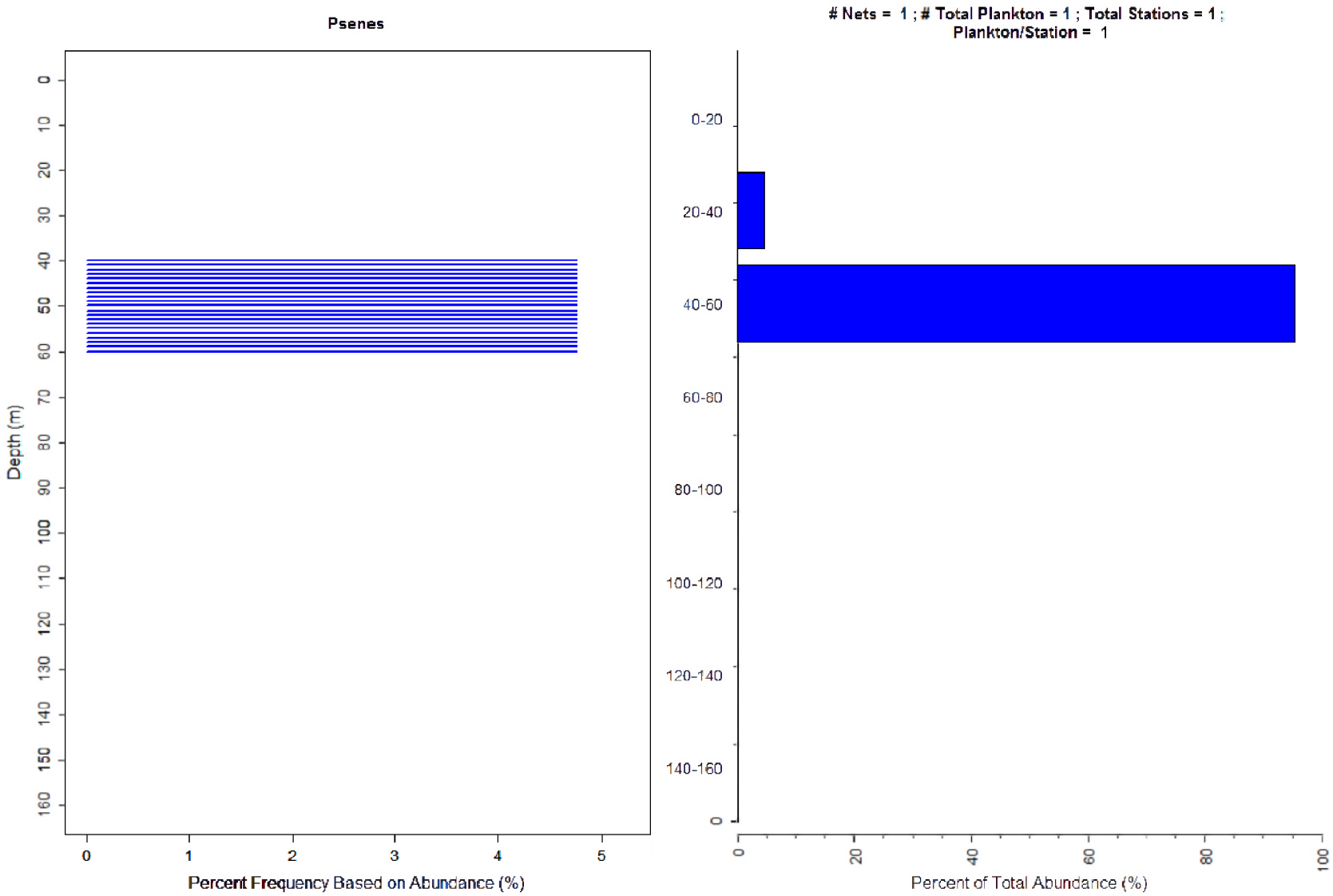
Portuninae_B - Shallow



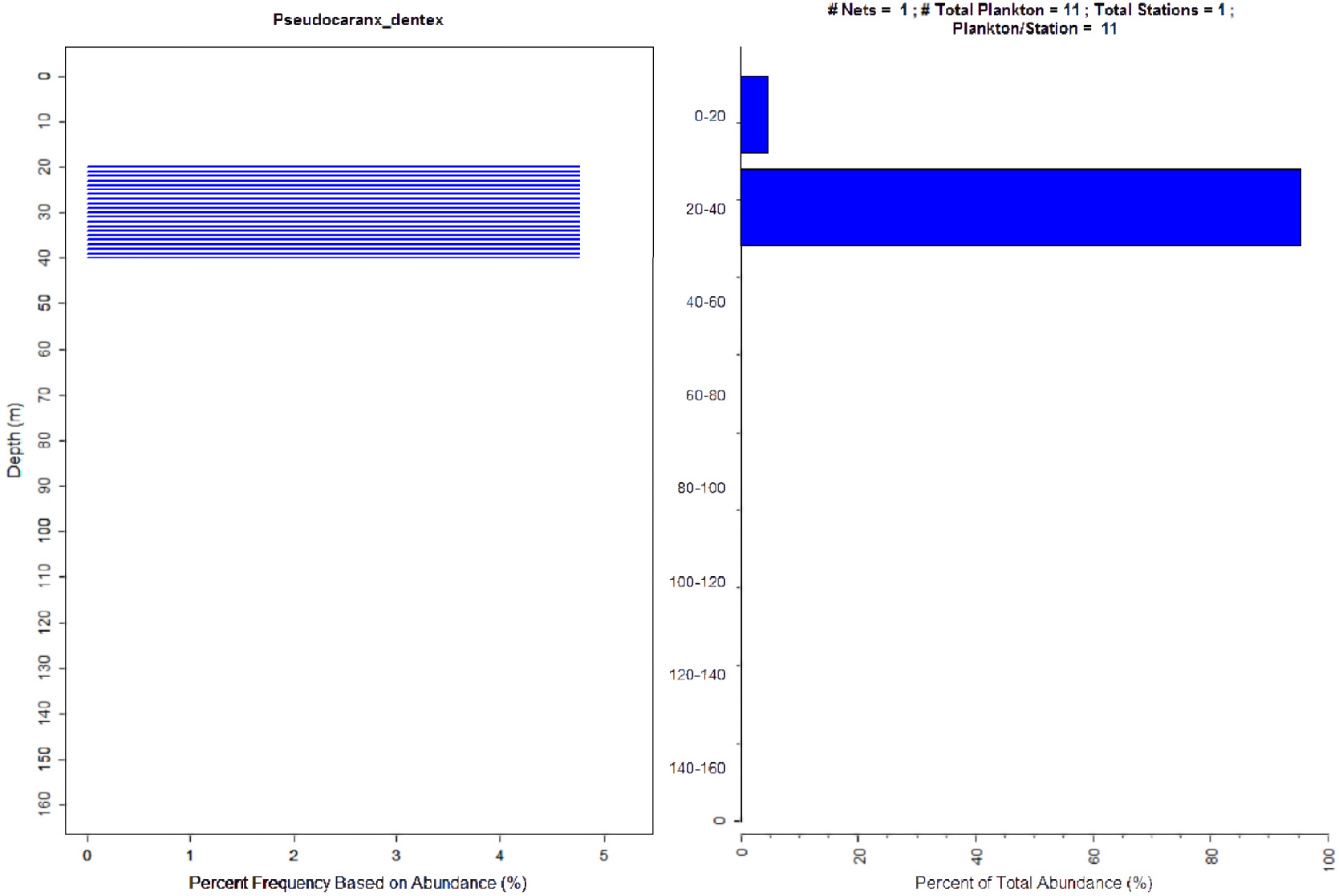
Prionotus - Shallow



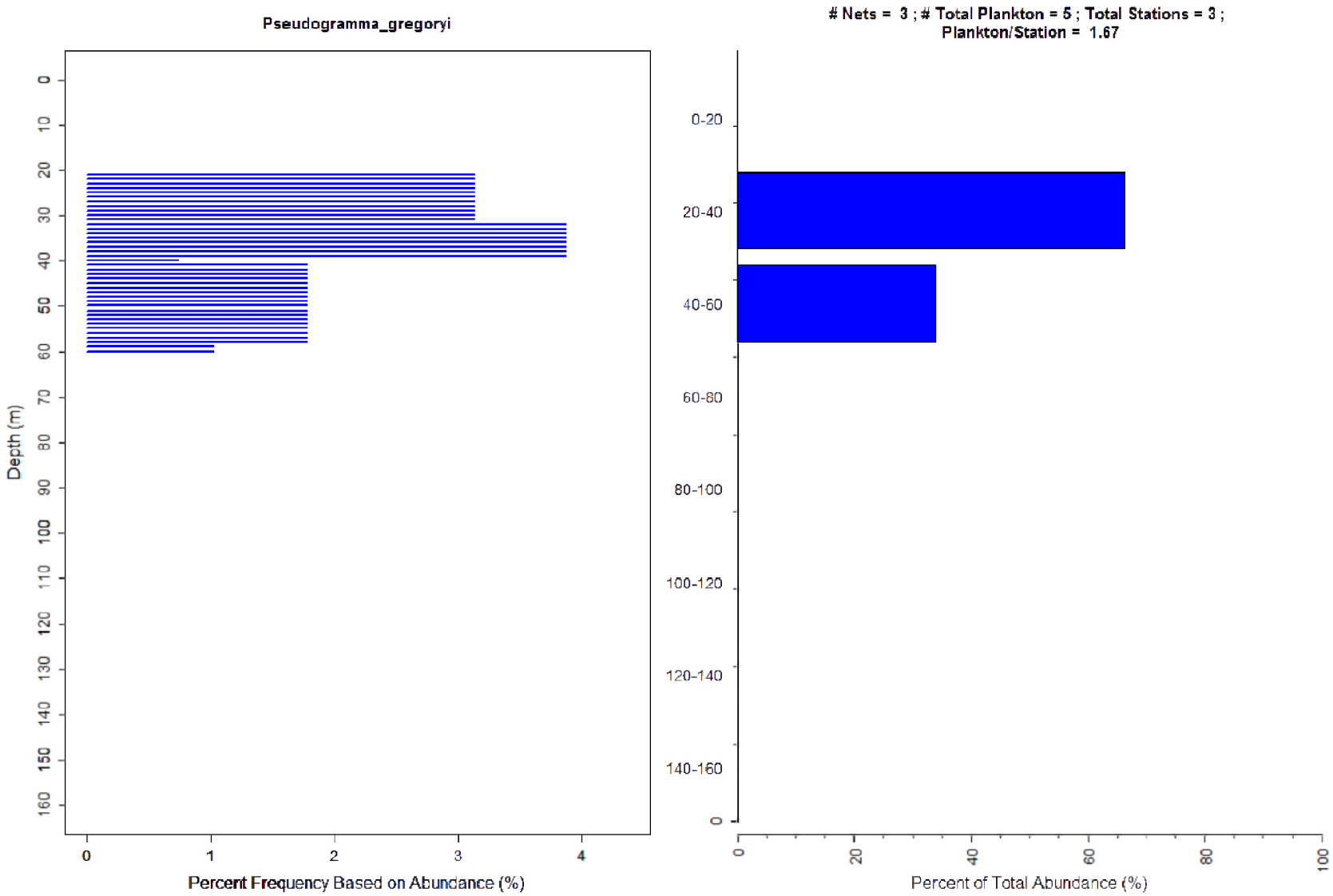
Pristigenys_alta - Shallow



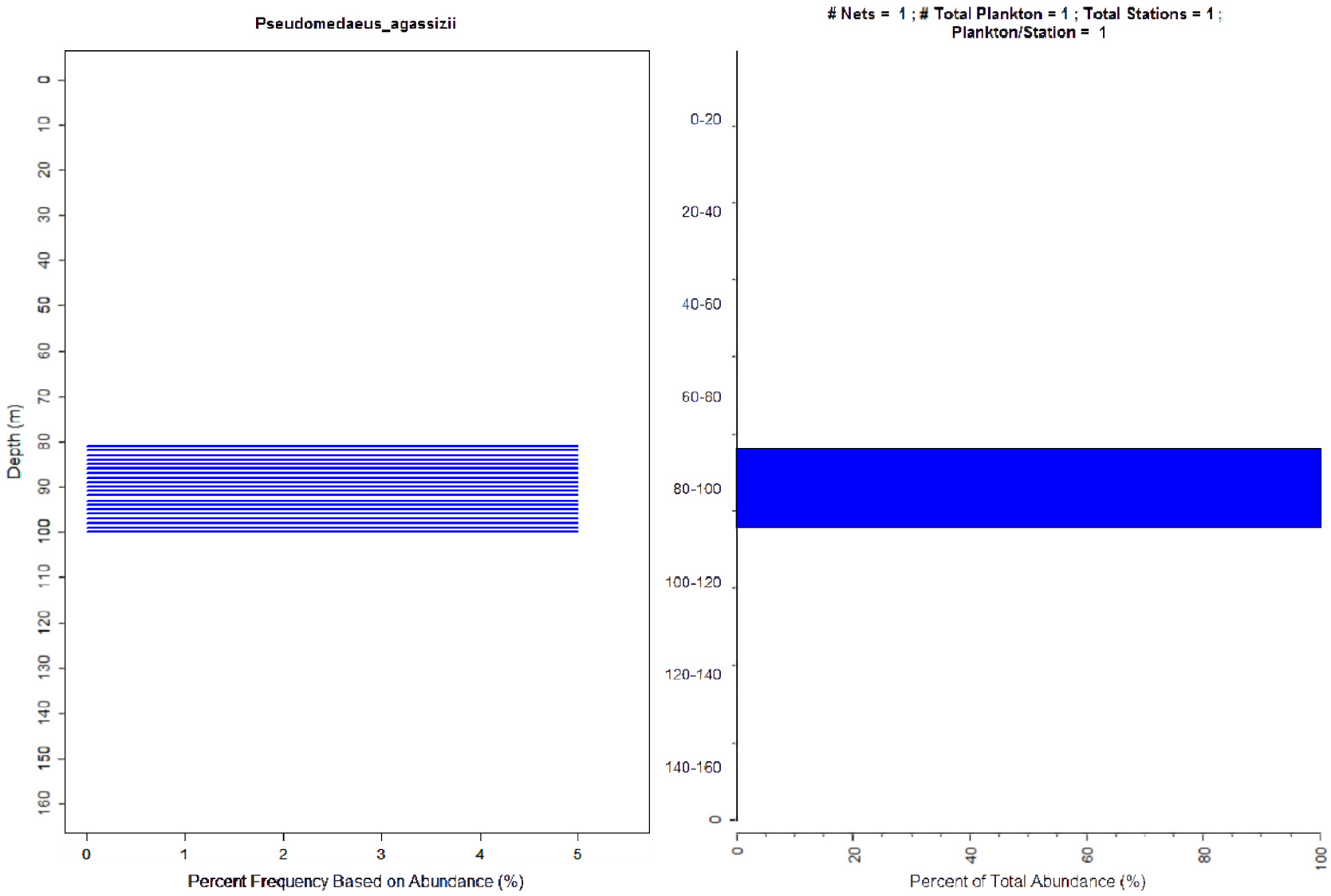
Psenes - Shallow



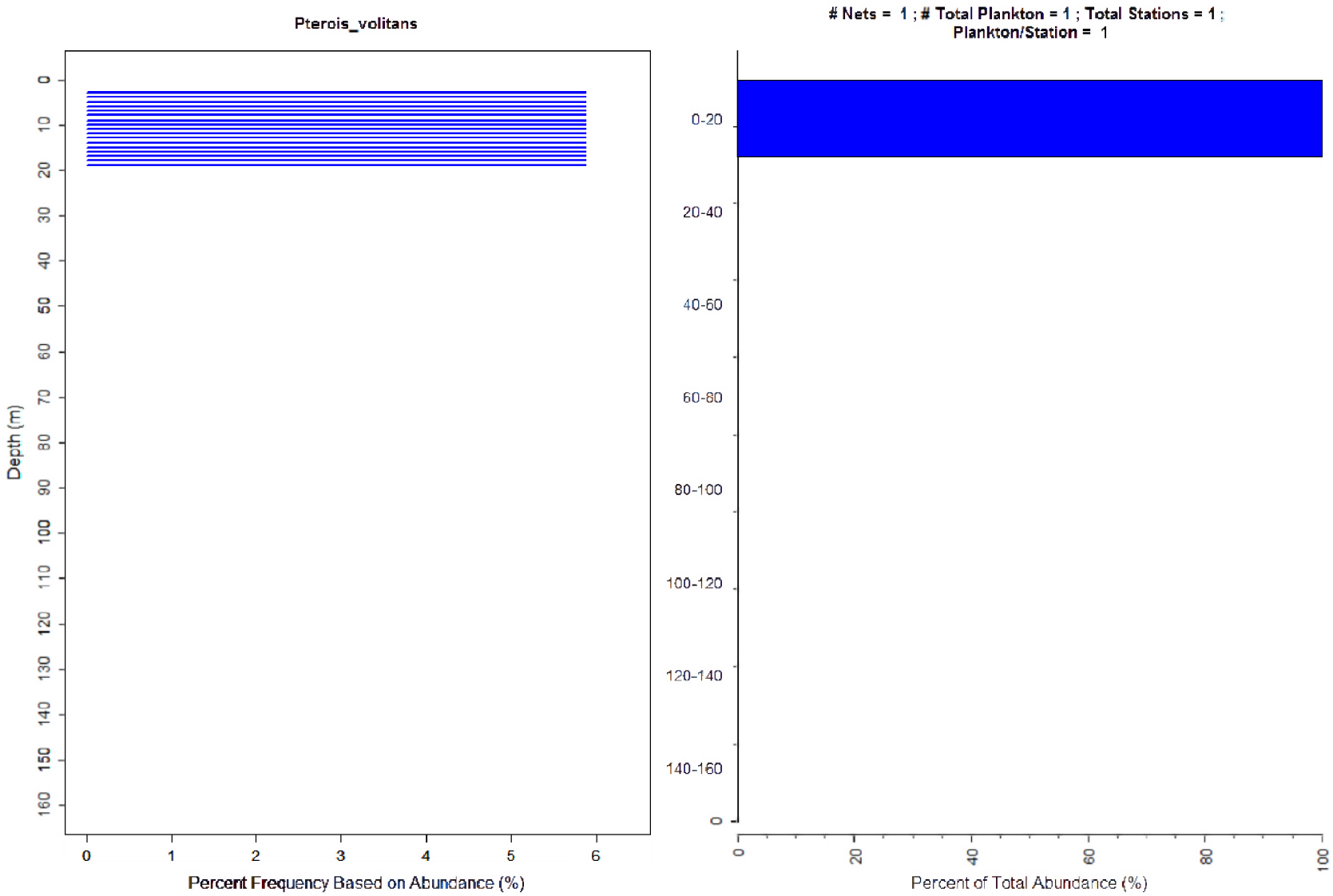
Pseudocaranx_dentex - Shallow



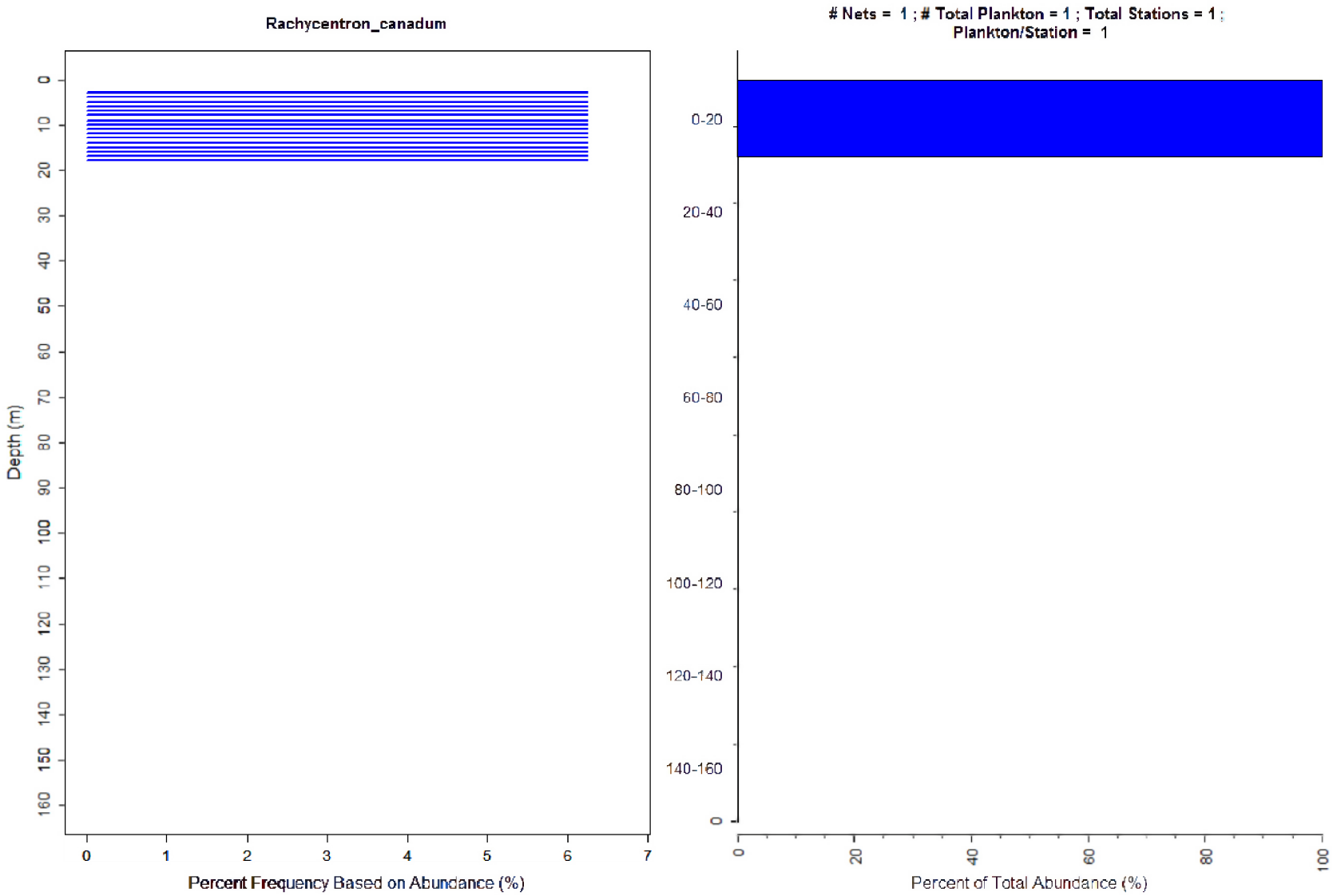
Pseudogramma_gregoryi - Shallow



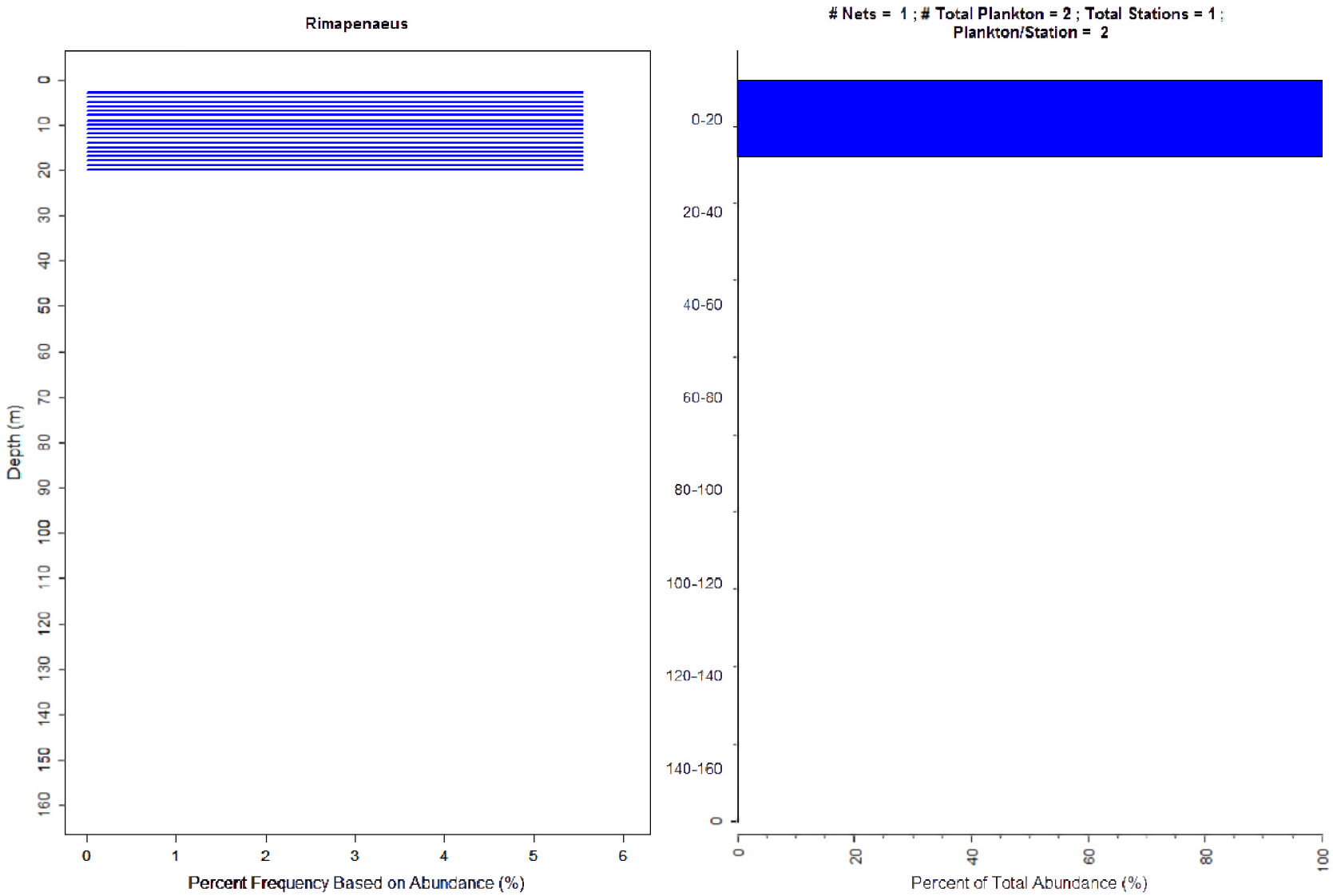
Pseudomedaeus_agassizii - Shallow



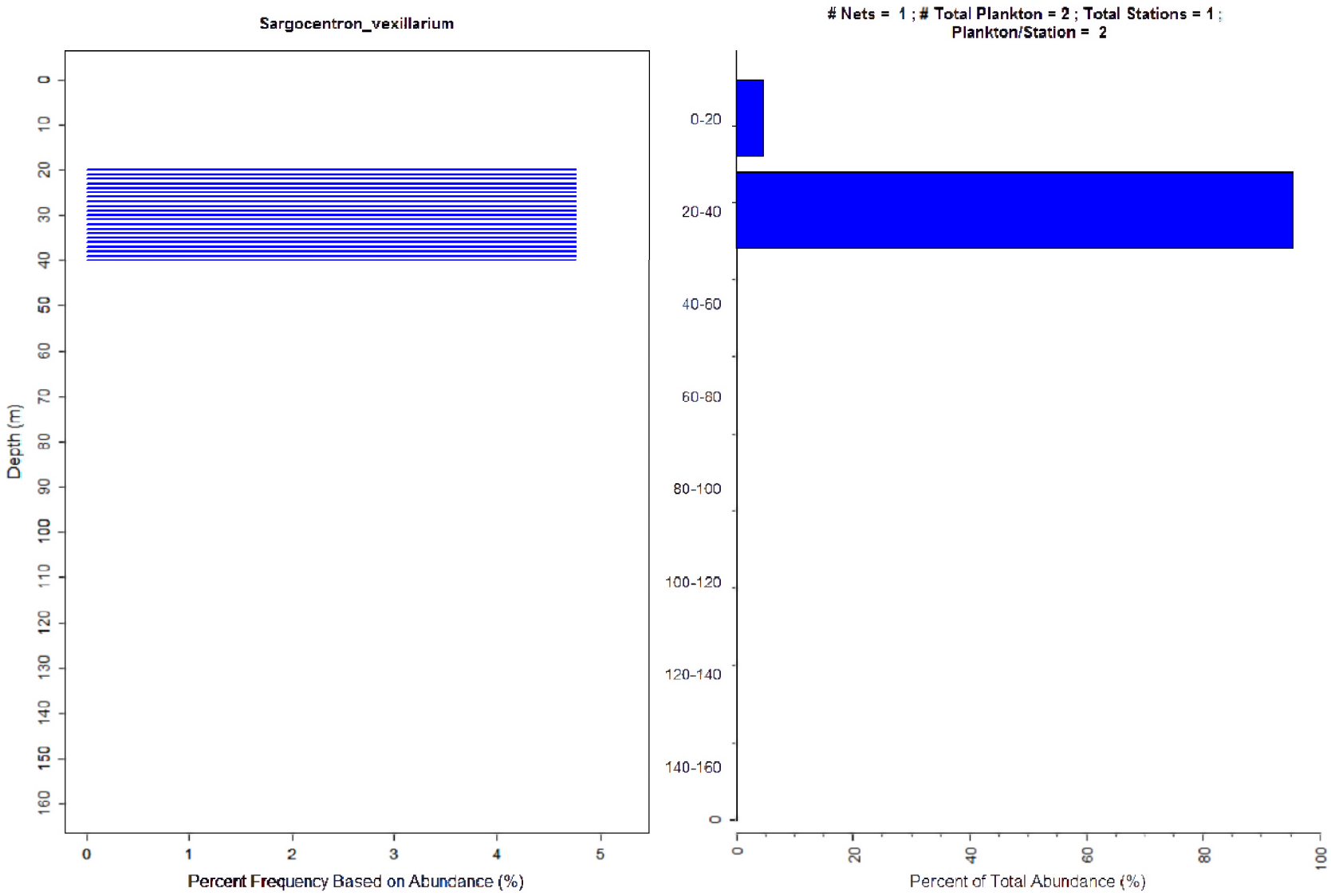
Pterois_volitans - Shallow



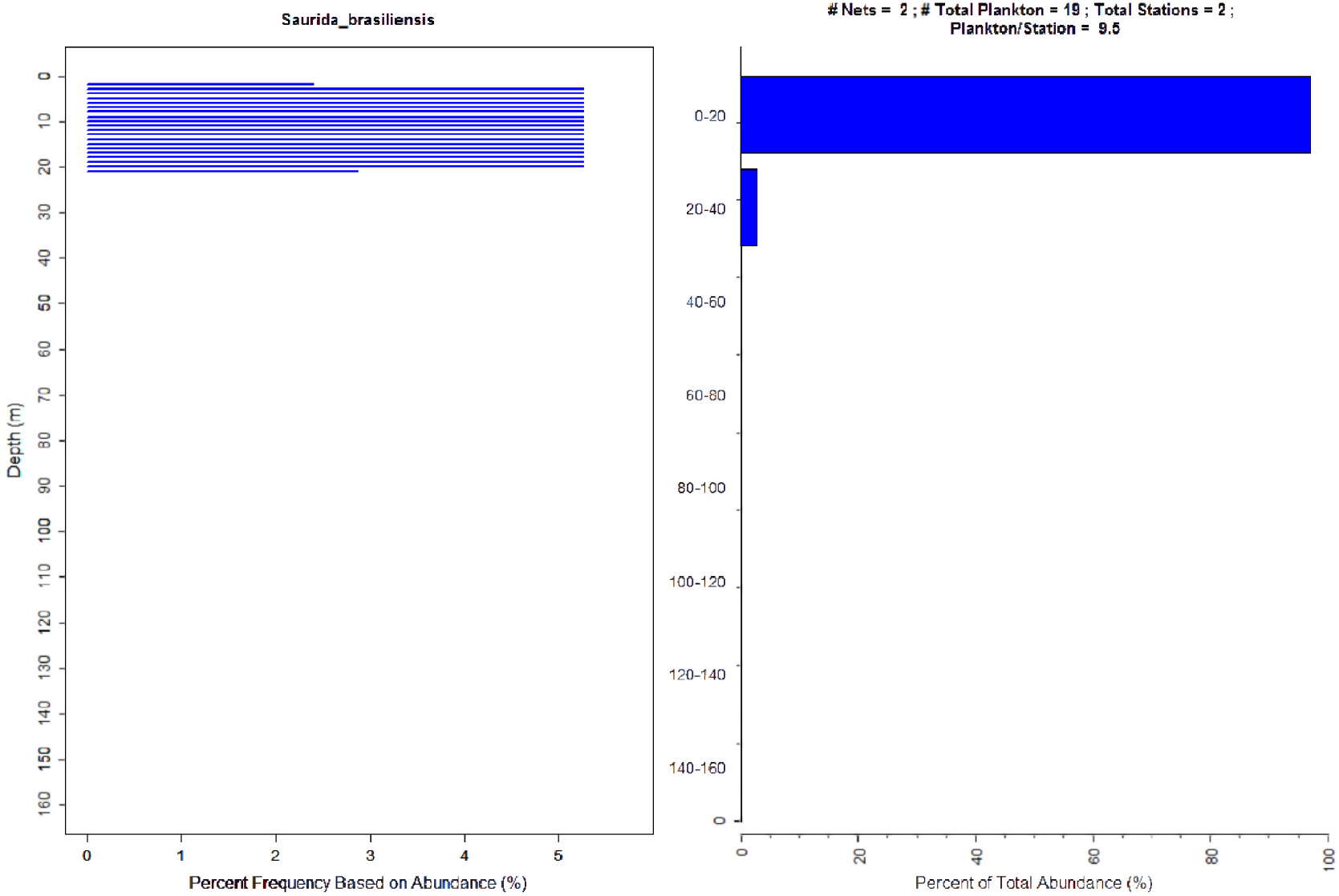
Rachycentron_canadum - Shallow



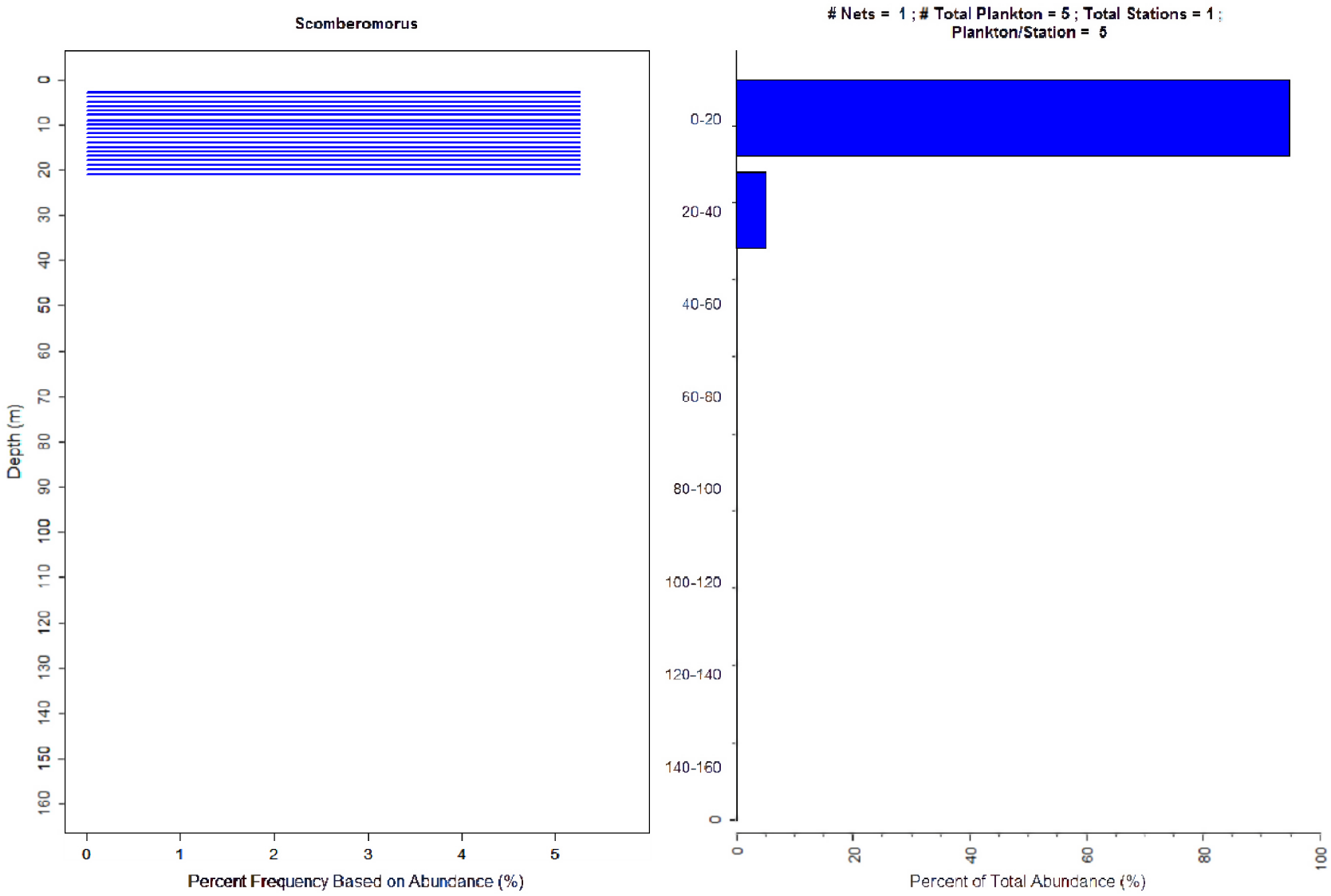
Rimapenaeus - Shallow



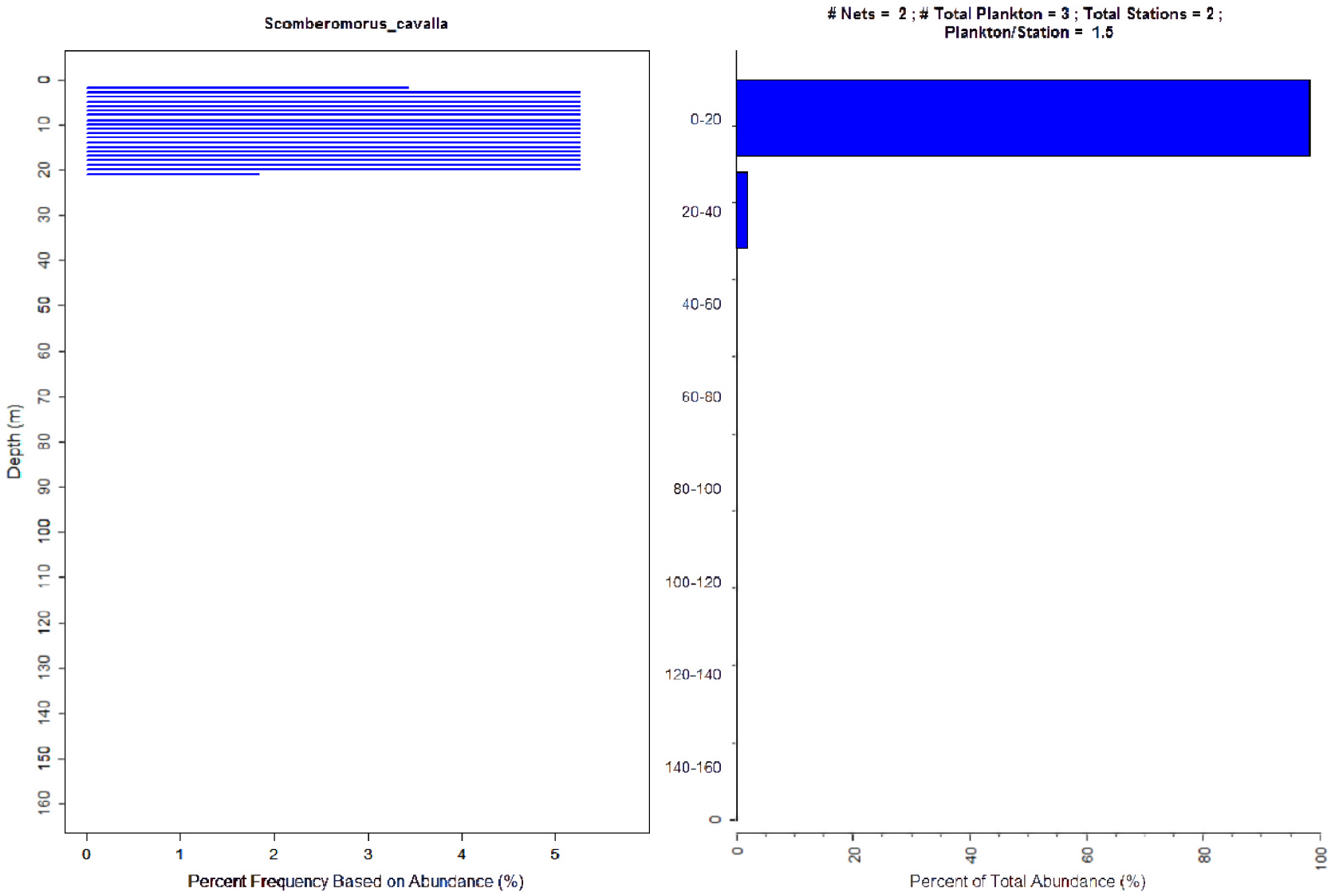
Sargocentron_vexillarium - Shallow



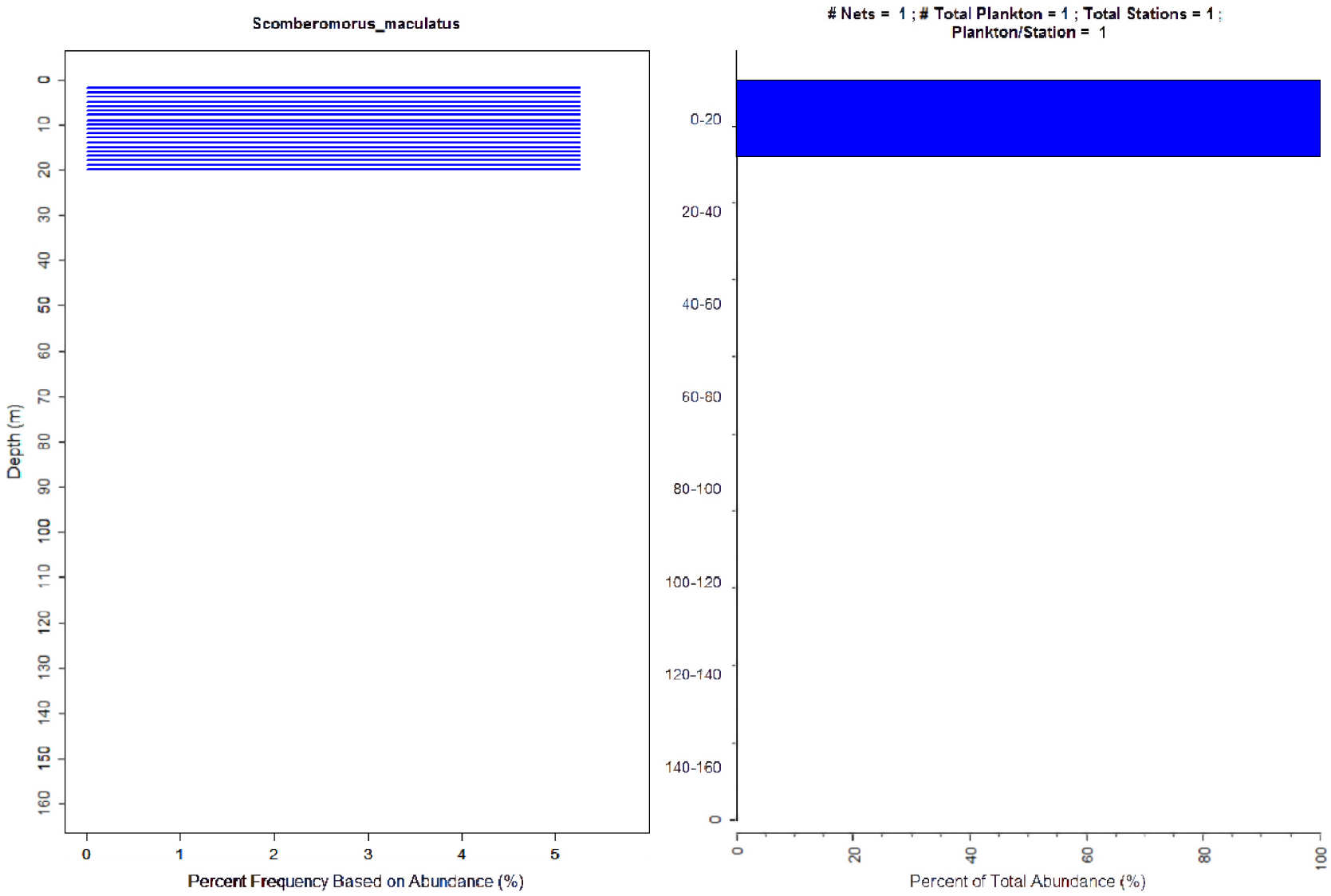
Saurida_brasiliensis - Shallow



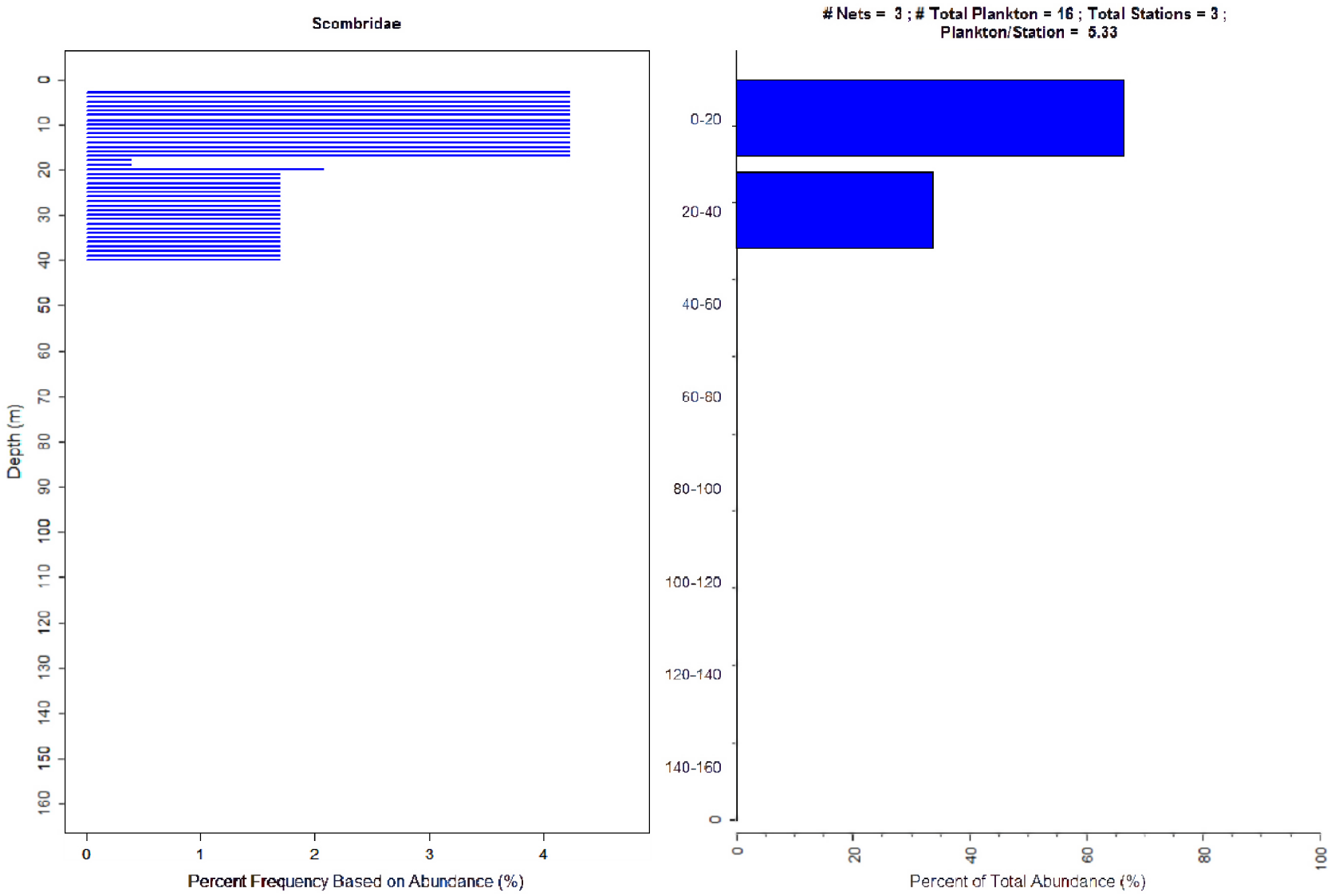
Scomberomorus - Shallow



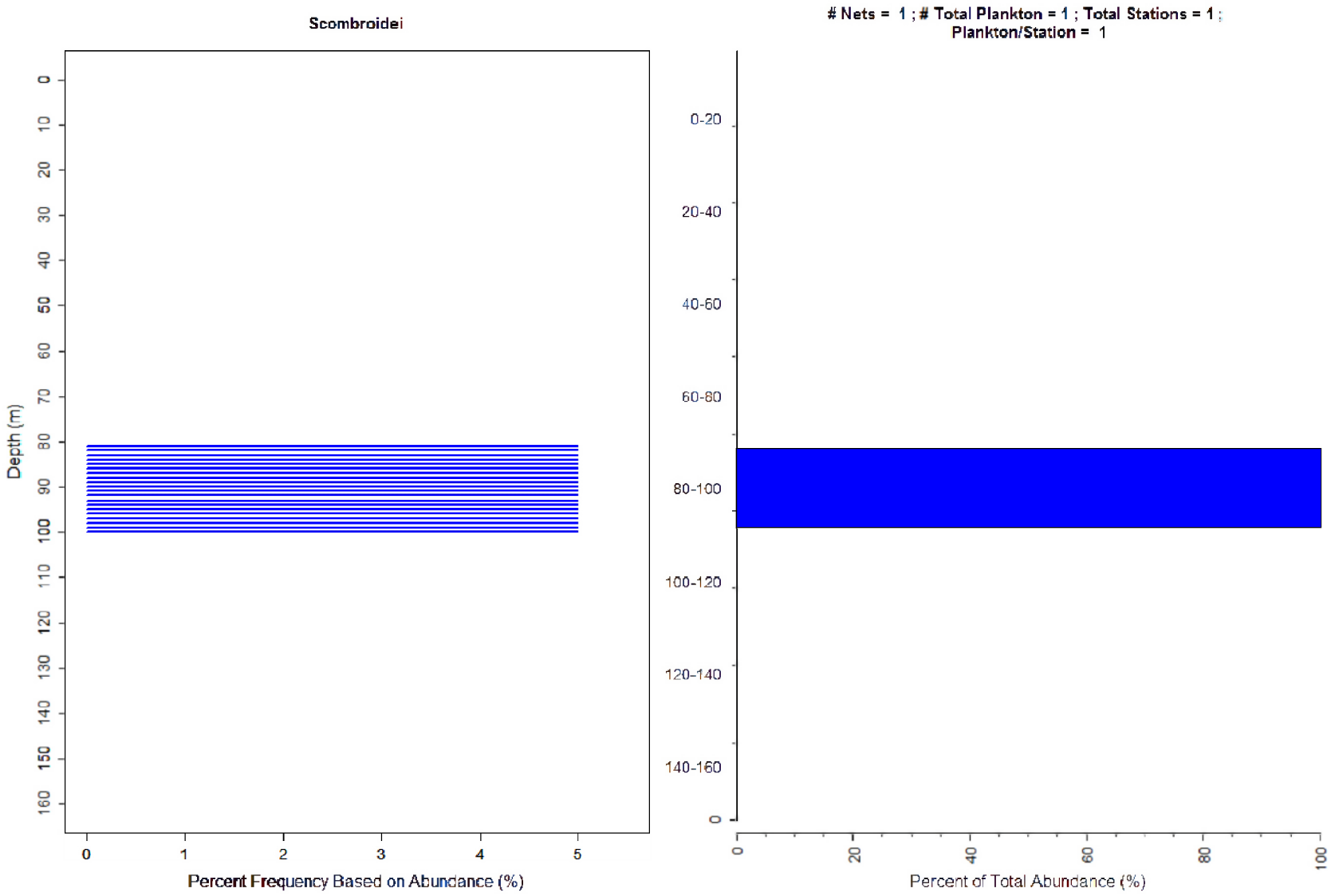
Scomberomorus_cavalla - Shallow



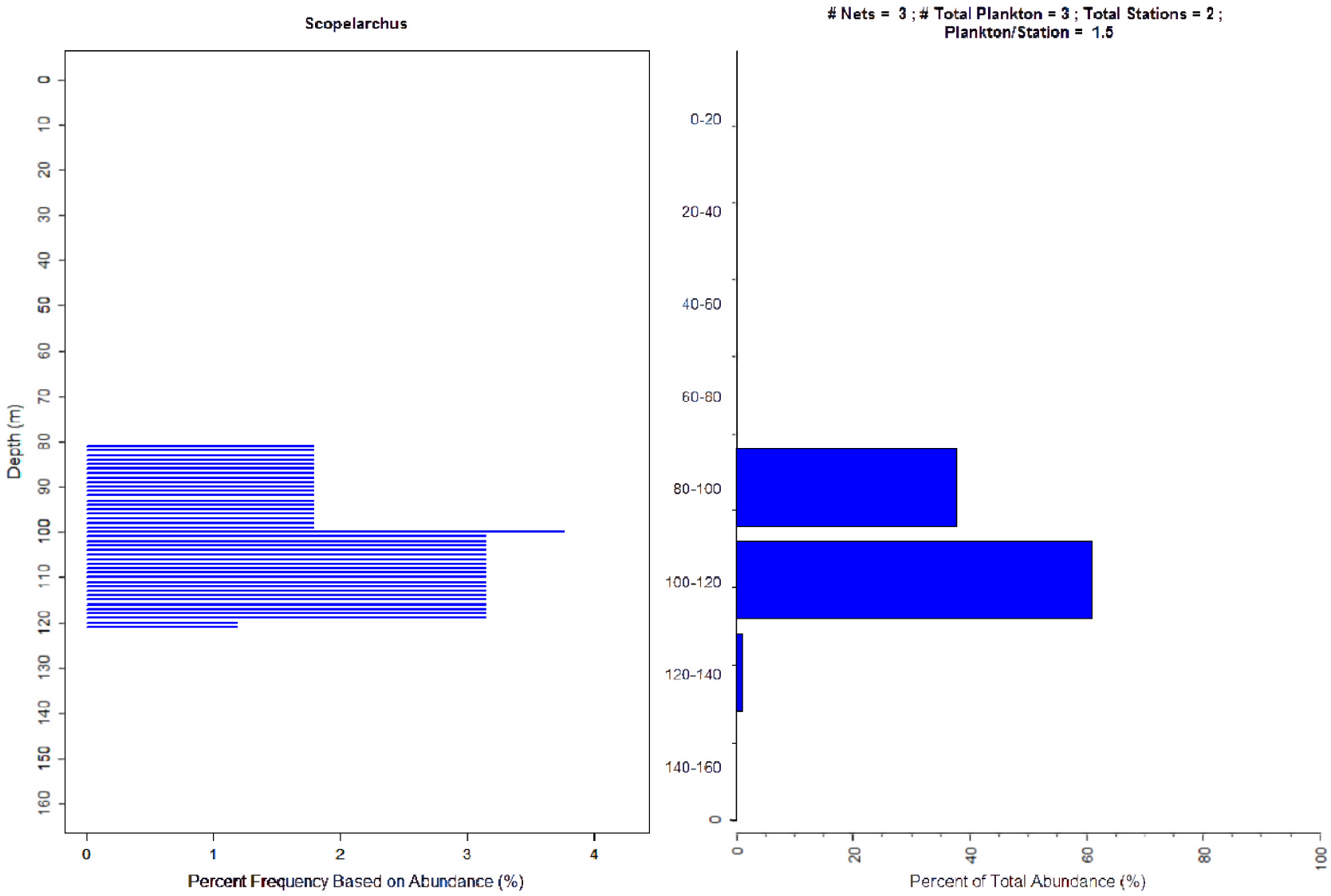
Scomberomorus_maculatus - Shallow



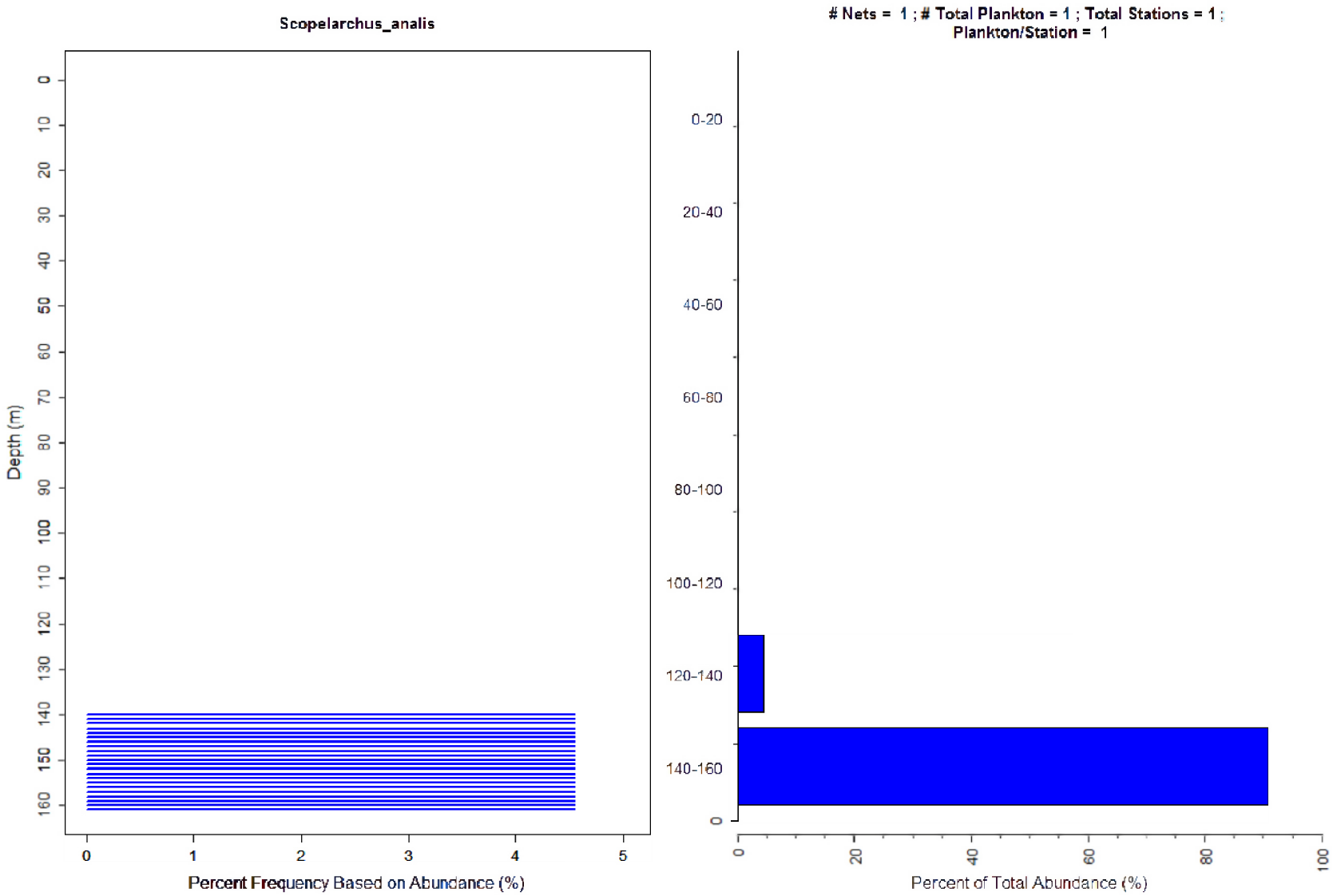
Scombridae - Shallow



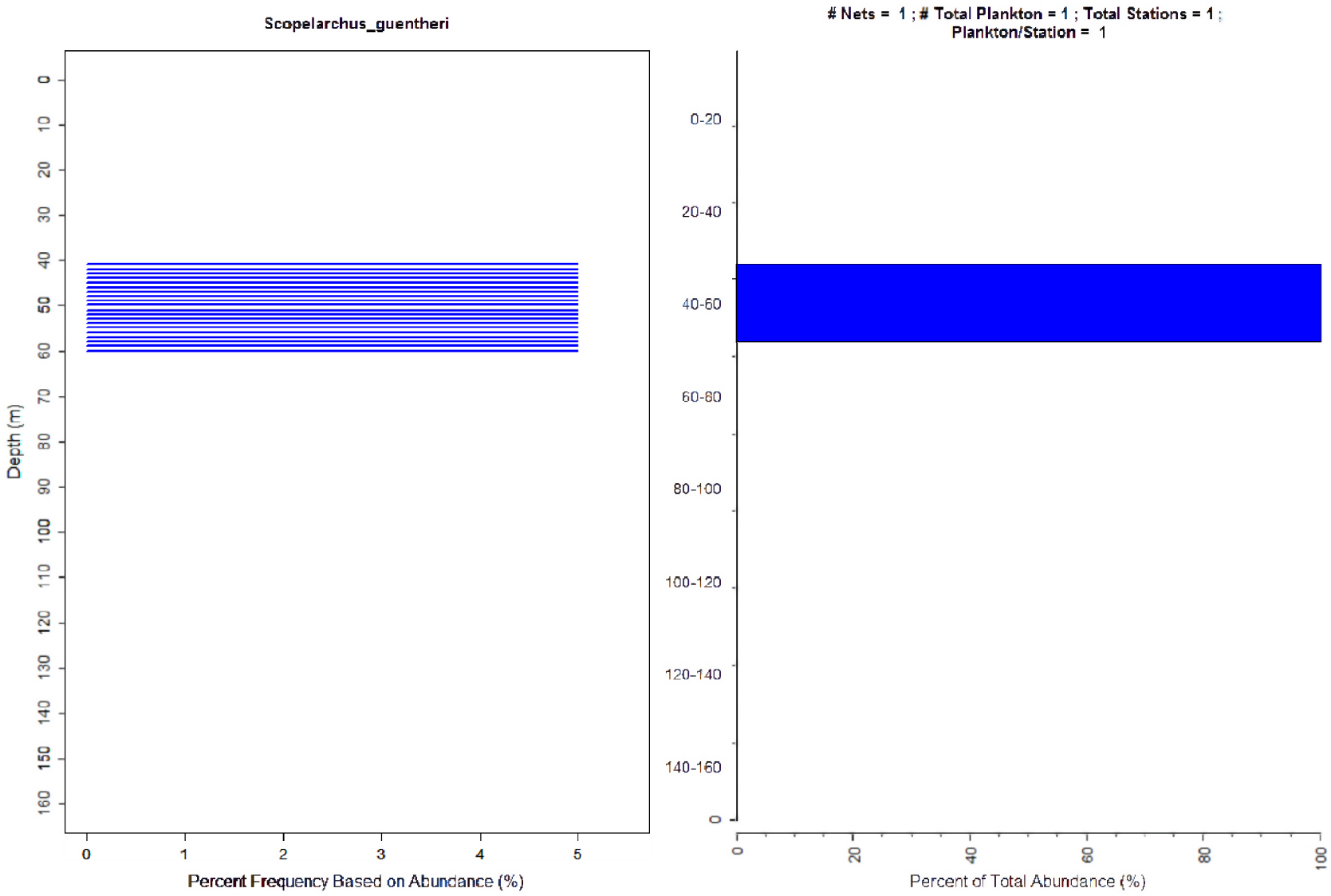
Scombroidei - Shallow



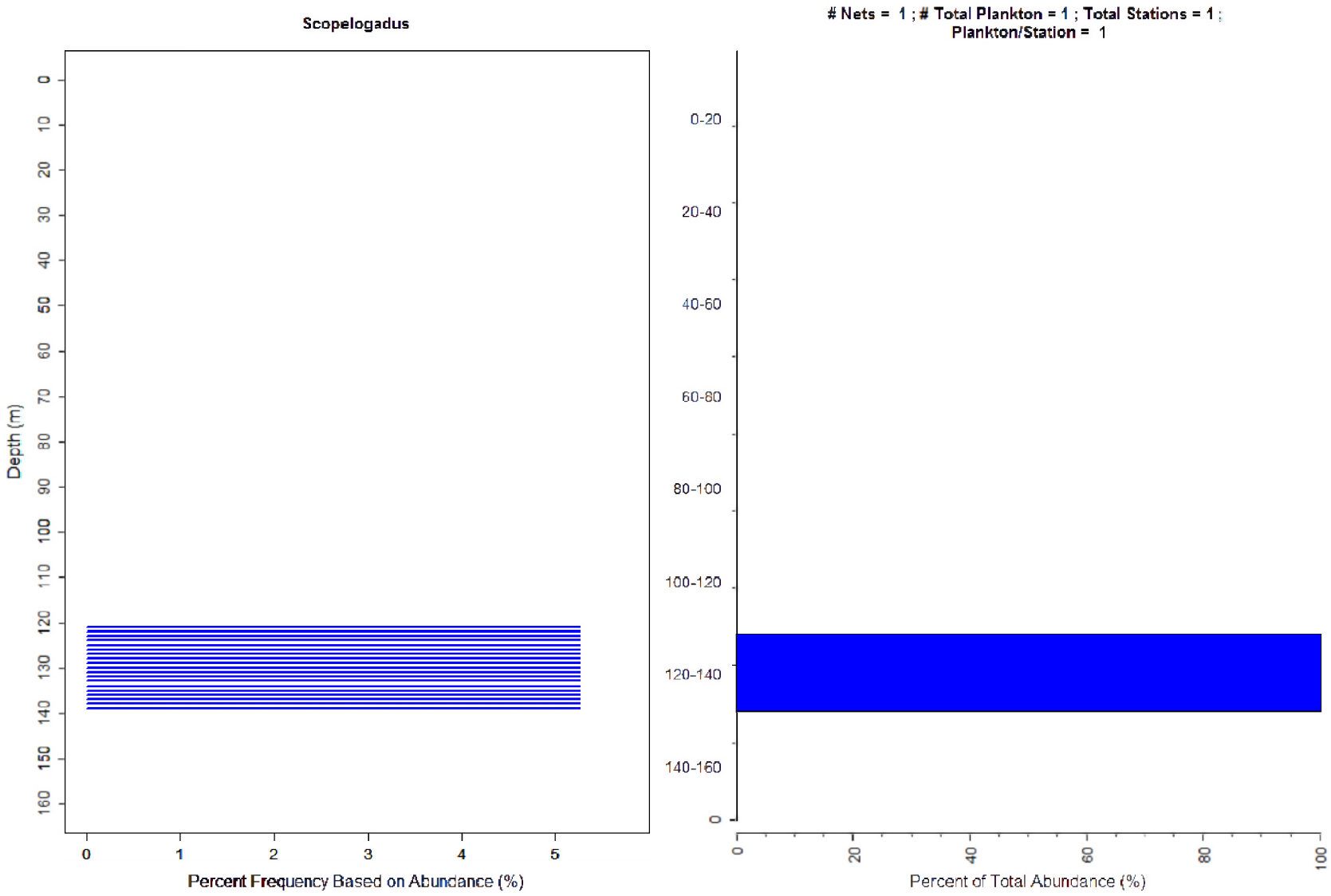
Scopelarchus - Shallow



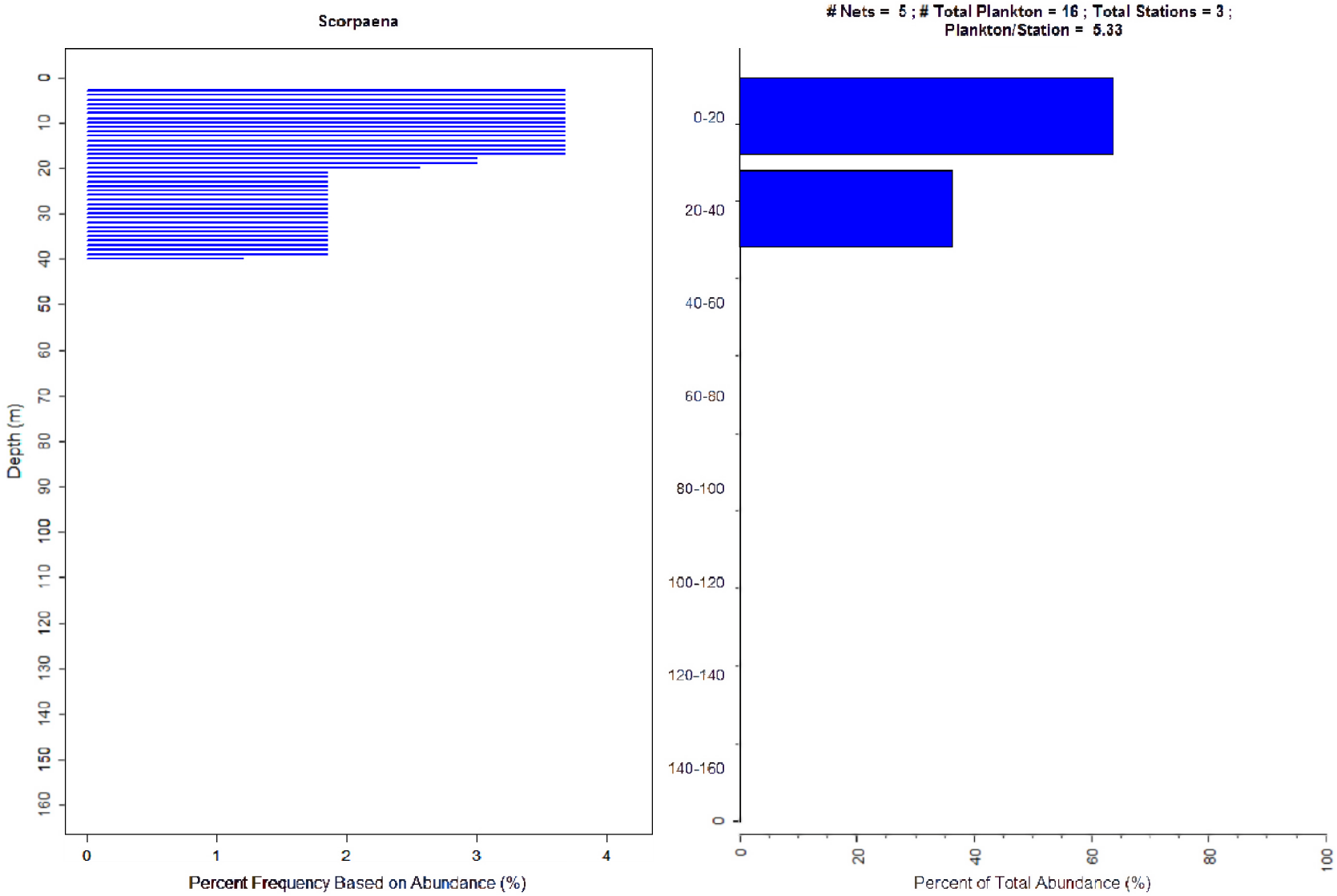
Scopelarchus_analis - Shallow



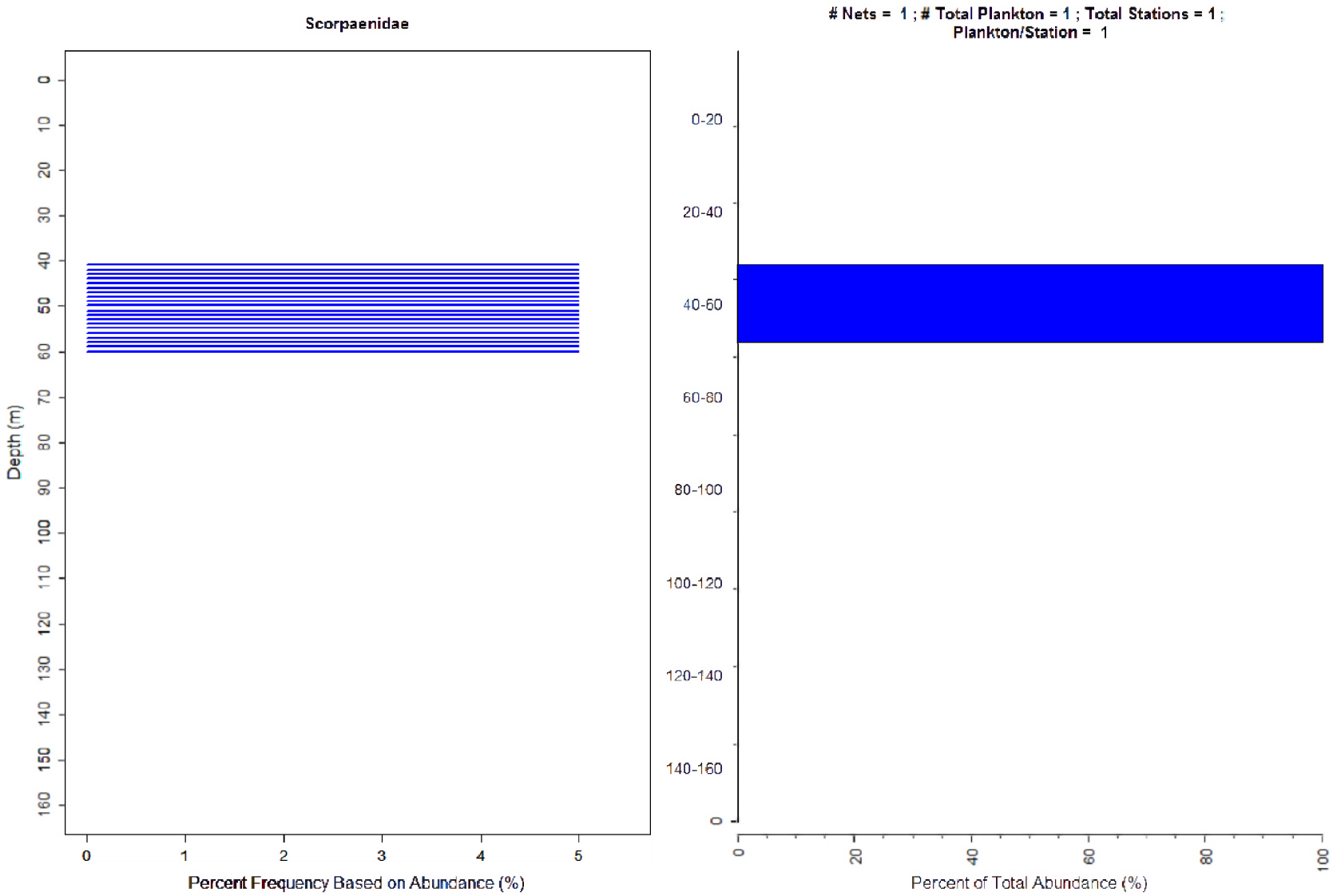
Scopelarchus_guentheri - Shallow



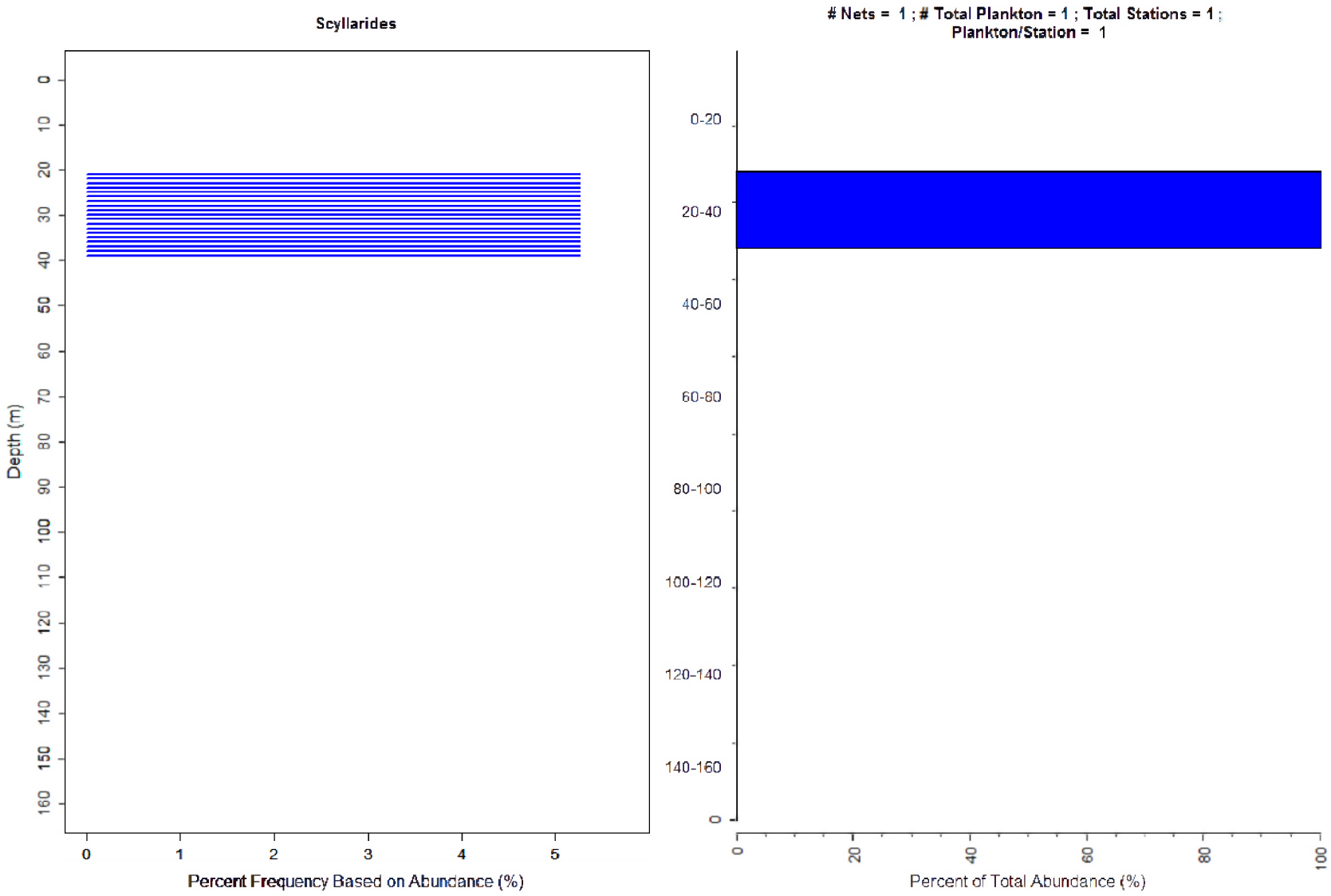
Scopelogadus - Shallow



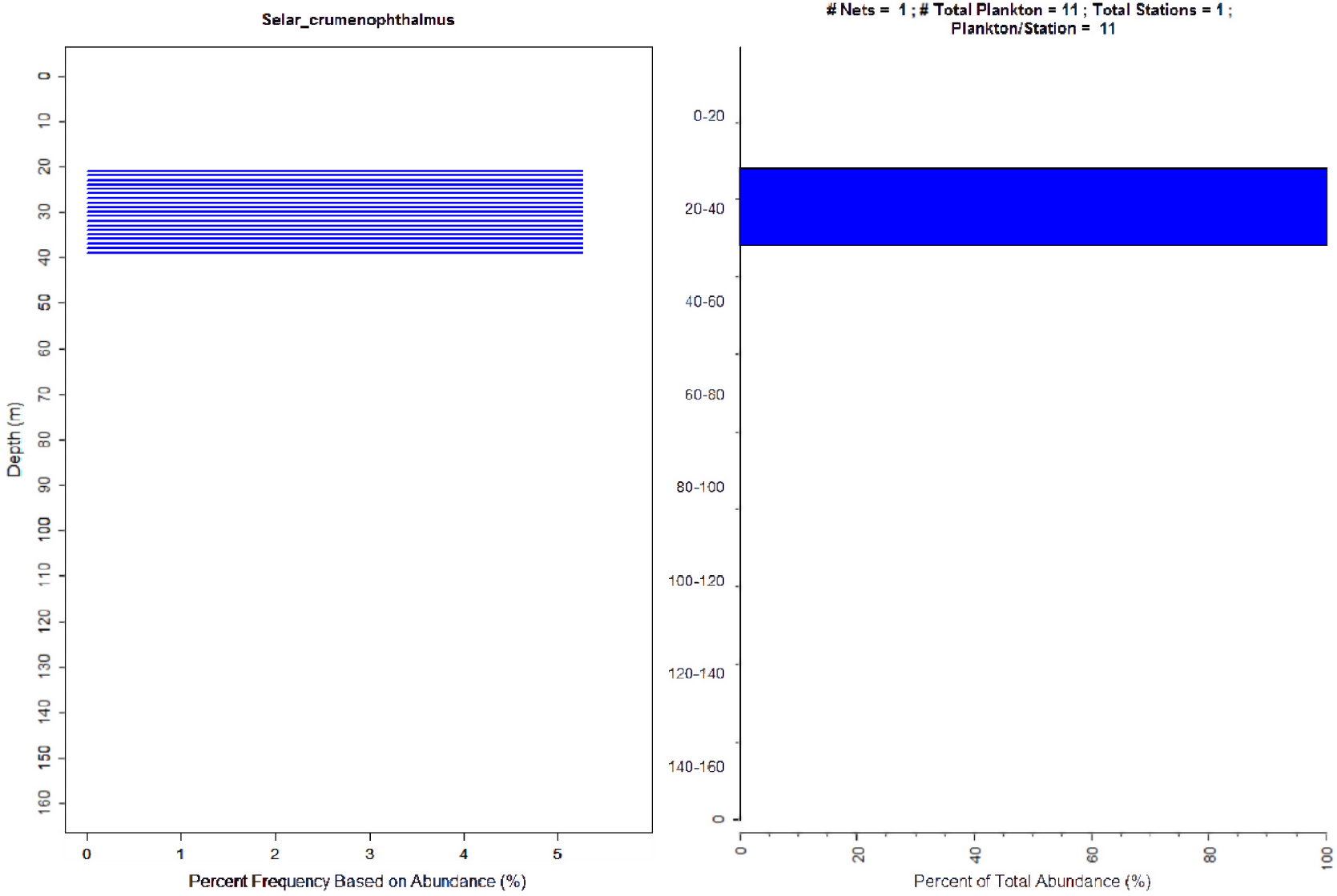
Scorpaena - Shallow



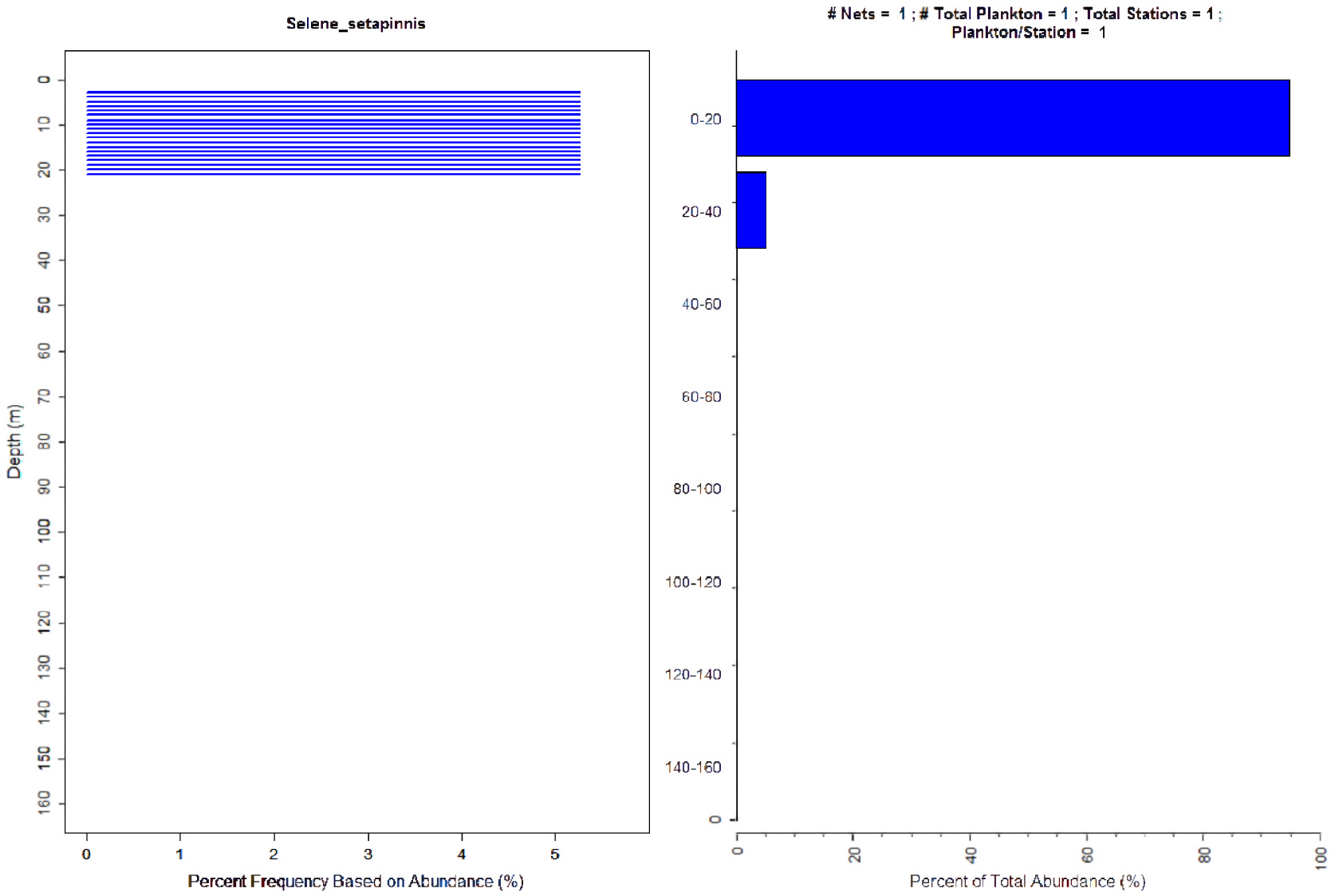
Scorpaenidae - Shallow



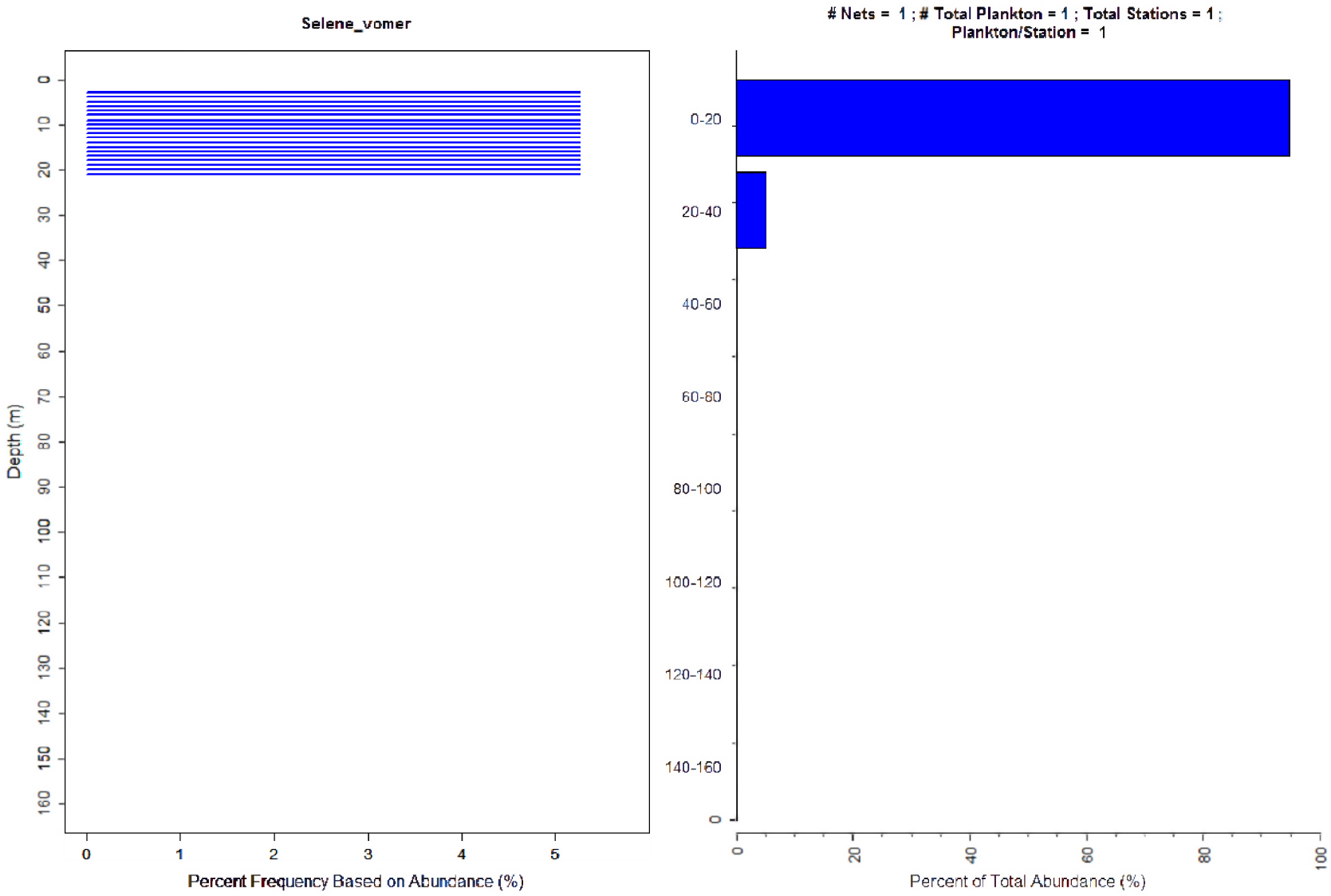
Scyllarides - Shallow



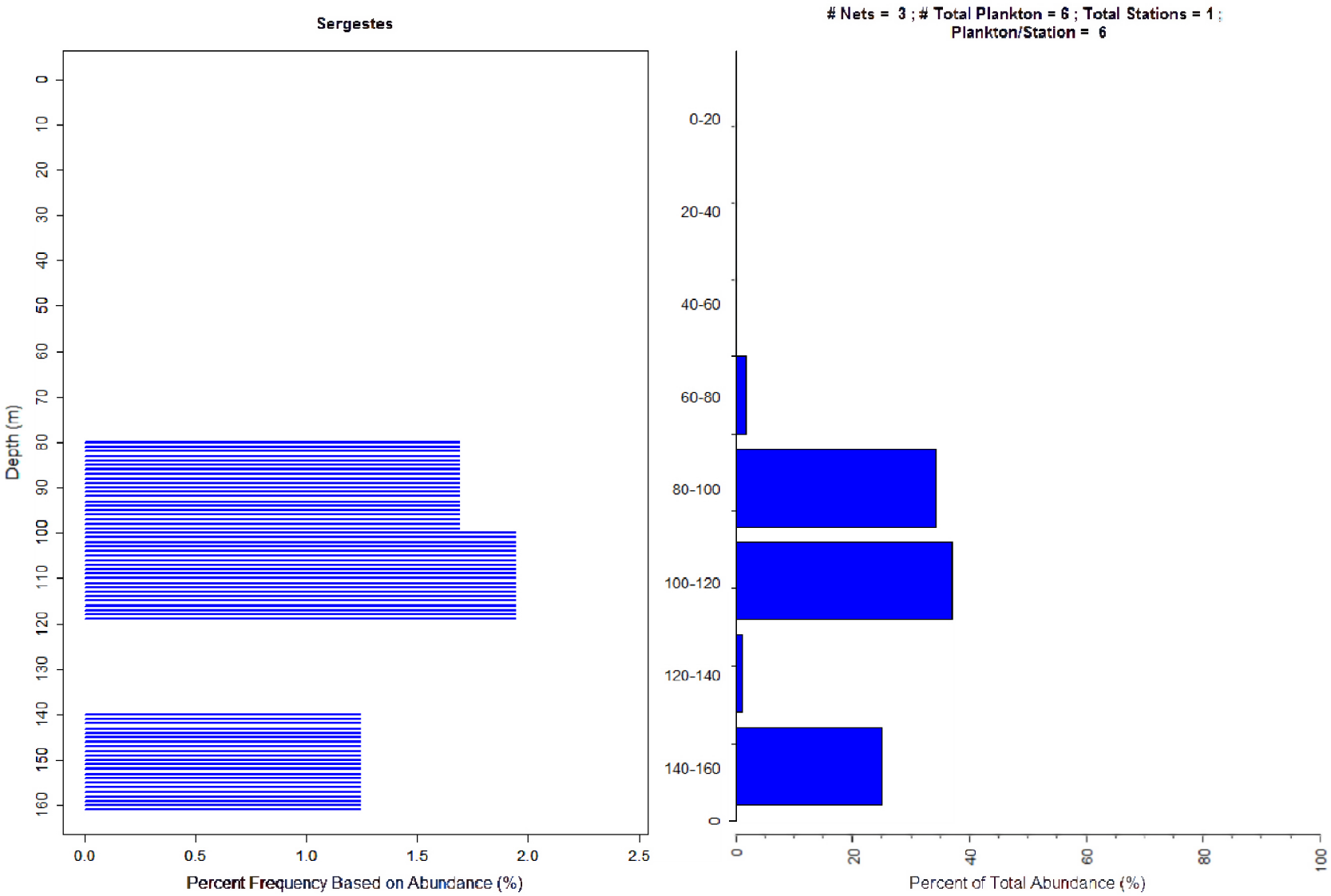
Selar_crumenophthalmus - Shallow



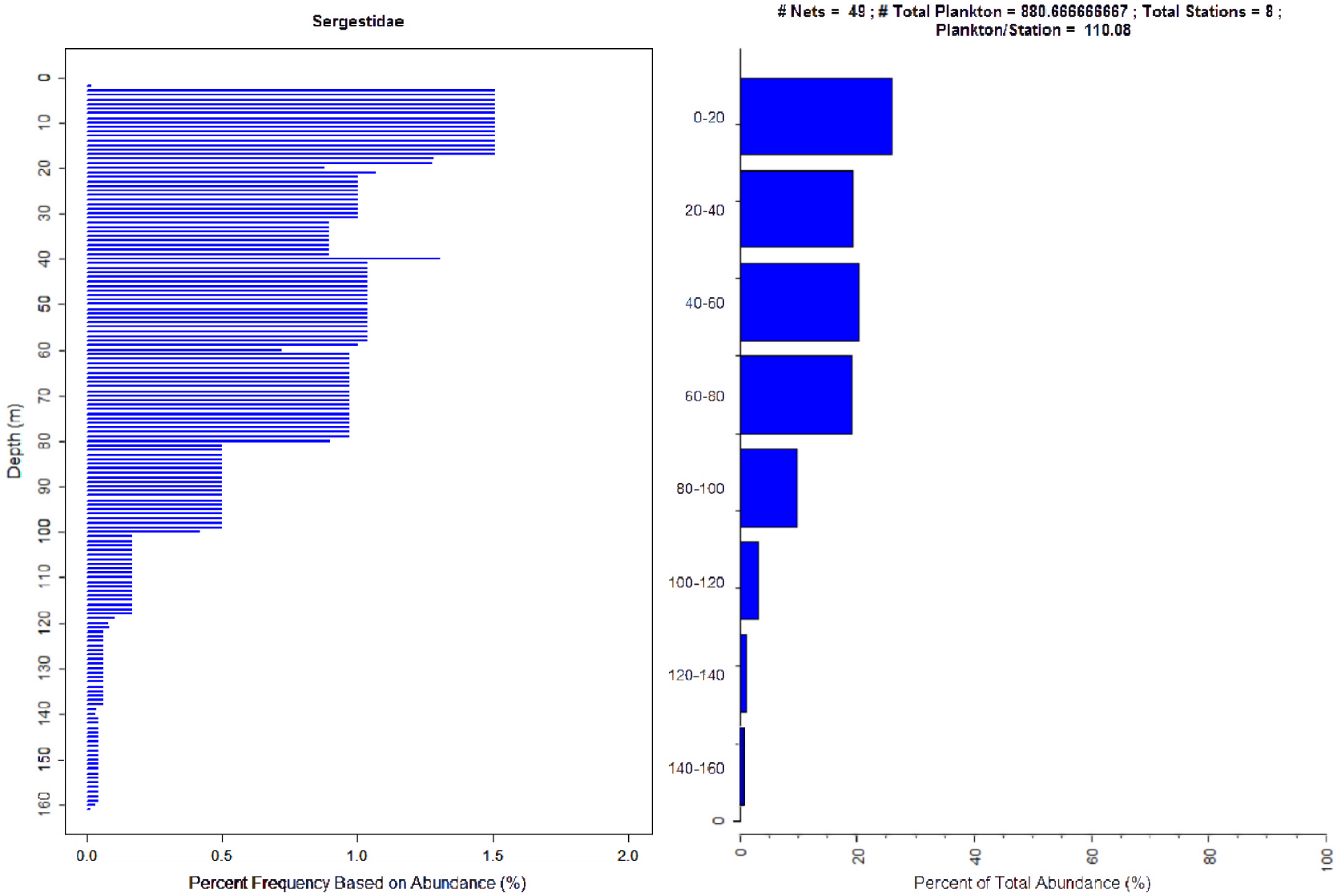
Selene_setapinnis - Shallow



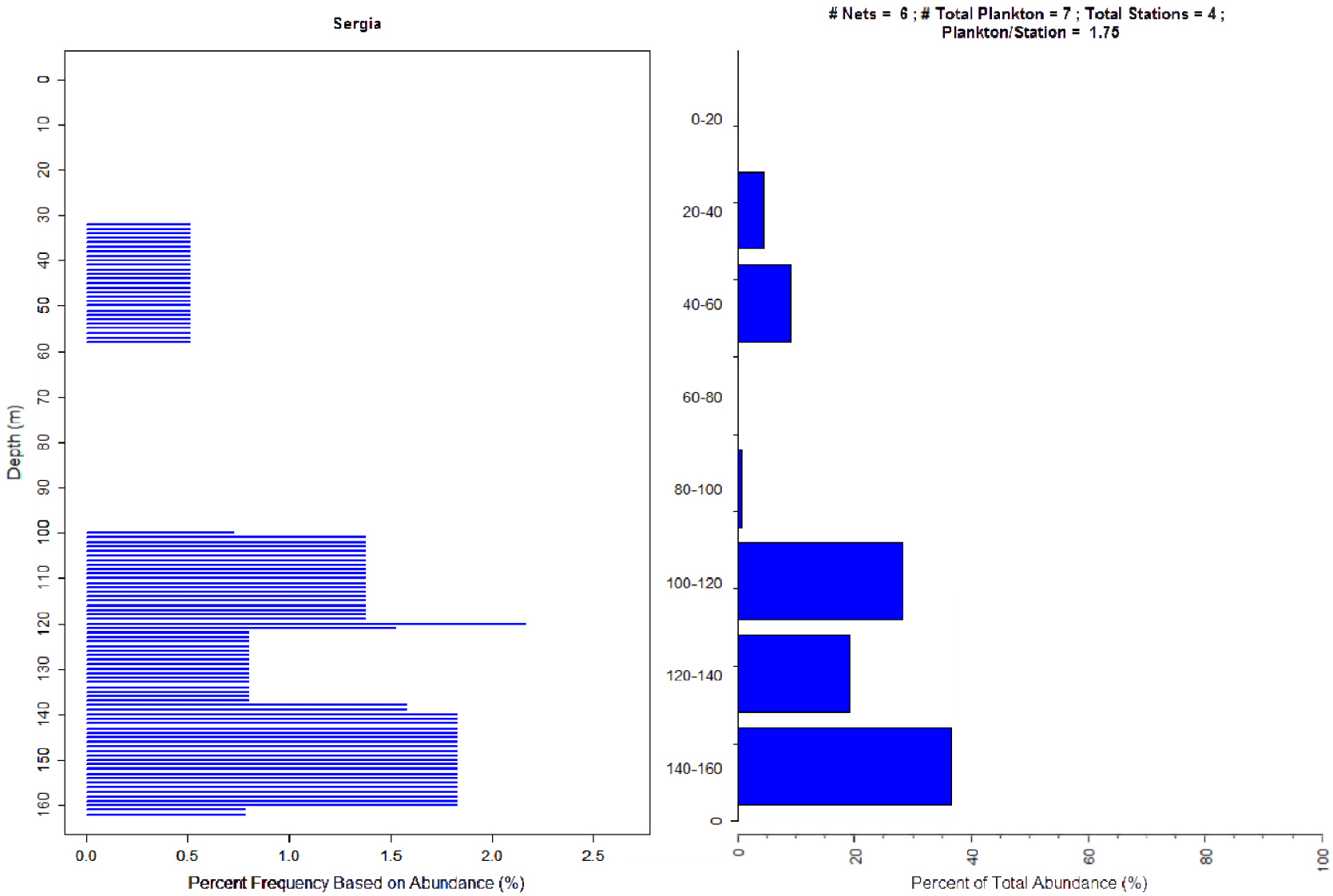
Selene_vomer - Shallow



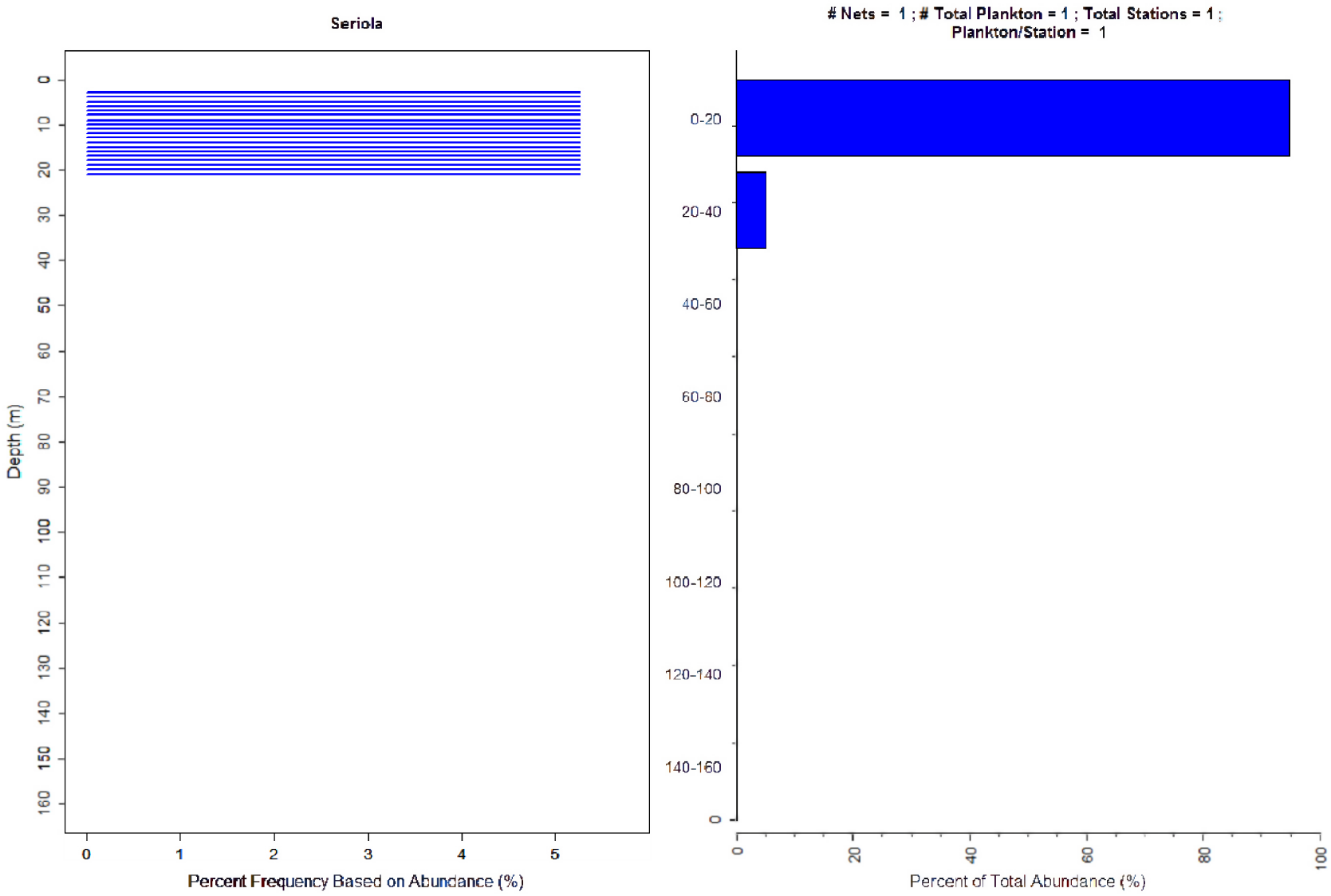
Sergestes - Shallow



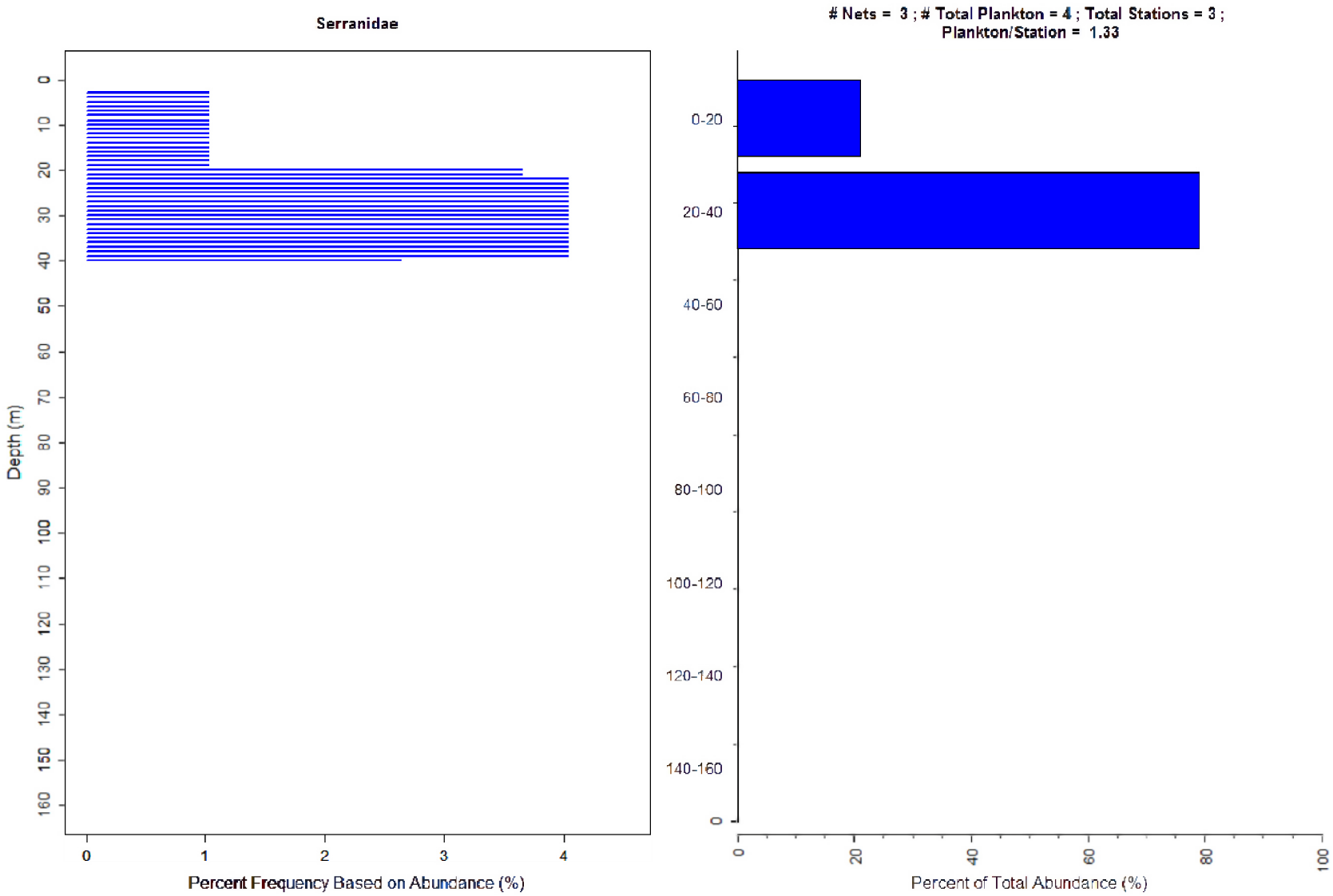
Sergestidae - Shallow



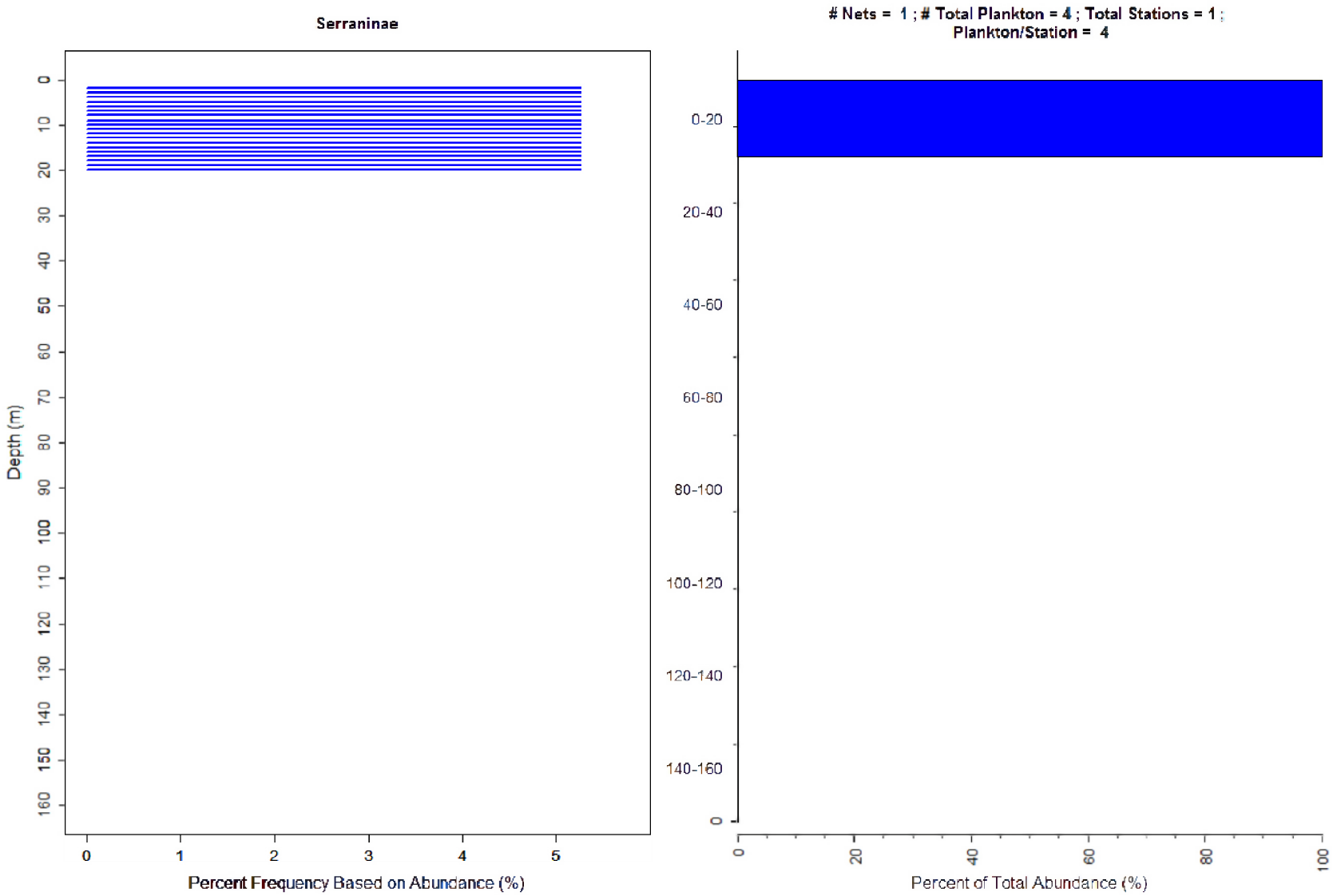
Sergia - Shallow



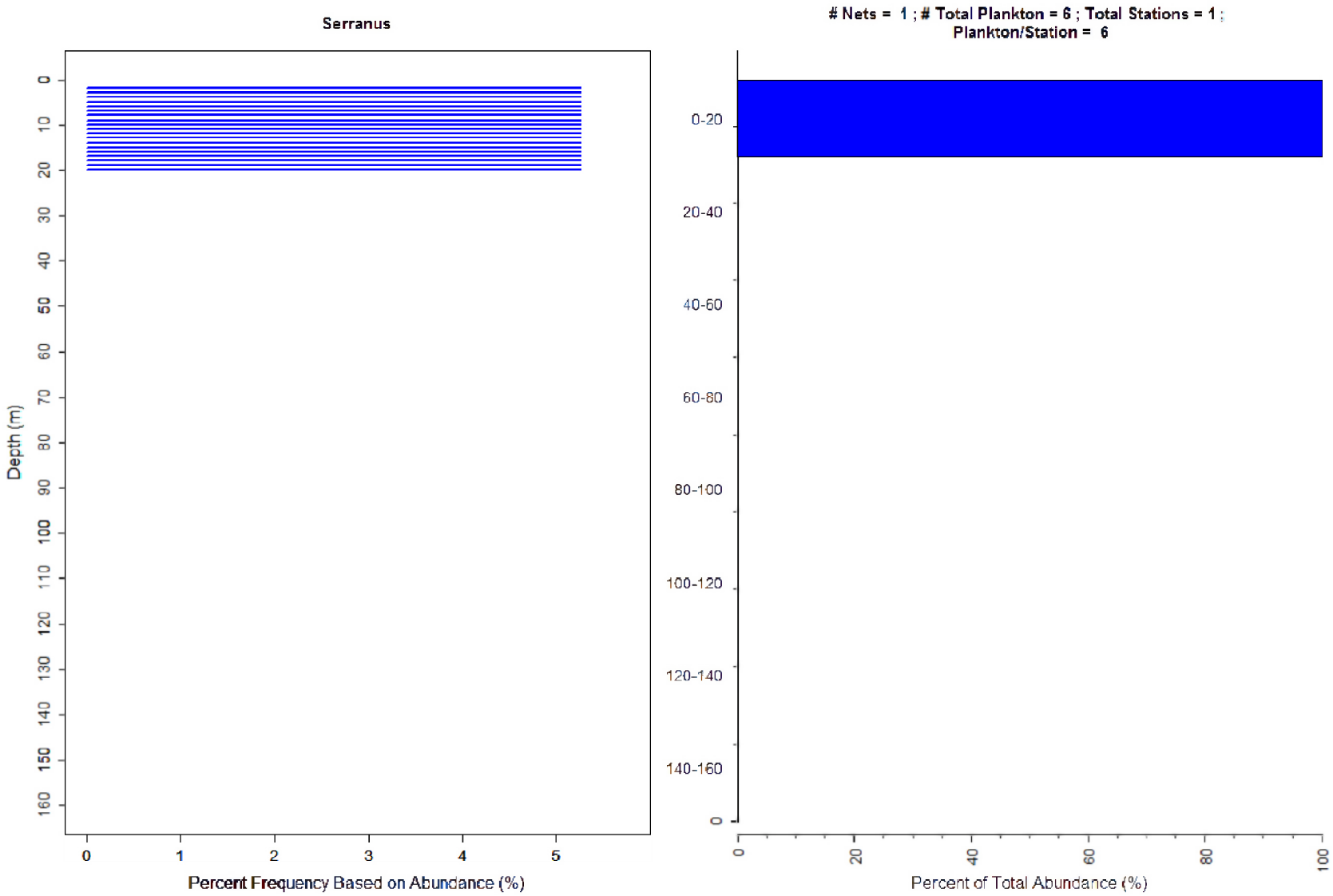
Seriola - Shallow



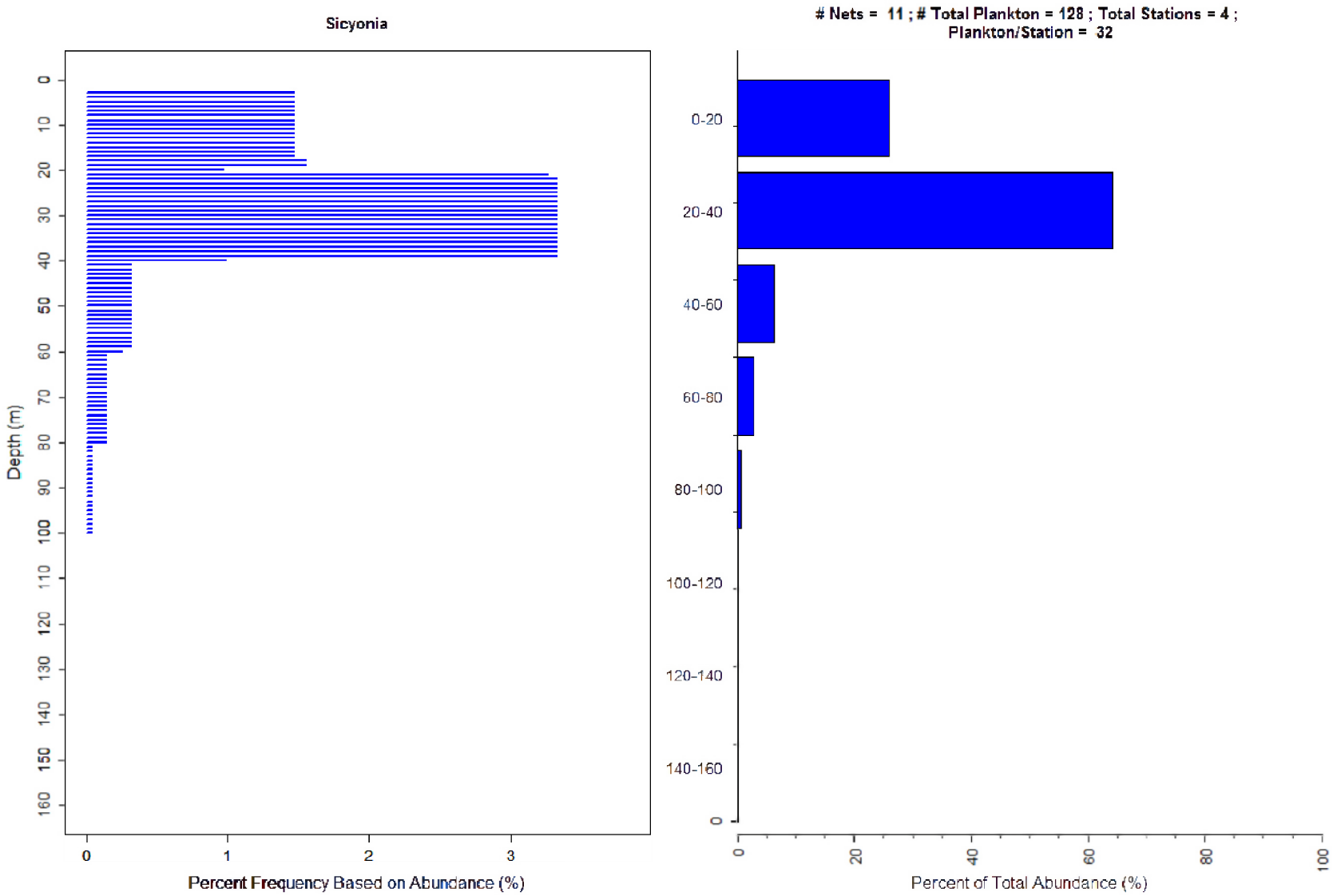
Serranidae - Shallow



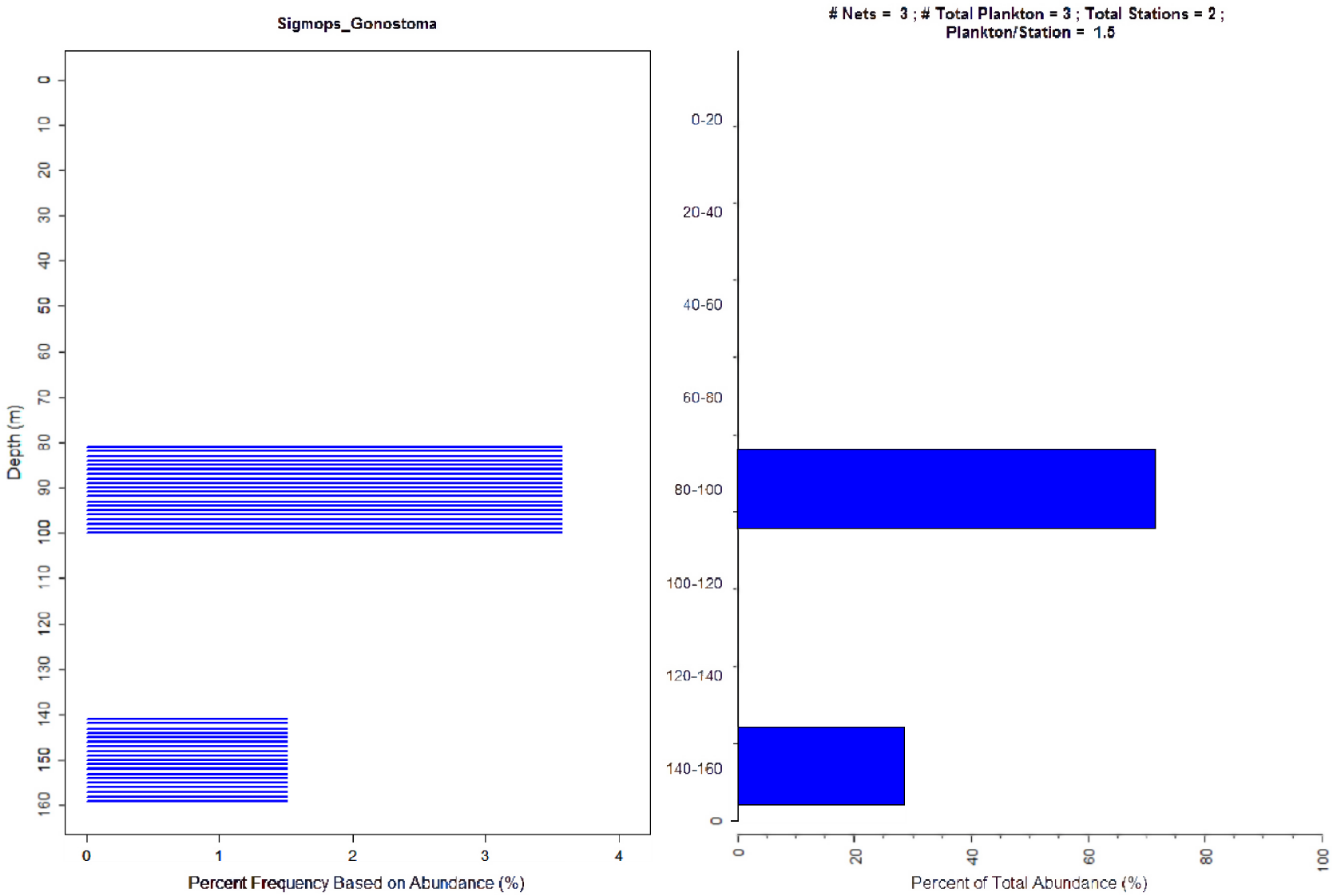
Serraninae - Shallow



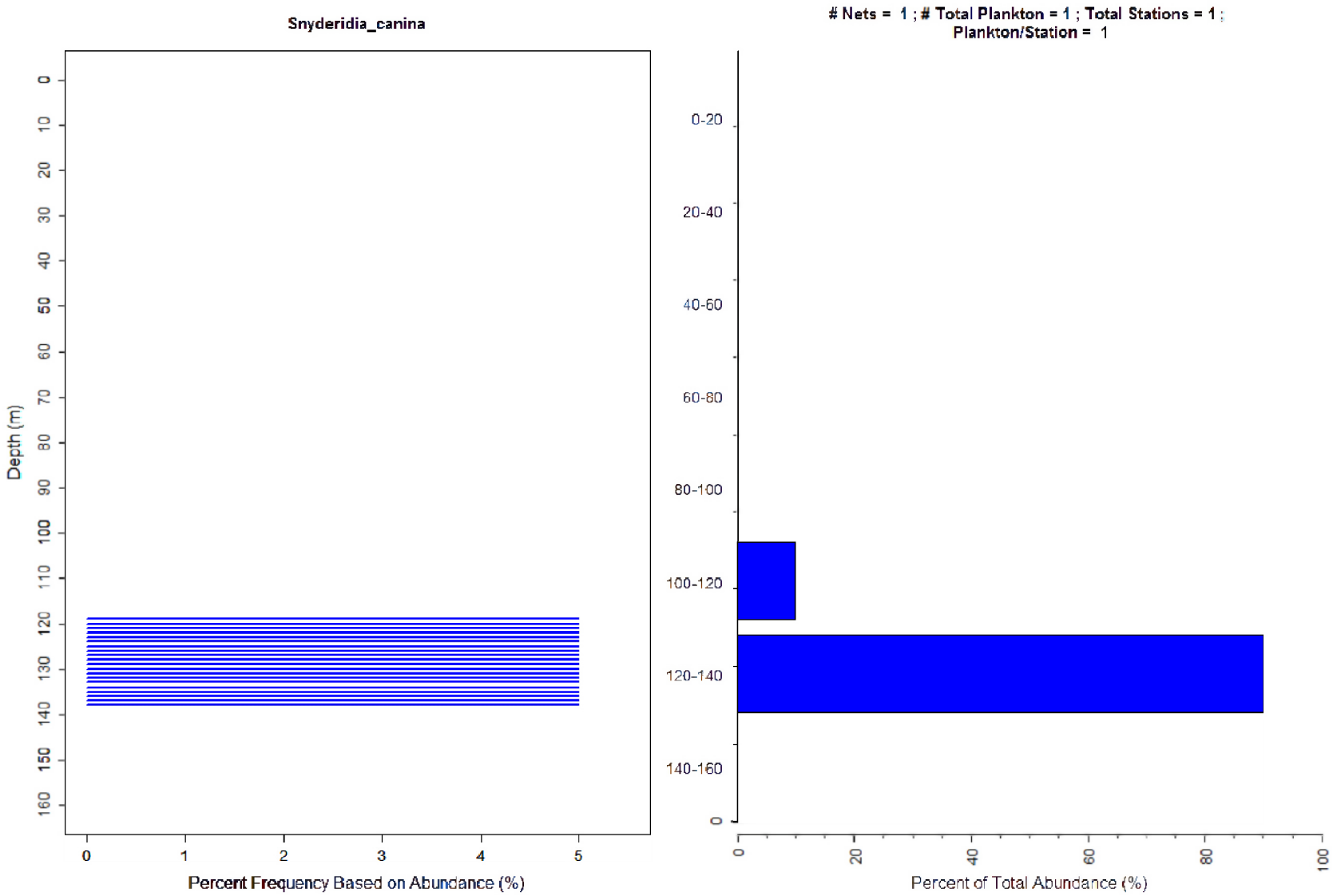
Serranus - Shallow



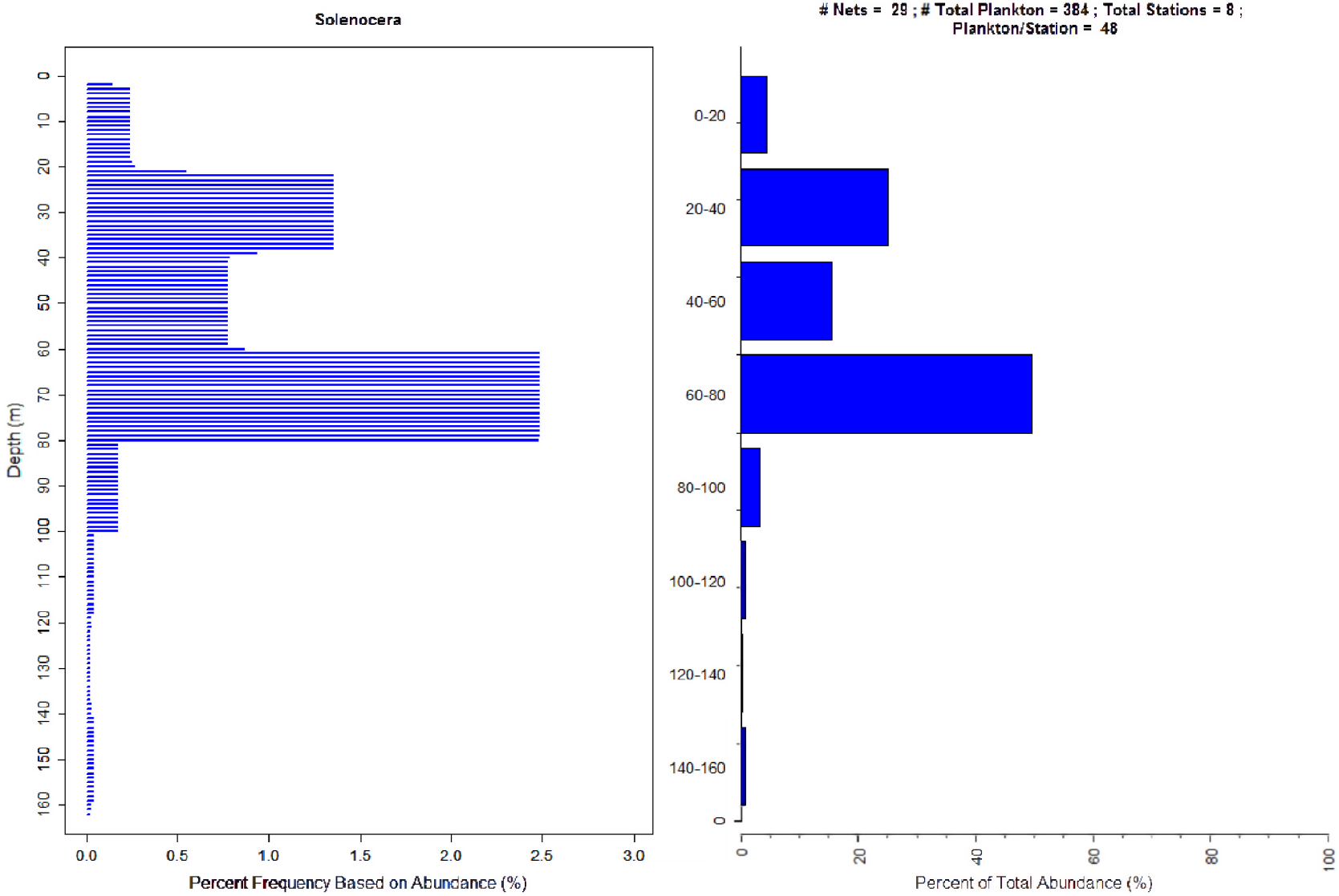
Sicyonia - Shallow



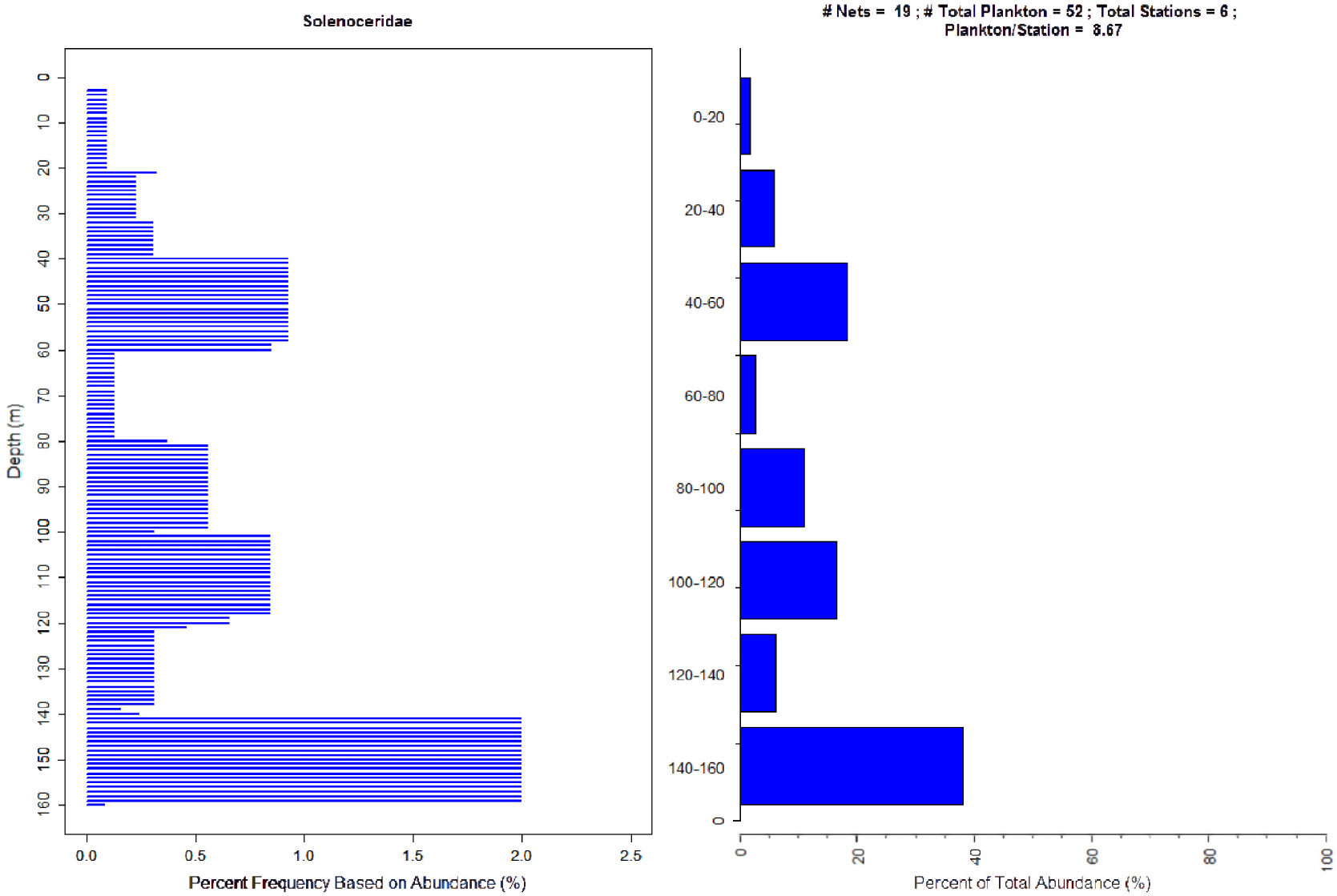
Sigmops_Gonostoma - Shallow



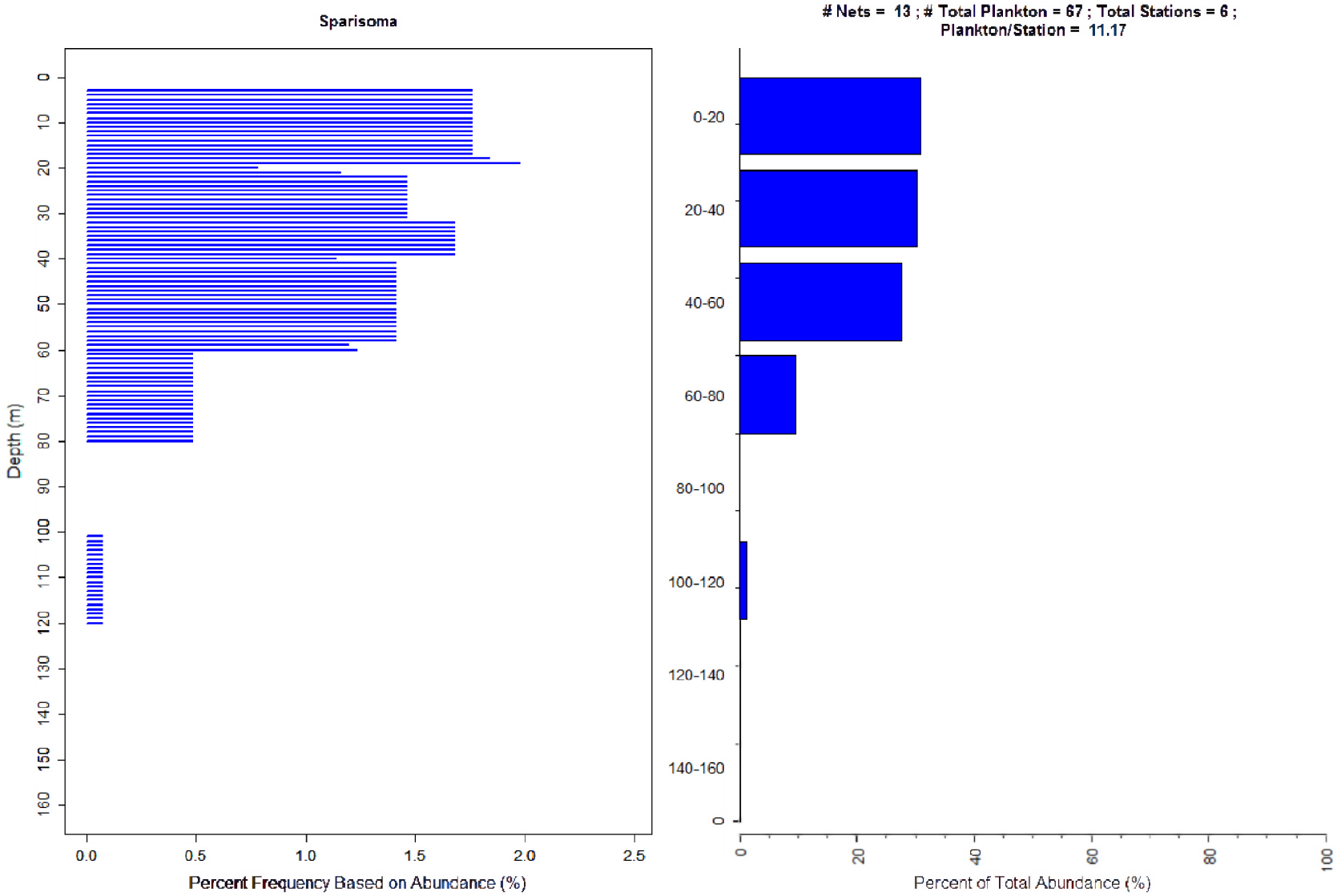
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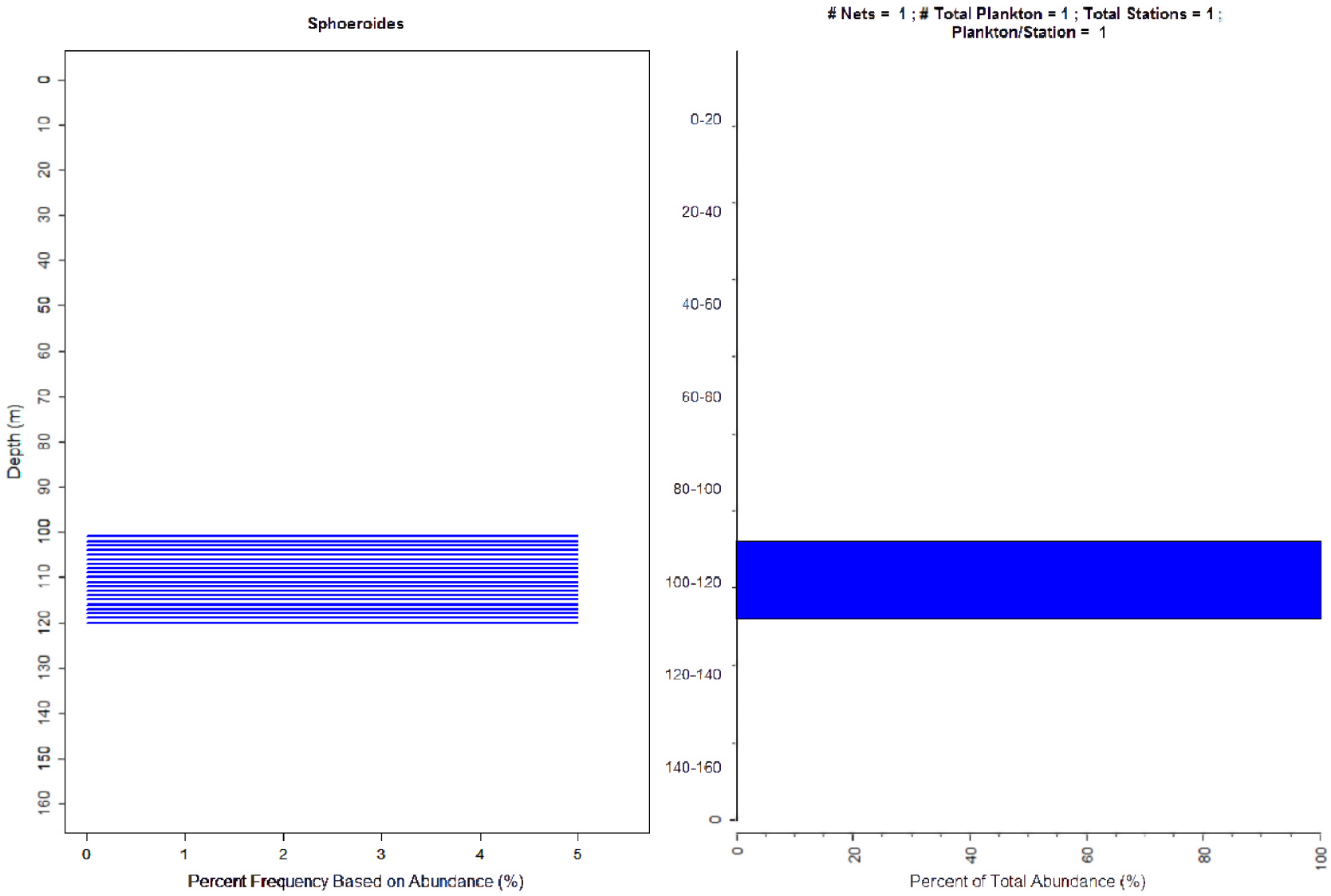
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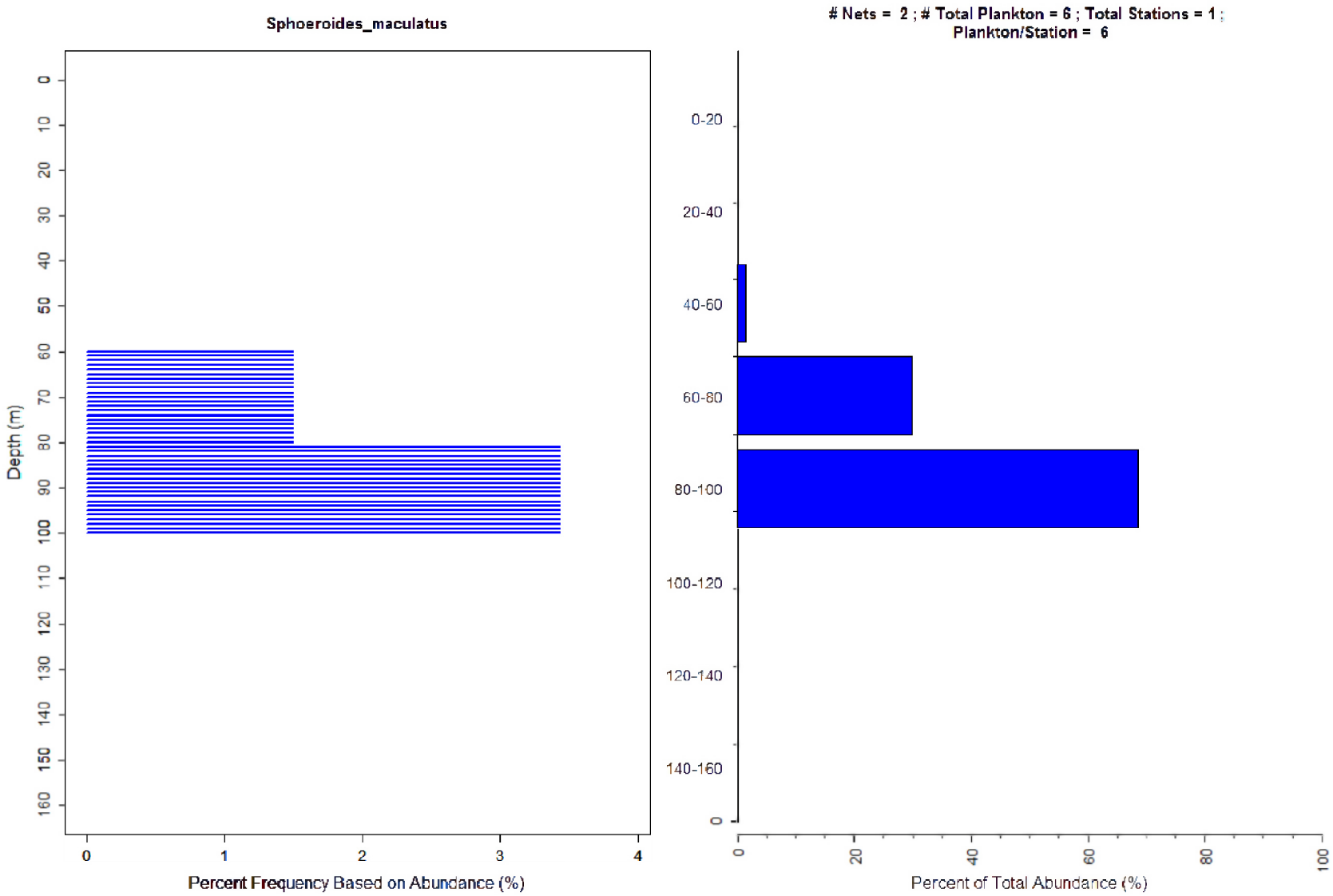
Solenoceridae - Shallow



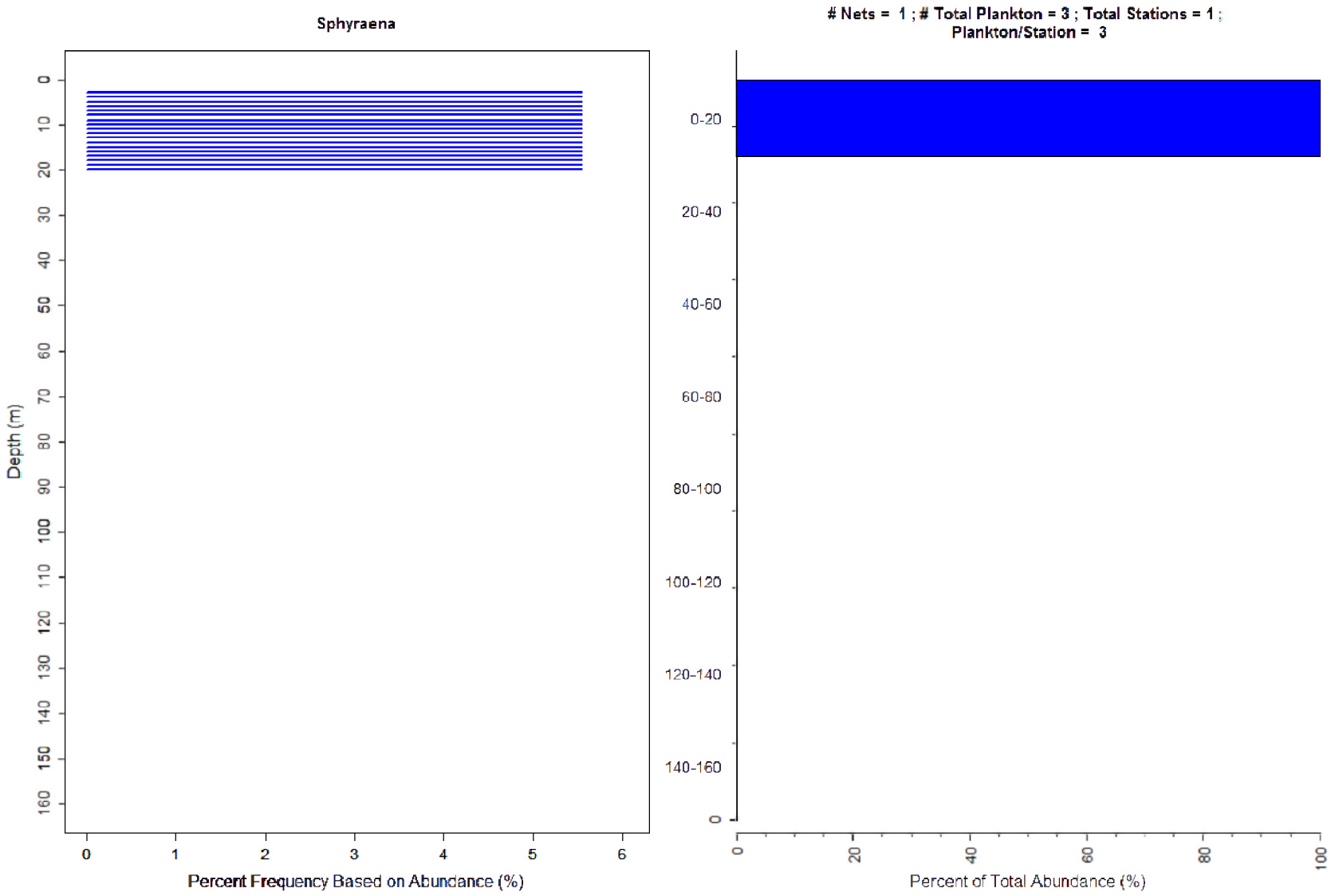
Sparisoma - Shallow



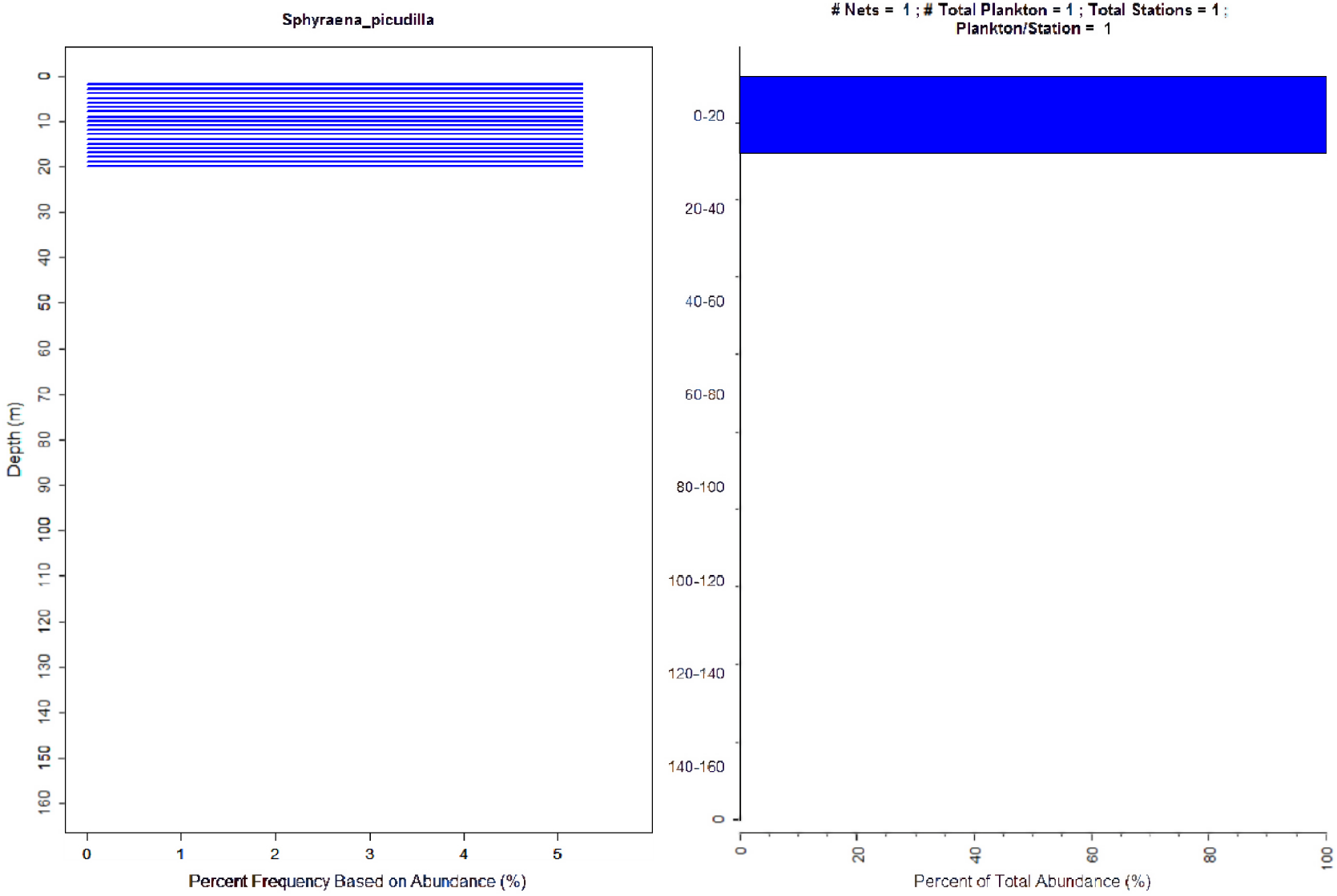
Sphoeroides - Shallow



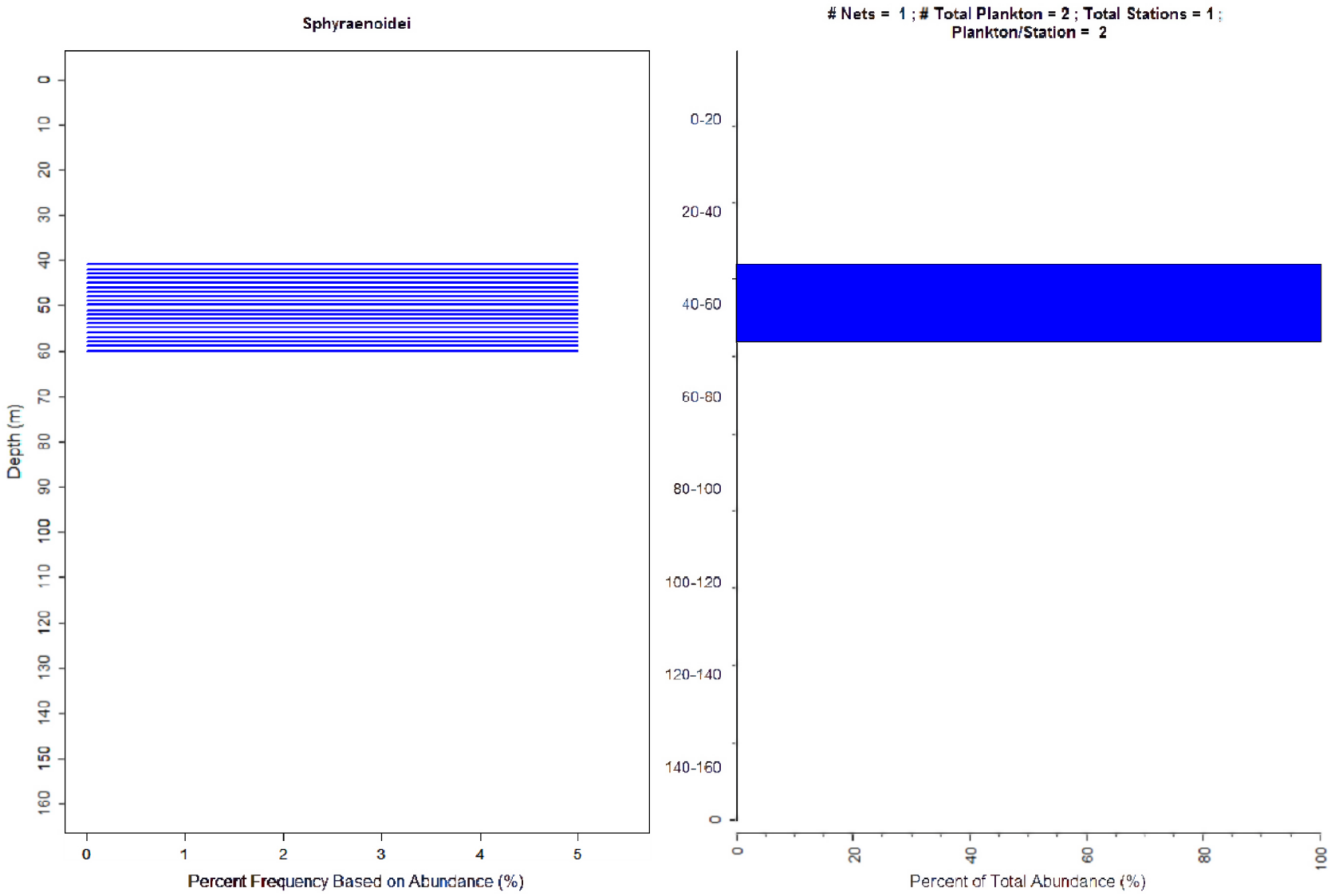
Sphoeroides_maculatus - Shallow



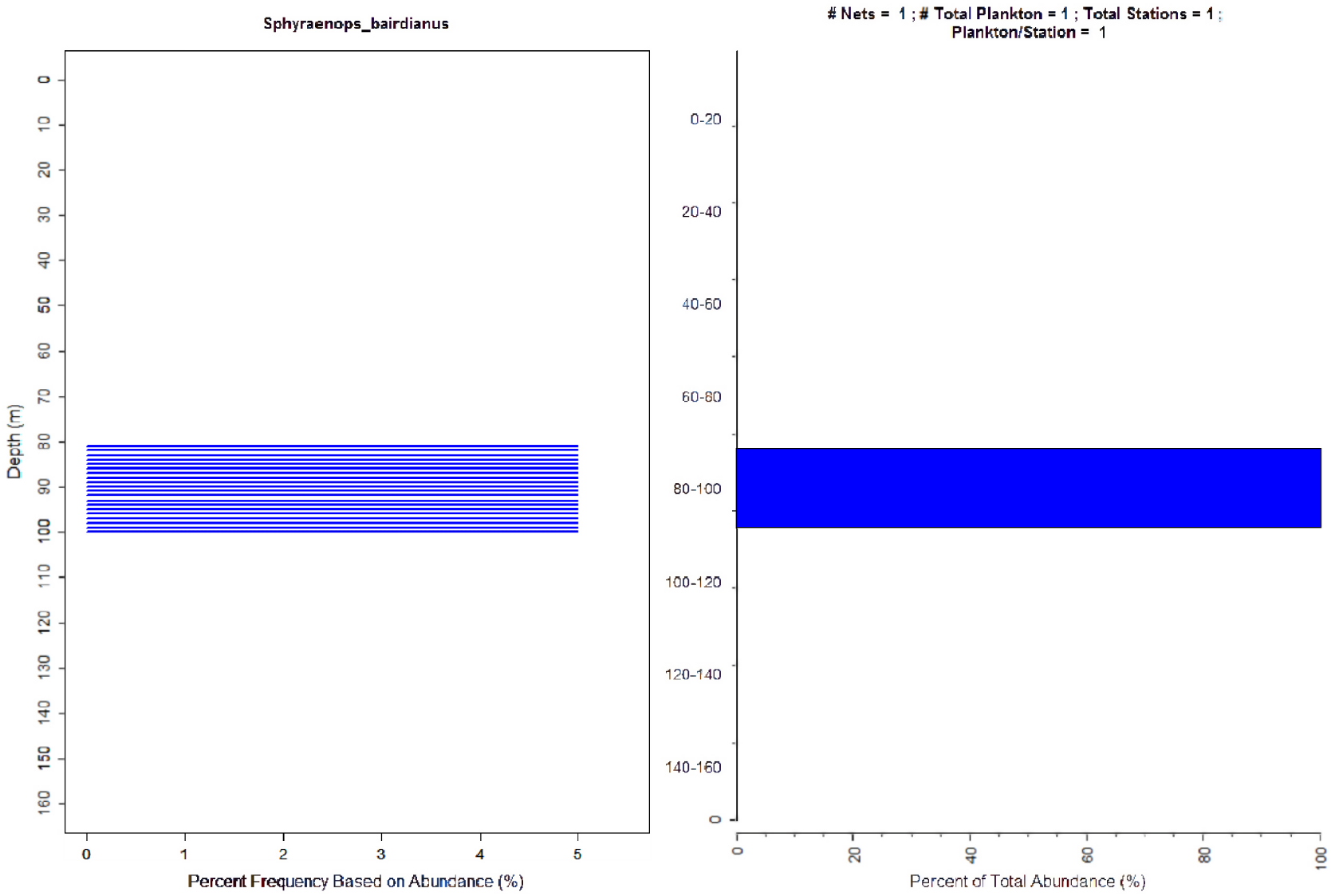
Sphyraena - Shallow



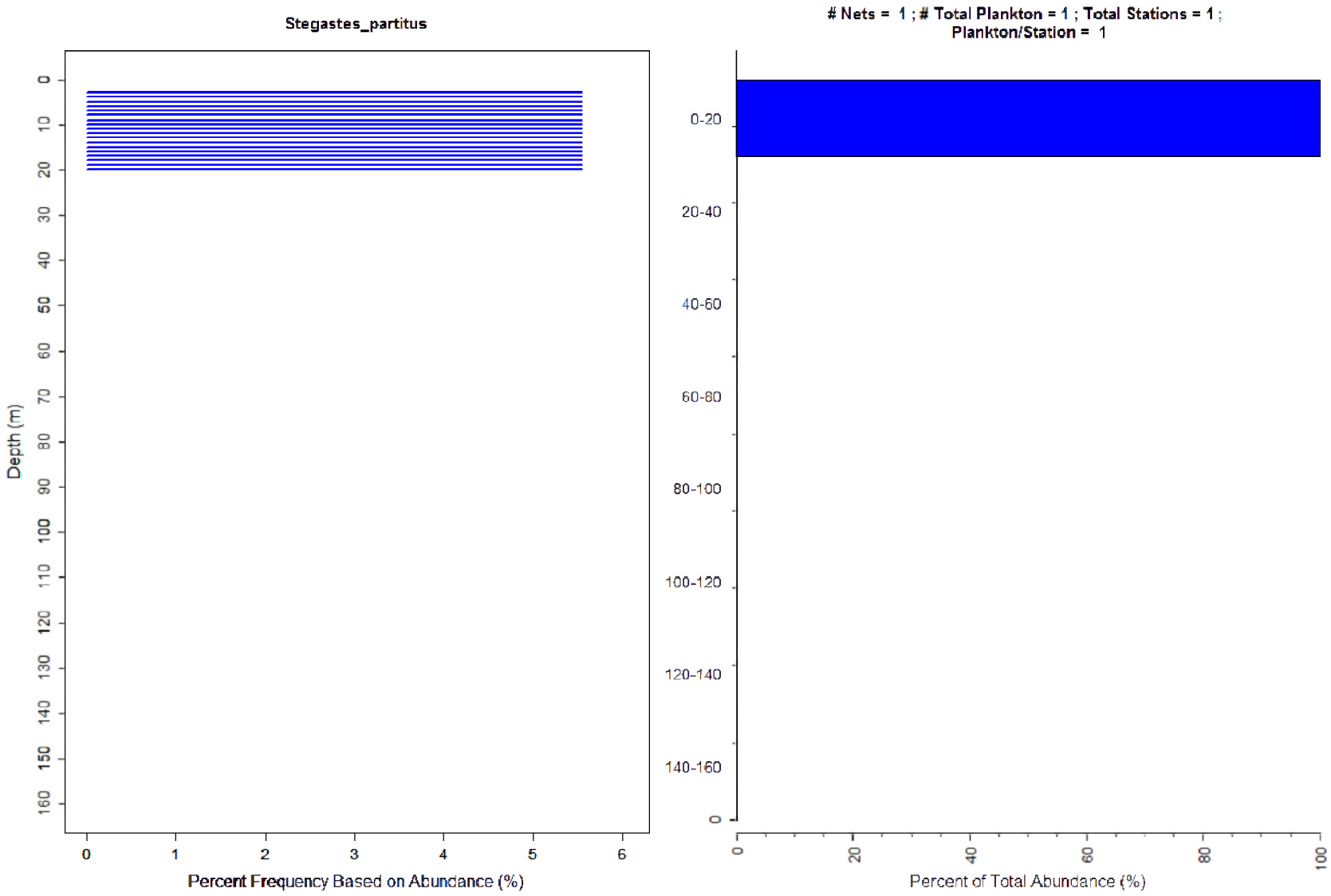
Sphyraena_picudilla - Shallow



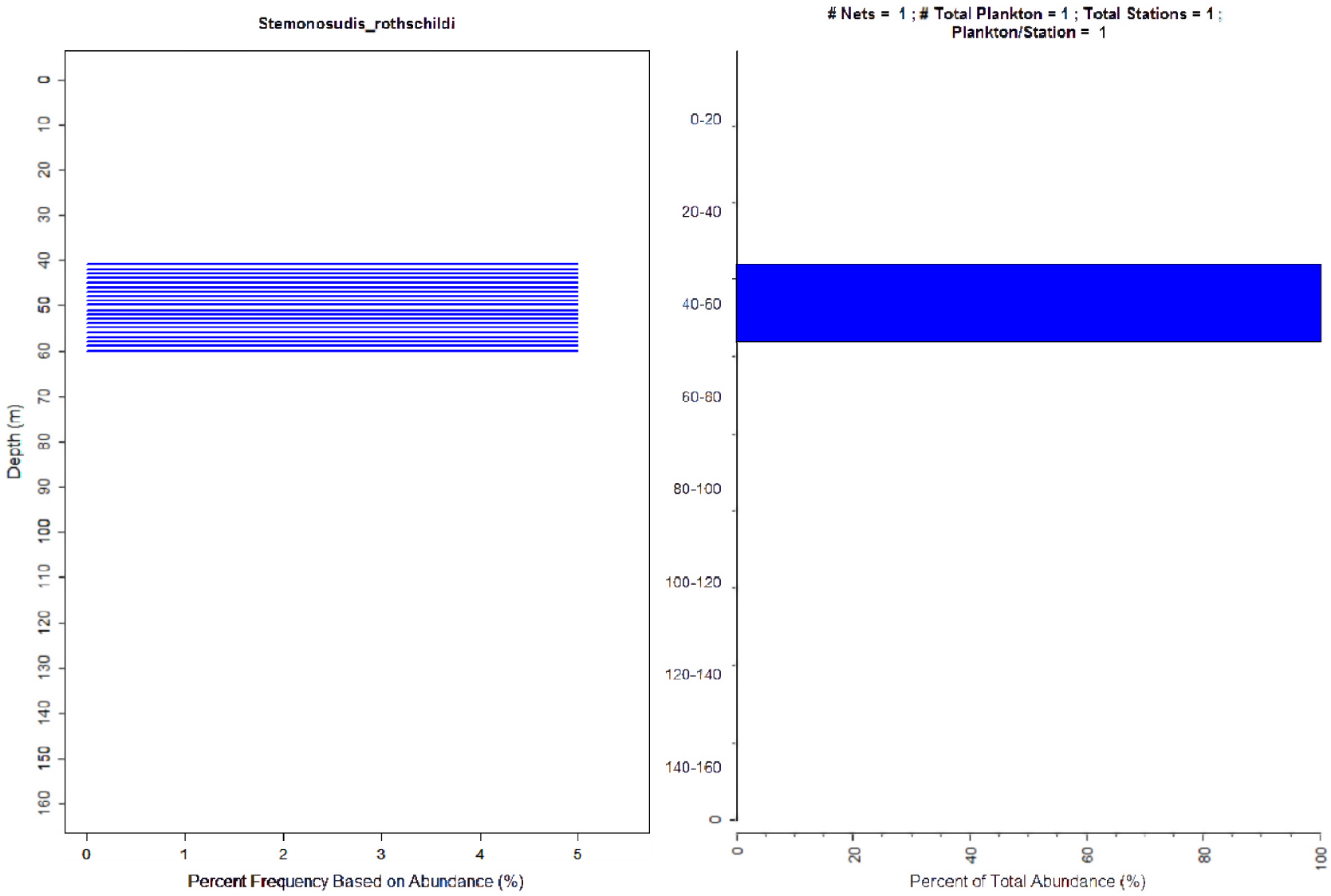
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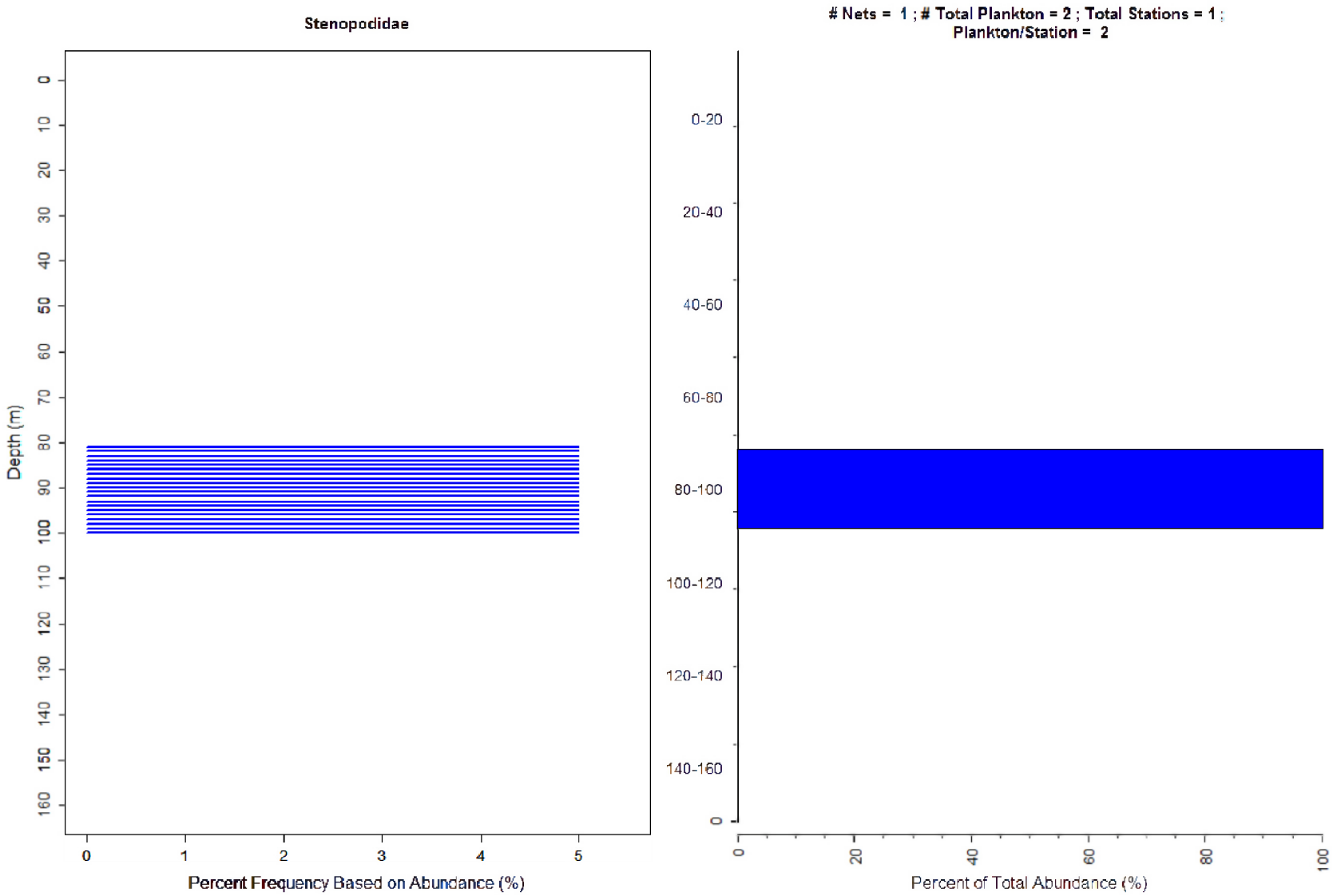
Sphyraenops_bairdianus - Shallow



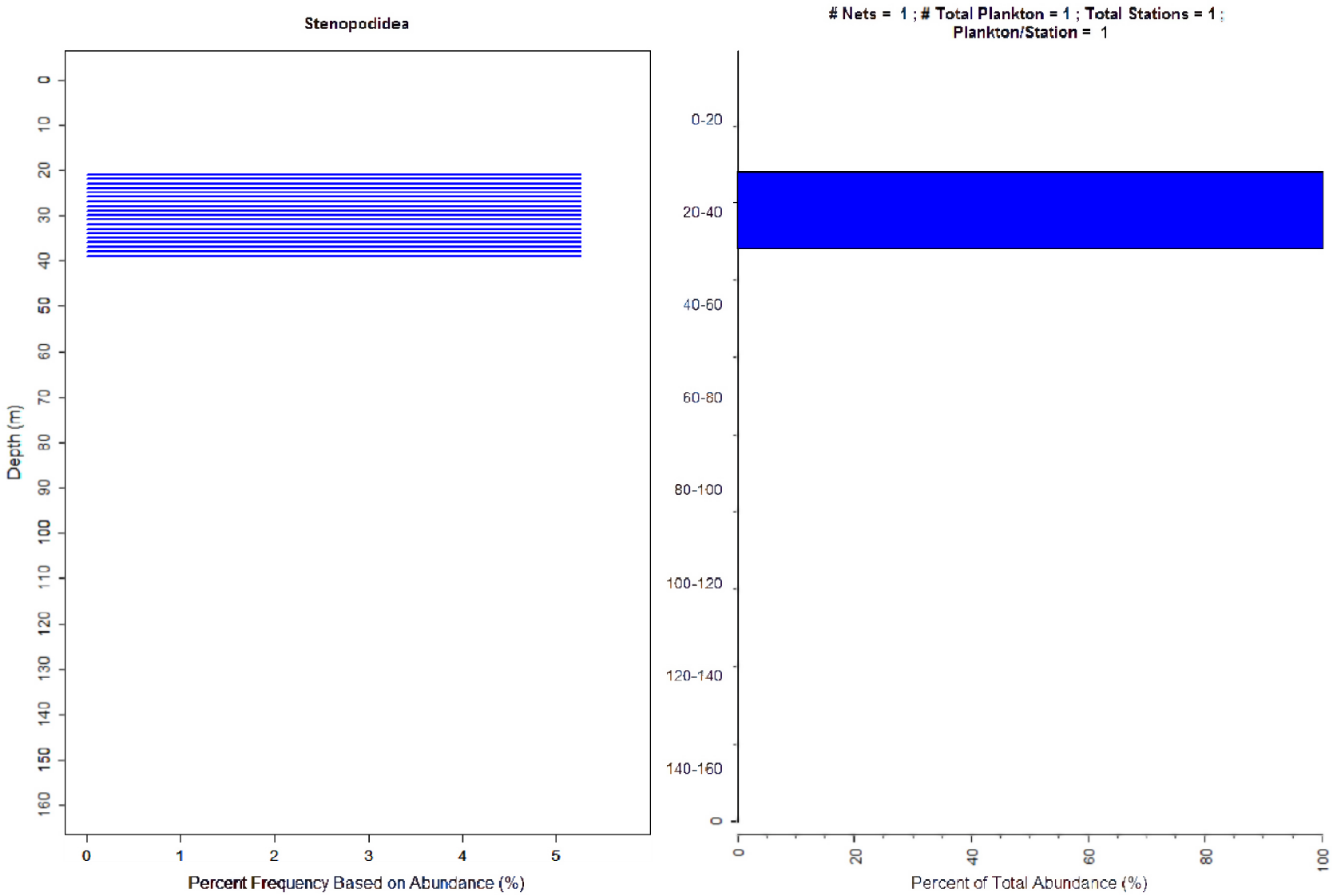
Stegastes_partitus - Shallow



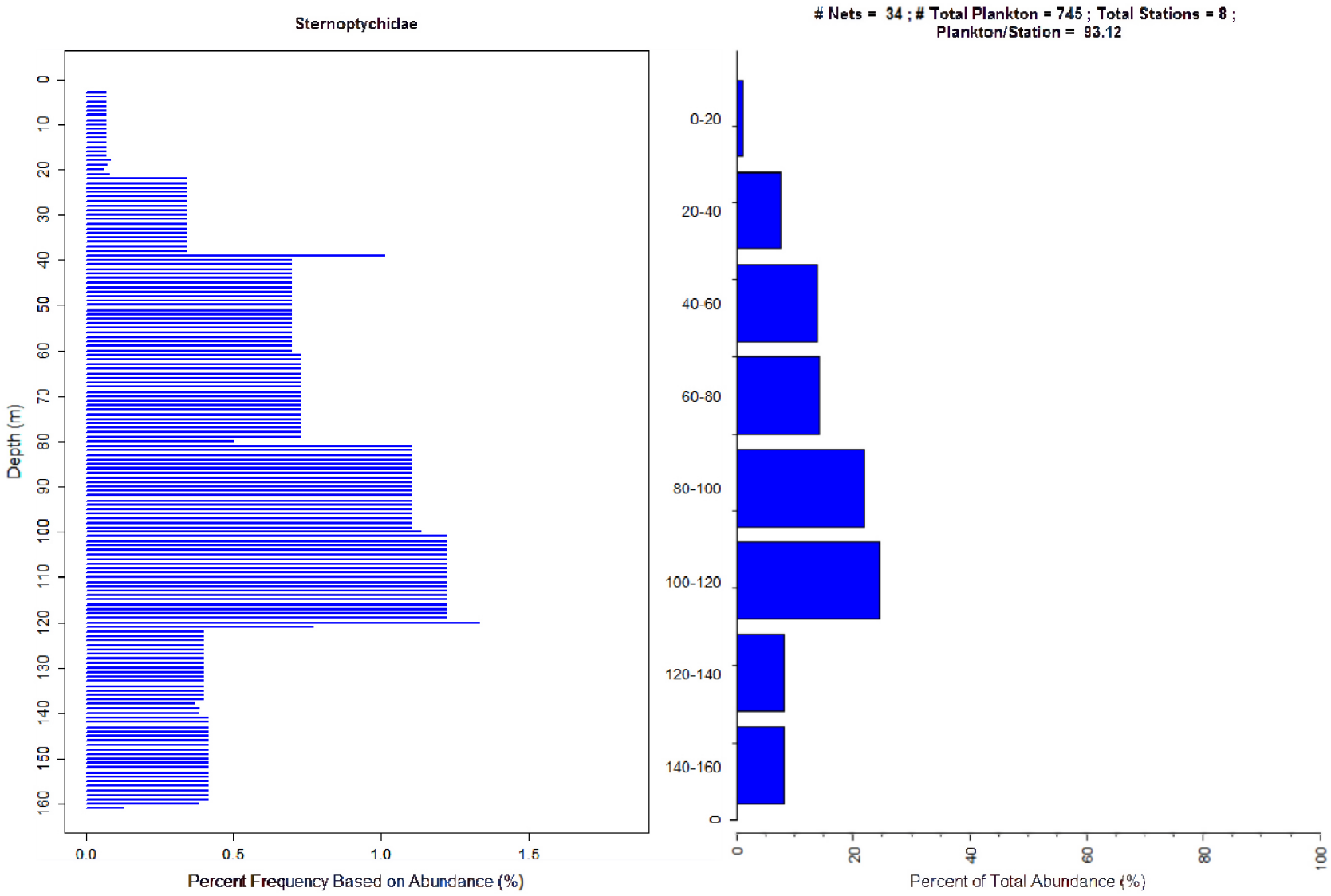
Stemonosudis_rothschildi - Shallow



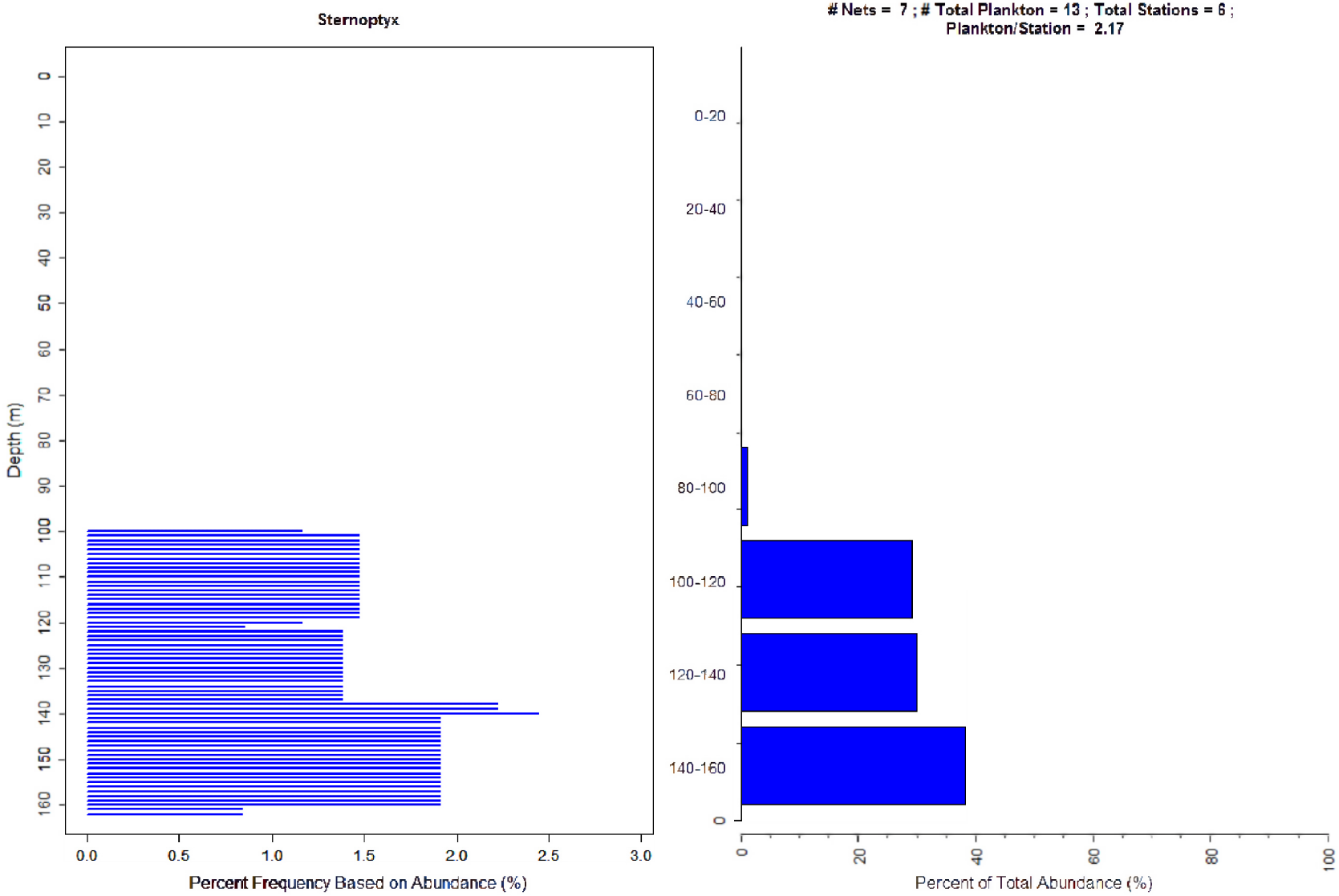
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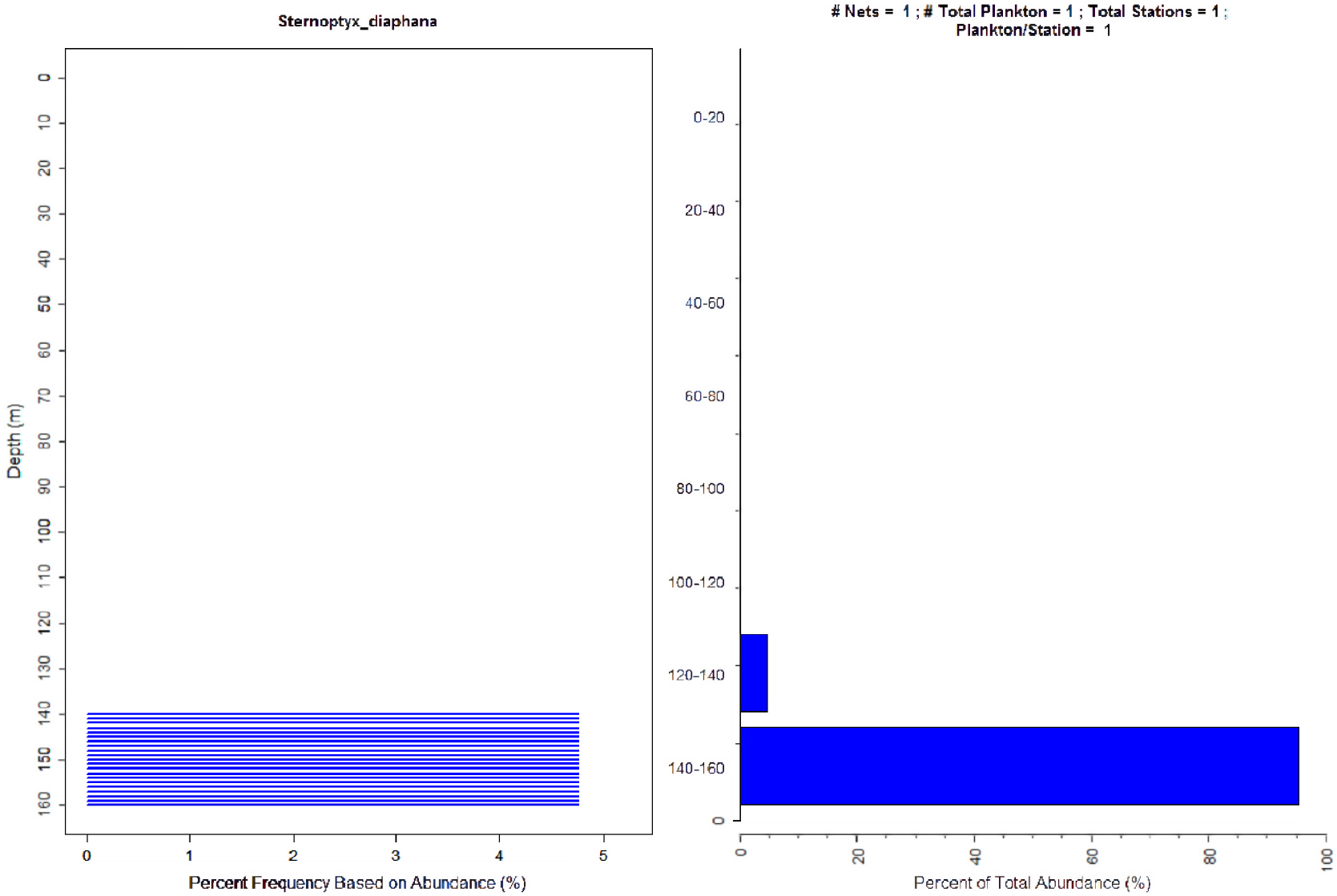
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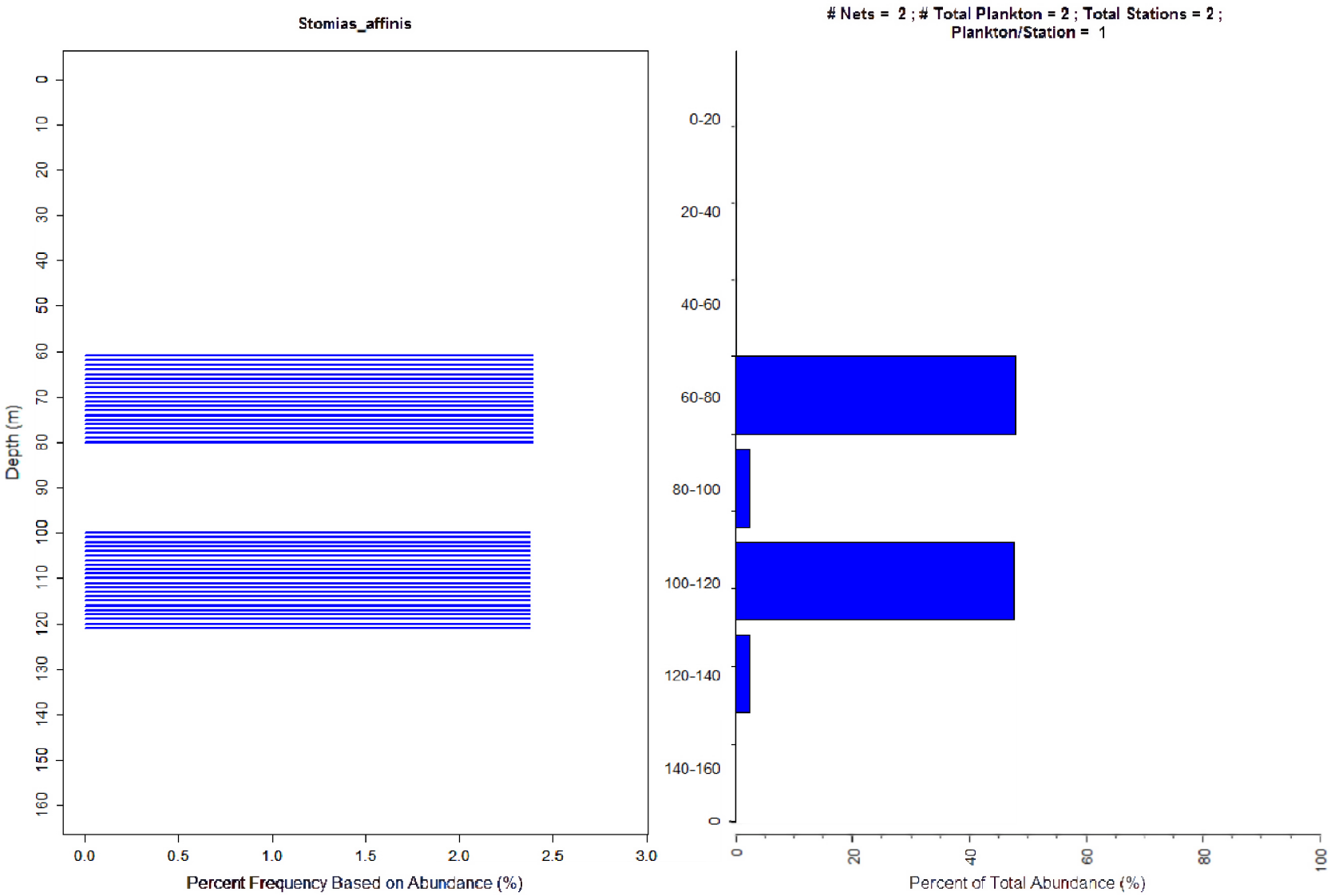
Sternoptychidae - Shallow



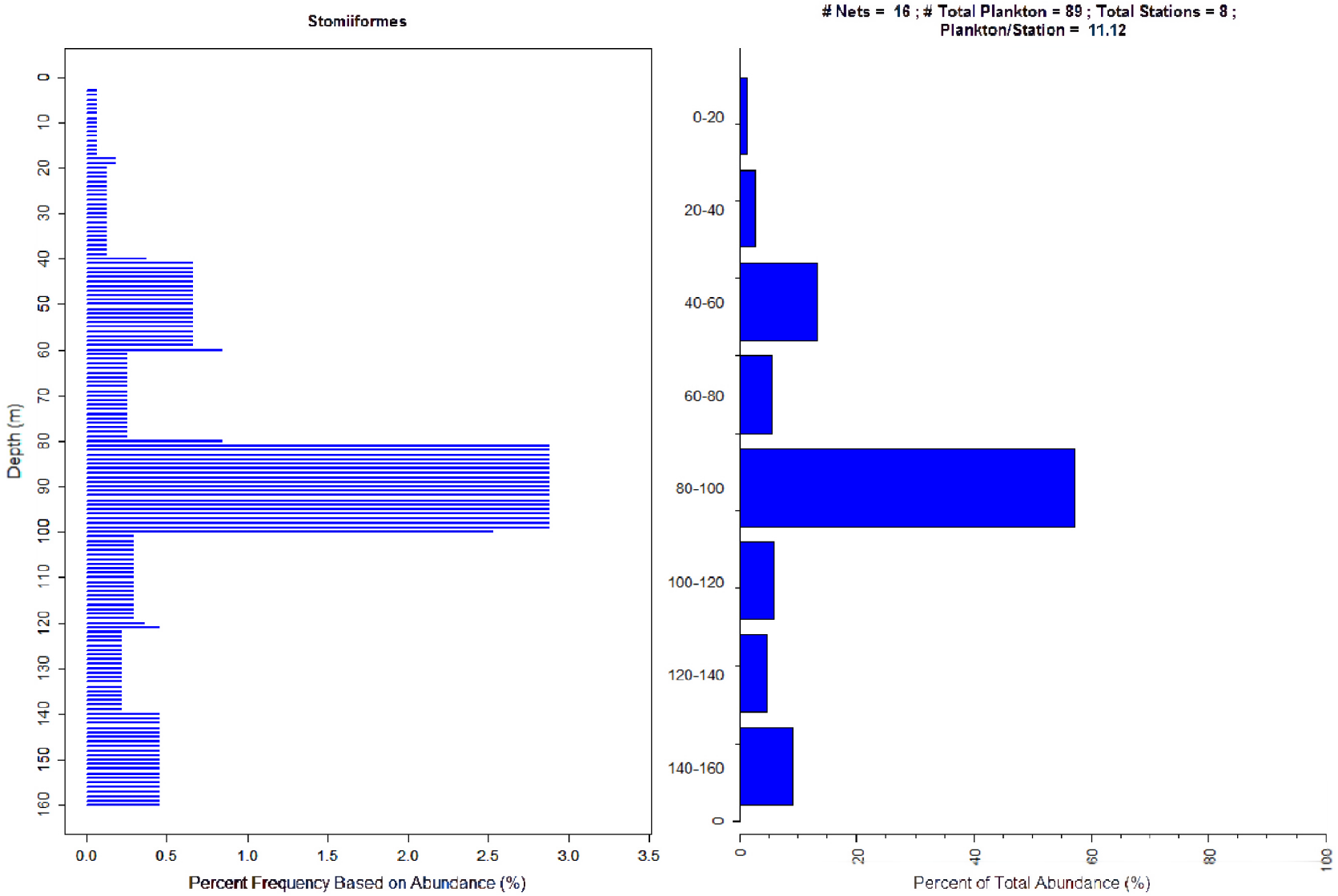
Sternoptyx - Shallow



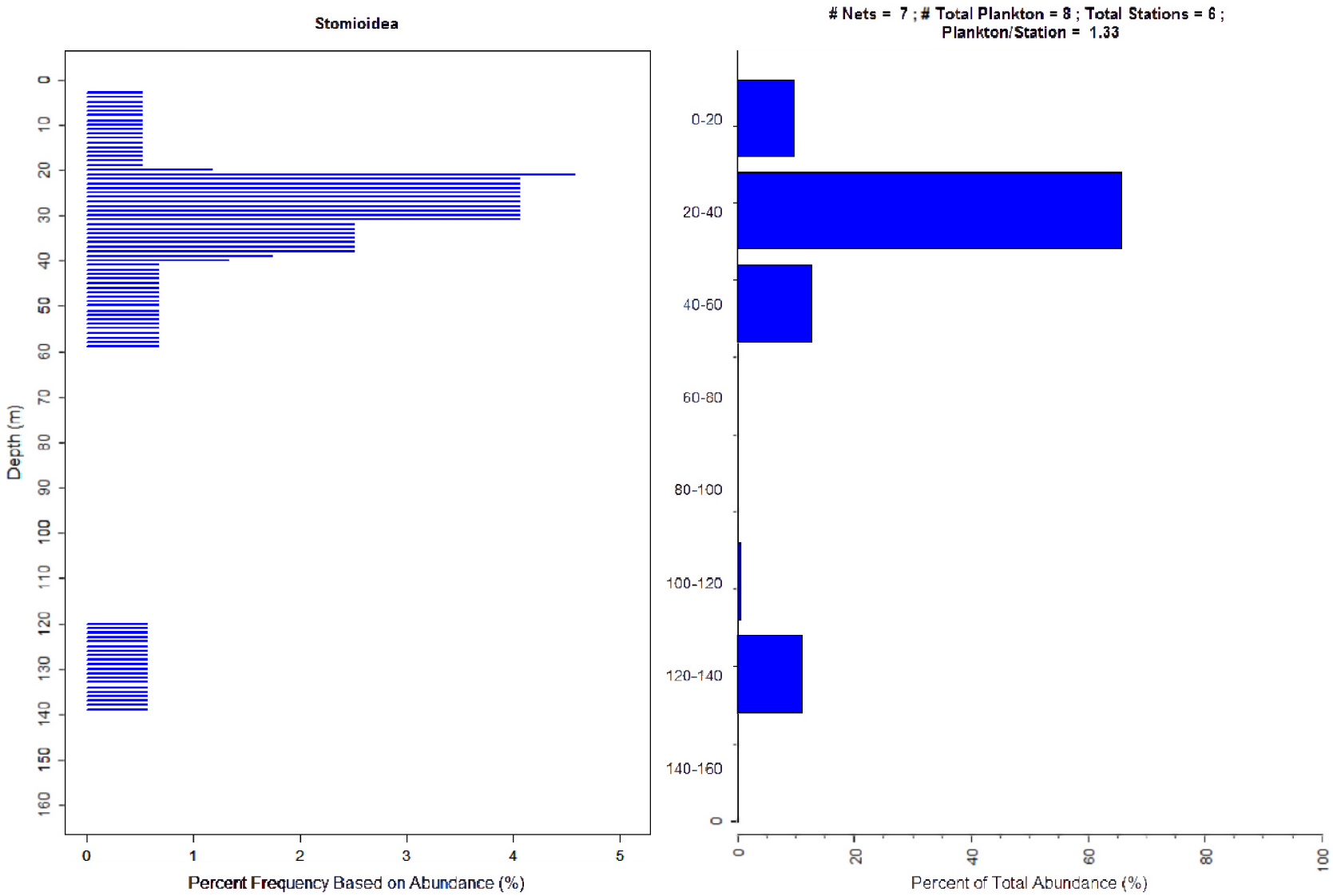
Sternoptyx_diaphana - Shallow



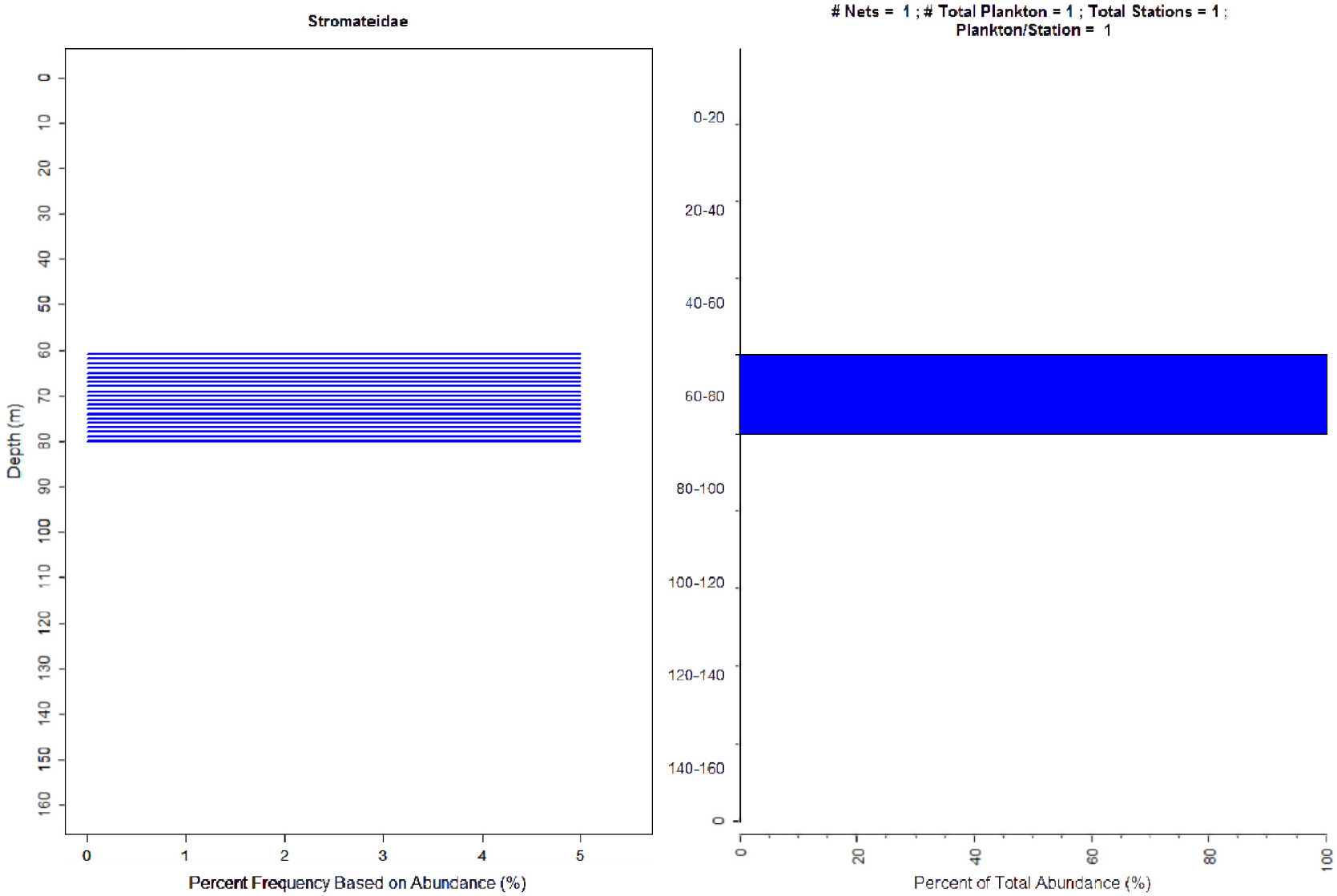
Stomias_affinis - Shallow



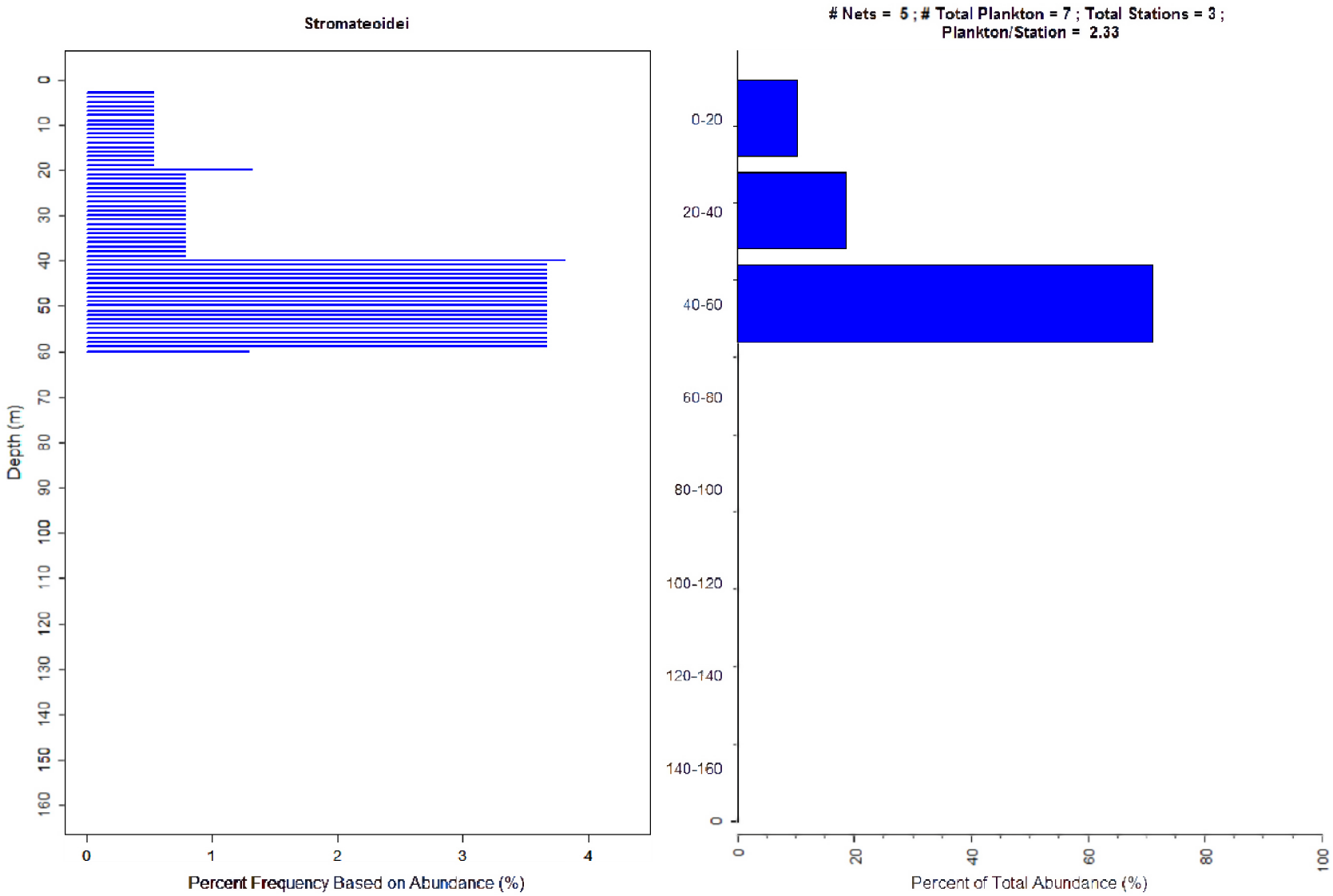
Stomiiformes - Shallow



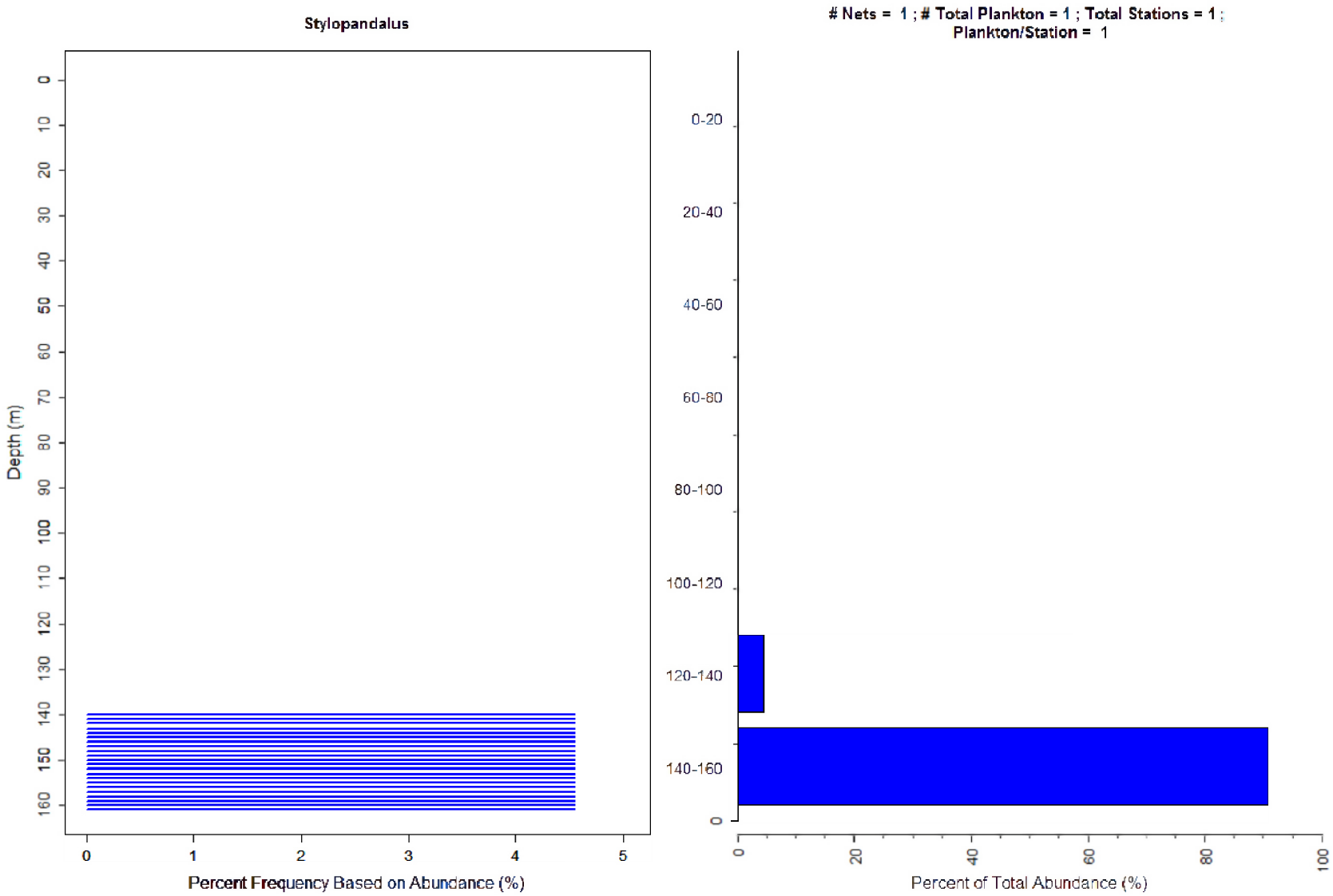
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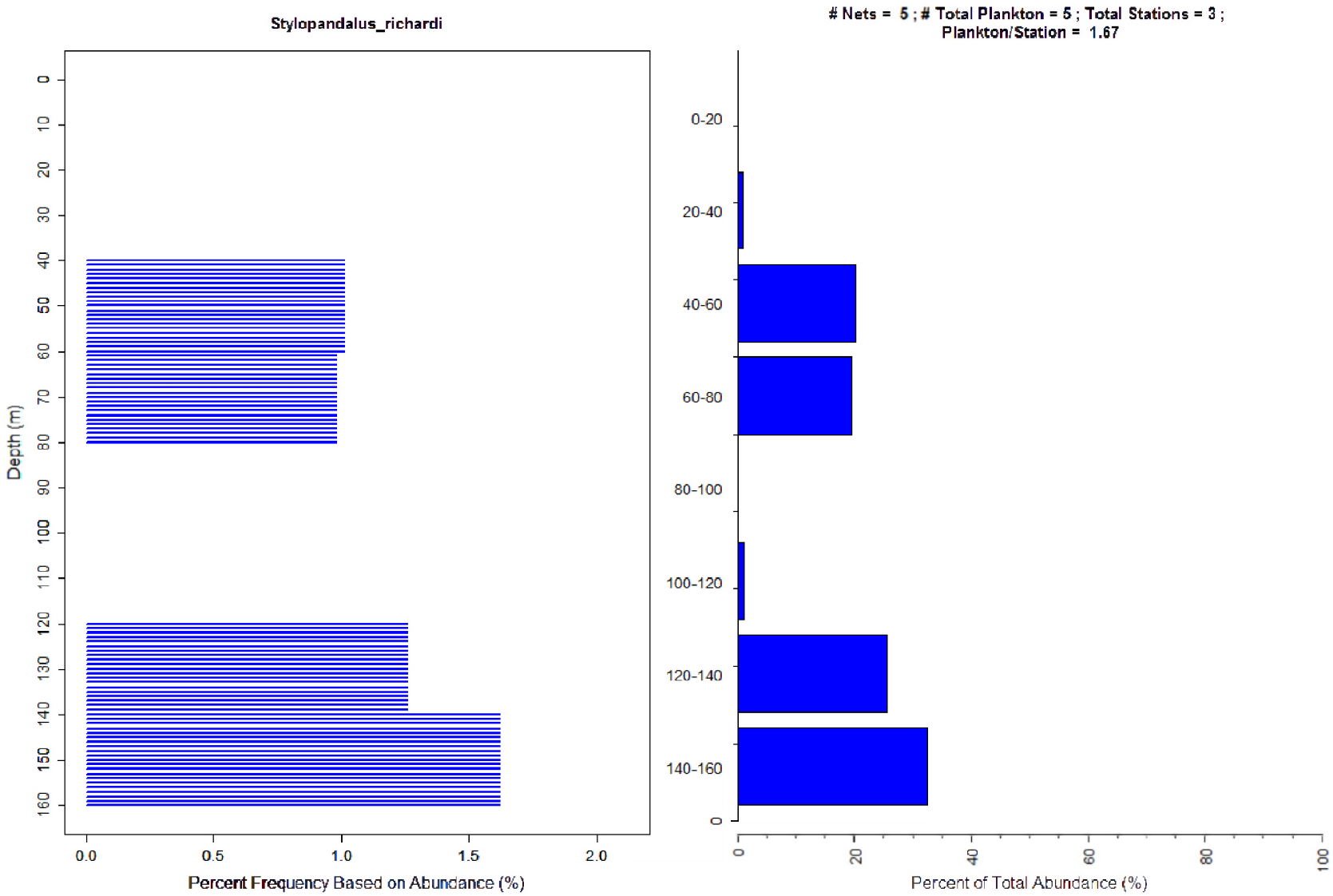
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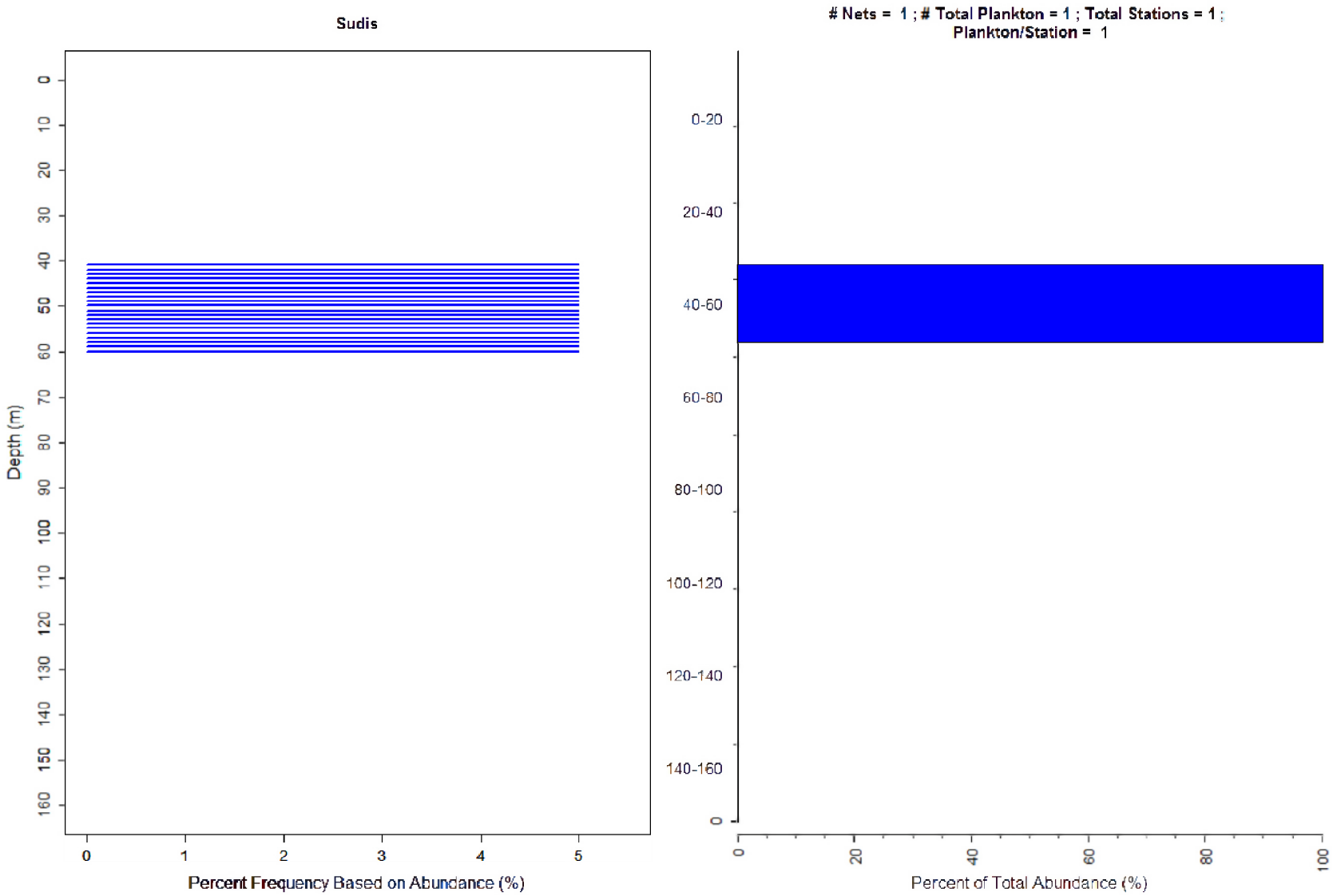
Stromateoidei - Shallow



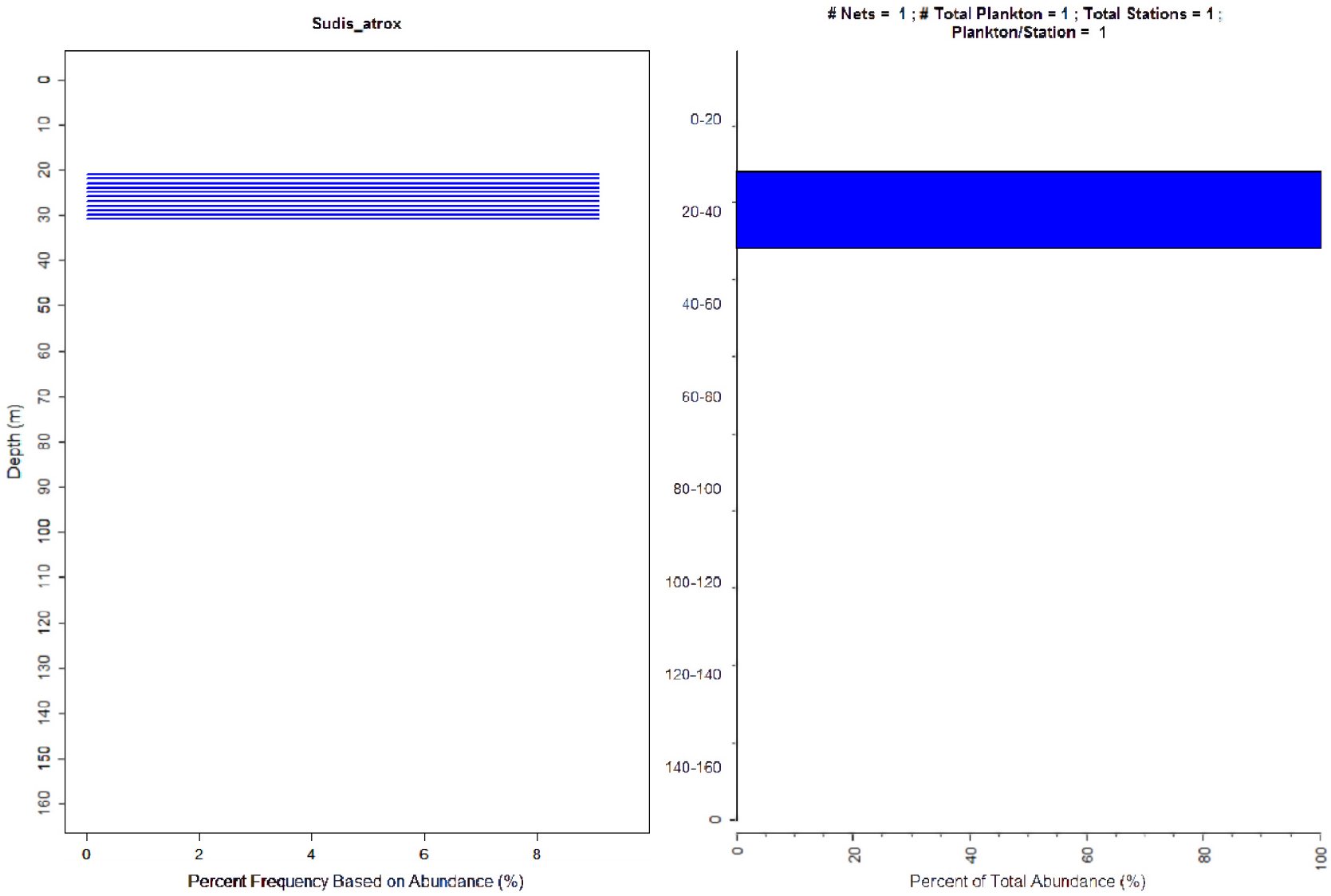
Stylopandalus - Shallow



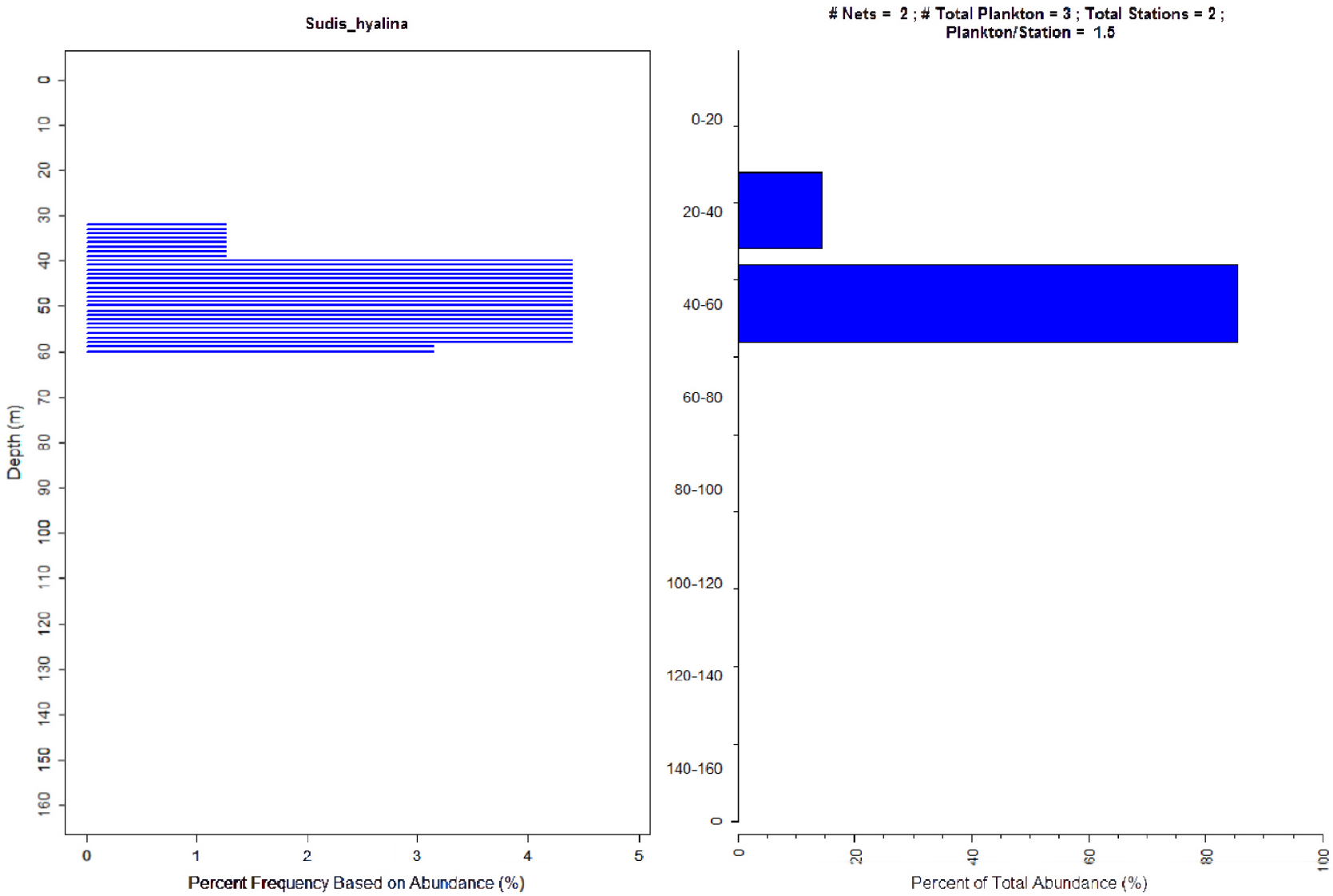
Stylopandalus_richardi - Shallow



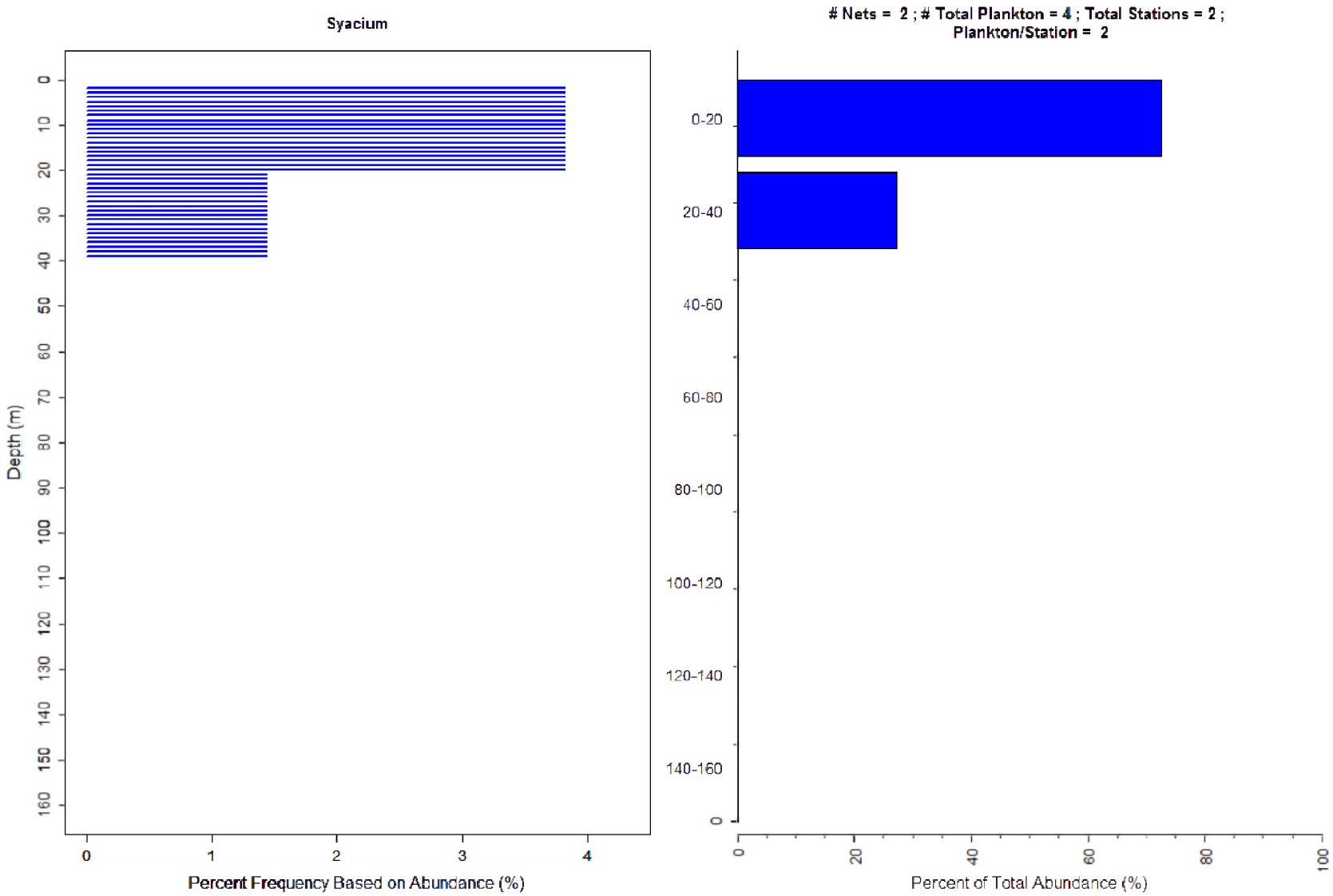
Sudis - Shallow



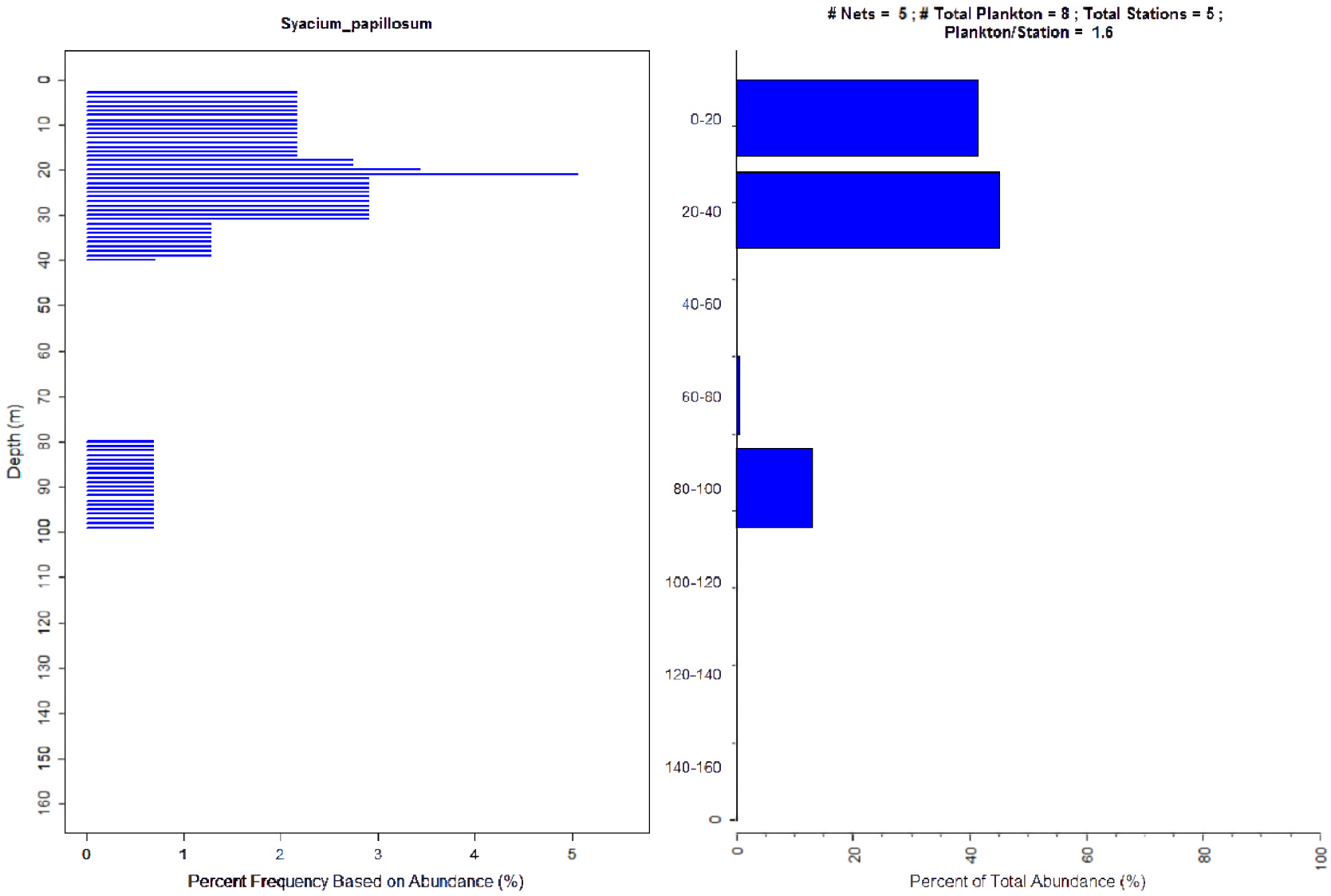
Sudis_atrox - Shallow



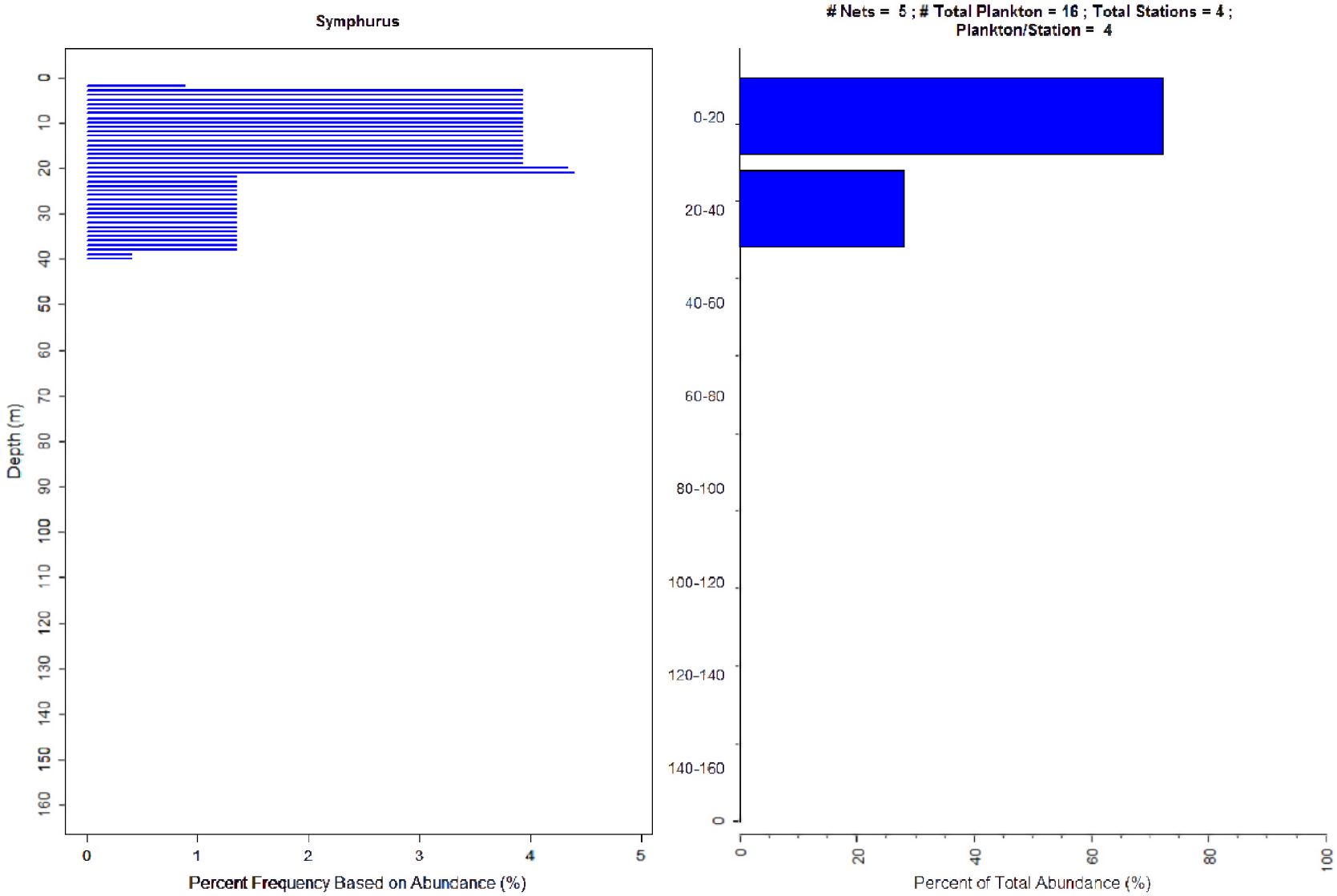
Sudis_hyalina - Shallow



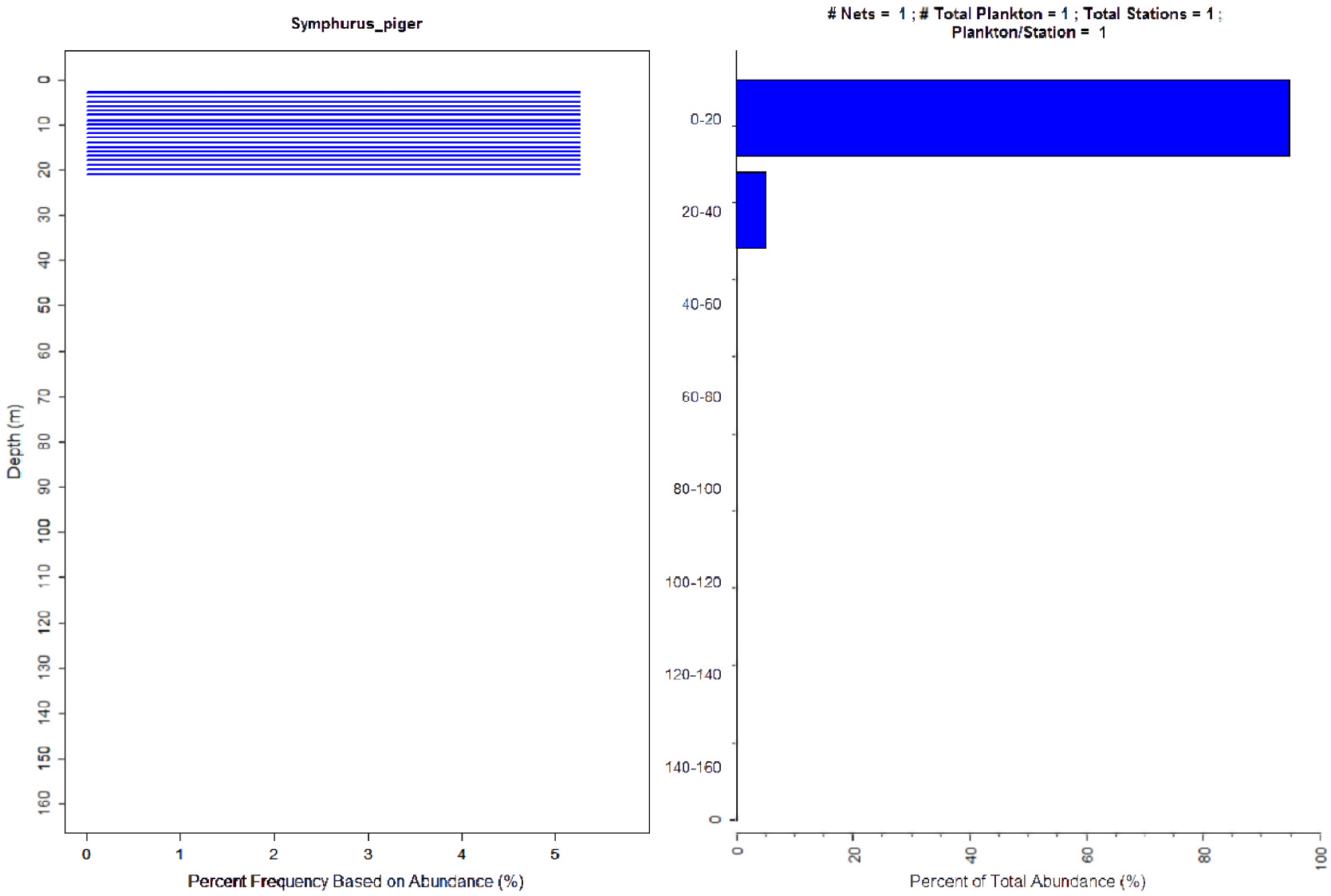
Syacium - Shallow



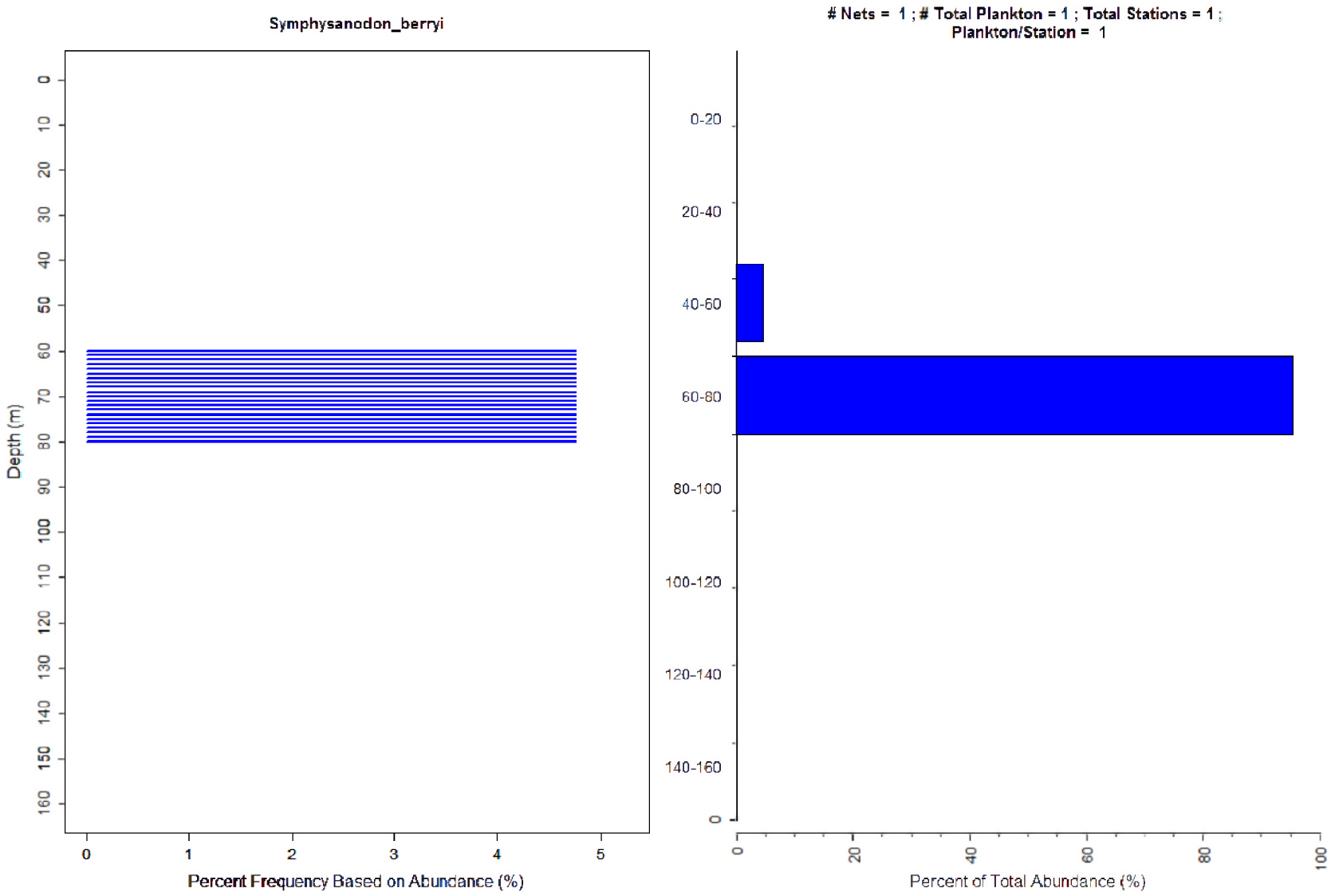
Syacium_papillosum - Shallow



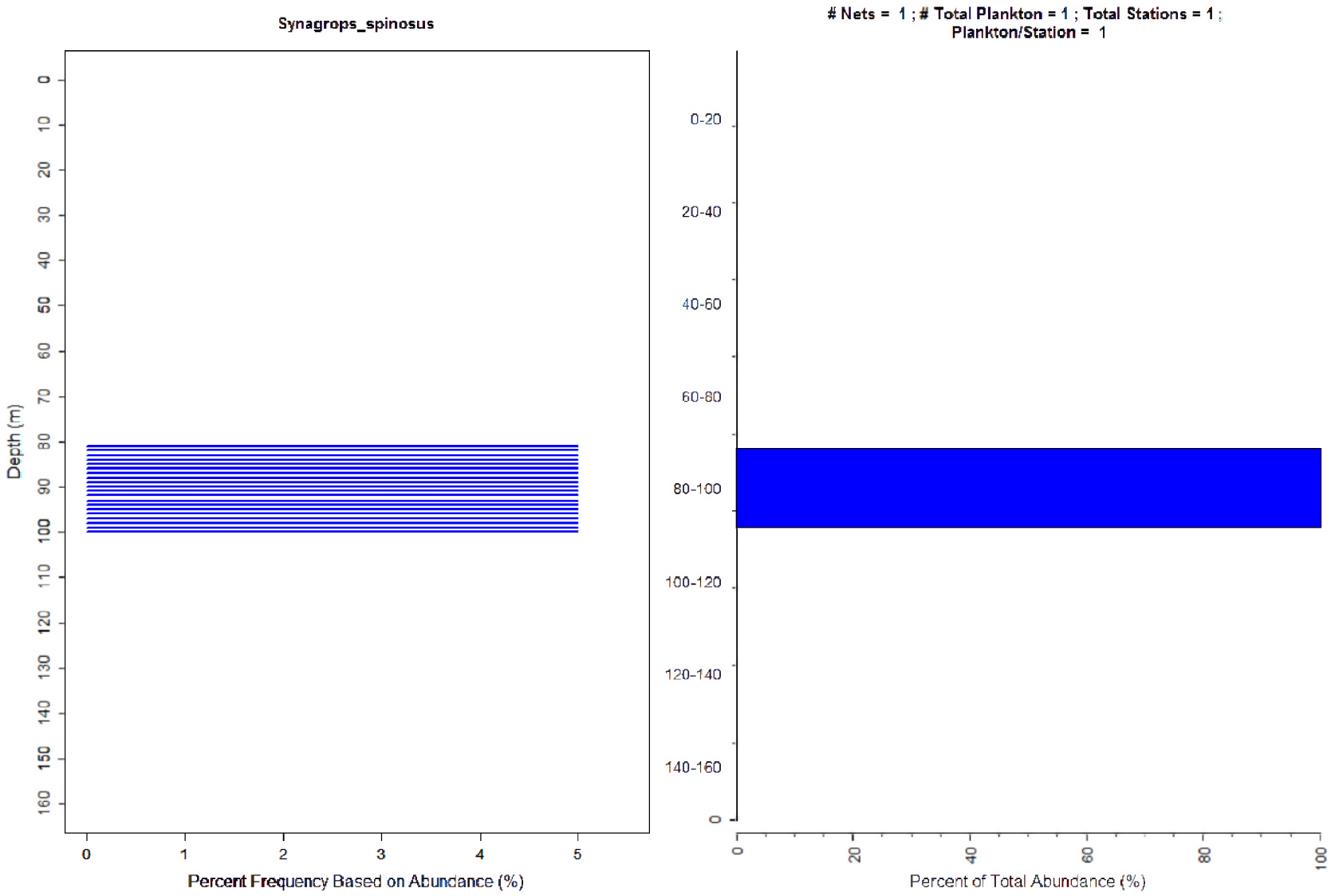
Symphurus - Shallow



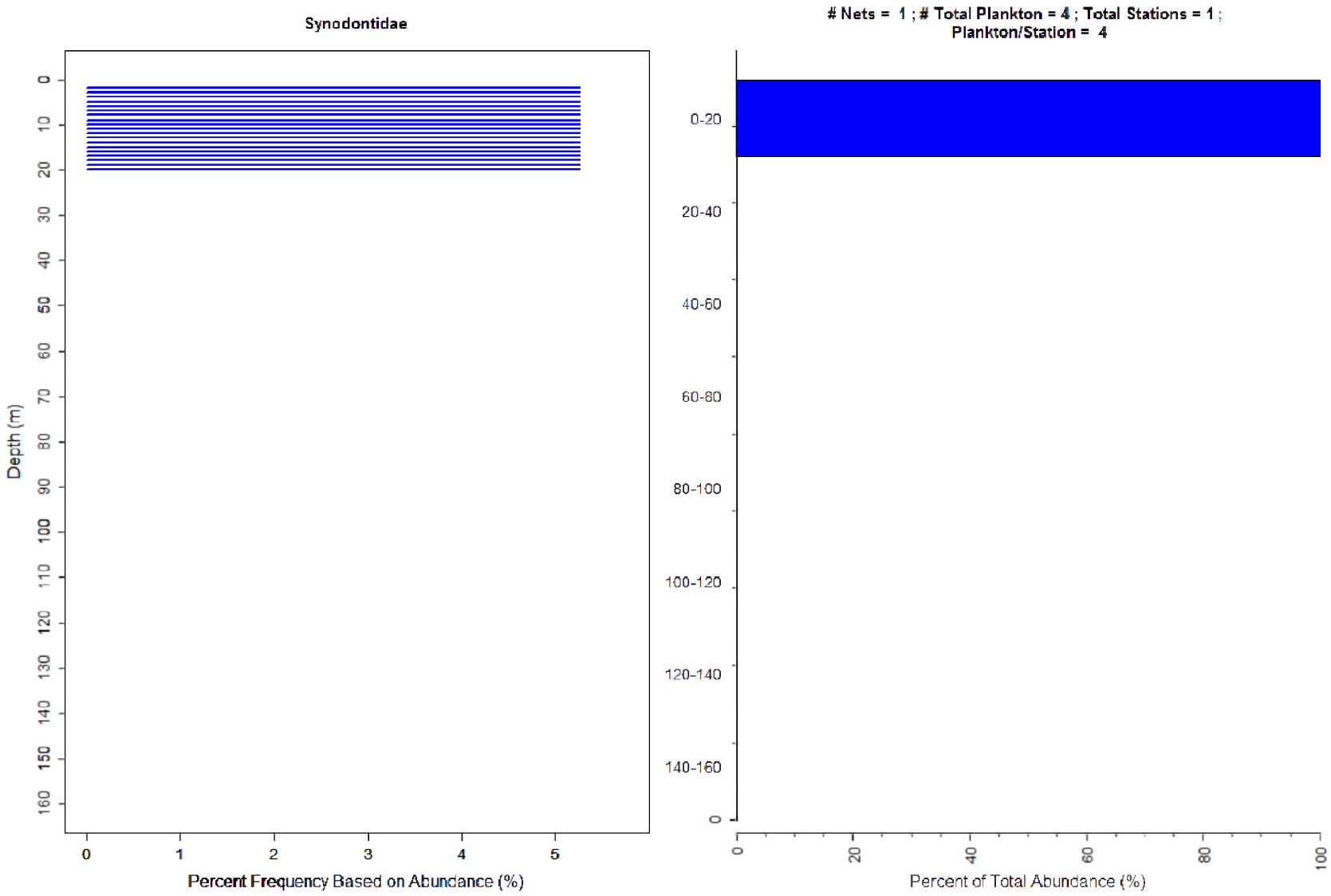
Symphurus_piger - Shallow



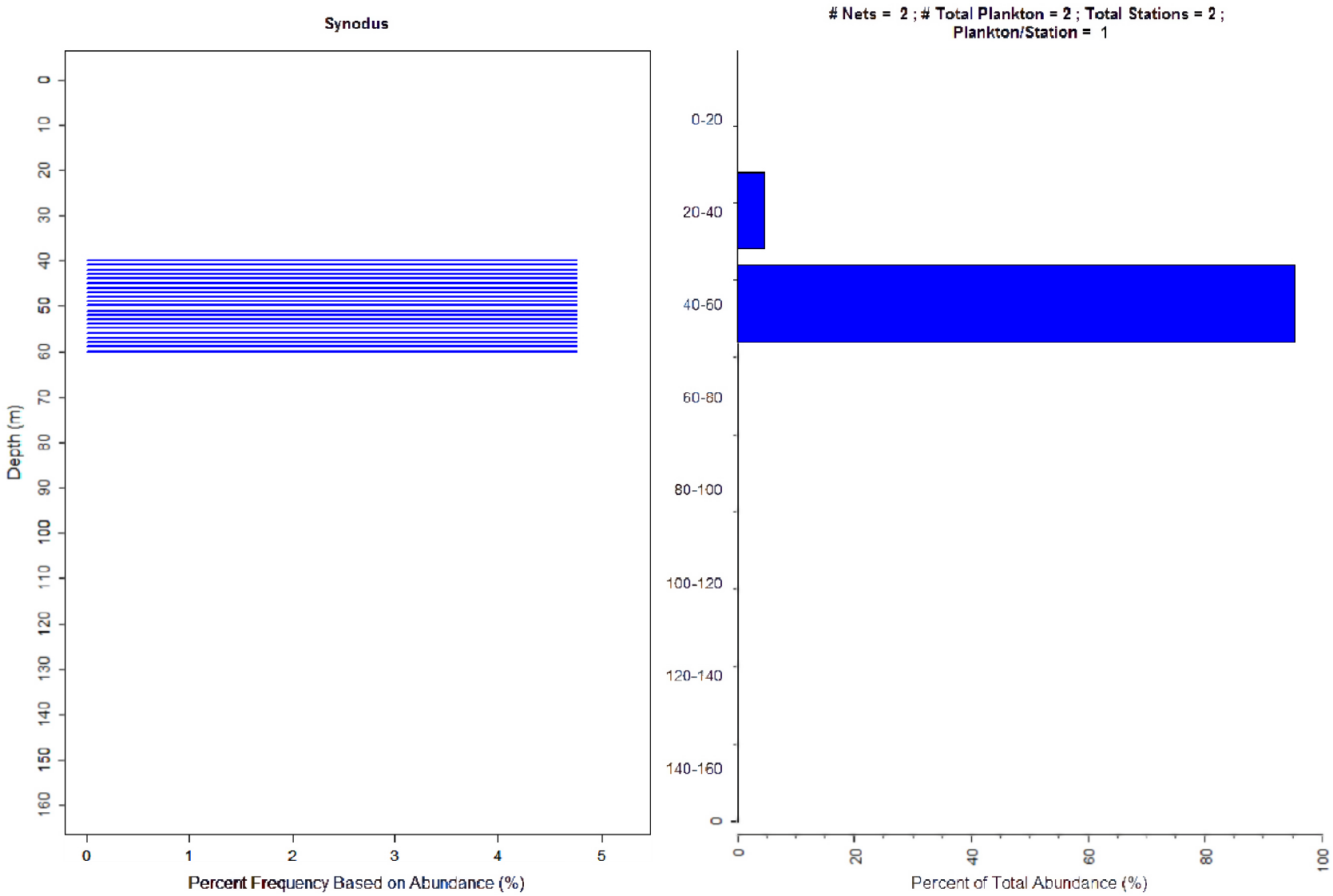
Symphysanodon_berryi - Shallow



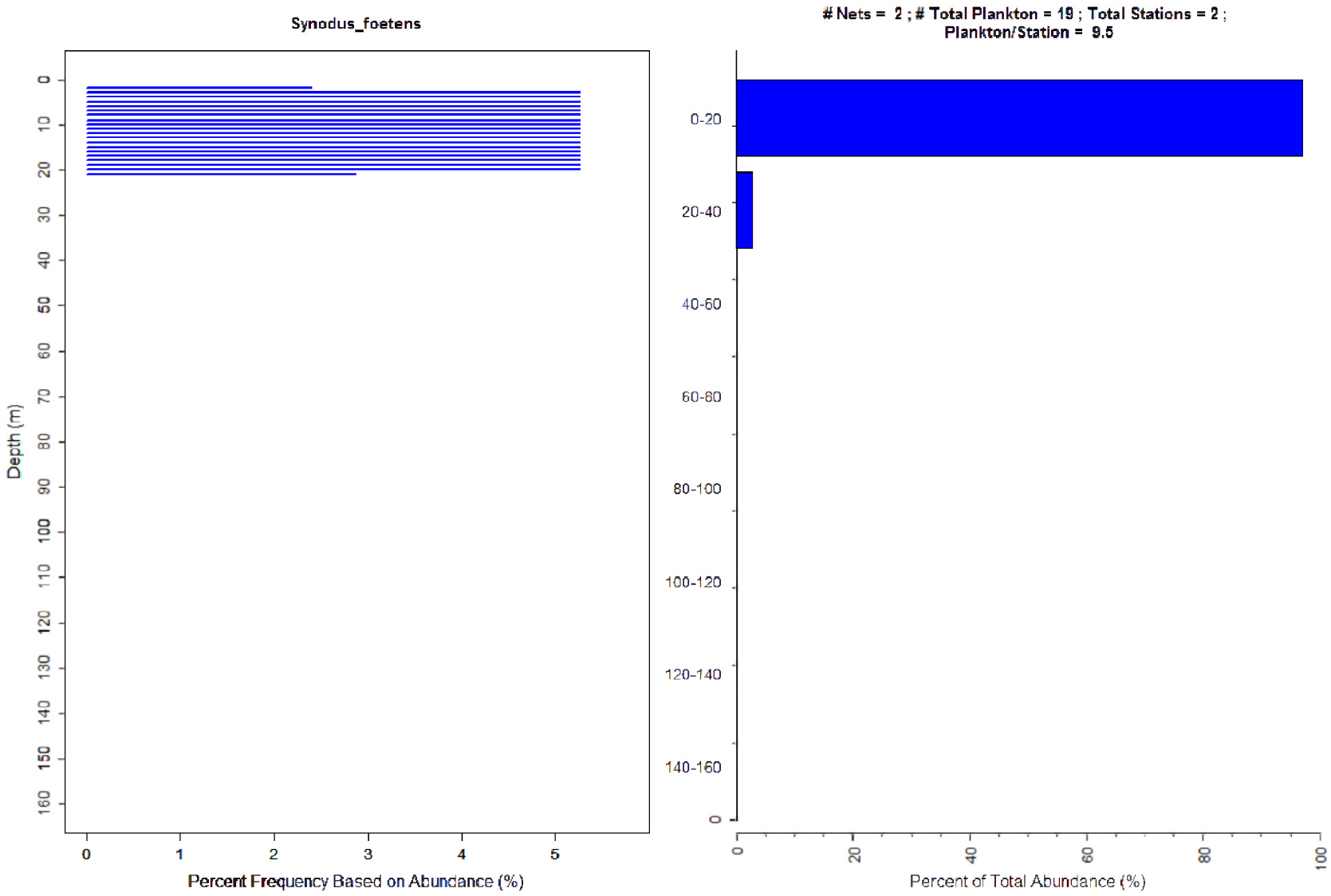
Synagrops_spinosus - Shallow



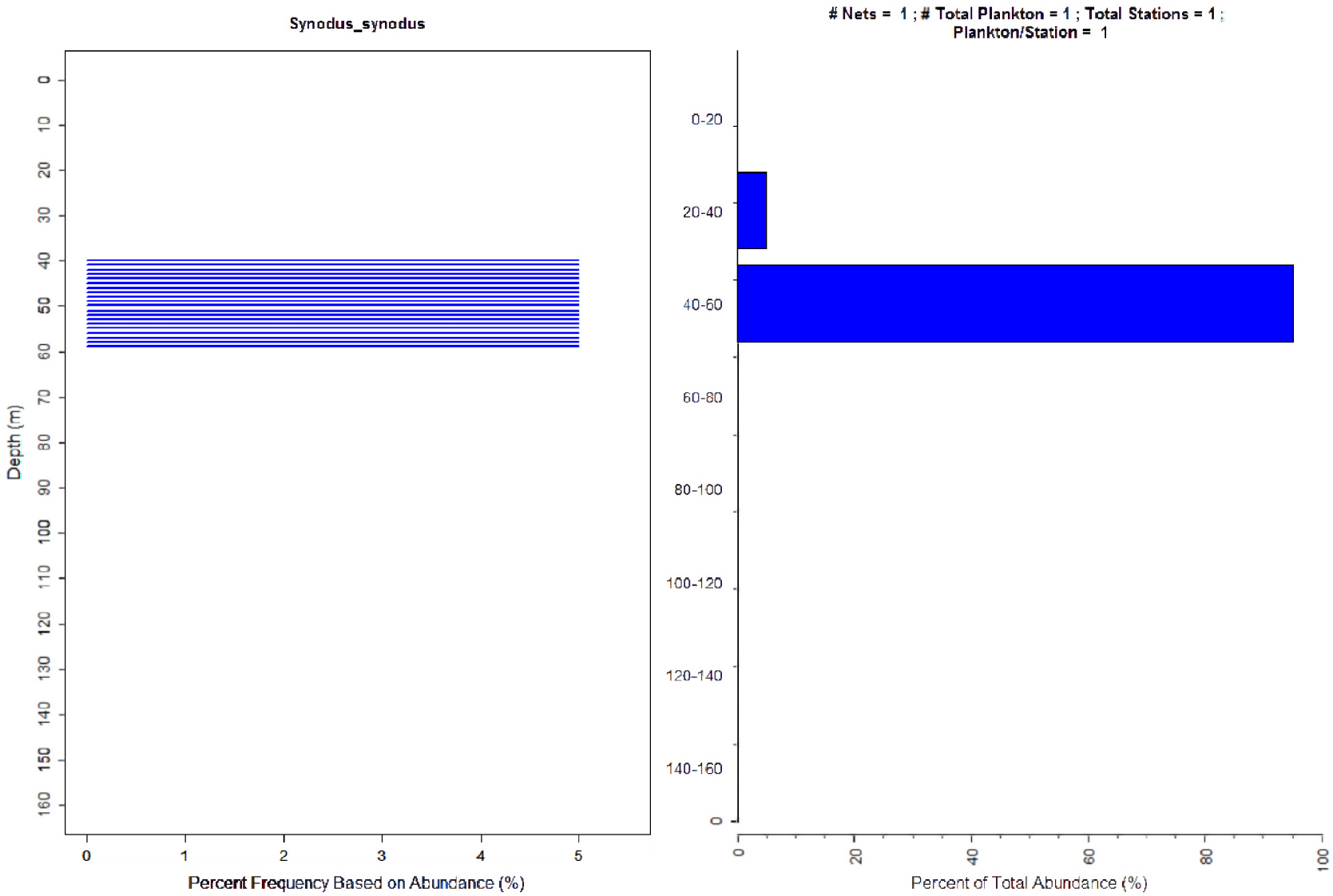
Synodontidae - Shallow



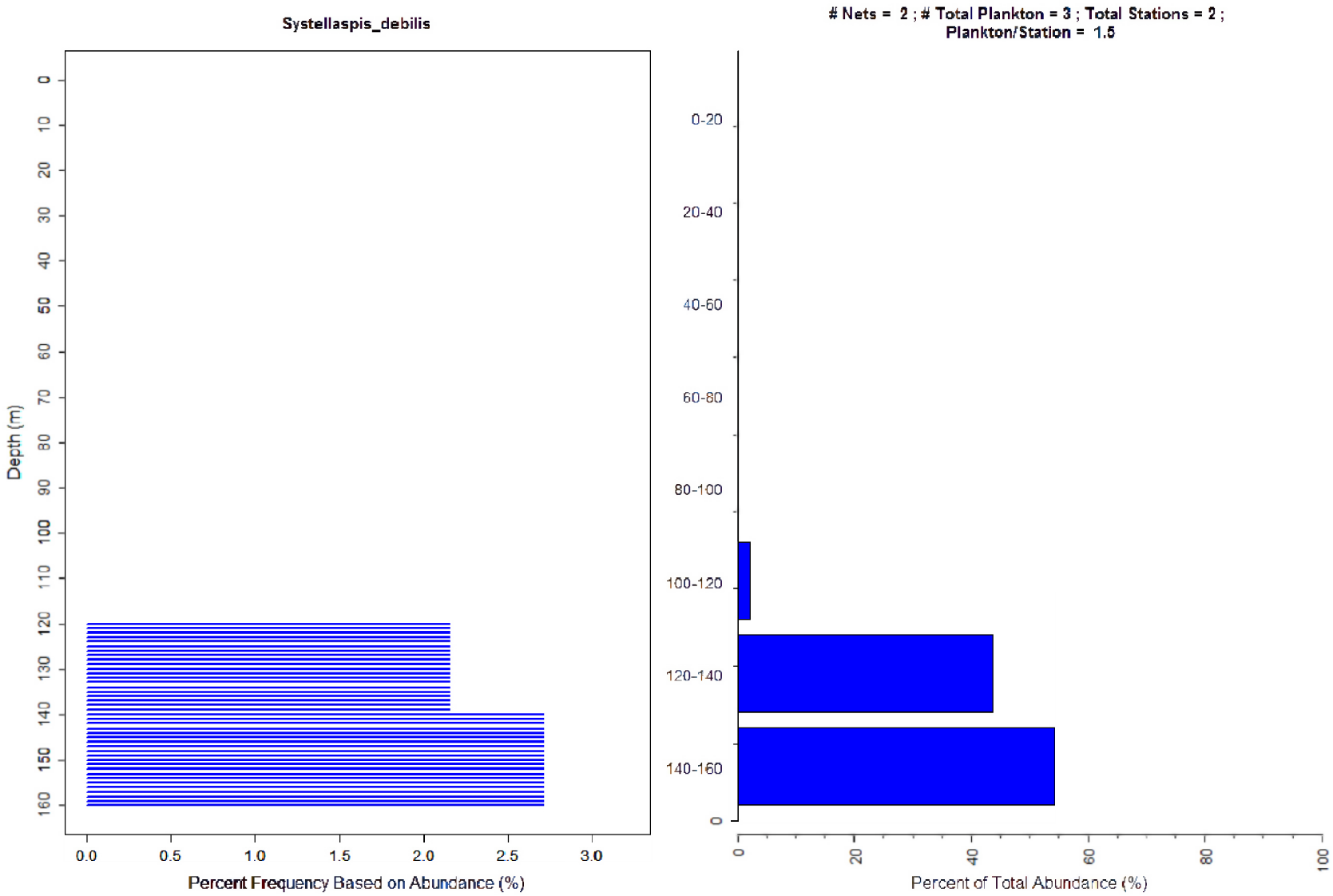
Synodus - Shallow



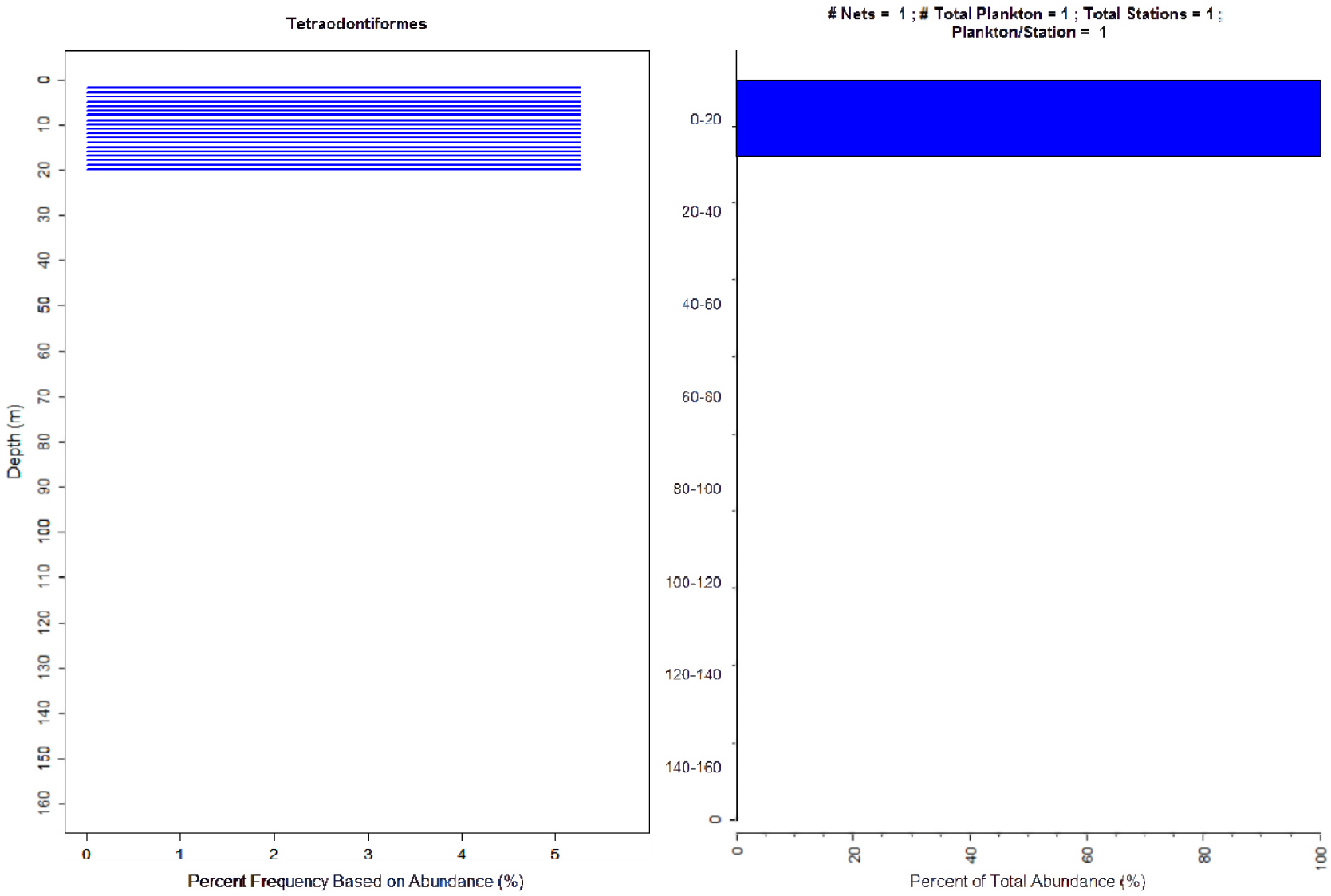
Synodus_foetens - Shallow



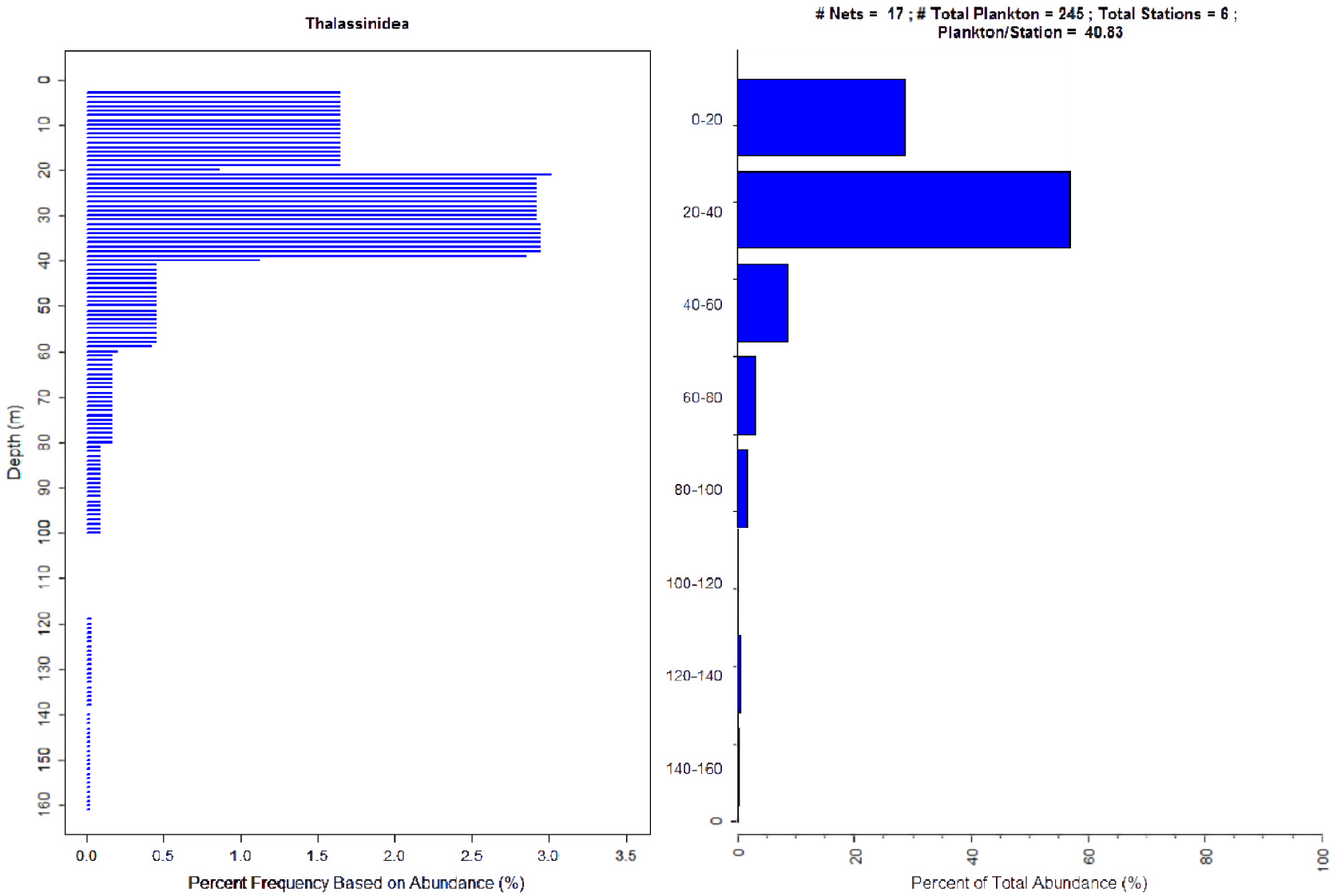
Synodus_synodus - Shallow



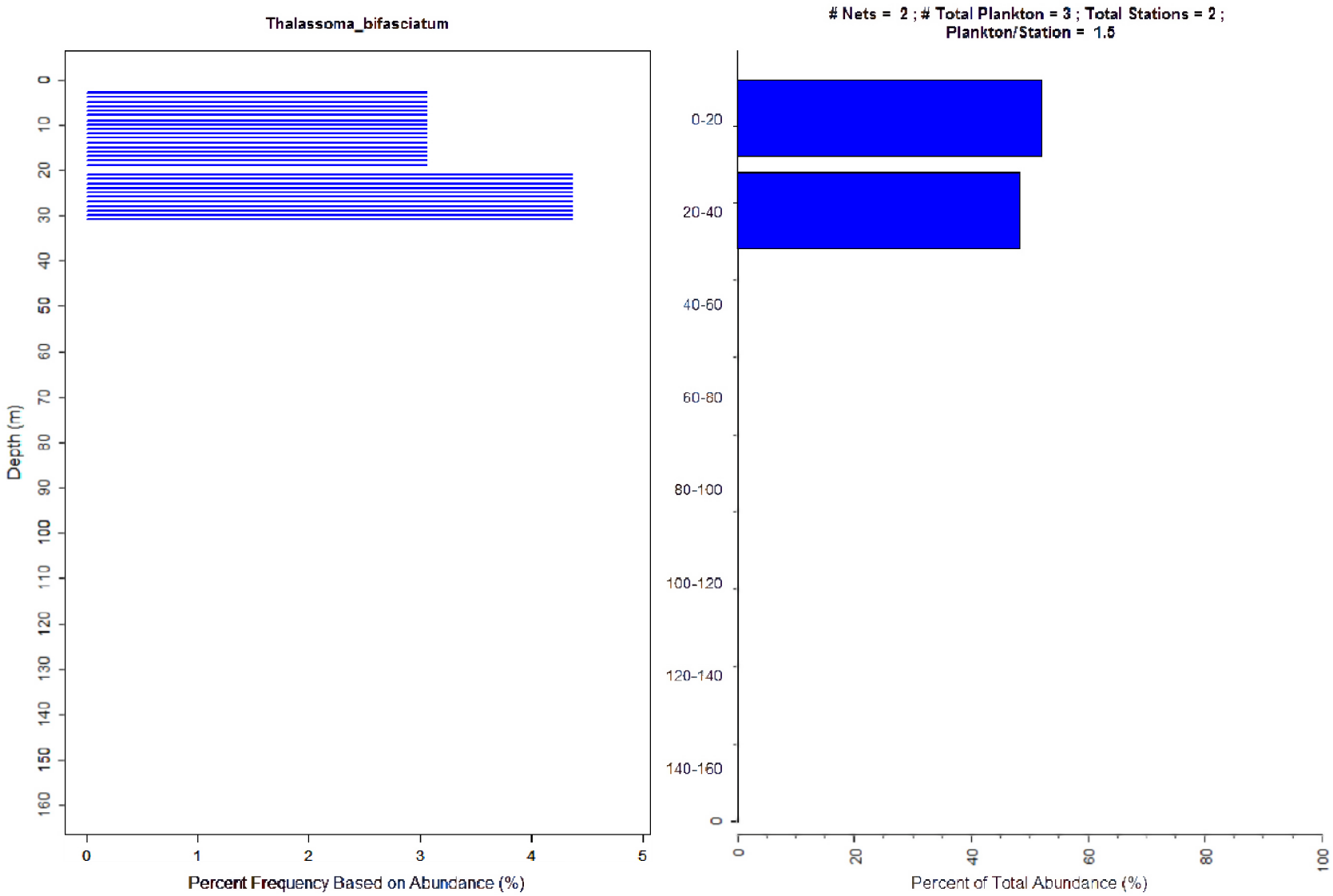
Systellaspis_debilis - Shallow



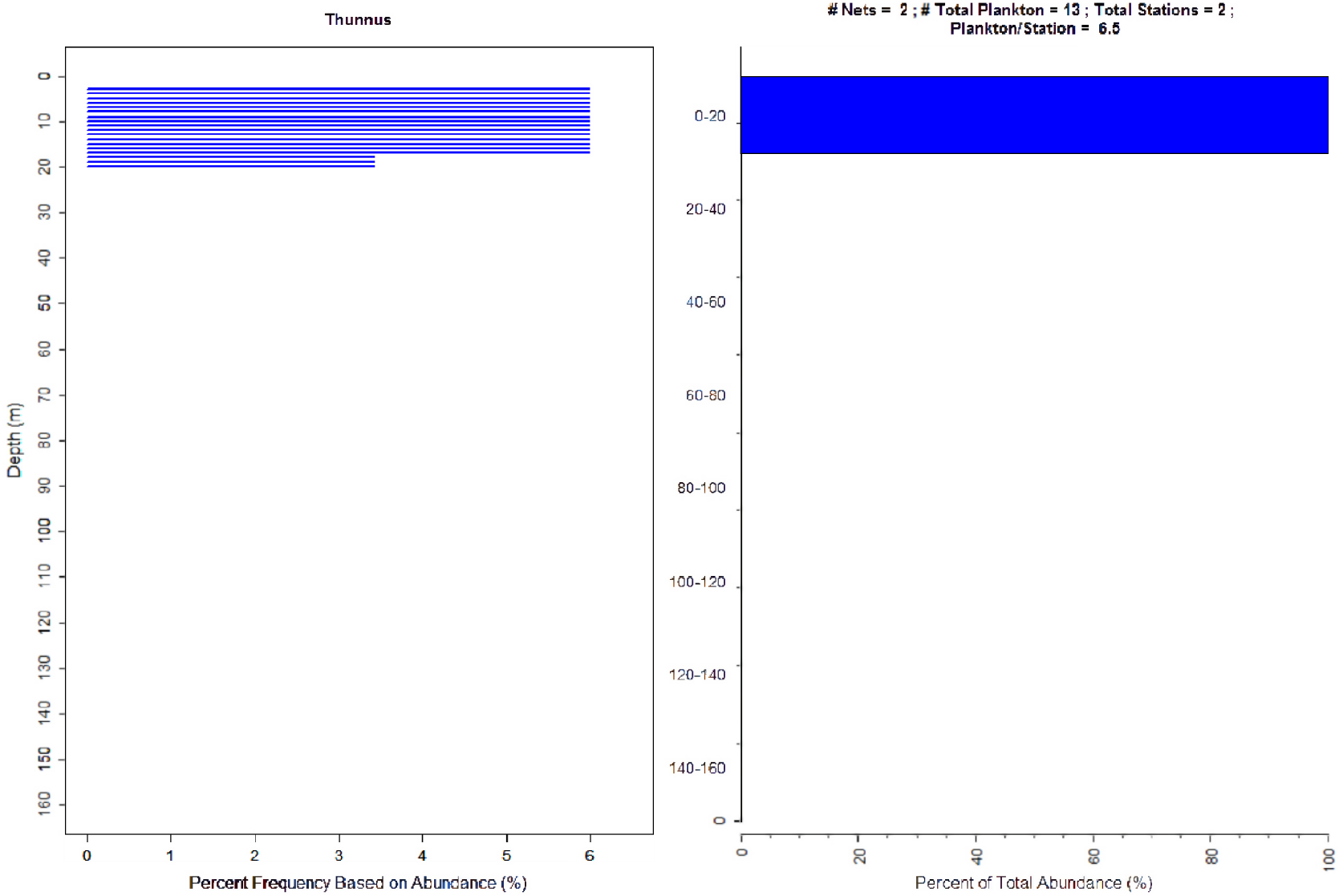
Tetraodontiformes - Shallow



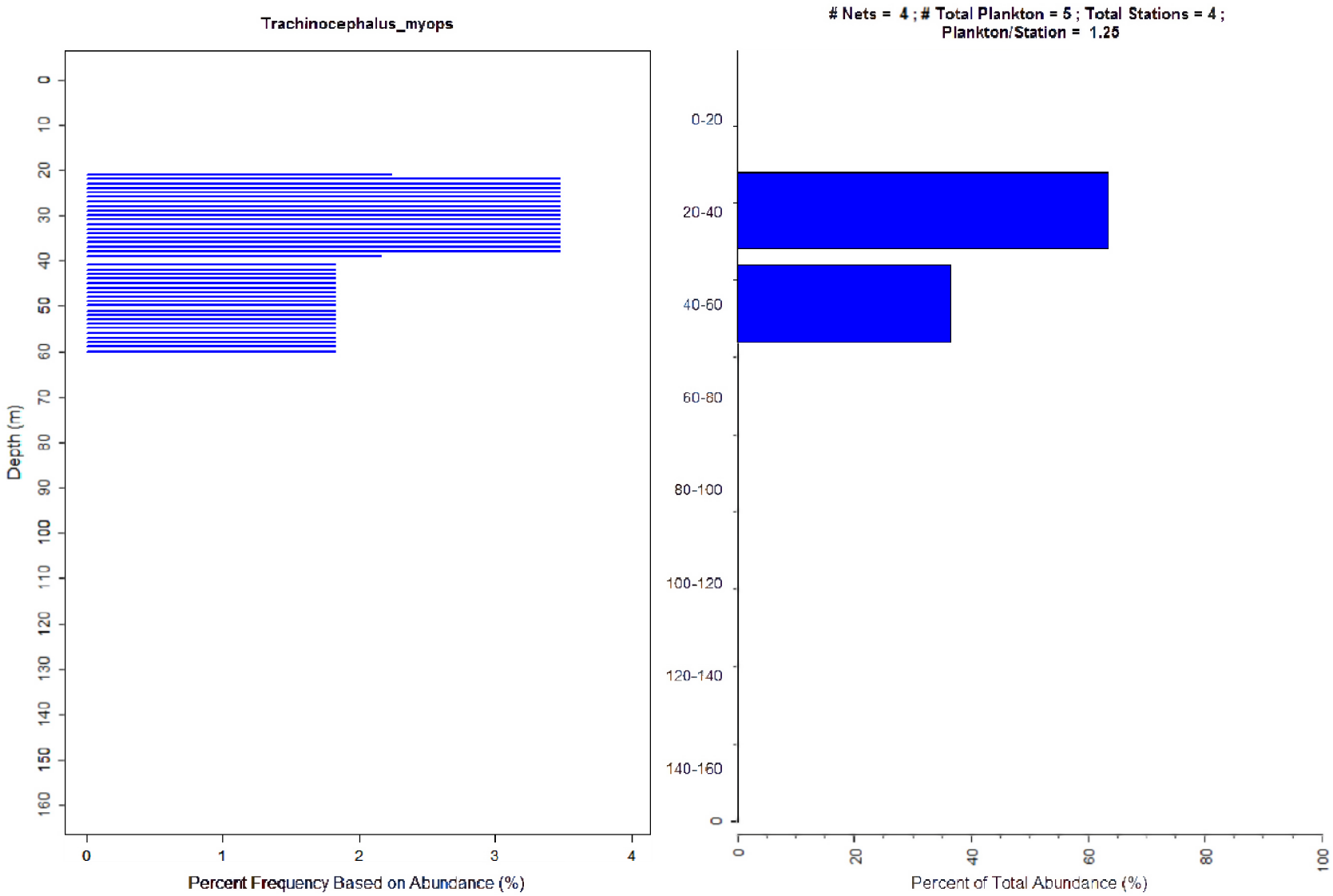
Thalassinidea - Shallow



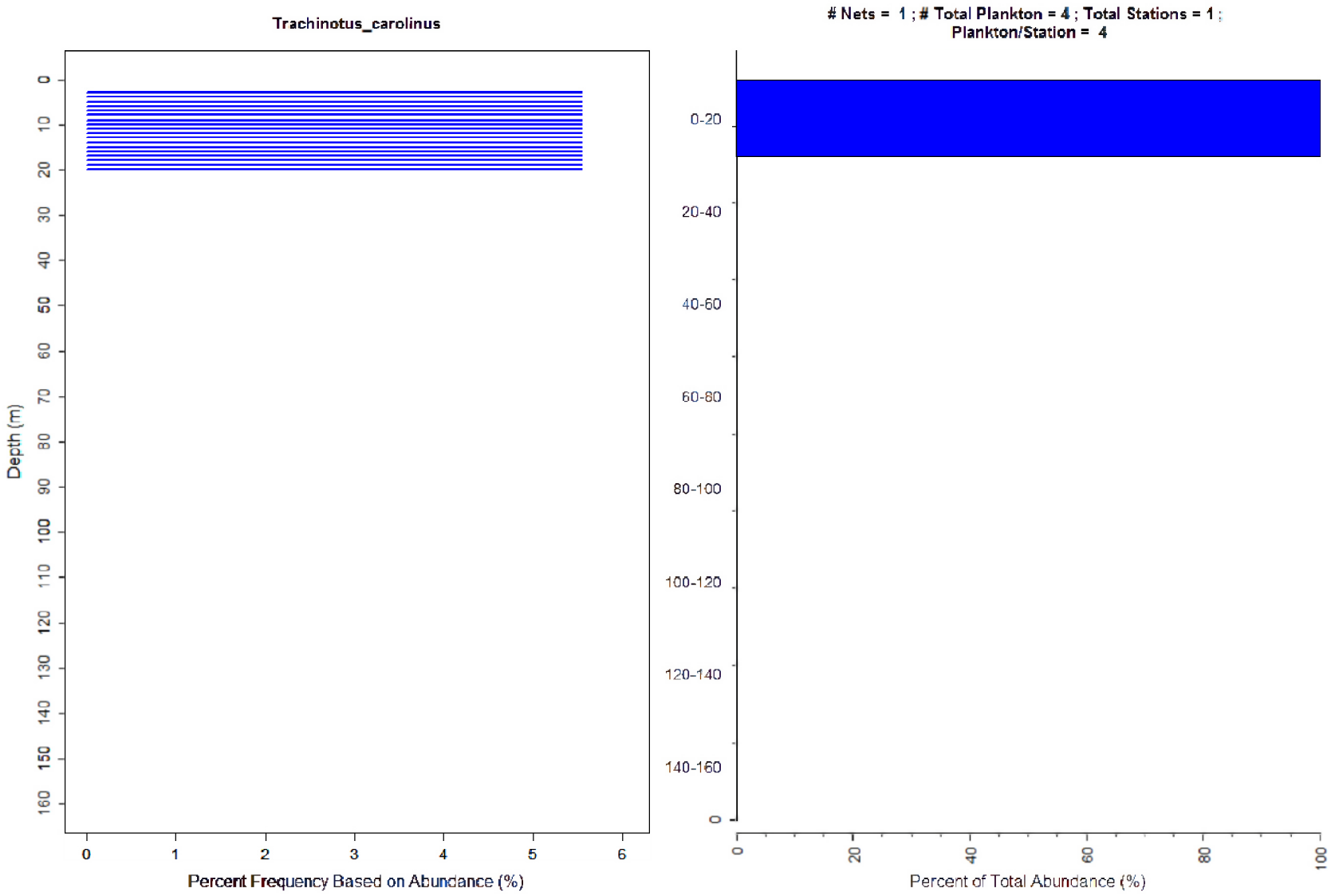
Thalassoma_bifasciatum - Shallow



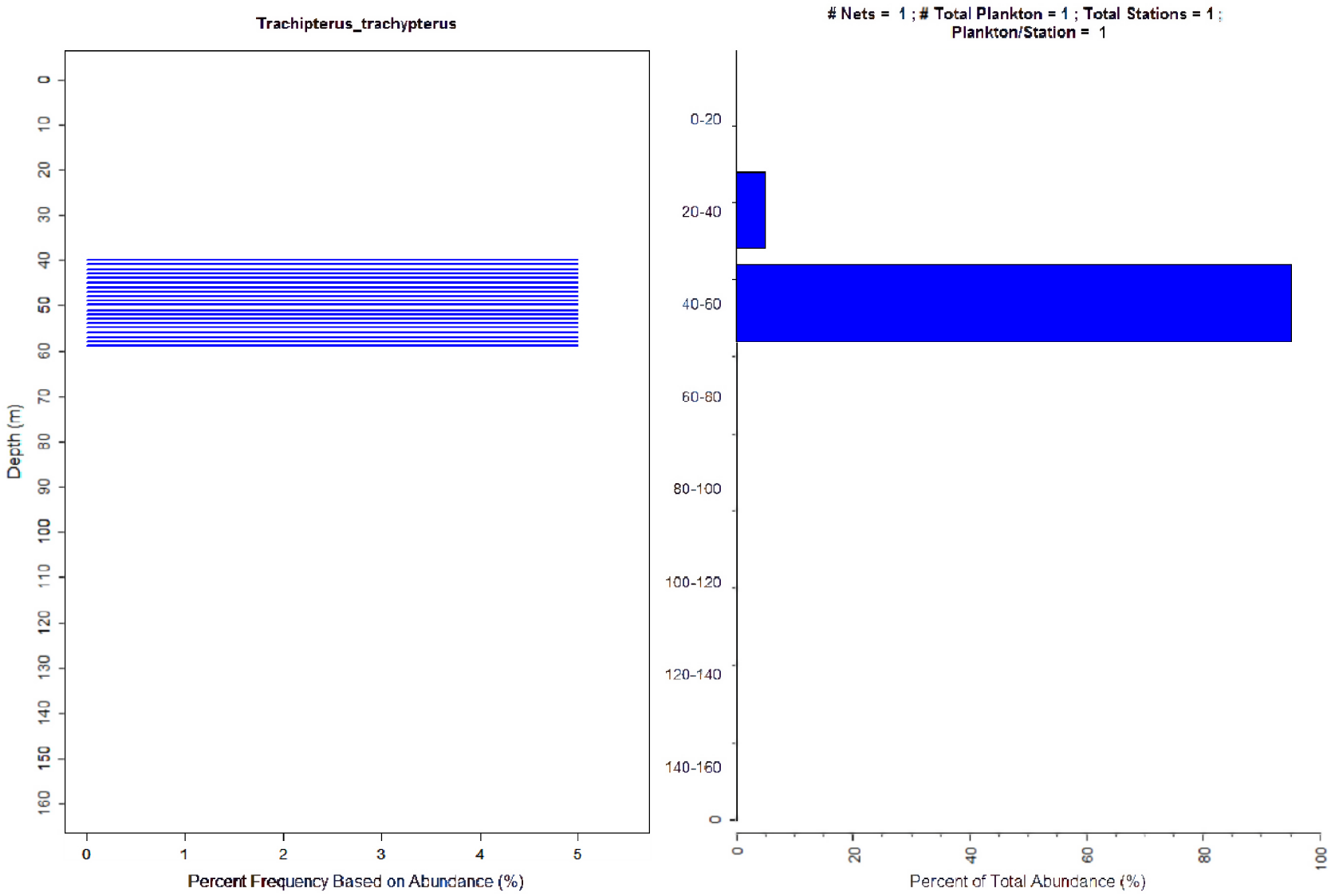
Thunnus - Shallow



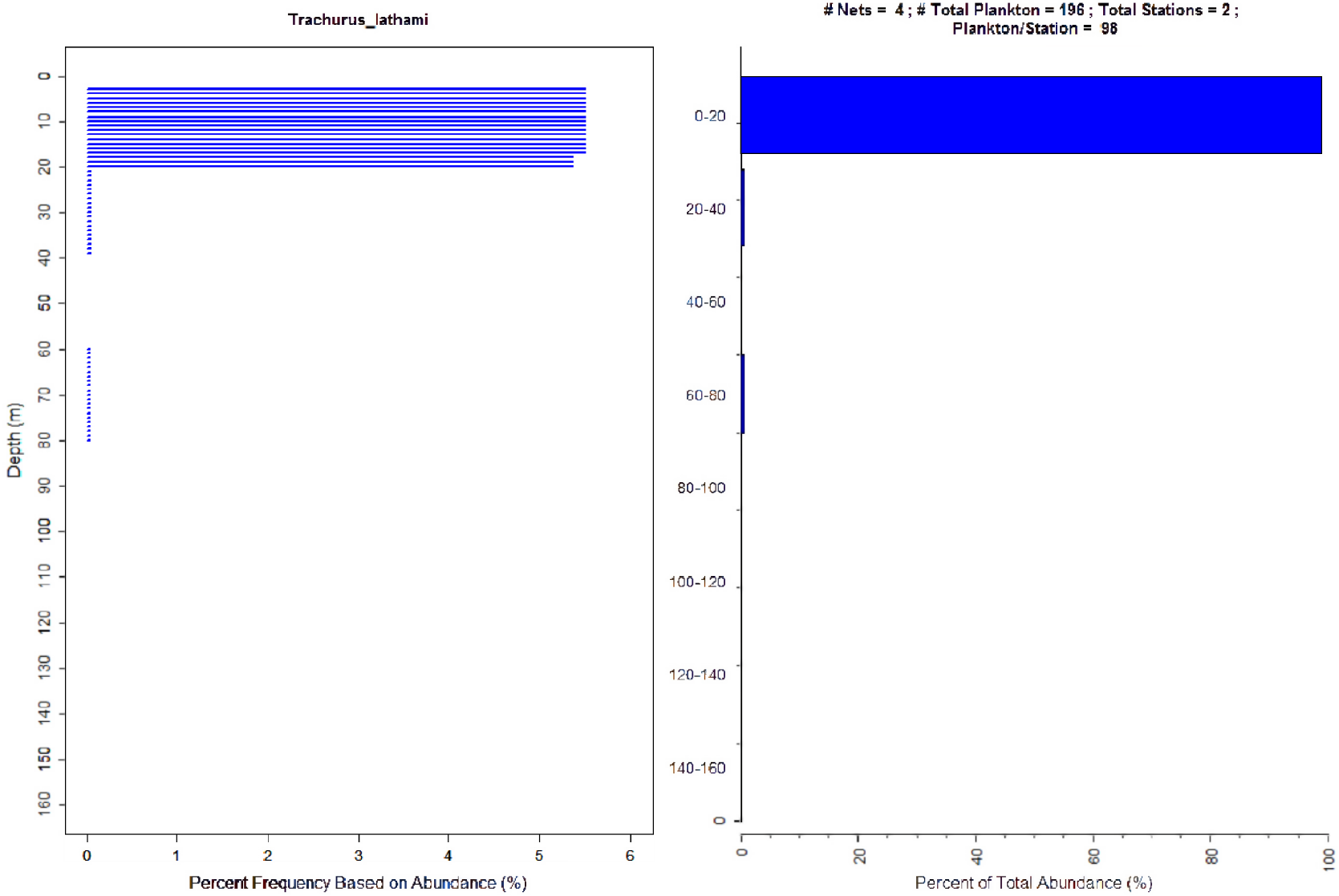
Trachinocephalus_myops - Shallow



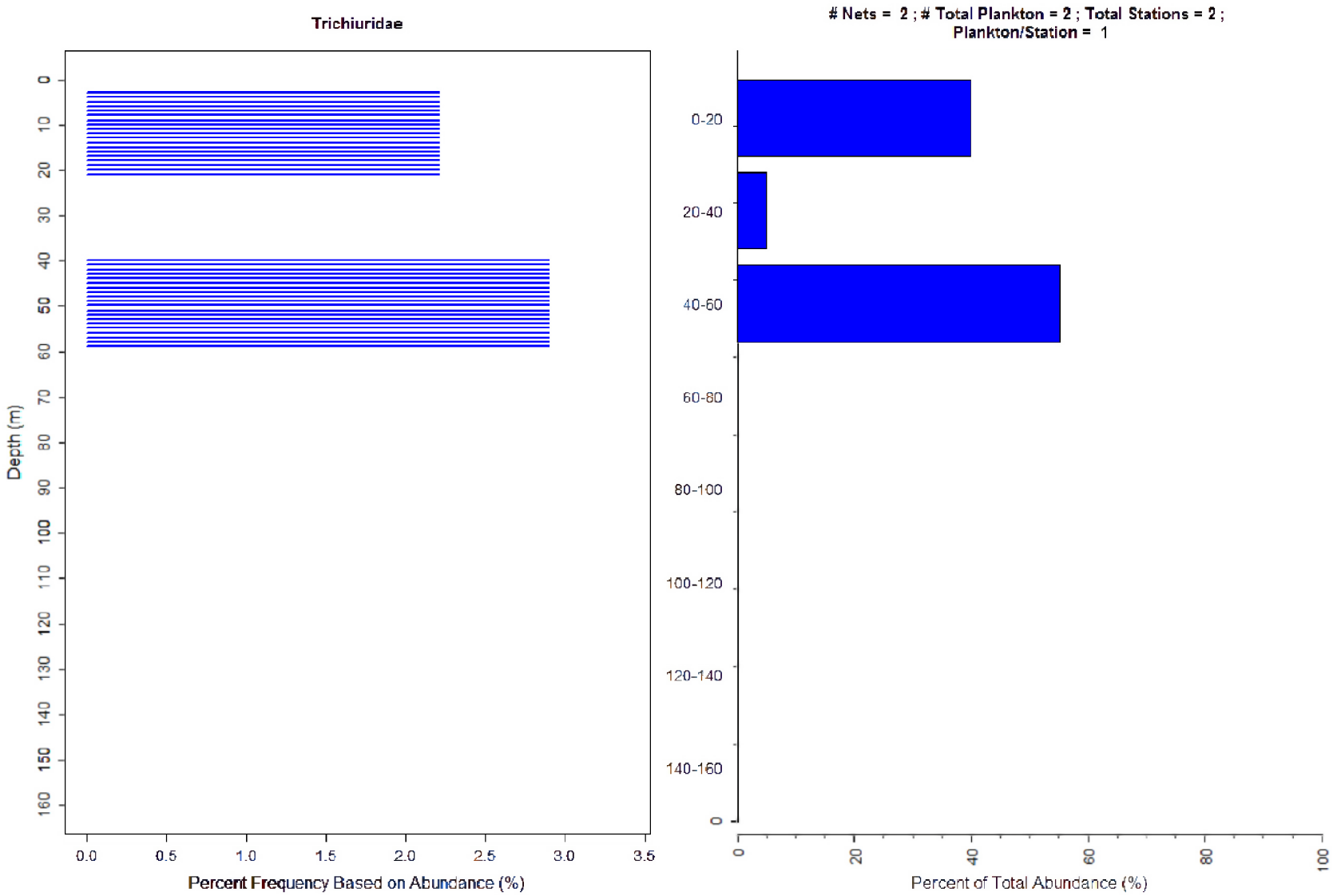
Trachinotus_carolinus - Shallow



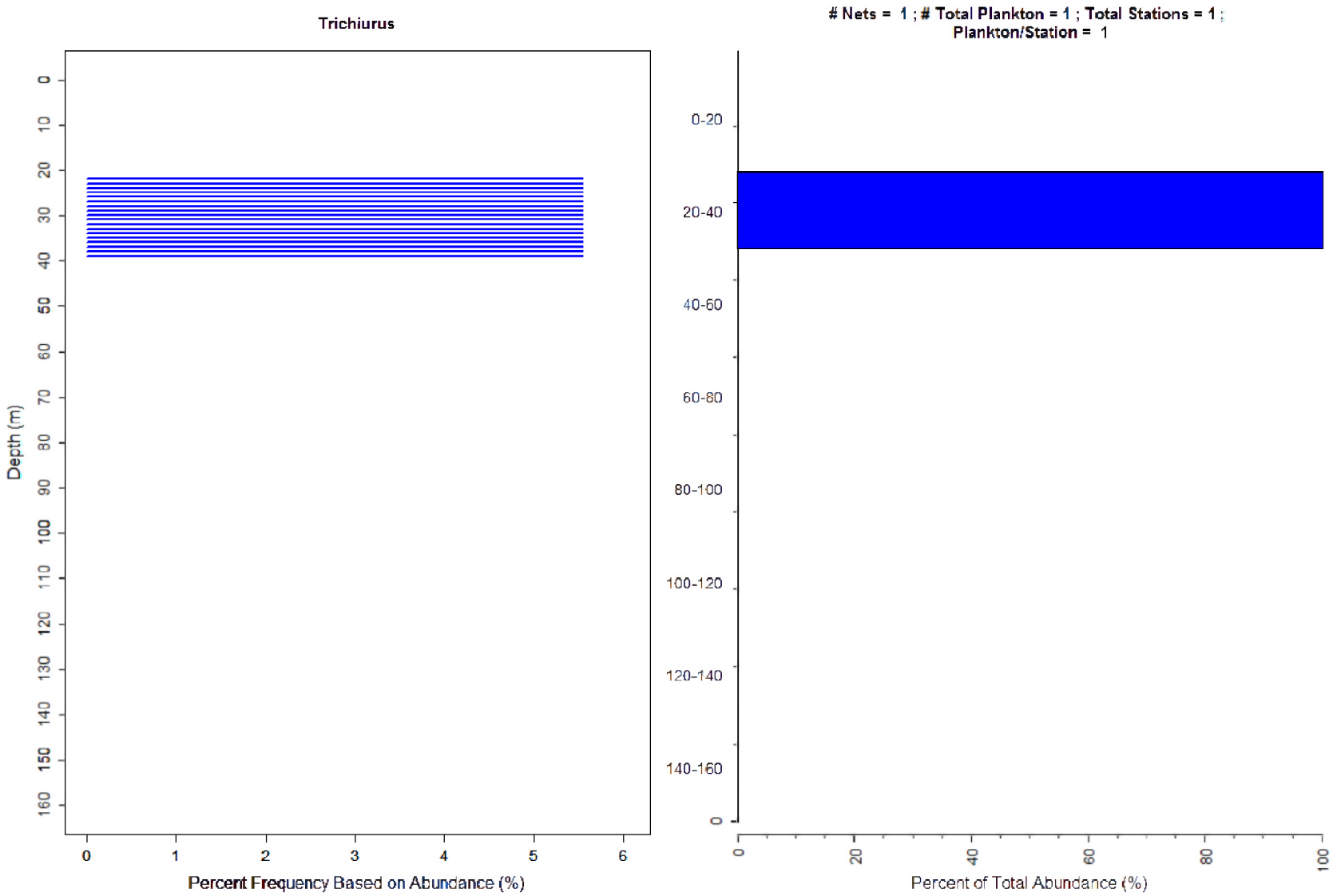
Trachipterus_trachypterus - Shallow



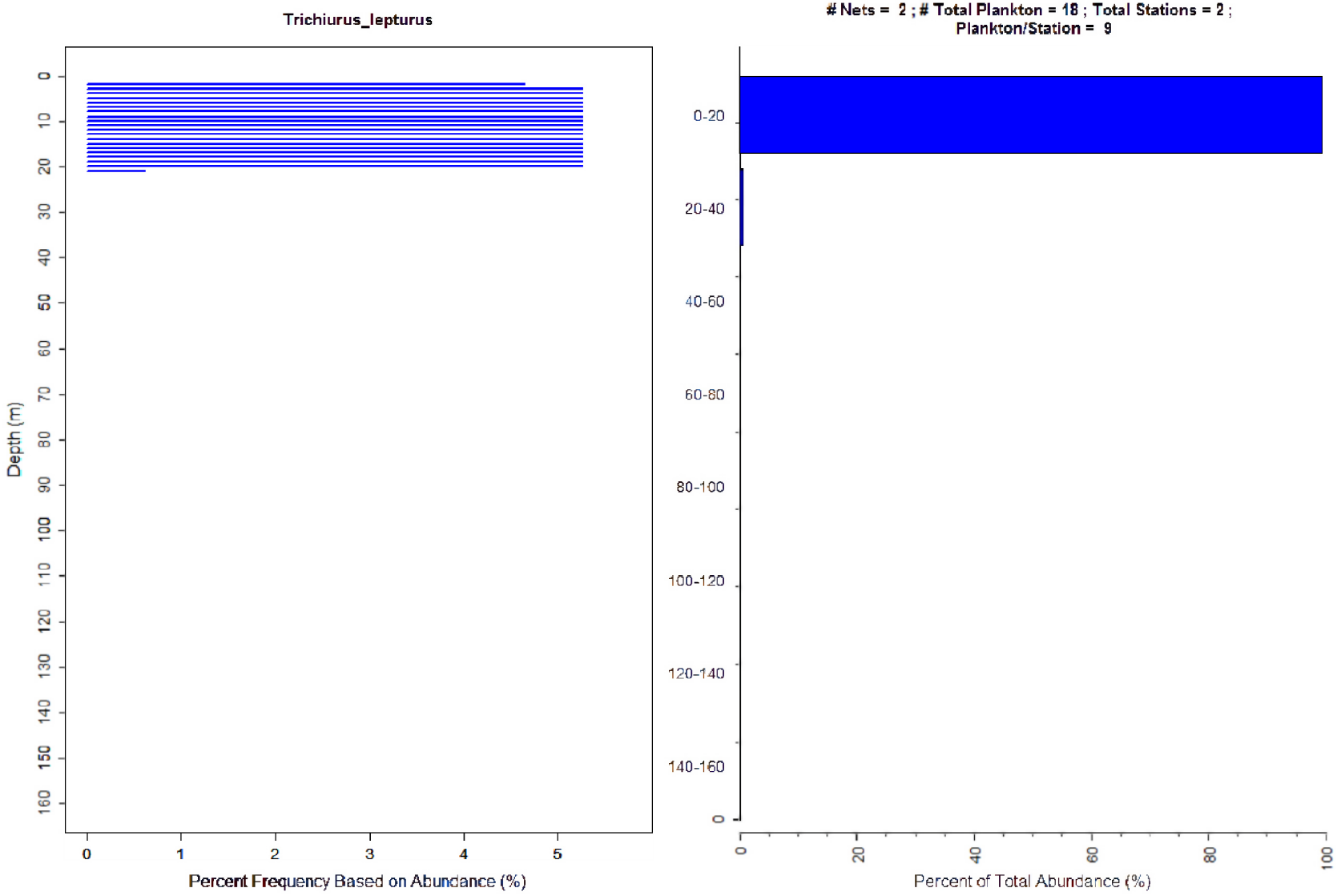
Trachurus_lathami - Shallow



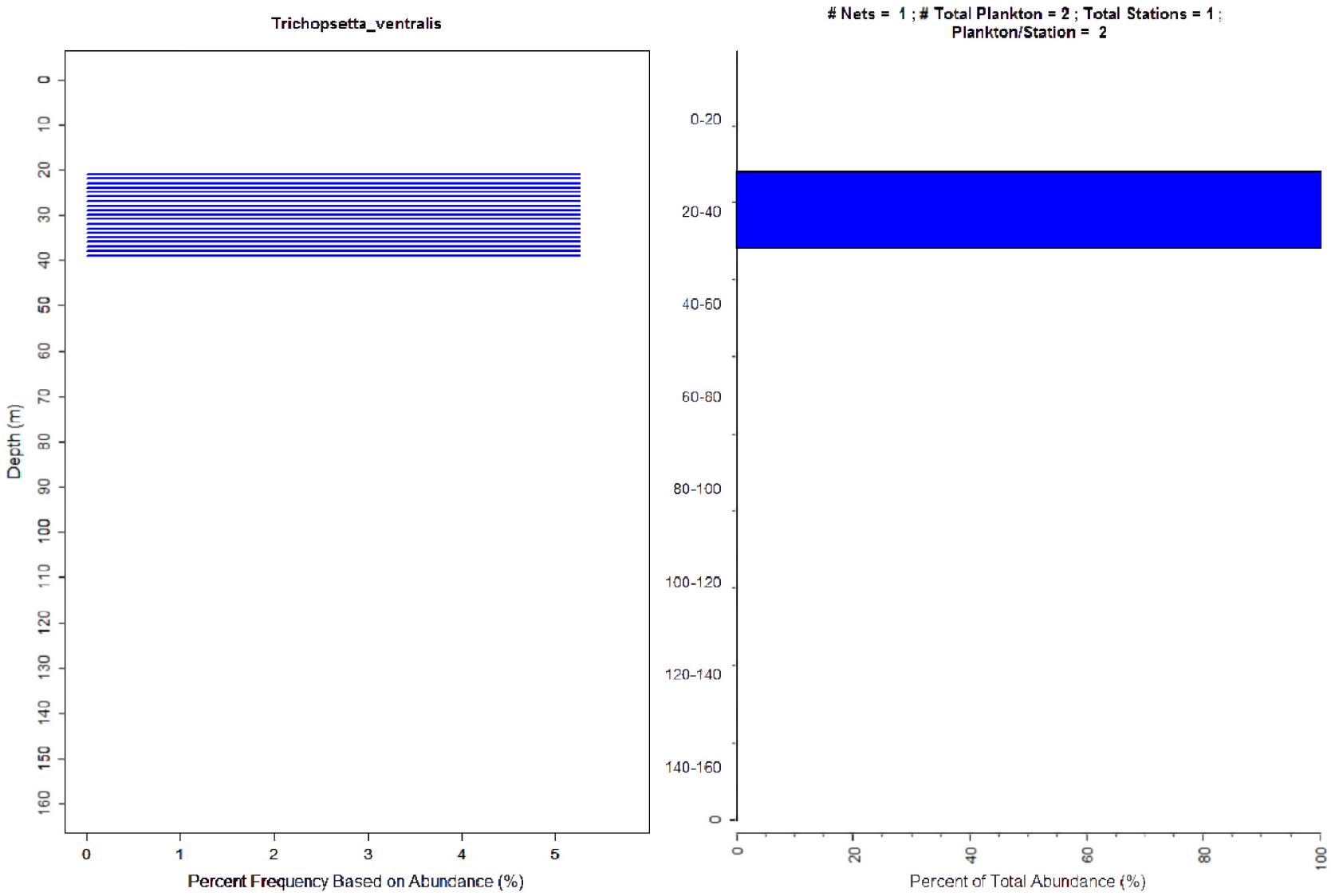
Trichiuridae - Shallow



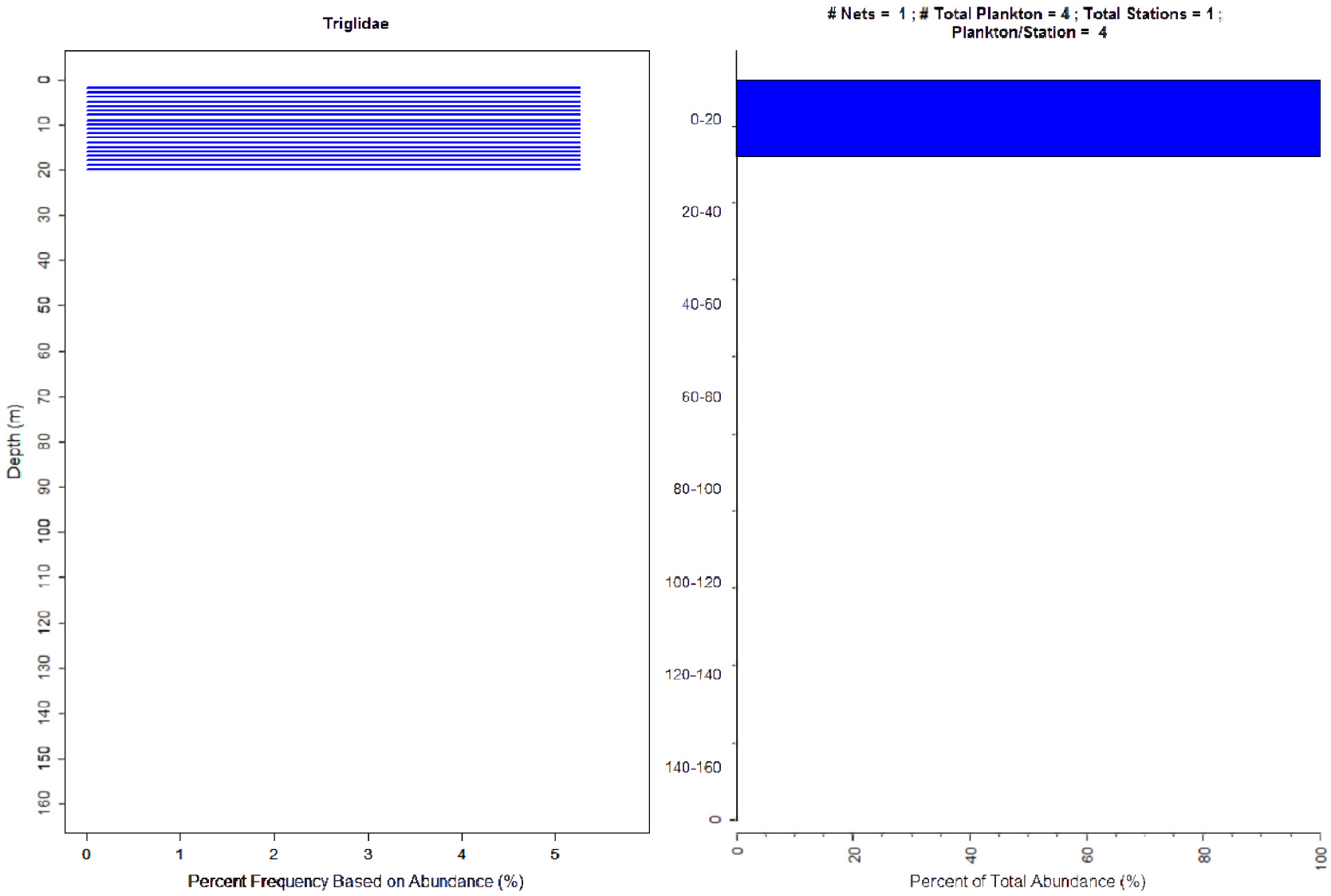
Trichiurus - Shallow



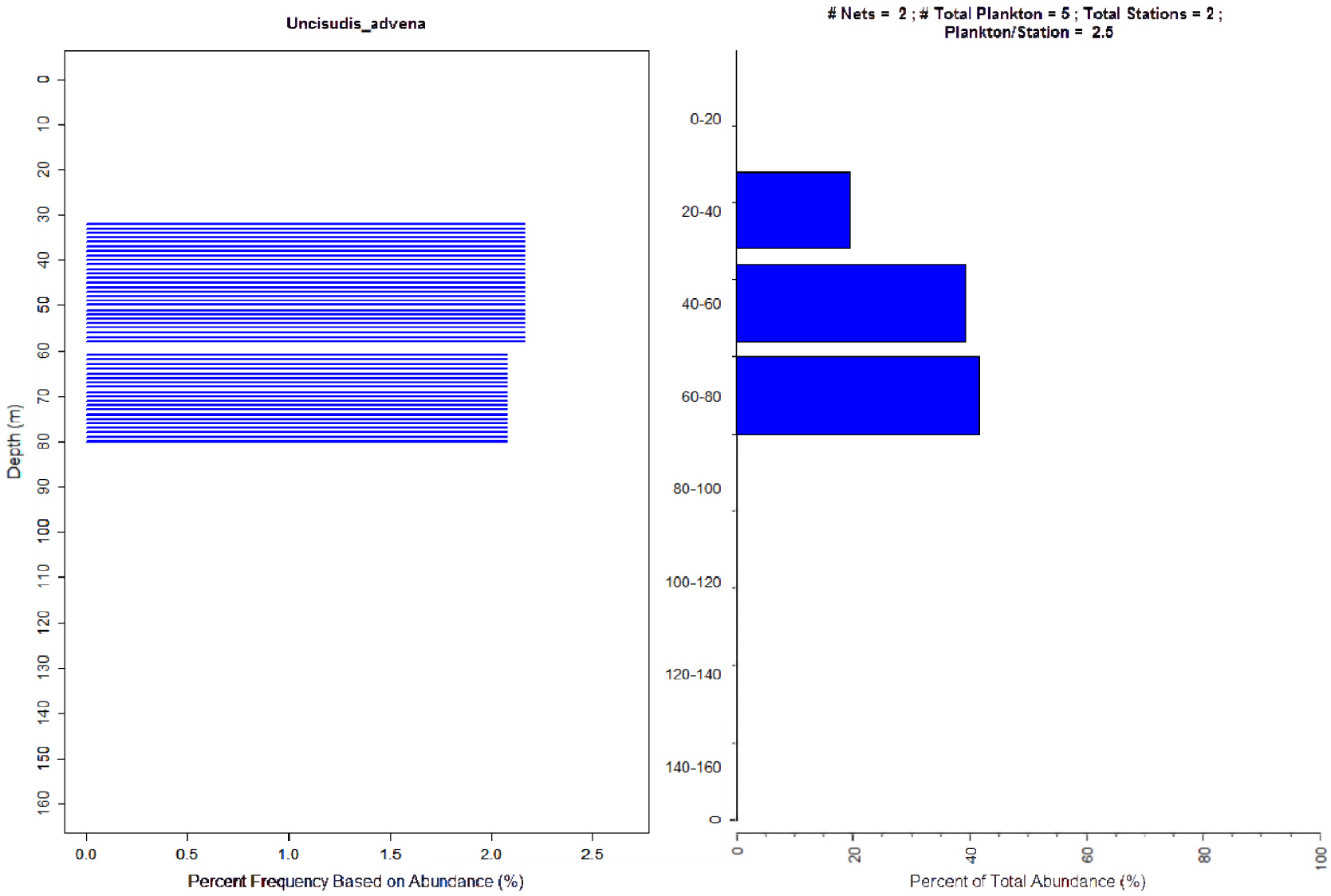
Trichiurus_lepturus - Shallow



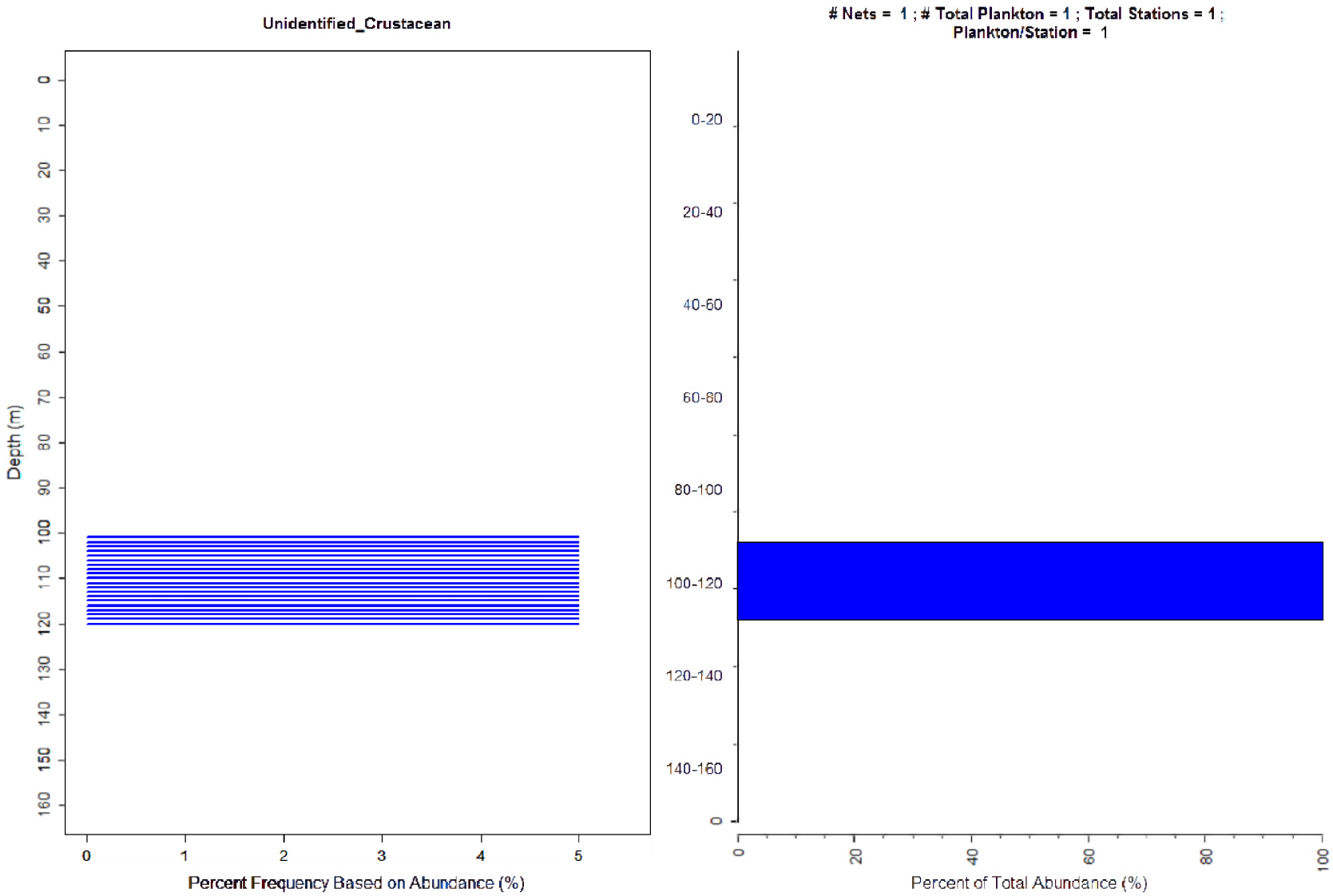
Trichopsetta_ventralis - Shallow



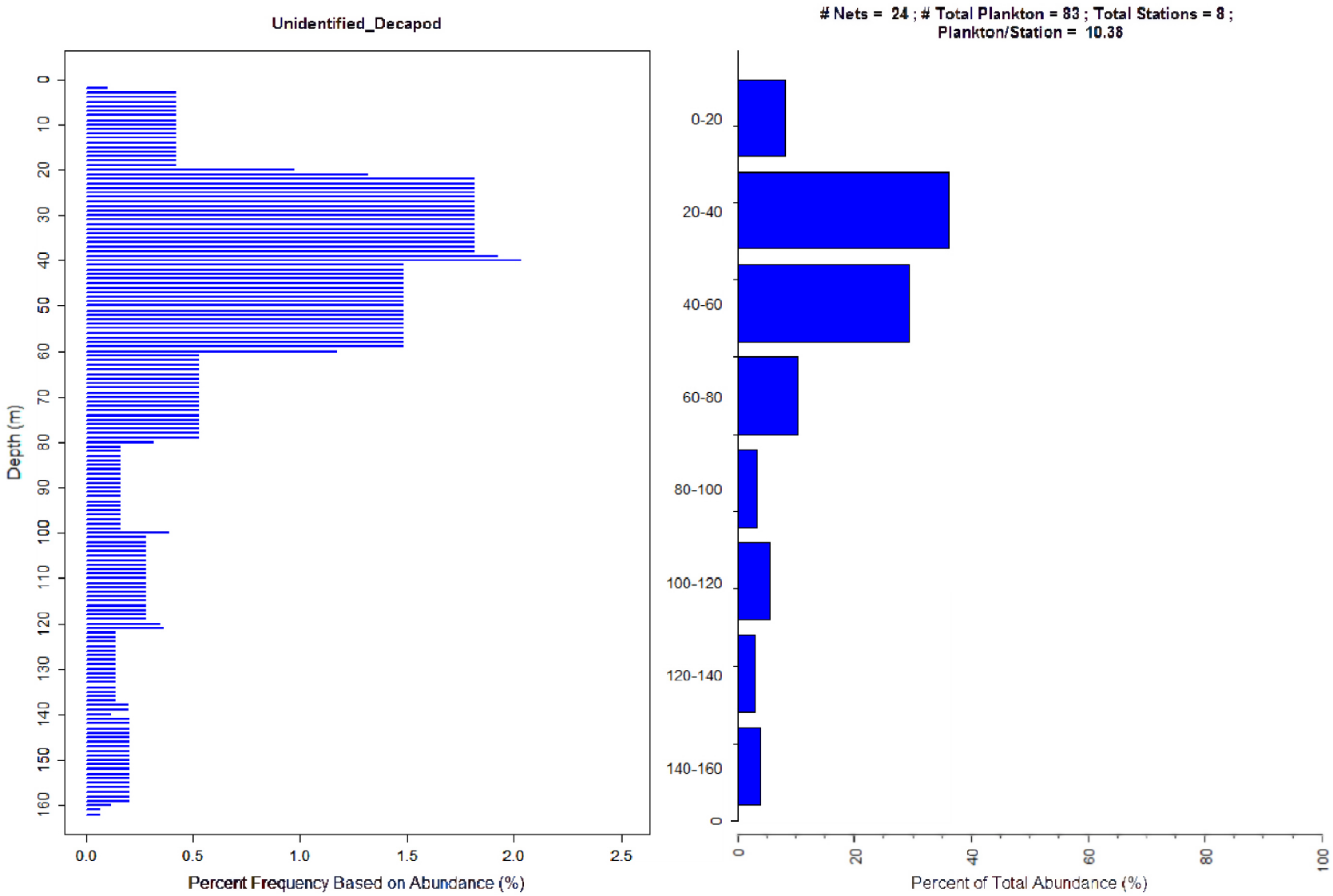
Triglidae - Shallow



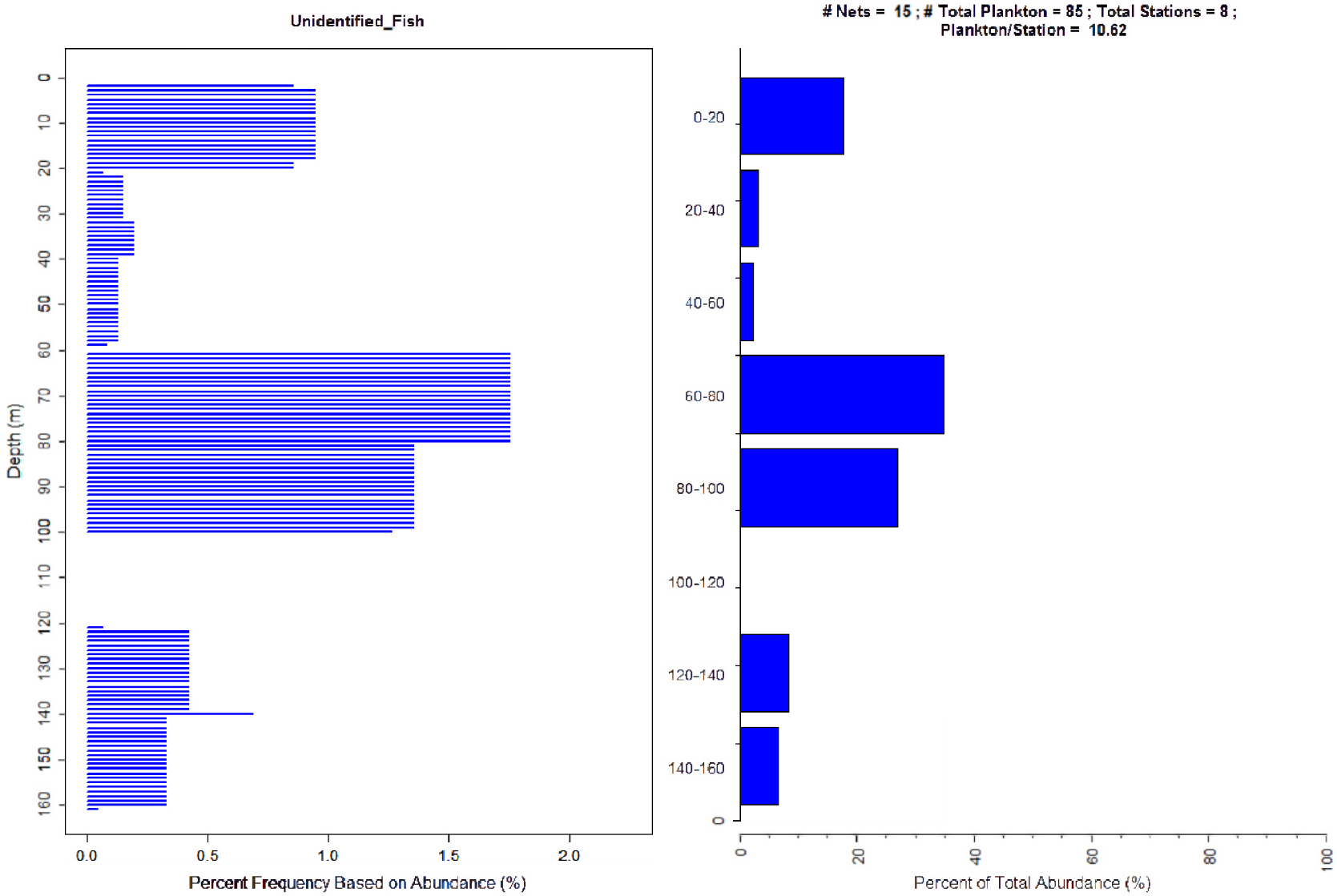
Uncisudis_advena - Shallow



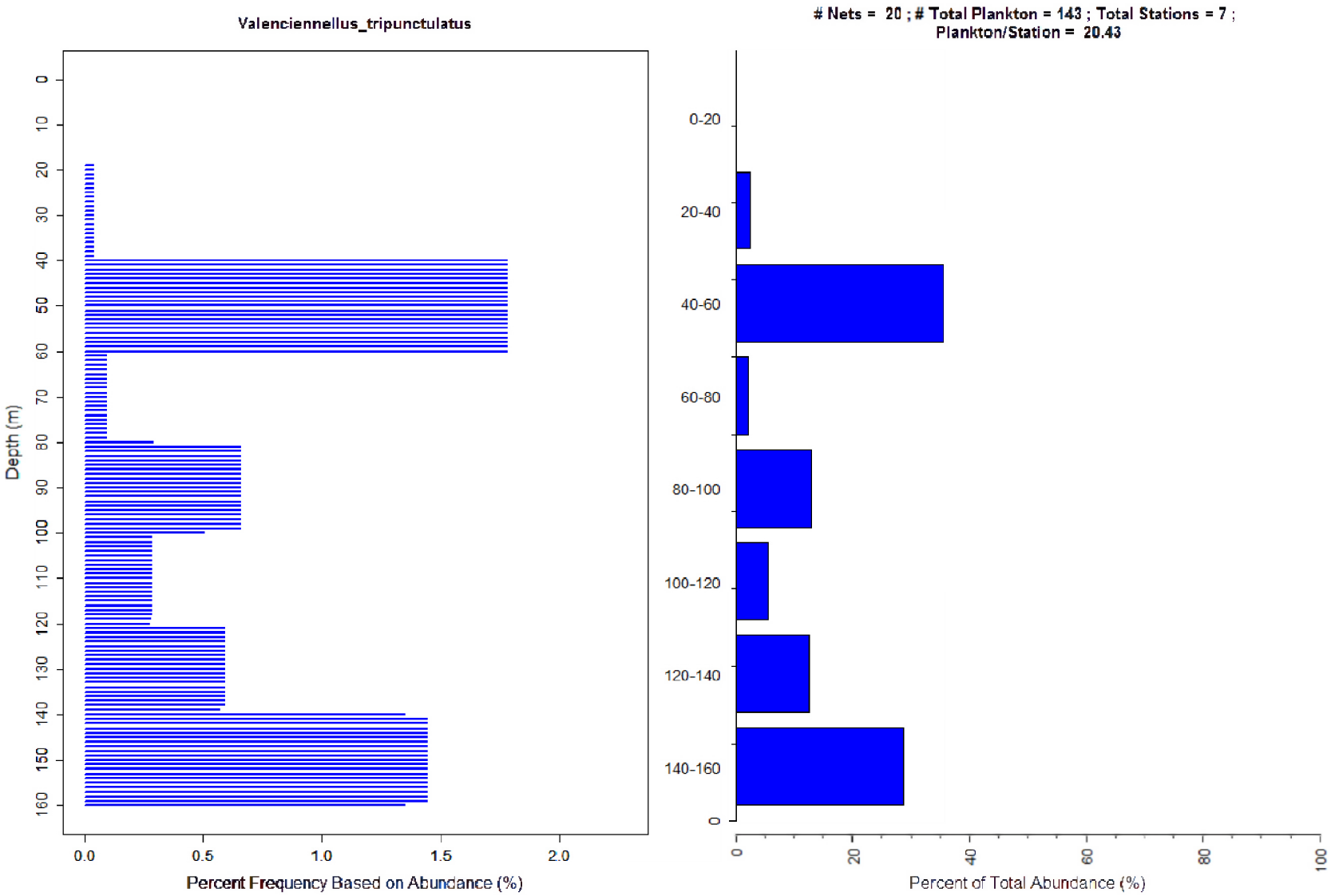
Unidentified_Crustacean - Shallow



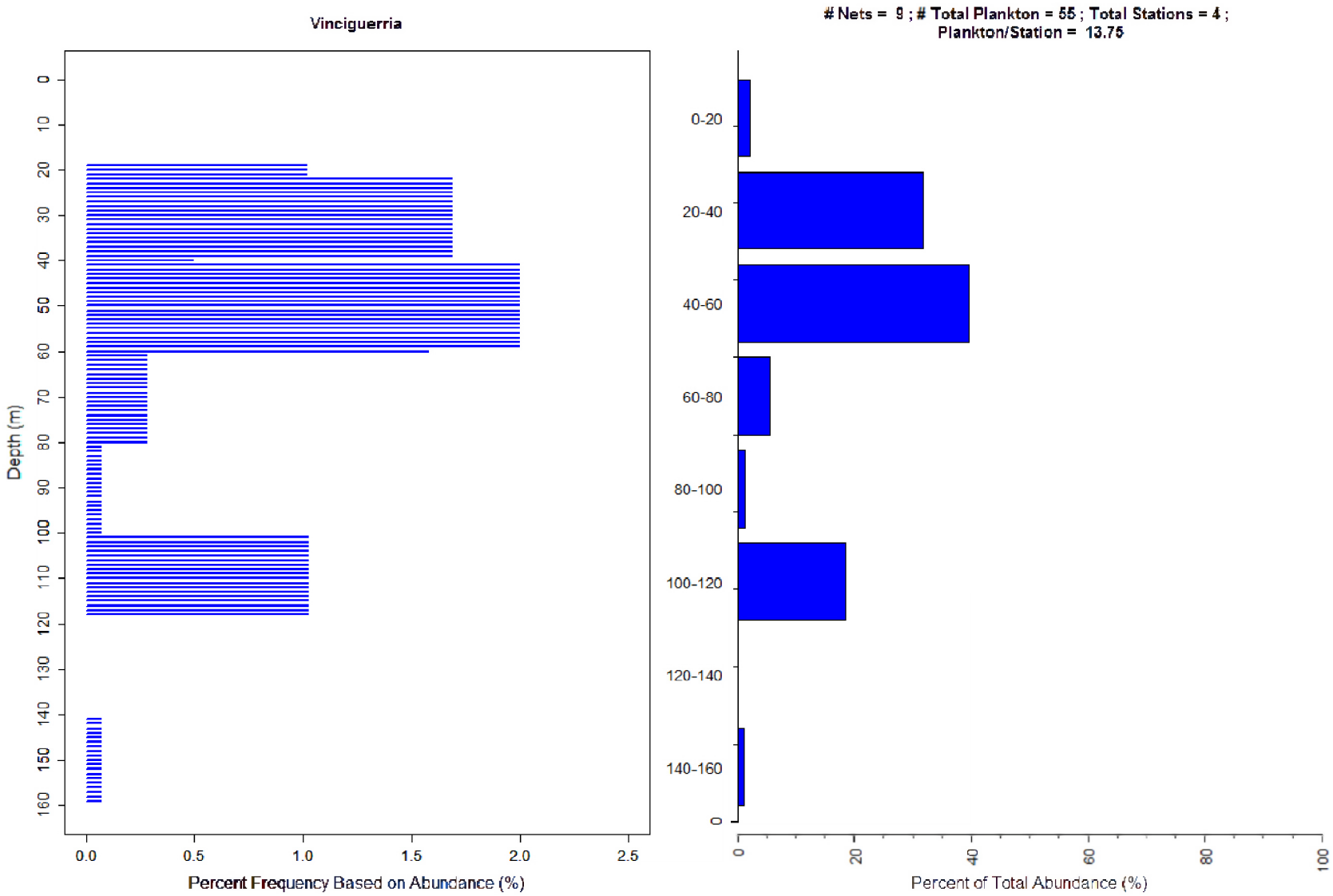
Unidentified_Decapod - Shallow



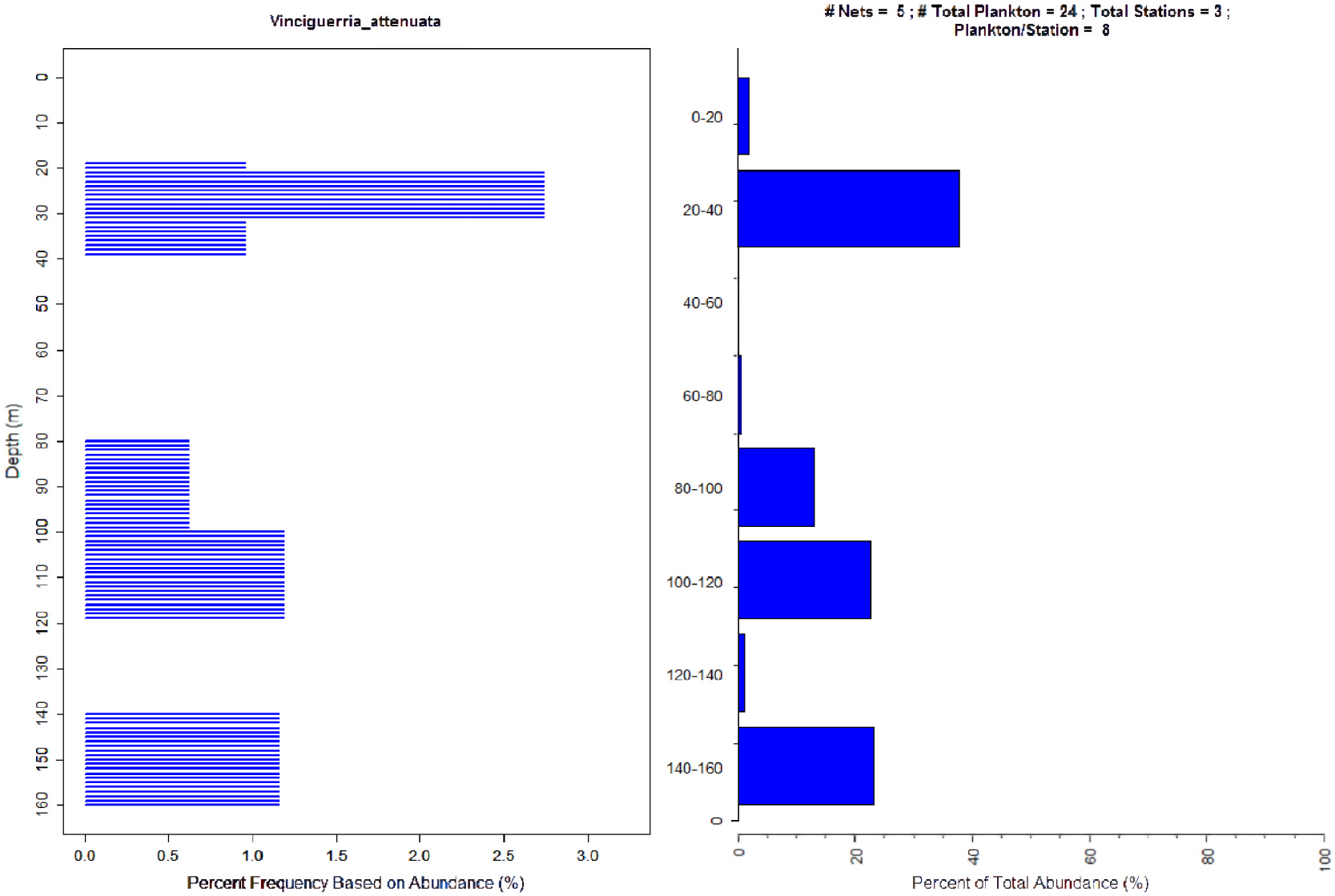
Unidentified_Fish - Shallow



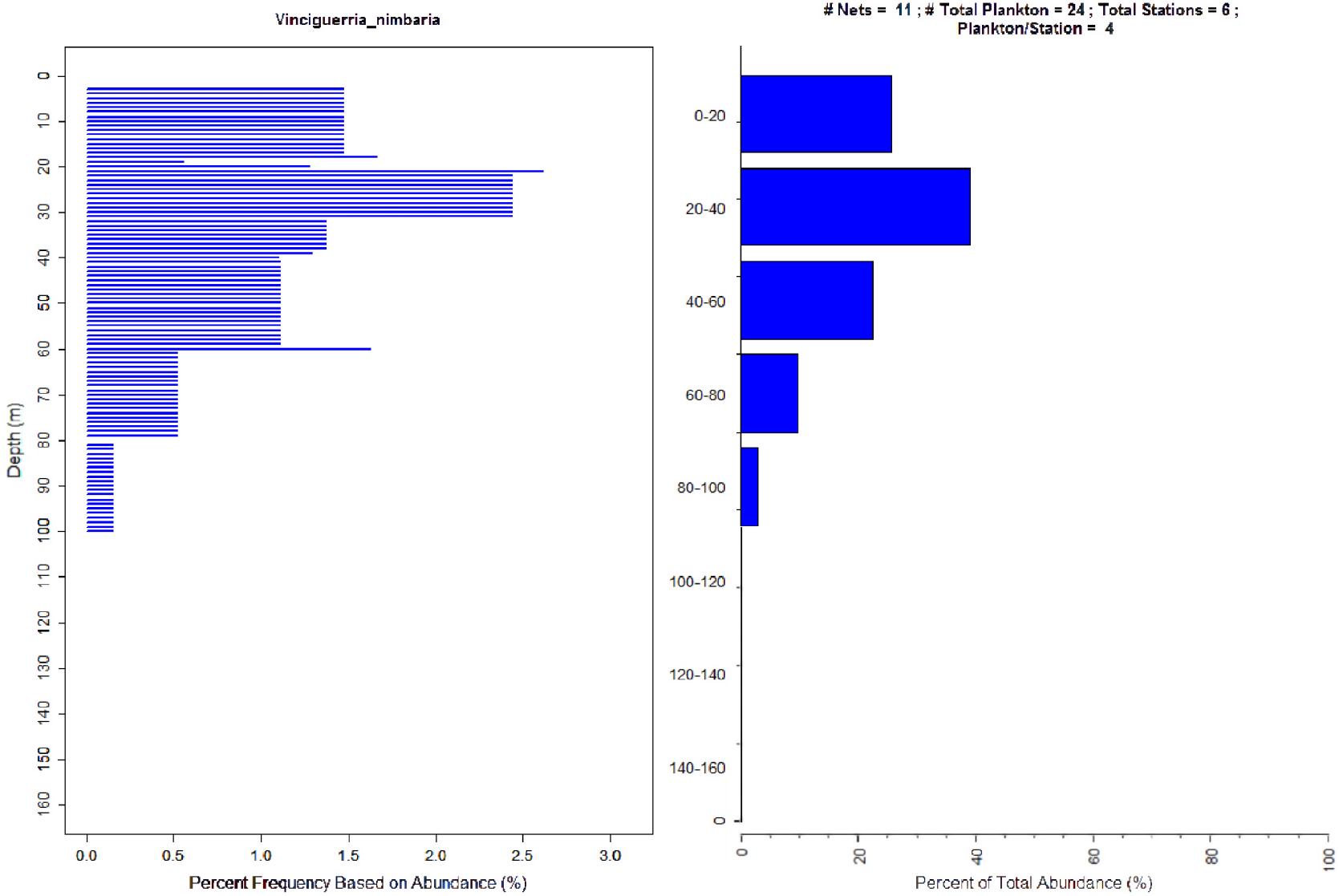
Valenciennellus_tripunctulatus - Shallow



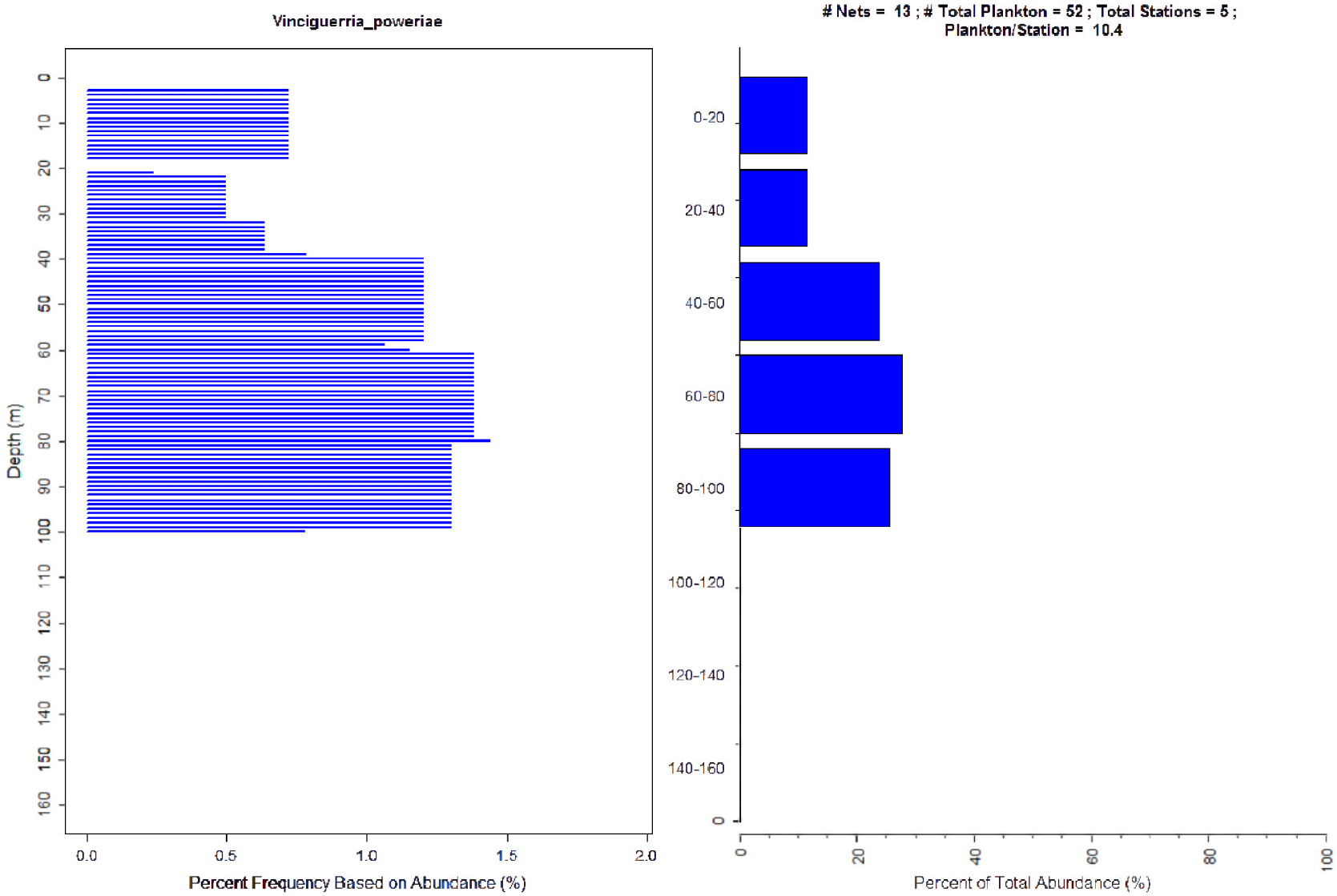
Vinciguerria - Shallow



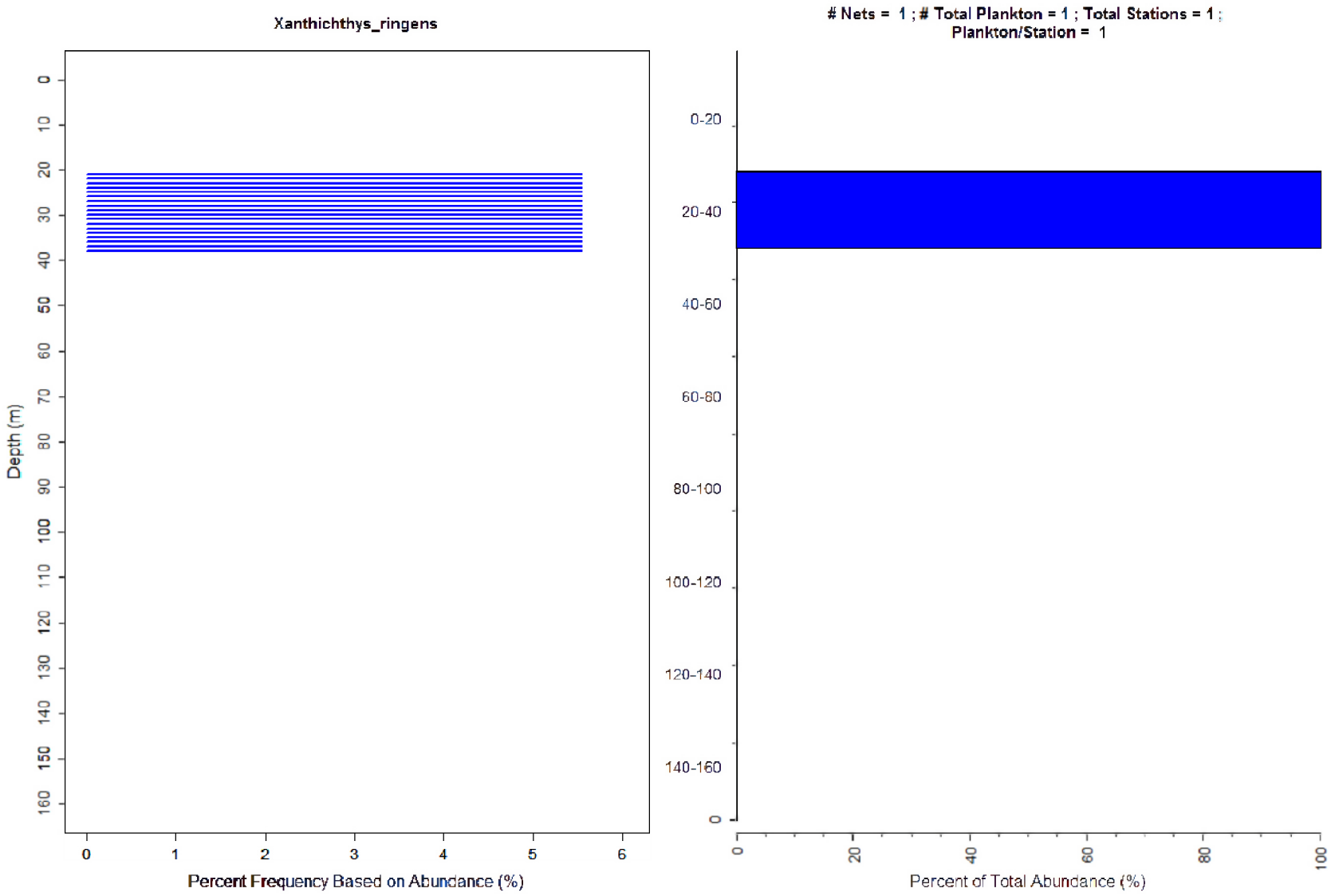
Vinciguerria_attenuata - Shallow



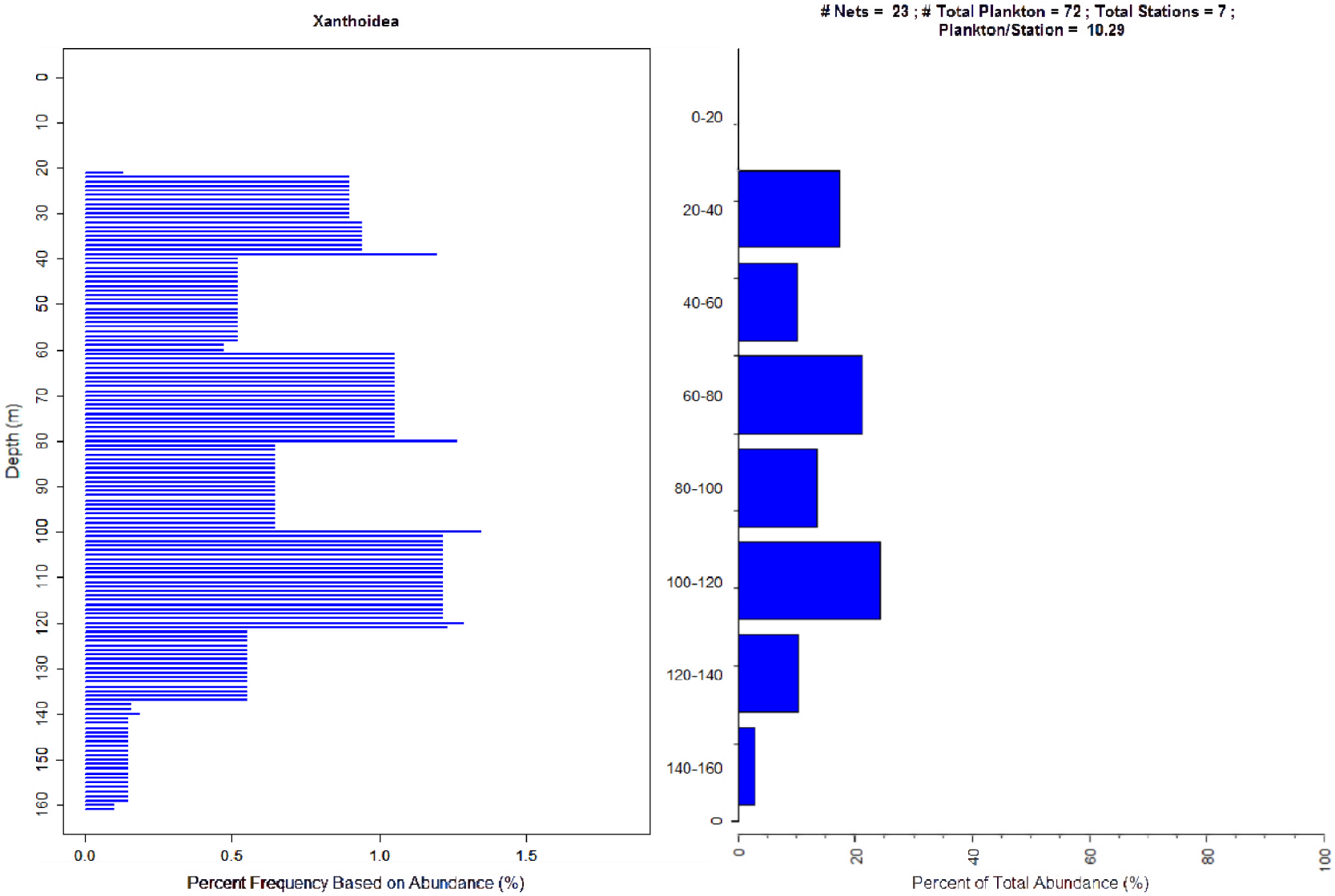
Vinciguerria_nimbaria - Shallow



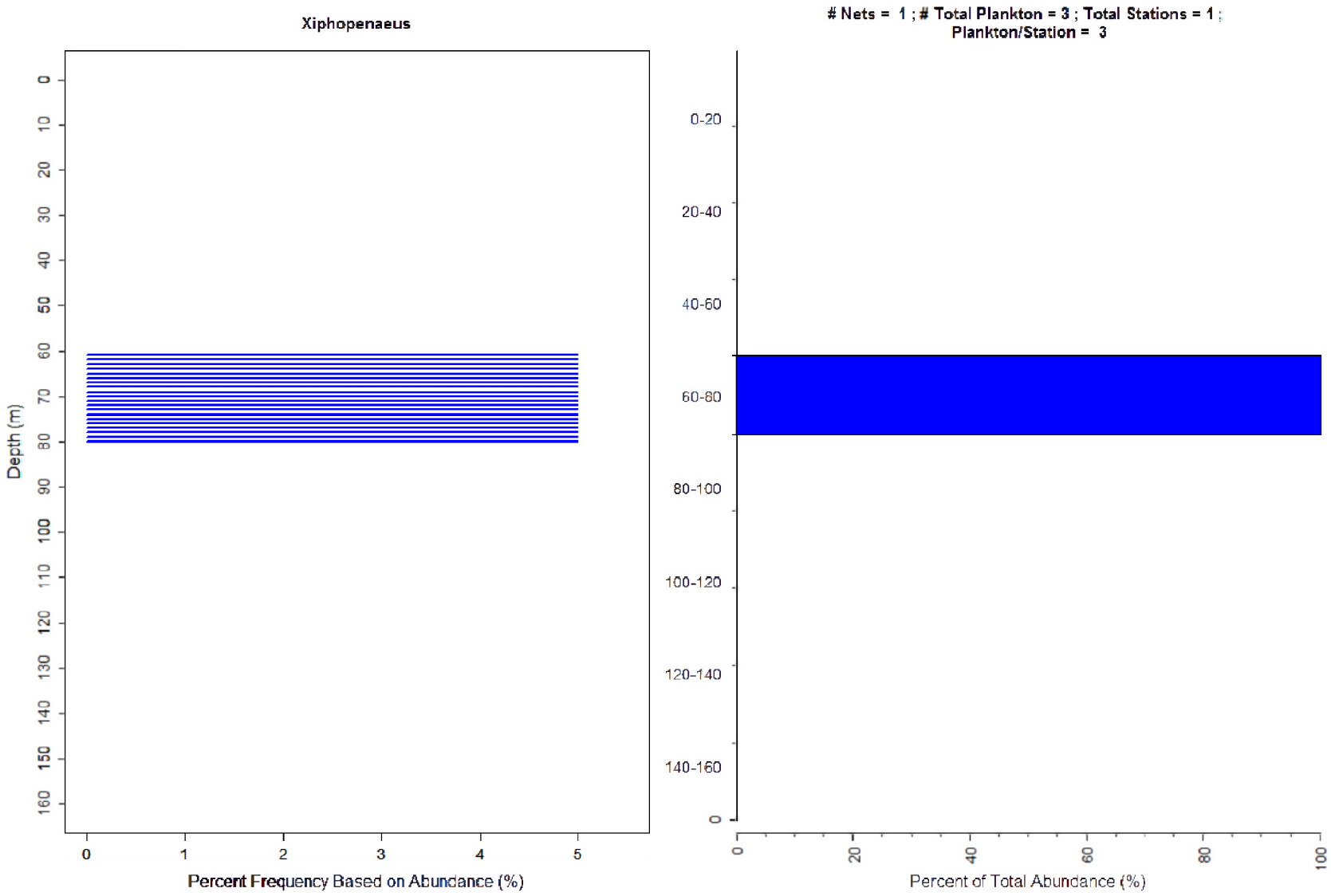
Vinciguerria_poweriae - Shallow



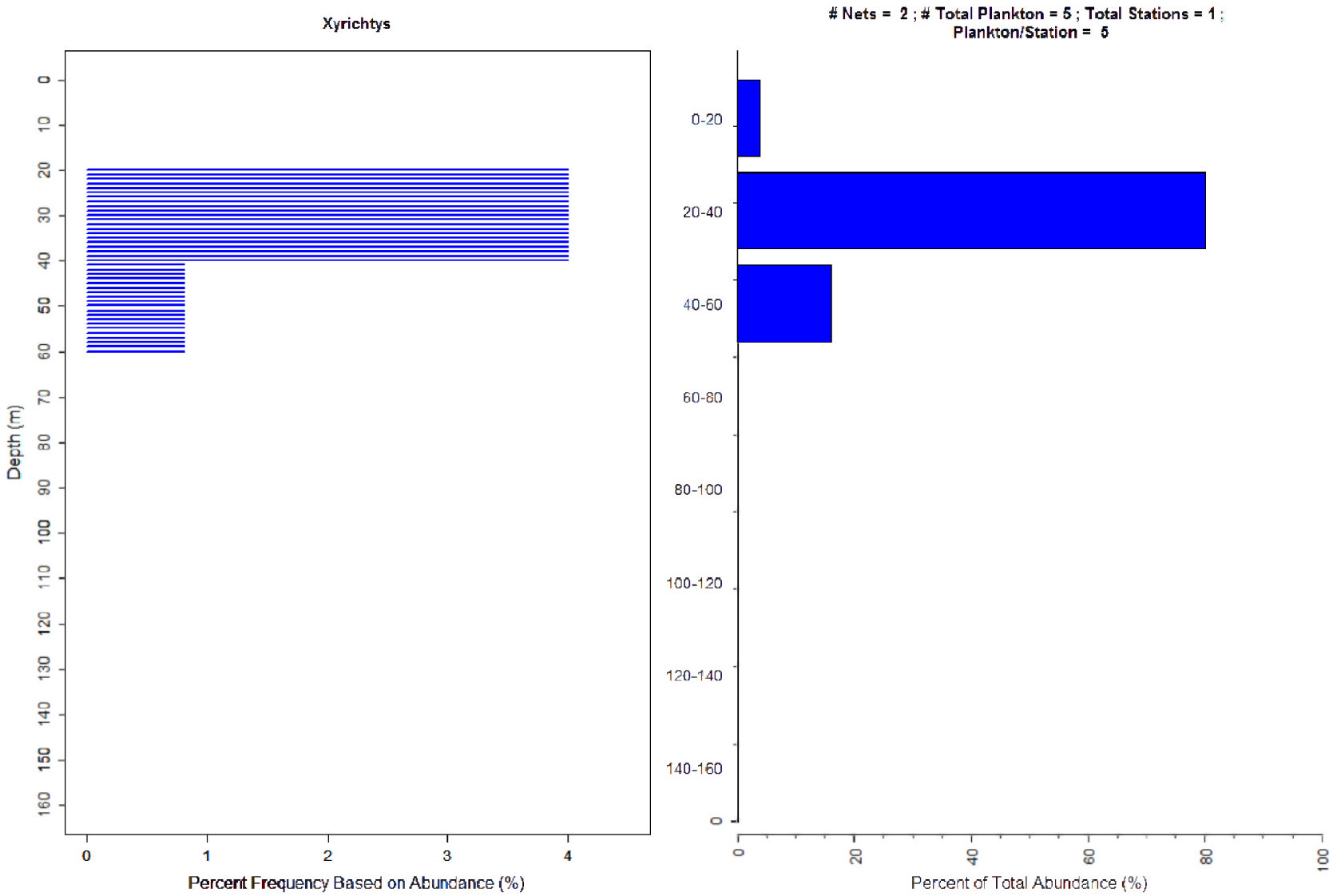
Xanthichthys_ringens - Shallow



Xanthoidea - Shallow



Xiphopenaeus - Shallow



Xyrichtys - Shallow

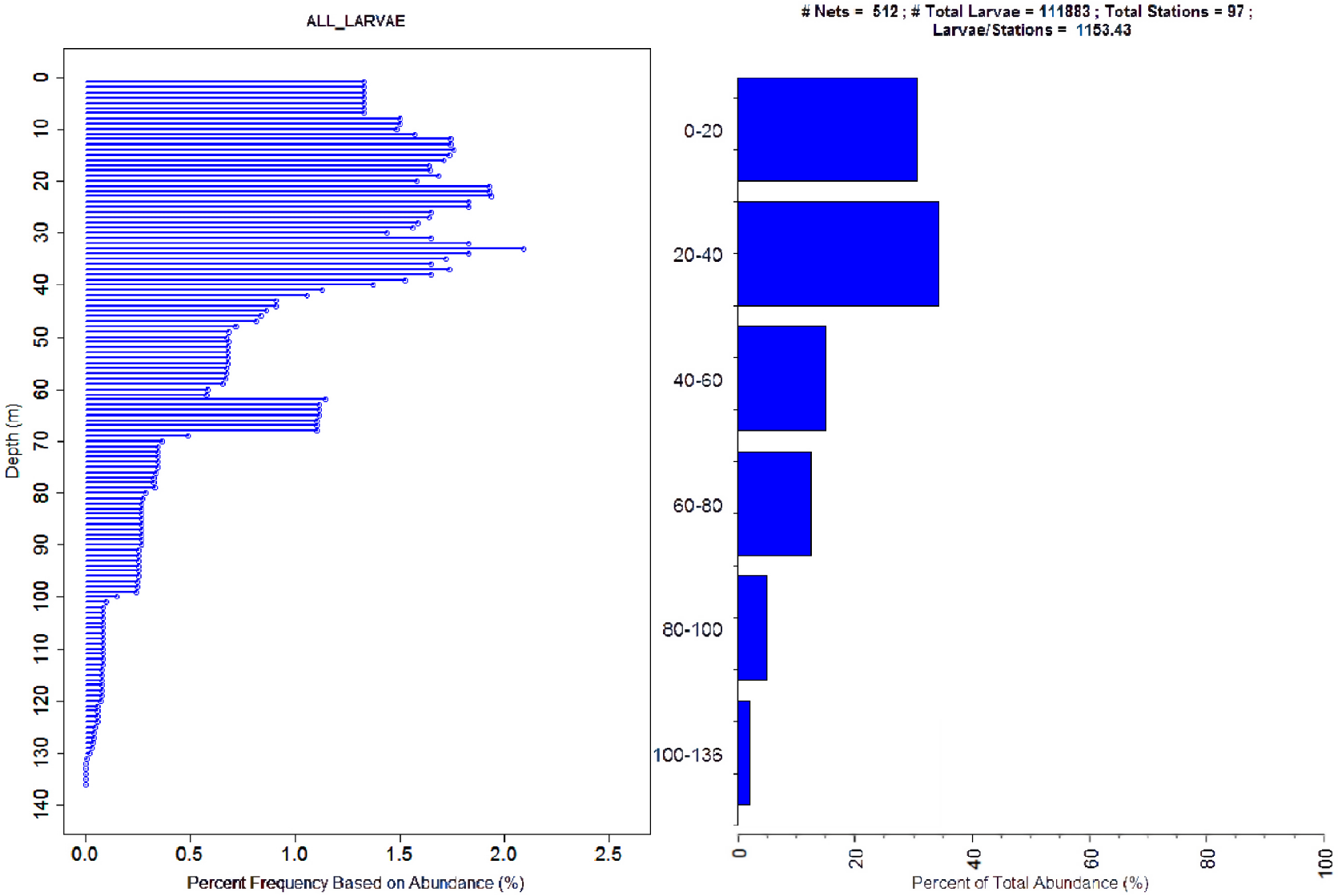
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

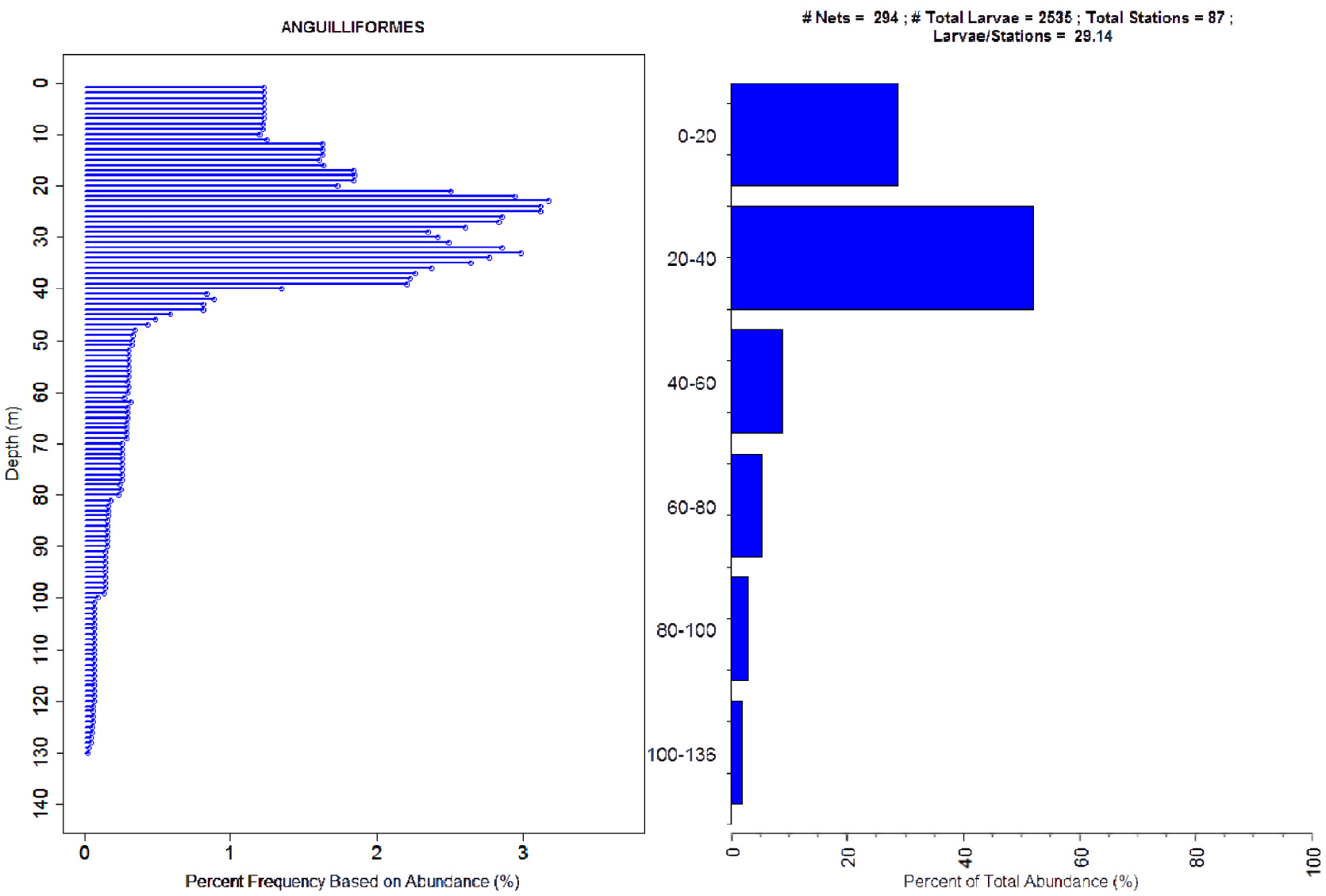
Appendix C4 – SEAMAP Historical MOC1 Plots Order Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

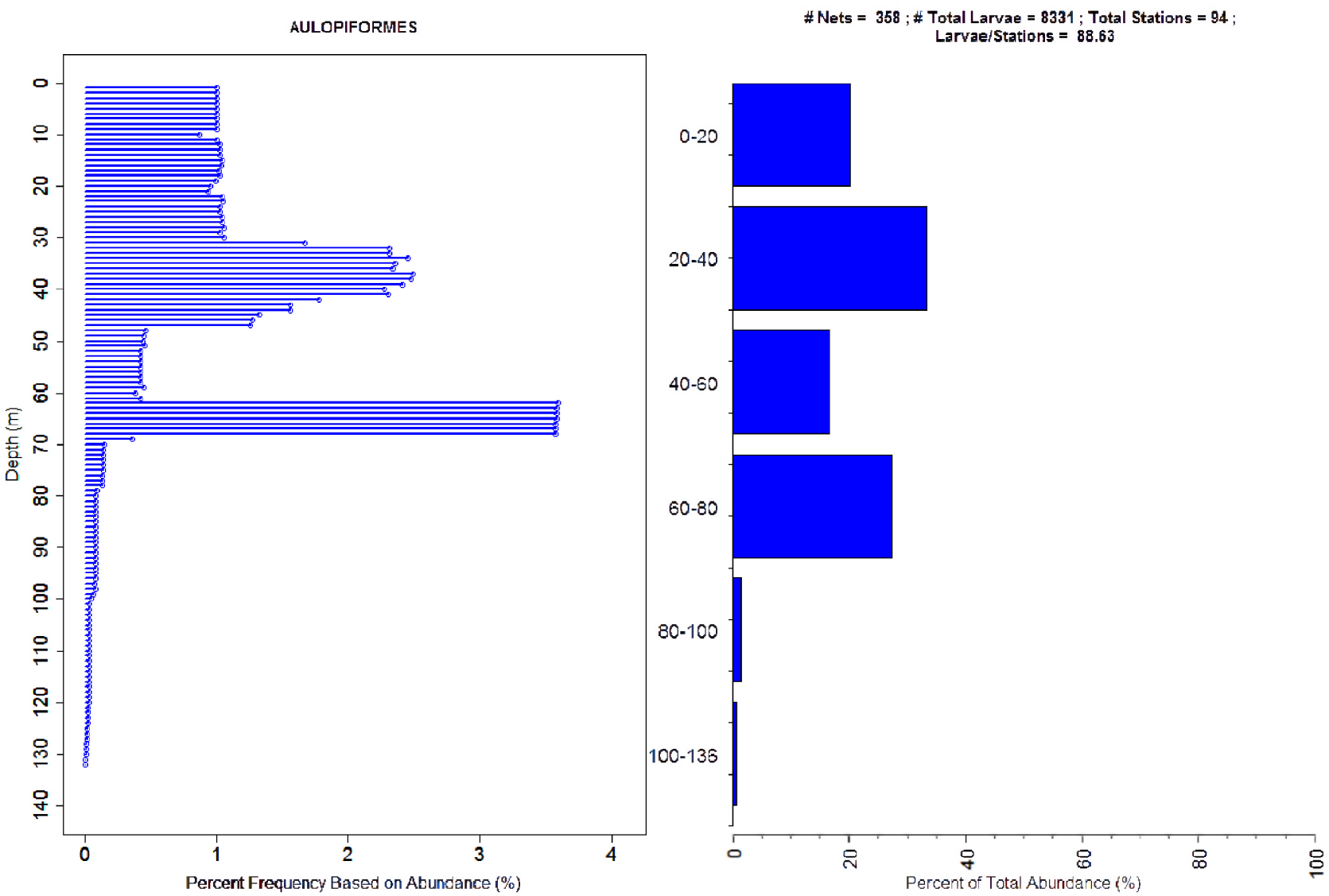
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879


ALL_LARVAE
Nets = 512 ; # Total Larvae = 111883 ; Total Stations = 97 ;
Larvae/Stations = 1153.43
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

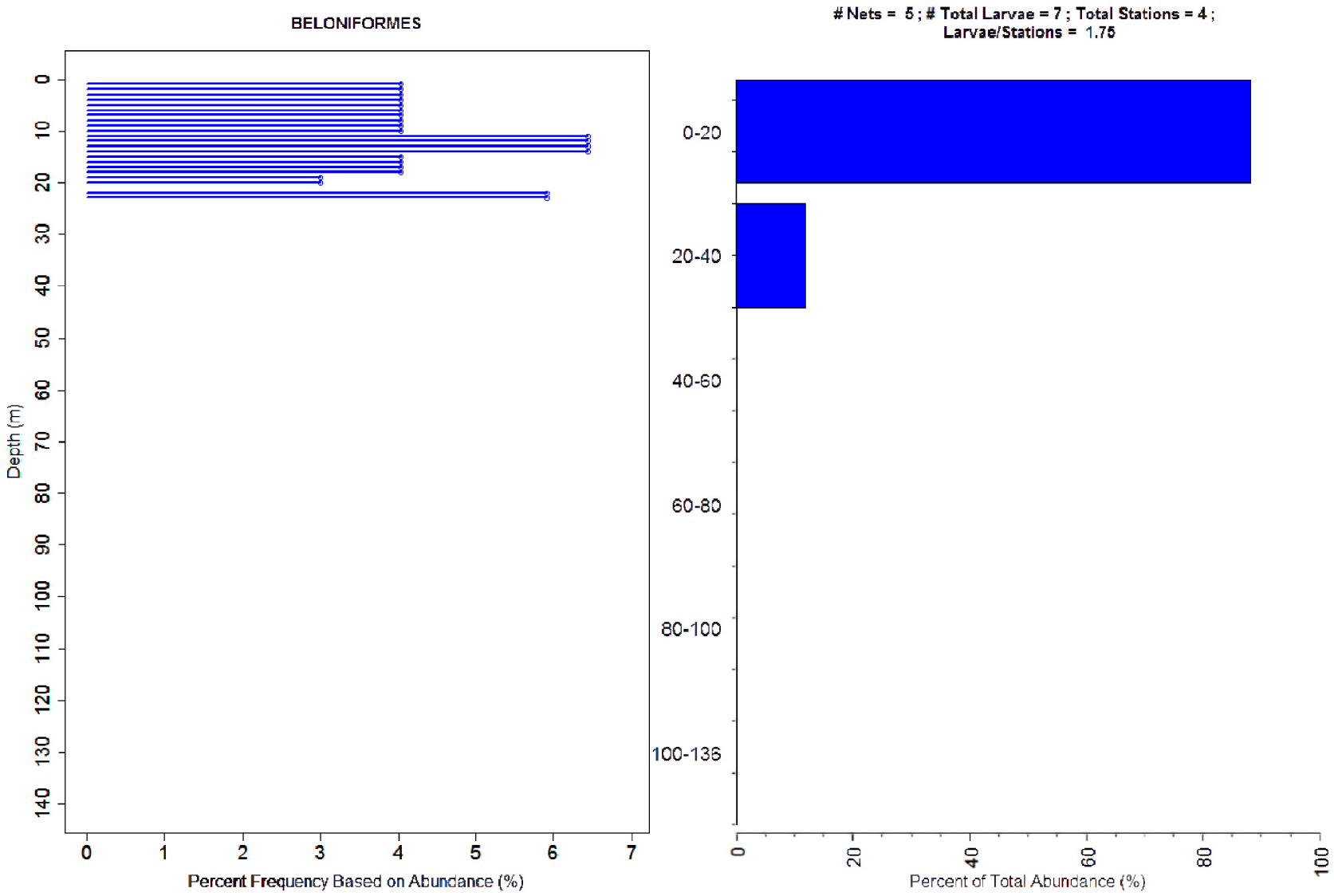
ALL_LARVAE



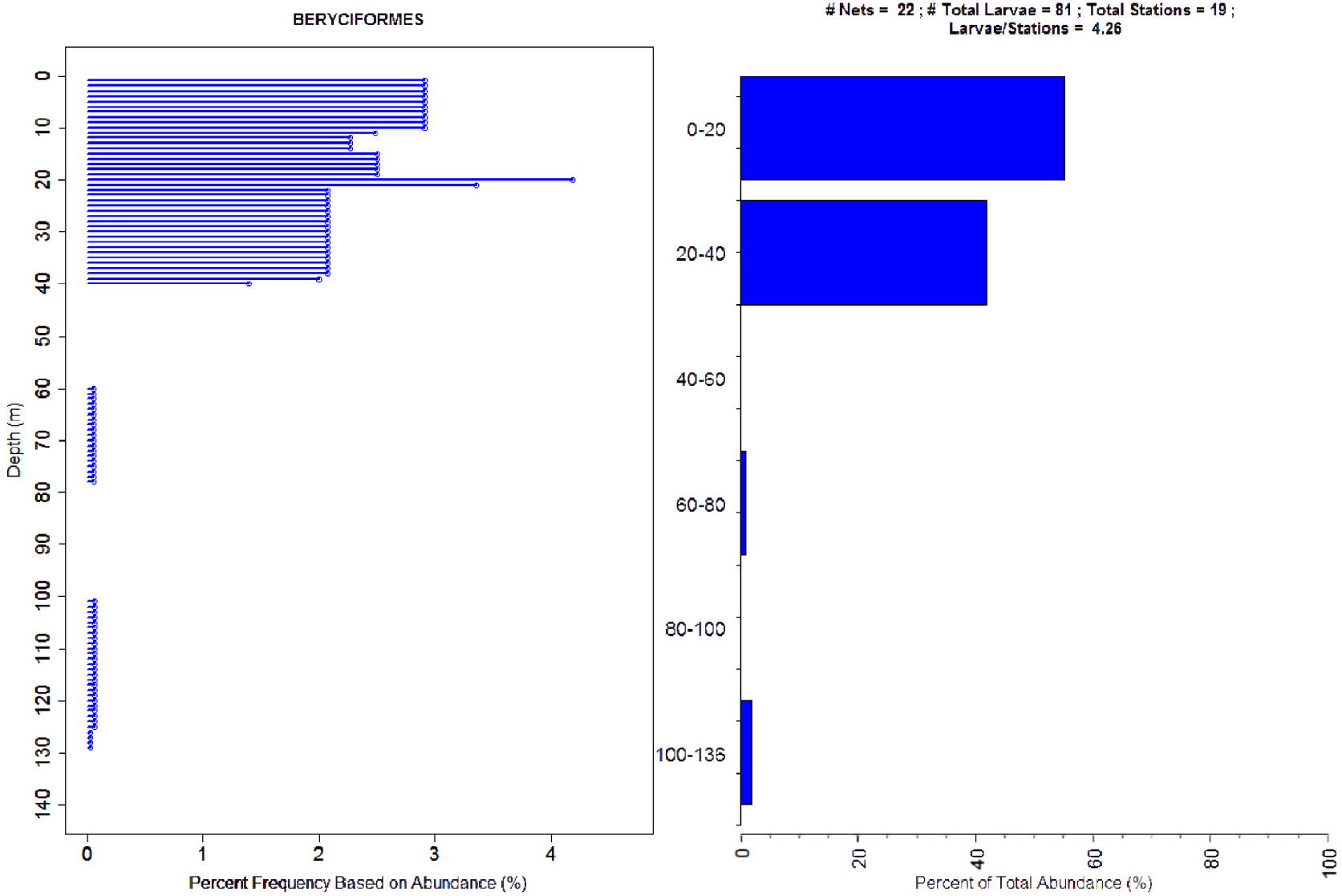
ANGUILLIFORMES



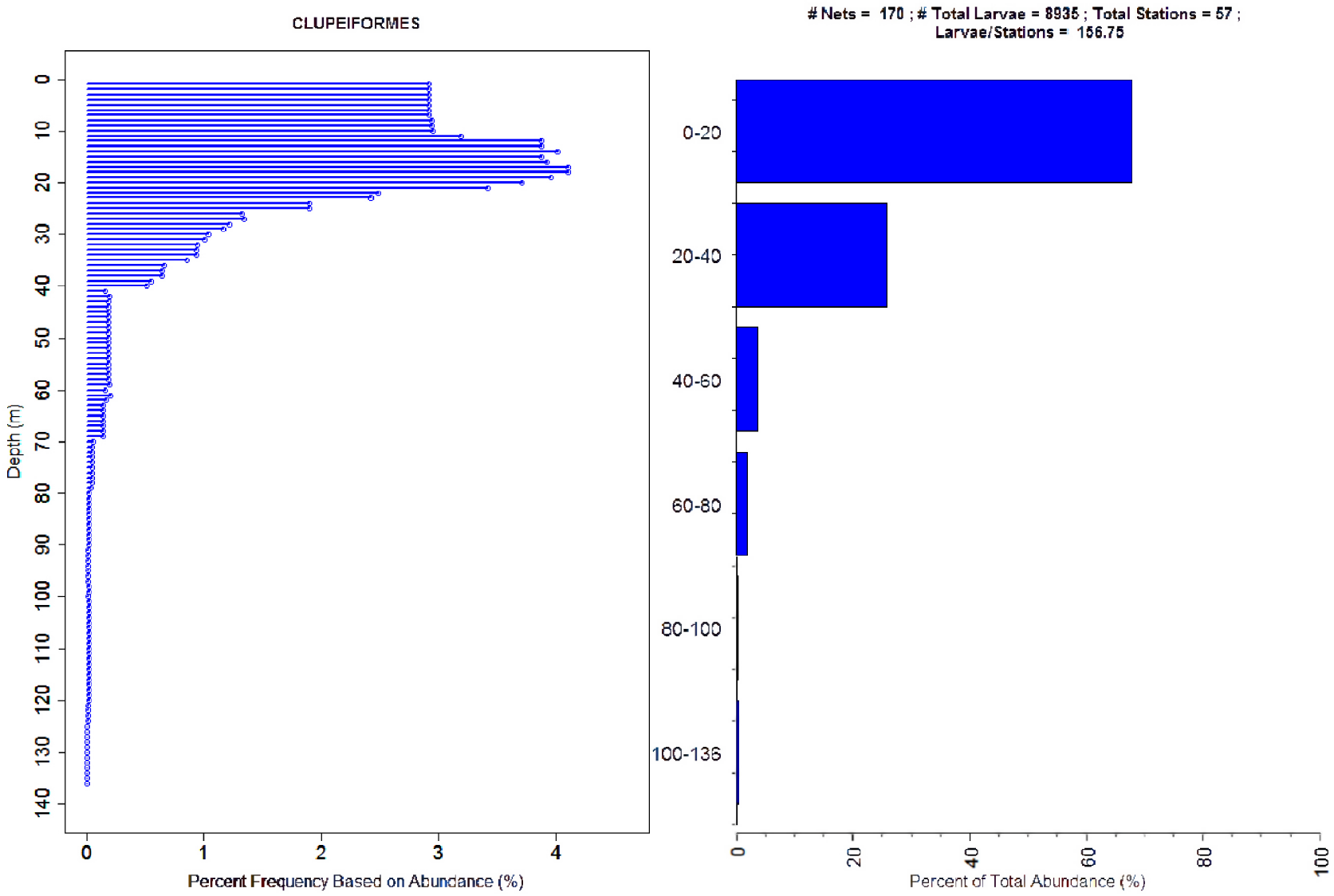
AULOPIFORMES



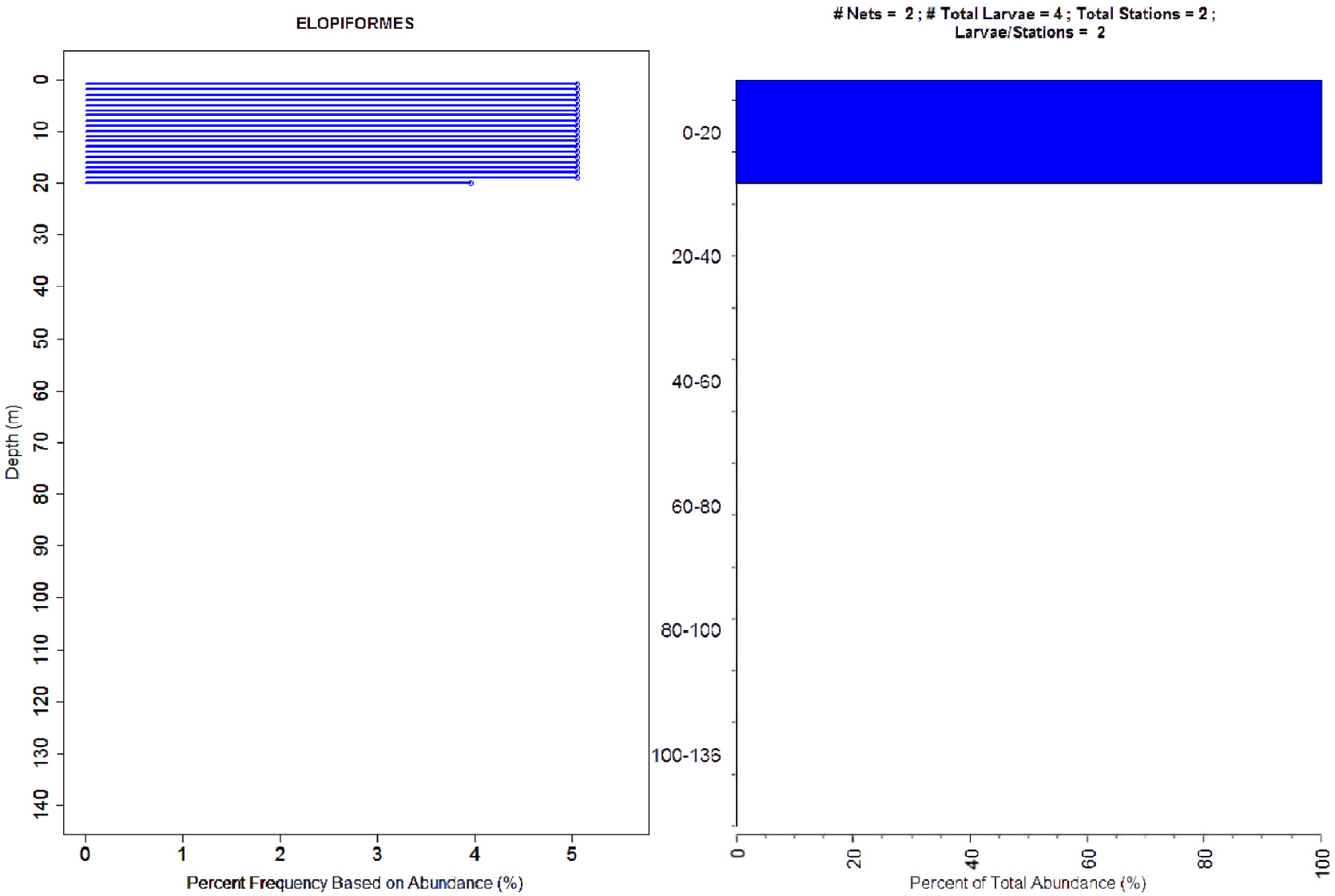
BELONIFORMES



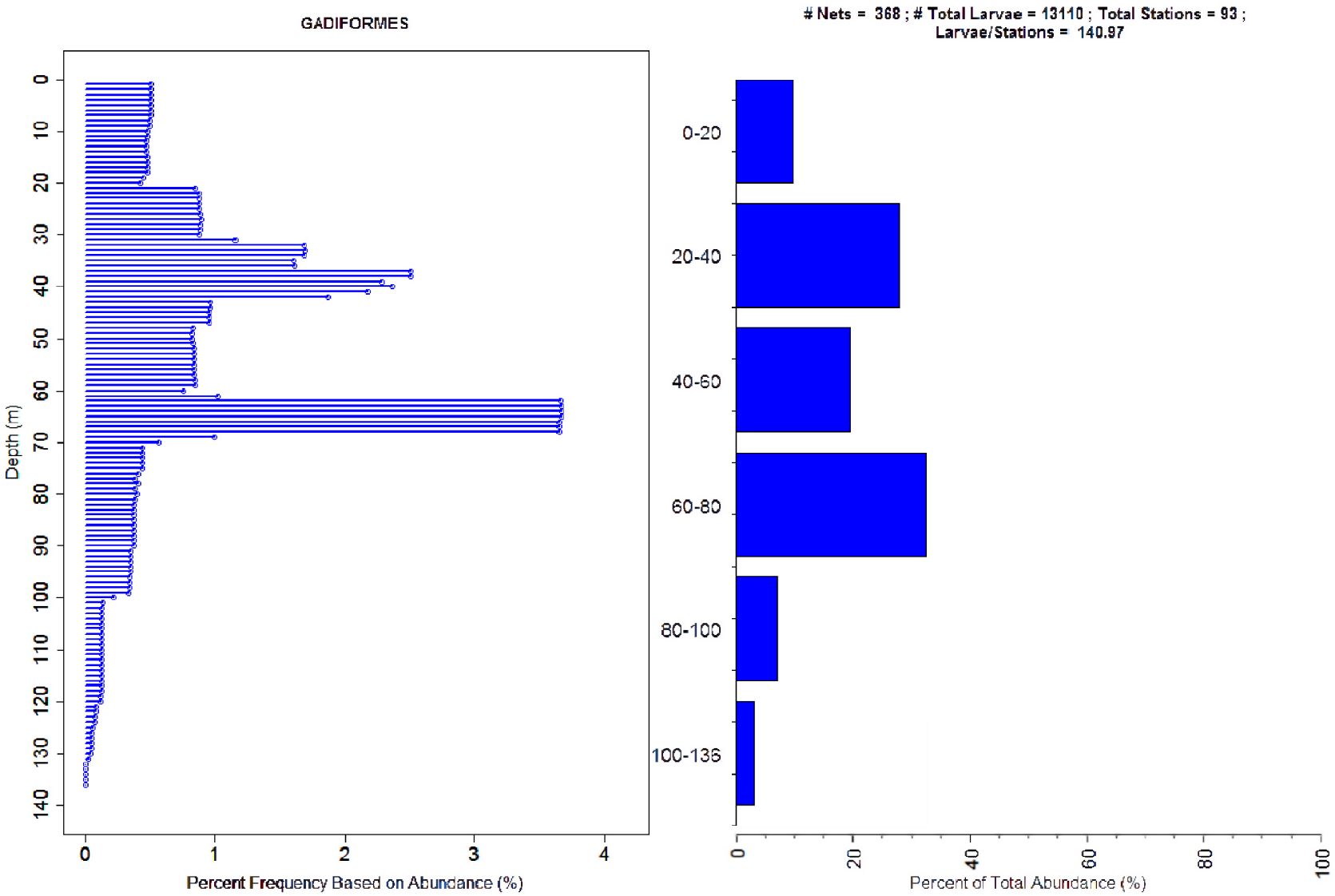
BERYCIFORMES



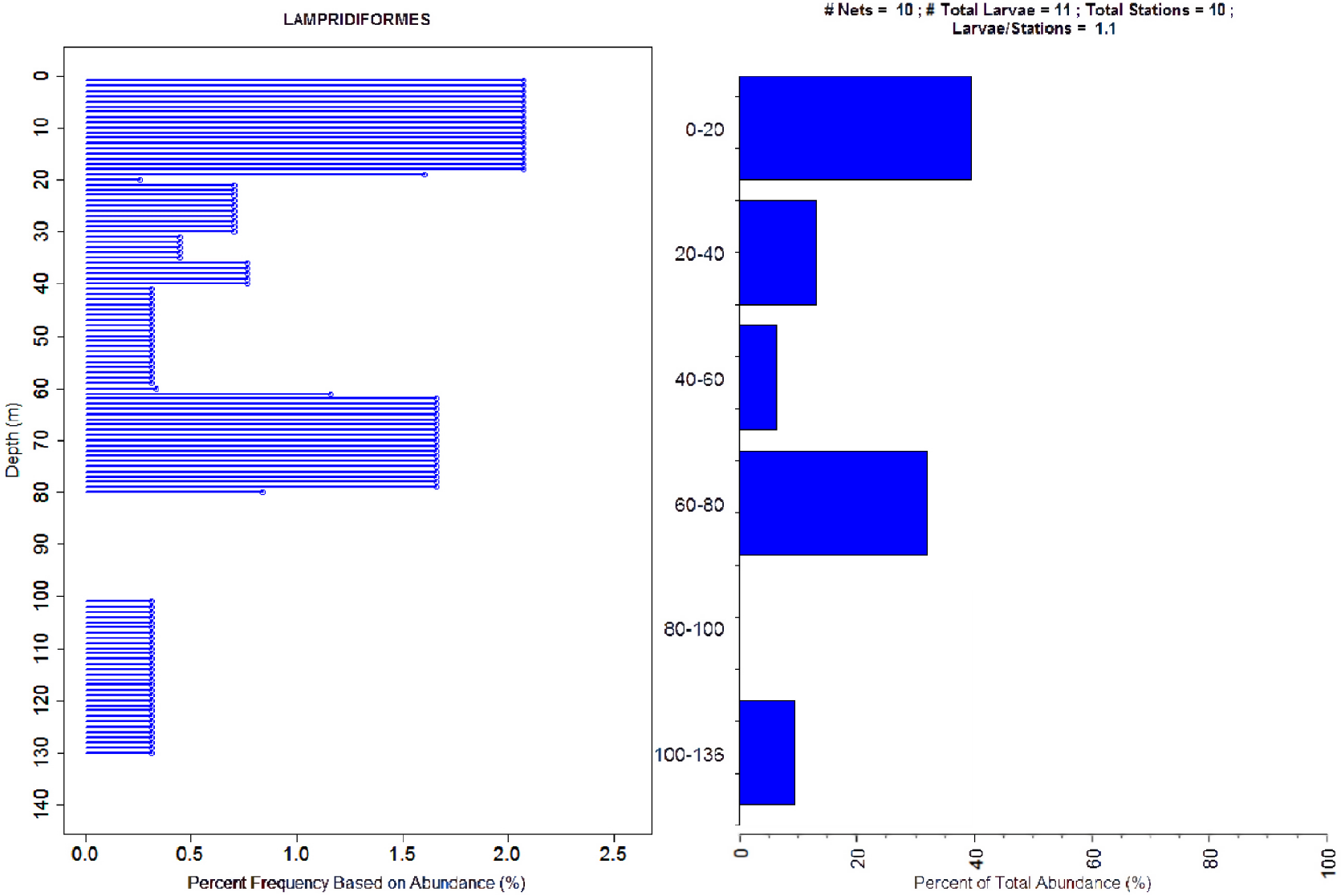
CLUPEIFORMES



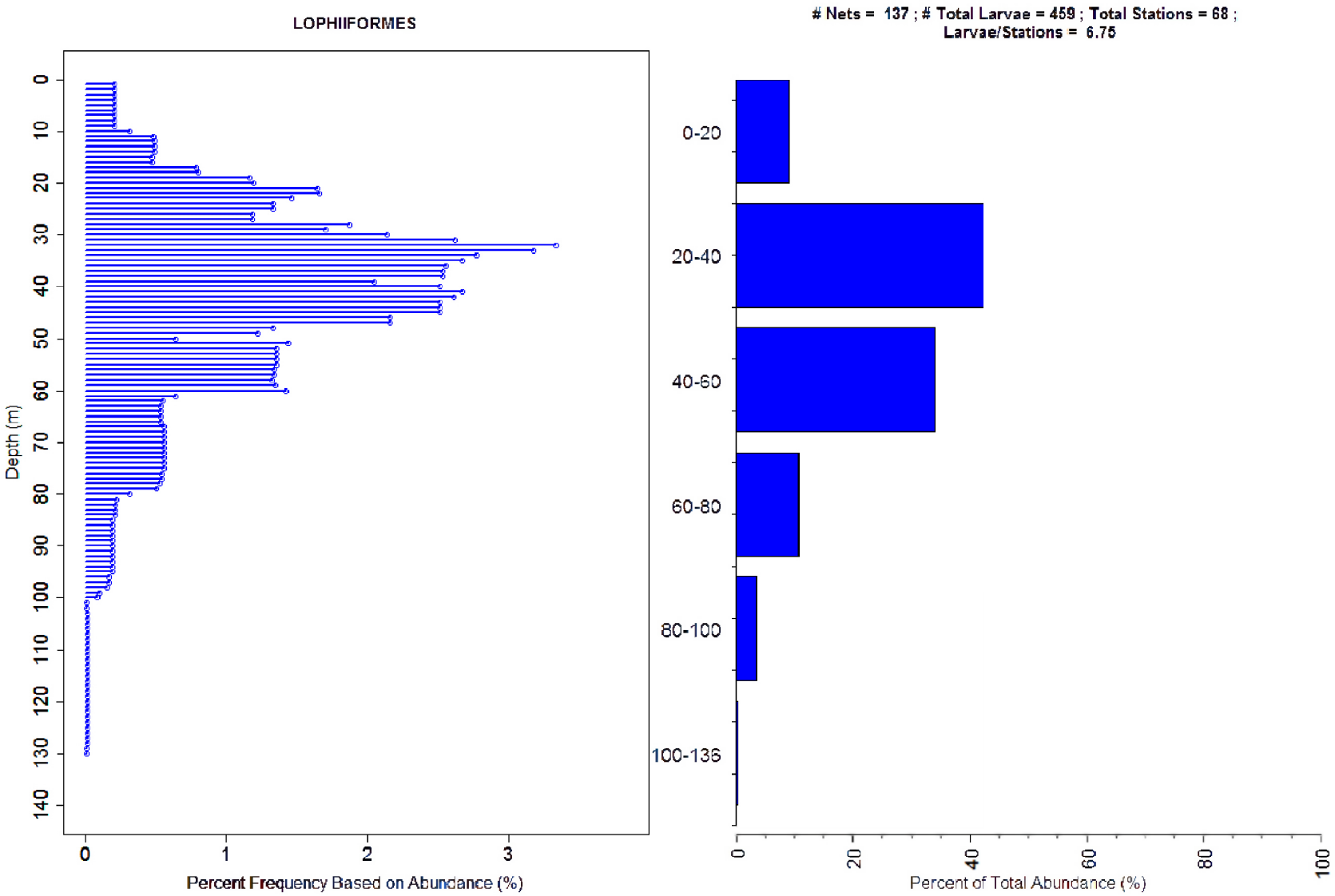
ELOPIFORMES


GADIFORMES
Nets = 368 ; # Total Larvae = 13110 ; Total Stations = 93 ;
Larvae/Stations = 140.97
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

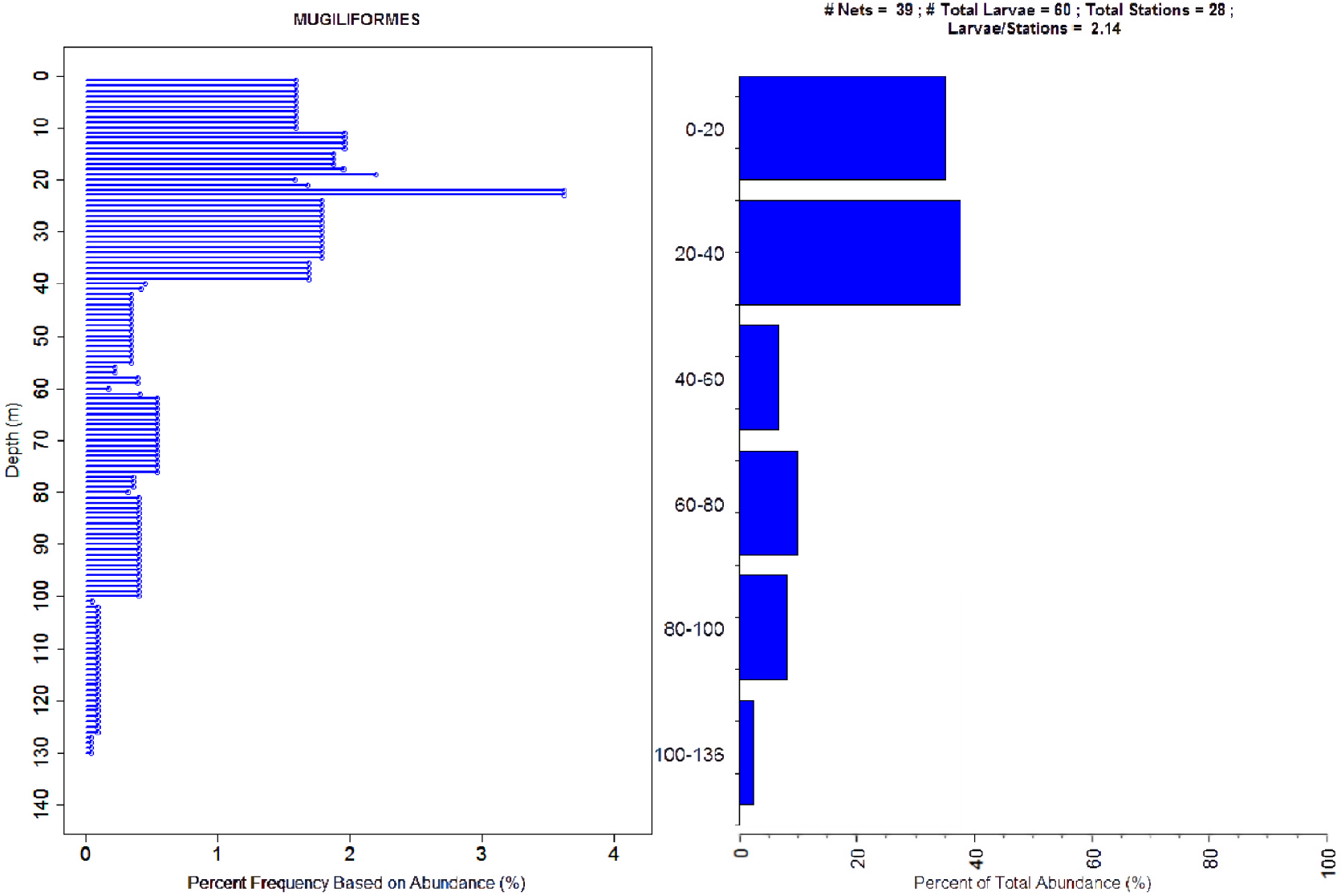
GADIFORMES



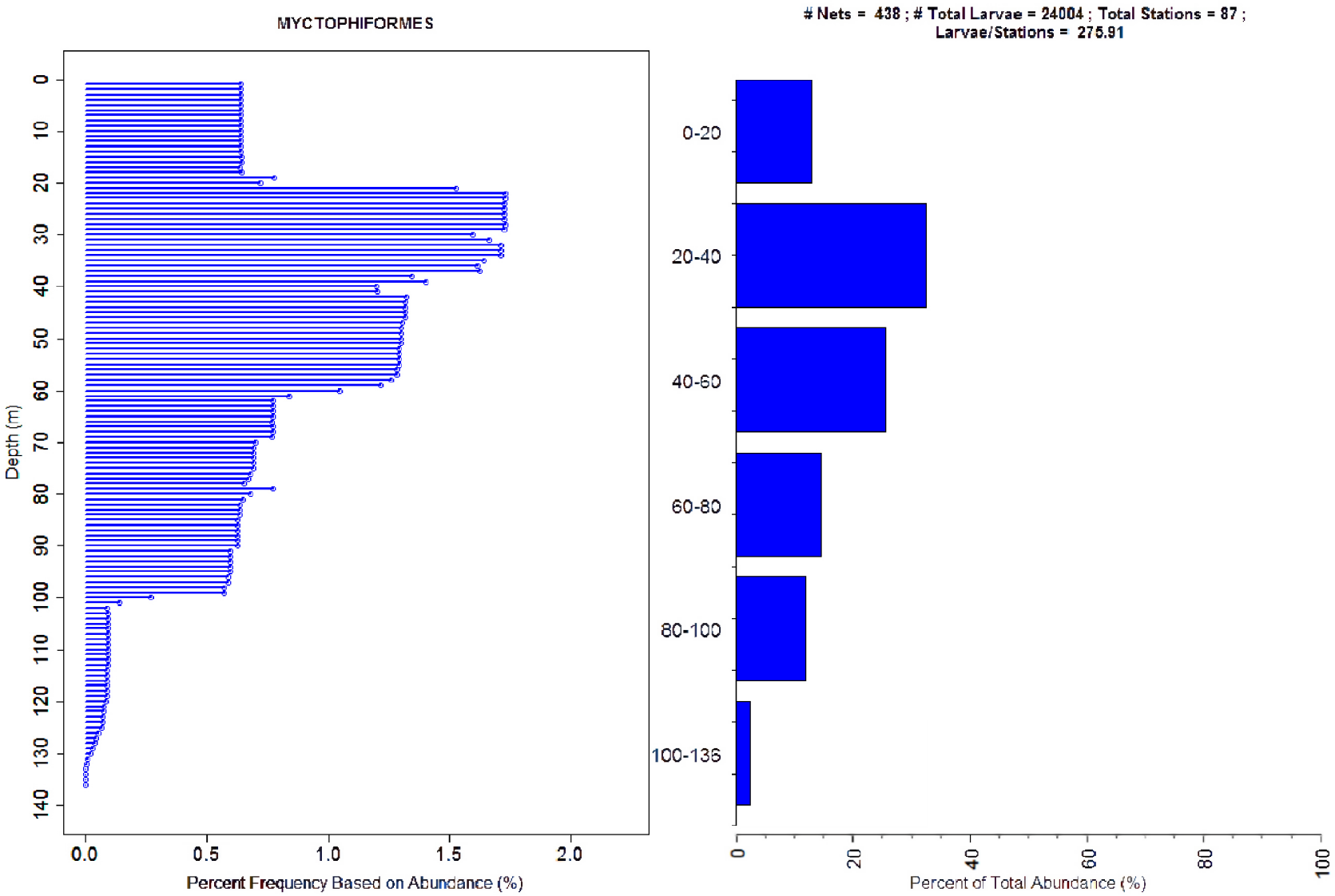
LAMPRIDIFORMES



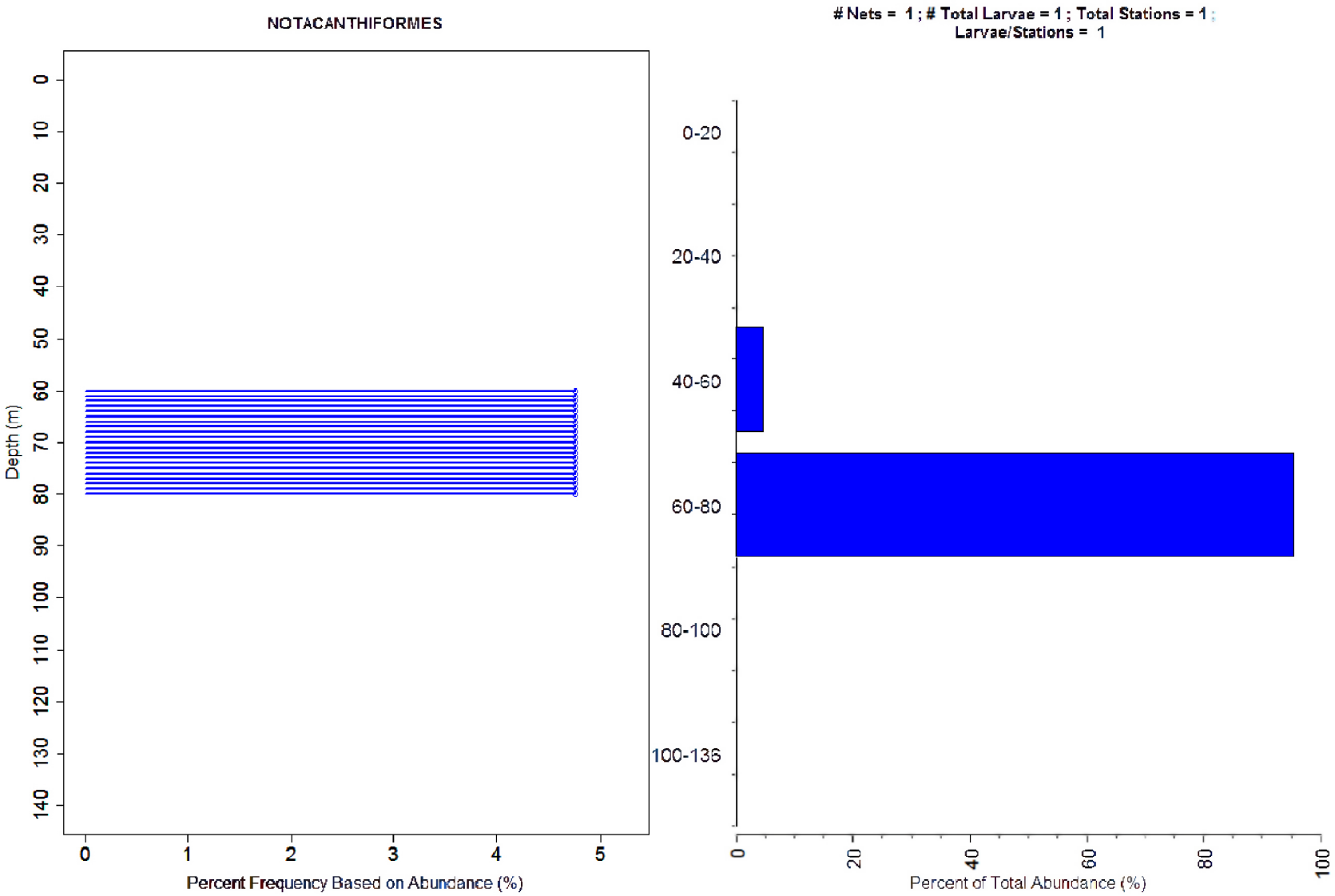
LOPHIIFORMES



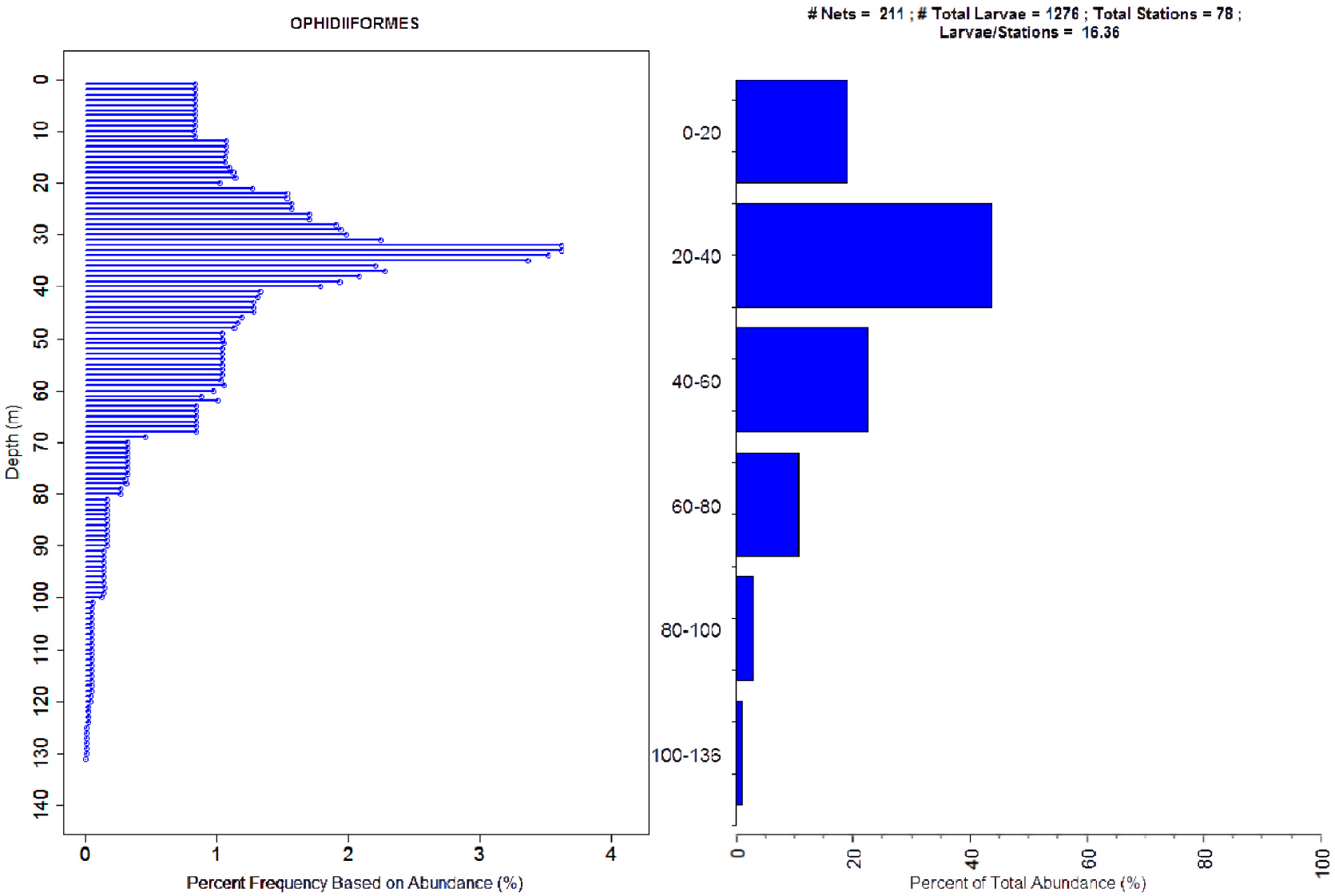
MUGILIFORMES



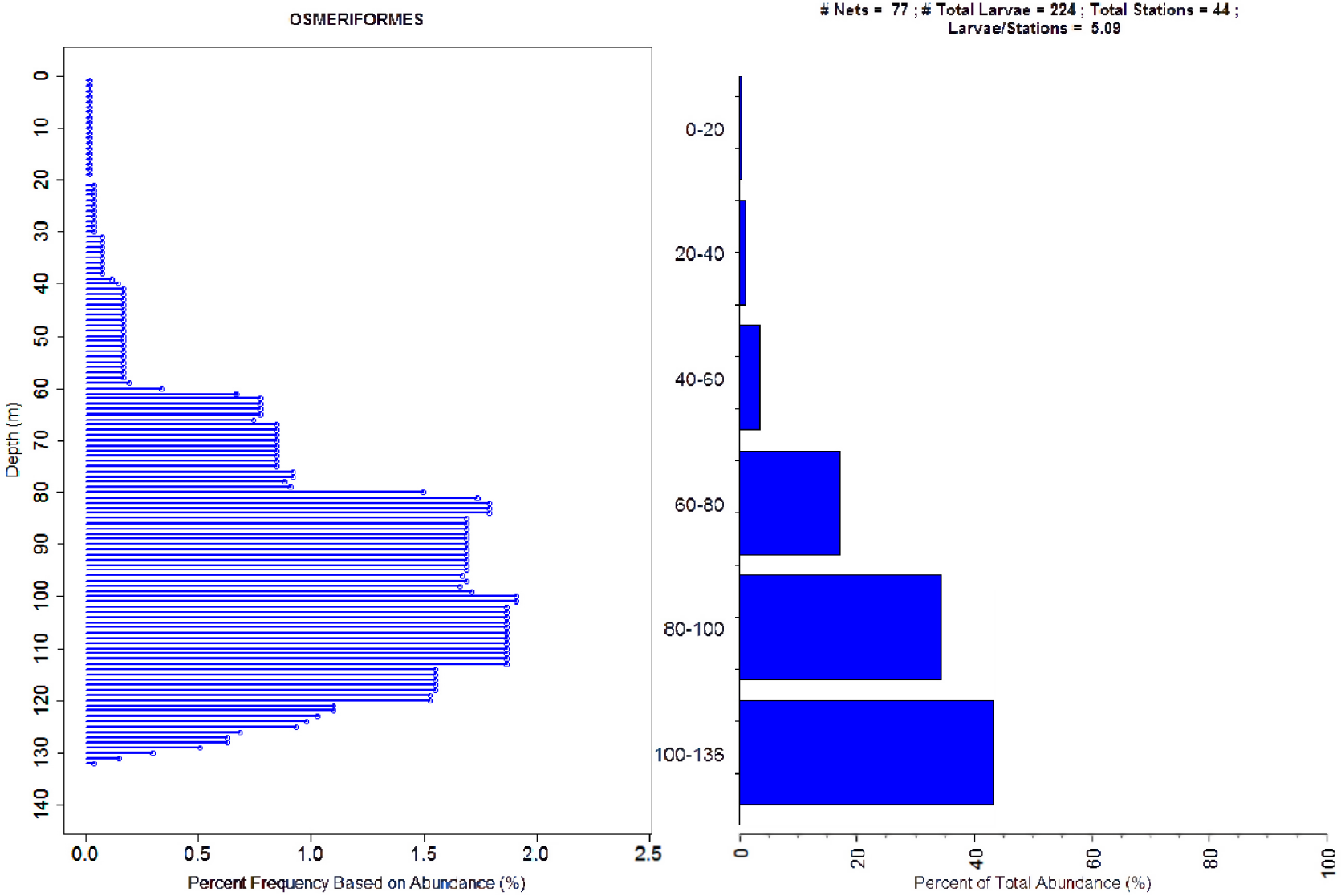
MYCTOPHIFORMES



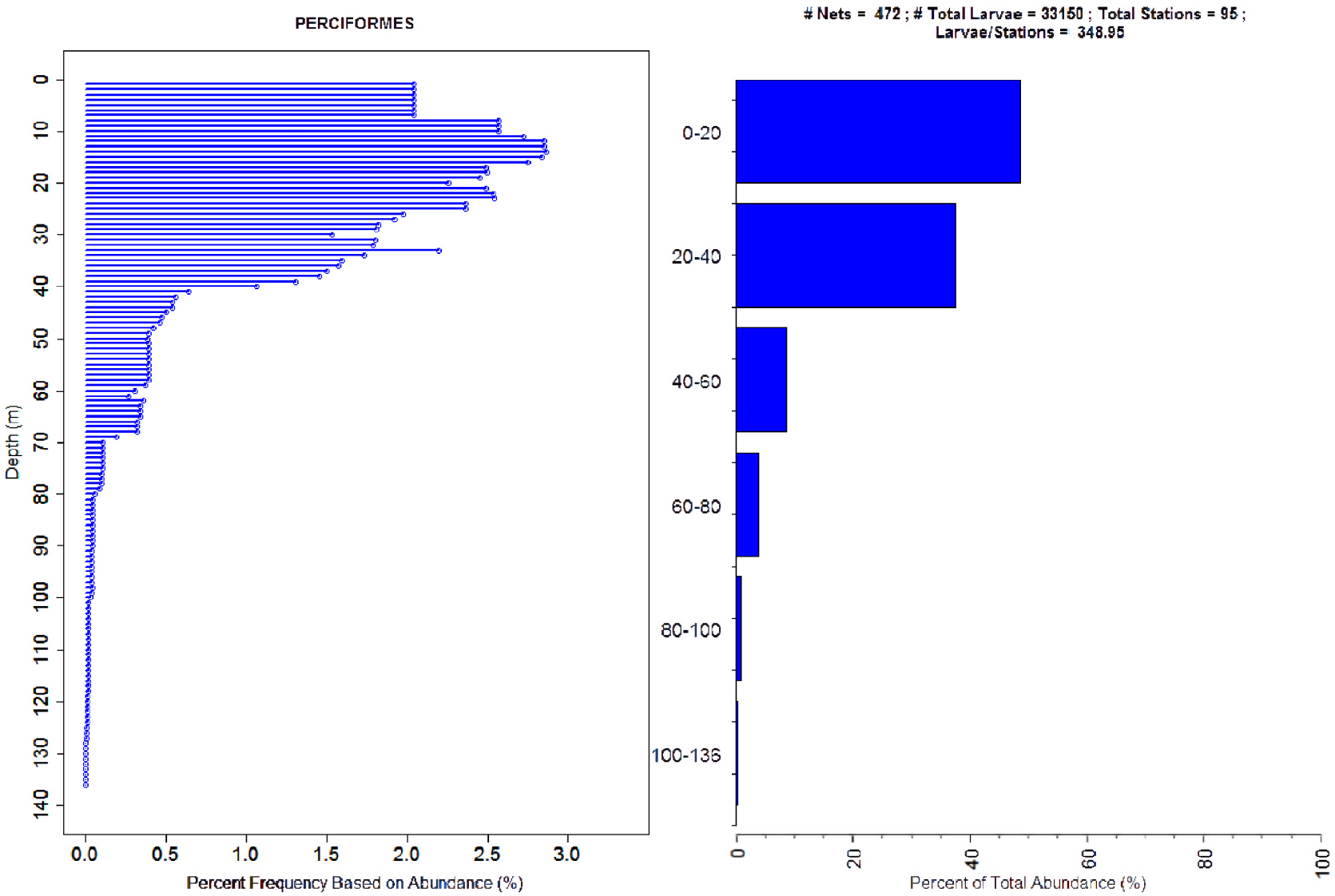
NOTACANTHIFORMES



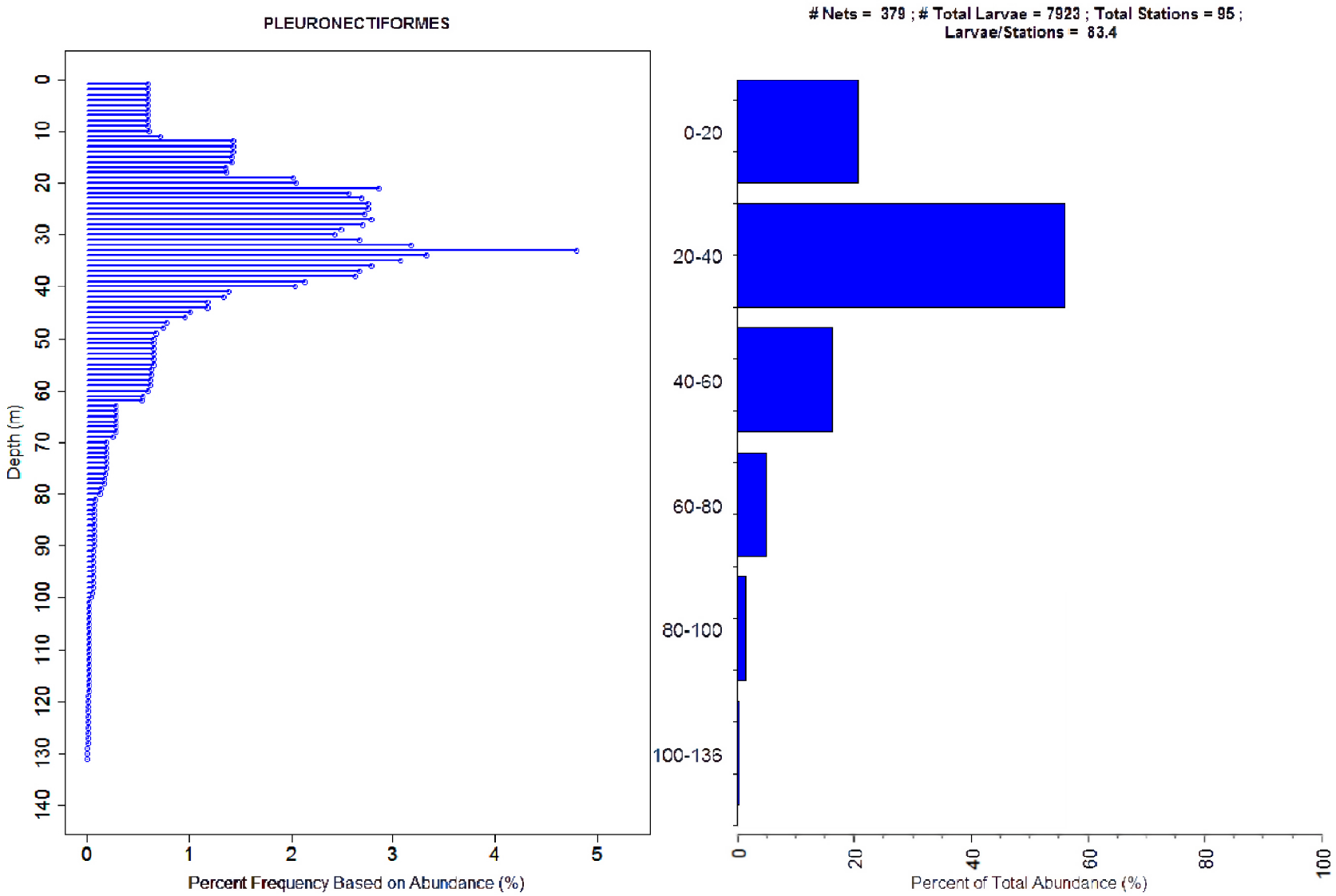
OPHIDIIFORMES



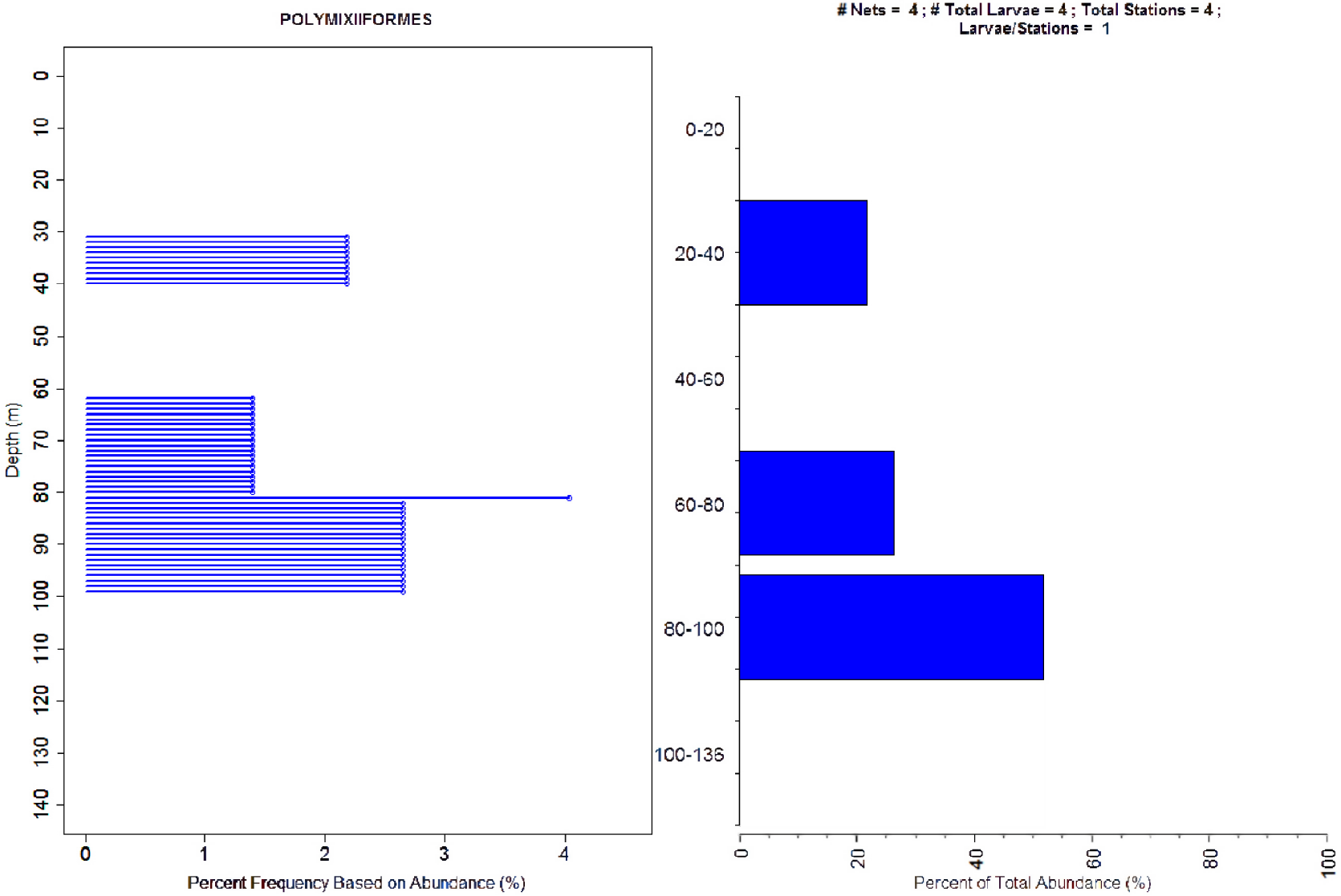
OSMERIFORMES



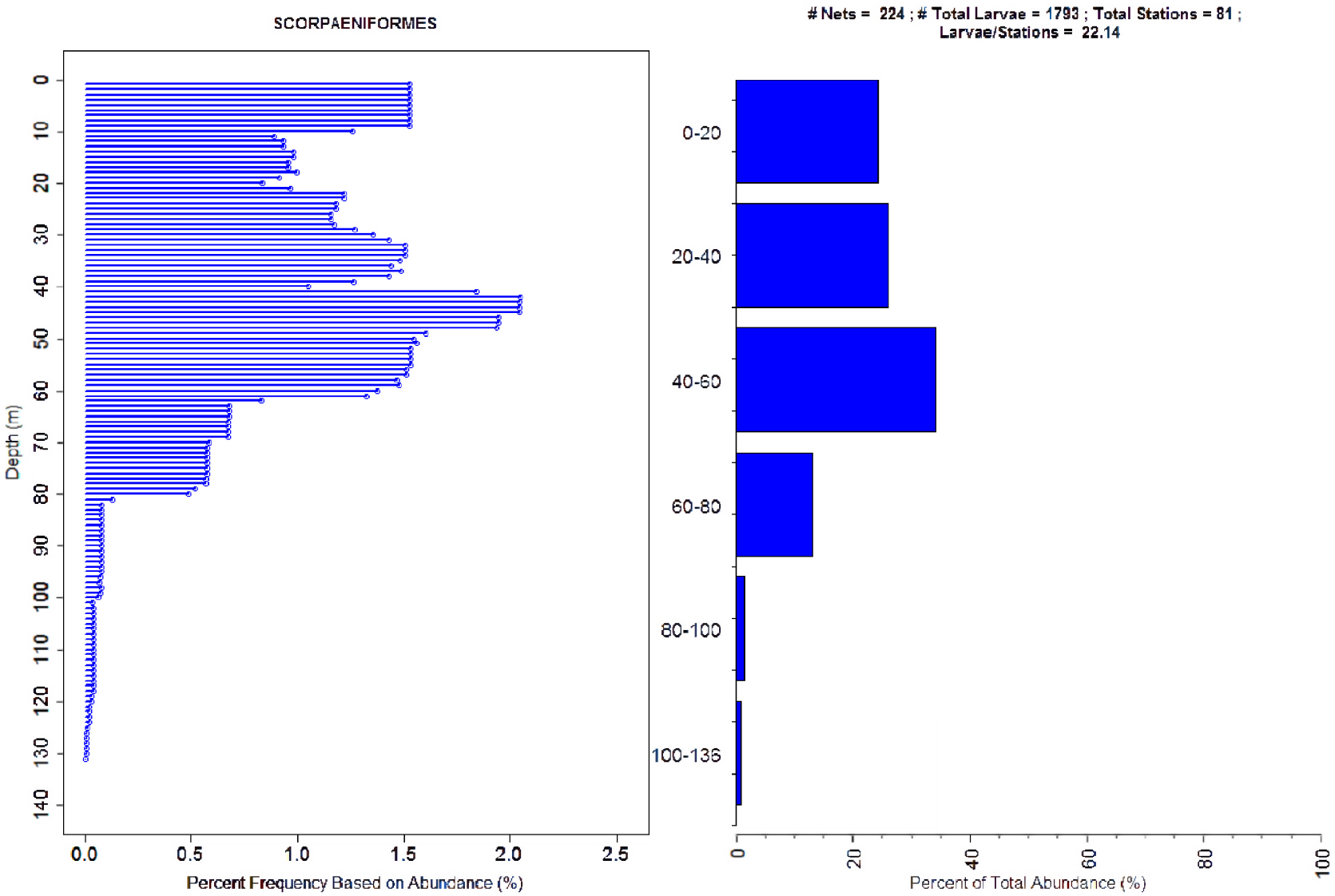
PERCIFORMES



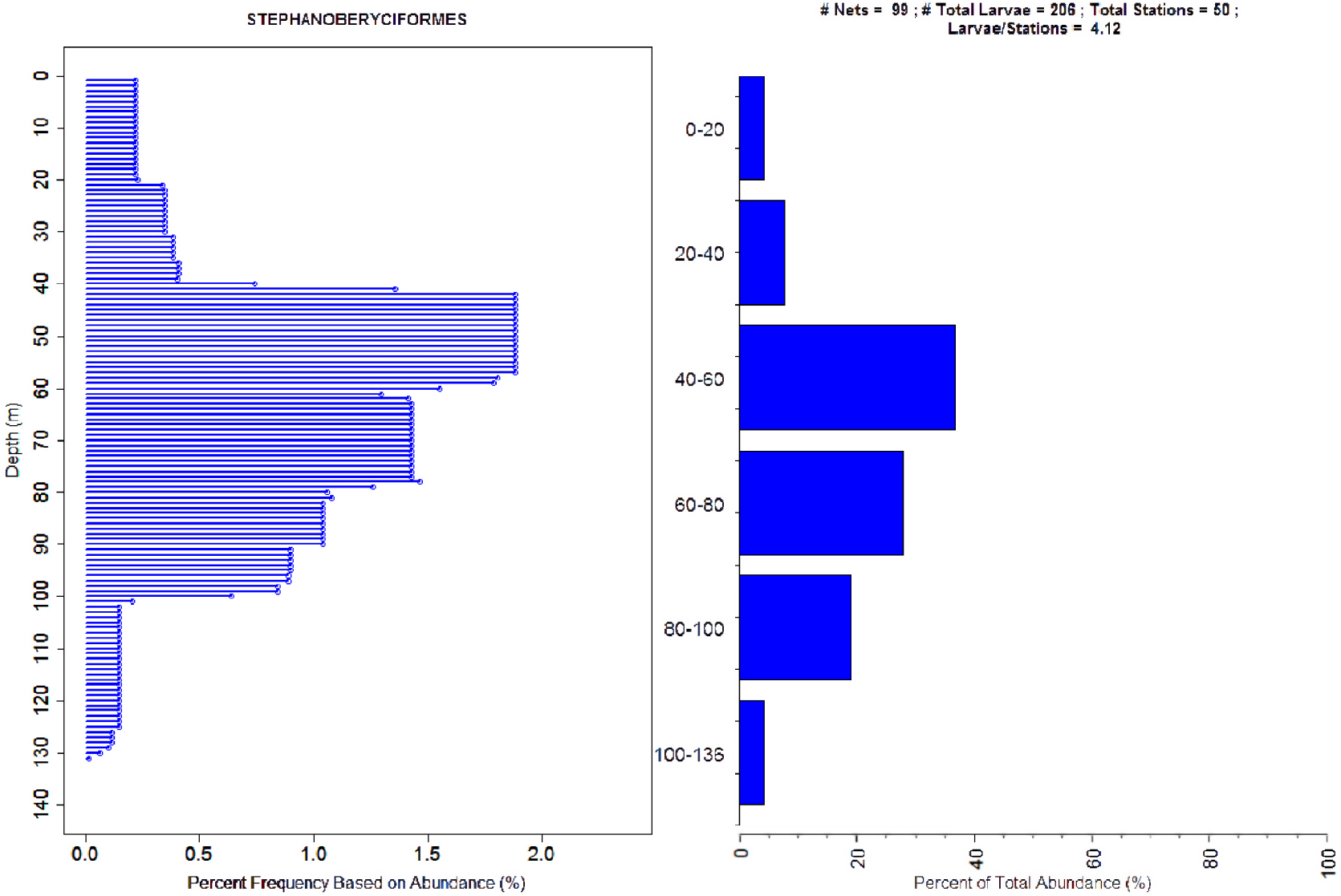
PLEURONECTIFORMES



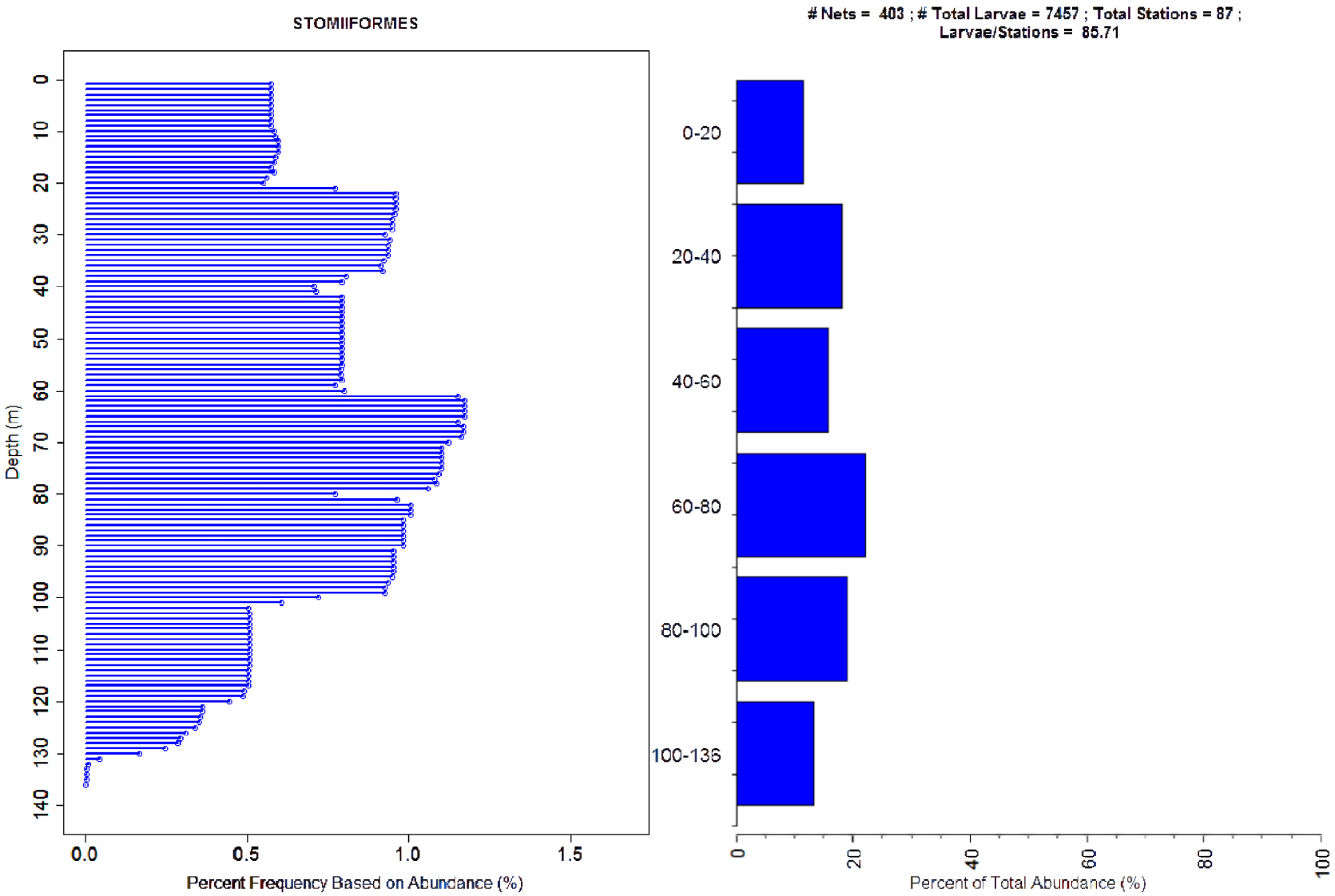
POLYMIXIIFORMES



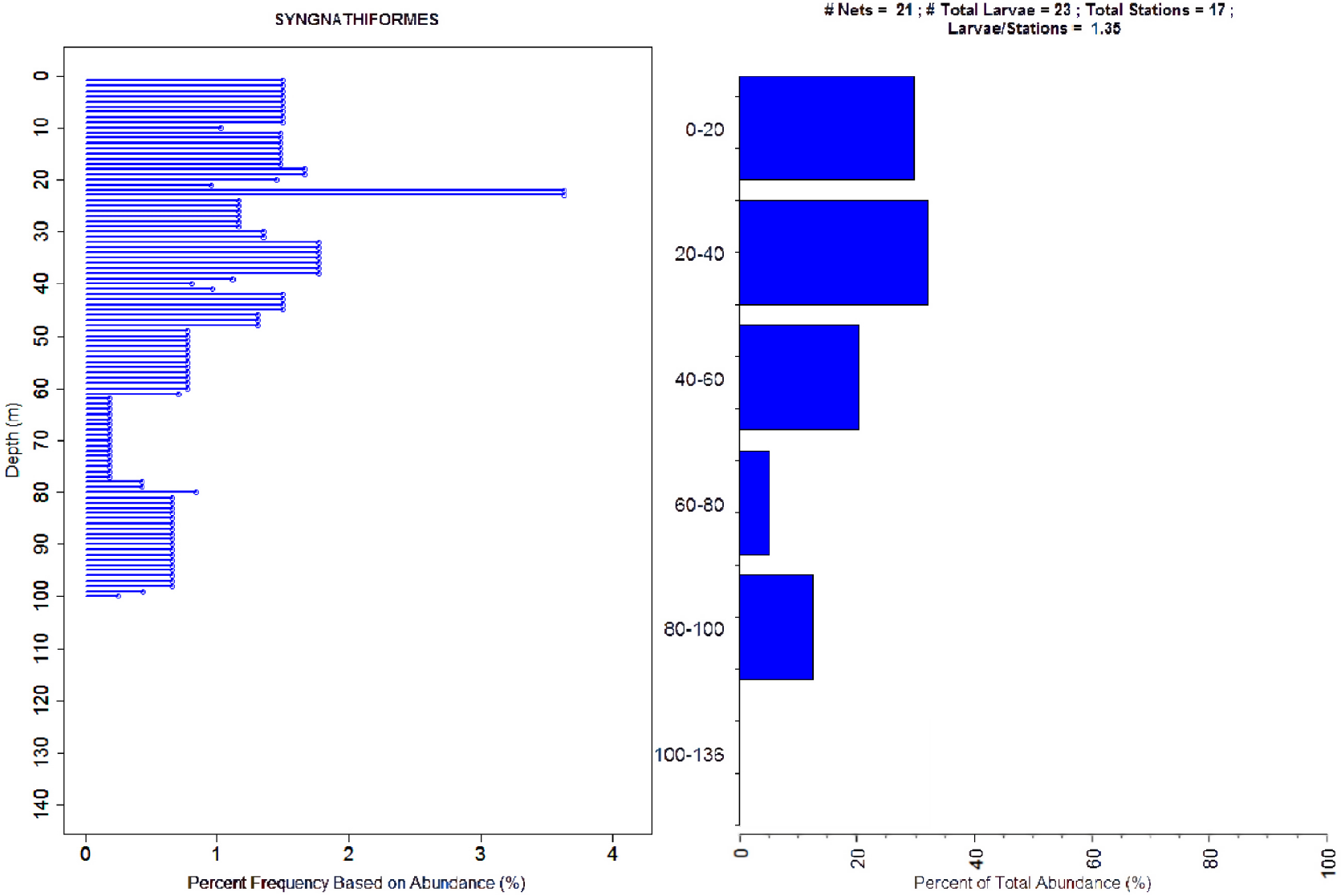
SCORPAENIFORMES



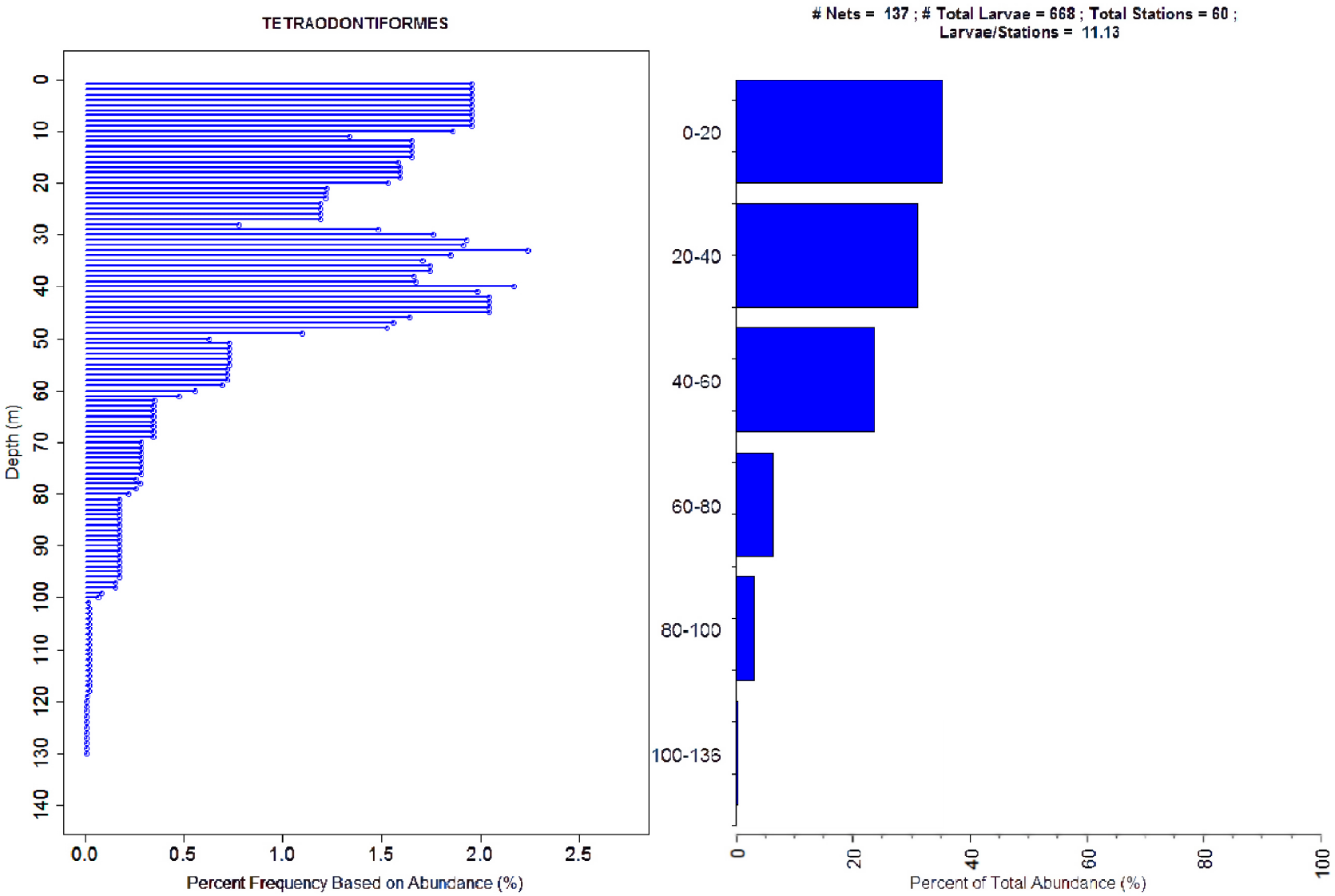
STEPHANOBERYCIFORMES



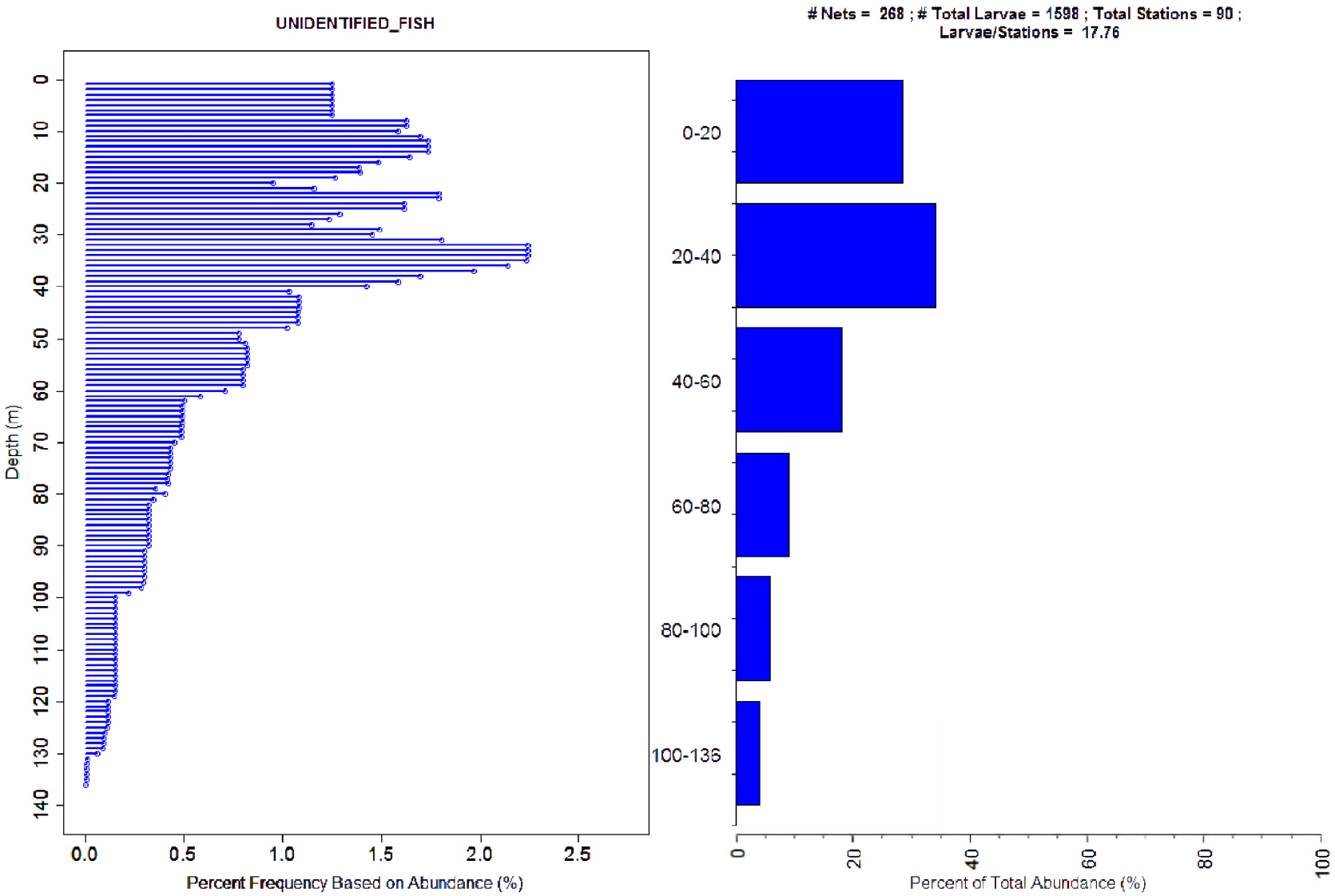
STOMIIFORMES



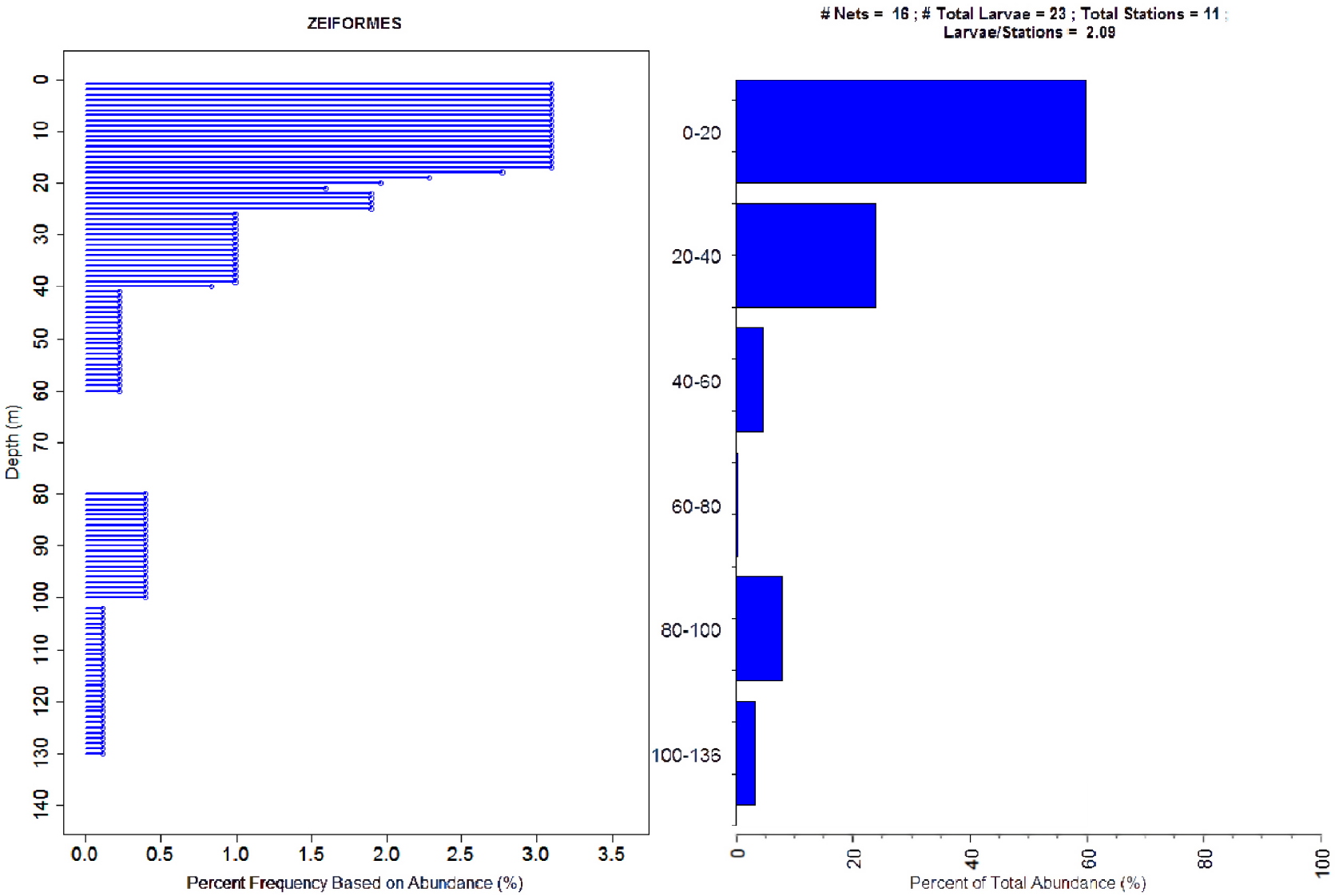
SYNGNATHIFORMES



TETRAODONTIFORMES



UNIDENTIFIED_FISH


ZEIFORMES
Nets = 16 ; # Total Larvae = 23 ; Total Stations = 11 ;
Larvae/Stations = 2.09
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Percent Frequency Based on Abundance (%)
0-20
20-40
40-60
60-80
80-100
100-136
0
20
40
60
80
100
Percent of Total Abundance (%)

ZEIFORMES

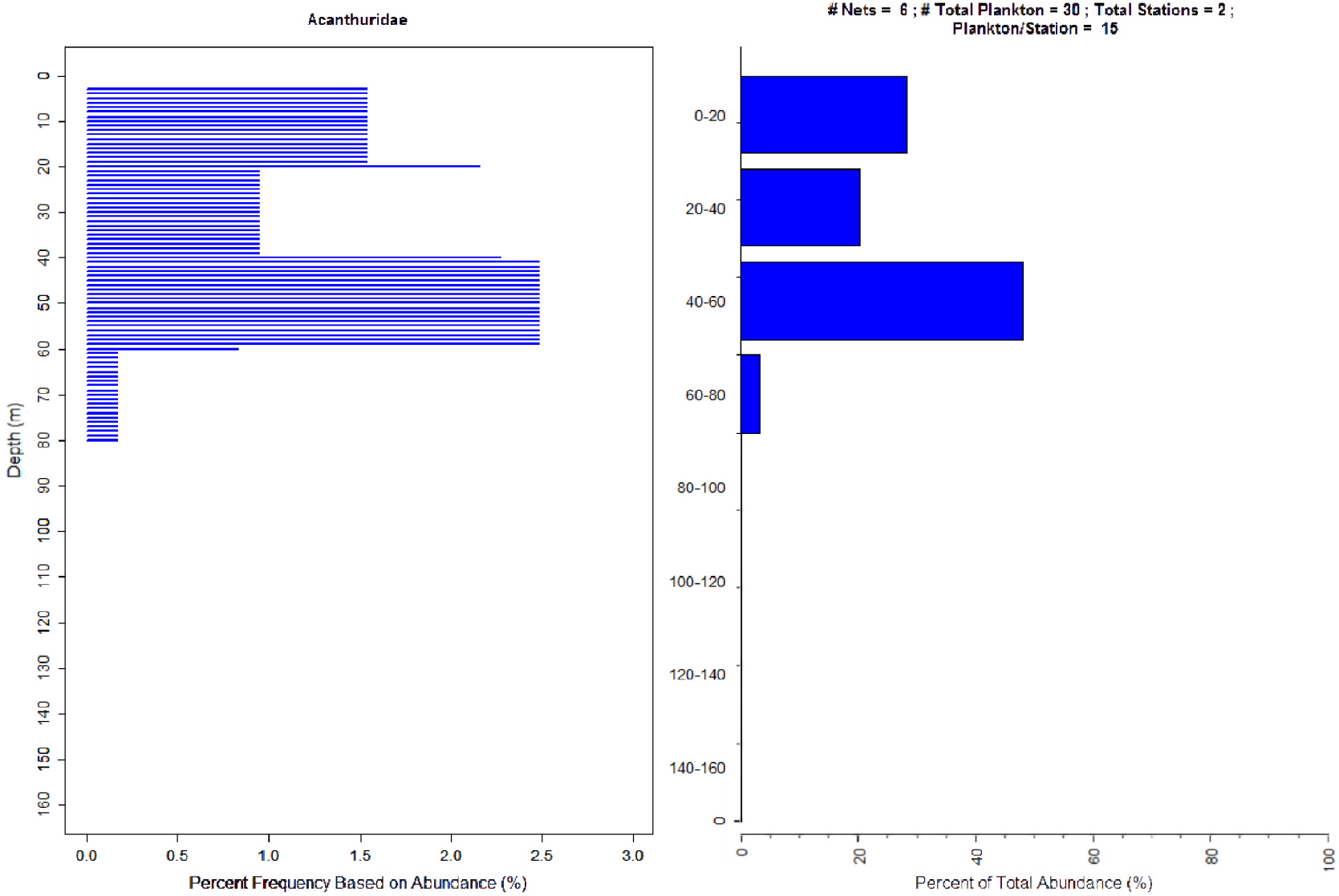
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

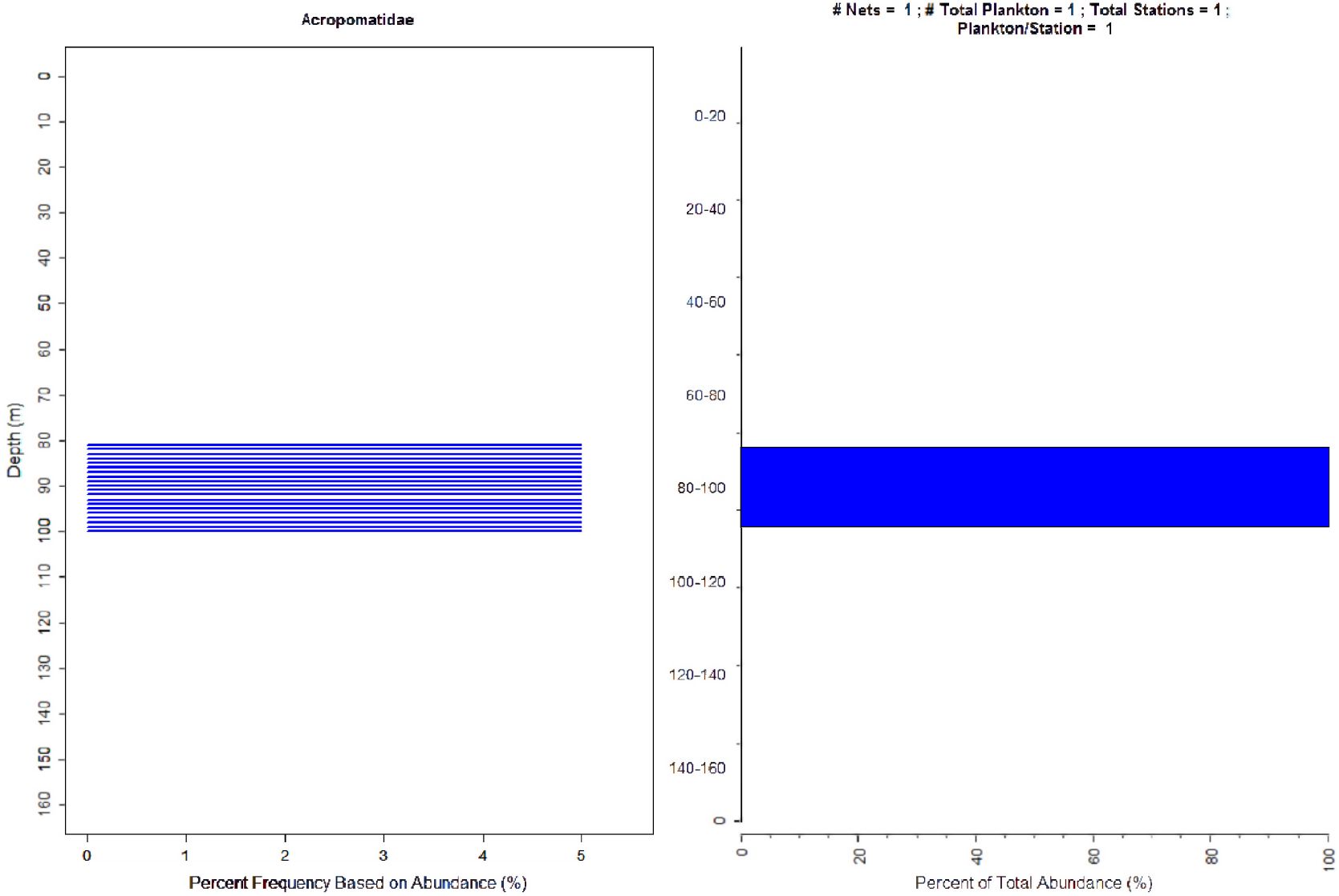
Appendix D2 – NRDA Tier1A Shallow MOC1 Plots Family Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

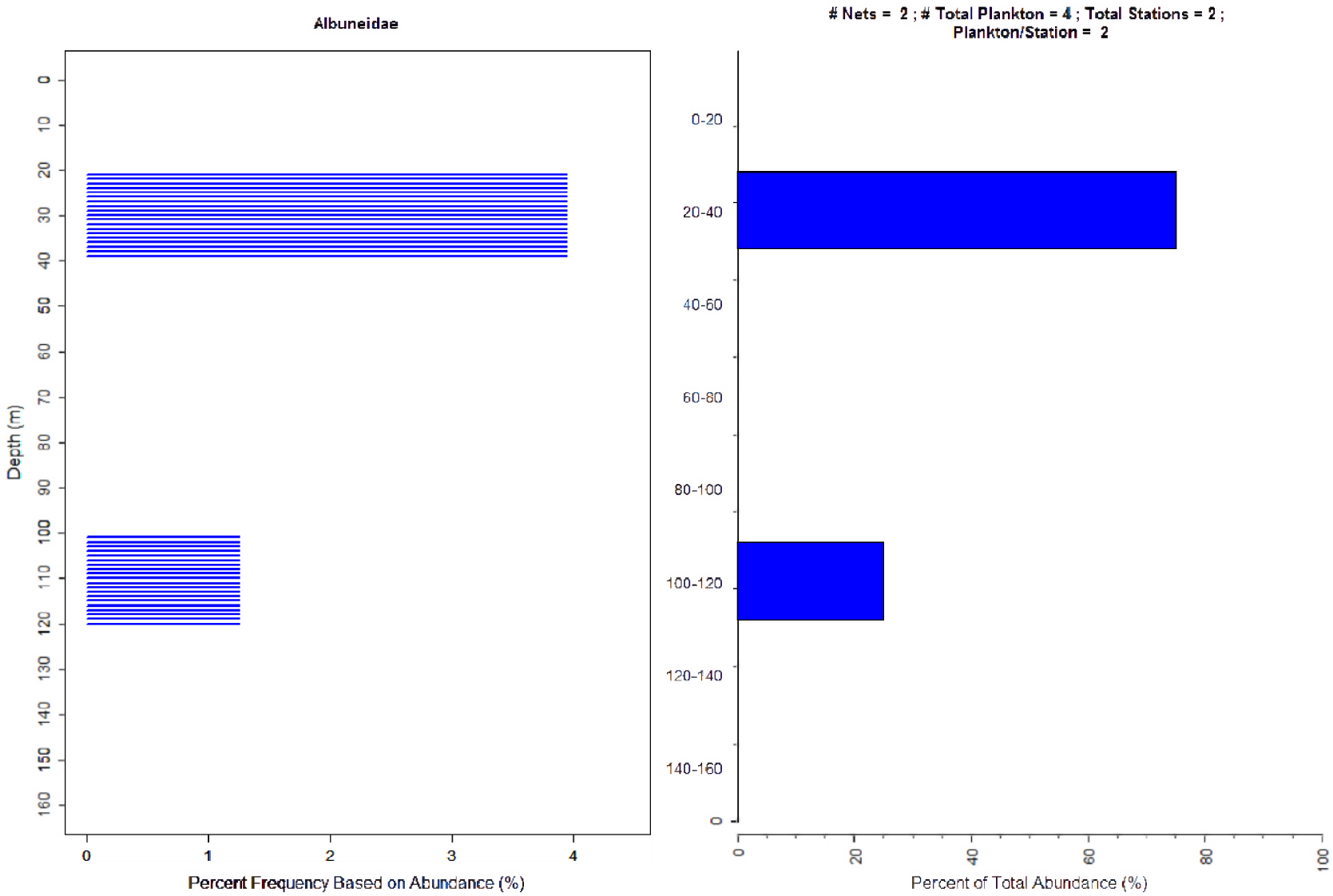
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



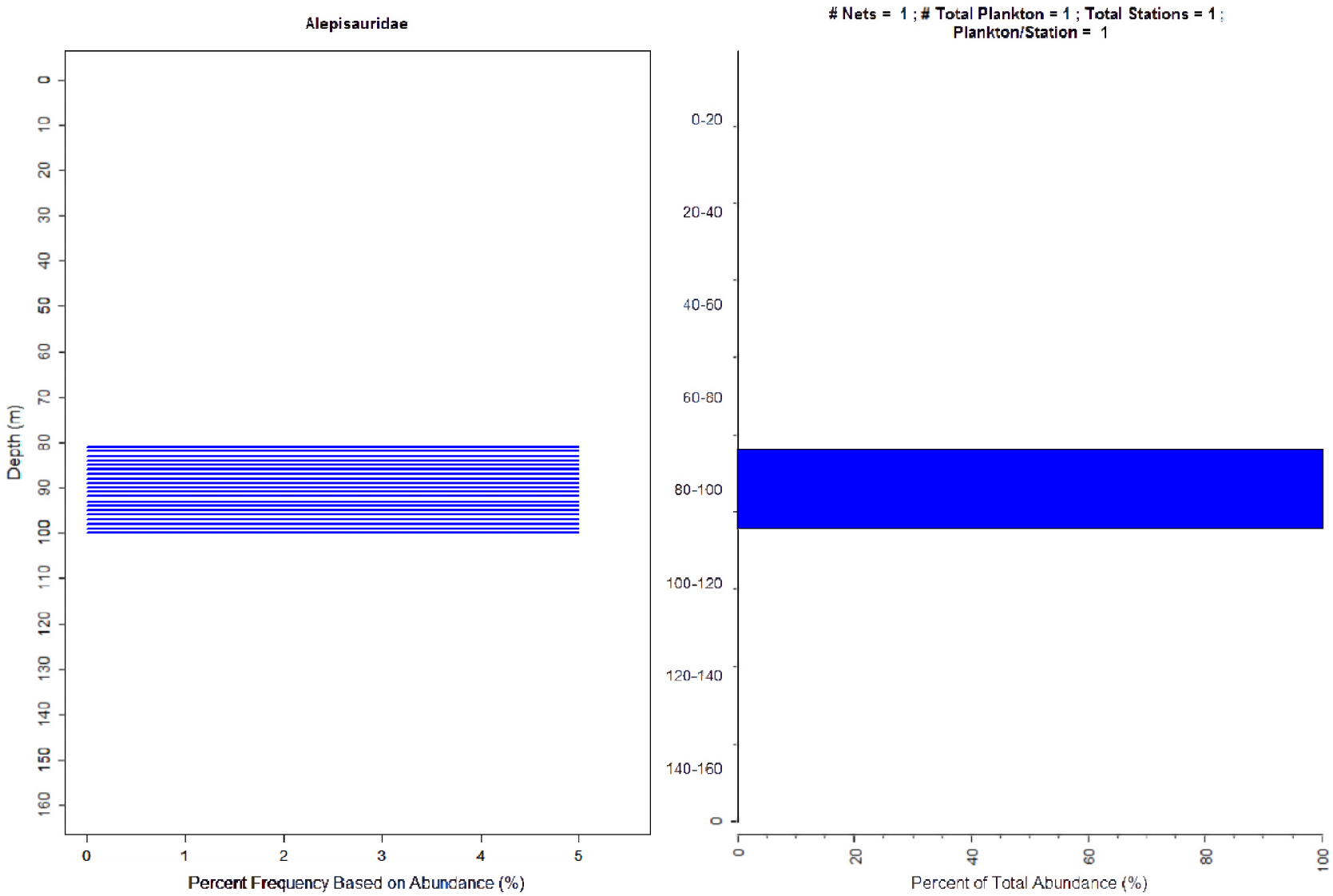
Acanthuridae - Shallow



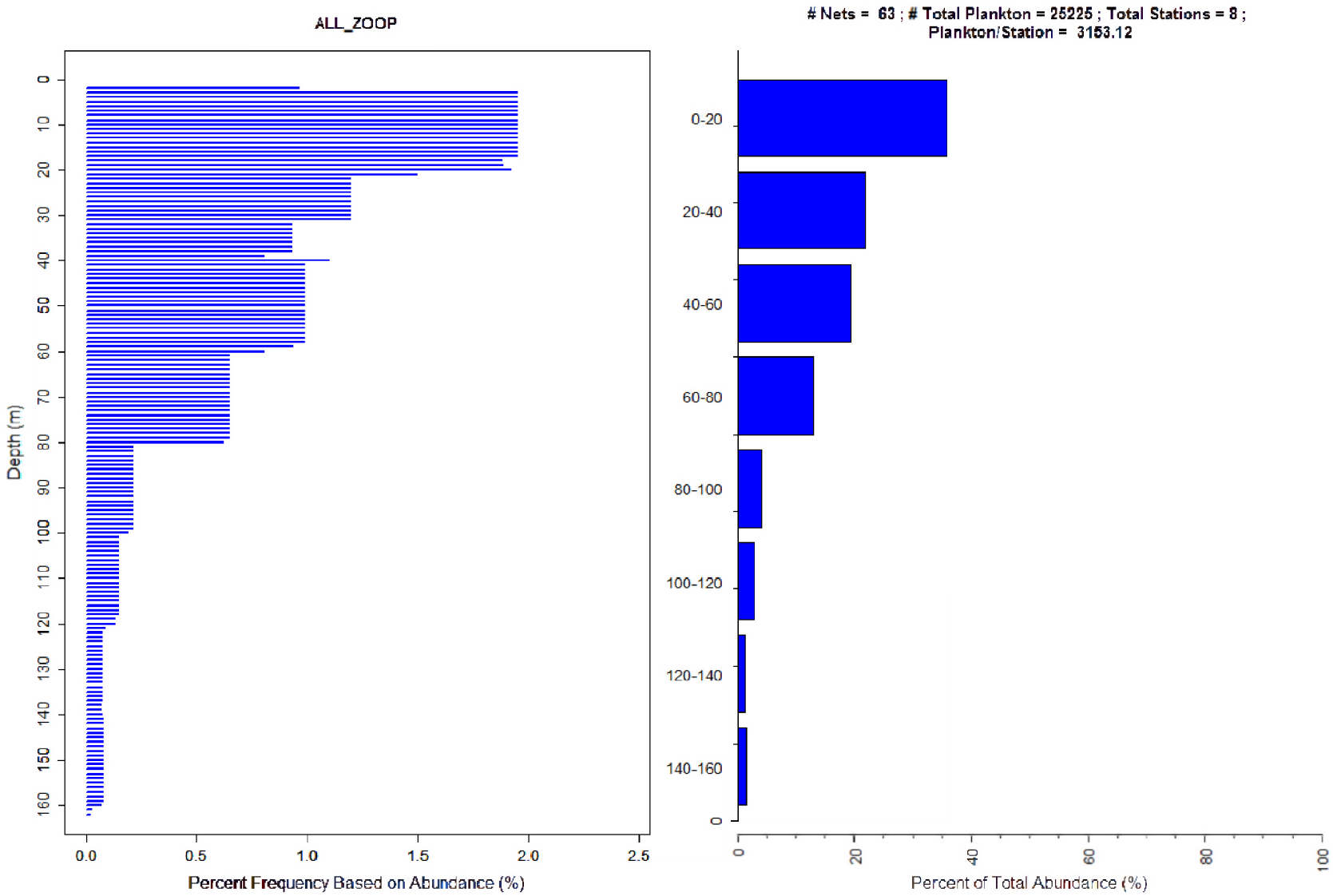
Acropomatidae - Shallow



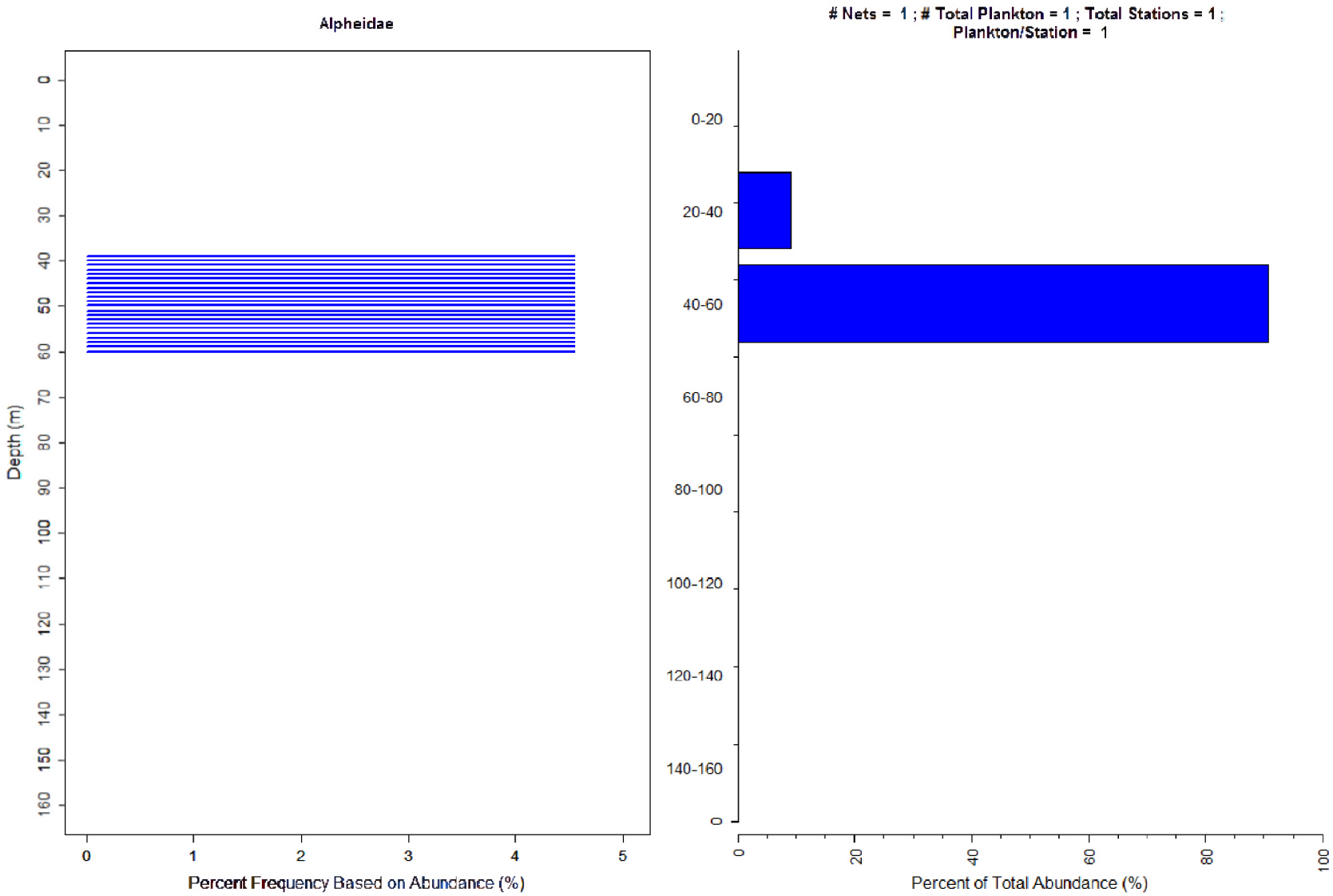
Albuneidae - Shallow



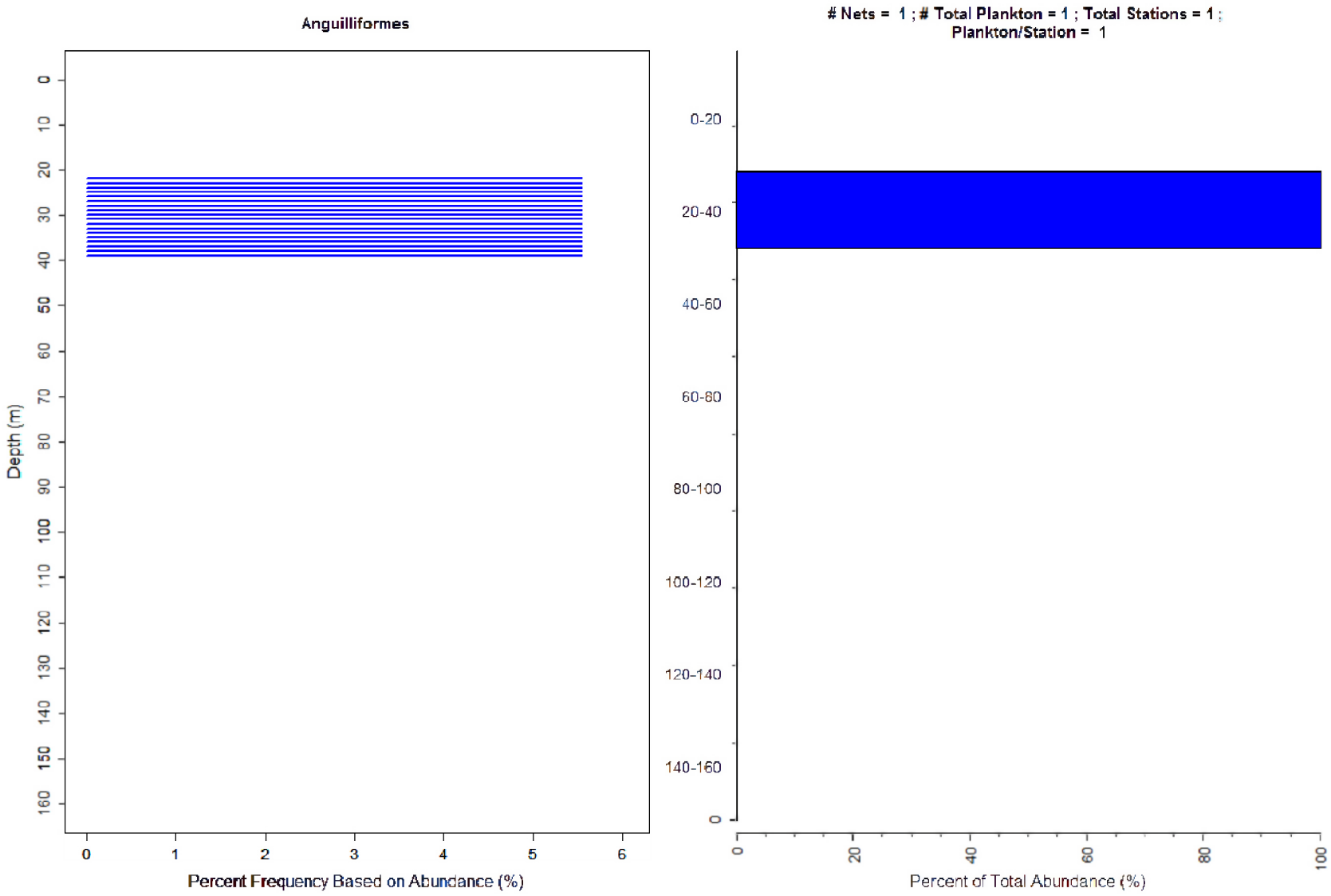
Alepisauridae - Shallow



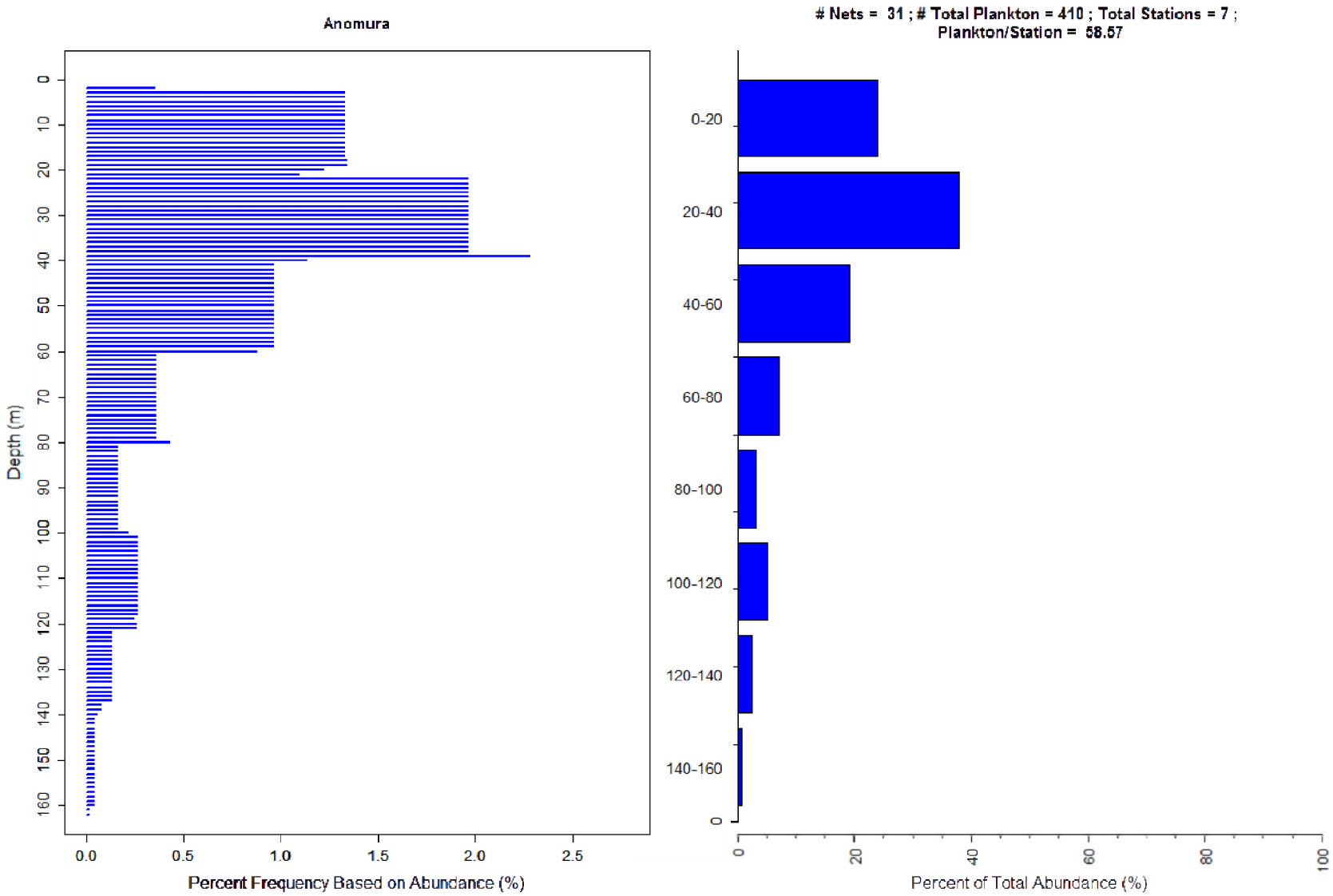
ALL_ZOOP - Shallow



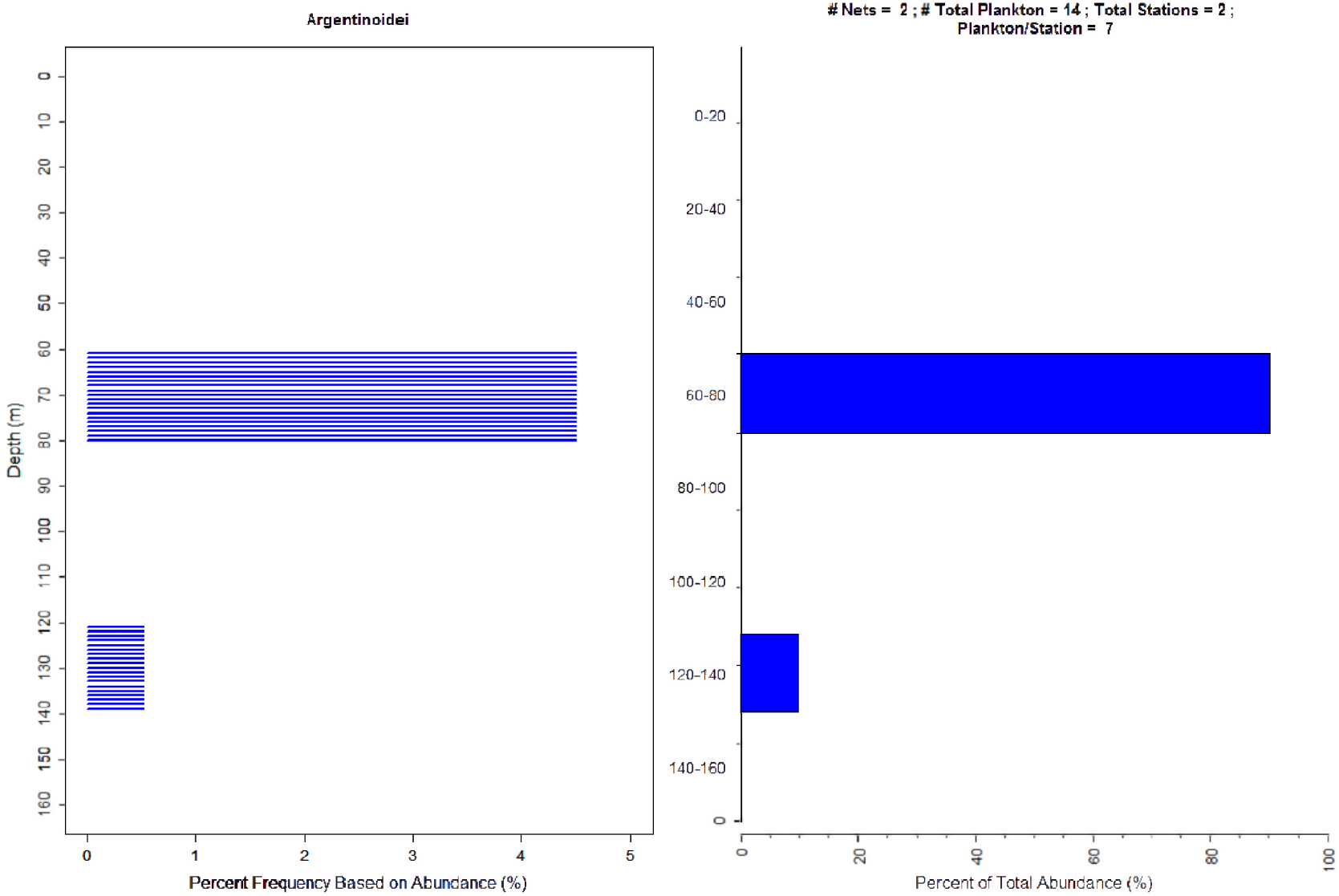
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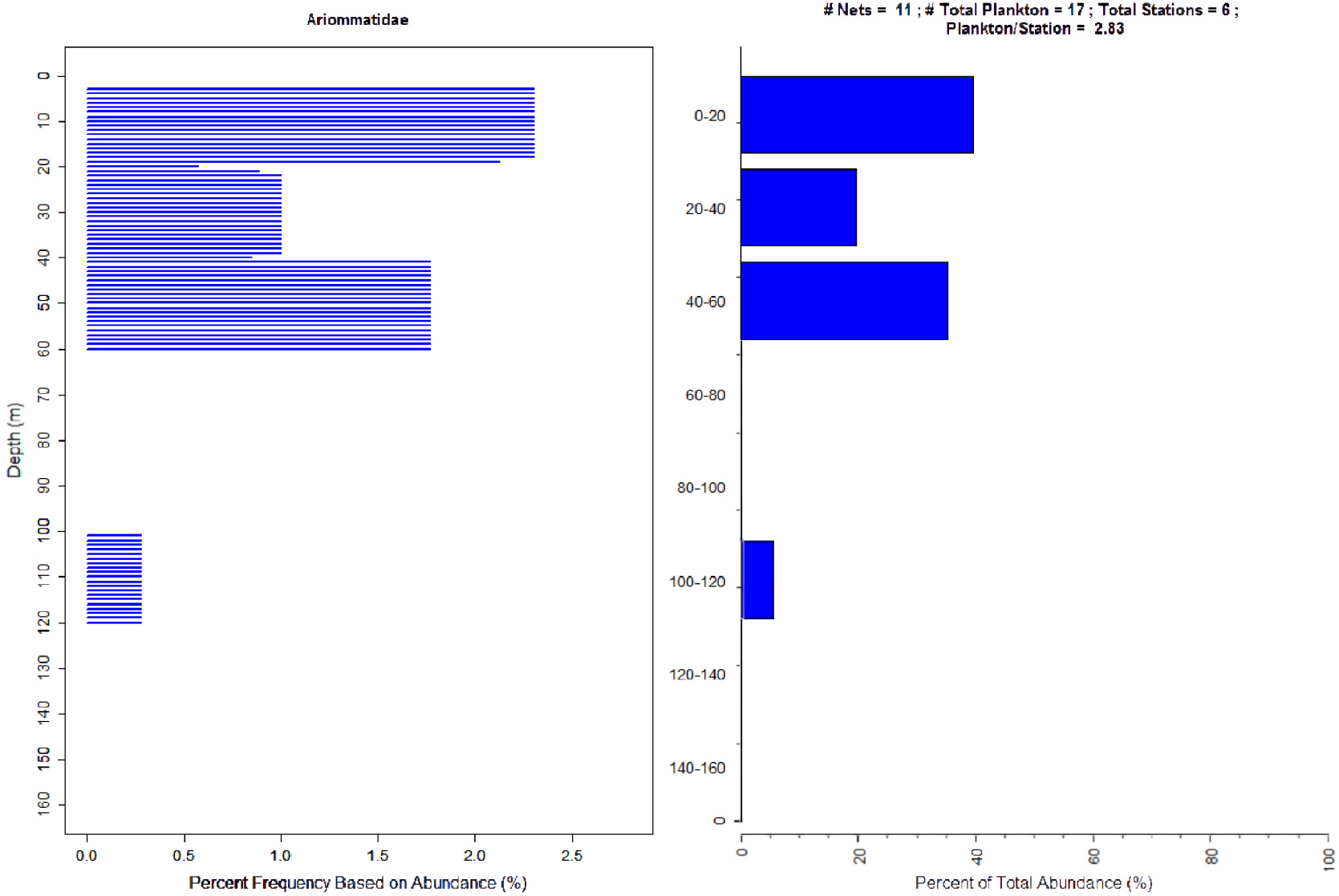
Anguilliformes - Shallow



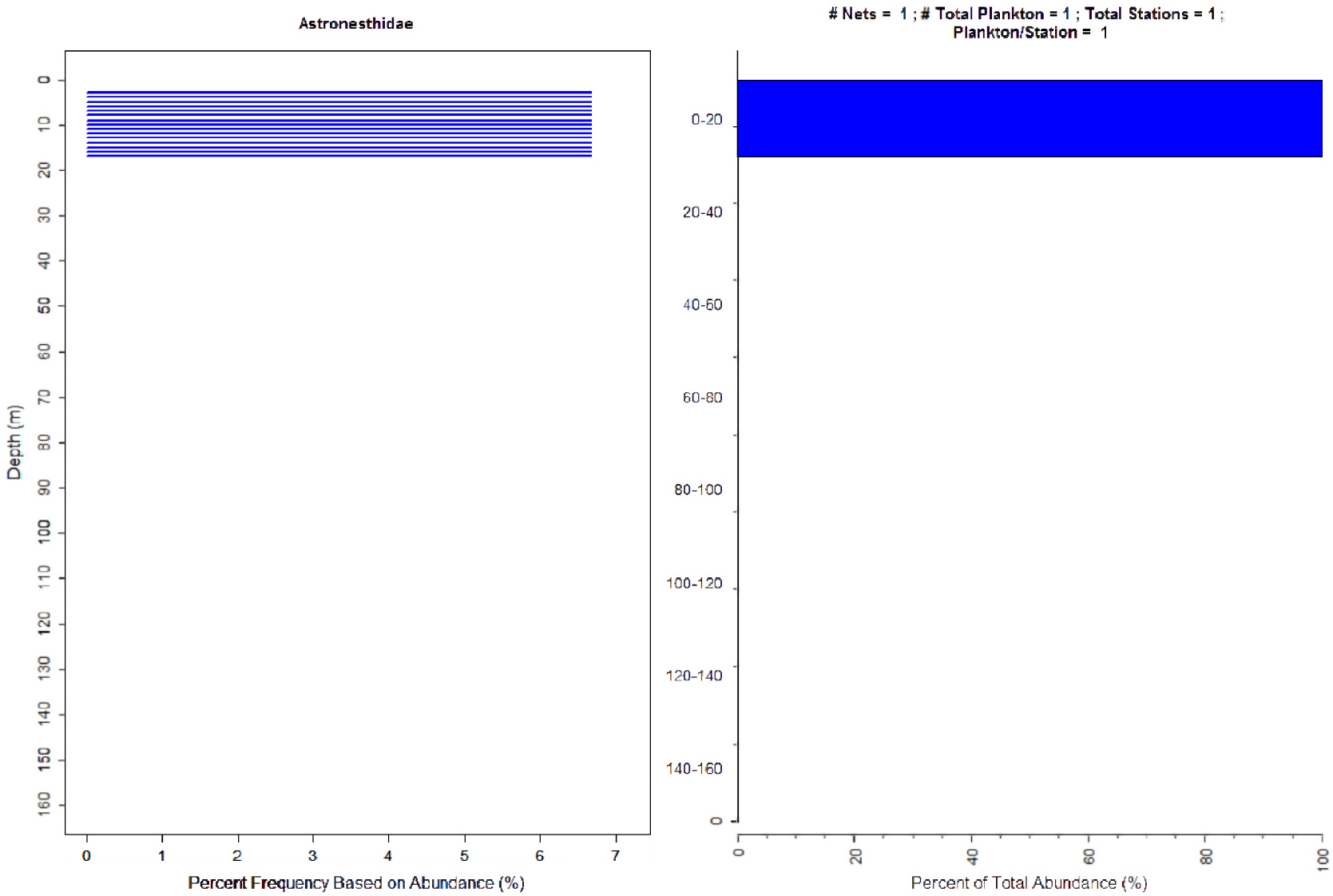
Anomura - Shallow



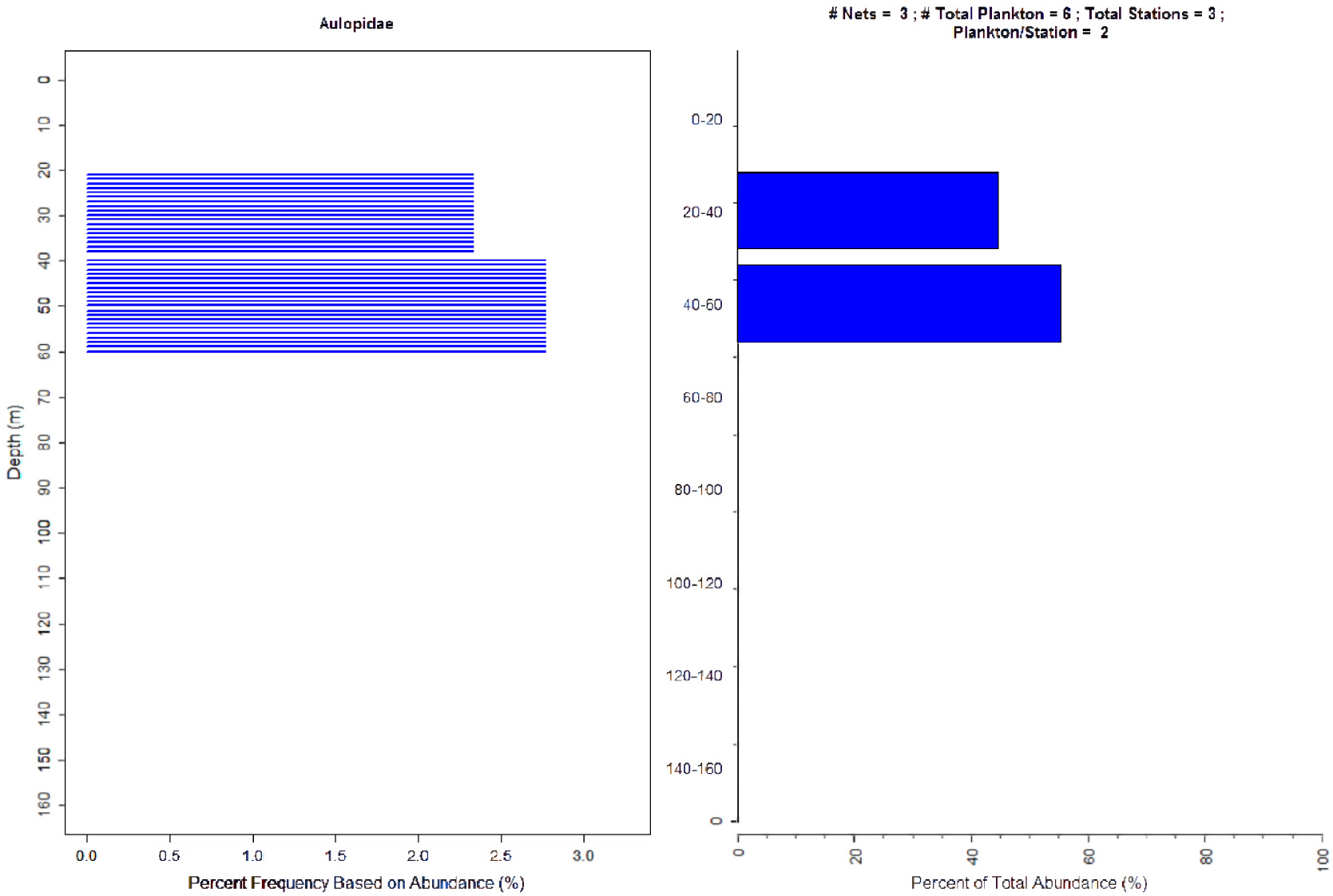
Argentinoidei - Shallow



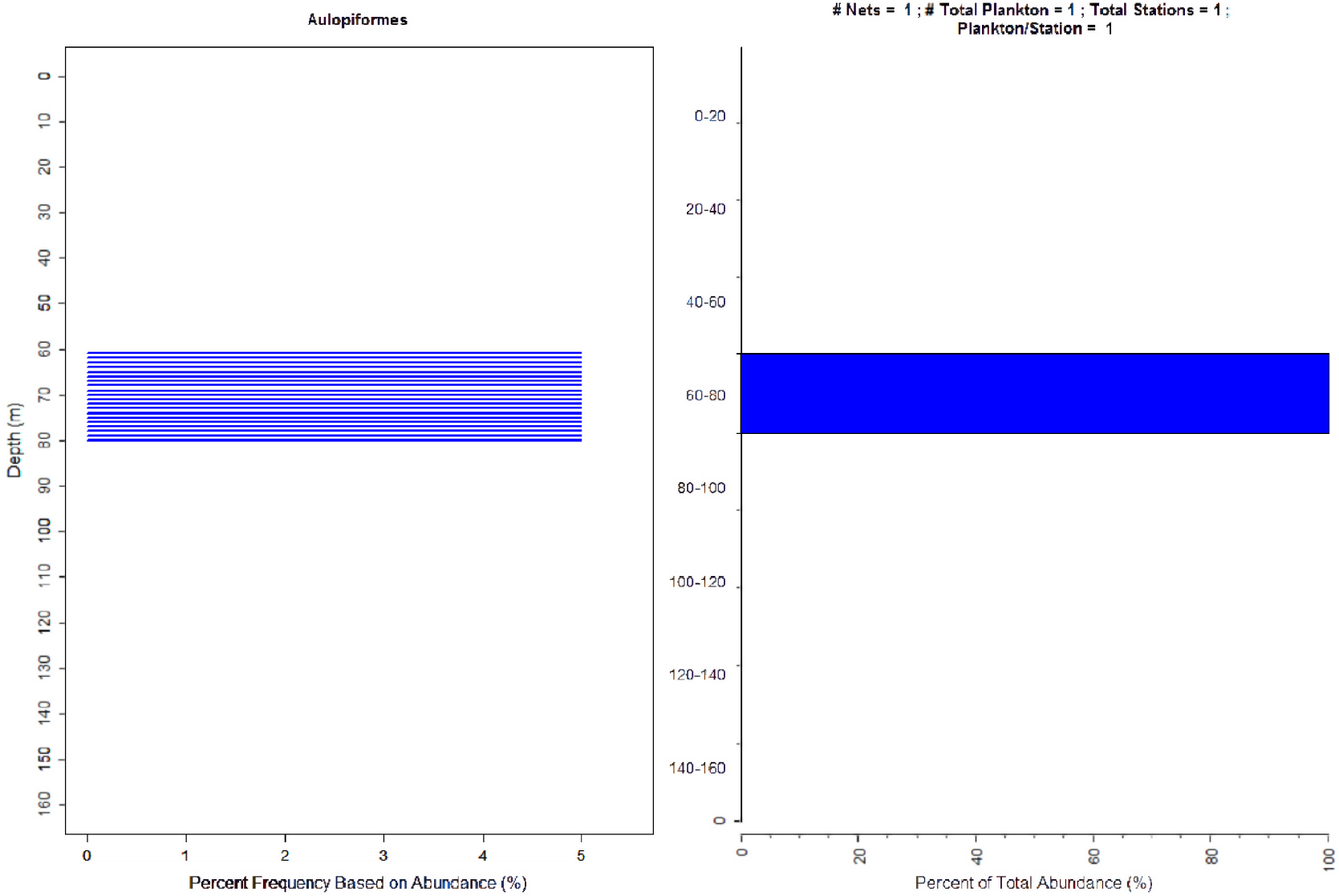
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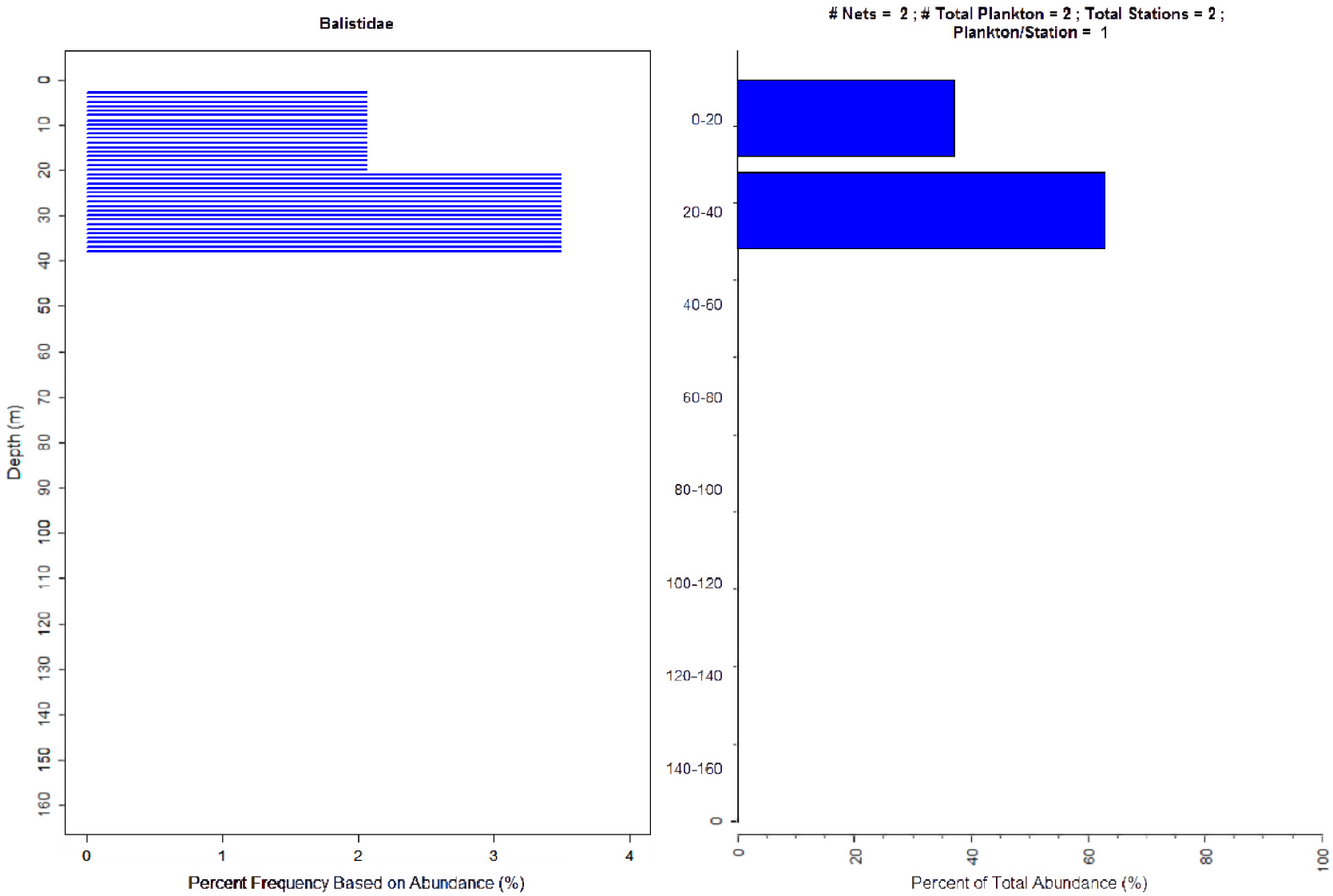
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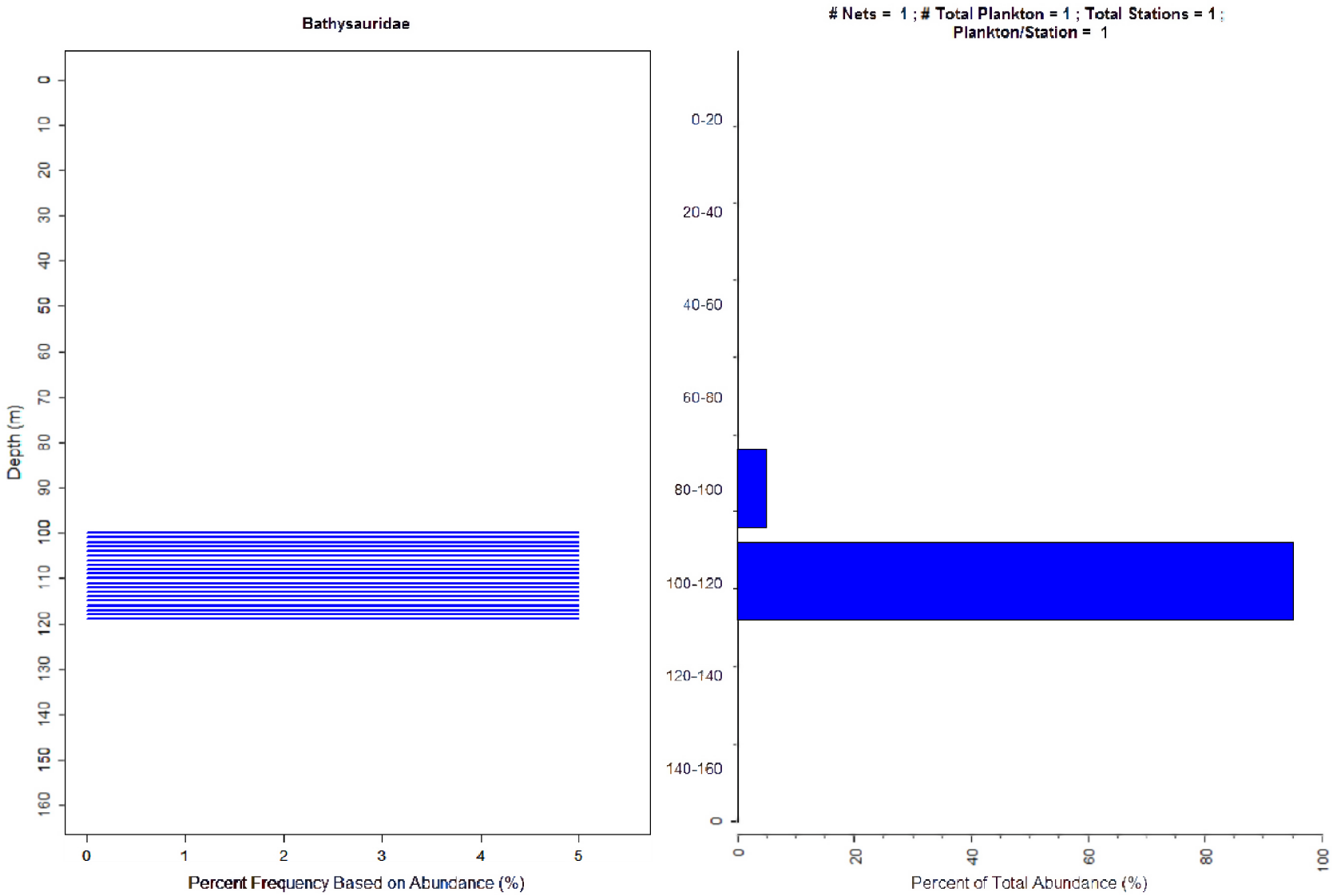
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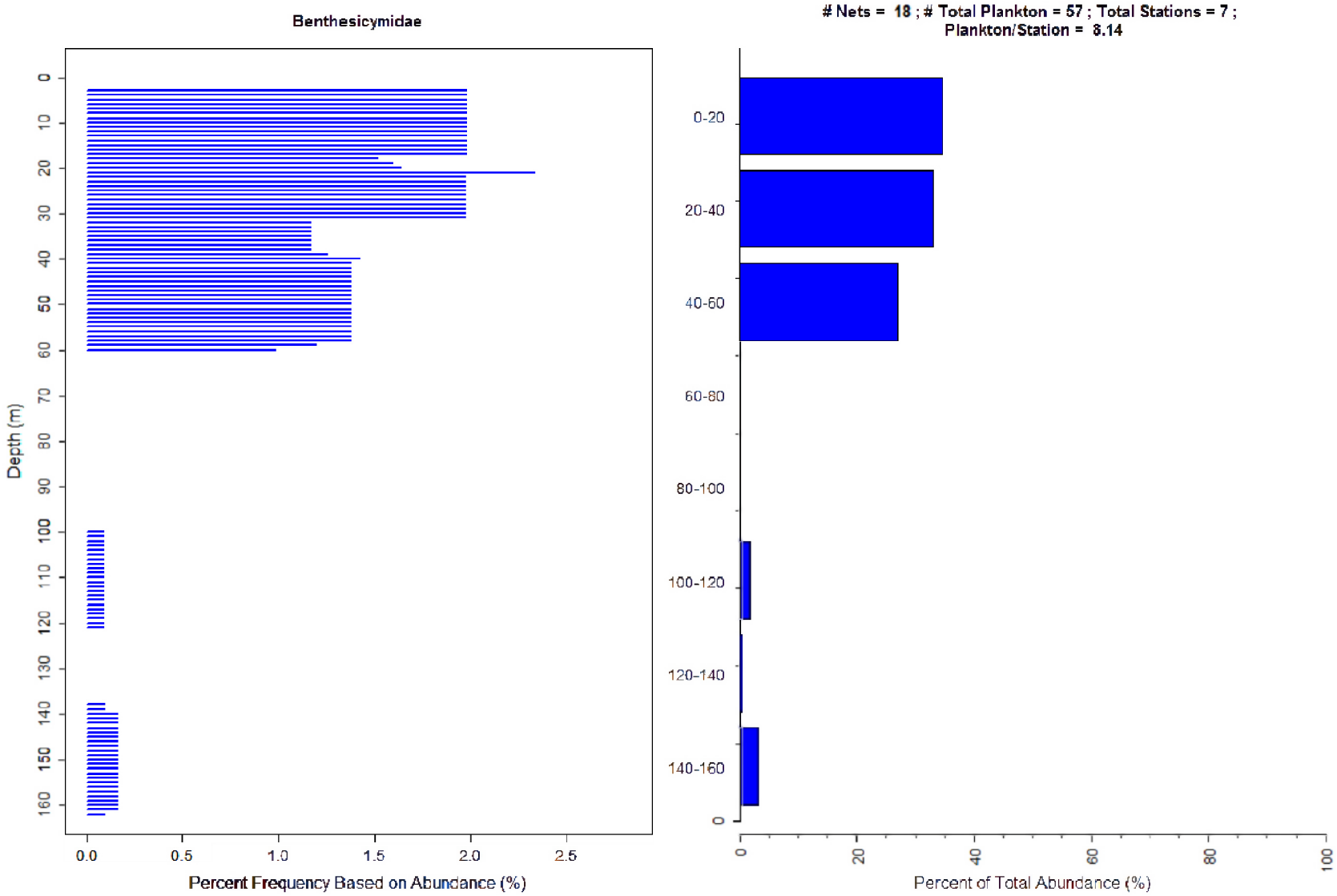
Aulopiformes - Shallow



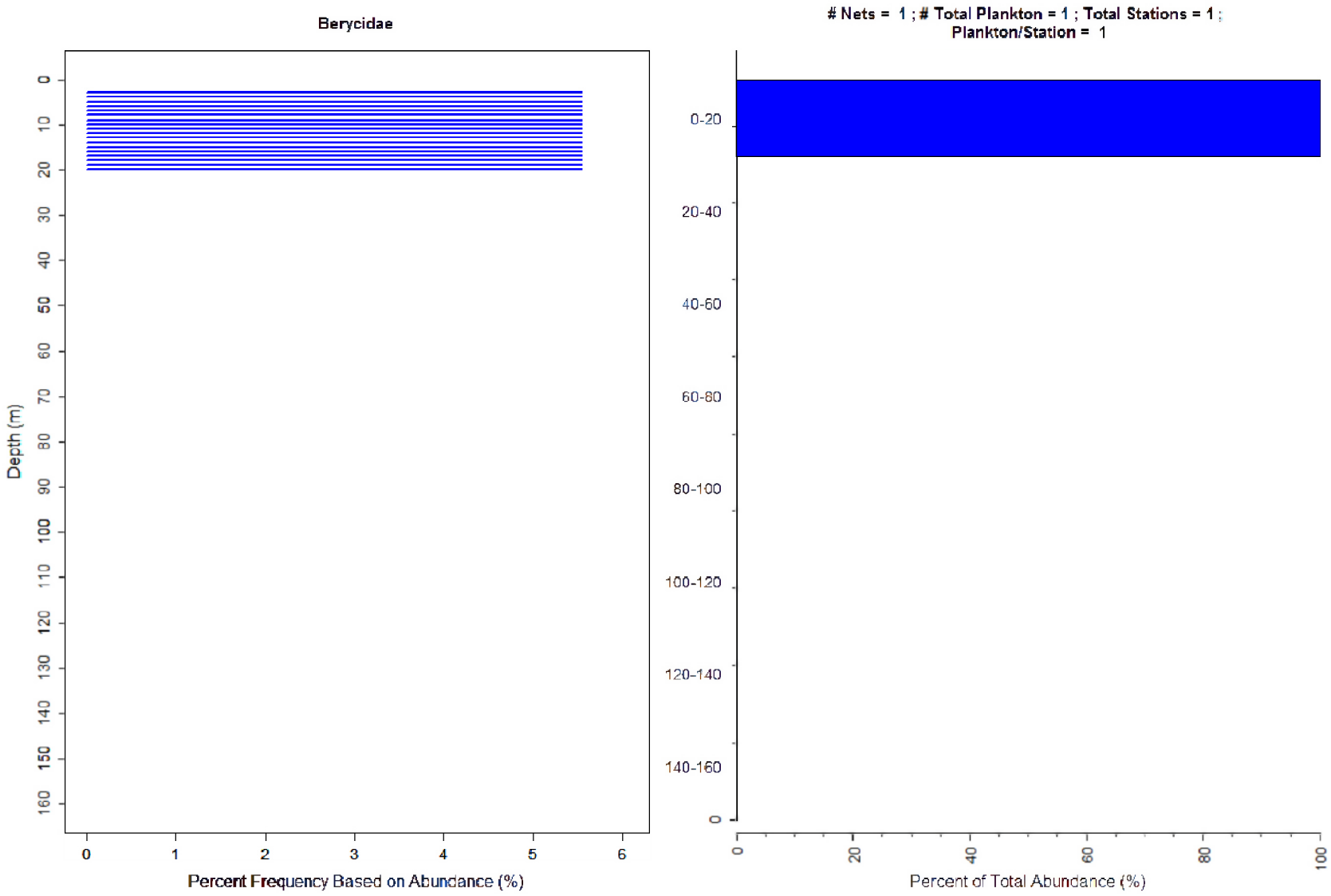
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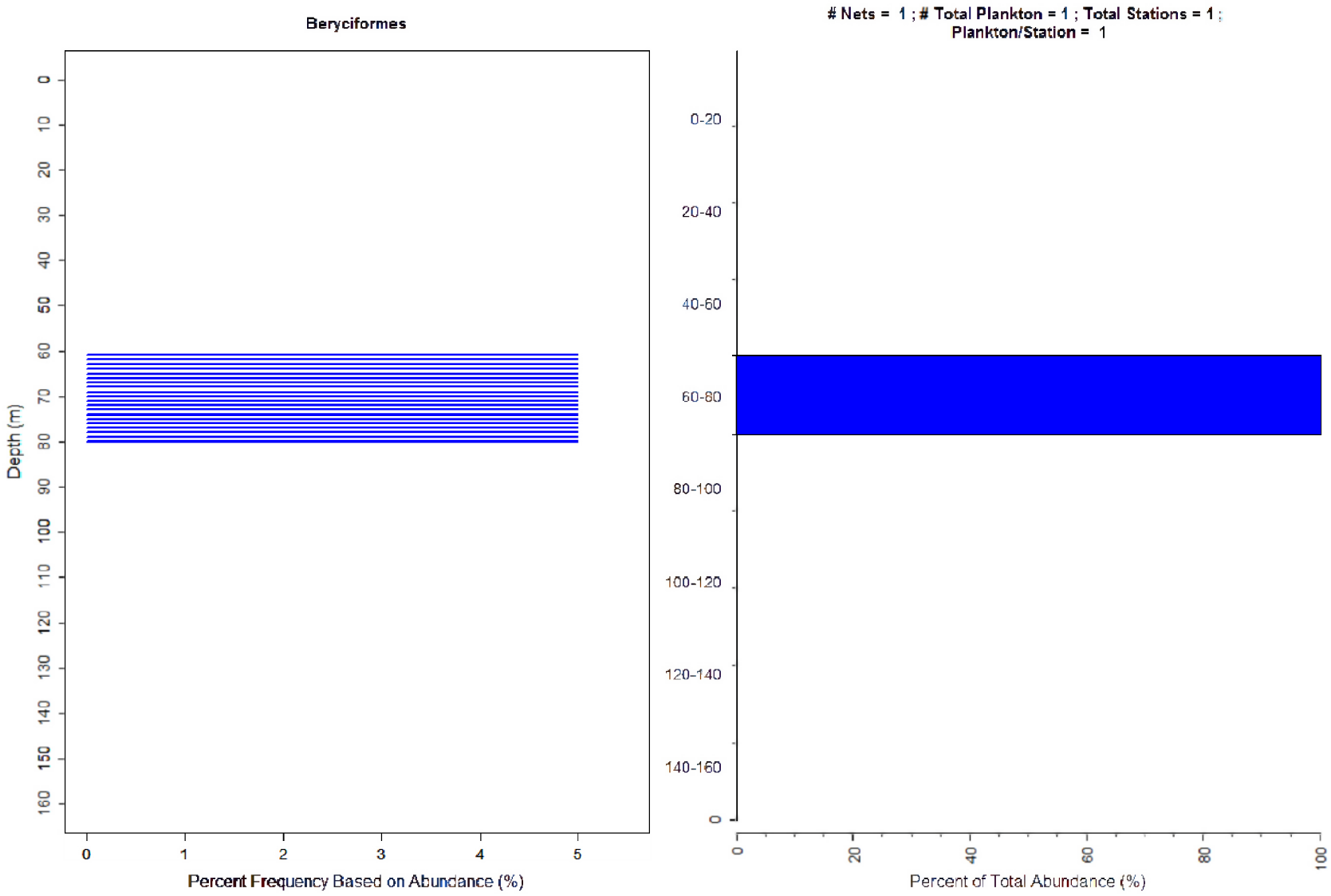
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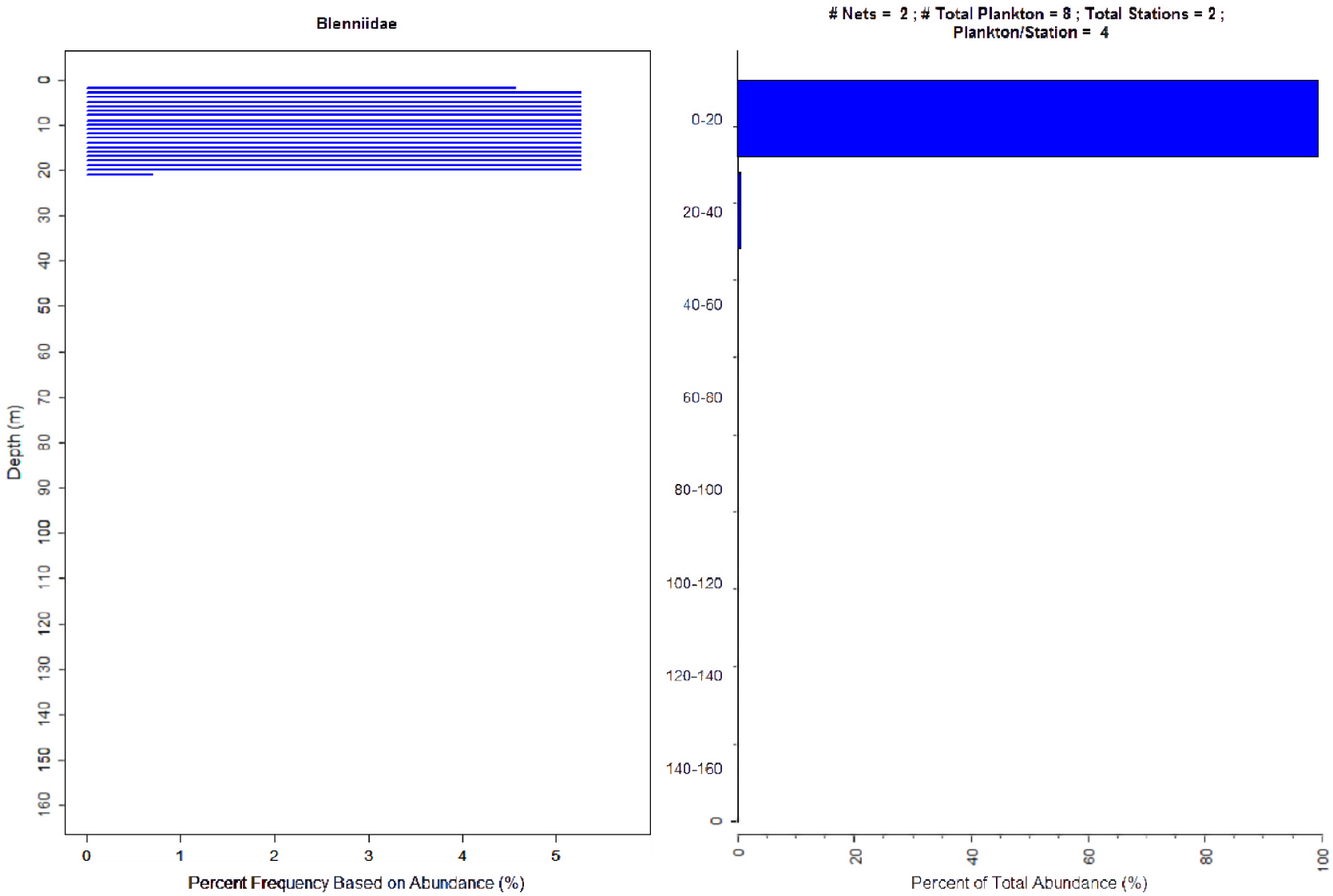
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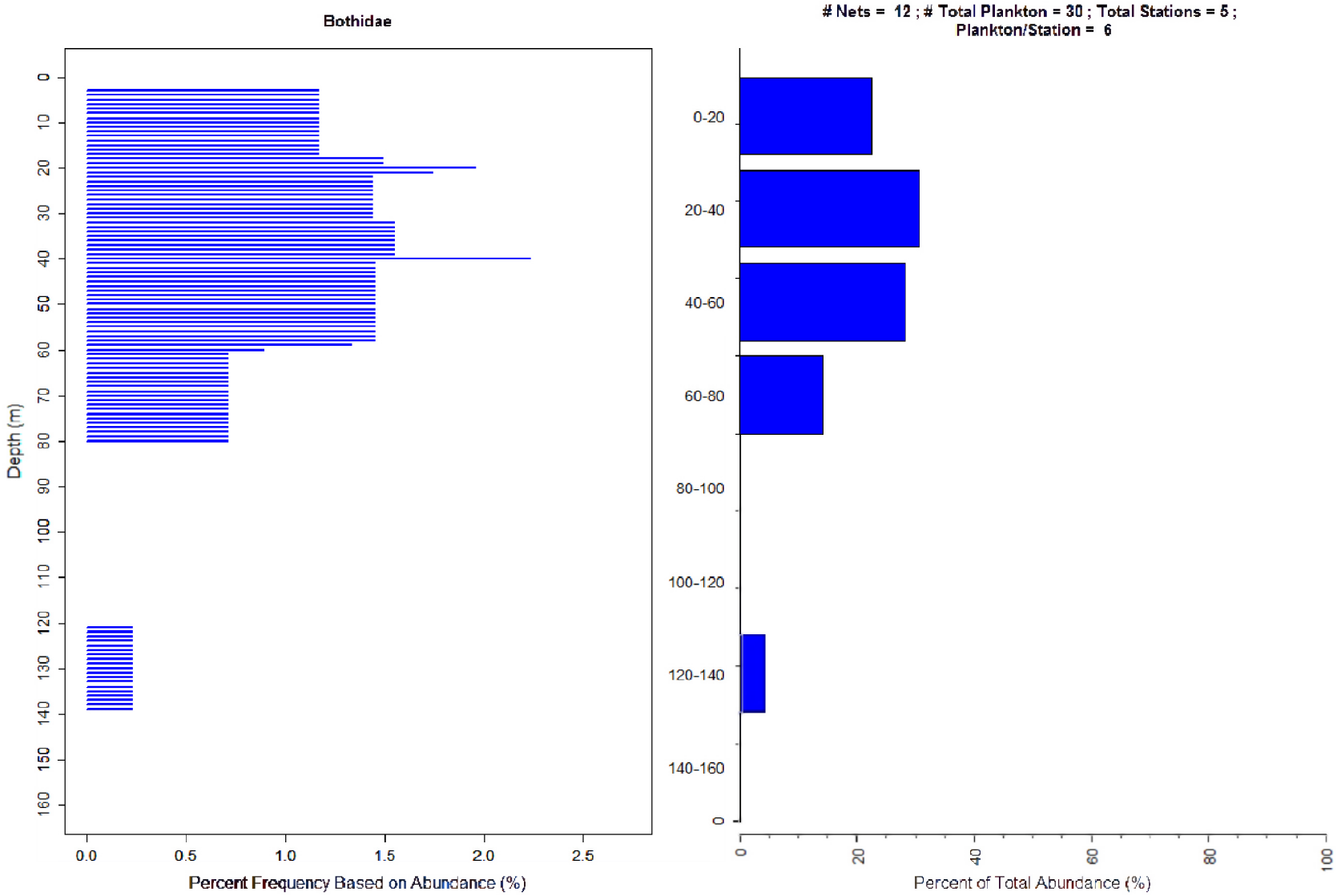
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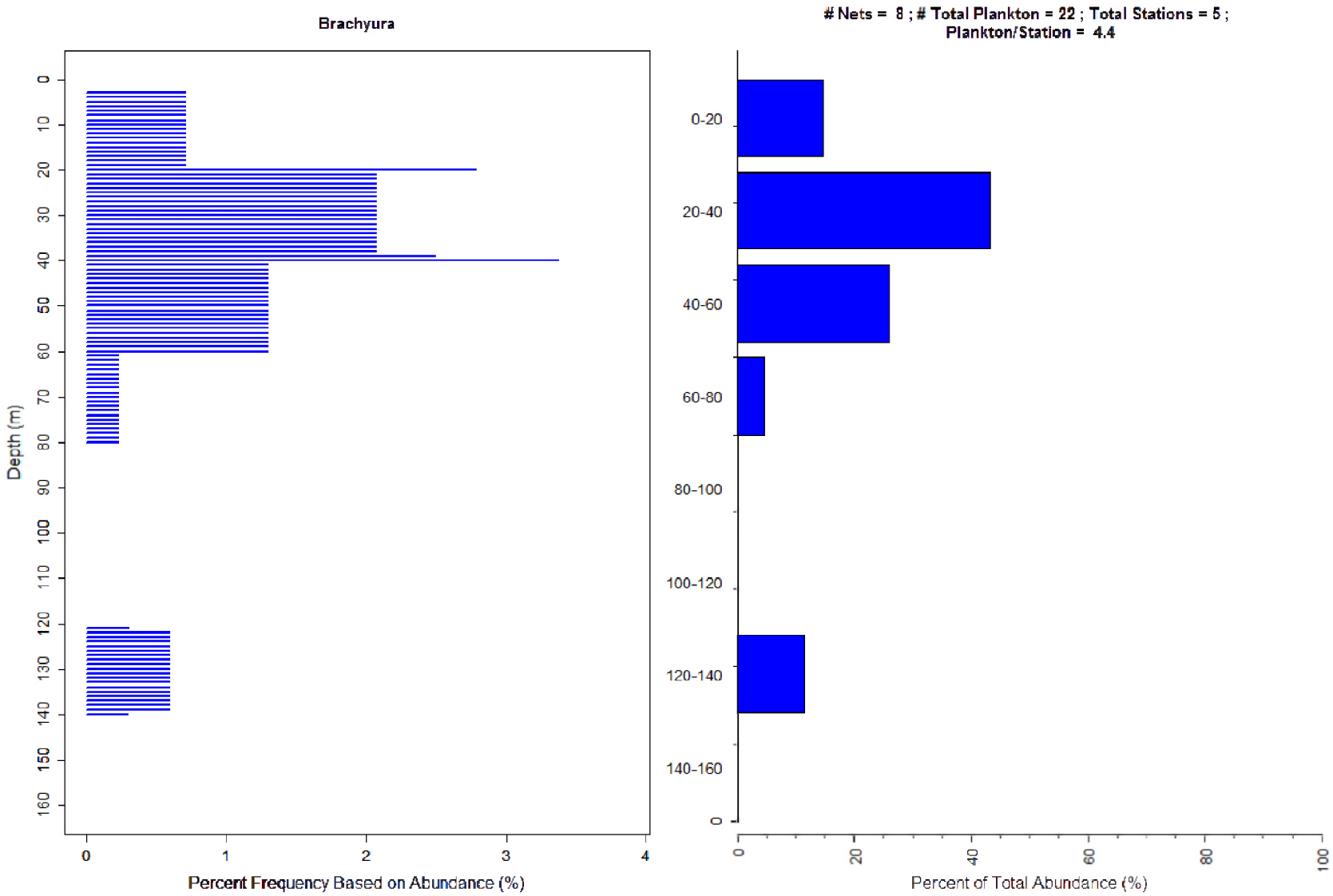
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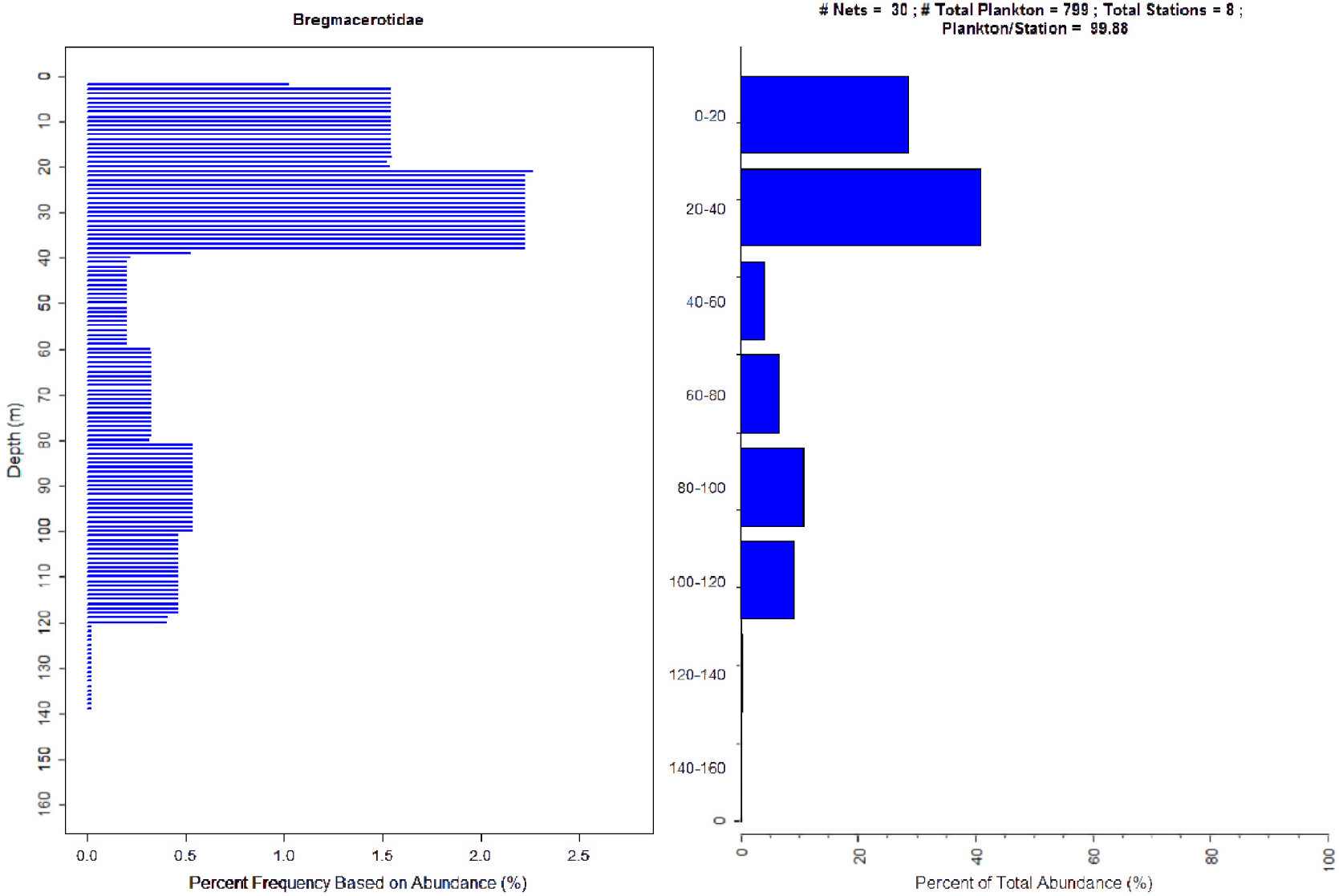
Blenniidae - Shallow



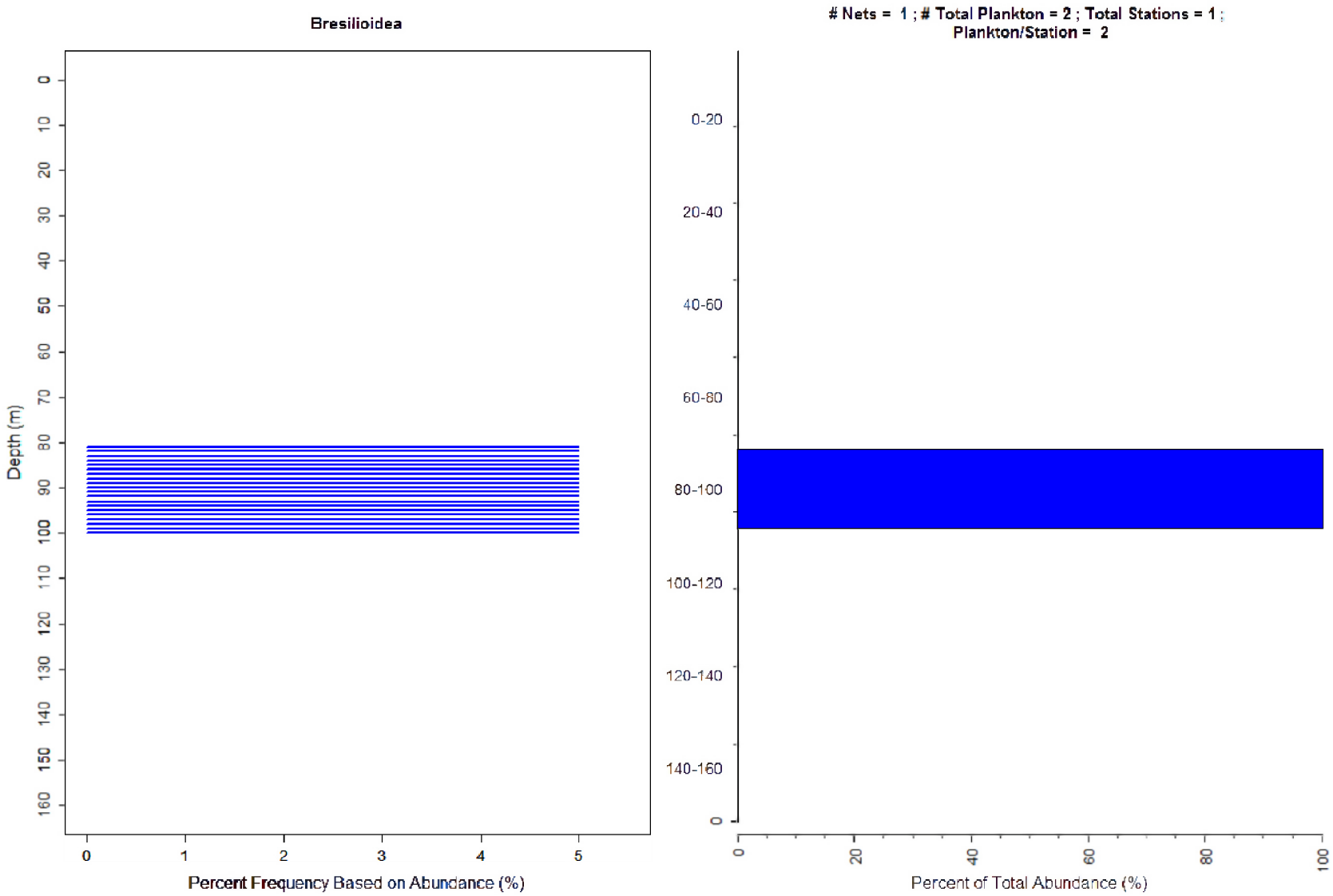
Bothidae - Shallow



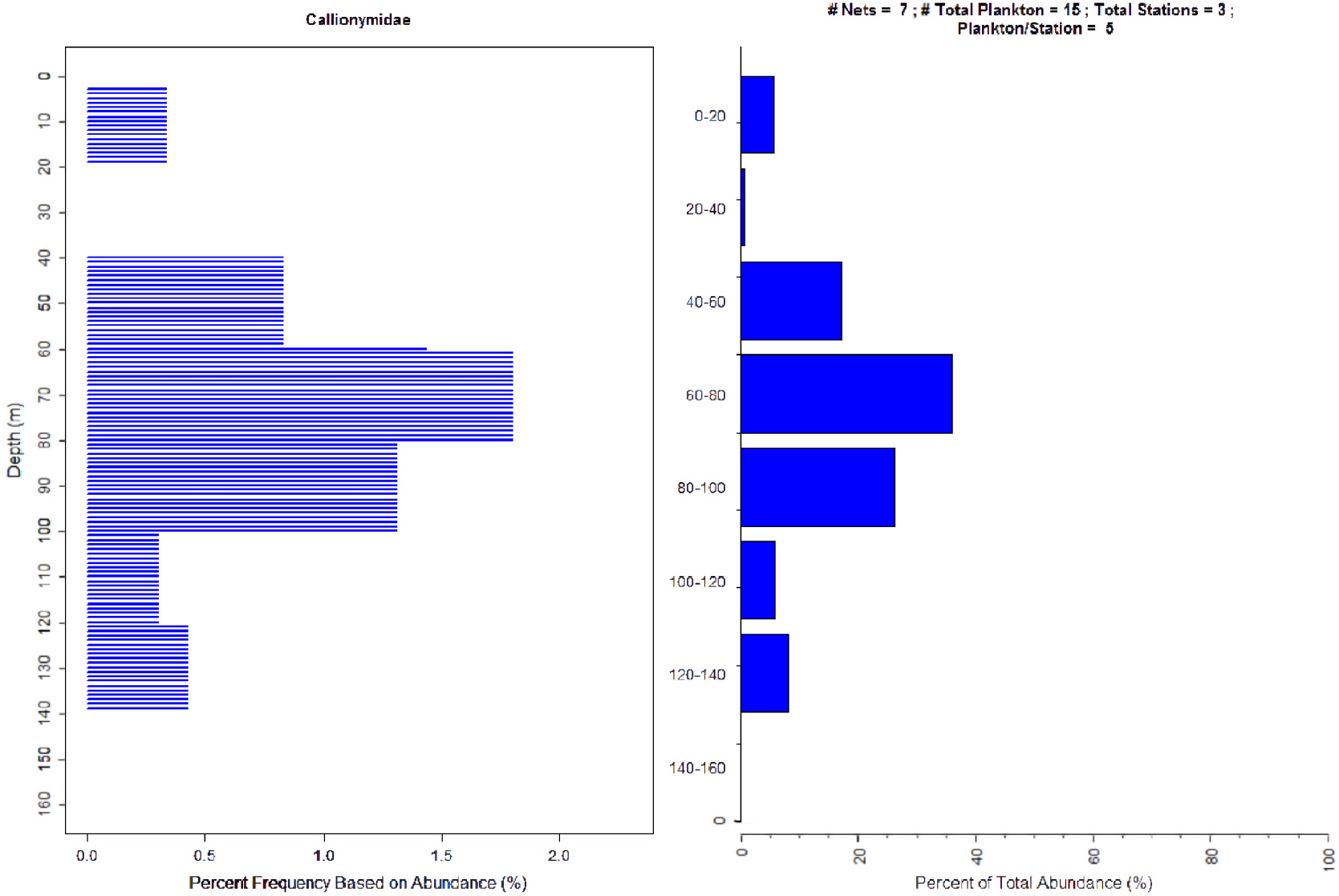
Brachyura - Shallow



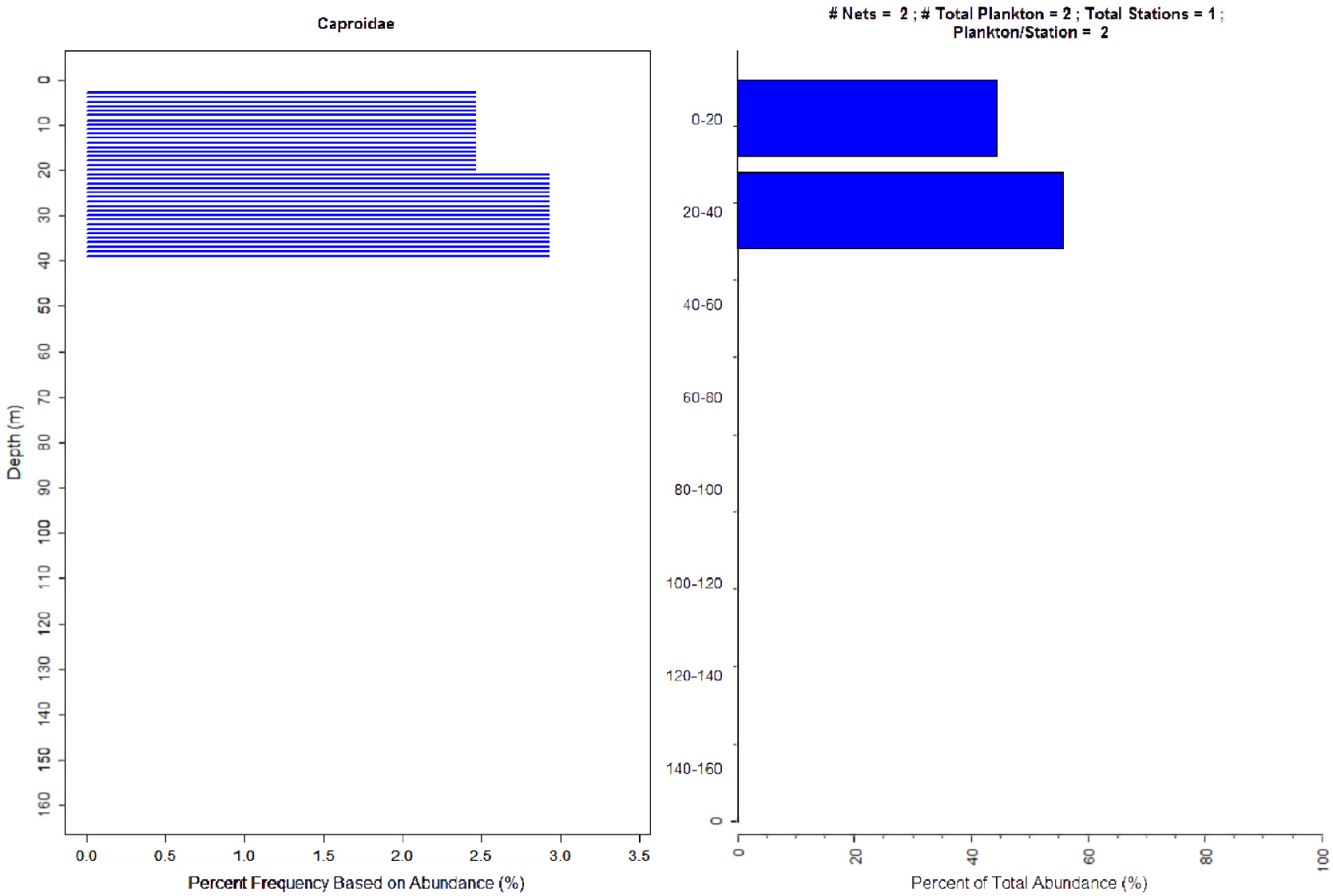
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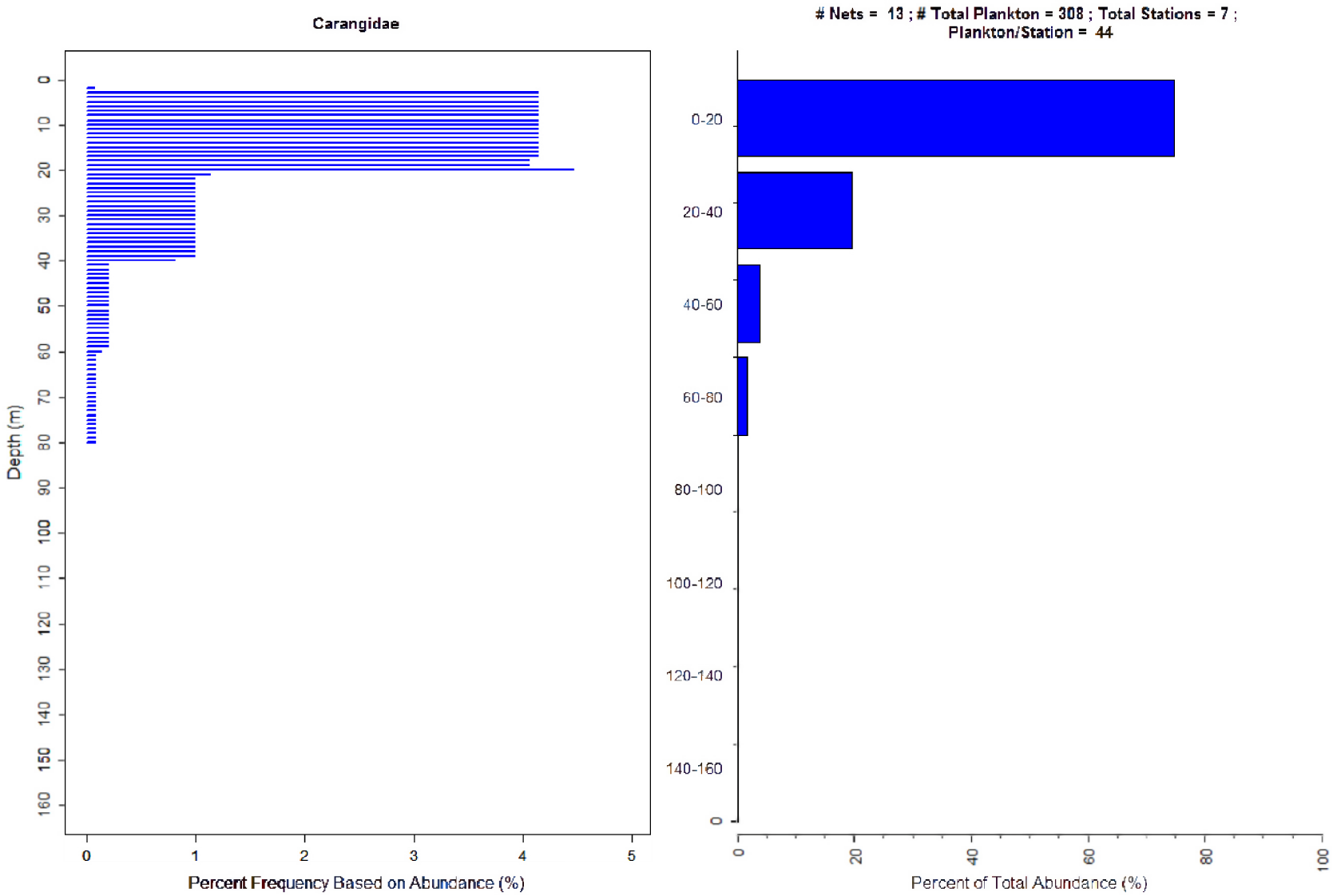
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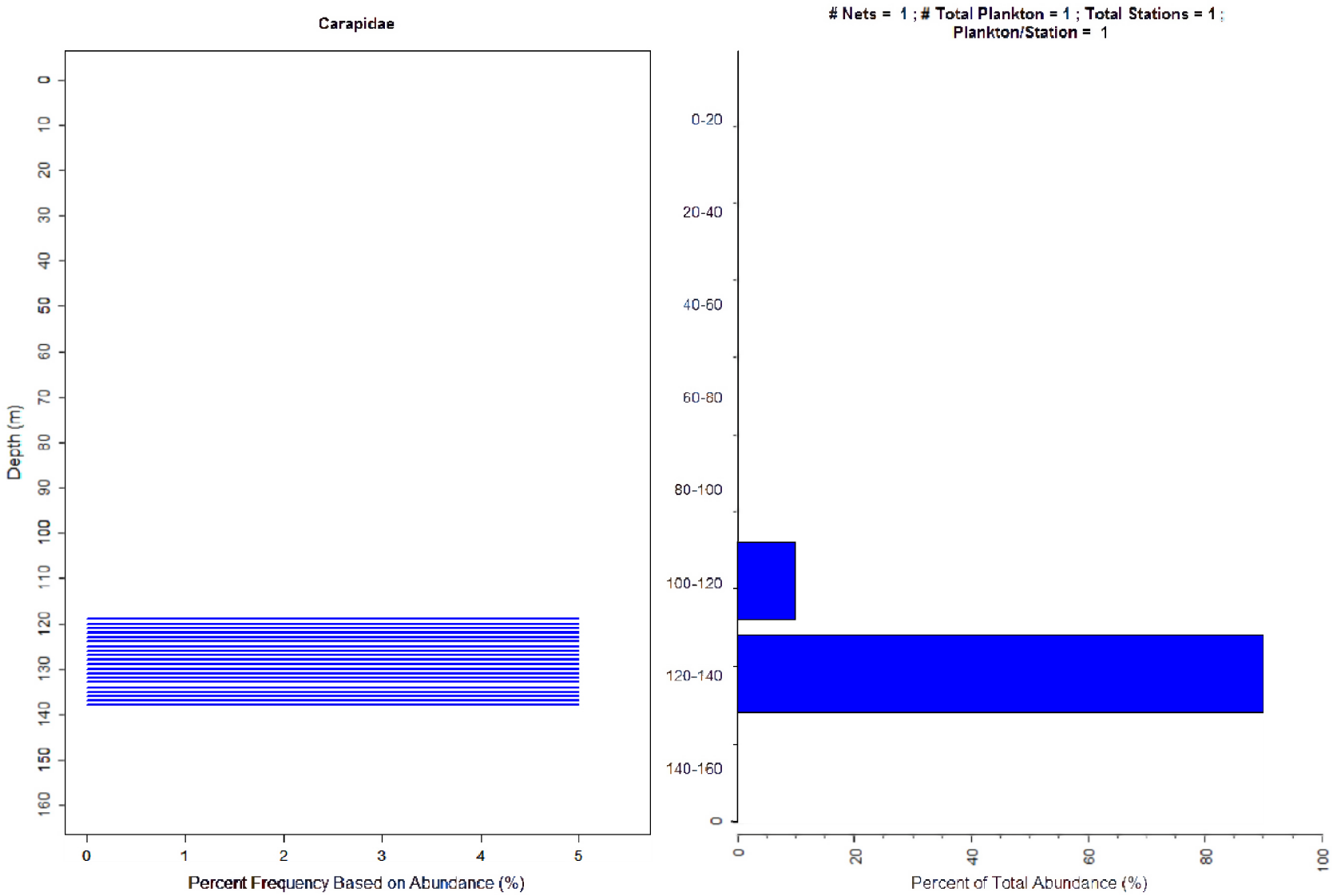
Callionymidae - Shallow



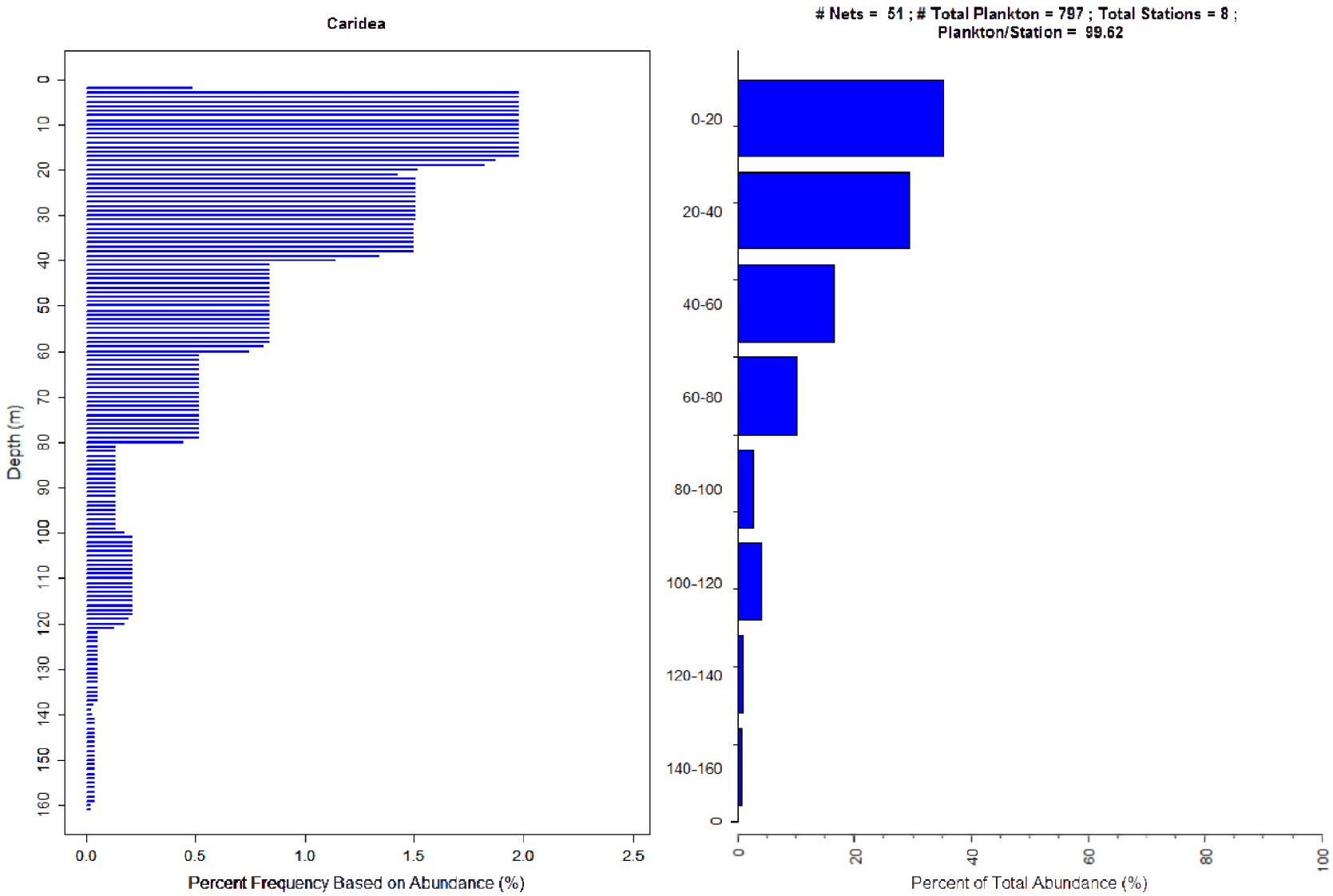
Caproidae - Shallow



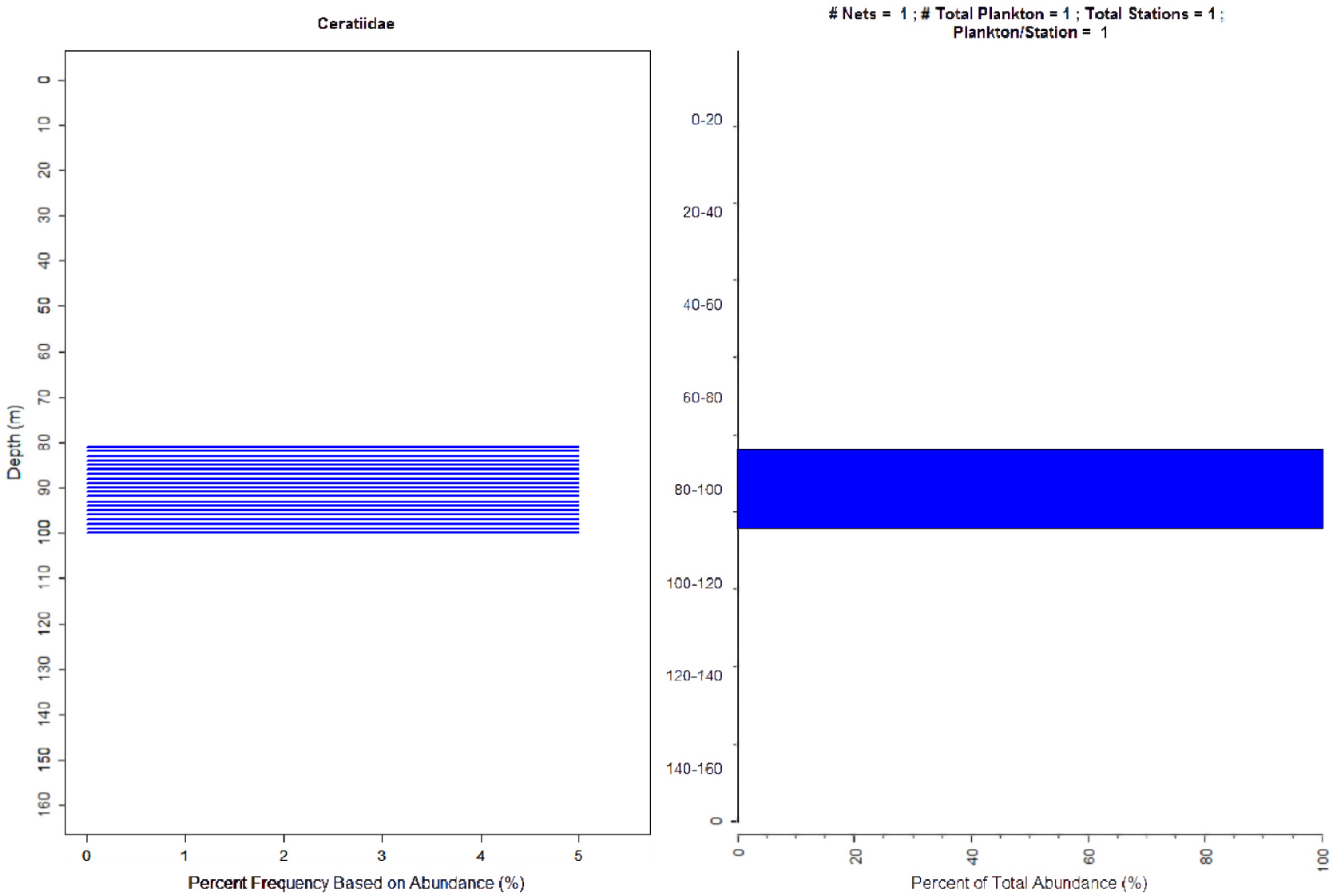
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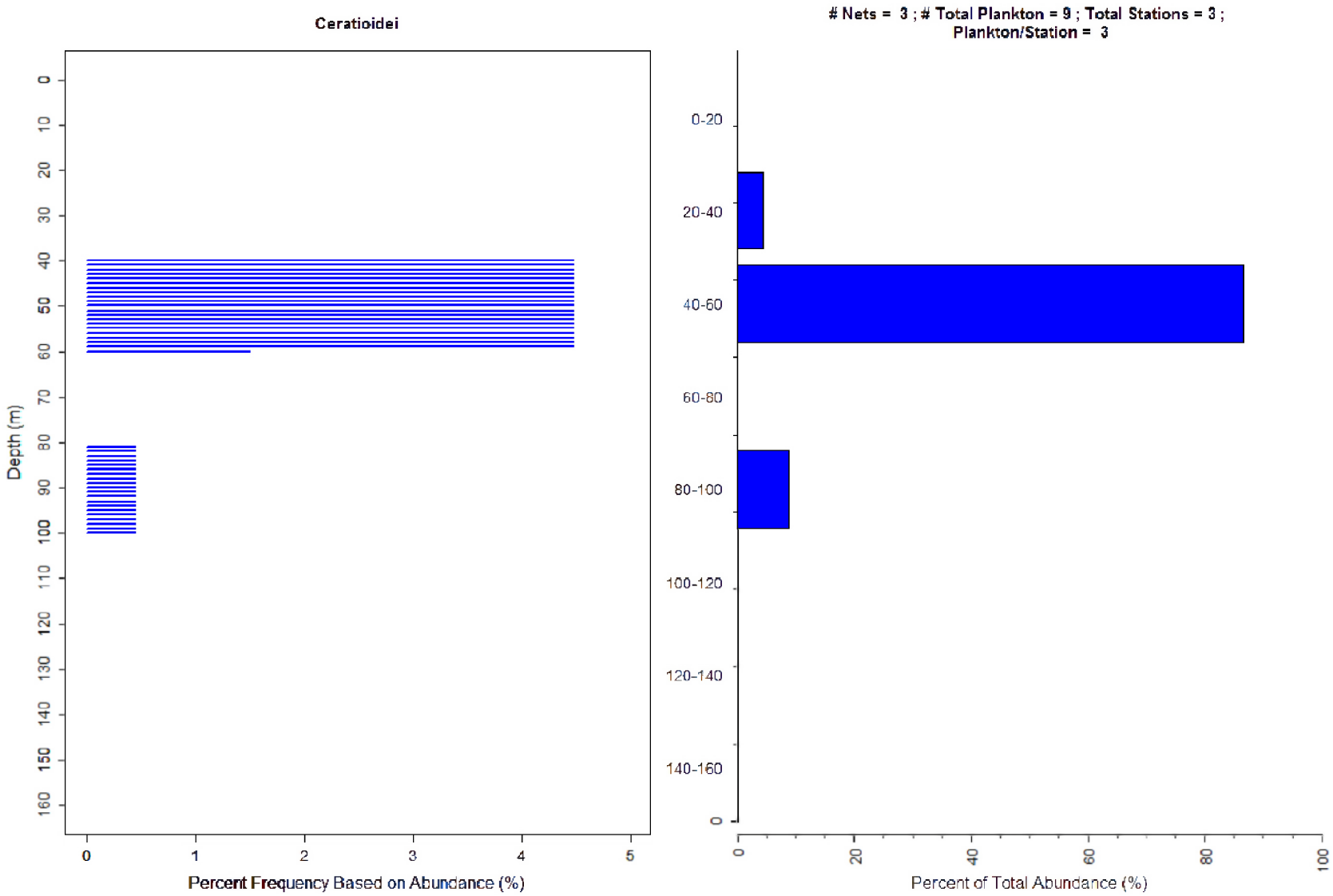
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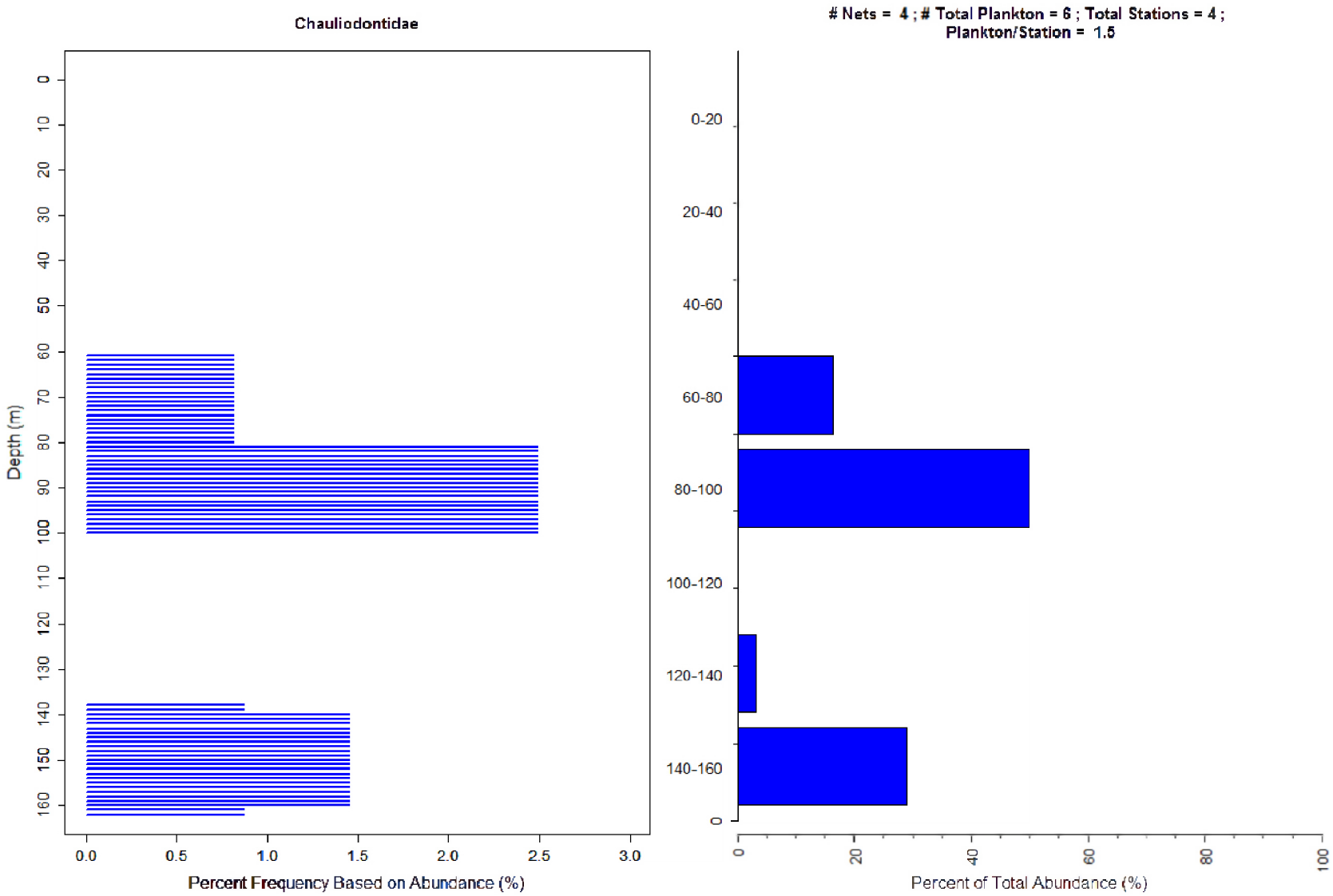
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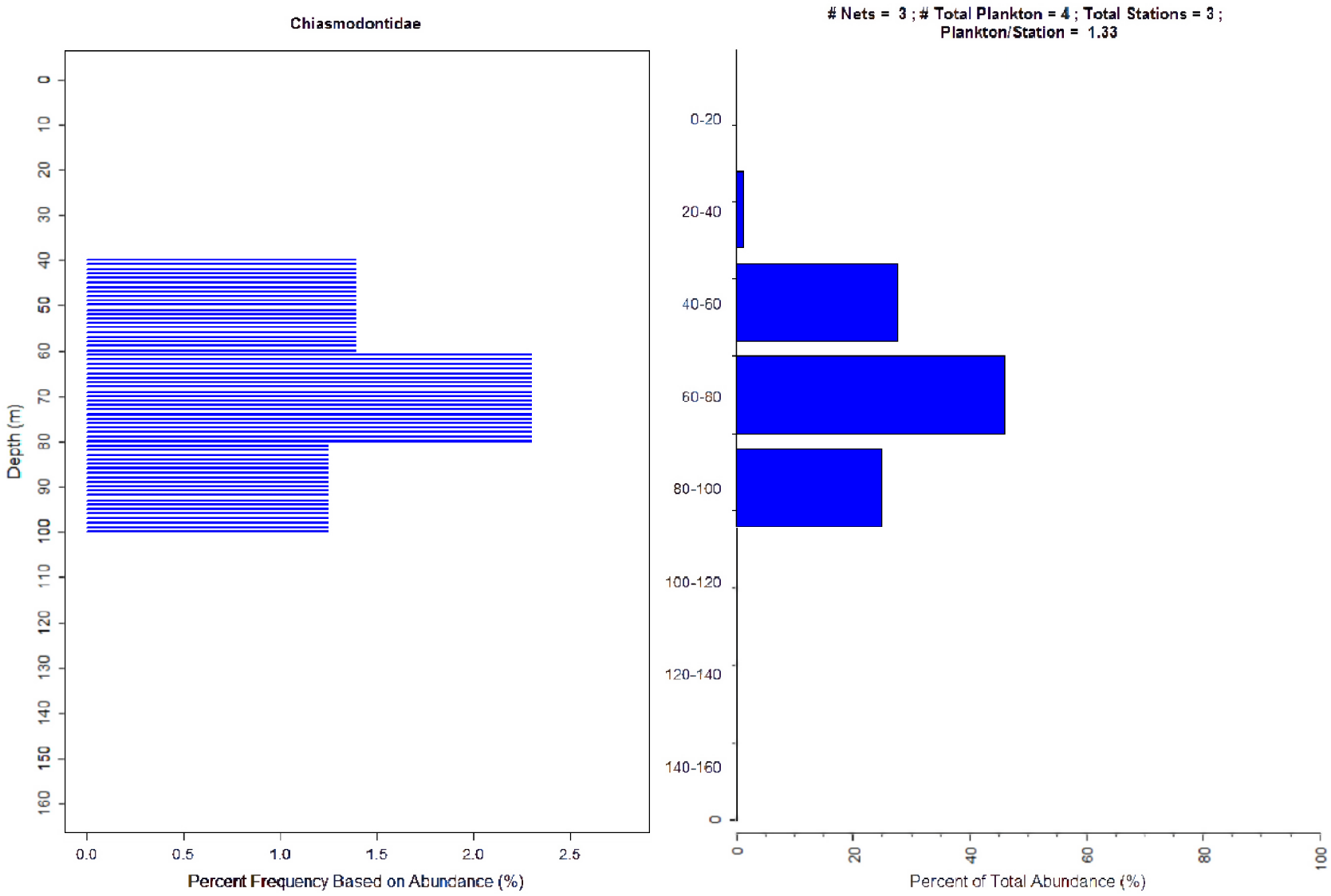
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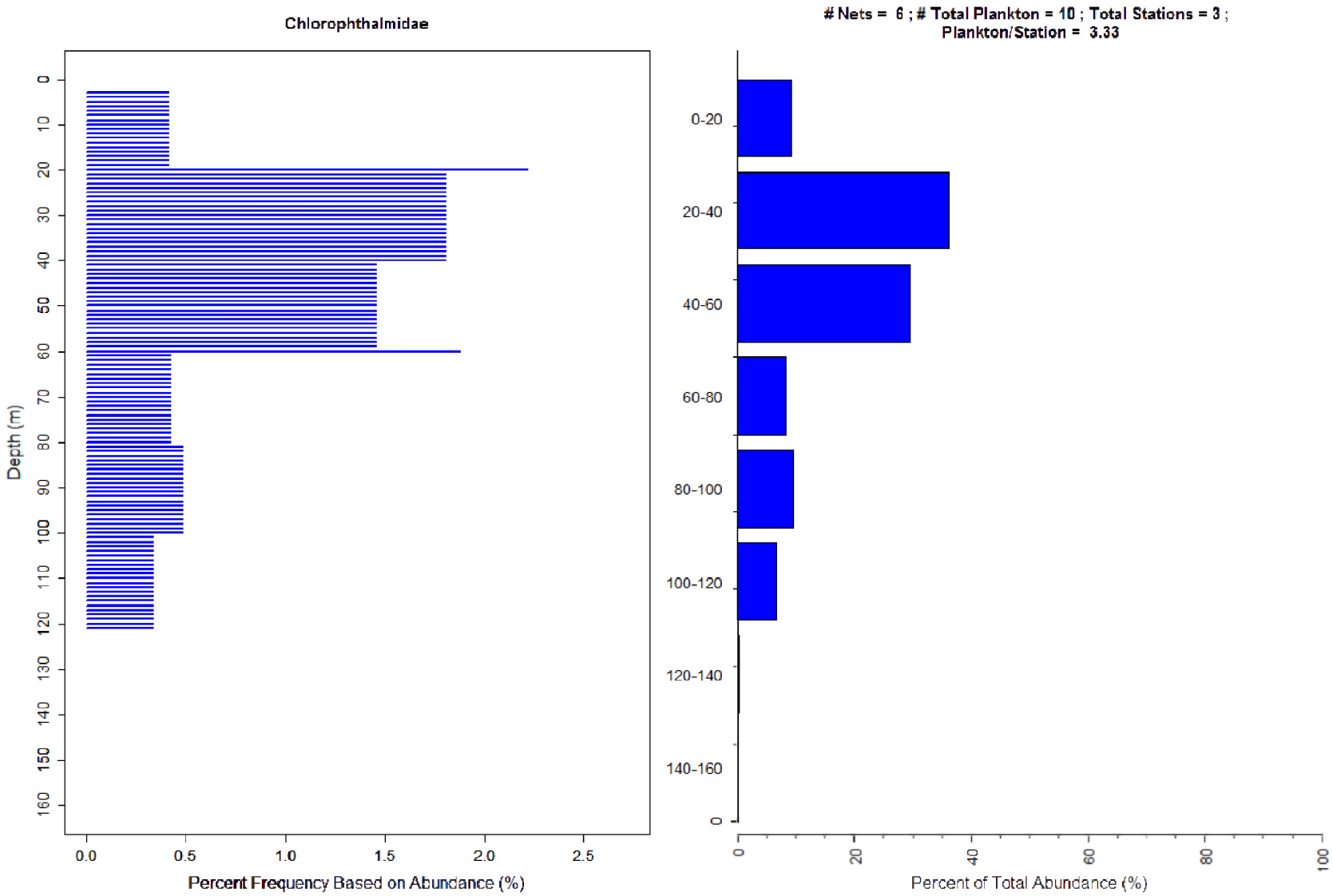
Ceratioidei - Shallow



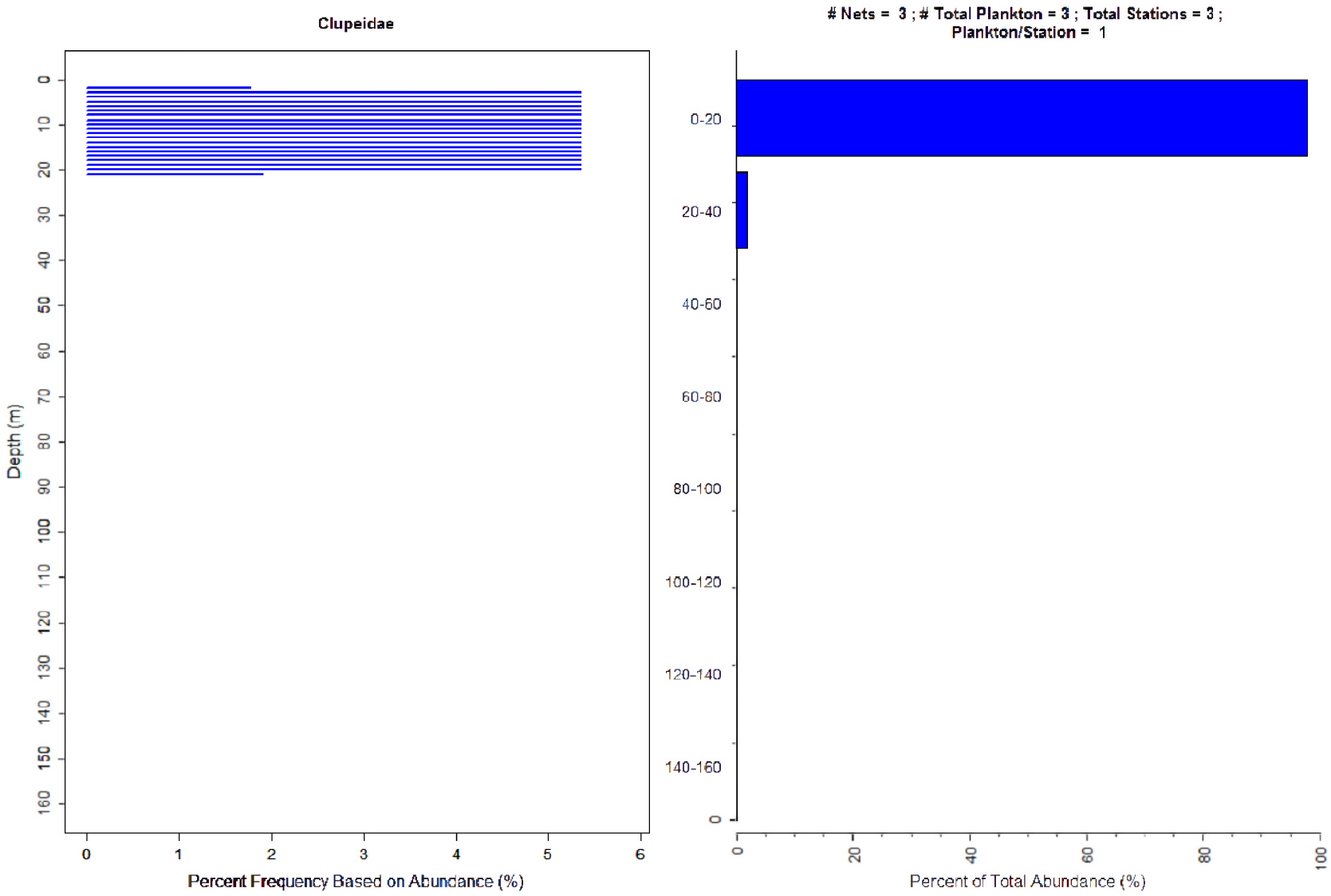
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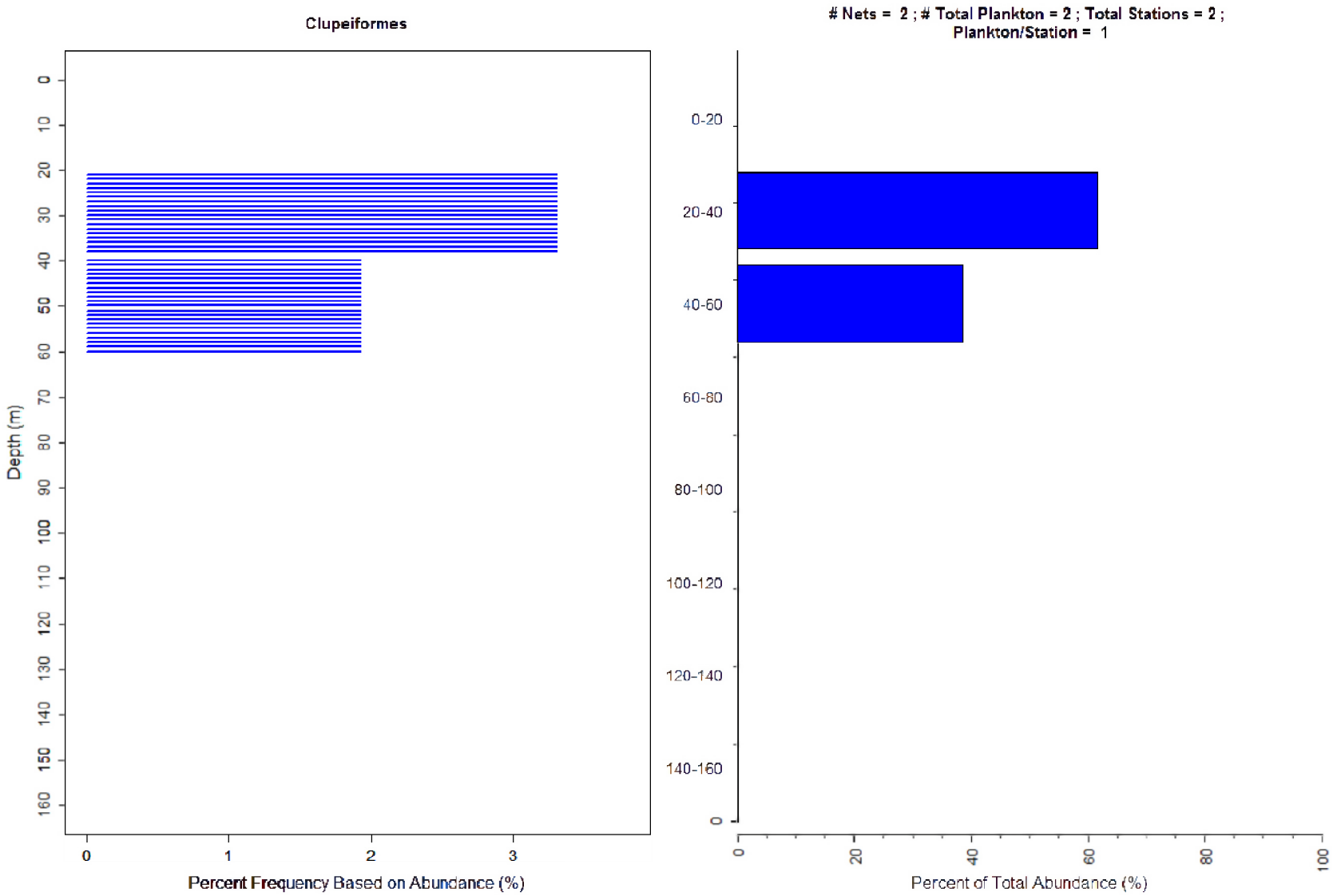
Chiasmodontidae - Shallow



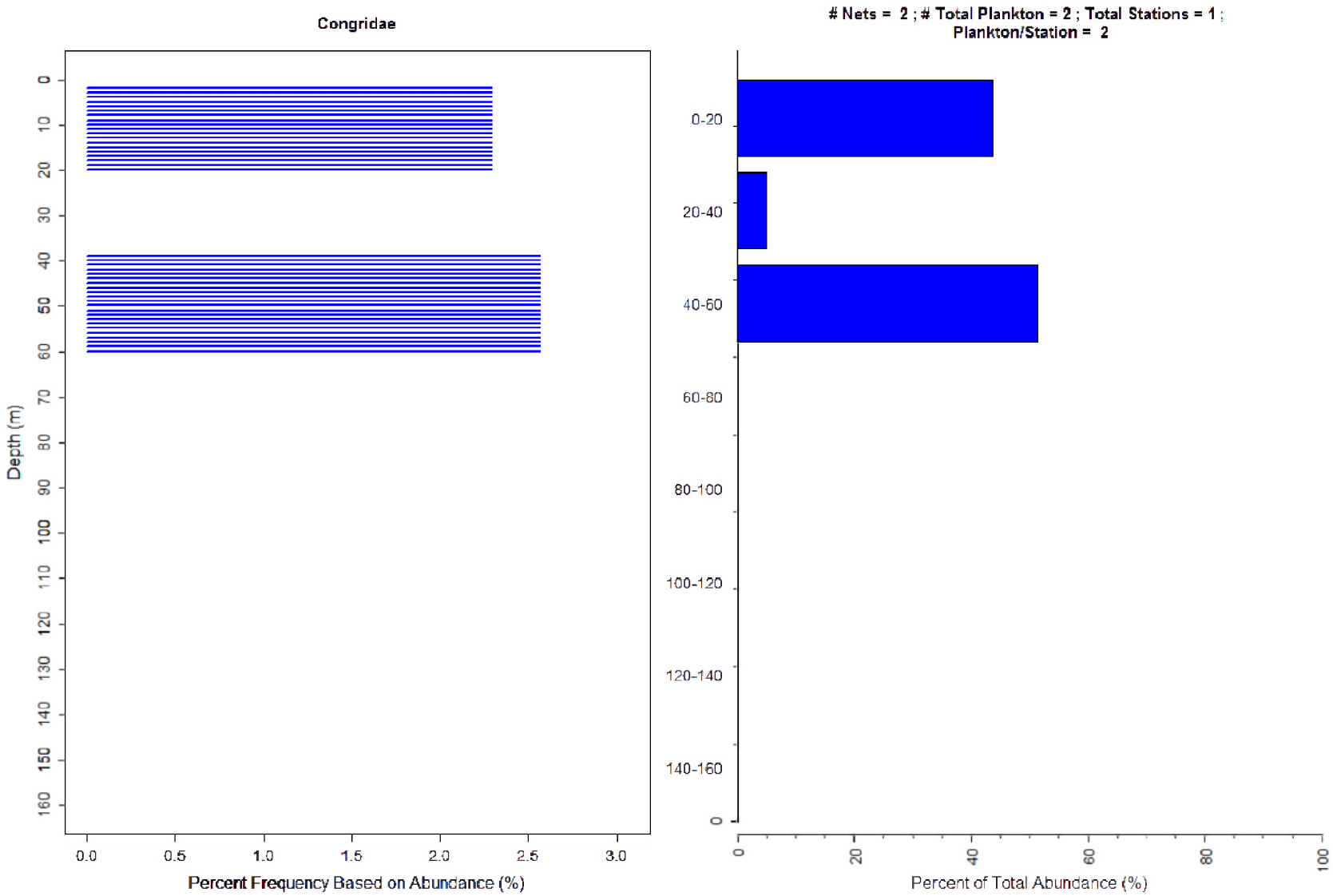
Chlorophthalmidae - Shallow



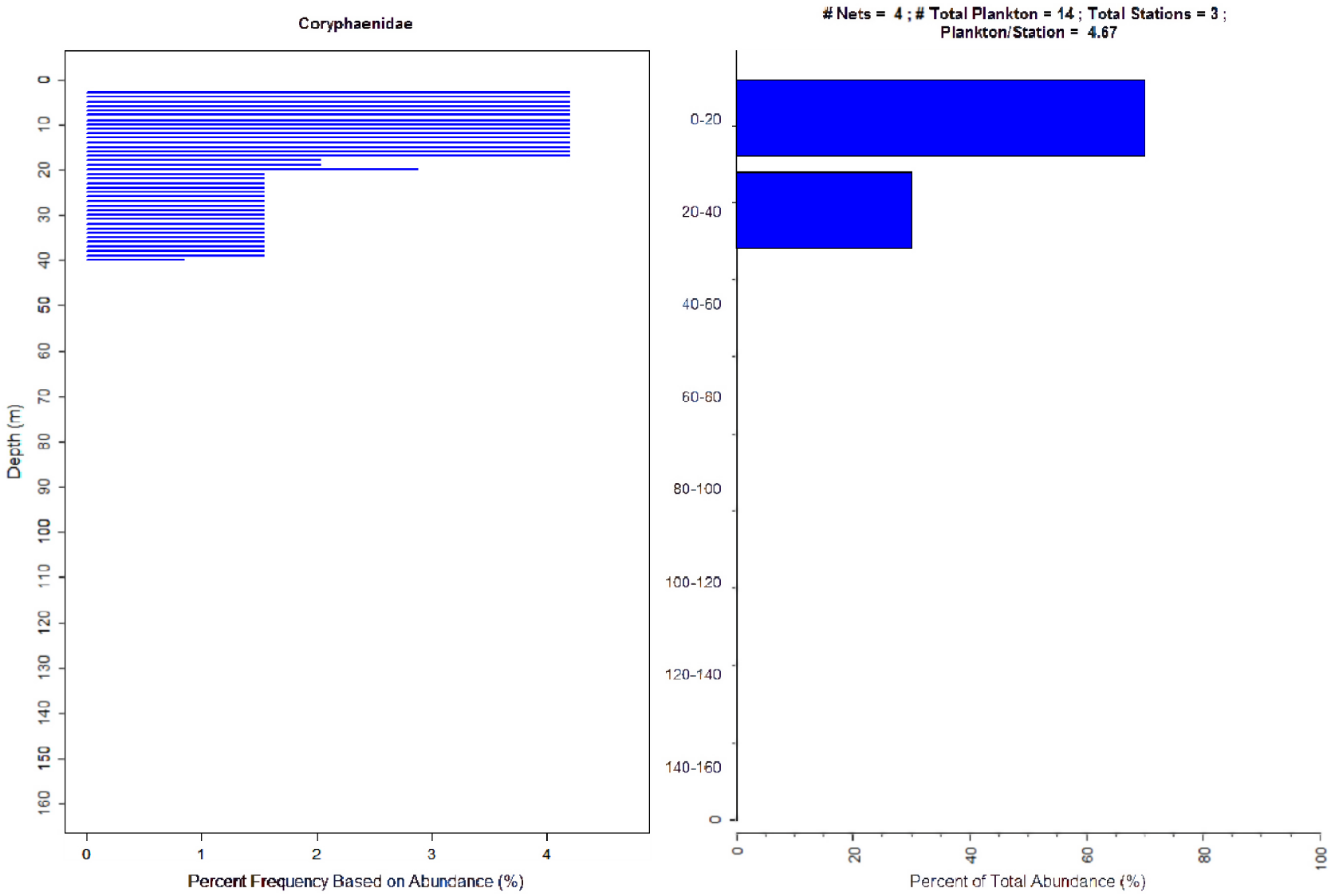
Clupeidae - Shallow



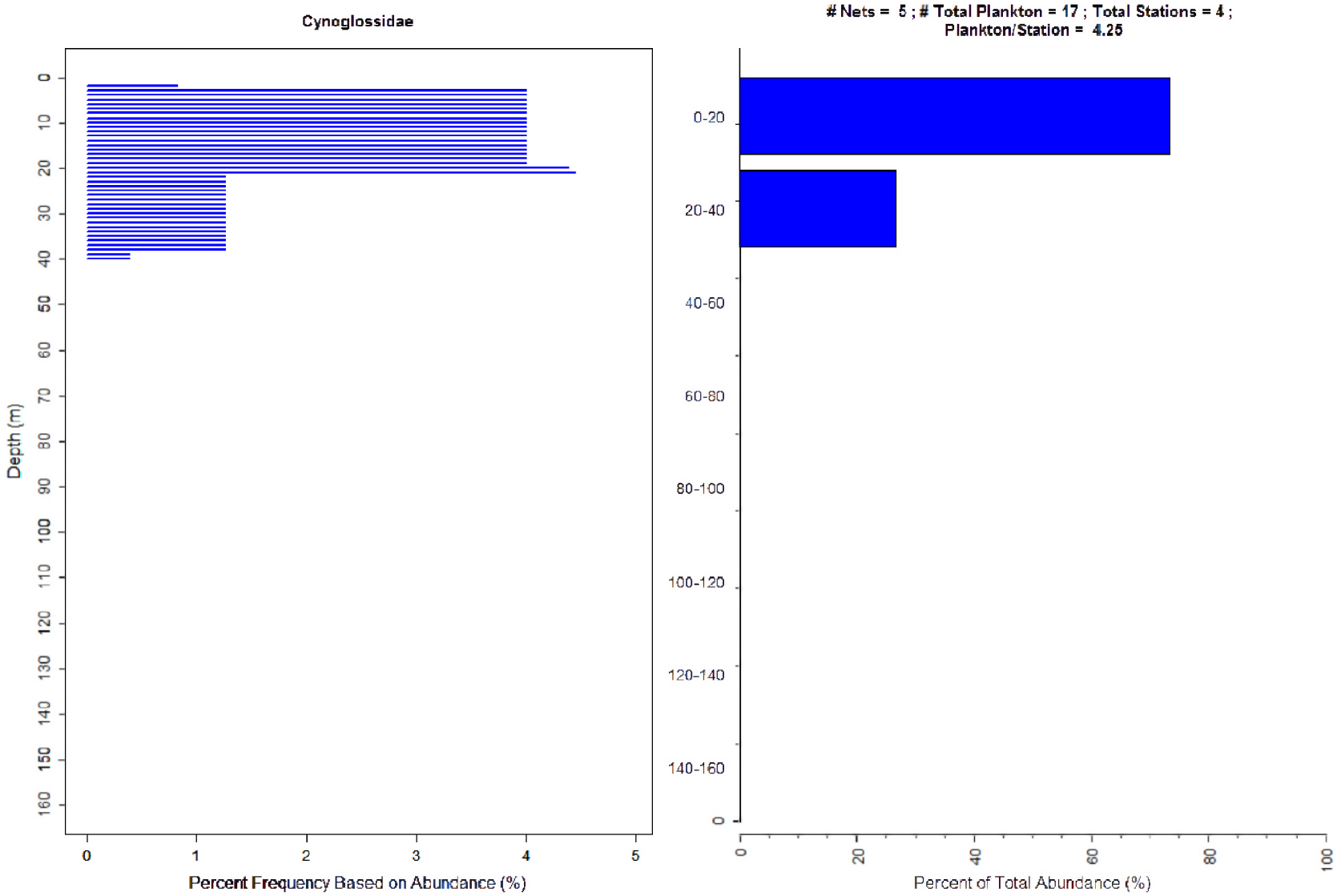
Clupeiformes - Shallow



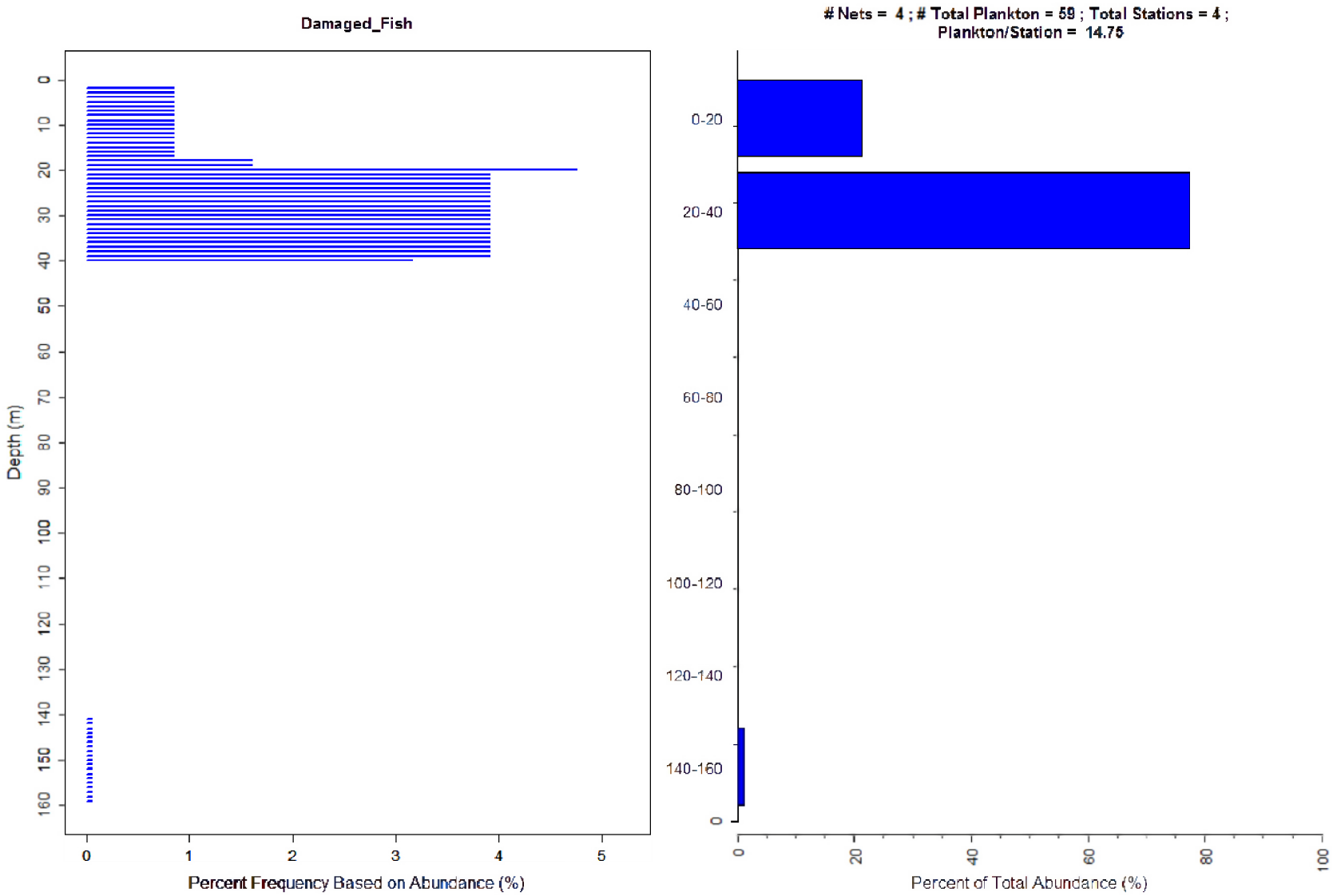
Congridae - Shallow



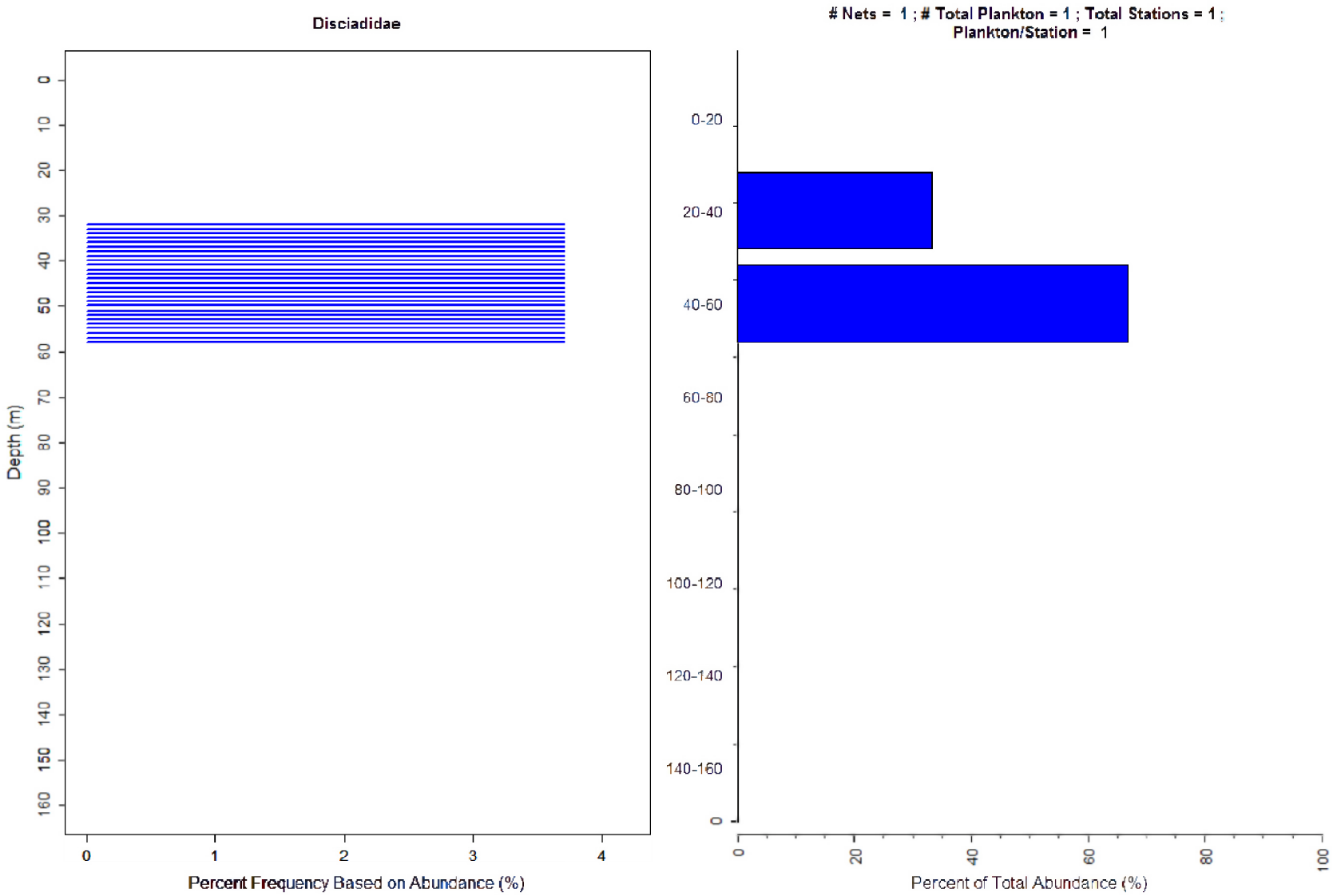
Coryphaenidae - Shallow



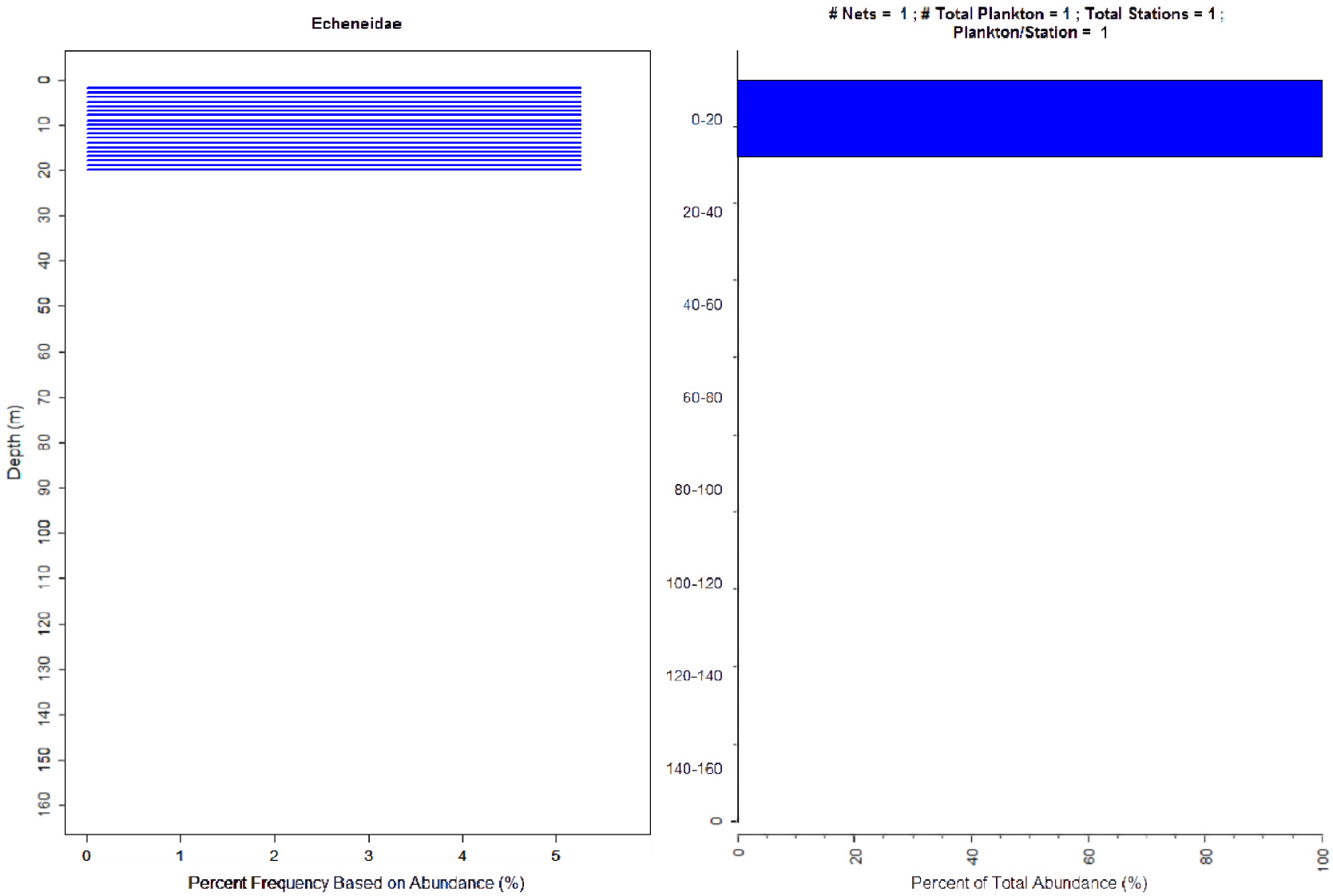
Cynoglossidae - Shallow



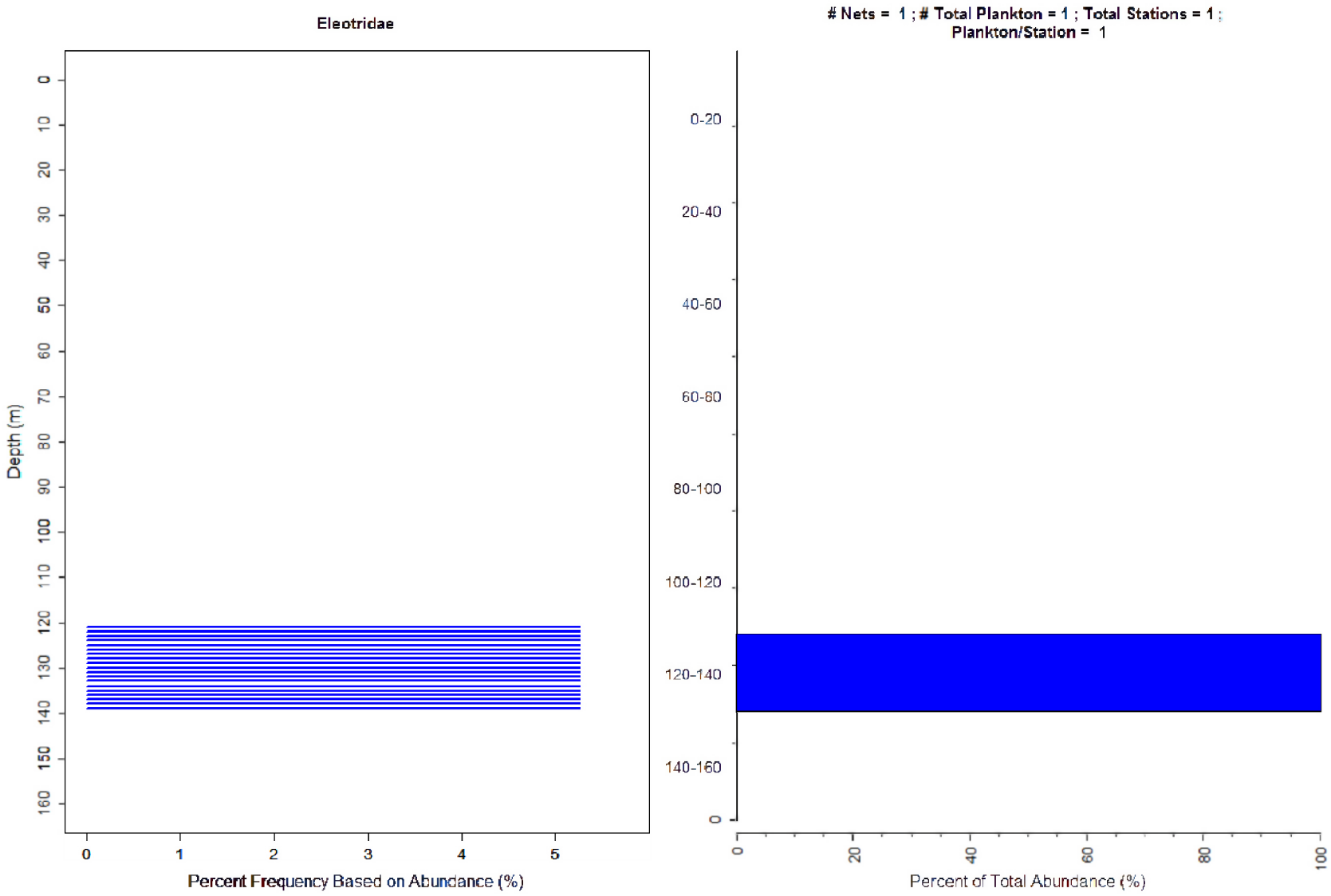
Damaged_Fish - Shallow



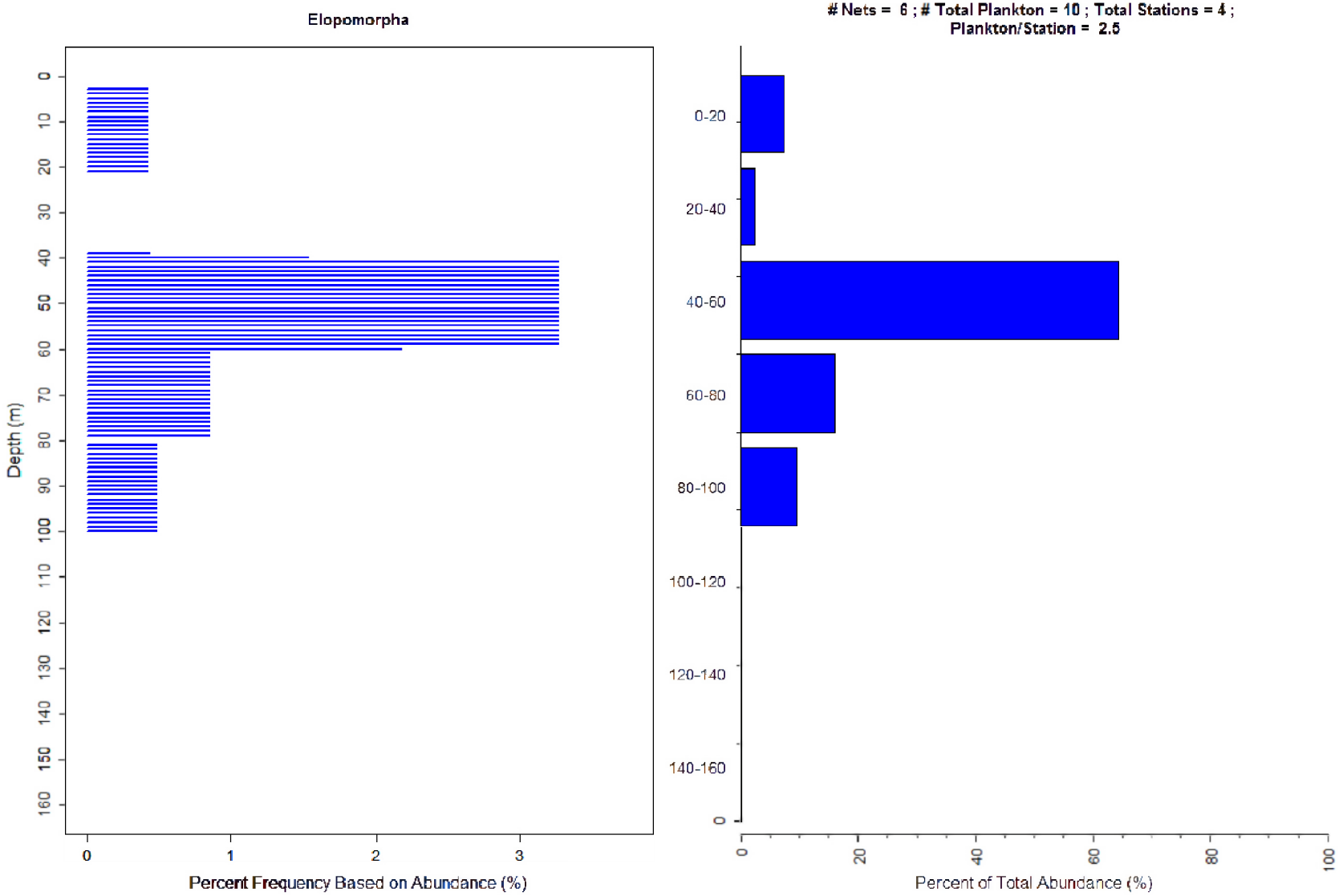
Disciadidae - Shallow



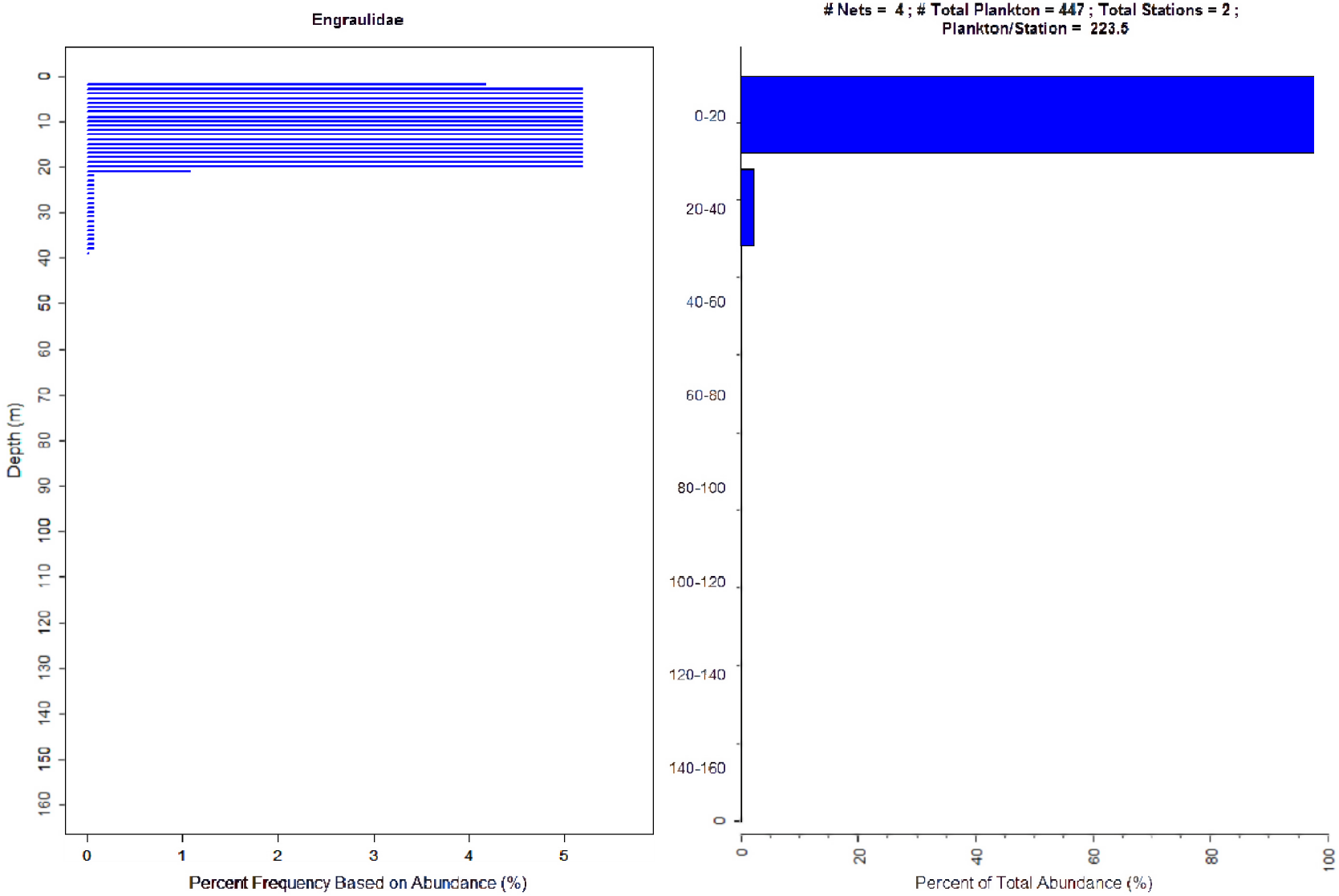
Echeneidae - Shallow



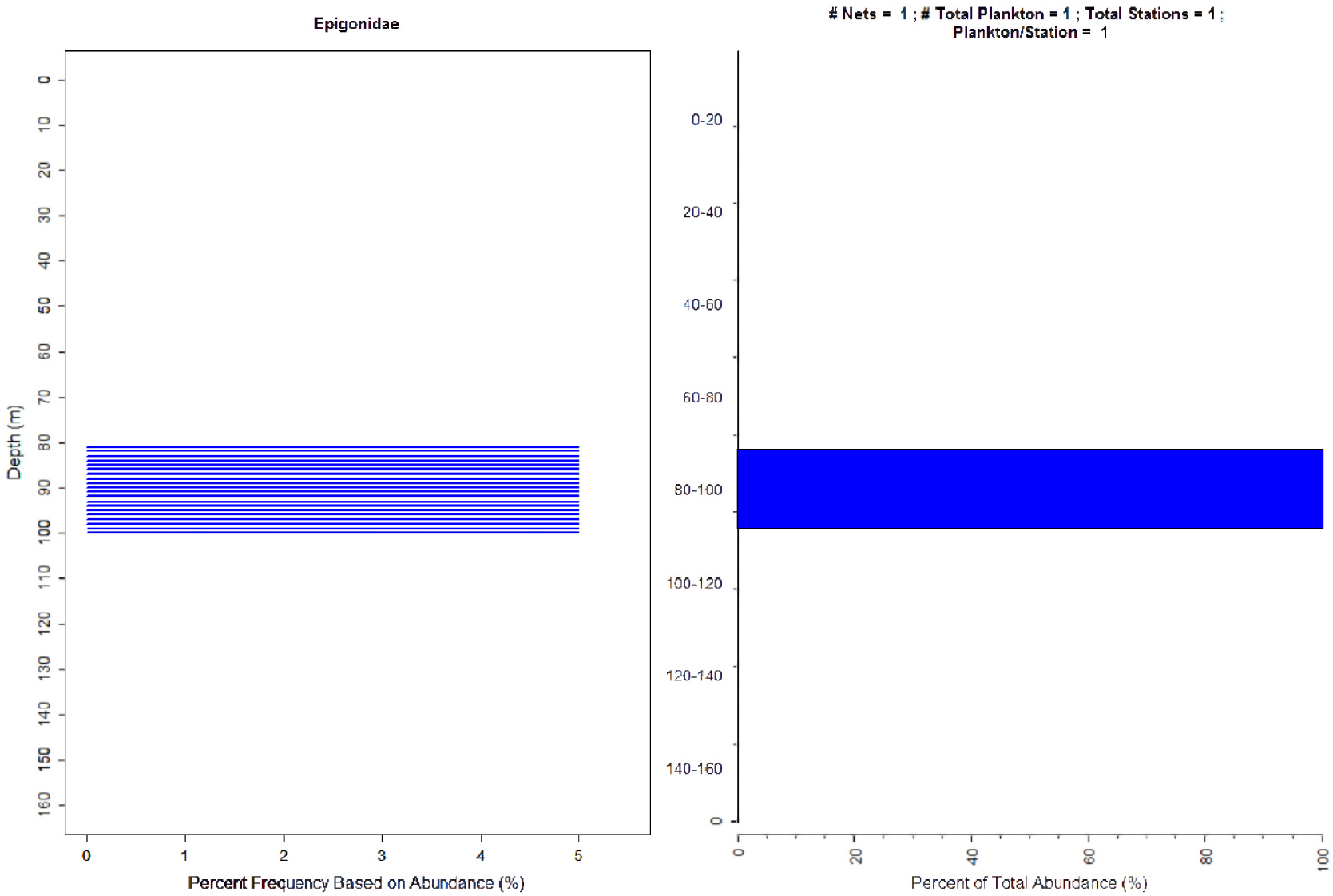
Eleotridae - Shallow



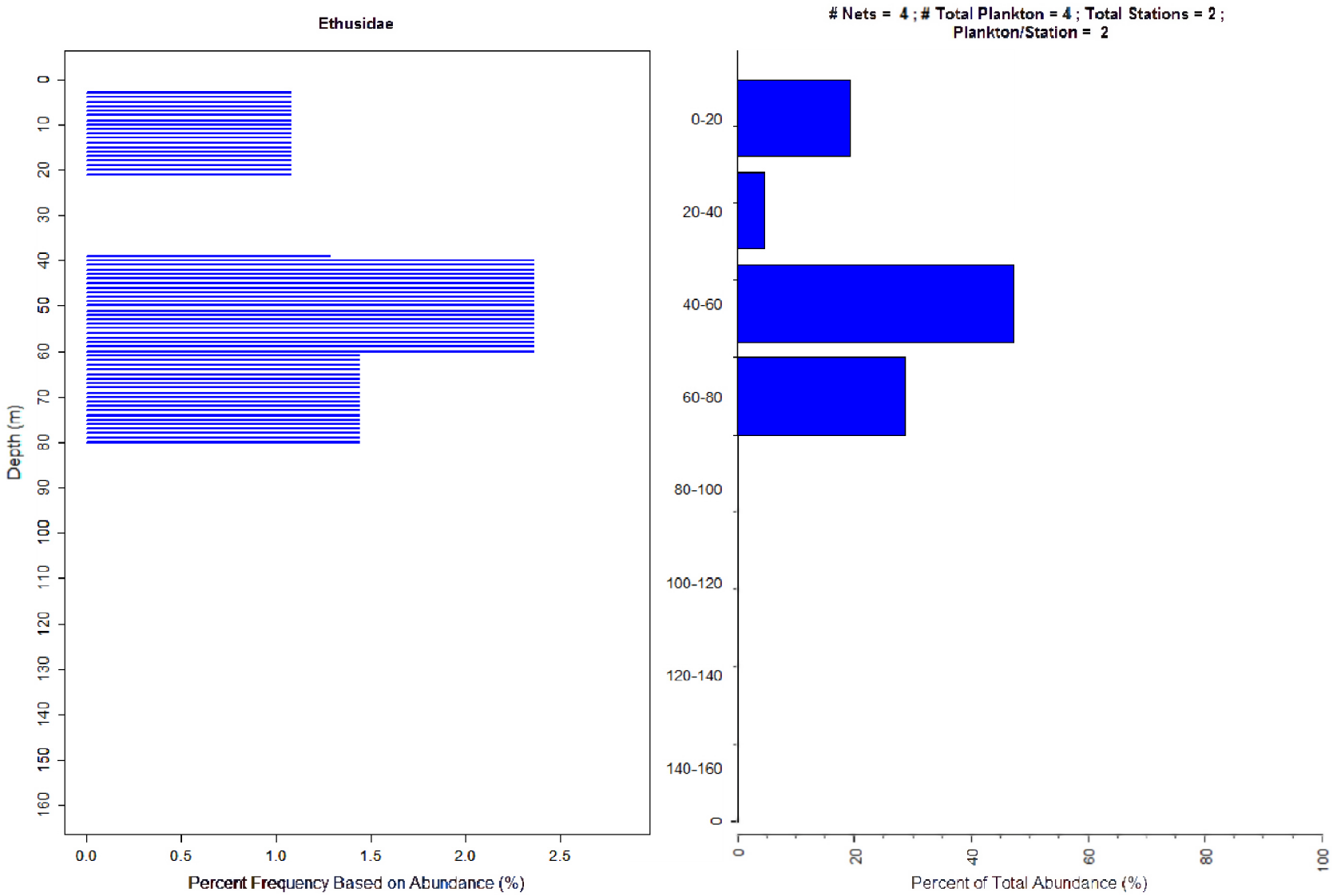
Elopomorpha - Shallow



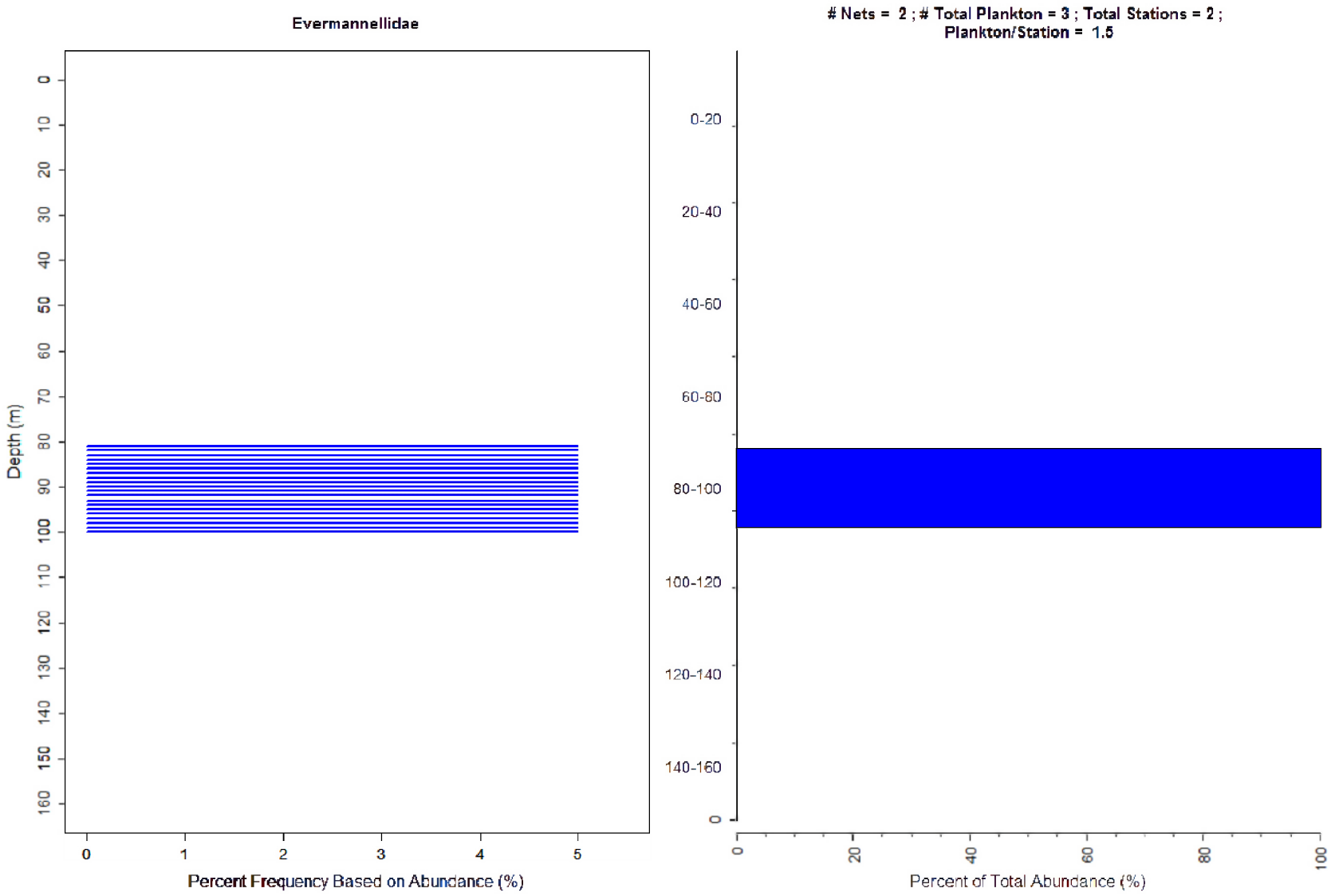
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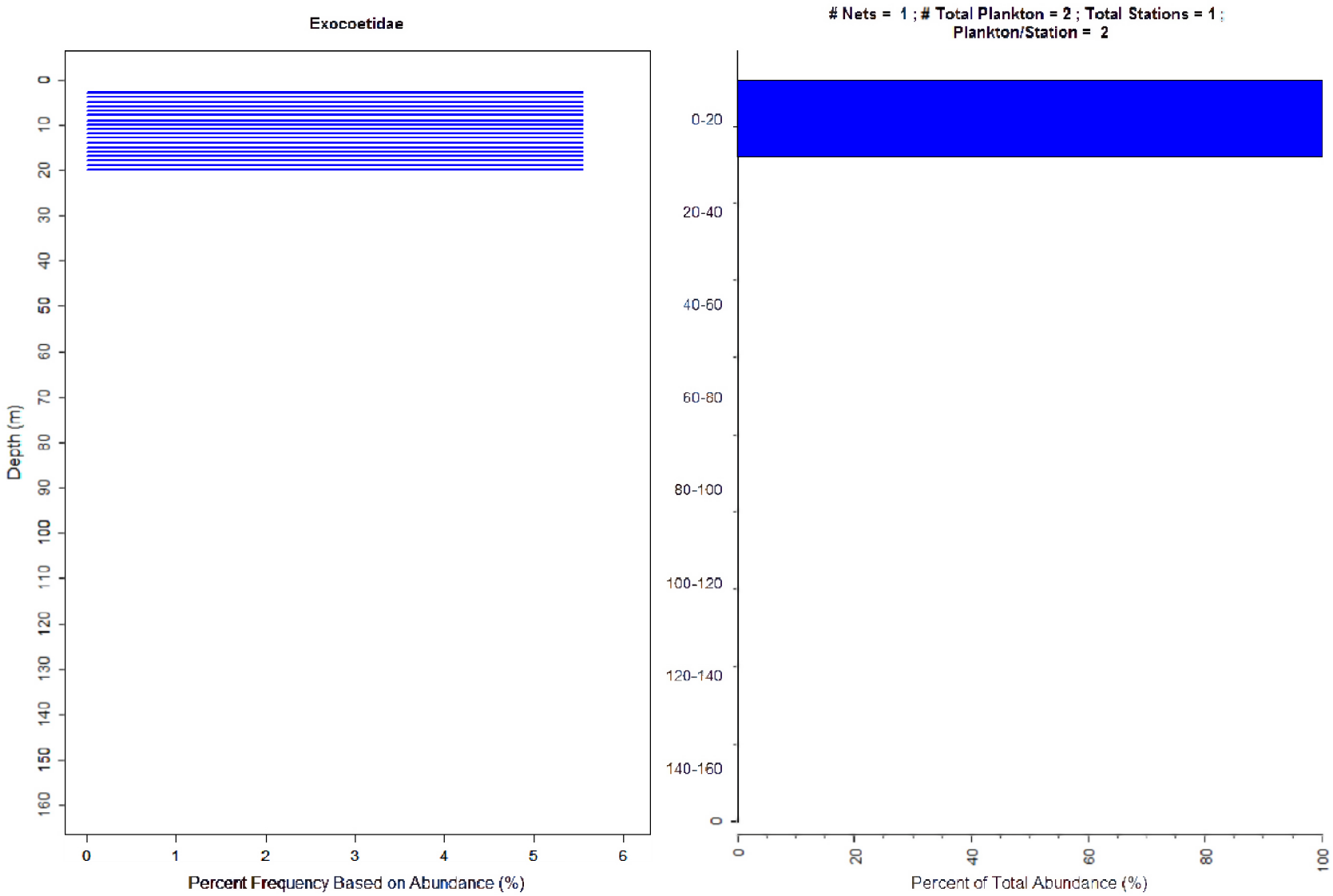
Epigonidae - Shallow



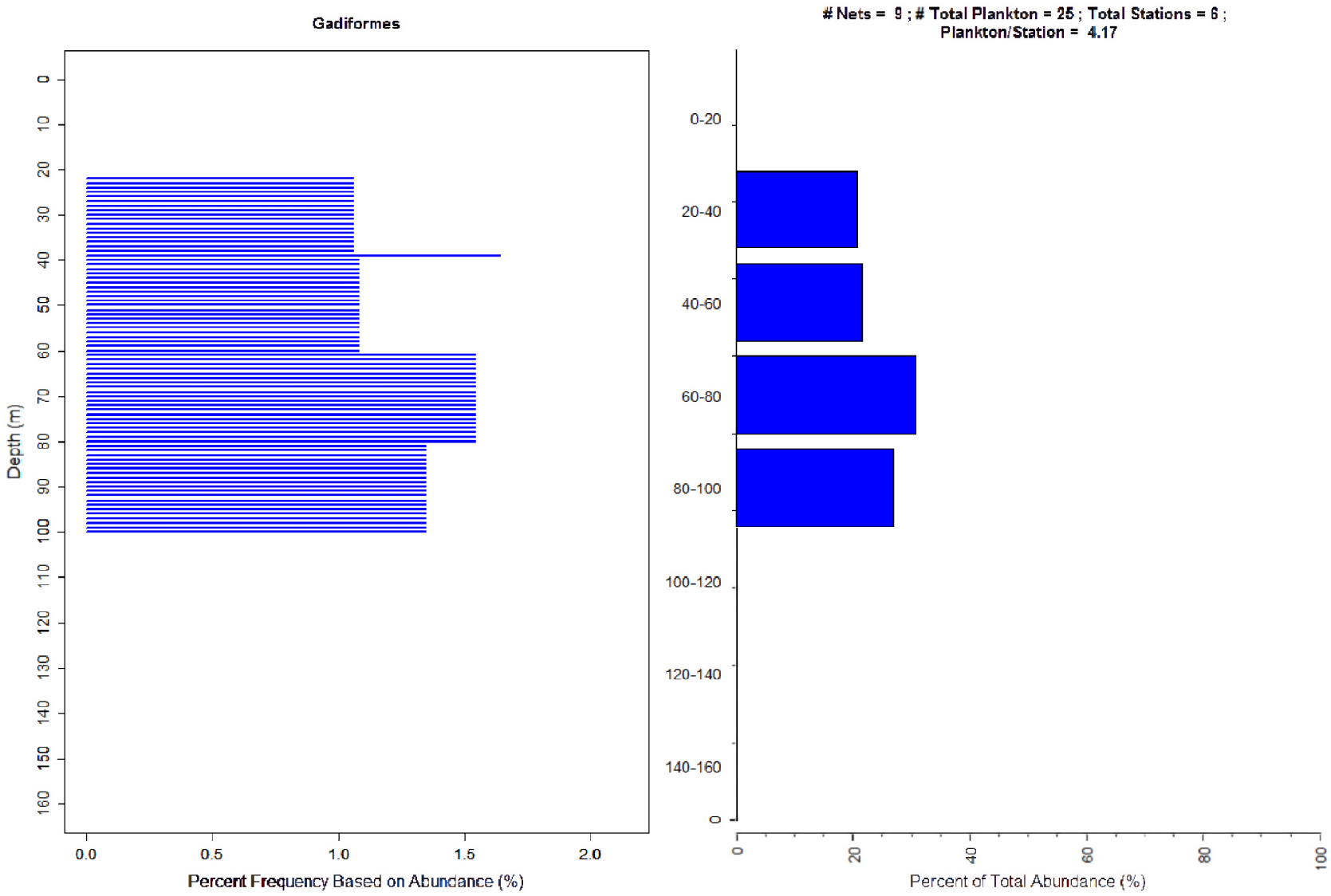
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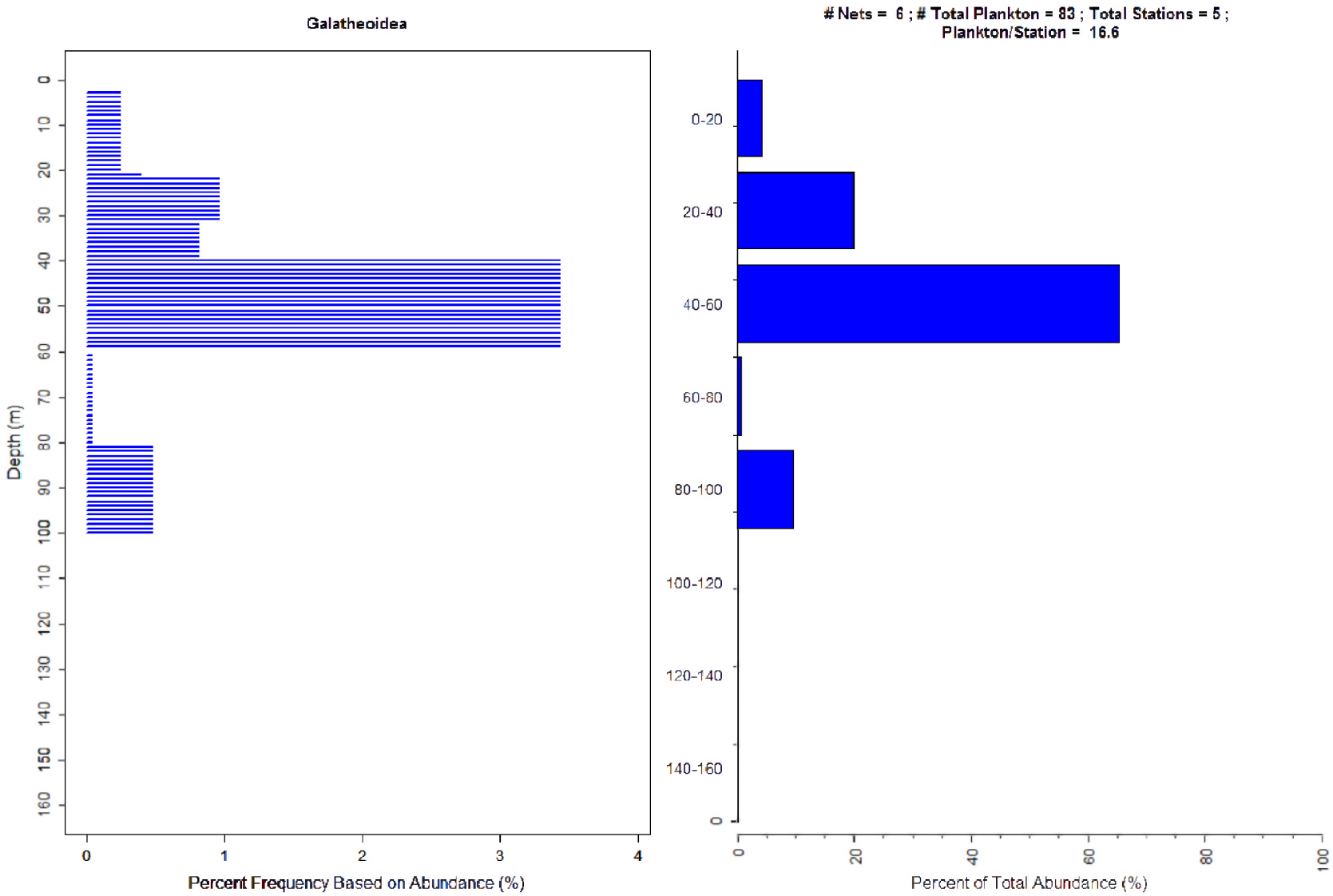
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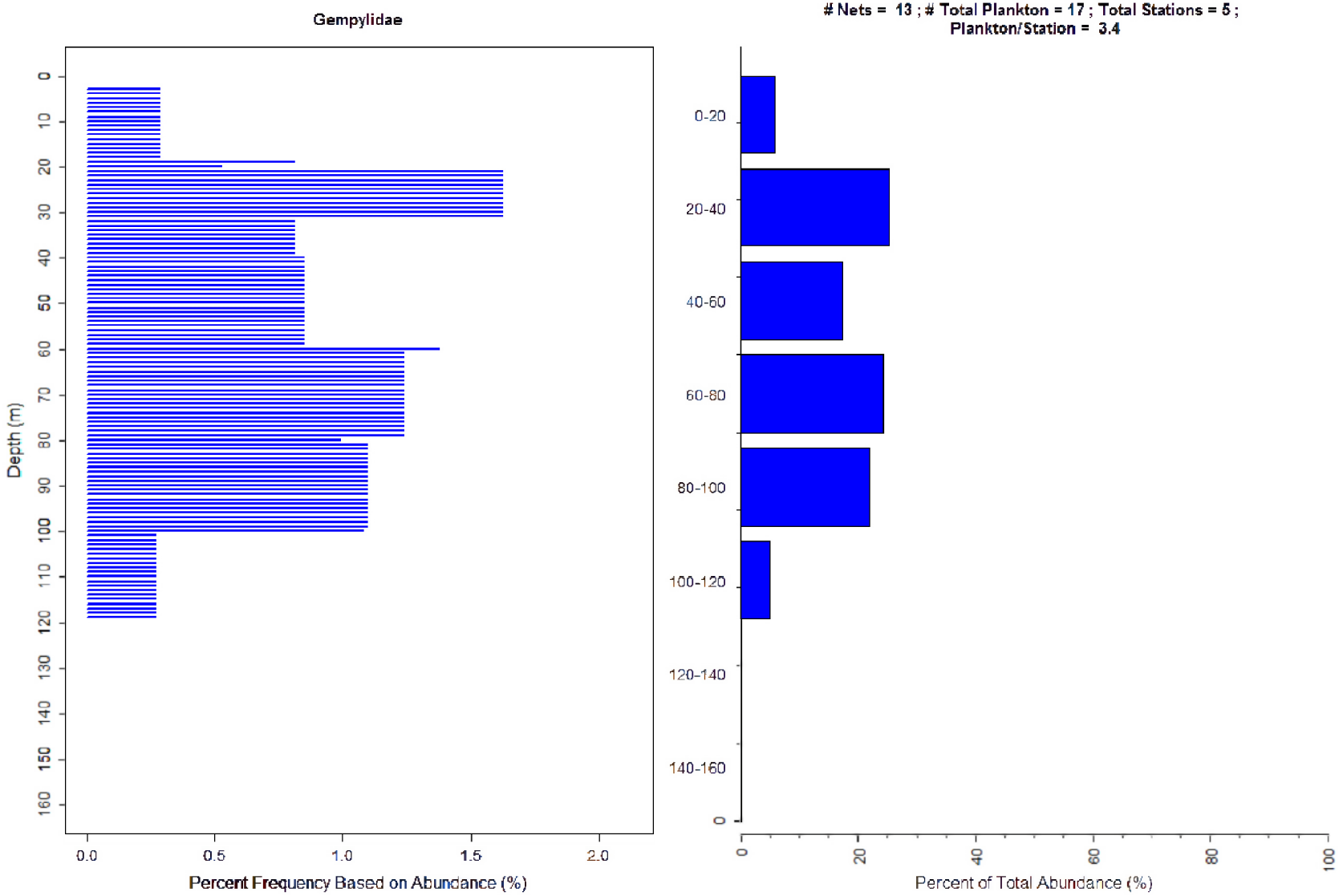
Exocoetidae - Shallow



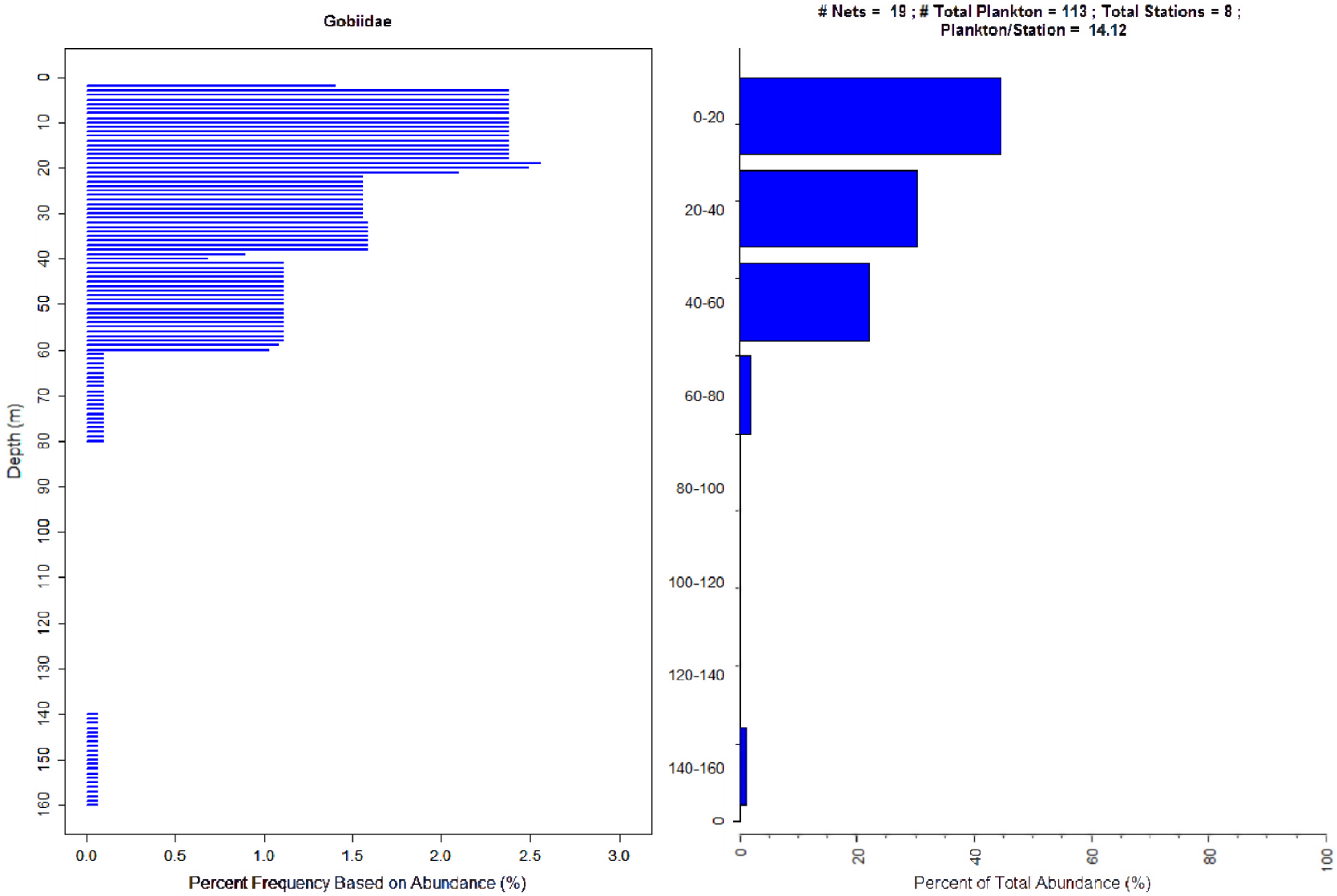
Gadiformes - Shallow



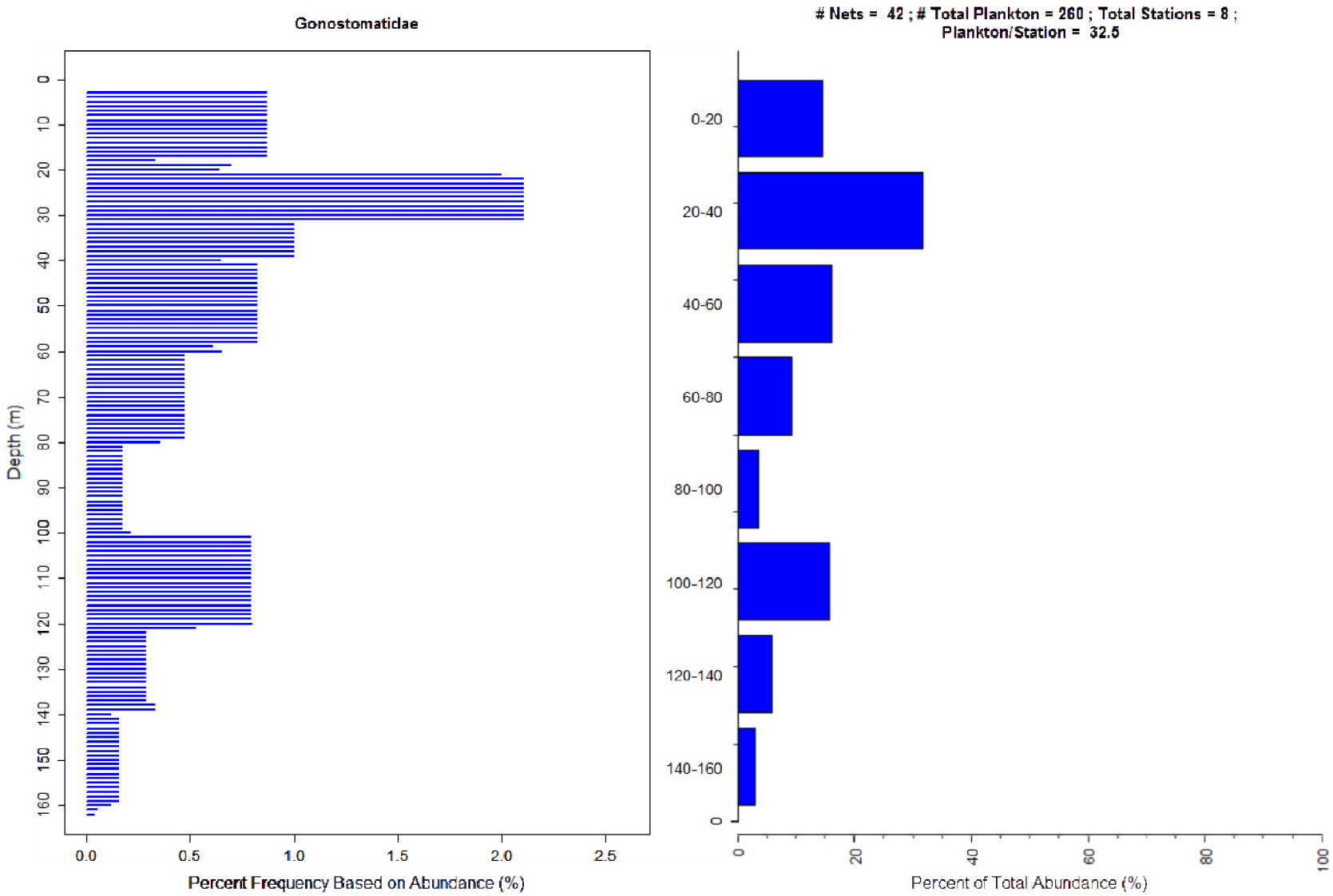
Galatheoidea - Shallow



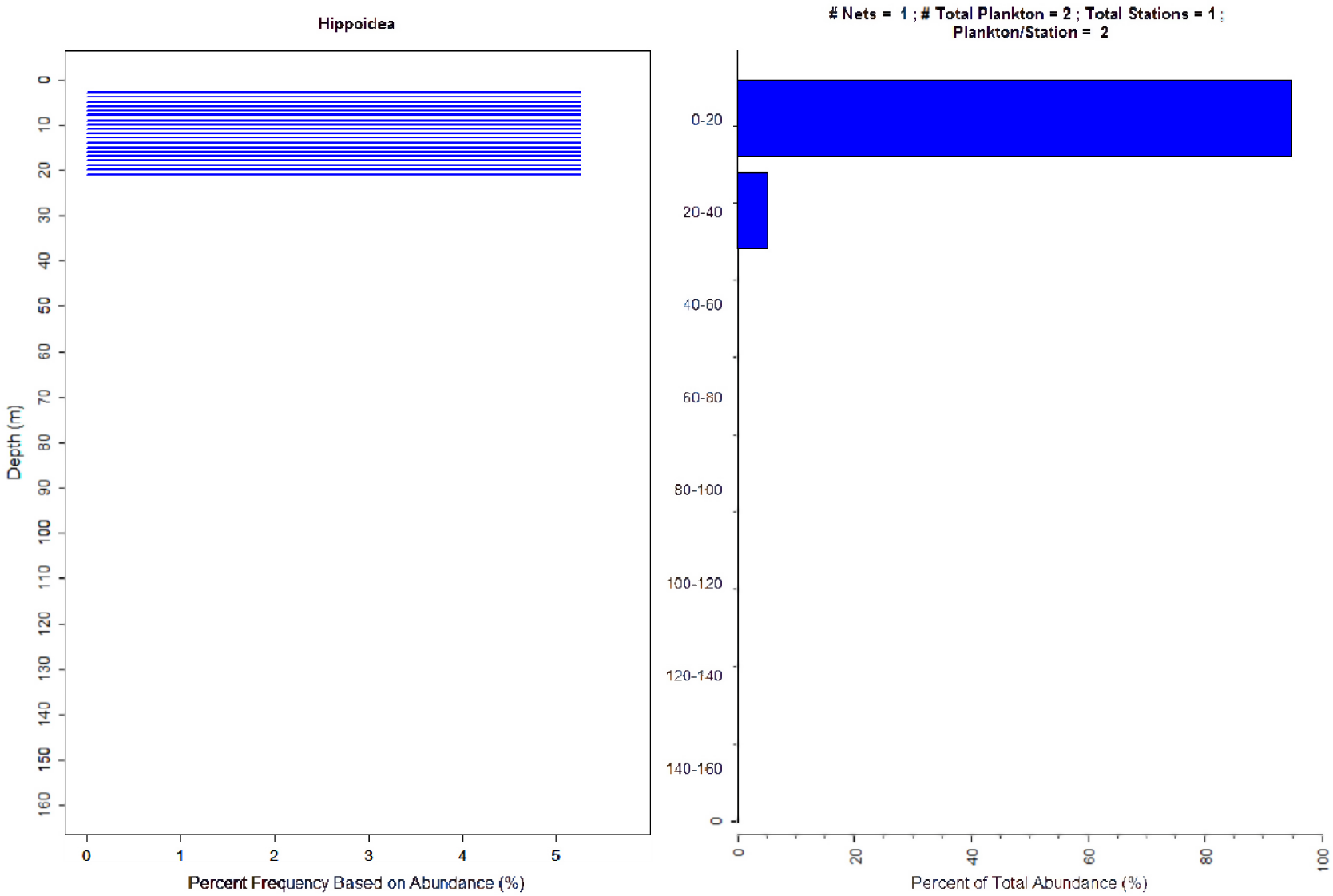
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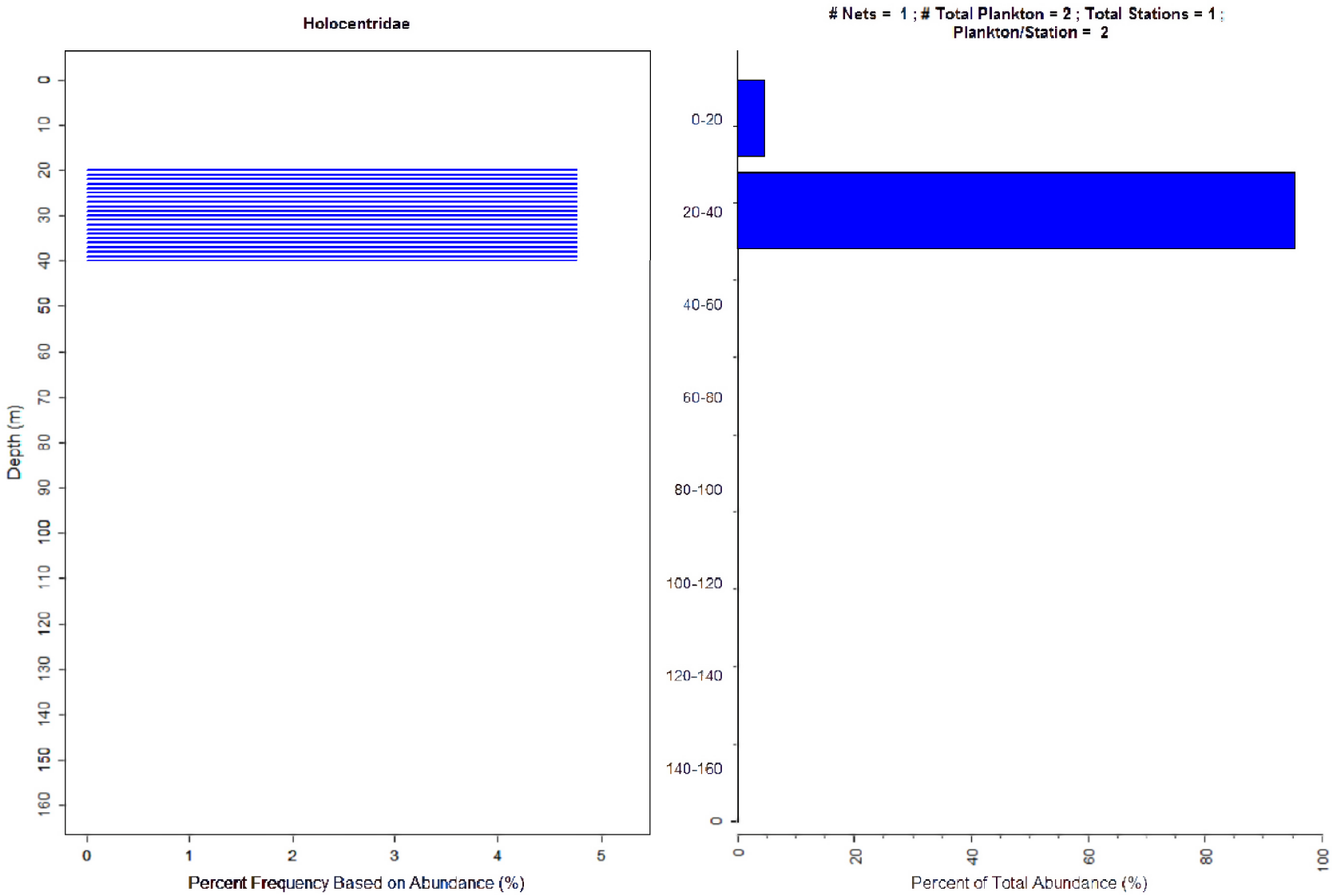
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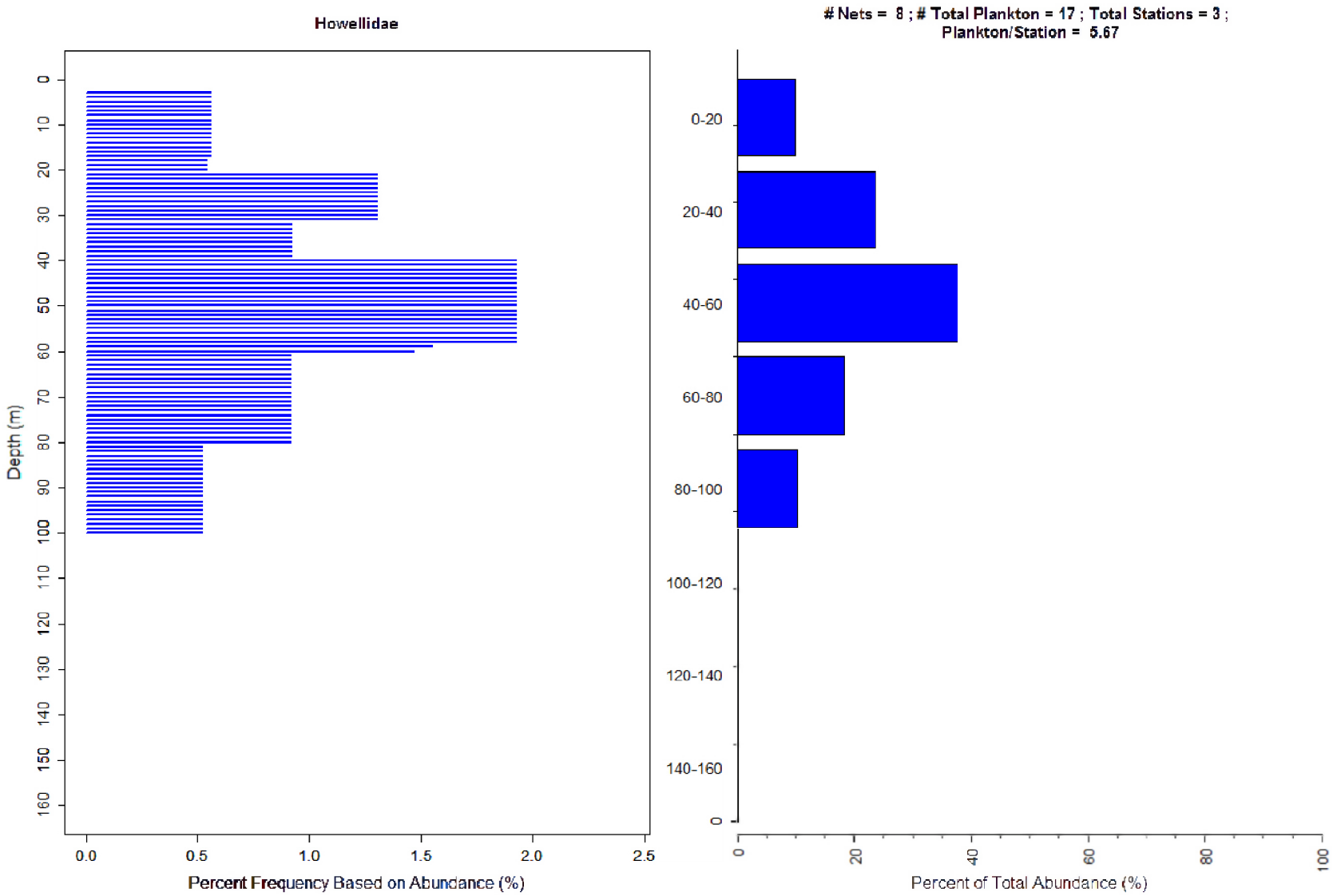
Gonostomatidae - Shallow



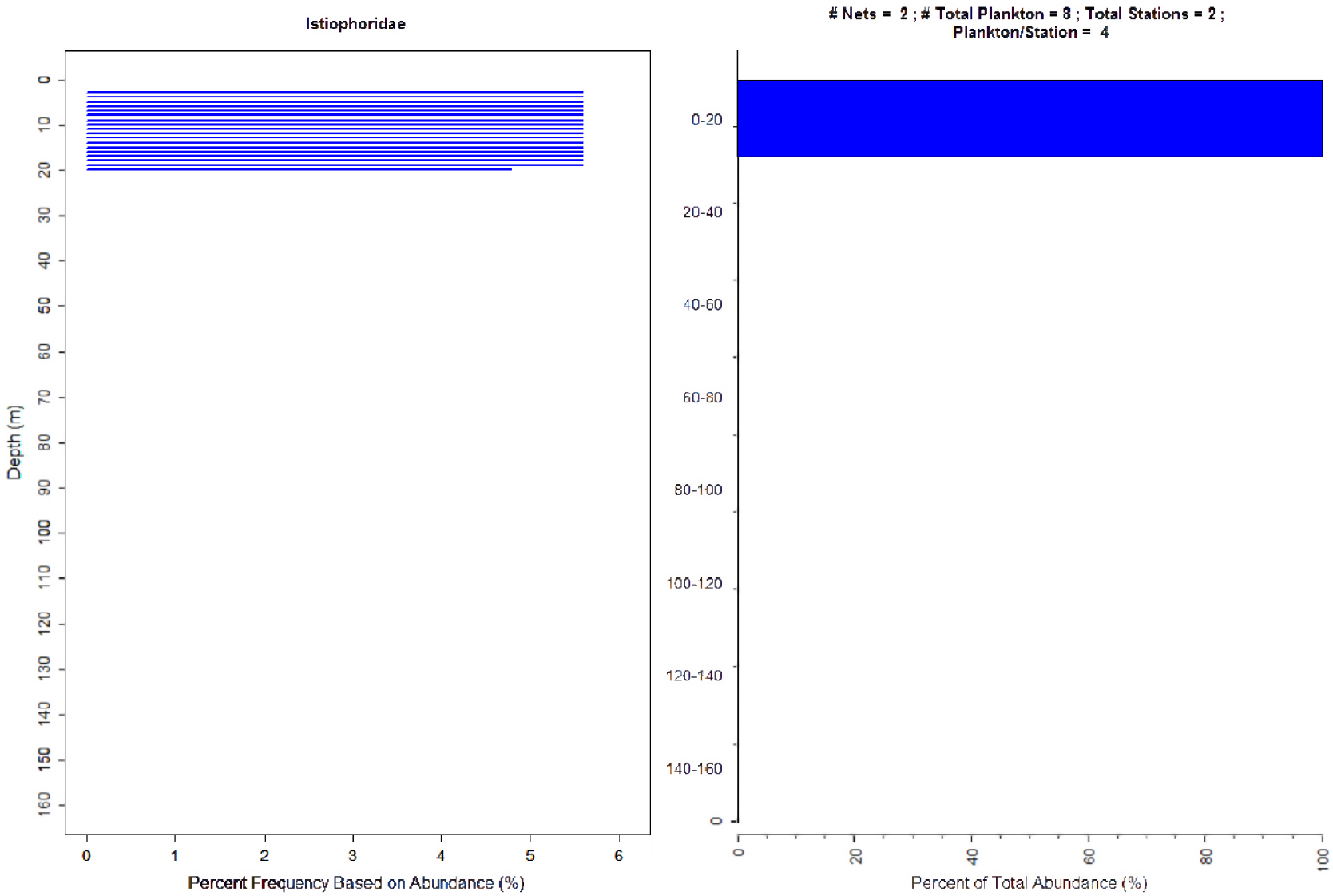
Hippoidea - Shallow



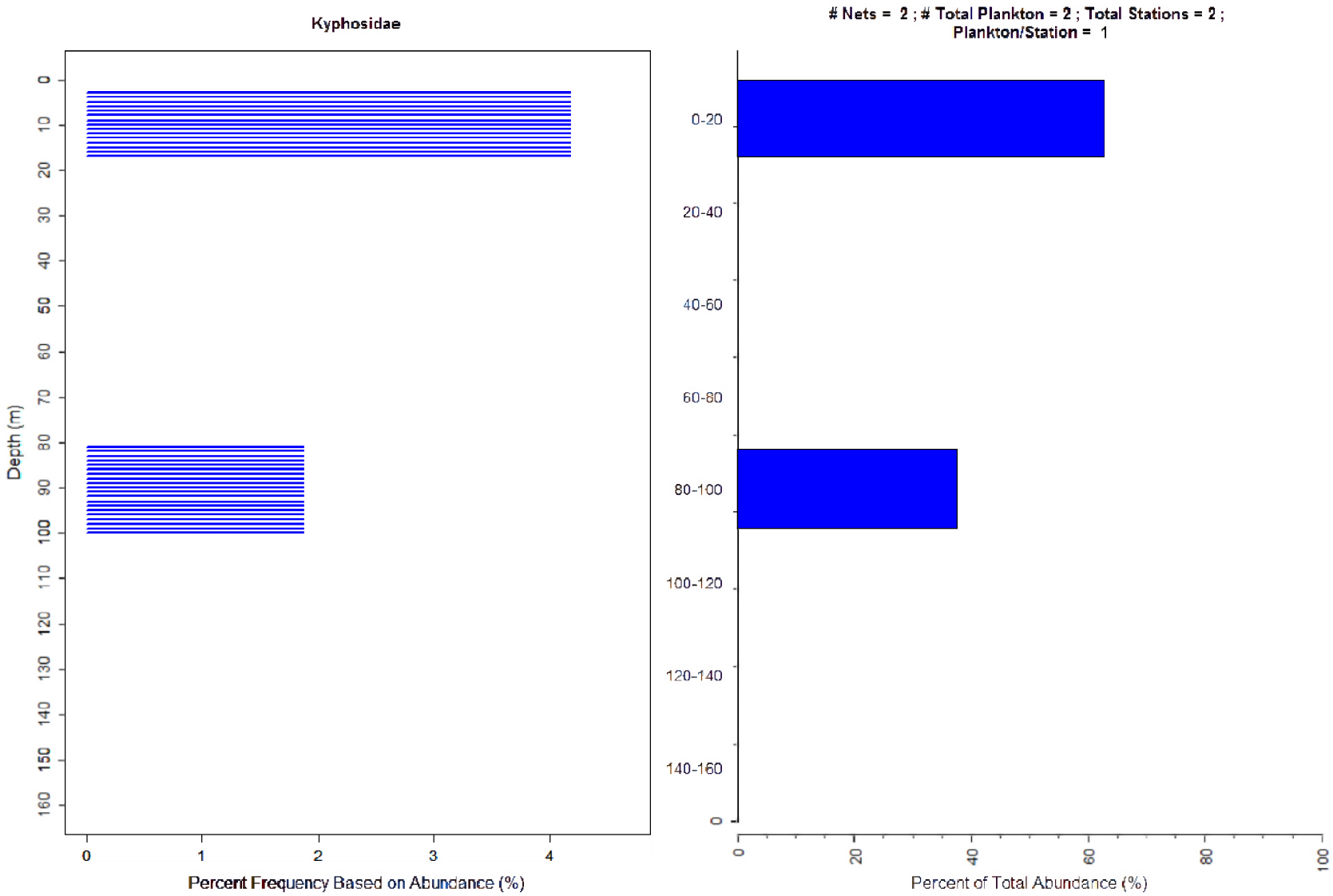
Holocentridae - Shallow



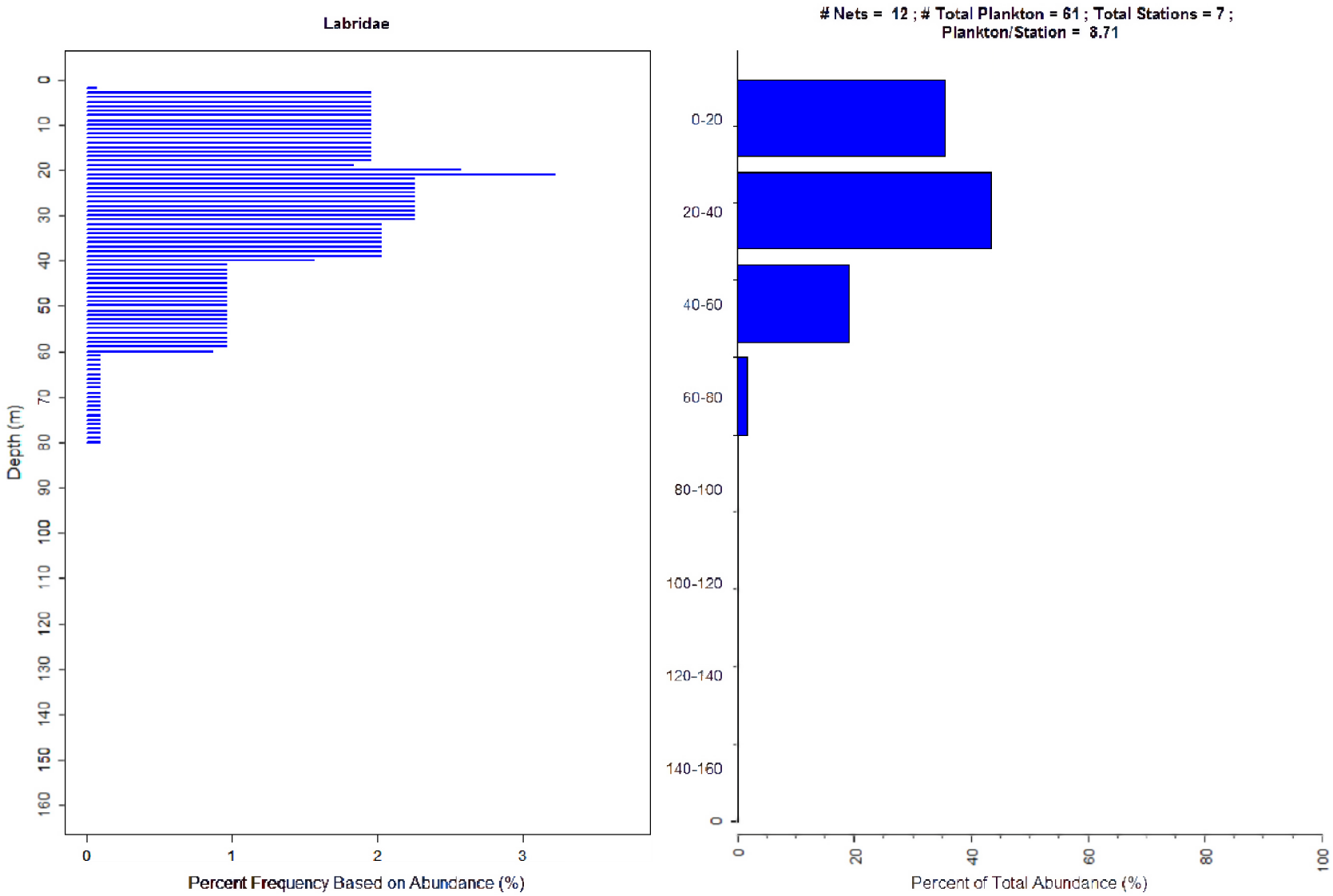
Howellidae - Shallow



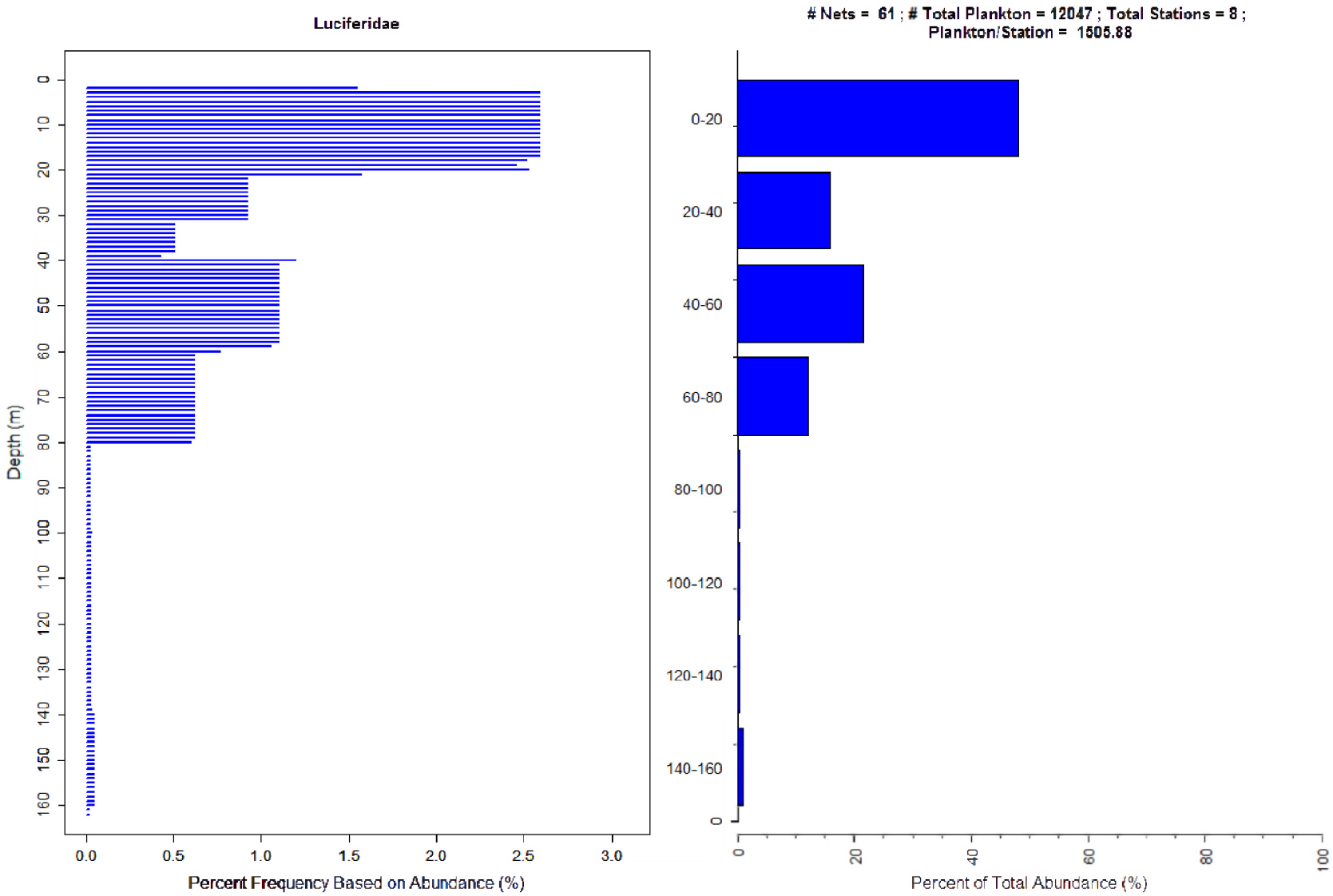
Istiophoridae - Shallow



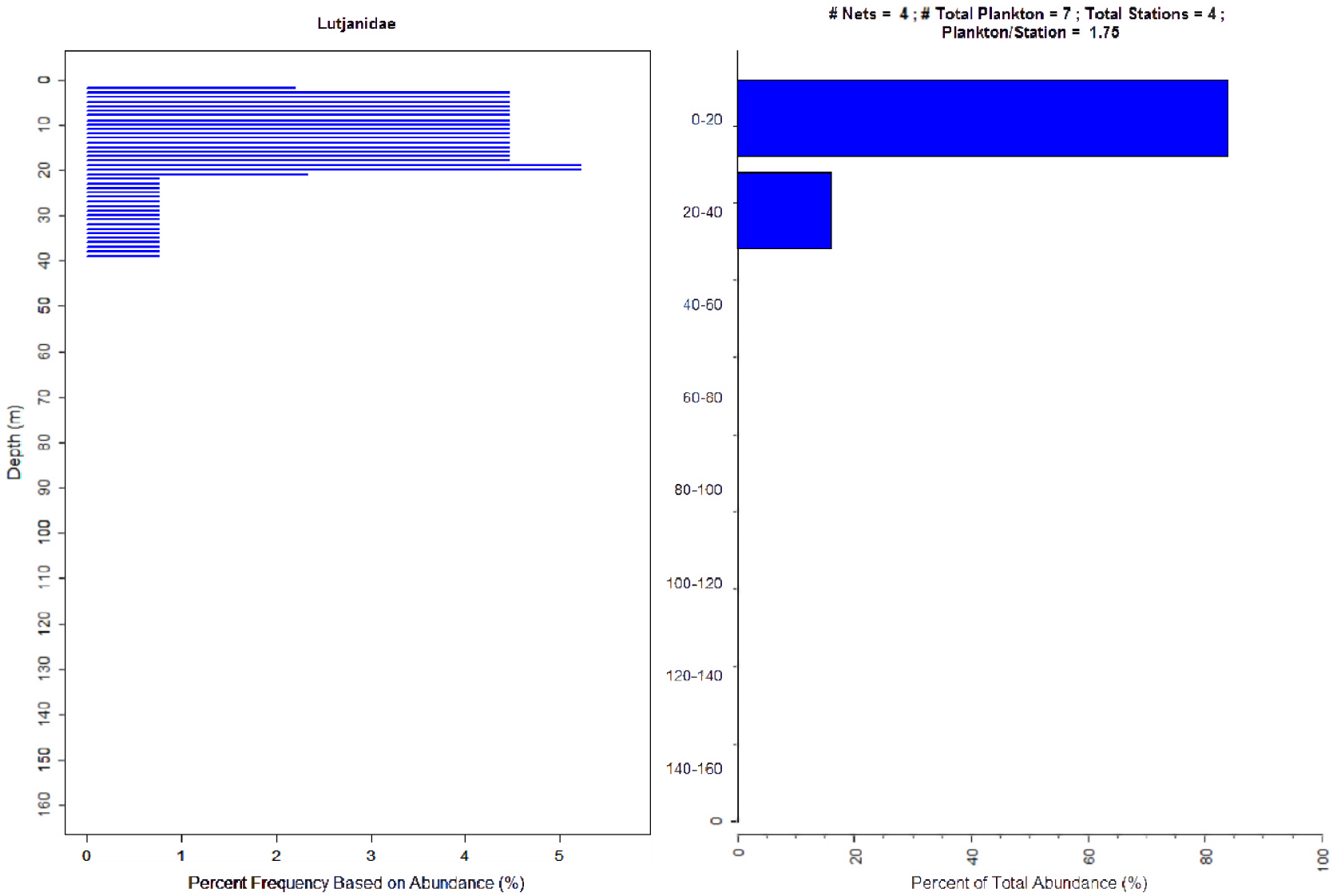
Kyphosidae - Shallow



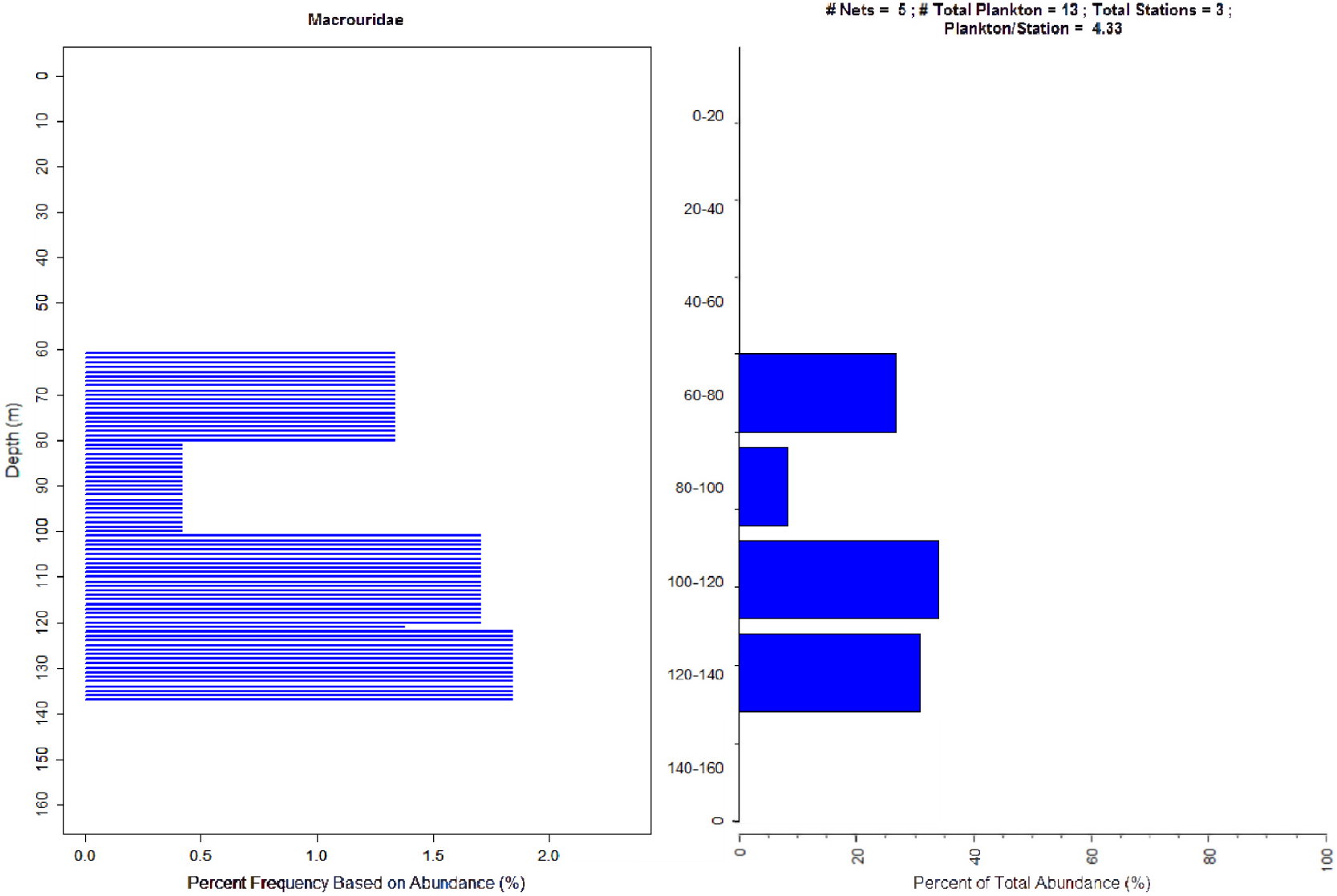
Labridae - Shallow



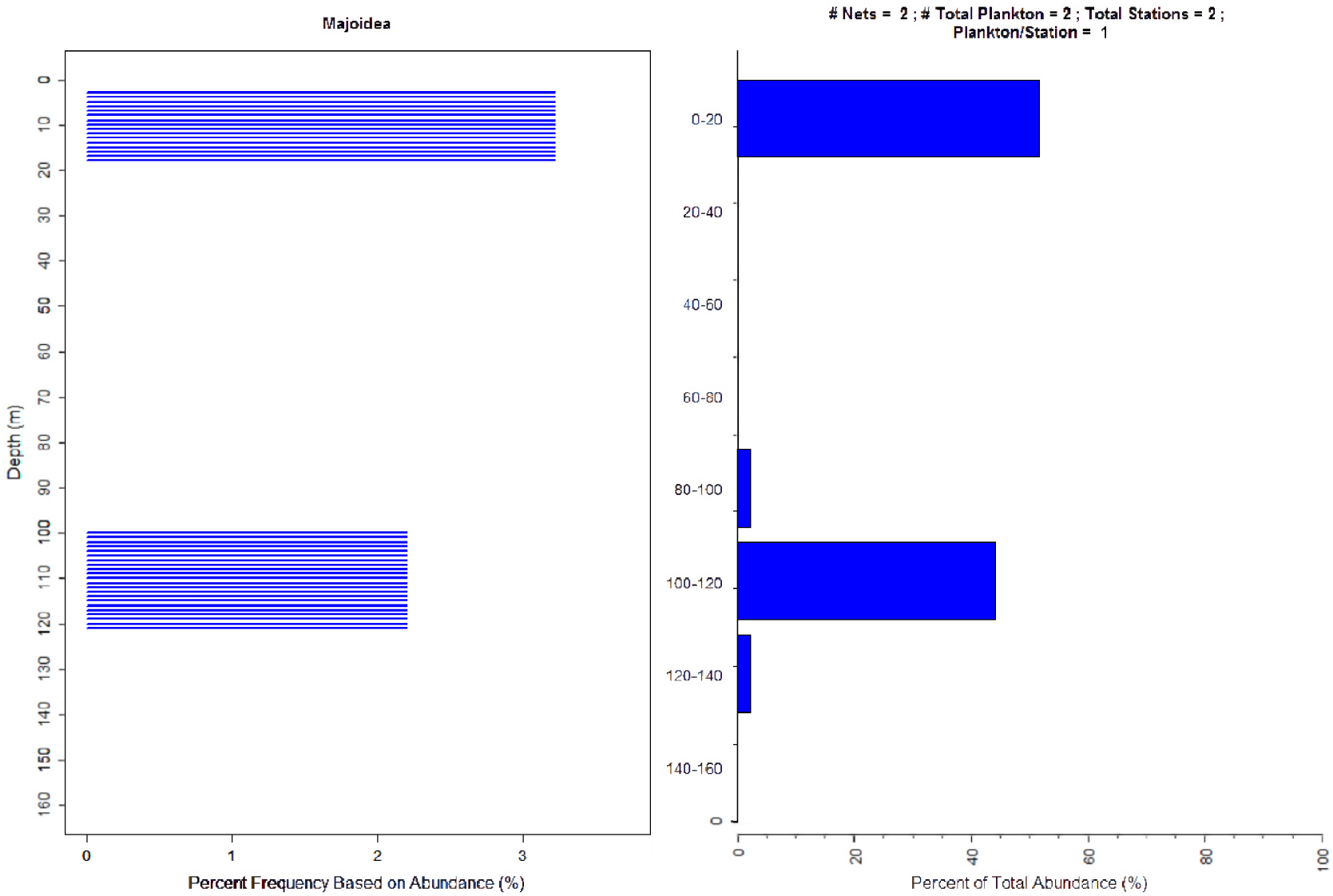
Luciferidae - Shallow



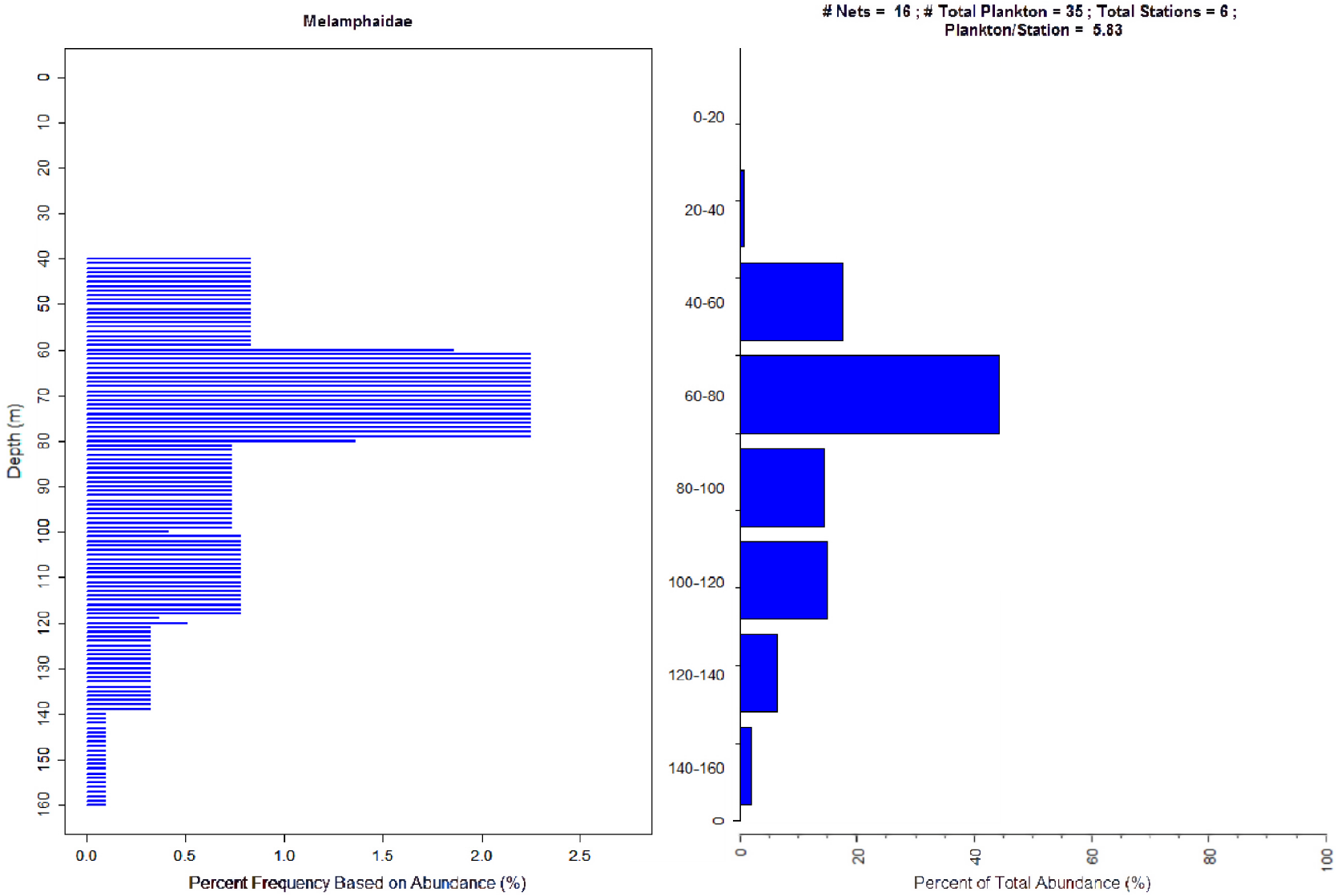
Lutjanidae - Shallow



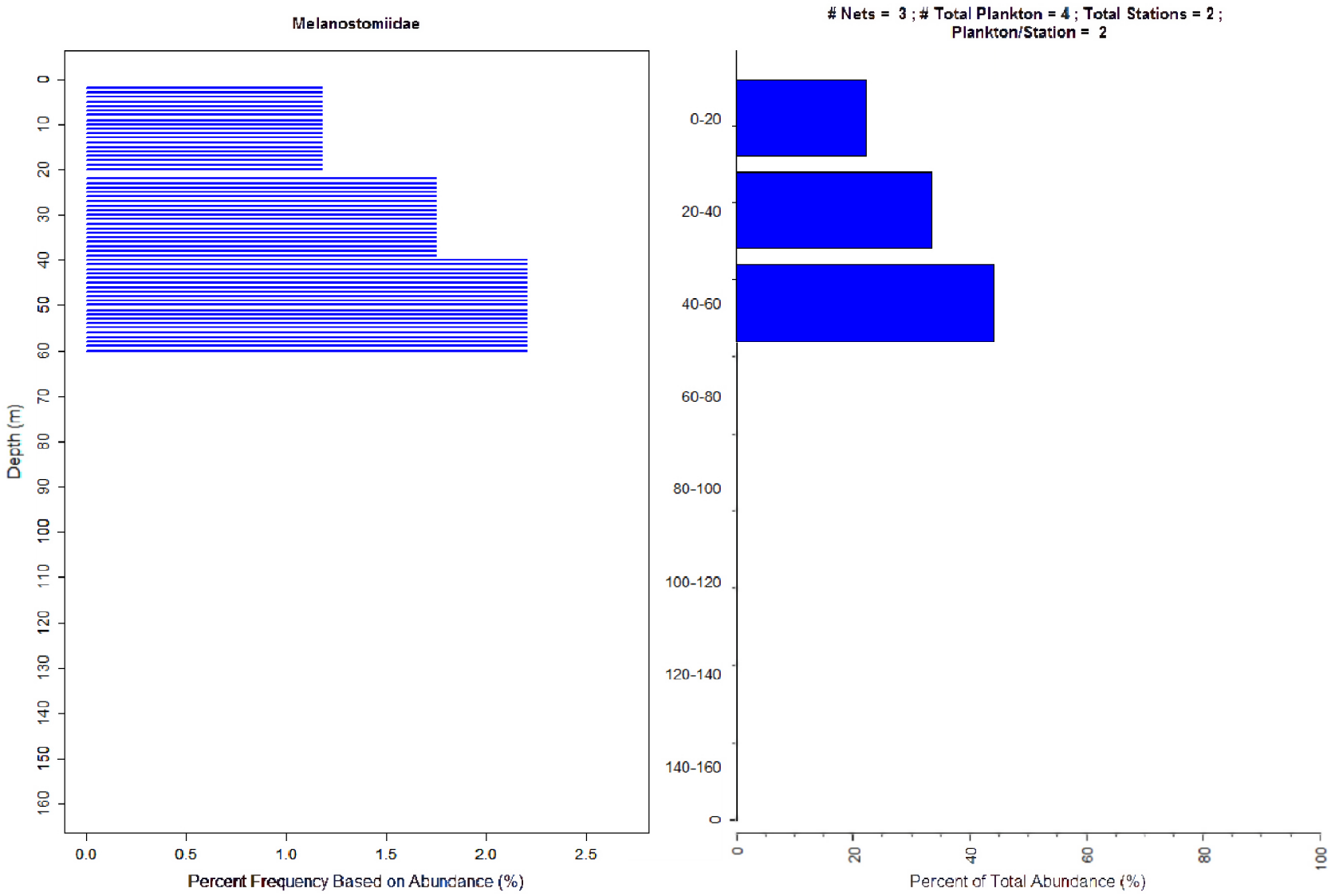
Macrouridae - Shallow



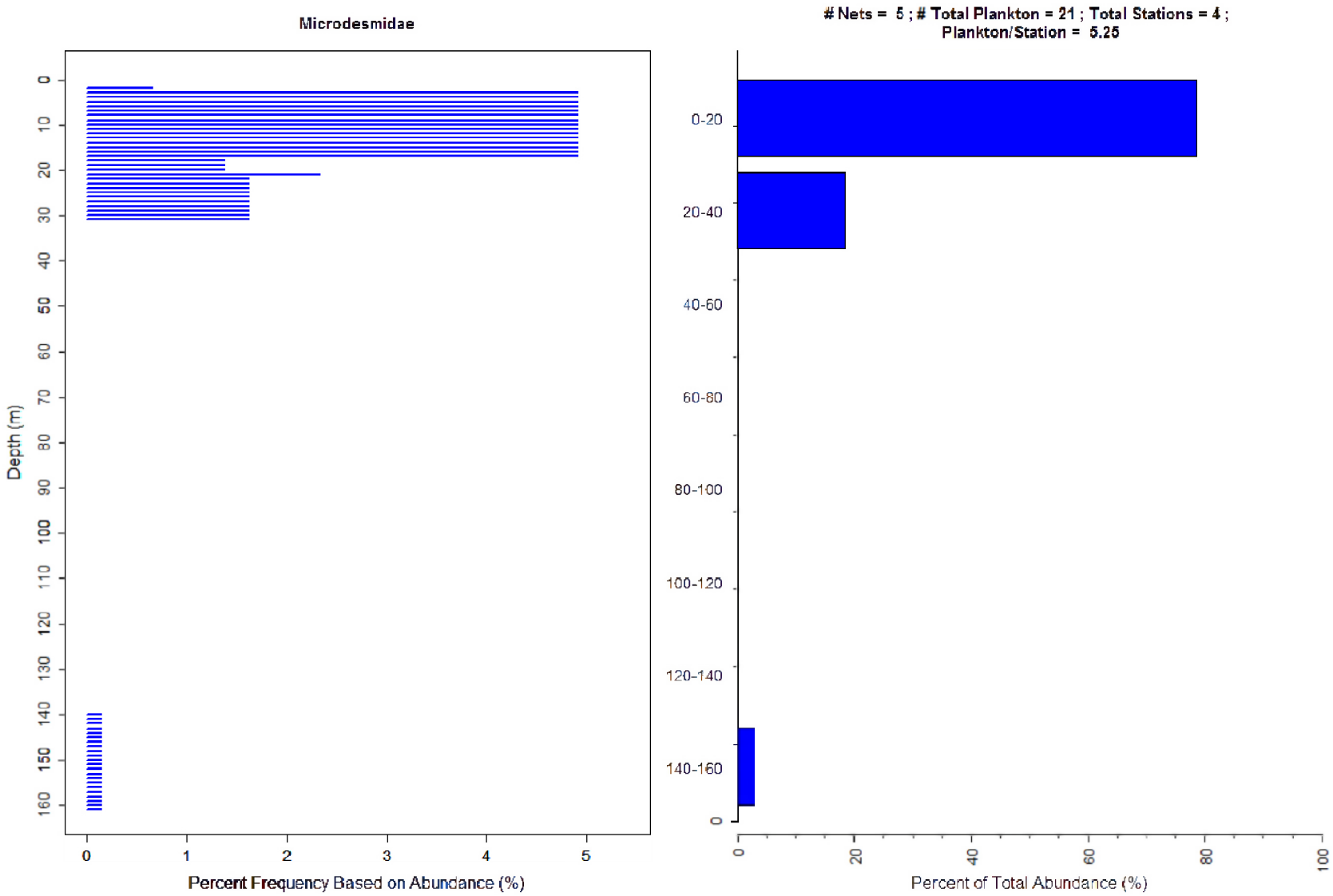
Majoidea - Shallow



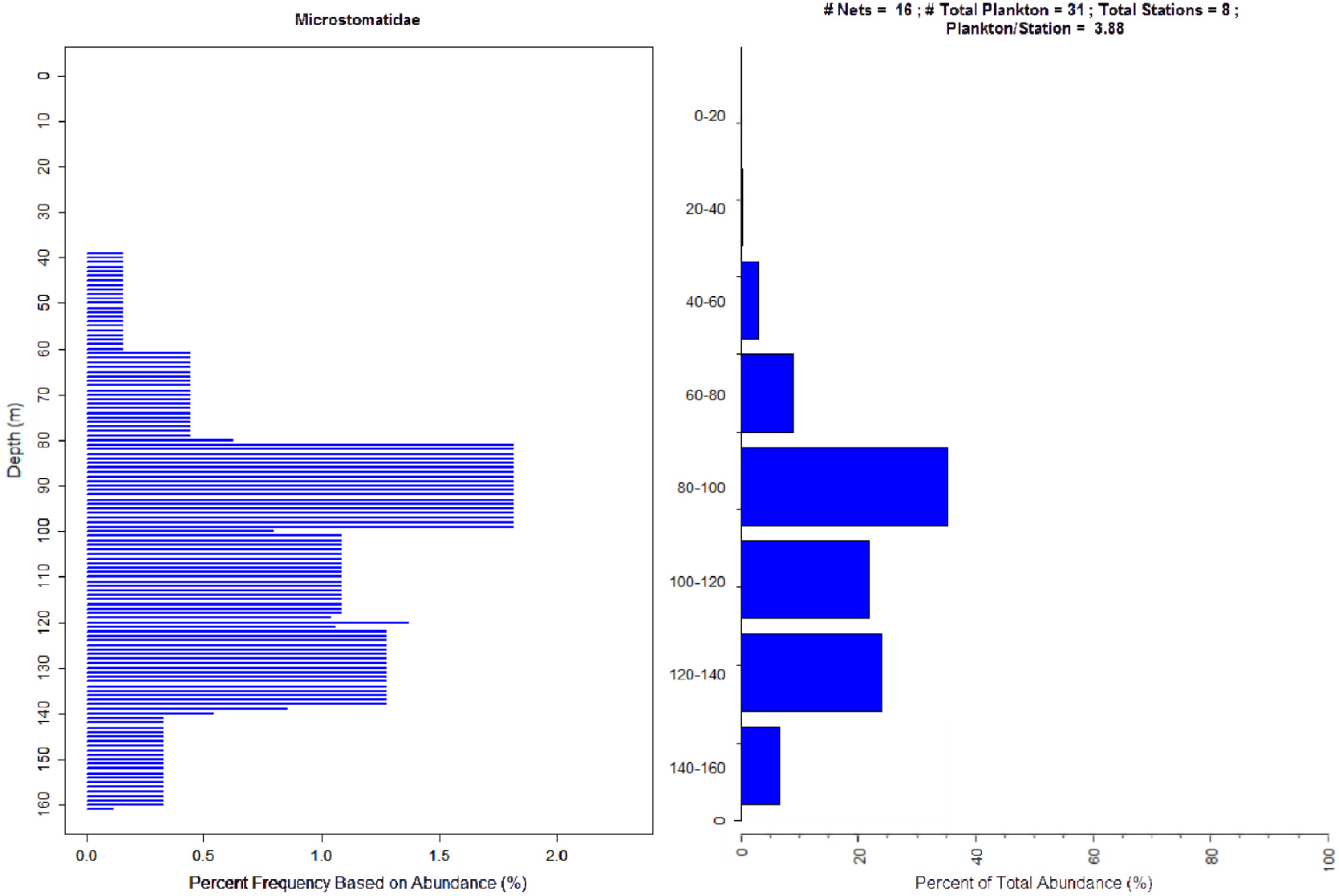
Melamphaidae - Shallow



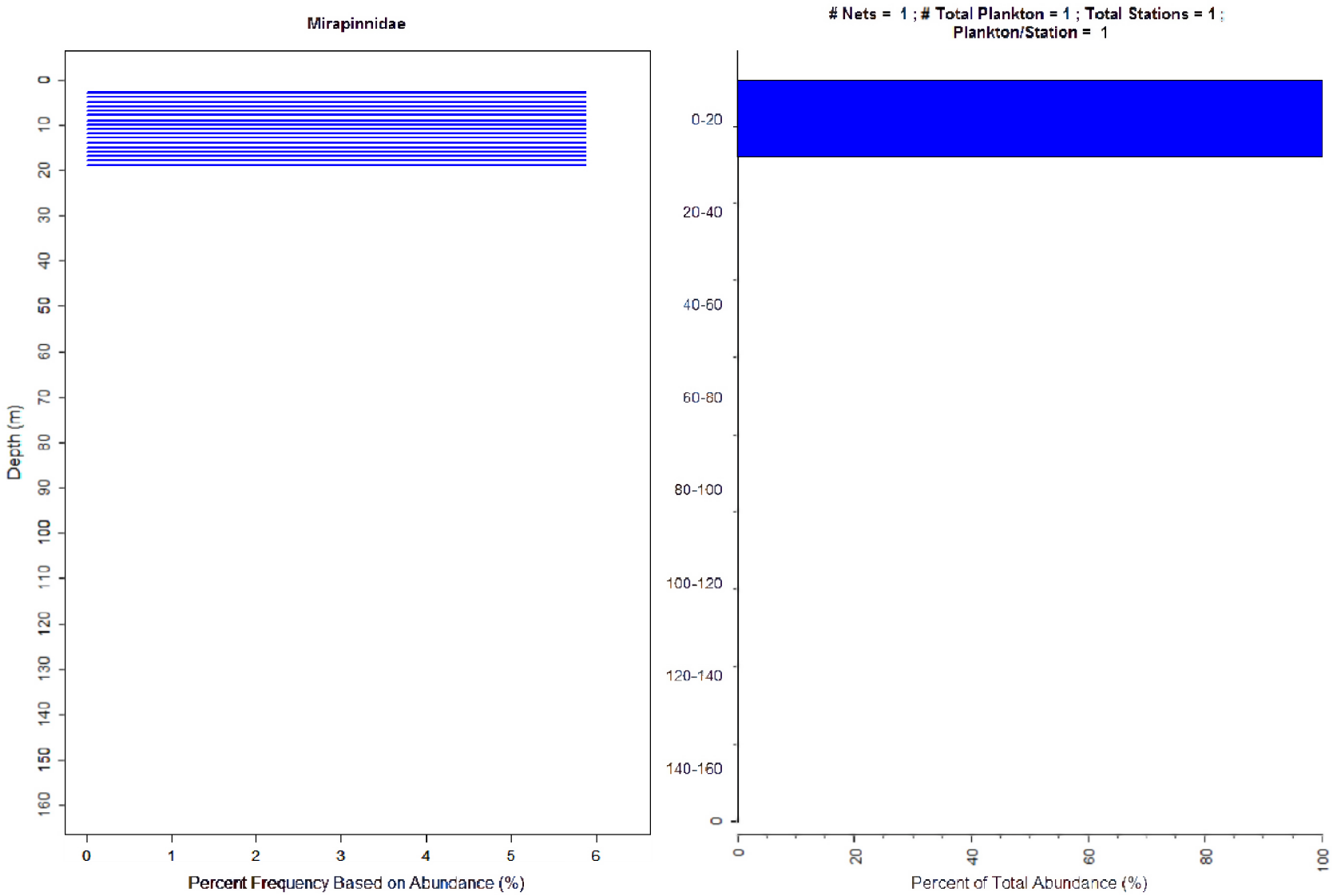
Melanostomiidae - Shallow



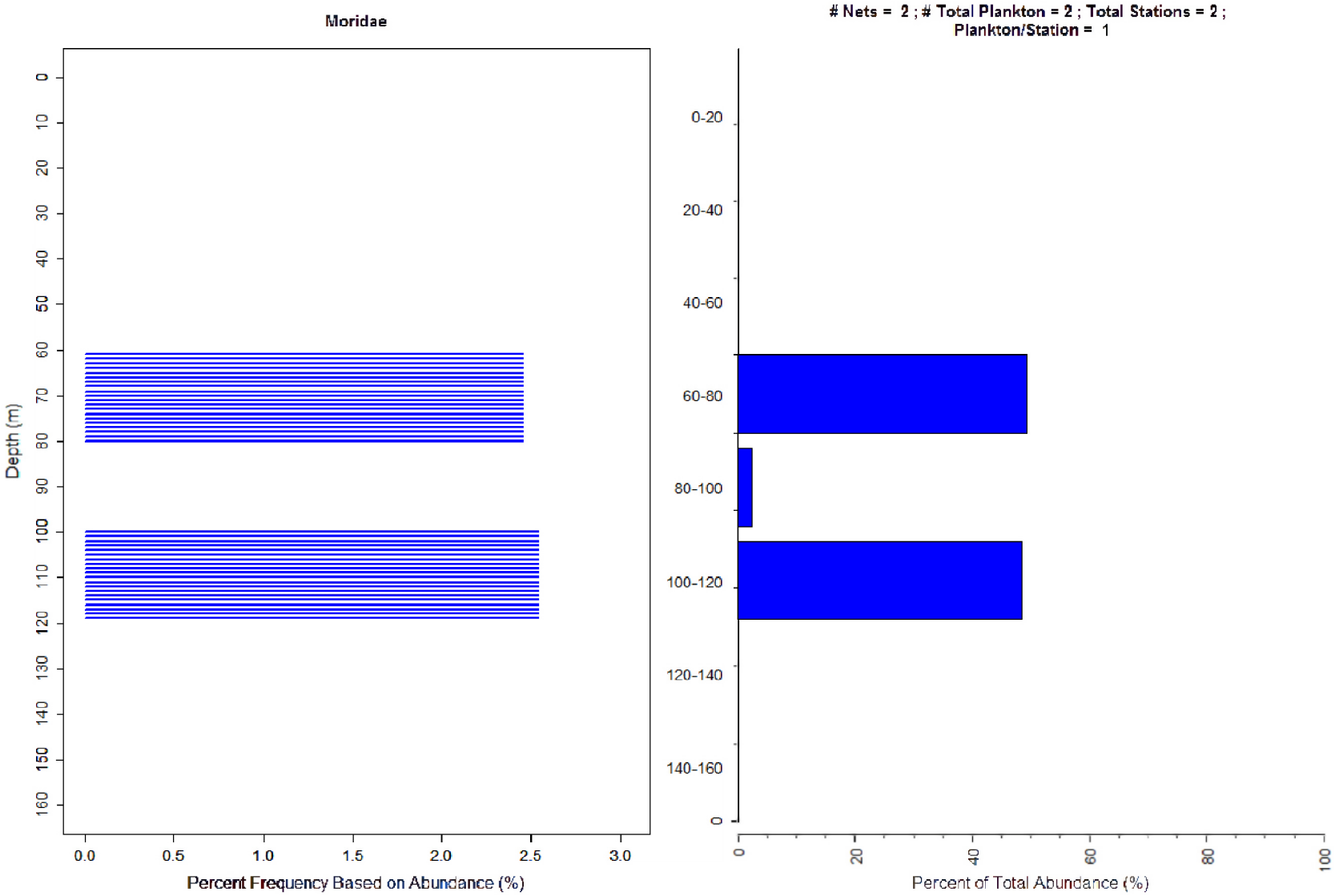
Microdesmidae - Shallow



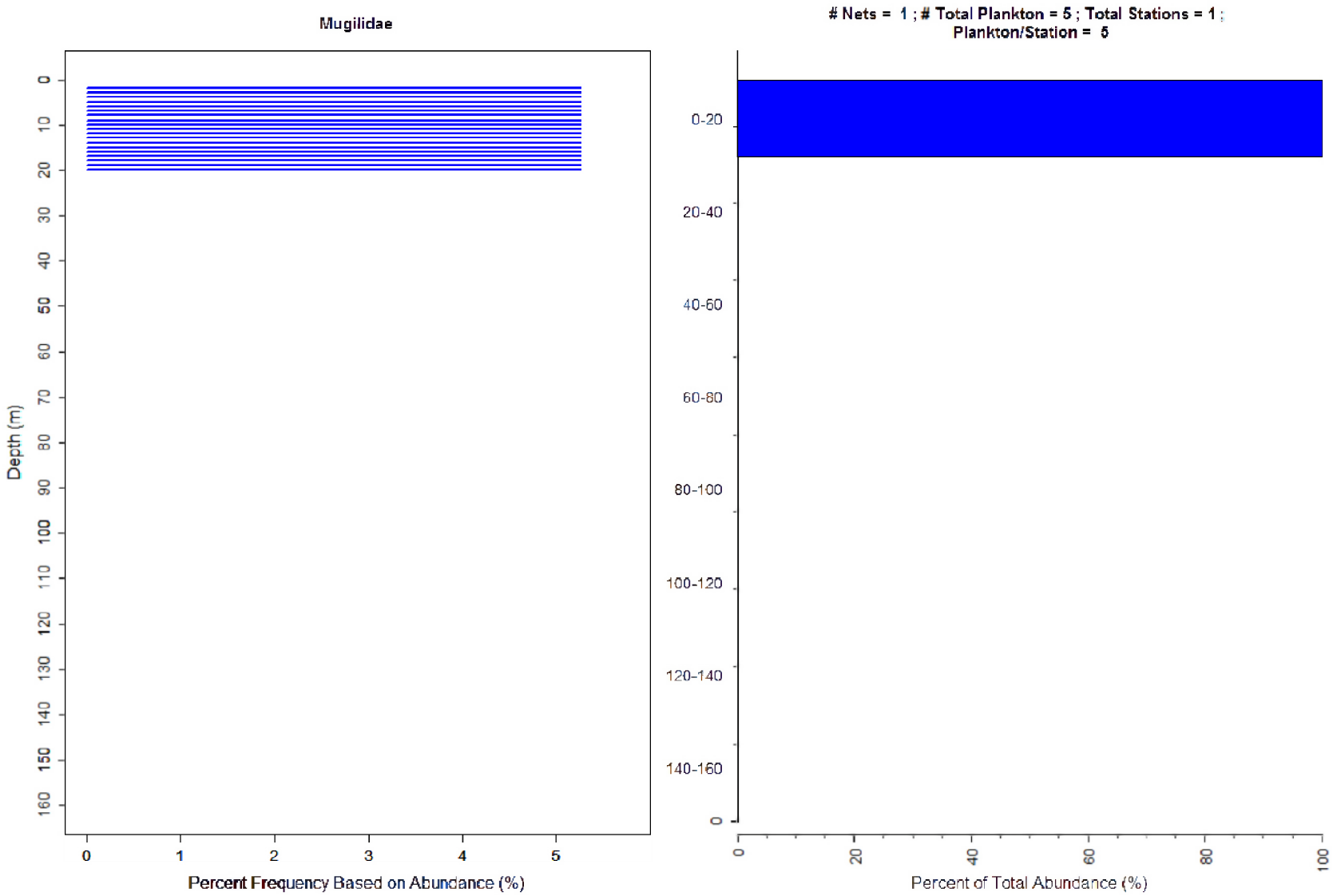
Microstomatidae - Shallow



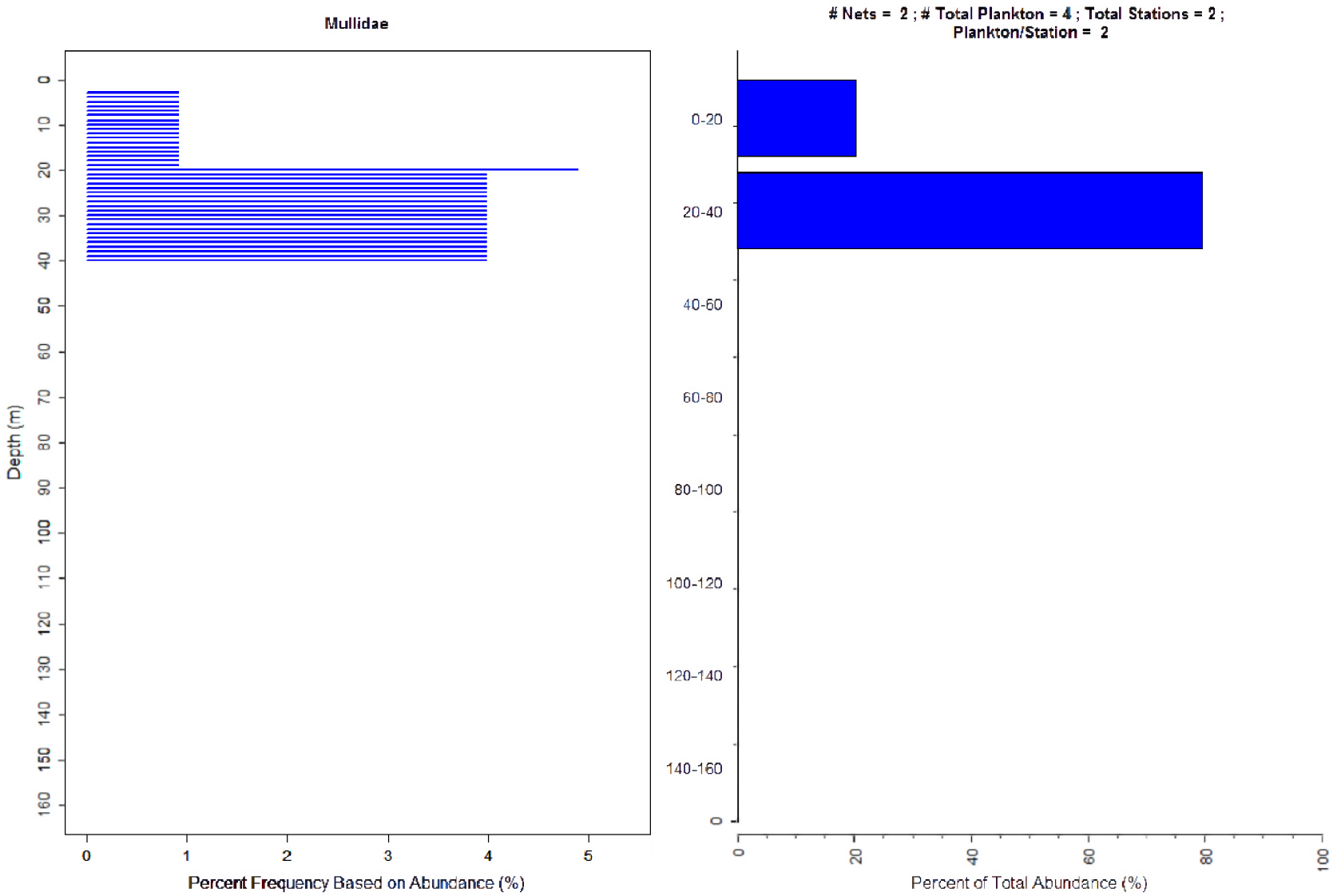
Mirapinnidae - Shallow



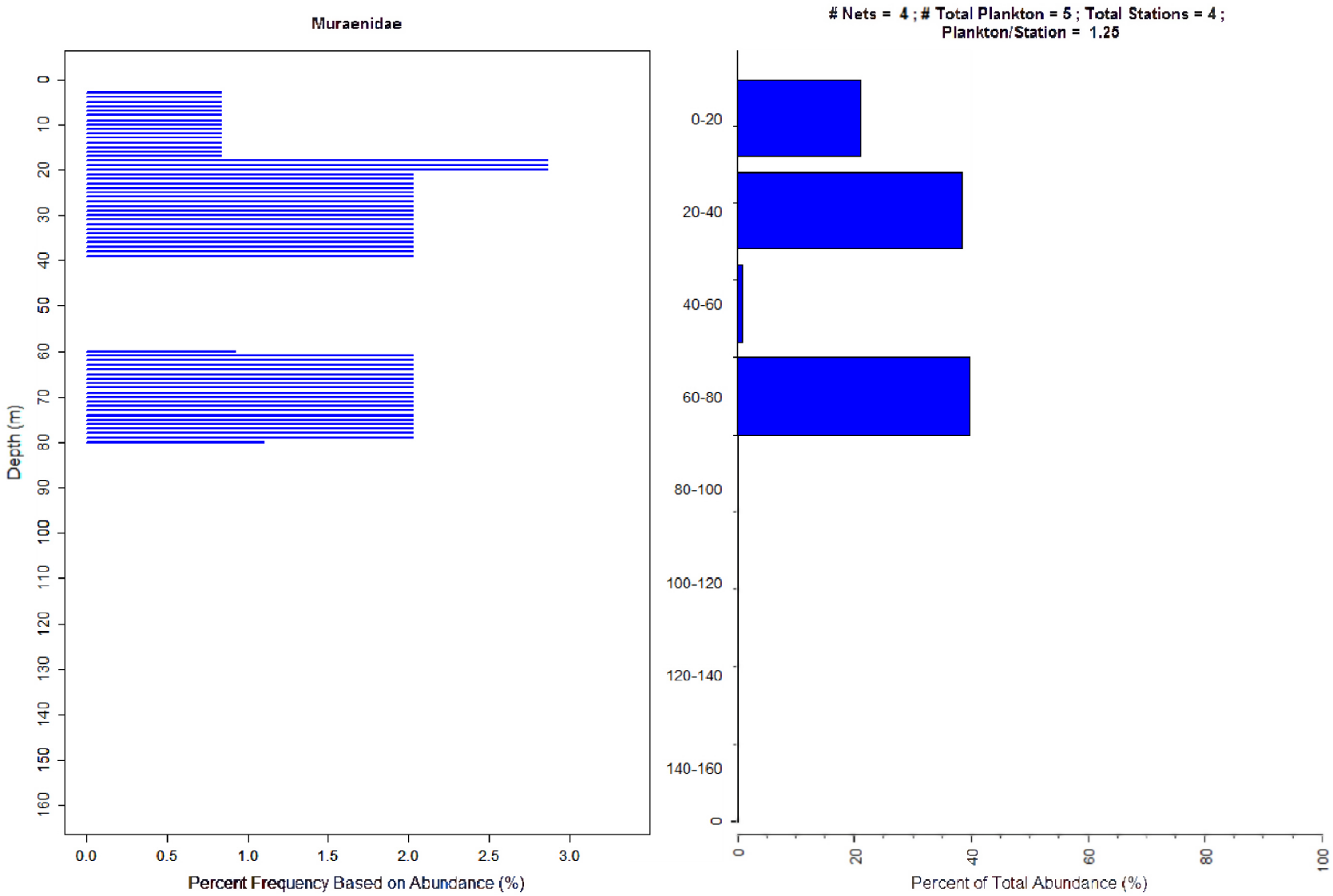
Moridae - Shallow



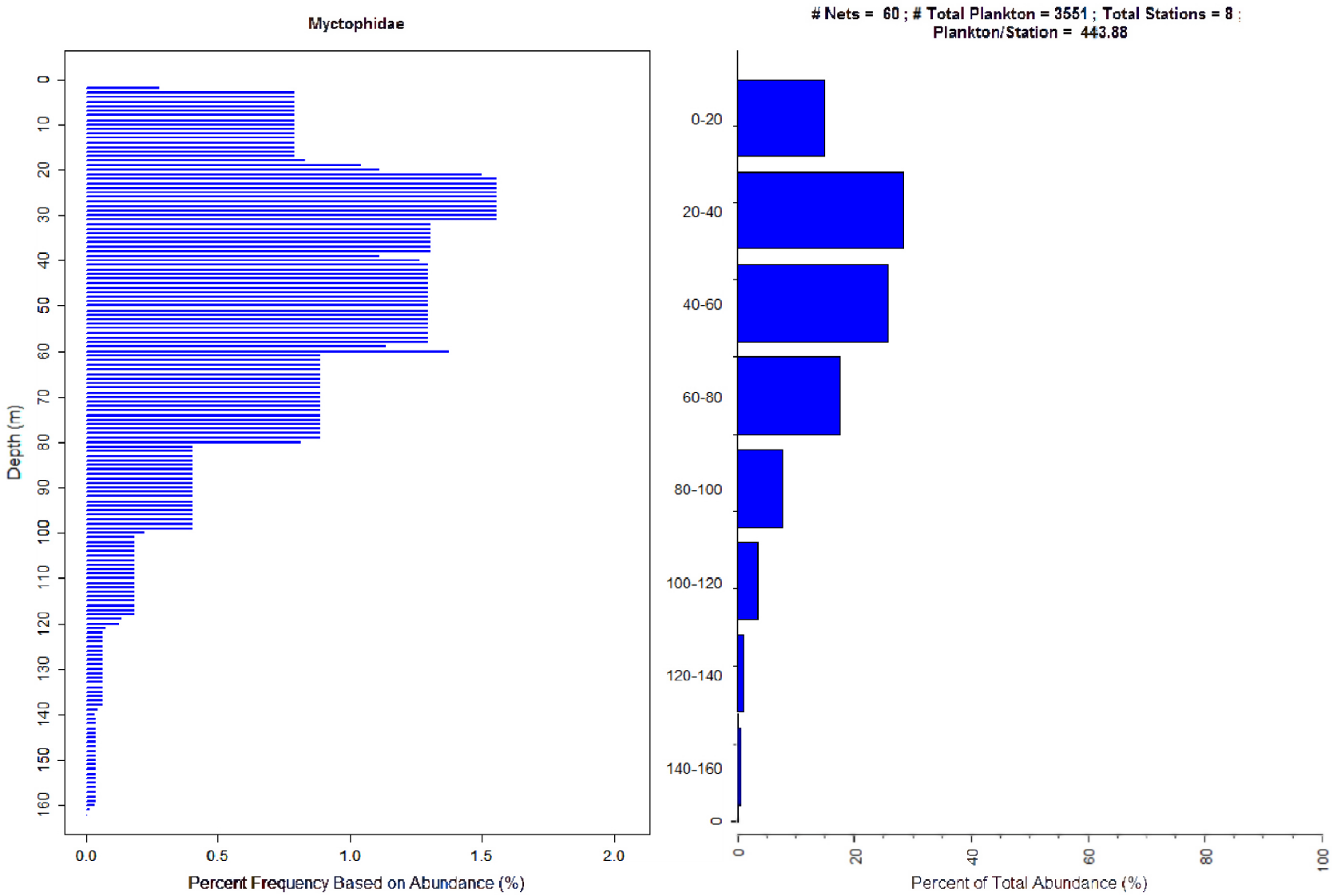
Mugilidae - Shallow



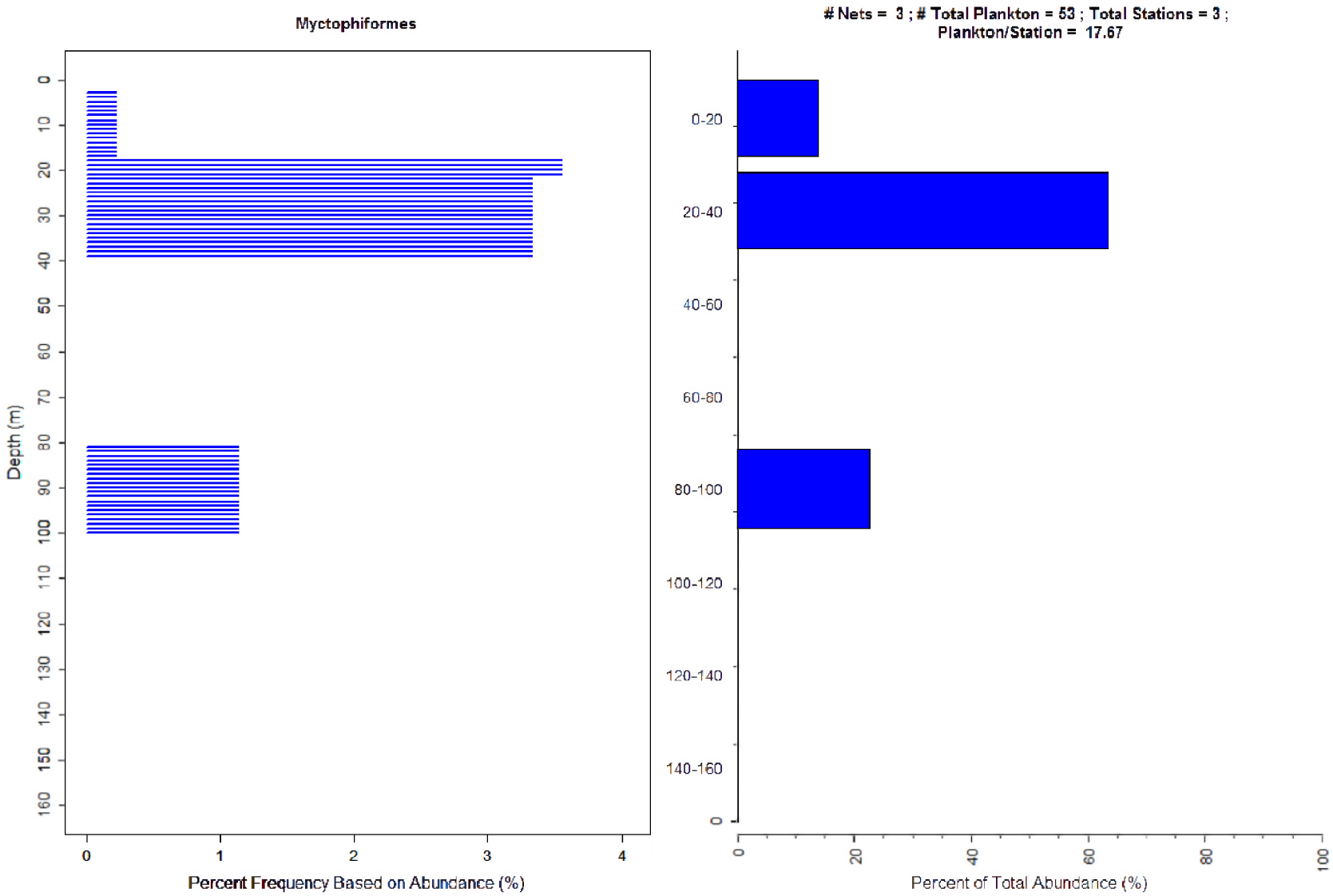
Mullidae - Shallow



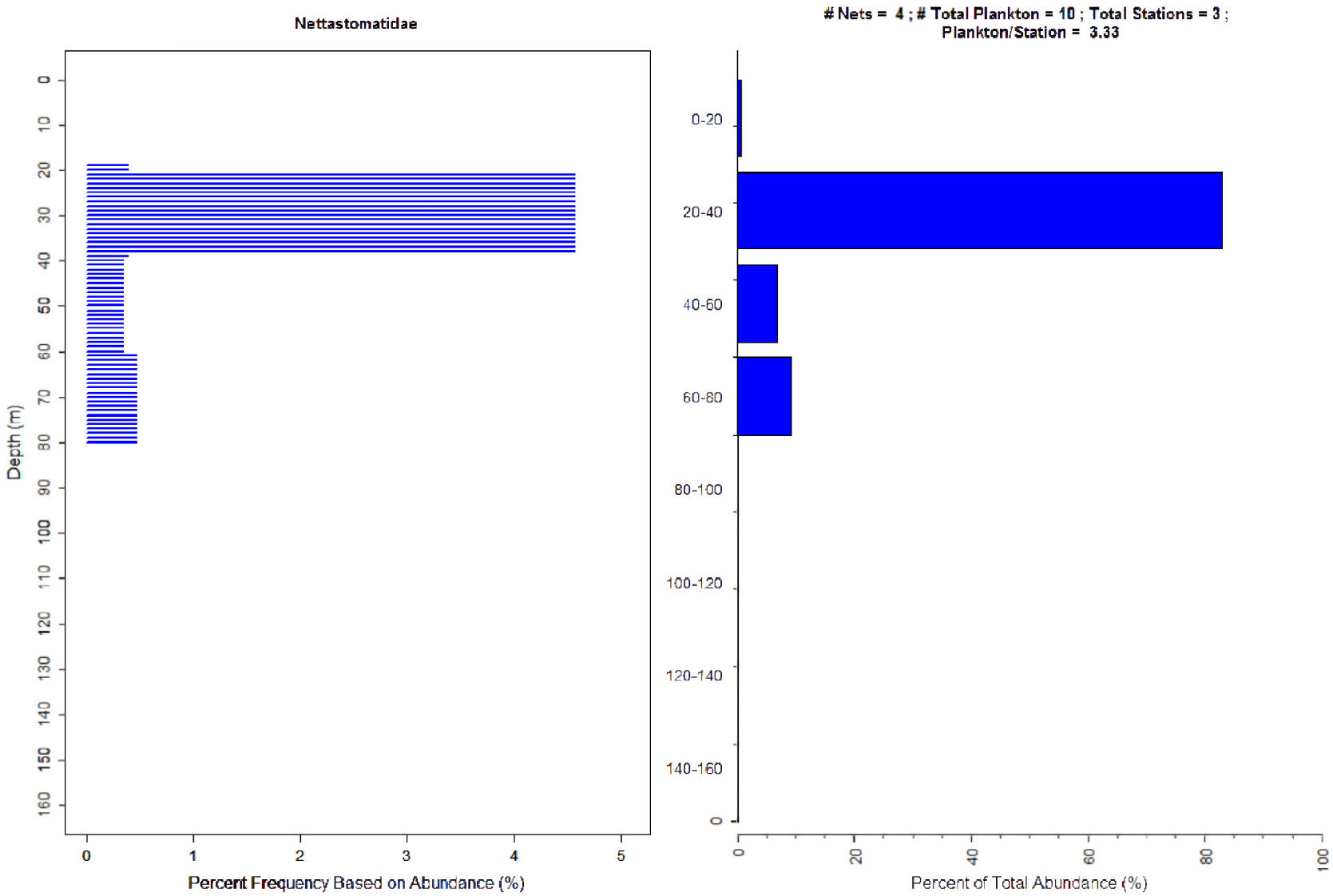
Muraenidae - Shallow



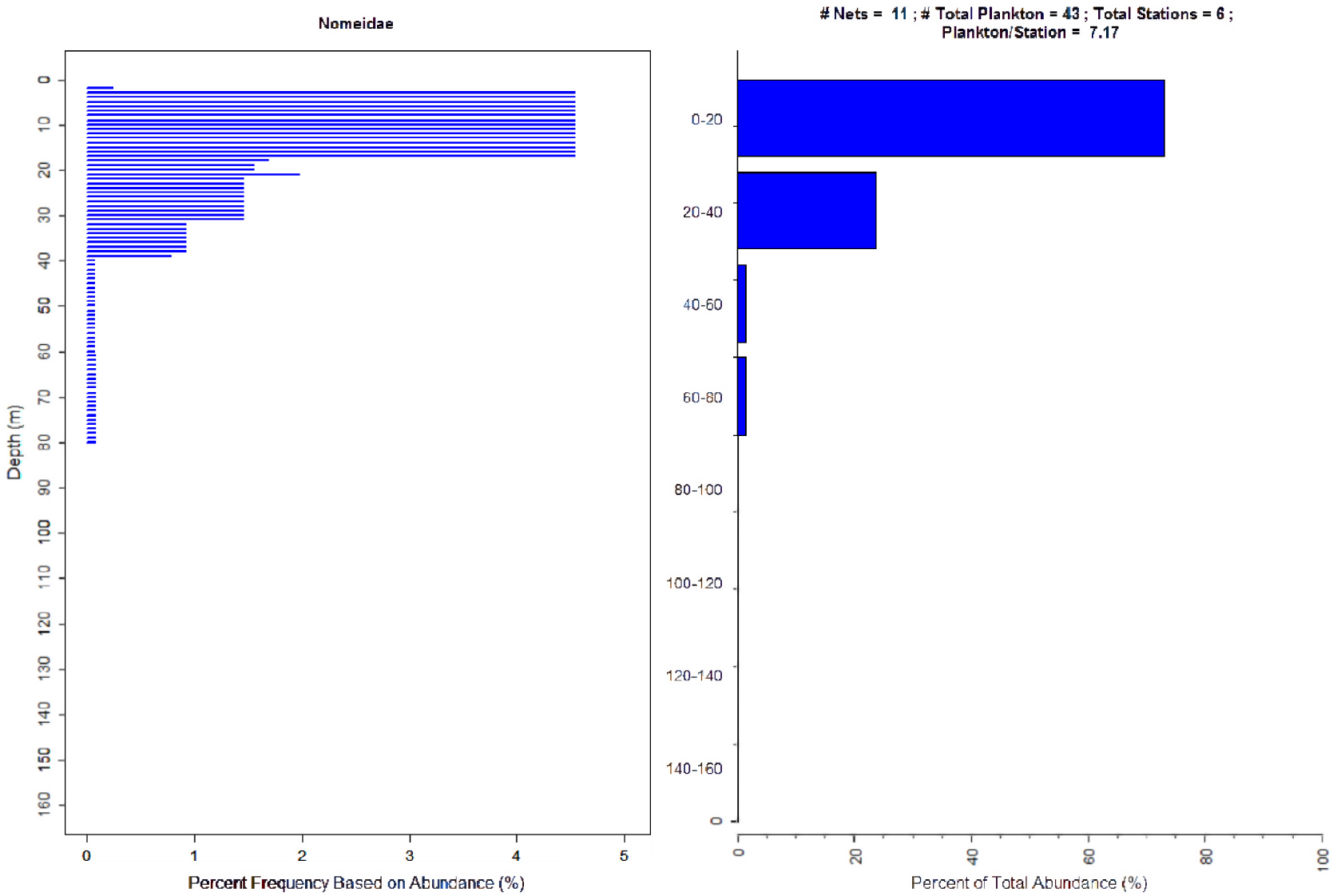
Myctophidae - Shallow



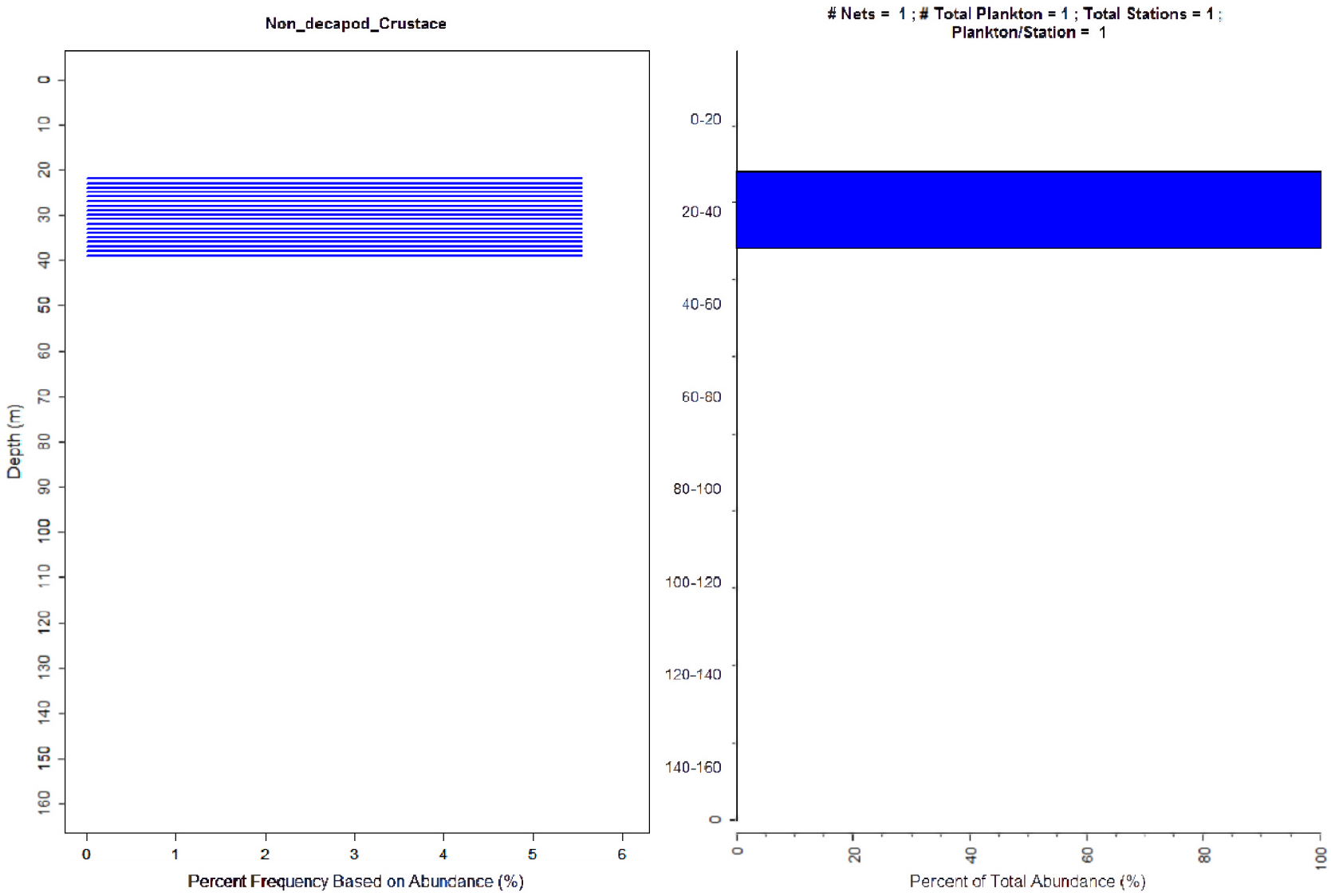
Myctophiformes - Shallow



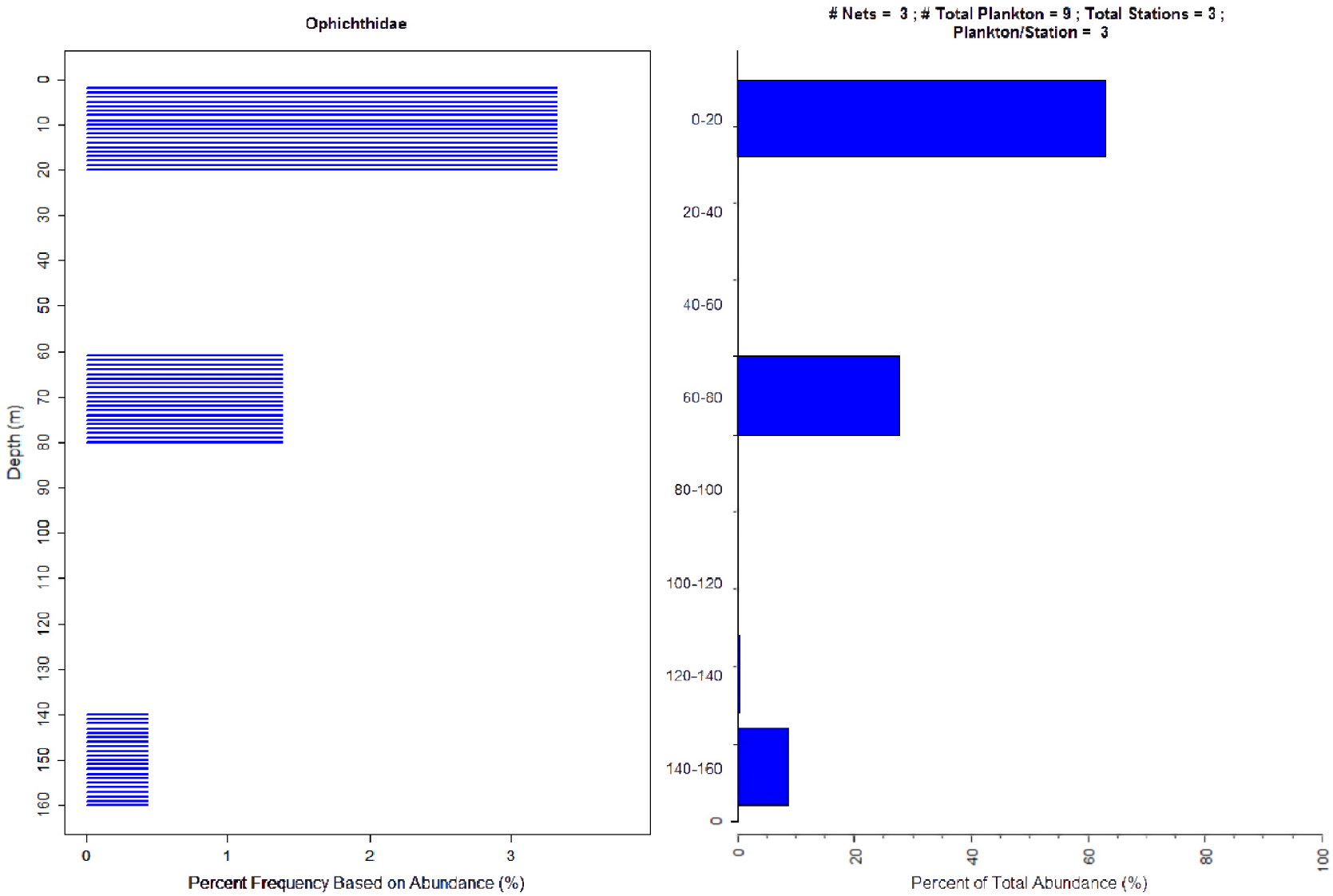
Nettastomatidae - Shallow



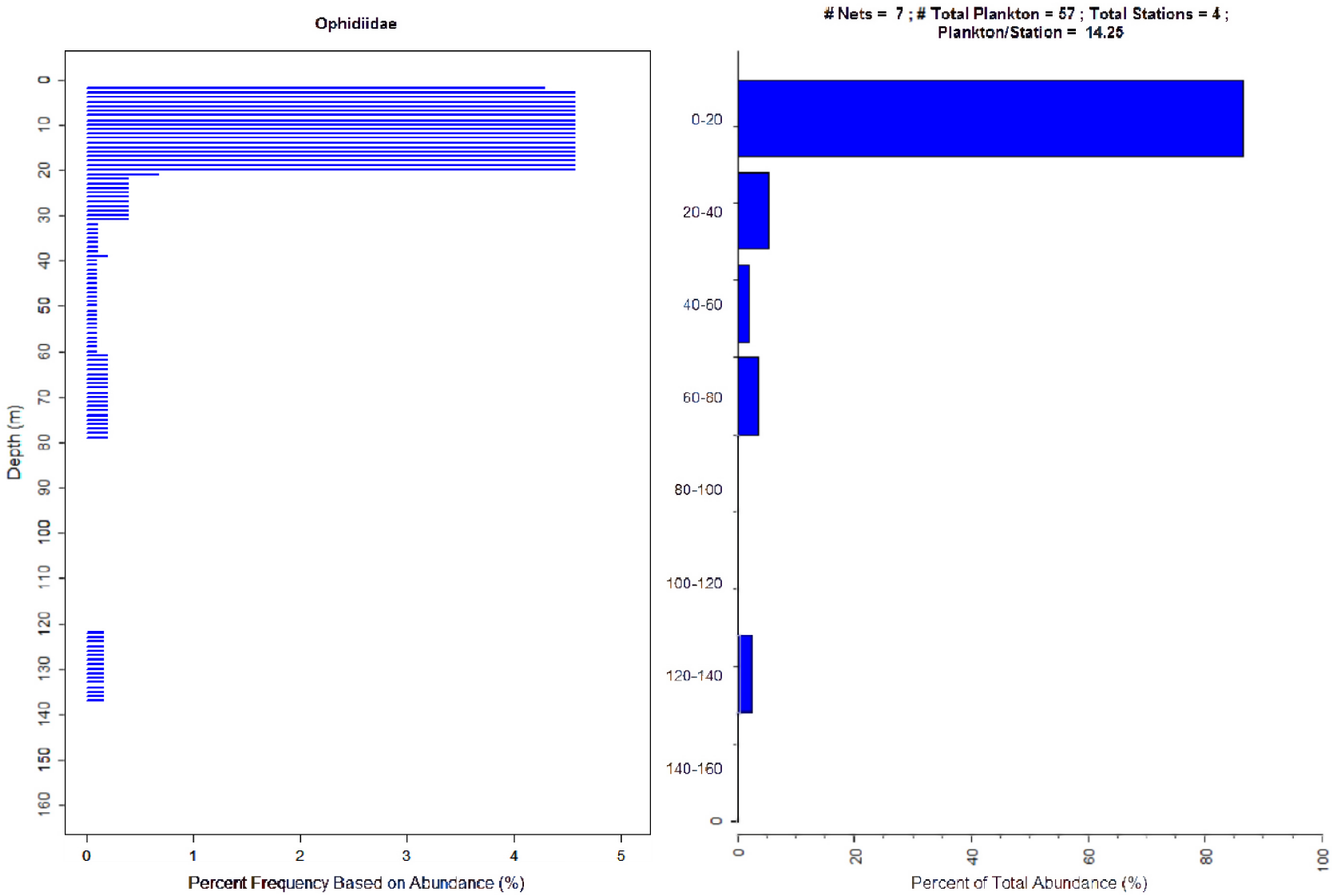
Nomeidae - Shallow



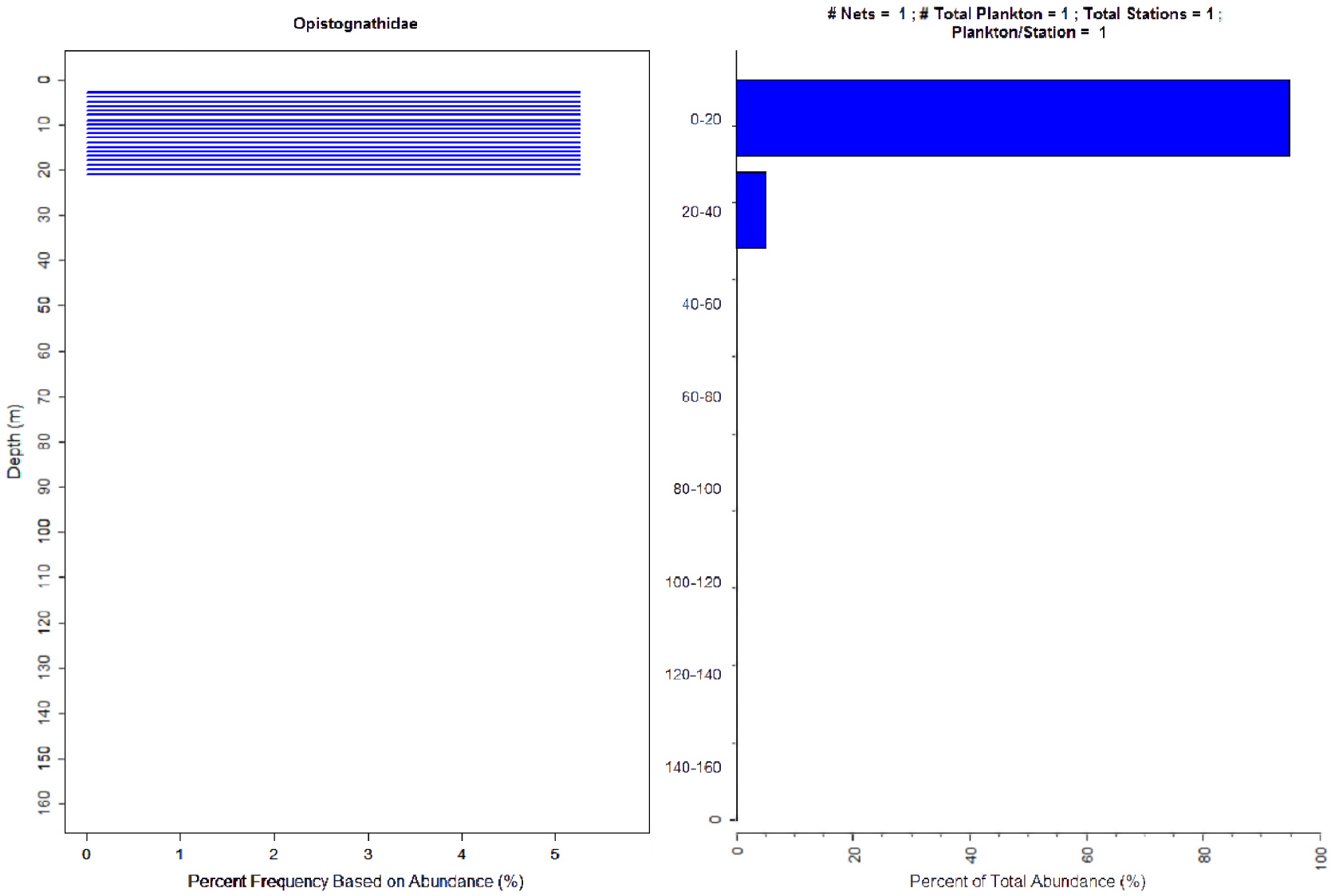
Non_decapod_Crustace - Shallow



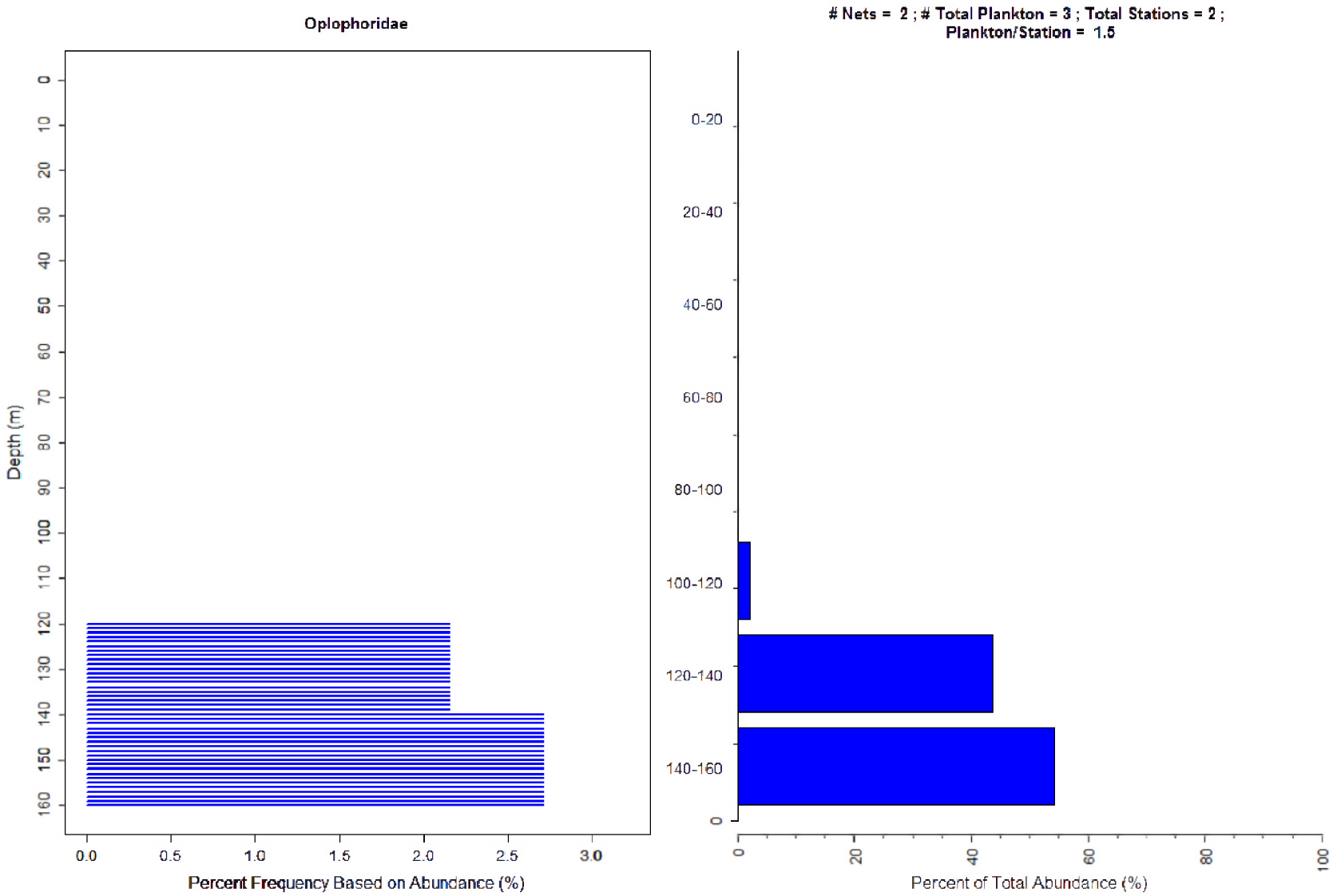
Ophichthidae - Shallow



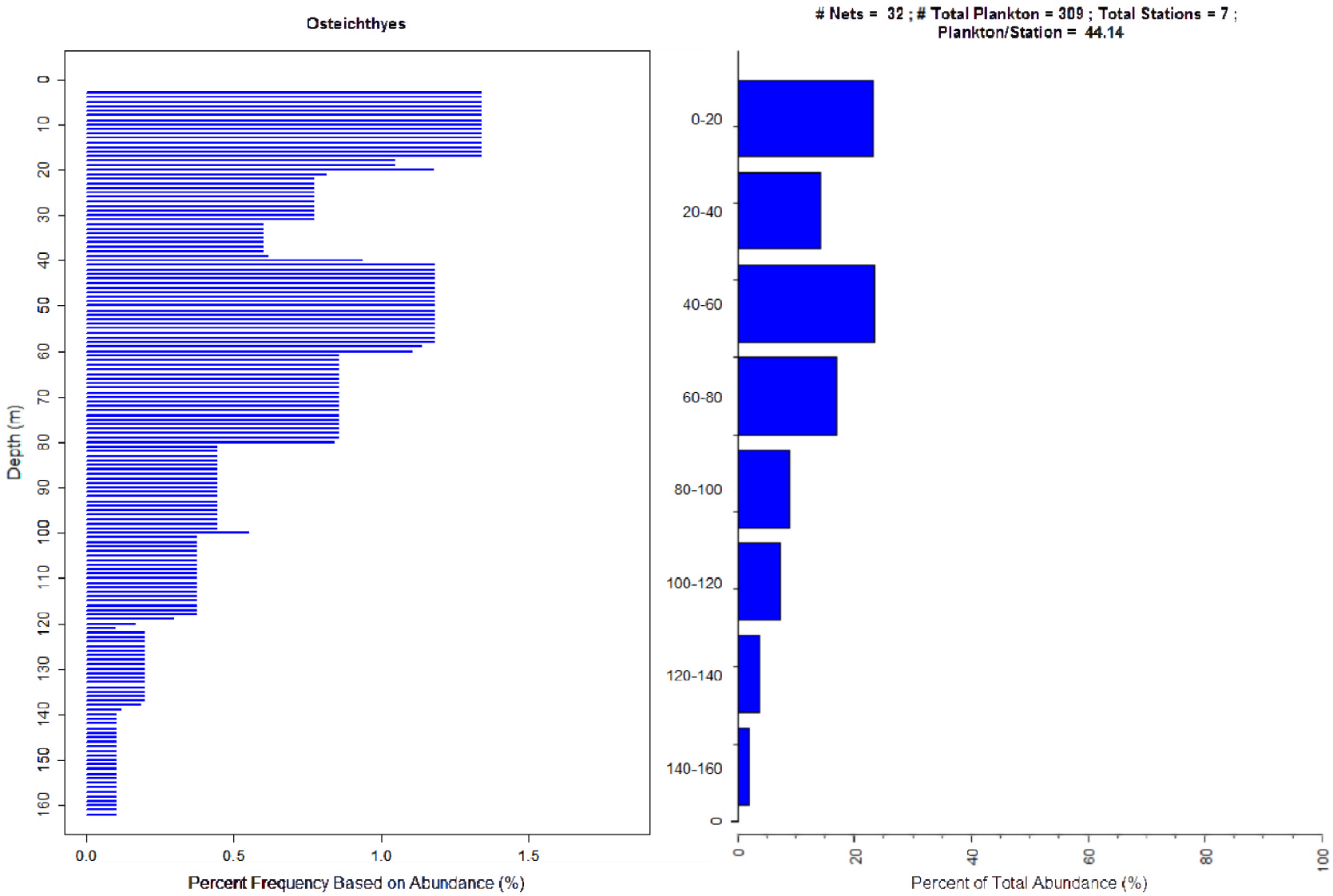
Ophidiidae - Shallow



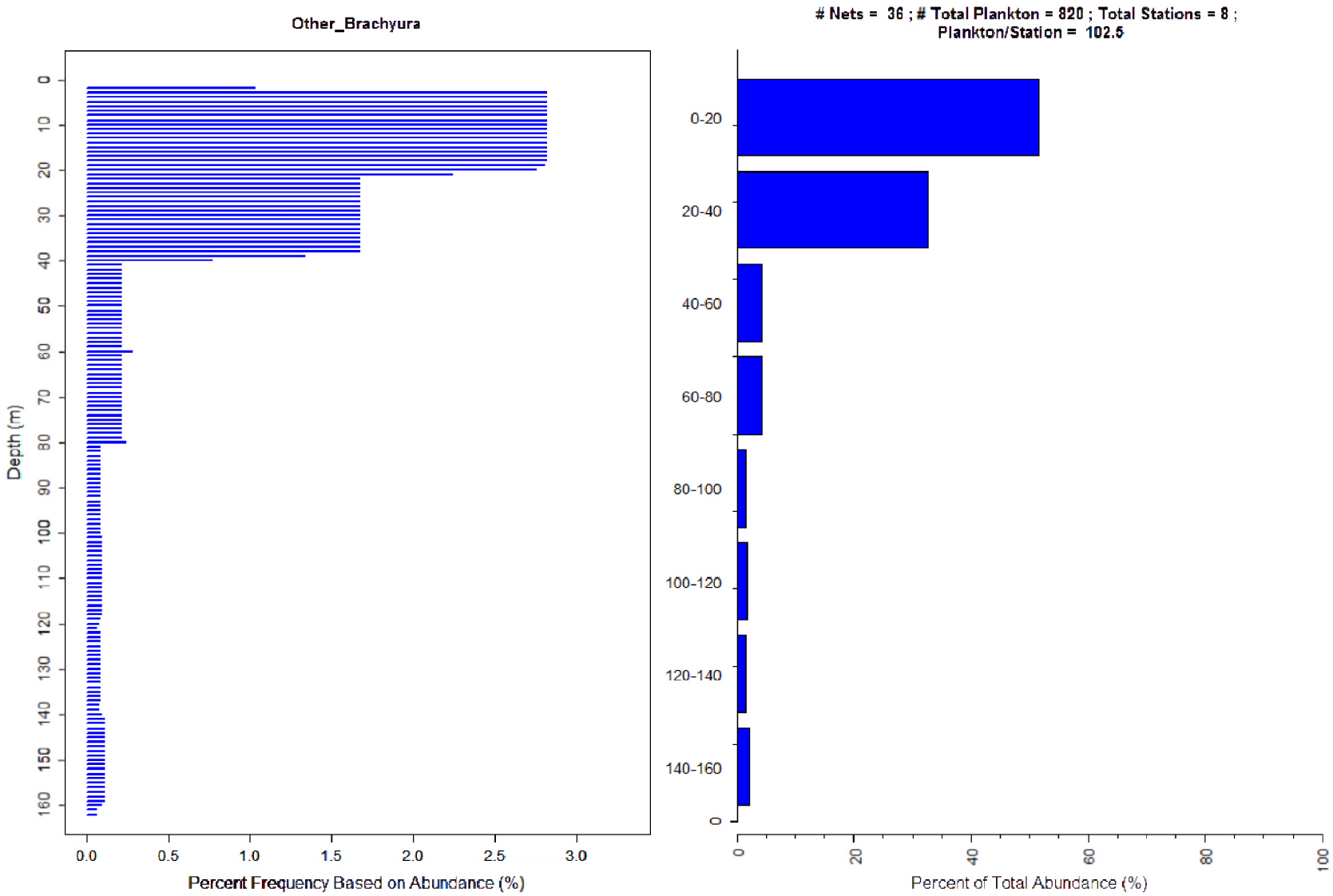
Opistognathidae - Shallow



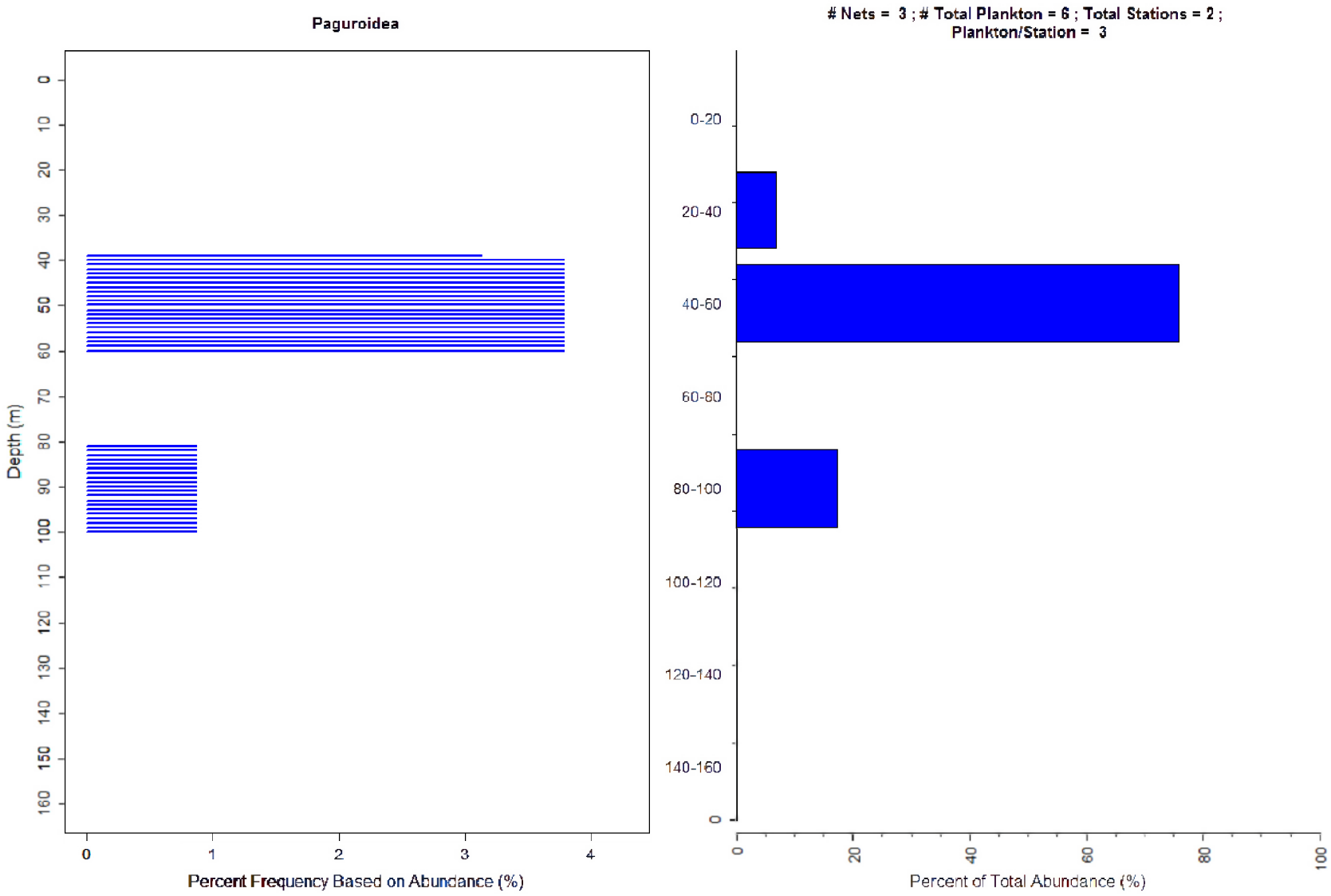
Oplophoridae - Shallow



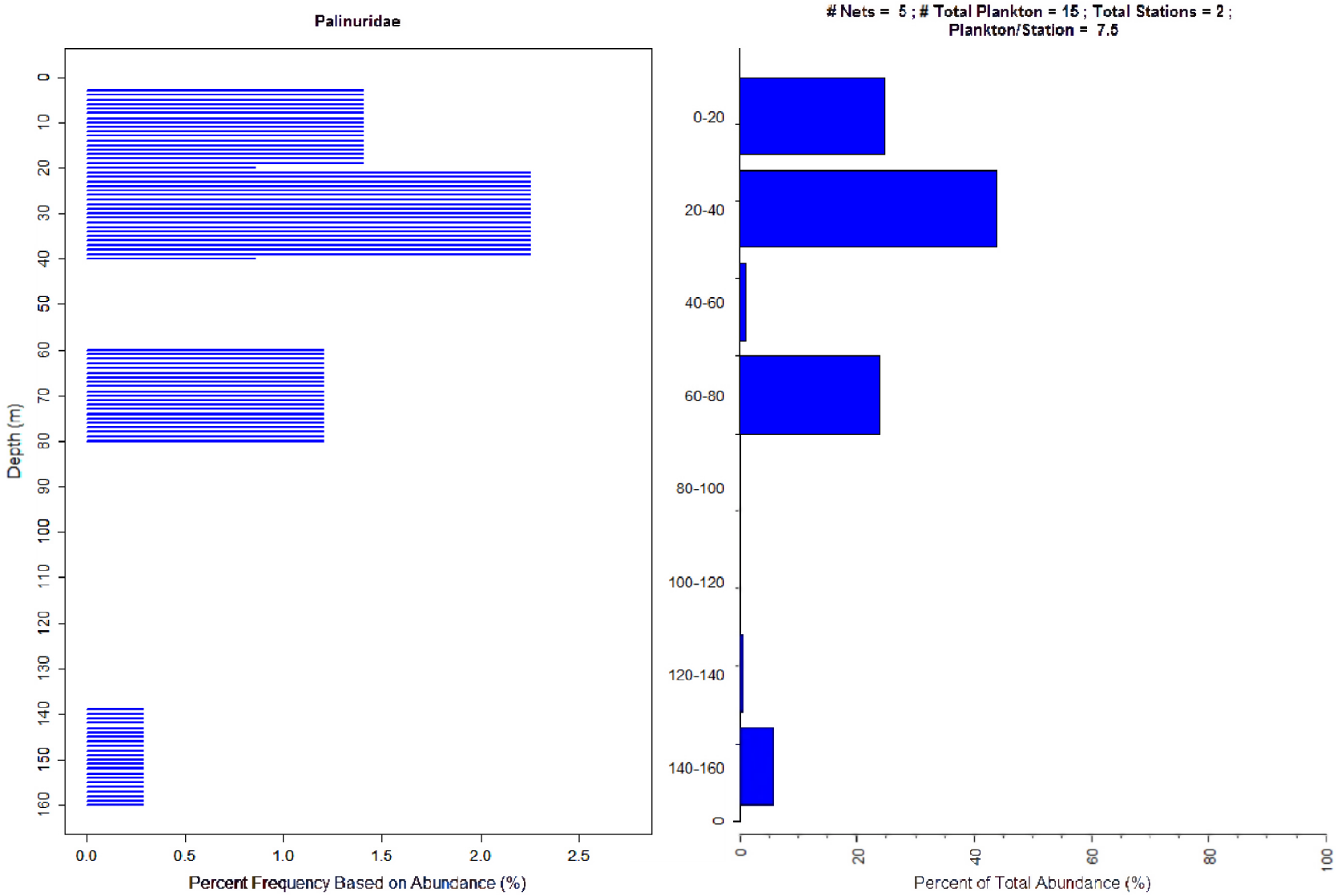
Osteichthyes - Shallow



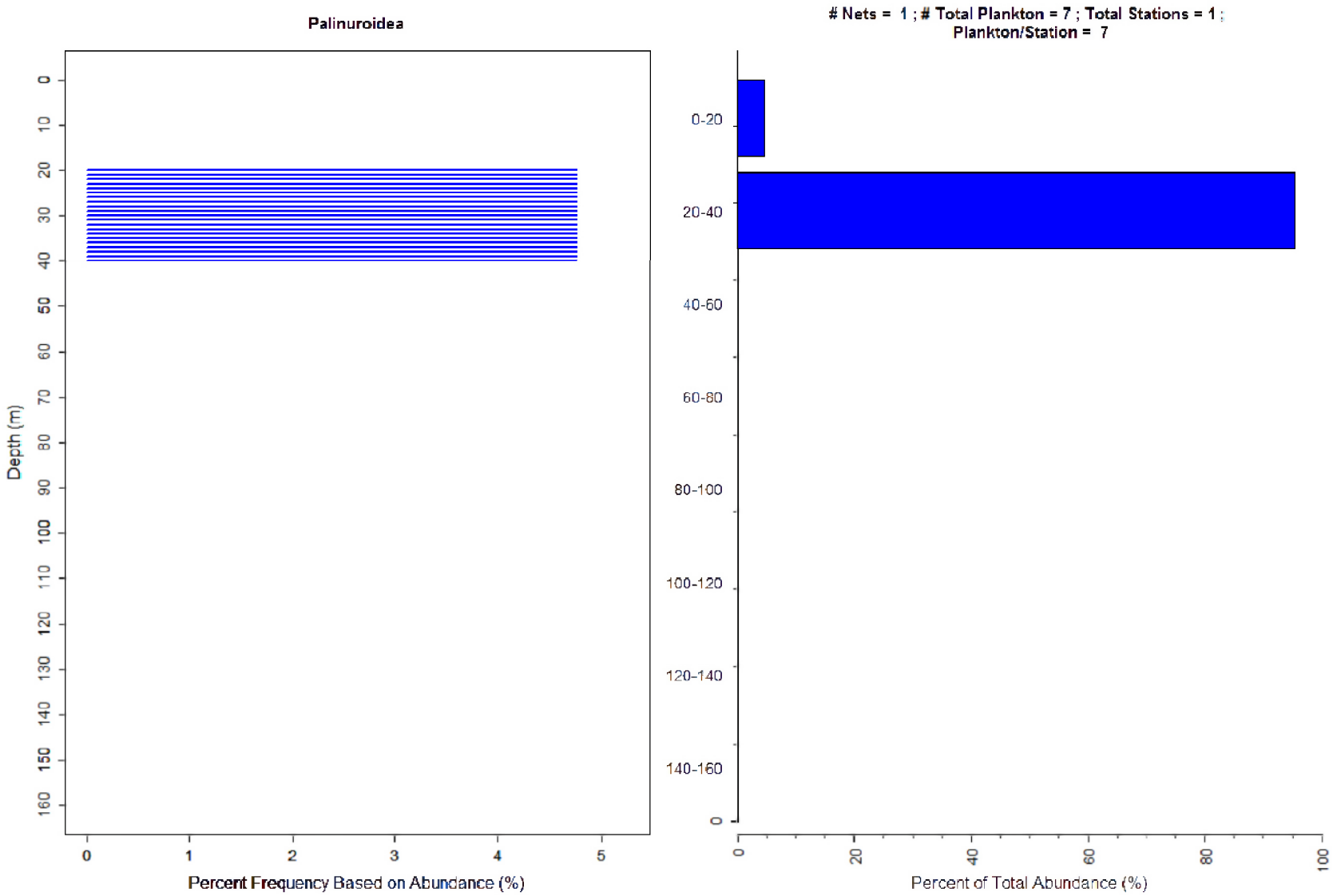
Other_Brachyura - Shallow



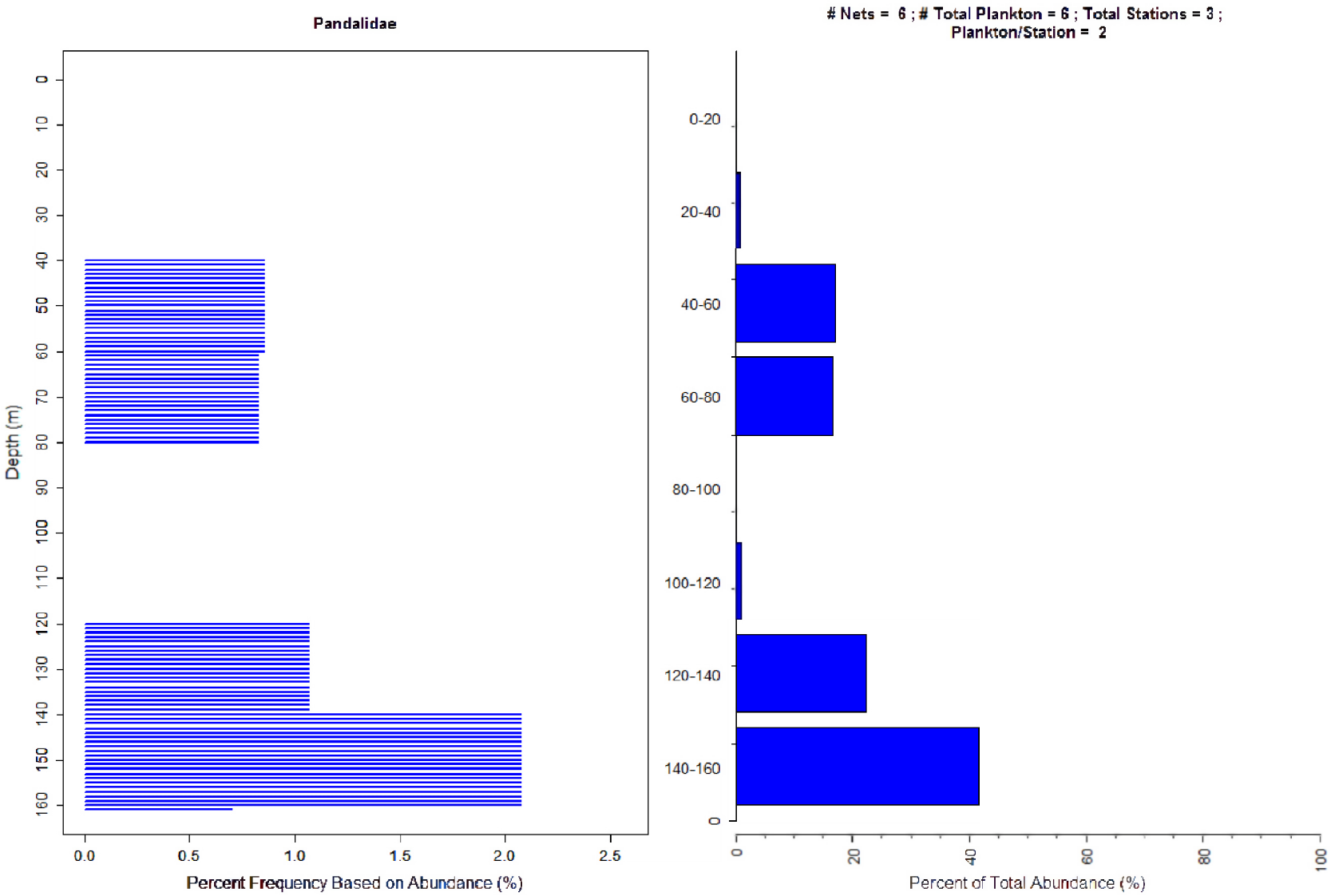
Paguroidea - Shallow



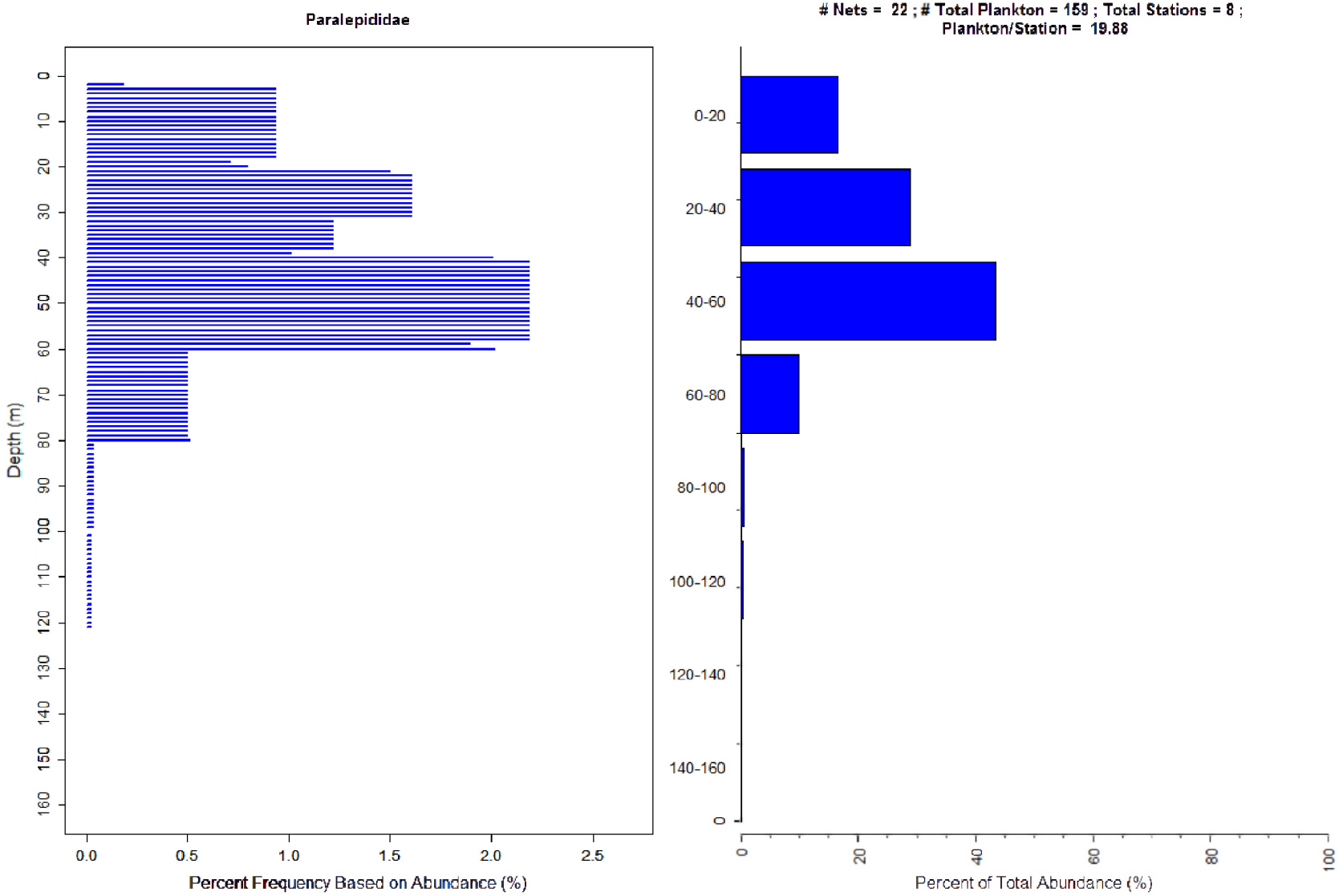
Palinuridae - Shallow



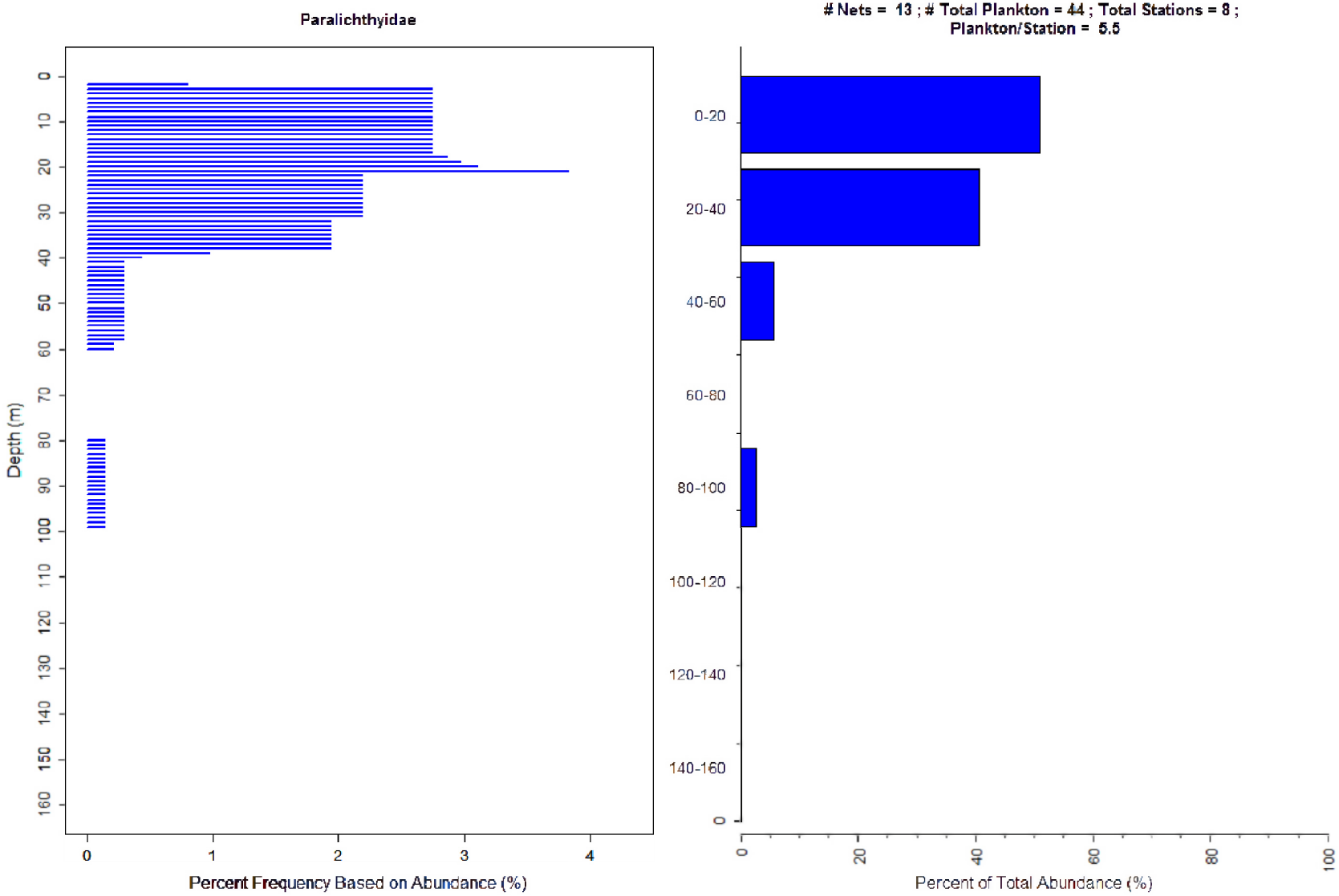
Palinuroidea - Shallow



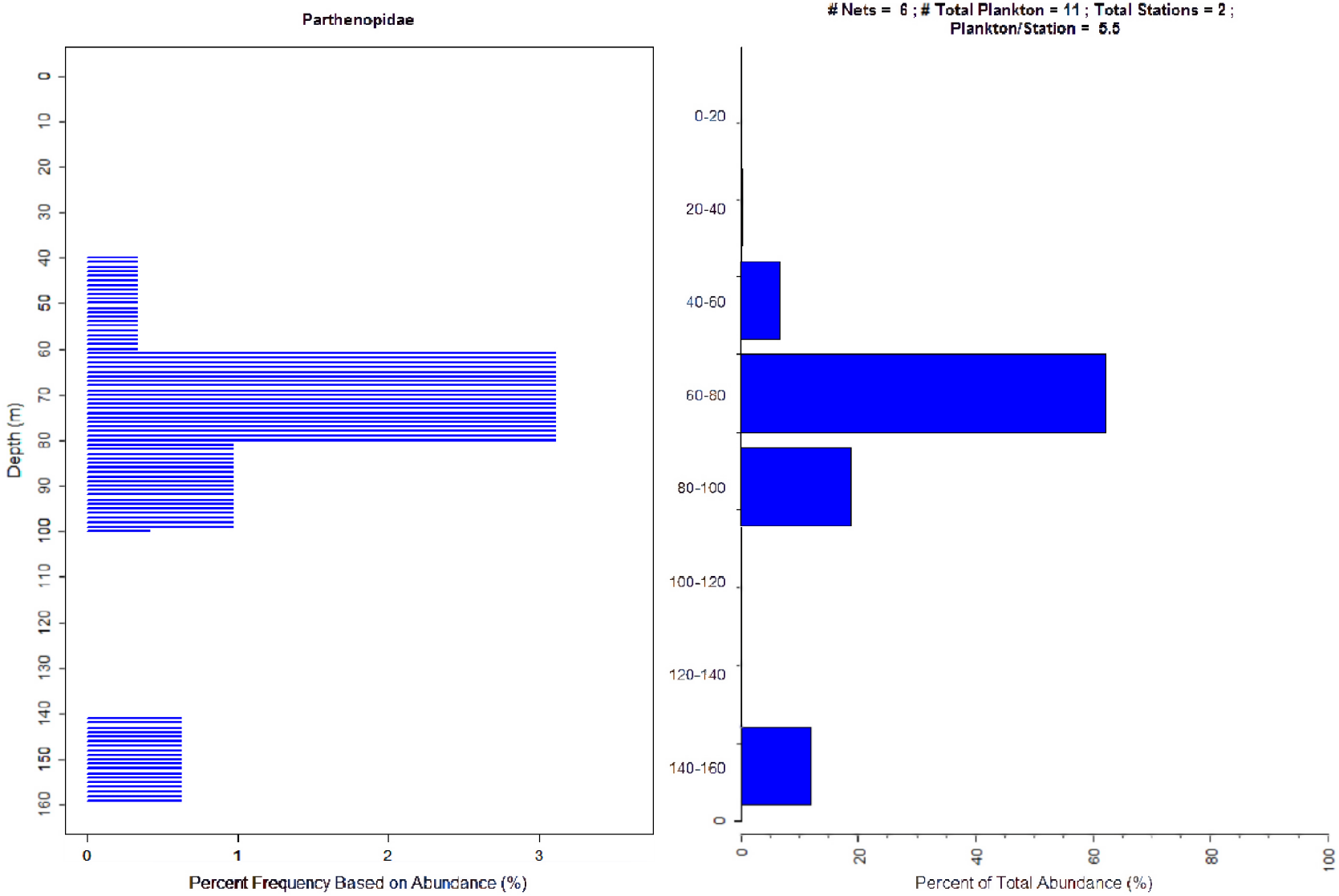
Pandalidae - Shallow



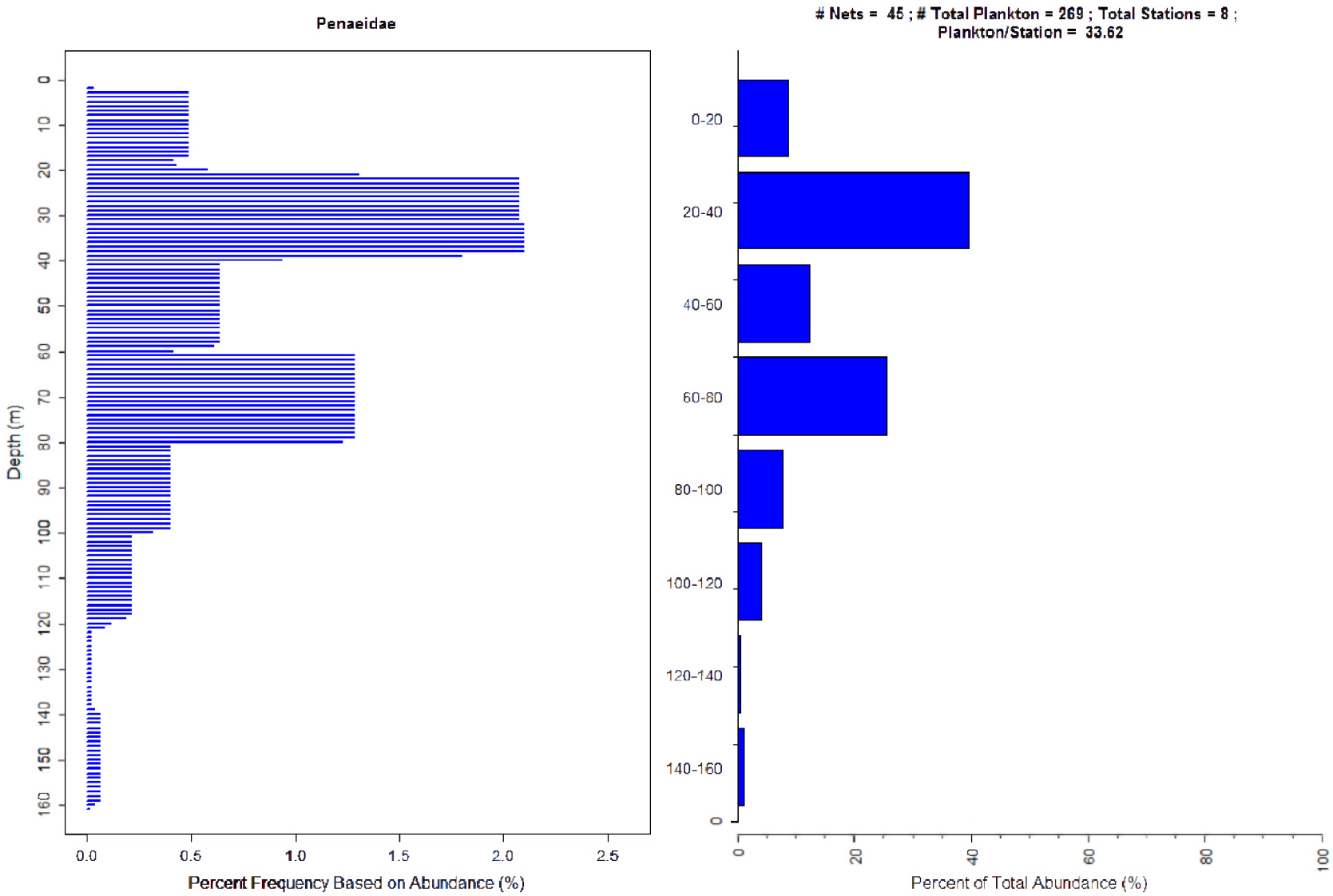
Paralepididae - Shallow



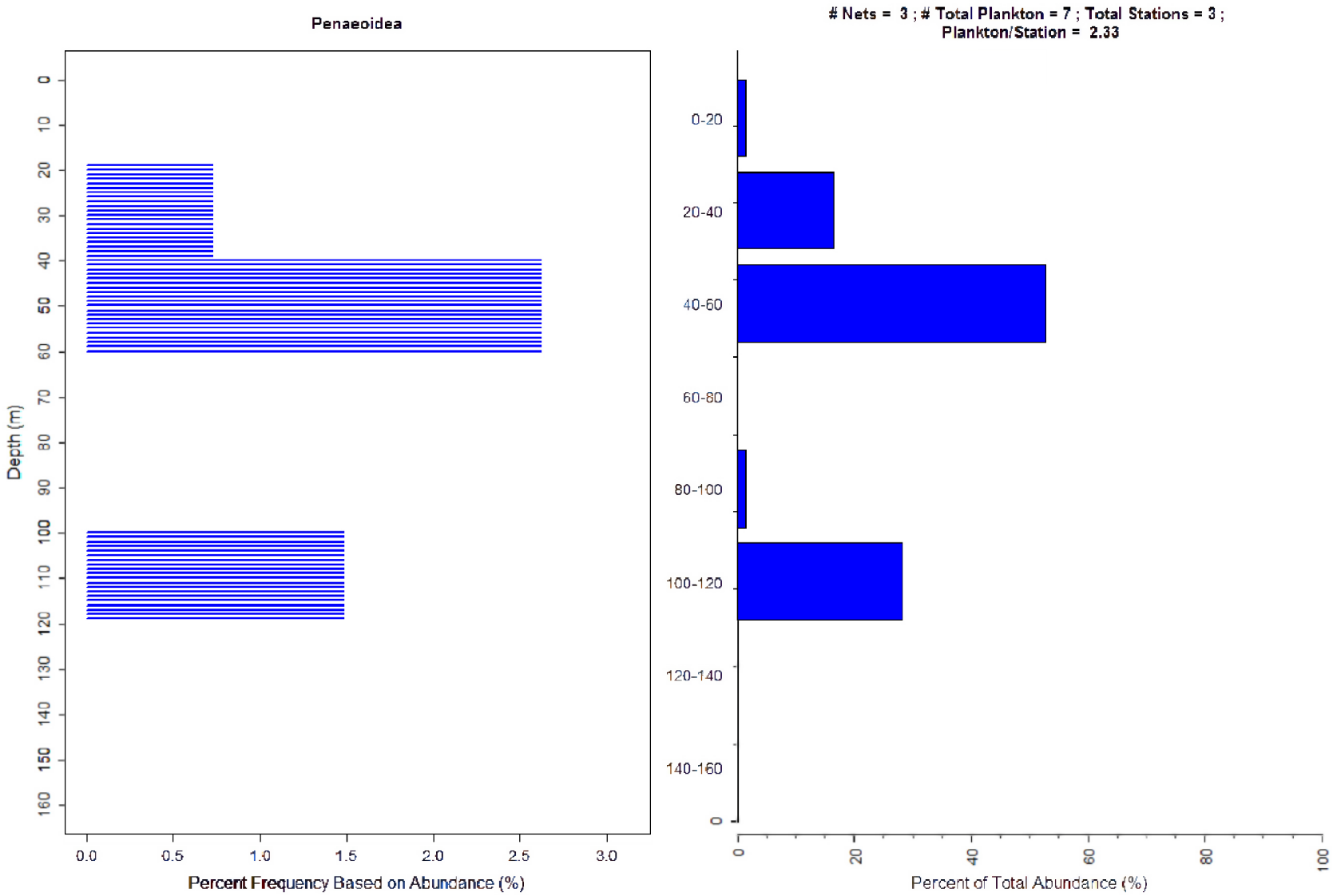
Paralichthyidae - Shallow



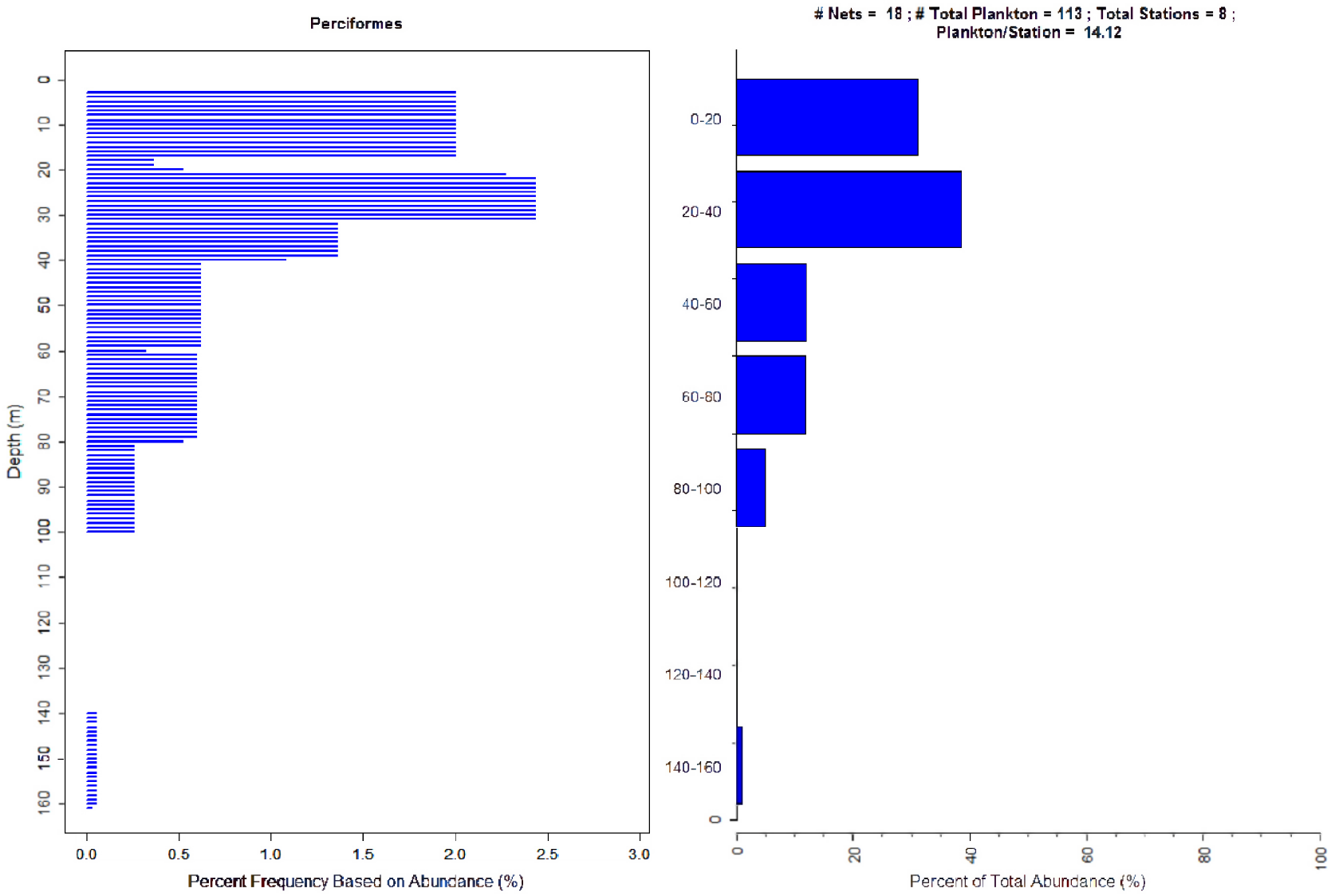
Parthenopidae - Shallow



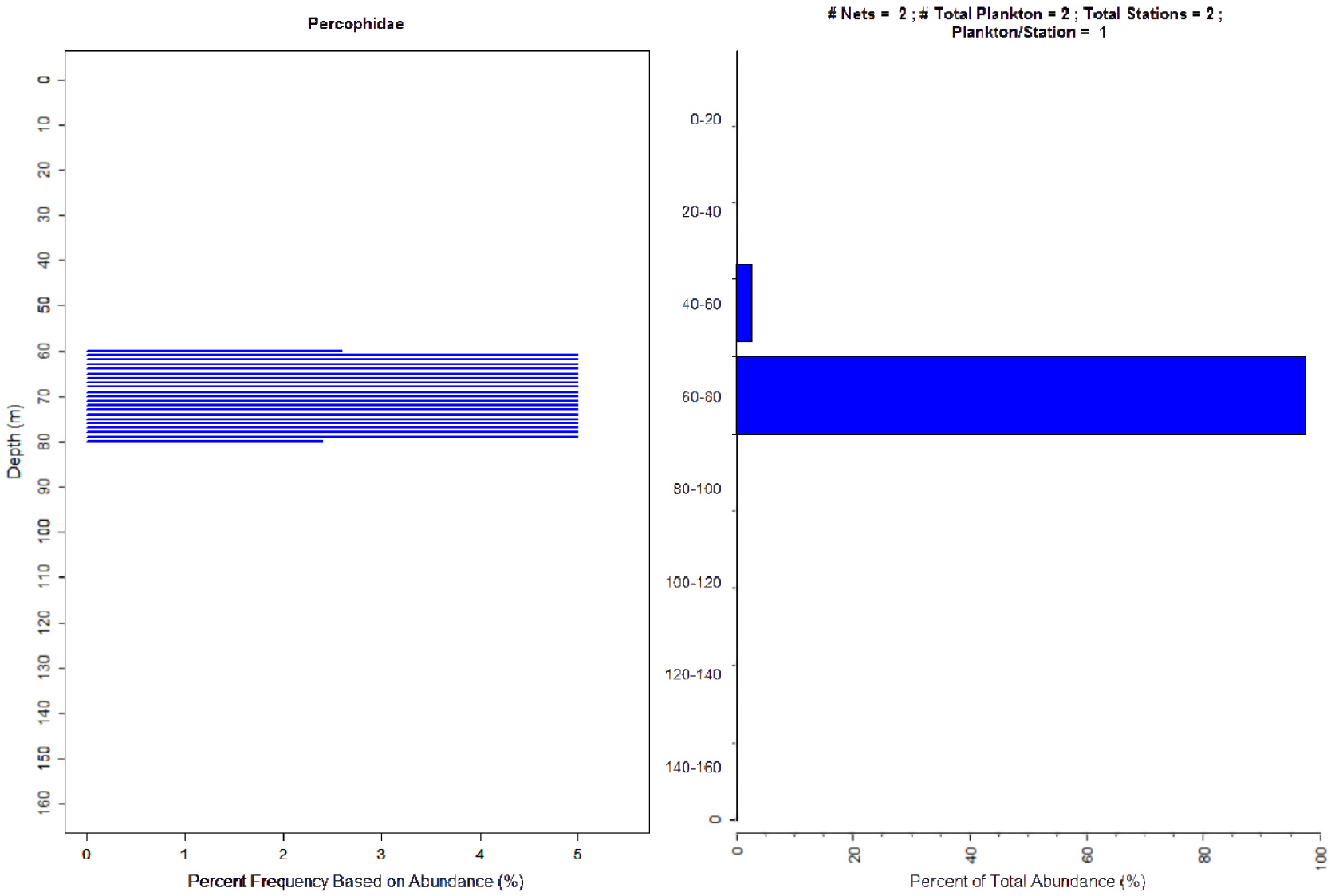
Penaeidae - Shallow



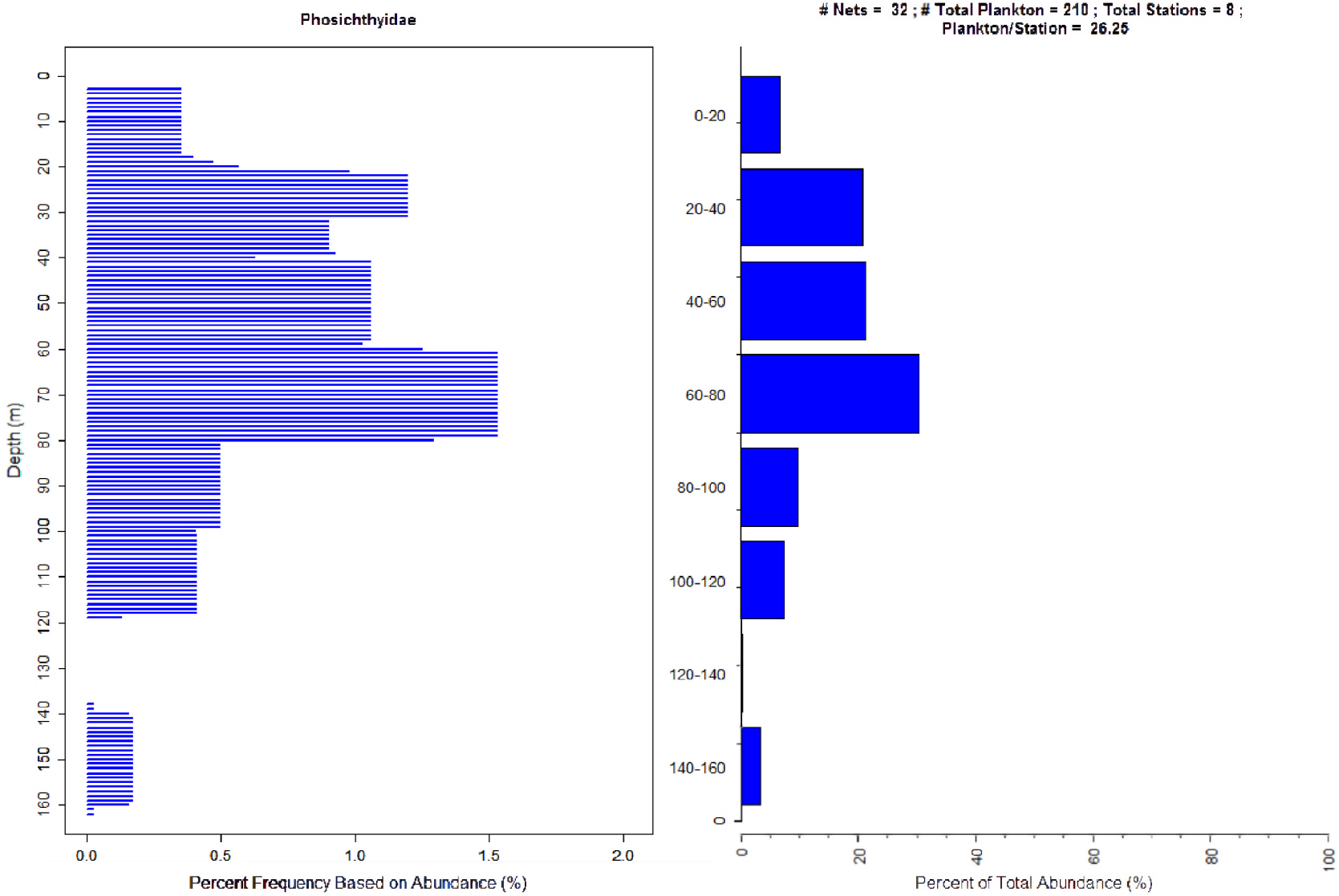
Penaeoidea - Shallow



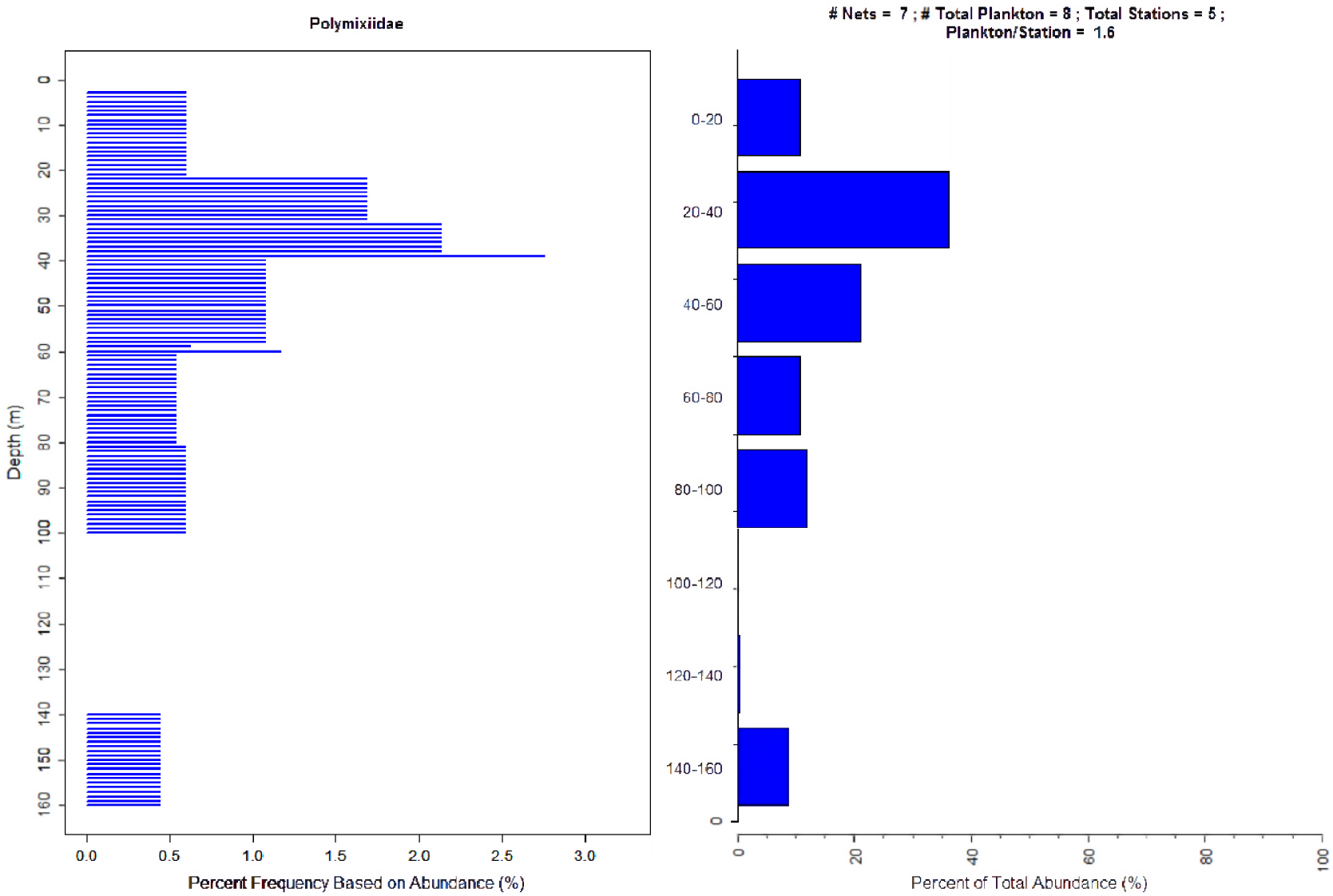
Perciformes - Shallow



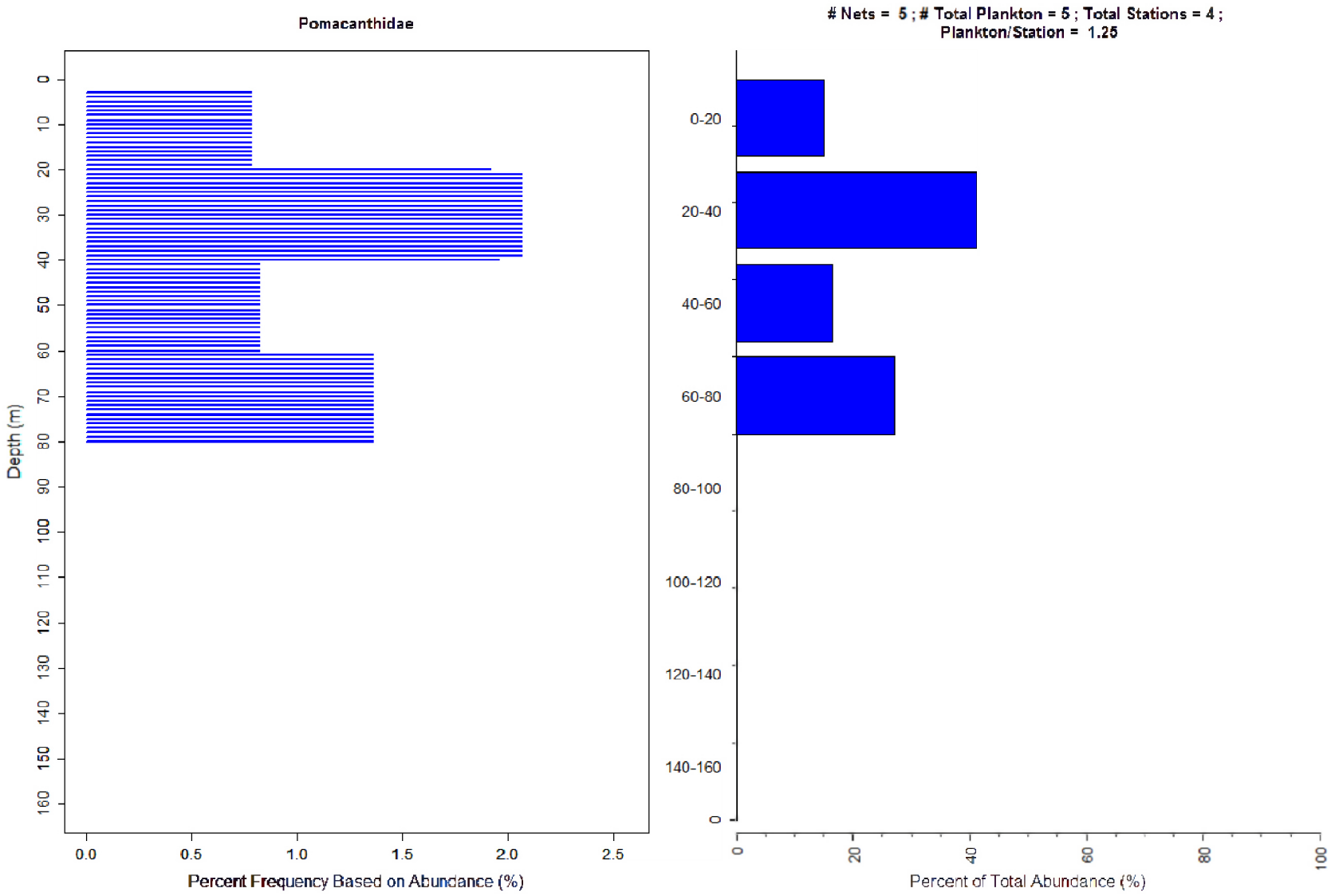
Percophidae - Shallow



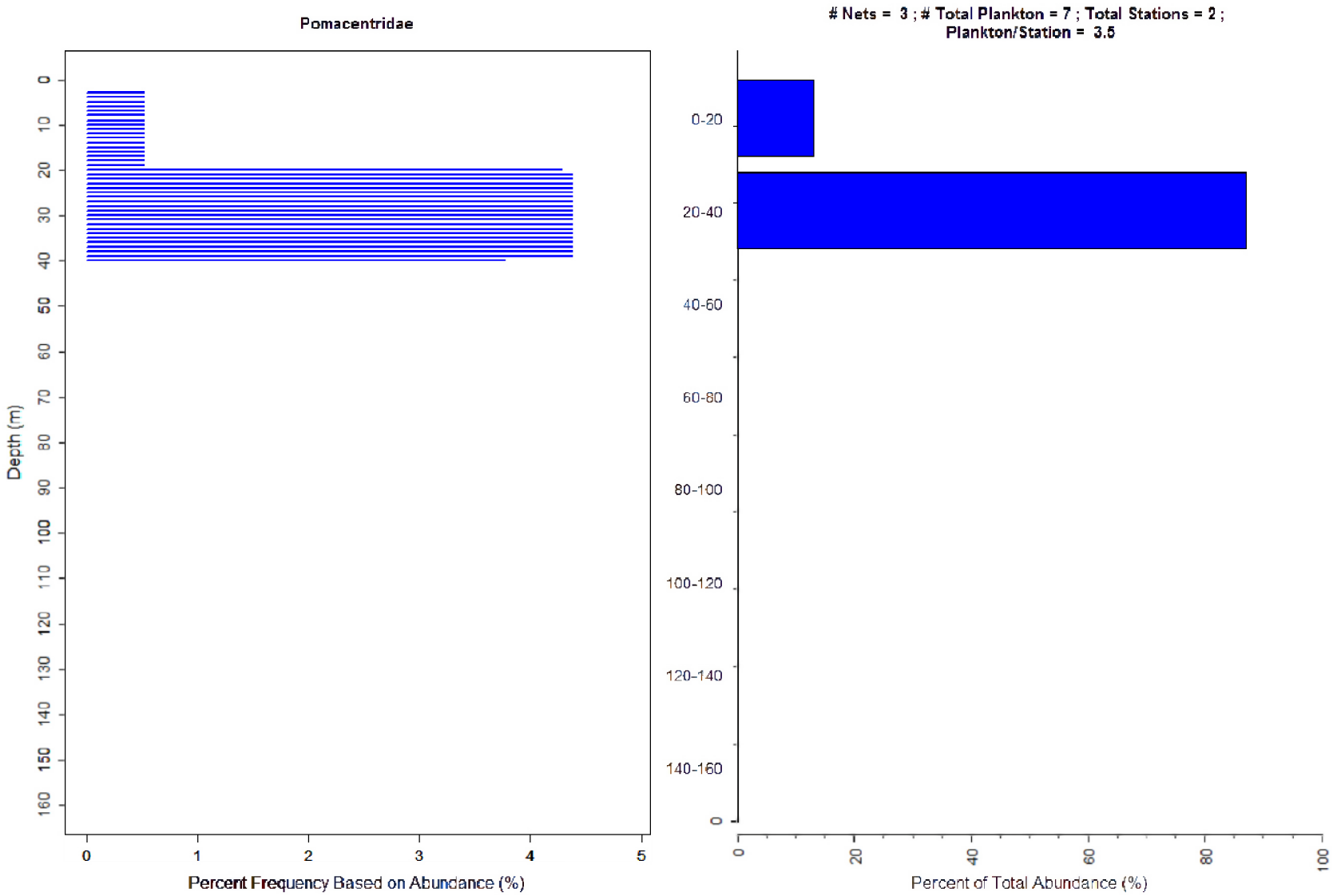
Phosichthyidae - Shallow



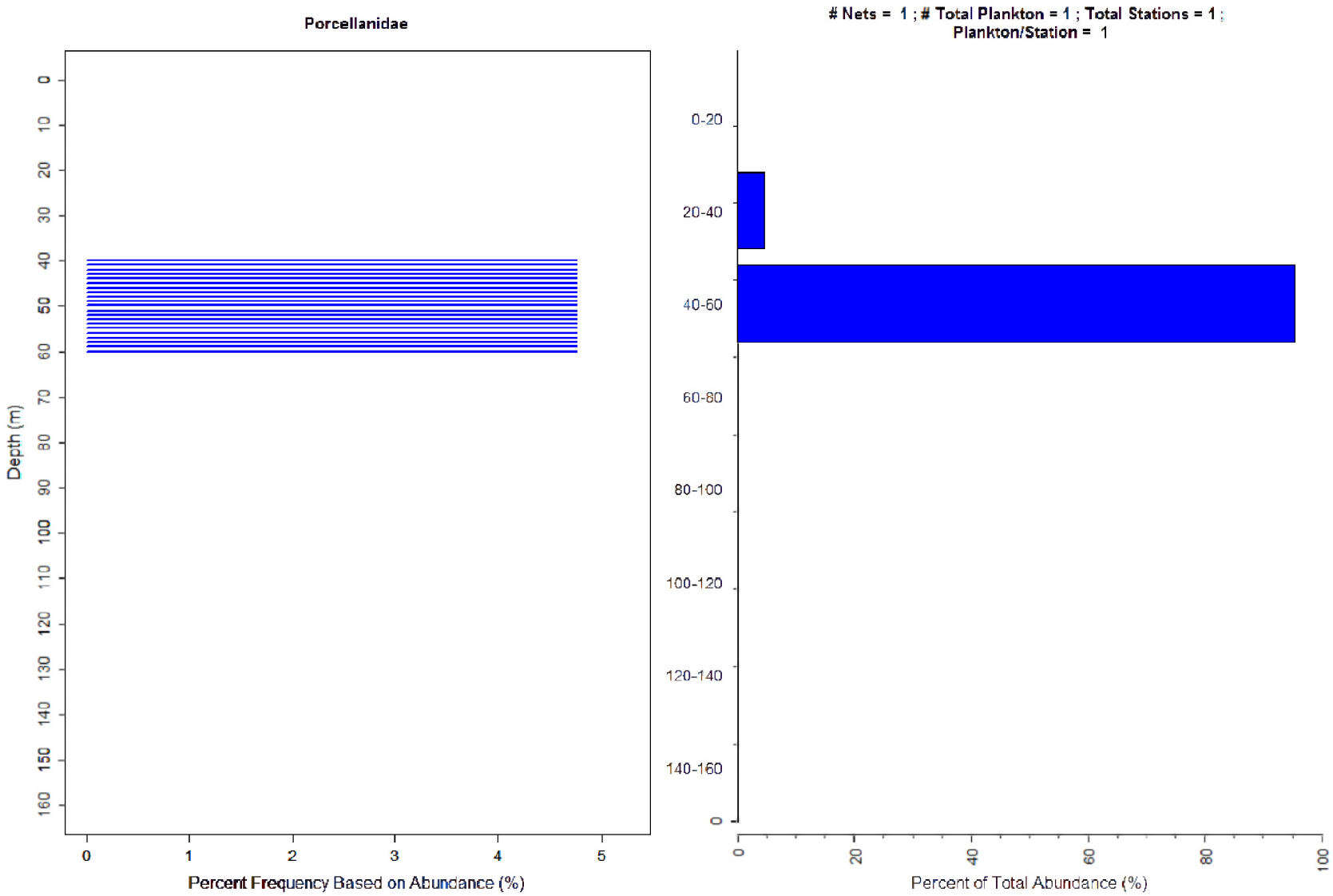
Polymixiidae - Shallow



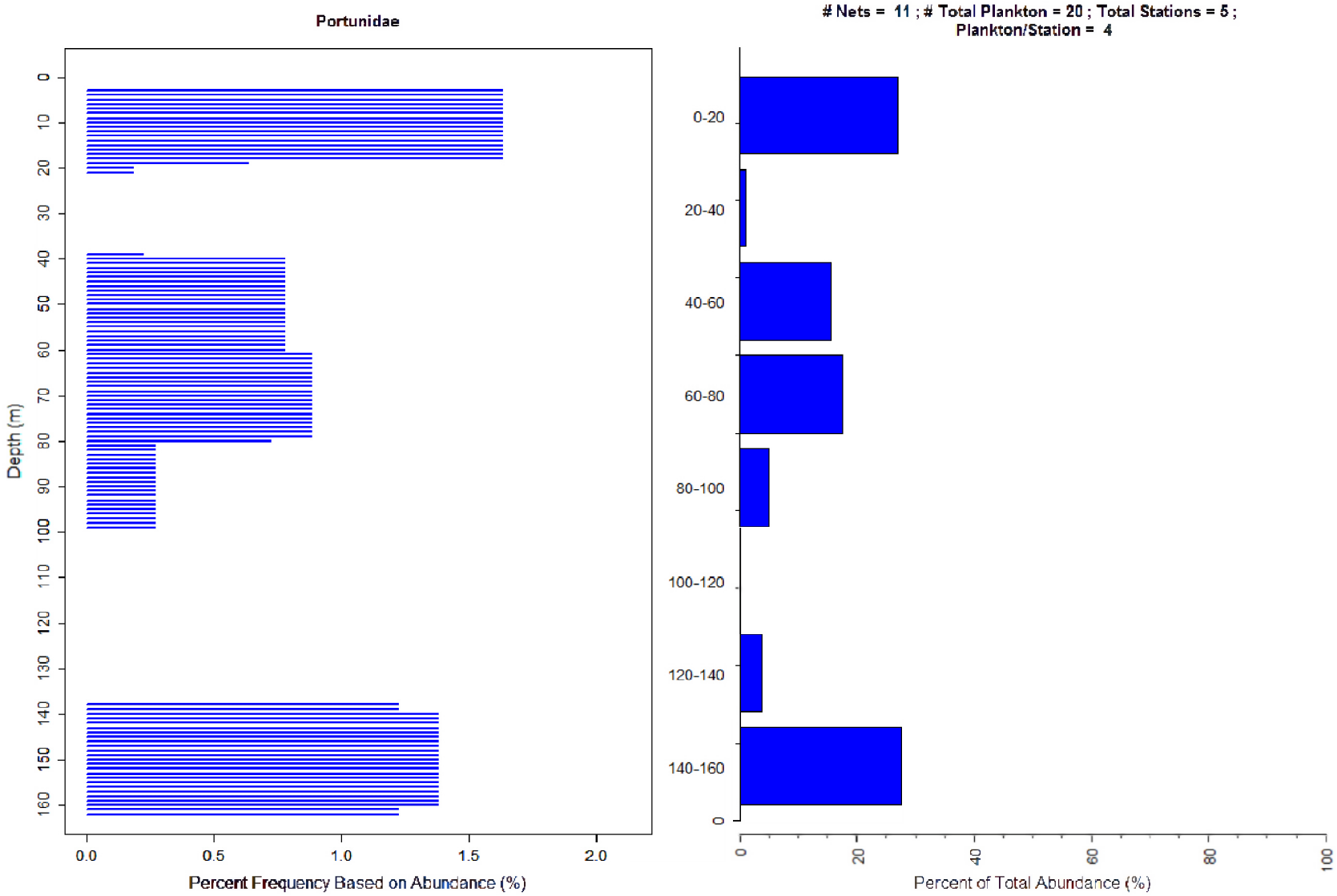
Pomacanthidae - Shallow



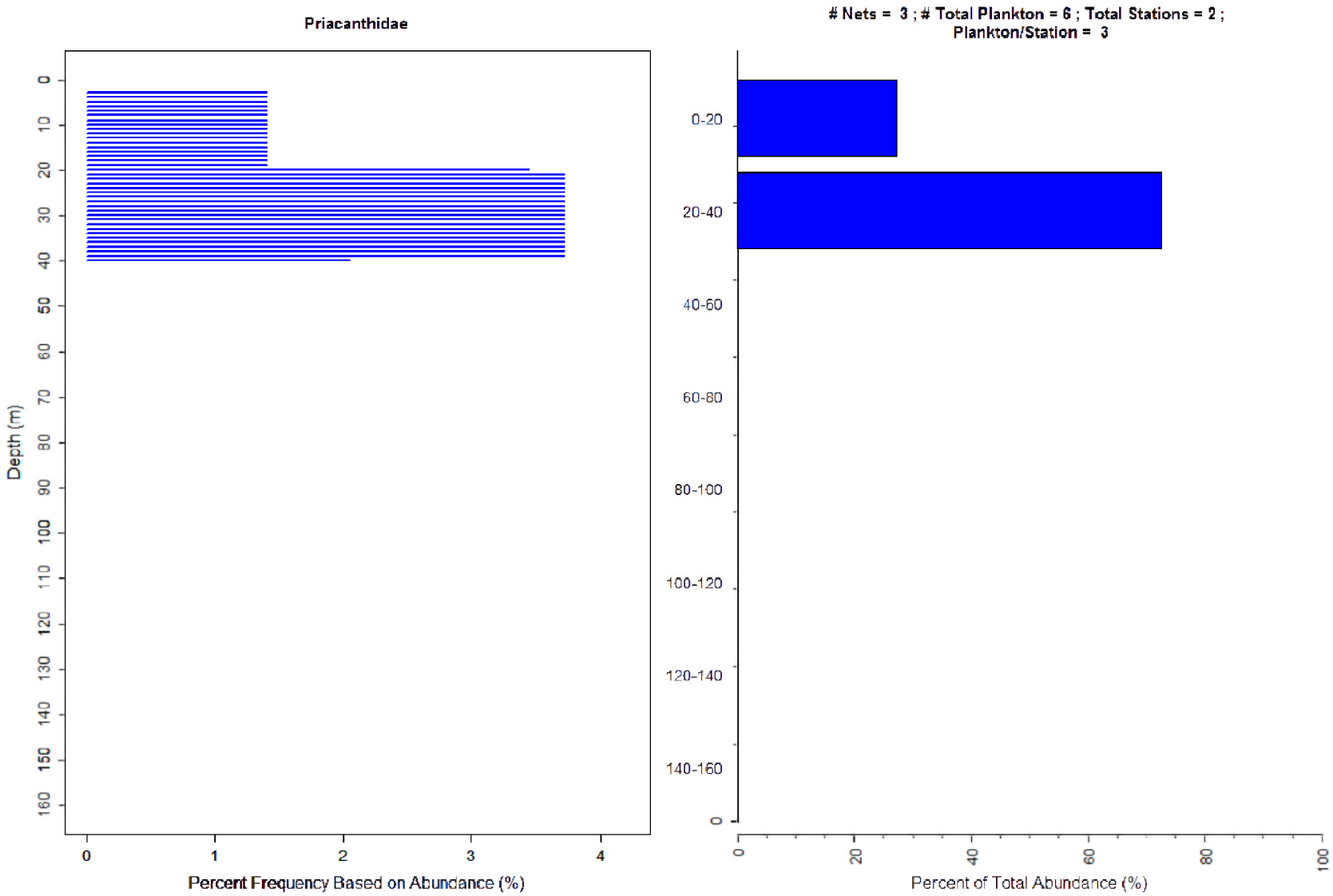
Pomacentridae - Shallow



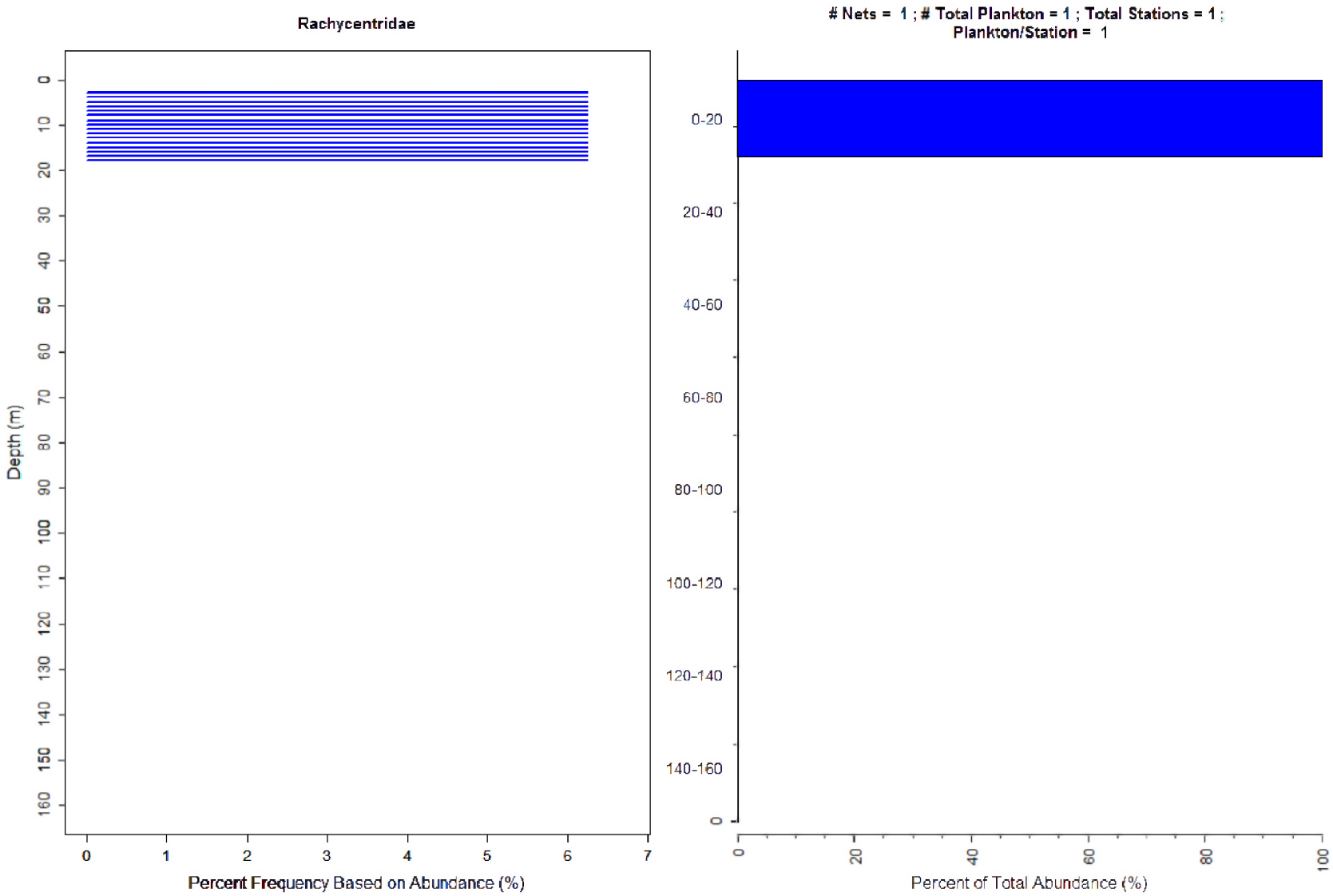
Porcellanidae - Shallow



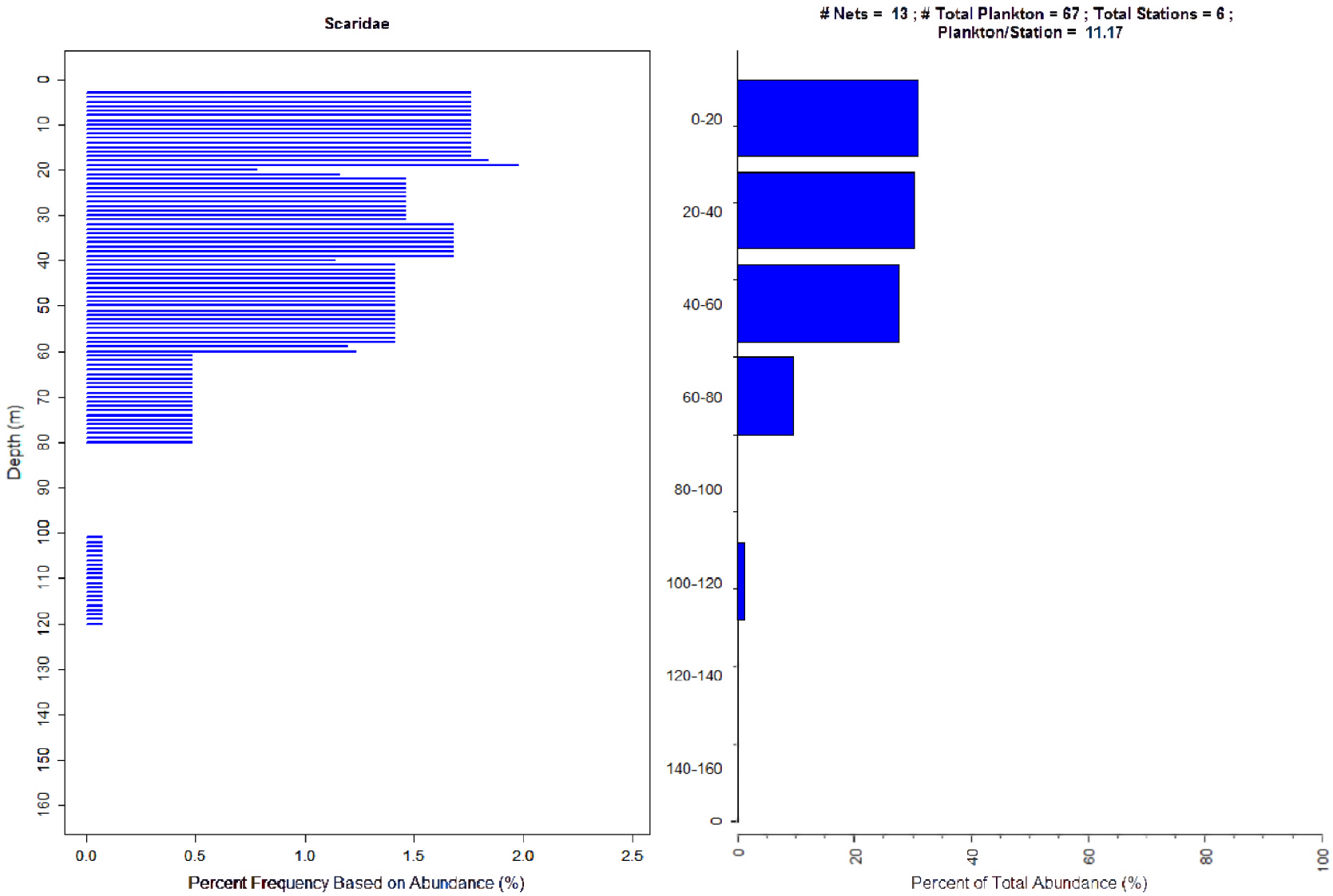
Portunidae - Shallow



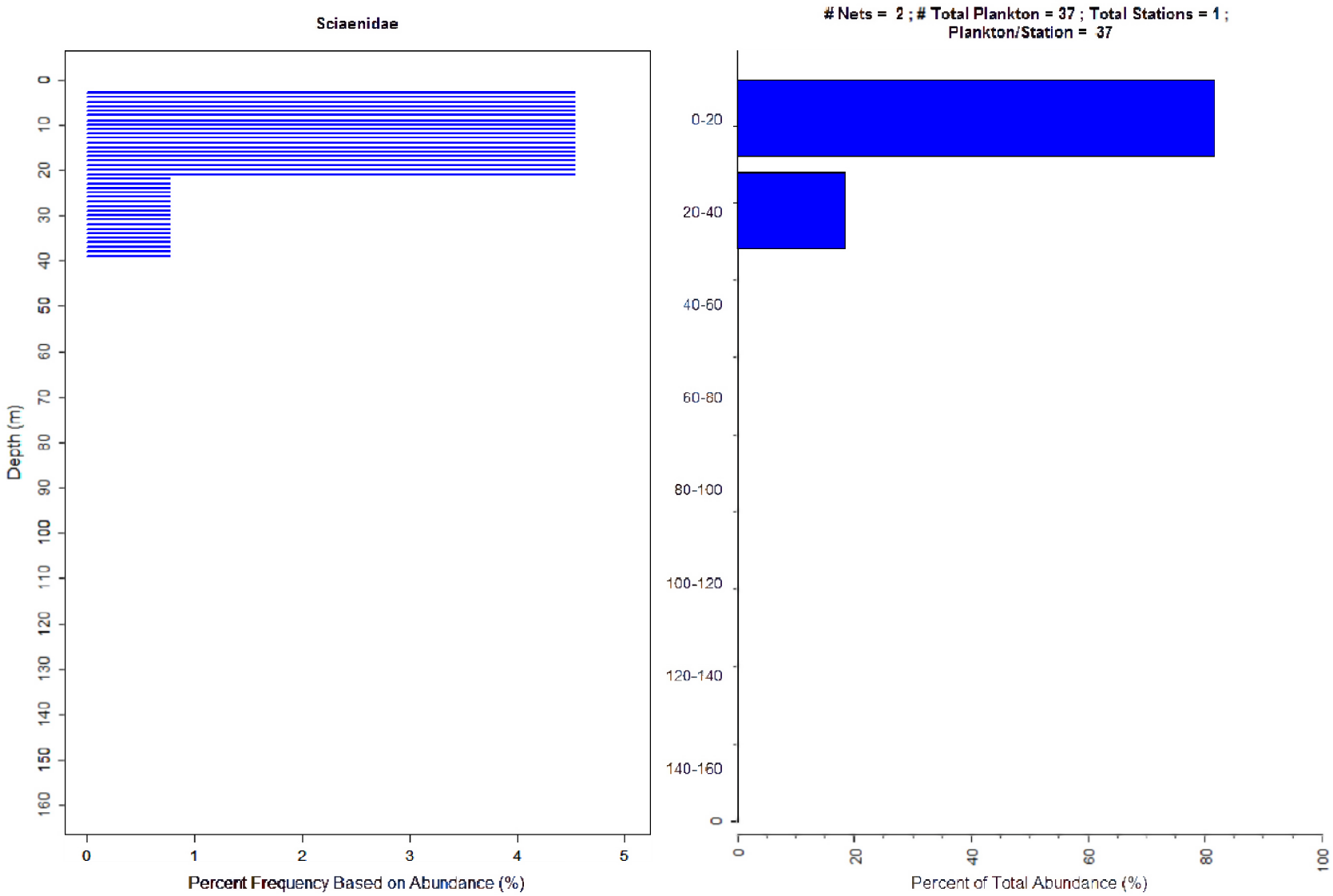
Priacanthidae - Shallow



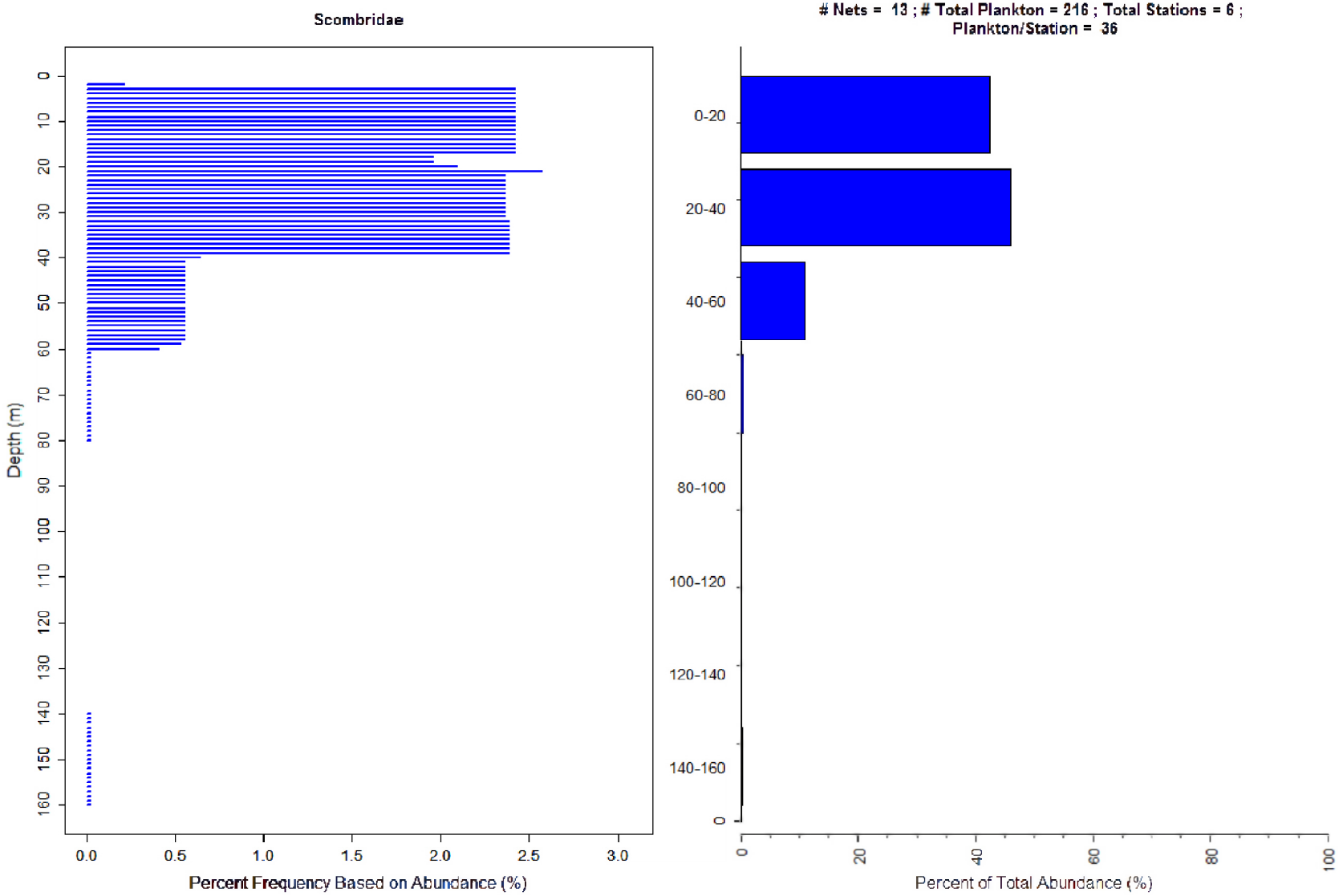
Rachycentridae - Shallow



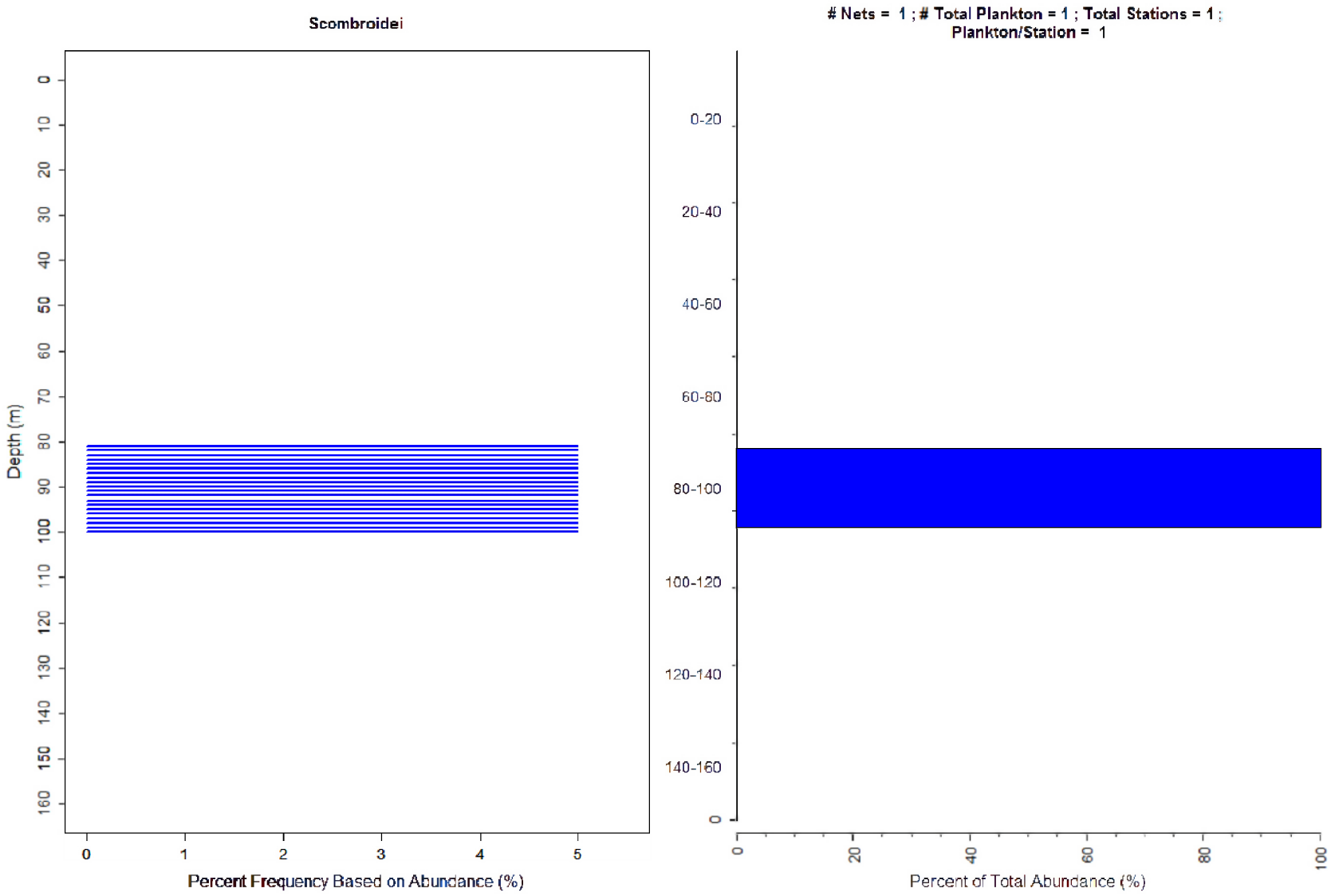
Scaridae - Shallow



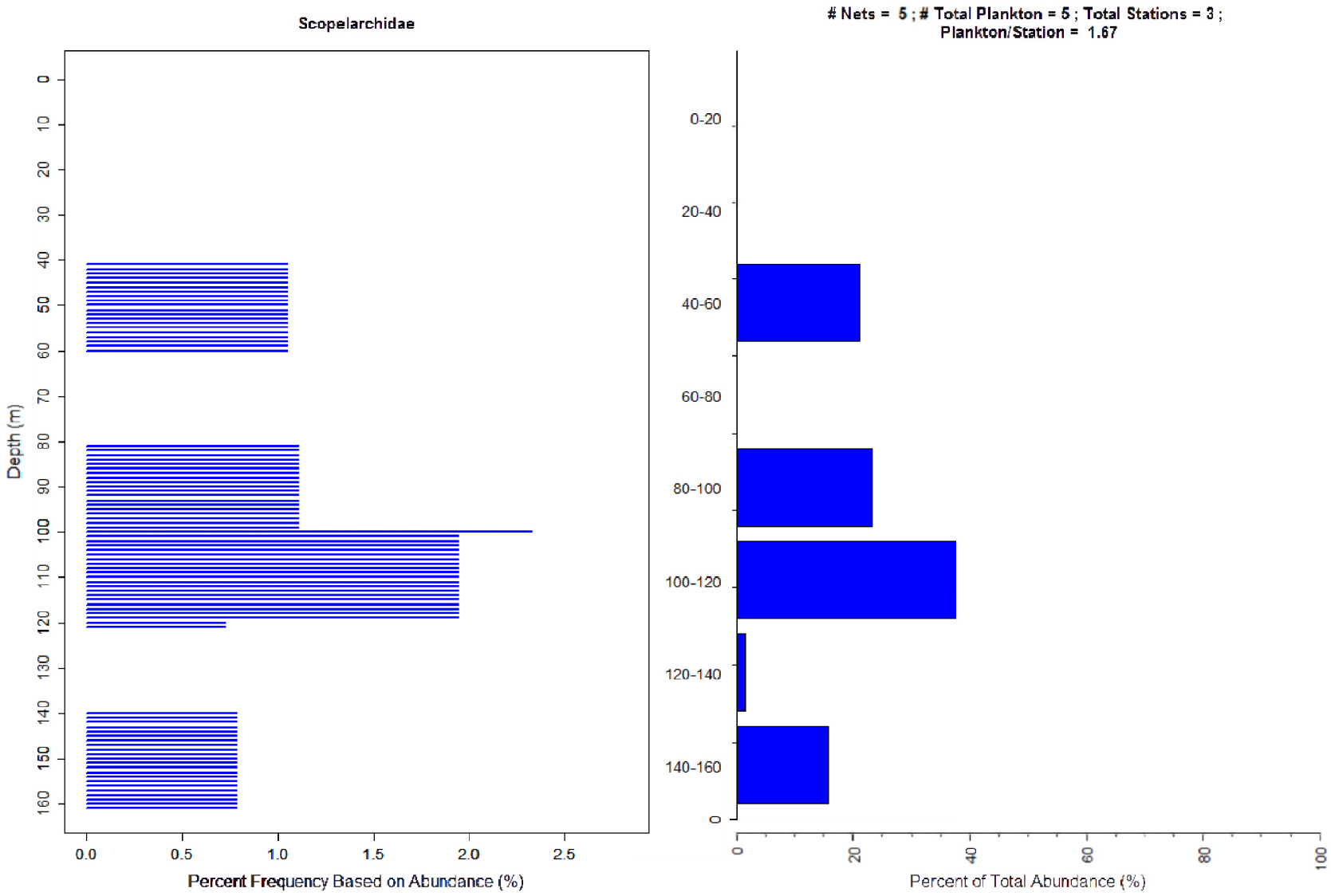
Sciaenidae - Shallow



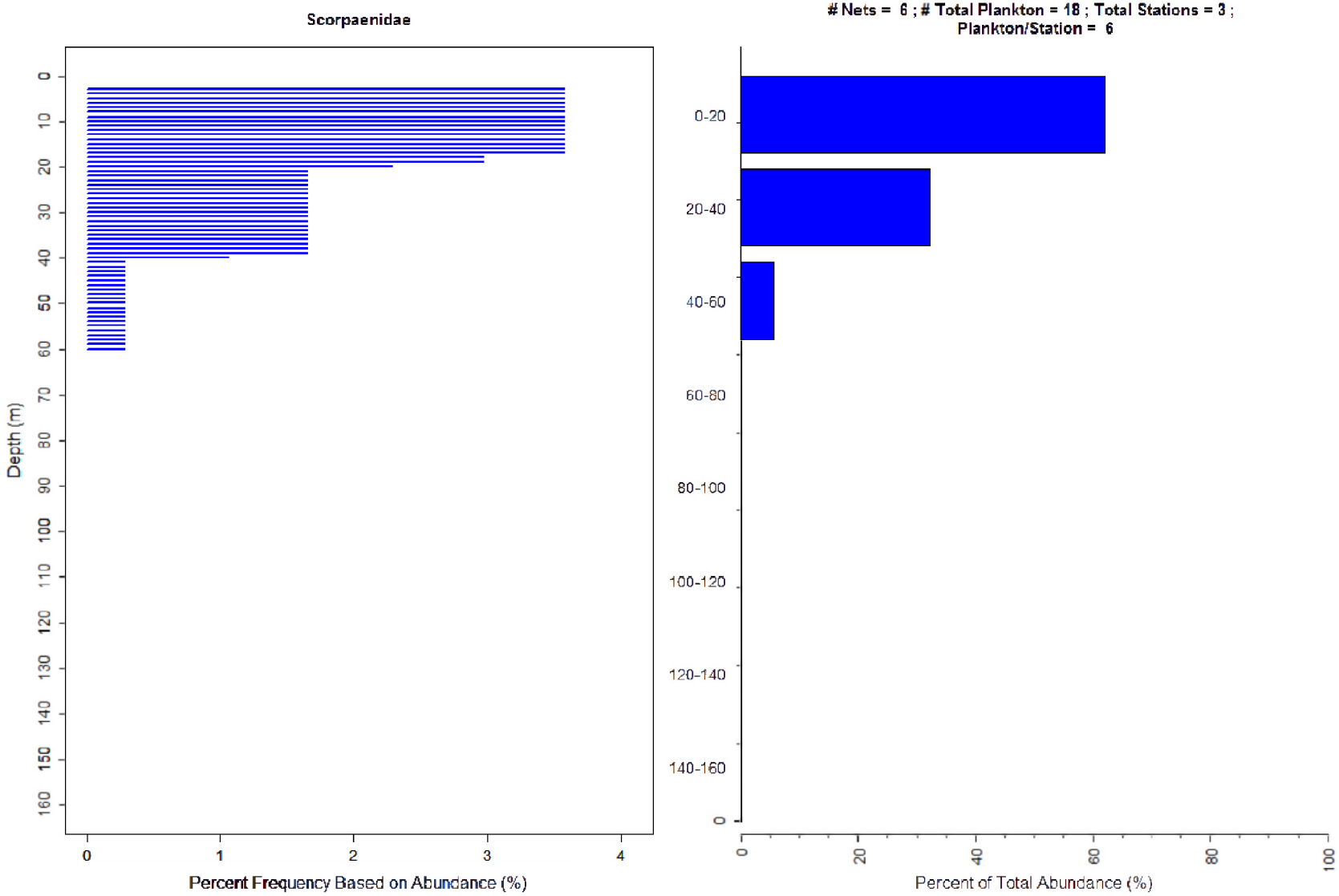
Scombridae - Shallow



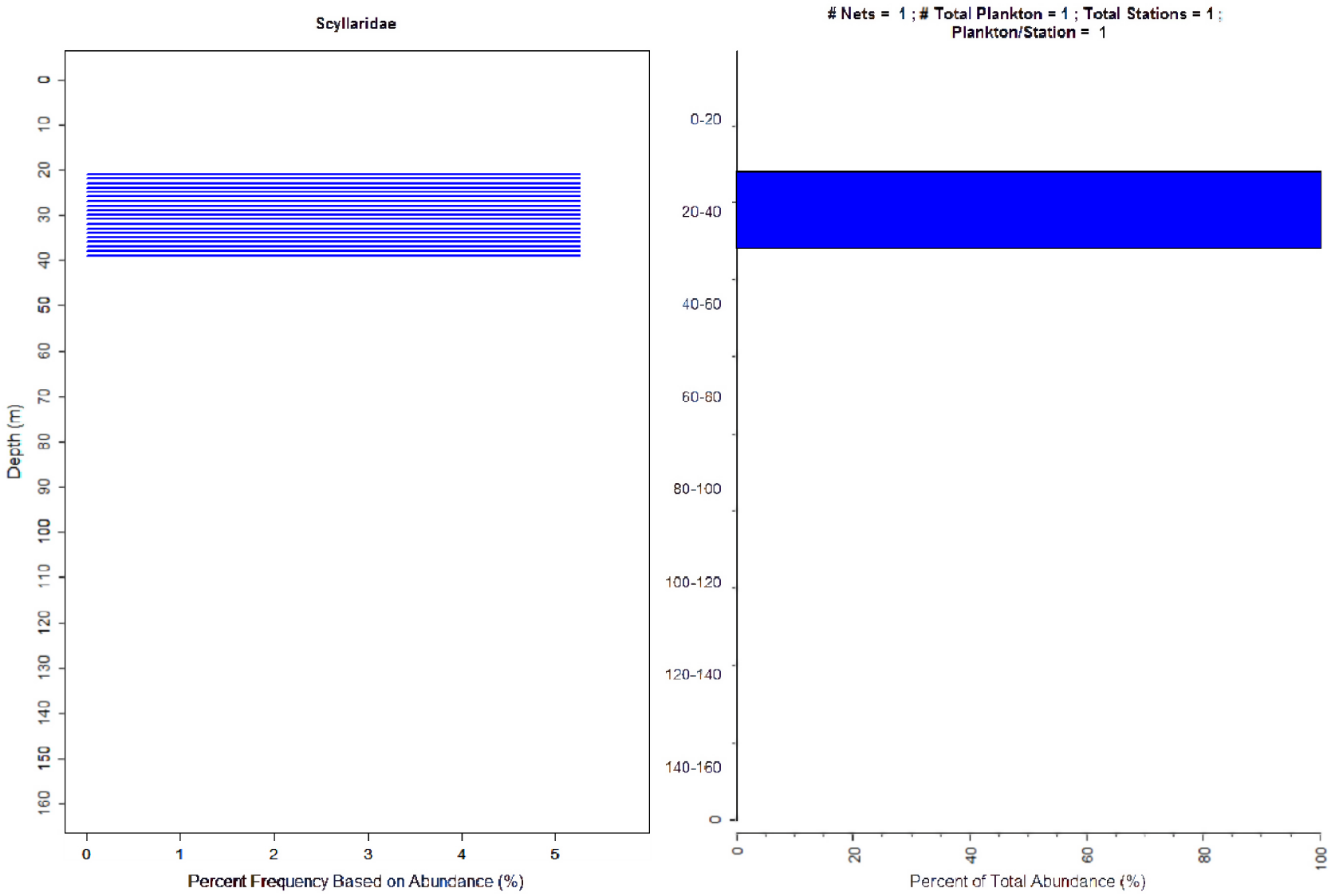
Scombroidei - Shallow



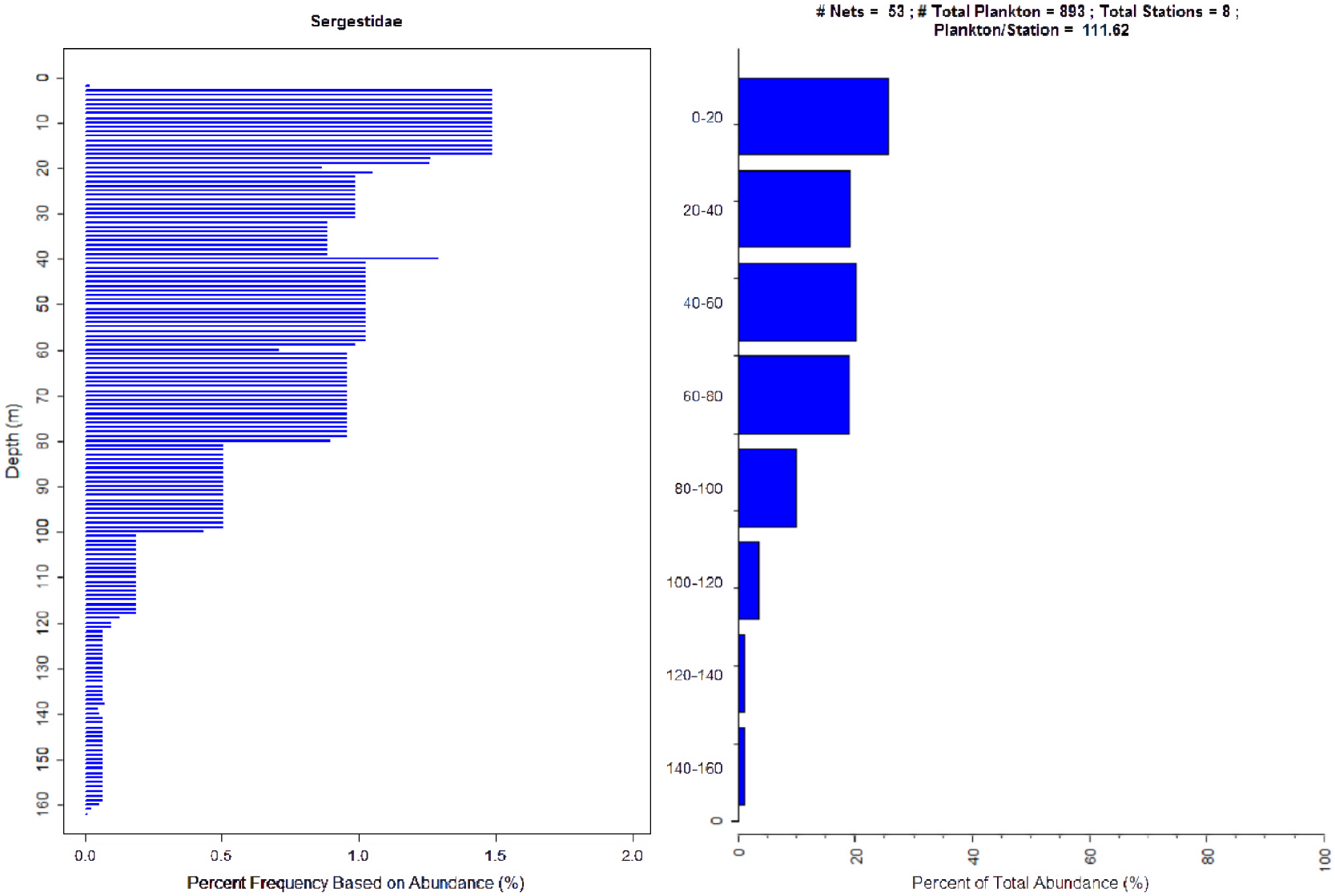
Scopelarchidae - Shallow



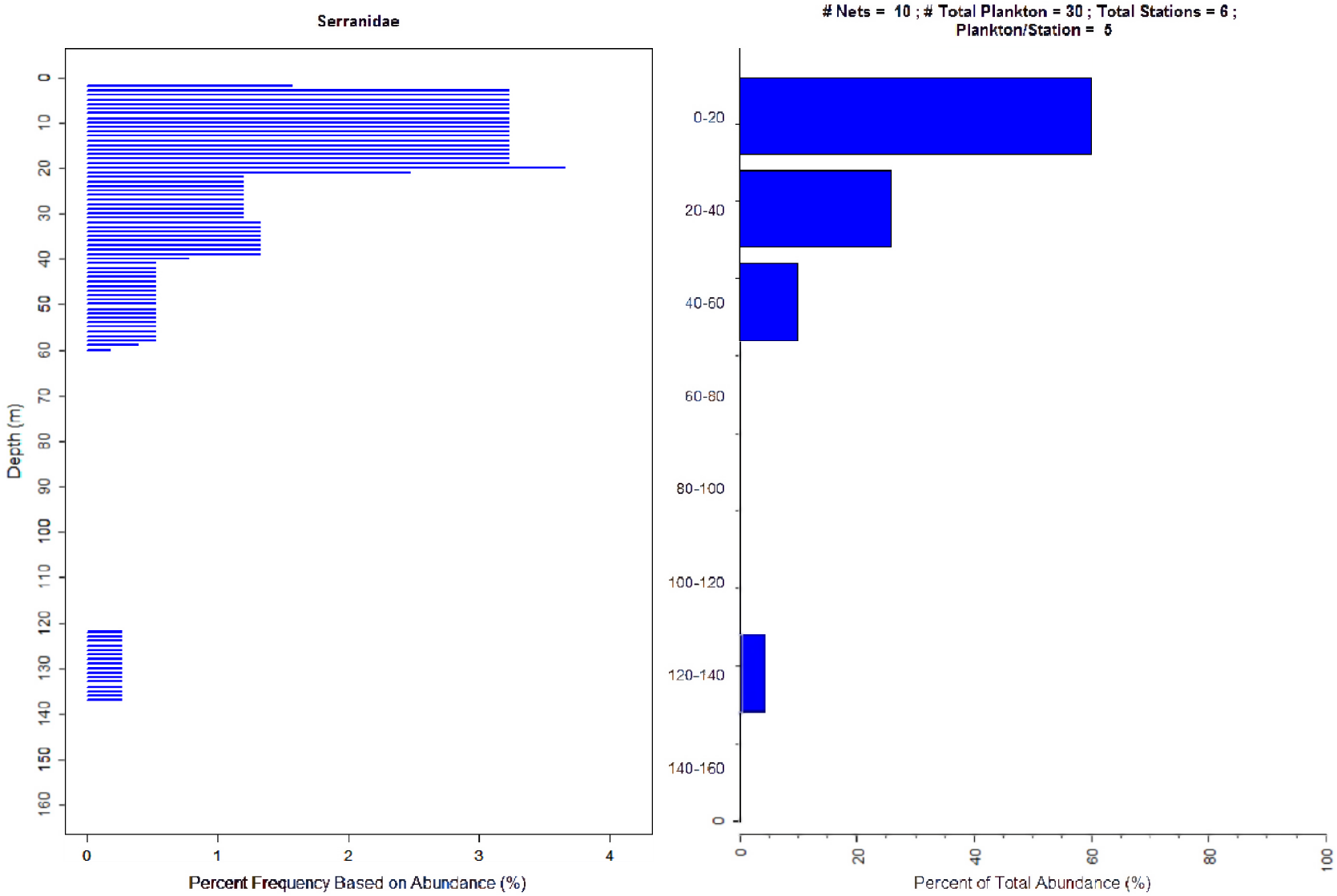
Scorpaenidae - Shallow



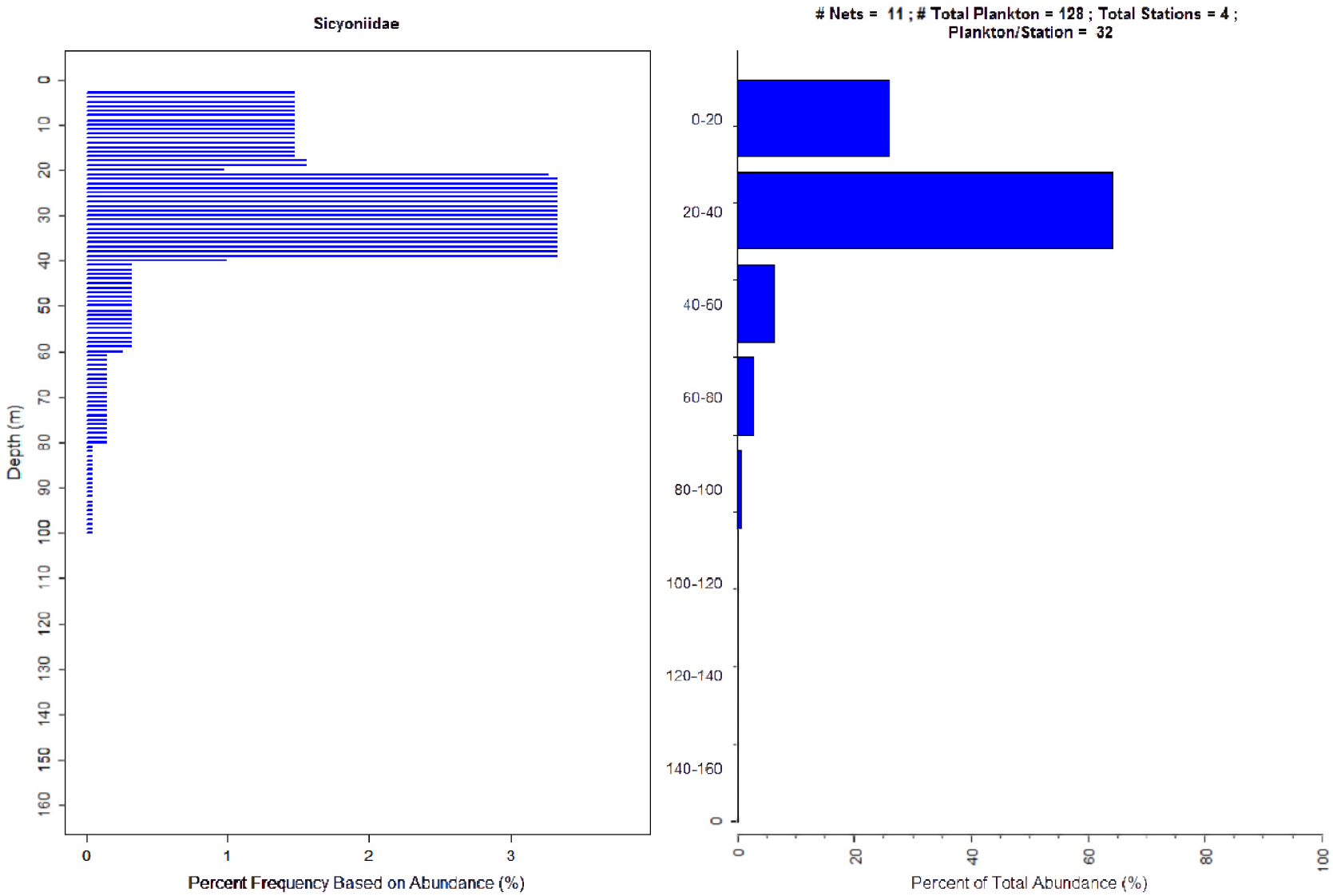
Scyllaridae - Shallow



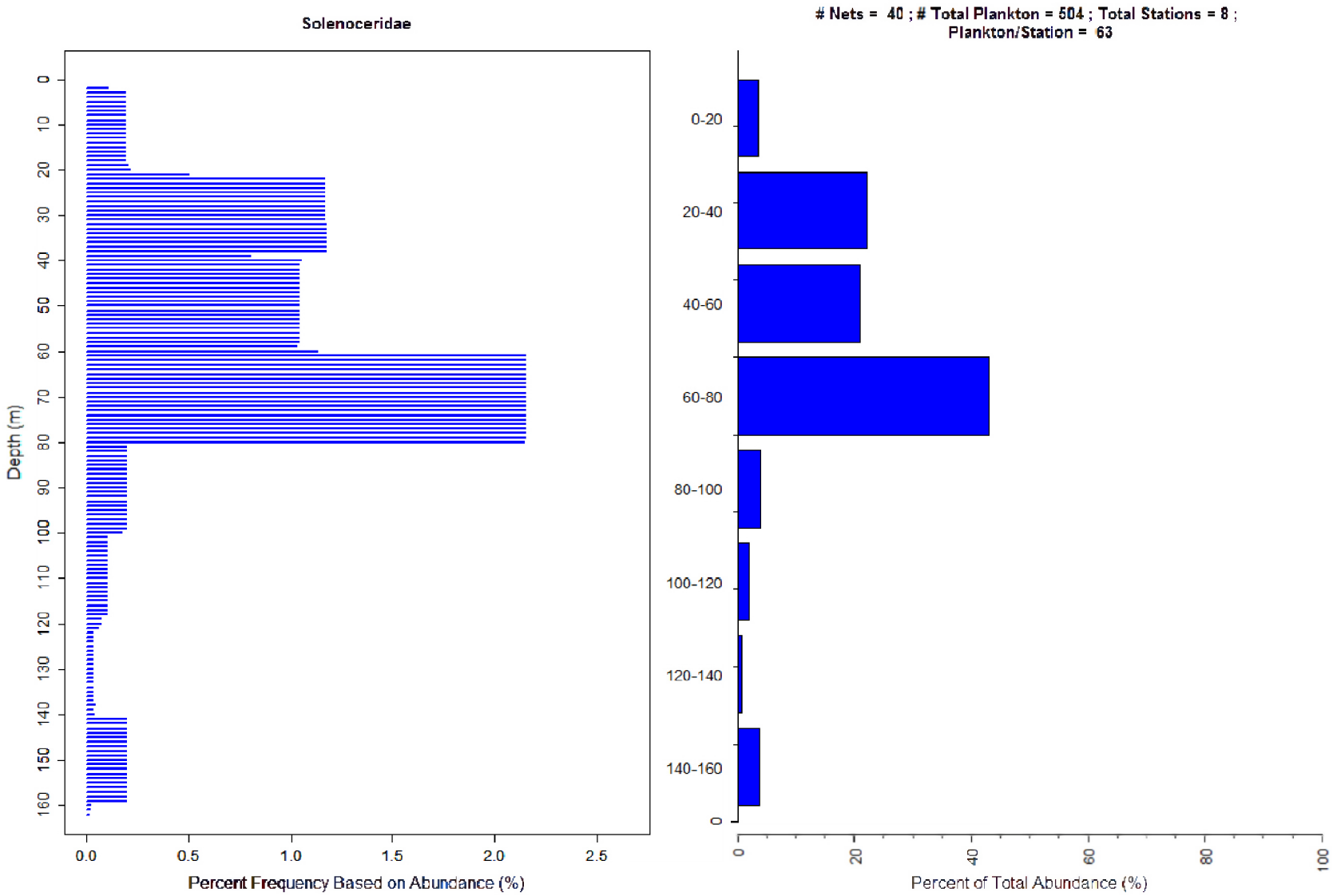
Sergestidae - Shallow



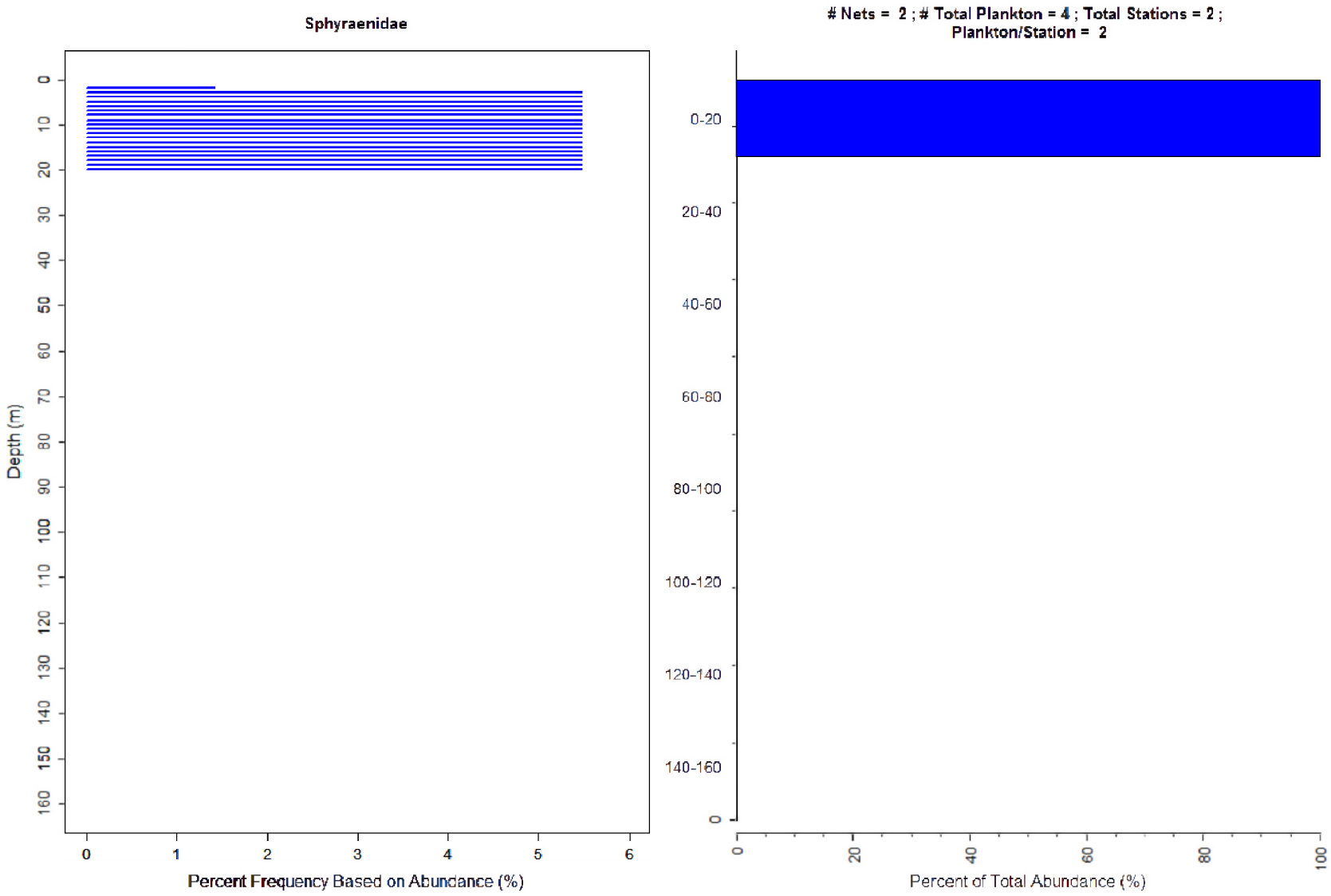
Serranidae - Shallow



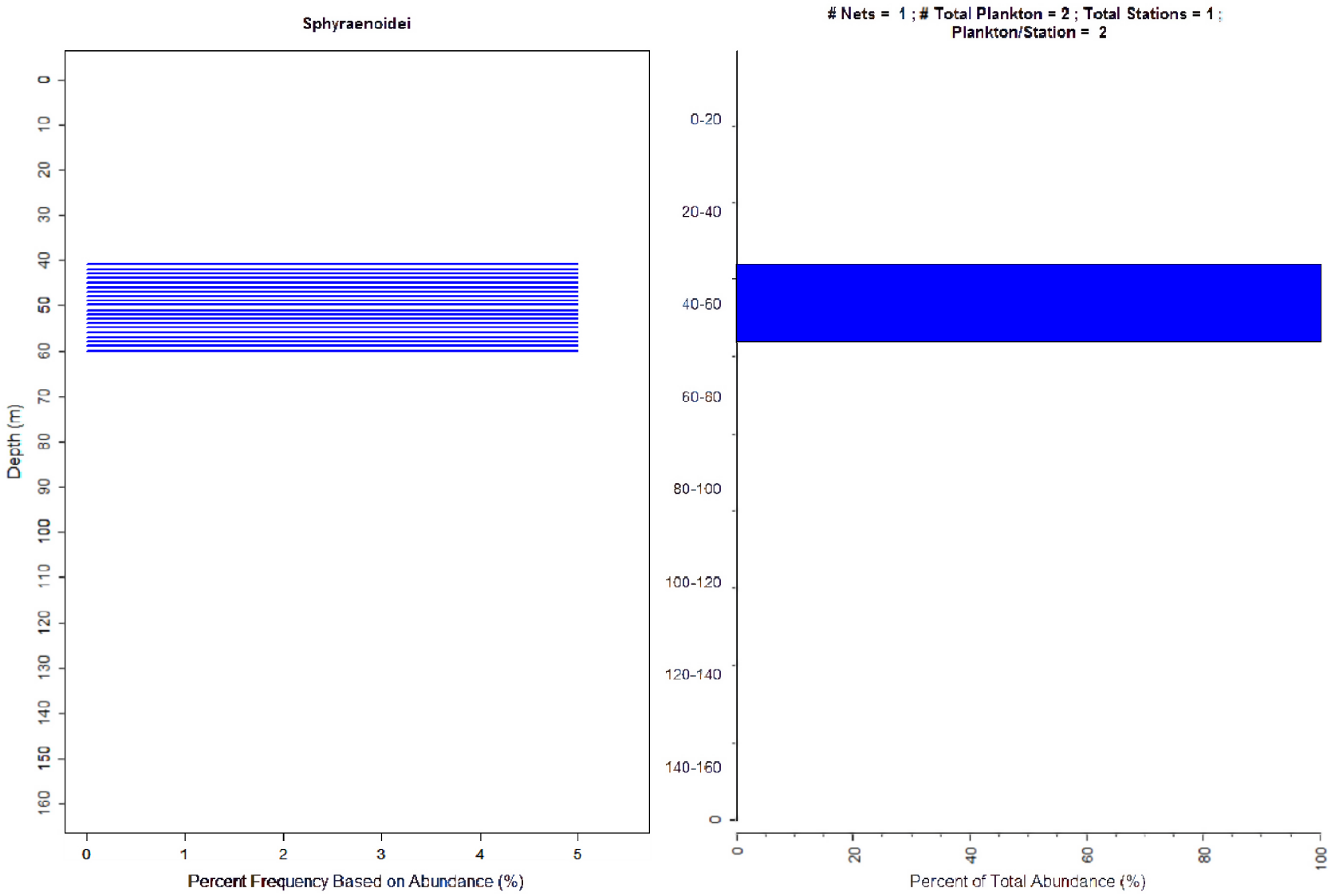
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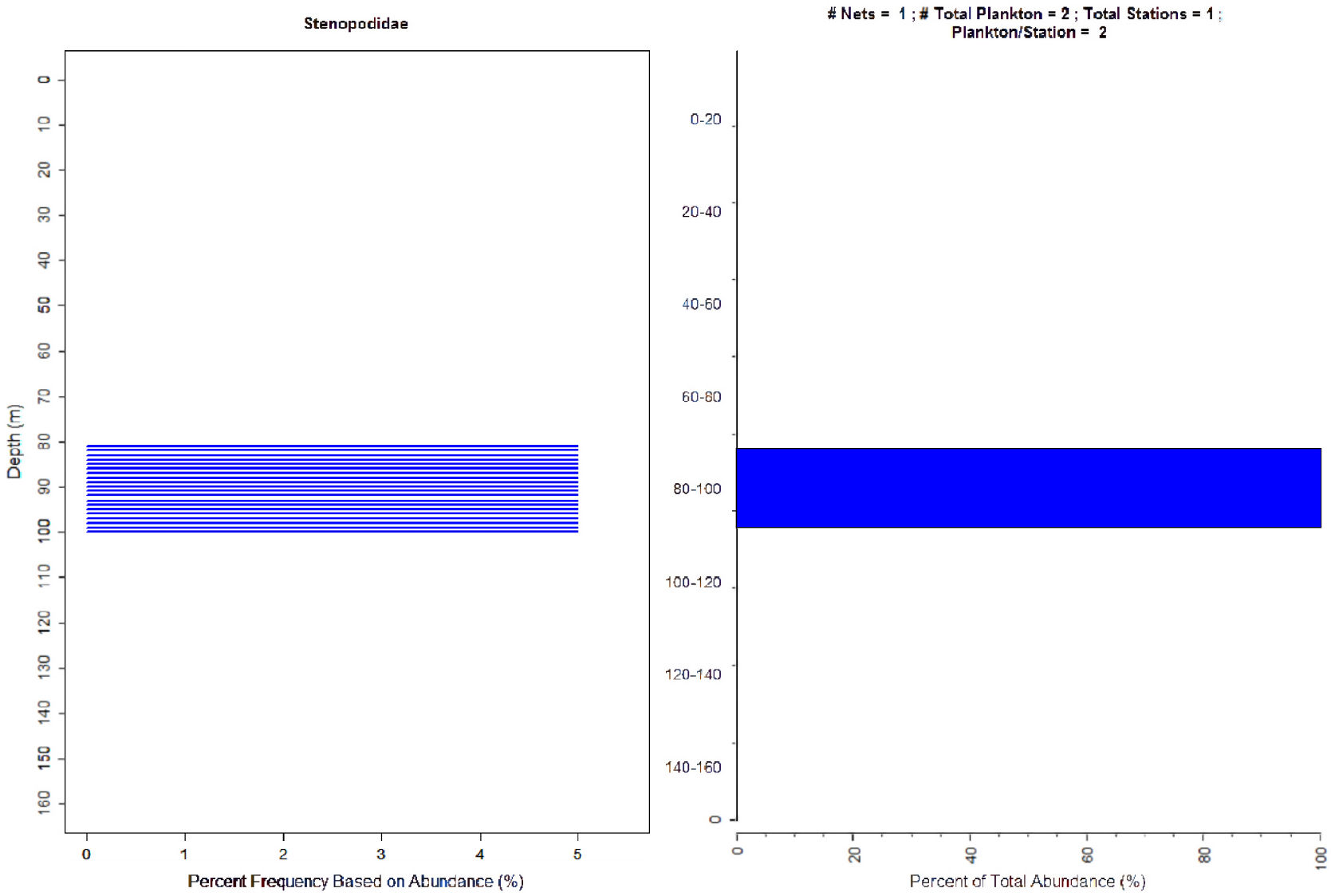
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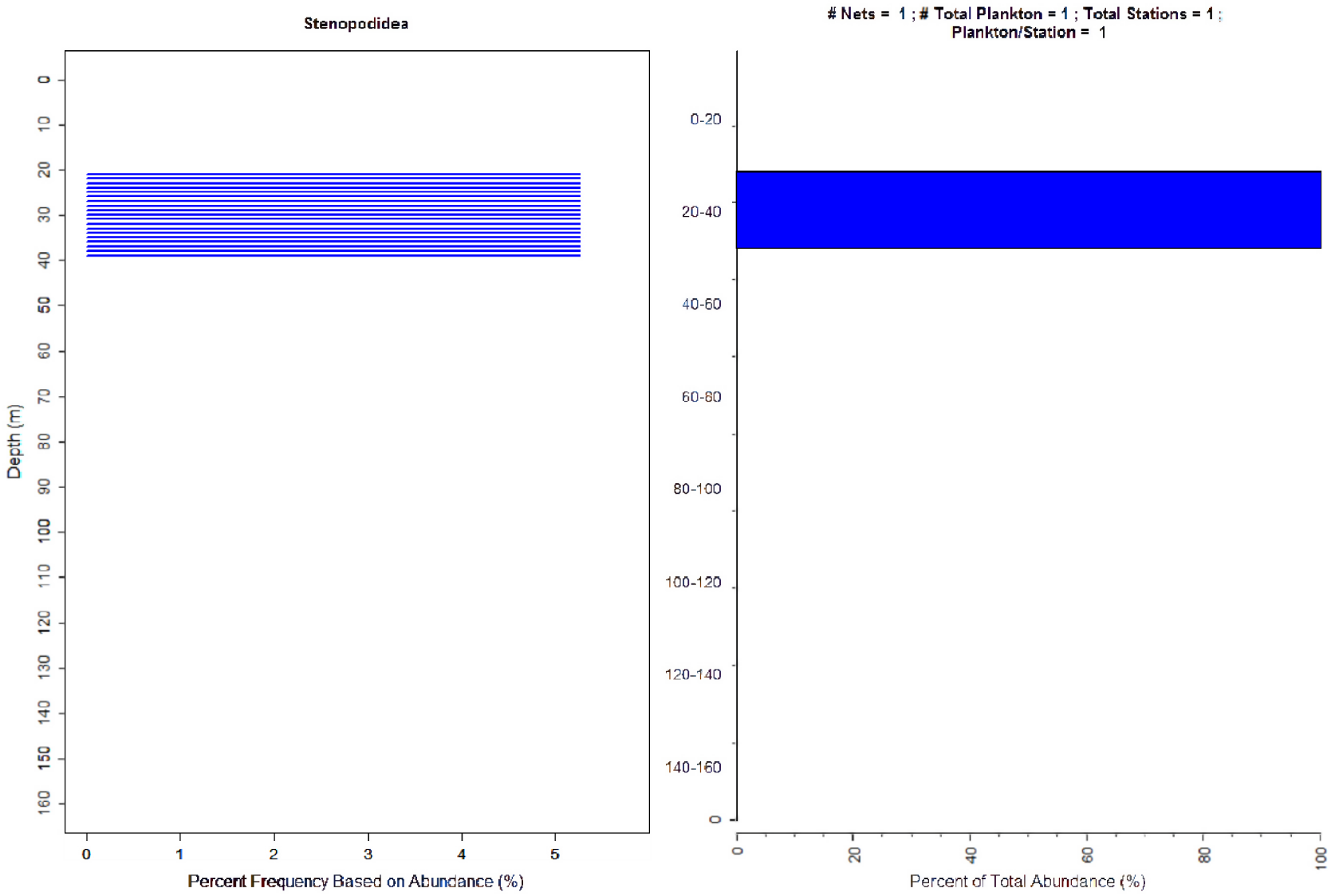
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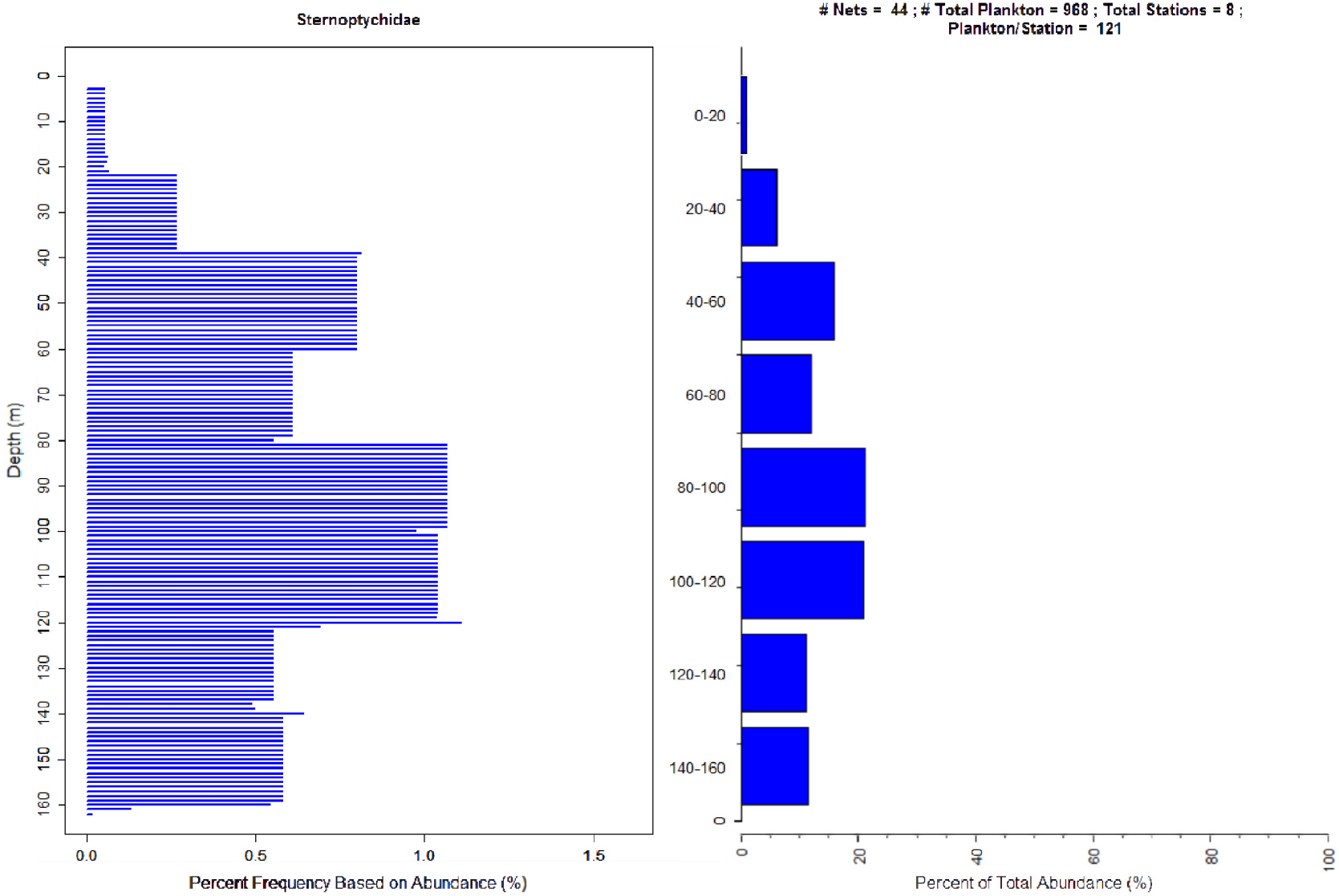
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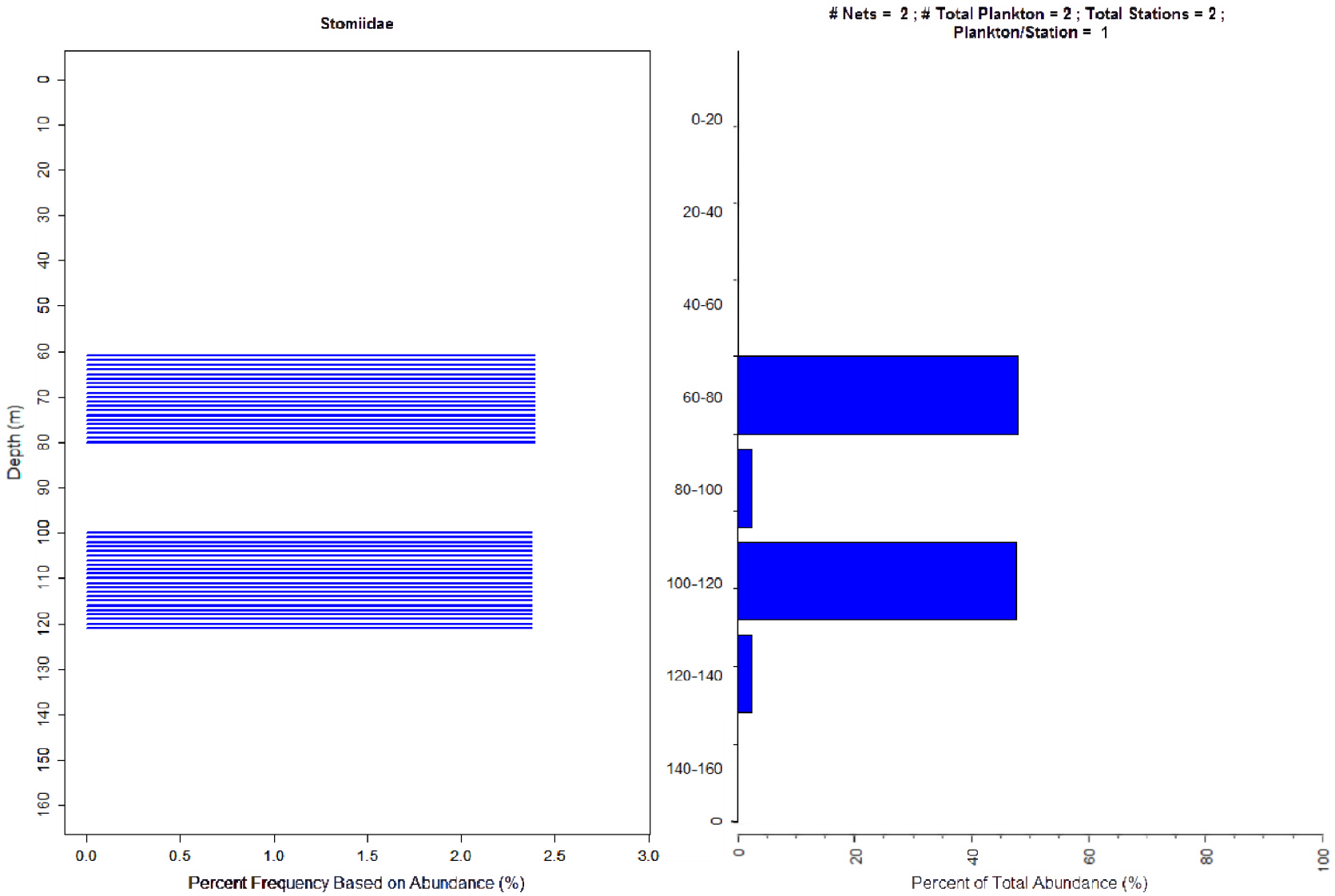
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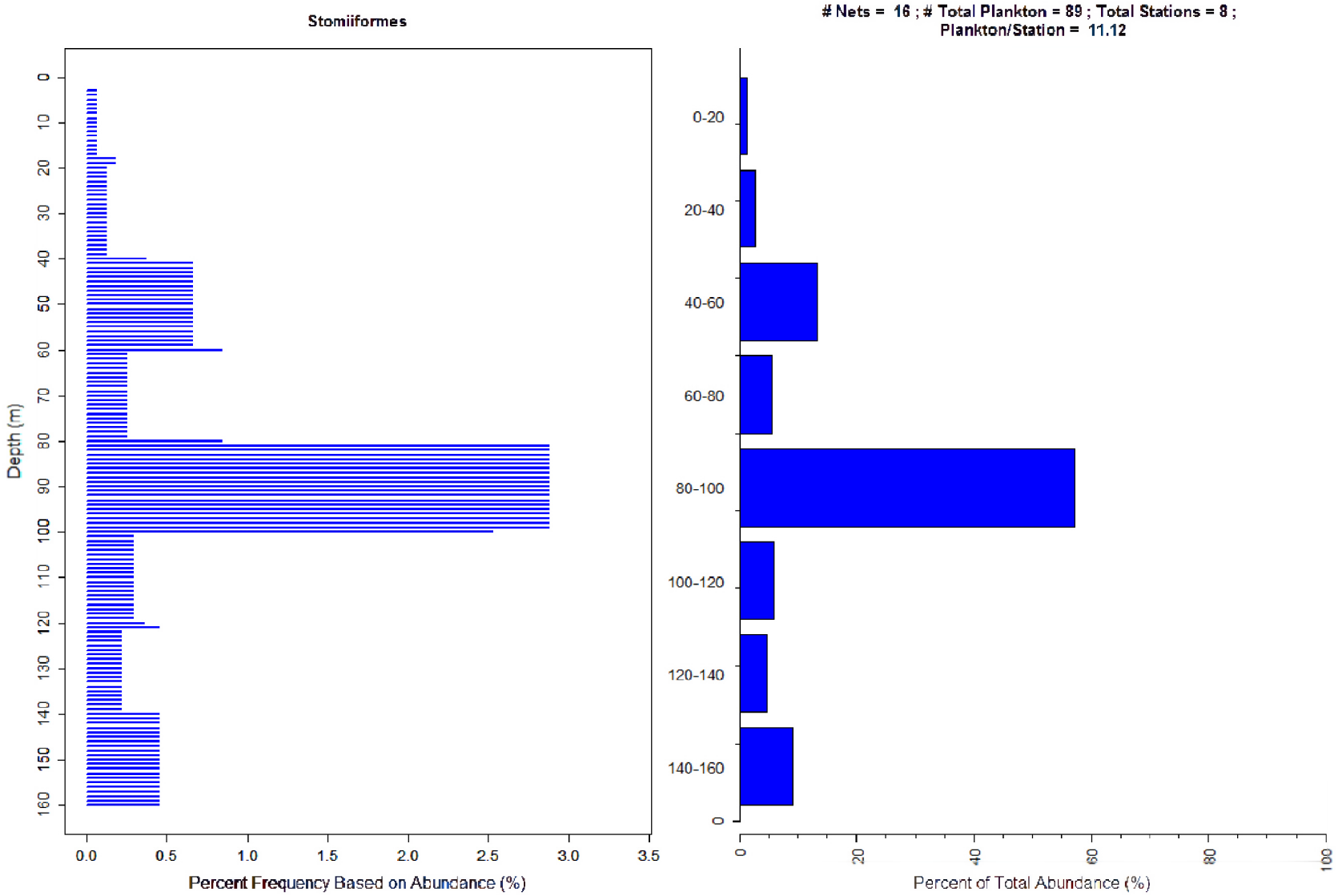
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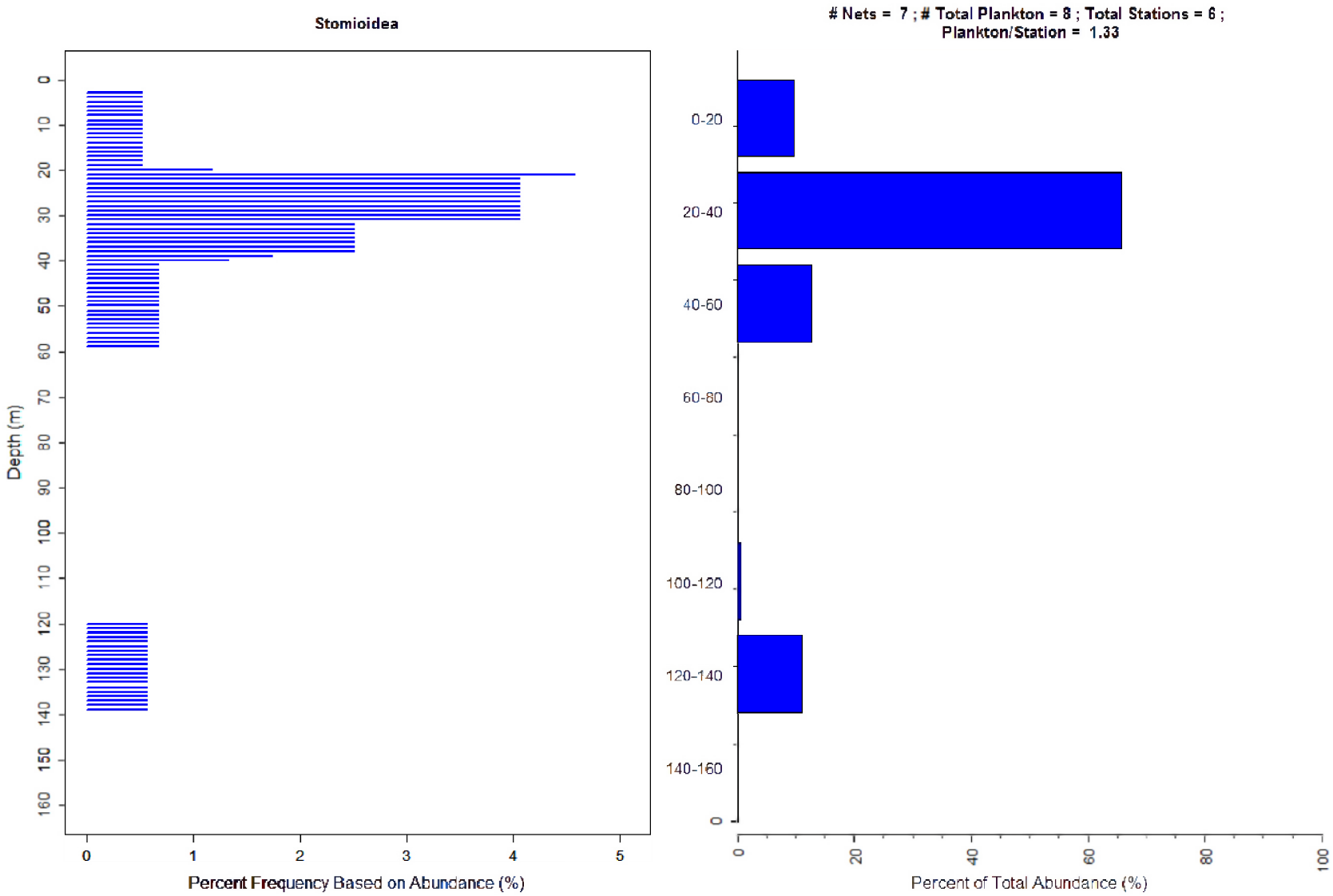
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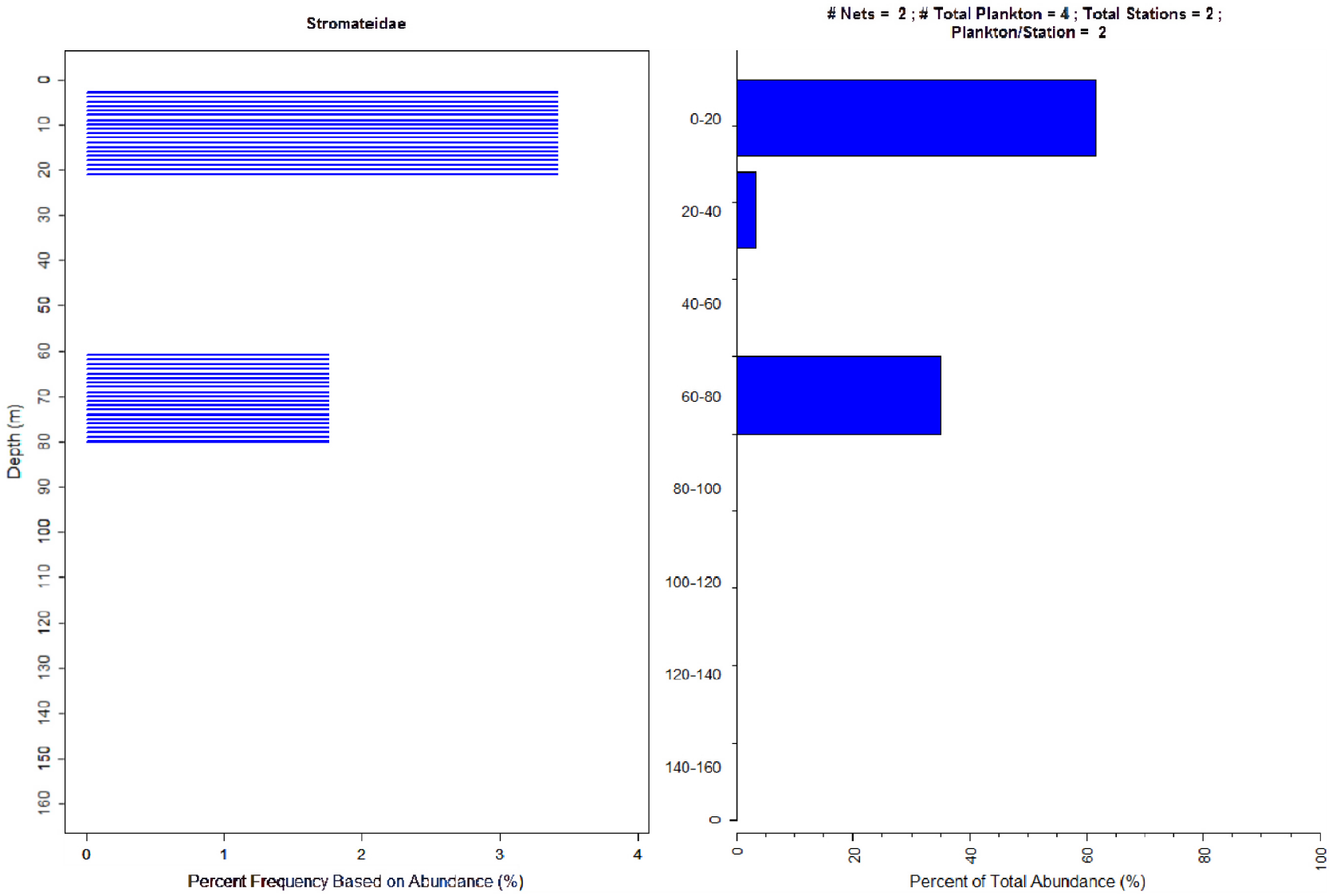
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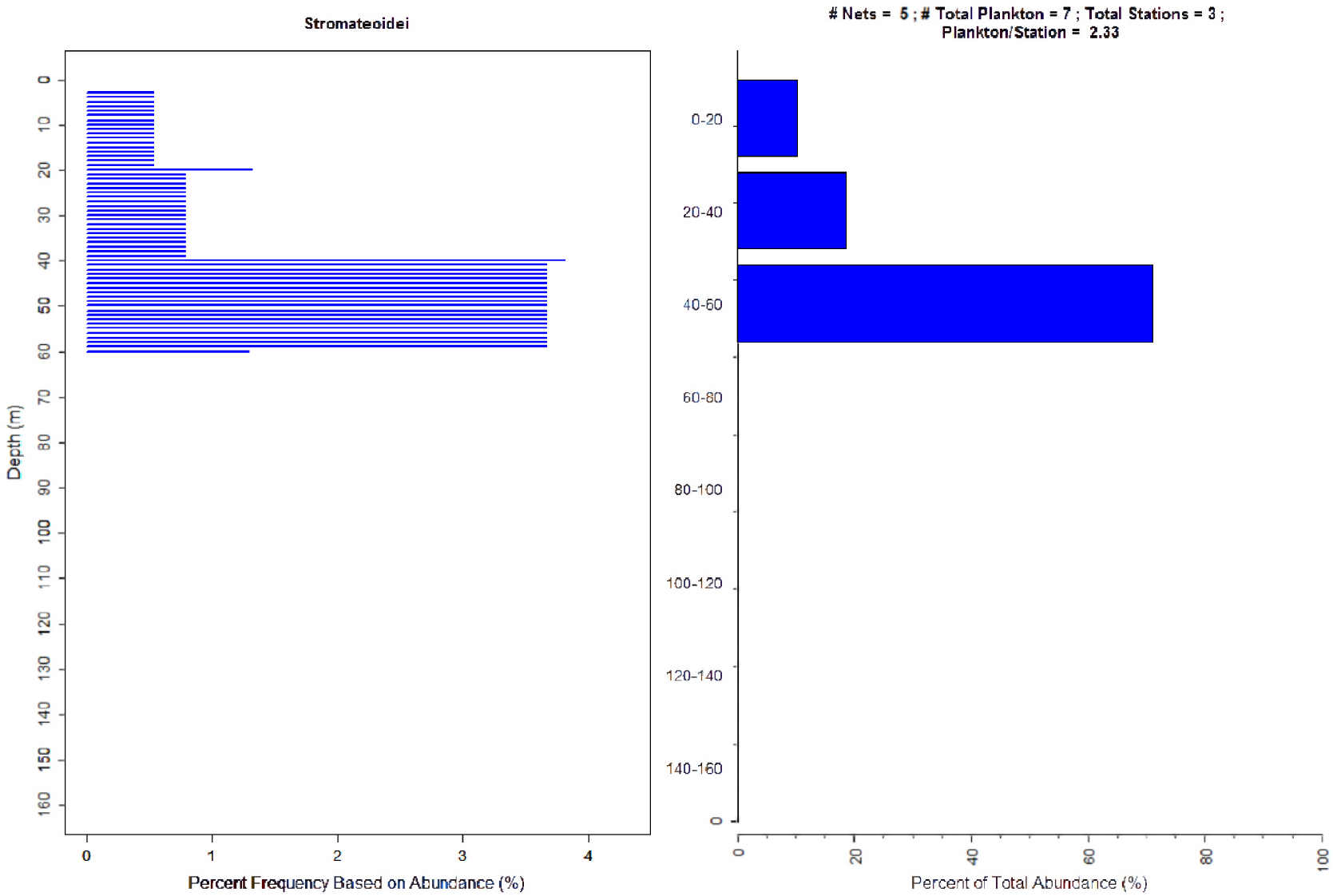
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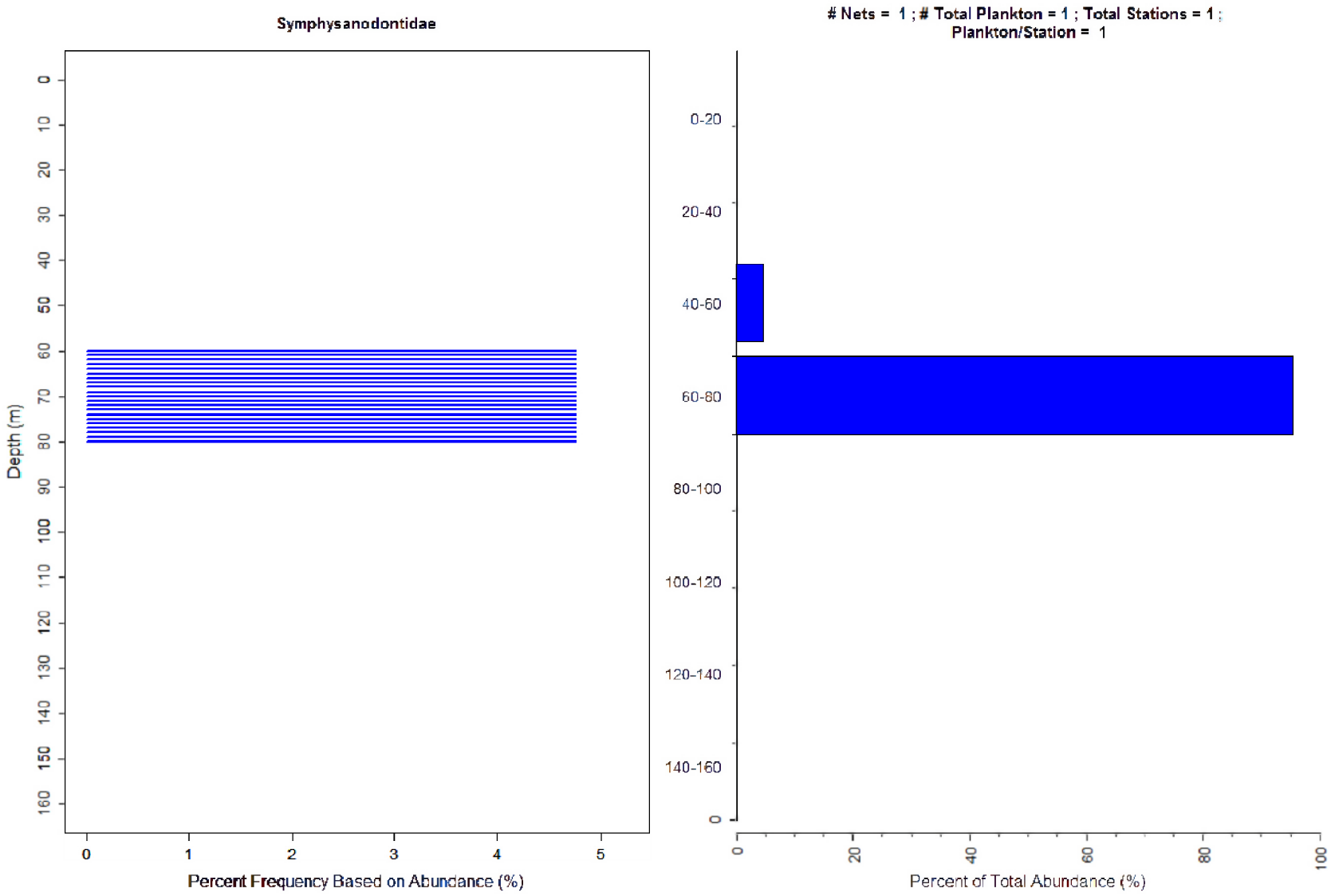
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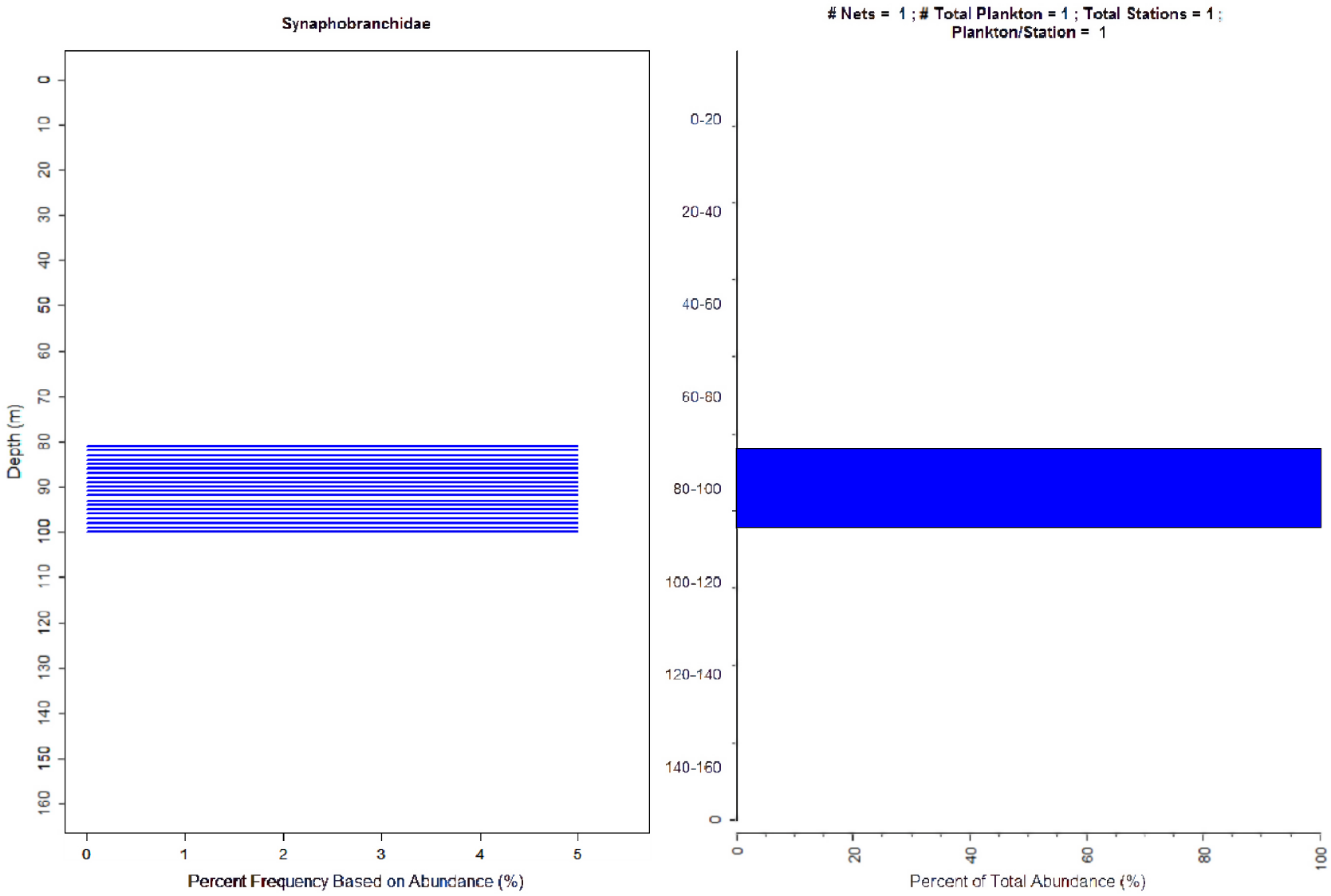
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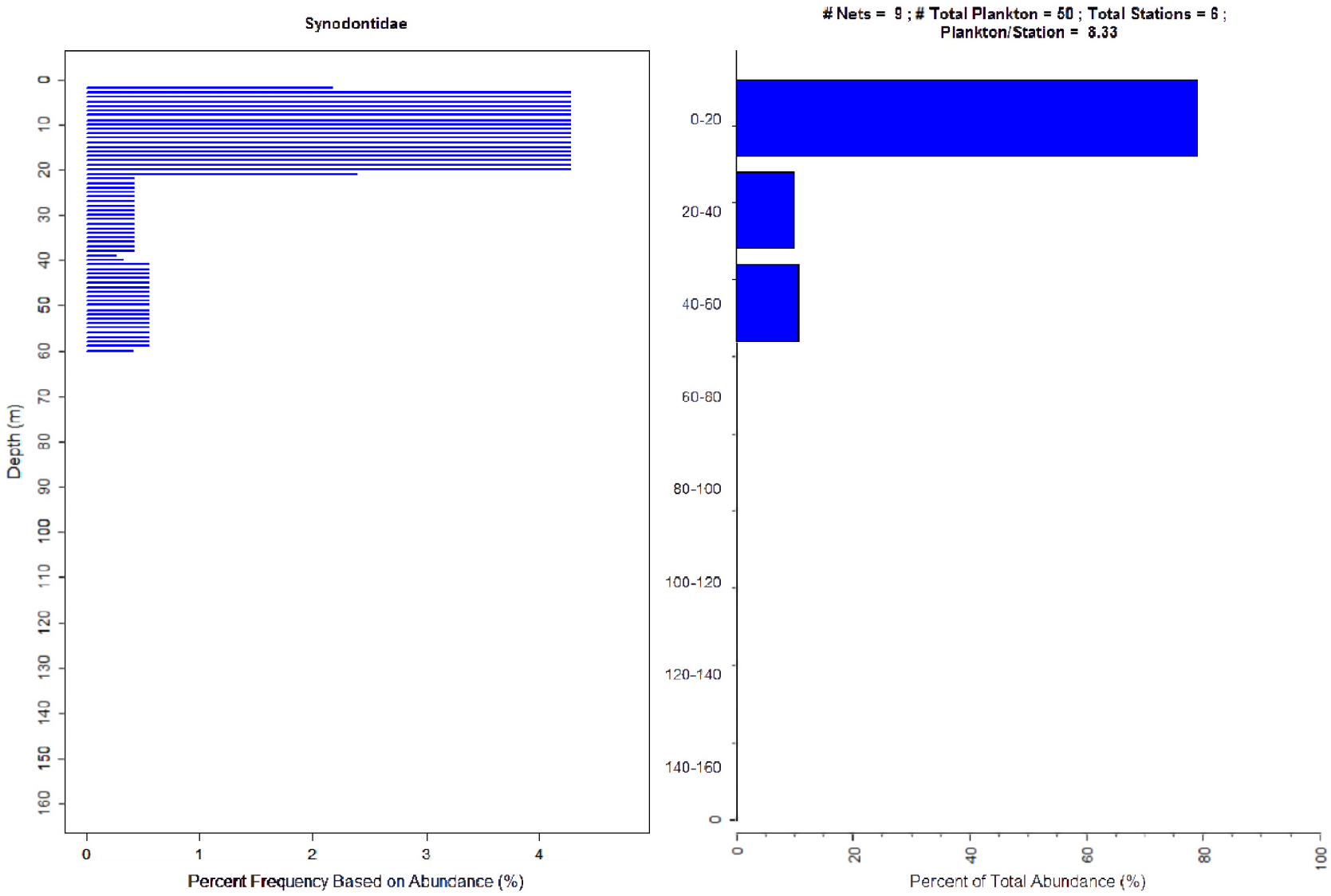
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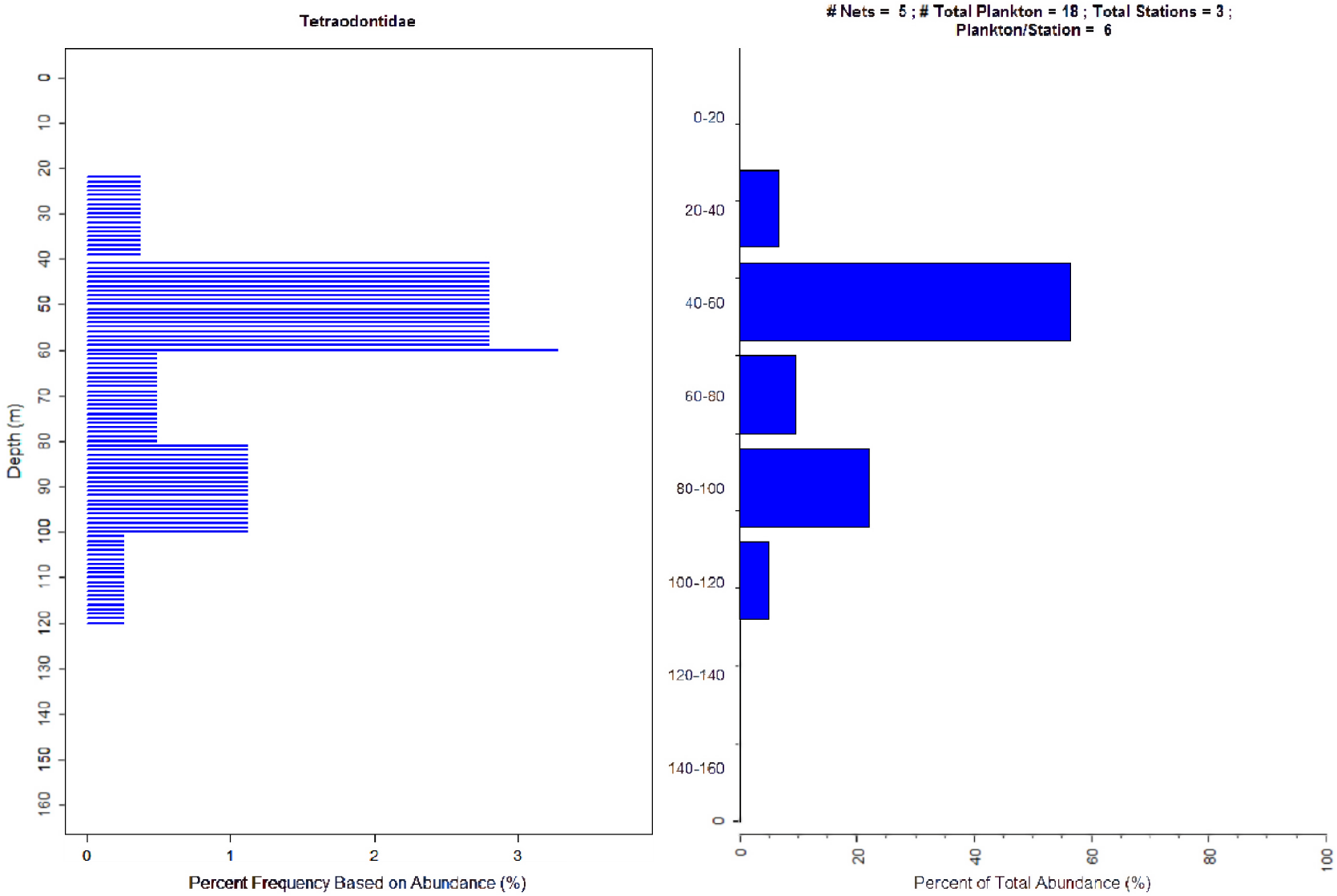
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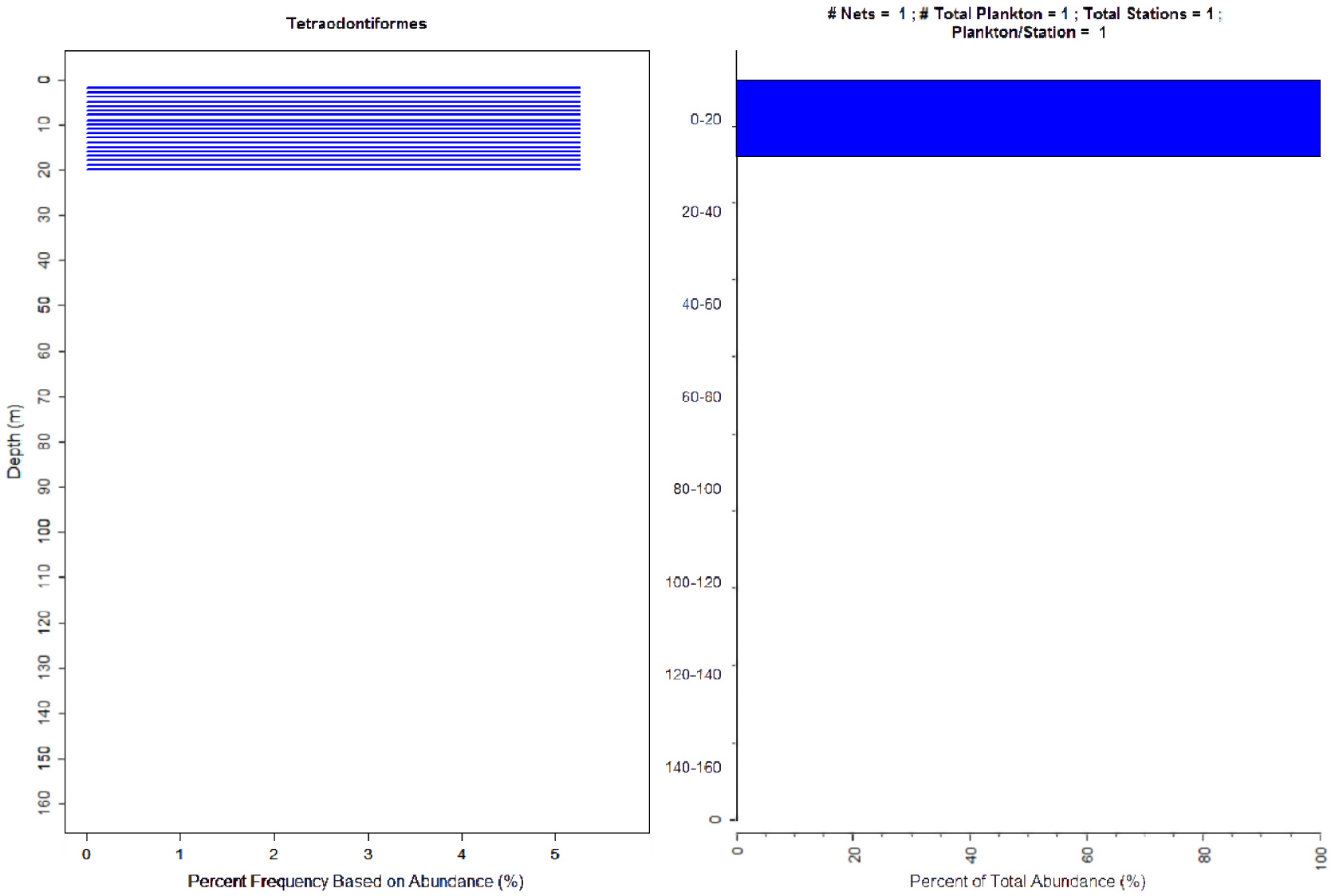
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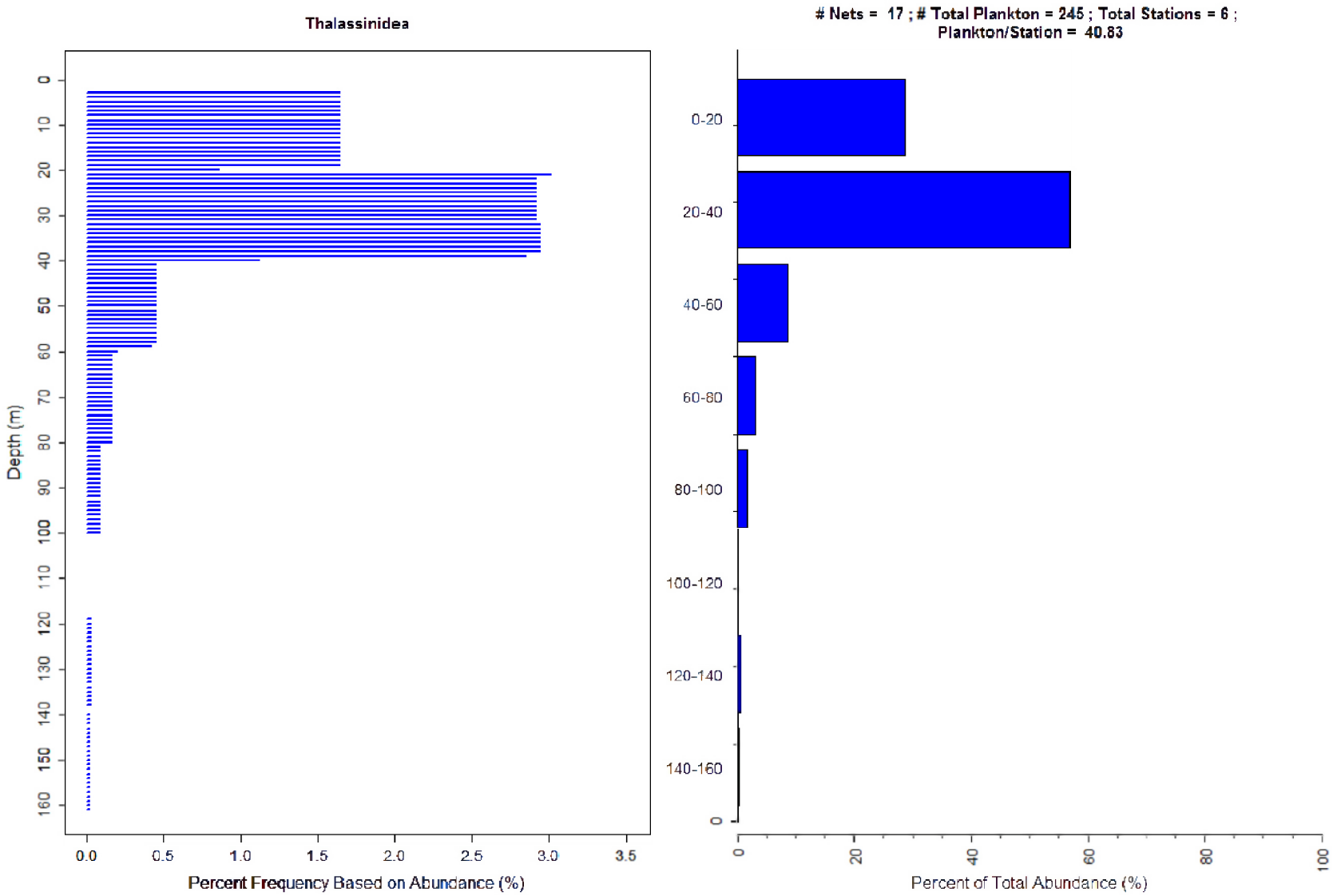
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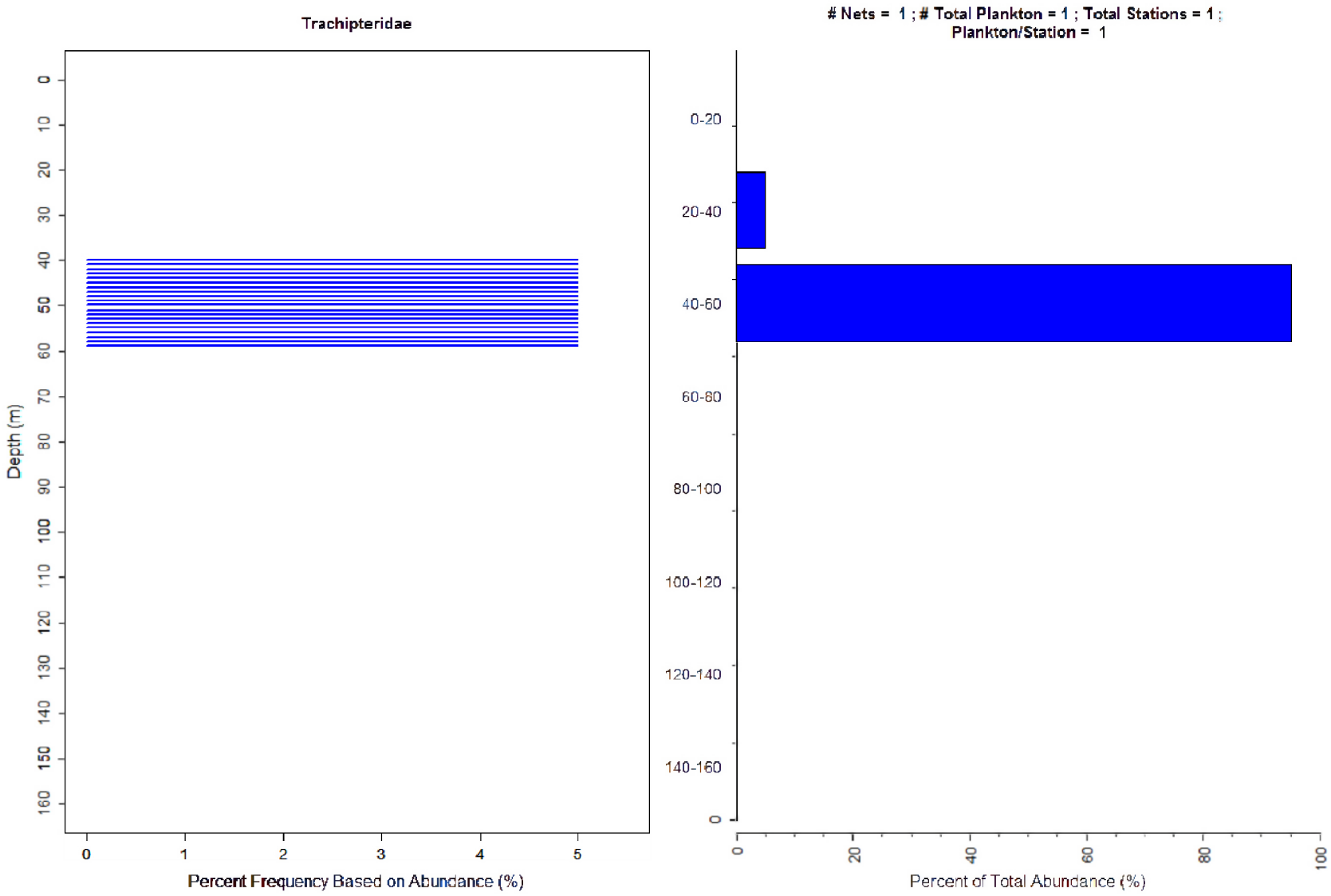
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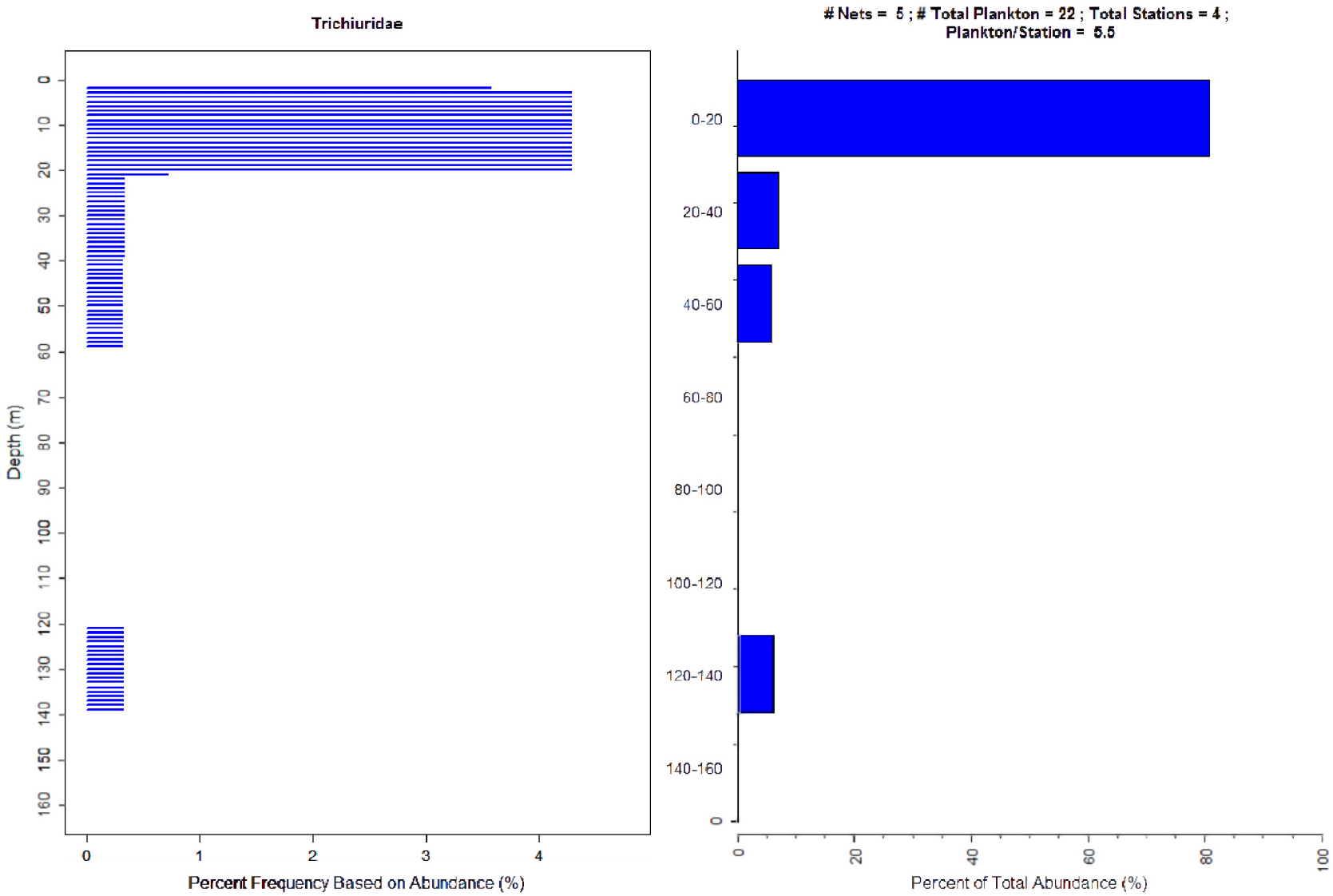
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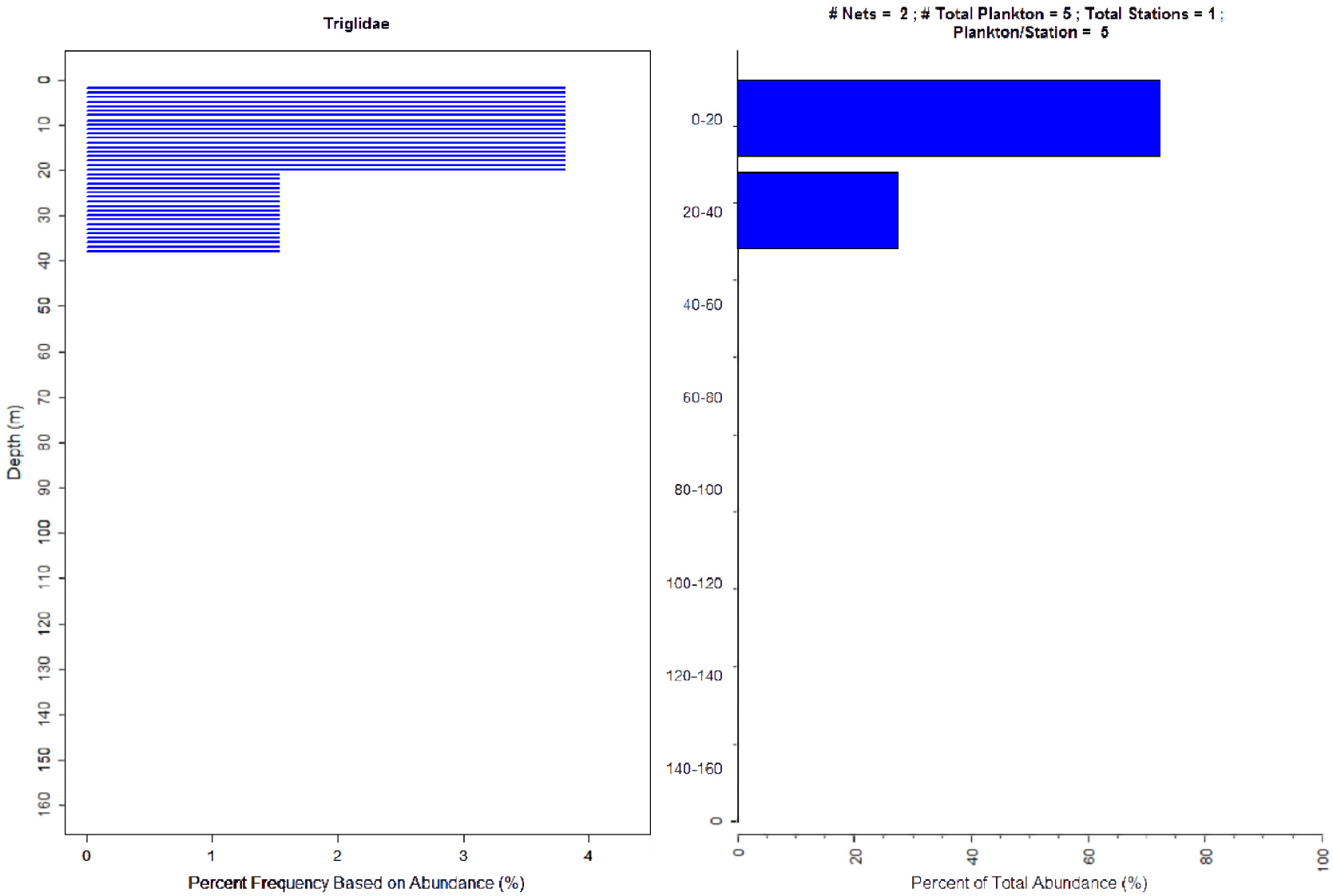
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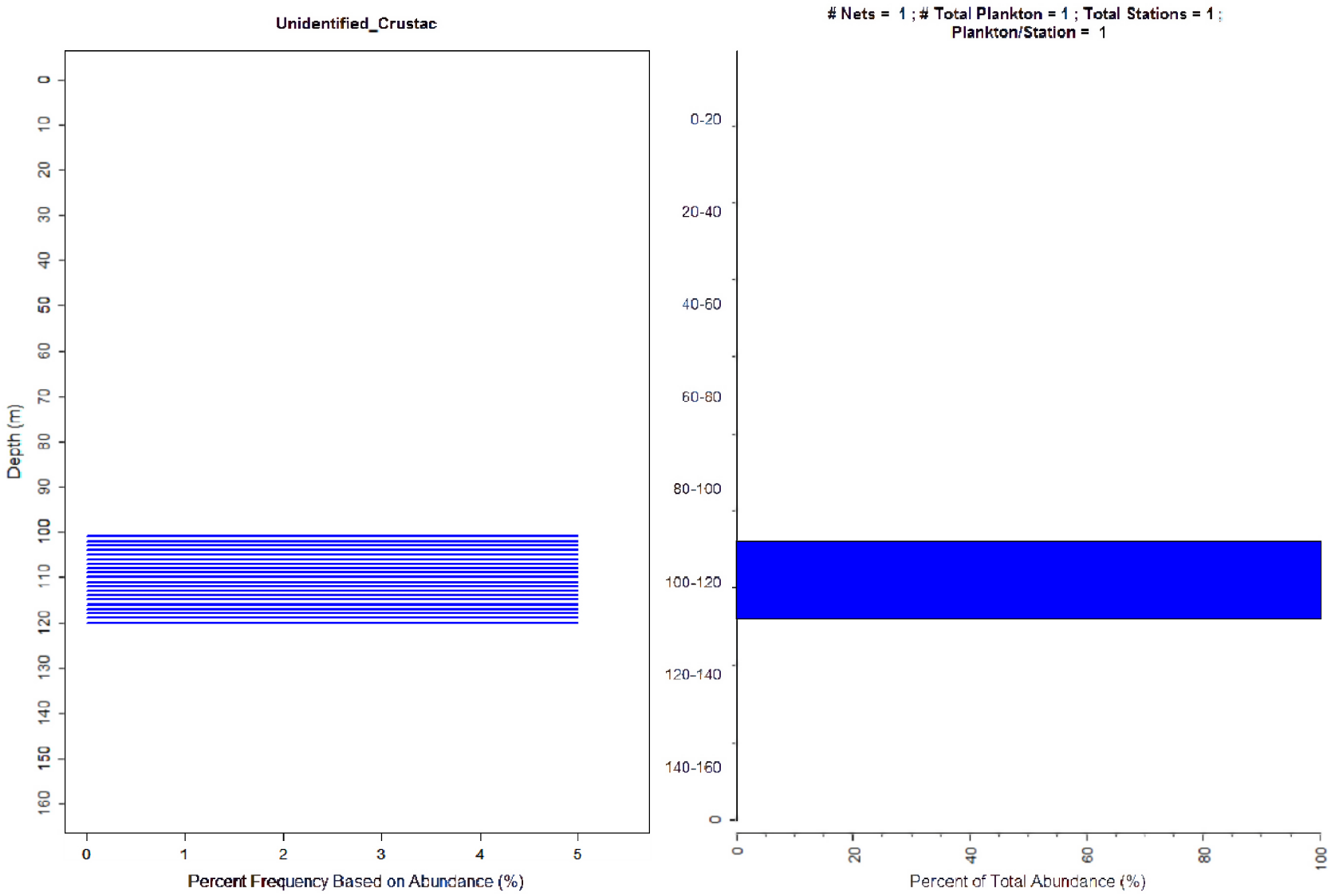
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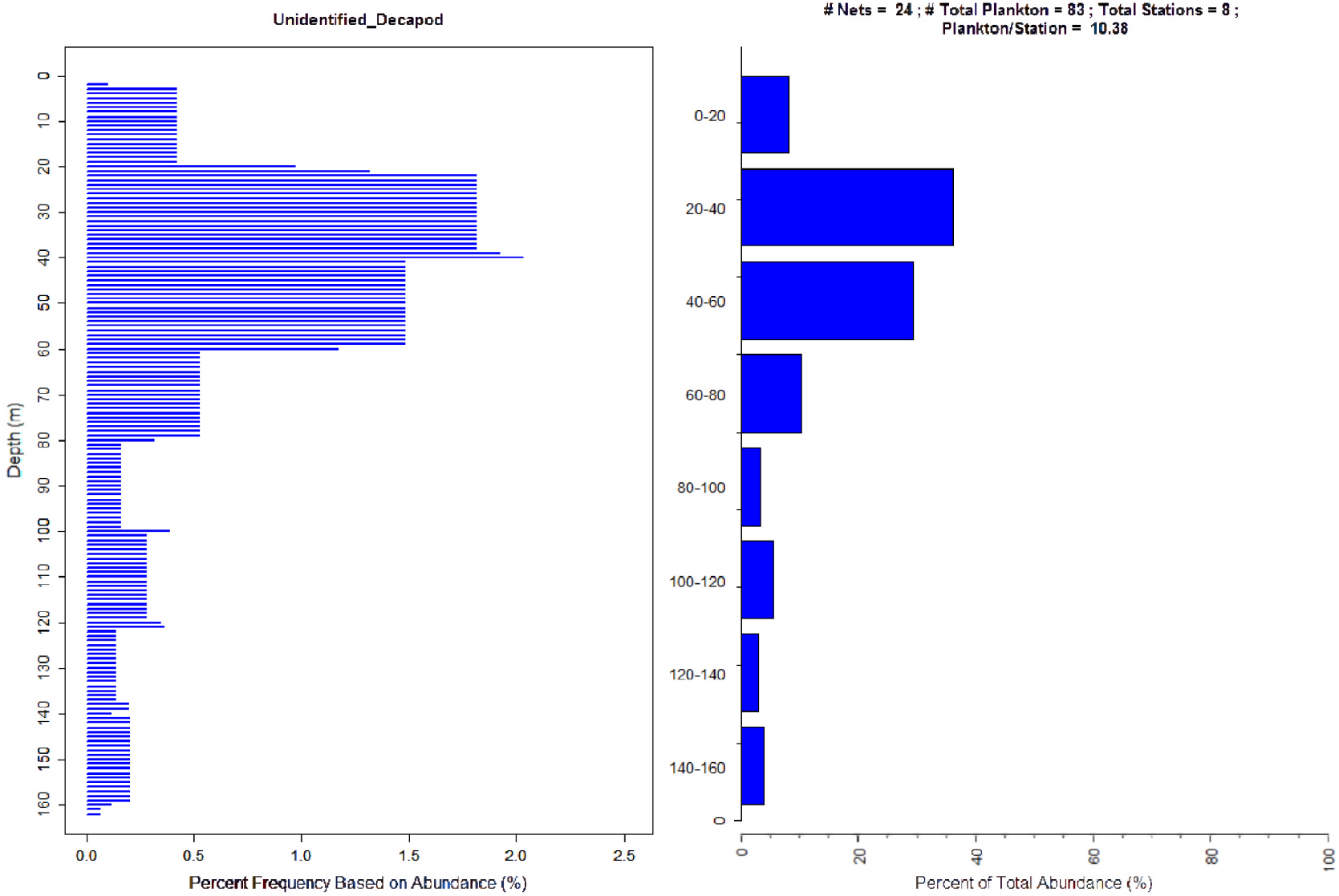
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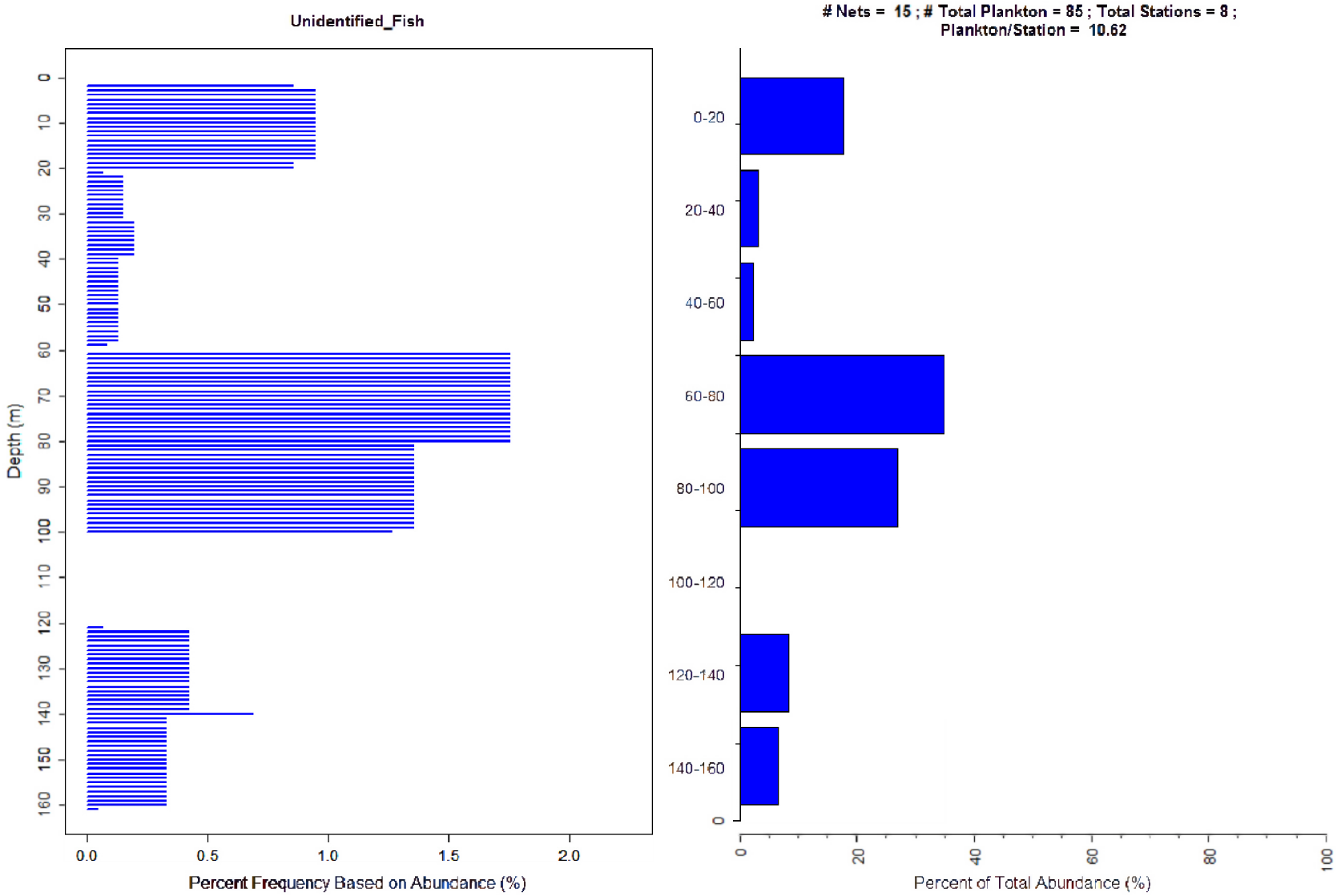
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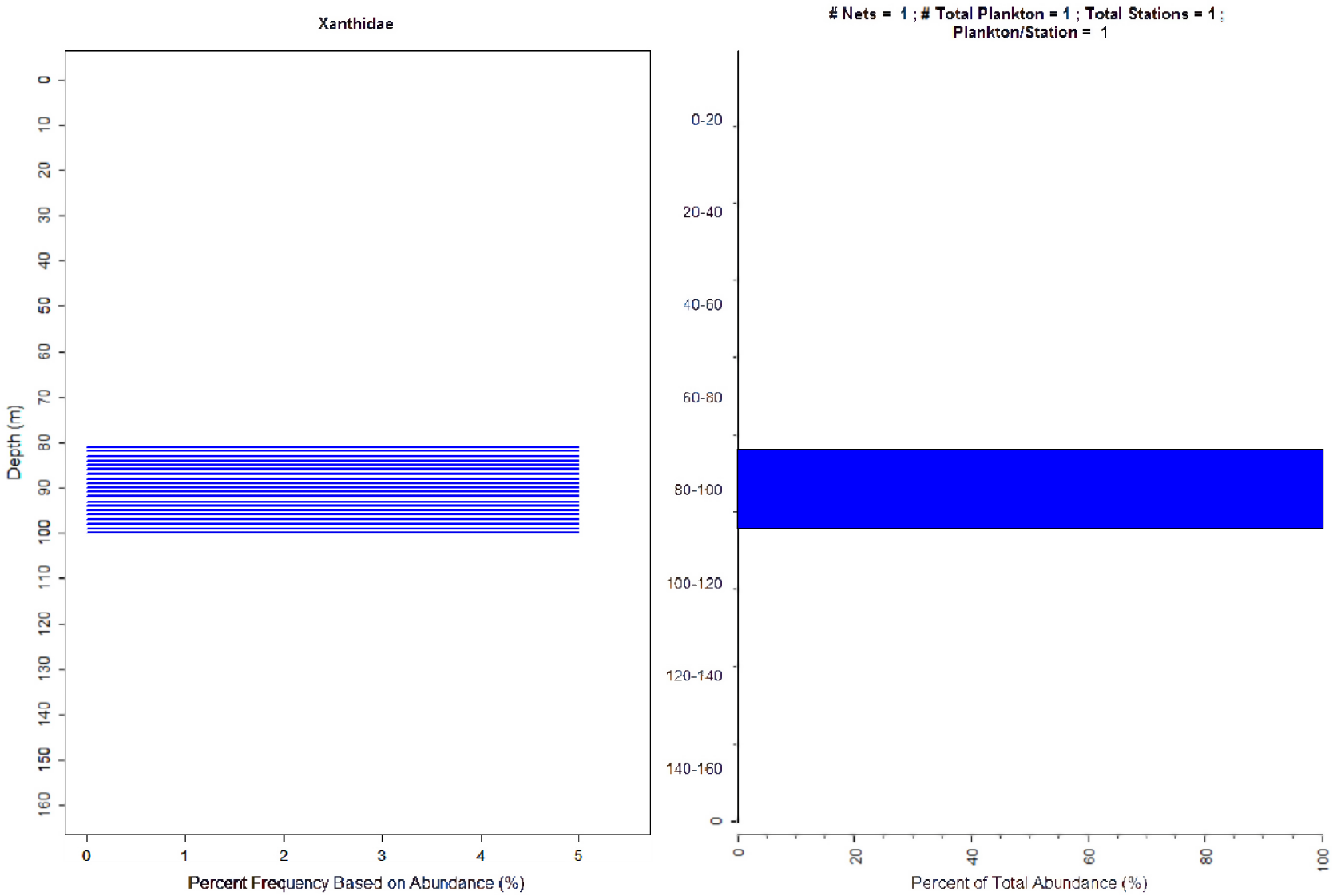
Unidentified_Crustac - Shallow



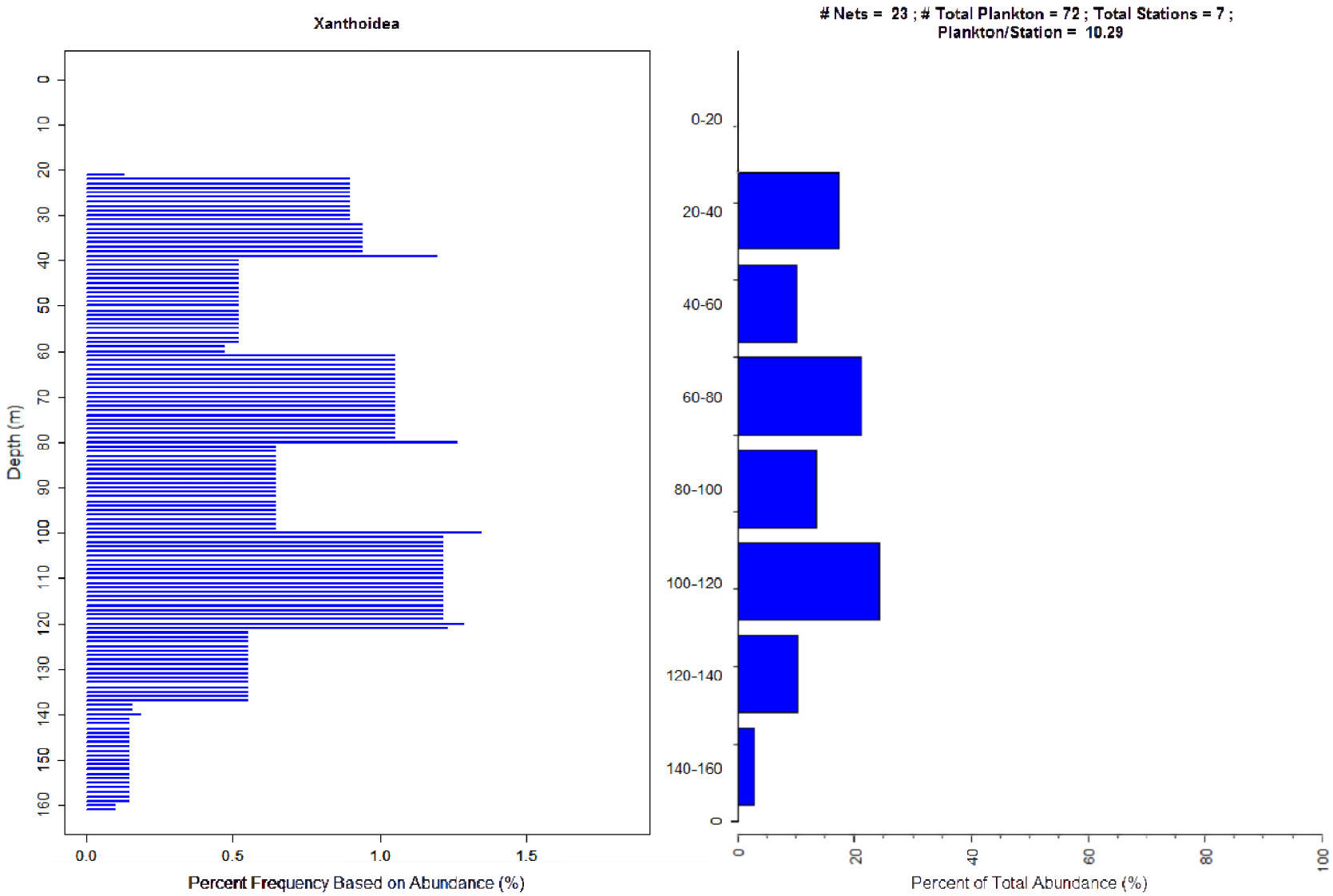
Unidentified_Decapod - Shallow



Unidentified_Fish - Shallow



Xanthidae - Shallow



Xanthoidea - Shallow

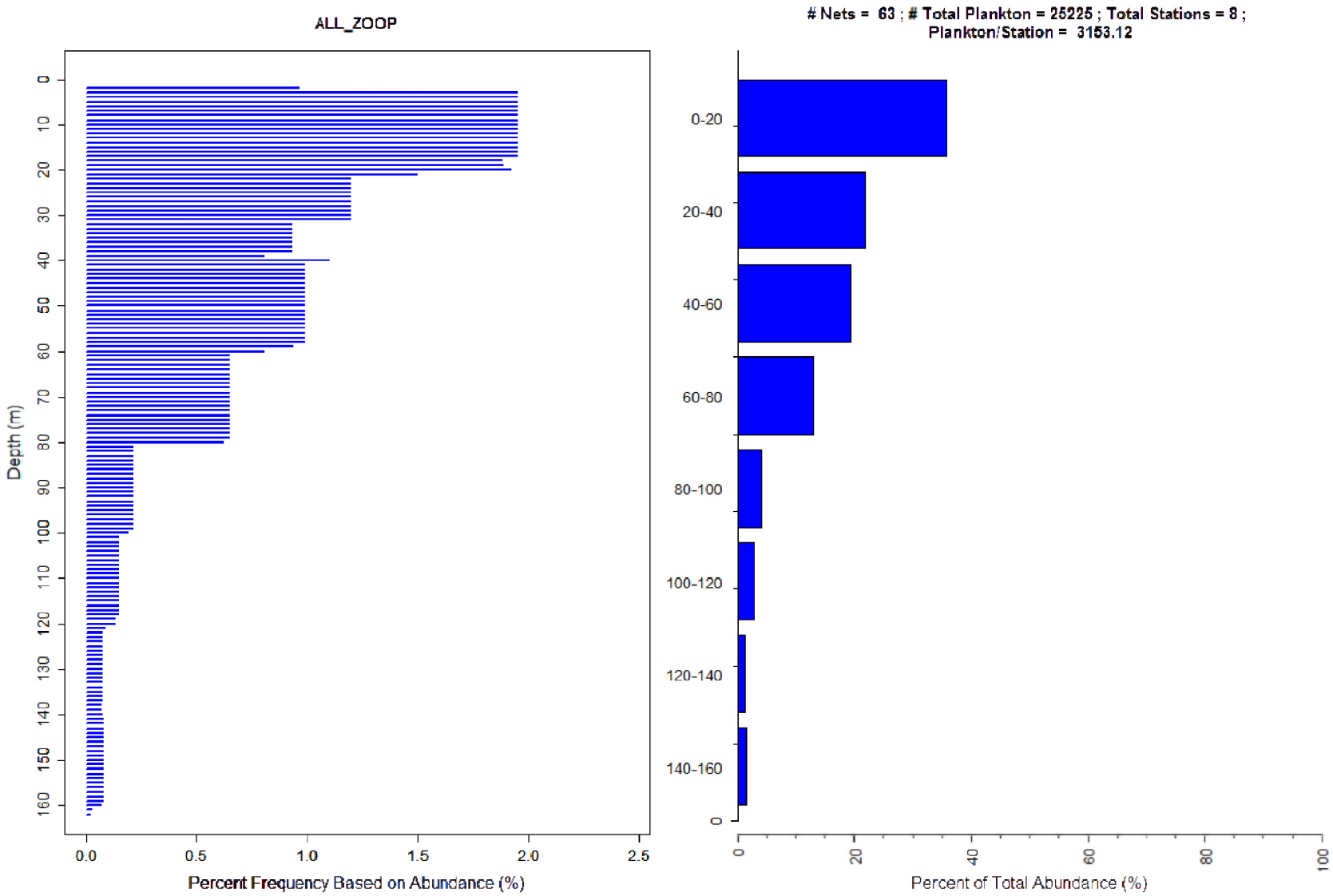
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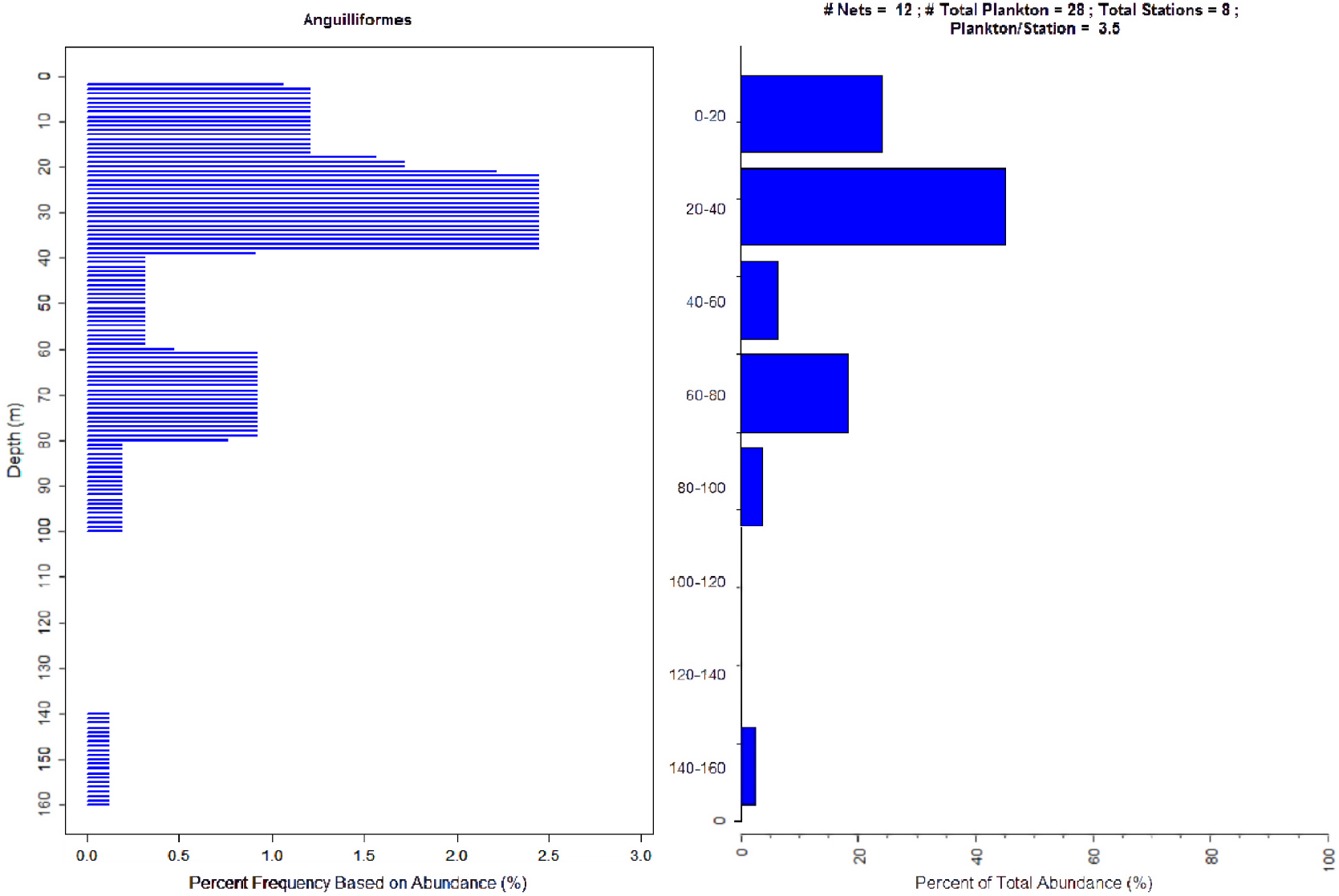
Appendix D3 – NRDA Tier1A Shallow MOC1 Plots Order Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

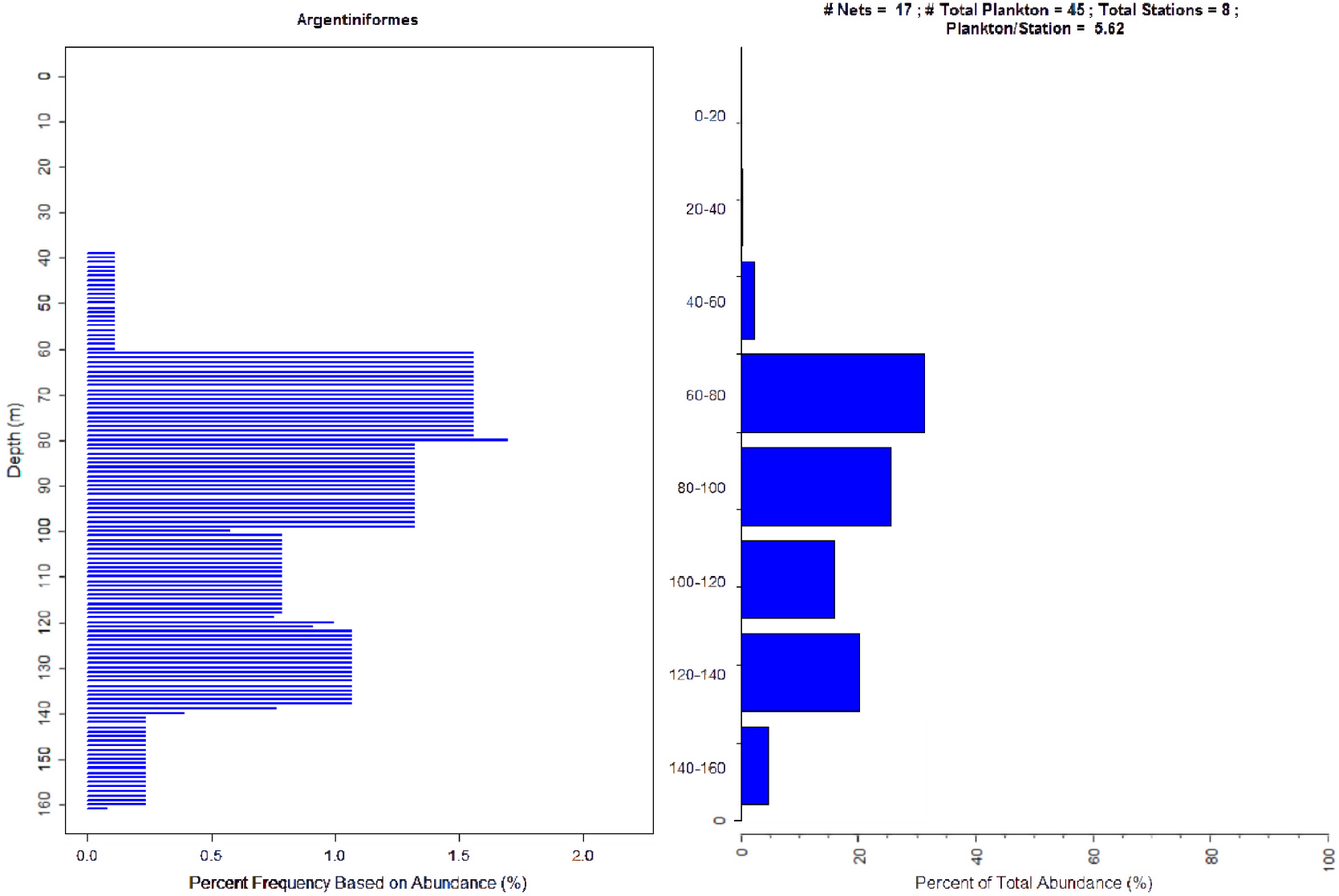
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Project Number: 2011-144
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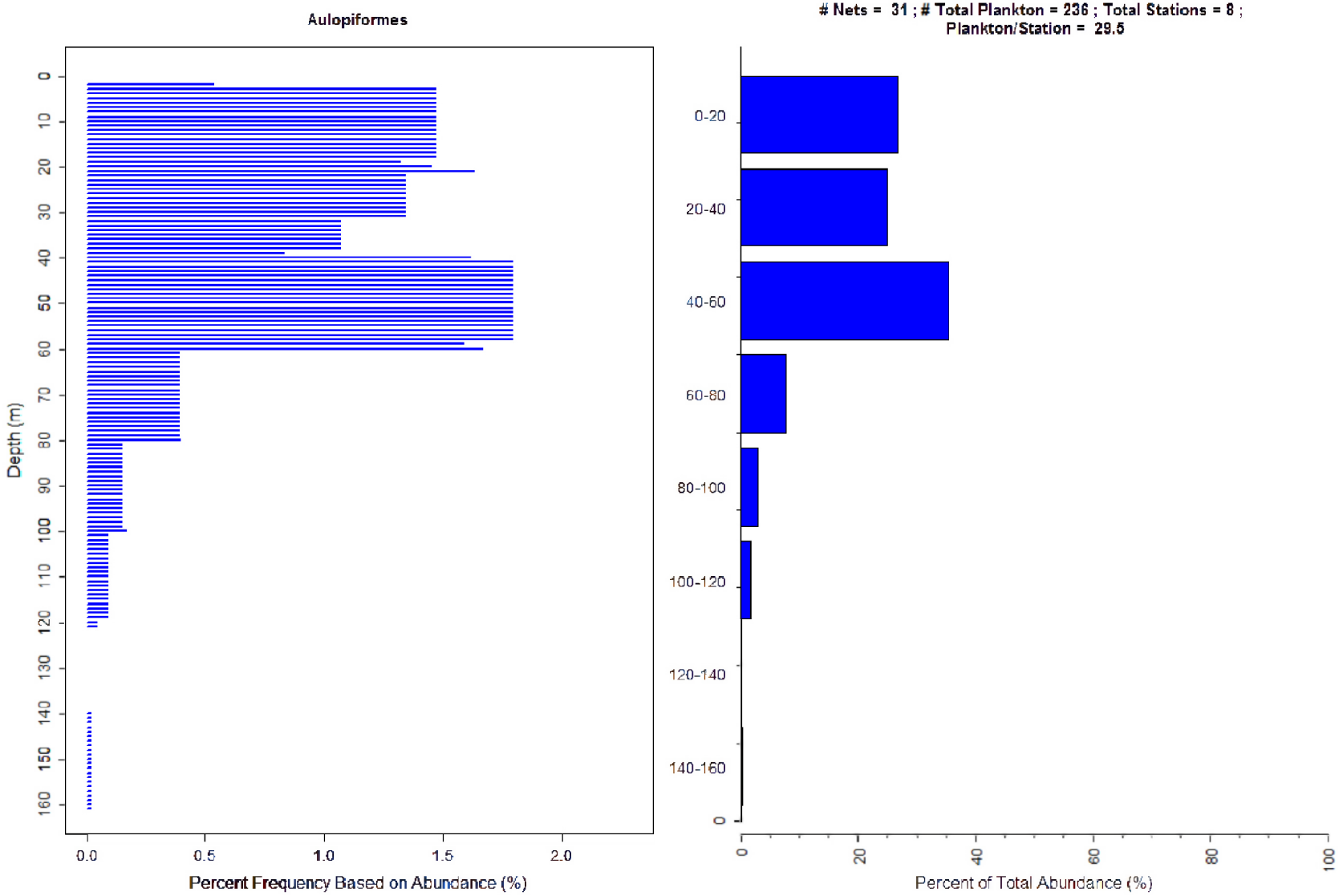
ALL_ZOOP - Shallow



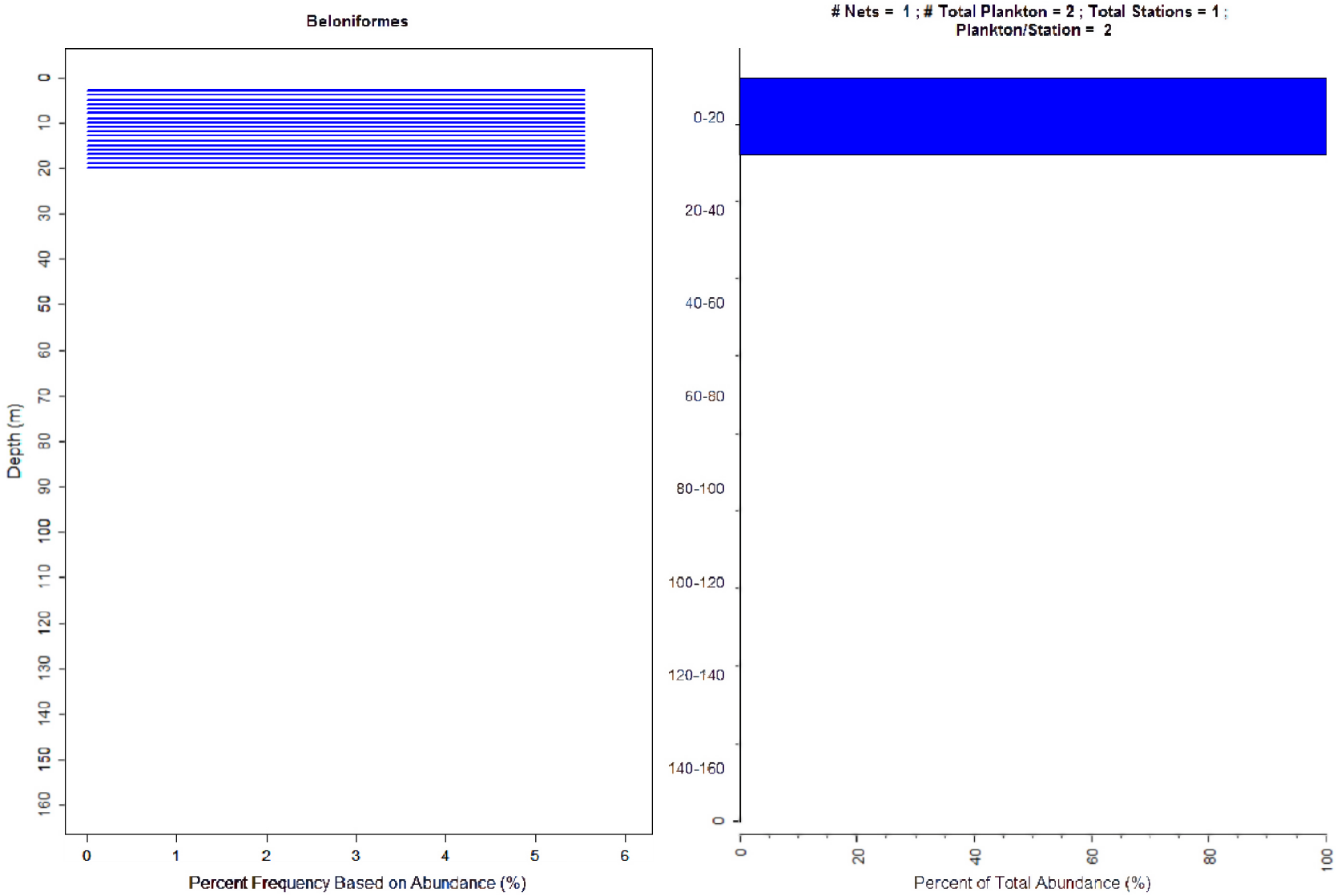
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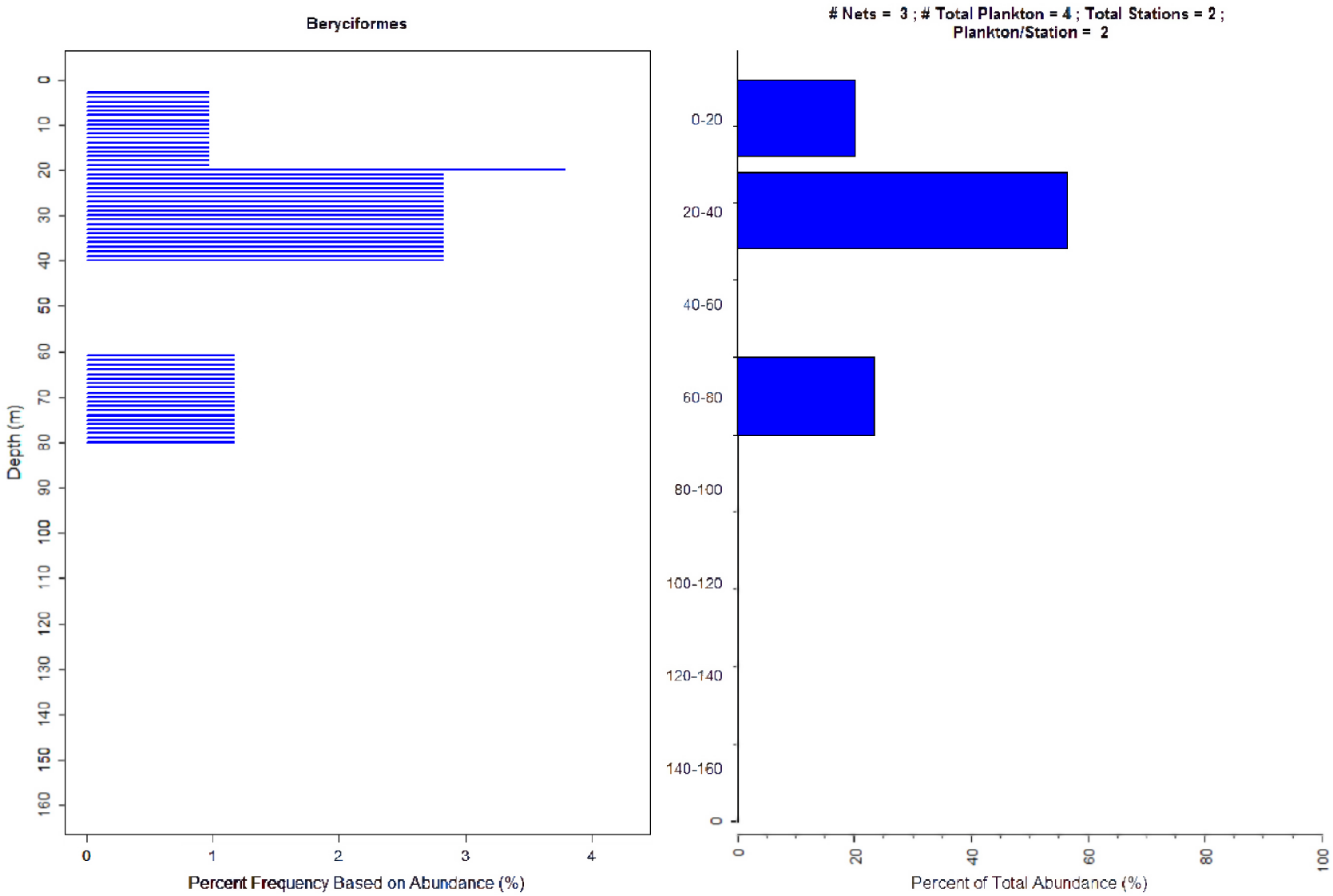
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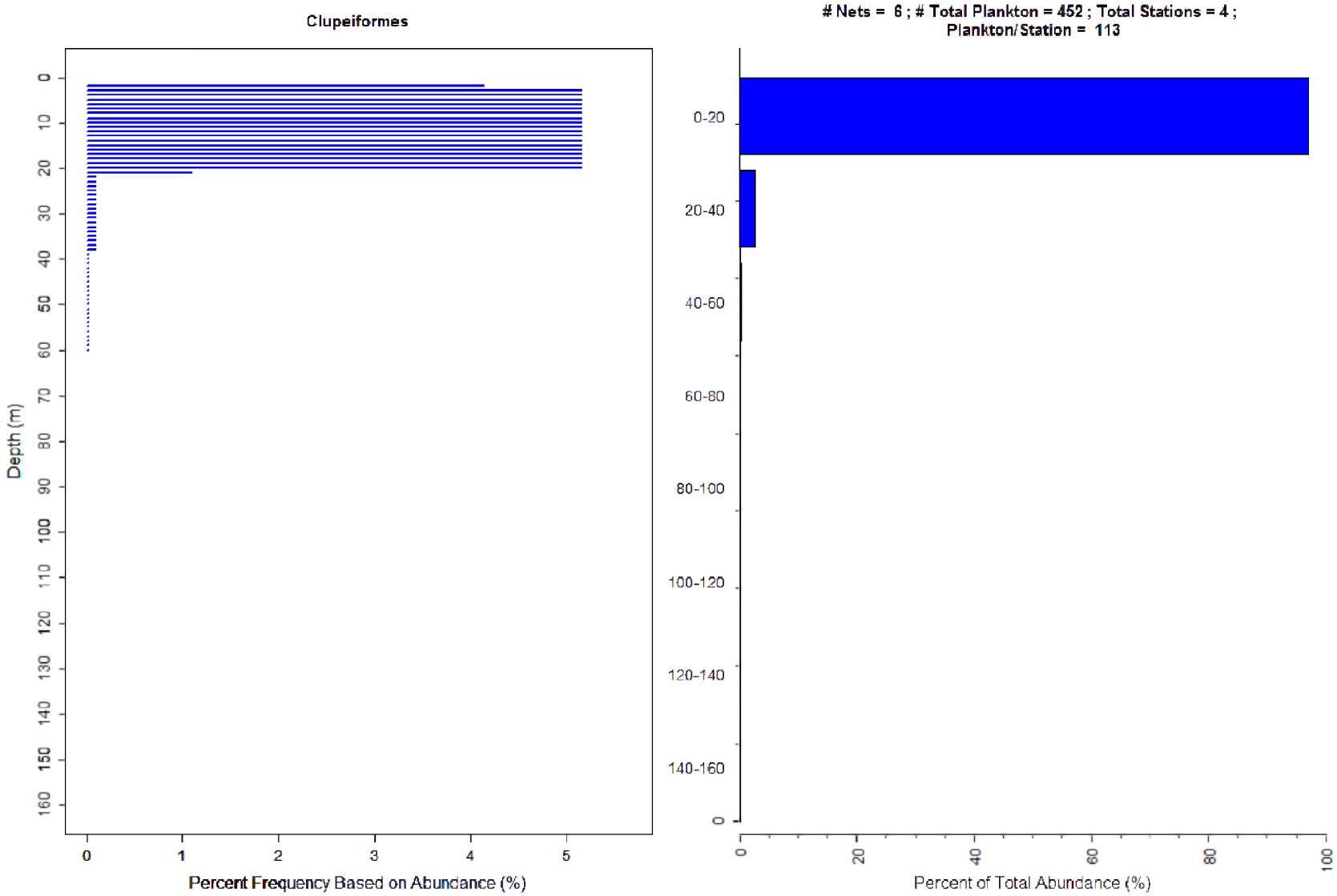
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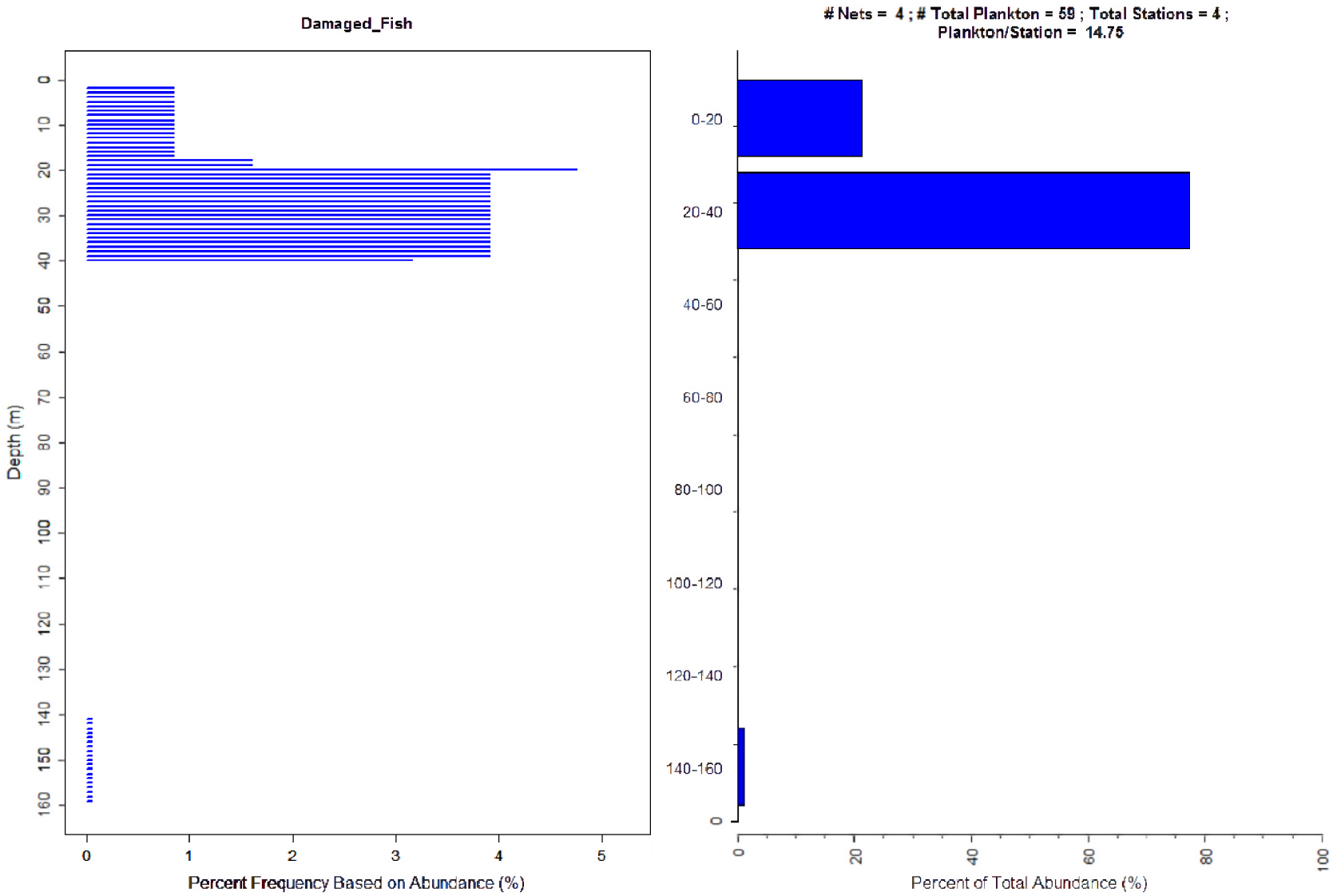
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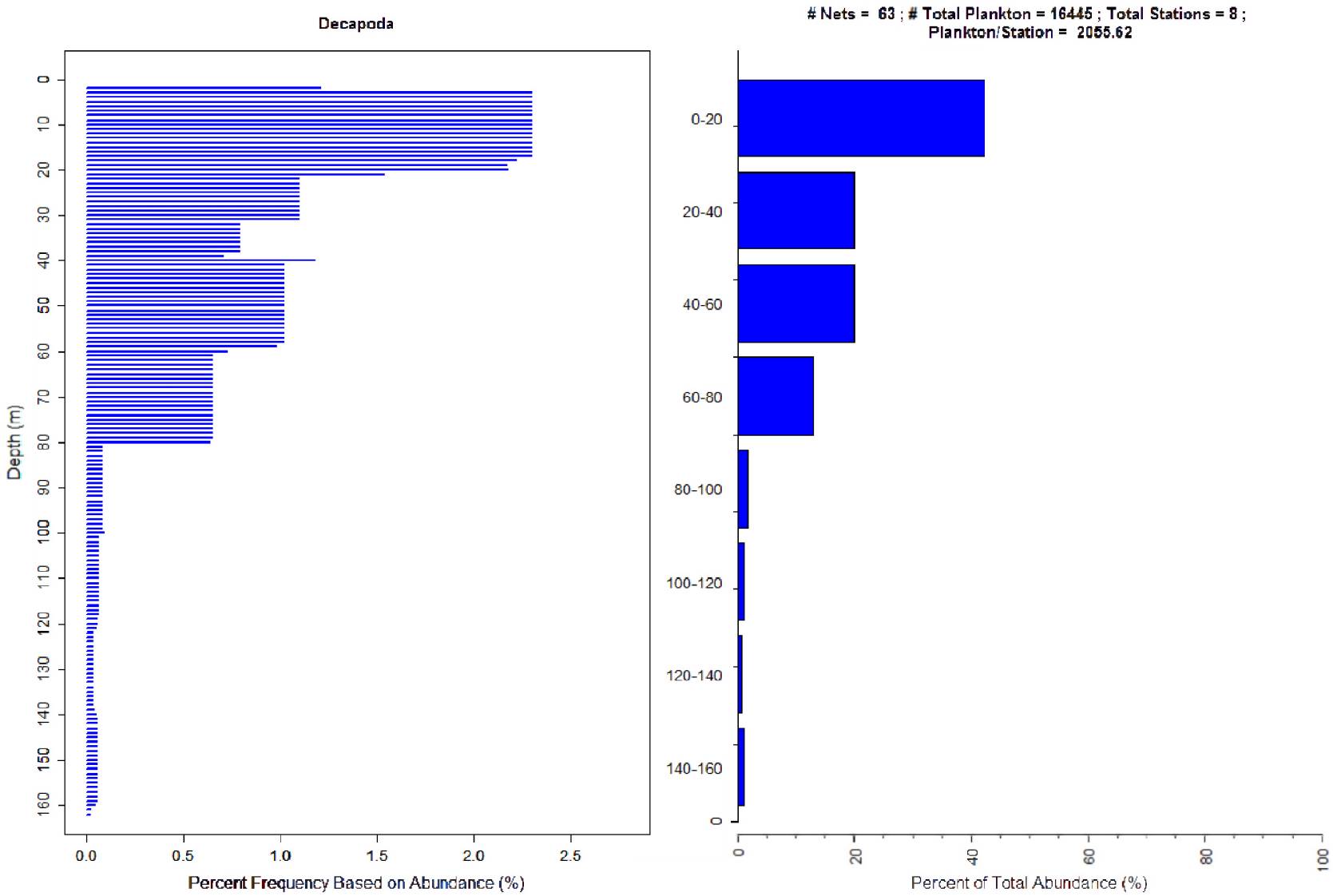
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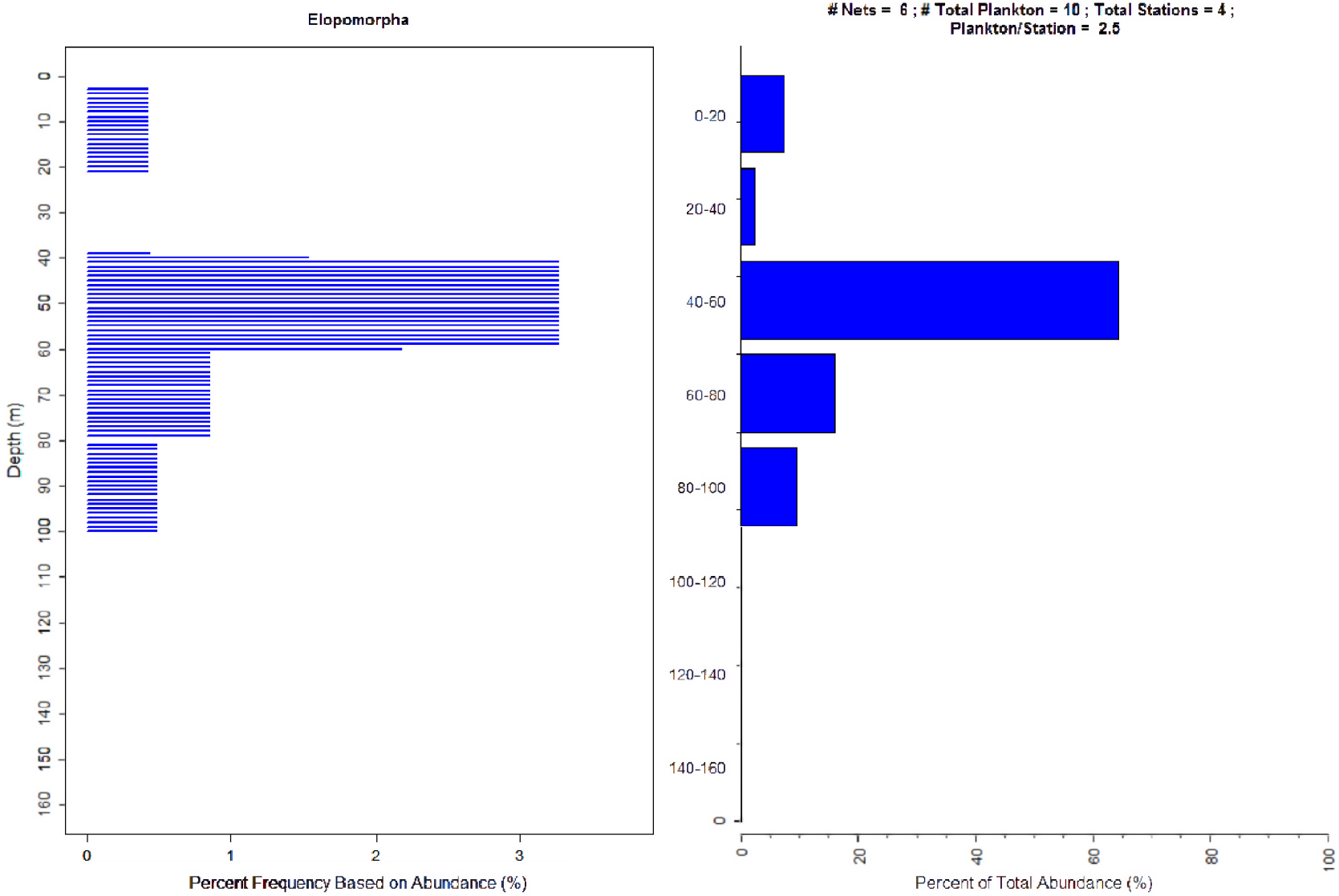
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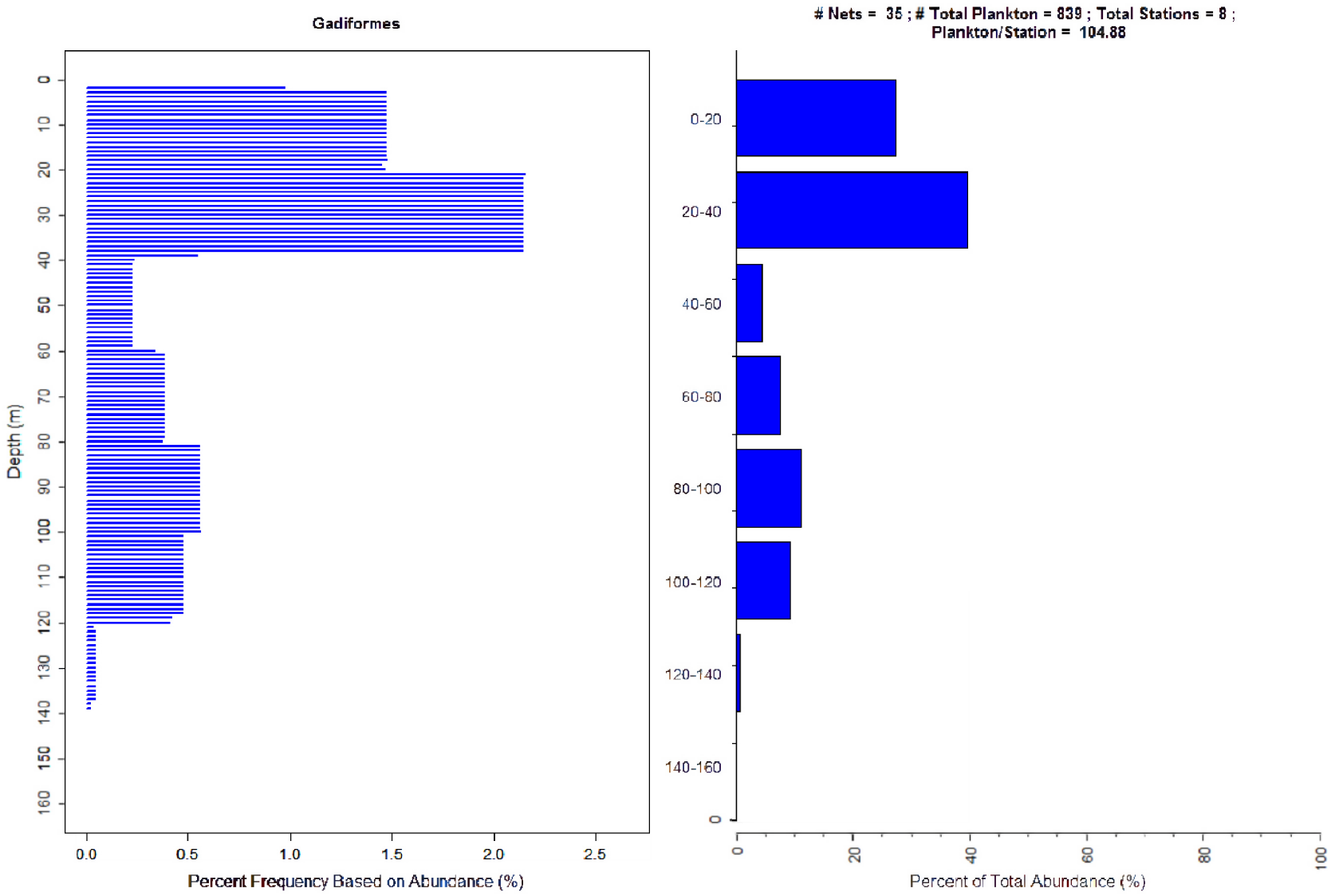
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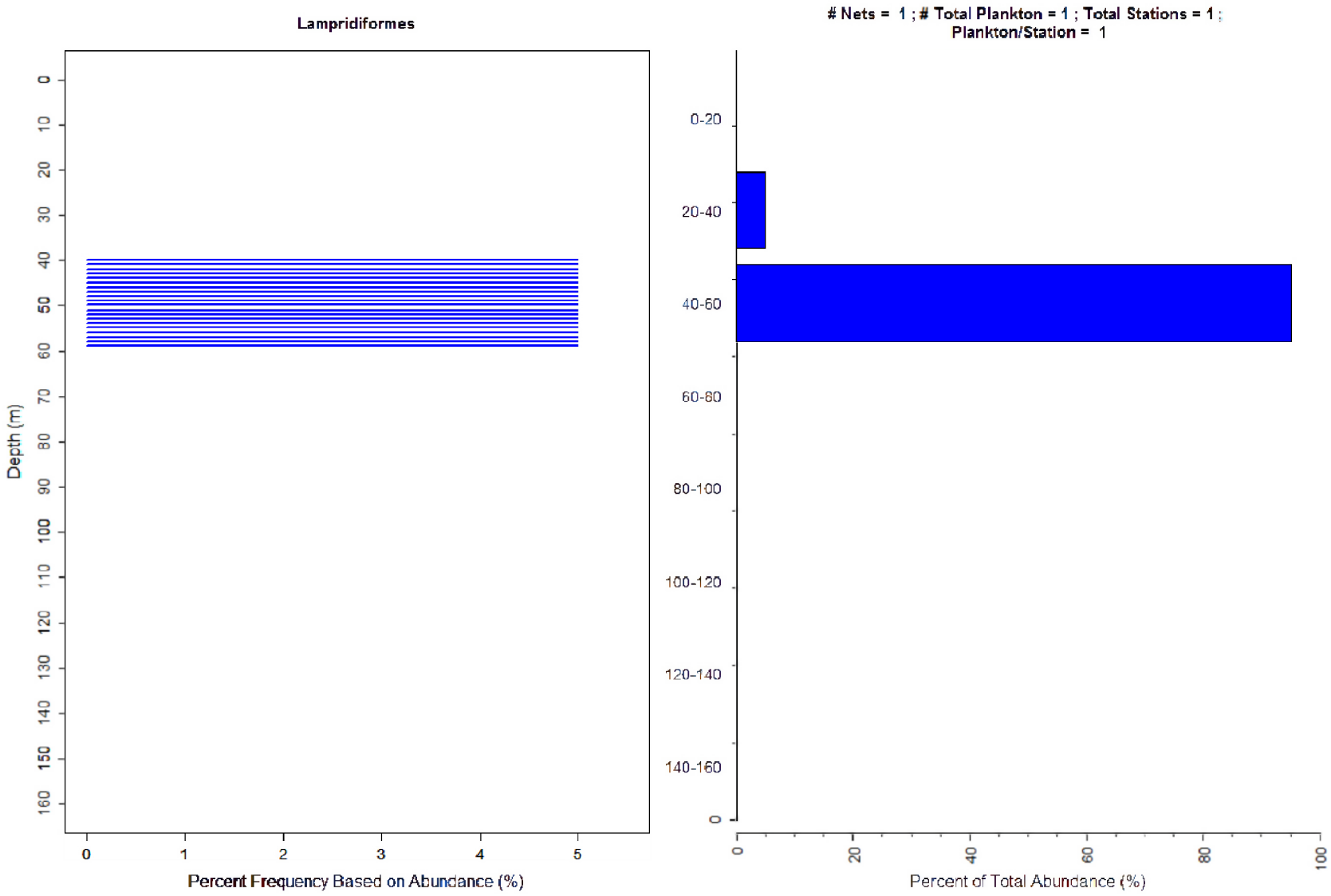
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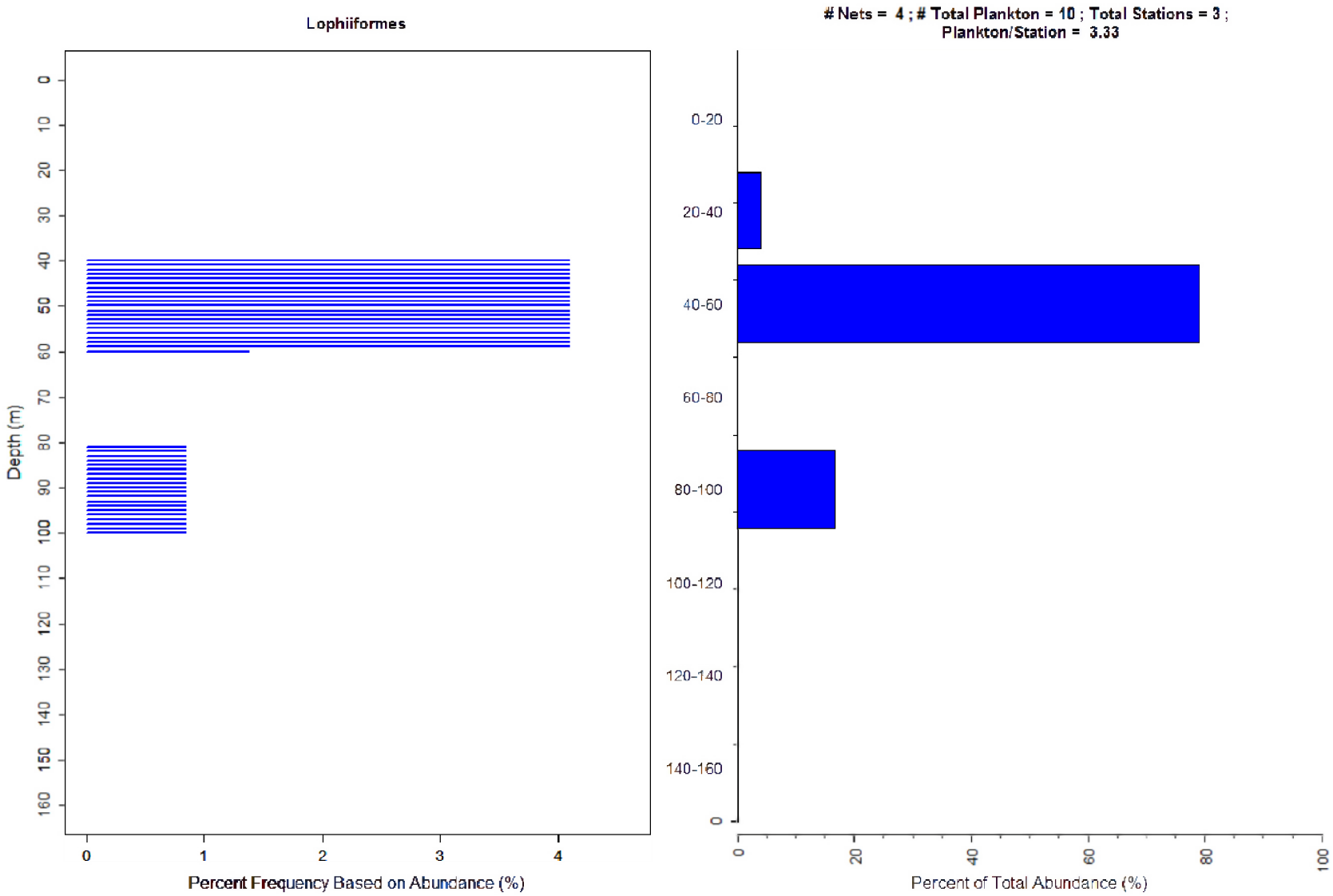
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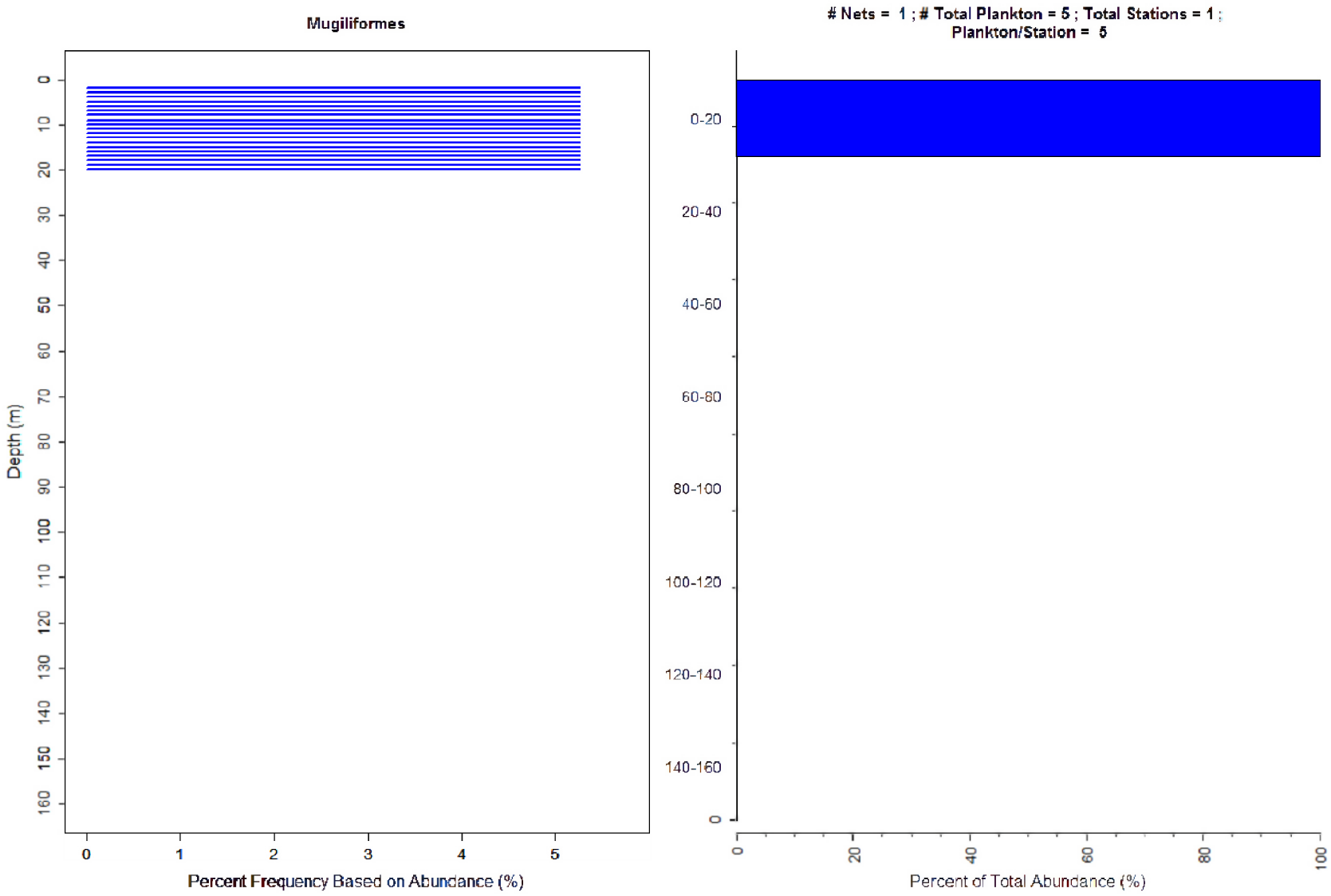
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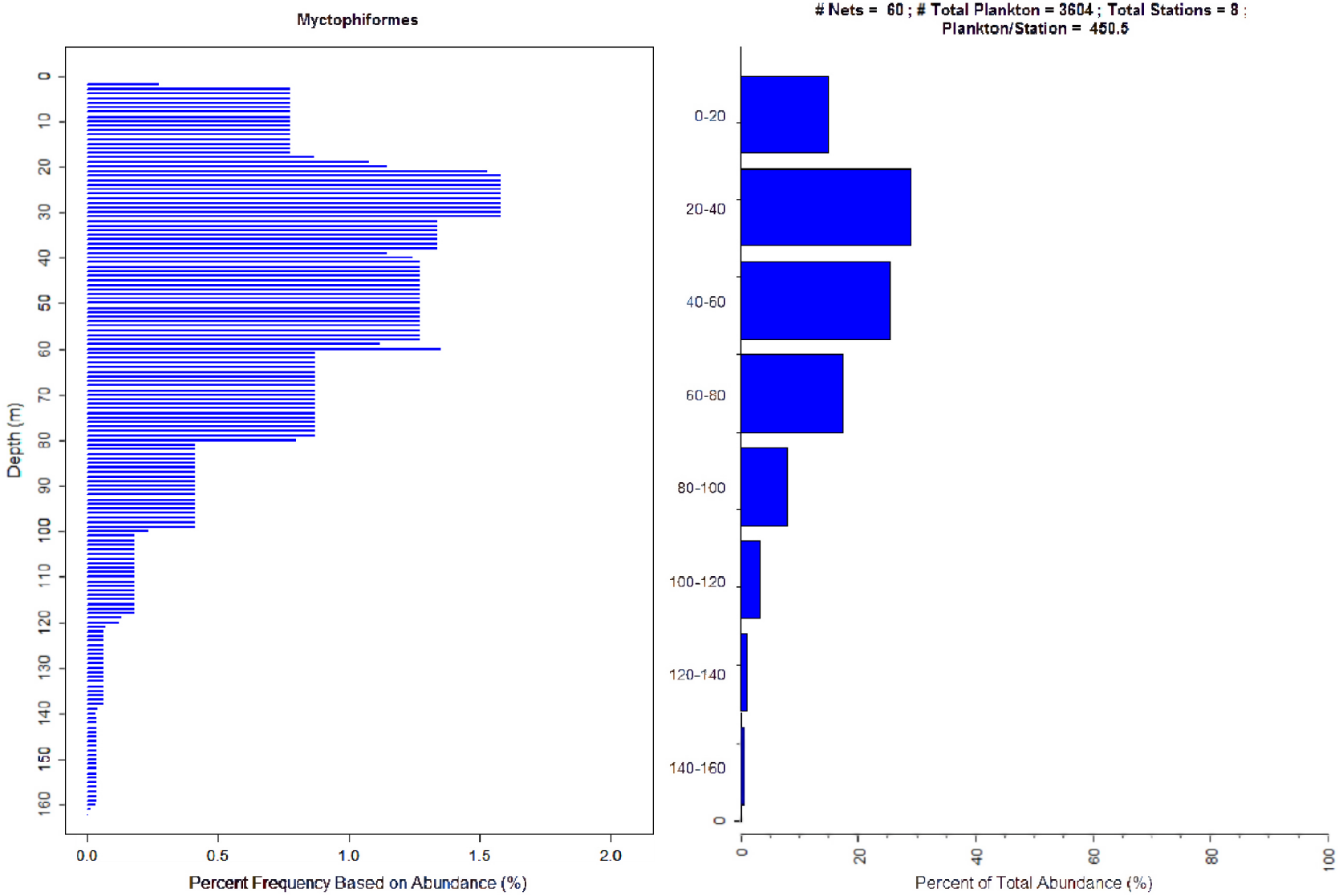
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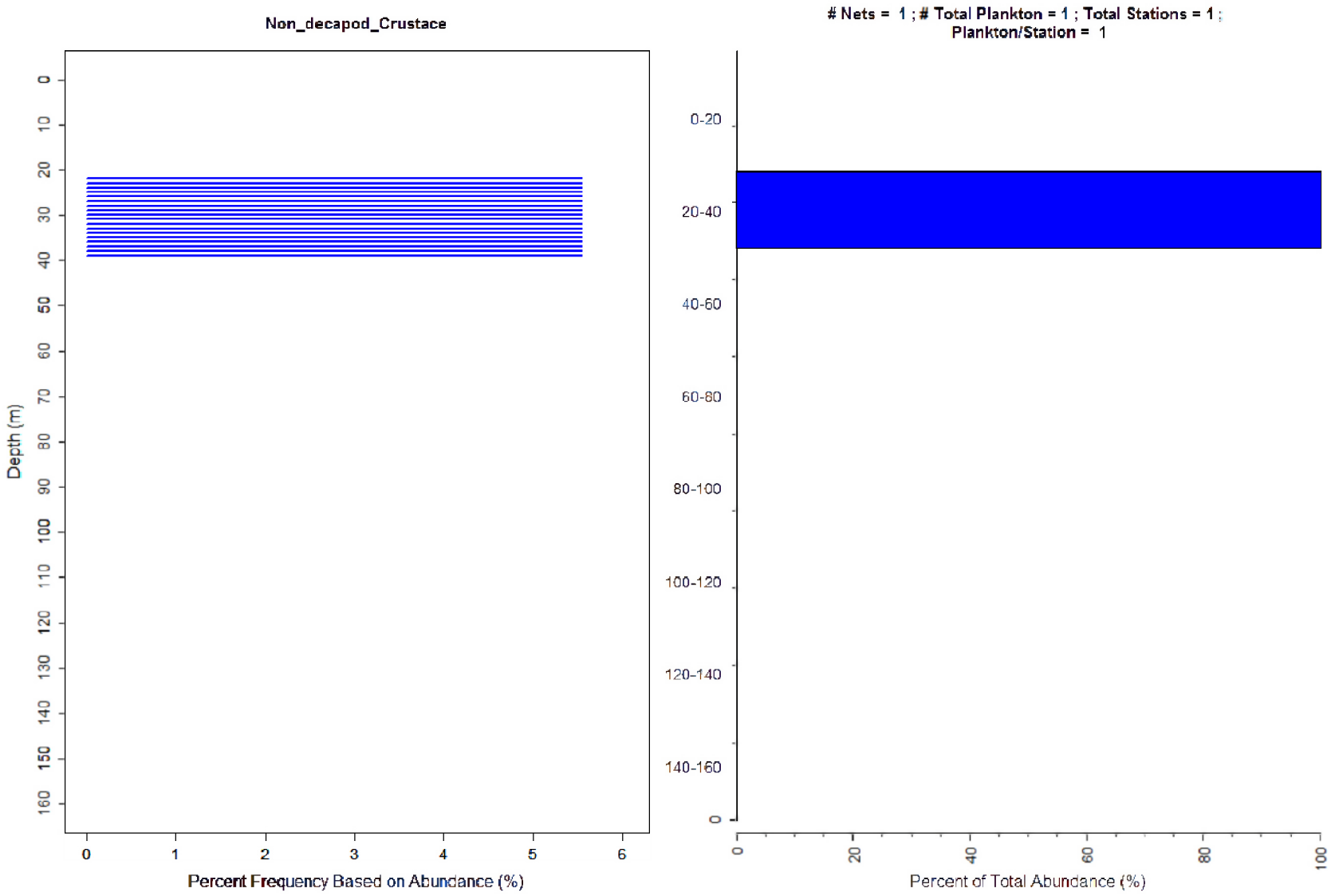
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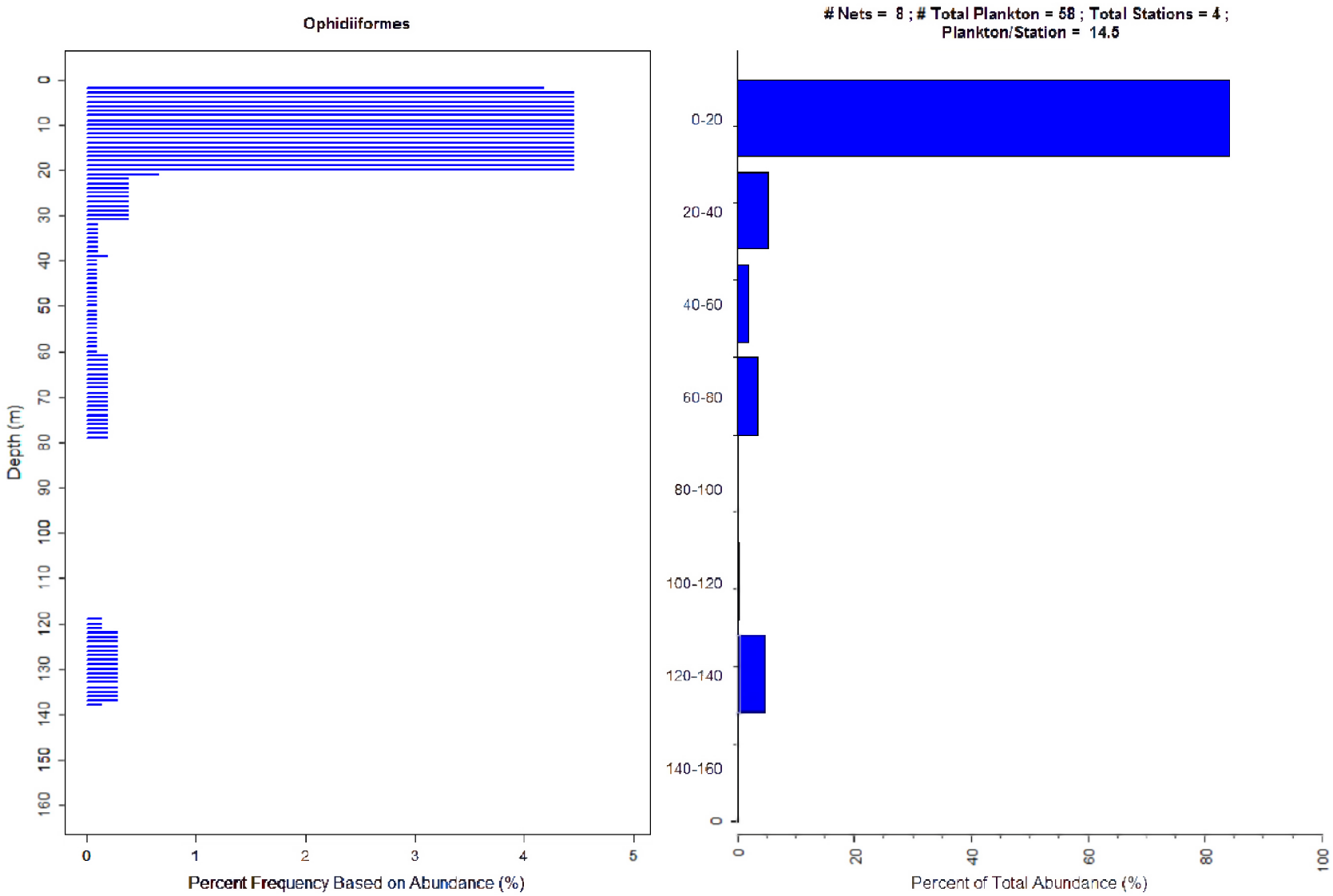
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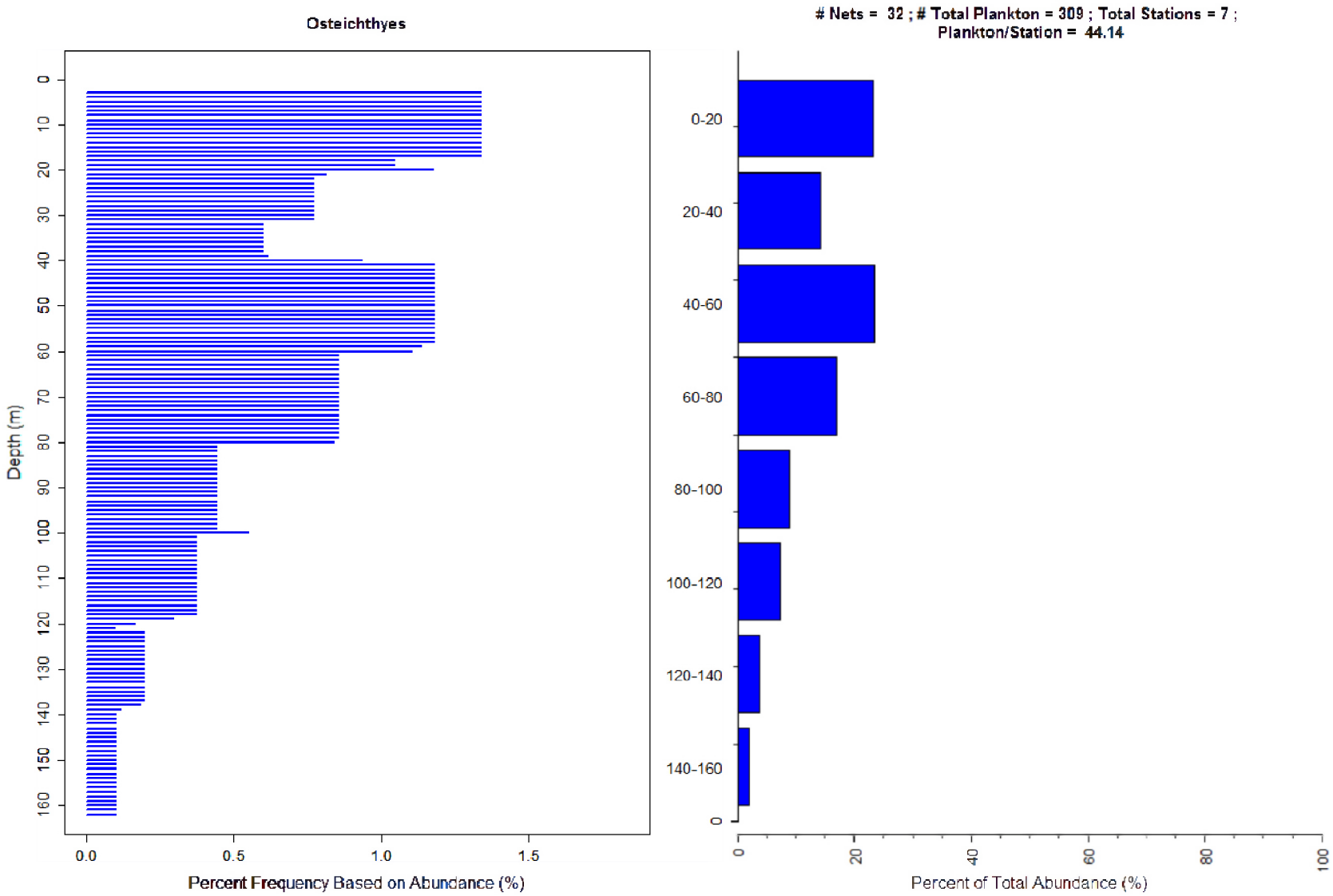
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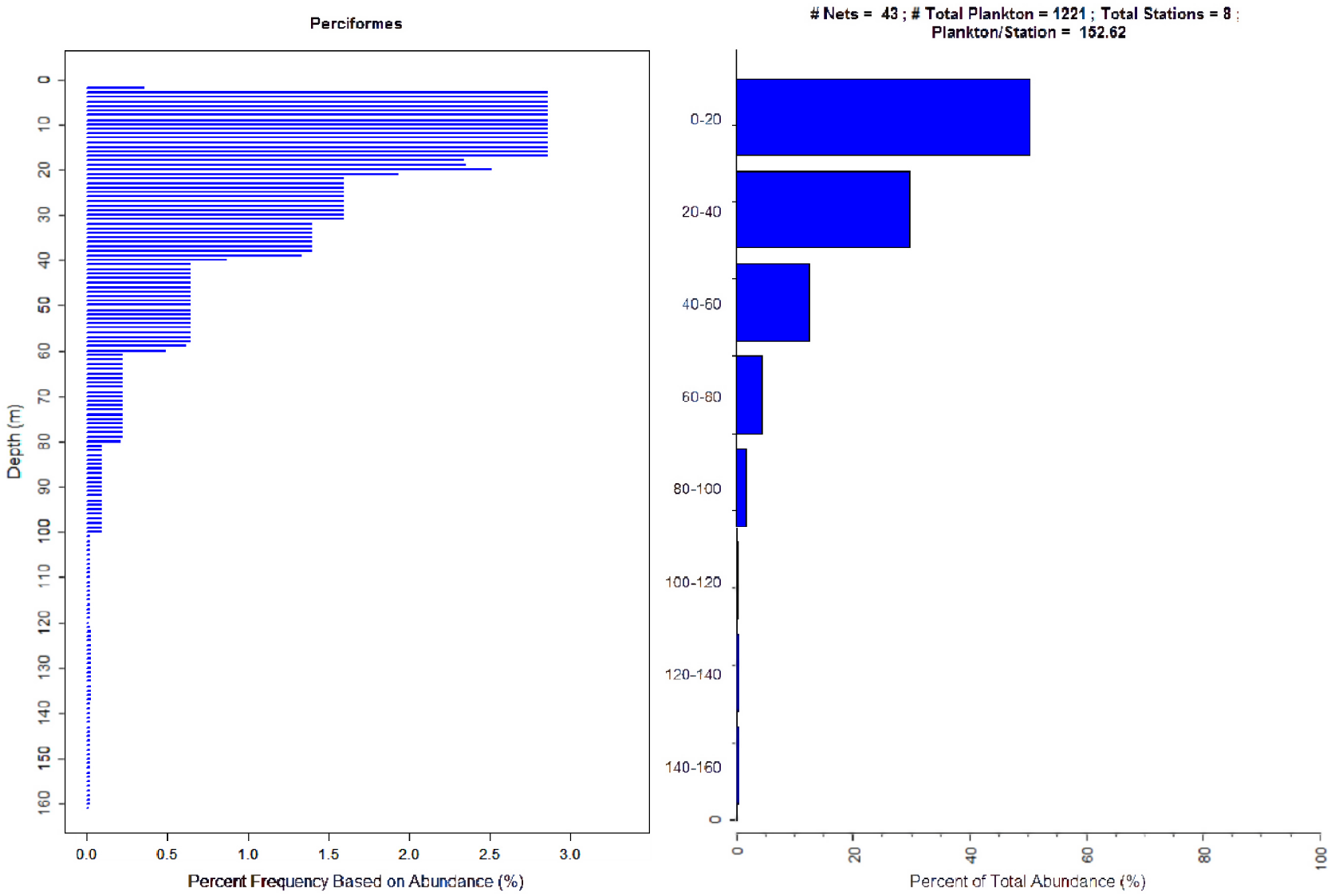
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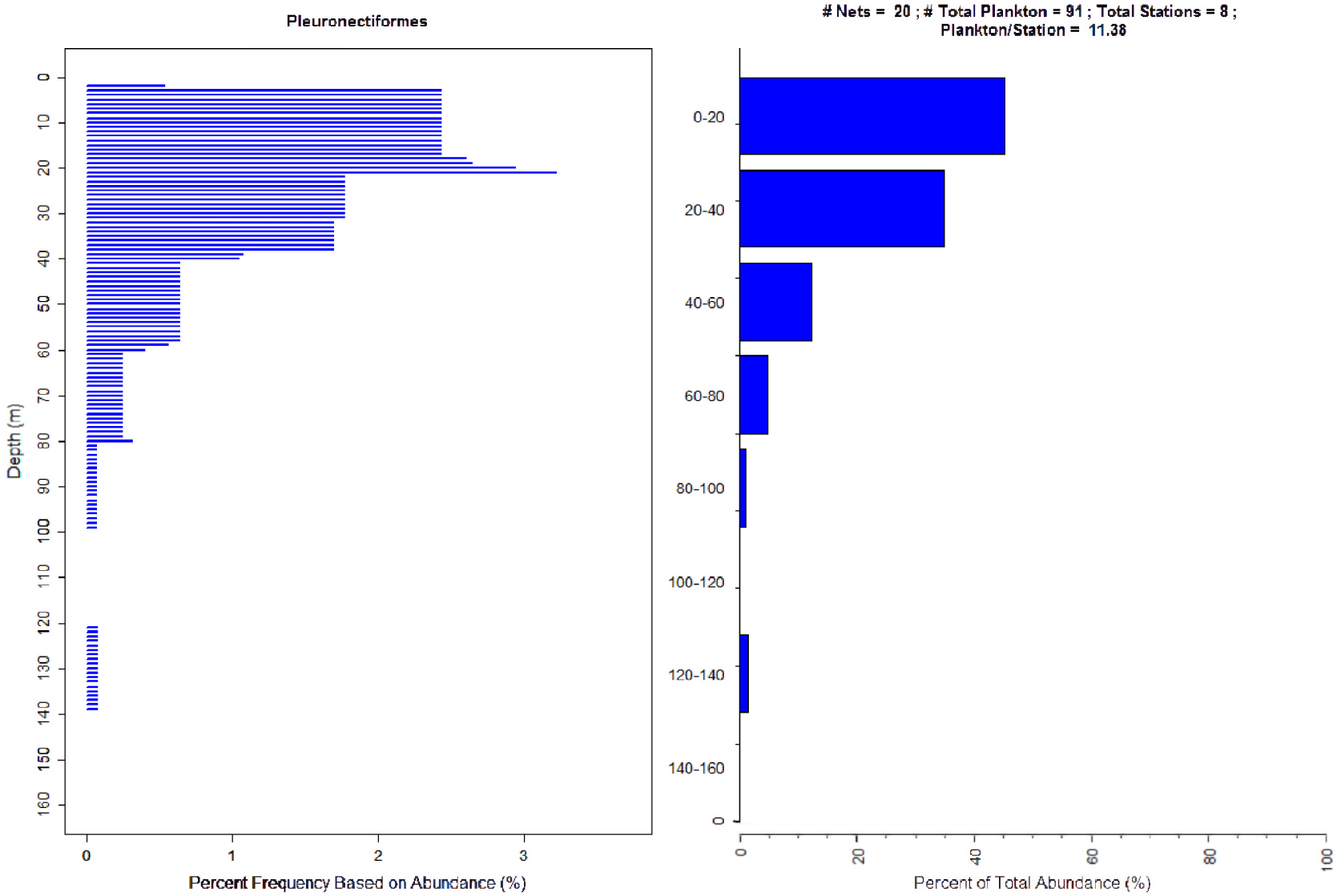
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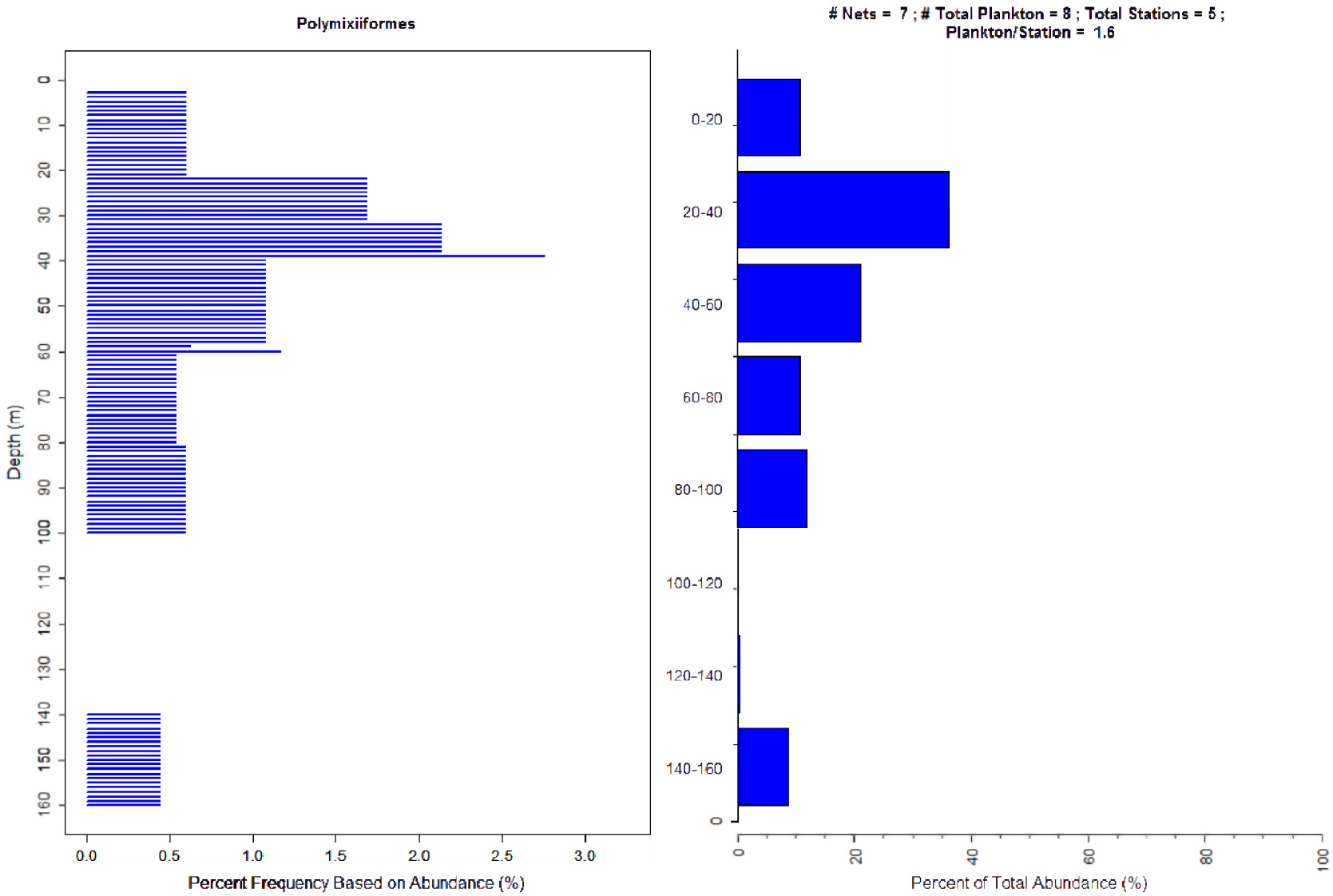
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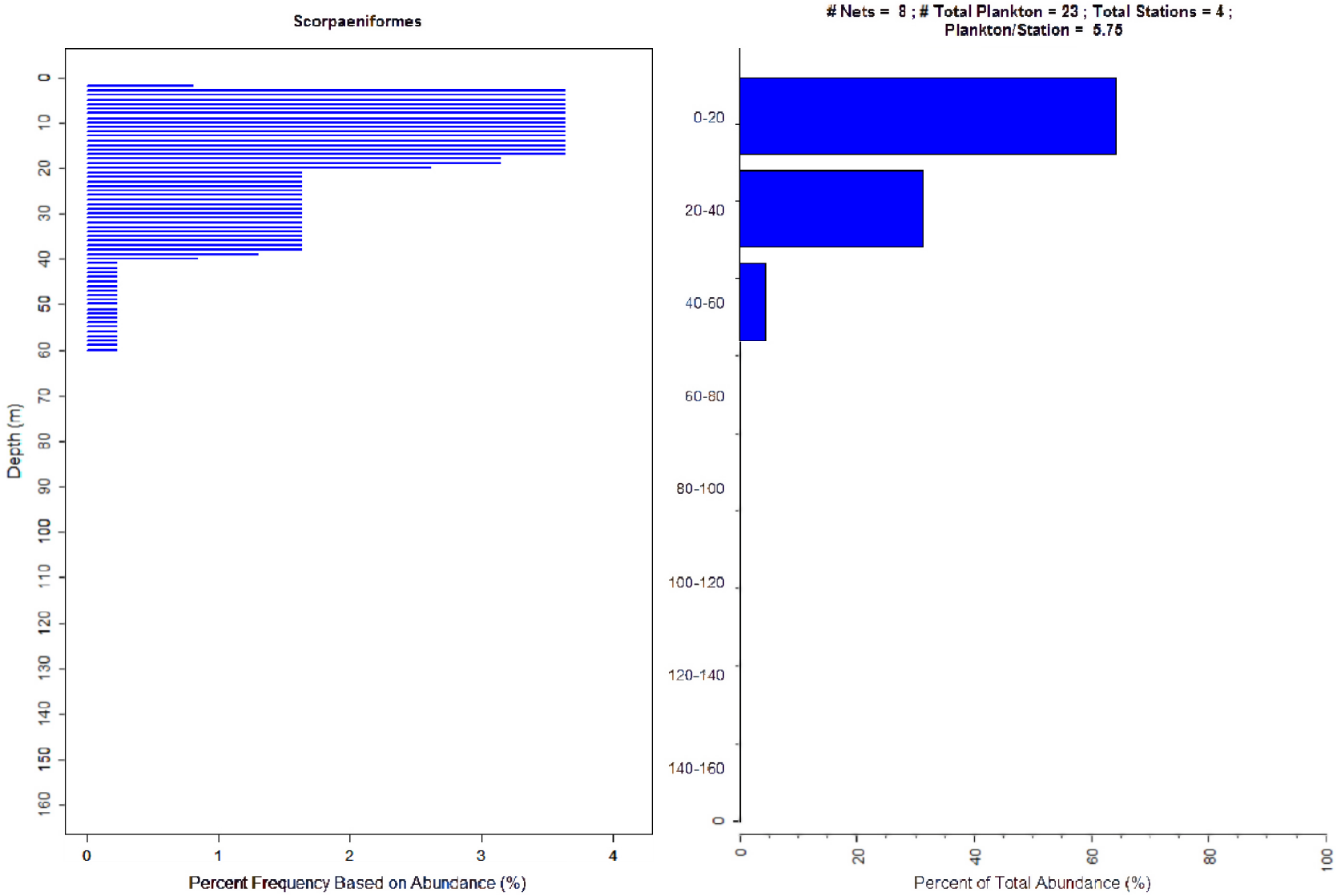
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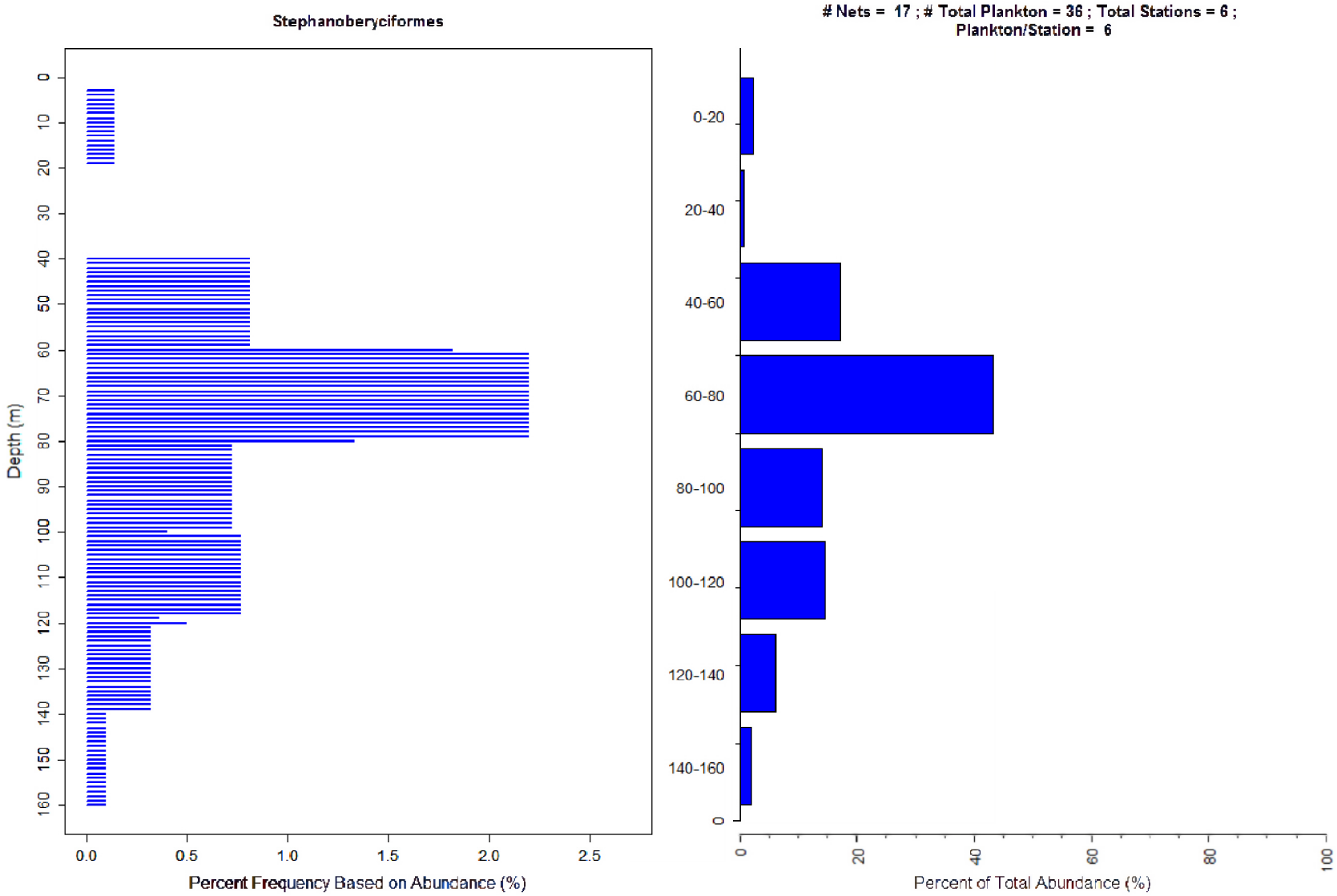
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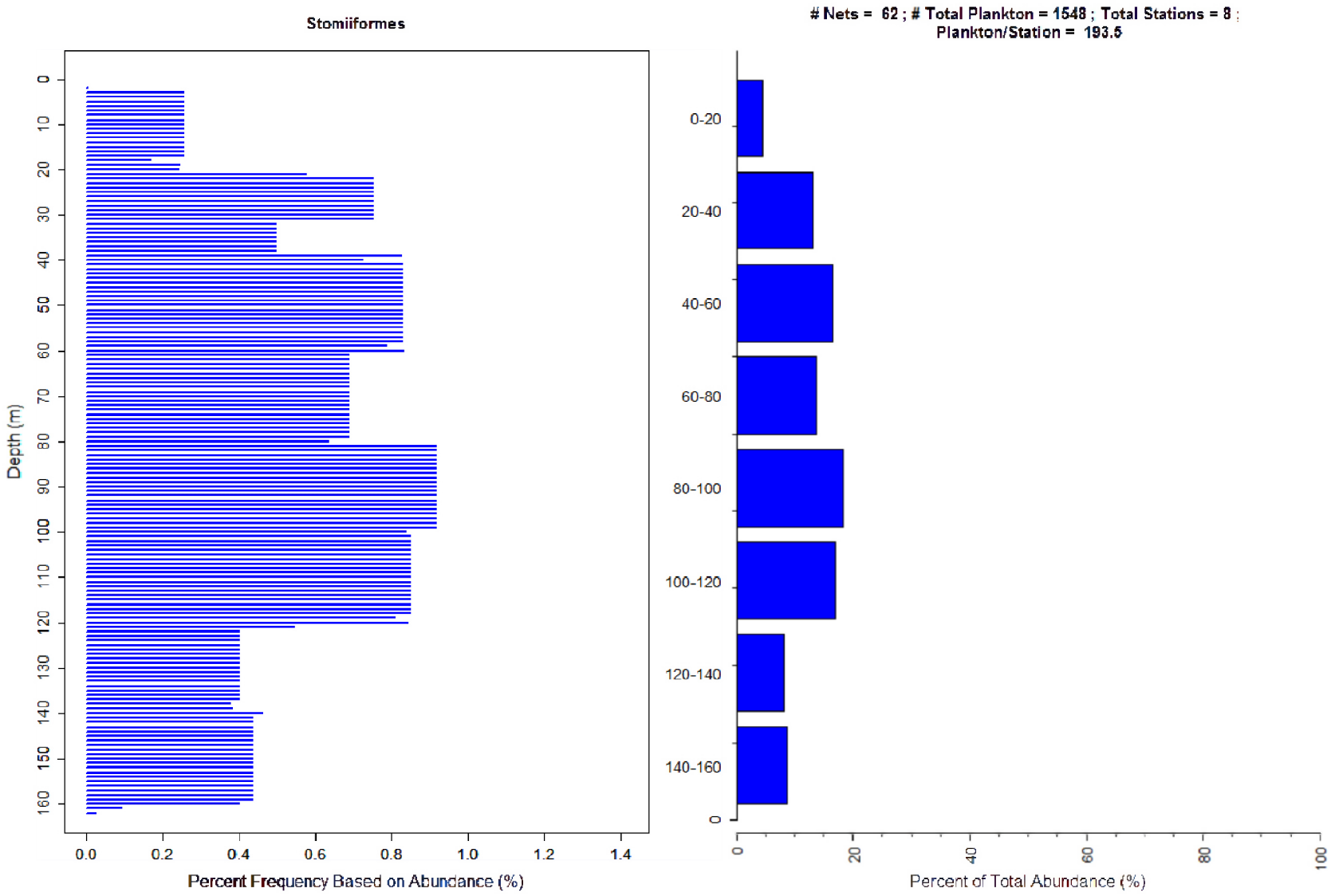
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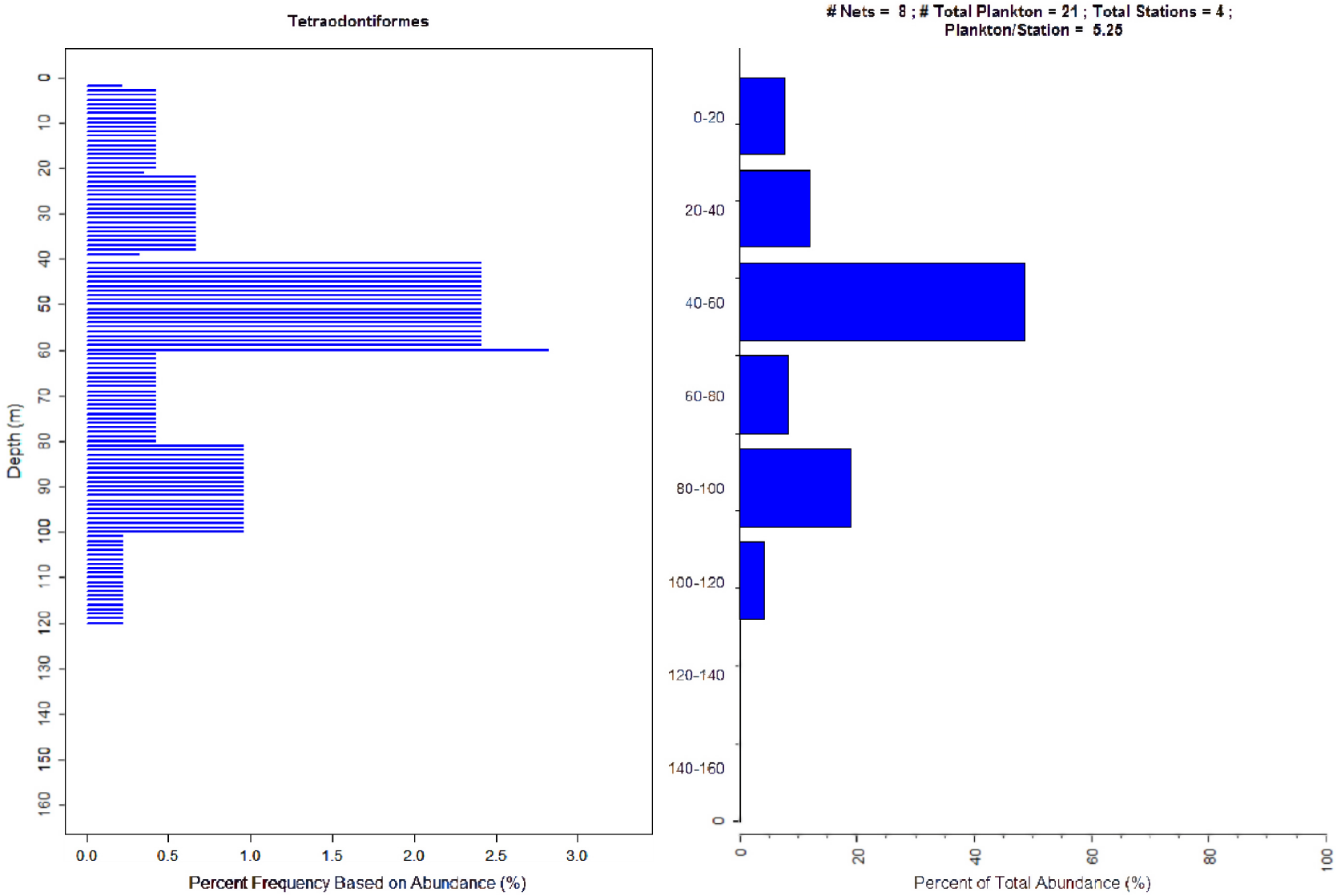
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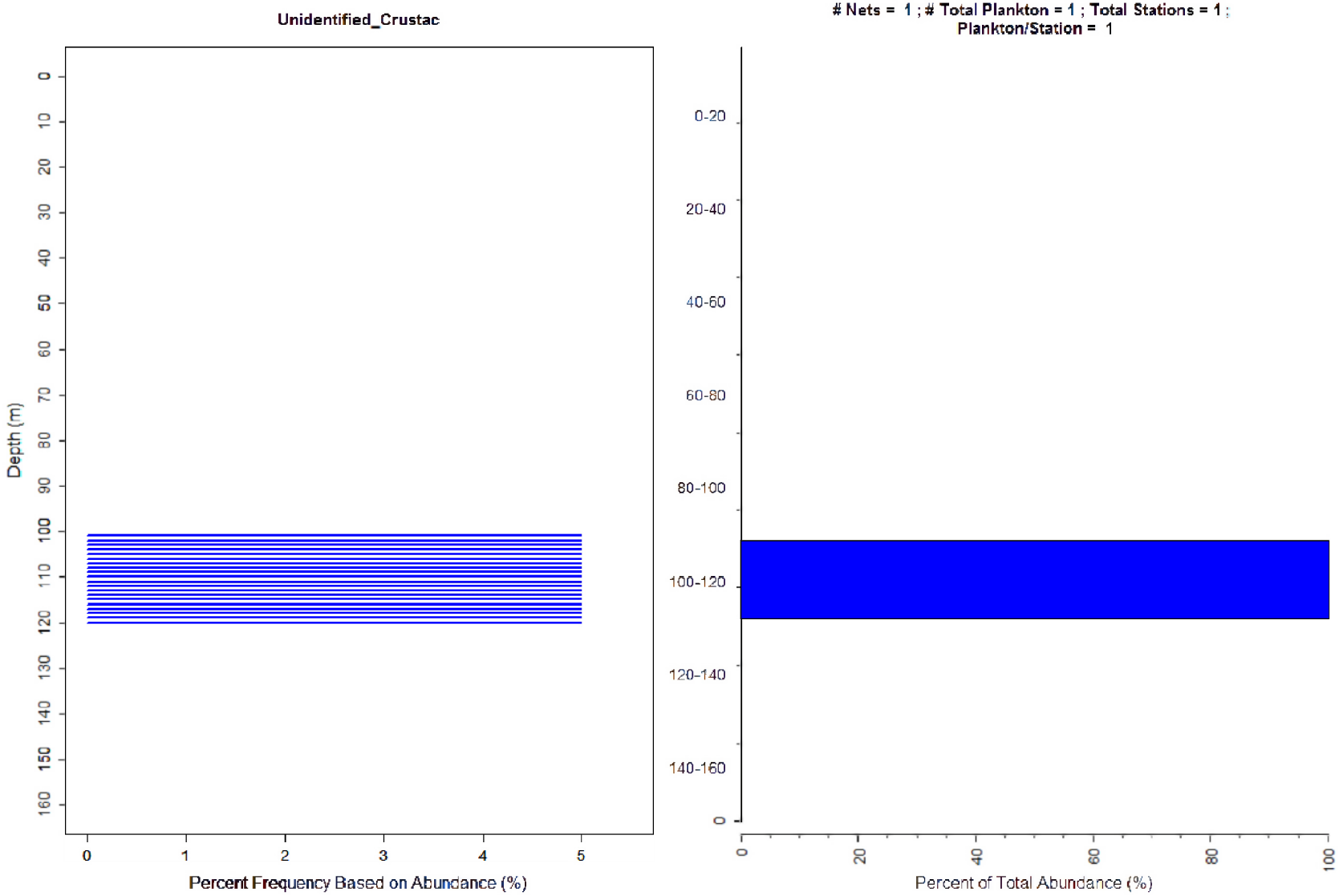
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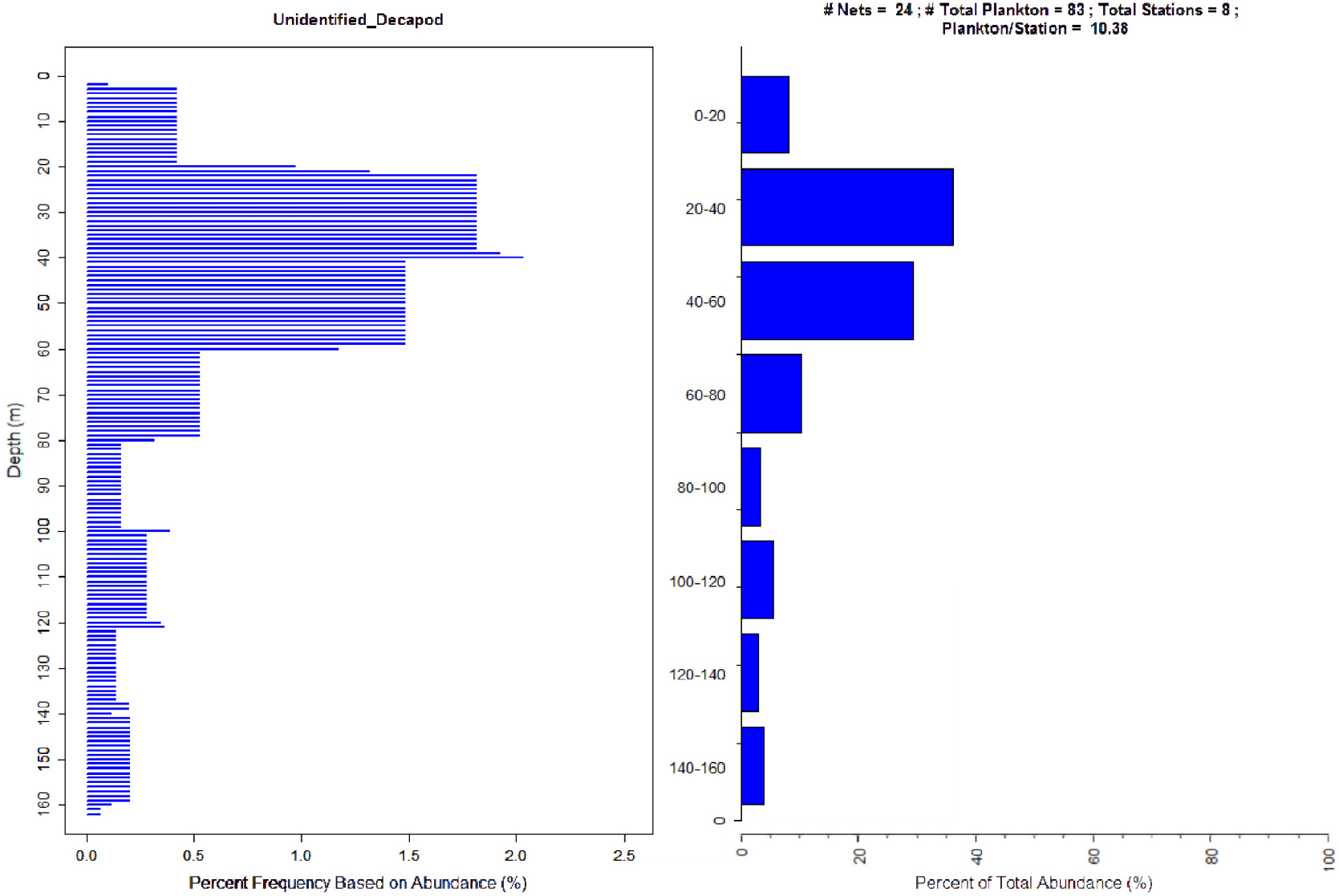
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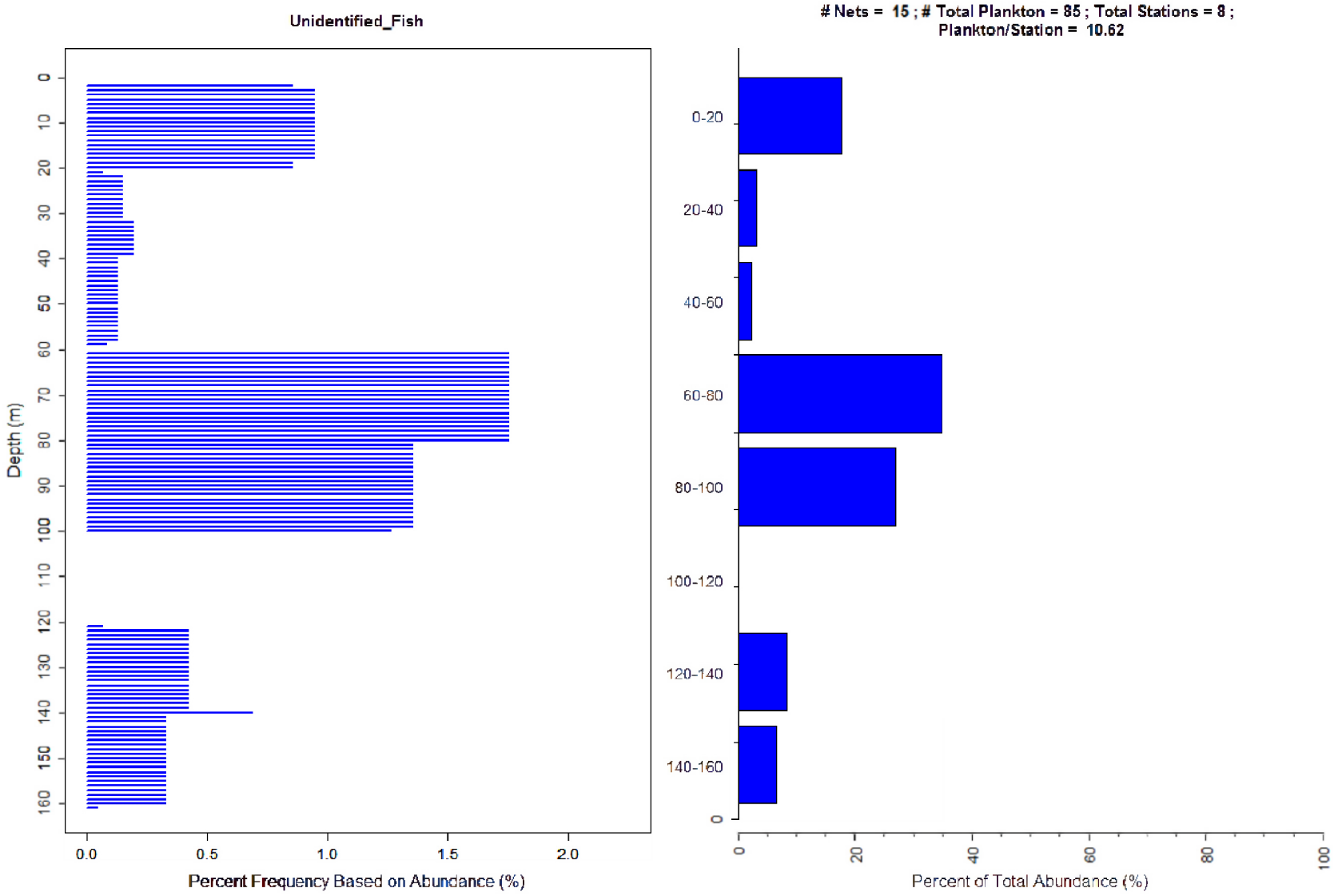
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Unidentified_Crustac - Shallow



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Unidentified_Fish - Shallow

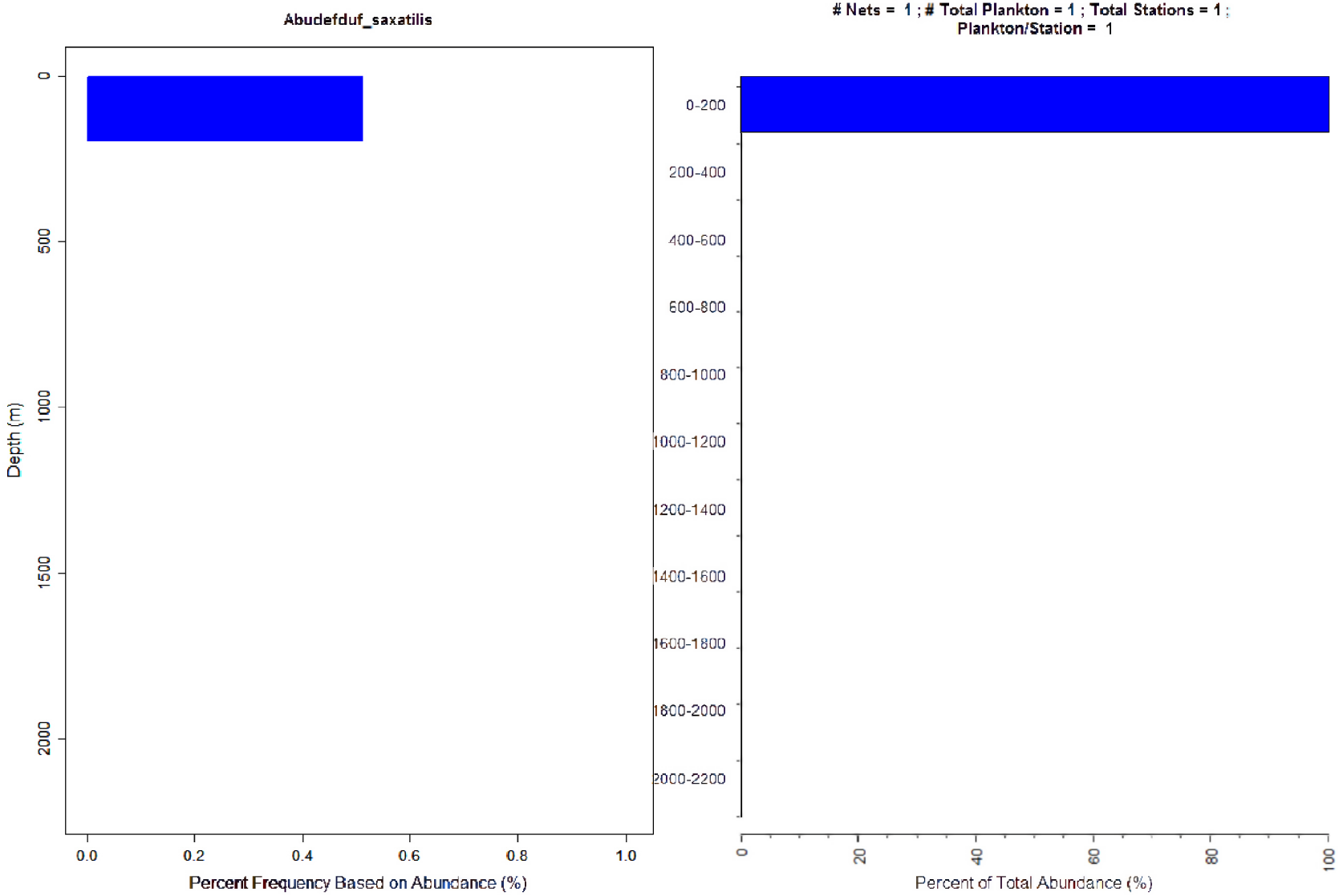
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

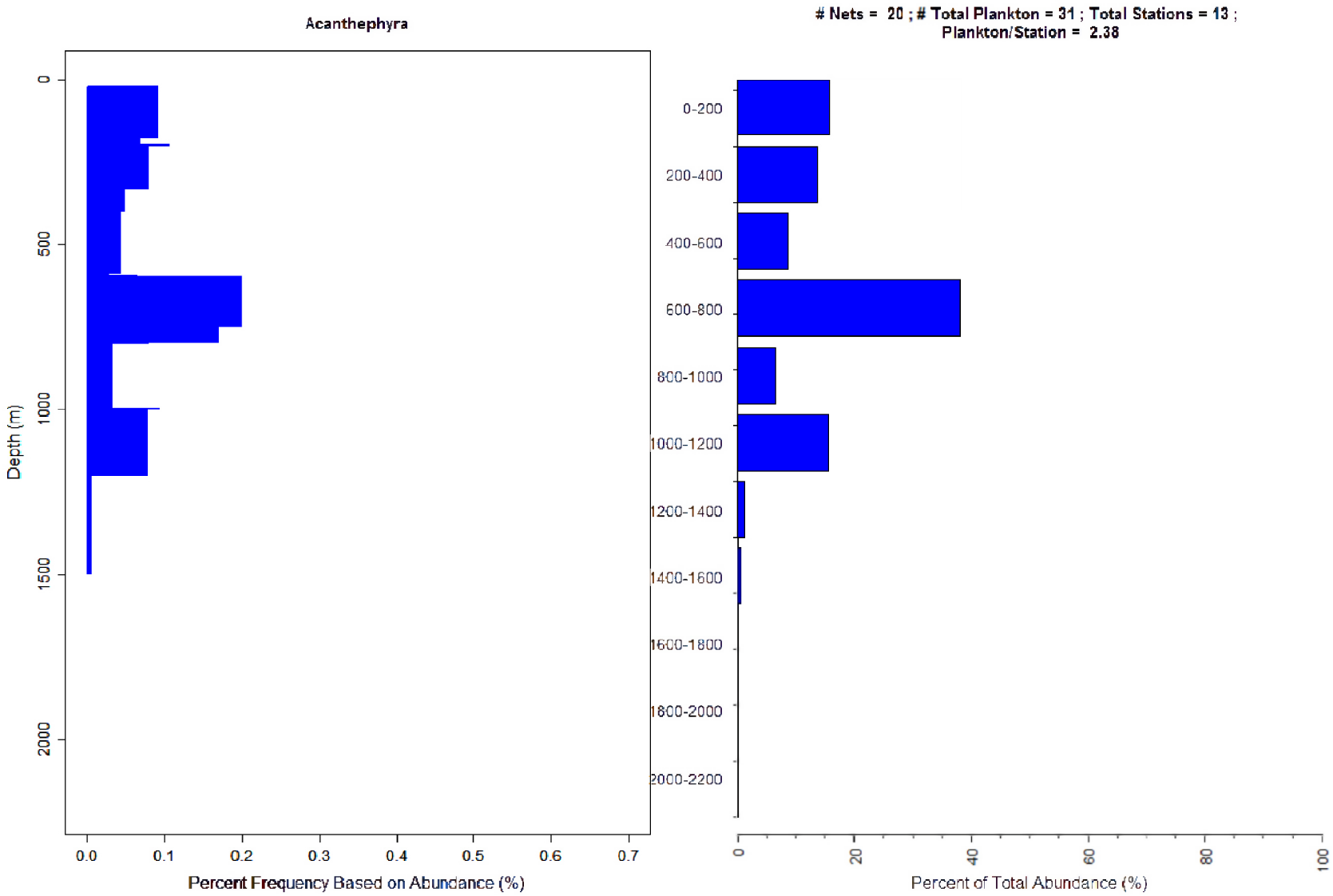
Appendix E1 – NRDA Tier1A Deep MOC1 Plots Analysis Taxa Level, Pooled Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

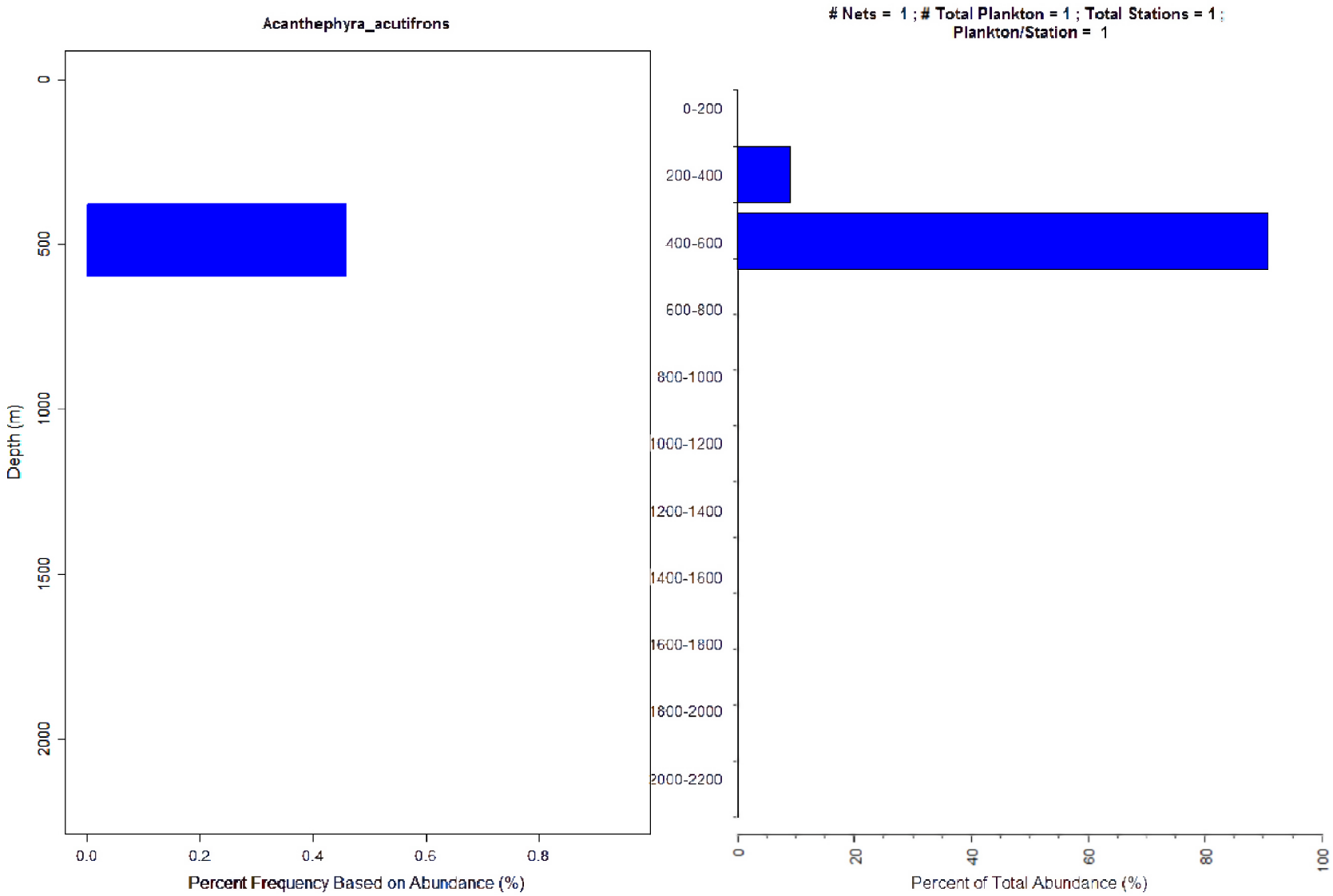
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



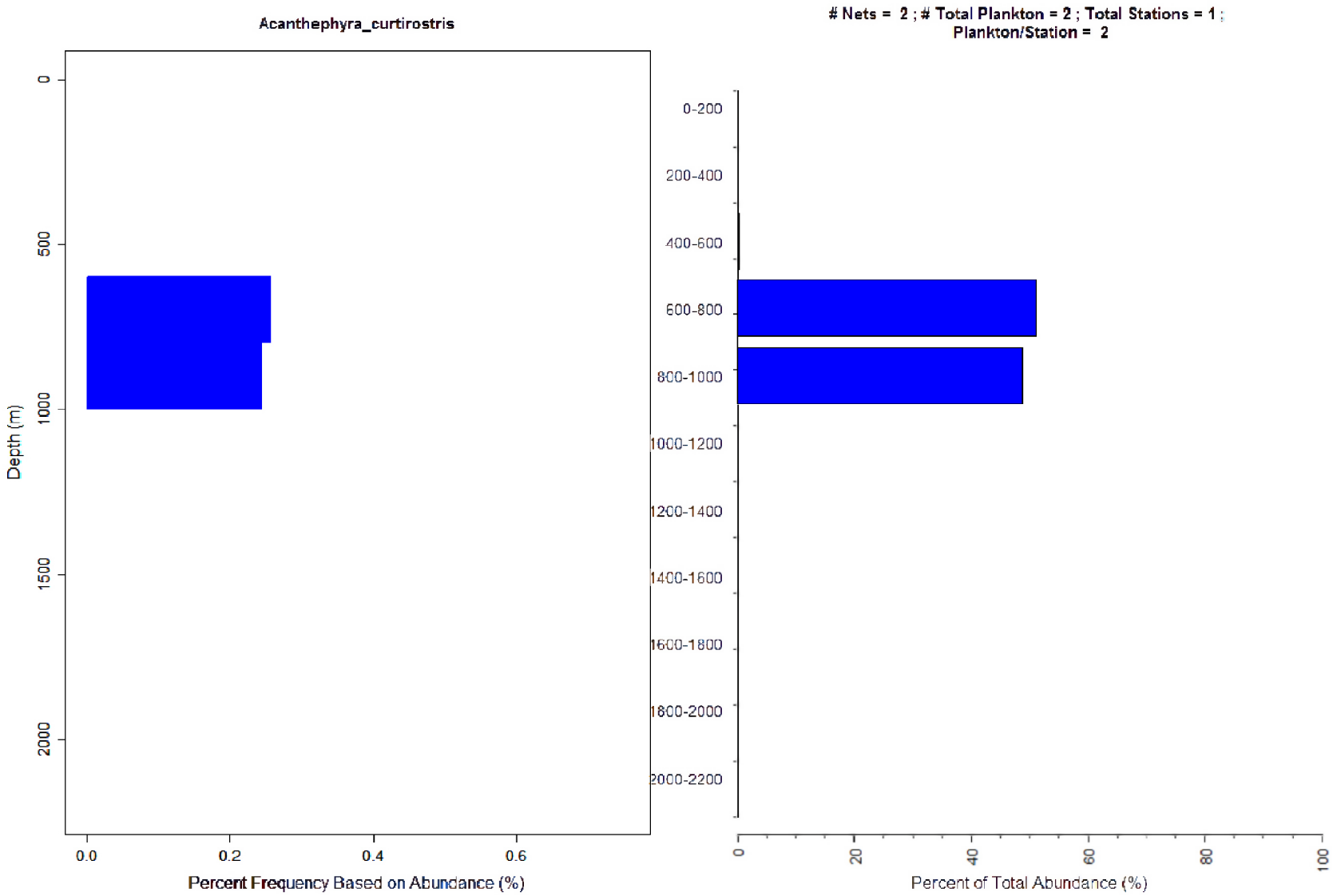
Abudefduf_saxatilis - Deep



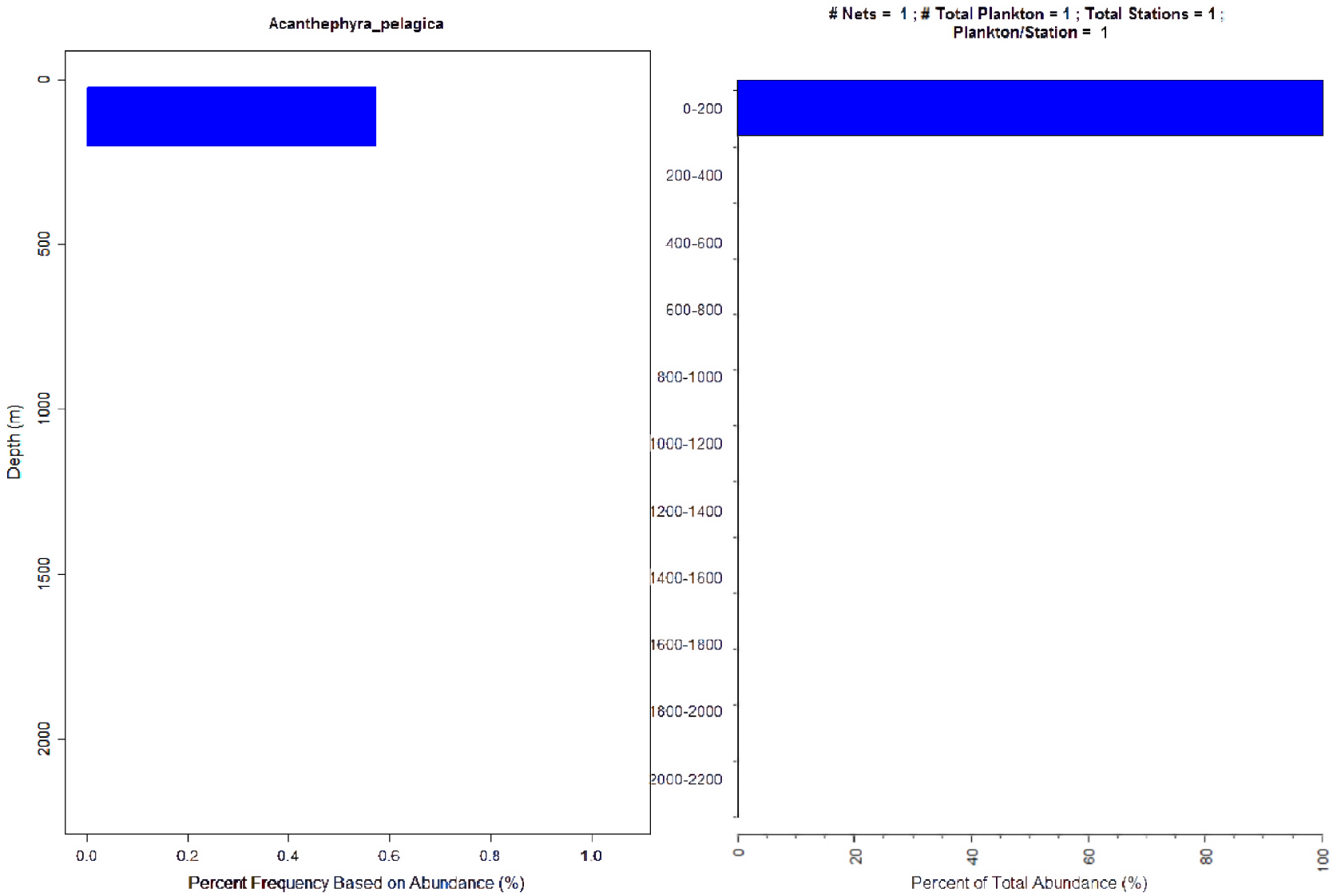
Acanthephyra - Deep



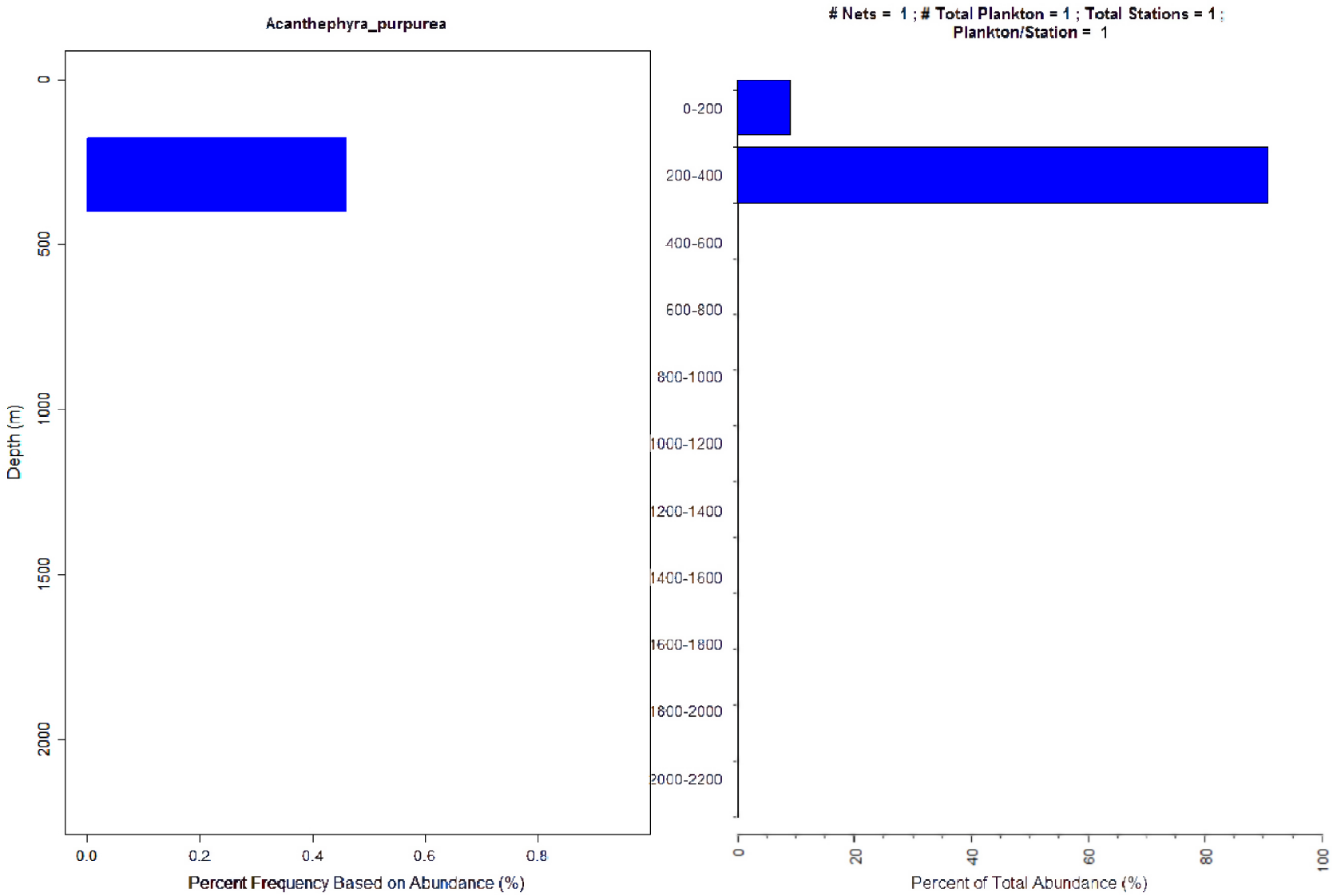
Acanthephyra_acutifrons - Deep



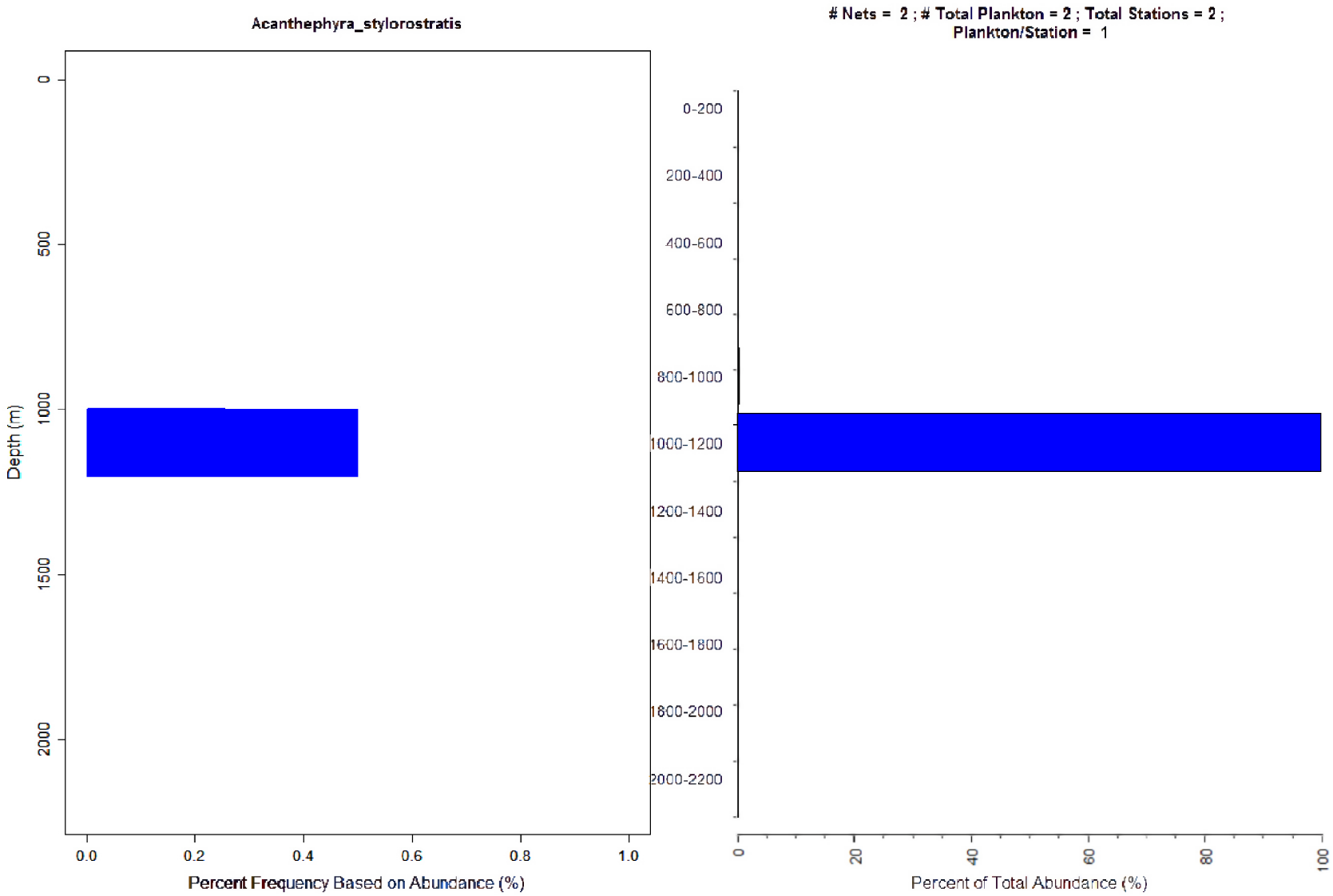
Acanthephyra_curtirostris - Deep



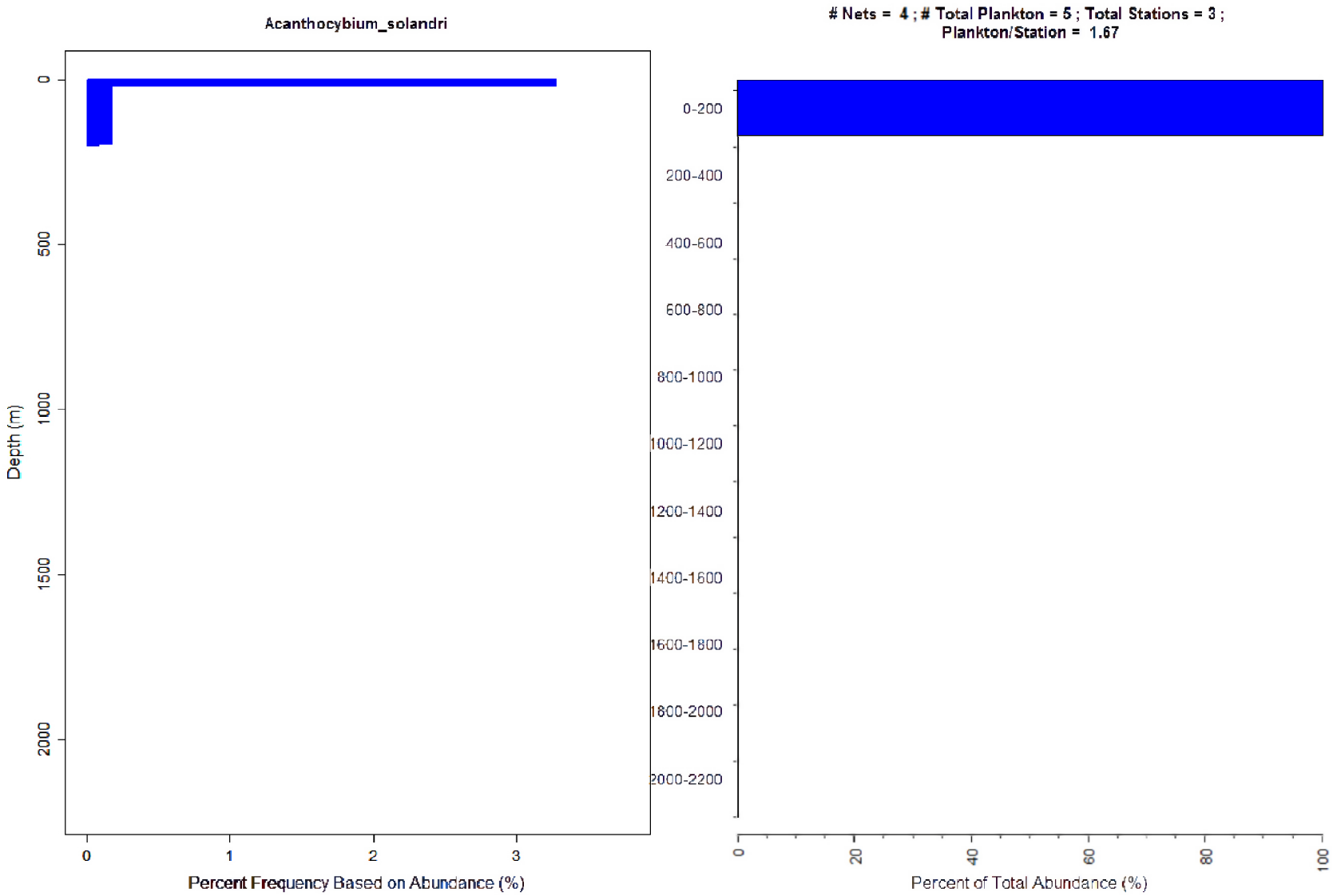
Acanthephyra_pelagica - Deep



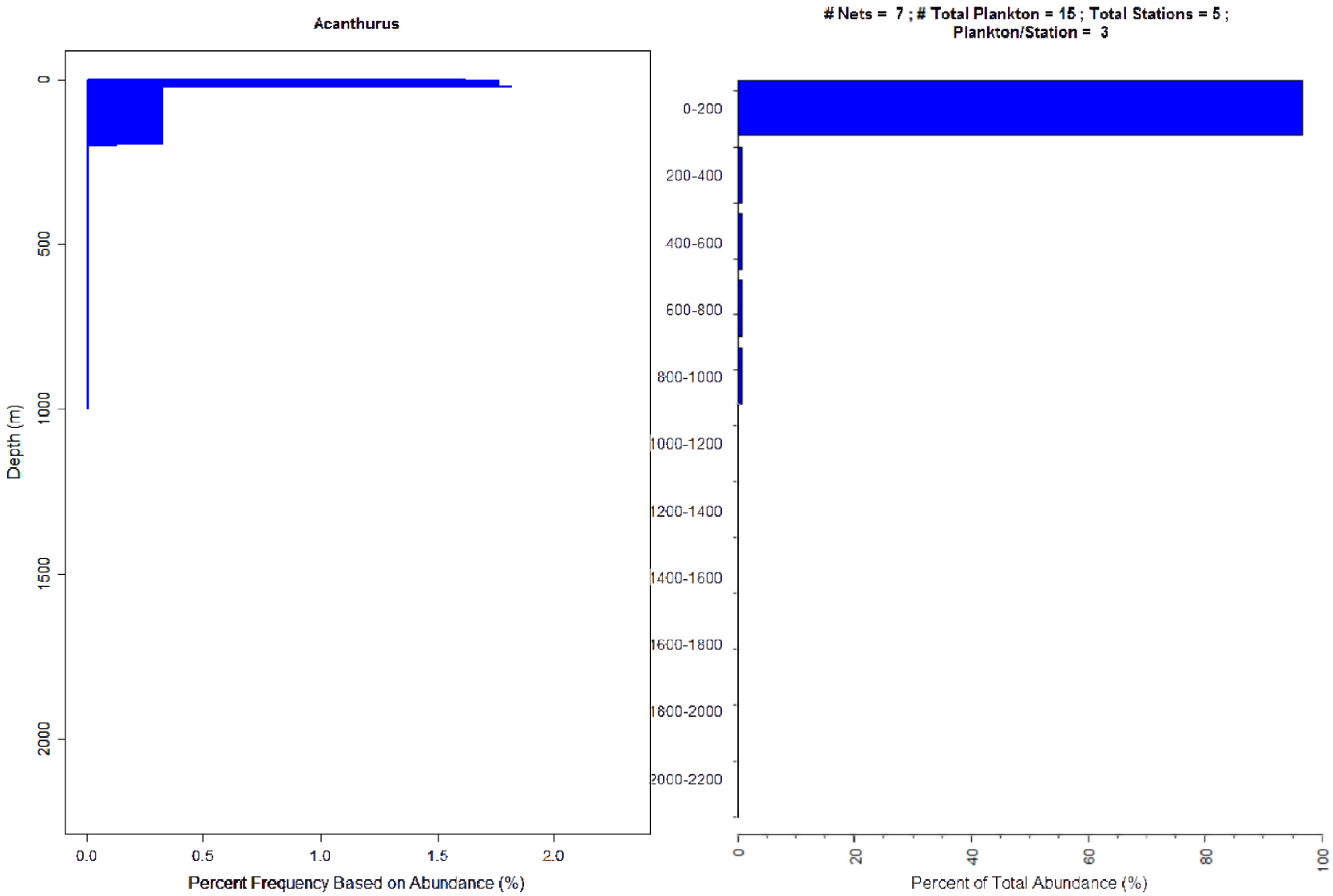
Acanthephyra_purpurea - Deep



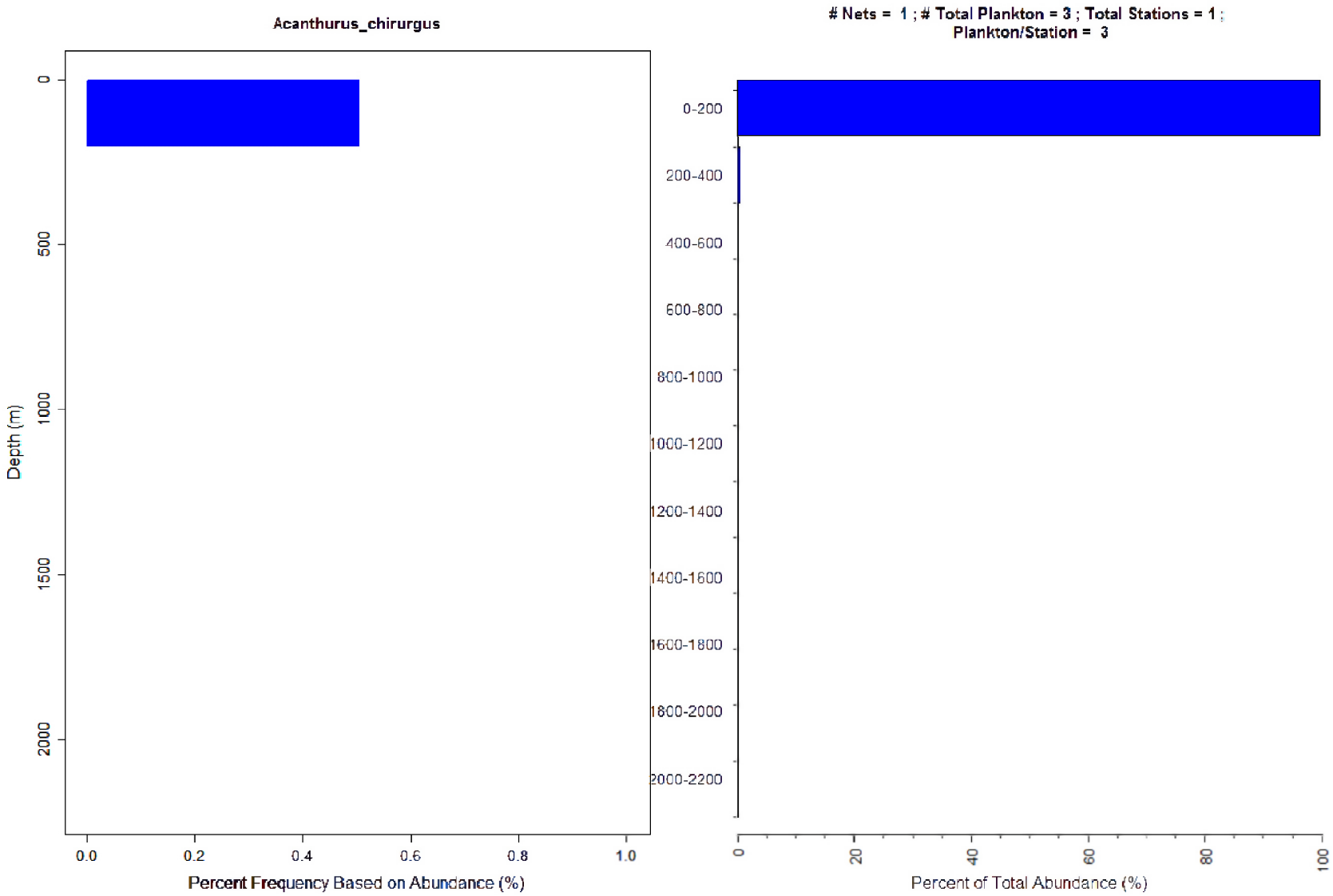
Acanthephyra_stylorostratis - Deep



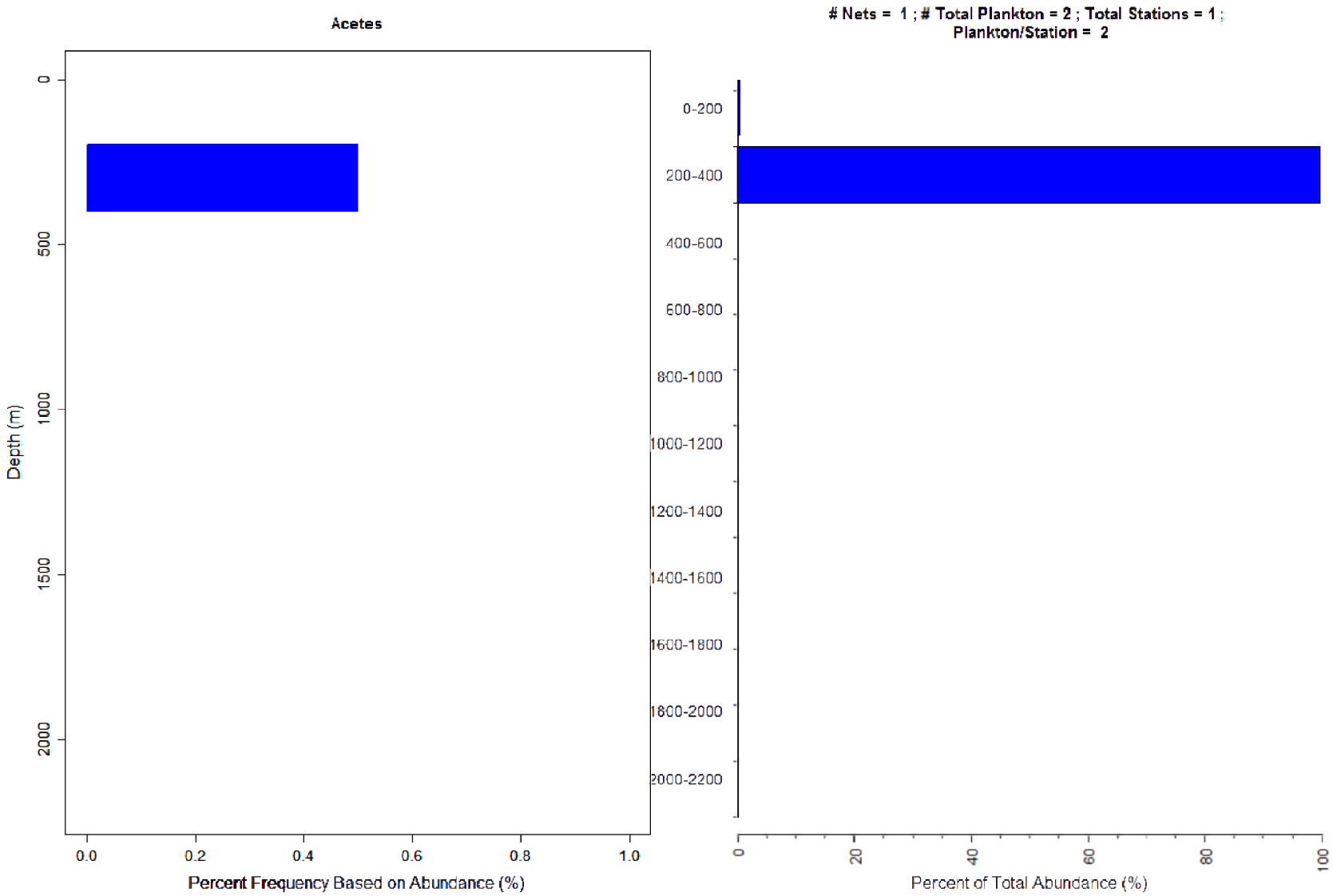
Acanthocybium_solandri - Deep



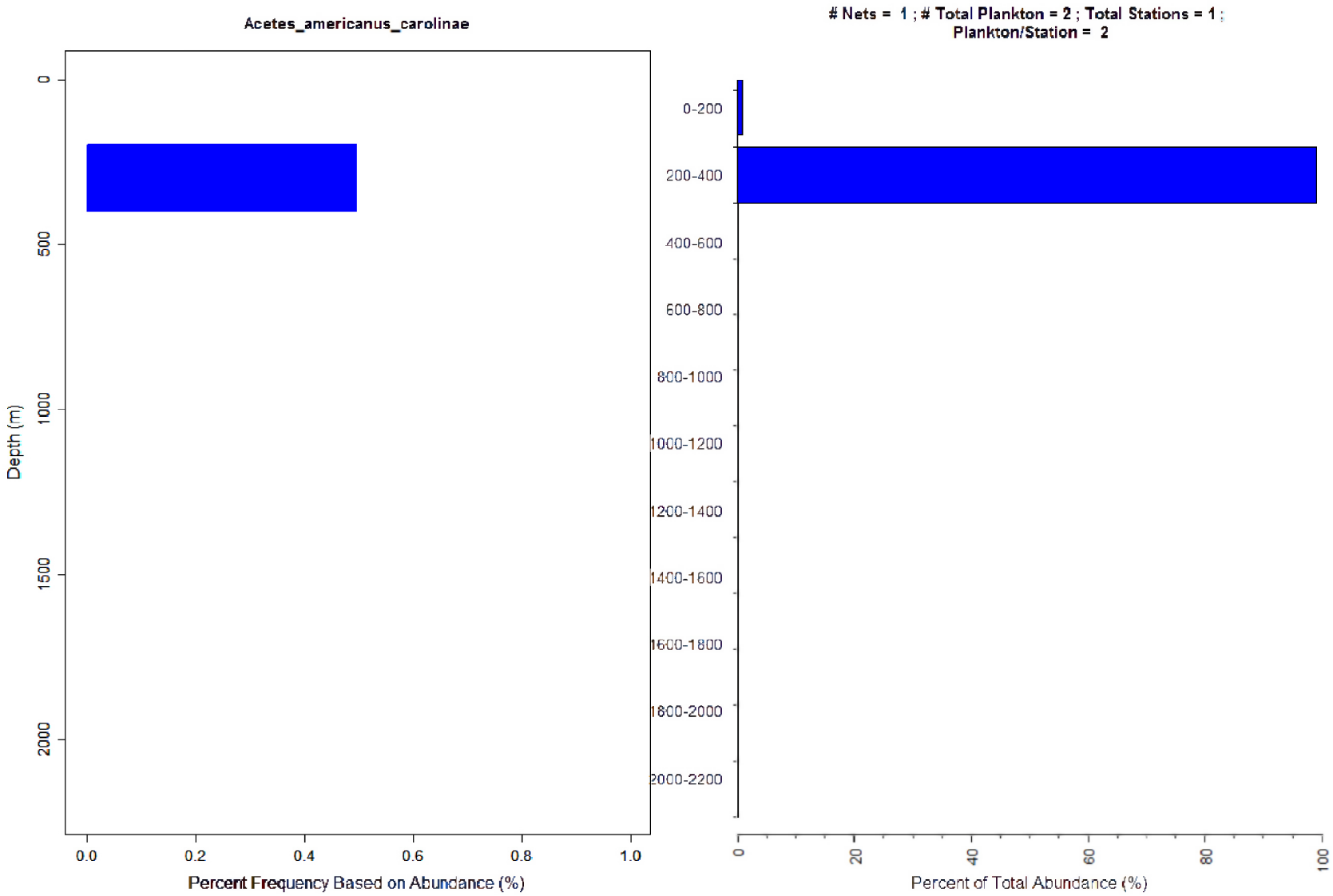
Acanthurus - Deep



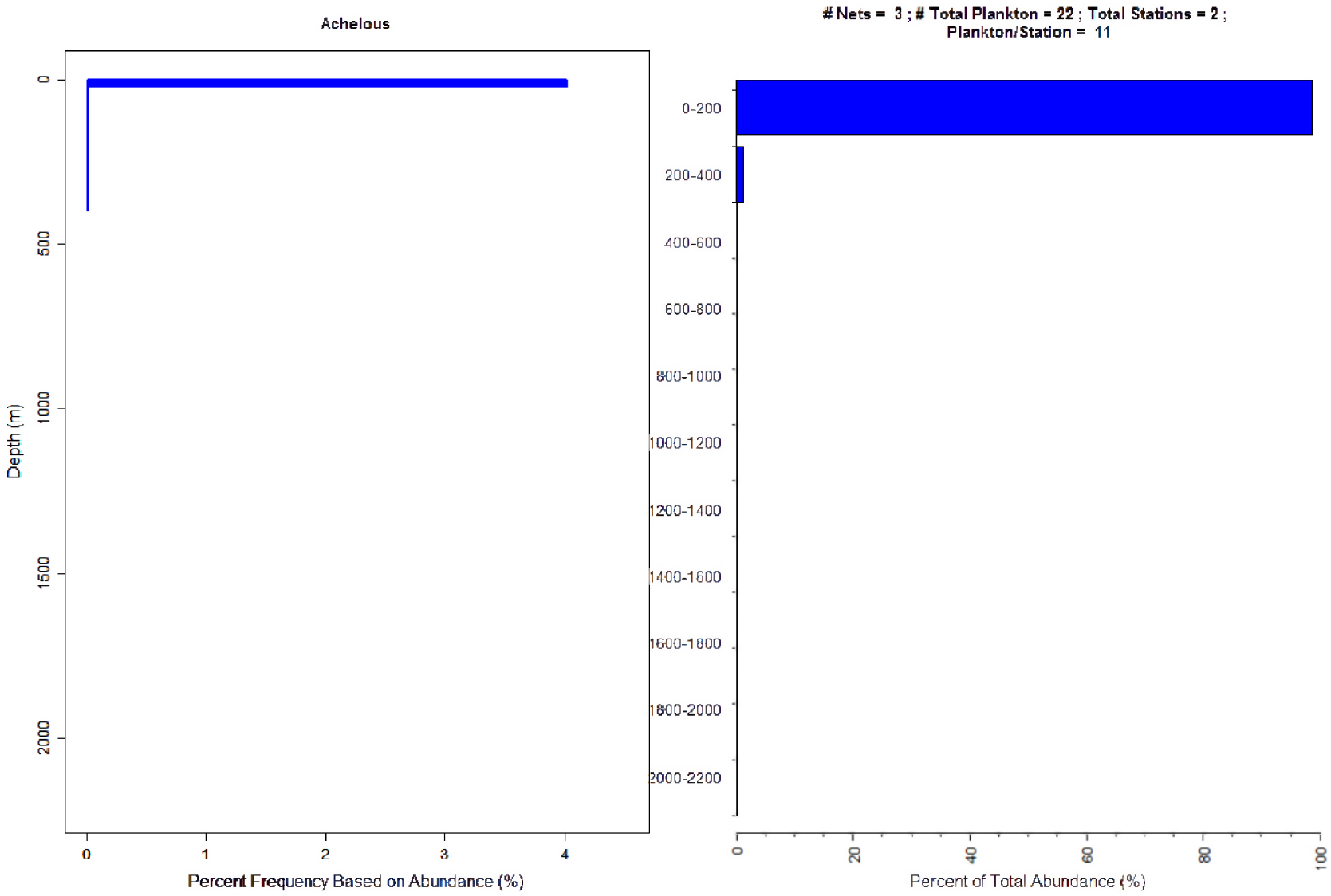
Acanthurus_chirurgus - Deep


Acetes
Nets = 1 ; # Total Plankton = 2 ; Total Stations = 1 ;
Plankton/Station = 2
Depth (m)
0
500
1000
1500
2000
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

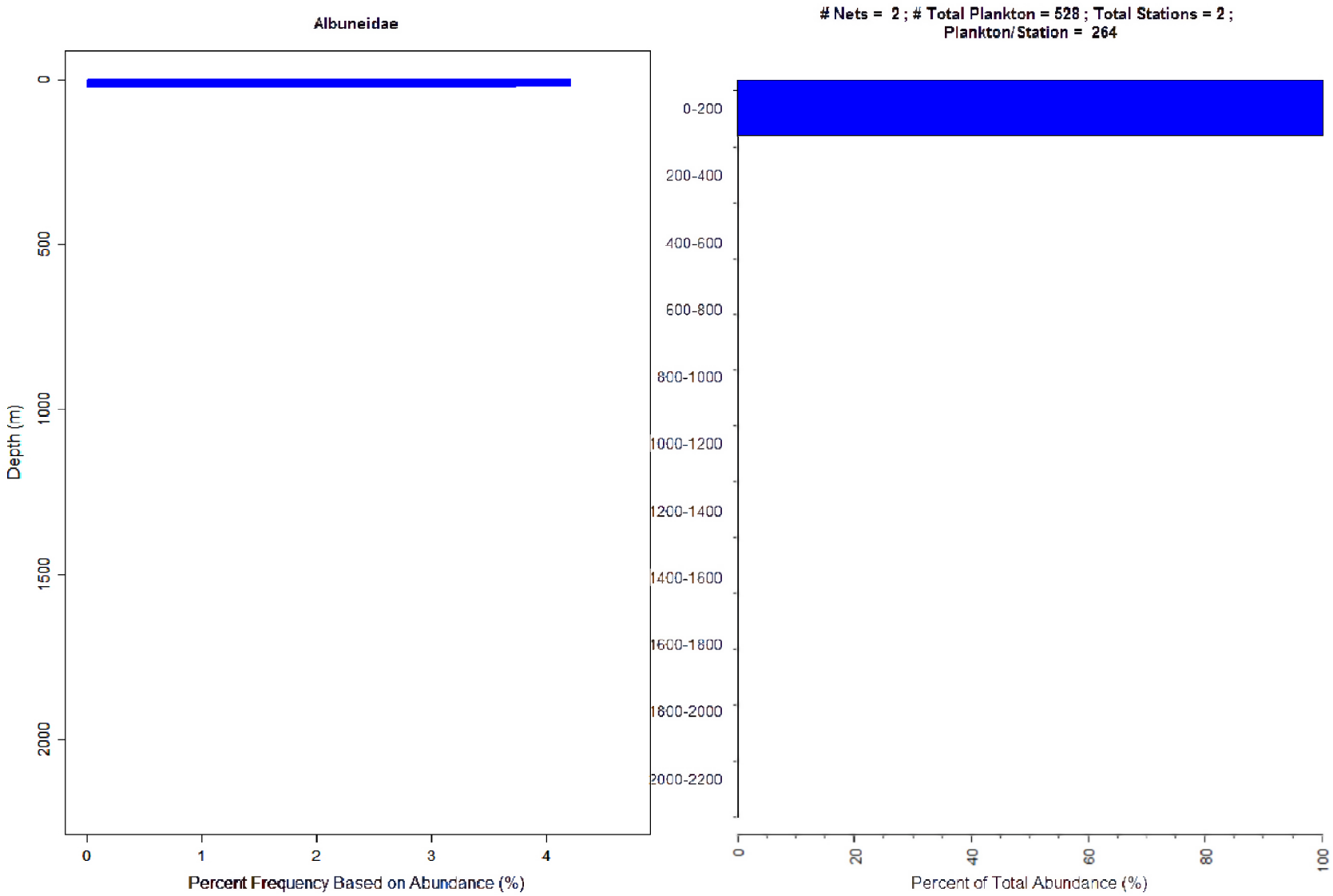
Acetes - Deep



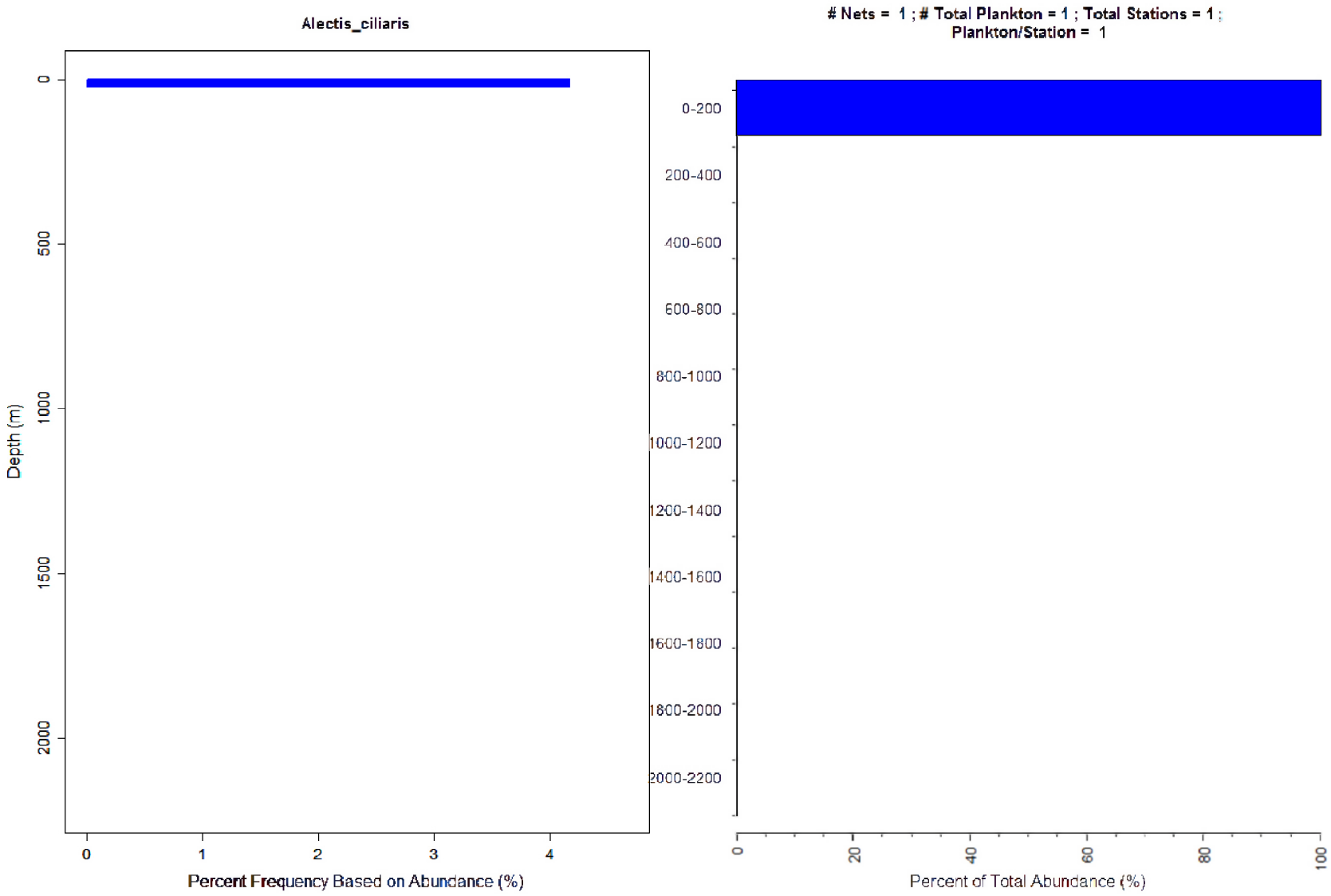
Acetes_americanus_carolinae - Deep



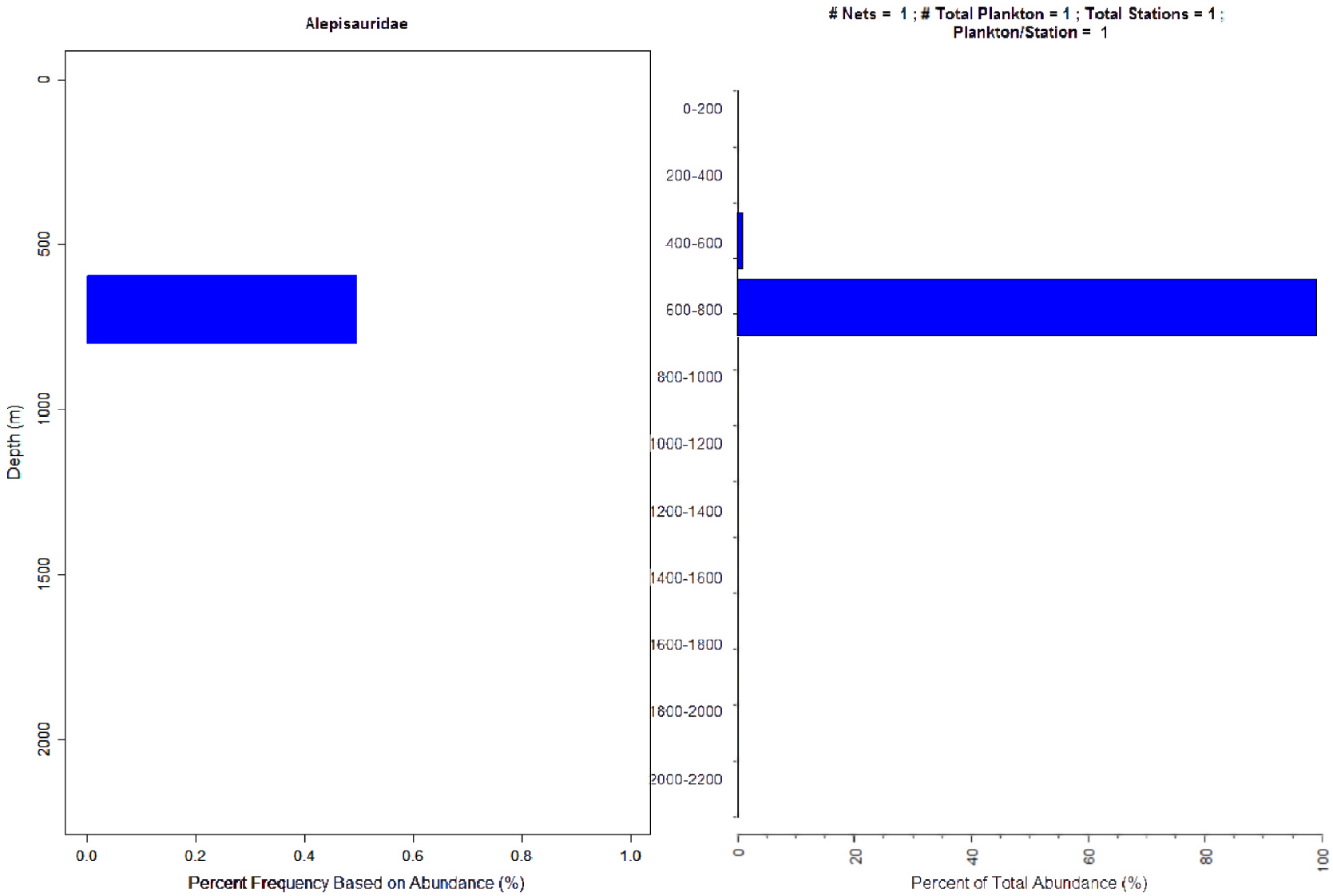
Achelous - Deep



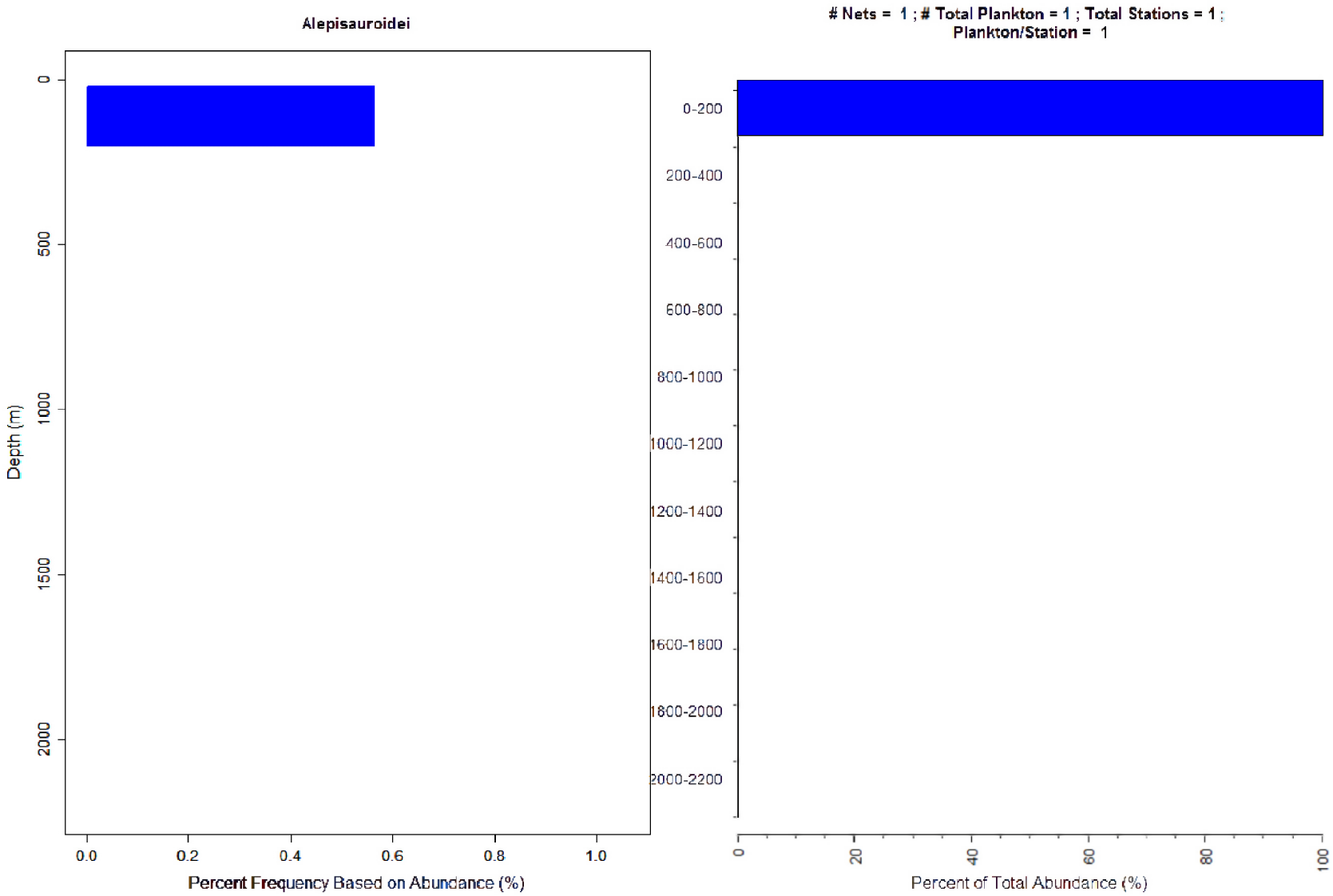
Albuneidae - Deep



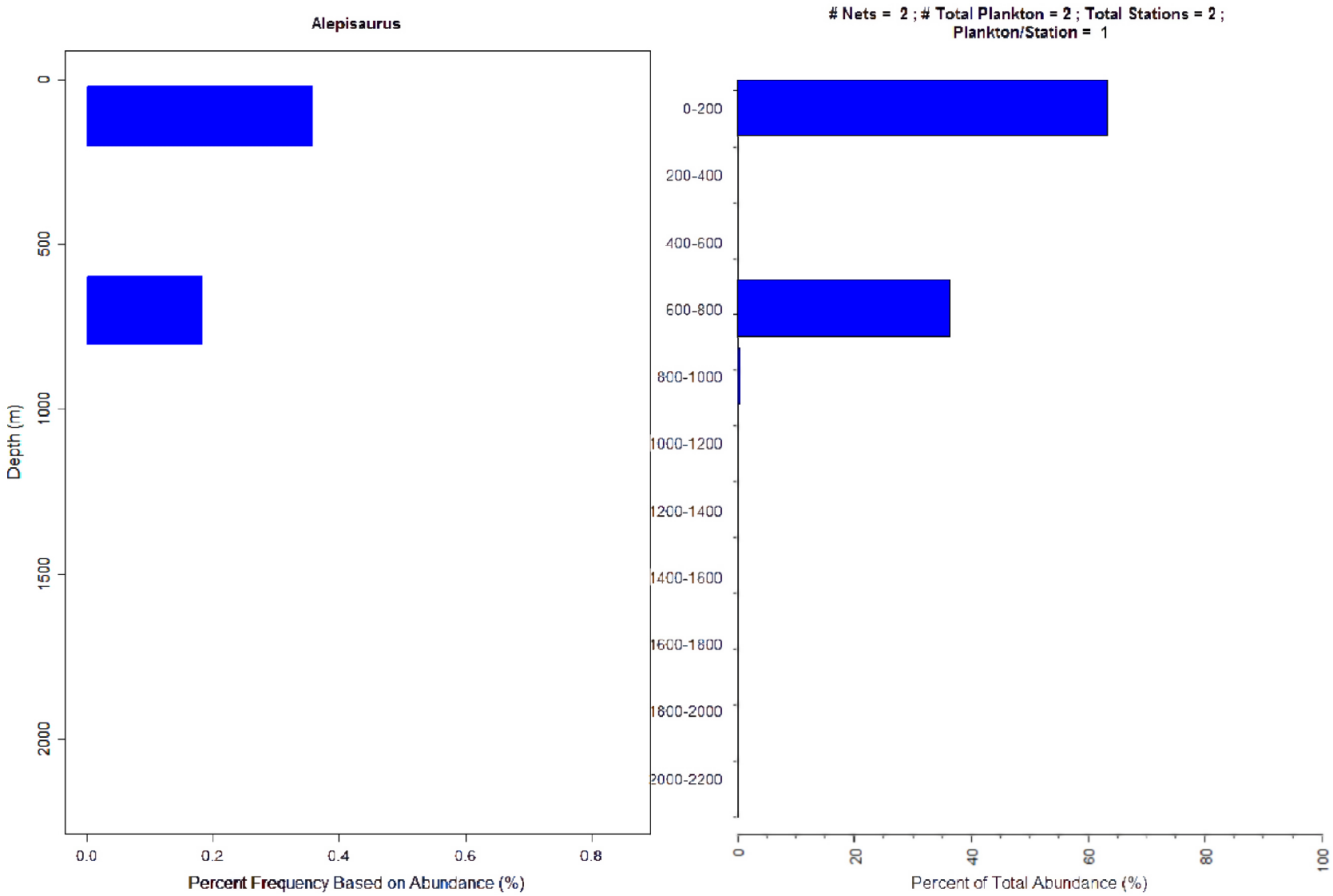
Alectis_ciliaris - Deep



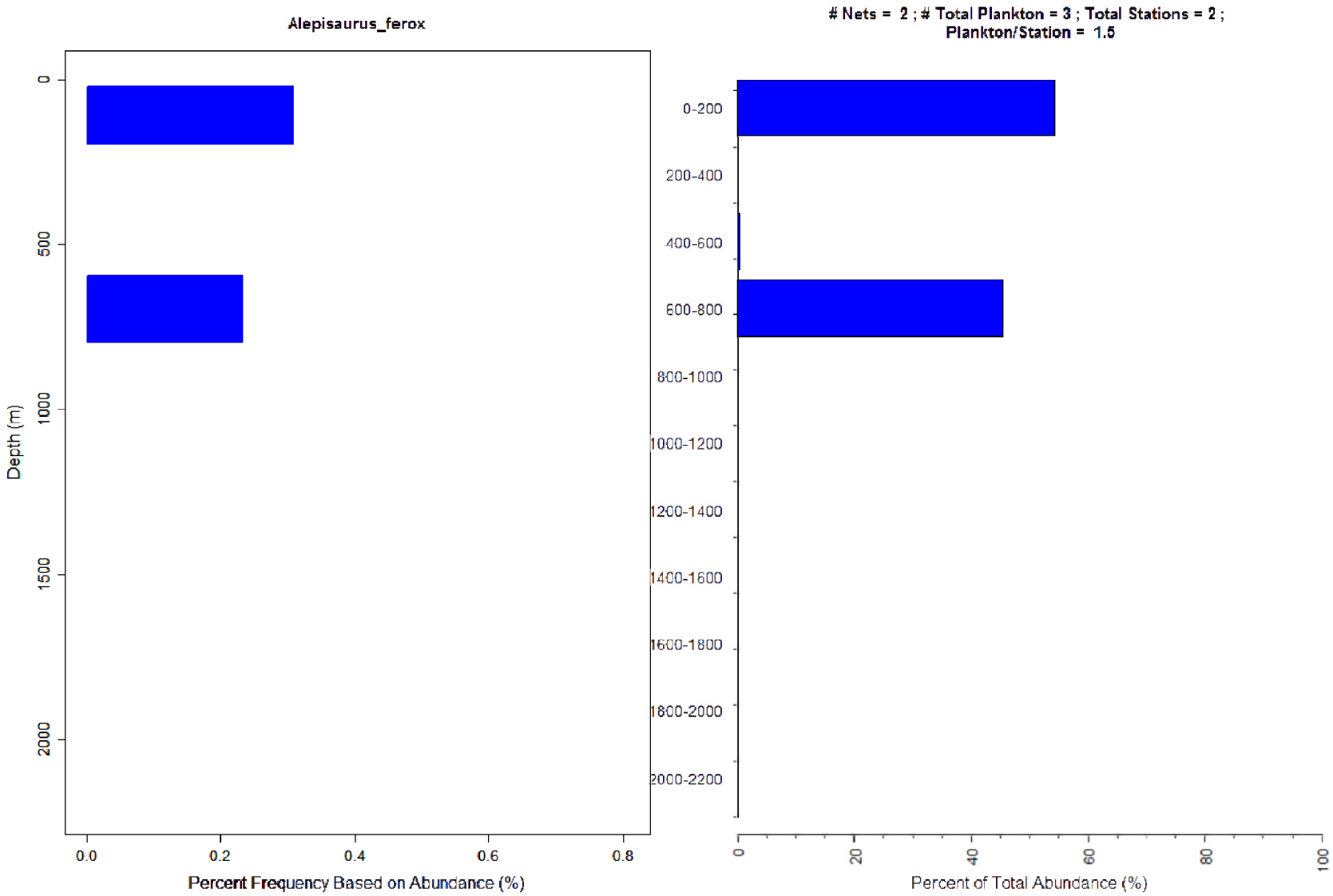
Alepisauridae - Deep



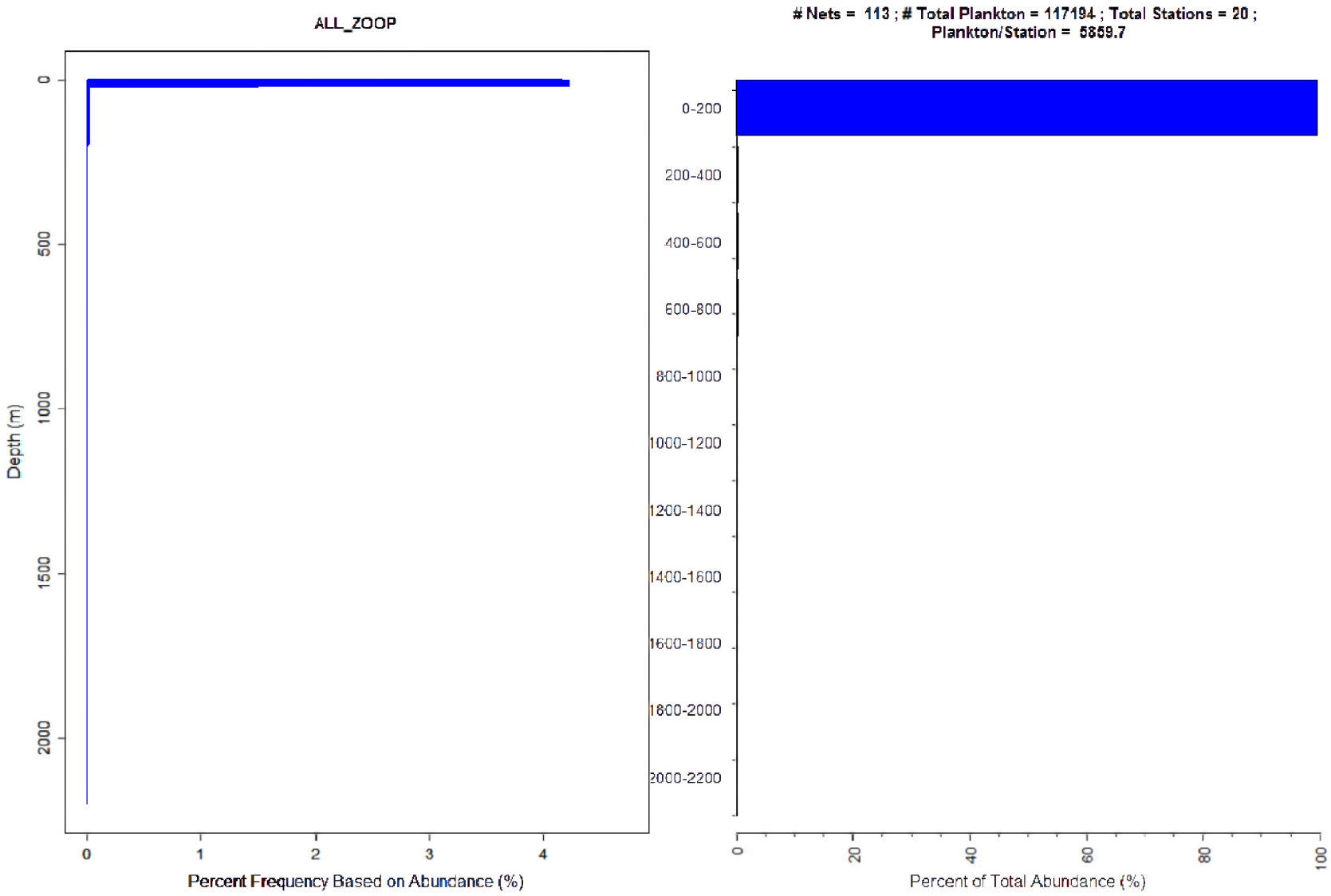
Alepisauroidei - Deep



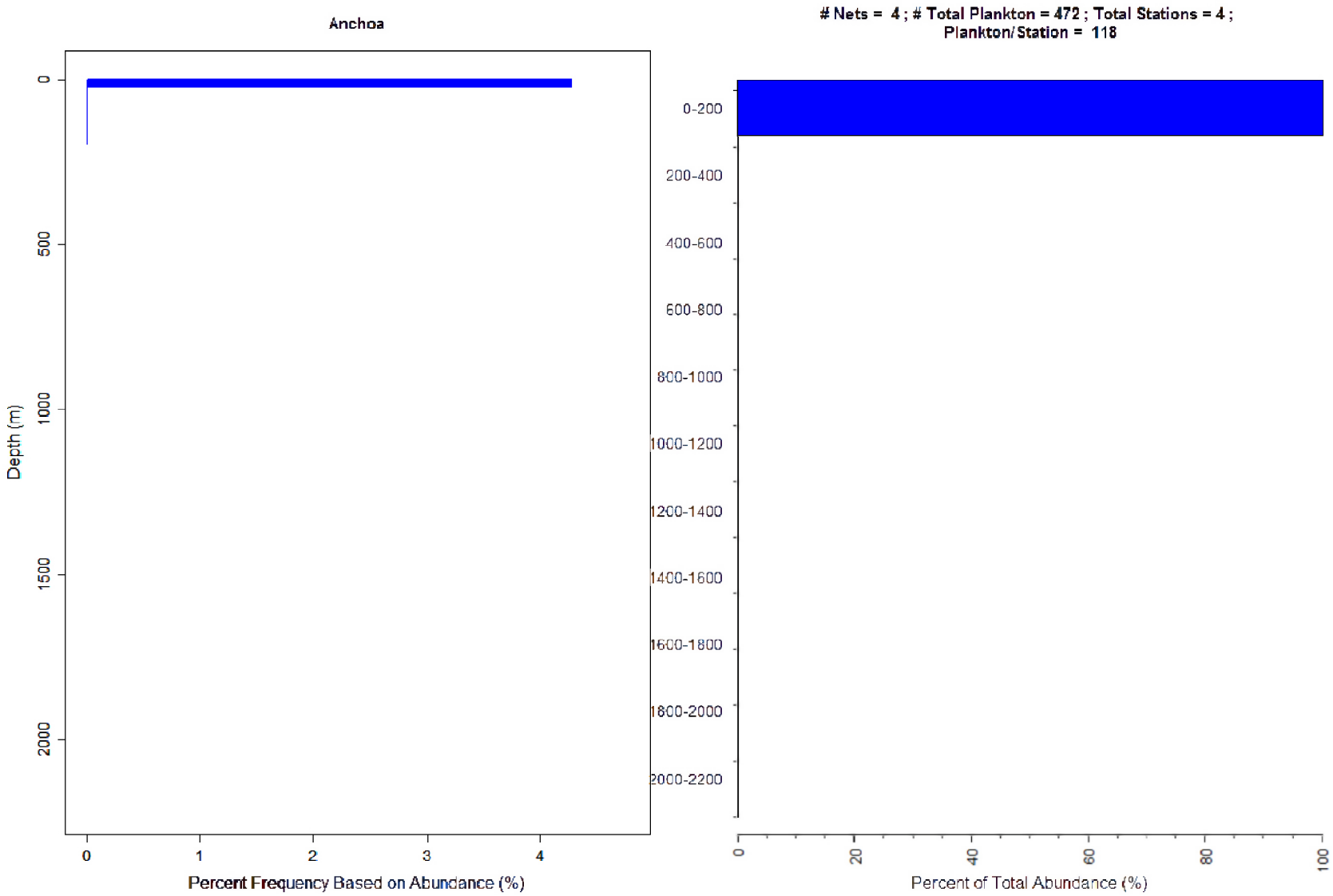
Alepisaurus - Deep



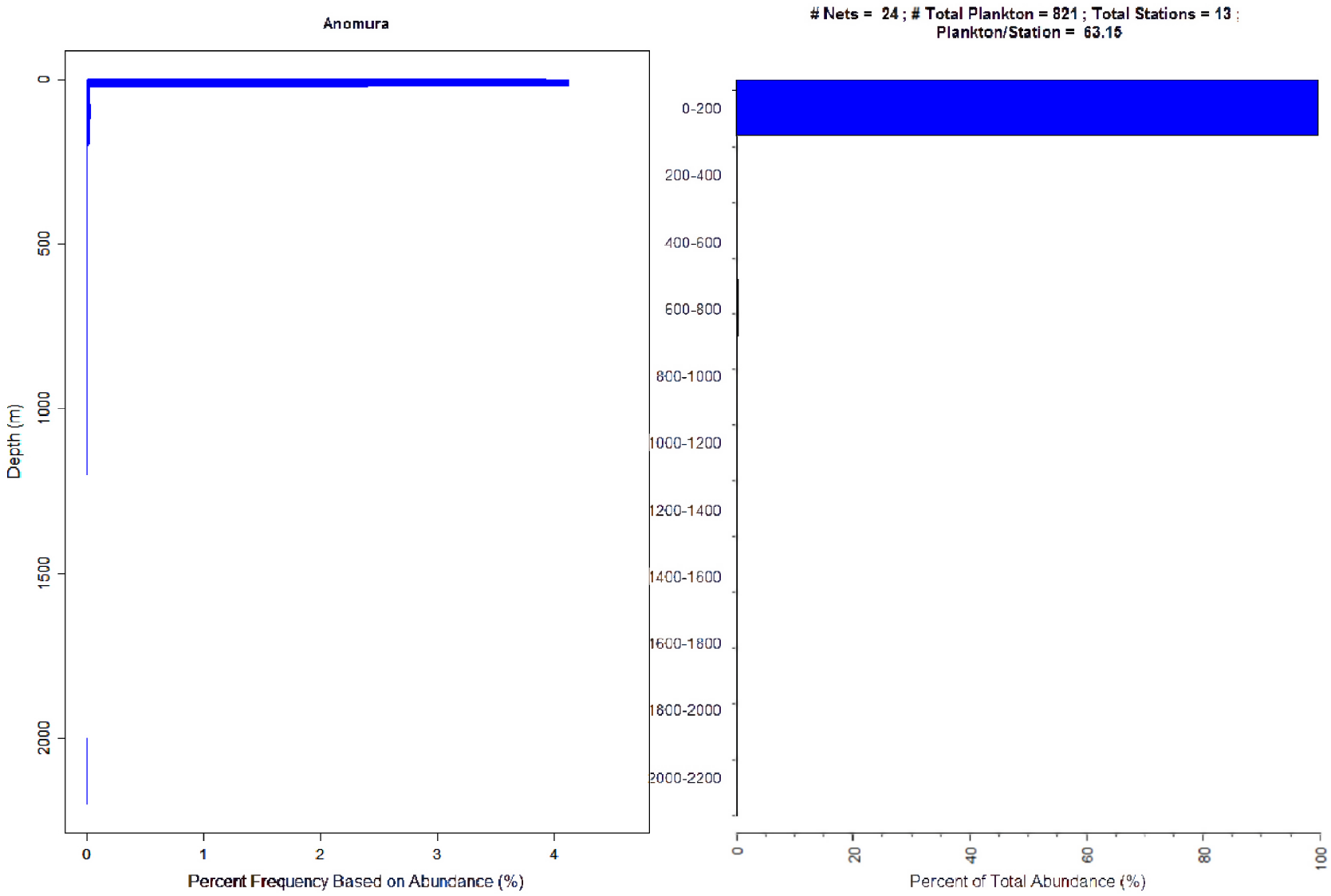
Alepisaurus_ferox - Deep



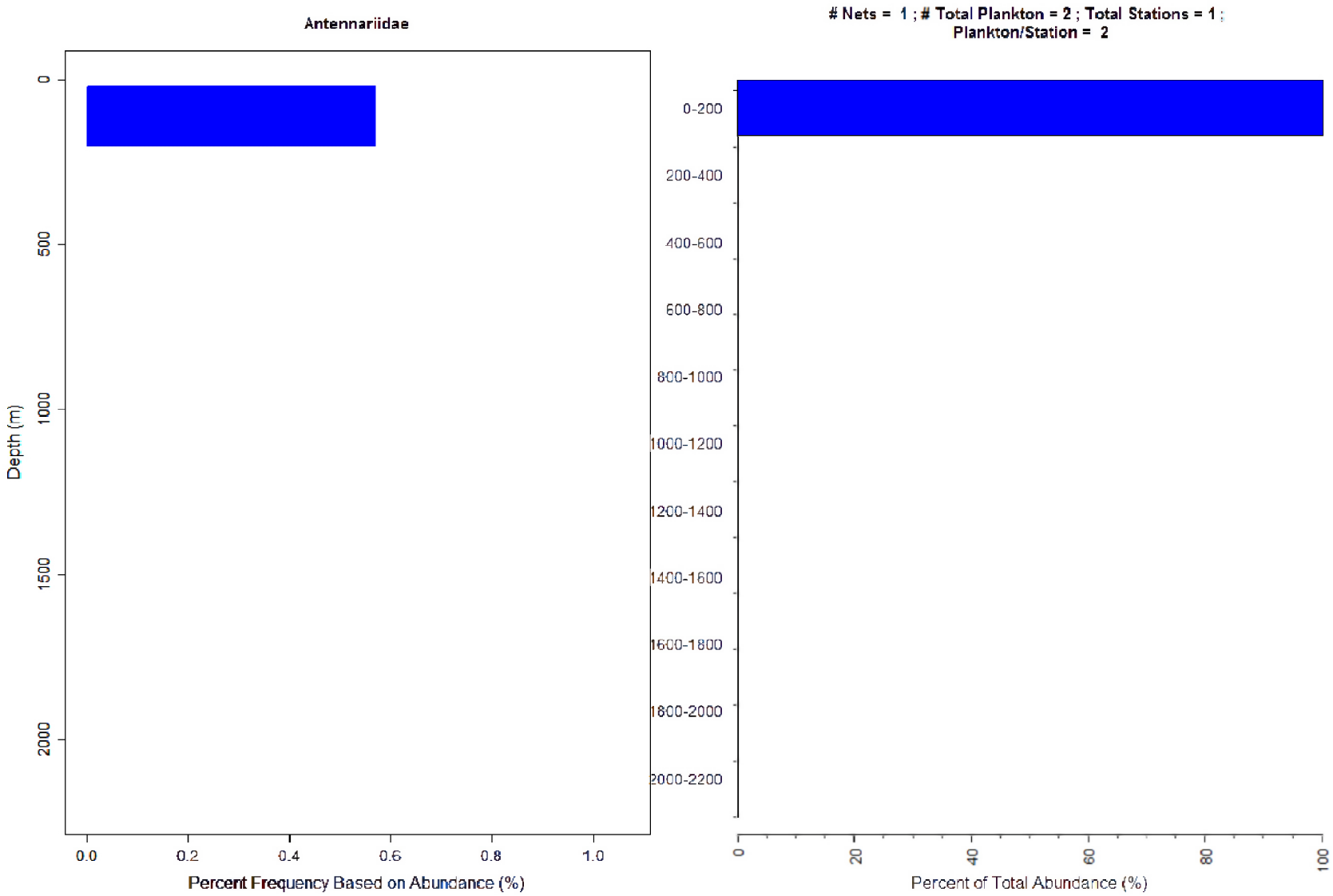
ALL_ZOOP - Deep


Anchoa
Nets = 4 ; # Total Plankton = 472 ; Total Stations = 4 ;
Plankton/Station = 118
Depth (m)
0
500
1000
1500
2000
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0
20
40
60
80
100
Percent of Total Abundance (%)

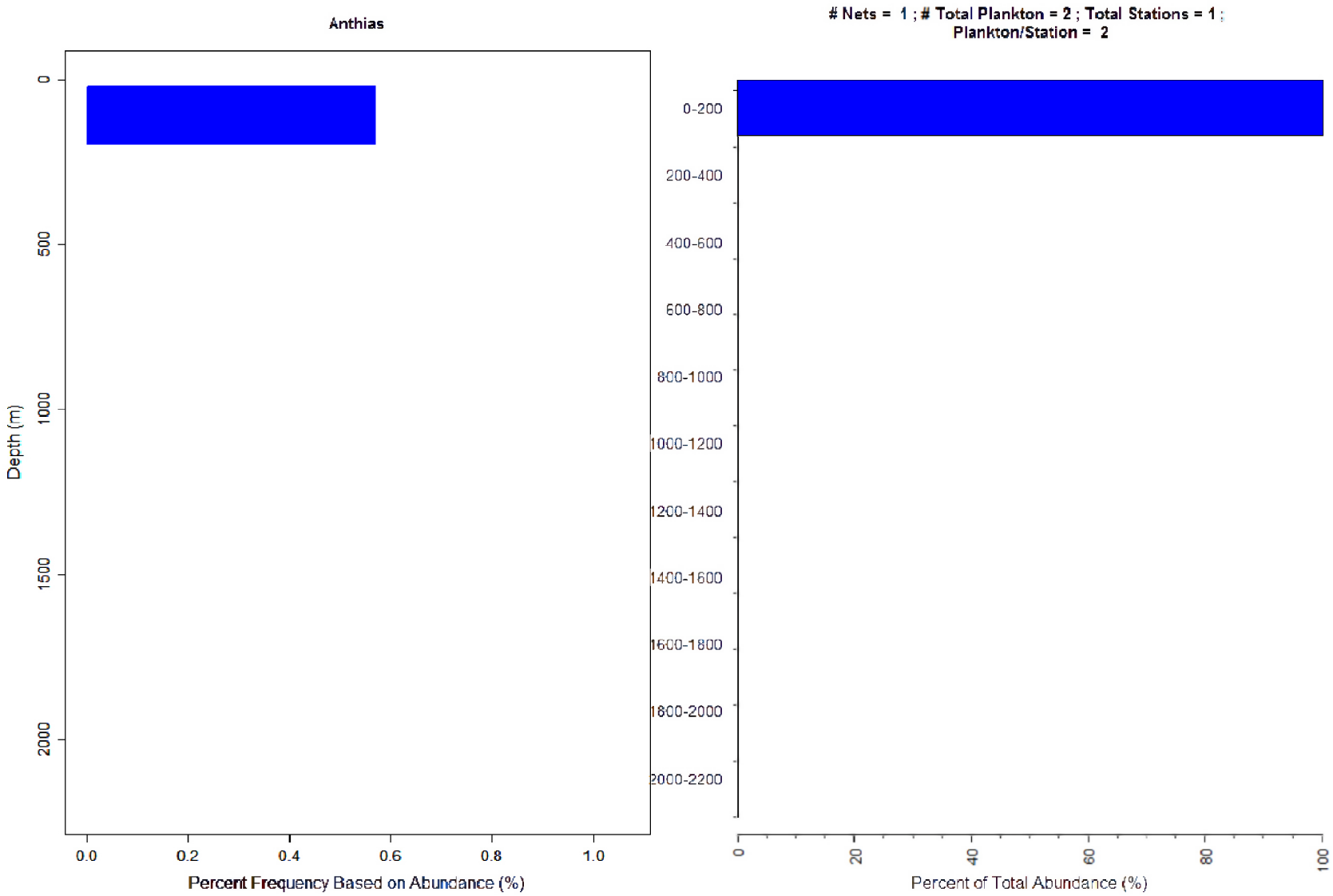
Anchoa - Deep



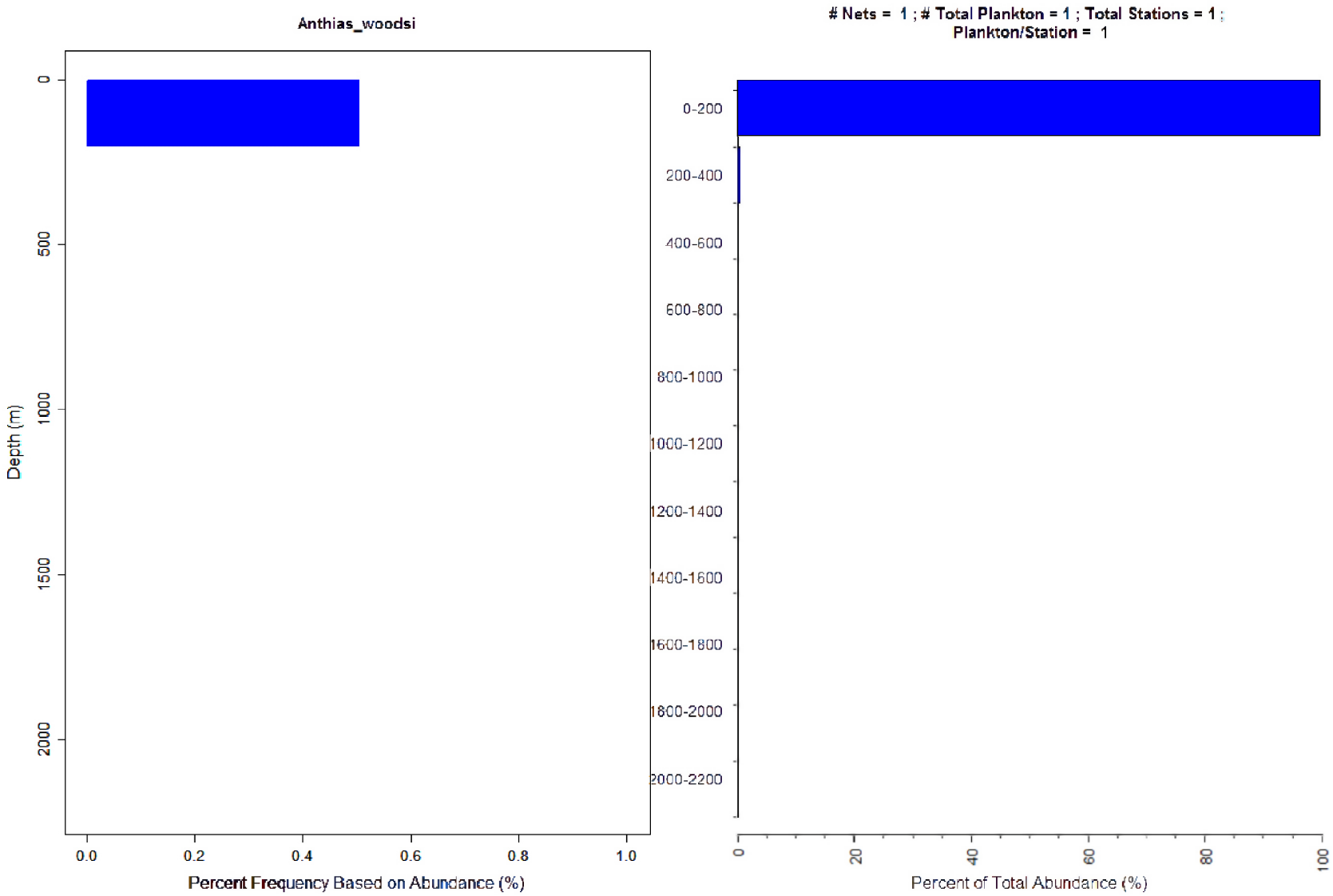
Anomura - Deep



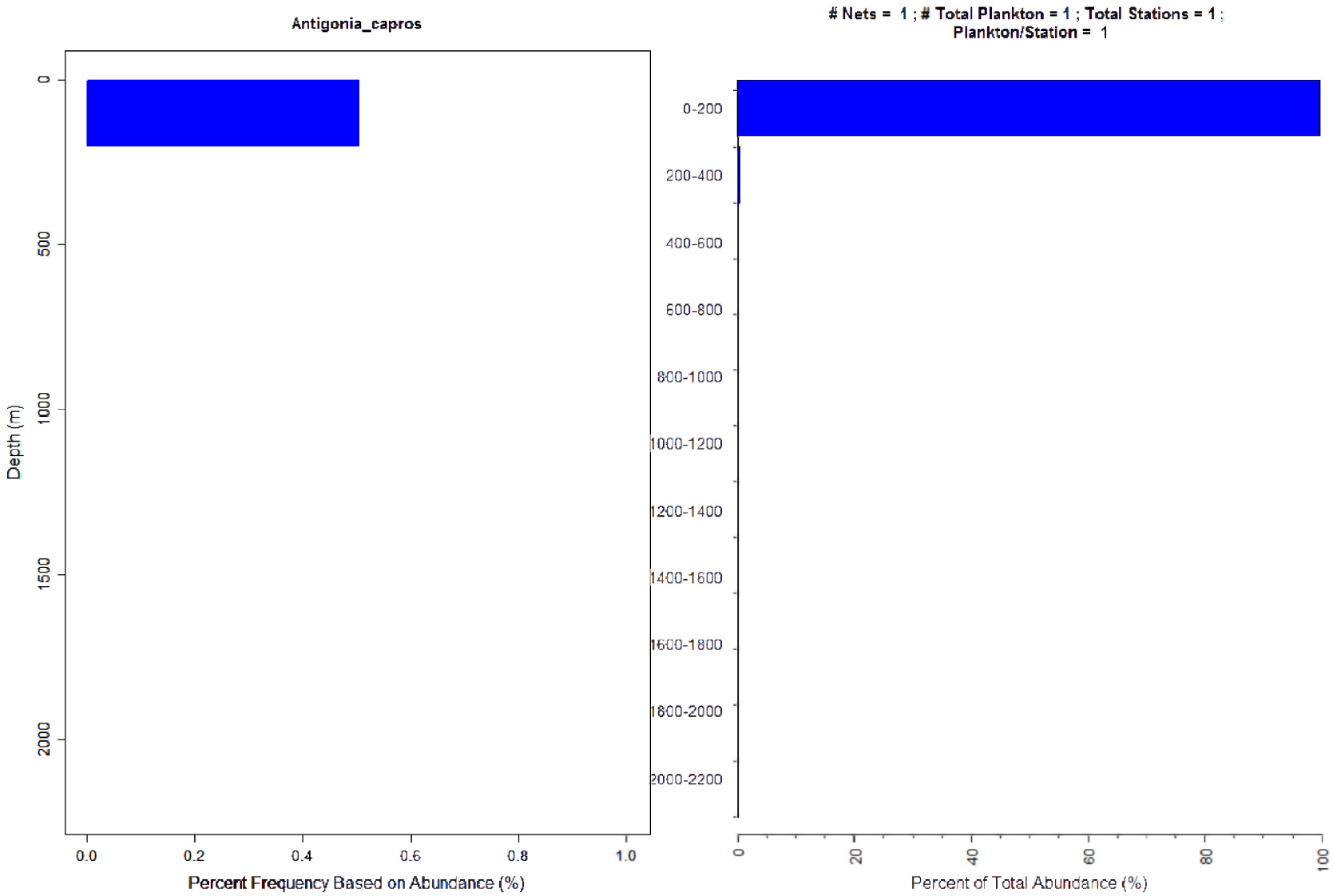
Antennariidae - Deep



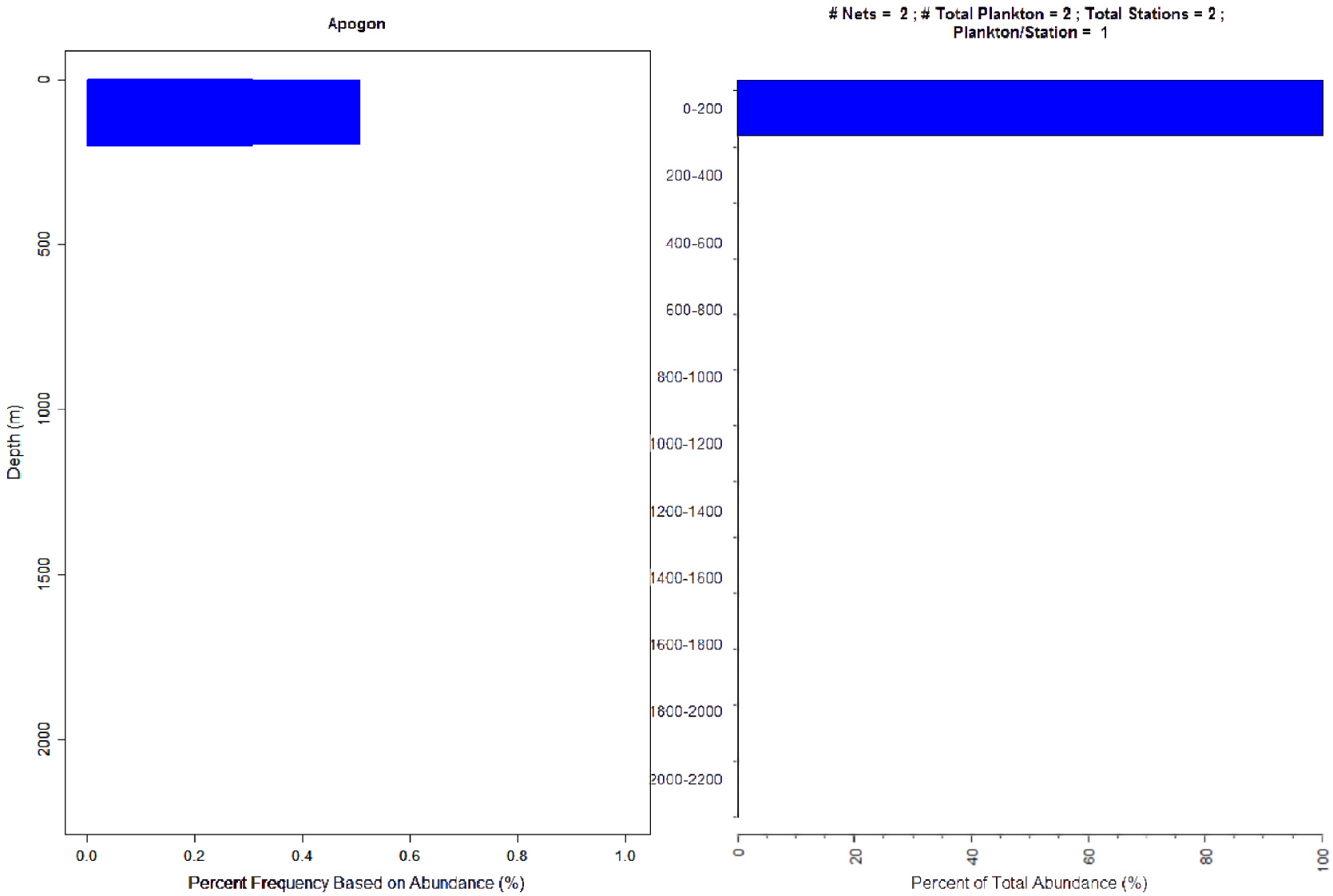
Anthias - Deep



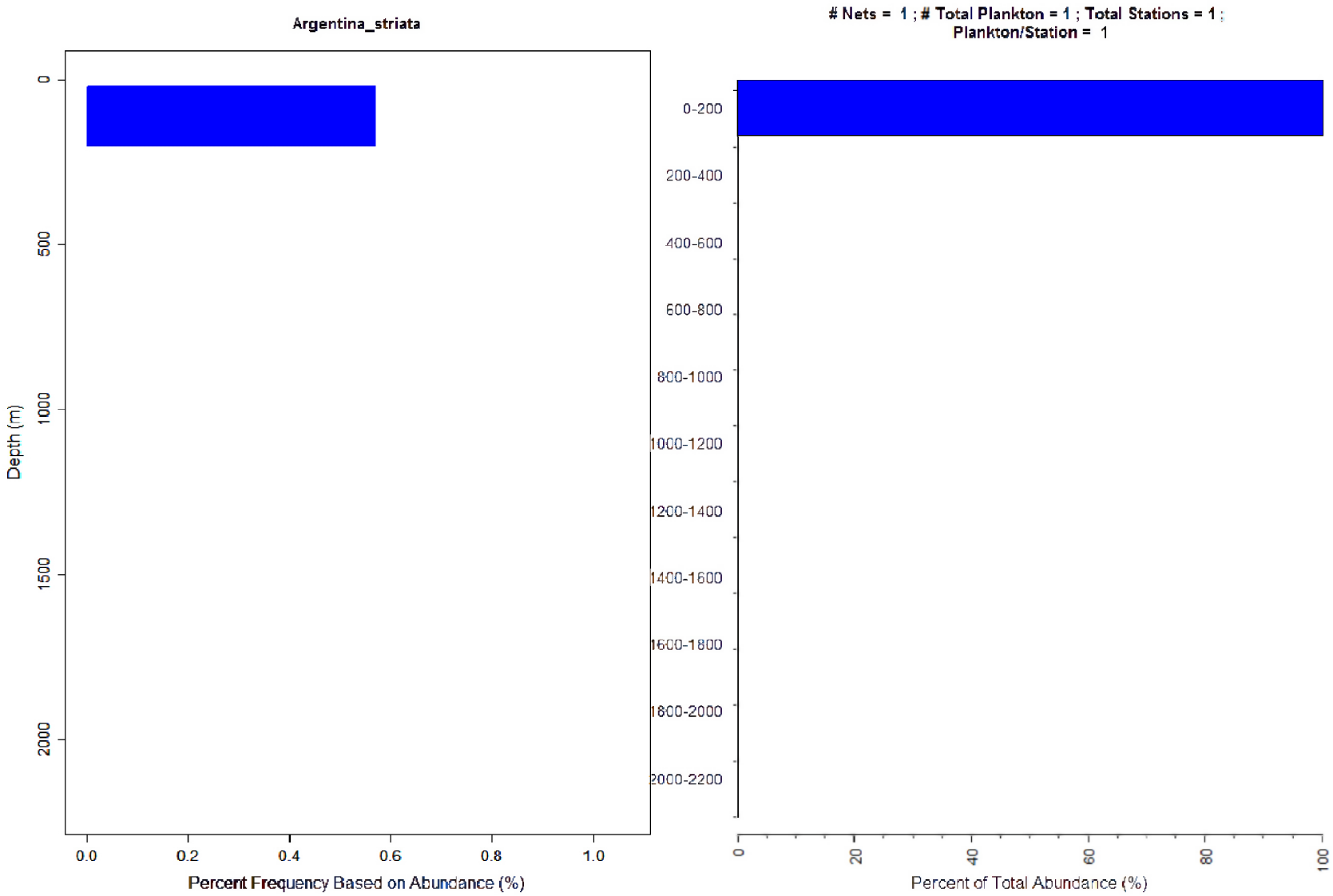
Anthias_woodsi - Deep



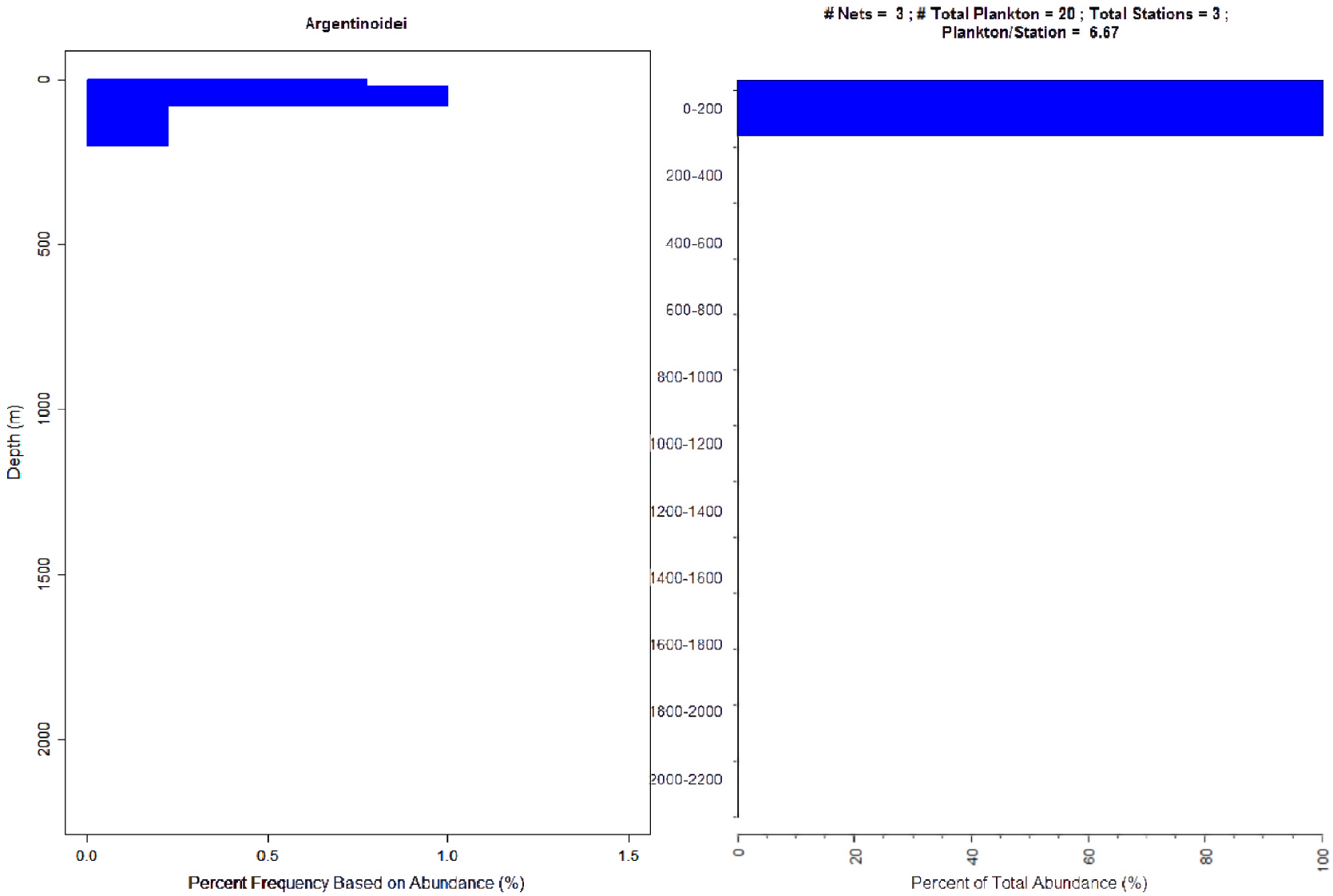
Antigonia_capros - Deep


Apogon
Nets = 2 ; # Total Plankton = 2 ; Total Stations = 2 ;
Plankton/Station = 1
Depth (m)
0
500
1000
1500
2000
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

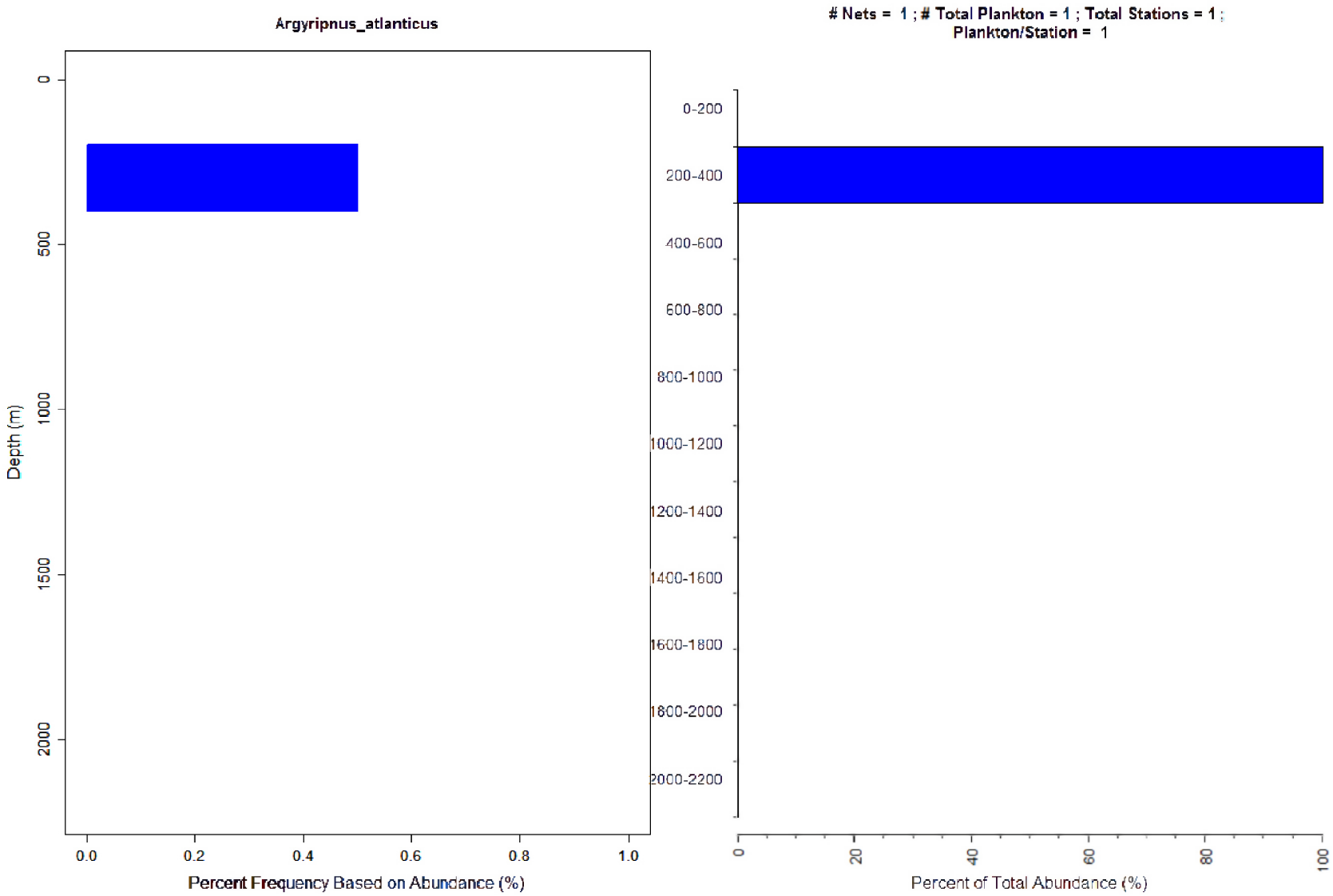
Apogon - Deep



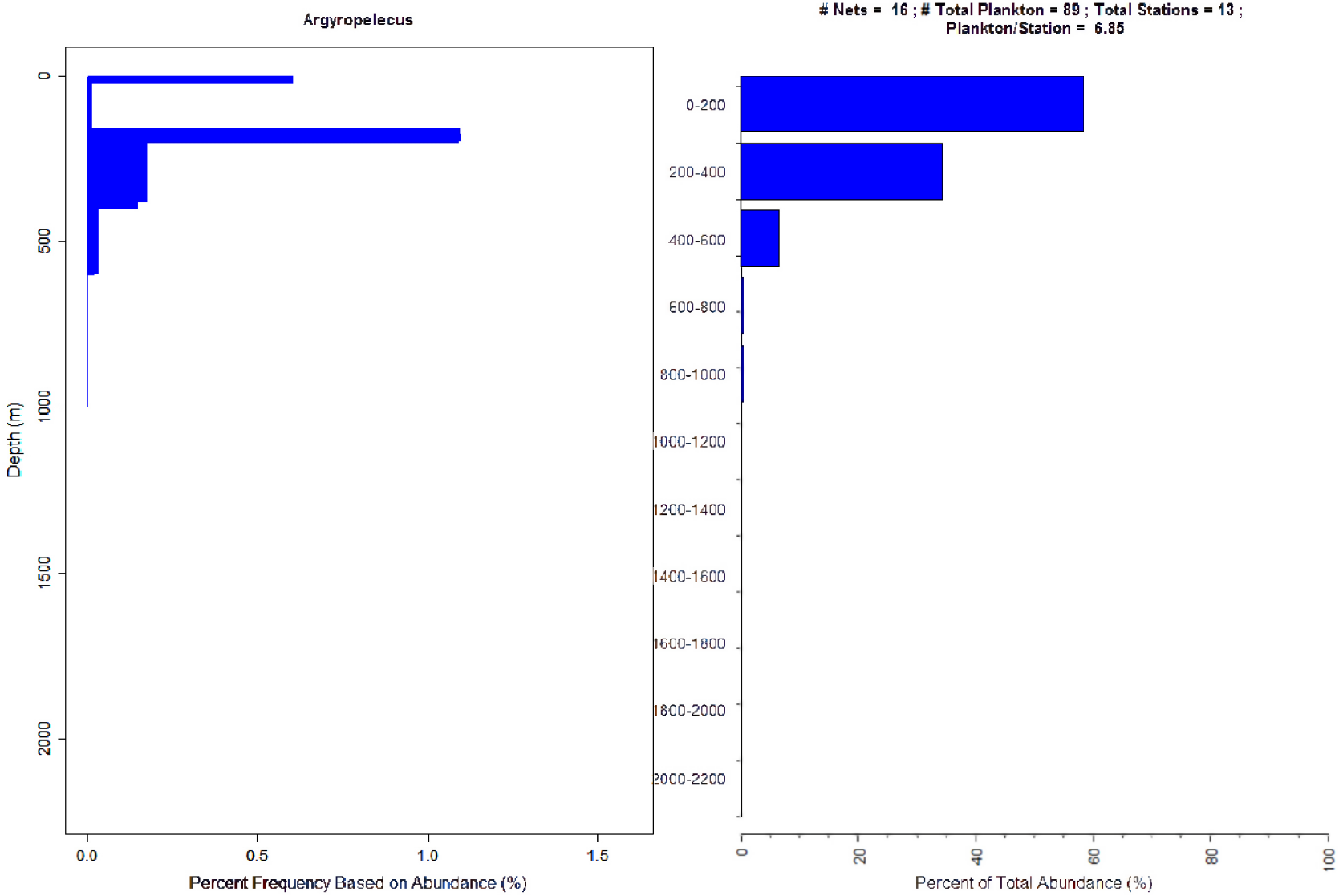
Argentina_striata - Deep



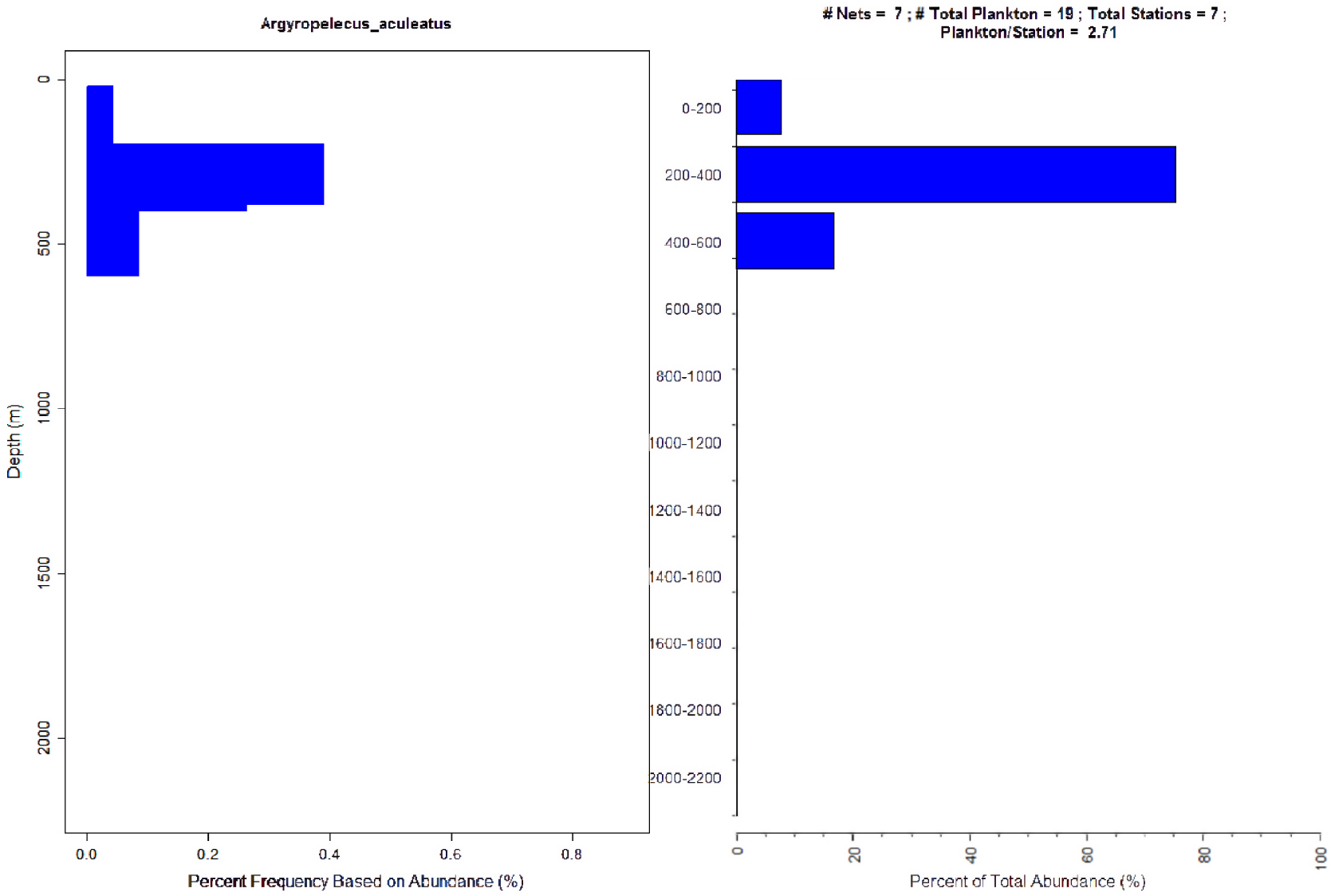
Argentinoidei - Deep



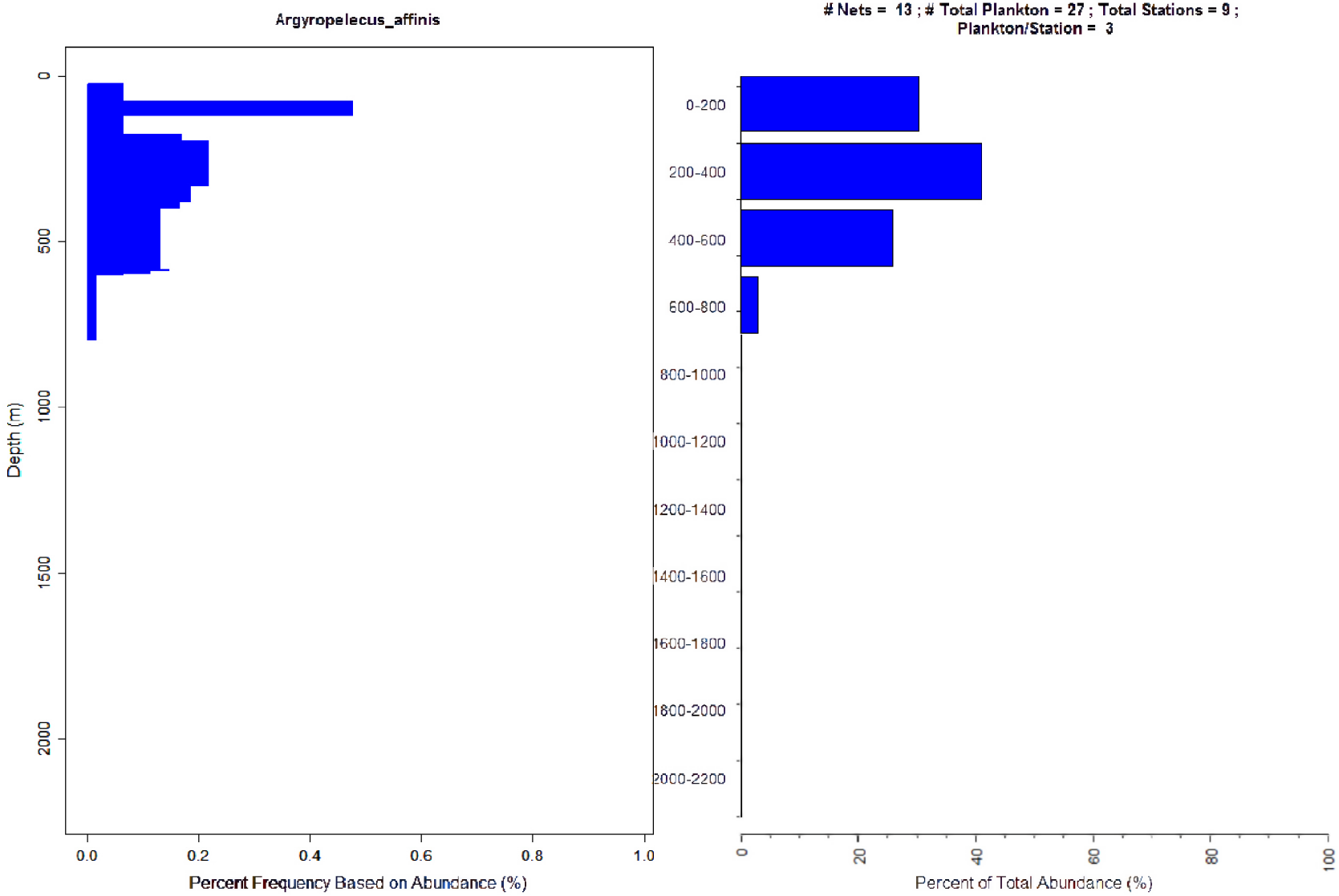
Argyripnus_atlanticus - Deep



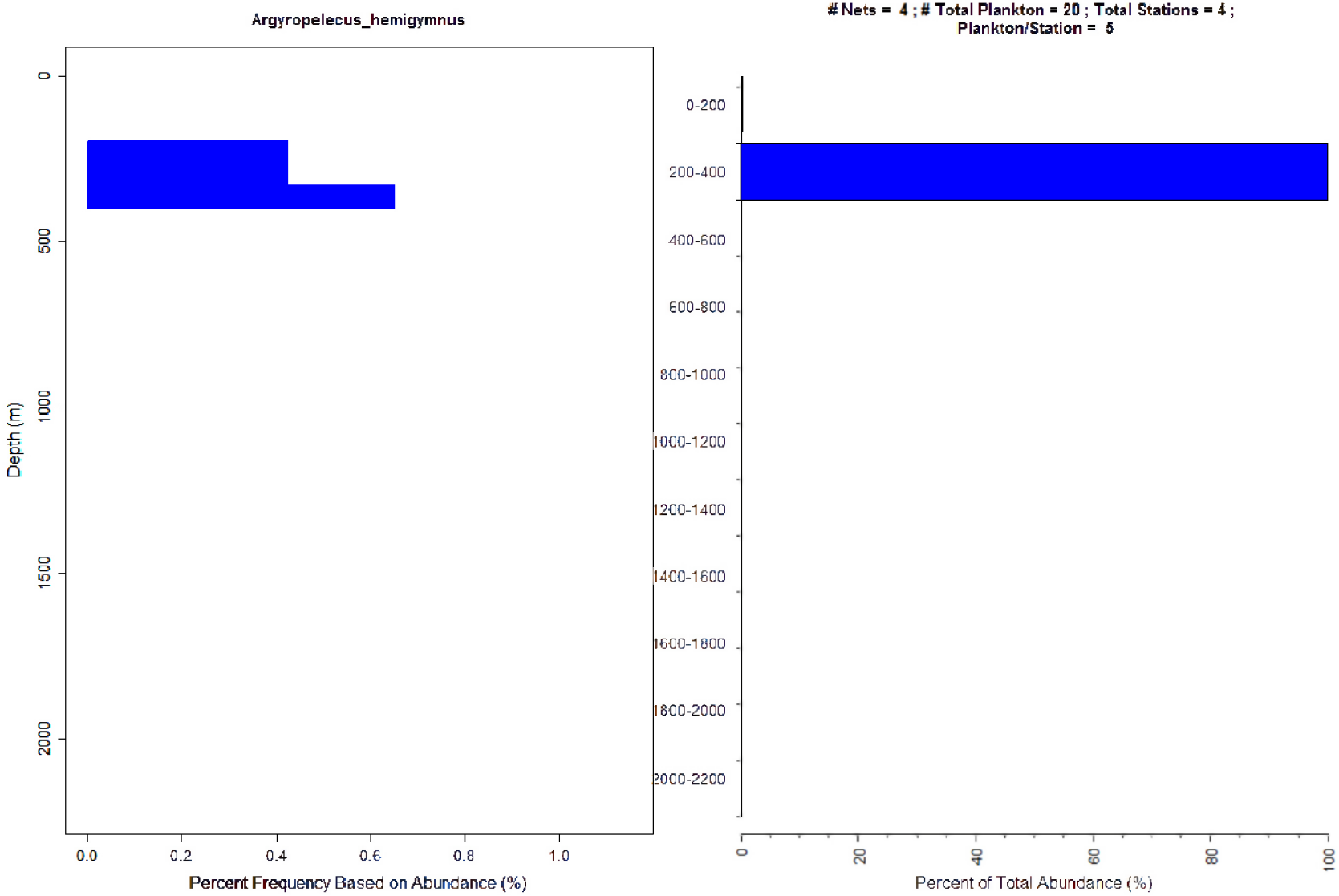
Argyropelecus - Deep



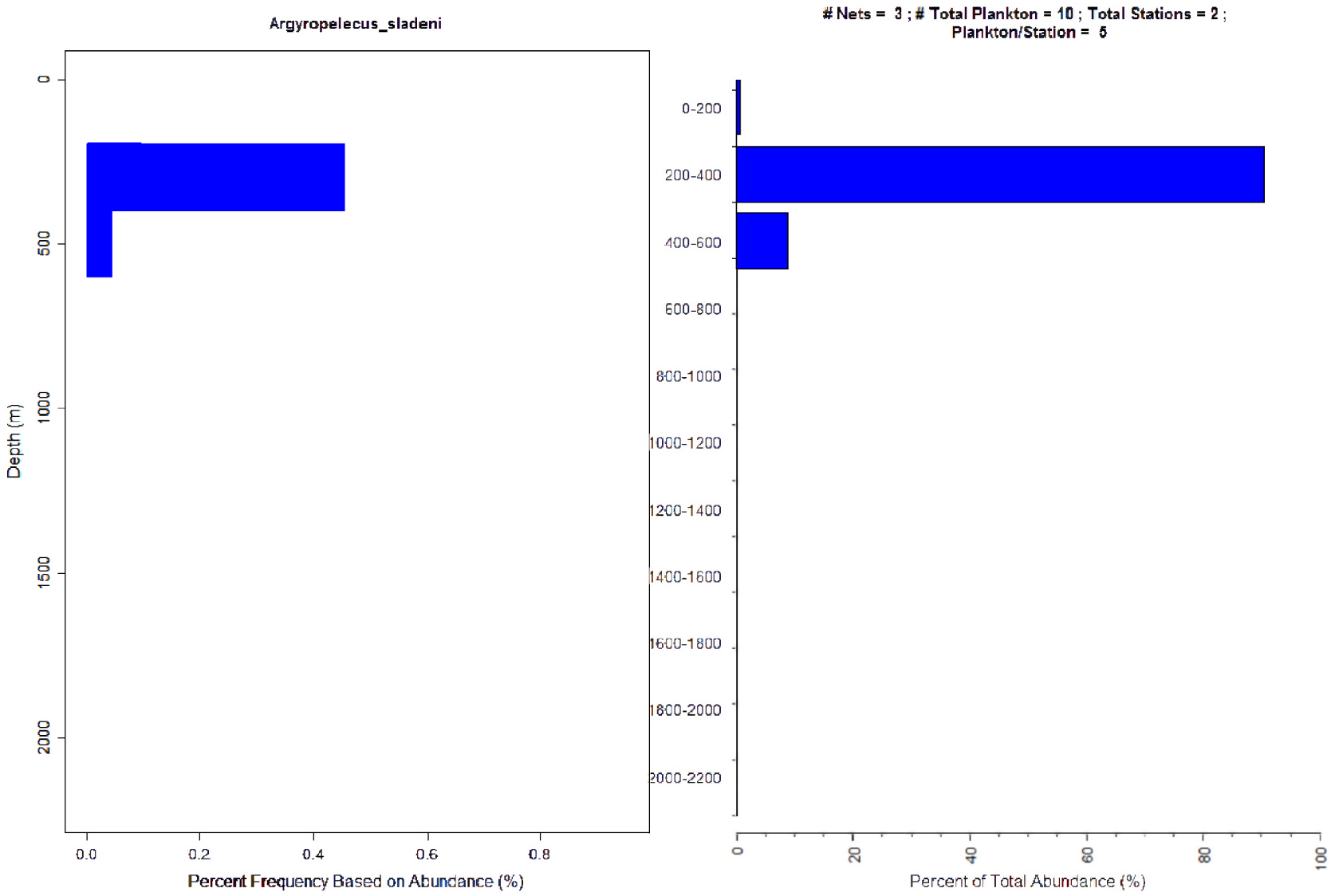
Argyropelecus_aculeatus - Deep



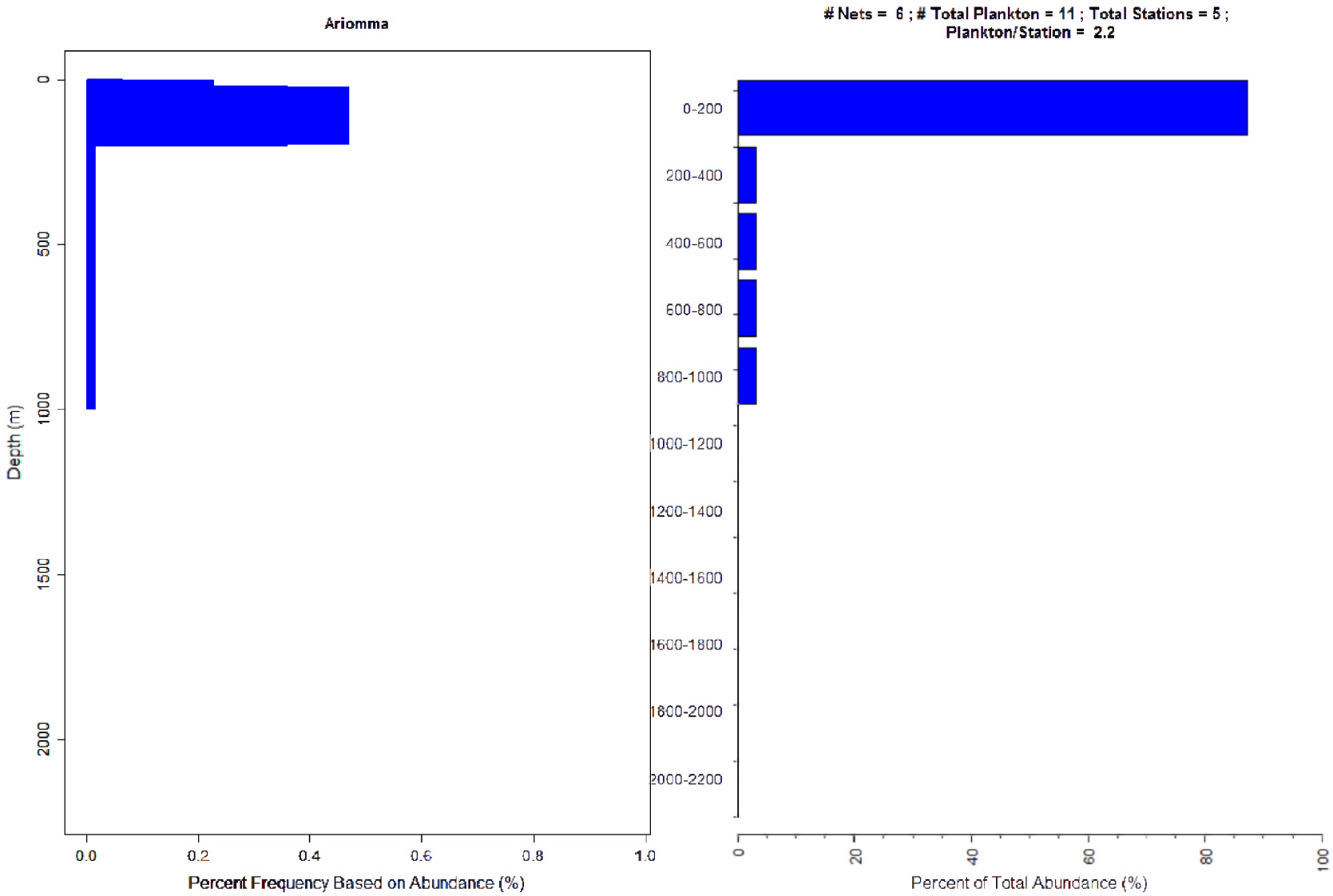
Argyropelecus_affinis - Deep



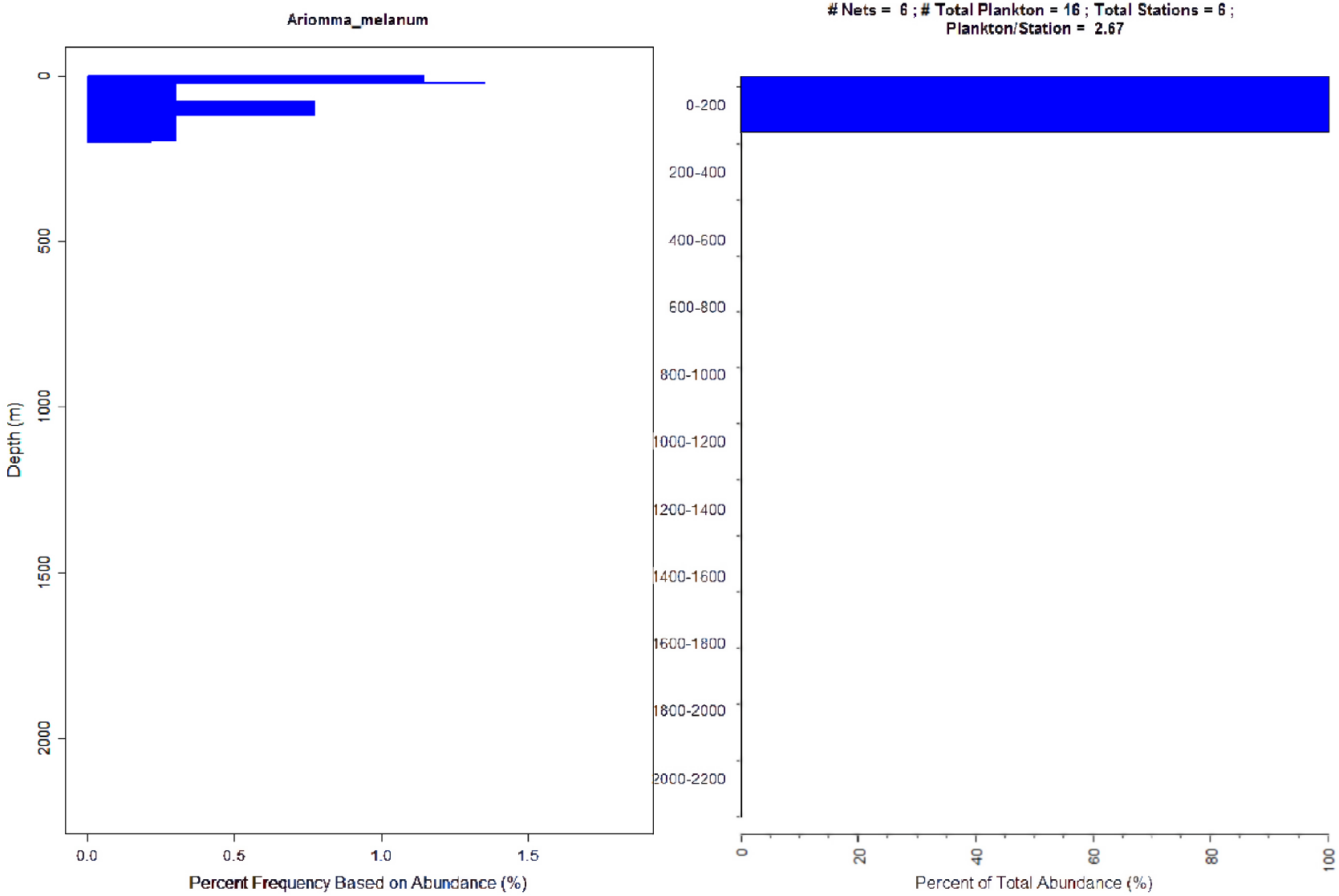
Argyropelecus_hemigymnus - Deep



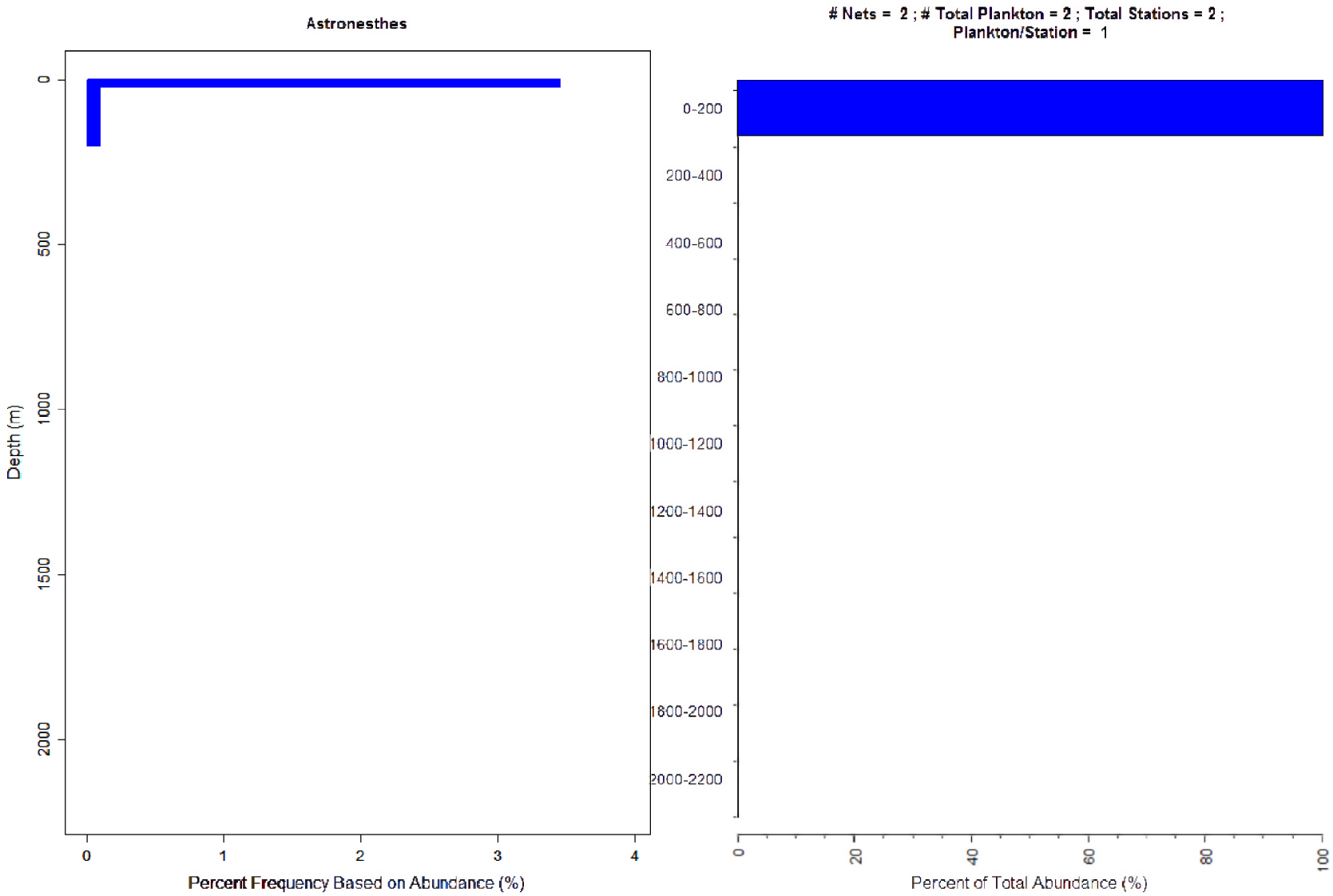
Argyropelecus_sladeni - Deep



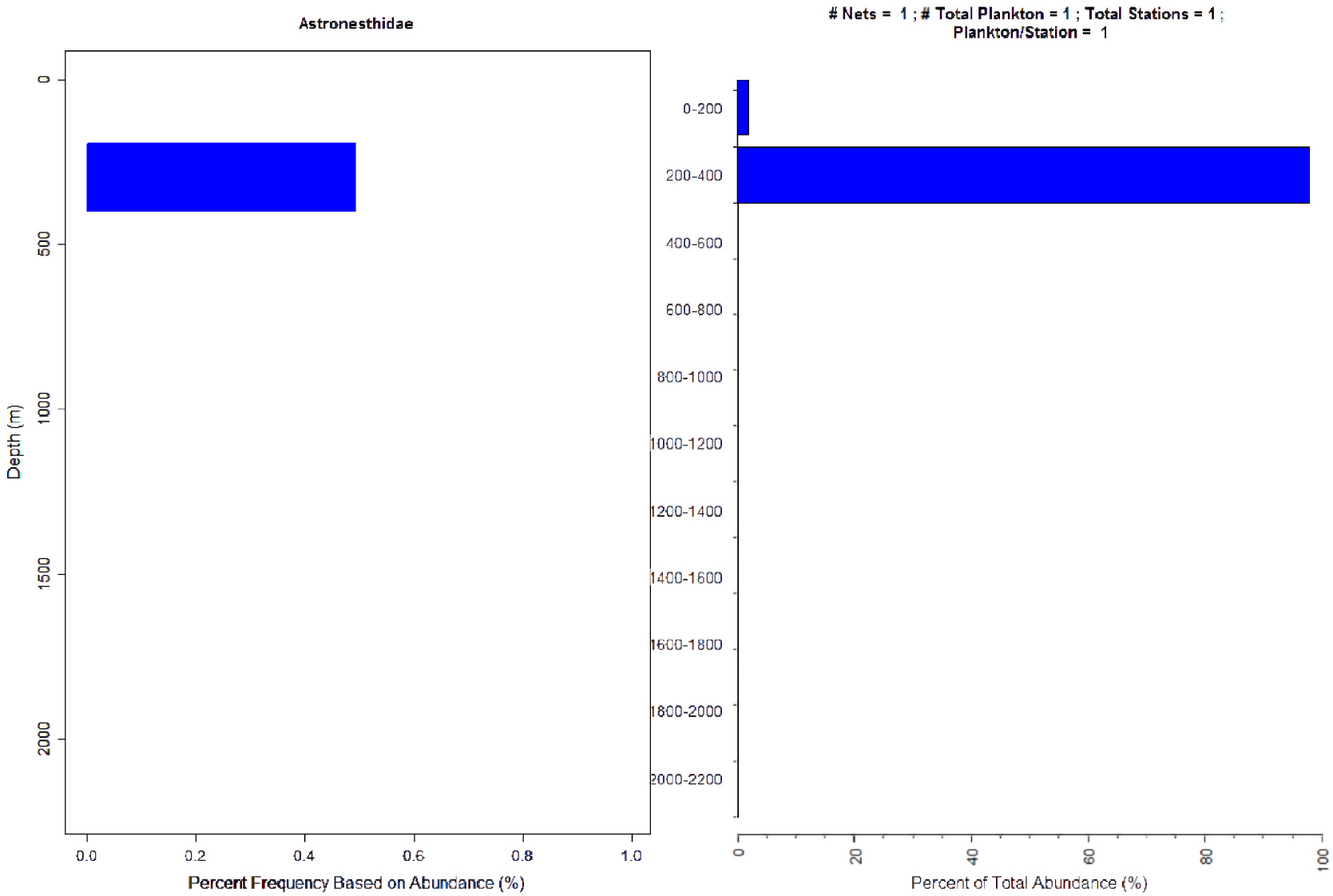
Ariomma - Deep



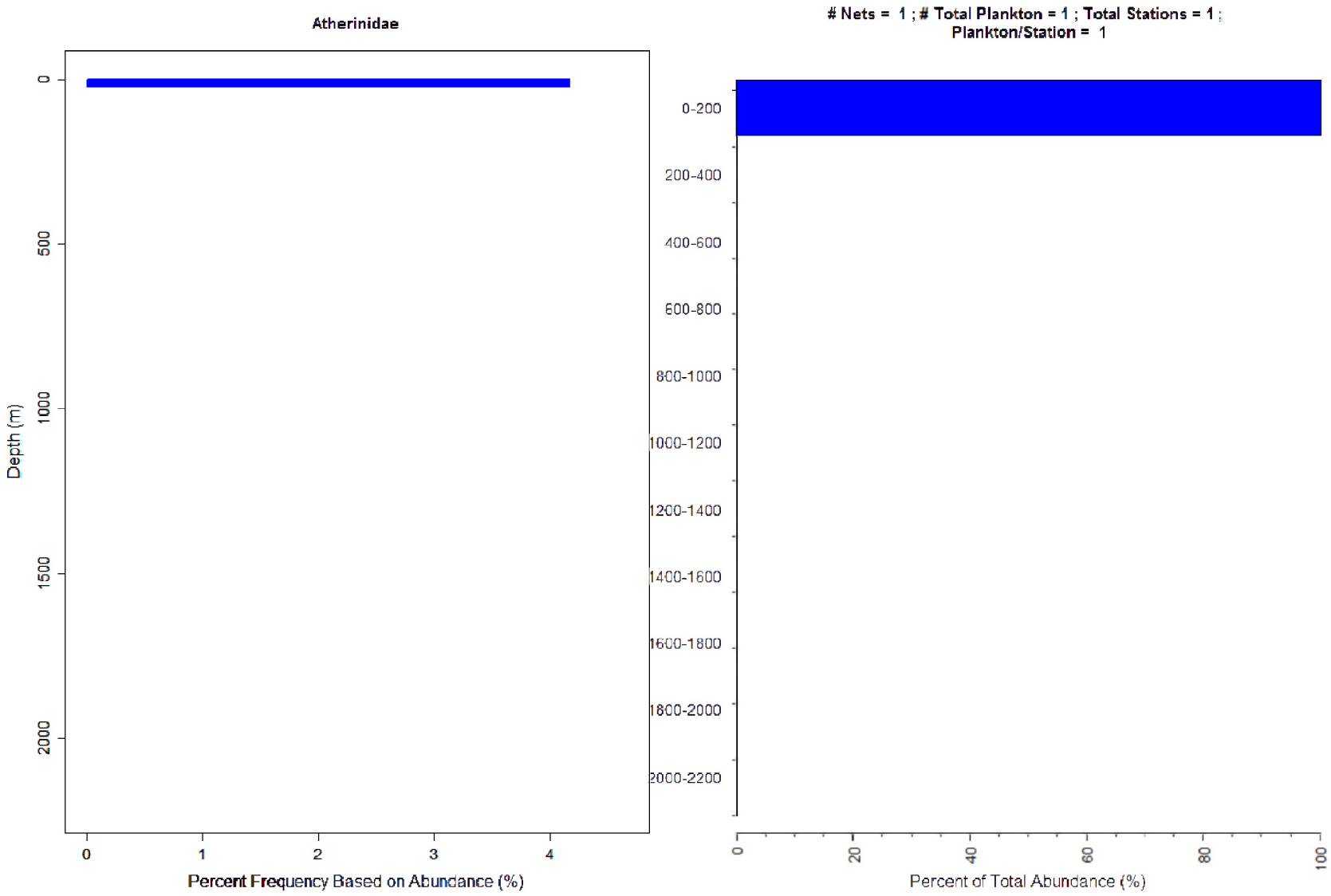
Ariomma_melanum - Deep



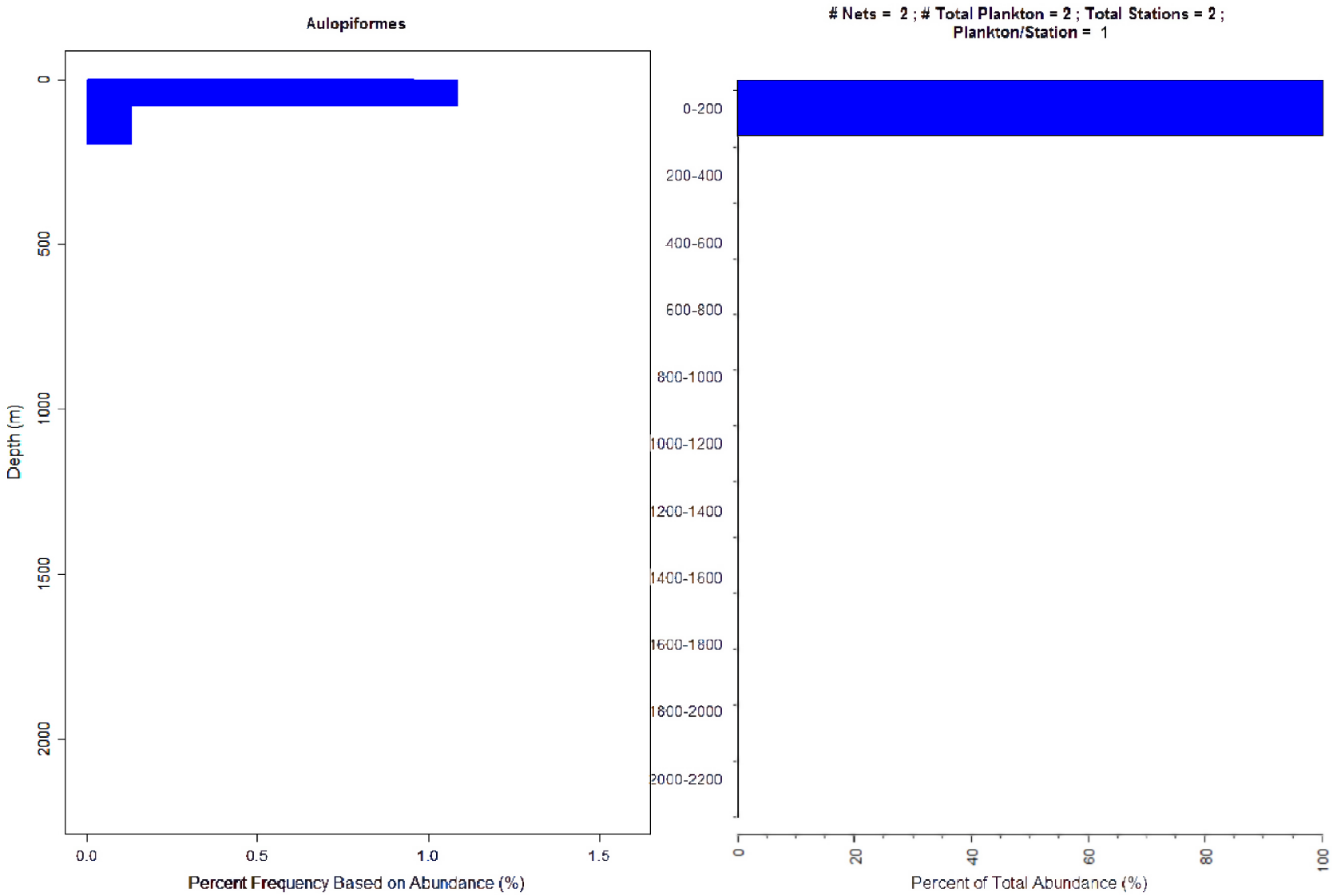
Astronesthes - Deep



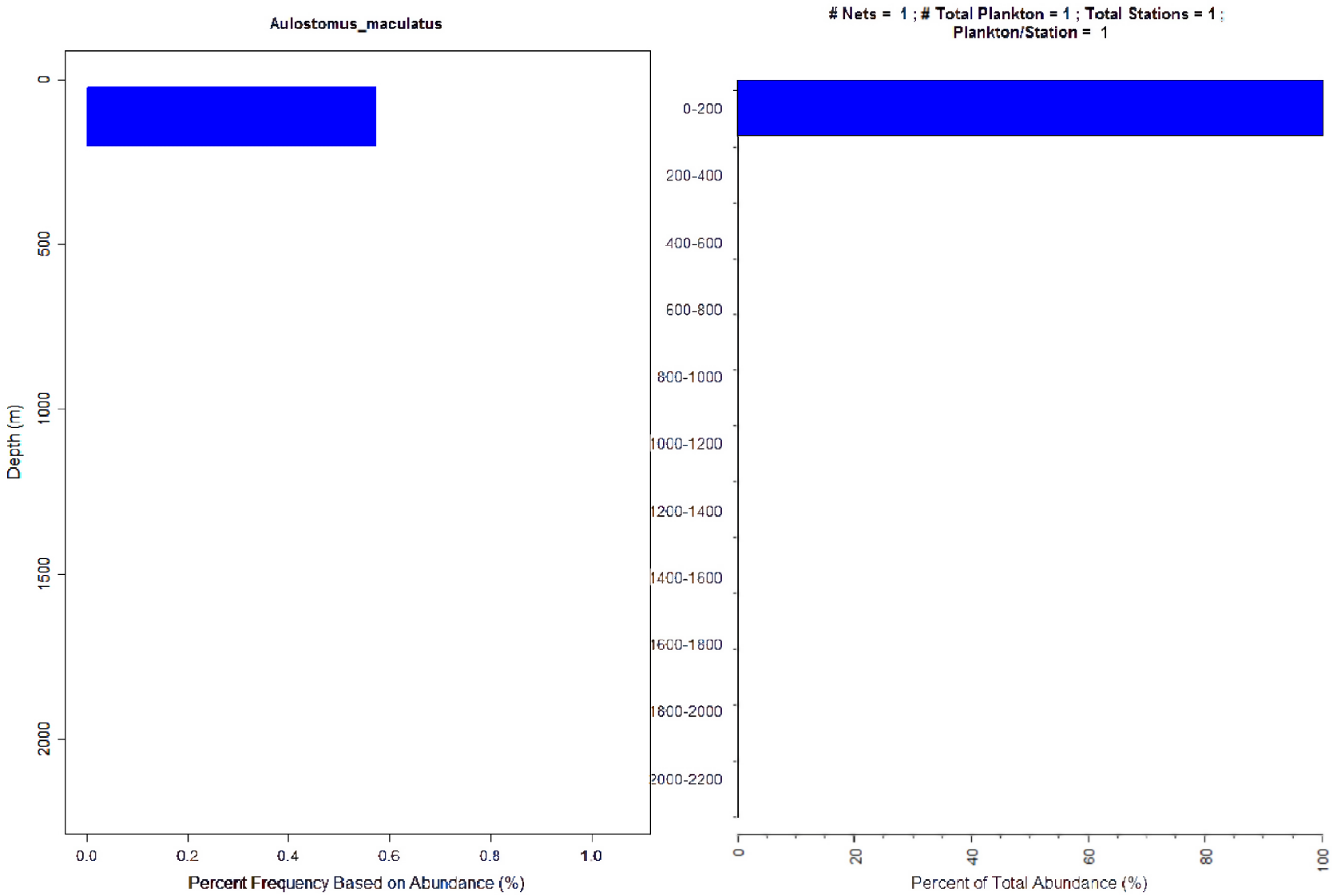
Astronesthidae - Deep



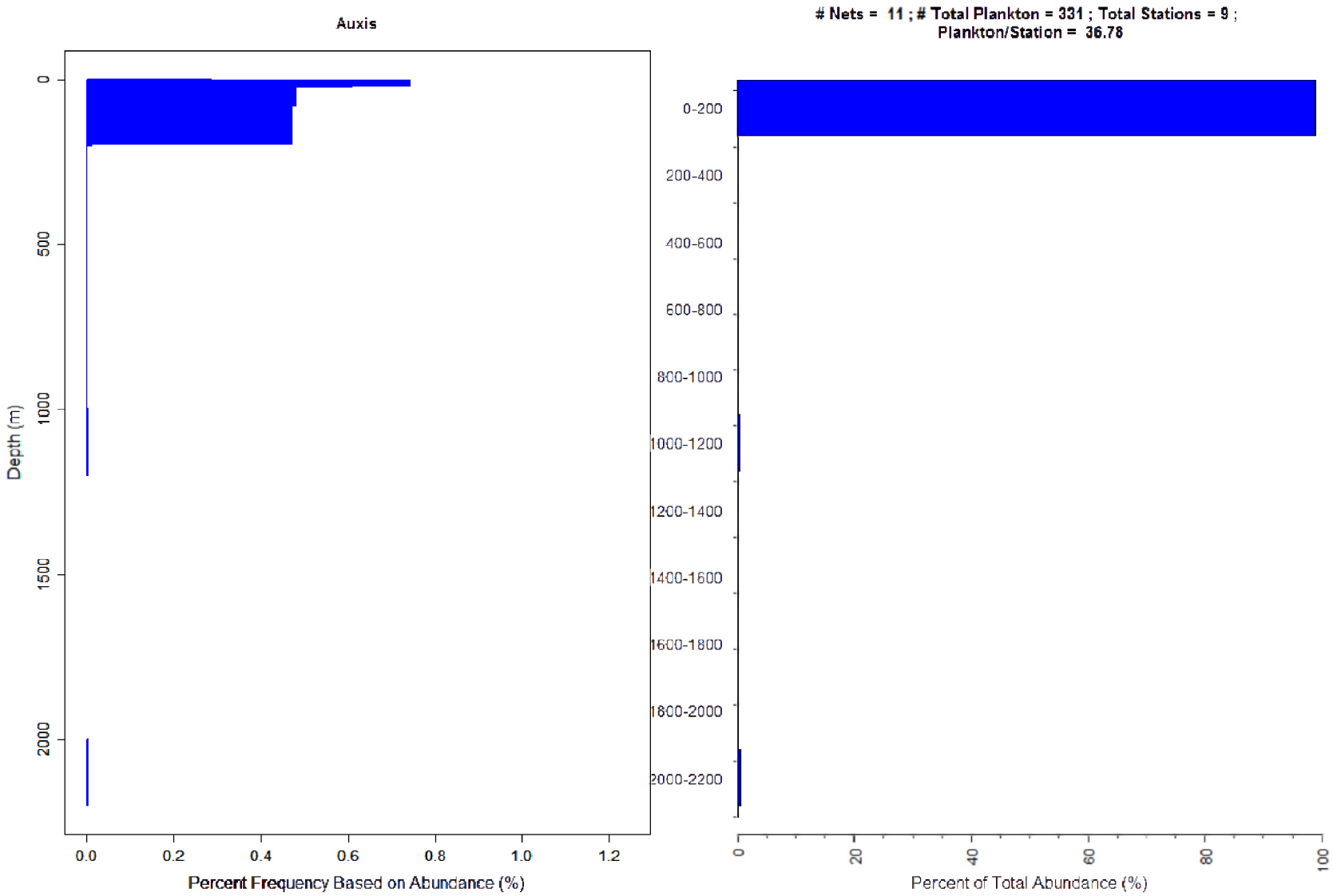
Atherinidae - Deep



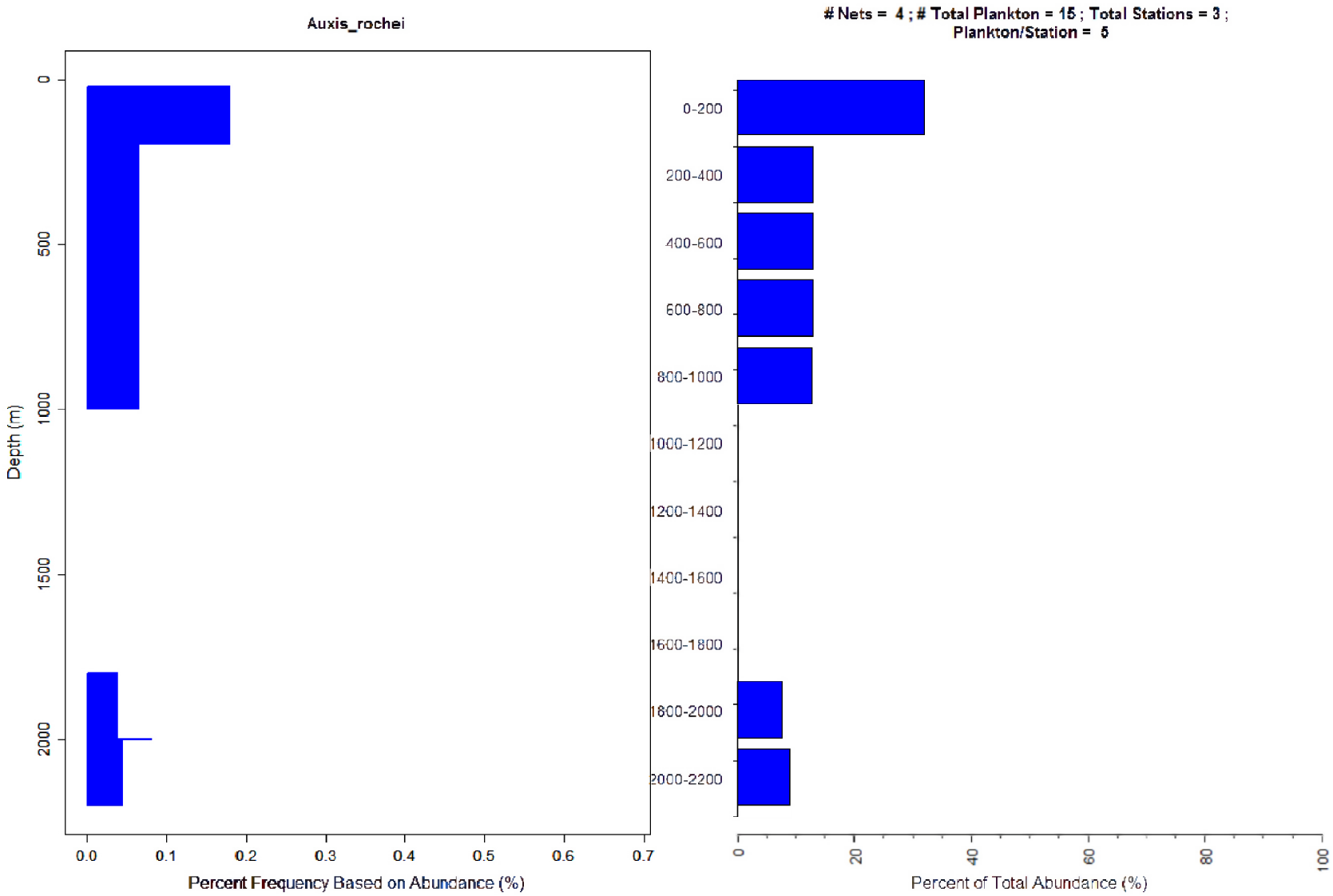
Aulopiformes - Deep



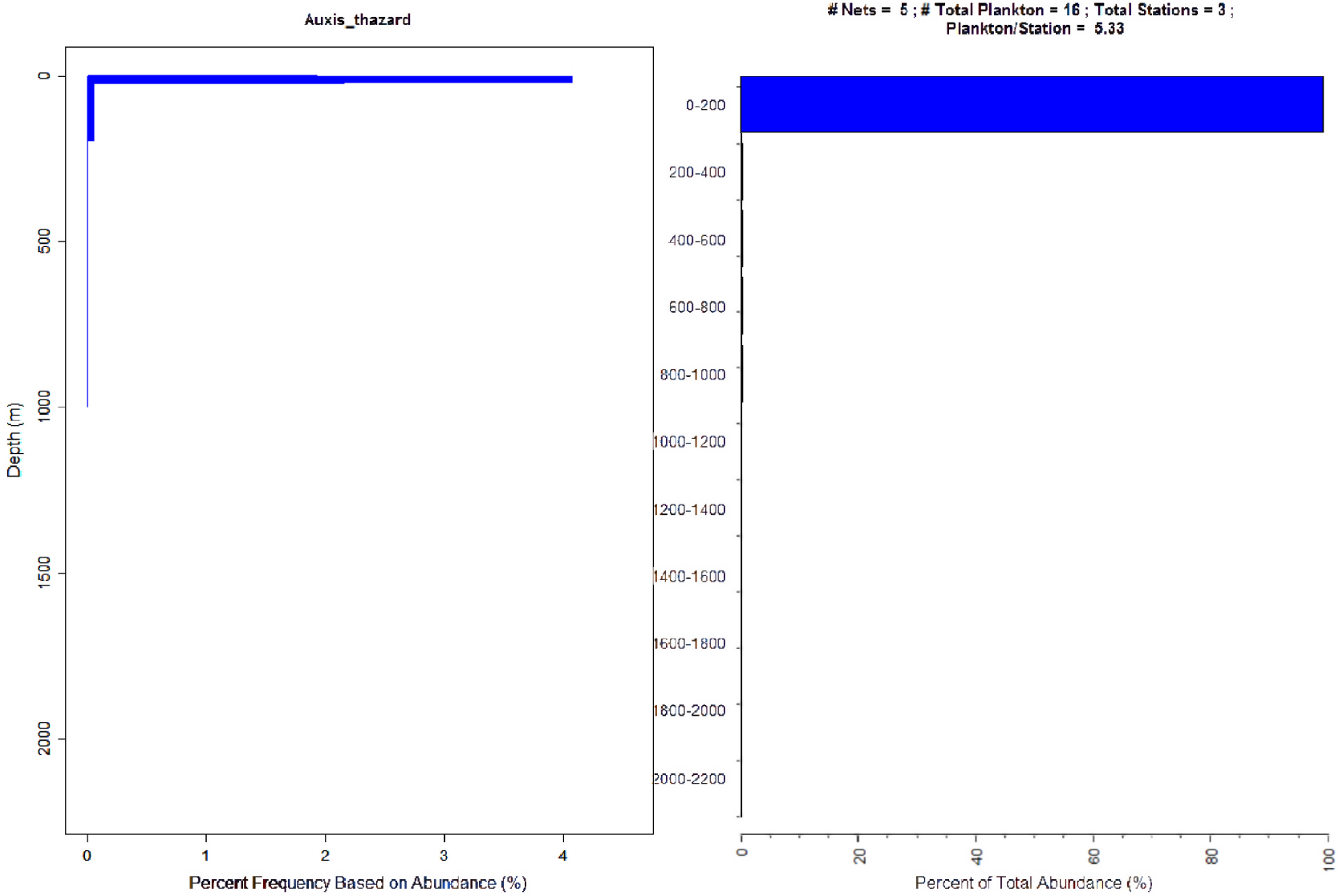
Aulostomus_maculatus - Deep


Auxis
Nets = 11 ; # Total Plankton = 331 ; Total Stations = 9 ;
Plankton/Station = 36.78
Depth (m)
0
500
1000
1500
2000
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

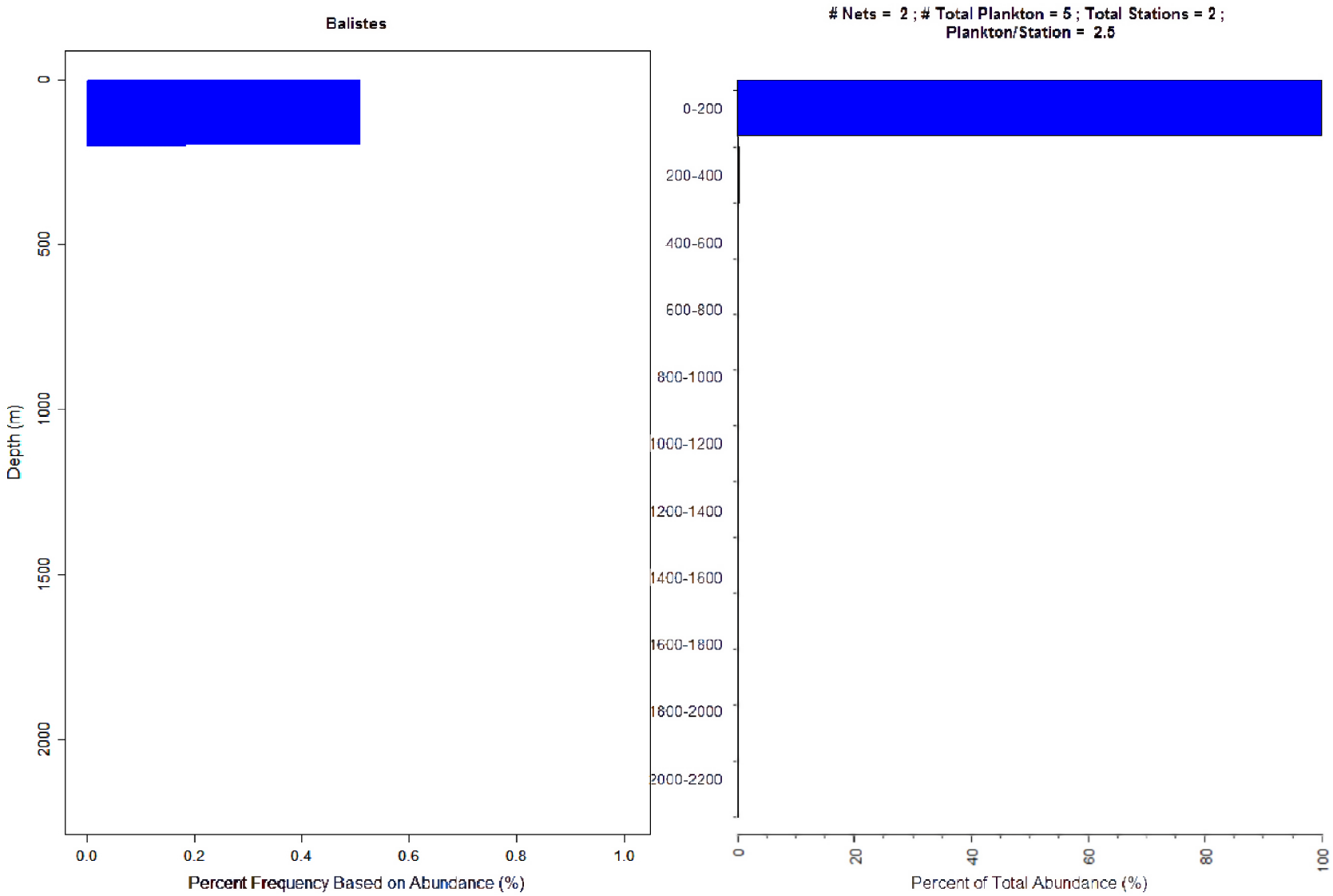
Auxis - Deep



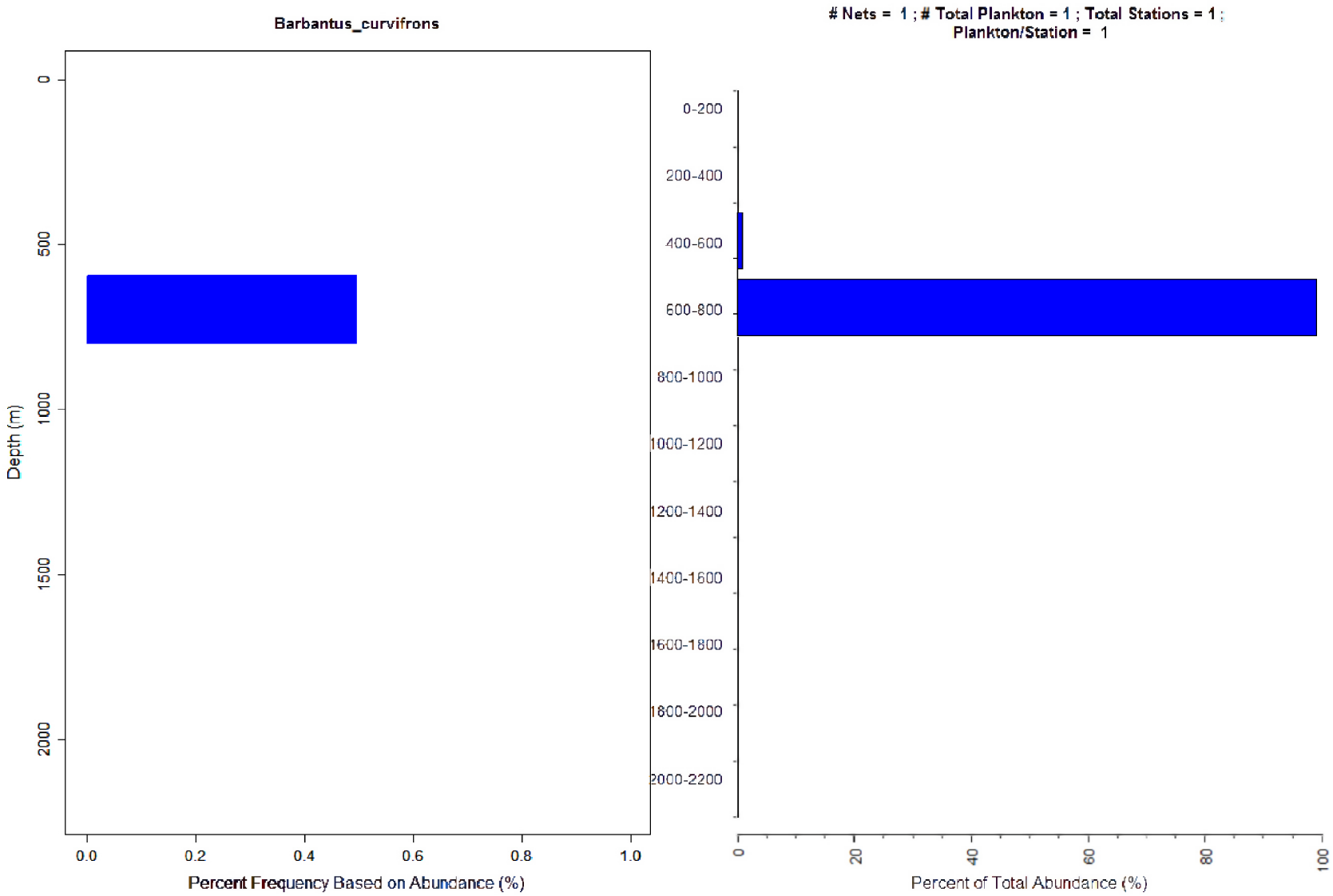
Auxis_rochei - Deep



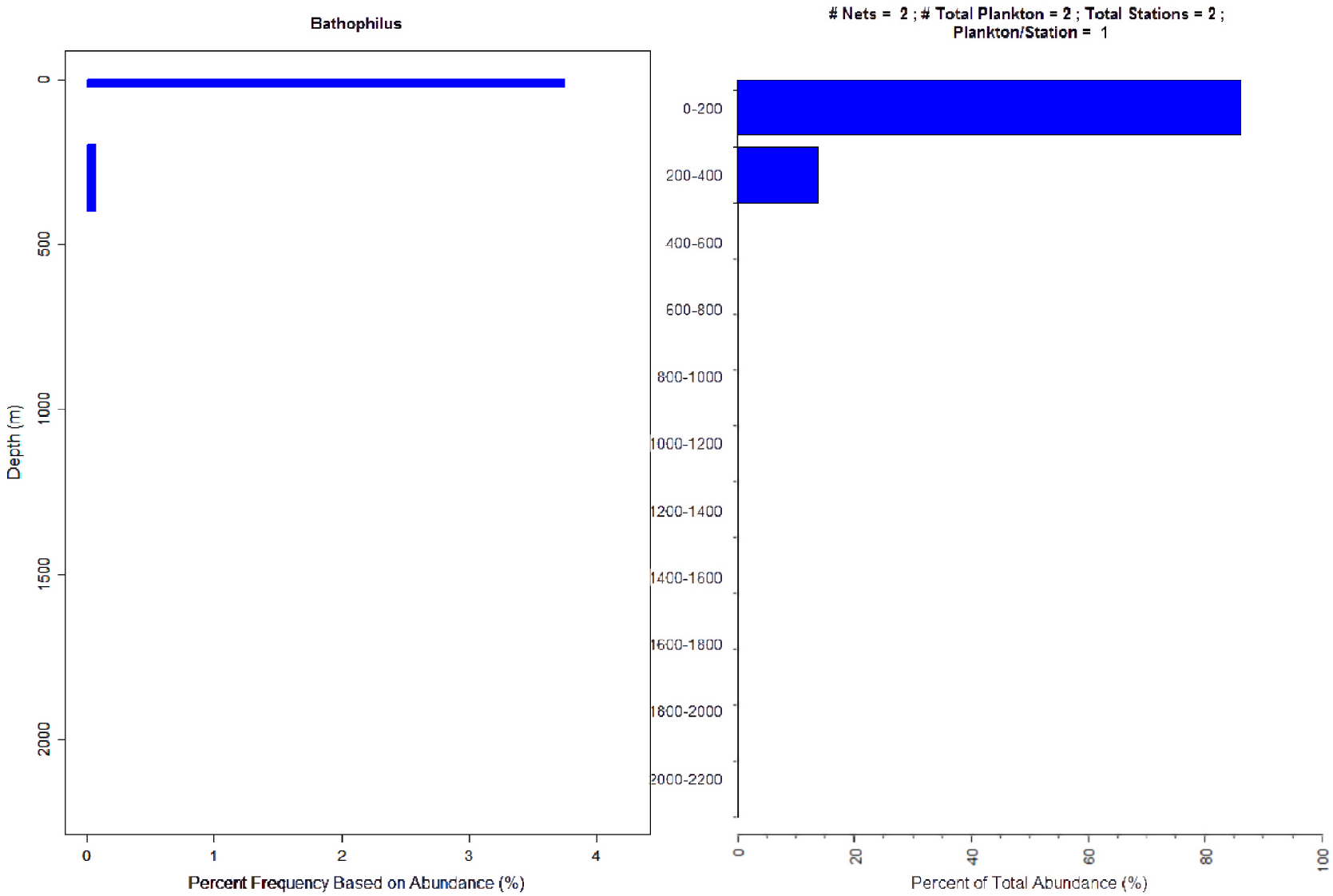
Auxis_thazard - Deep



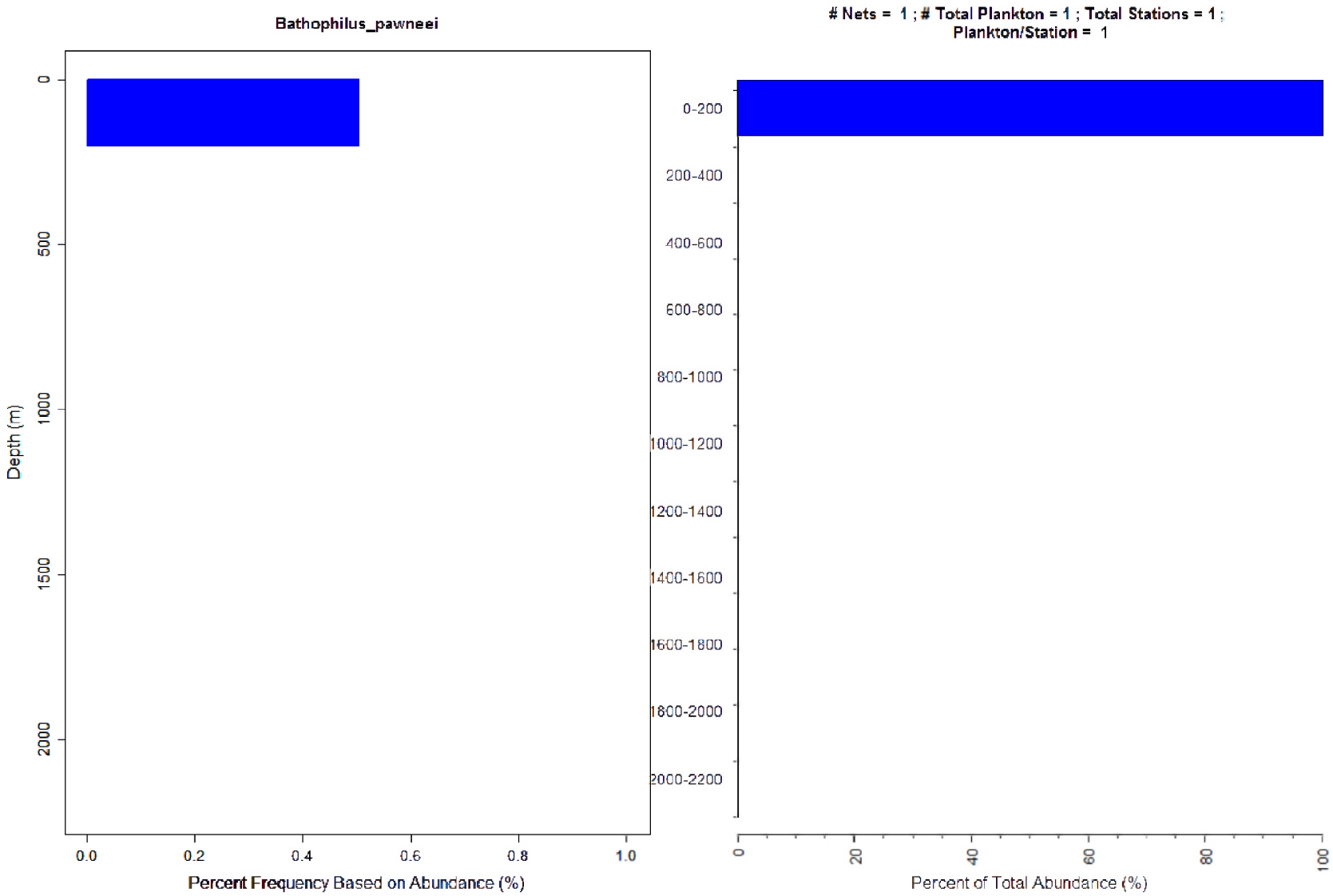
Balistes - Deep



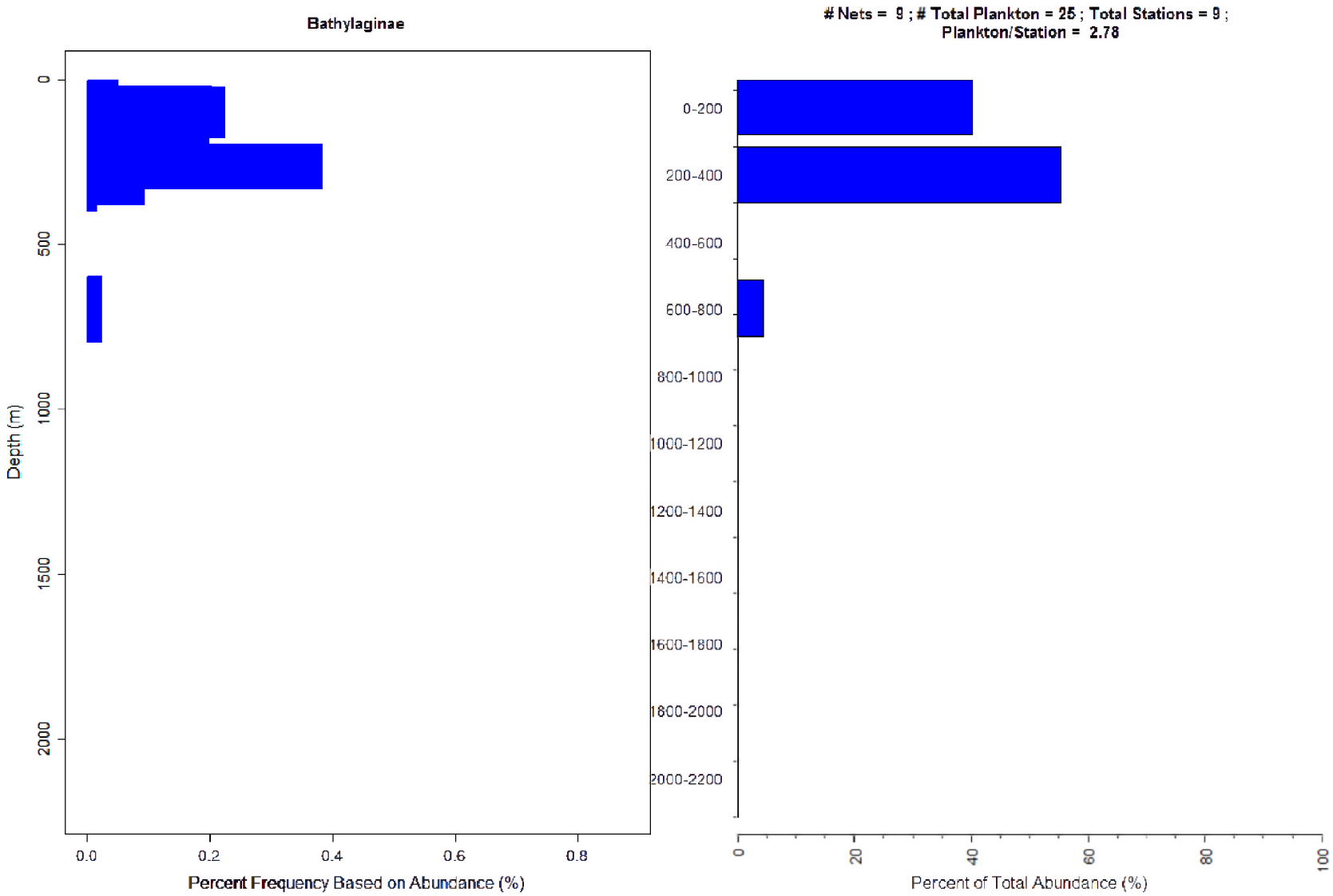
Barbantus_curvifrons - Deep



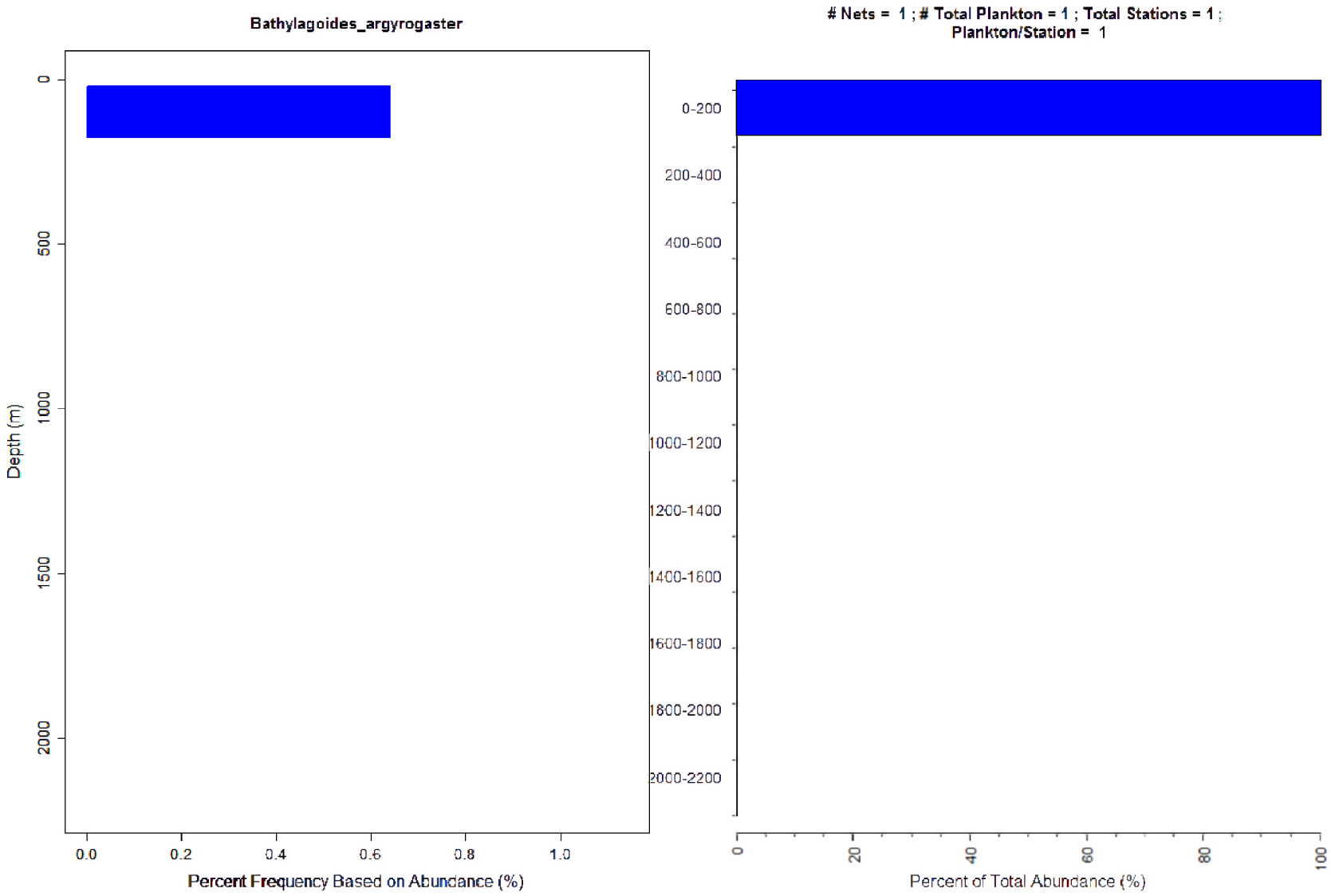
Bathophilus - Deep



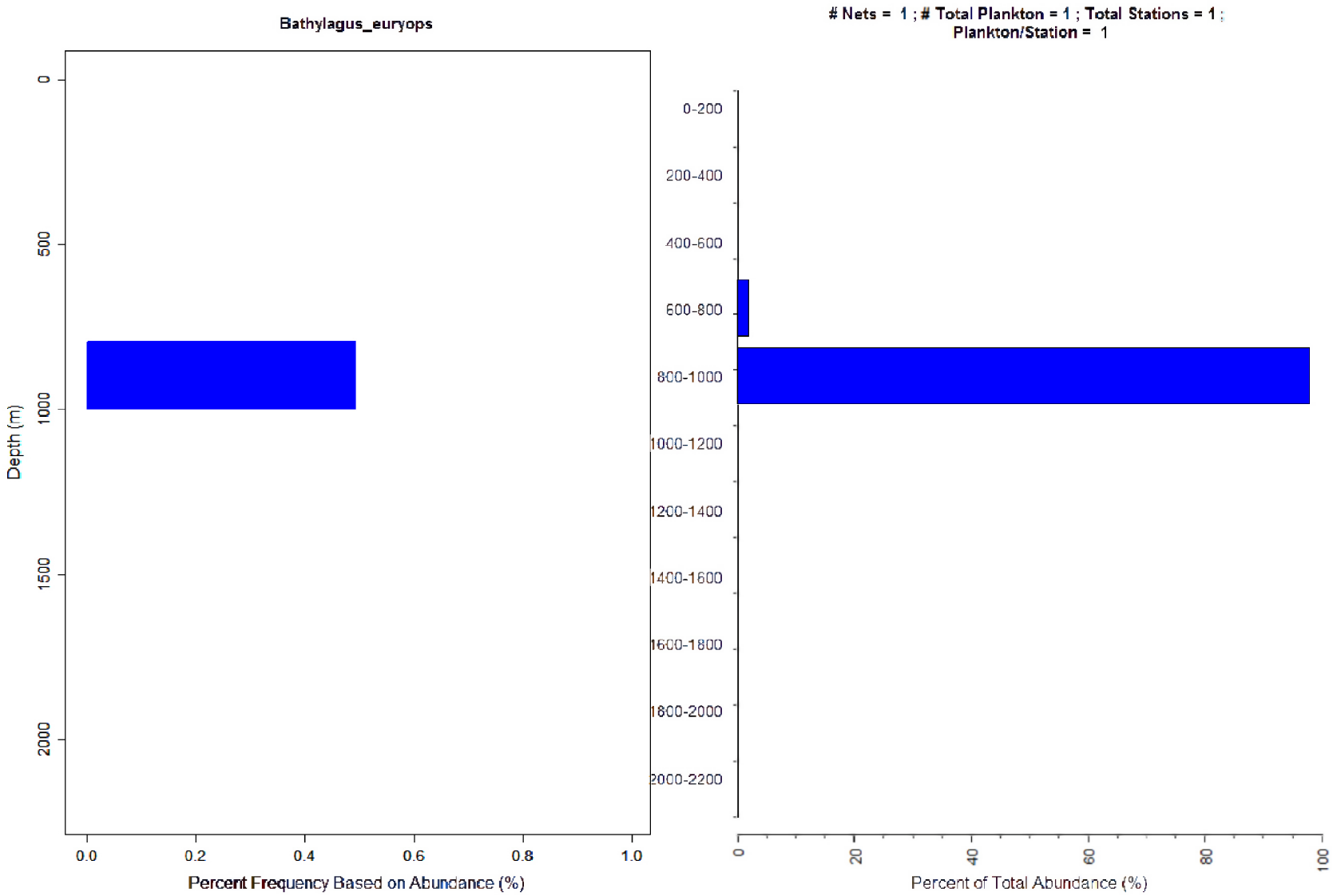
Bathophilus_pawneei - Deep



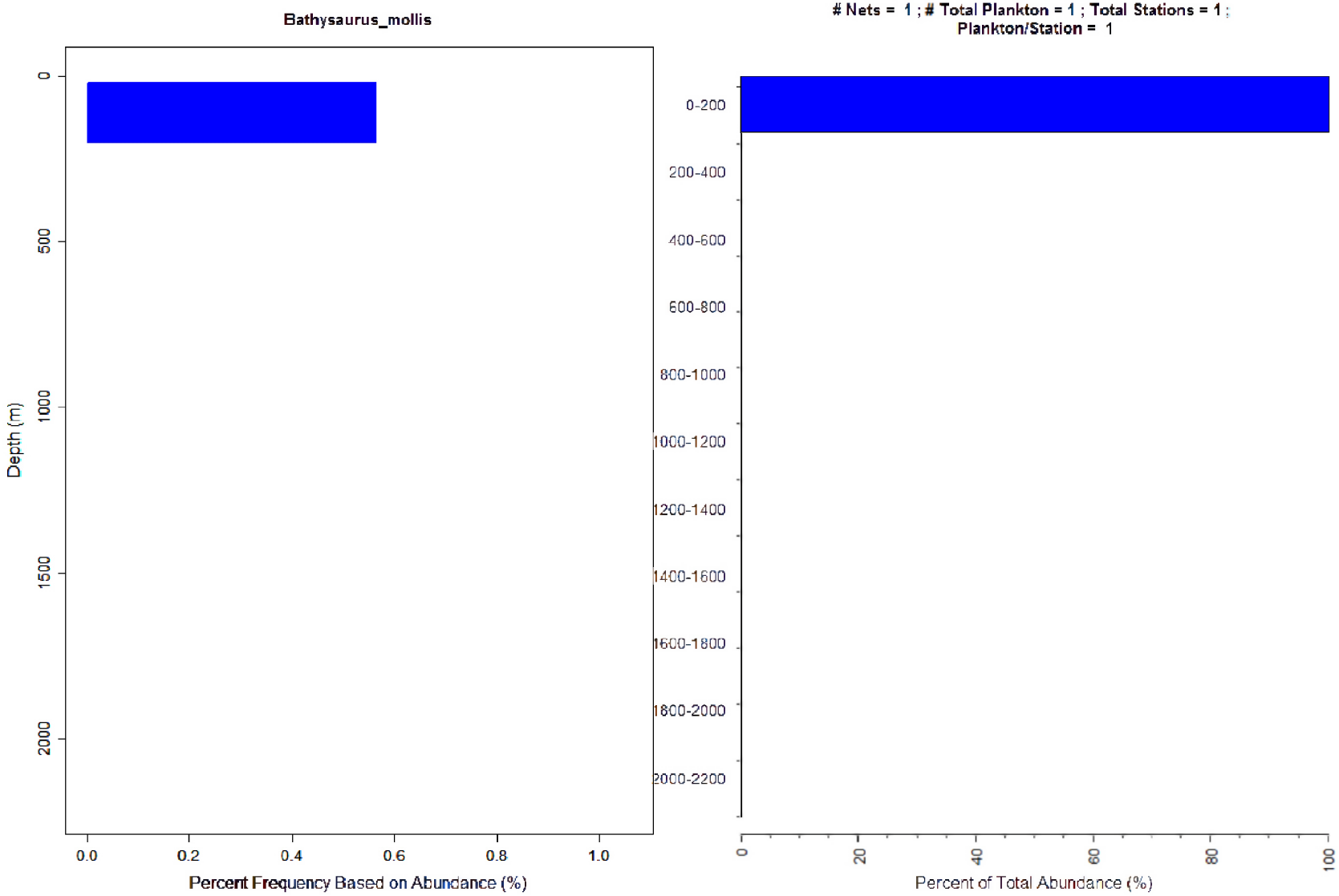
Bathylaginae - Deep



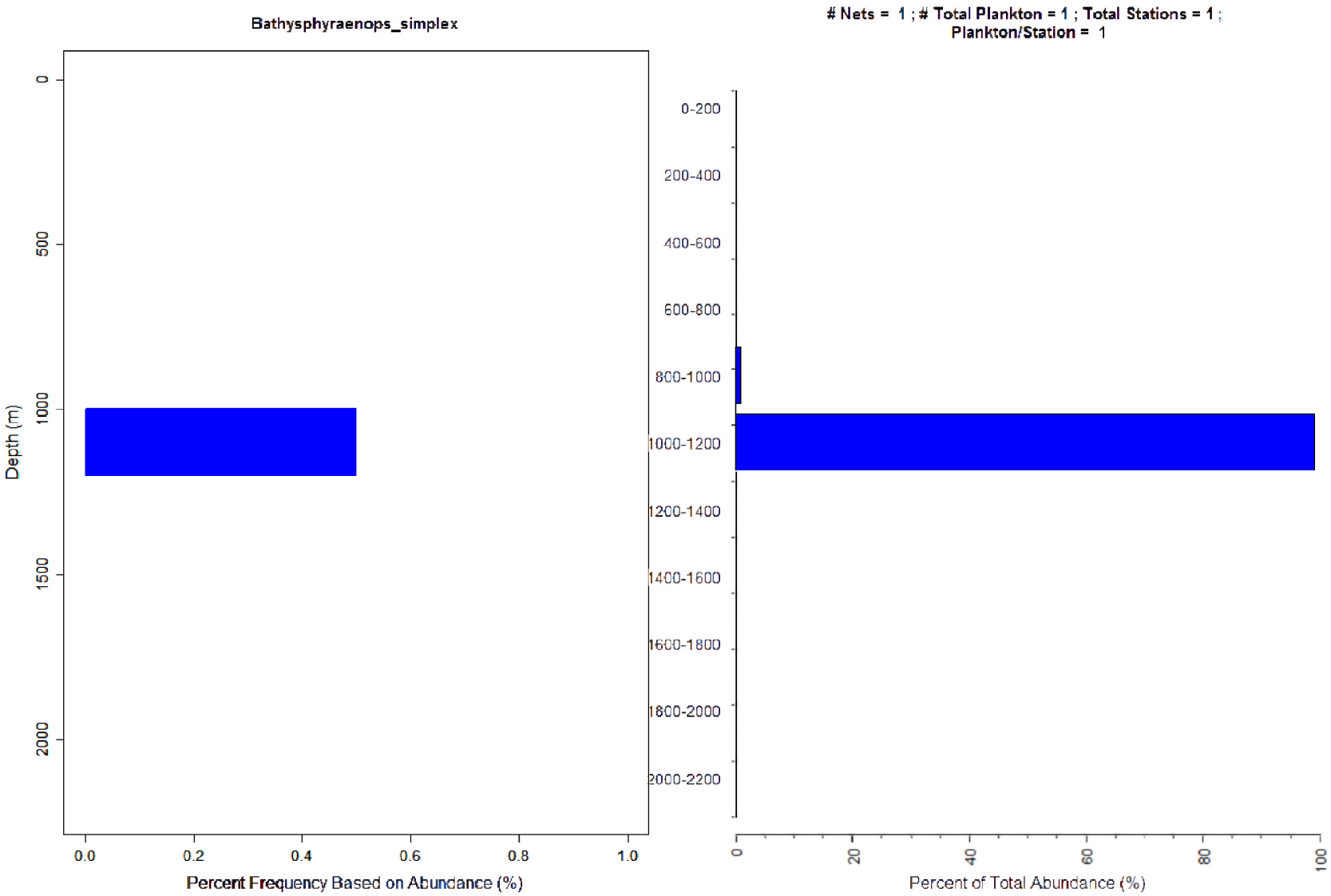
Bathylagoides_argyrogaster - Deep



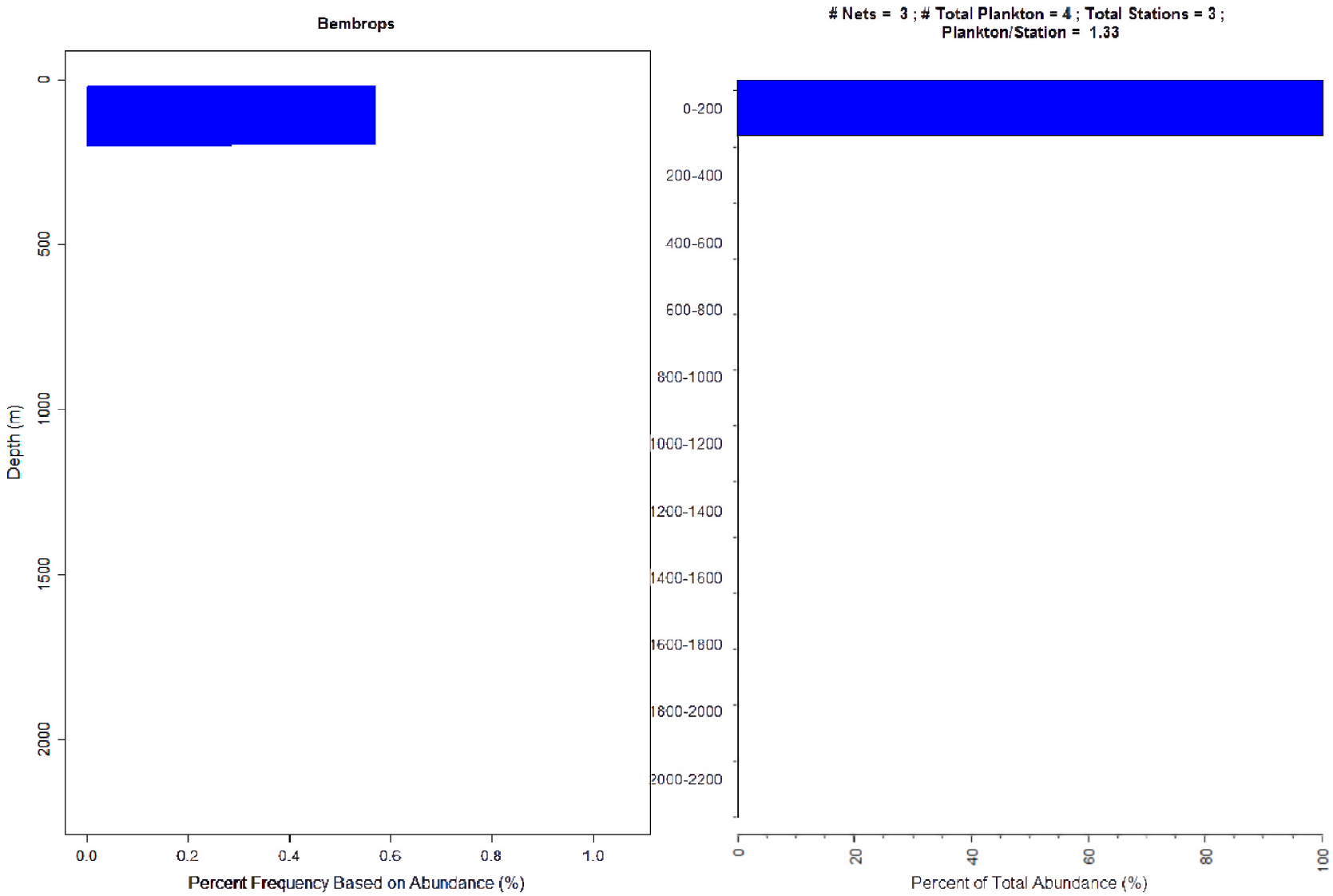
Bathylagus_euryops - Deep



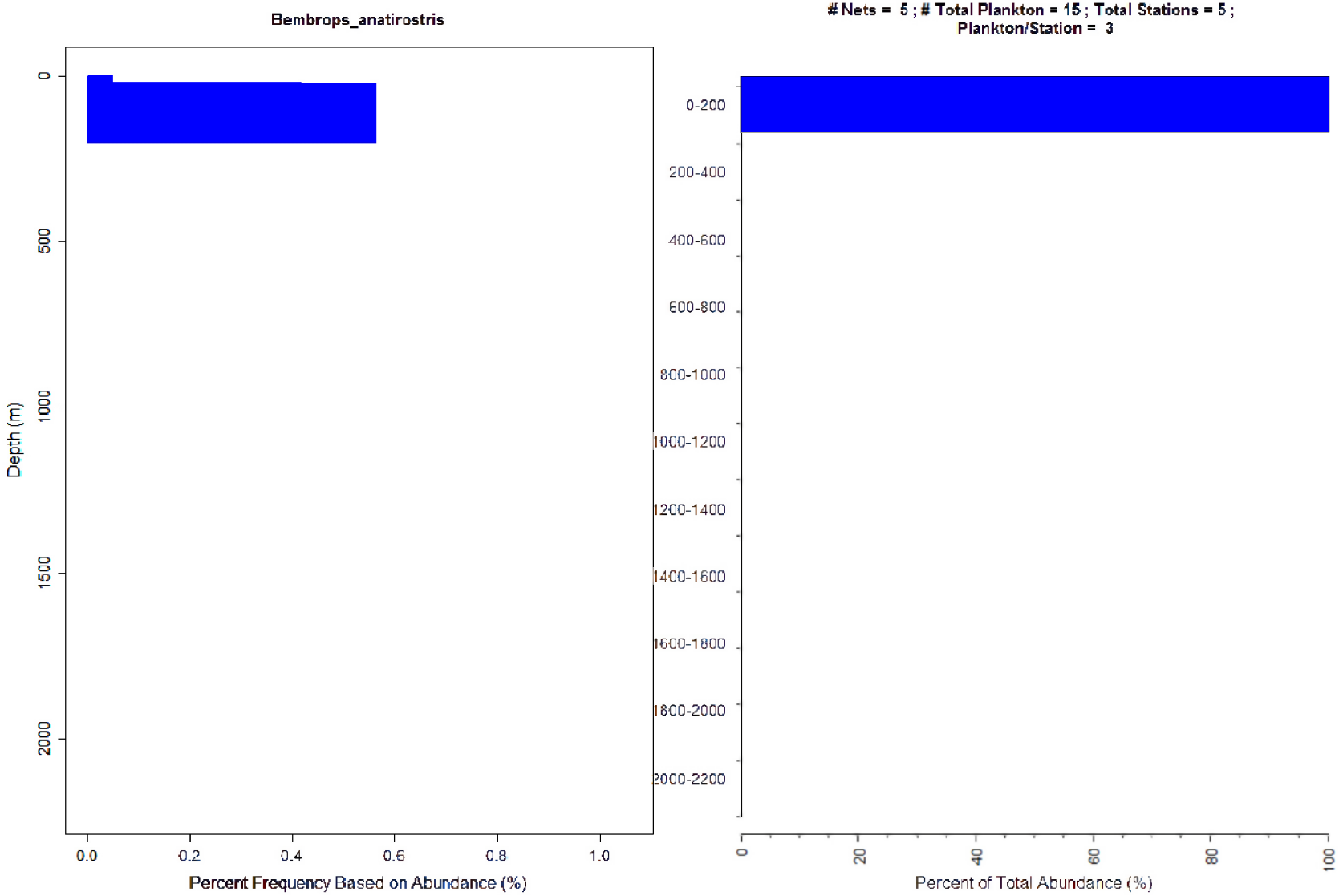
Bathysaurus_mollis - Deep



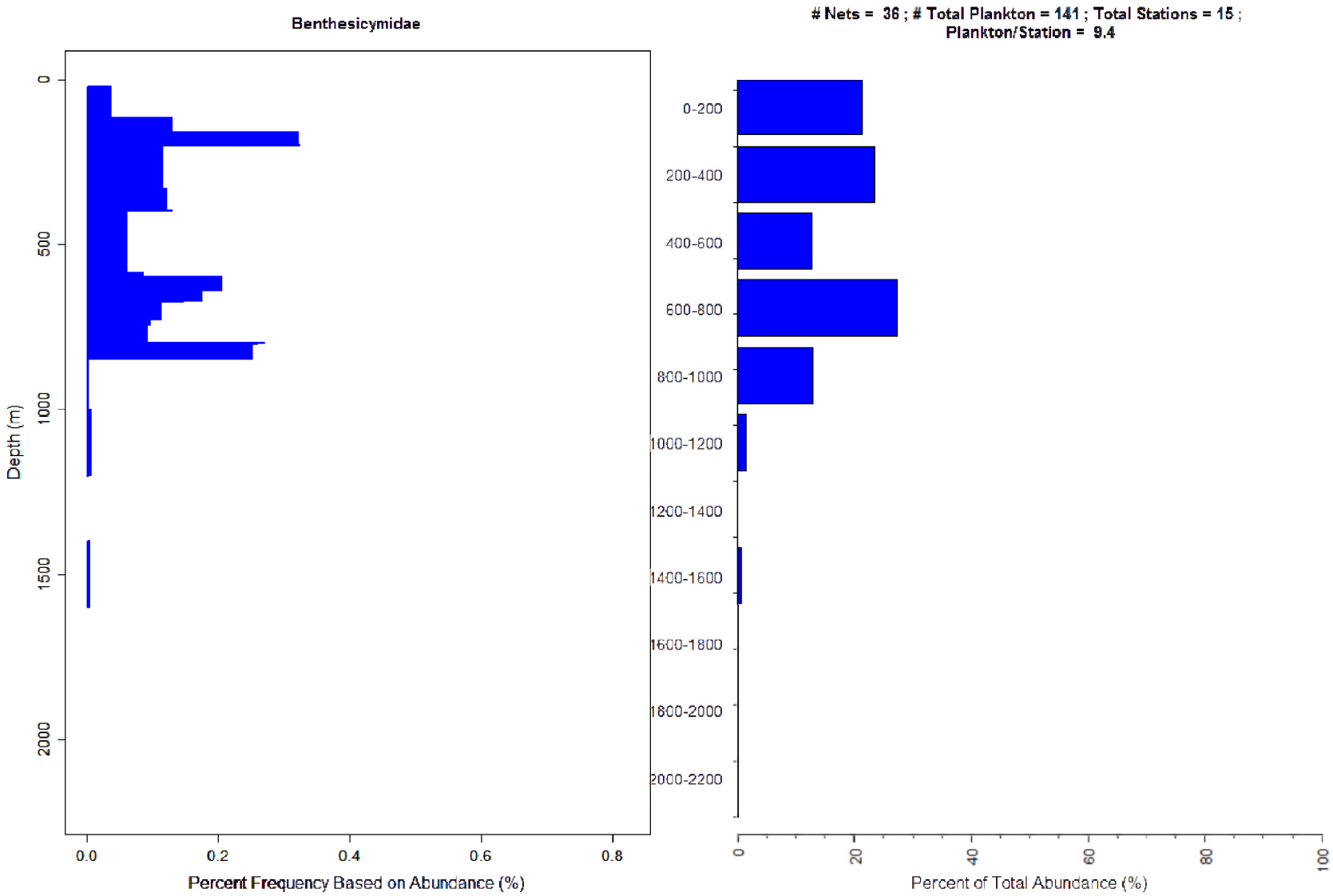
Bathysphyraenops_simplex - Deep



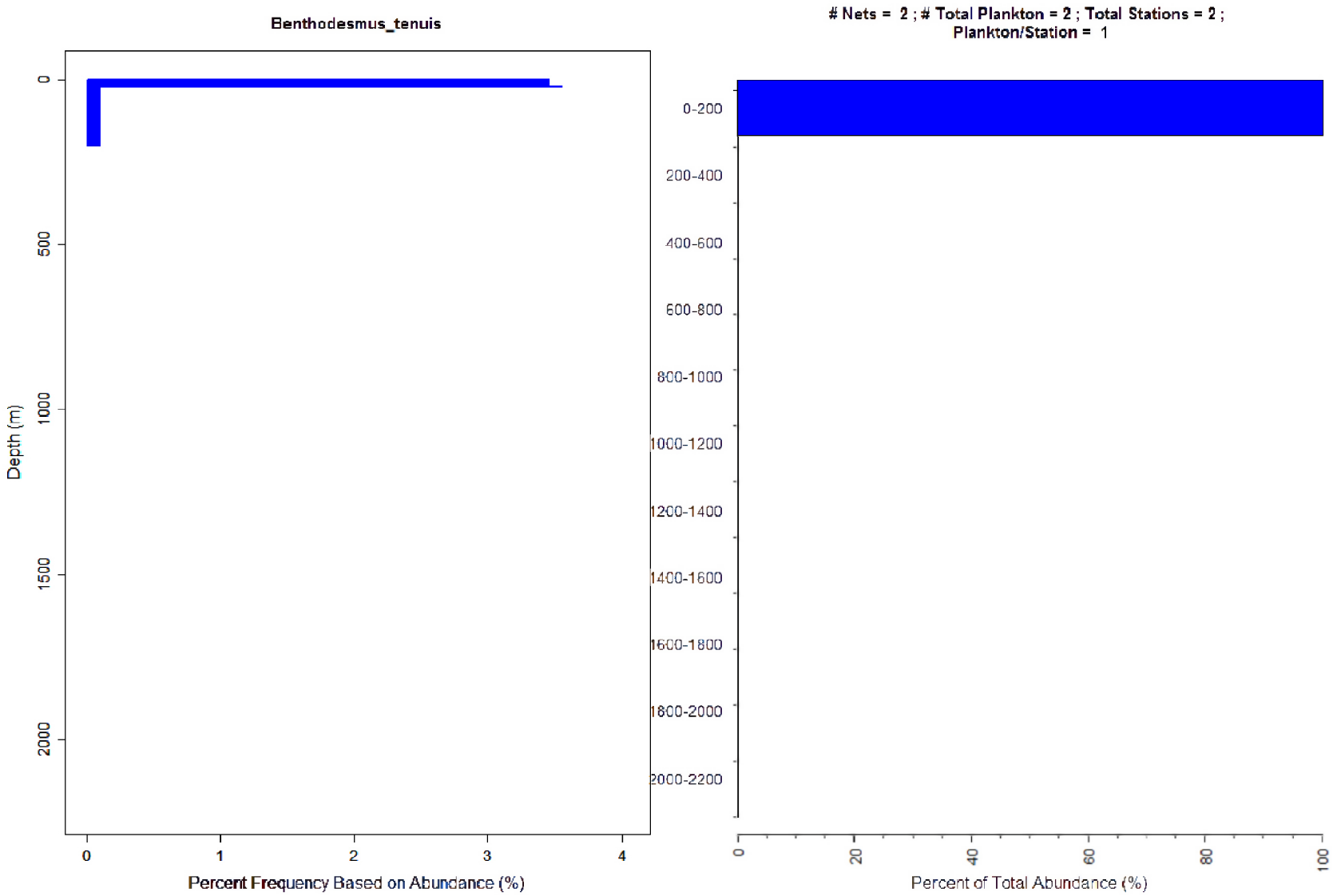
Bembrops - Deep



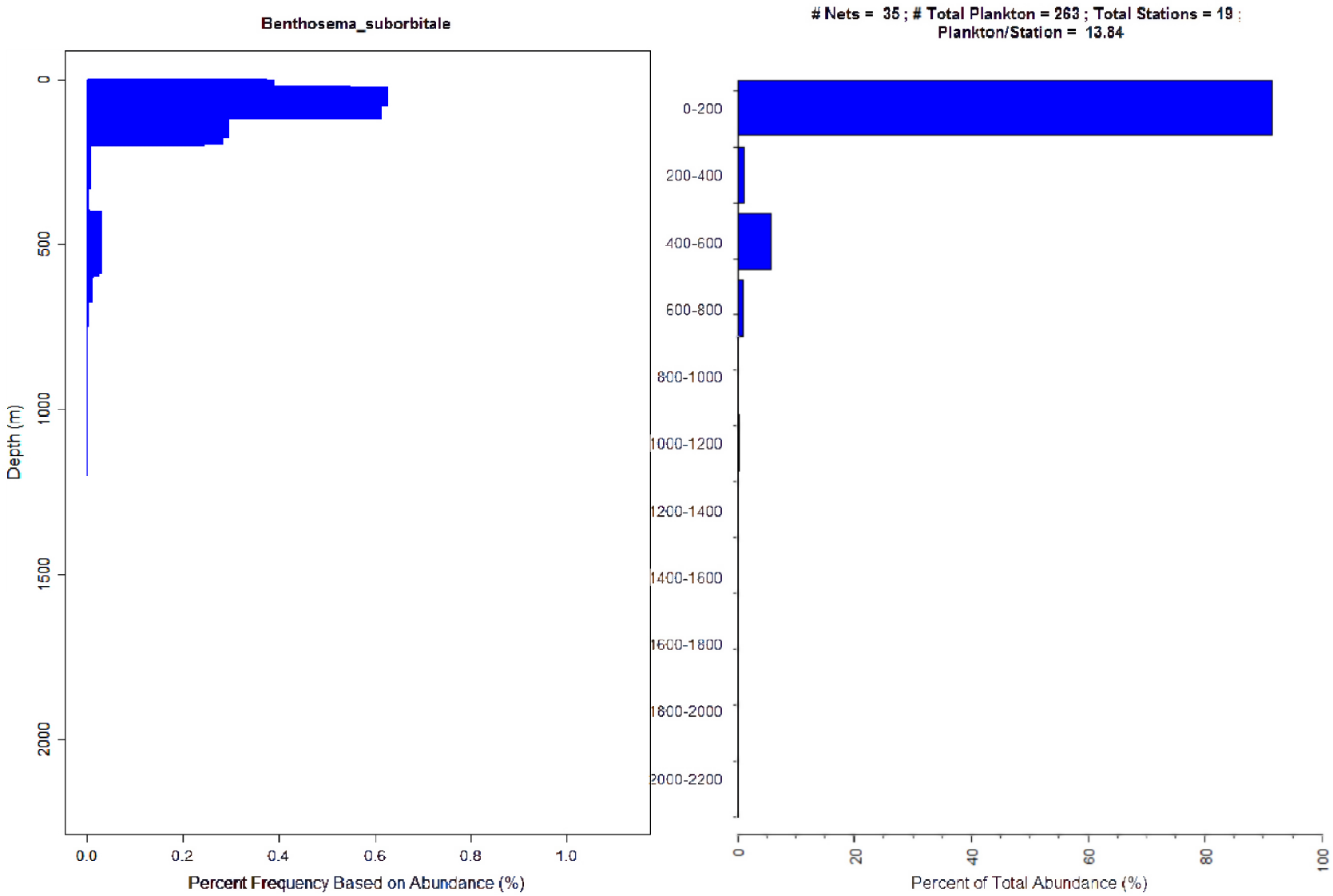
Bembrops_anatirostris - Deep



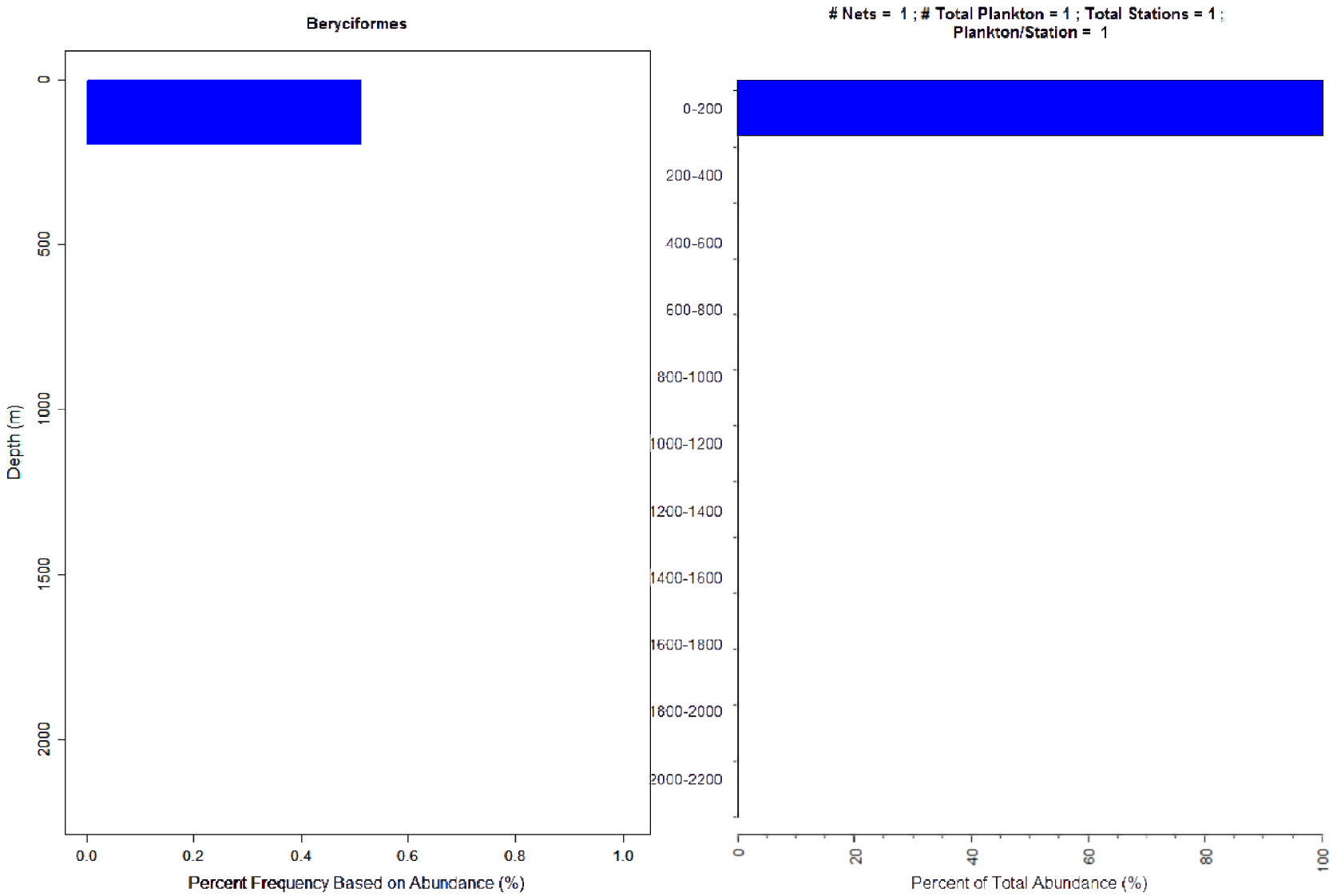
Benthesicymidae - Deep



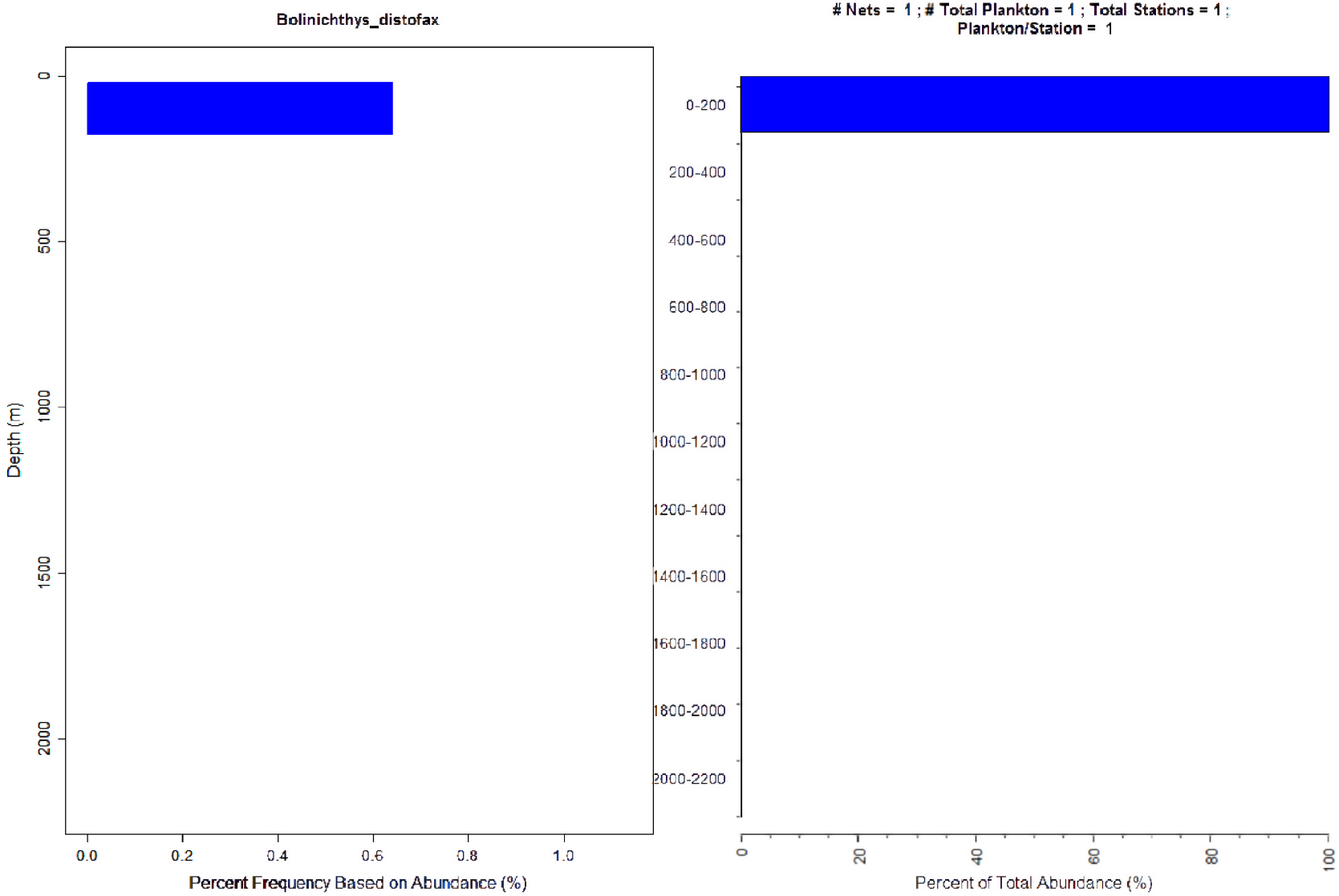
Benthodesmus_tenuis - Deep



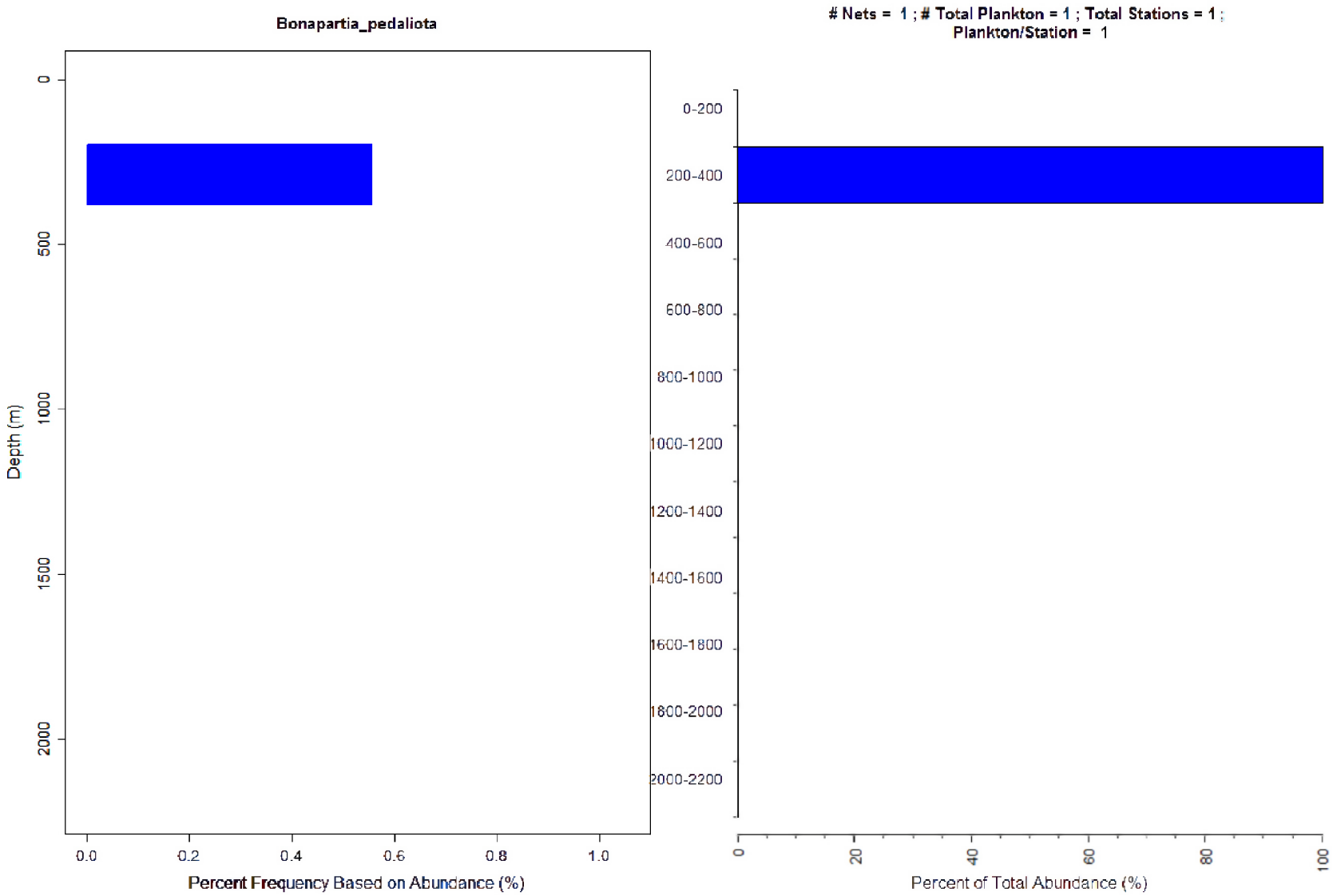
Benthosema_suborbitale - Deep



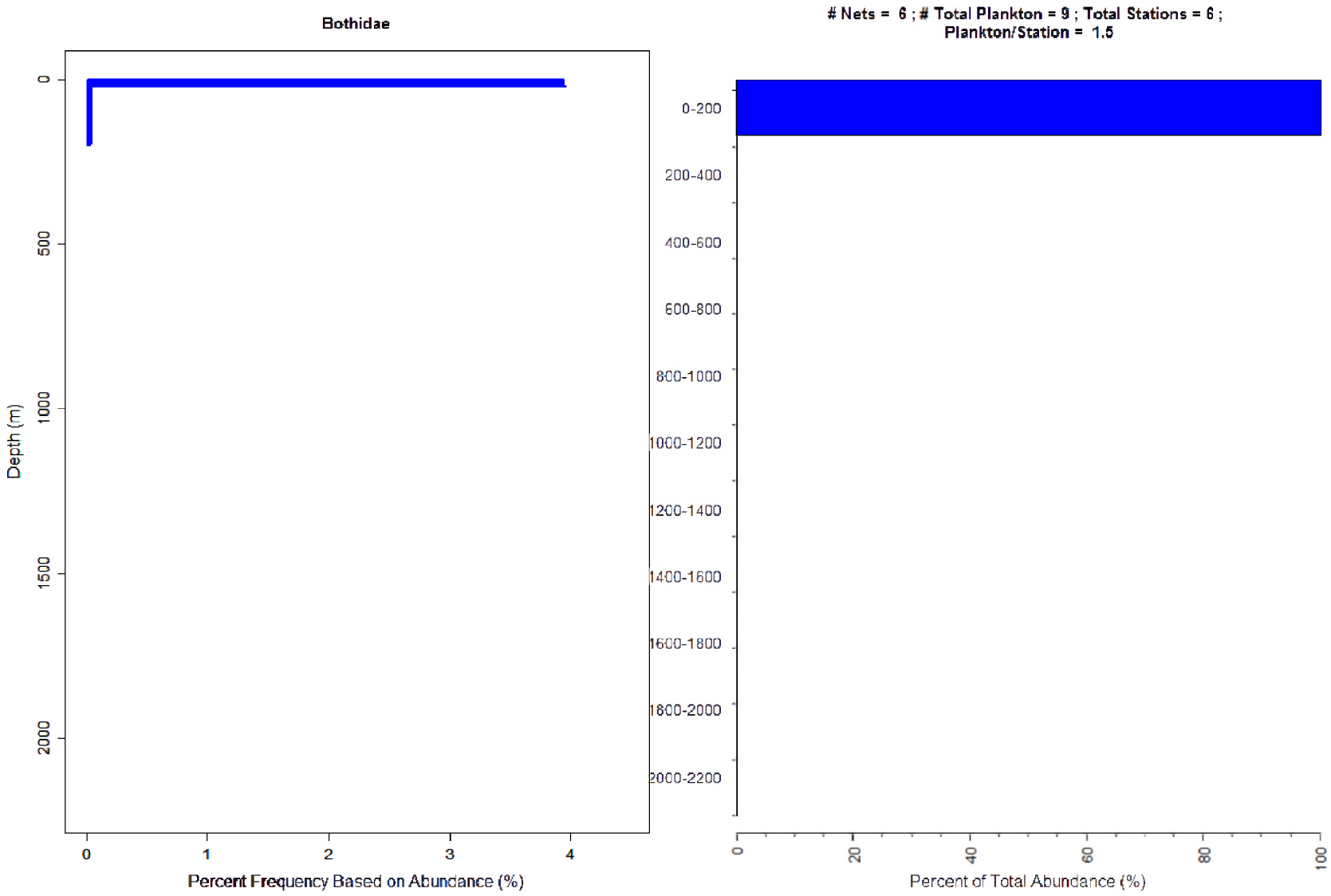
Beryciformes - Deep



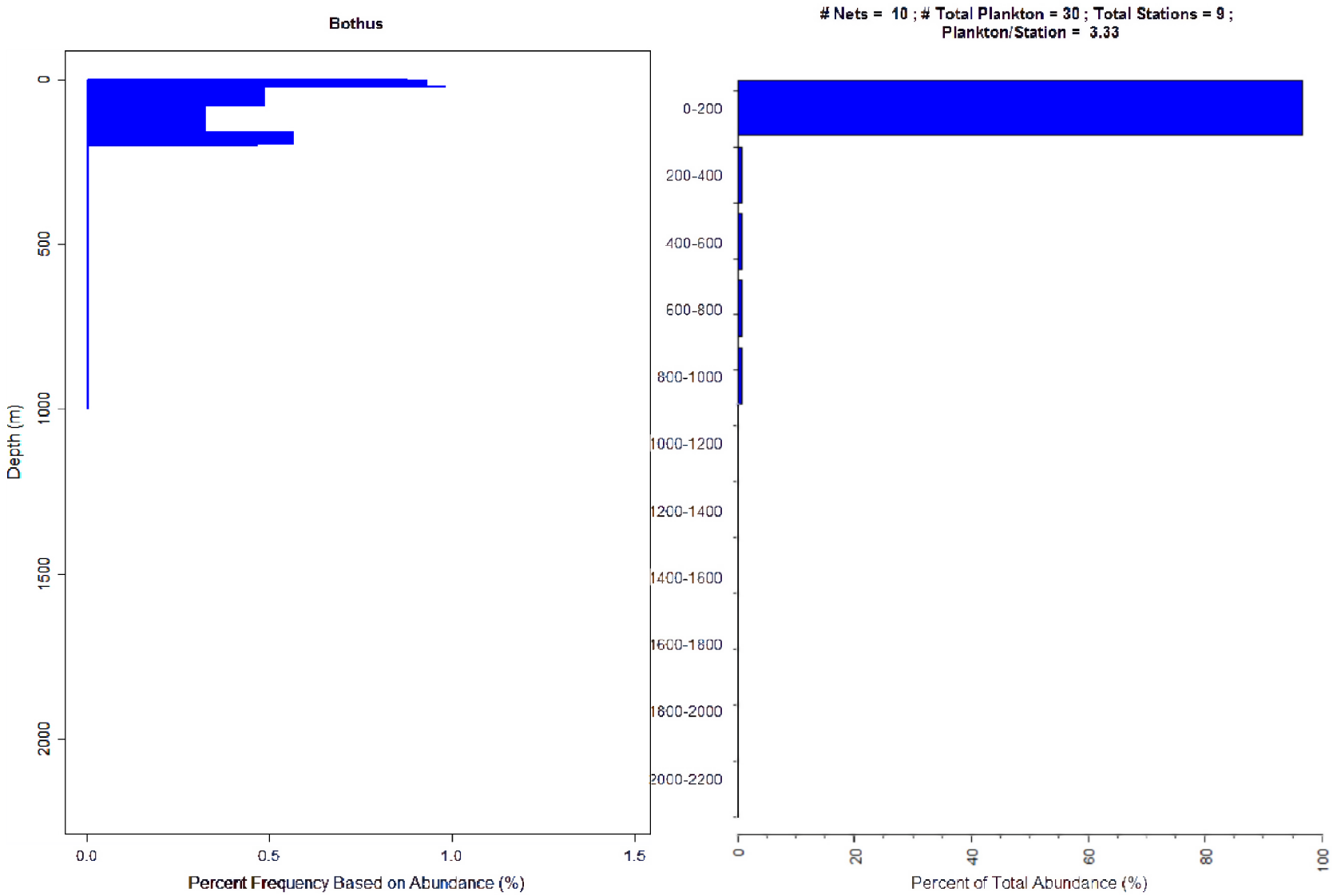
Bolinichthys_distofax - Deep



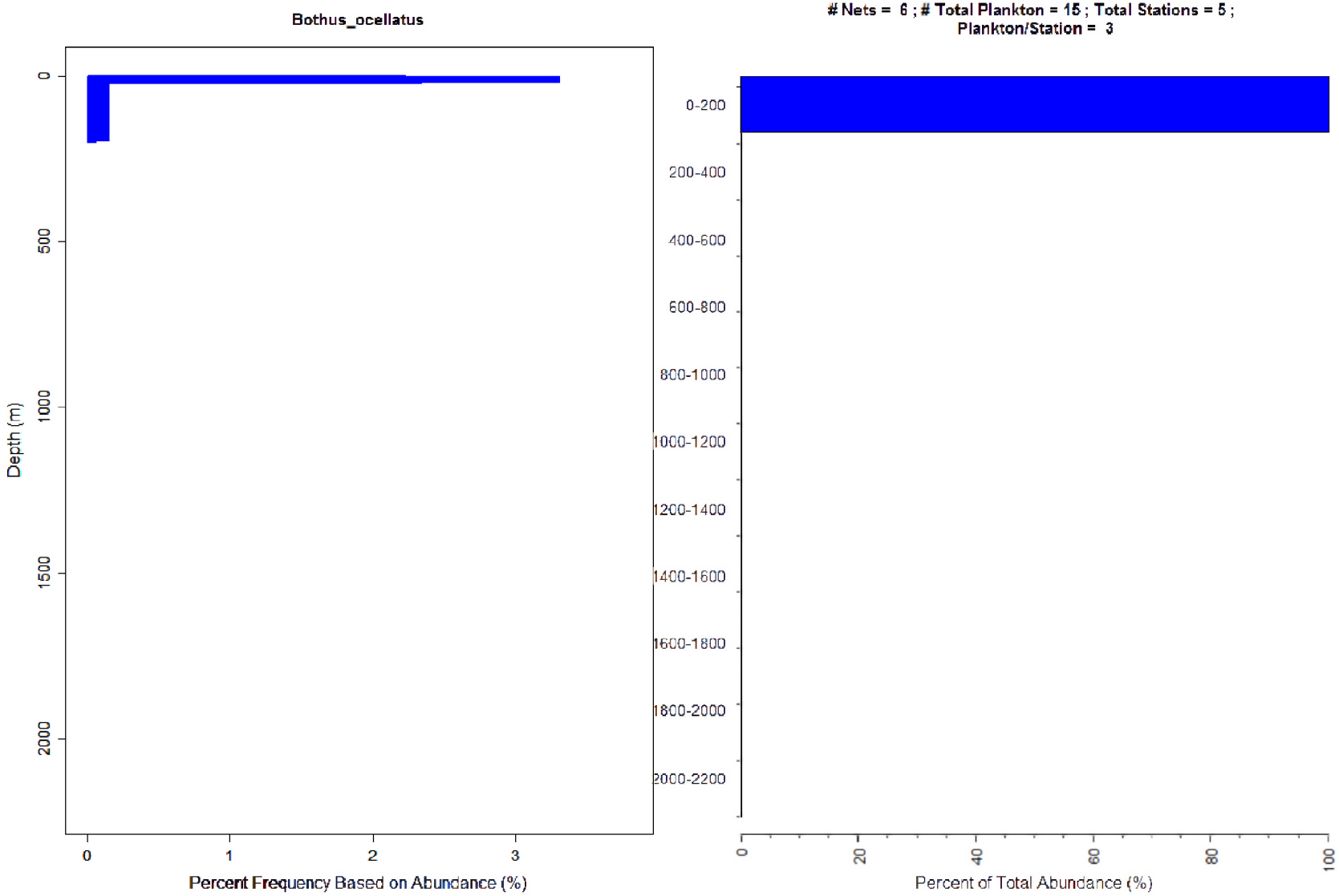
Bonapartia_pedaliota - Deep



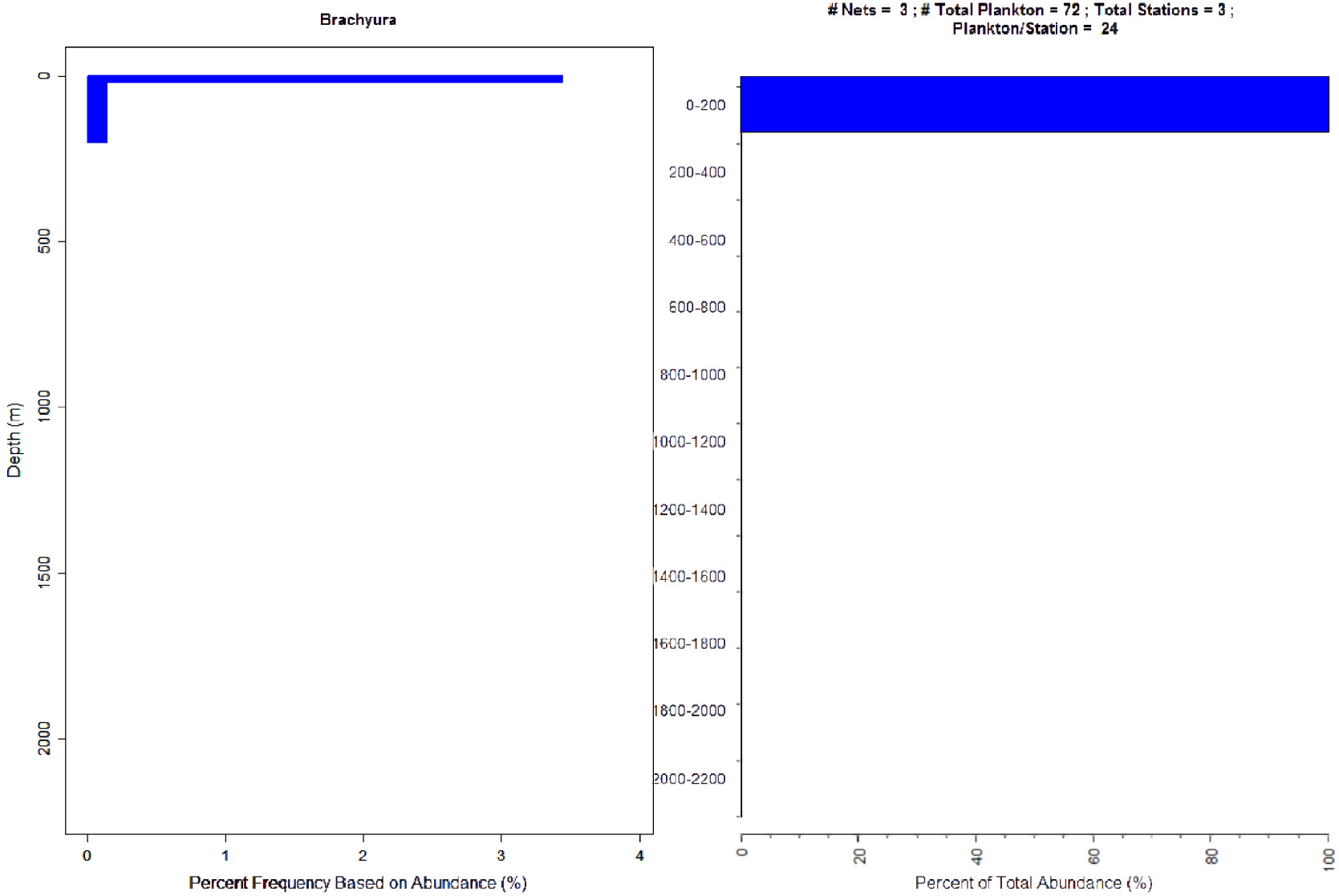
Bothidae - Deep


Bothus
Nets = 10 ; # Total Plankton = 30 ; Total Stations = 9 ;
Plankton/Station = 3.33
Depth (m)
0
500
1000
1500
2000
0.0
0.5
1.0
1.5
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

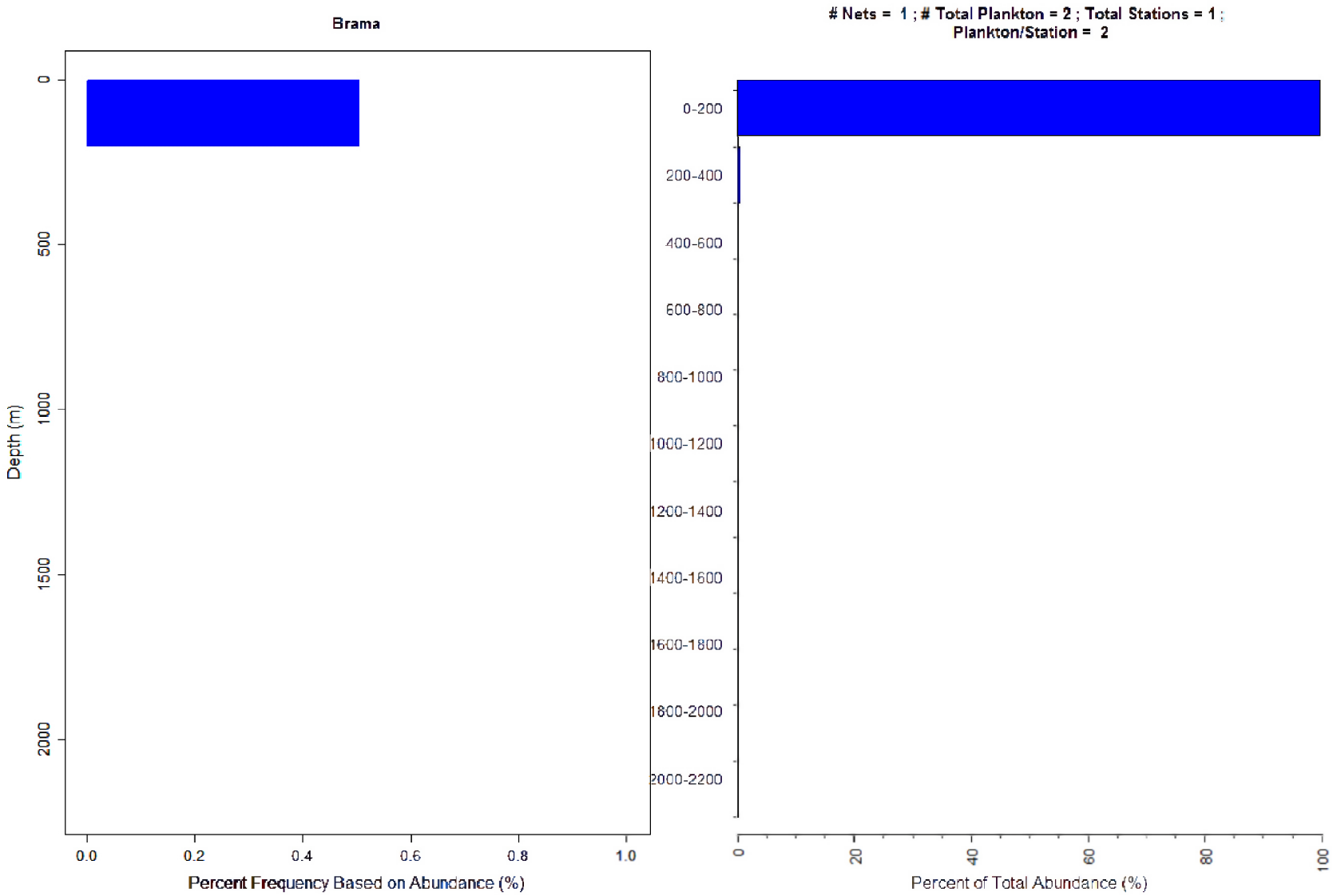
Bothus - Deep



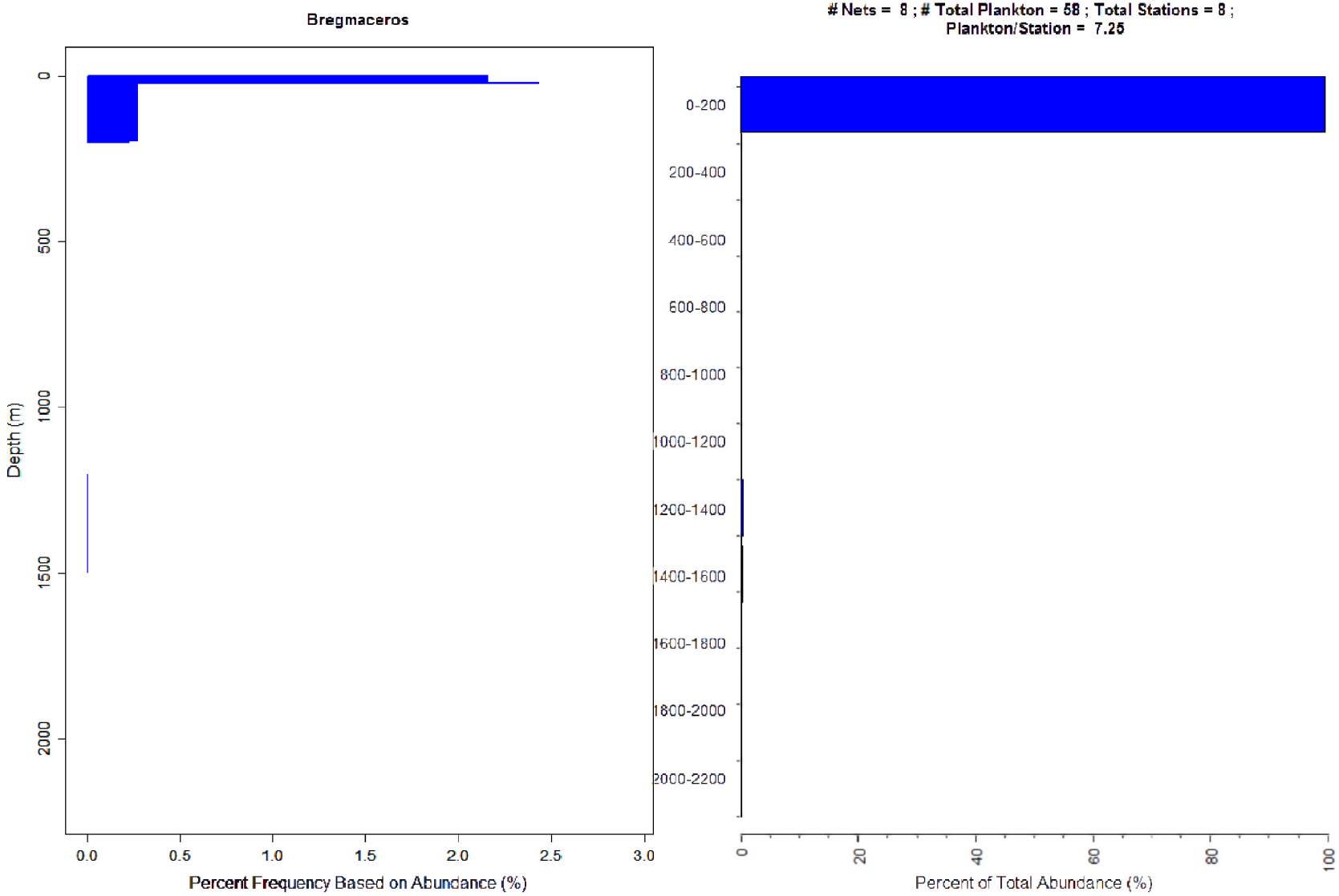
Bothus_ocellatus - Deep



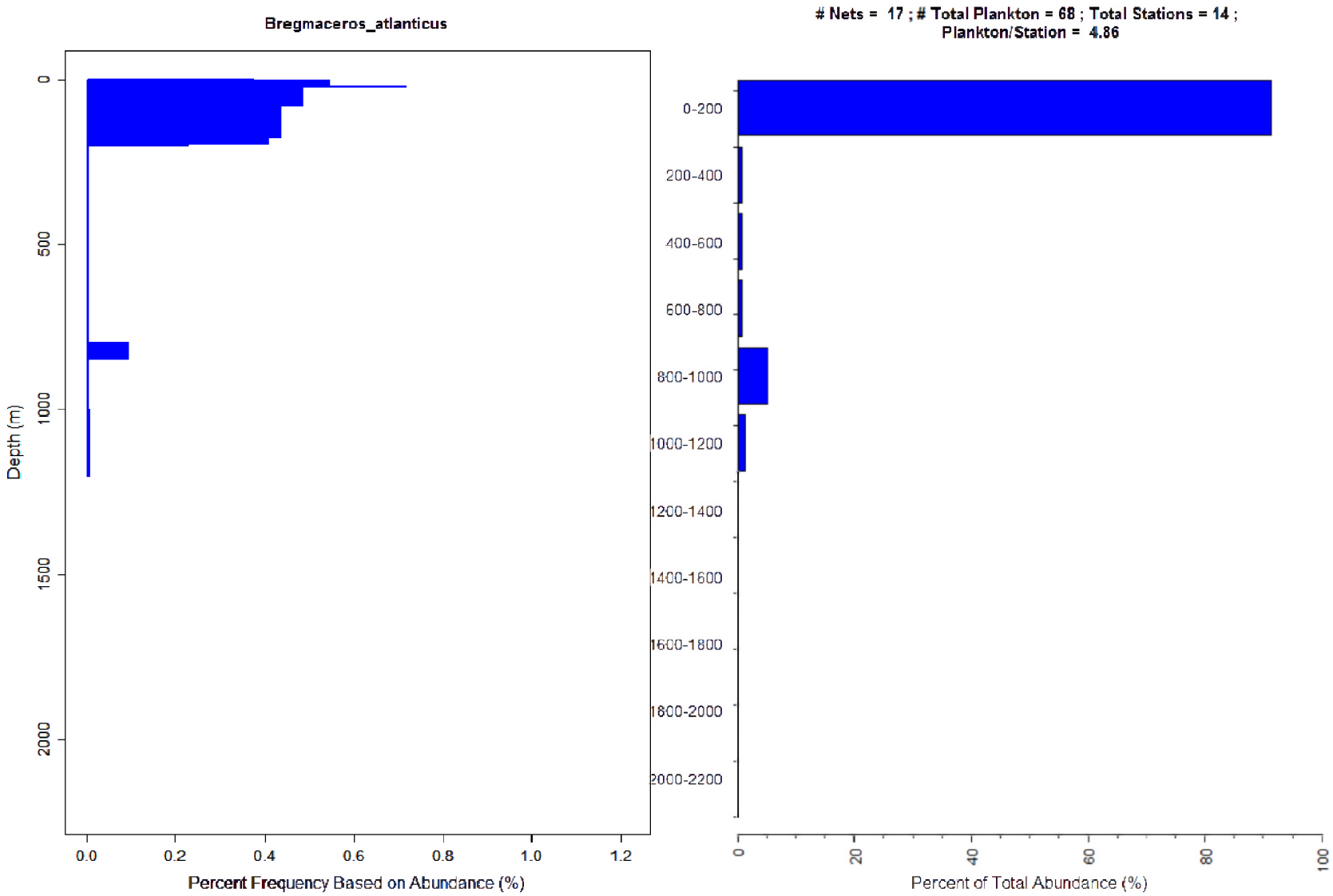
Brachyura - Deep


Brama
Nets = 1 ; # Total Plankton = 2 ; Total Stations = 1 ;
Plankton/Station = 2
Depth (m)
0
500
1000
1500
2000
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

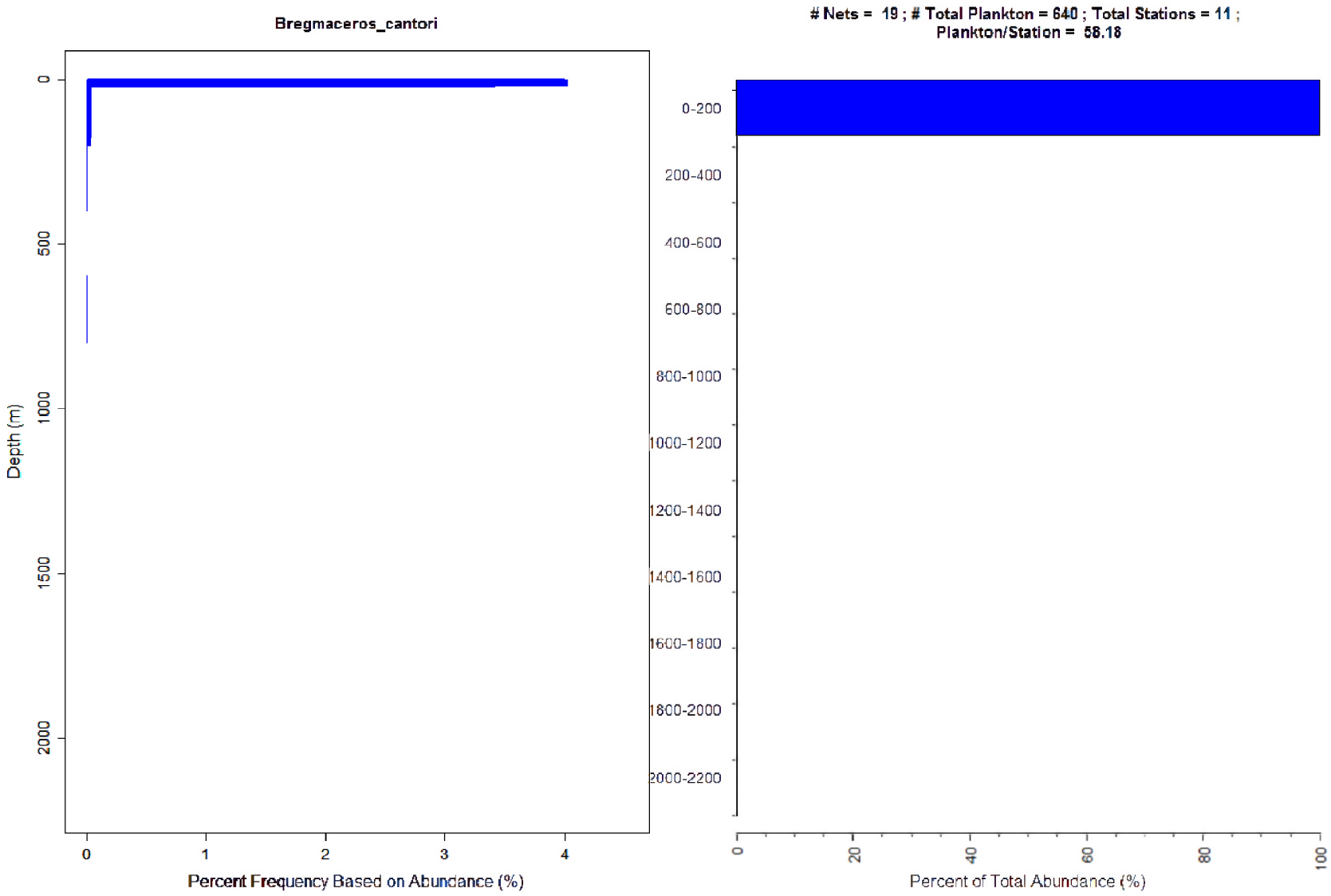
Brama - Deep



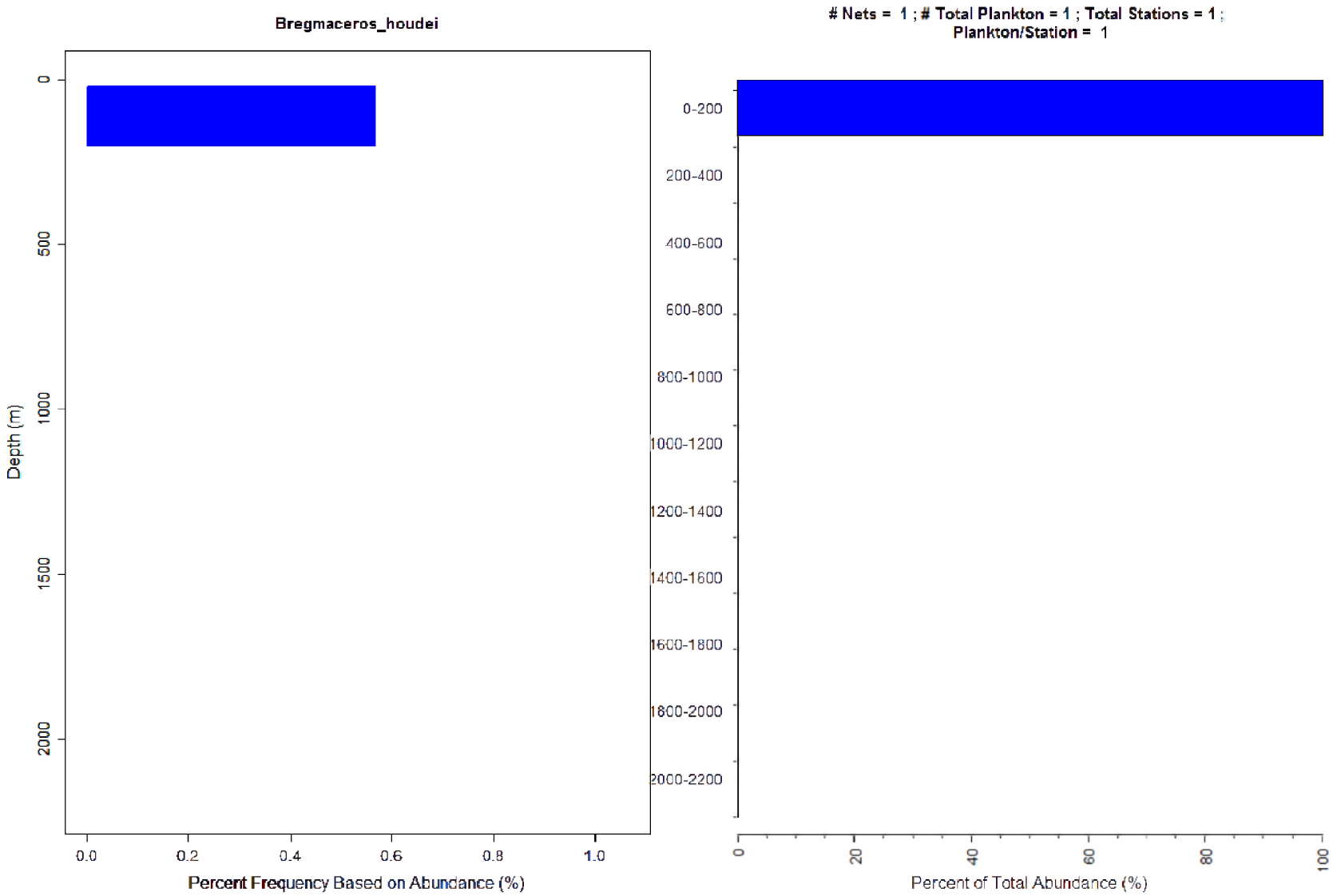
Bregmaceros - Deep



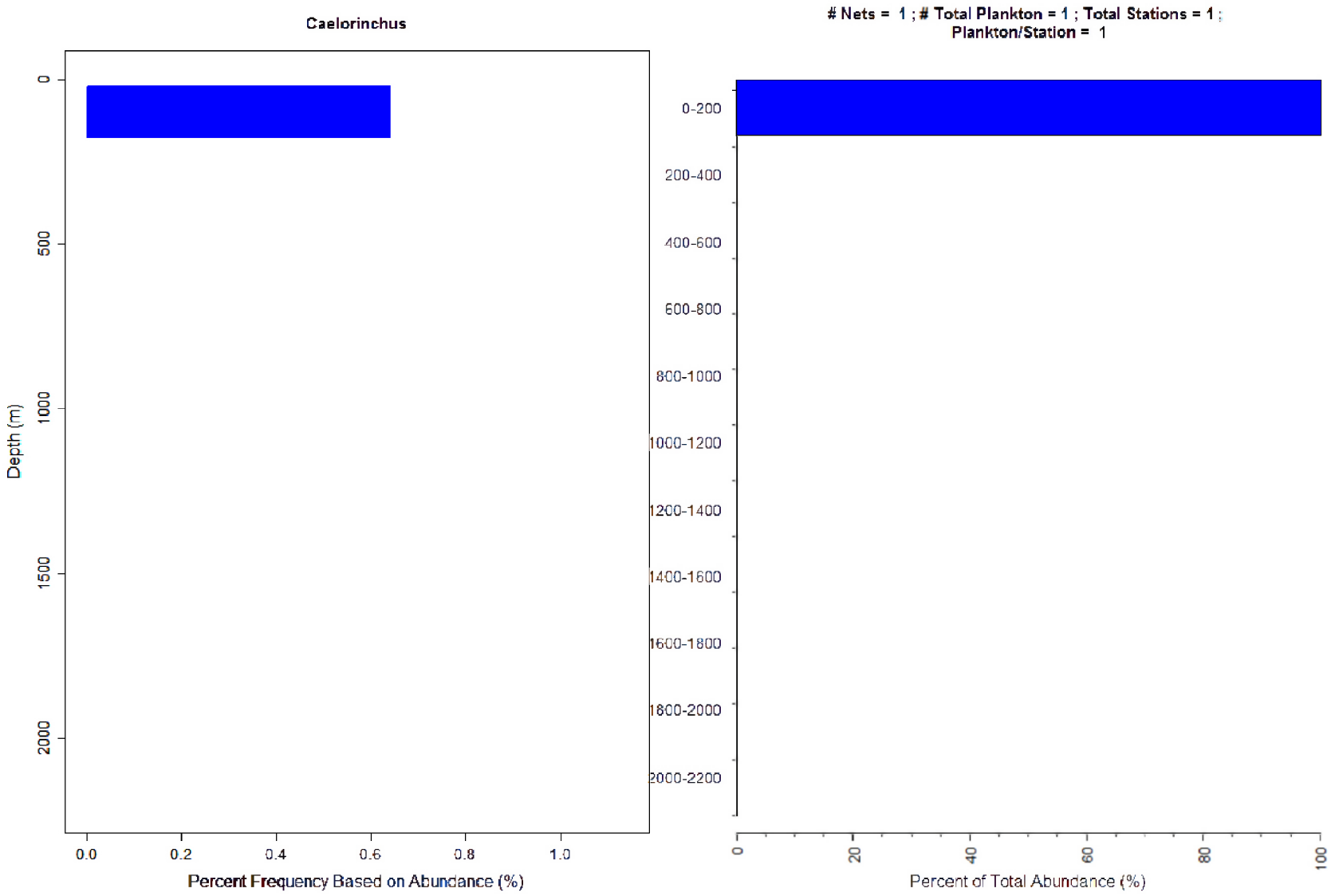
Bregmaceros_atlanticus - Deep



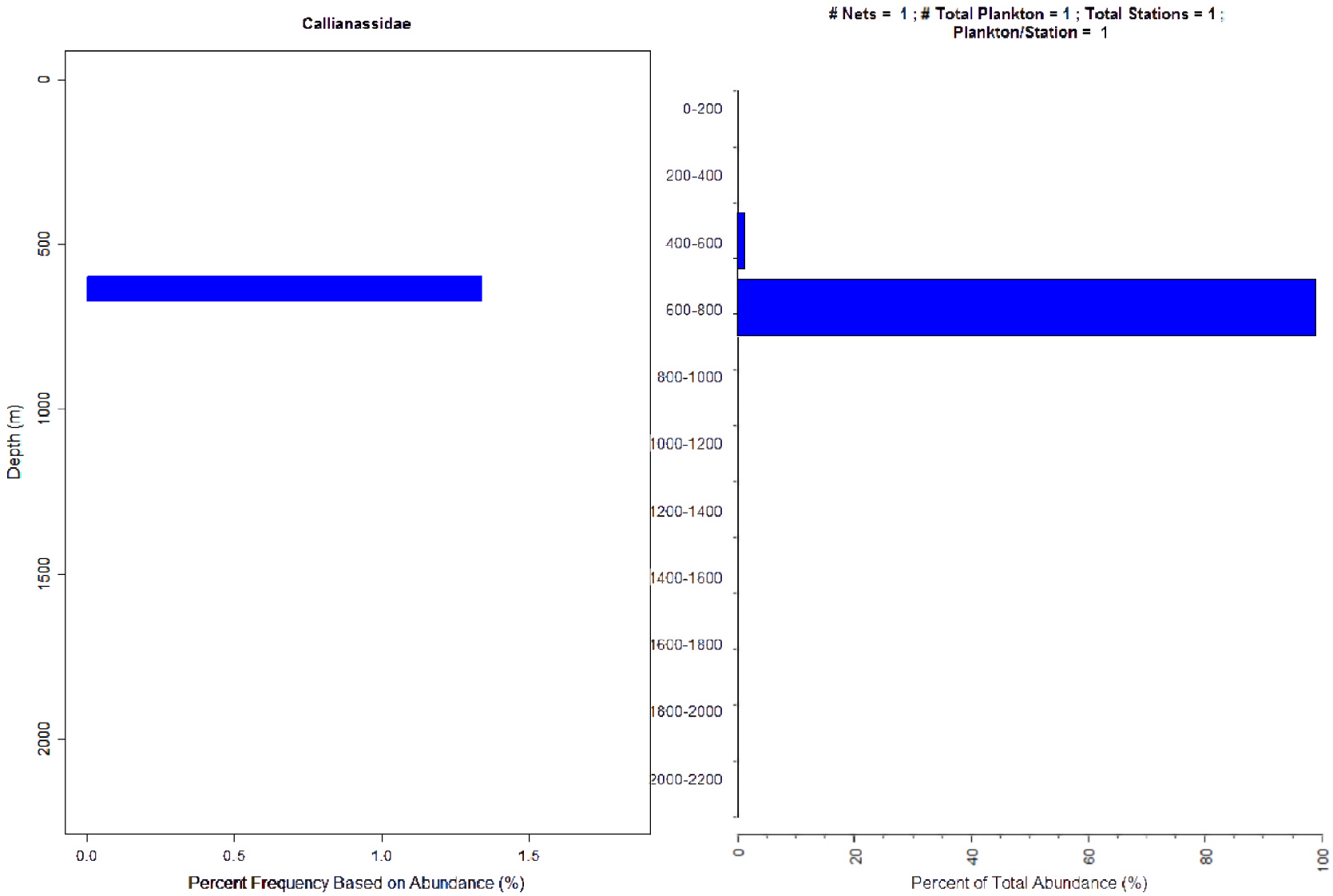
Bregmaceros_cantori - Deep



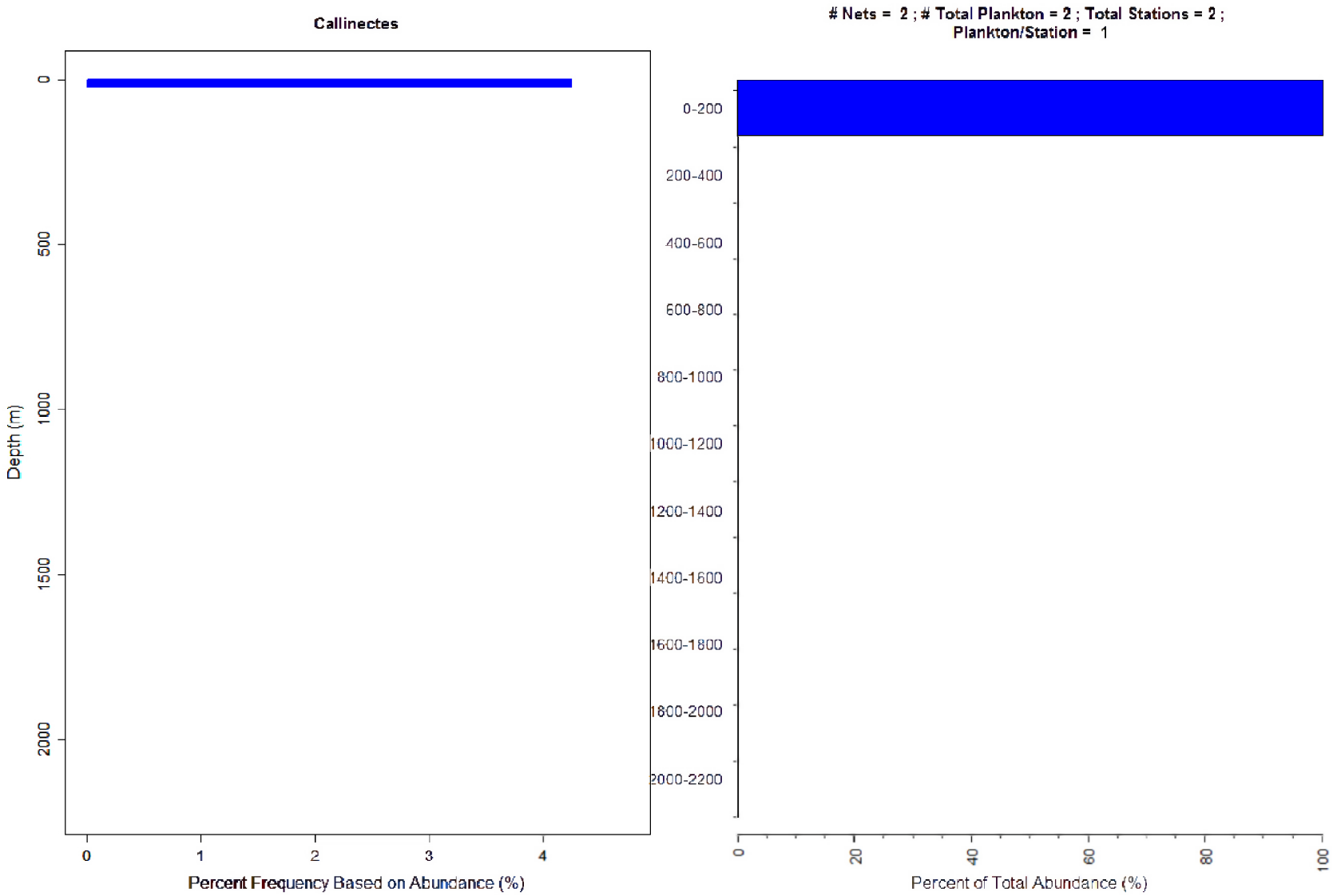
Bregmaceros_houdei - Deep



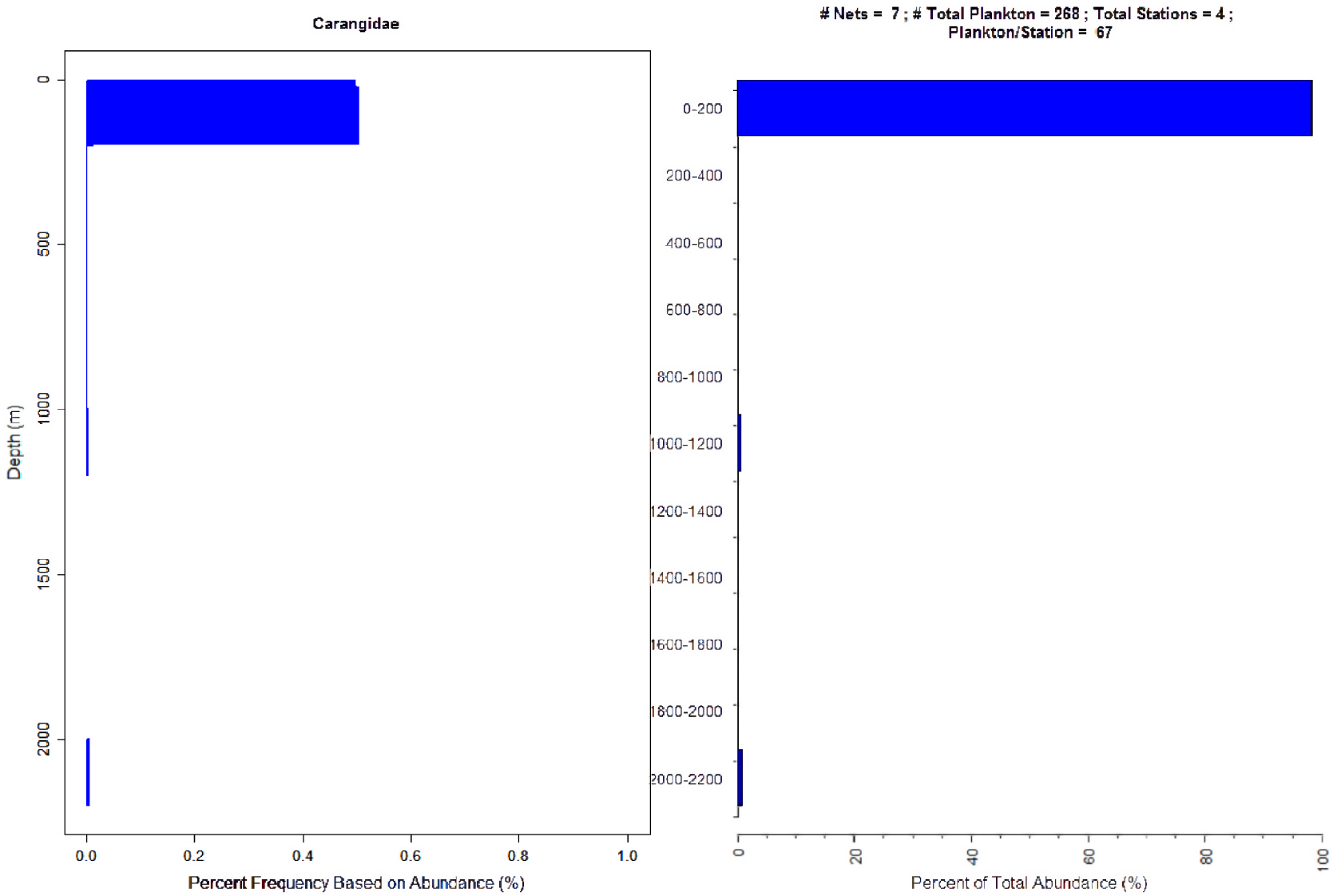
Caelorinchus - Deep



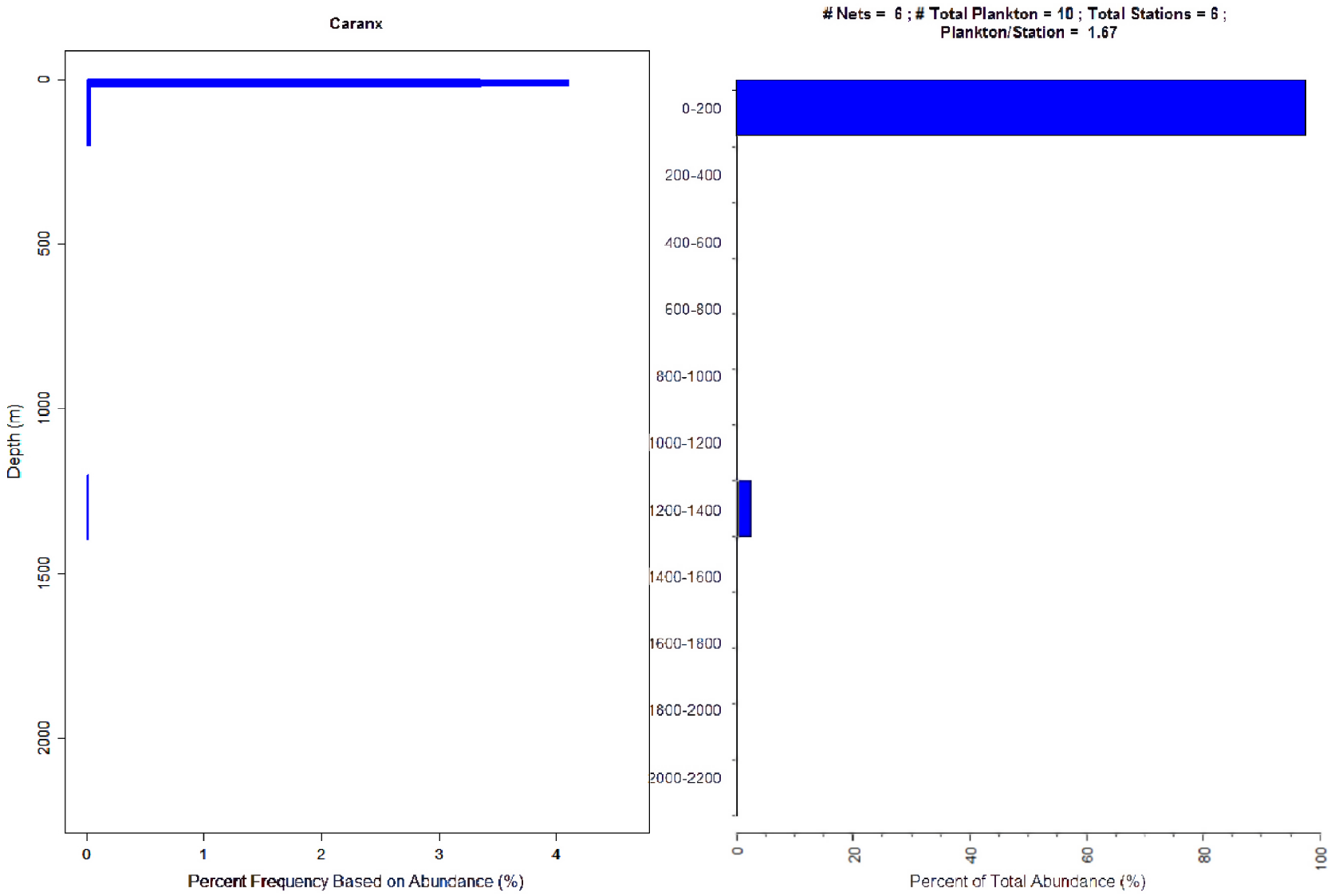
Callianassidae - Deep



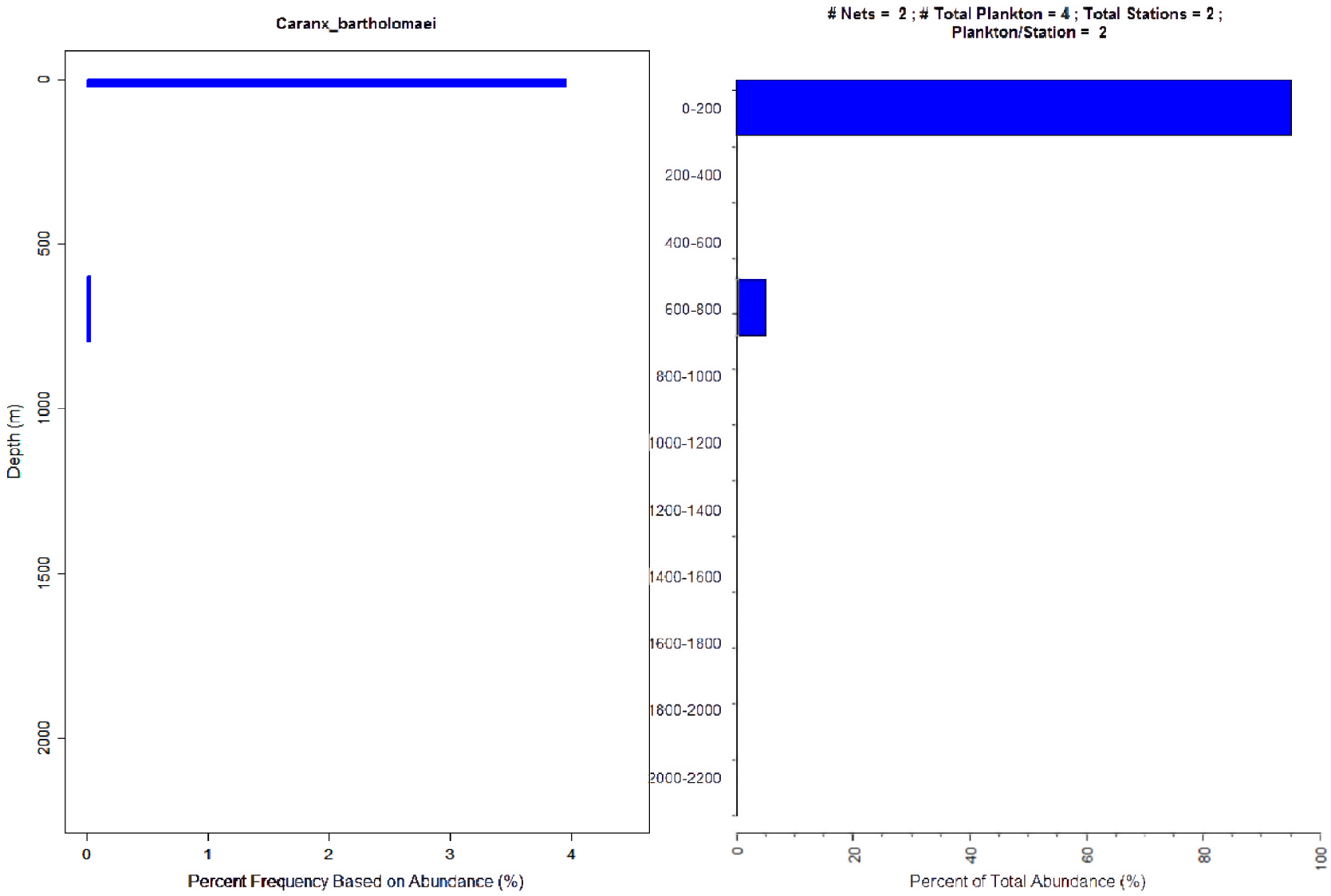
Callinectes - Deep



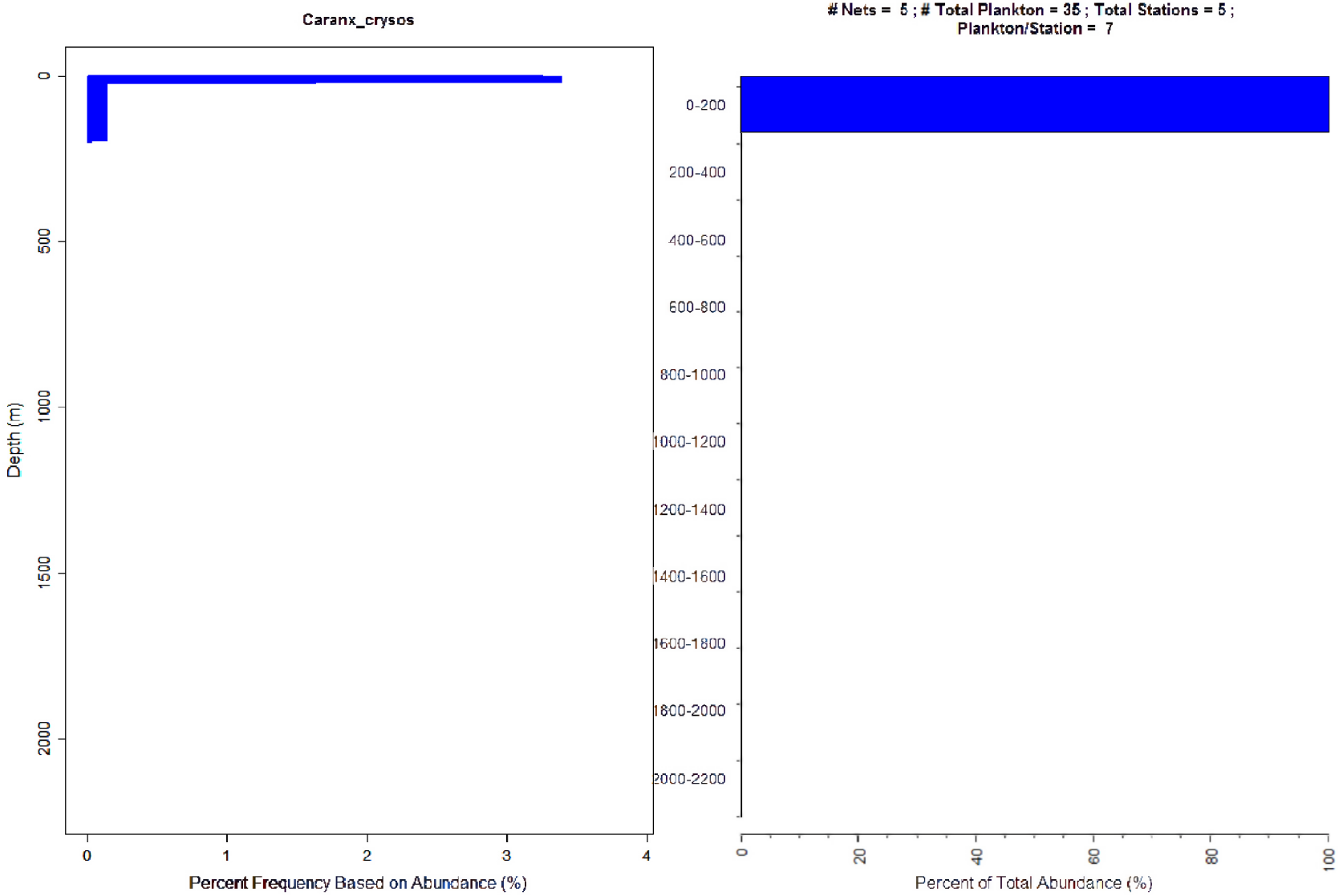
Carangidae - Deep


Caranx
Nets = 6 ; # Total Plankton = 10 ; Total Stations = 6 ;
Plankton/Station = 1.67
Depth (m)
0
500
1000
1500
2000
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

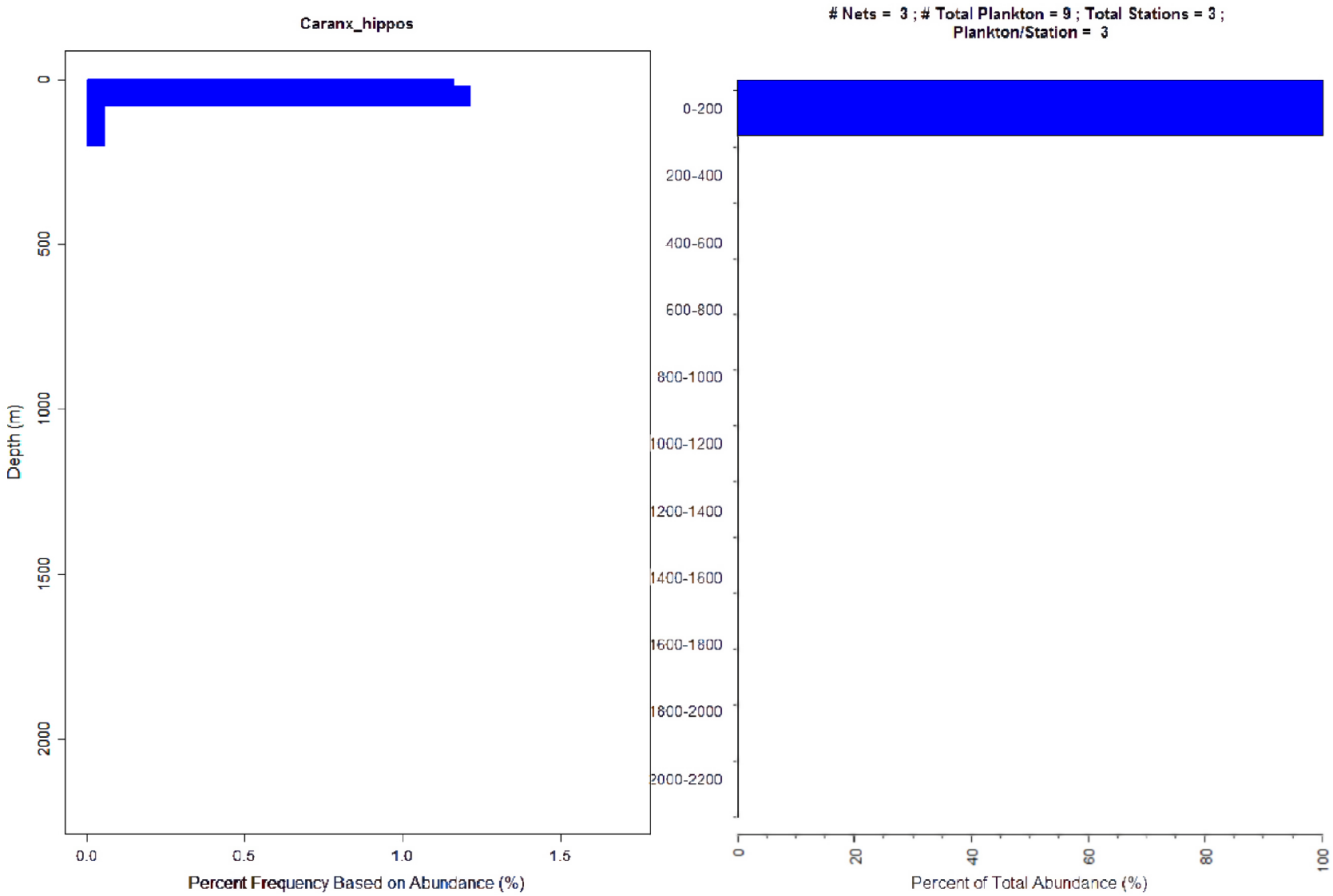
Caranx - Deep



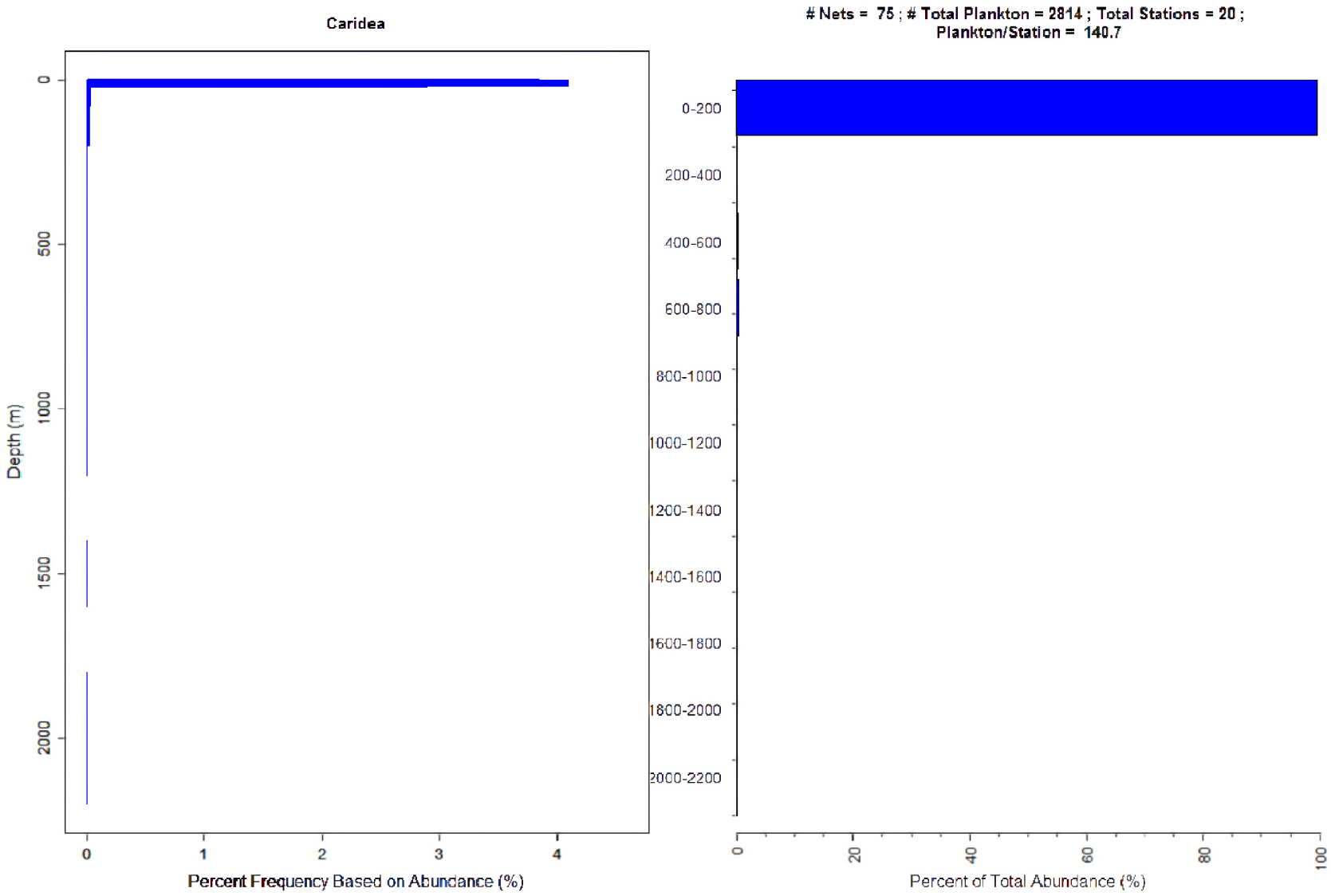
Caranx_bartholomaei - Deep



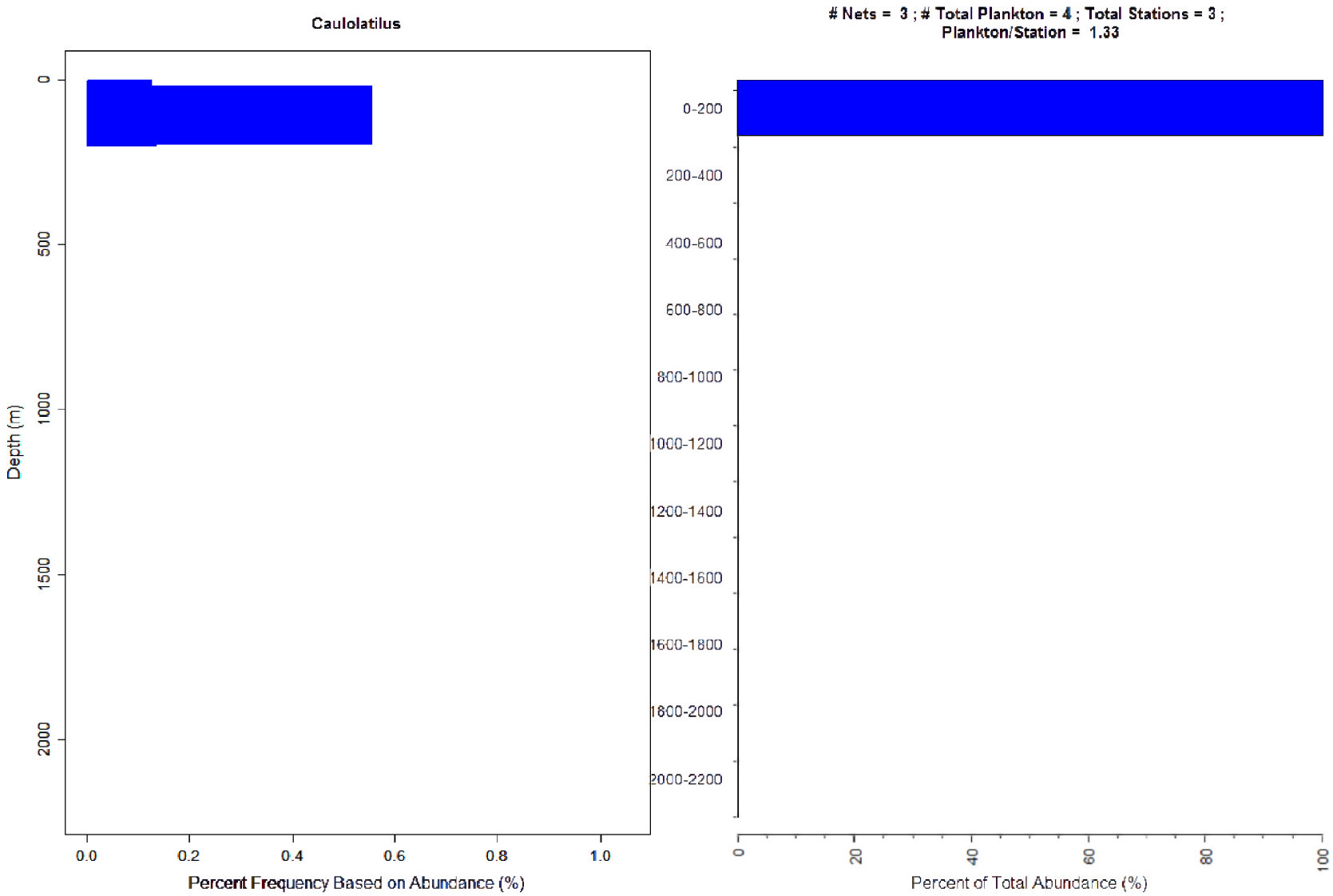
Caranx_crysos - Deep



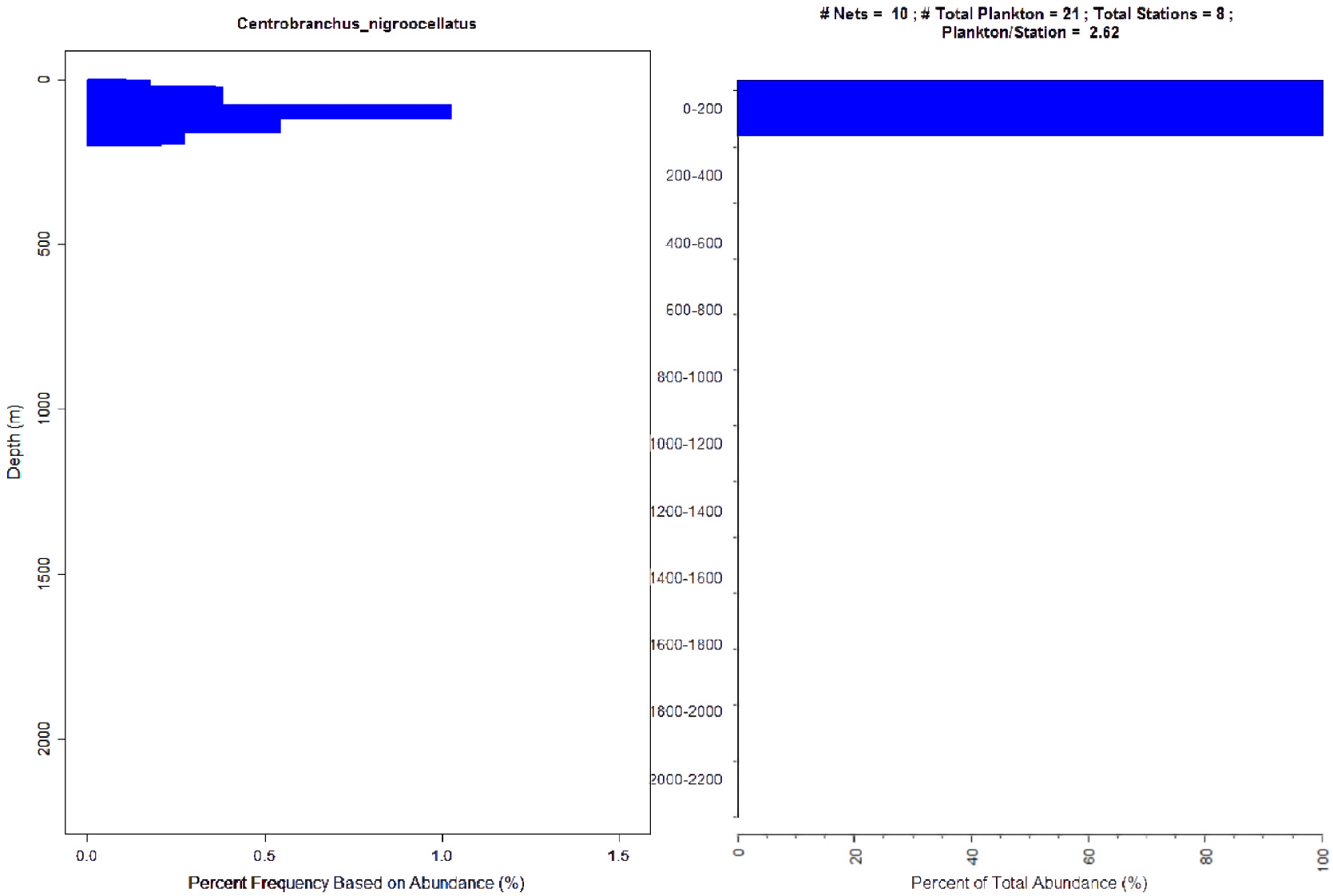
Caranx_hippos - Deep



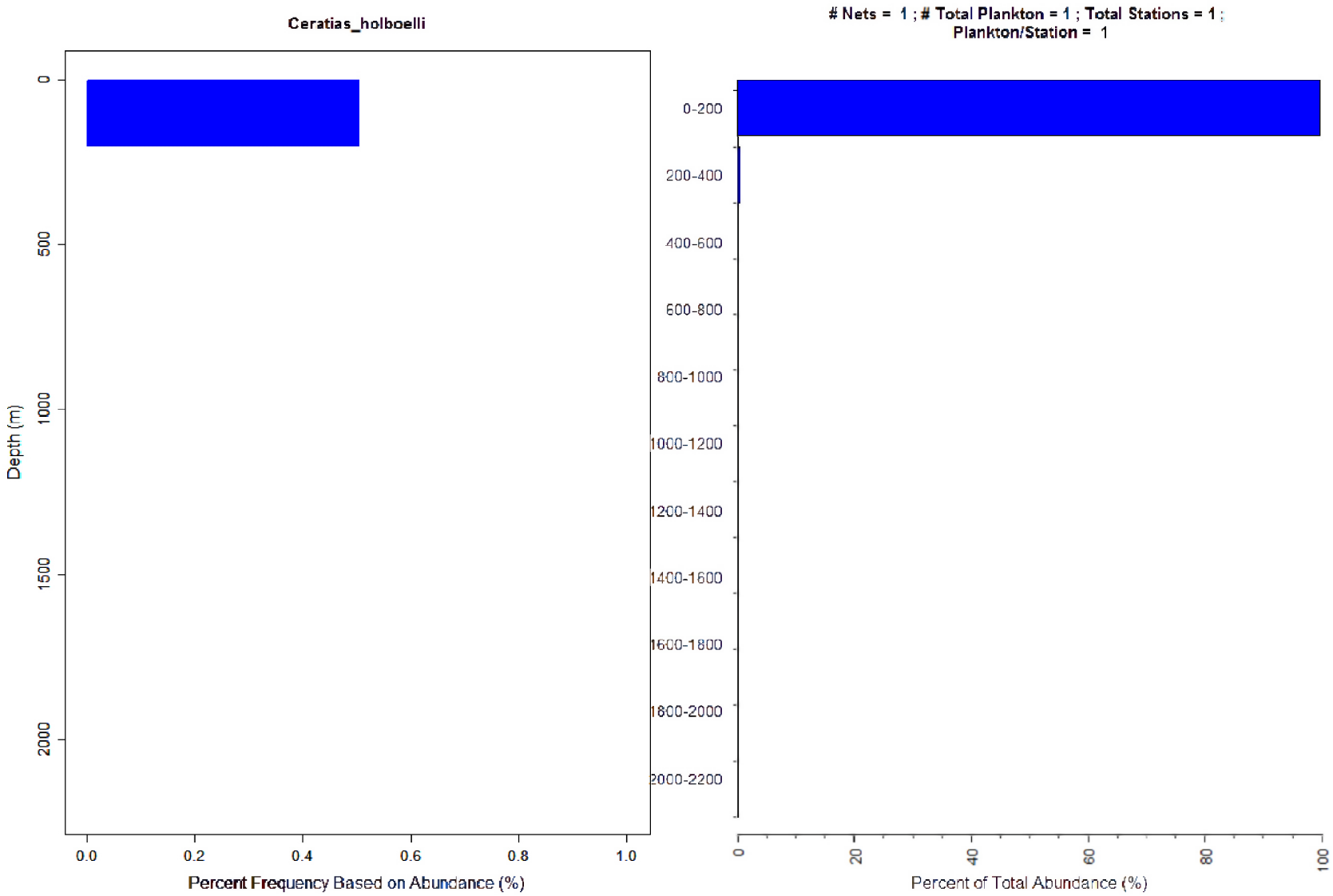
Caridea - Deep



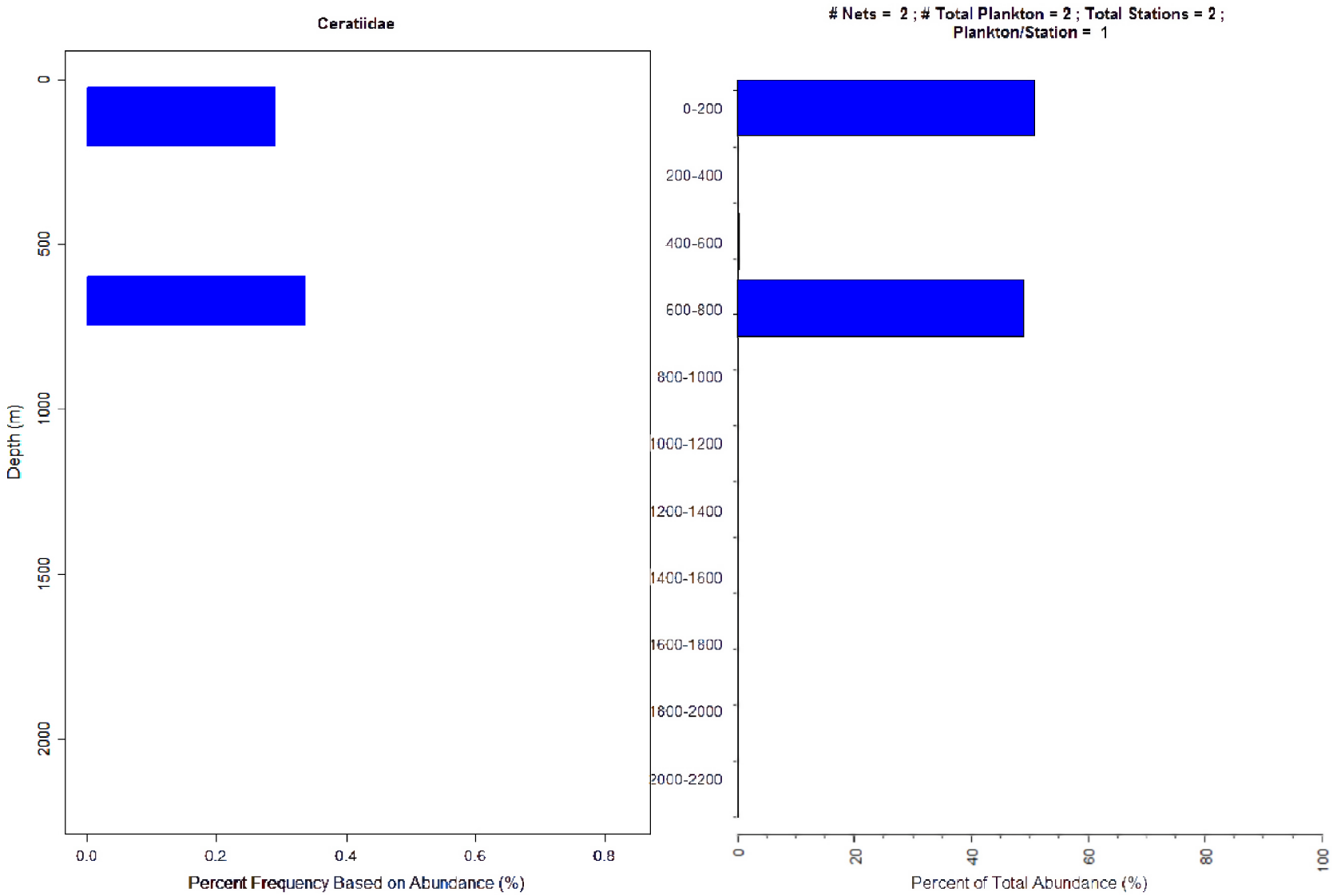
Caulolatilus - Deep



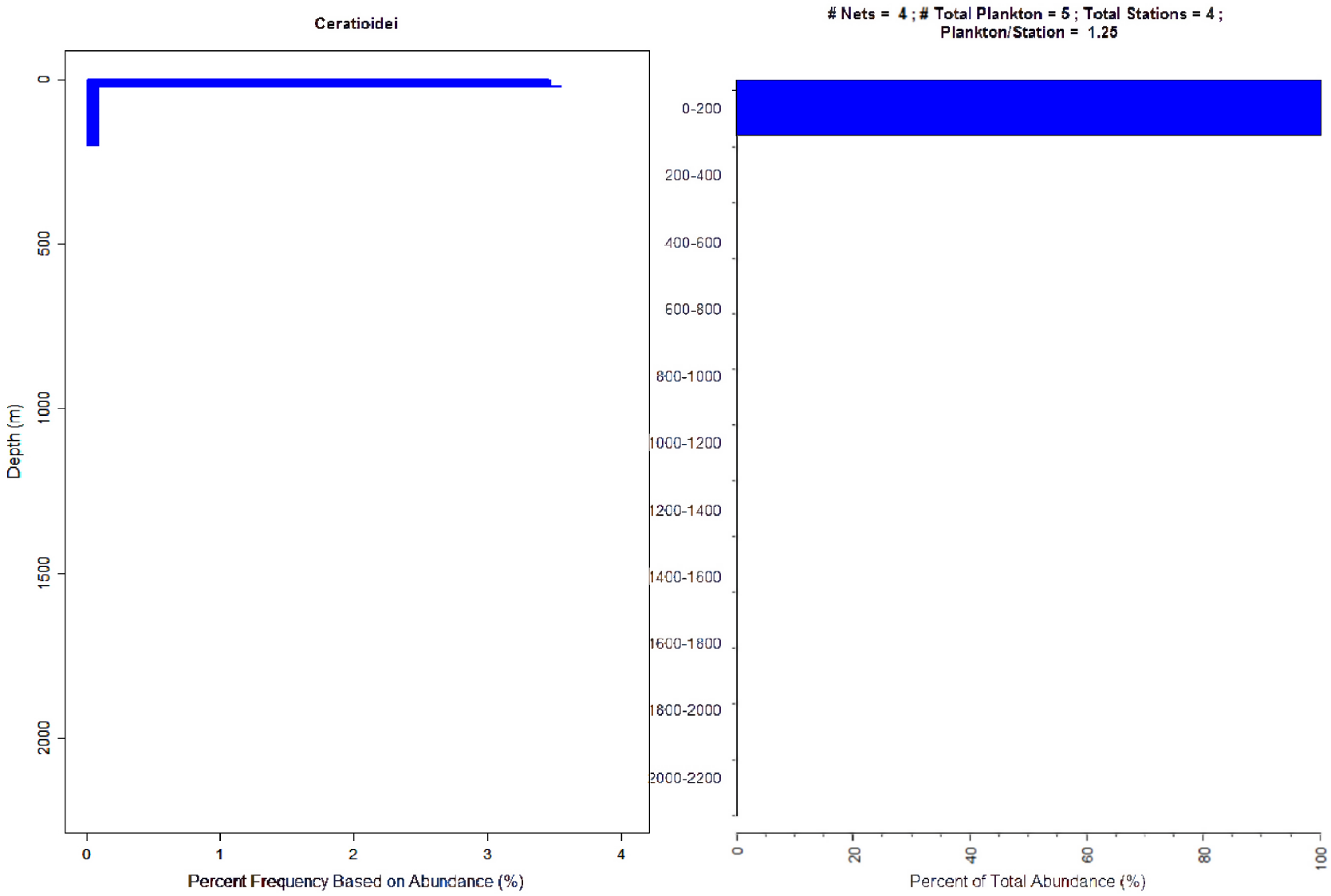
Centrobranchus_nigroocellatus - Deep



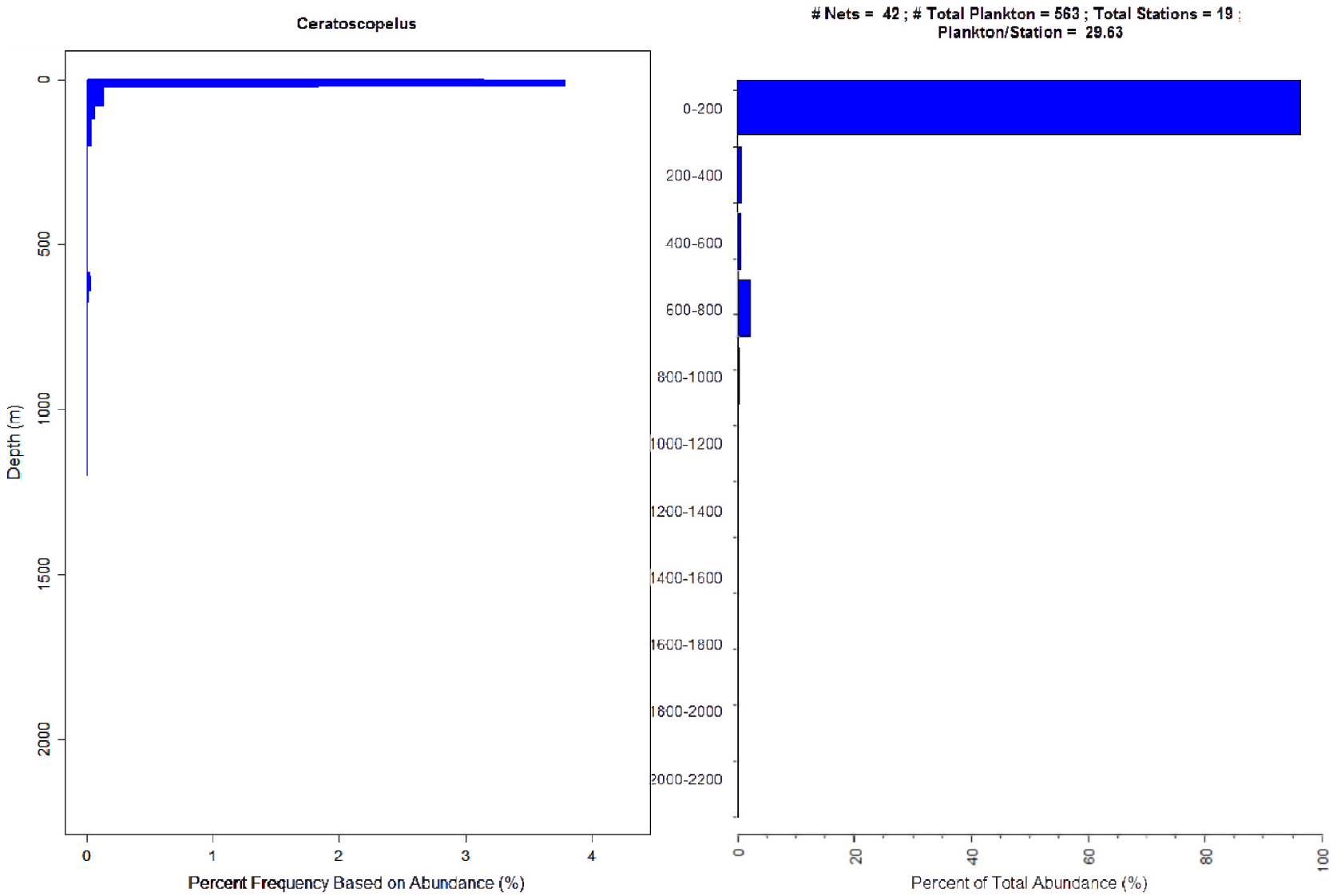
Ceratias_holboelli - Deep



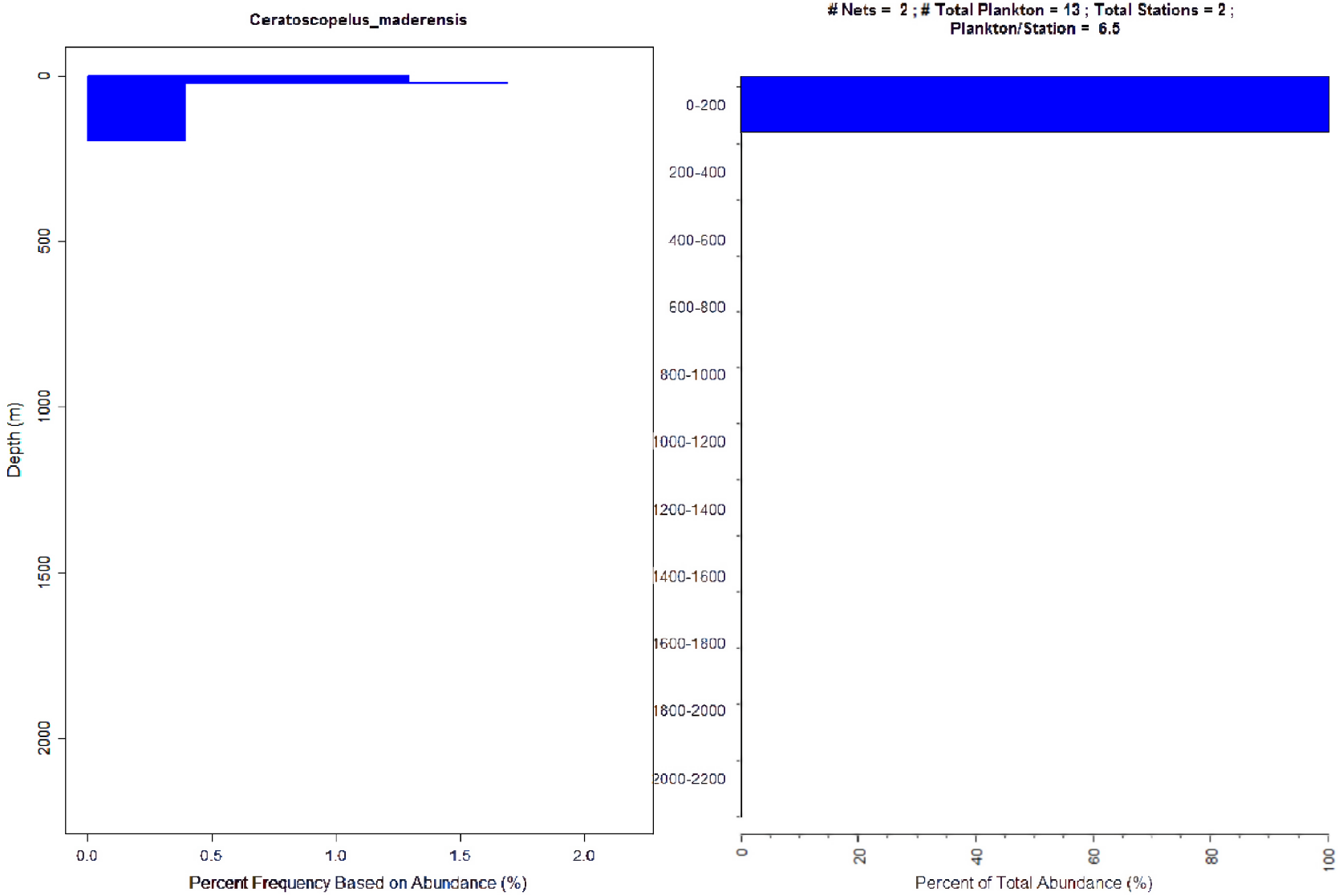
Ceratiidae - Deep



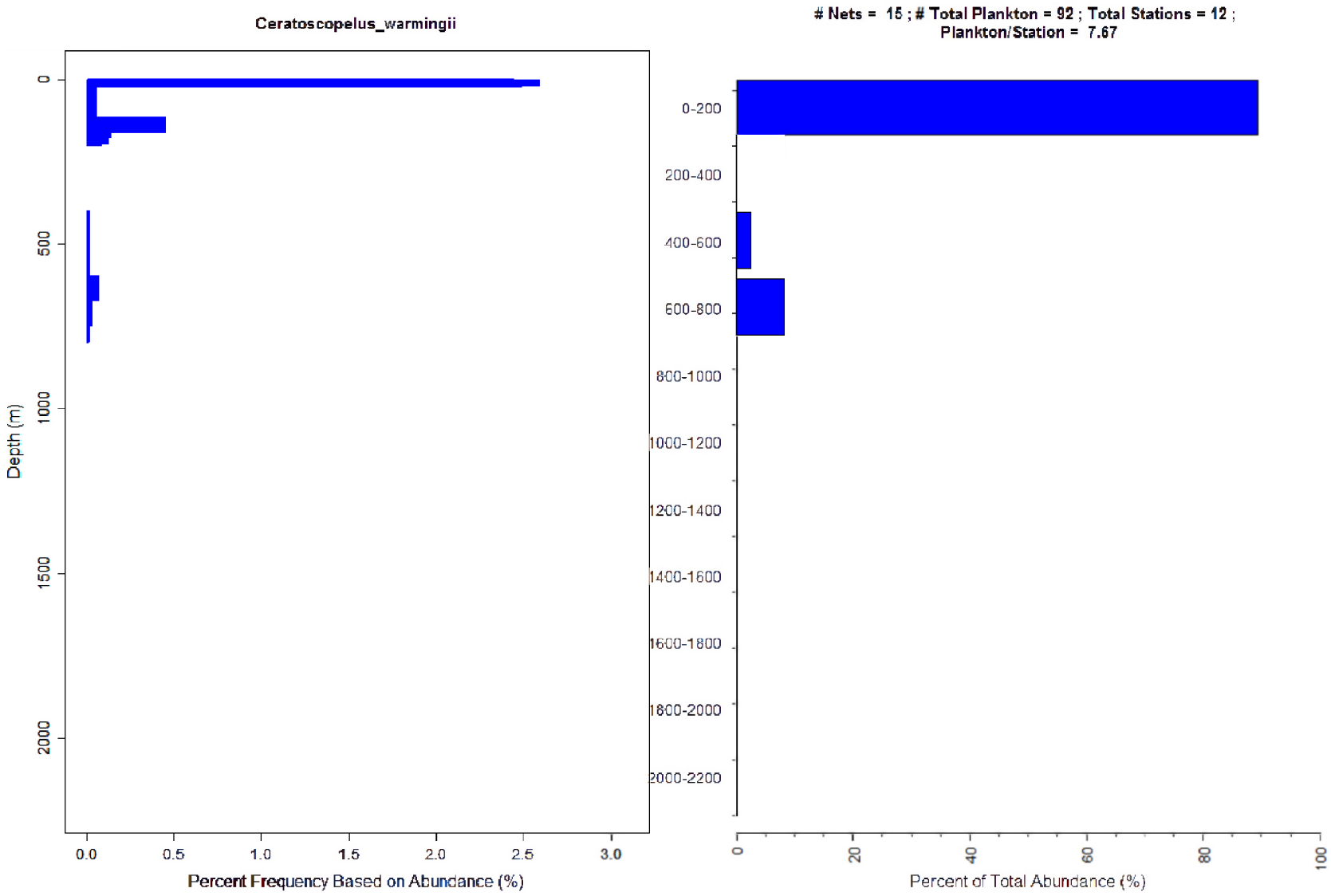
Ceratioidei - Deep



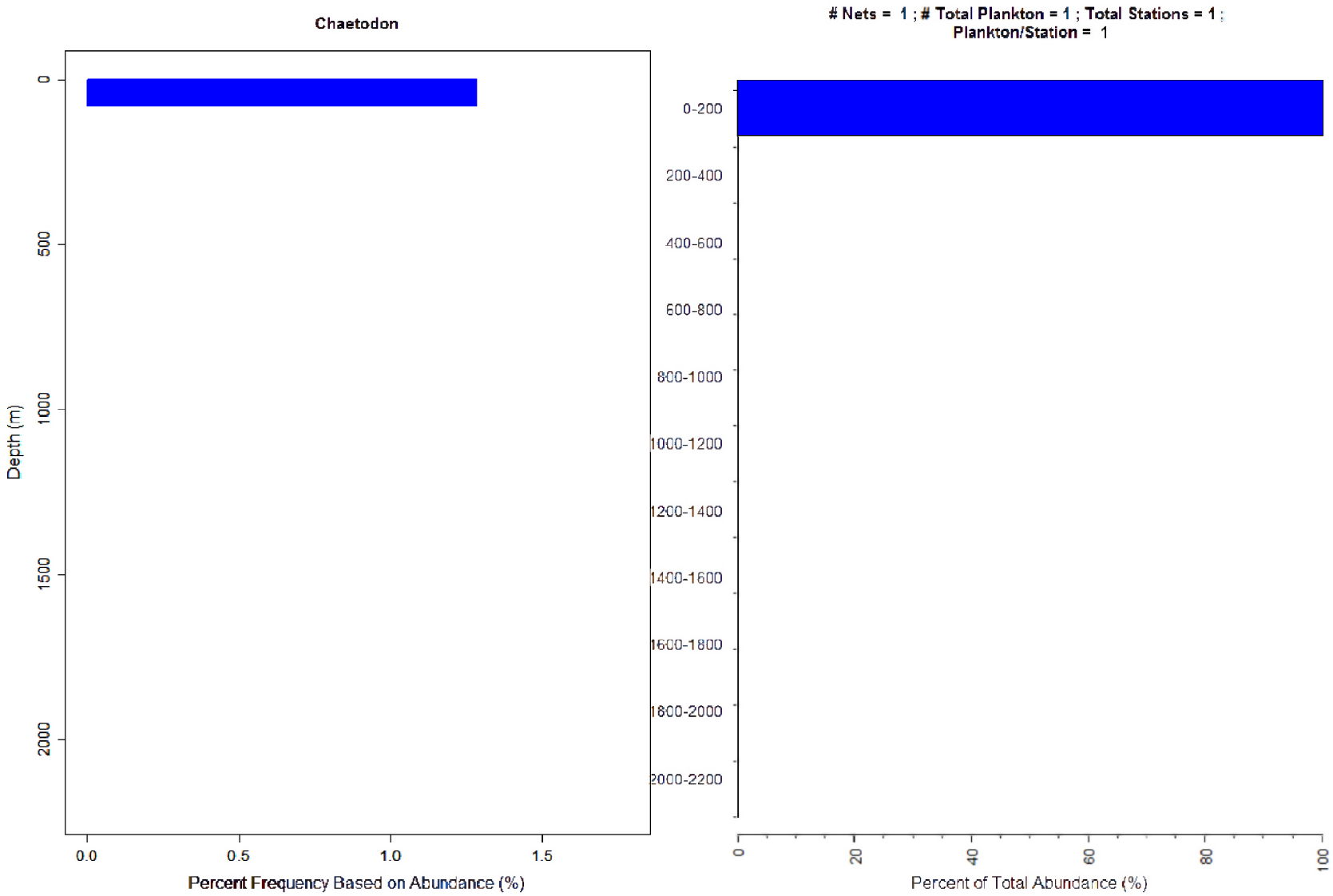
Ceratoscopelus - Deep



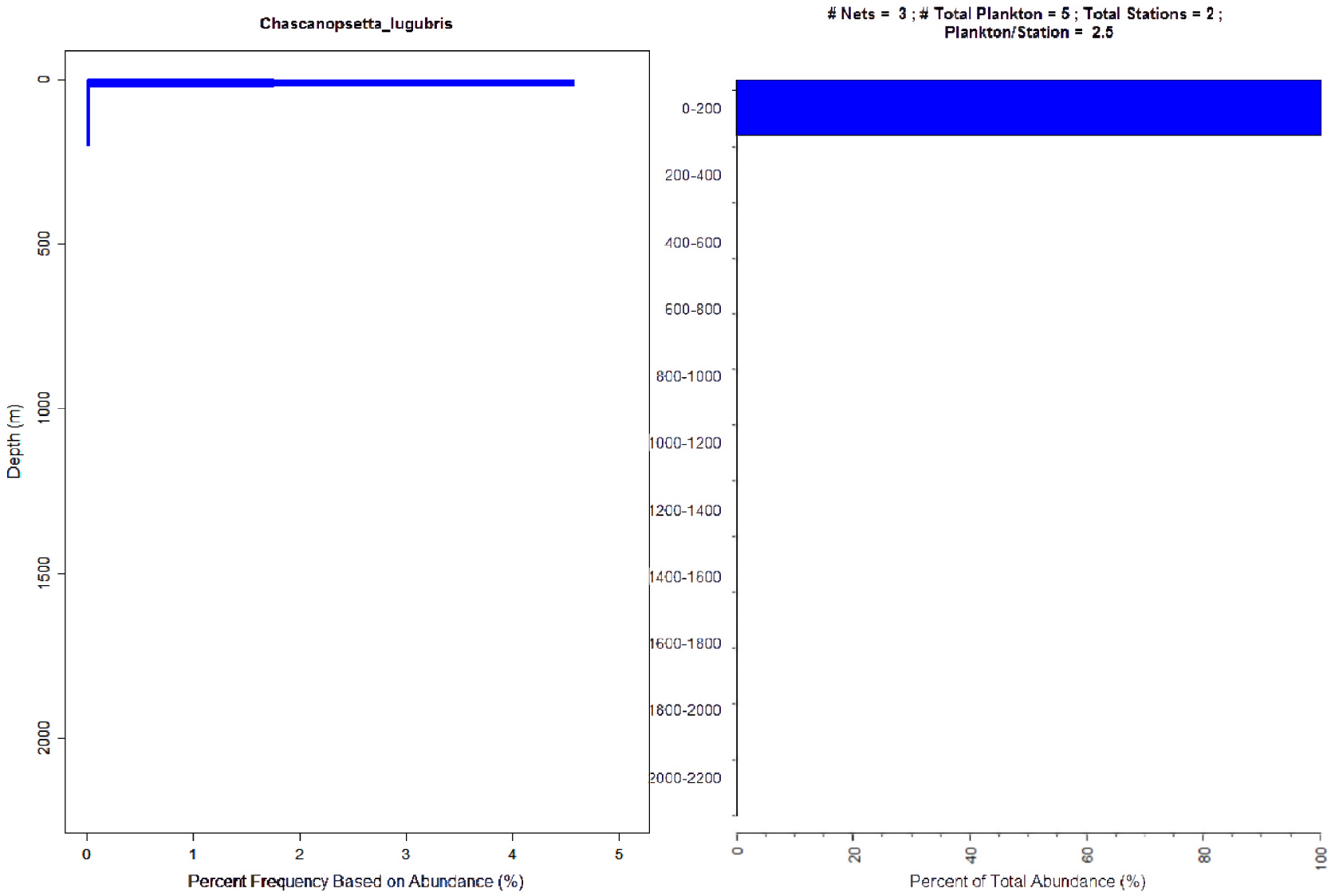
Ceratoscopelus_maderensis - Deep



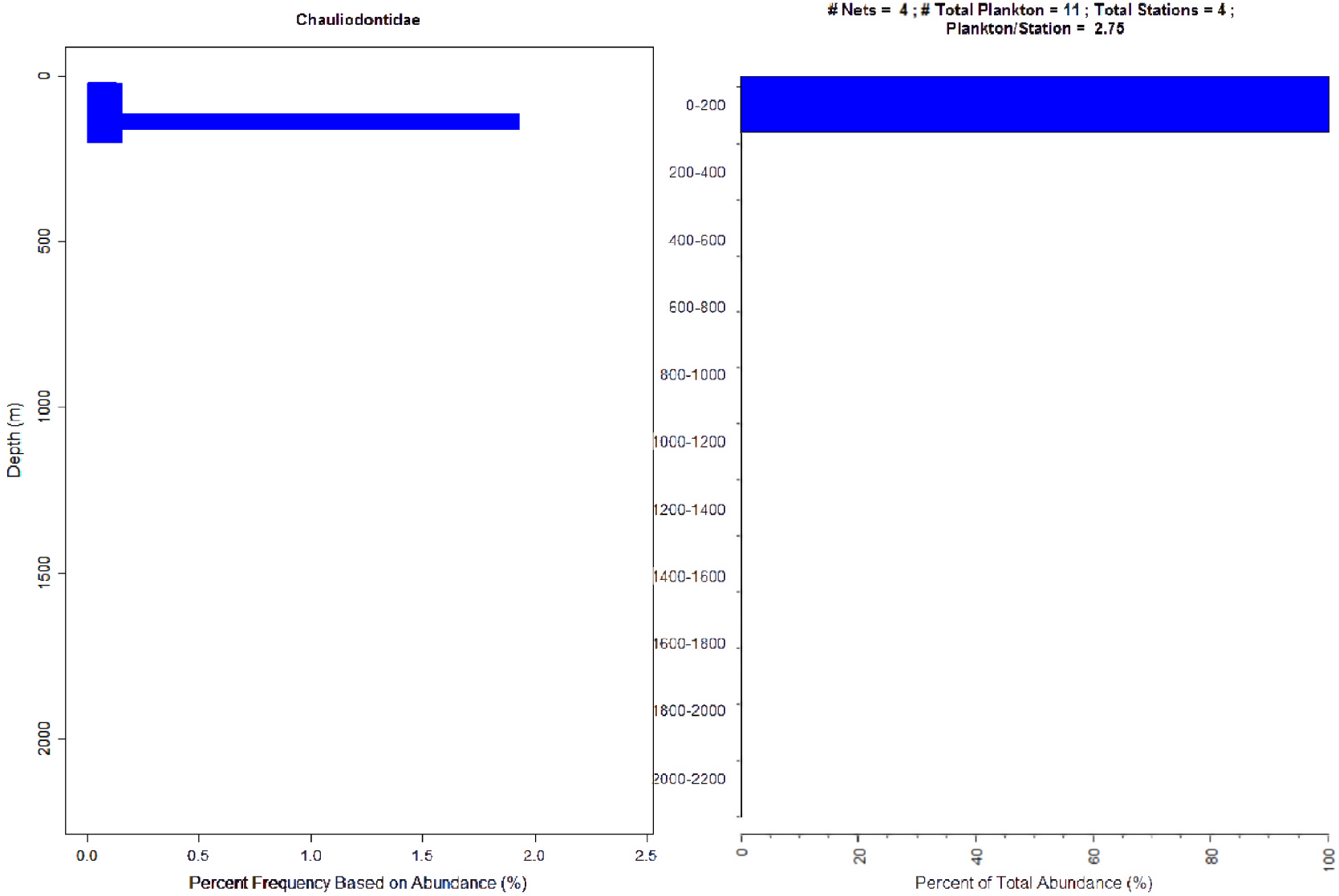
Ceratoscopelus_warmingii - Deep



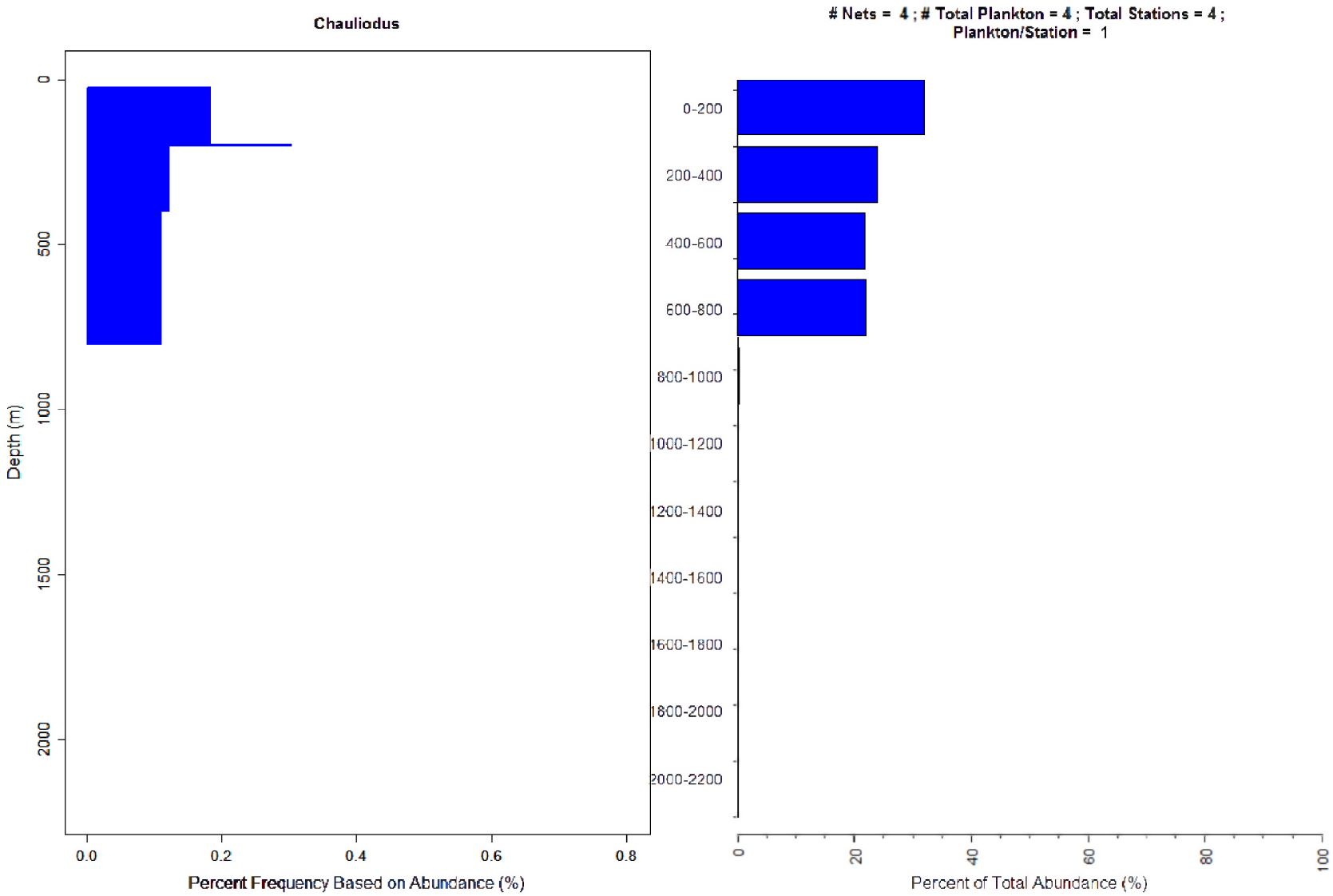
Chaetodon - Deep



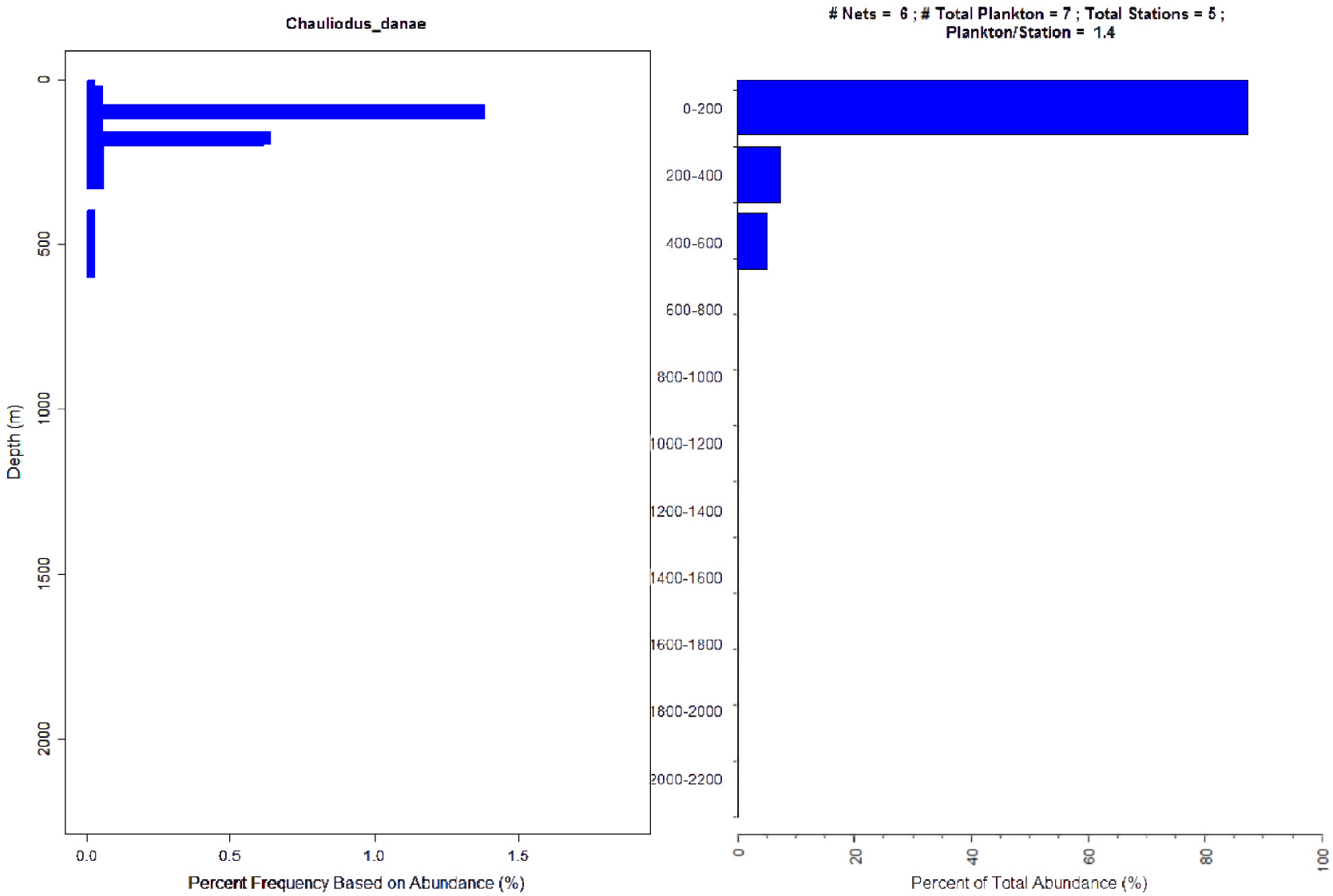
Chascanopsetta_lugubris - Deep



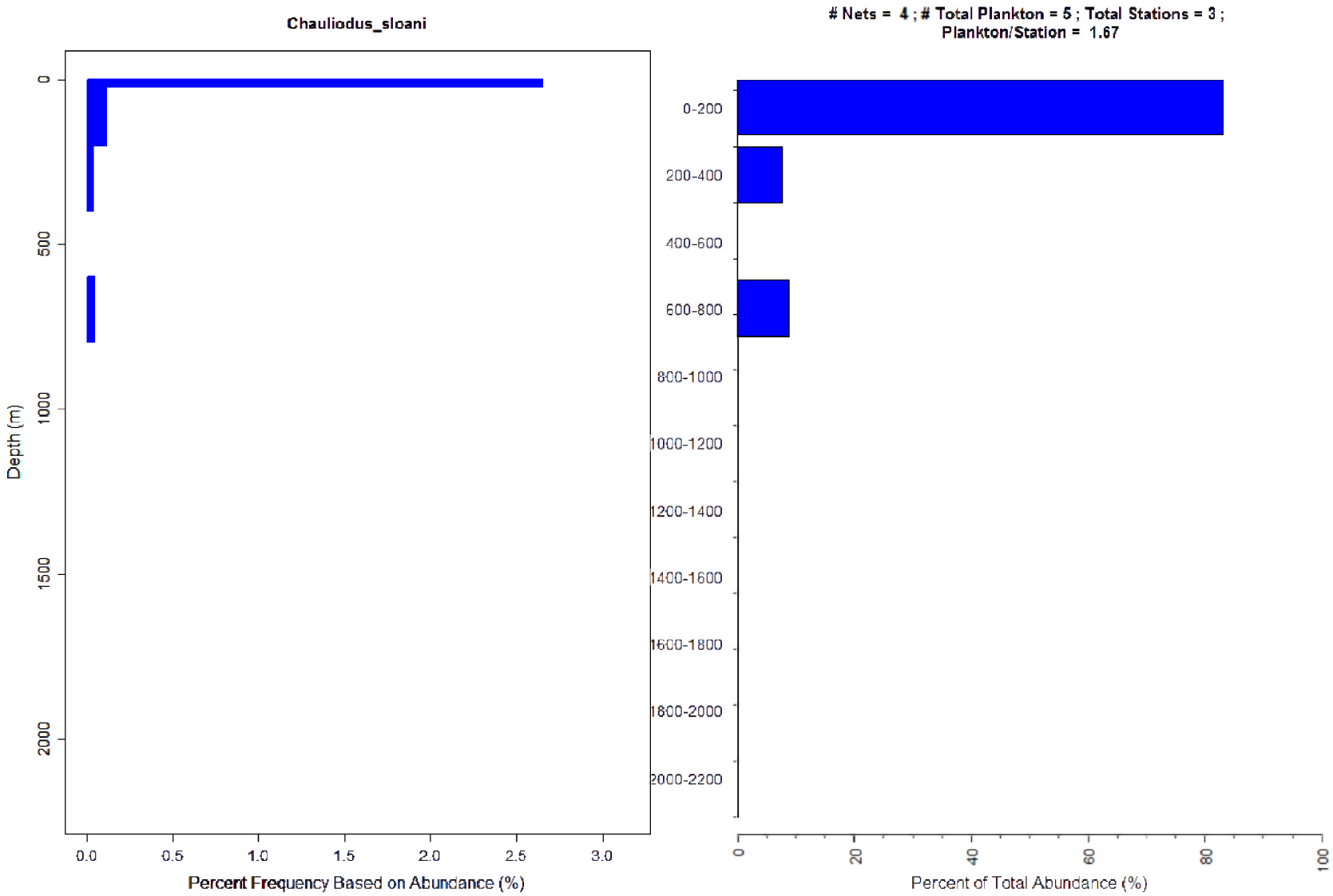
Chauliodontidae - Deep



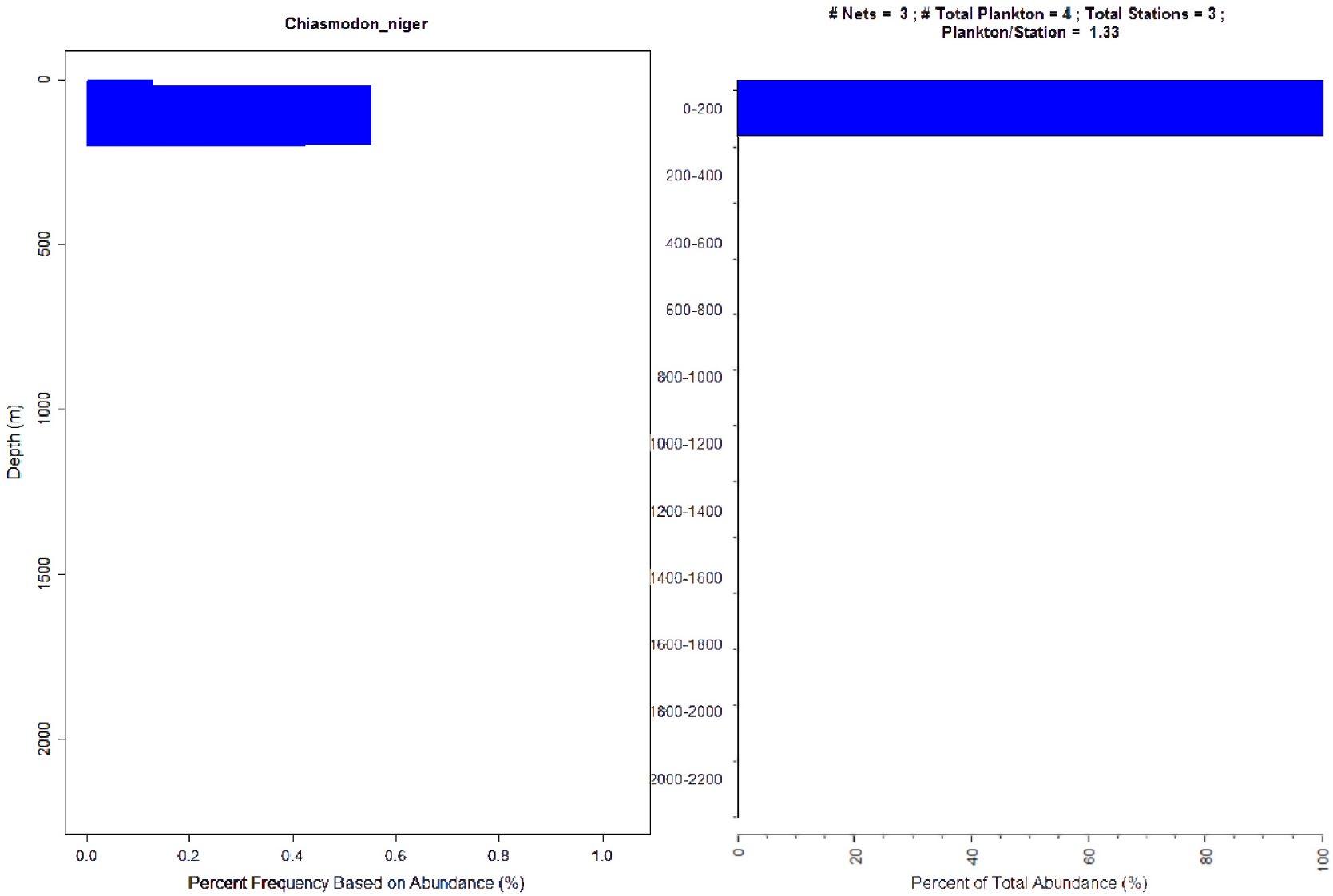
Chauliodus - Deep



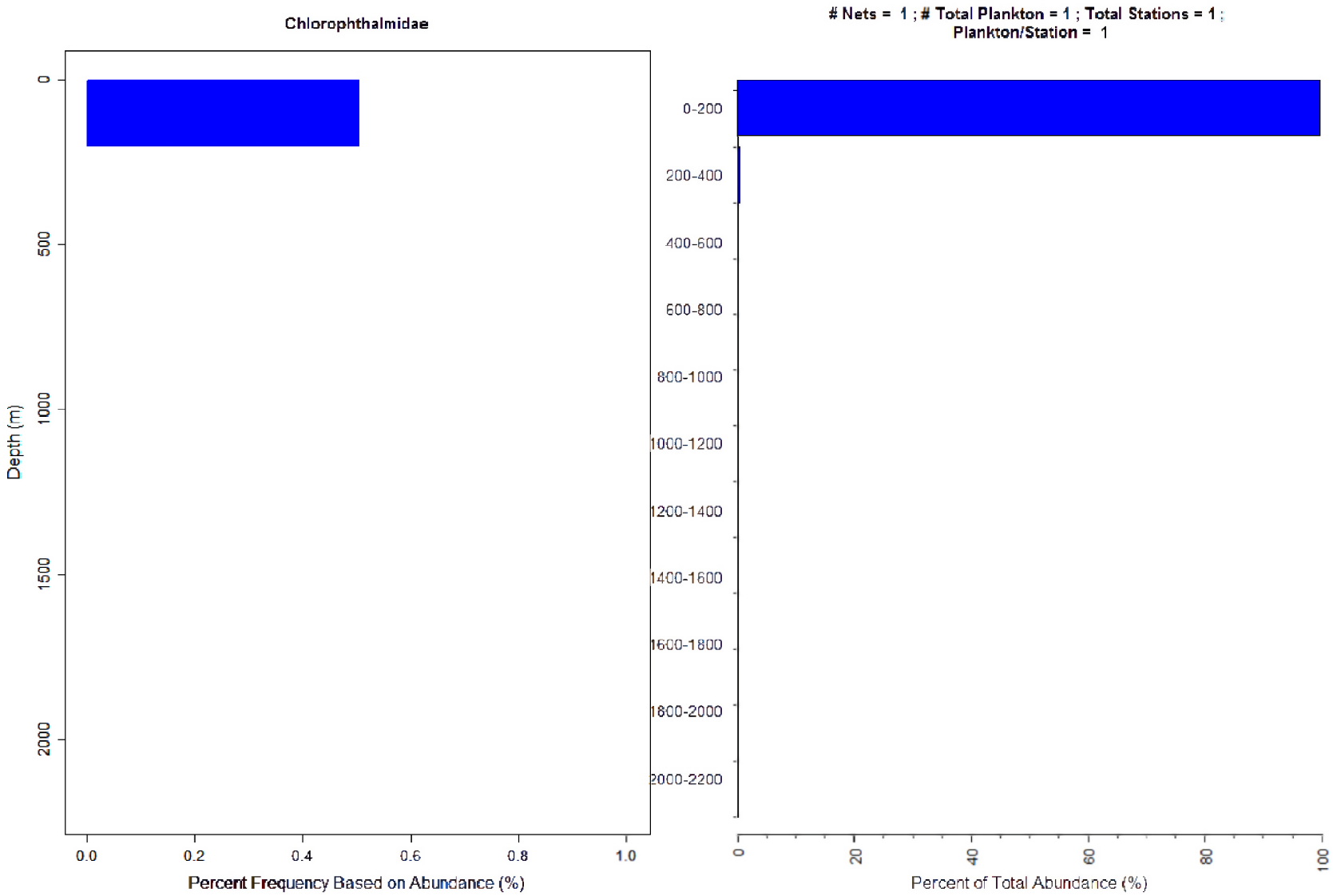
Chauliodus_danae - Deep



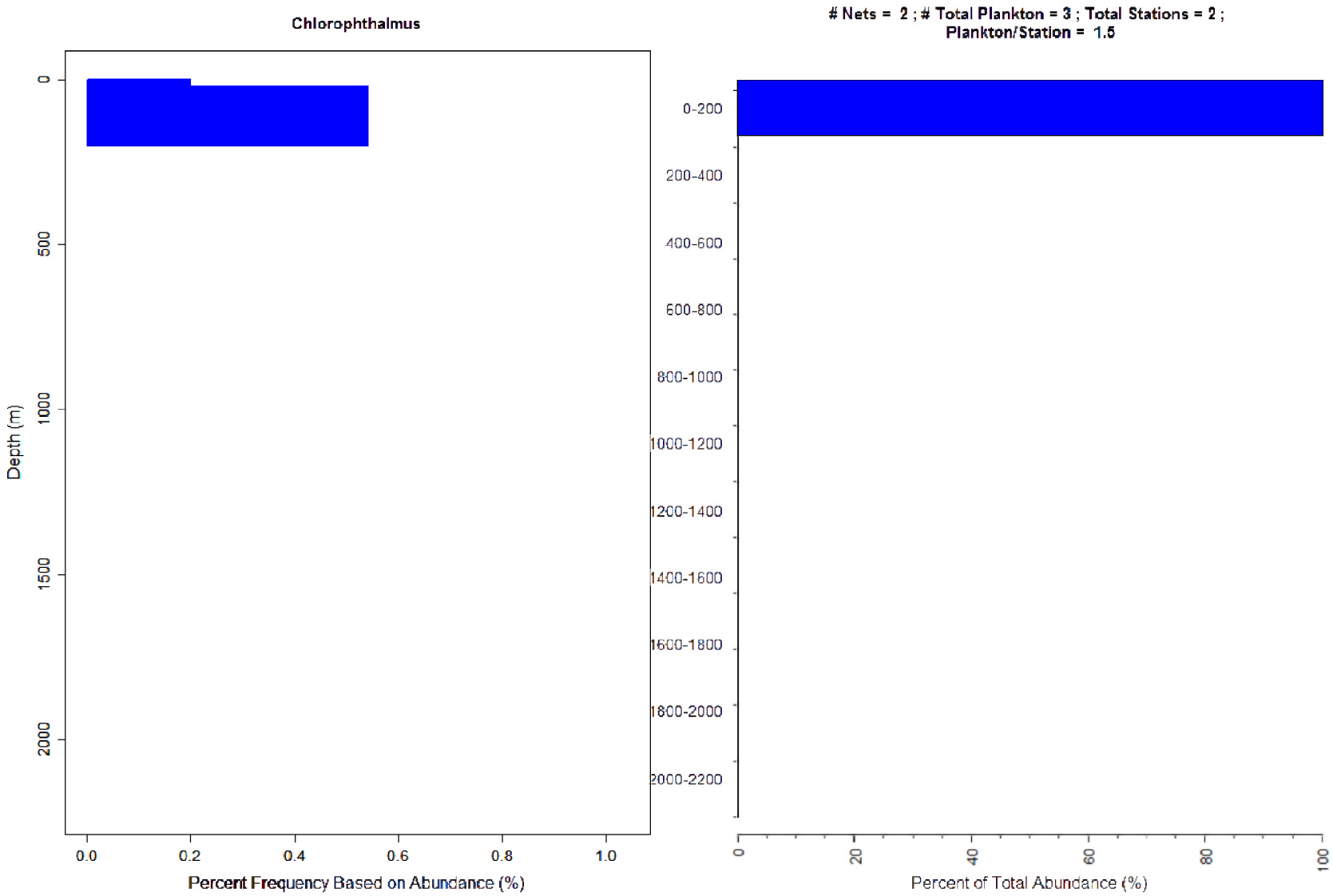
Chauliodus_sloani - Deep



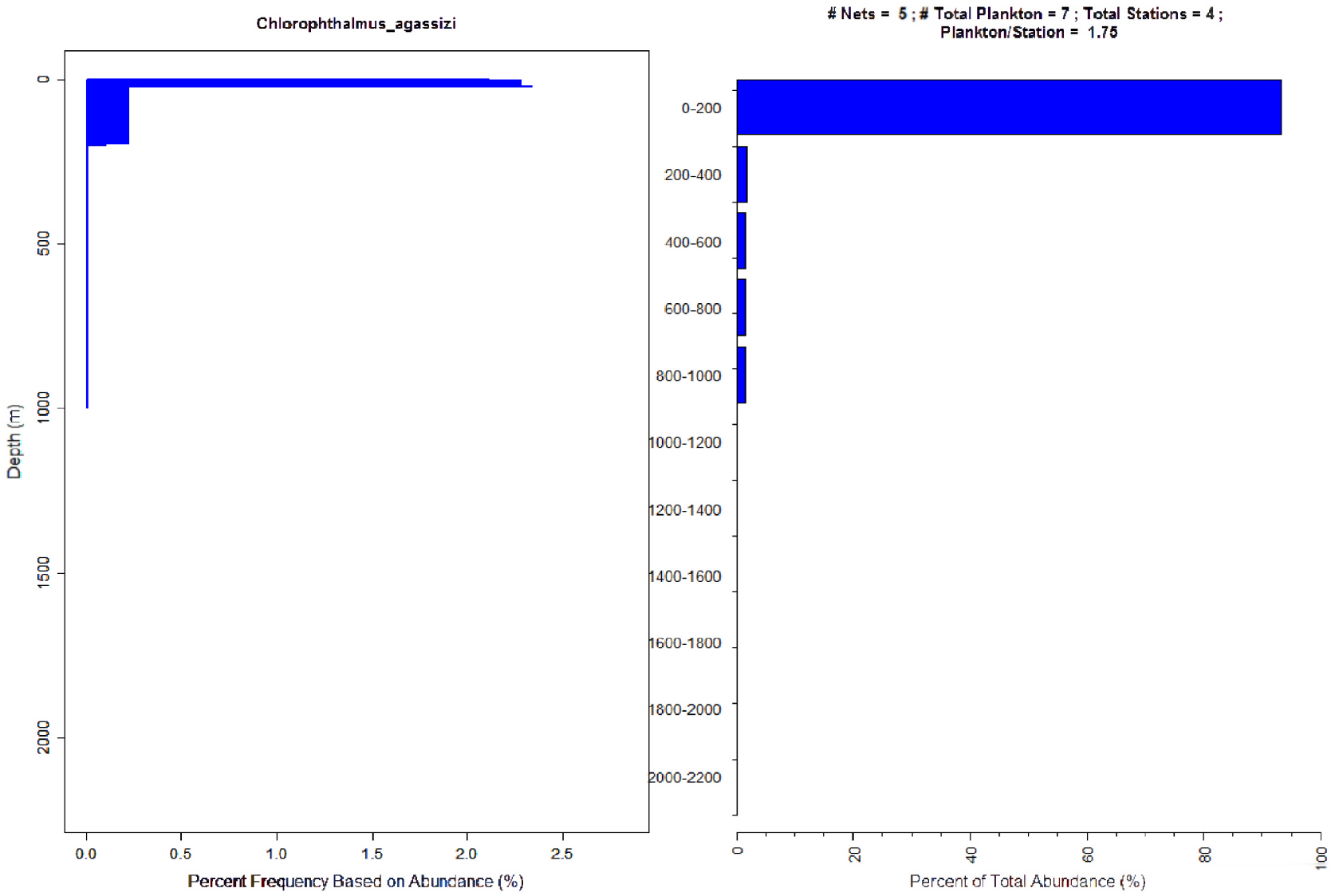
Chiasmodon_niger - Deep



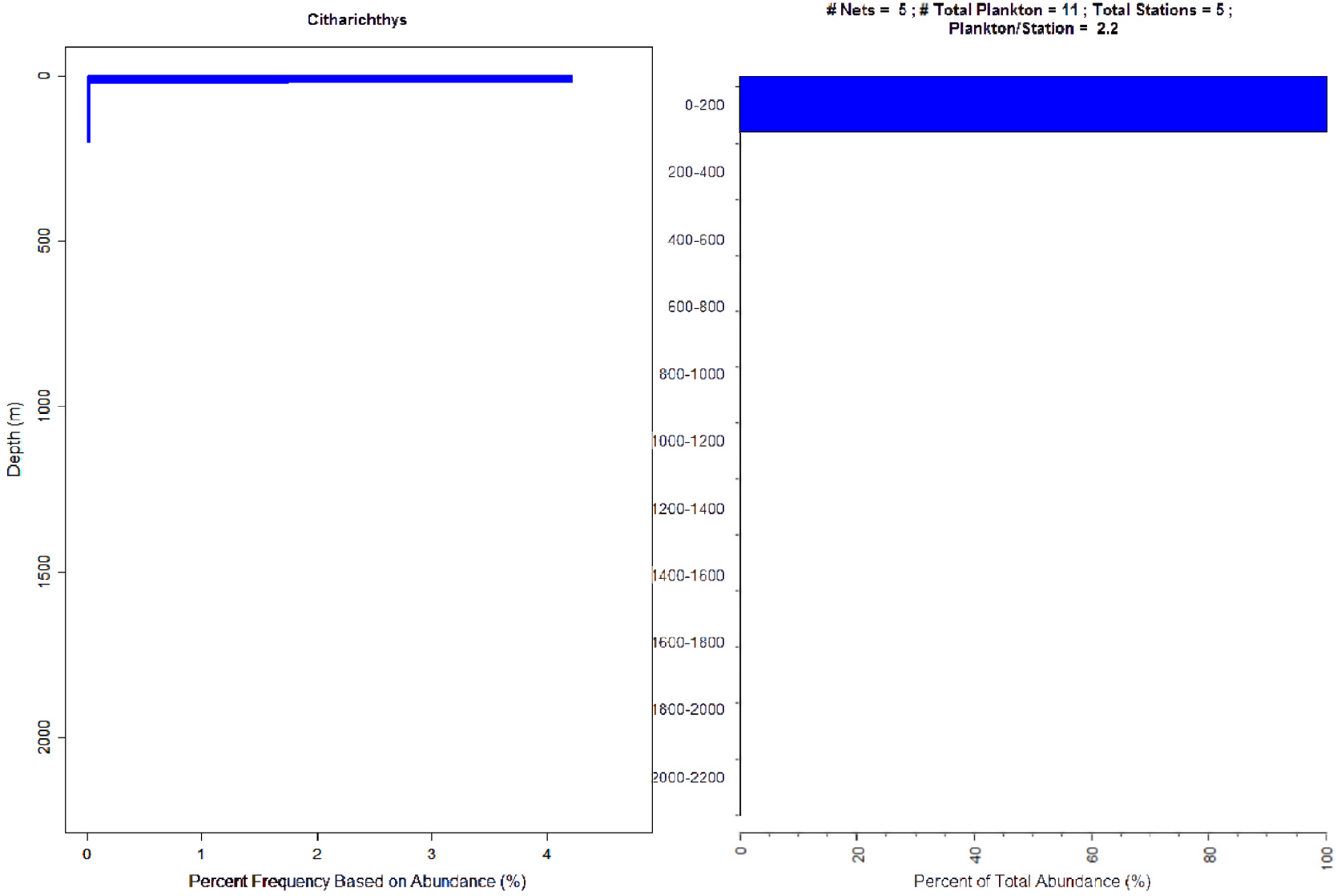
Chlorophthalmidae - Deep



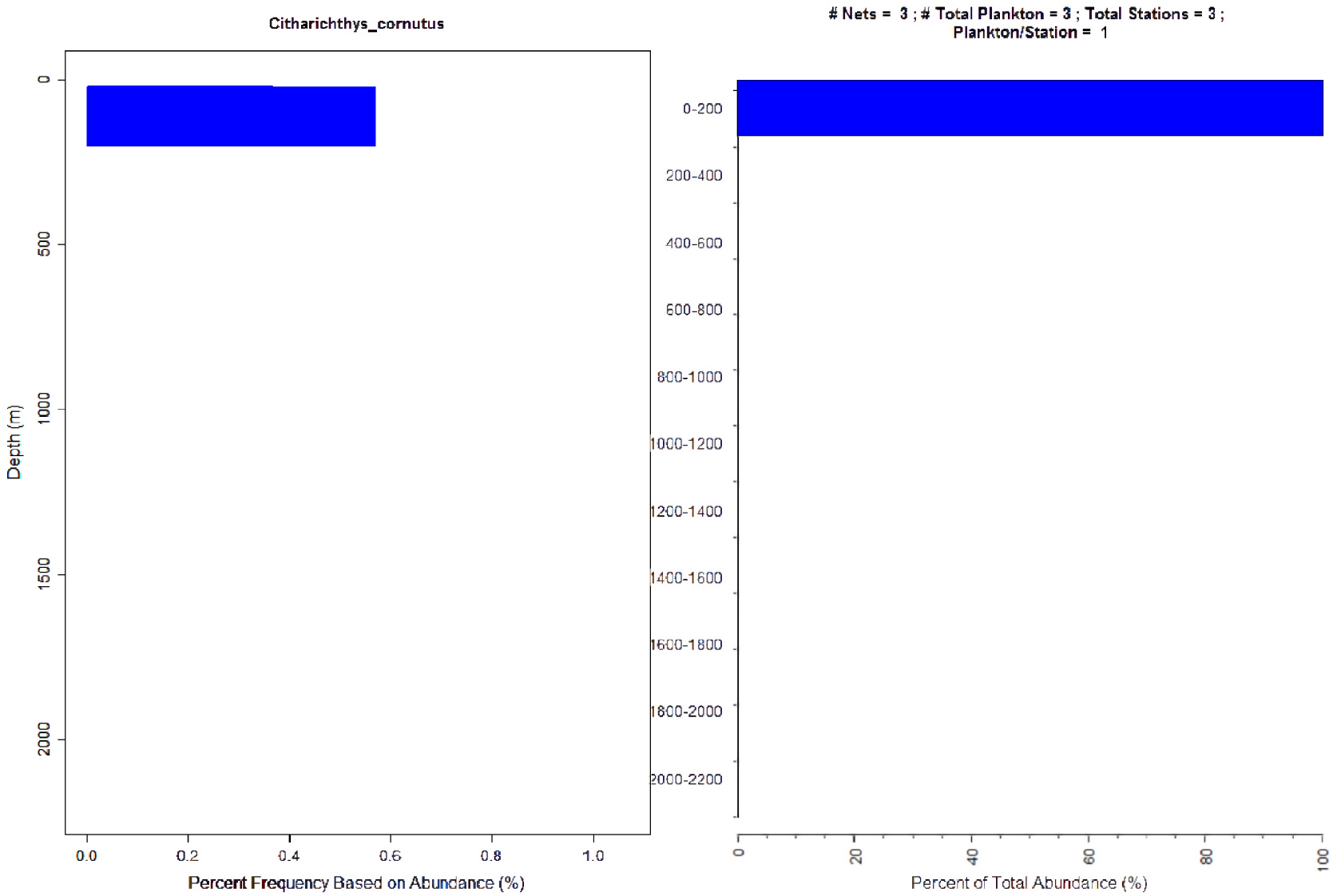
Chlorophthalmus - Deep



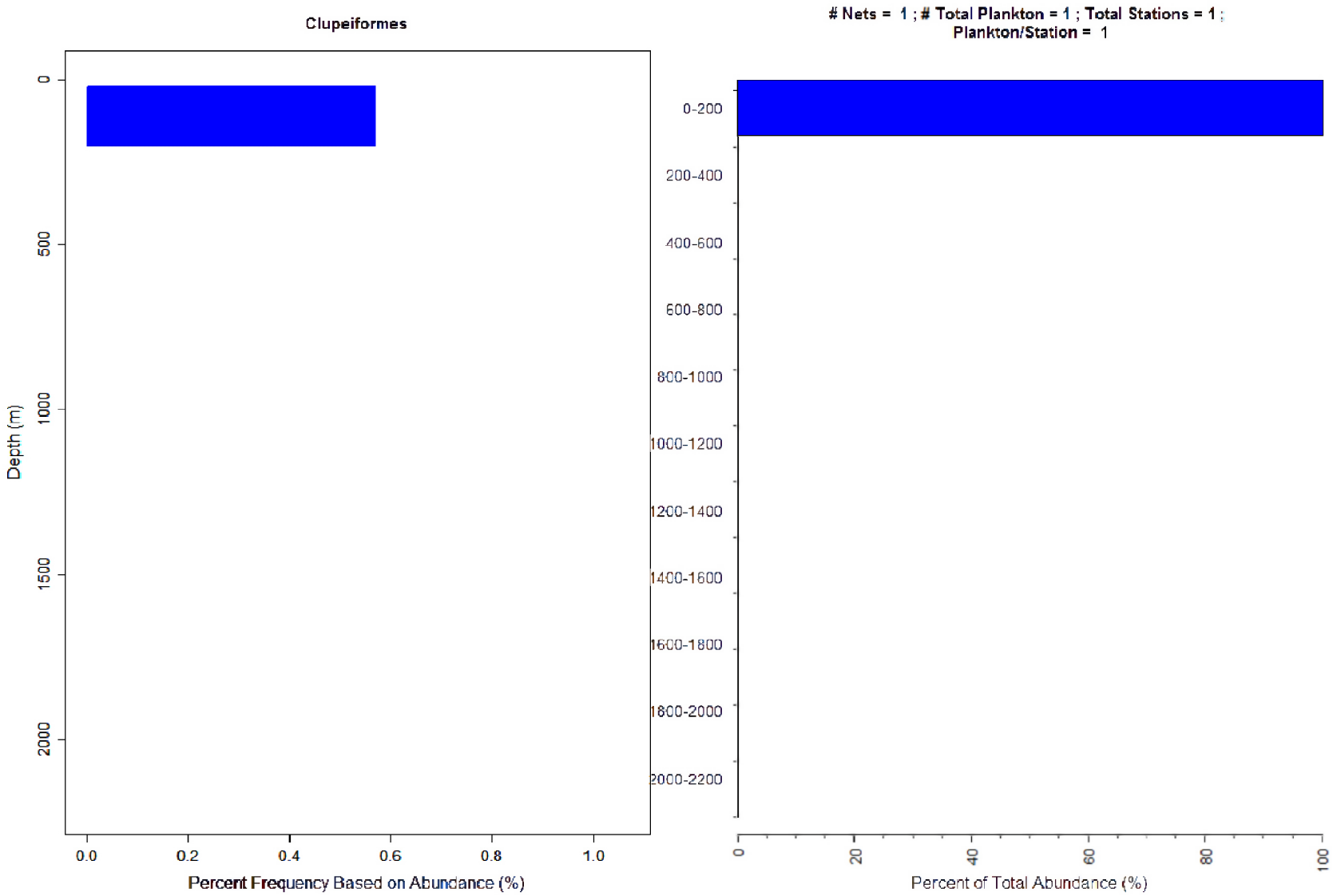
Chlorophthalmus_agassizi - Deep



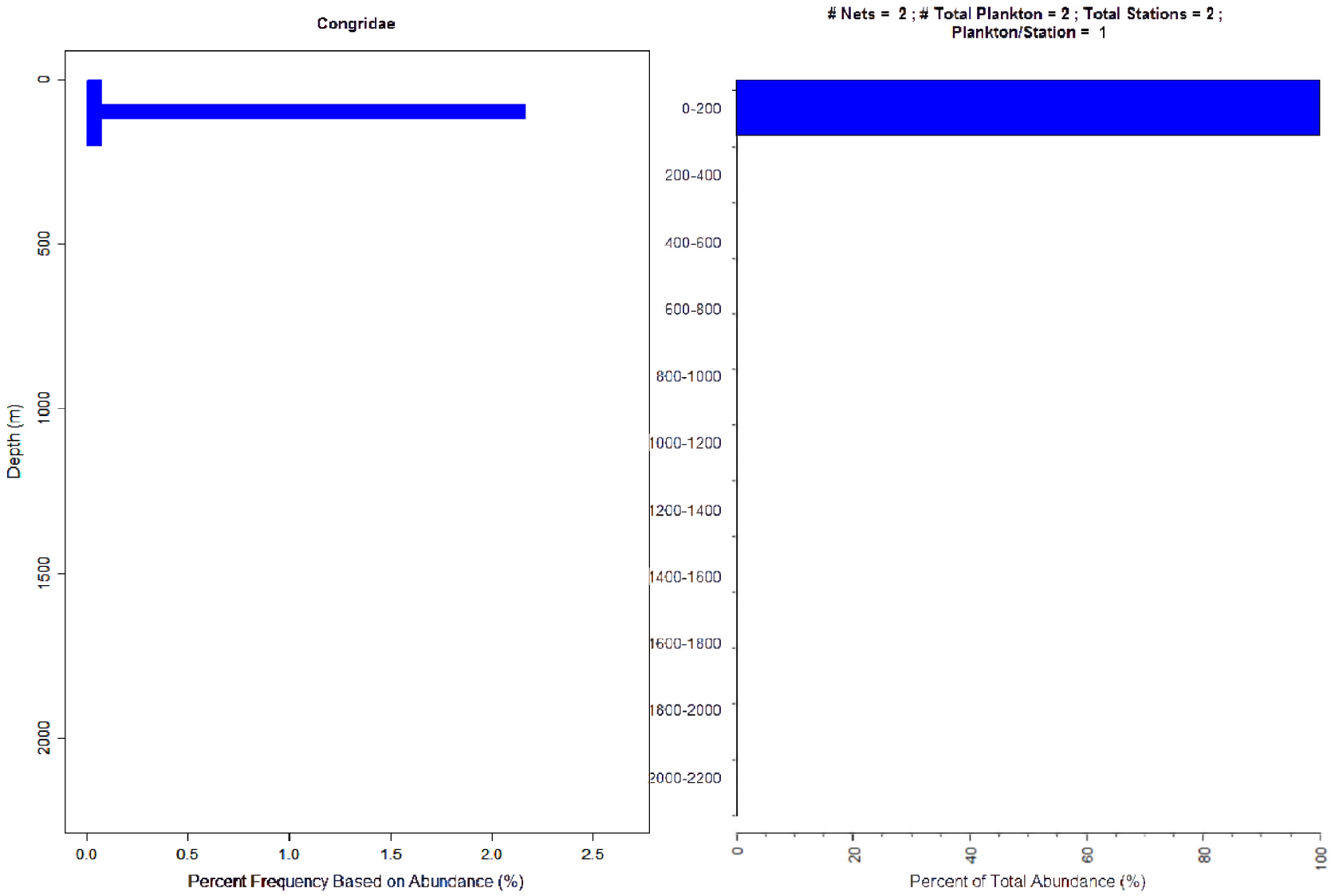
Citharichthys - Deep



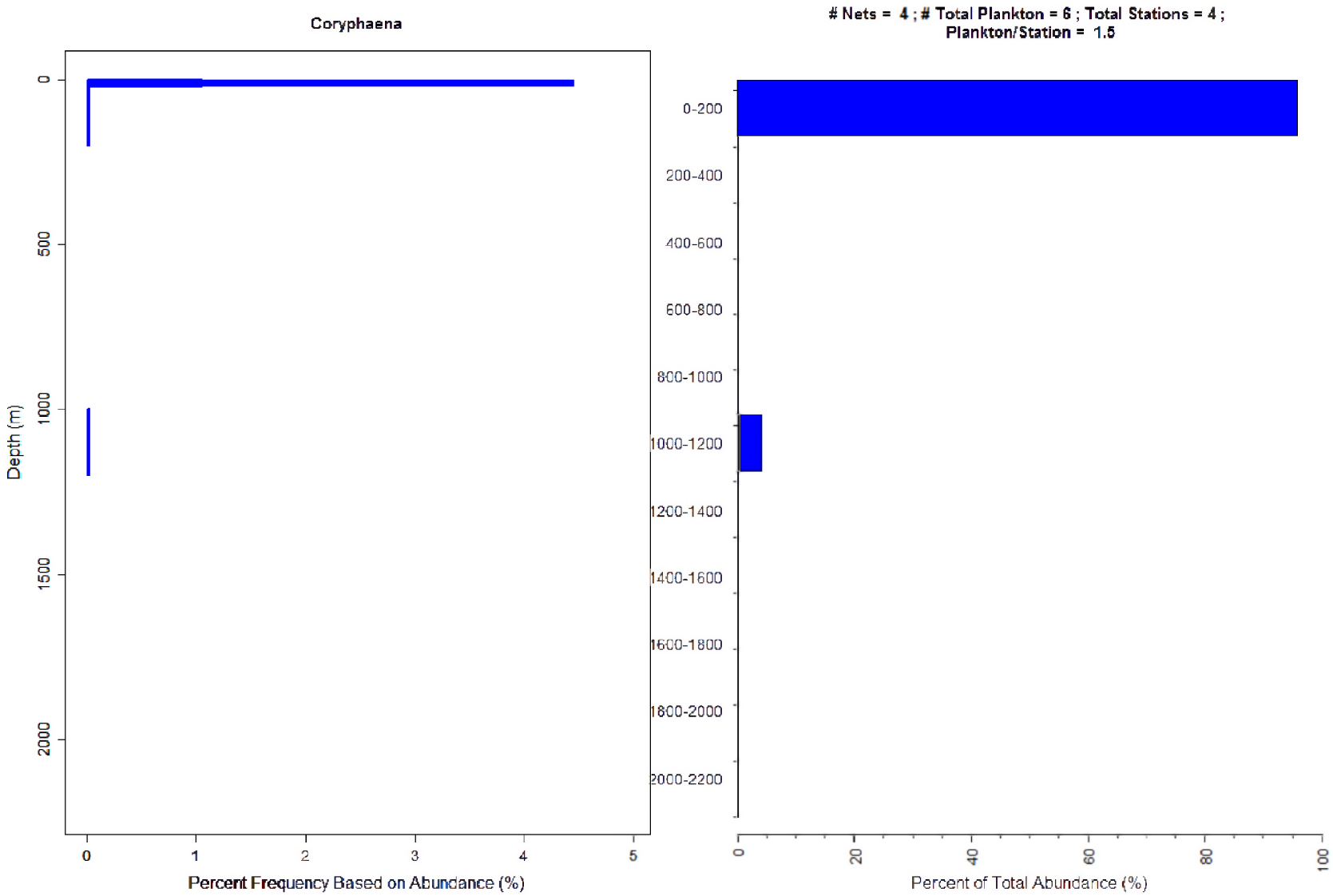
Citharichthys_cornutus - Deep



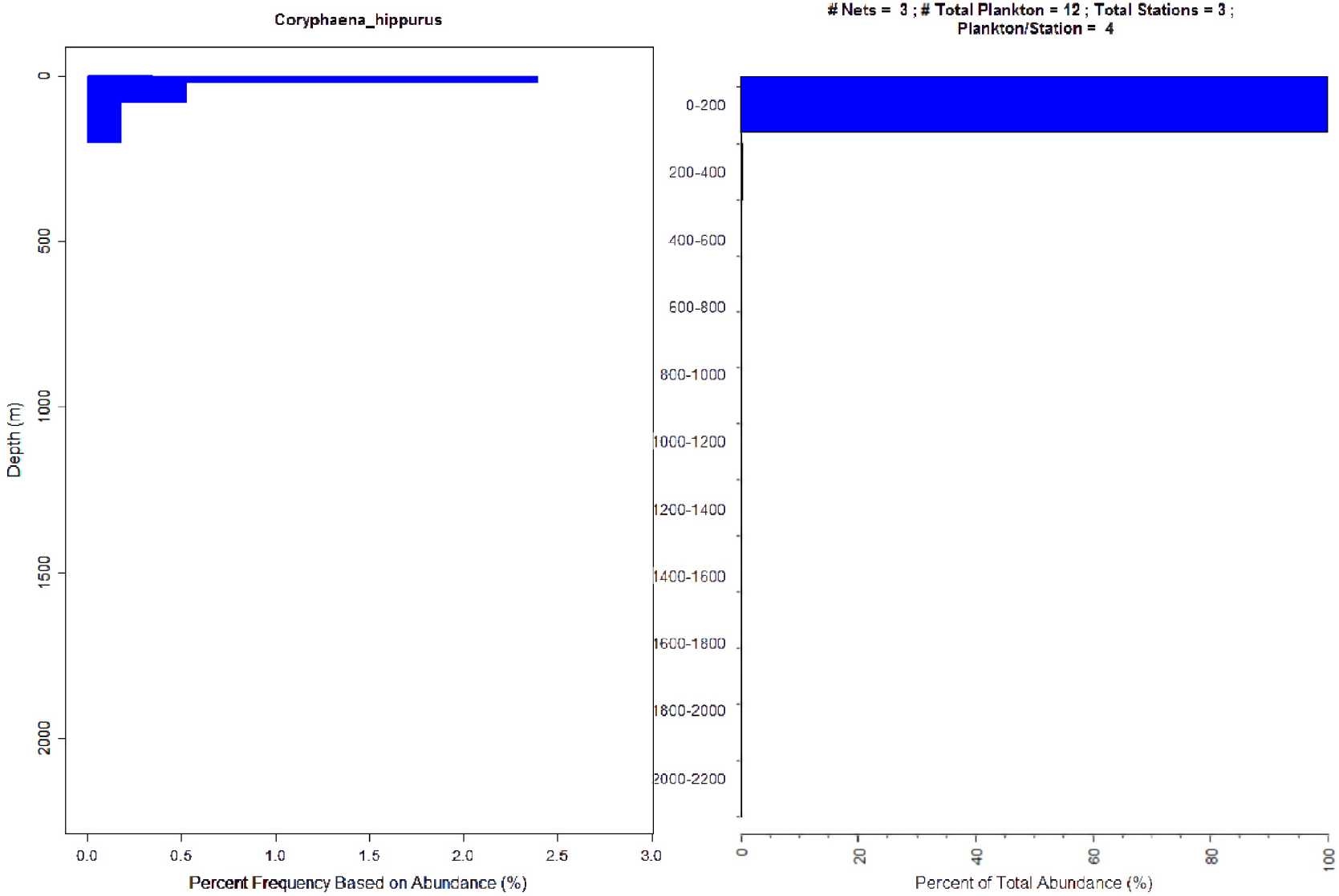
Clupeiformes - Deep



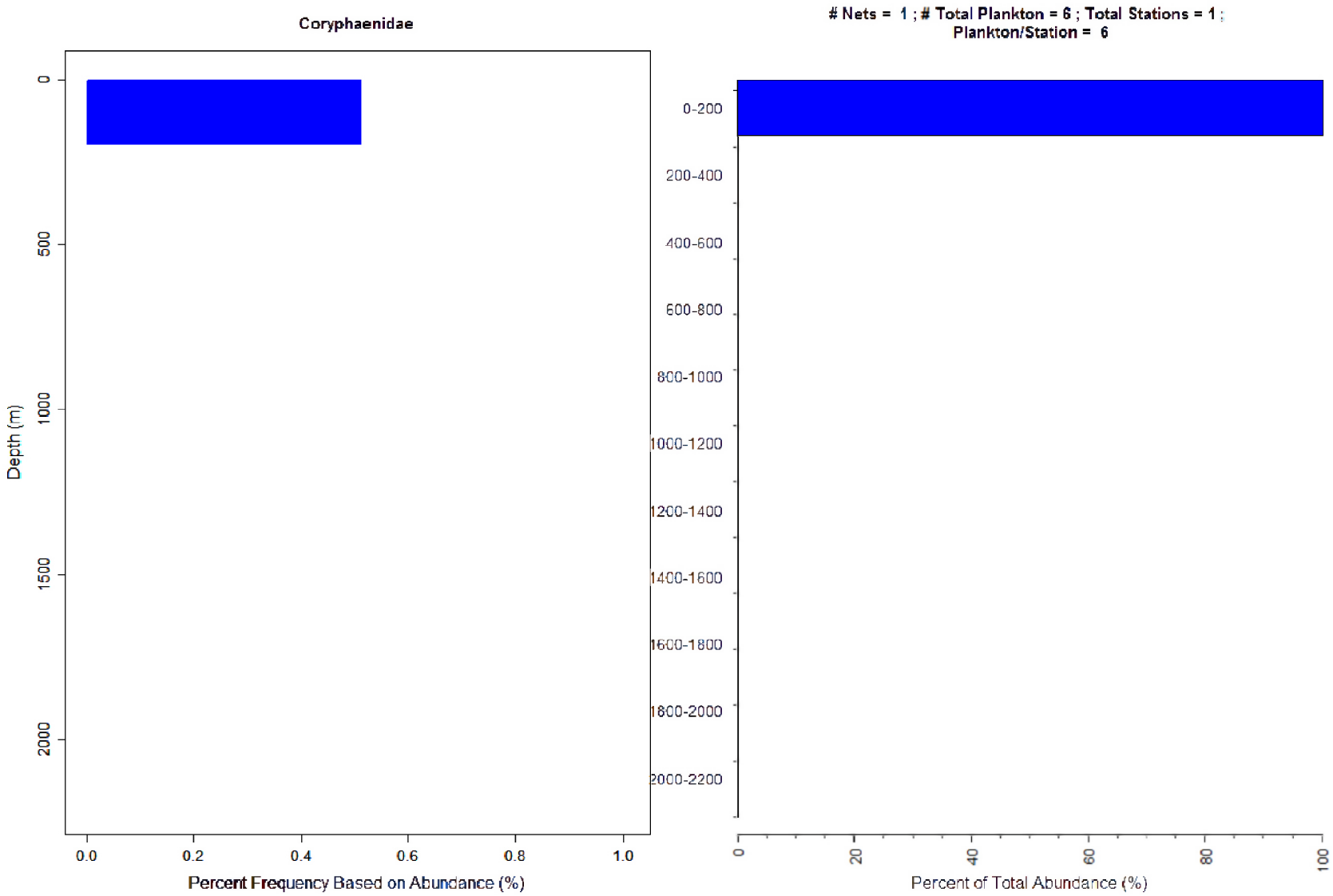
Congridae - Deep



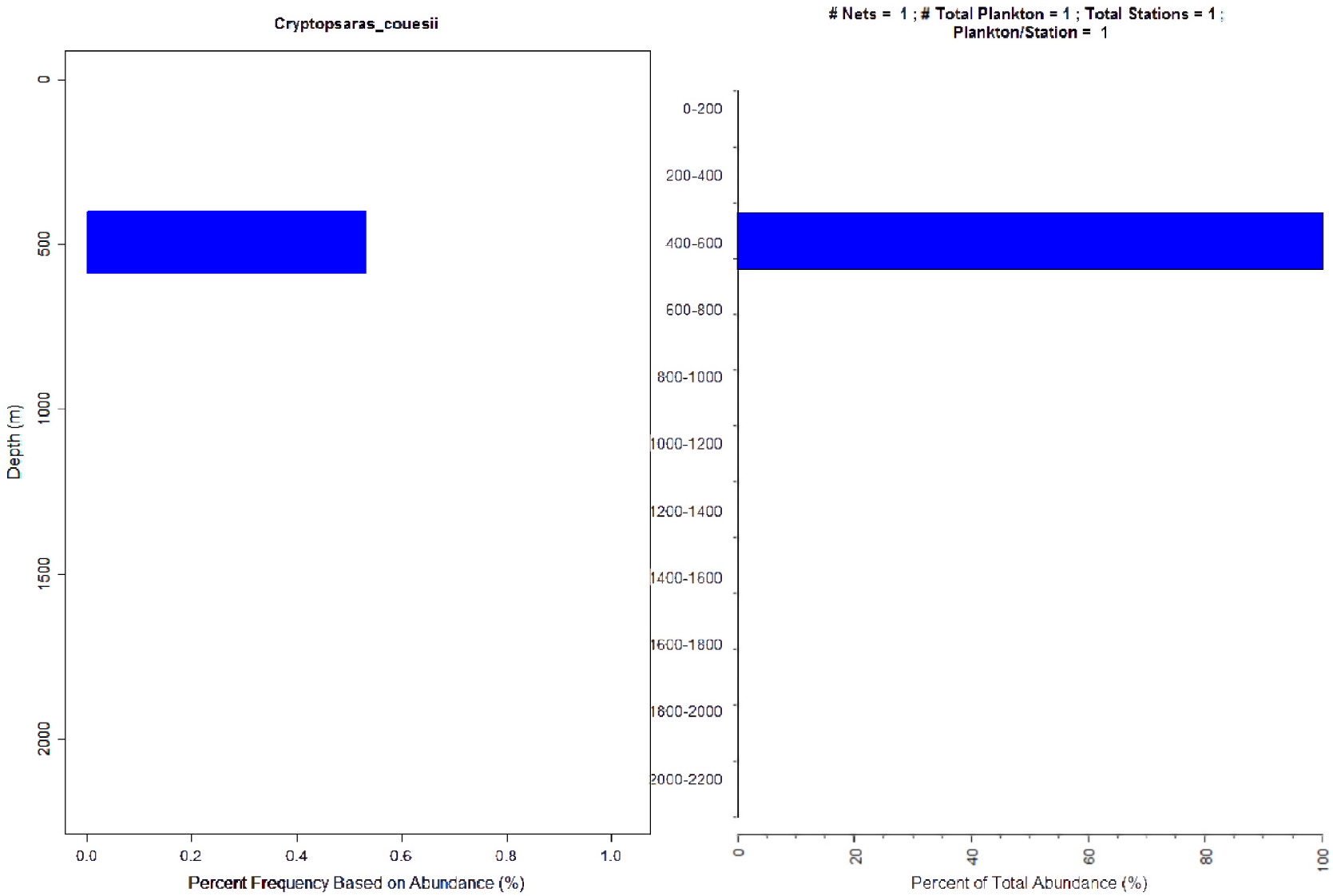
Coryphaena - Deep



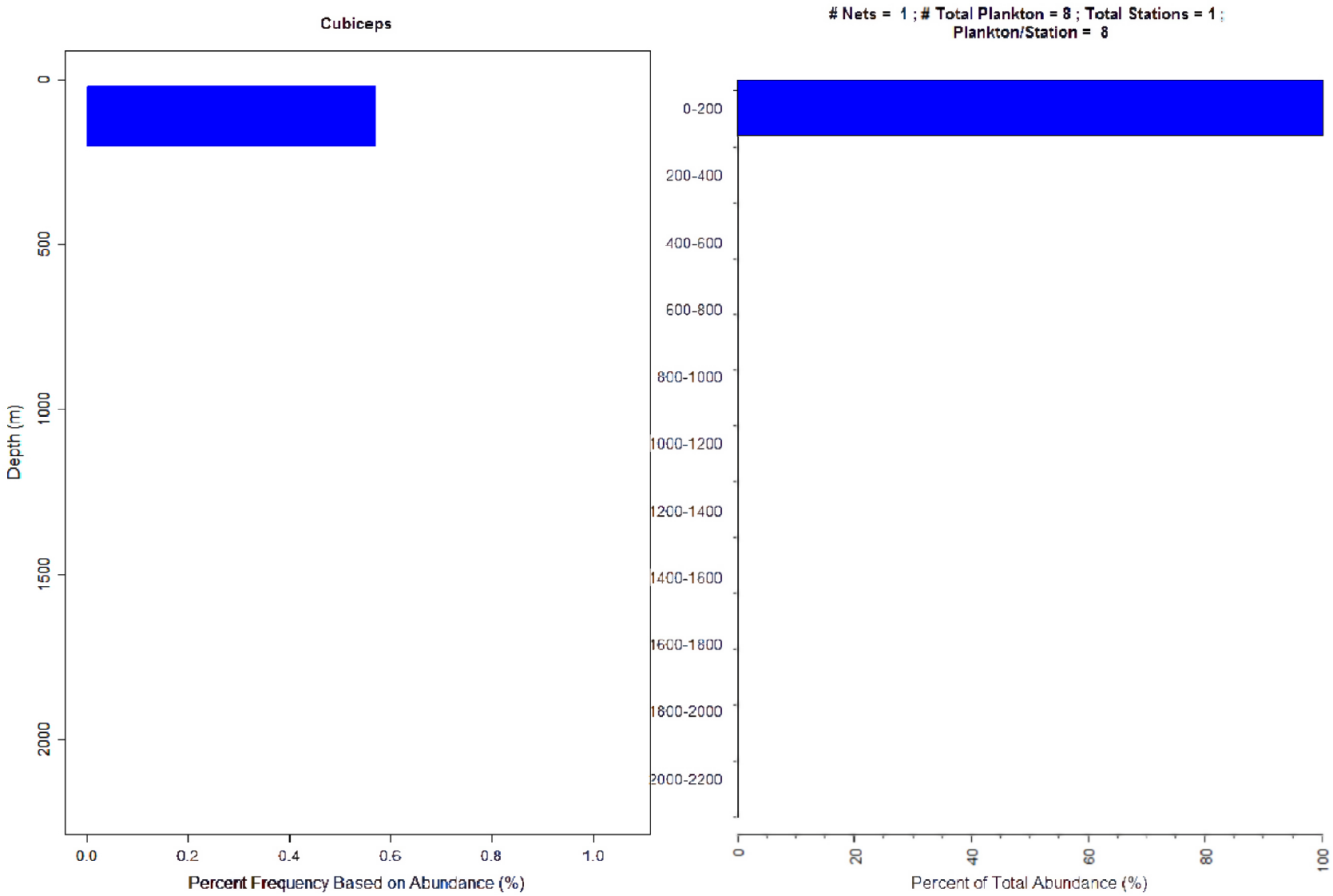
Coryphaena_hippurus - Deep



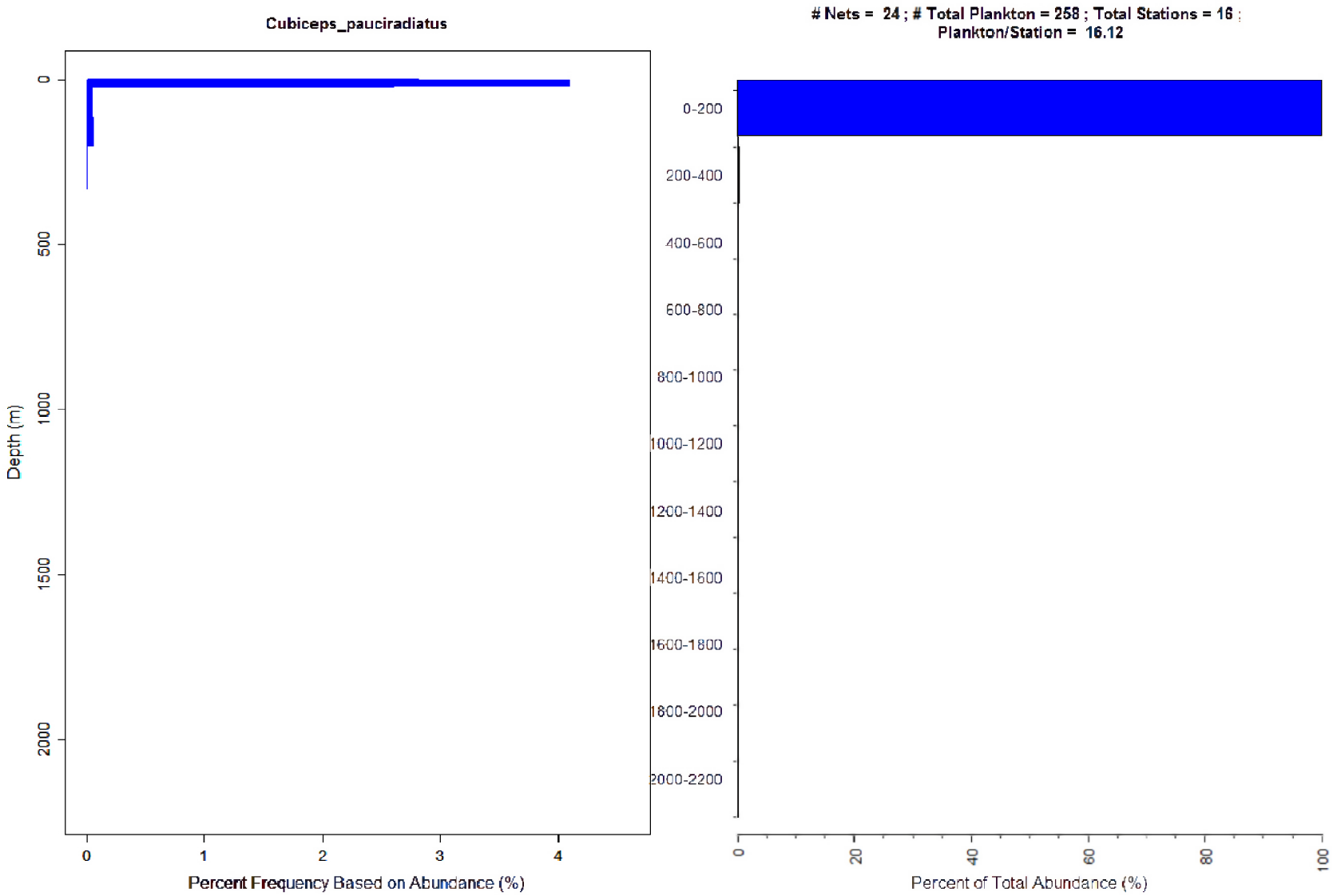
Coryphaenidae - Deep



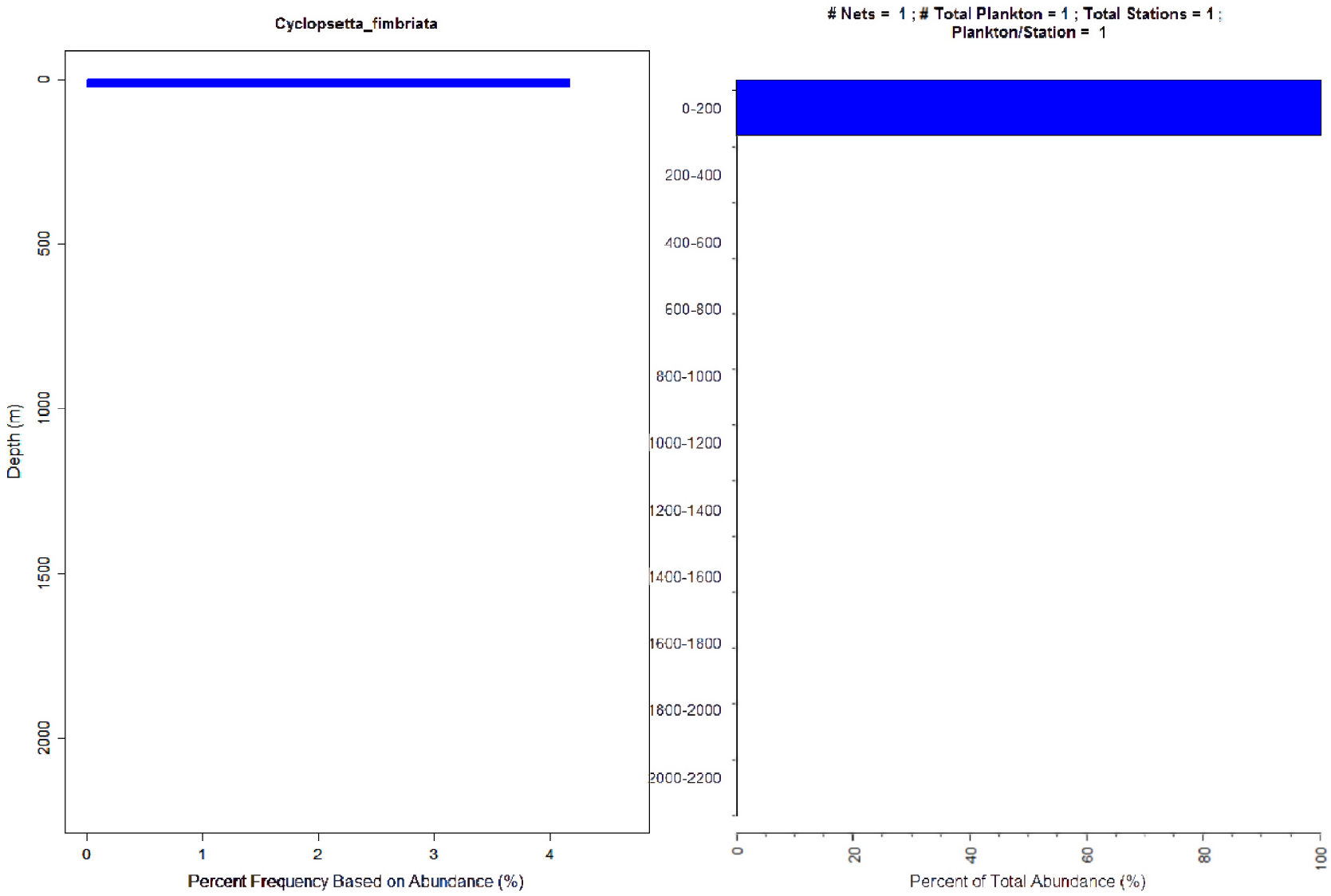
Cryptopsaras_couesii - Deep



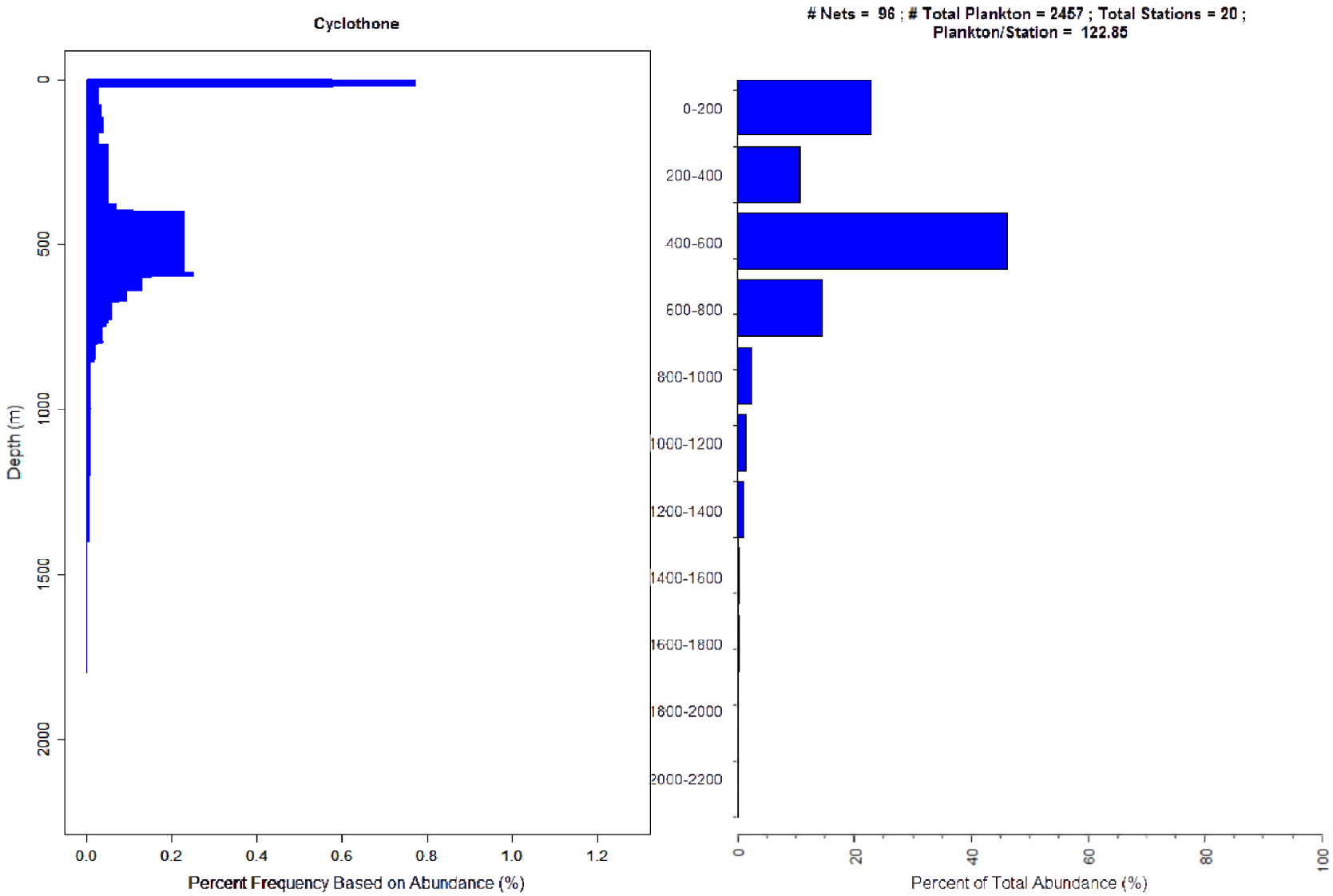
Cubiceps - Deep



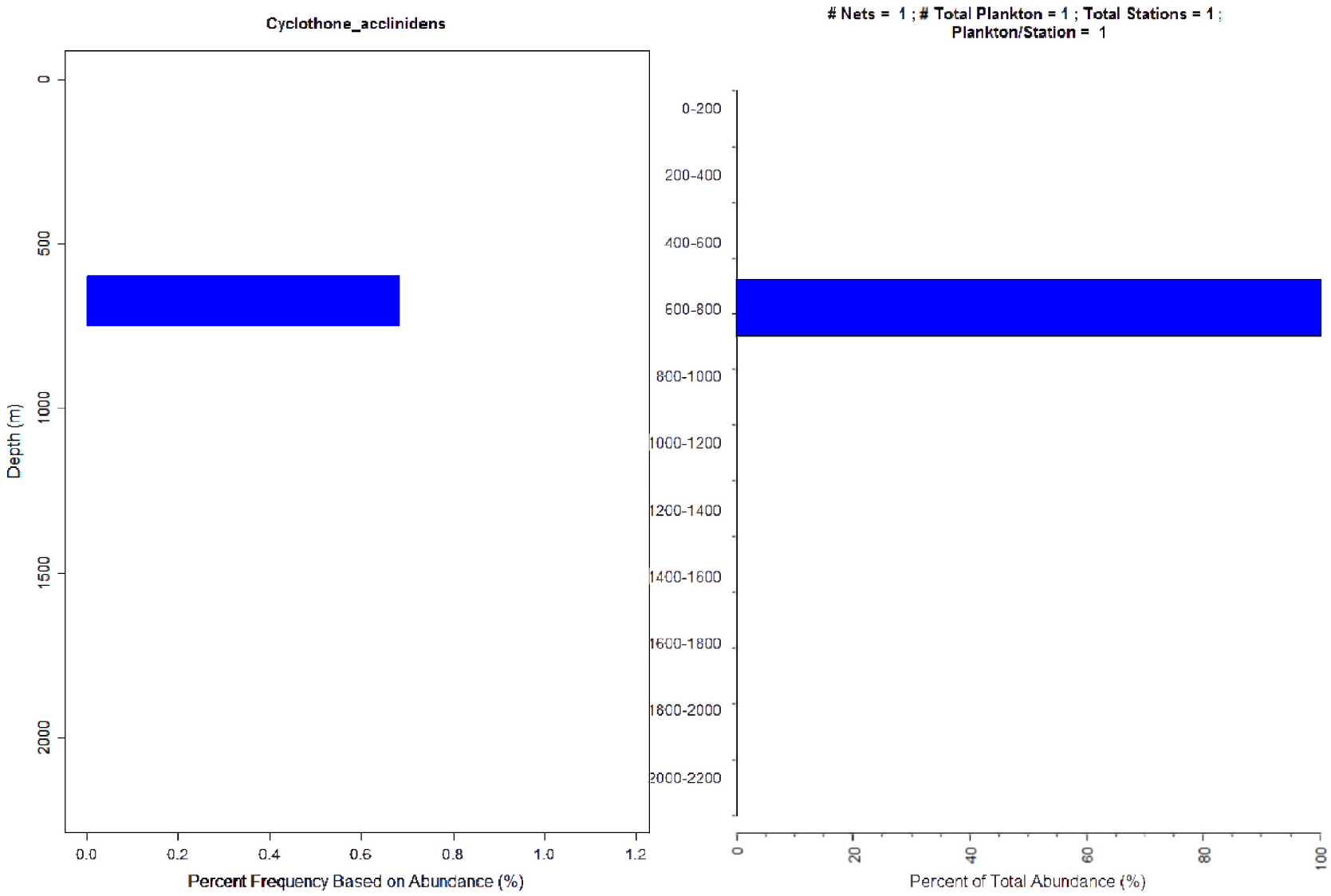
Cubiceps_pauciradiatus - Deep



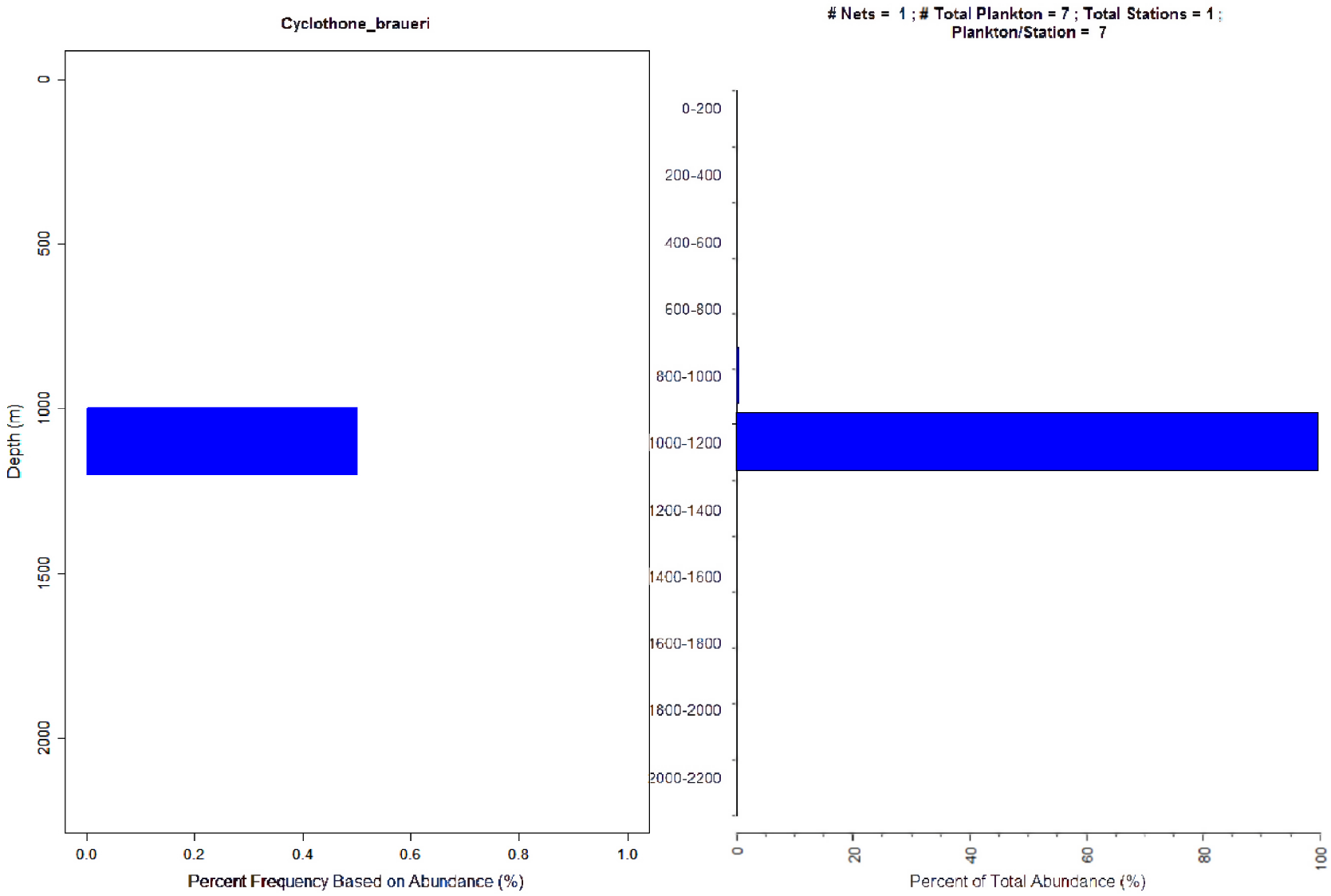
Cyclopsetta_fimbriata - Deep



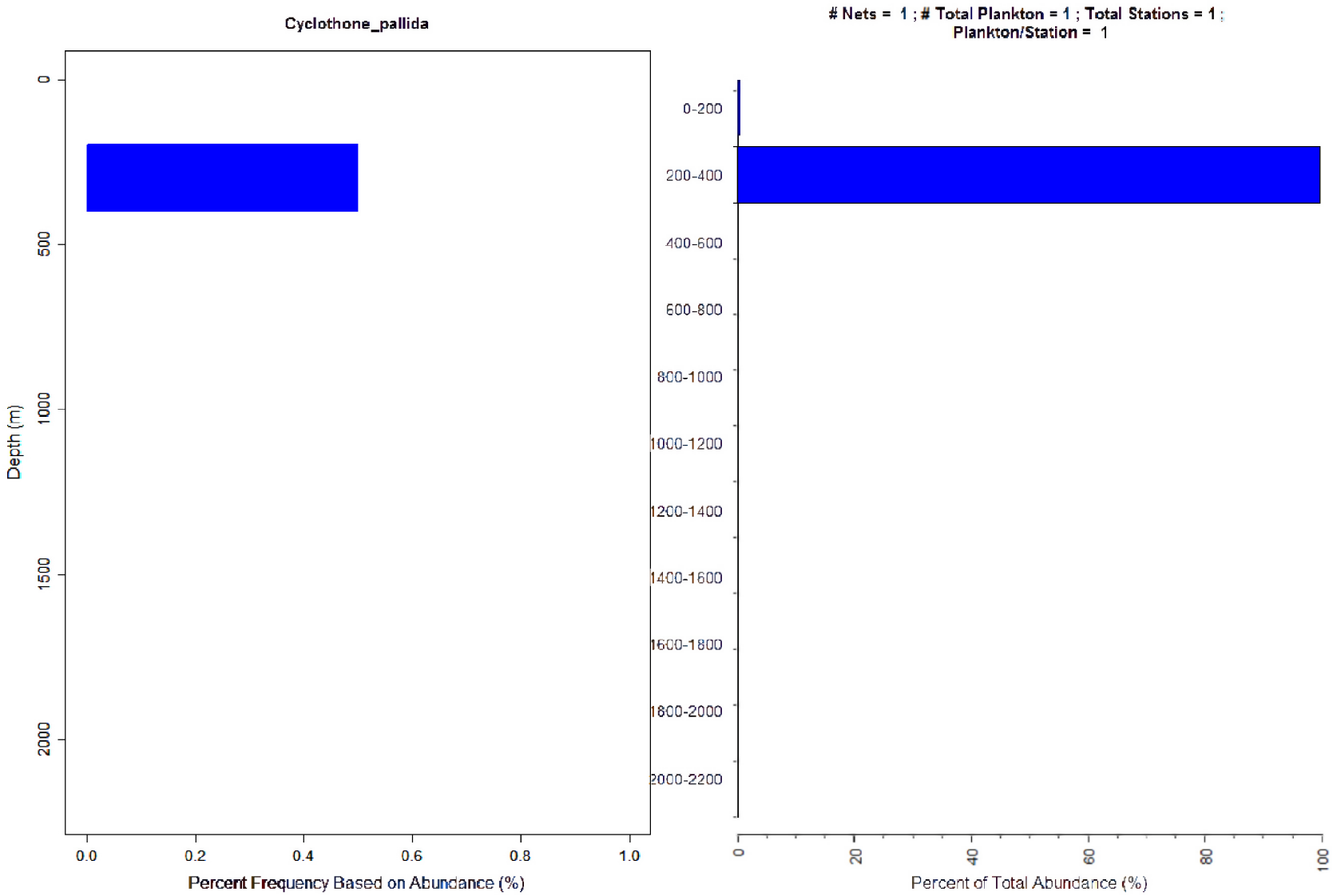
Cyclothone - Deep



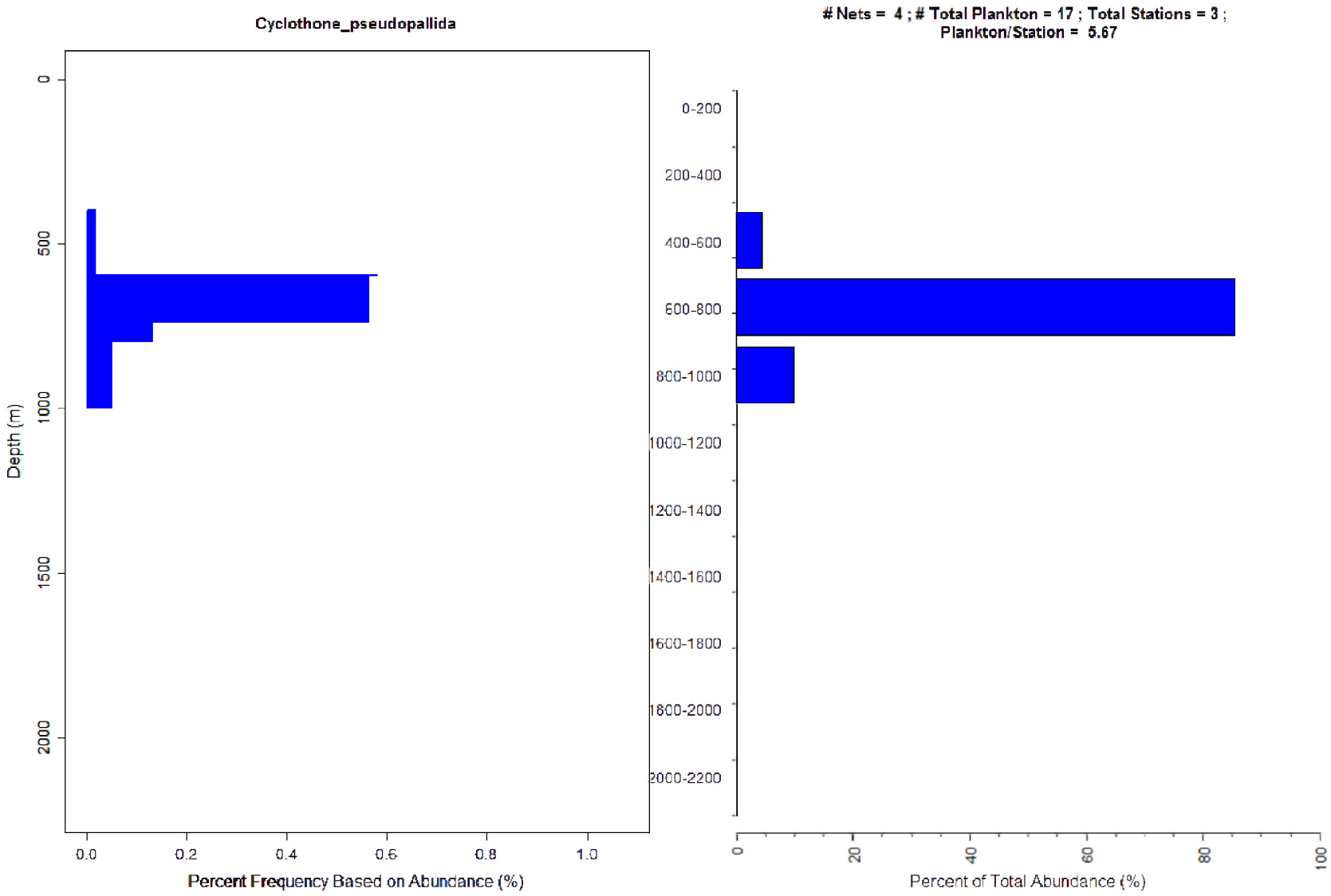
Cyclothone_acclinidens - Deep



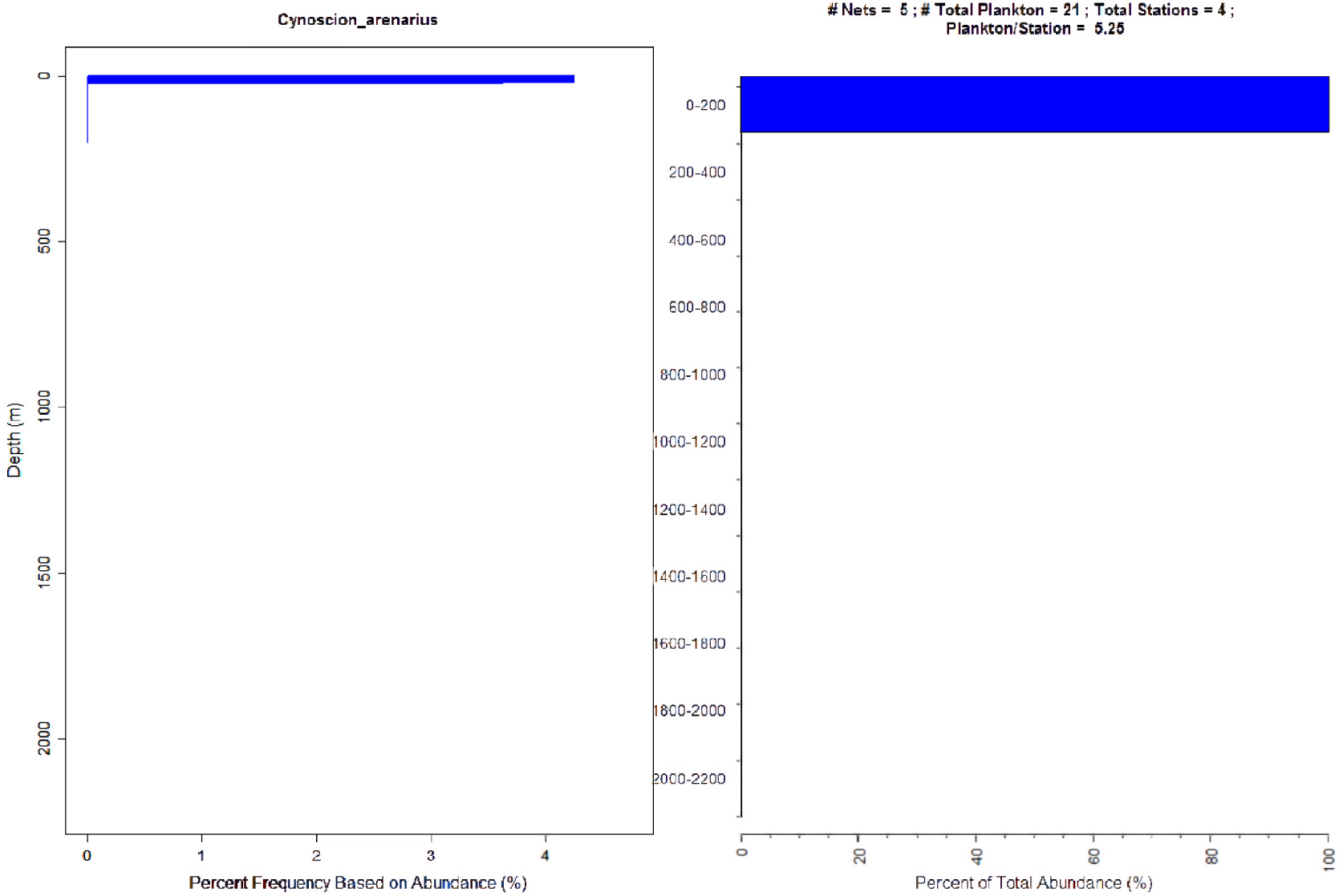
Cyclothone_braueri - Deep



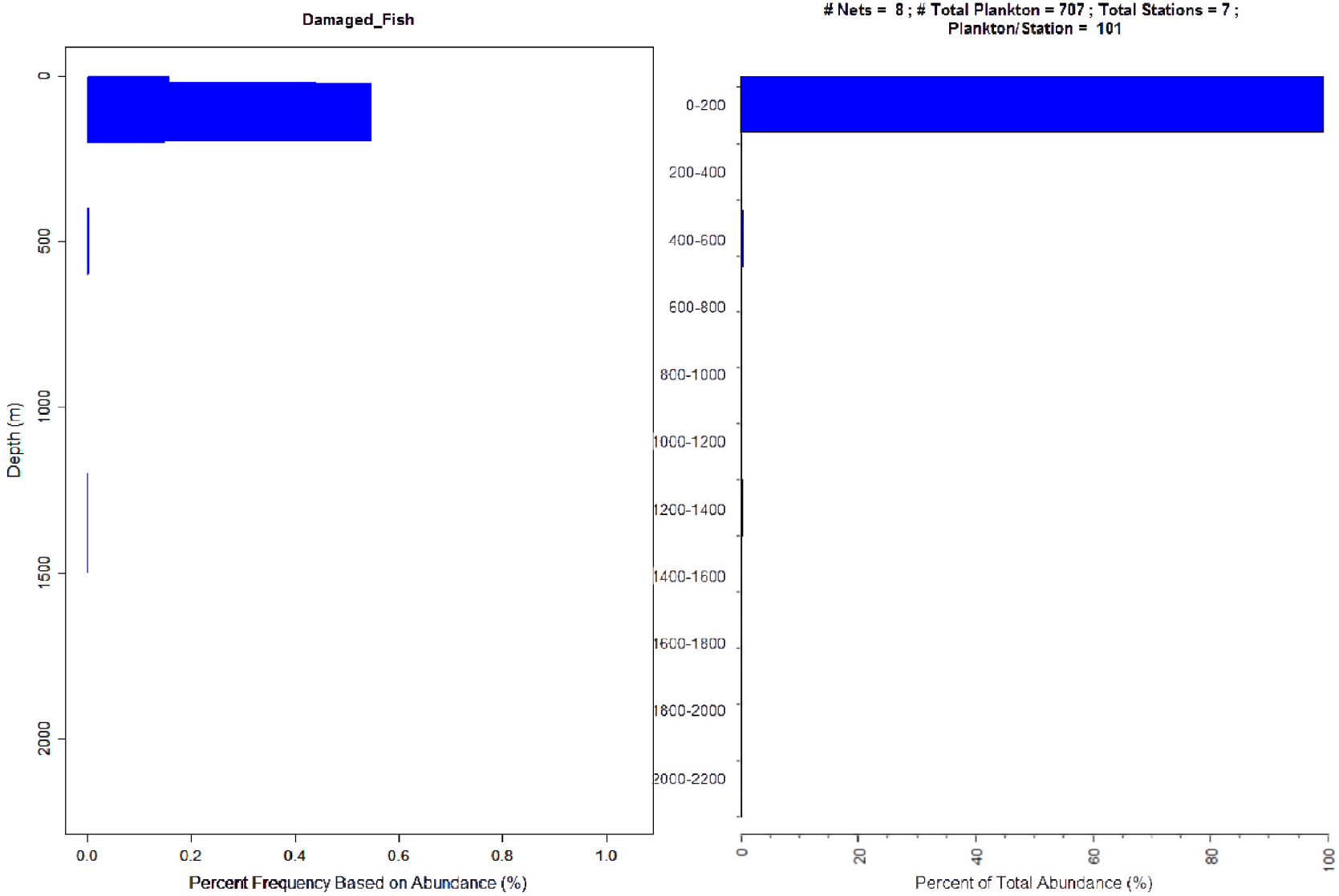
Cyclothone_pallida - Deep



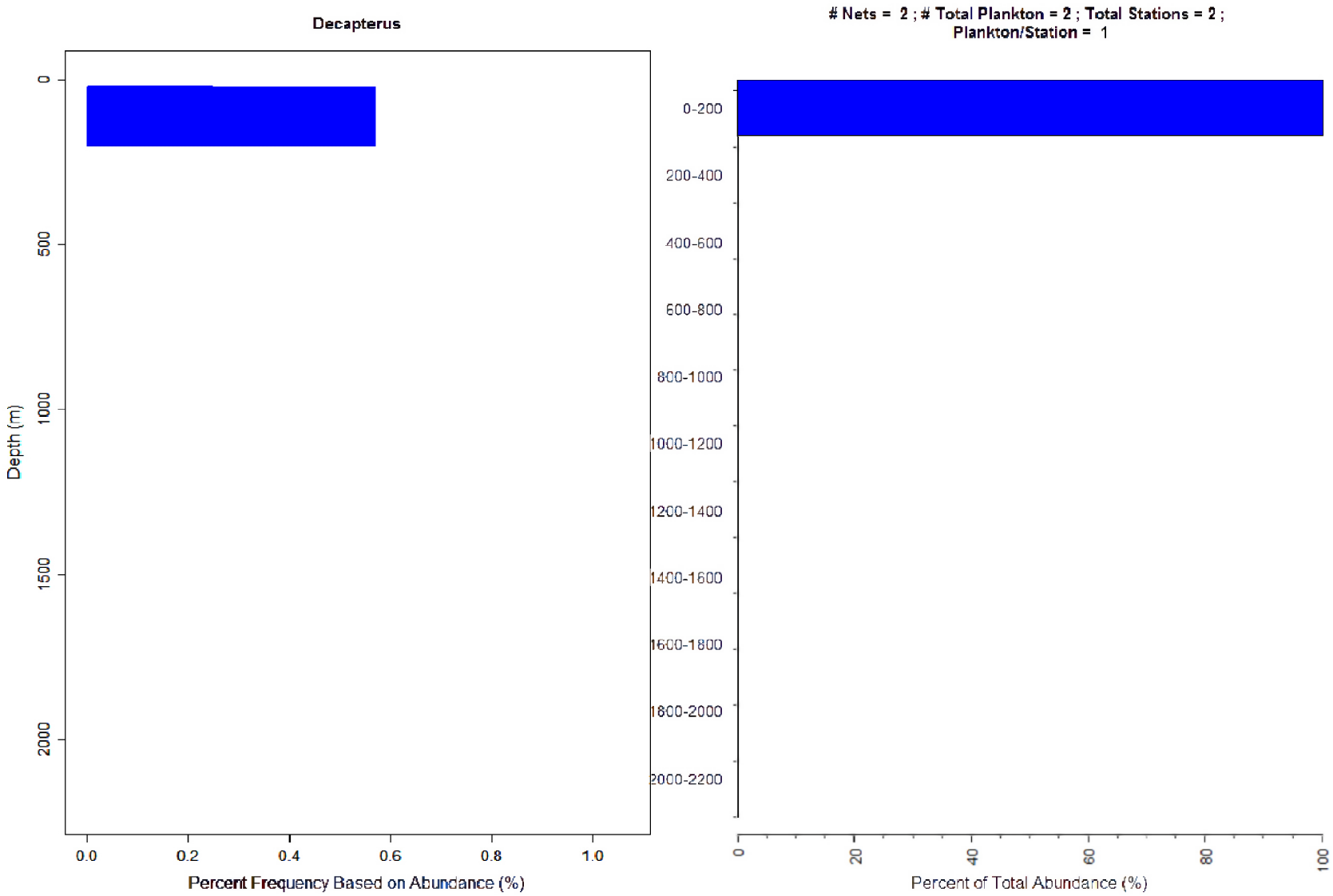
Cyclothone_pseudopallida - Deep



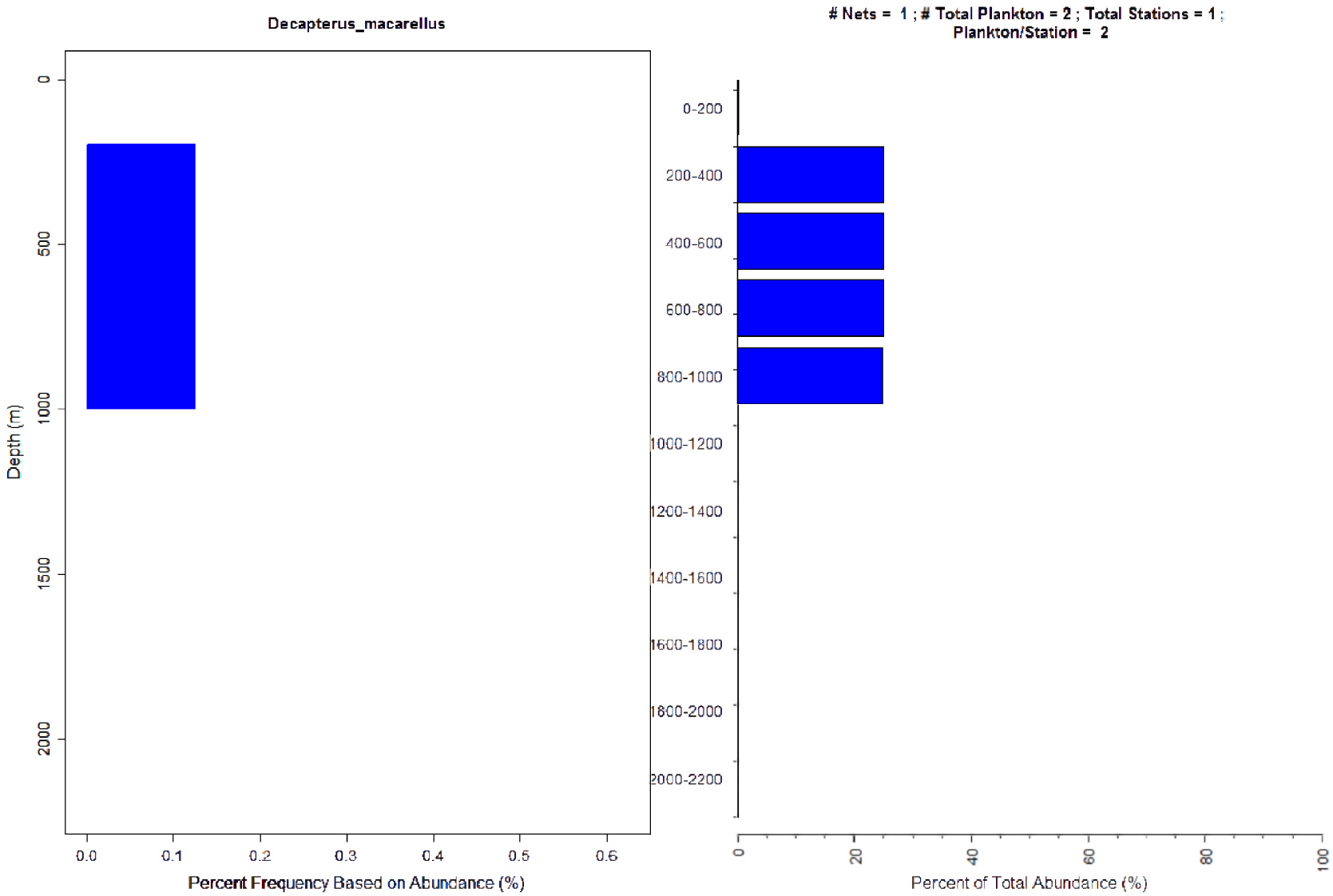
Cynoscion_arenarius - Deep



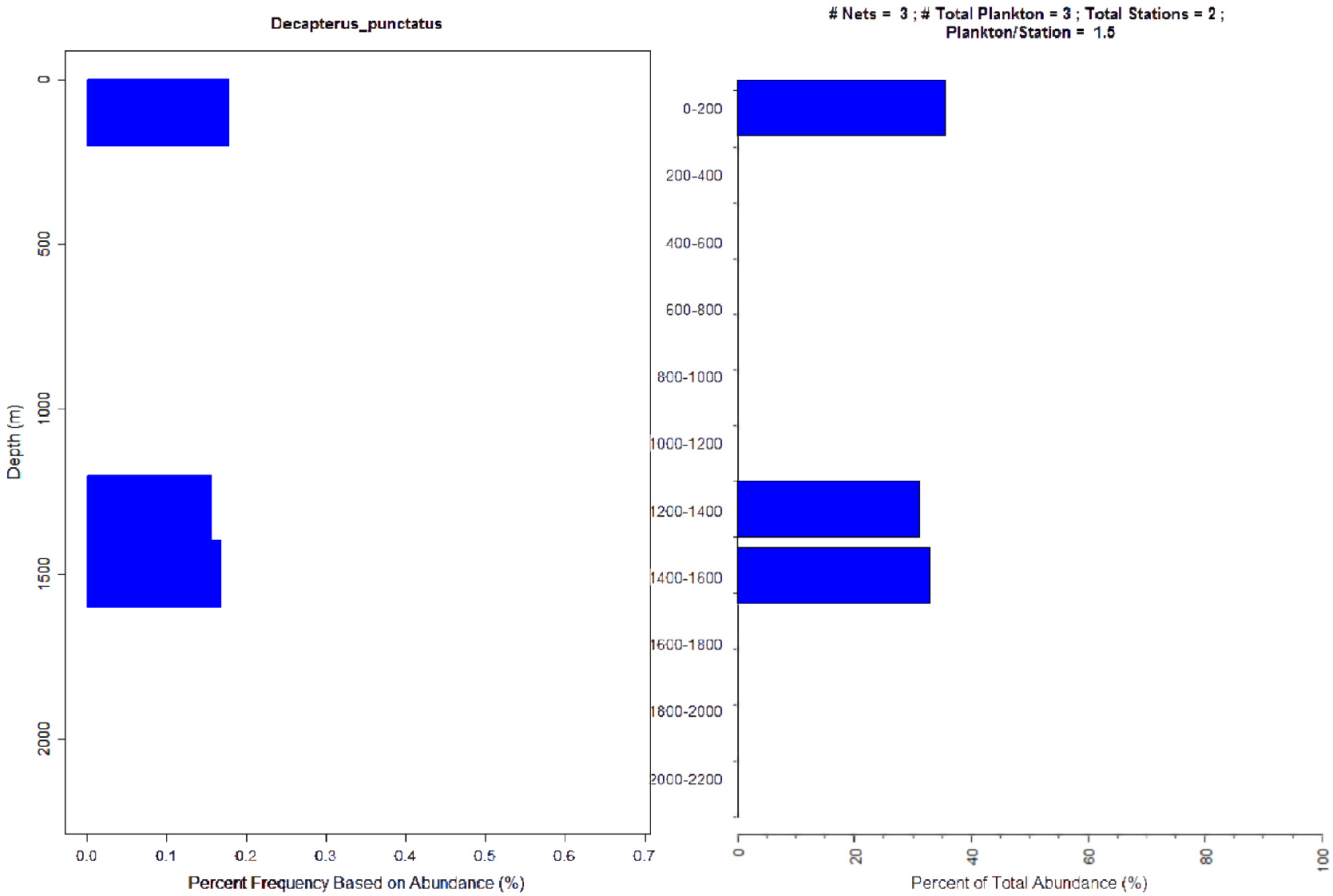
Damaged_Fish - Deep



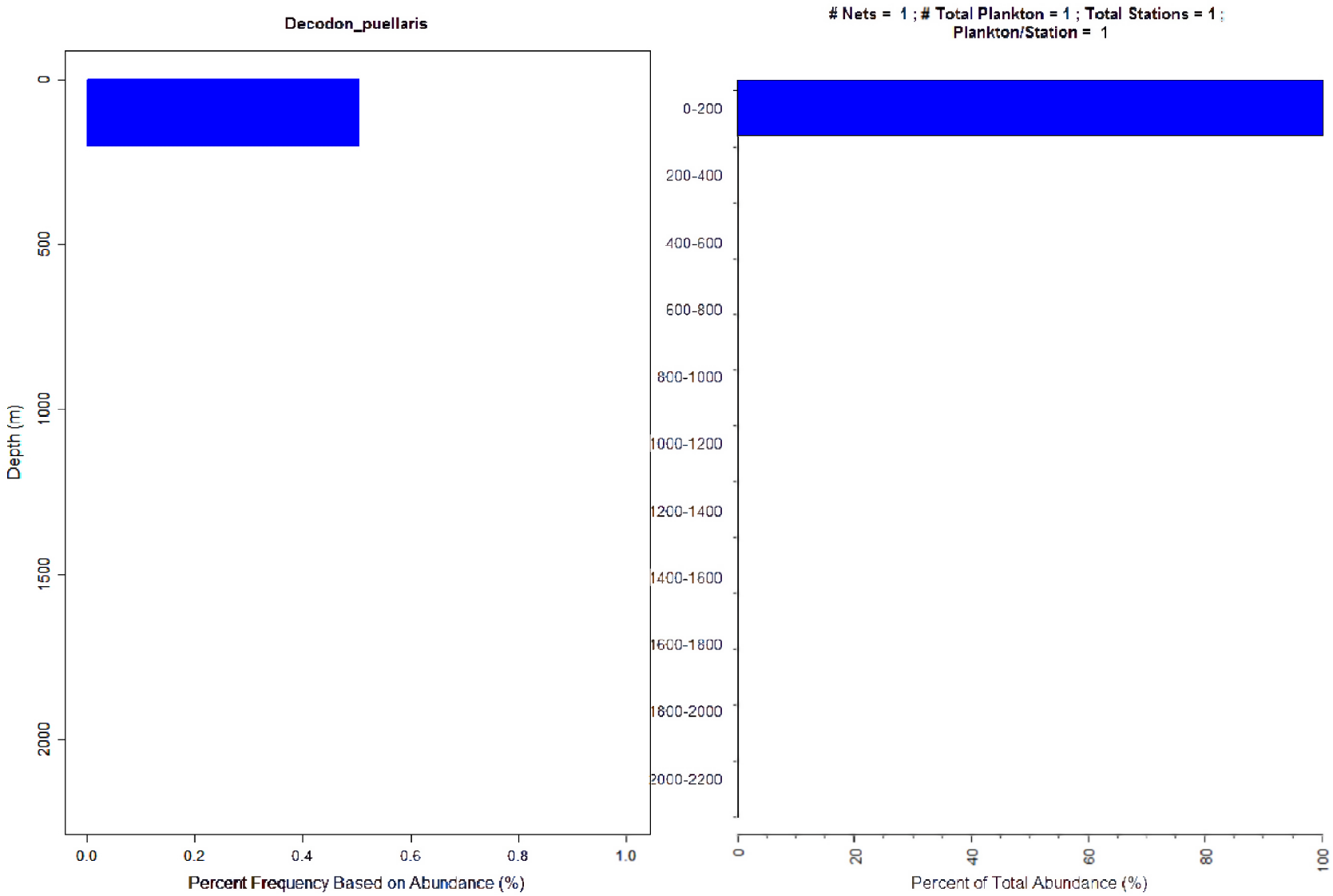
Decapterus - Deep



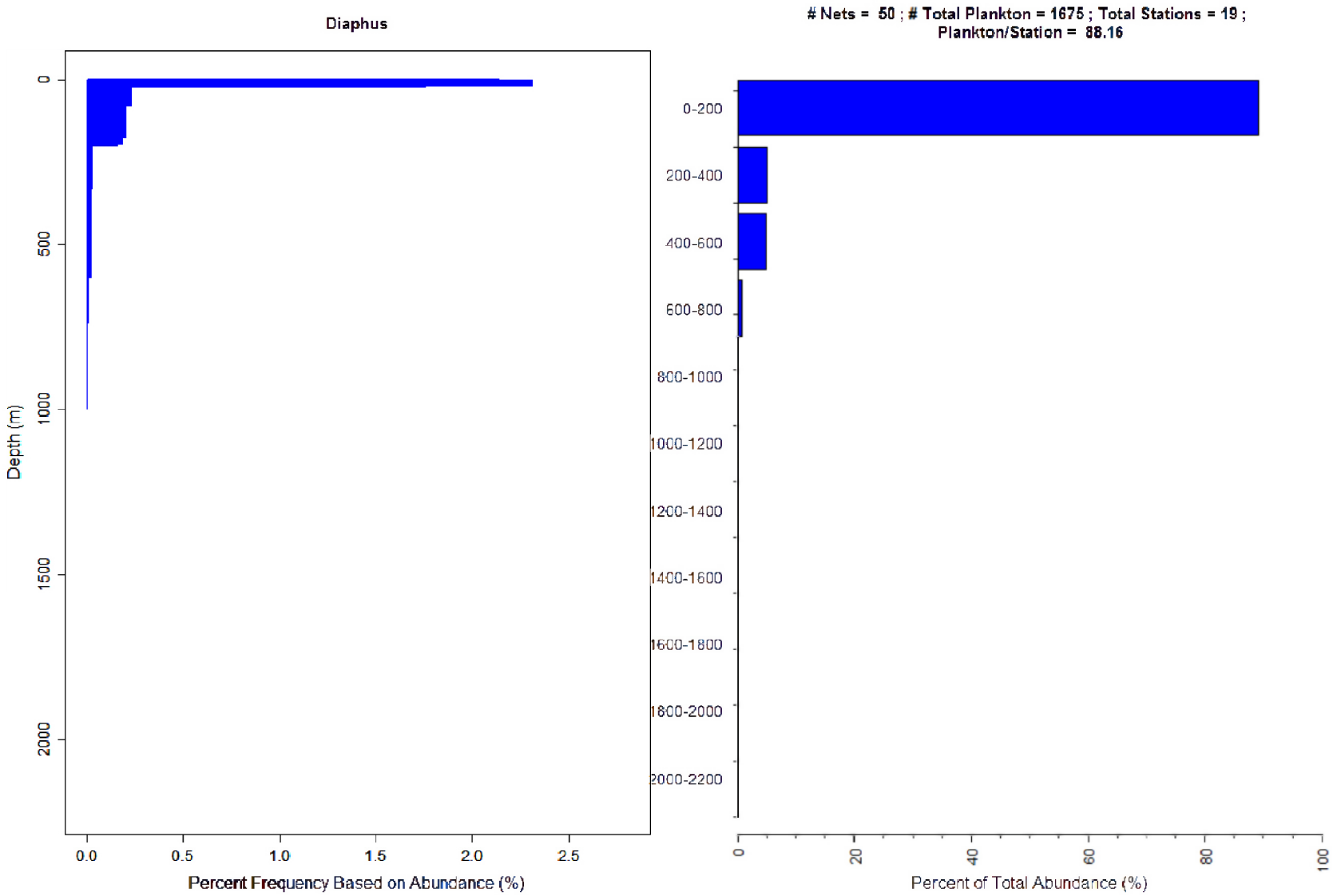
Decapterus_macarellus - Deep



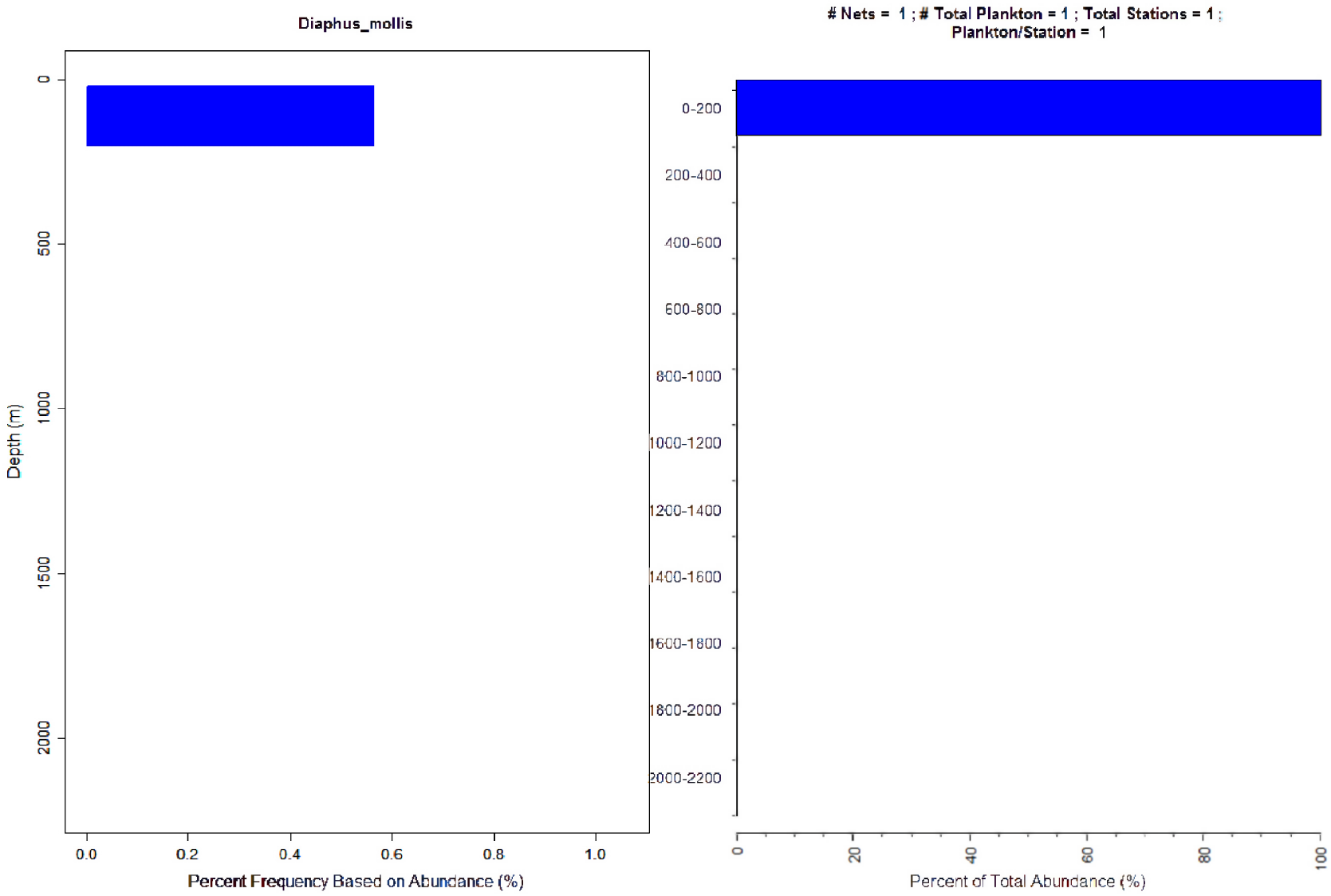
Decapterus_punctatus - Deep



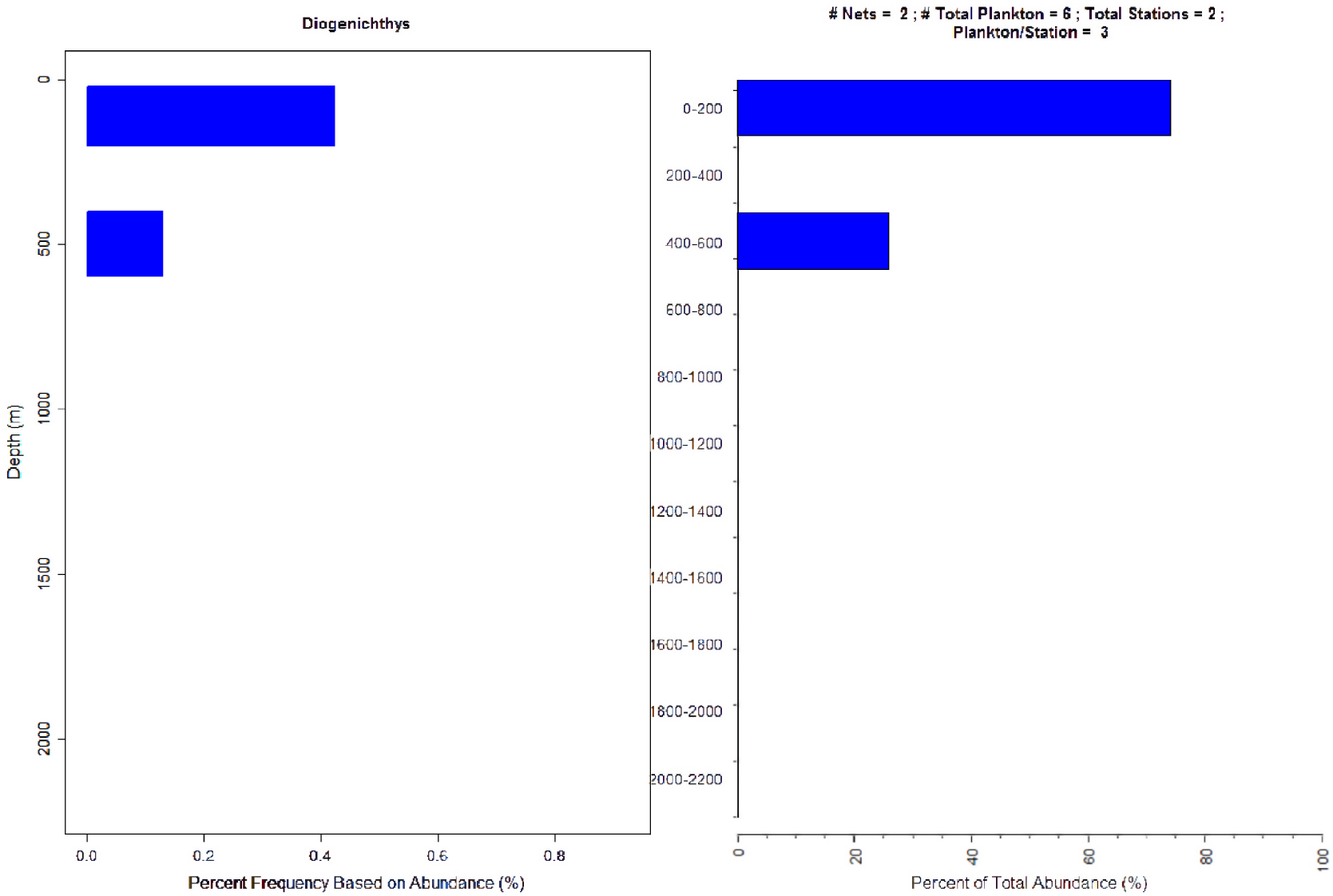
Decodon_puellaris - Deep



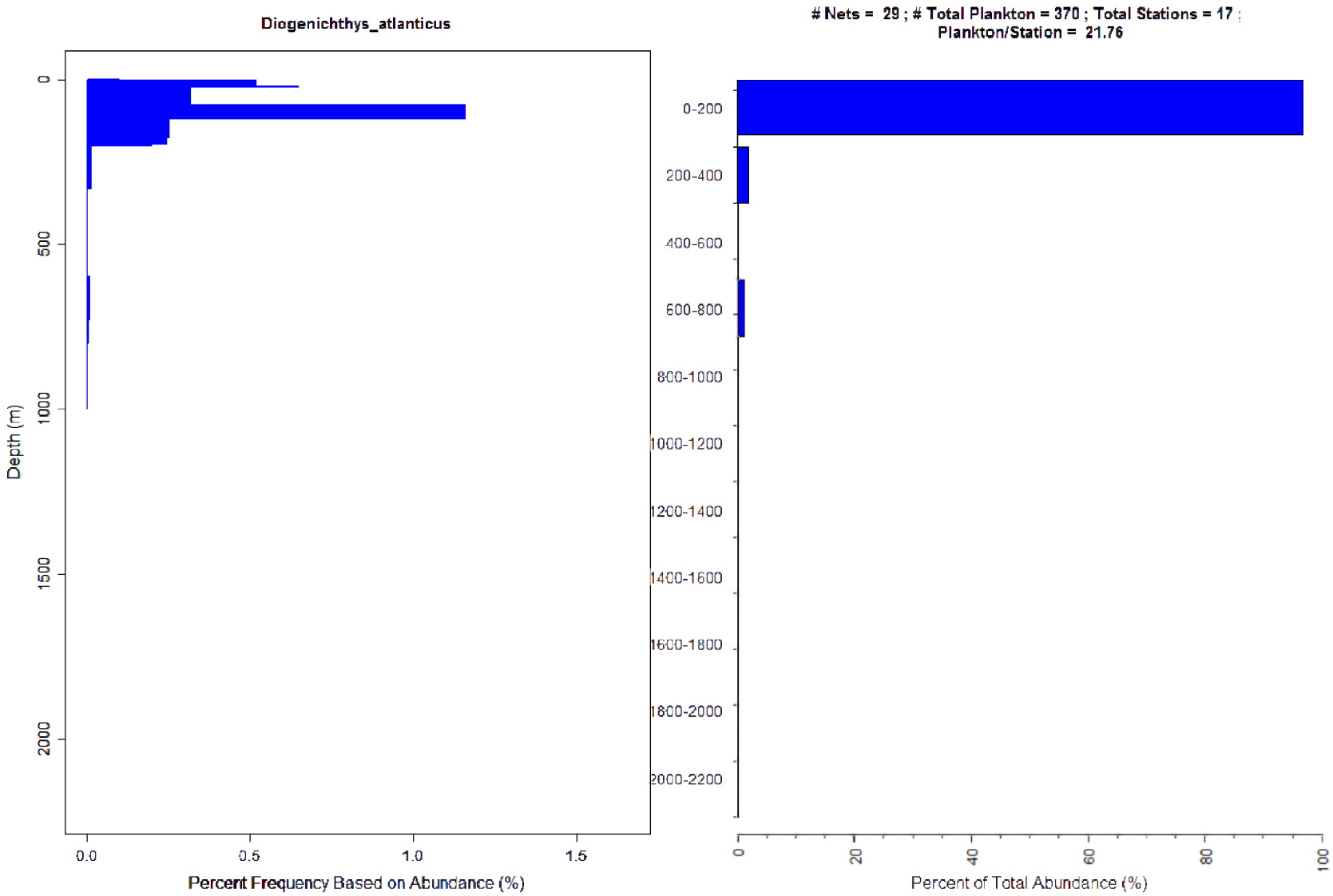
Diaphus - Deep



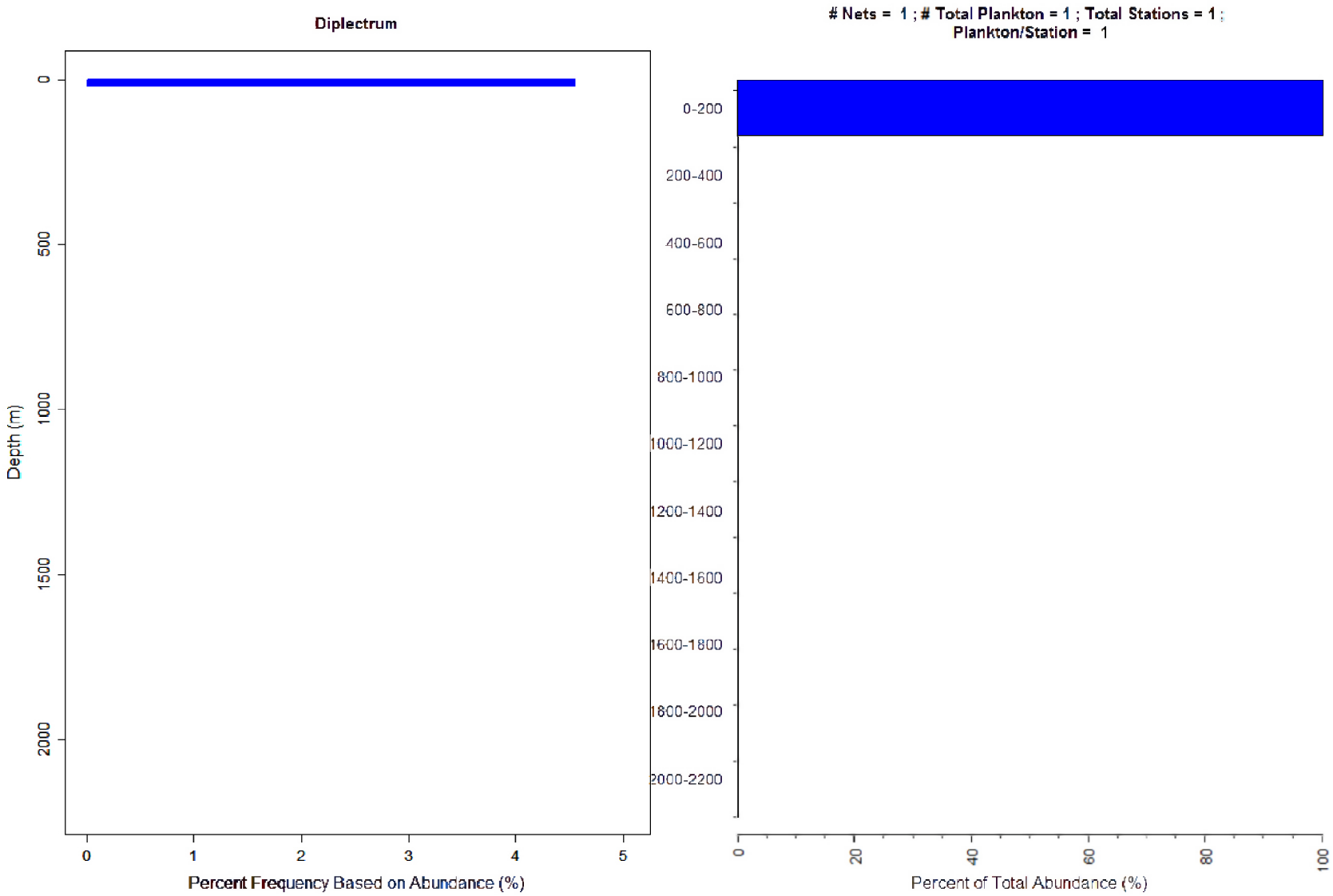
Diaphus_mollis - Deep



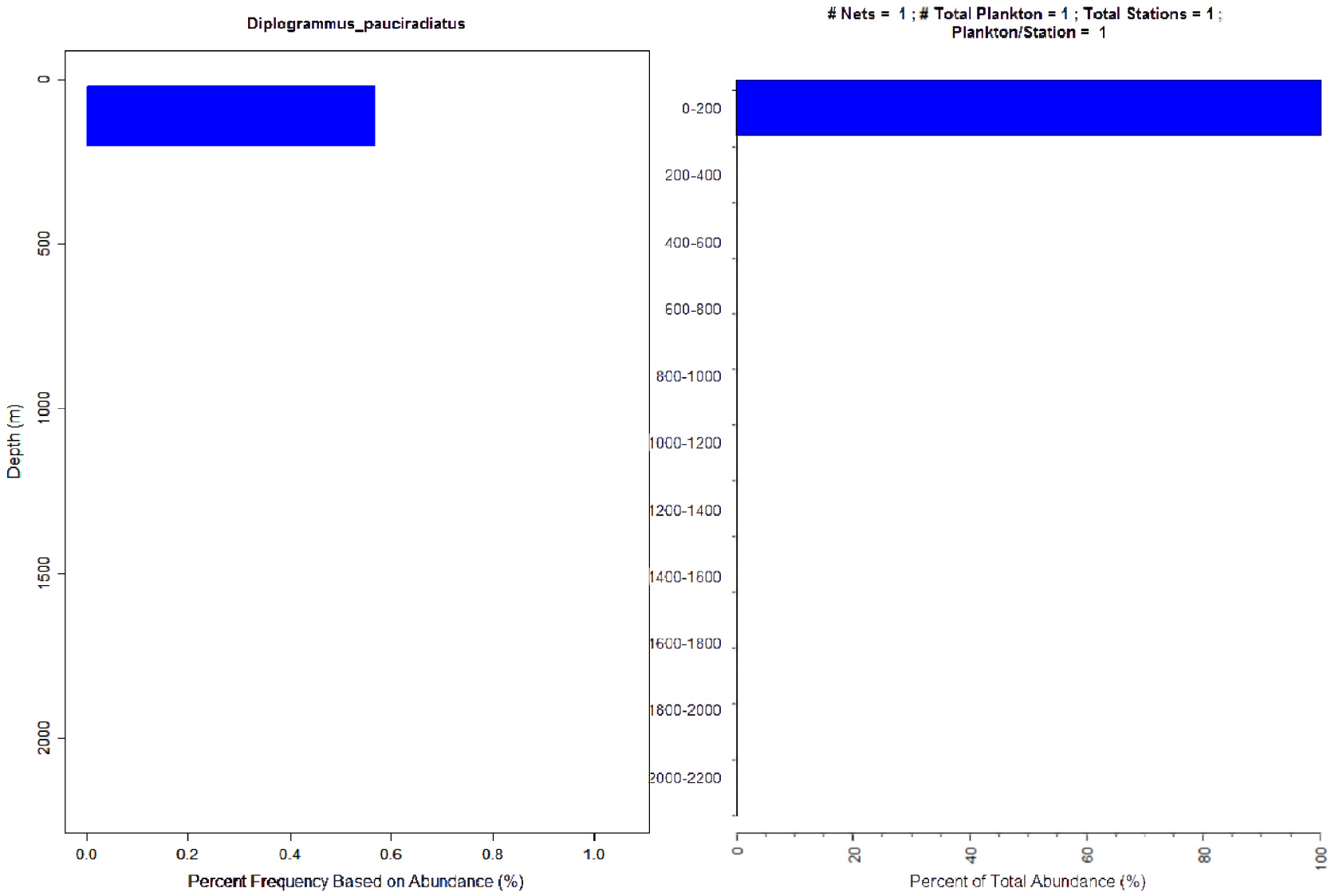
Diogenichthys - Deep



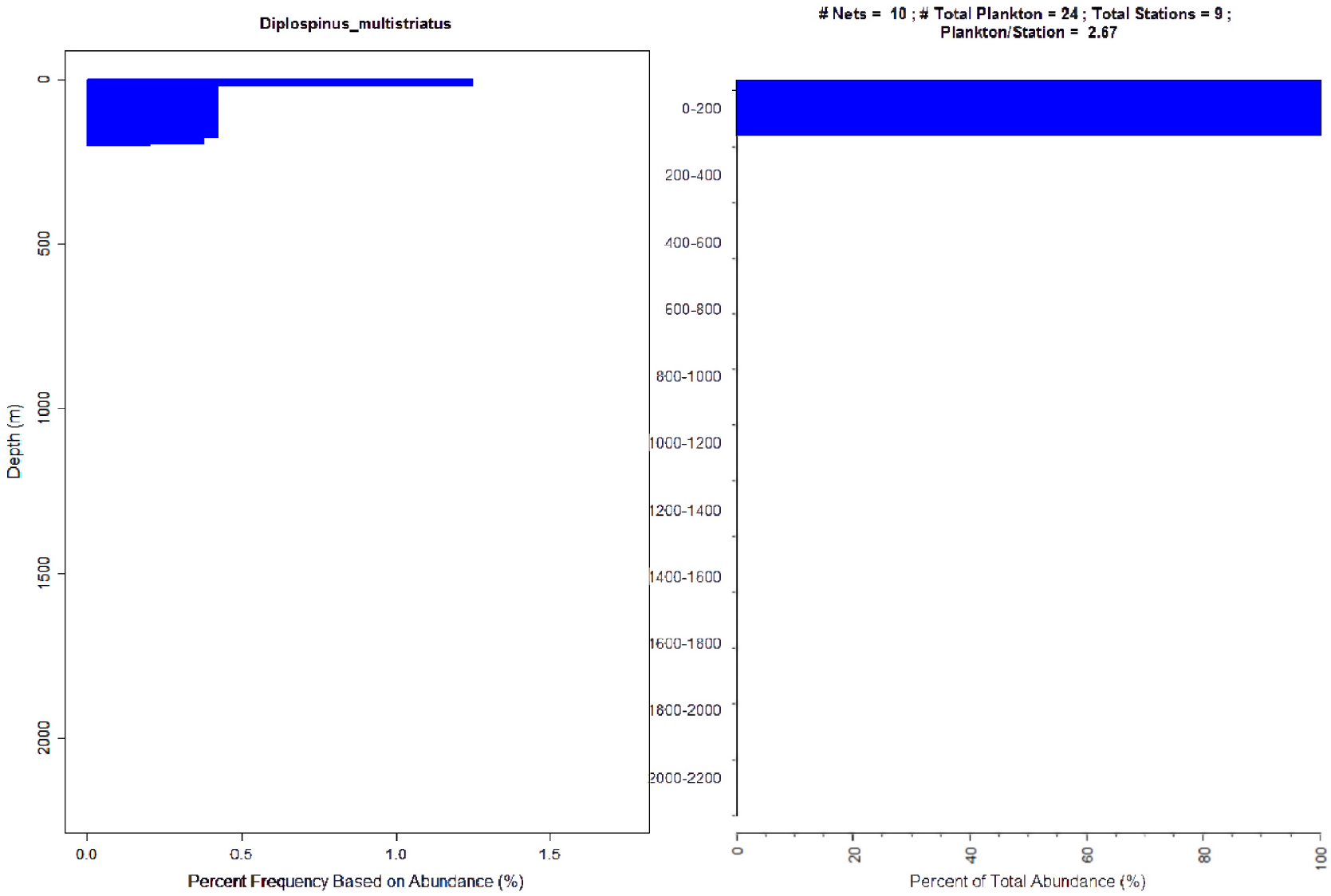
Diogenichthys_atlanticus - Deep



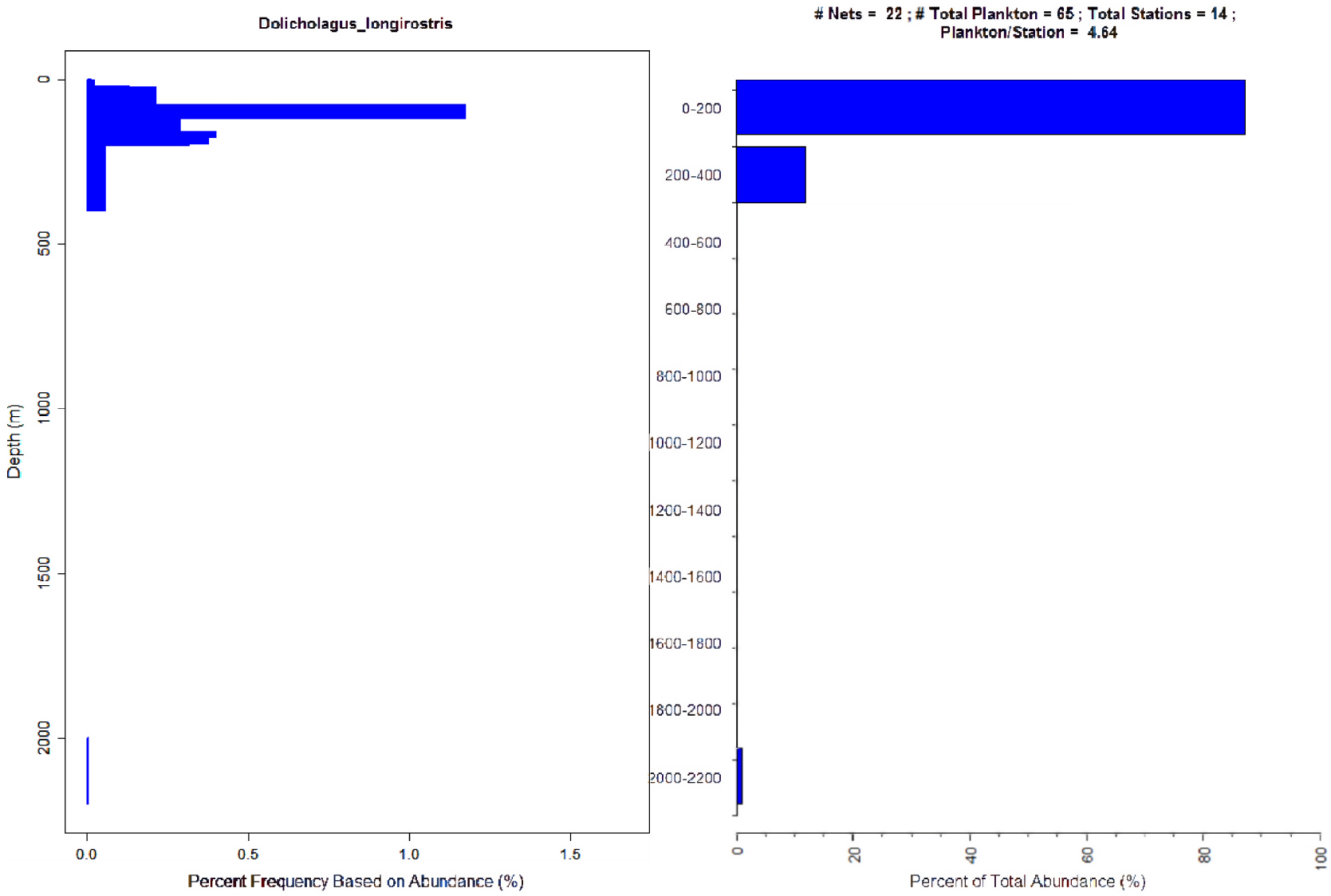
Diplectrum - Deep



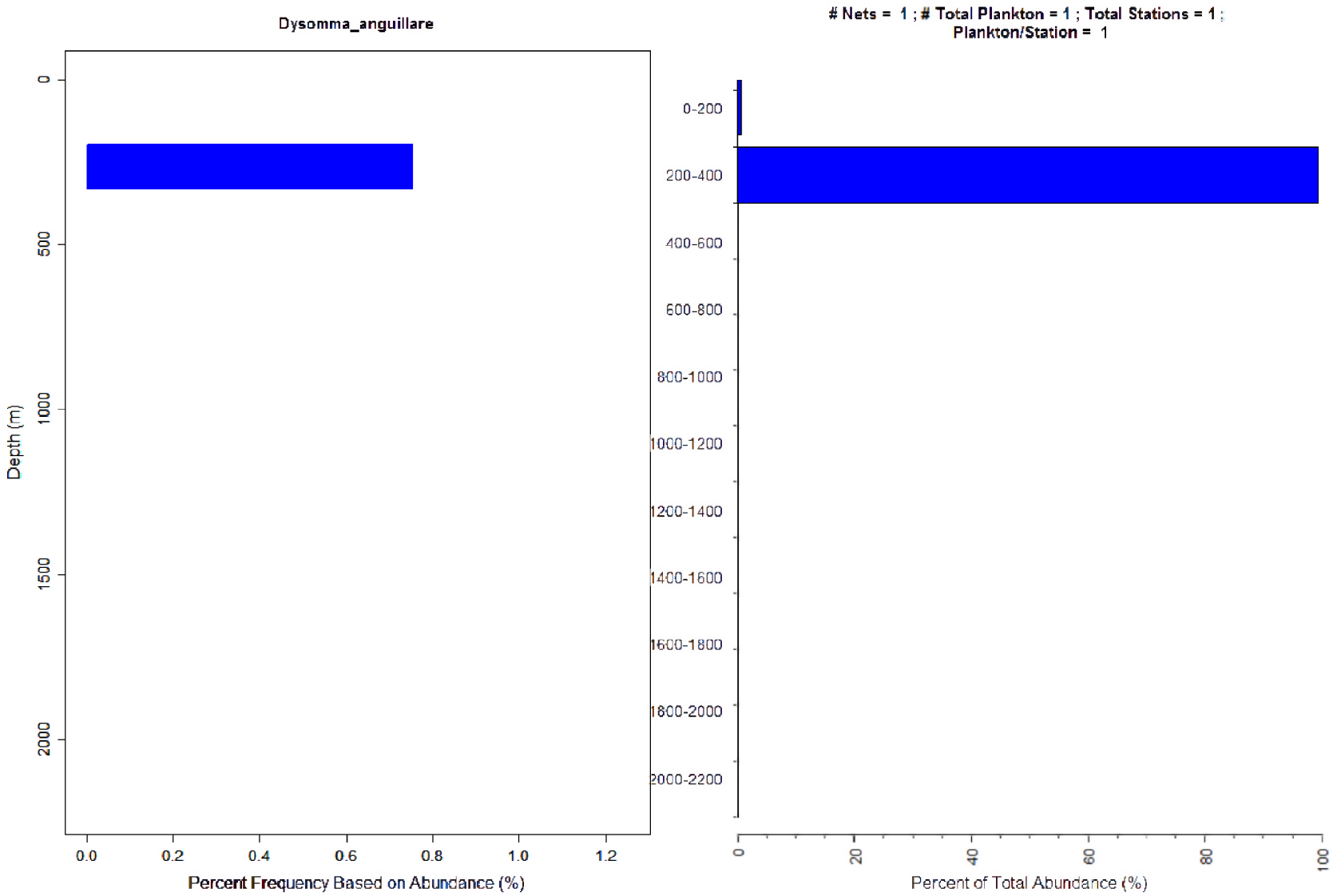
Diplogrammus_pauciradiatus - Deep



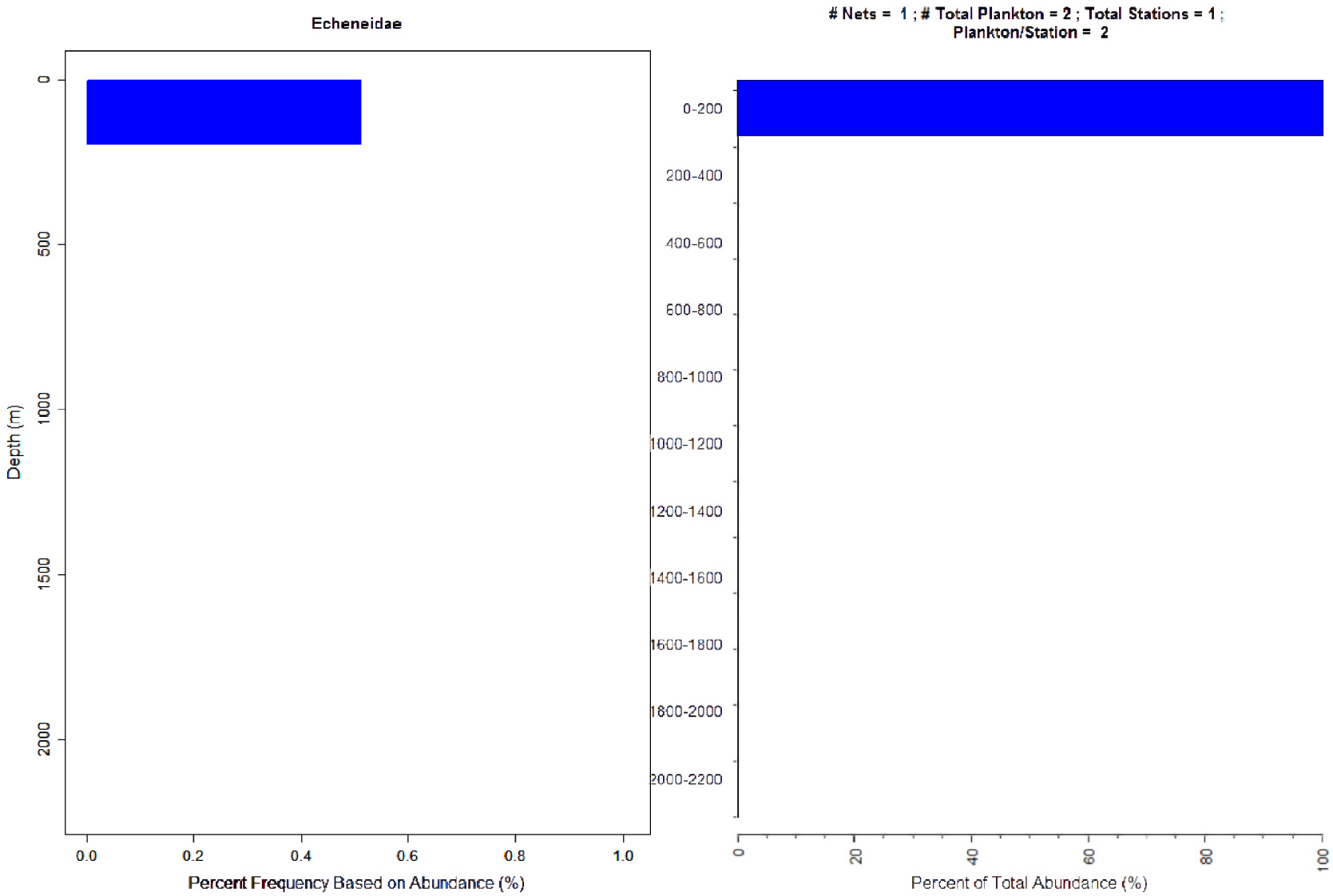
Diplospinus_multistriatus - Deep



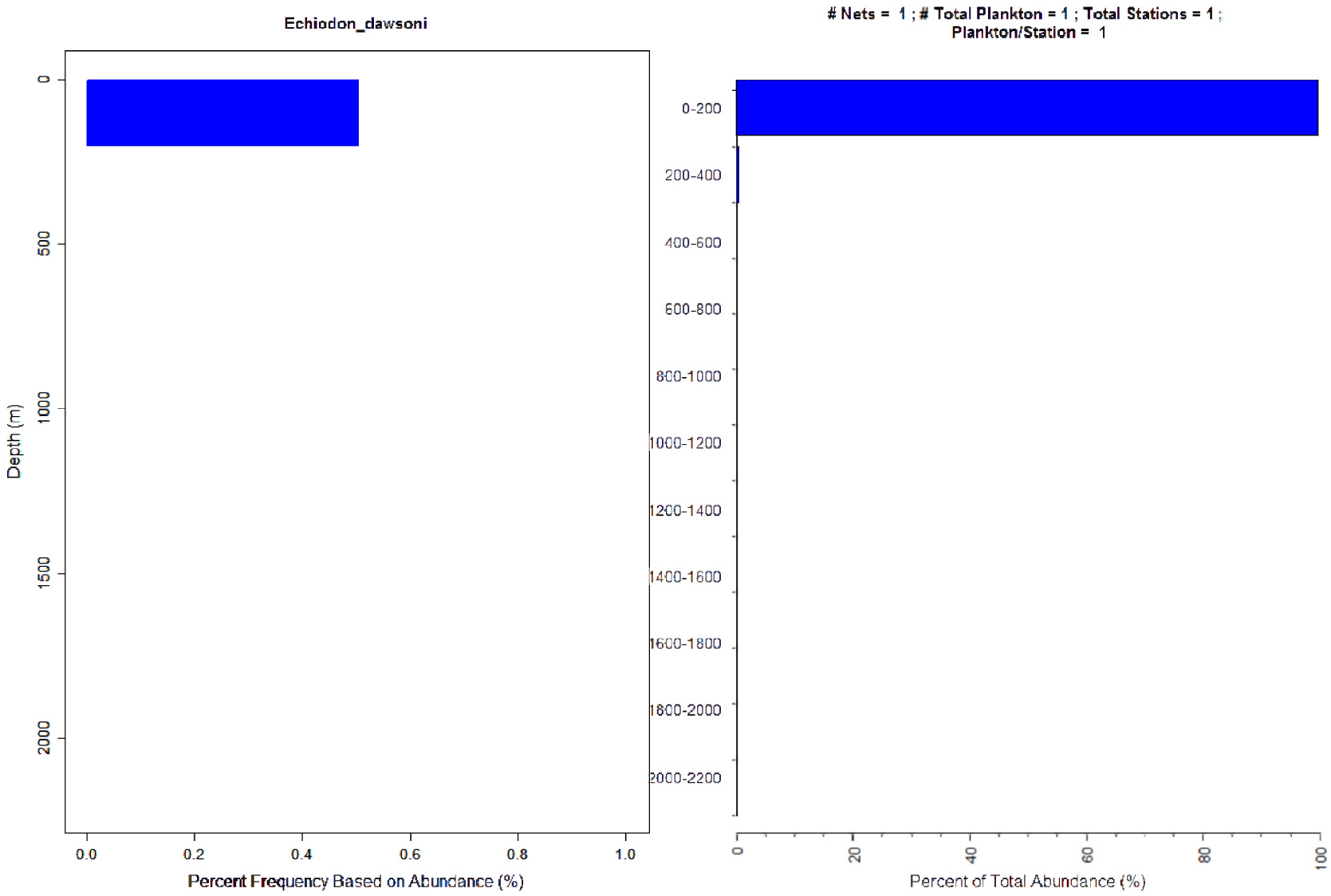
Dolicholagus_longirostris - Deep



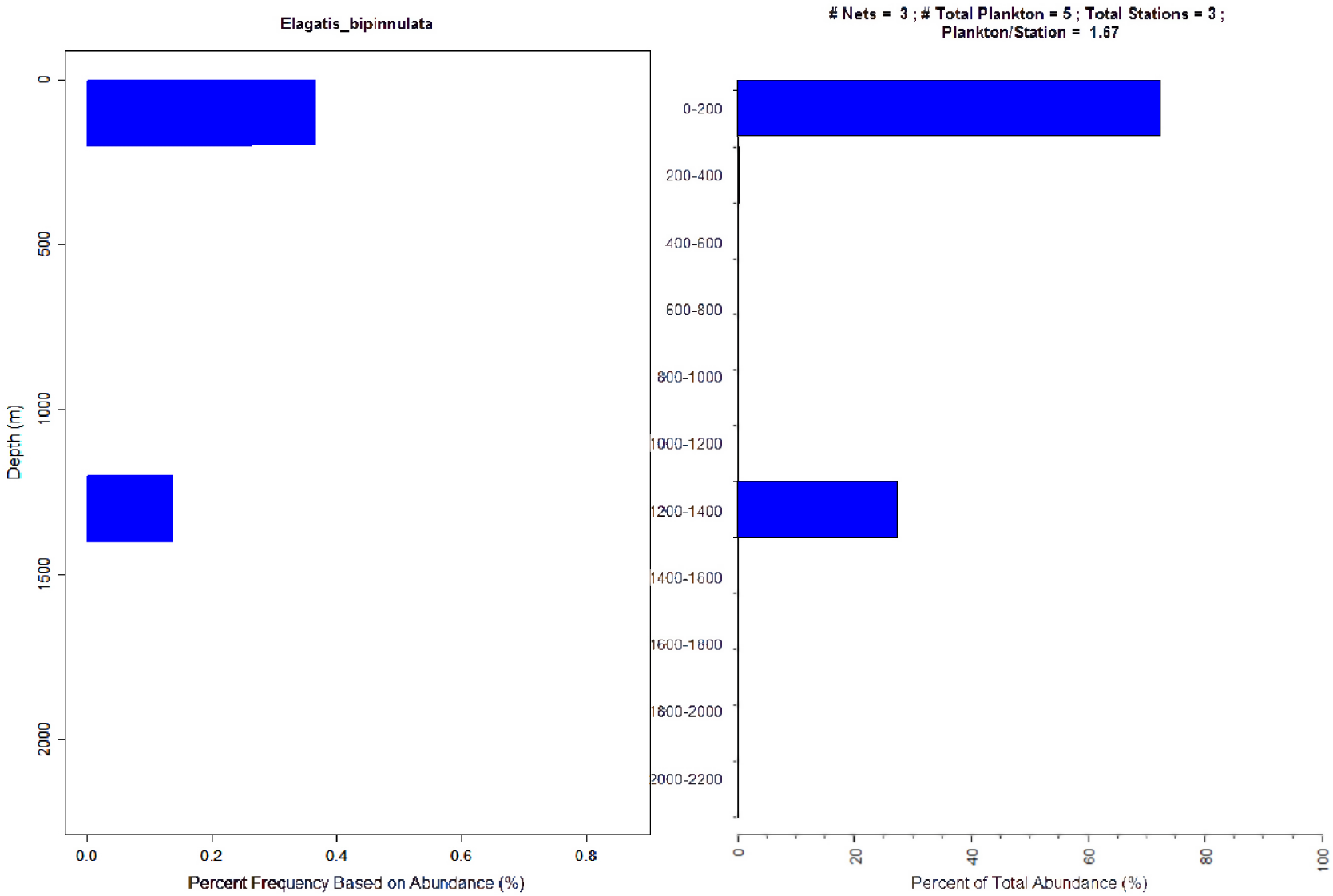
Dysomma_anguillare - Deep



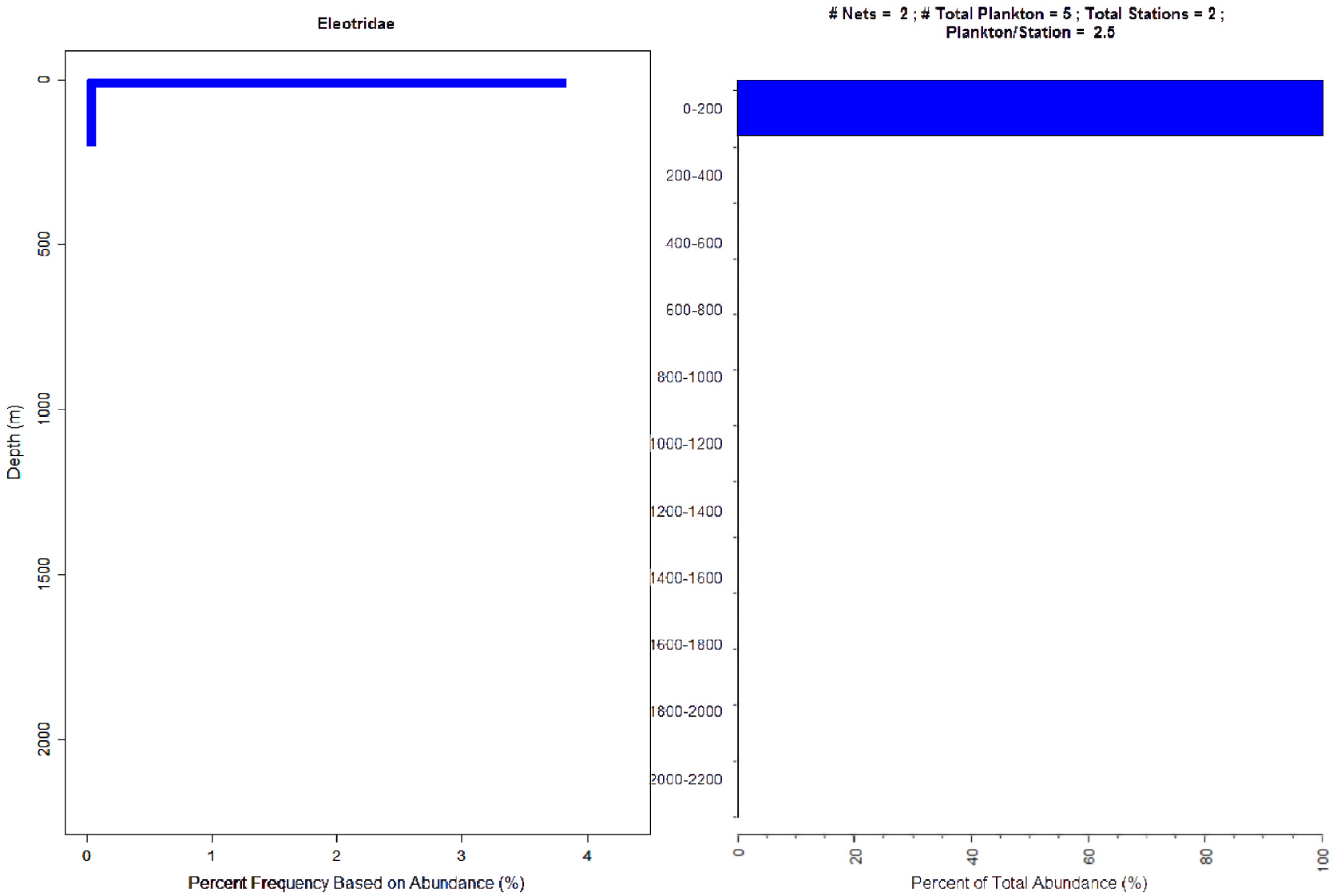
Echeneidae - Deep



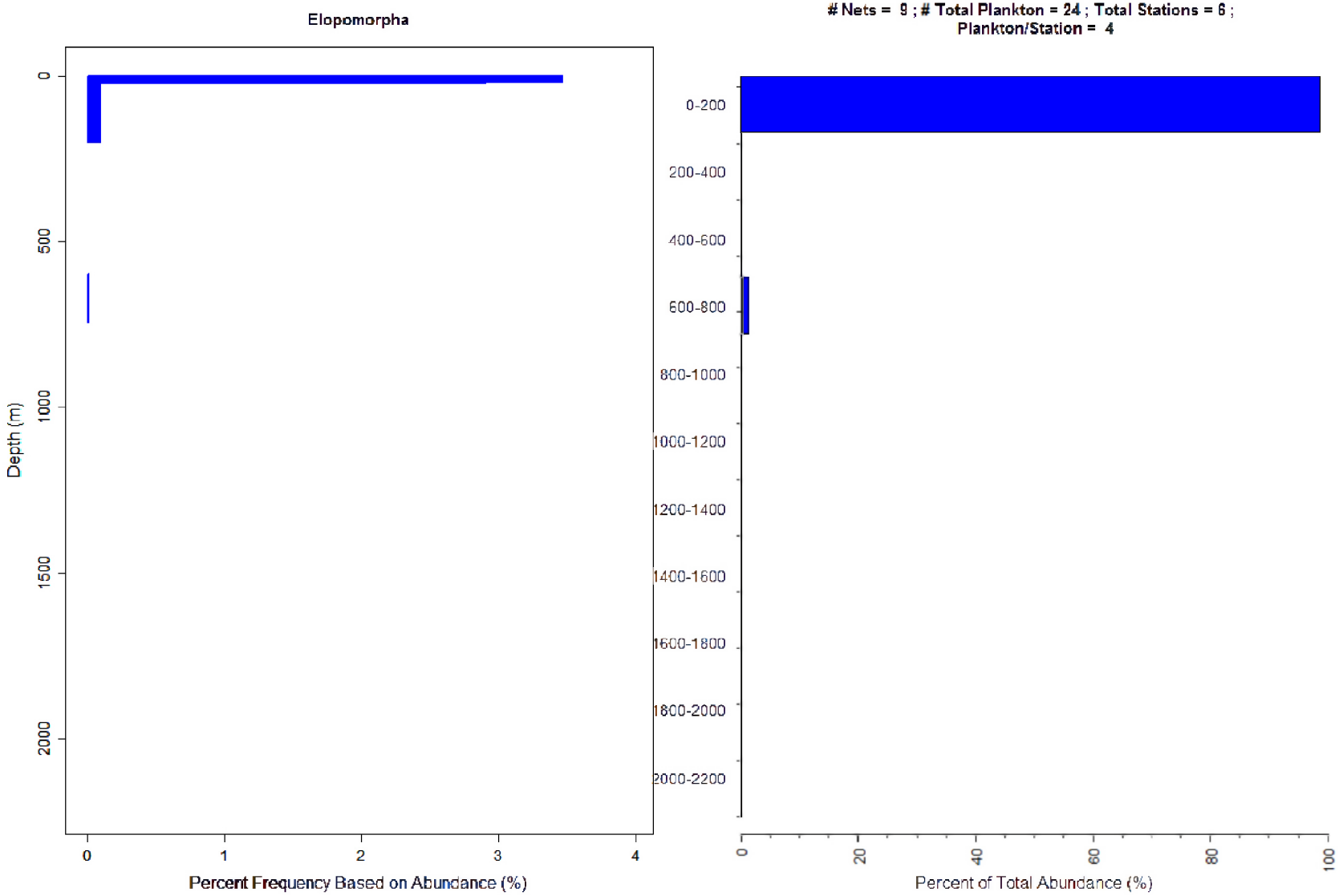
Echiodon_dawsoni - Deep



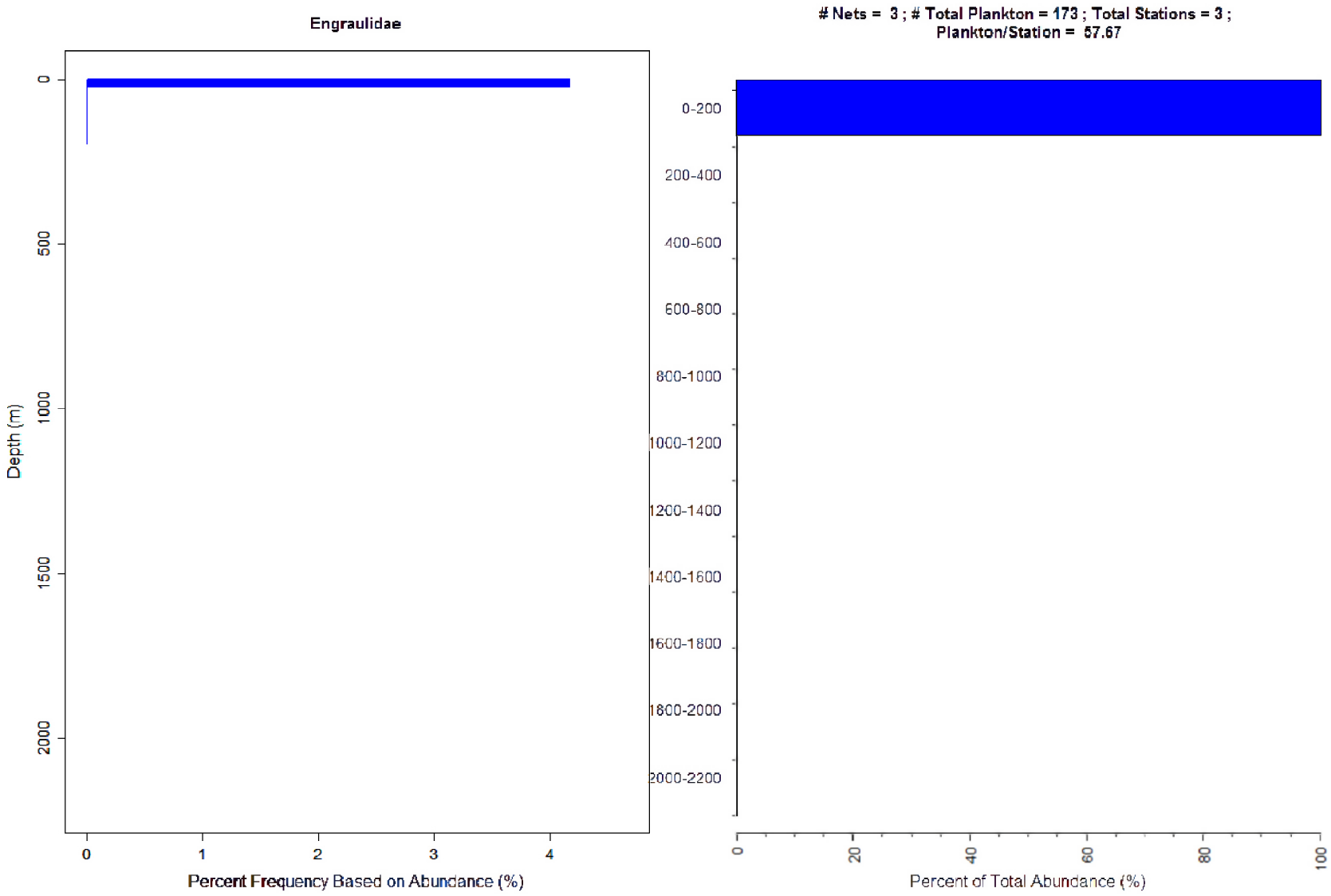
Elagatis_bipinnulata - Deep



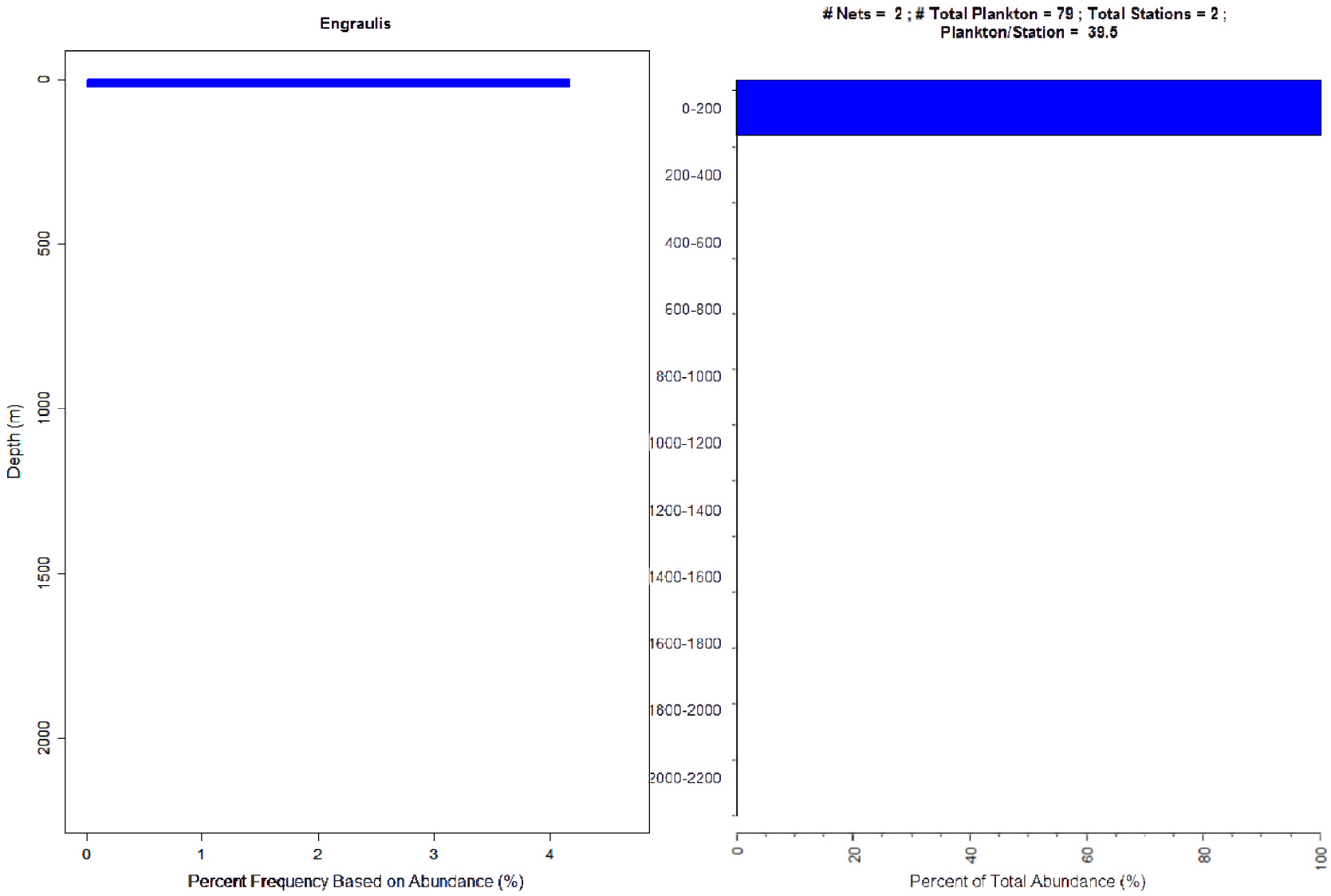
Eleotridae - Deep



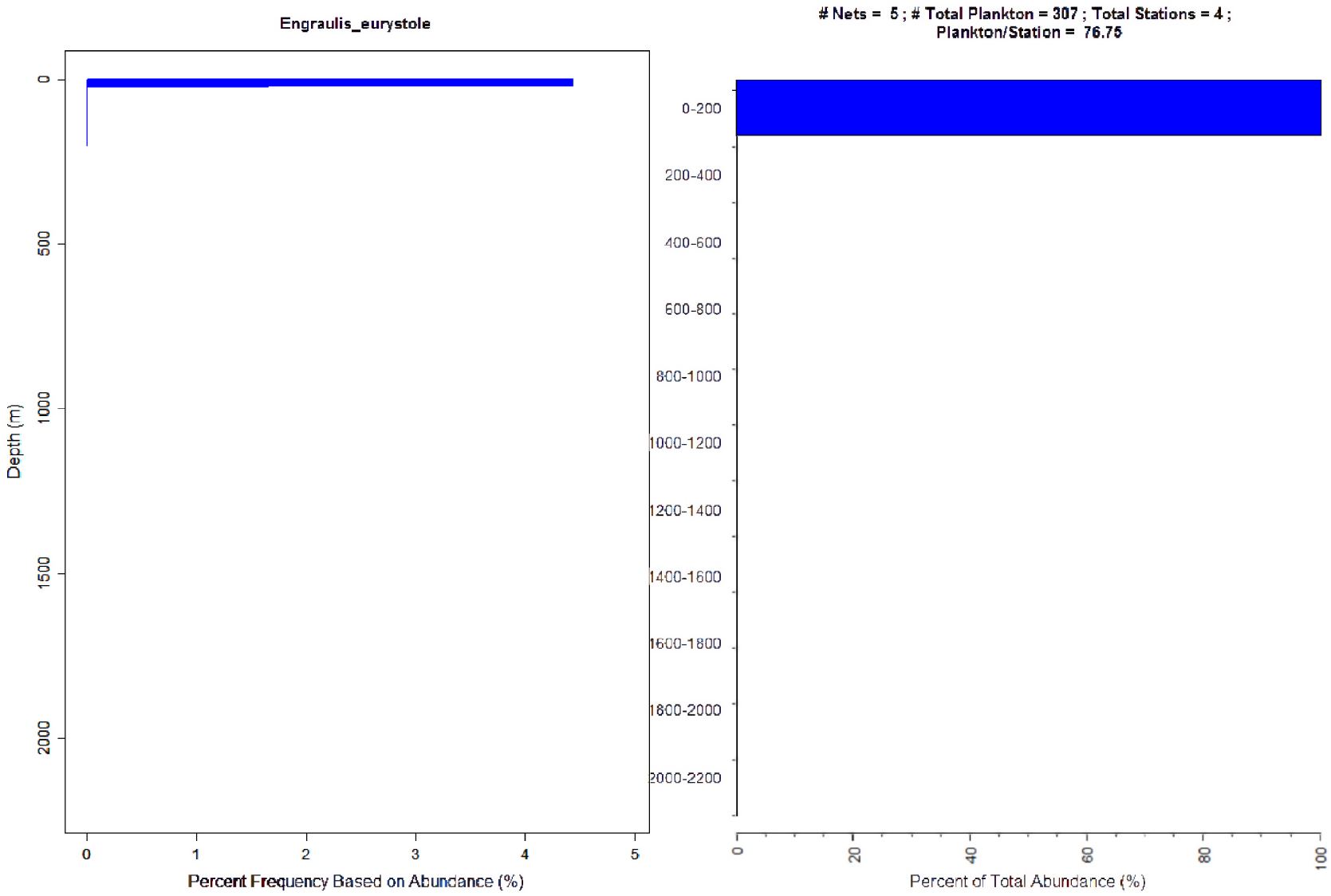
Elopomorpha - Deep



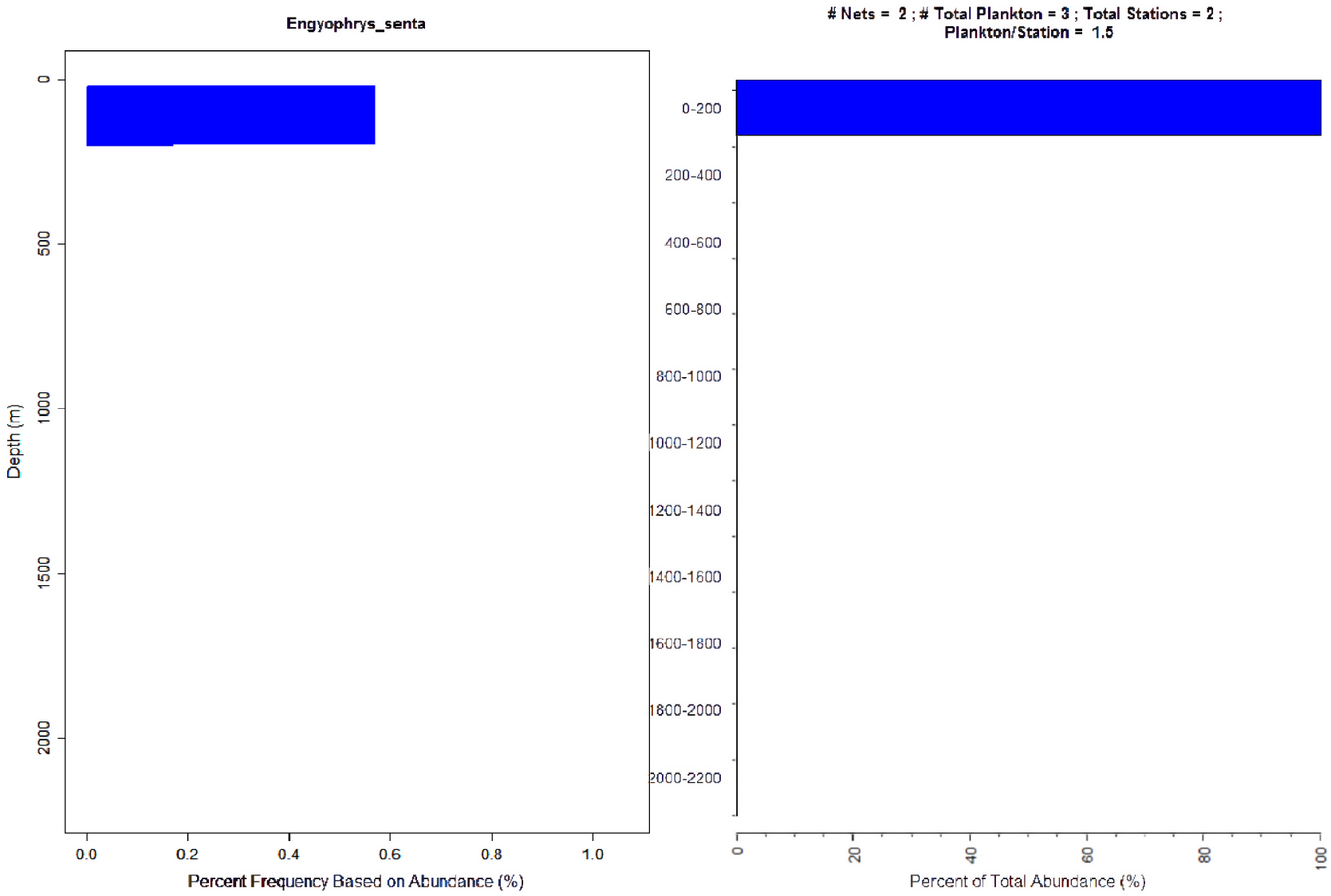
Engraulidae - Deep



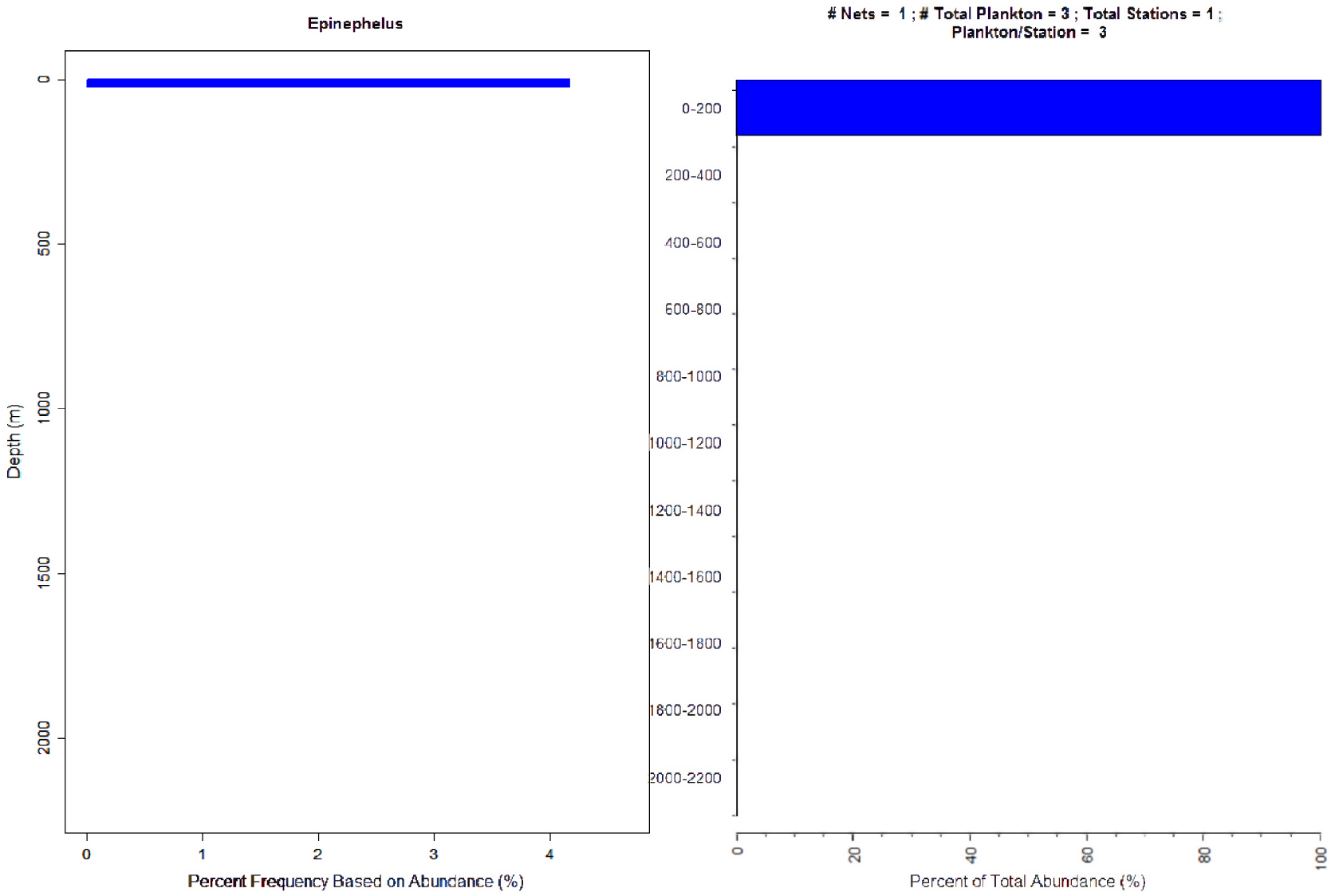
Engraulis - Deep



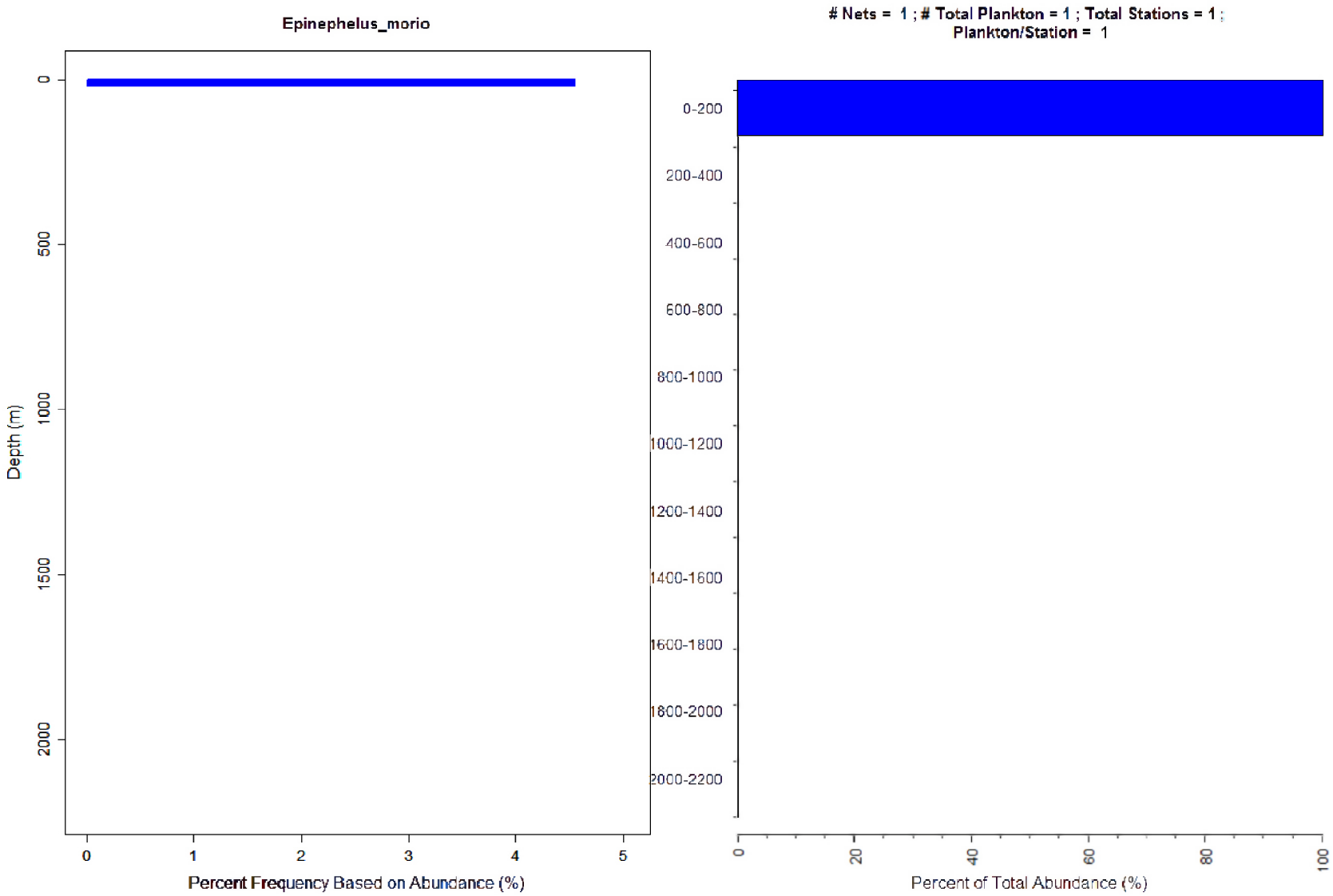
Engraulis_eurystole - Deep



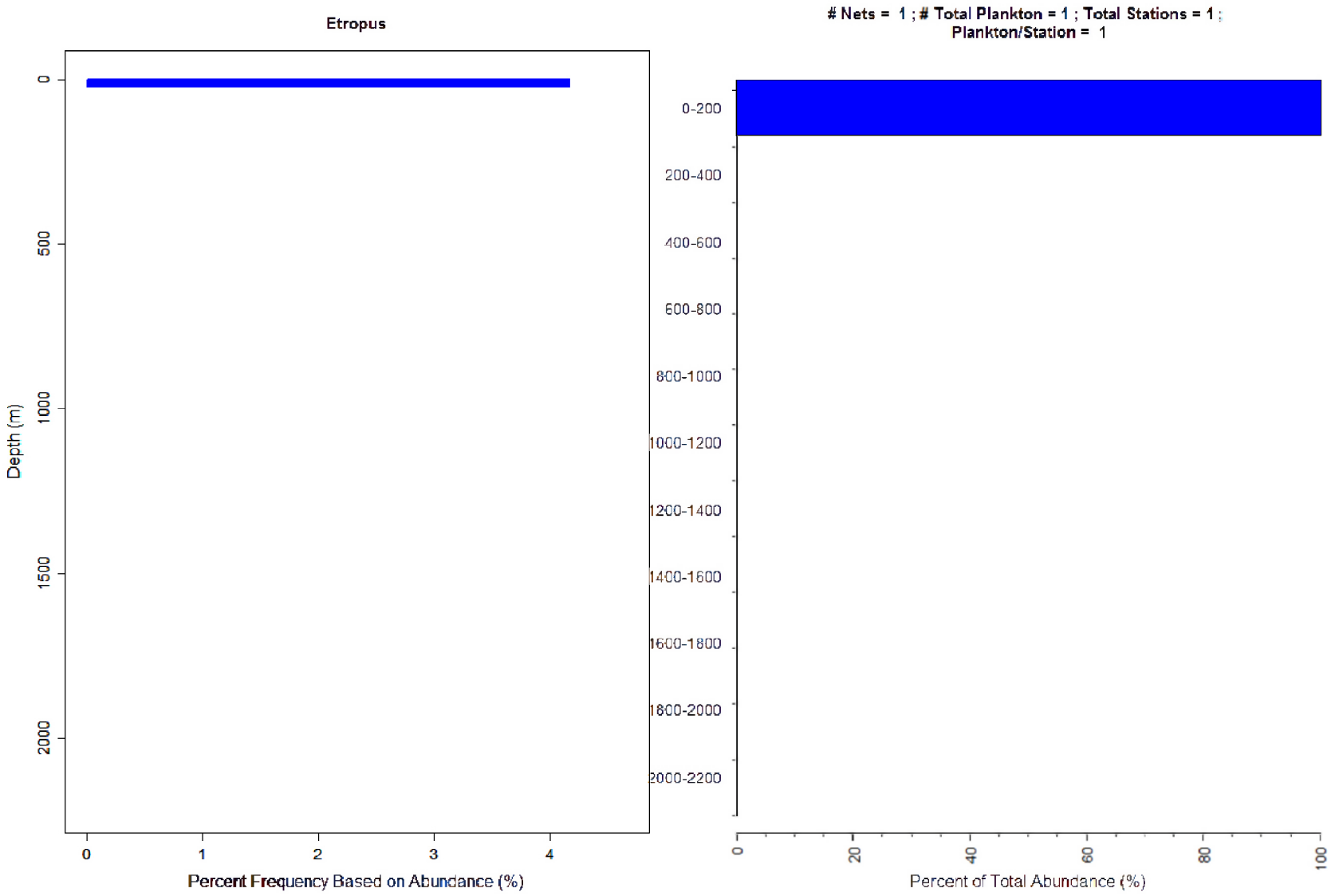
Engyophrys_senta - Deep



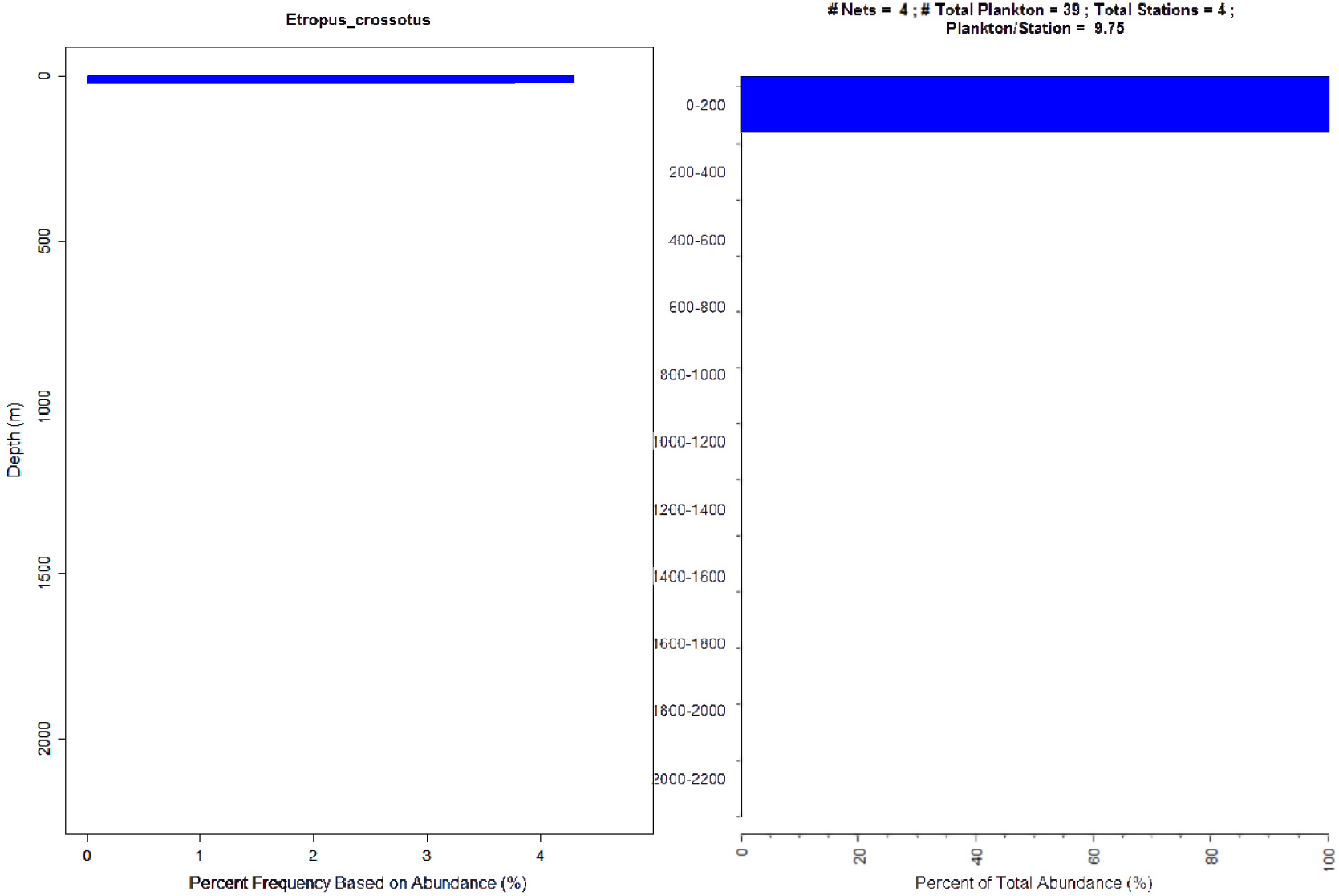
Epinephelus - Deep



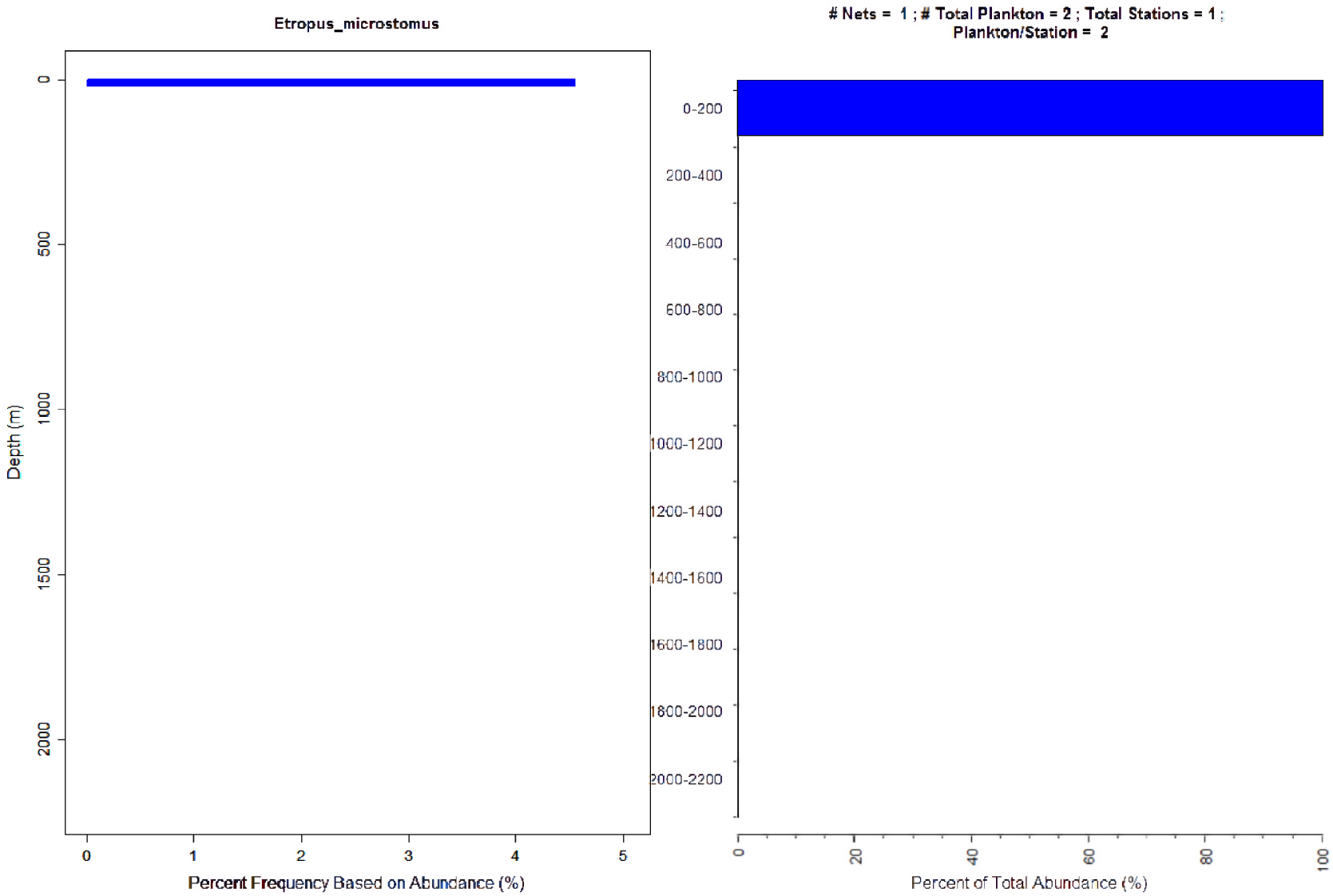
Epinephelus_morio - Deep



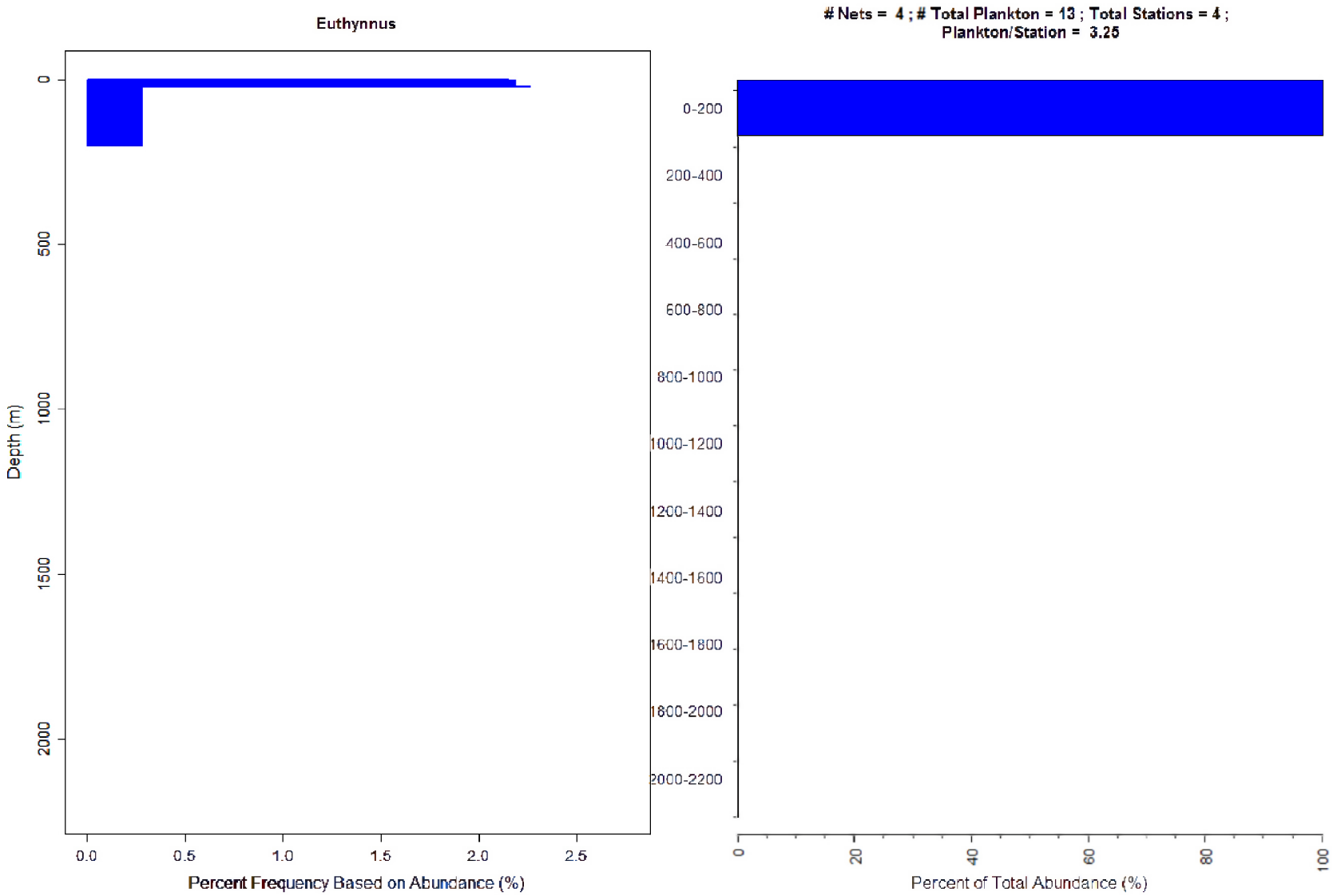
Etropus - Deep



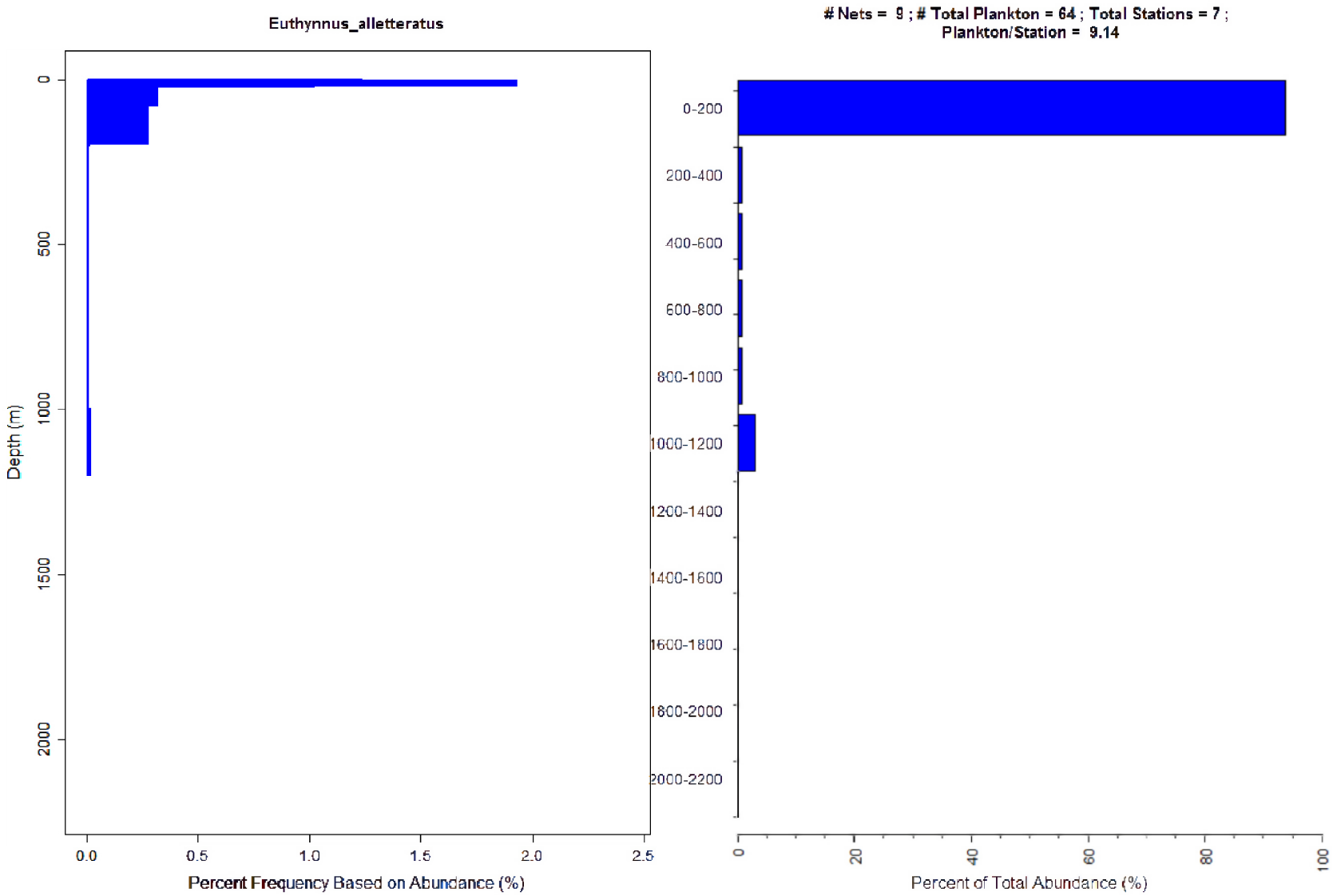
Etropus_crossotus - Deep



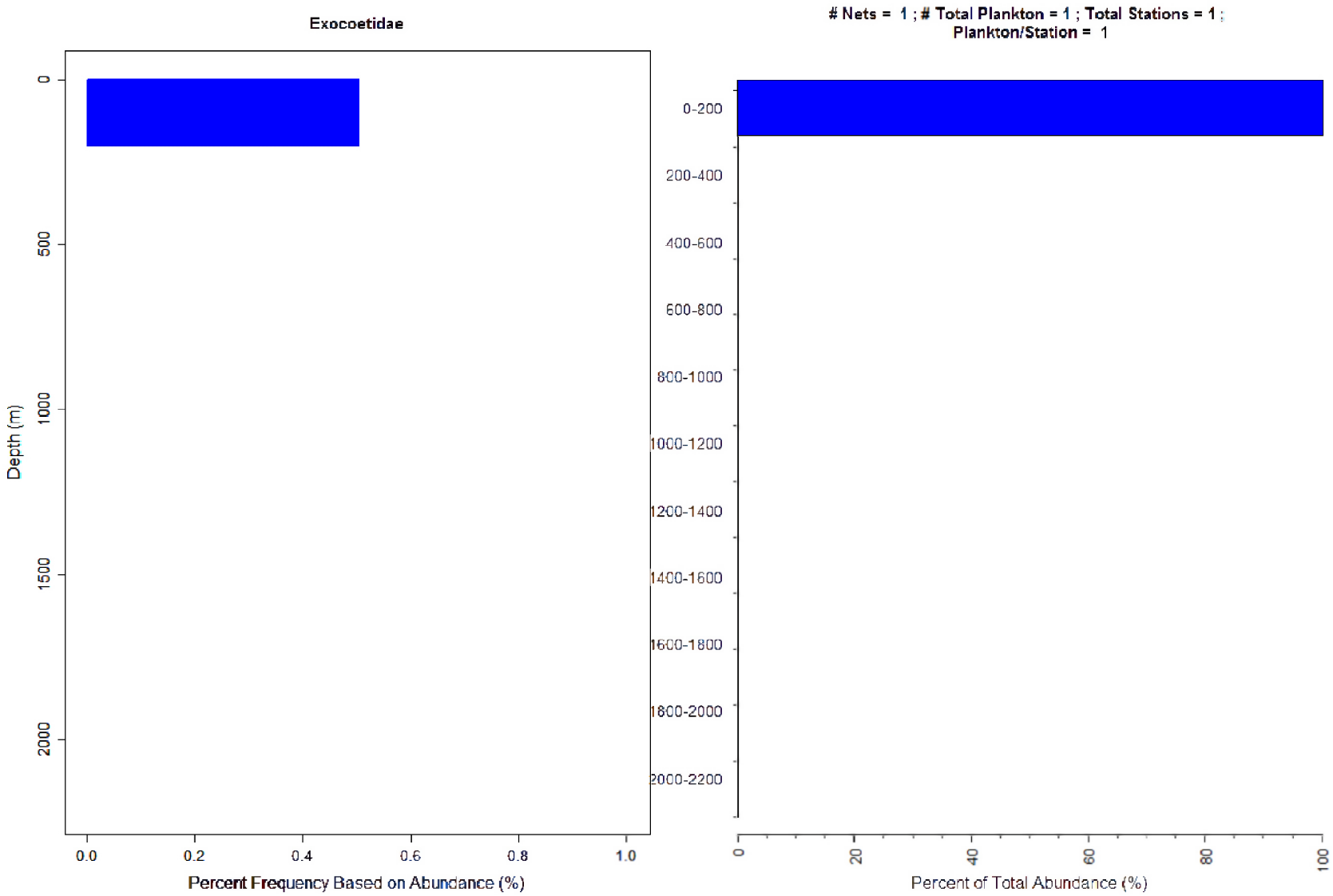
Etropus_microstomus - Deep



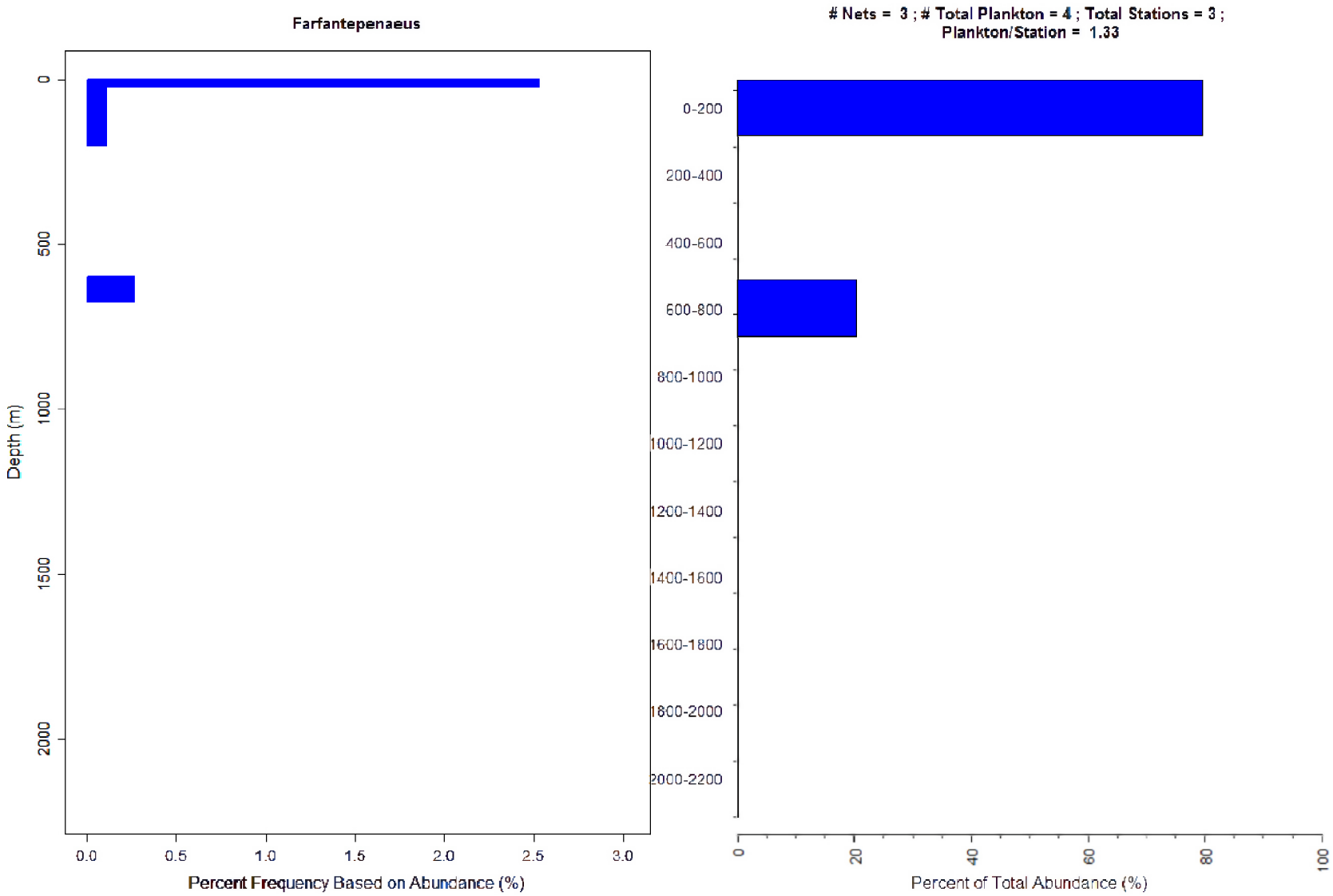
Euthynnus - Deep



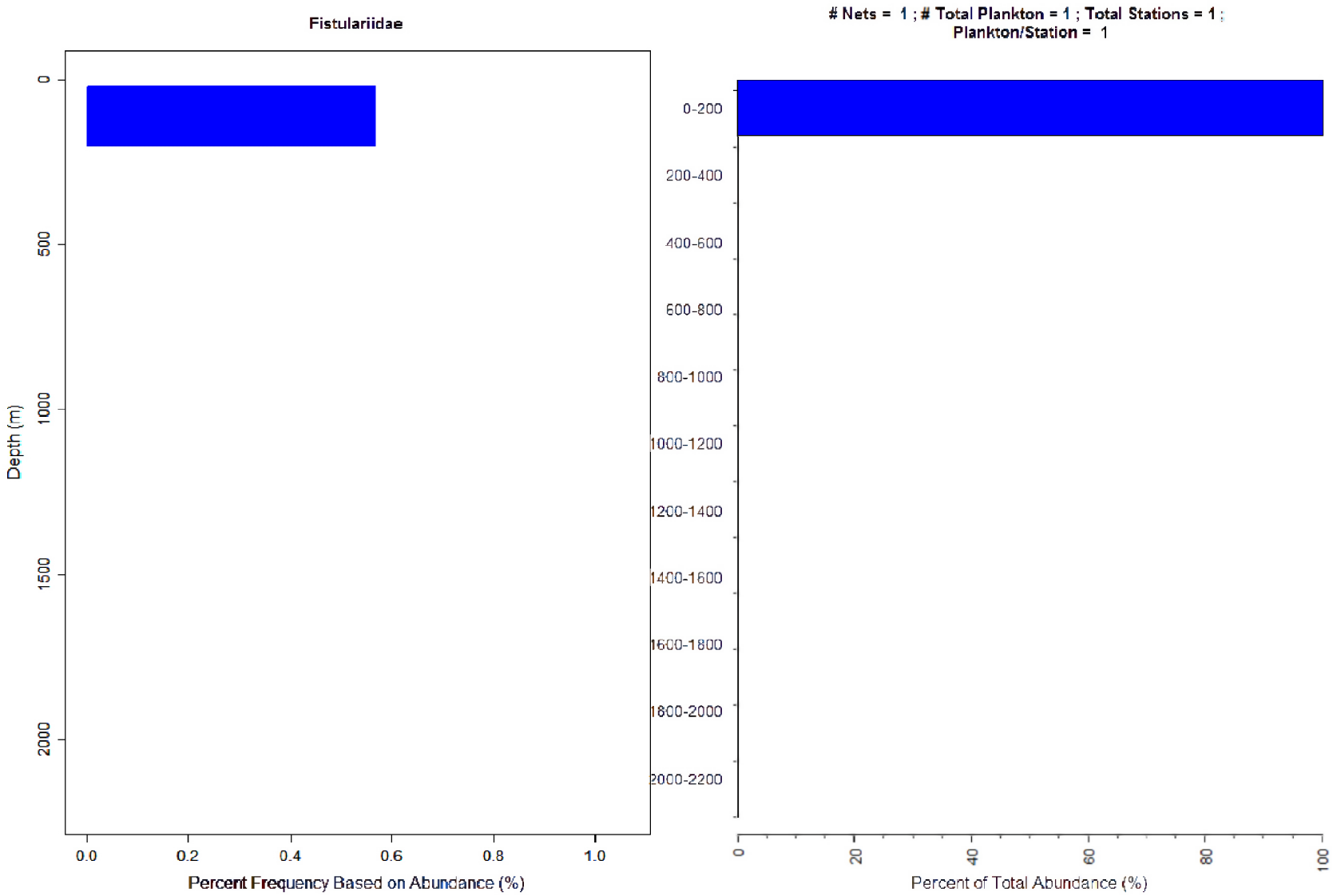
Euthynnus_alletteratus - Deep



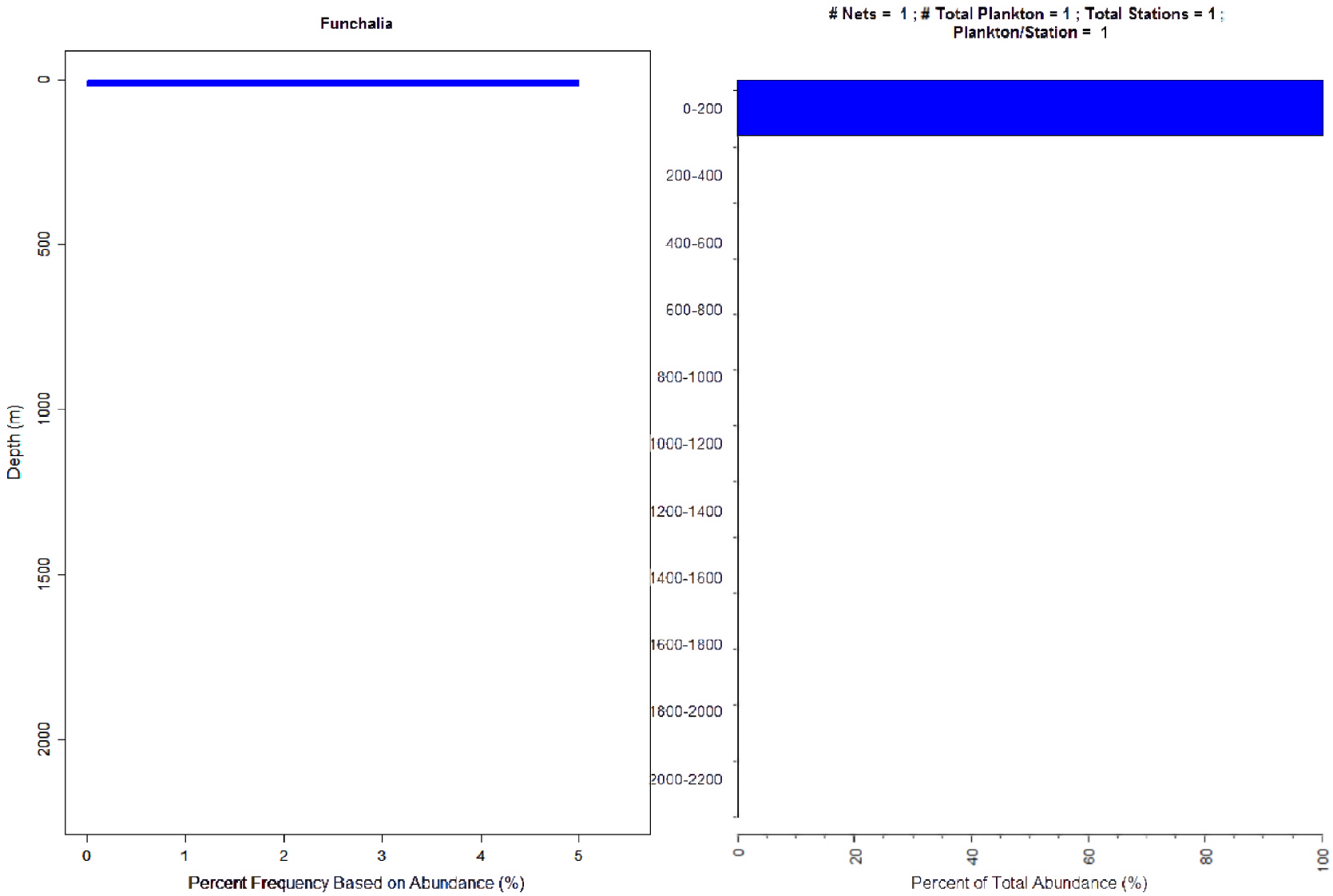
Exocoetidae - Deep



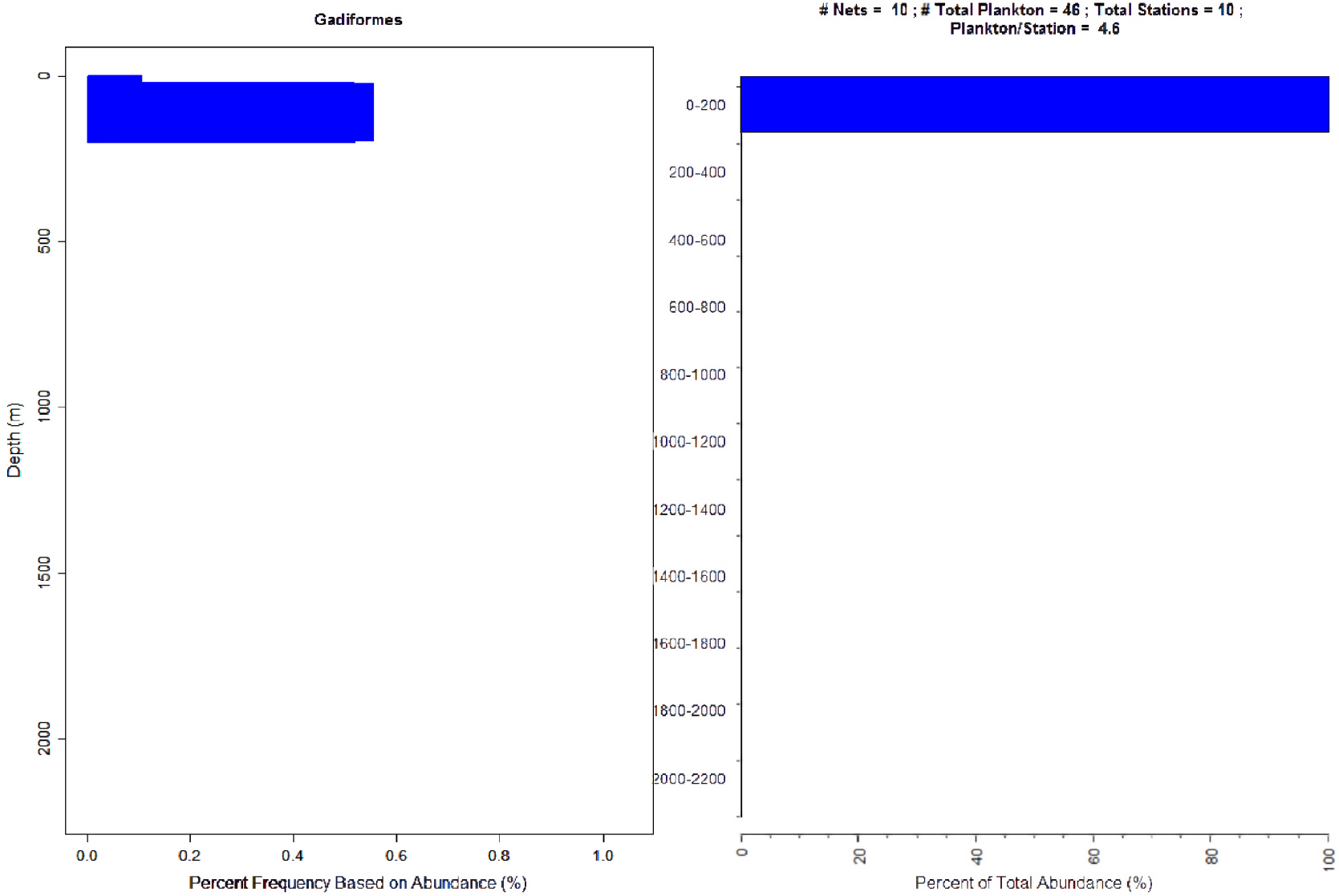
Farfantepenaeus - Deep



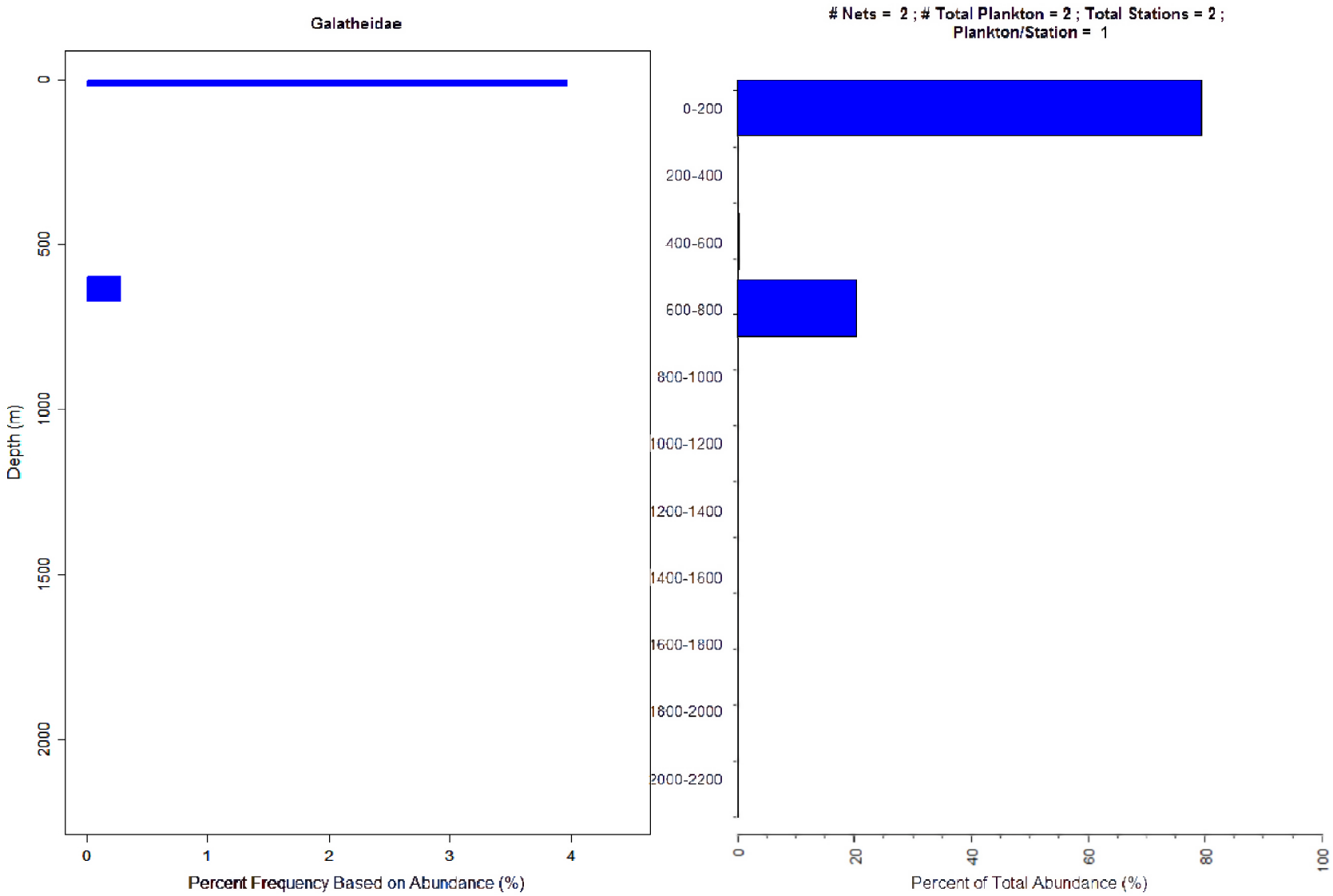
Fistulariidae - Deep



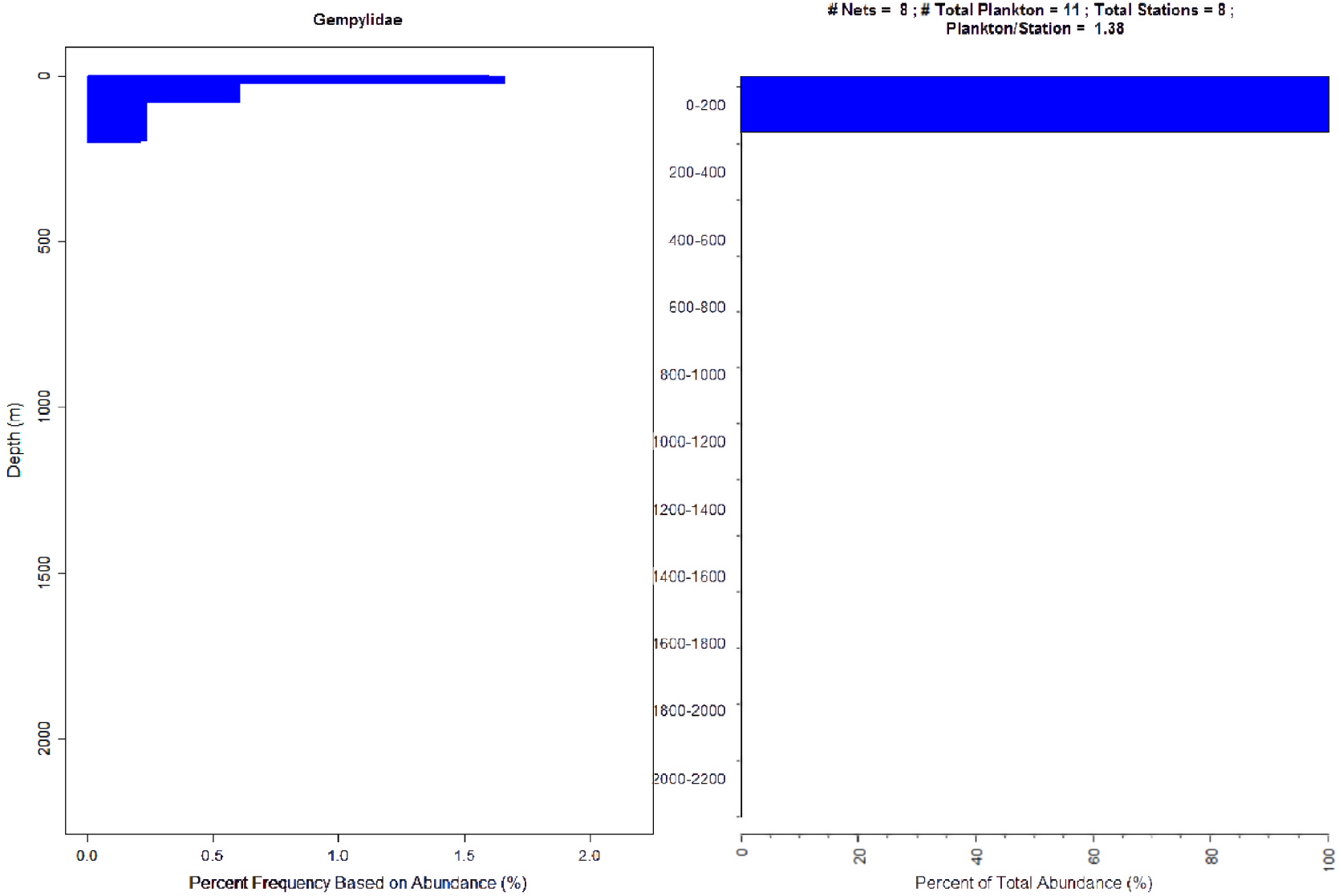
Funchalia - Deep



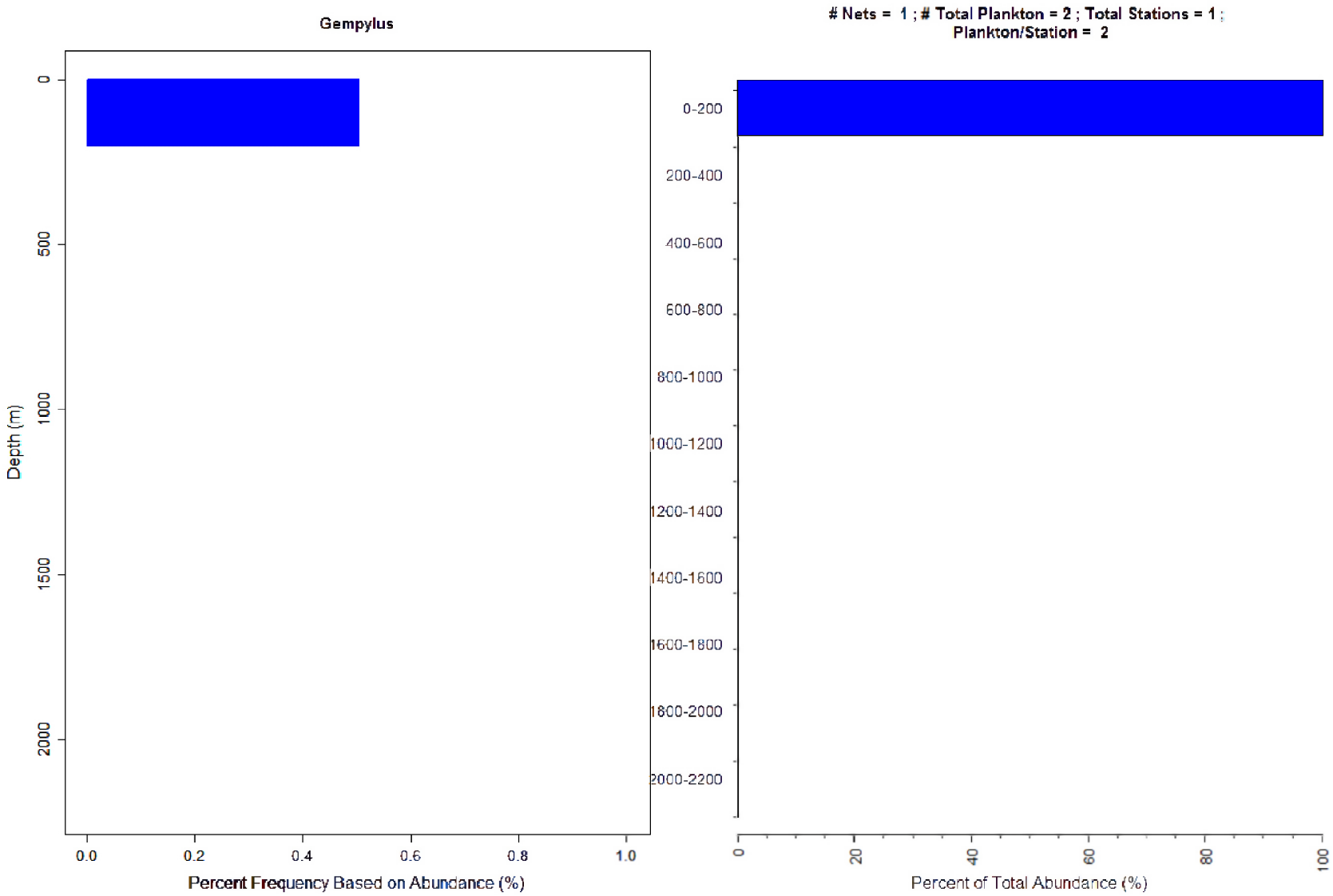
Gadiformes - Deep



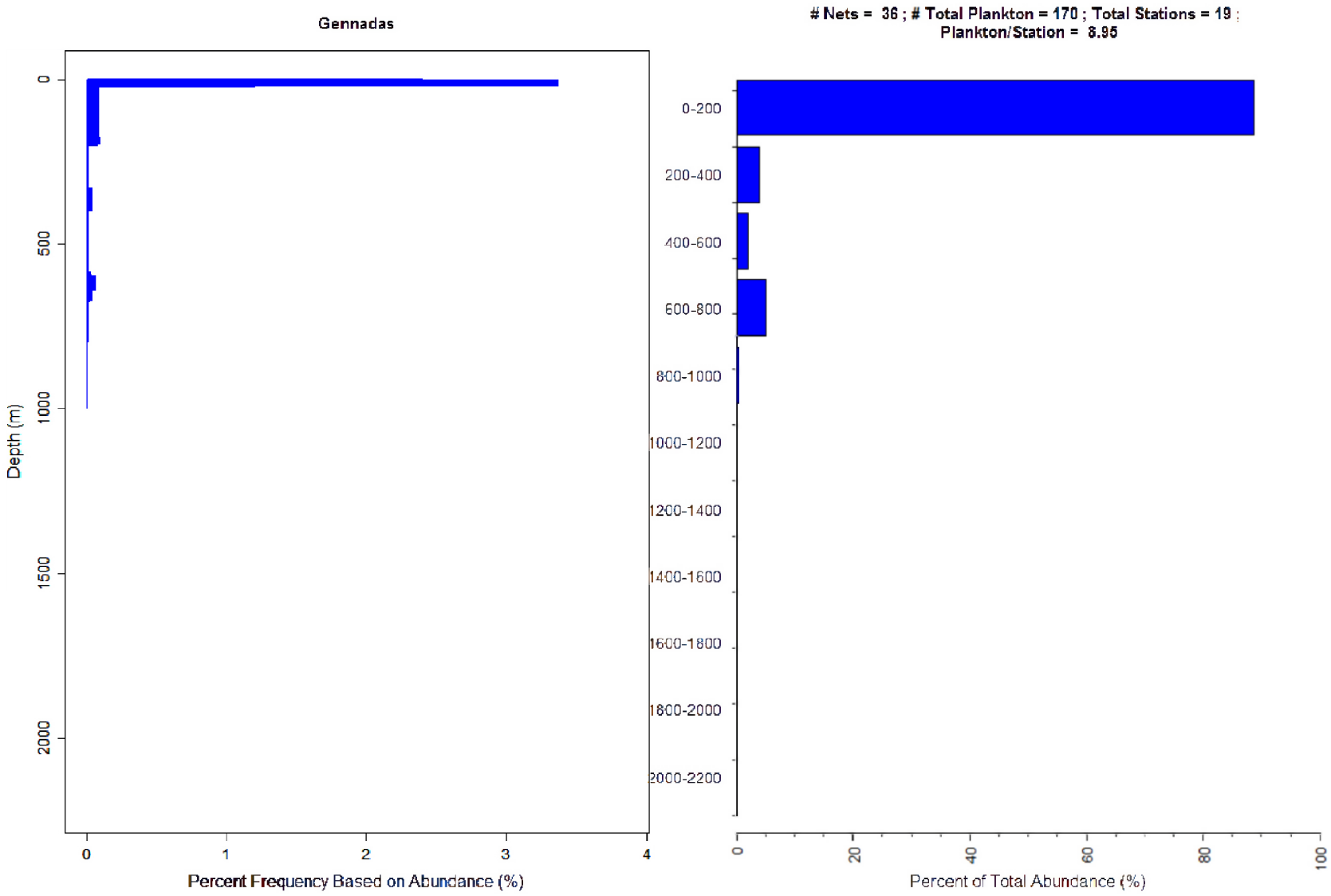
Galatheidae - Deep



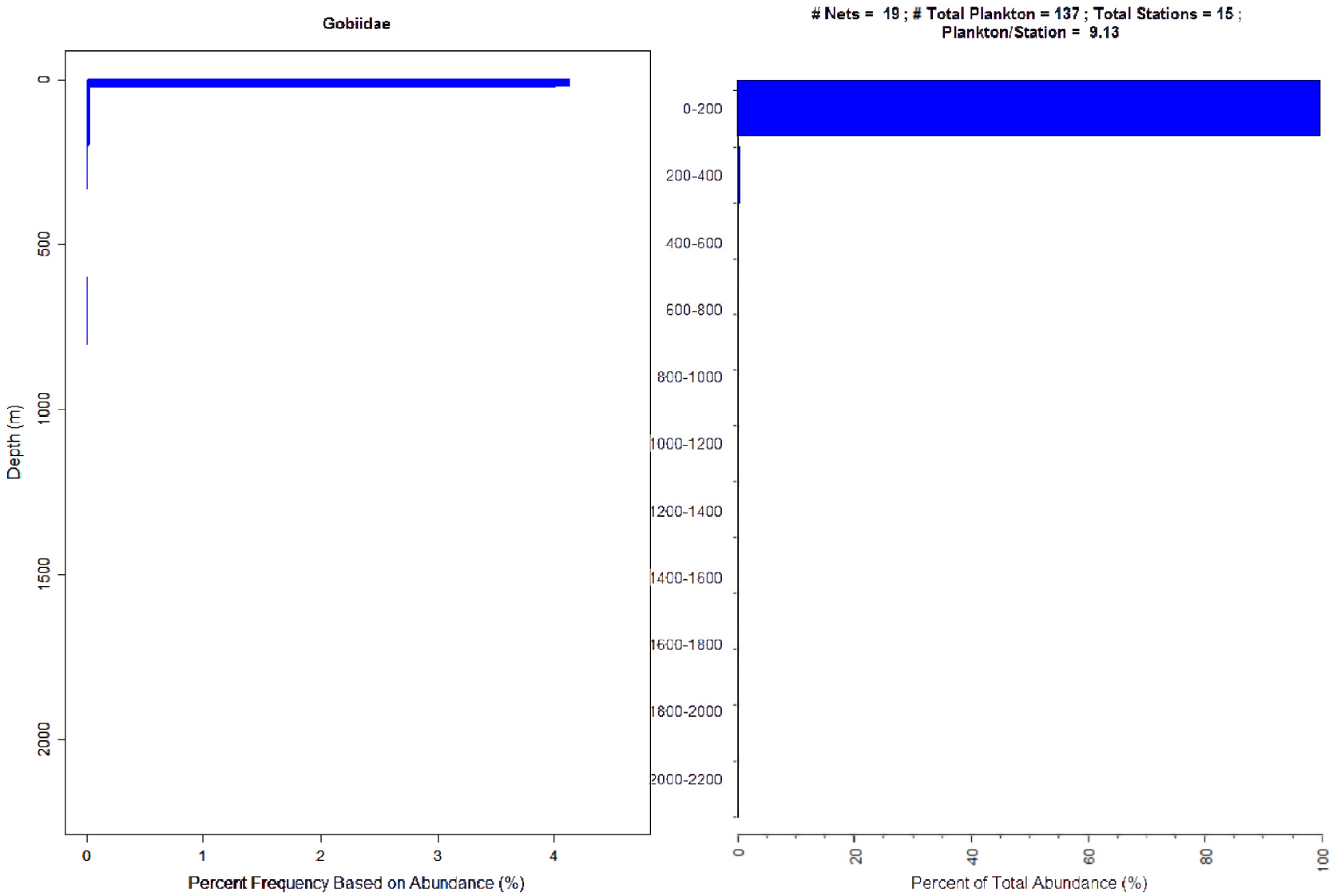
Gempylidae - Deep



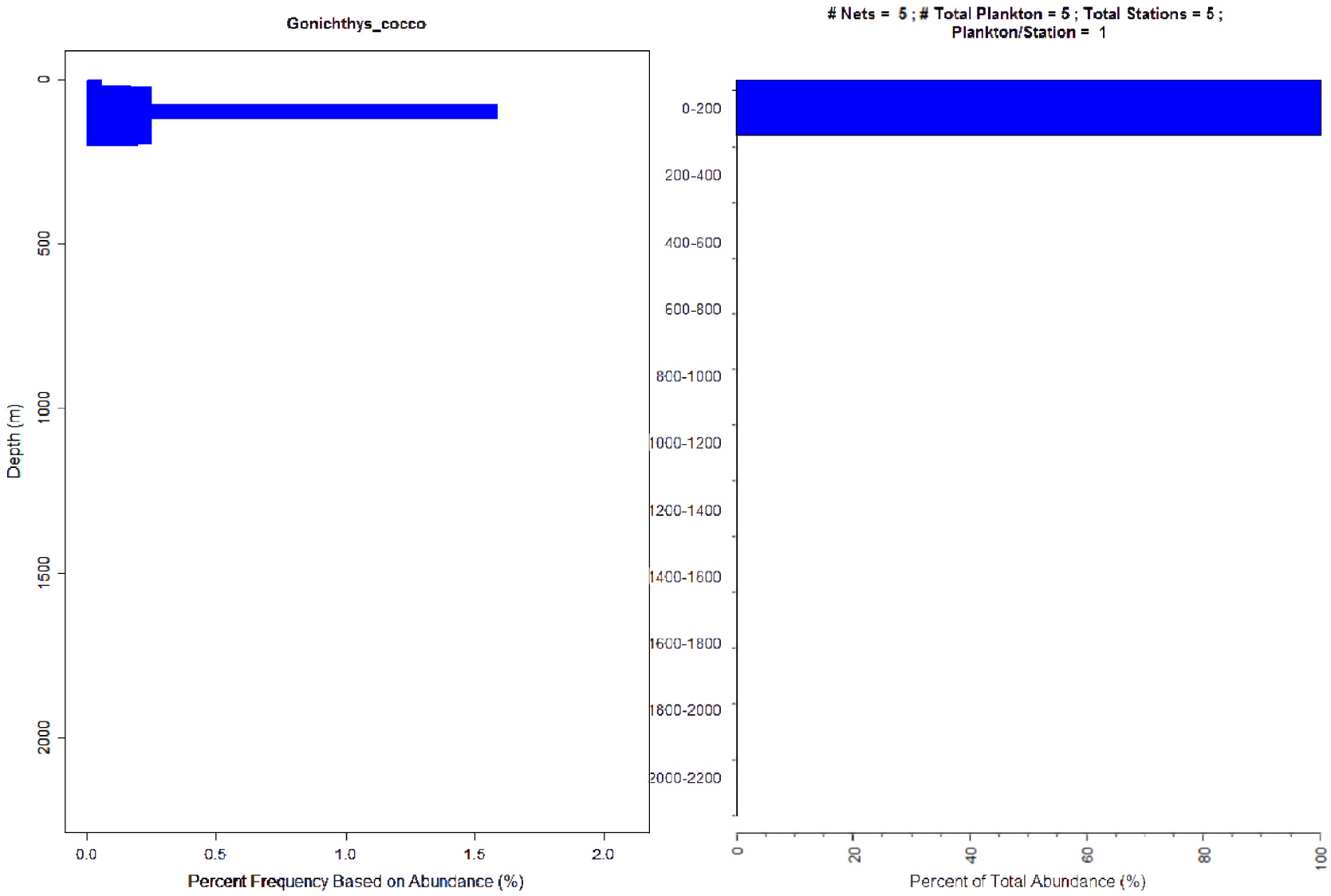
Gempylus - Deep



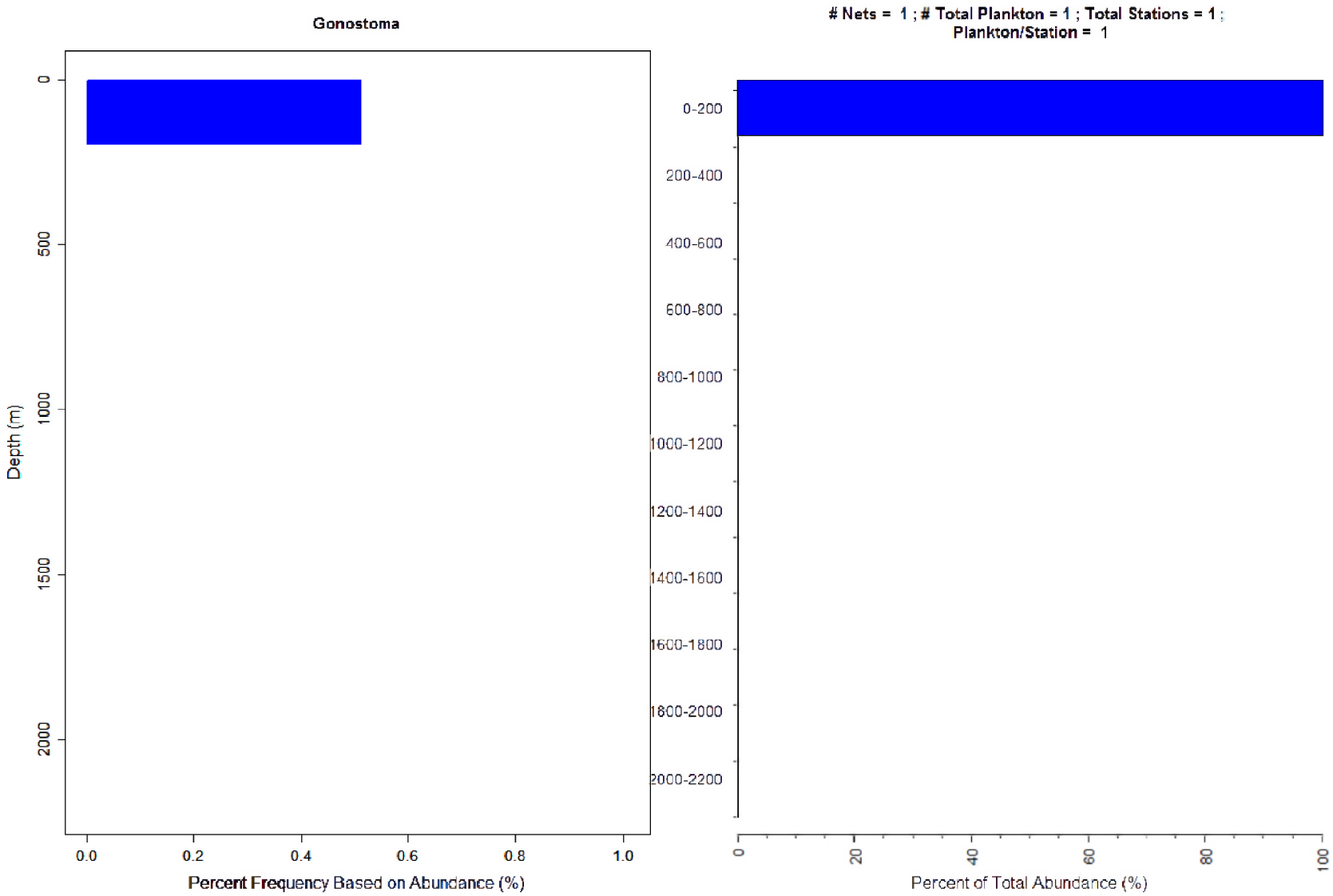
Gennadas - Deep



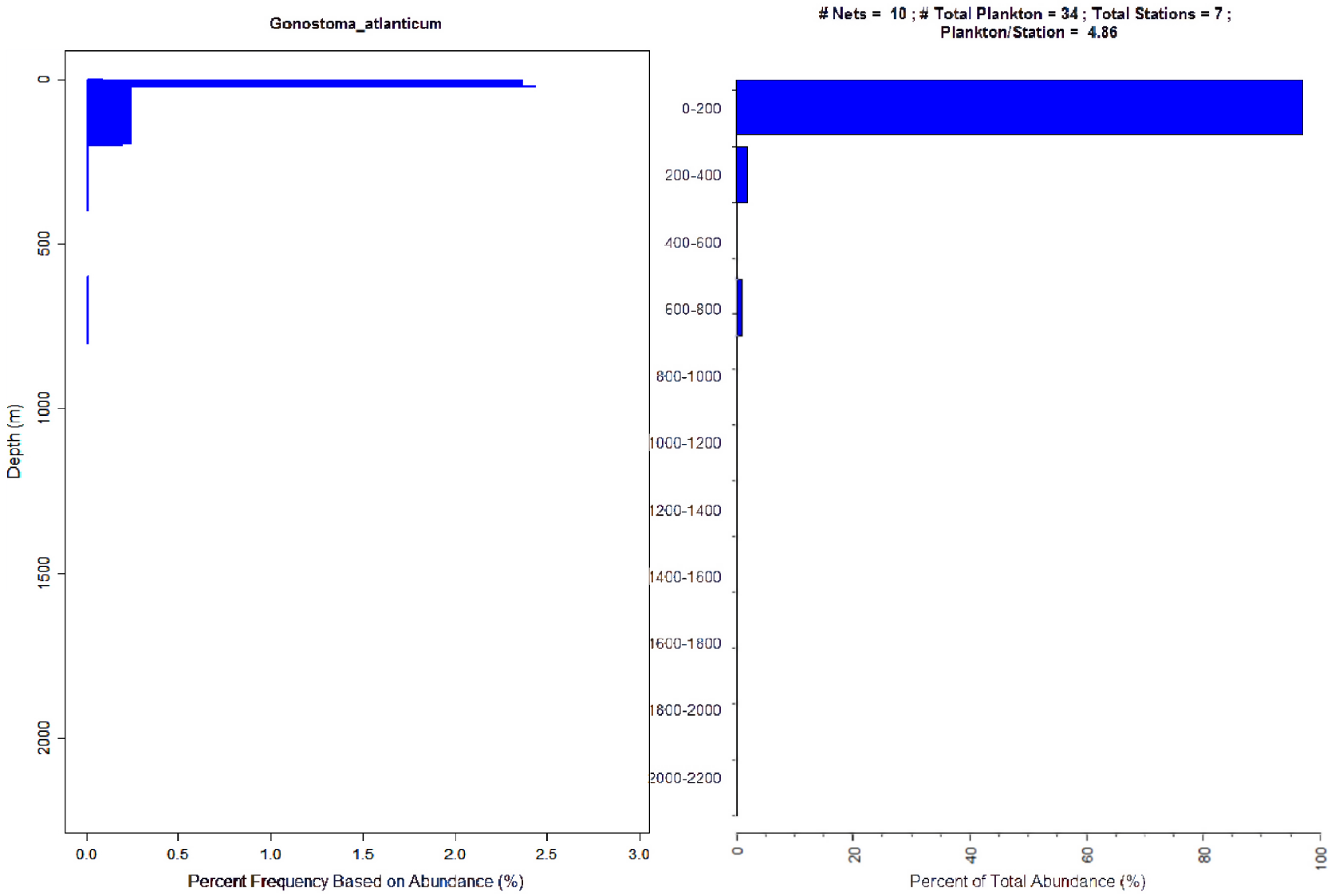
Gobiidae - Deep



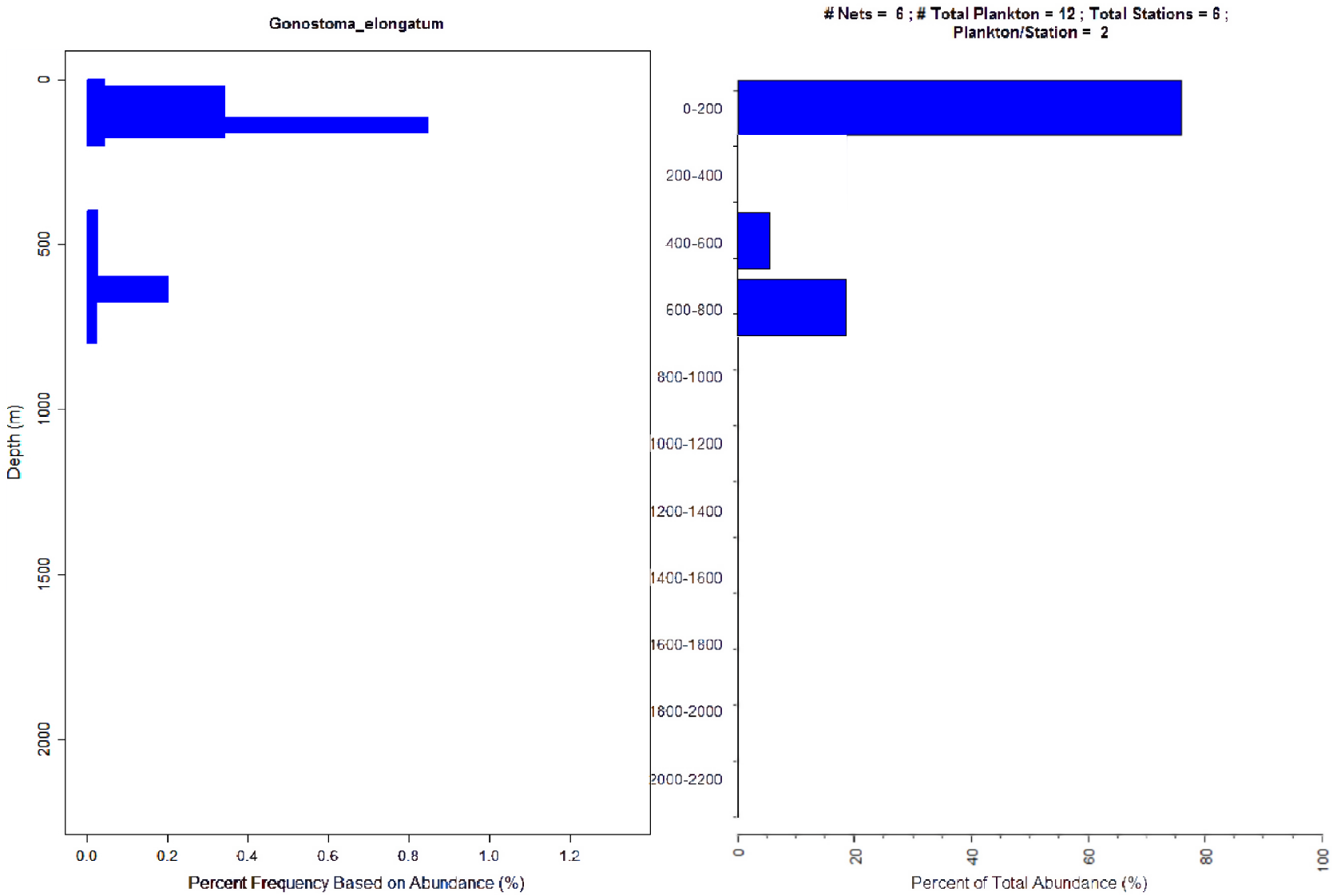
Gonichthys_cocco - Deep



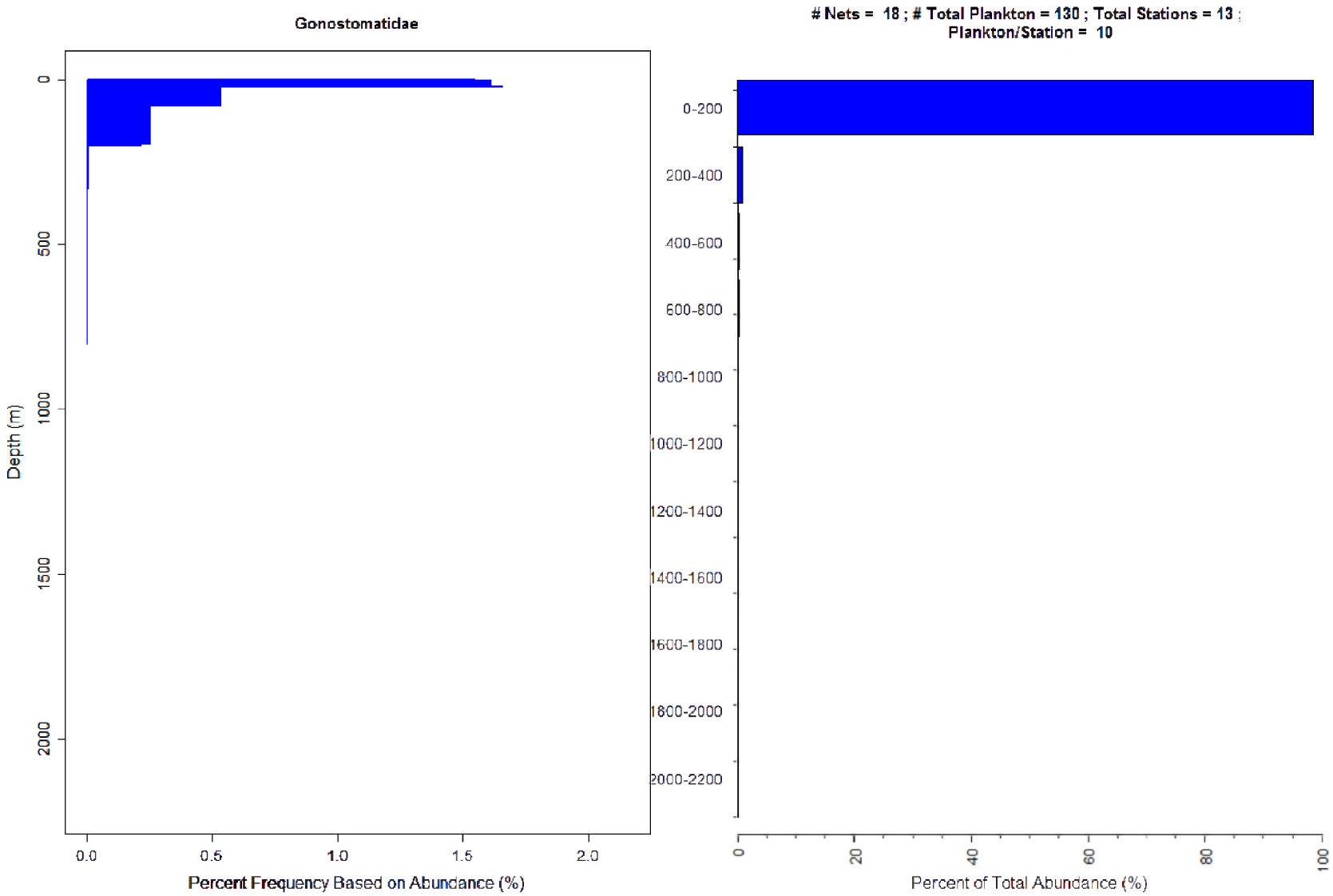
Gonostoma - Deep



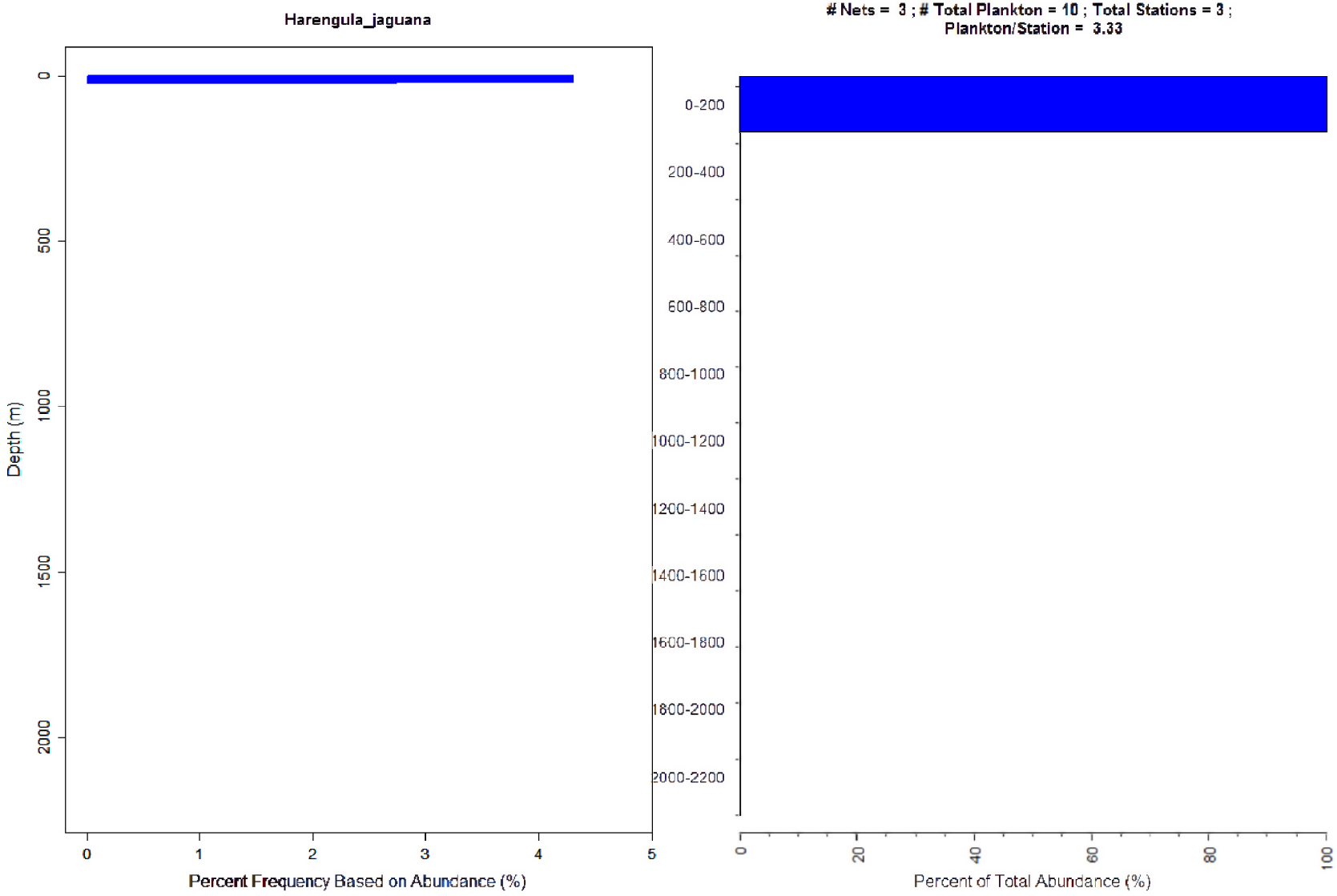
Gonostoma_atlanticum - Deep



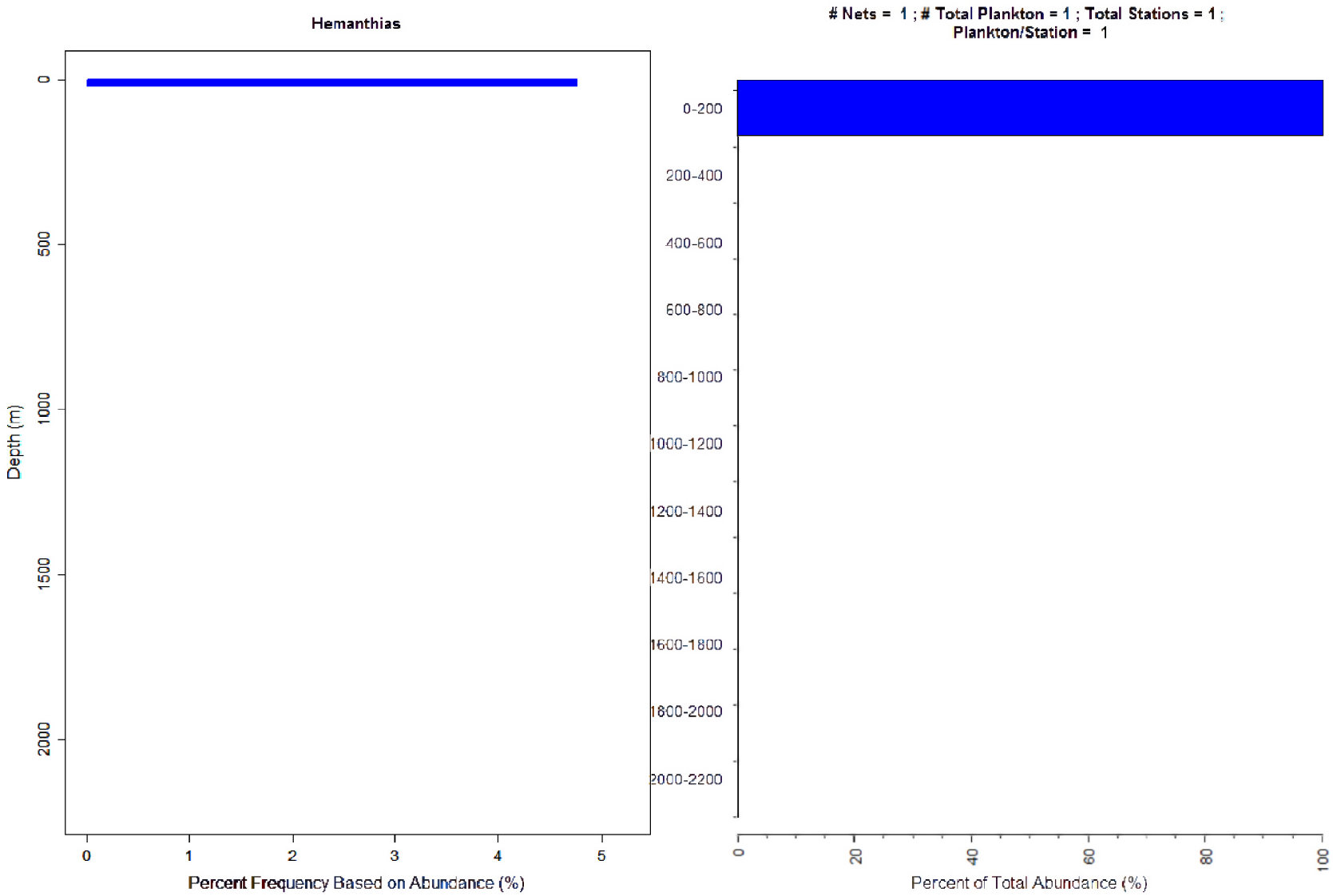
Gonostoma_elongatum - Deep



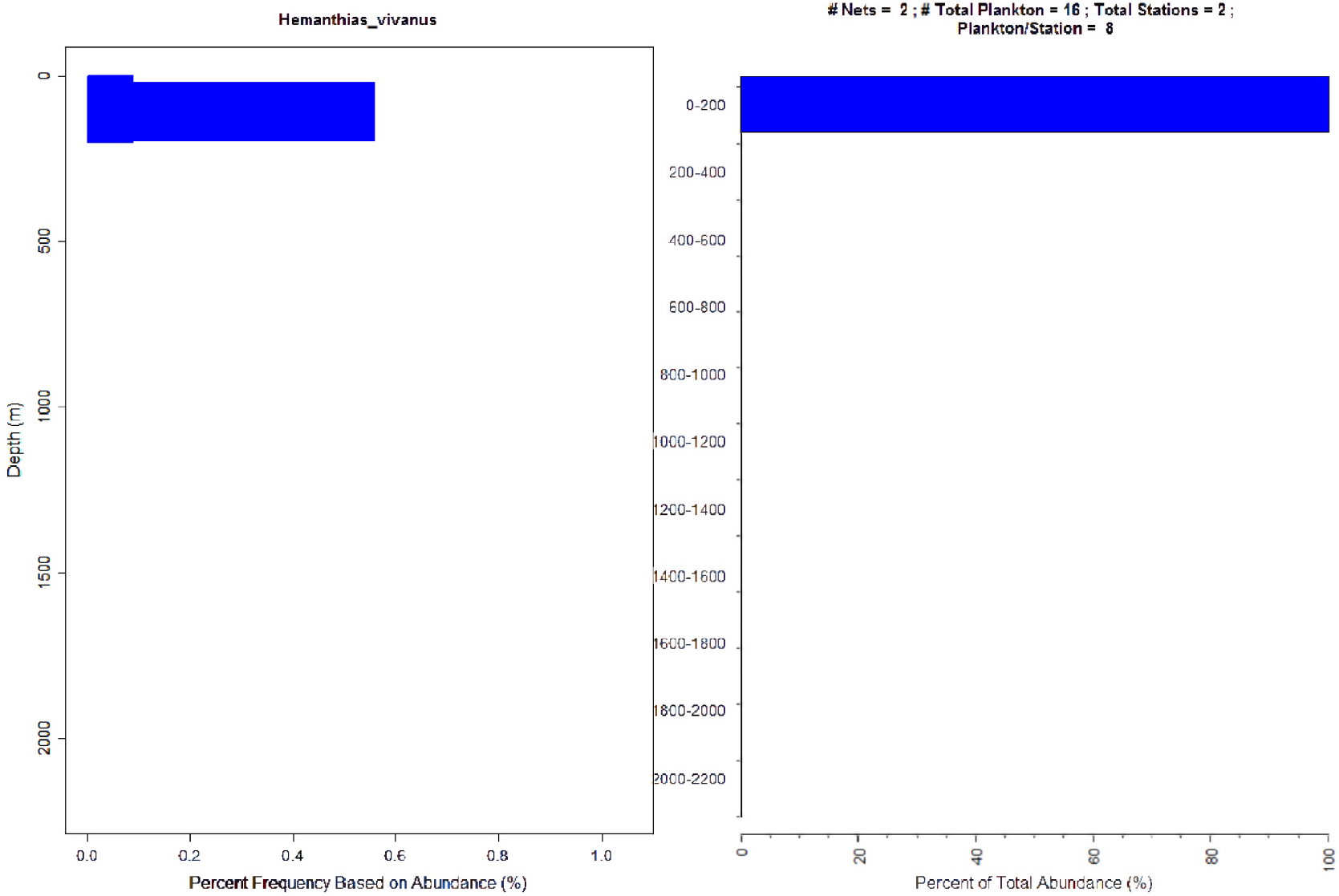
Gonostomatidae - Deep



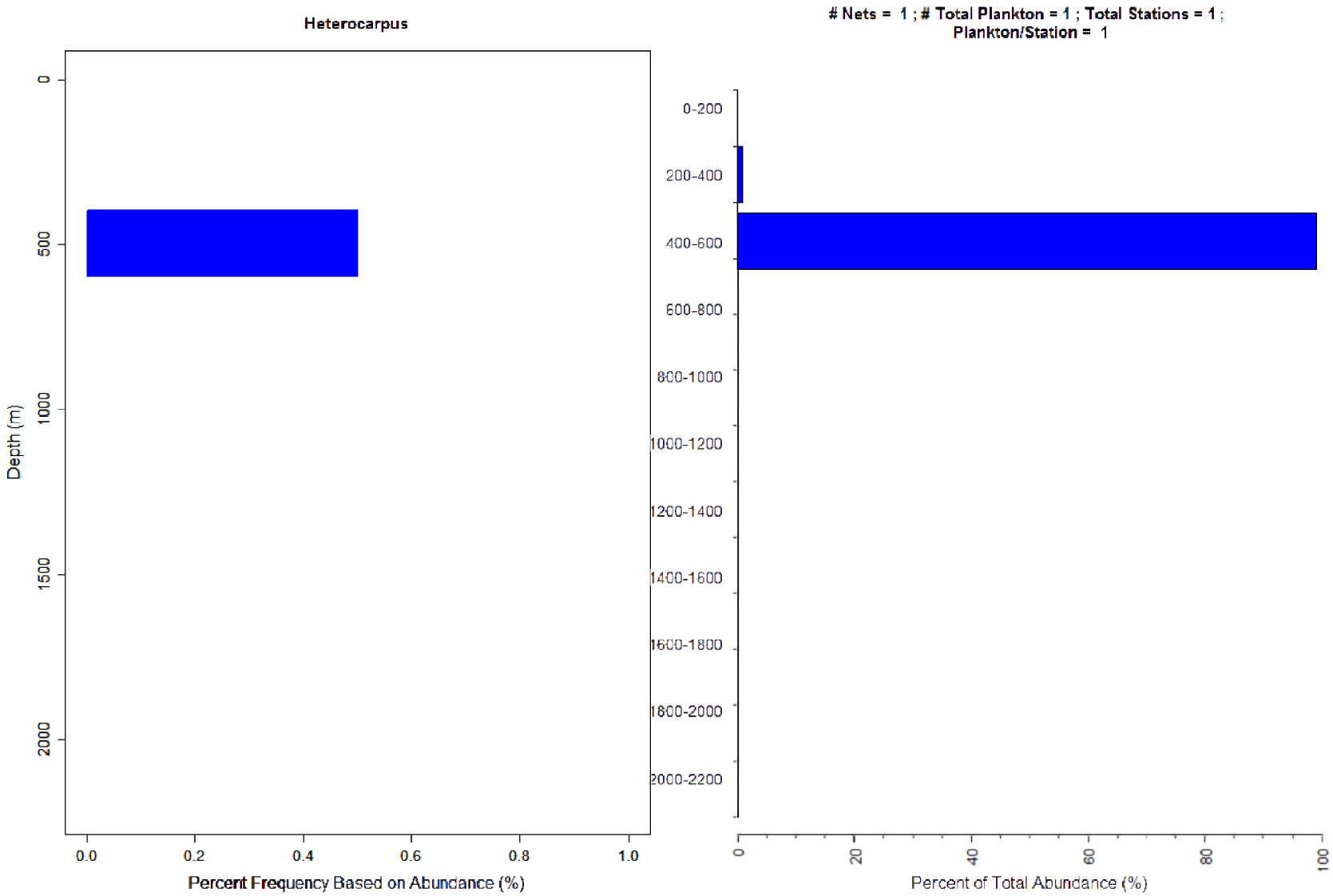
Harengula_jaguana - Deep



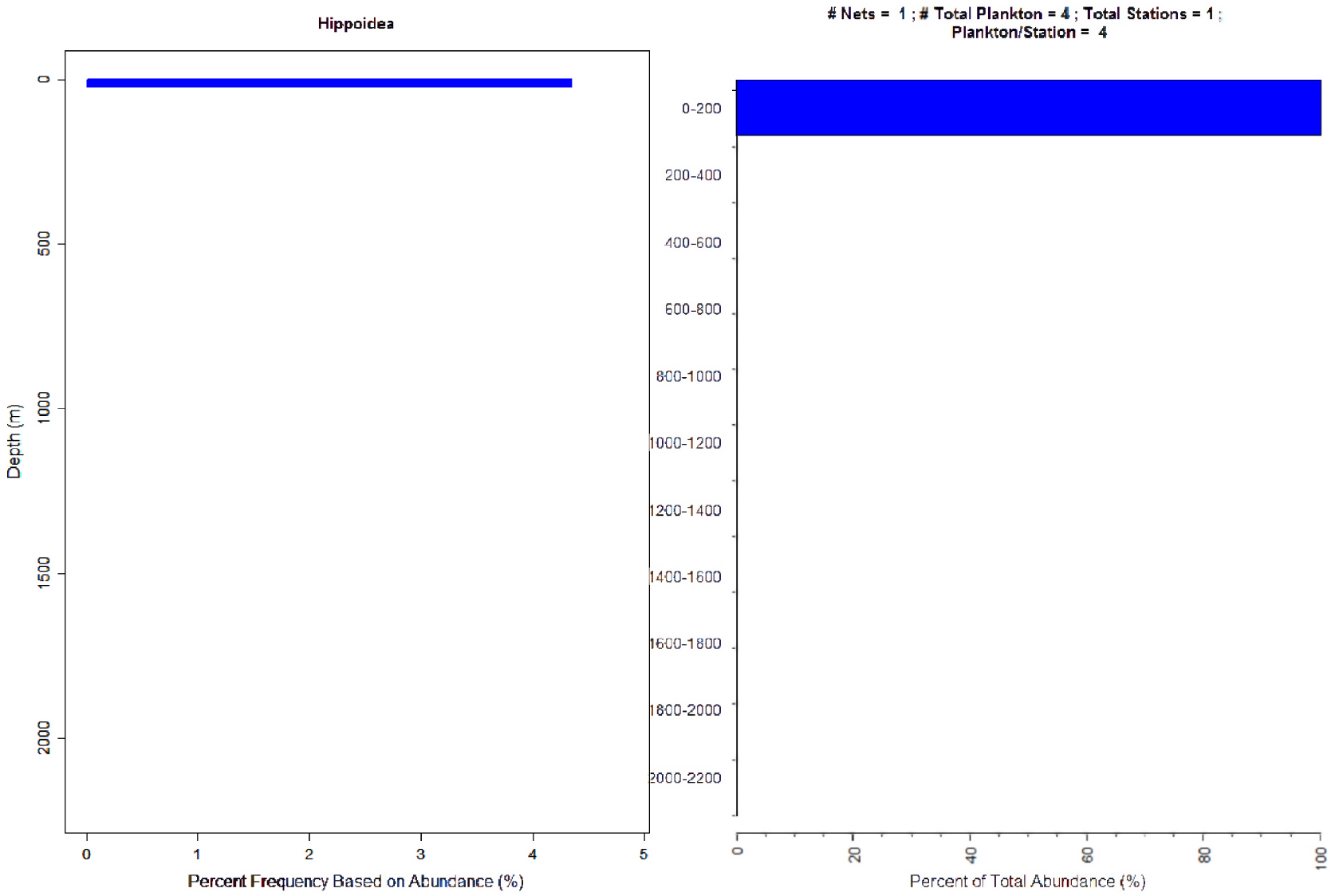
Hemanthias - Deep



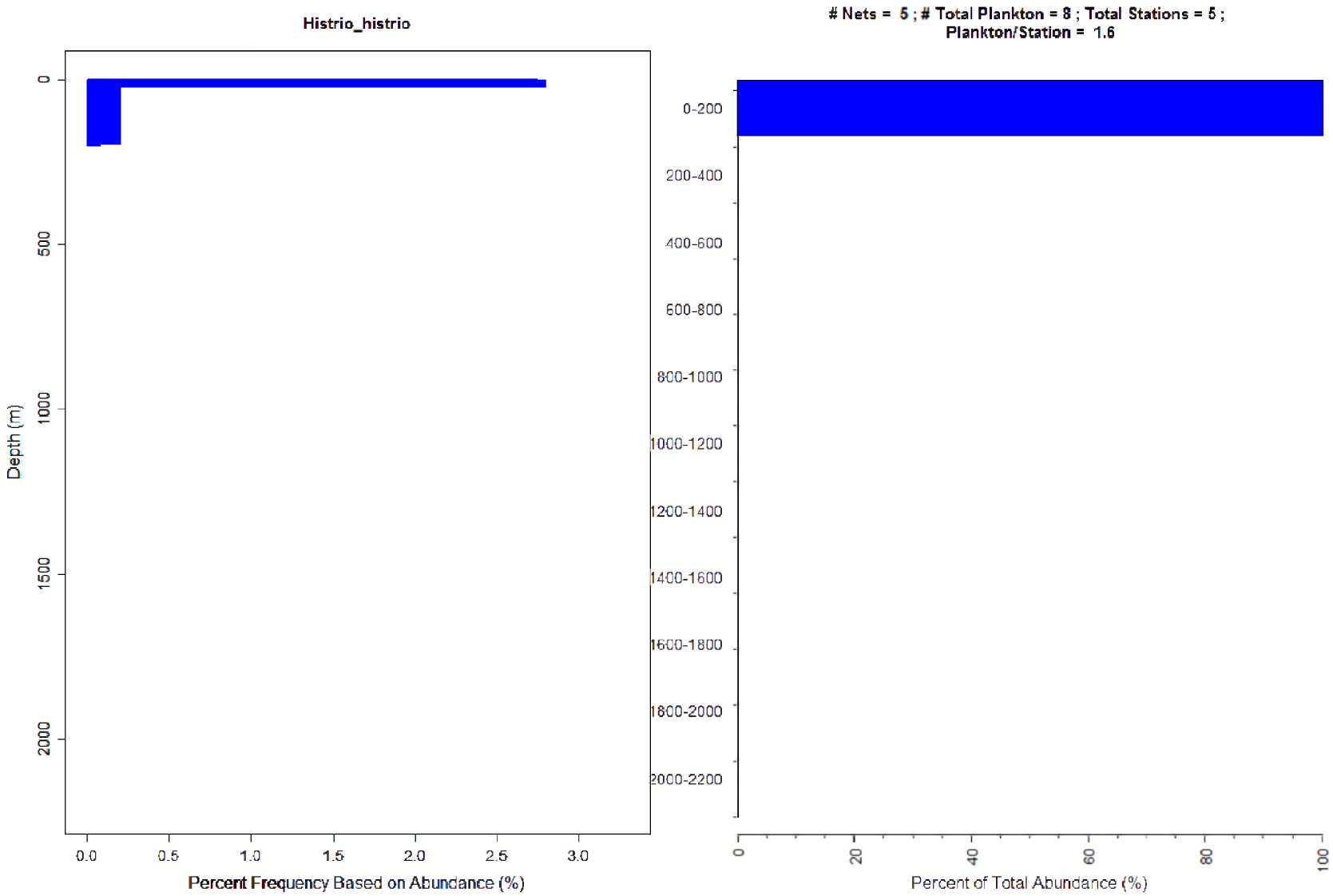
Hemanthias_vivanus - Deep



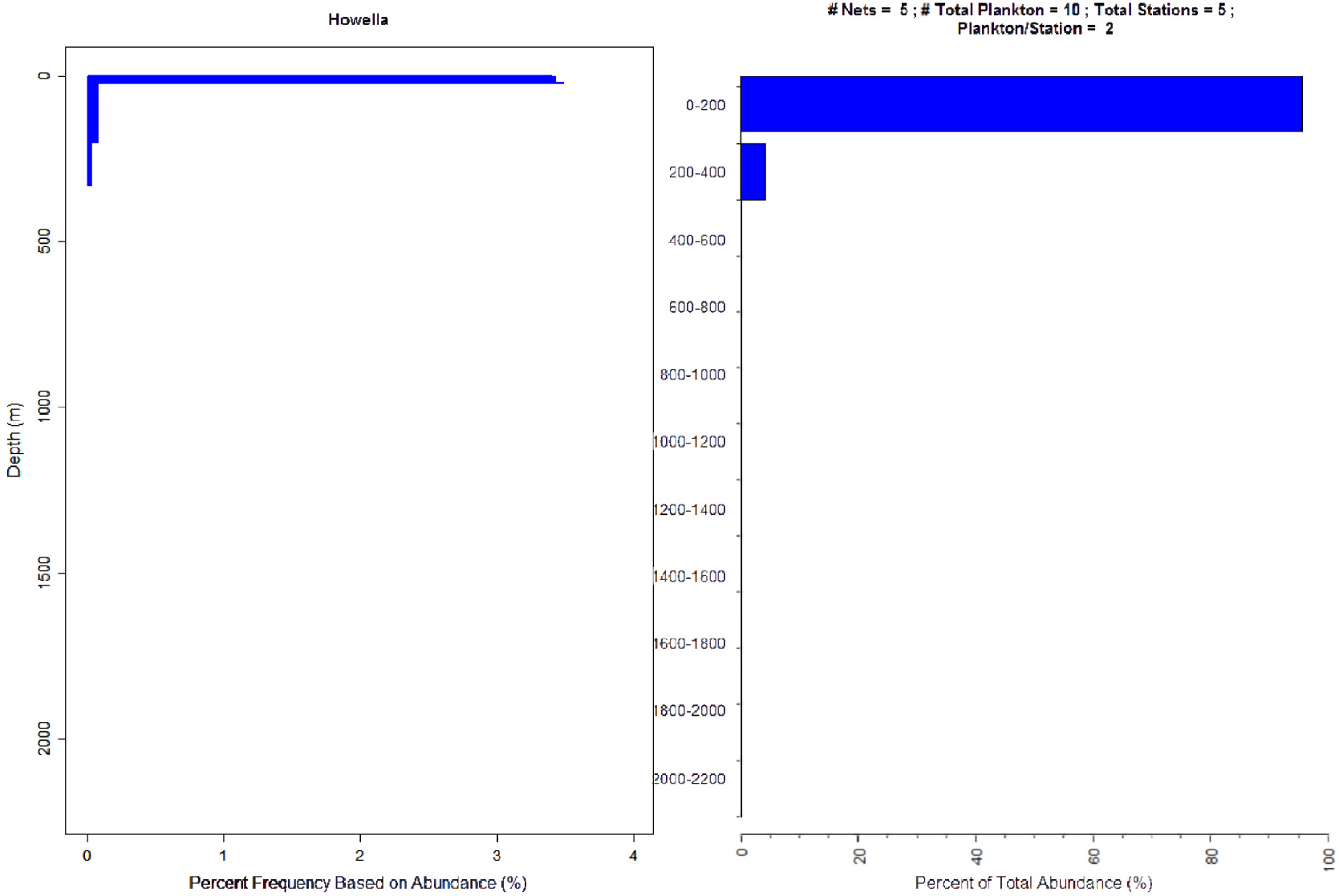
Heterocarpus - Deep



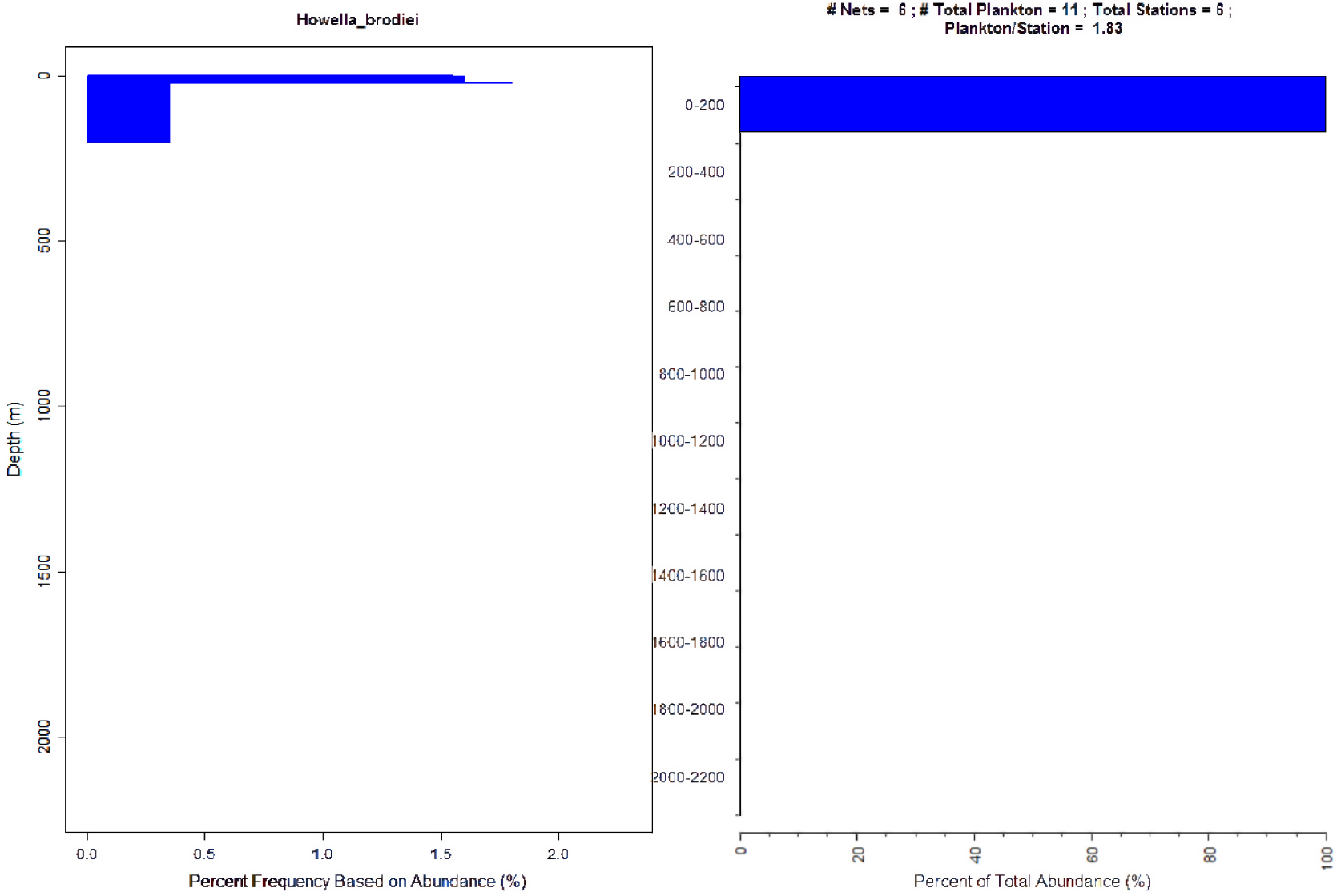
Hippoidea - Deep



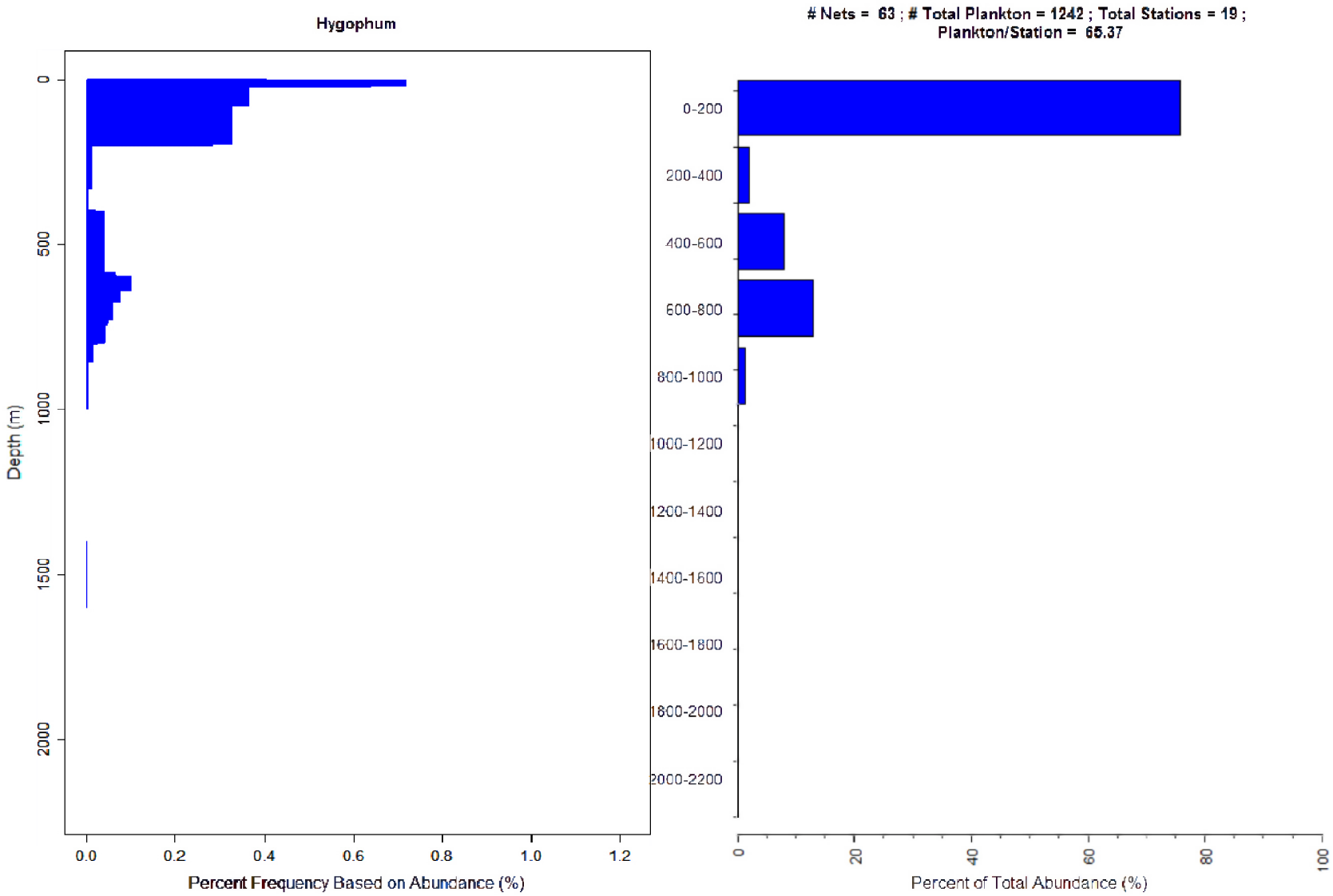
Histrio_histrio - Deep



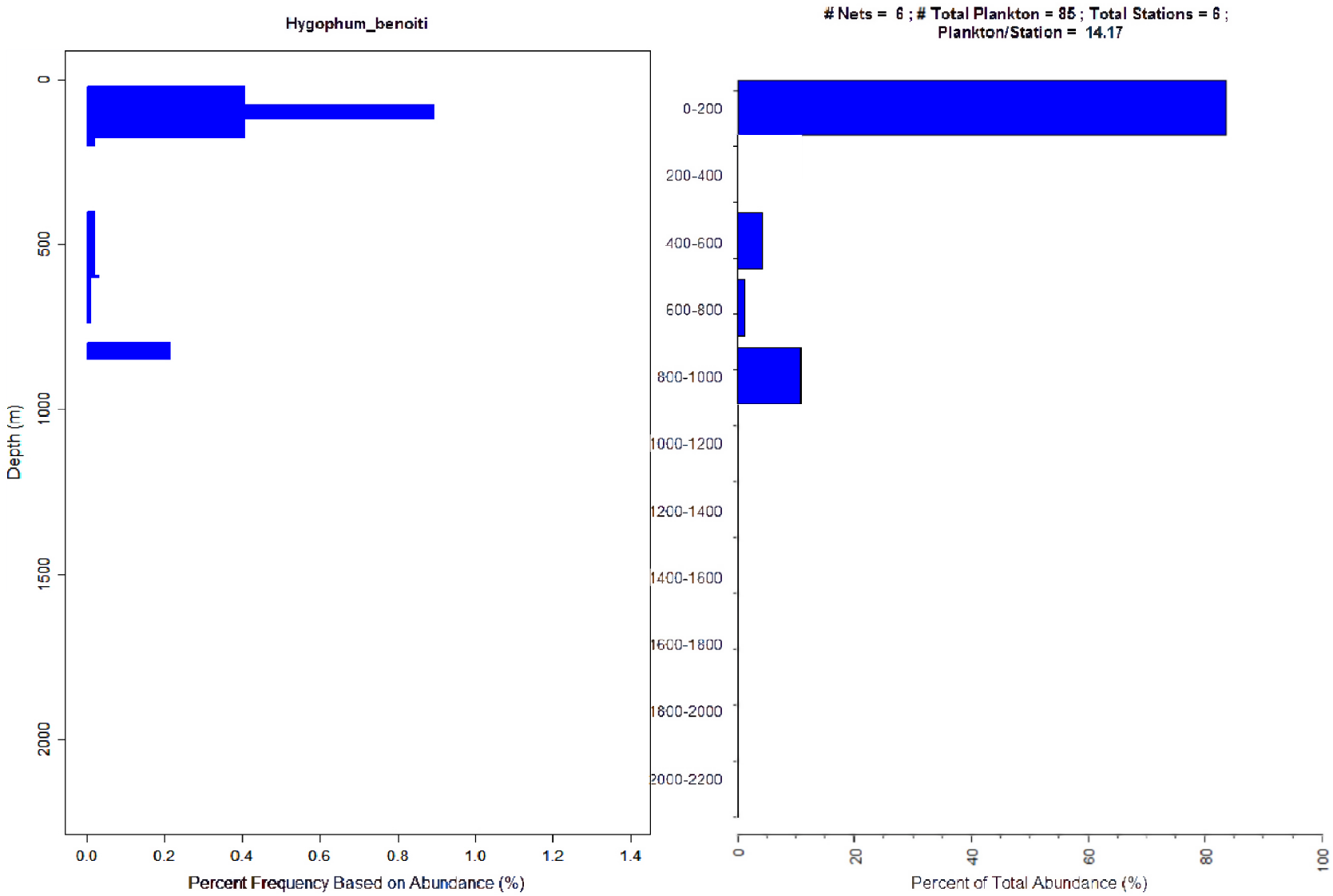
Howella - Deep



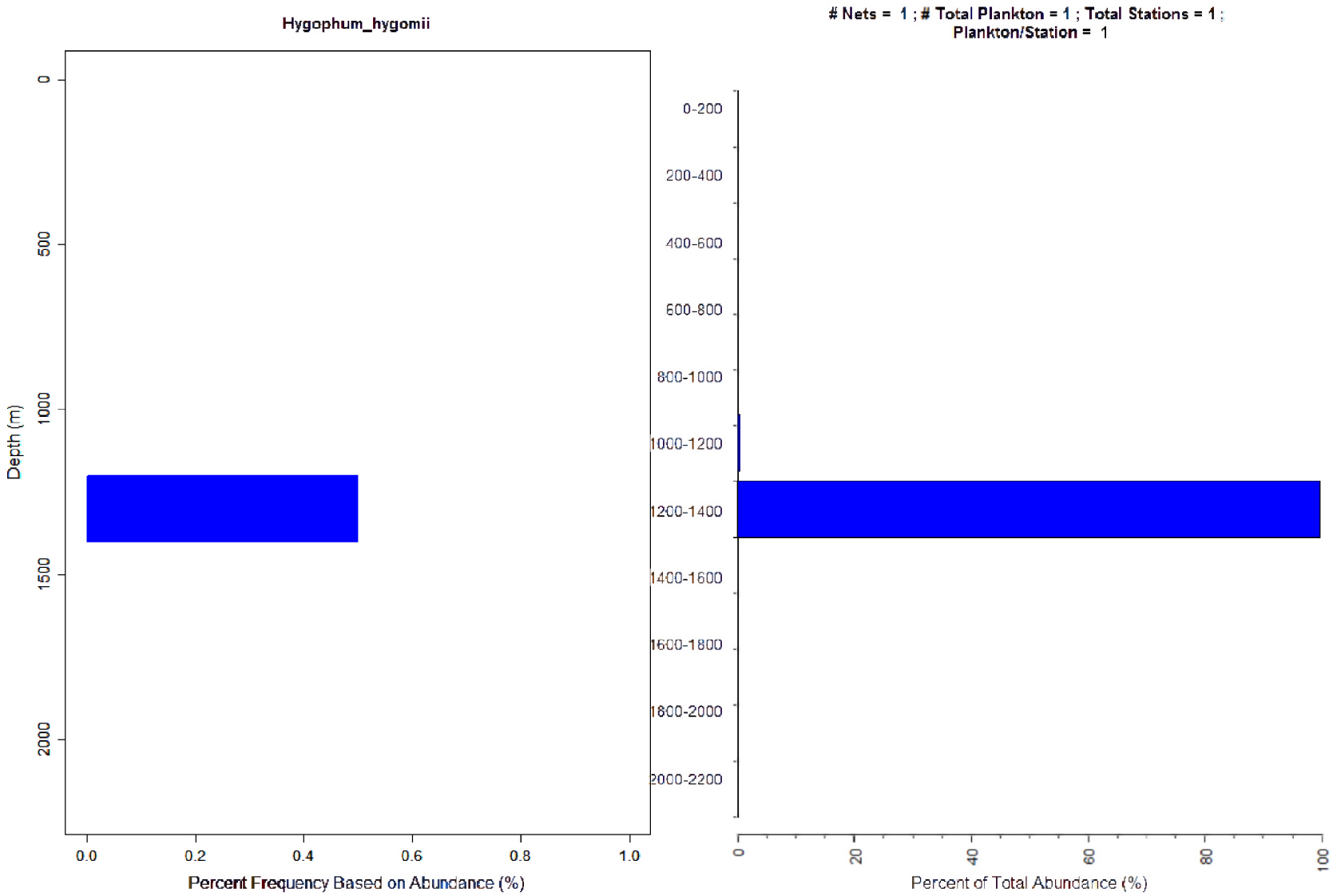
Howella_brodiei - Deep



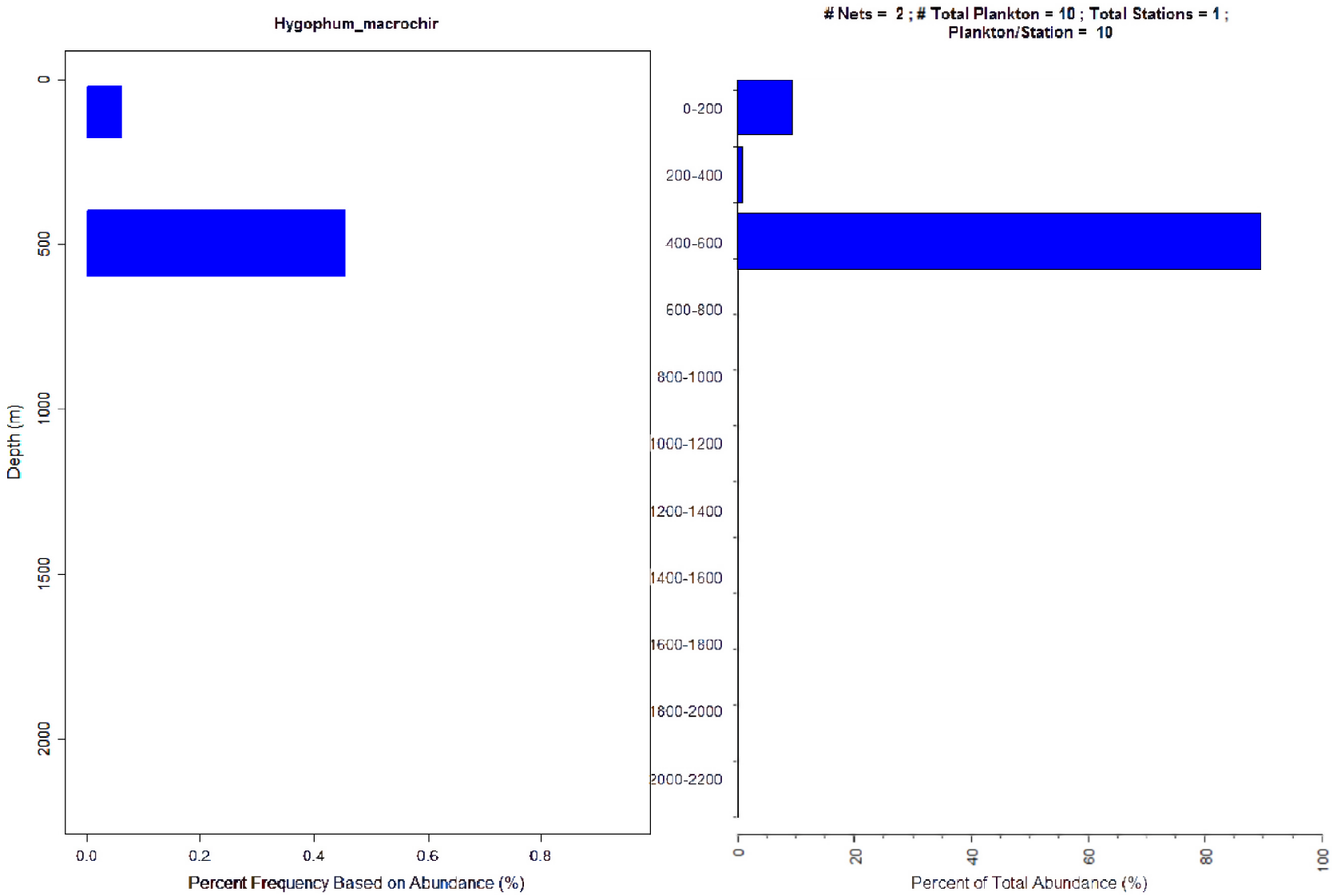
Hygophum - Deep



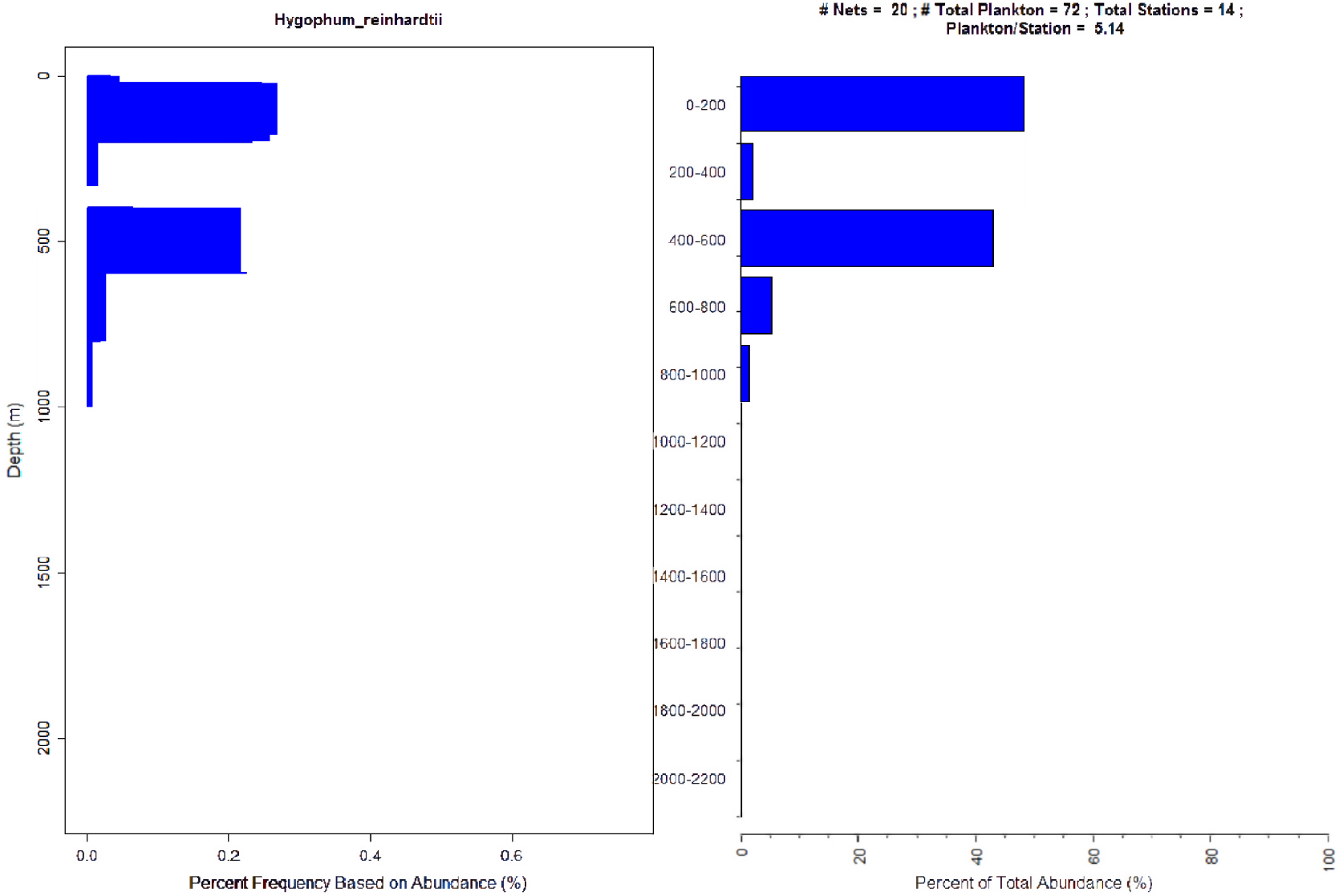
Hygophum_benoiti - Deep



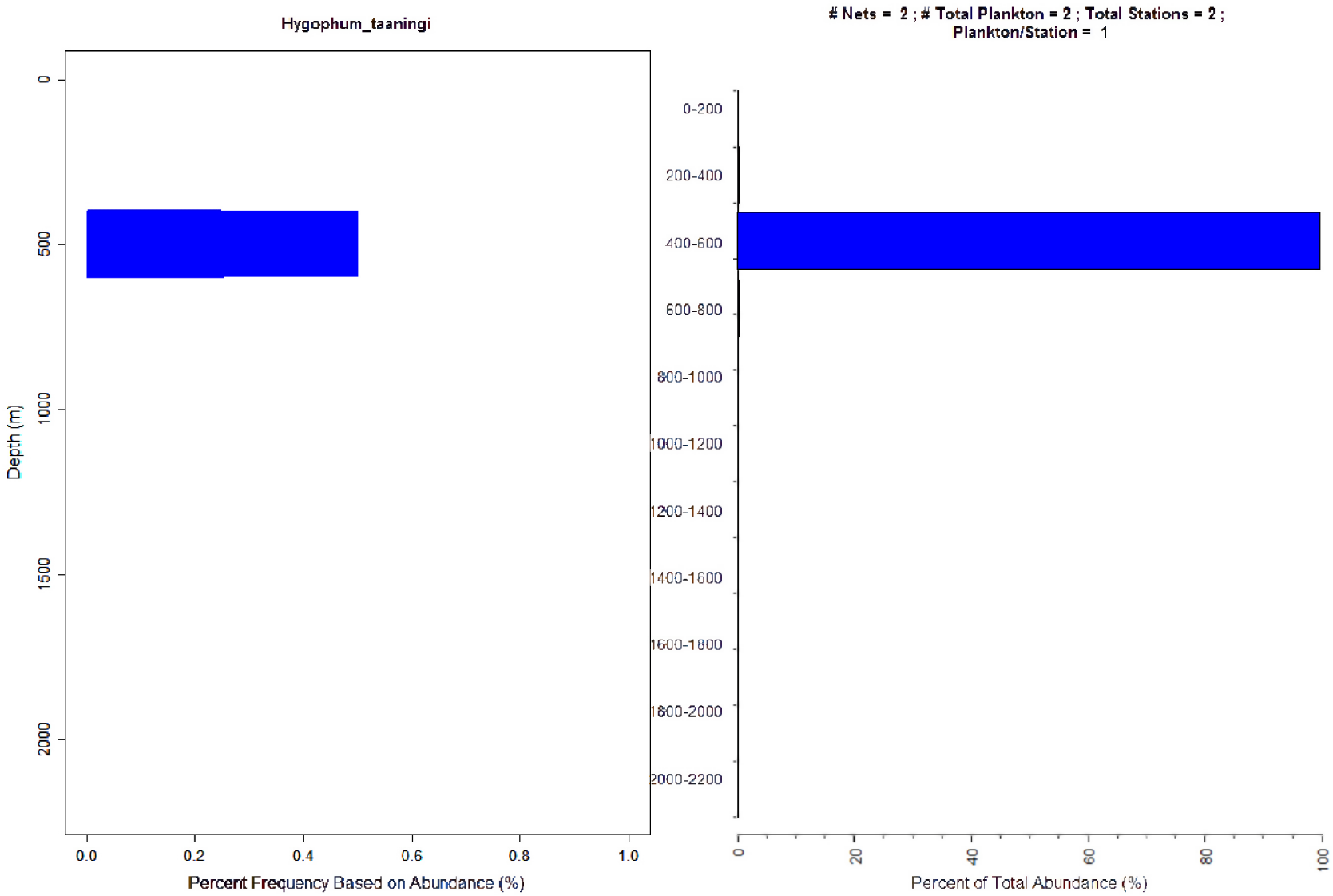
Hygophum_hygomii - Deep



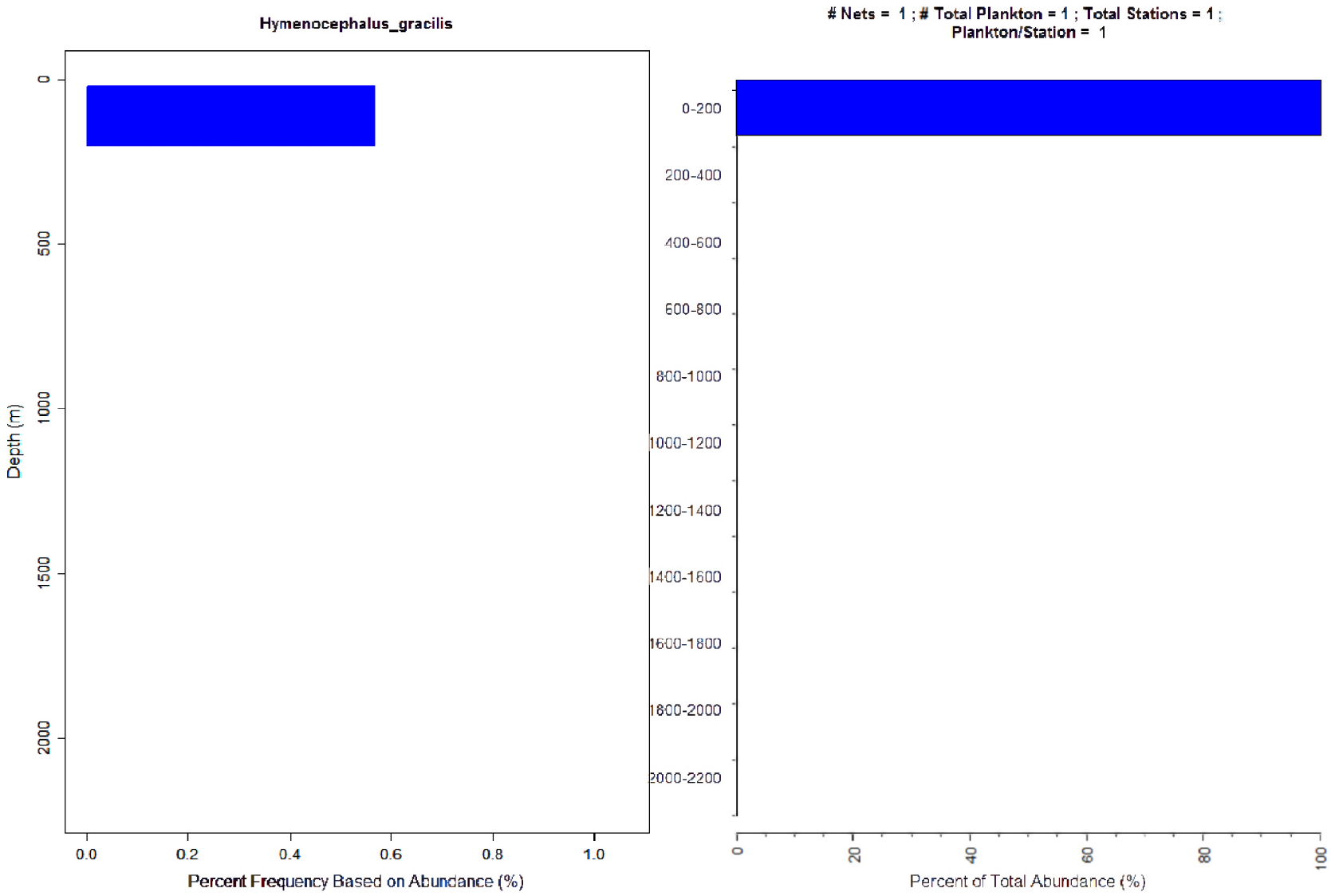
Hygophum_macrochir - Deep



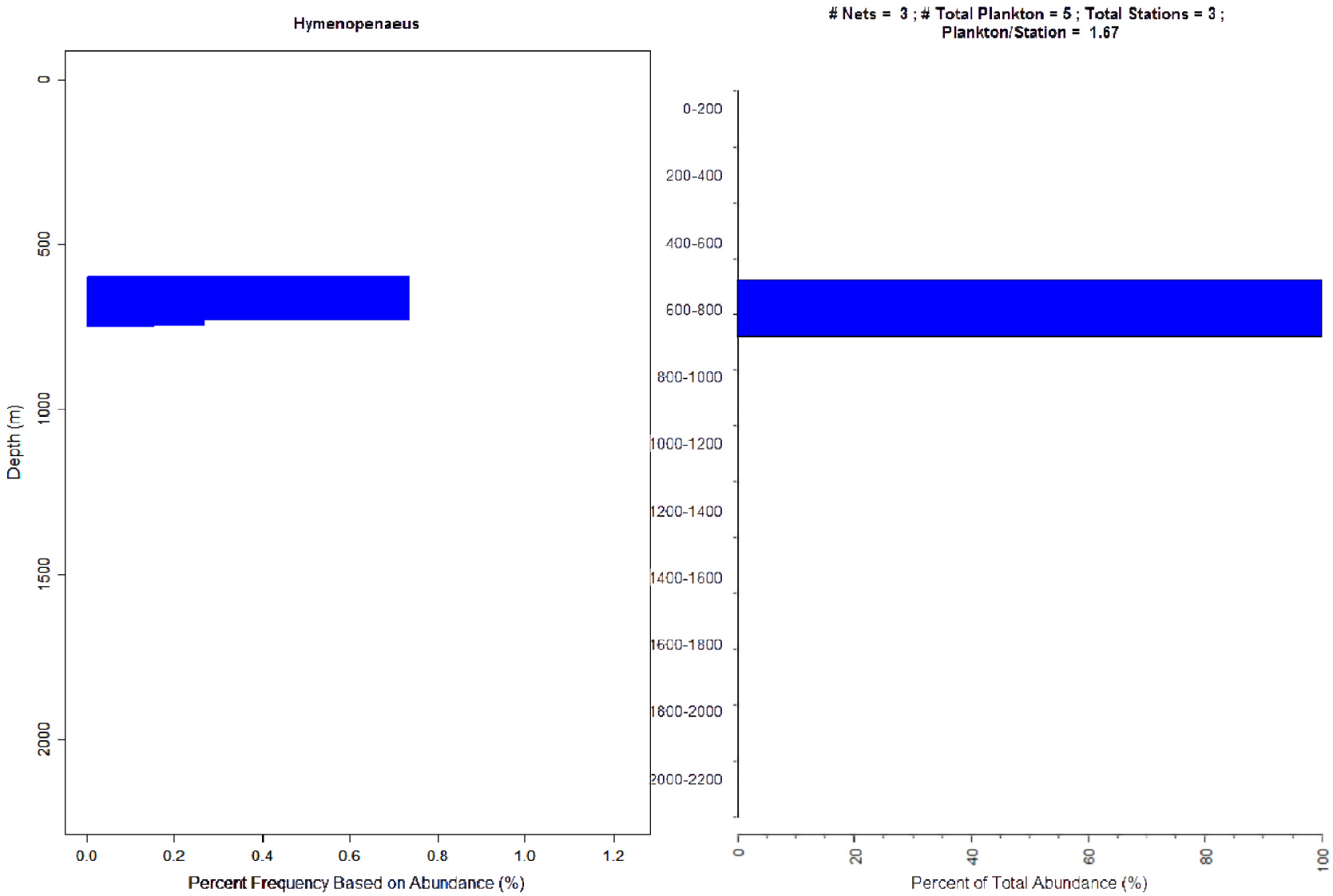
Hygophum_reinhardtii - Deep



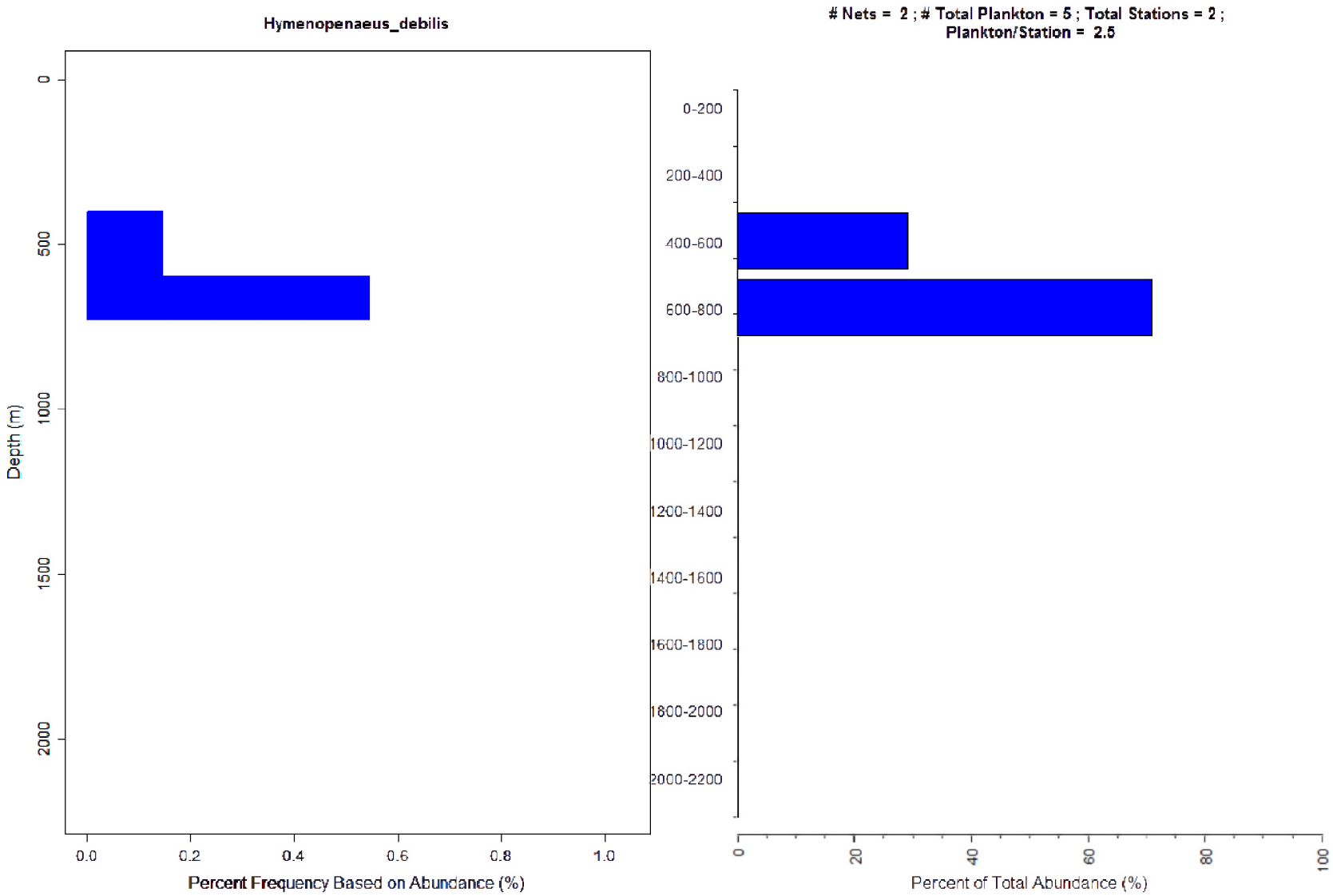
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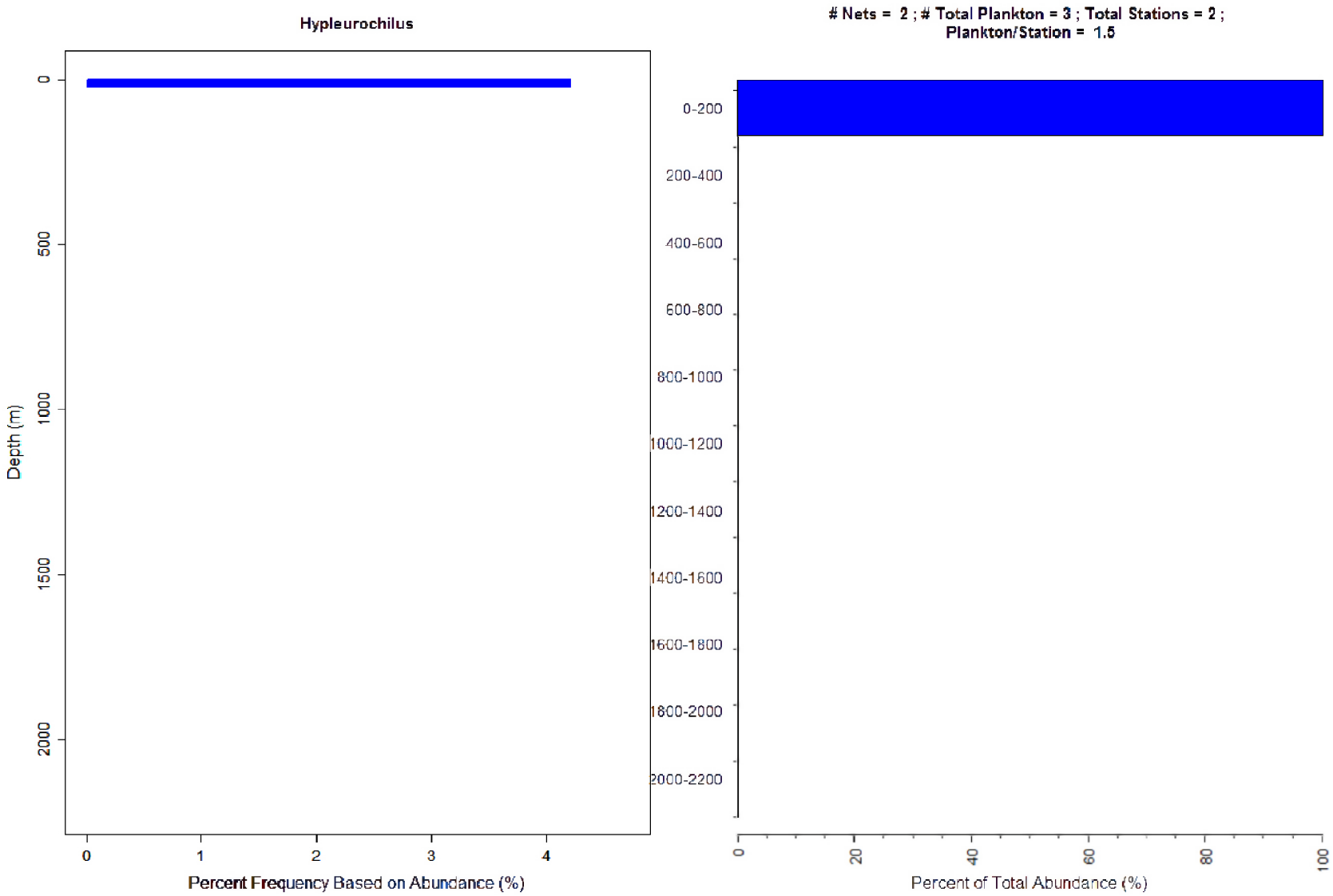
Hymenocephalus_gracilis - Deep



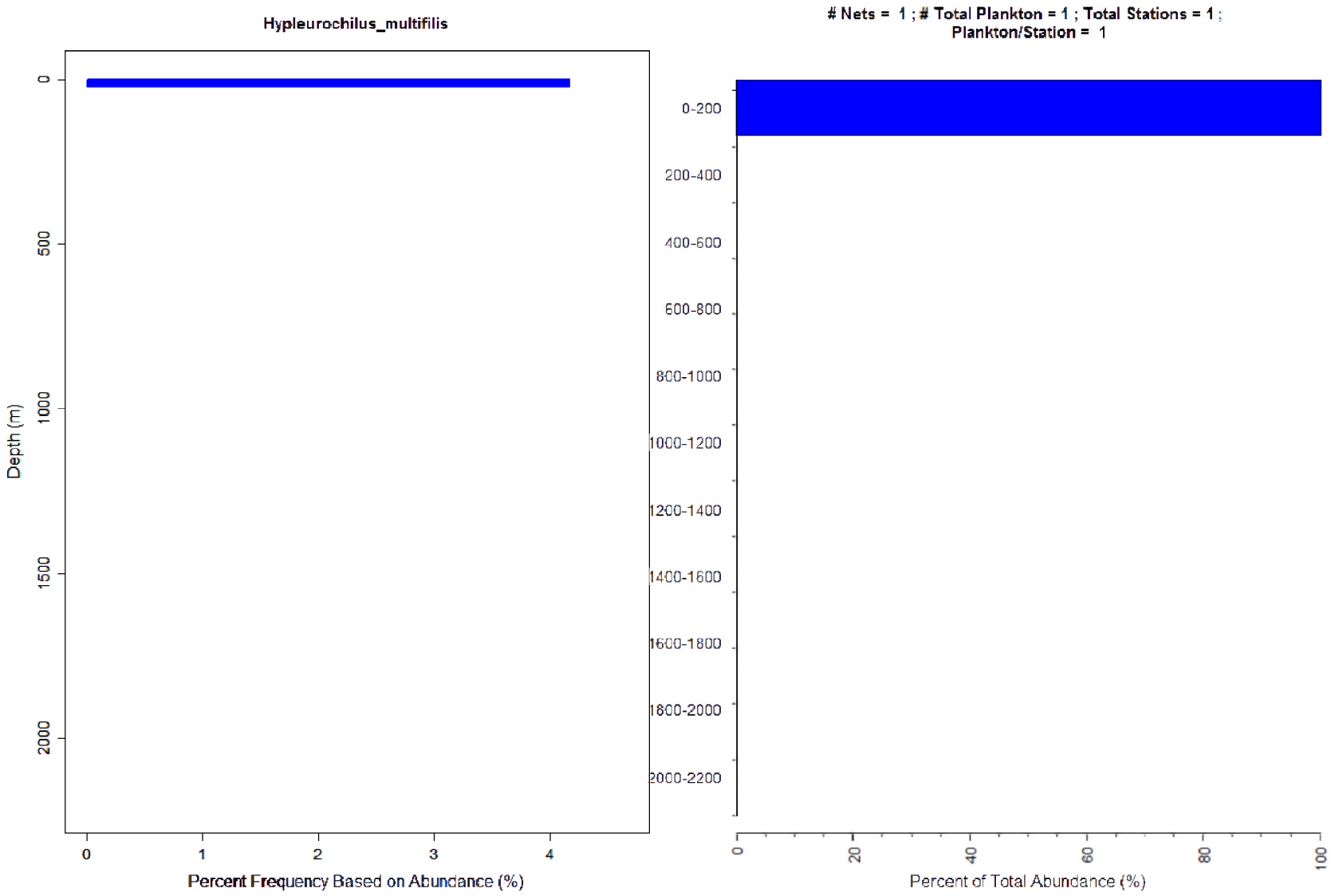
Hymenopenaeus - Deep



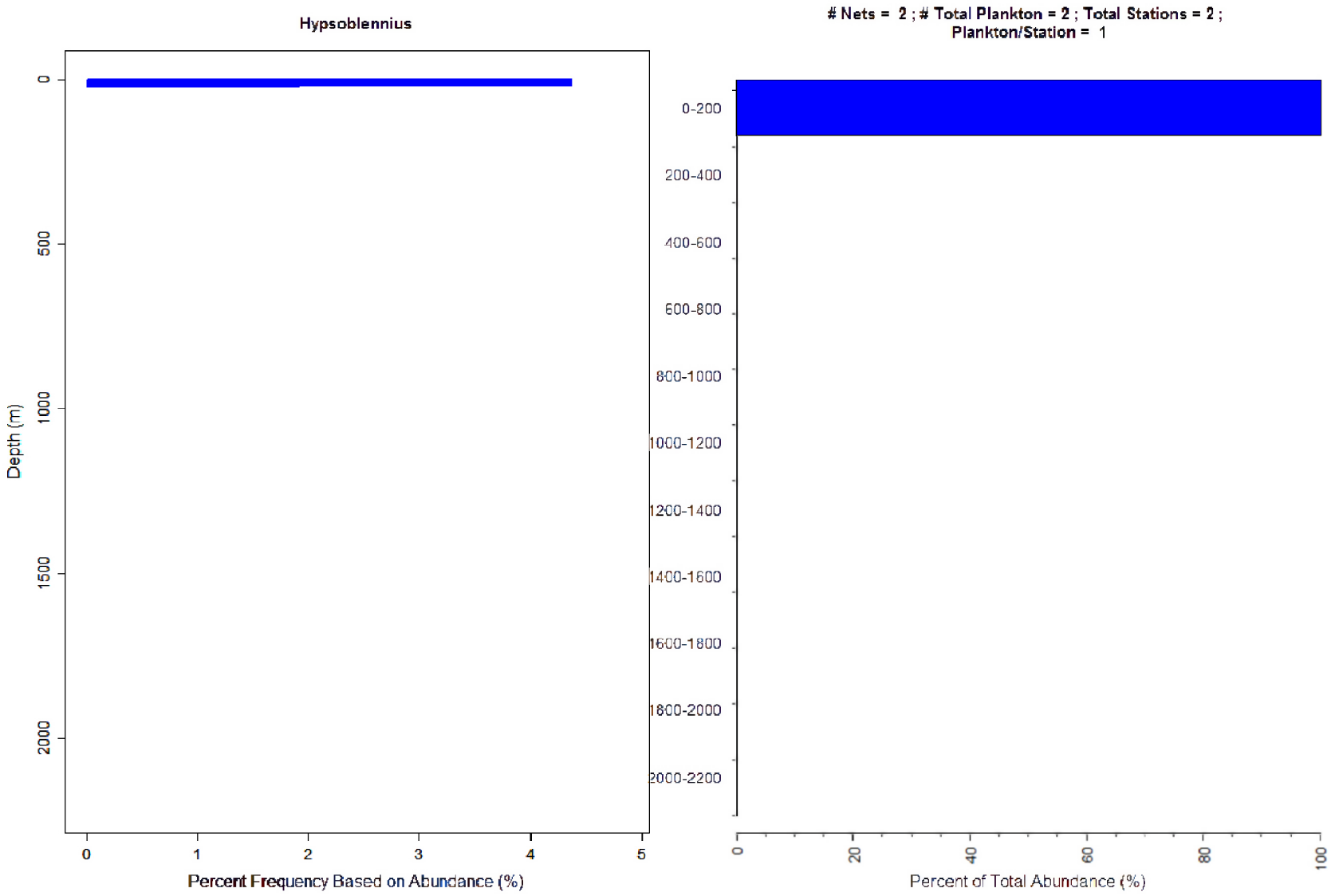
Hymenopenaeus_debilis - Deep



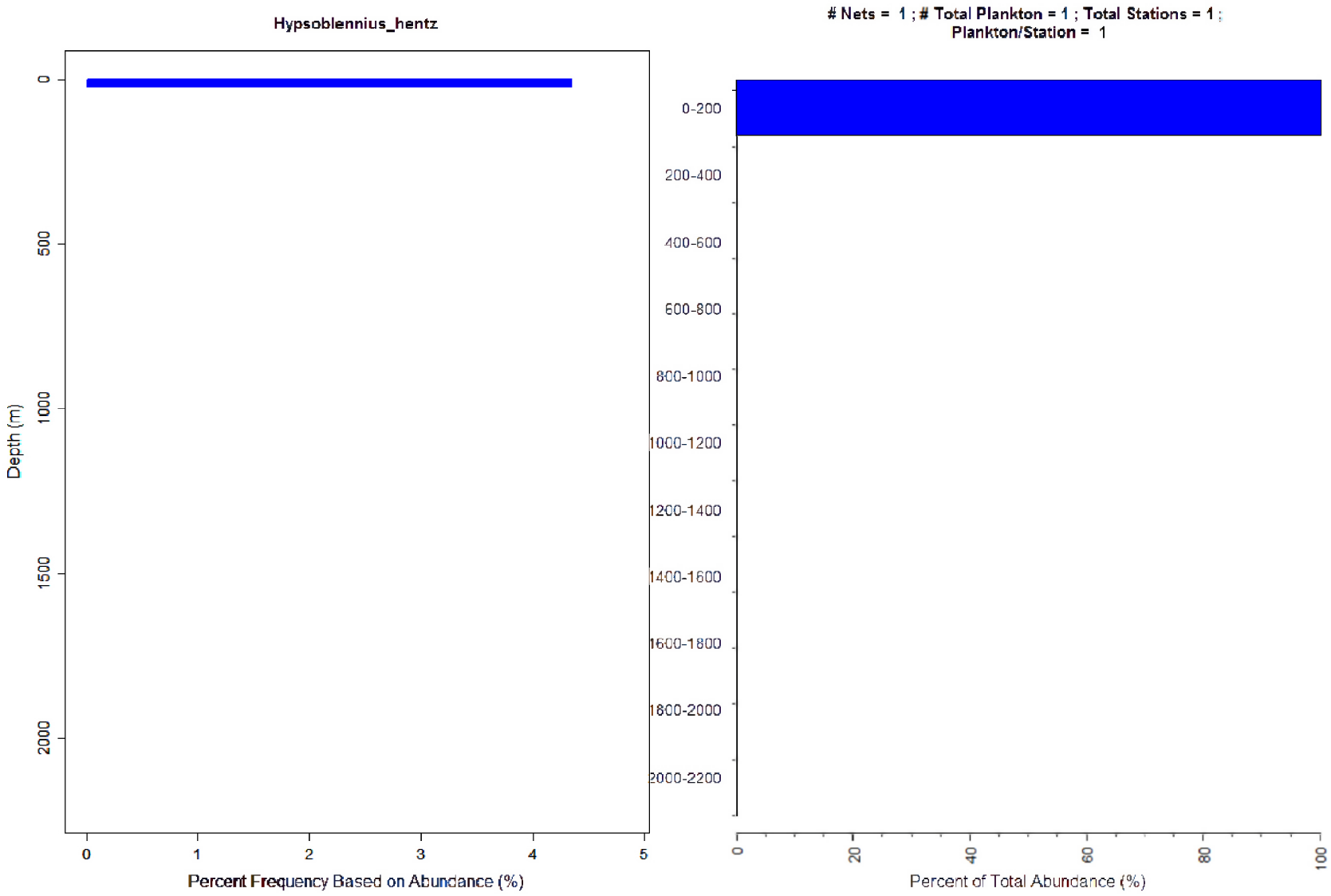
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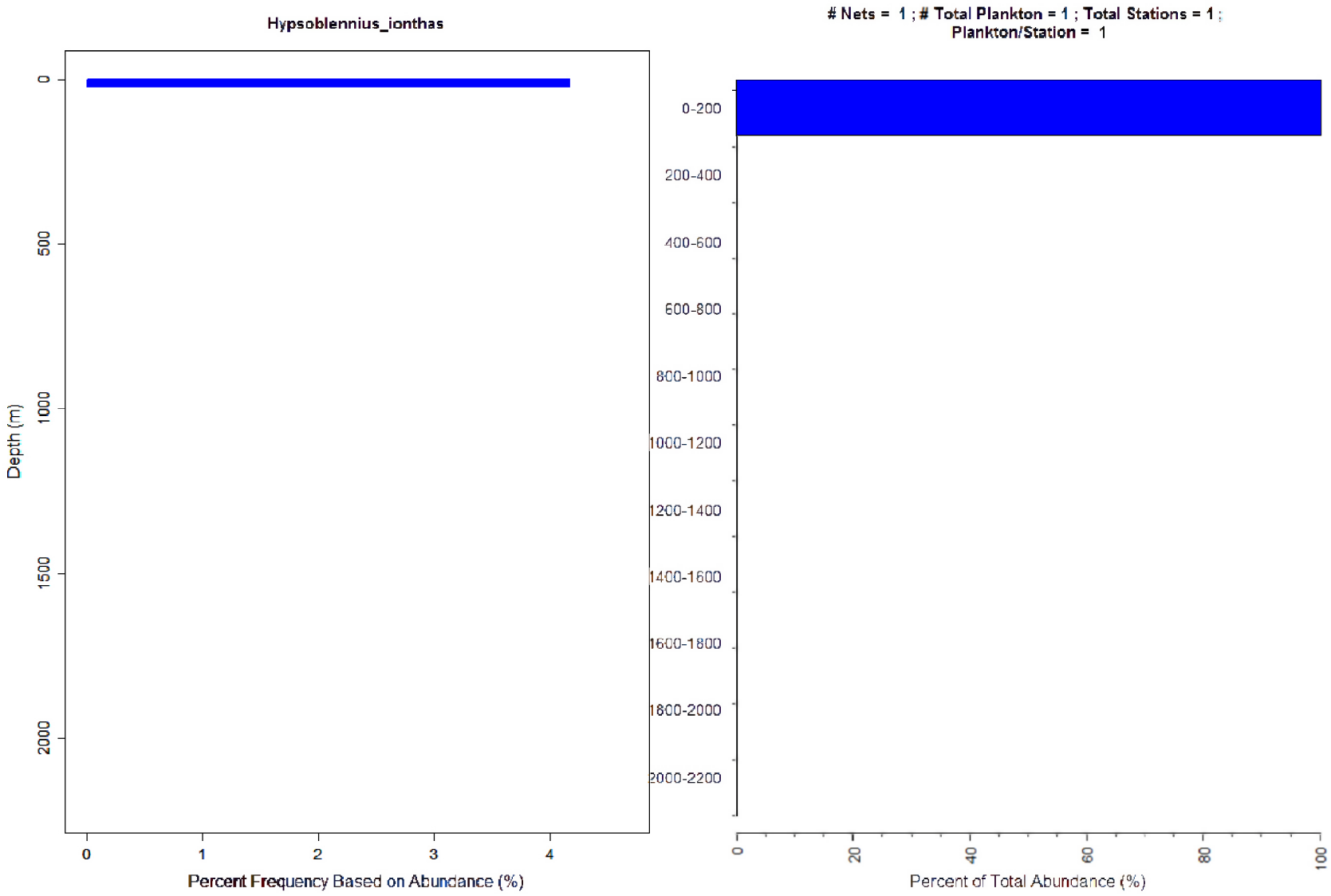
Hypleurochilus_multifilis - Deep



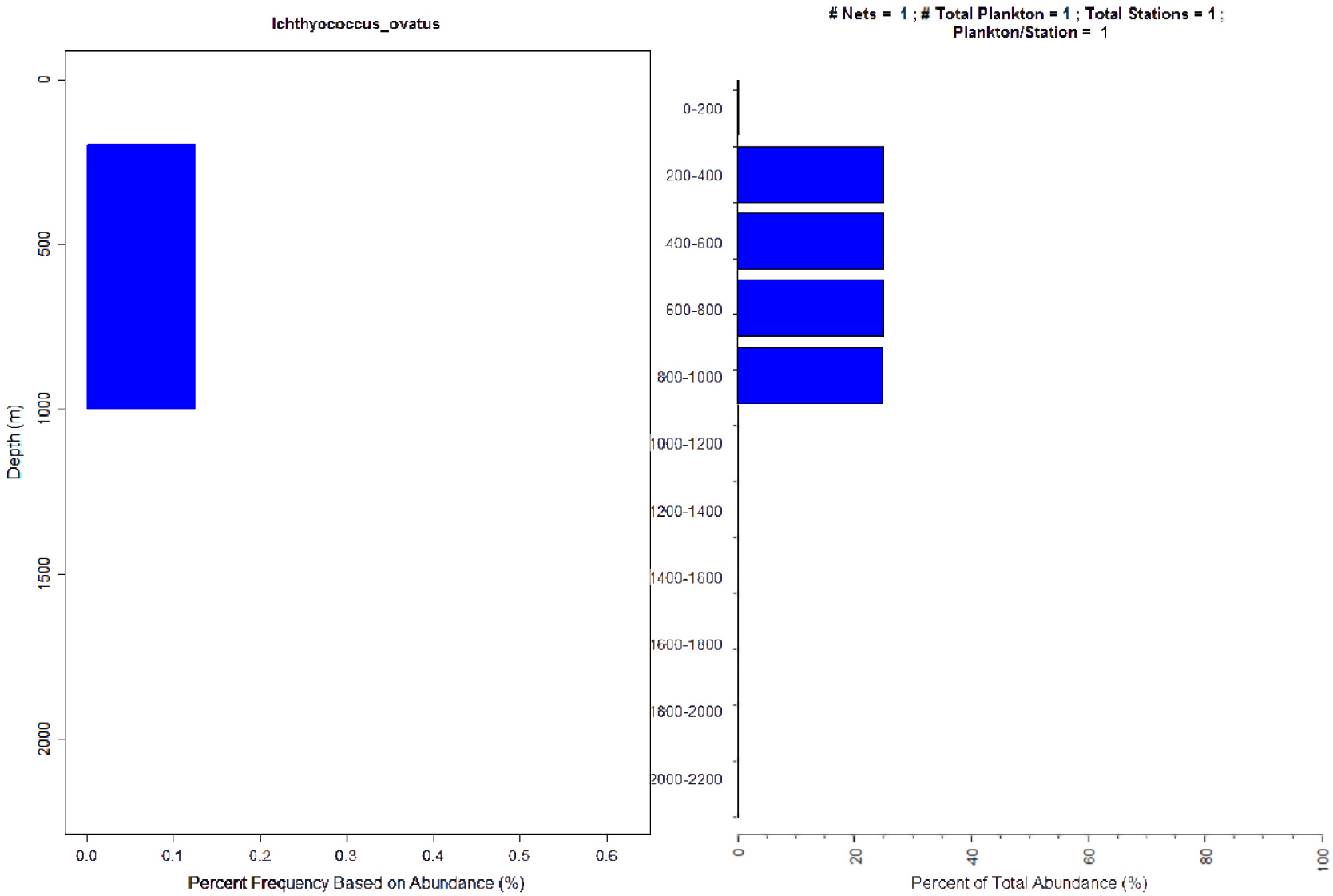
Hypsoblennius - Deep



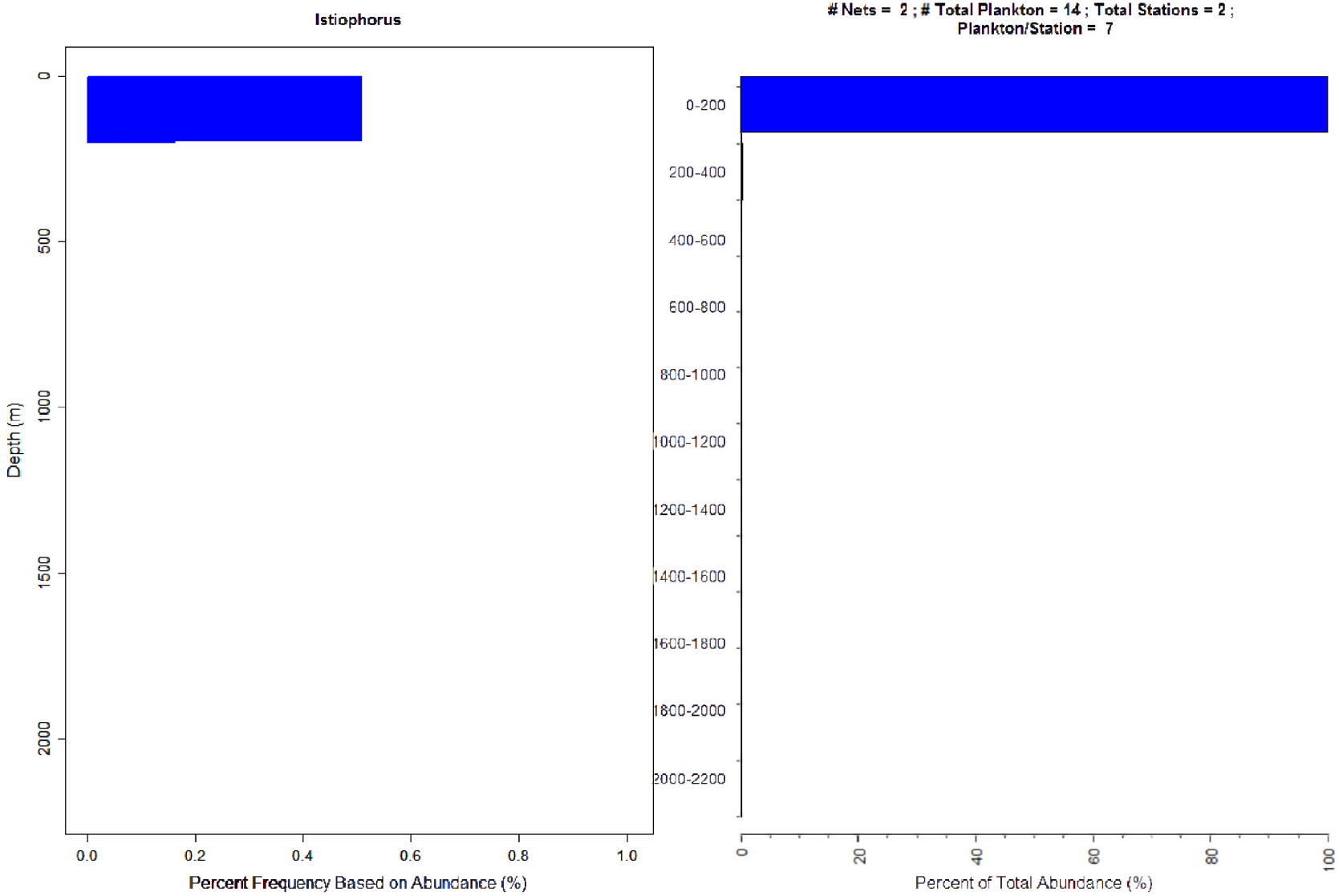
Hypsoblennius_hentz - Deep



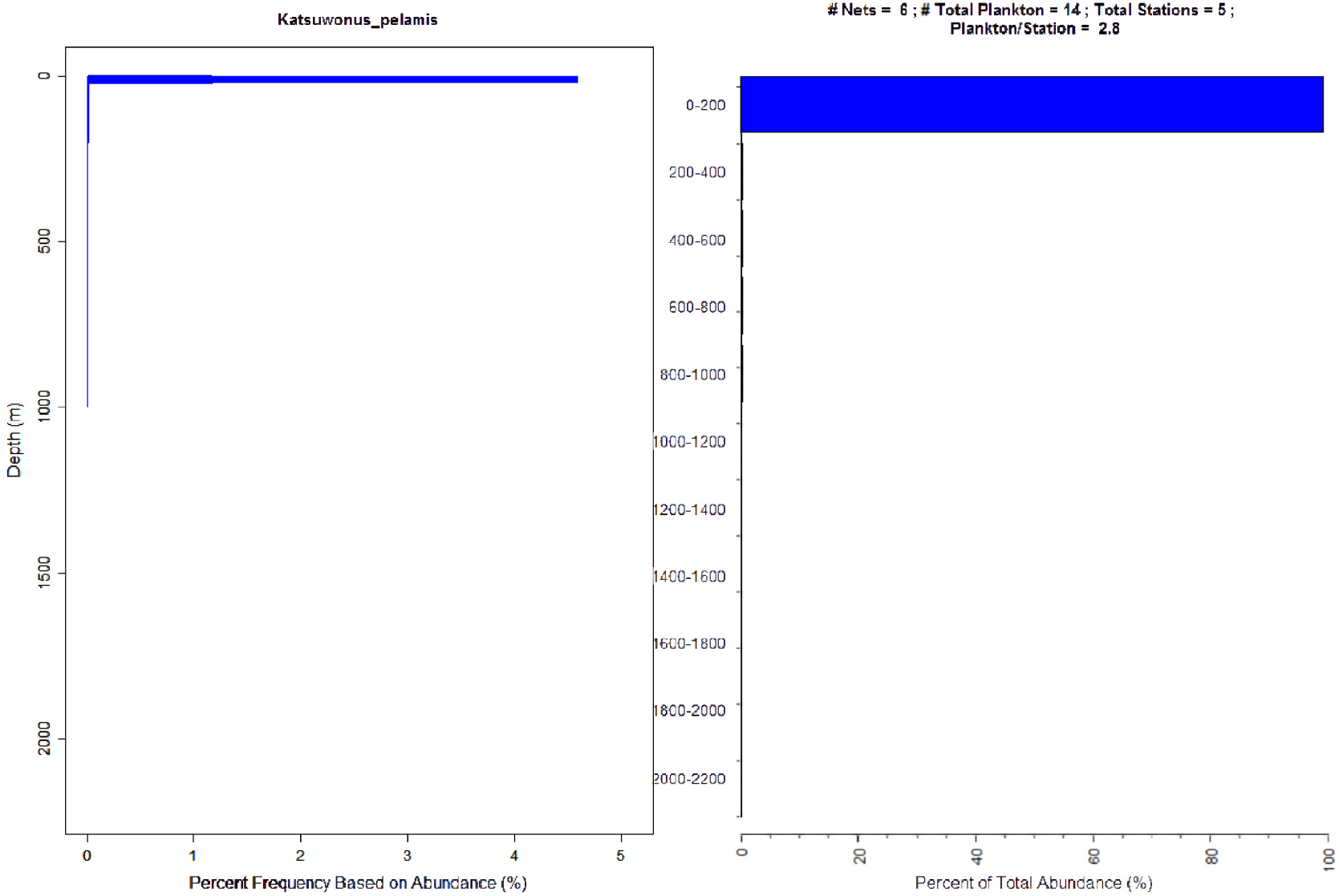
Hypsoblennius_ionthas - Deep



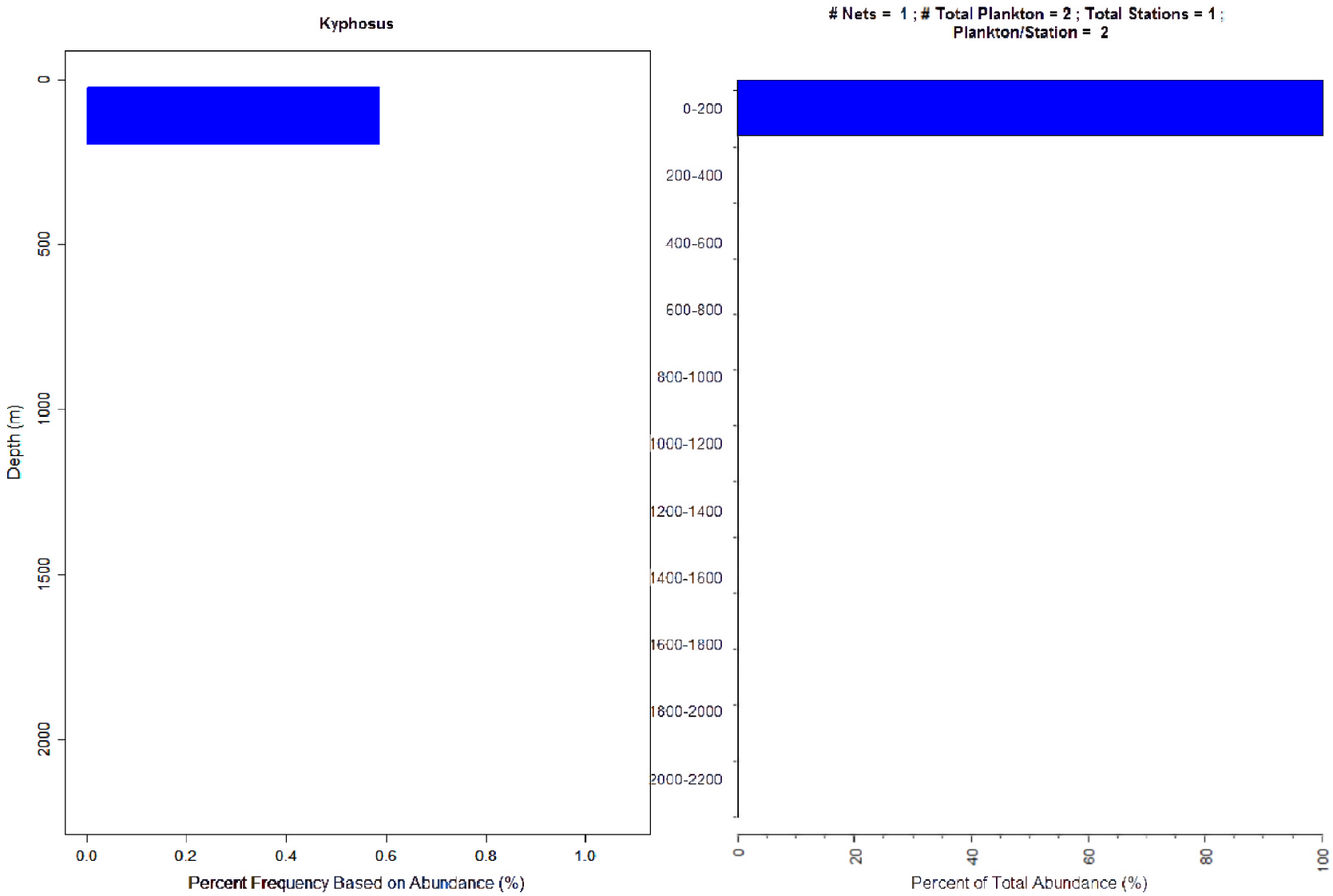
Ichthyococcus_ovatus - Deep



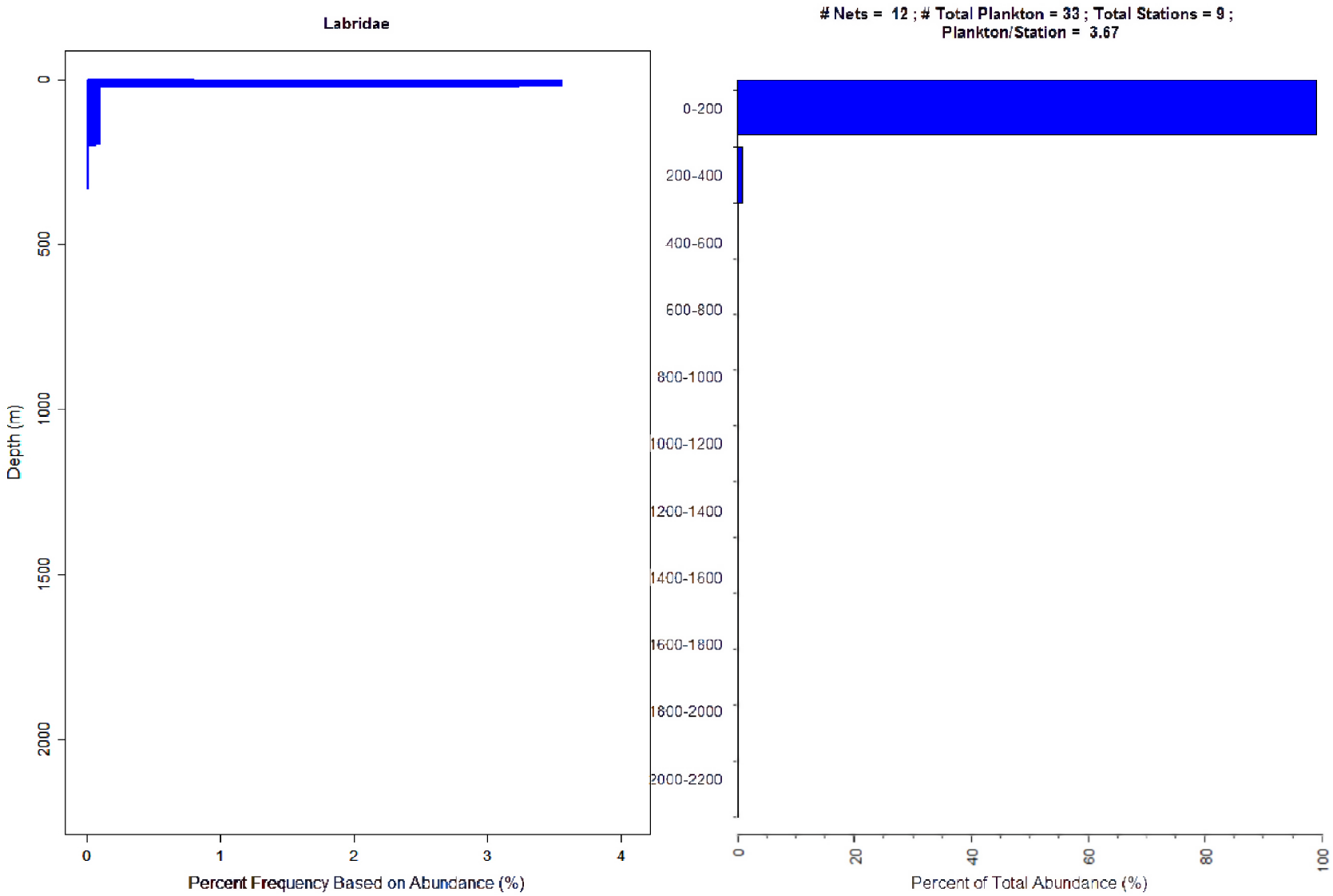
Istiophorus - Deep



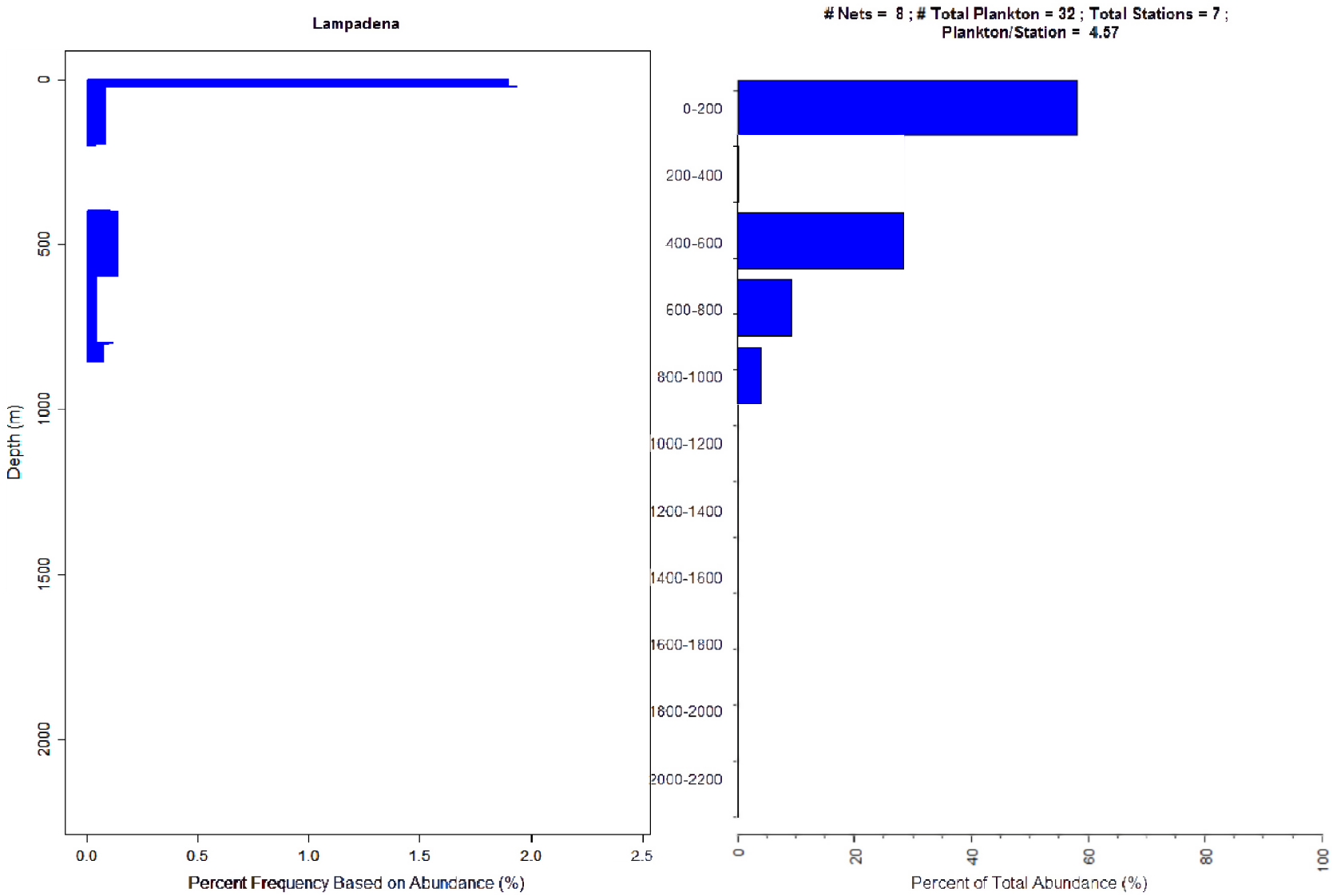
Katsuwonus_pelamis - Deep



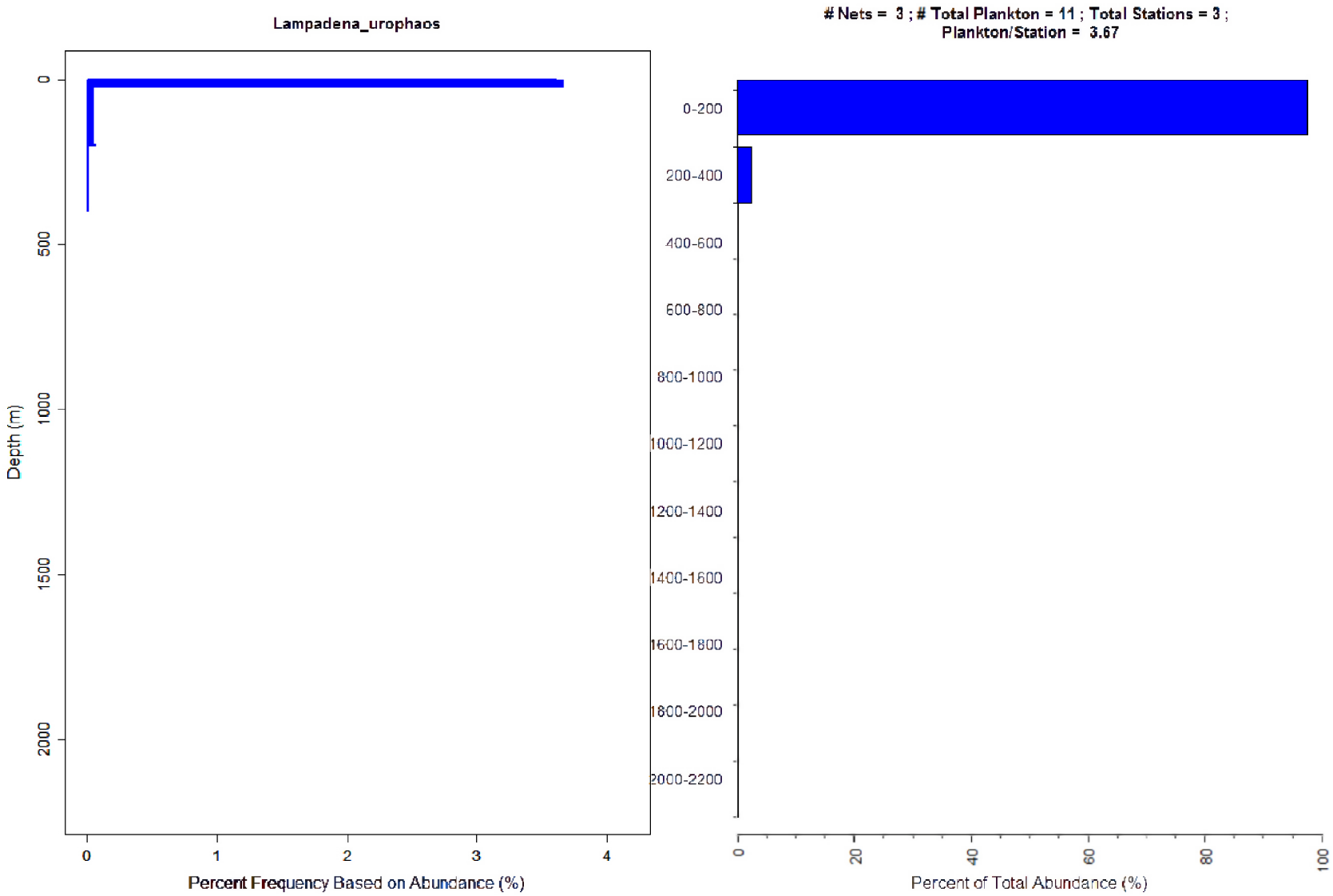
Kyphosus - Deep



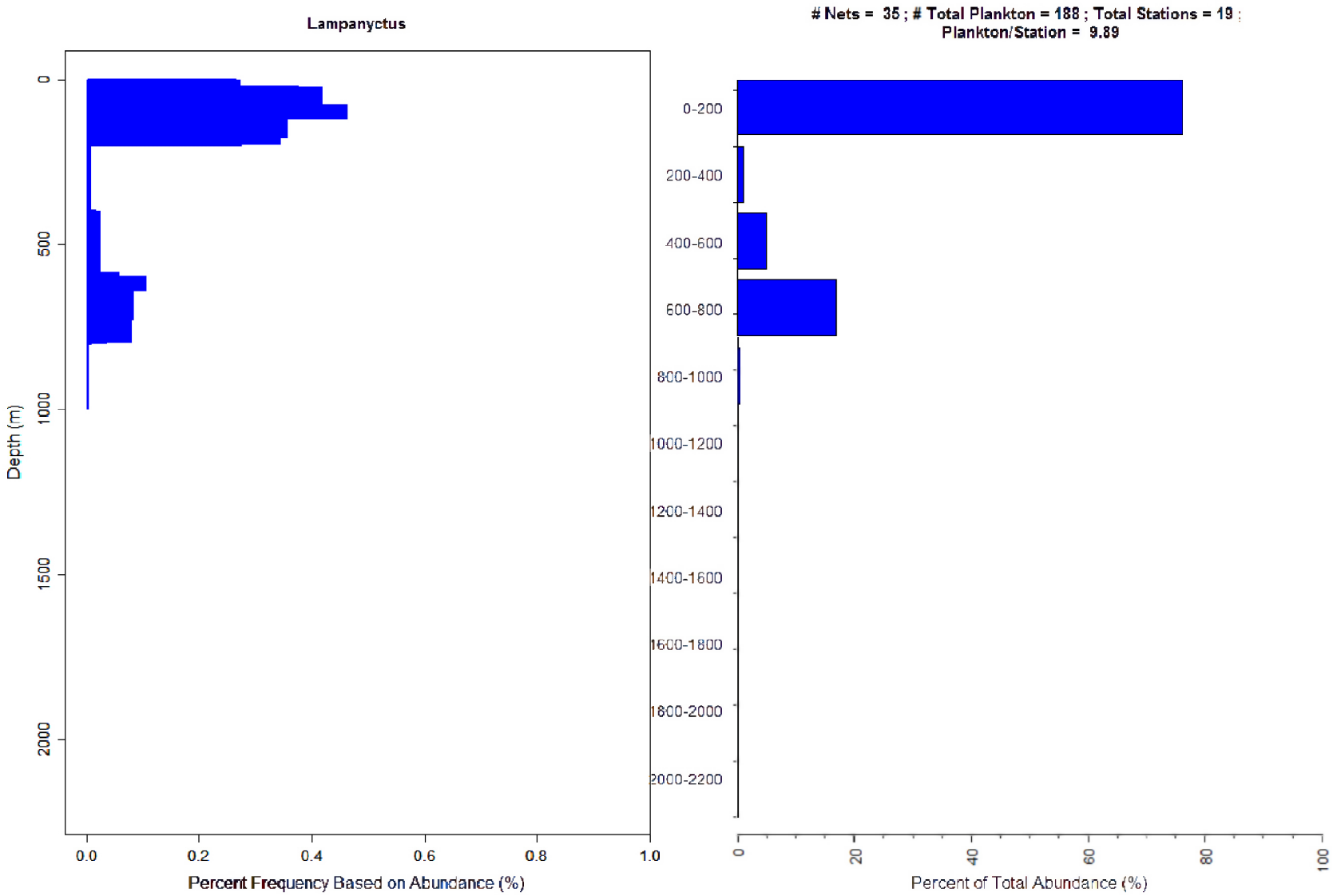
Labridae - Deep



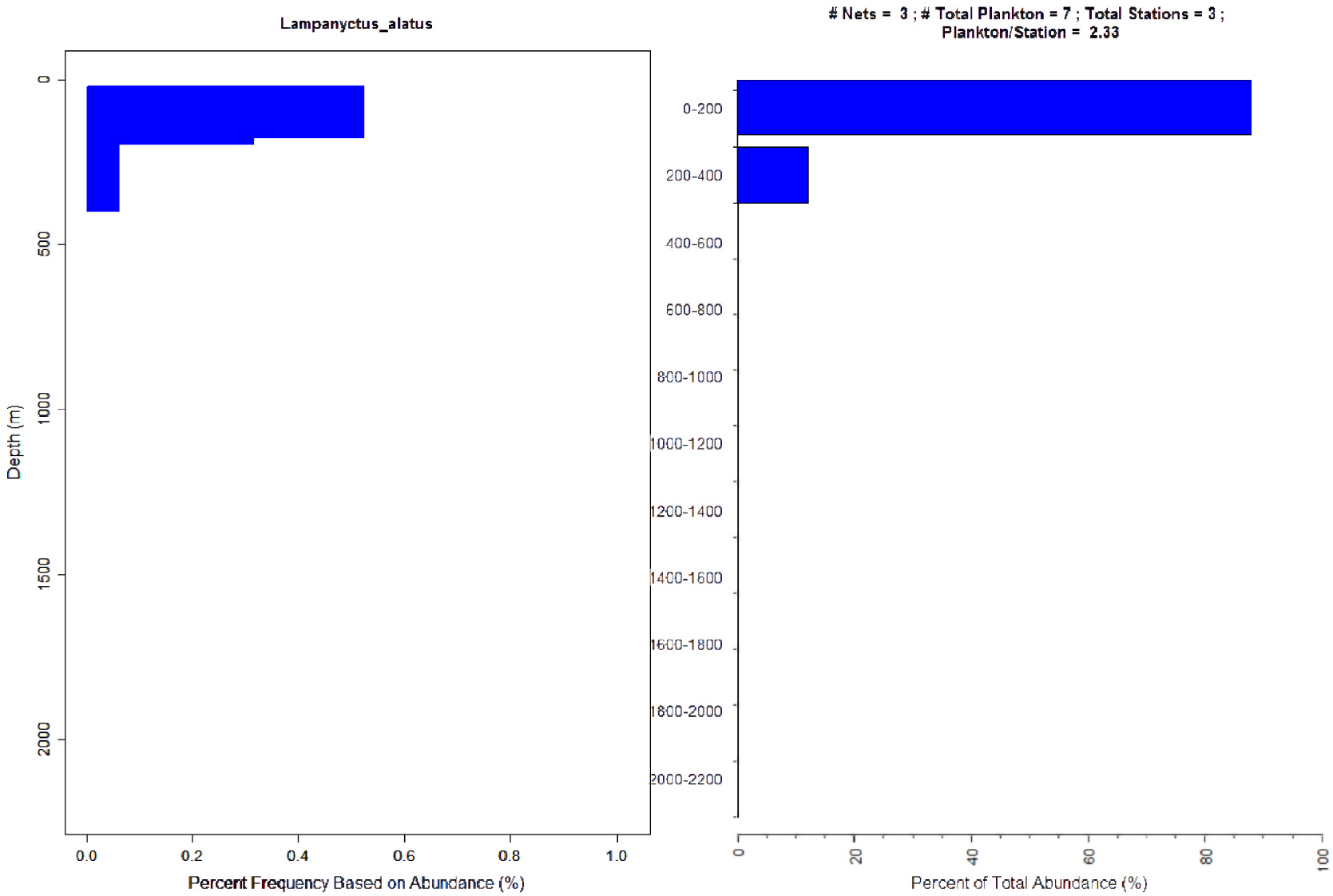
Lampadena - Deep



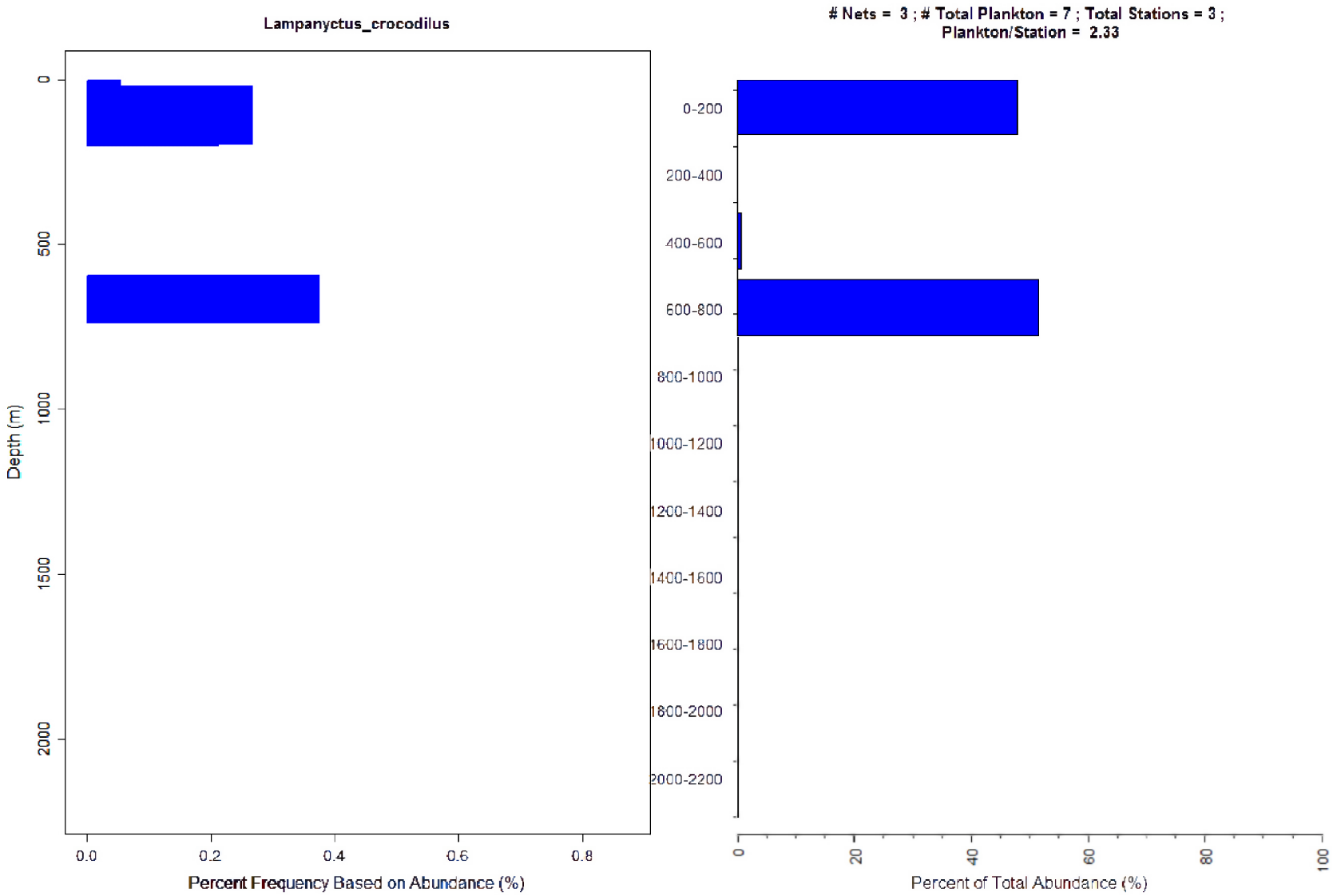
Lampadena_urophaos - Deep



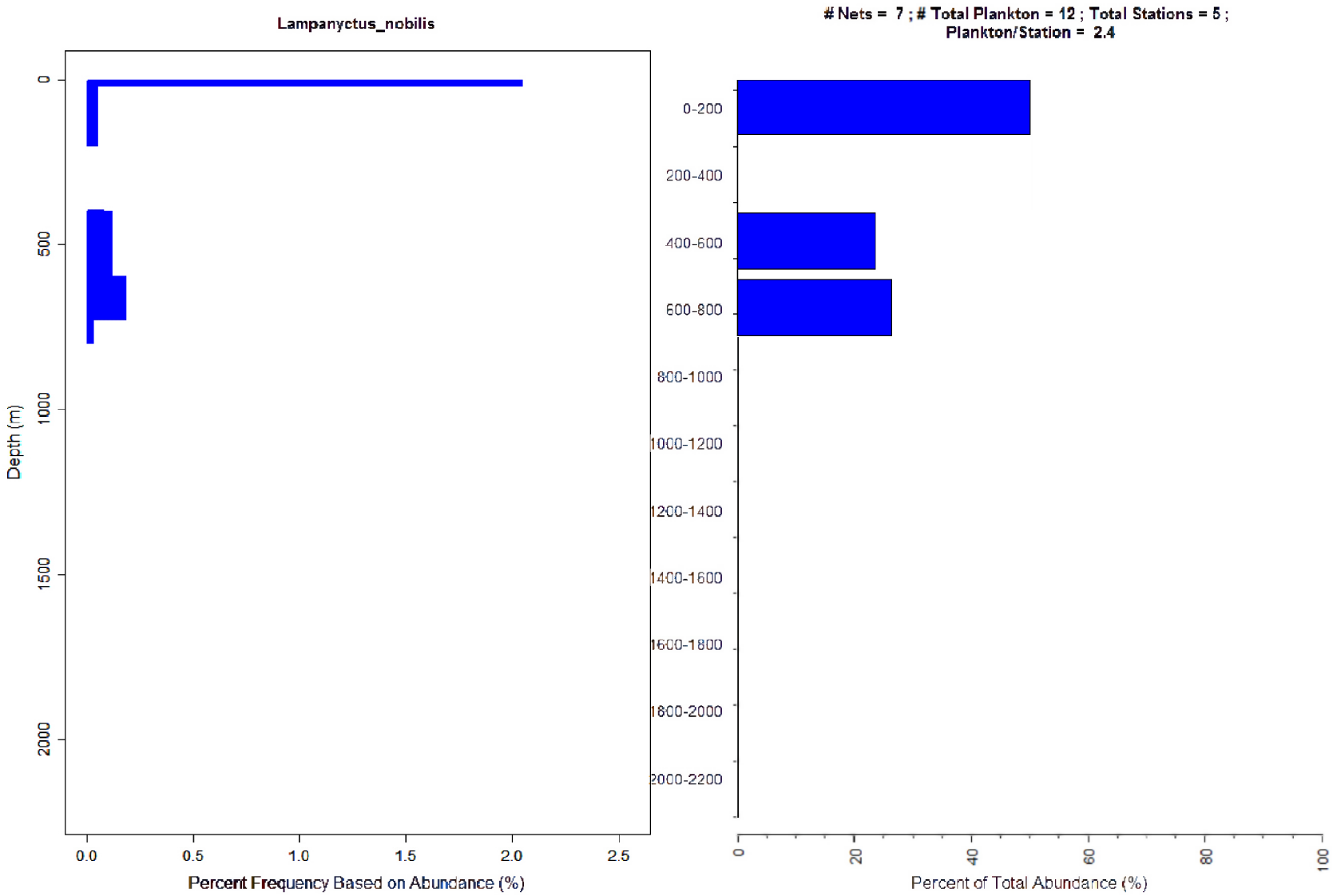
Lampanyctus - Deep



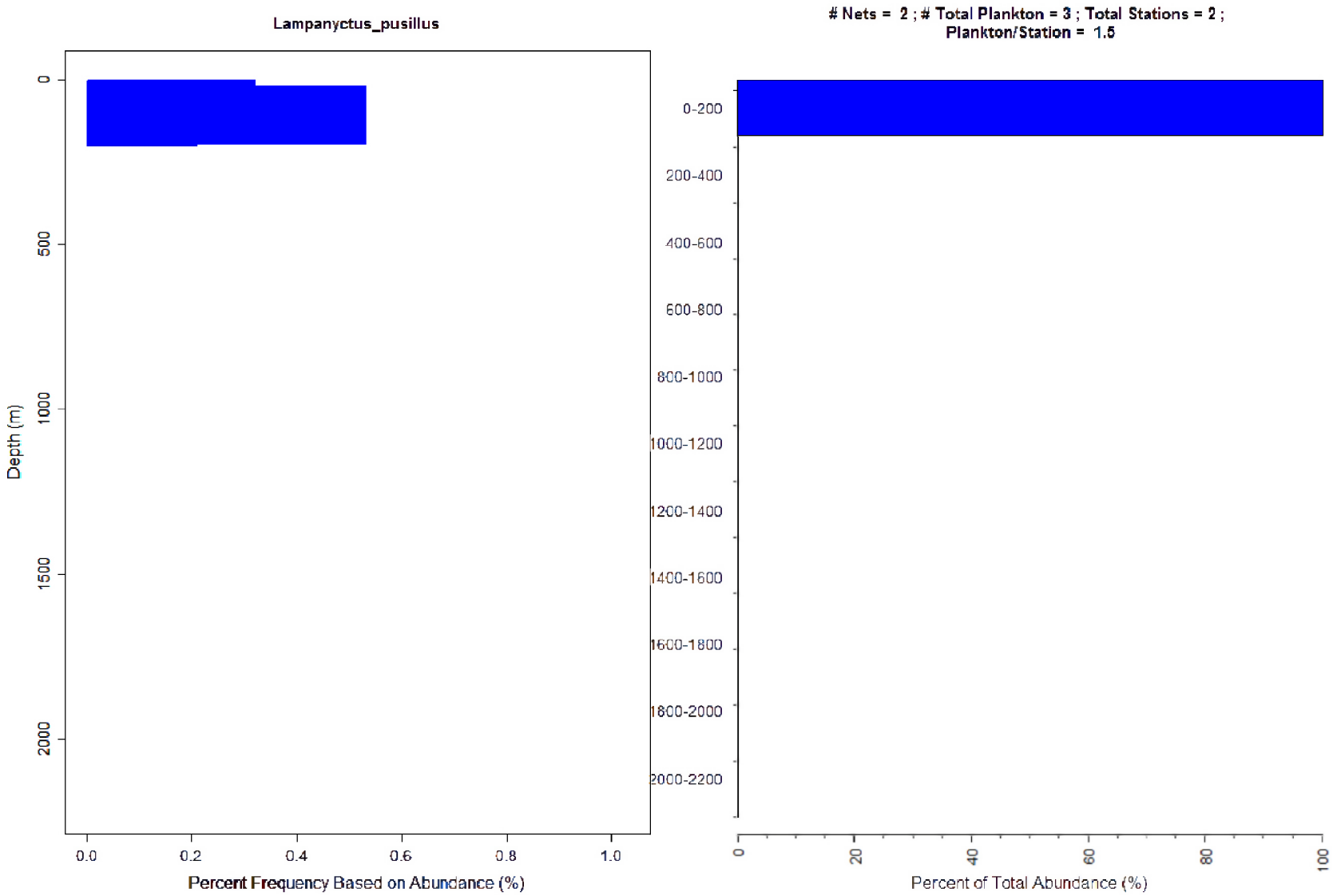
Lampanyctus_alatus - Deep



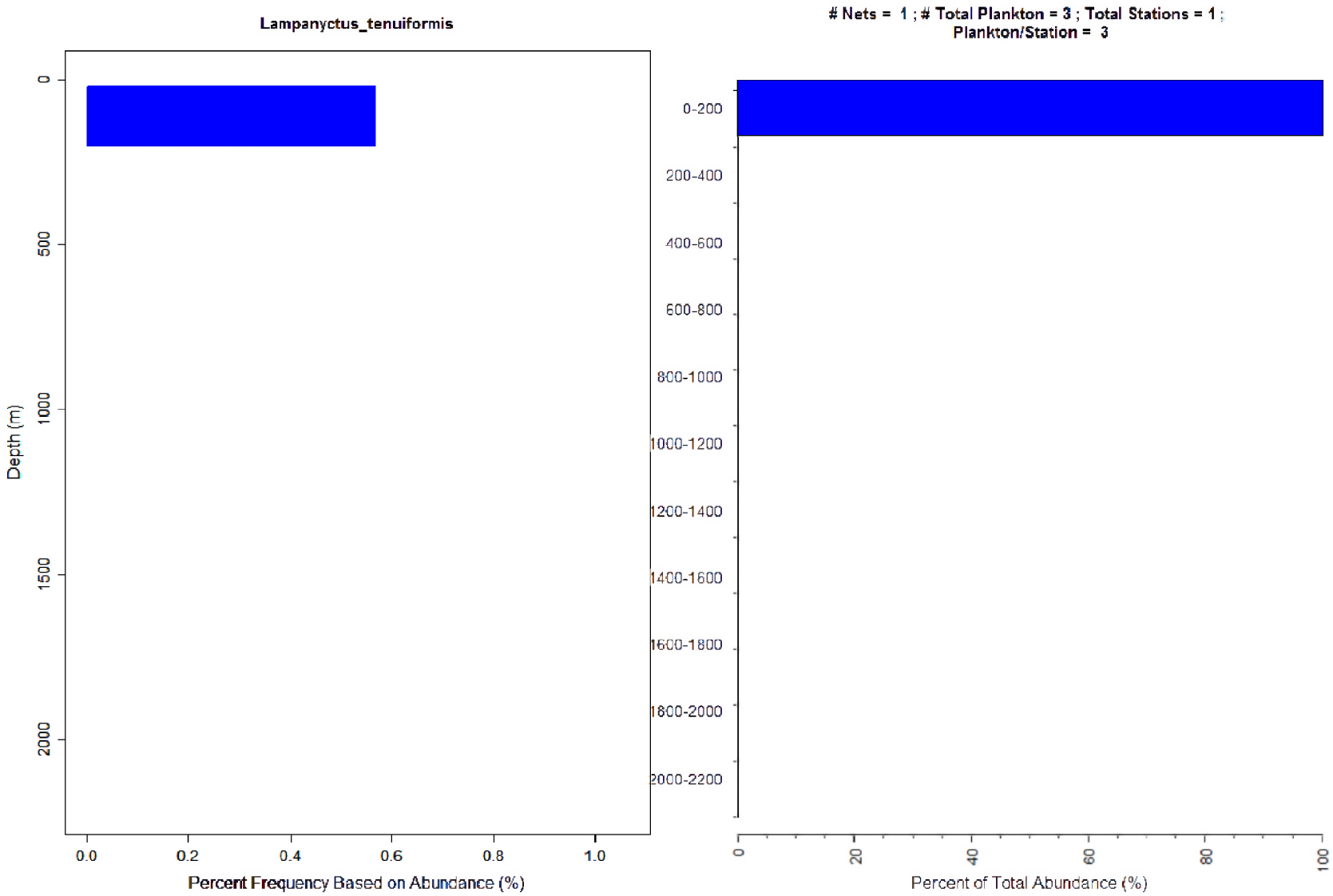
Lampanyctus_crocodilus - Deep



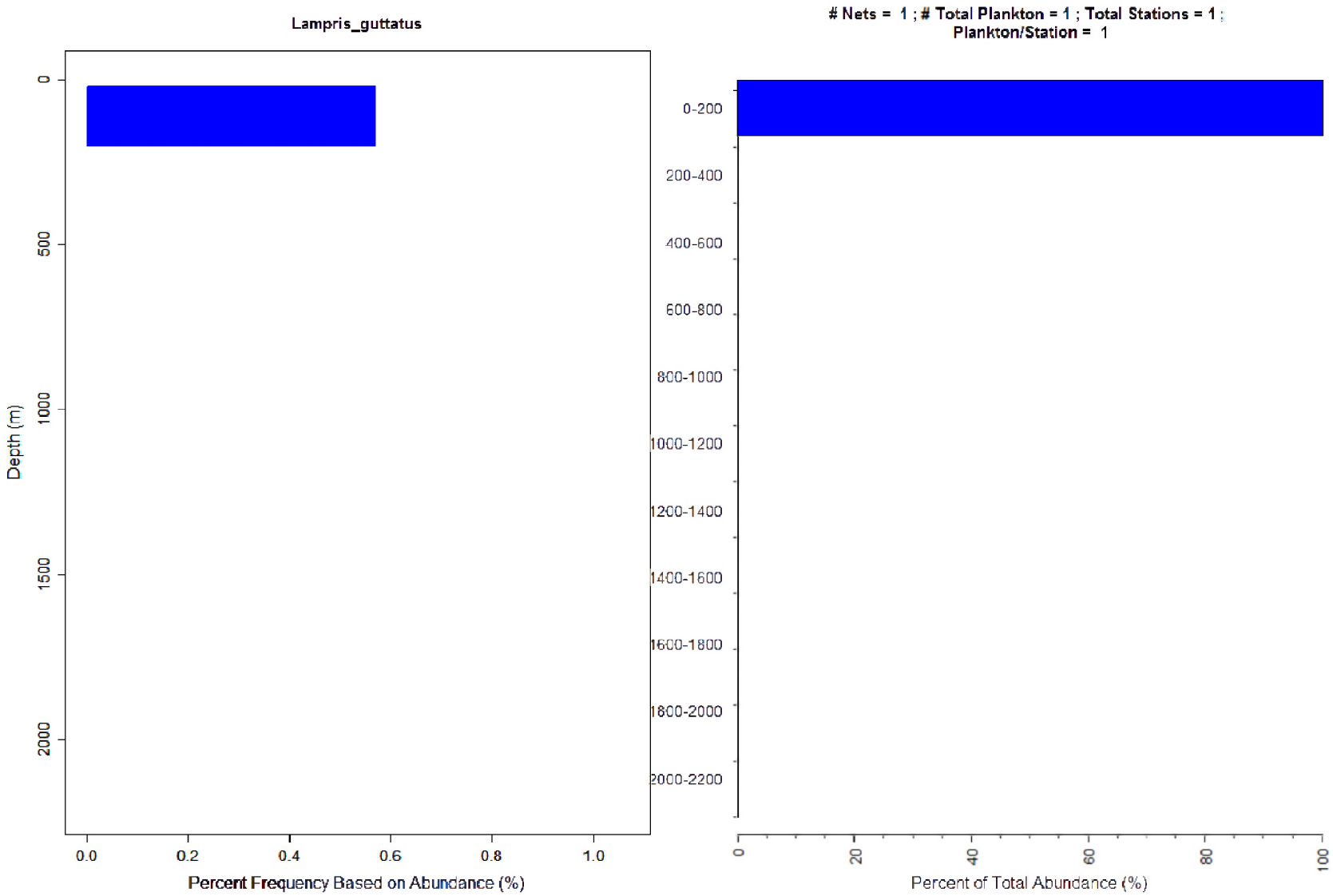
Lampanyctus_nobilis - Deep



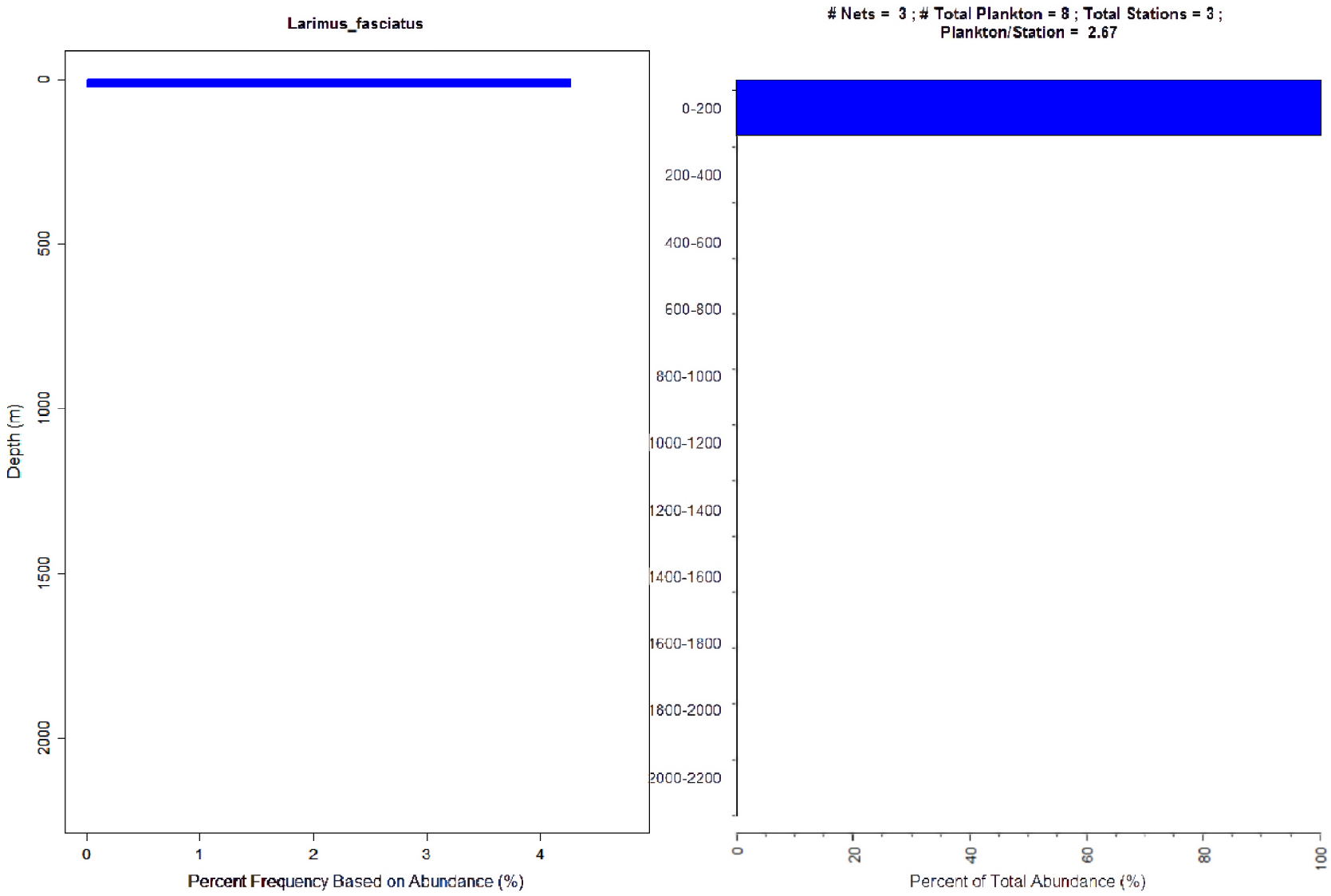
Lampanyctus_pusillus - Deep



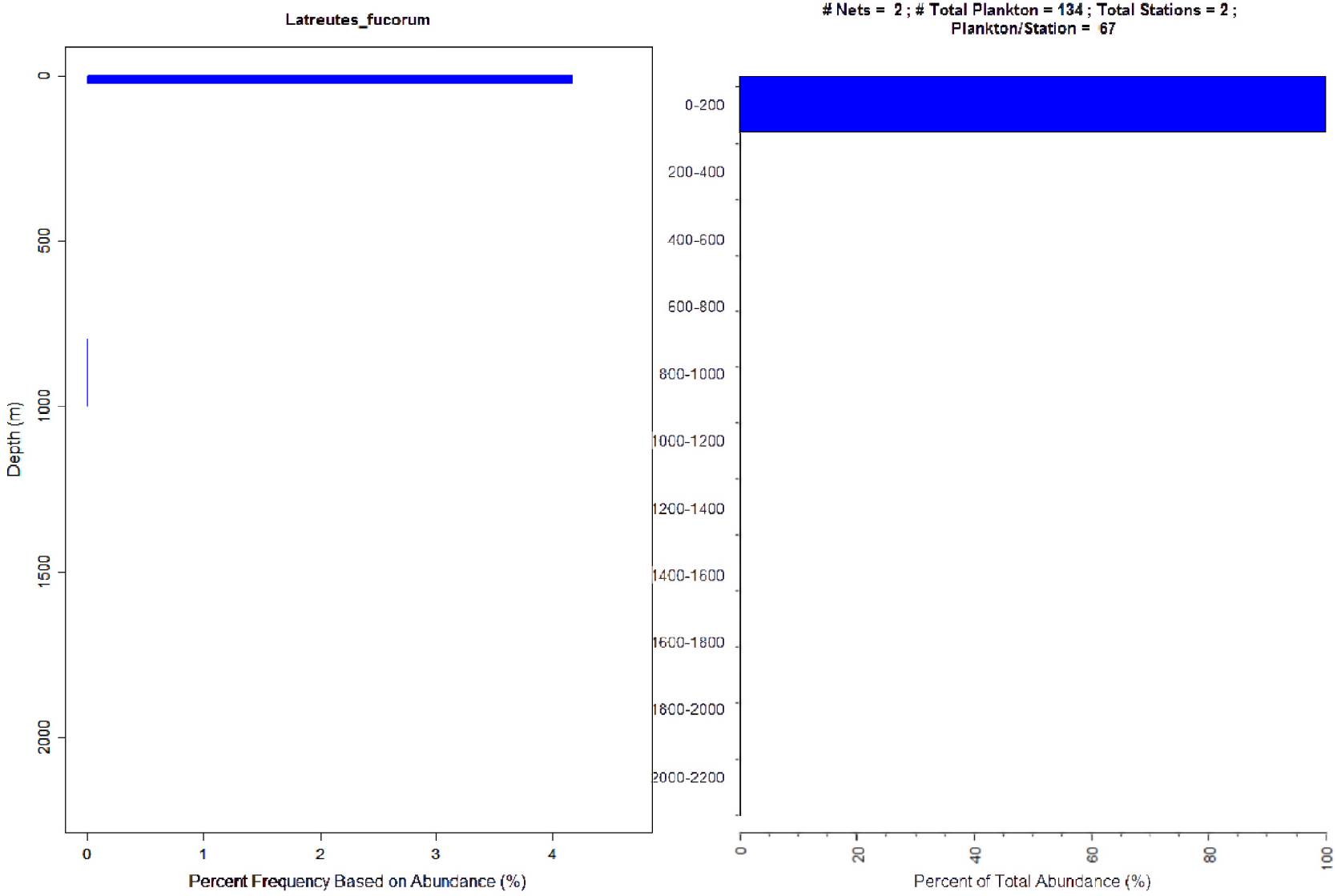
Lampanyctus_tenuiformis - Deep



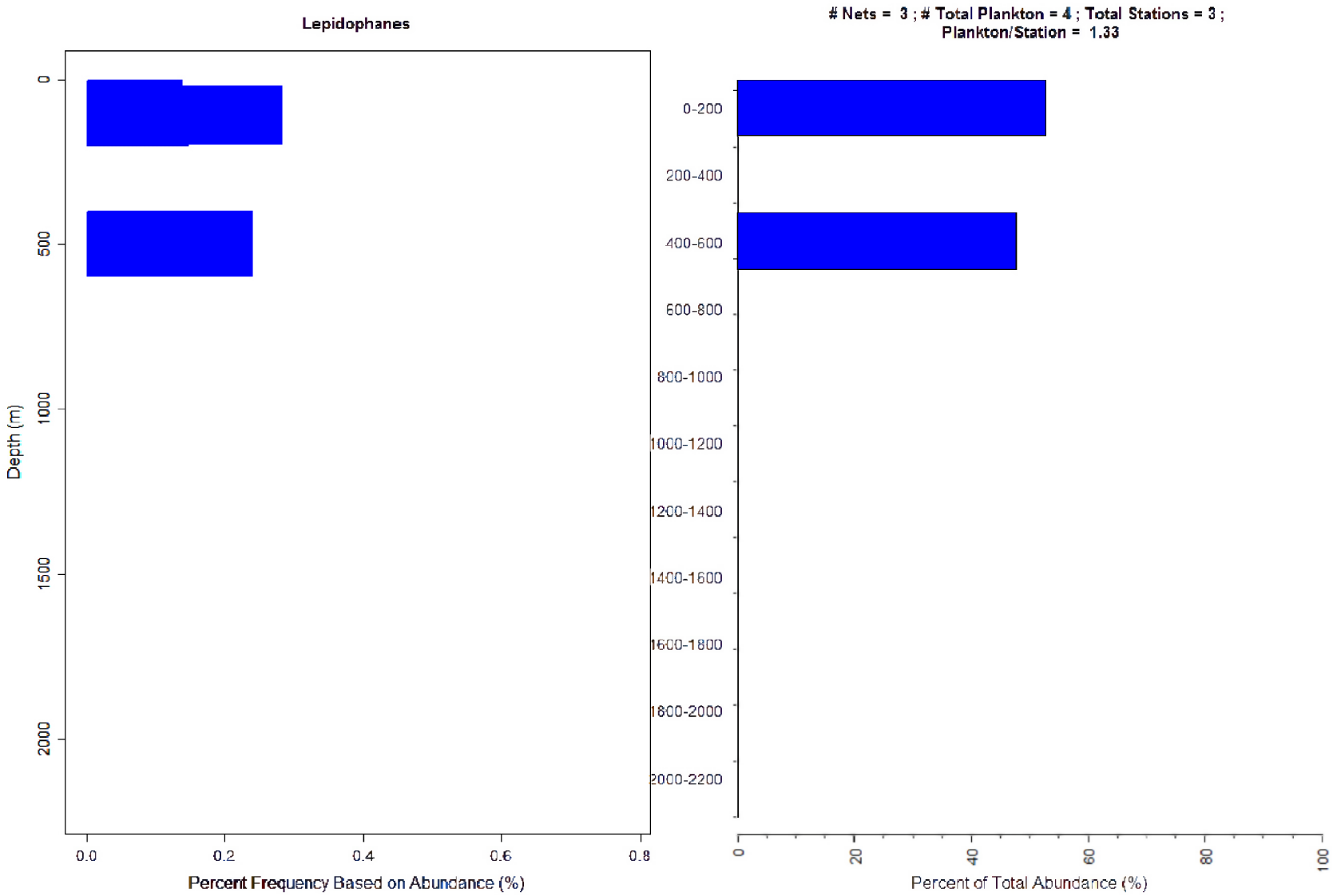
Lampris_guttatus - Deep



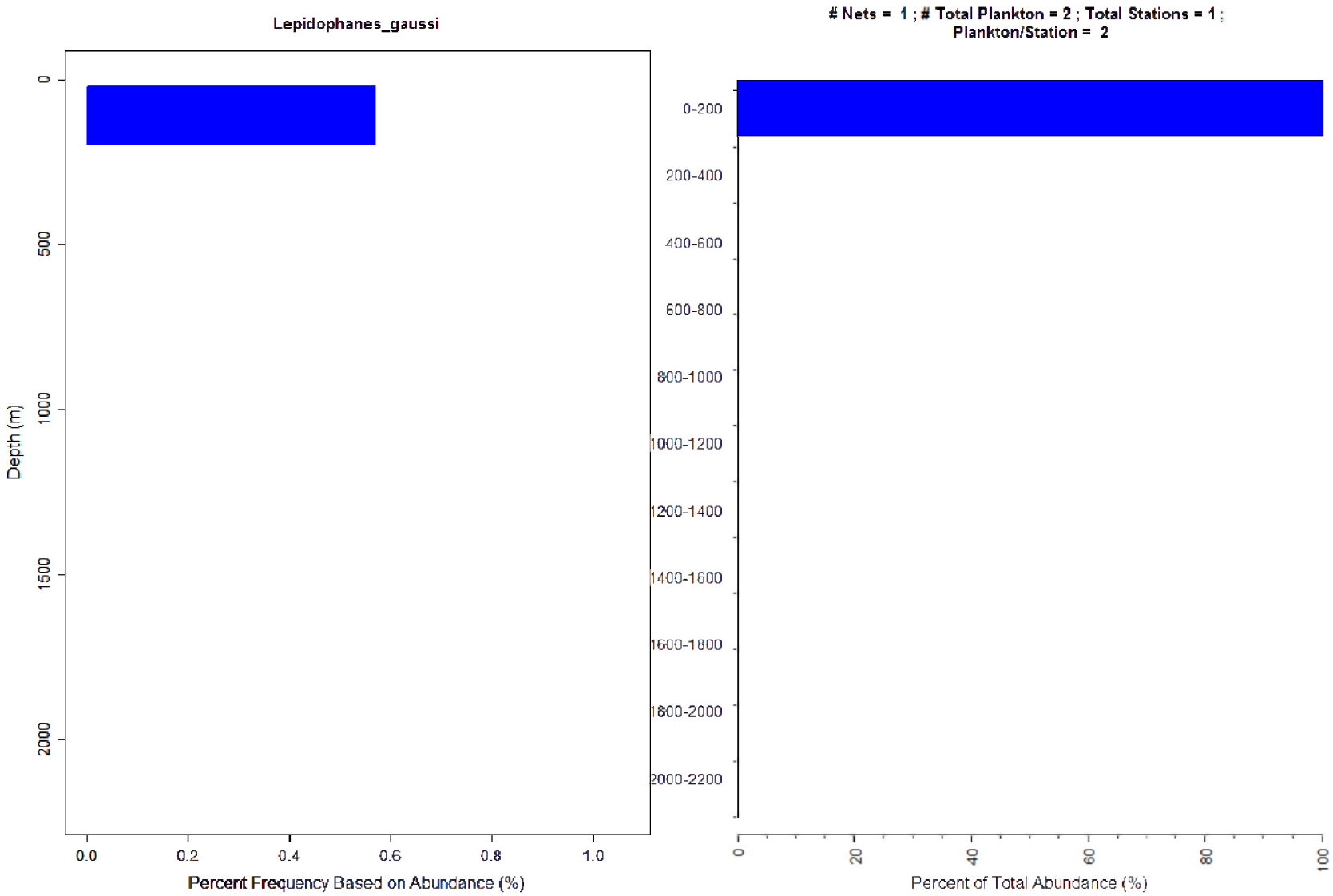
Larimus_fasciatus - Deep



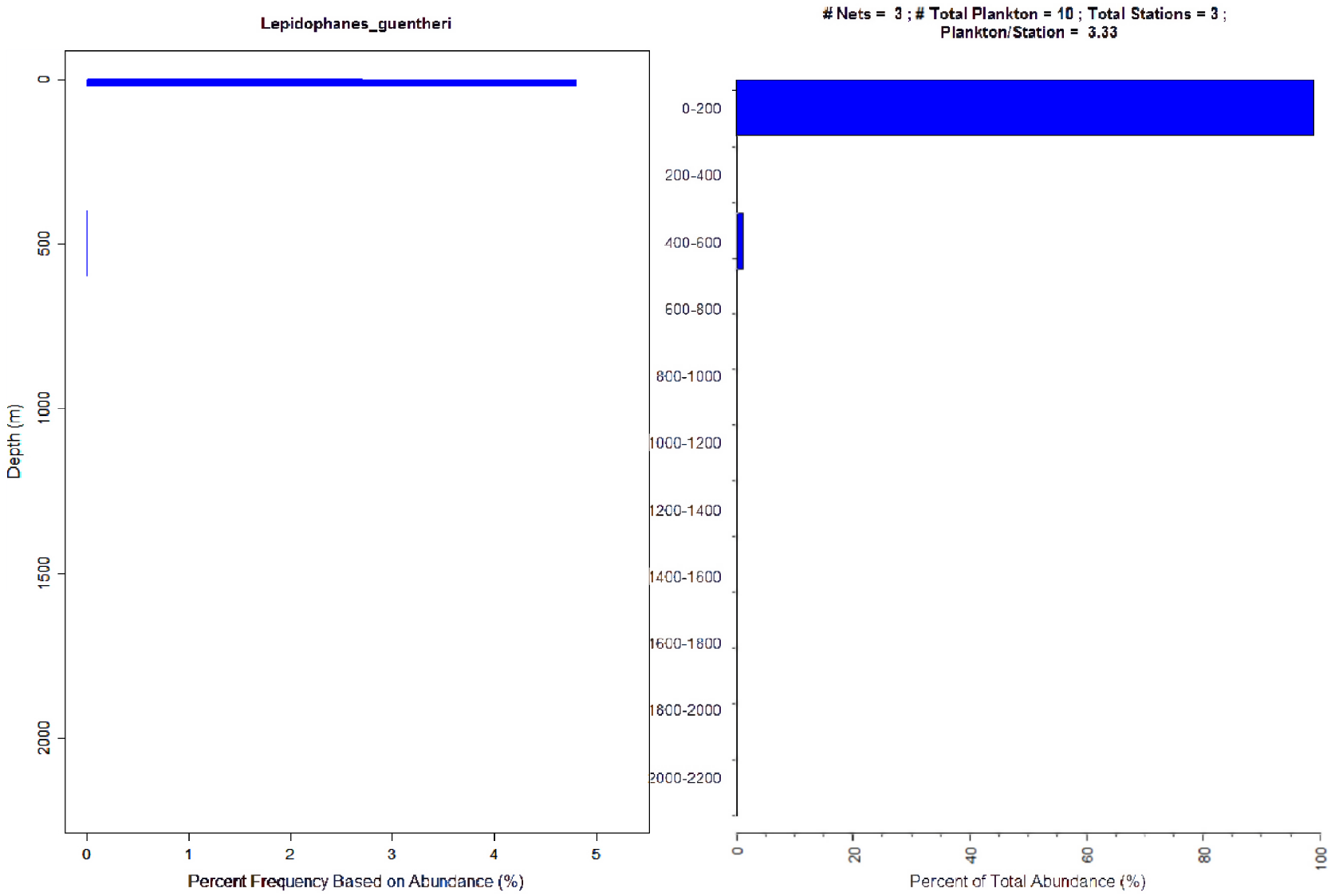
Latreutes_fucorum - Deep



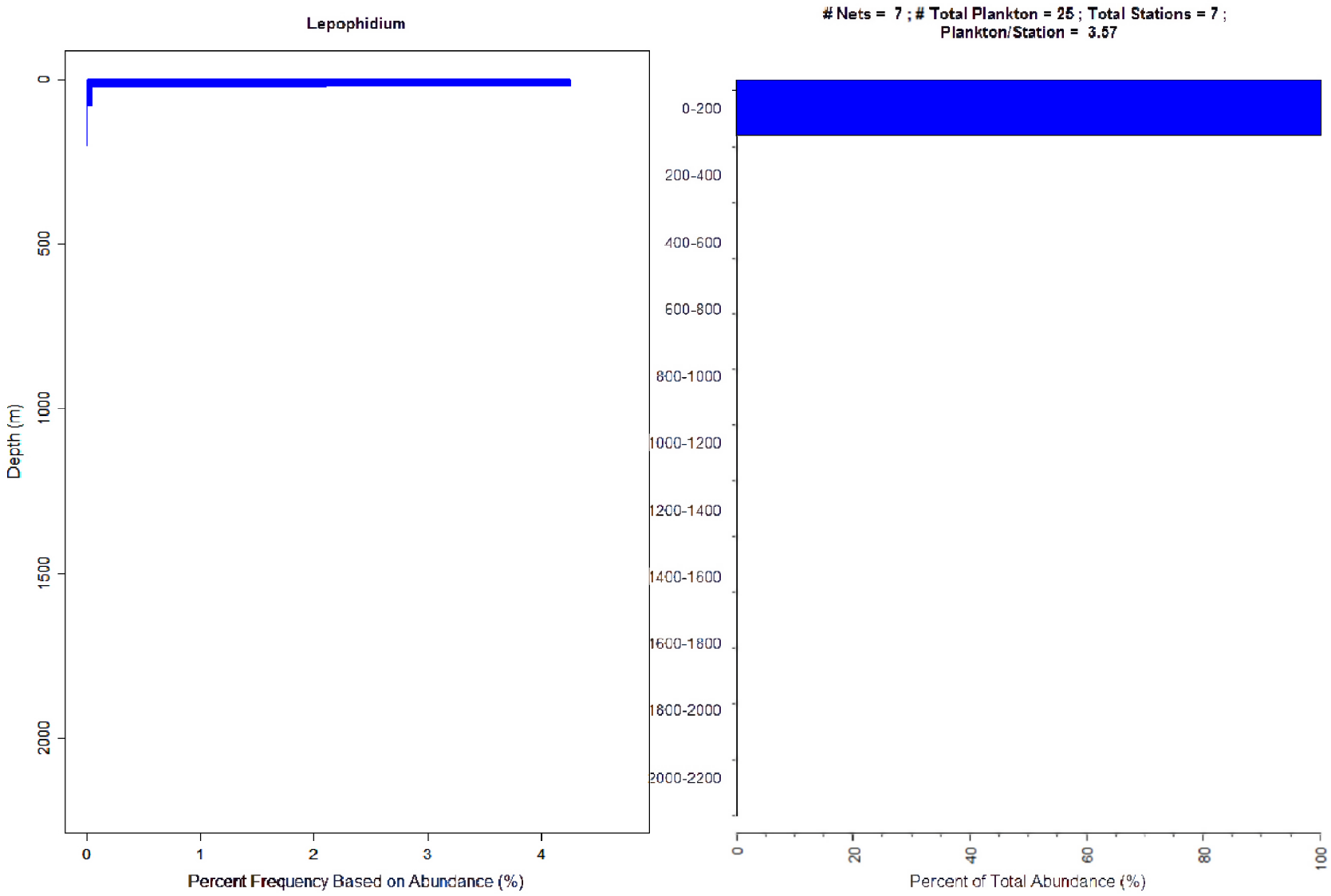
Lepidophanes - Deep



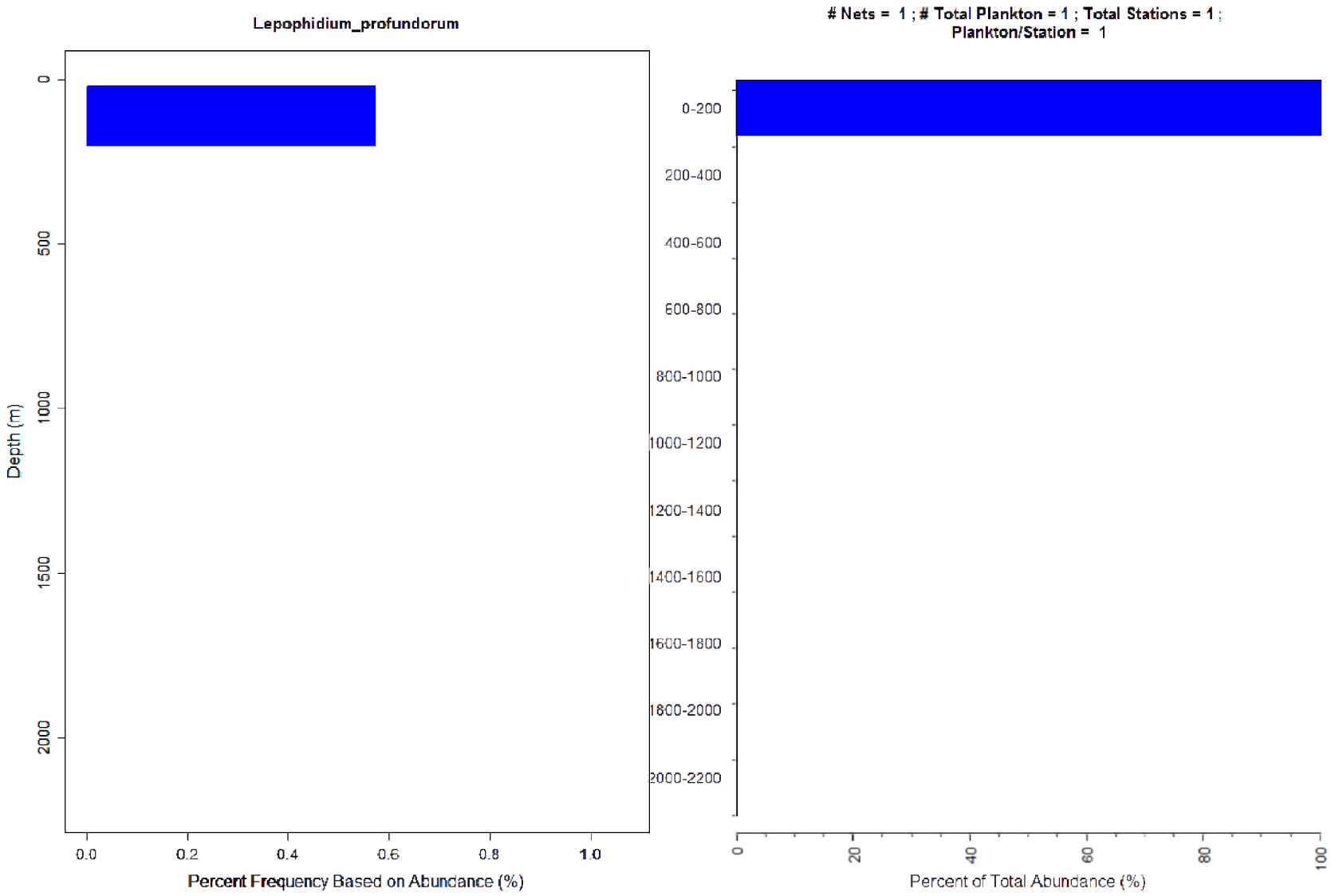
Lepidophanes_gaussi - Deep



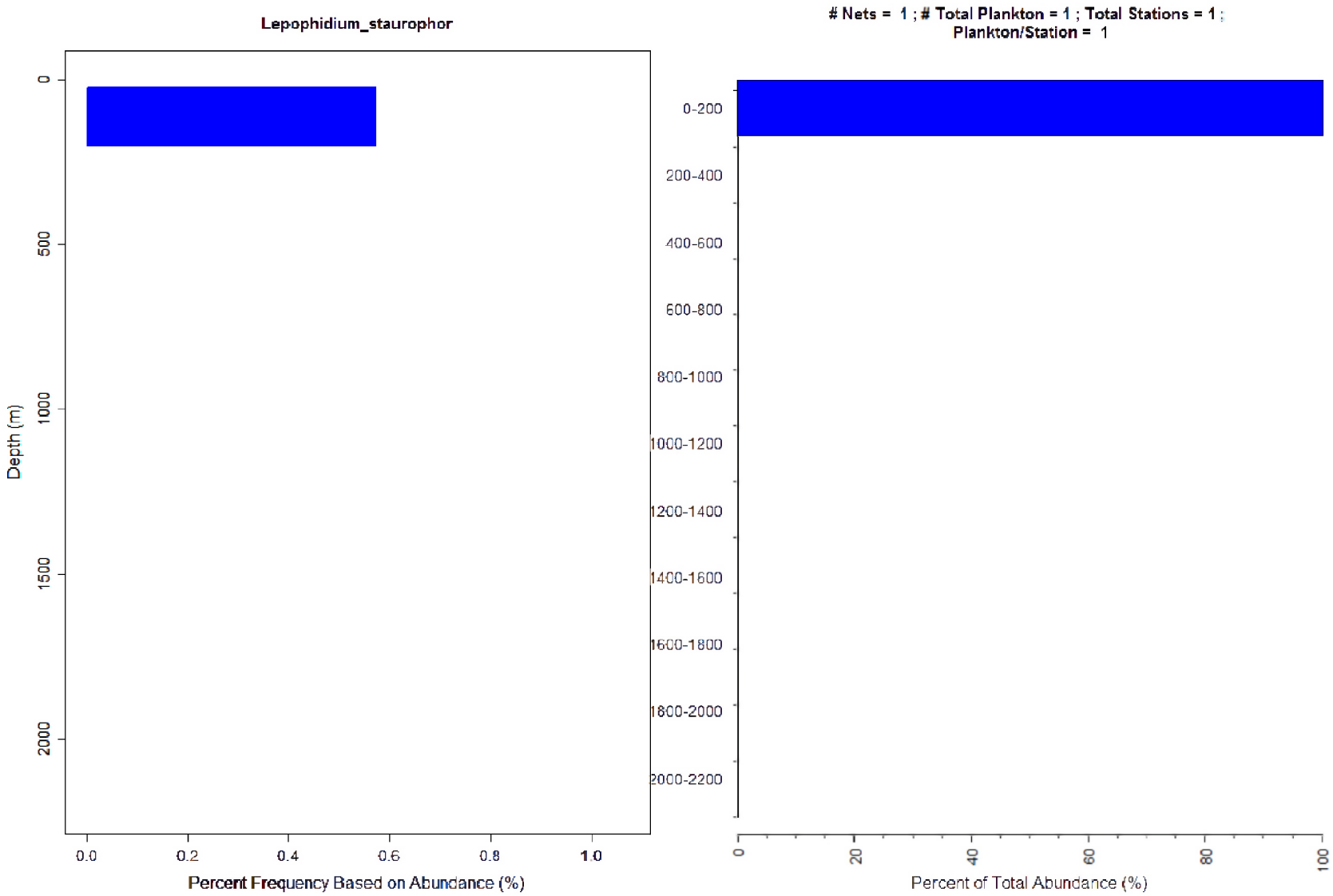
Lepidophanes_guentheri - Deep



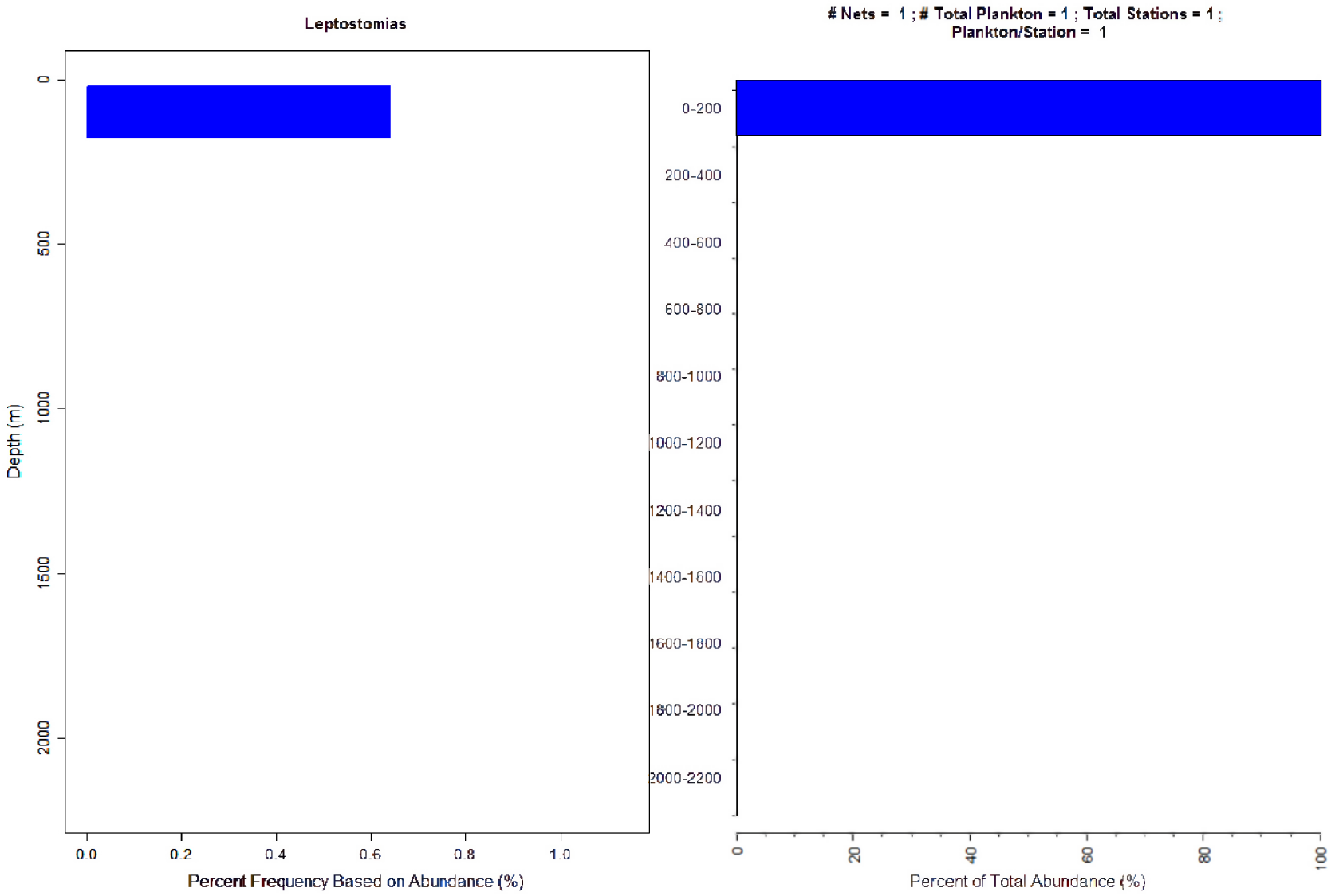
Lepophidium - Deep



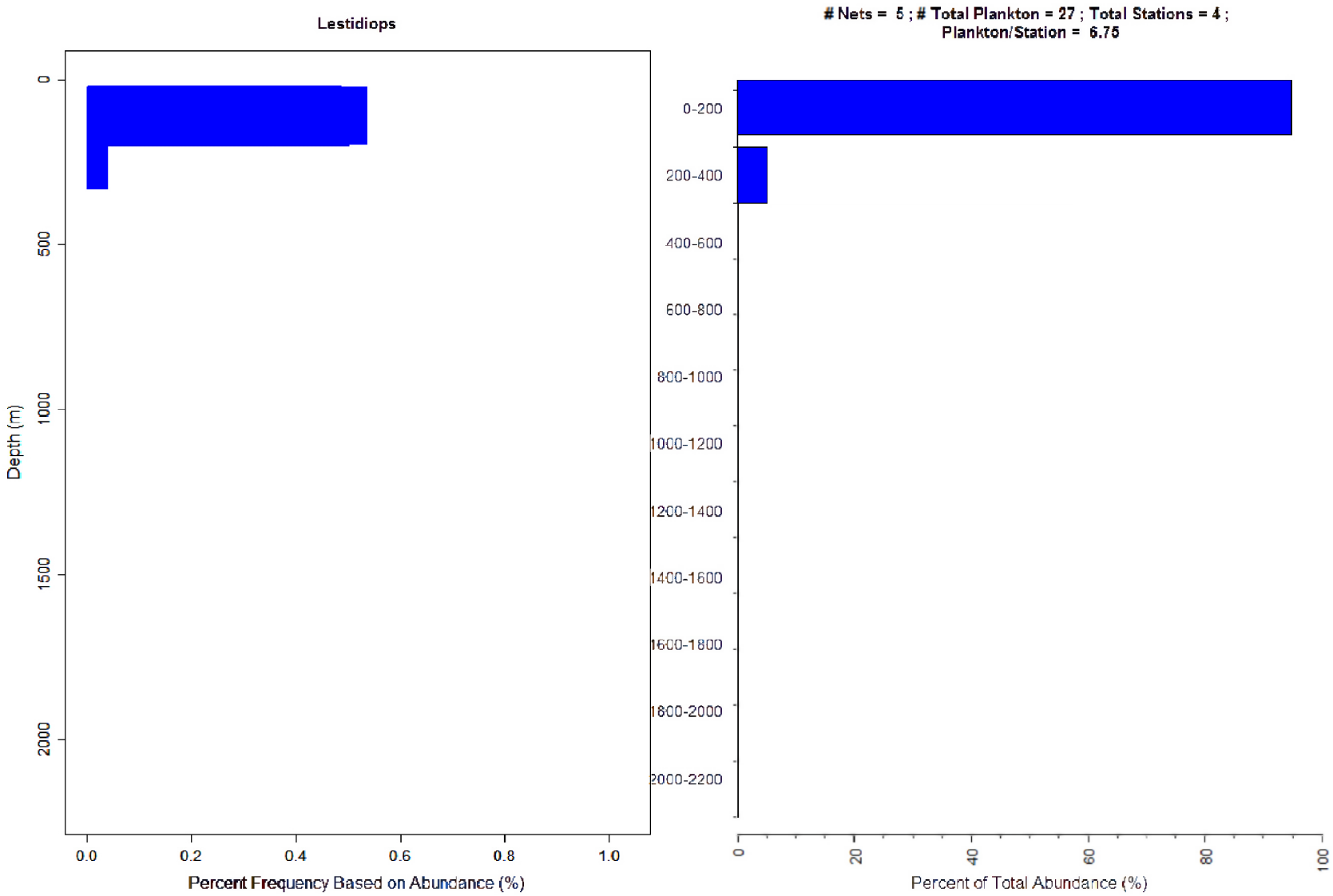
Lepophidium_profundorum - Deep



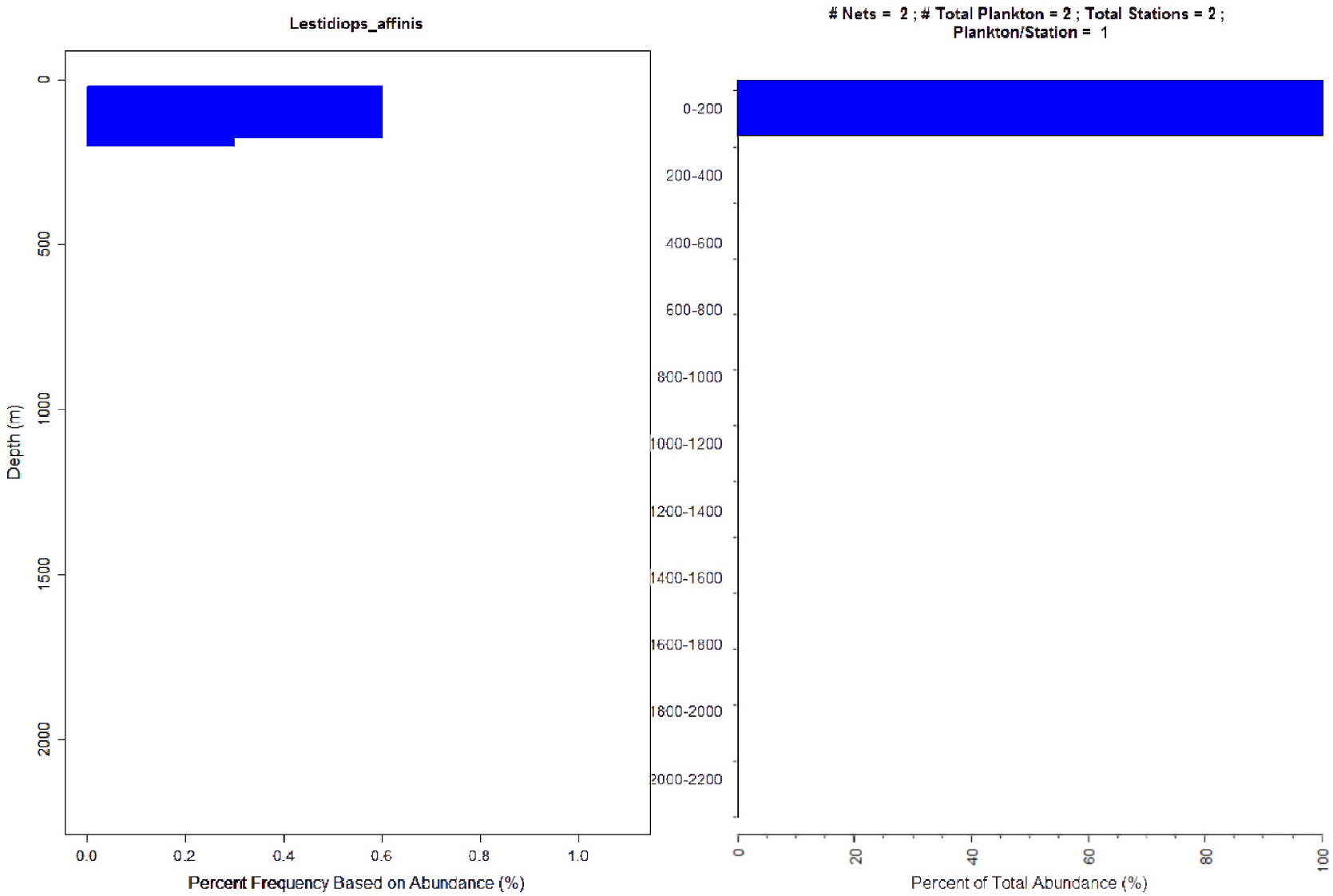
Lepophidium_staurophor - Deep



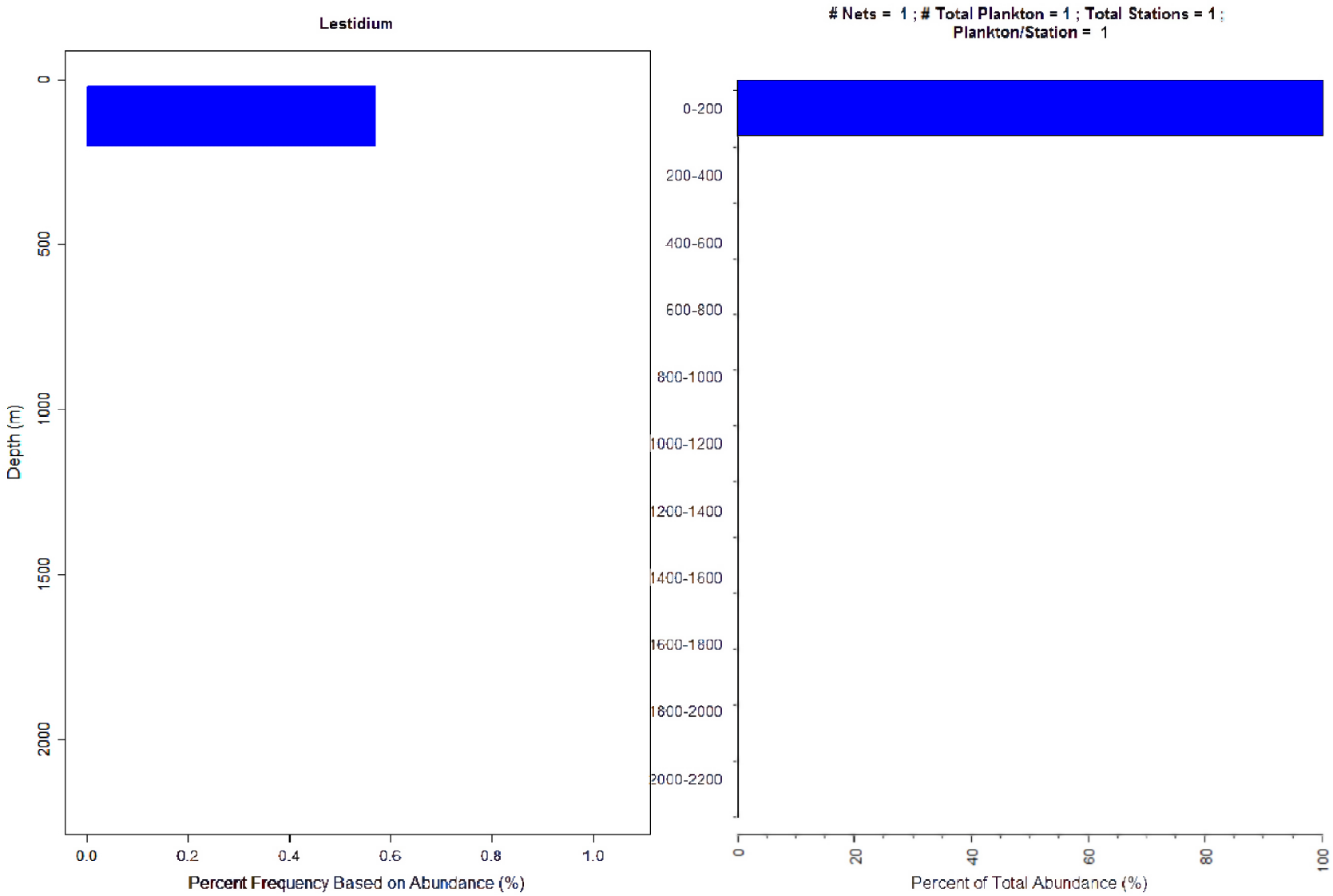
Leptostomias - Deep



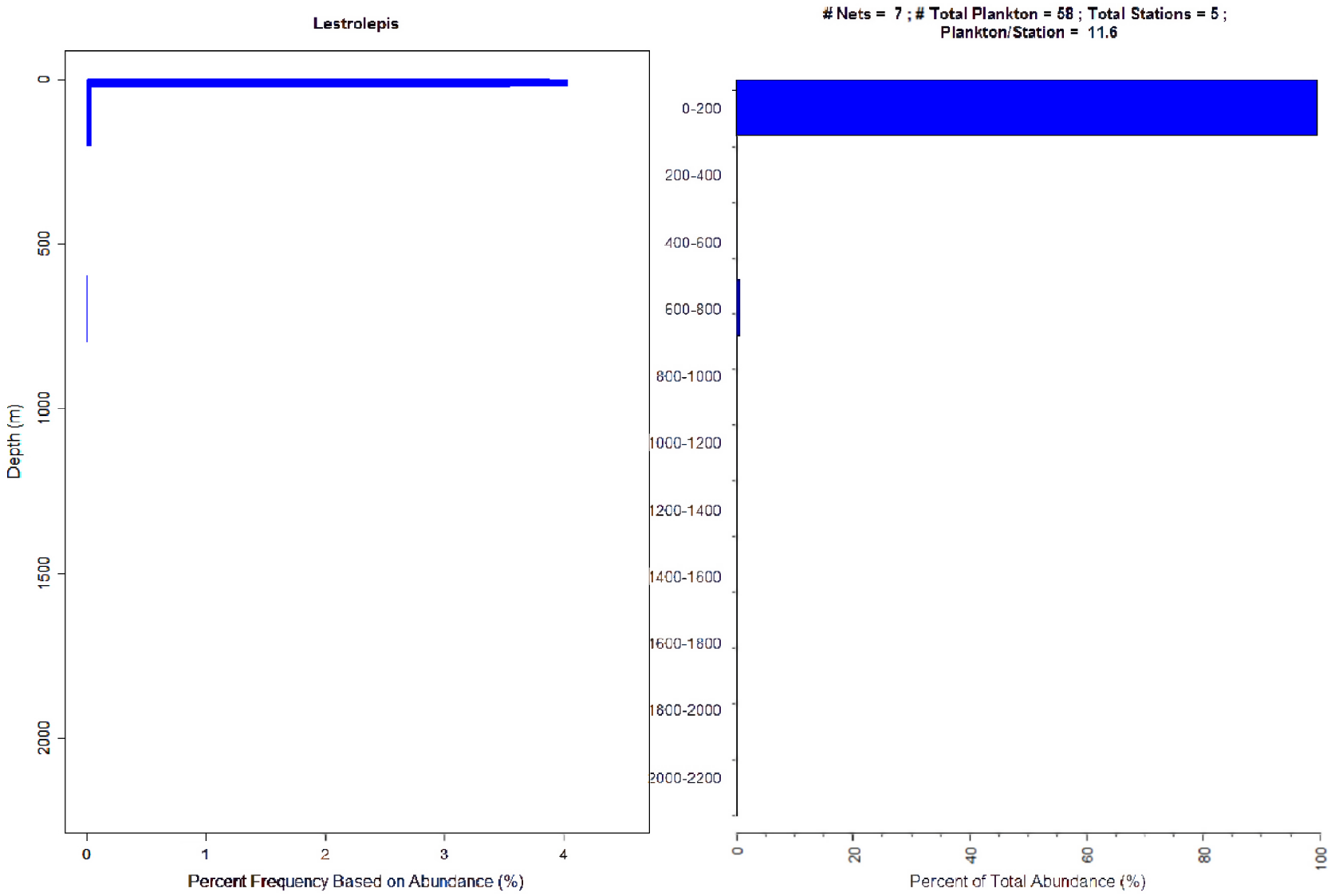
Lestidiops - Deep



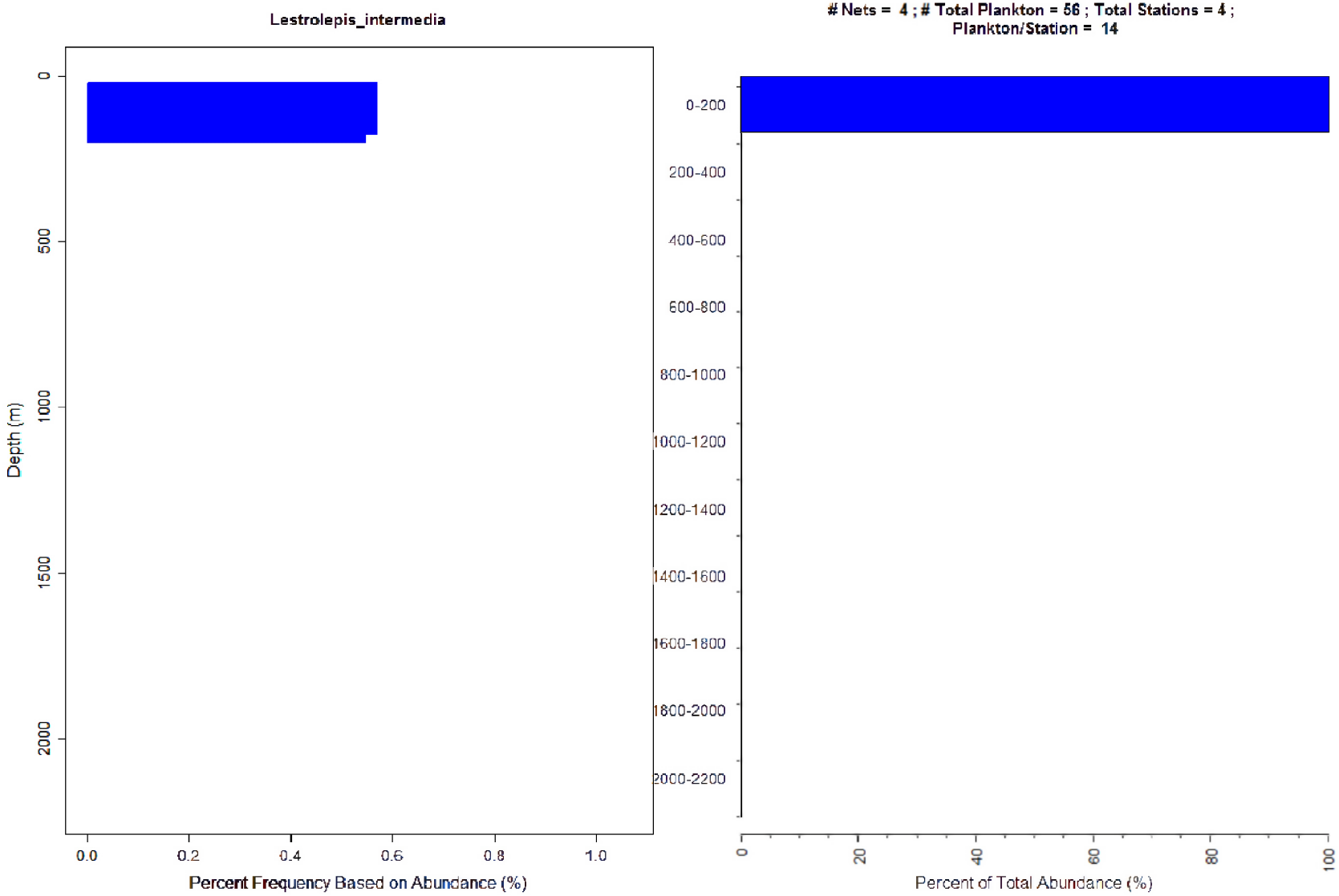
Lestidiops_affinis - Deep



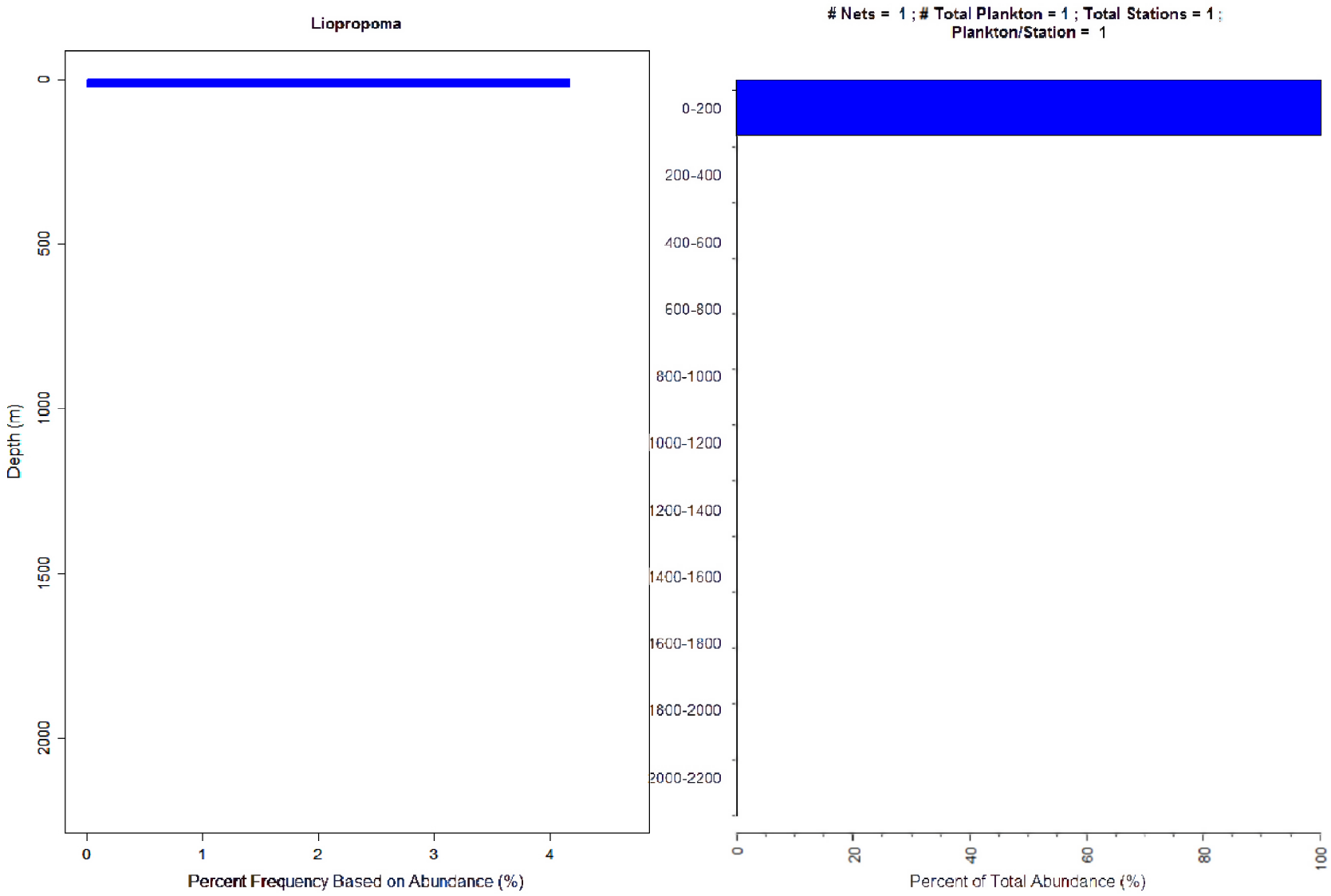
Lestidium - Deep



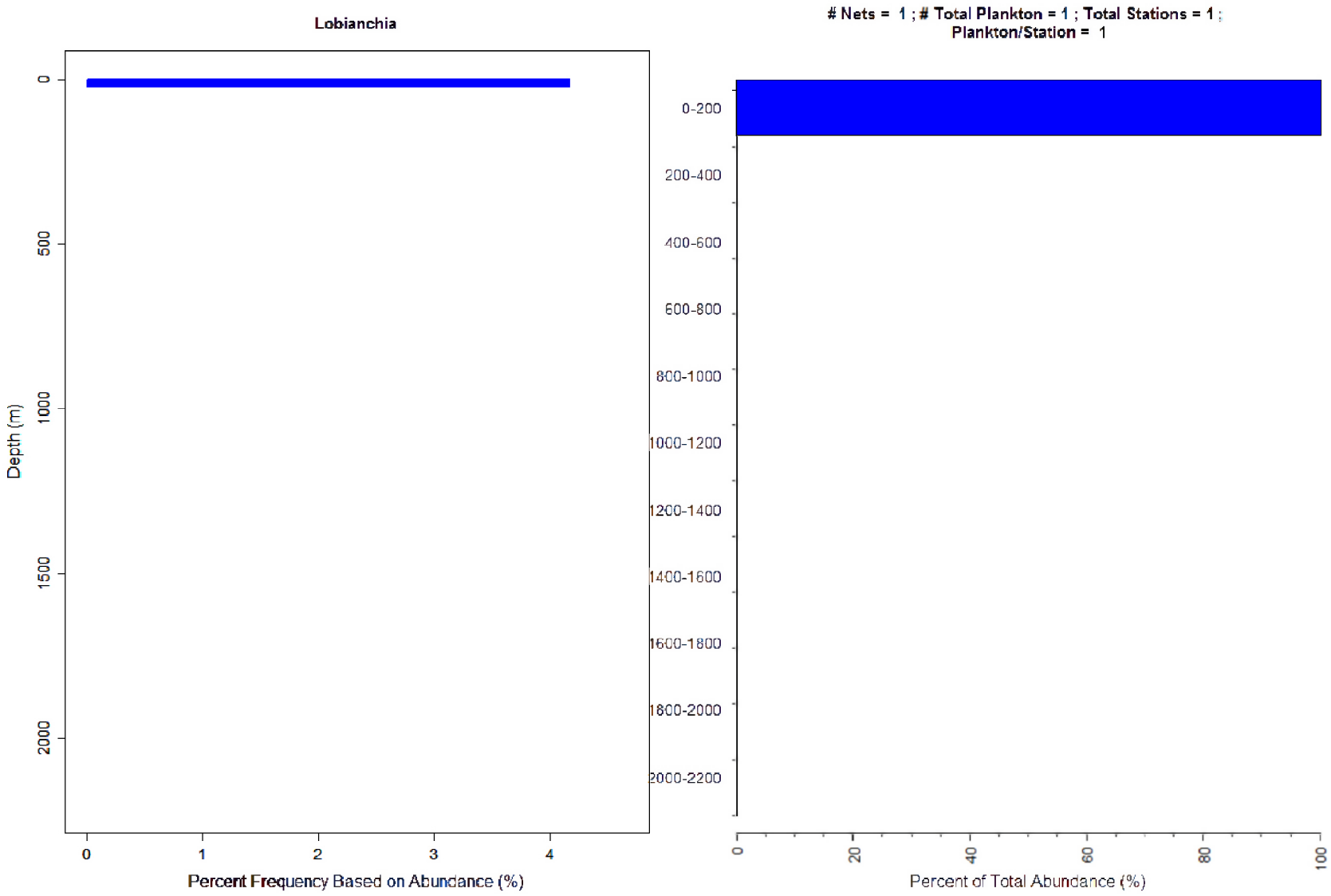
Lestrolepis - Deep



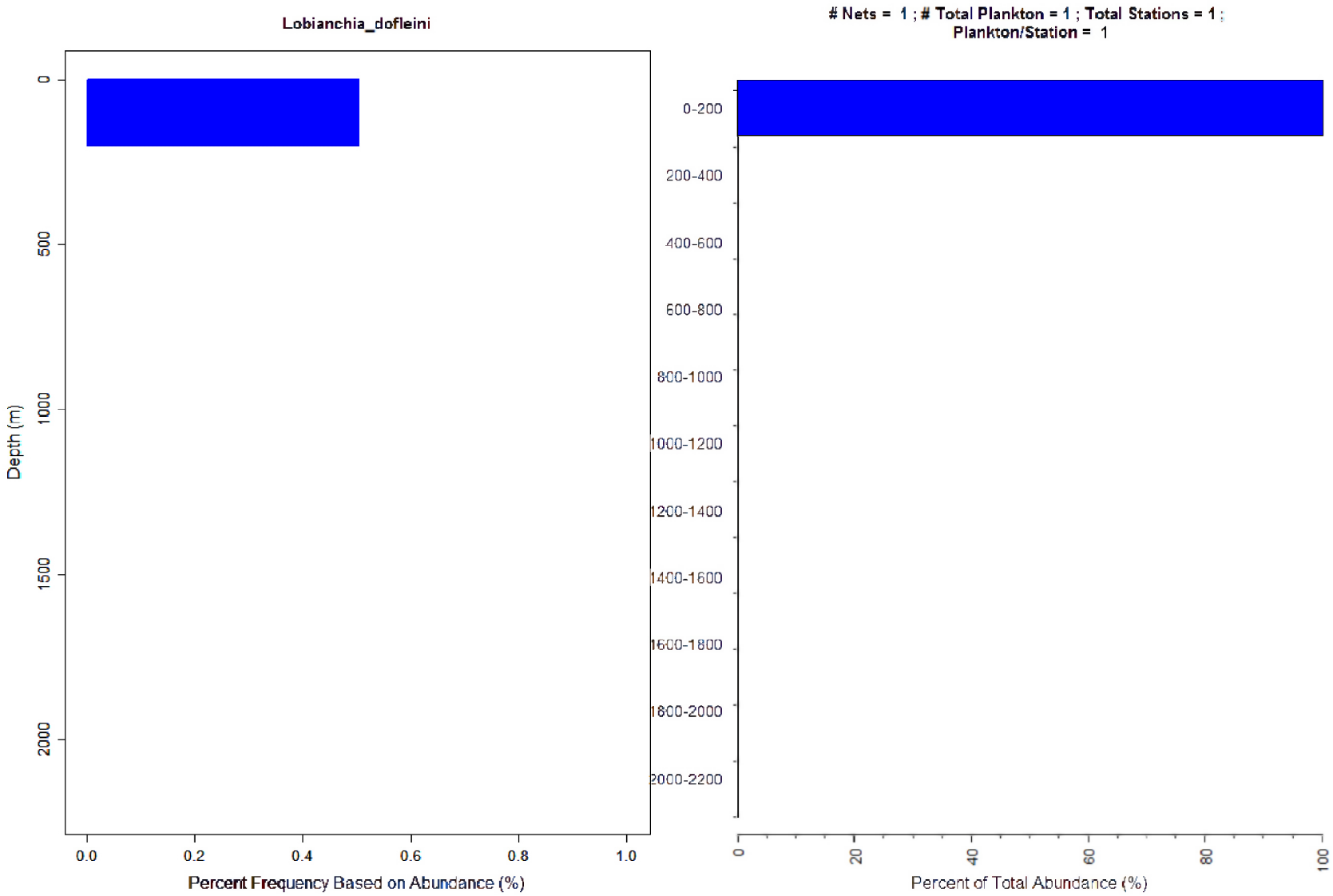
Lestrolepis_intermedia - Deep



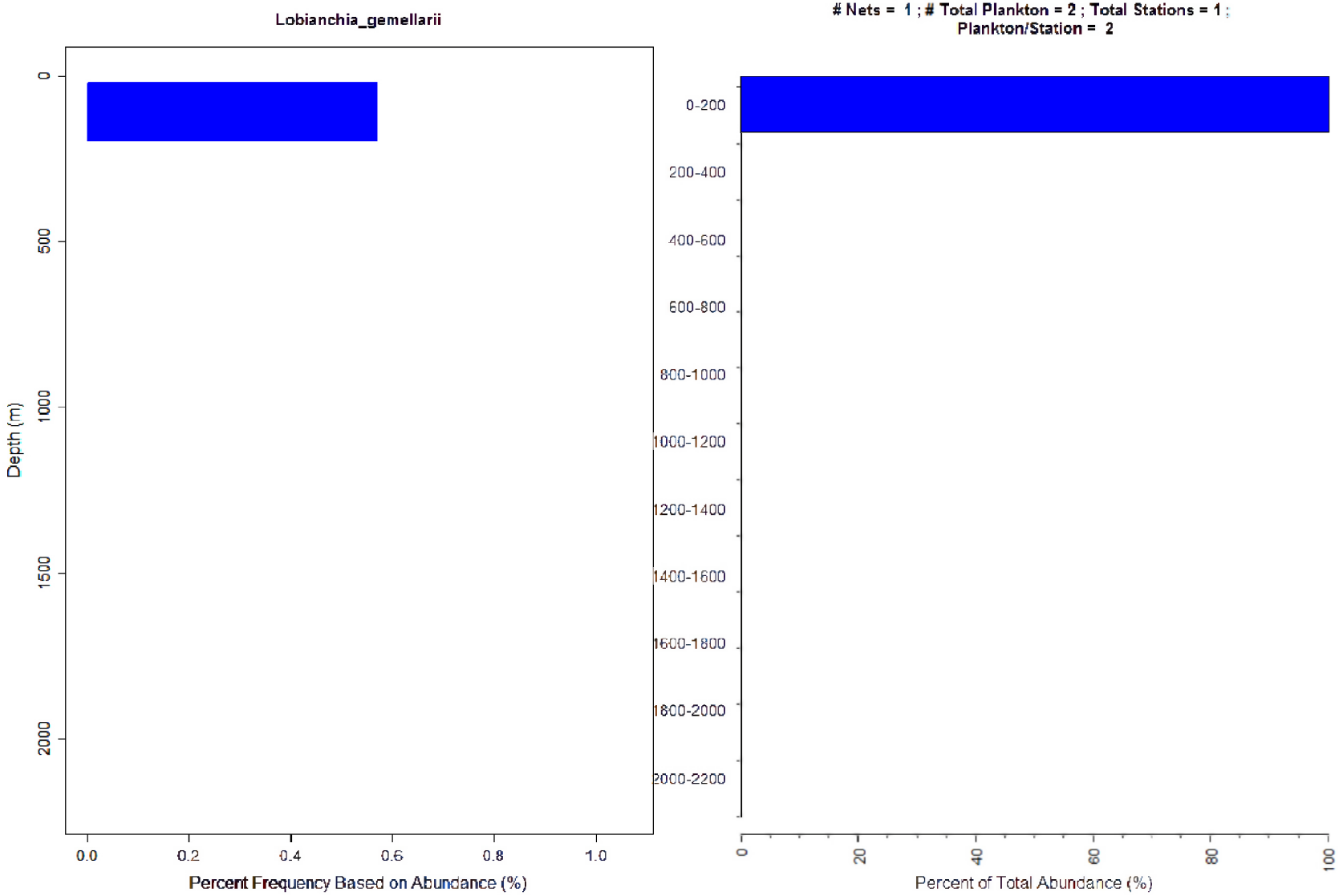
Liopropoma - Deep



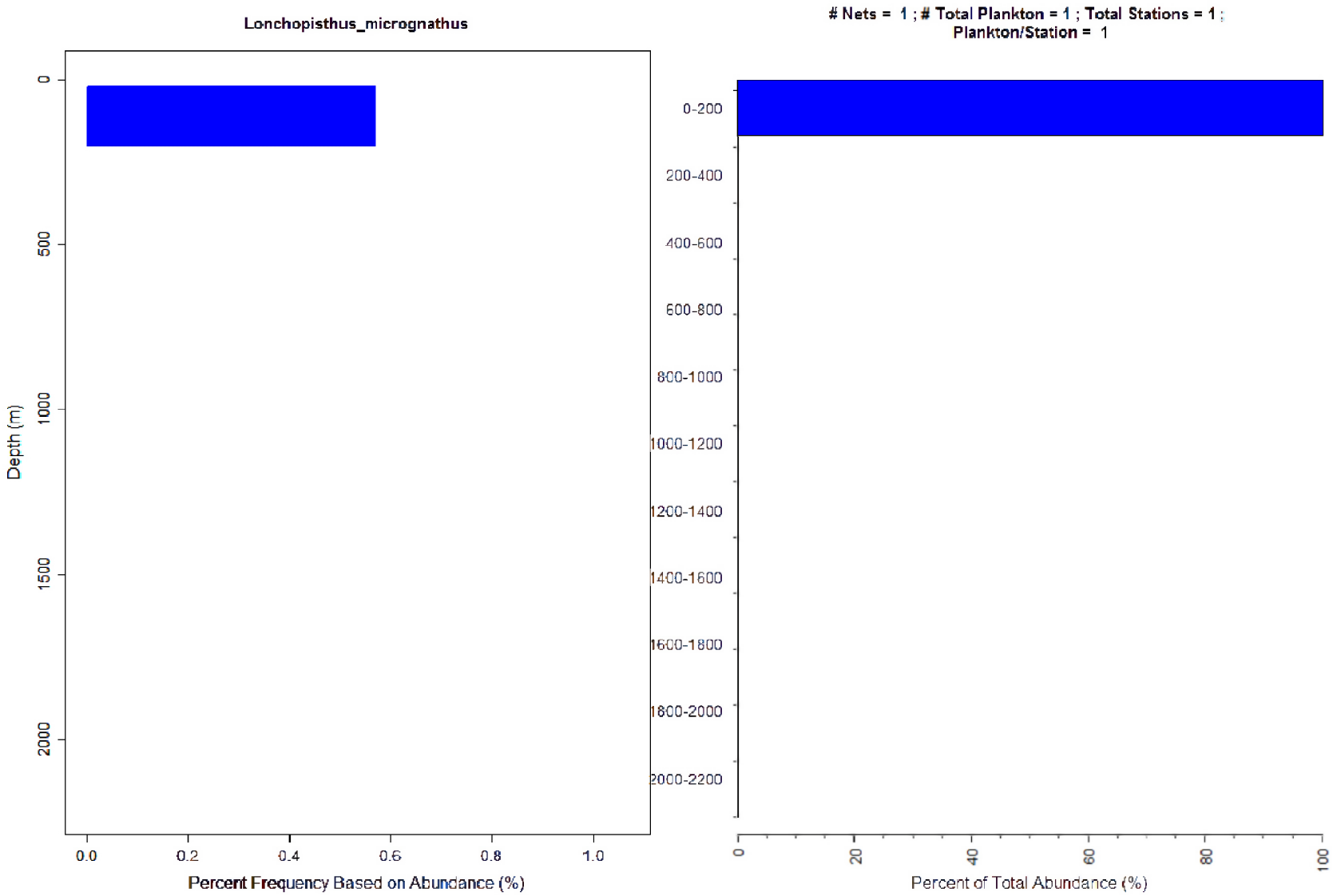
Lobianchia - Deep



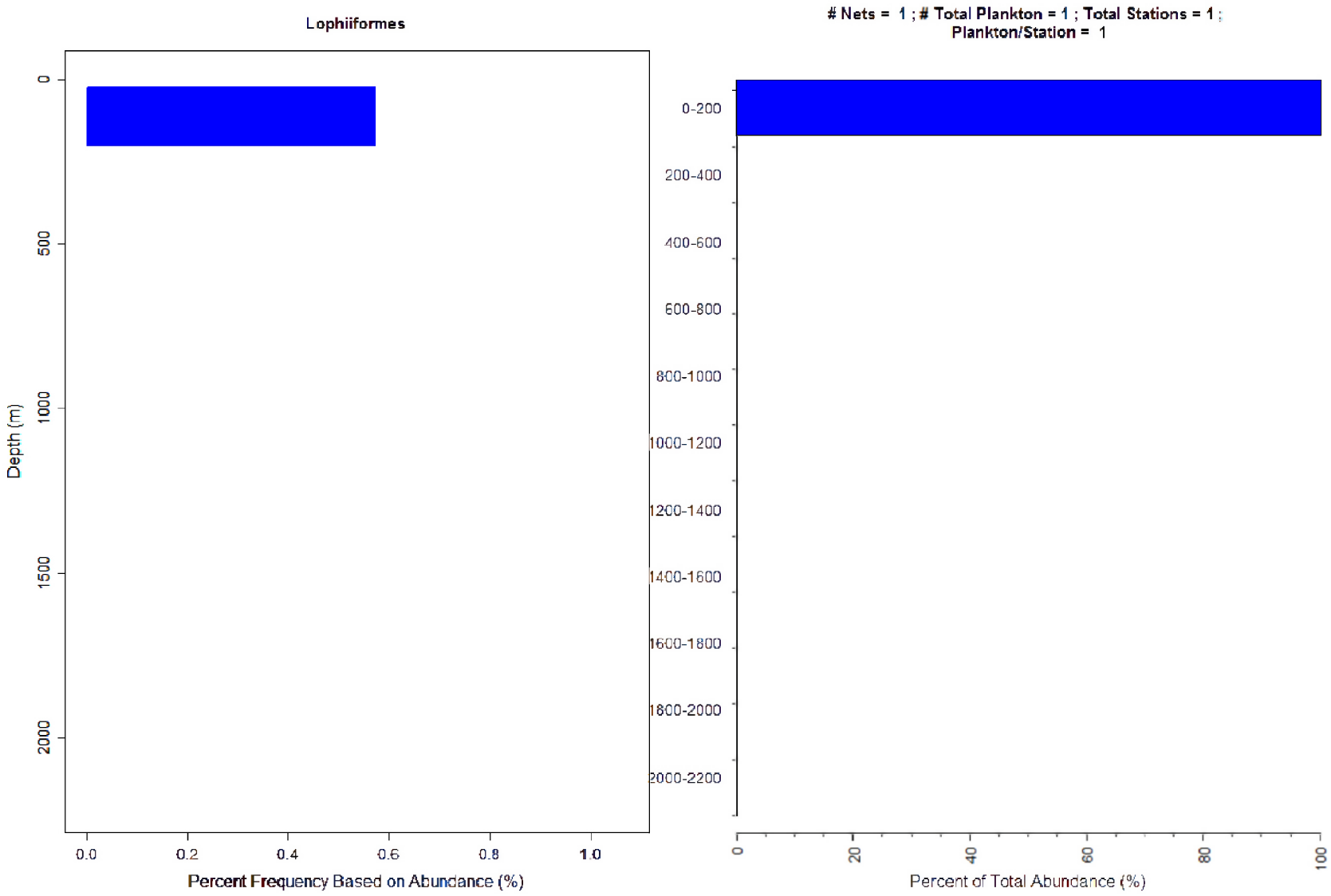
Lobianchia_dofleini - Deep



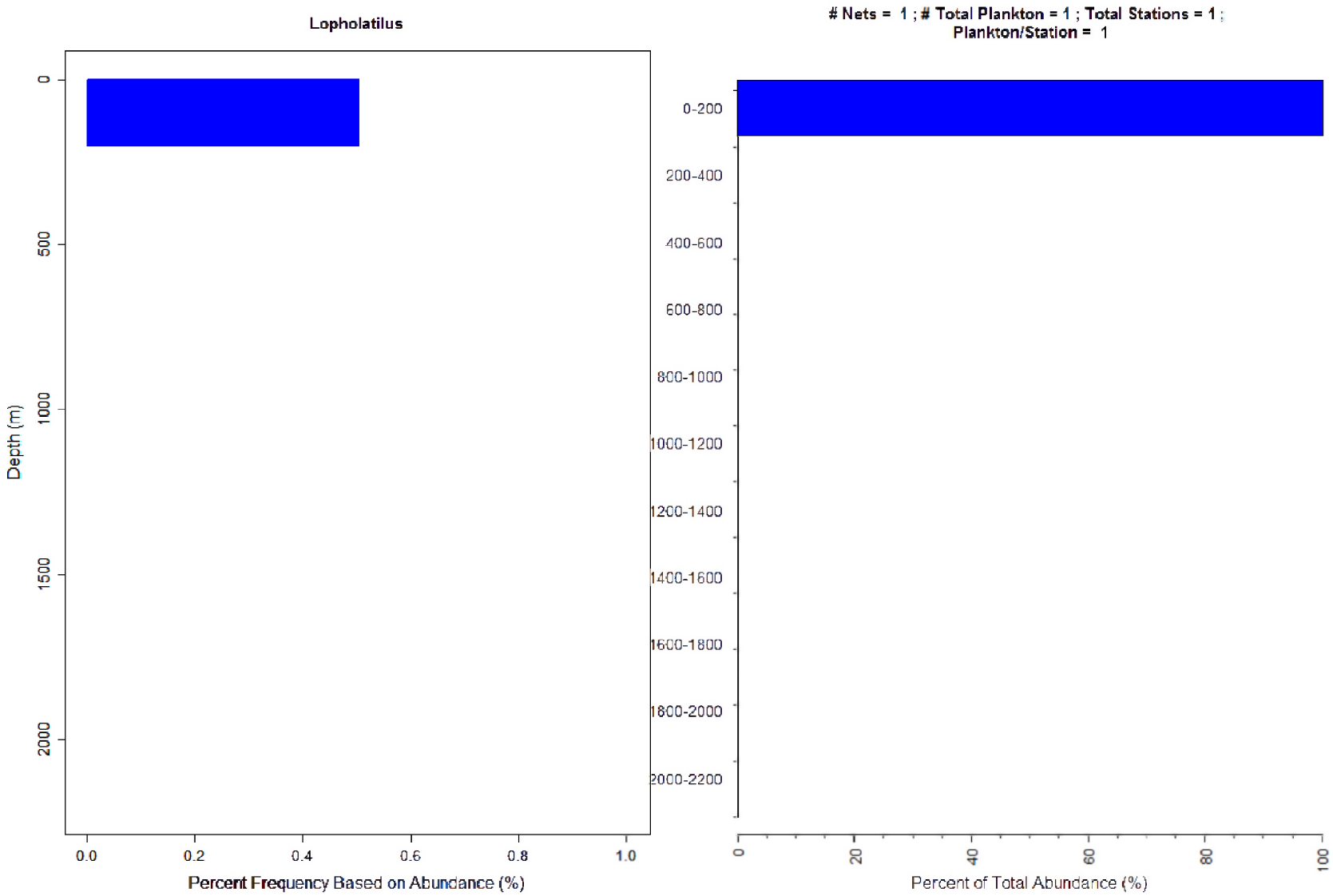
Lobianchia_gemellarii - Deep



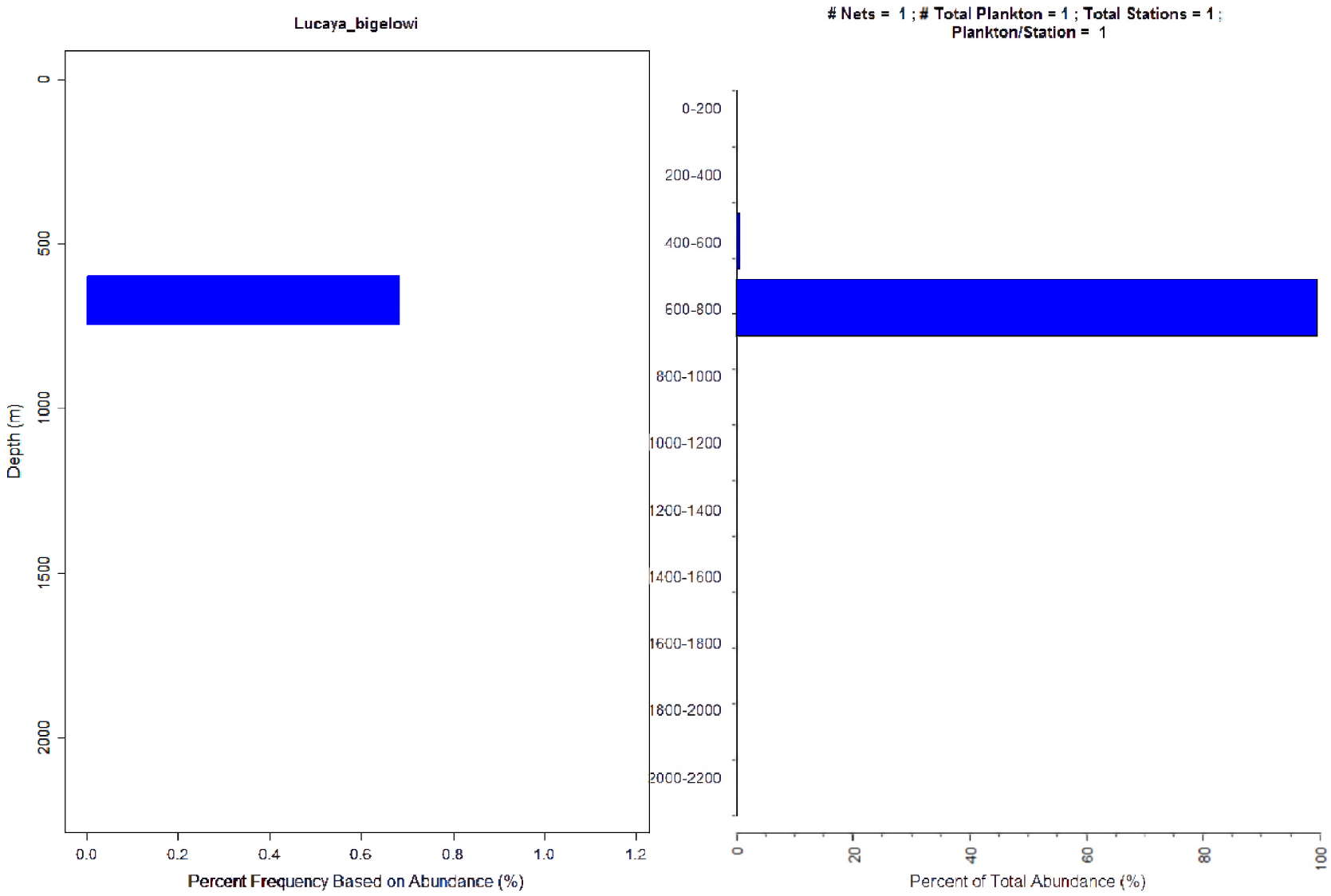
Lonchopisthus_micrognathus - Deep



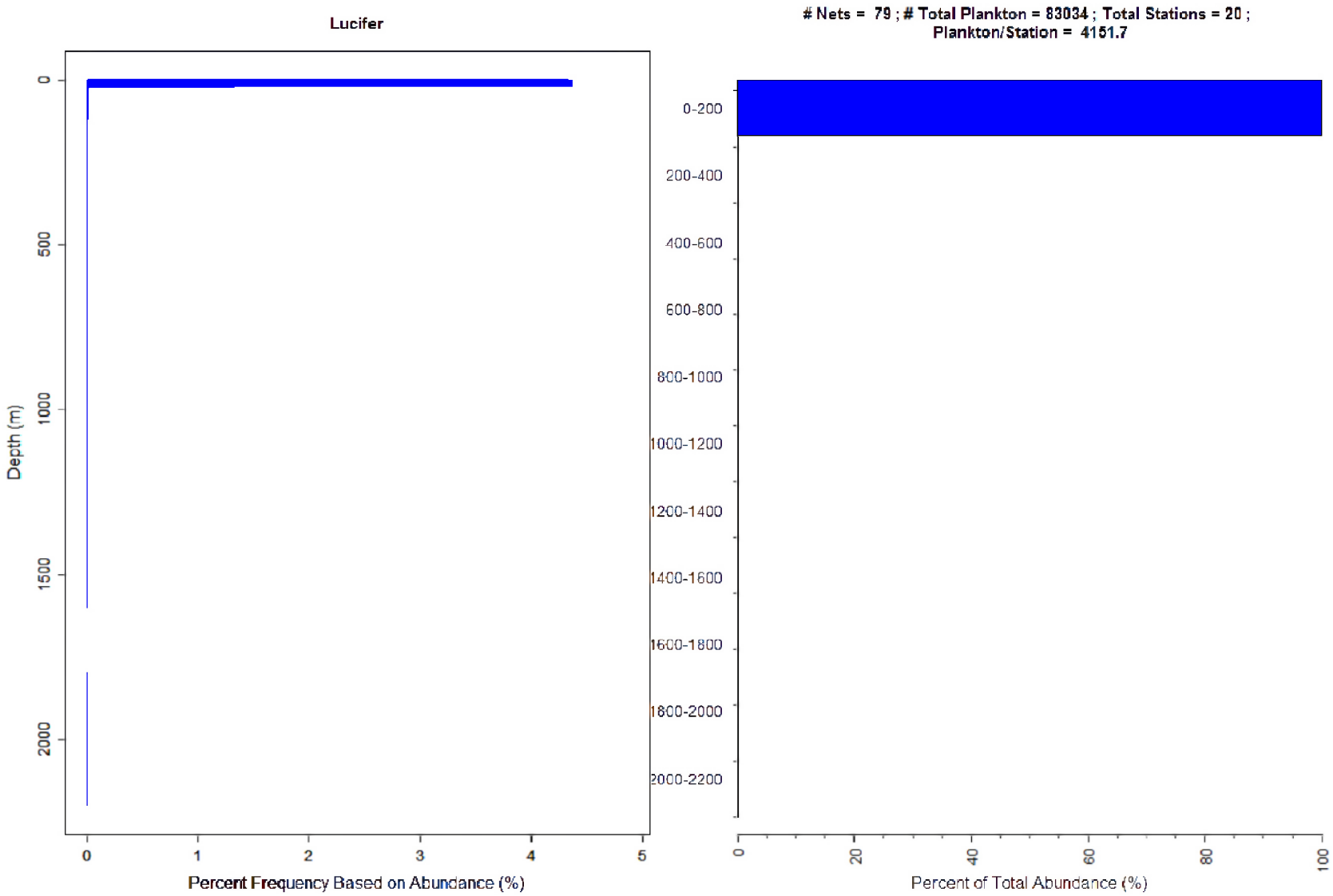
Lophiiformes - Deep



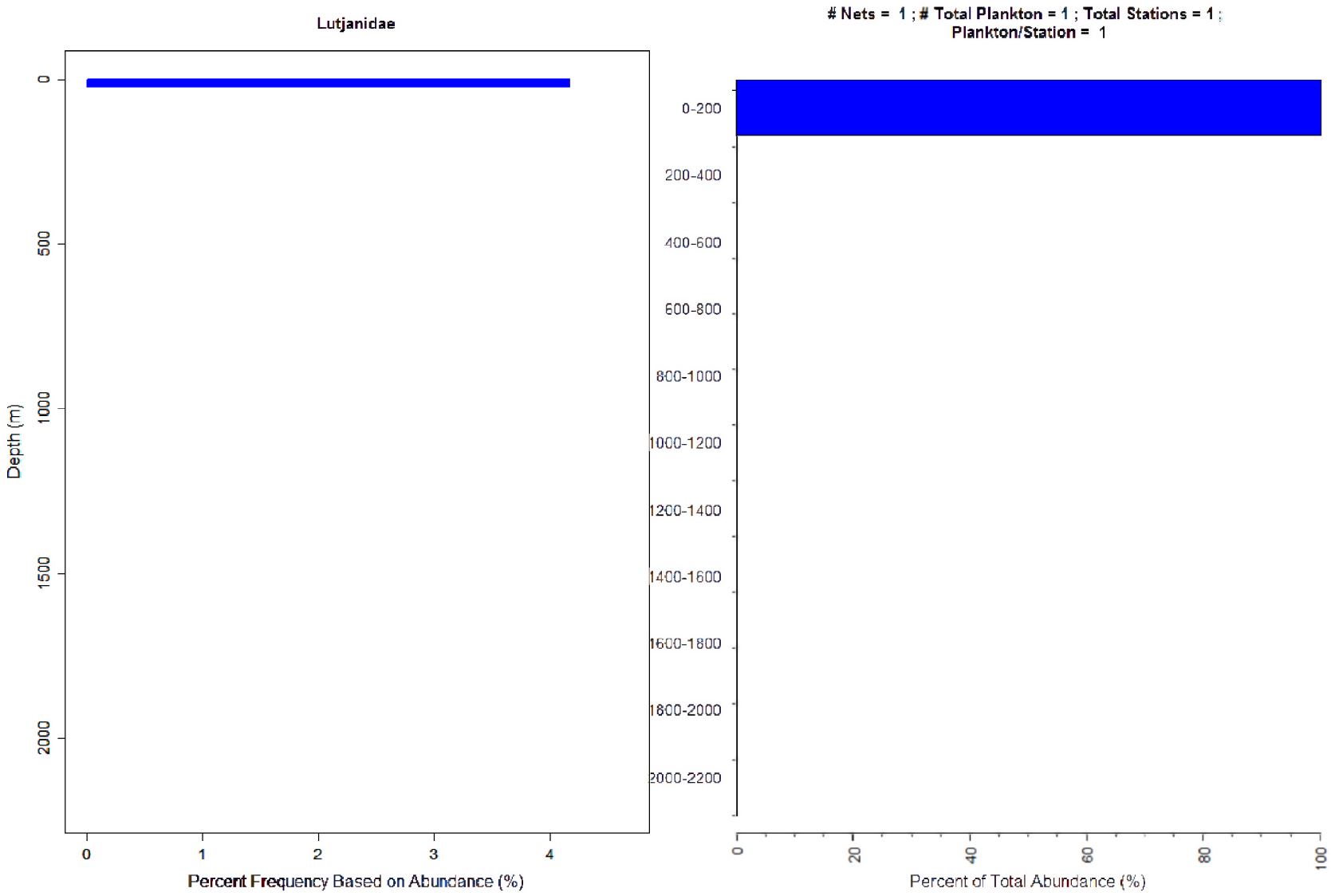
Lopholatilus - Deep



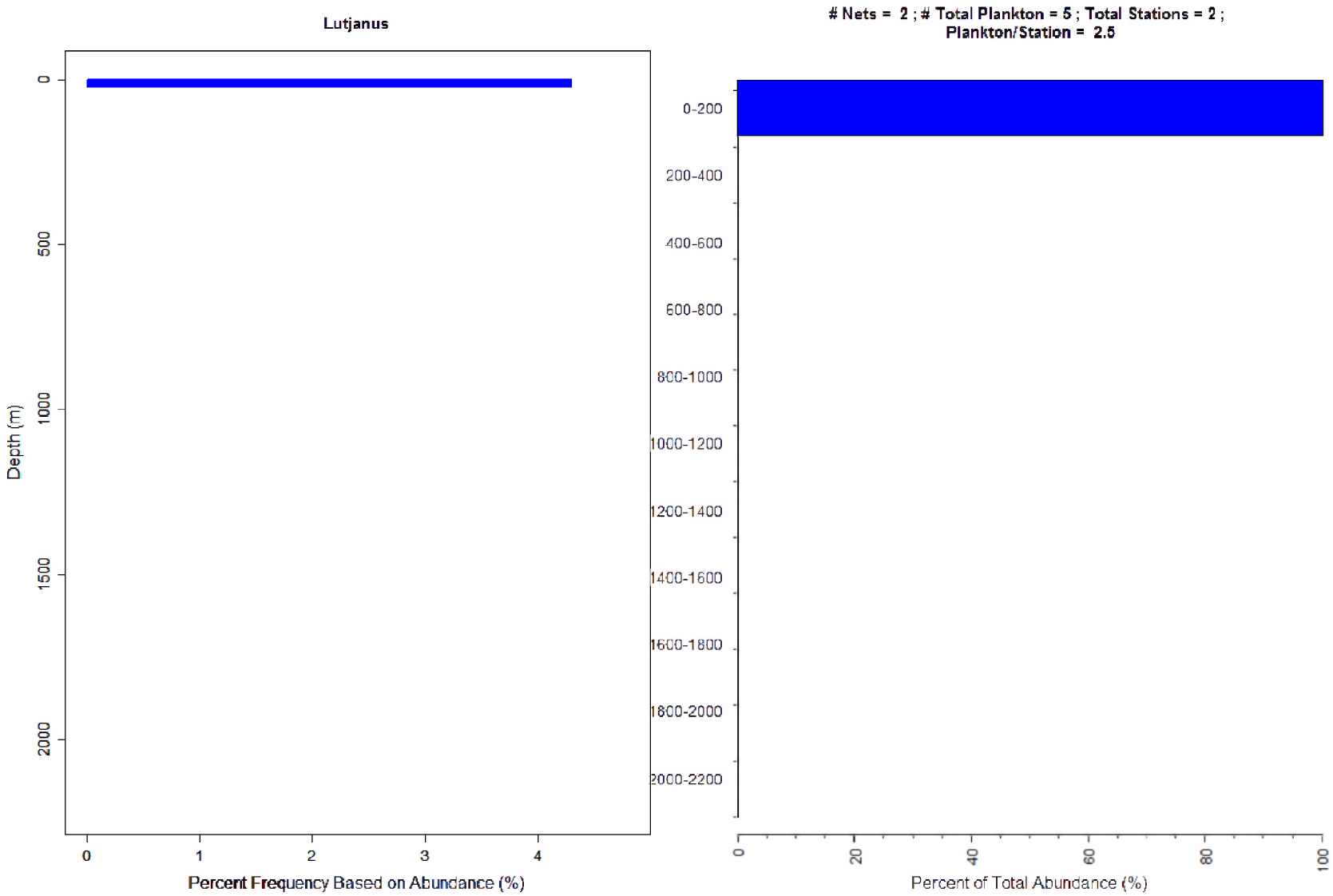
Lucaya_bigelowi - Deep



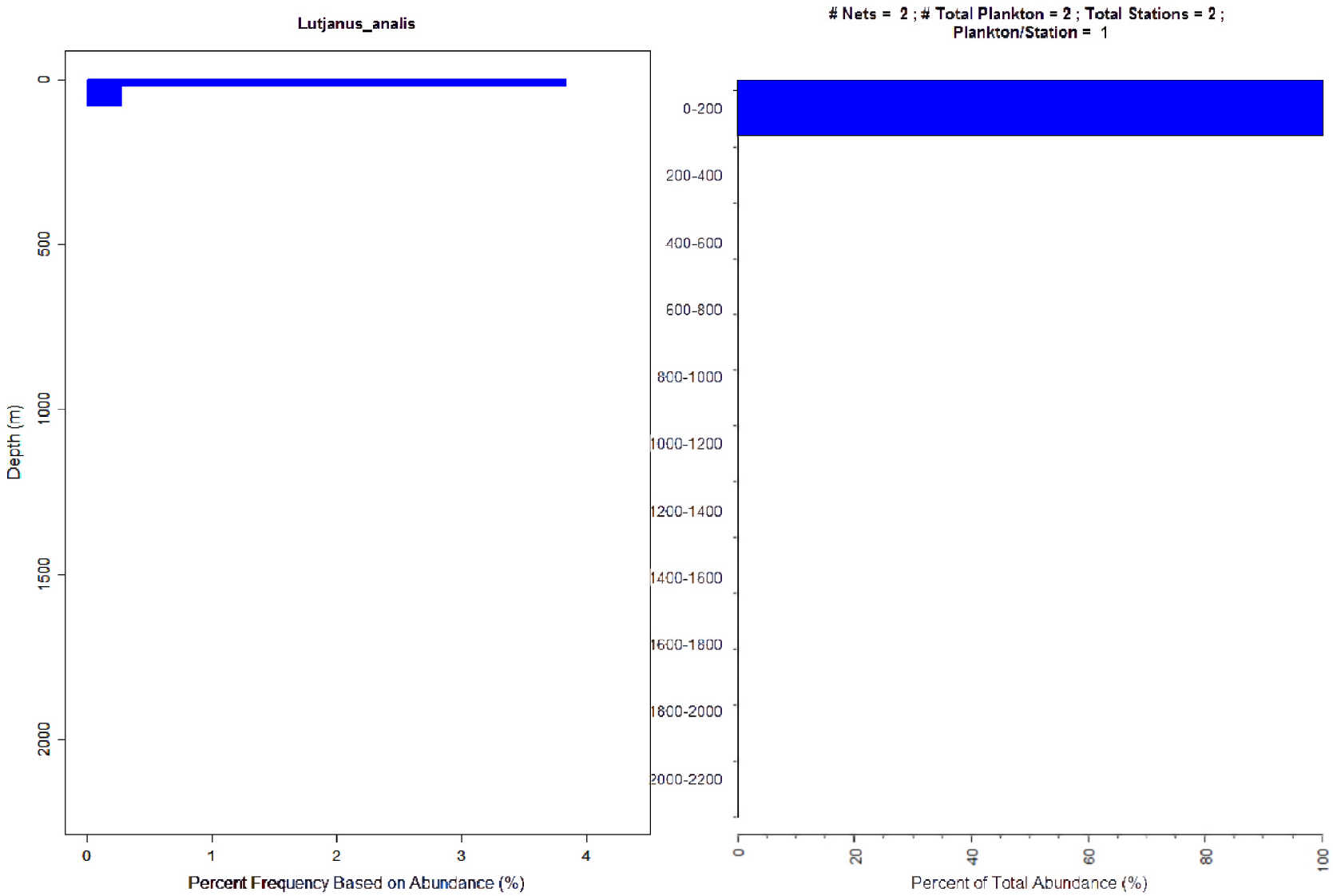
Lucifer - Deep



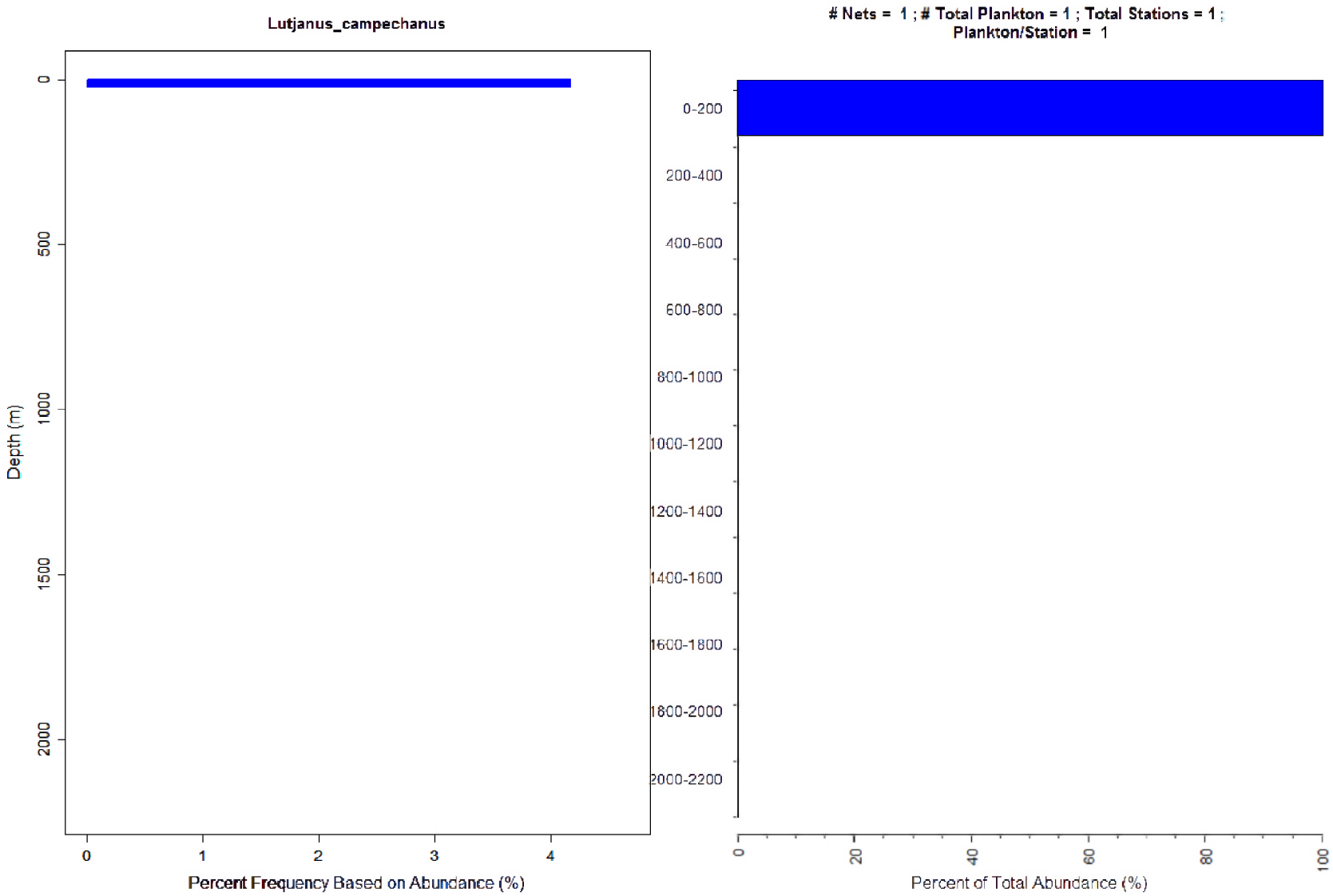
Lutjanidae - Deep



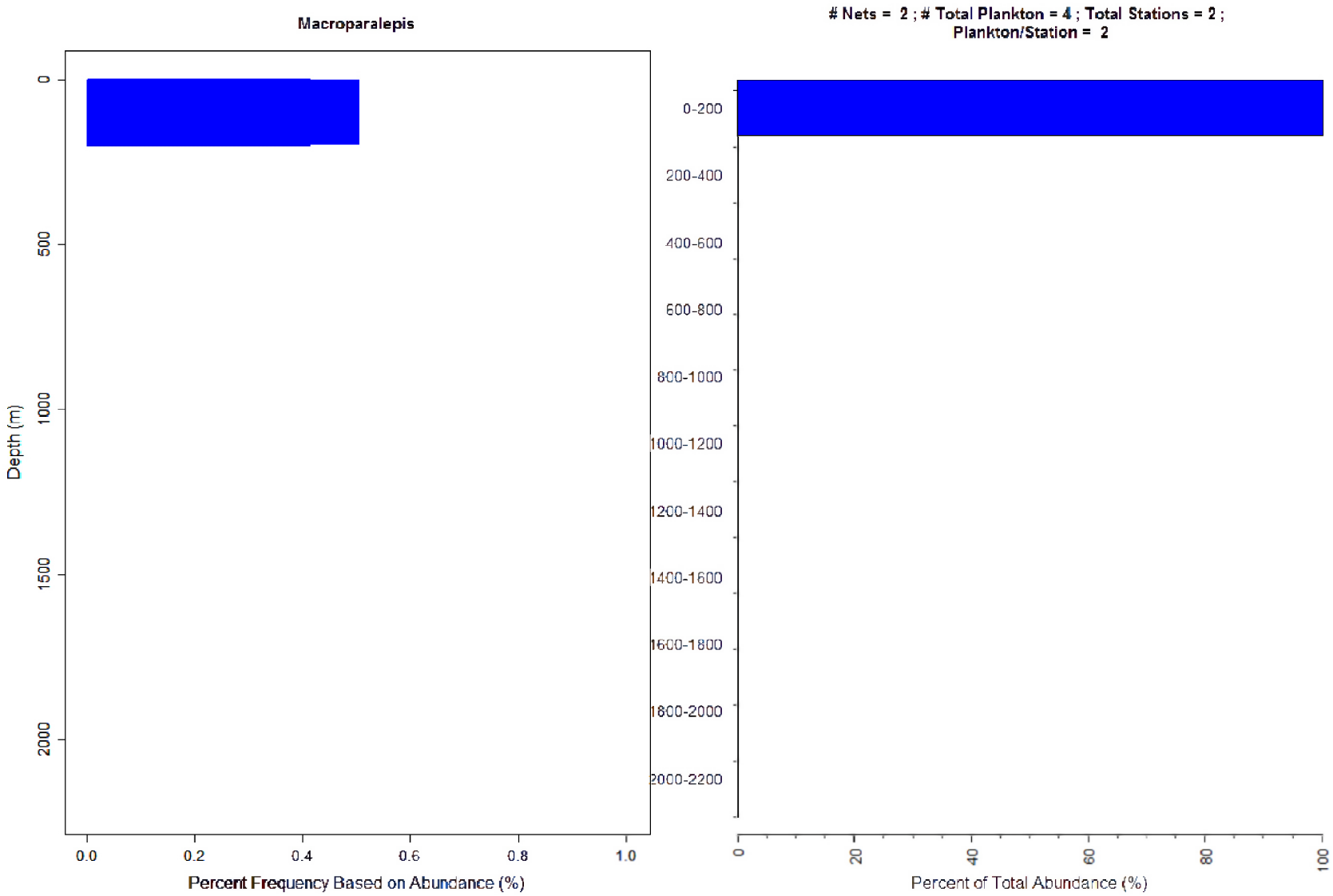
Lutjanus - Deep



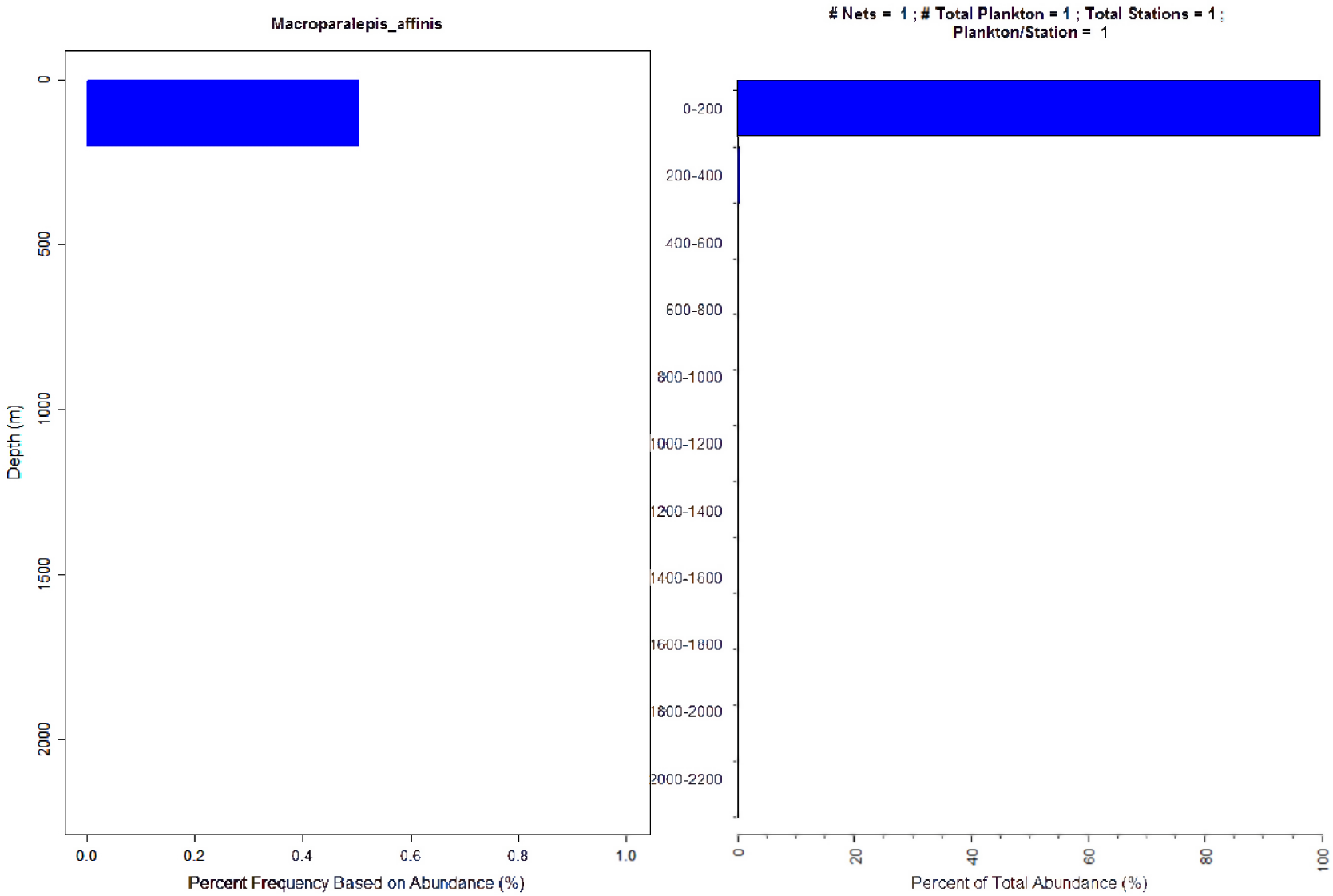
Lutjanus_analis - Deep



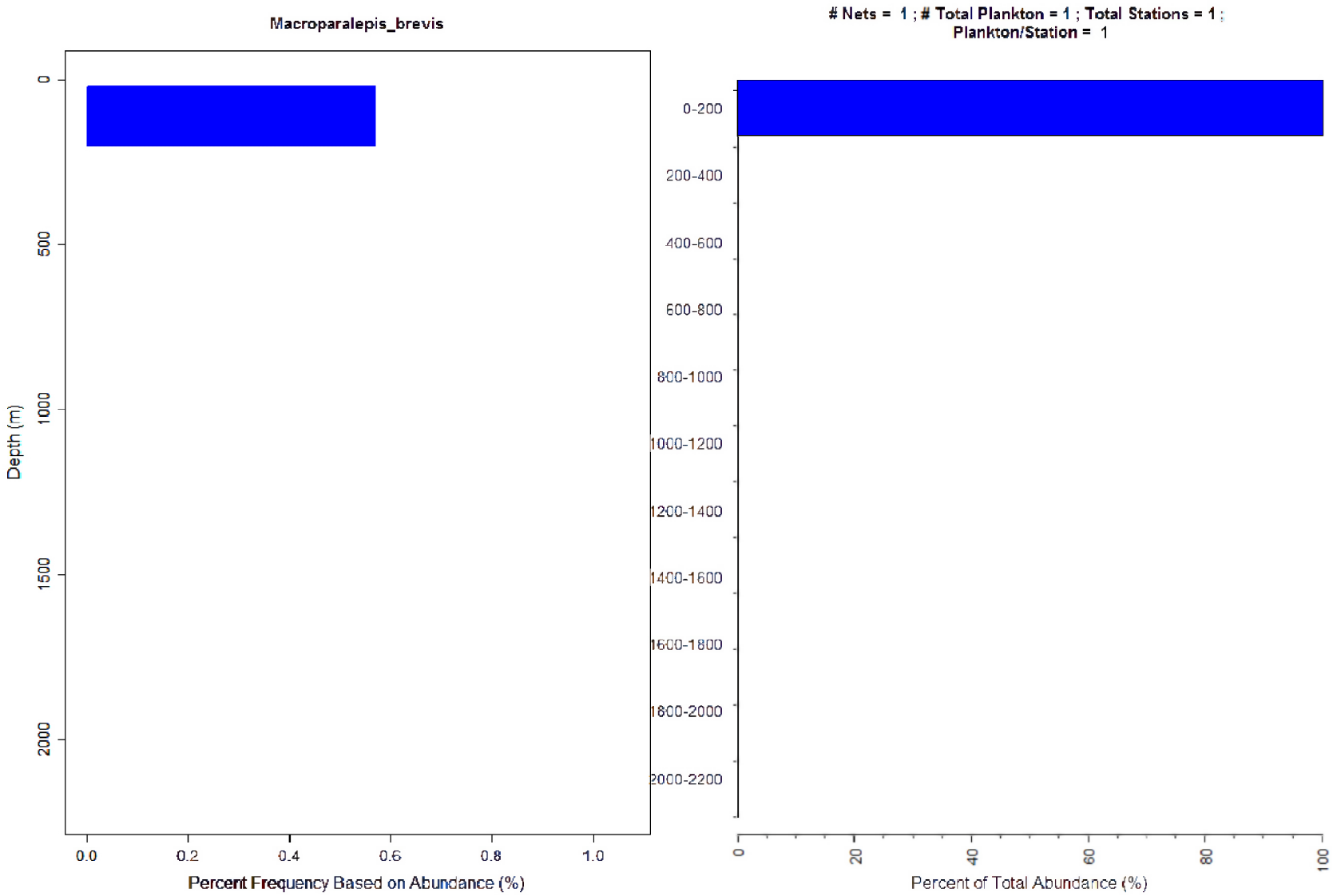
Lutjanus_campechanus - Deep



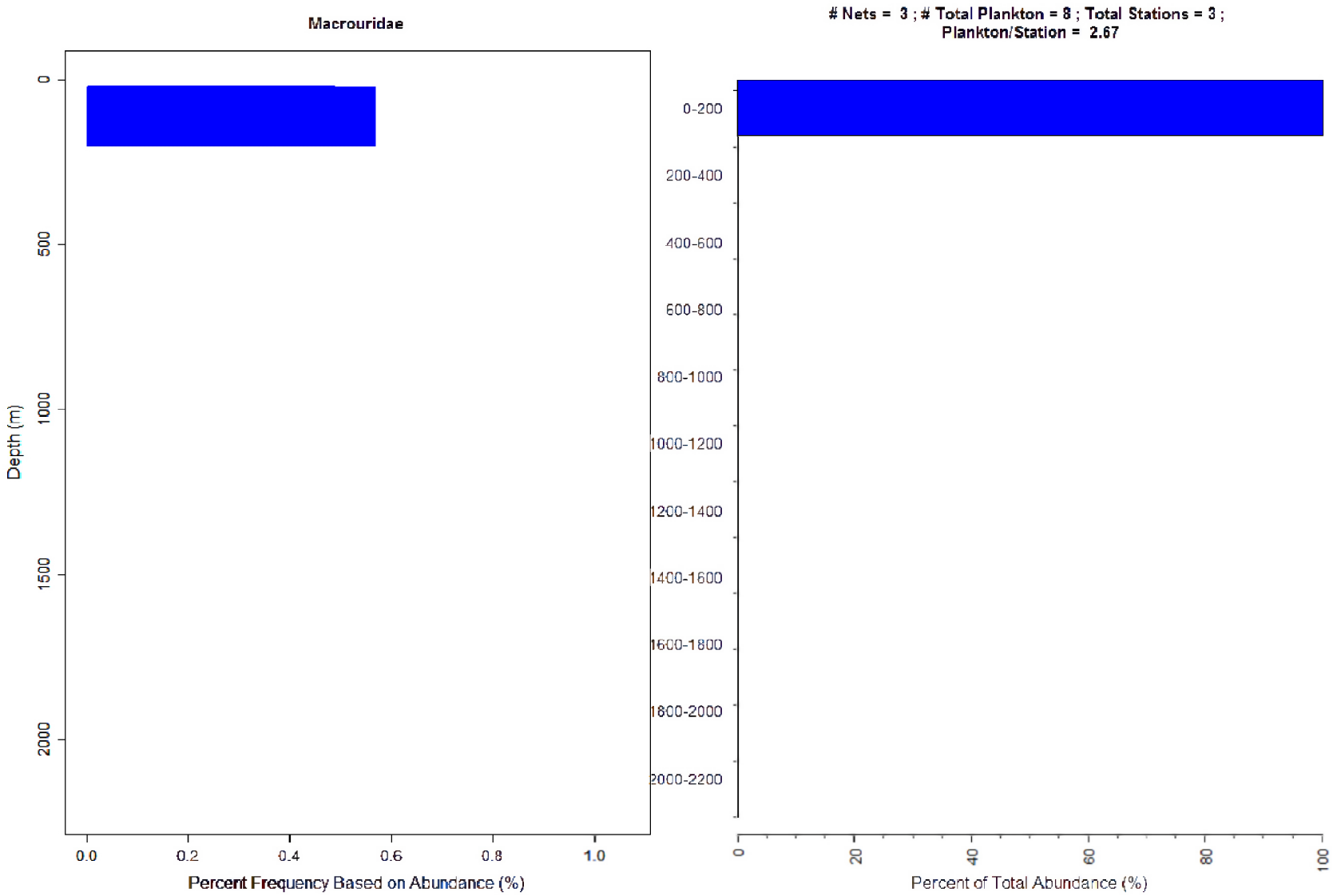
Macroparalepis - Deep



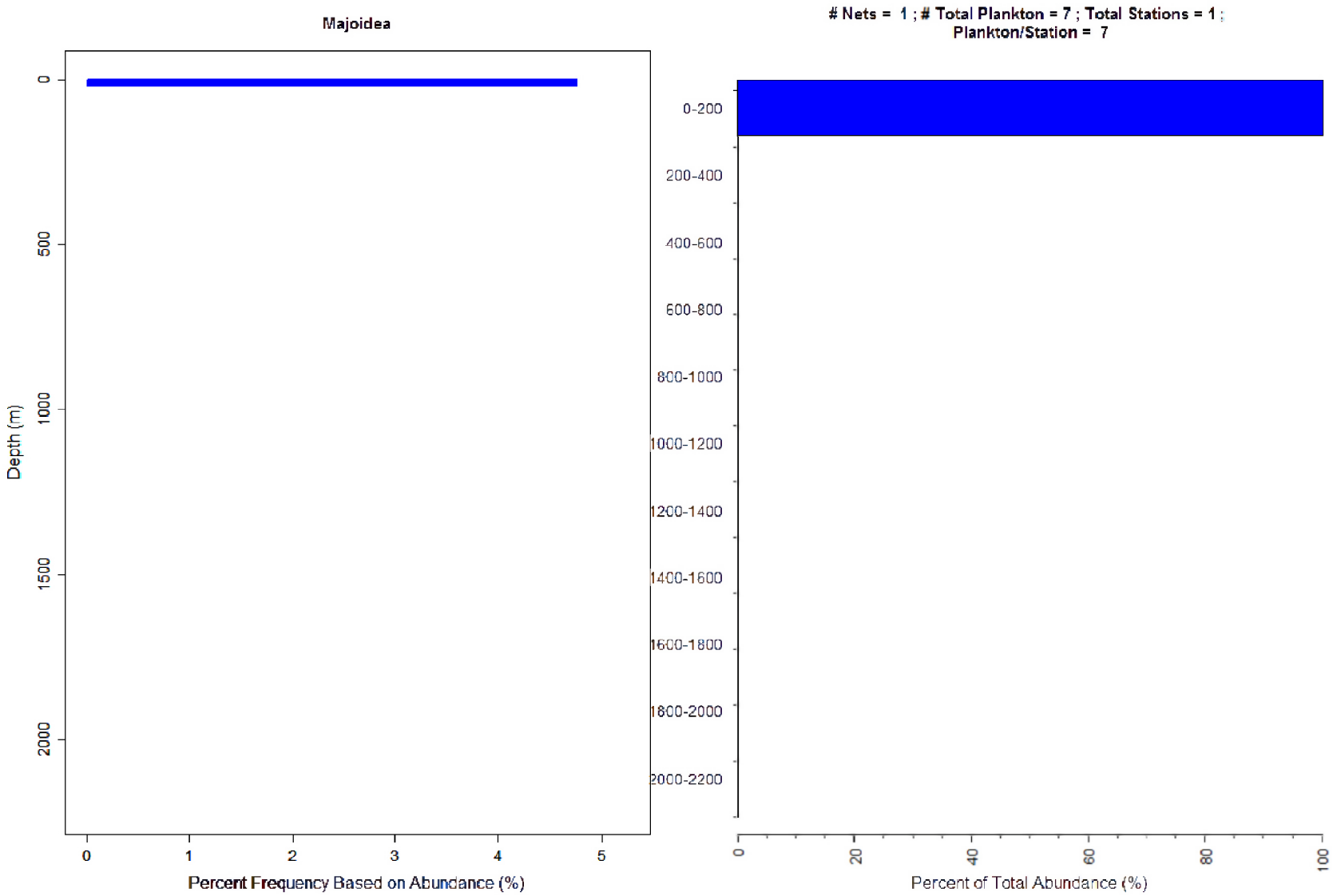
Macroparalepis_affinis - Deep



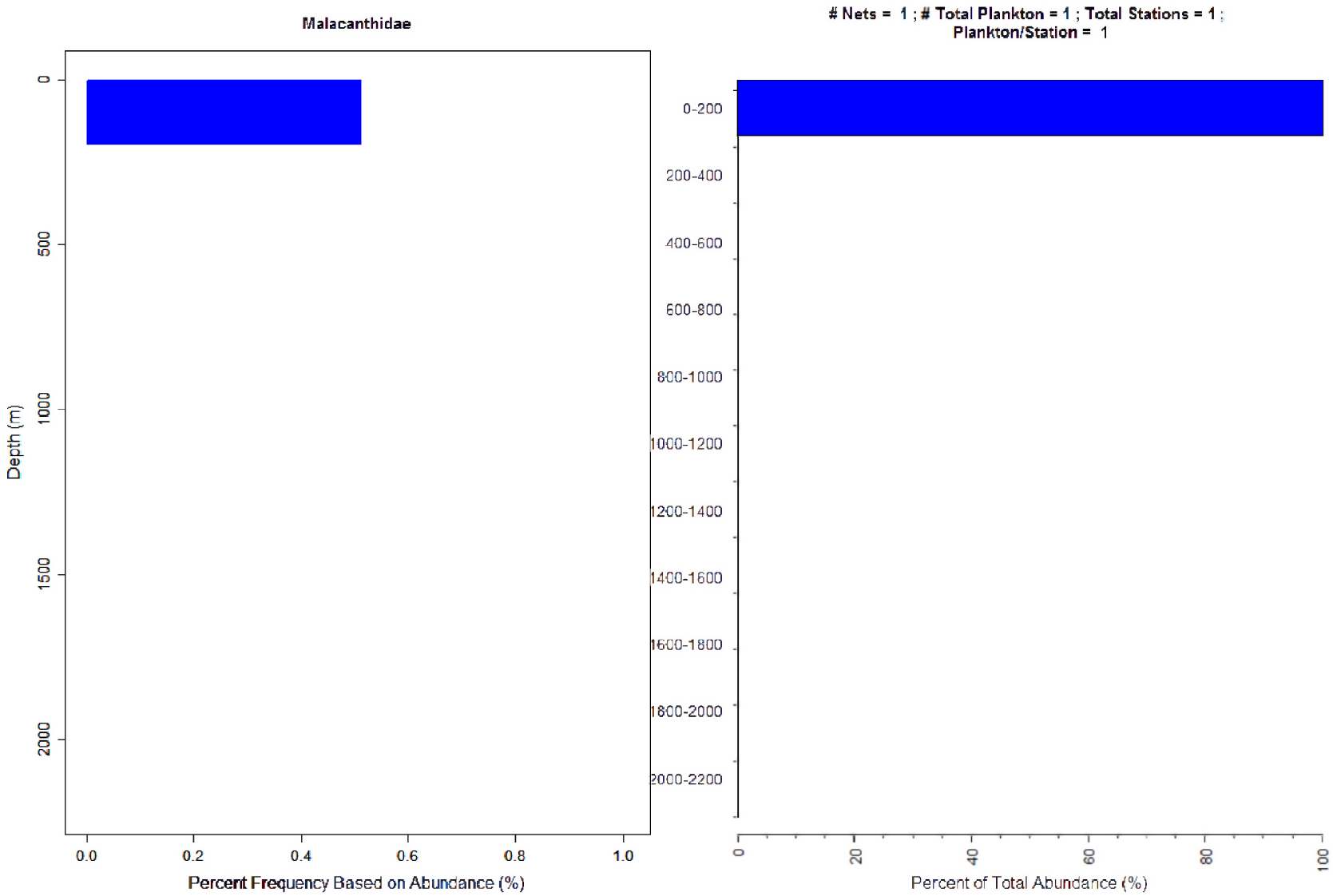
Macroparalepis_brevis - Deep



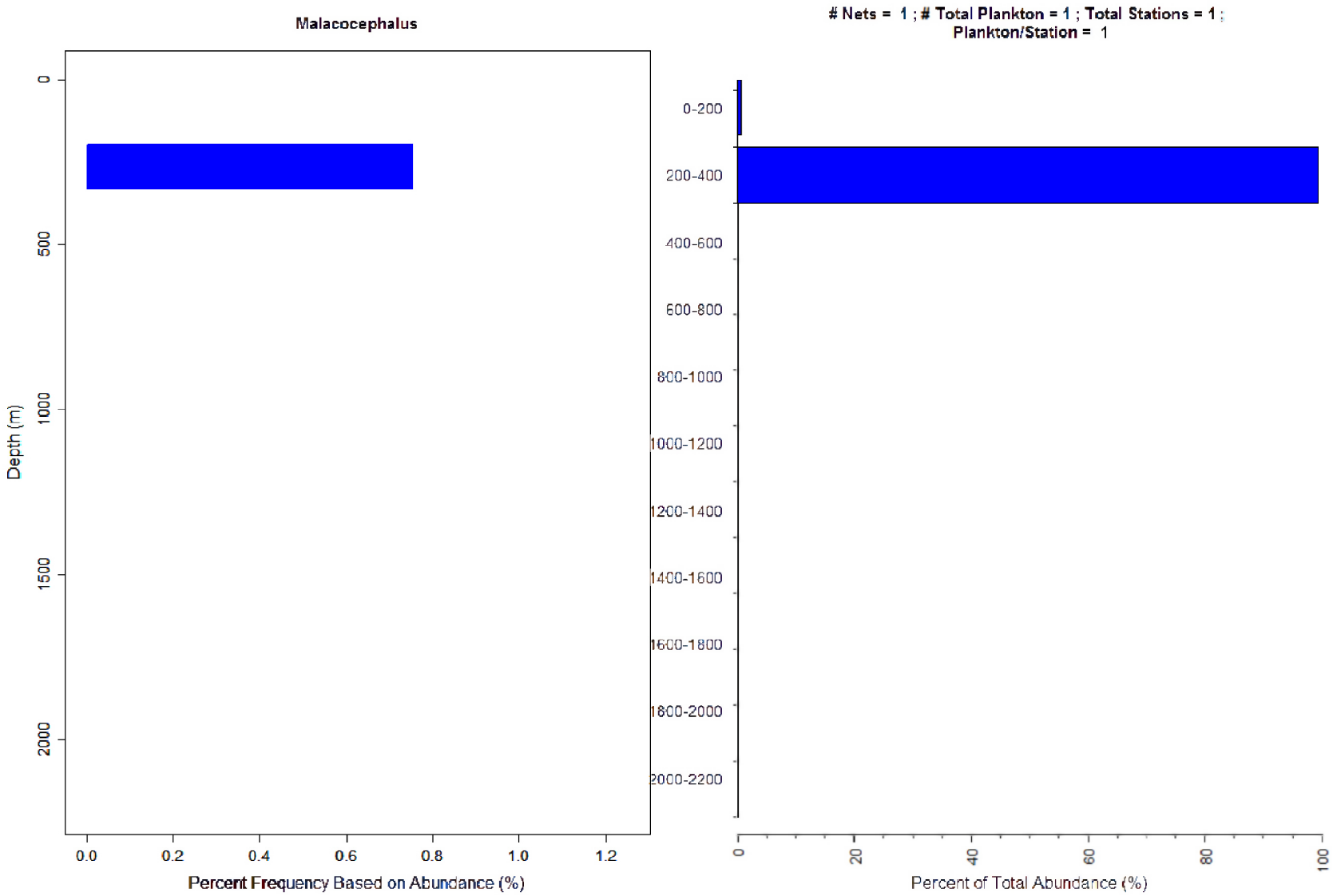
Macrouridae - Deep



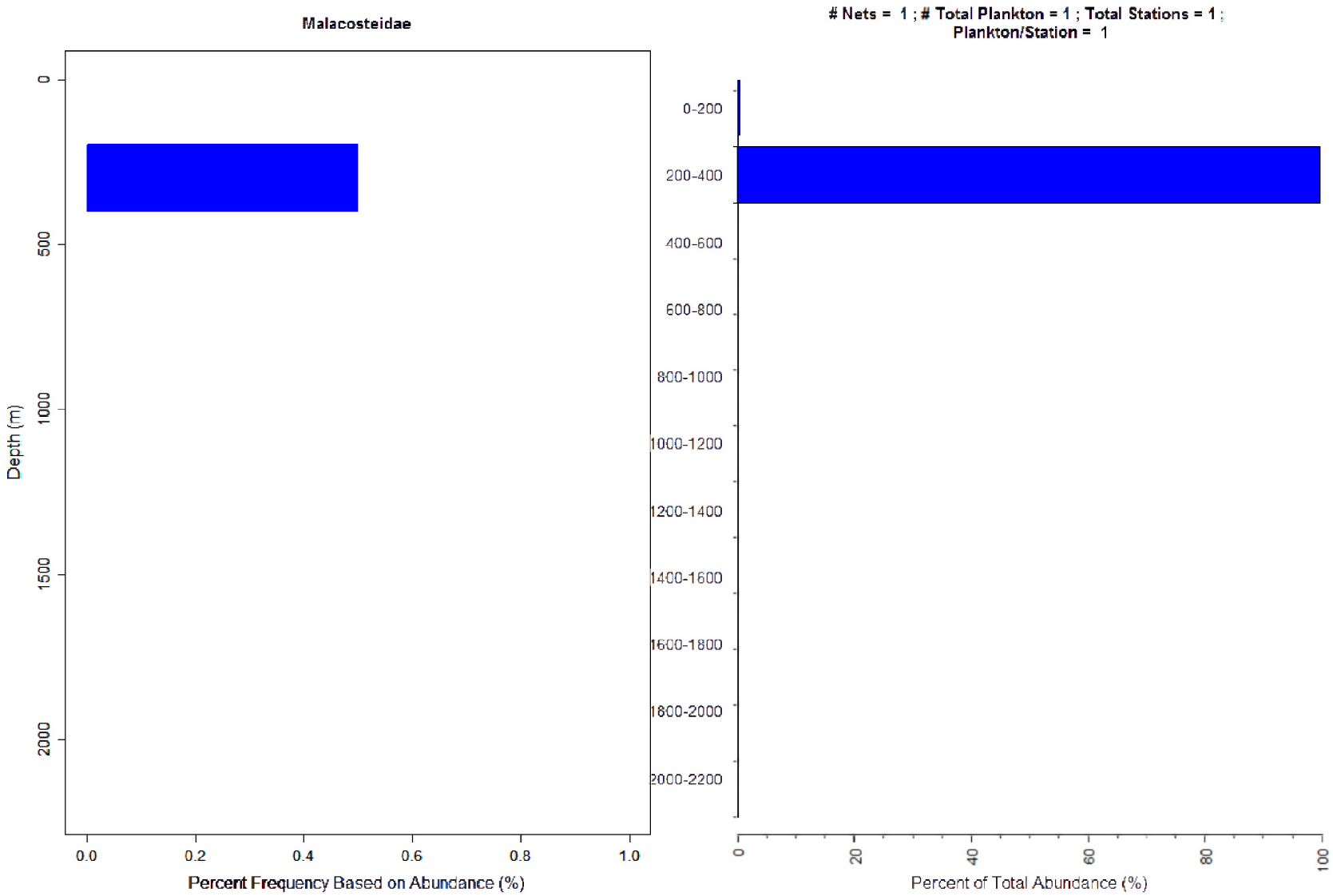
Majoidea - Deep



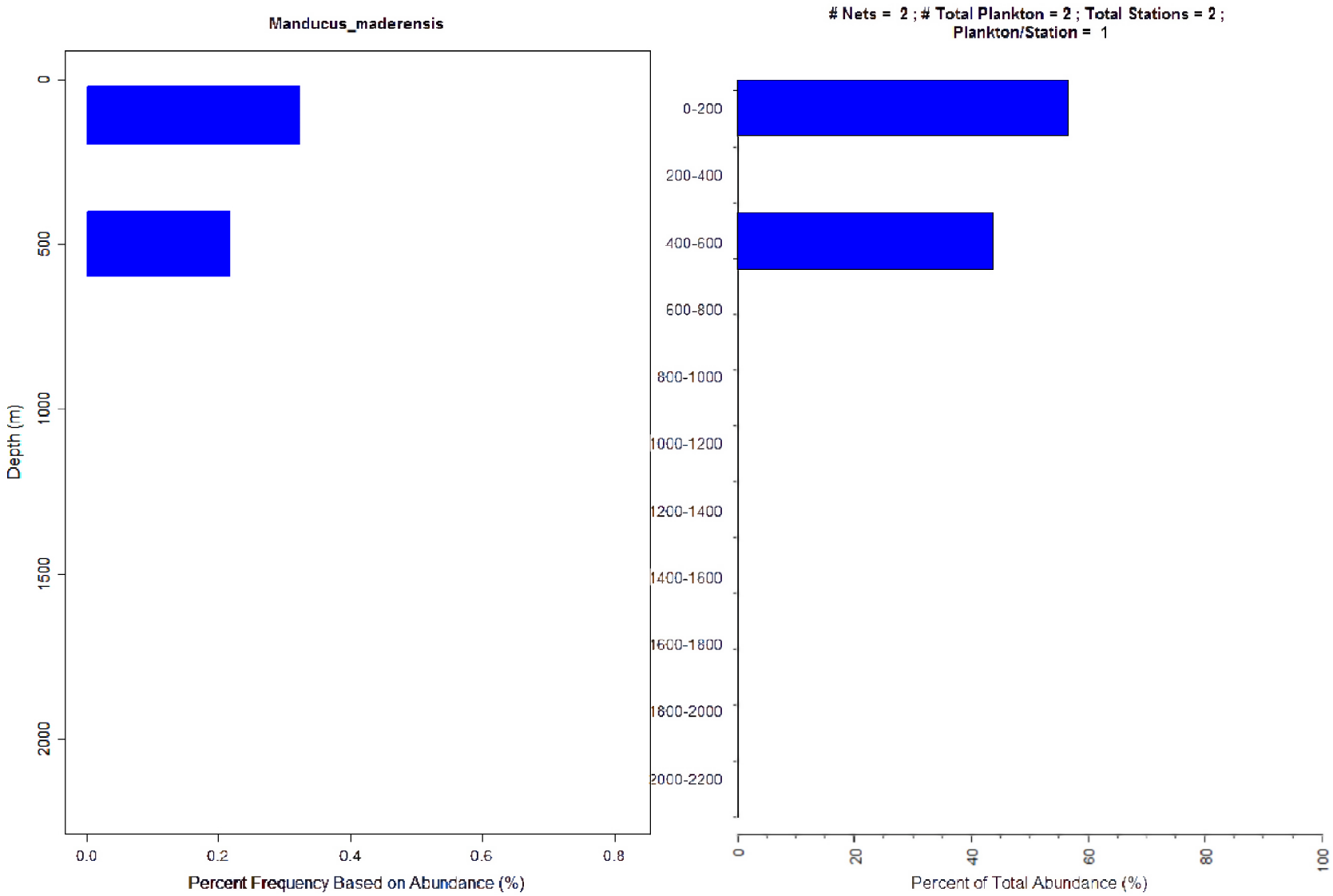
Malacanthidae - Deep



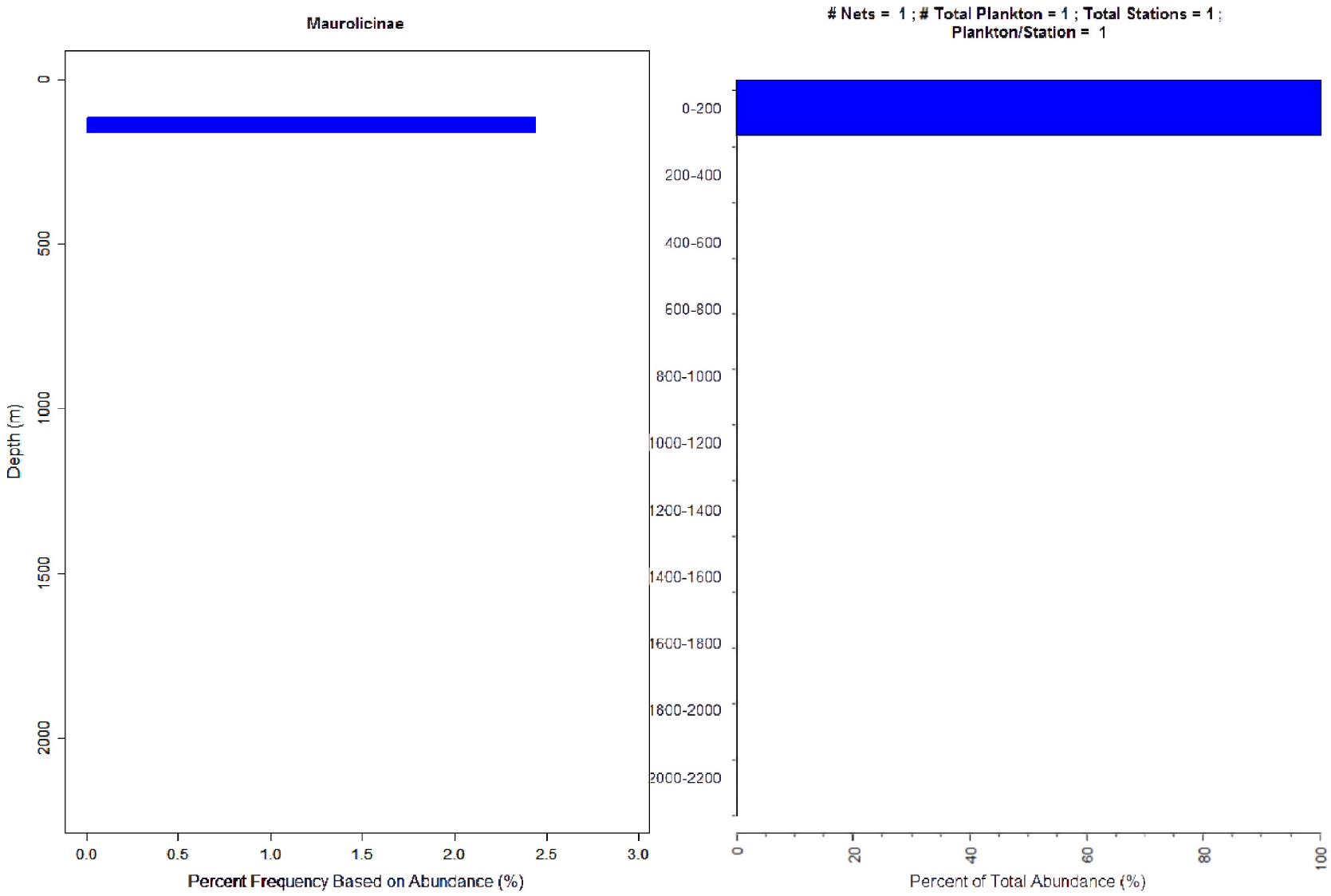
Malacocephalus - Deep



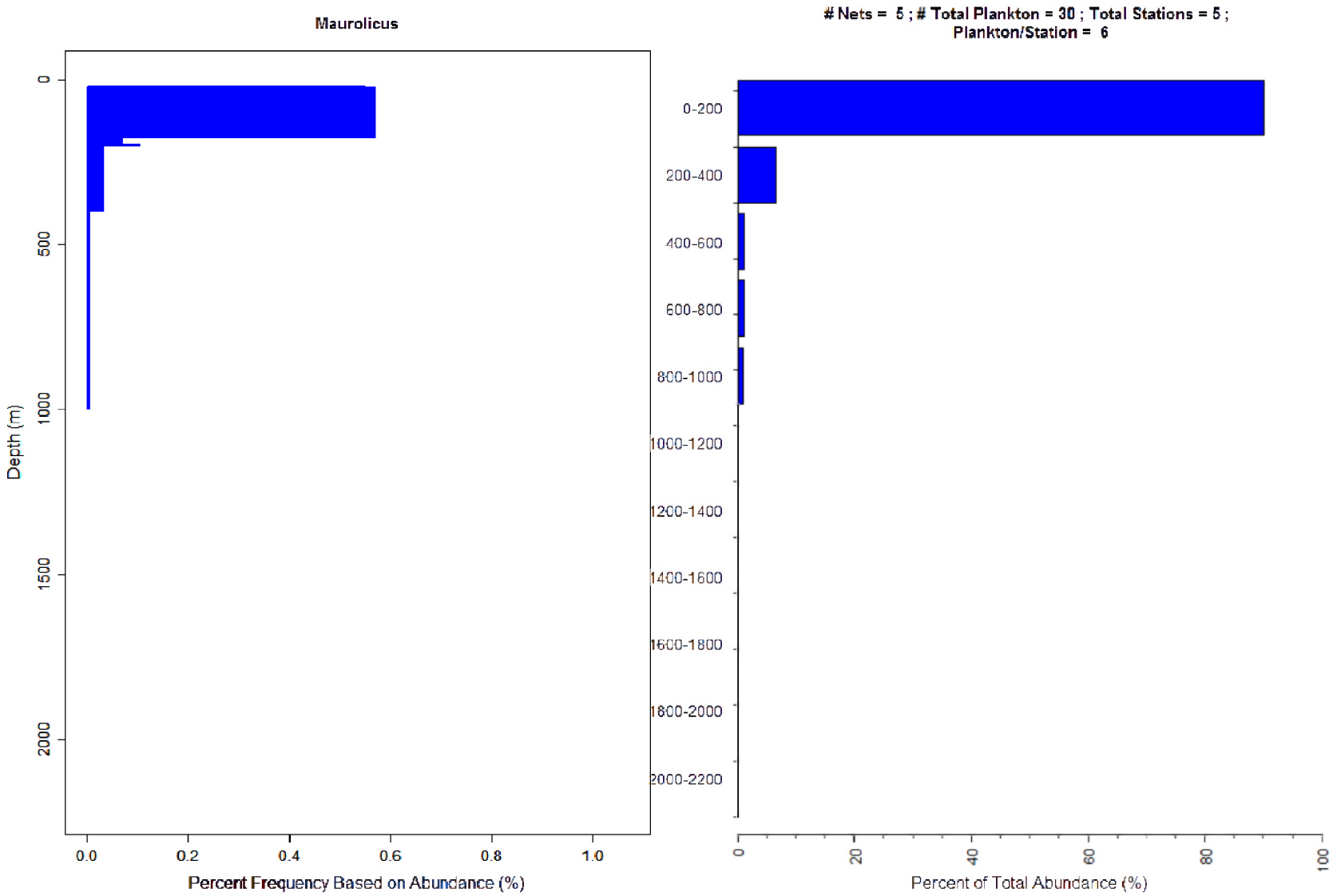
Malacosteidae - Deep



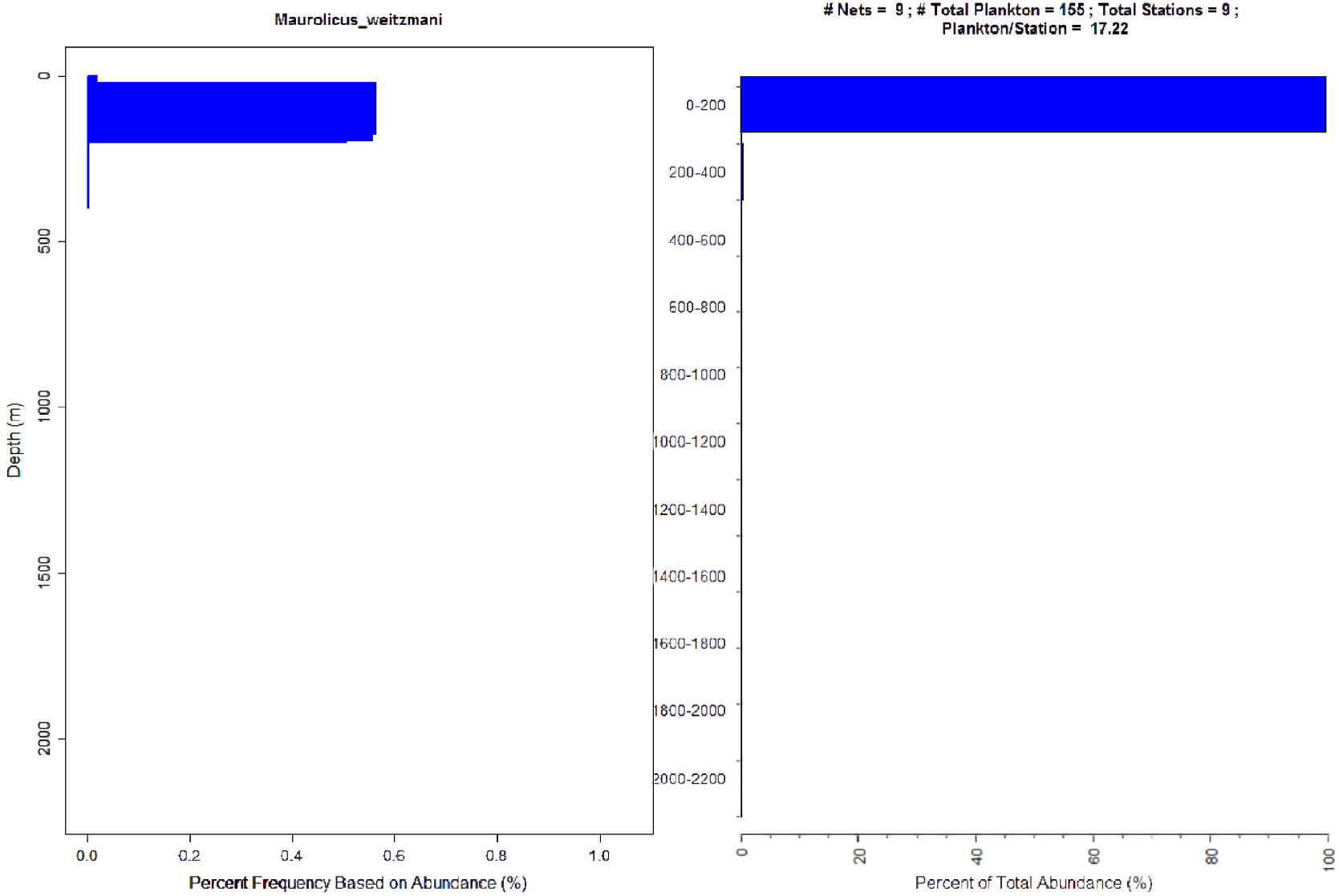
Manducus_maderensis - Deep



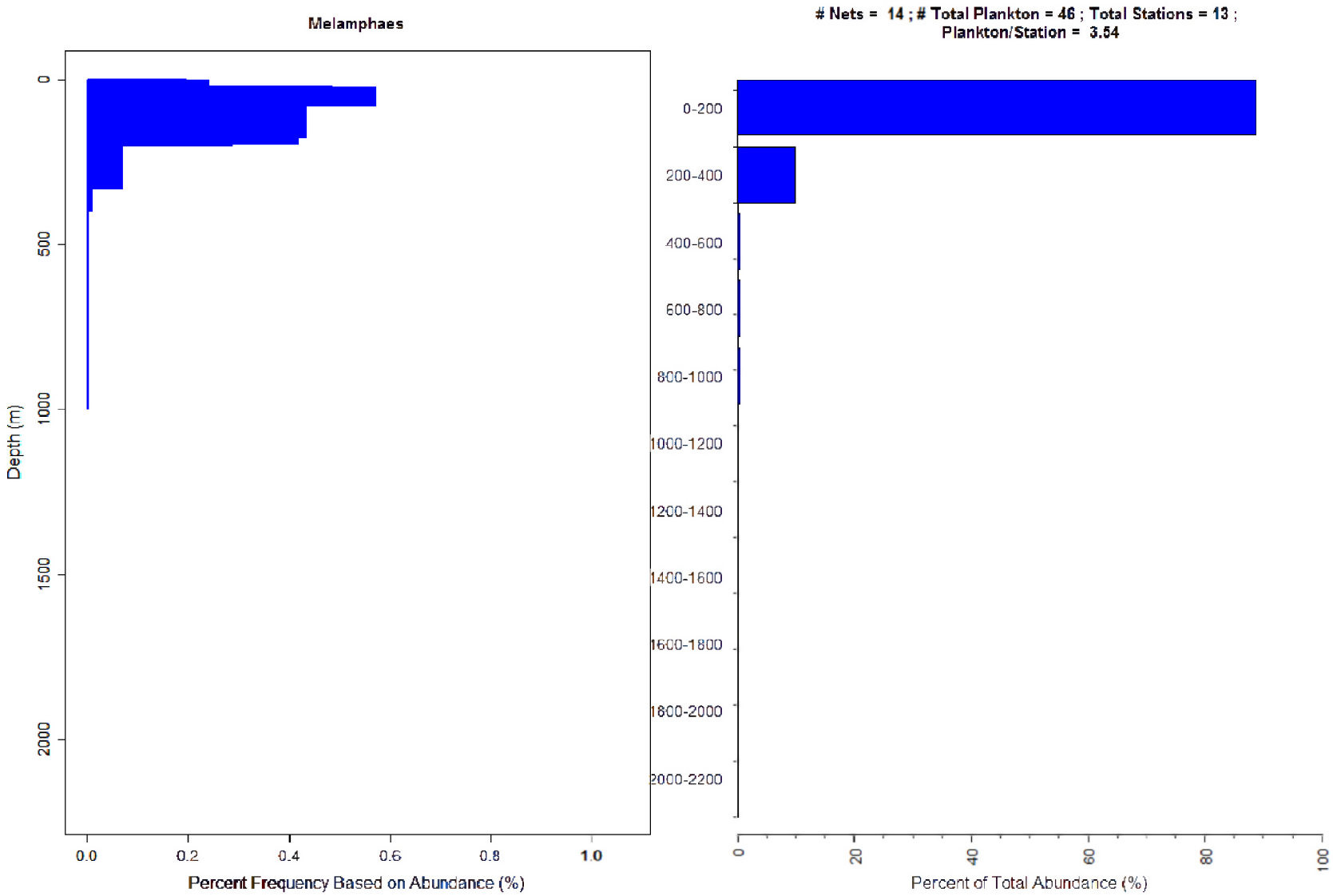
Maurolicinae - Deep



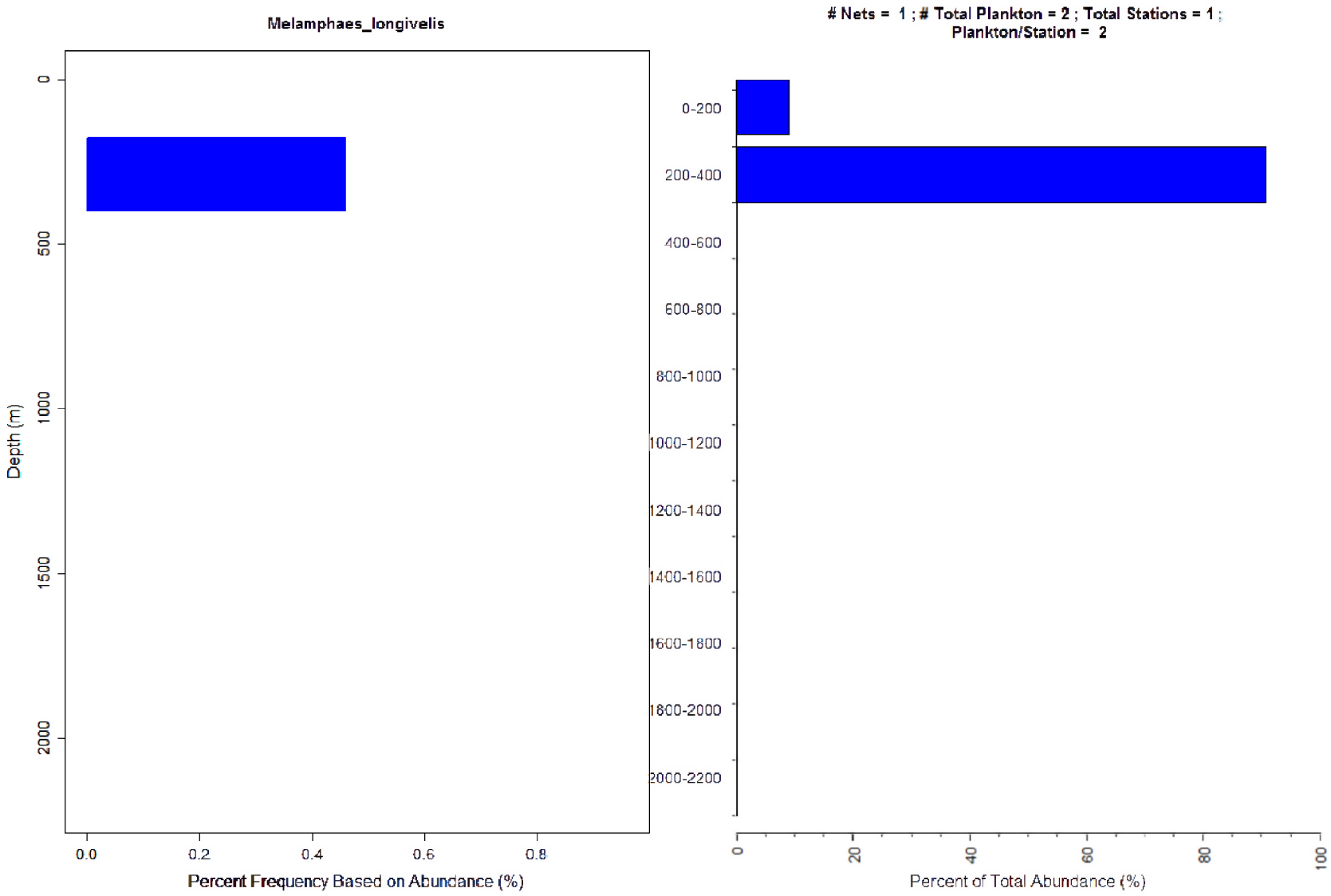
Maurolicus - Deep



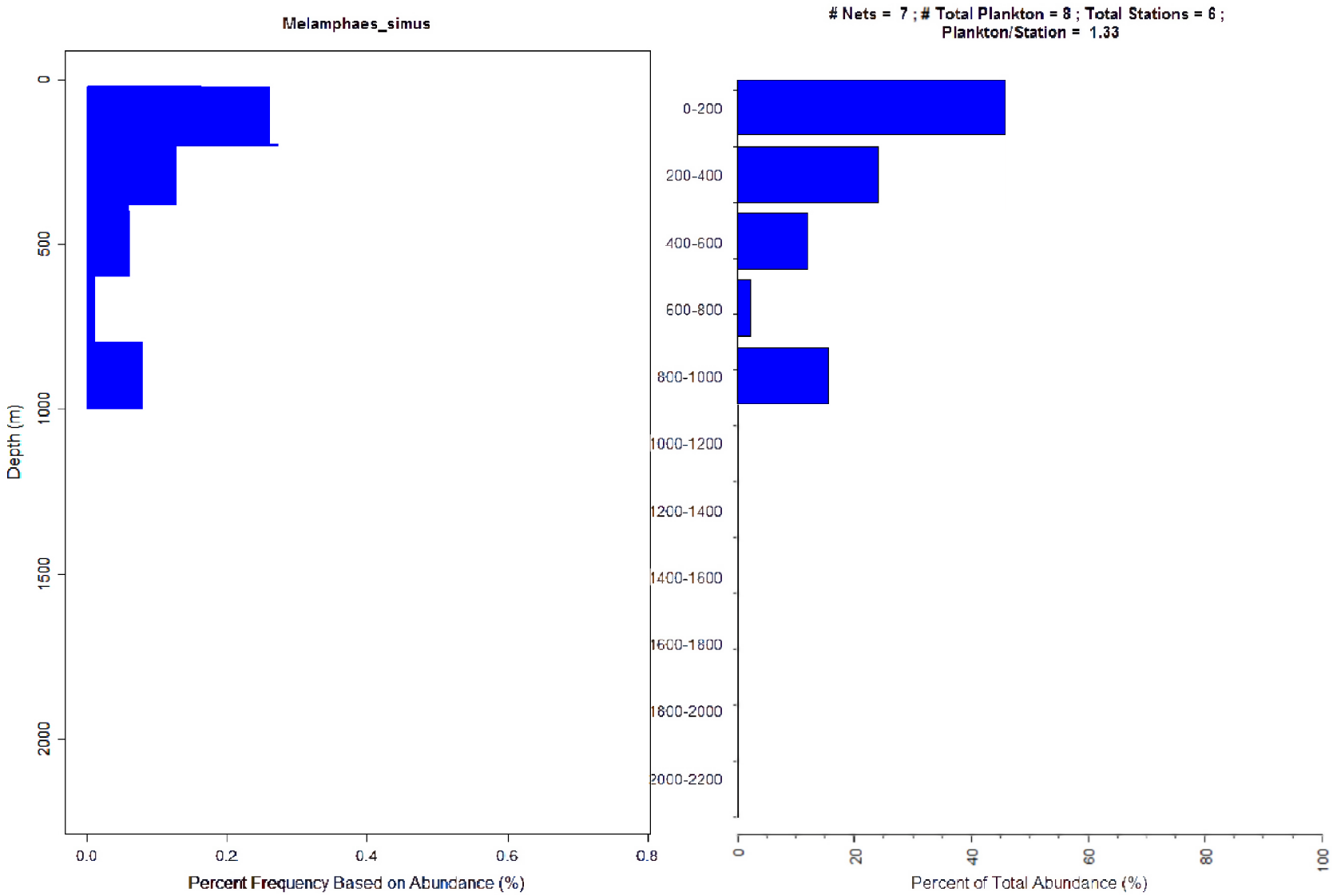
Maurolicus_weitzmani - Deep



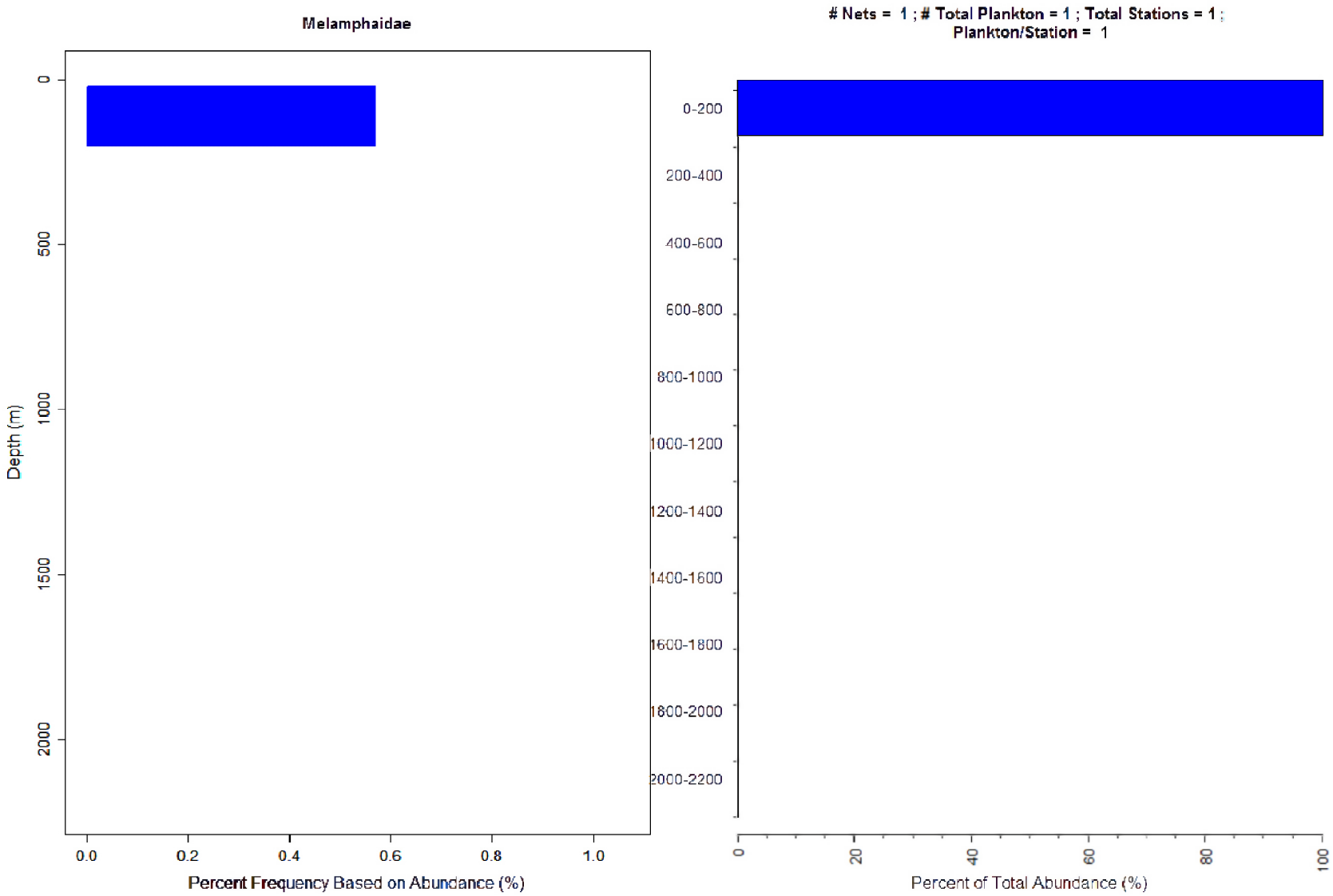
Melamphaes - Deep



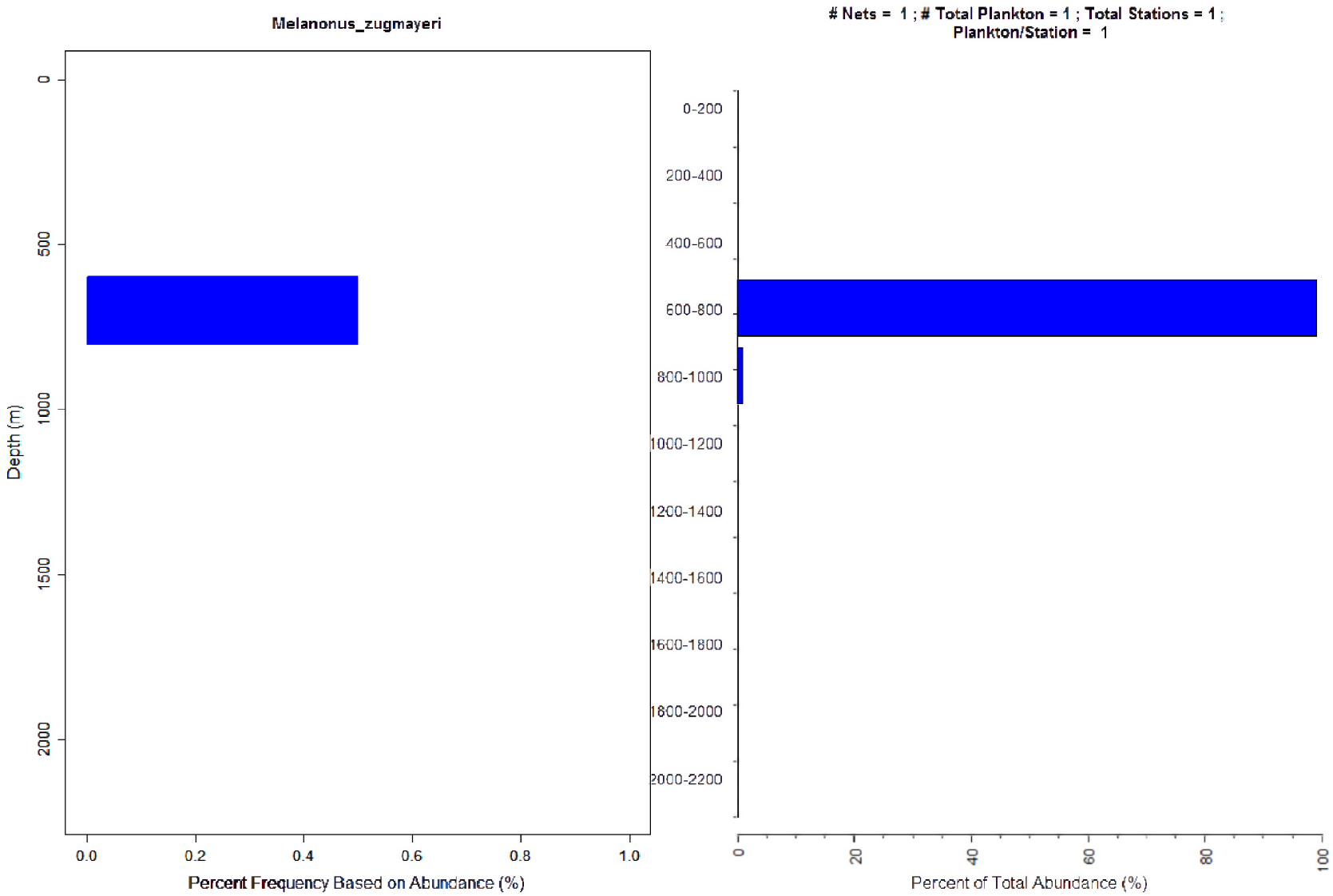
Melamphaes_longivelis - Deep



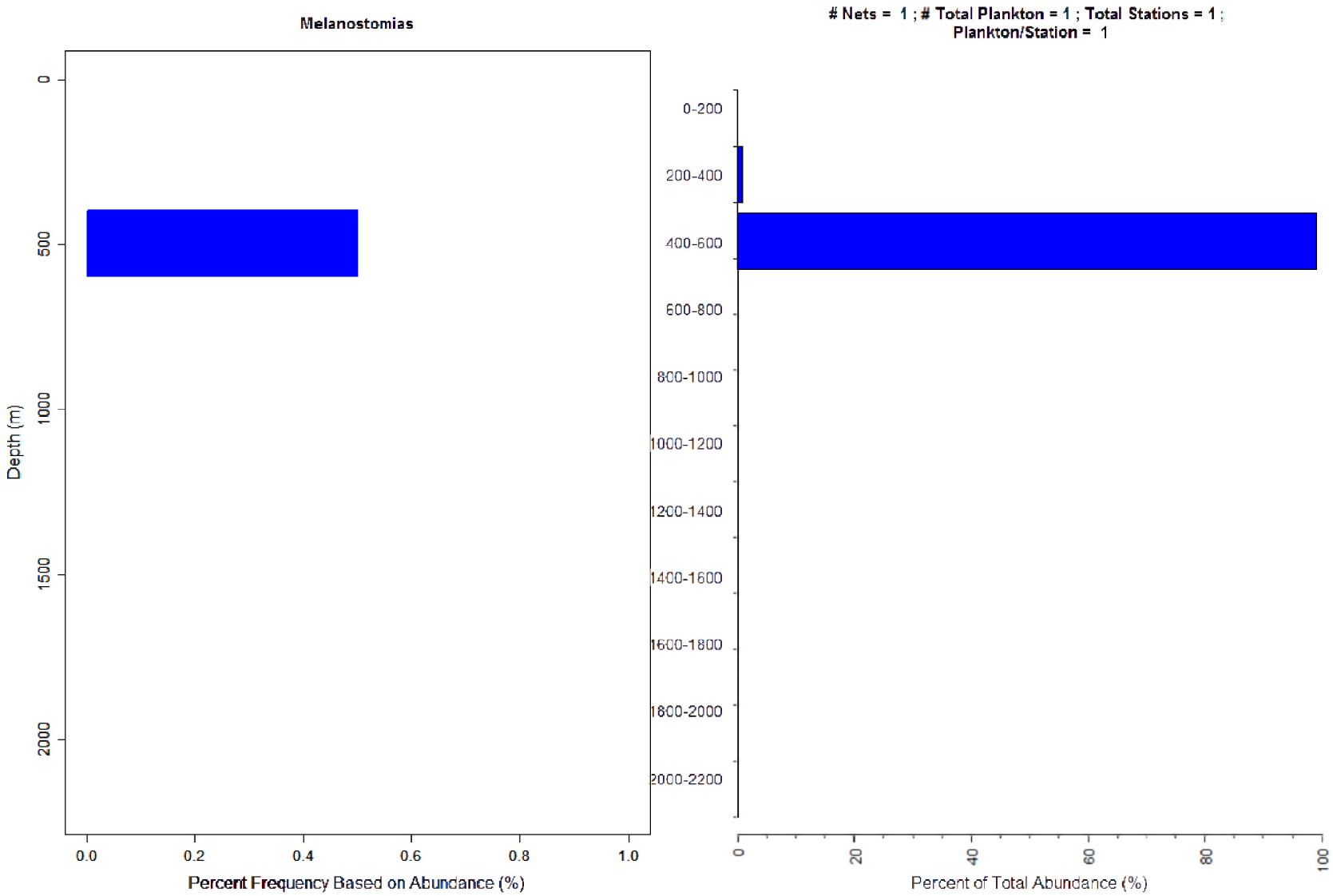
Melamphaes_simus - Deep



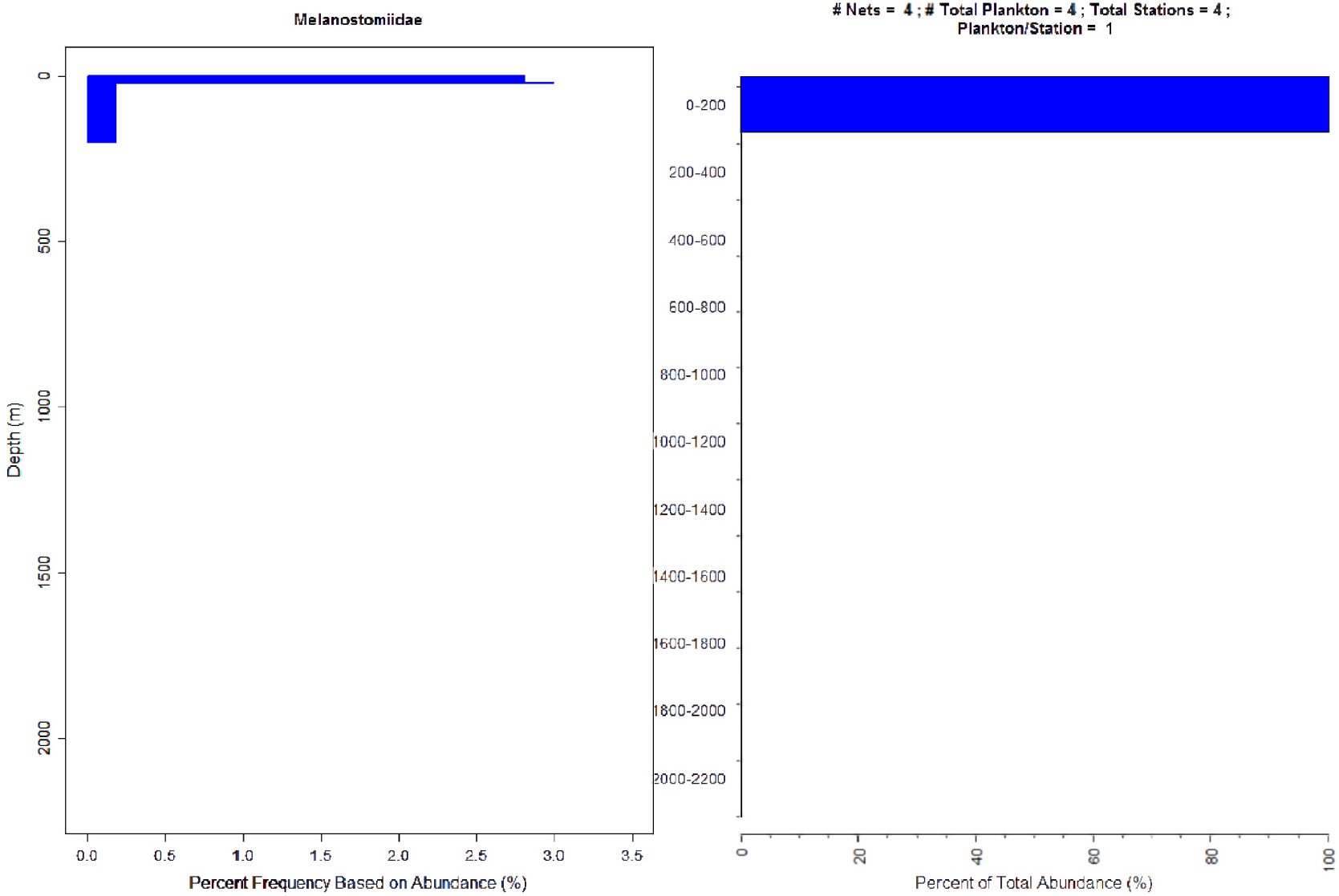
Melamphaidae - Deep



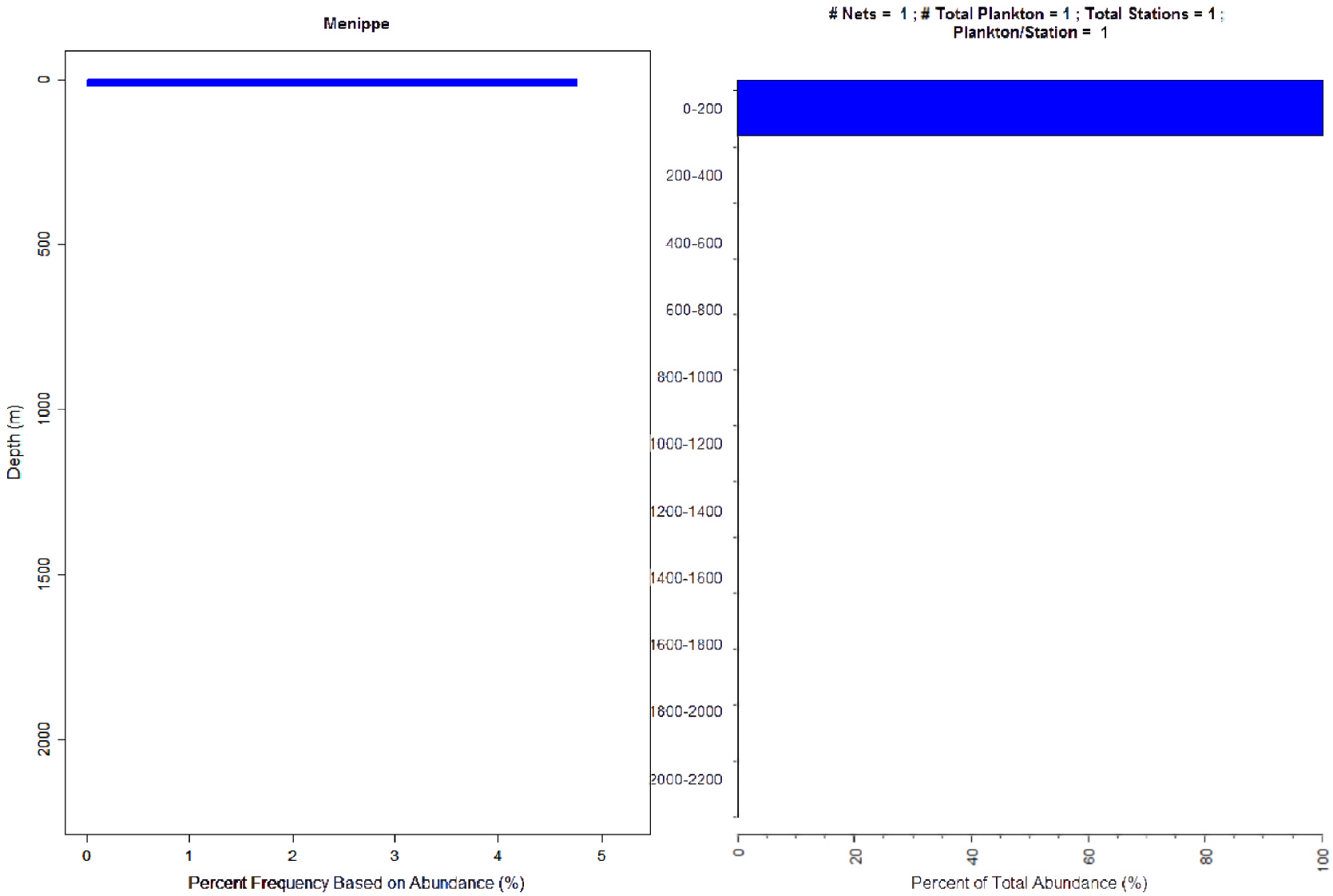
Melanonus_zugmayeri - Deep



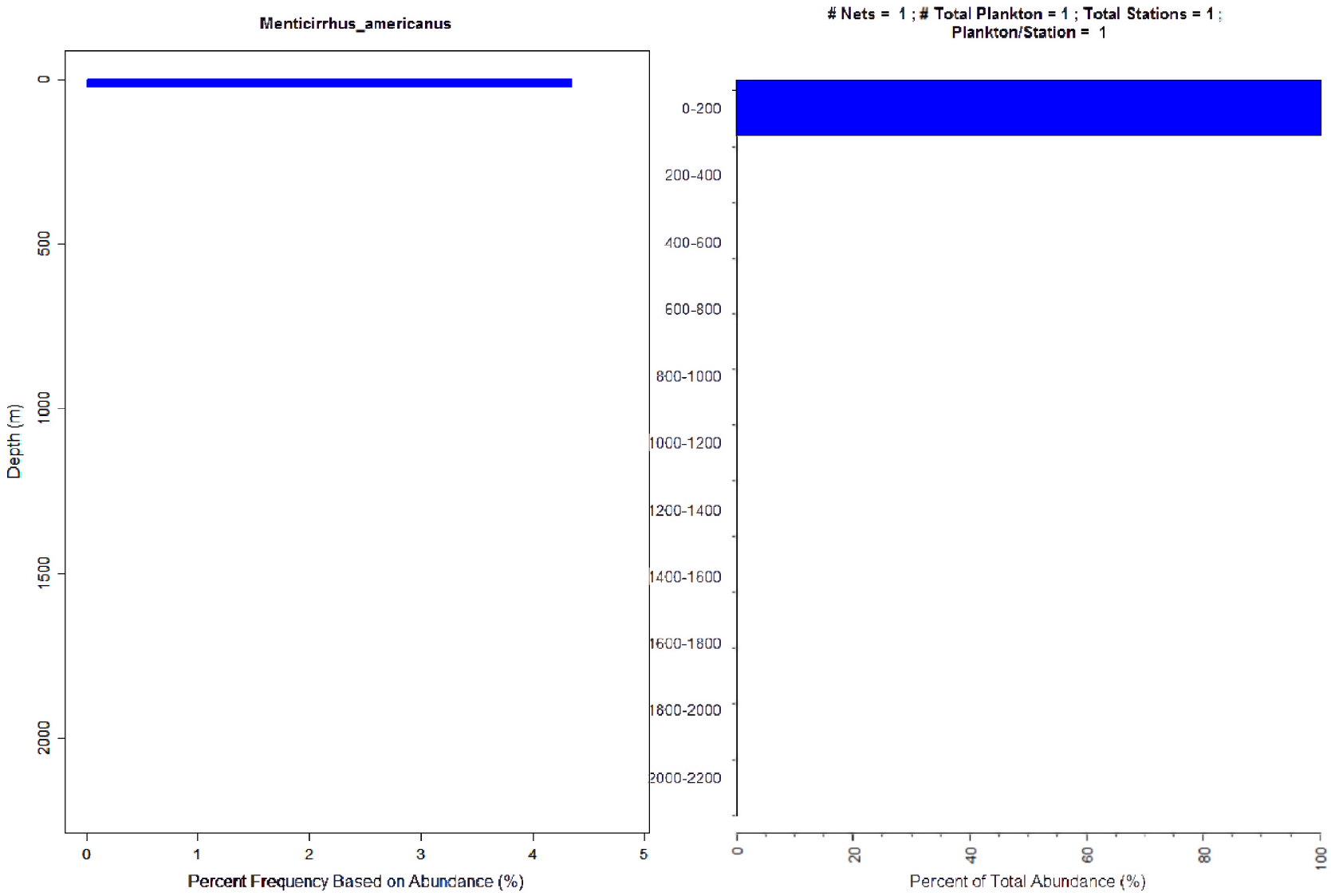
Melanostomias - Deep



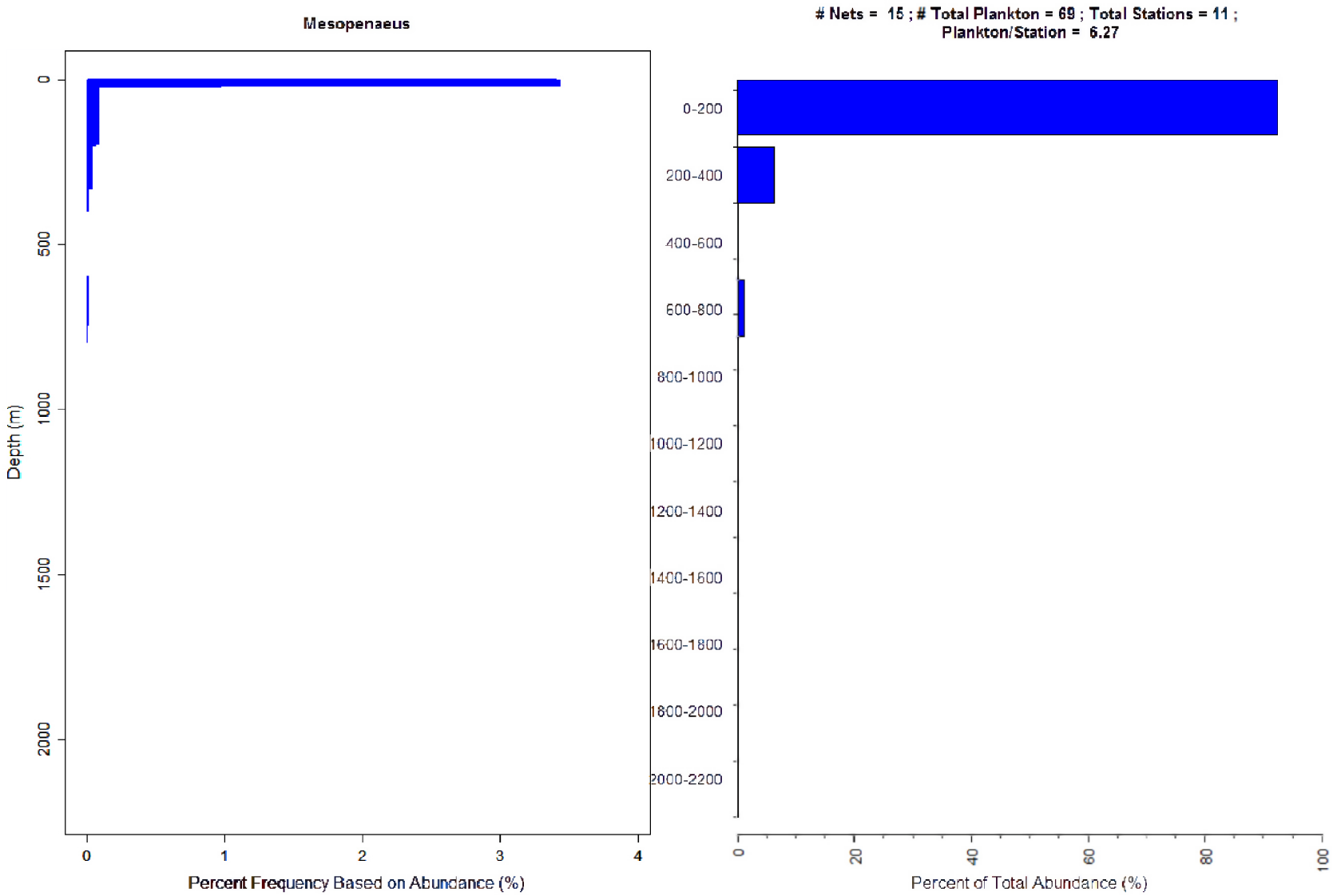
Melanostomiidae - Deep



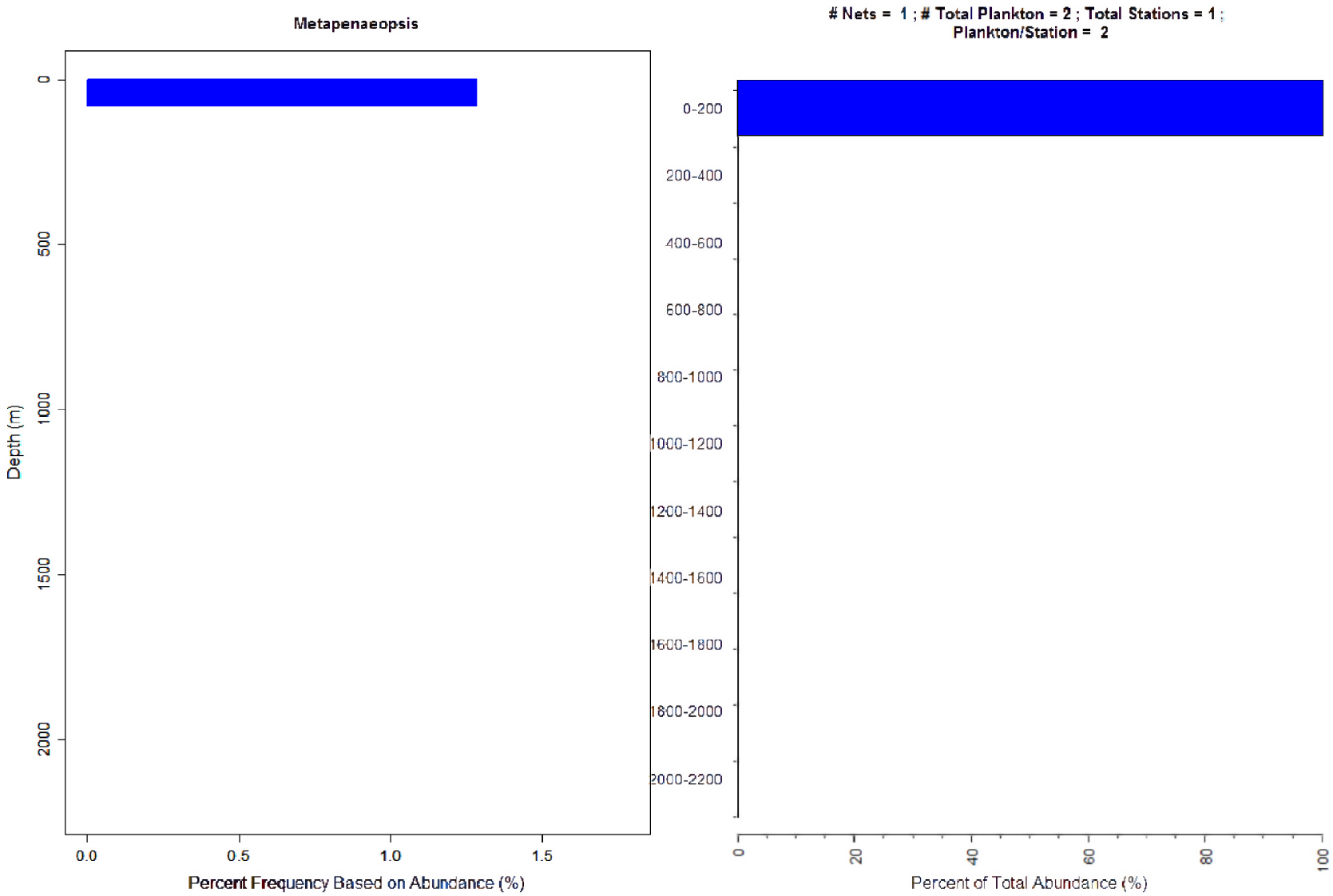
Menippe - Deep



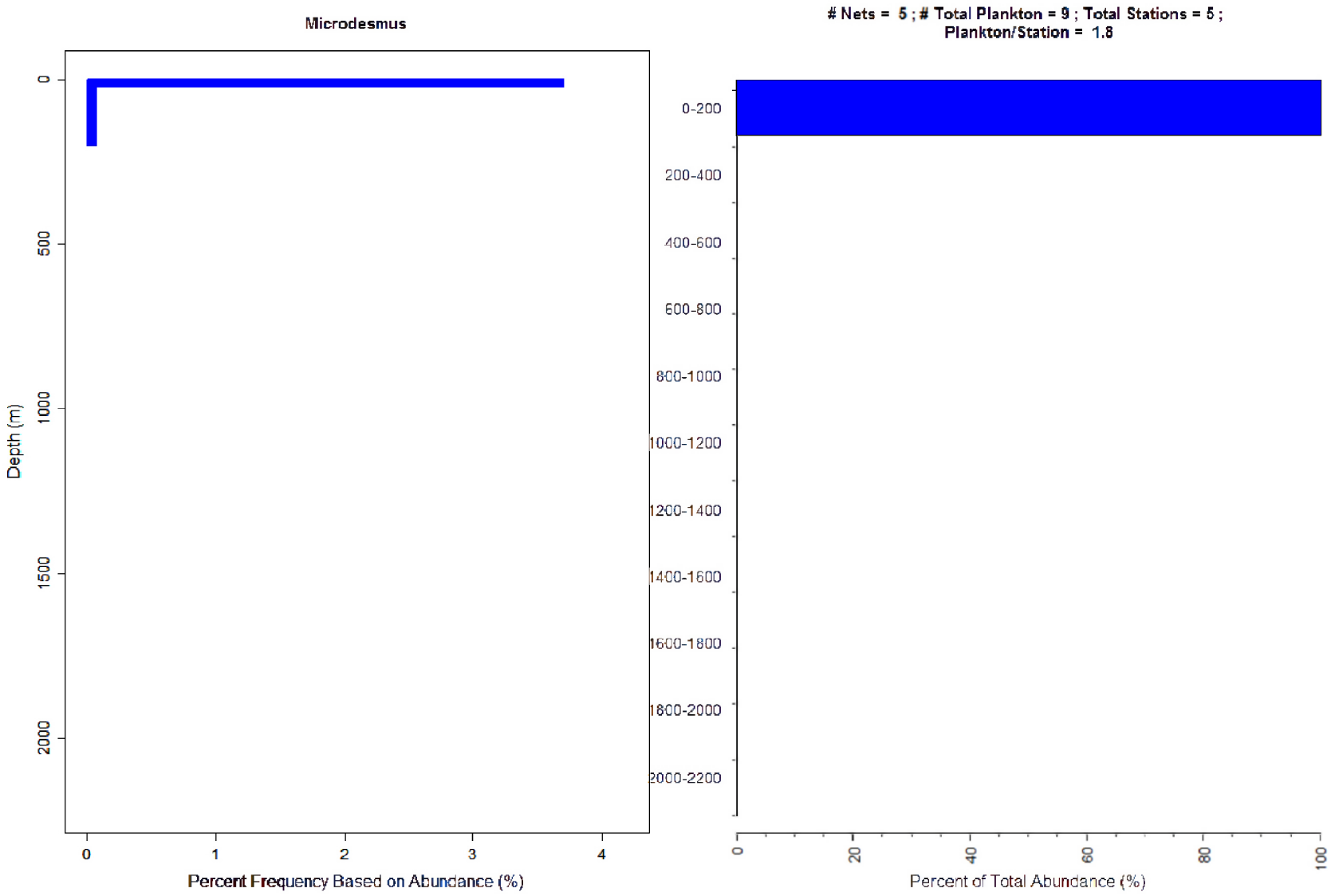
Menticirrhus_americanus - Deep



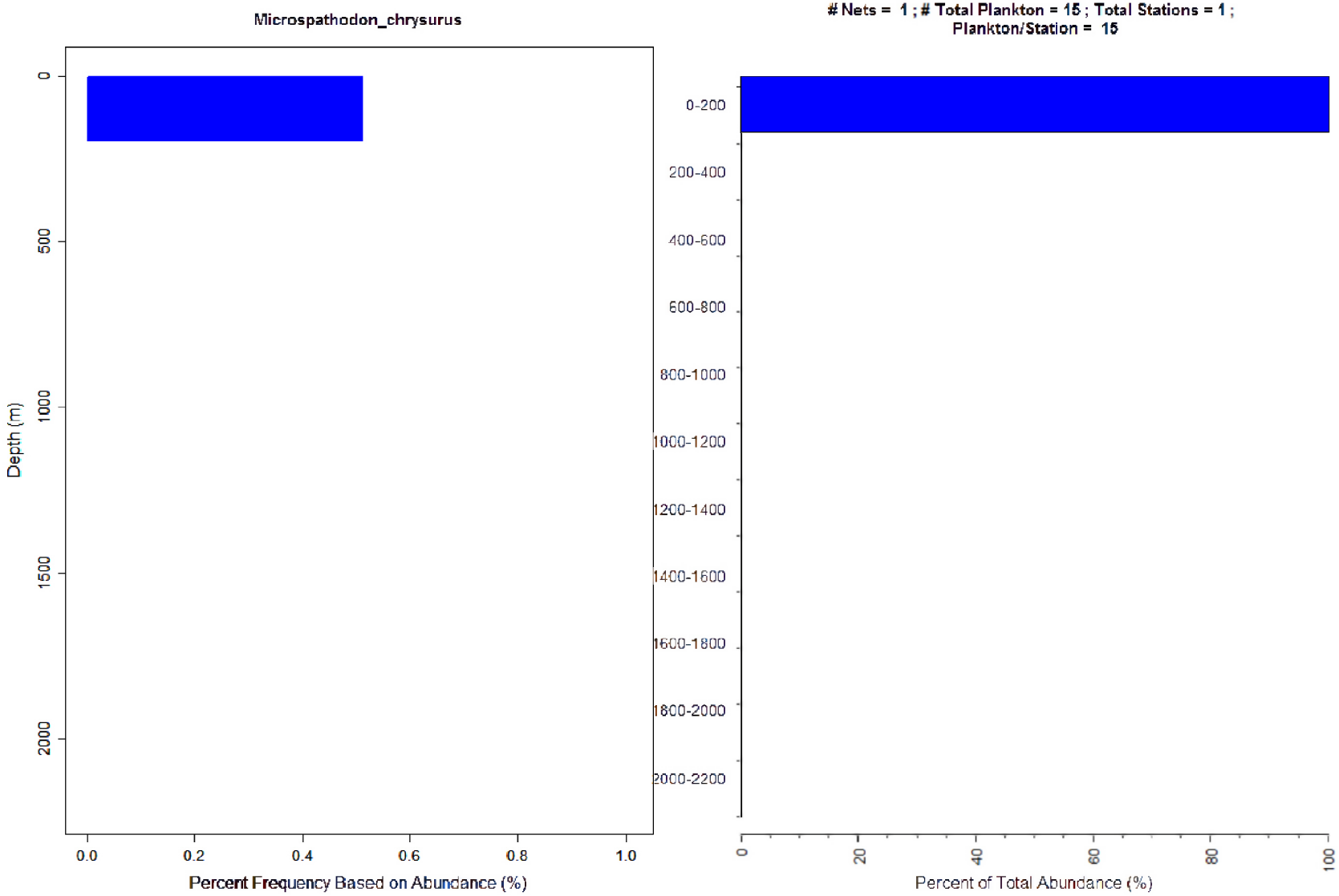
Mesopenaeus - Deep



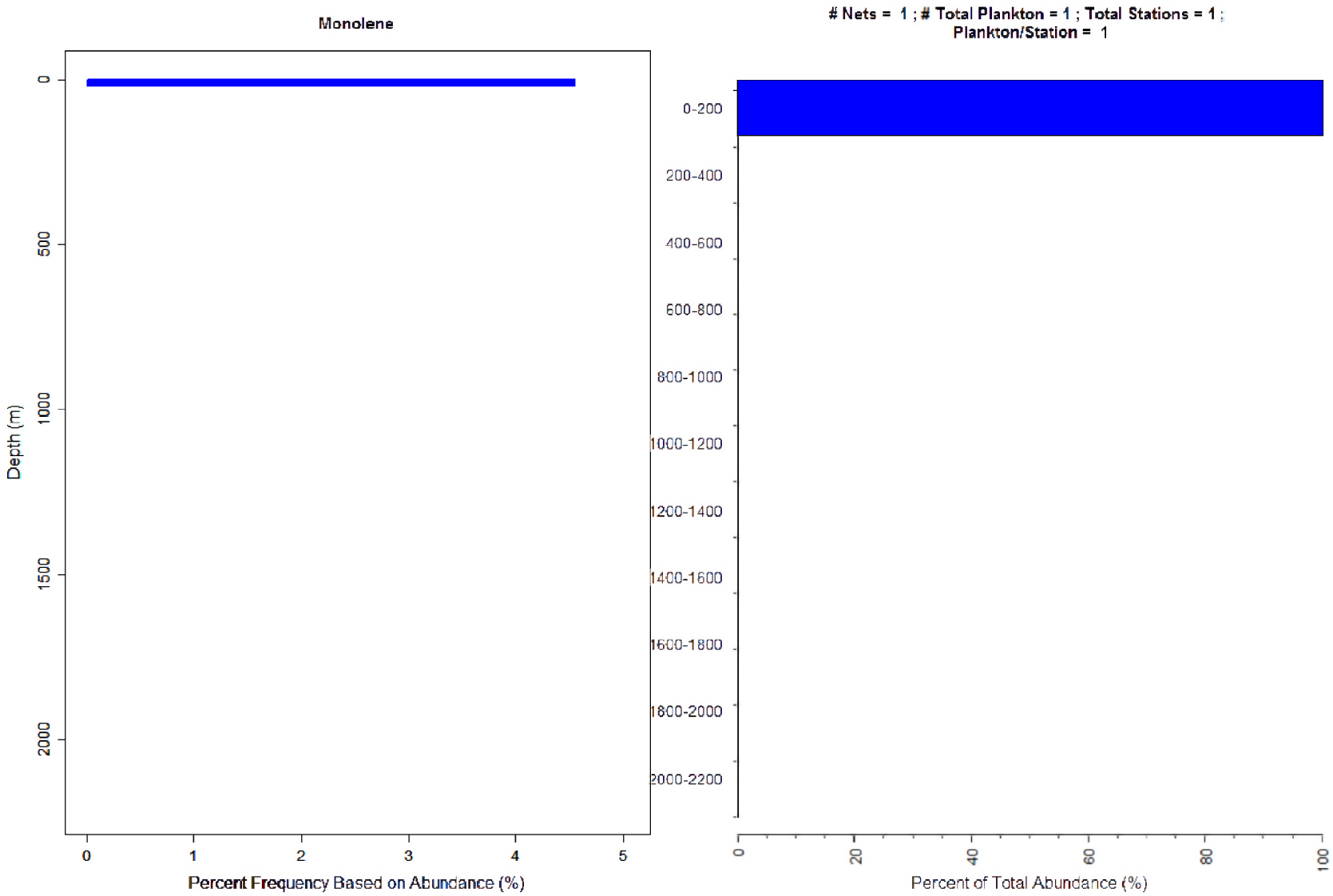
Metapenaeopsis - Deep



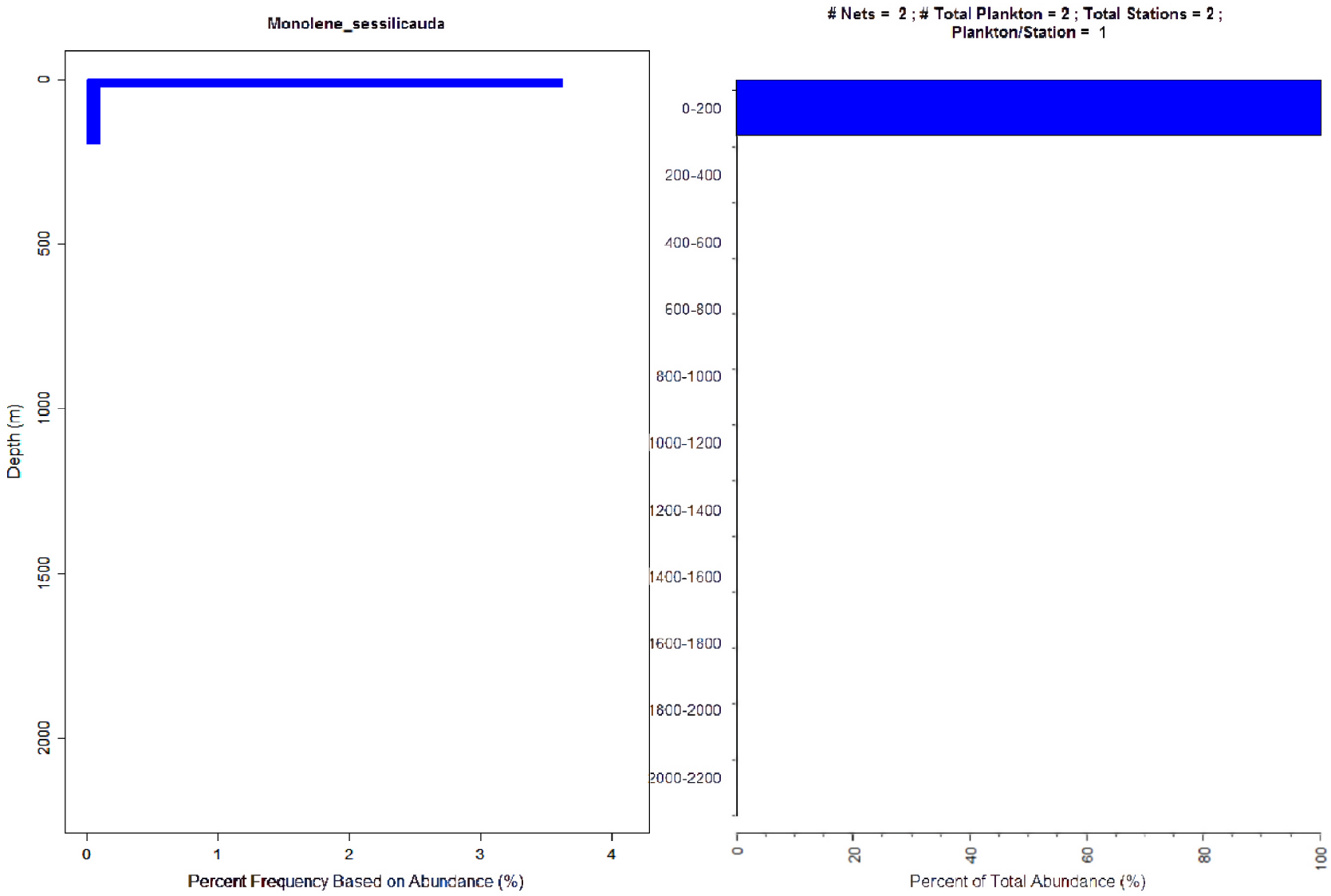
Microdesmus - Deep



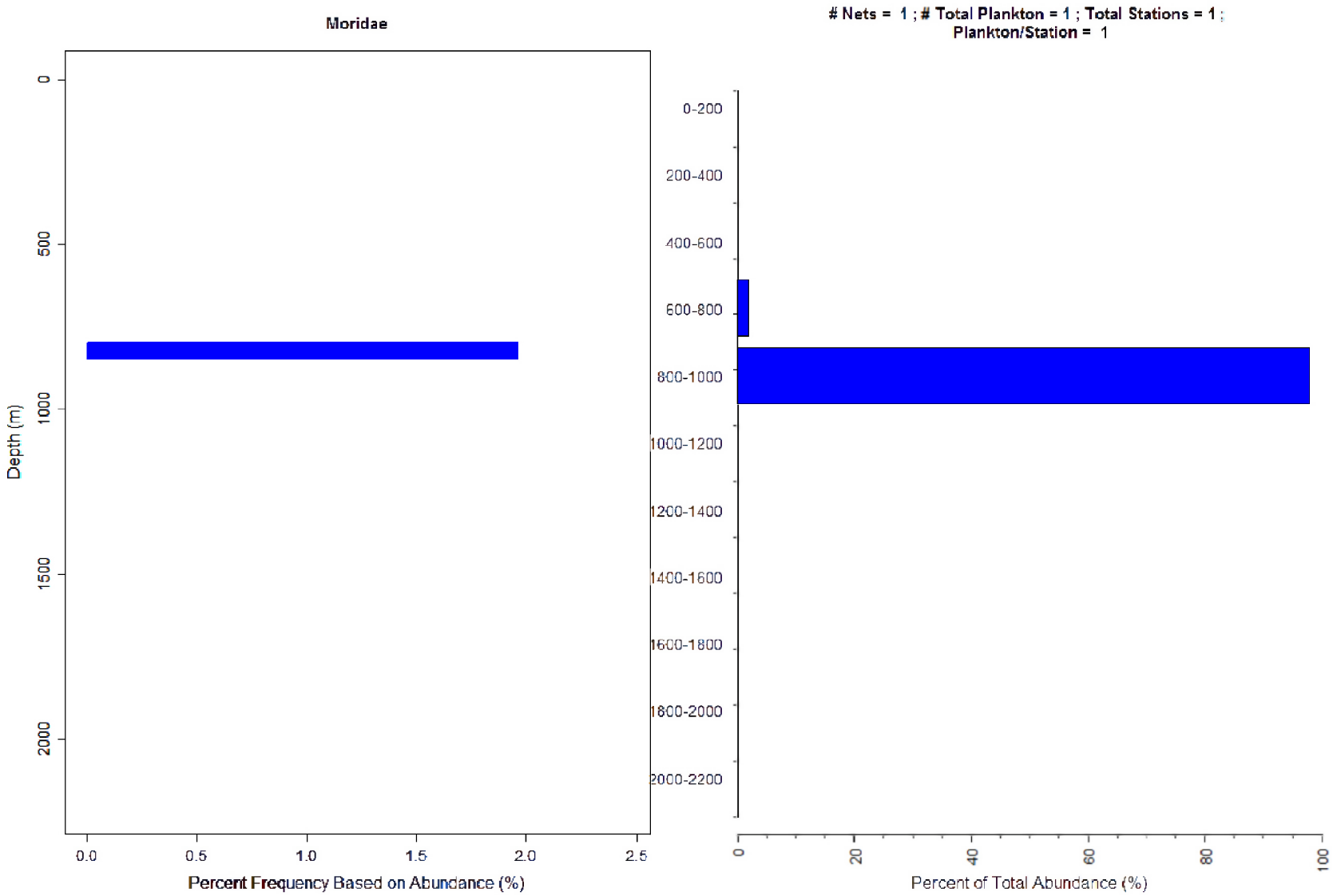
Microspathodon_chrysurus - Deep



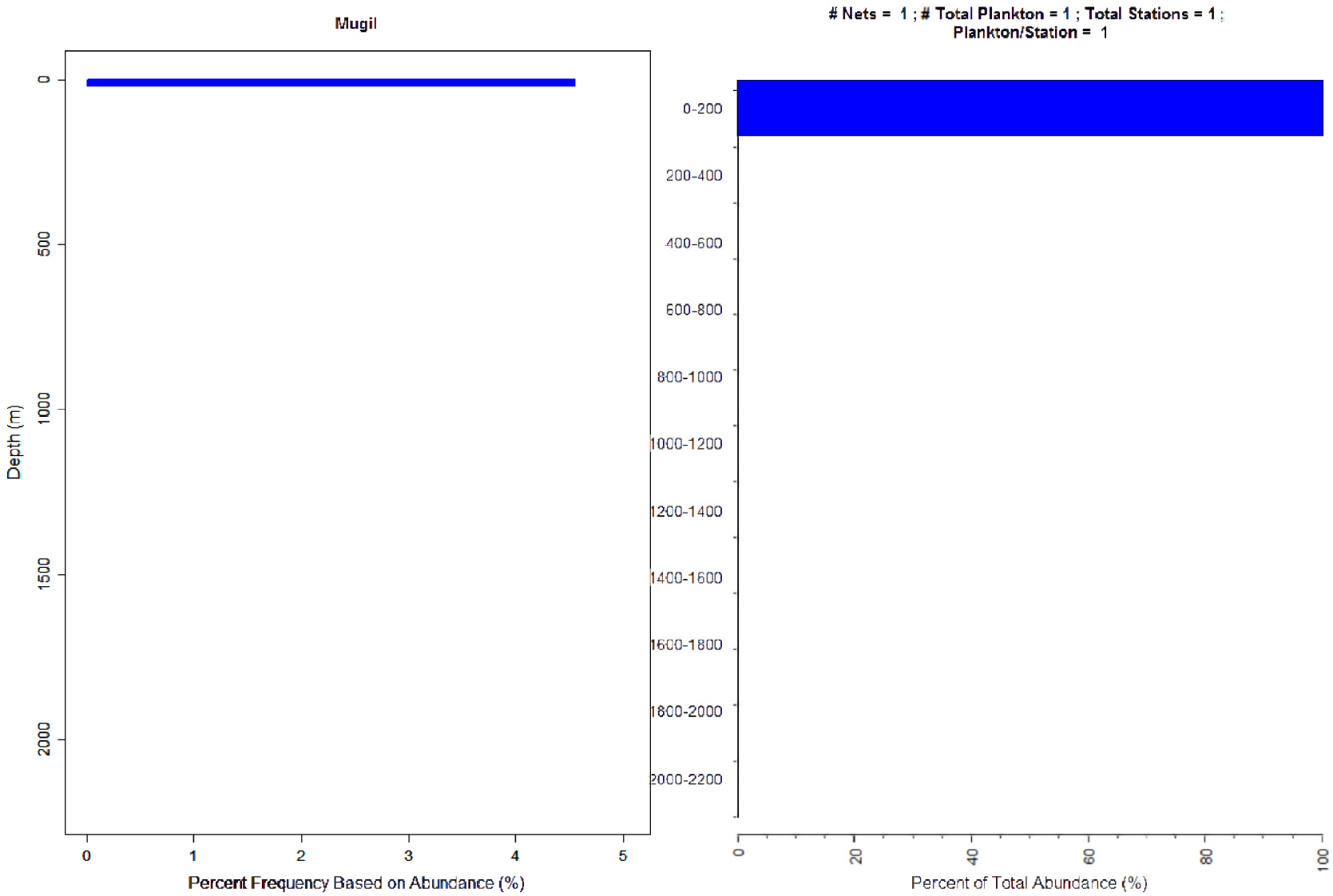
Monolene - Deep



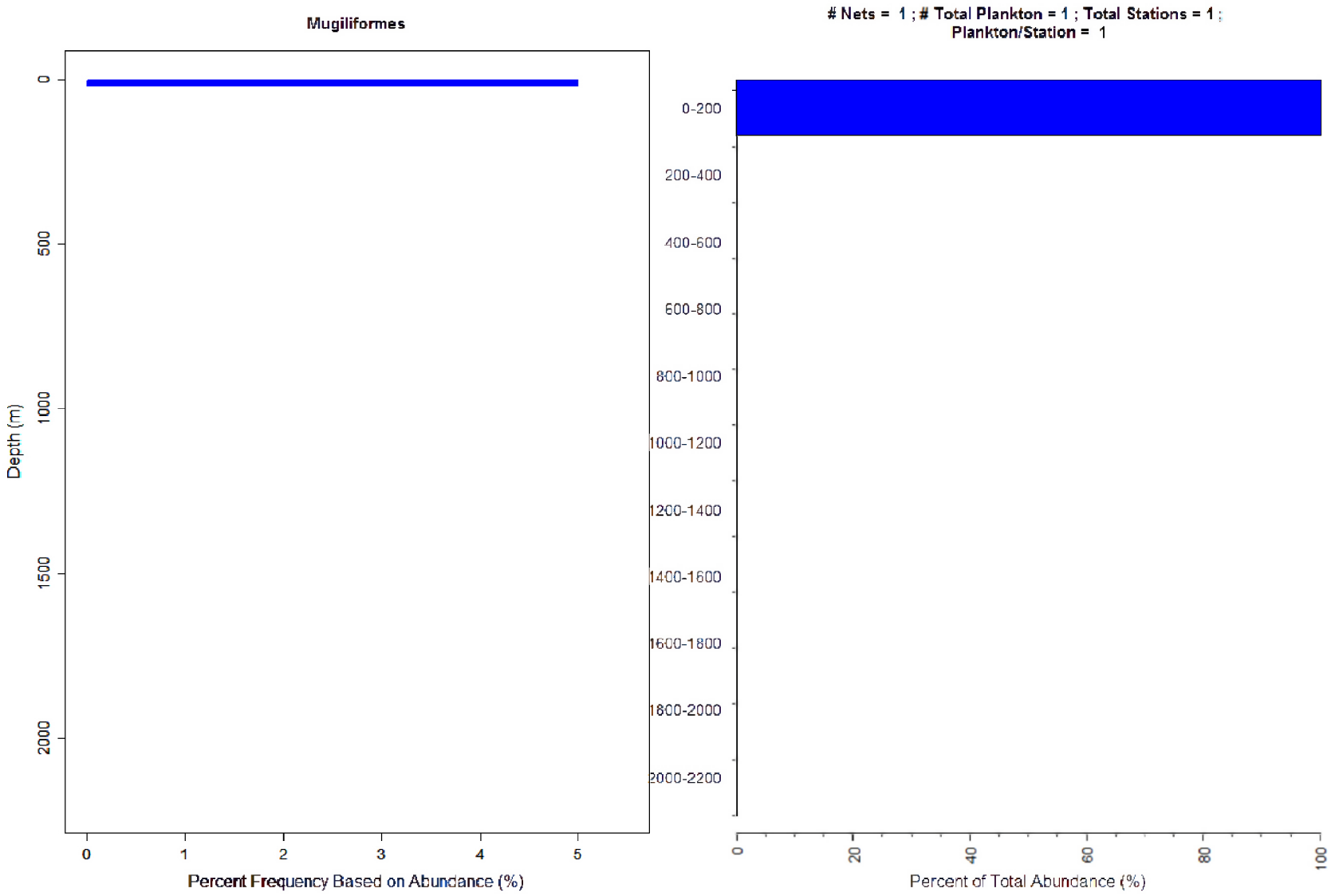
Monolene_sessilicauda - Deep



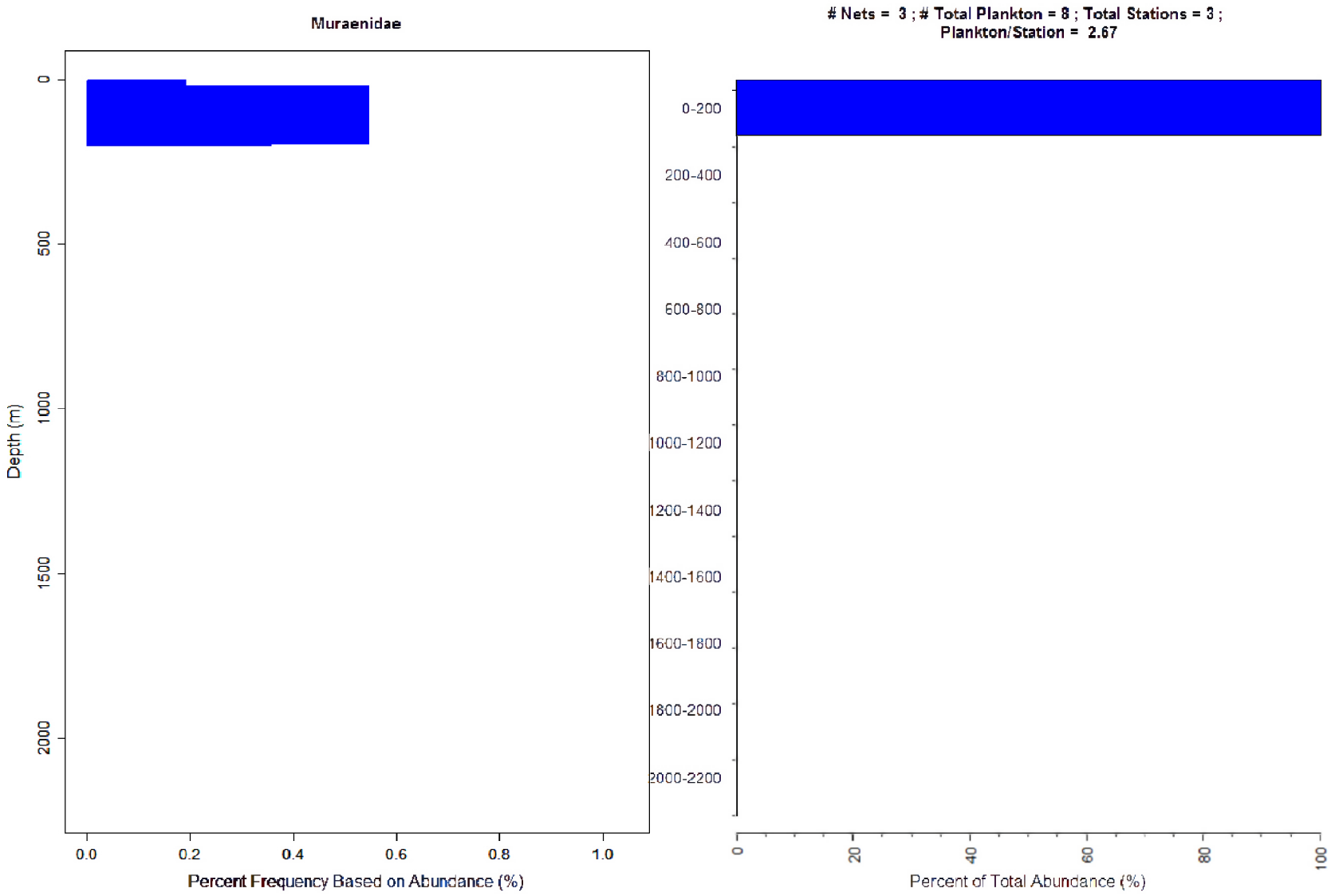
Moridae - Deep


Mugil
Nets = 1 ; # Total Plankton = 1 ; Total Stations = 1 ;
Plankton/Station = 1
Depth (m)
0
500
1000
1500
2000
0
1
2
3
4
5
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

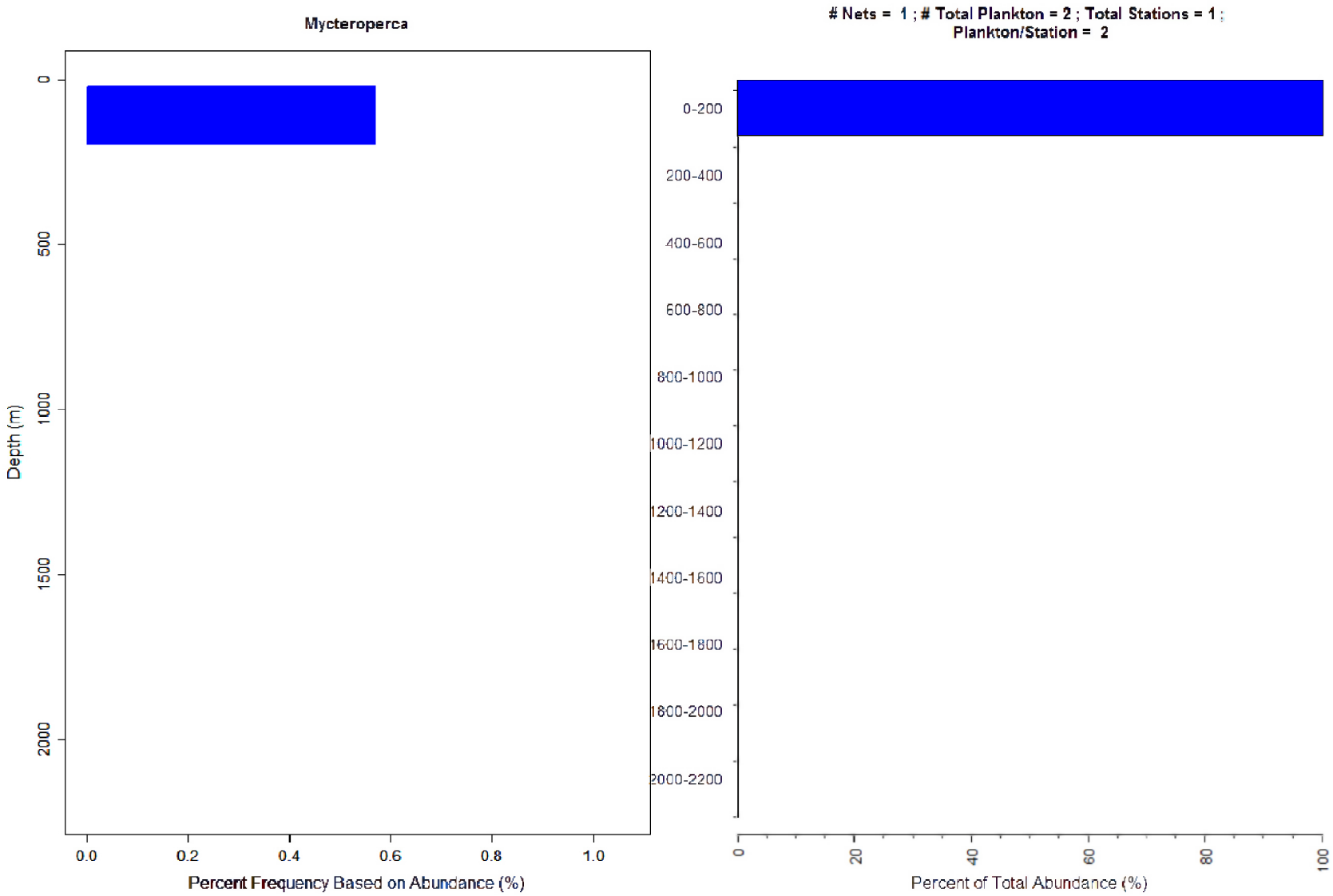
Mugil - Deep



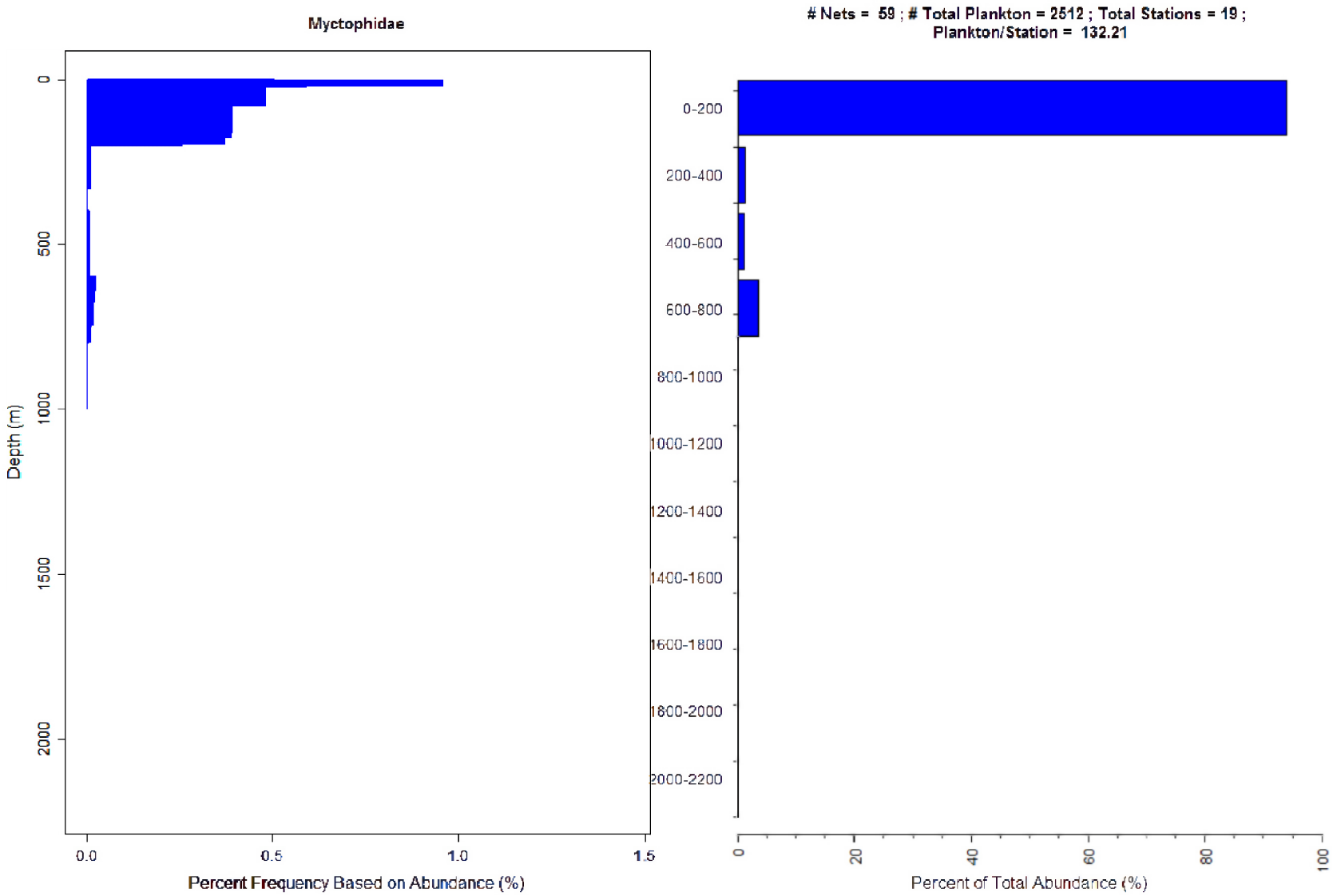
Mugiliformes - Deep



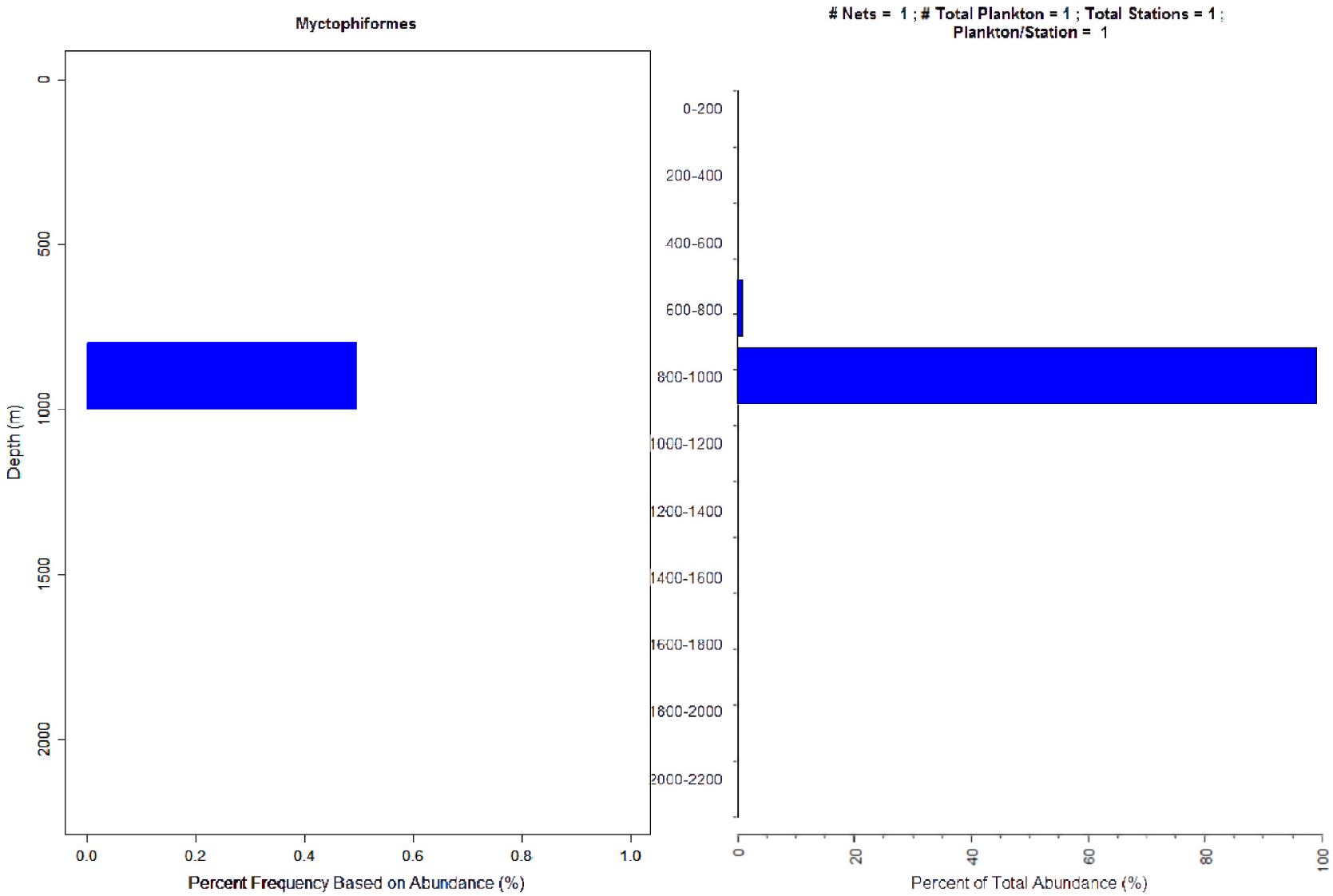
Muraenidae - Deep



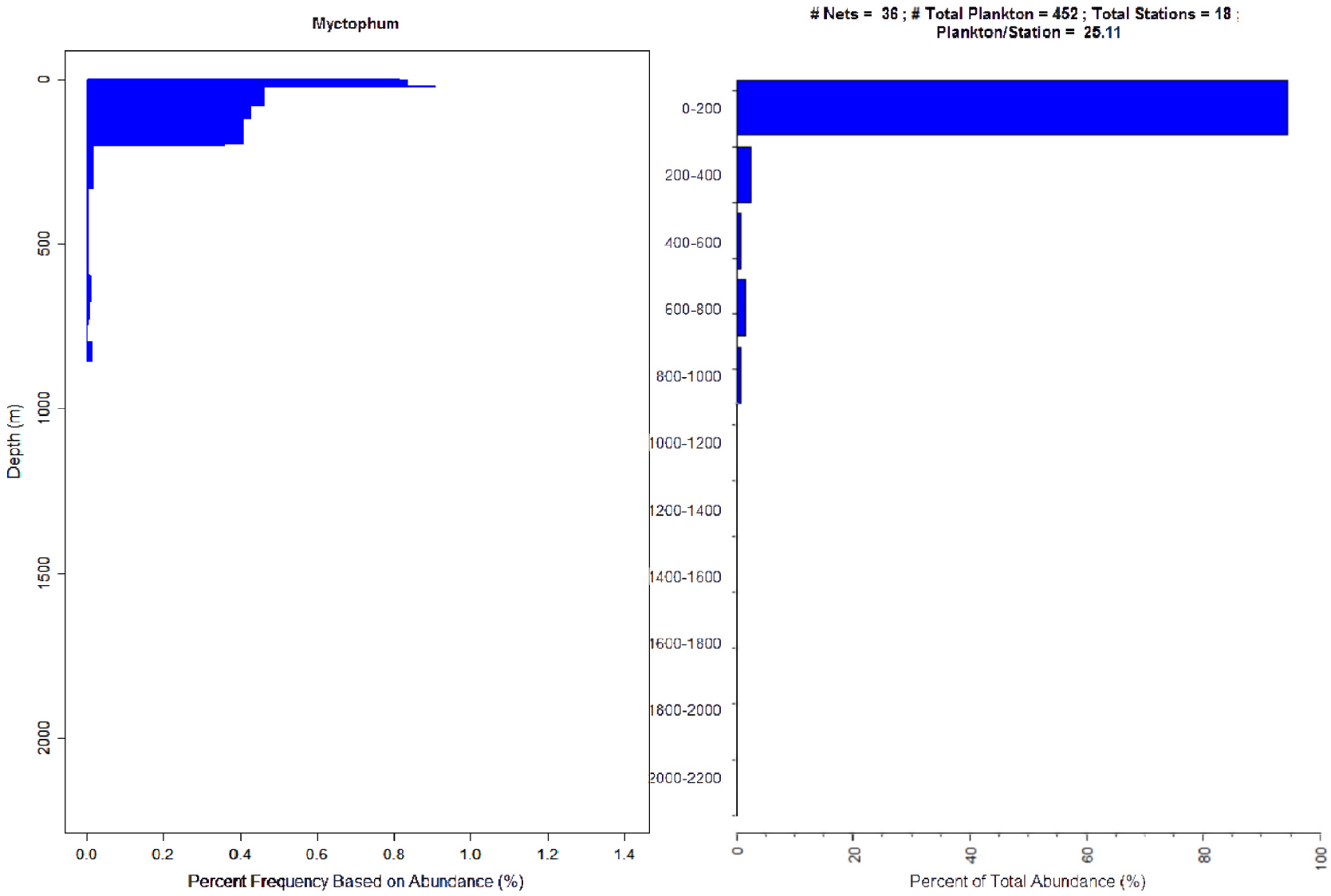
Mycteroperca - Deep



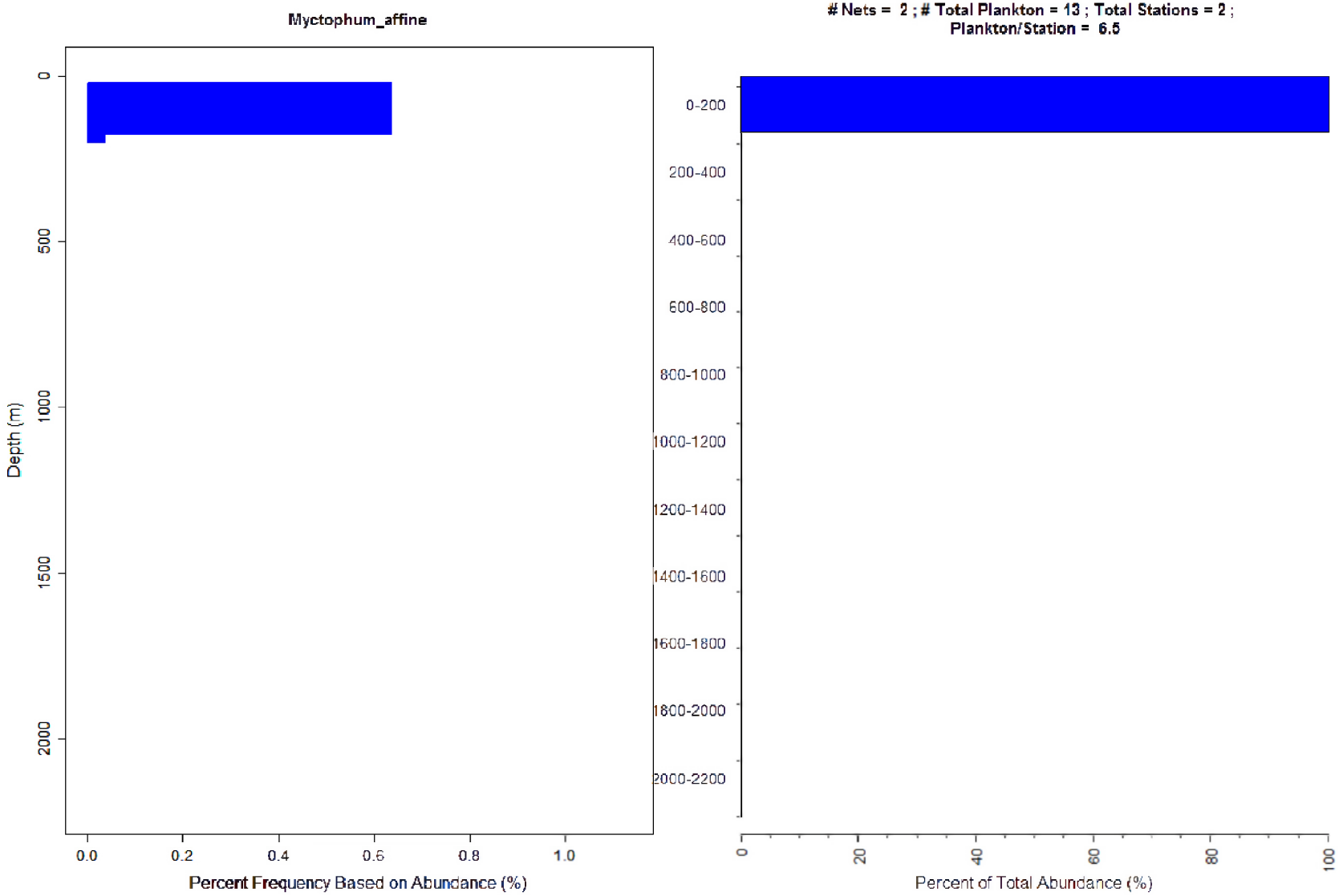
Myctophidae - Deep



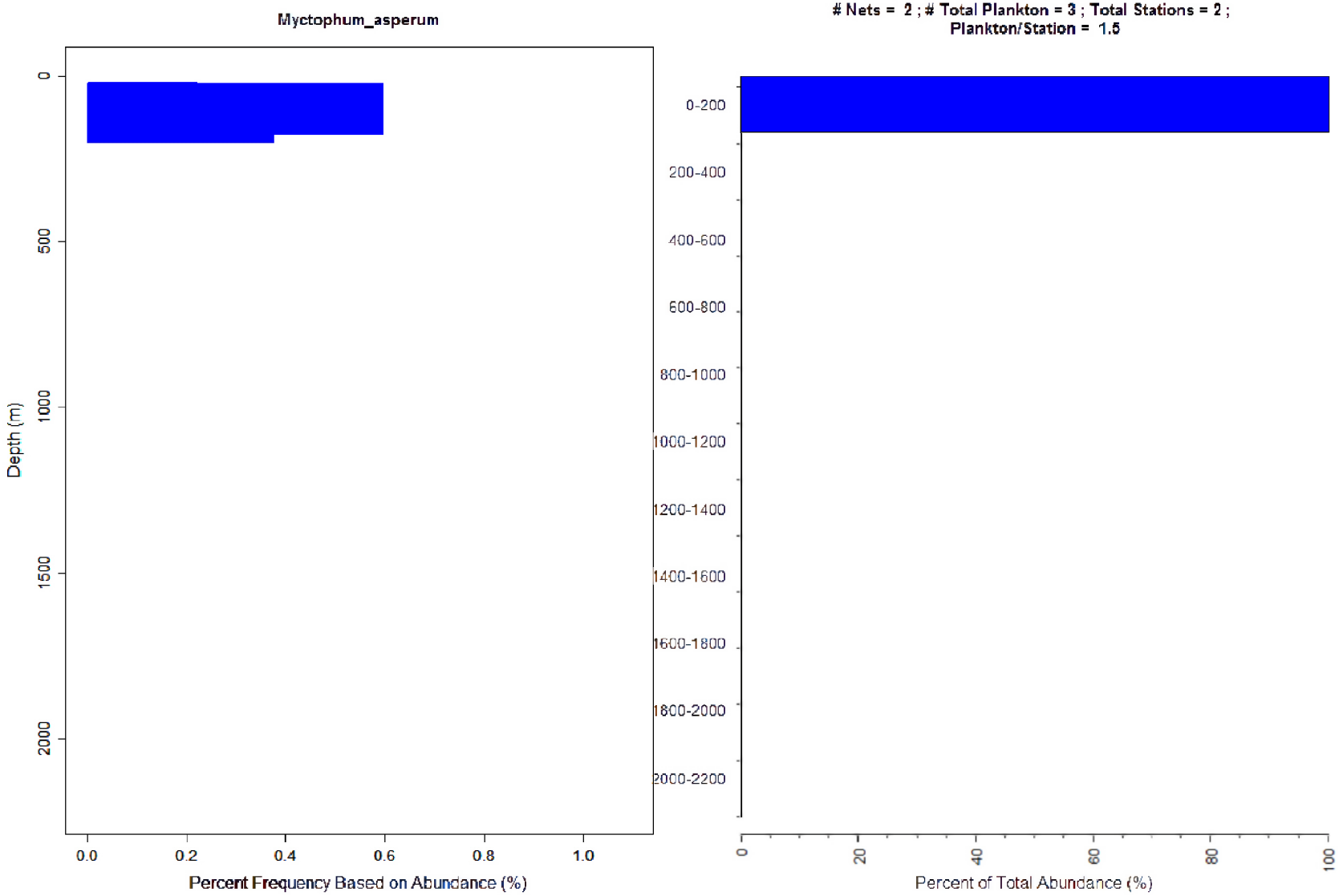
Myctophiformes - Deep



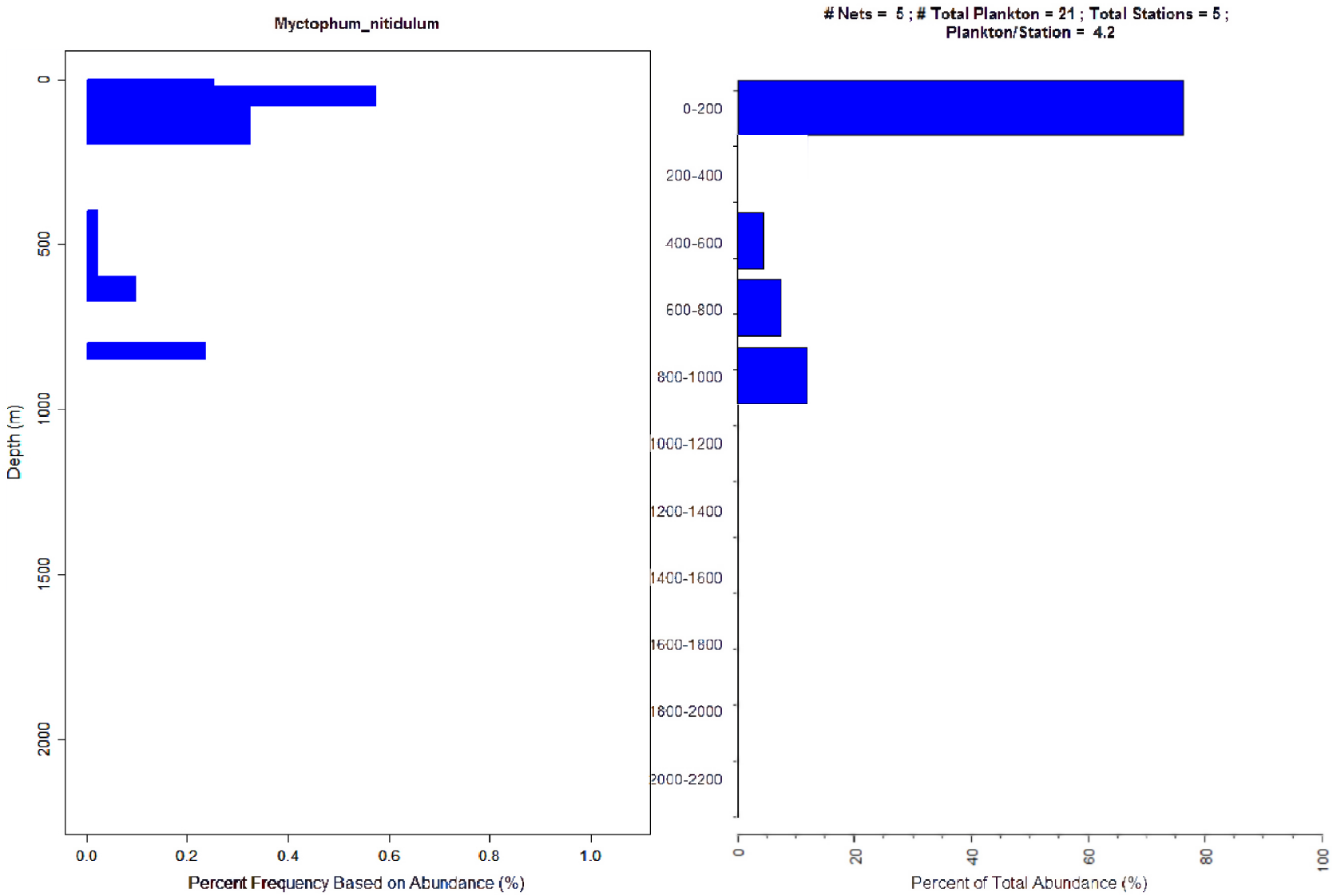
Myctophum - Deep



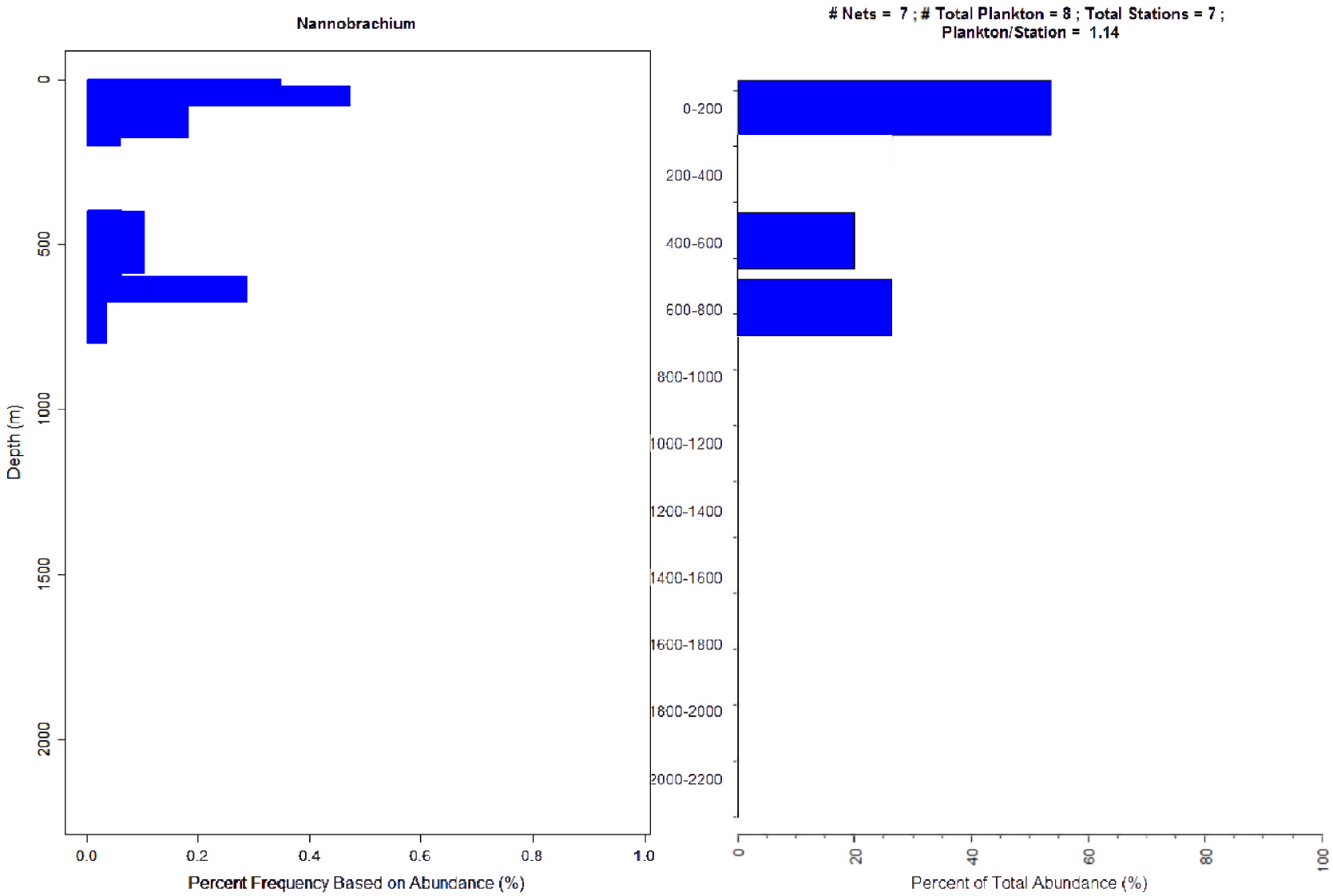
Myctophum_affine - Deep



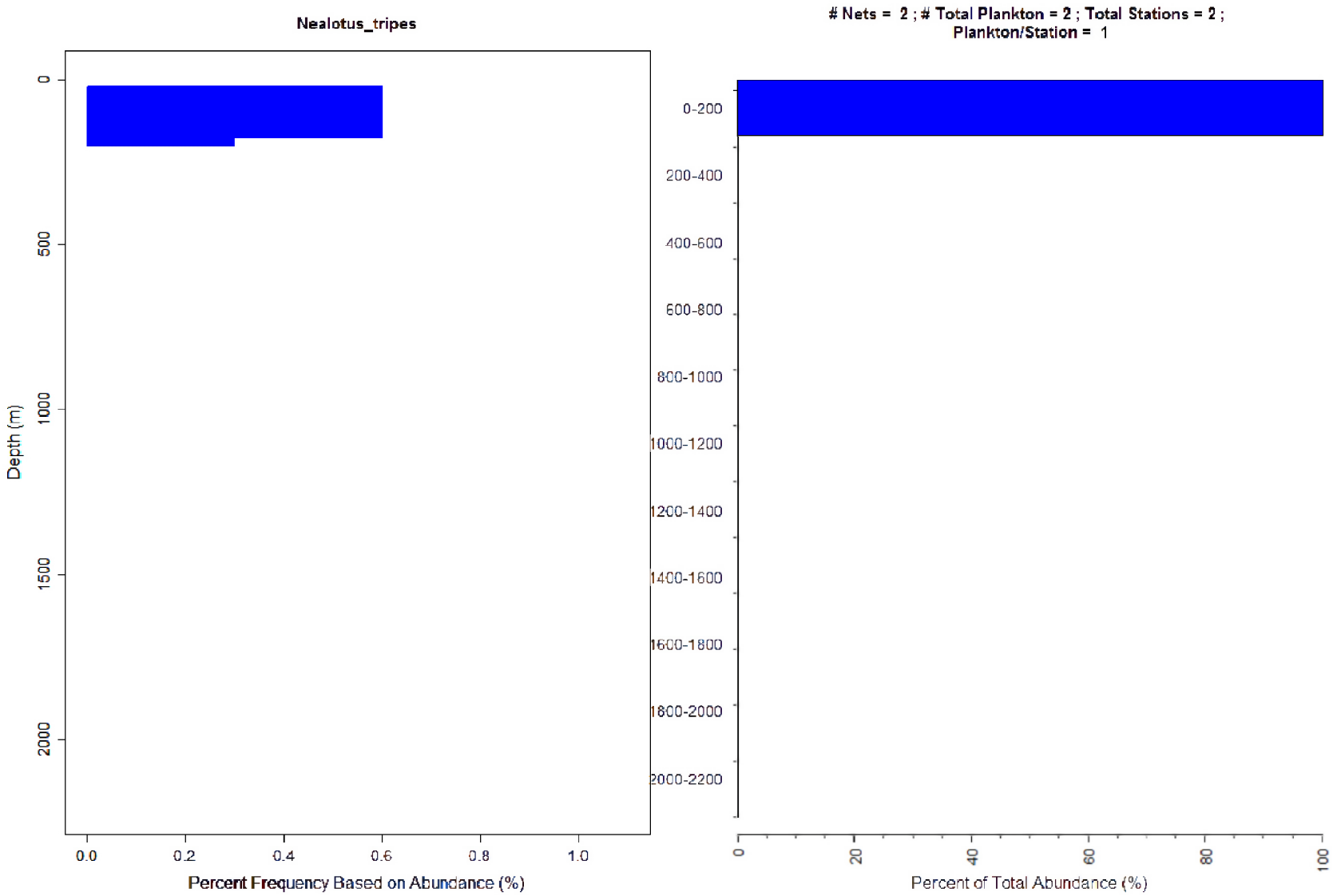
Myctophum_asperum - Deep



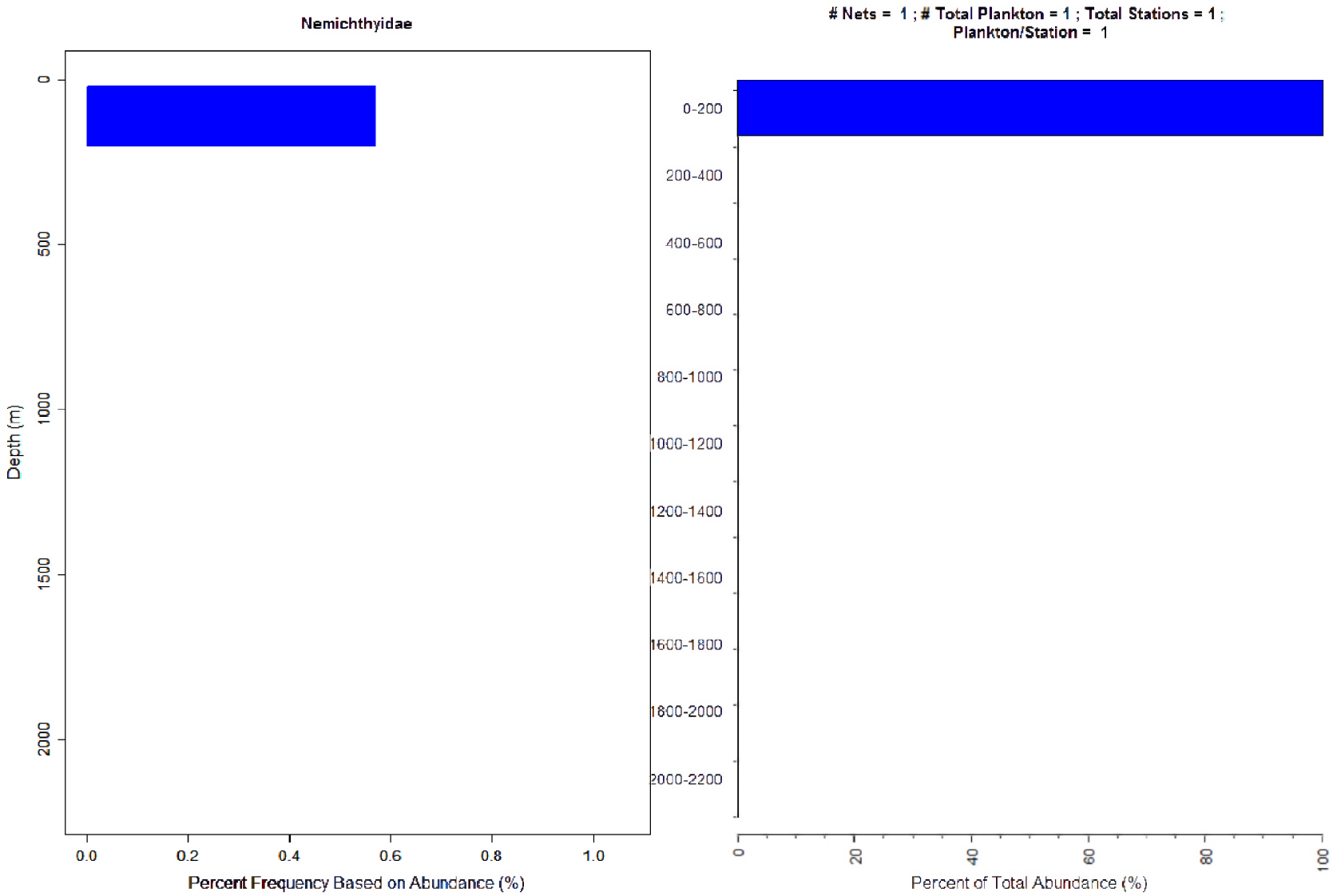
Myctophum_nitidulum - Deep



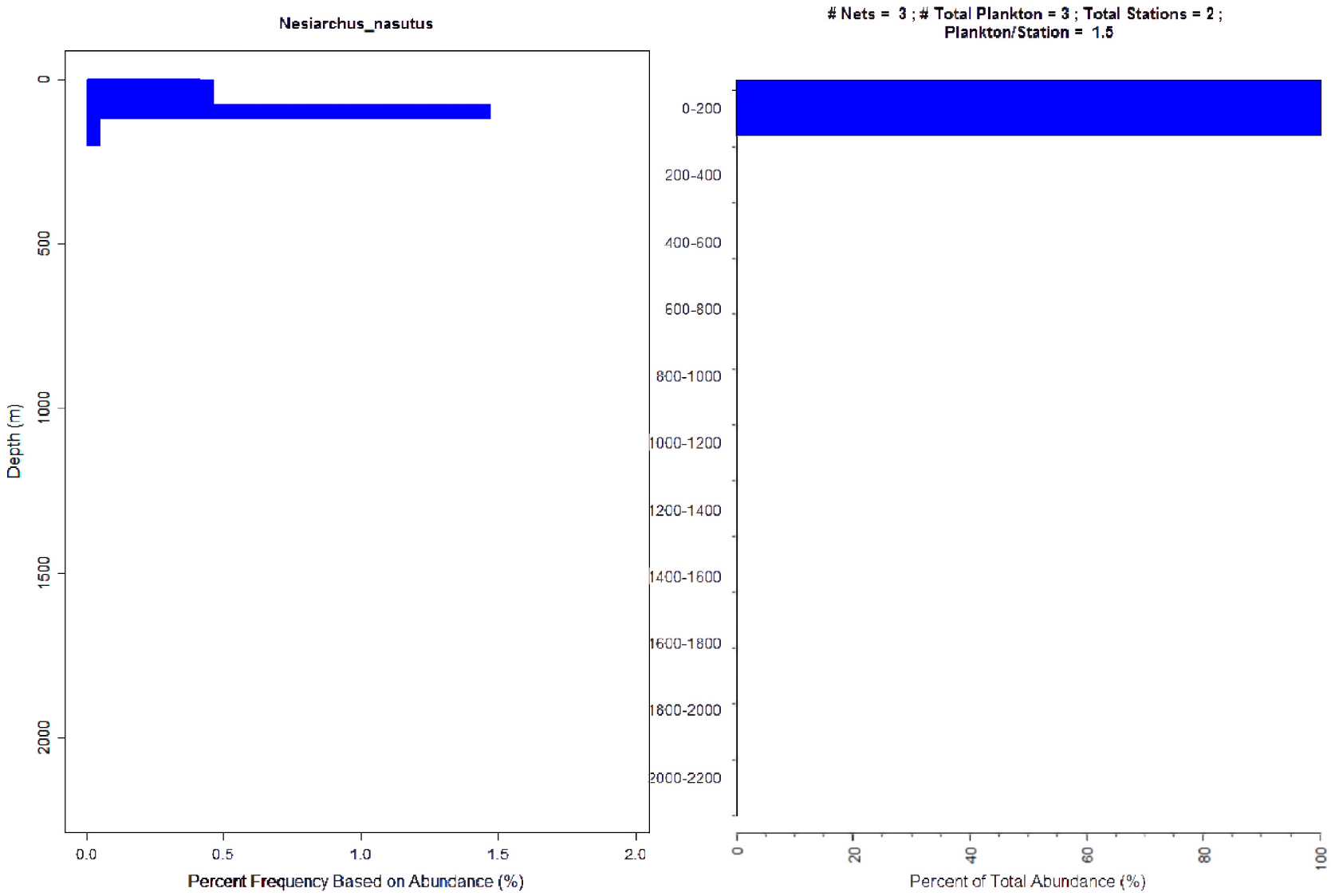
Nannobrachium - Deep



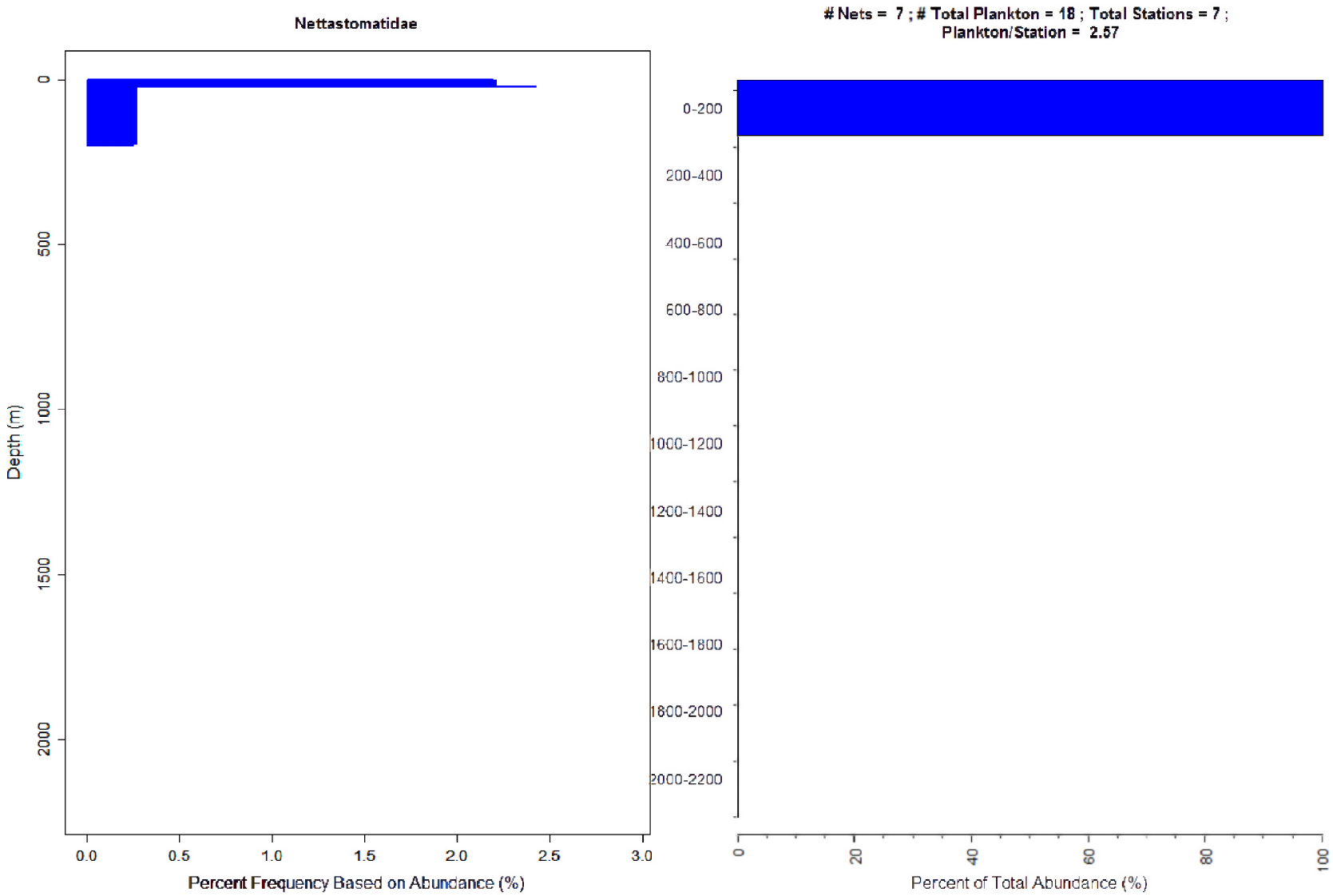
Nealotus_tripes - Deep



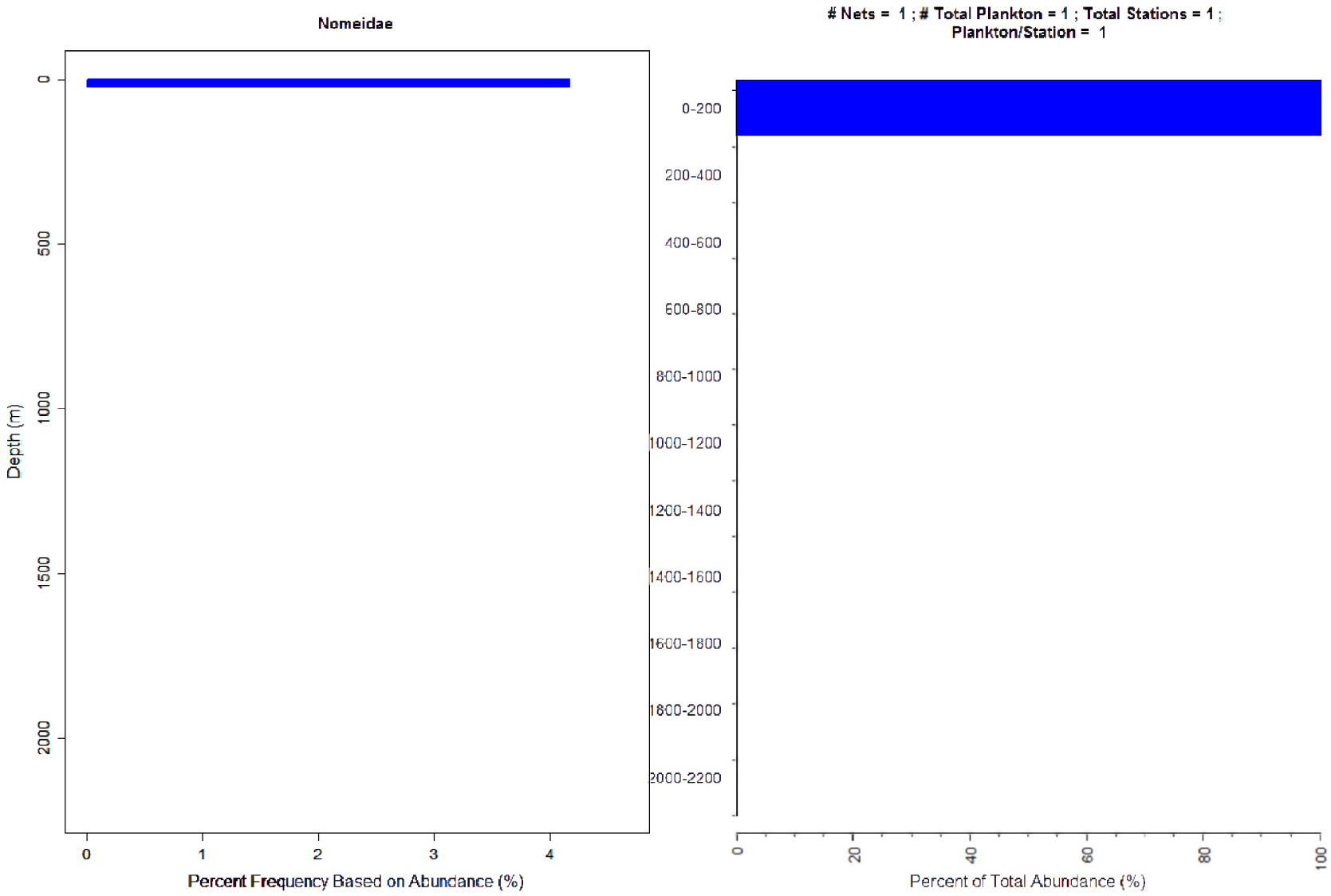
Nemichthyidae - Deep



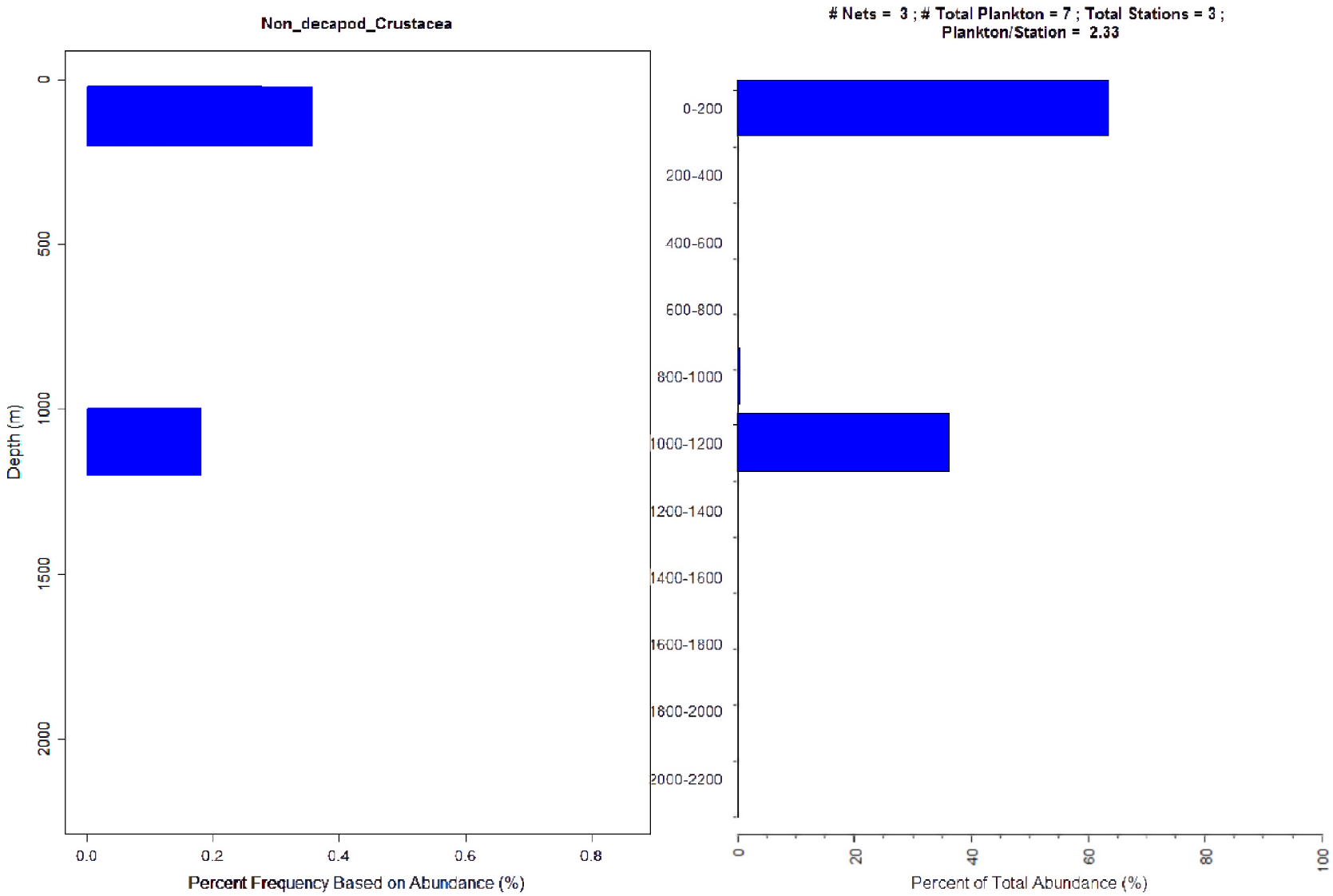
Nesiarchus_nasutus - Deep



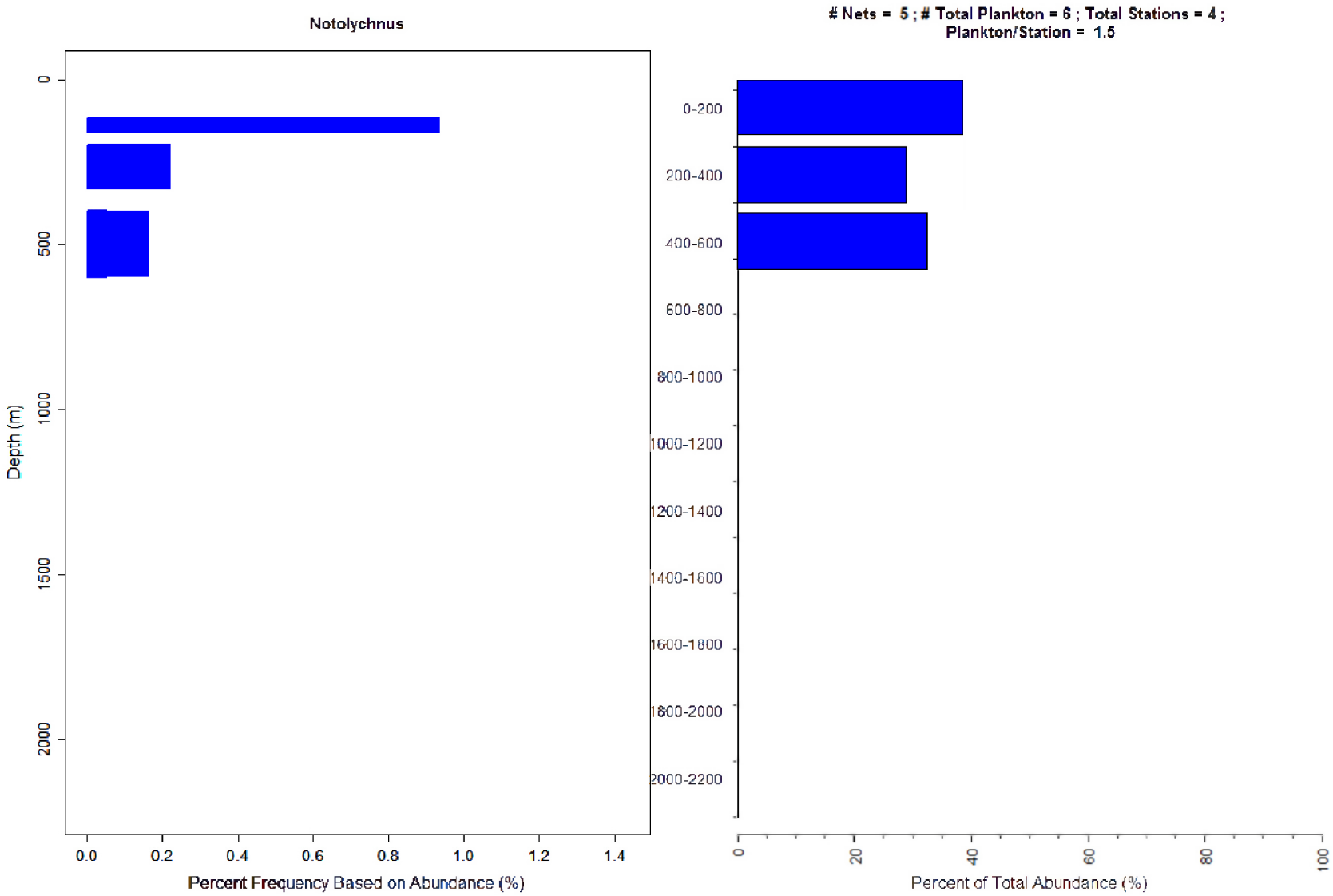
Nettastomatidae - Deep



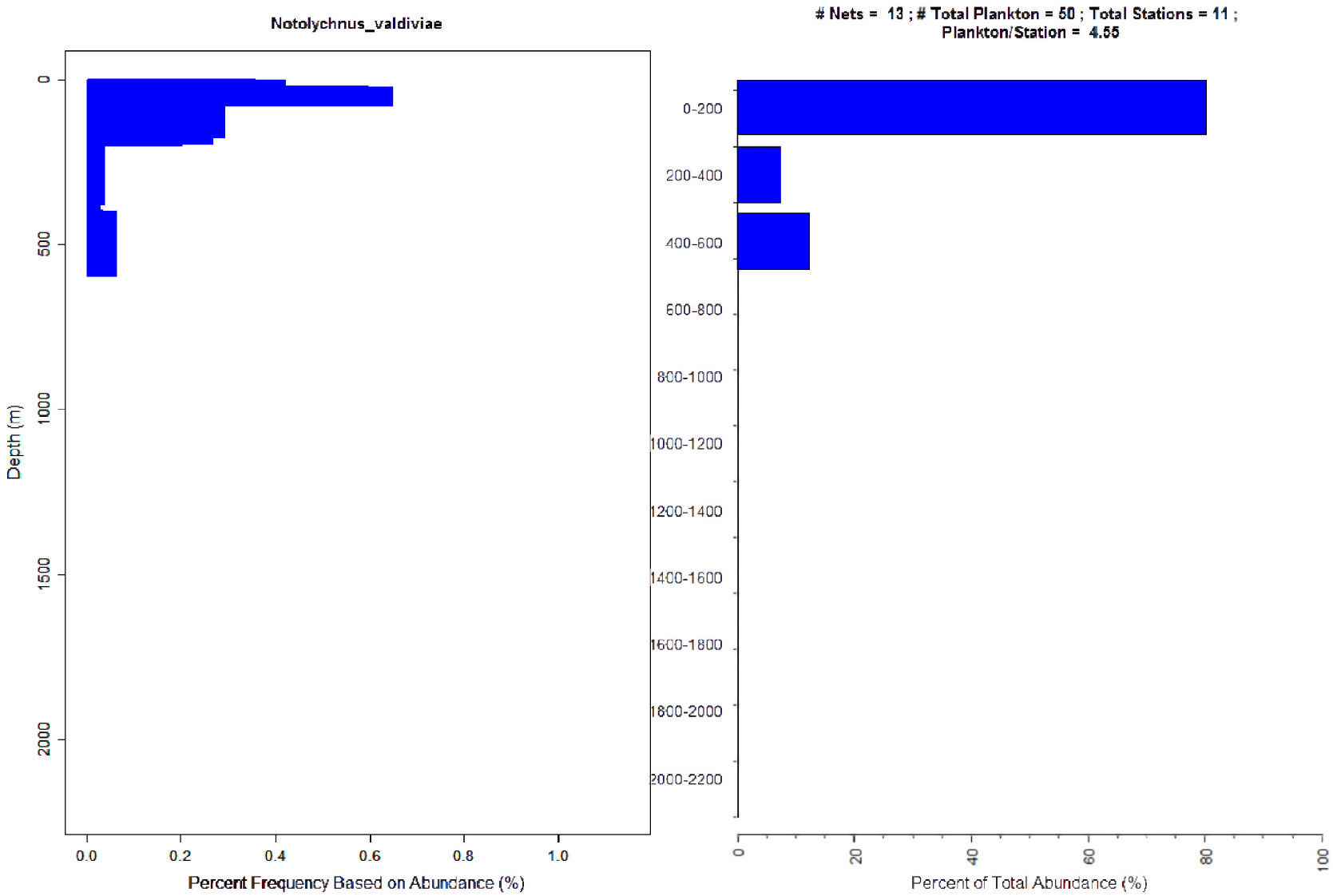
Nomeidae - Deep



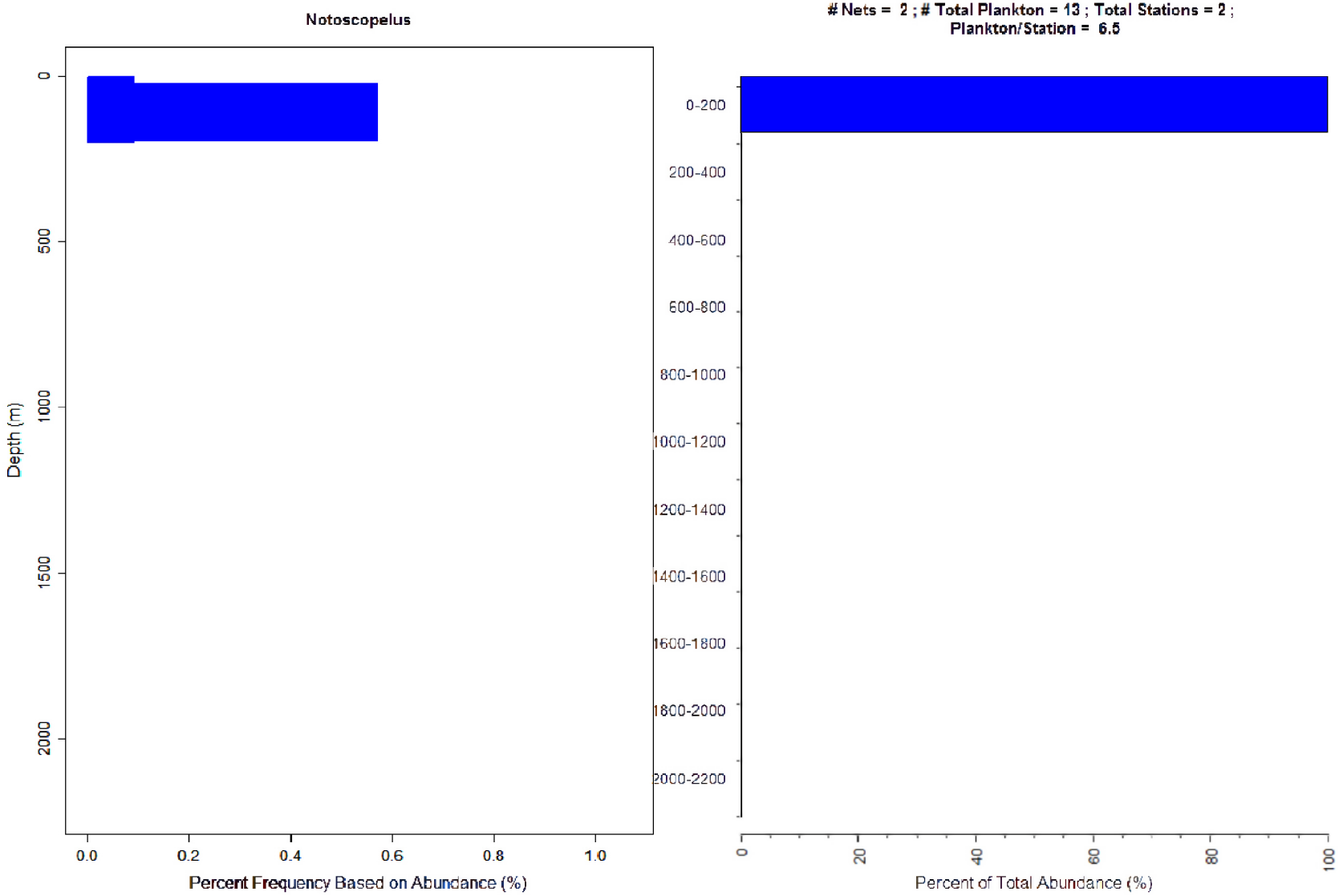
Non_decapod_Crustacea - Deep



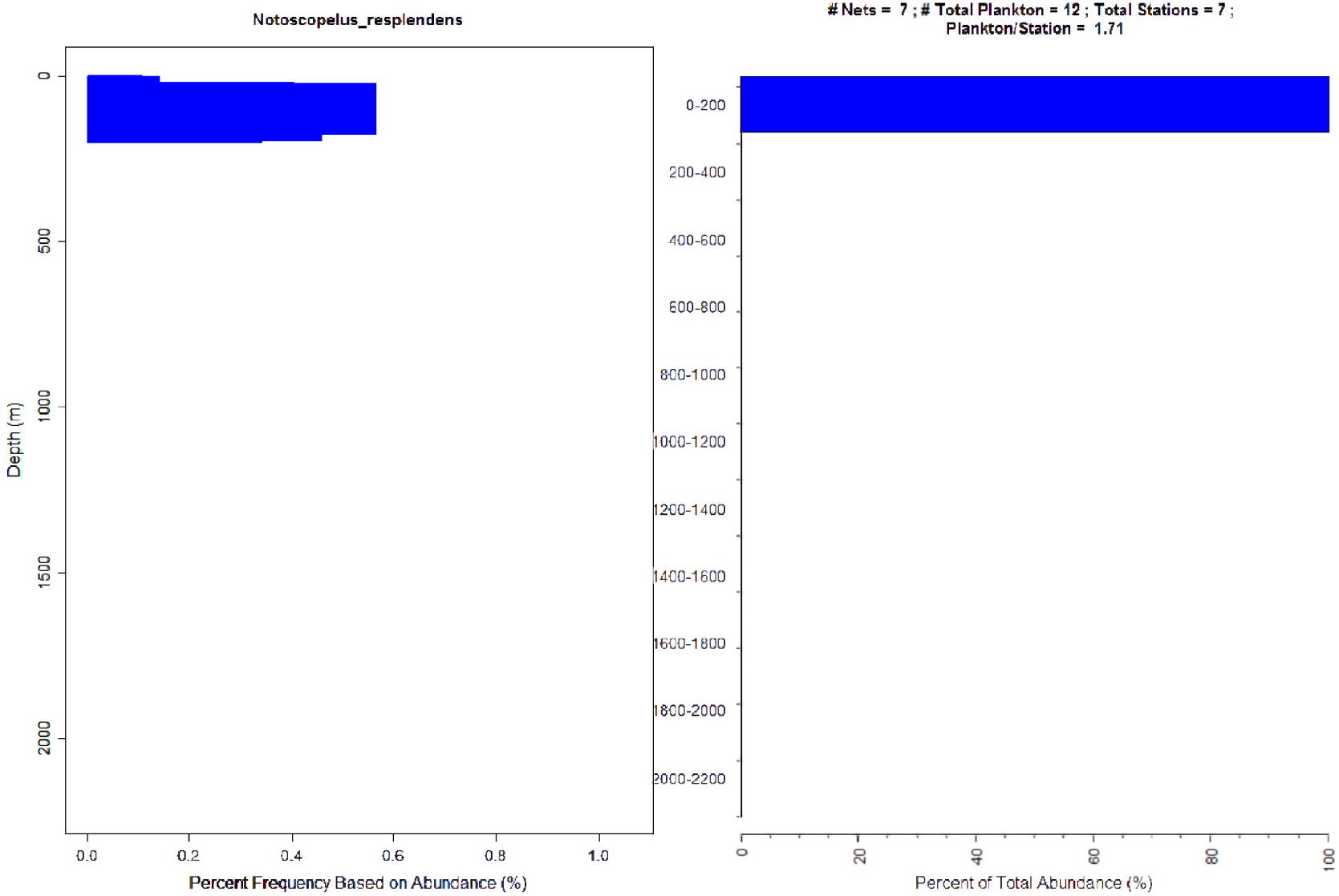
Notolychnus - Deep



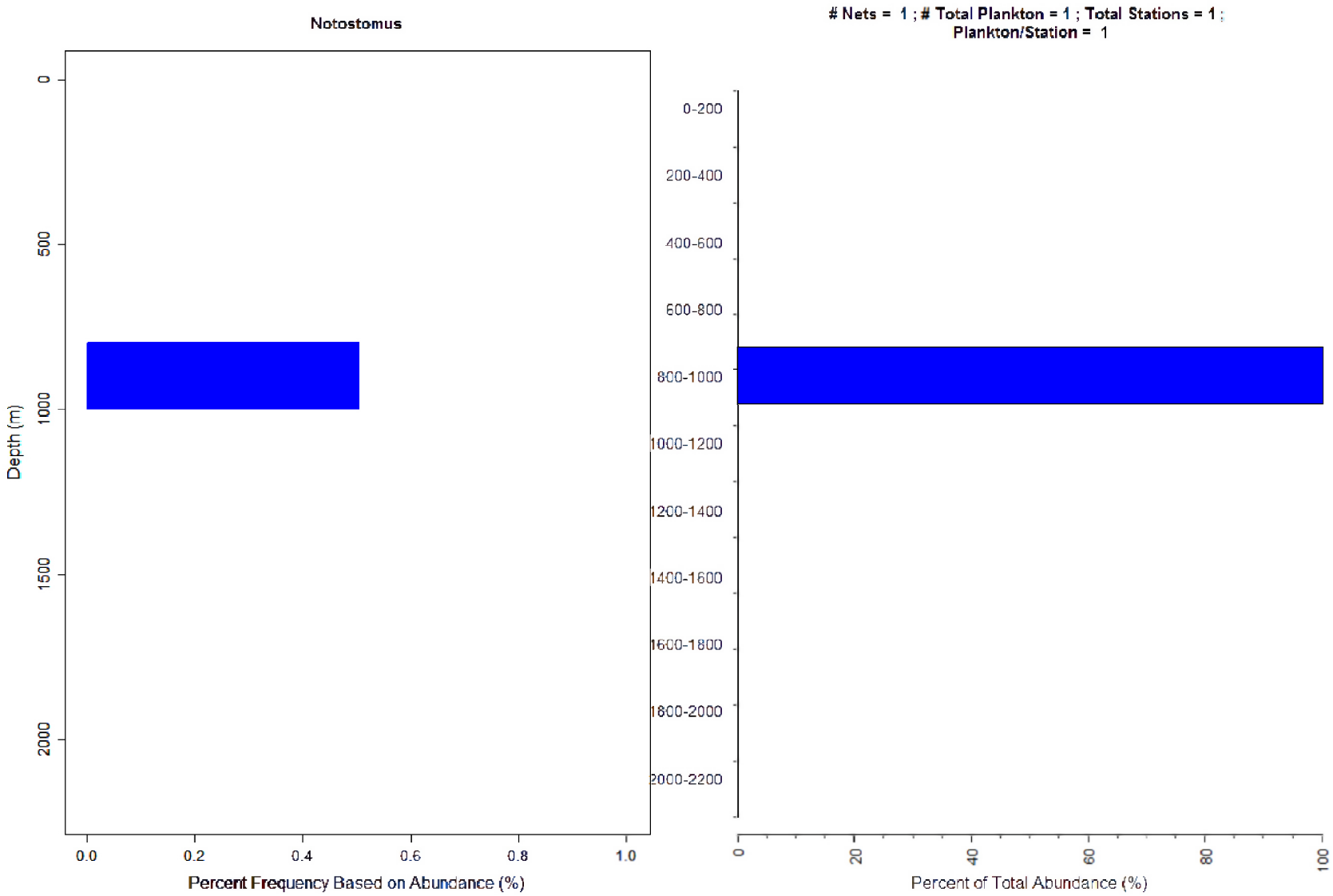
Notolychnus_valdiviae - Deep



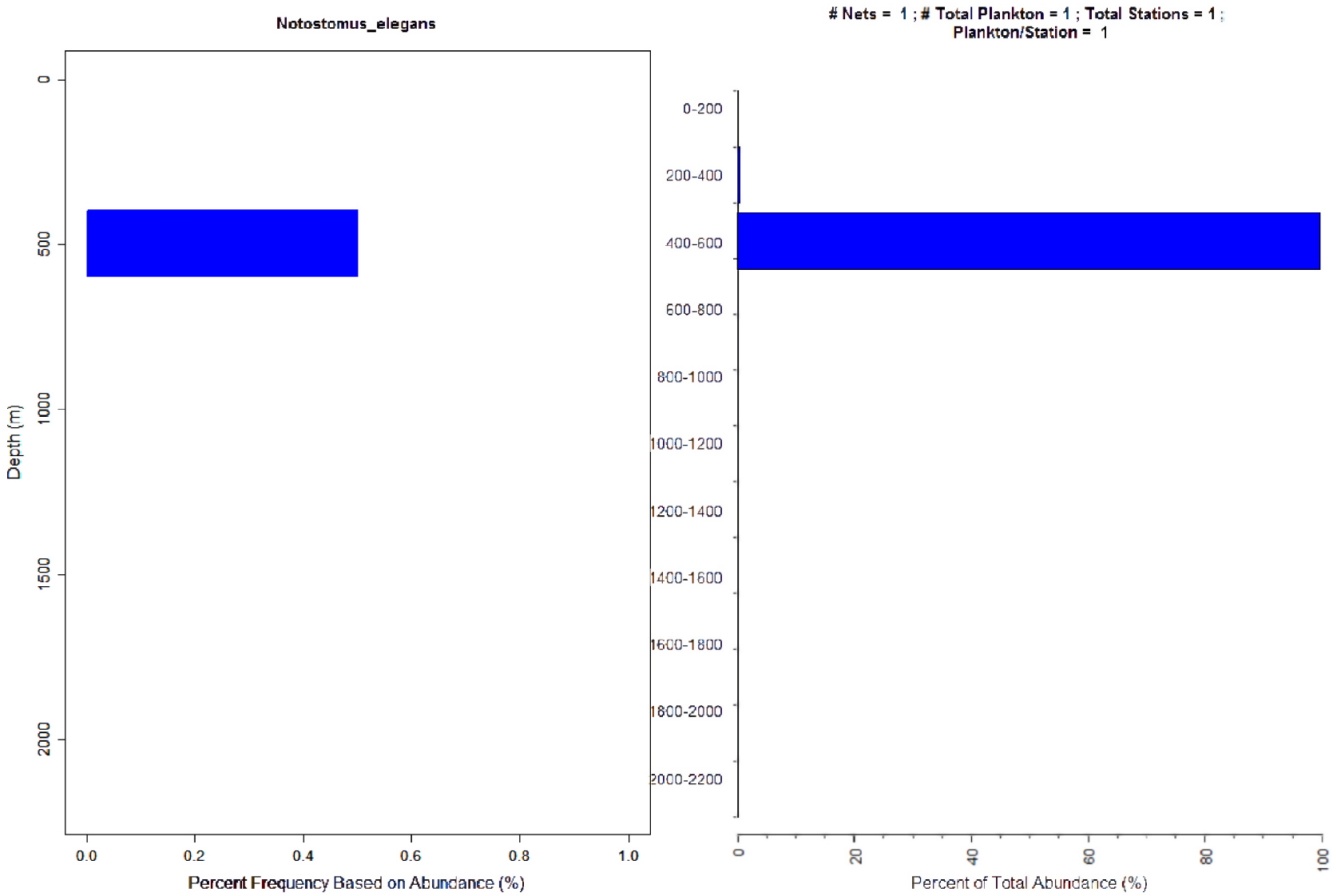
Notoscopelus - Deep



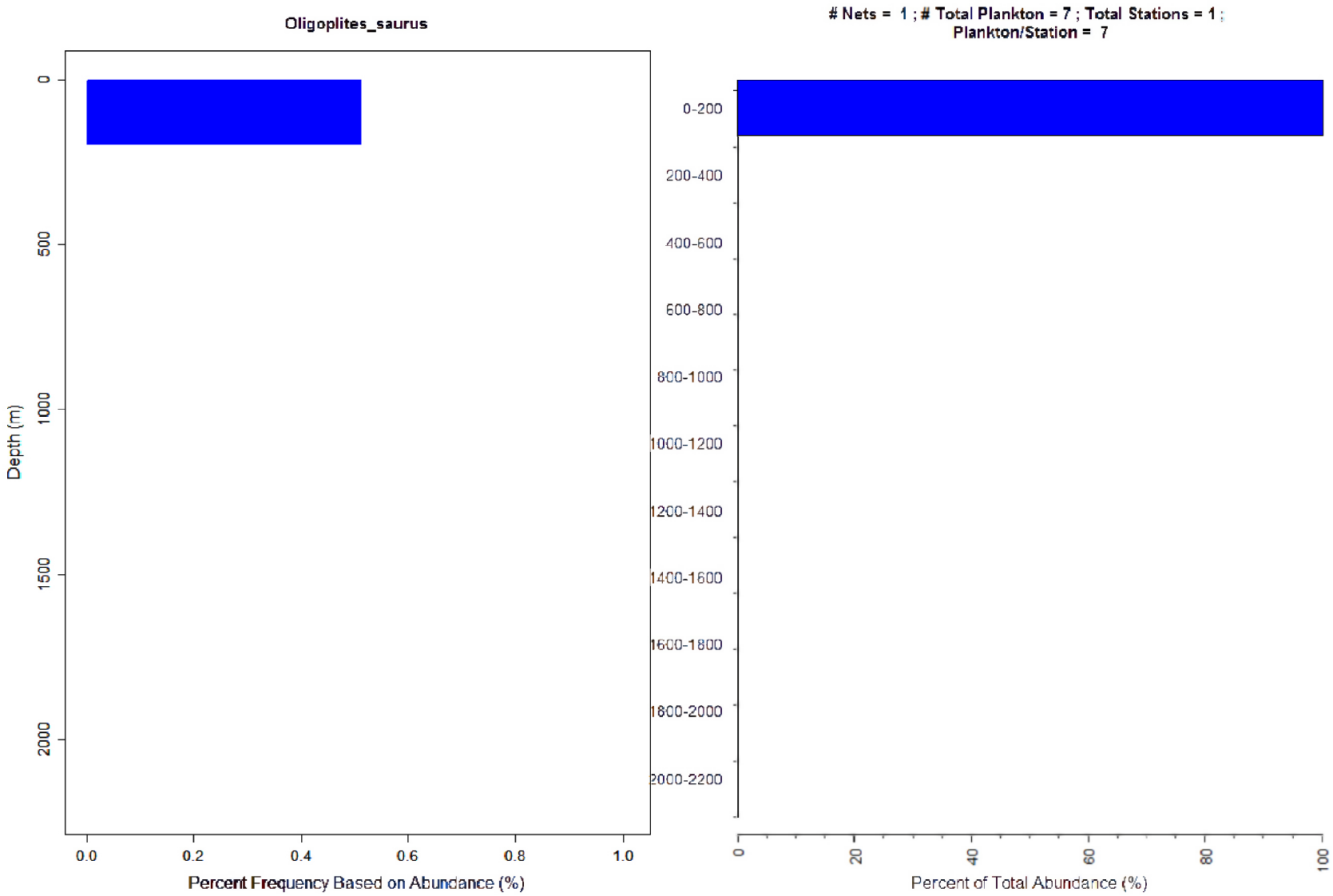
Notoscopelus_resplendens - Deep



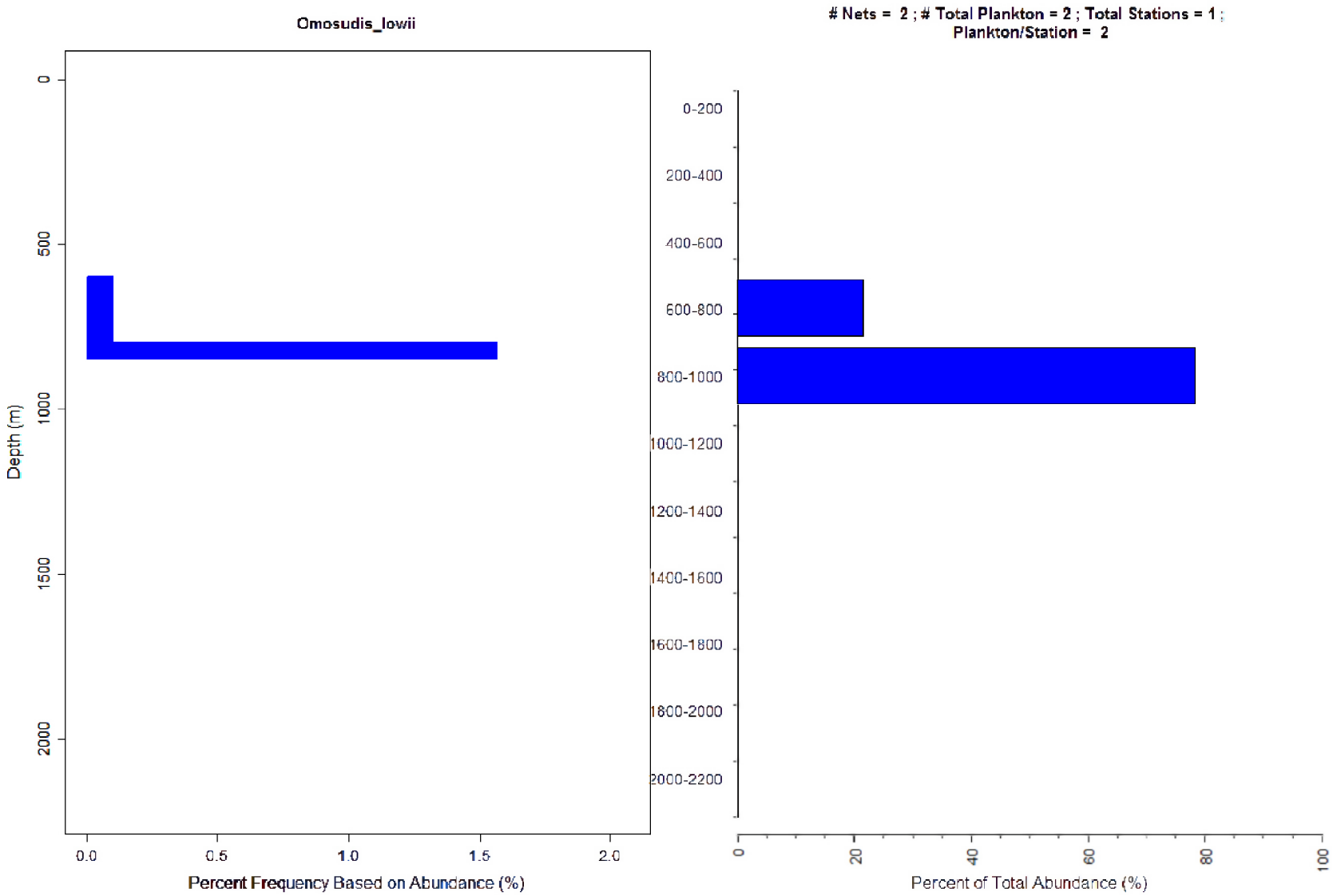
Notostomus - Deep



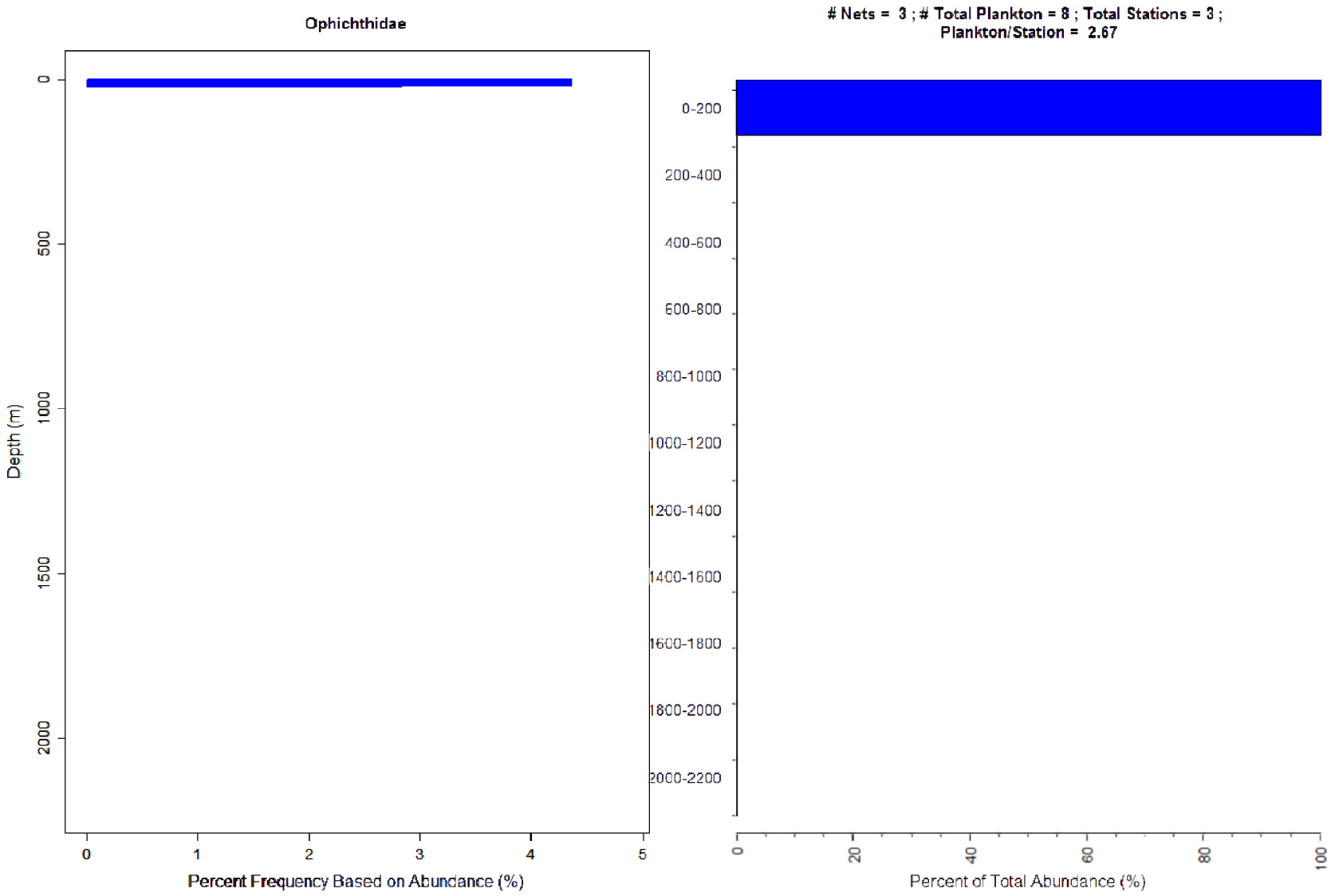
Notostomus_elegans - Deep



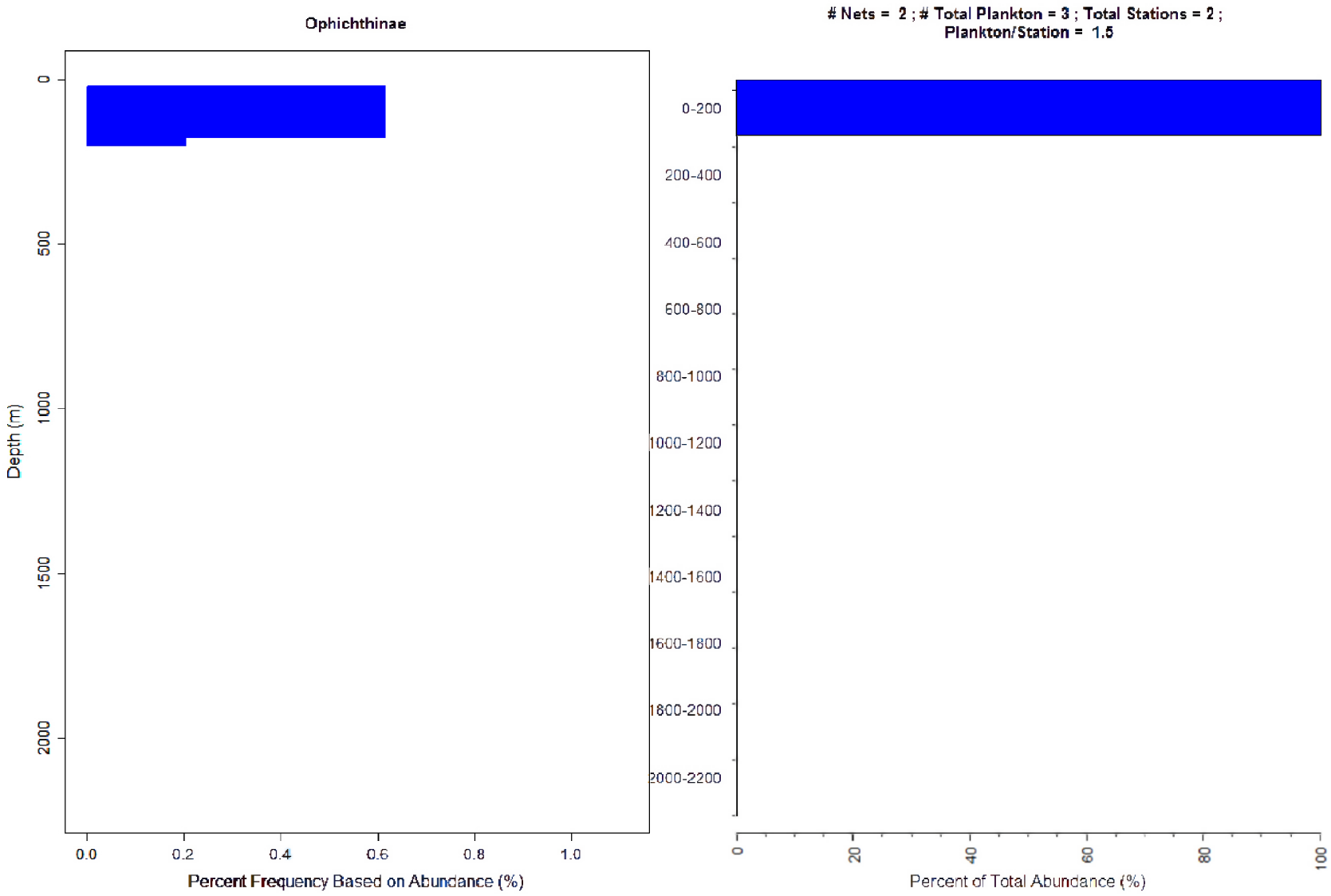
Oligoplites_saurus - Deep



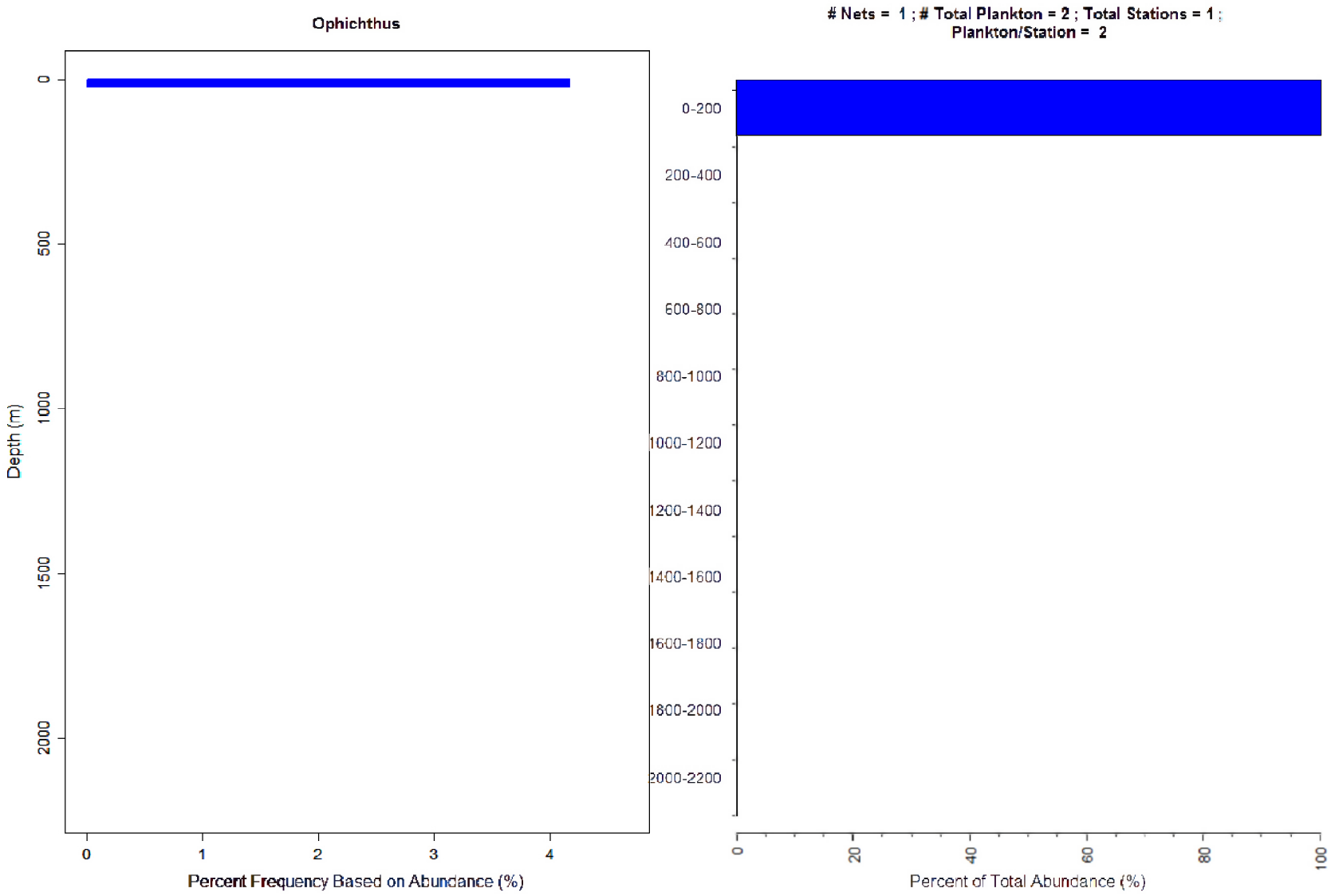
Omosudis_lowii - Deep



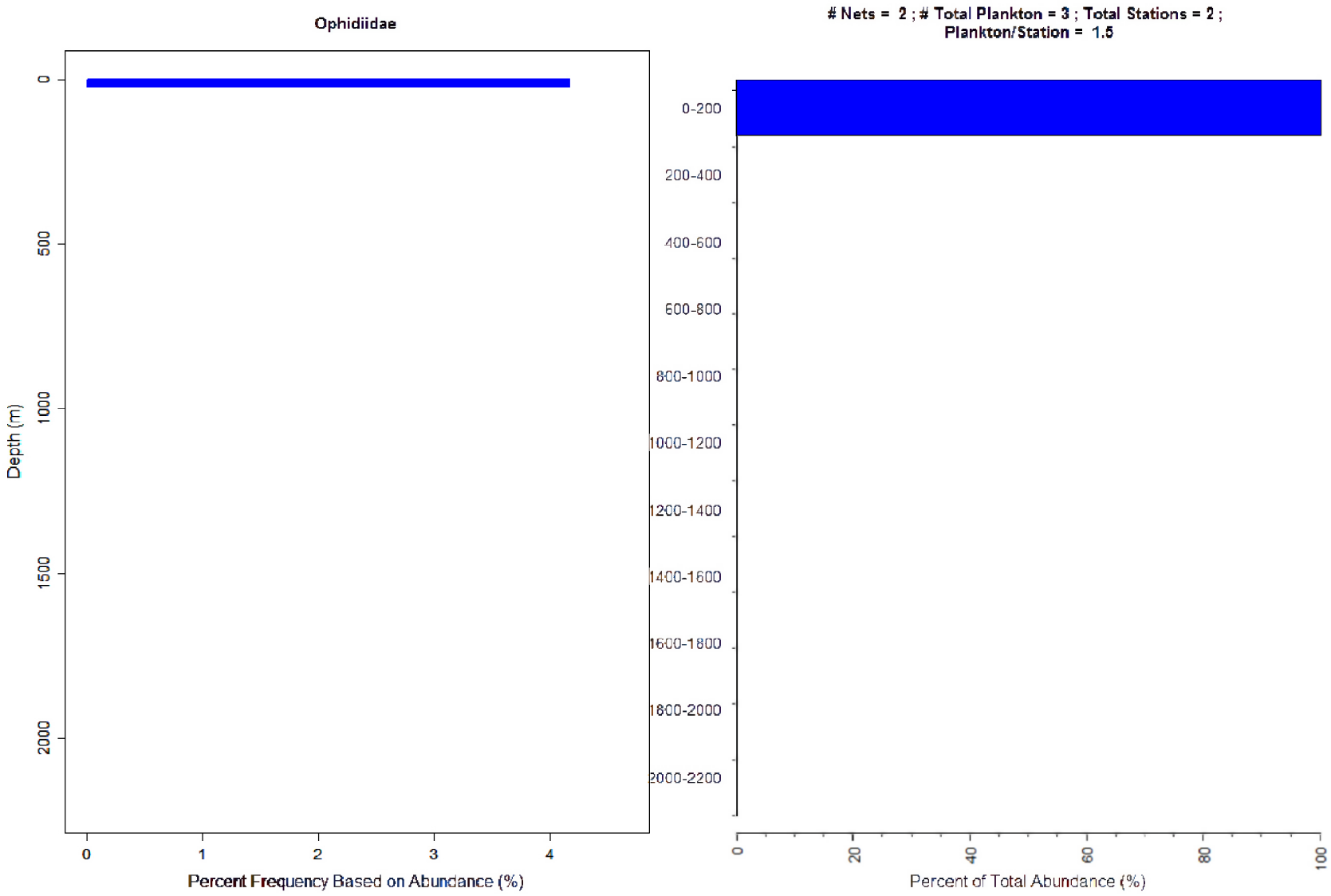
Ophichthidae - Deep



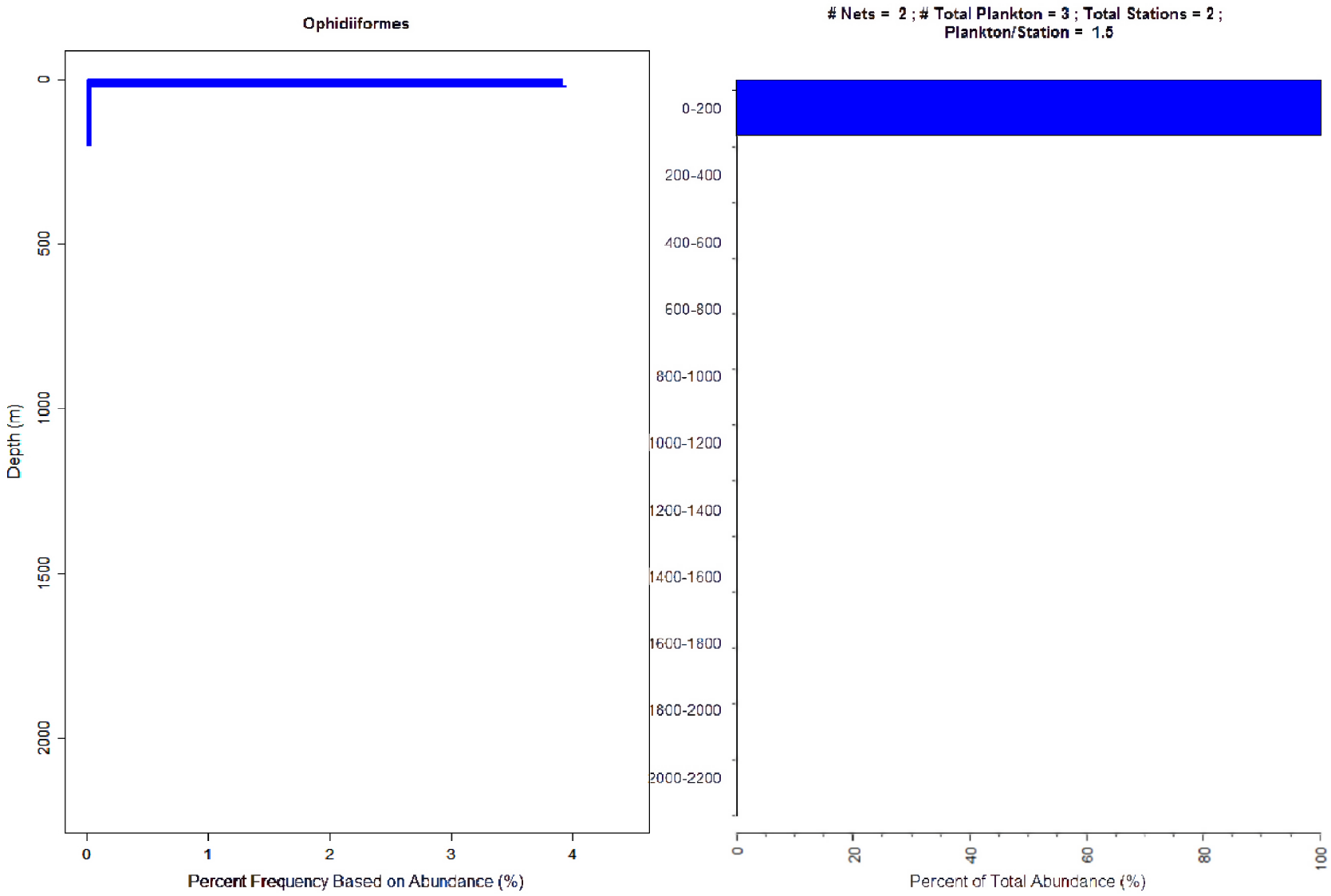
Ophichthinae - Deep



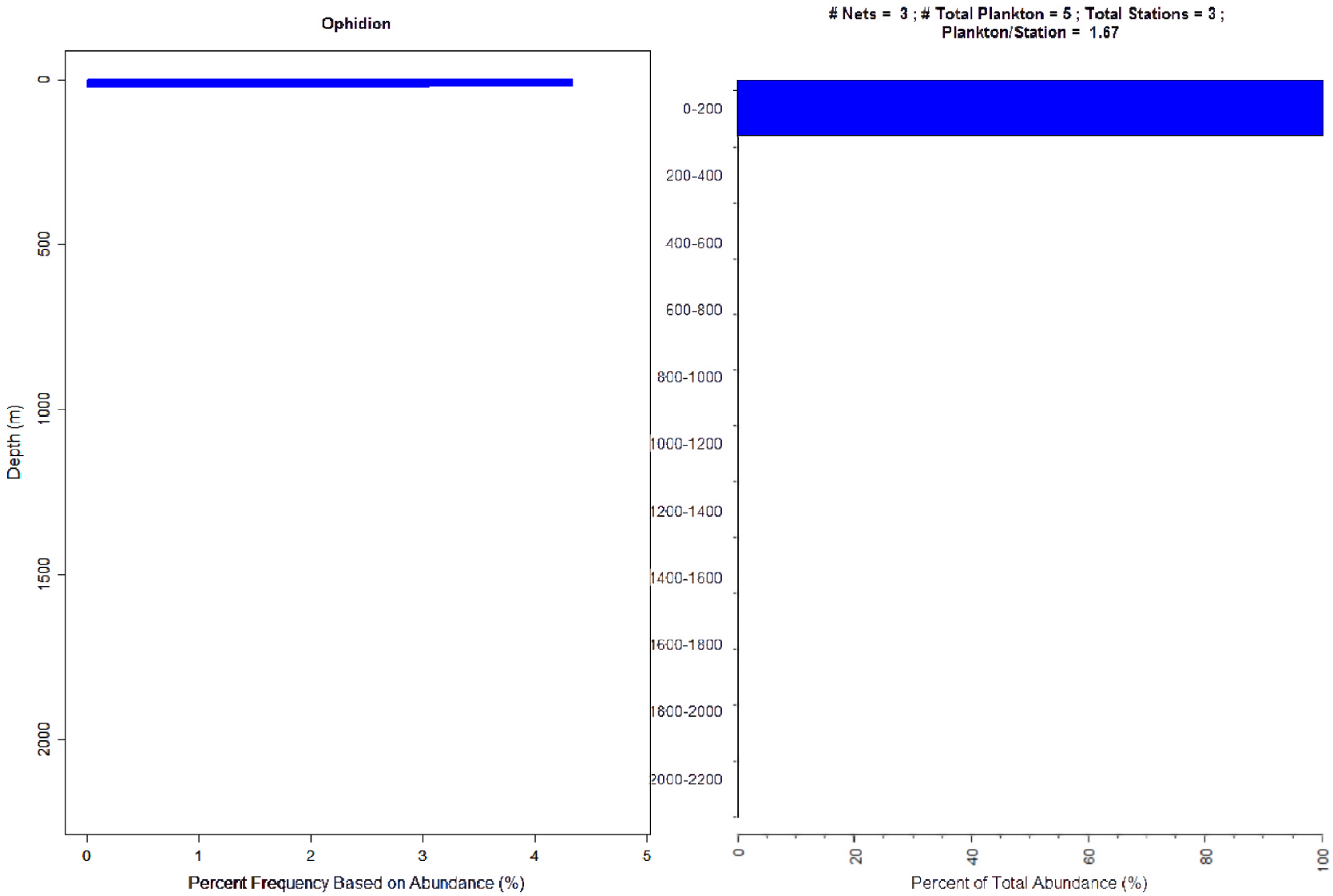
Ophichthus - Deep



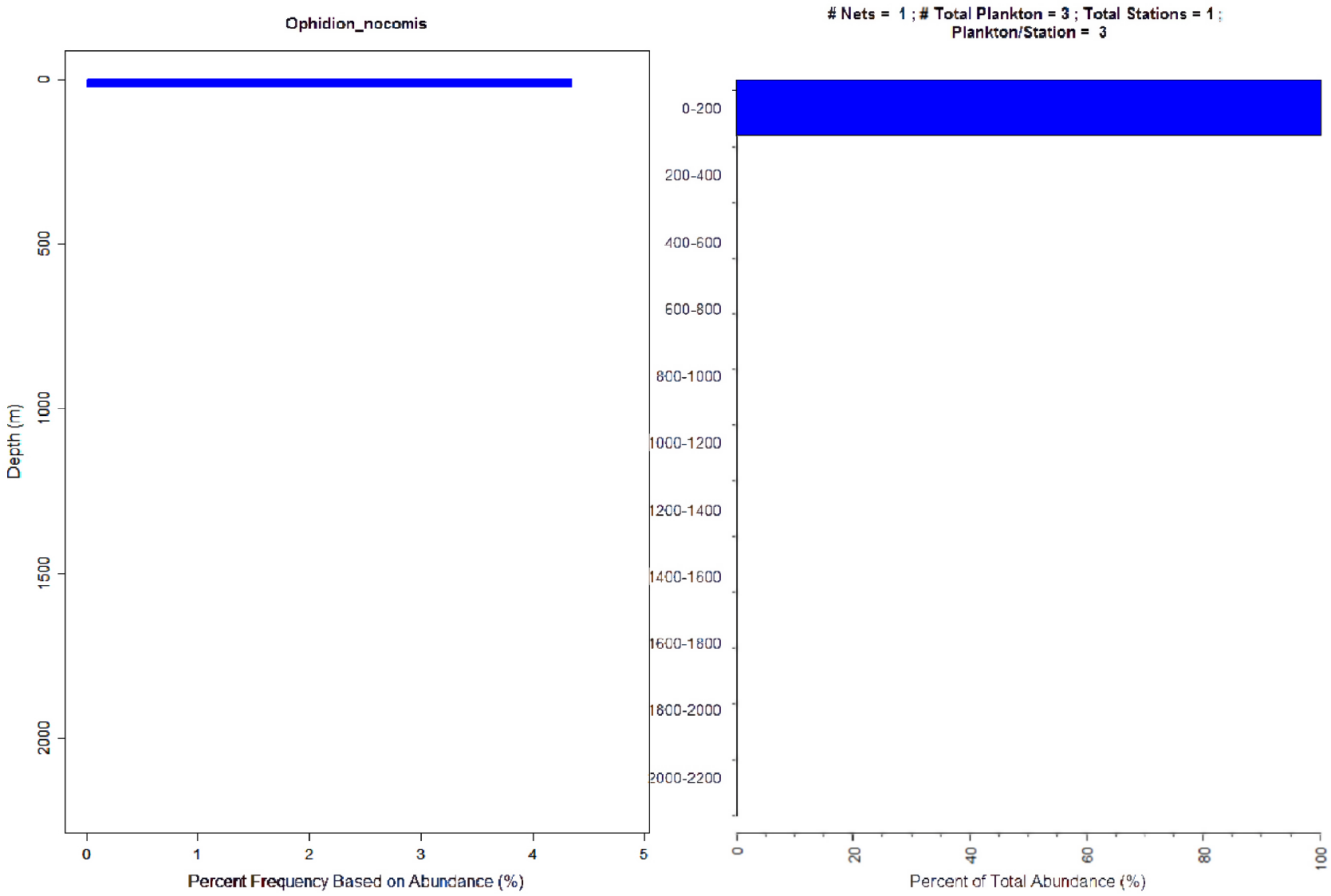
Ophidiidae - Deep



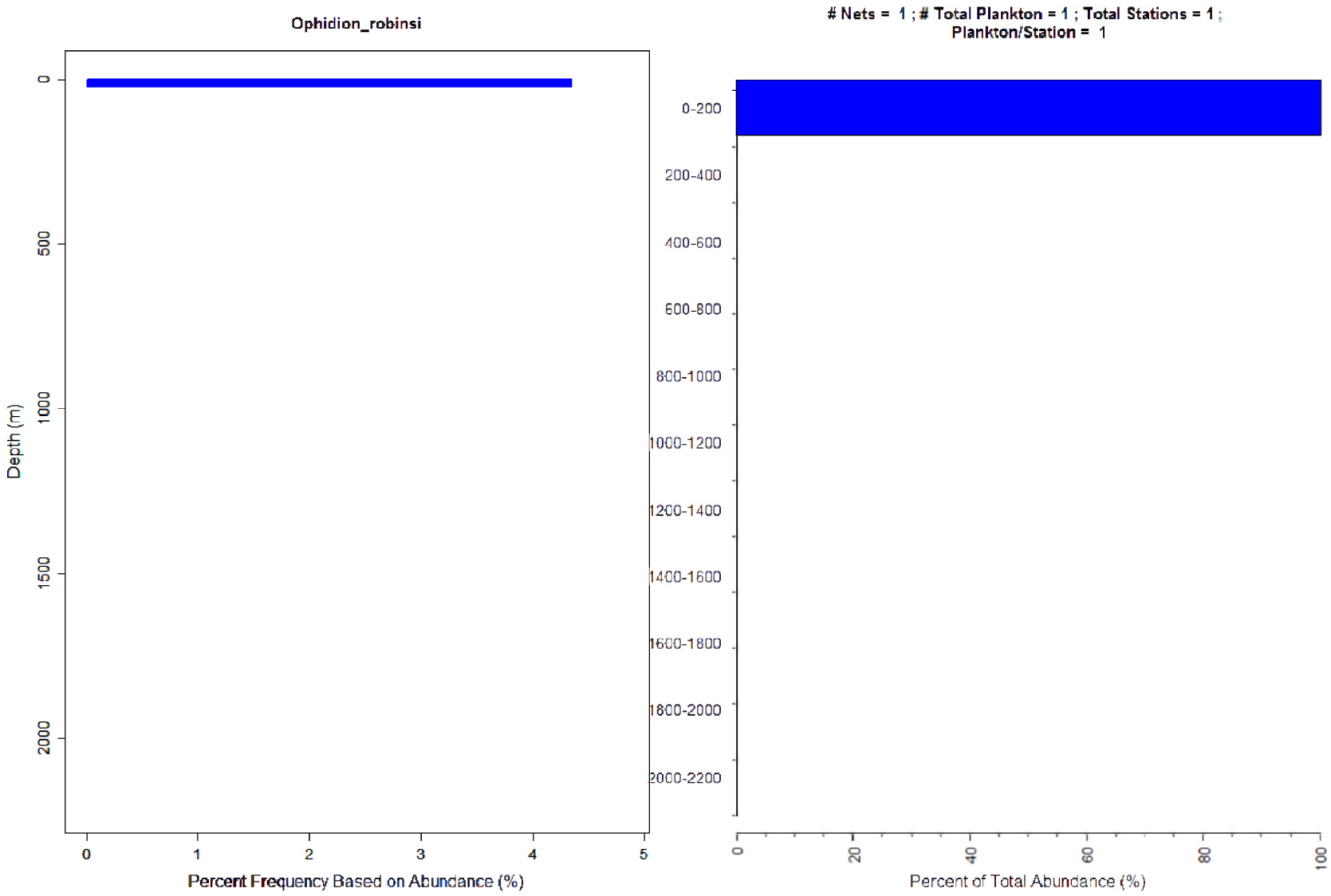
Ophidiiformes - Deep



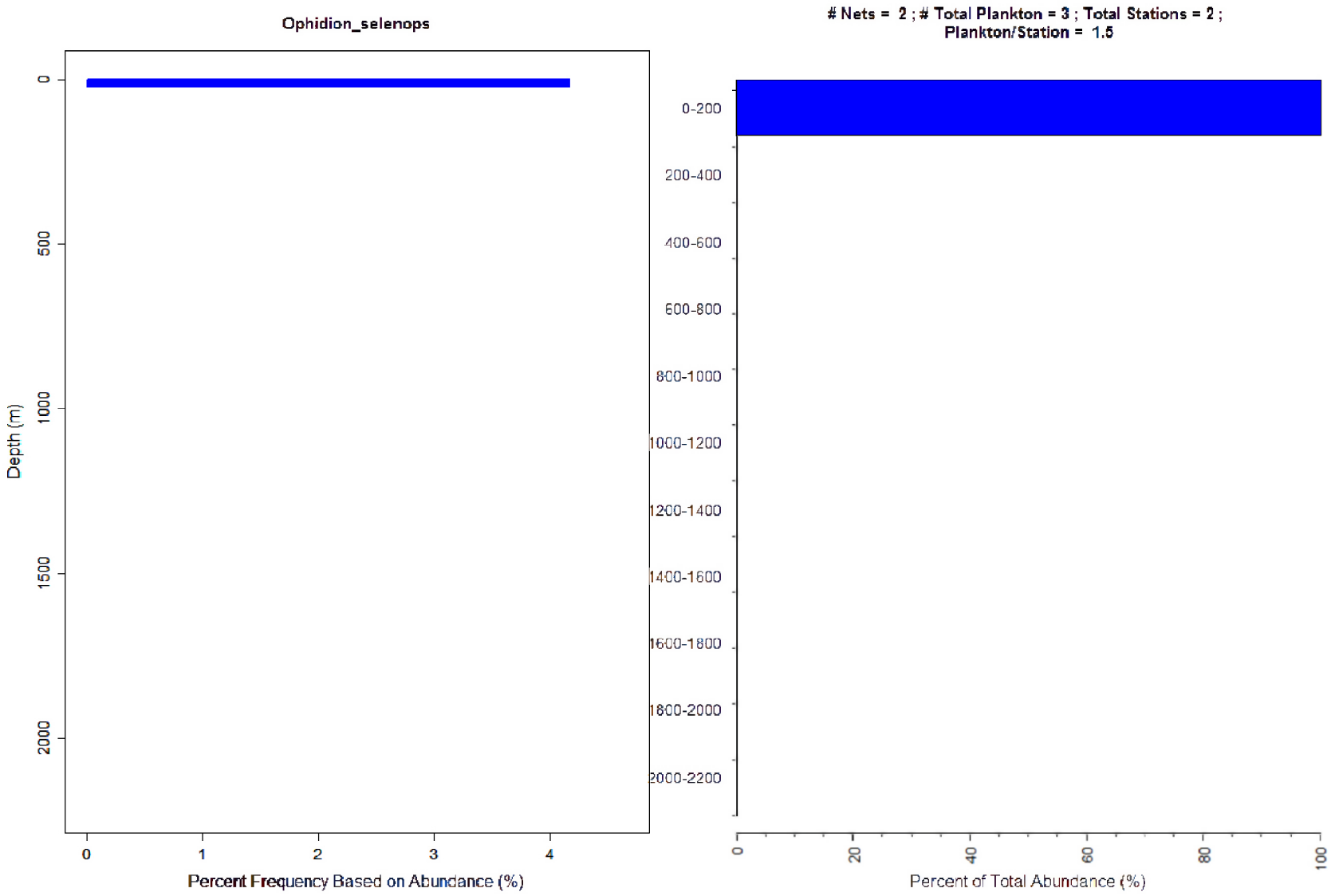
Ophidion - Deep



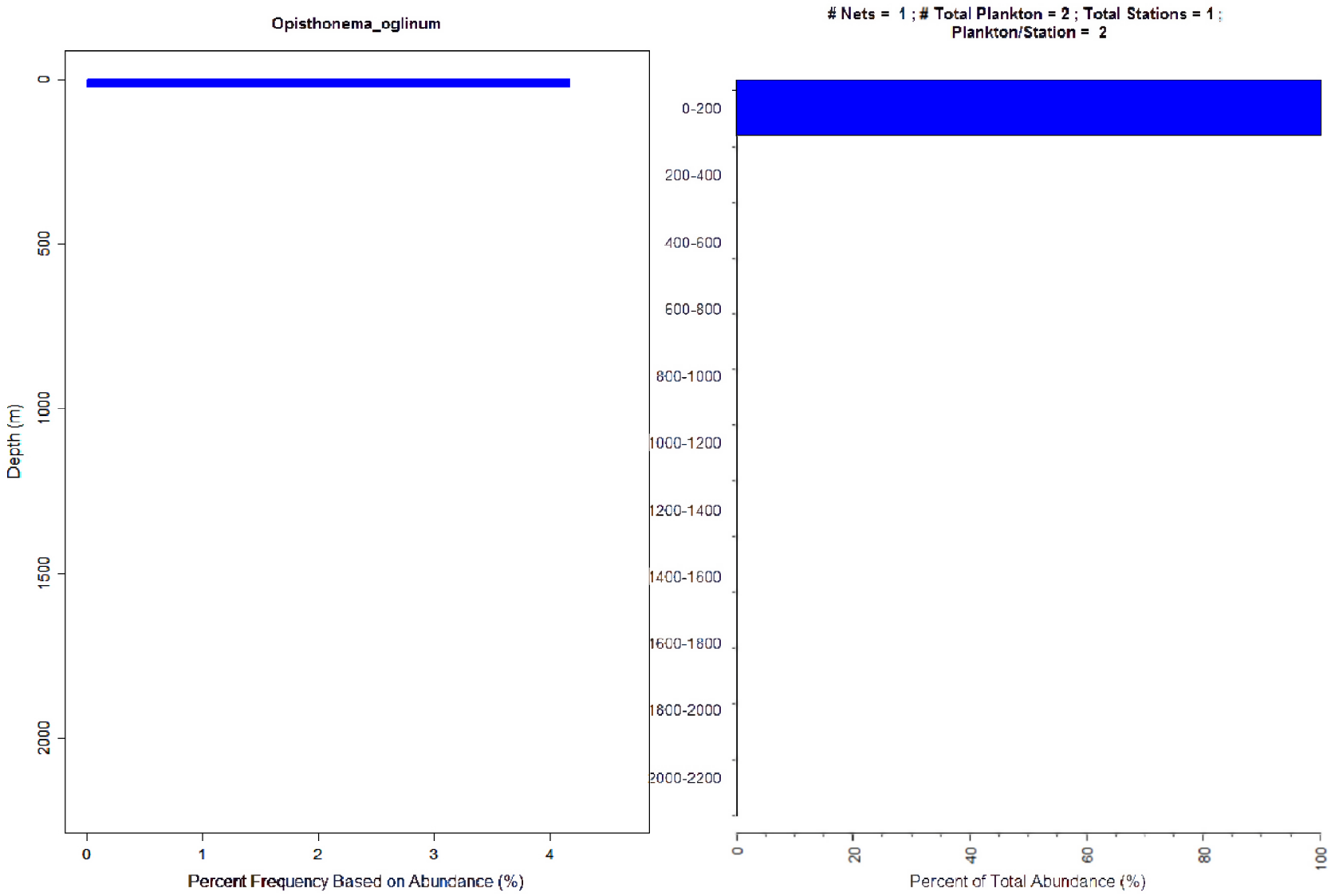
Ophidion_nocomis - Deep



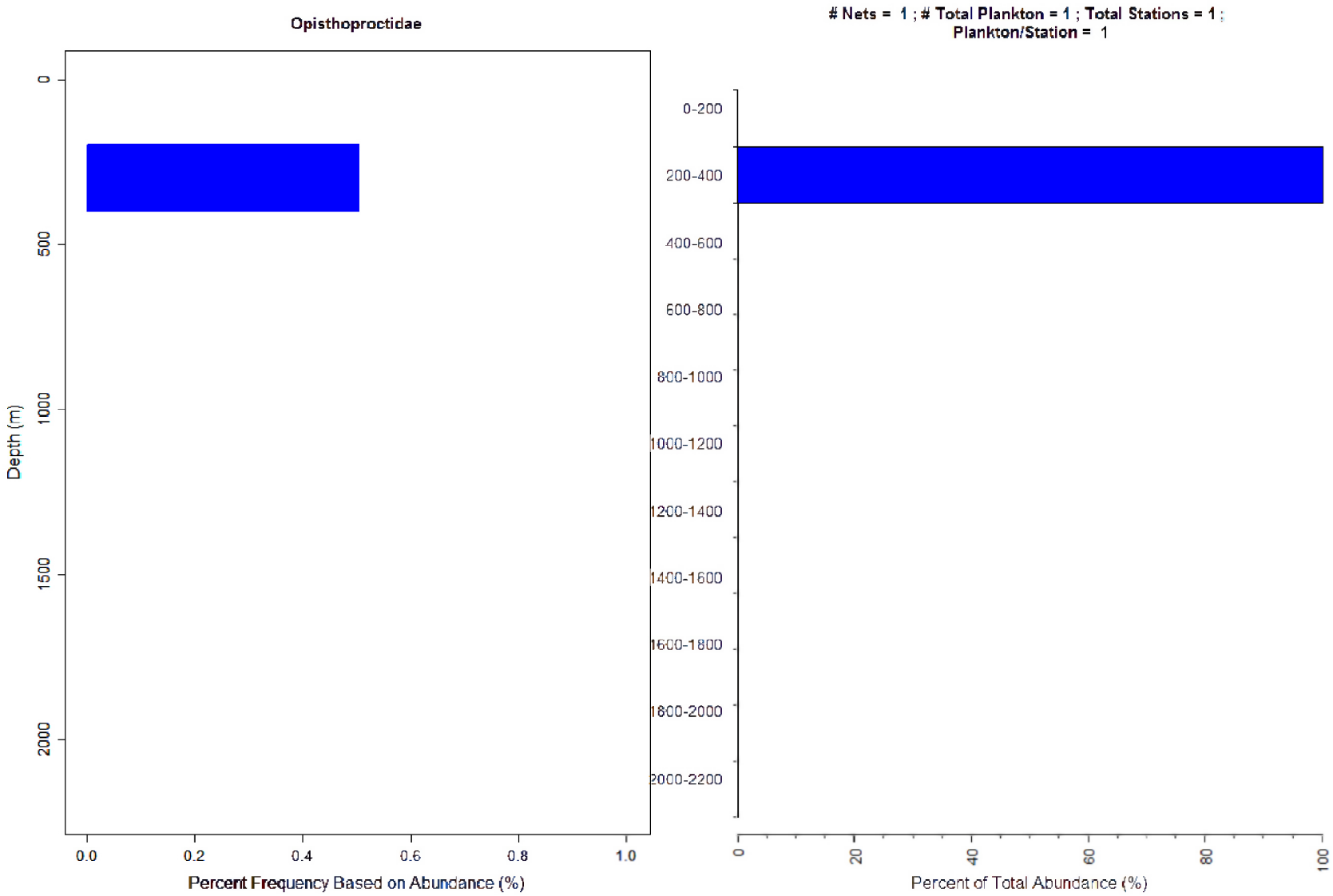
Ophidion_robinsi - Deep



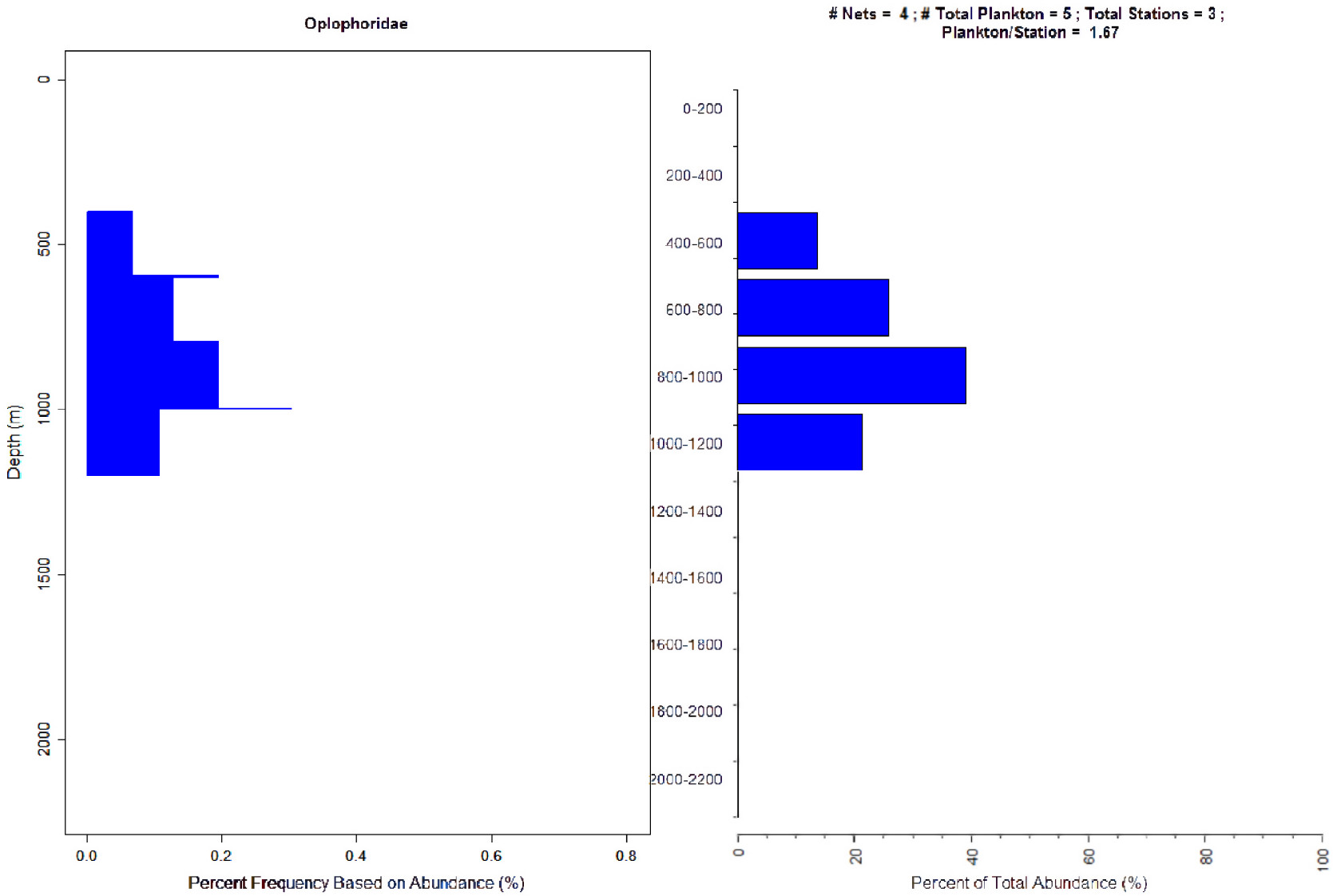
Ophidion_selenops - Deep



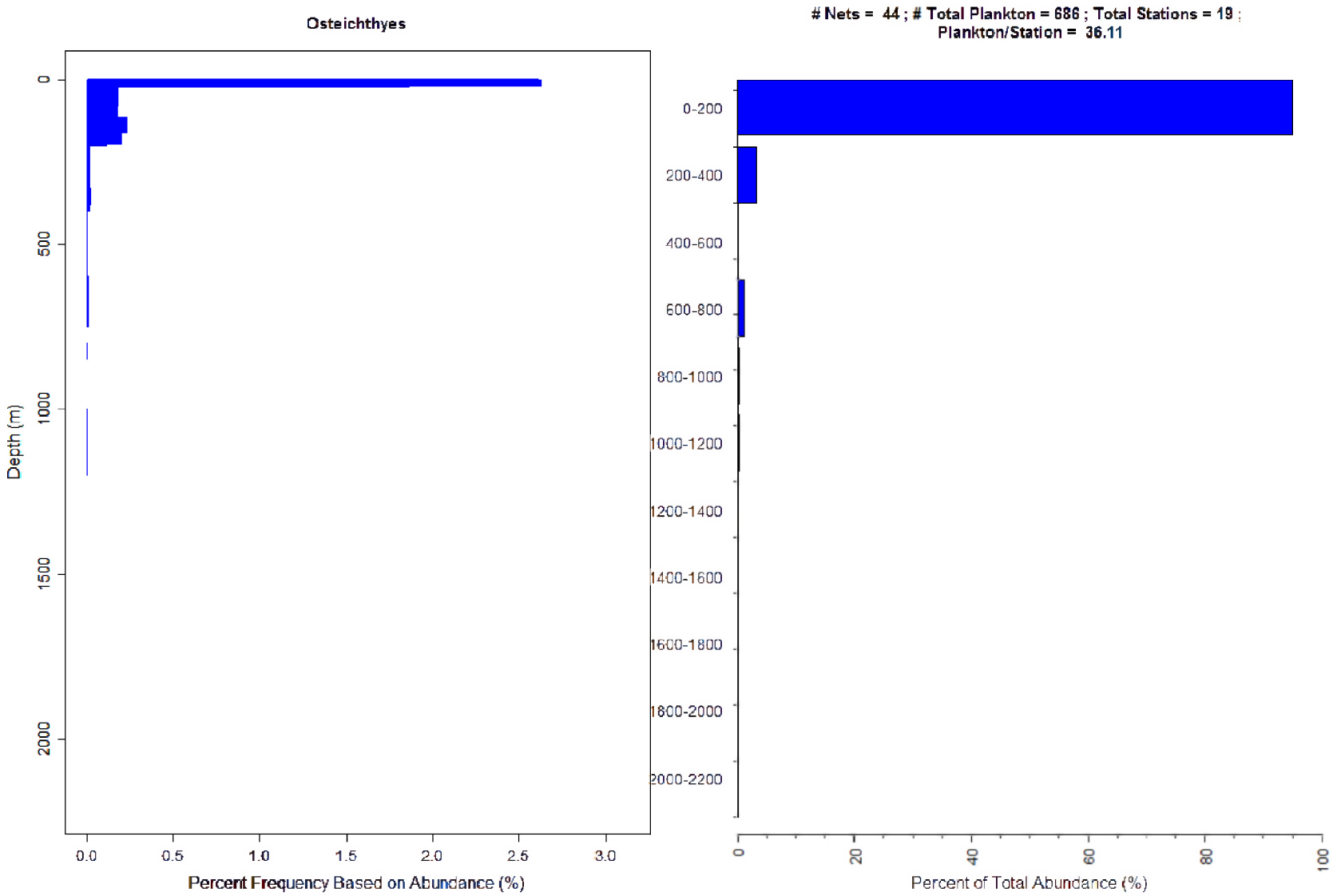
Opisthonema_oglinum - Deep



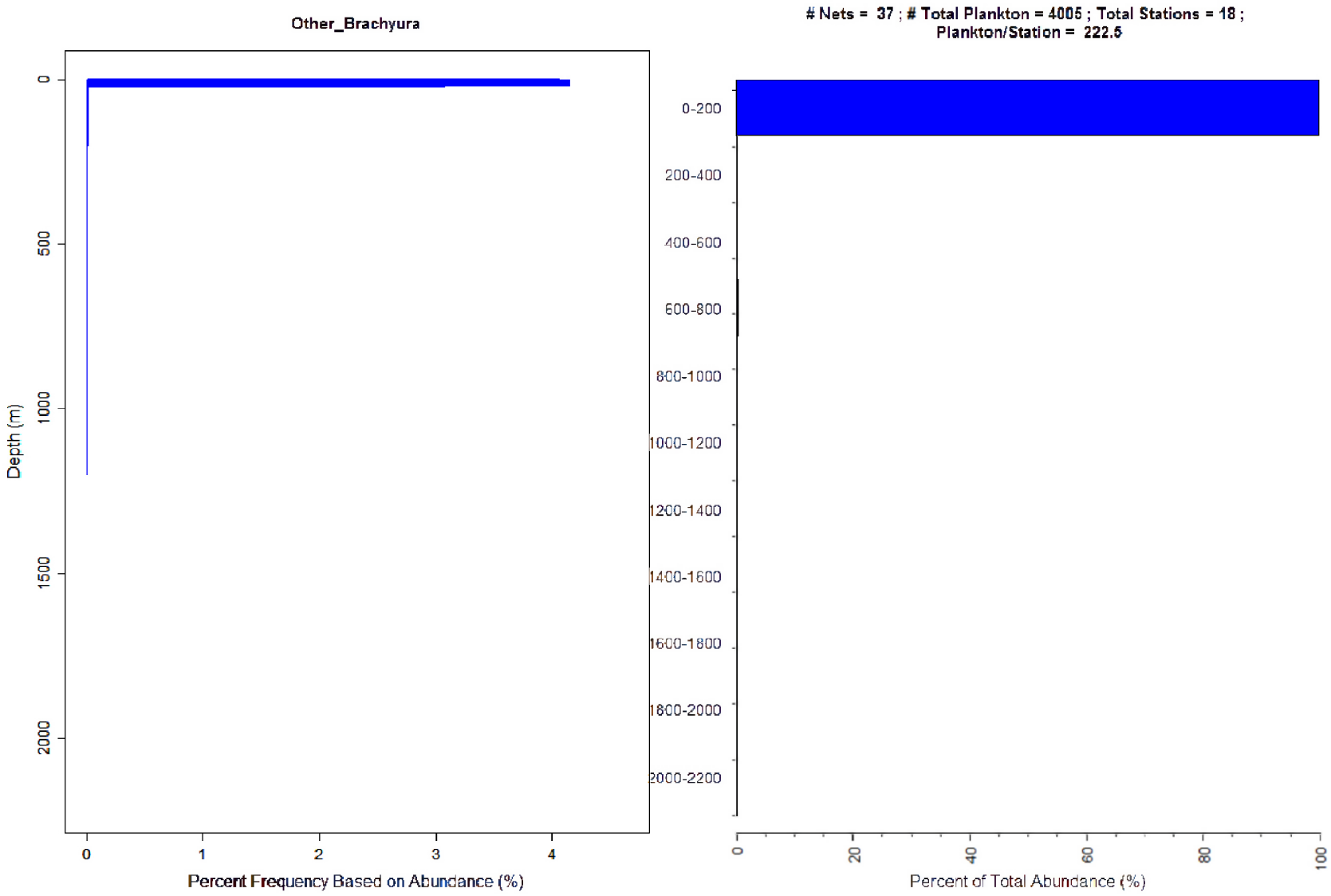
Opisthoproctidae - Deep



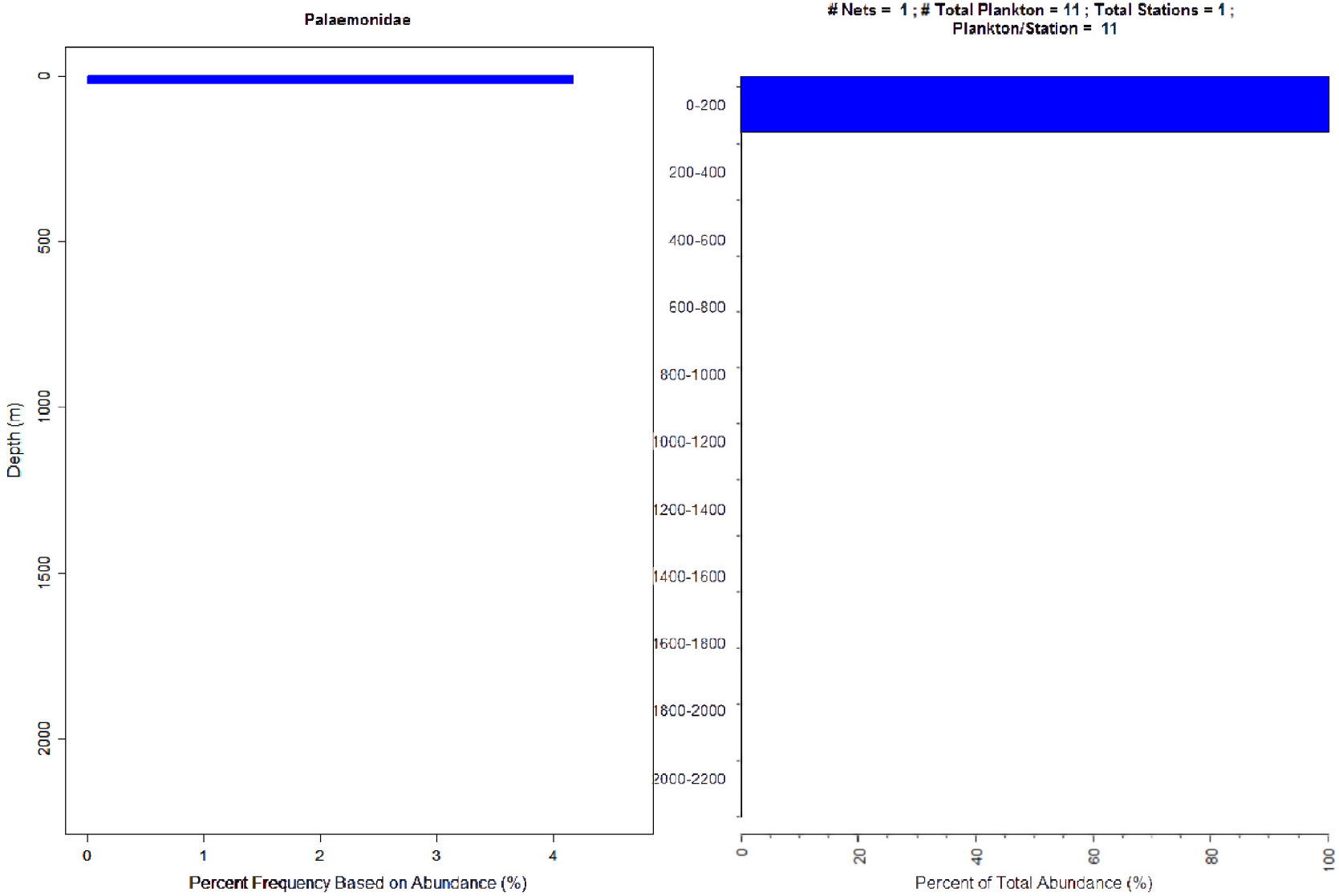
Oplophoridae - Deep



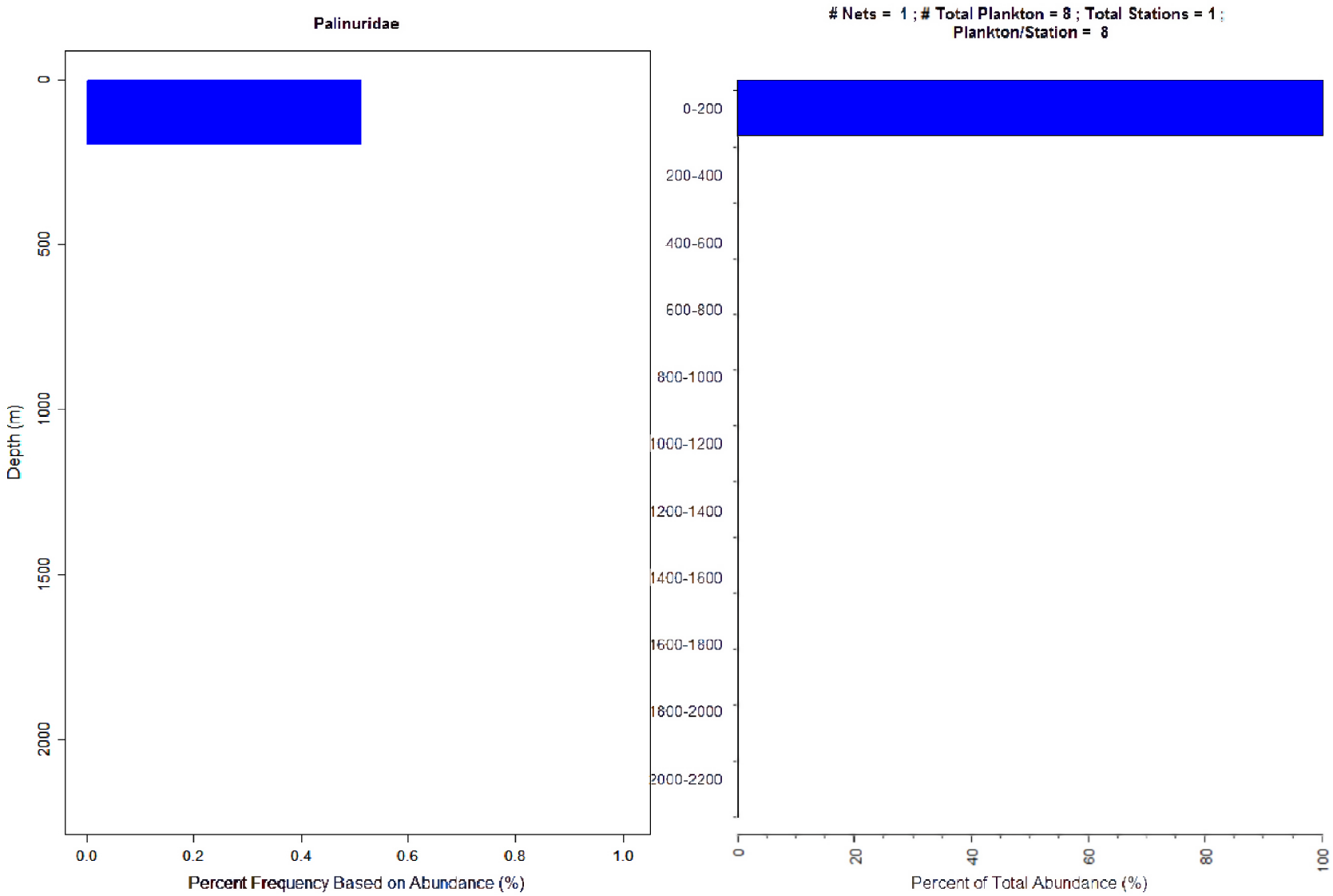
Osteichthyes - Deep



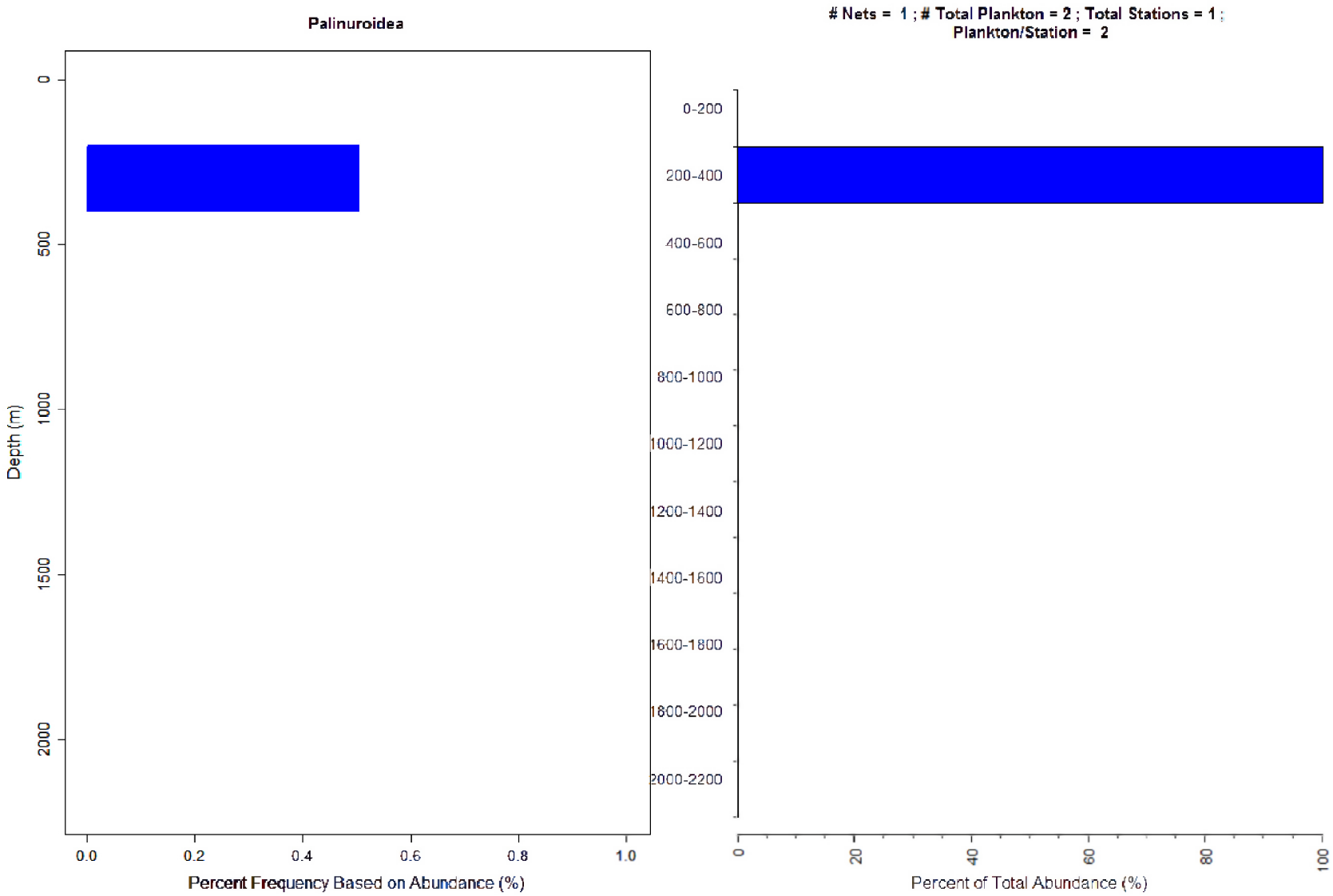
Other_Brachyura - Deep



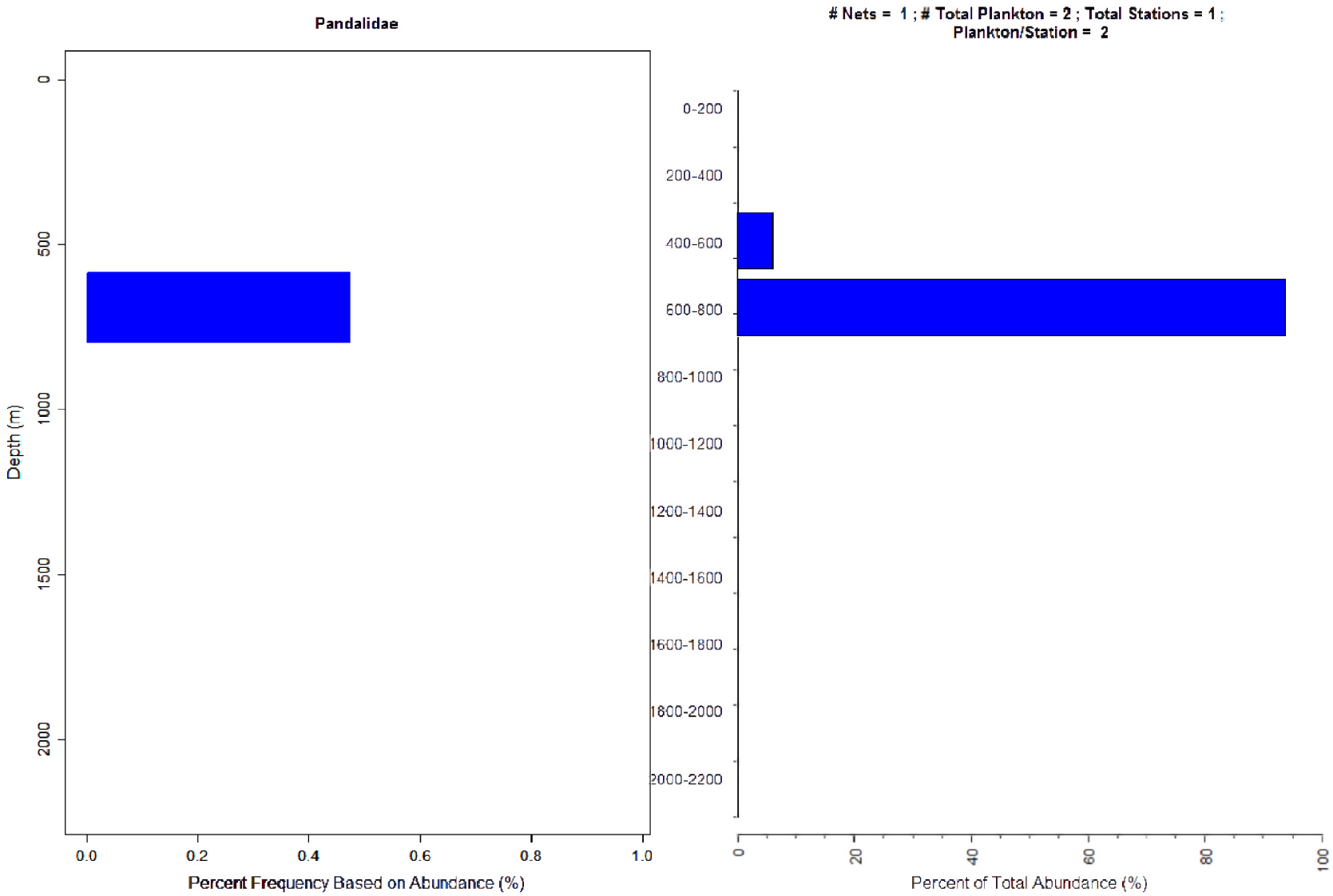
Palaemonidae - Deep



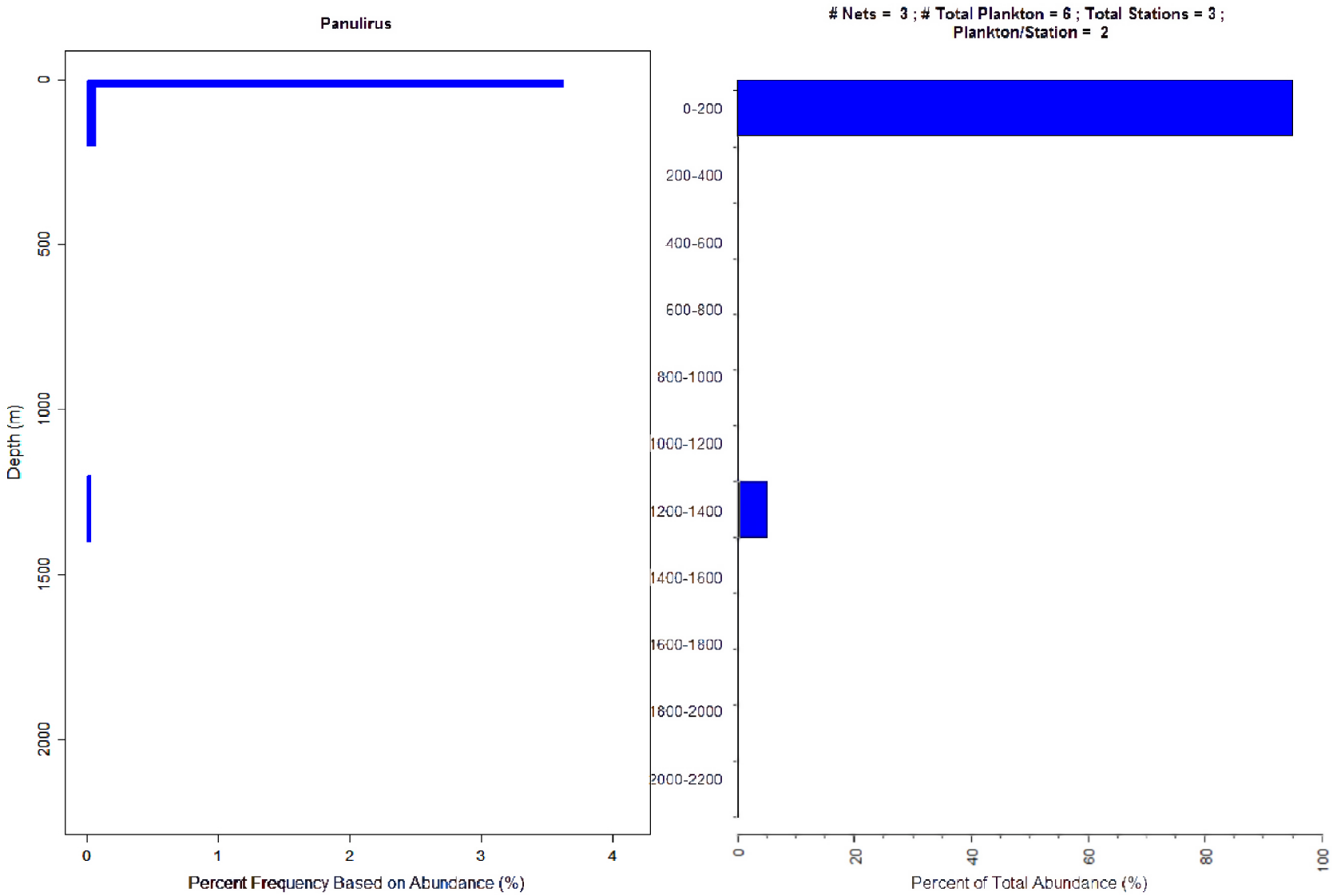
Palinuridae - Deep



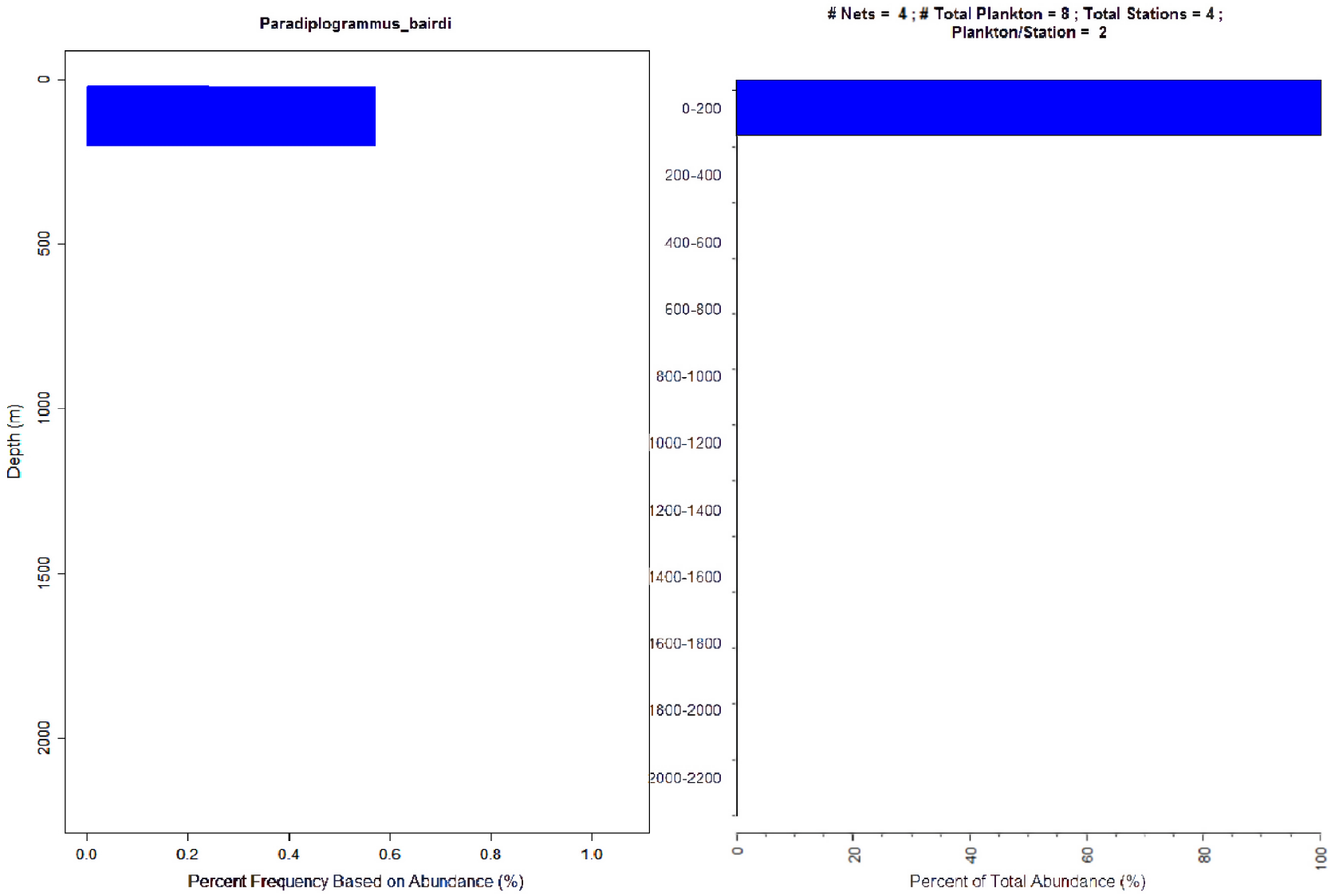
Palinuroidea - Deep



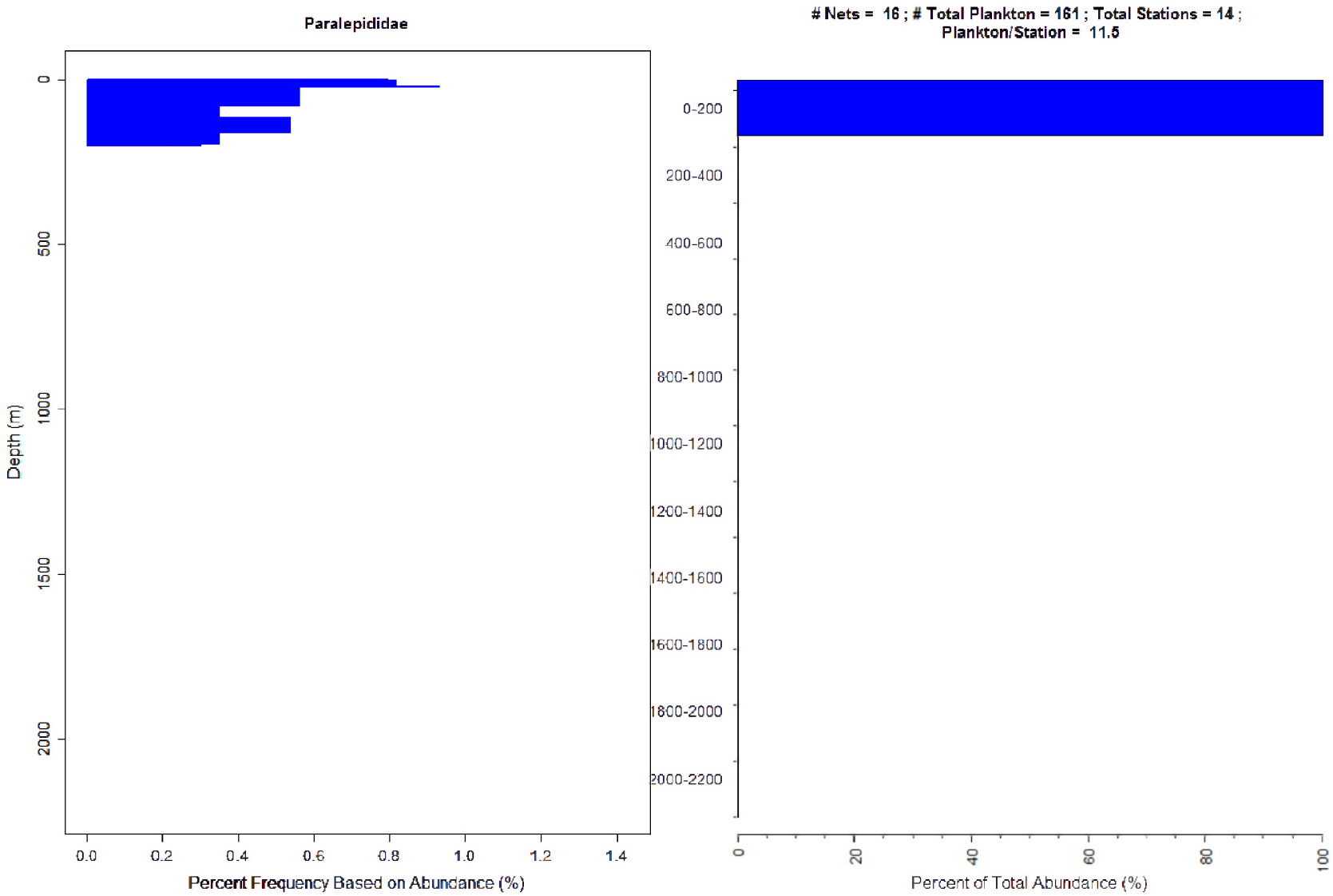
Pandalidae - Deep



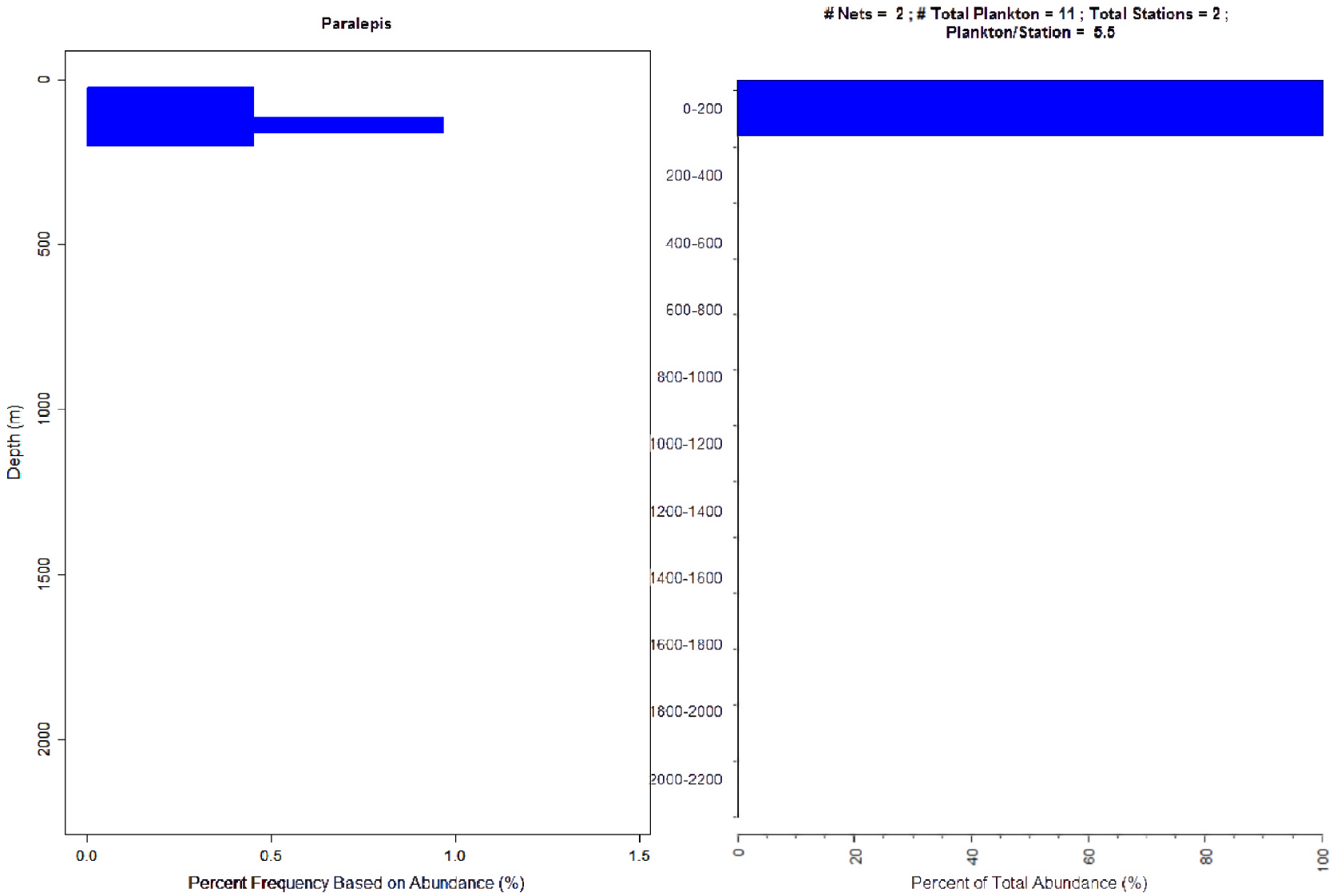
Panulirus - Deep



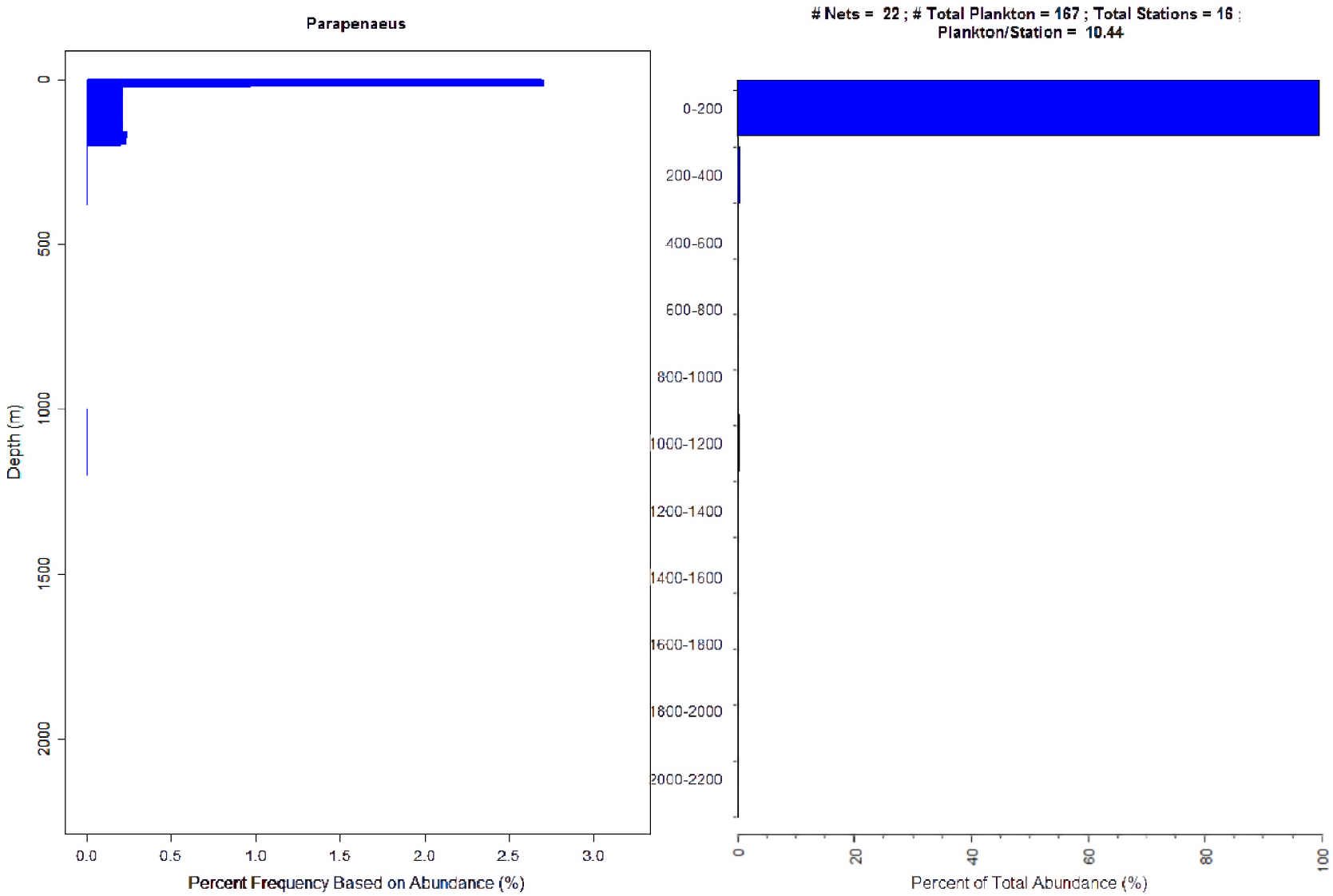
Paradiplogrammus_bairdi - Deep



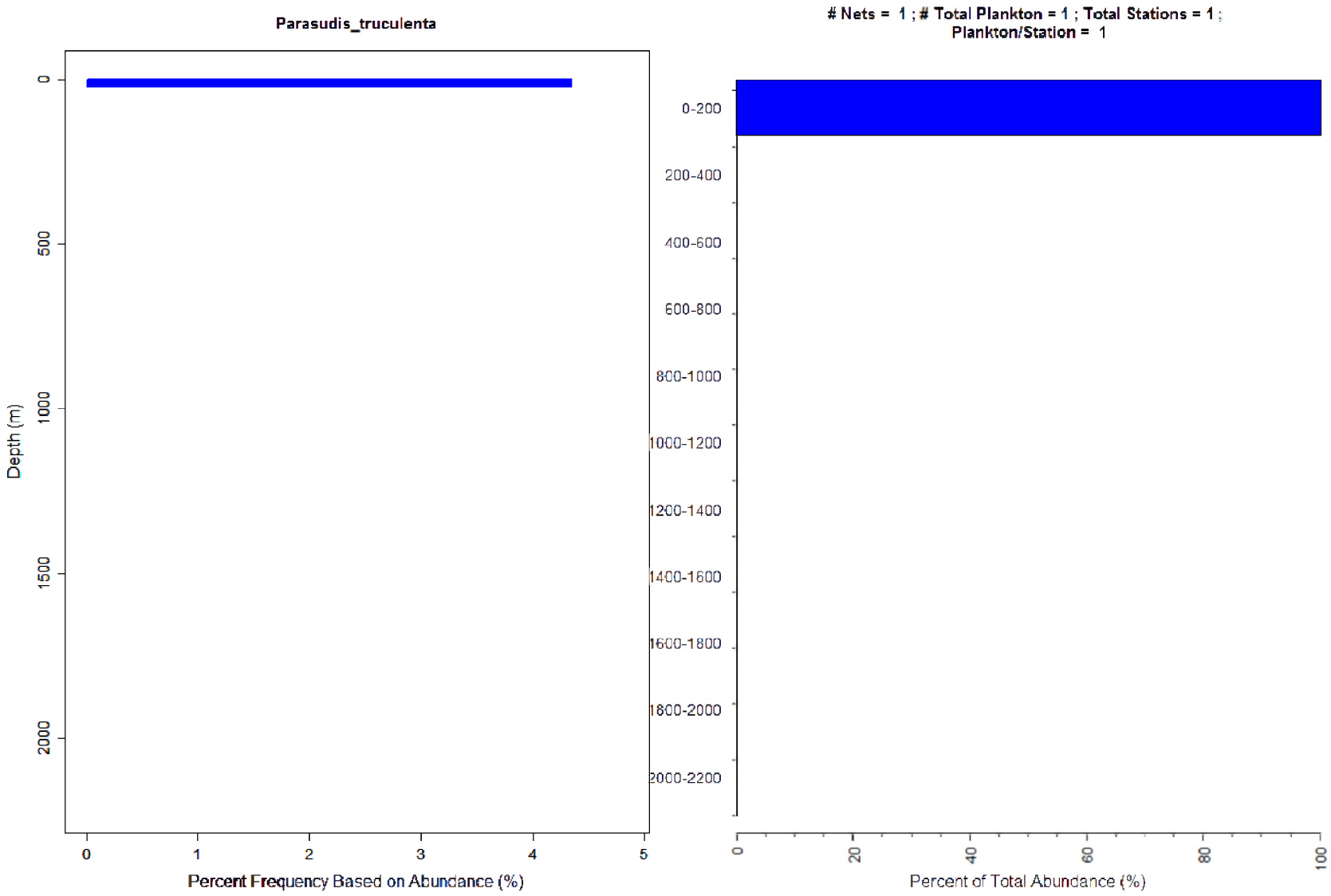
Paralepididae - Deep



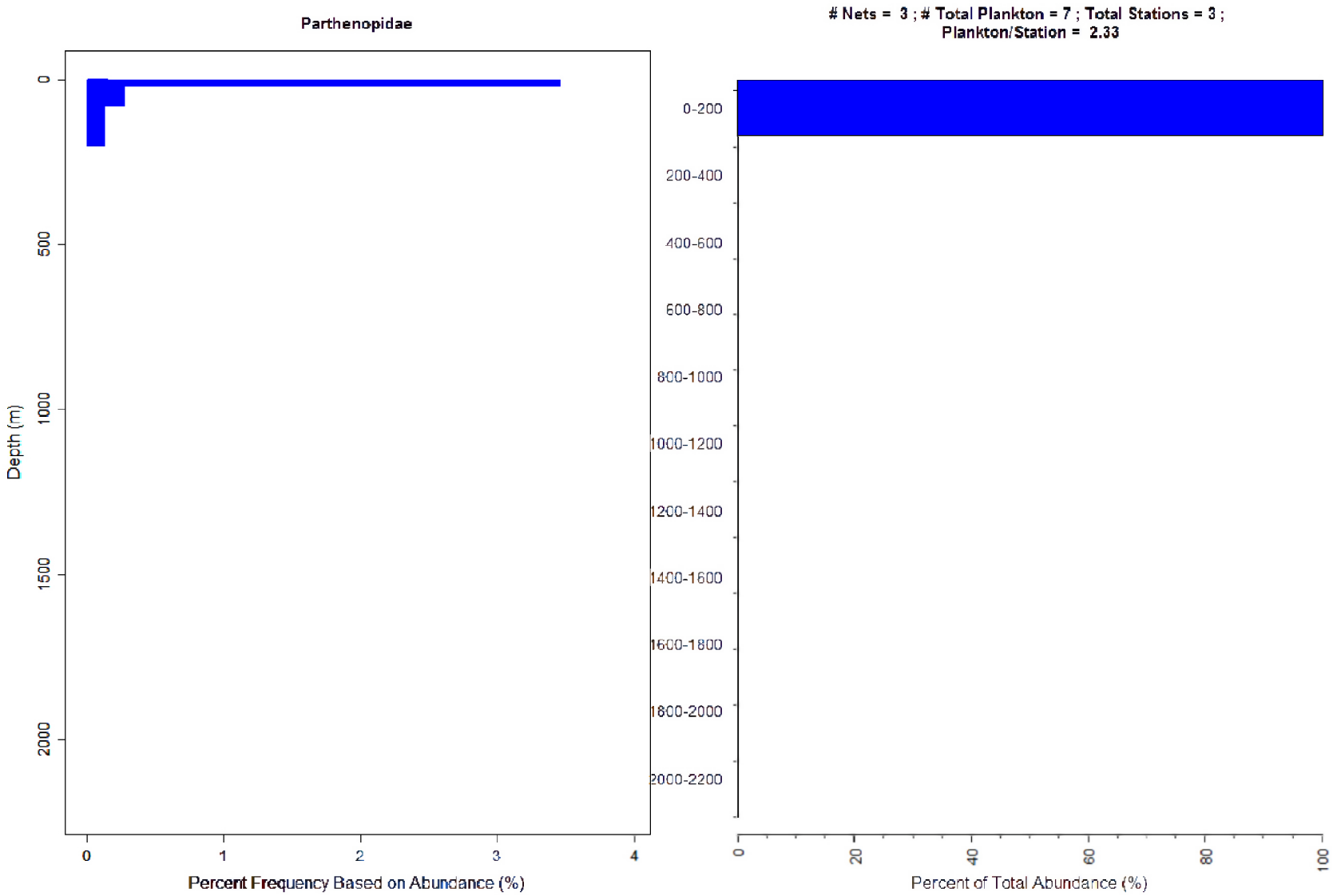
Paralepis - Deep



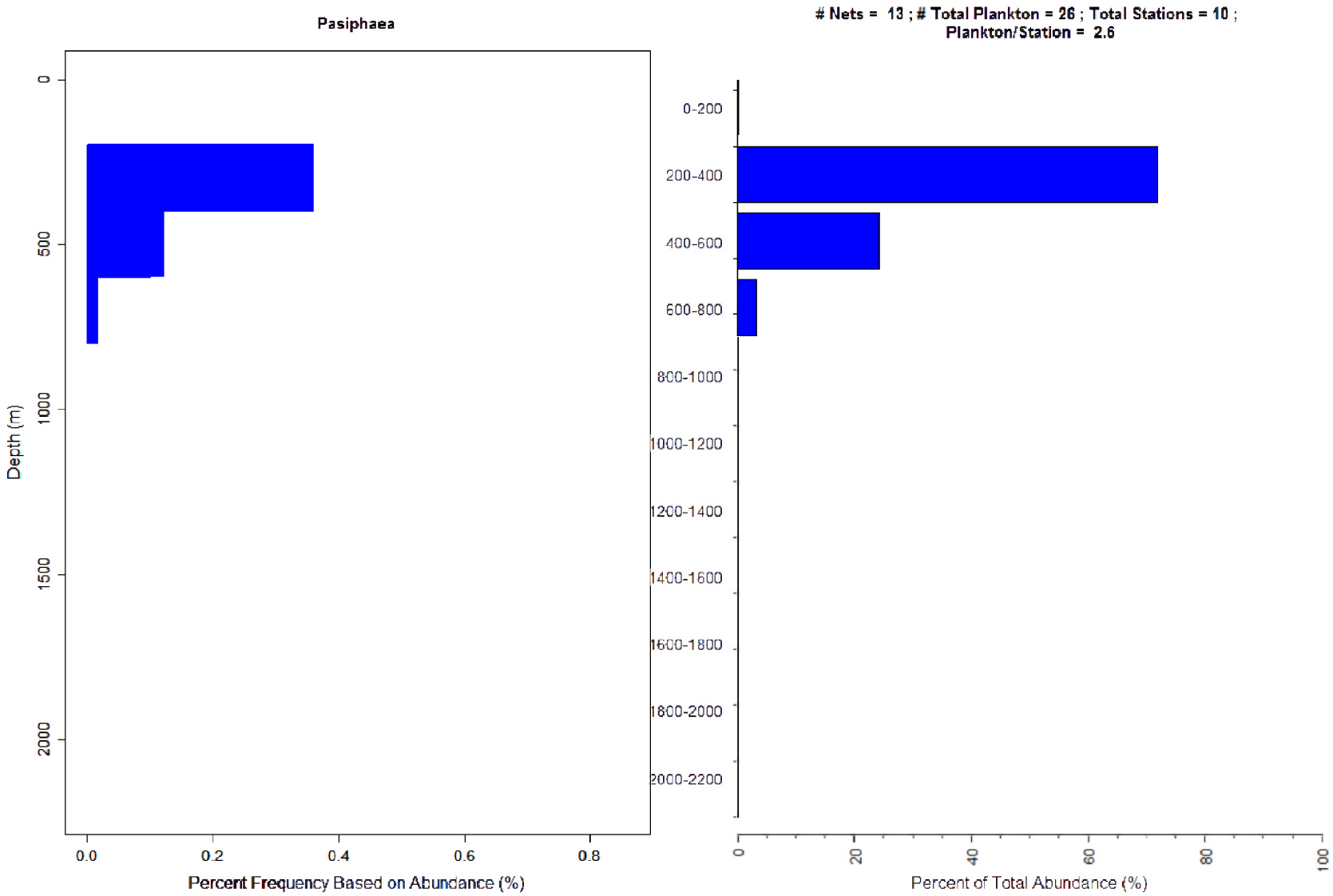
Parapenaeus - Deep



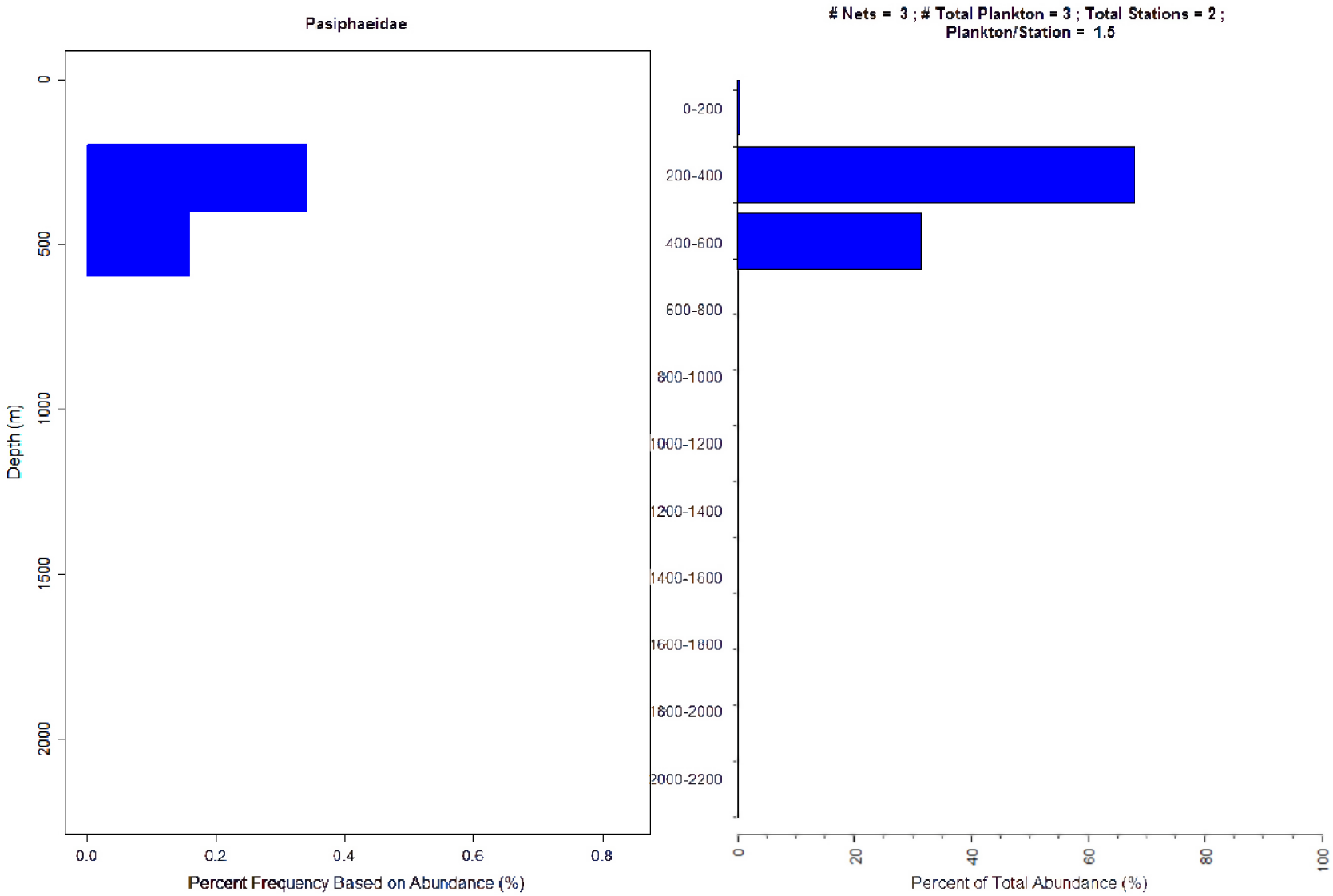
Parasudis_truculenta - Deep



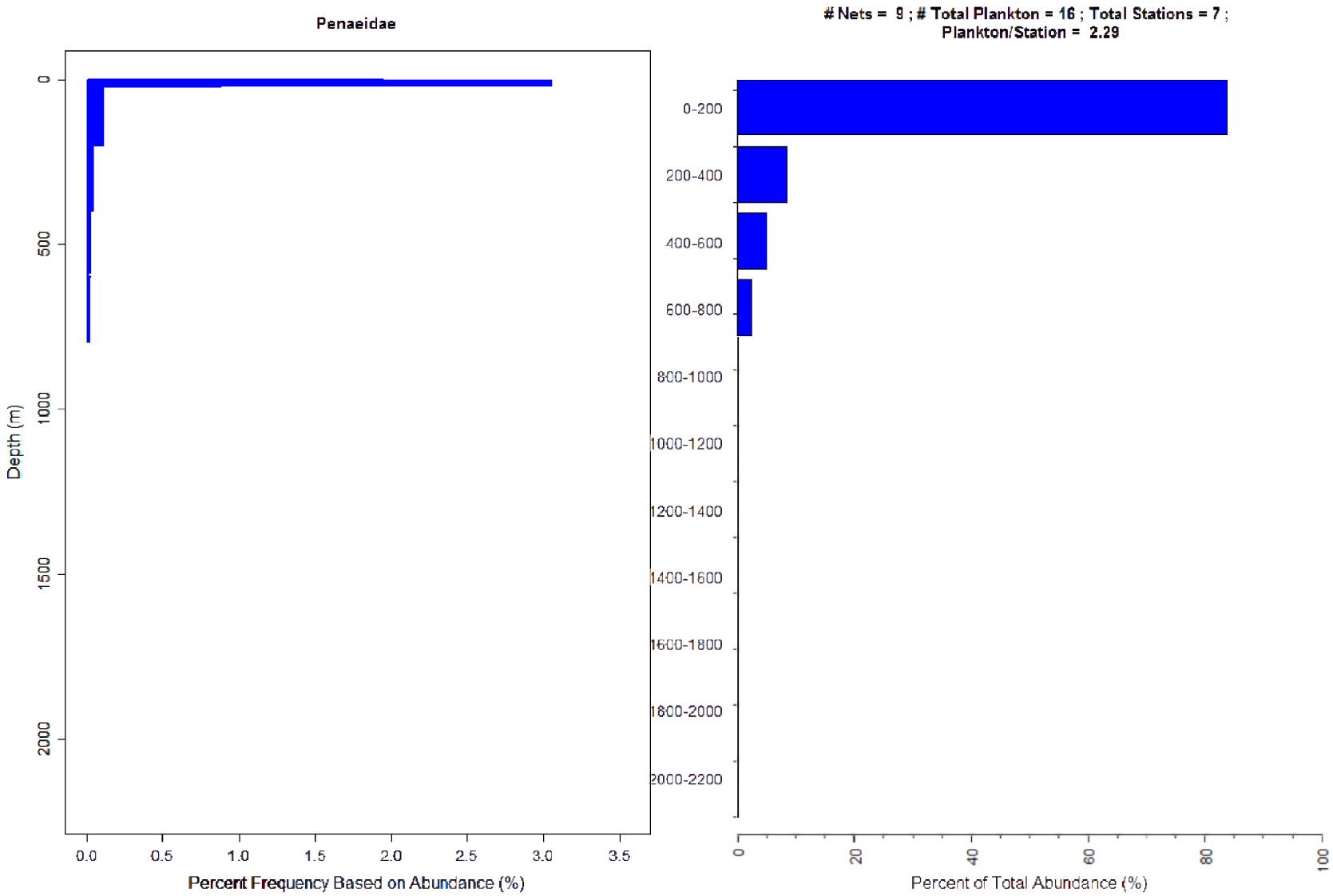
Parthenopidae - Deep



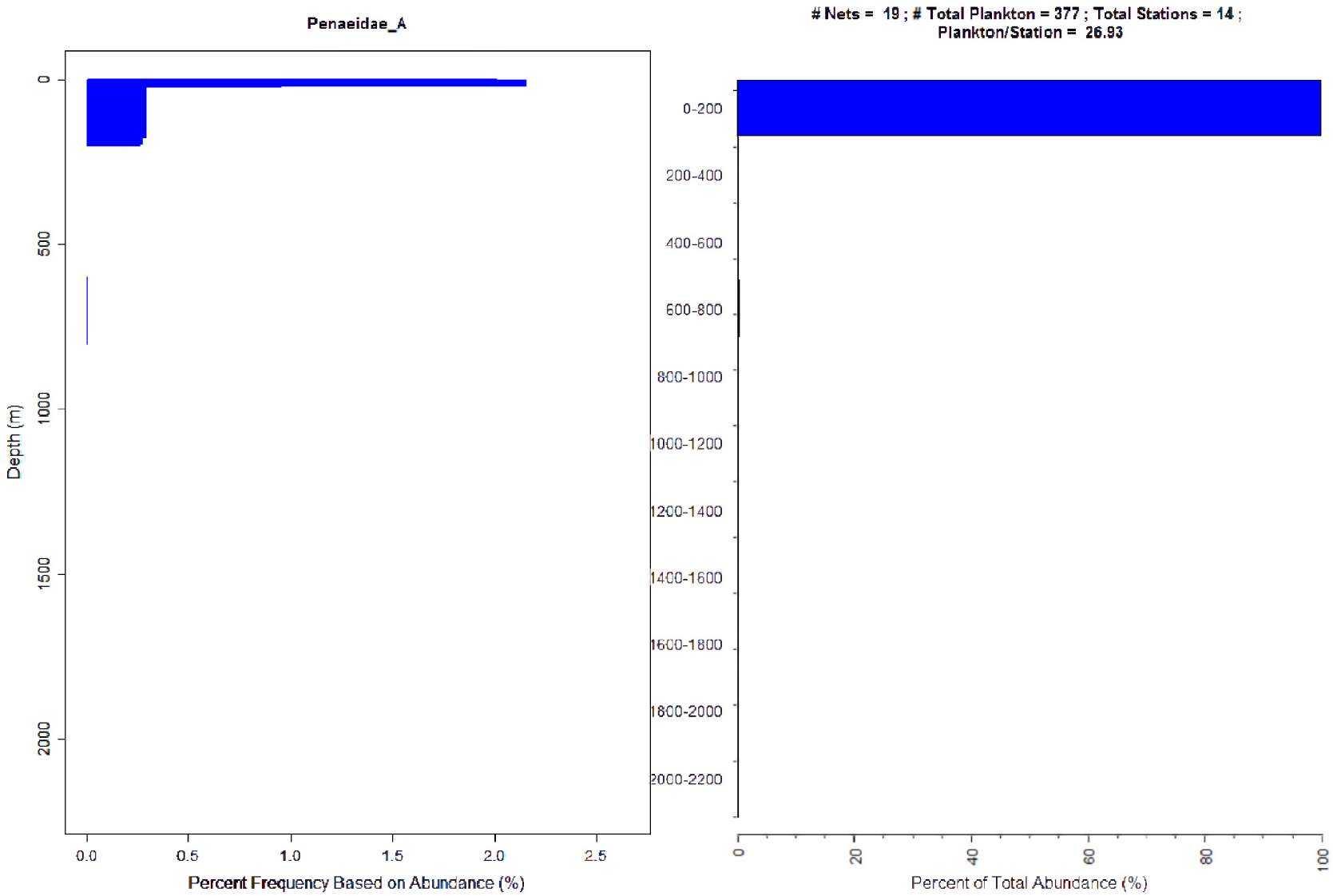
Pasiphaea - Deep



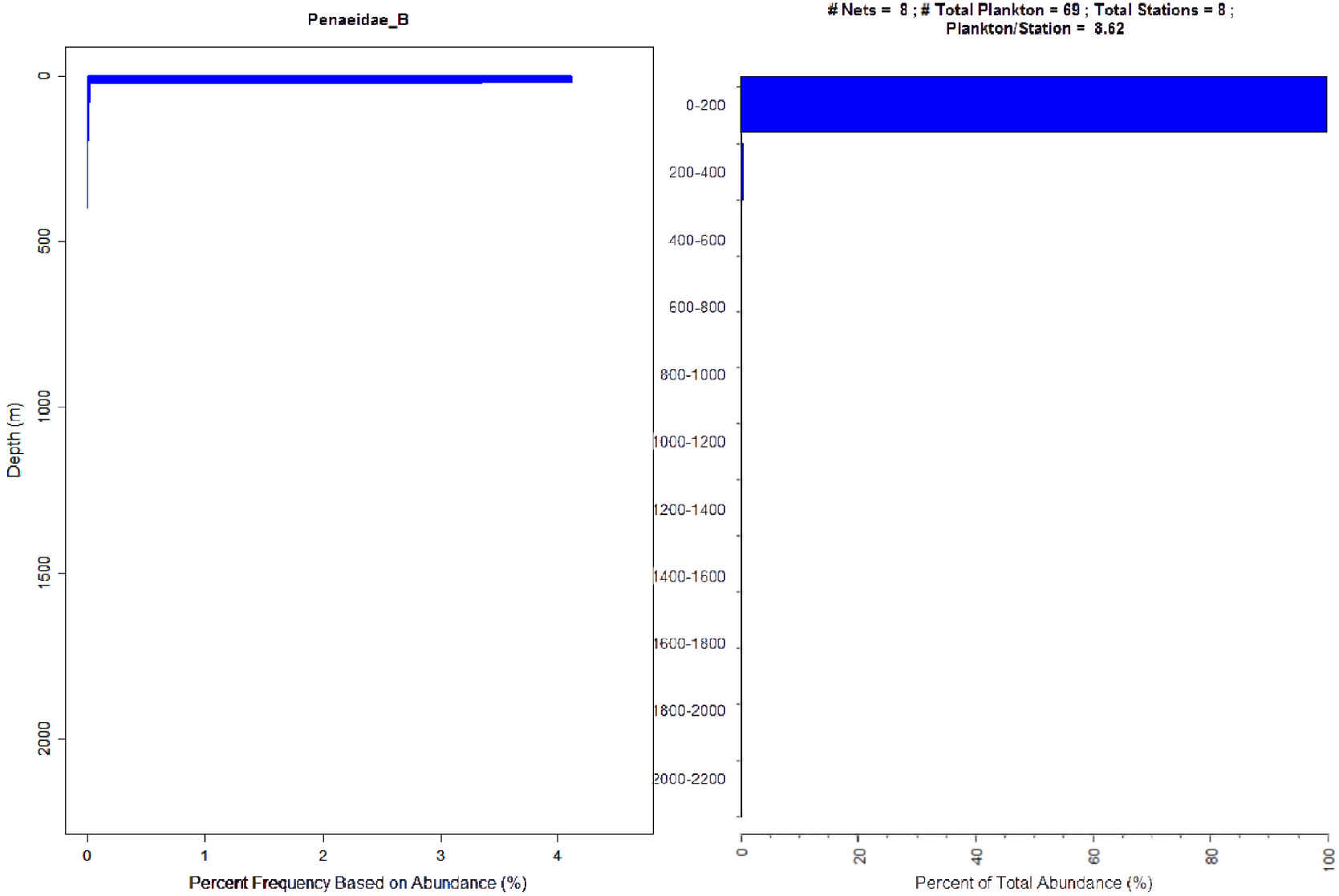
Pasiphaeidae - Deep



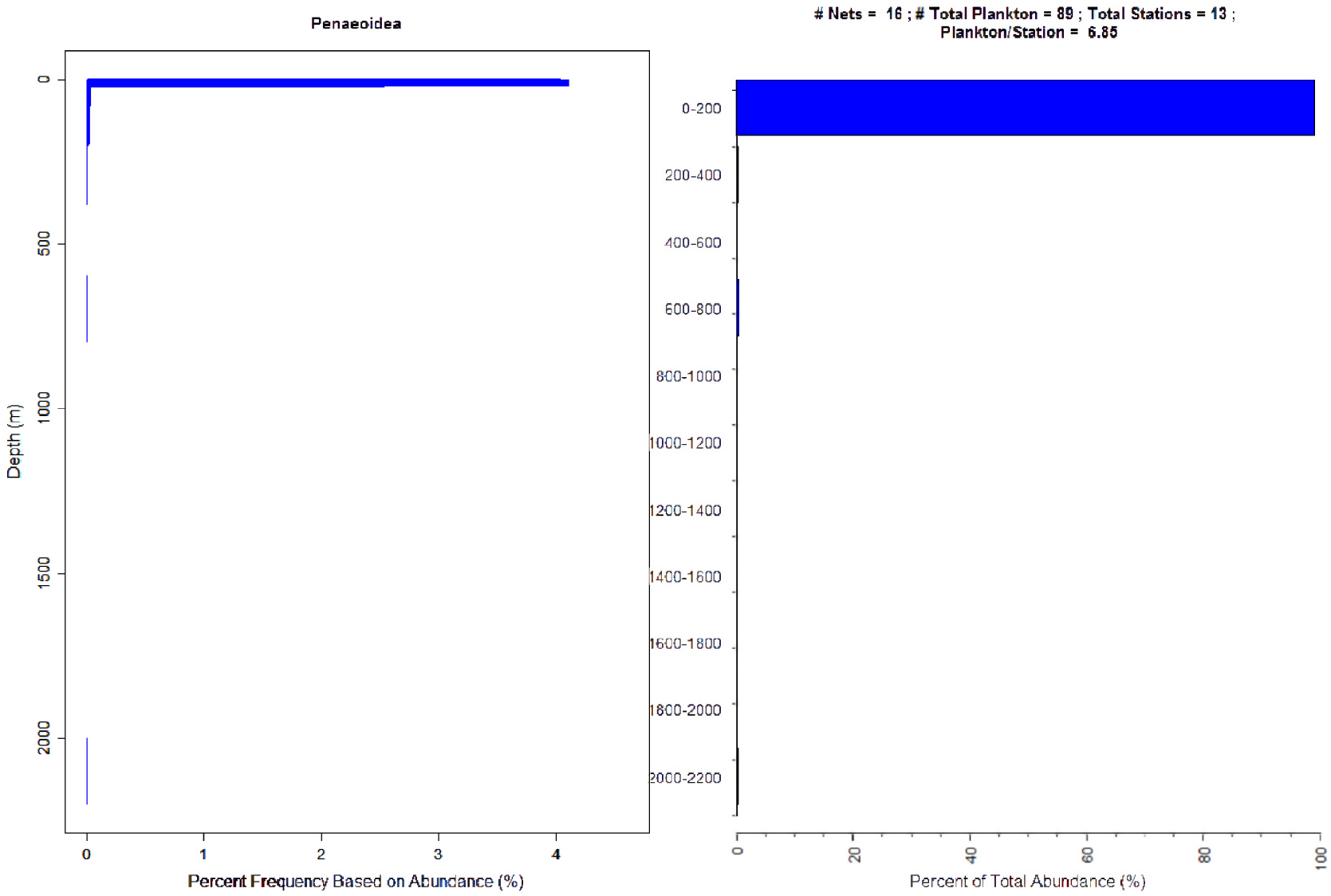
Penaeidae - Deep



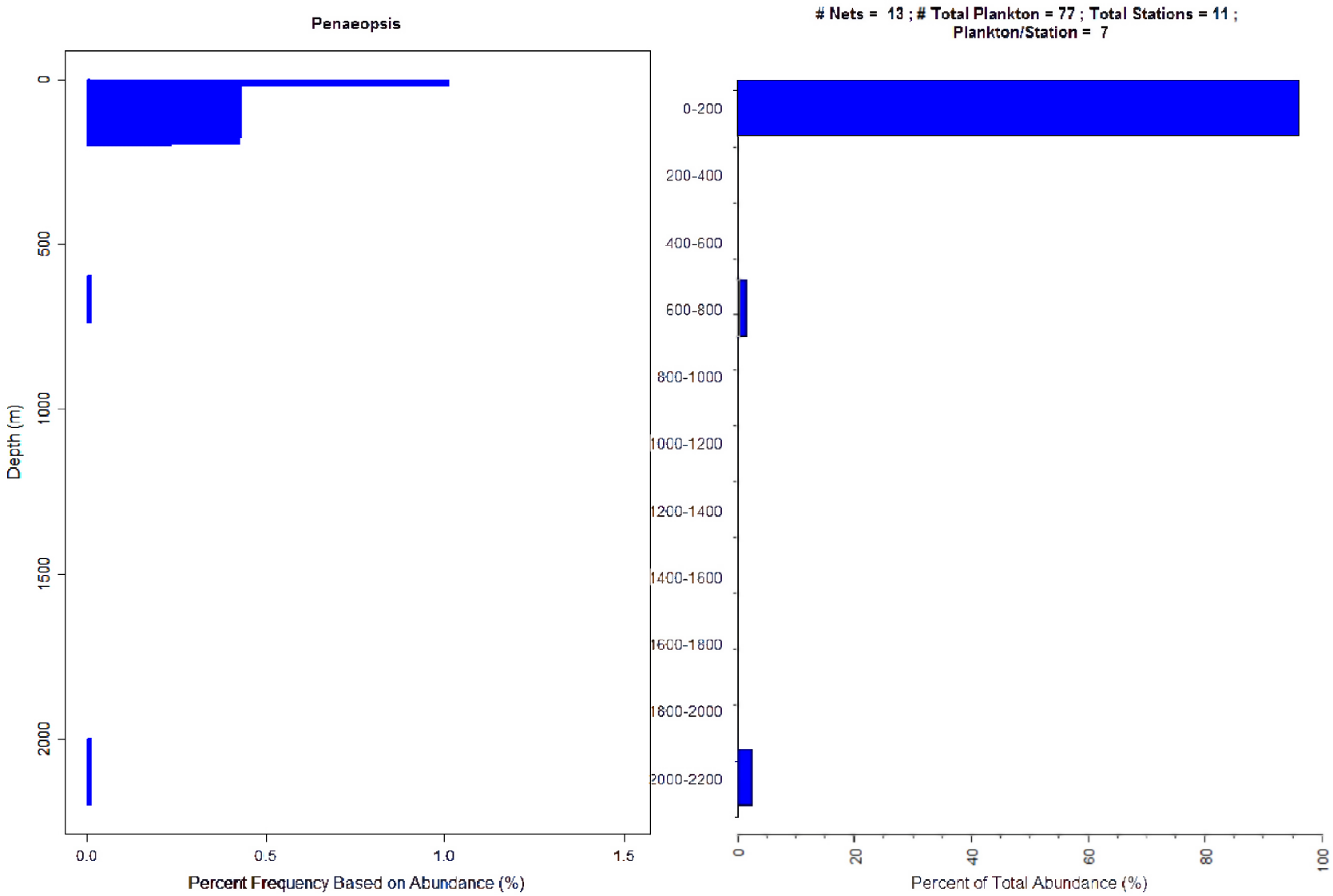
Penaeidae_A - Deep



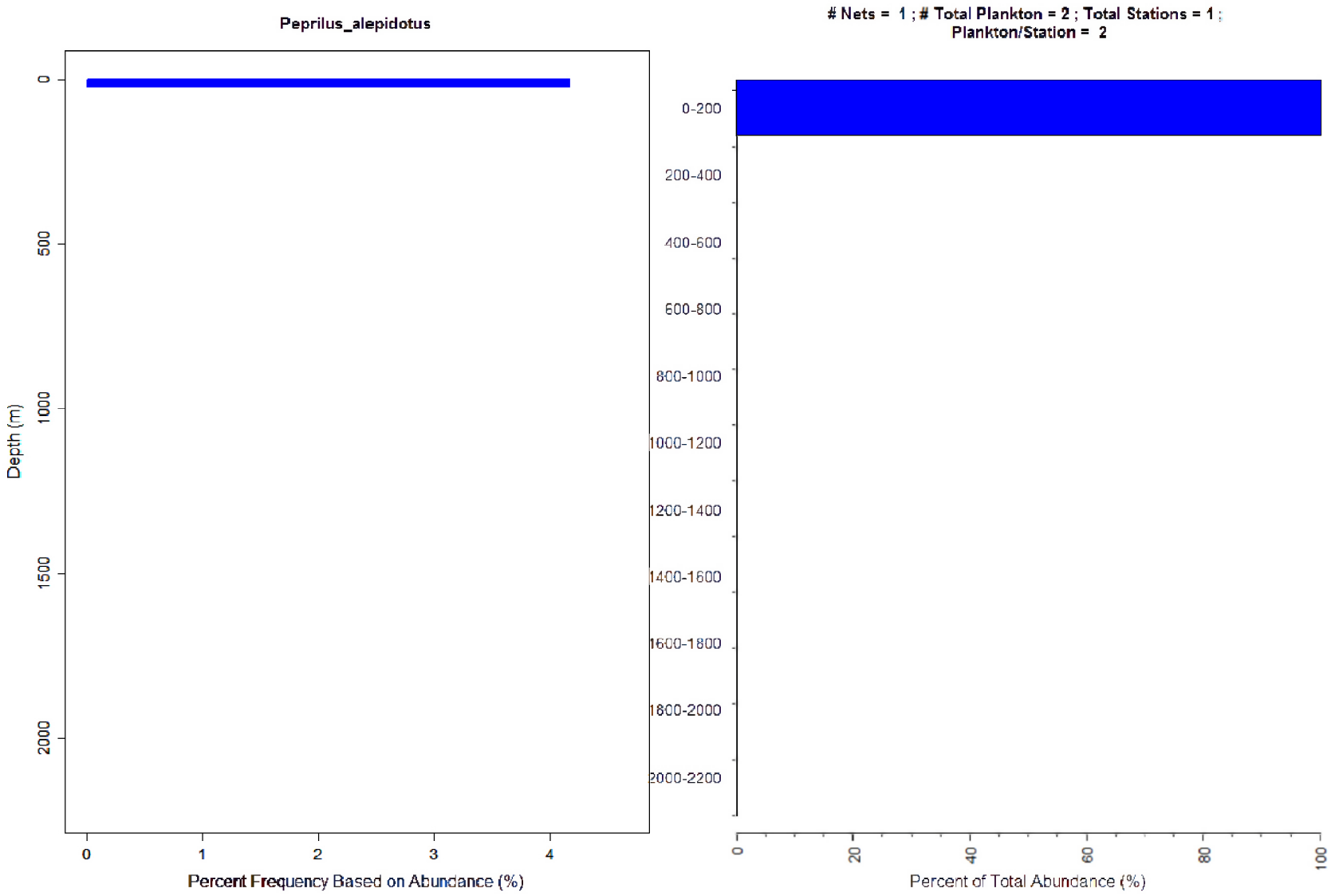
Penaeidae_B - Deep



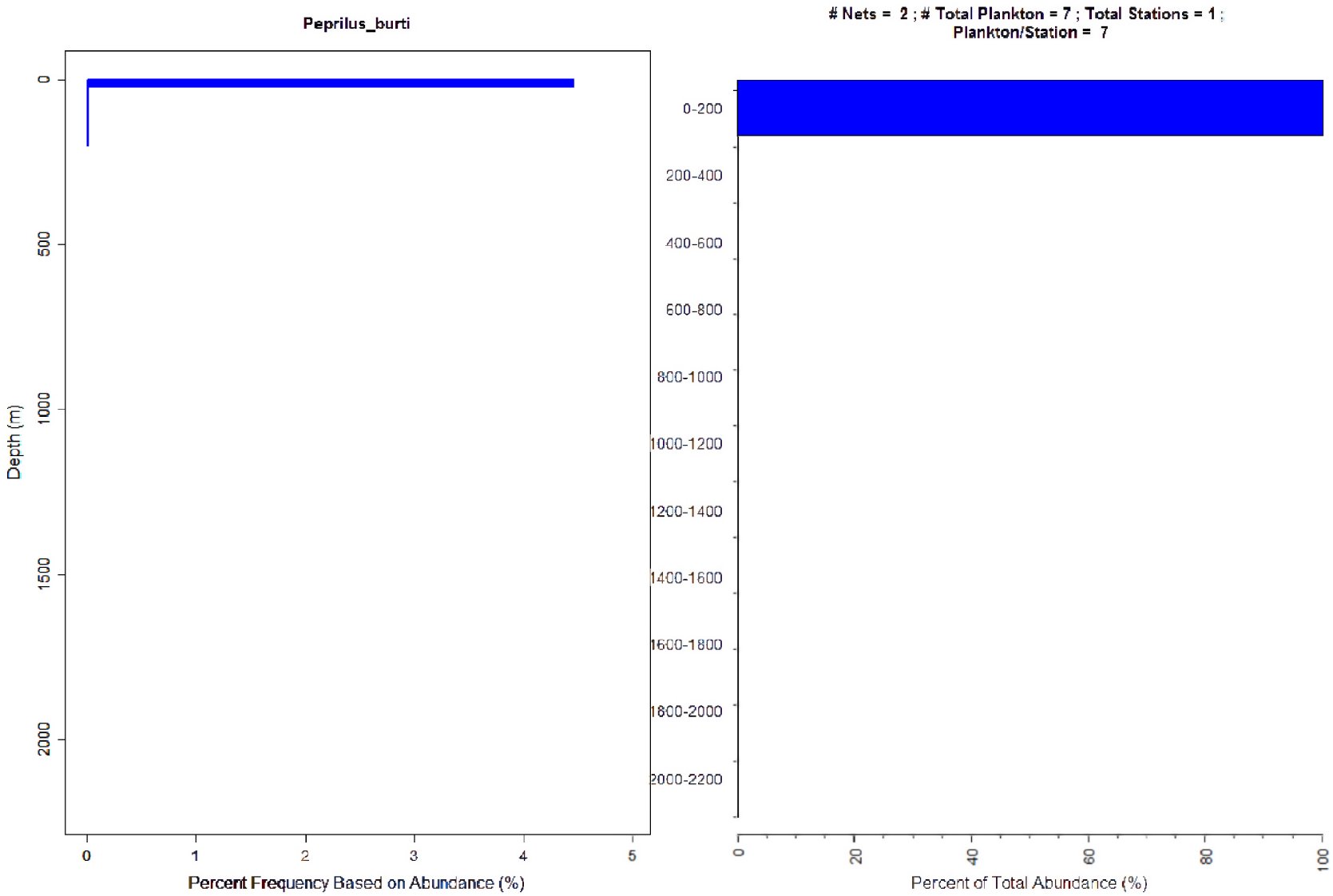
Penaeoidea - Deep



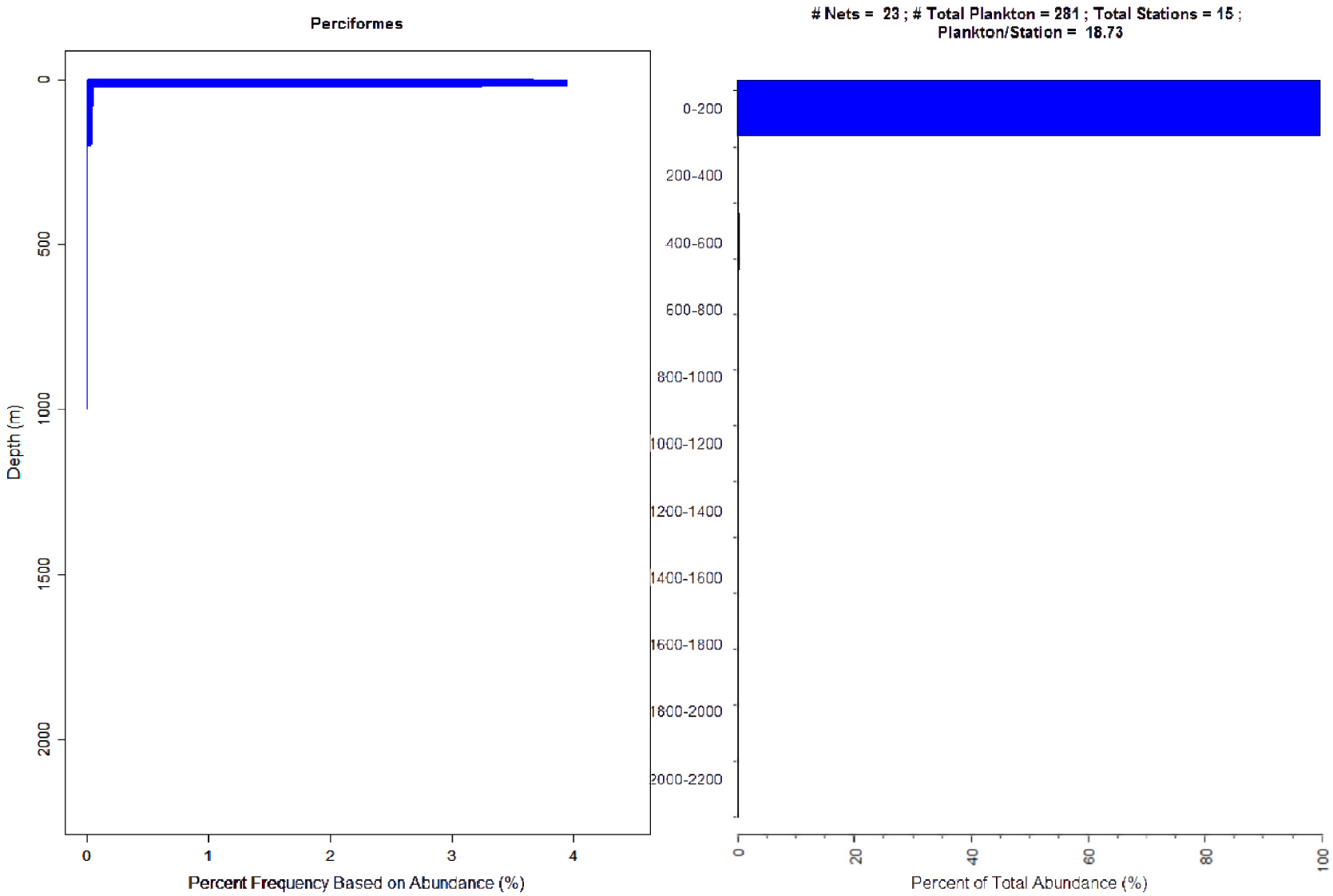
Penaeopsis - Deep



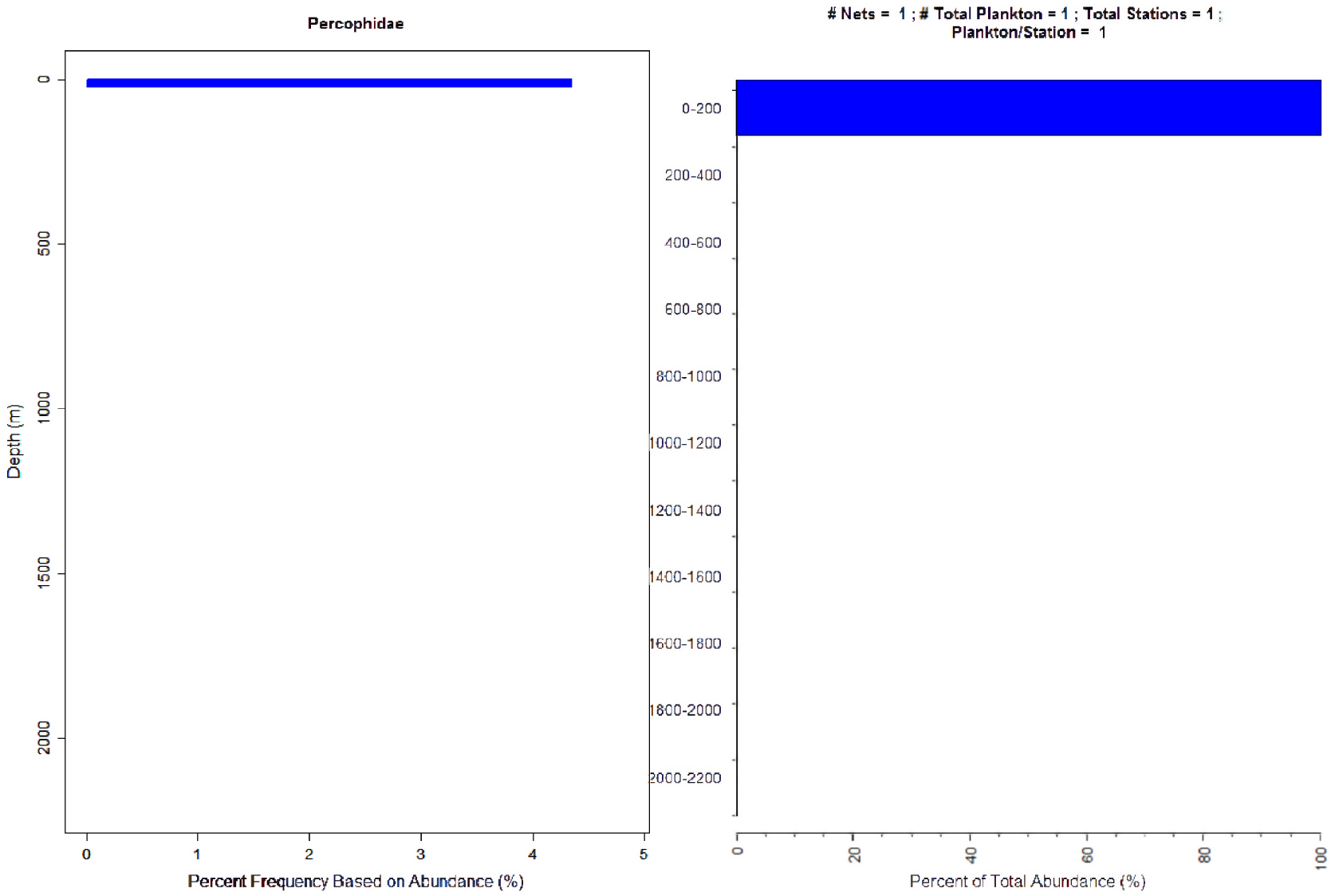
Peprilus_alepidotus - Deep



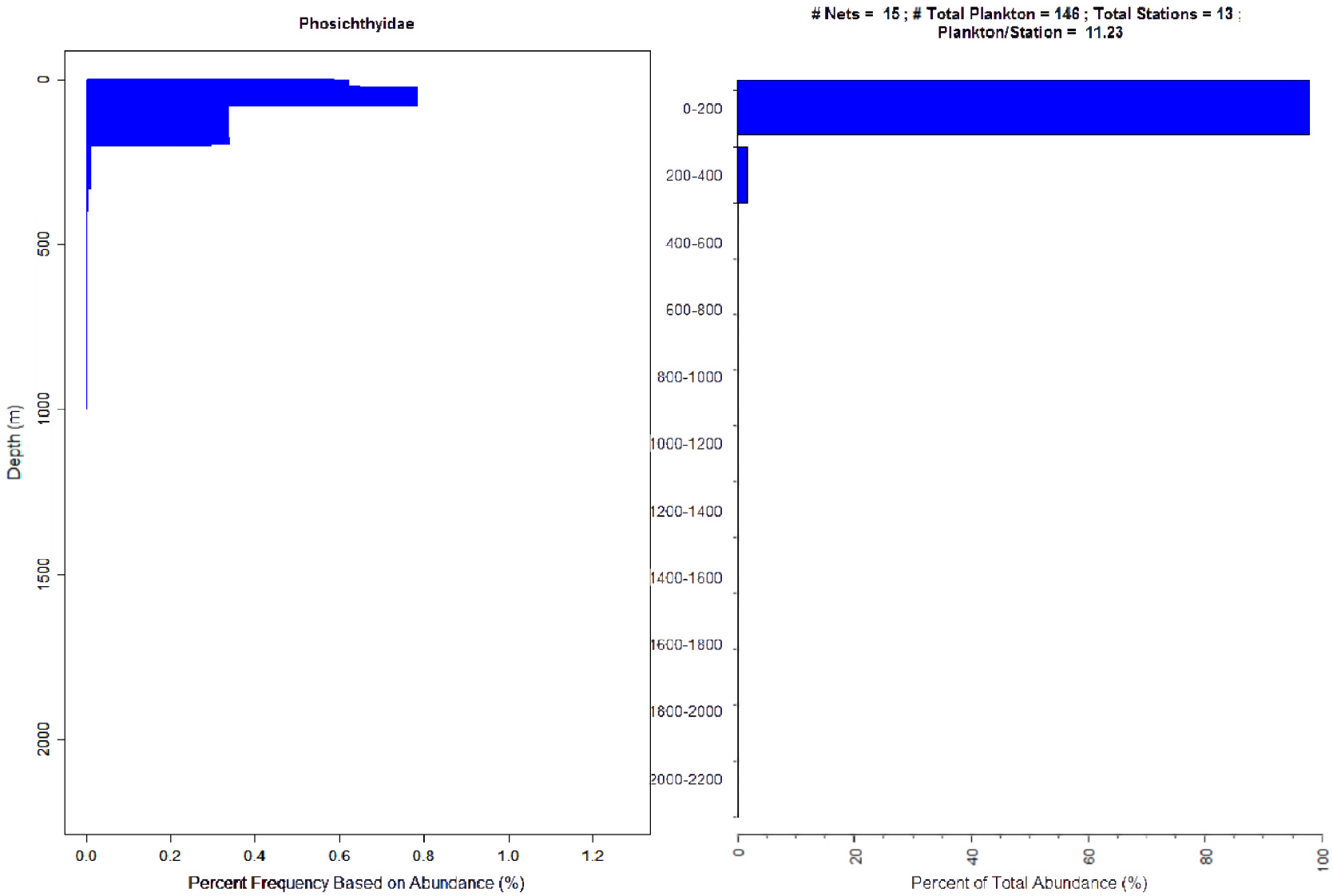
Peprilus_burti - Deep



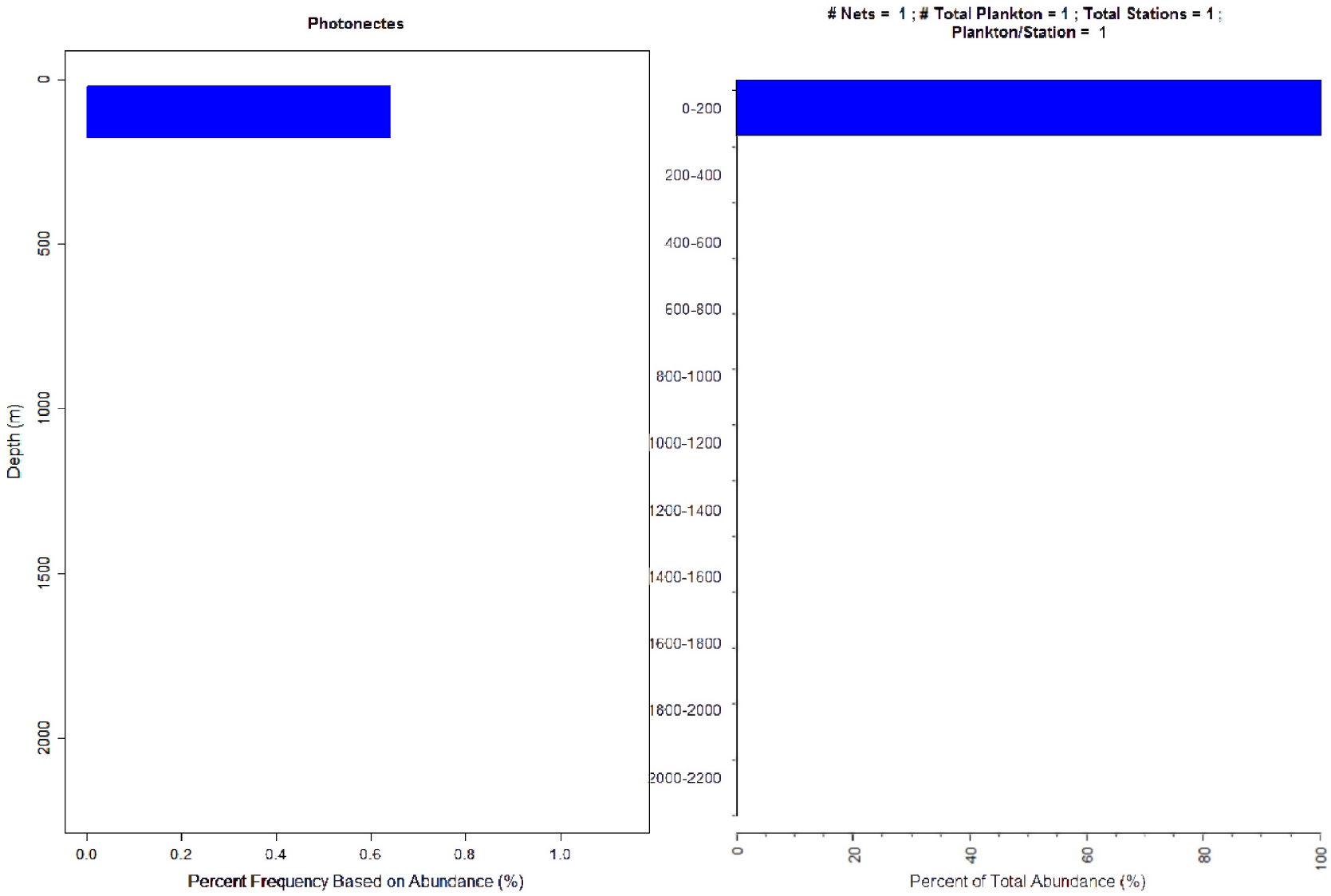
Perciformes - Deep



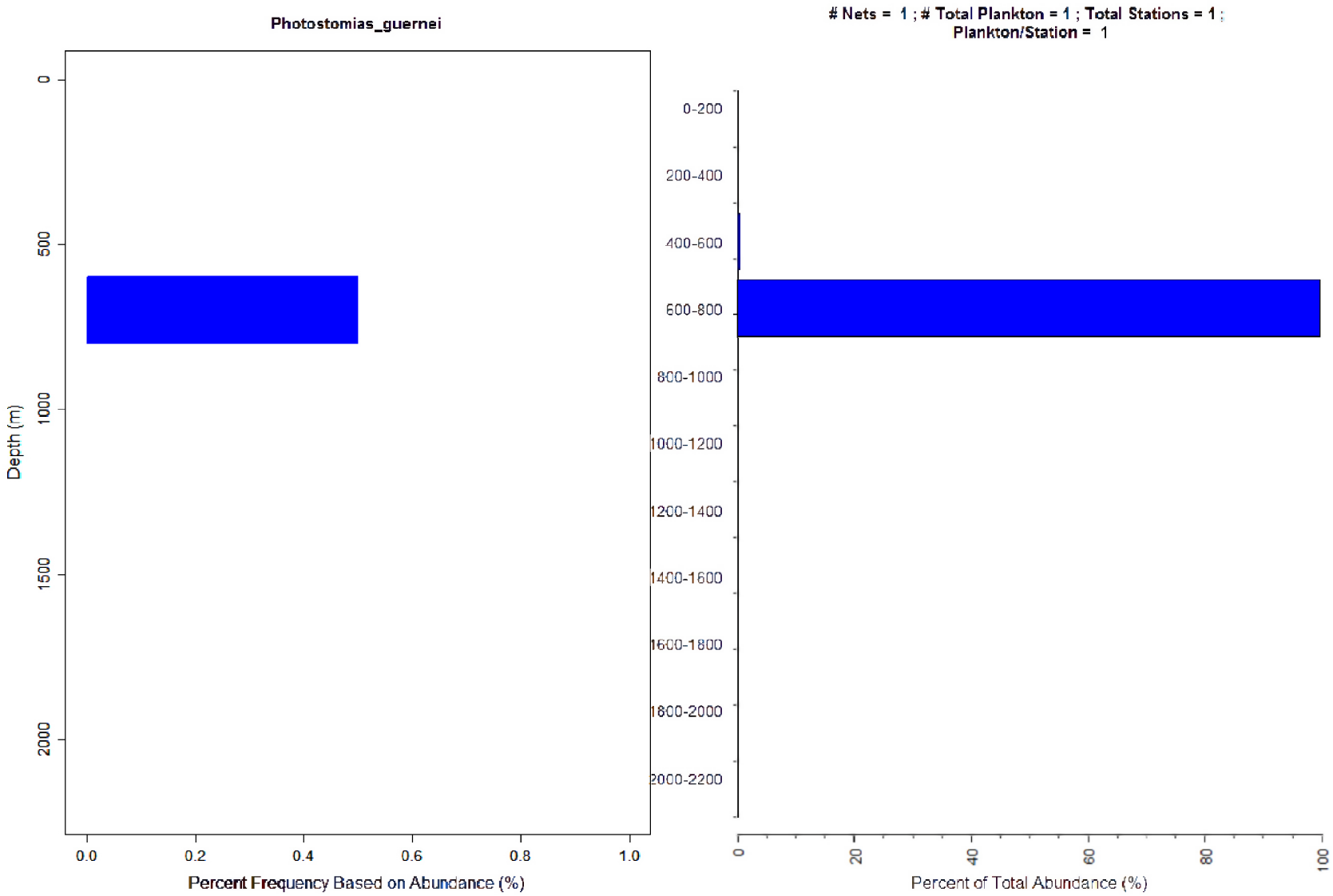
Percophidae - Deep



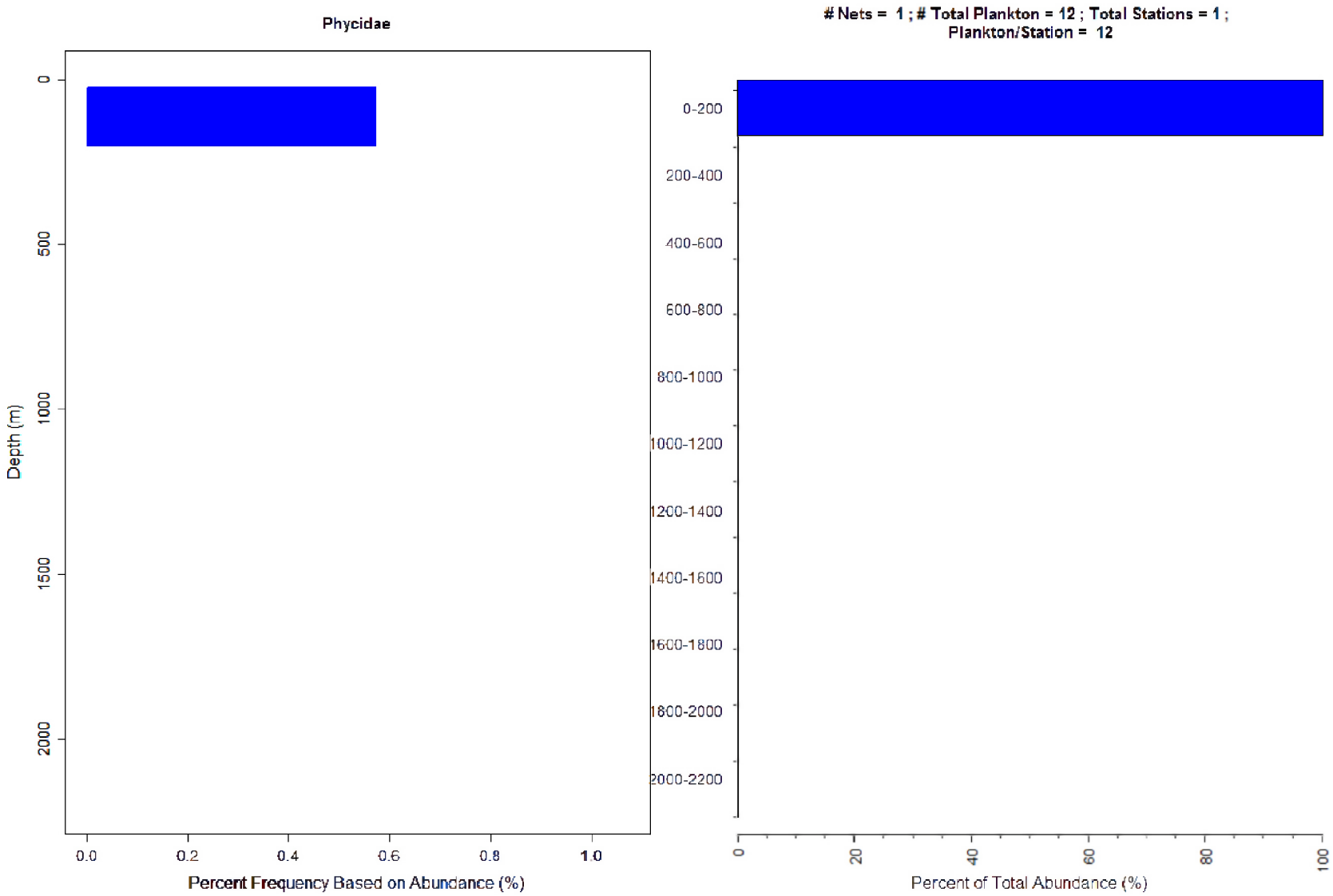
Phosichthyidae - Deep



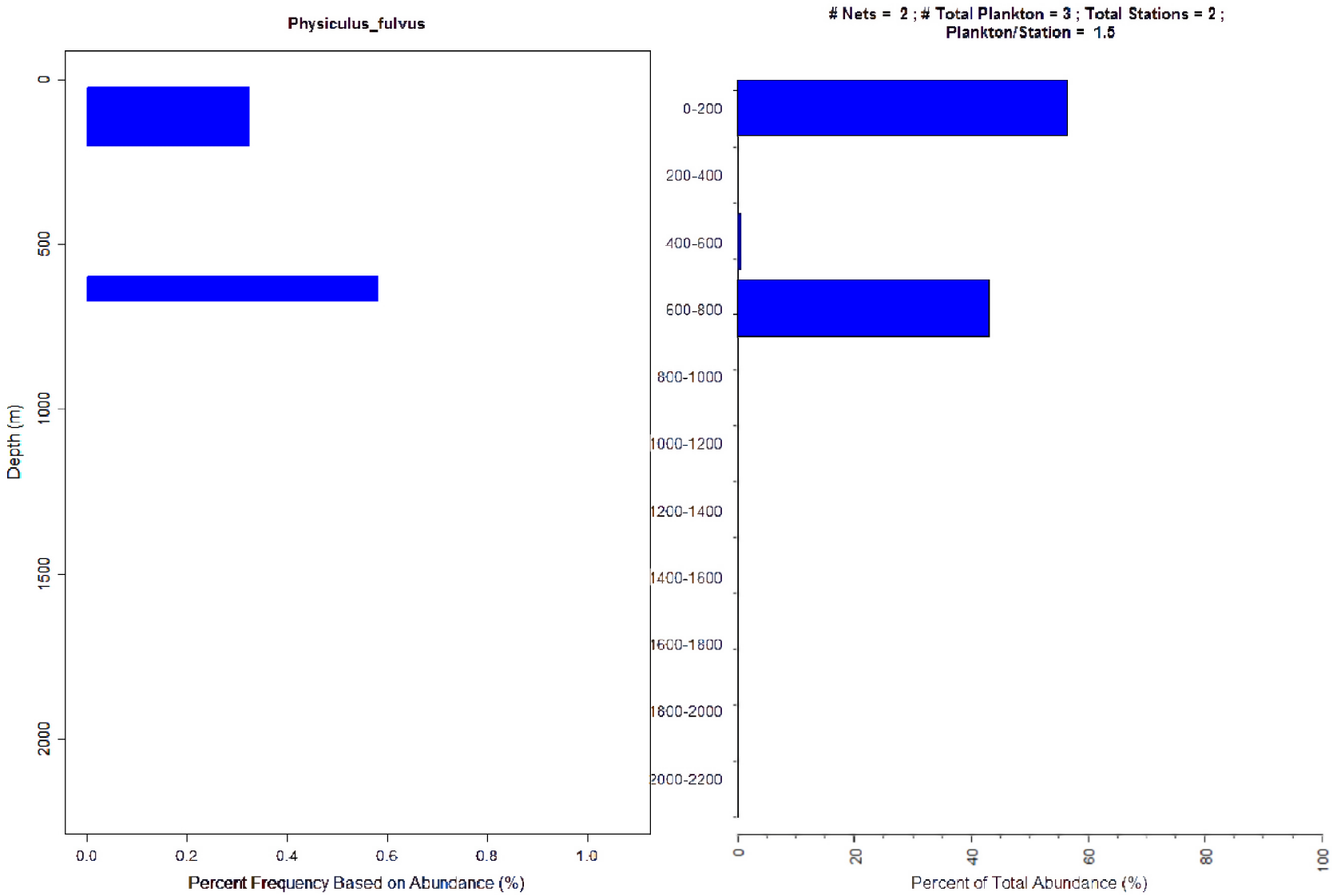
Photonectes - Deep



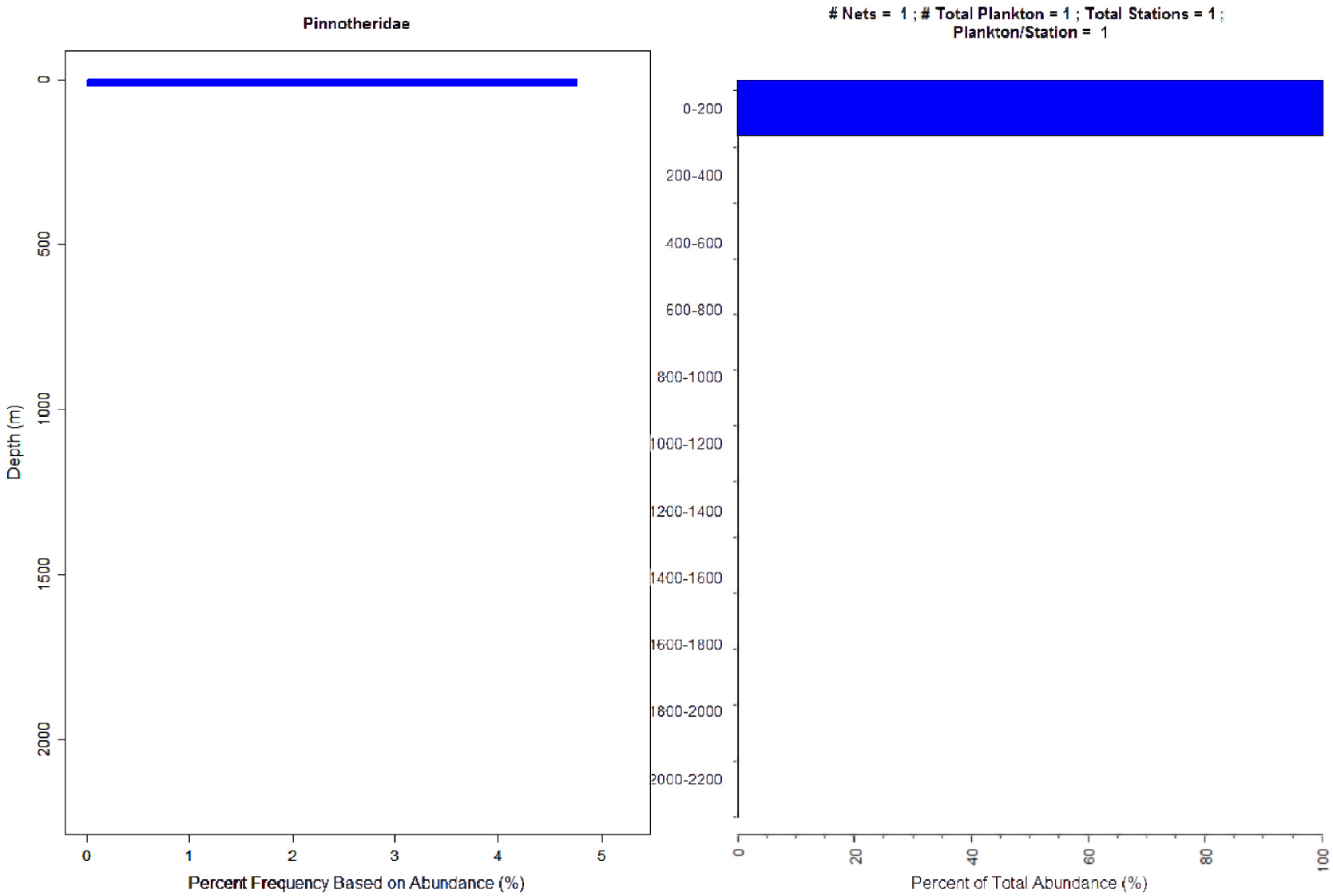
Photostomias_guernei - Deep



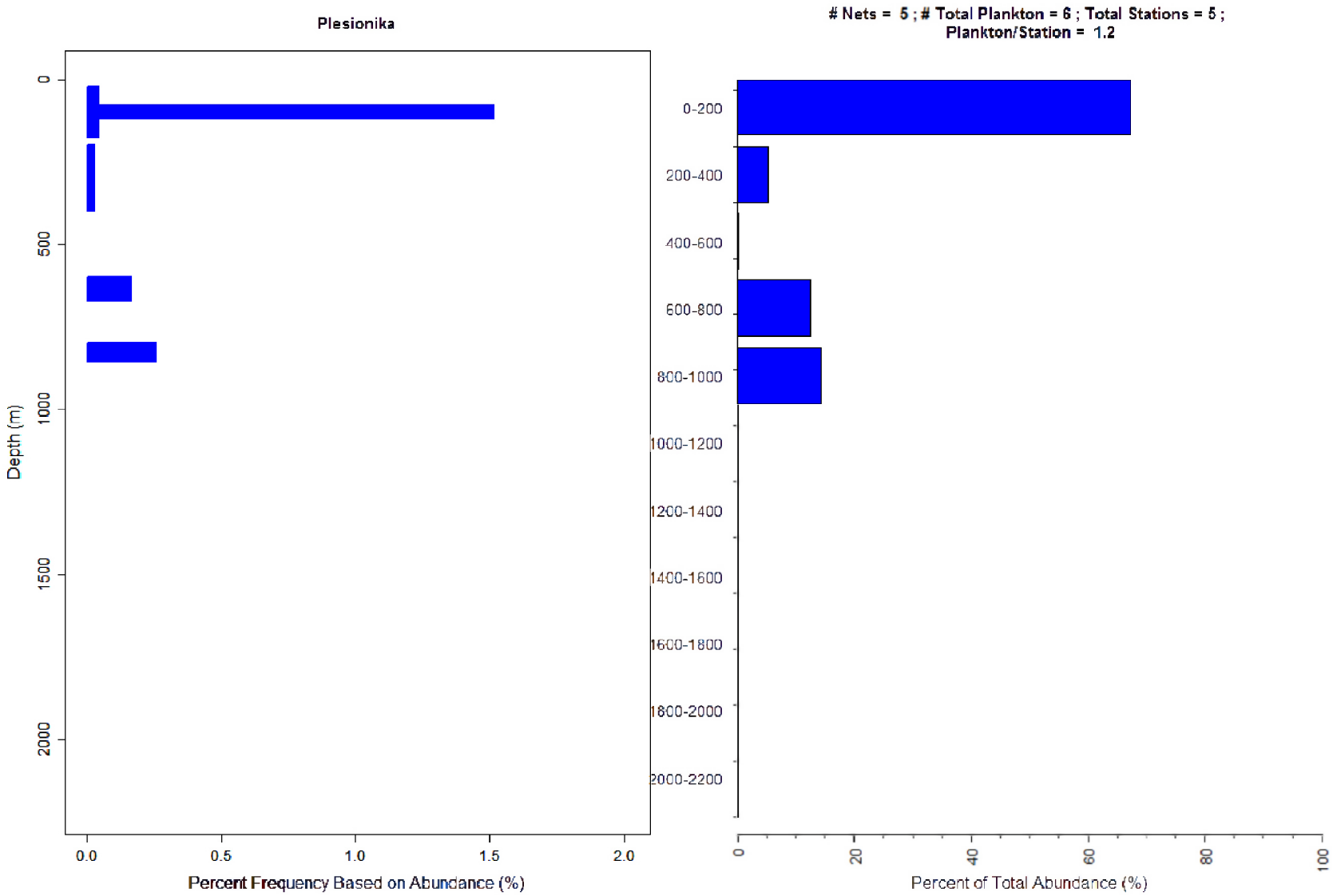
Phycidae - Deep



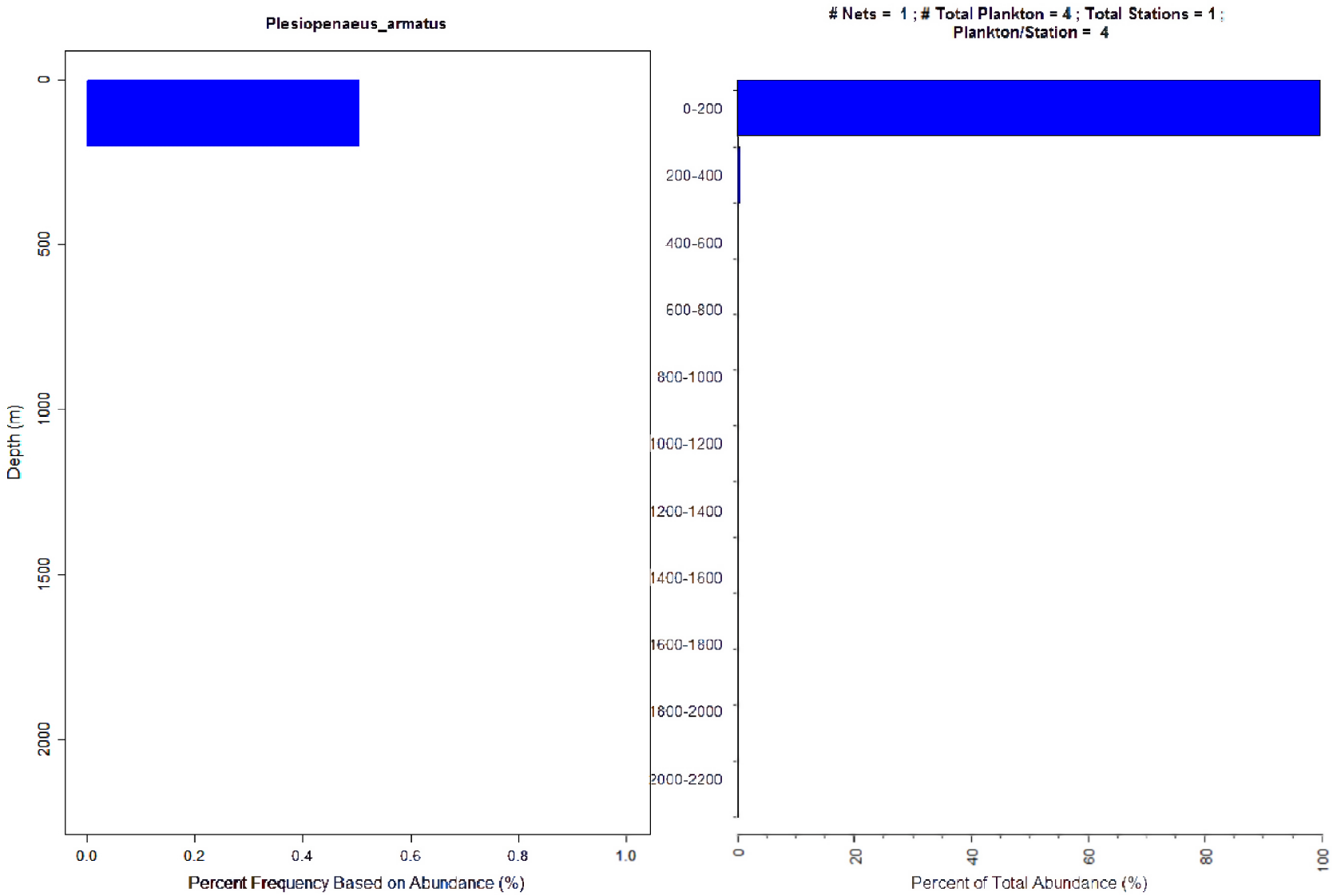
Physiculus_fulvus - Deep



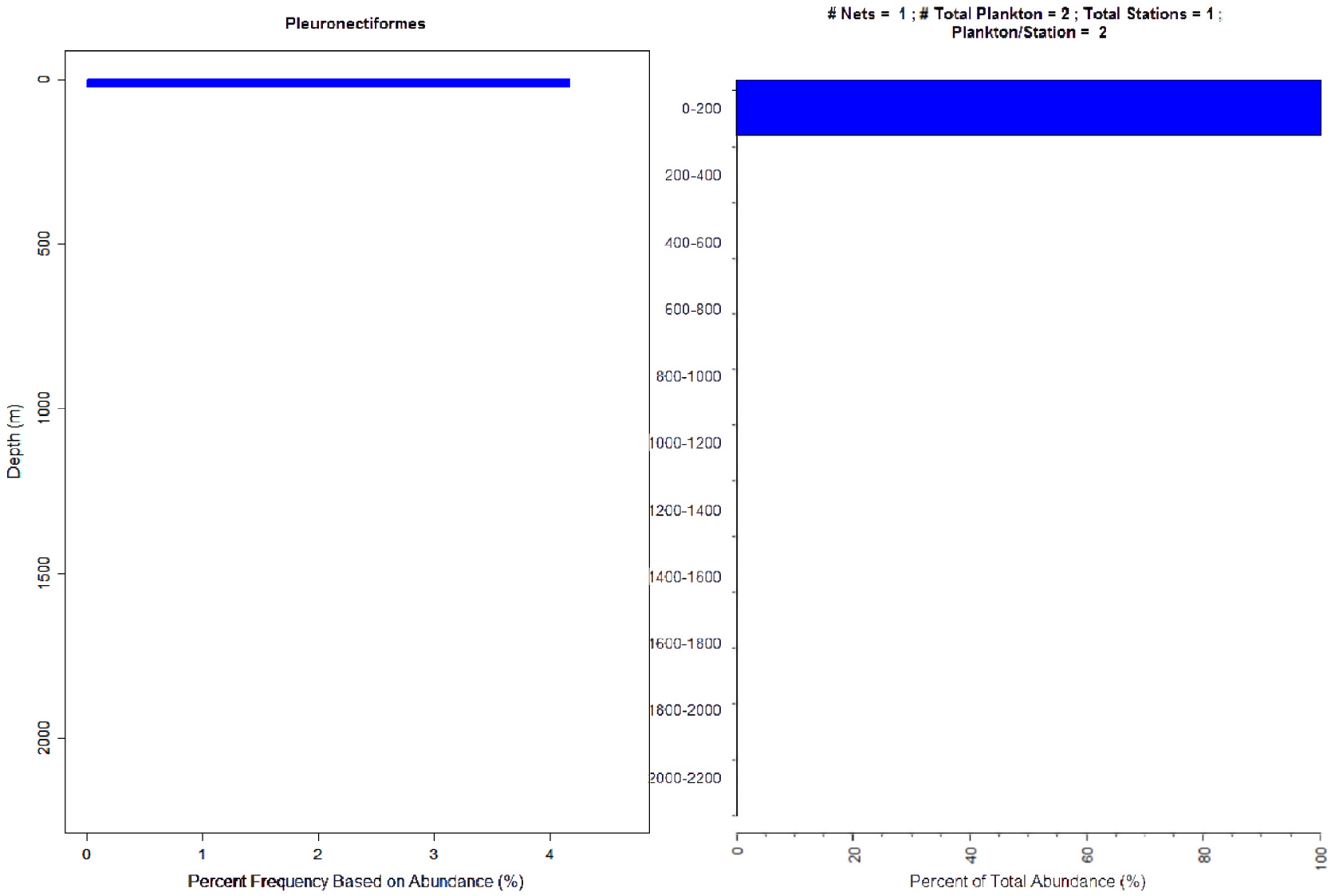
Pinnotheridae - Deep



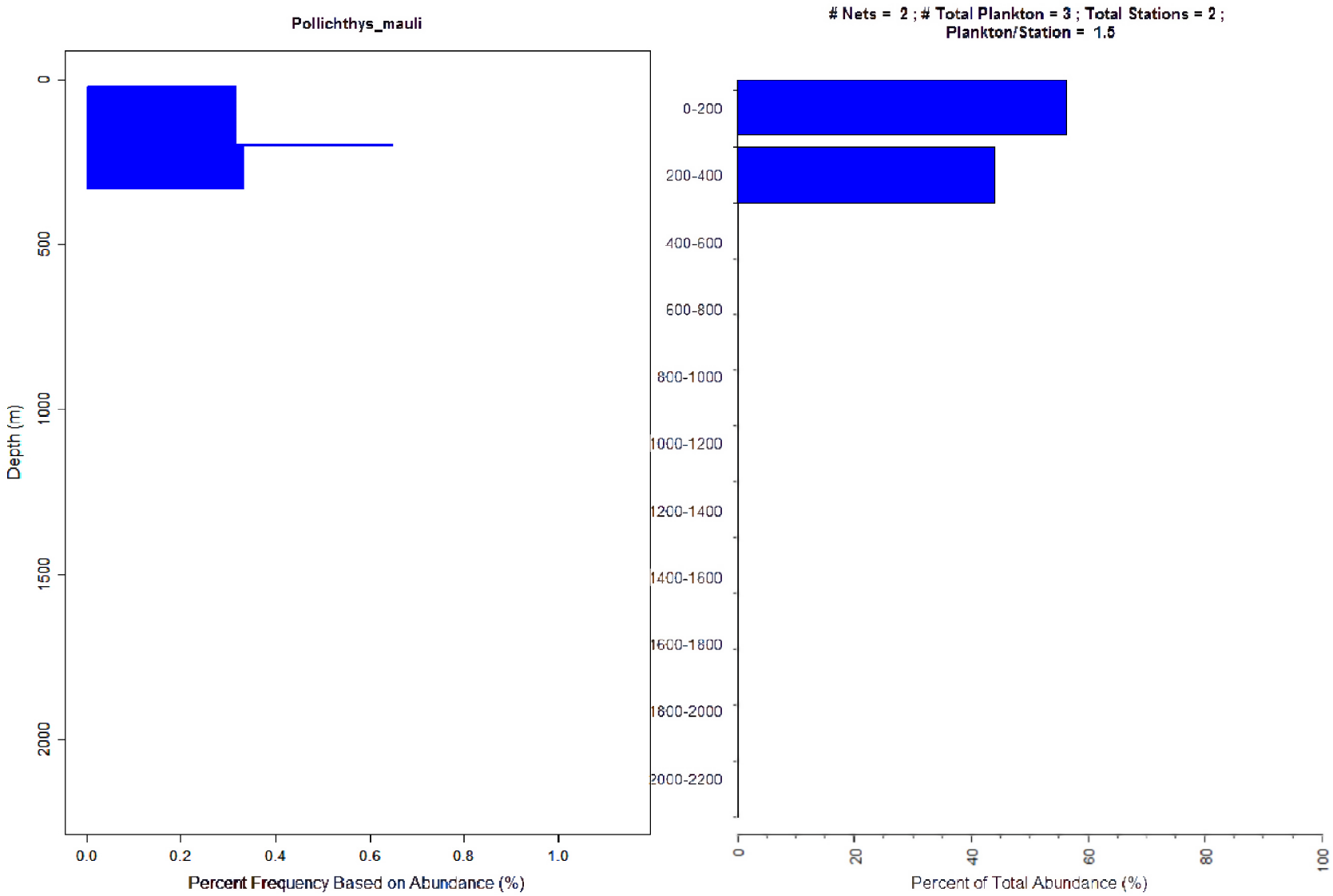
Plesionika - Deep



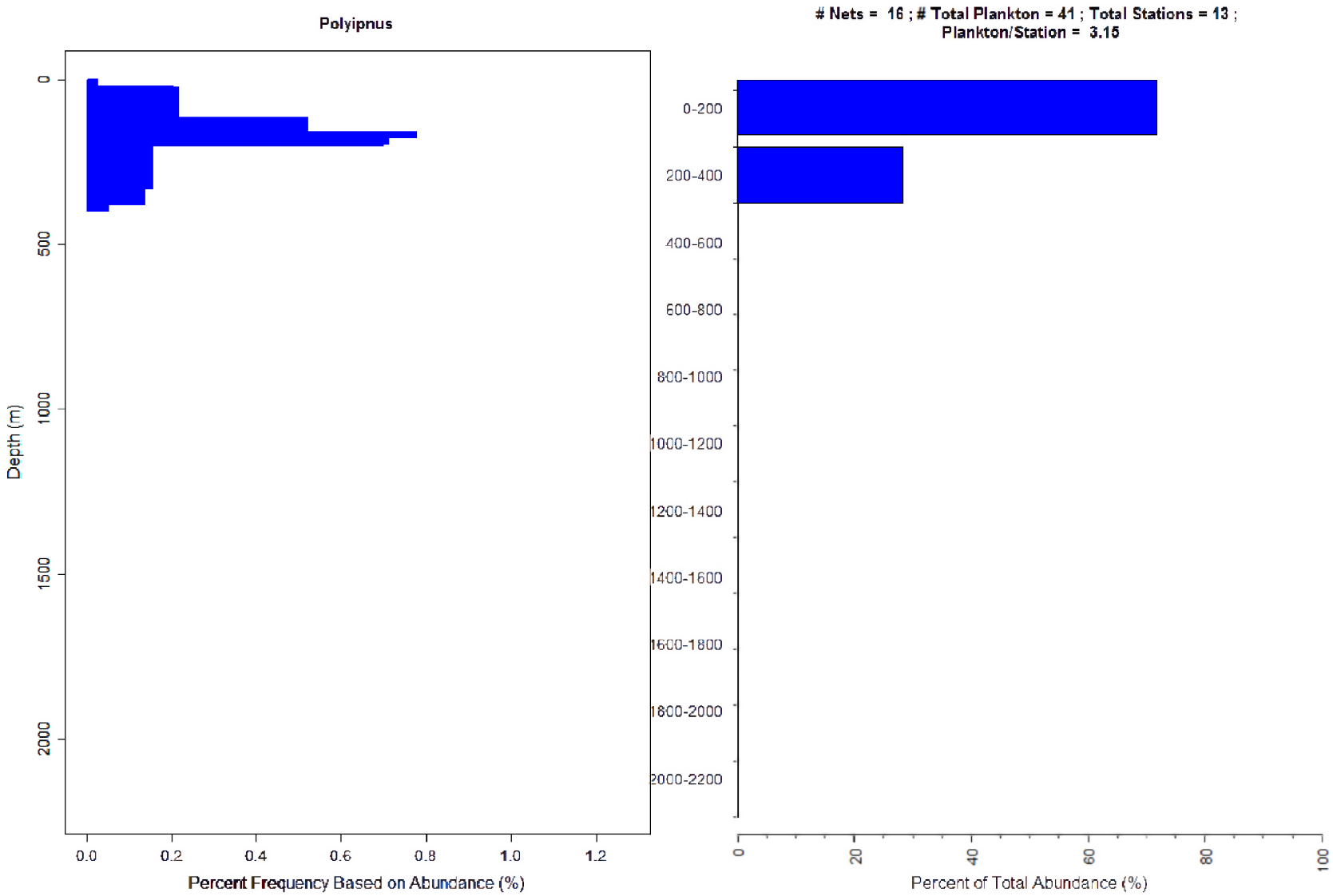
Plesiopenaeus_armatus - Deep



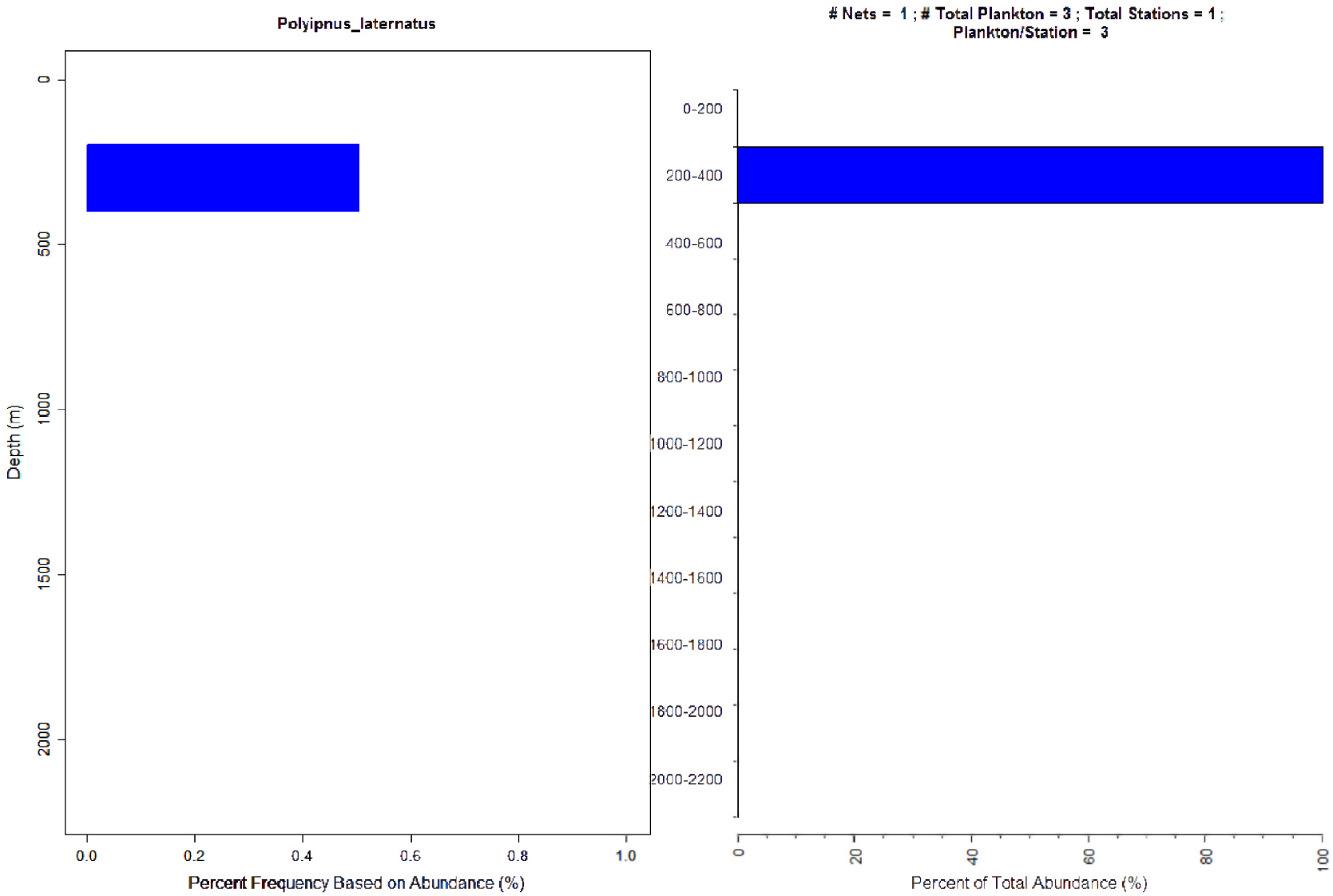
Pleuronectiformes - Deep



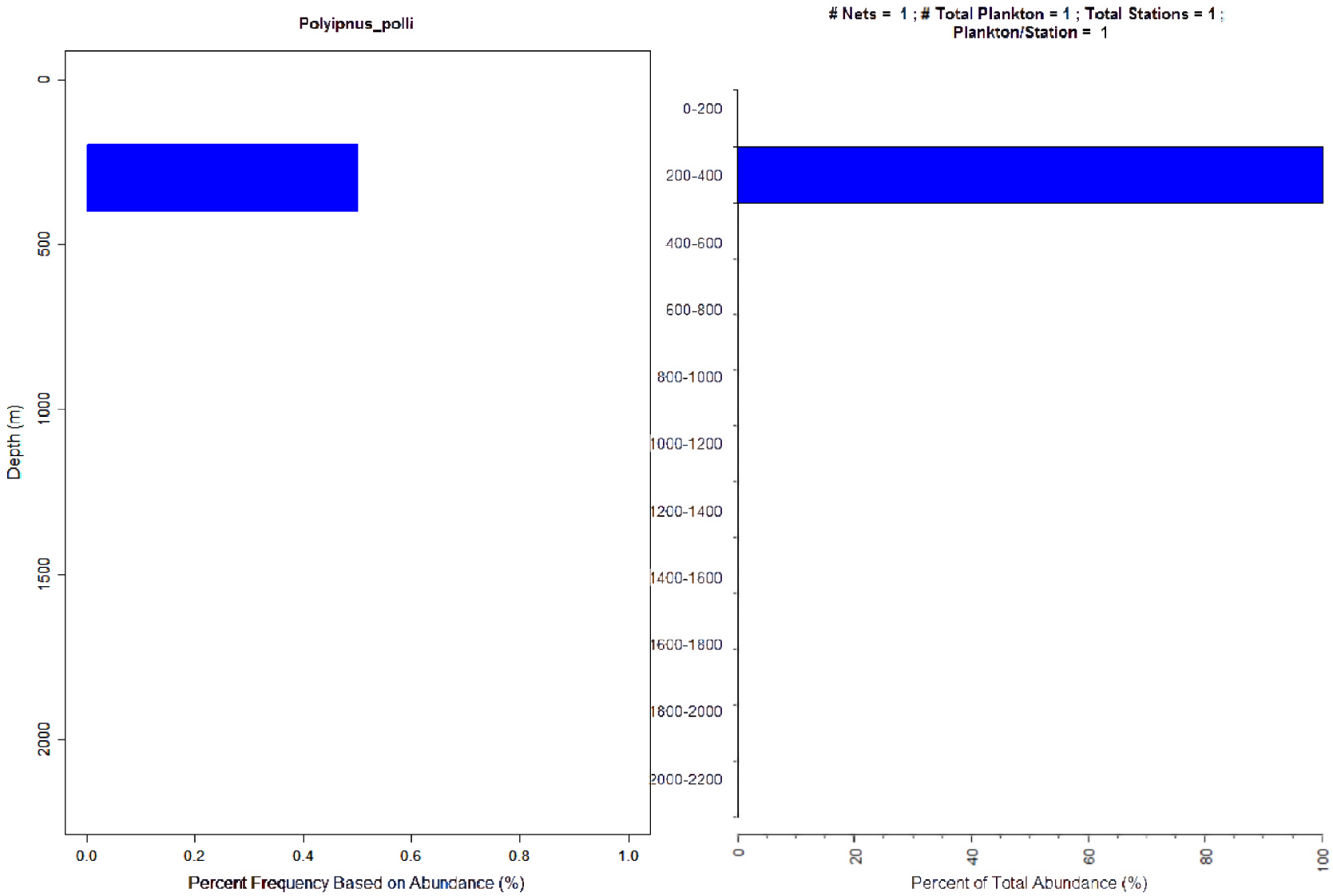
Pollichthys_mauli - Deep



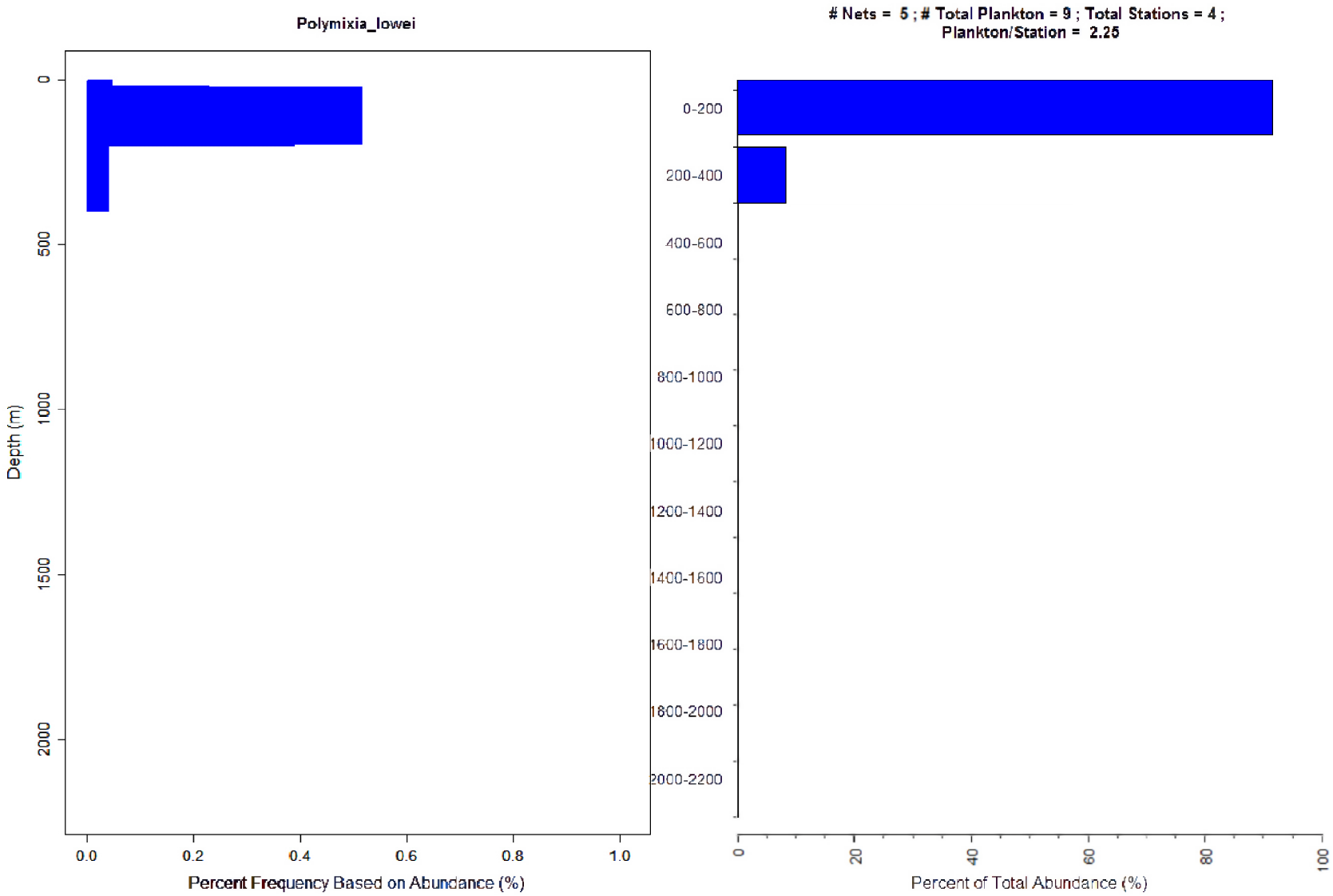
Polyipnus - Deep



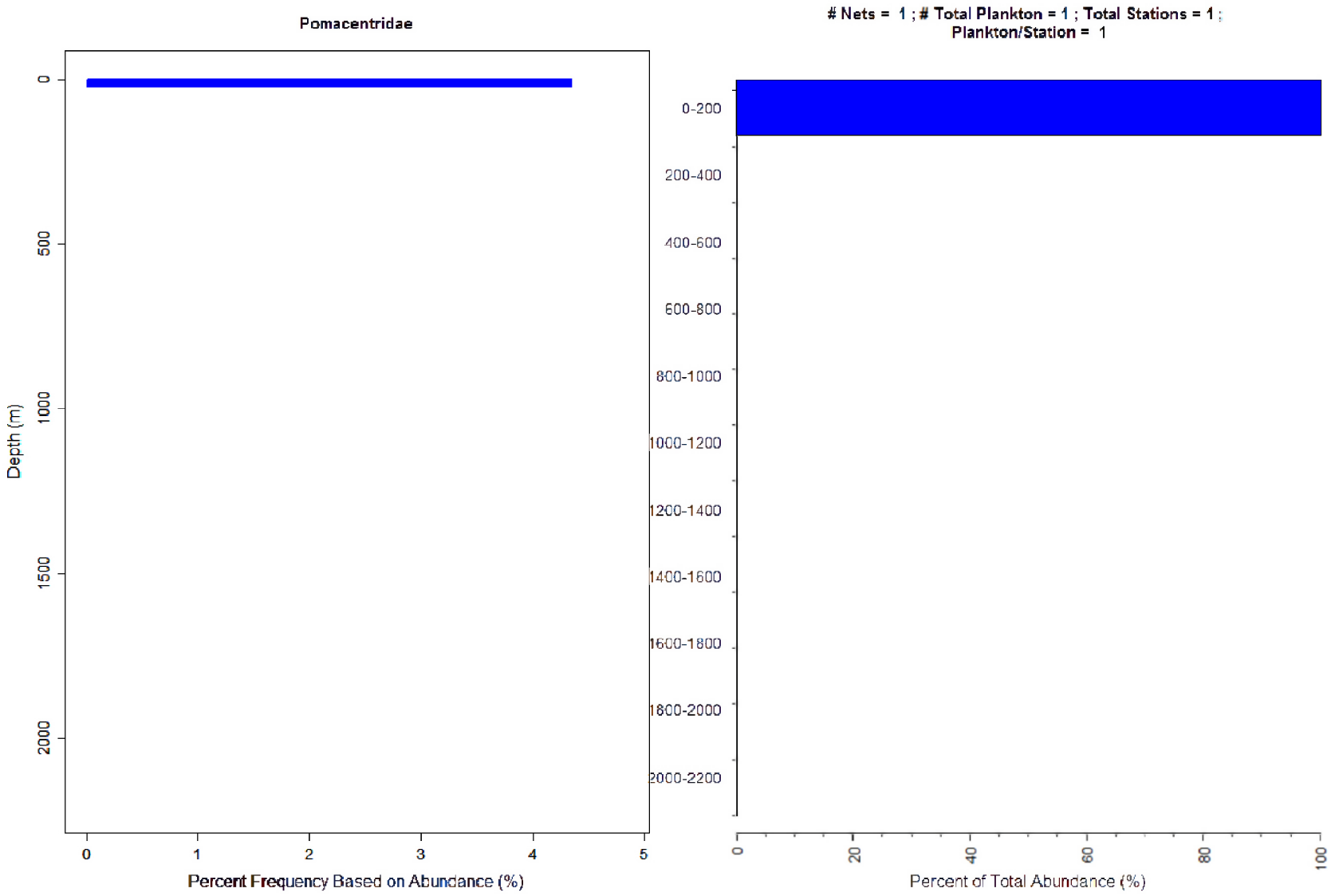
Polyipnus_laternatus - Deep



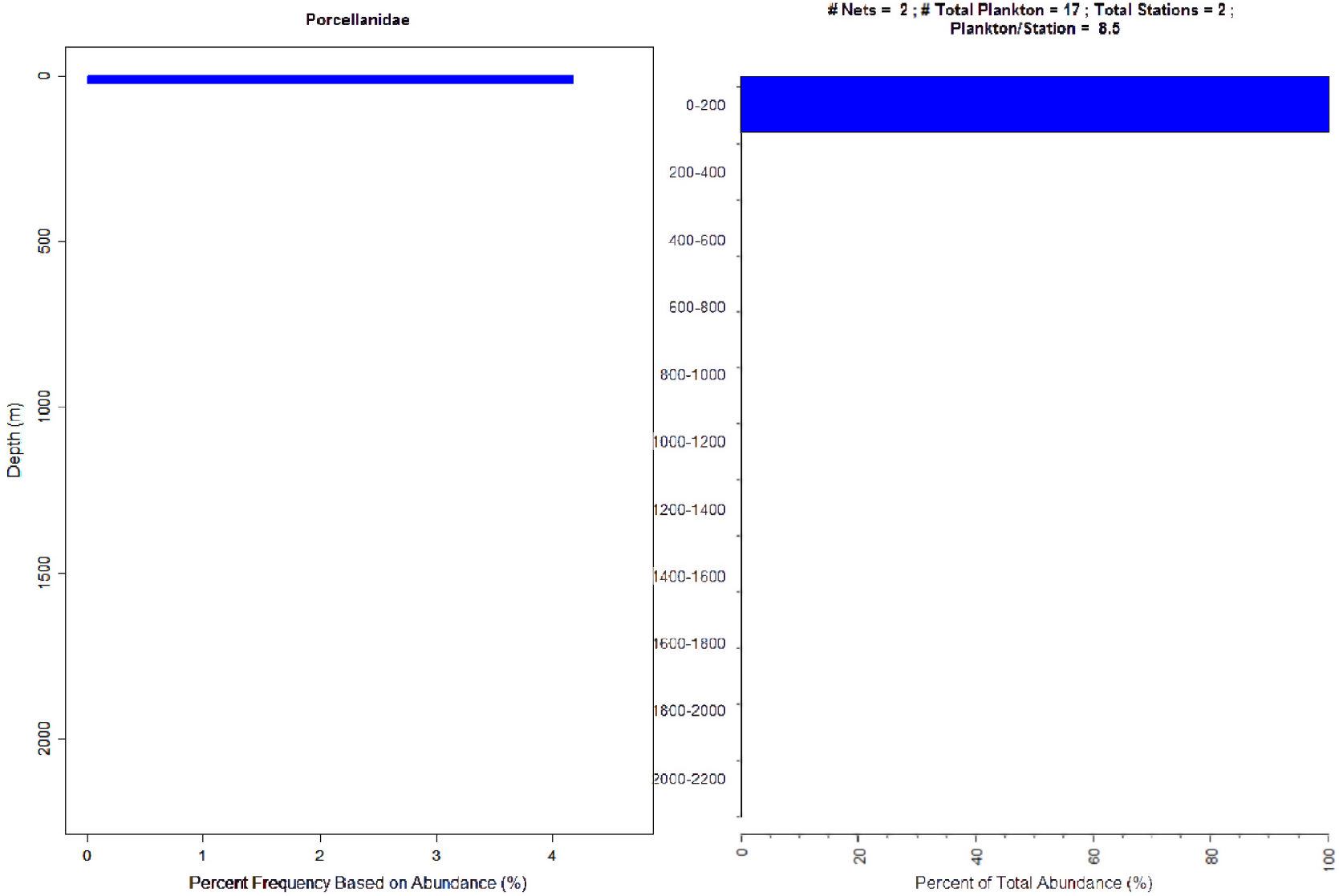
Polyipnus_polli - Deep



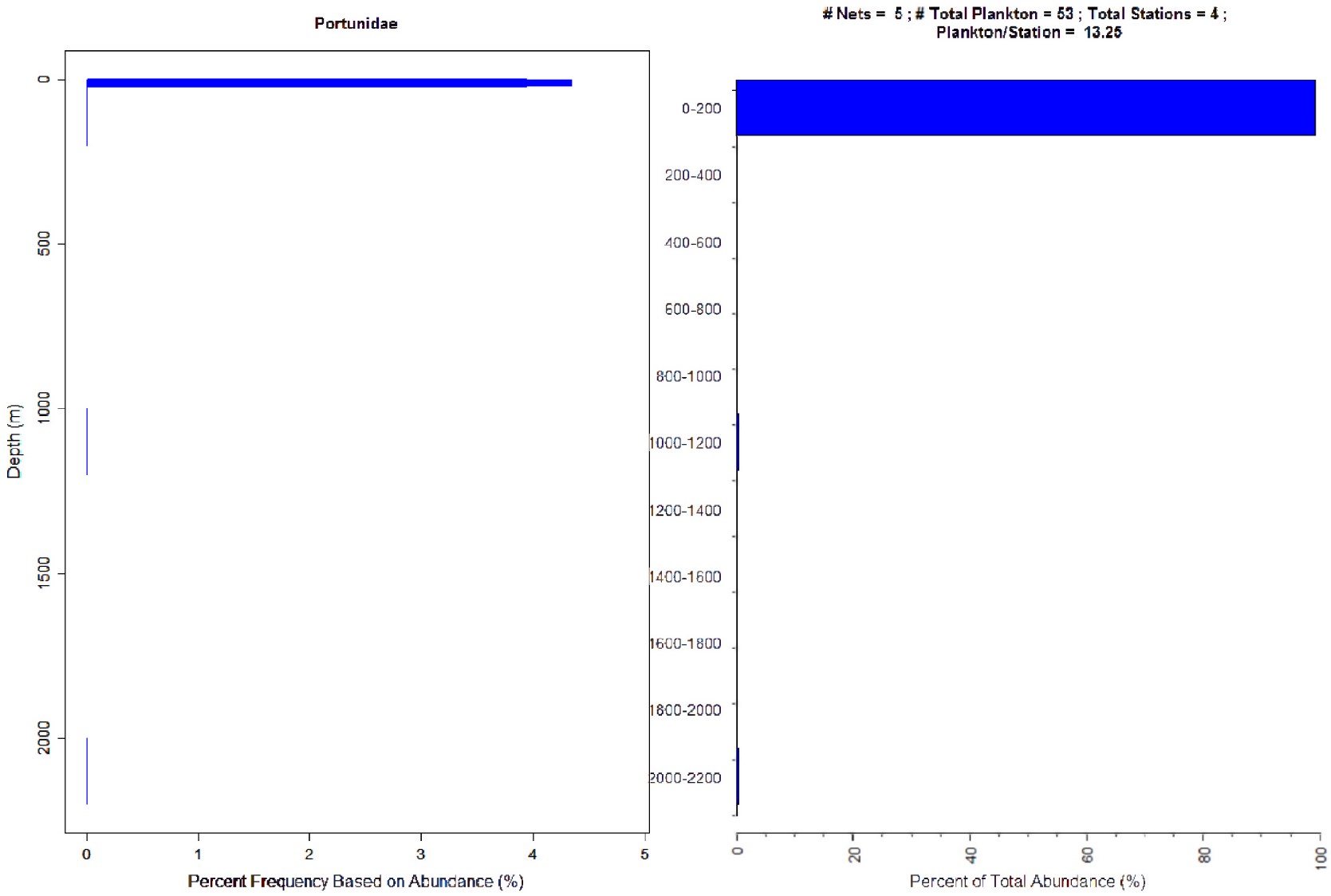
Polymixia_lowei - Deep



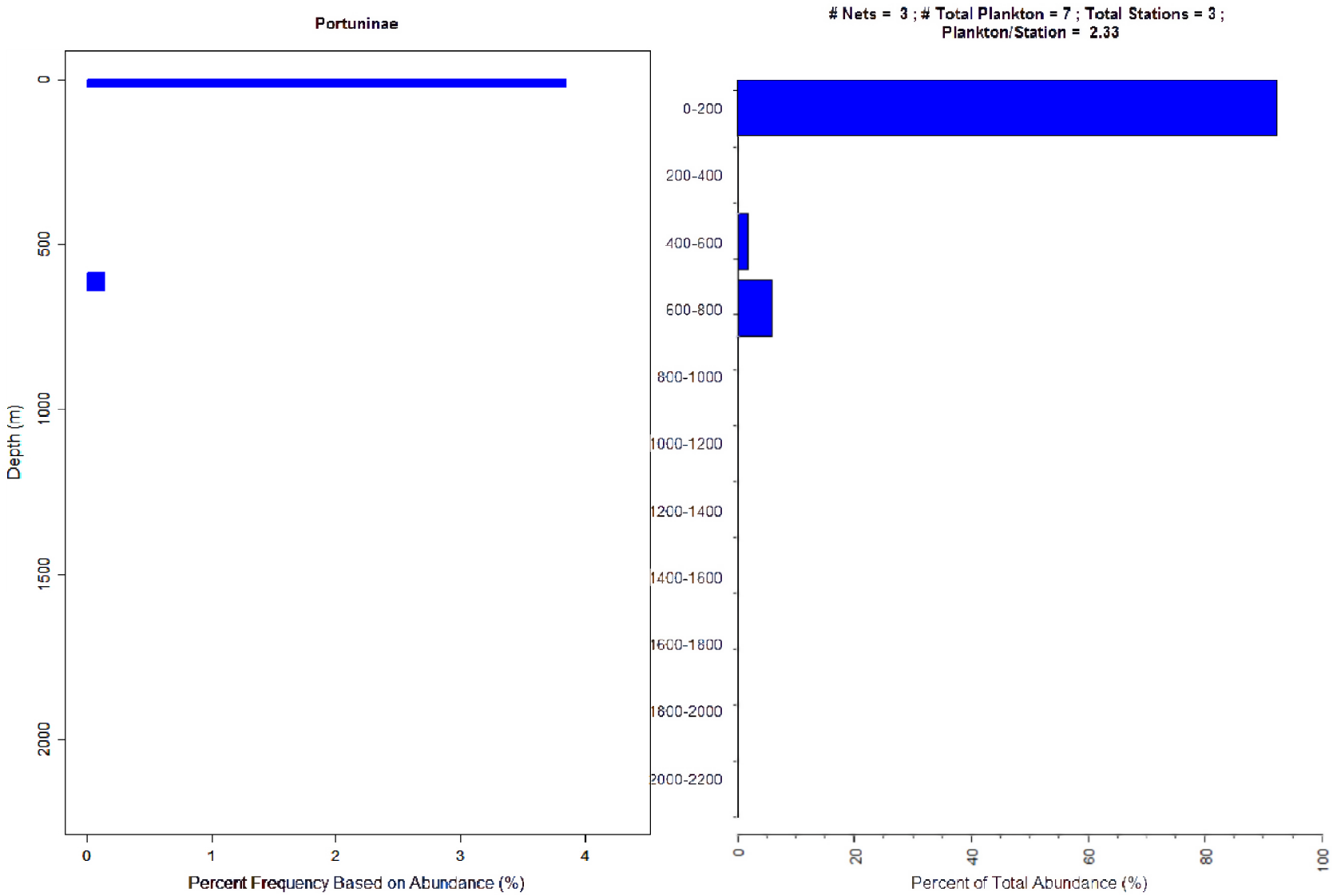
Pomacentridae - Deep



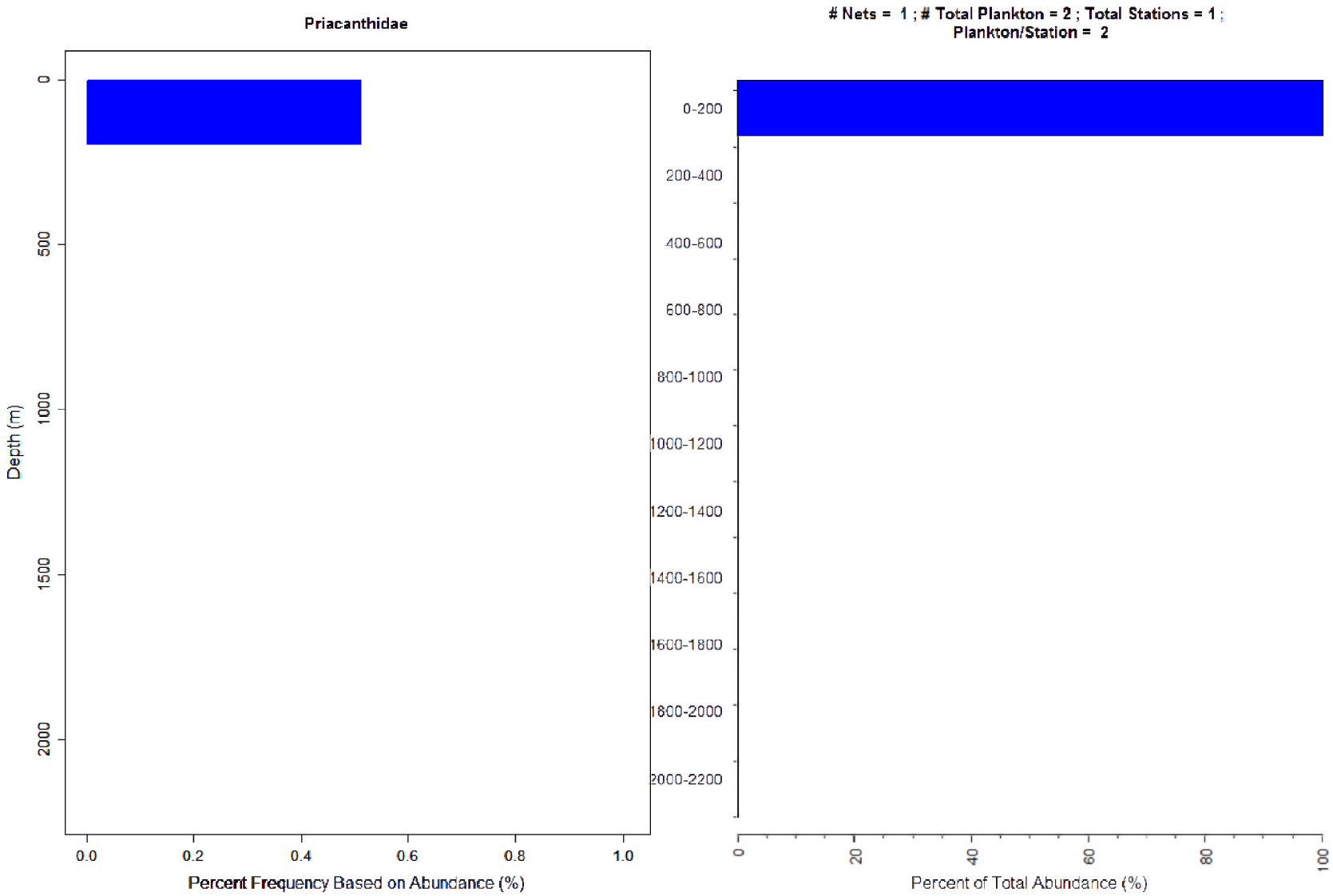
Porcellanidae - Deep



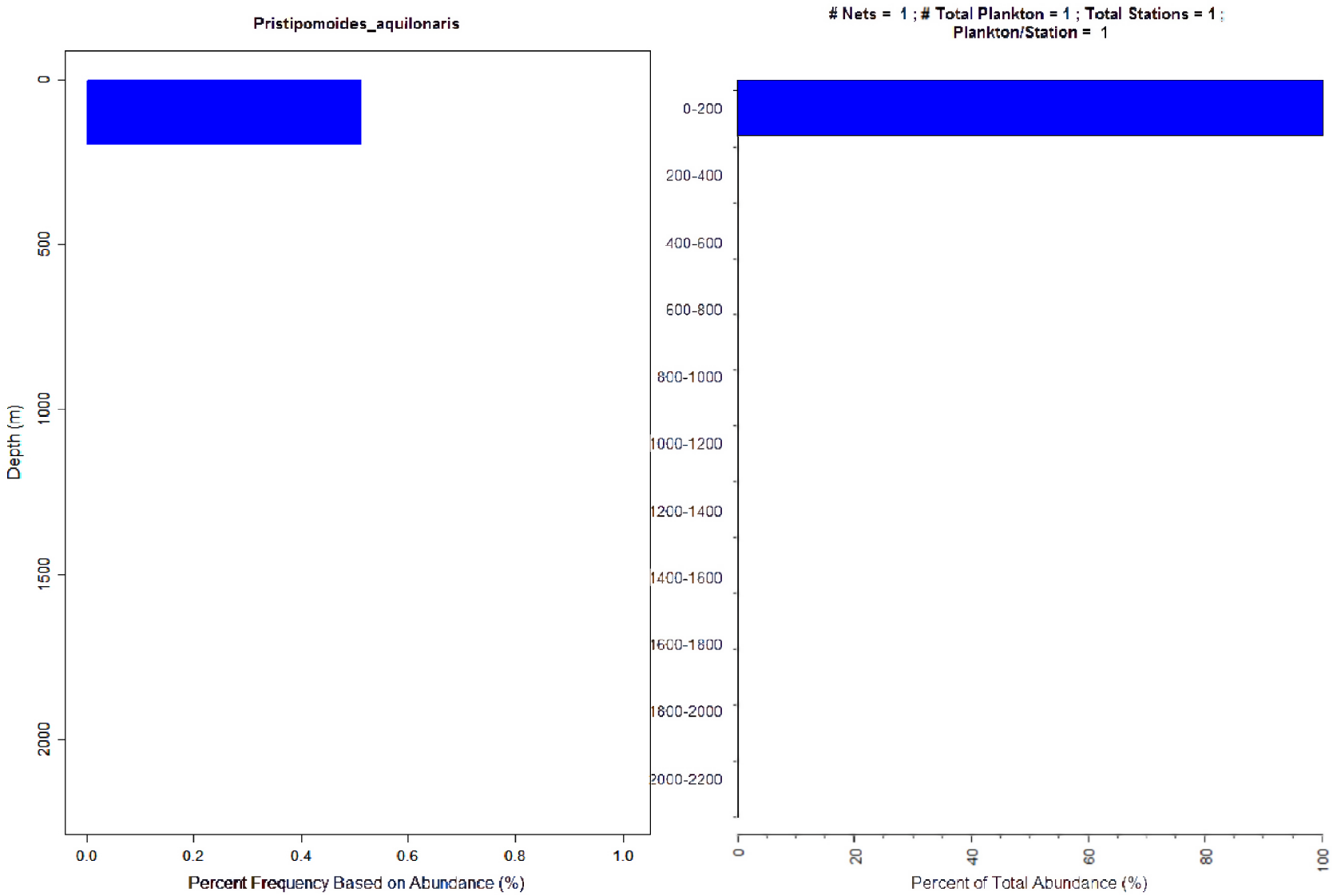
Portunidae - Deep



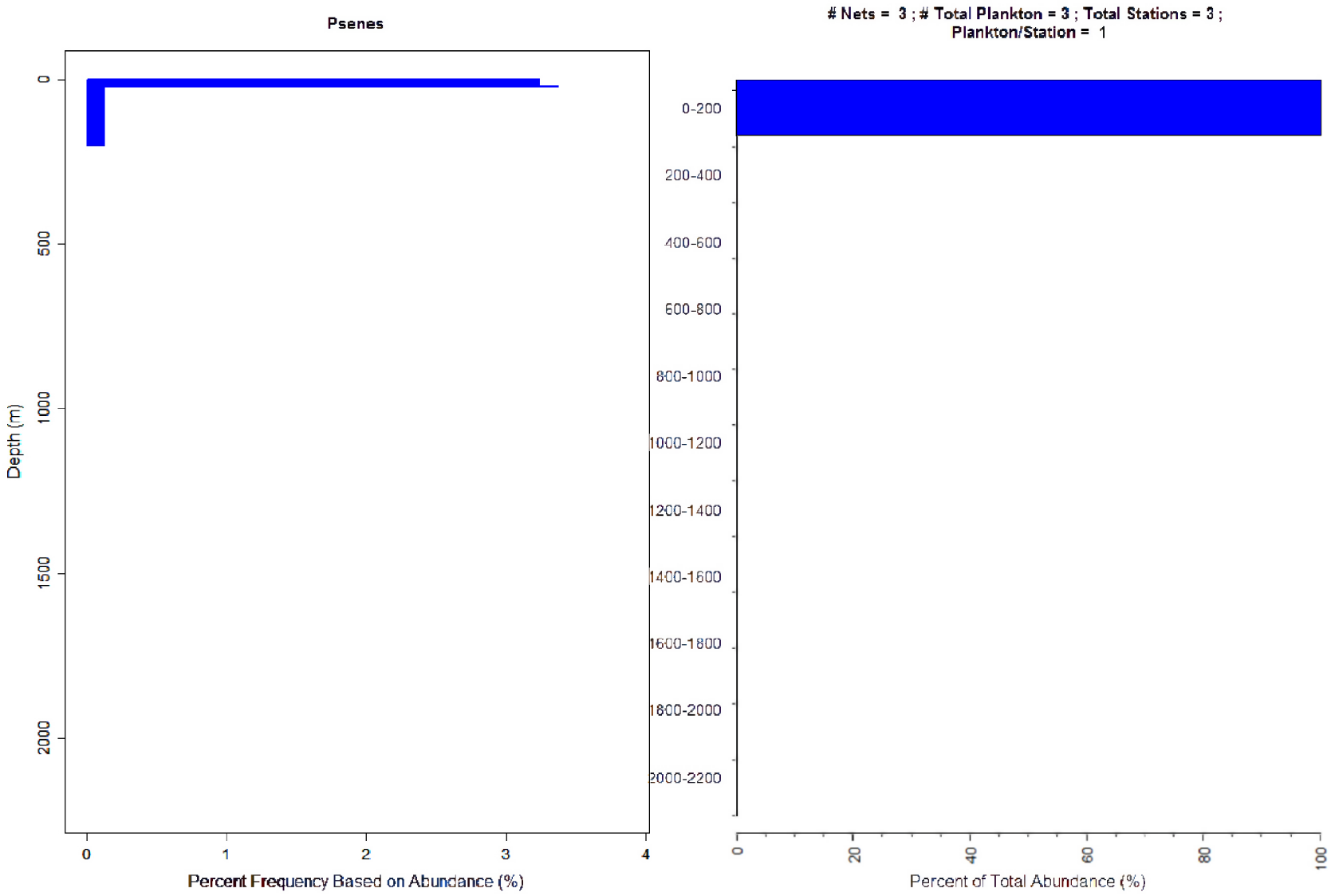
Portuninae - Deep



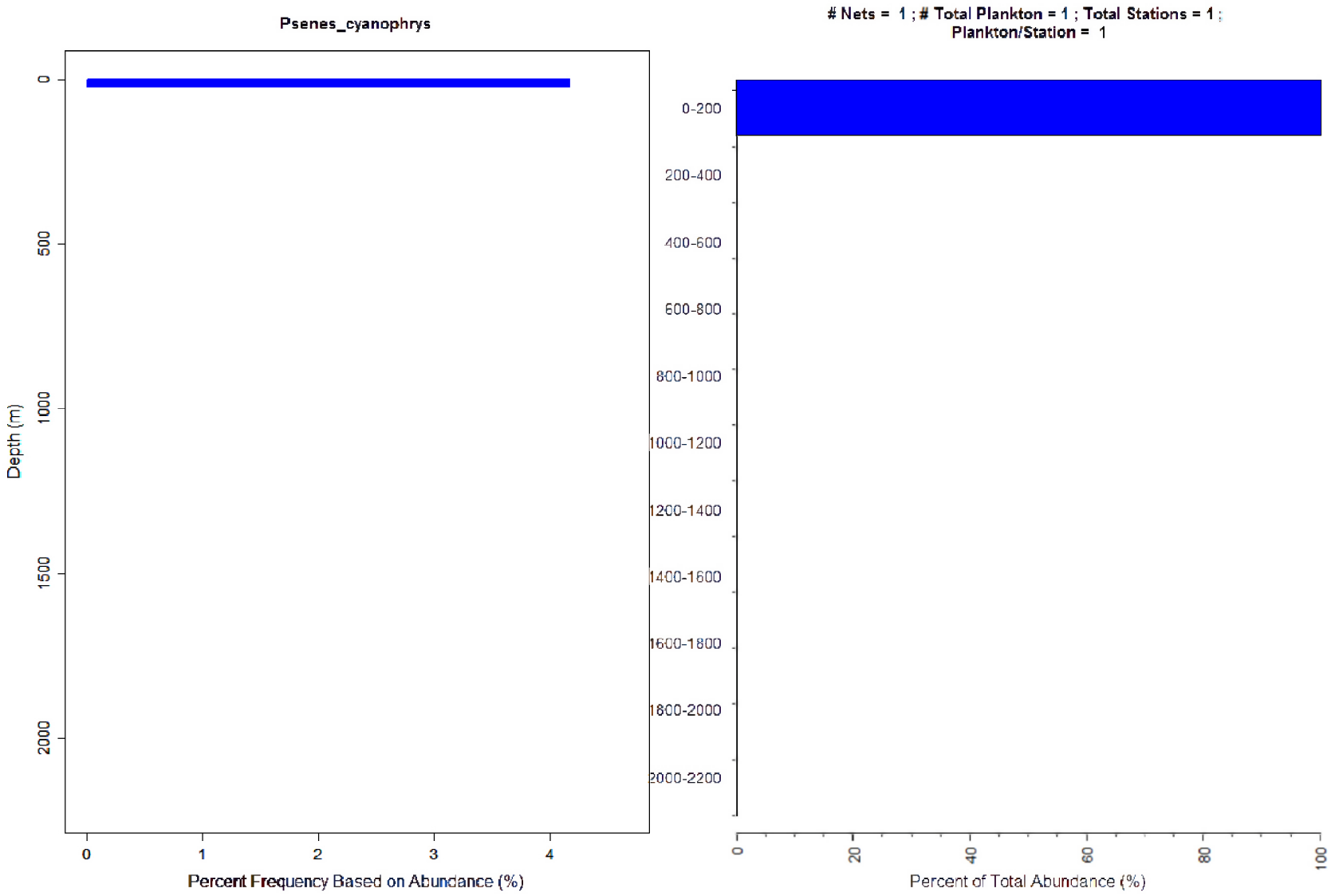
Priacanthidae - Deep



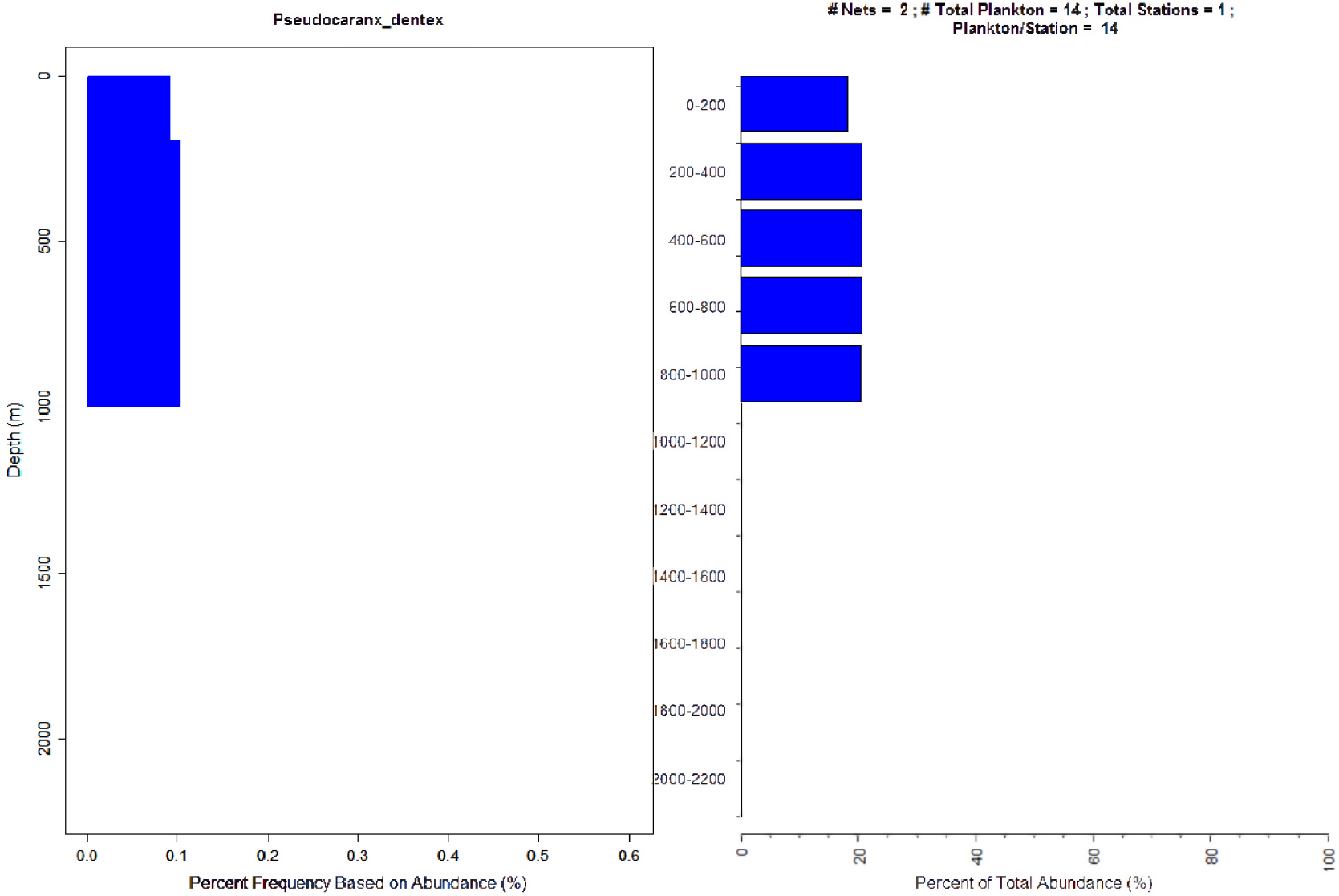
Pristipomoides_aquilonaris - Deep


Psenes
Nets = 3 ; # Total Plankton = 3 ; Total Stations = 3 ;
Plankton/Station = 1
Depth (m)
0
500
1000
1500
2000
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
1
2
3
4
Percent Frequency Based on Abundance (%)
0
20
40
60
80
100
Percent of Total Abundance (%)

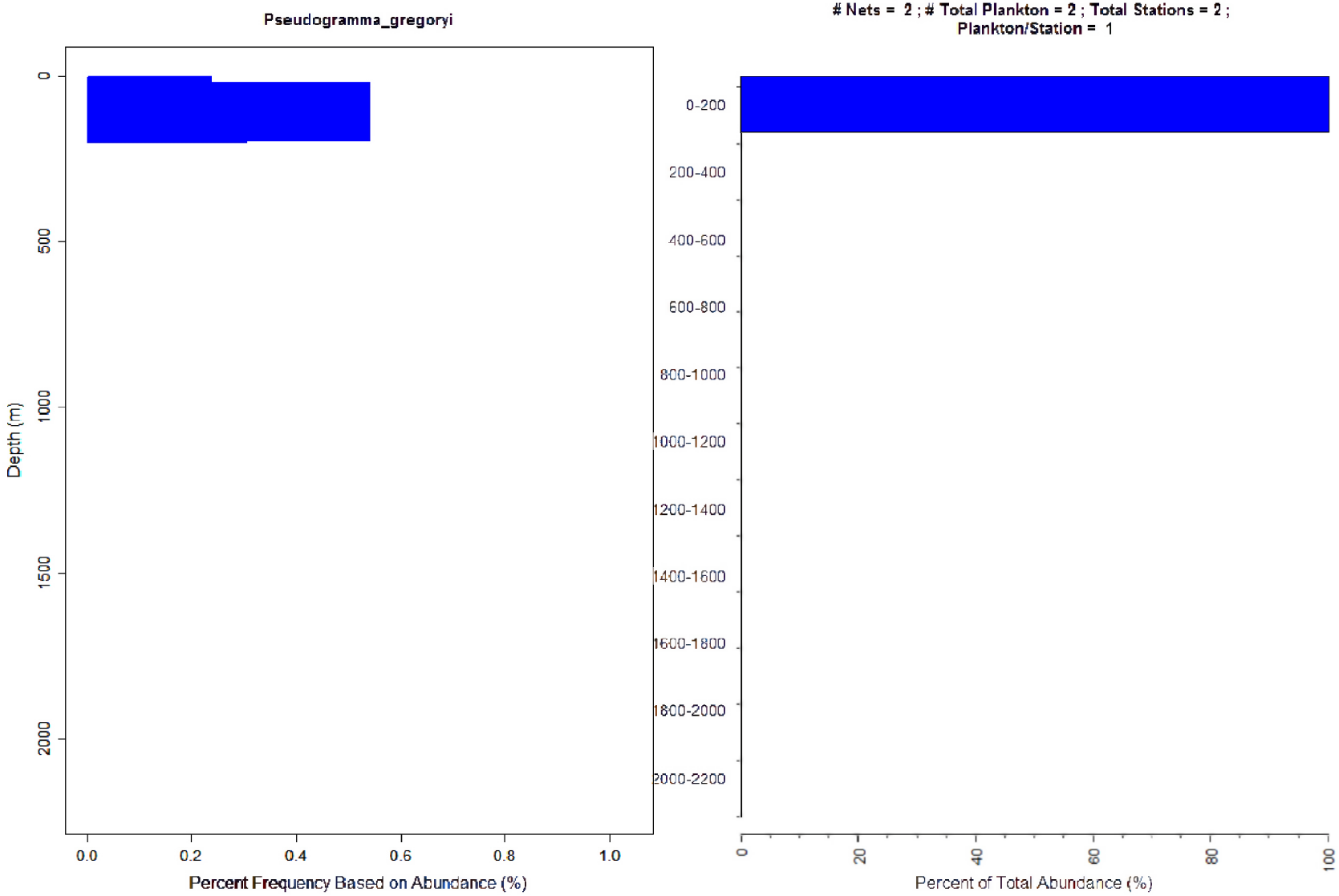
Psenes - Deep



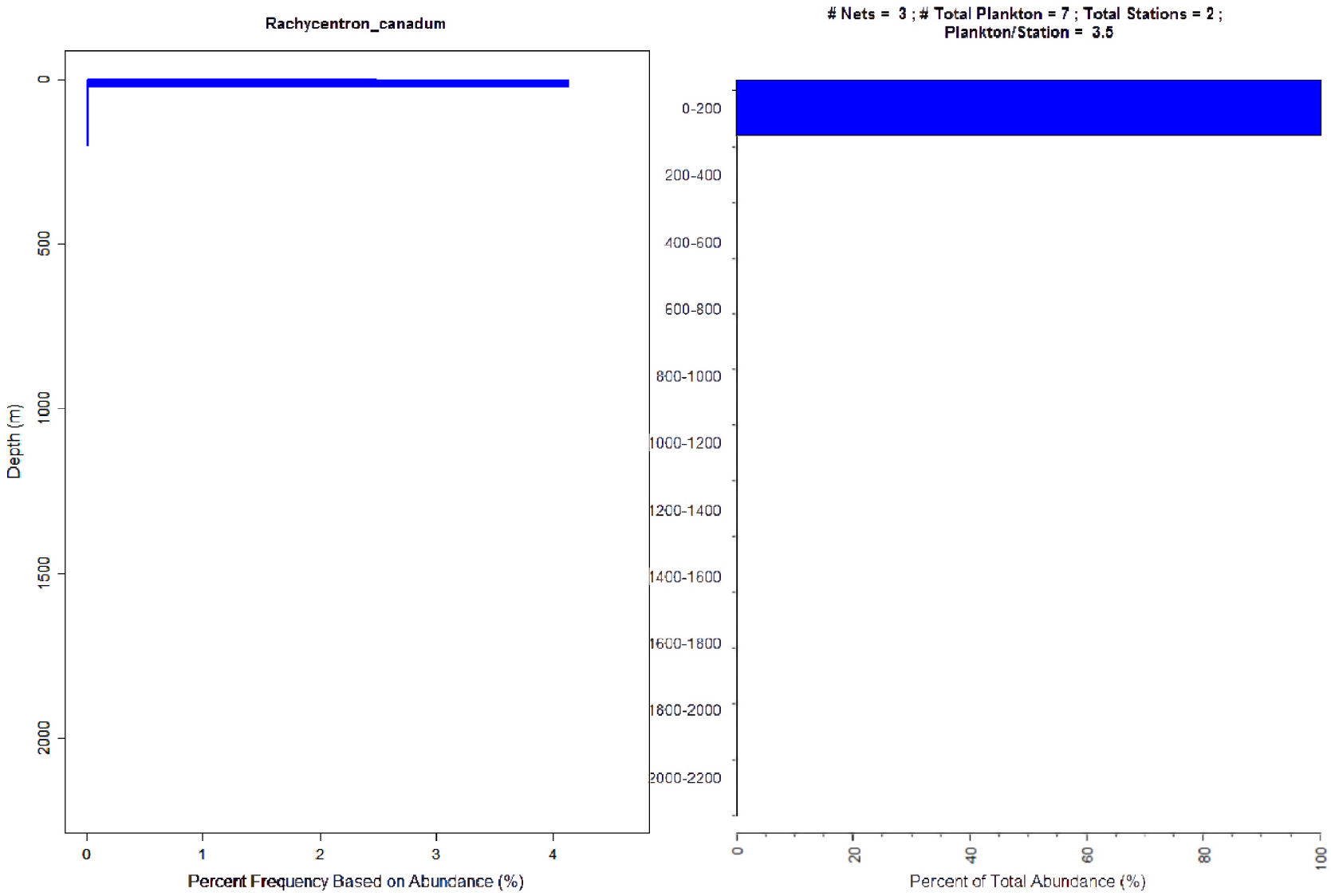
Psenes_cyanophrys - Deep



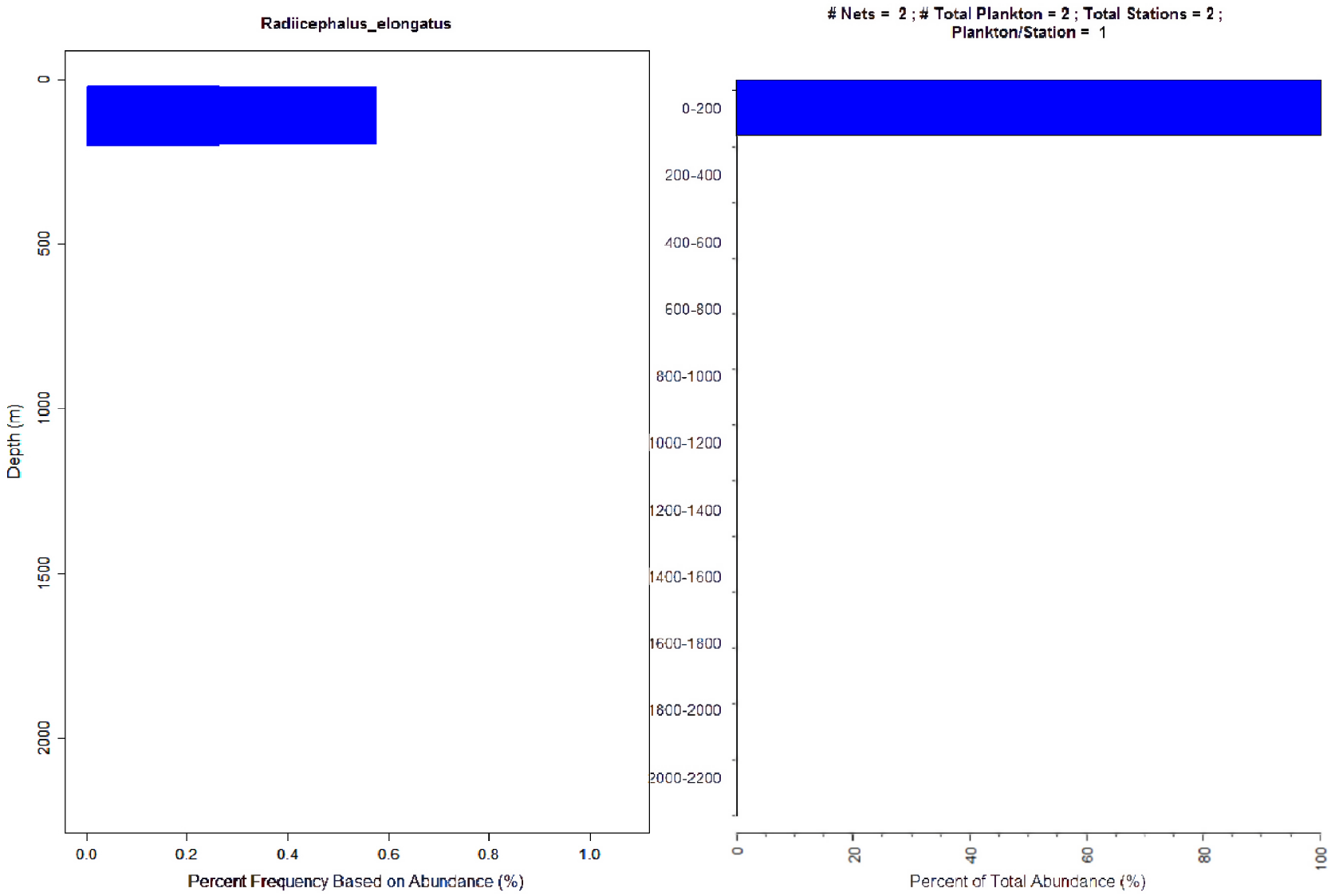
Pseudocaranx_dentex - Deep



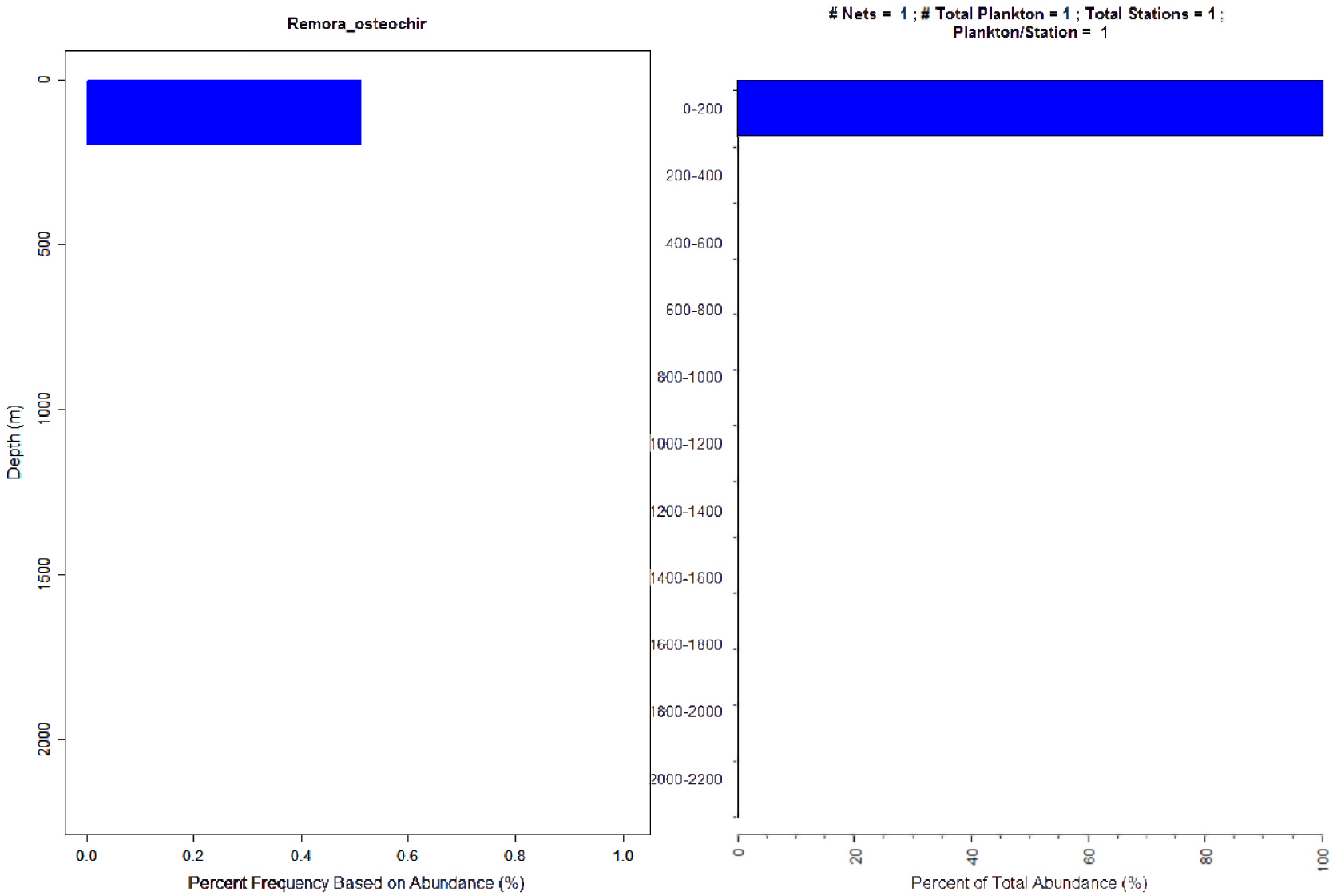
Pseudogramma_gregoryi - Deep



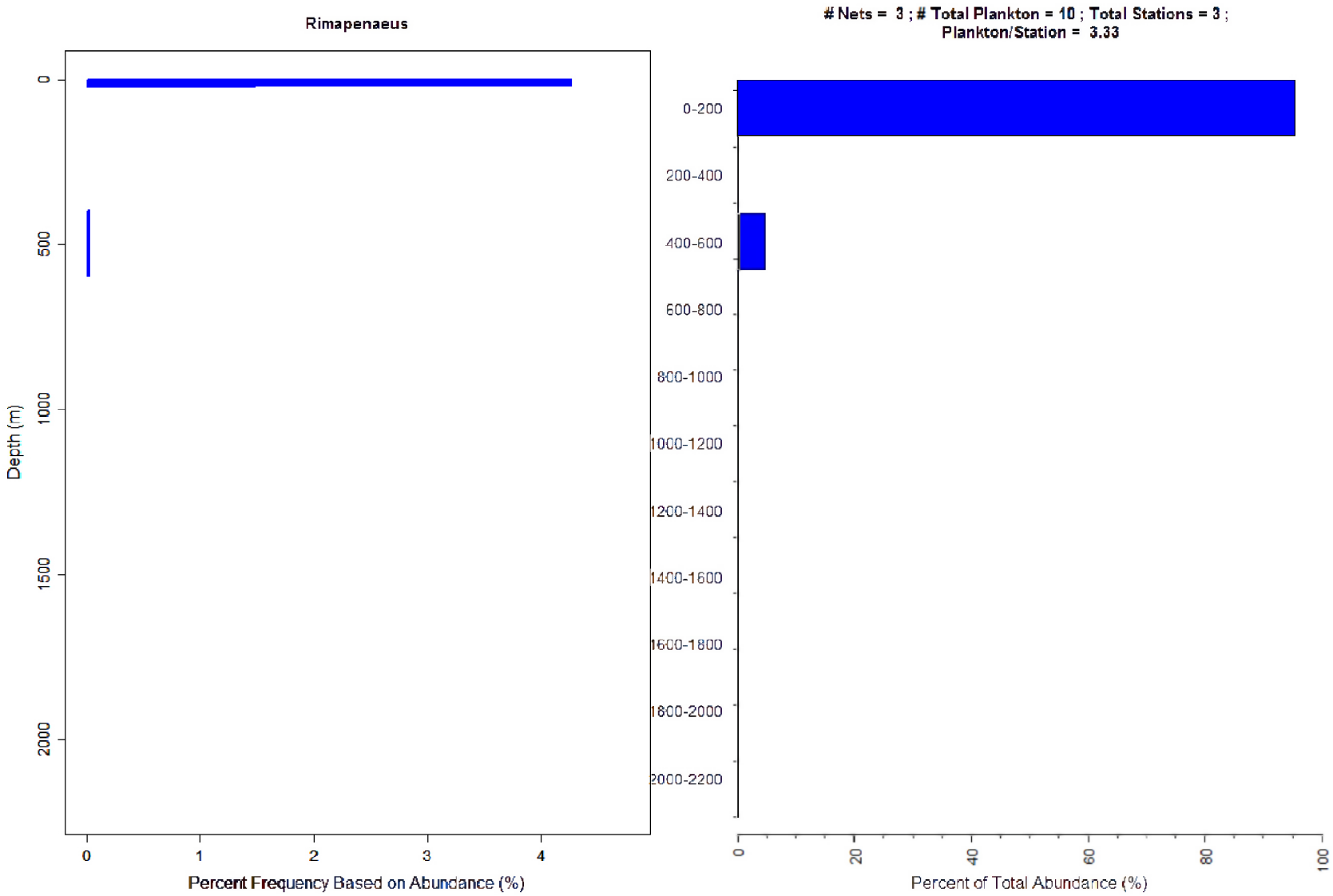
Rachycentron_canadum - Deep



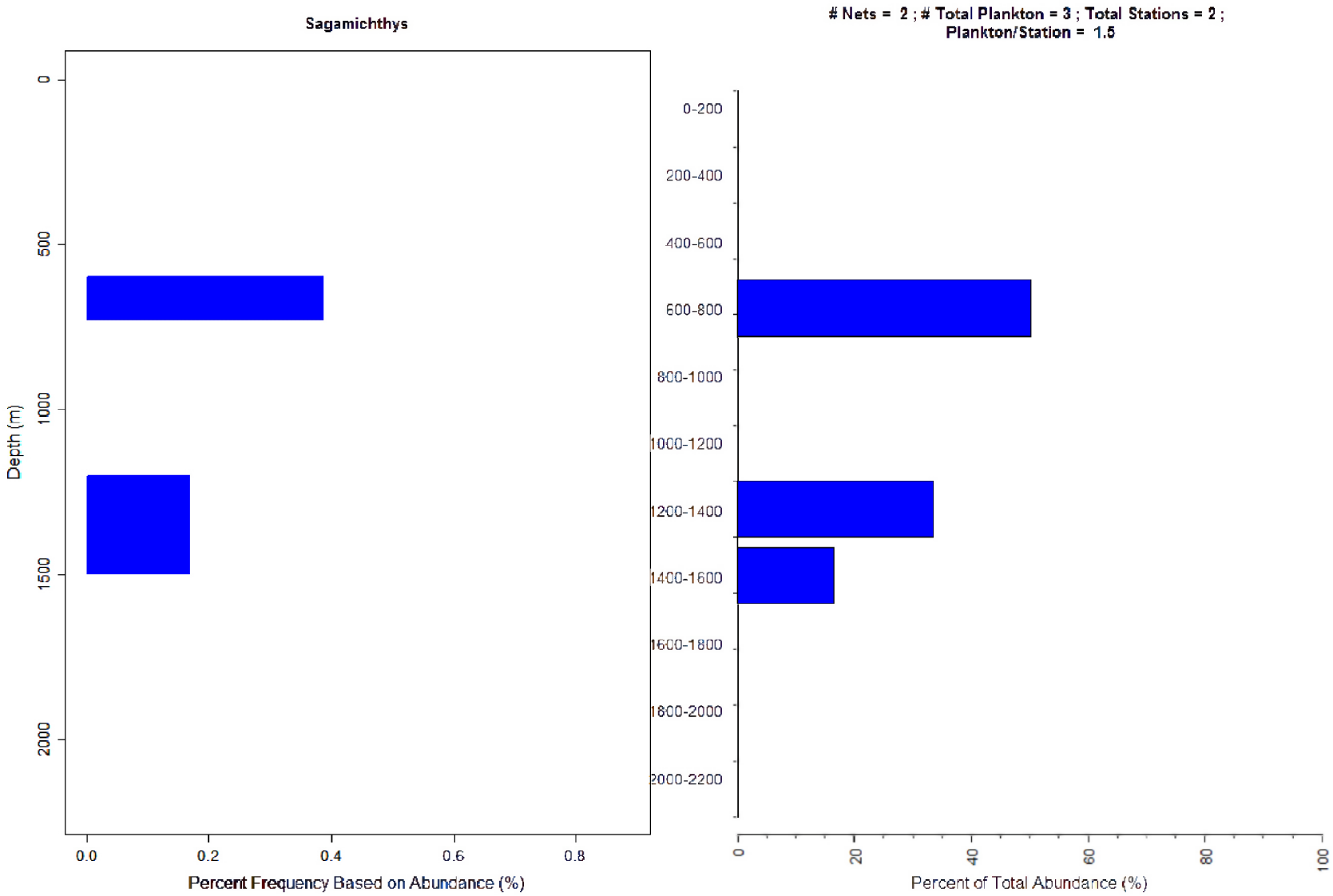
Radiicephalus_elongatus - Deep



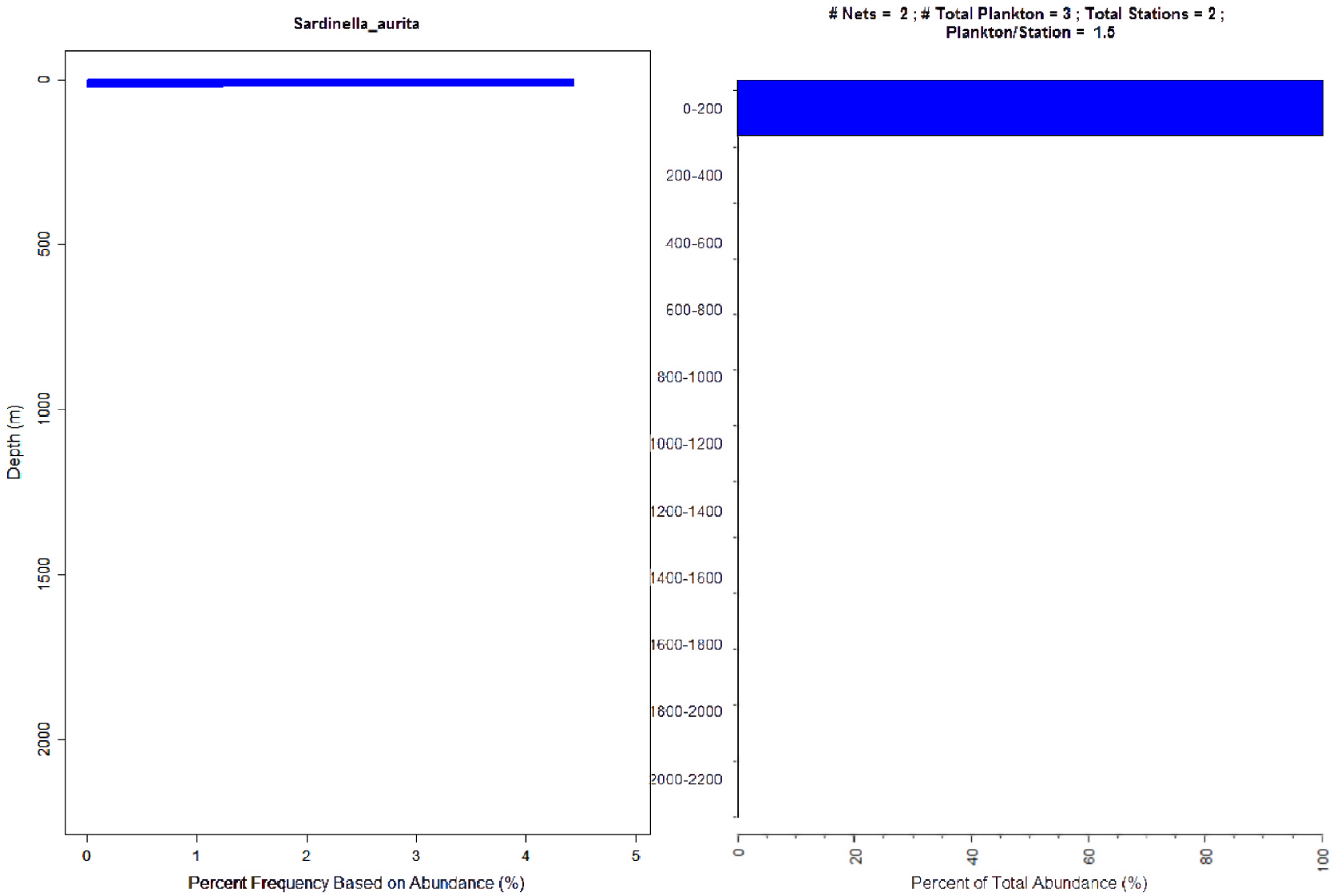
Remora_osteochir - Deep



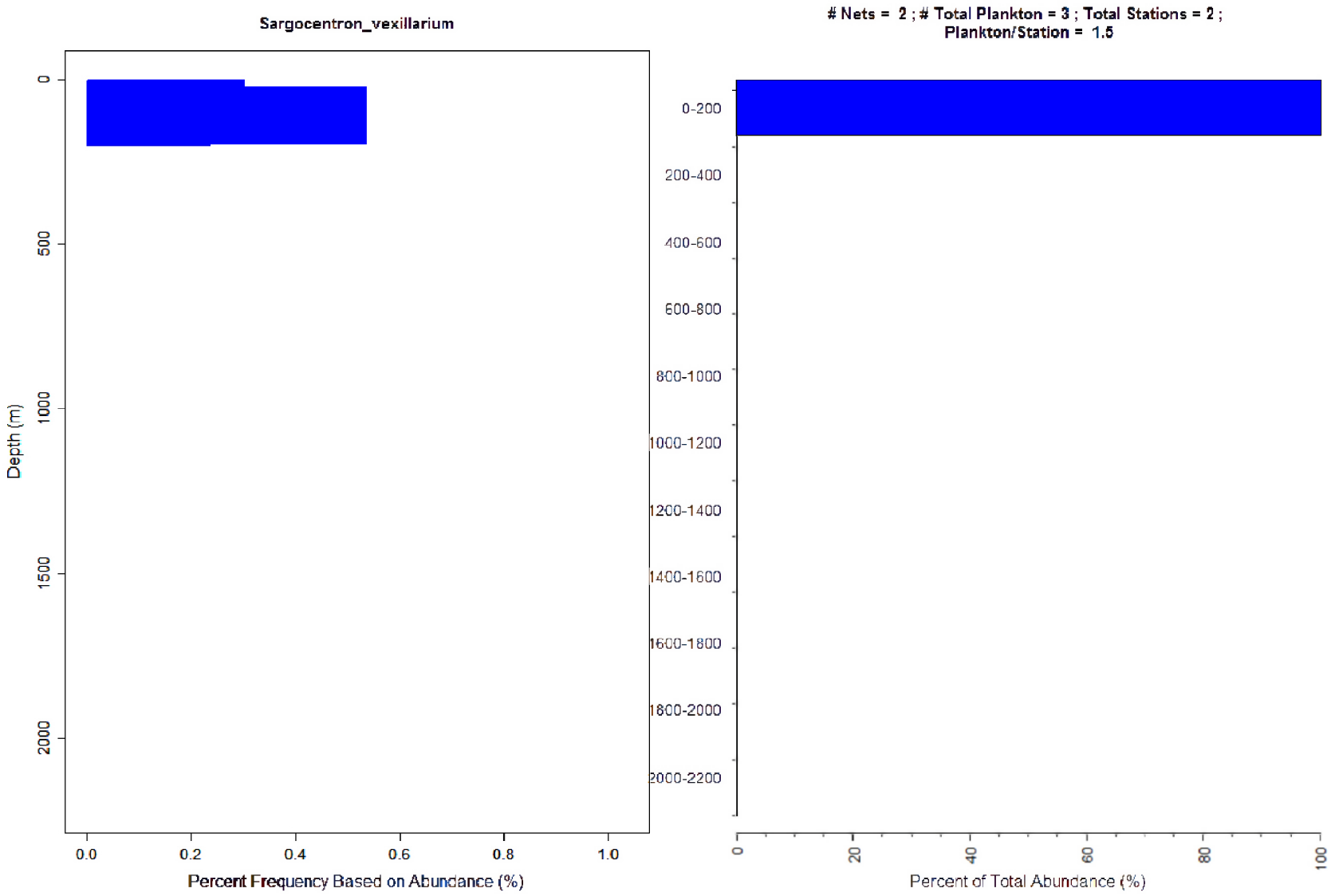
Rimapenaeus - Deep



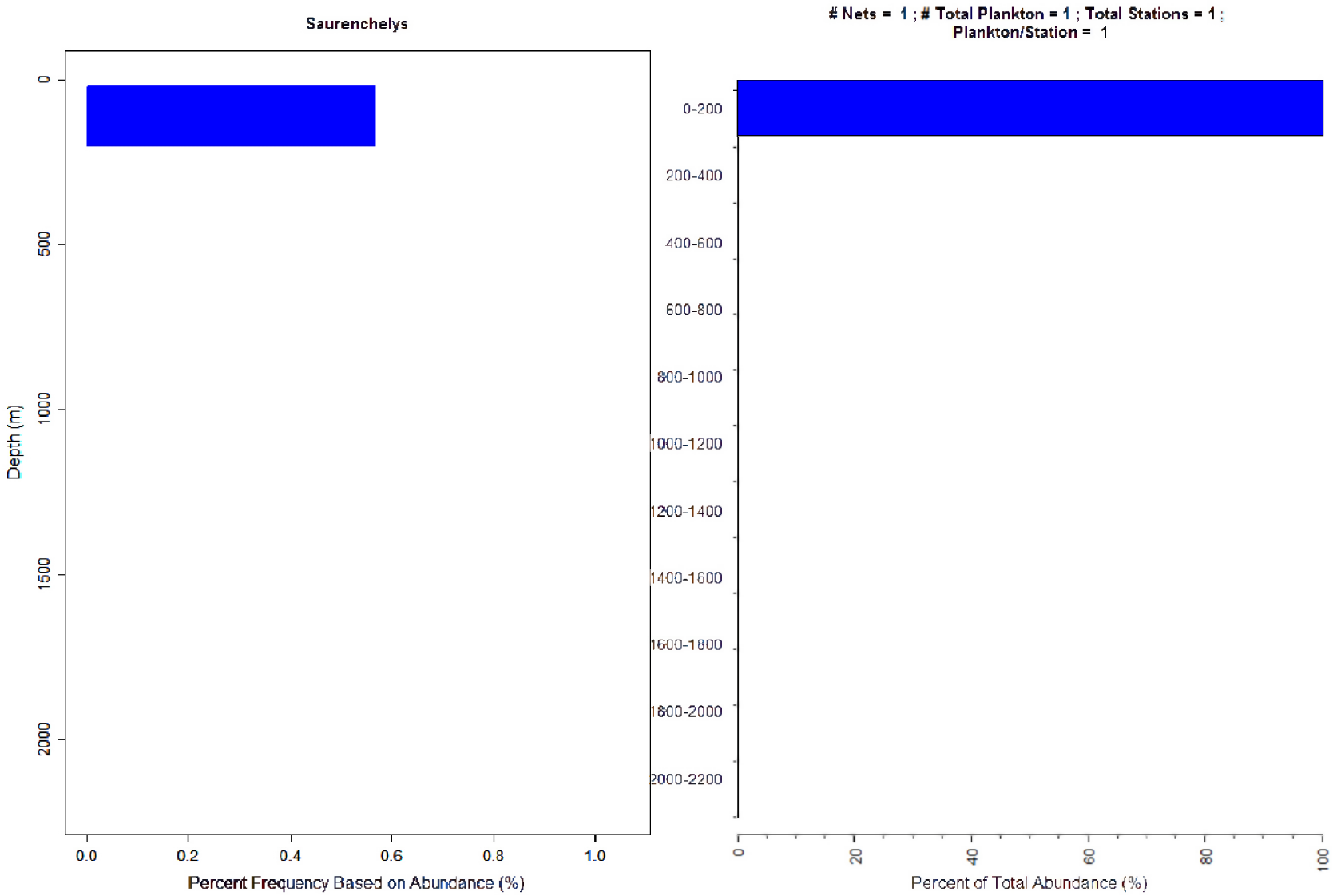
Sagamichthys - Deep



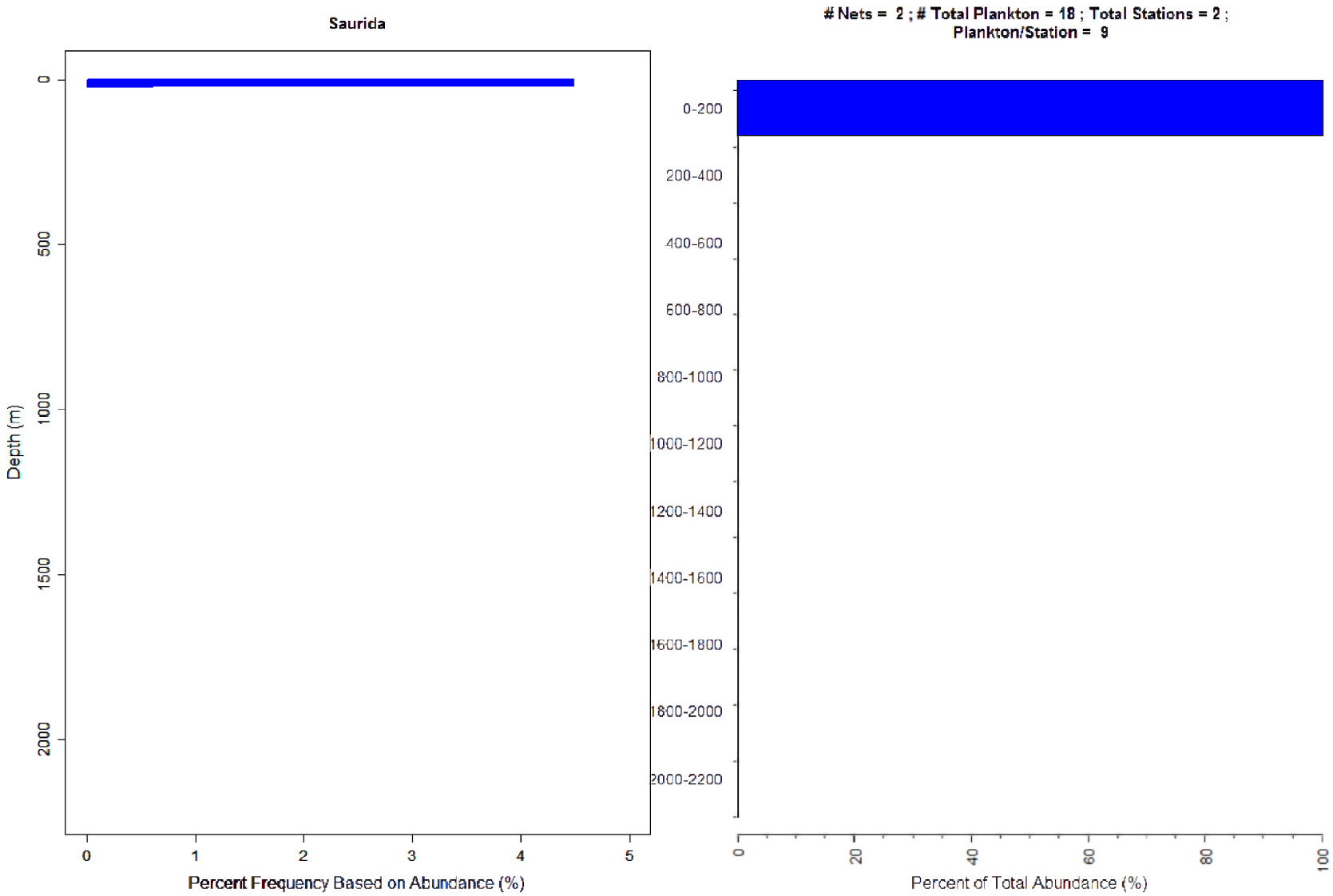
Sardinella_aurita - Deep



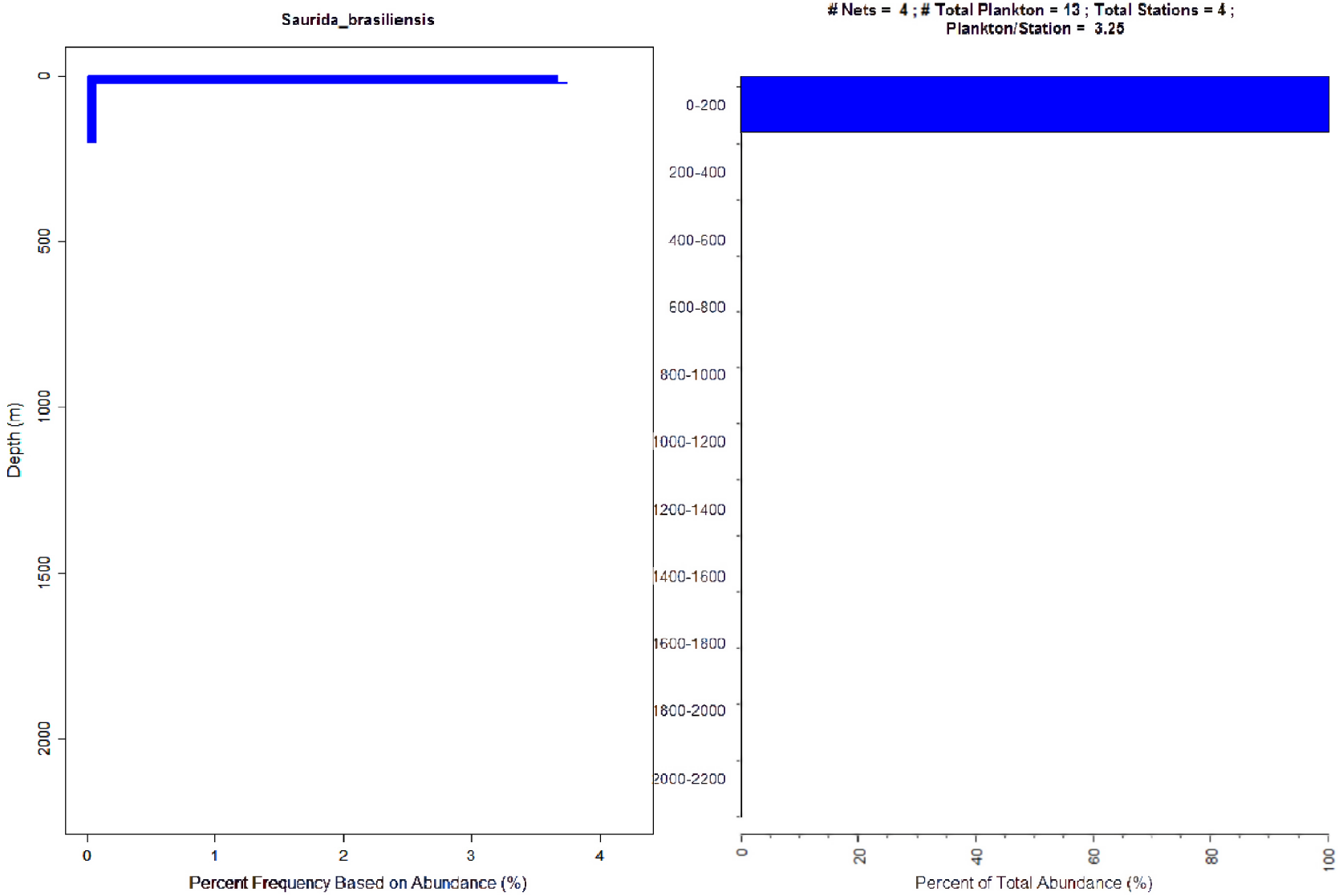
Sargocentron_vexillarium - Deep



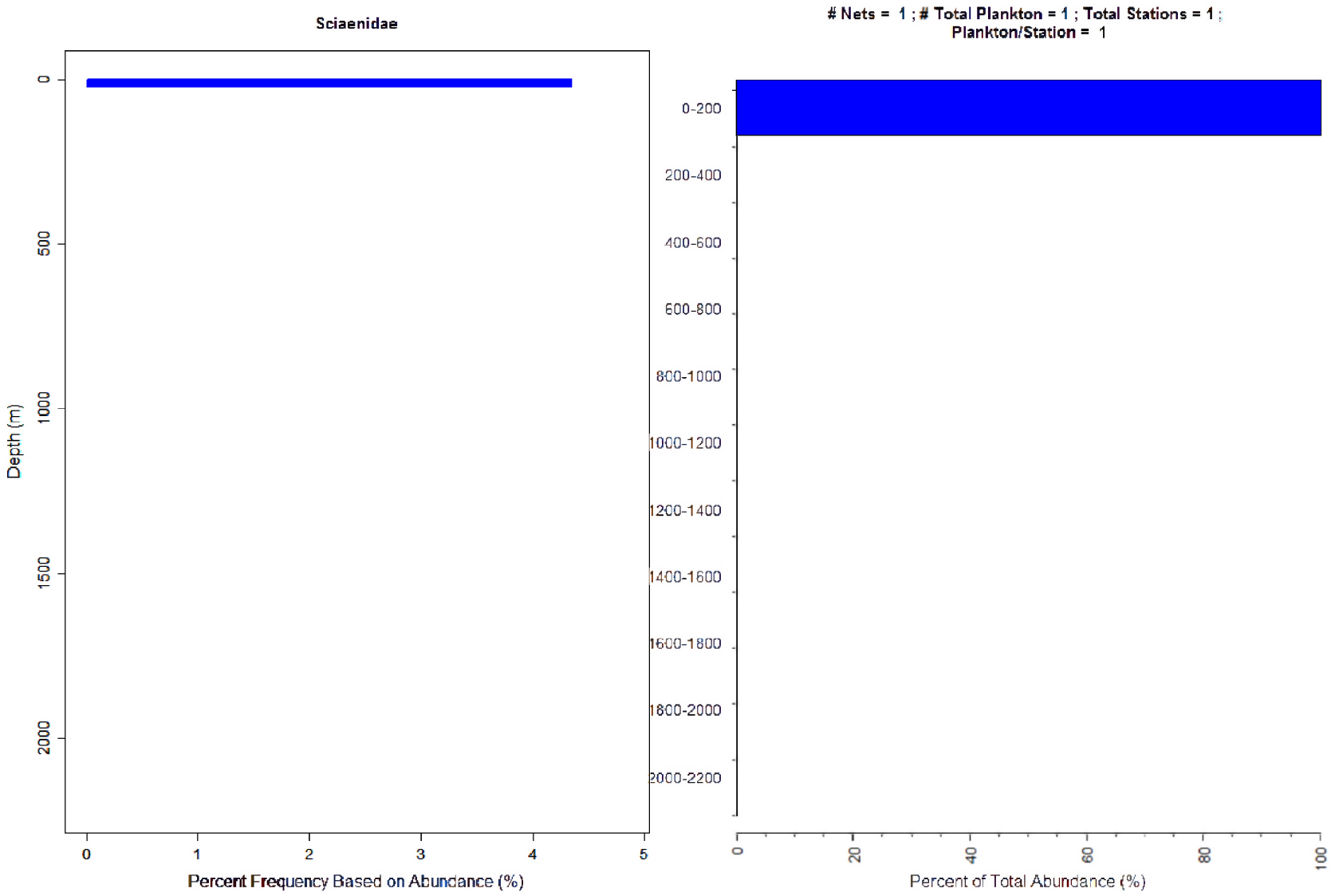
Saurenchelys - Deep



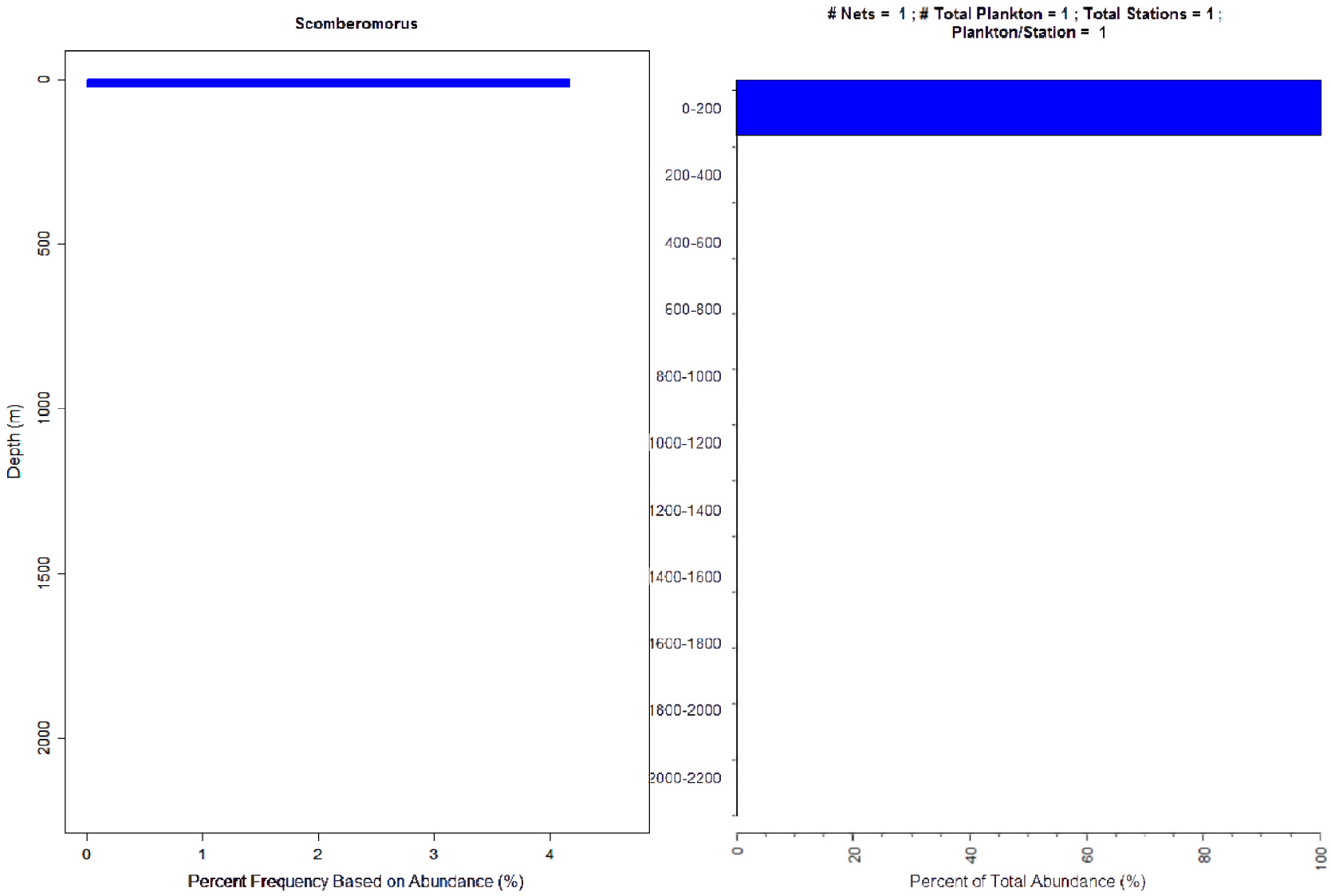
Saurida - Deep



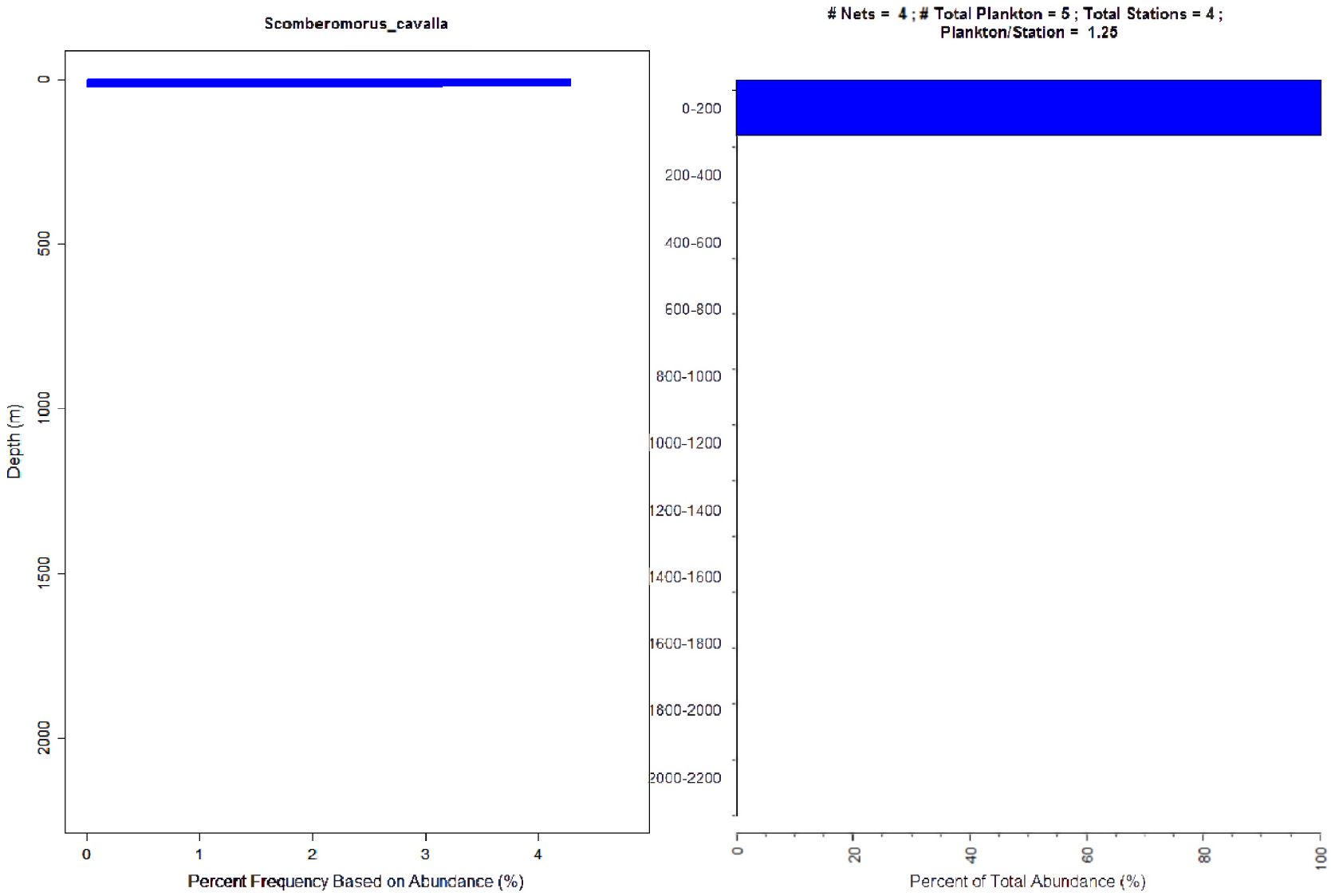
Saurida_brasiliensis - Deep



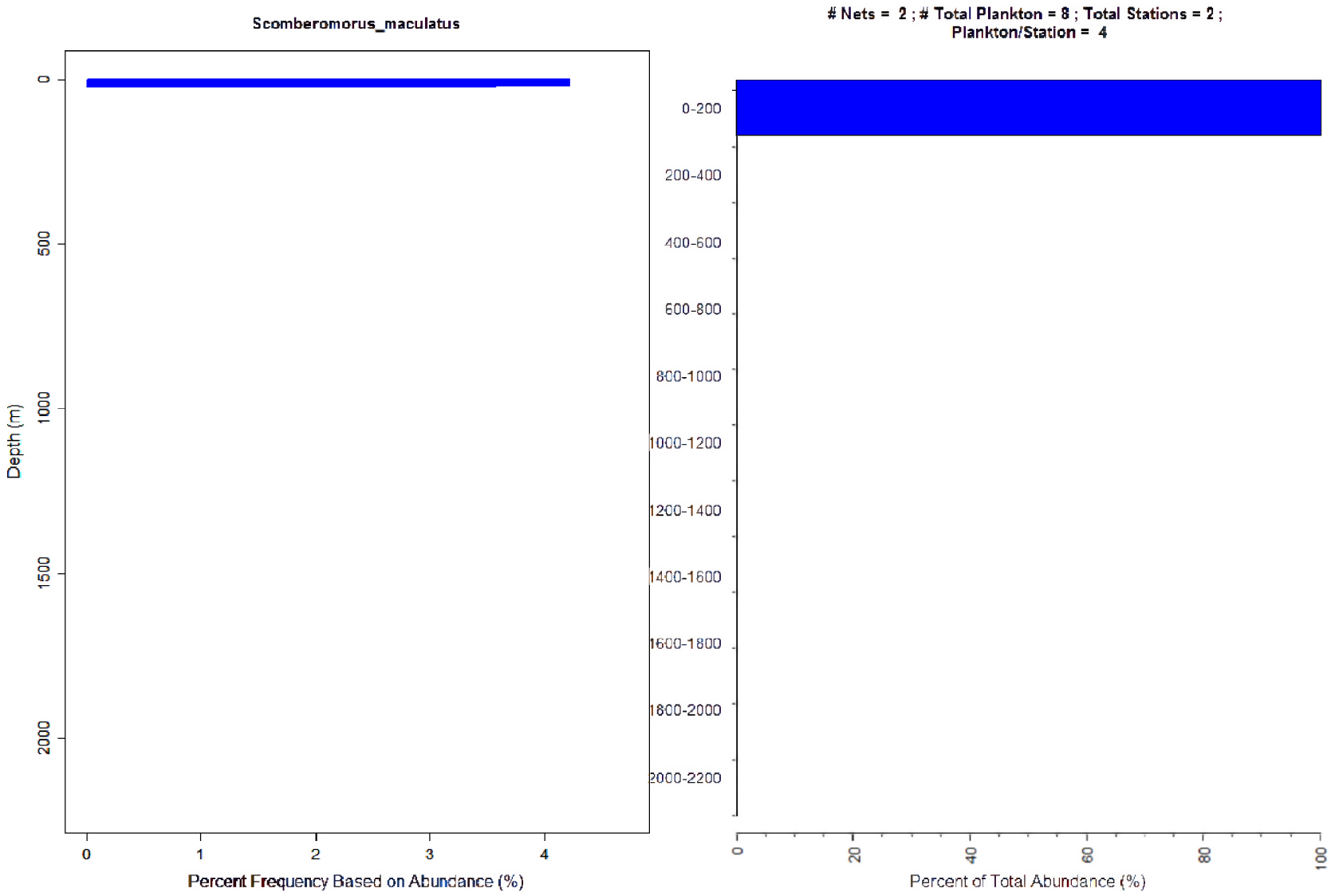
Sciaenidae - Deep



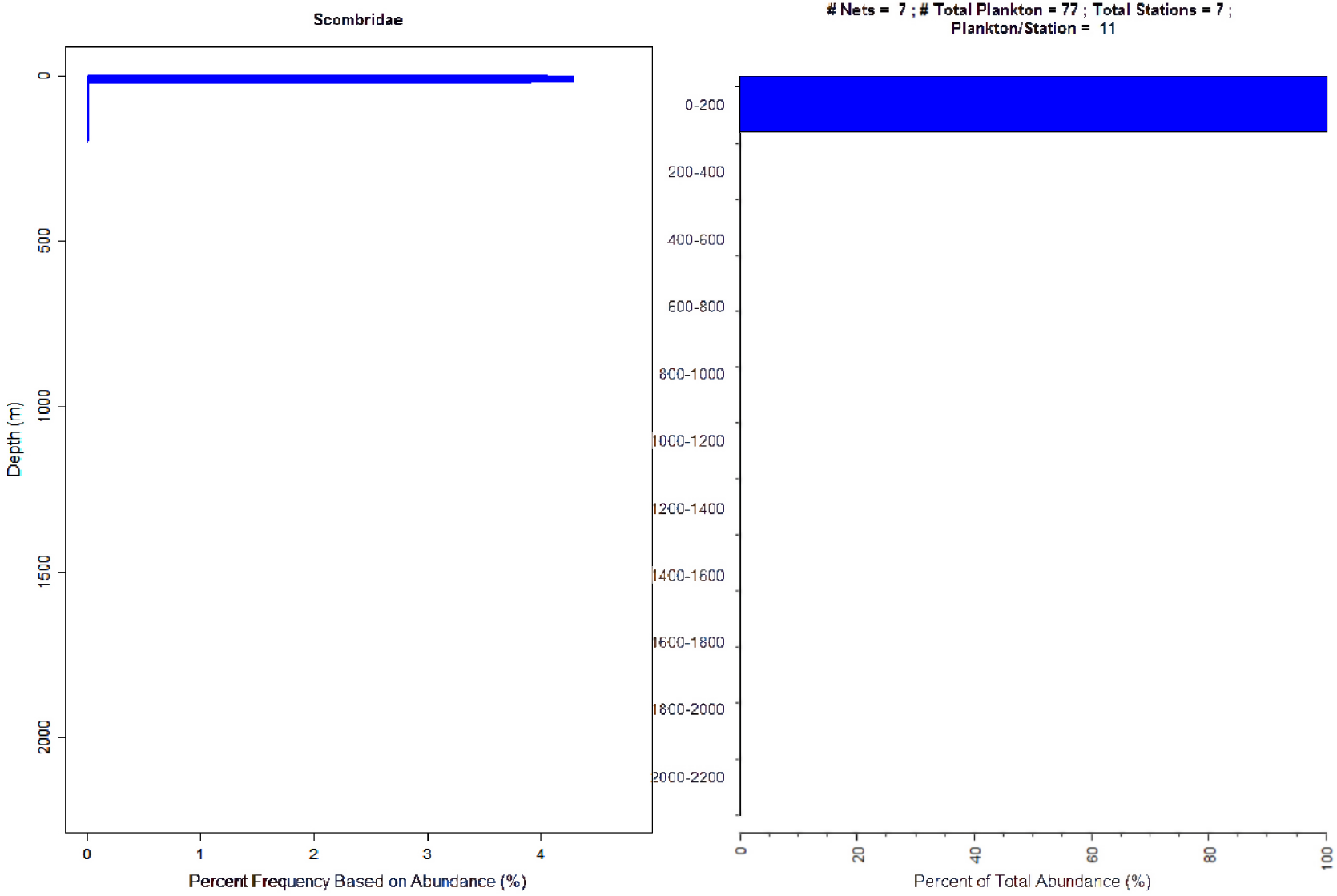
Scomberomorus - Deep



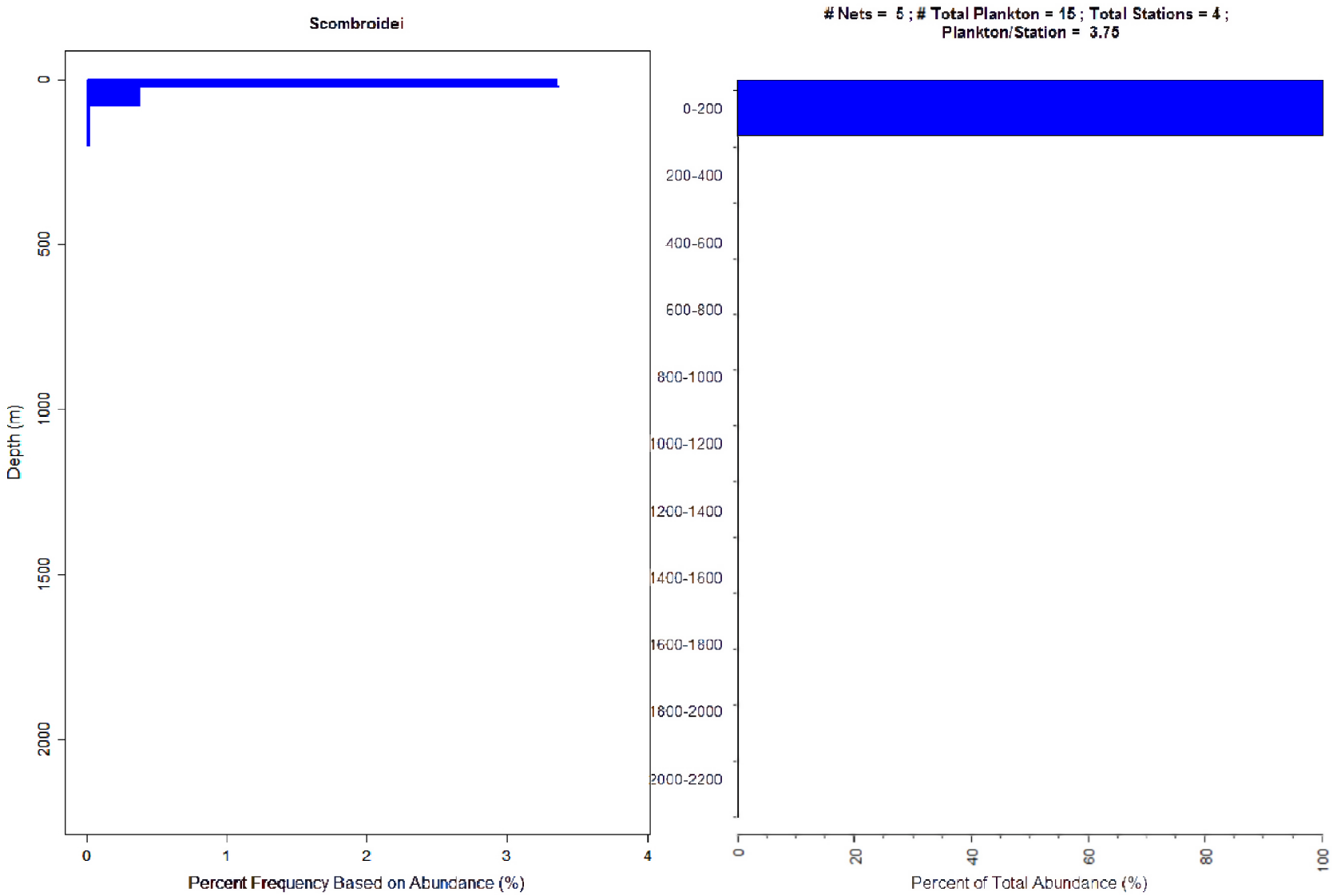
Scomberomorus_cavalla - Deep



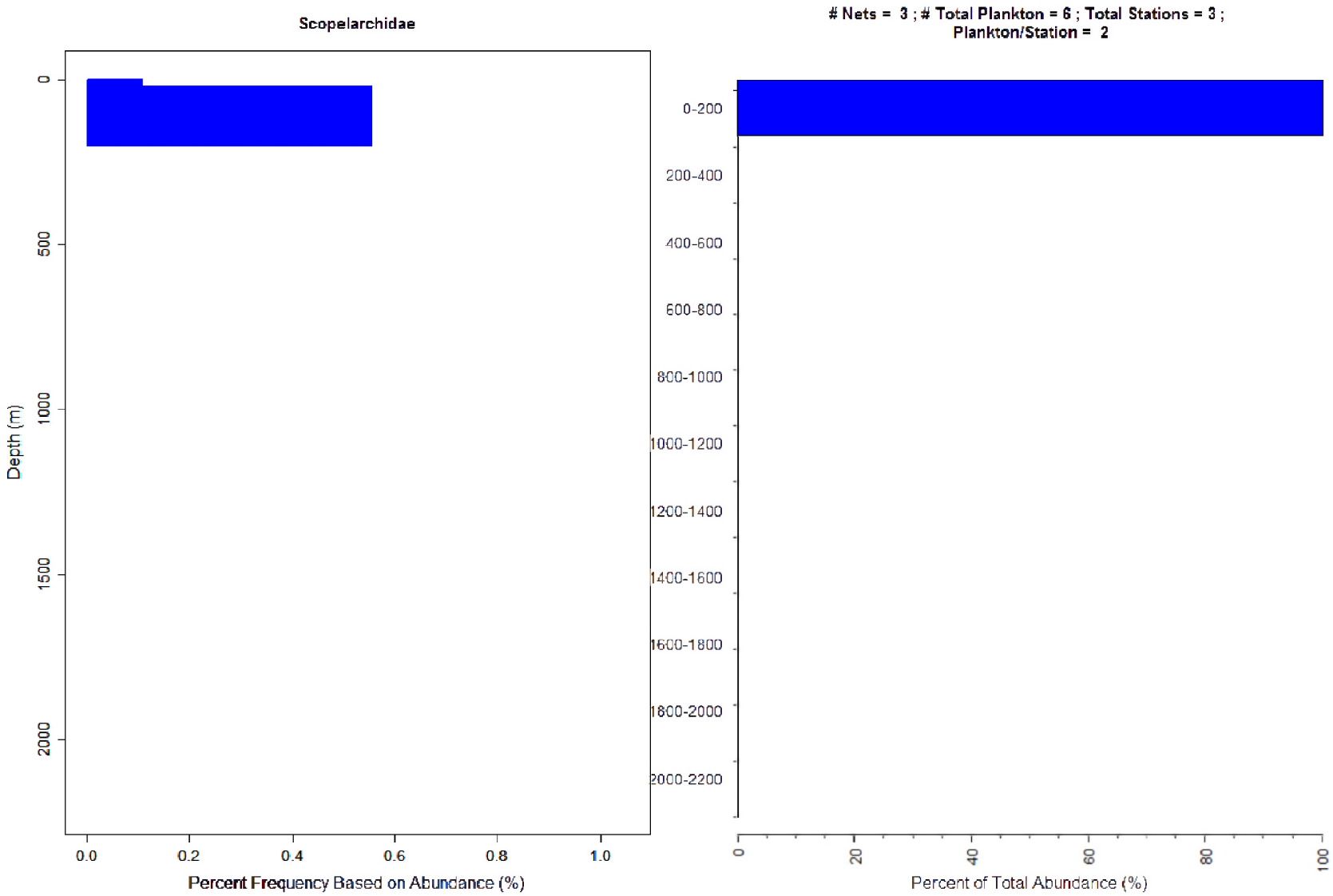
Scomberomorus_maculatus - Deep



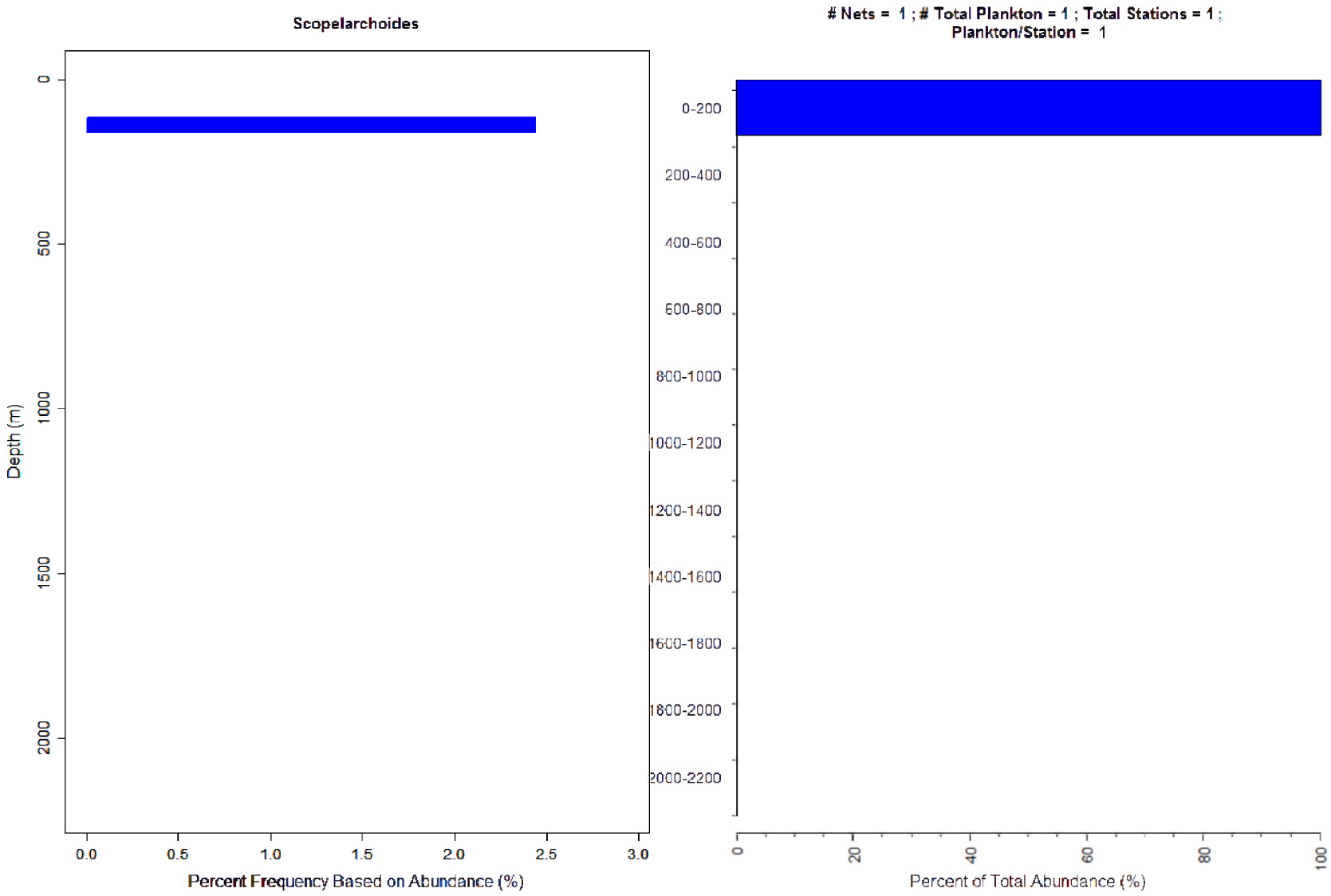
Scombridae - Deep



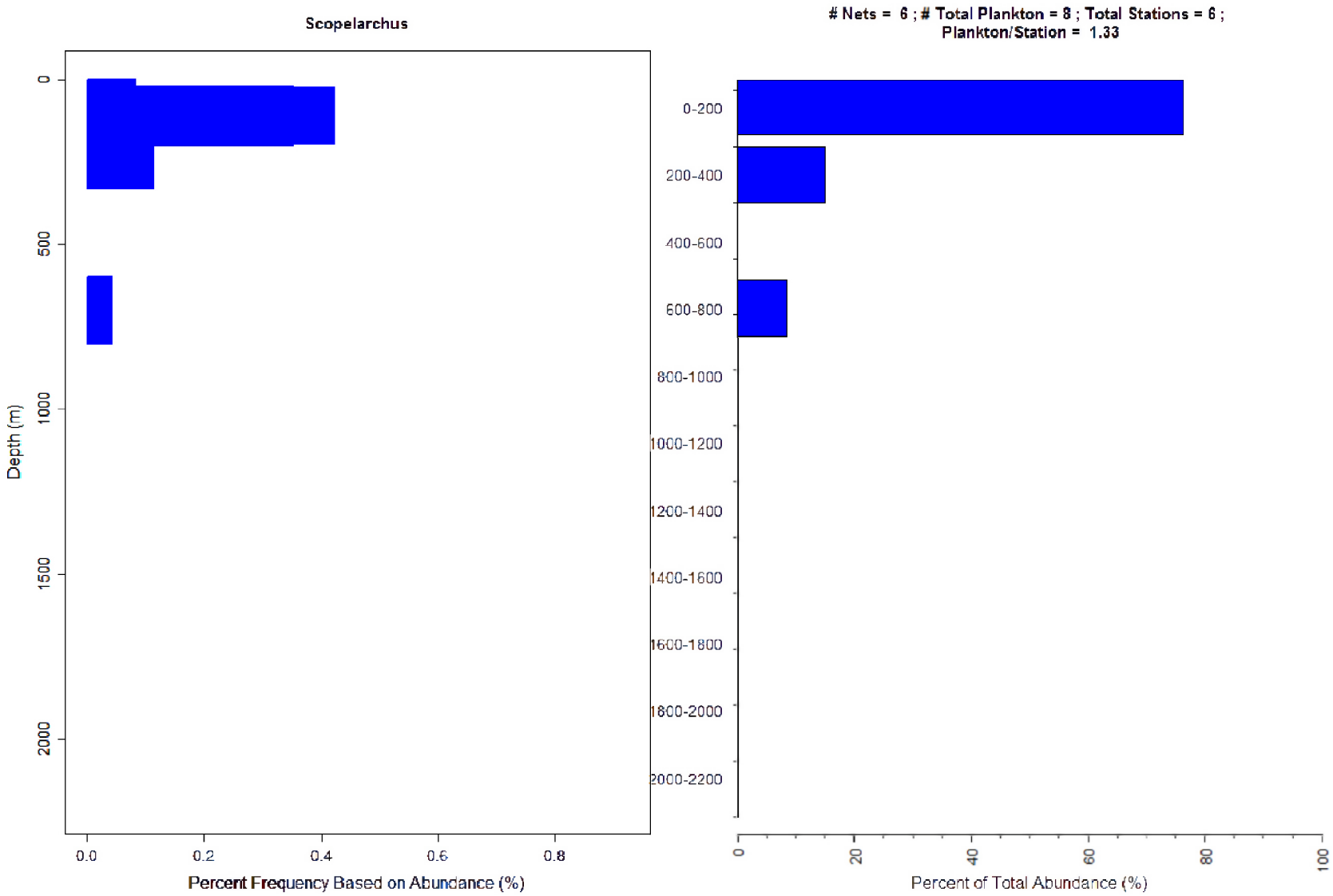
Scombroidei - Deep



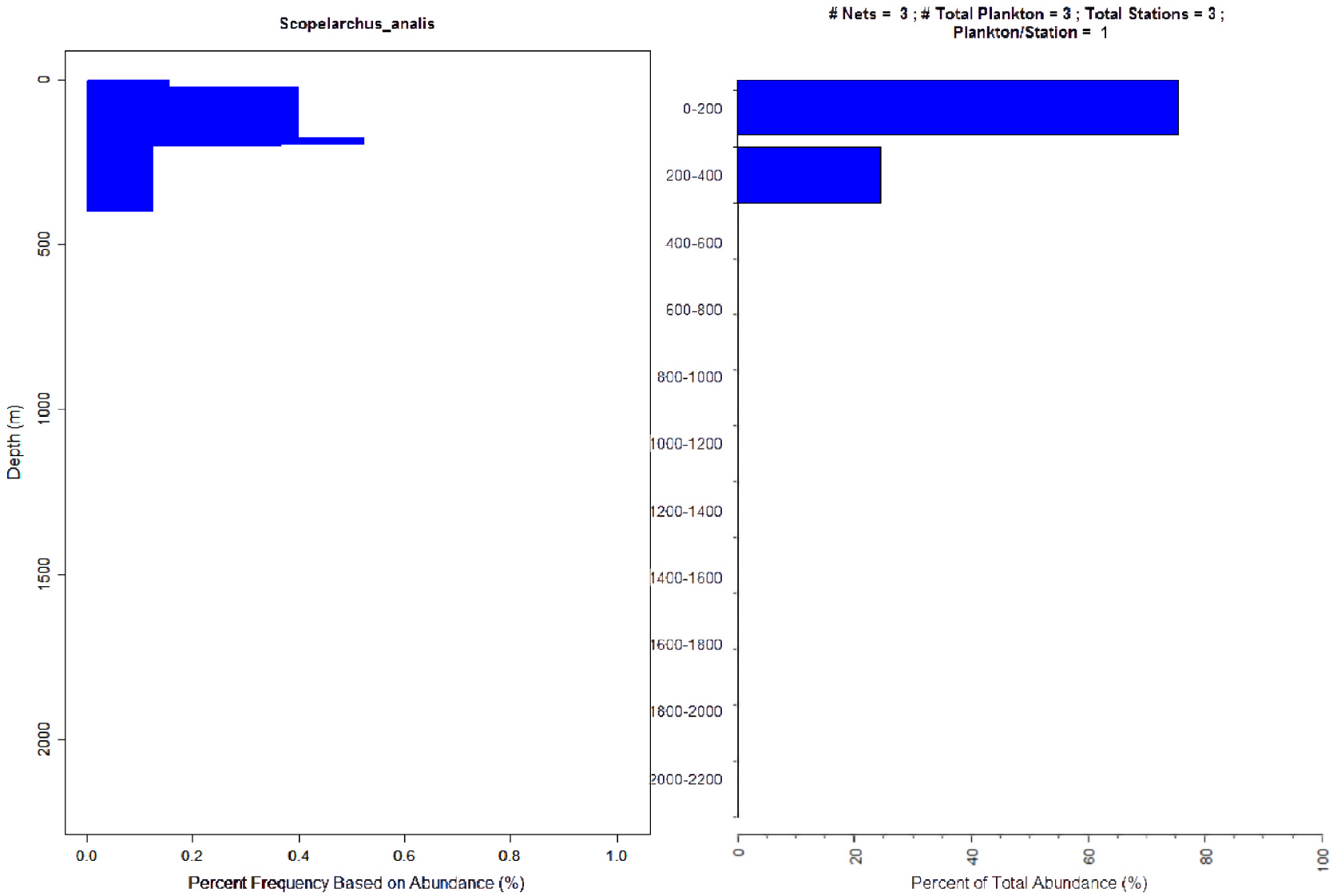
Scopelarchidae - Deep



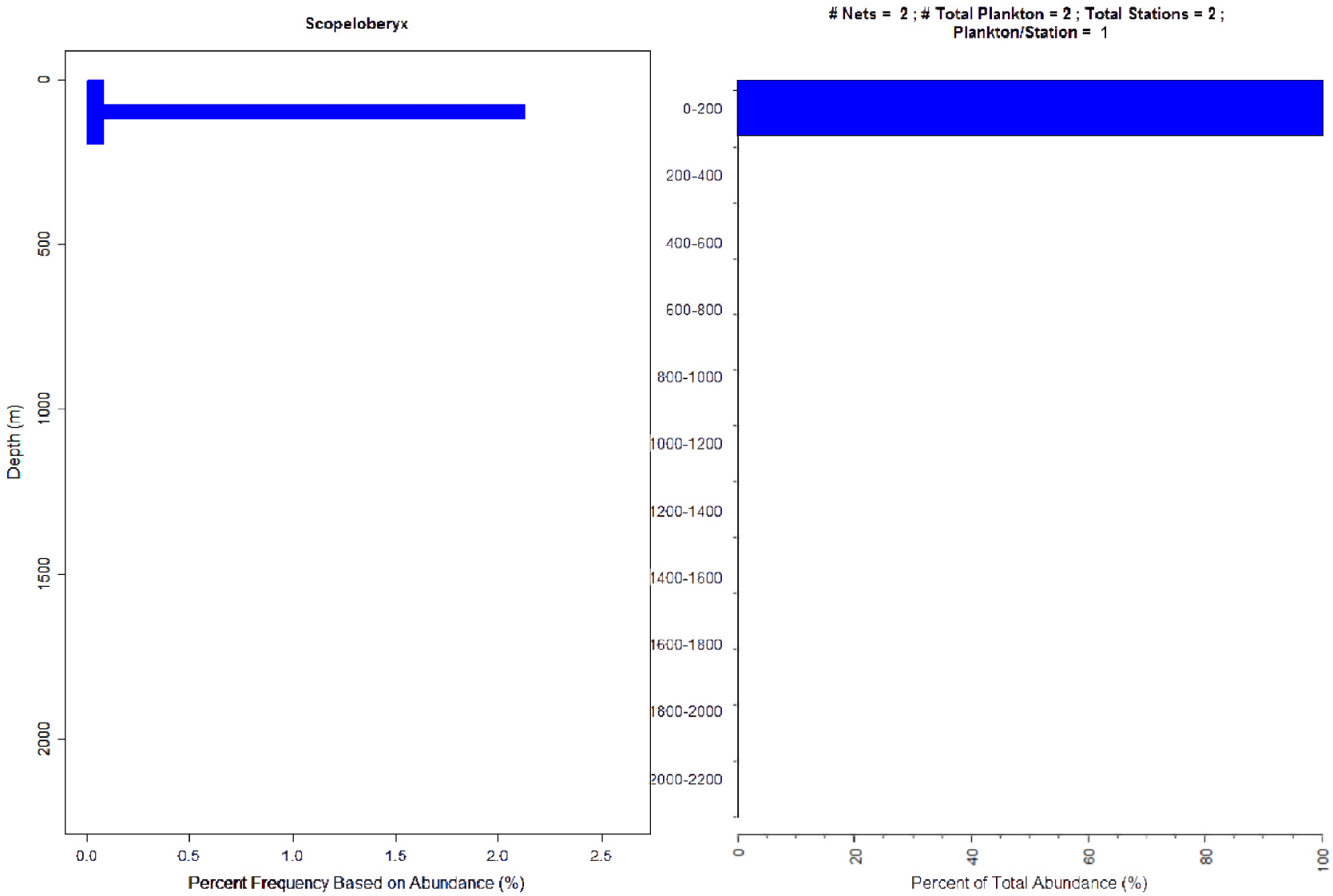
Scopelarchoides - Deep



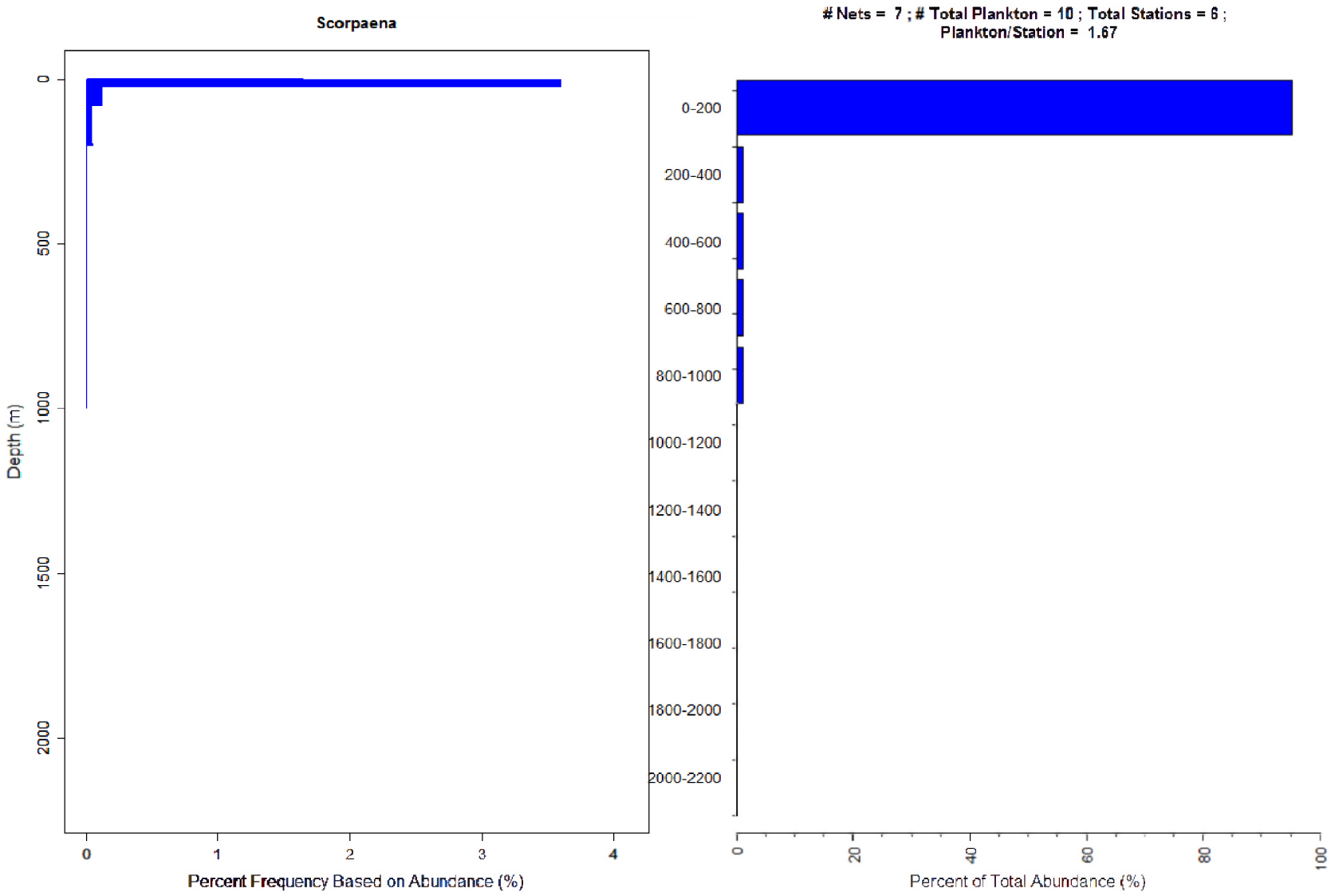
Scopelarchus - Deep



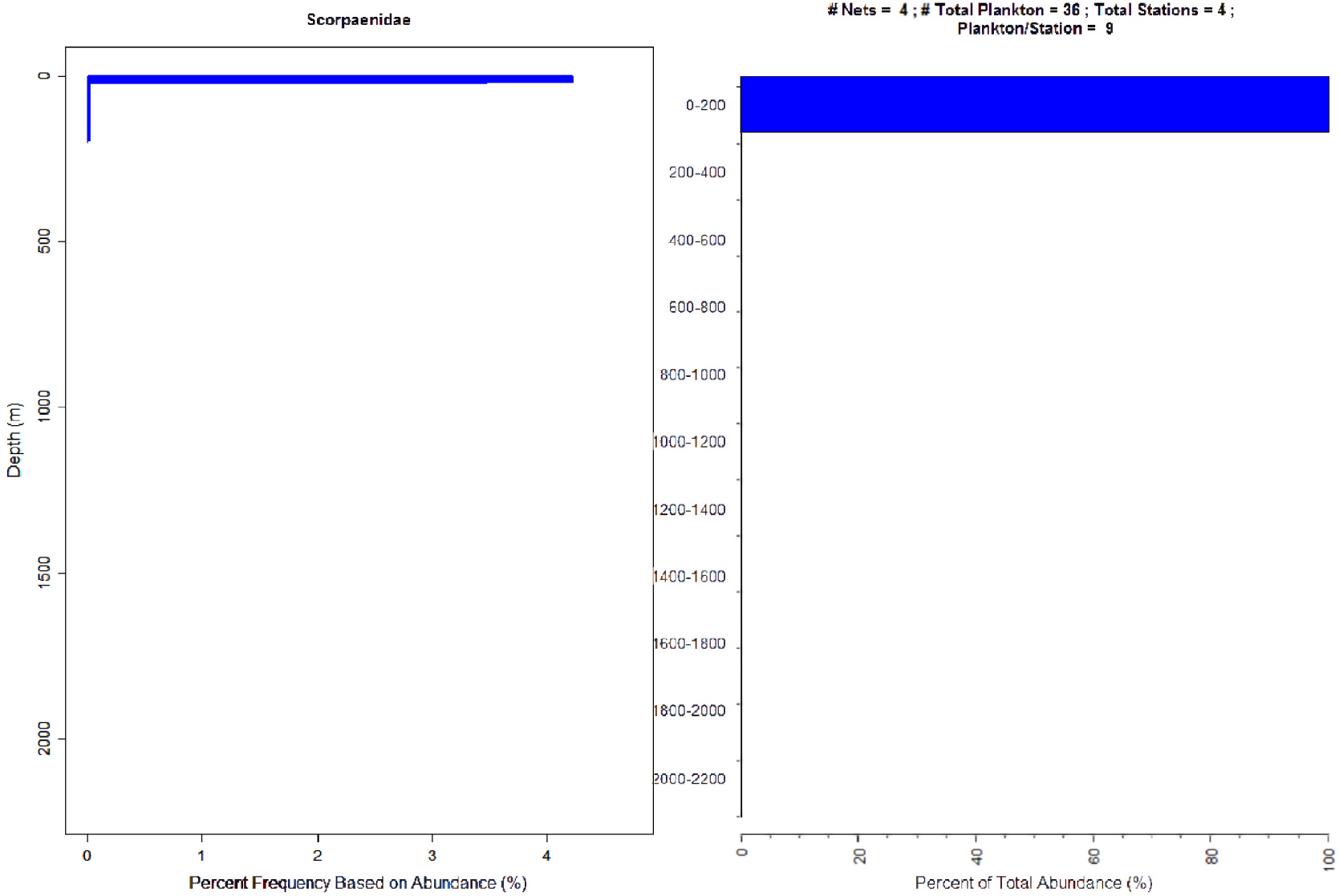
Scopelarchus_analis - Deep



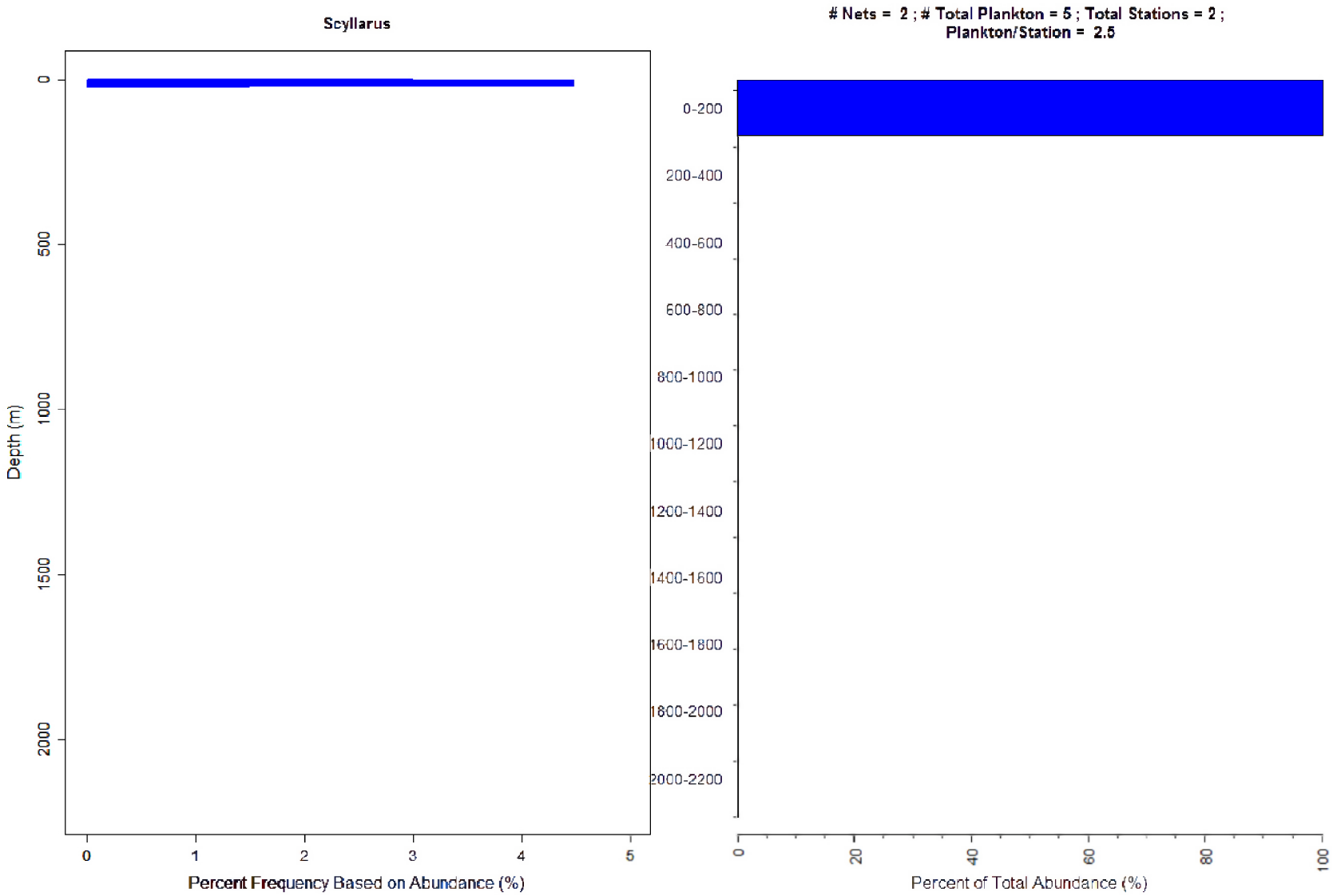
Scopeloberyx - Deep



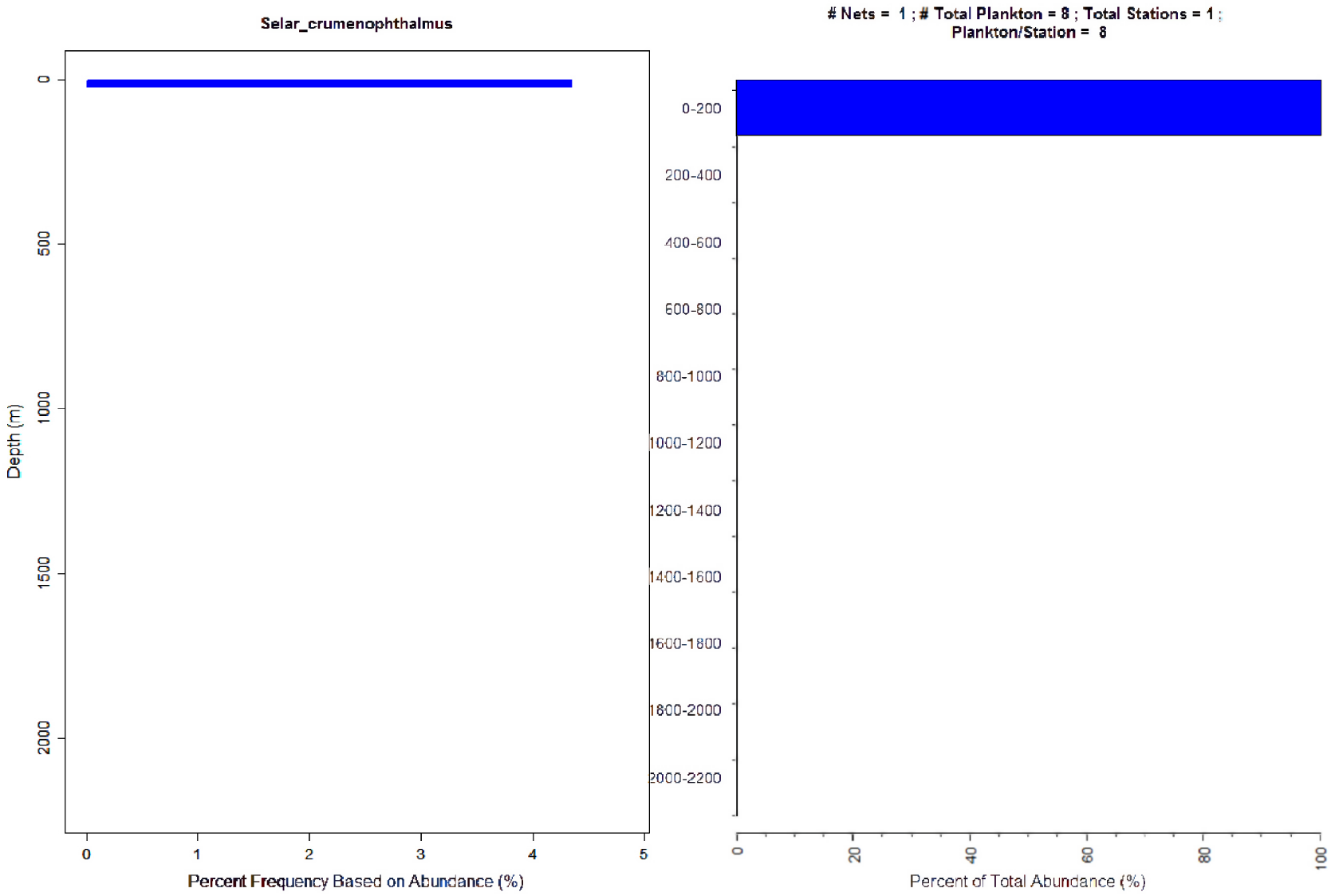
Scorpaena - Deep



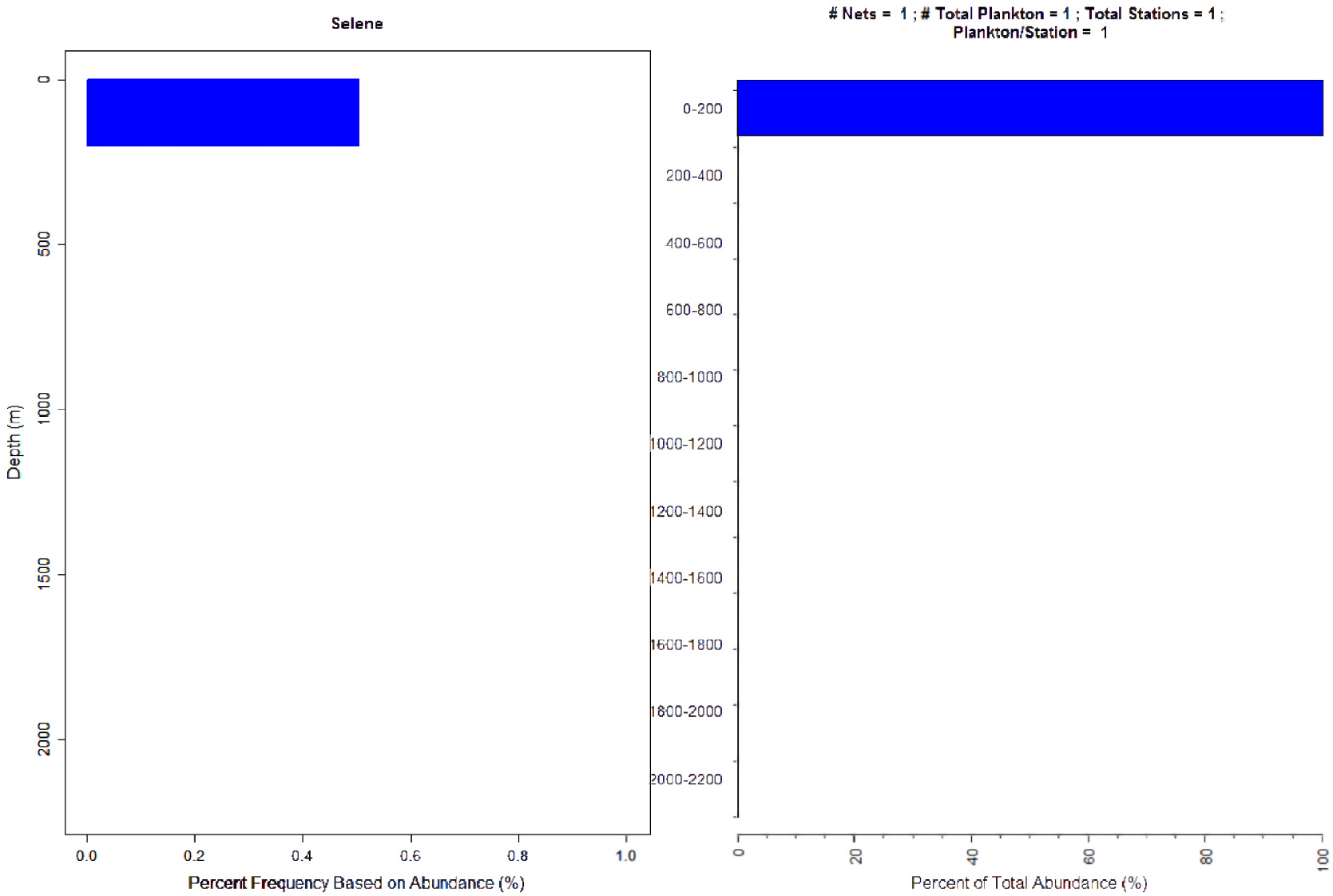
Scorpaenidae - Deep



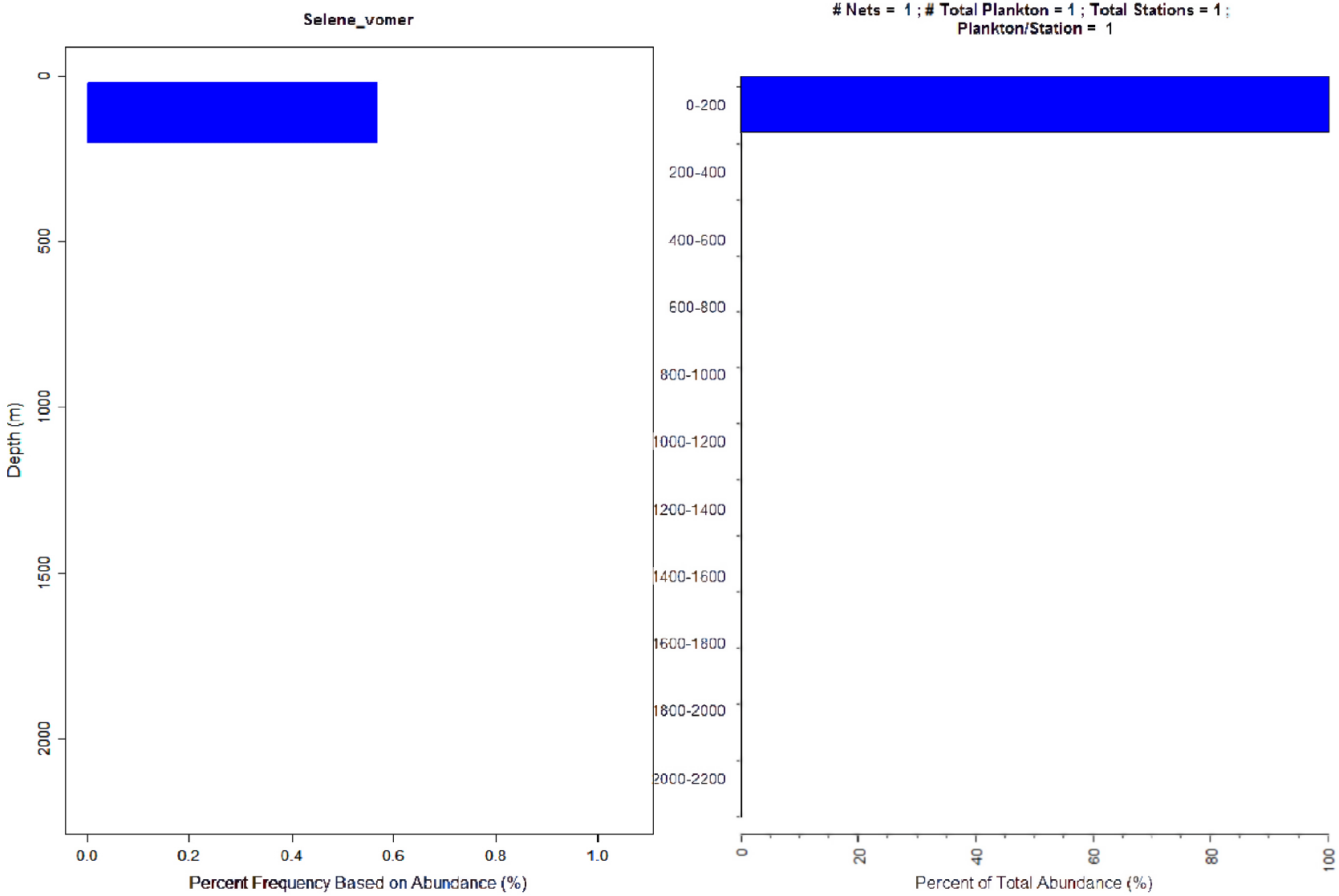
Scyllarus - Deep



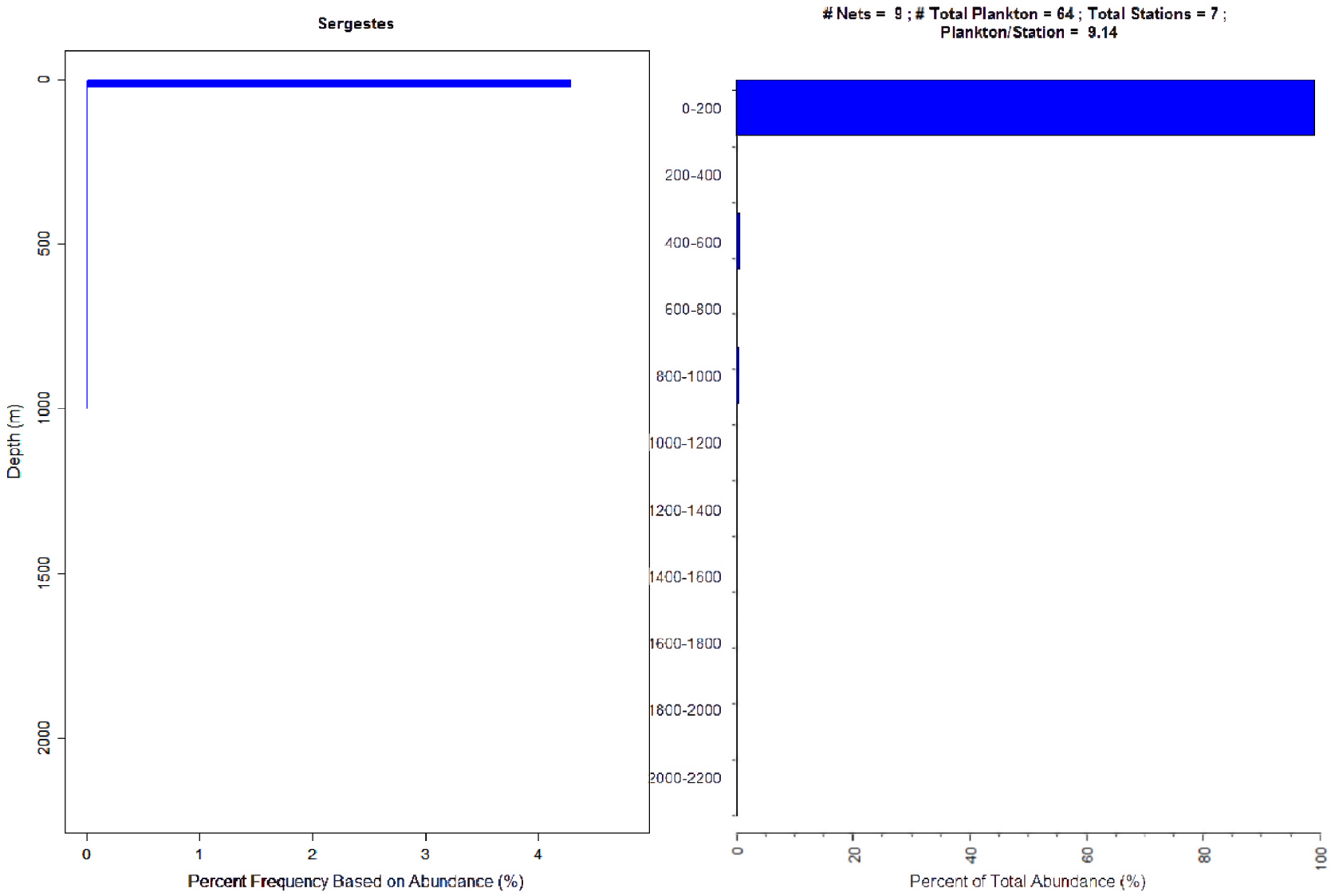
Selar_crumenophthalmus - Deep


Selene
Nets = 1 ; # Total Plankton = 1 ; Total Stations = 1 ;
Plankton/Station = 1
Depth (m)
0
500
1000
1500
2000
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

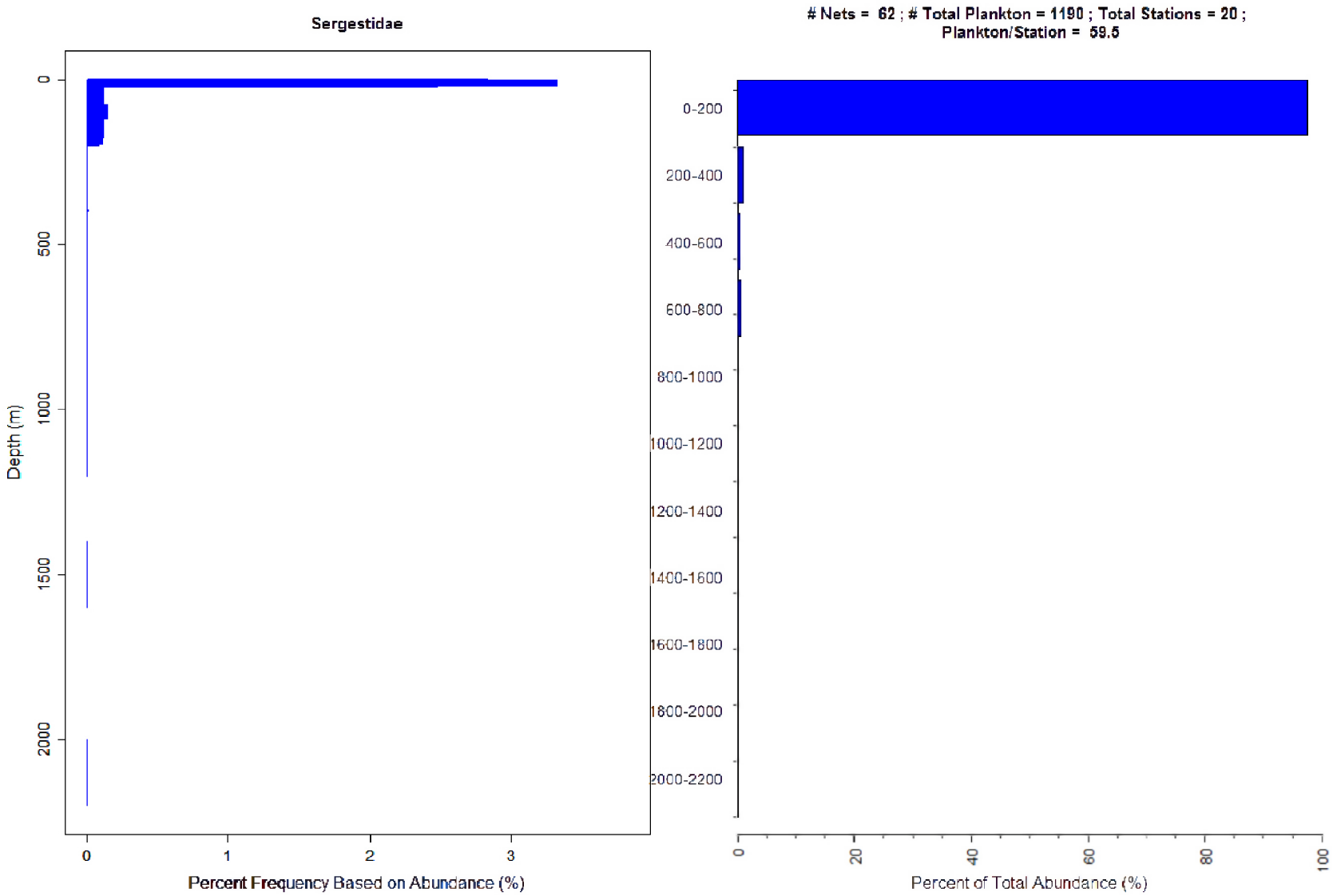
Selene - Deep



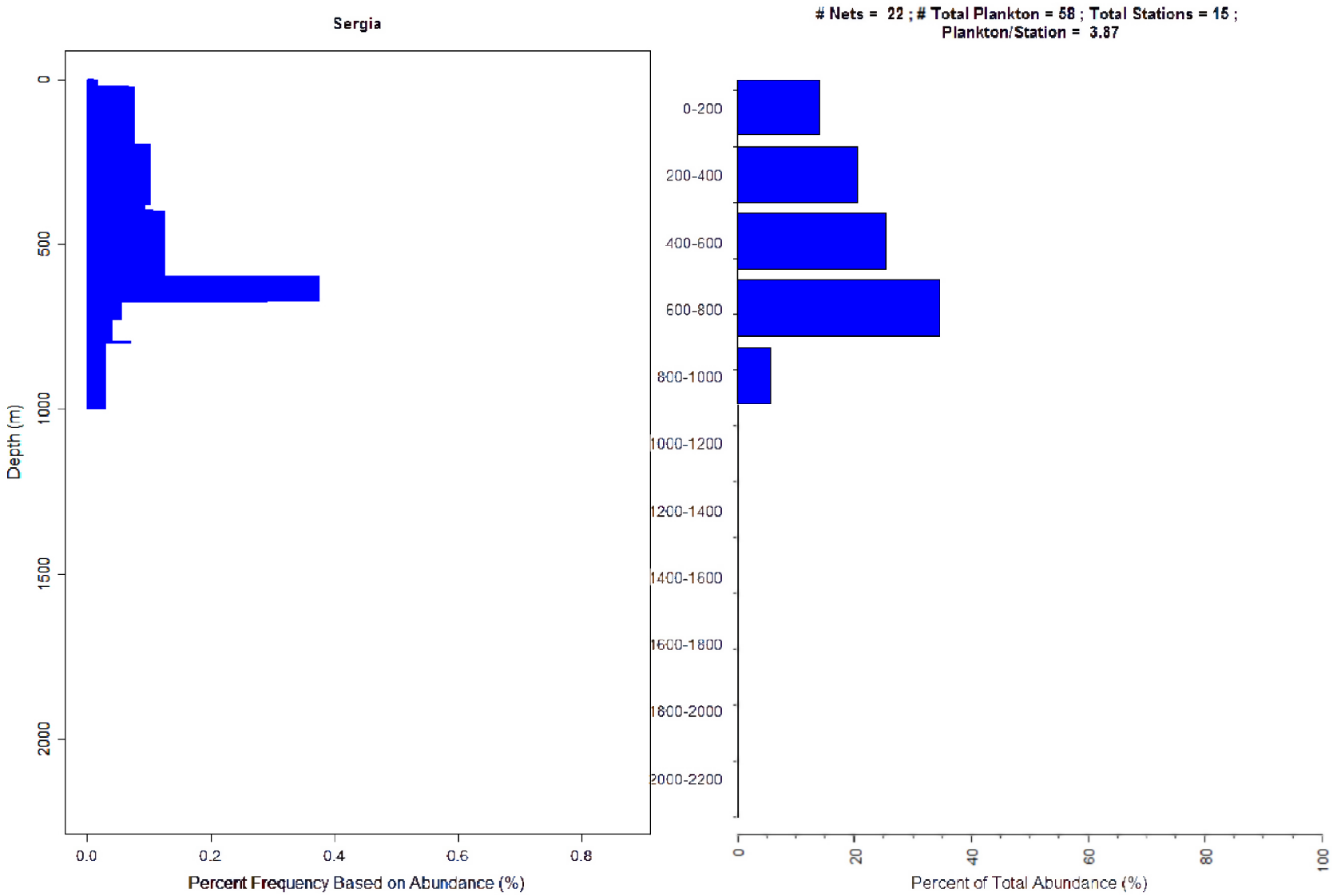
Selene_vomer - Deep



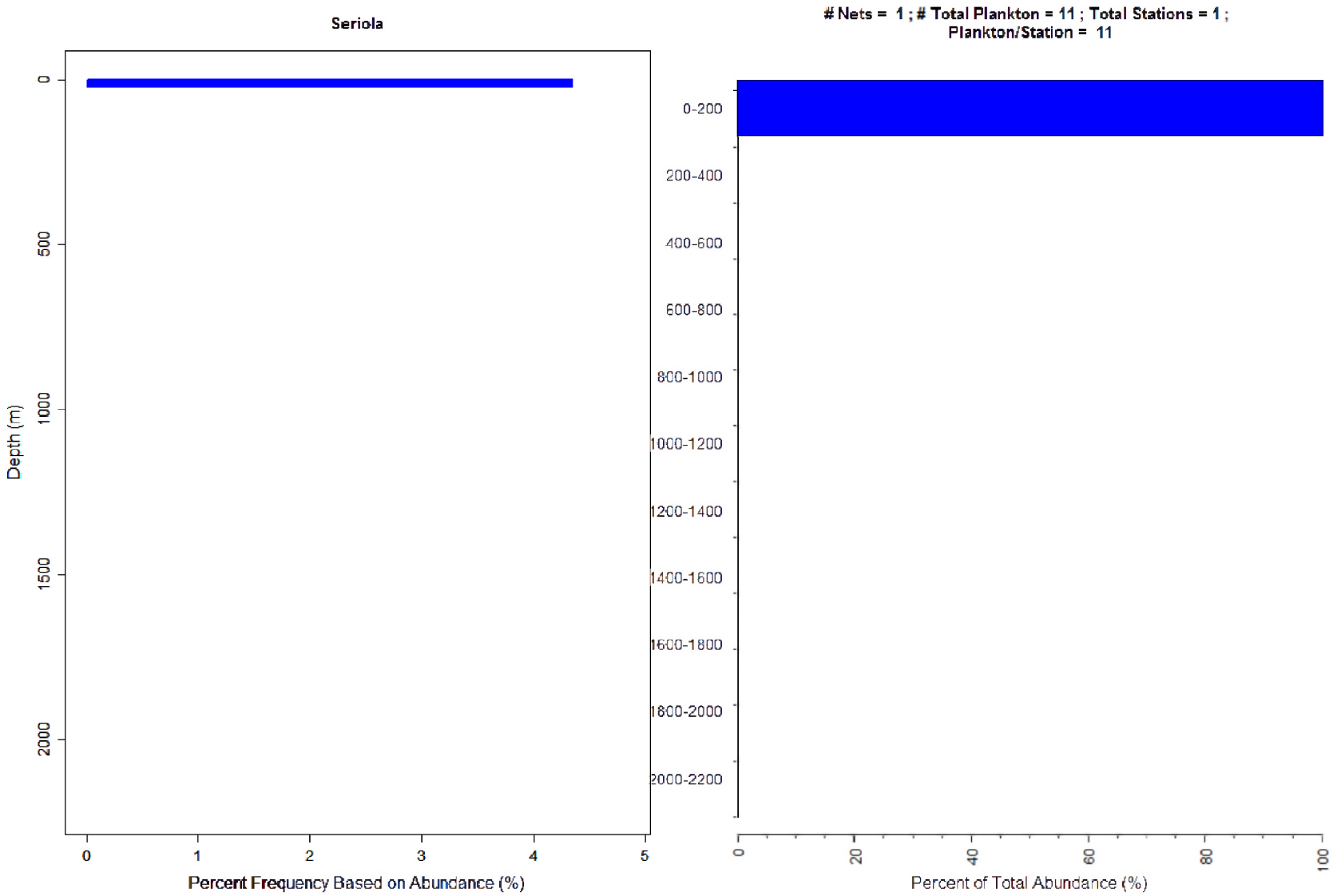
Sergestes - Deep



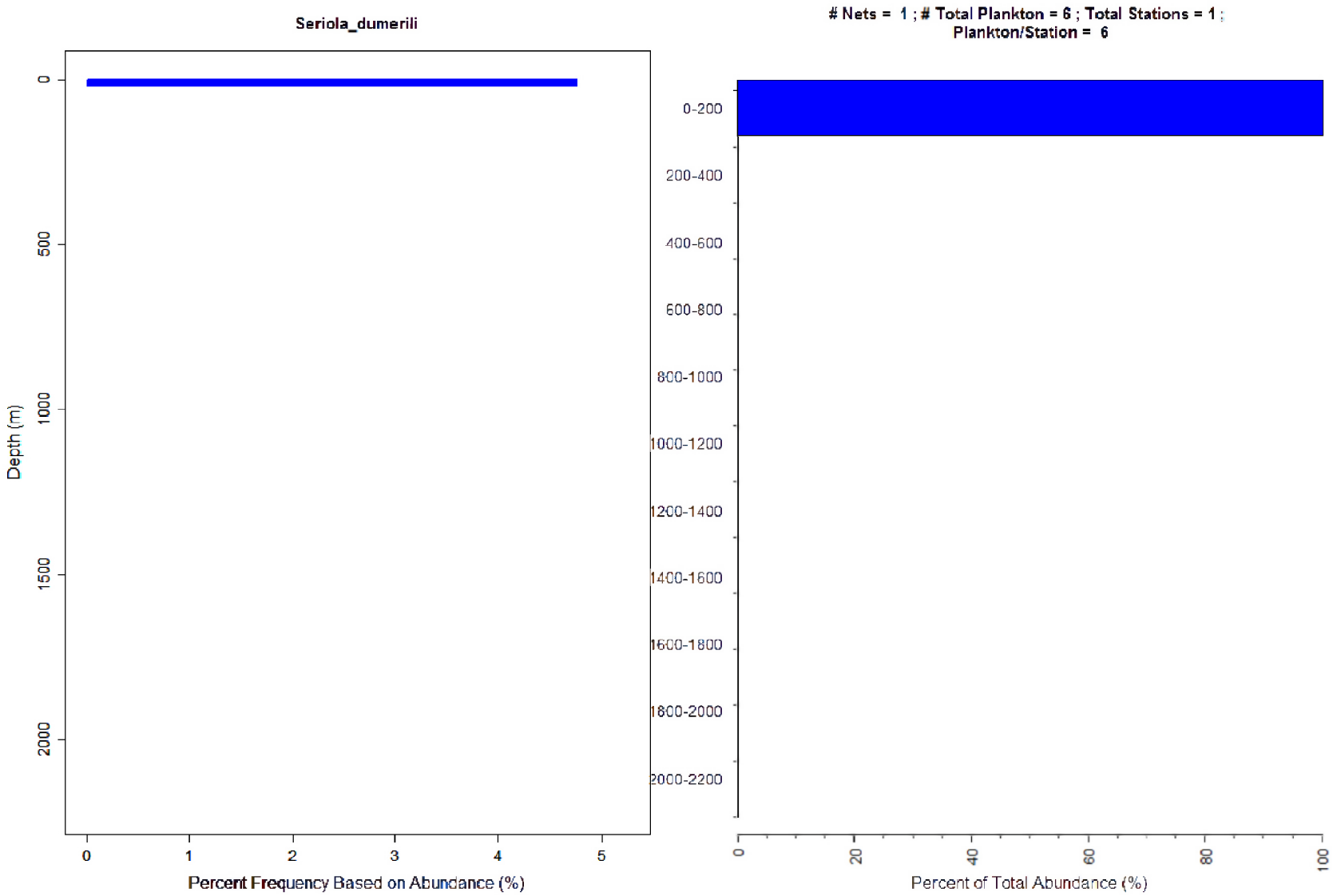
Sergestidae - Deep


Sergia
Nets = 22 ; # Total Plankton = 58 ; Total Stations = 15 ;
Plankton/Station = 3.87
Depth (m)
0
500
1000
1500
2000
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1400
1400-1600
1600-1800
1800-2000
2000-2200
0
20
40
60
80
100
Percent of Total Abundance (%)

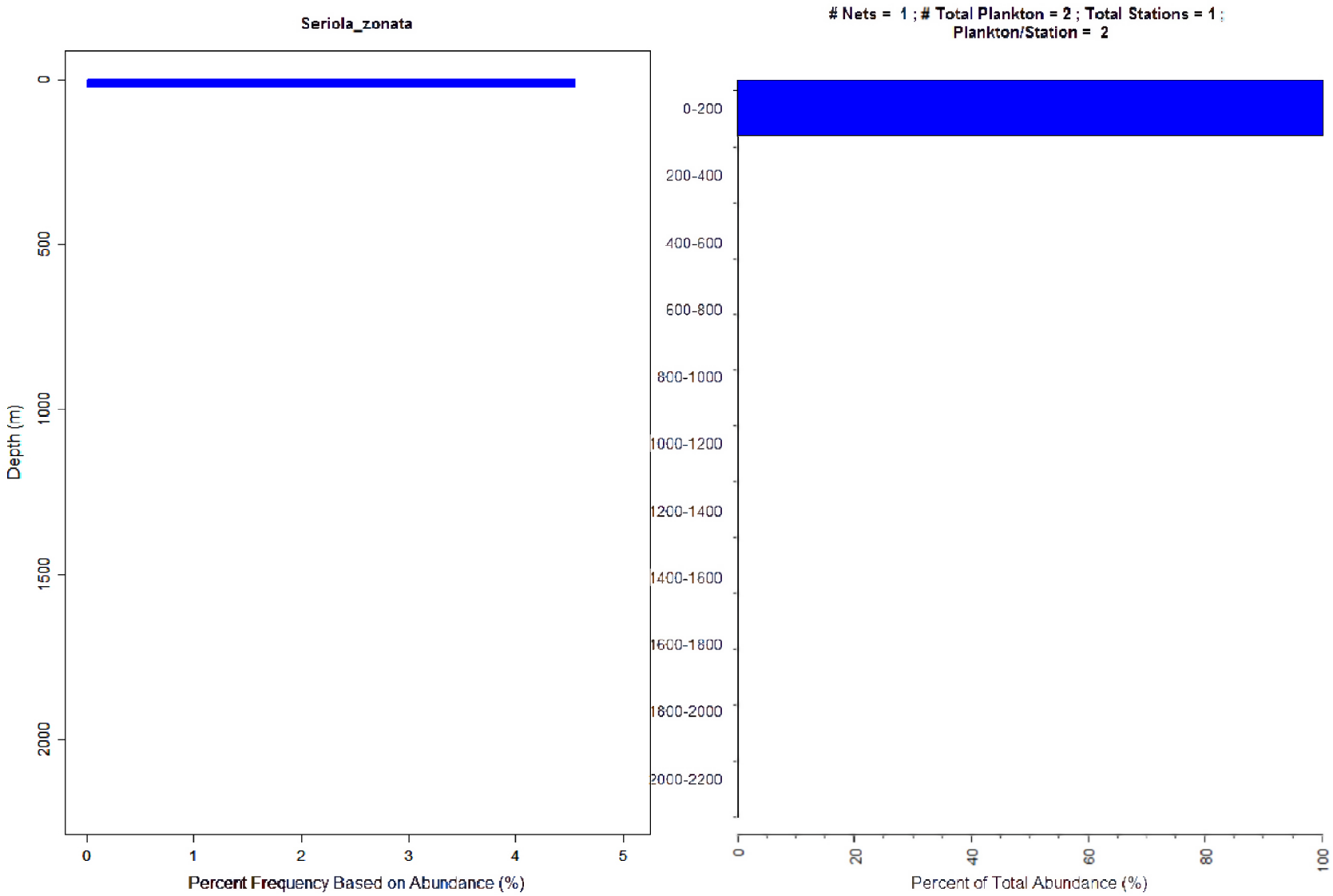
Sergia - Deep



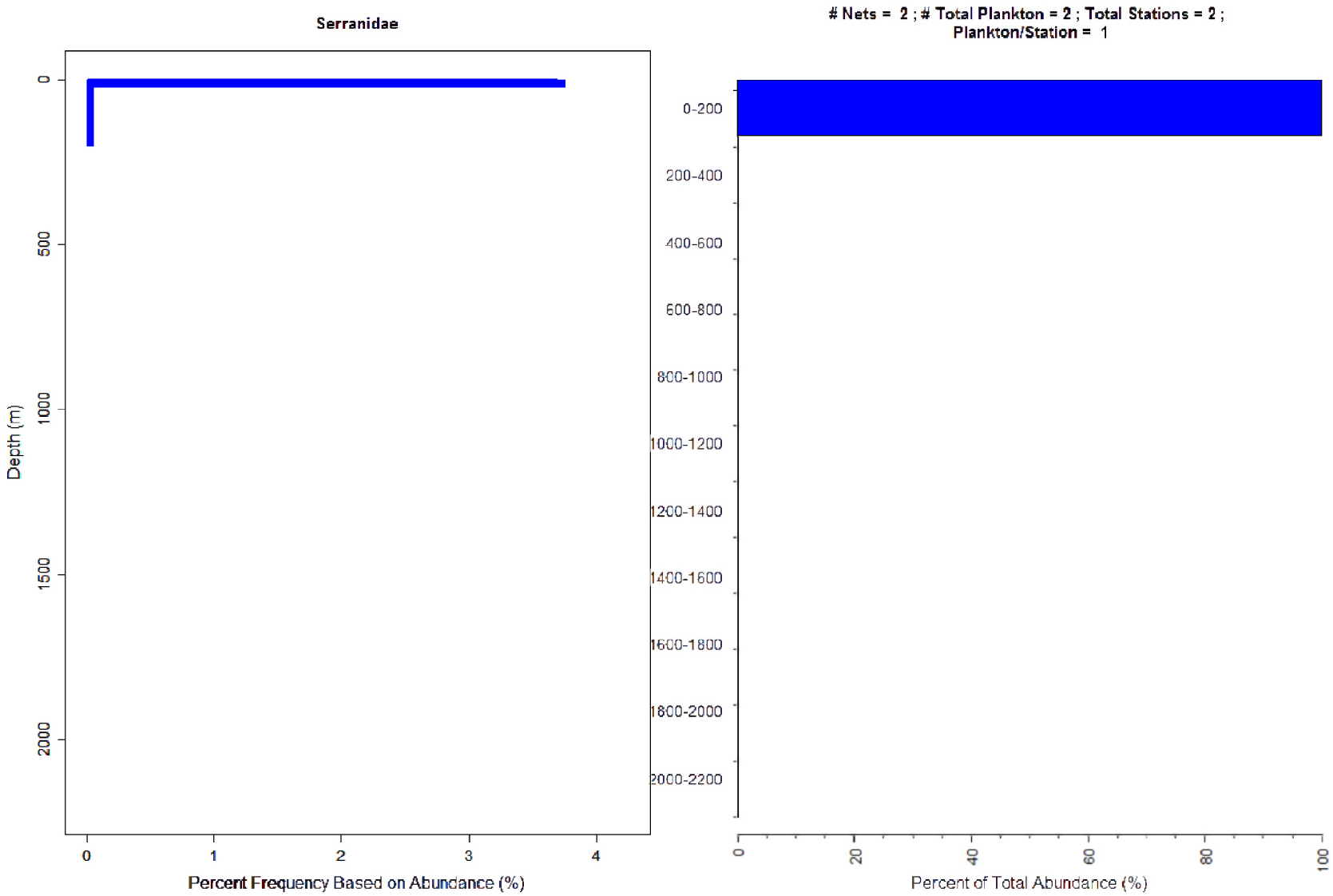
Seriola - Deep



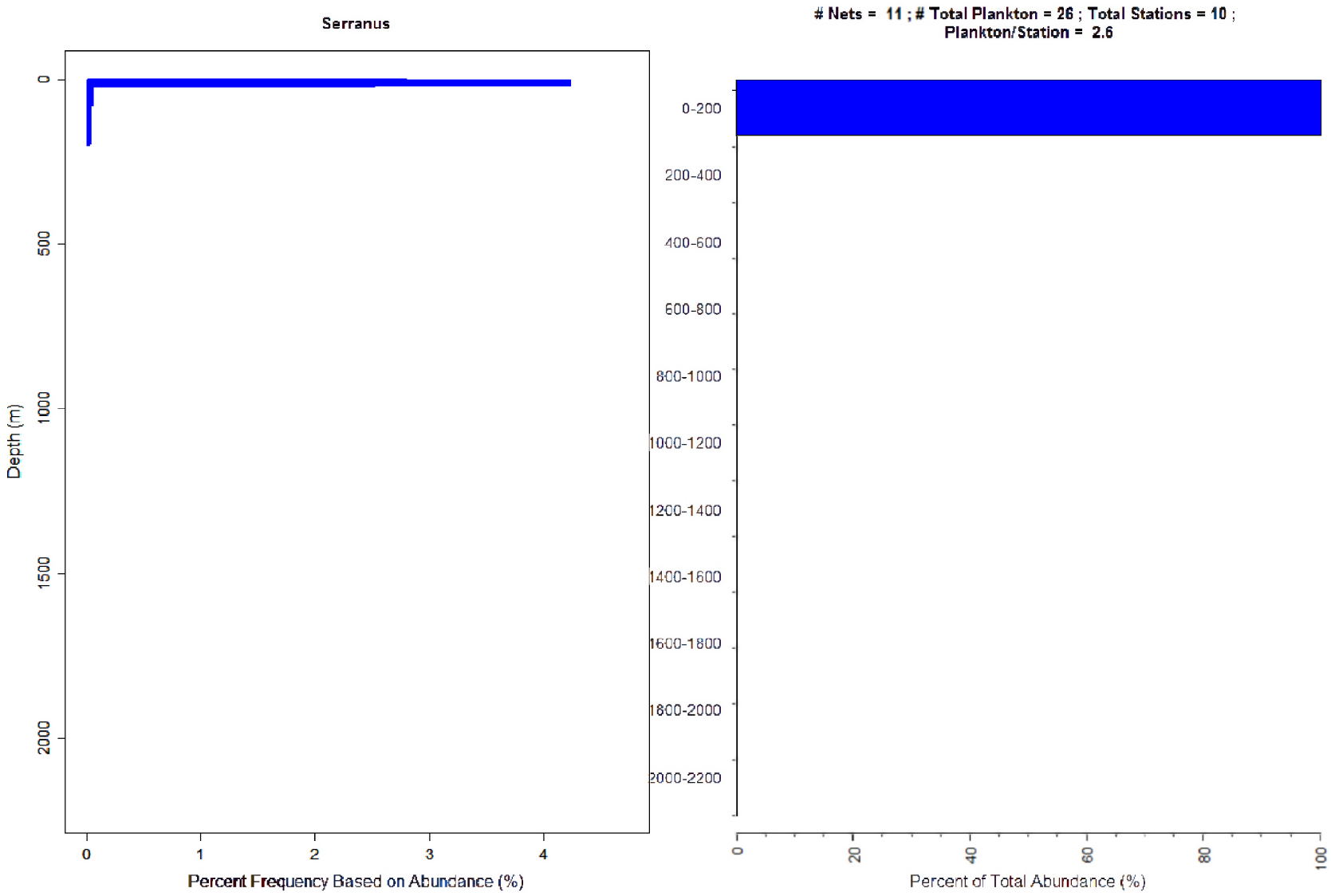
Seriola_dumerili - Deep



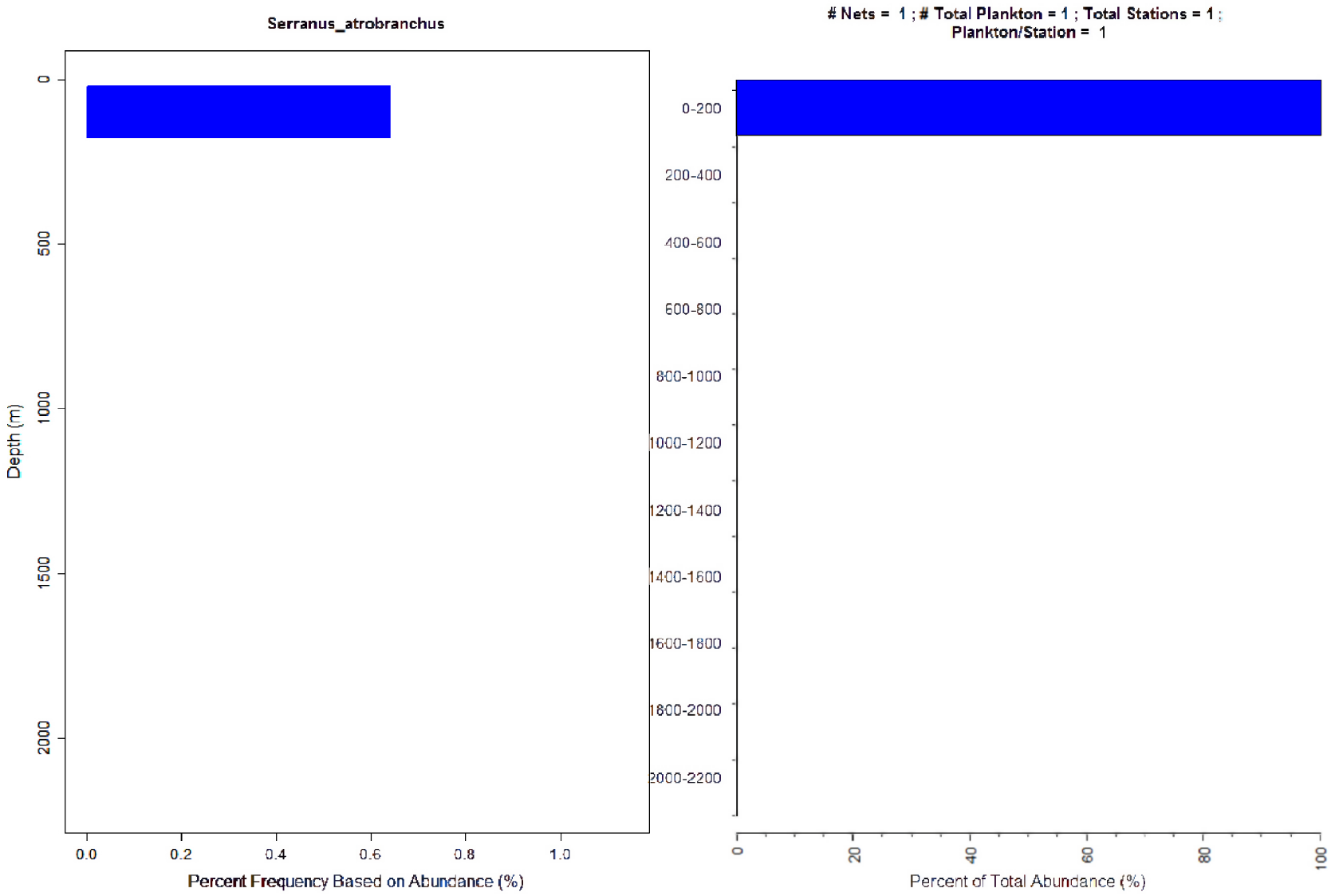
Seriola_zonata - Deep



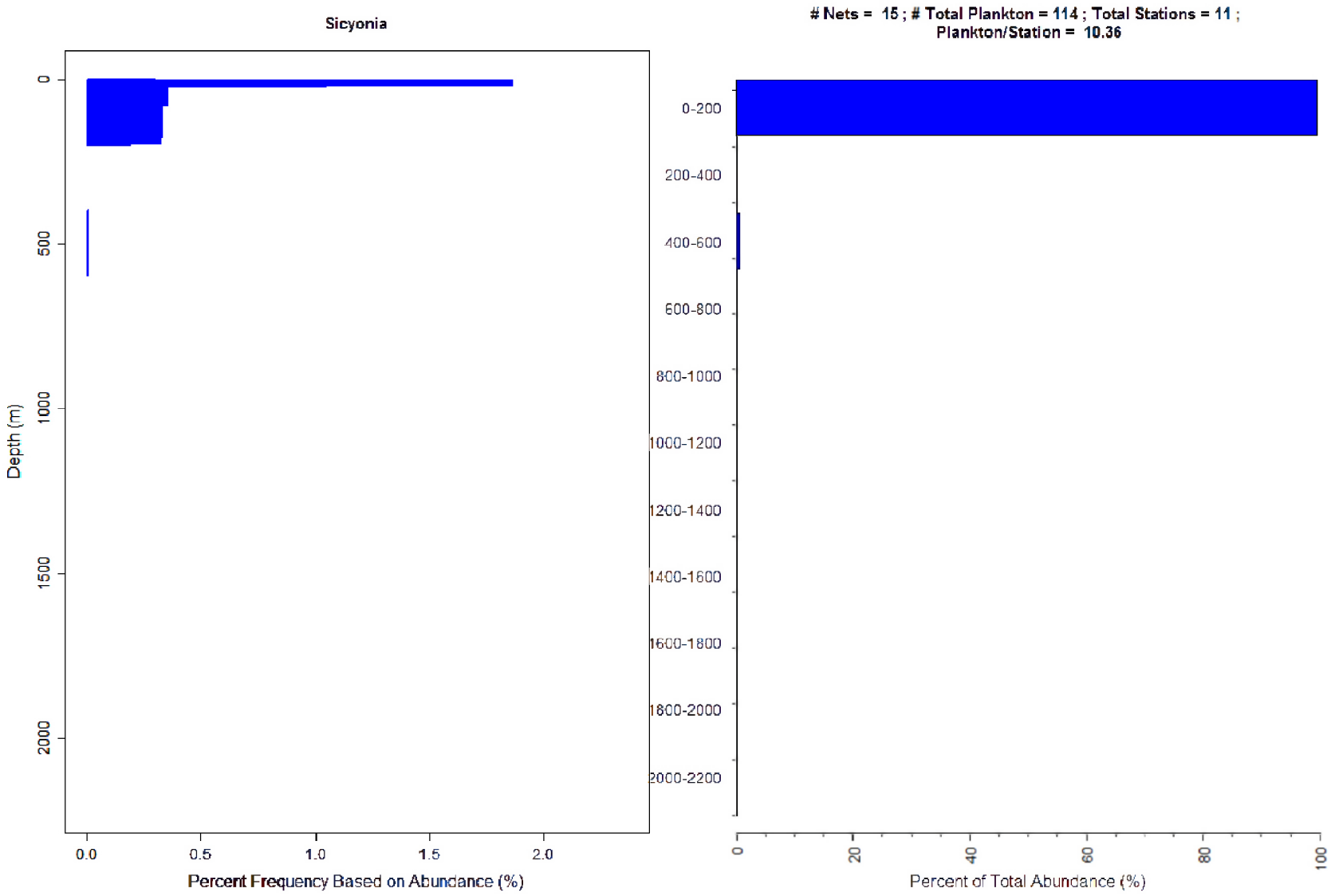
Serranidae - Deep



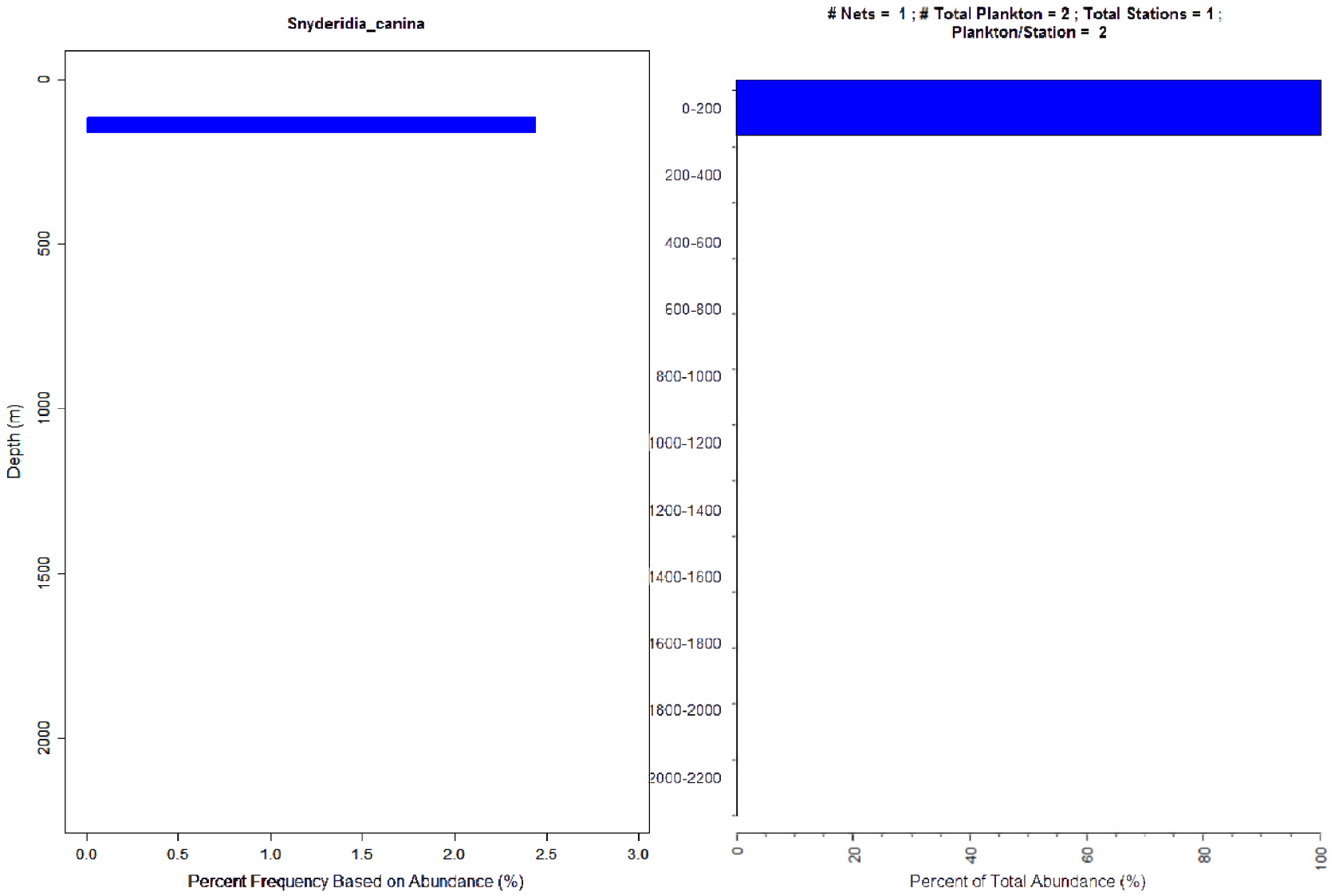
Serranus - Deep



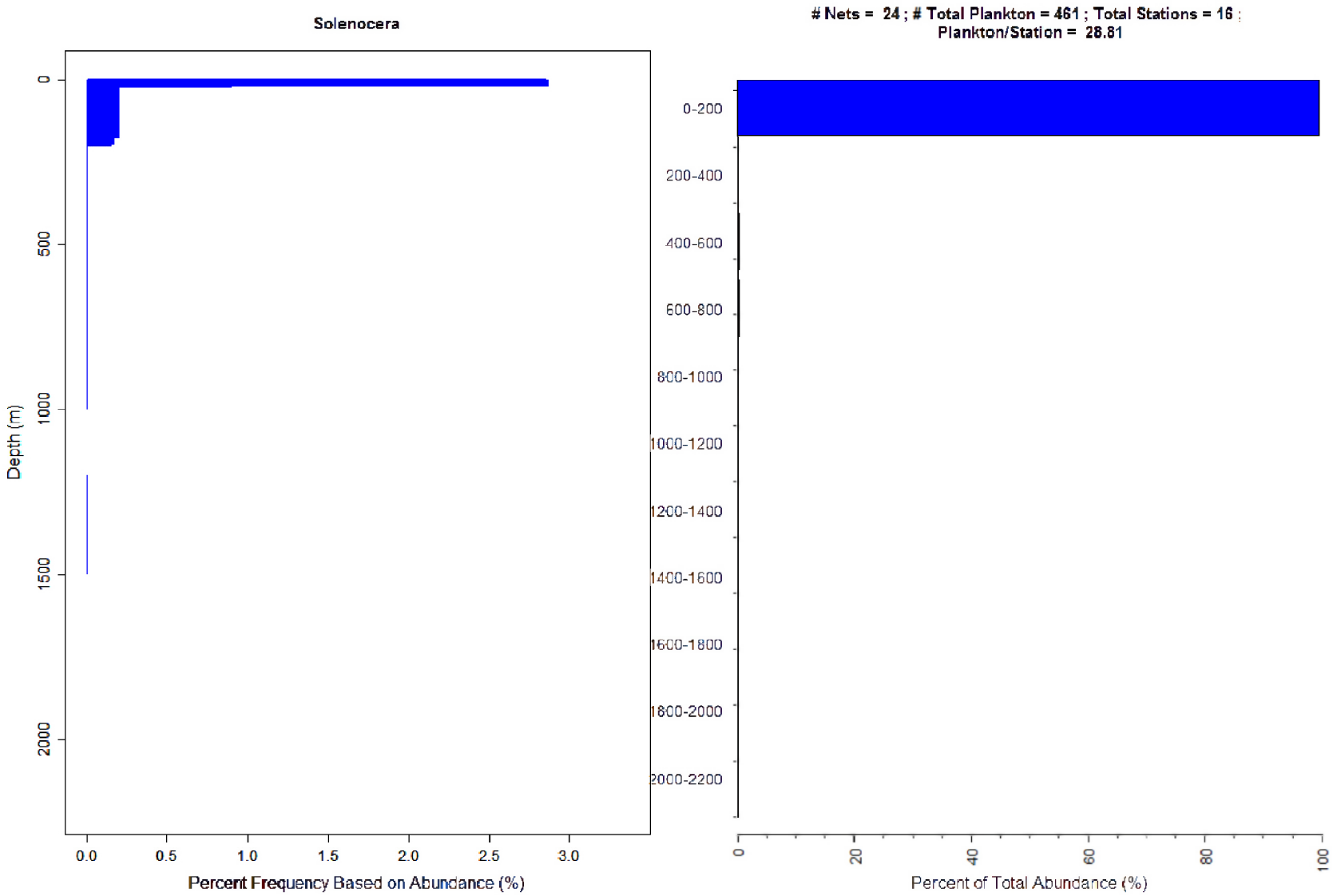
Serranus_atrobranchus - Deep



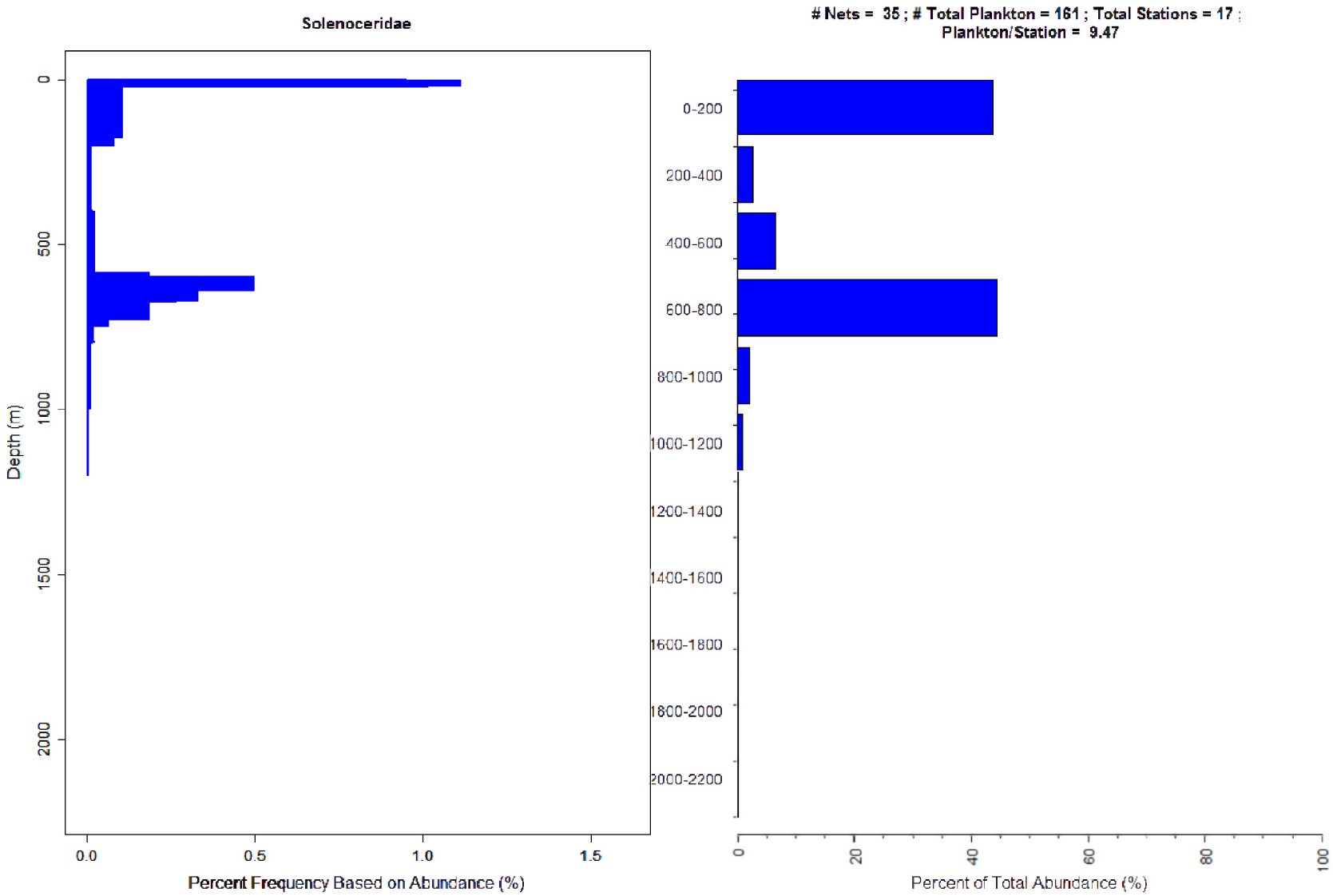
Sicyonia - Deep



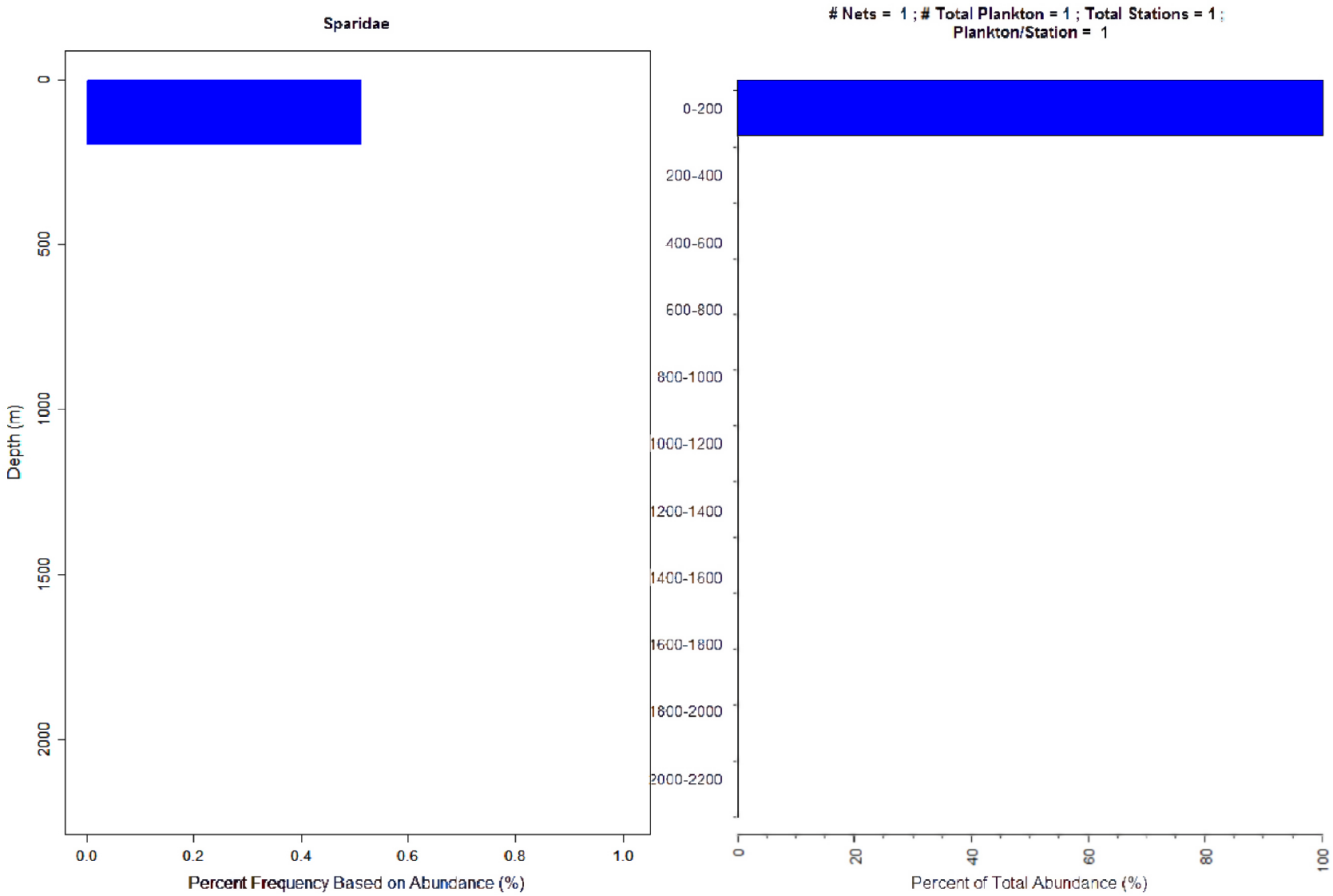
Snyderidia_canina - Deep



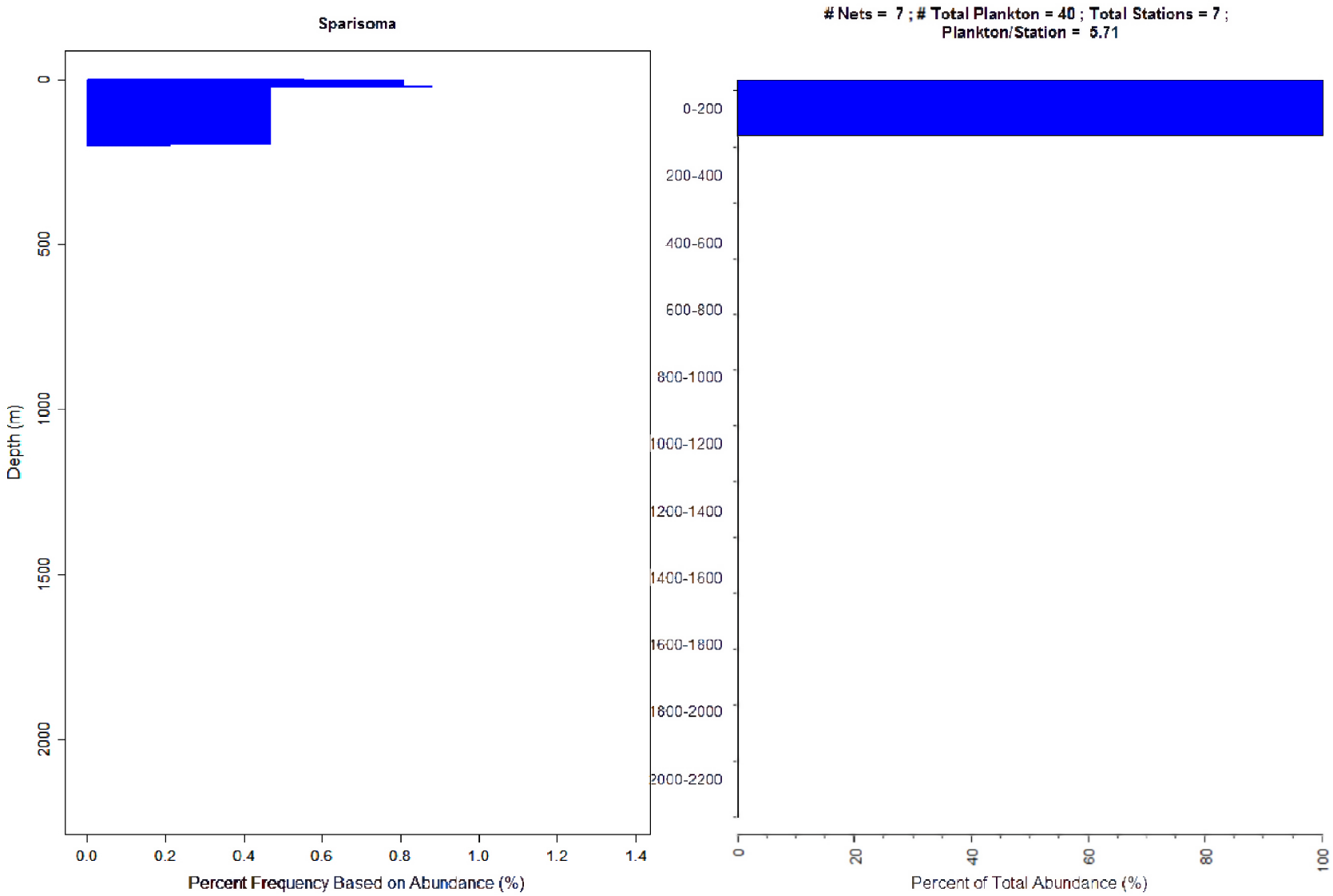
Solenocera - Deep



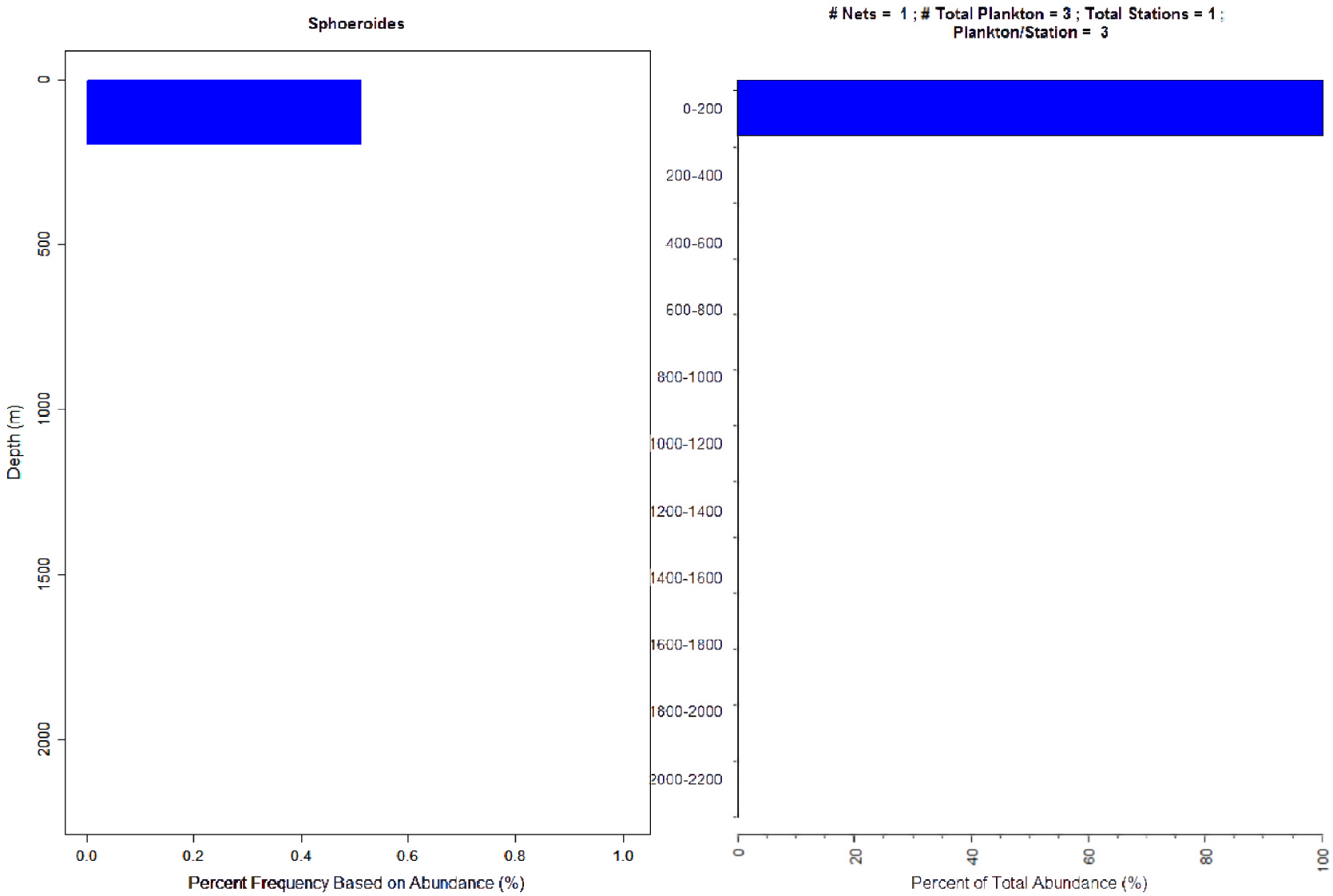
Solenoceridae - Deep



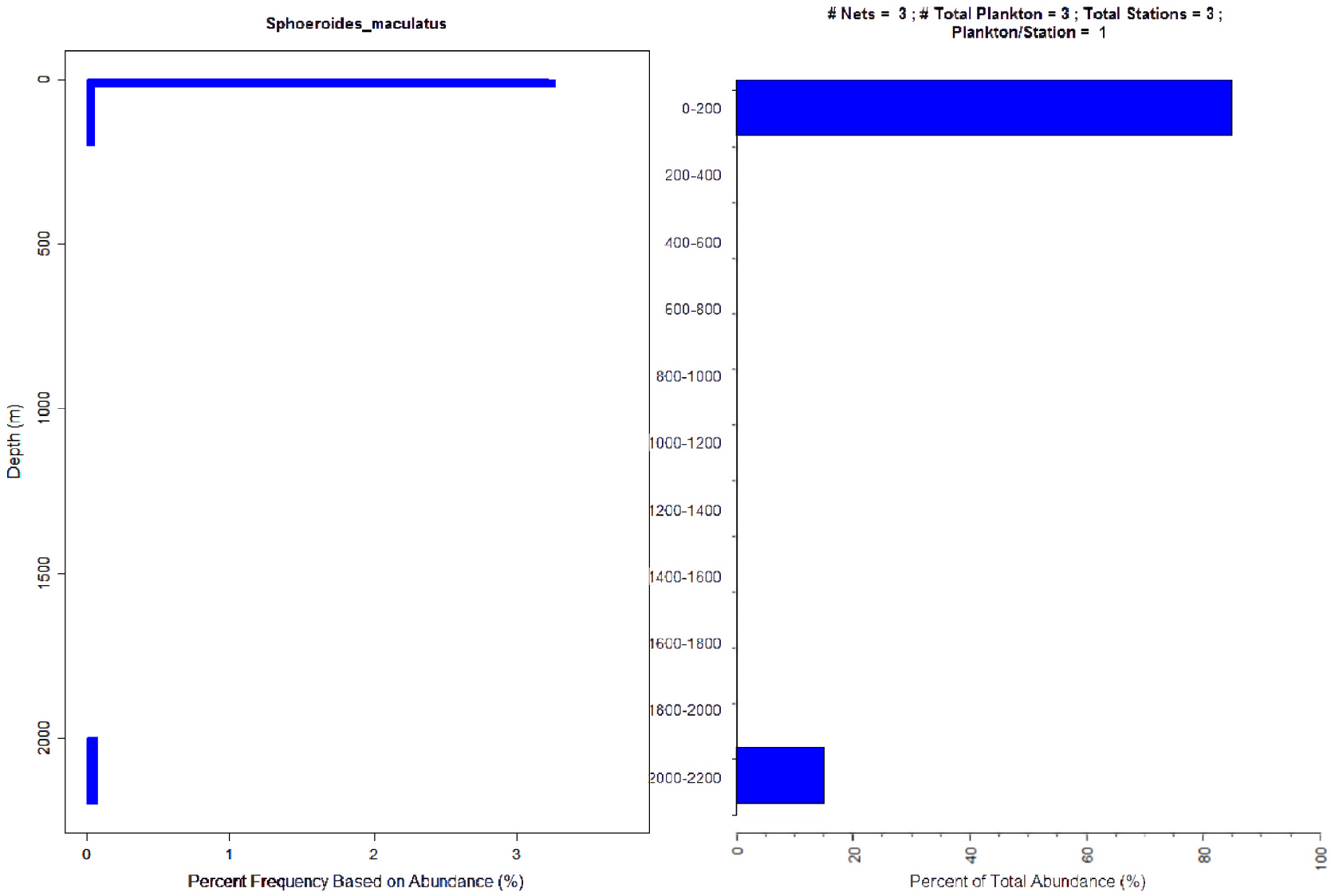
Sparidae - Deep



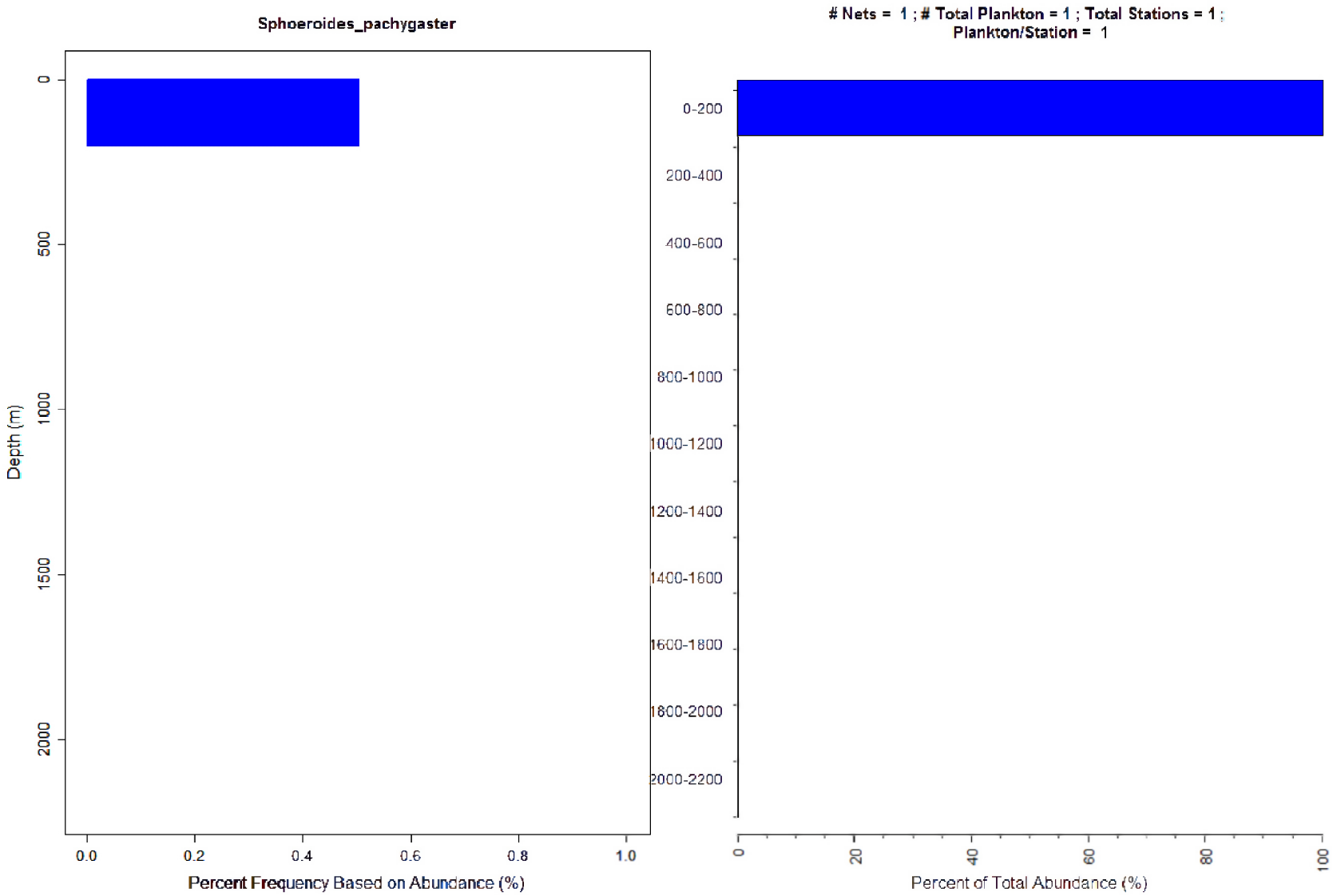
Sparisoma - Deep



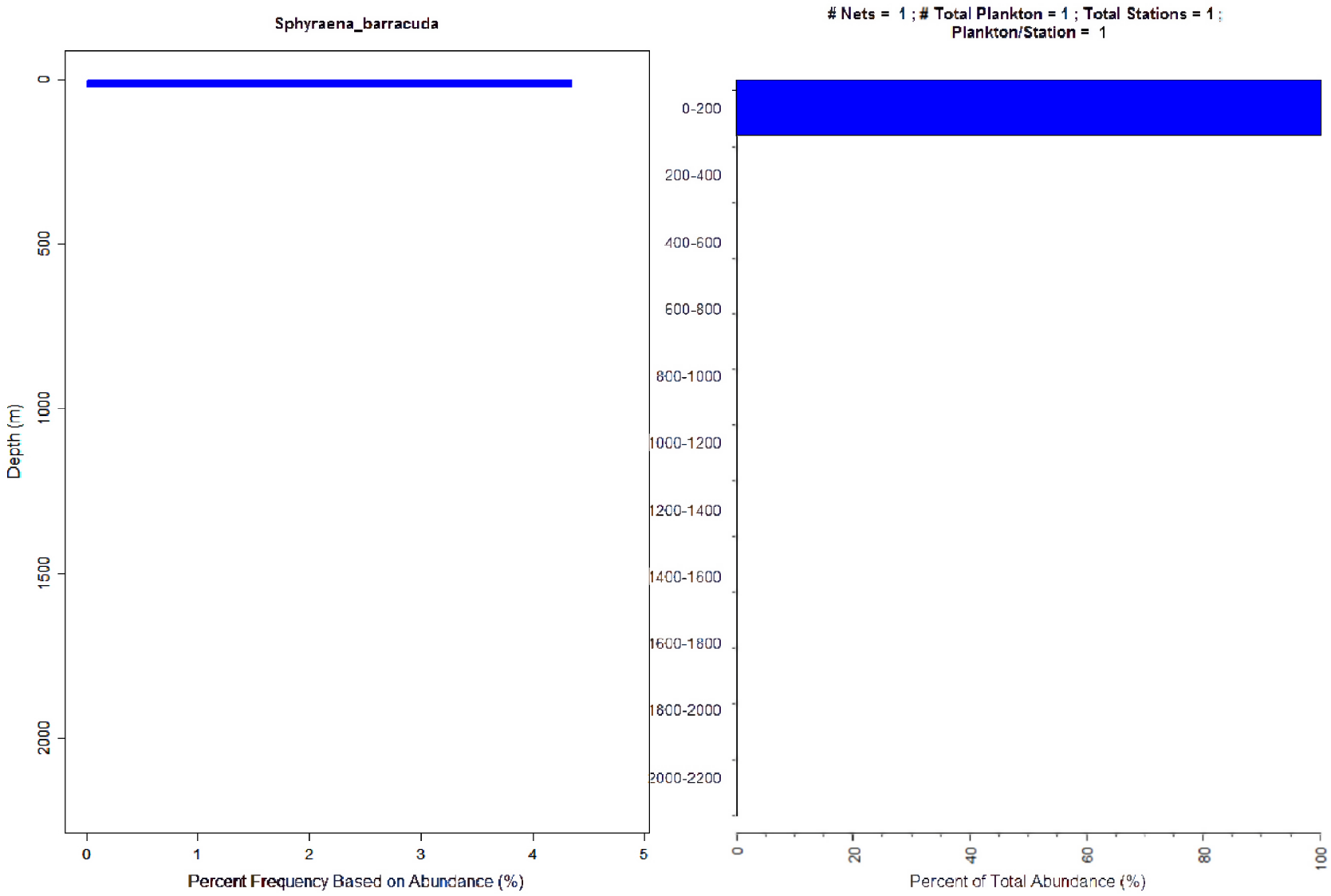
Sphoeroides - Deep



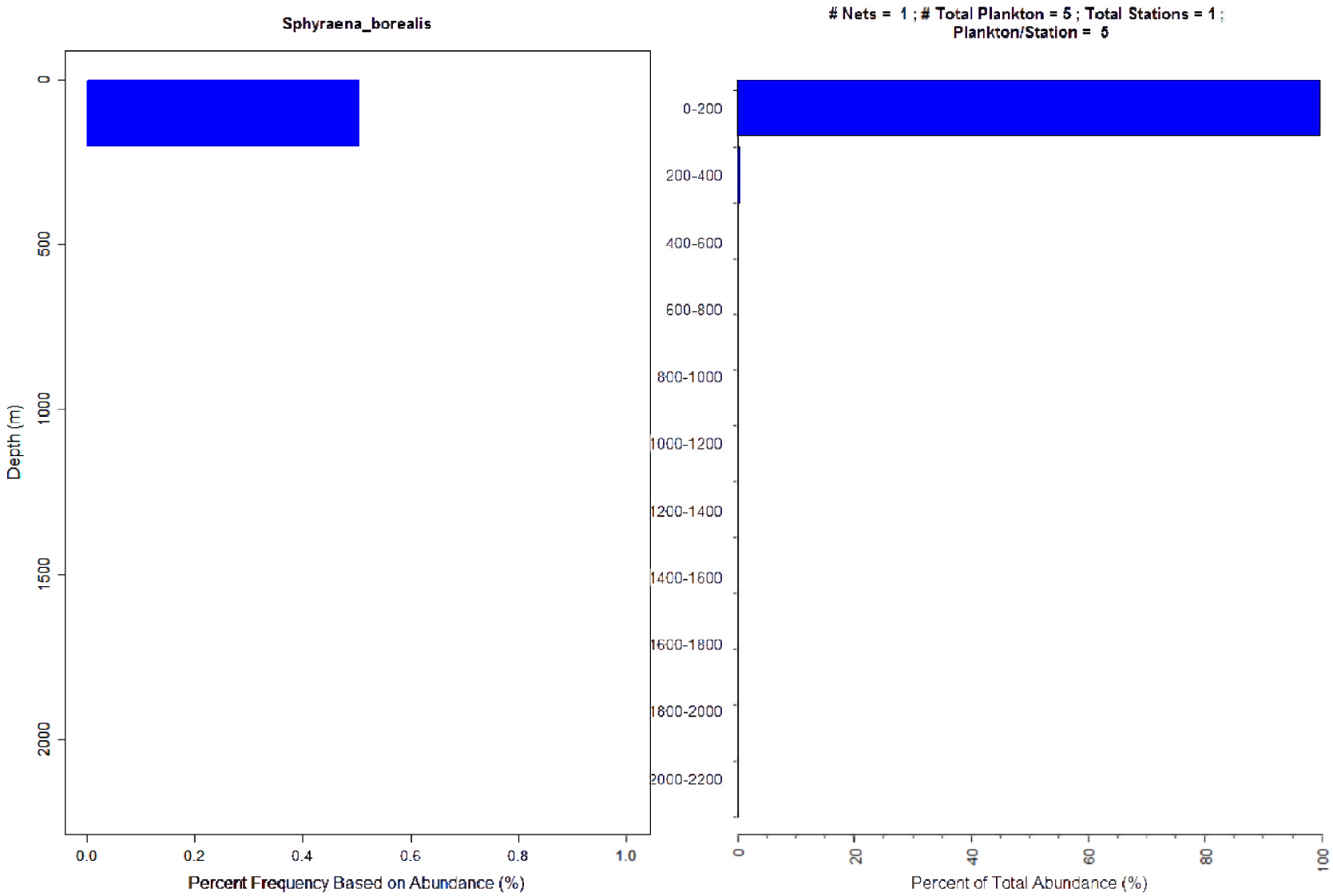
Sphoeroides_maculatus - Deep



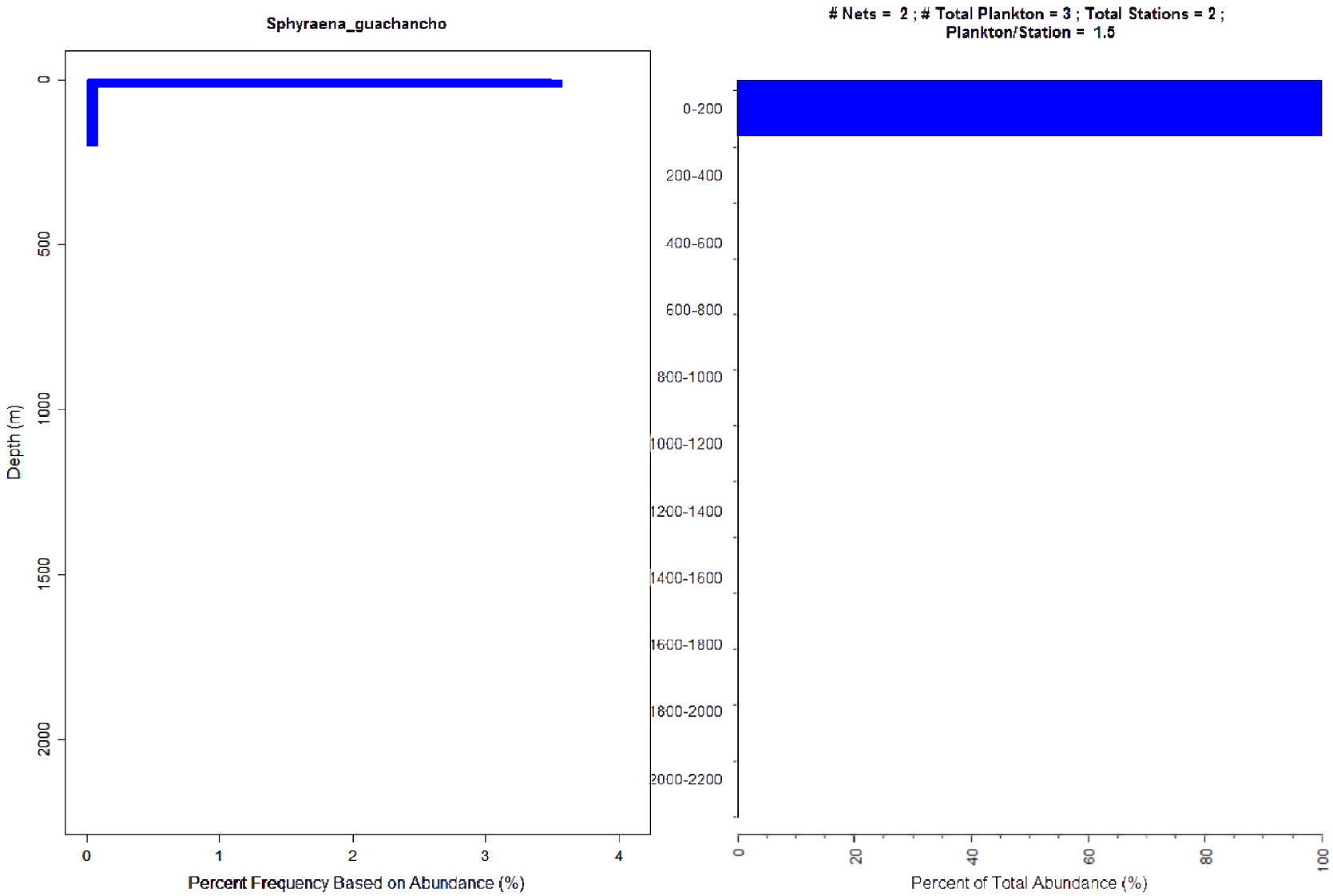
Sphoeroides_pachygaster - Deep



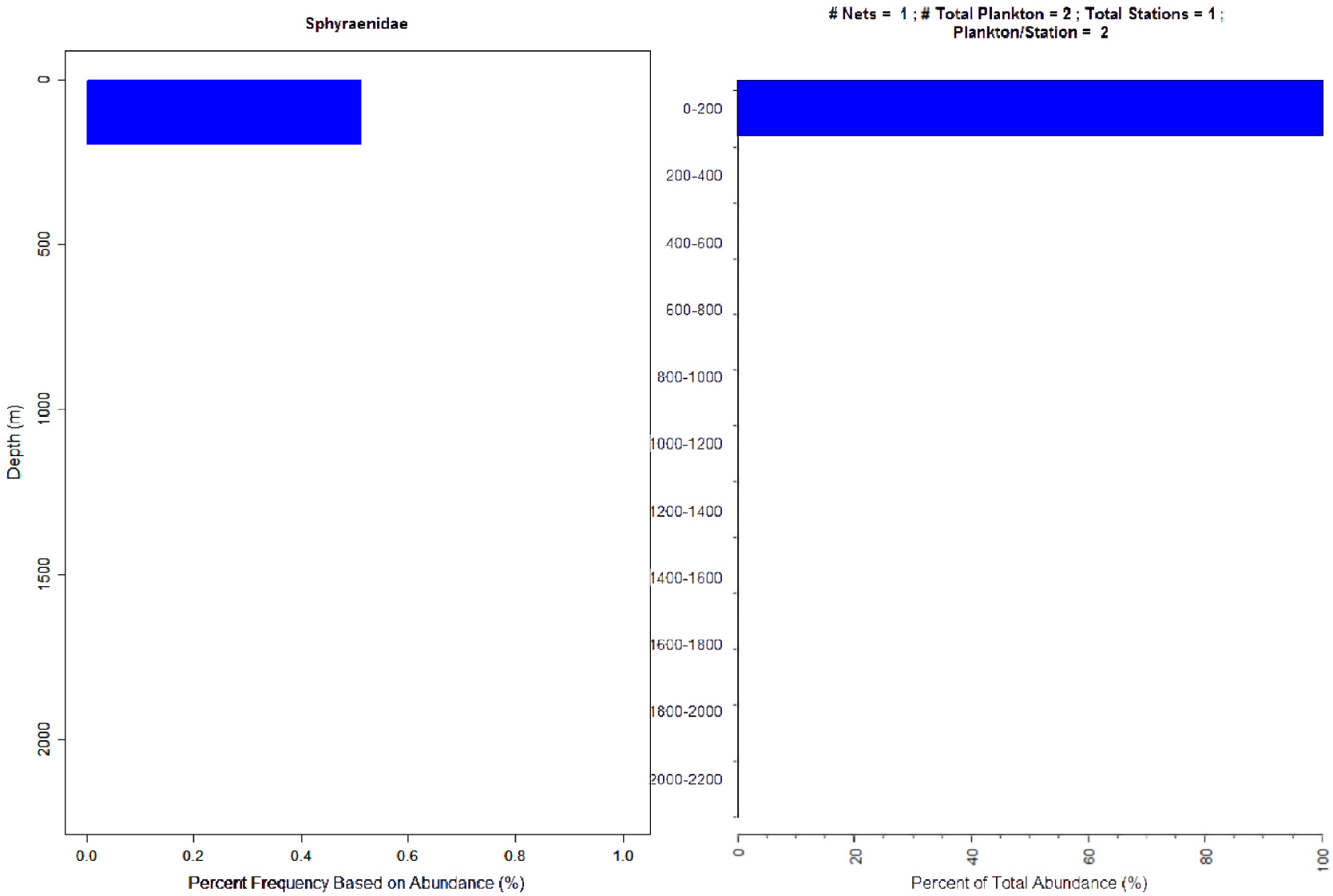
Sphyraena_barracuda - Deep



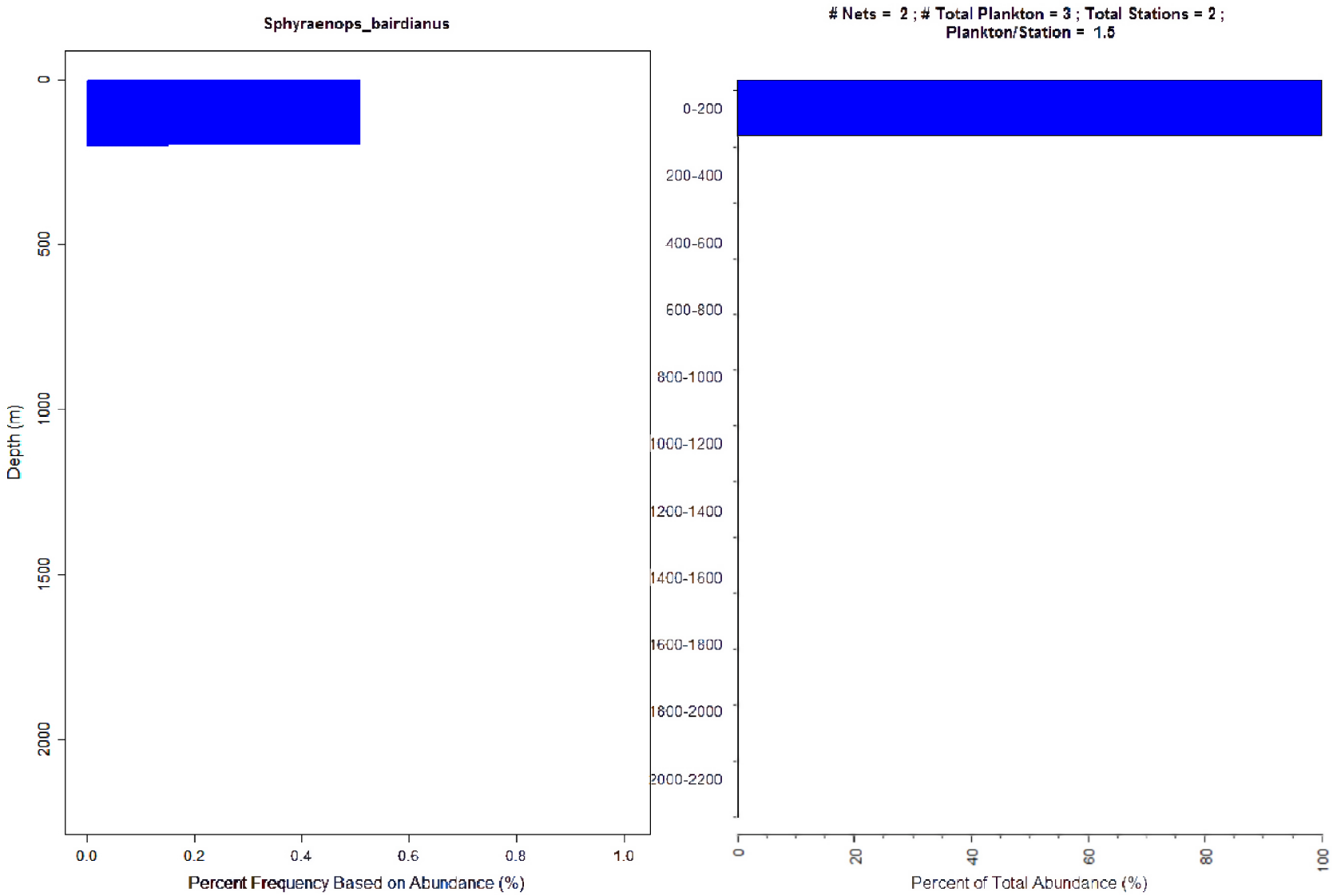
Sphyraena_borealis - Deep



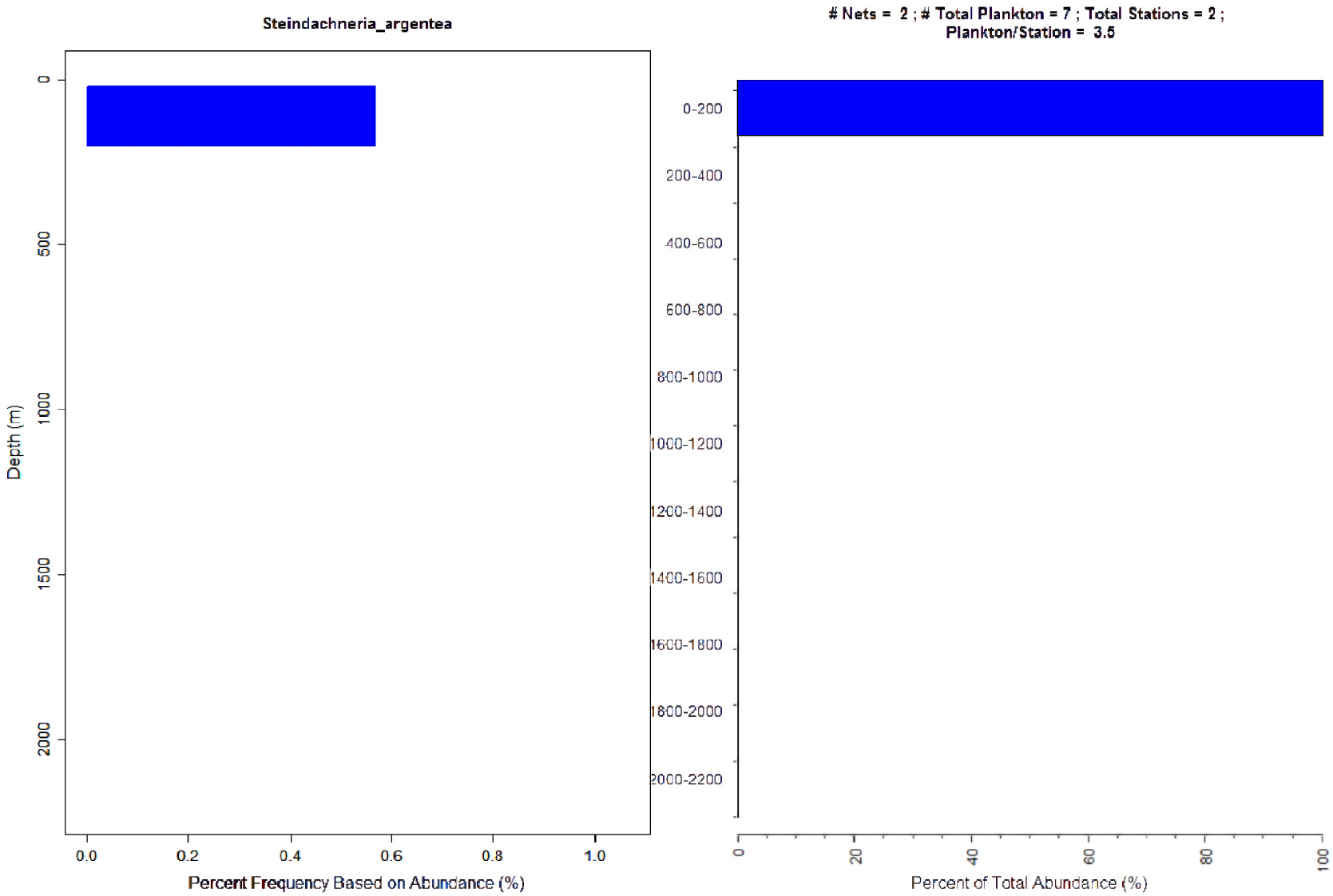
Sphyraena_guachancho - Deep



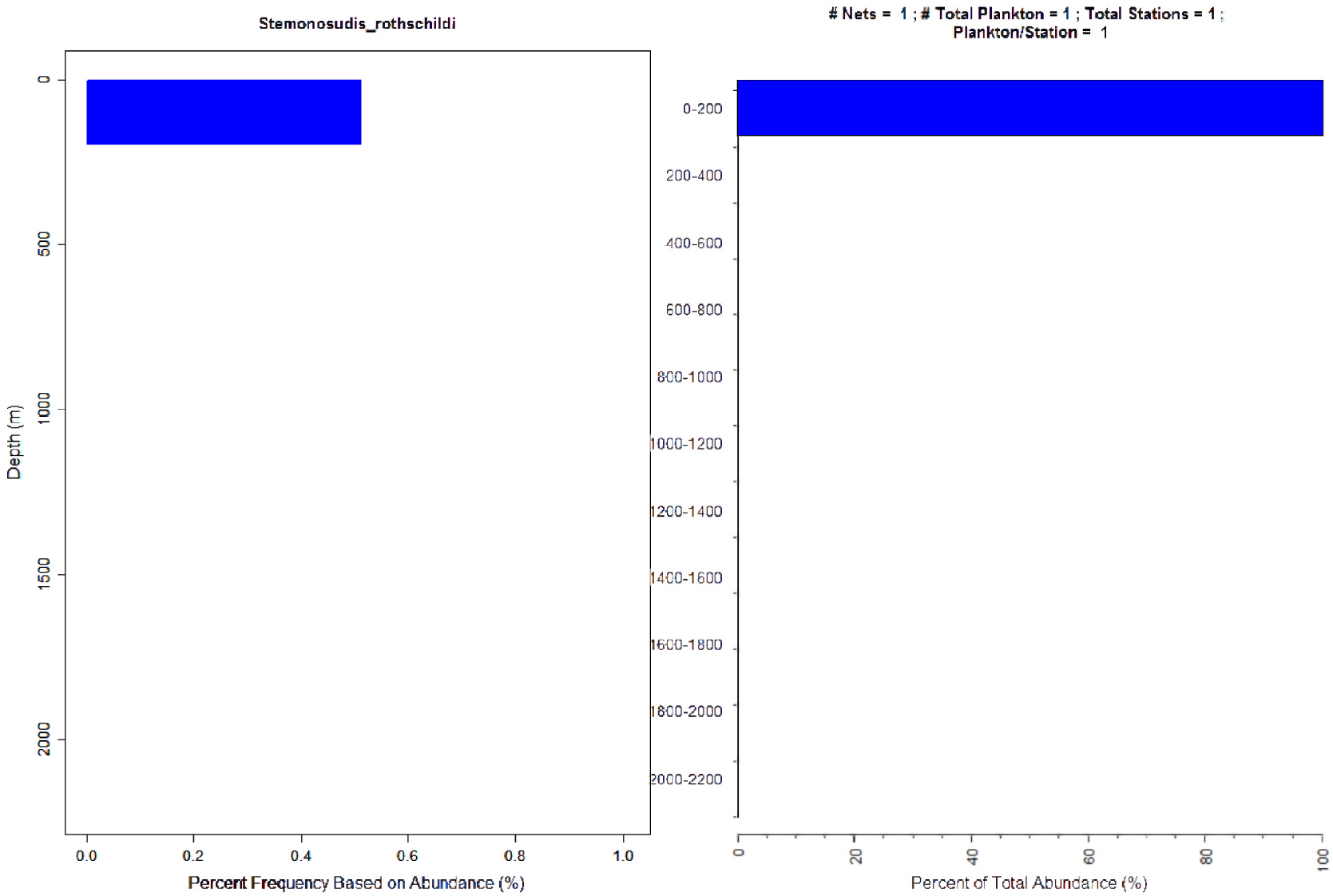
Sphyraenidae - Deep



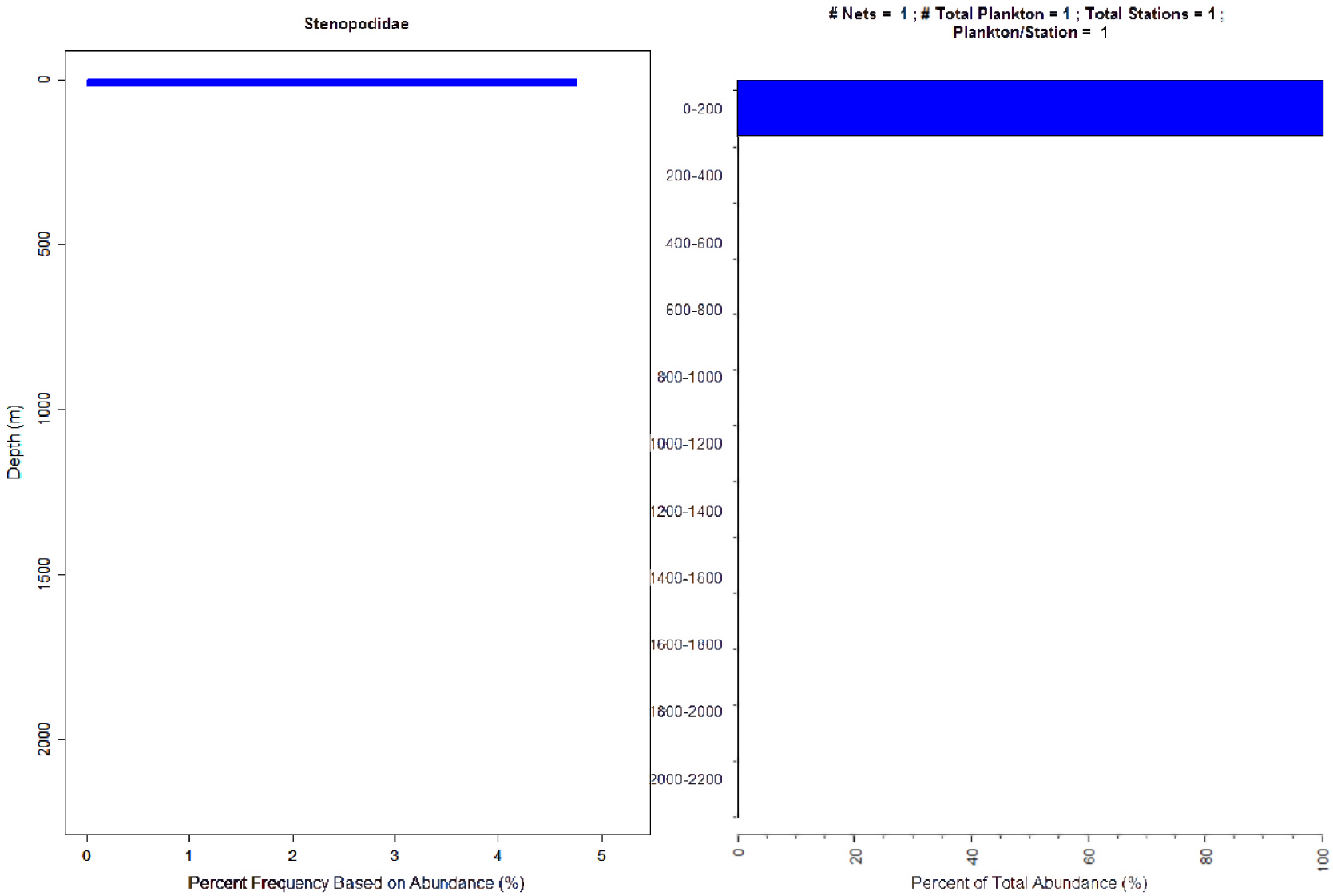
Sphyraenops_bairdianus - Deep



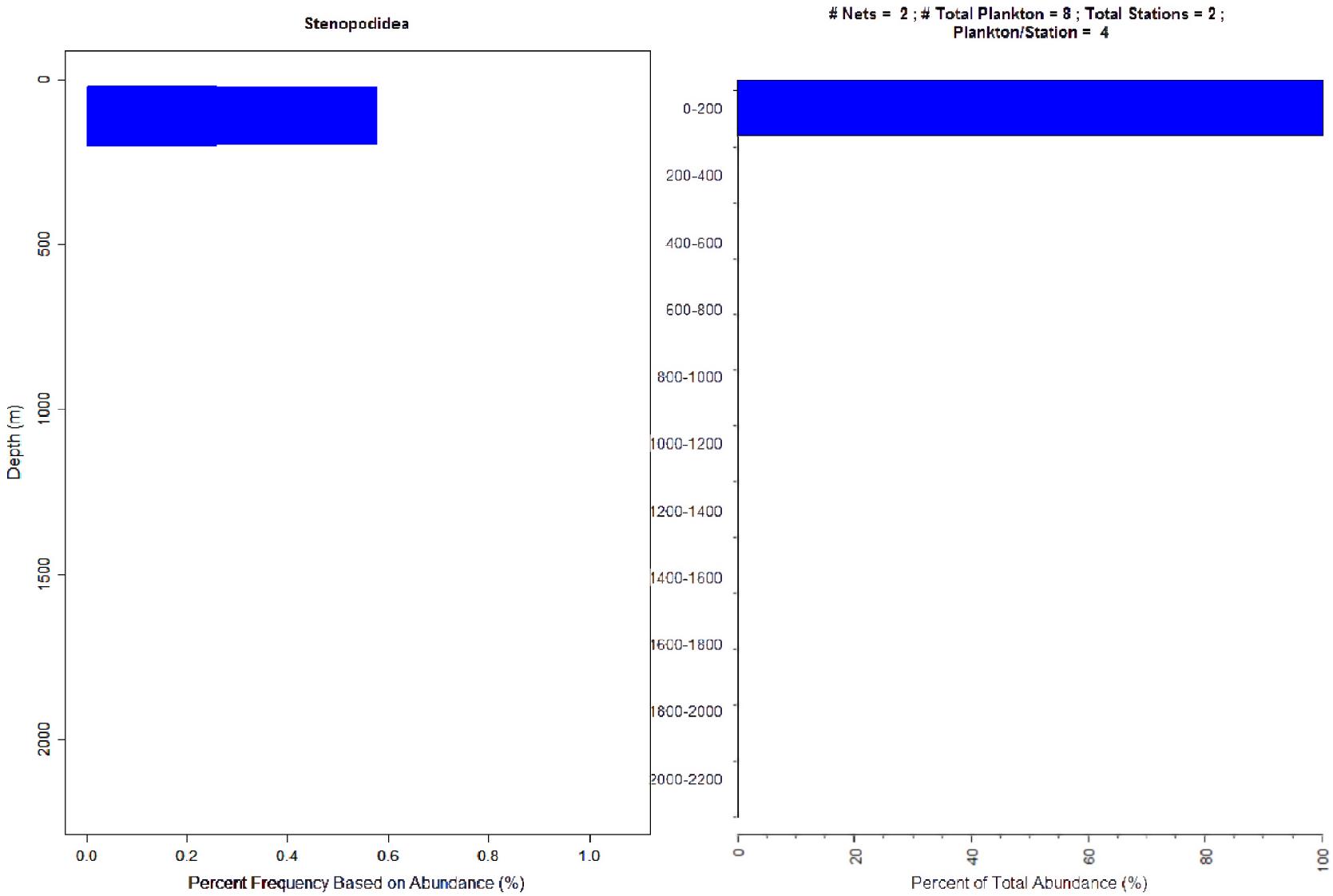
Steindachneria_argentea - Deep



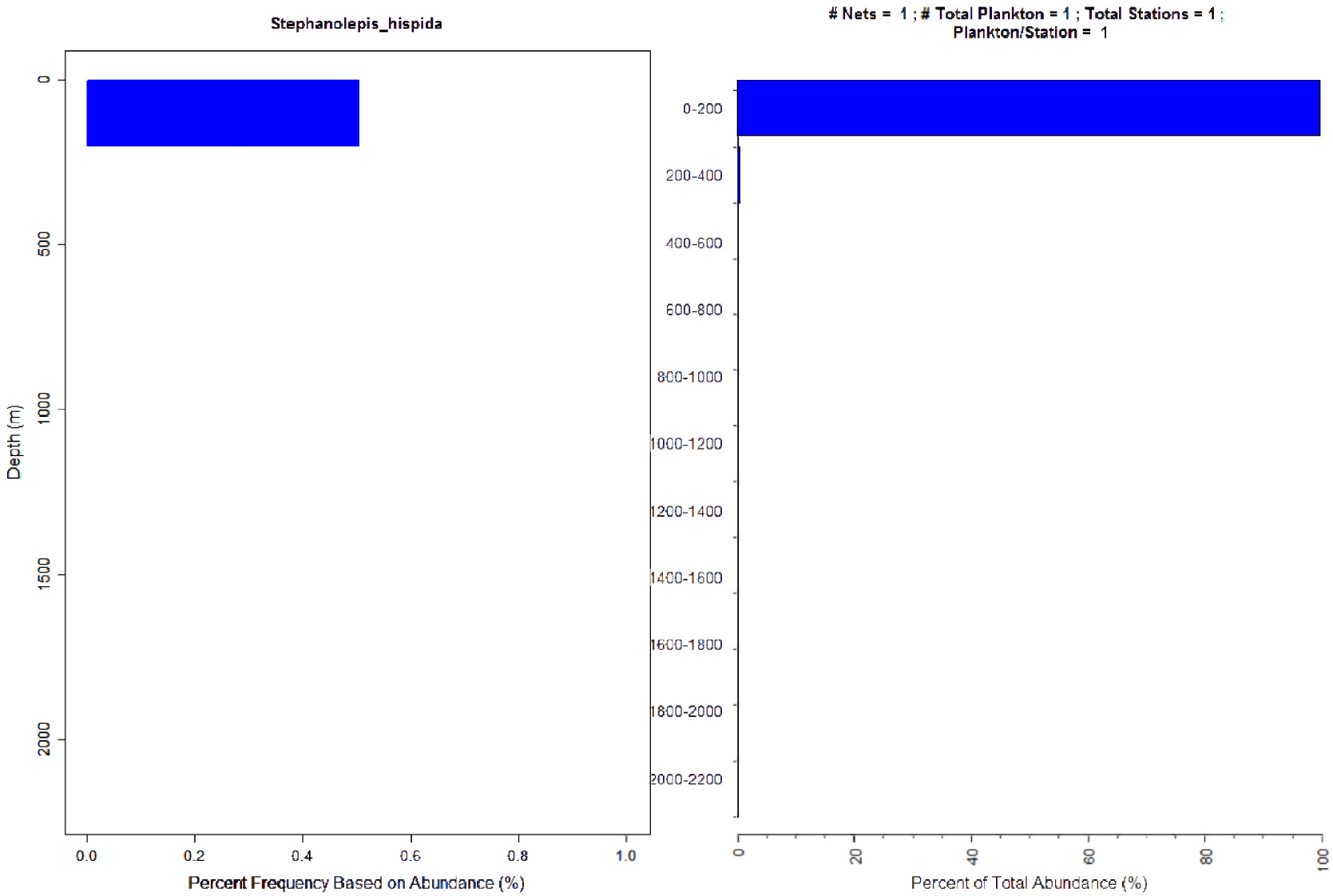
Stemonosudis_rothschildi - Deep



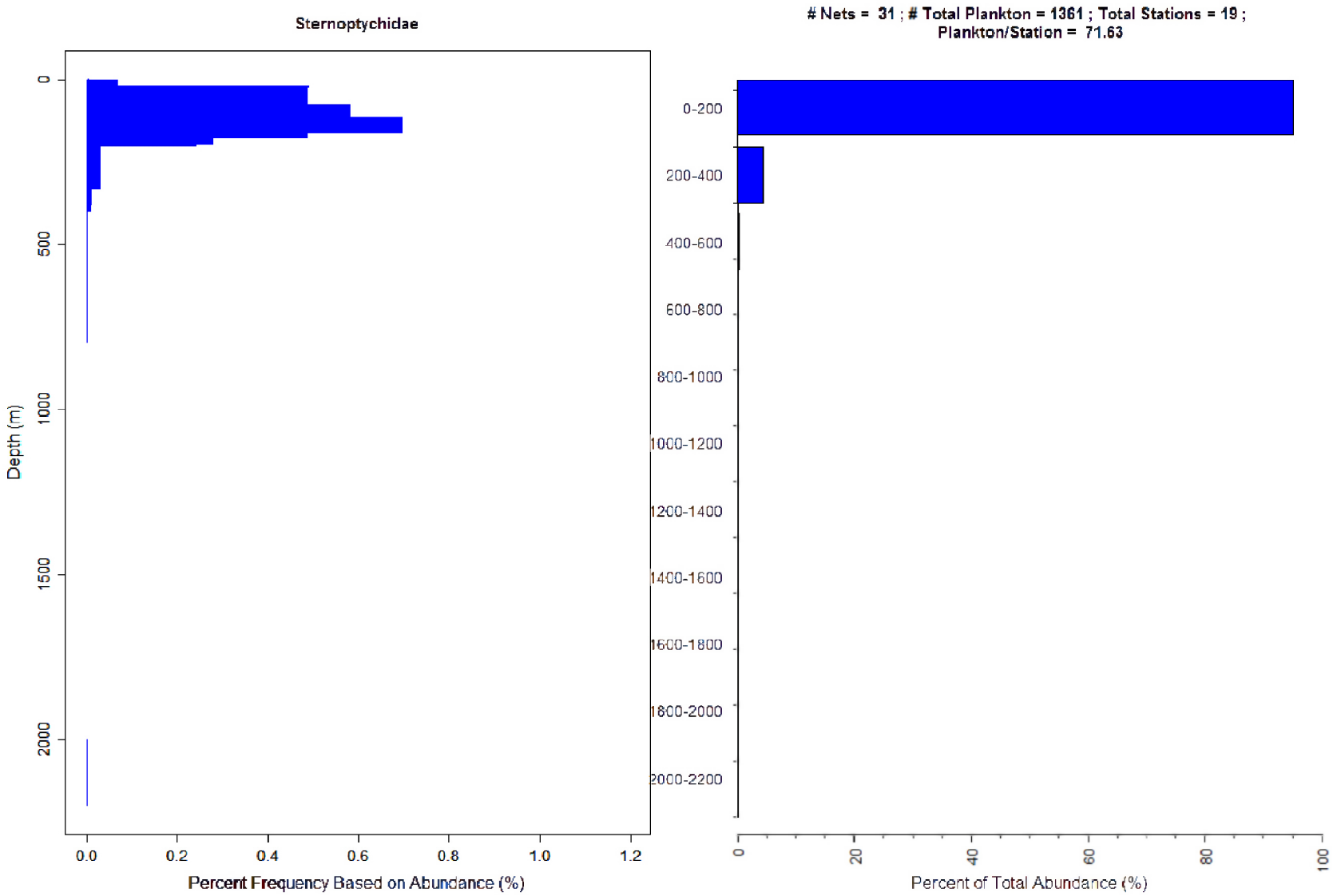
Stenopodidae - Deep



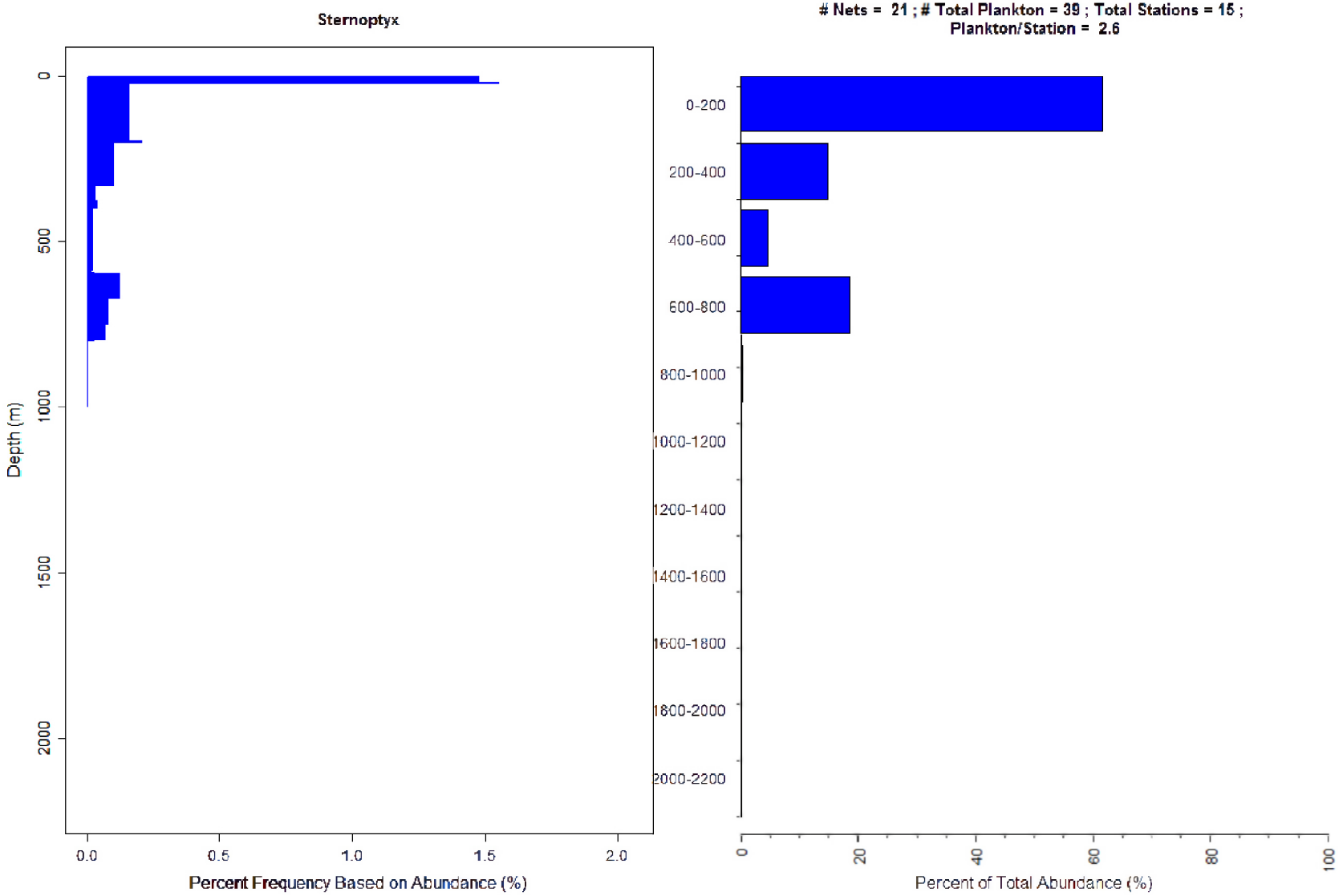
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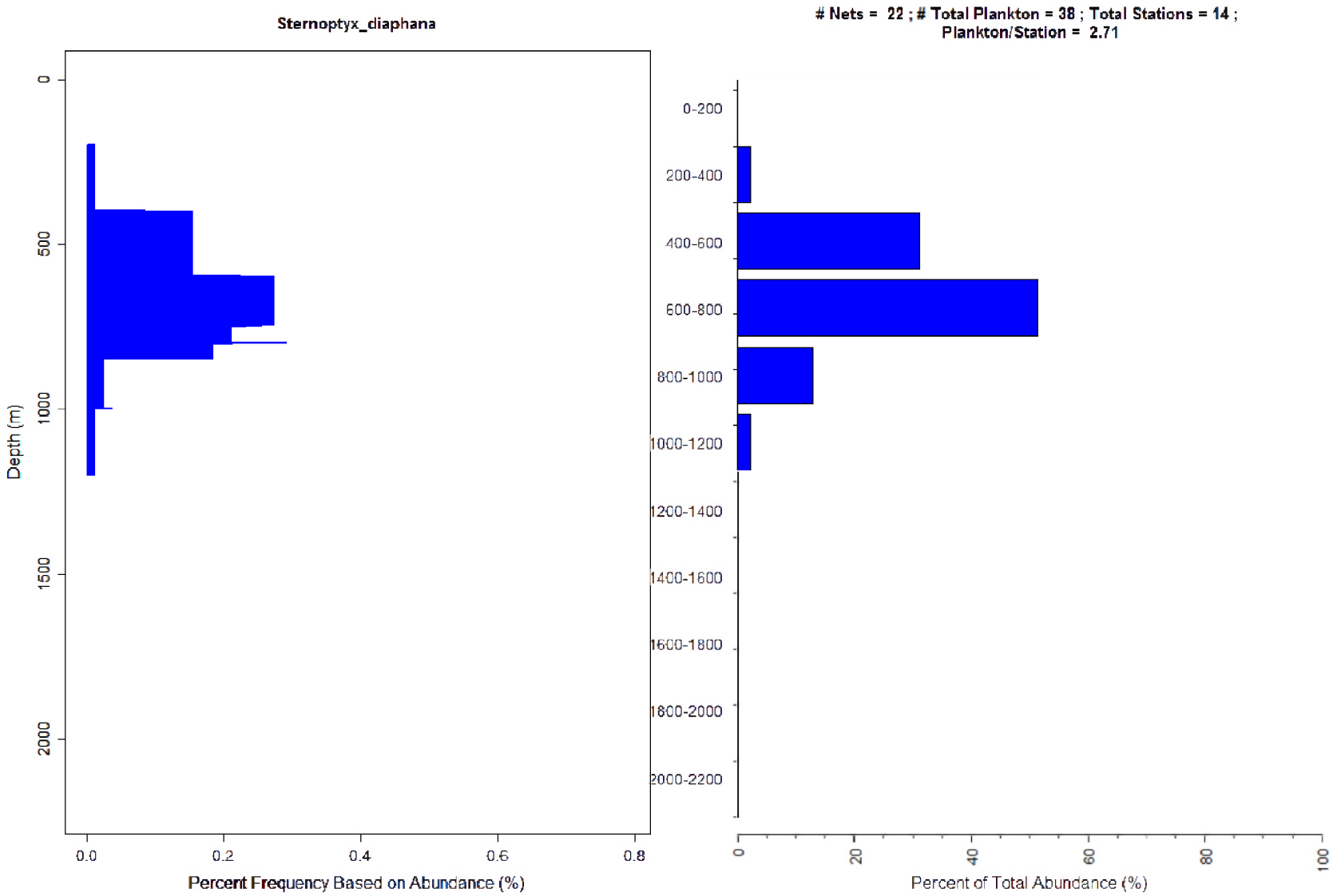
Stephanolepis_hispida - Deep



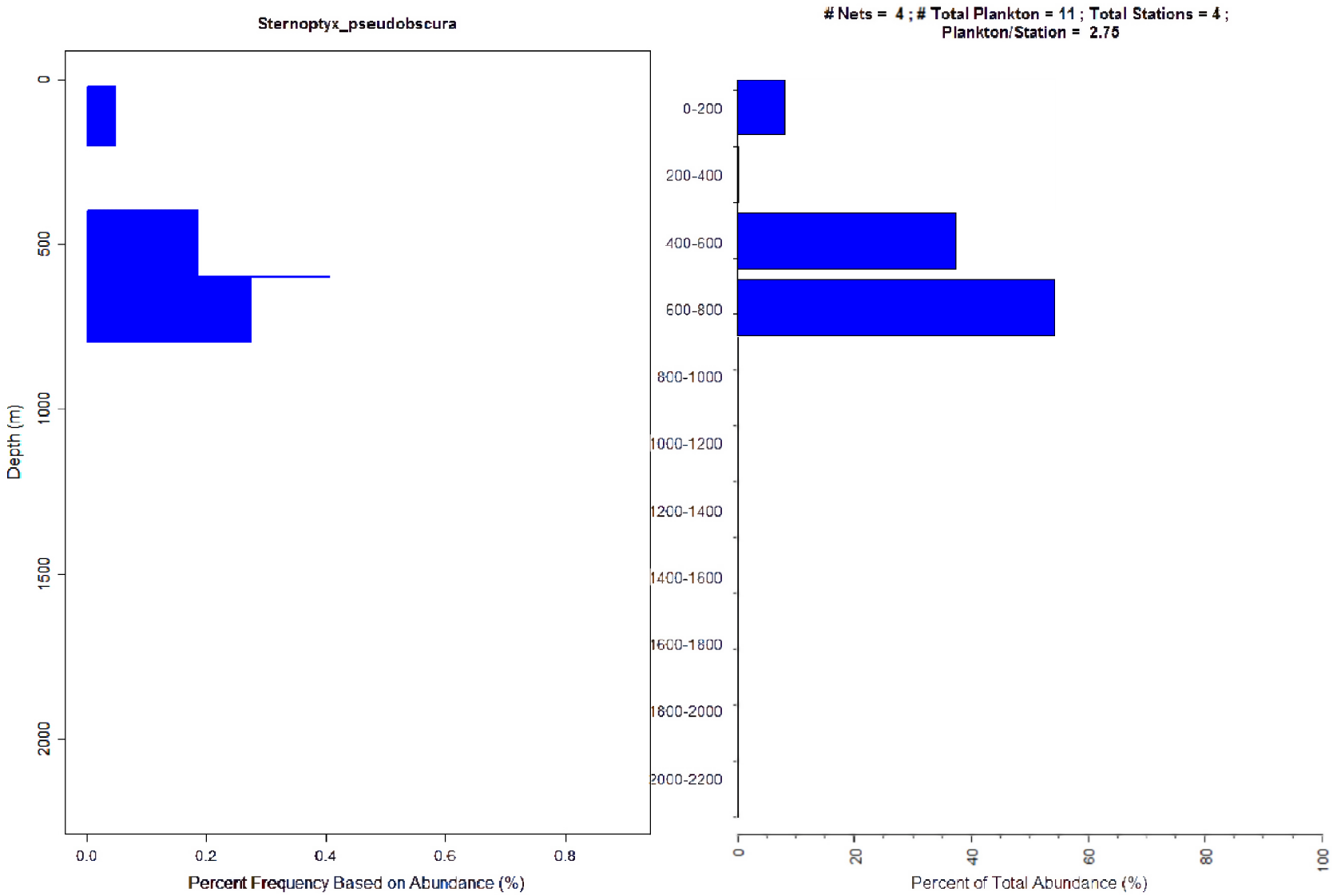
Sternoptychidae - Deep



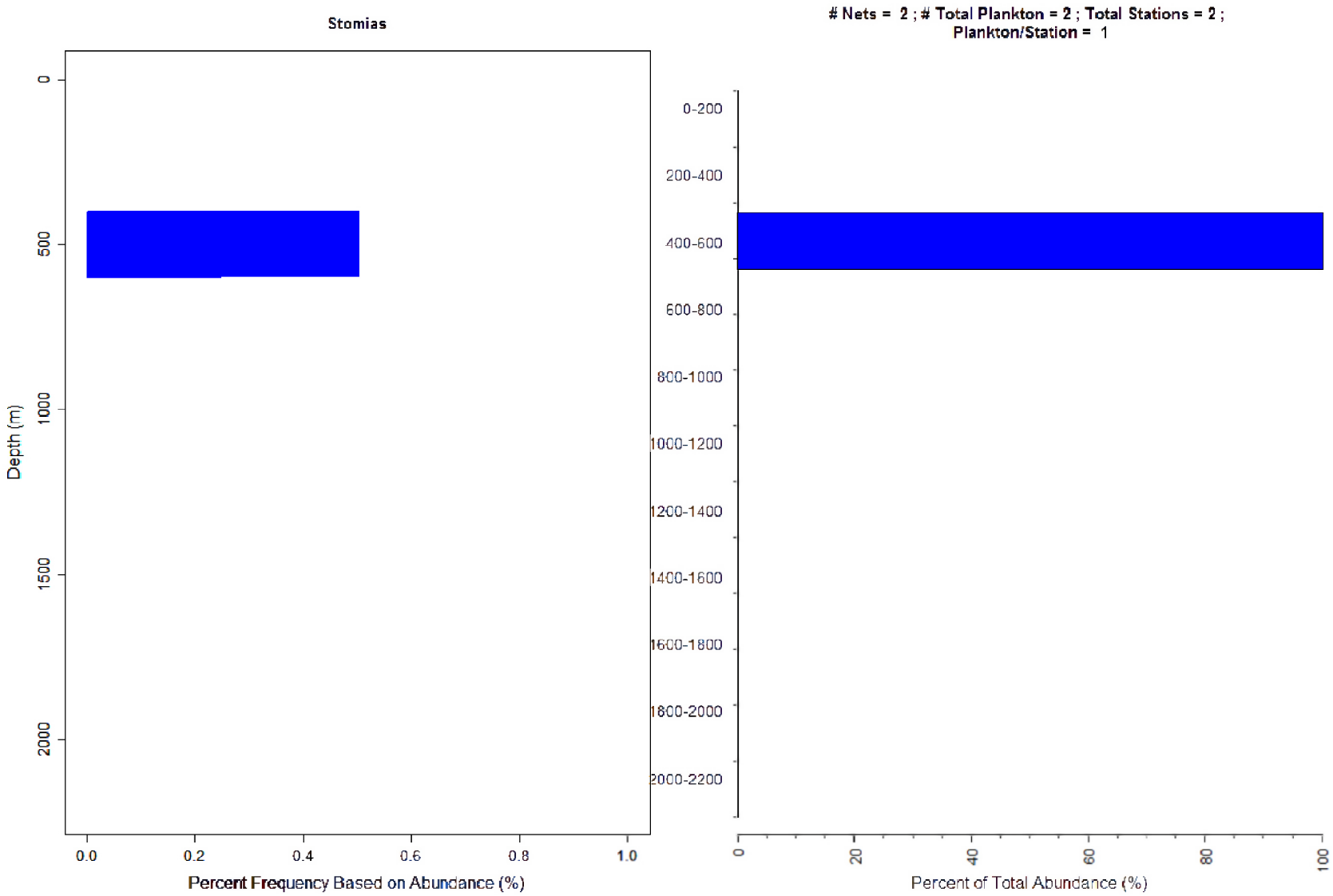
Sternoptyx - Deep



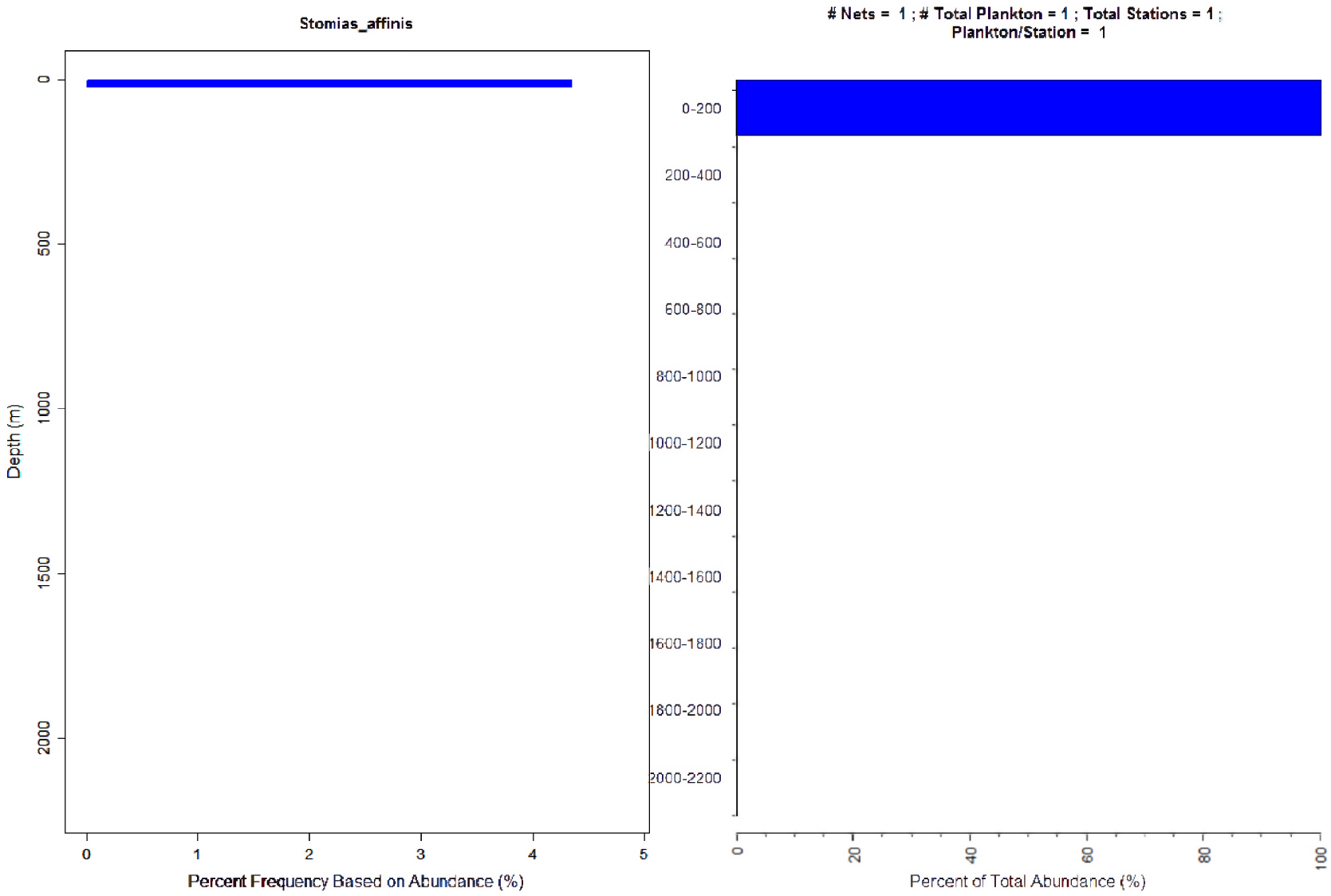
Sternoptyx_diaphana - Deep



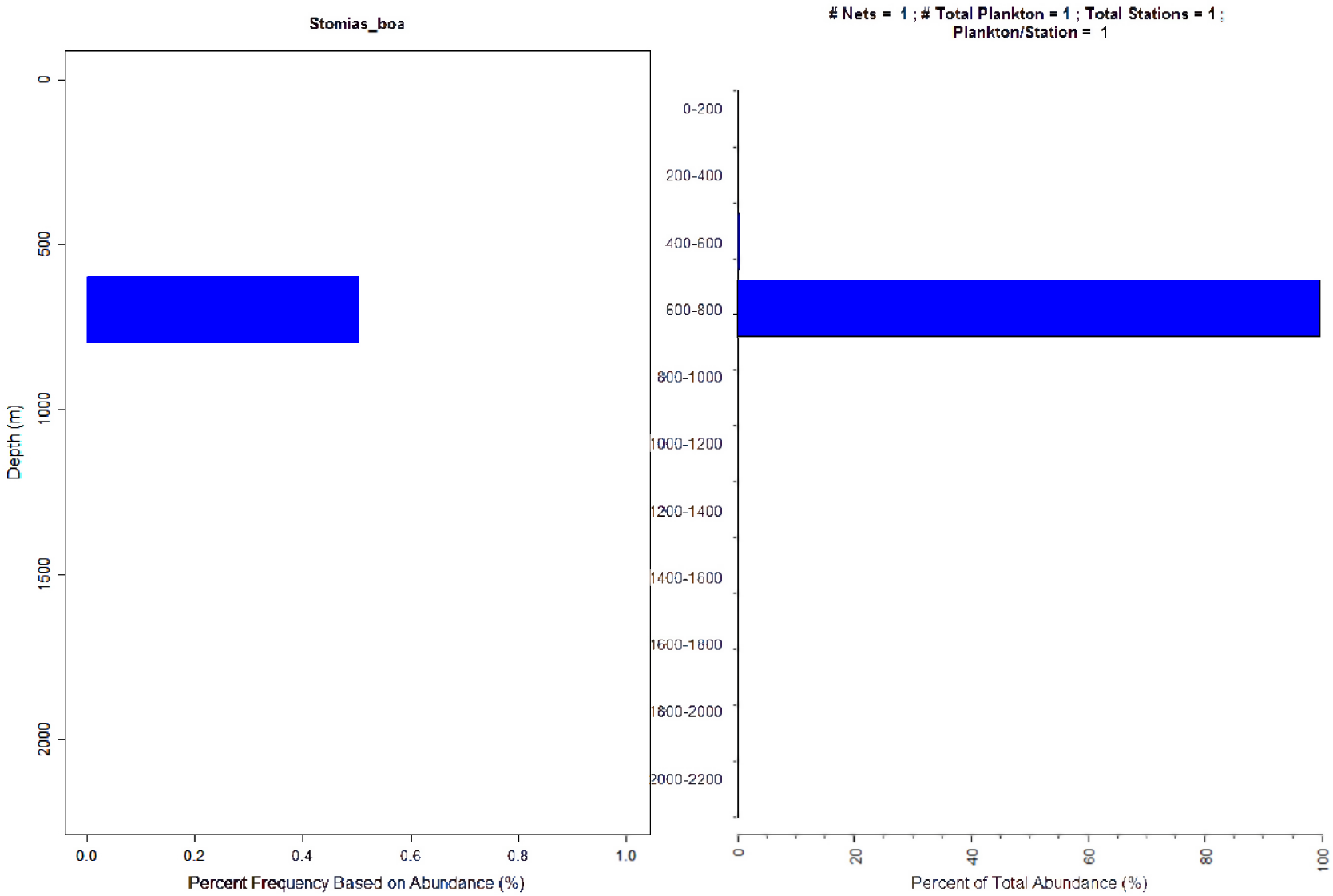
Sternoptyx_pseudobscura - Deep



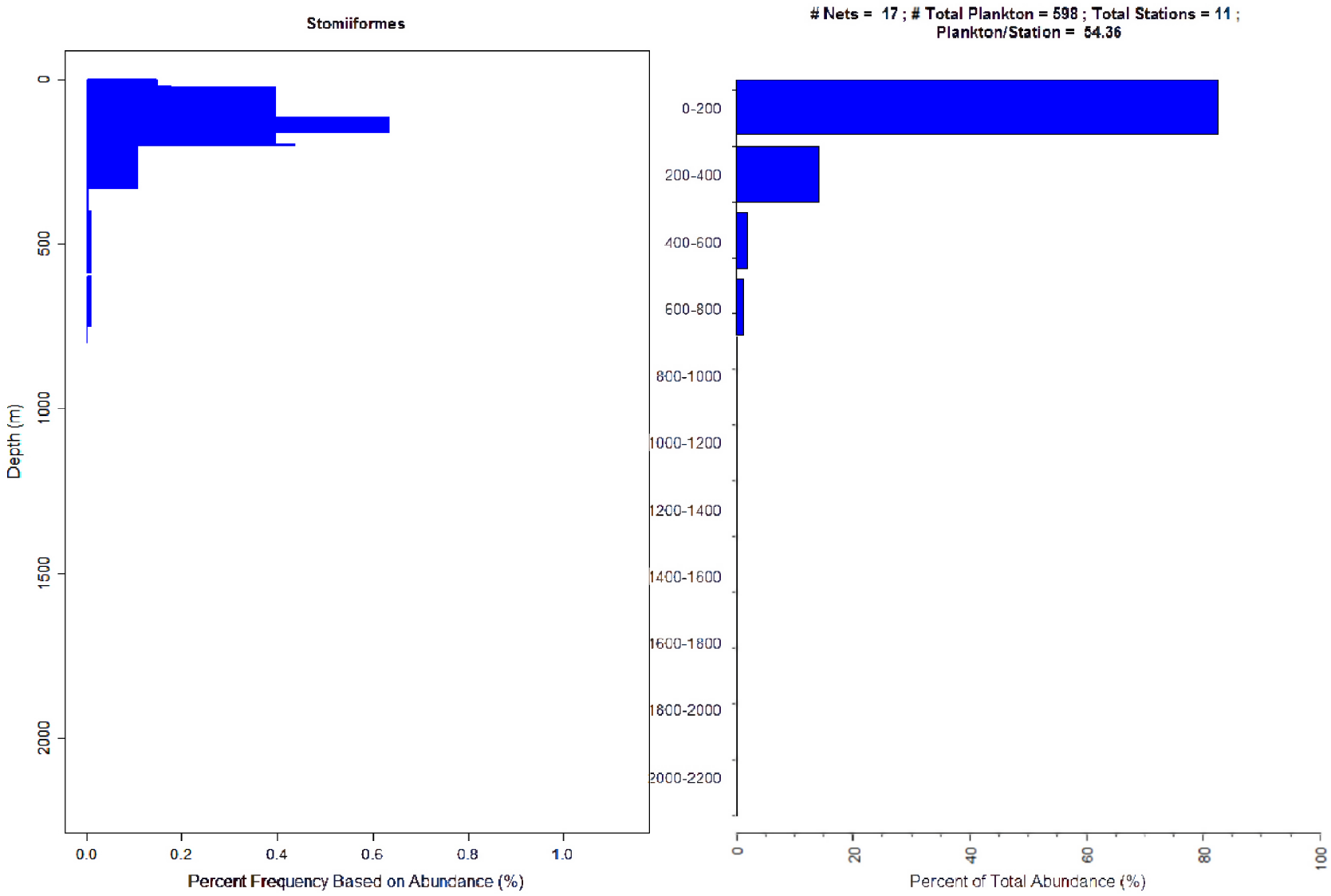
Stomias - Deep



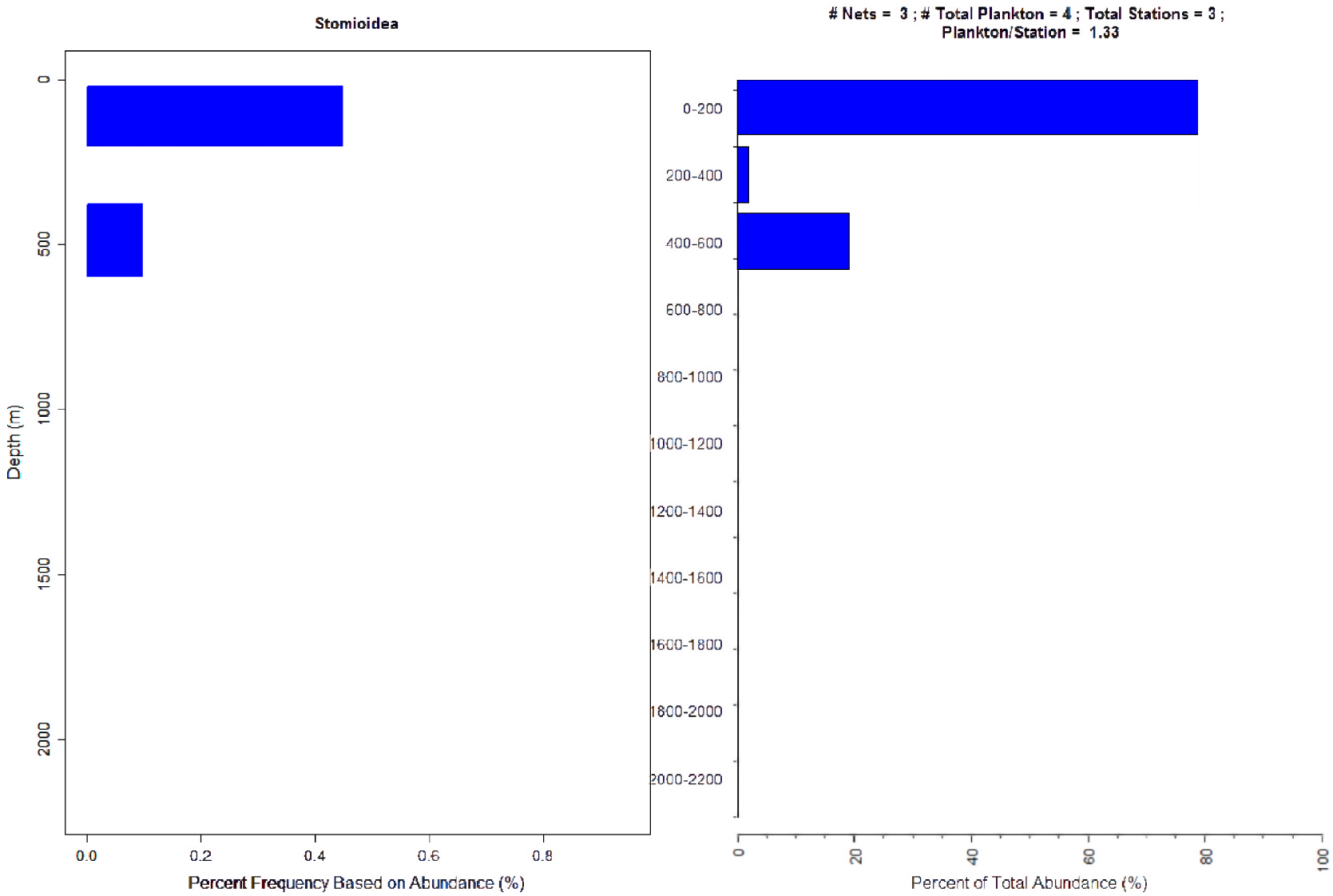
Stomias_affinis - Deep



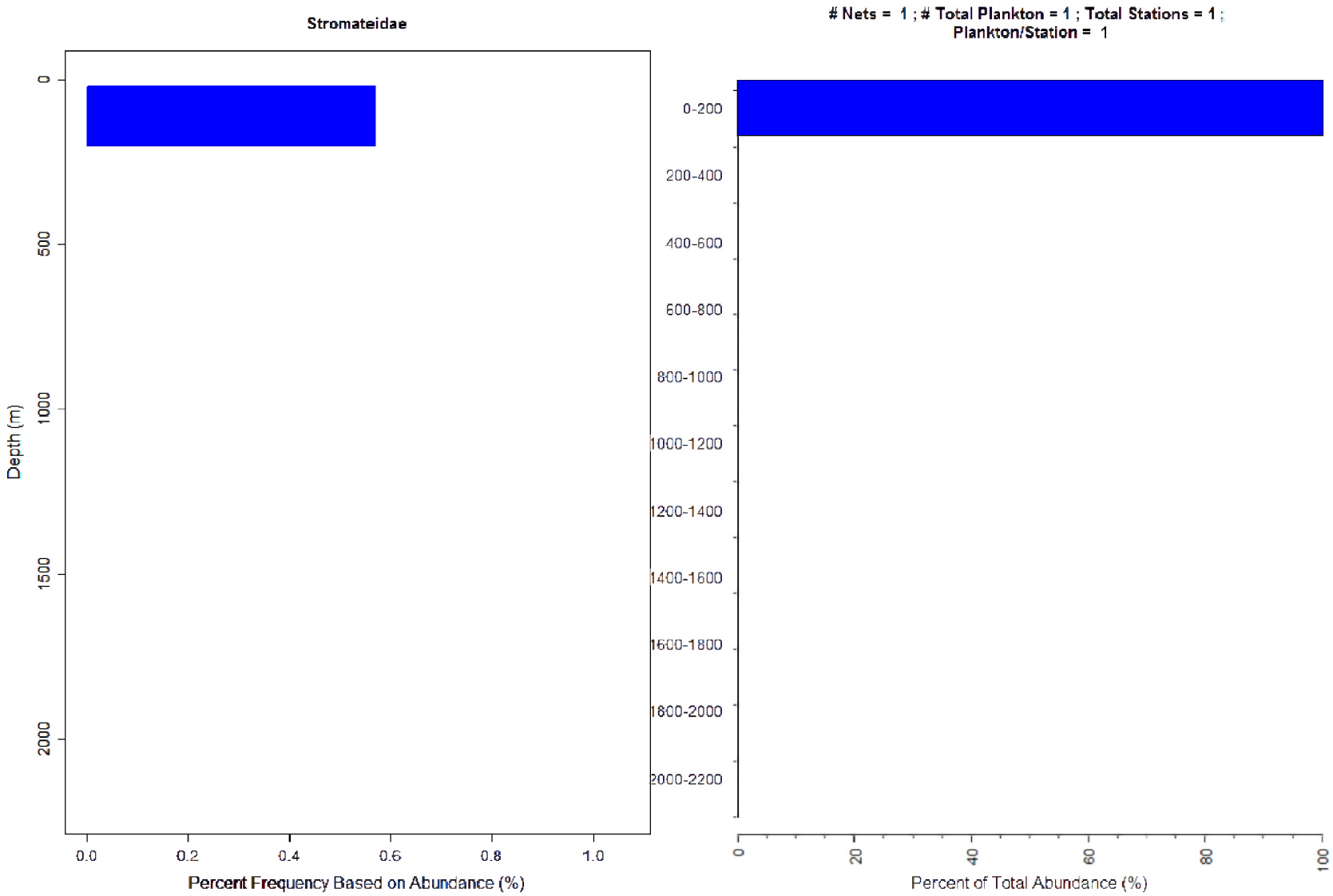
Stomias_boa - Deep



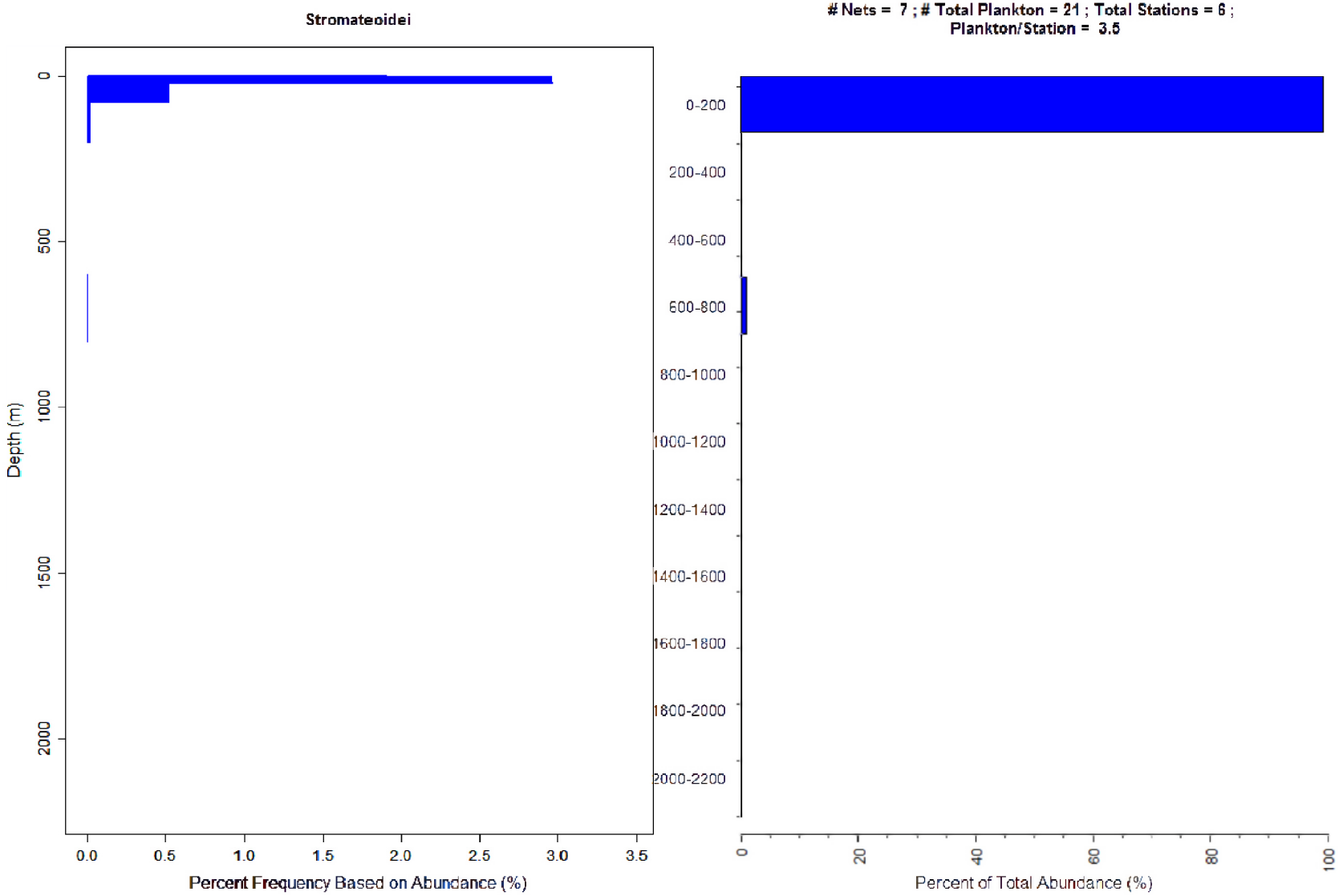
Stomiiformes - Deep



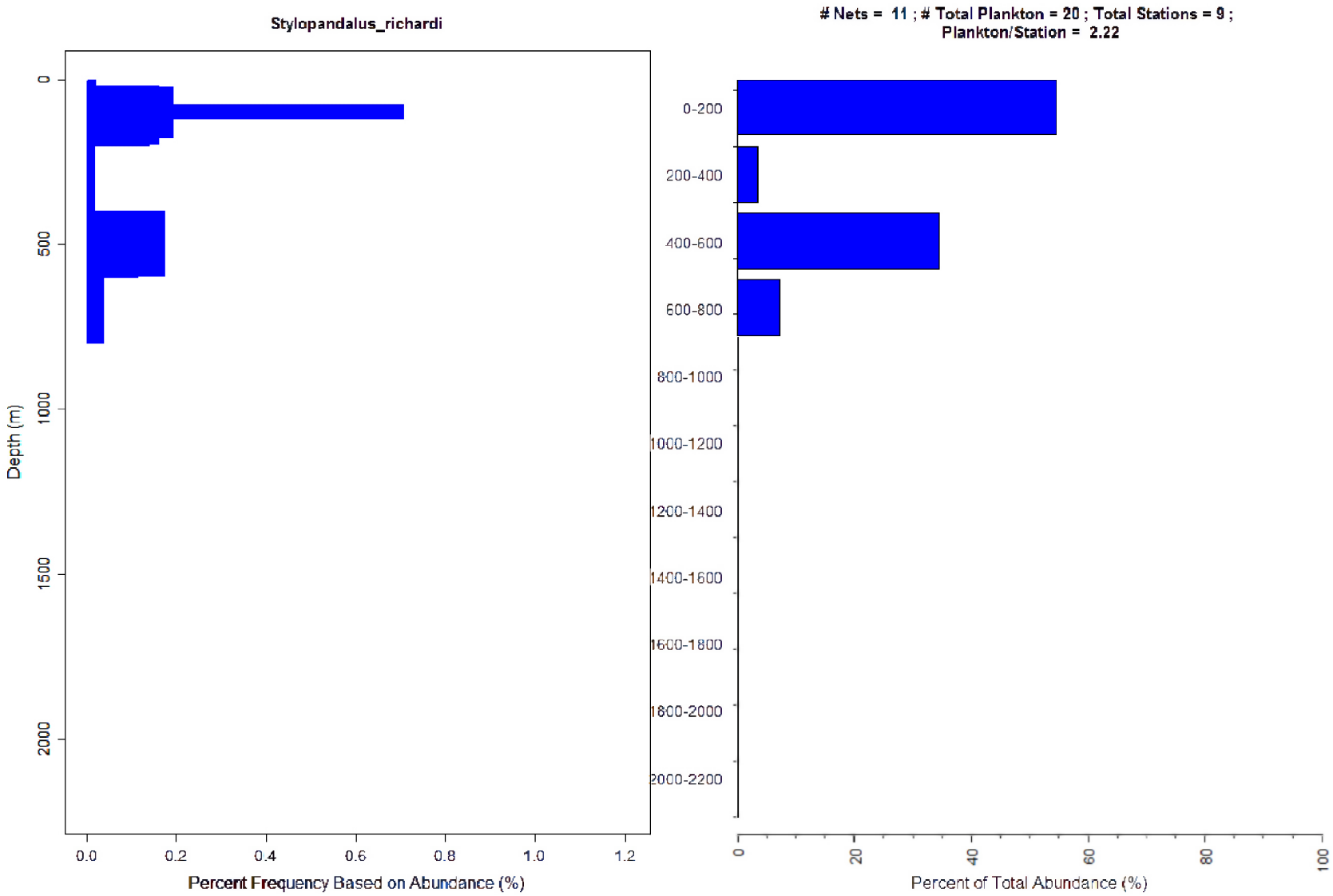
Stomioidea - Deep



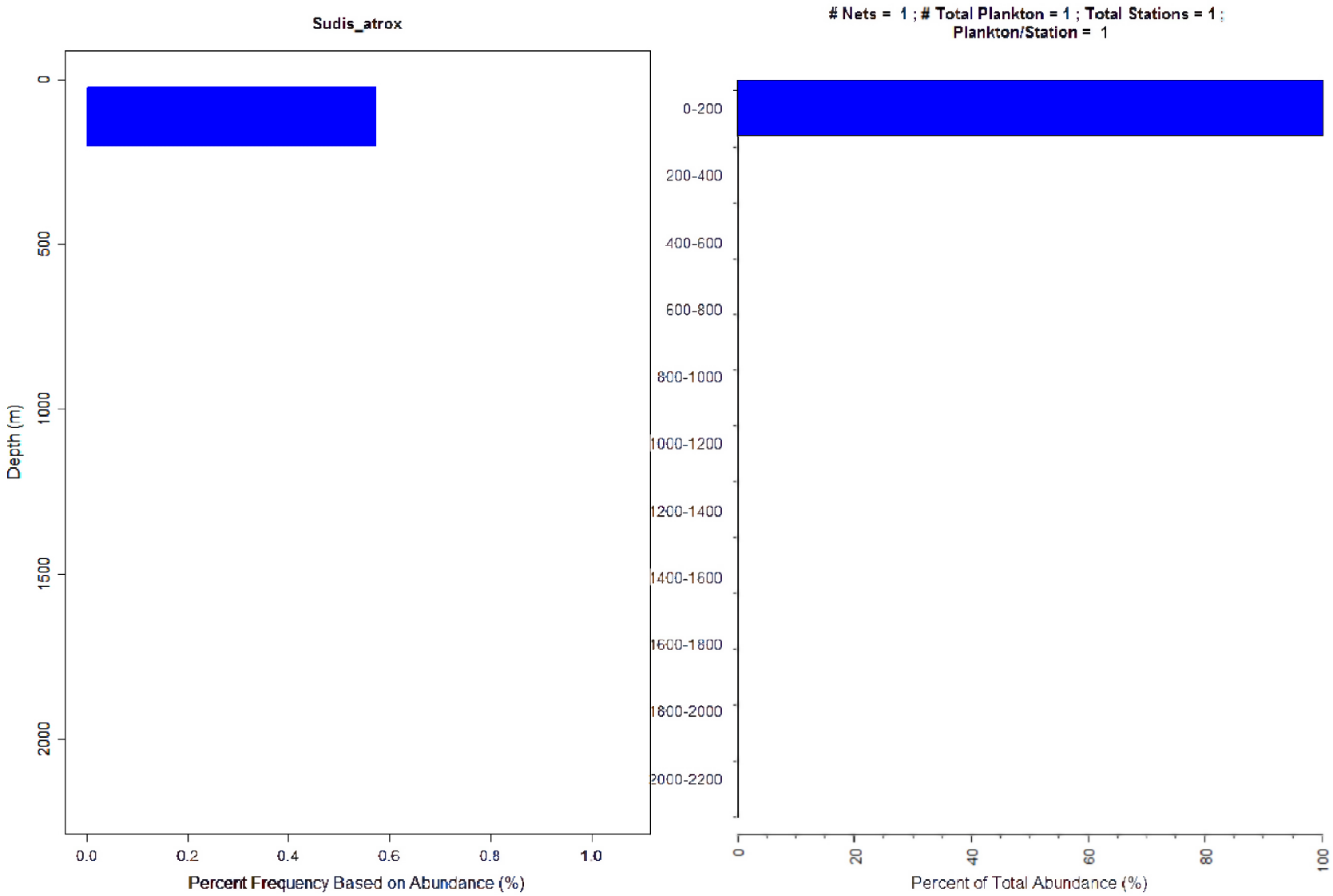
Stromateidae - Deep



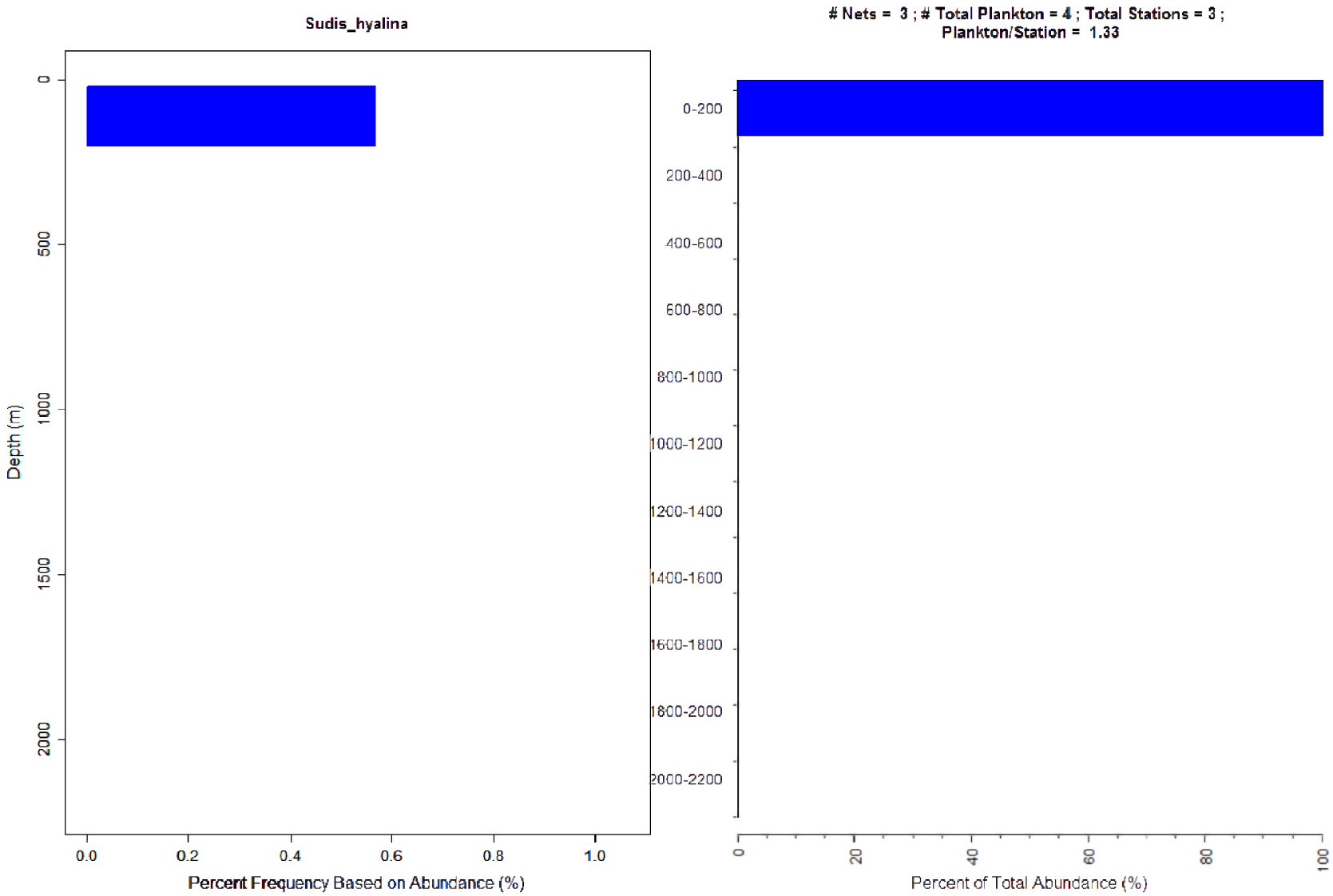
Stromateoidei - Deep



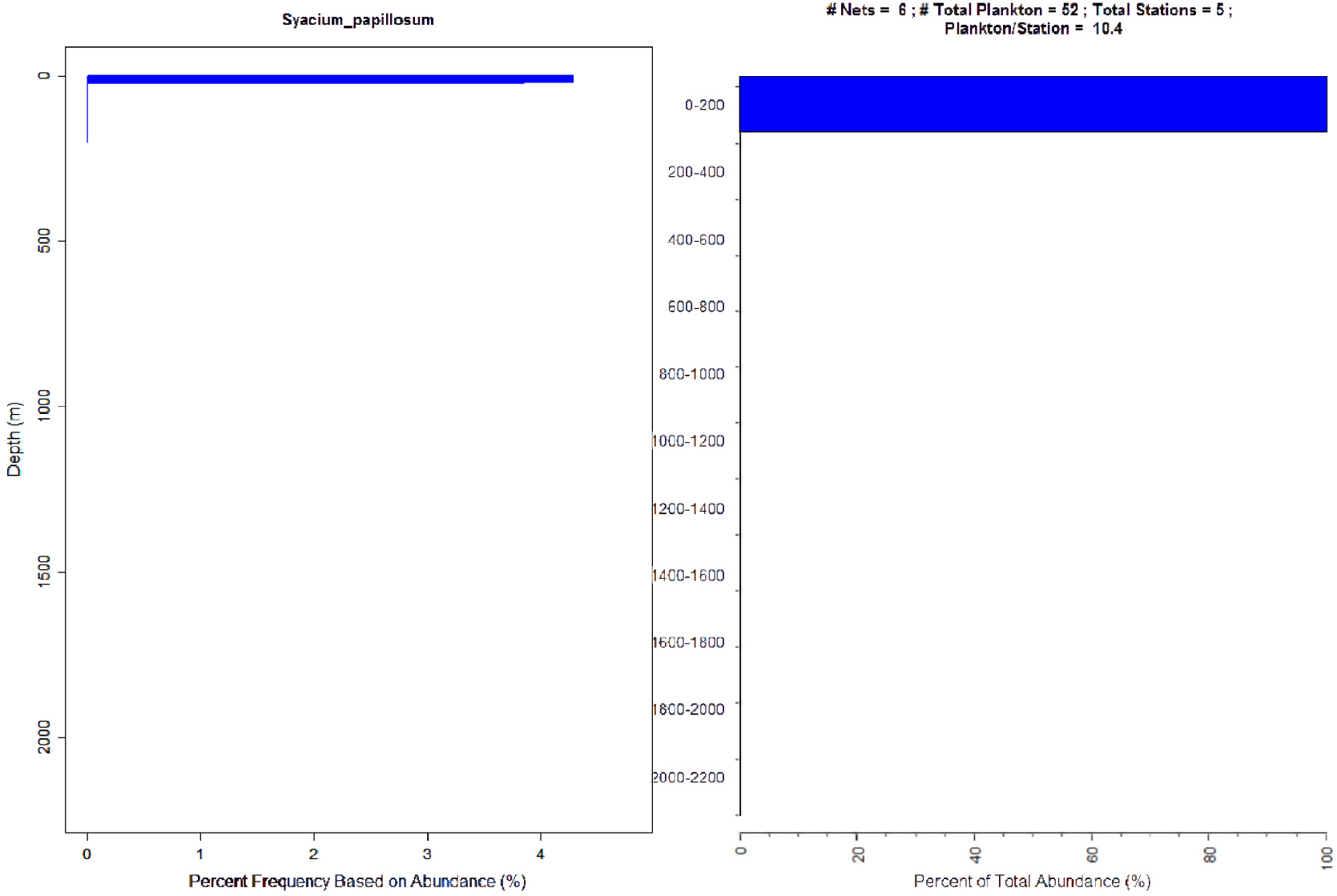
Stylopandalus_richardi - Deep



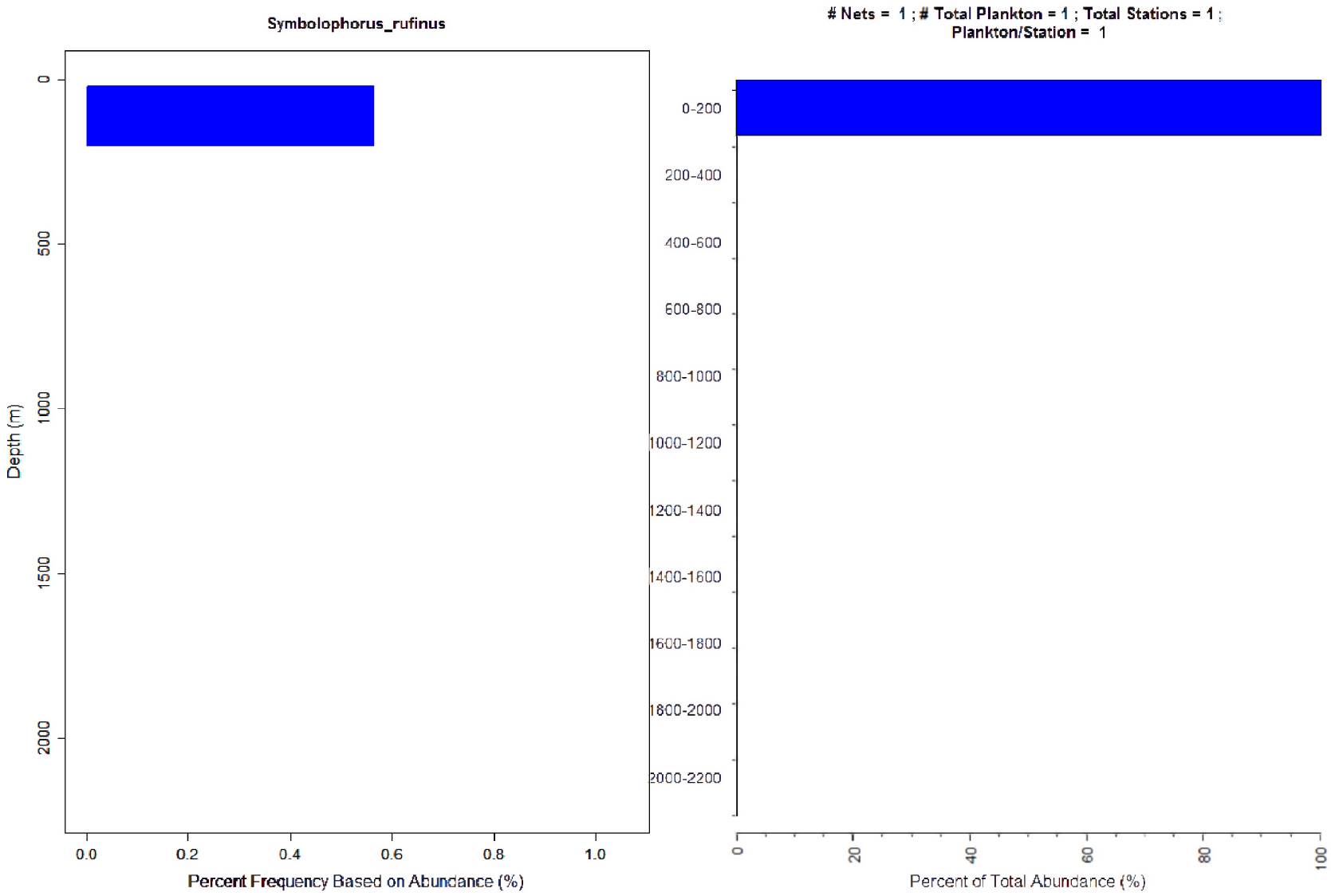
Sudis_atrox - Deep



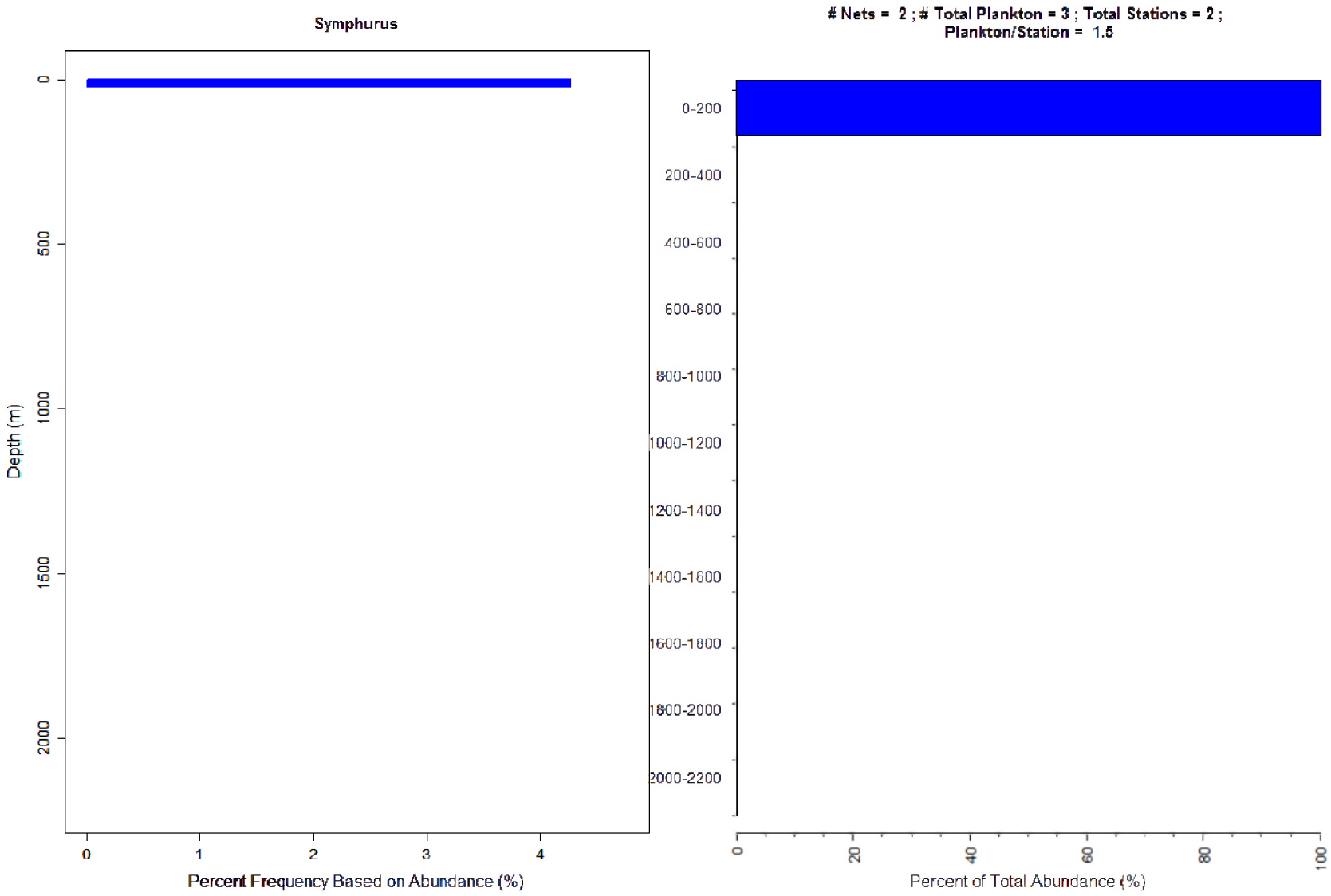
Sudis_hyalina - Deep



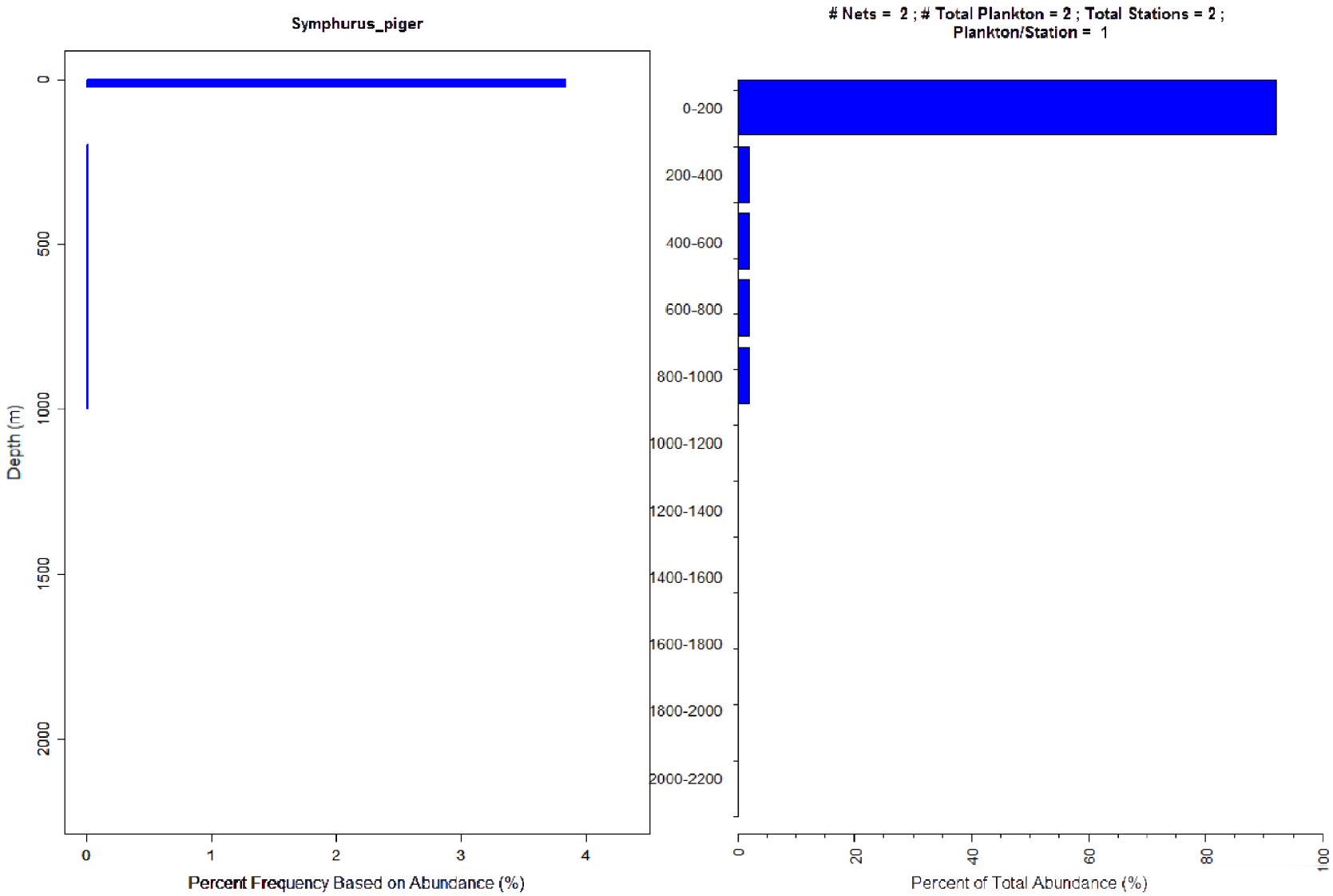
Syacium_papillosum - Deep



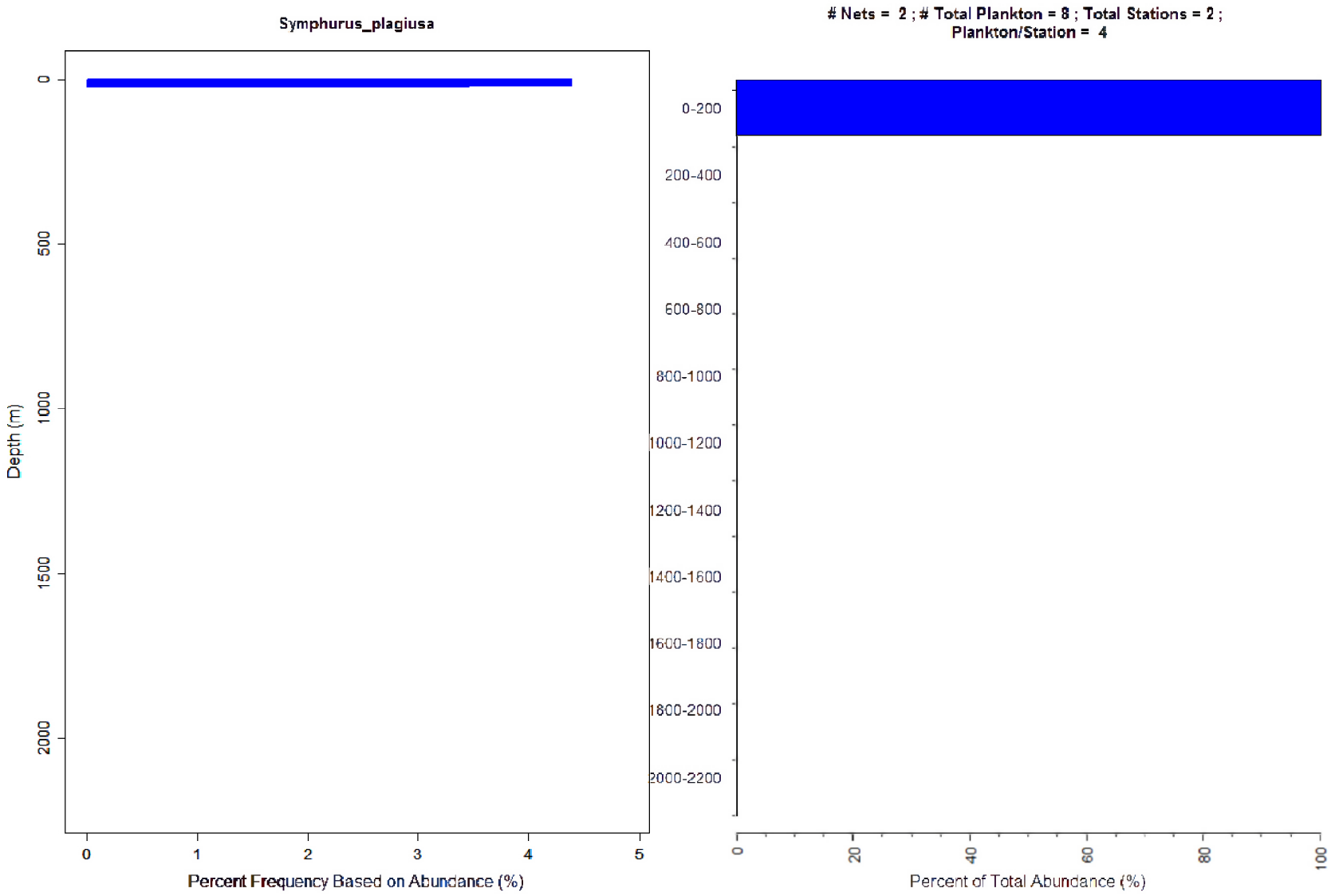
Symbolophorus_rufinus - Deep



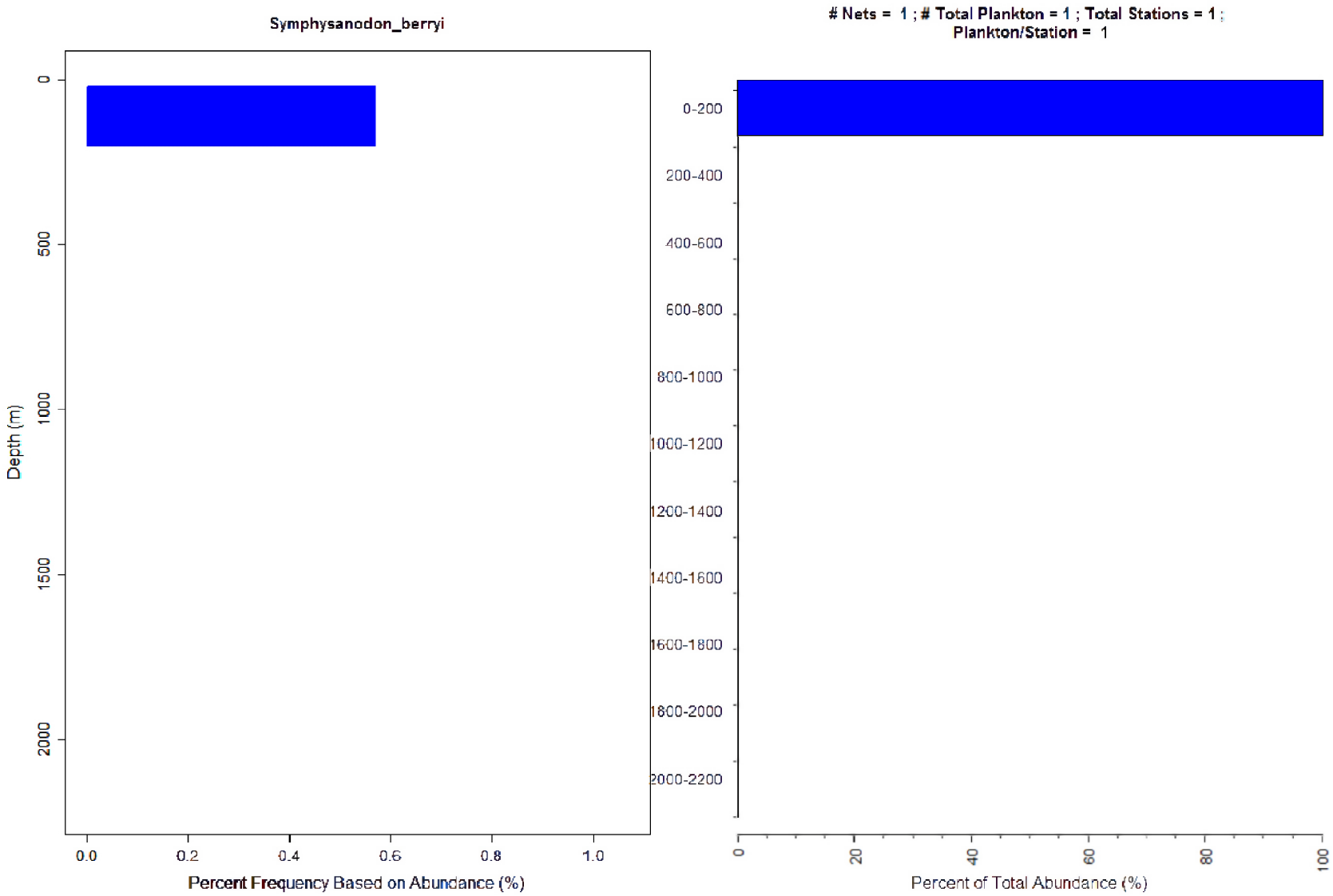
Symphurus - Deep



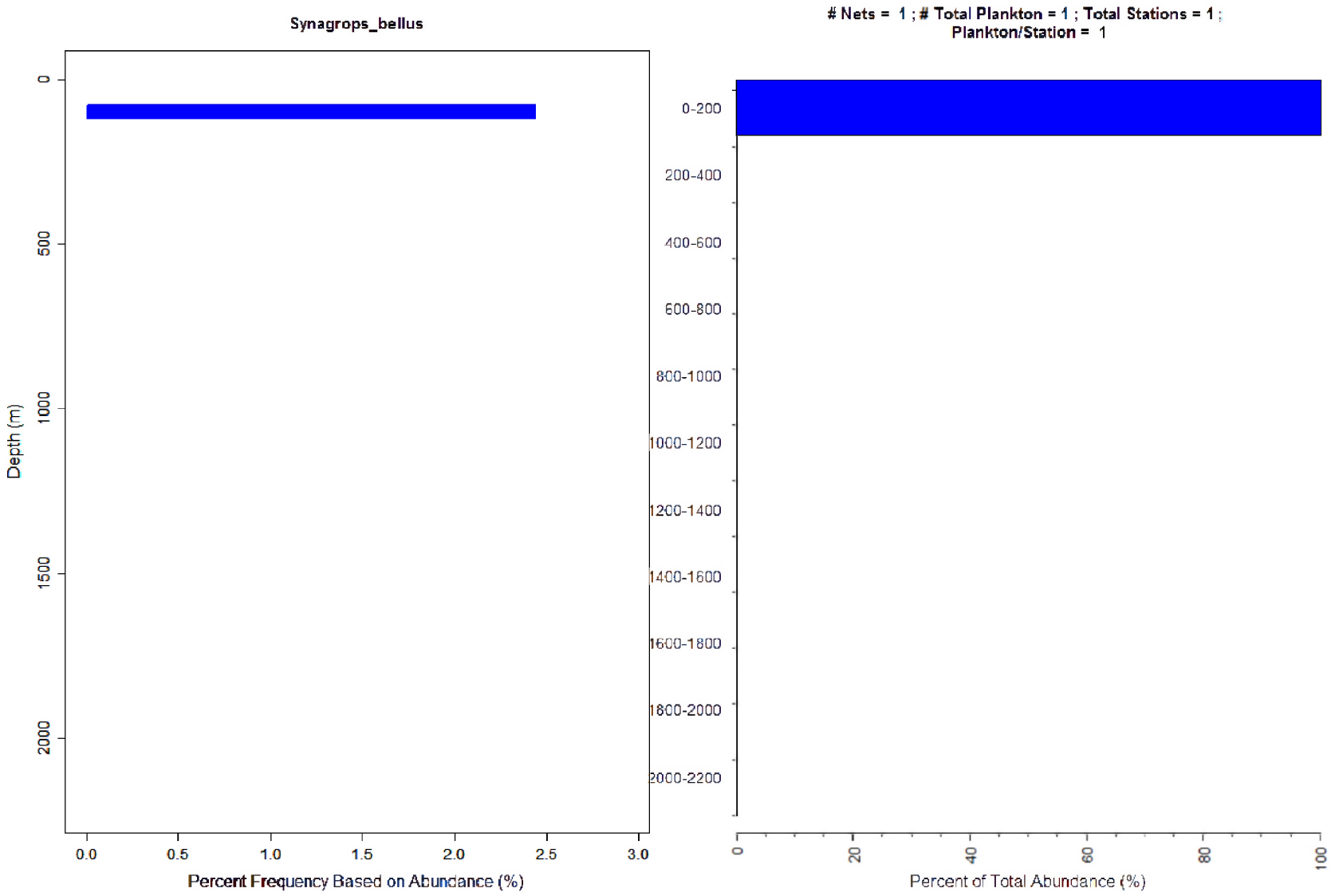
Symphurus_piger - Deep



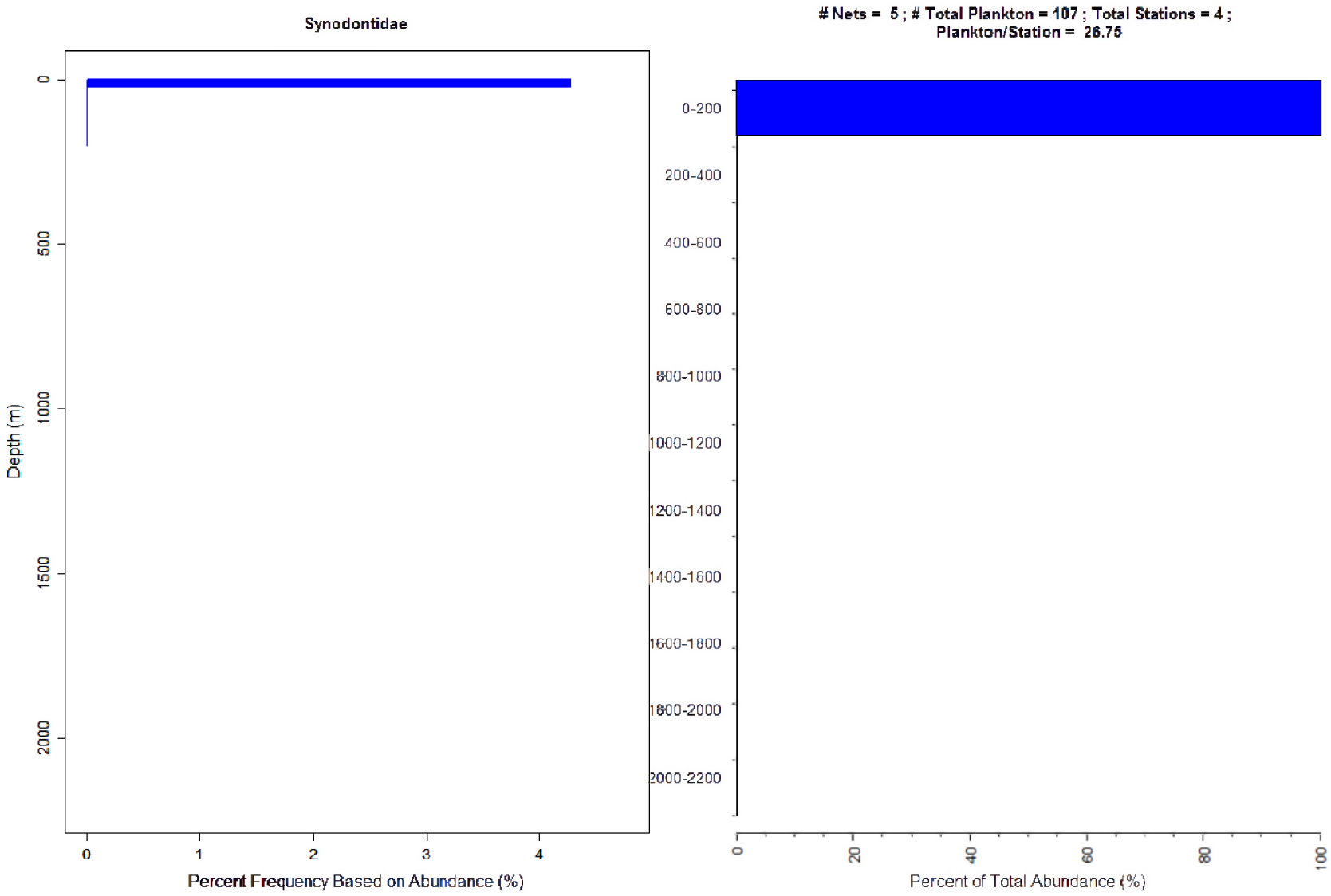
Symphurus_plagiusa - Deep



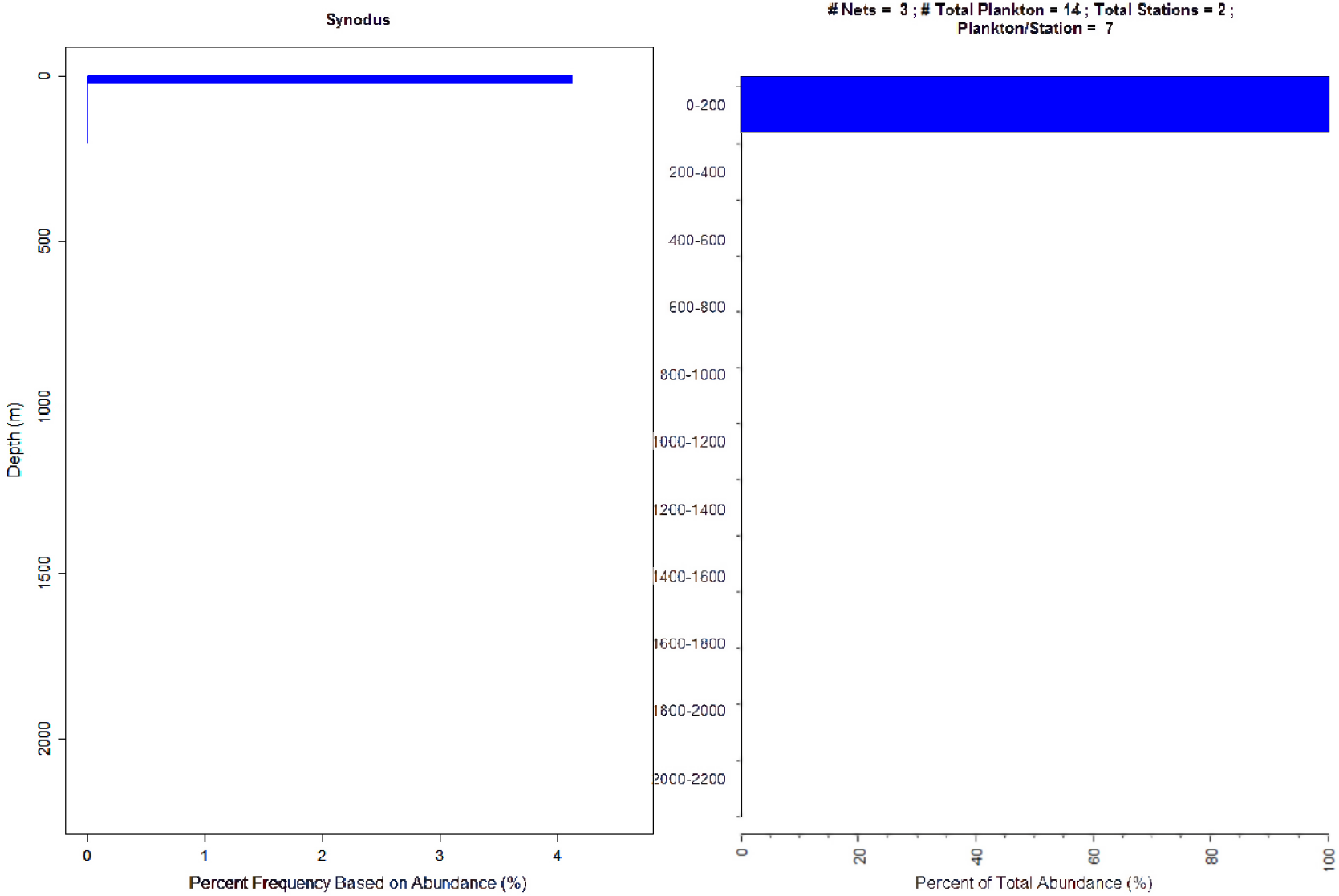
Symphysanodon_berryi - Deep



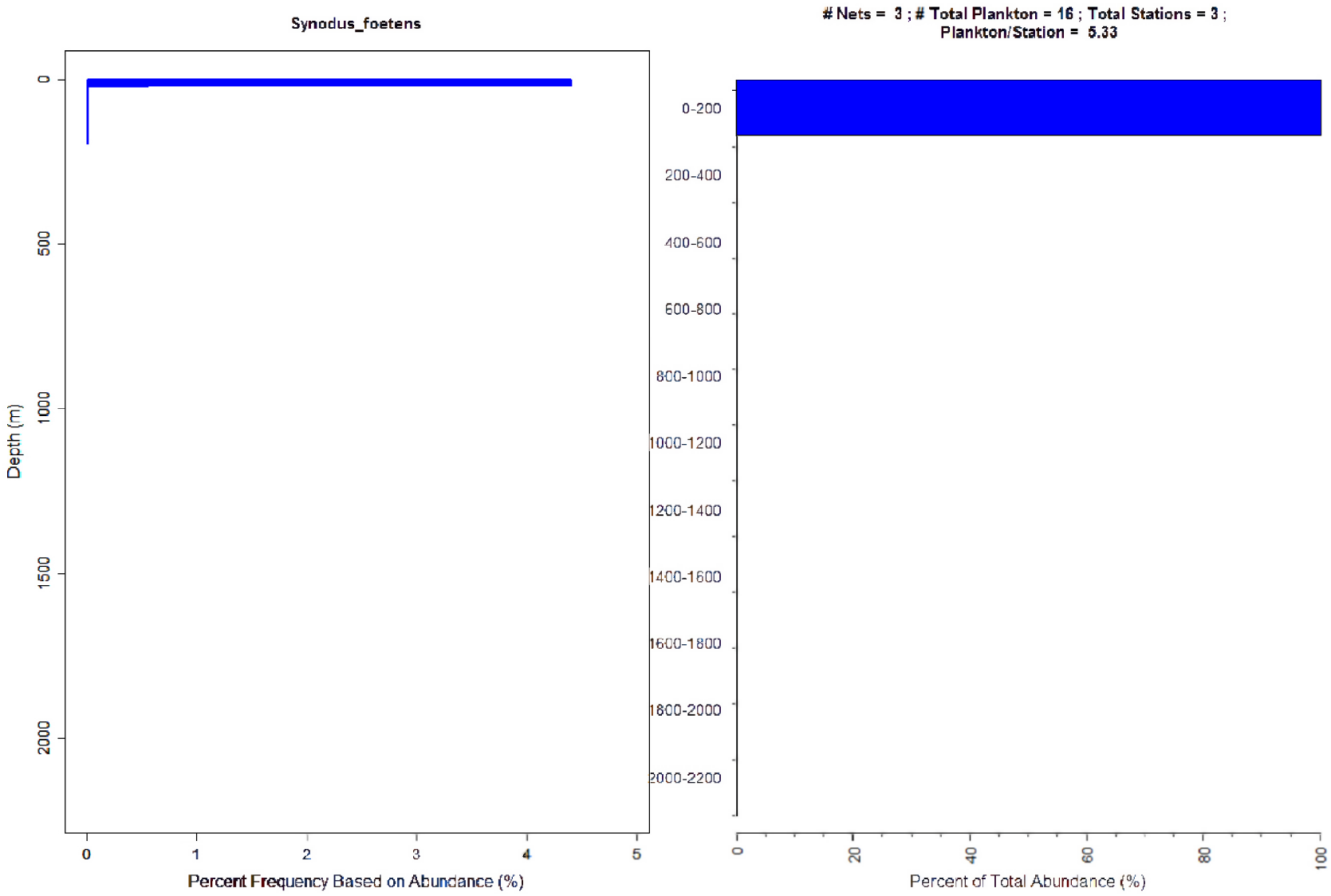
Synagrops_bellus - Deep



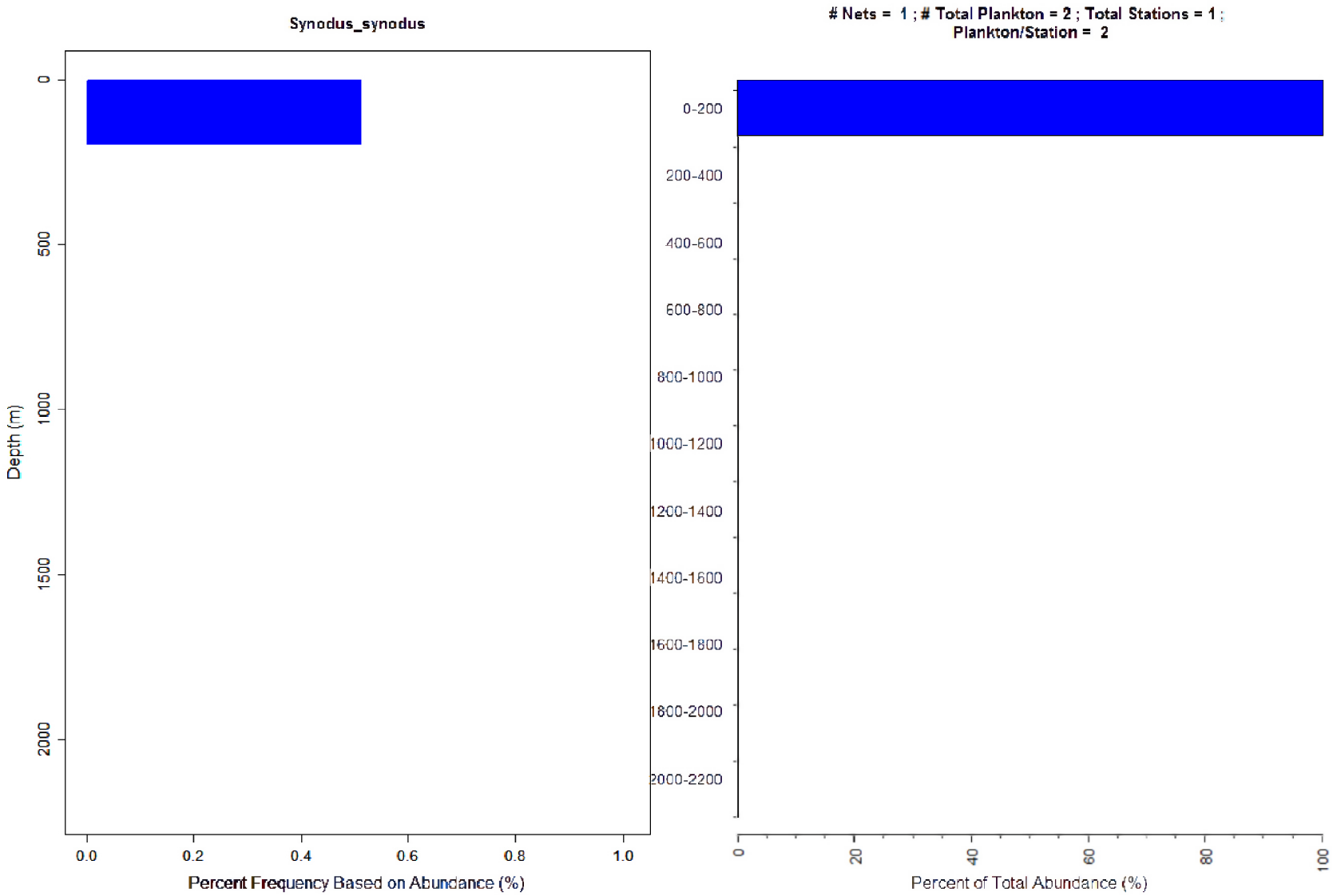
Synodontidae - Deep



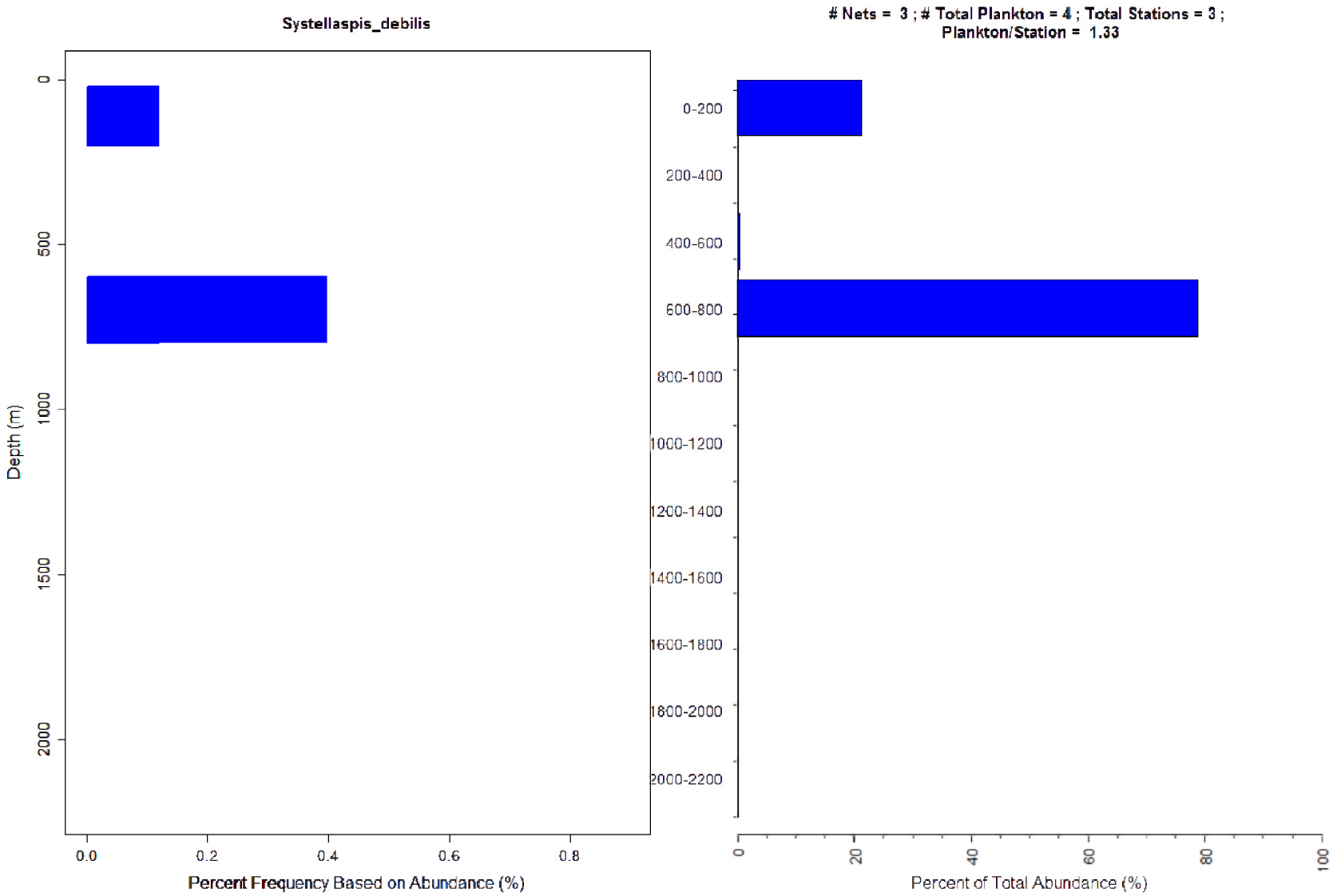
Synodus - Deep



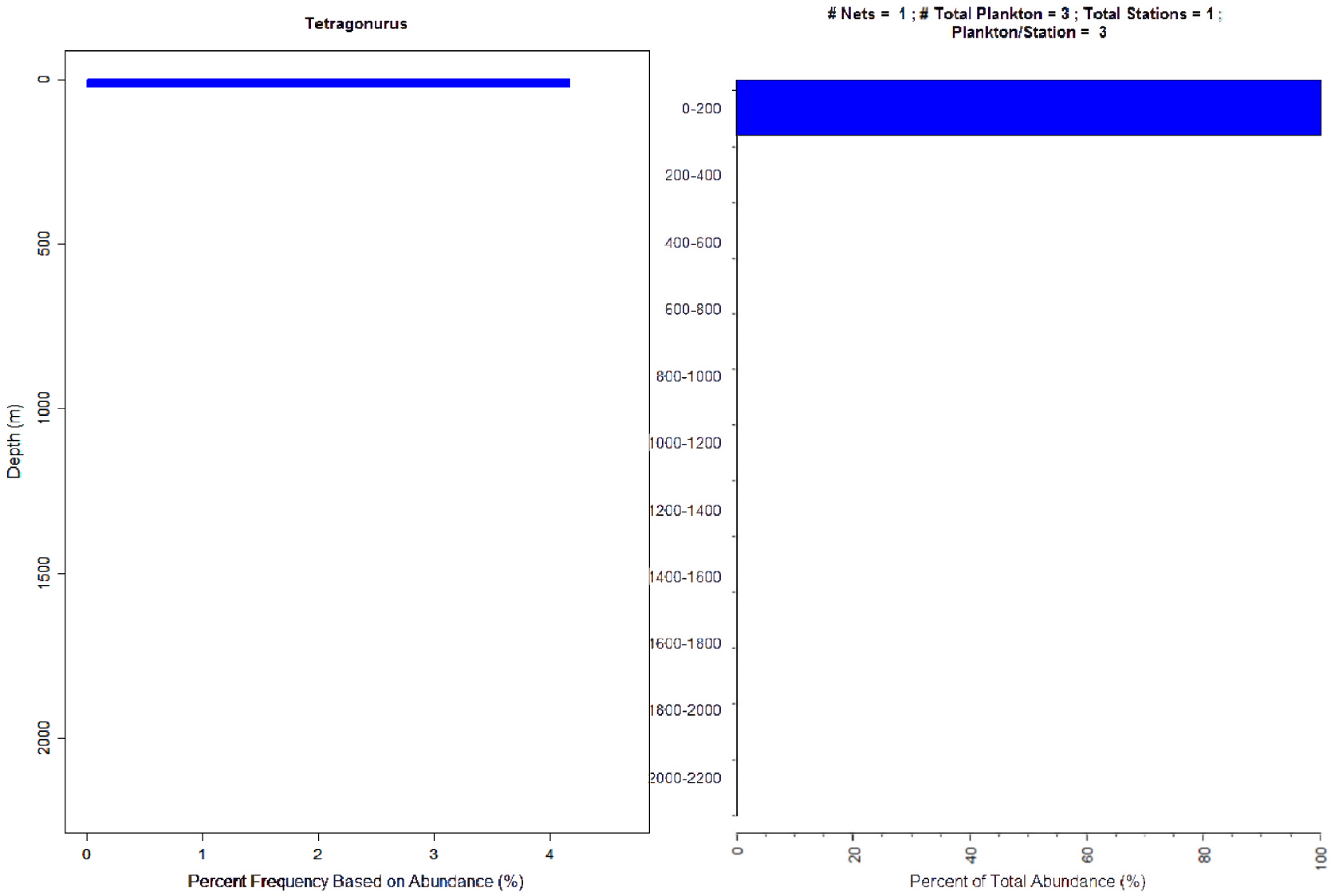
Synodus_foetens - Deep



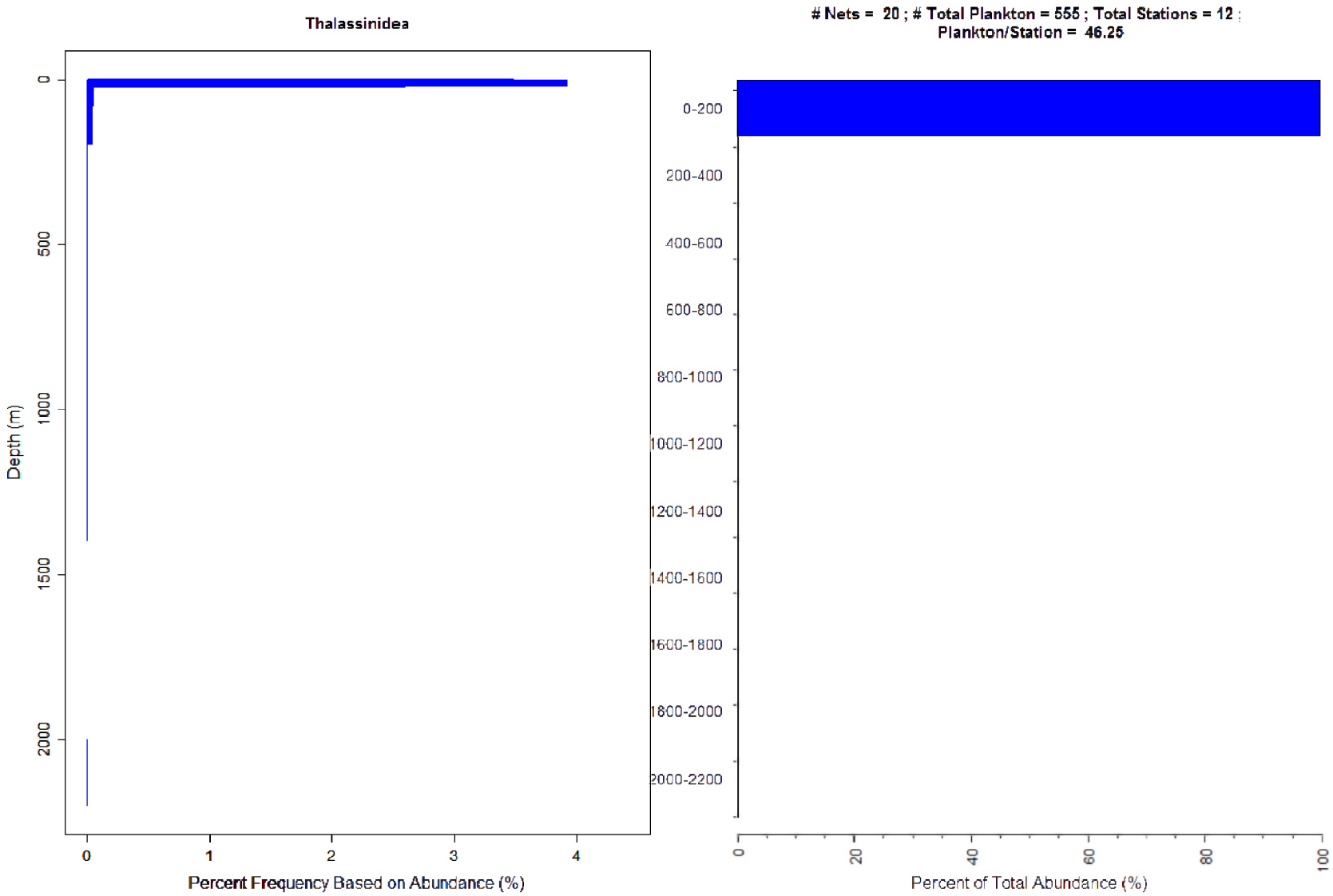
Synodus_synodus - Deep



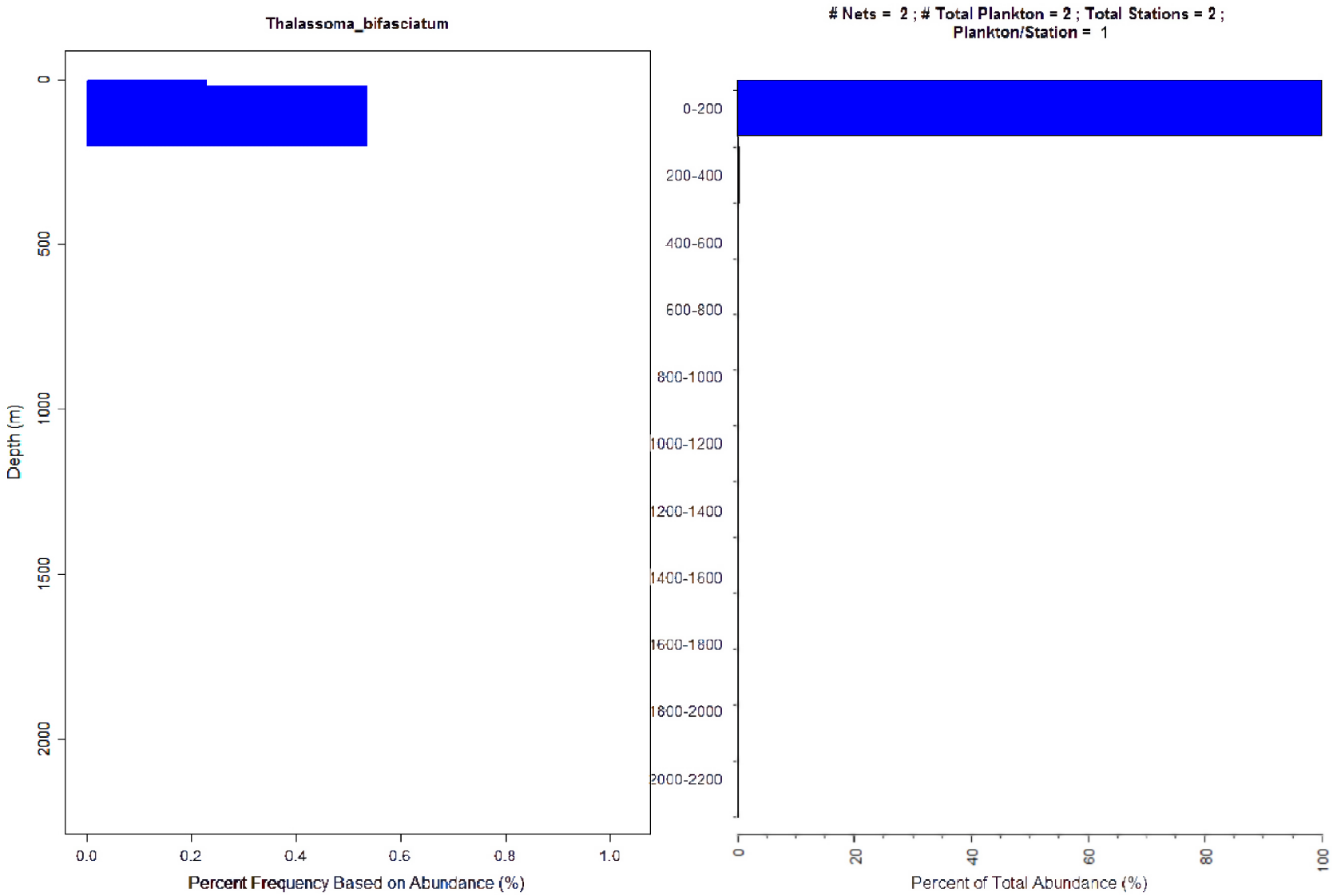
Systellaspis_debilis - Deep



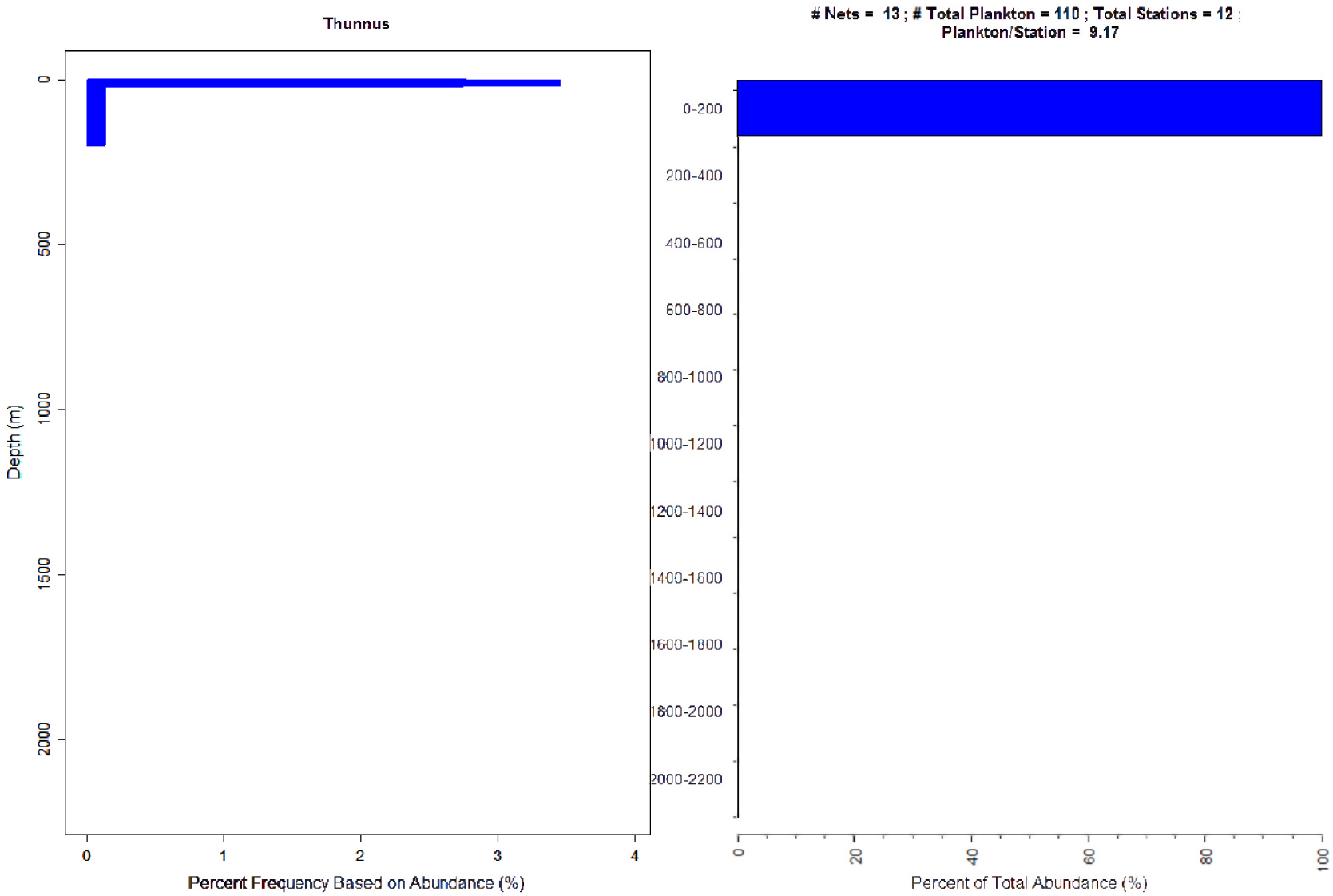
Tetragonurus - Deep



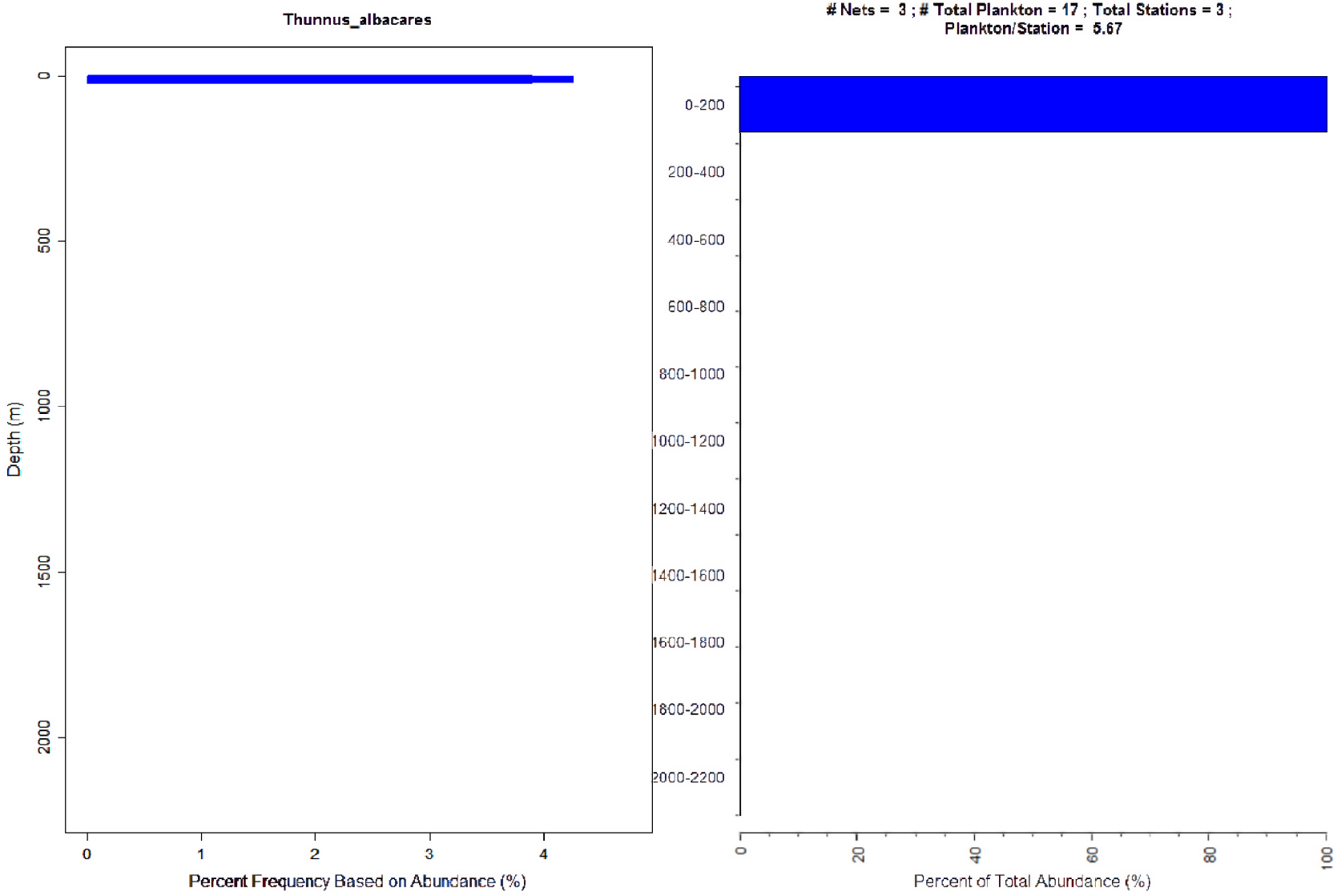
Thalassinidea - Deep



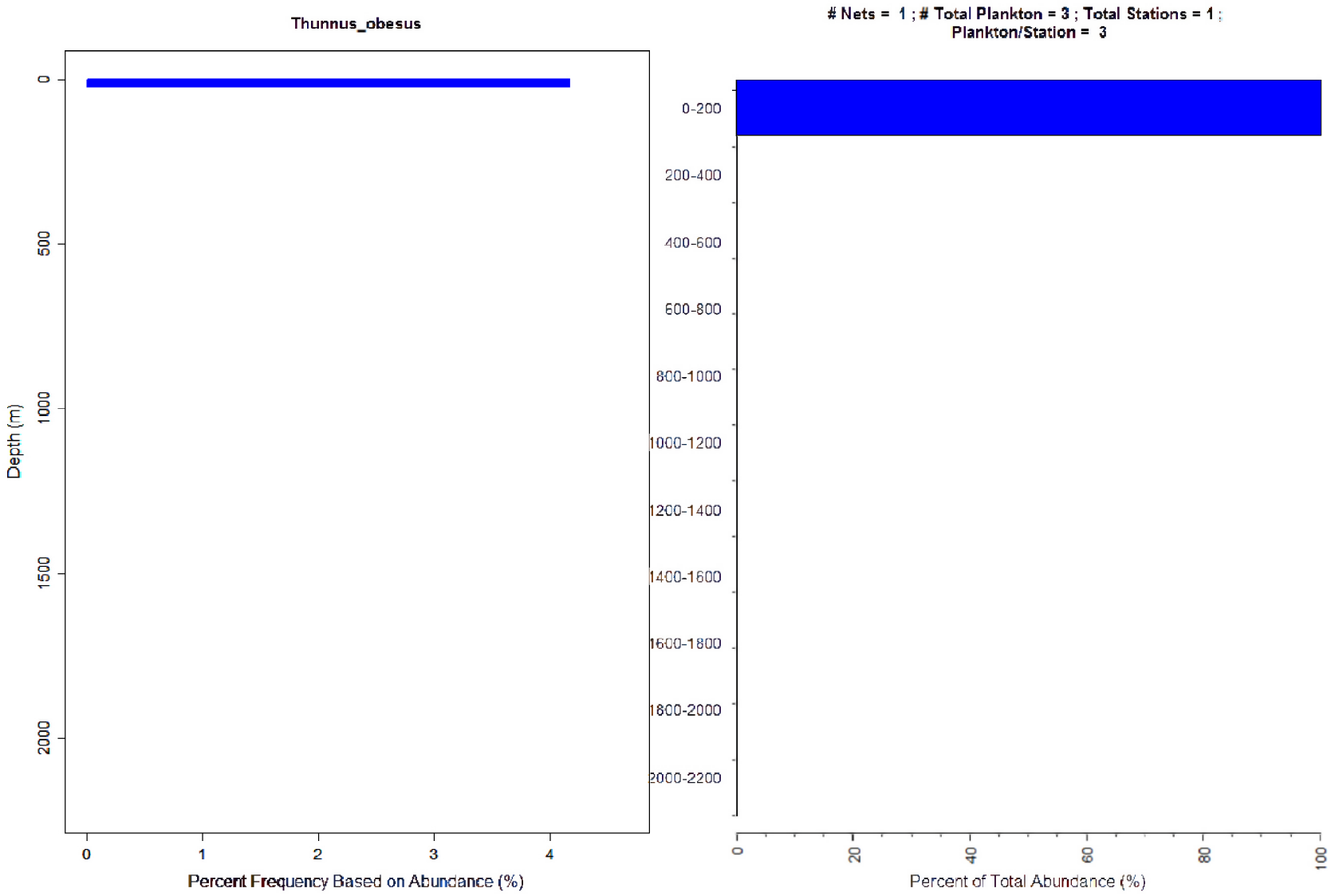
Thalassoma_bifasciatum - Deep



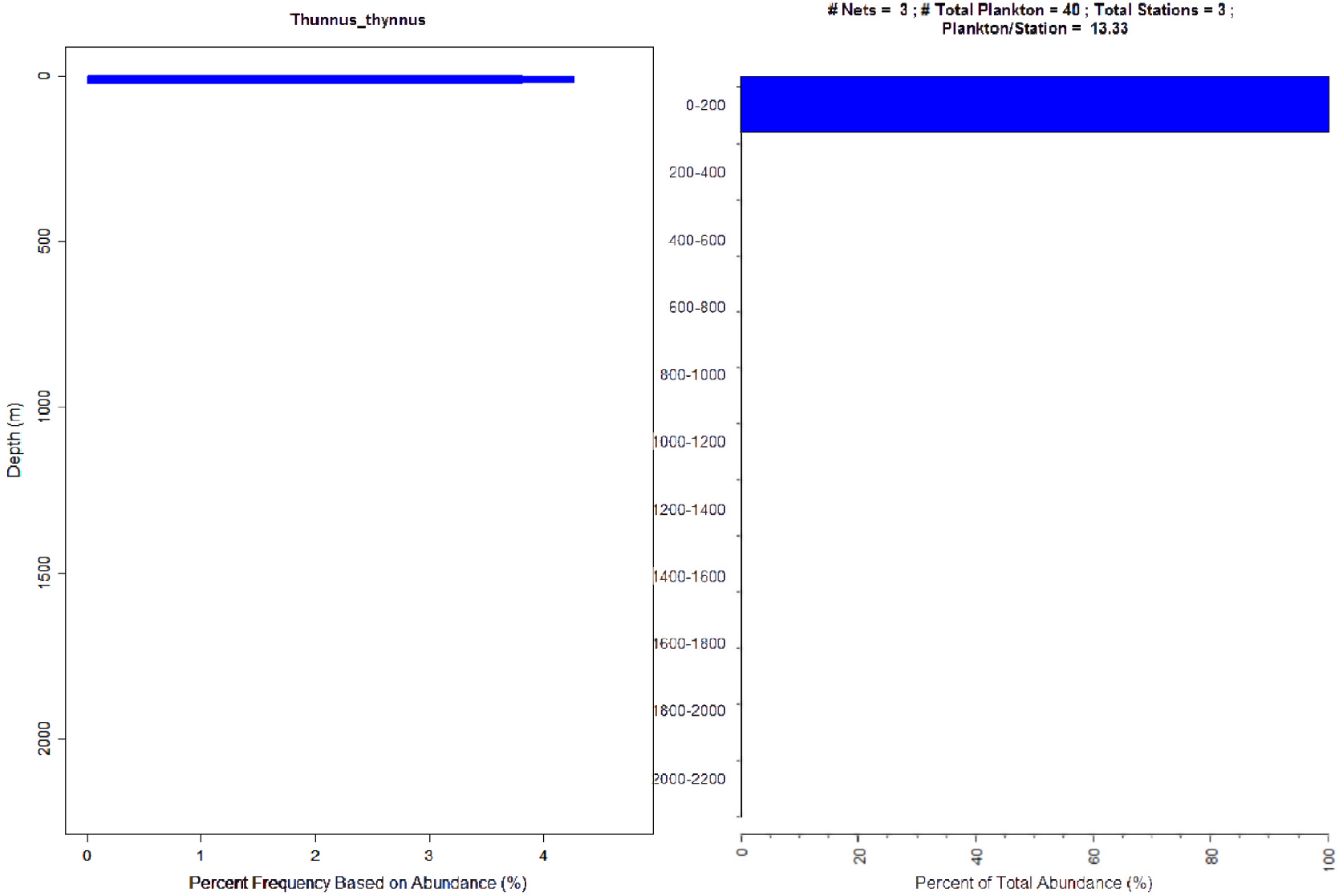
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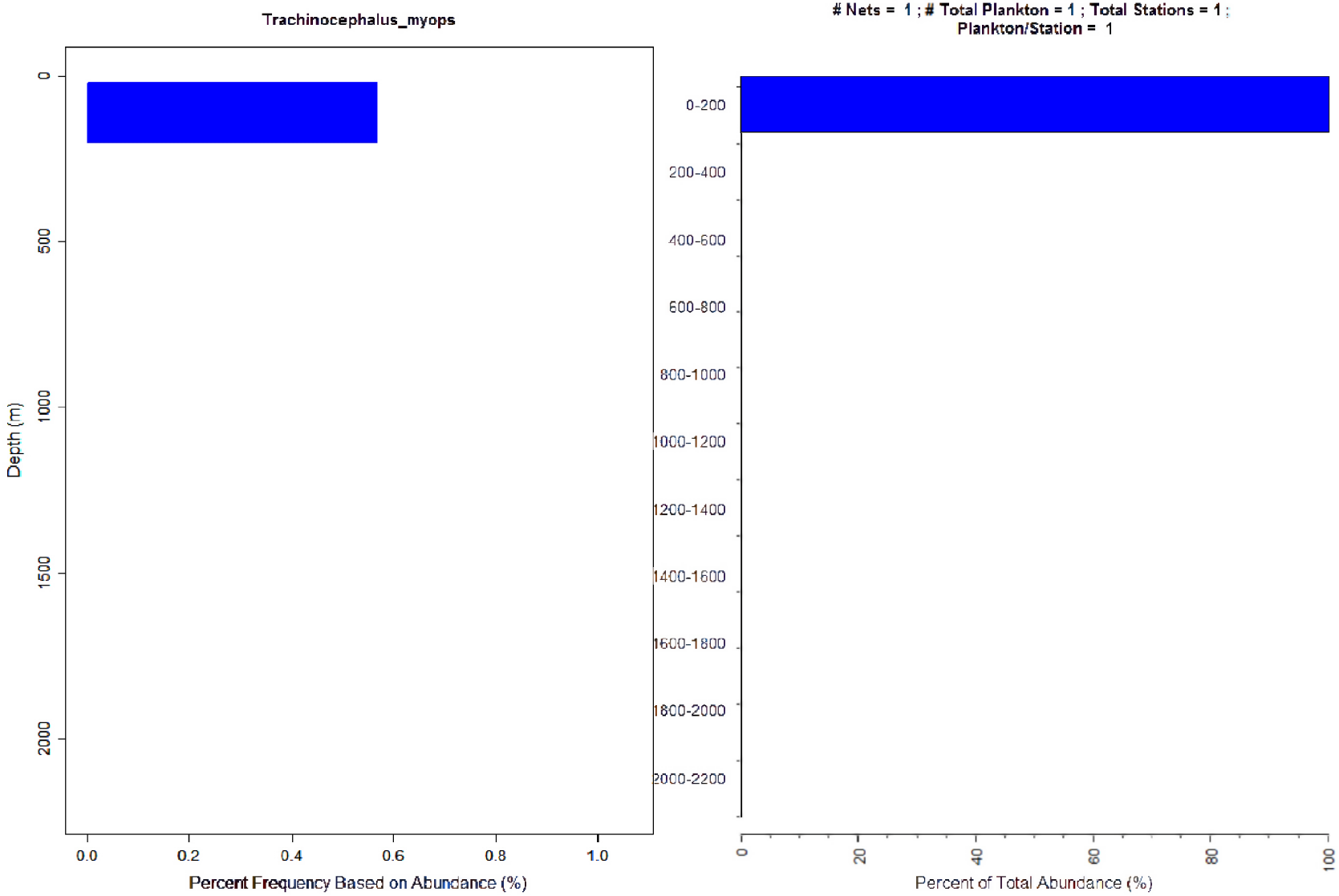
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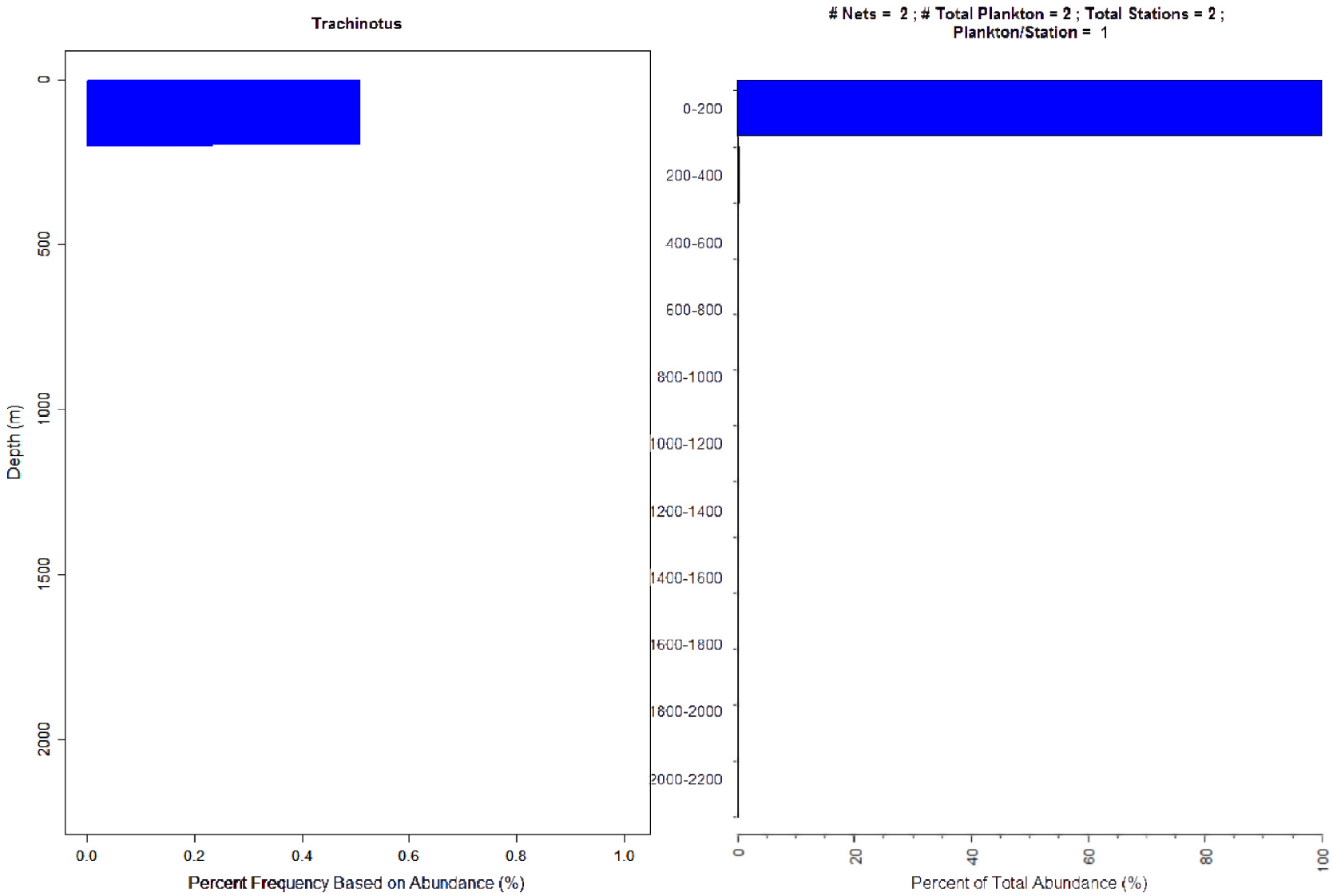
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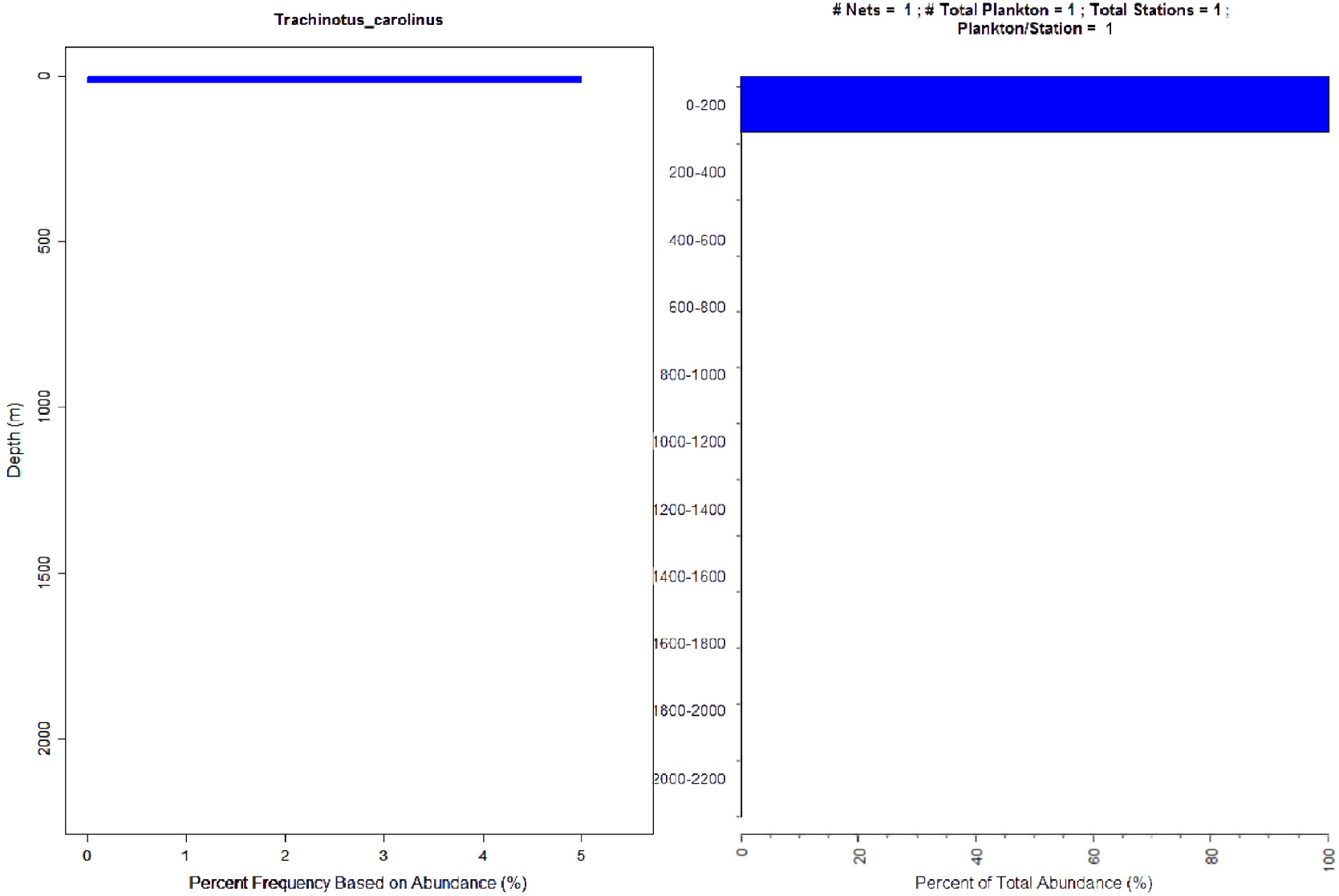
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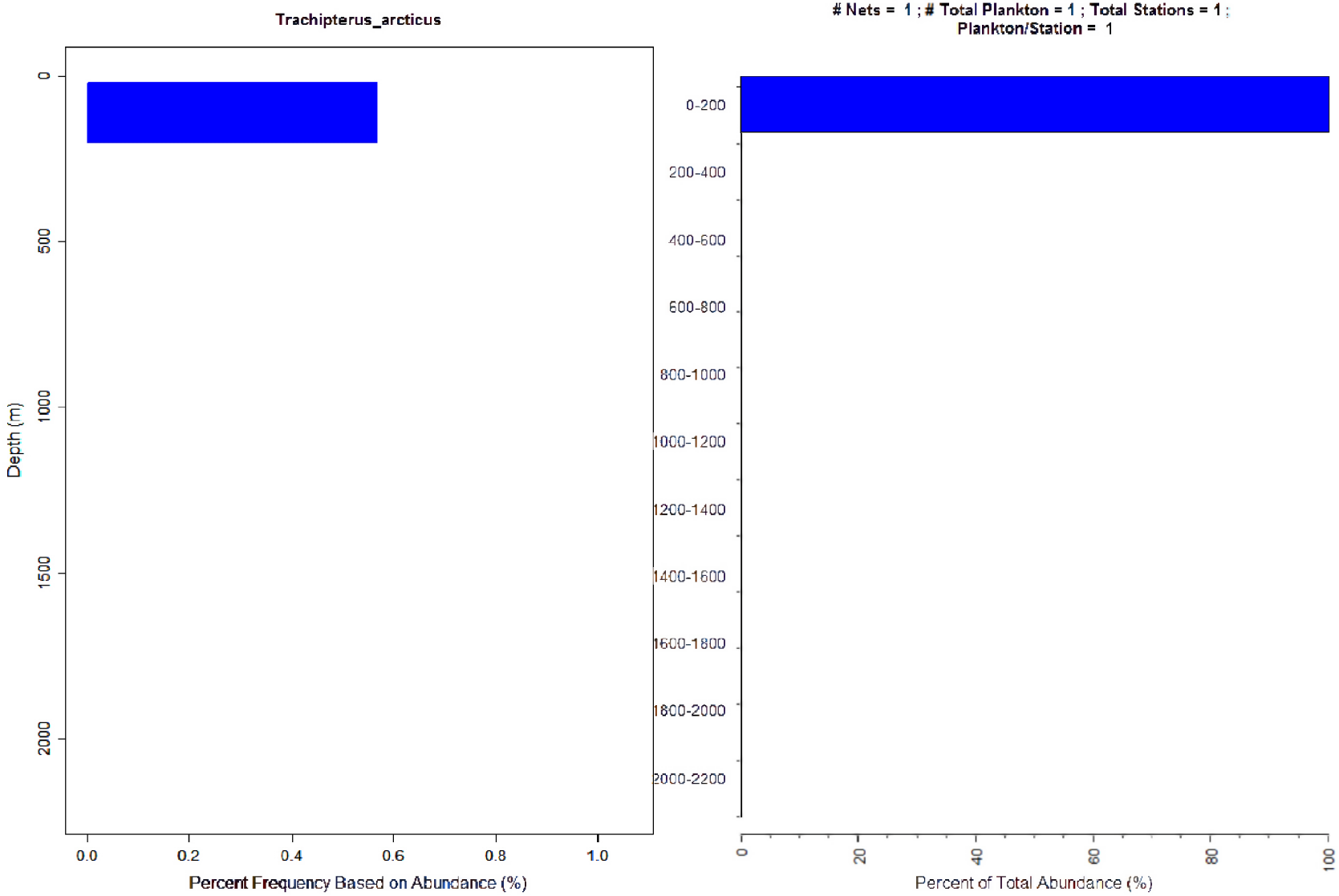
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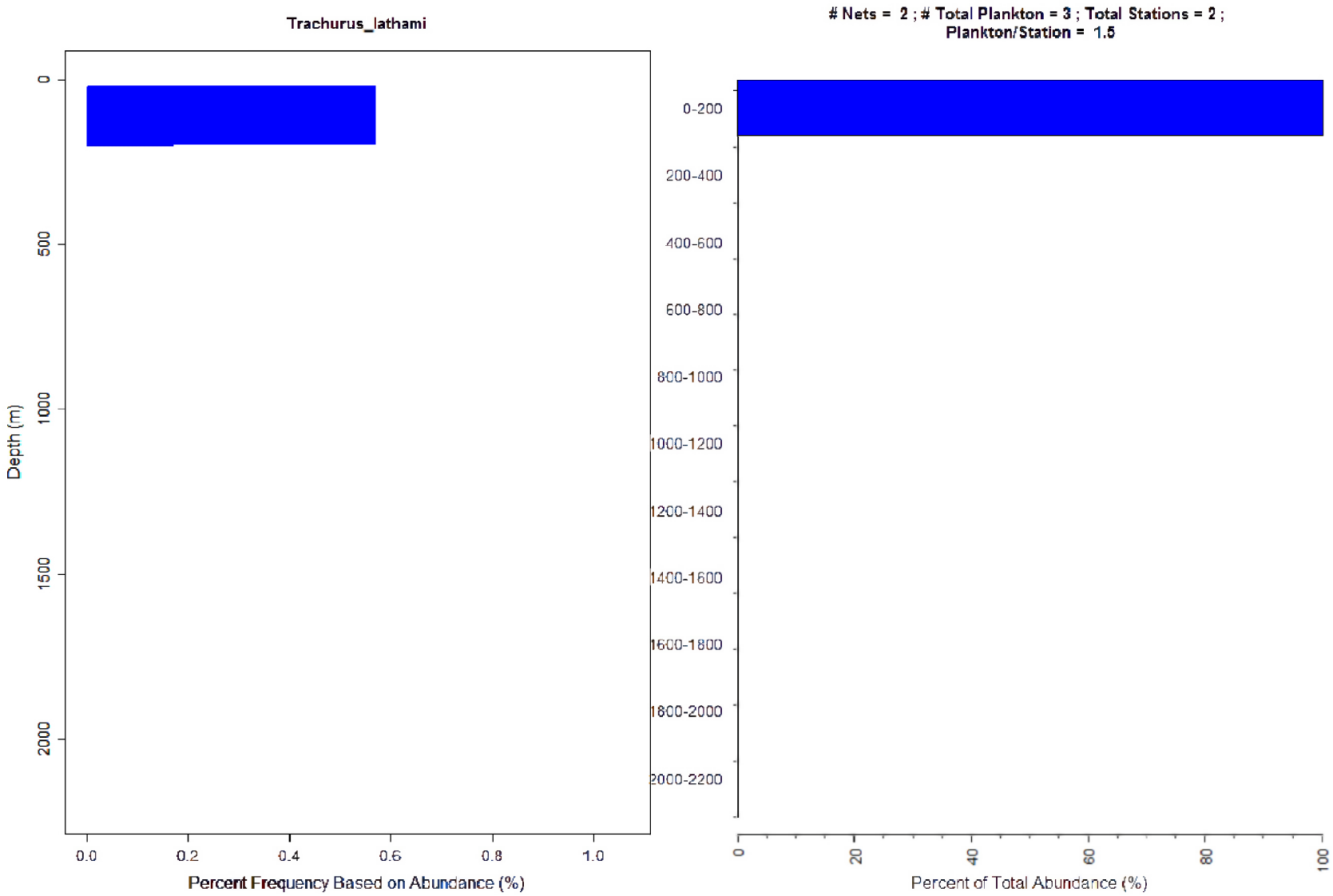
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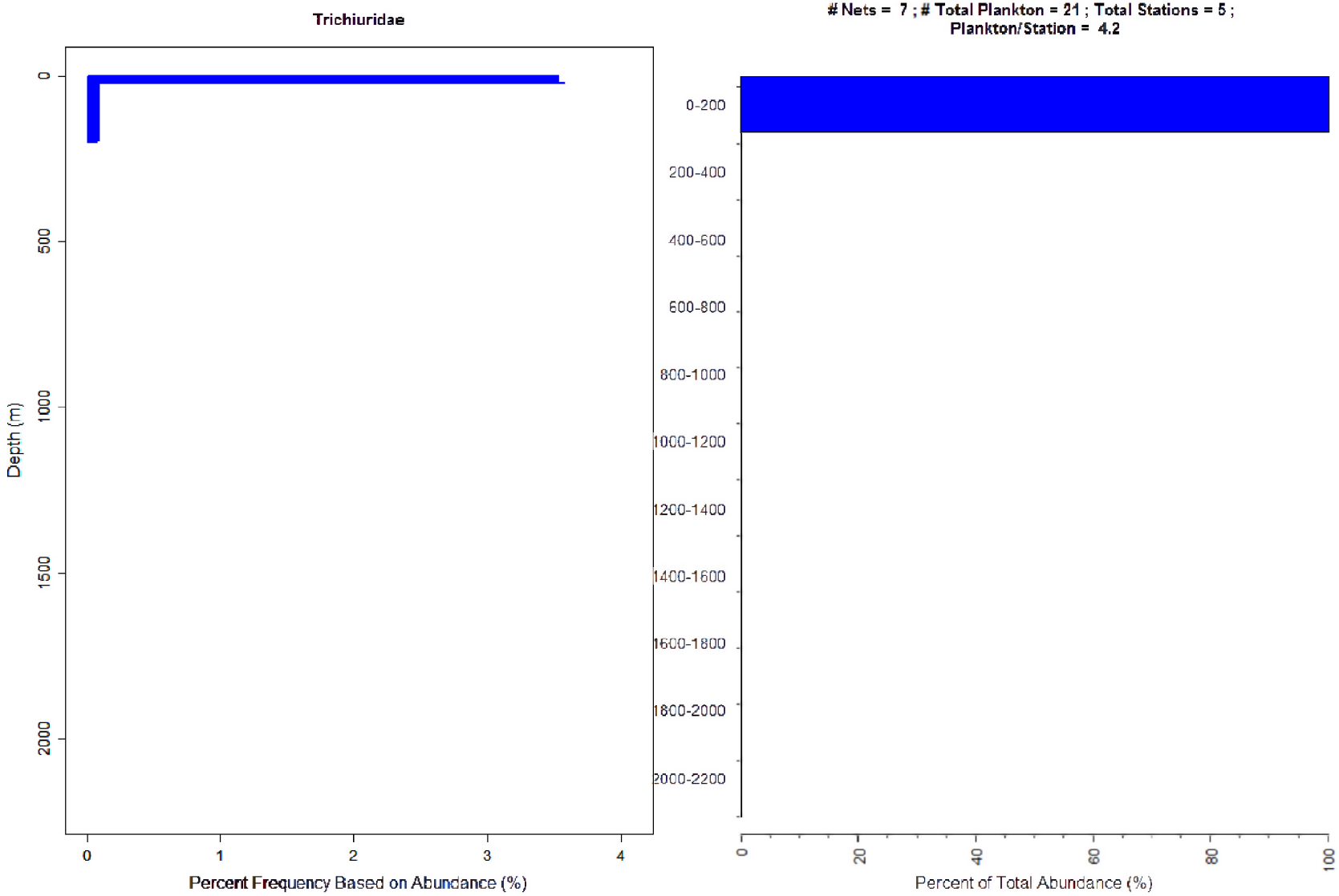
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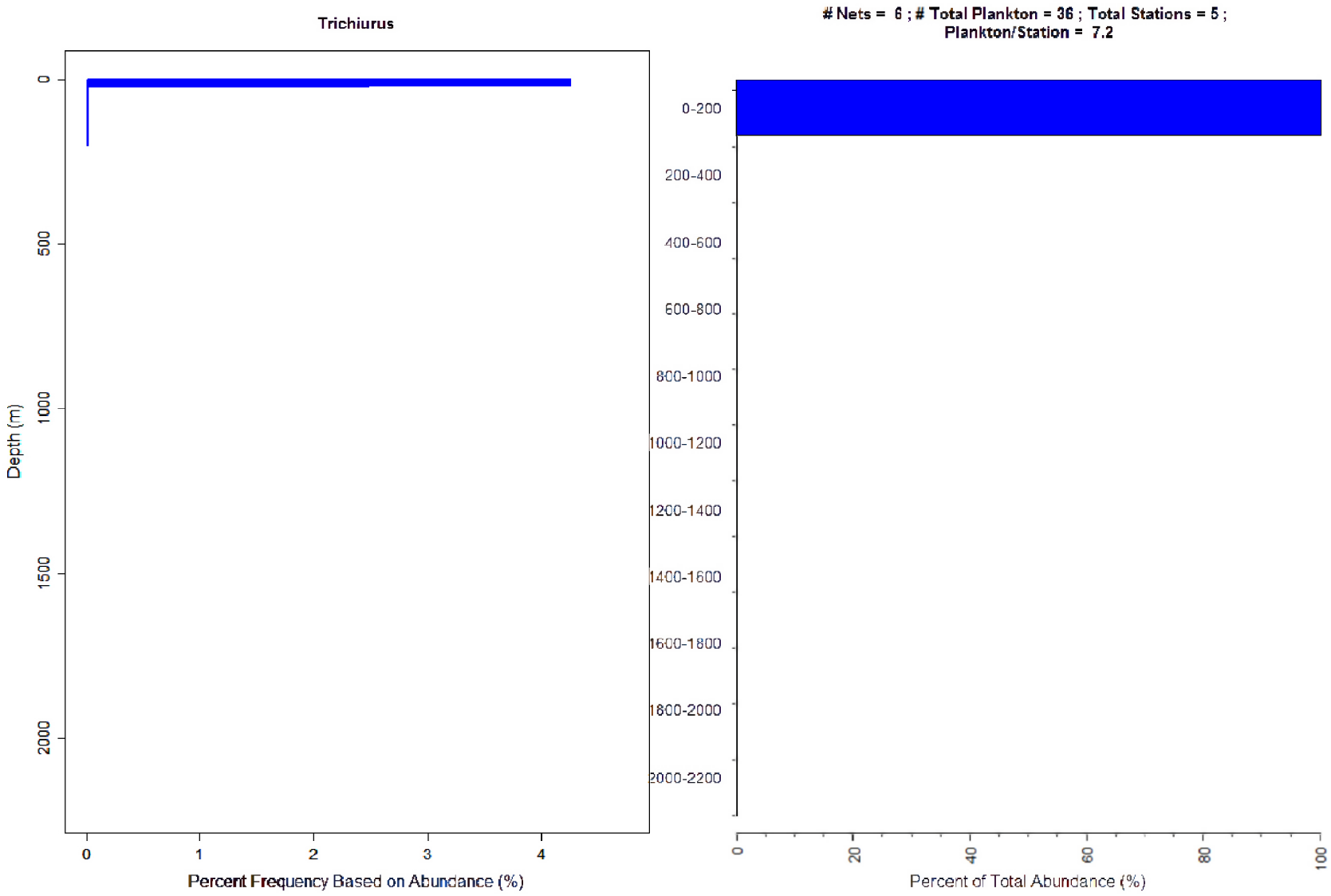
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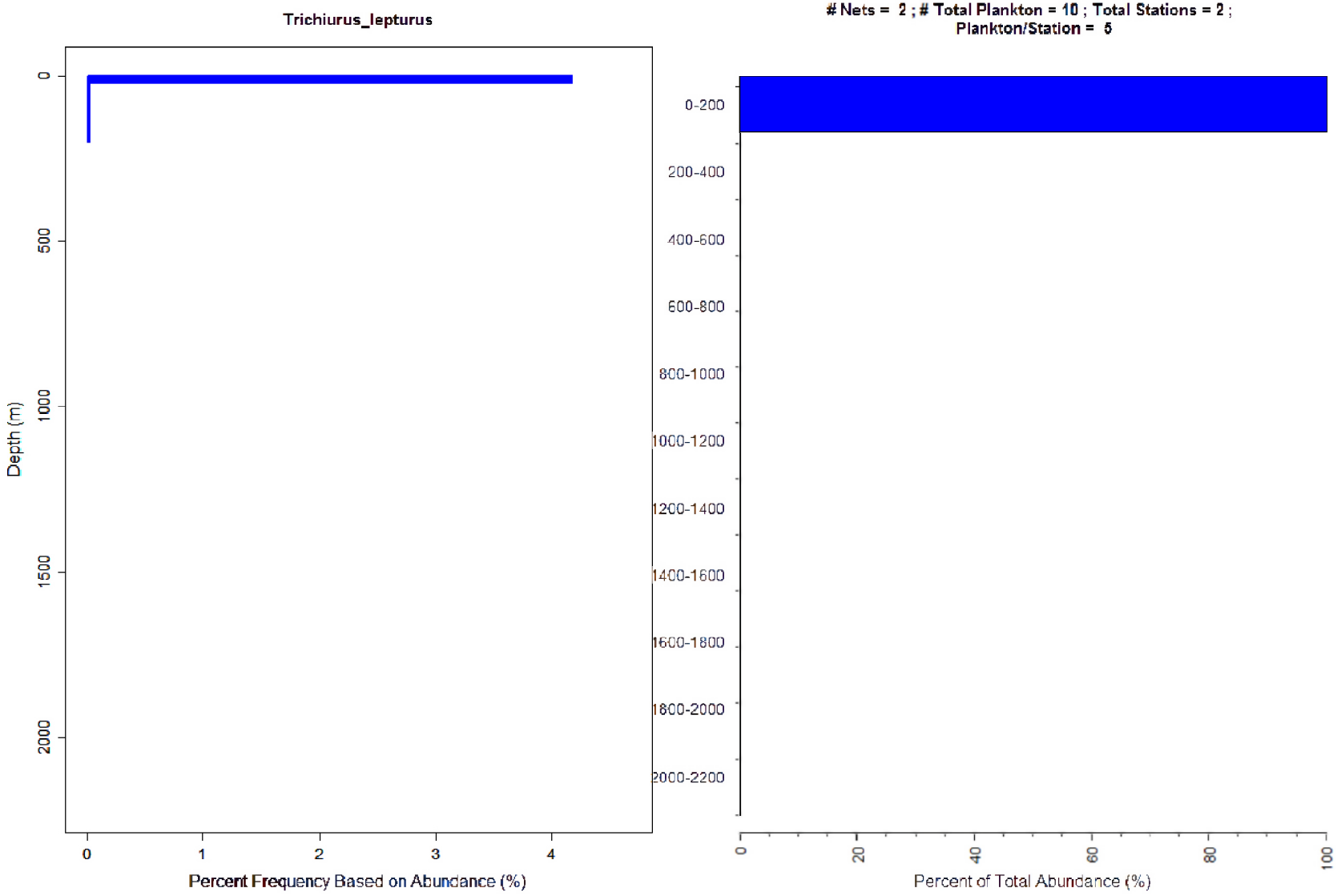
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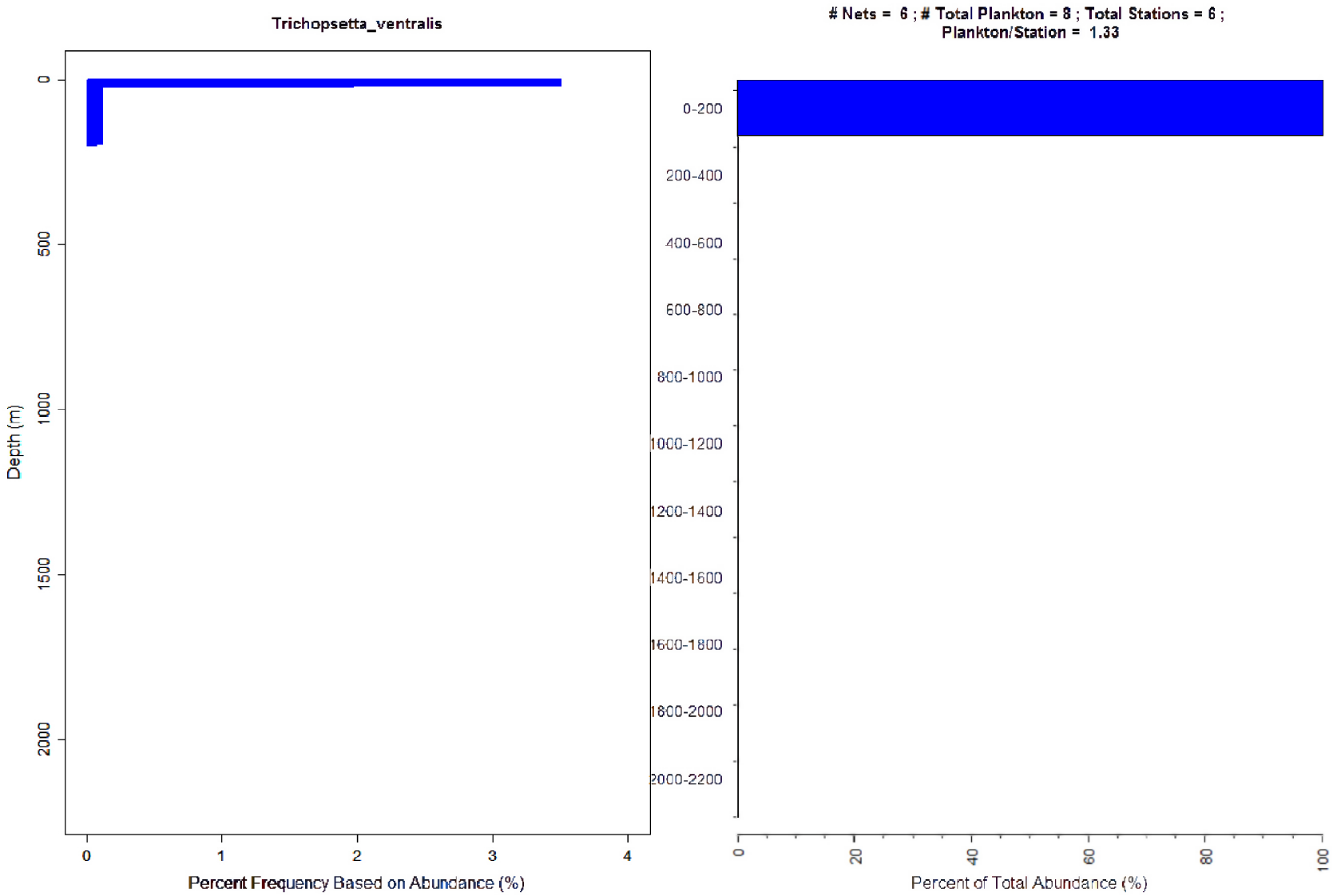
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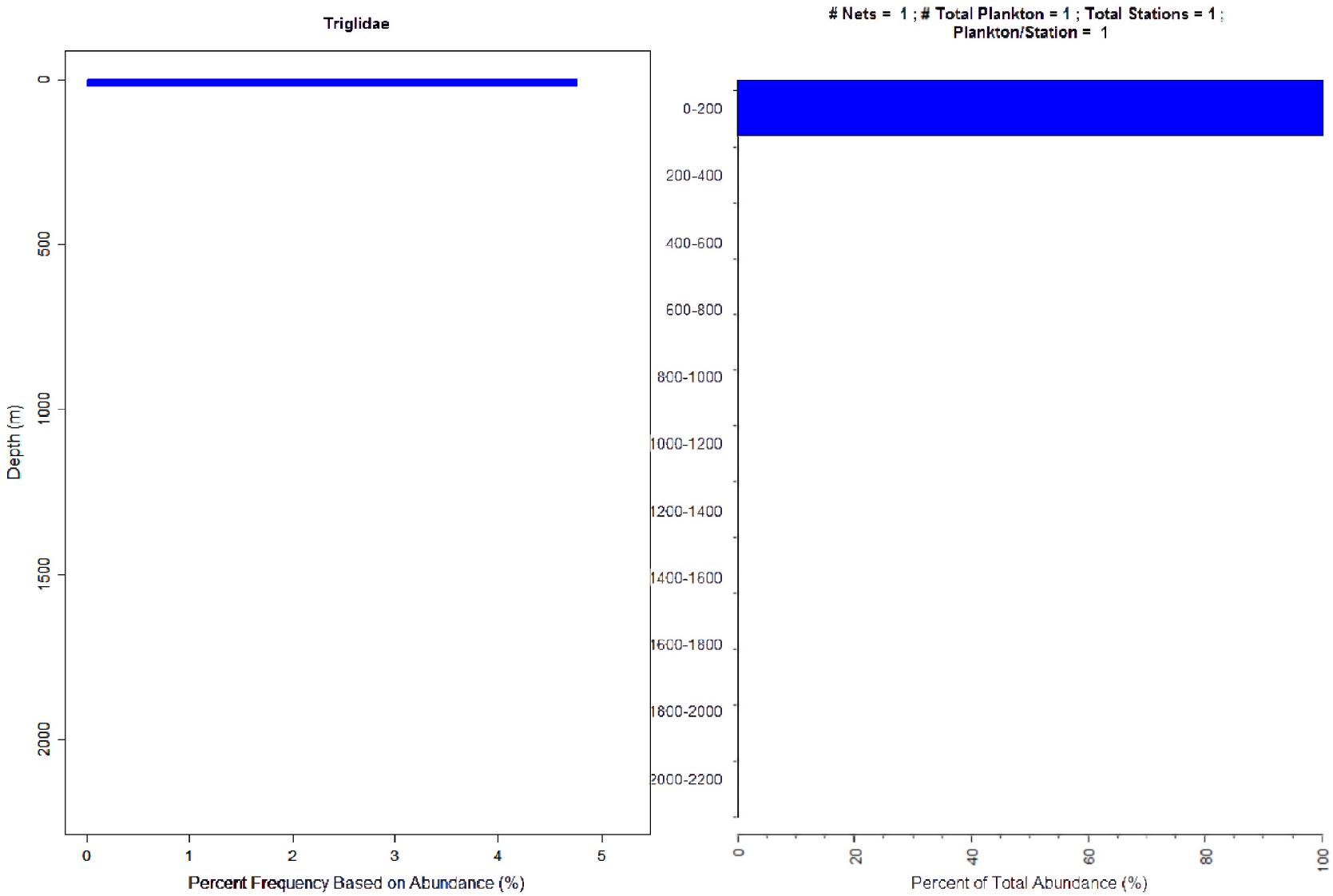
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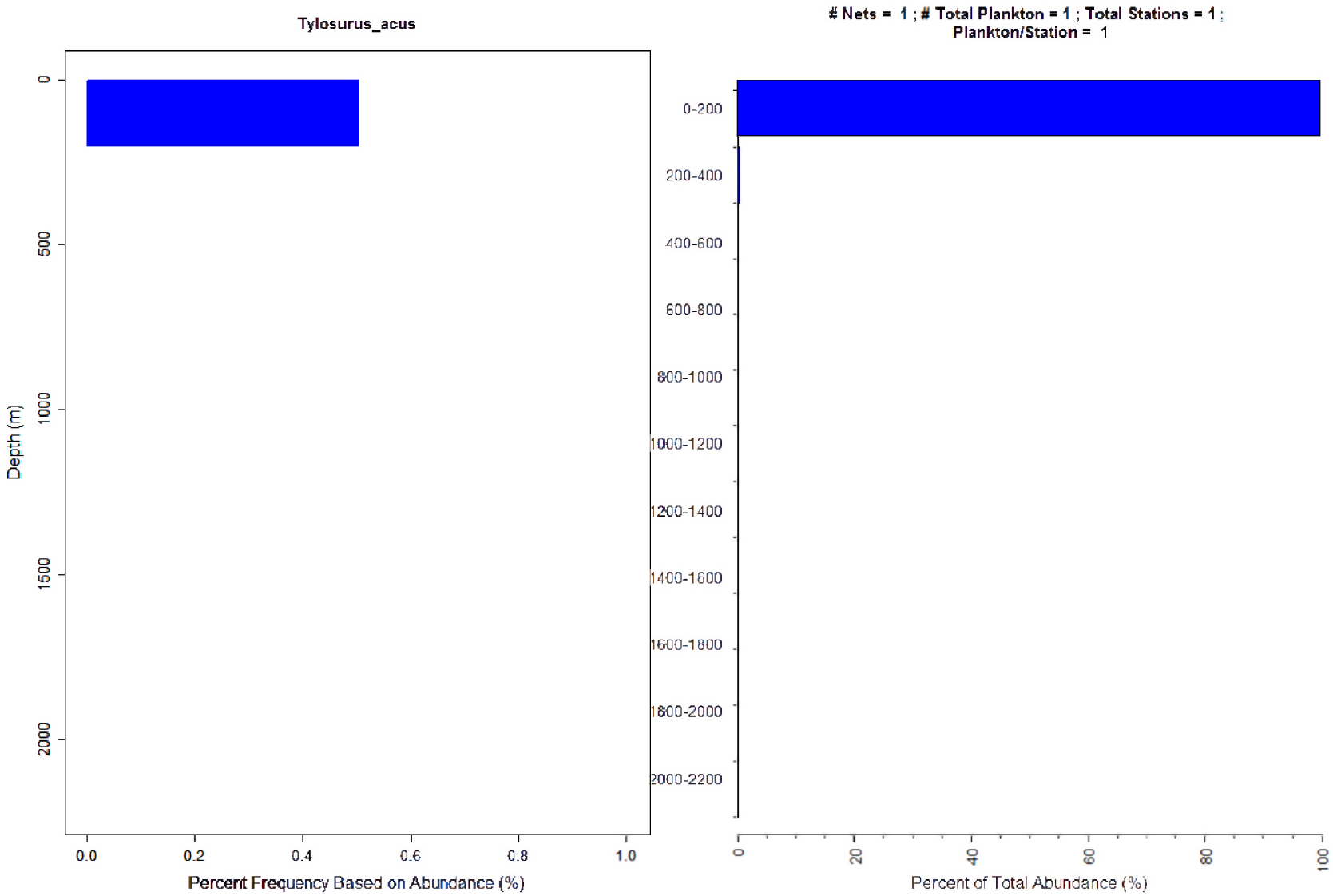
Trichiurus_lepturus - Deep



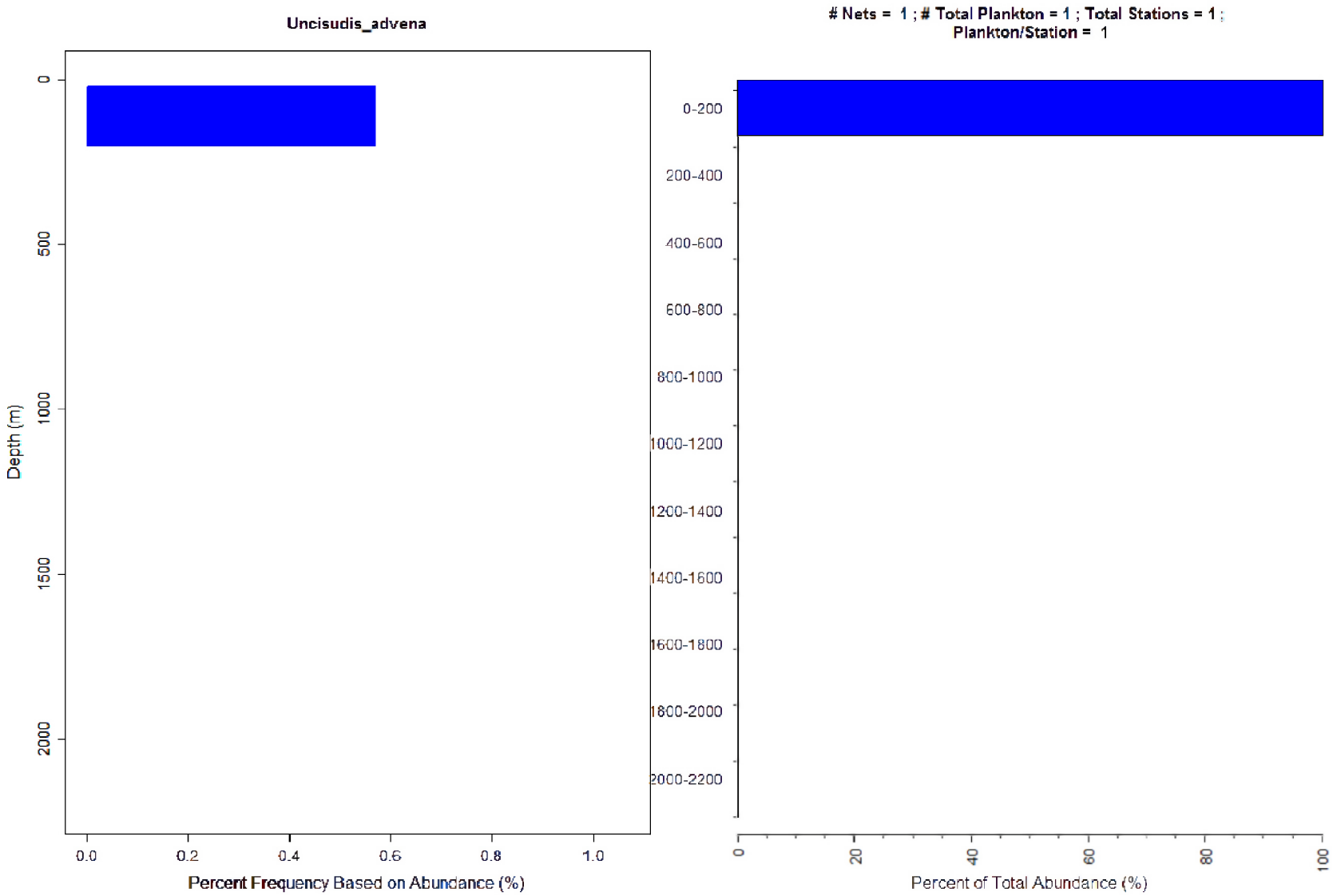
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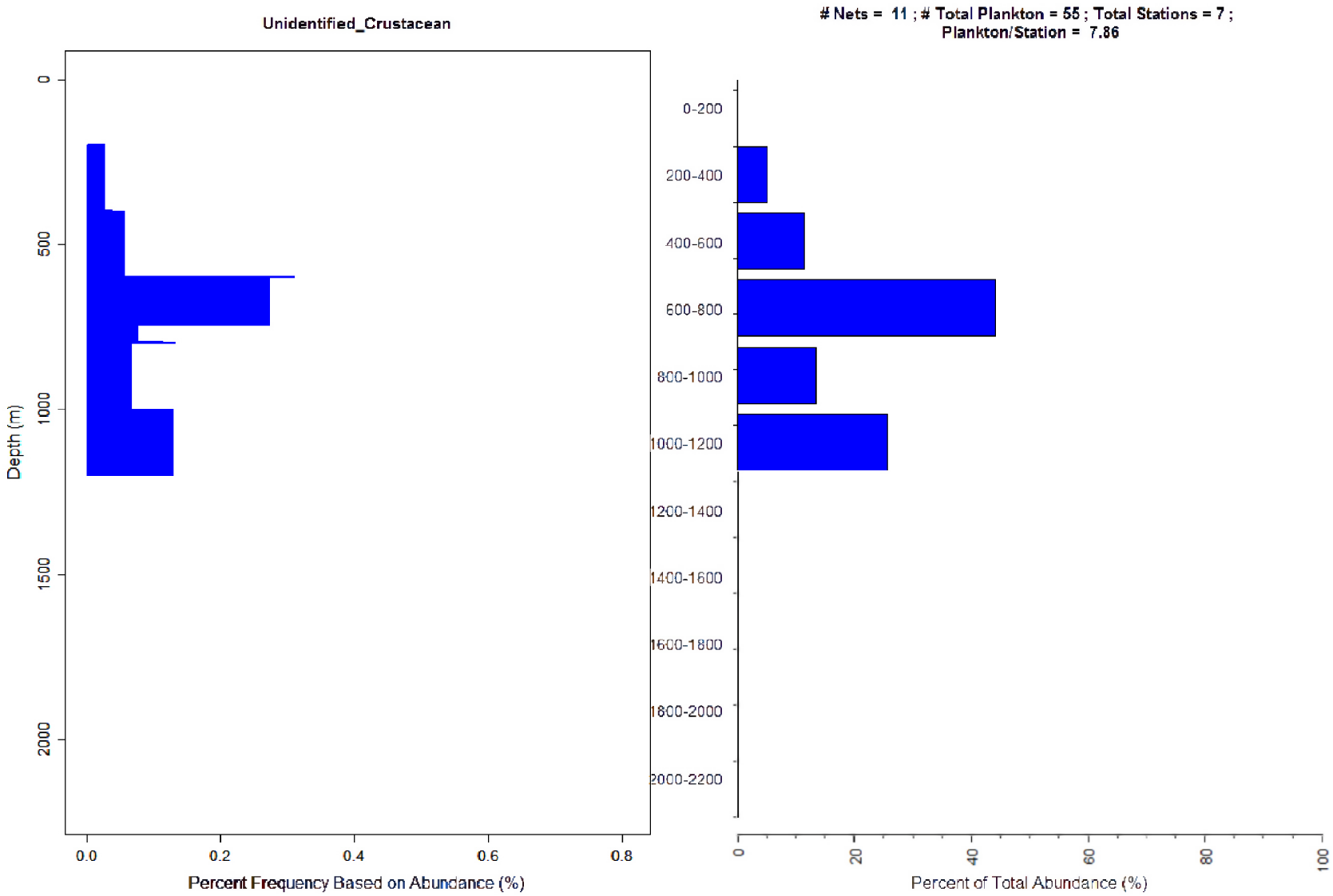
Triglidae - Deep



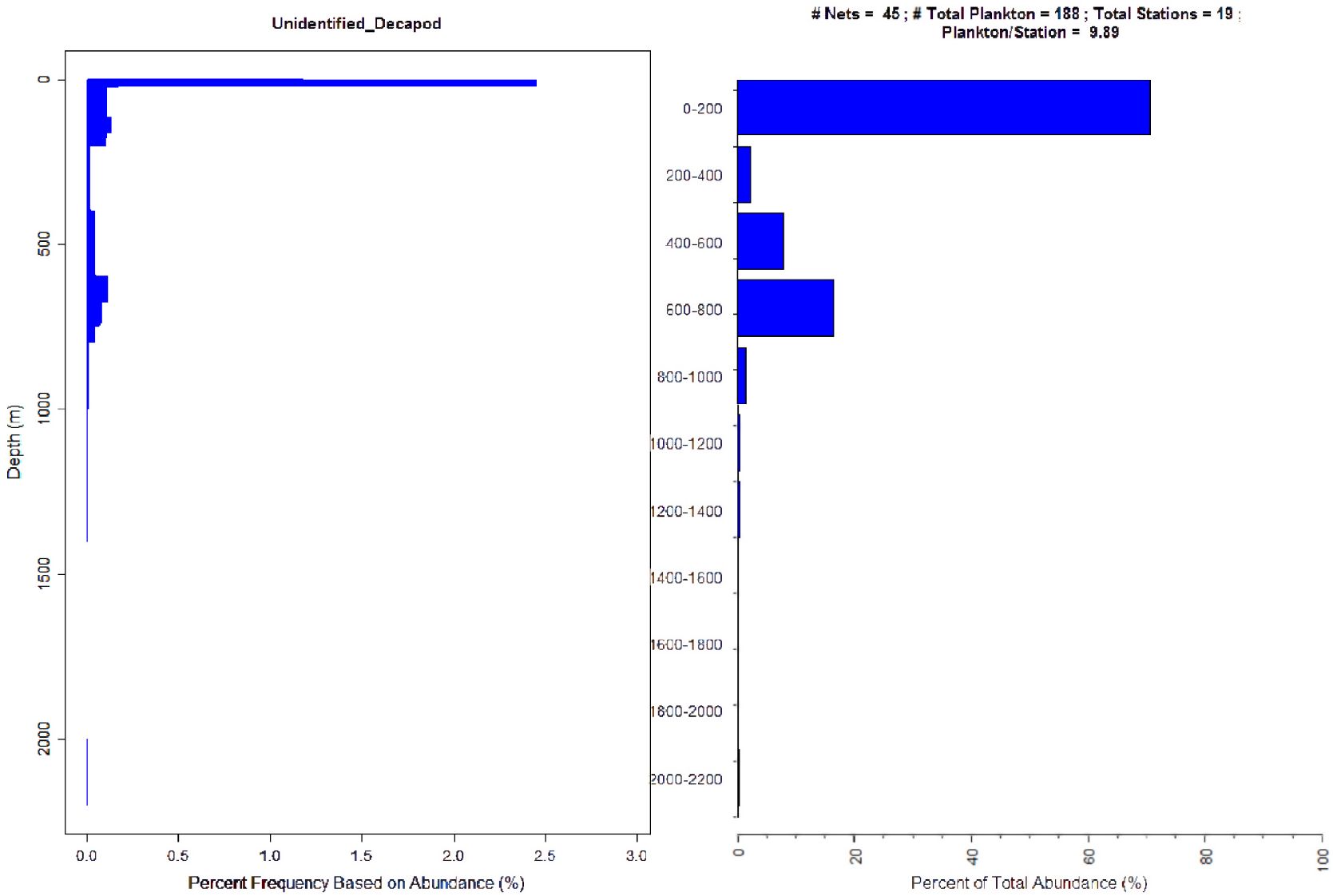
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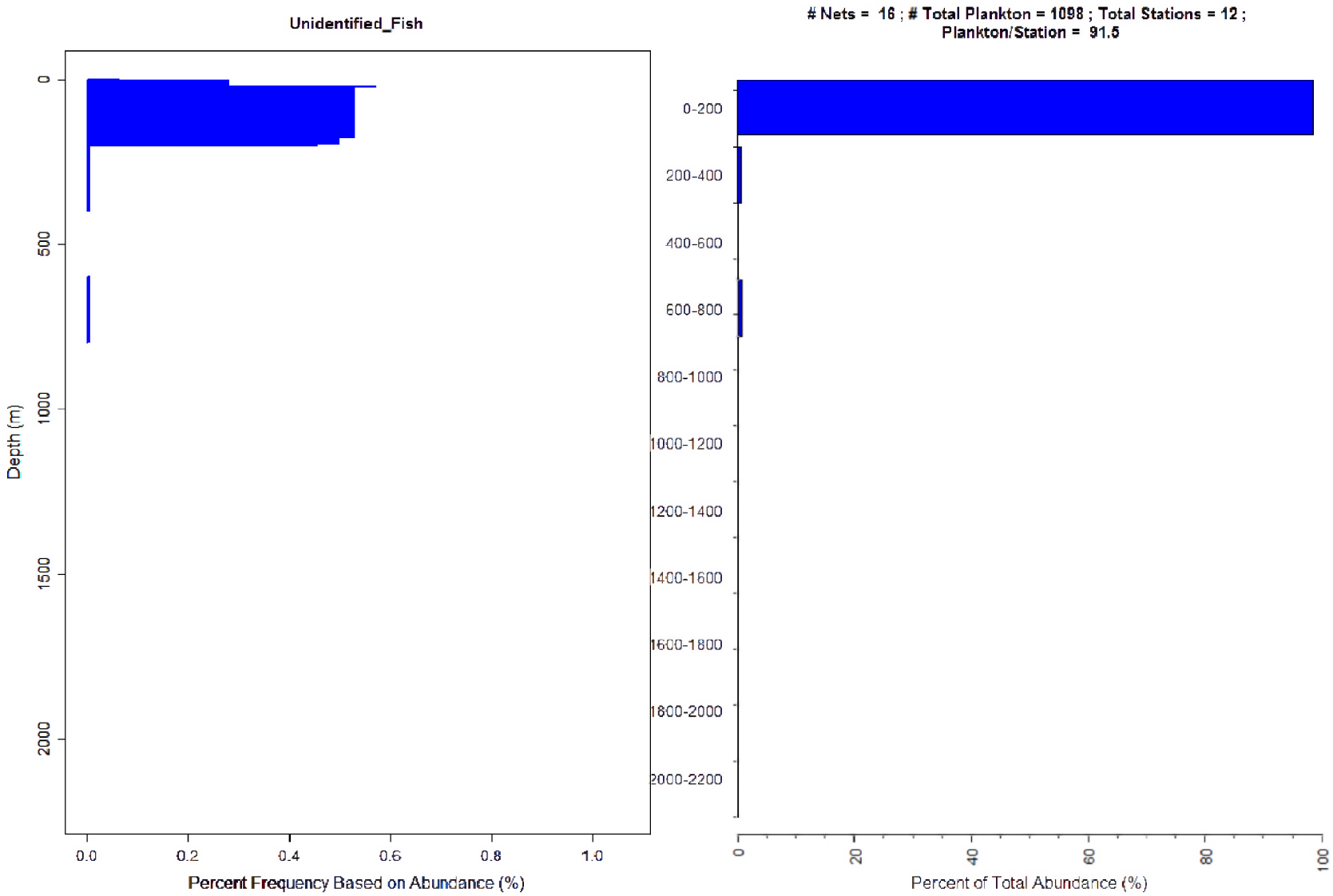
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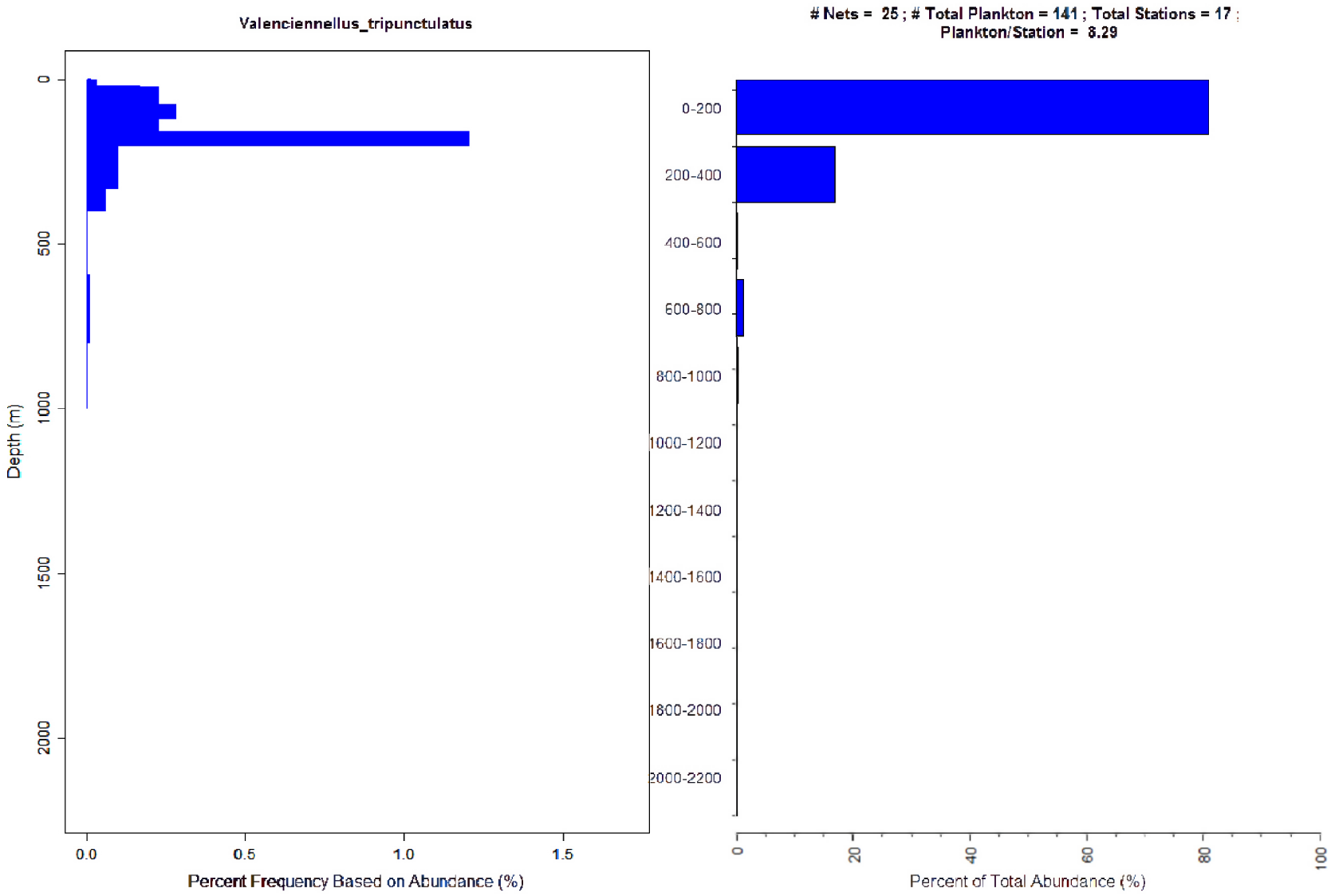
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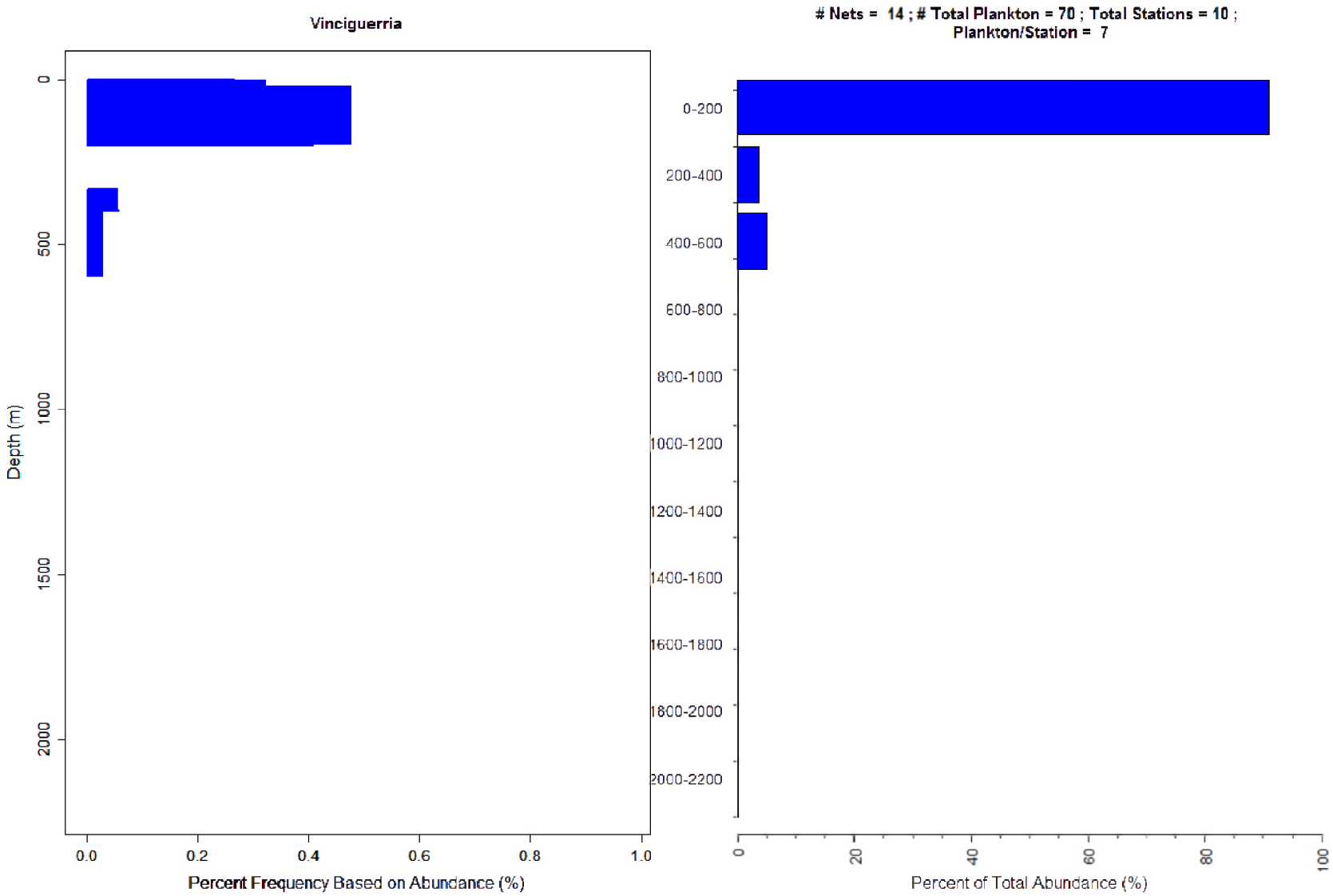
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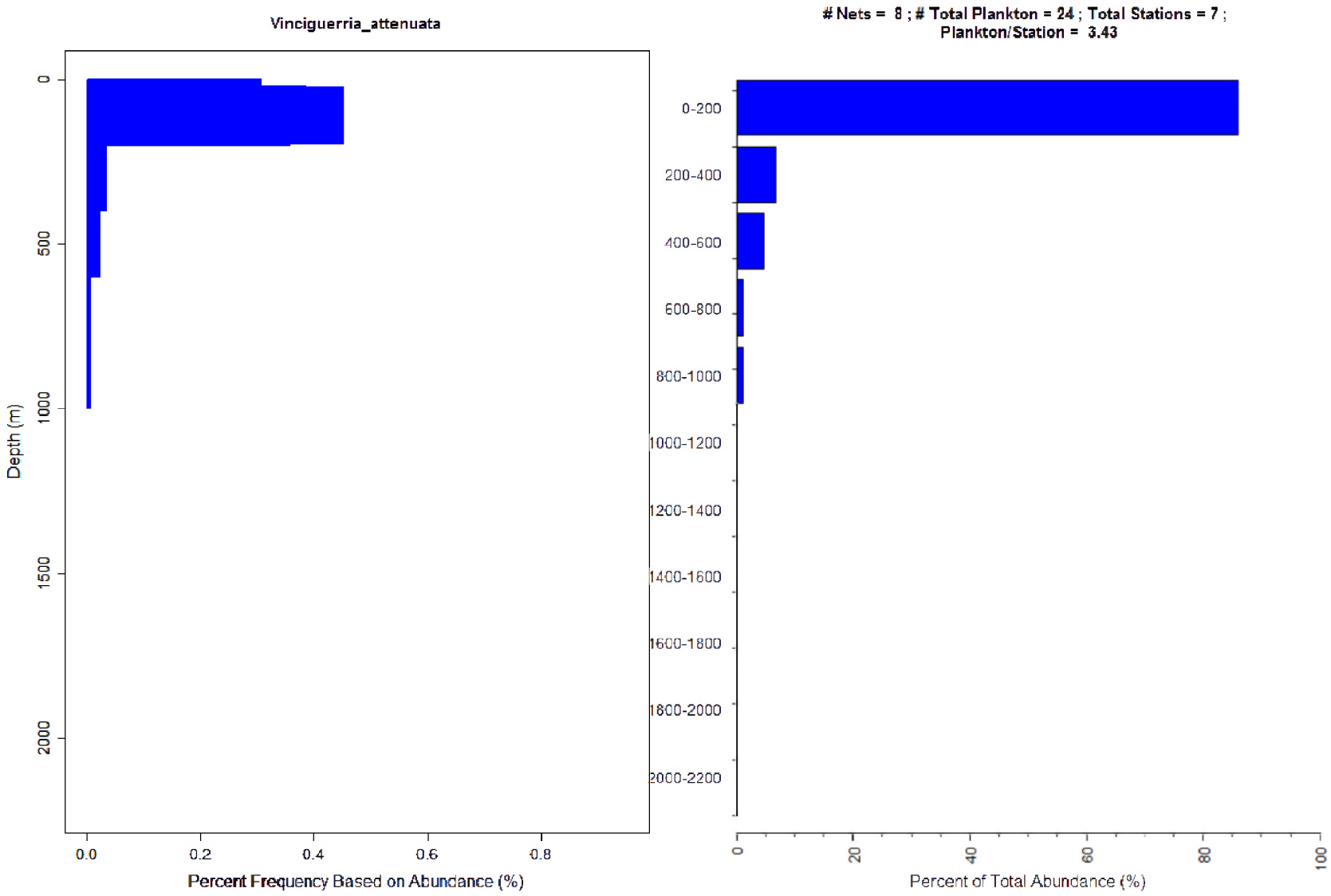
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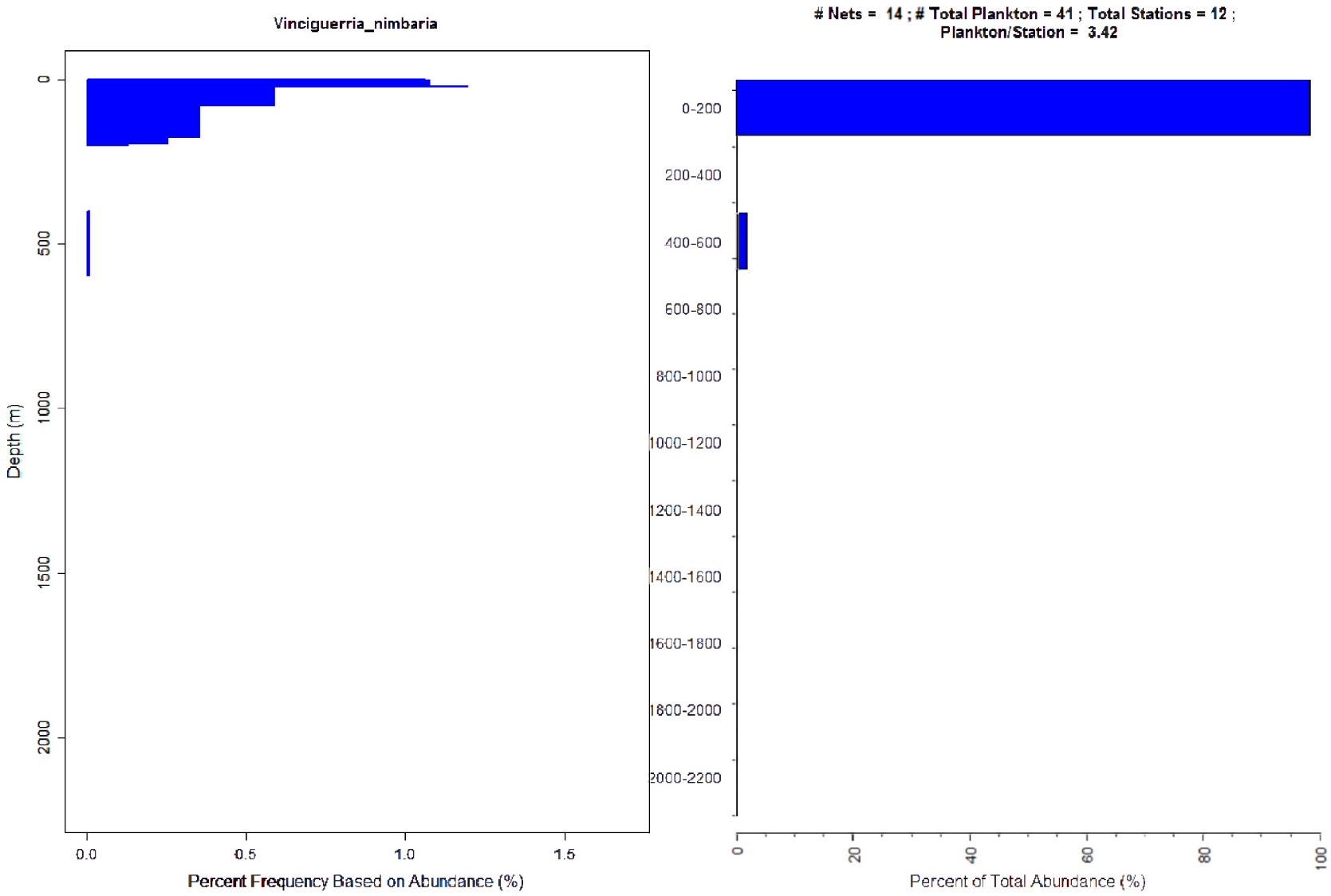
Valenciennellus_tripunctulatus - Deep



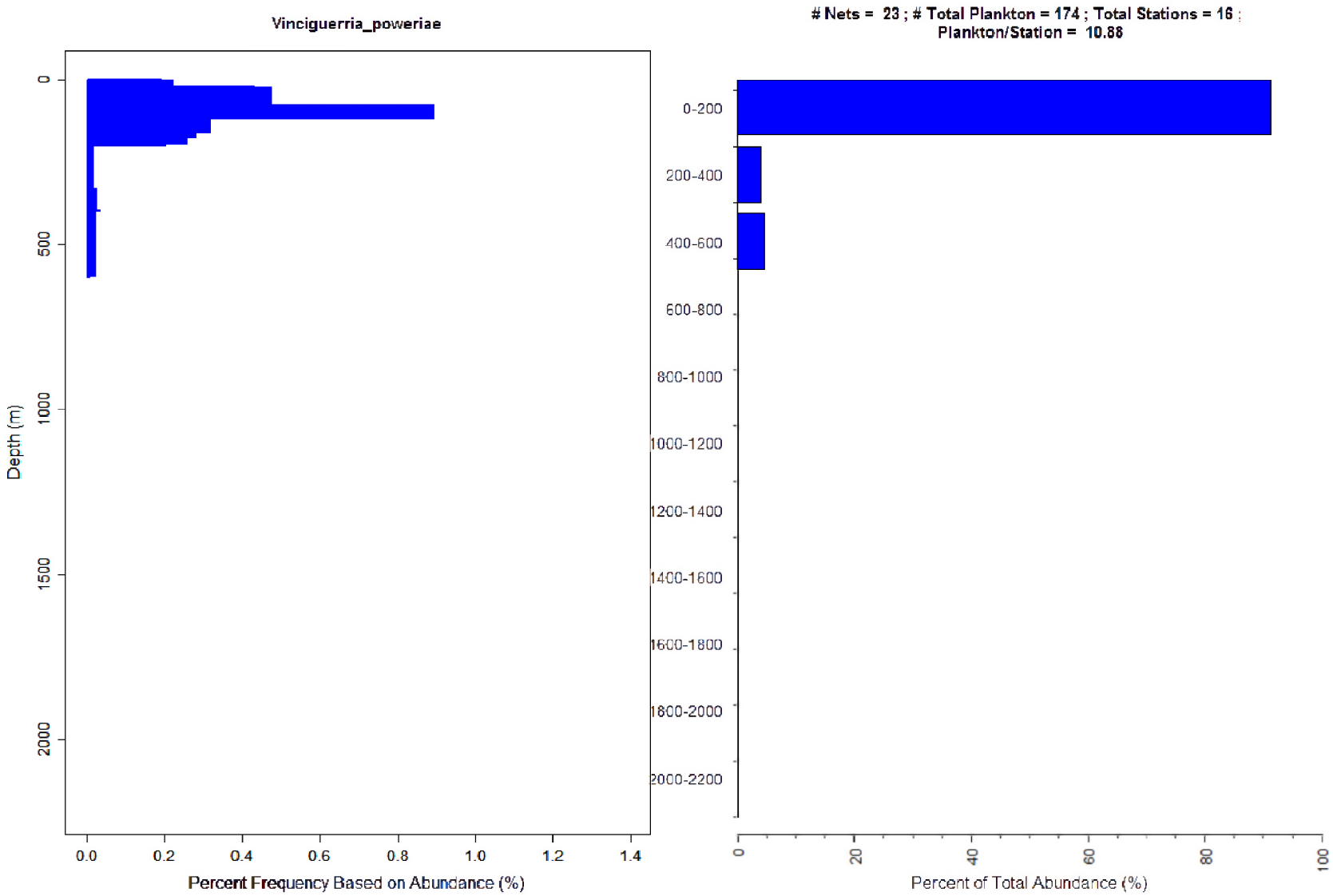
Vinciguerria - Deep



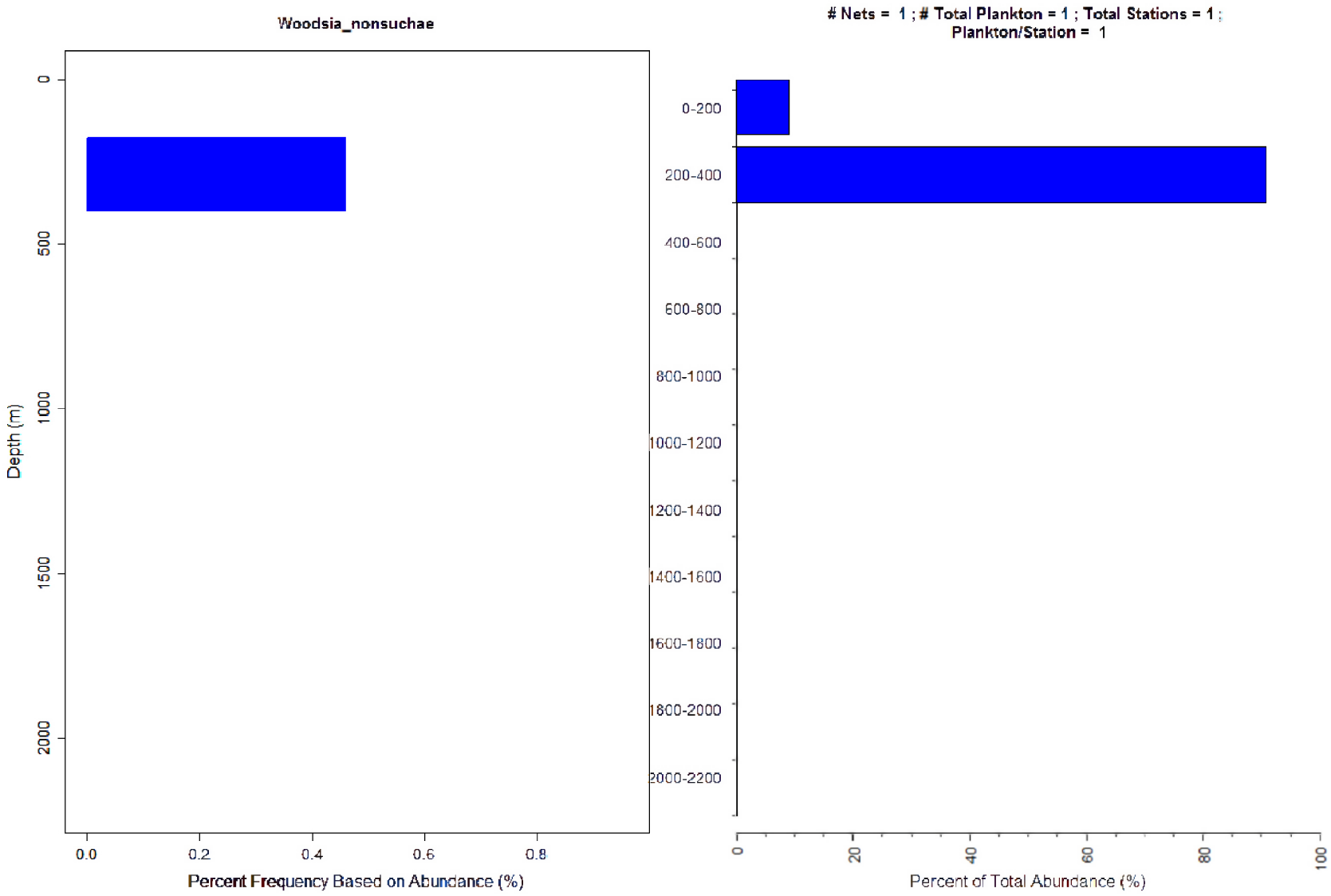
Vinciguerria_attenuata - Deep



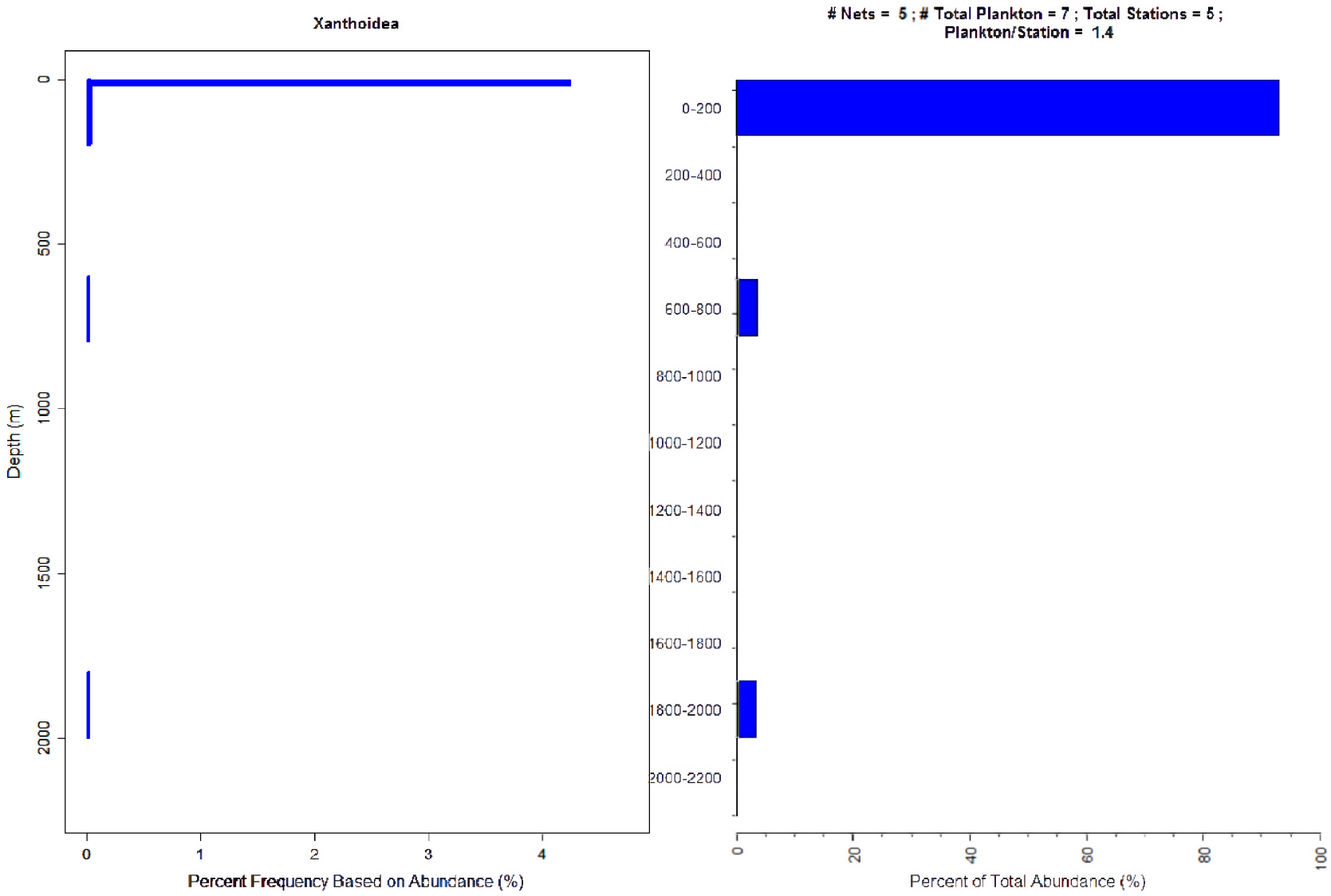
Vinciguerria_nimbaria - Deep



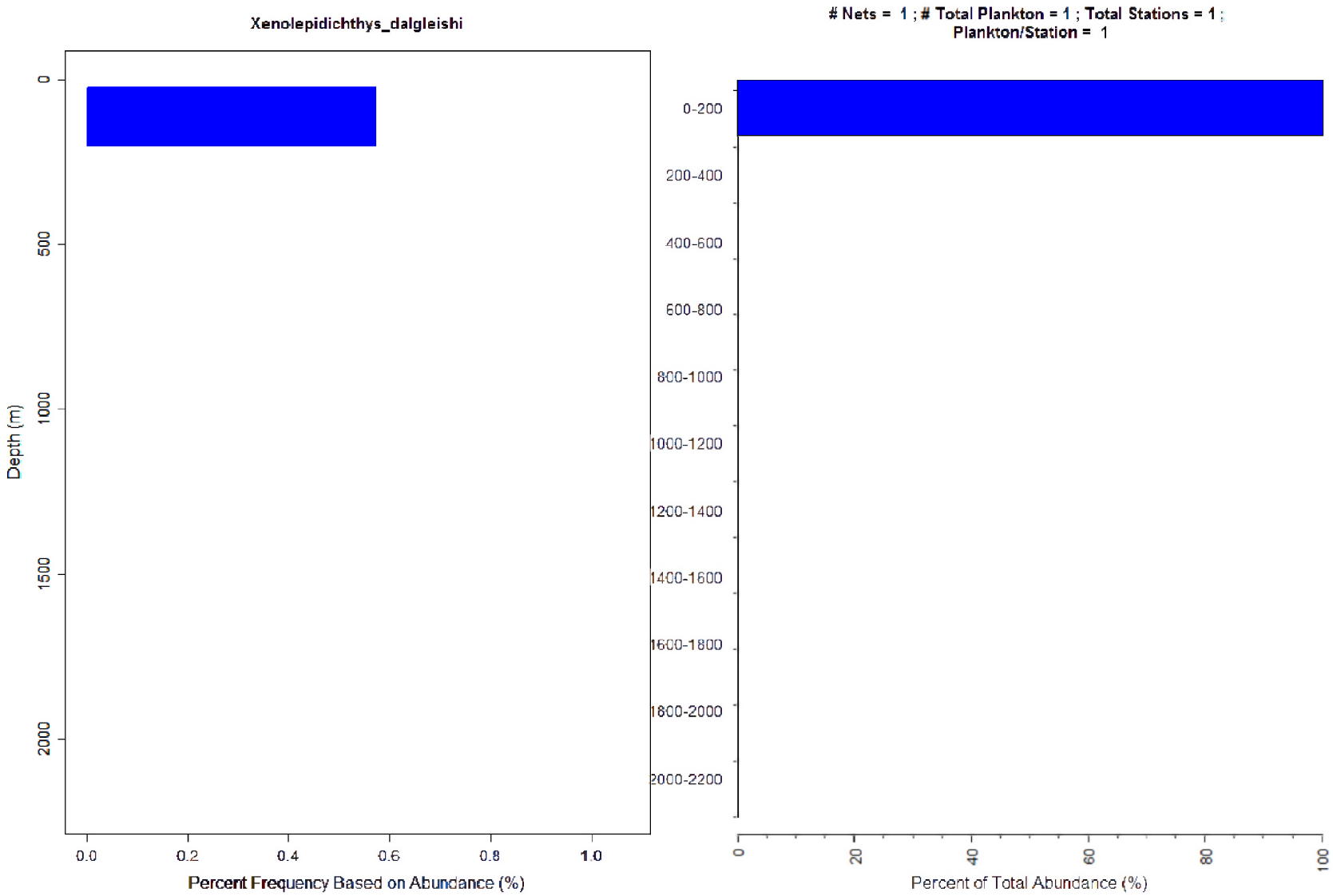
Vinciguerria_poweriae - Deep



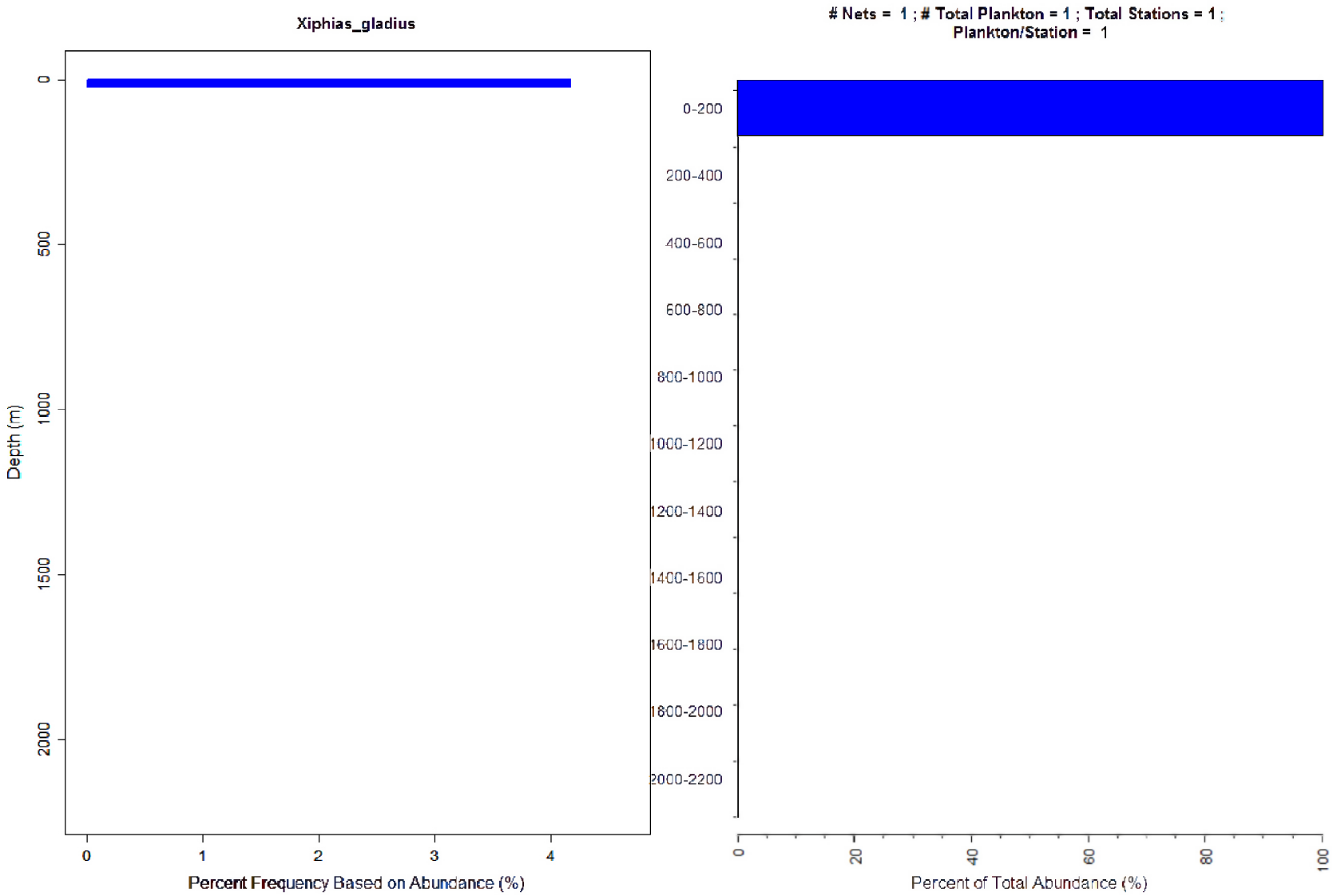
Woodsia_nonsuchae - Deep



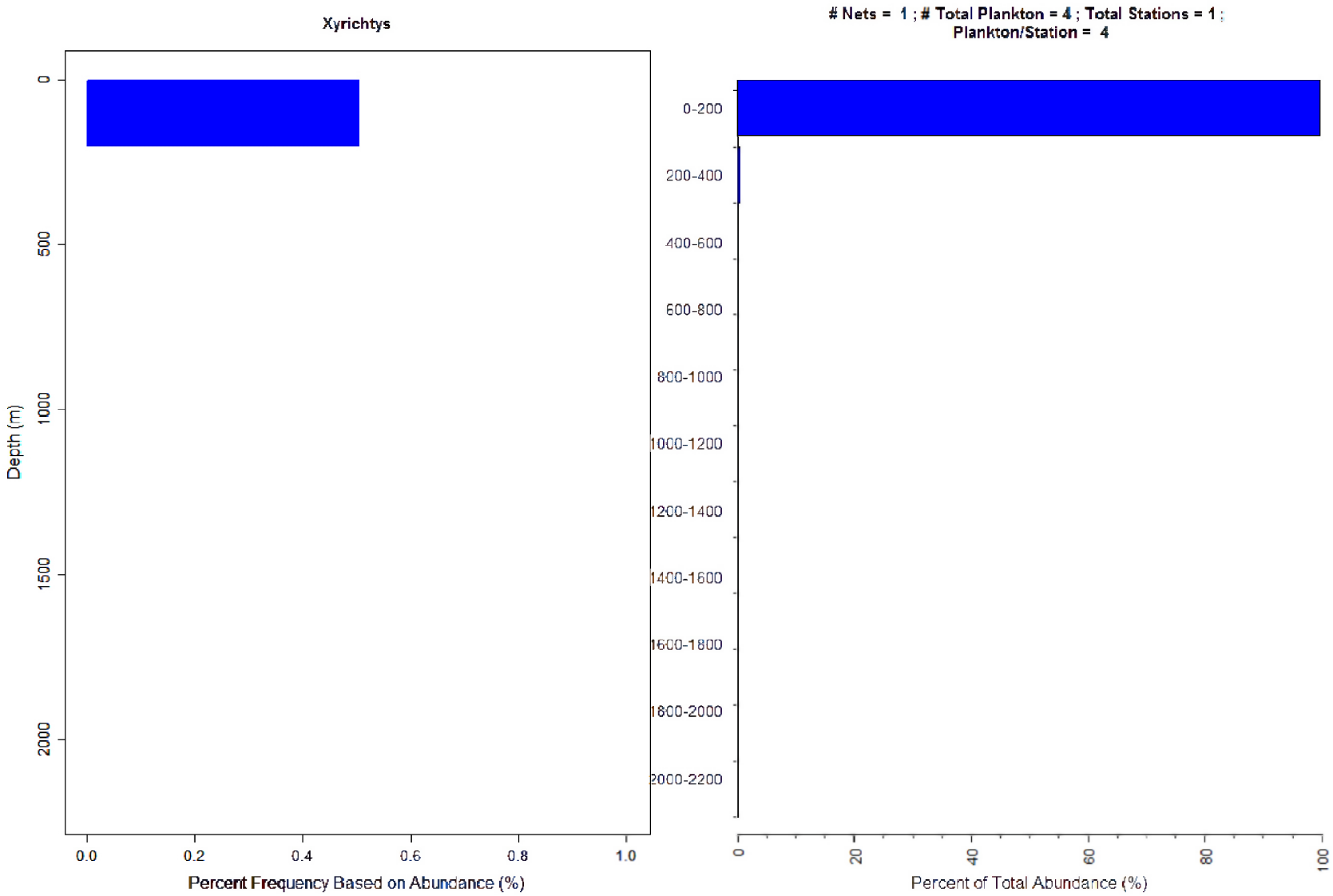
Xanthoidea - Deep



Xenolepidichthys_dalgleishi - Deep



Xiphias_gladius - Deep



Xyrichtys - Deep

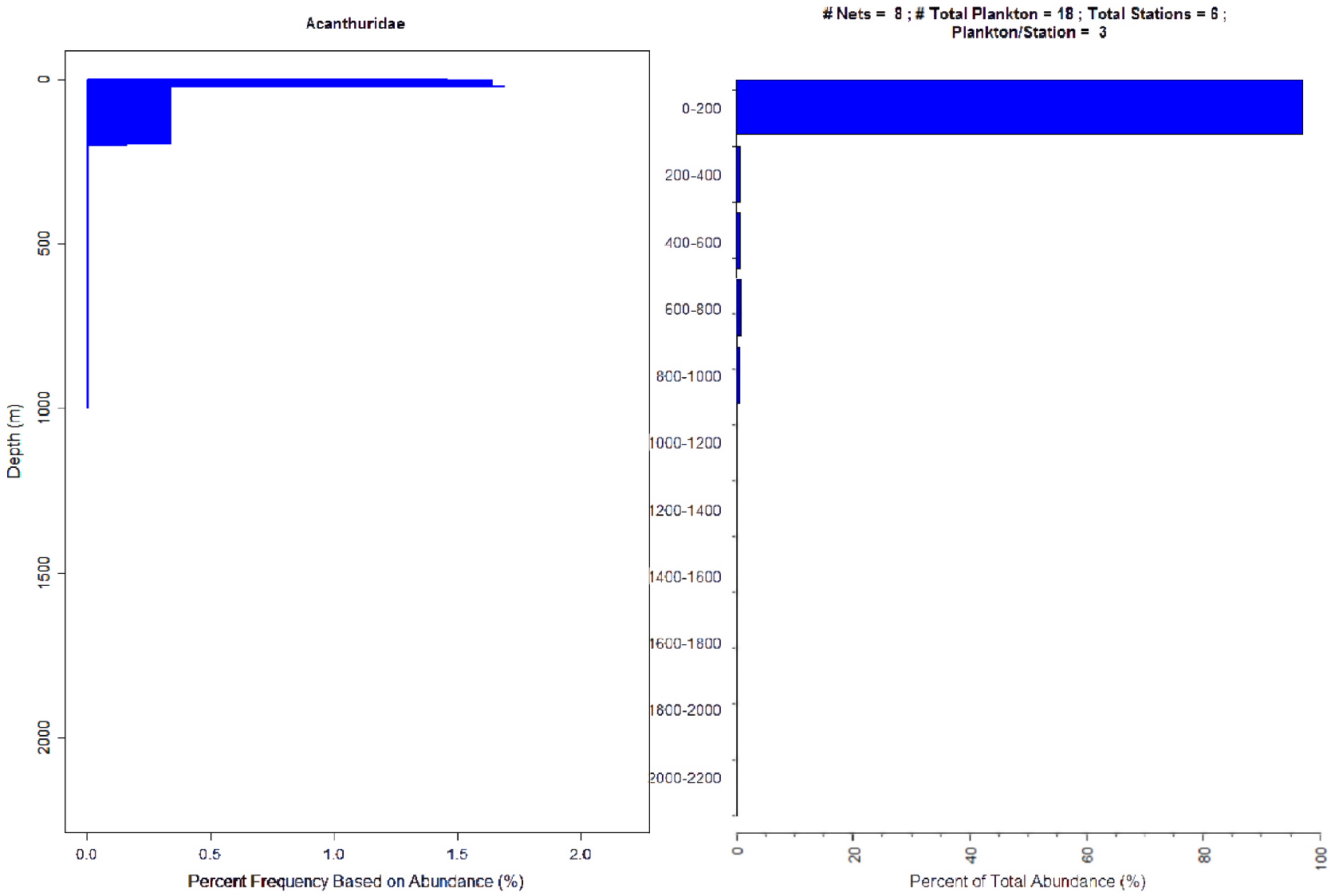
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

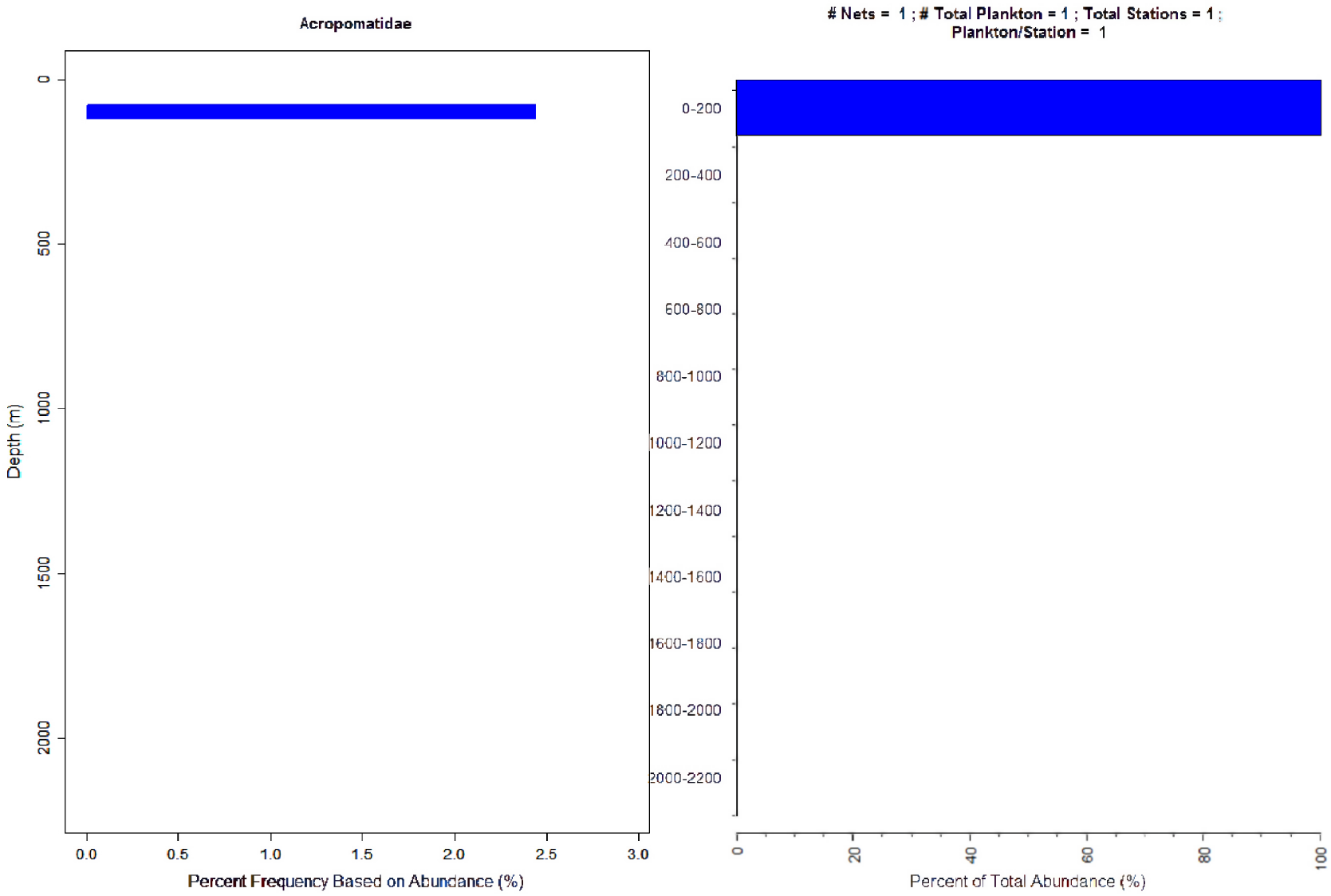
Appendix E2 – NRDA Tier1A Deep MOC1 Plots Family Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

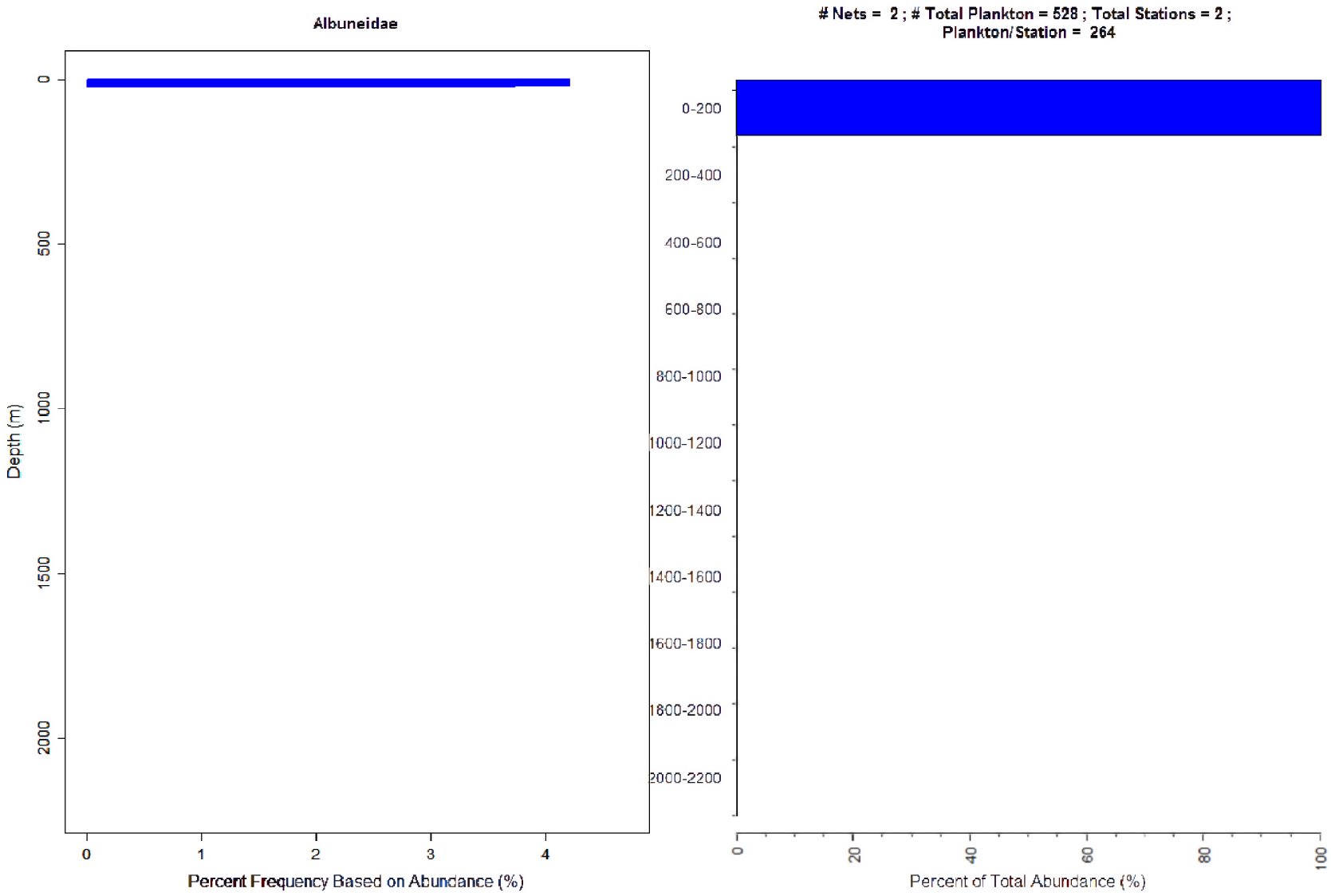
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



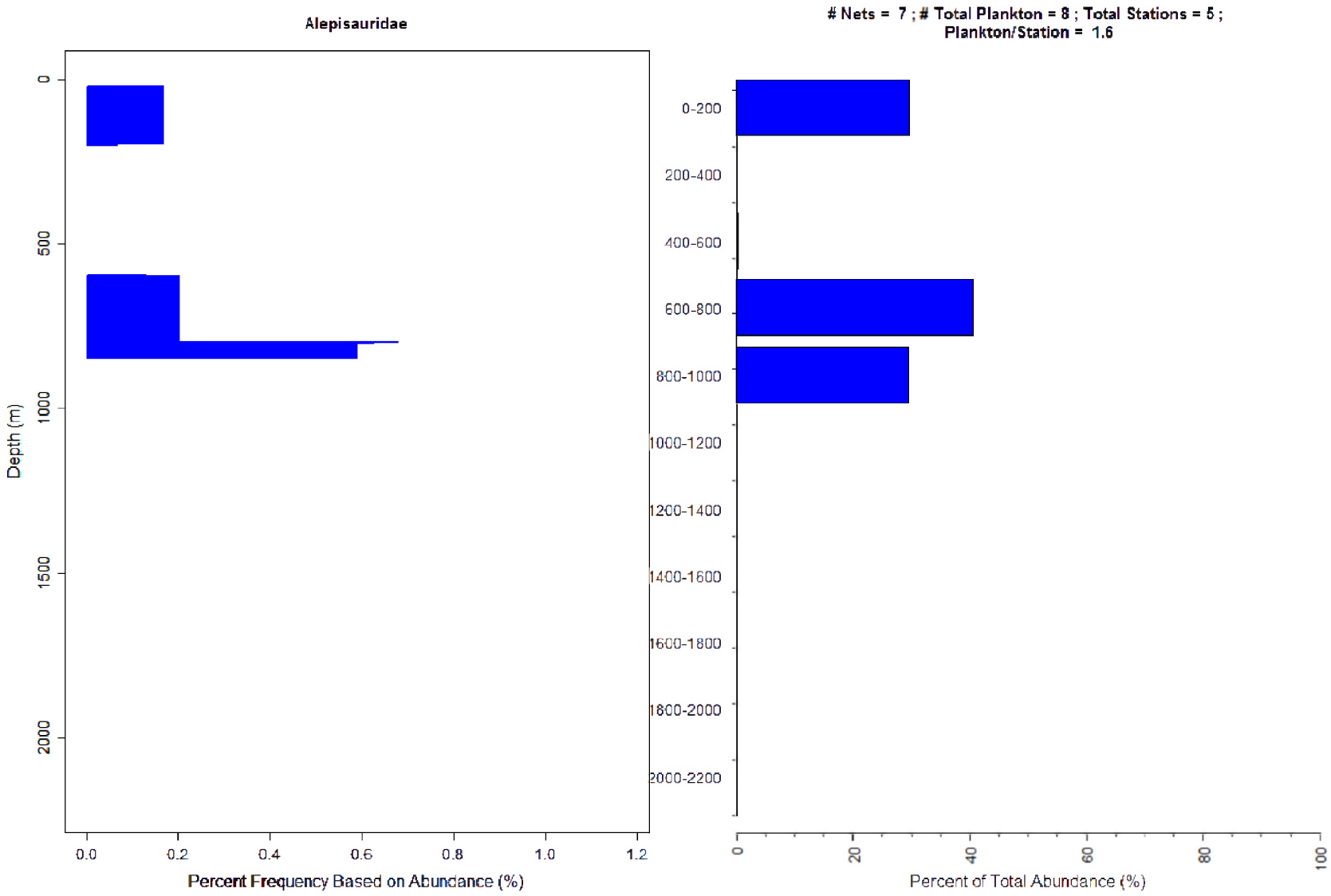
Acanthuridae - Deep



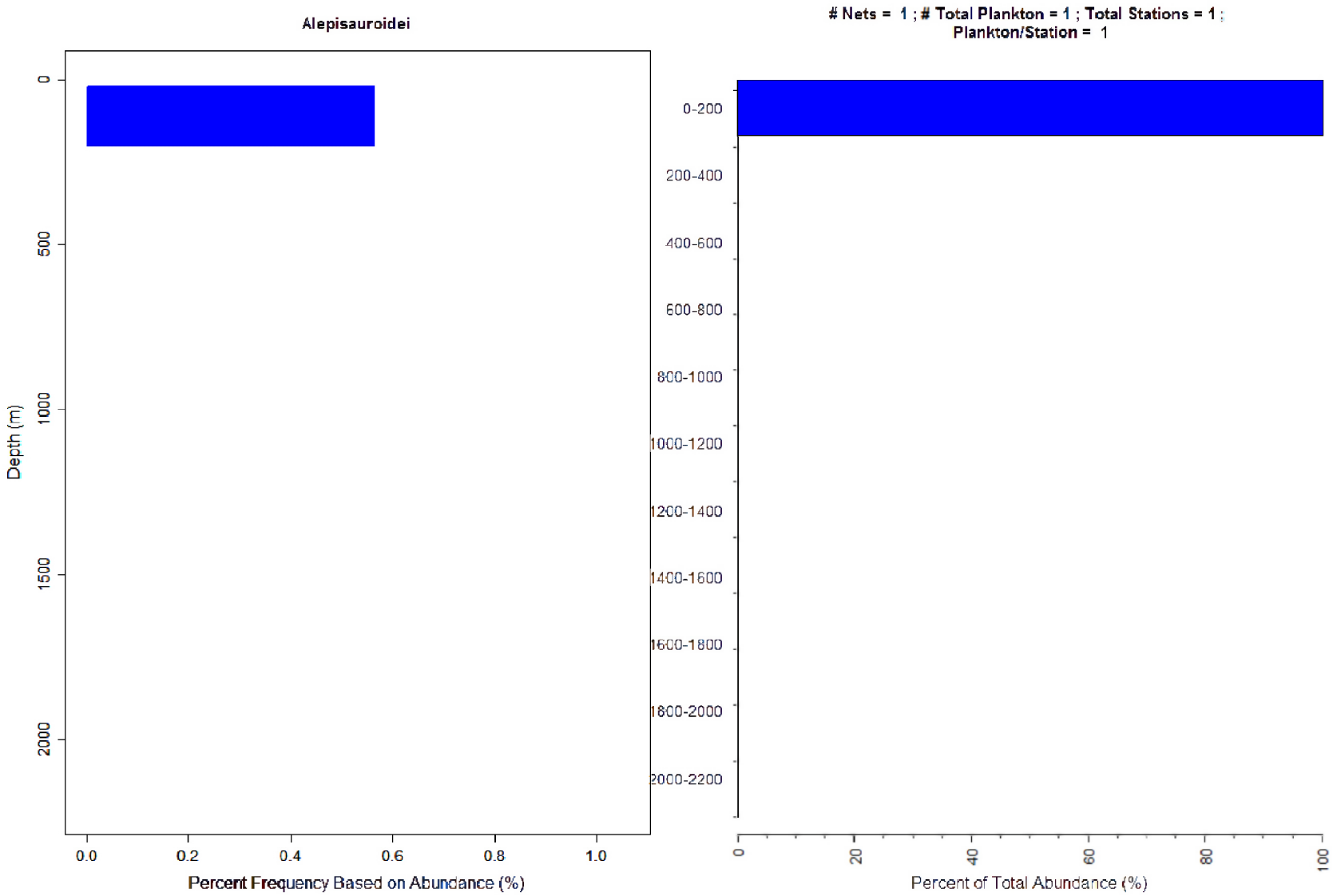
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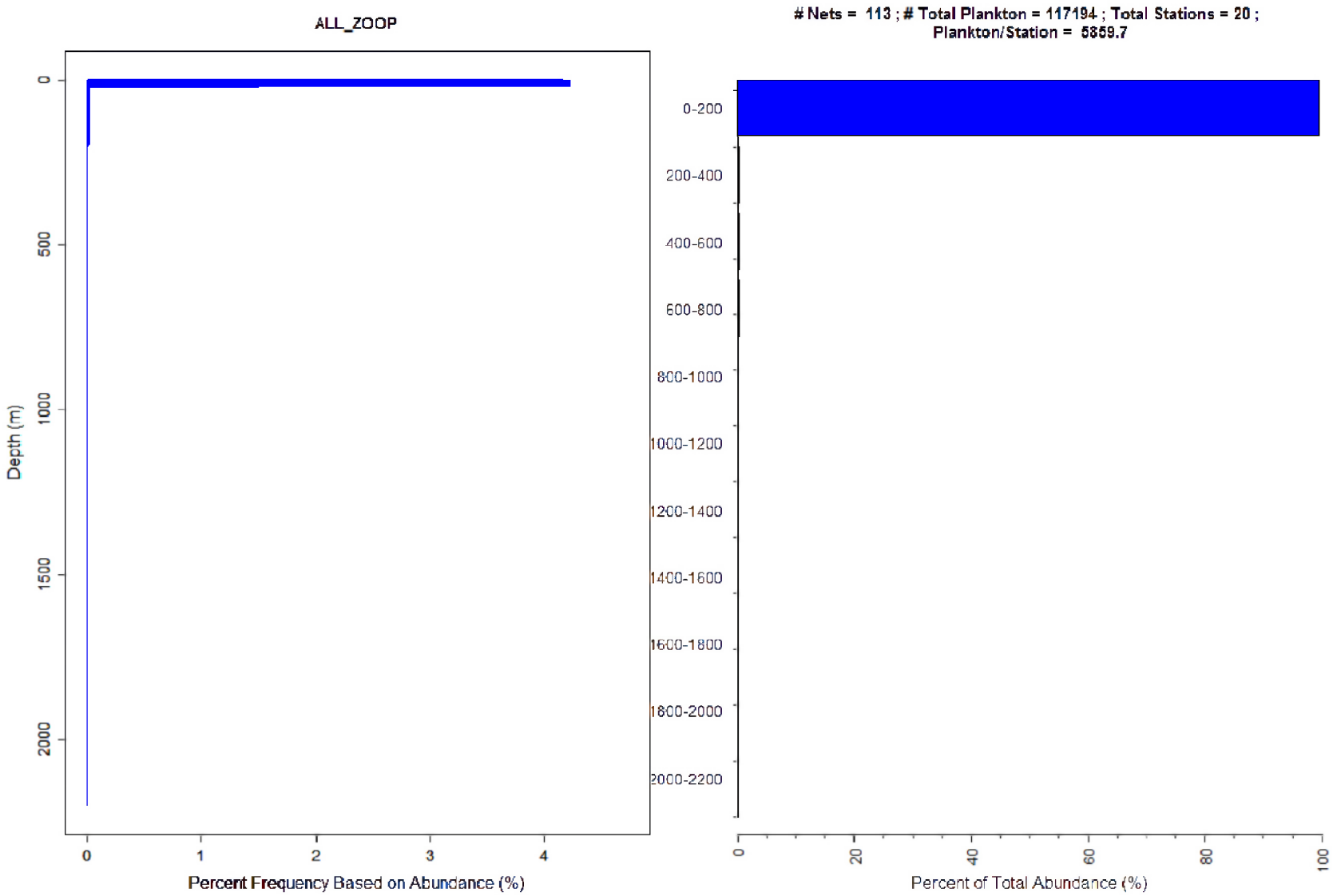
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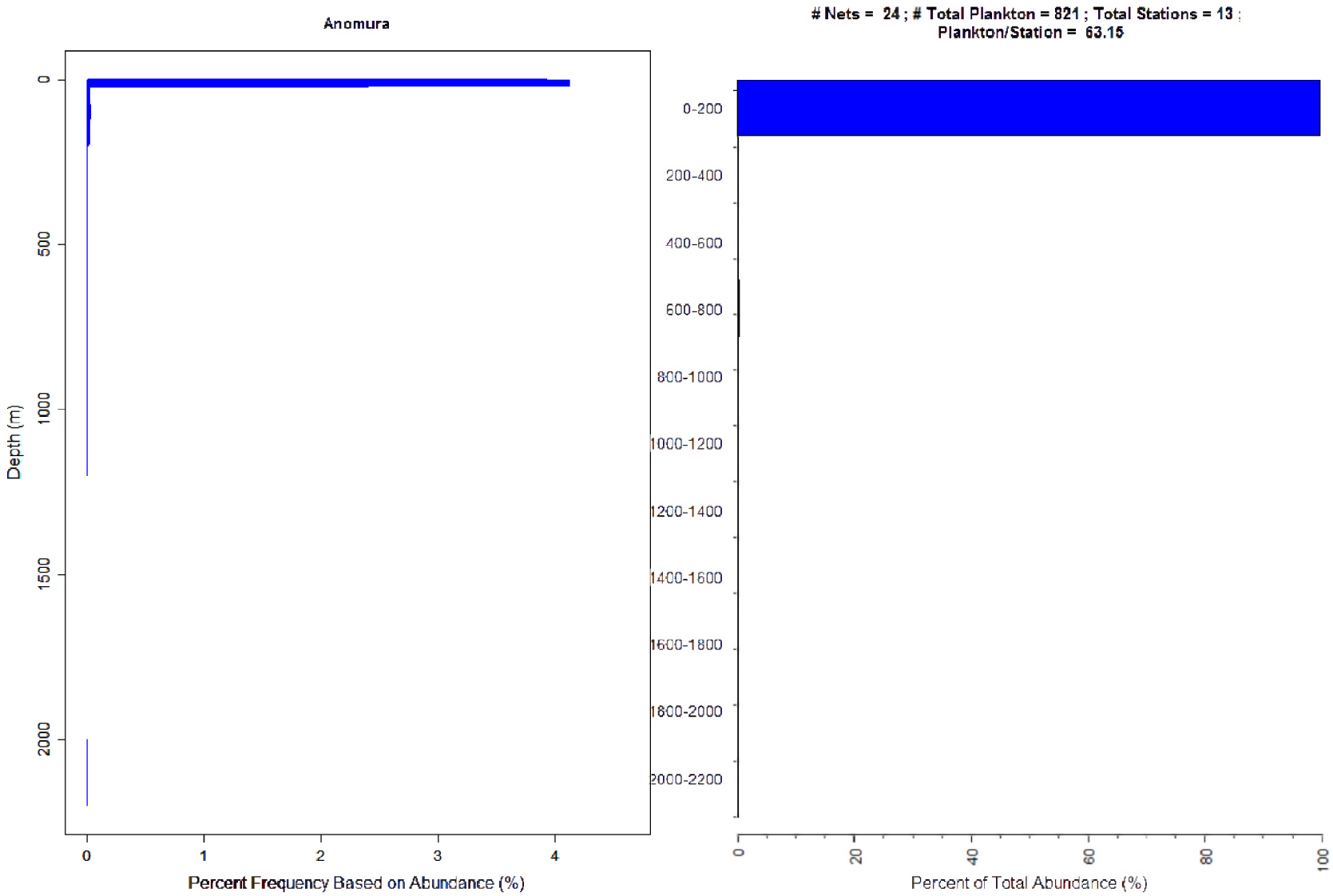
Alepisauridae - Deep



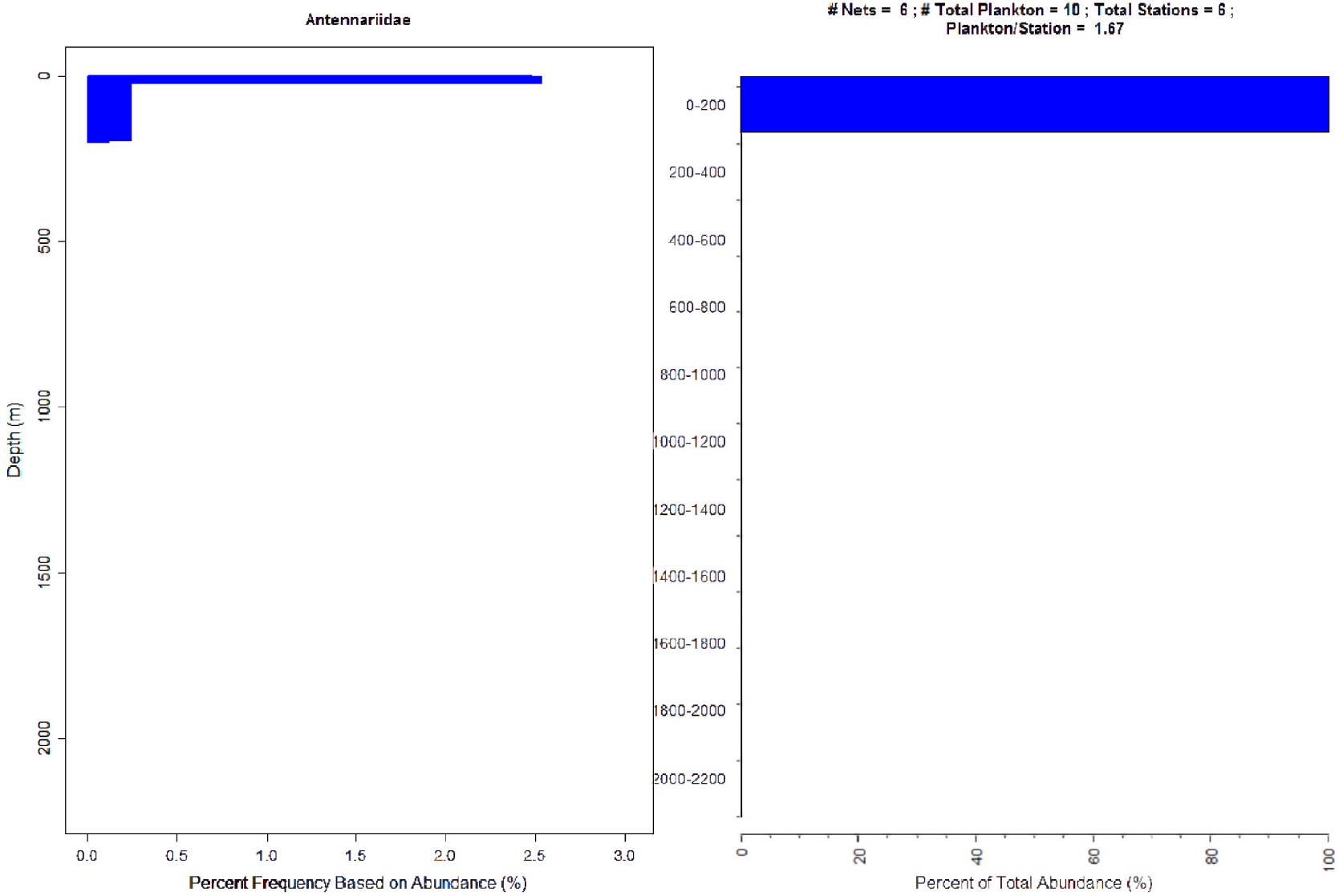
Alepisauroidei - Deep



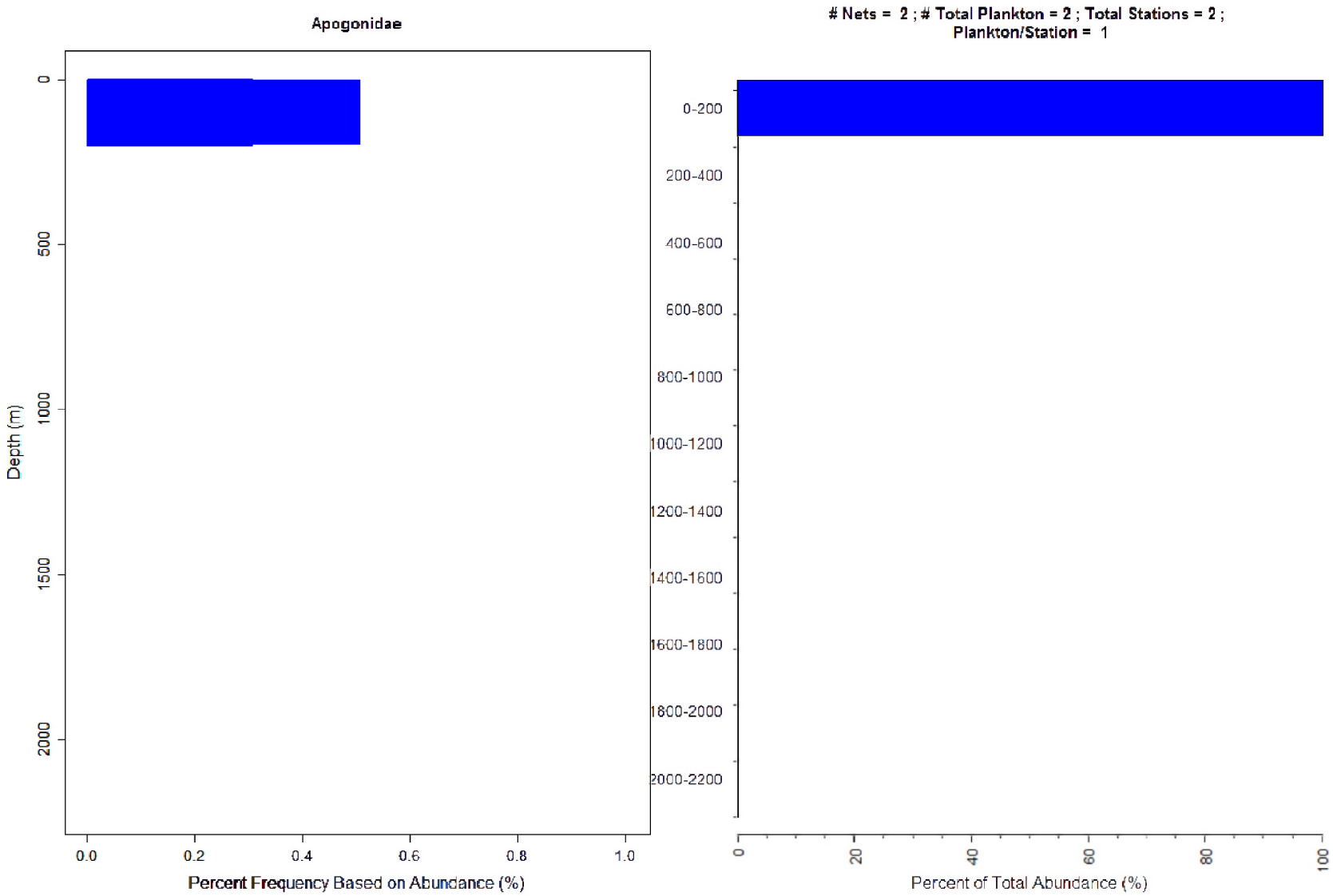
ALL_ZOOP - Deep



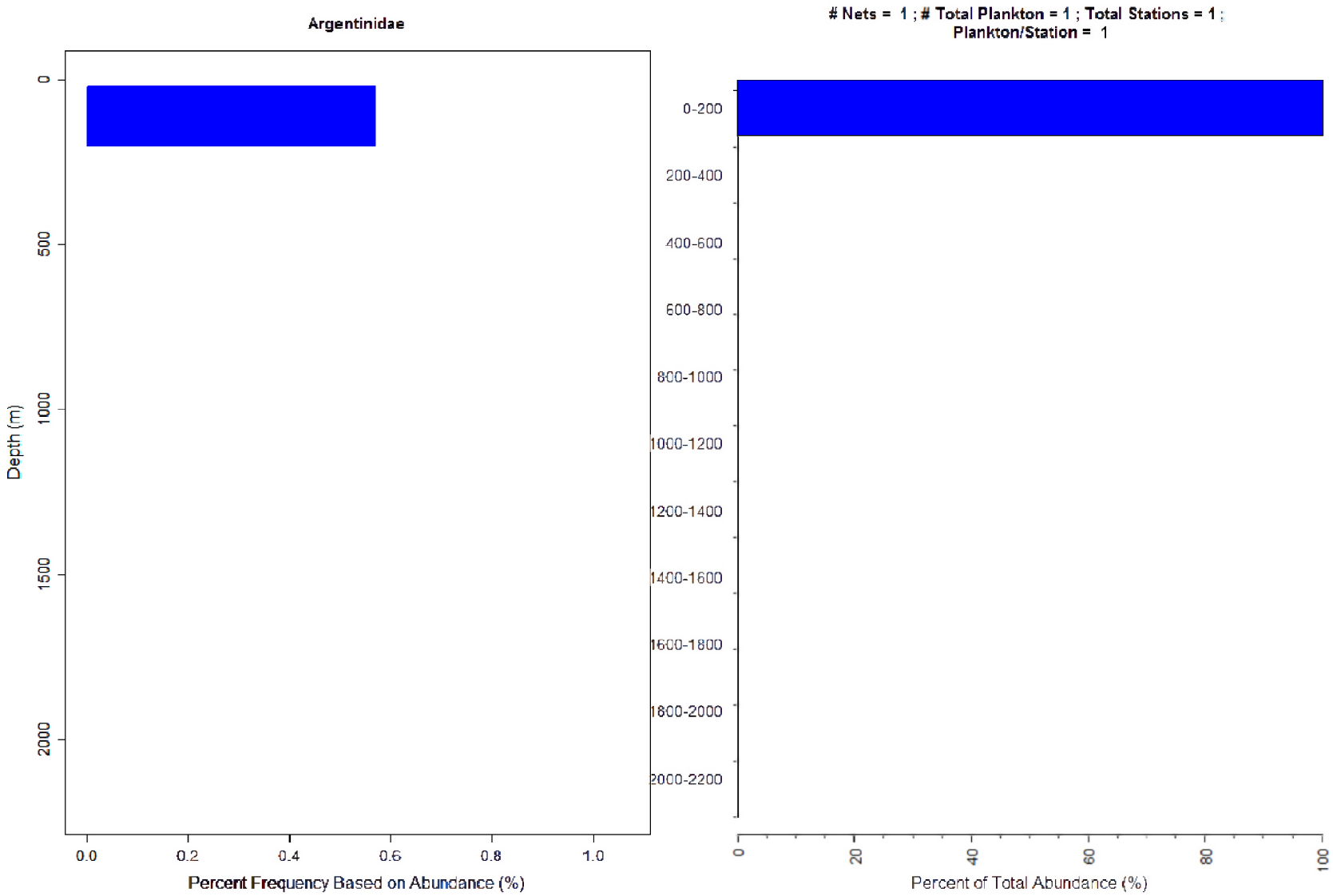
Anomura - Deep



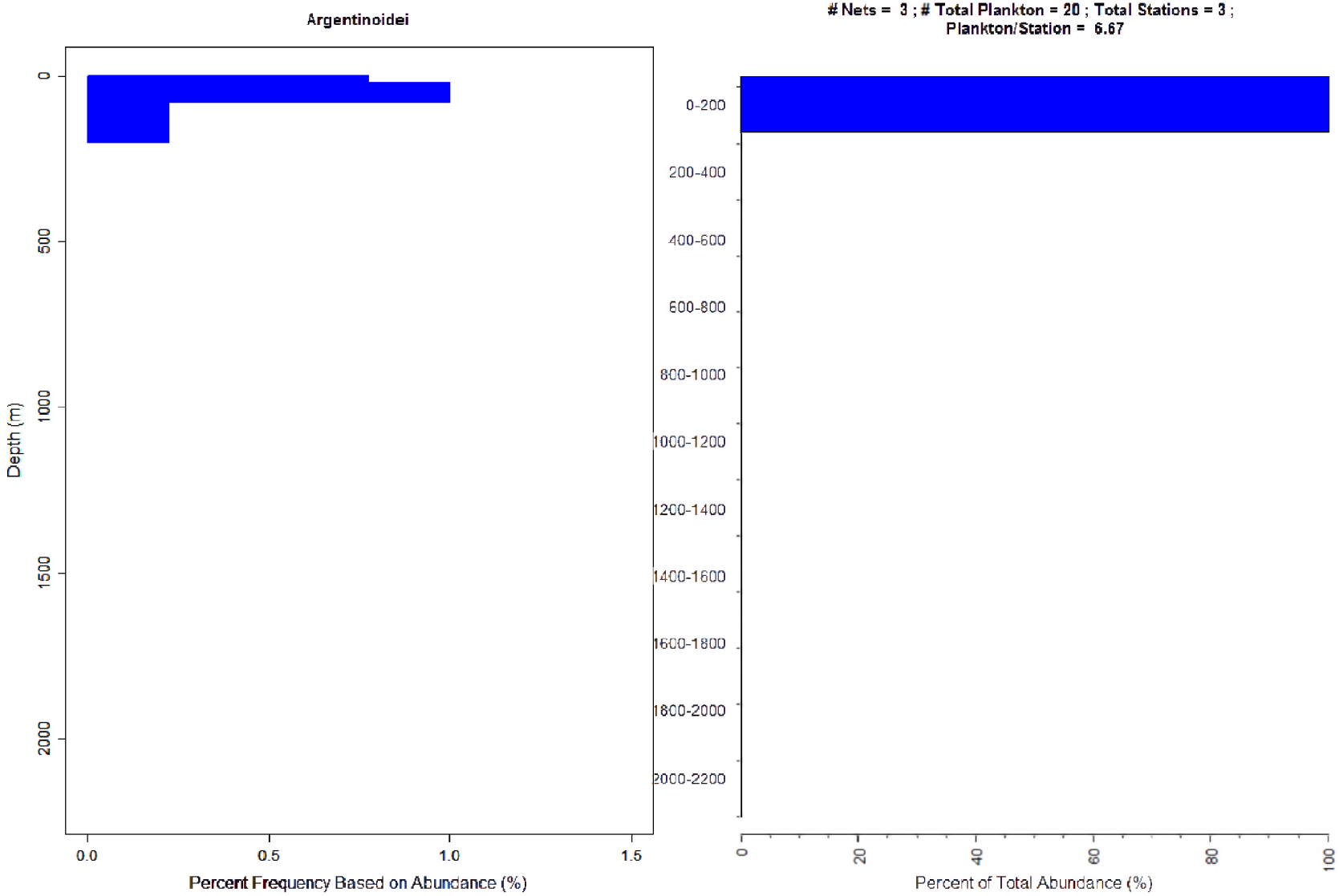
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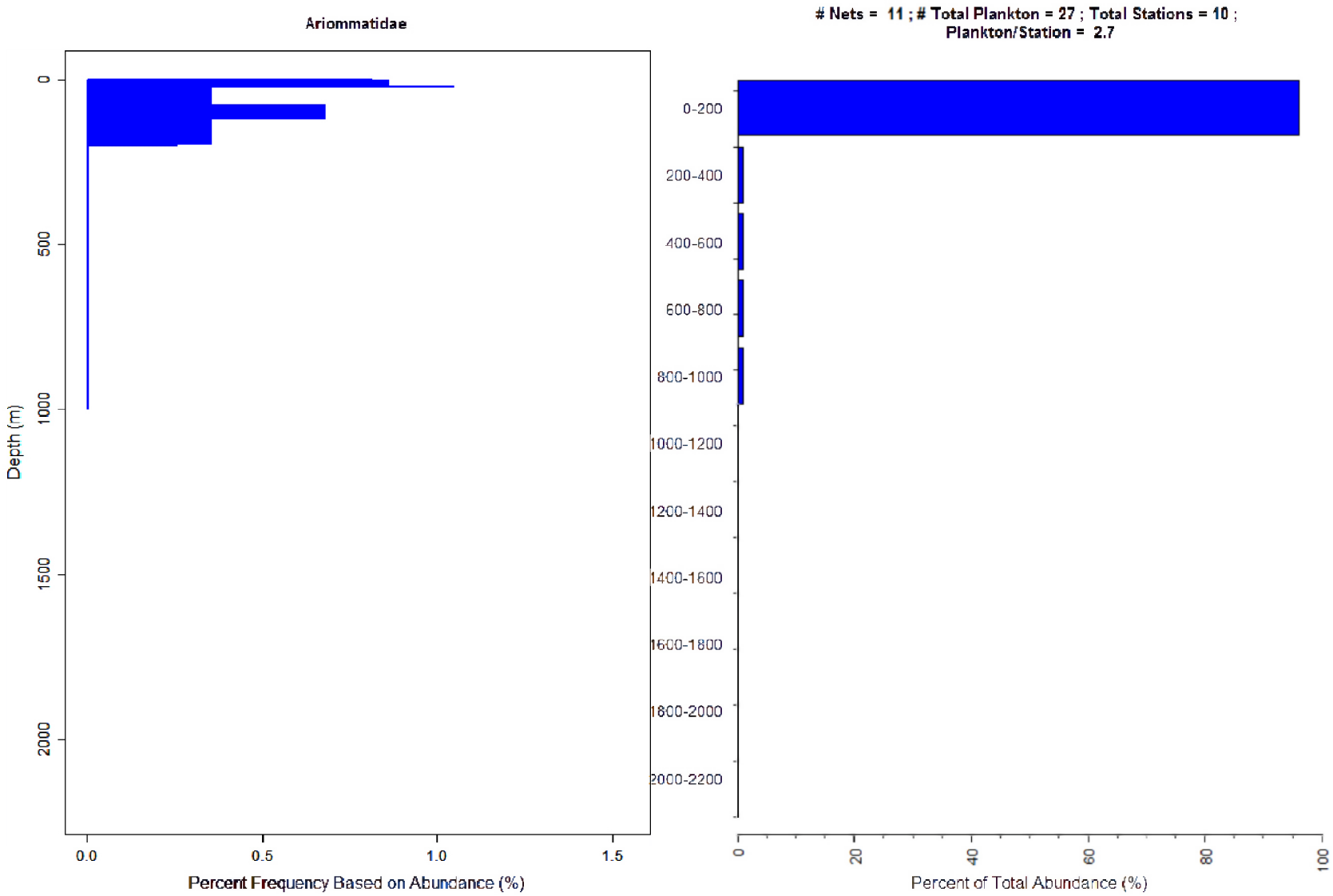
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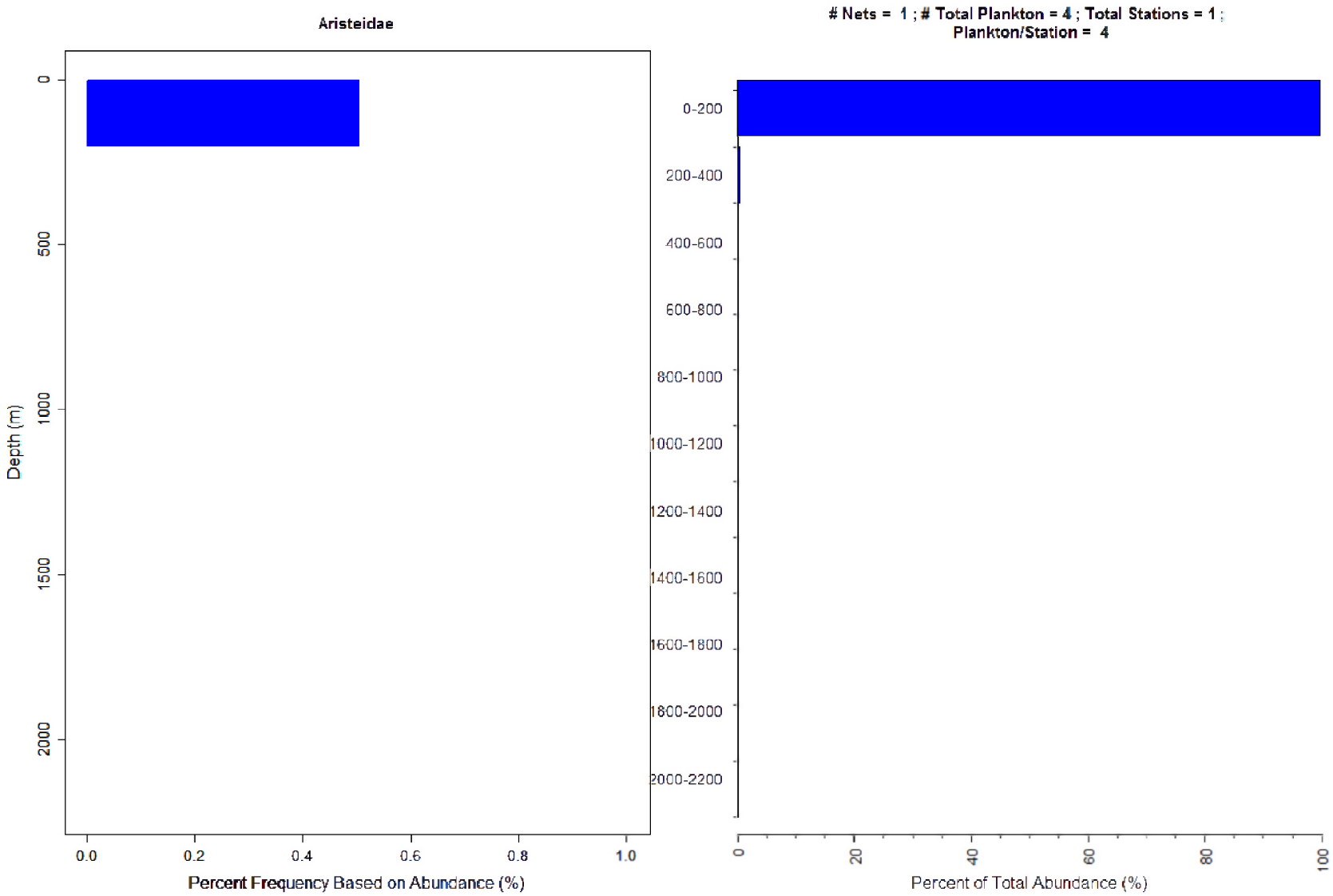
Argentinidae - Deep



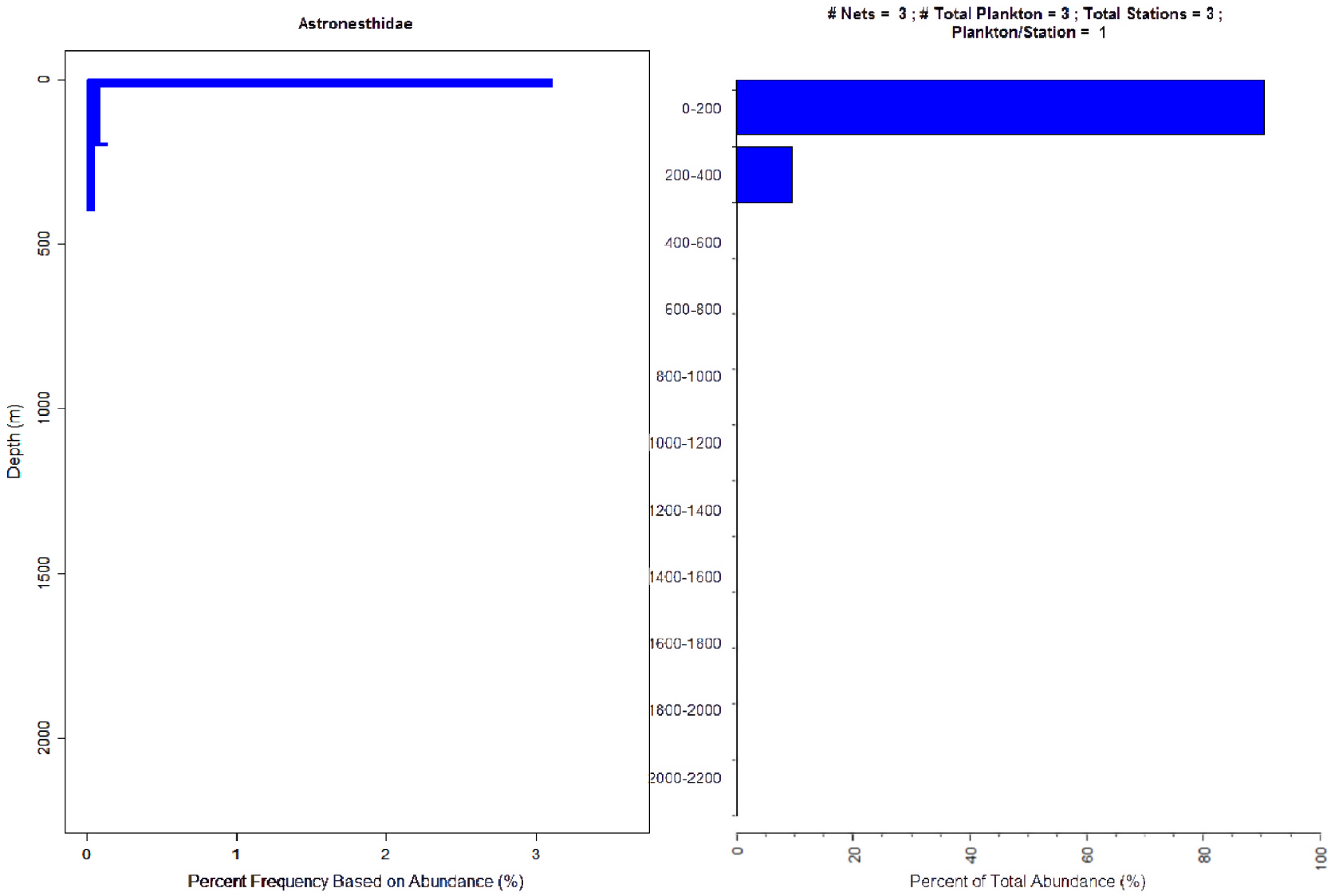
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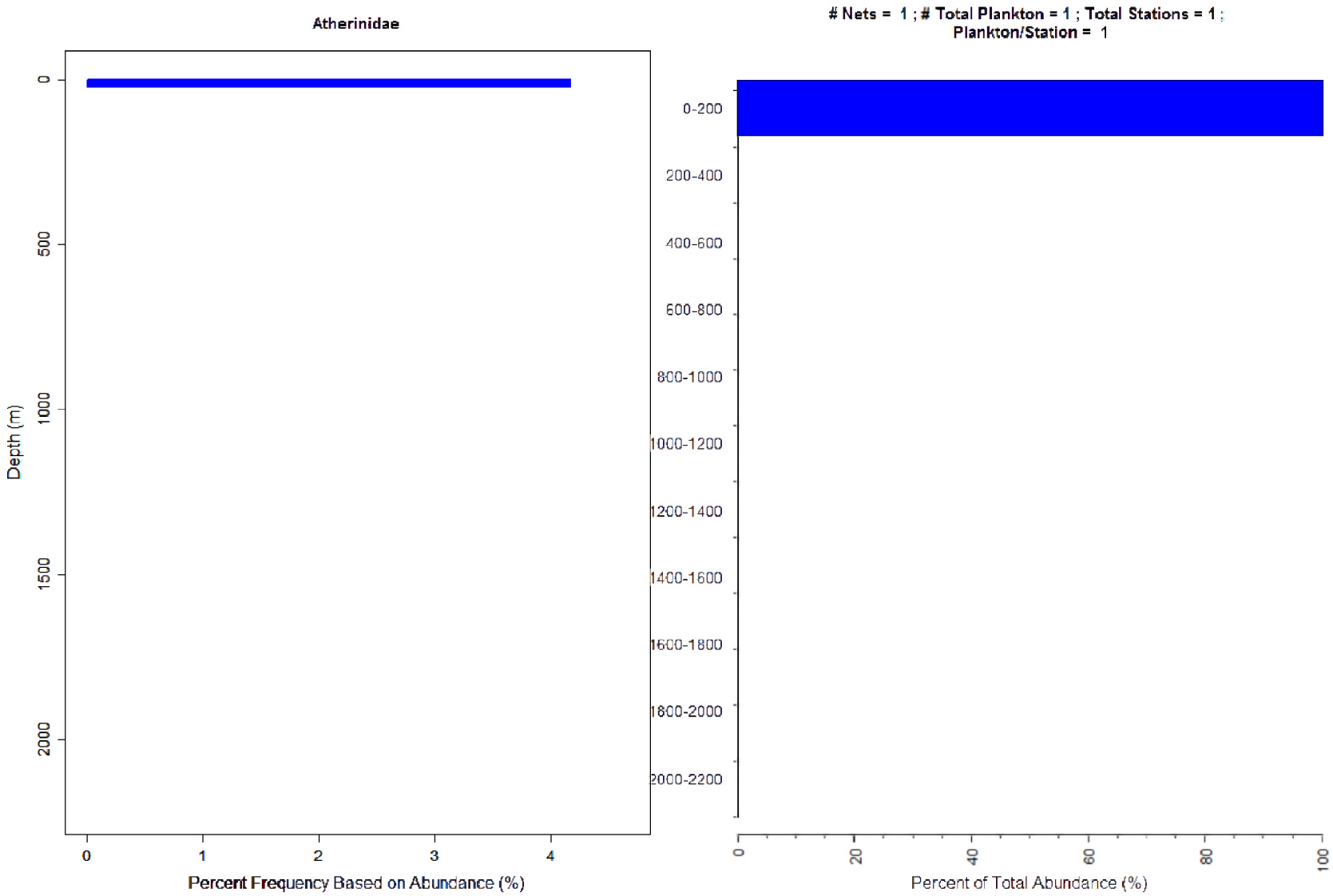
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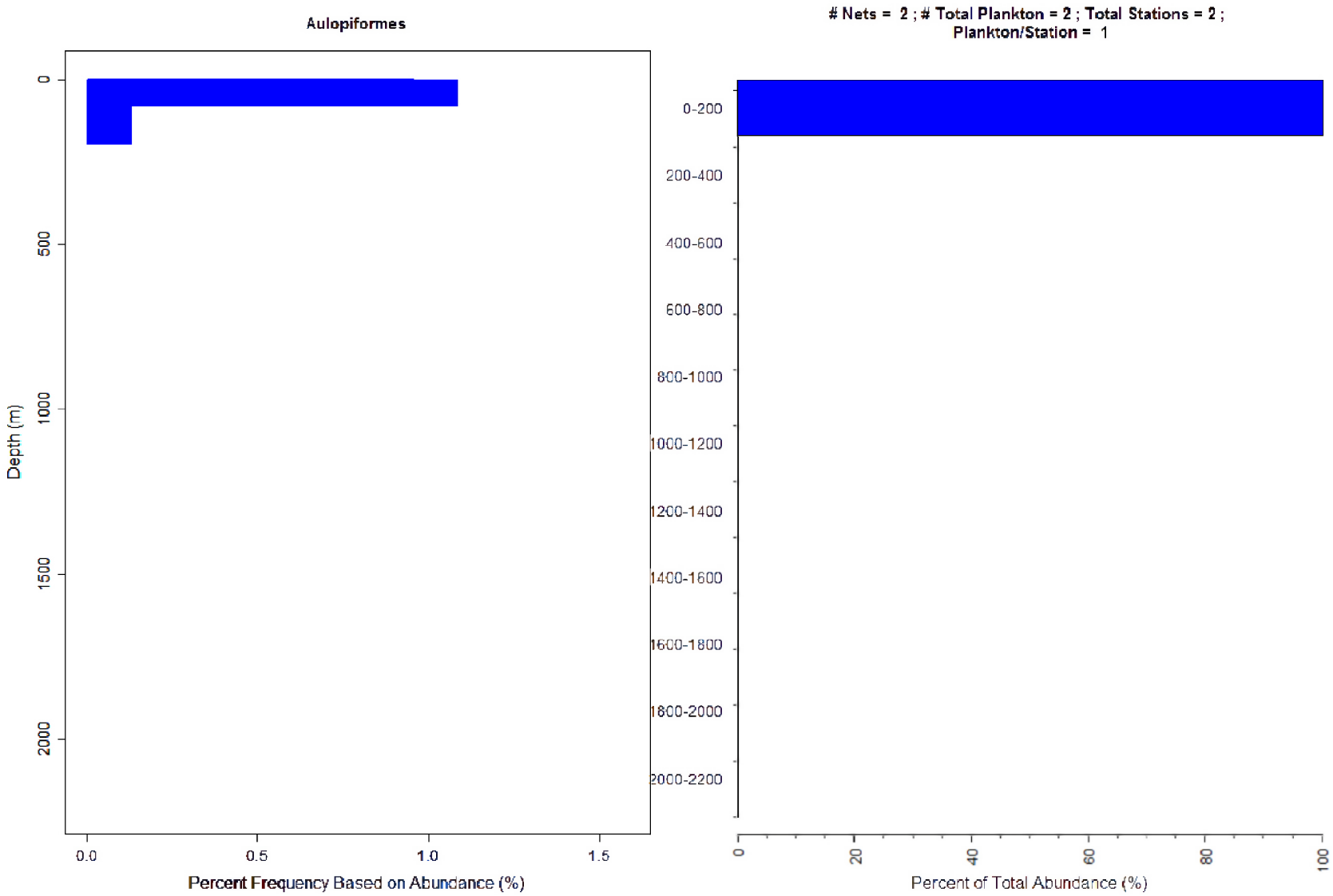
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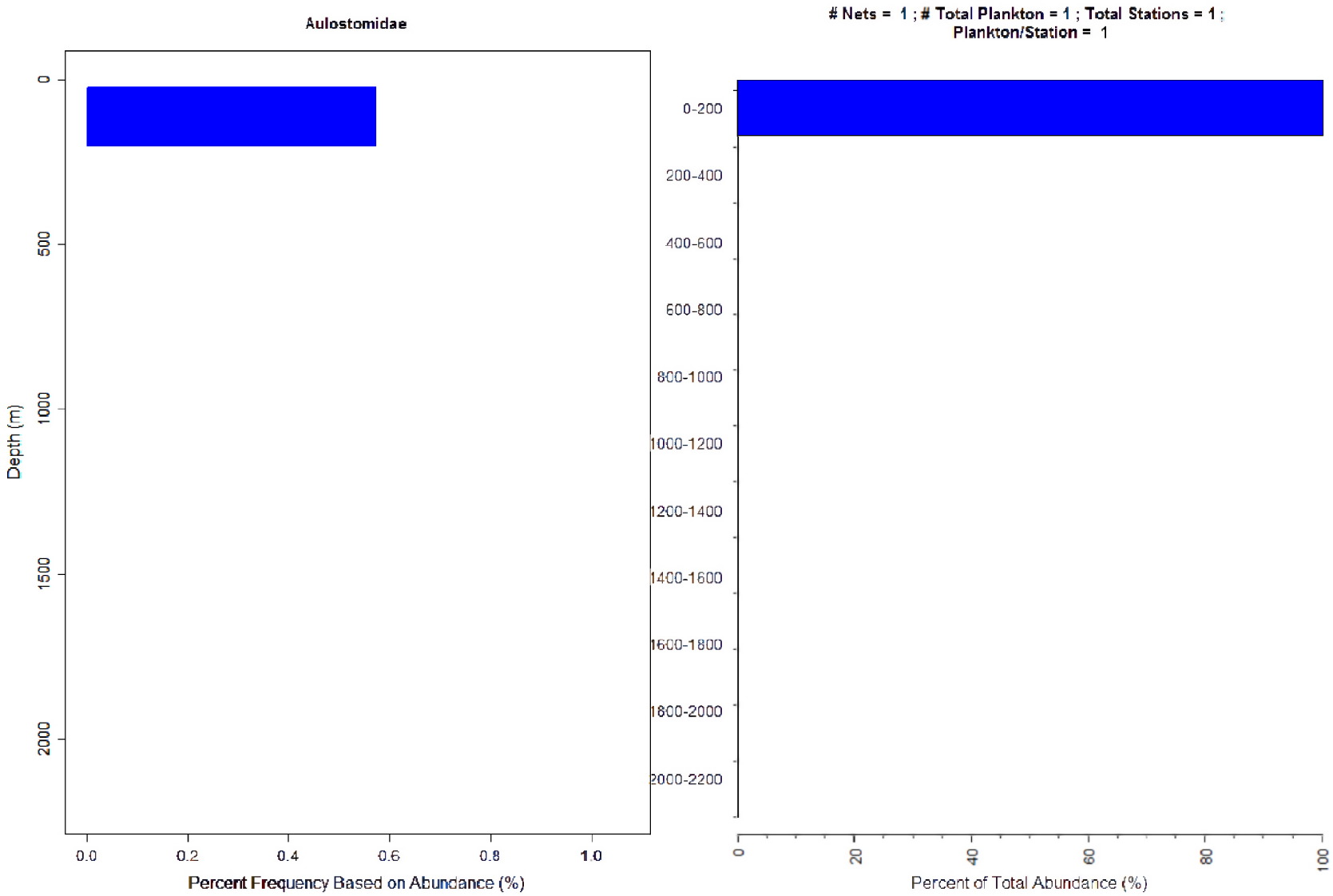
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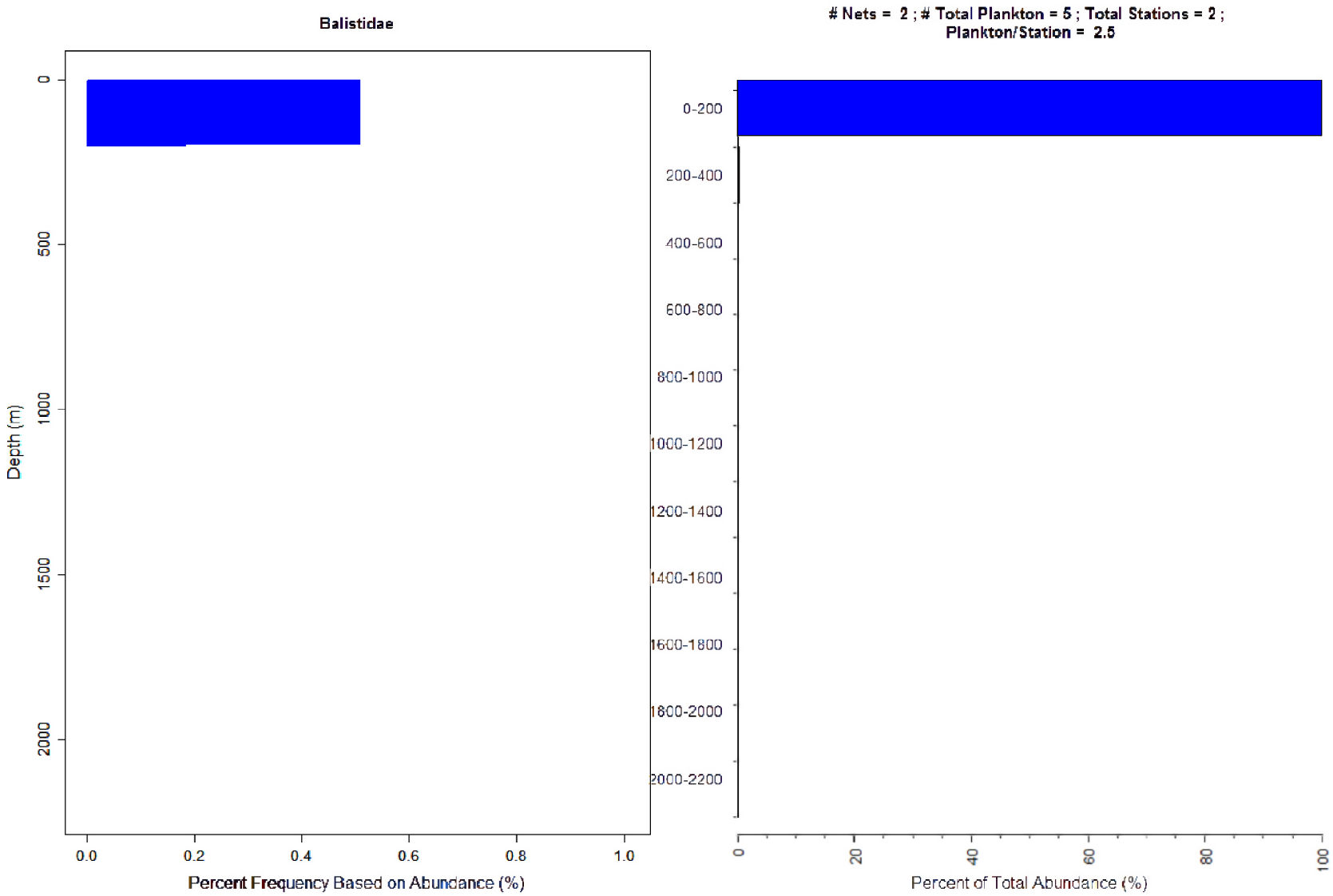
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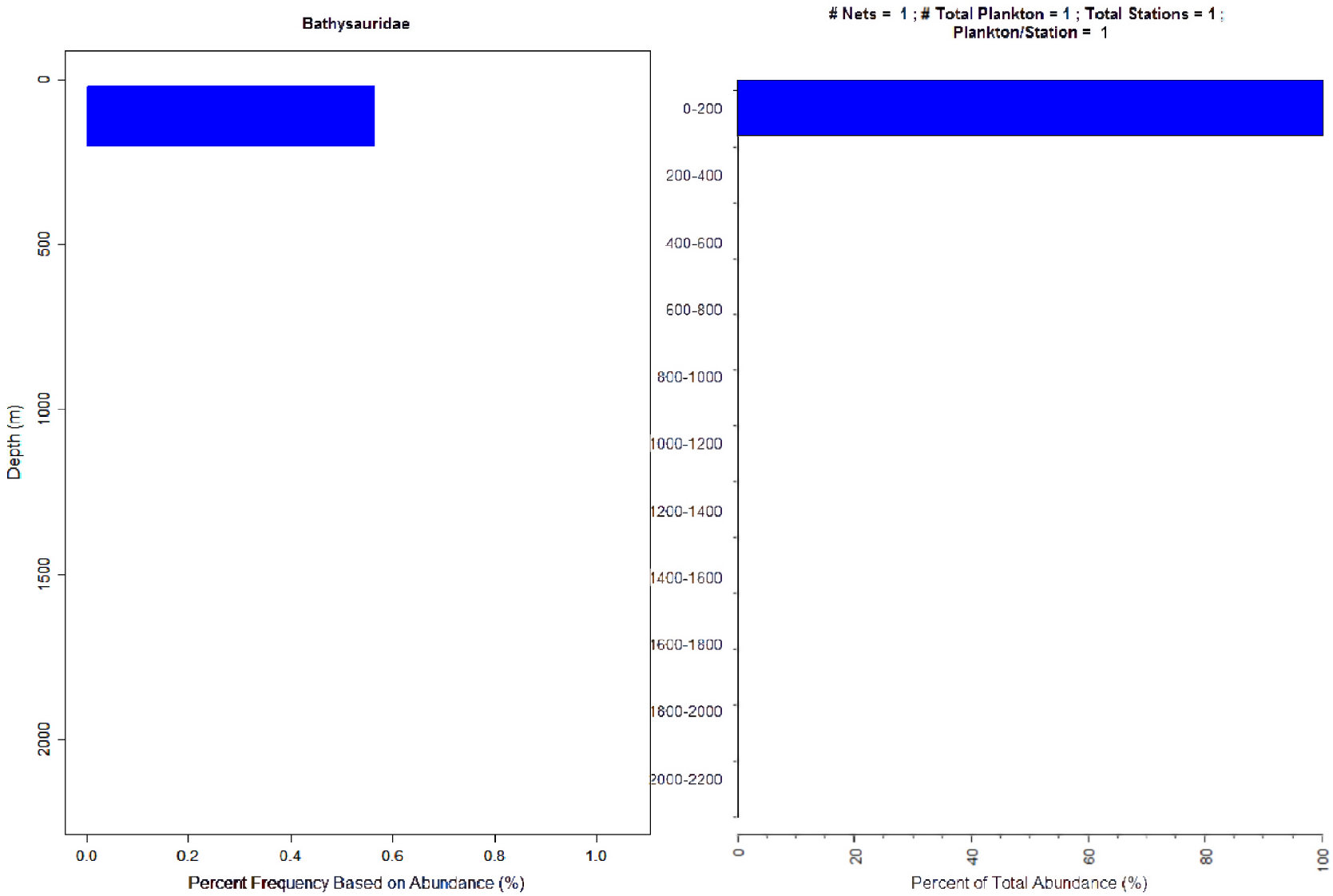
Aulopiformes - Deep



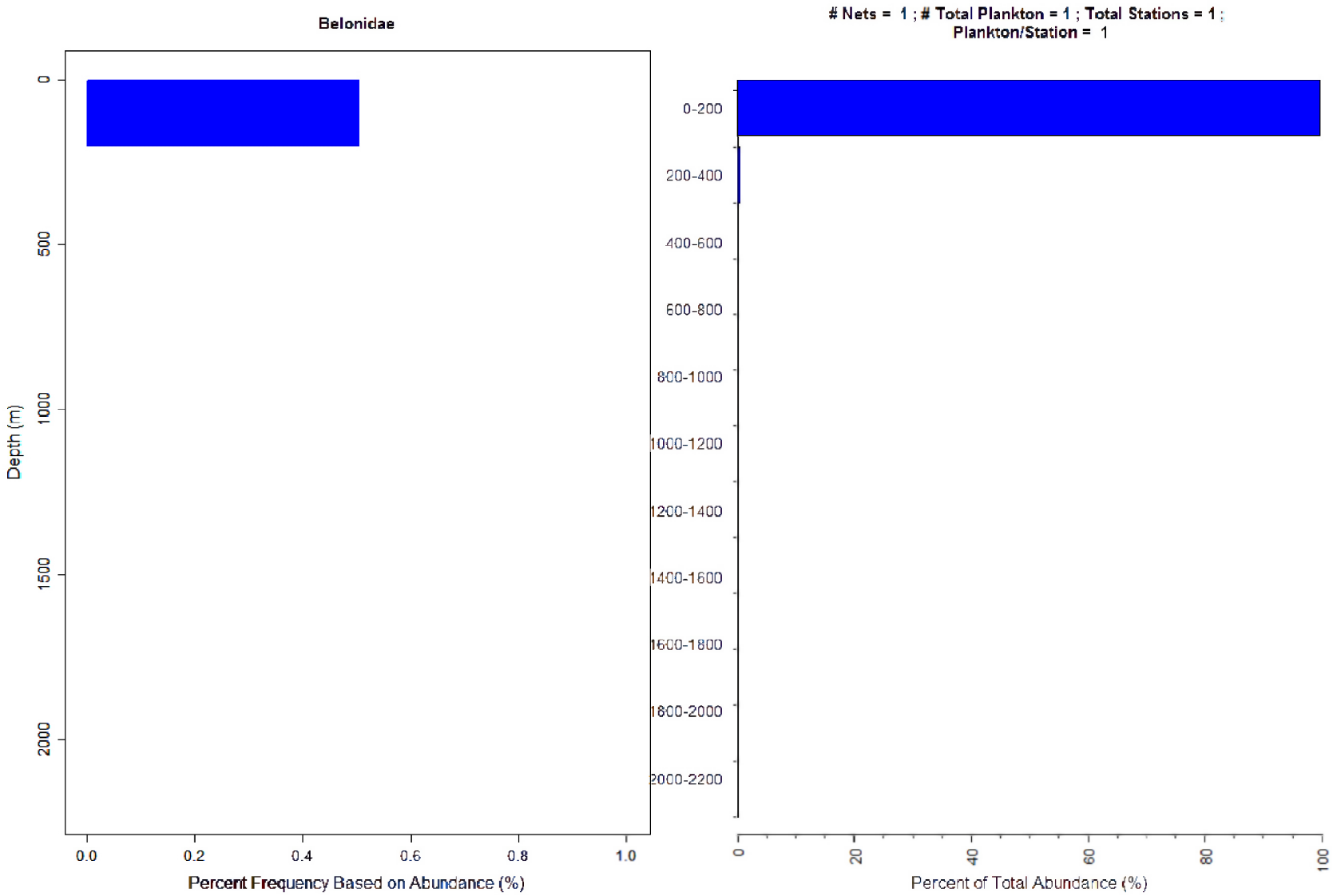
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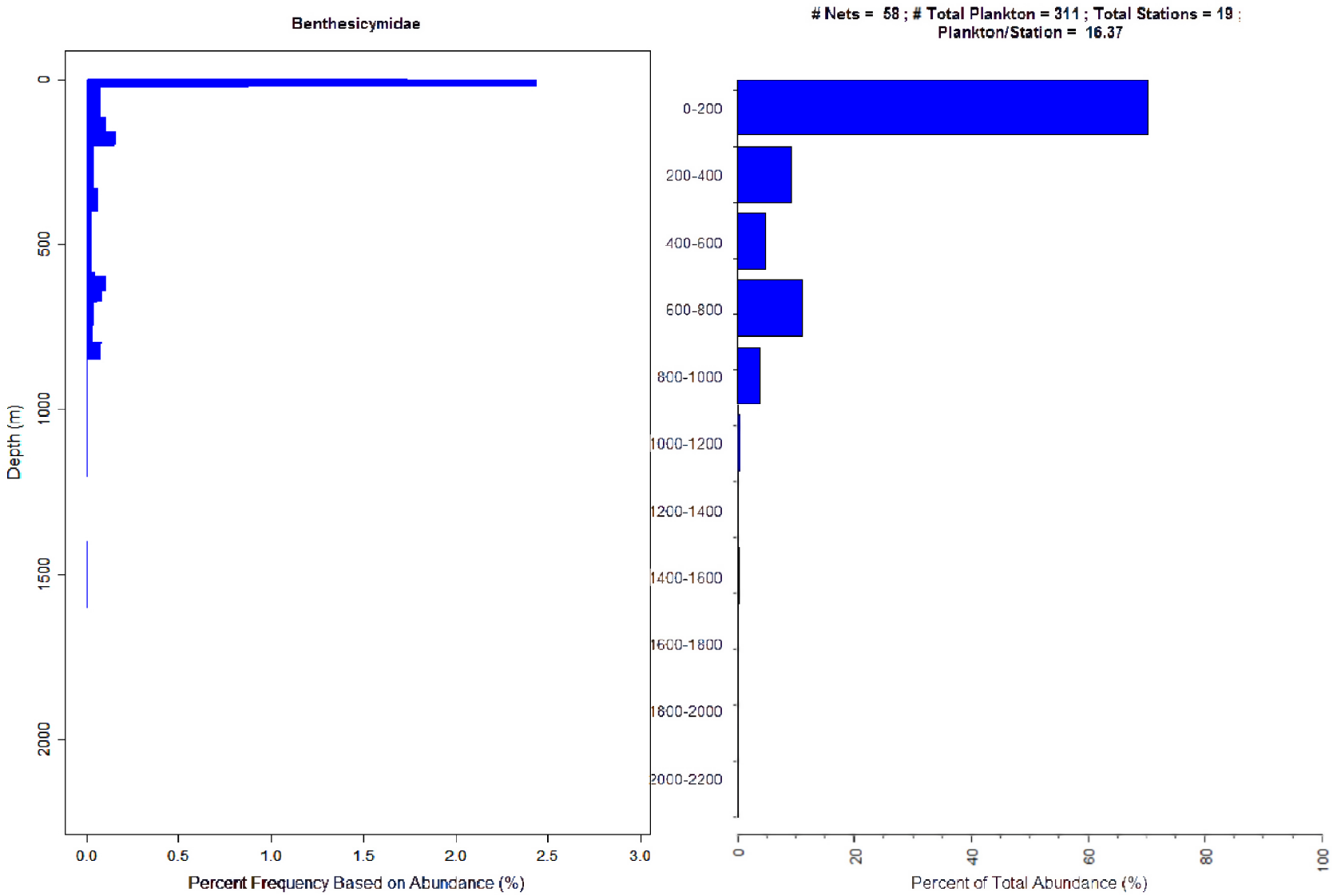
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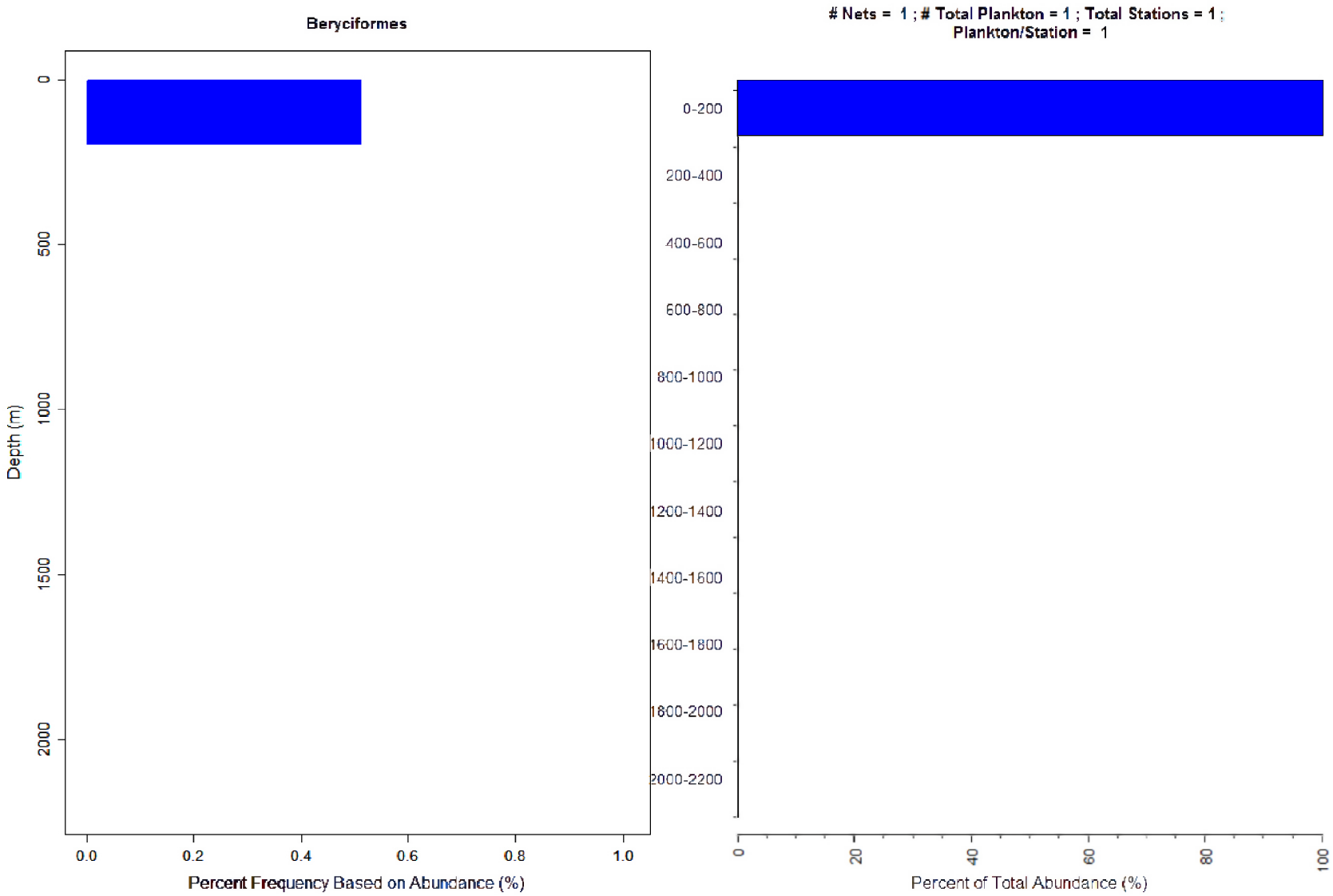
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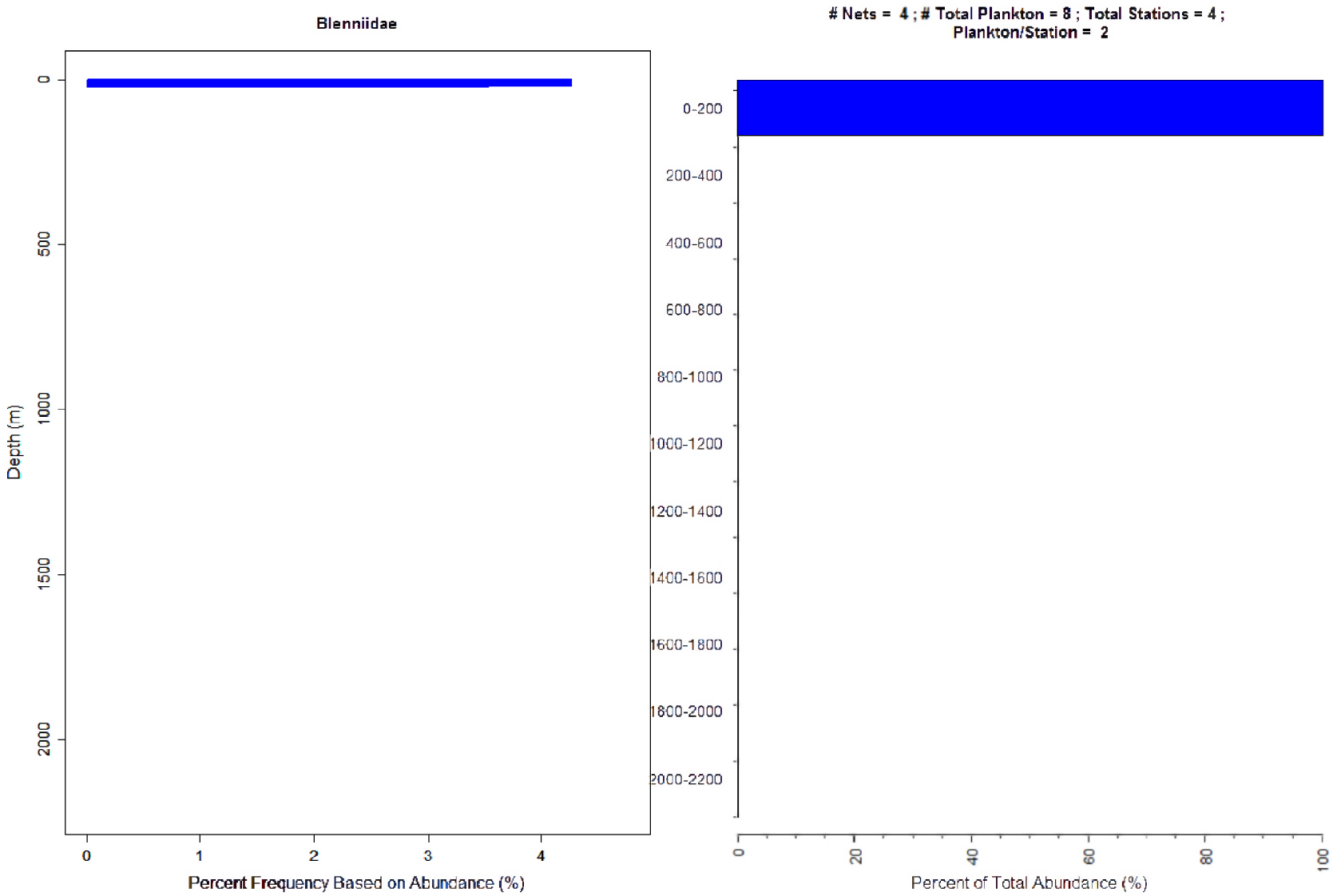
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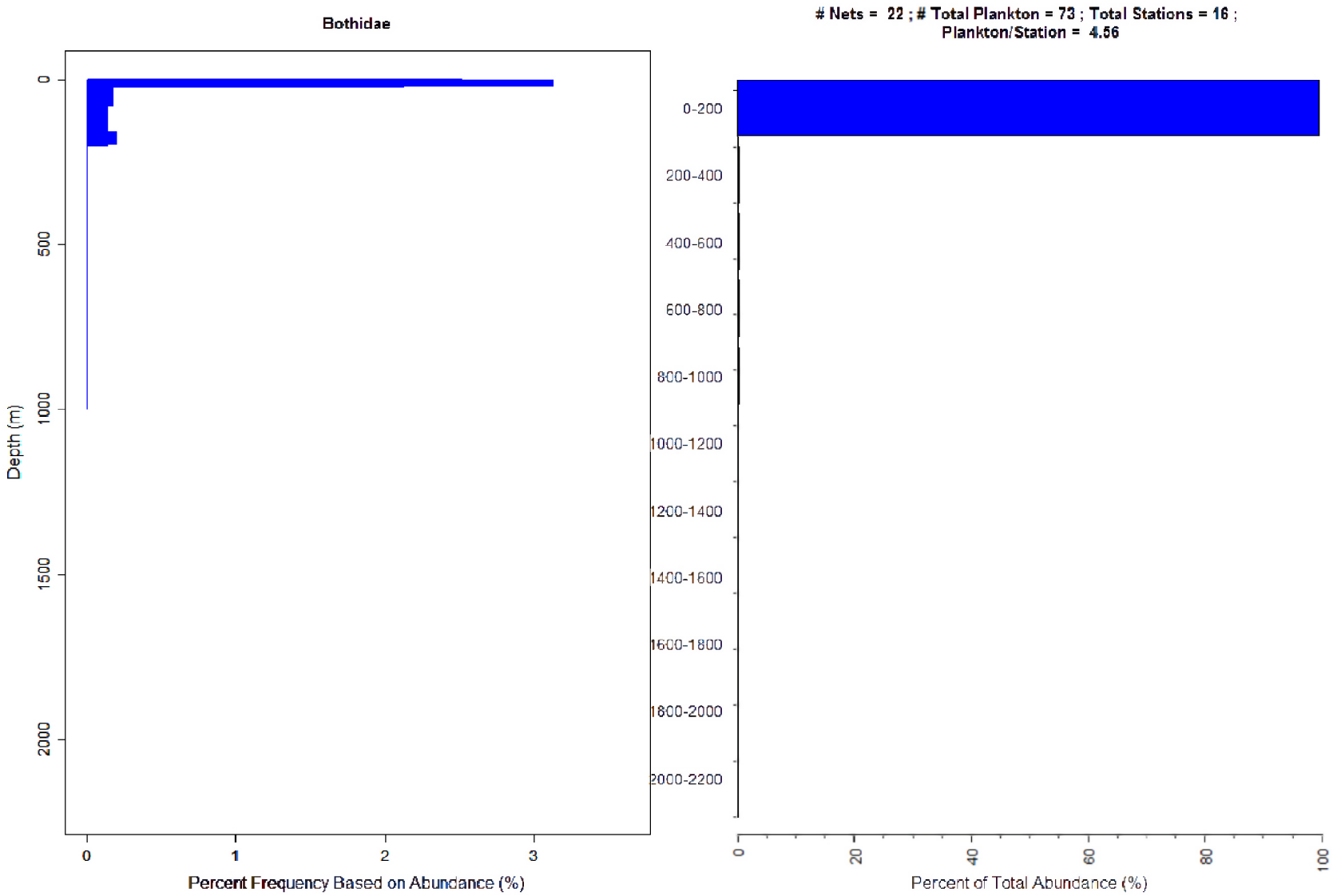
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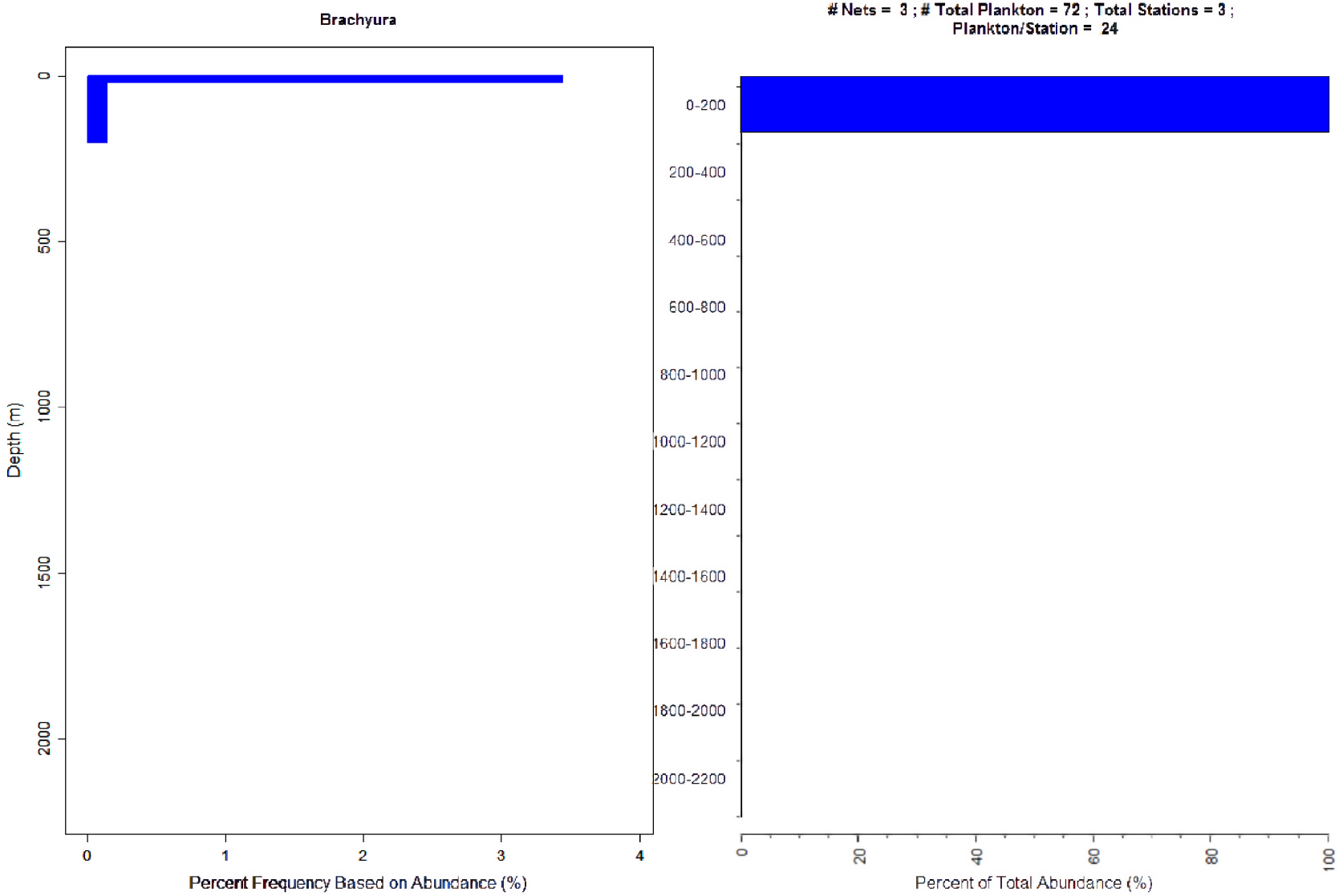
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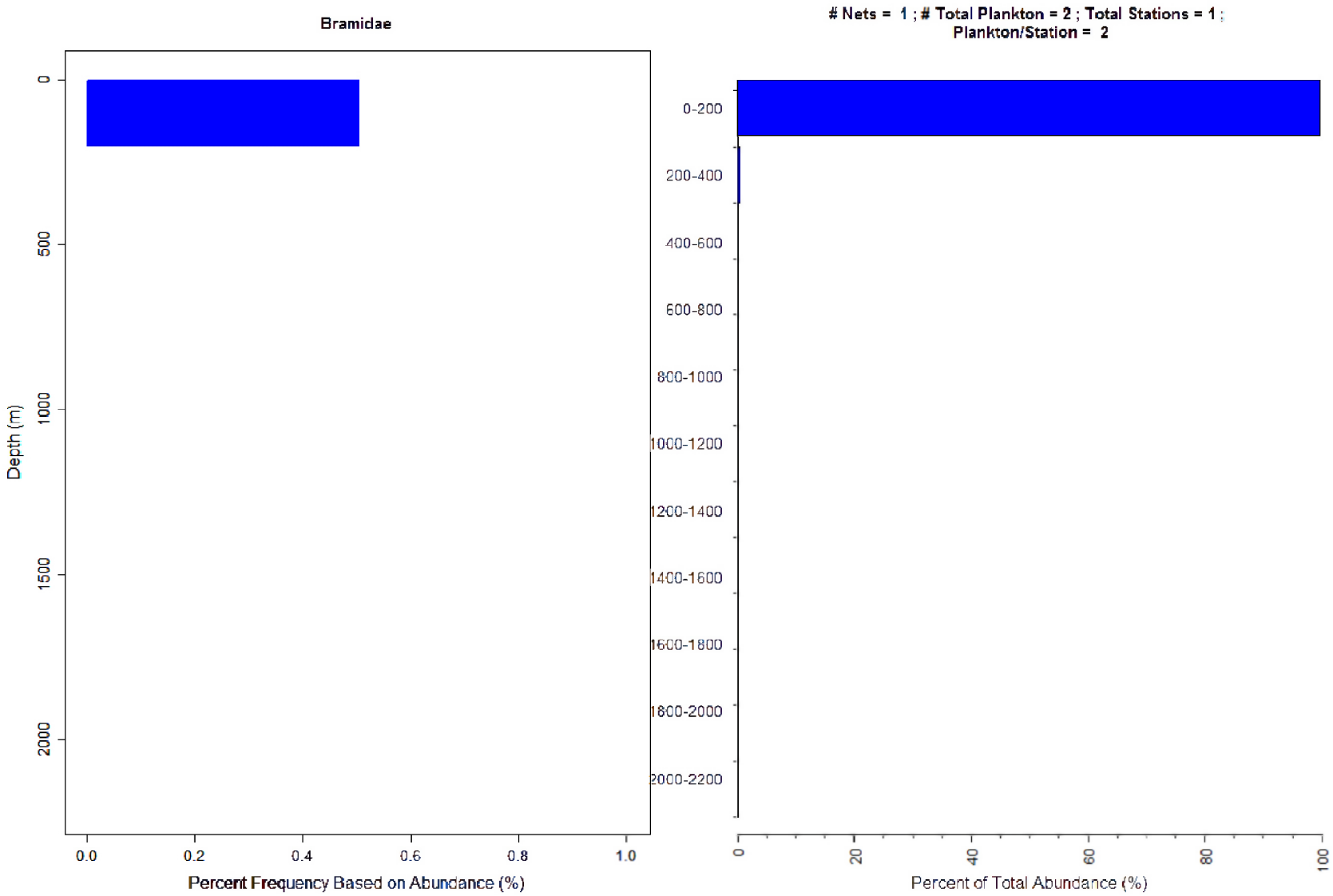
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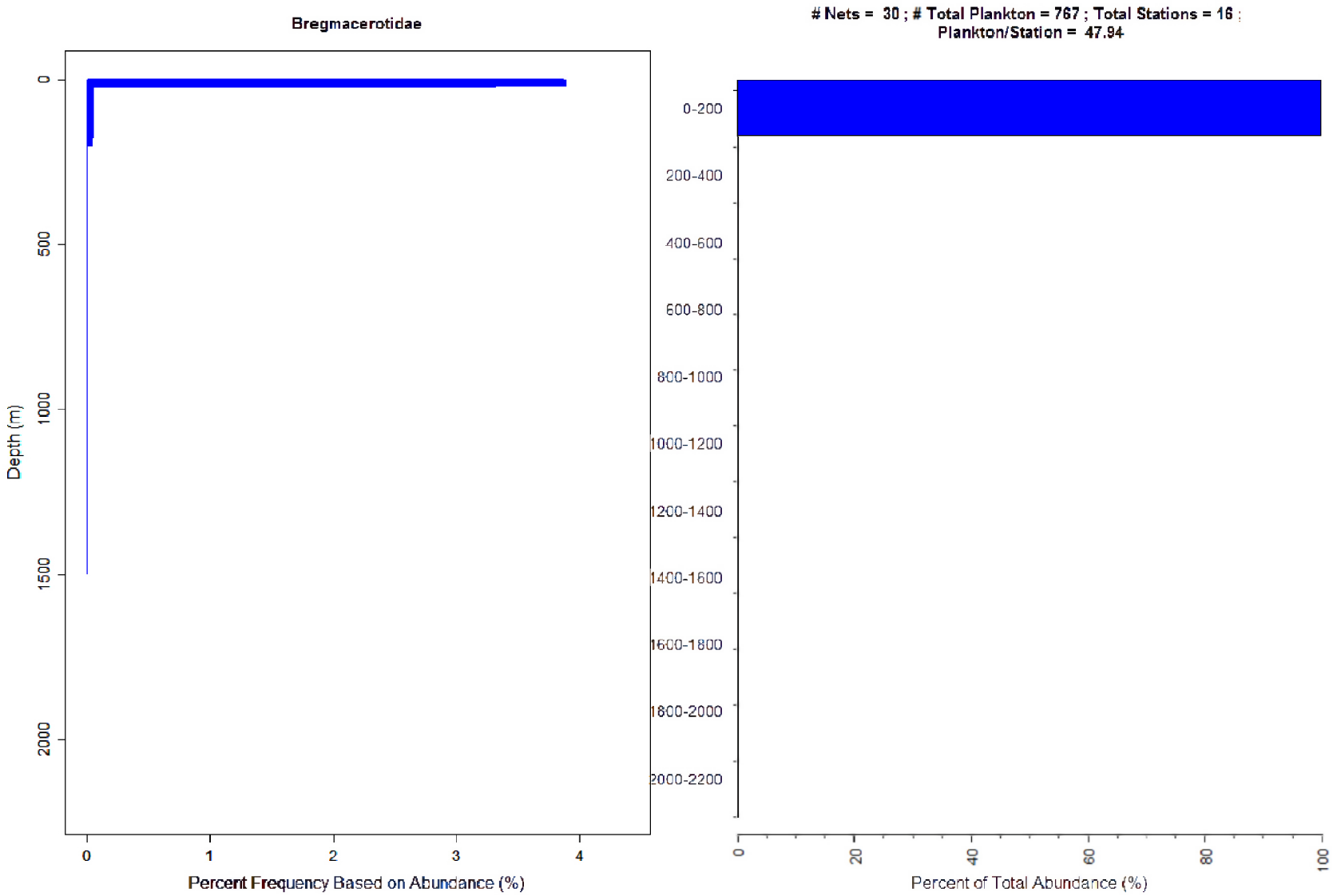
Bothidae - Deep



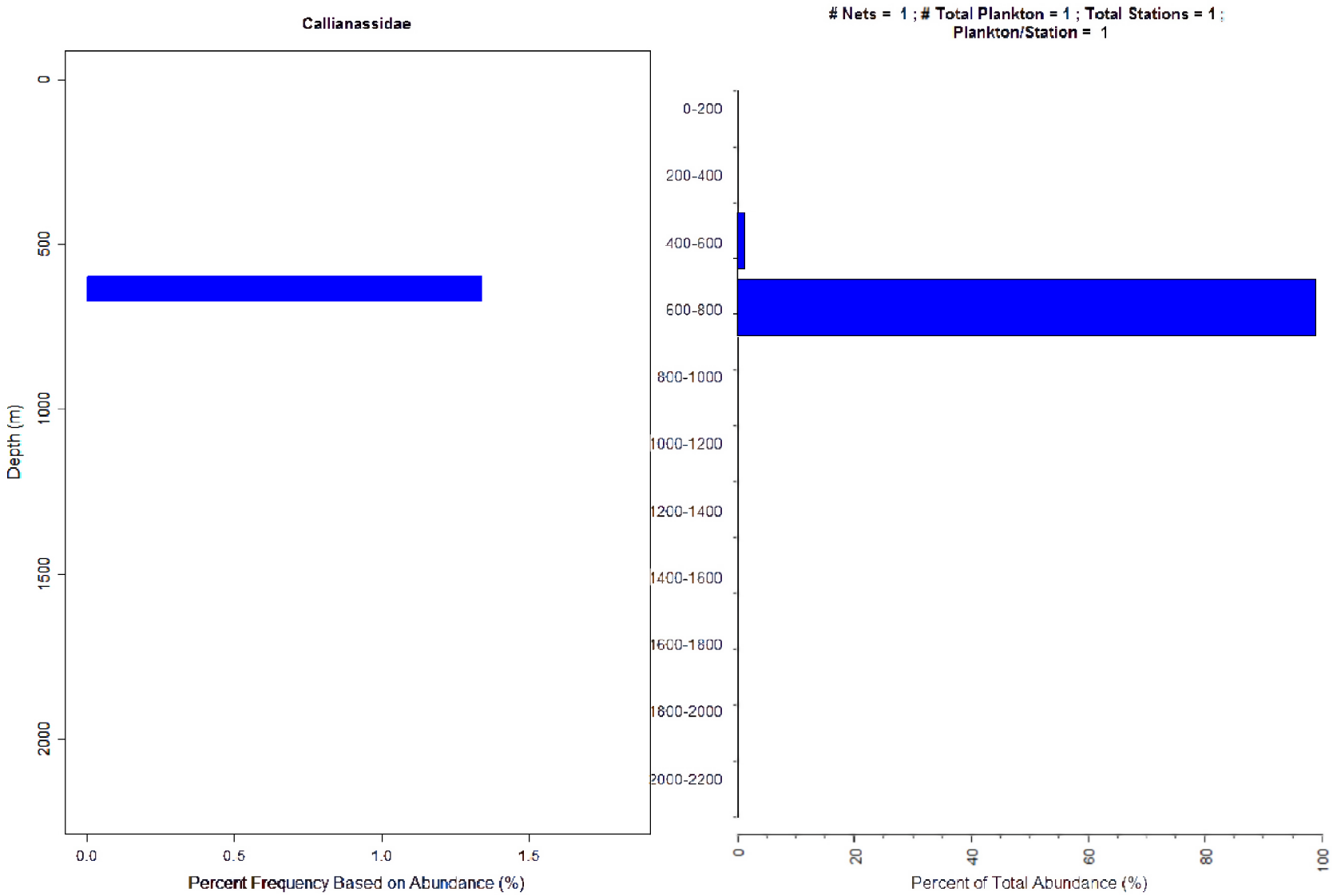
Brachyura - Deep



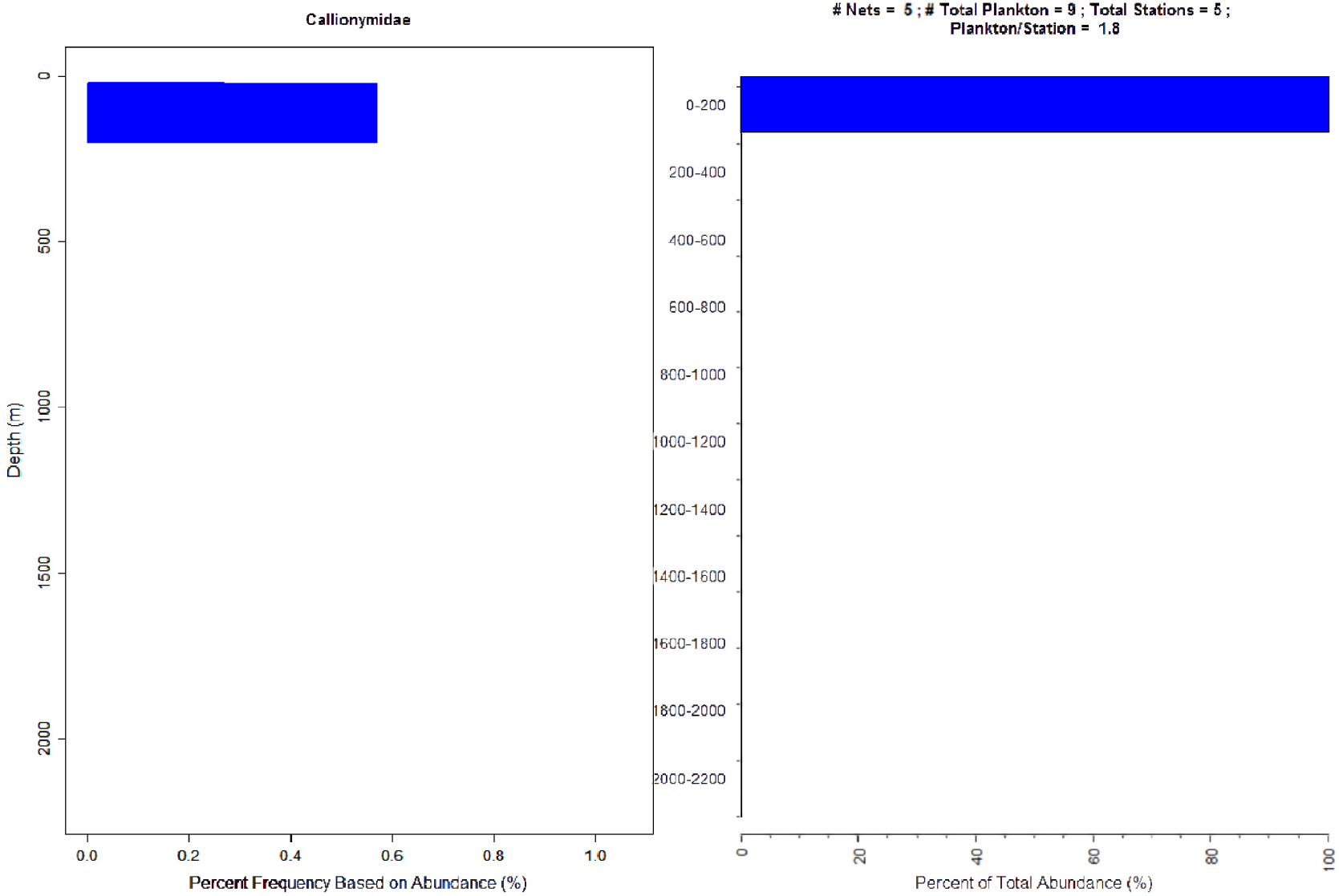
Bramidae - Deep



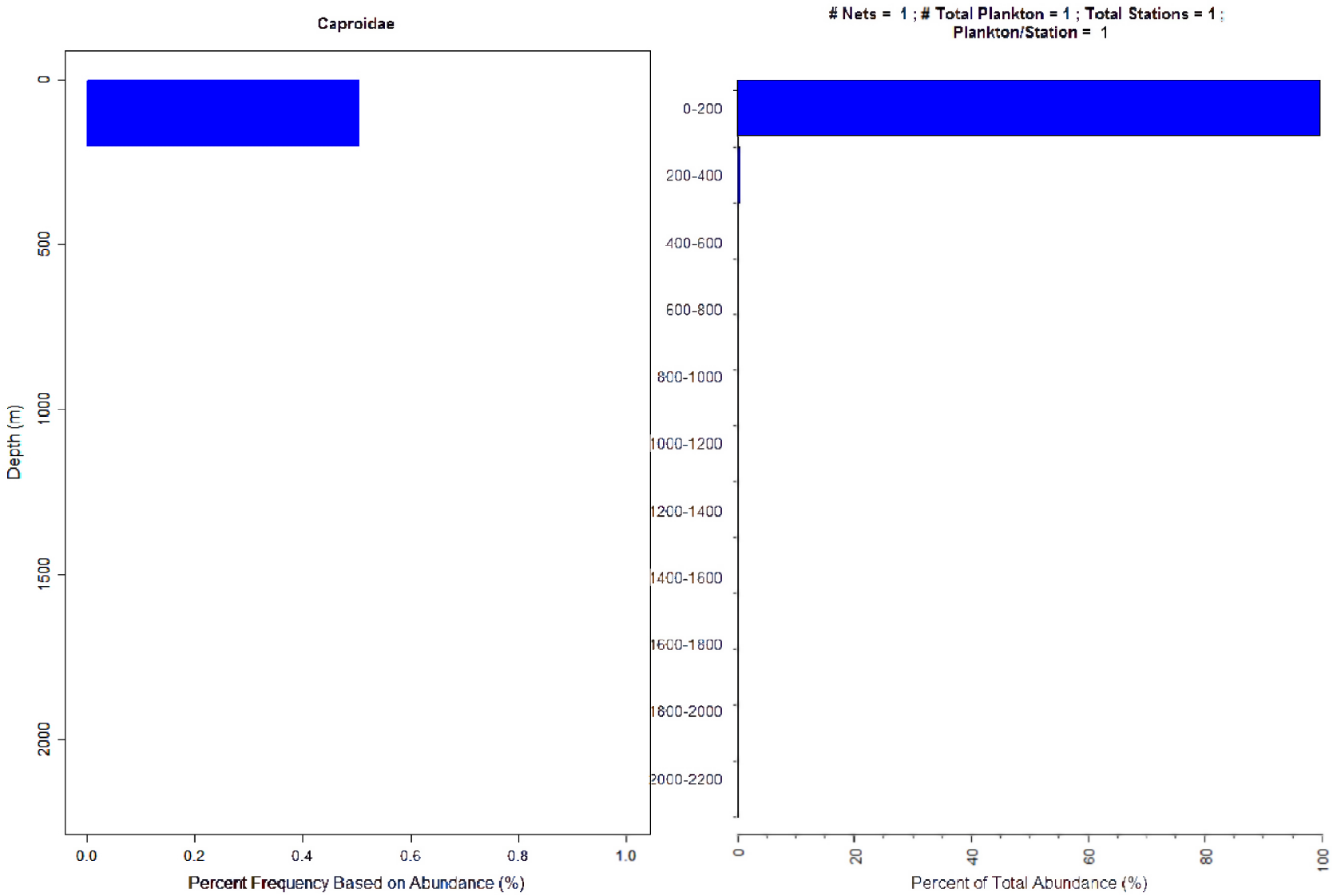
Bregmacerotidae - Deep



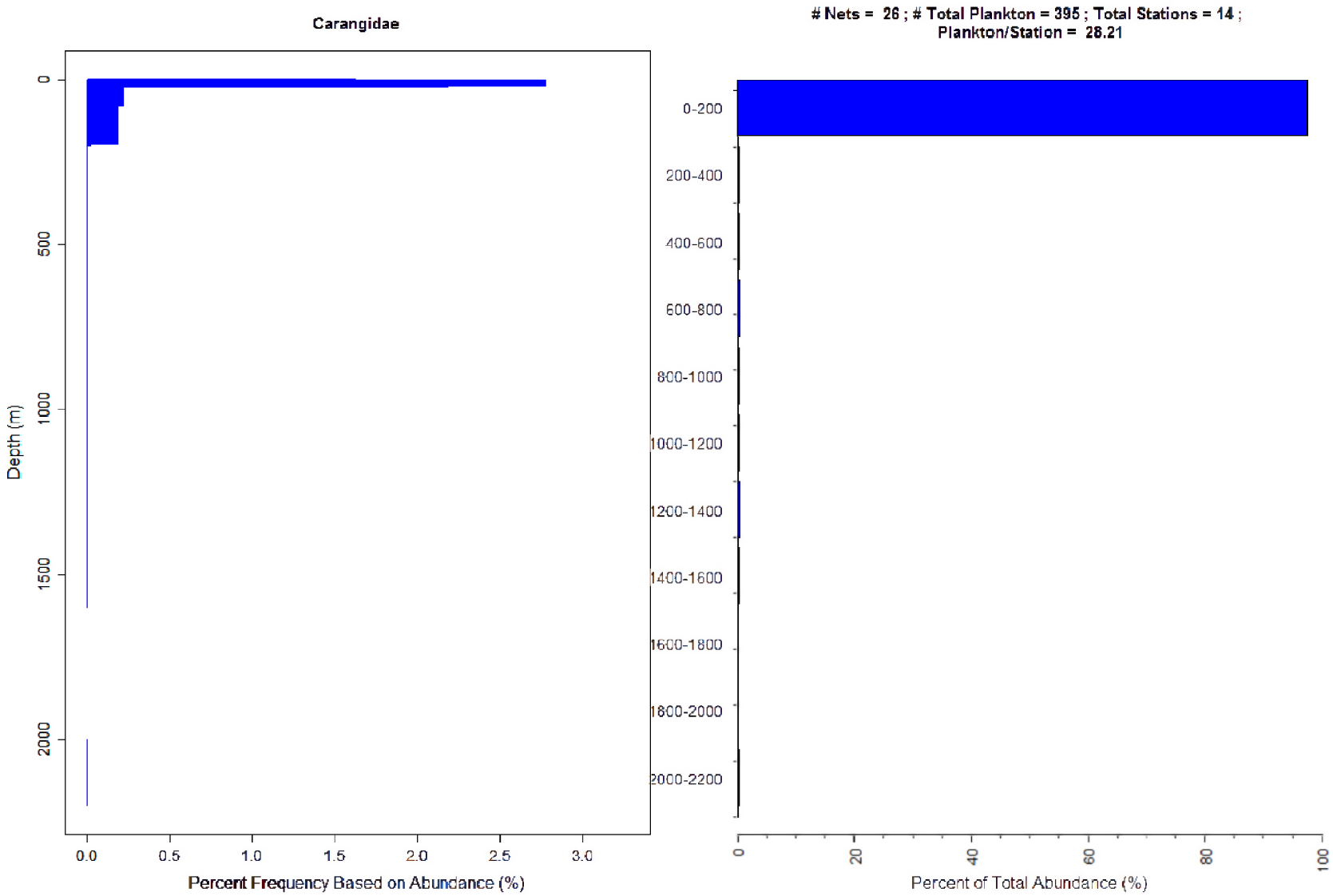
Callianassidae - Deep



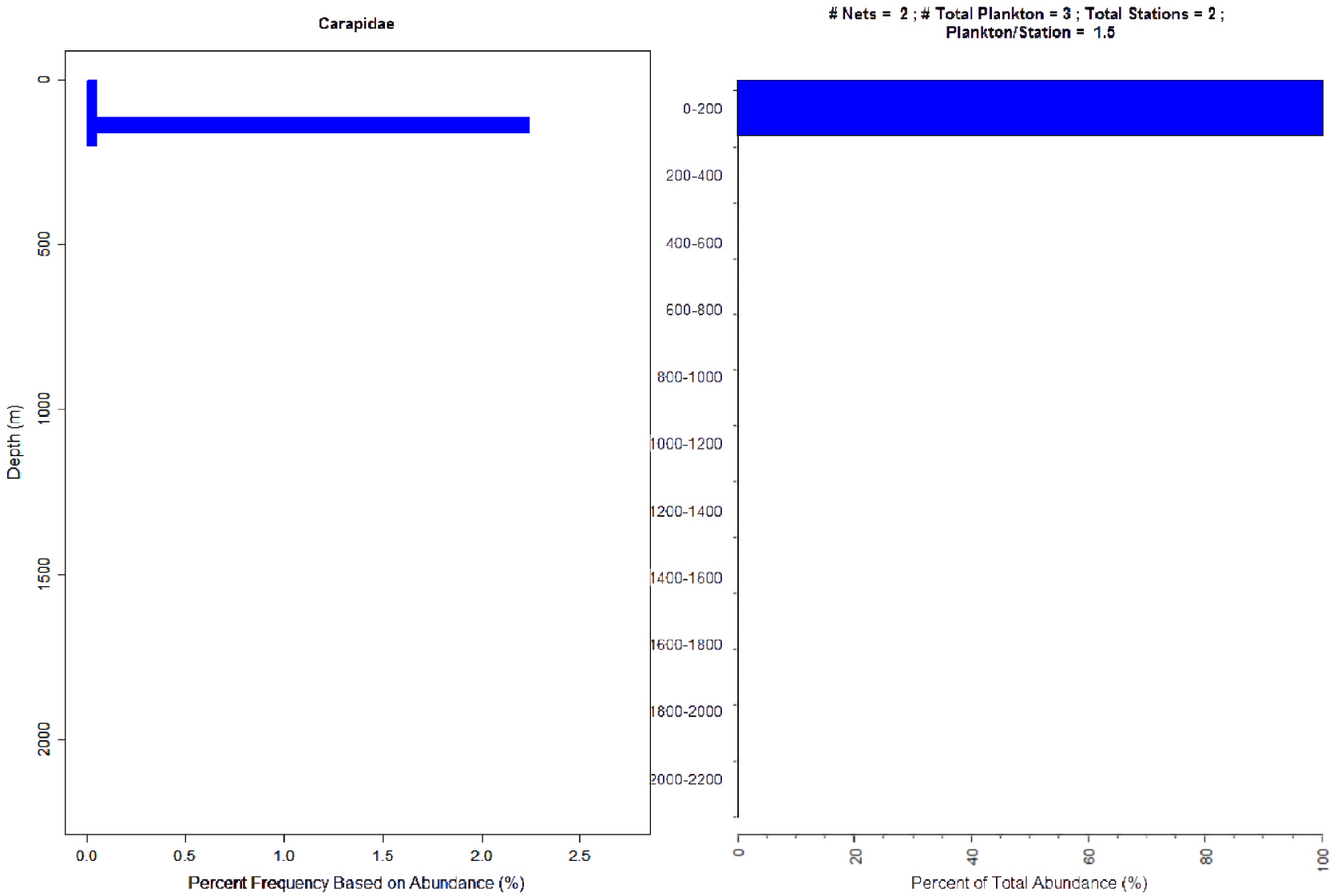
Callionymidae - Deep



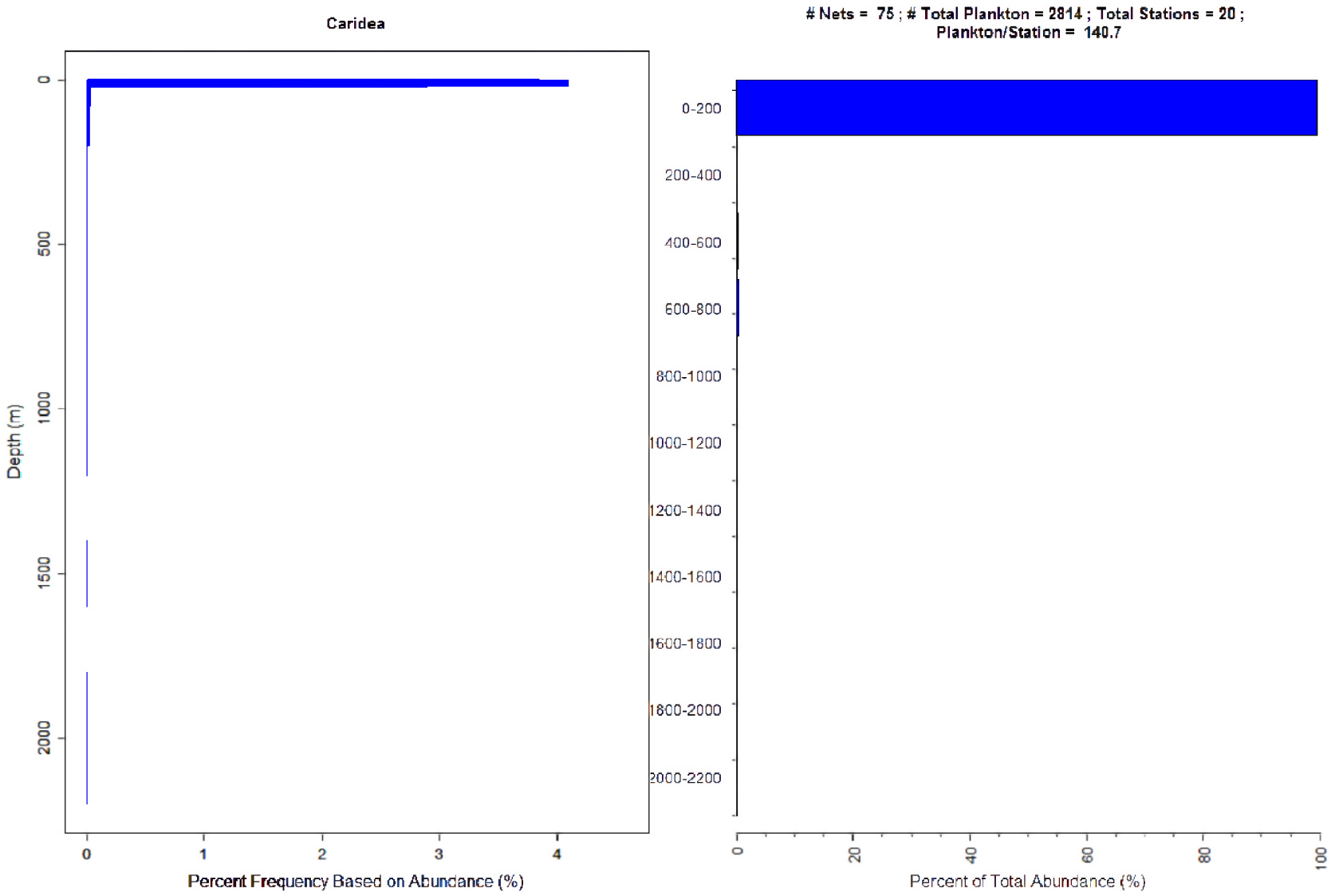
Caproidae - Deep



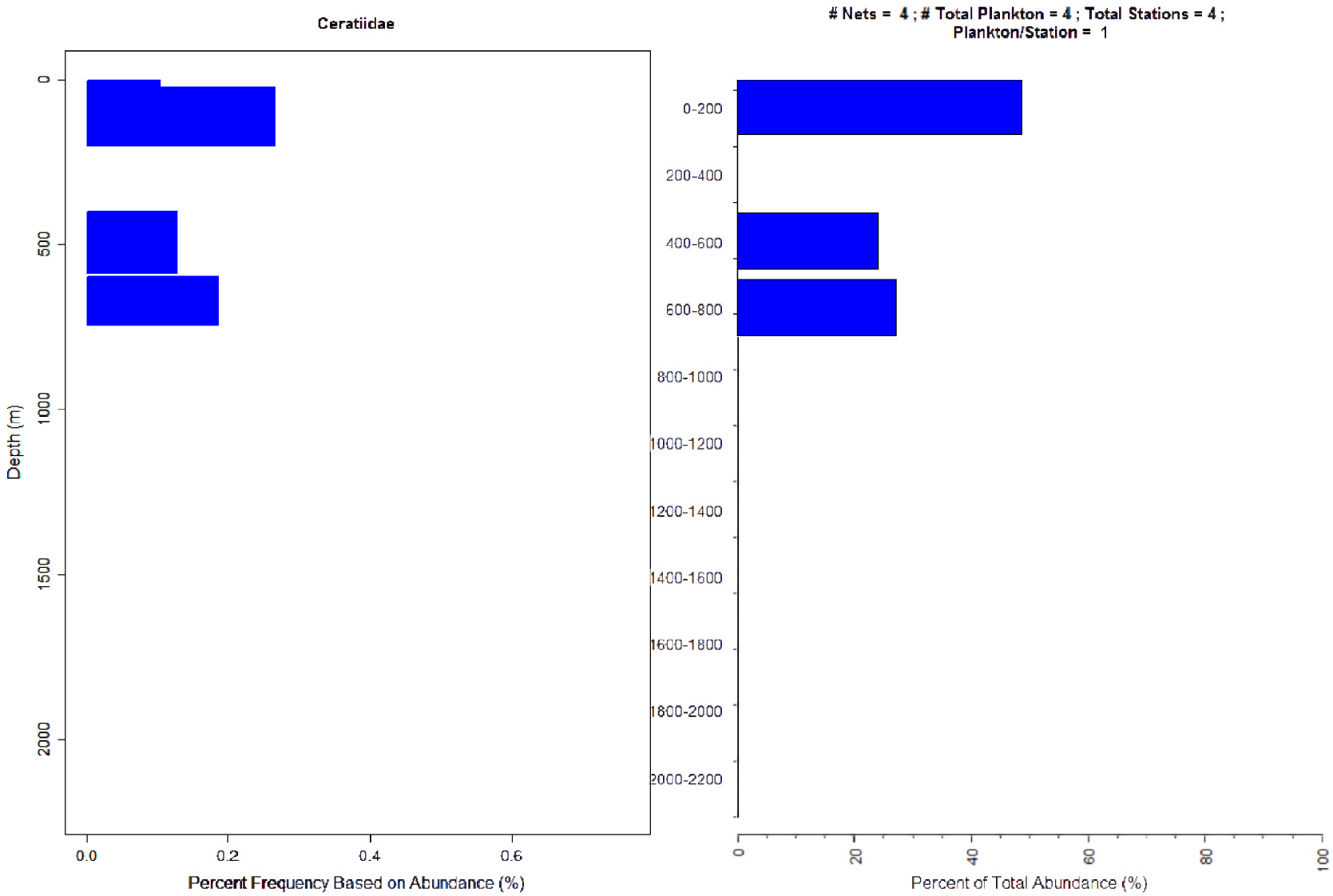
Carangidae - Deep



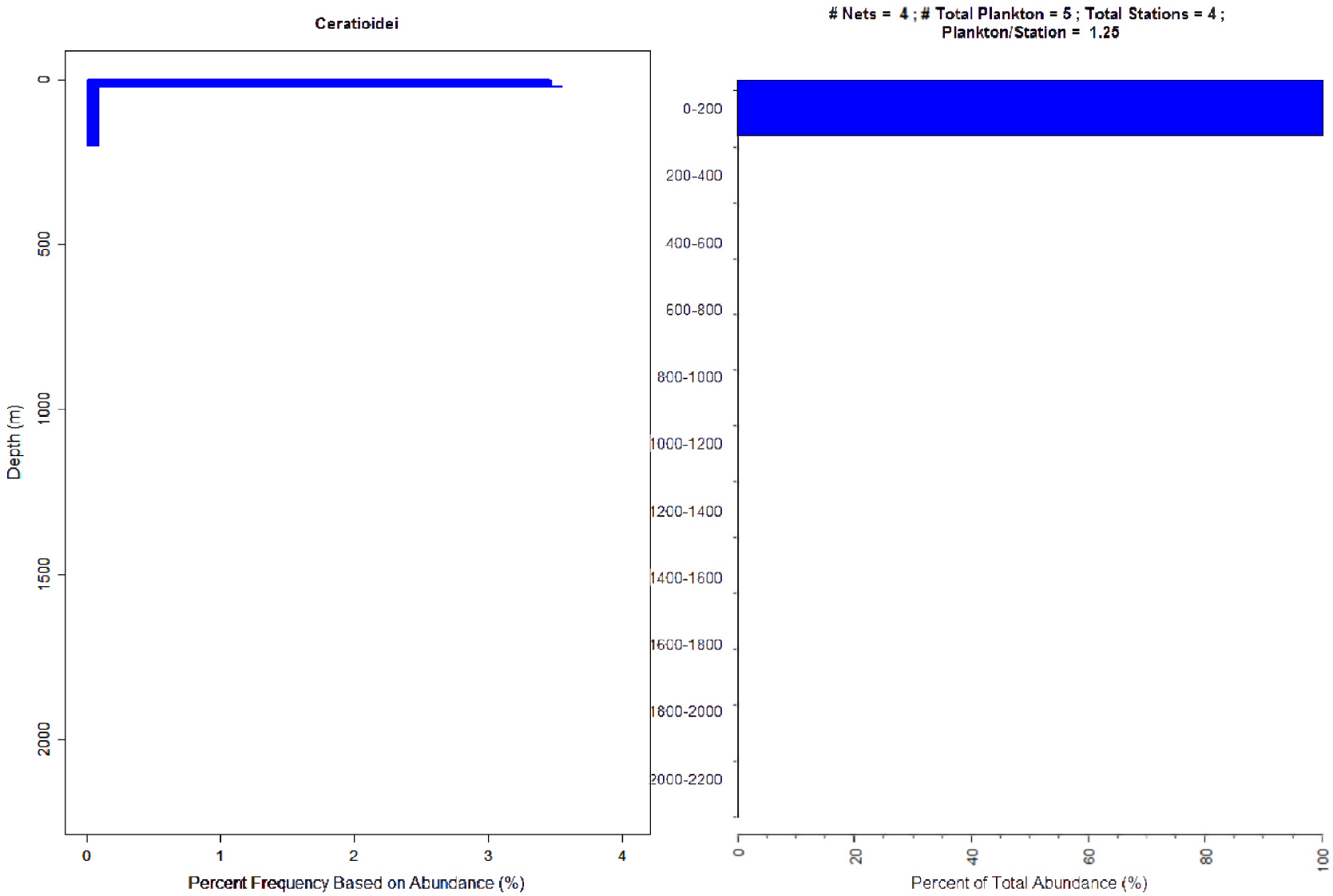
Carapidae - Deep



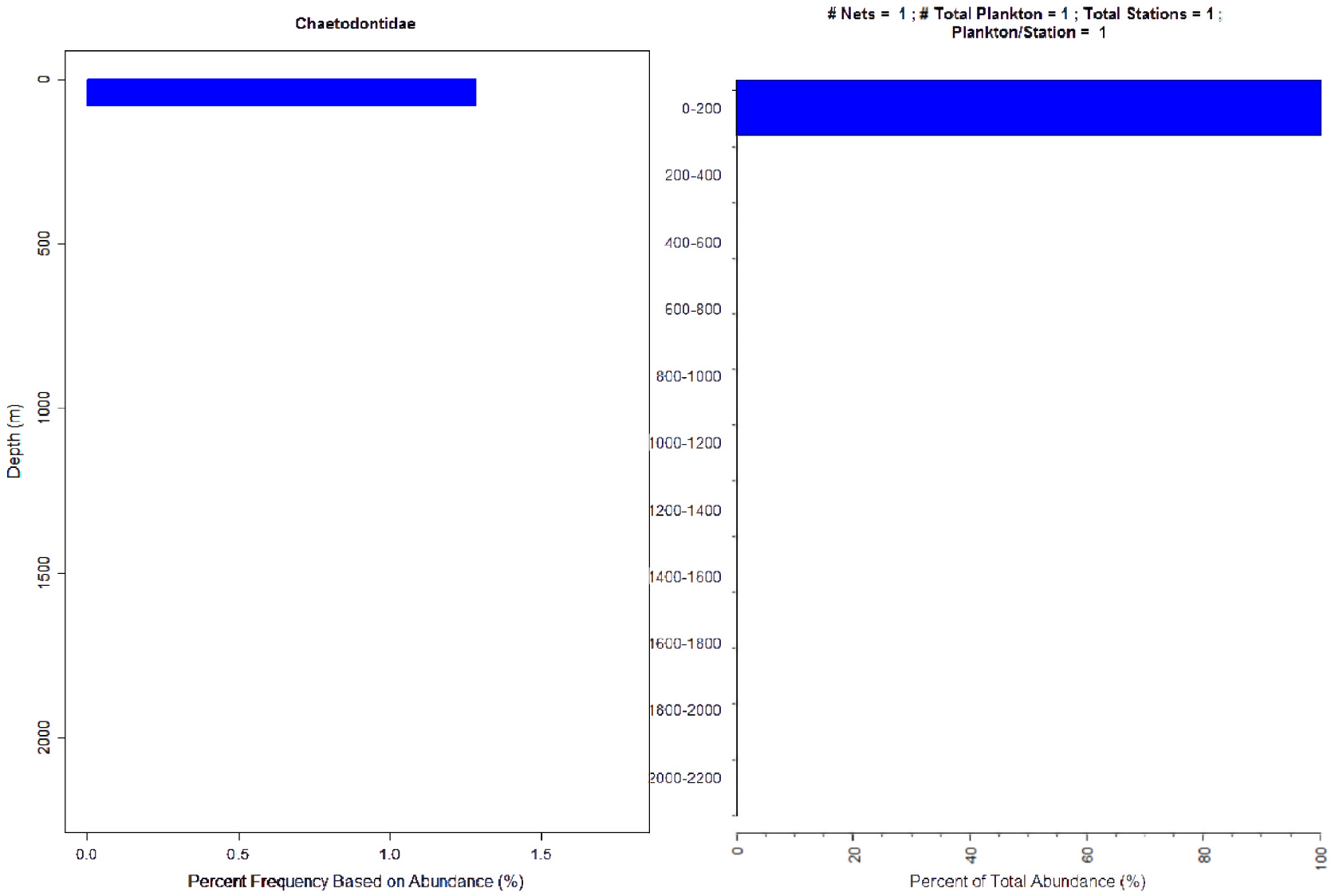
Caridea - Deep



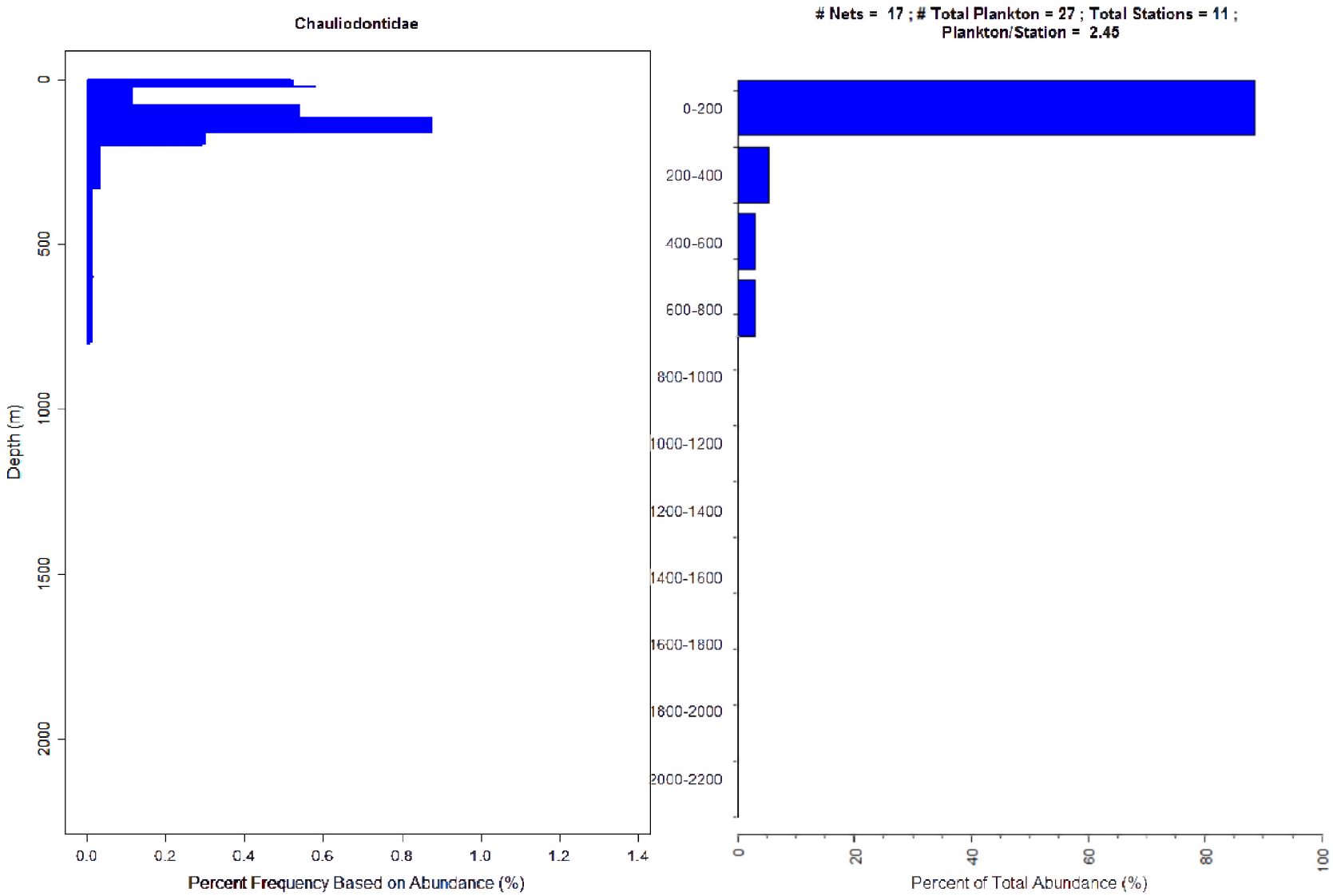
Ceratiidae - Deep



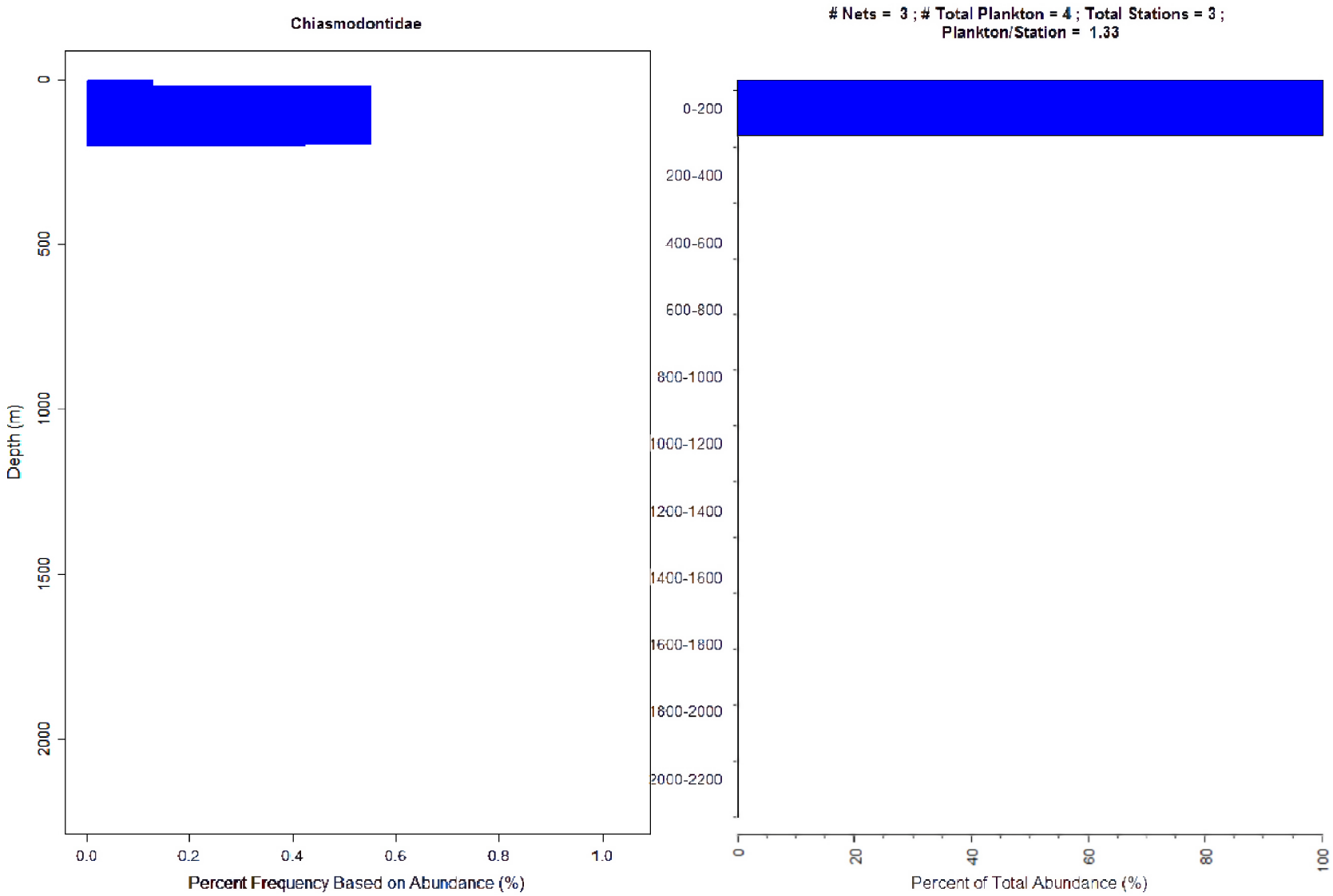
Ceratioidei - Deep



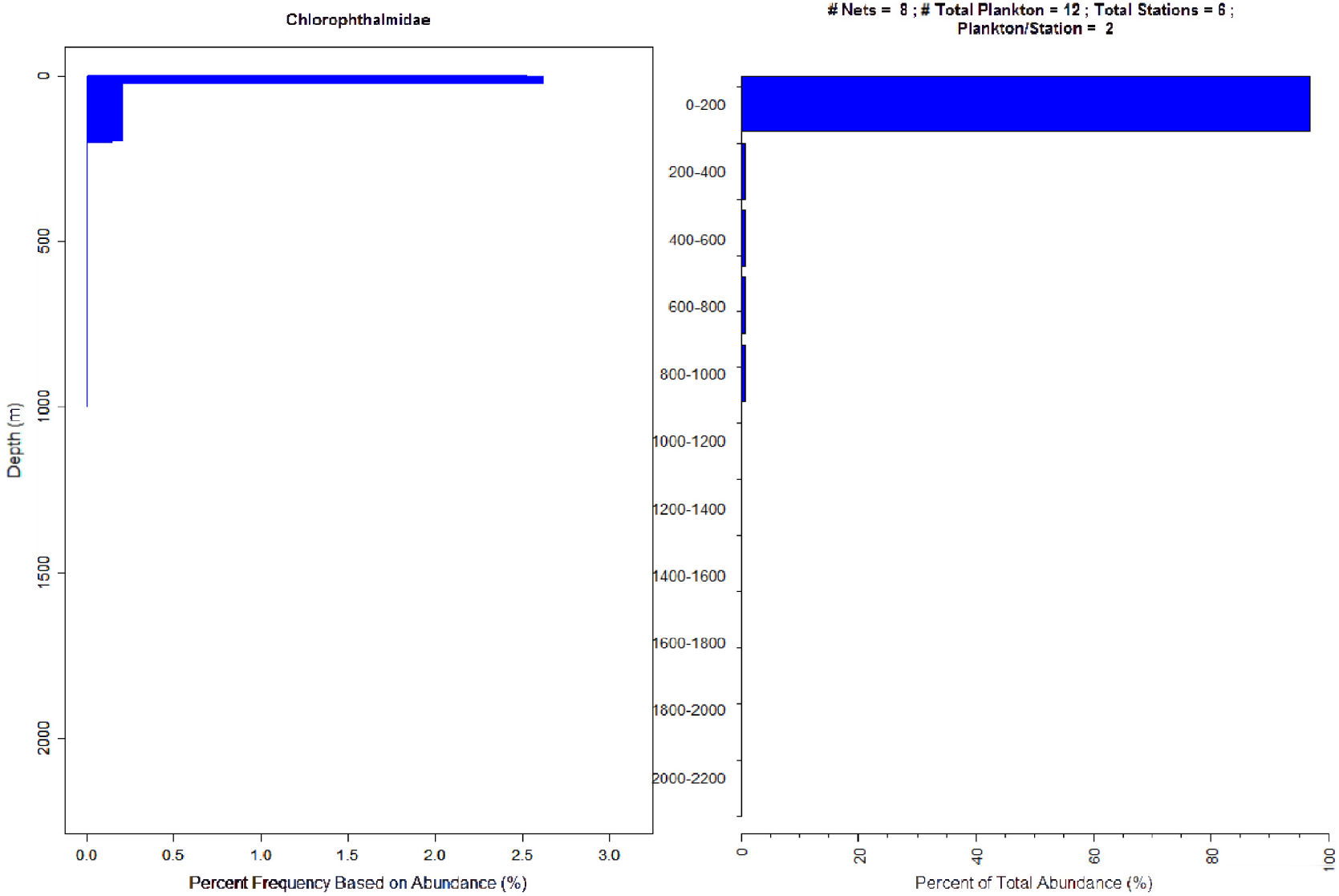
Chaetodontidae - Deep



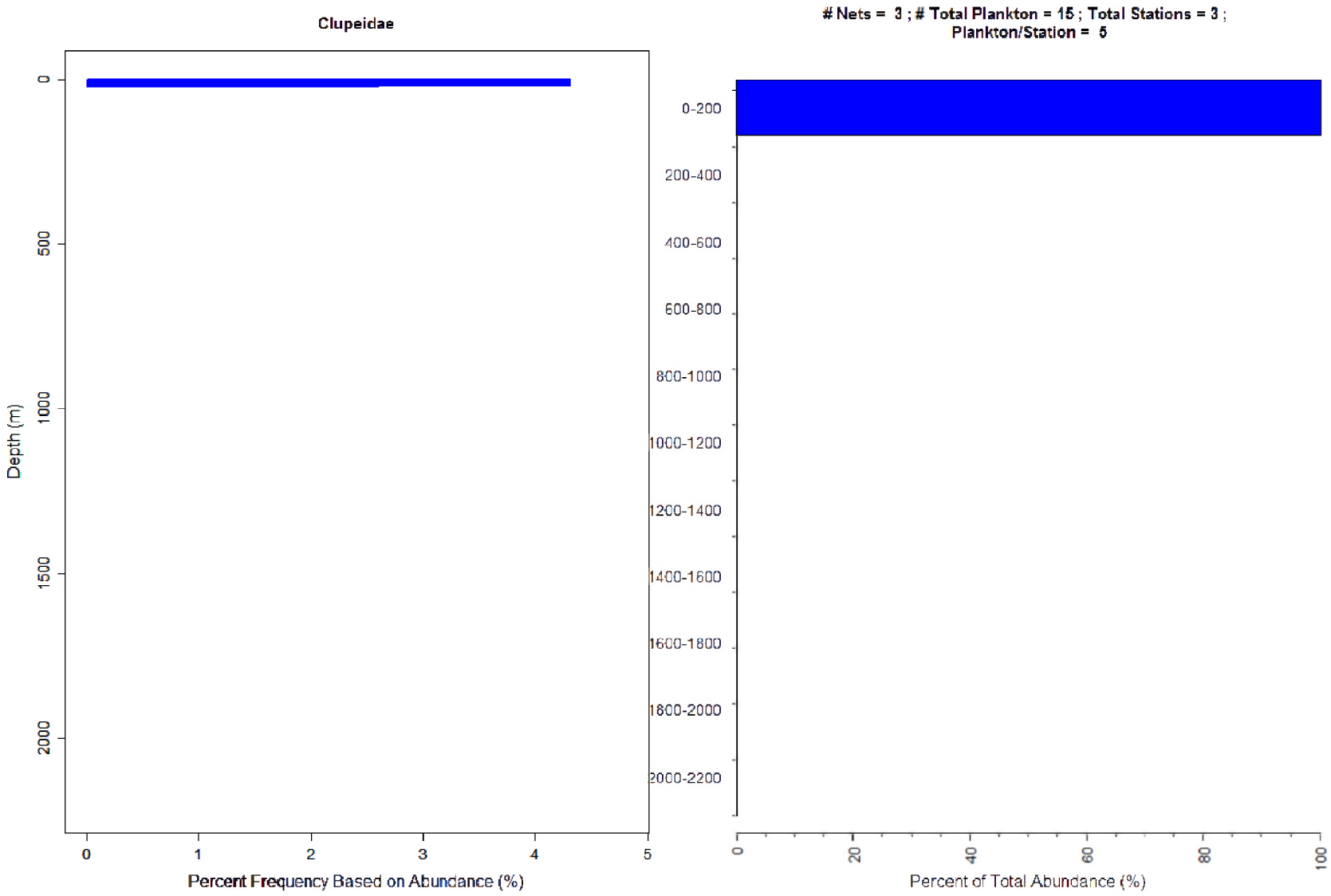
Chauliodontidae - Deep



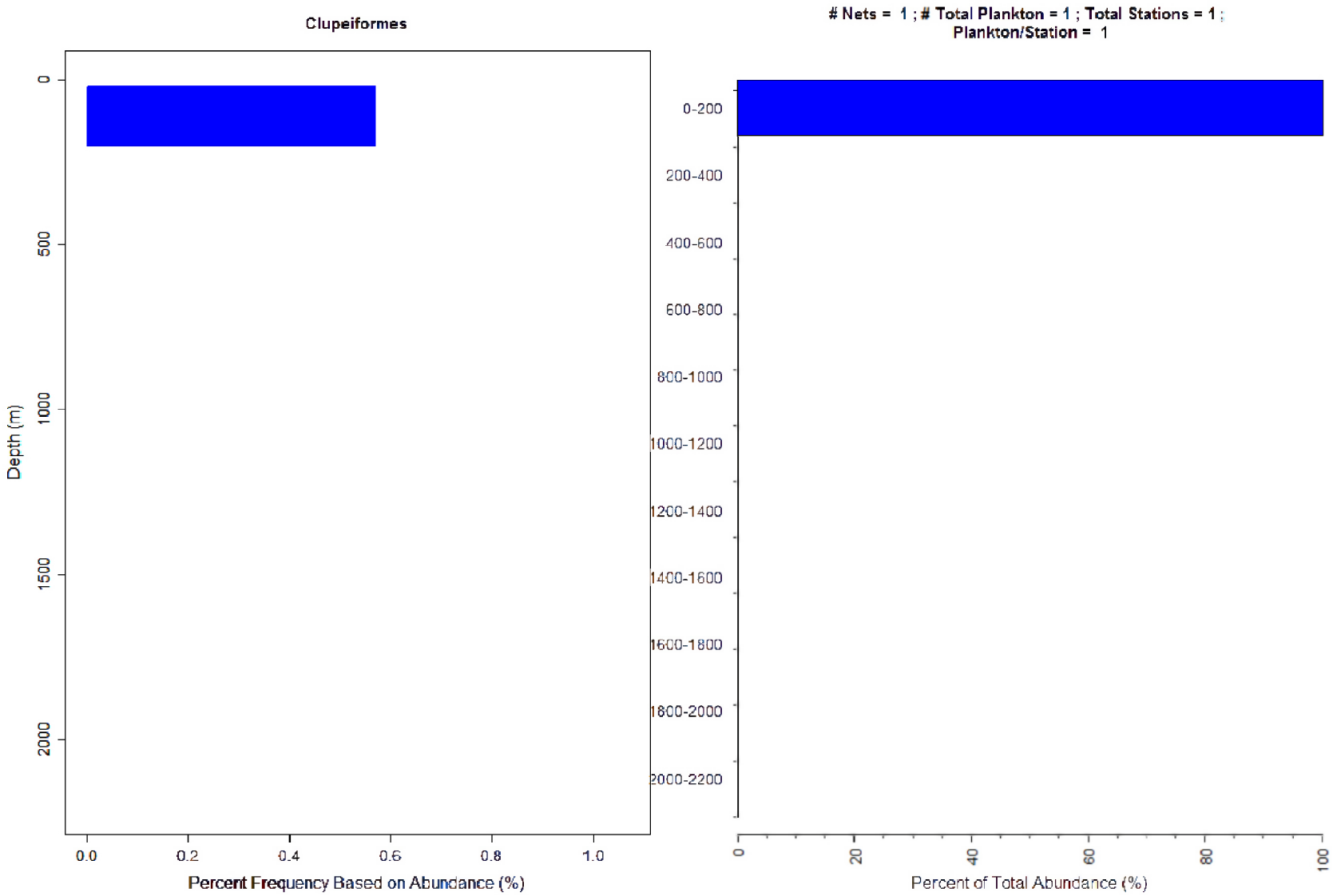
Chiasmodontidae - Deep



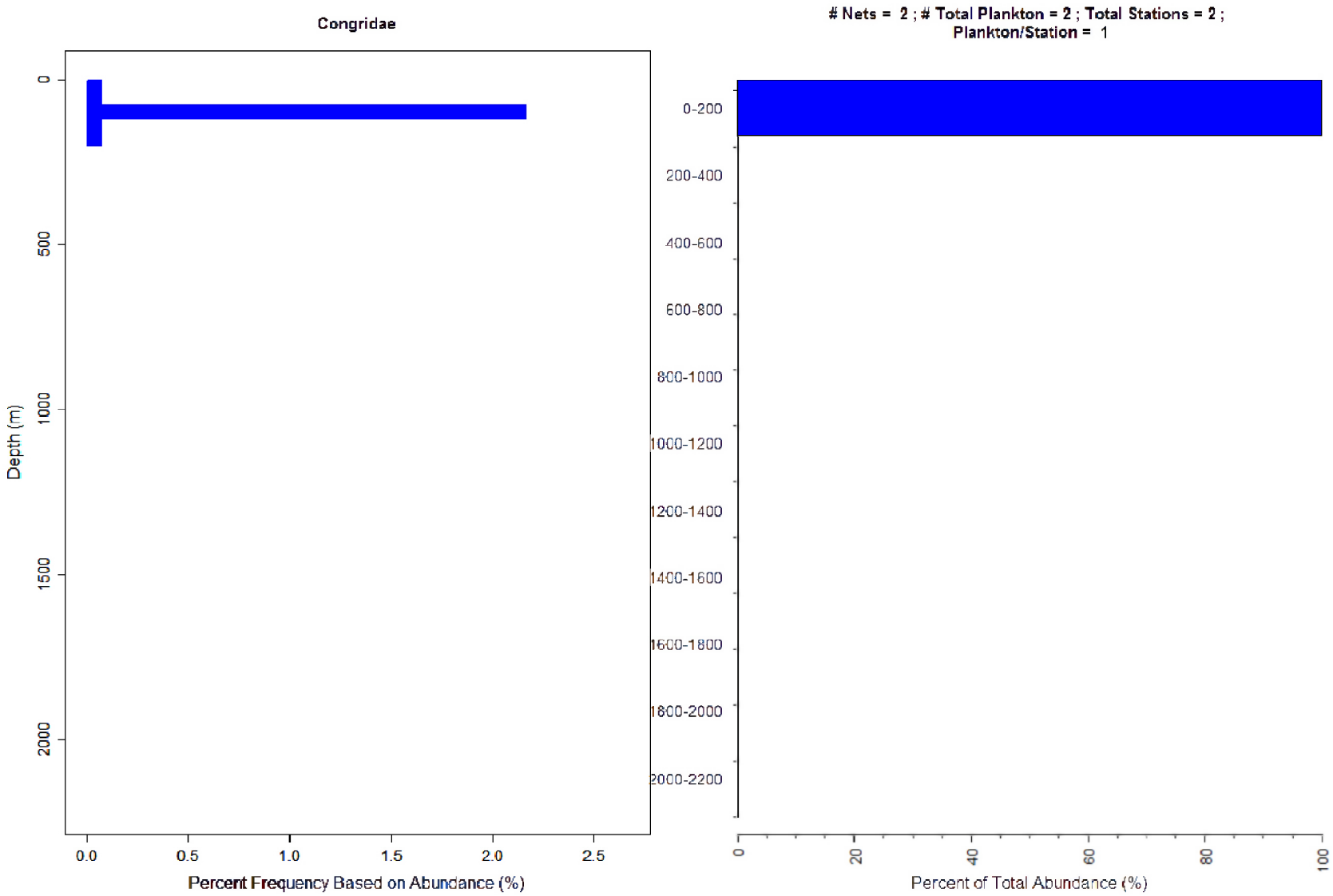
Chlorophthalmidae - Deep



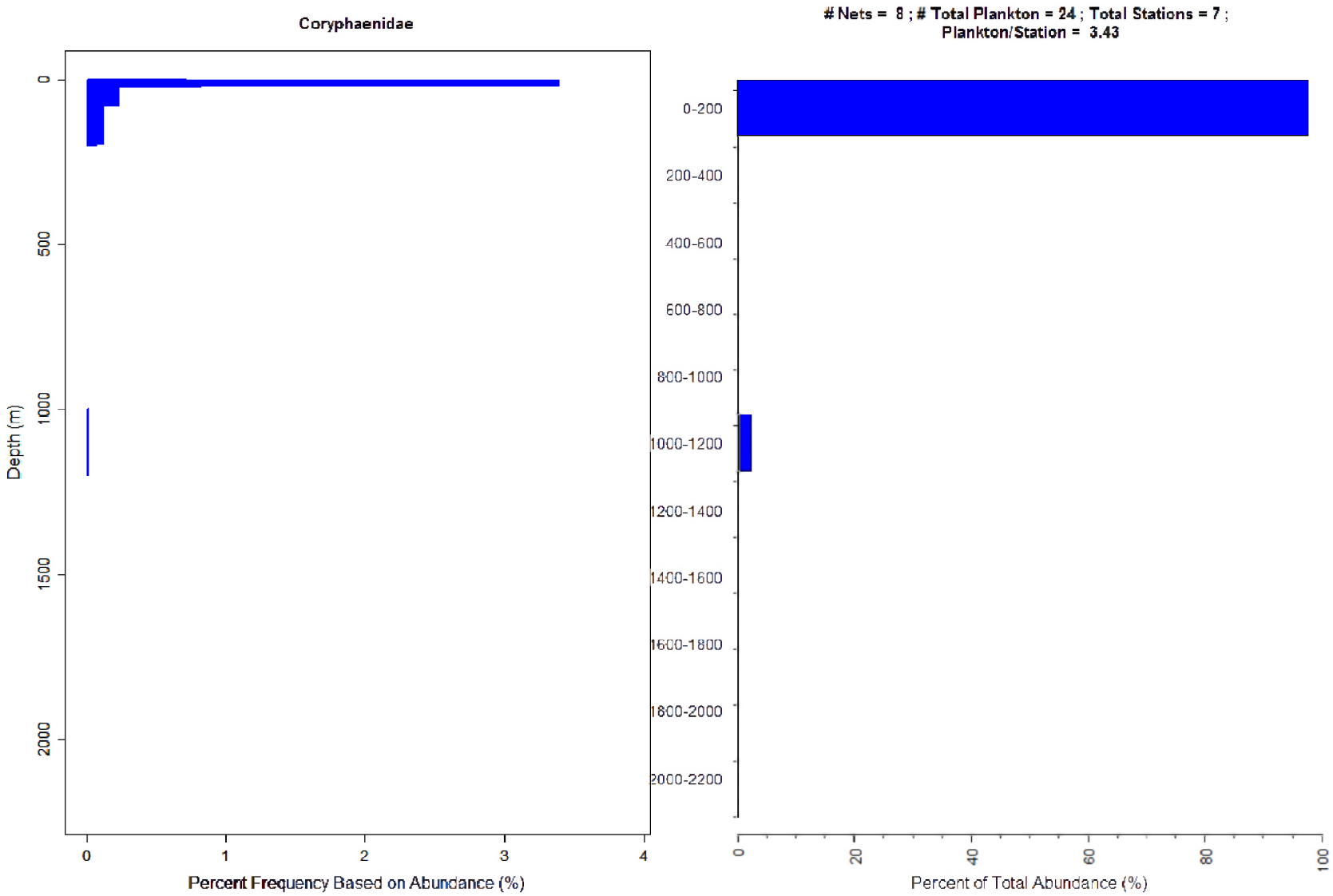
Clupeidae - Deep



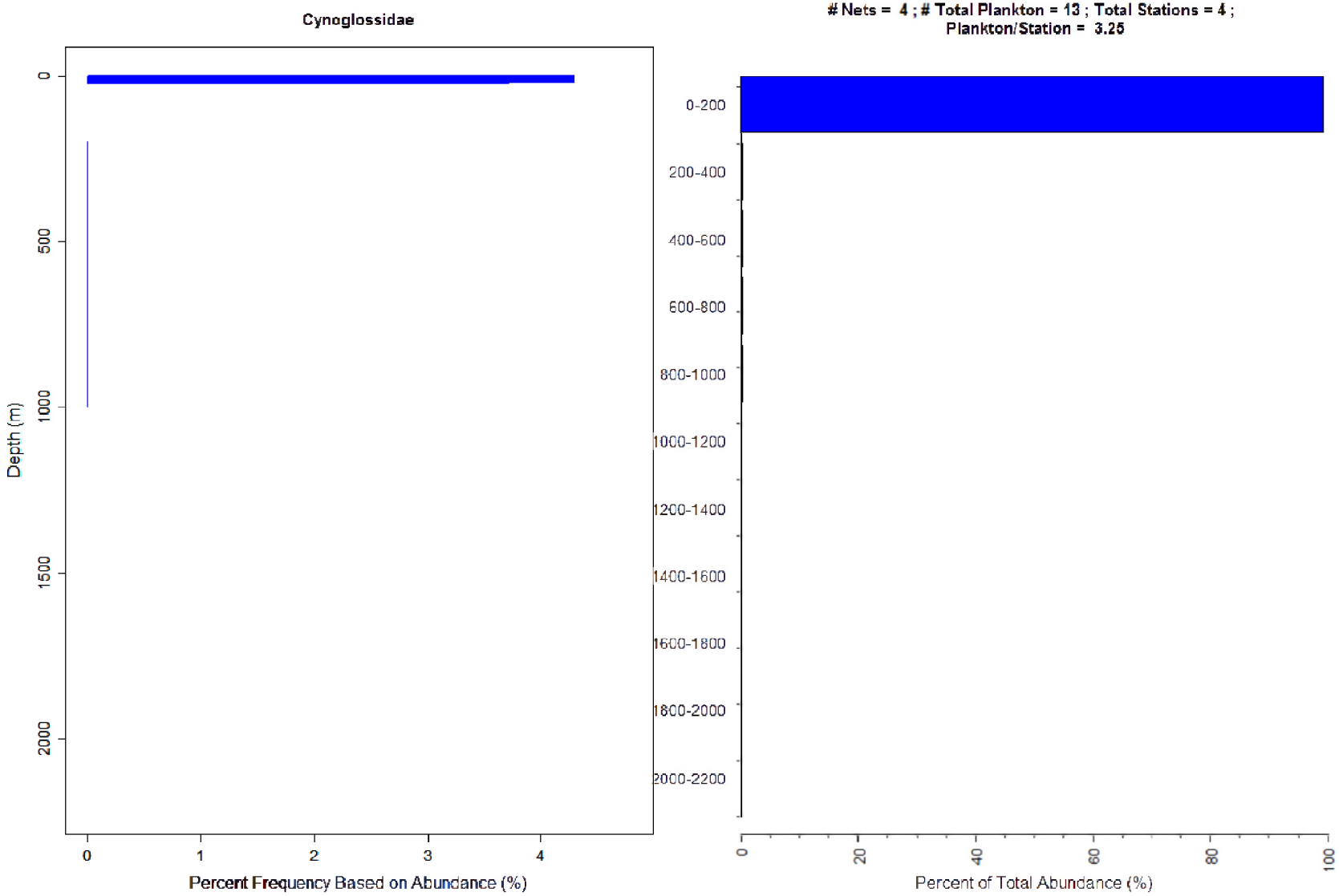
Clupeiformes - Deep



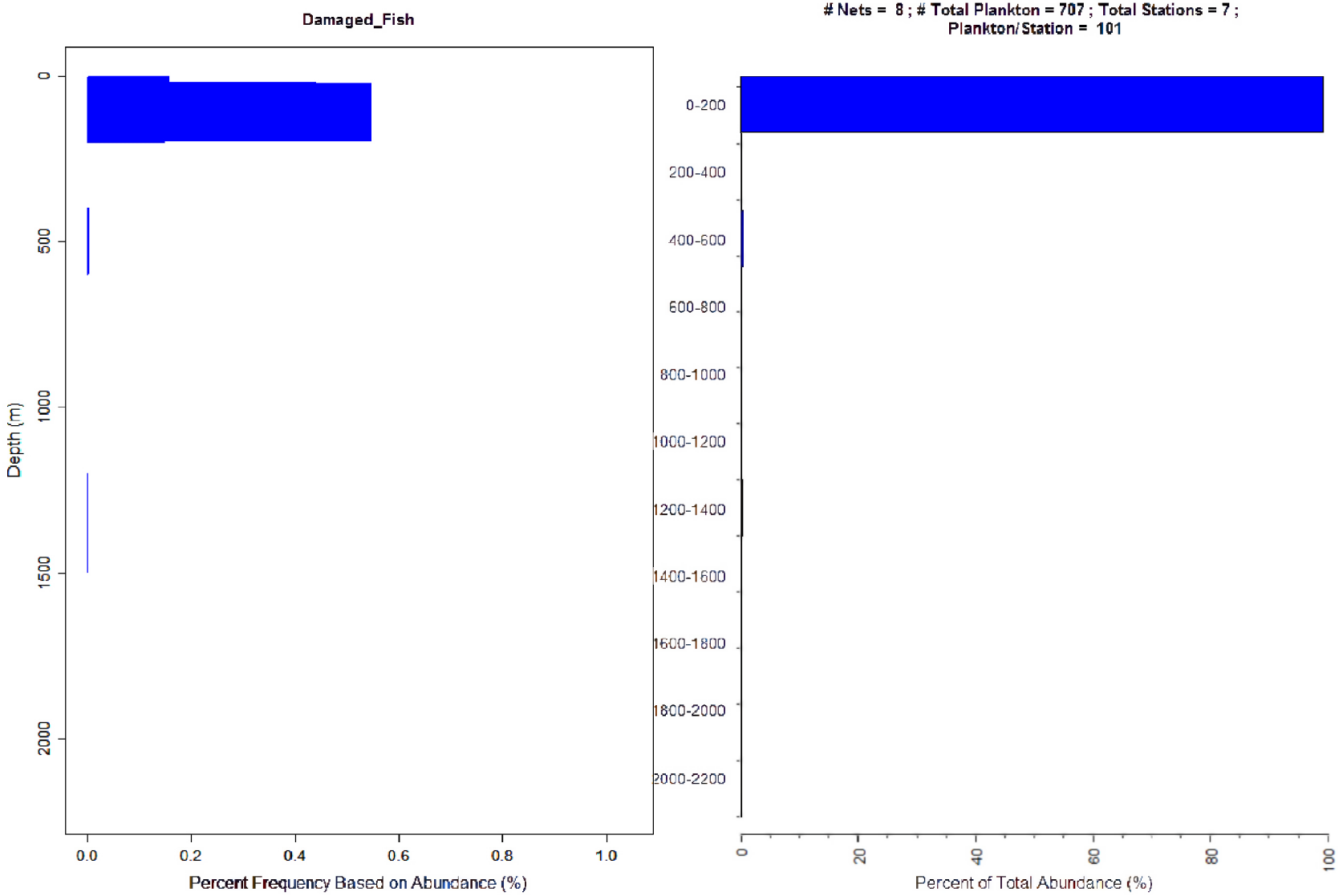
Congridae - Deep



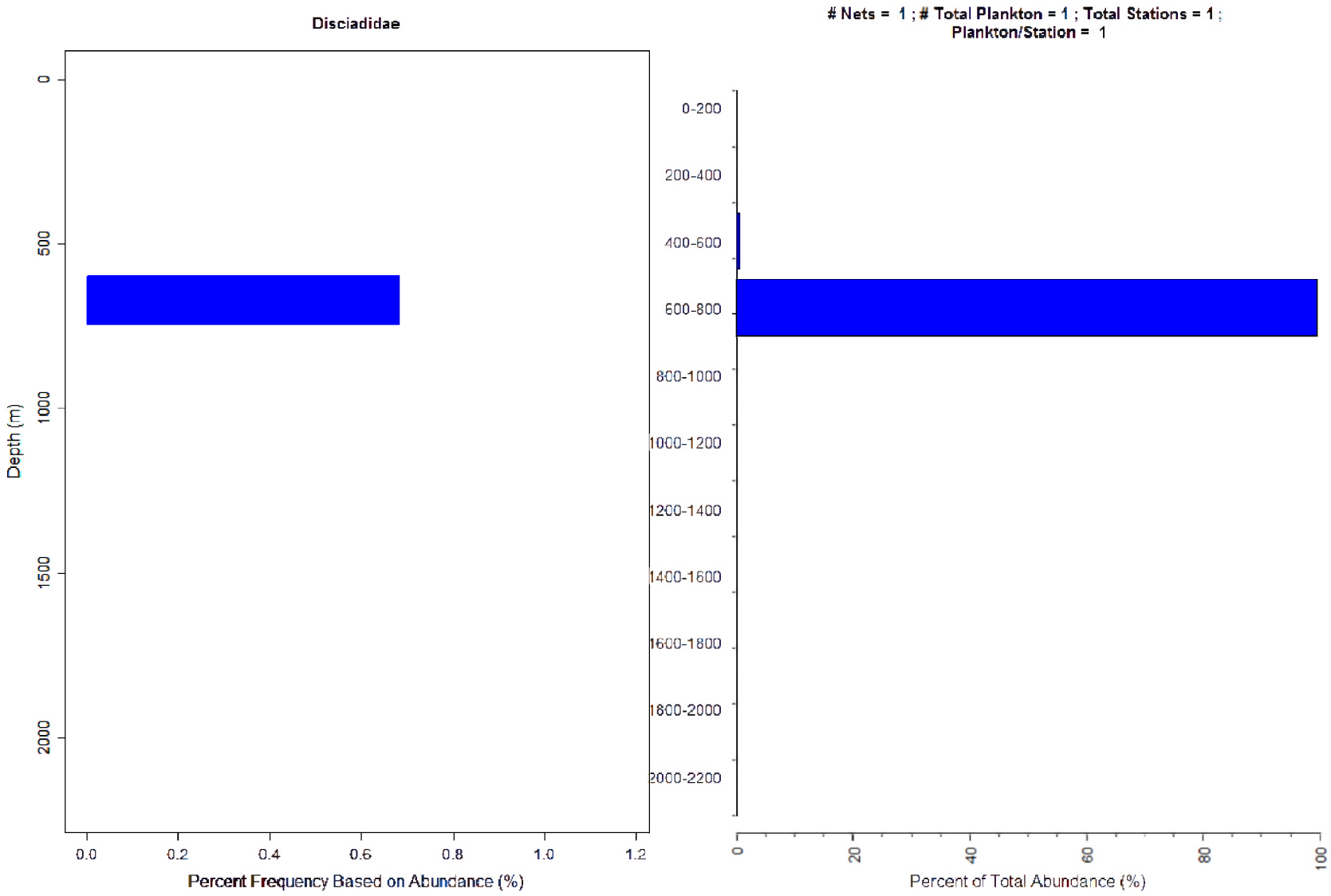
Coryphaenidae - Deep



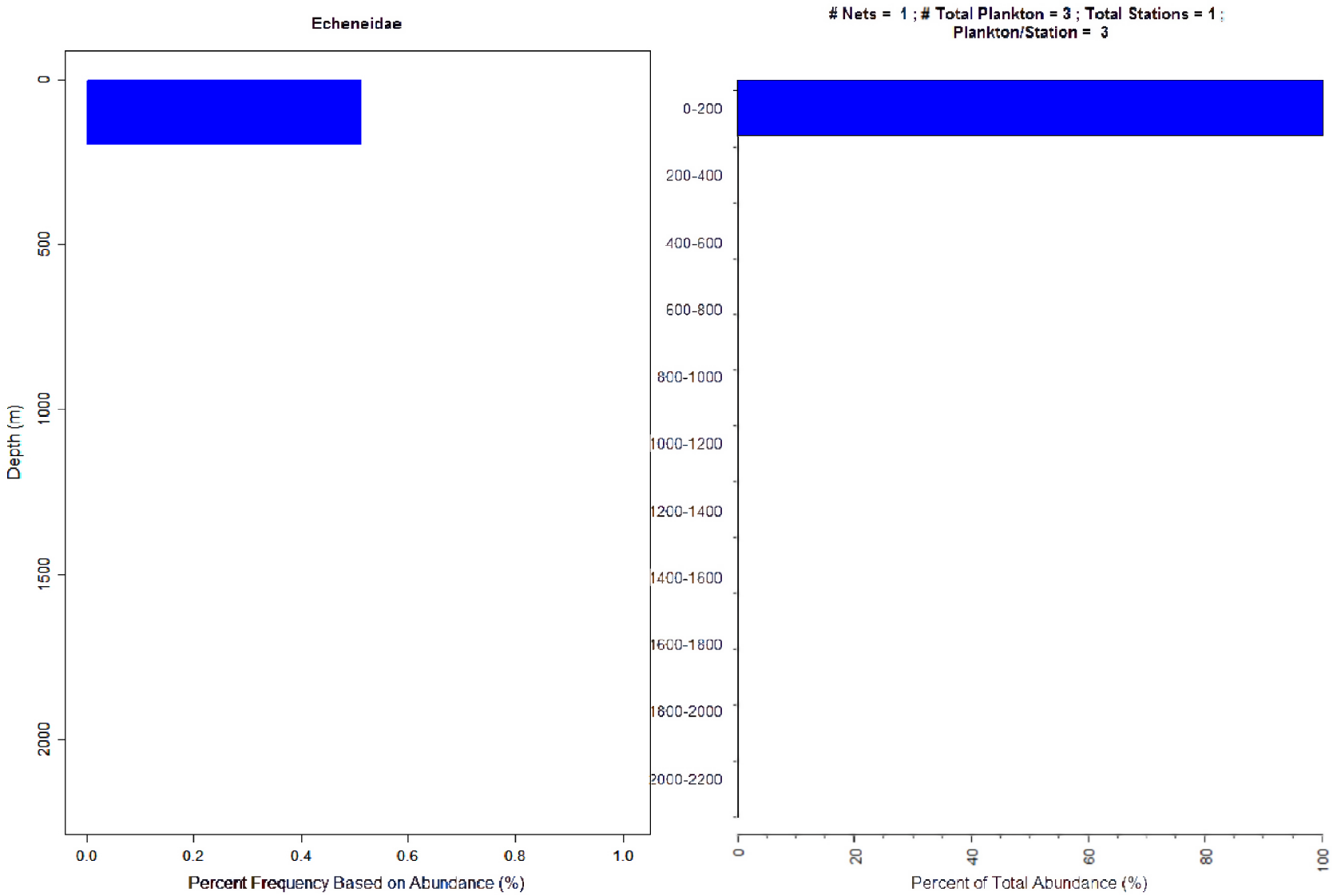
Cynoglossidae - Deep



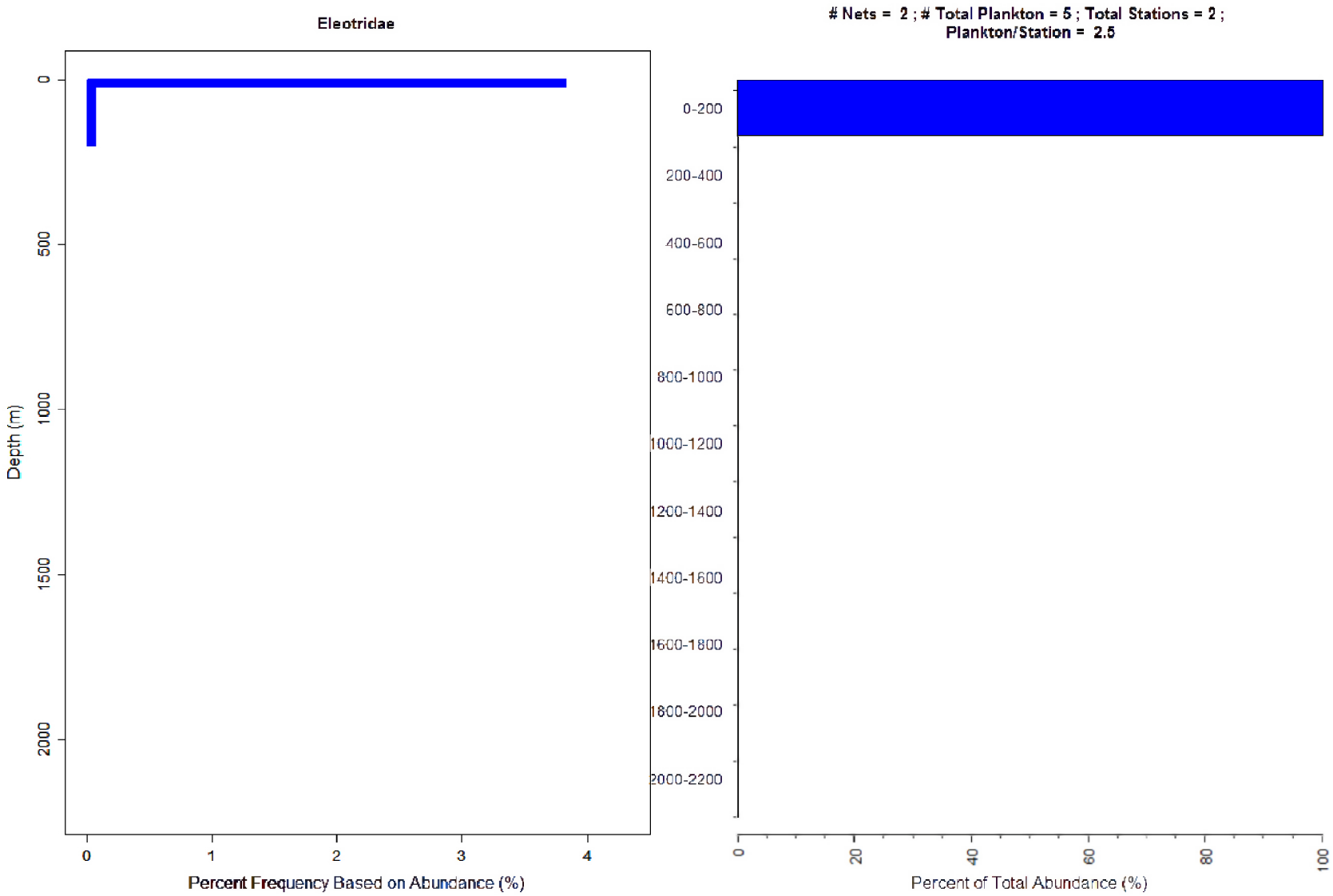
Damaged_Fish - Deep



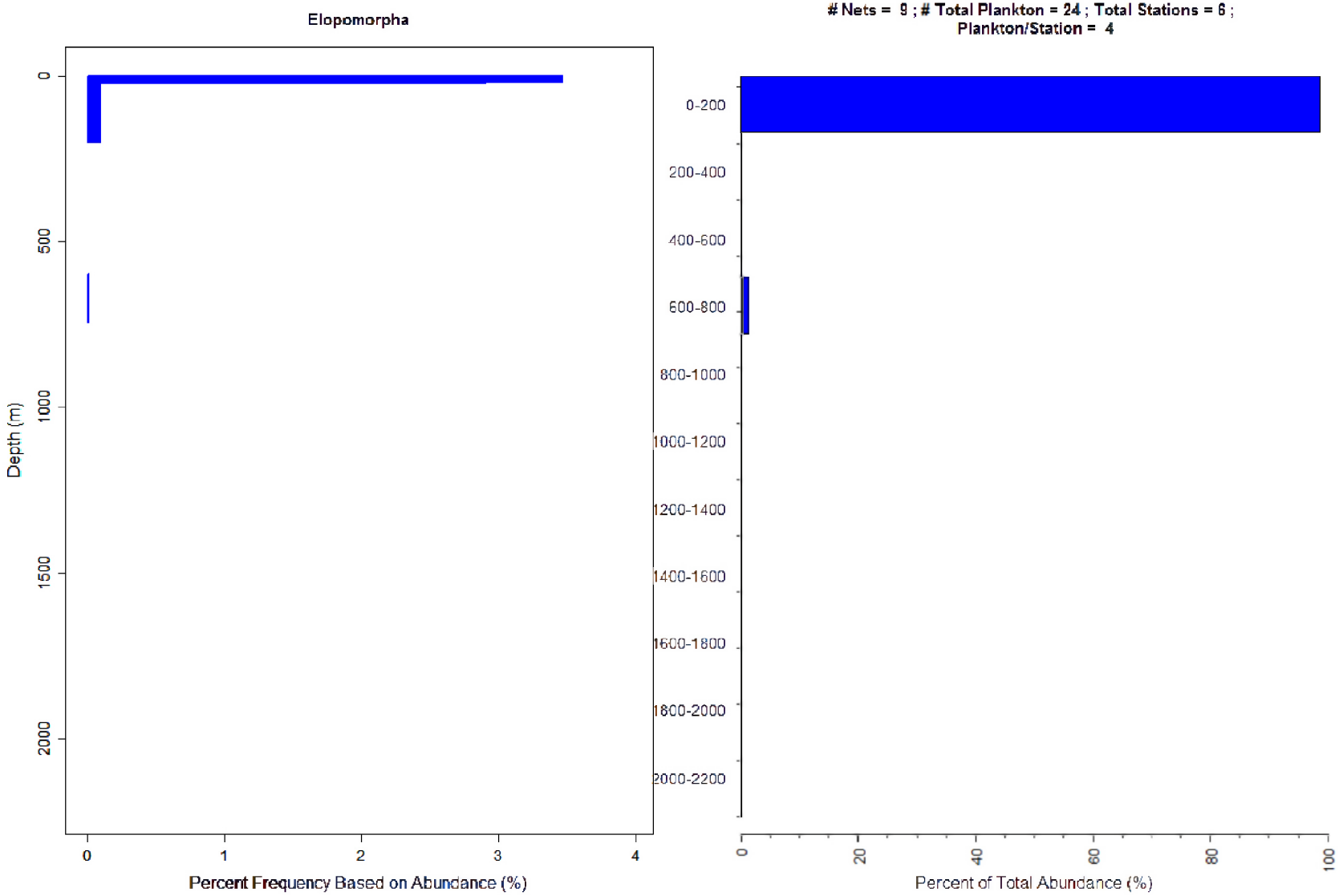
Disciadidae - Deep



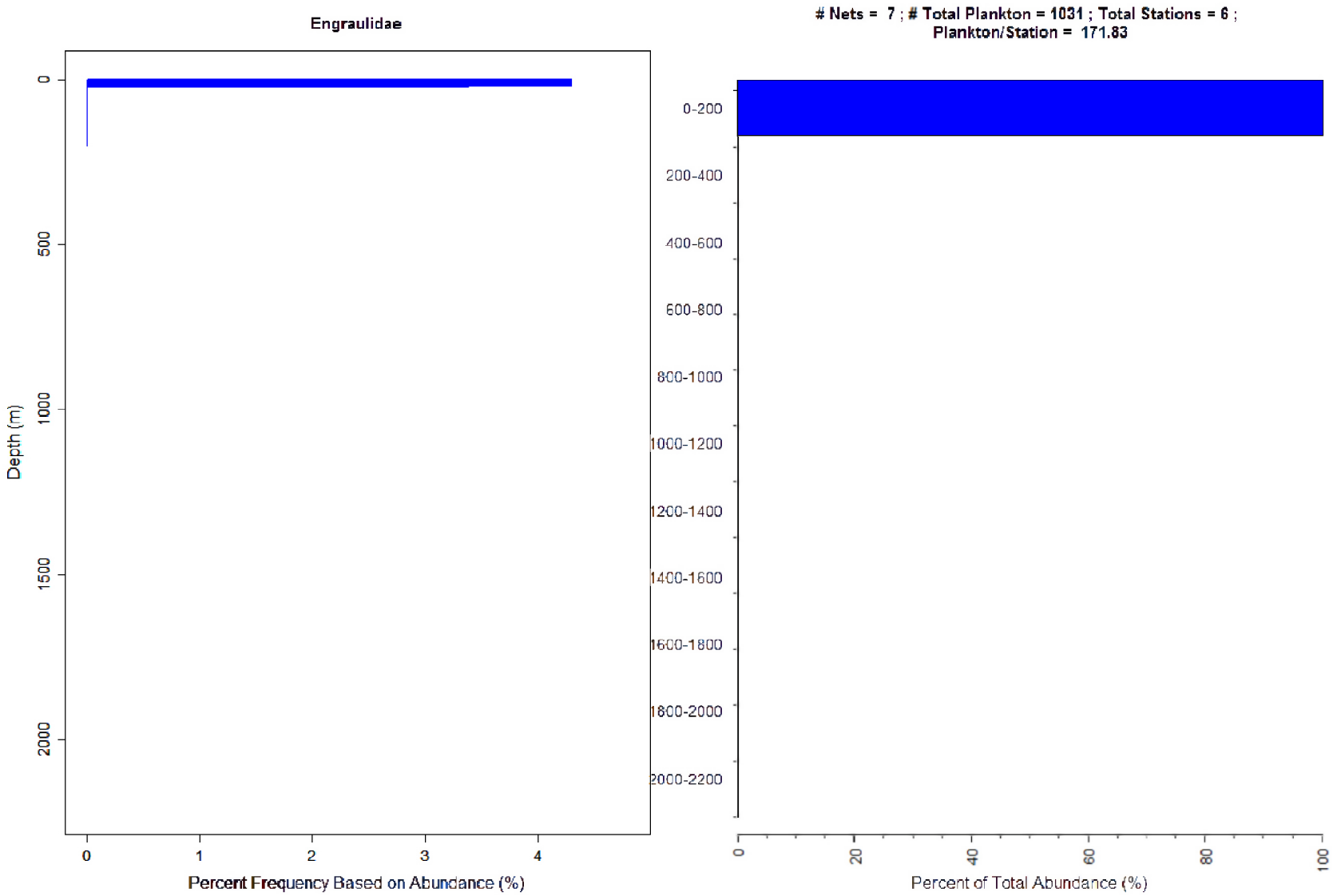
Echeneidae - Deep



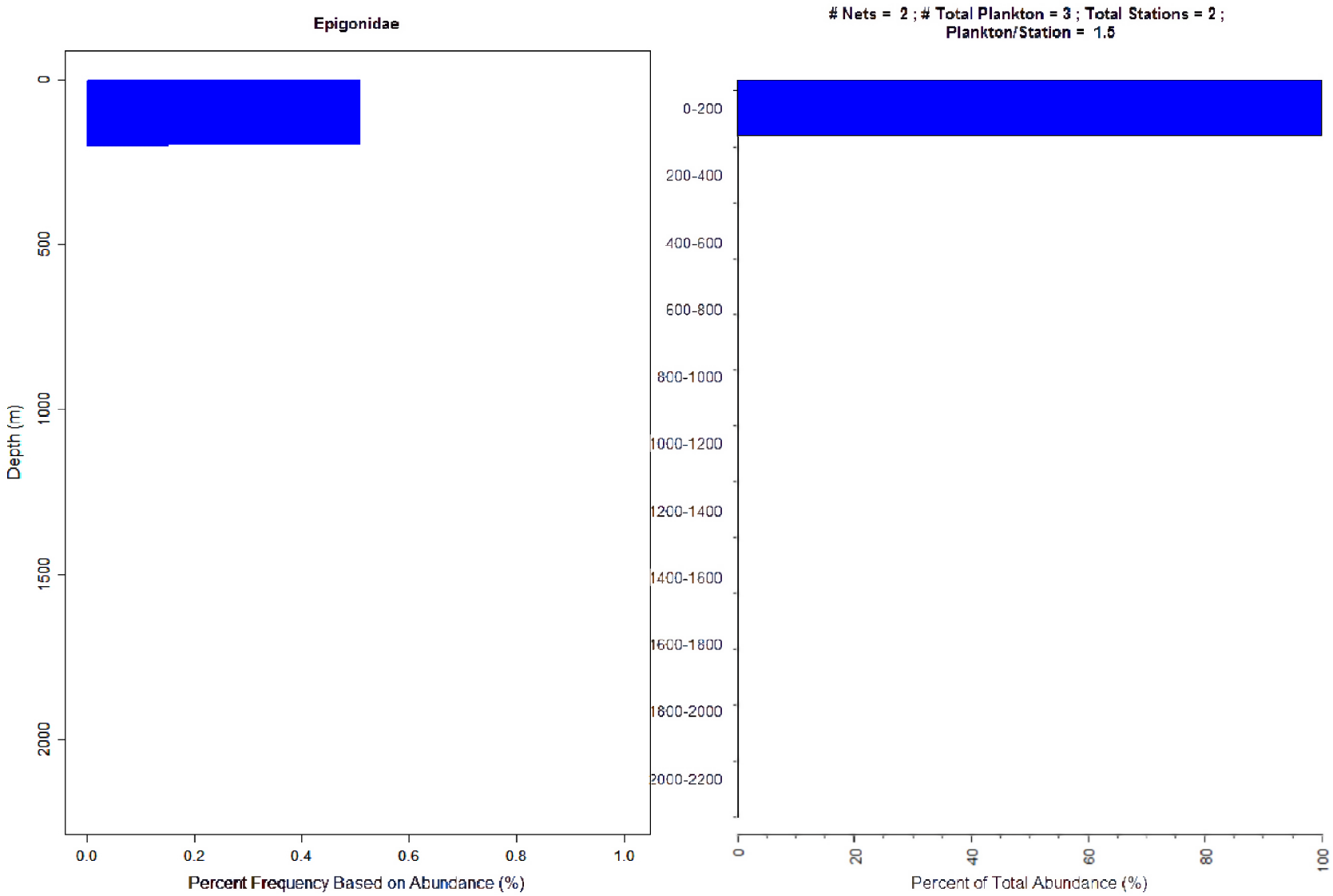
Eleotridae - Deep



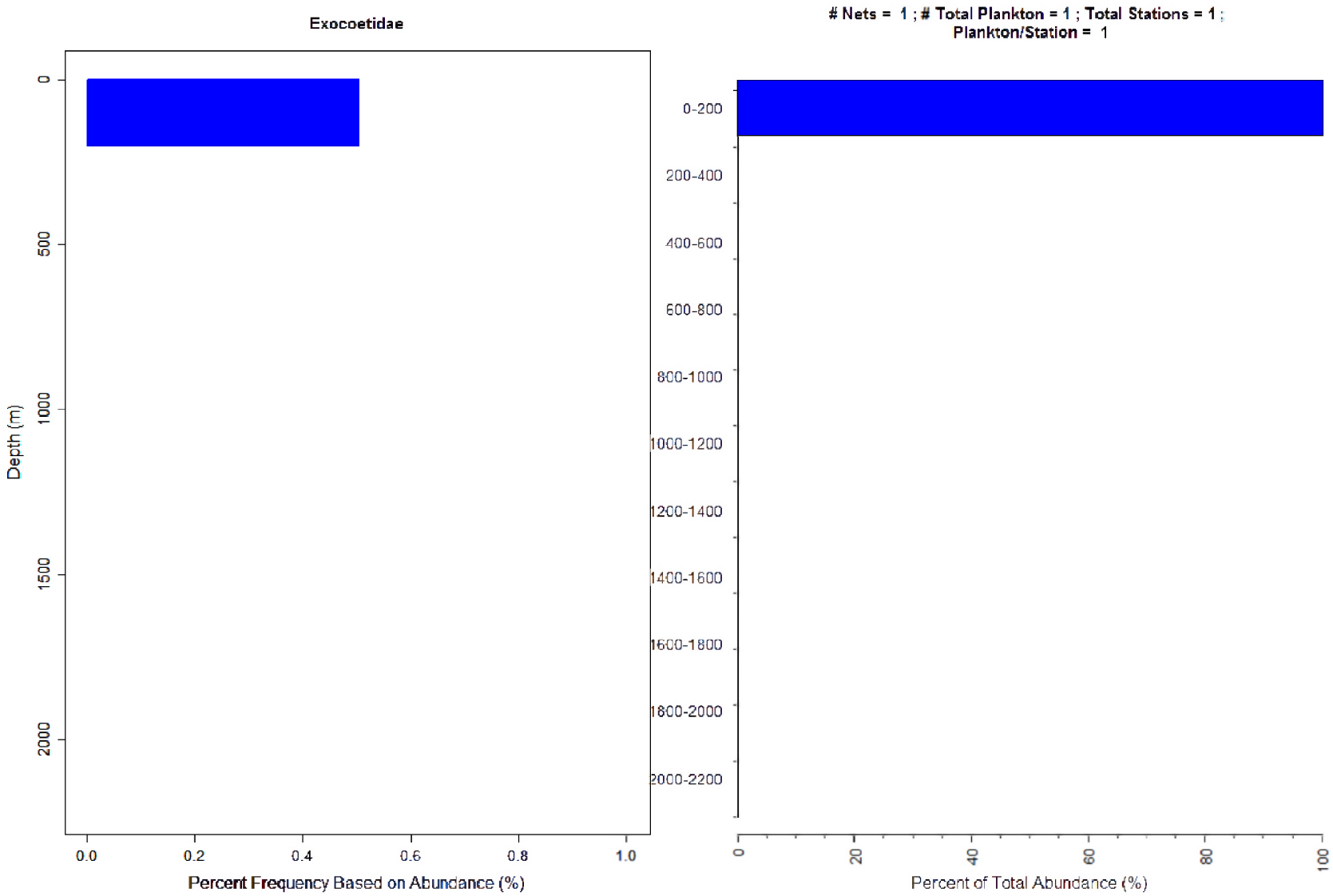
Elopomorpha - Deep



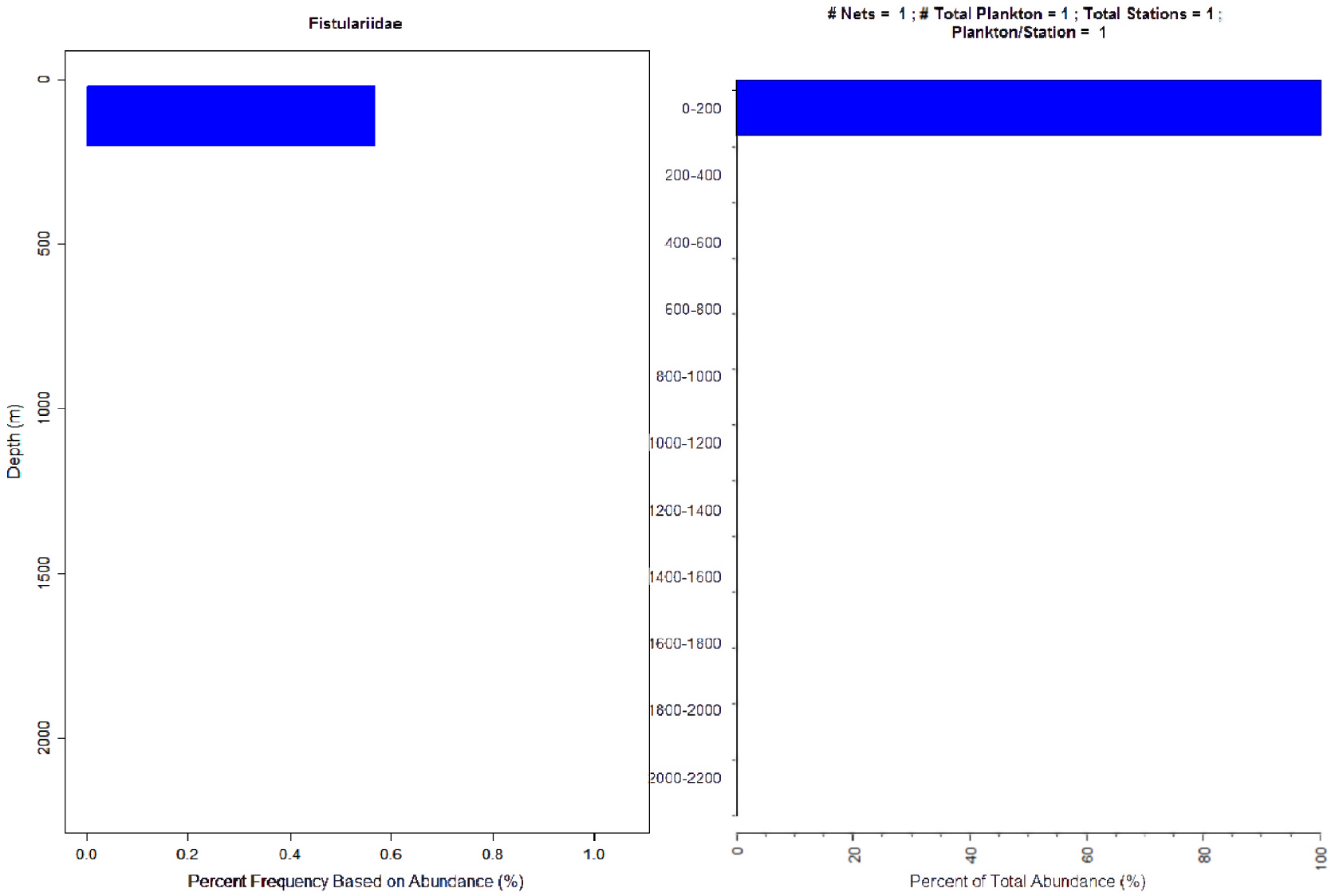
Engraulidae - Deep



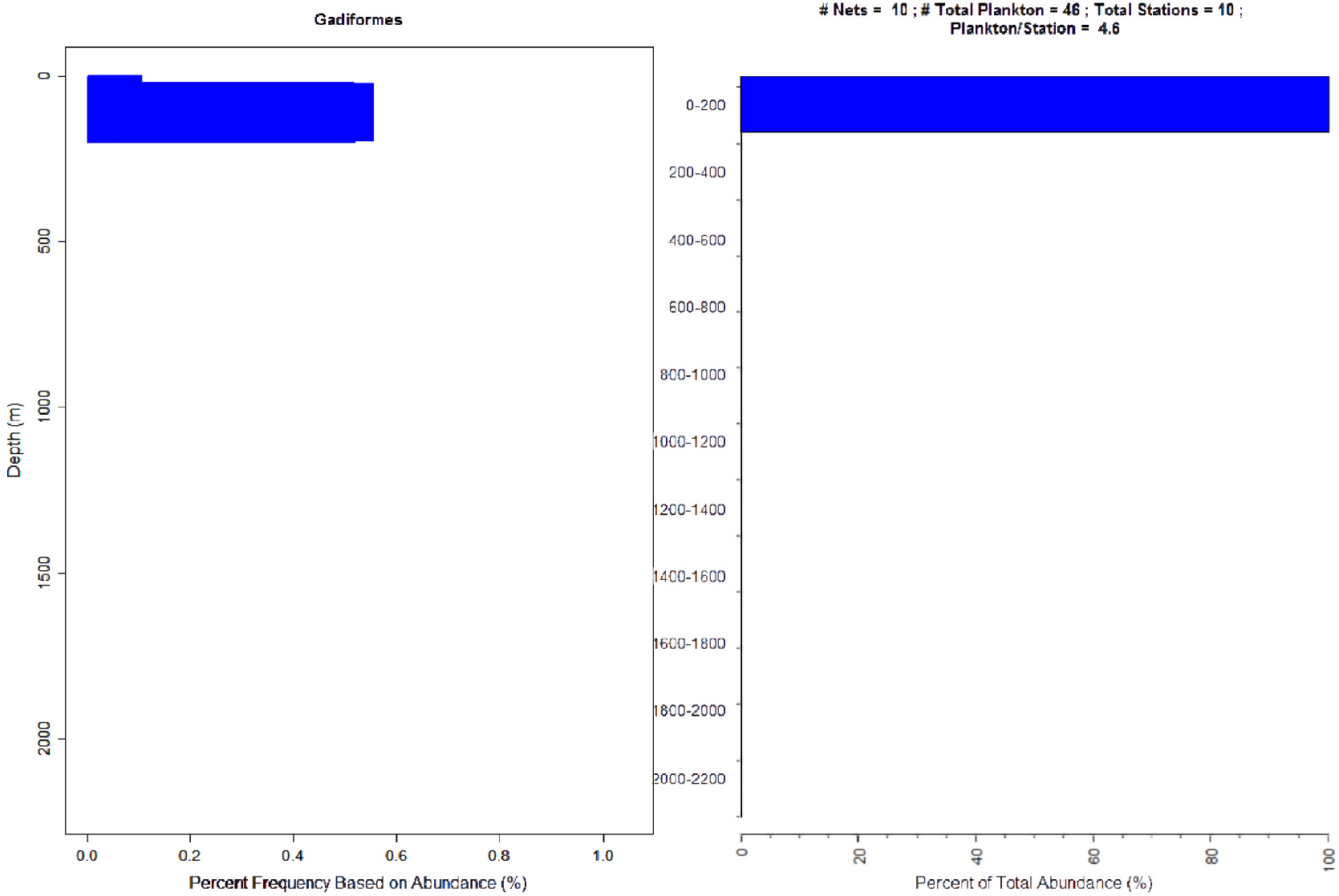
Epigonidae - Deep



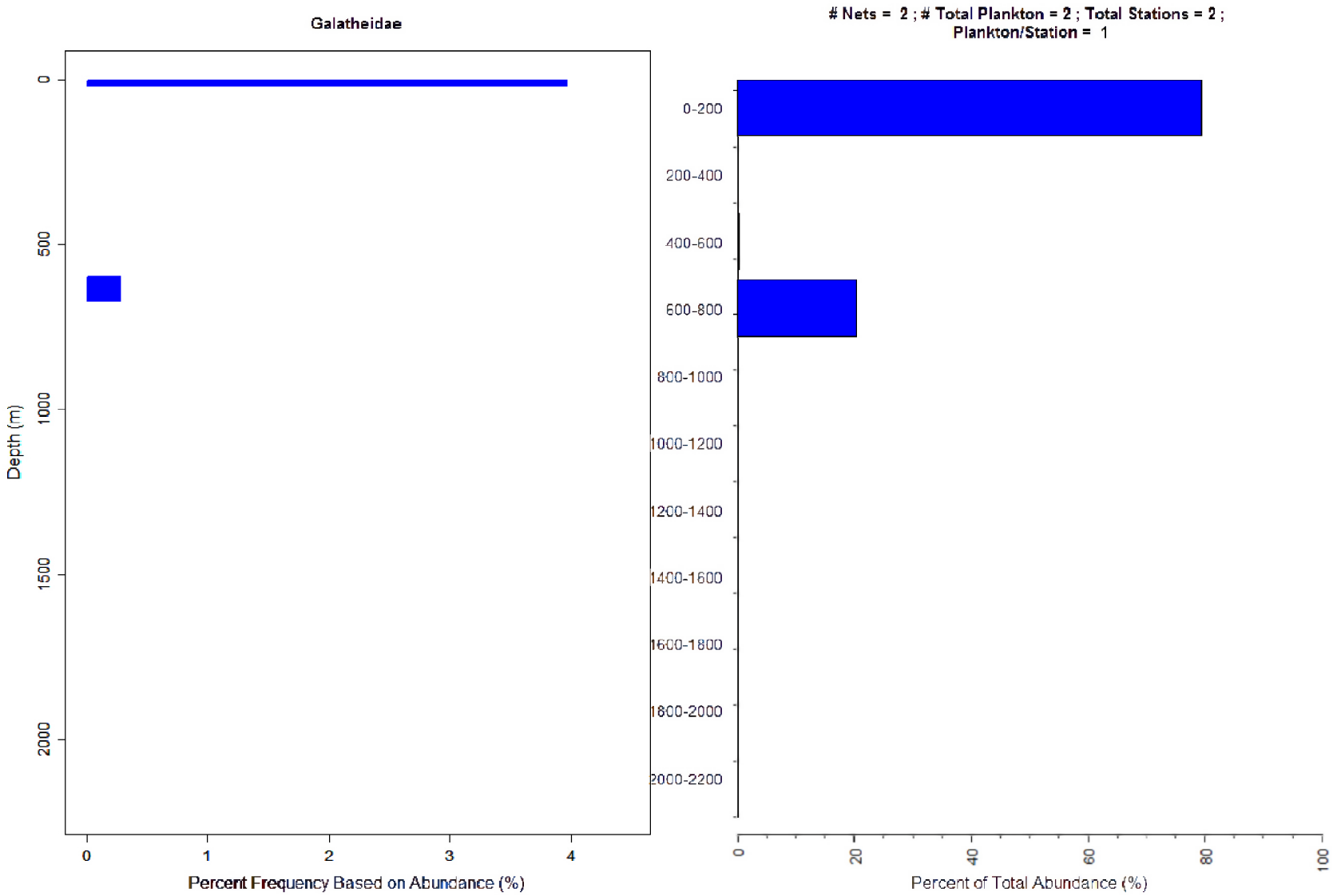
Exocoetidae - Deep



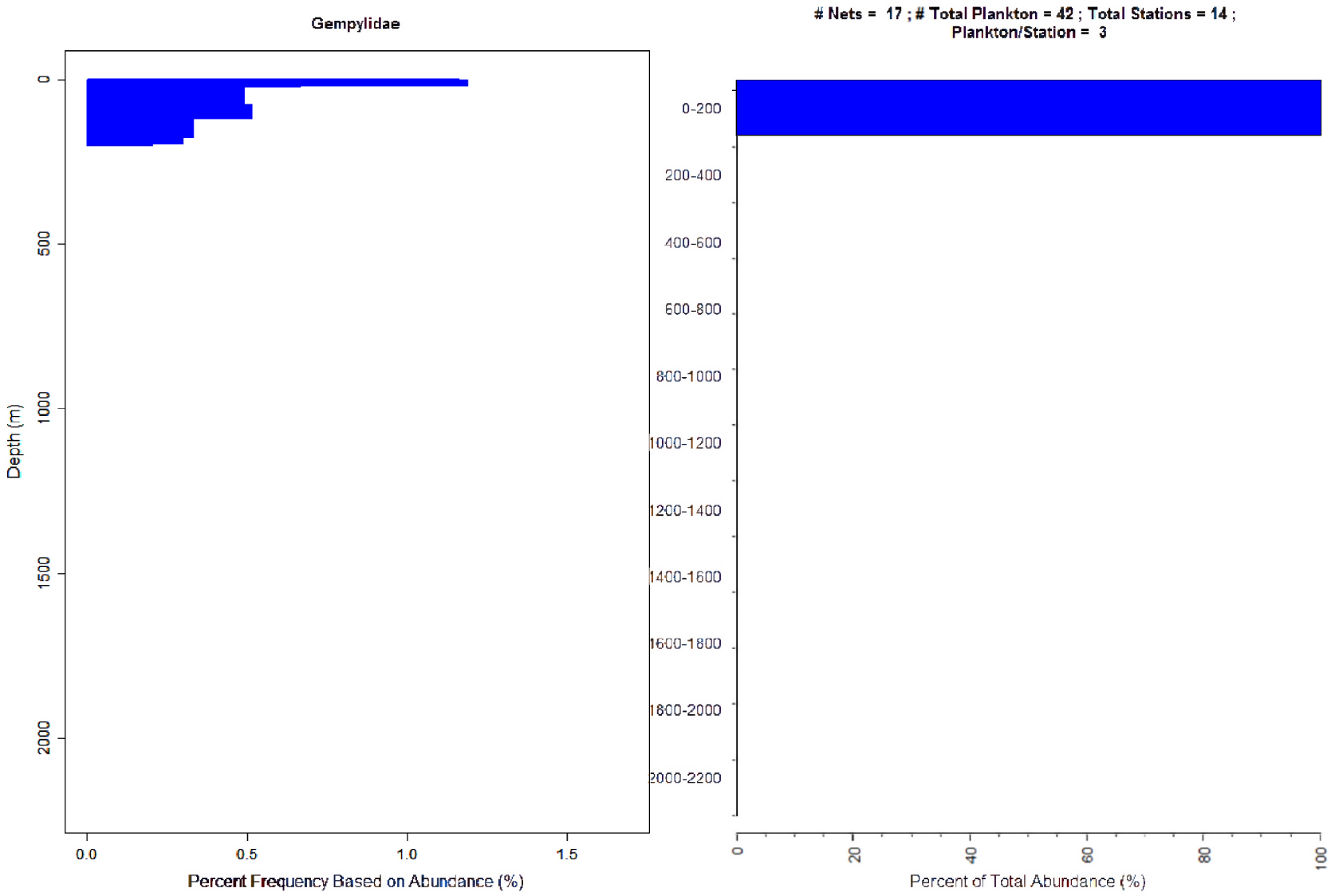
Fistulariidae - Deep



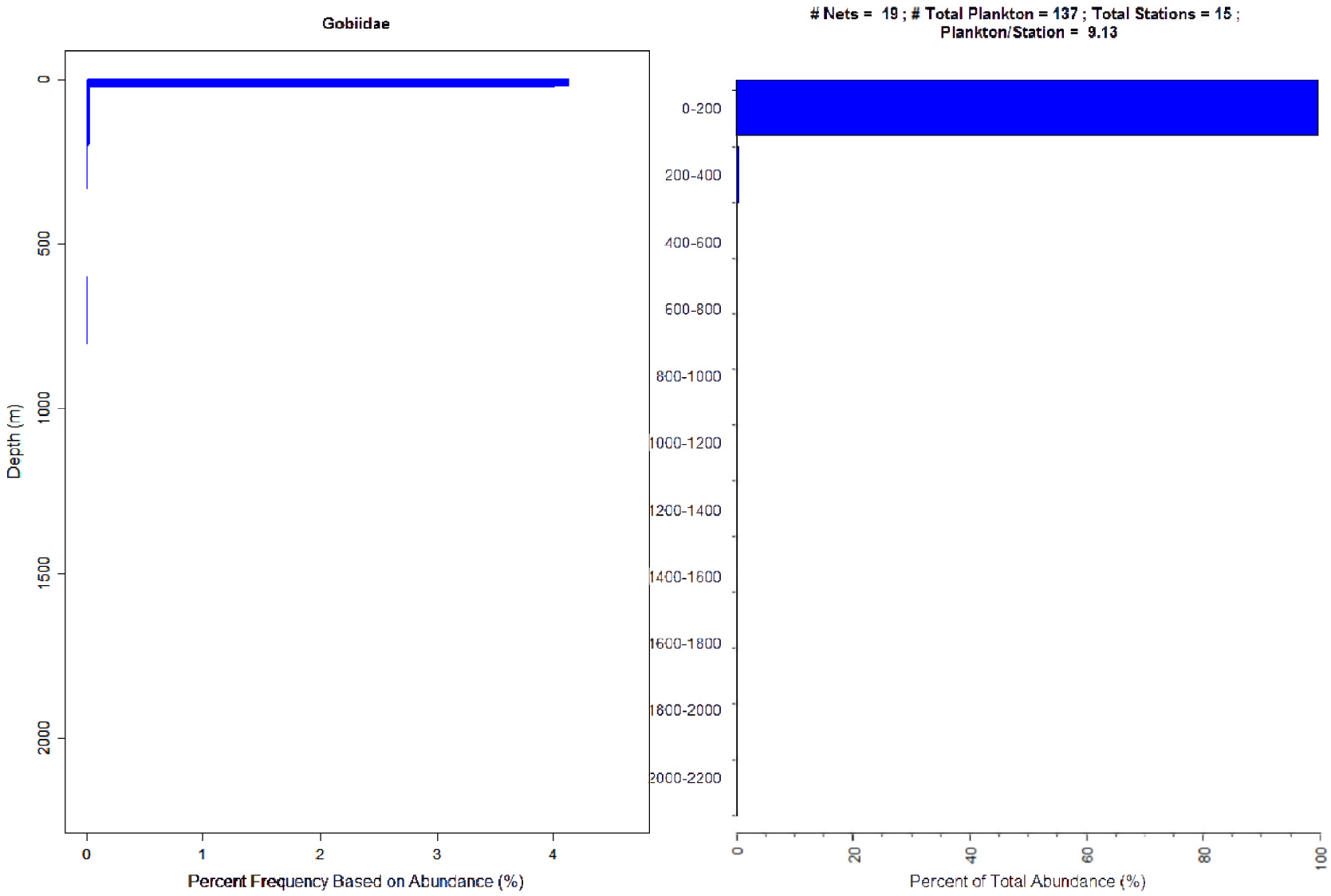
Gadiformes - Deep



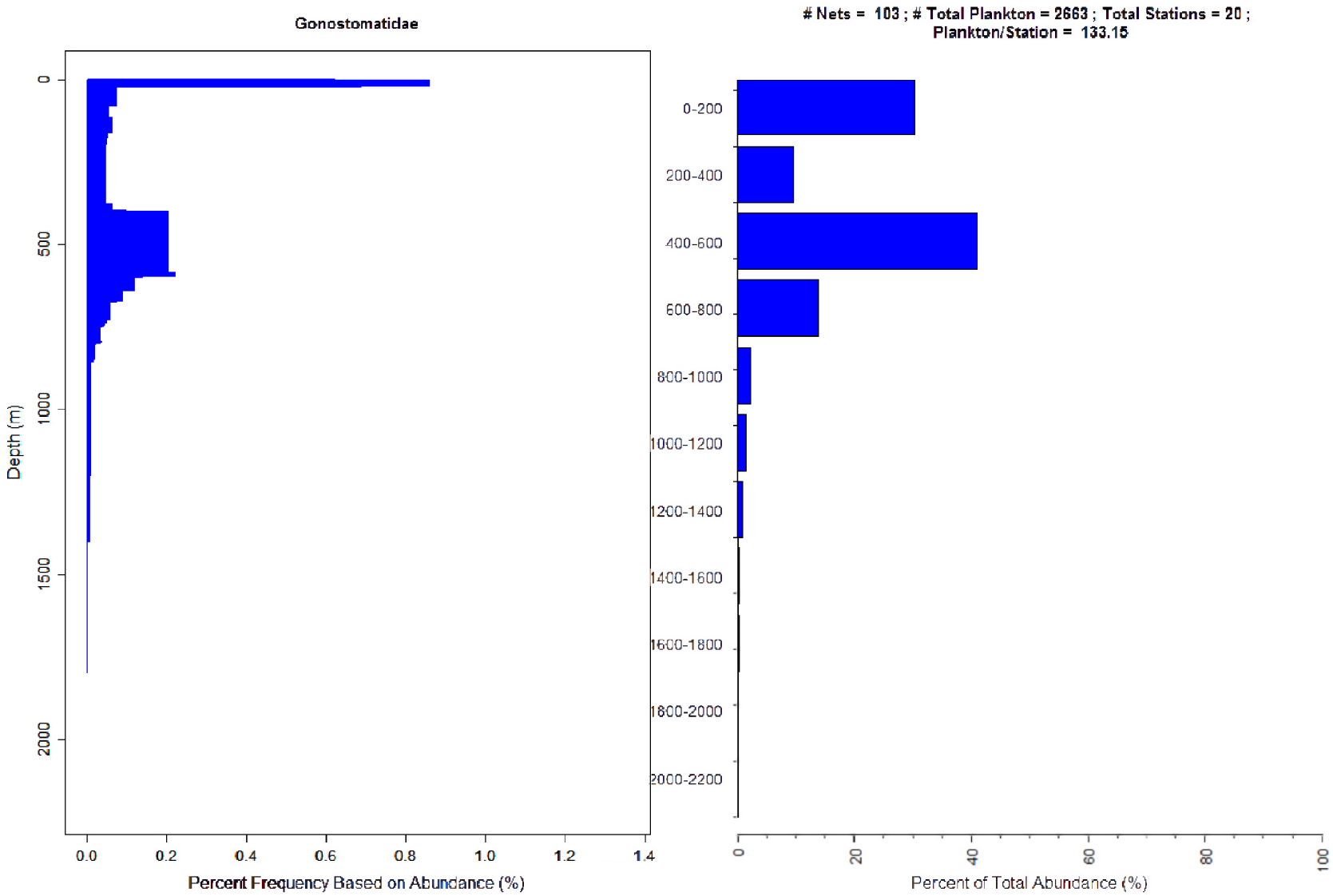
Galatheidae - Deep



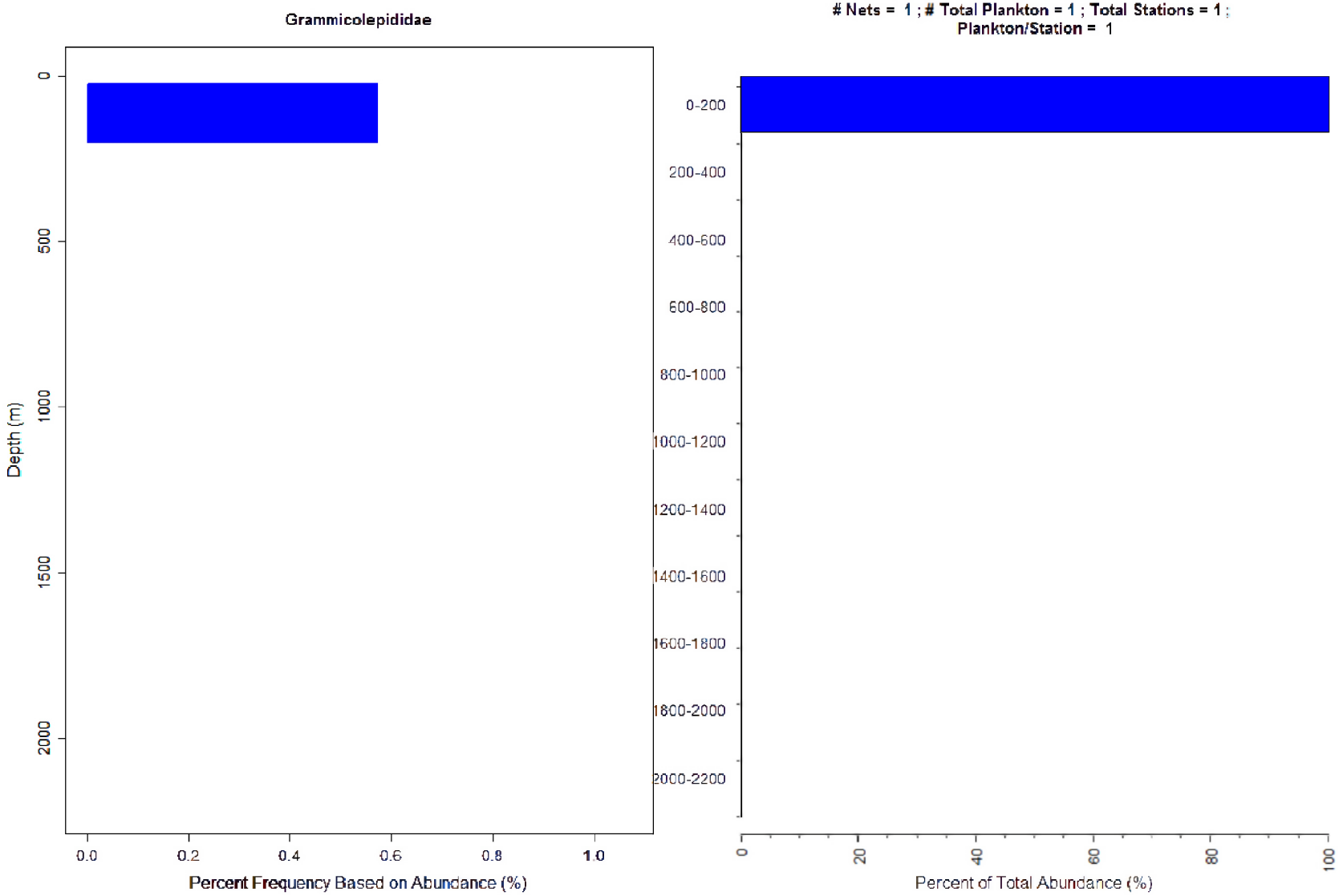
Gempylidae - Deep



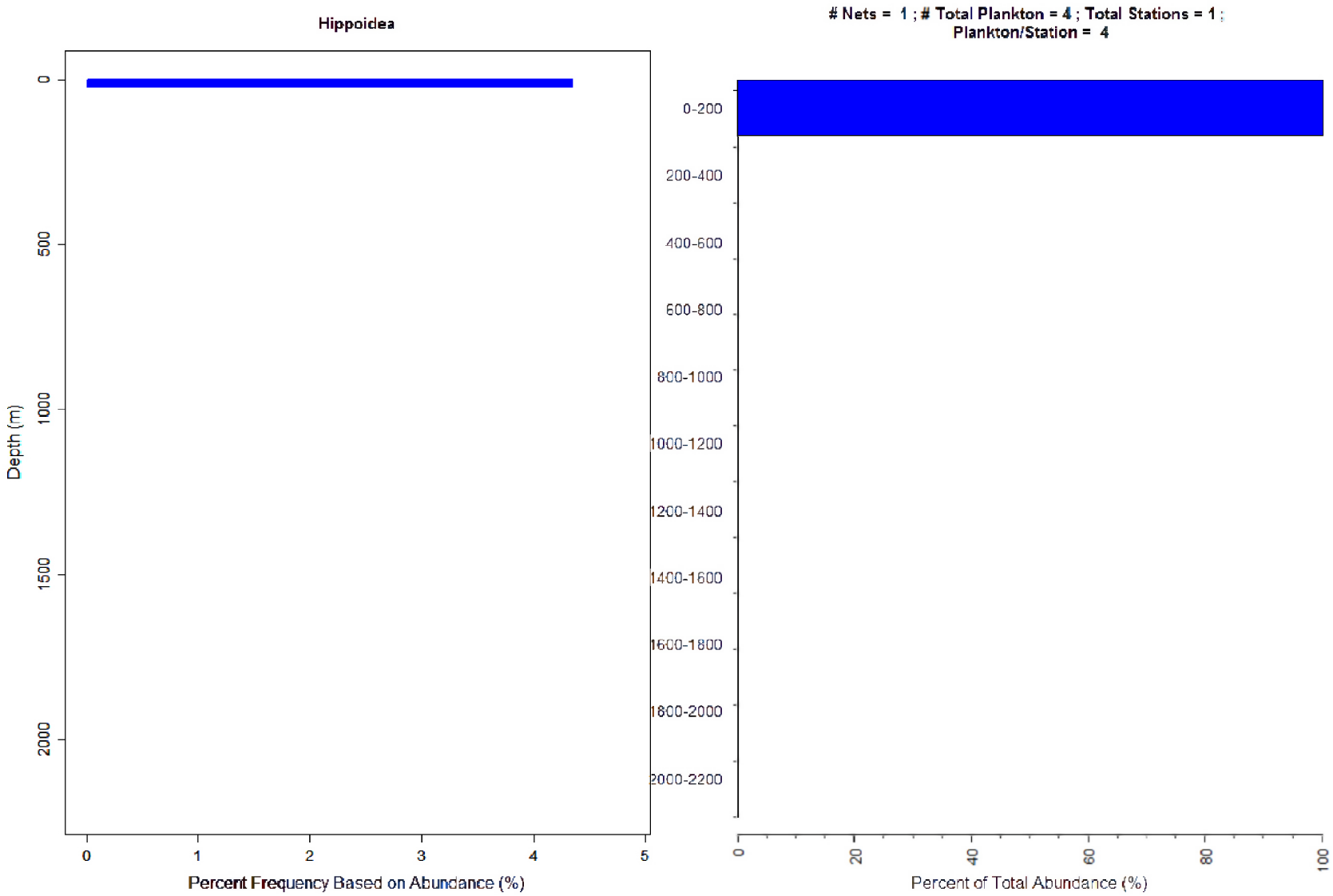
Gobiidae - Deep



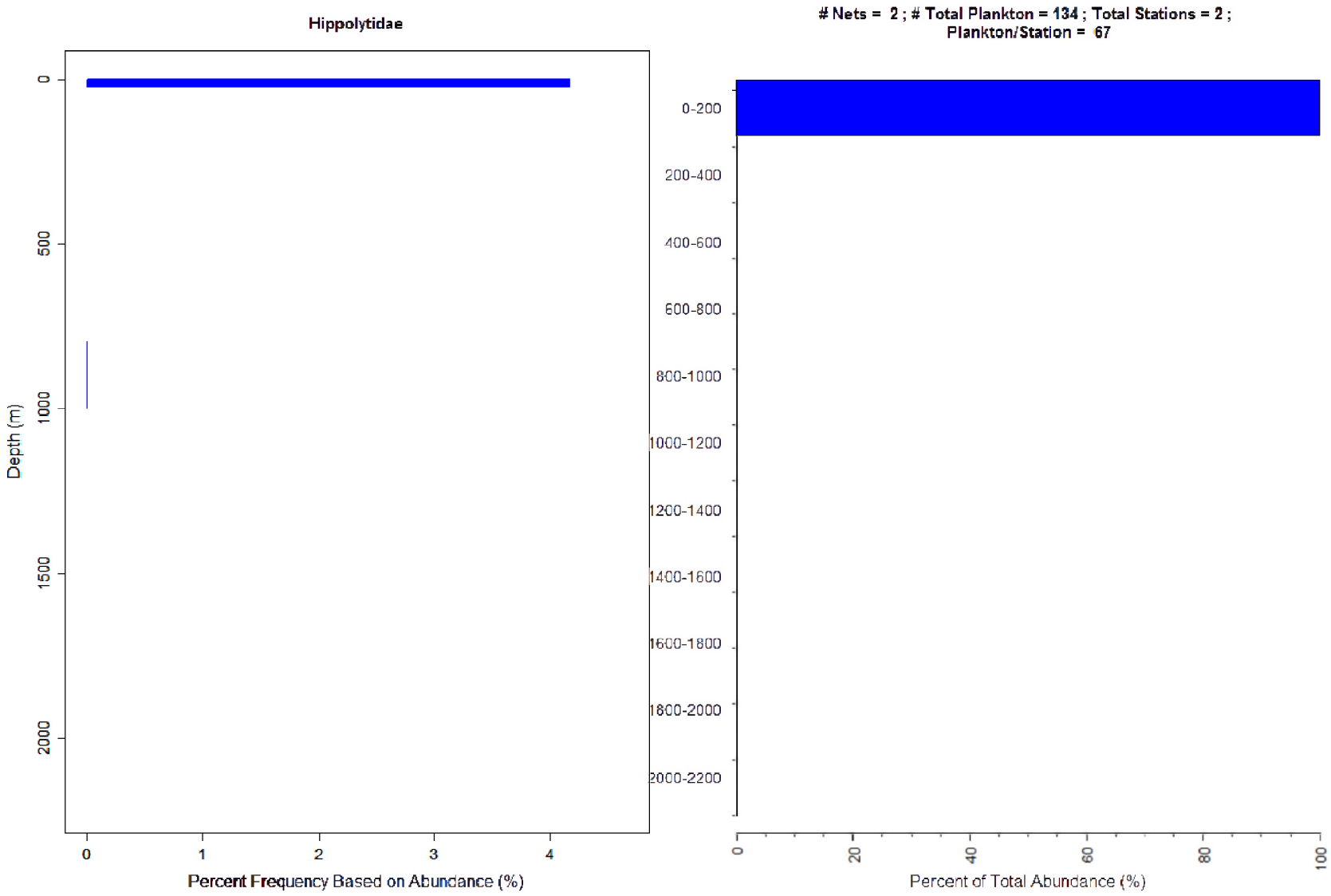
Gonostomatidae - Deep



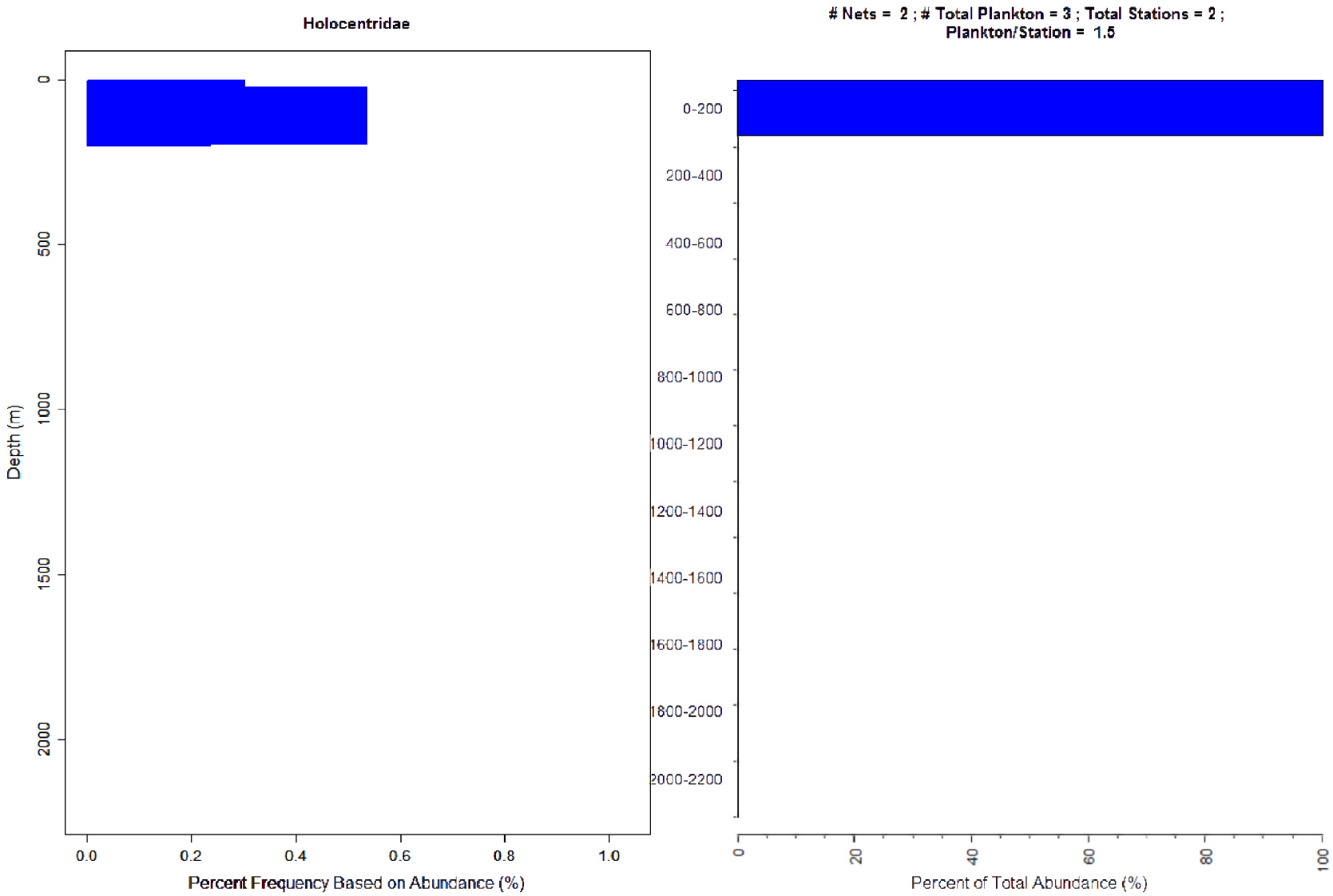
Grammicolepididae - Deep



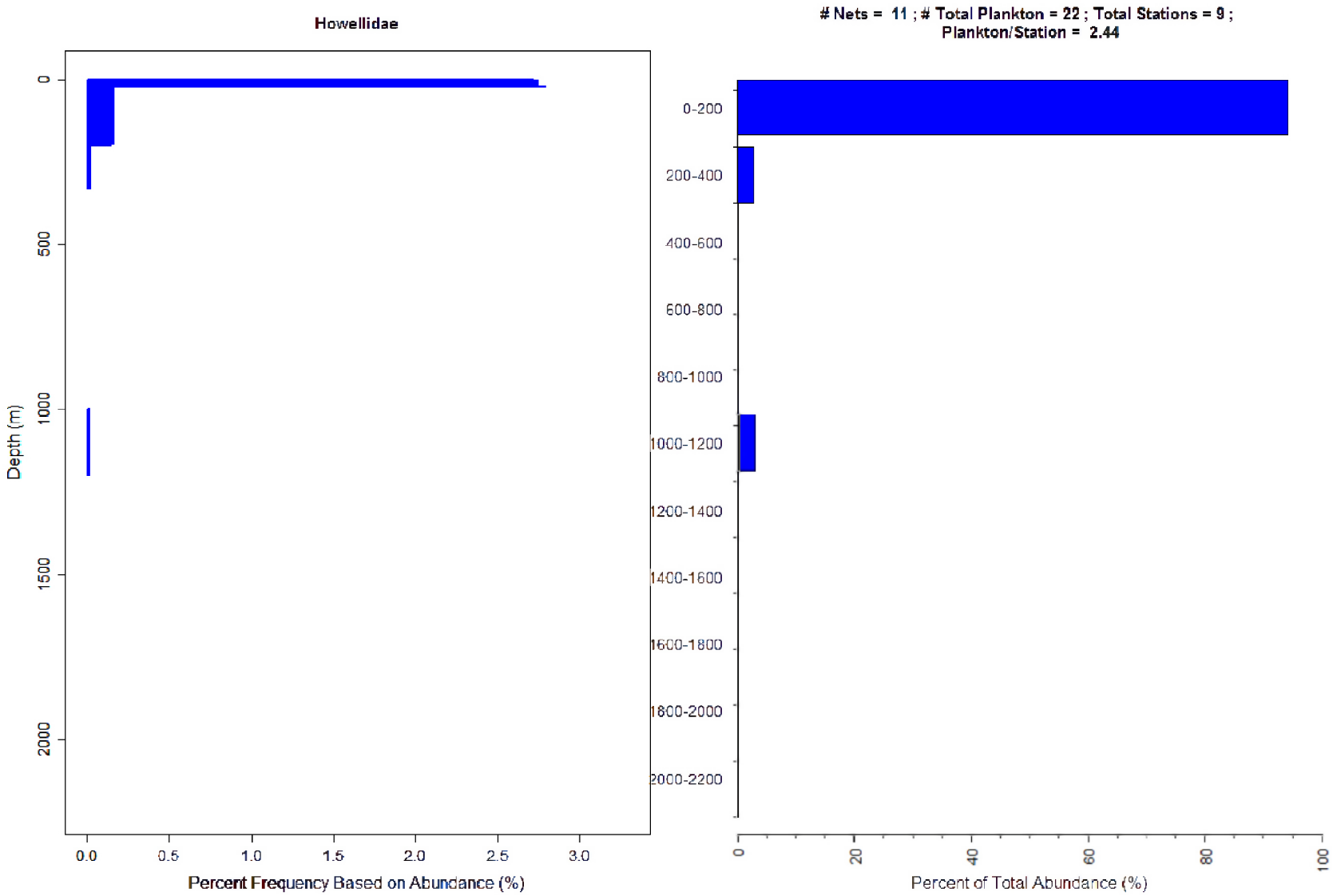
Hippoidea - Deep



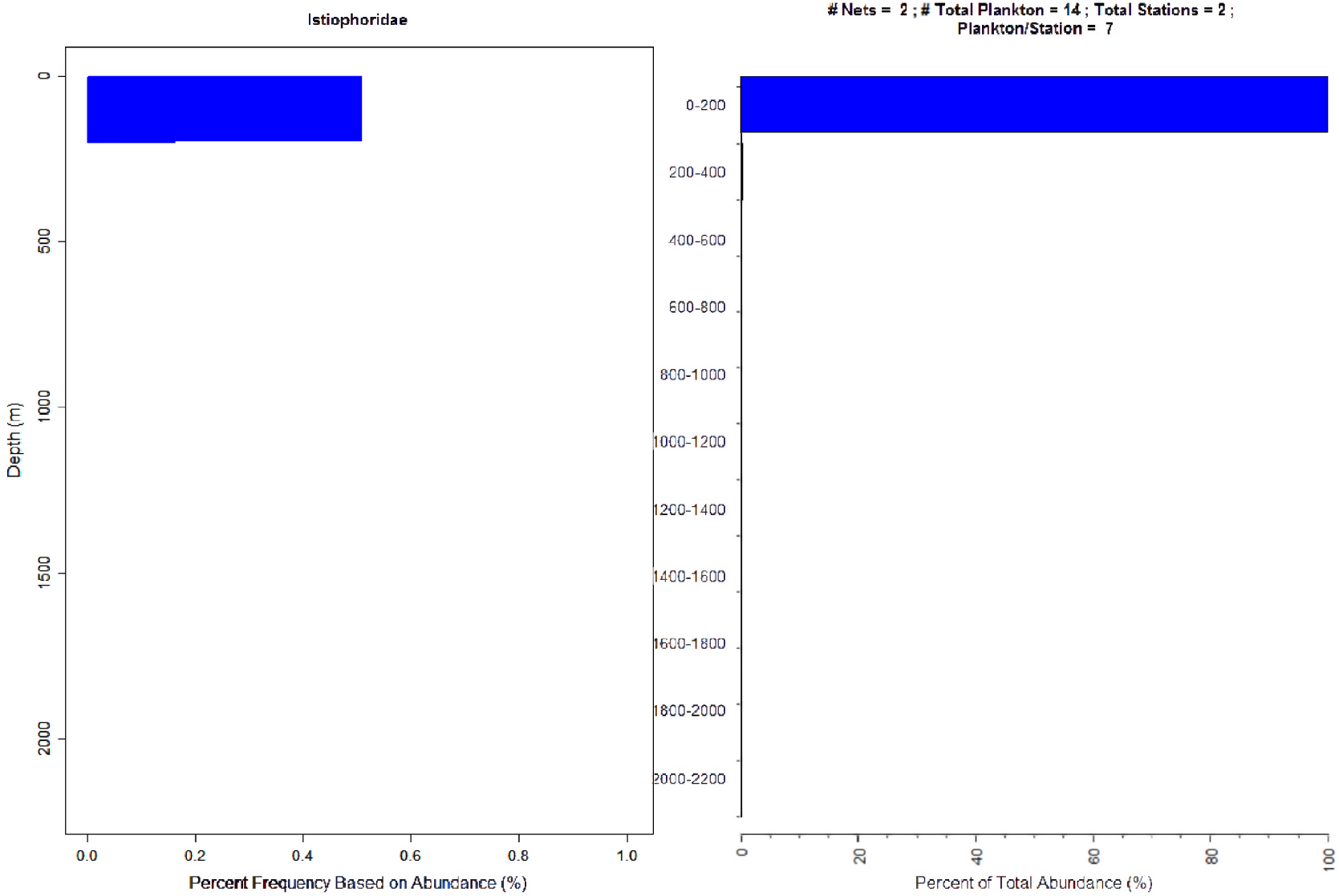
Hippolytidae - Deep



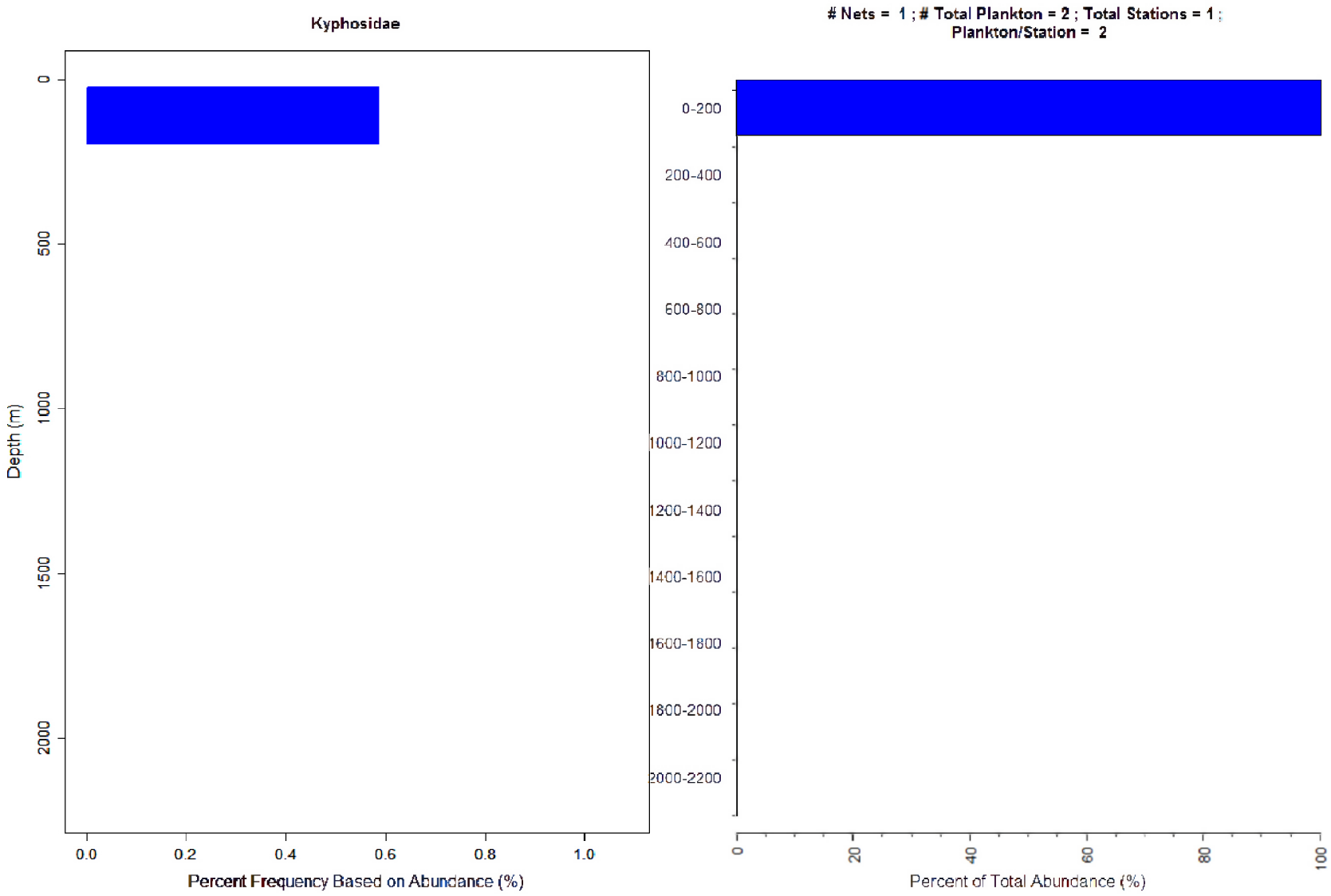
Holocentridae - Deep



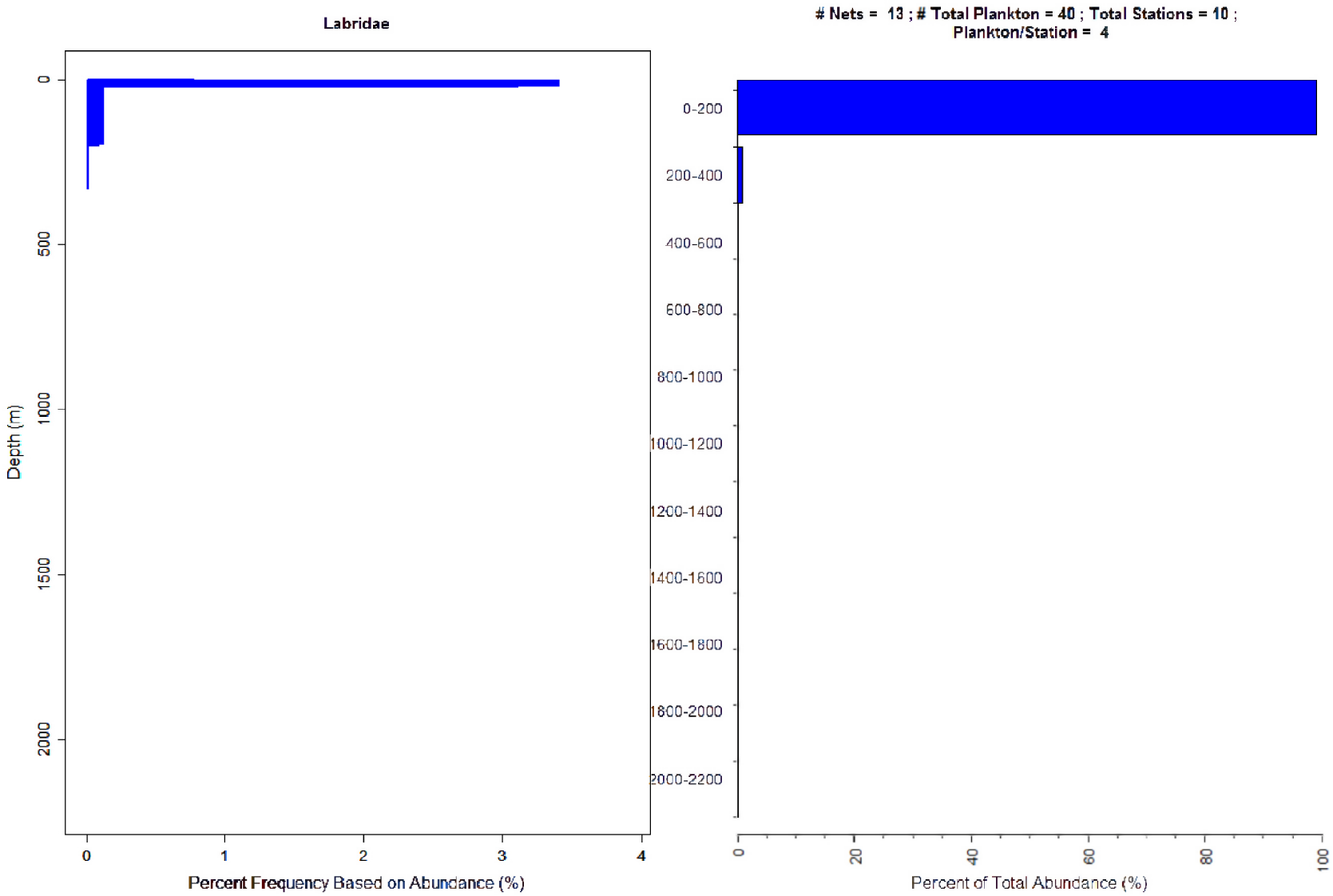
Howellidae - Deep



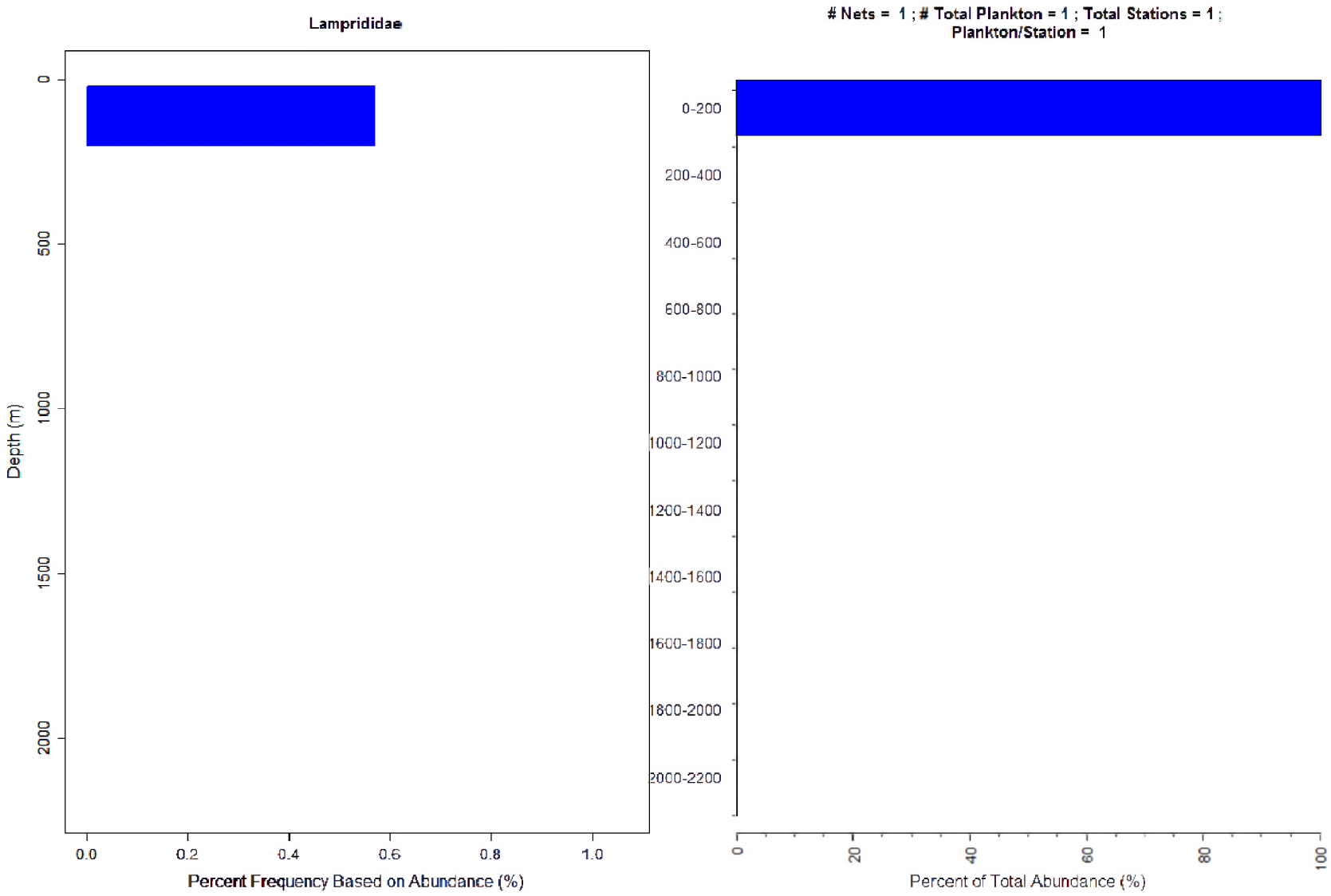
Istiophoridae - Deep



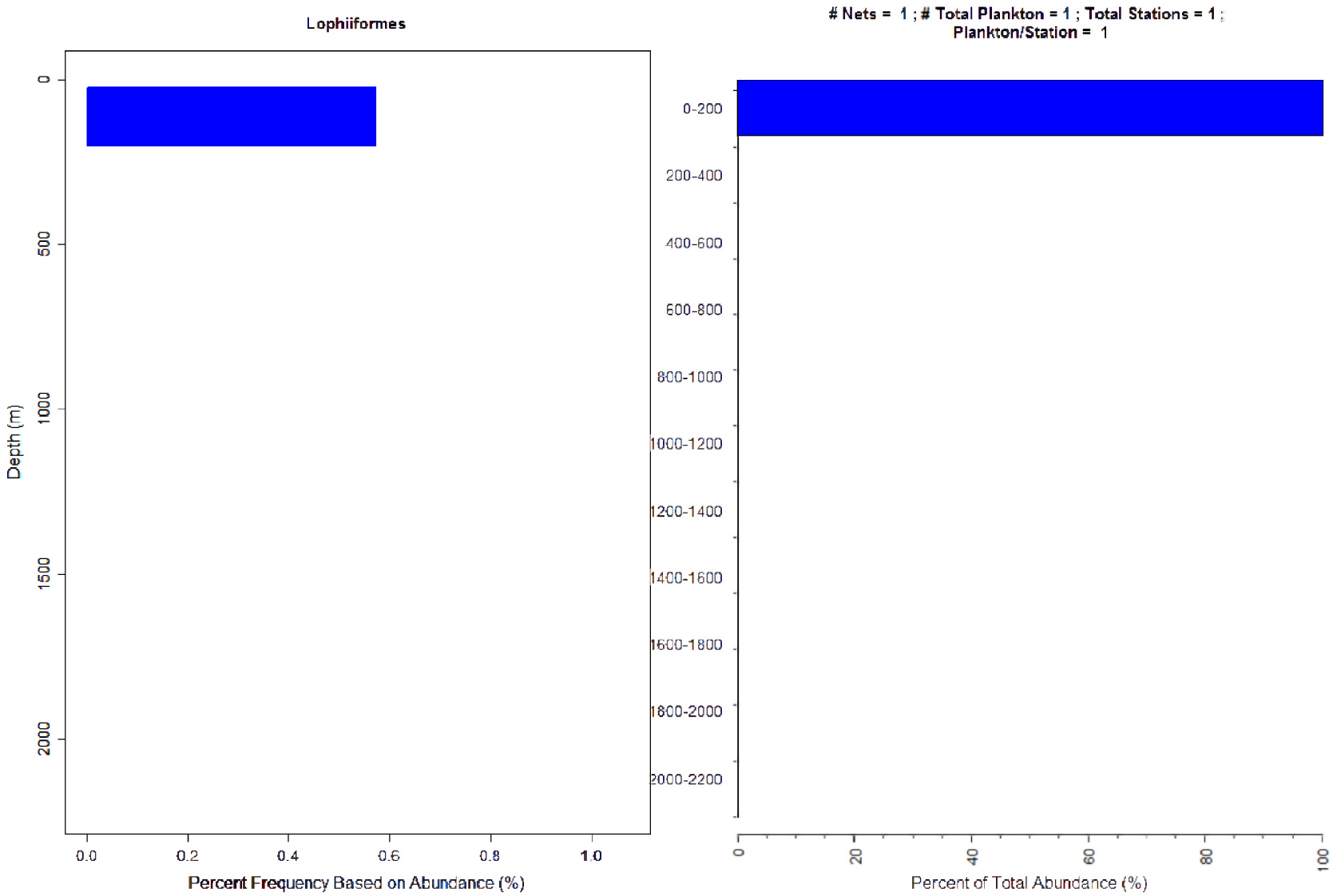
Kyphosidae - Deep



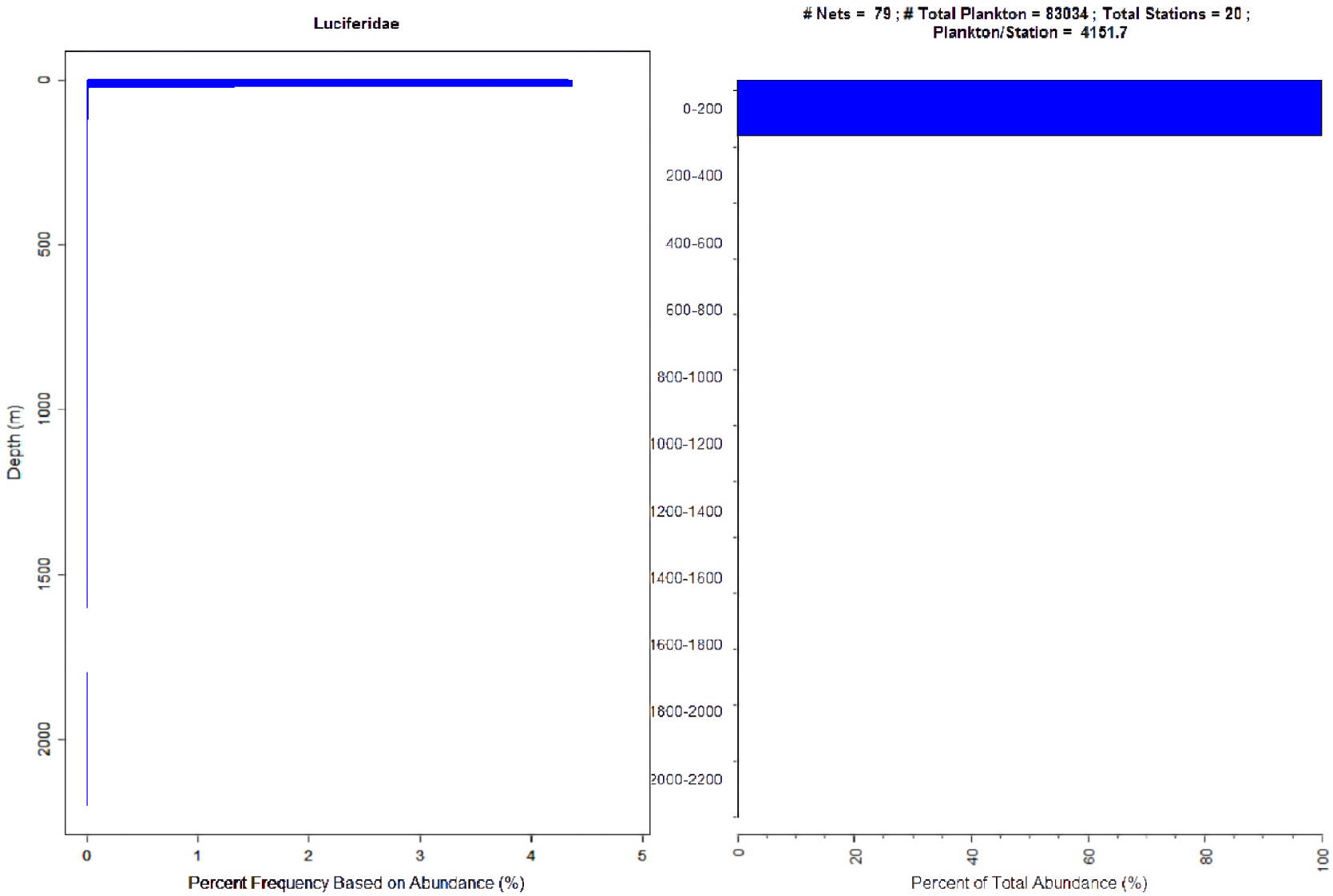
Labridae - Deep



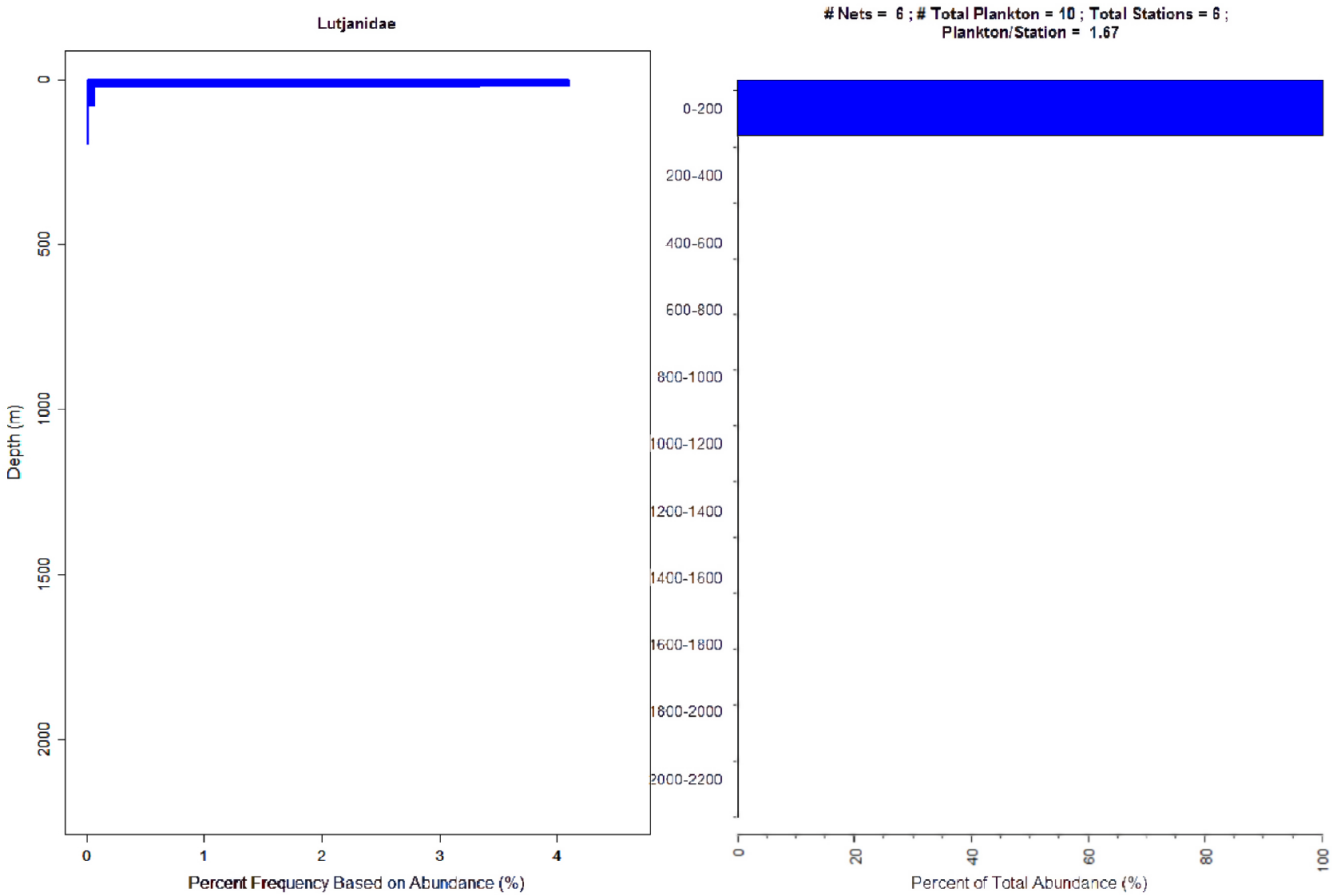
Lampridiidae - Deep



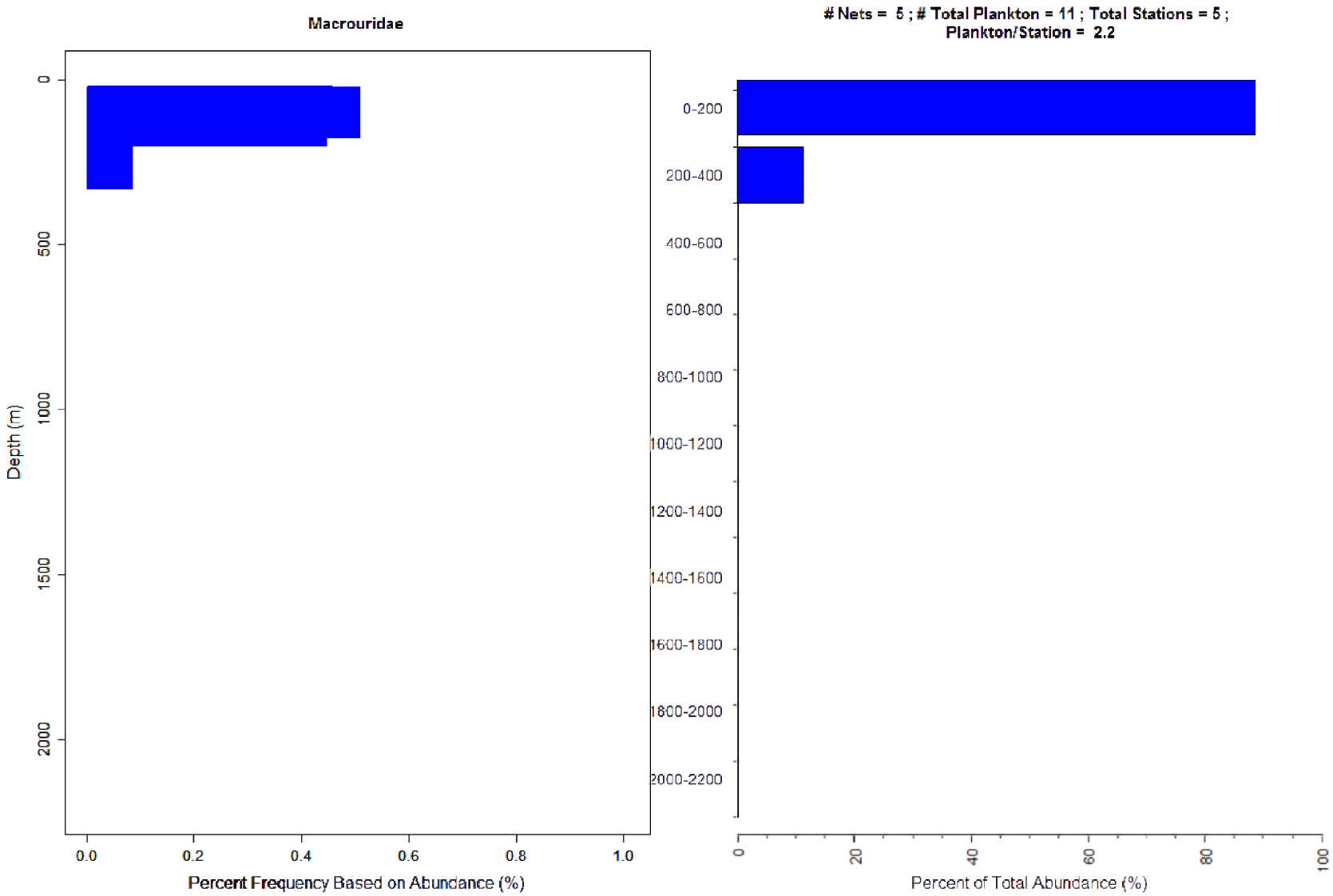
Lophiiformes - Deep



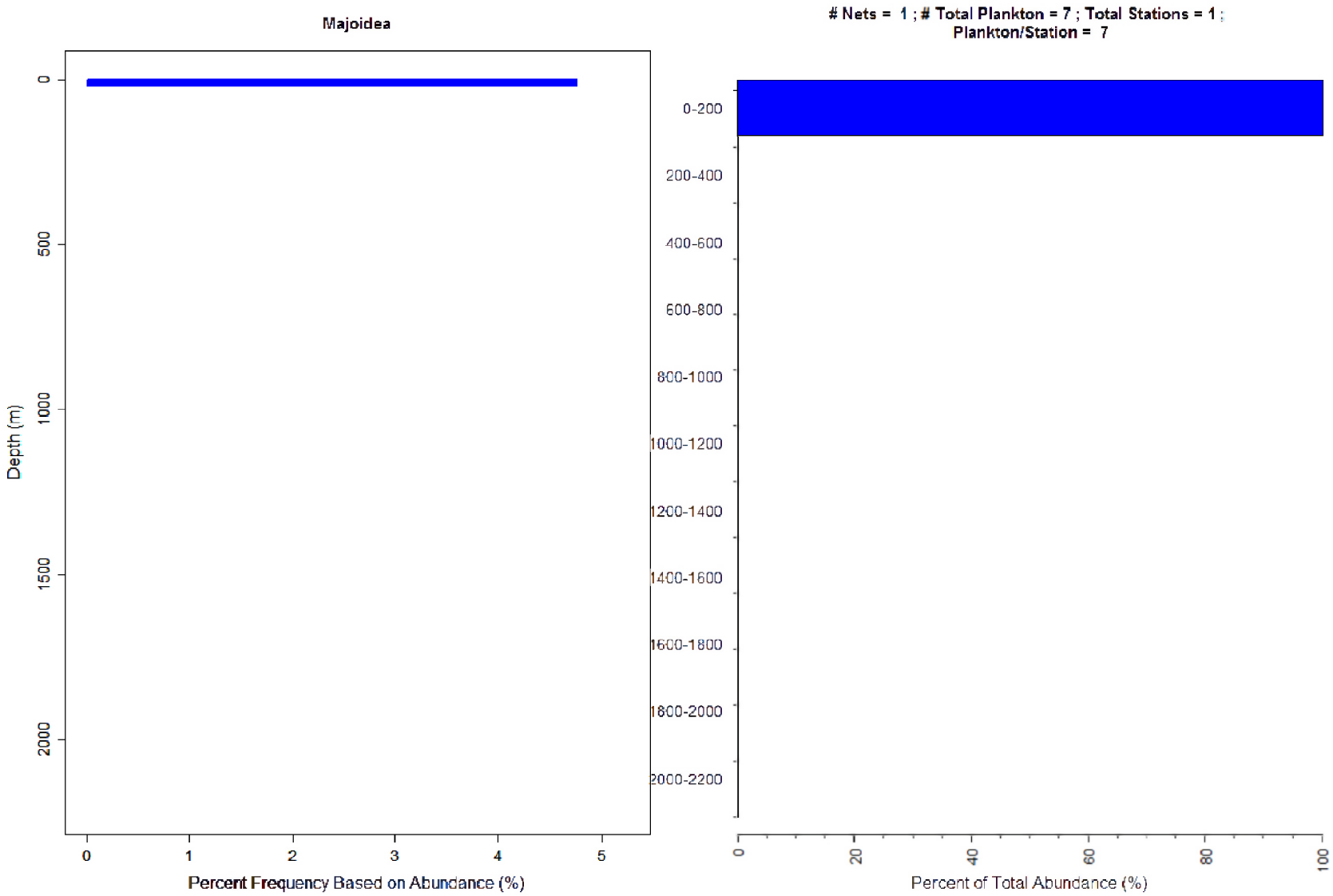
Luciferidae - Deep



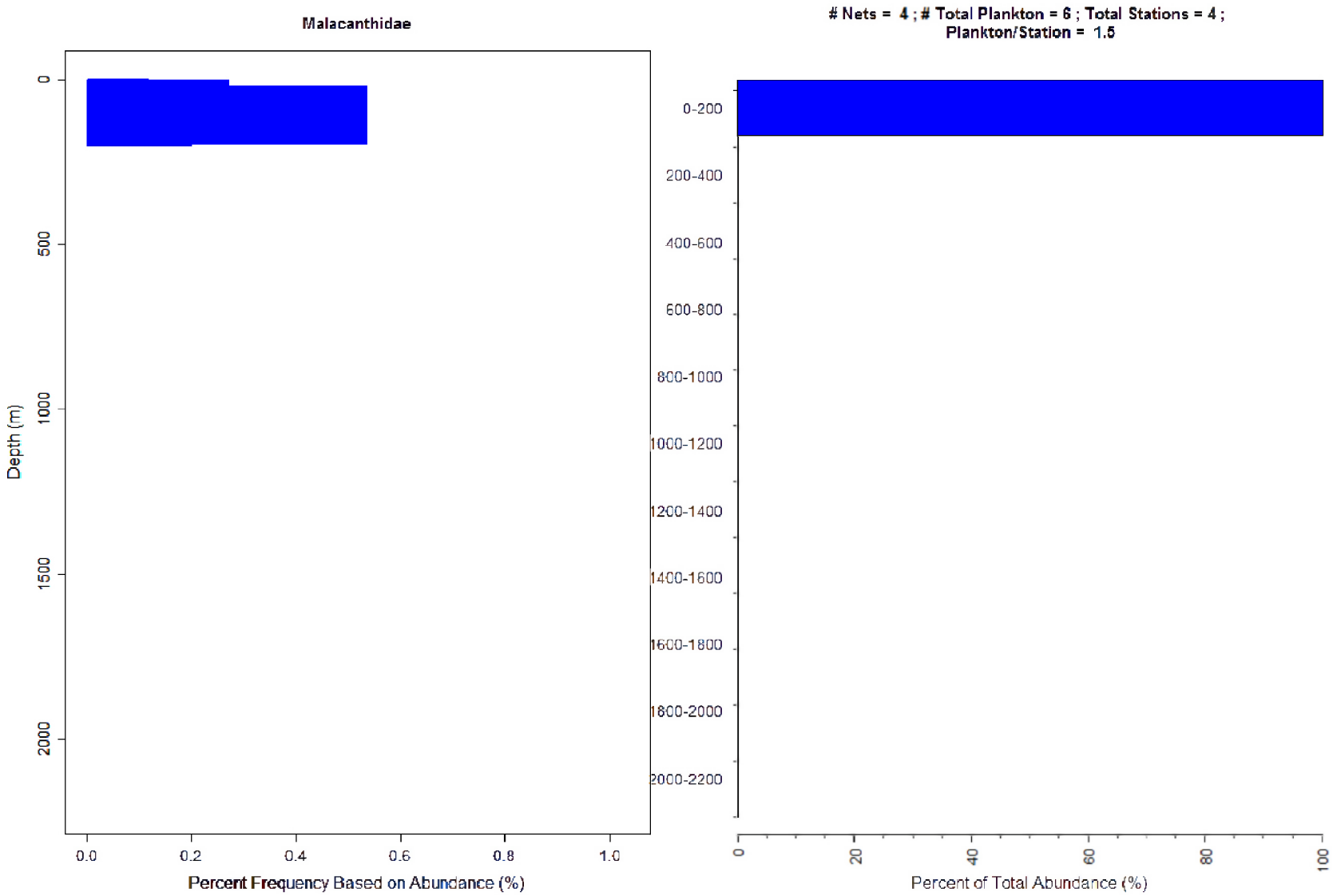
Lutjanidae - Deep



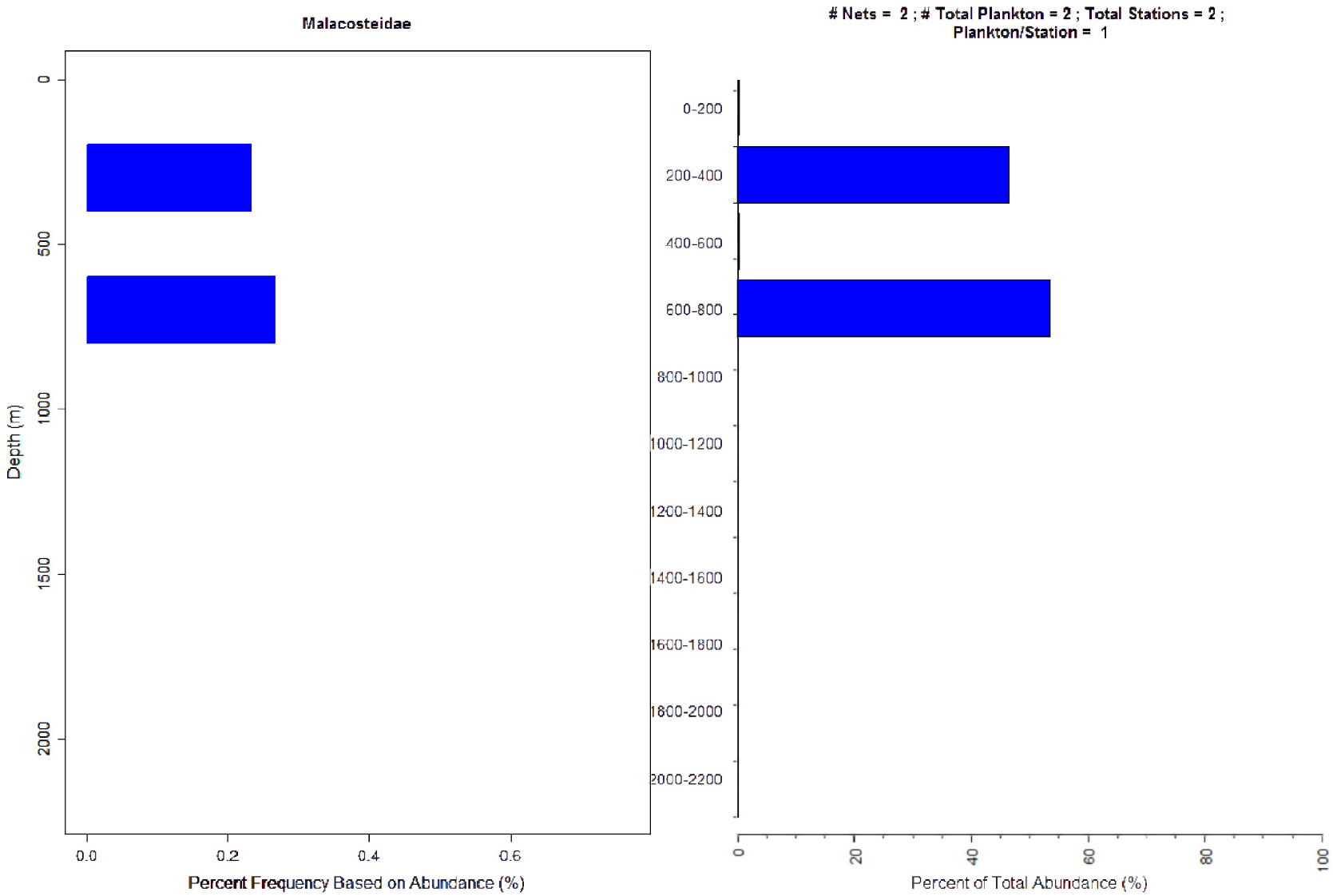
Macrouridae - Deep



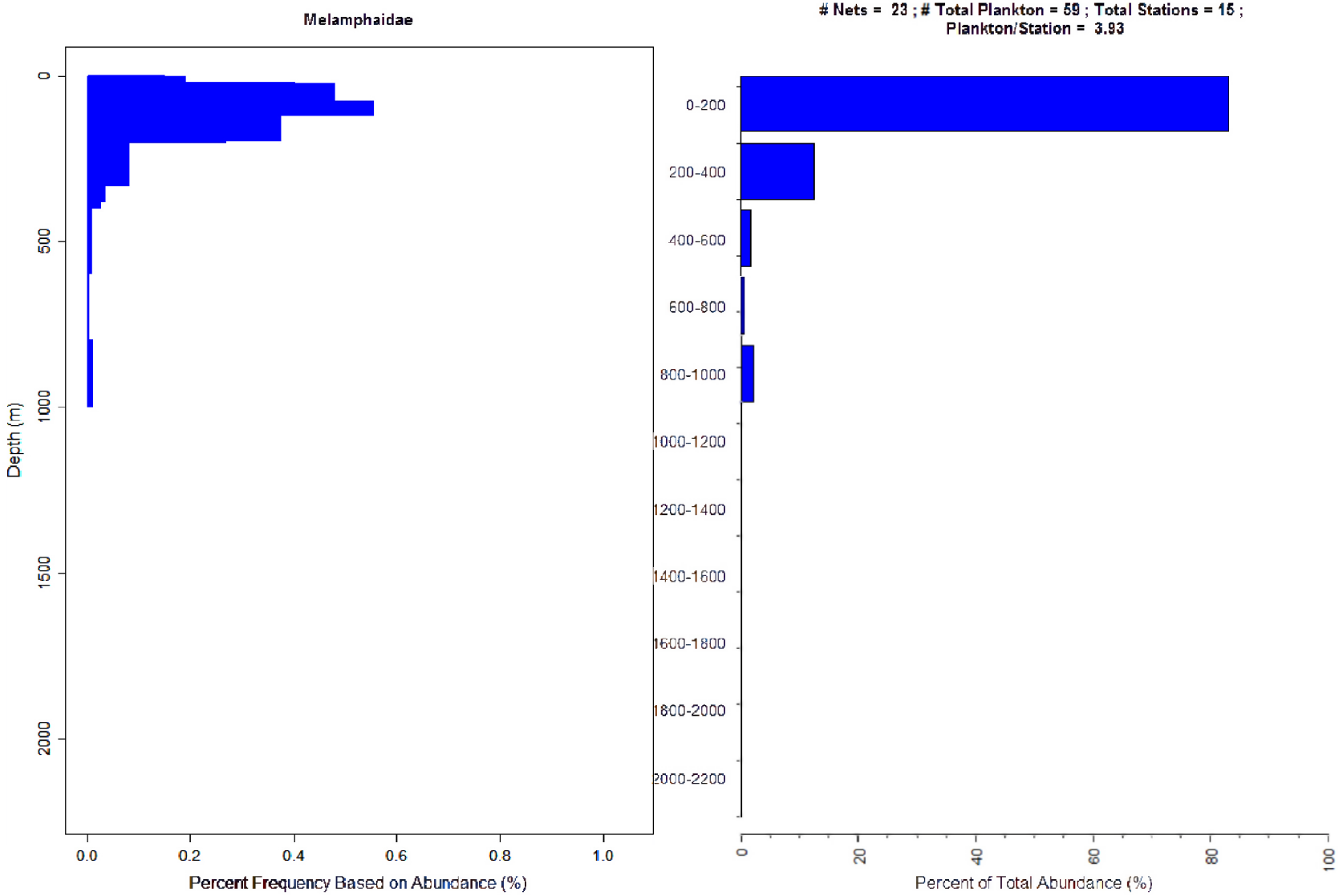
Majoidea - Deep



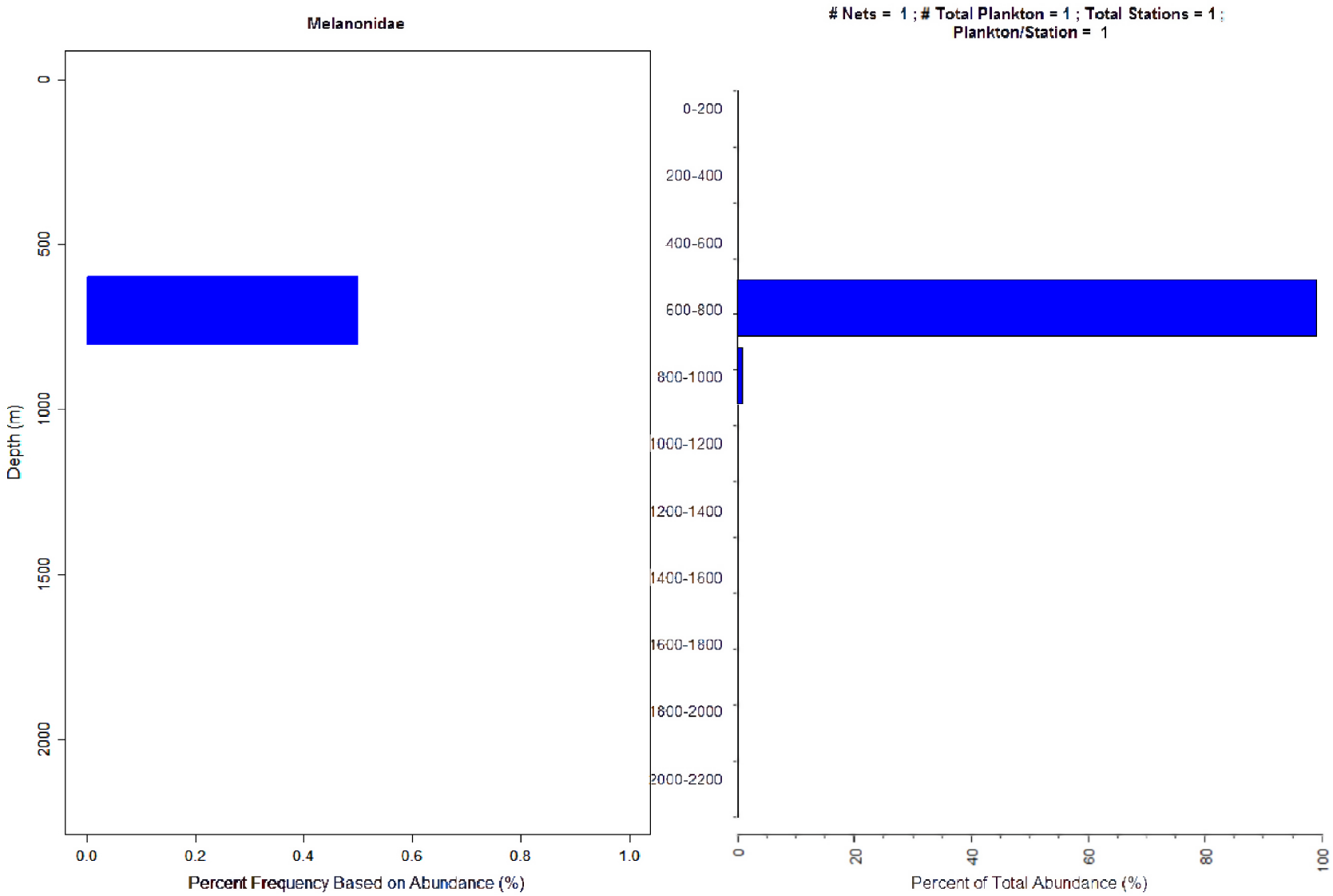
Malacanthidae - Deep



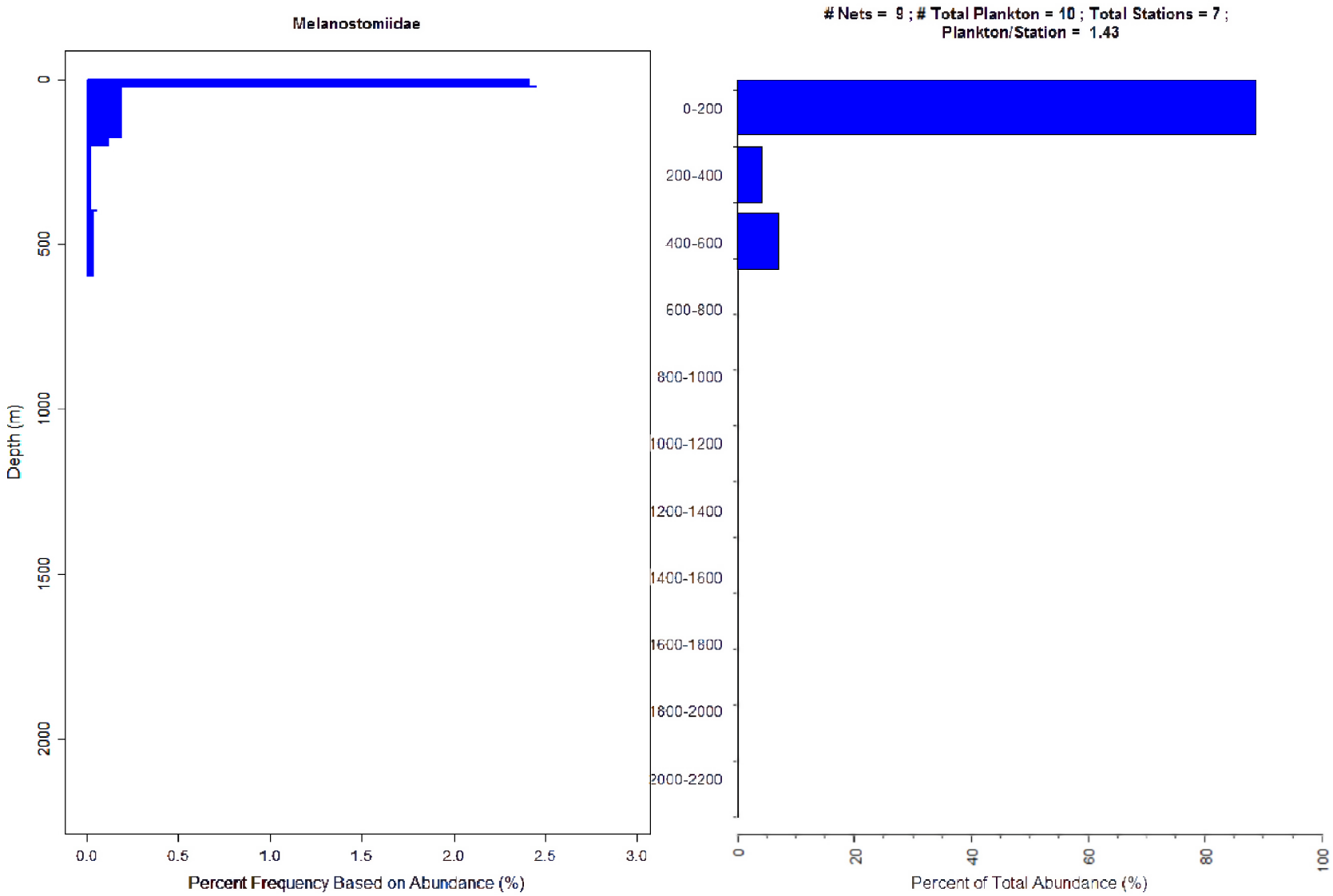
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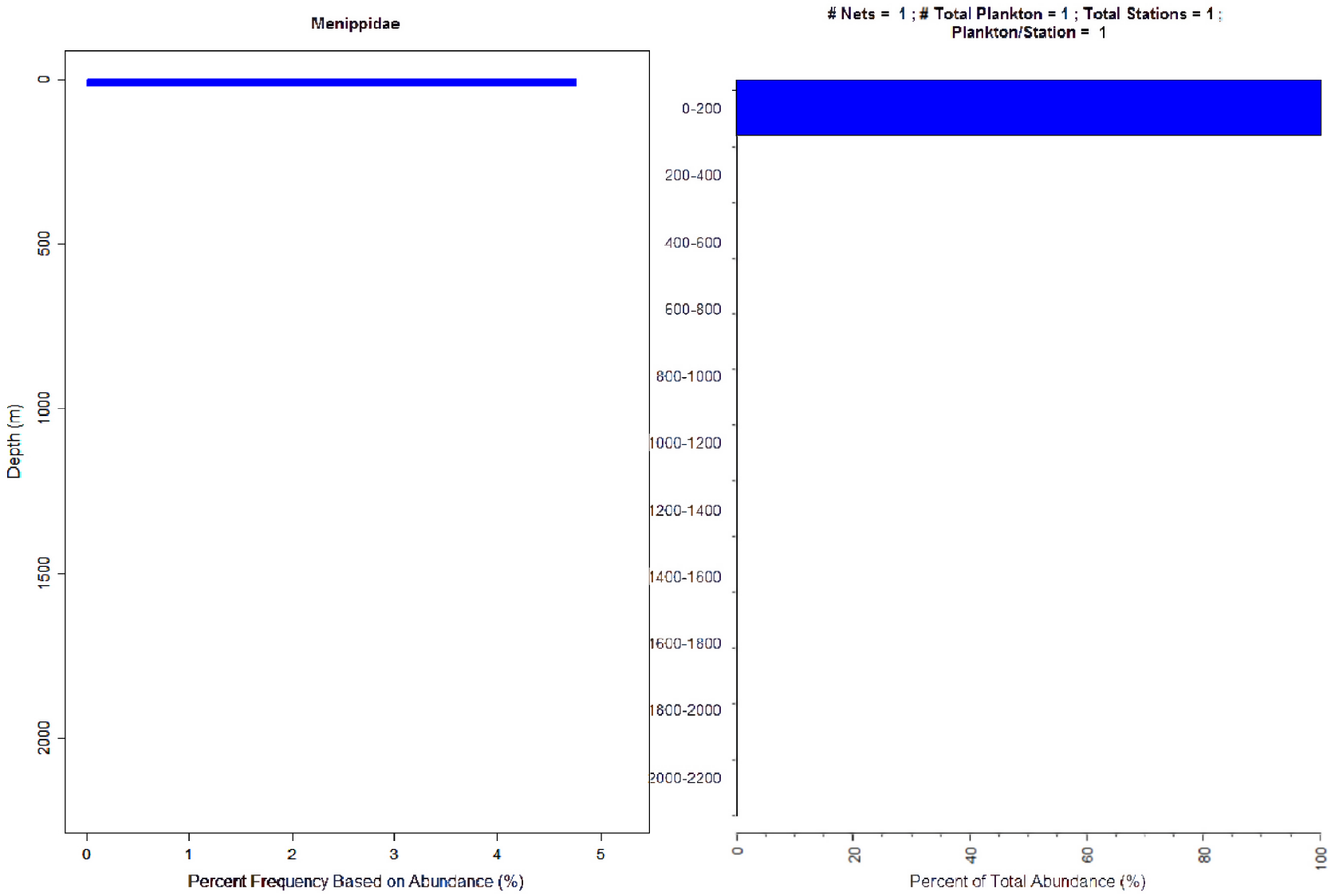
Melamphaidae - Deep



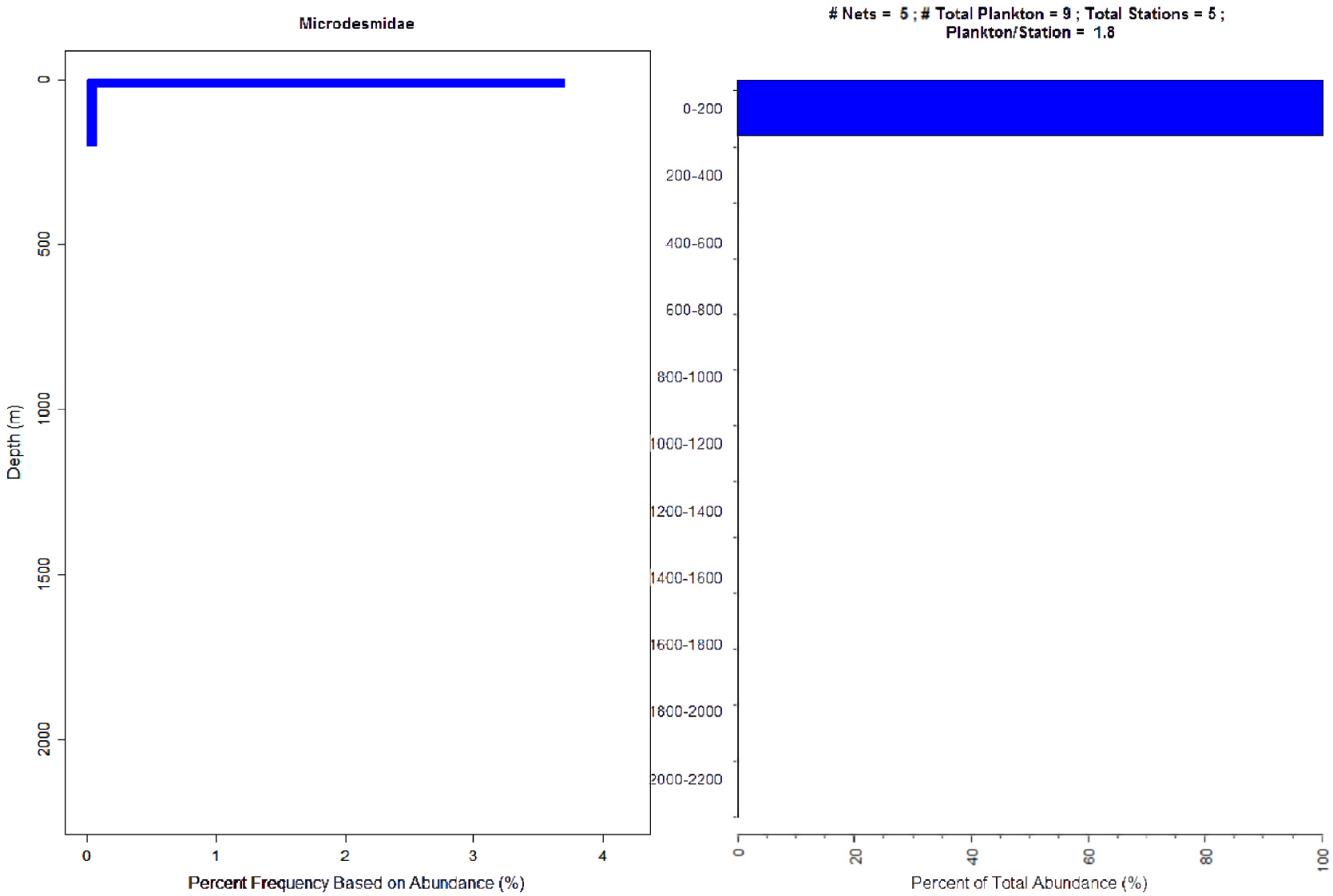
Melanonidae - Deep



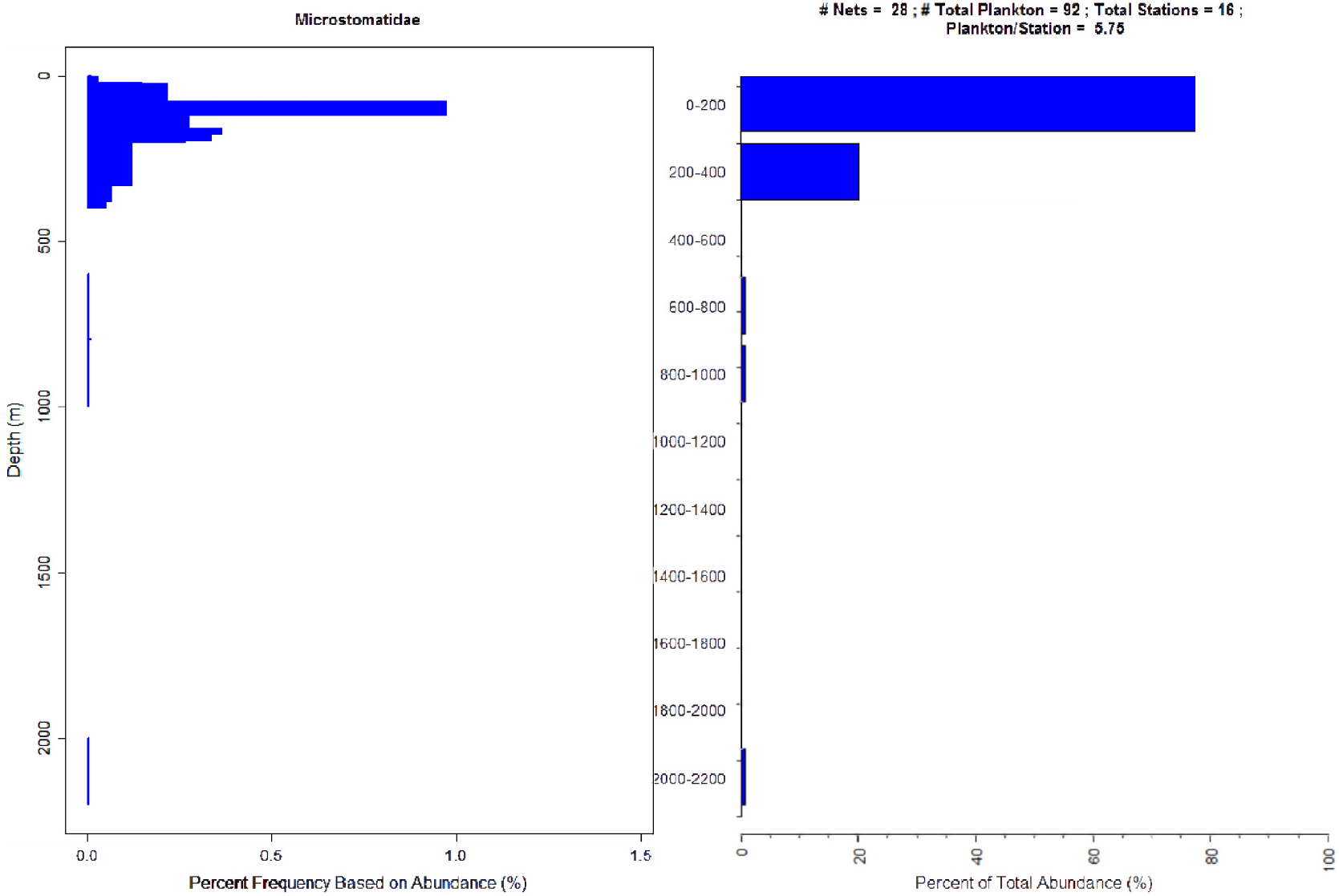
Melanostomiidae - Deep



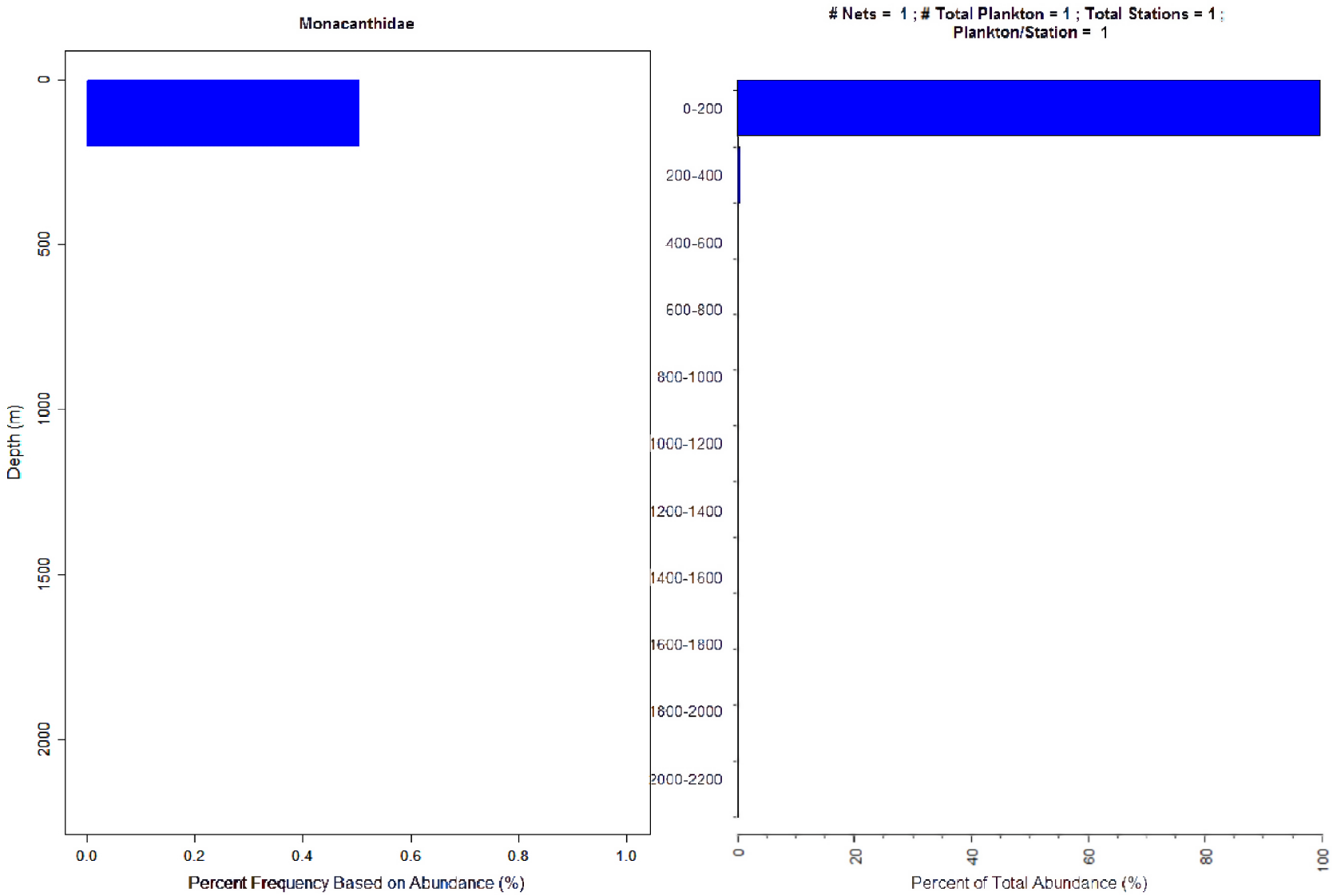
Menippidae - Deep



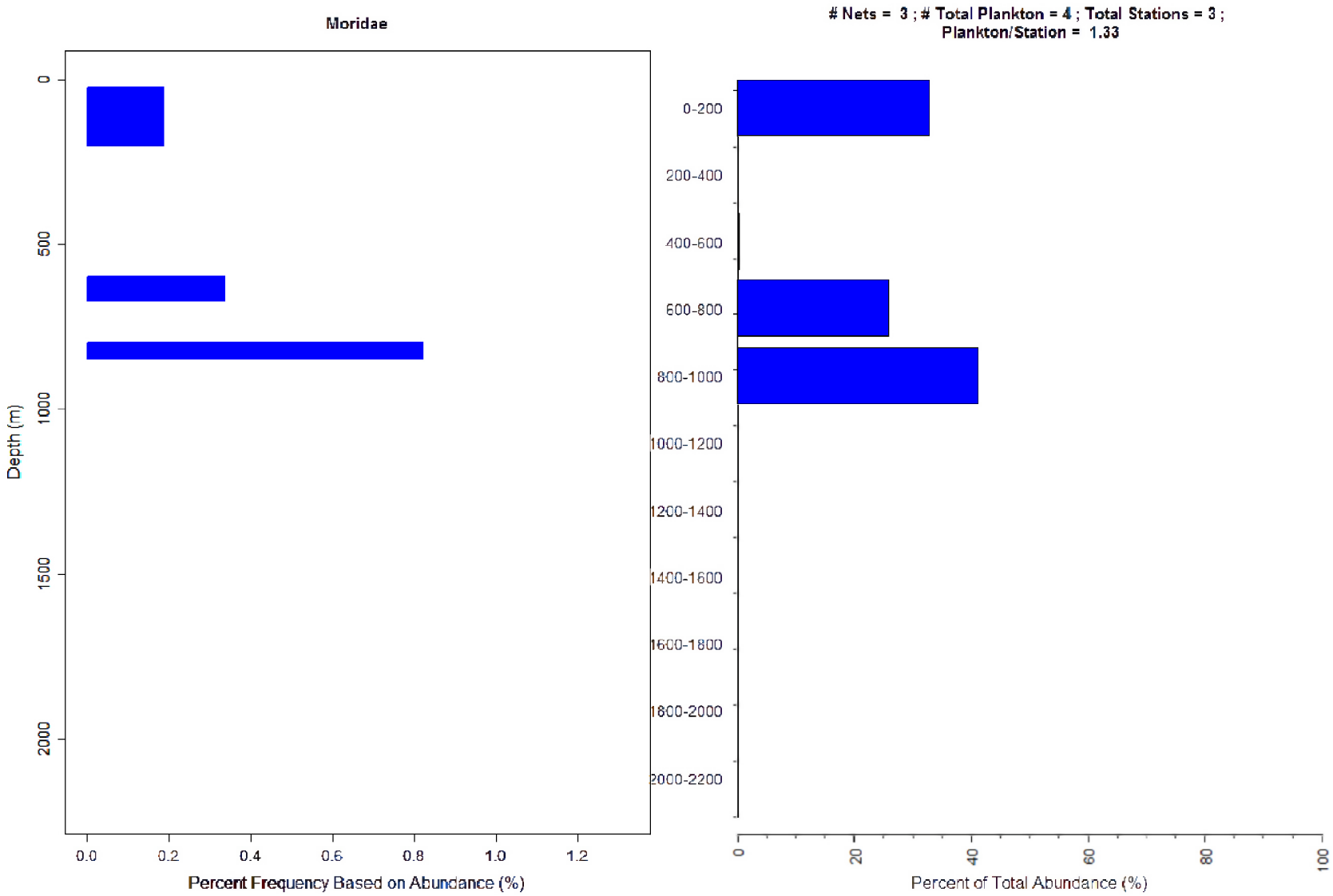
Microdesmidae - Deep



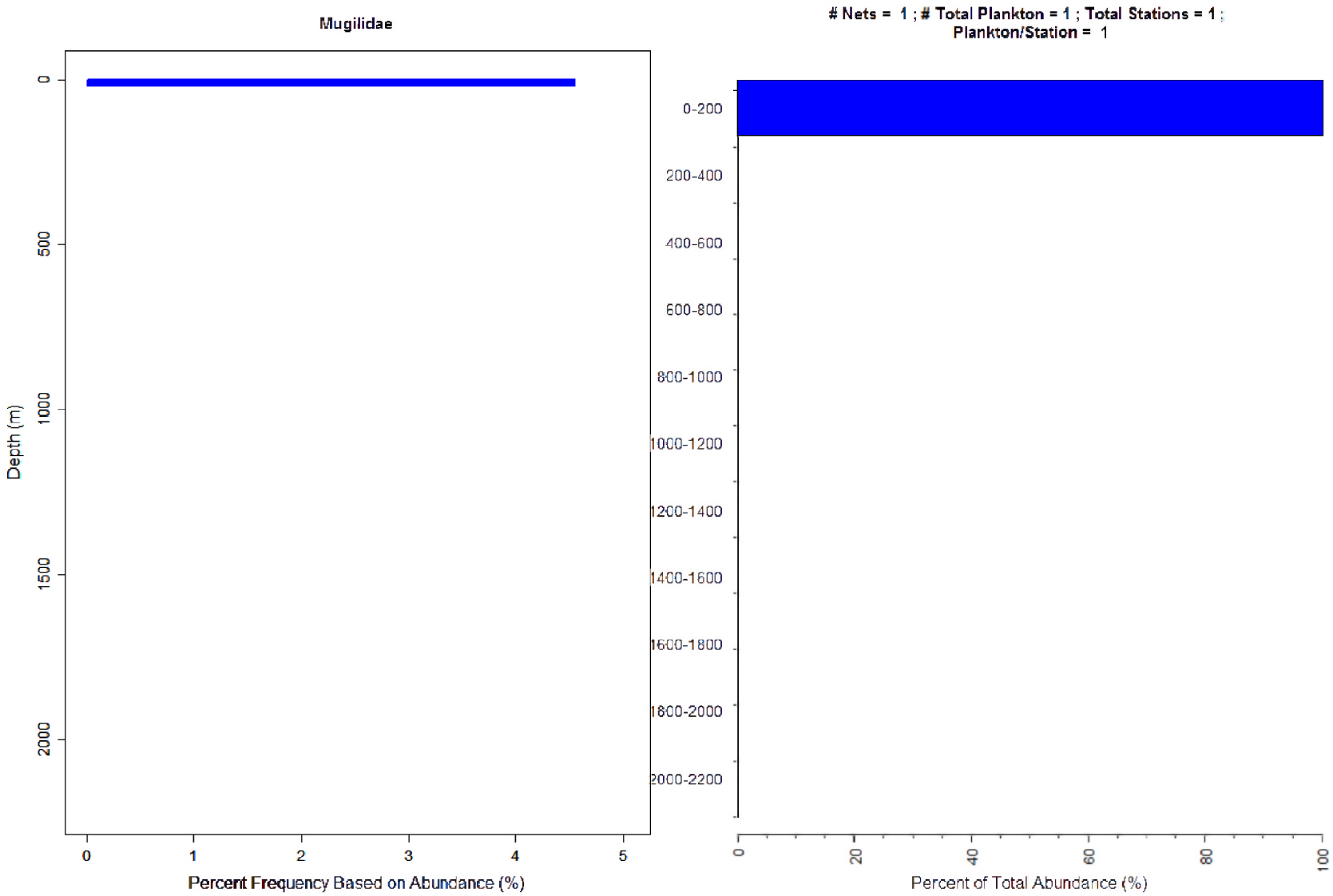
Microstomatidae - Deep



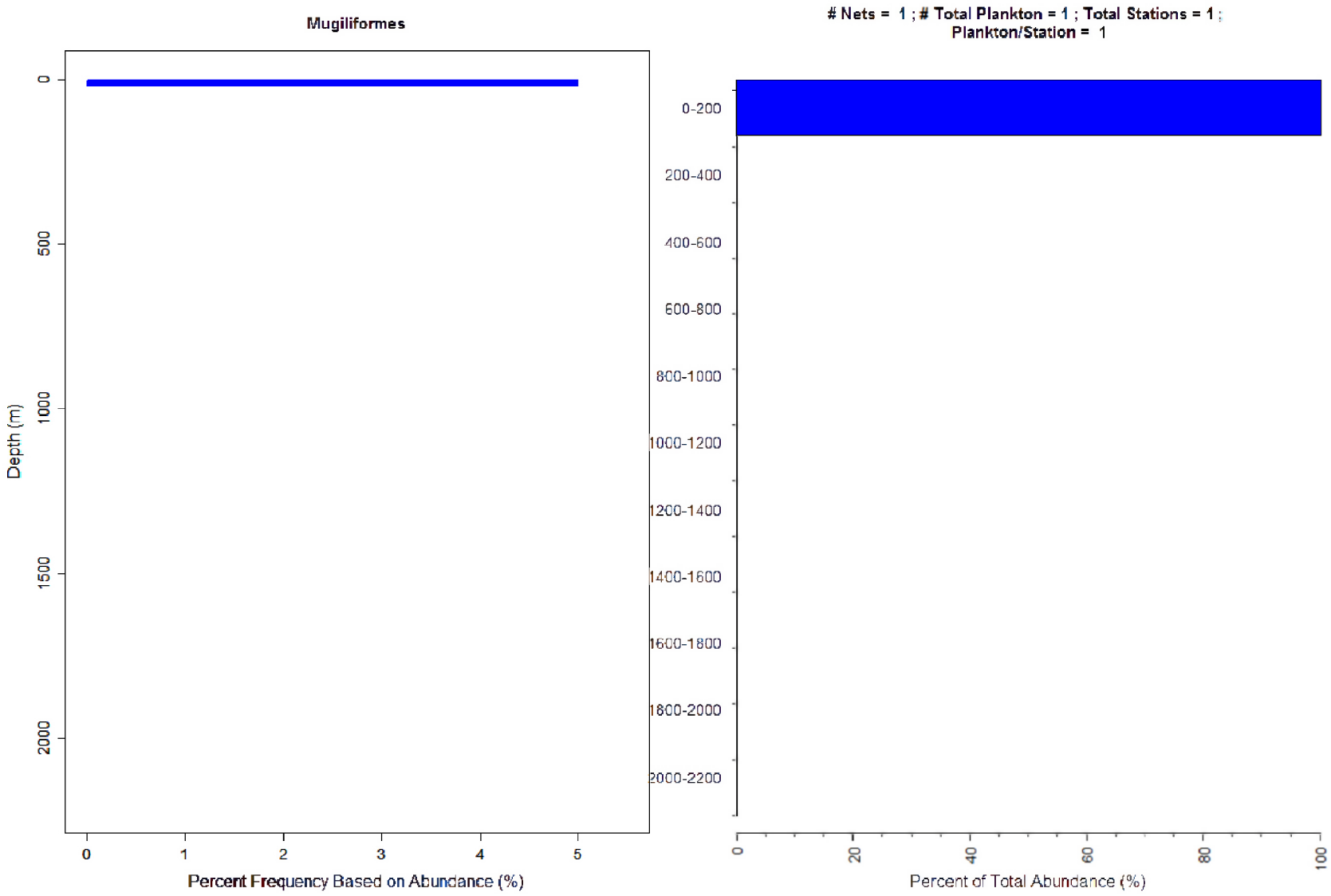
Monacanthidae - Deep



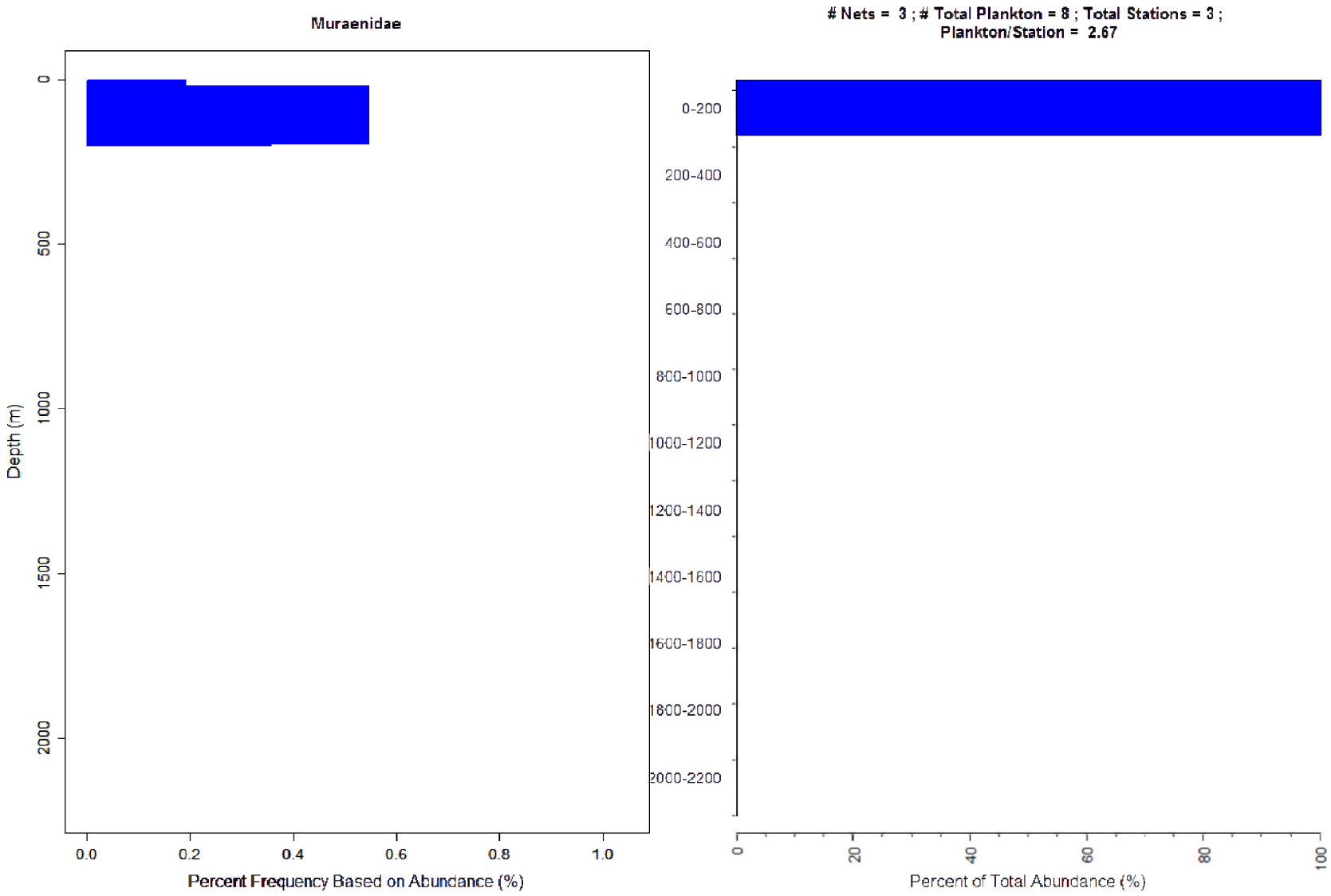
Moridae - Deep



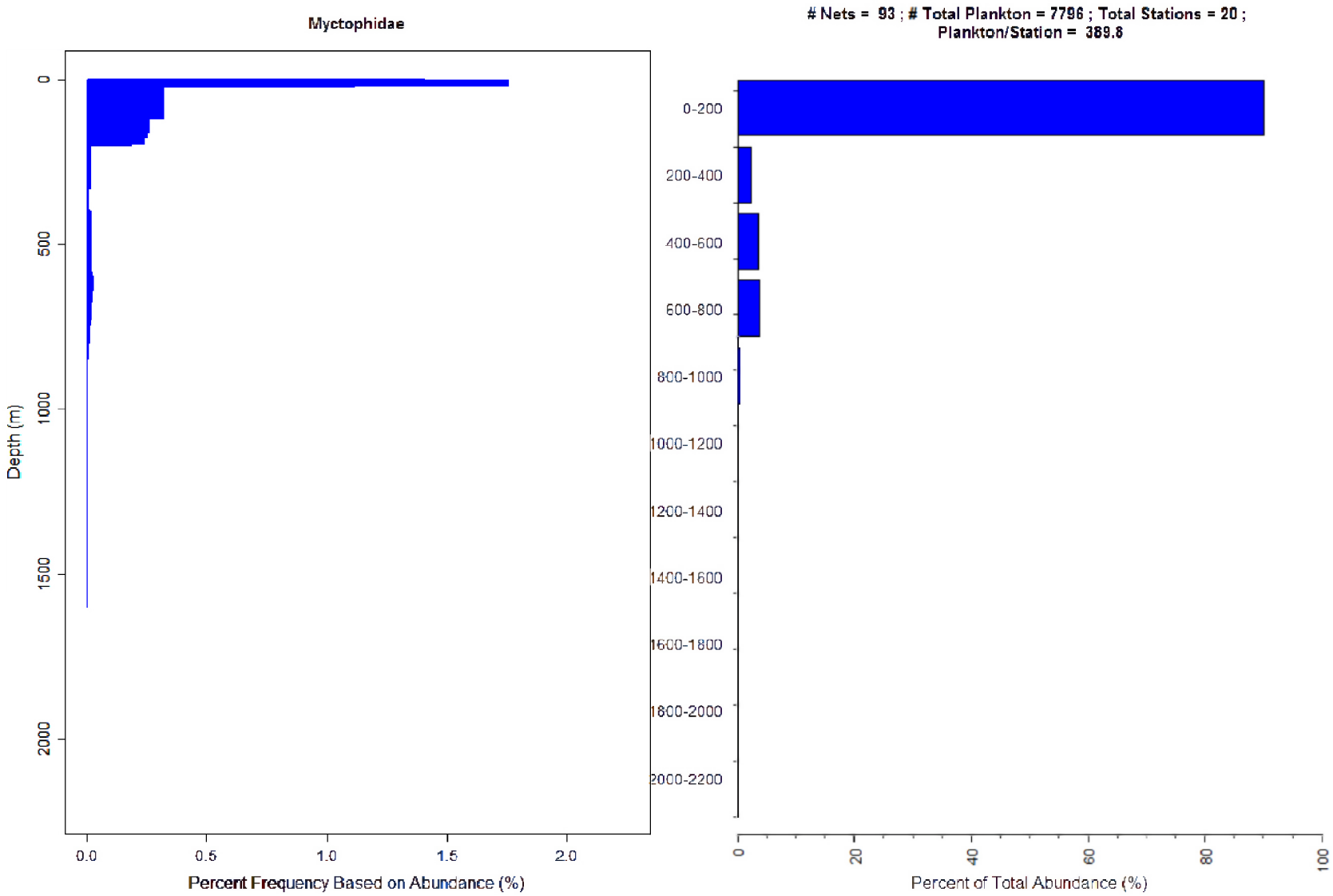
Mugilidae - Deep



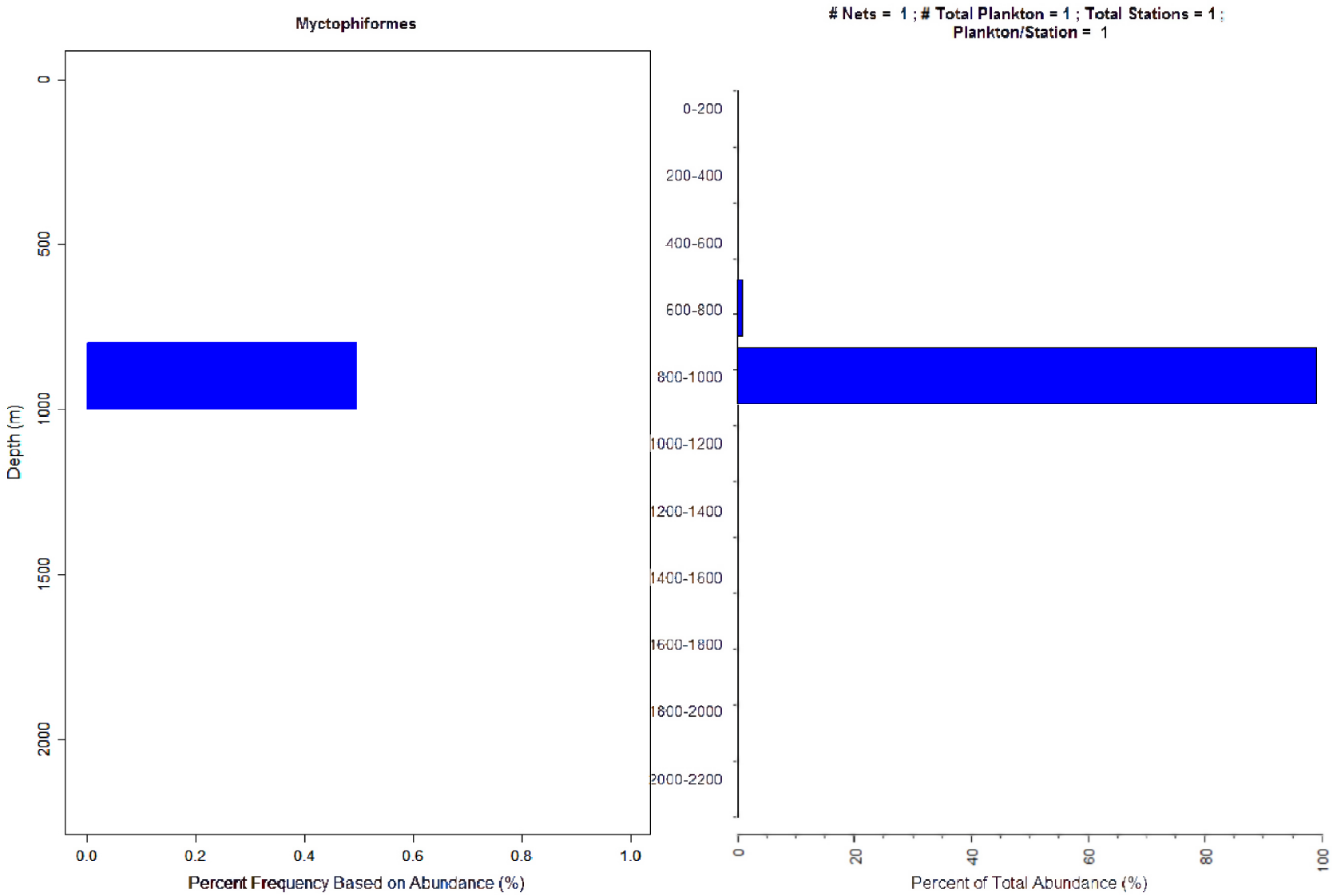
Mugiliformes - Deep



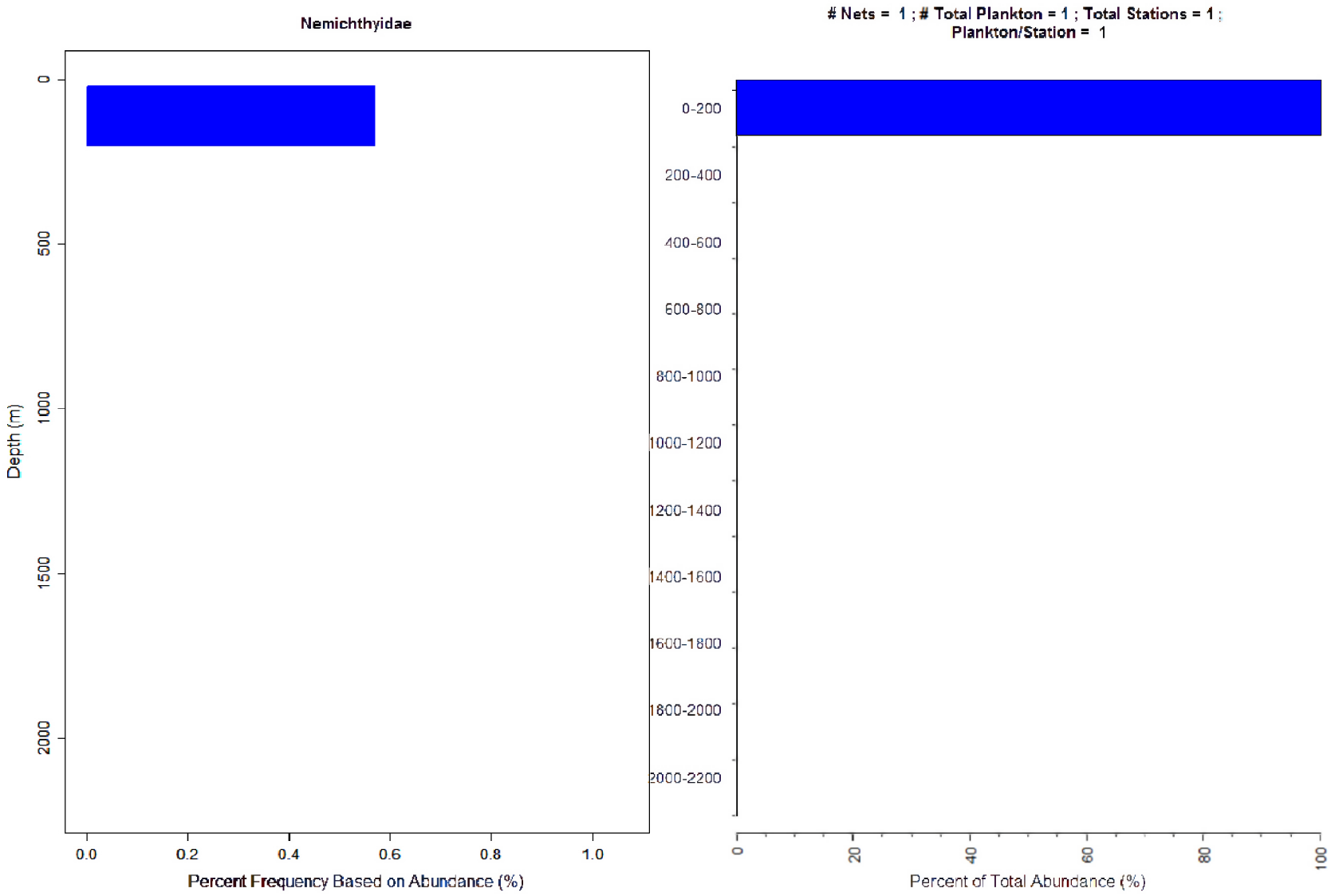
Muraenidae - Deep



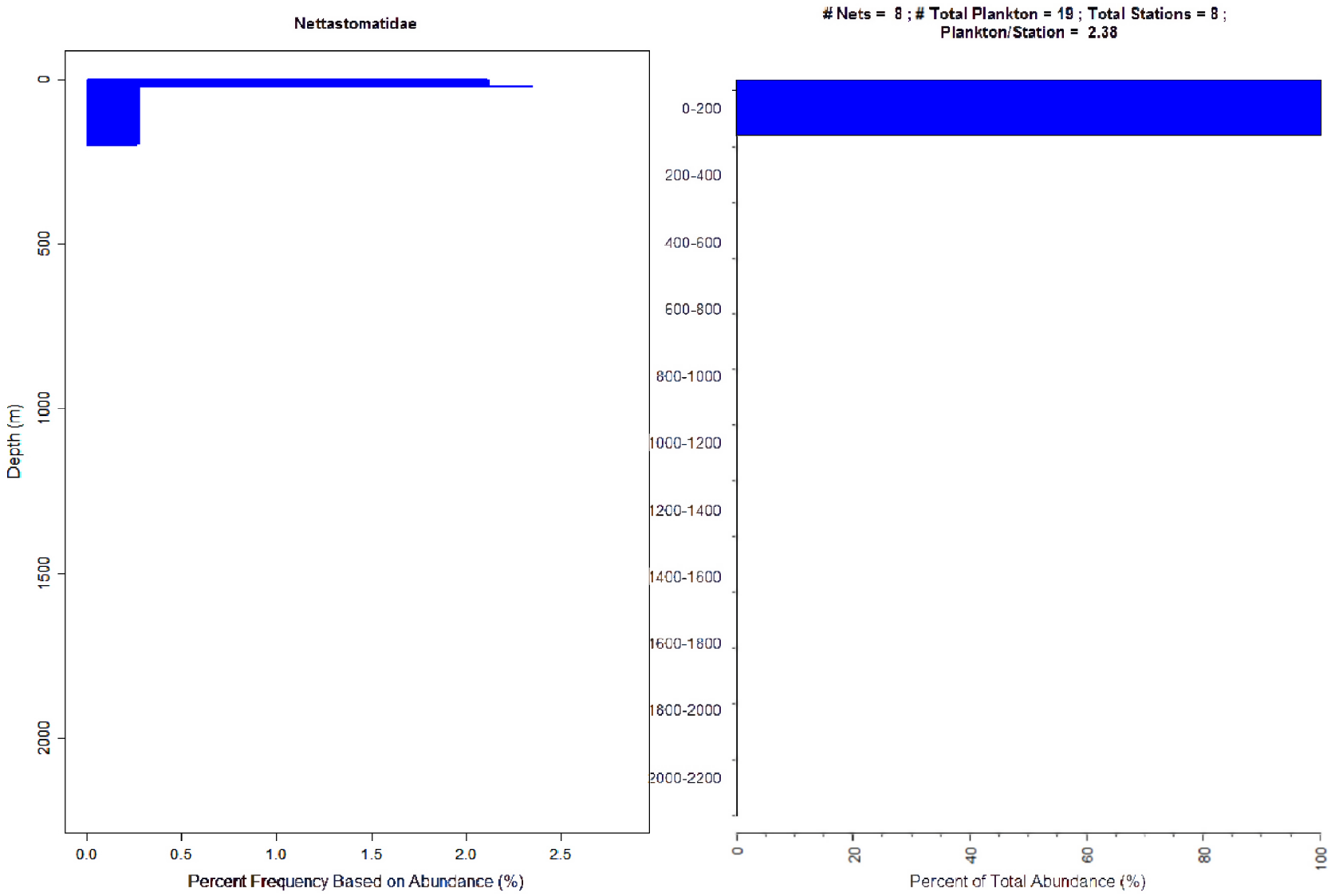
Myctophidae - Deep



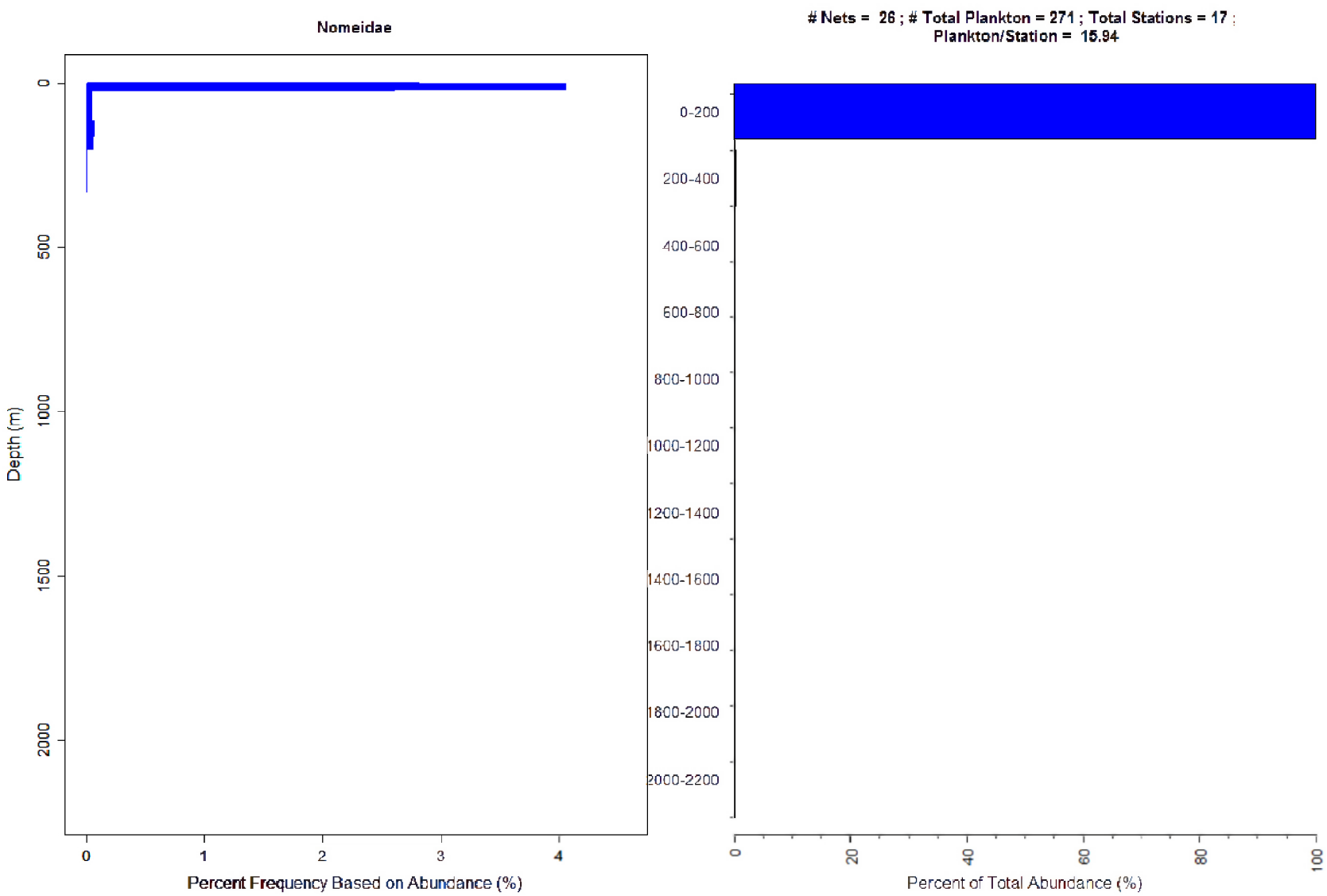
Myctophiformes - Deep



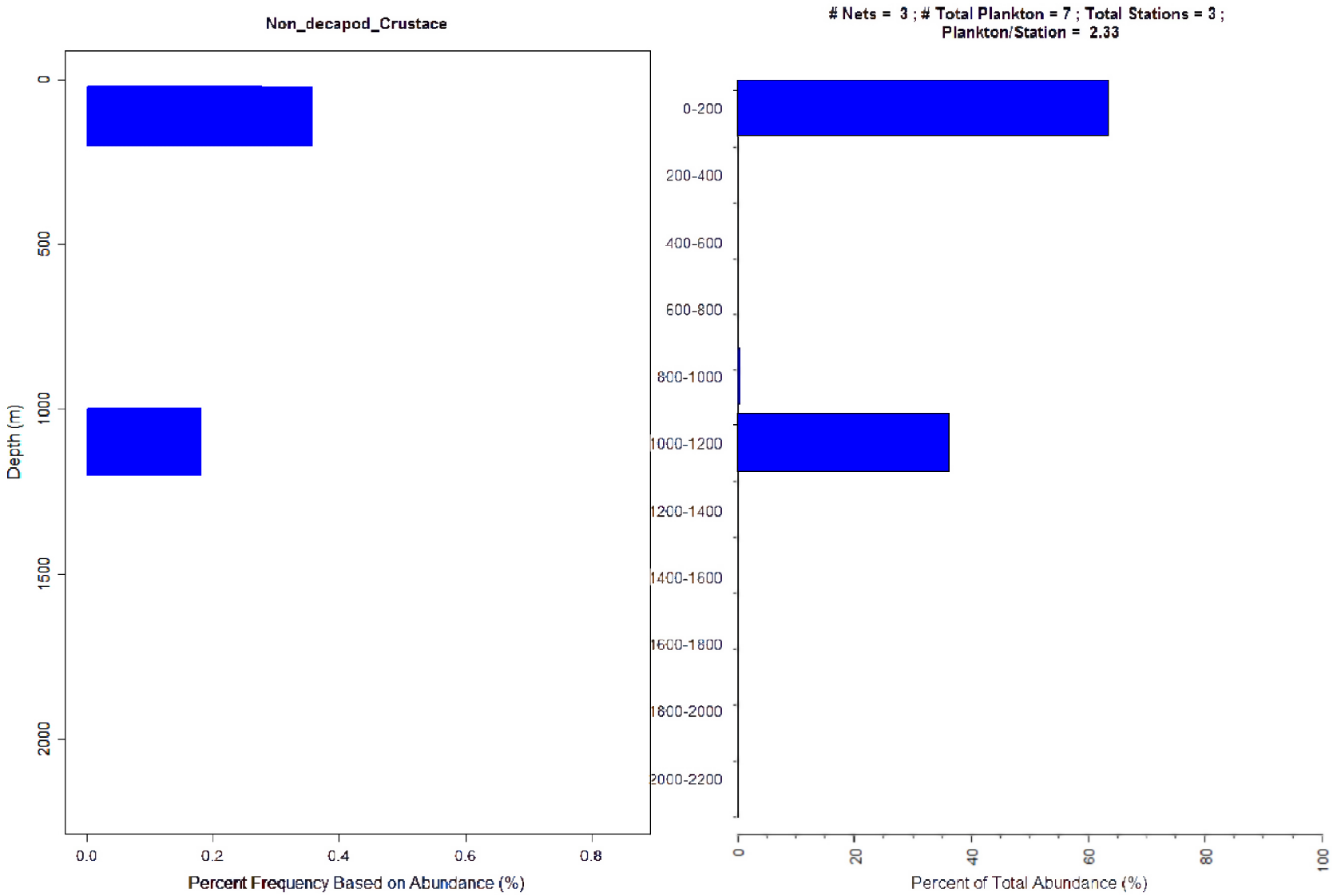
Nemichthyidae - Deep



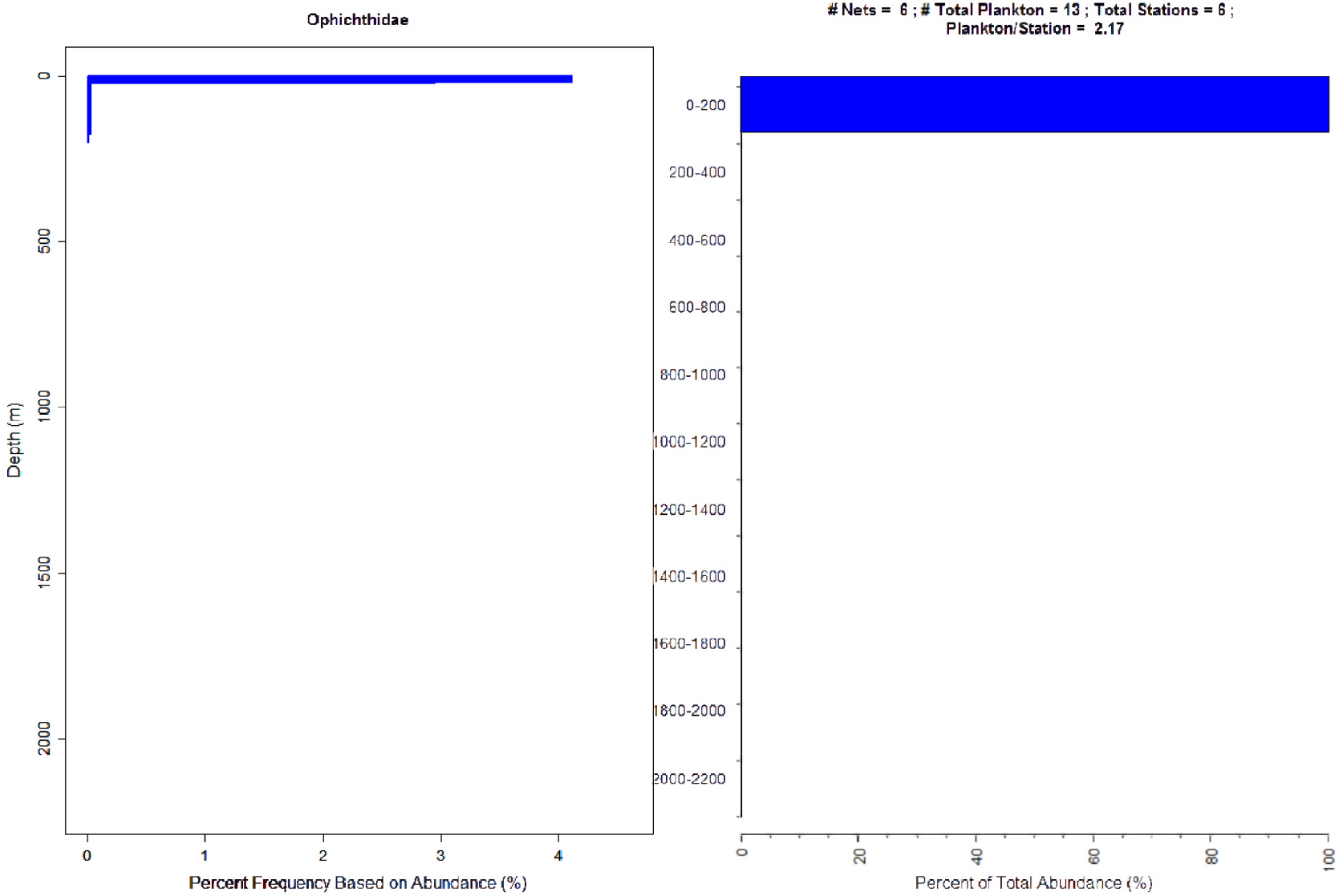
Nettastomatidae - Deep



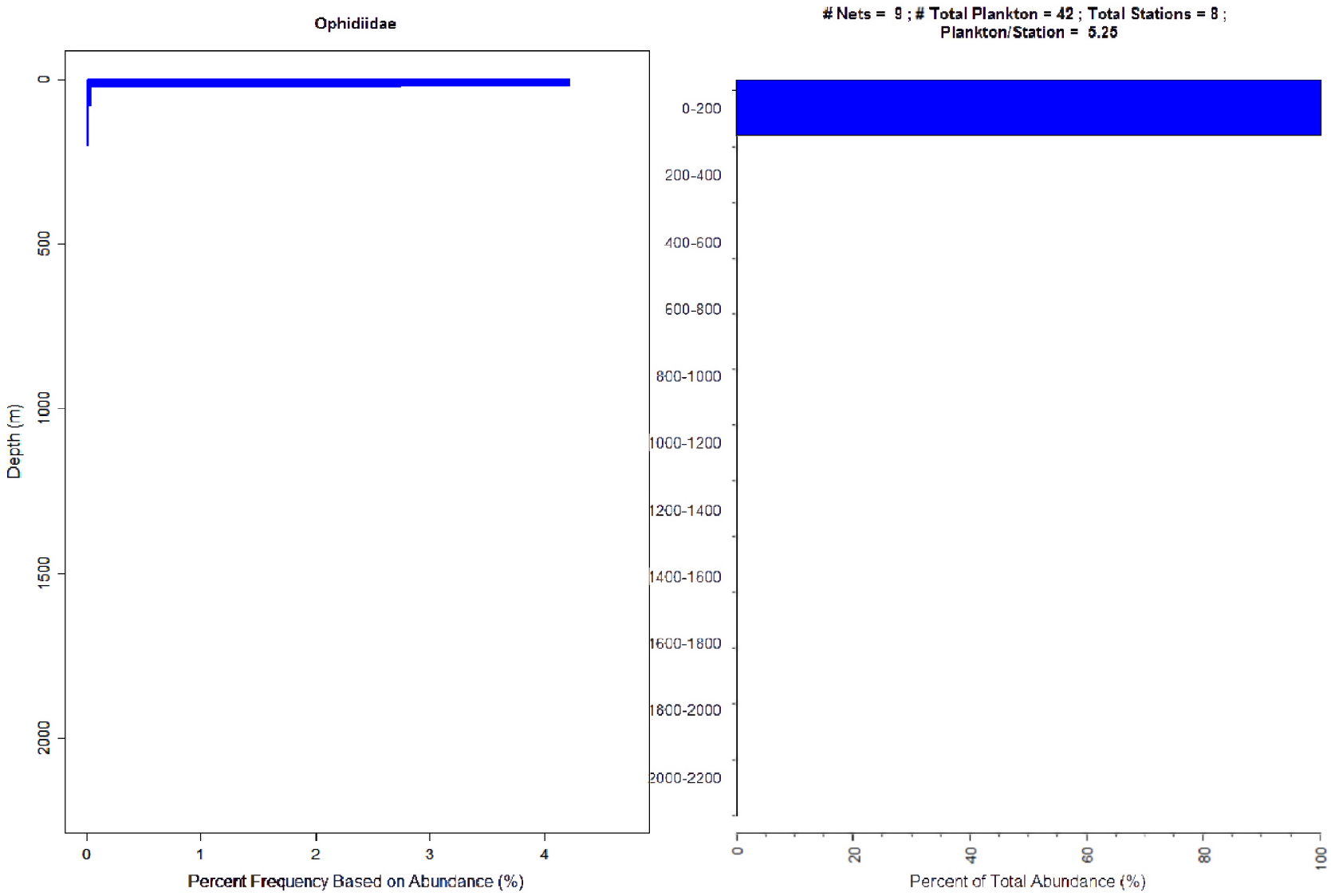
Nomeidae - Deep



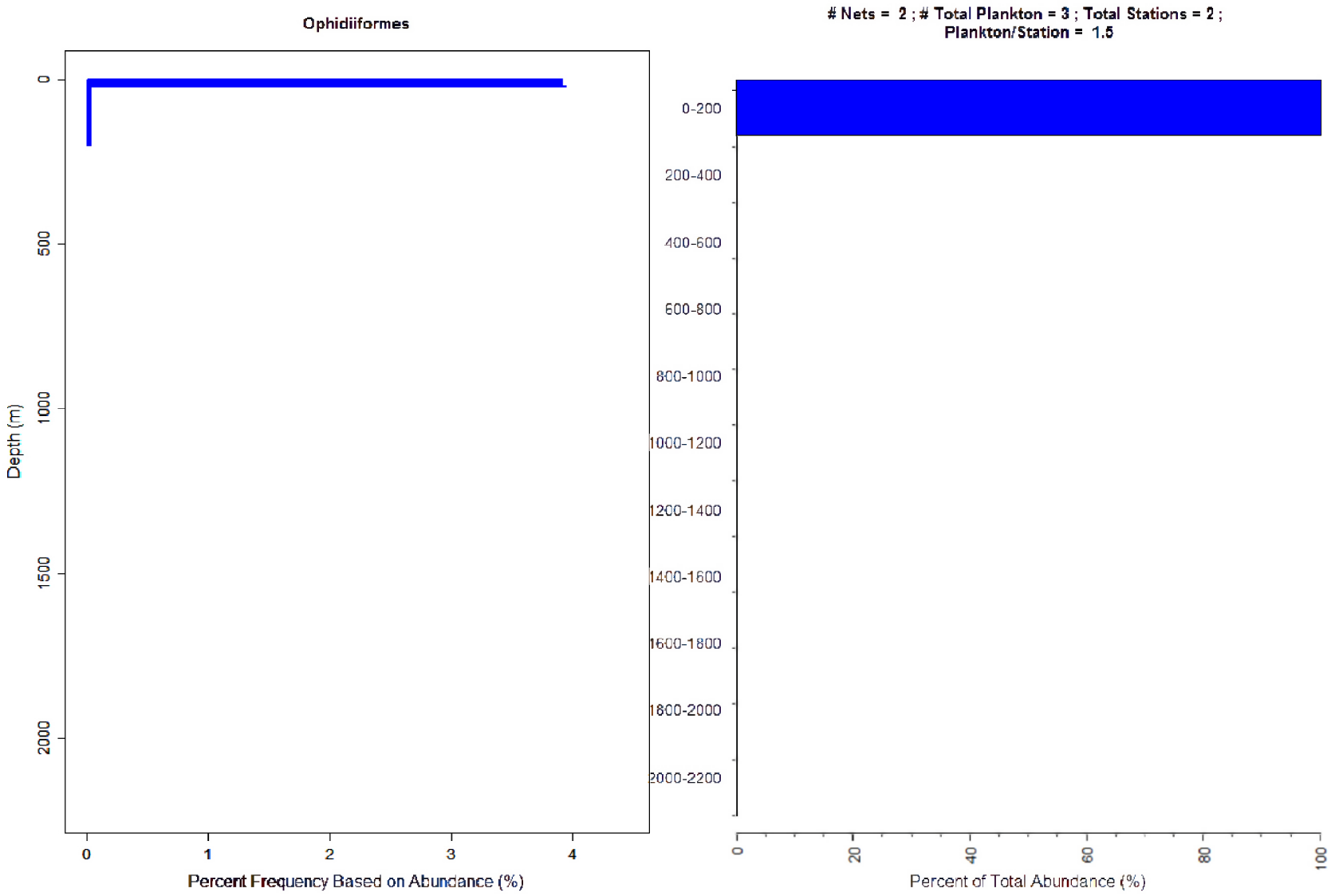
Non_decapod_Crustace - Deep



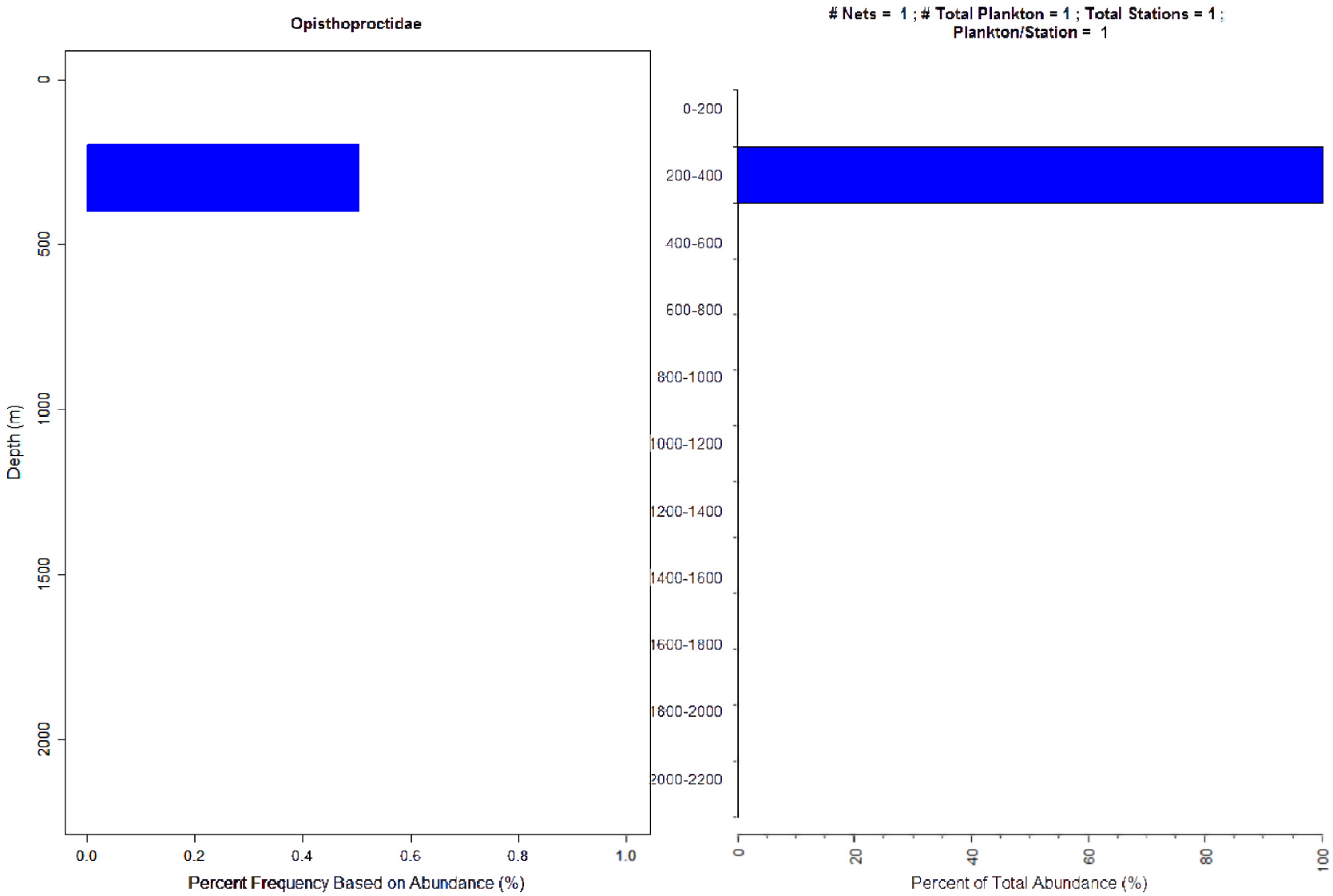
Ophichthidae - Deep



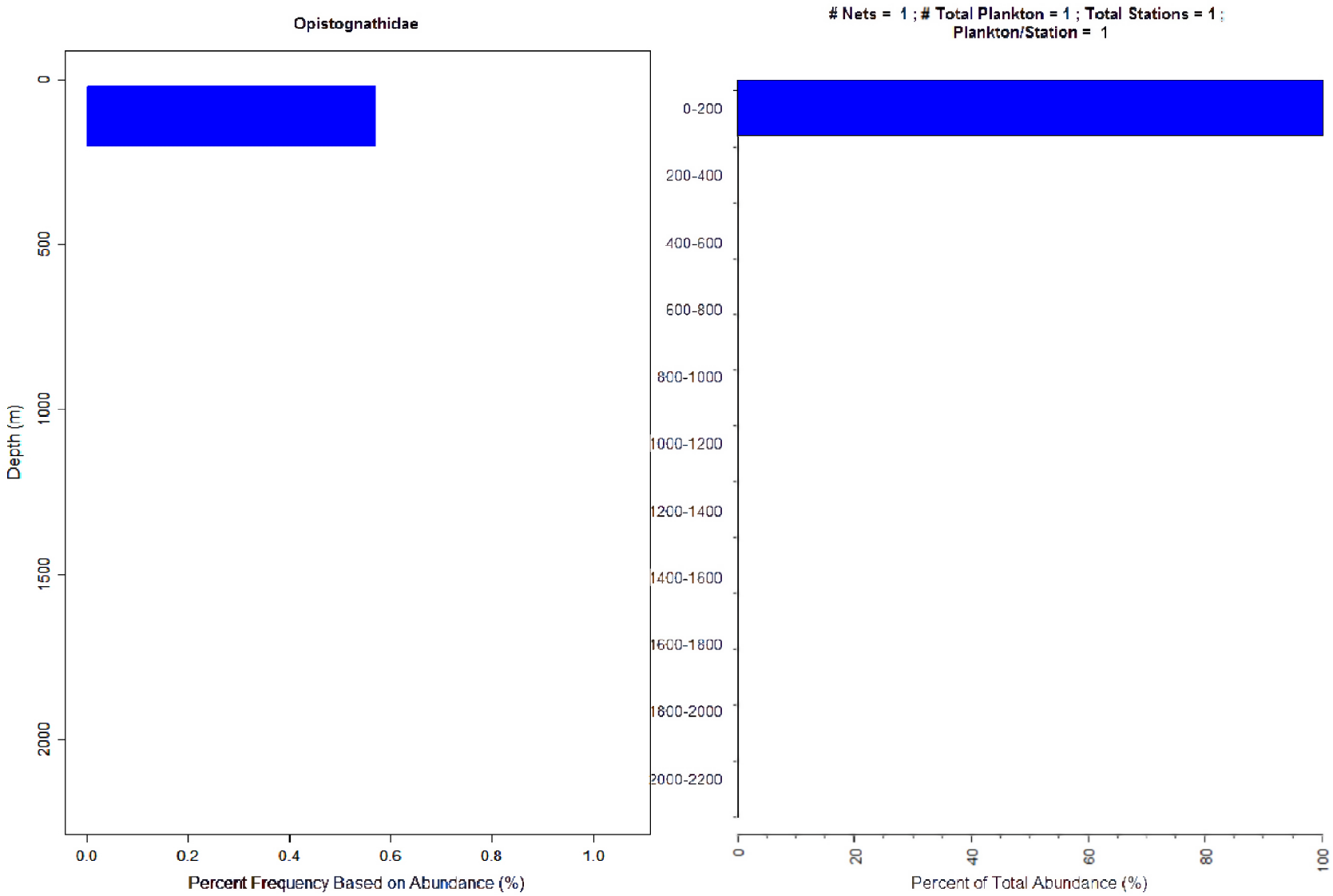
Ophidiidae - Deep



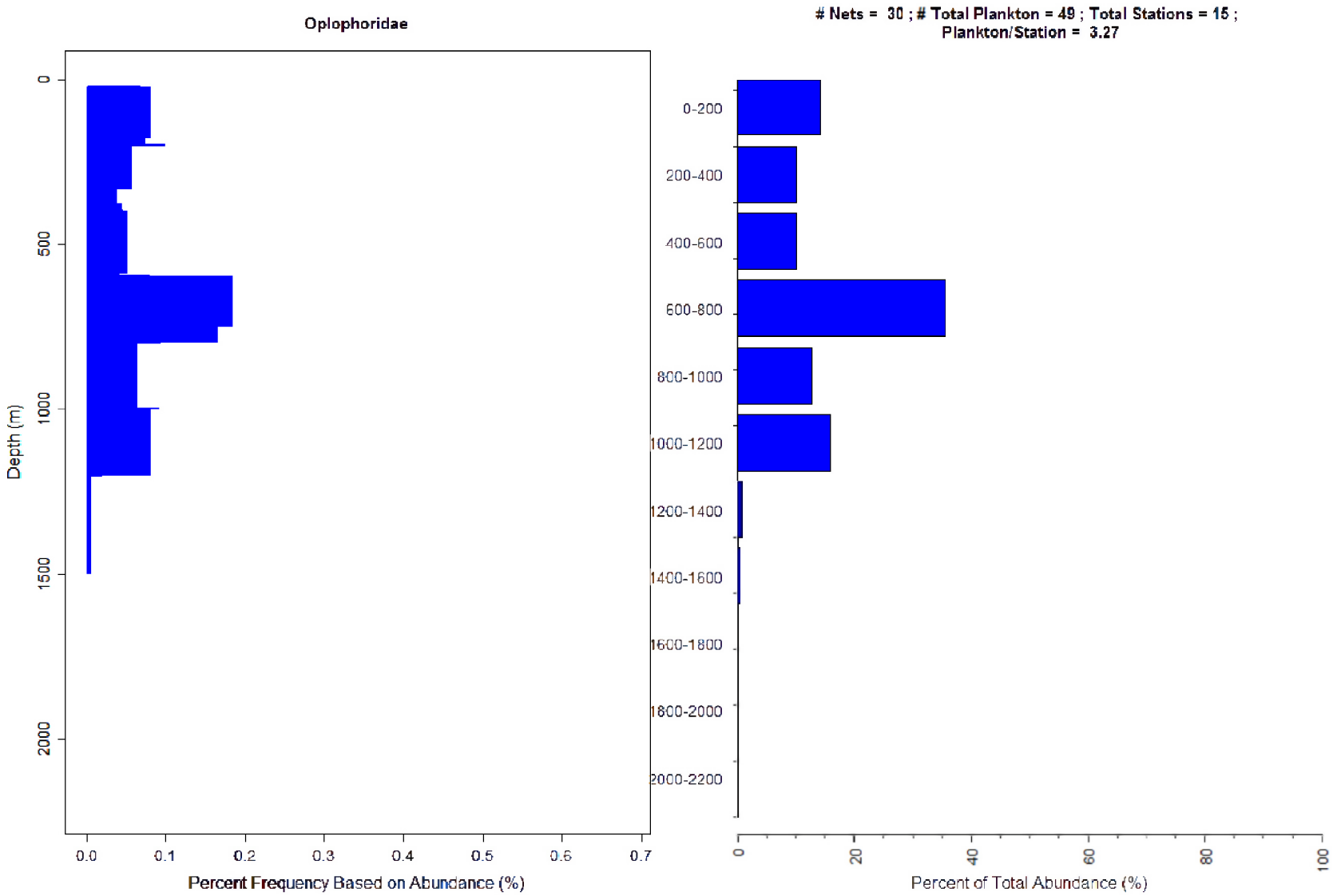
Ophidiiformes - Deep



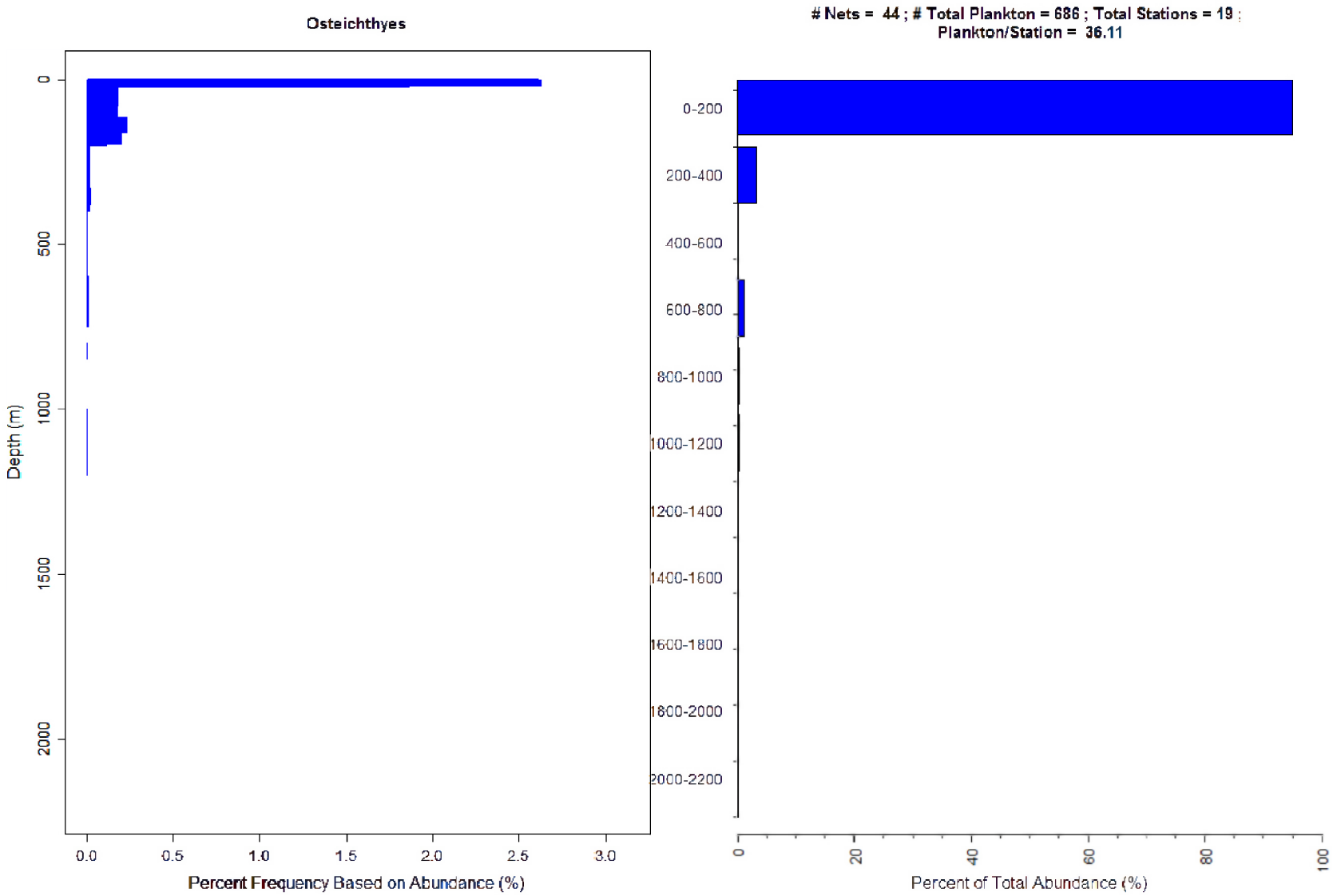
Opisthoproctidae - Deep



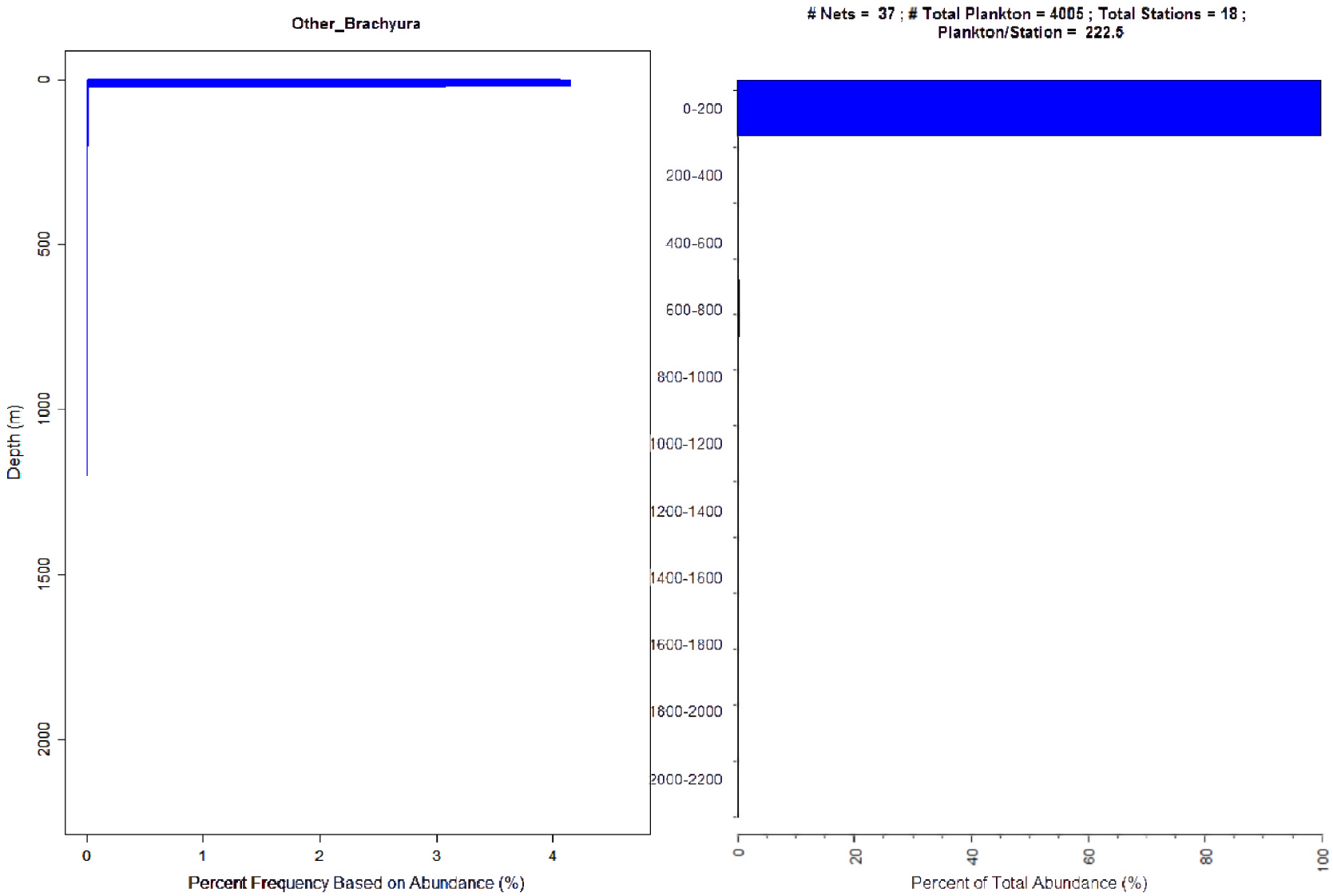
Opistognathidae - Deep



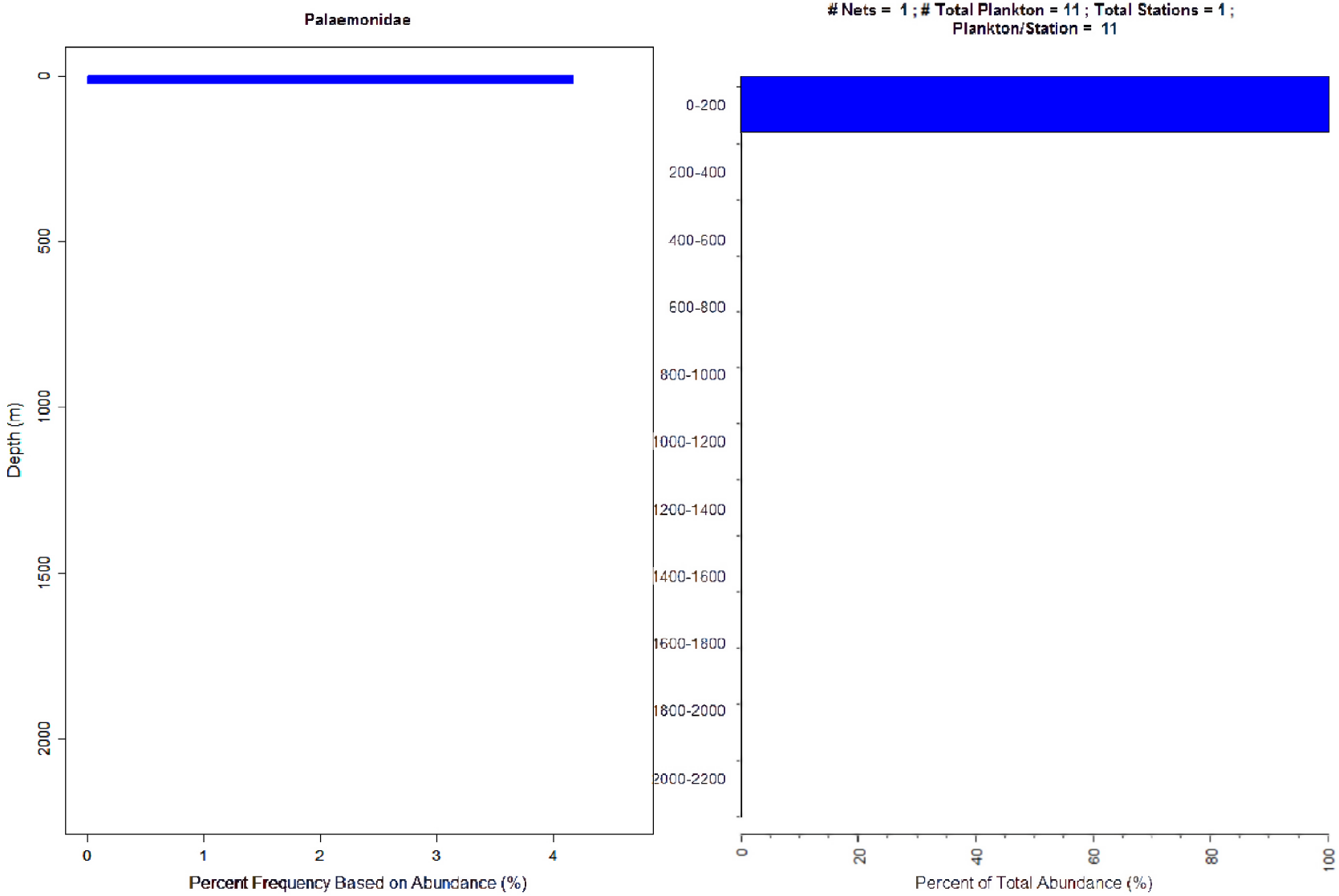
Oplophoridae - Deep



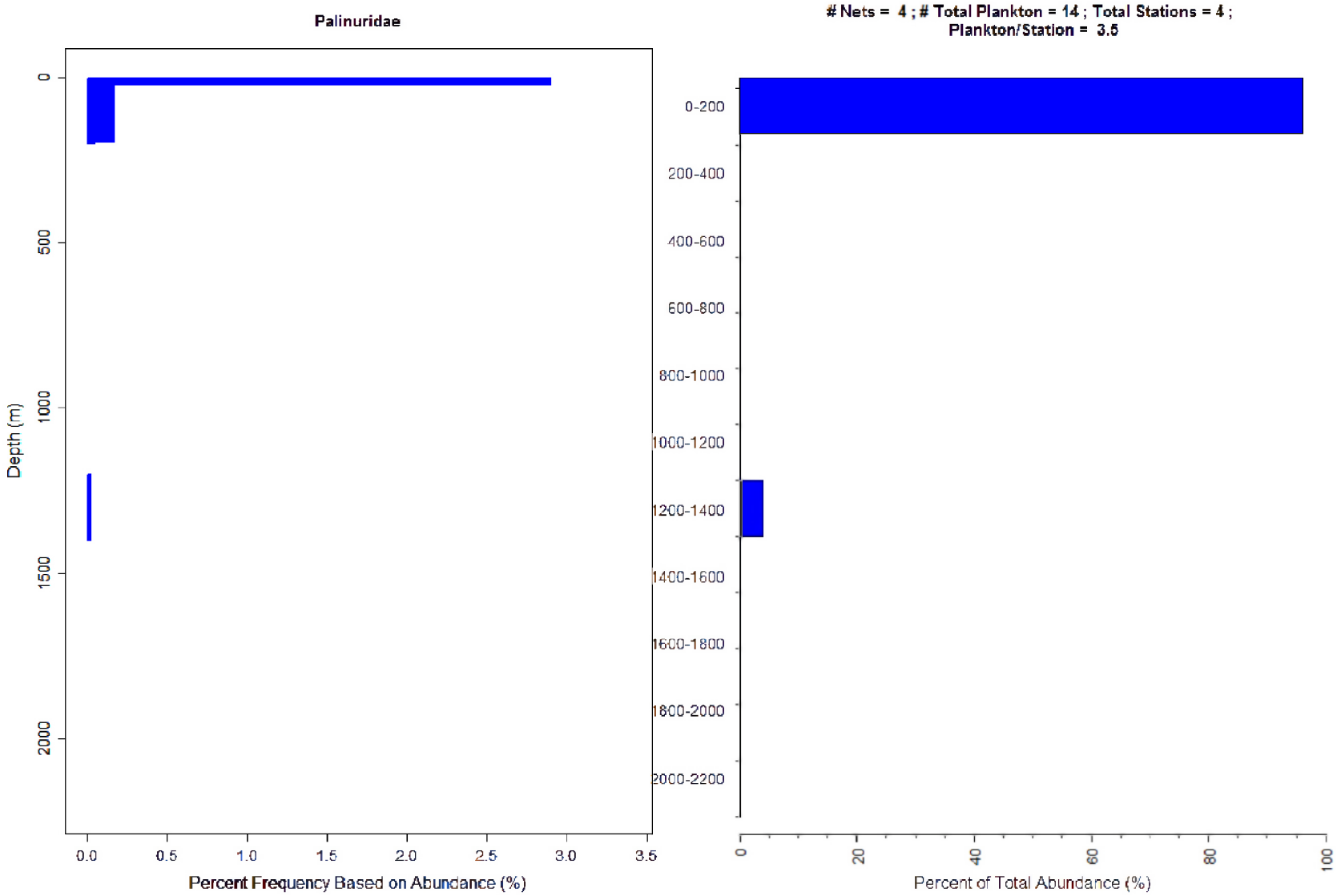
Osteichthyes - Deep



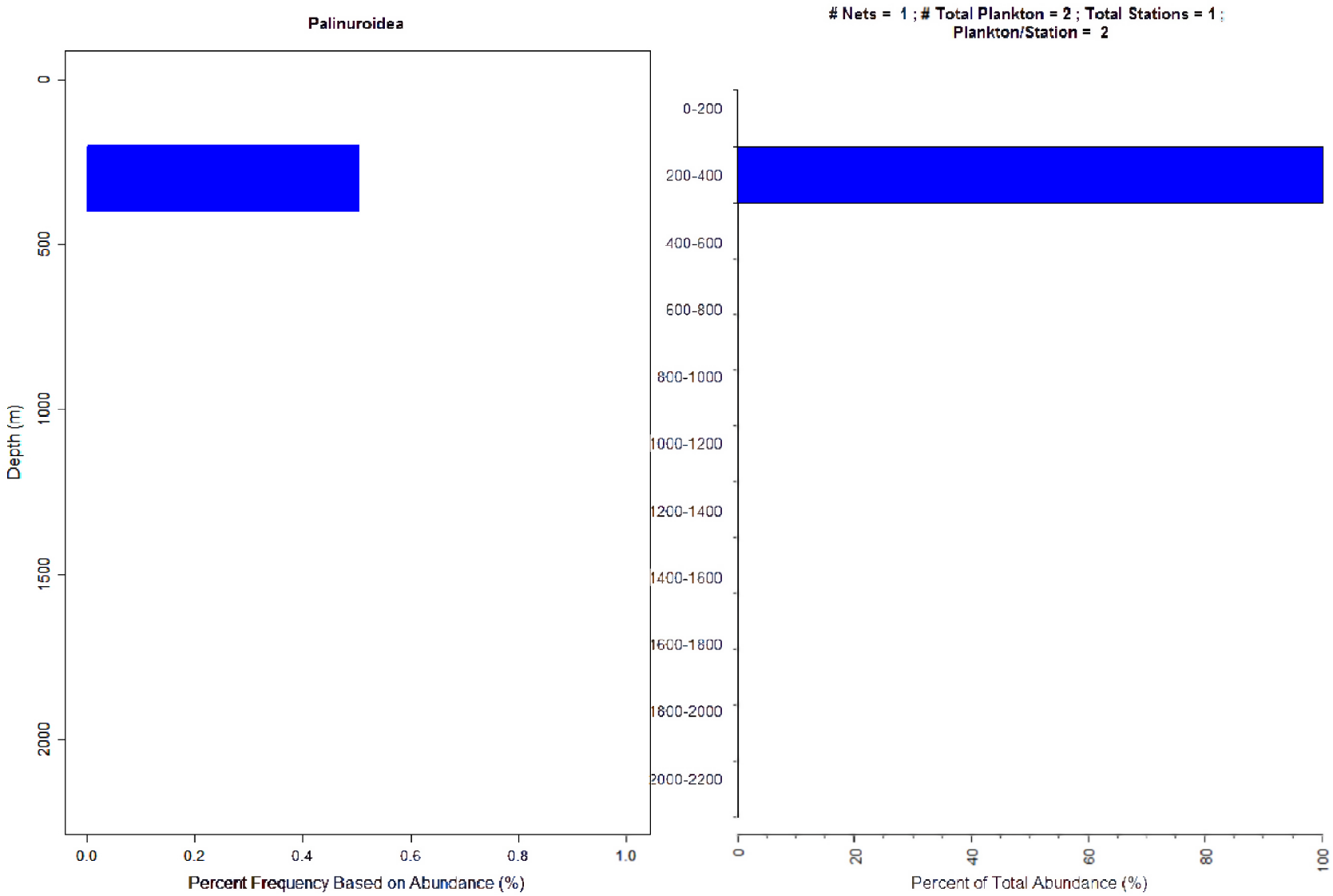
Other_Brachyura - Deep



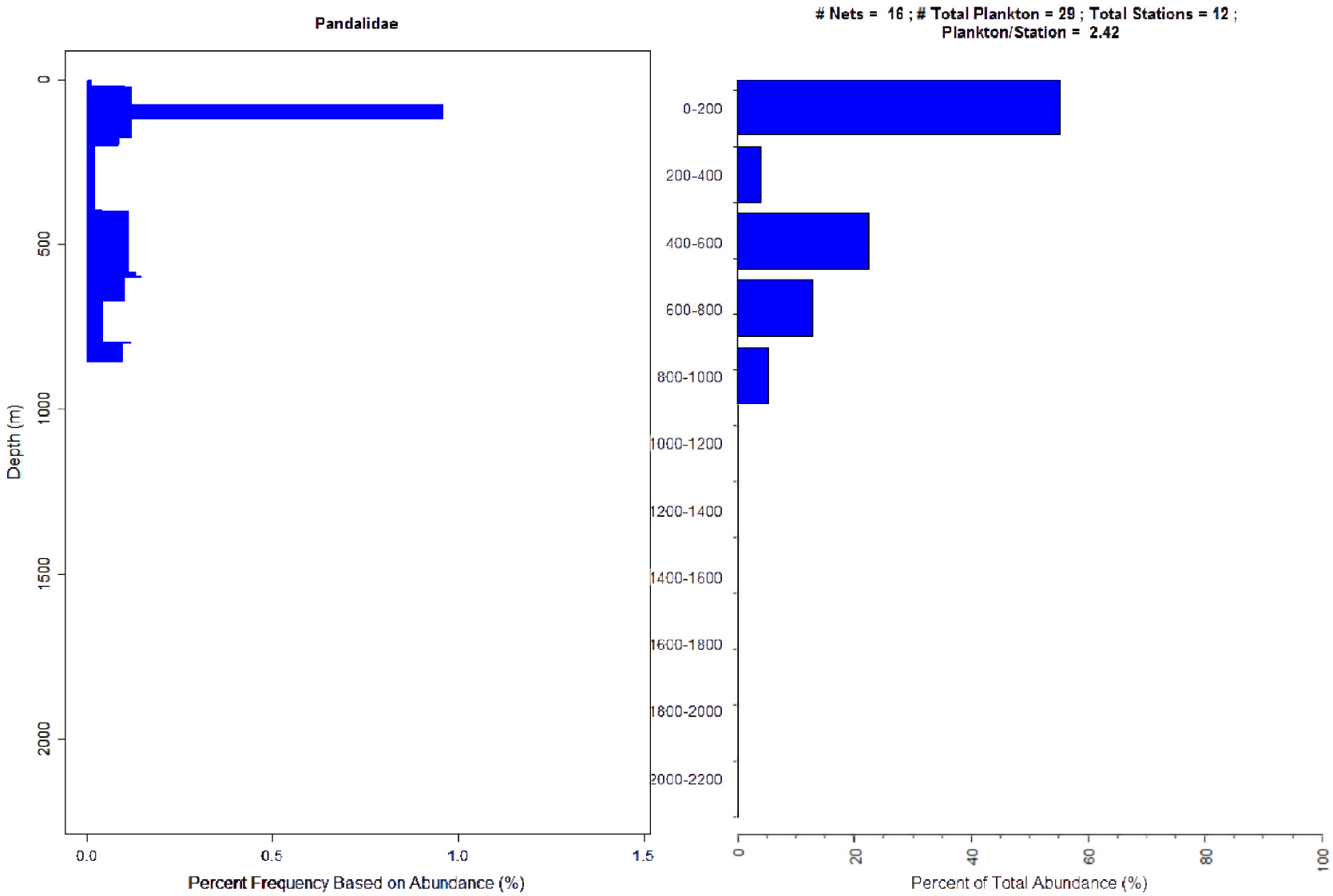
Palaemonidae - Deep



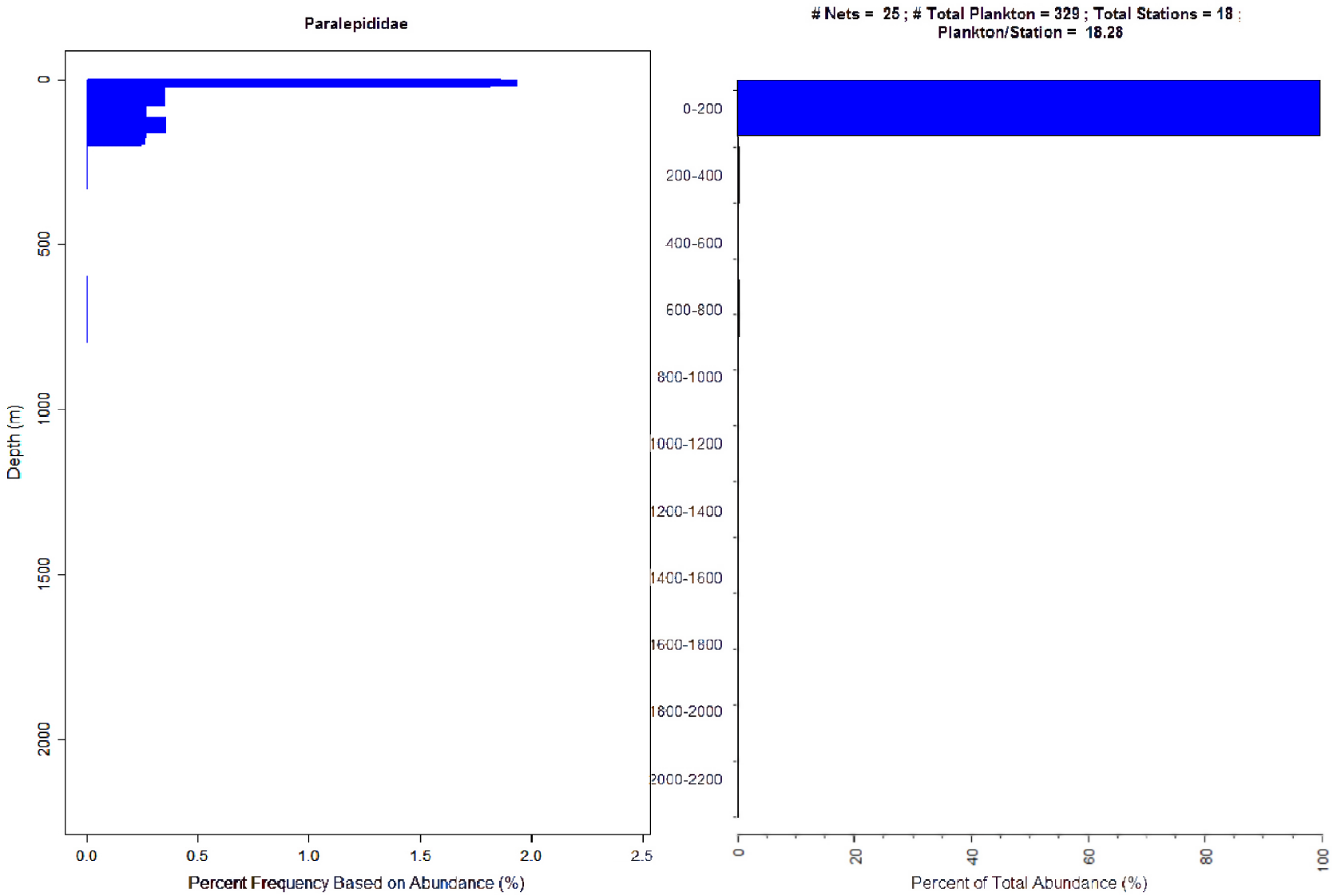
Palinuridae - Deep



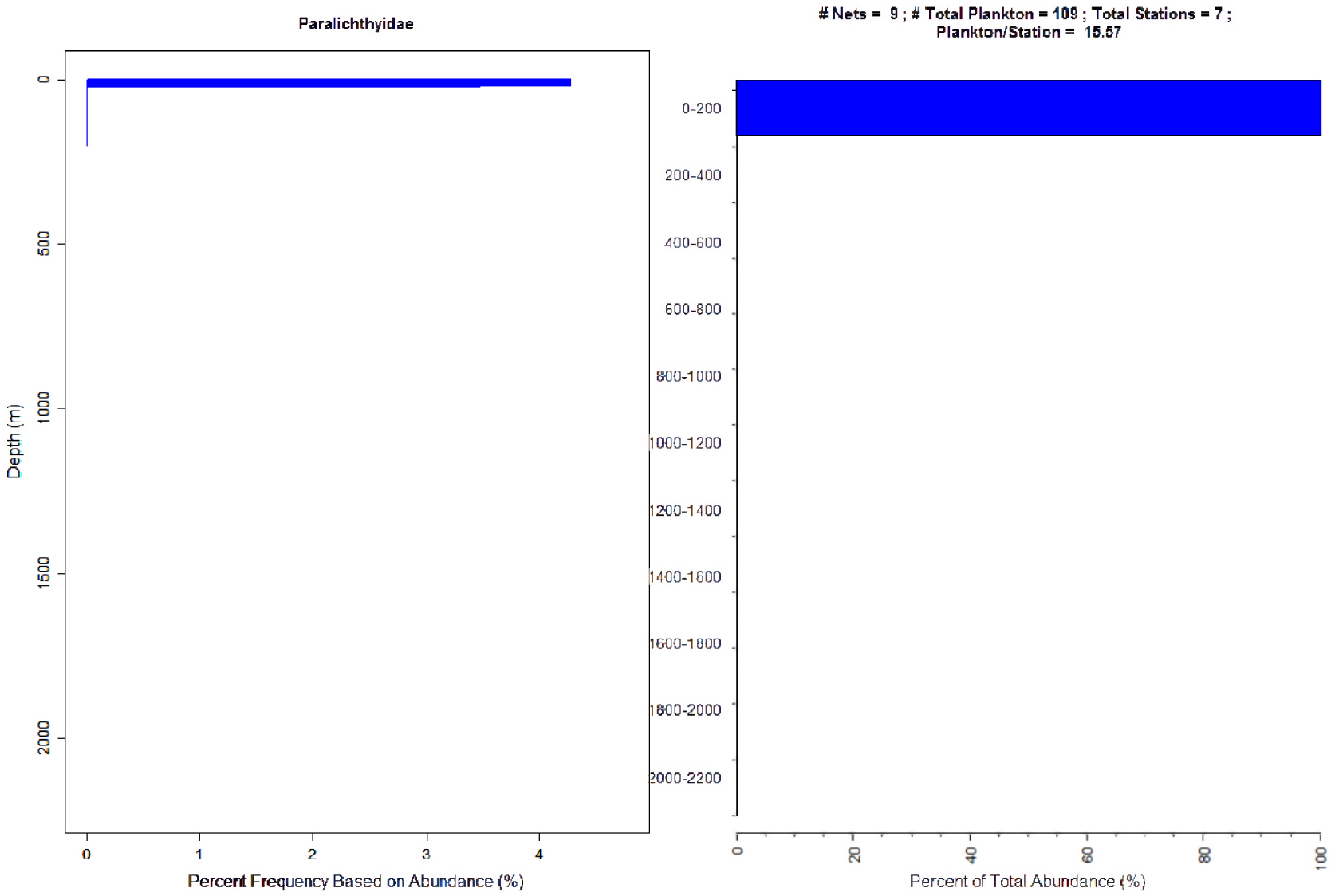
Palinuroidea - Deep



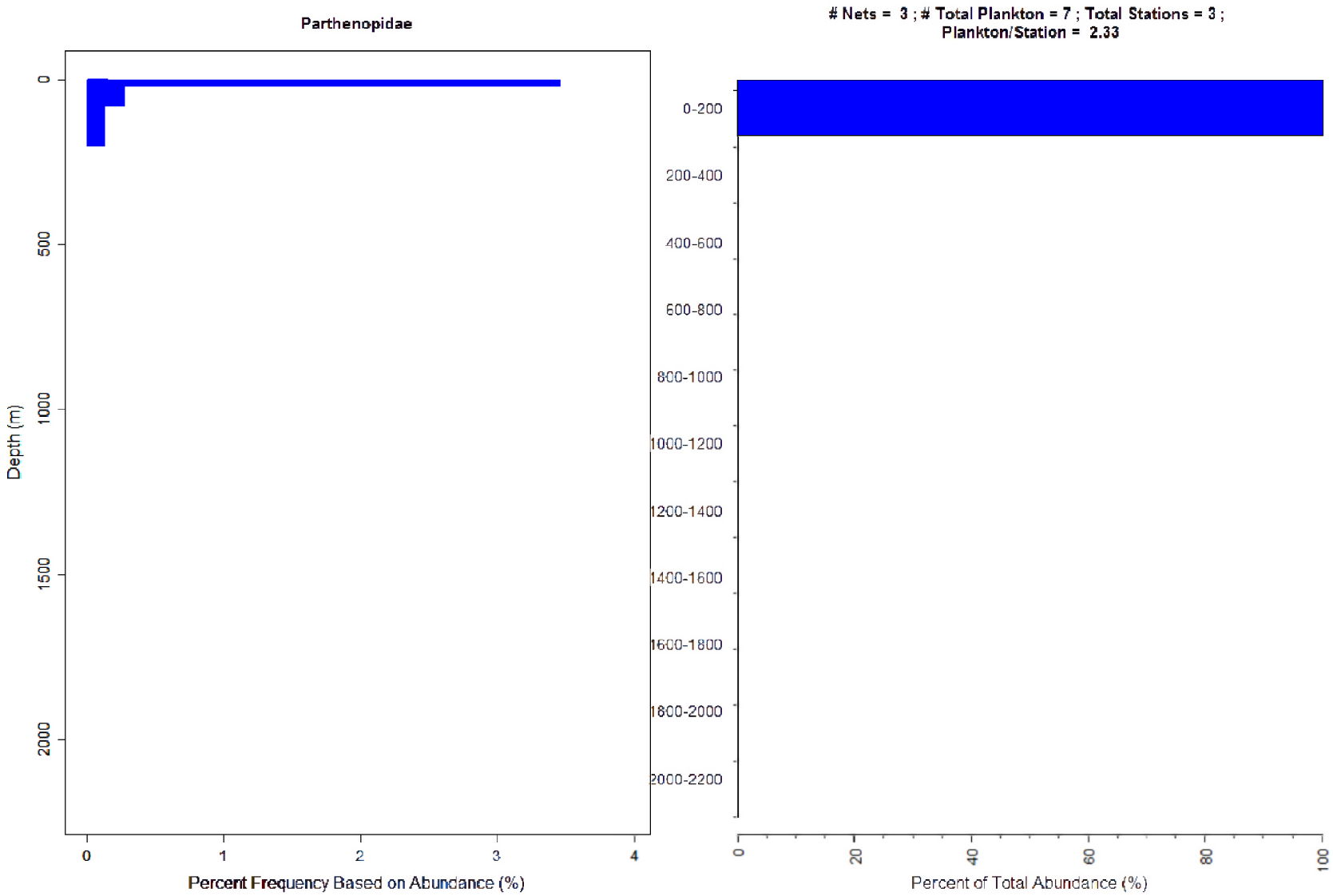
Pandalidae - Deep



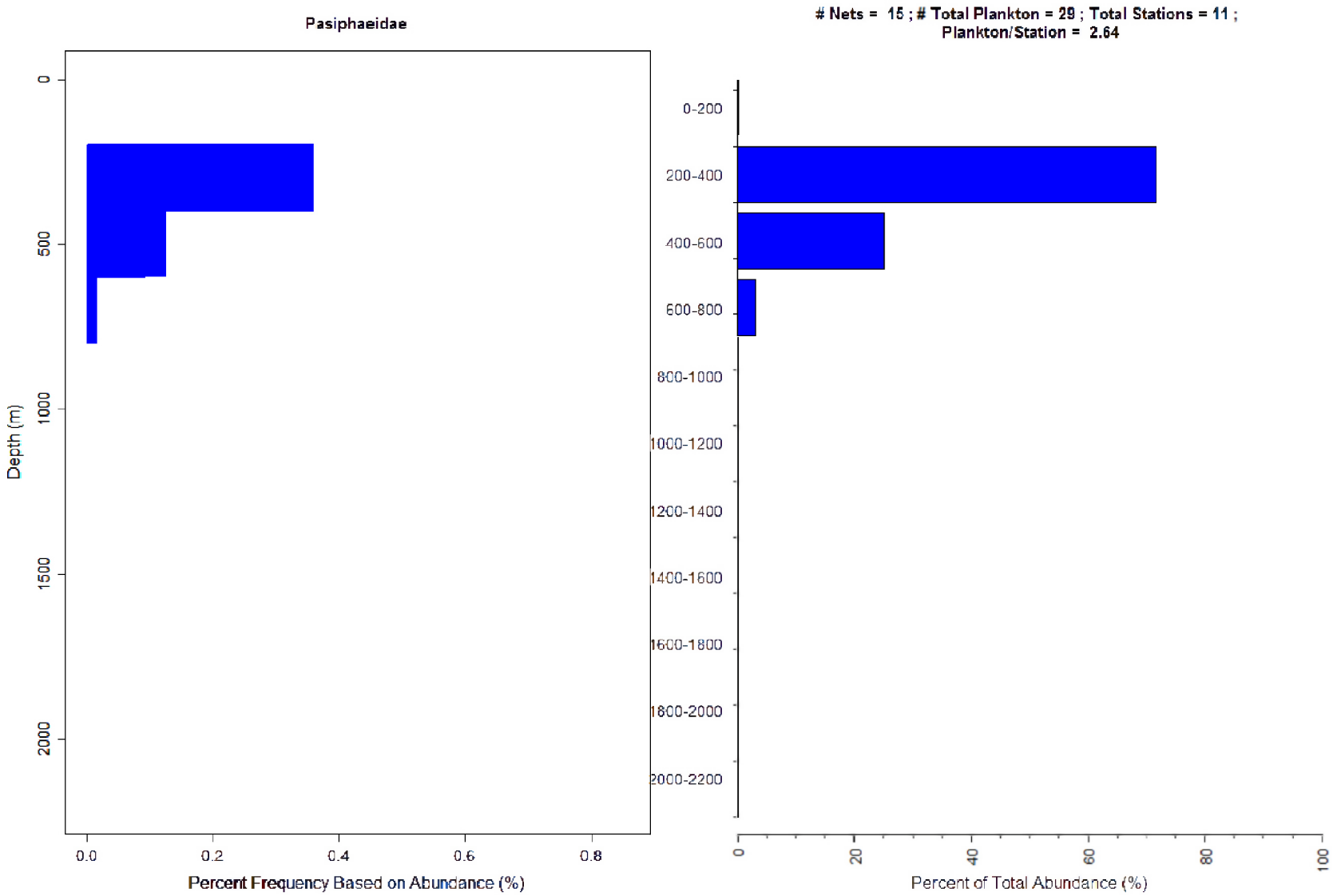
Paralepididae - Deep



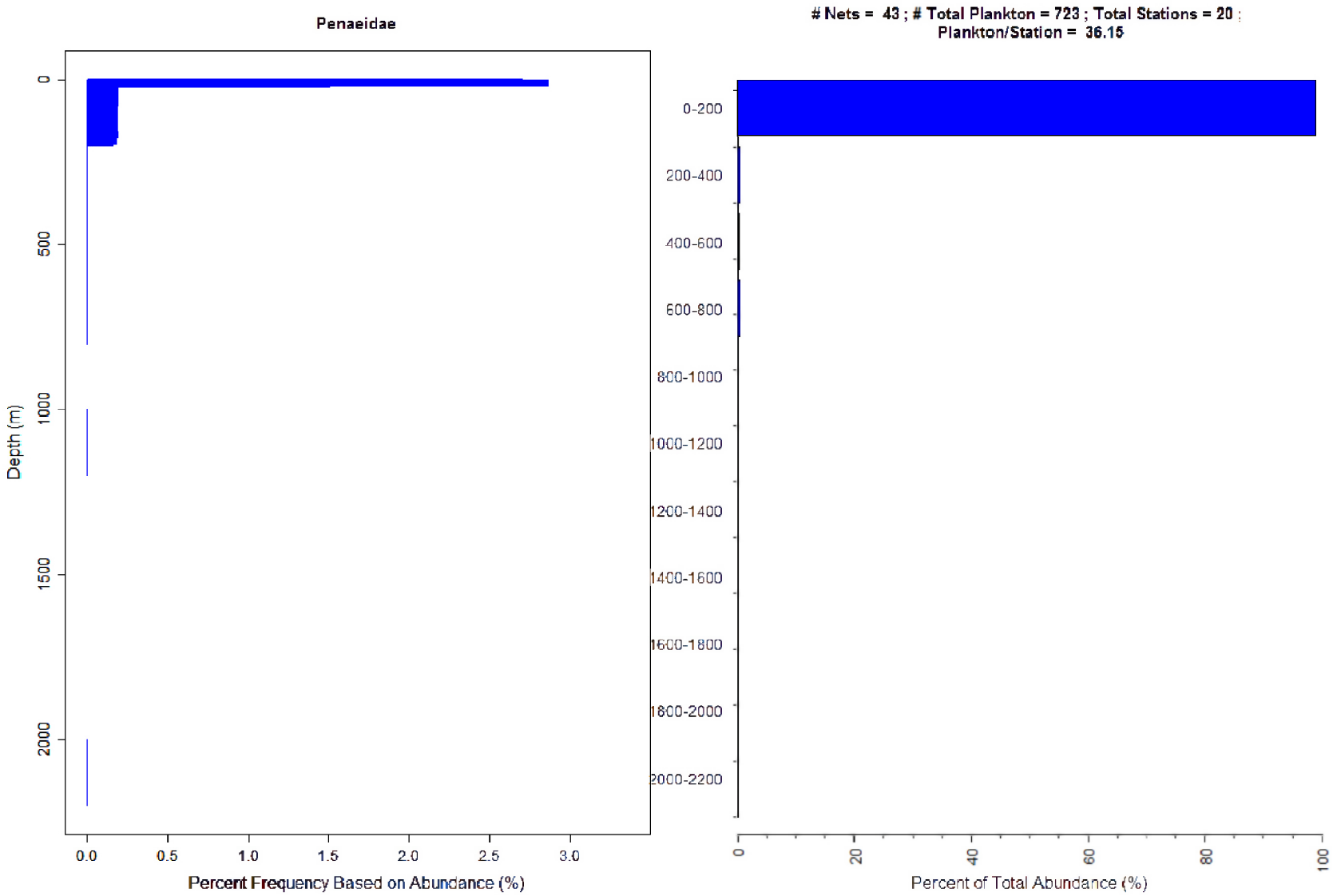
Paralichthyidae - Deep



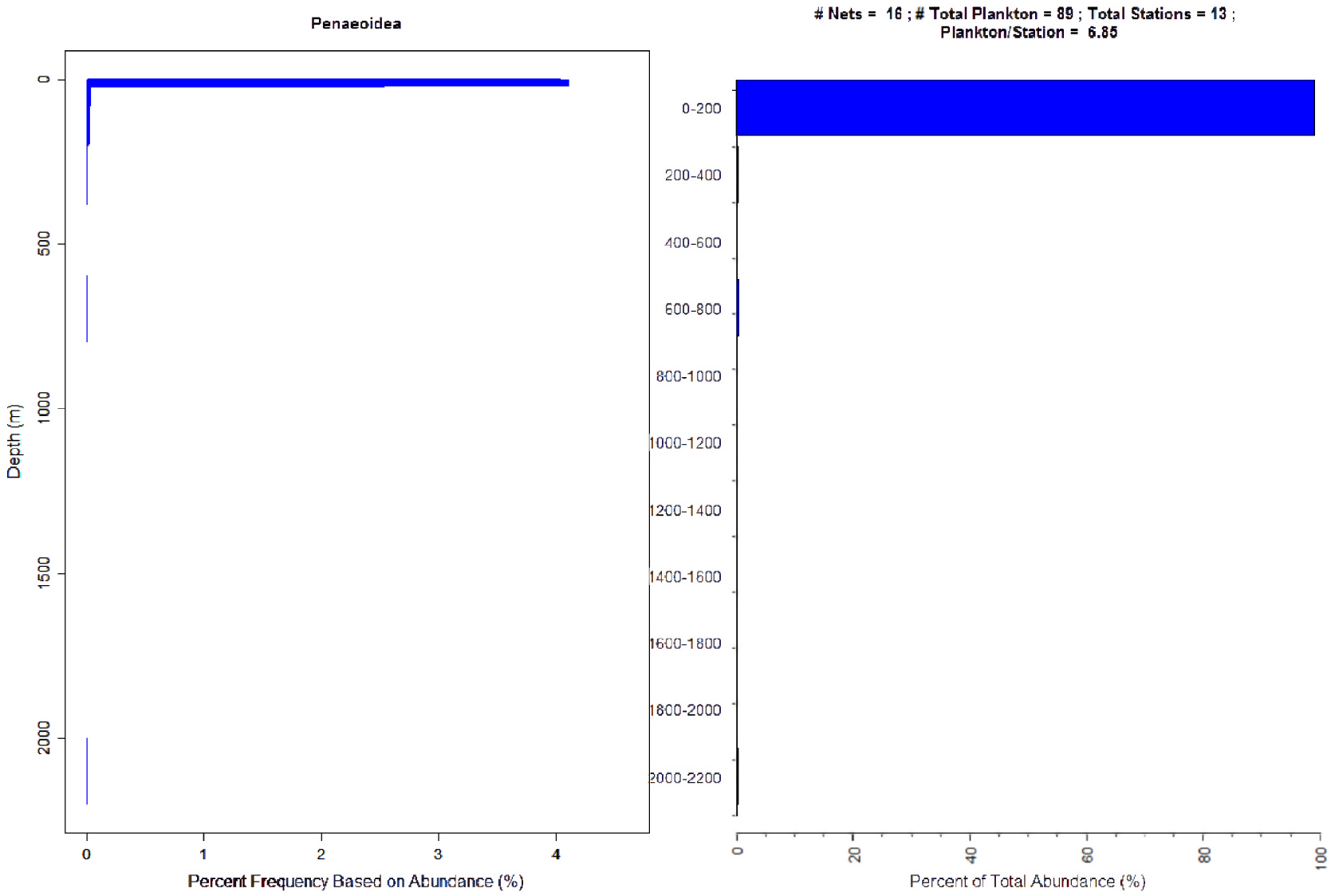
Parthenopidae - Deep



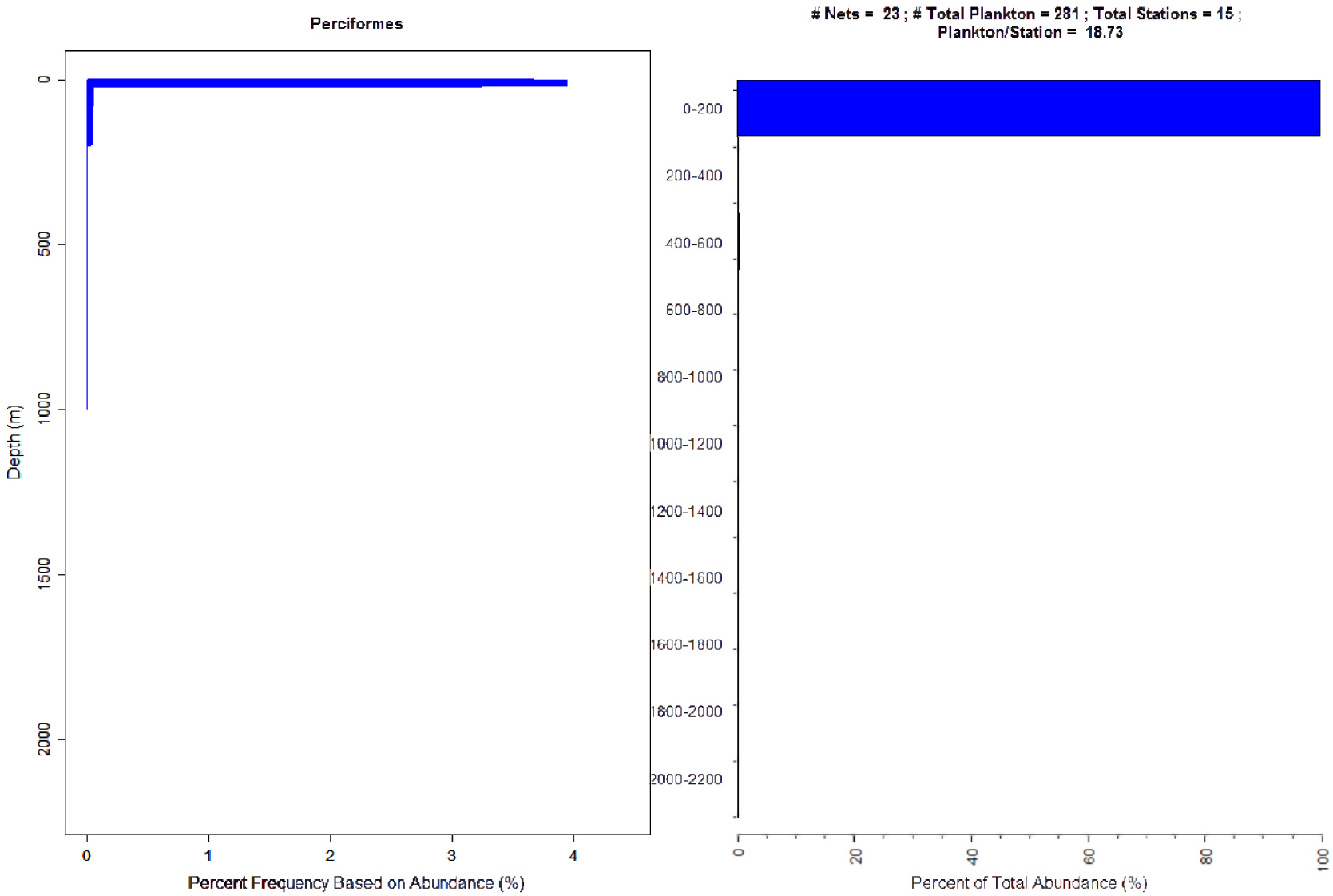
Pasiphaeidae - Deep



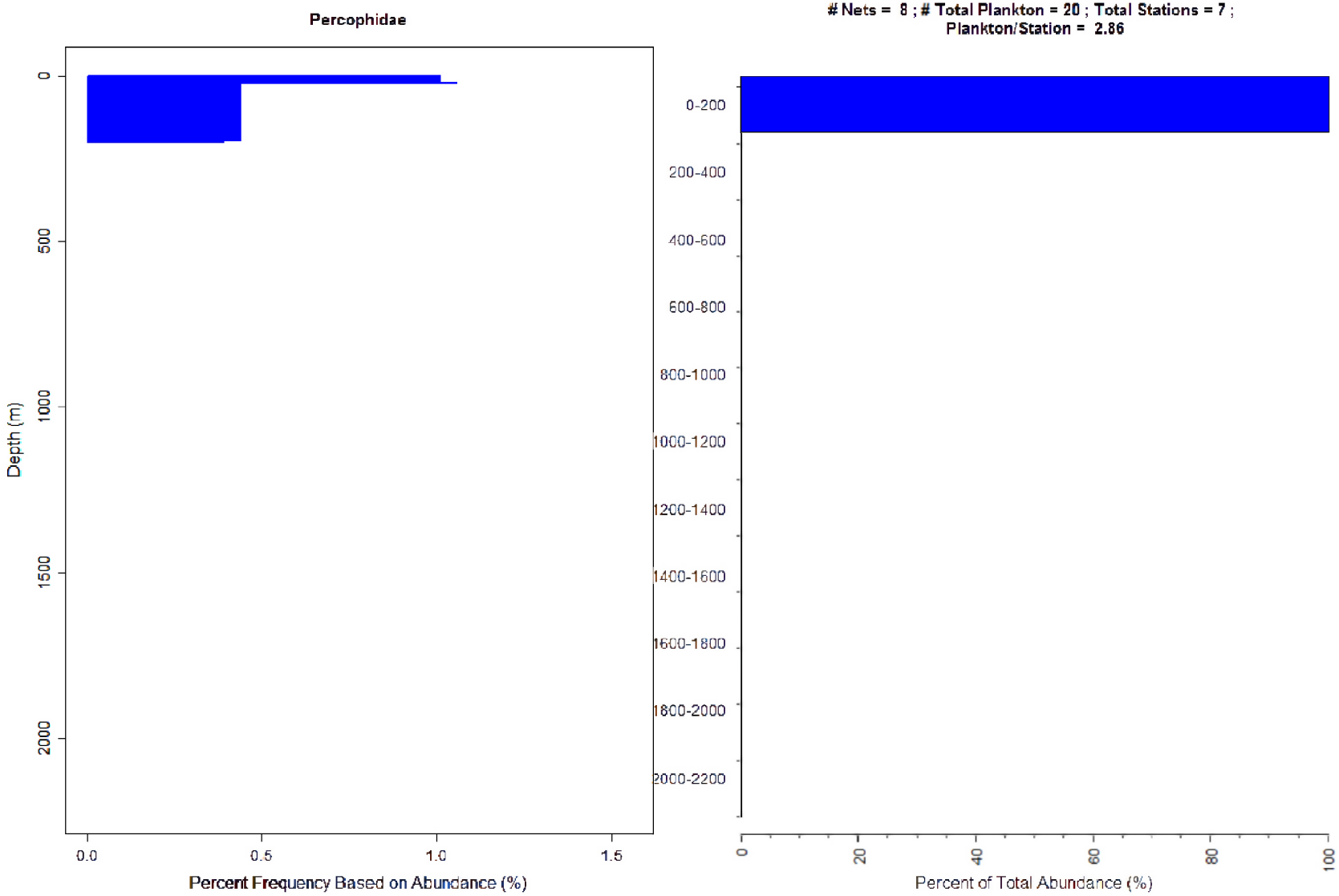
Penaeidae - Deep



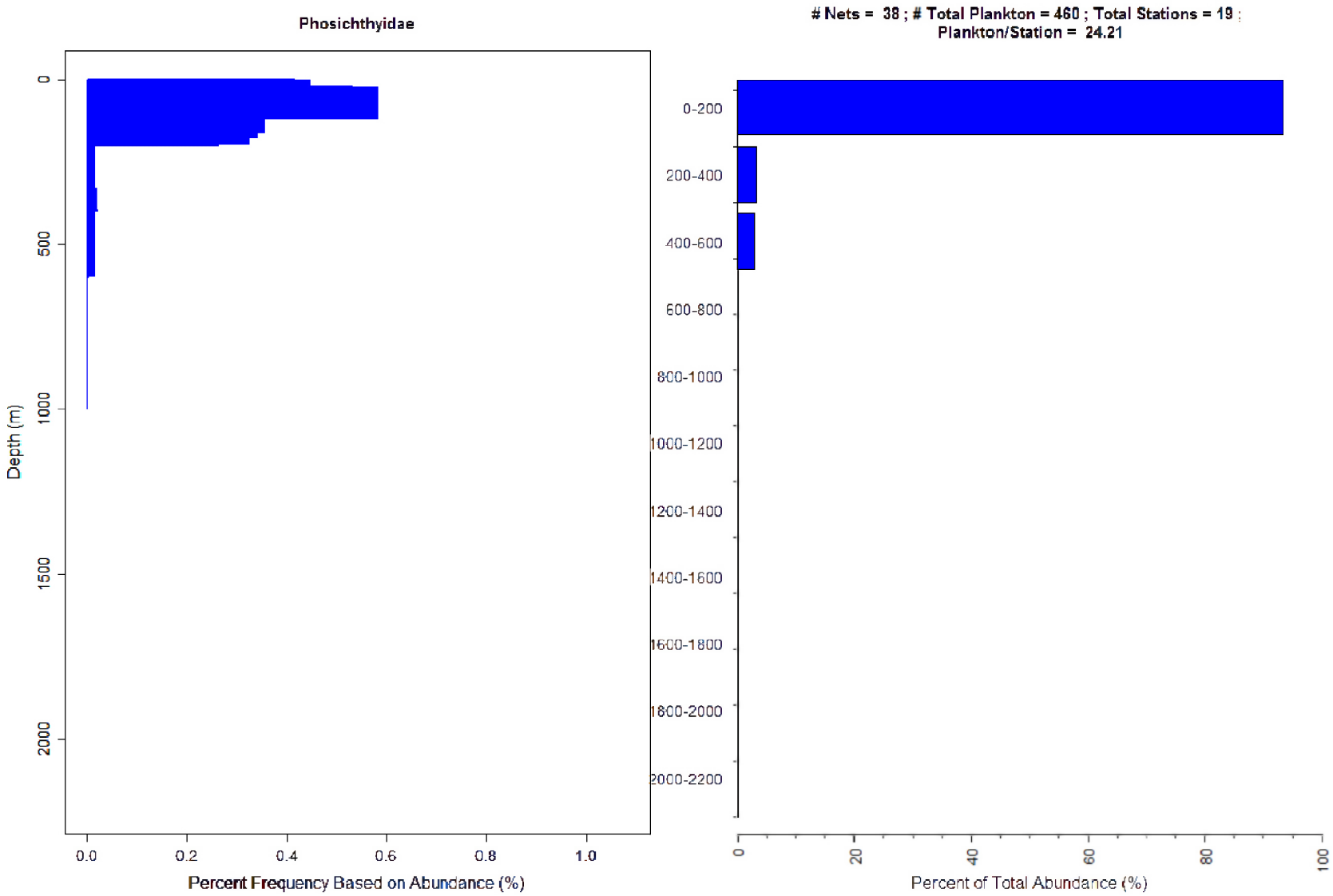
Penaeoidea - Deep



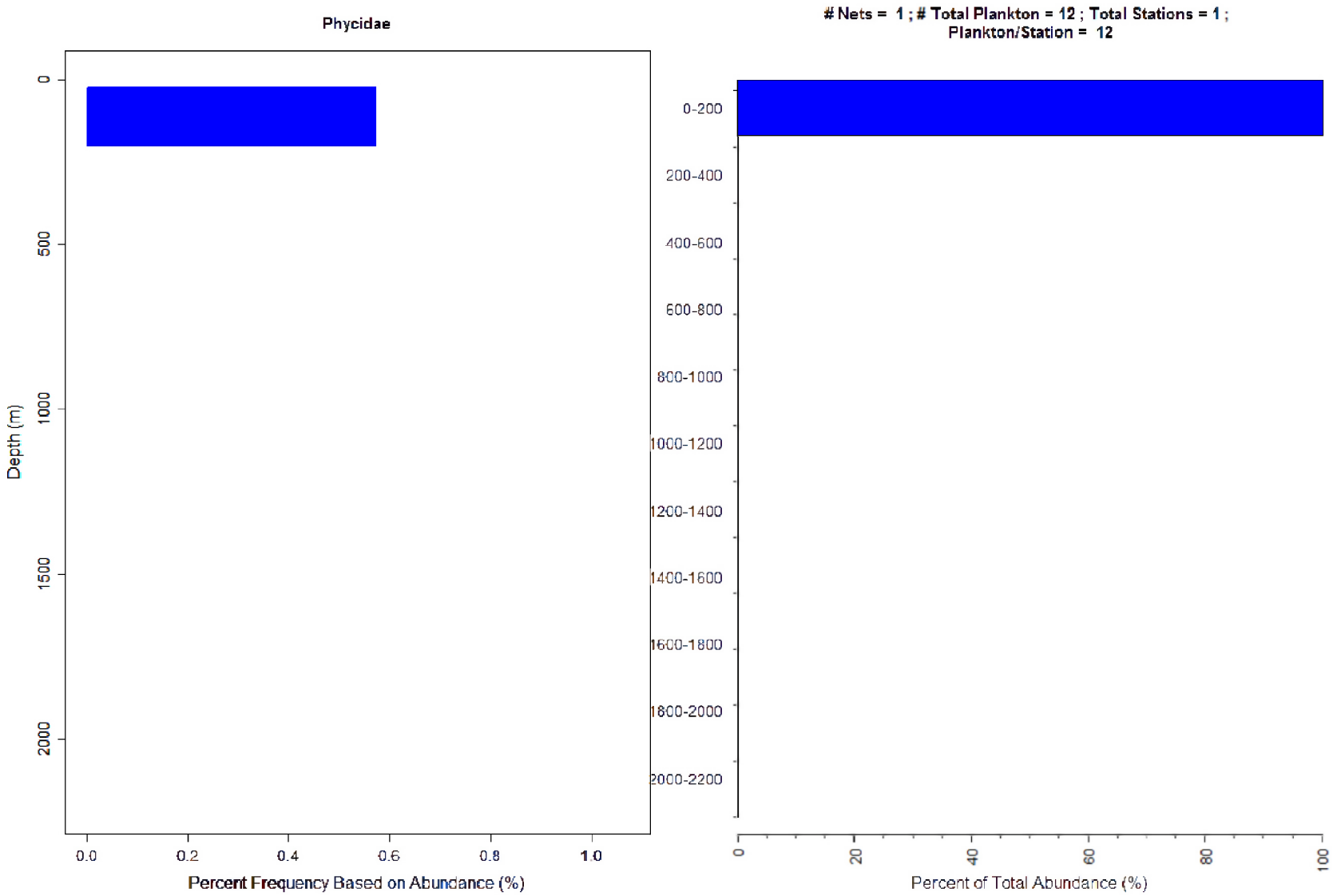
Perciformes - Deep



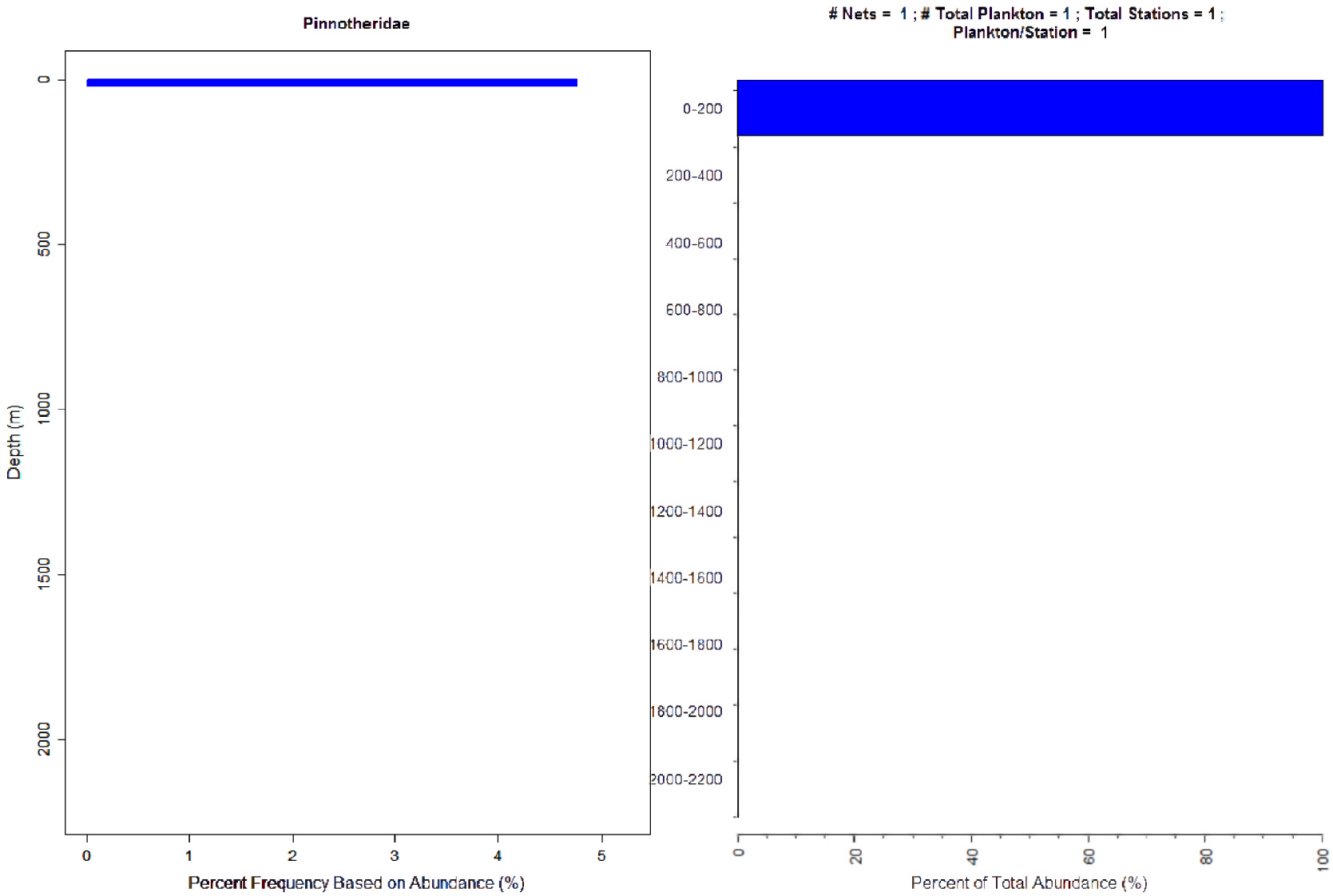
Percophidae - Deep



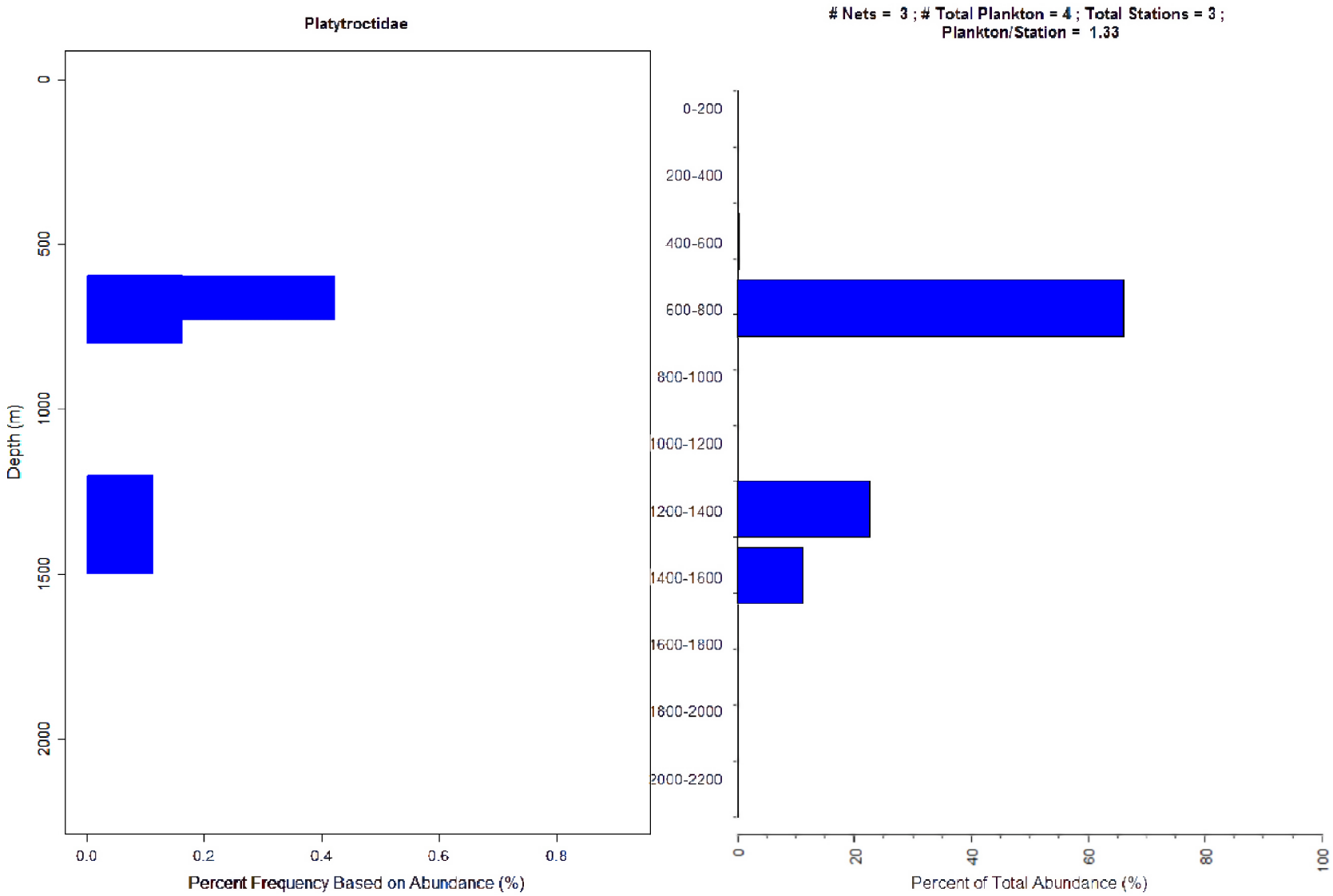
Phosichthyidae - Deep



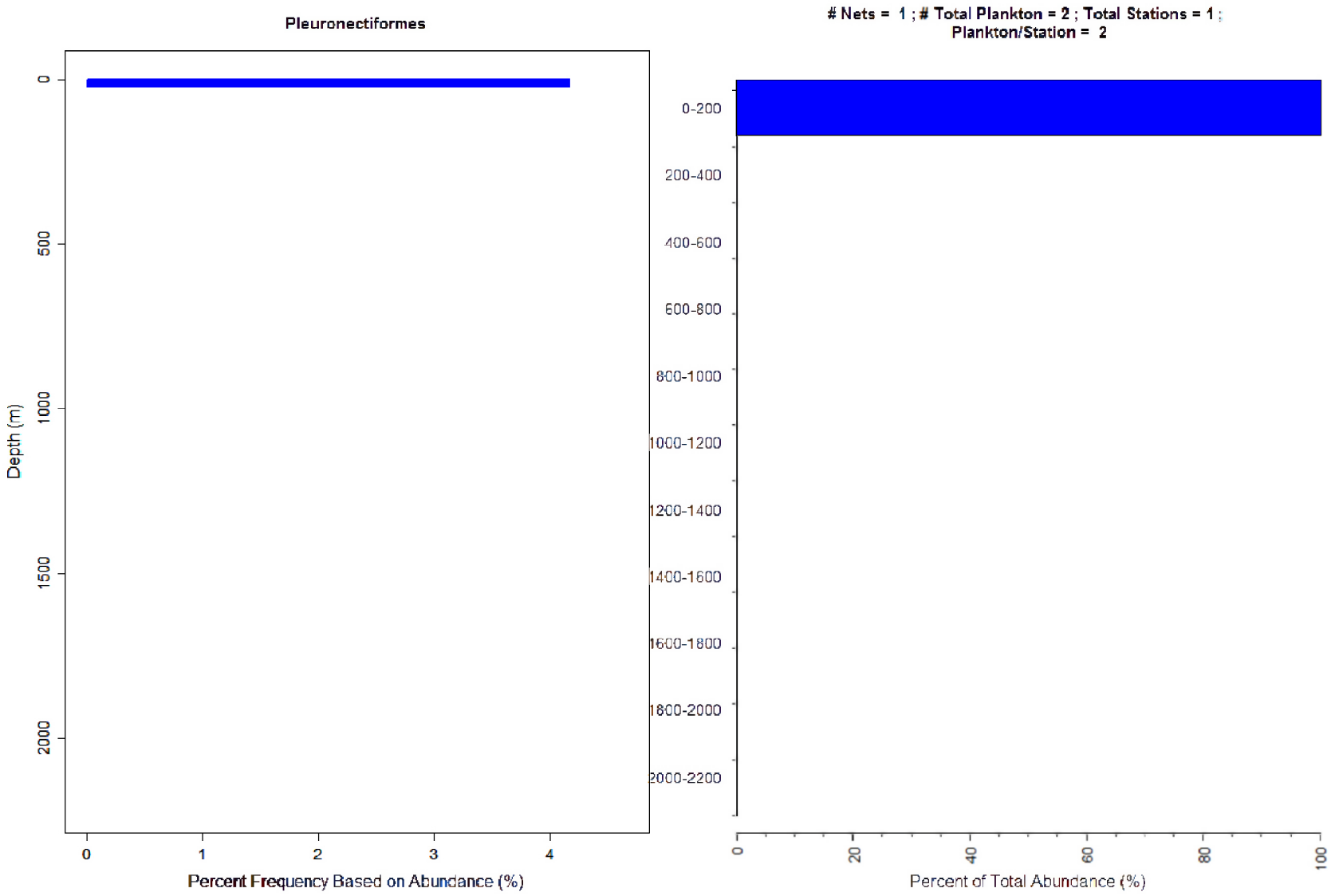
Phycidae - Deep



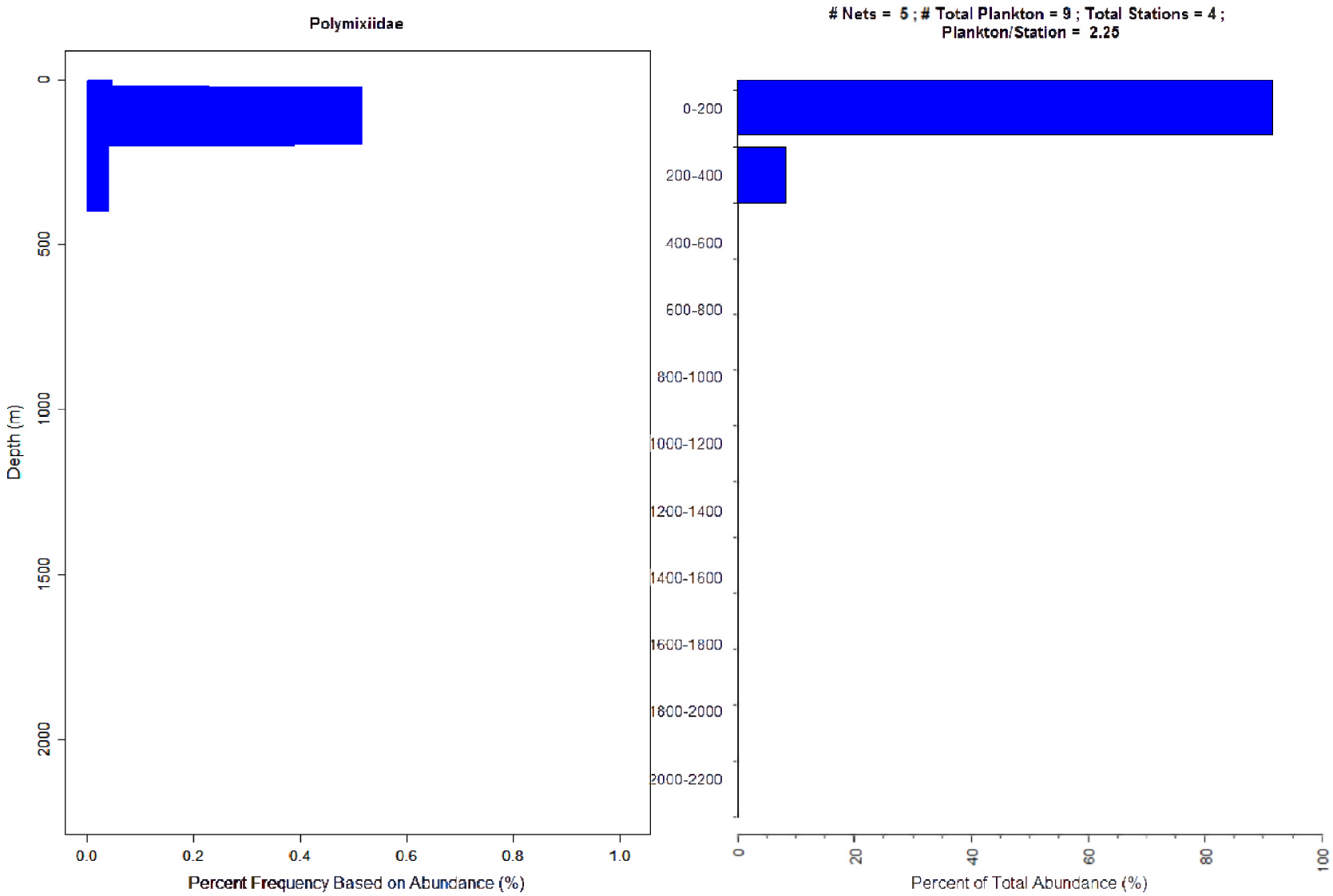
Pinnotheridae - Deep



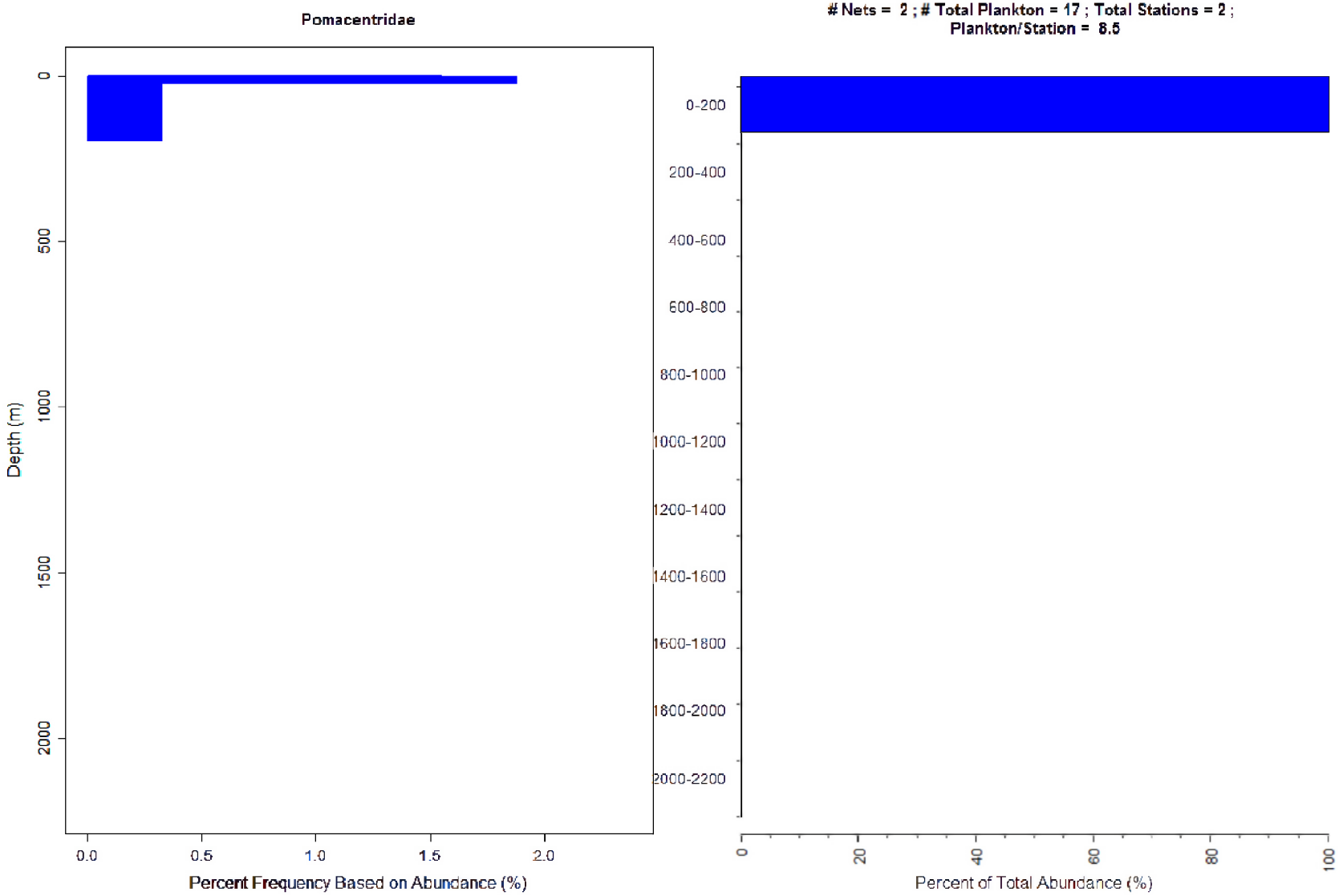
Platytroctidae - Deep



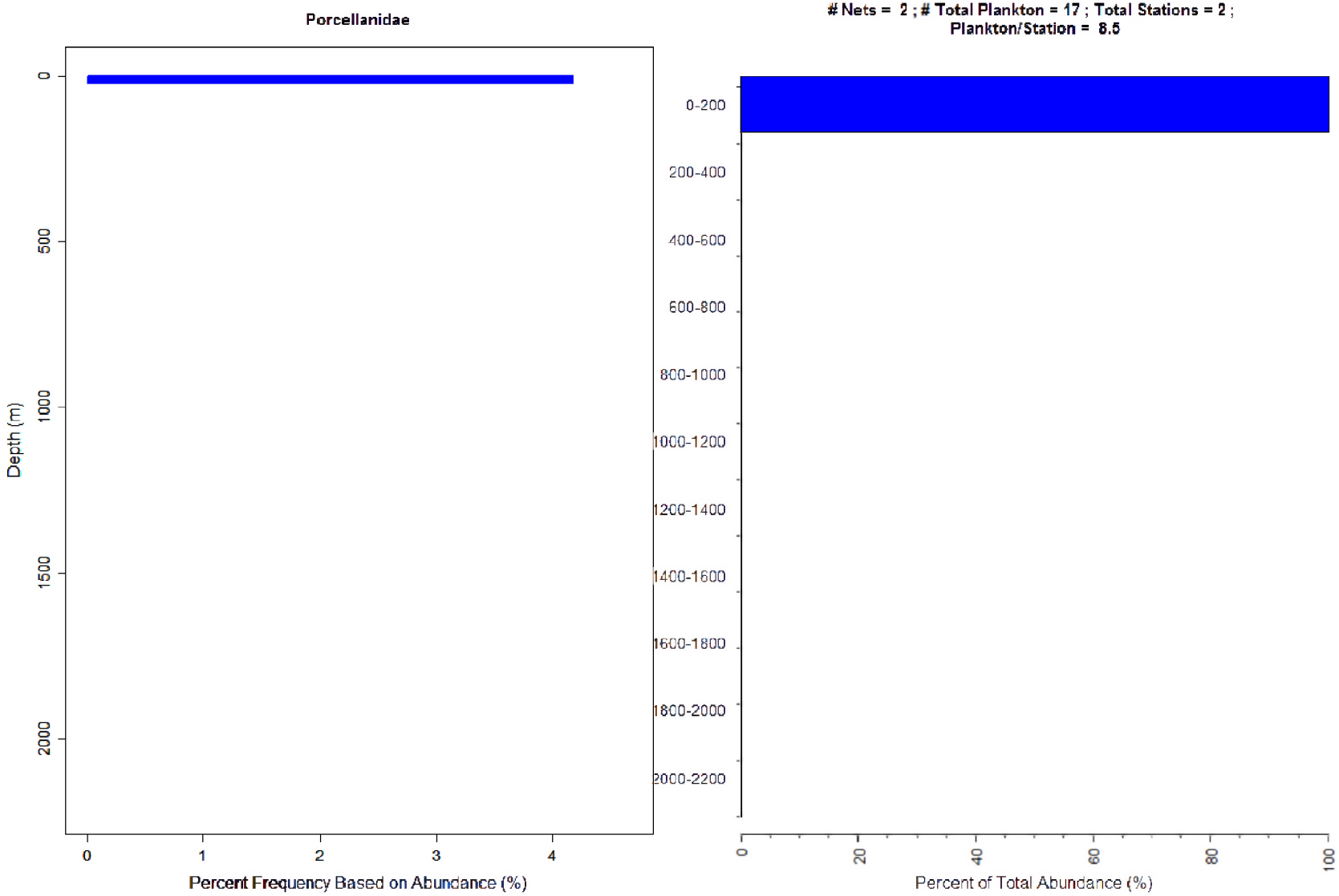
Pleuronectiformes - Deep



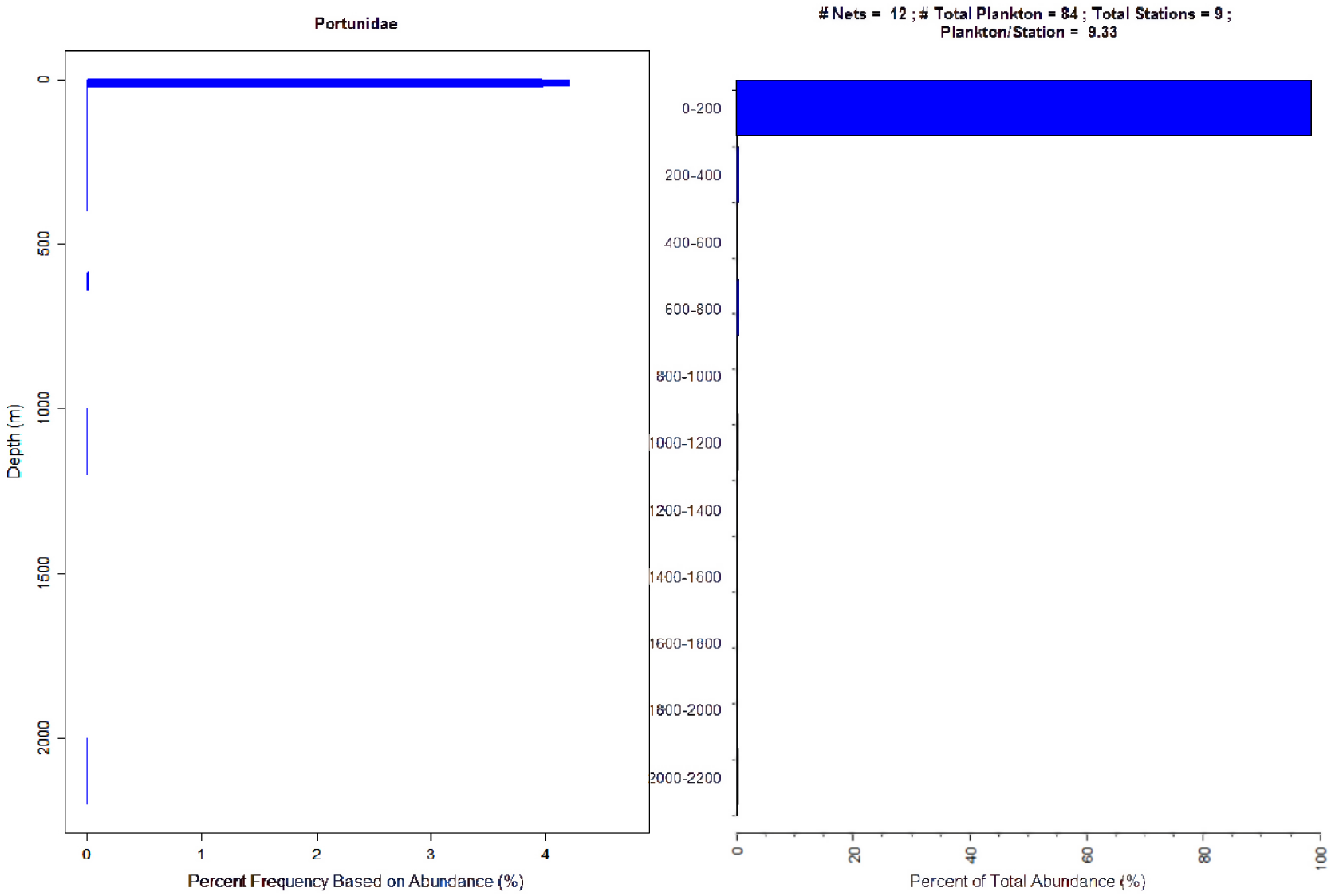
Polymixiidae - Deep



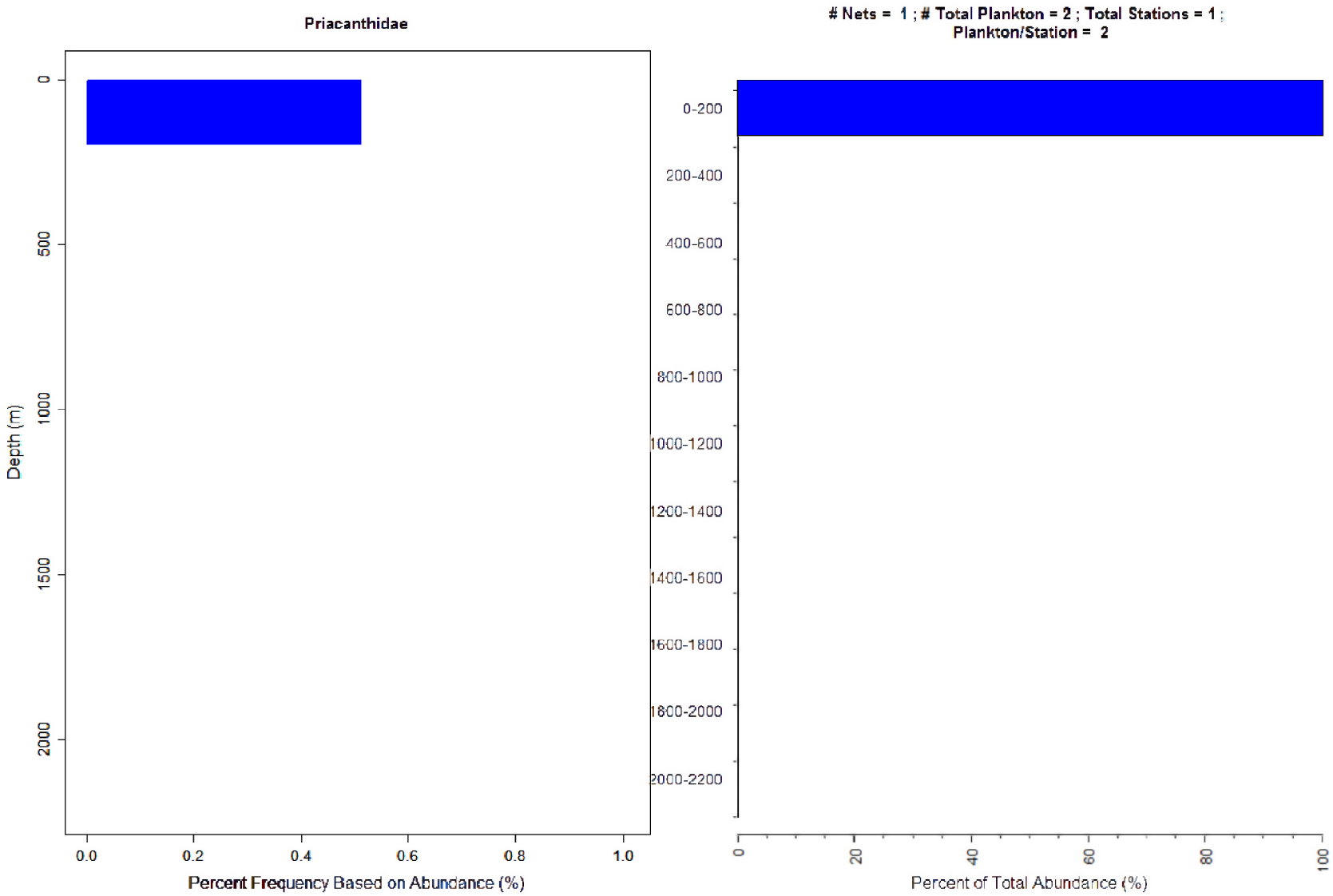
Pomacentridae - Deep



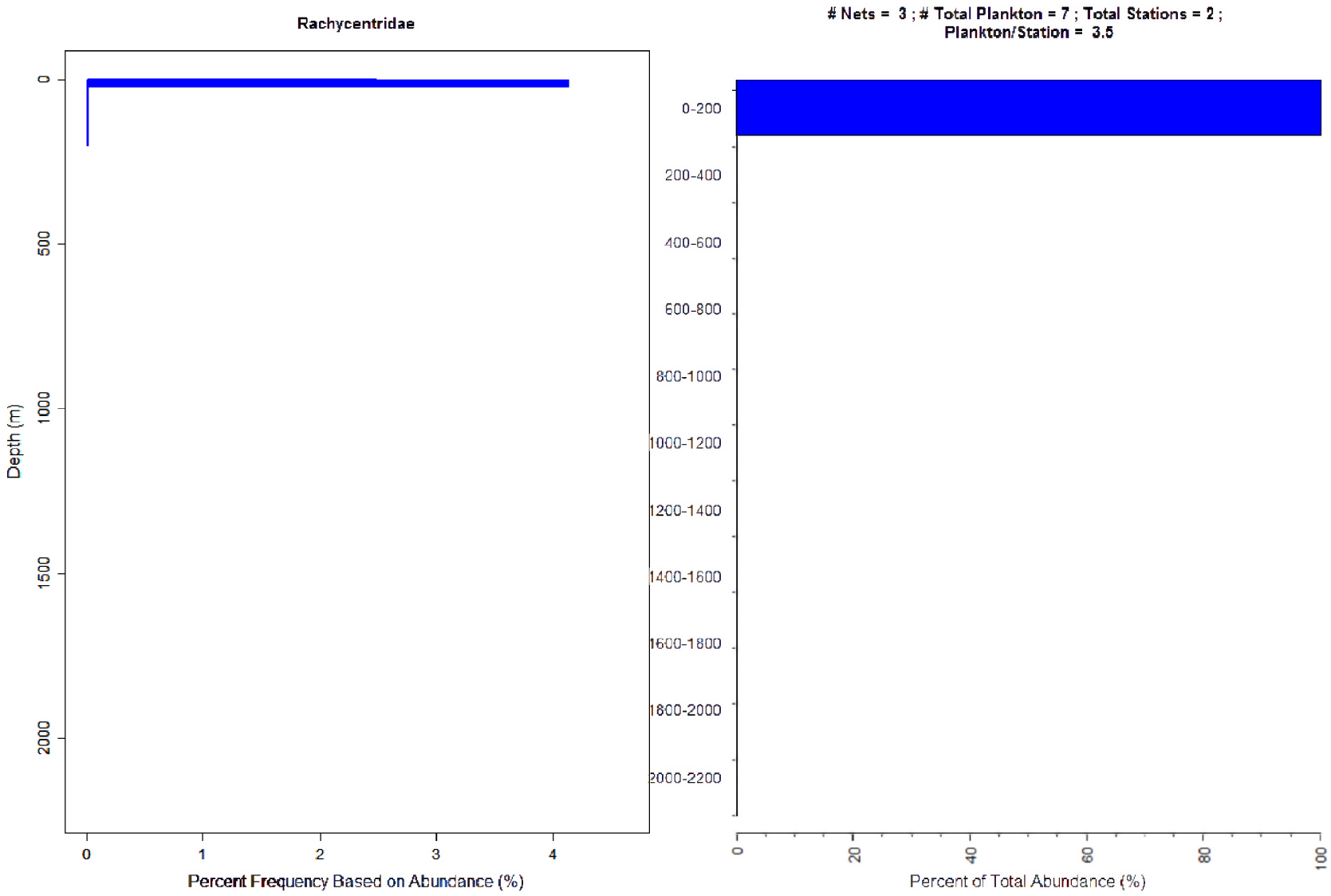
Porcellanidae - Deep



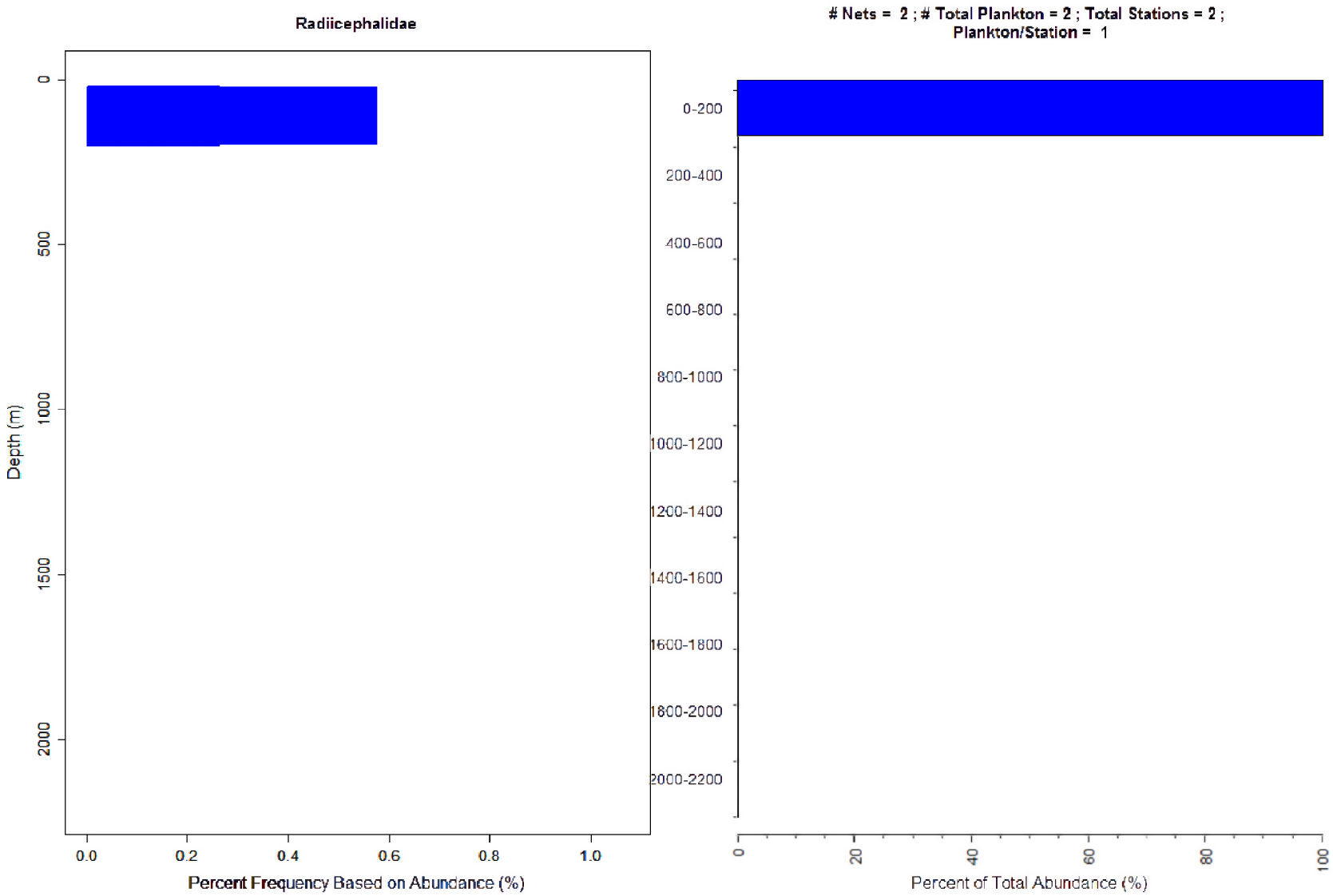
Portunidae - Deep



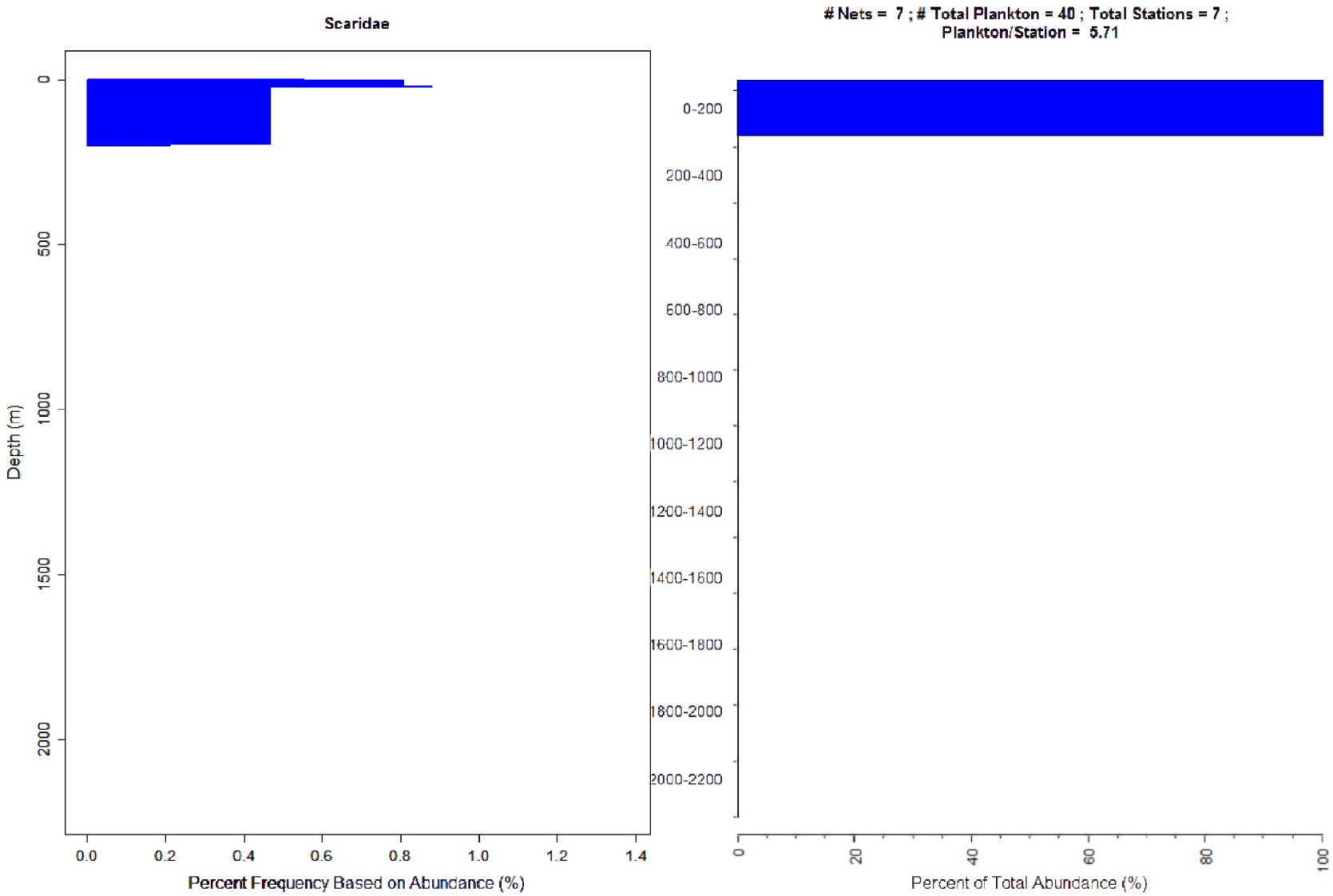
Priacanthidae - Deep



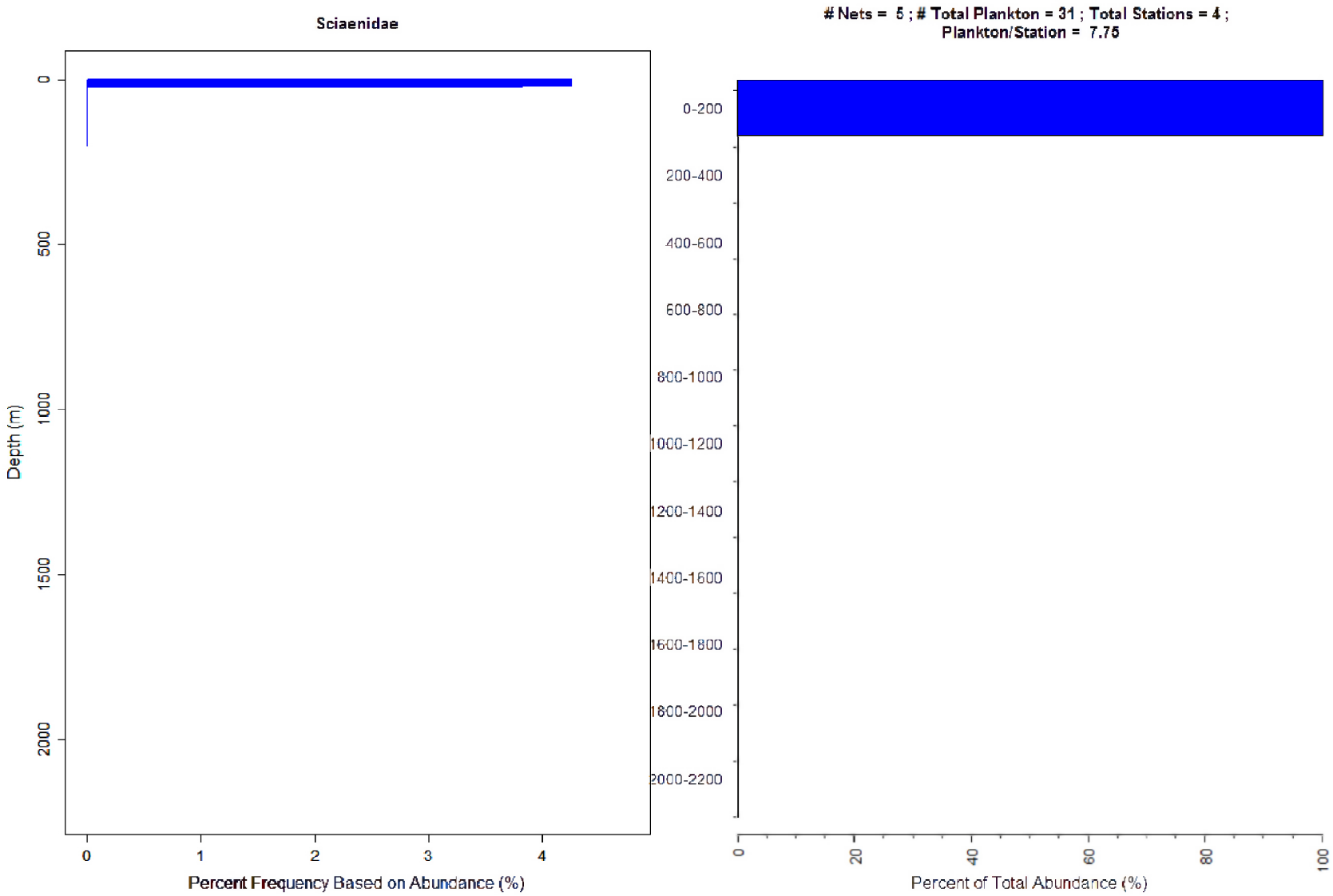
Rachycentridae - Deep



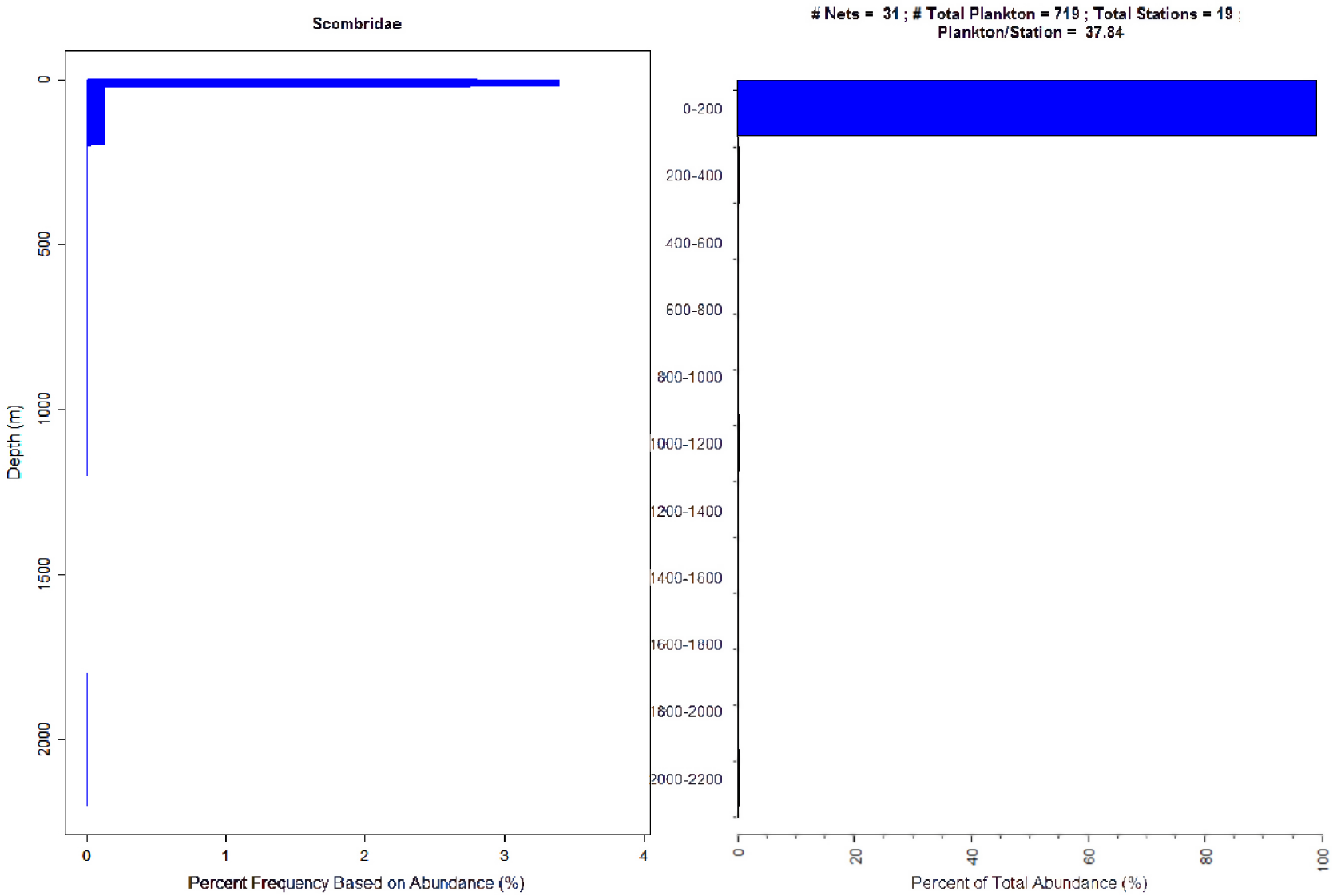
Radiicephalidae - Deep



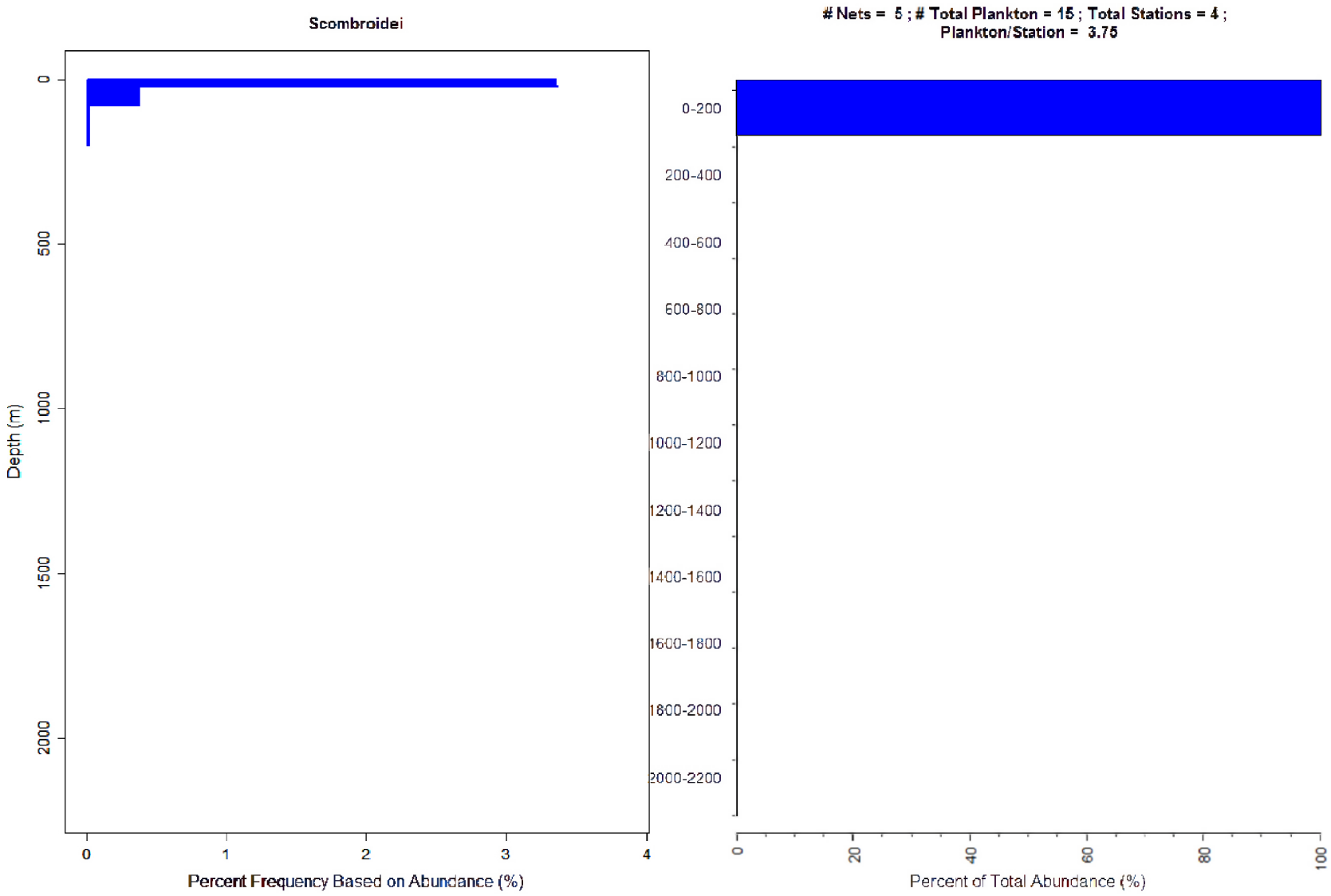
Scaridae - Deep



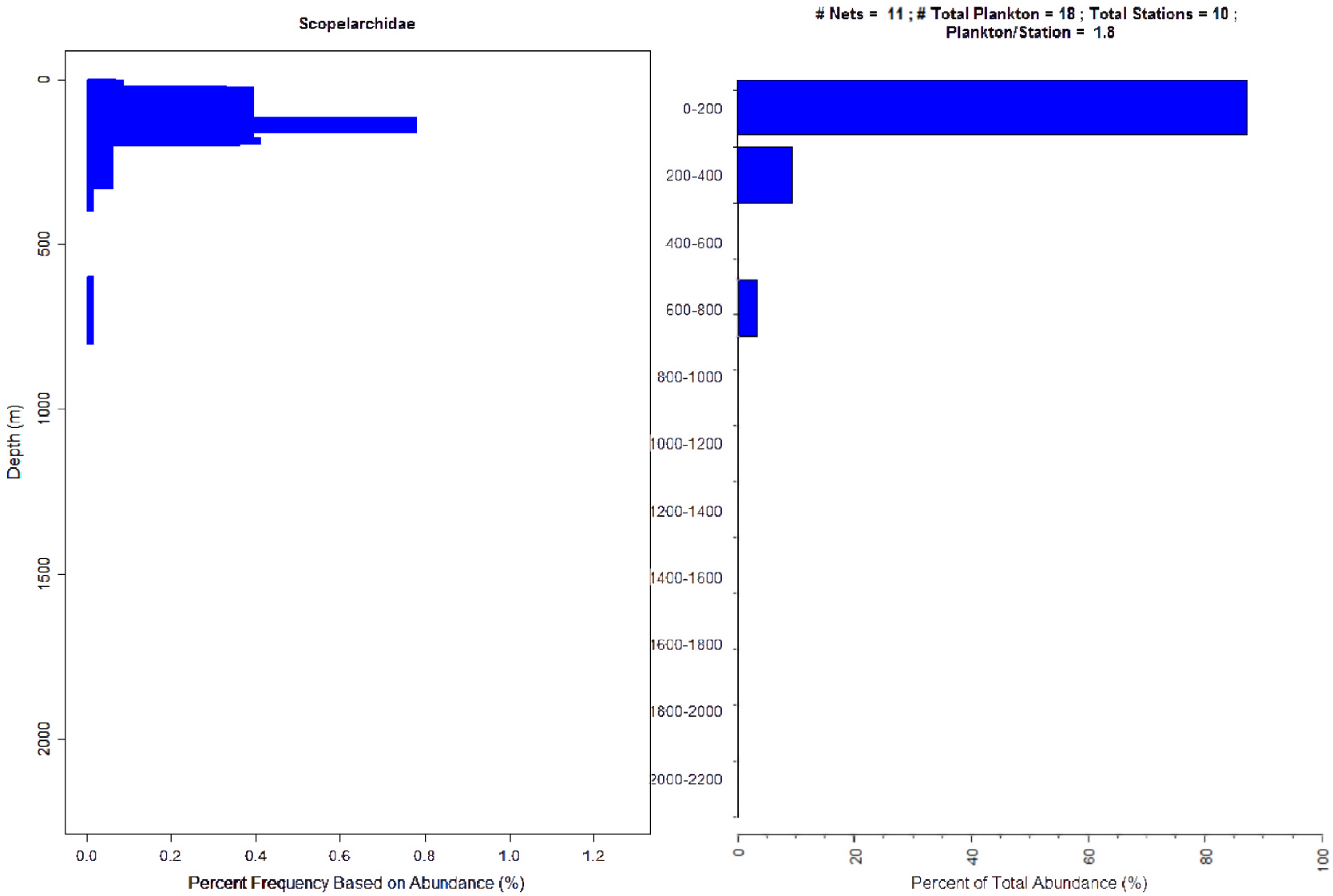
Sciaenidae - Deep



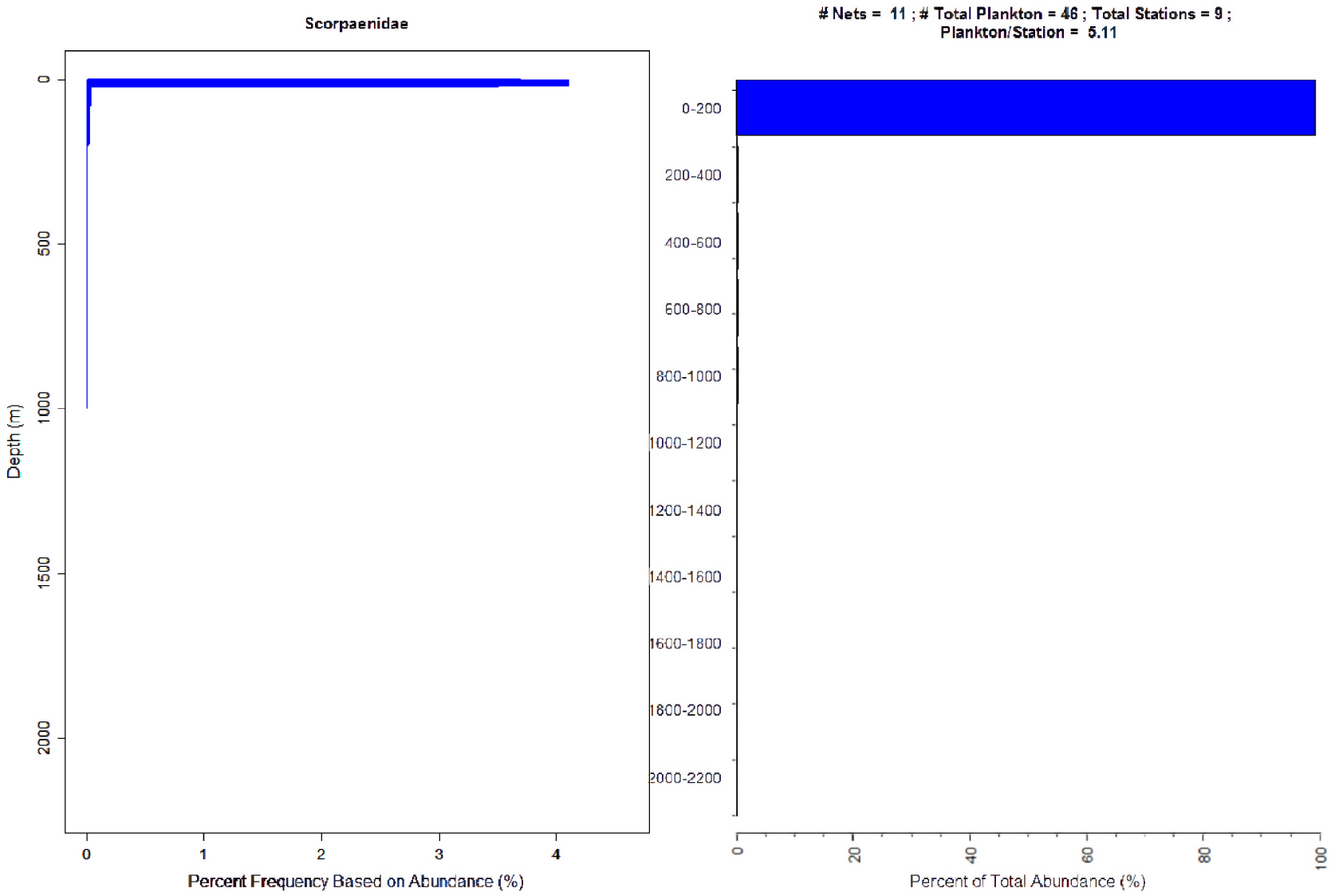
Scombridae - Deep



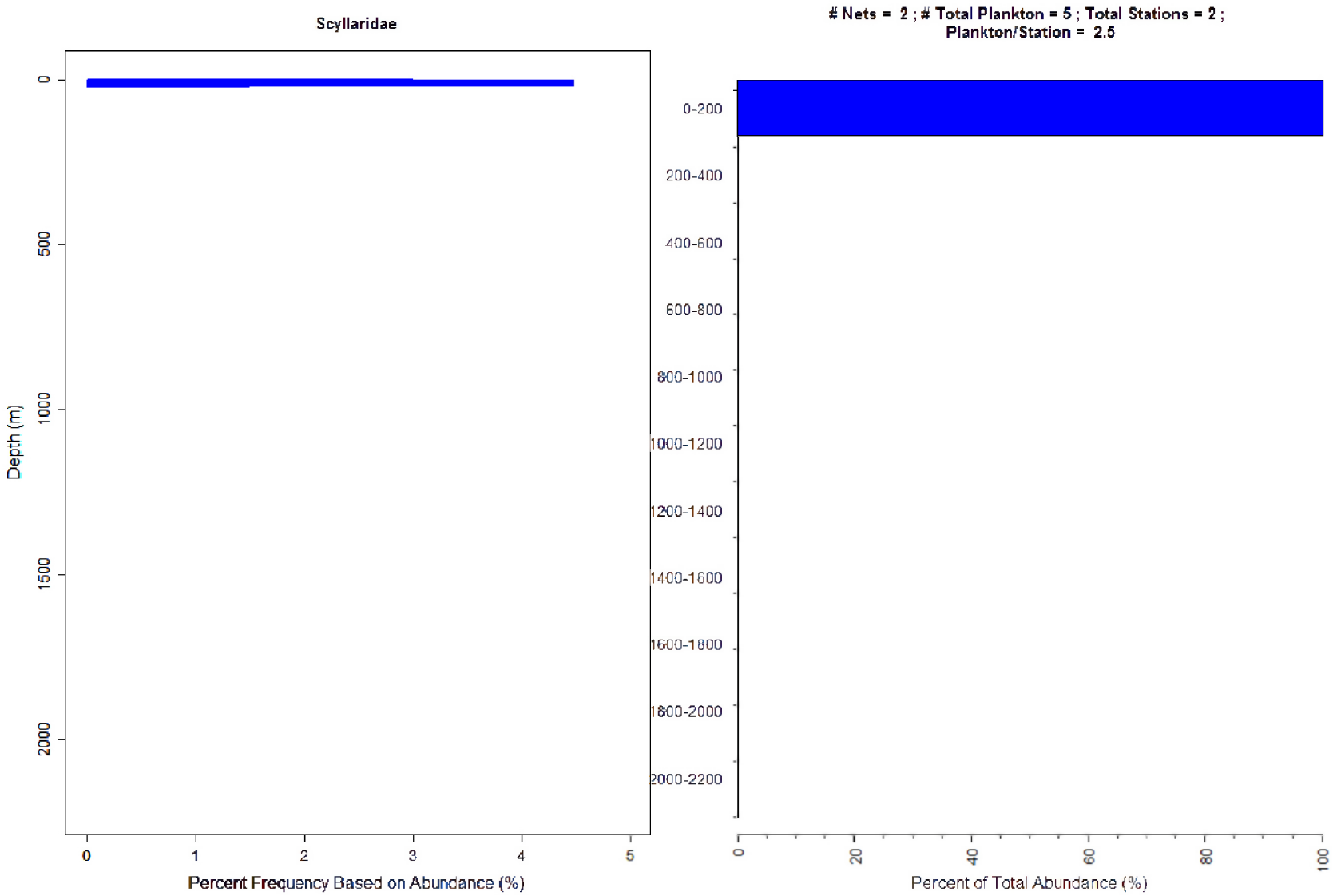
Scombroidei - Deep



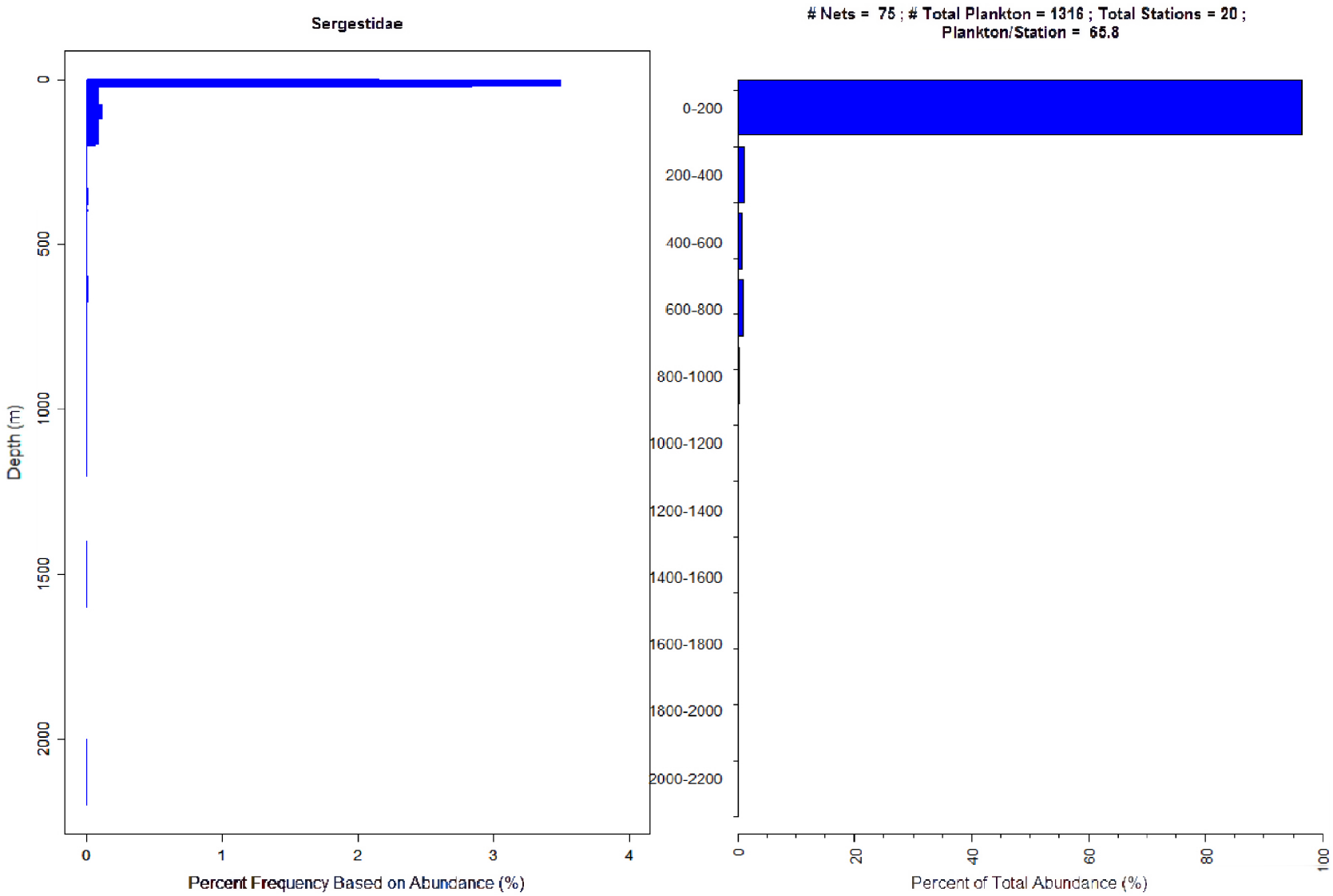
Scopelarchidae - Deep



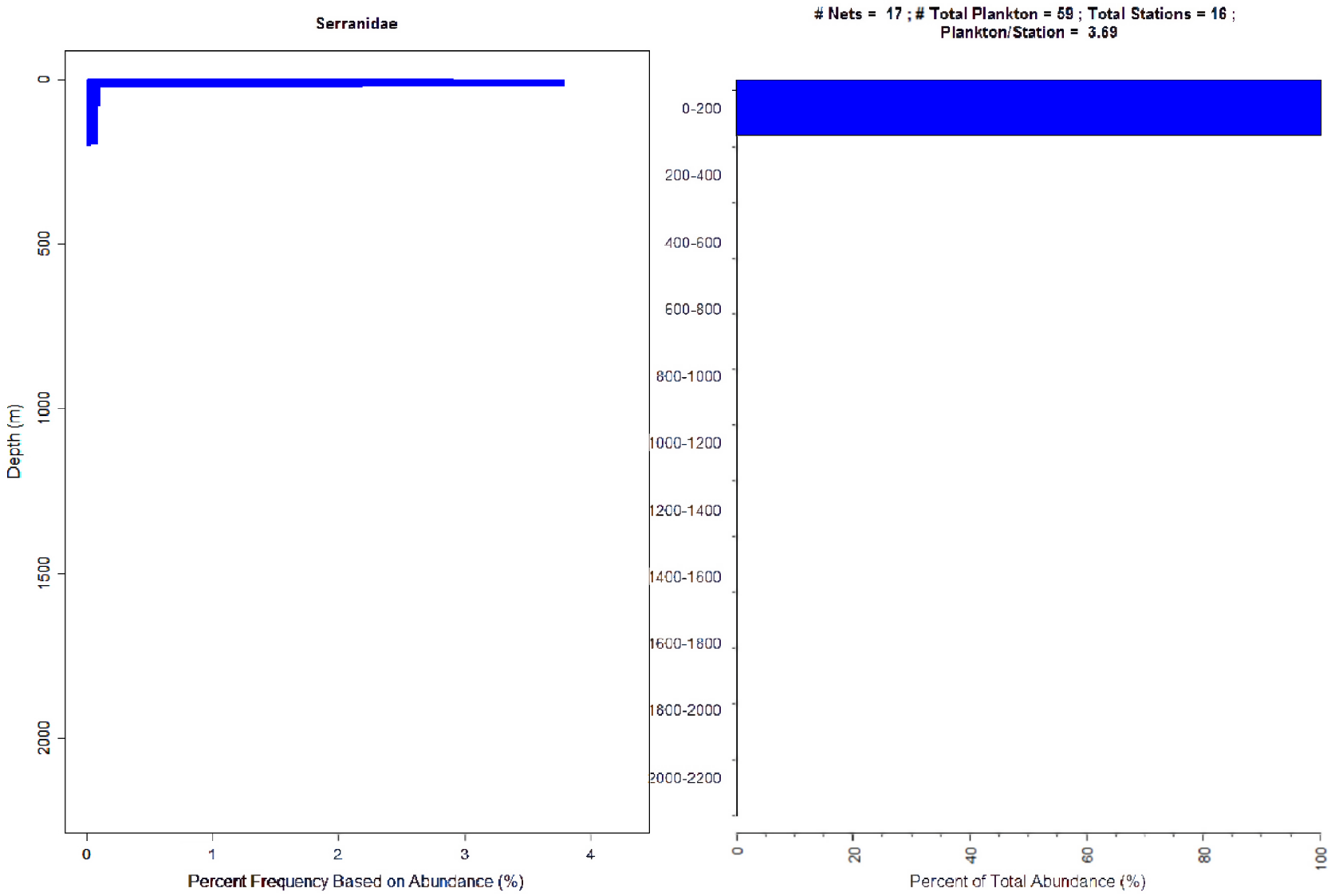
Scorpaenidae - Deep



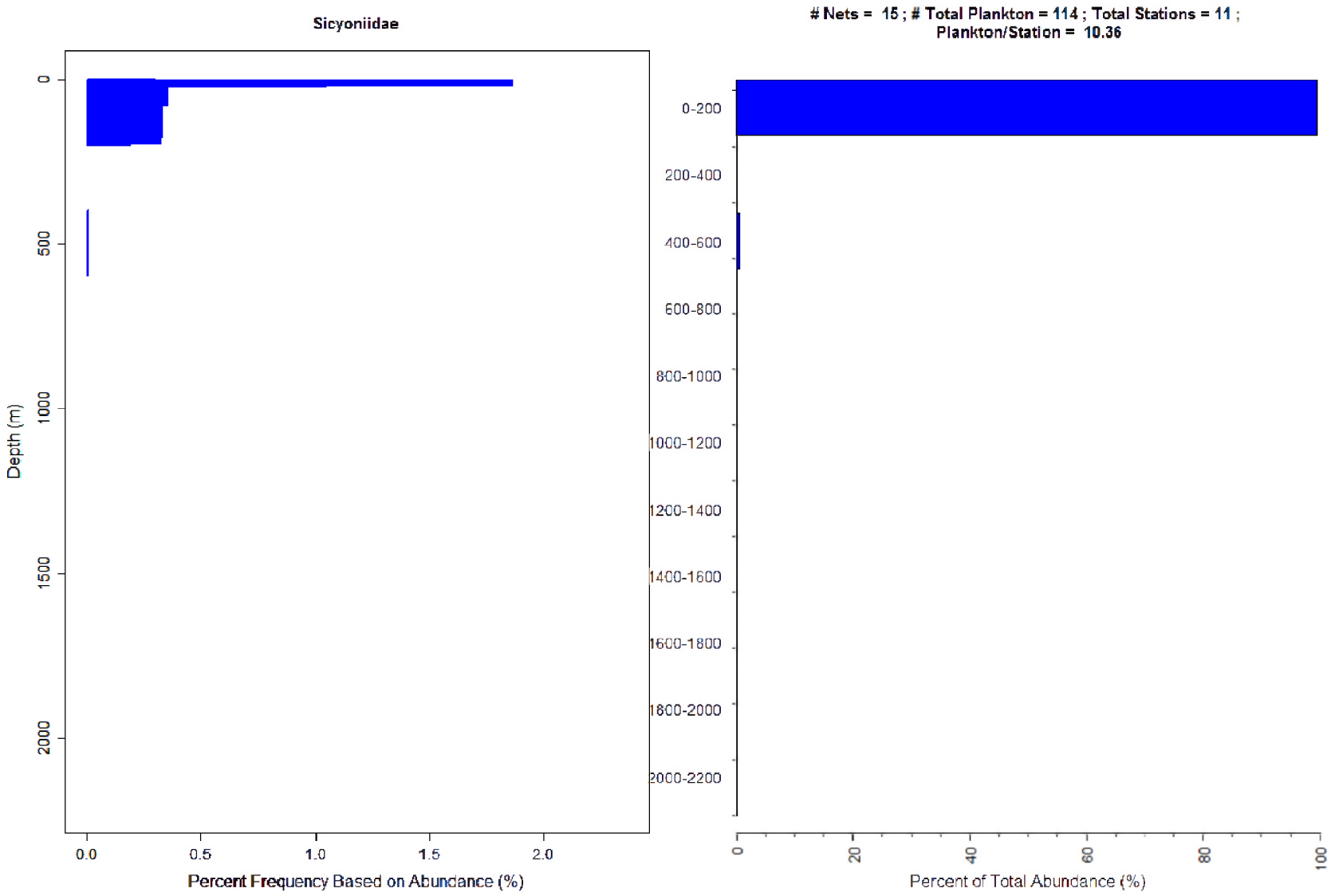
Scyllaridae - Deep



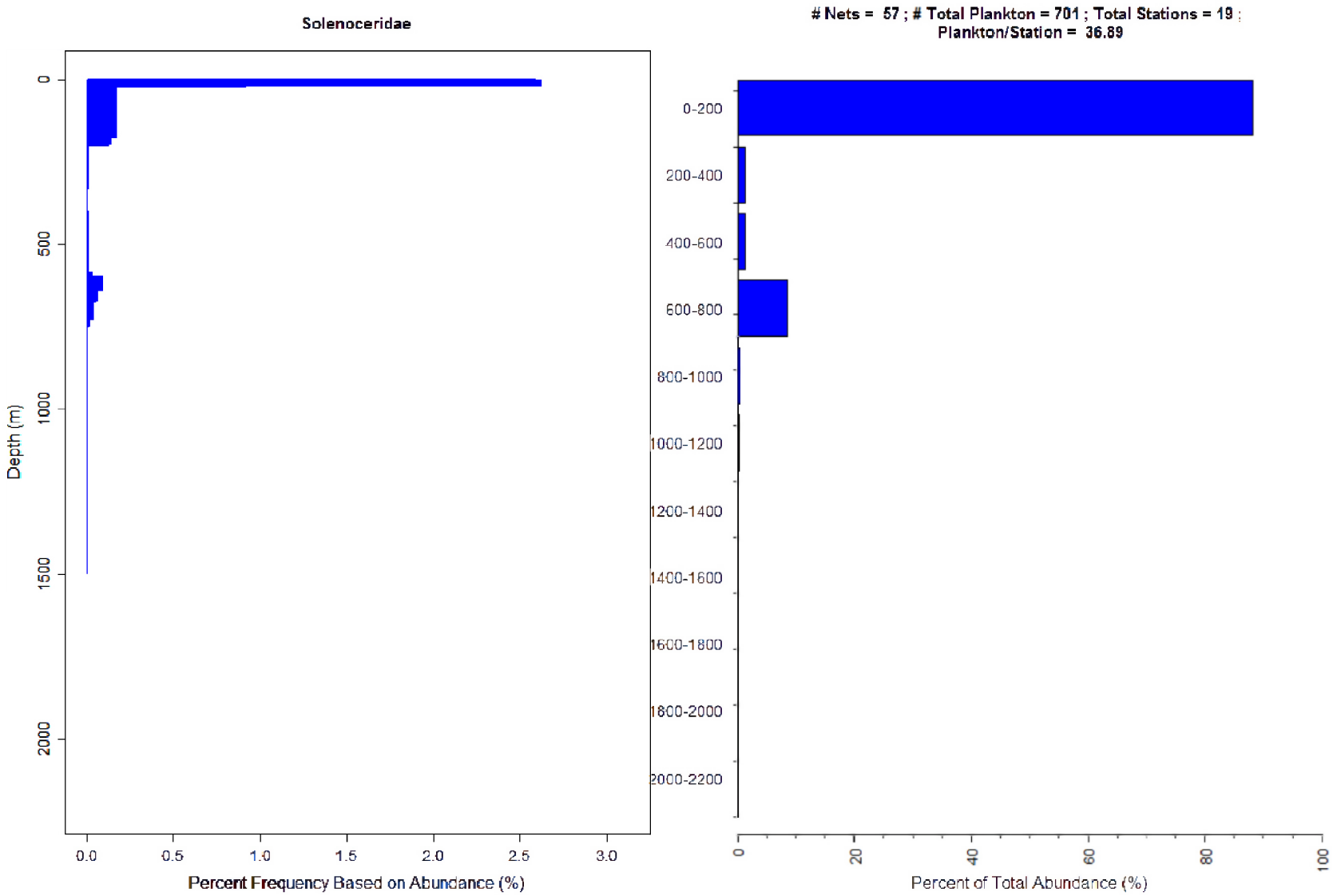
Sergestidae - Deep



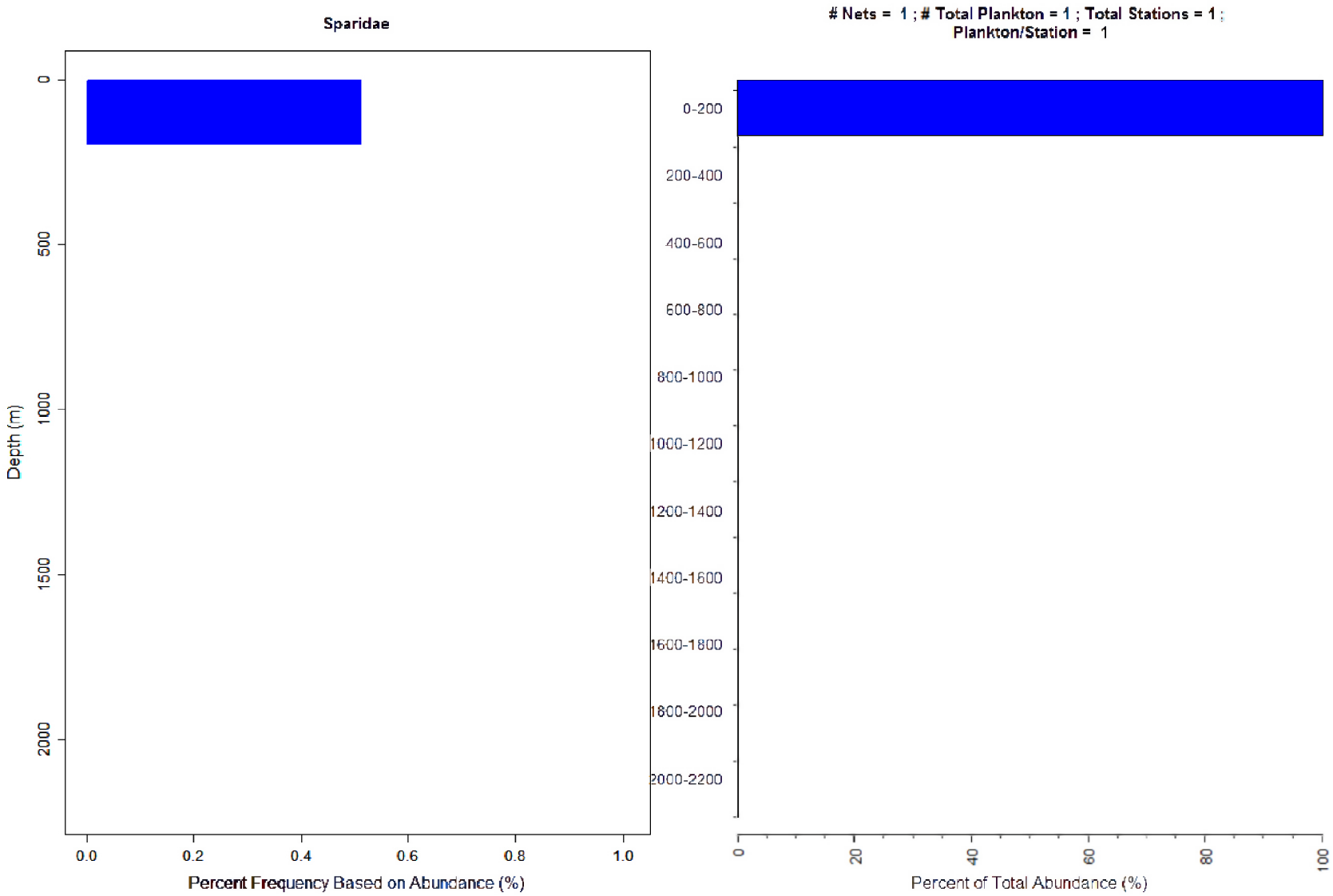
Serranidae - Deep



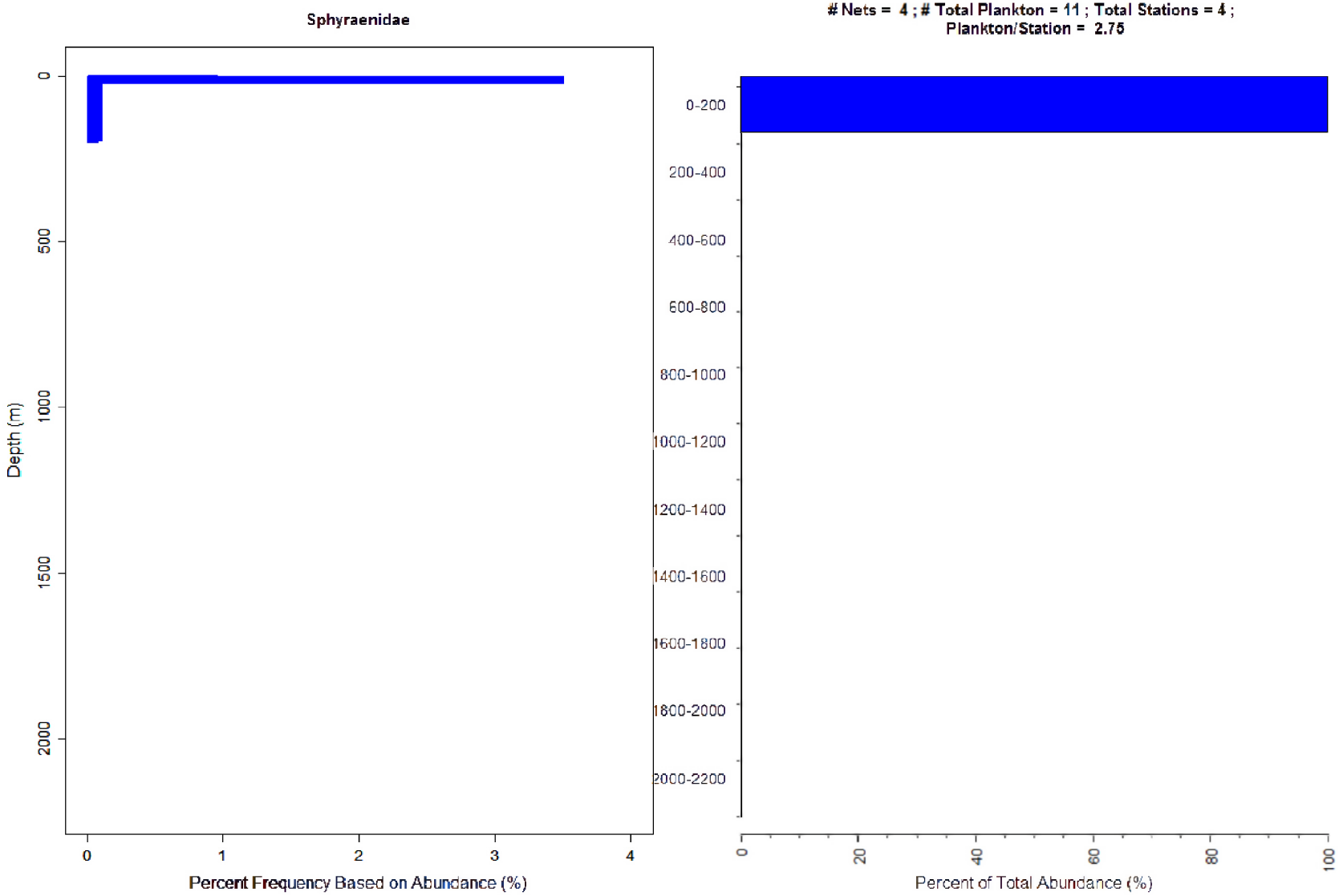
Sicyoniidae - Deep



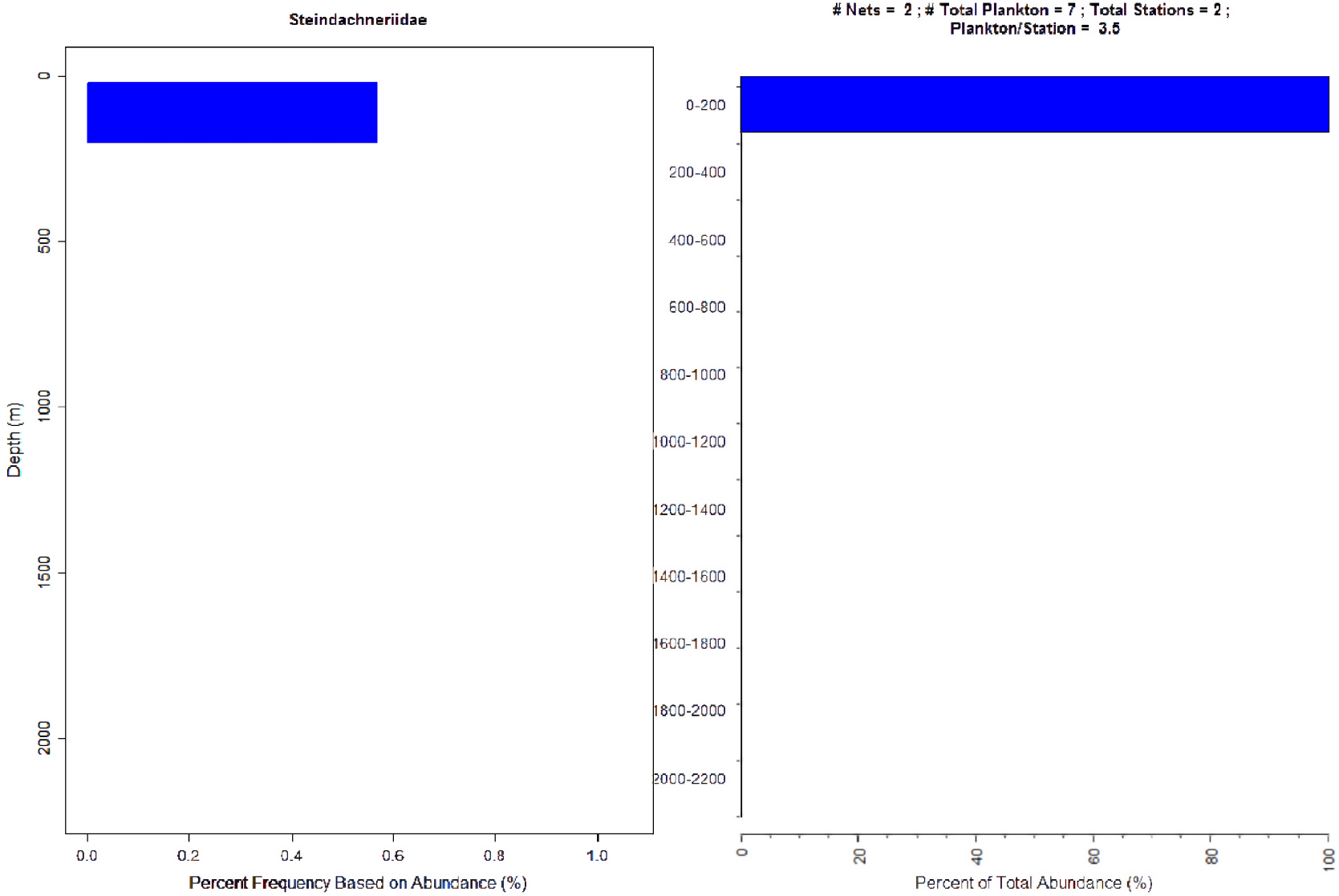
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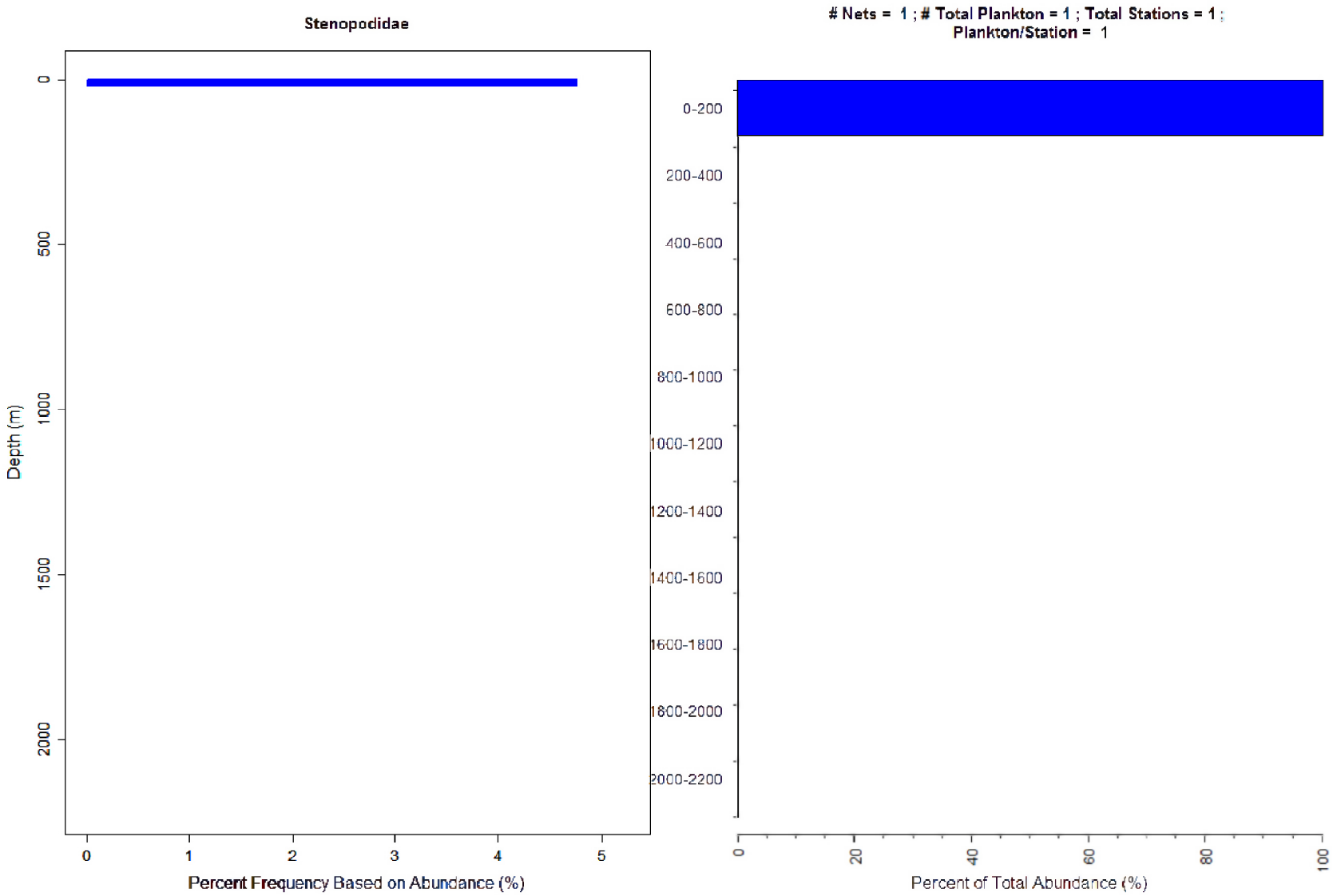
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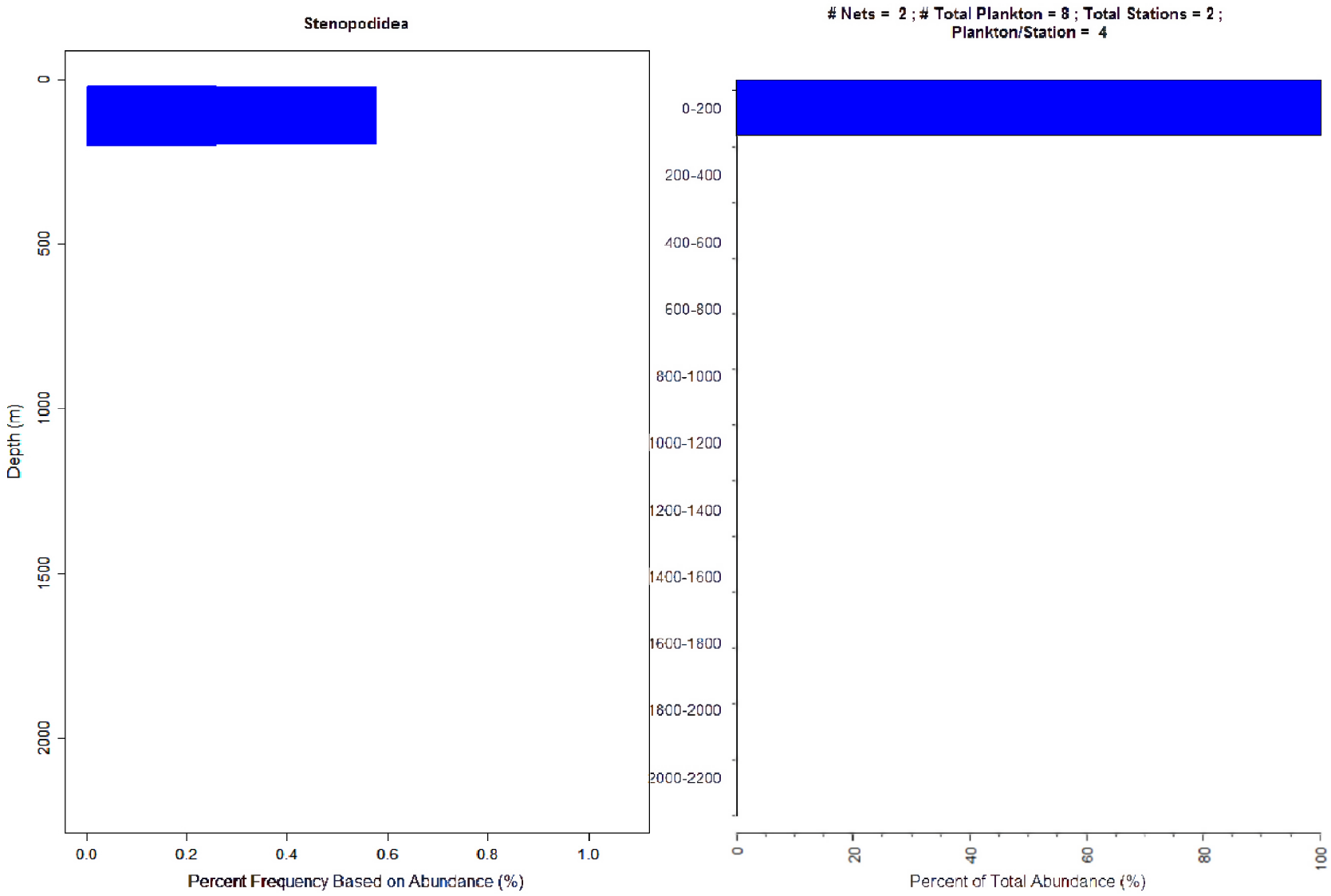
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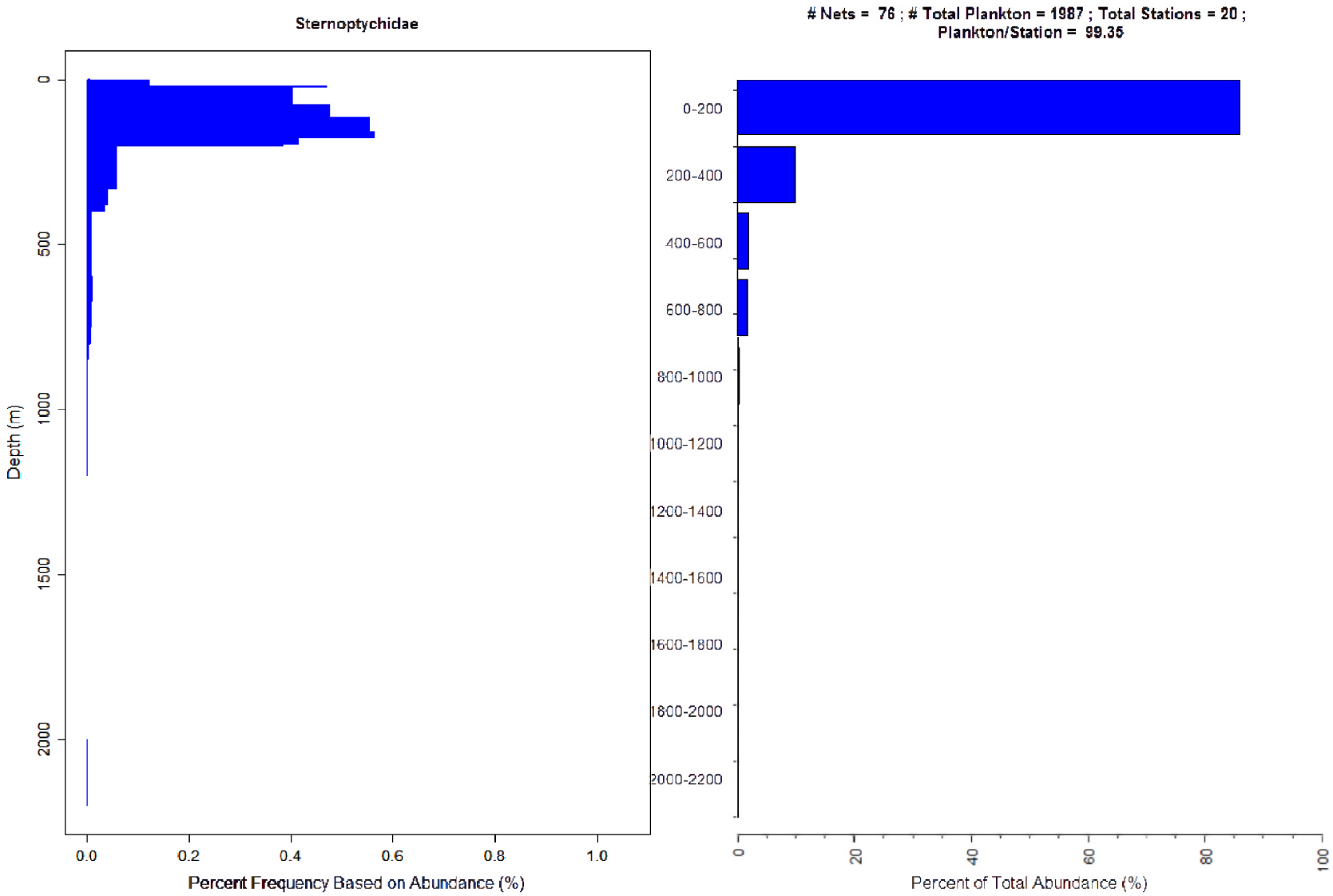
Steindachneriidae - Deep



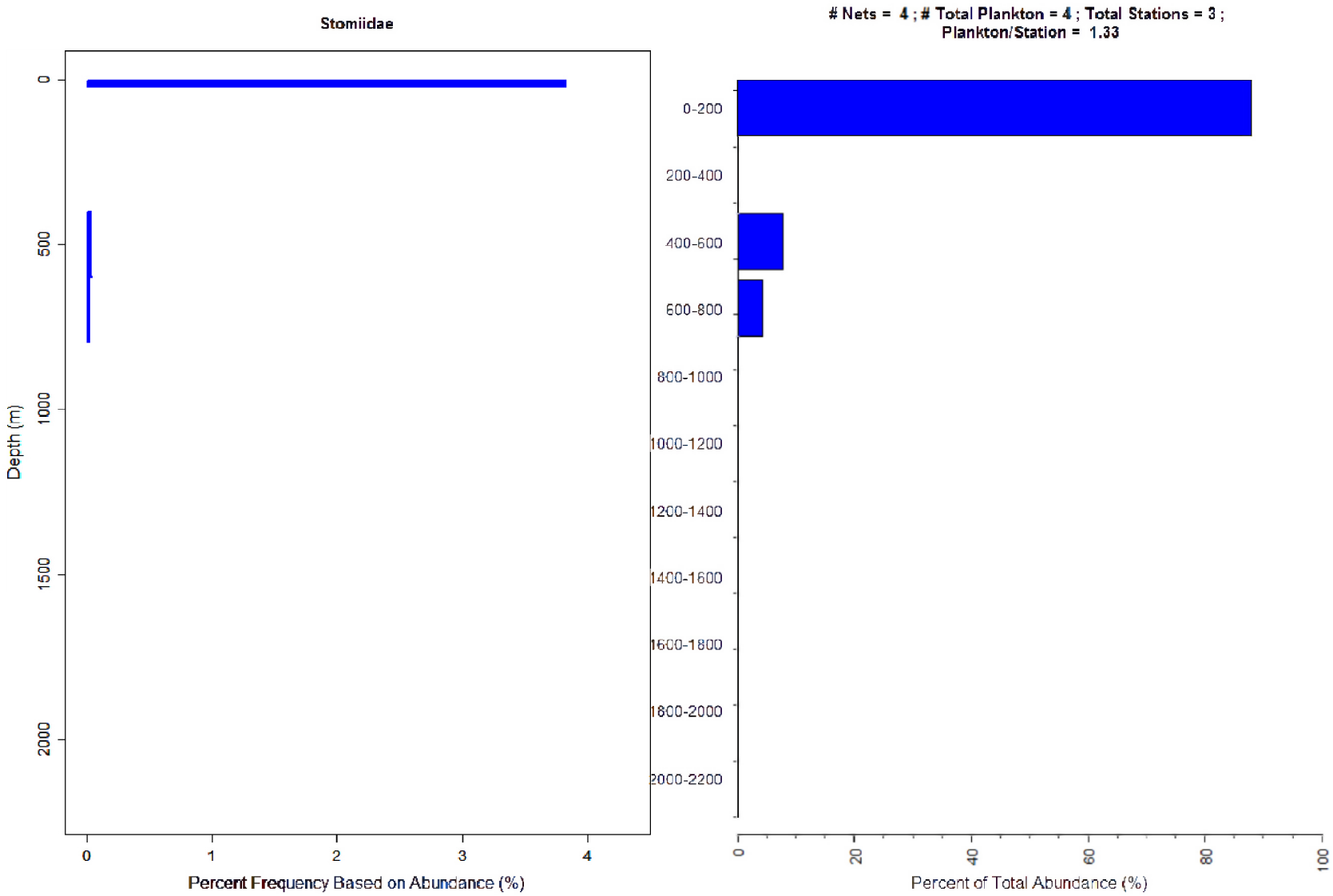
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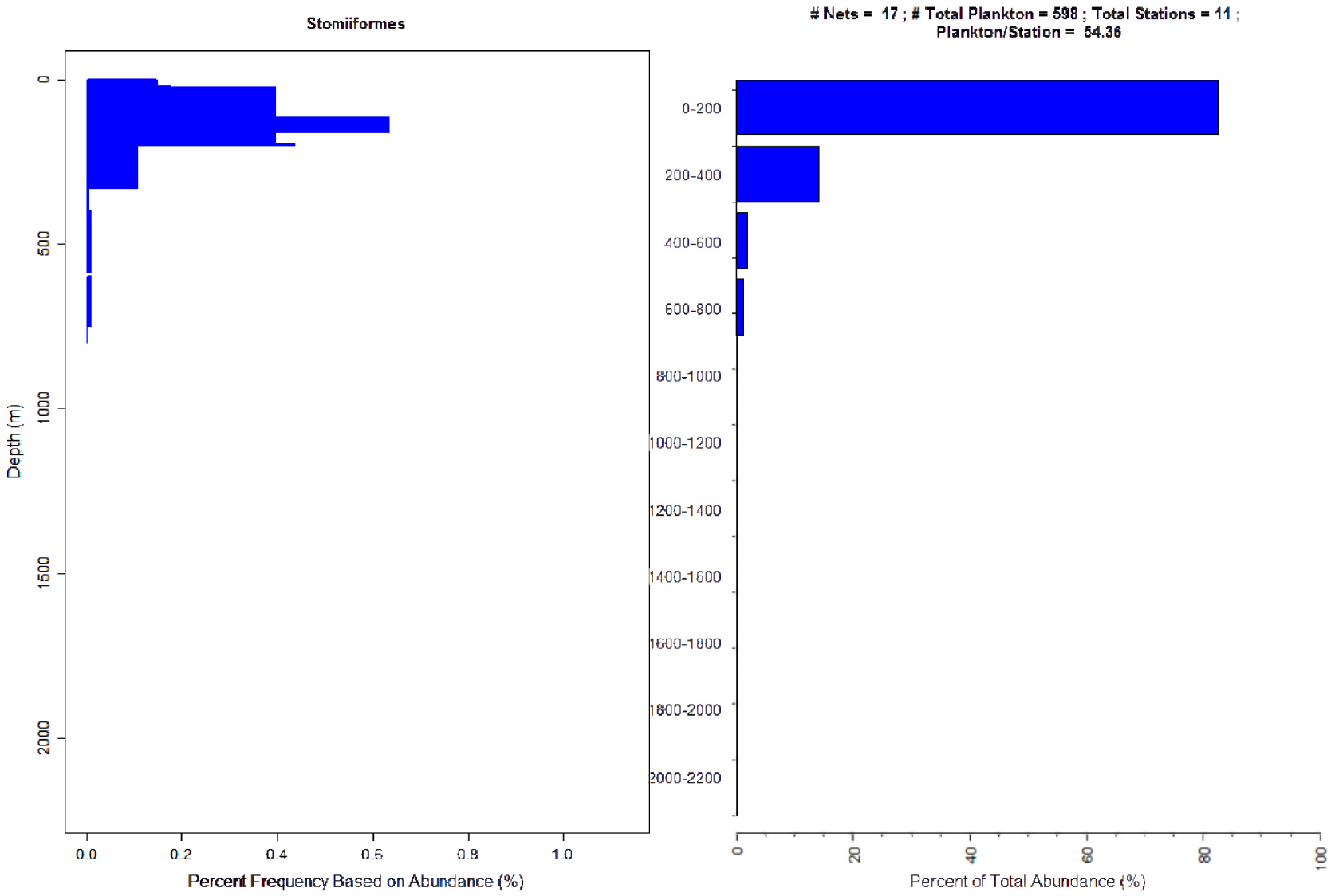
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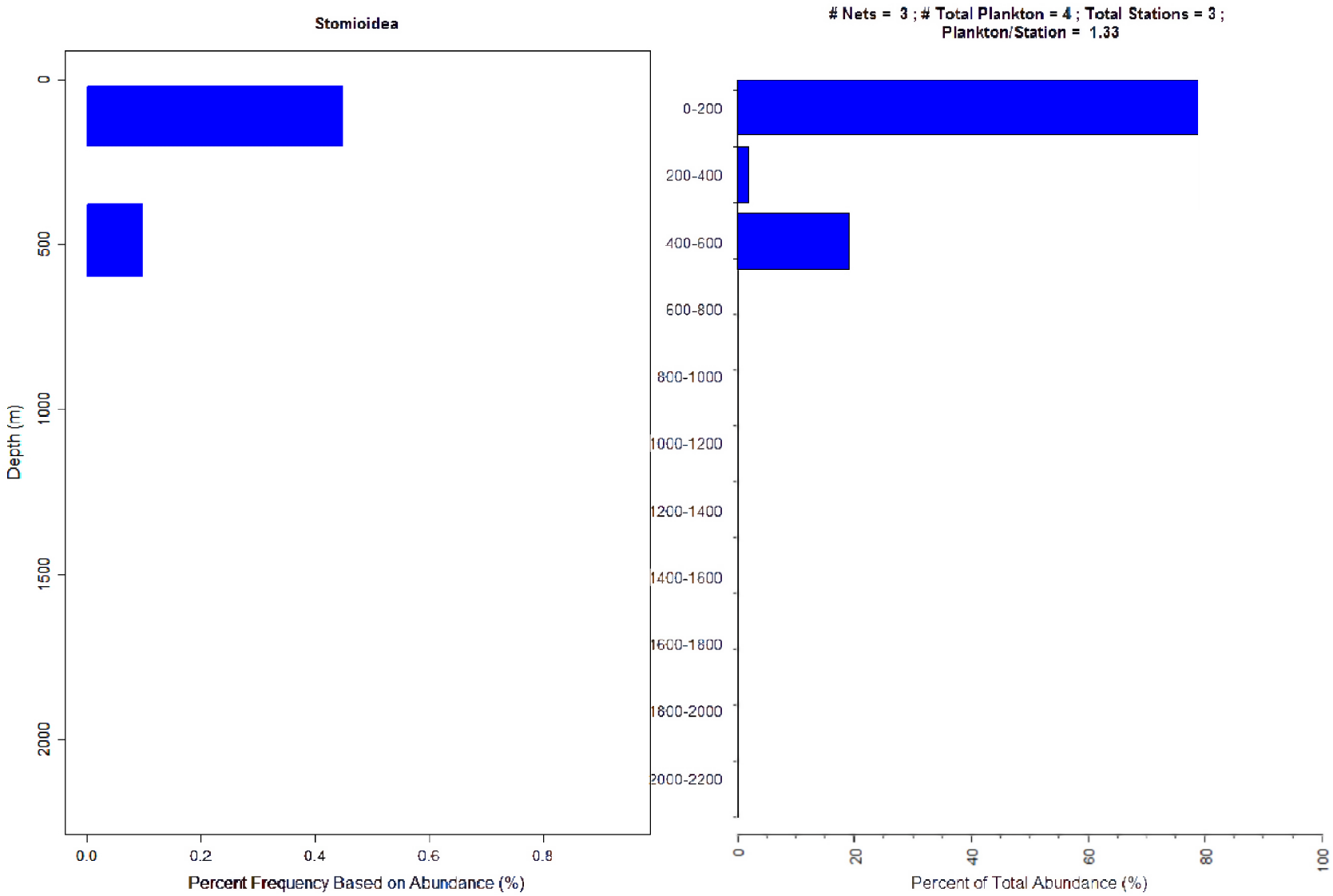
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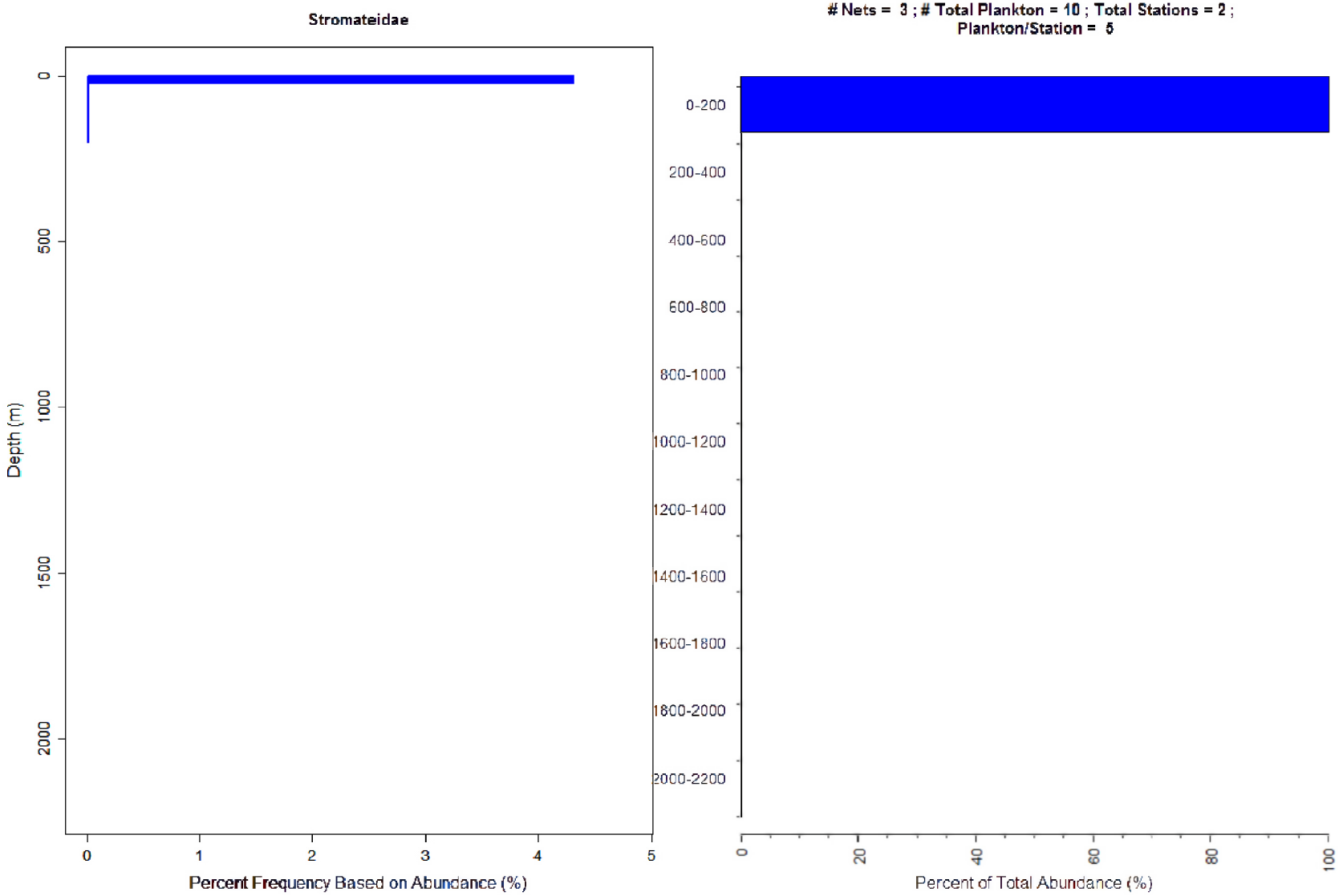
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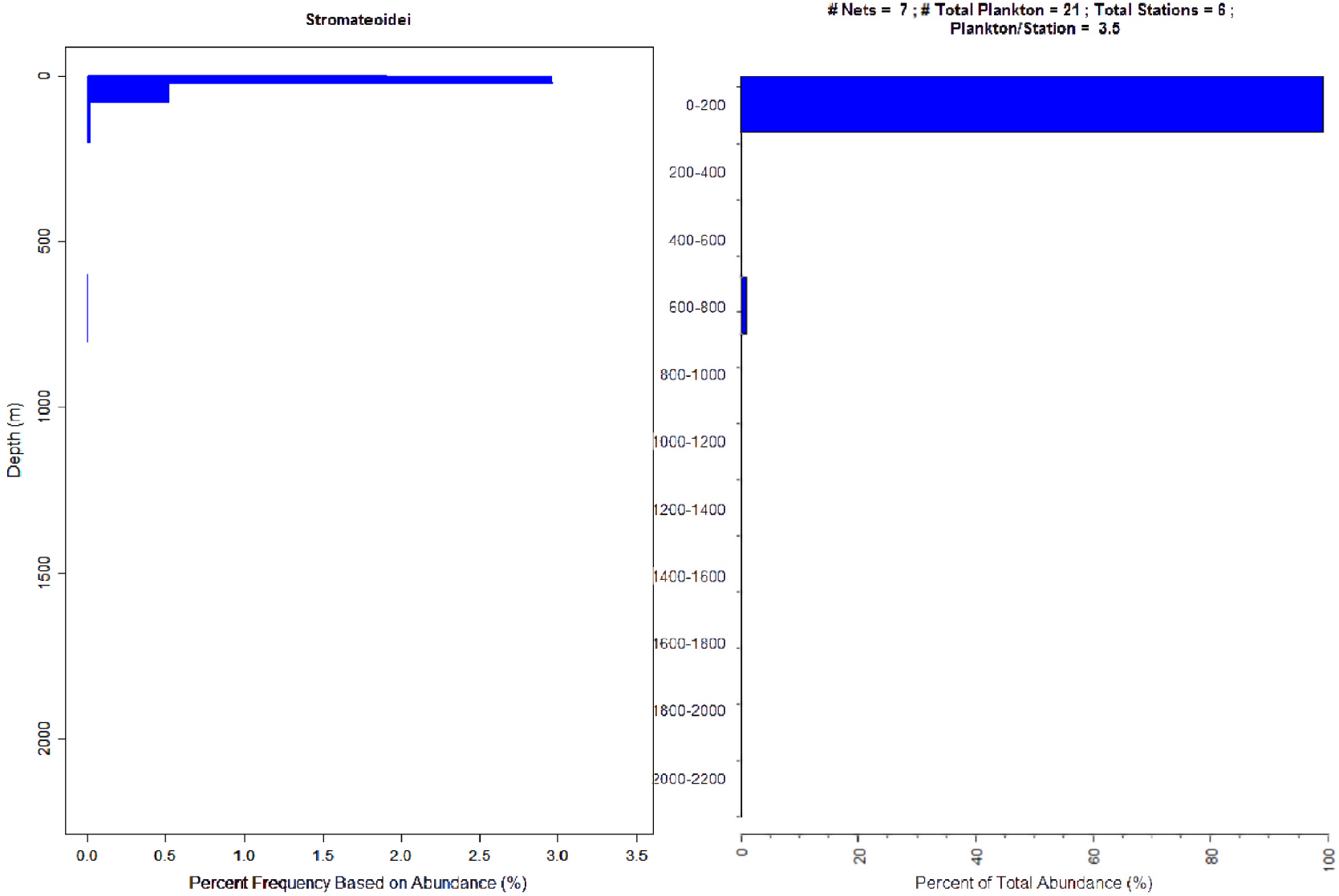
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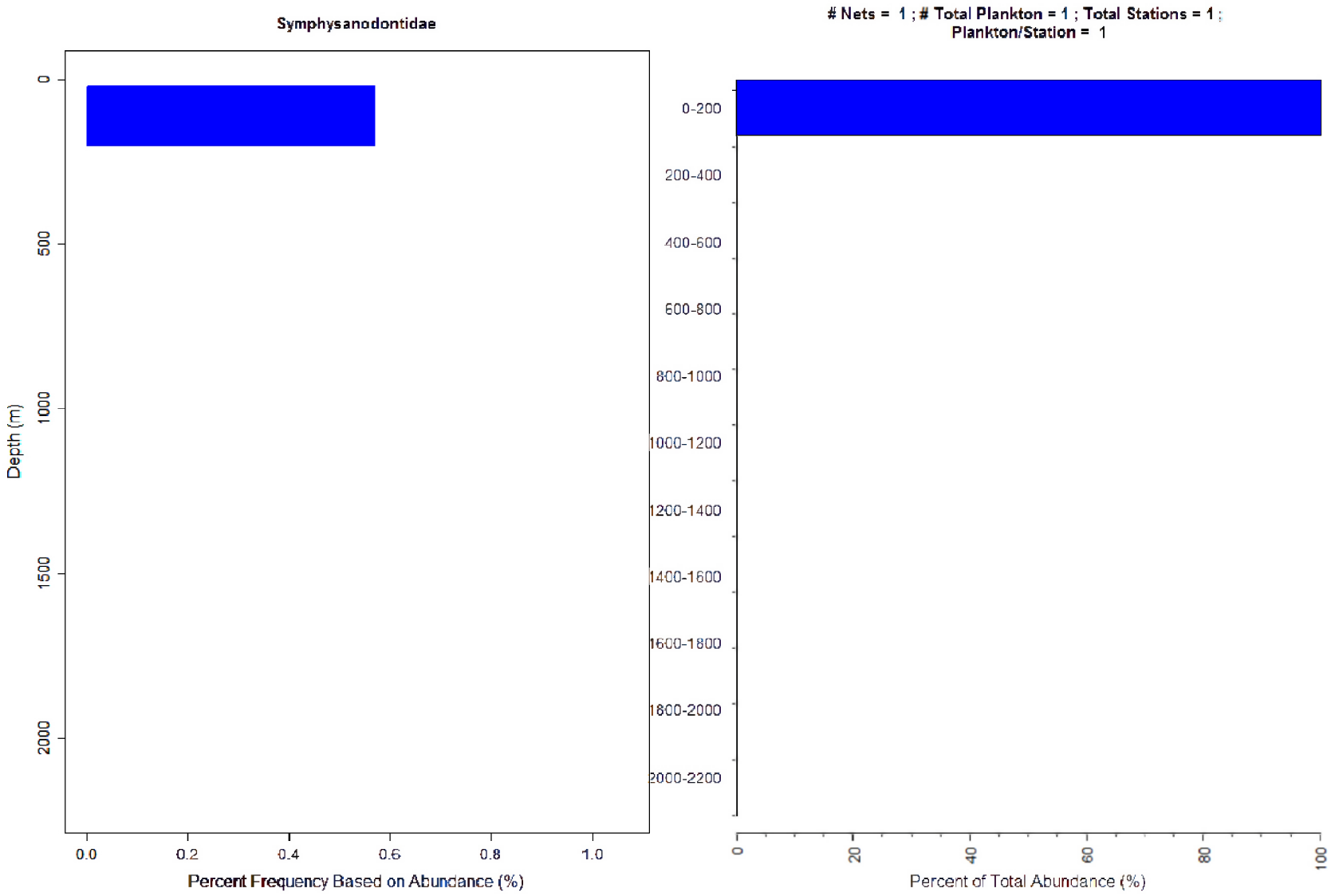
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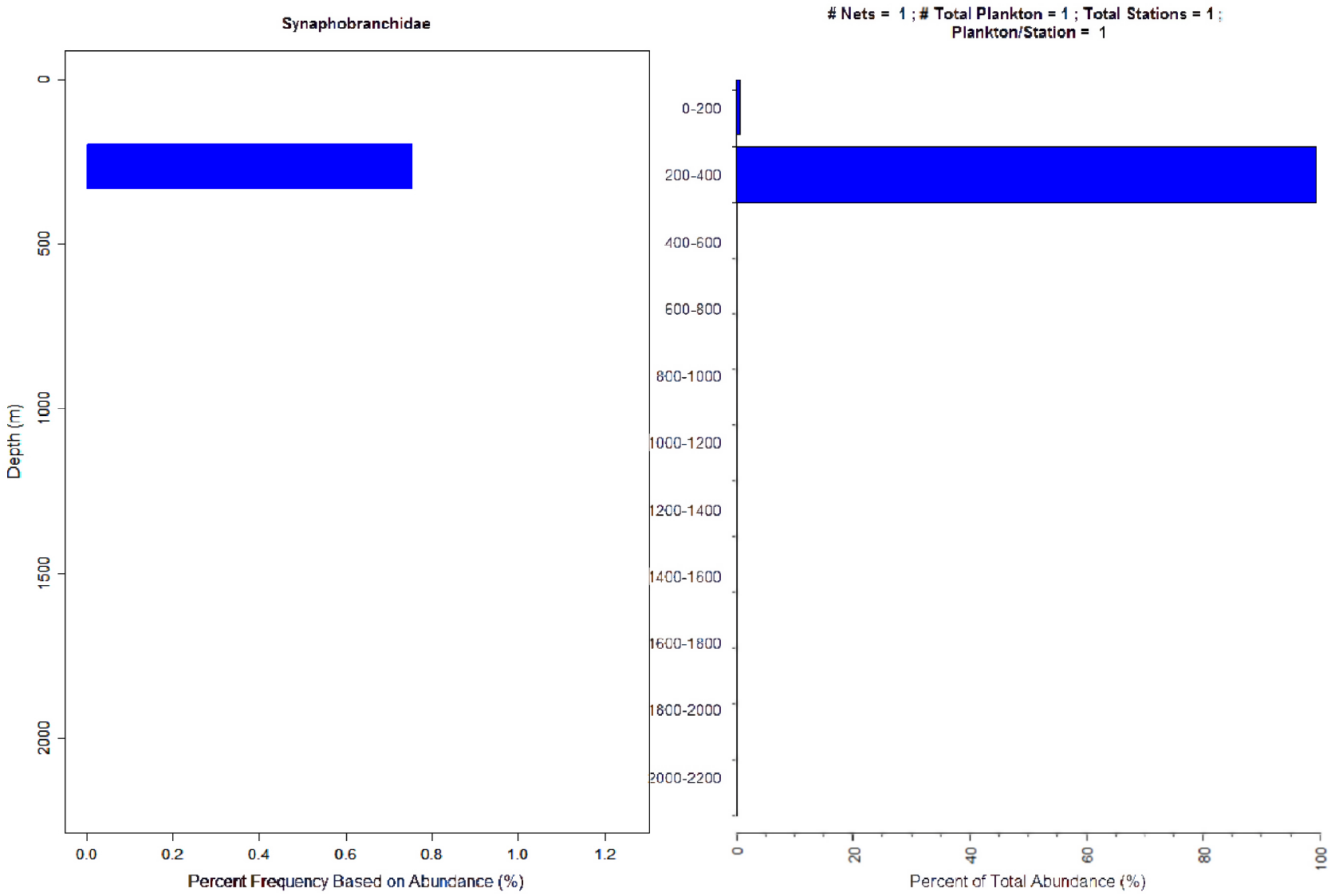
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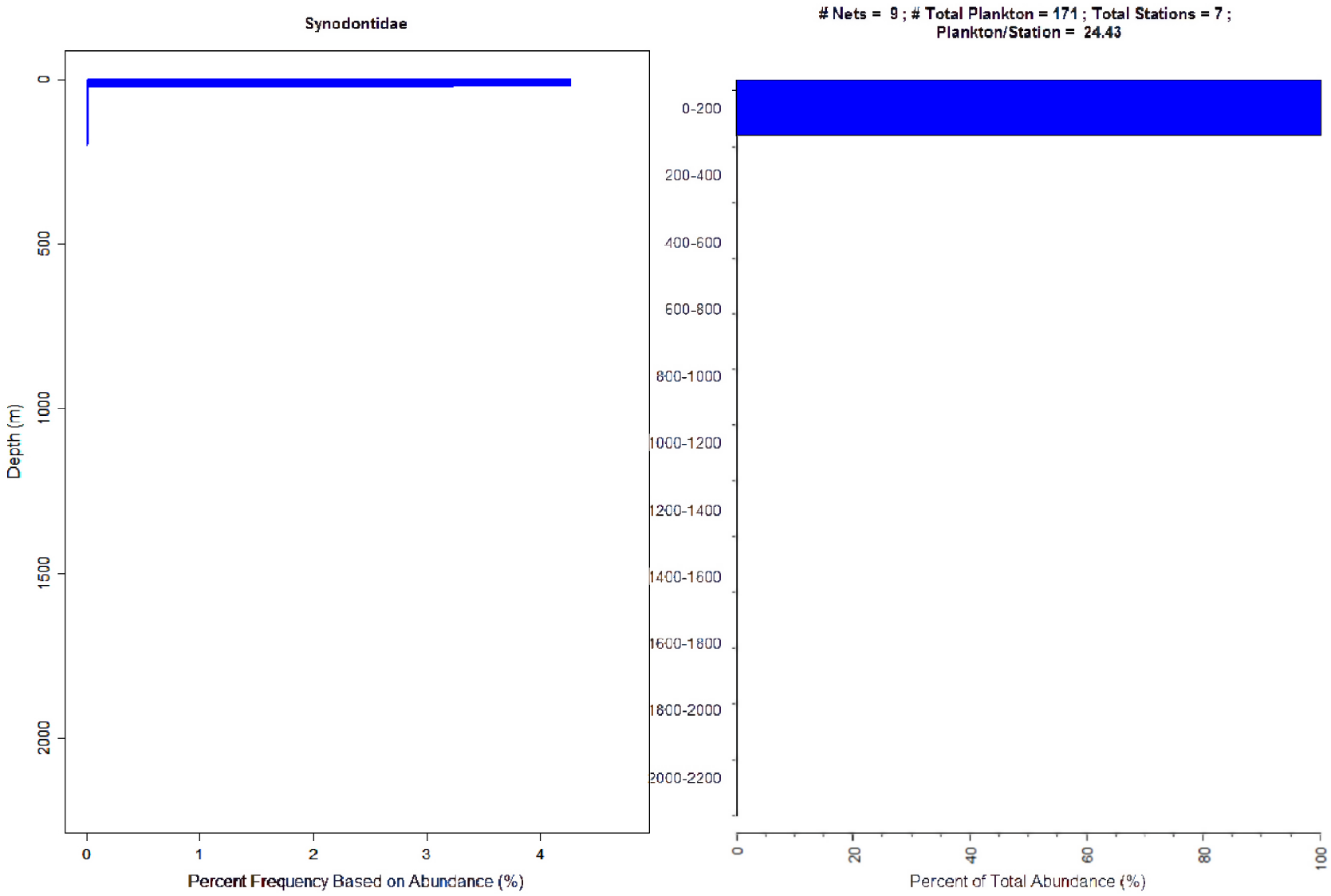
Stromateoidei - Deep



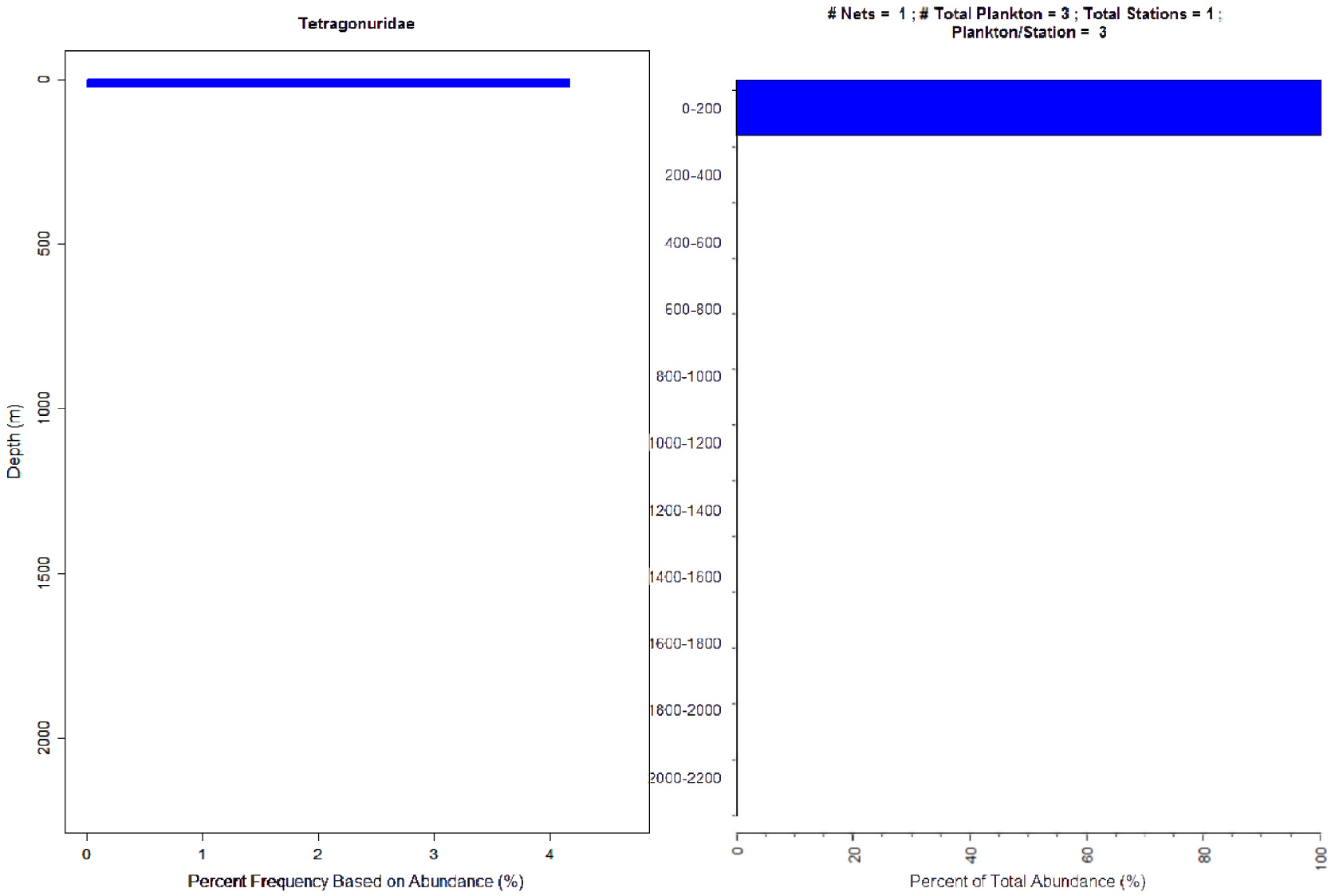
Symphysanodontidae - Deep



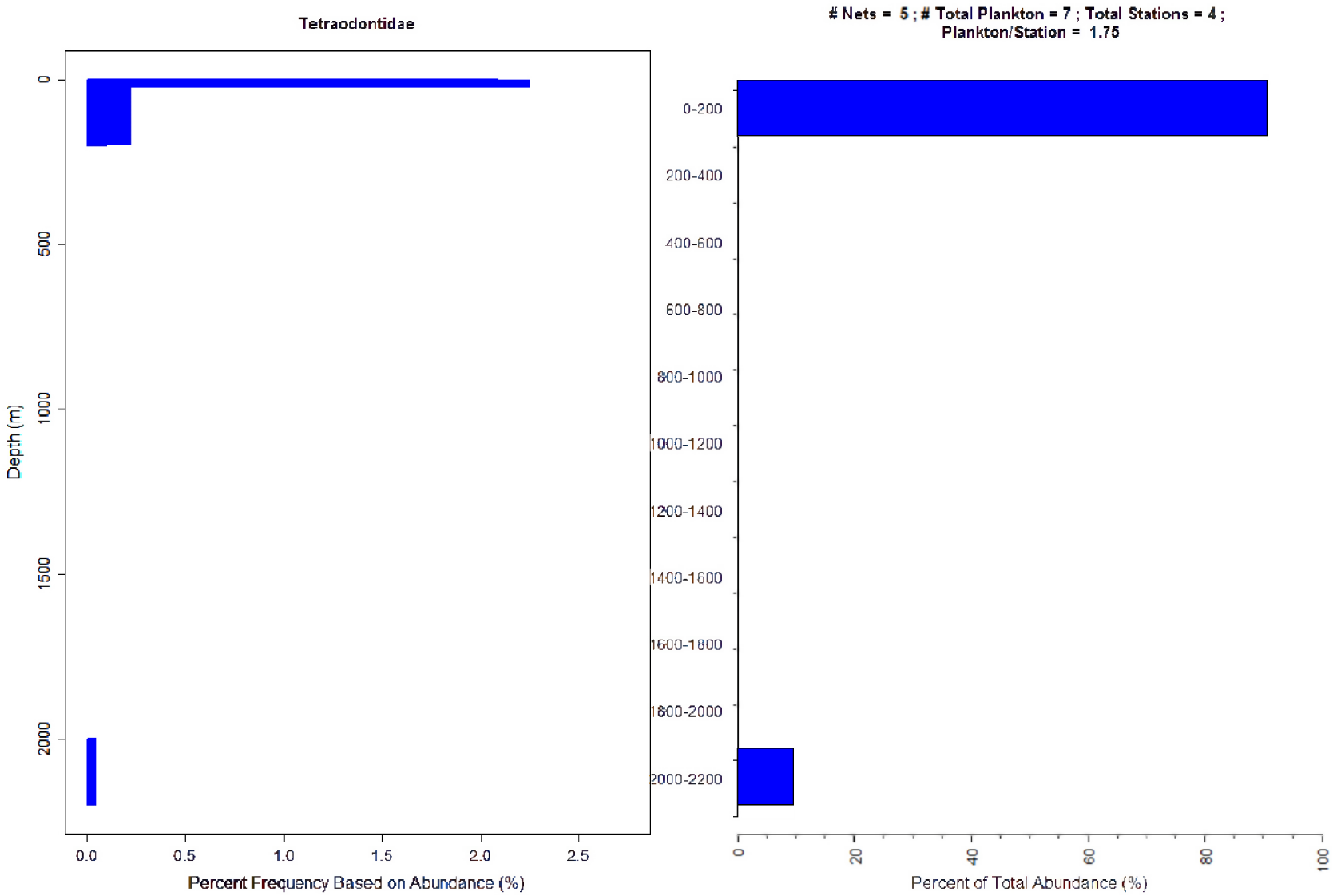
Synaphobranchidae - Deep



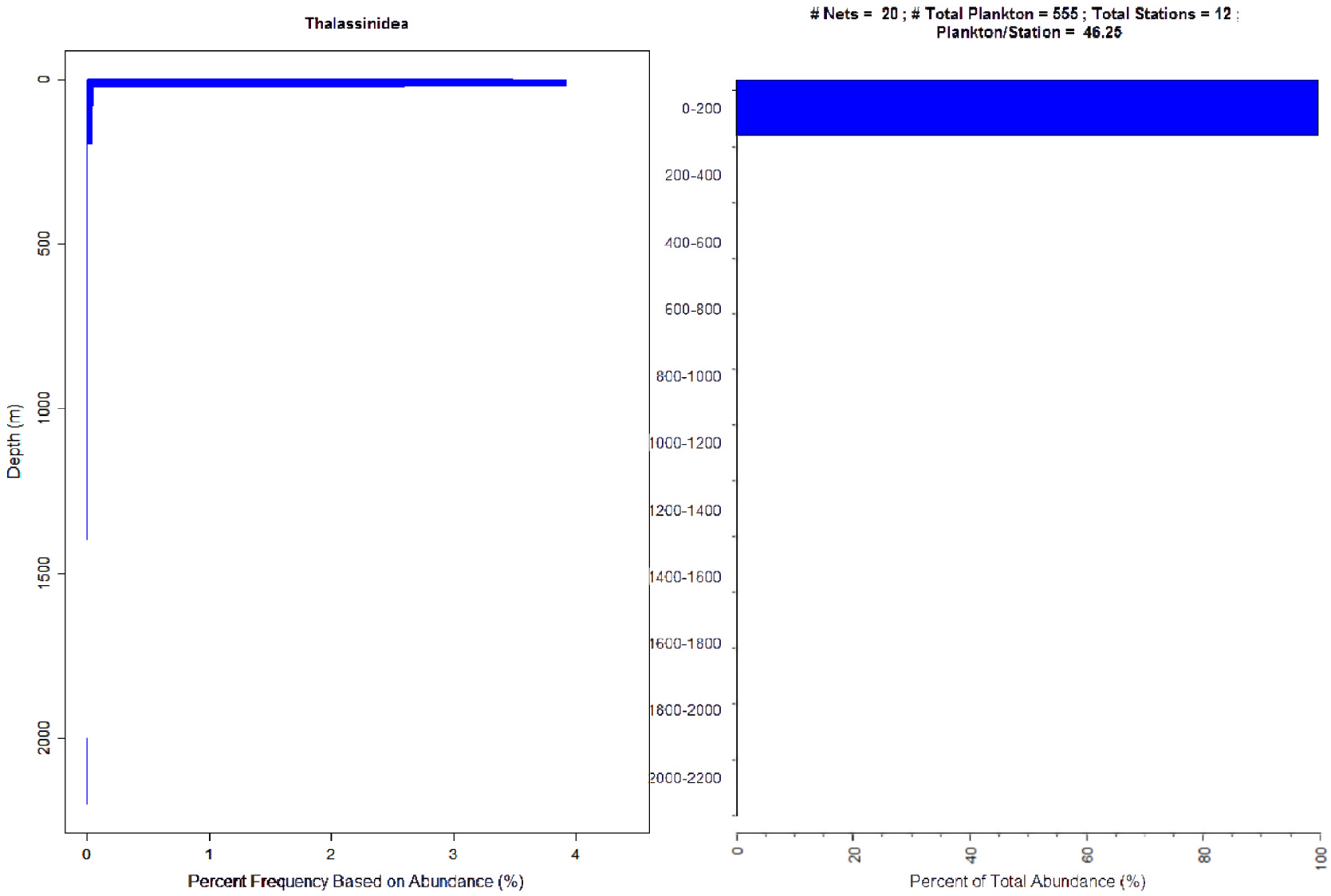
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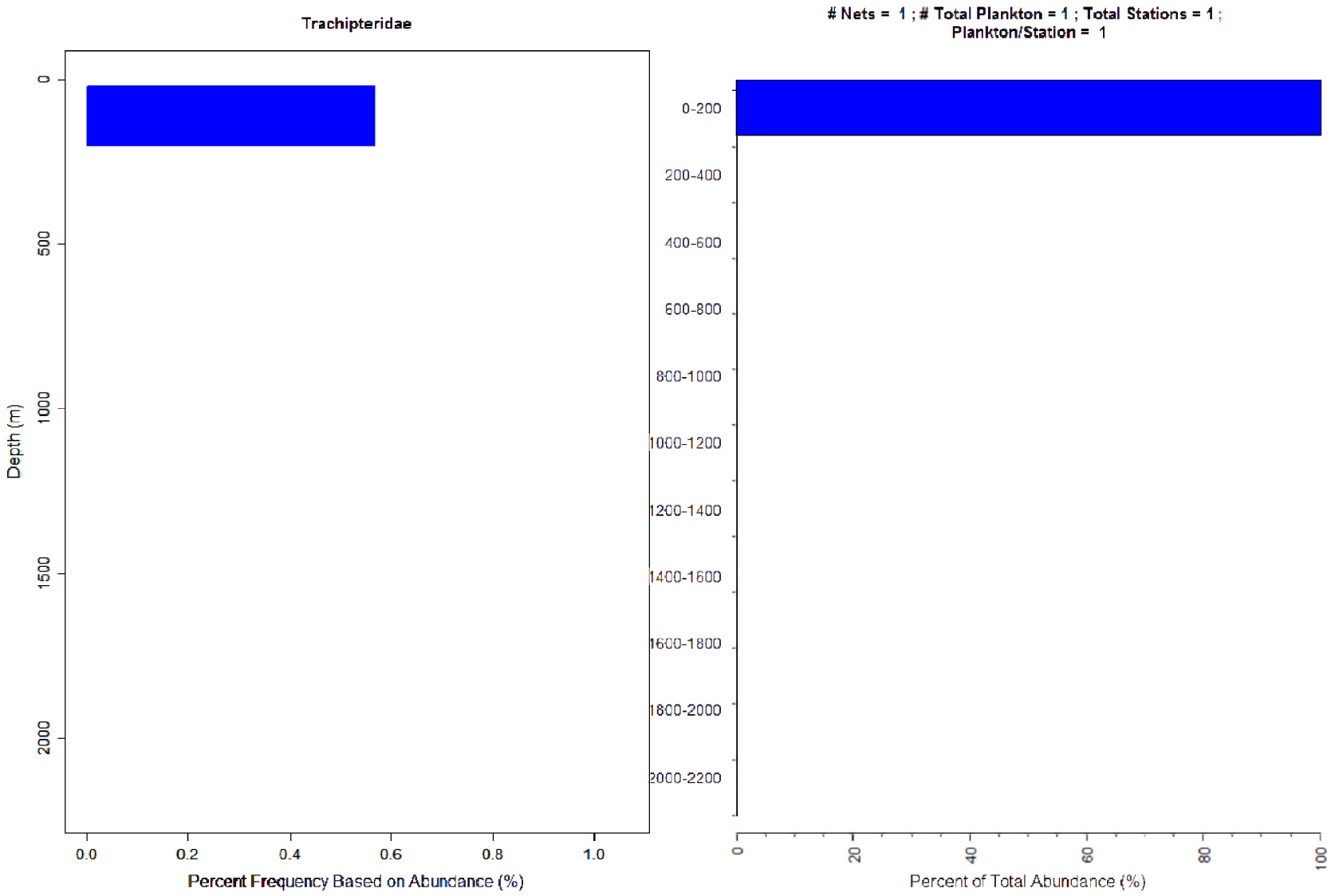
Tetragonuridae - Deep



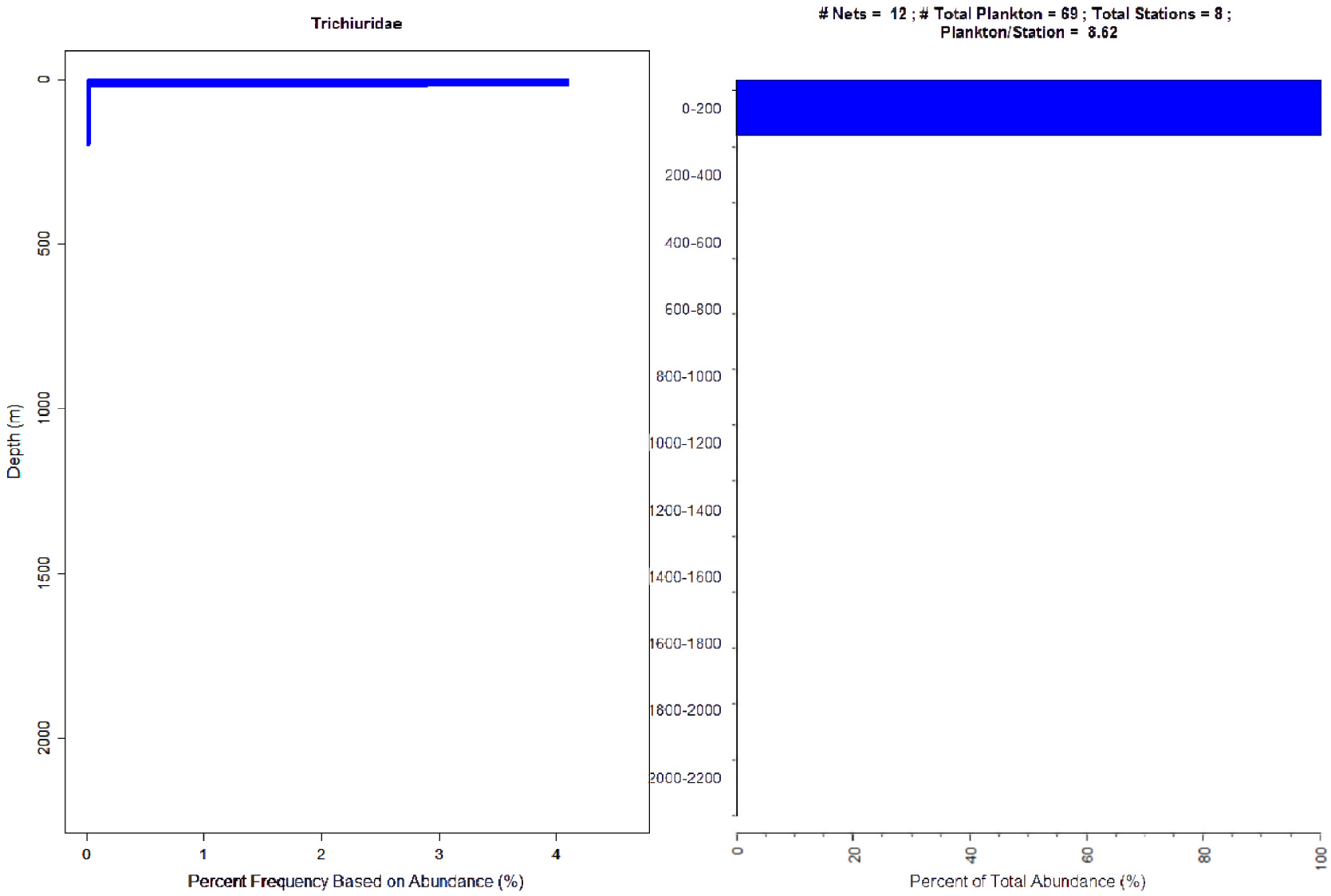
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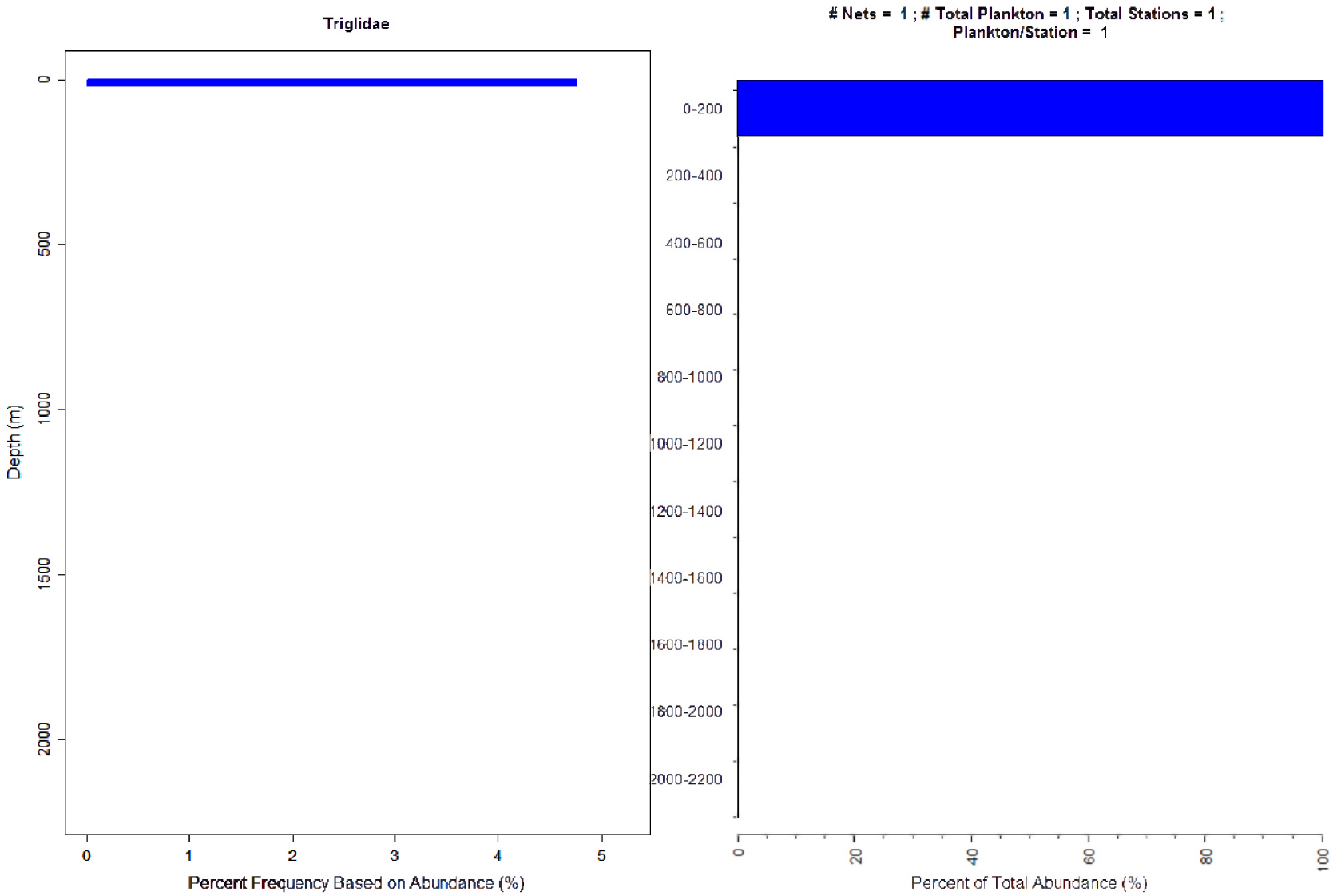
Thalassinidea - Deep



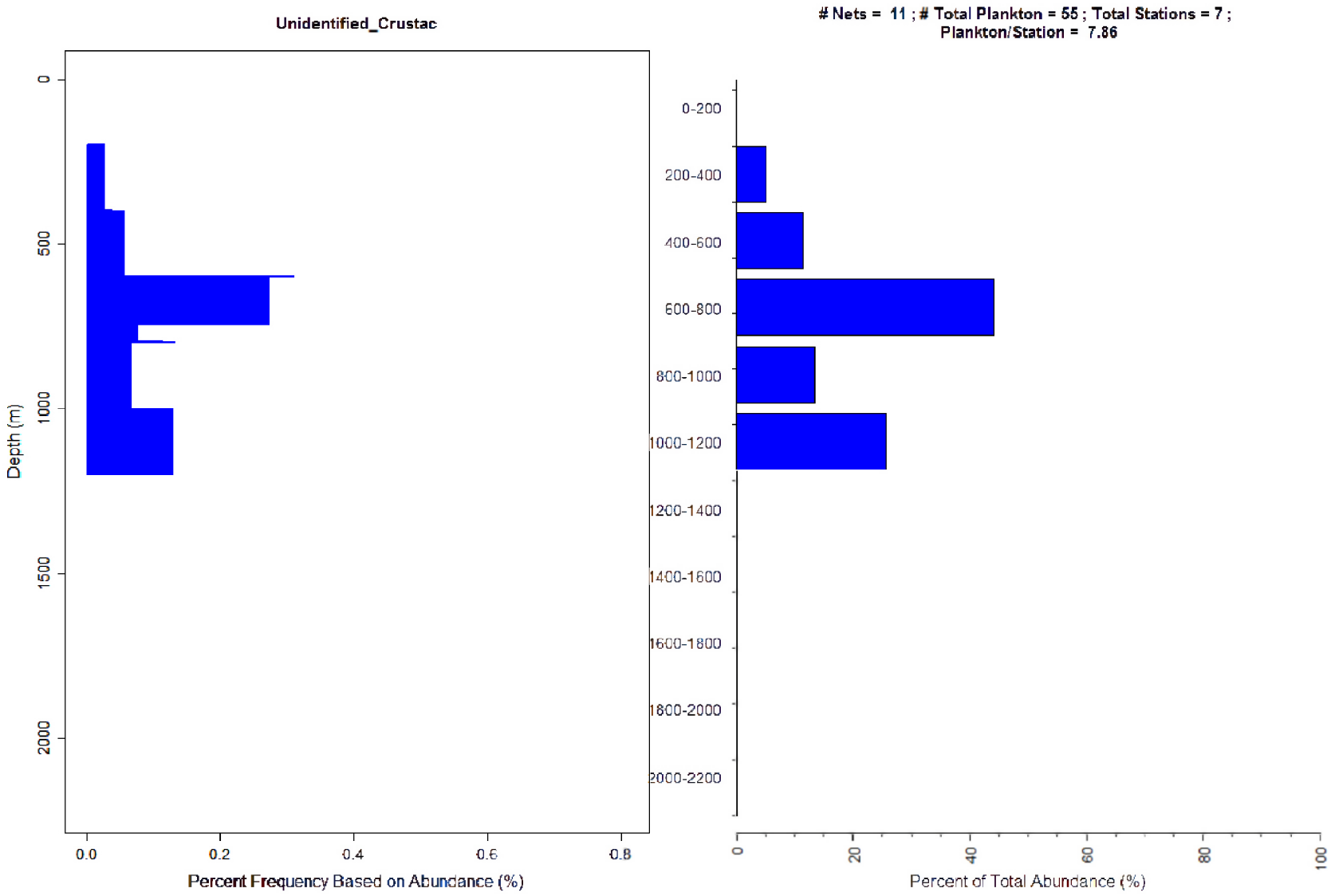
Trachipteridae - Deep



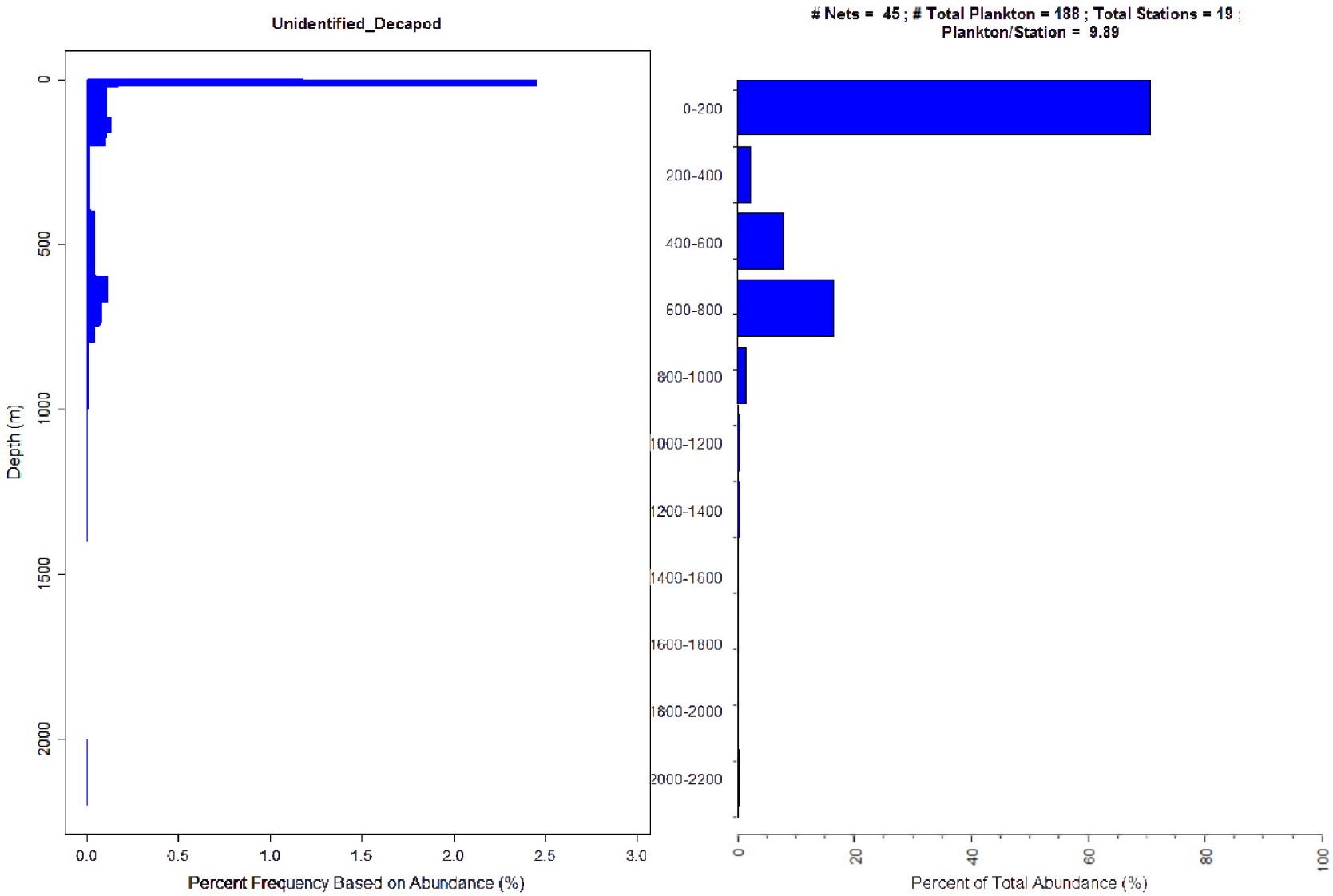
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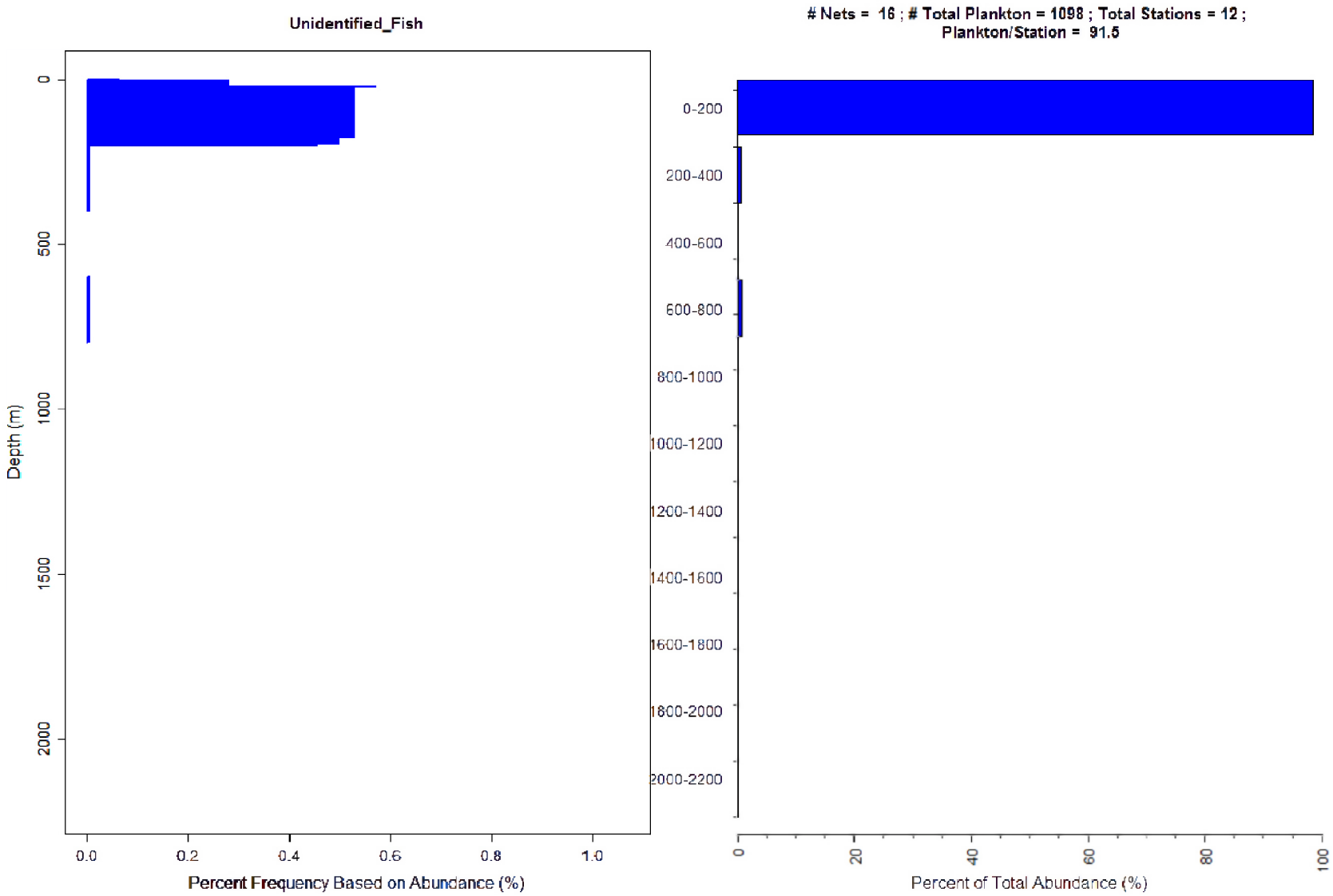
Triglidae - Deep



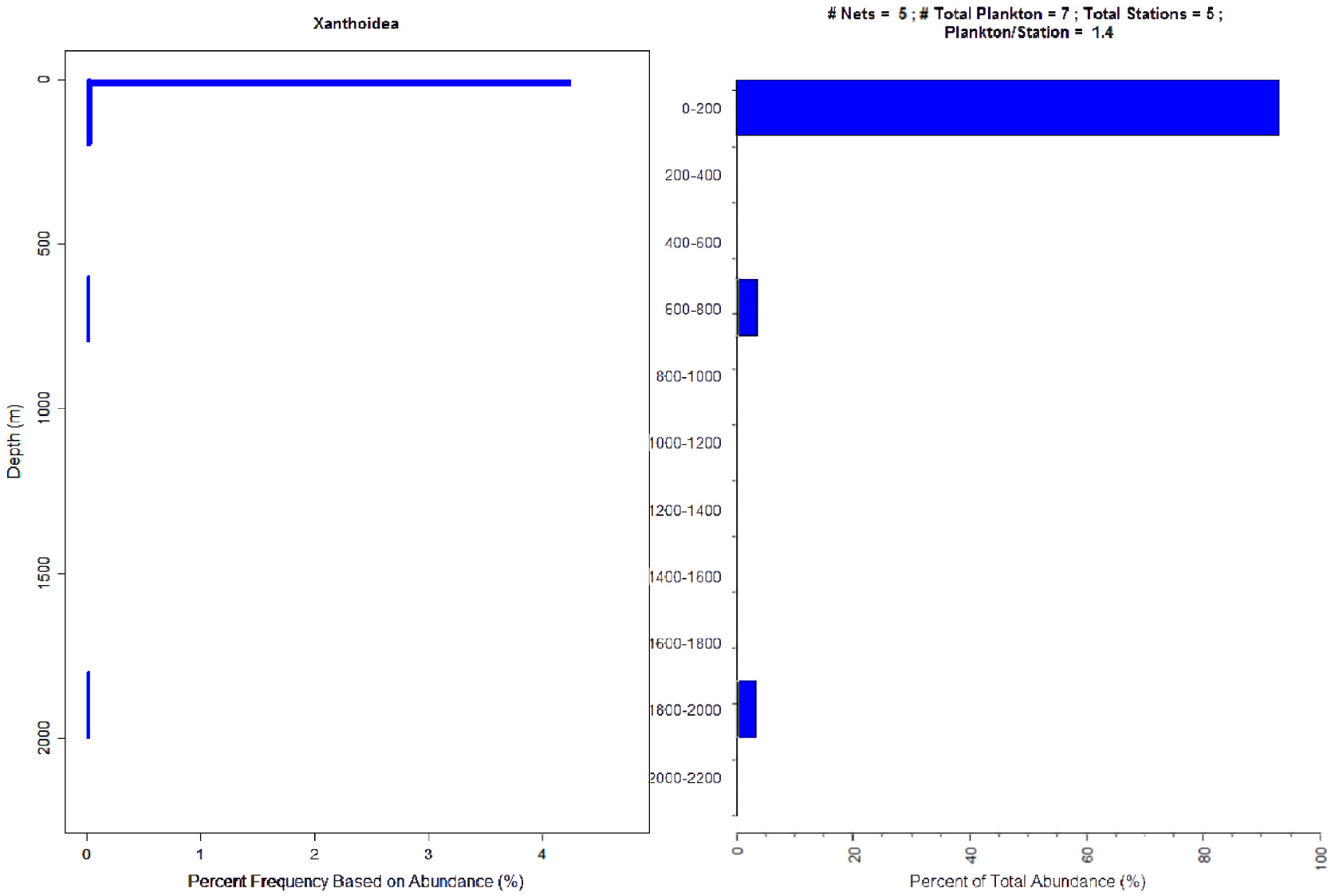
Unidentified_Crustac - Deep



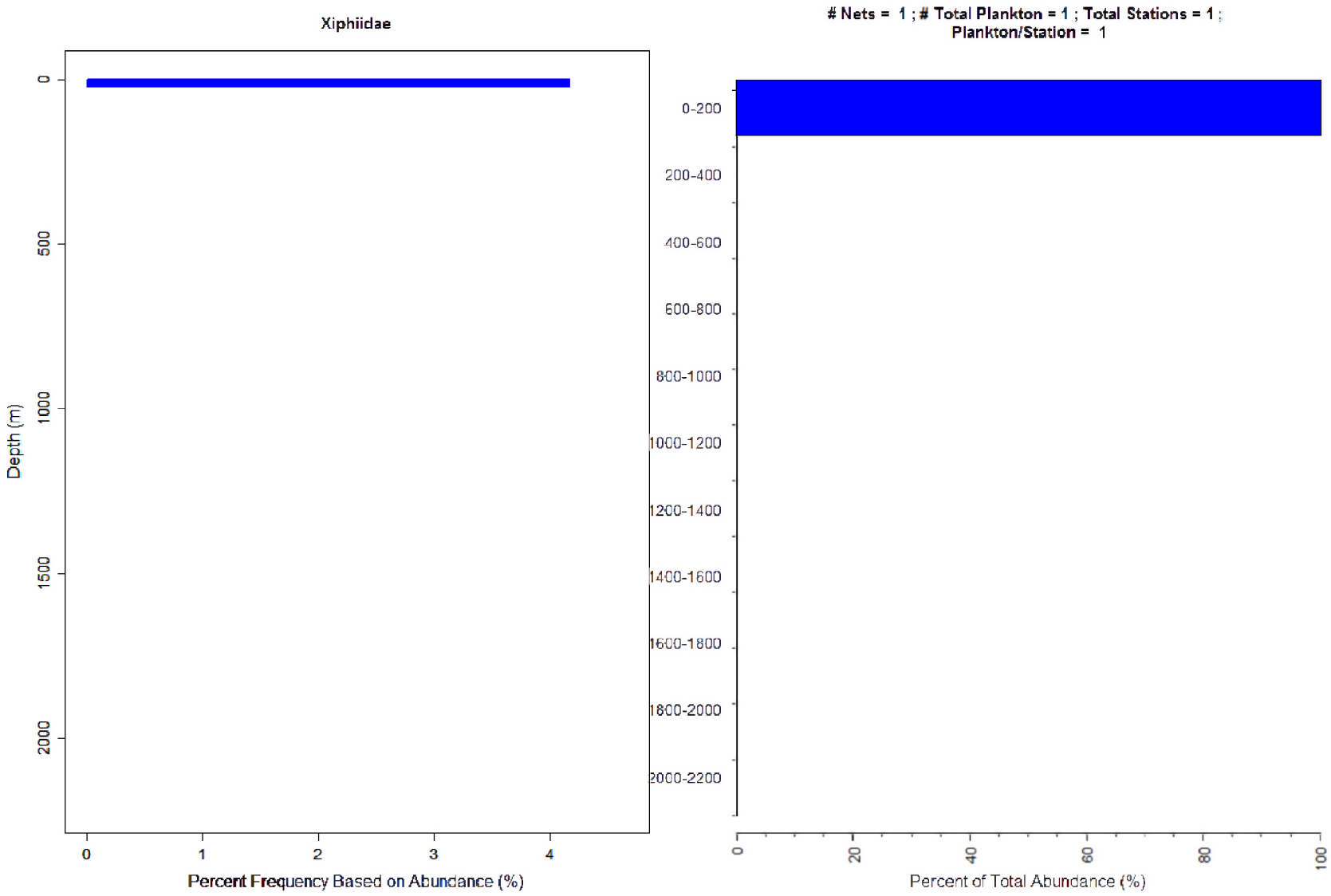
Unidentified_Decapod - Deep



Unidentified_Fish - Deep



Xanthoidea - Deep



Xiphiidae - Deep

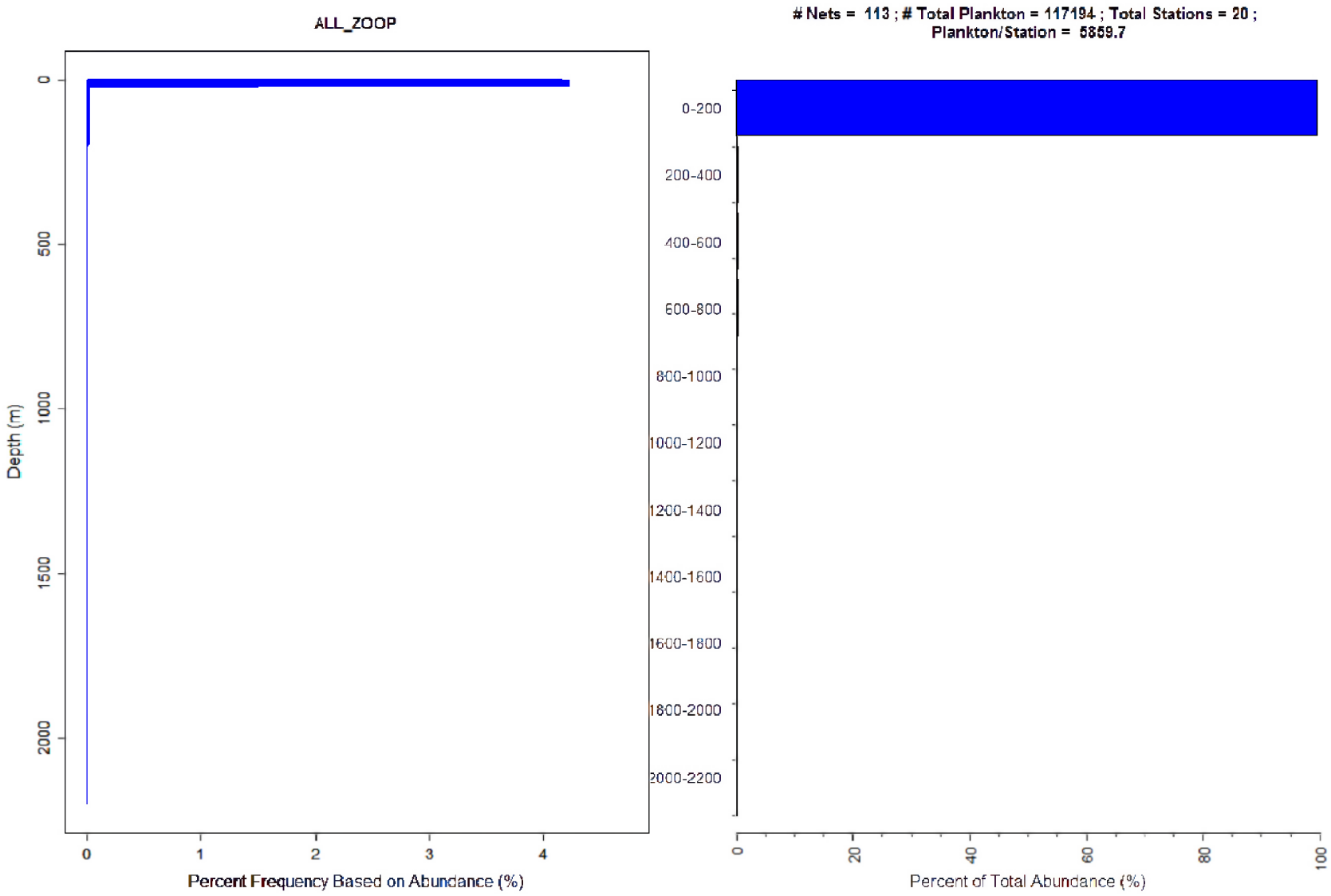
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

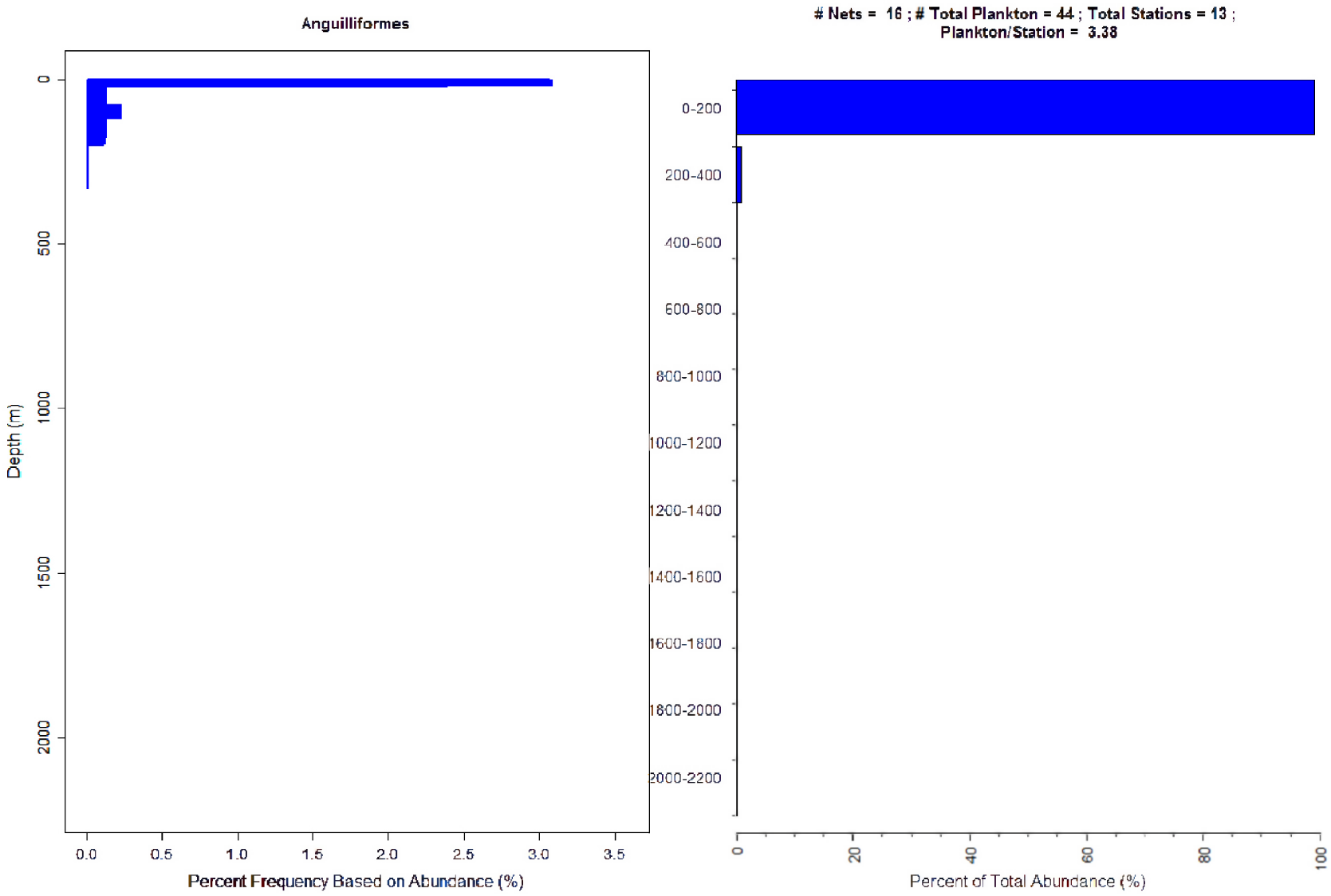
Appendix E3 – NRDA Tier1A Deep MOC1 Plots Order Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

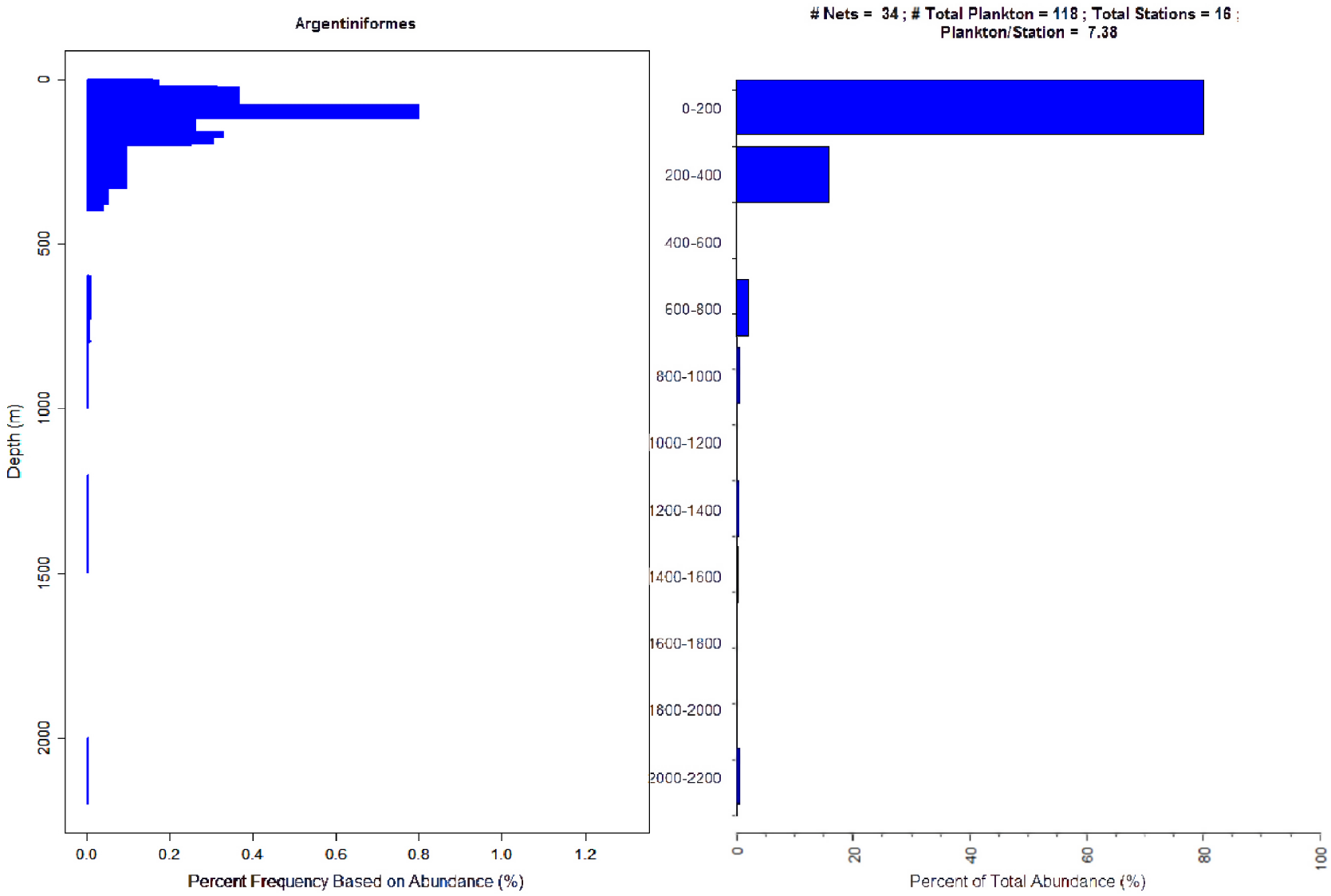
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Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



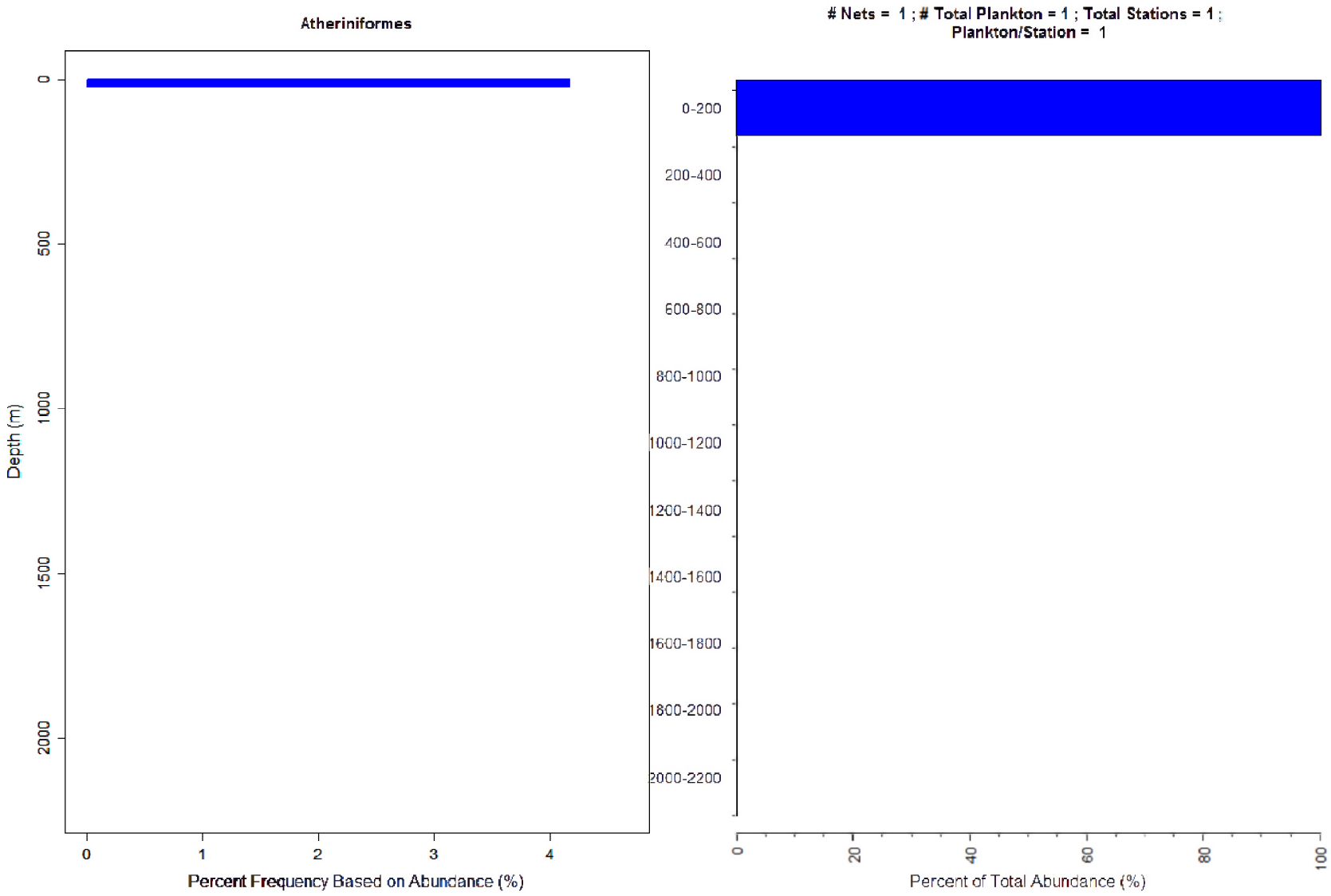
ALL_ZOOP - Deep



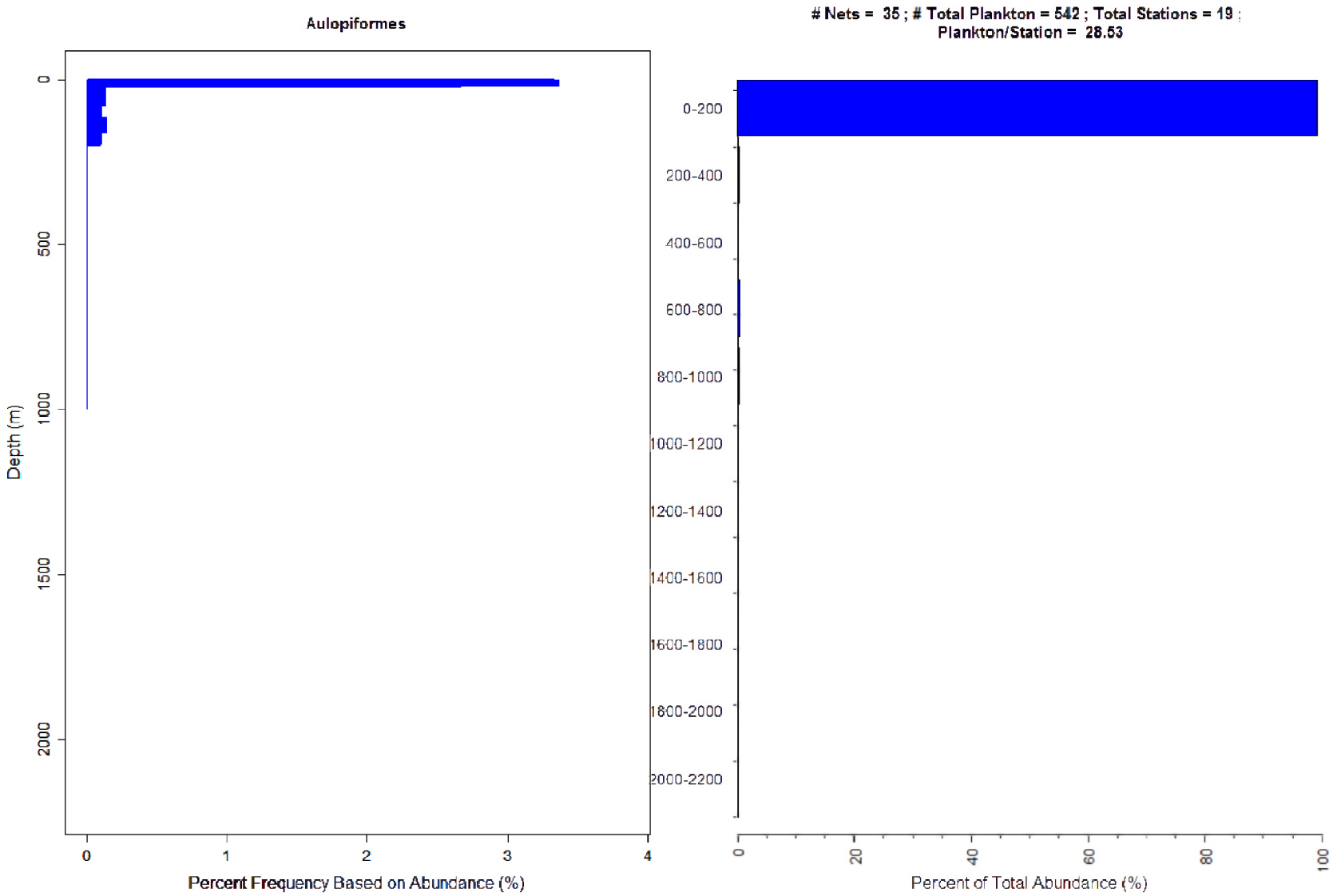
Anguilliformes - Deep



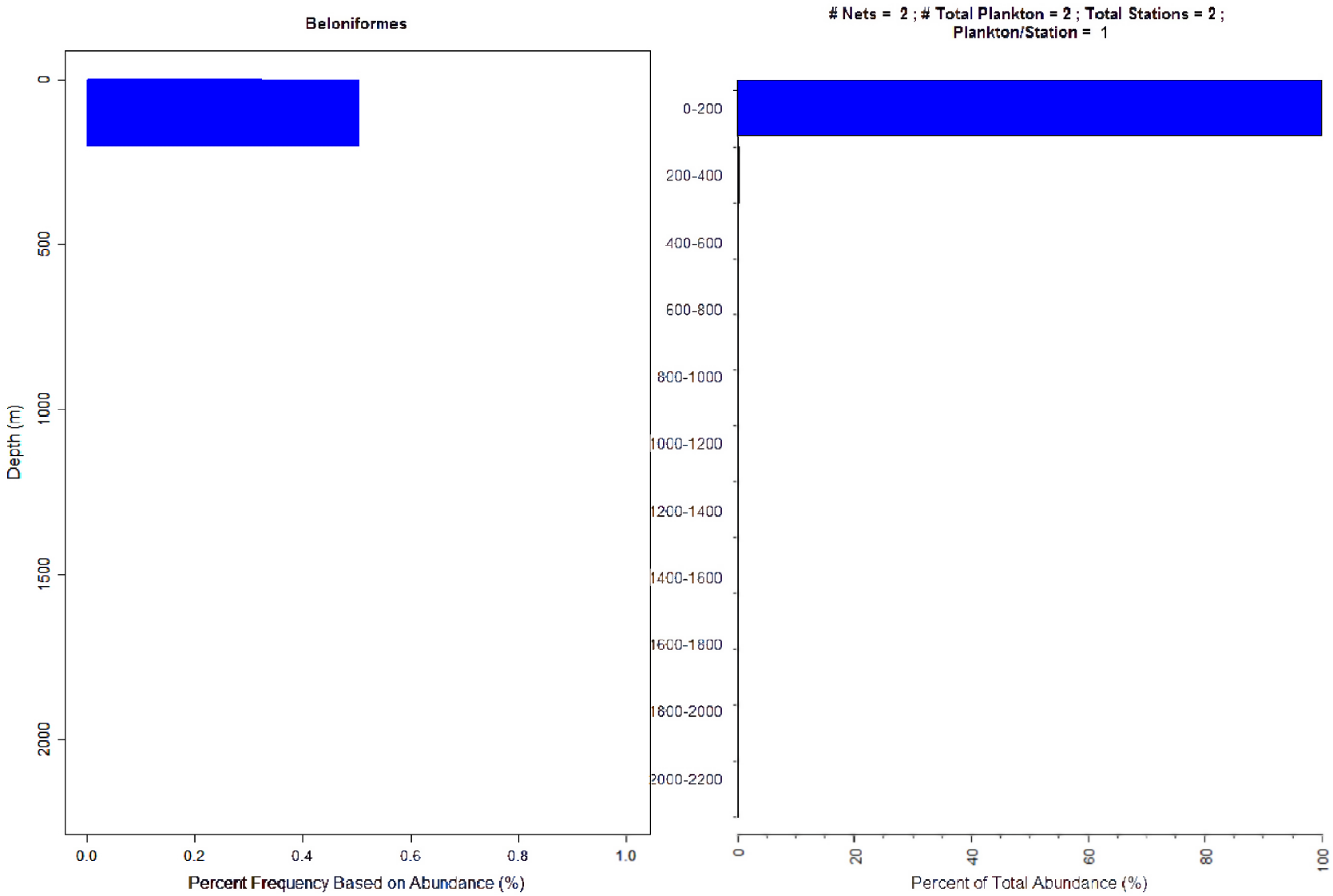
Argentiniformes - Deep



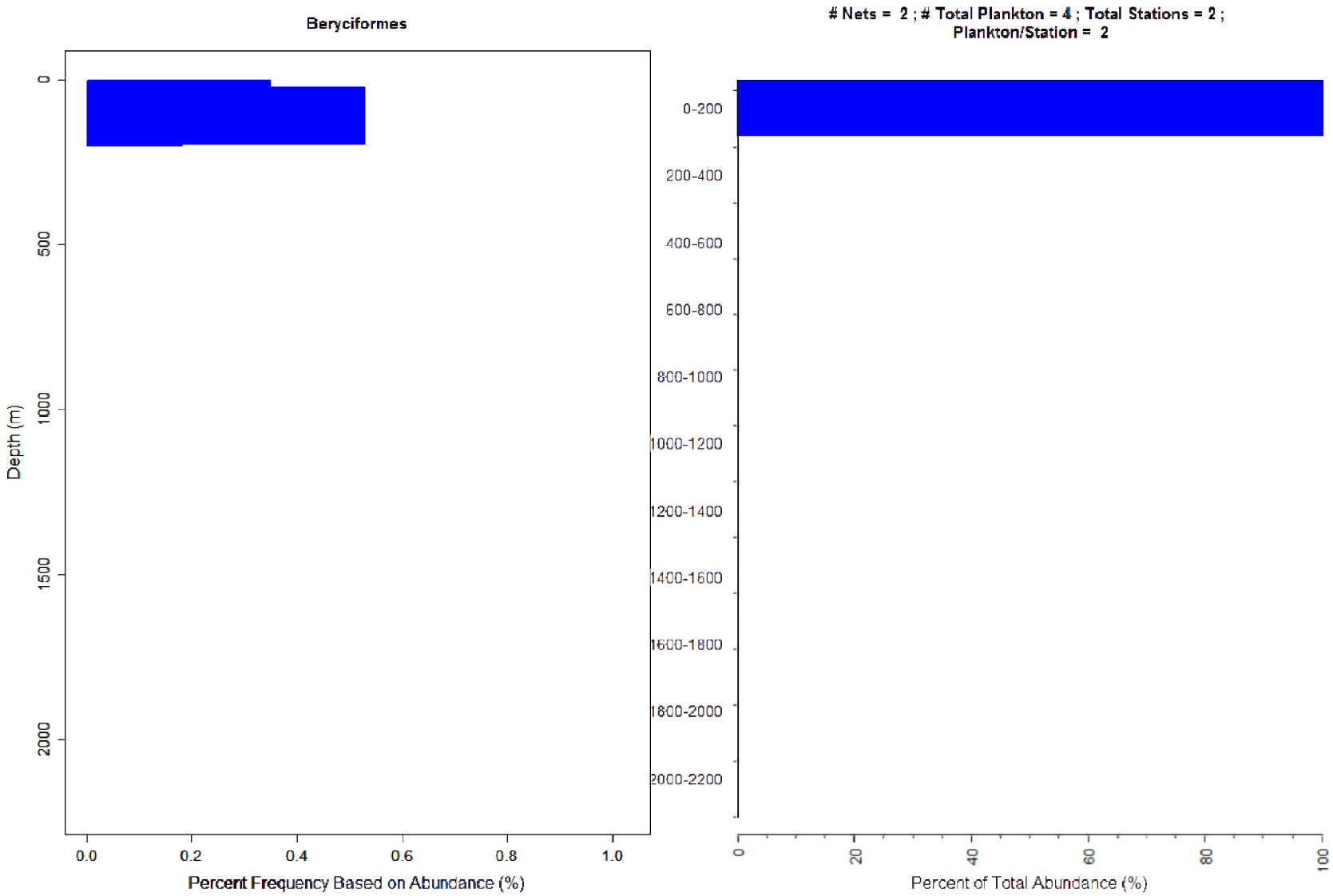
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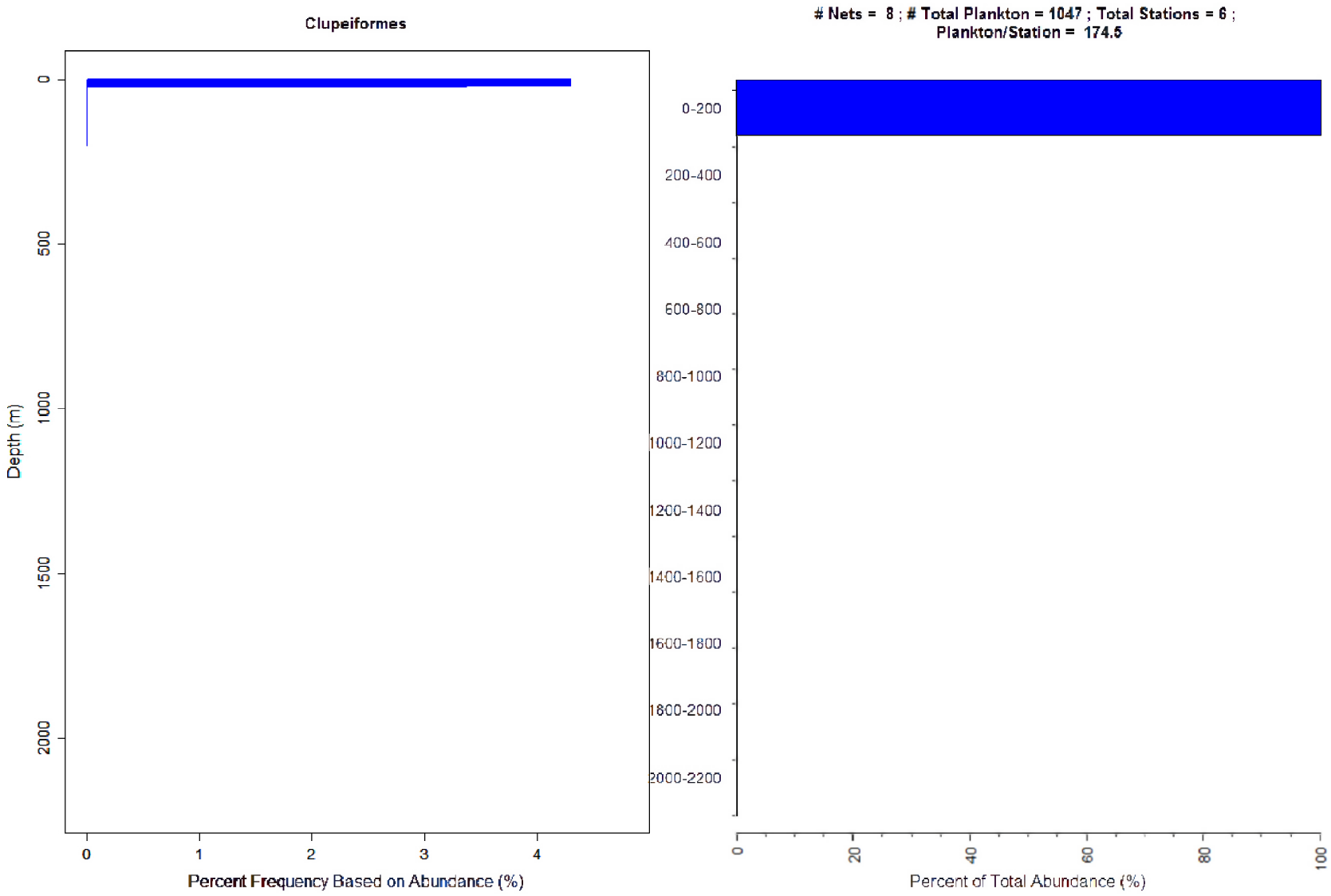
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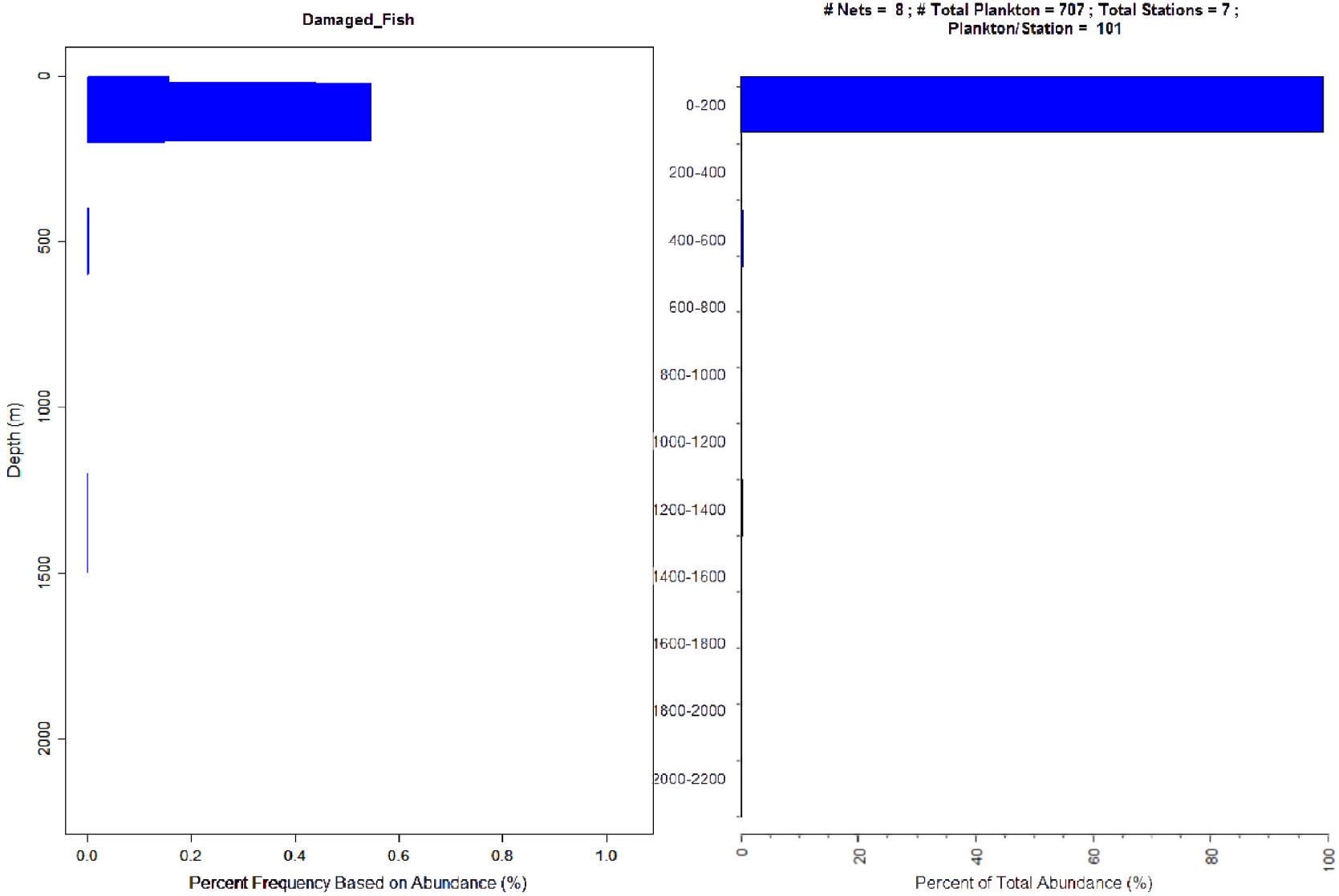
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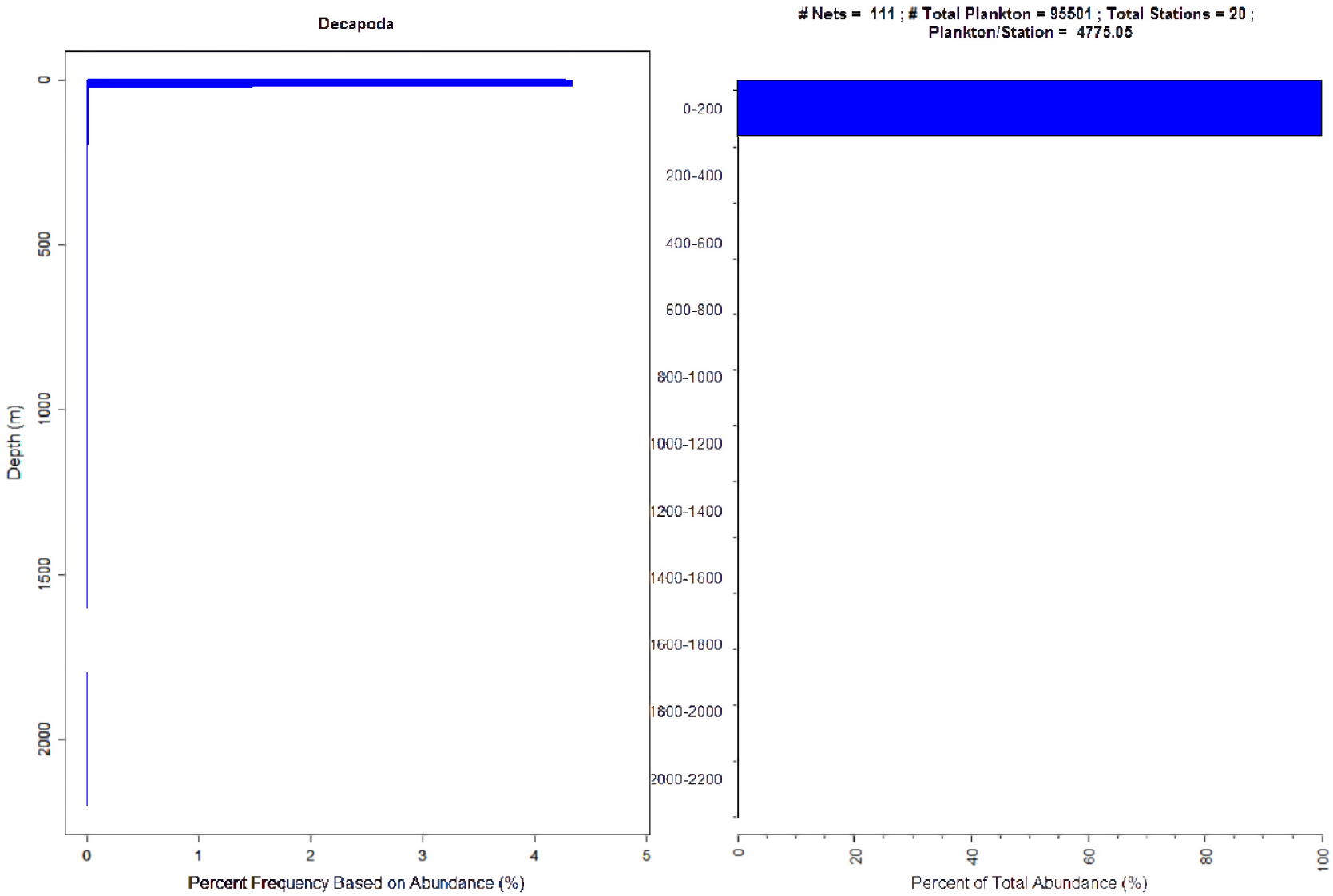
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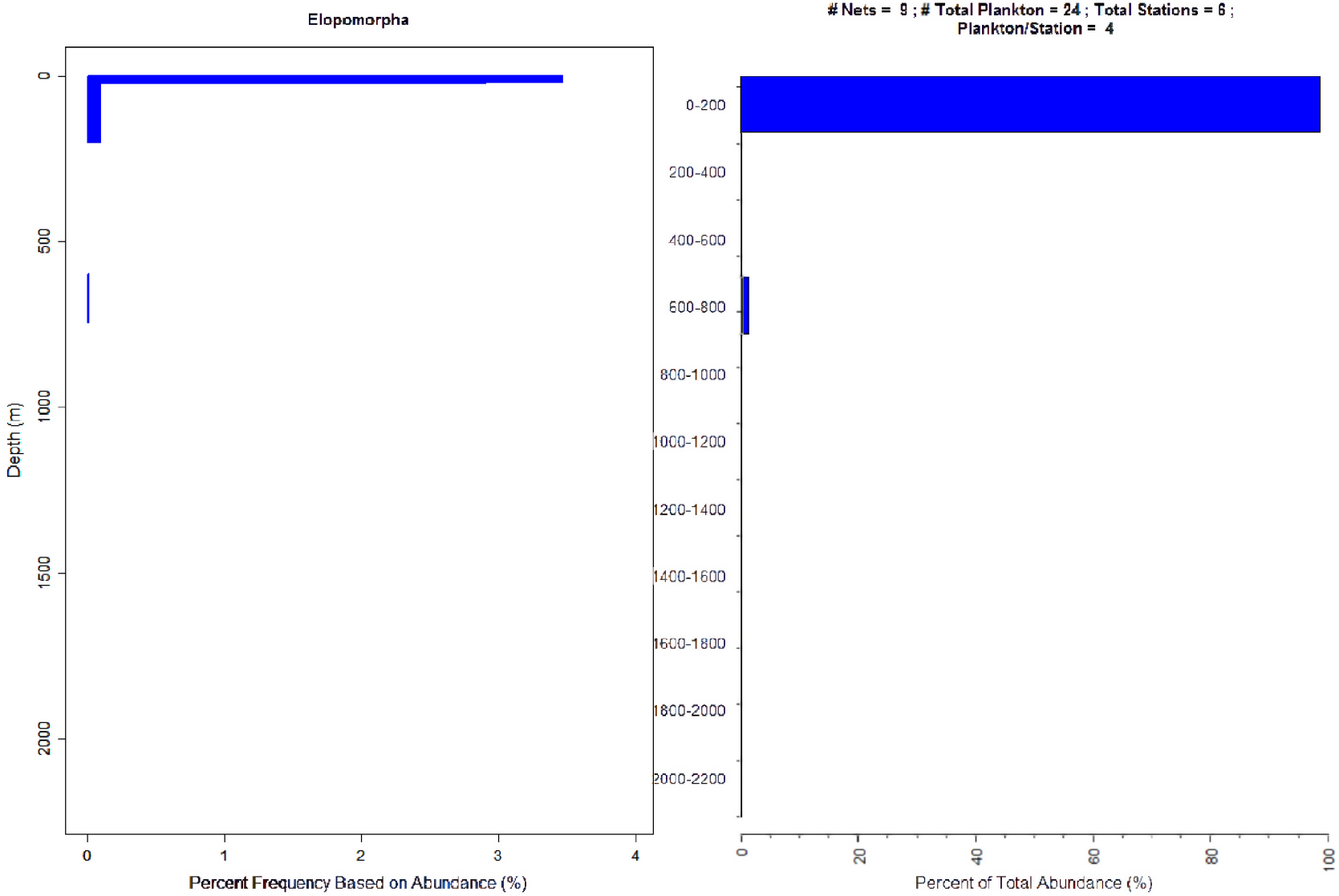
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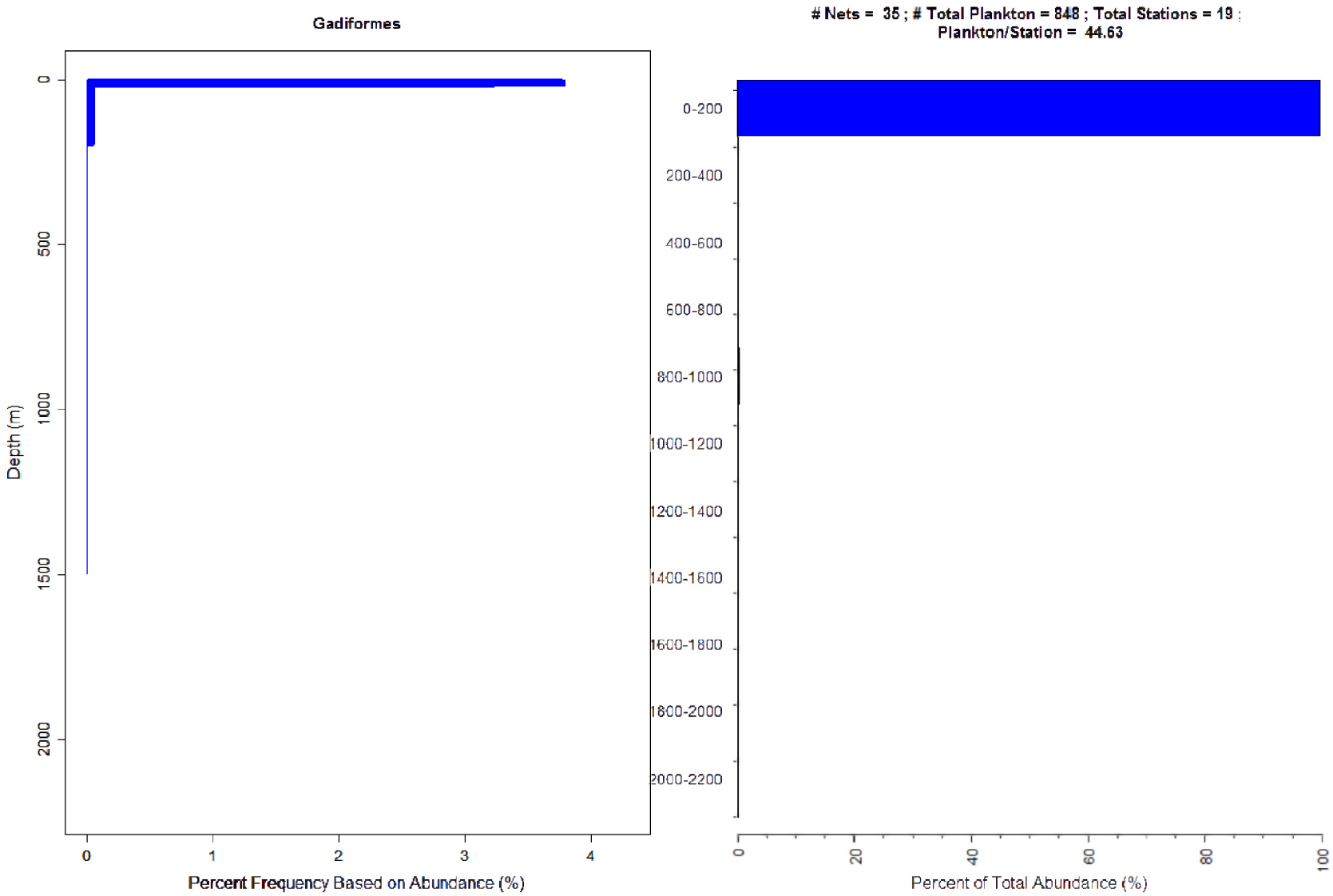
Damaged_Fish - Deep



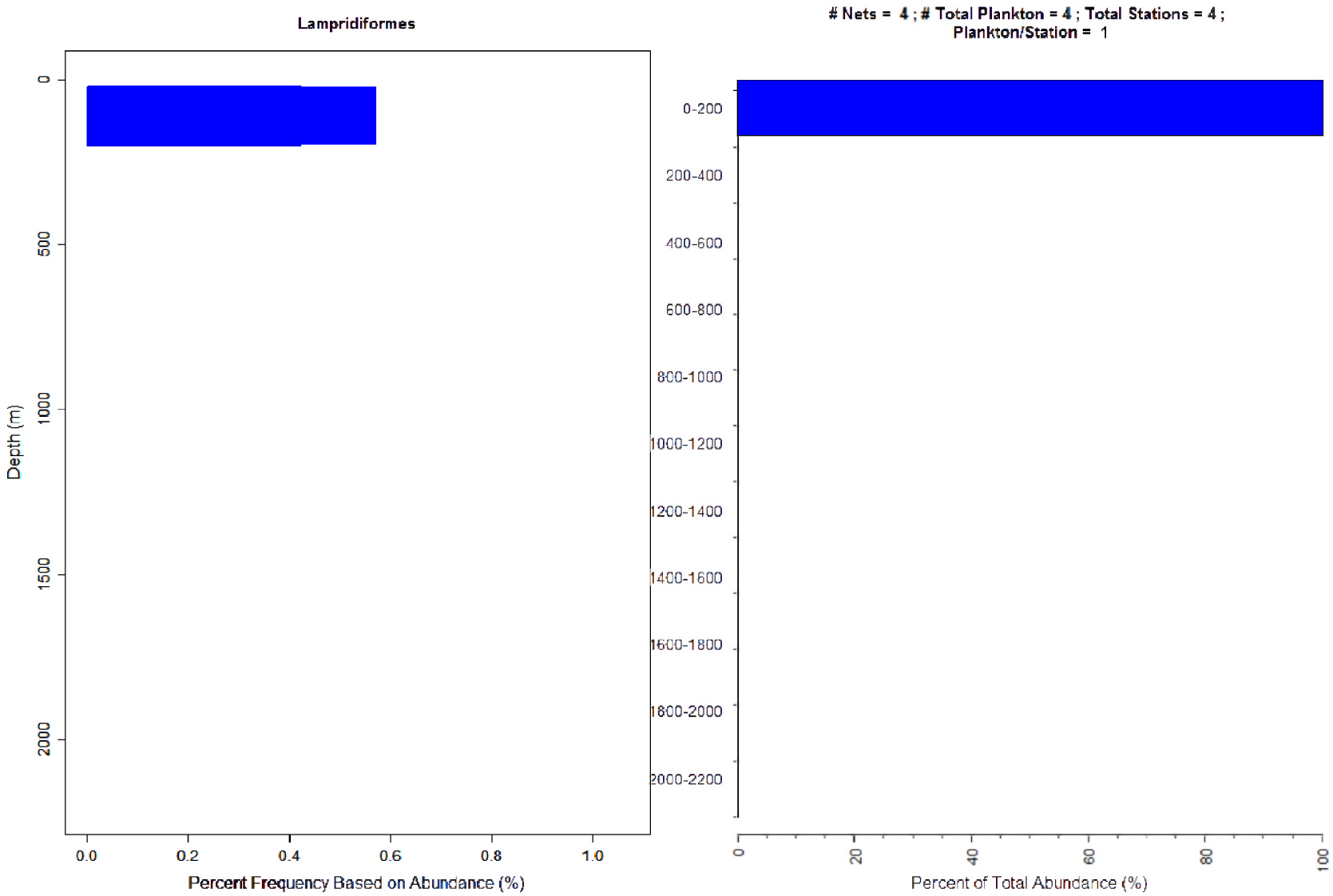
Decapoda - Deep



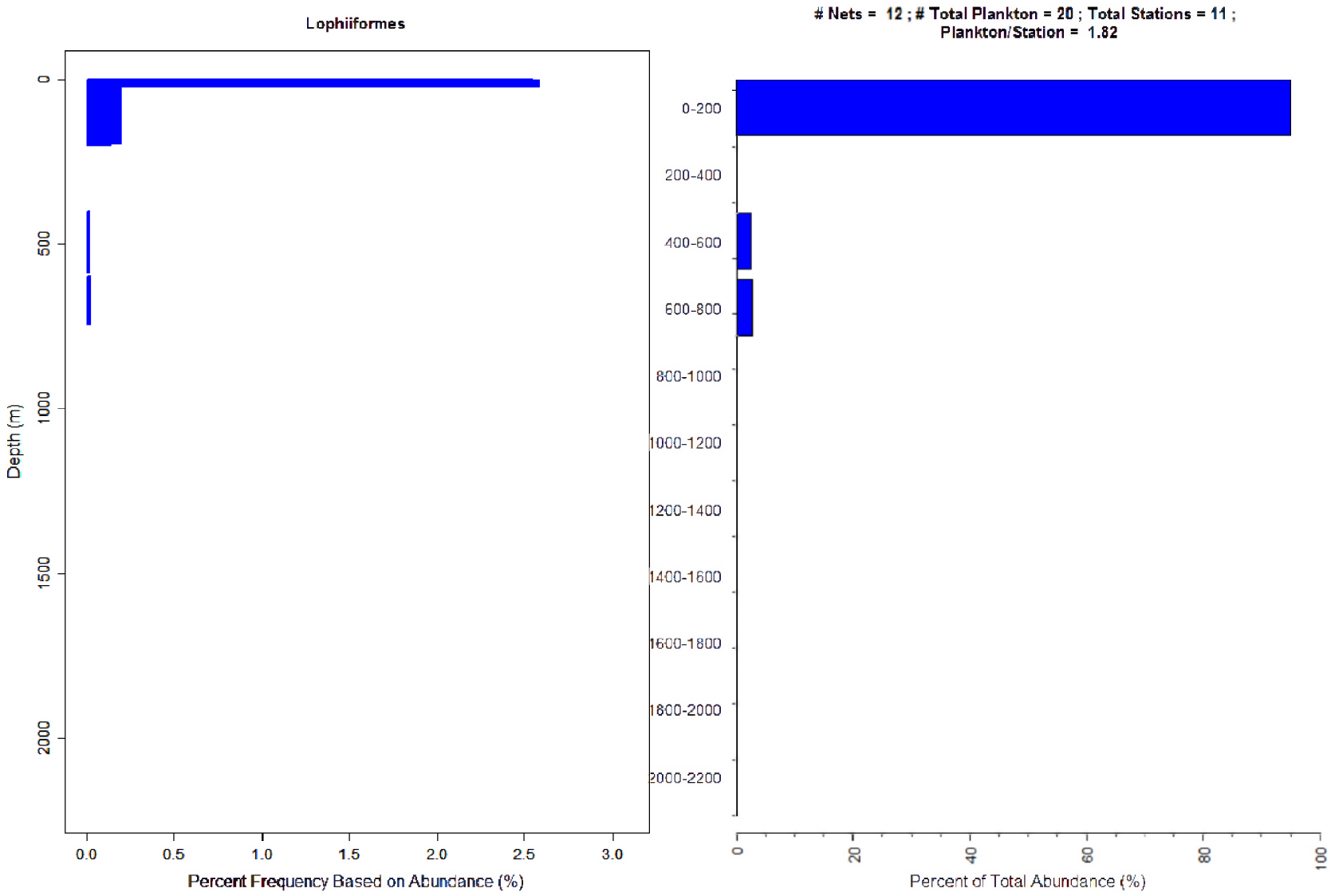
Elopomorpha - Deep



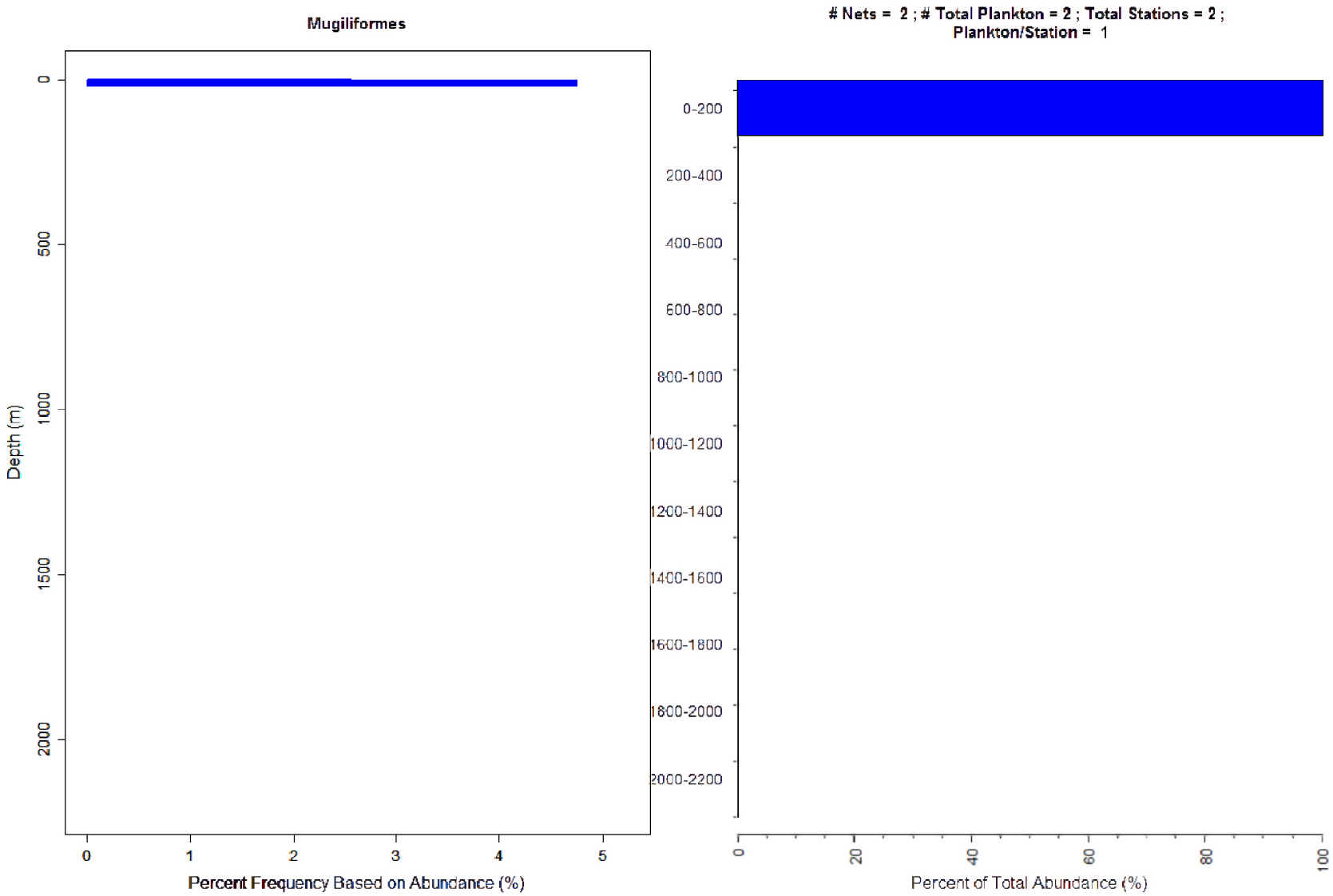
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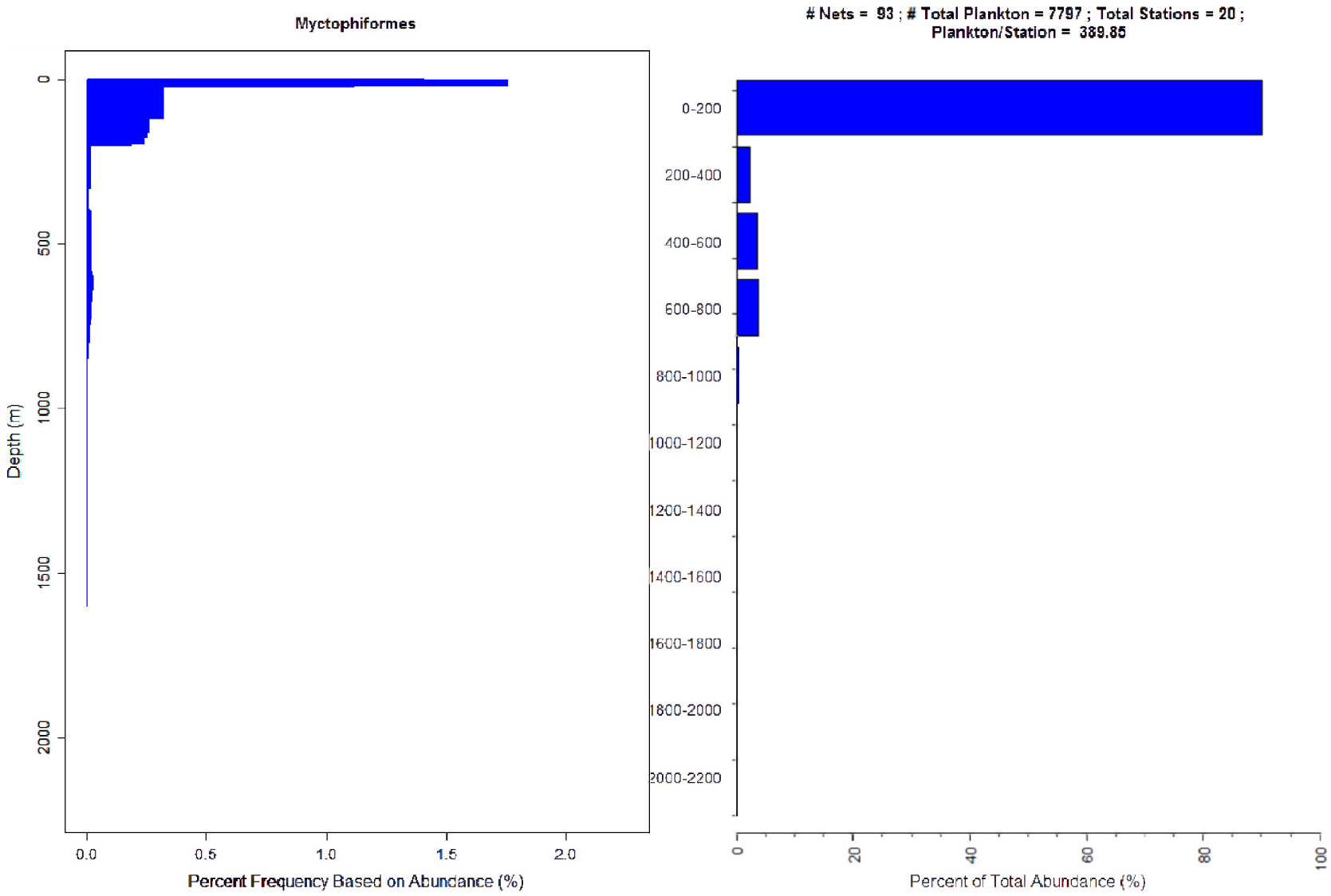
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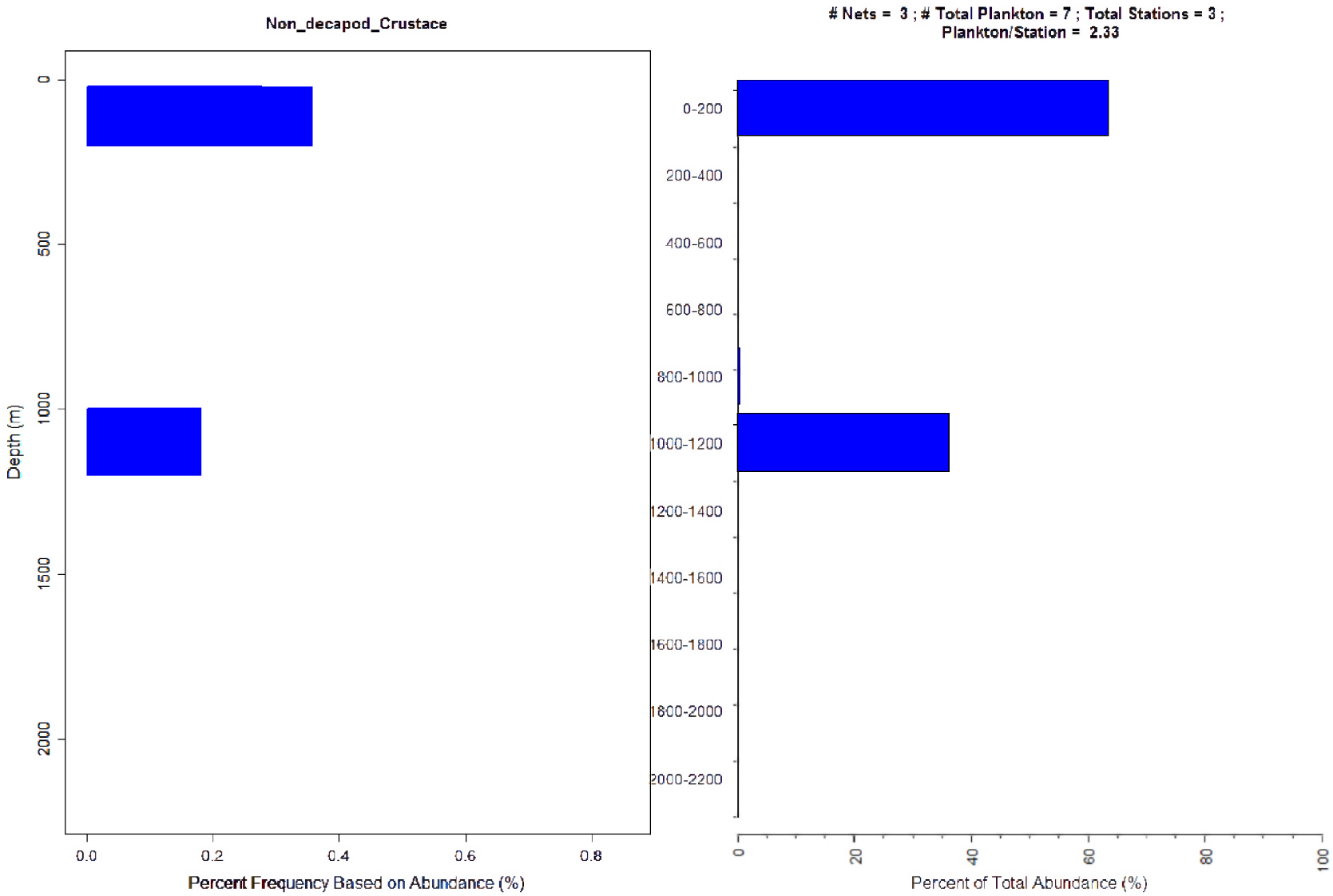
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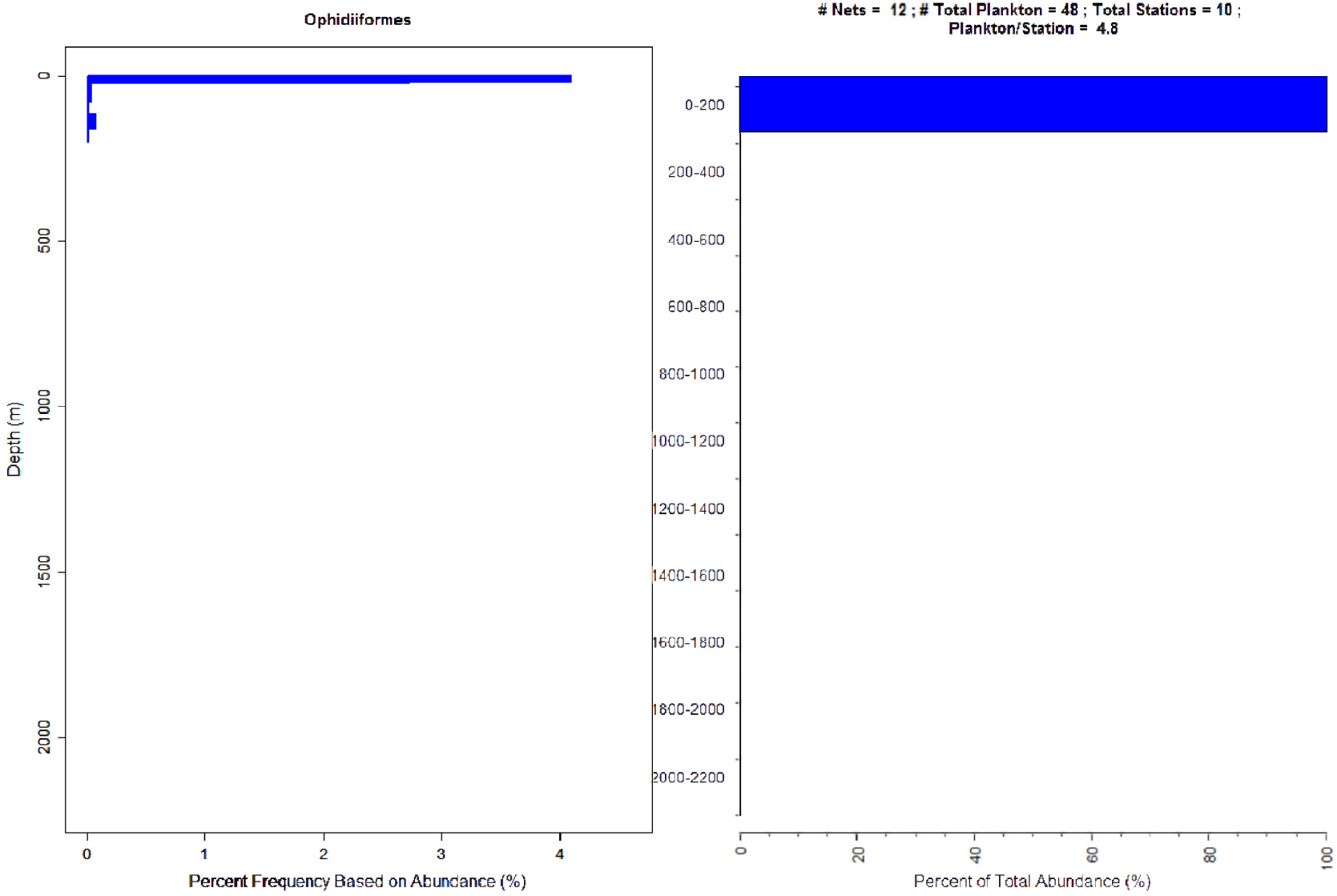
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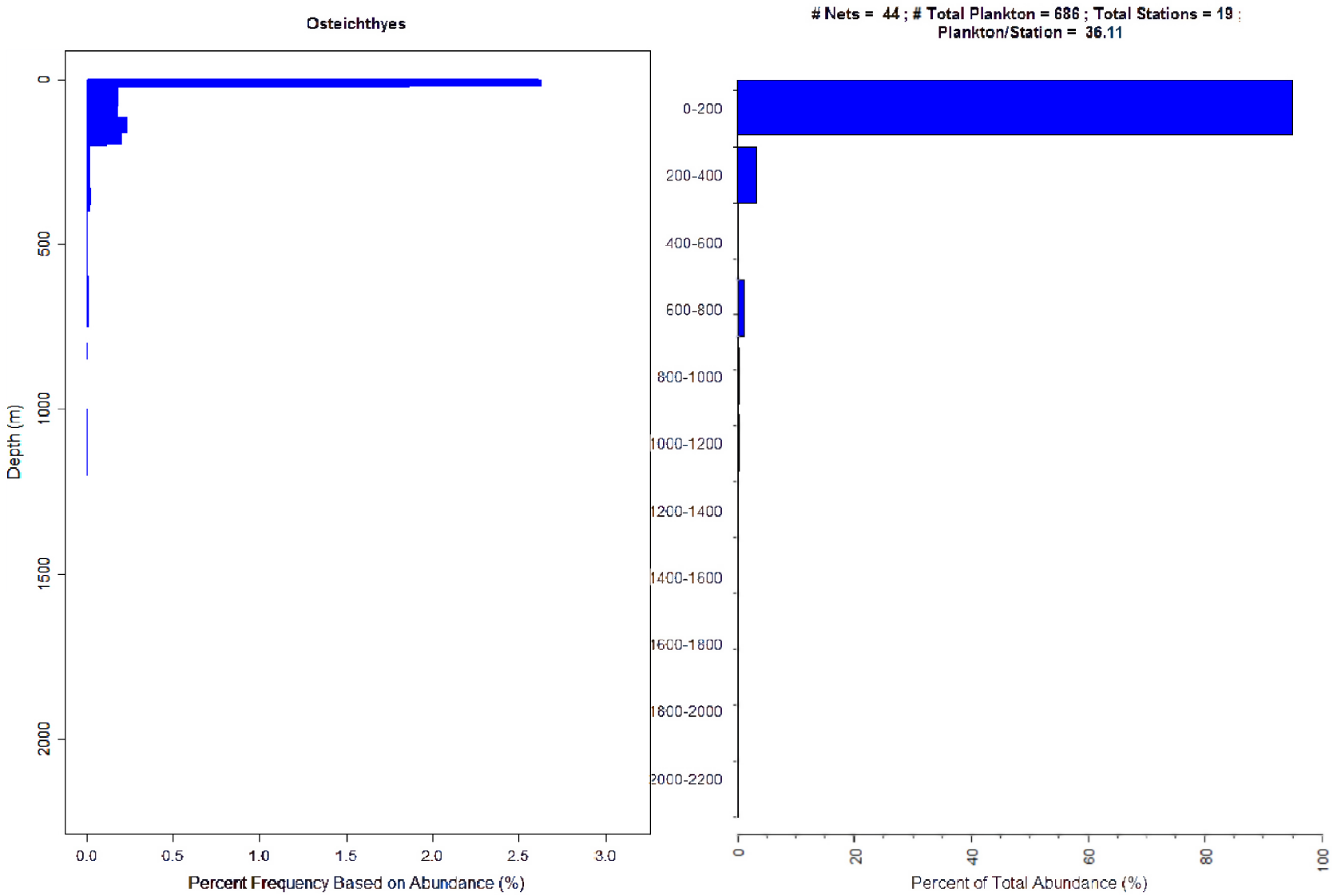
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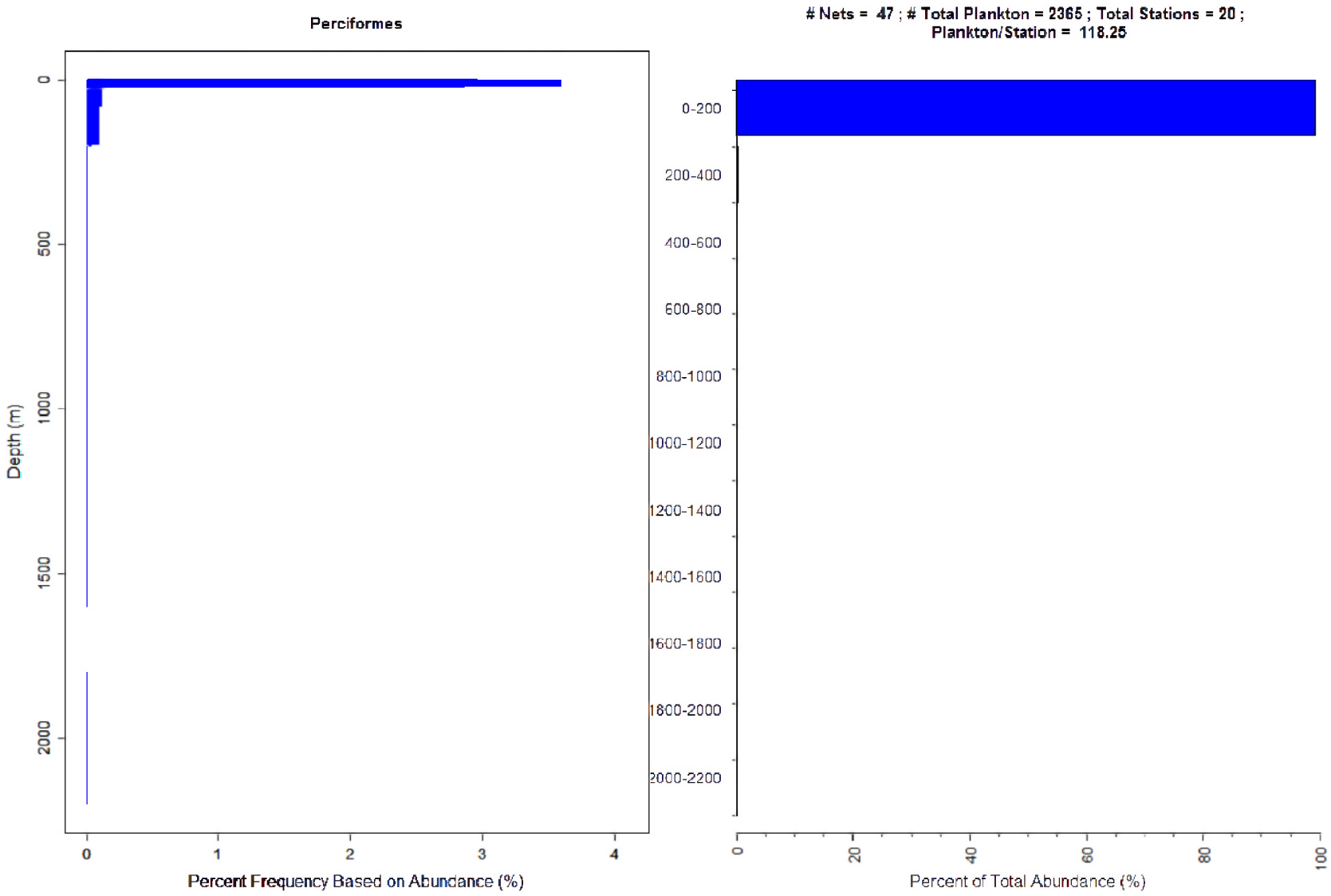
Non_decapod_Crustace - Deep



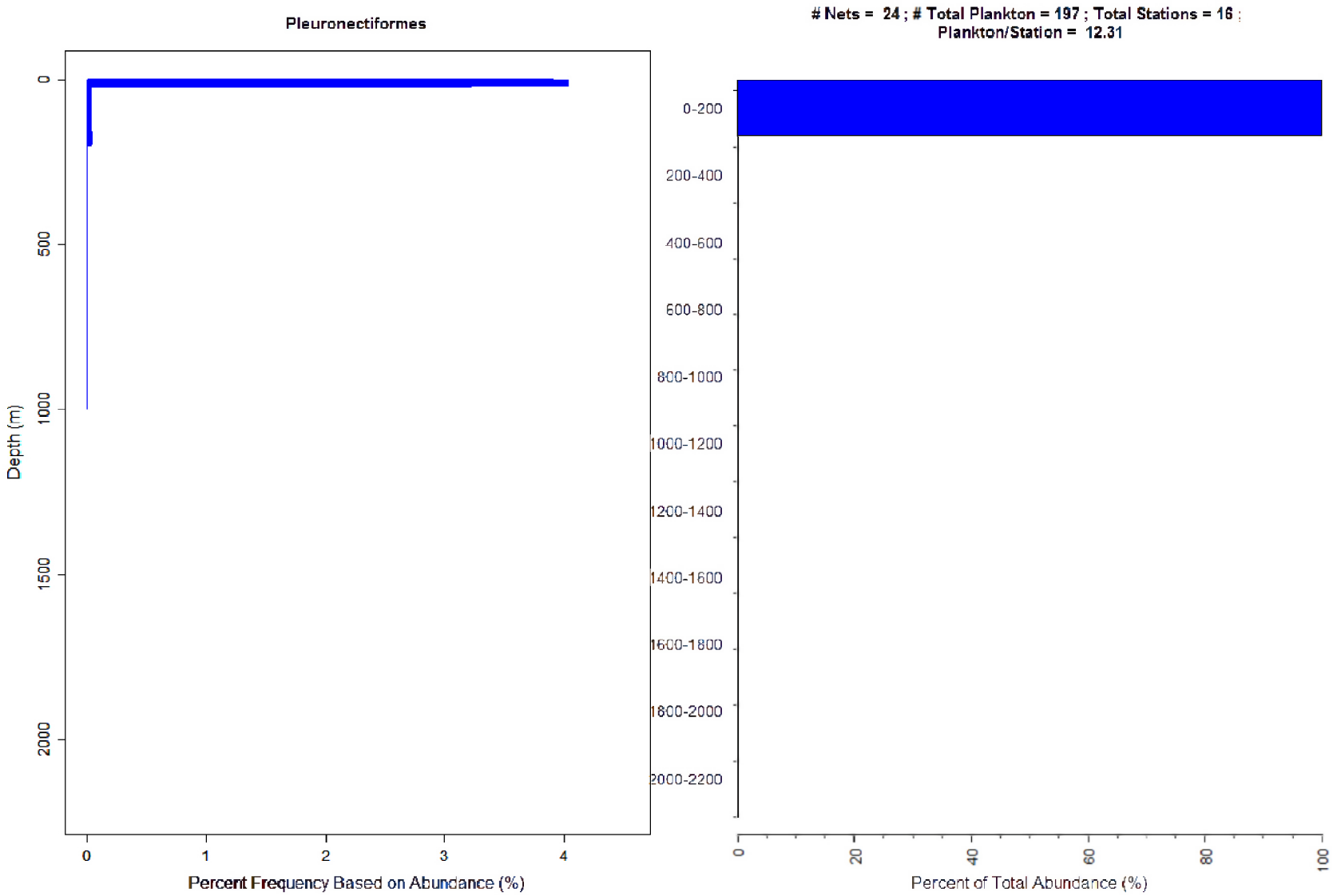
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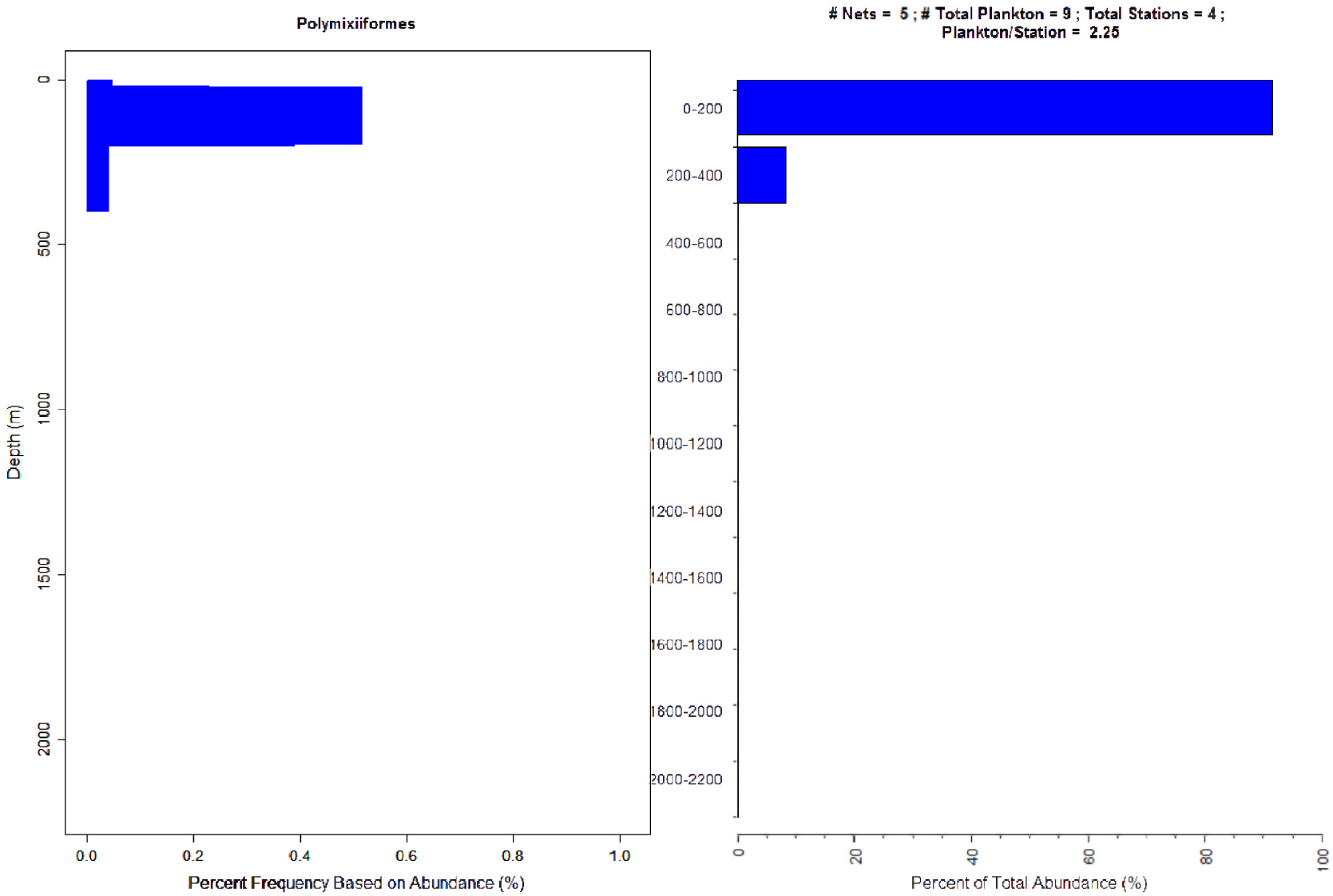
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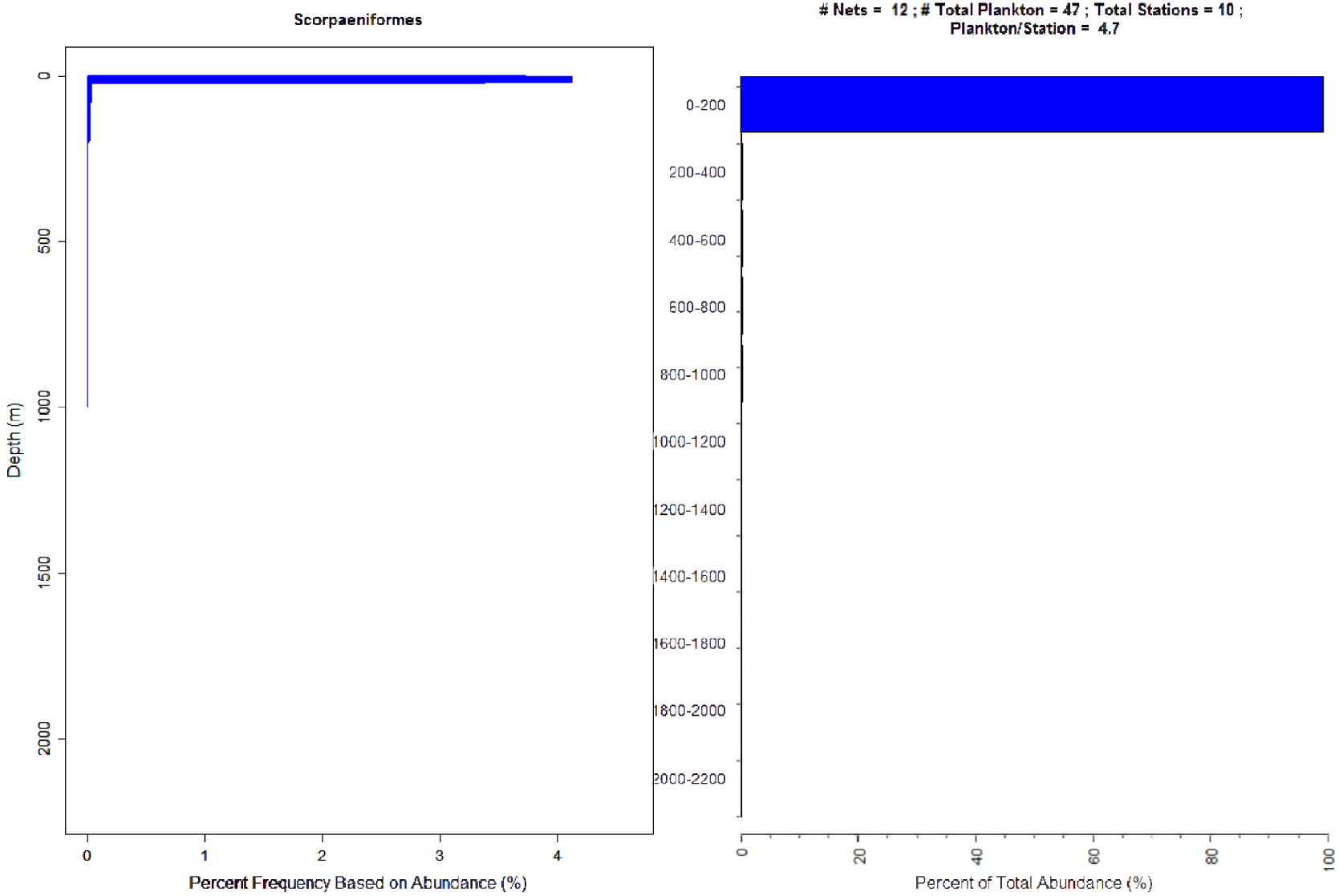
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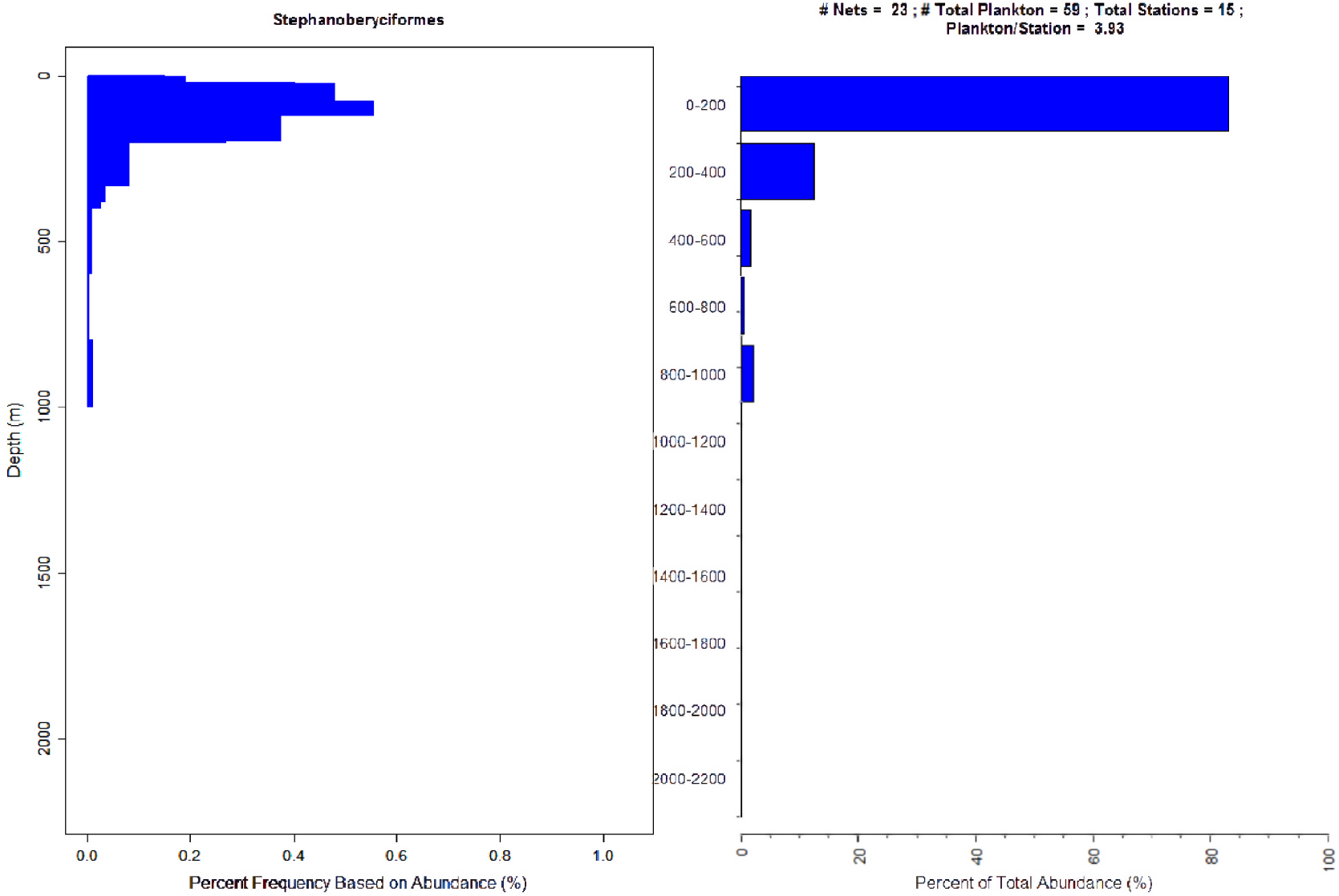
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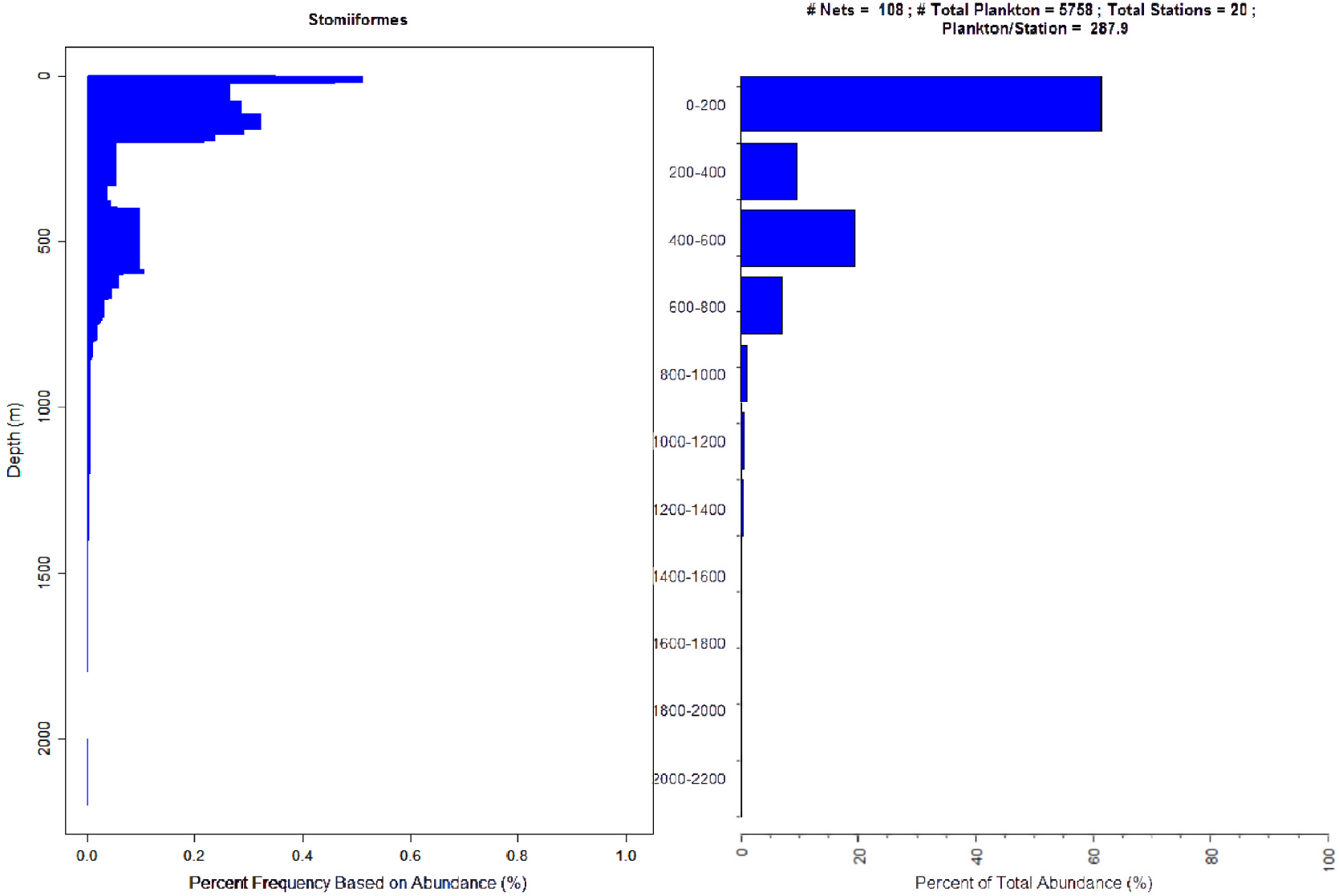
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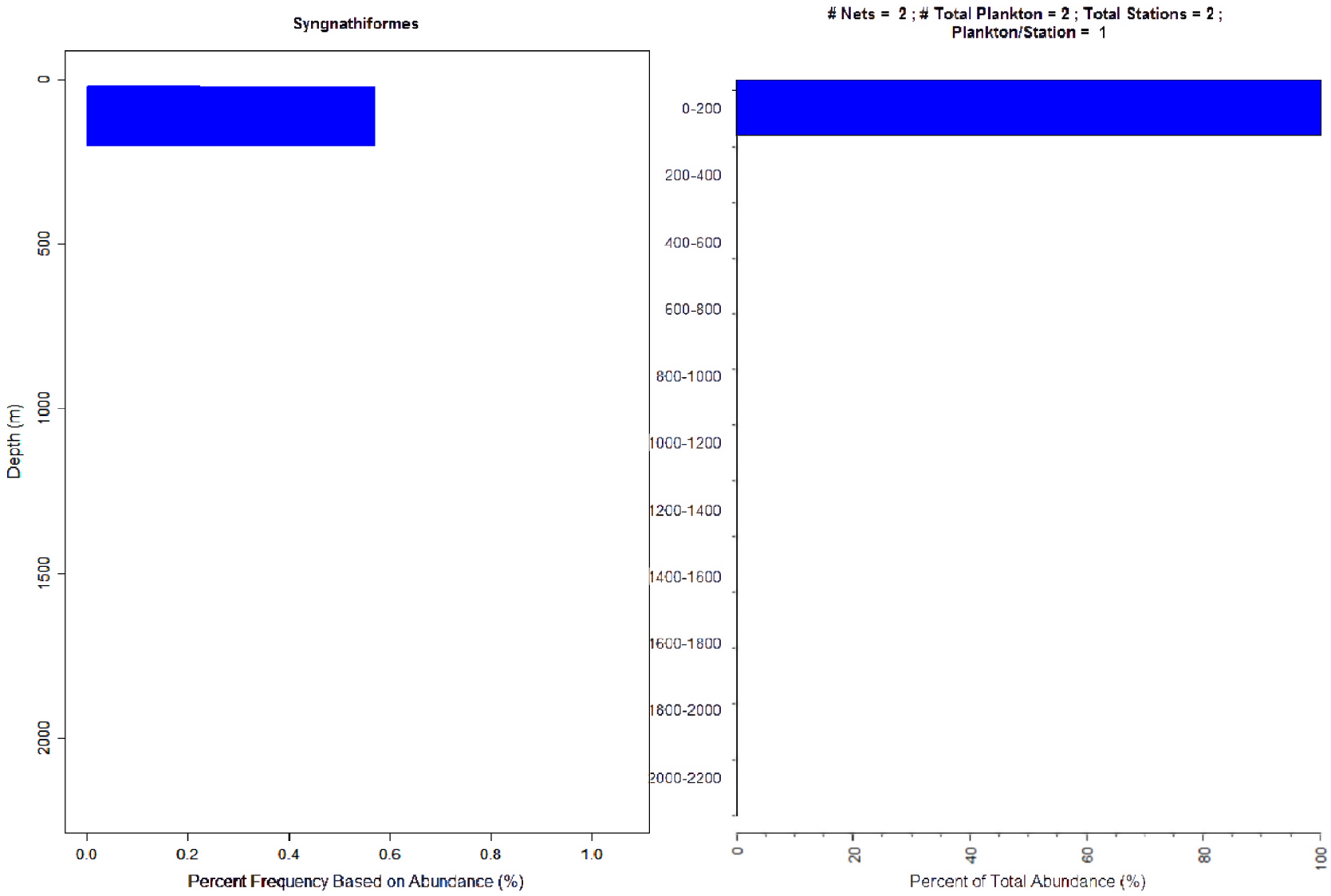
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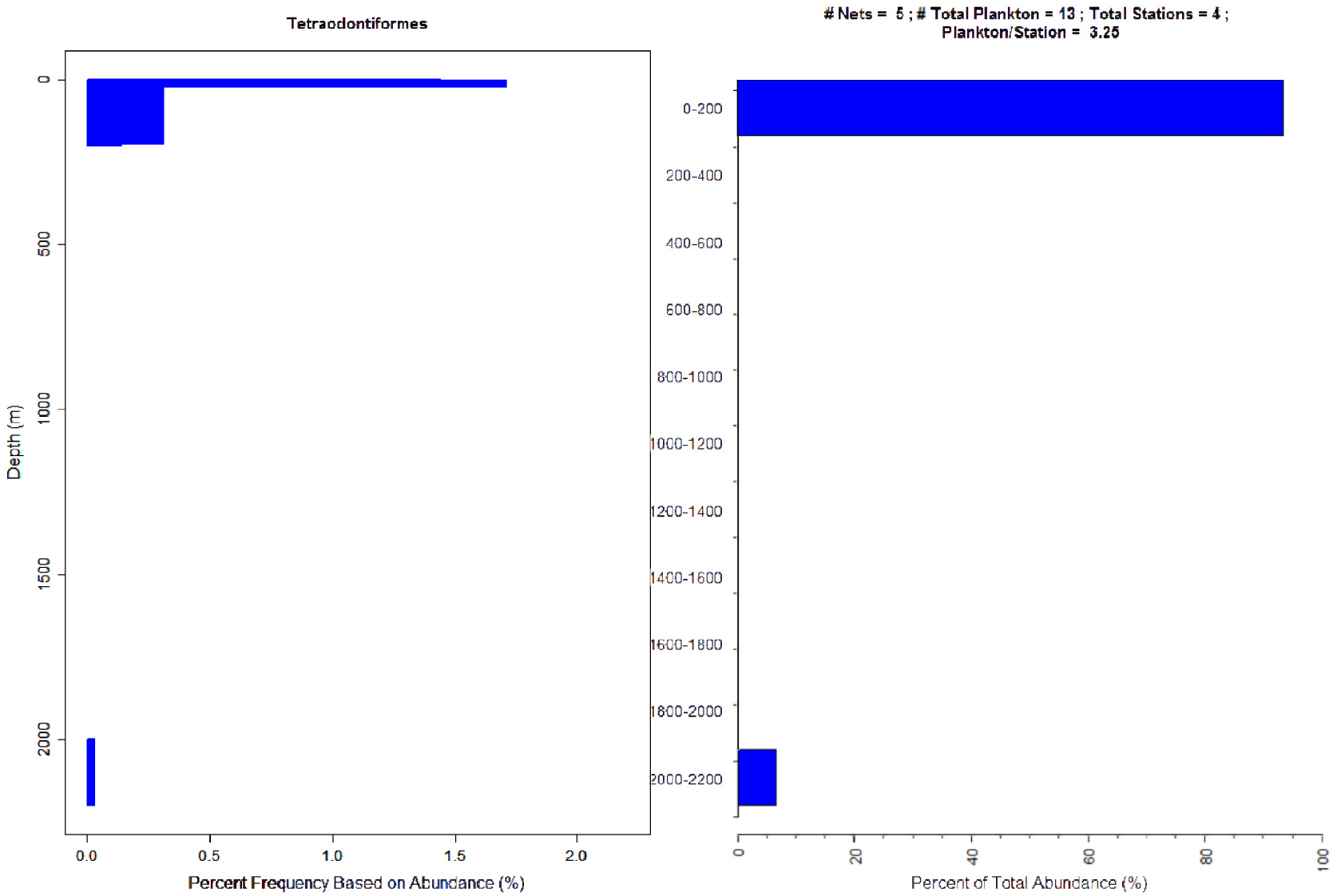
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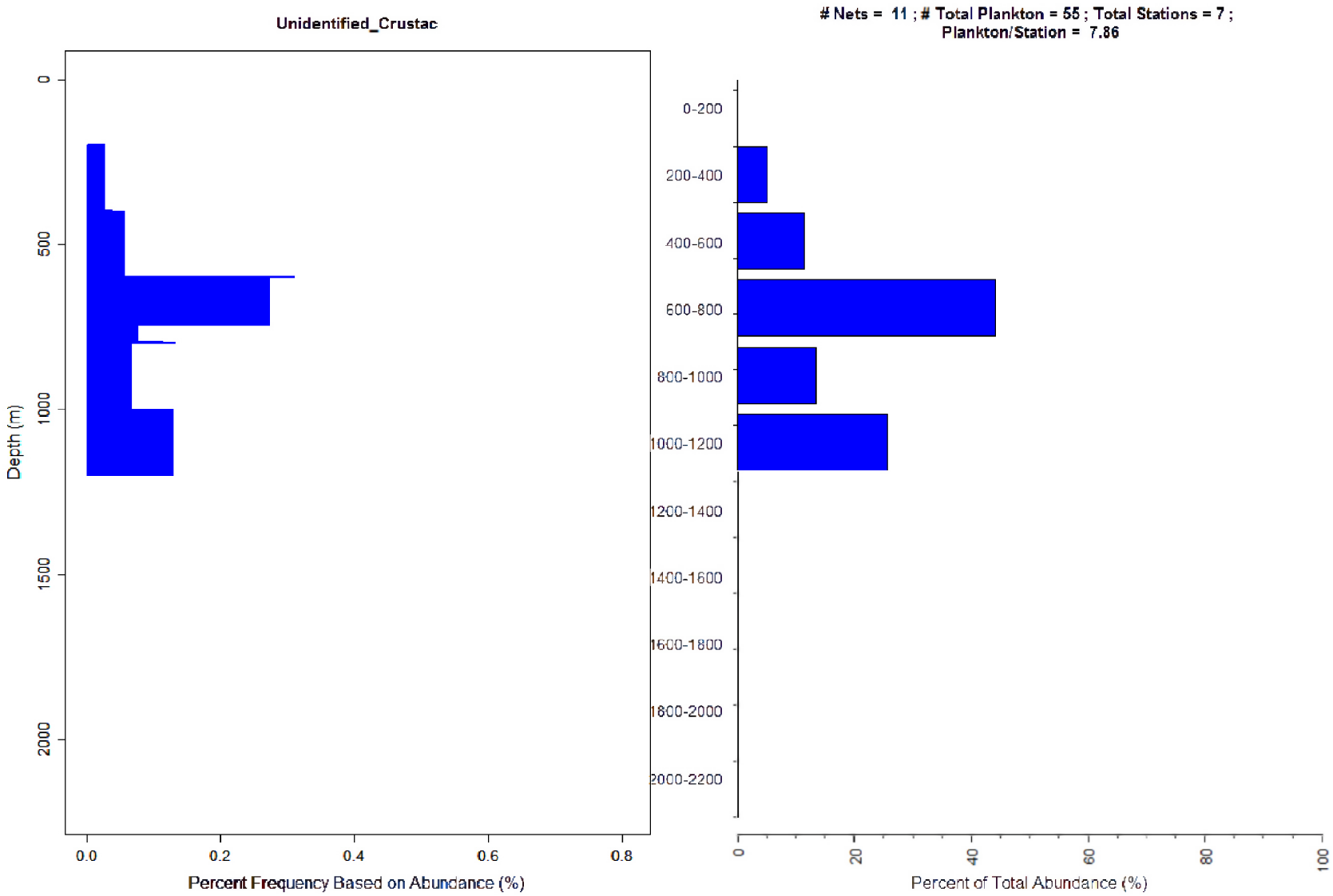
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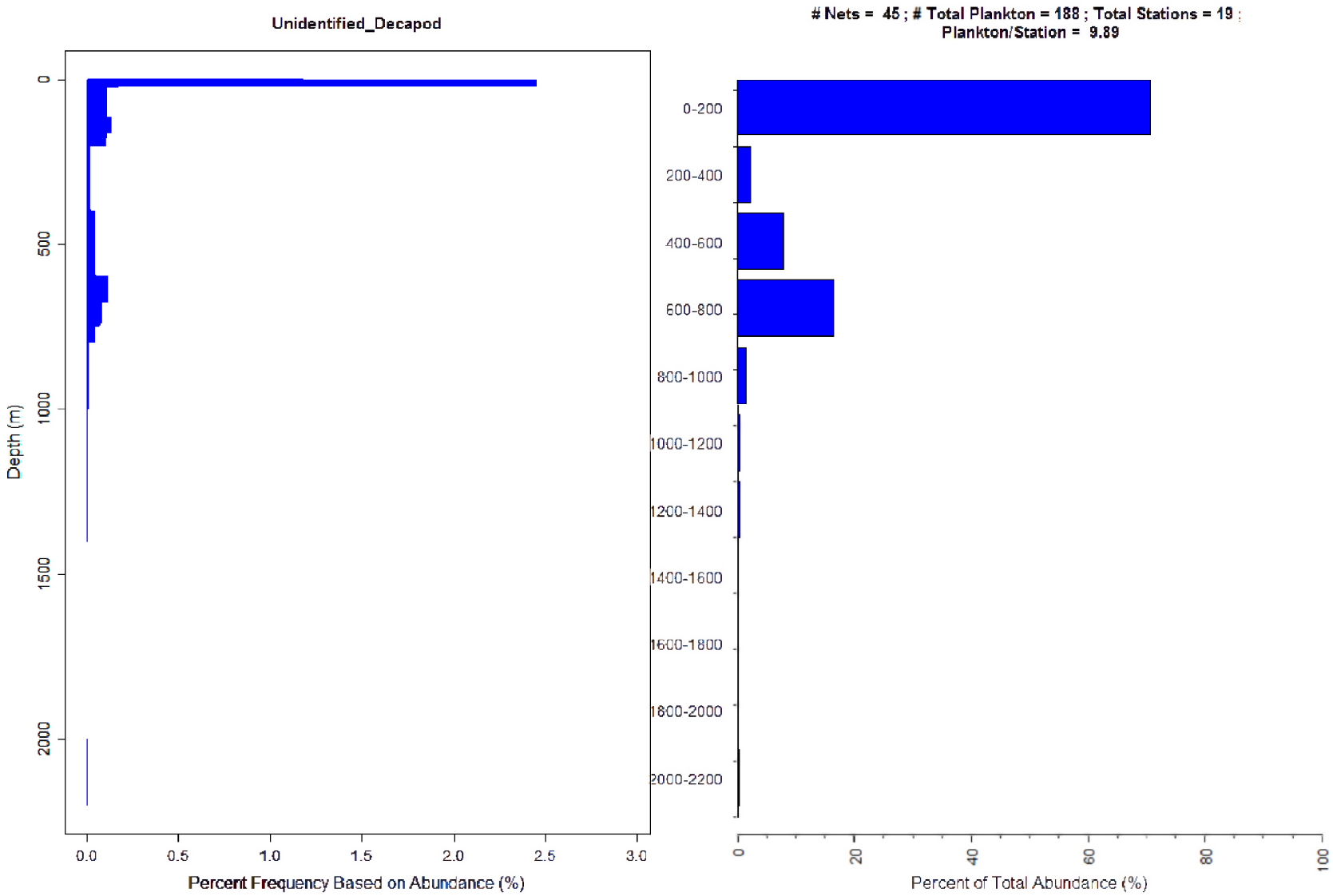
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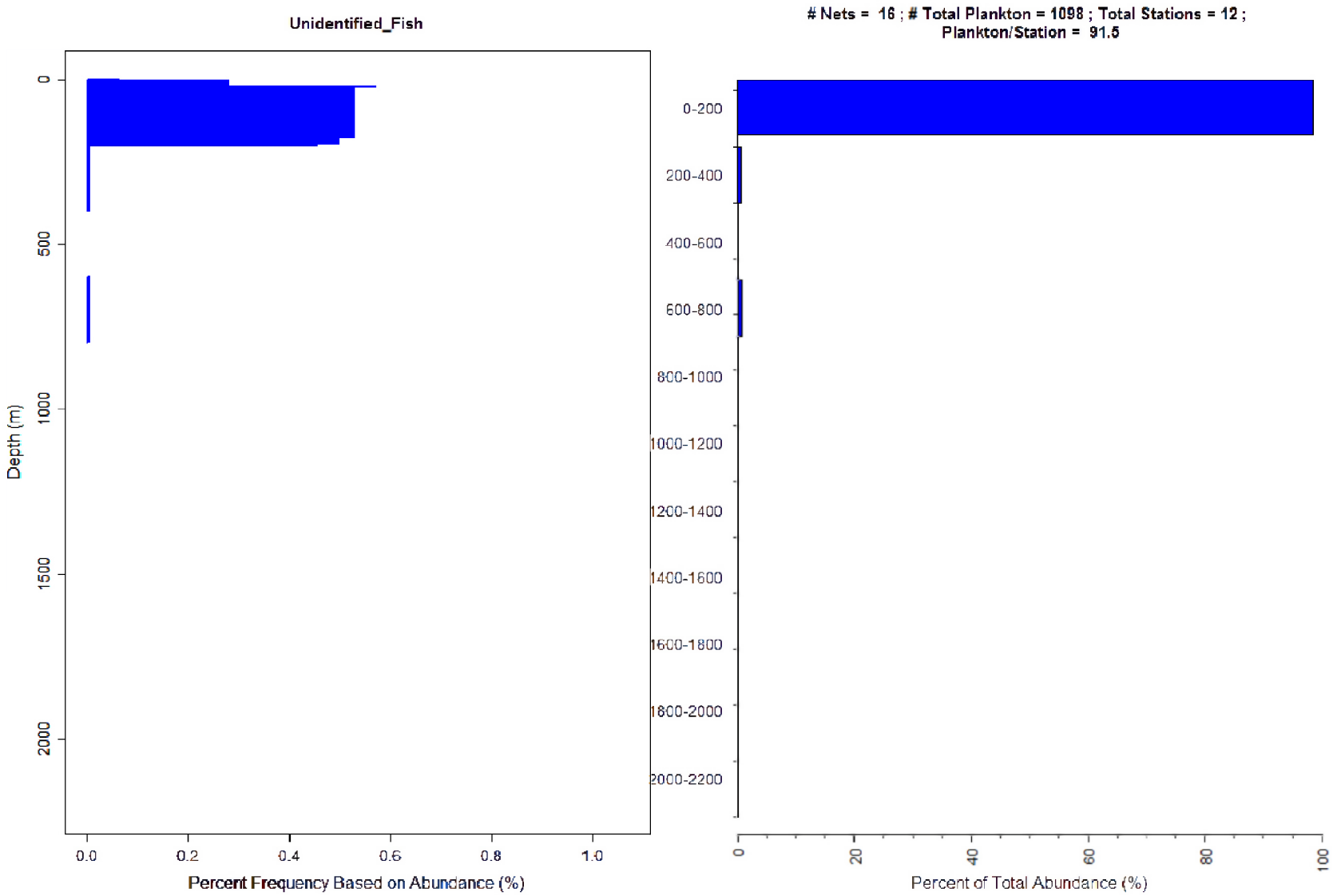
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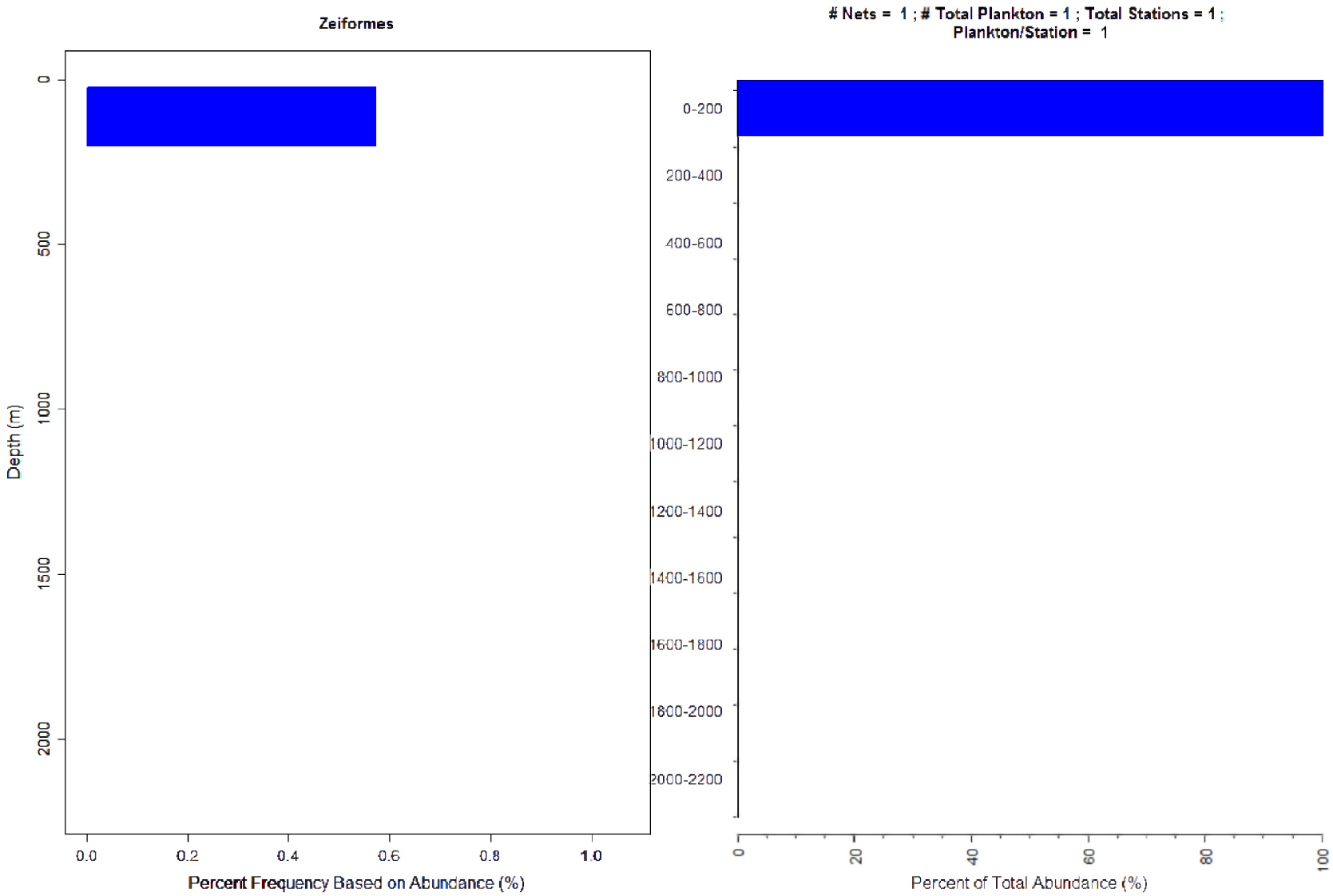
Unidentified_Crustac - Deep



Unidentified_Decapod - Deep



Unidentified_Fish - Deep



Zeiformes - Deep

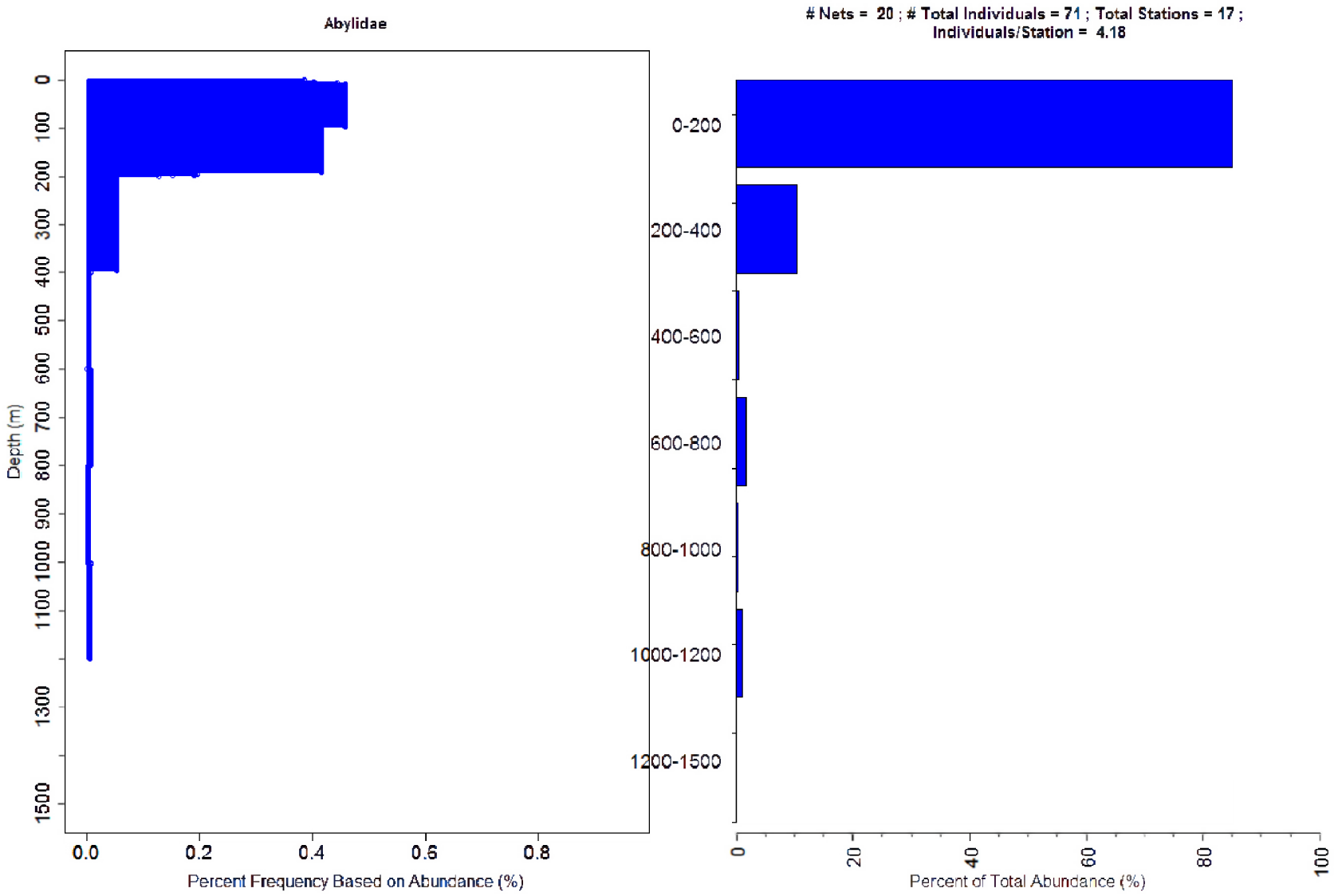
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

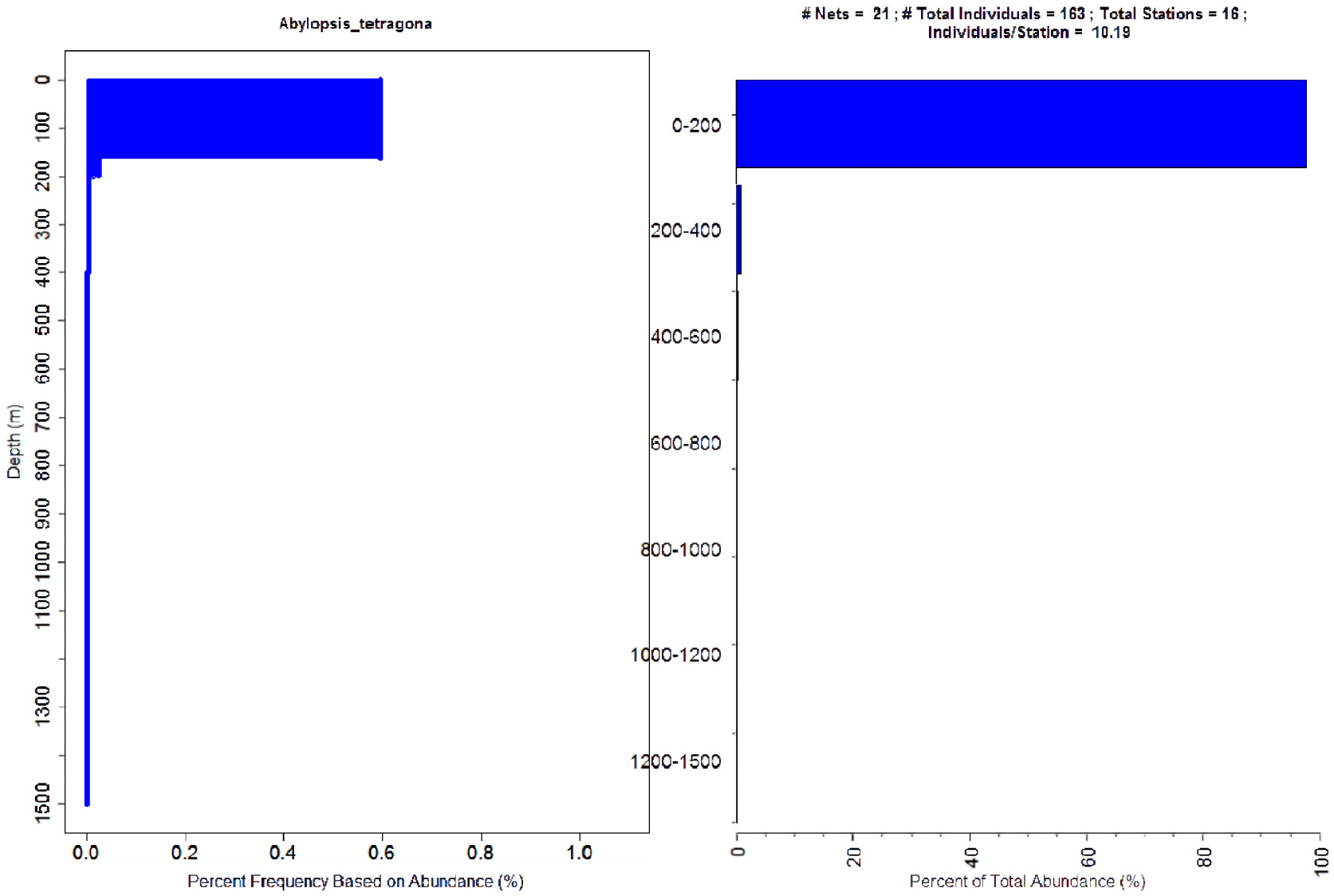
Appendix F1 – NRDA MOC10 Plots Analysis Taxa Level, Pooled Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

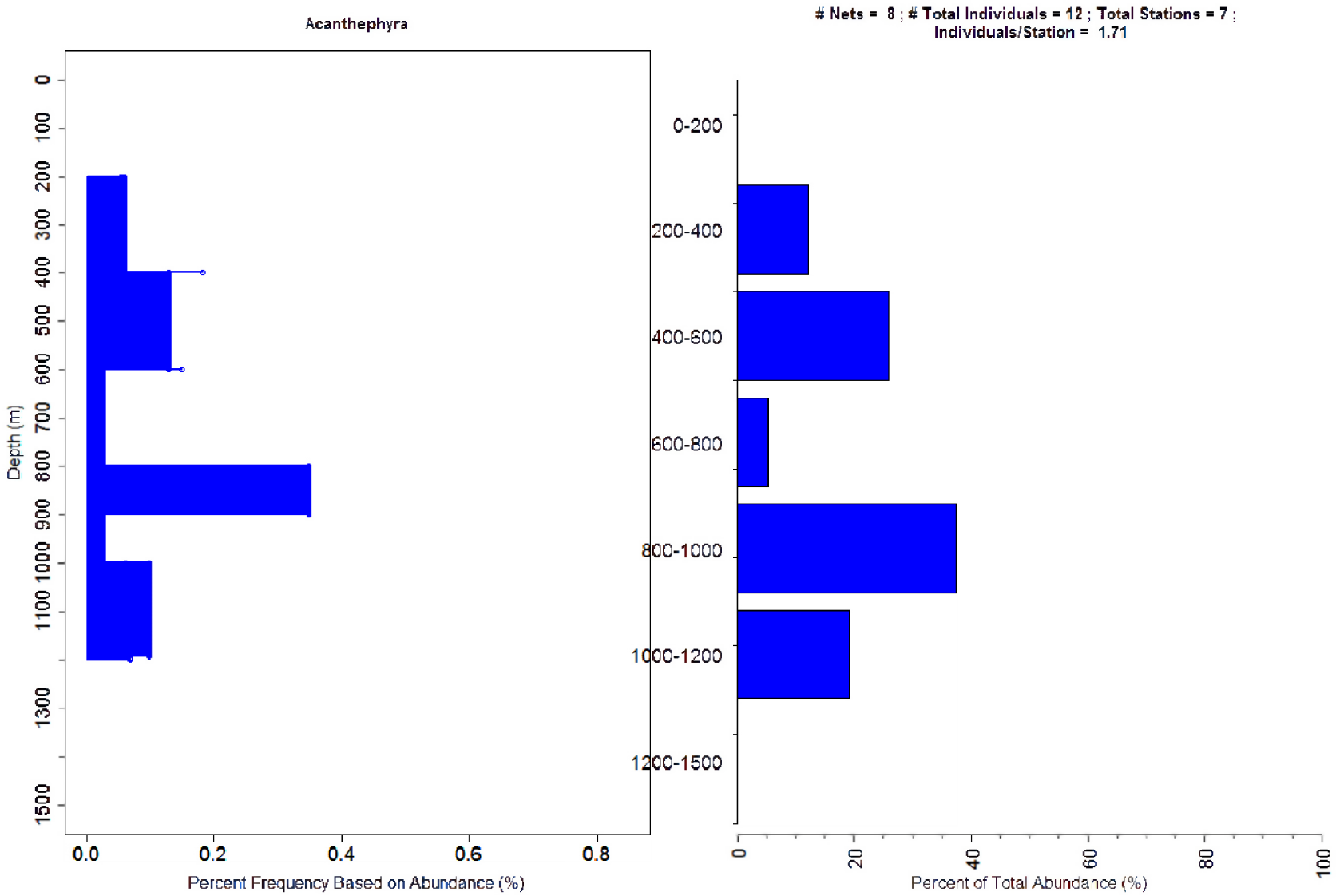
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879


Abylidae
Nets = 20 ; # Total Individuals = 71 ; Total Stations = 17 ;
Individuals/Station = 4.18
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

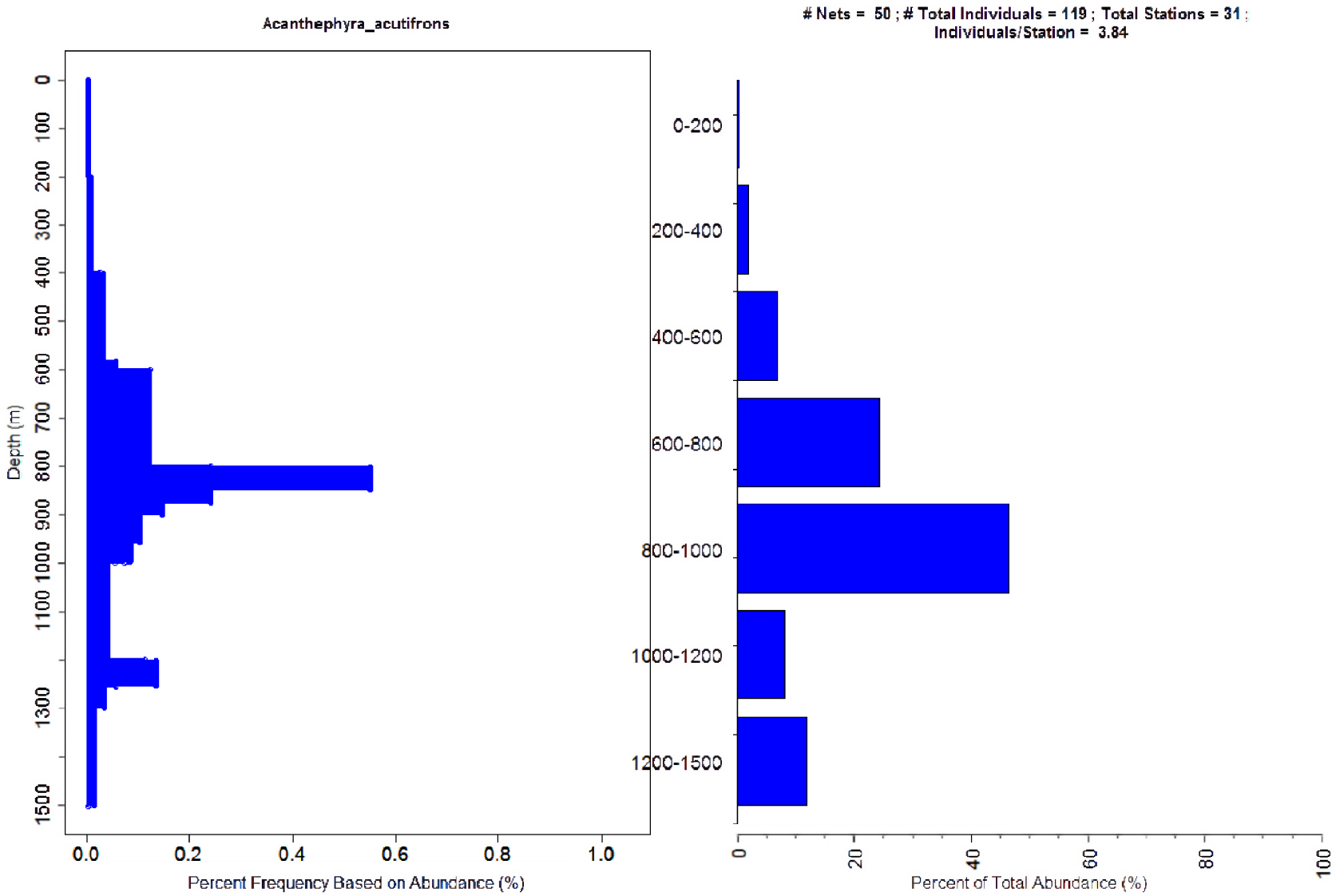
Abylidae



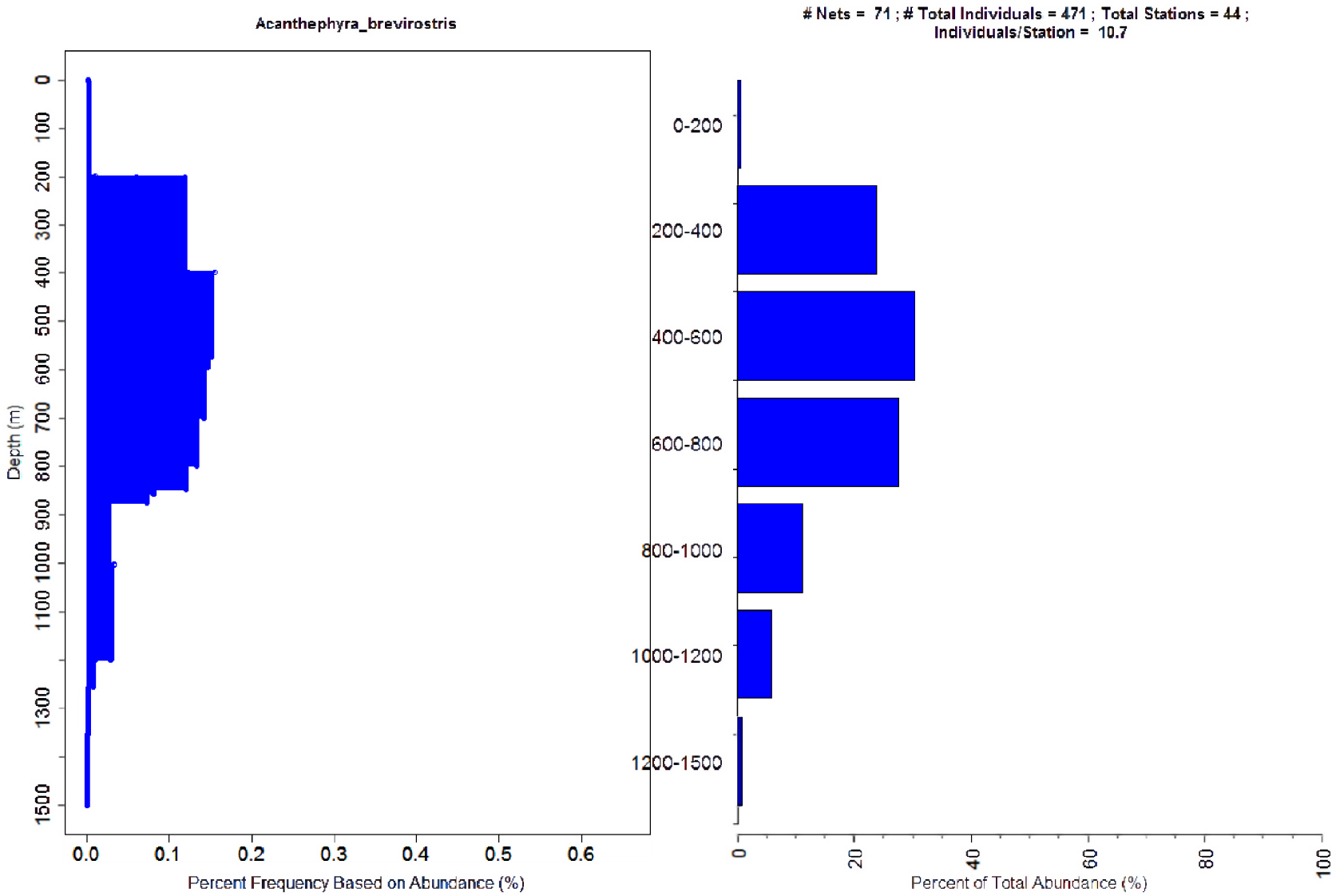
Abylopsis_tetragona



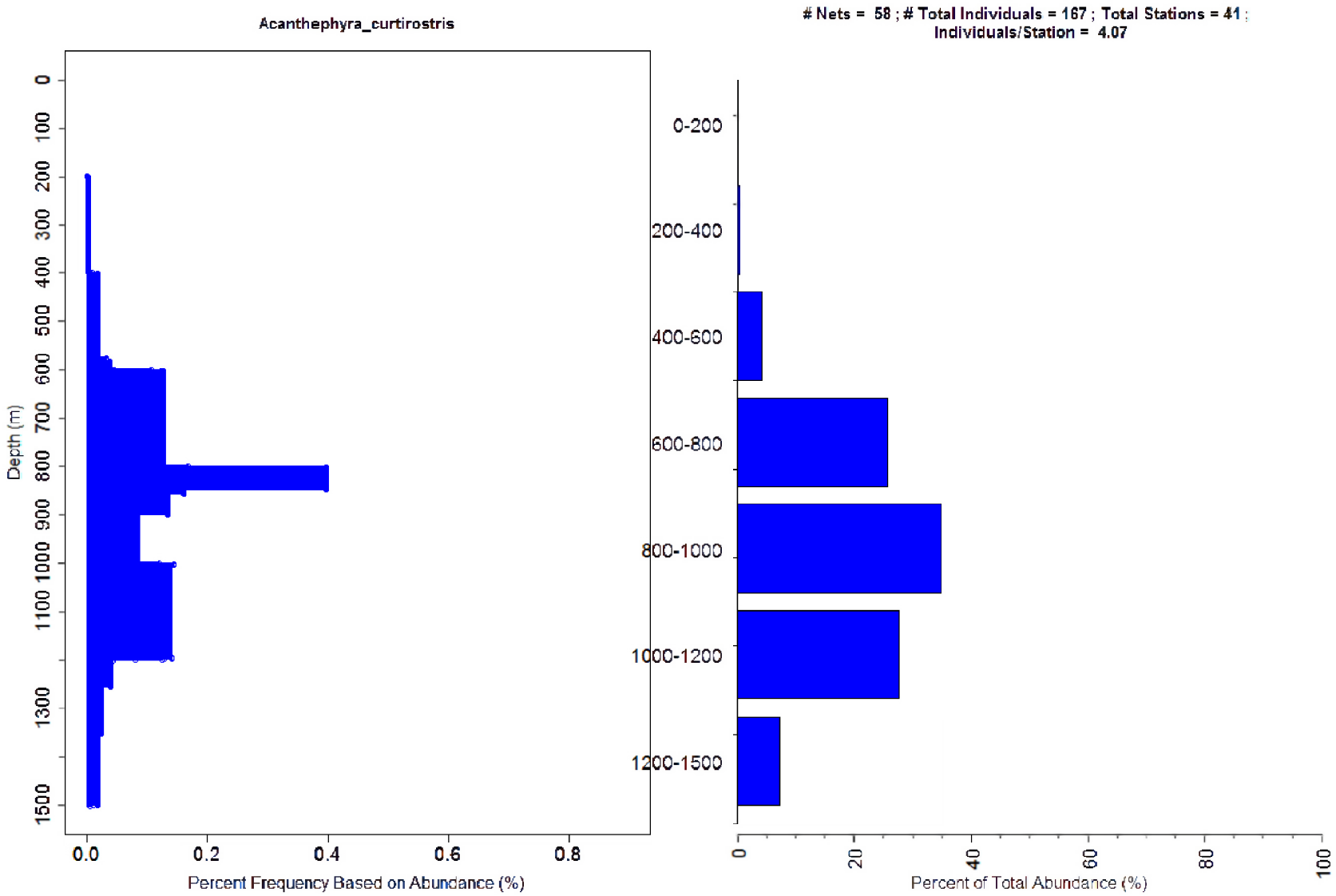
Acanthephyra



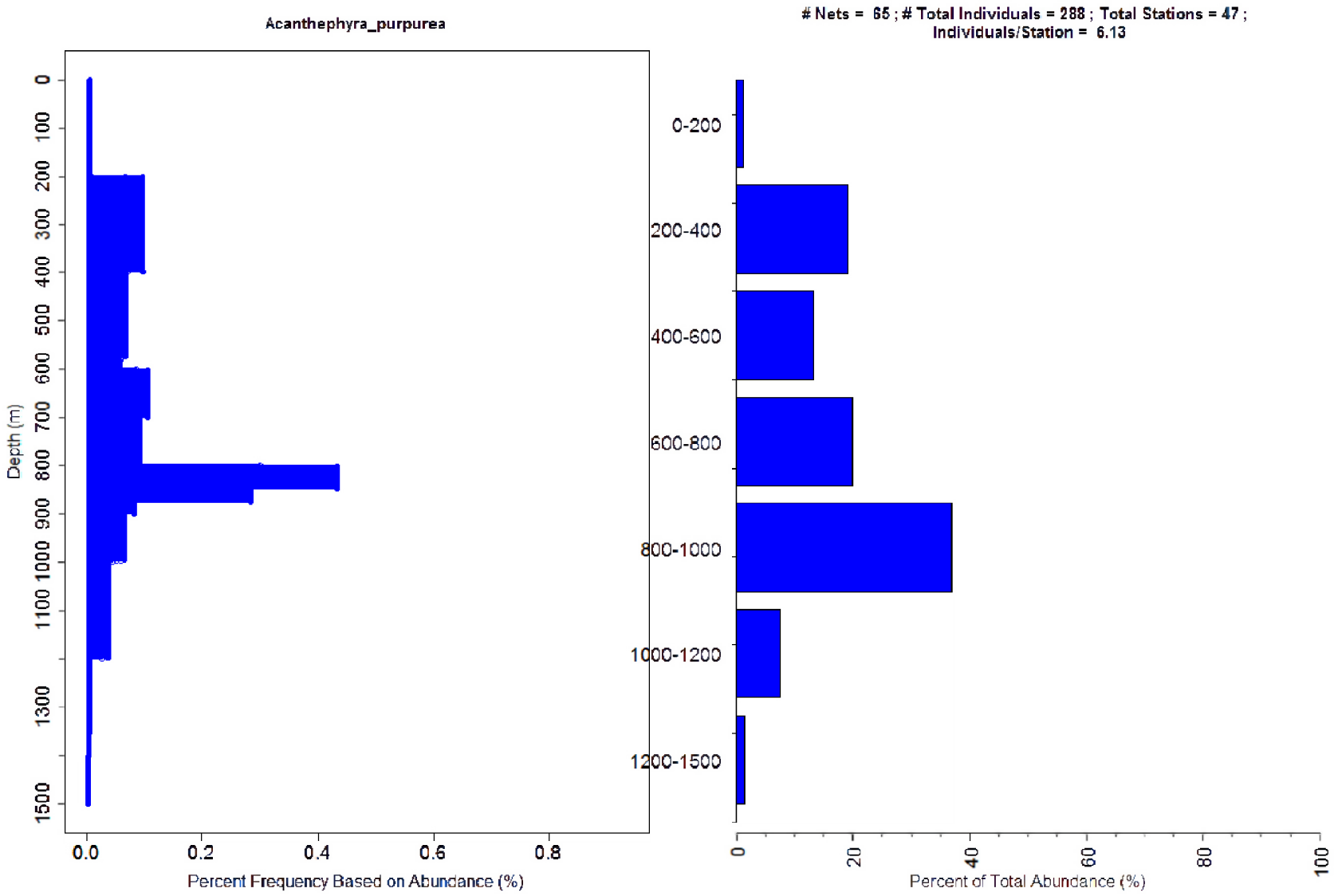
Acanthephyra_acutifrons



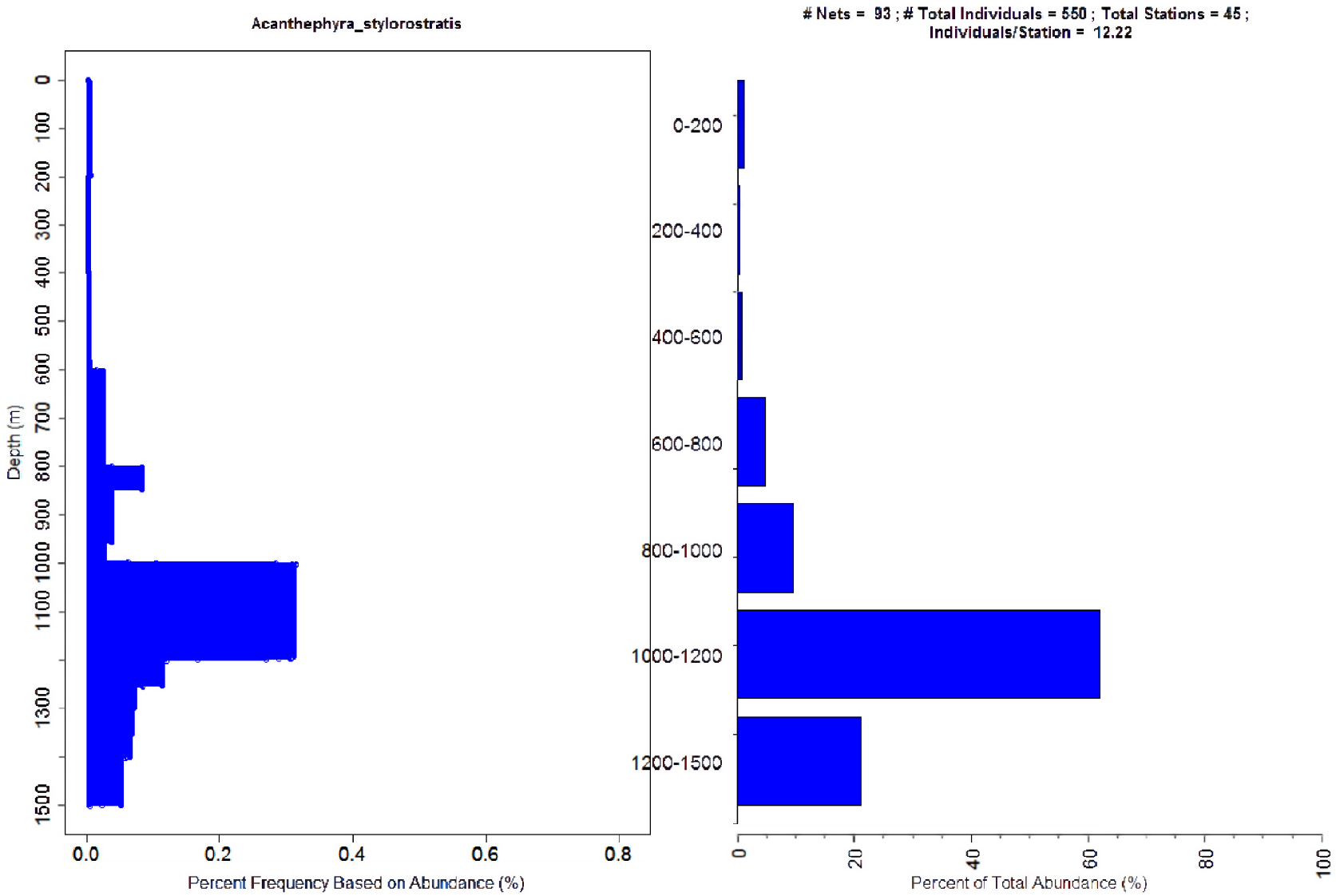
Acanthephyra_brevirostris



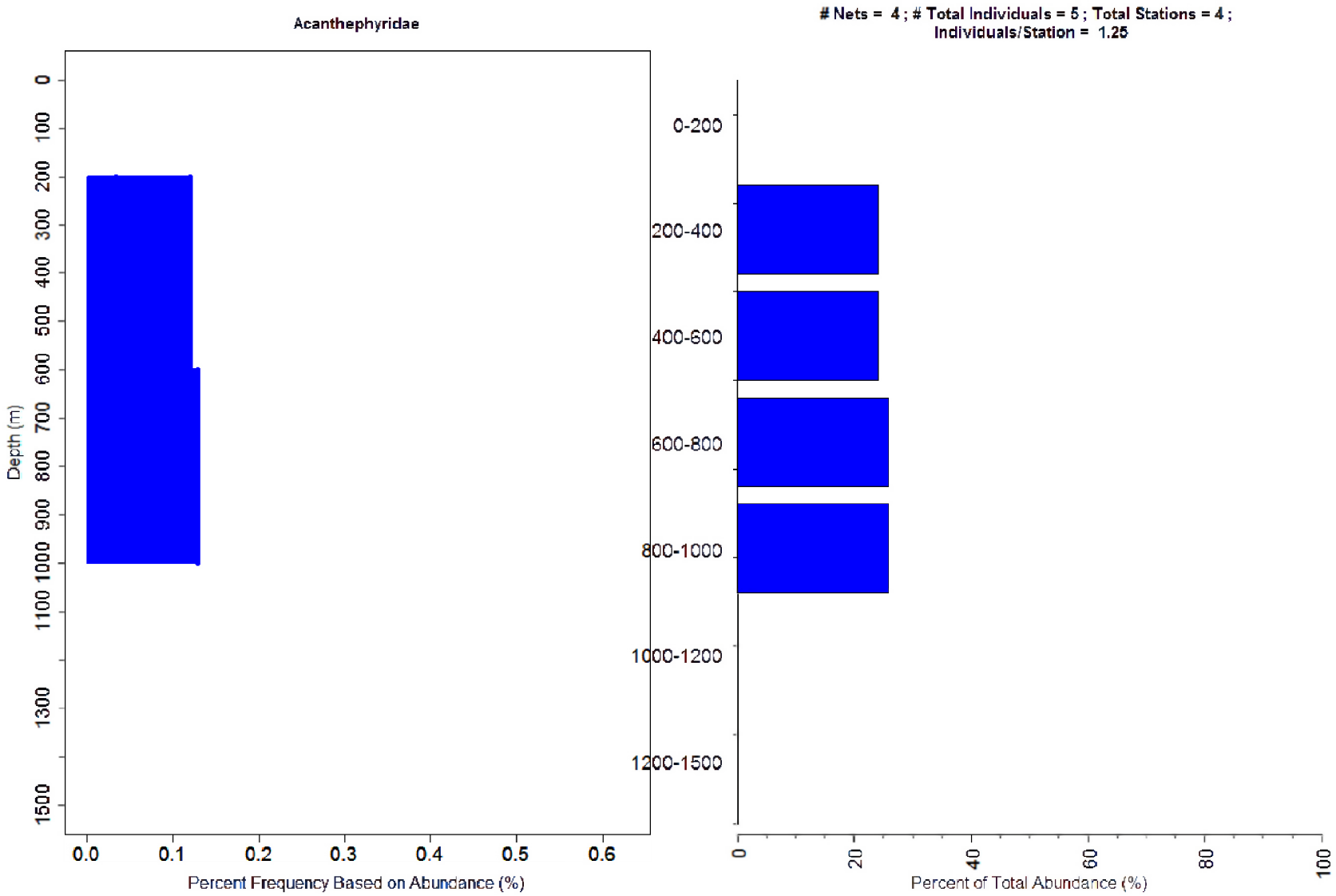
Acanthephyra_curtirostris



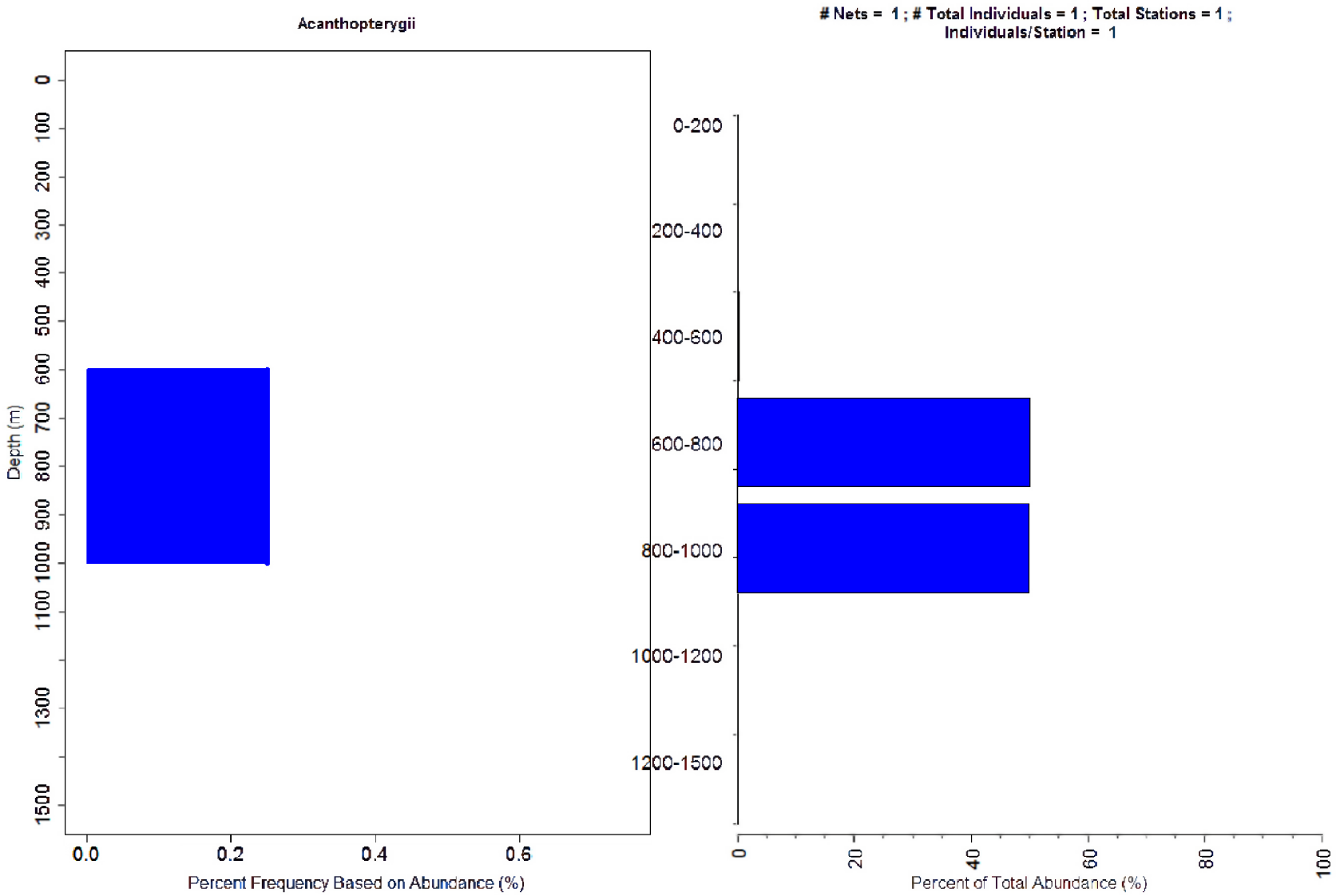
Acanthephyra_purpurea



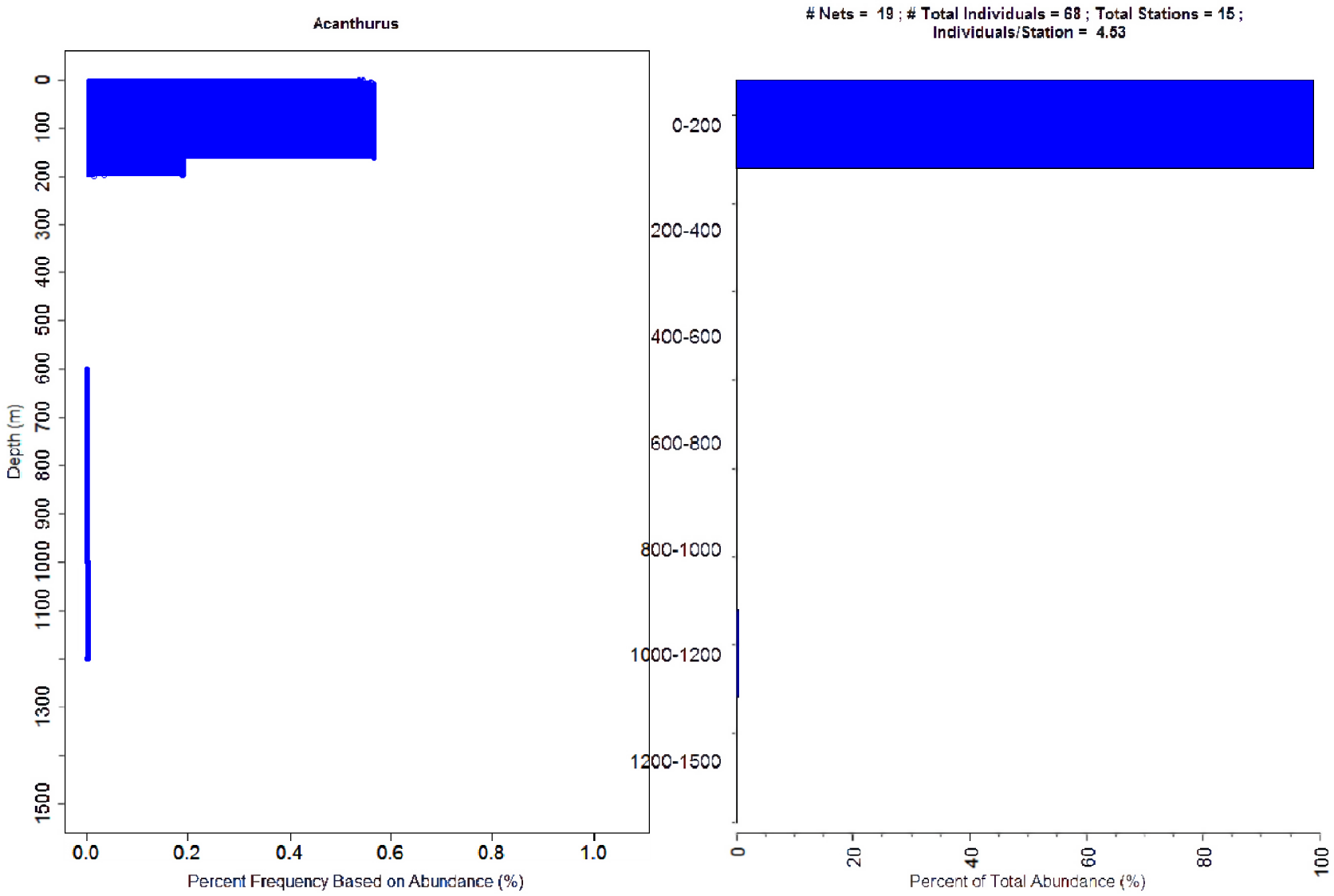
Acanthephyra_stylorostratis



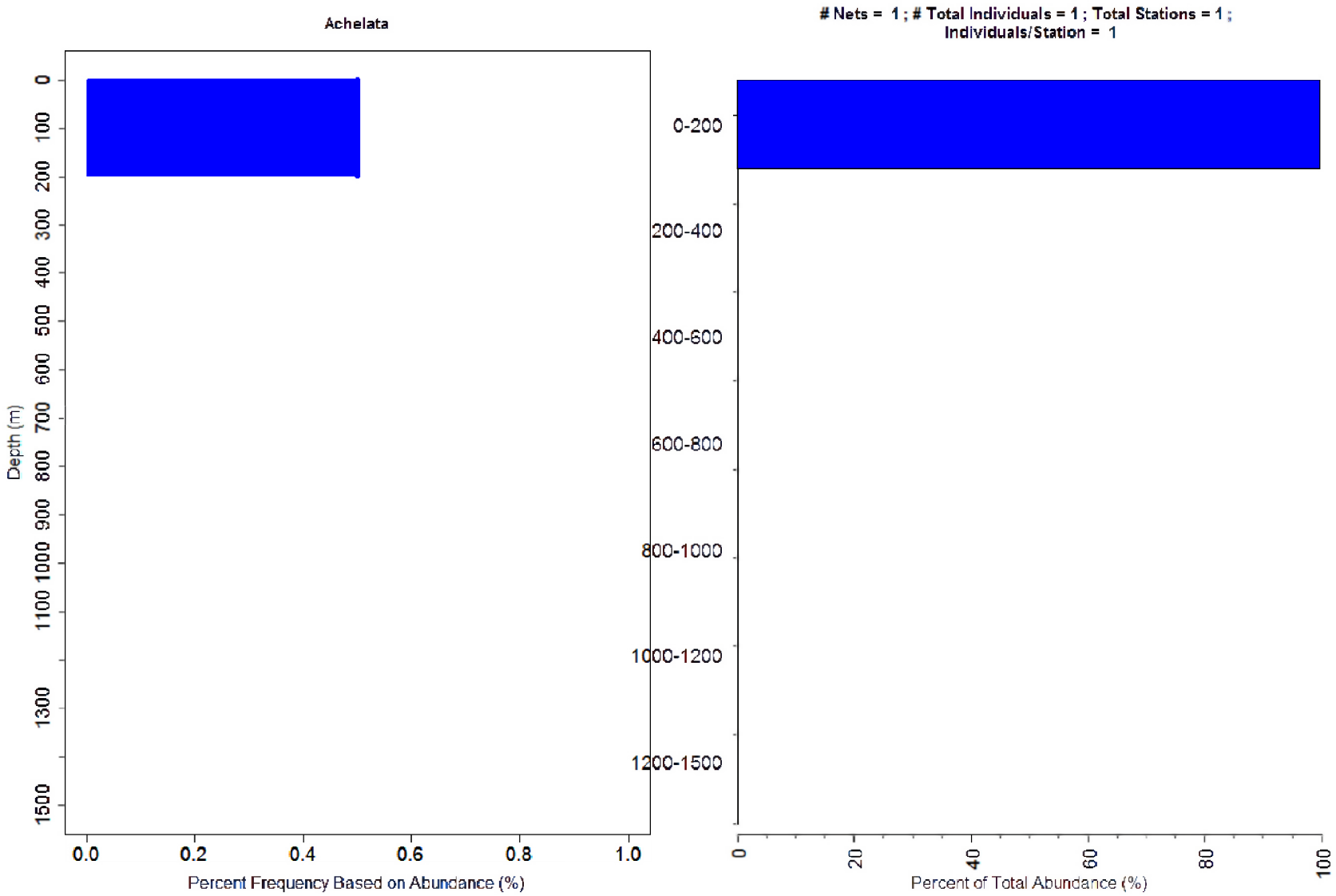
Acanthephyridae



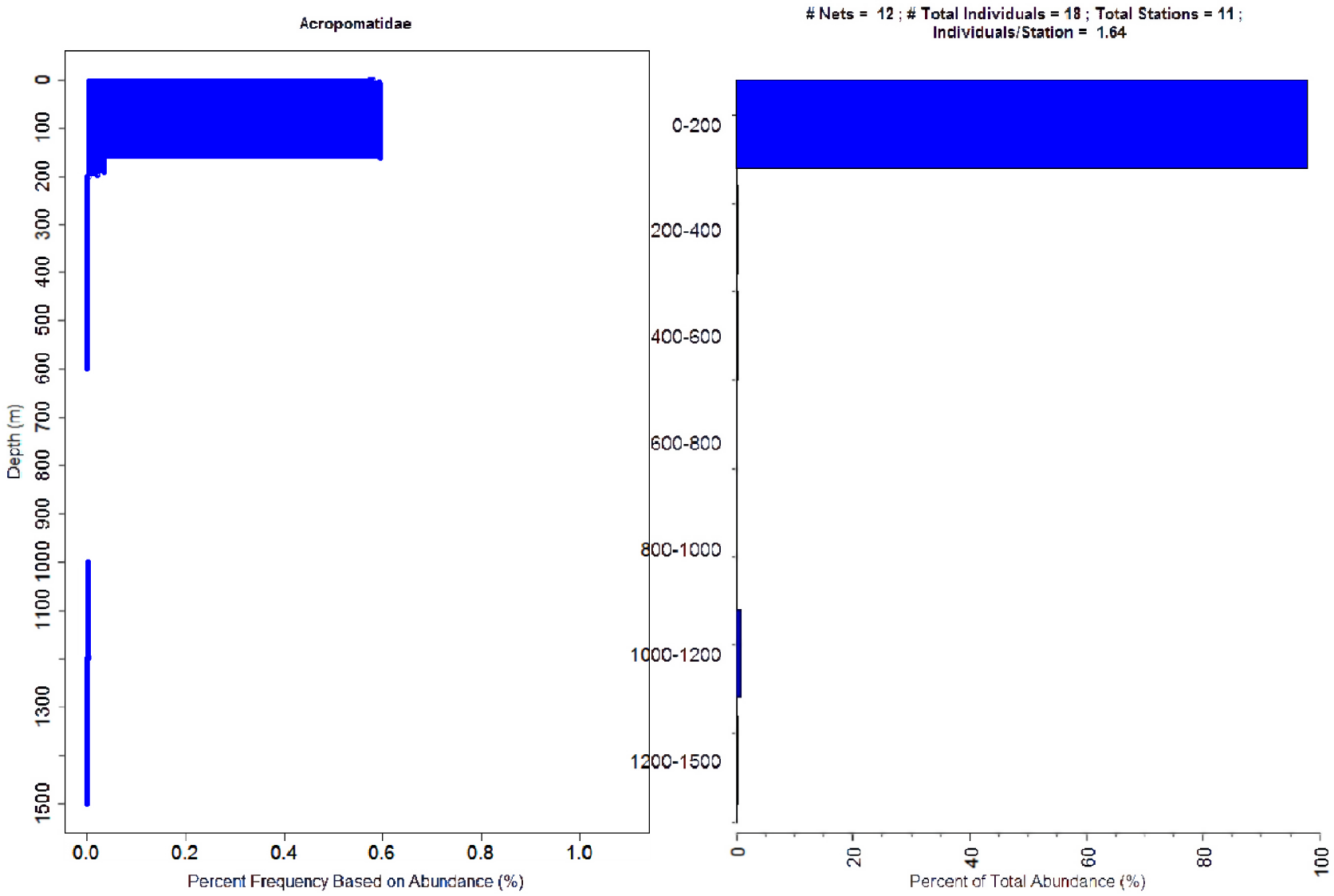
Acanthopterygii


Acanthurus
Nets = 19 ; # Total Individuals = 68 ; Total Stations = 15 ;
Individuals/Station = 4.53
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

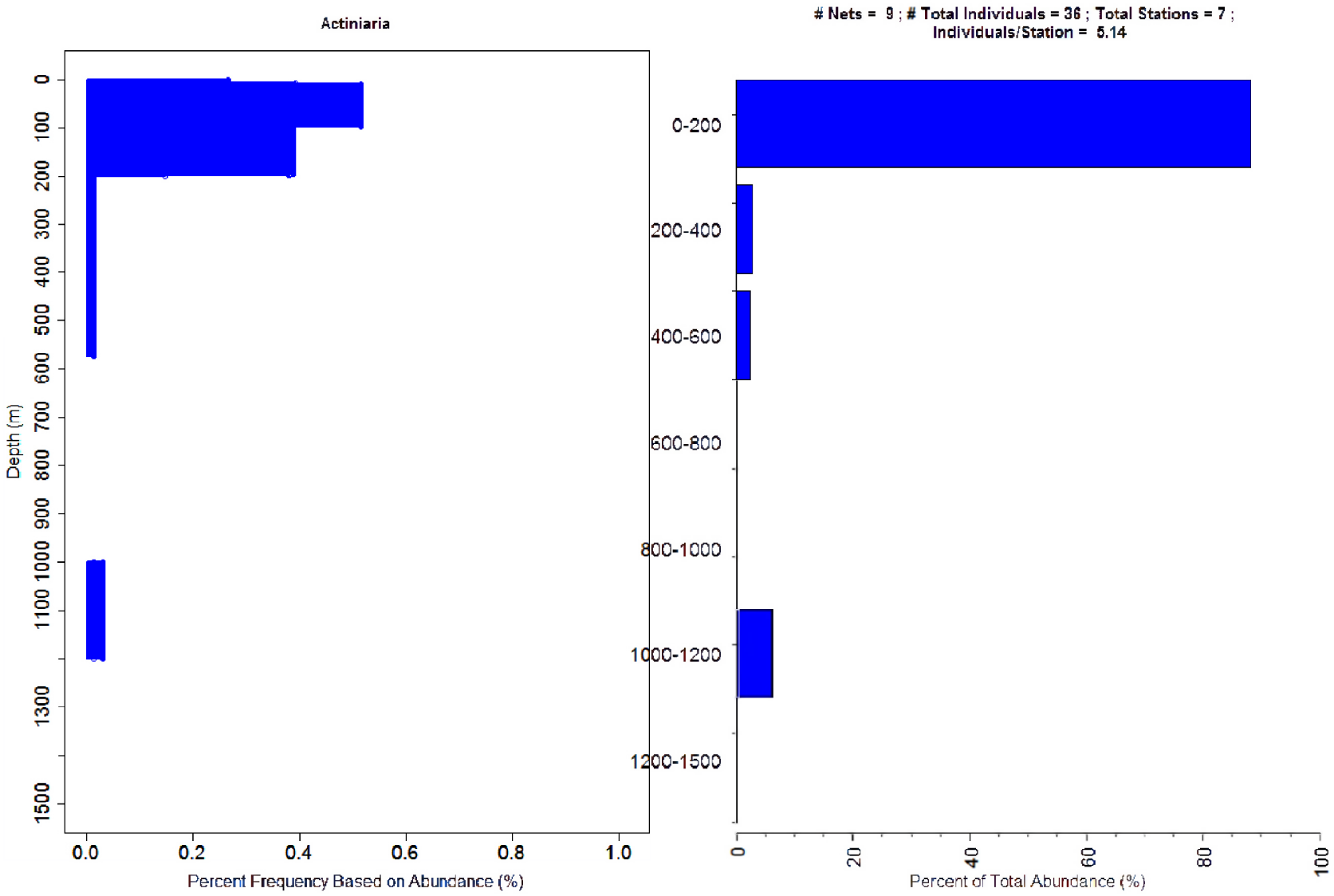
Acanthurus


Achelata
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

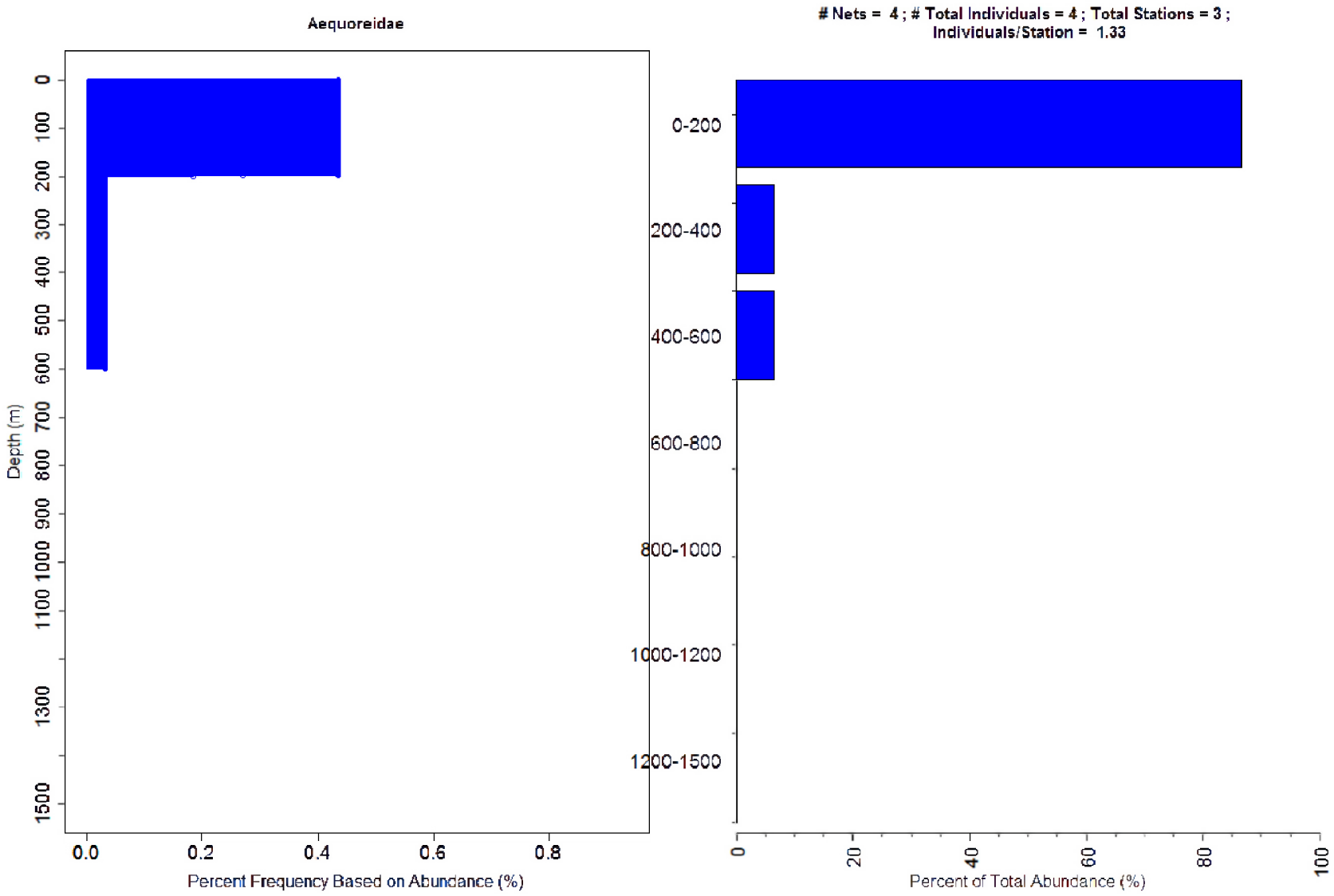
Achelata



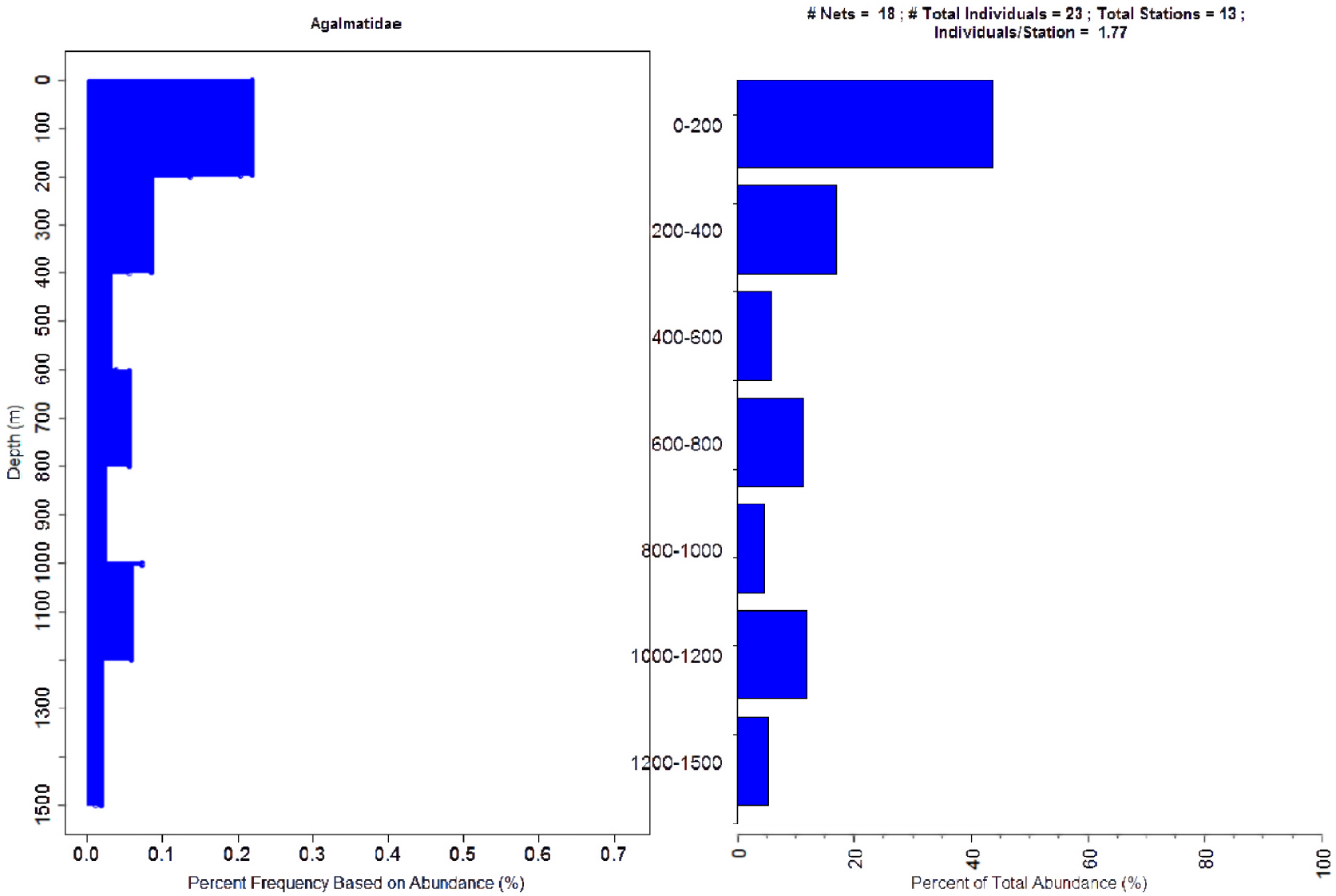
Acropomatidae


Actiniaria
Nets = 9 ; # Total Individuals = 36 ; Total Stations = 7 ;
Individuals/Station = 5.14
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

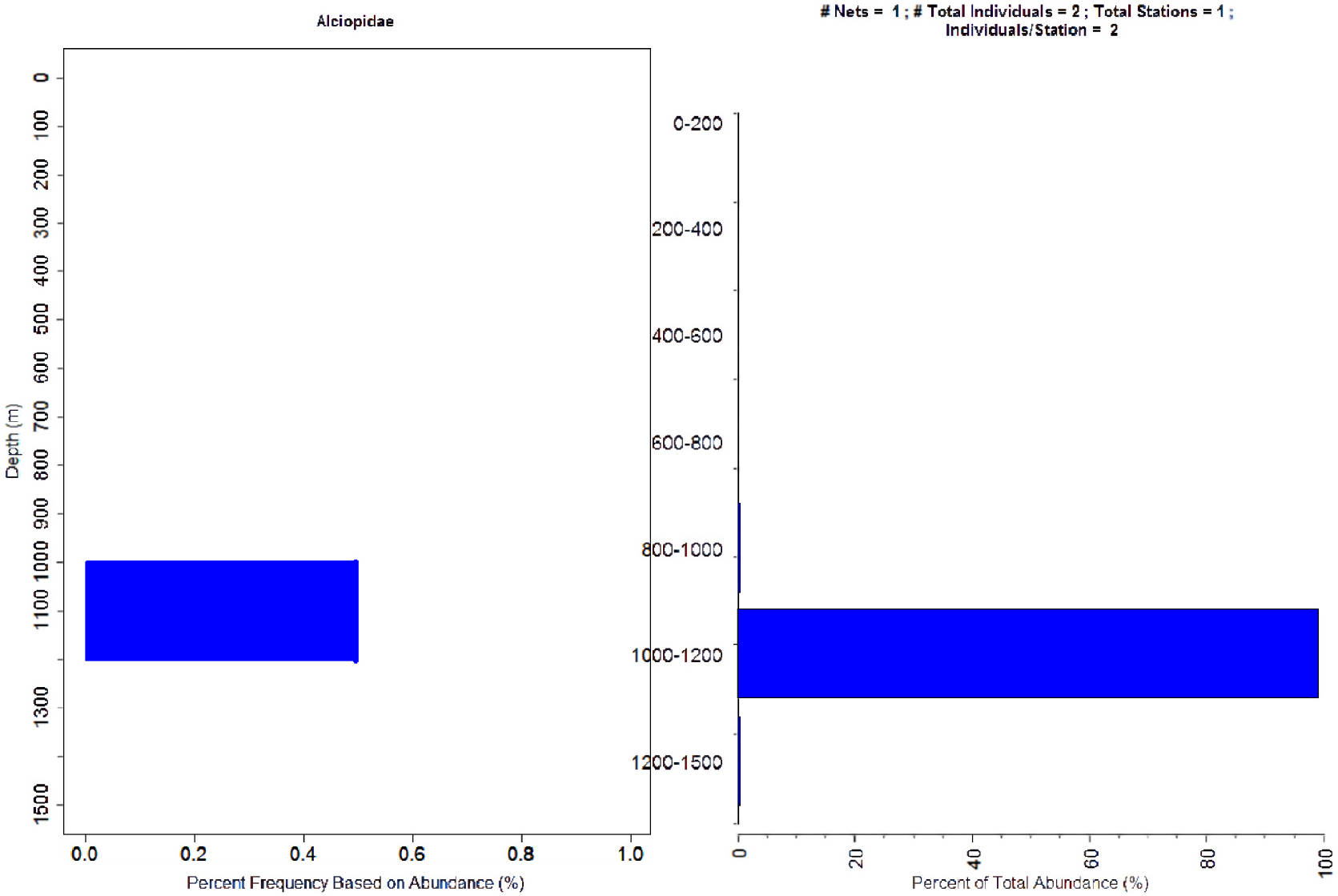
Actiniaria



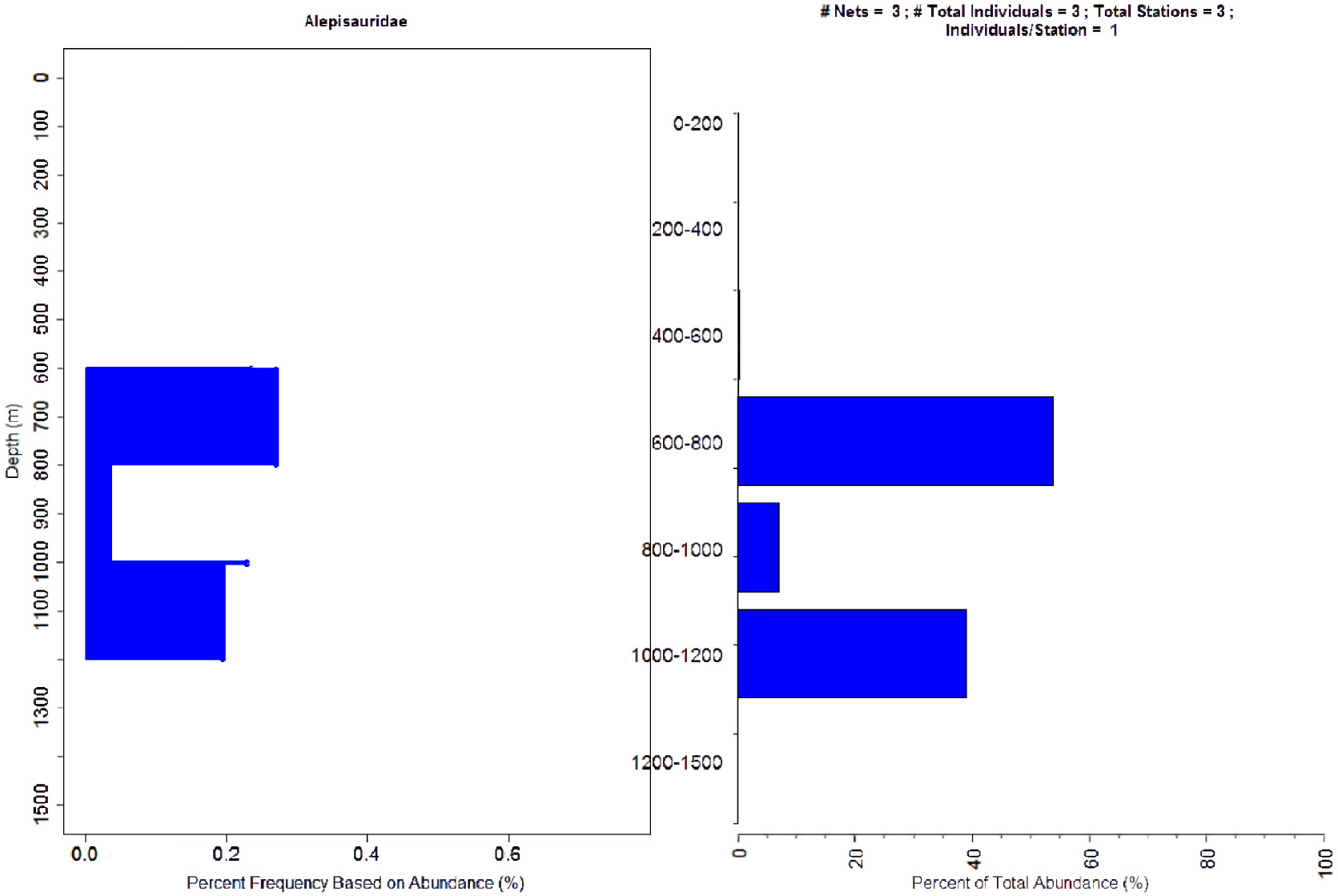
Aequoreidae



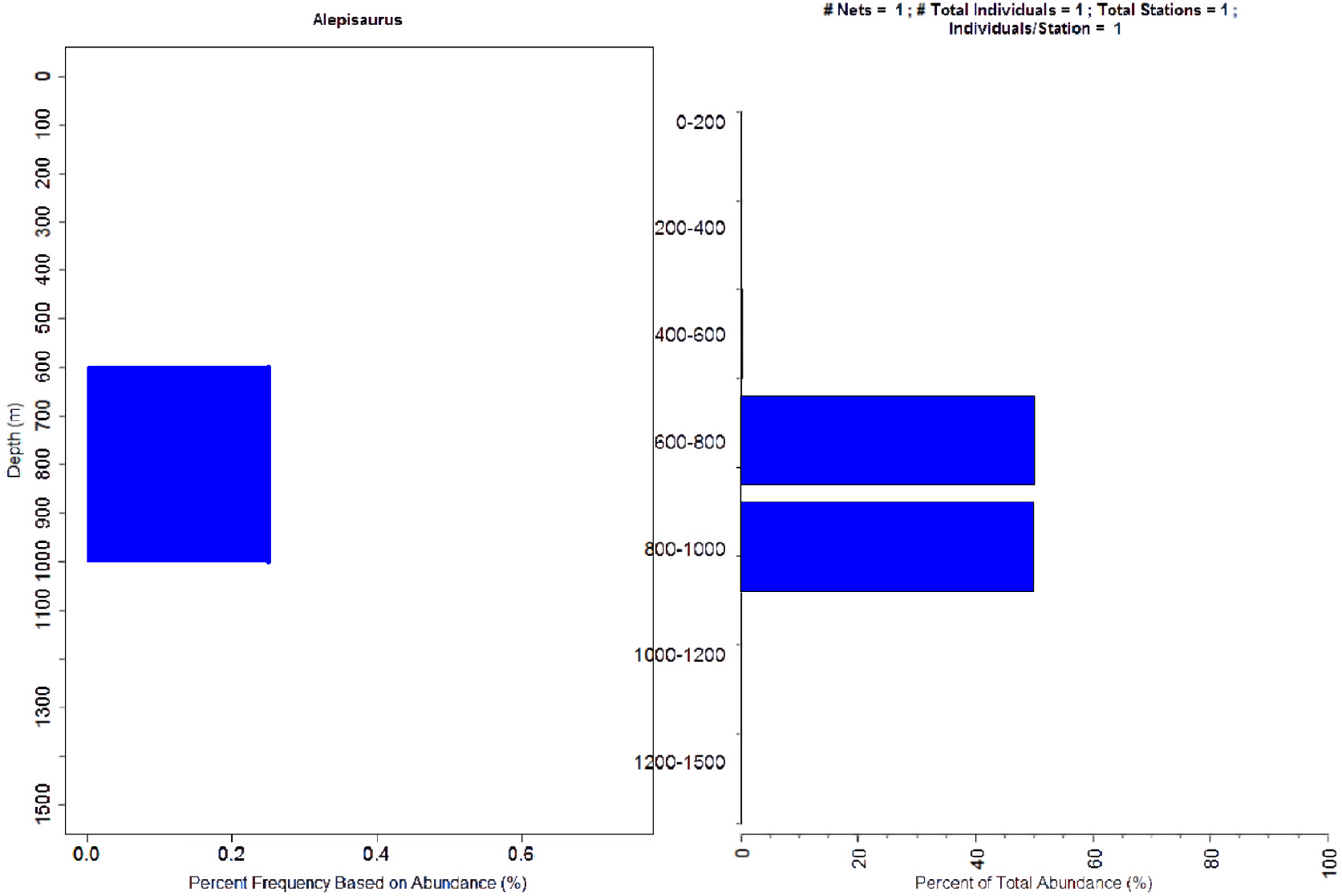
Agalmatidae


Alciopidae
Nets = 1 ; # Total Individuals = 2 ; Total Stations = 1 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

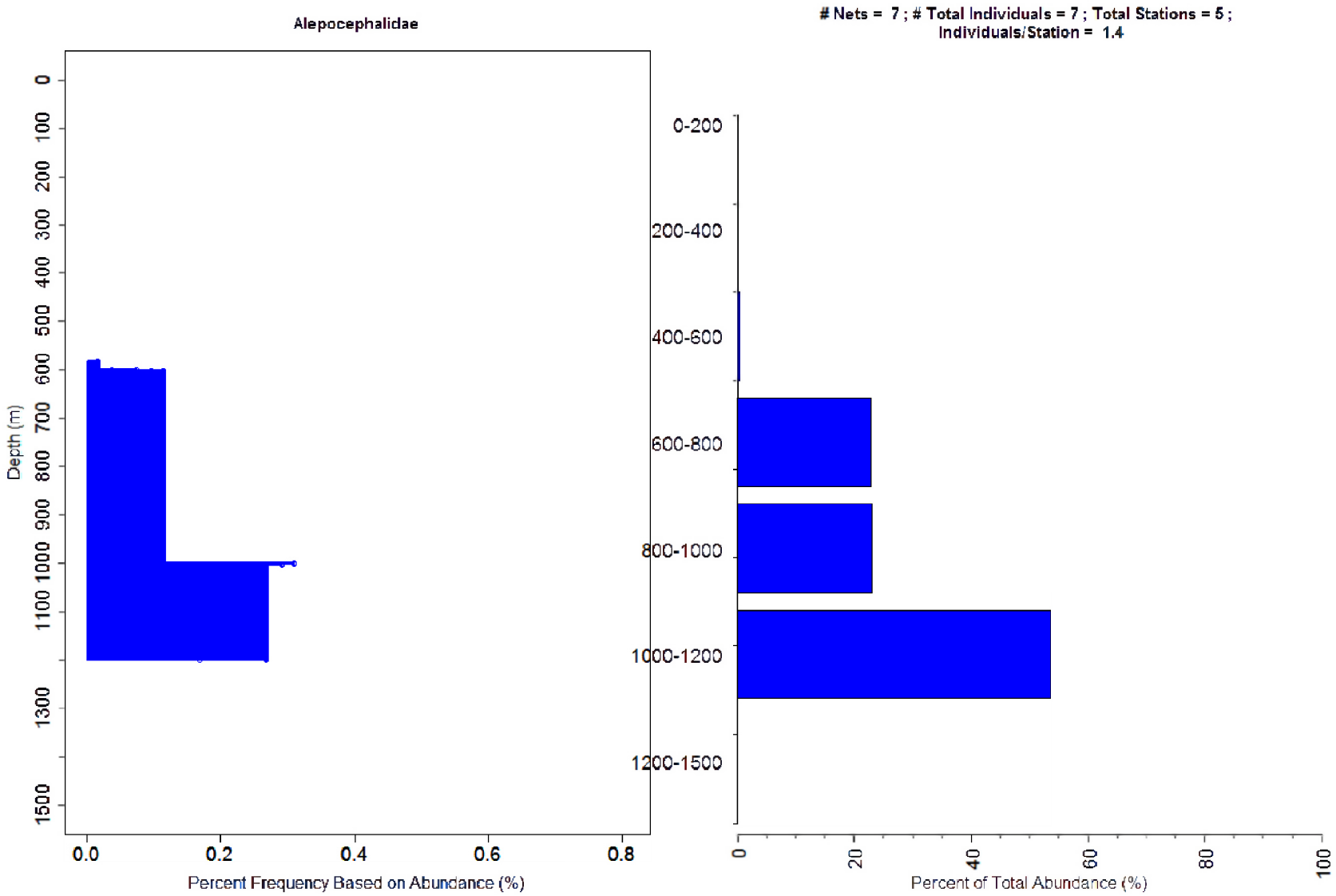
Alciopidae



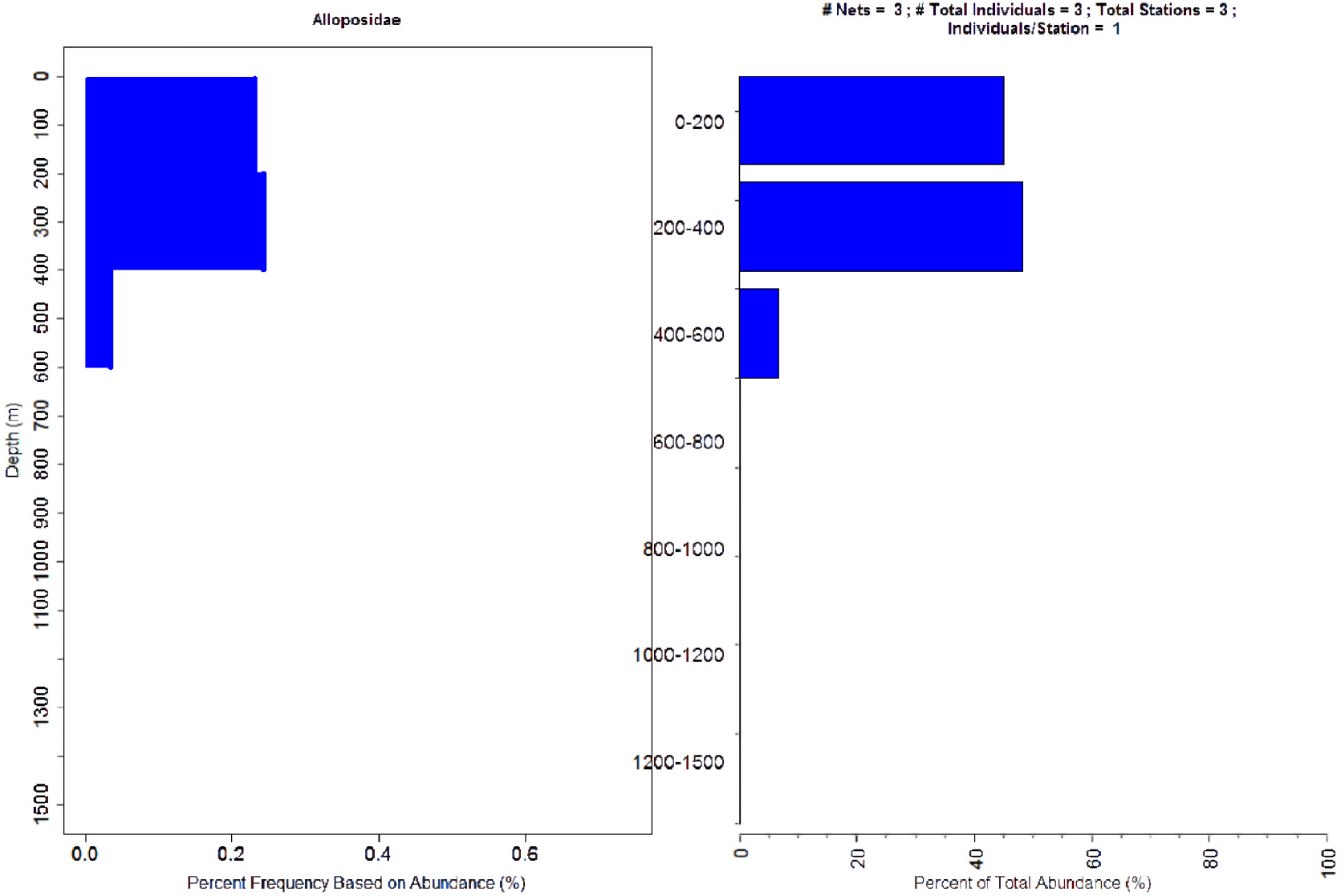
Alepisauridae



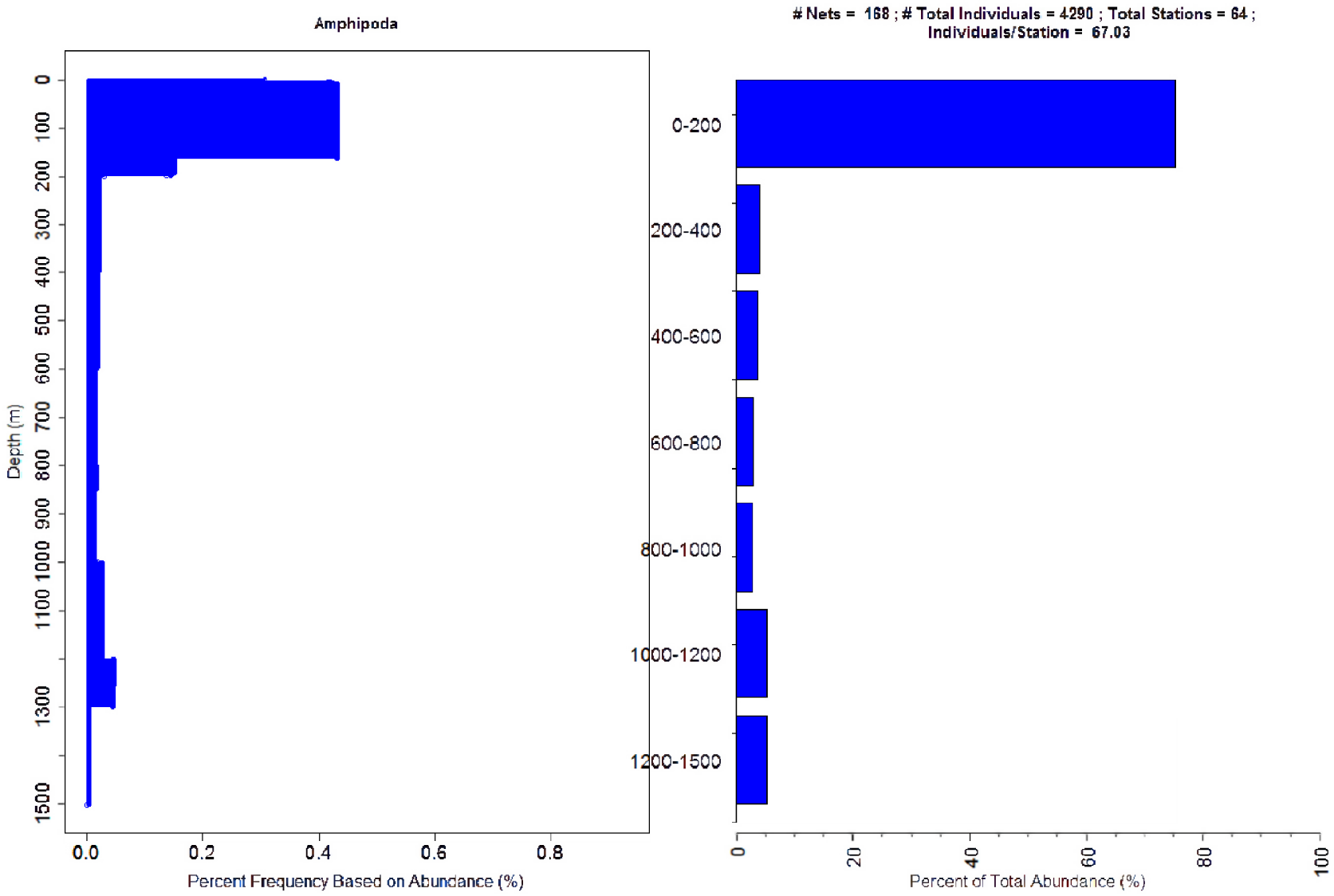
Alepisaurus



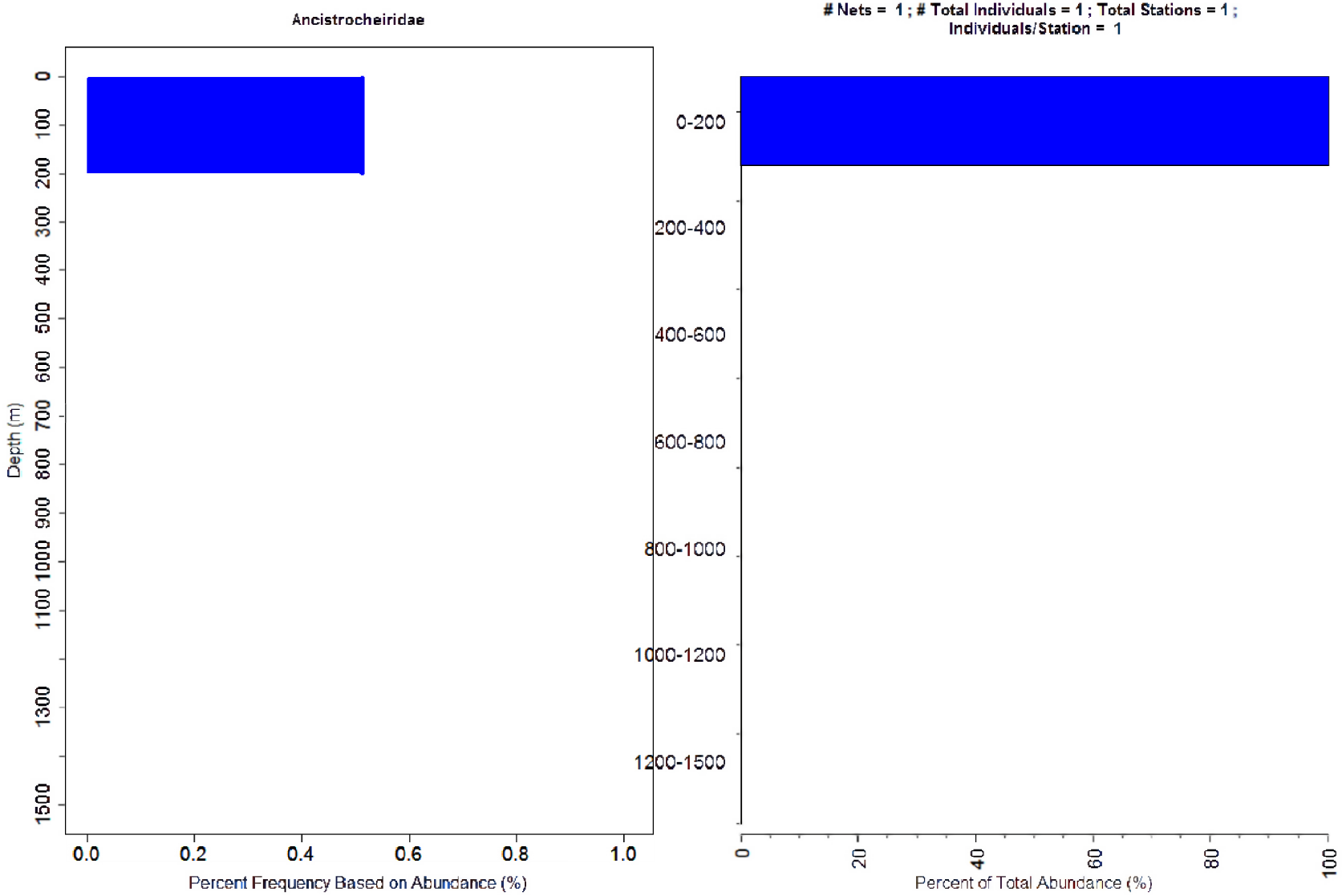
Alepocephalidae



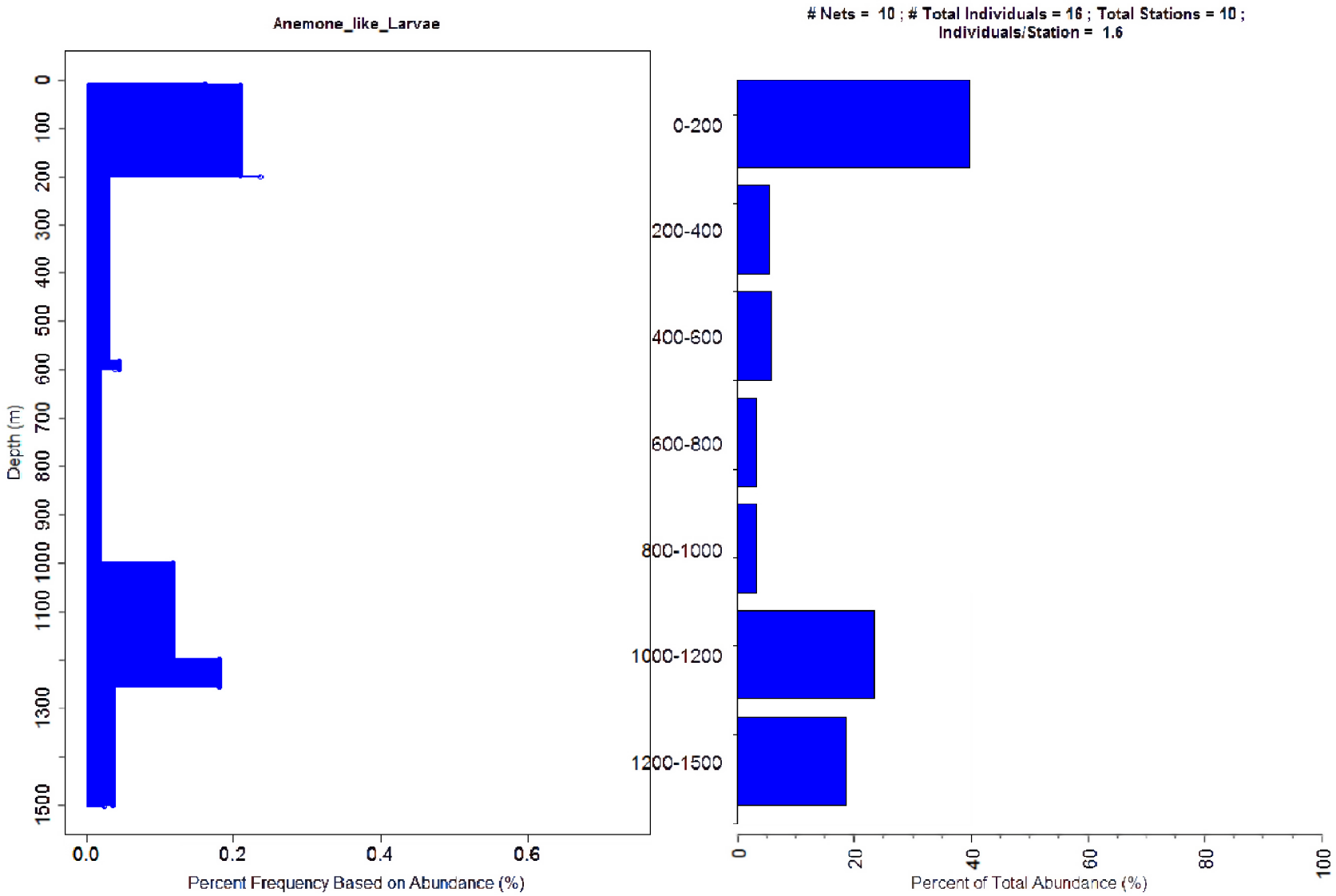
Alloposidae


Amphipoda
Nets = 168 ; # Total Individuals = 4290 ; Total Stations = 64 ;
Individuals/Station = 67.03
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

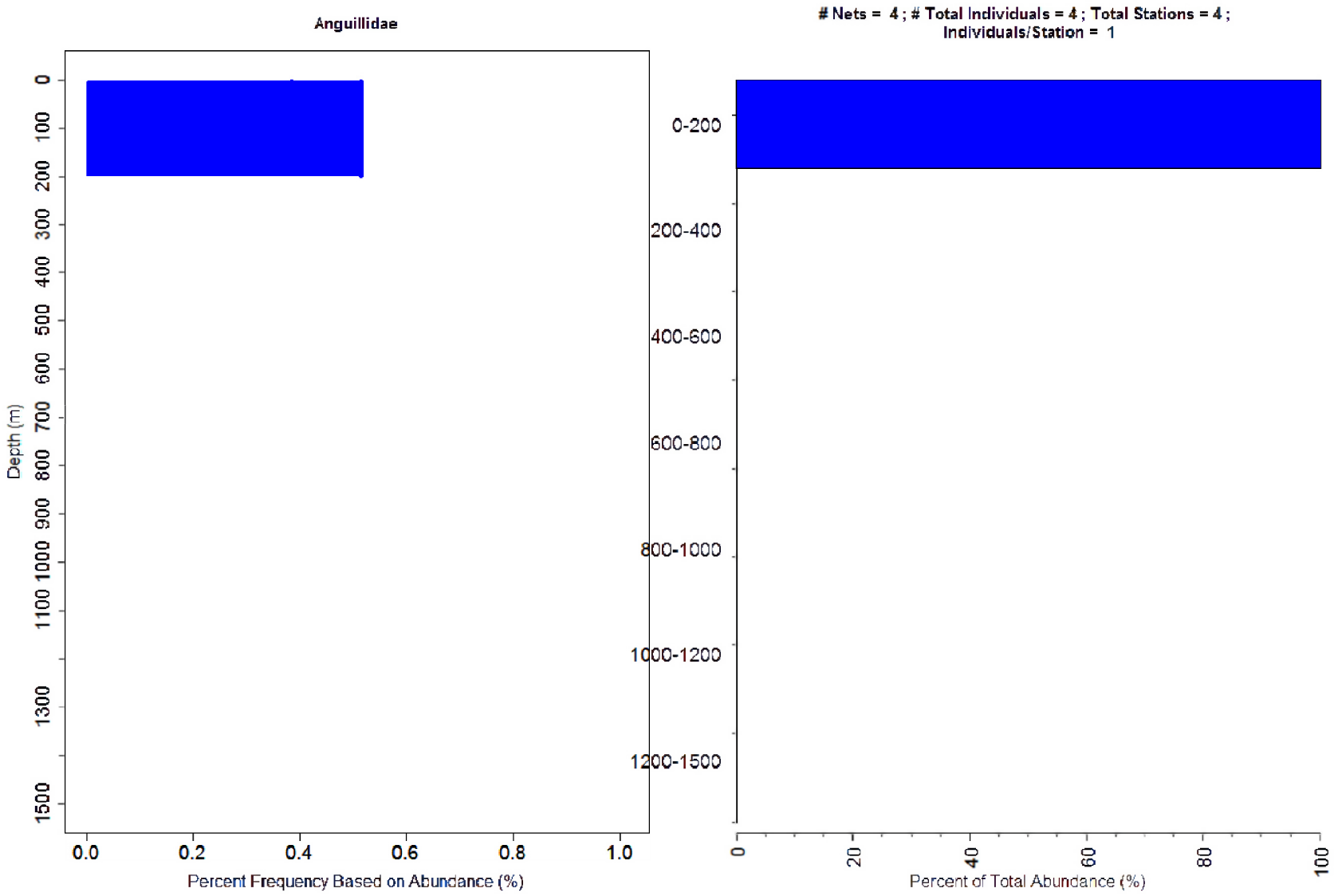
Amphipoda



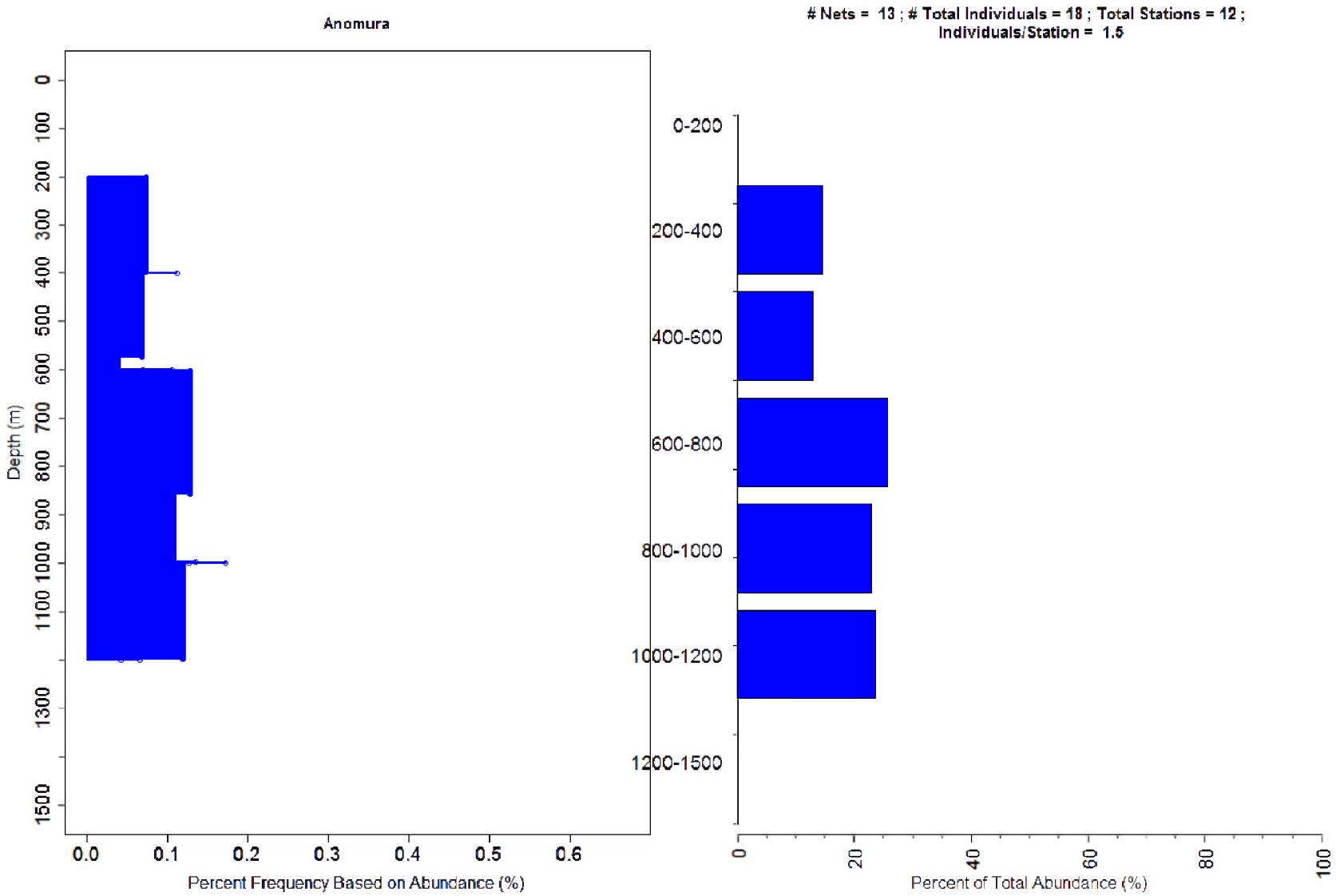
Ancistrocheiridae



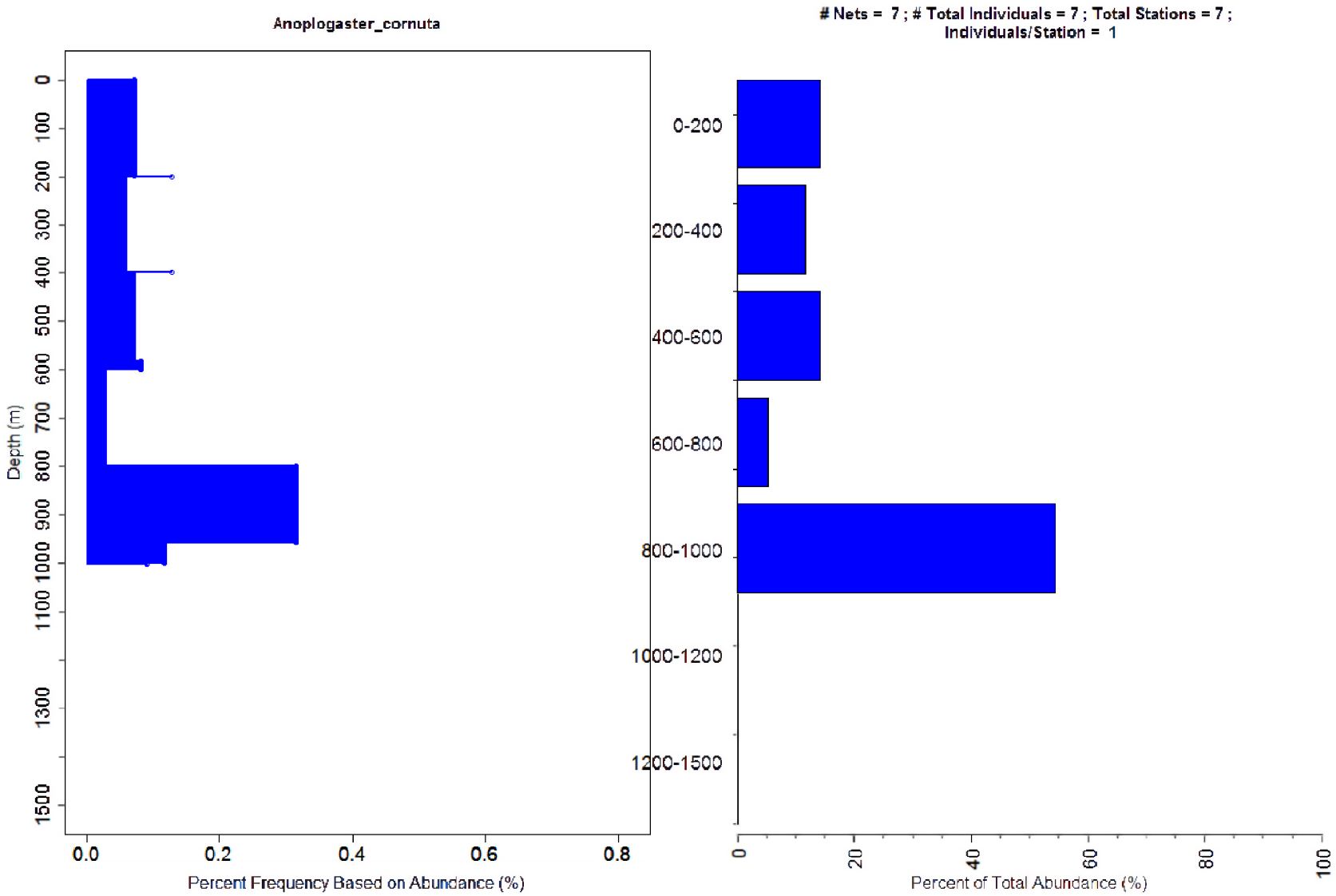
Anemone_like_Larvae



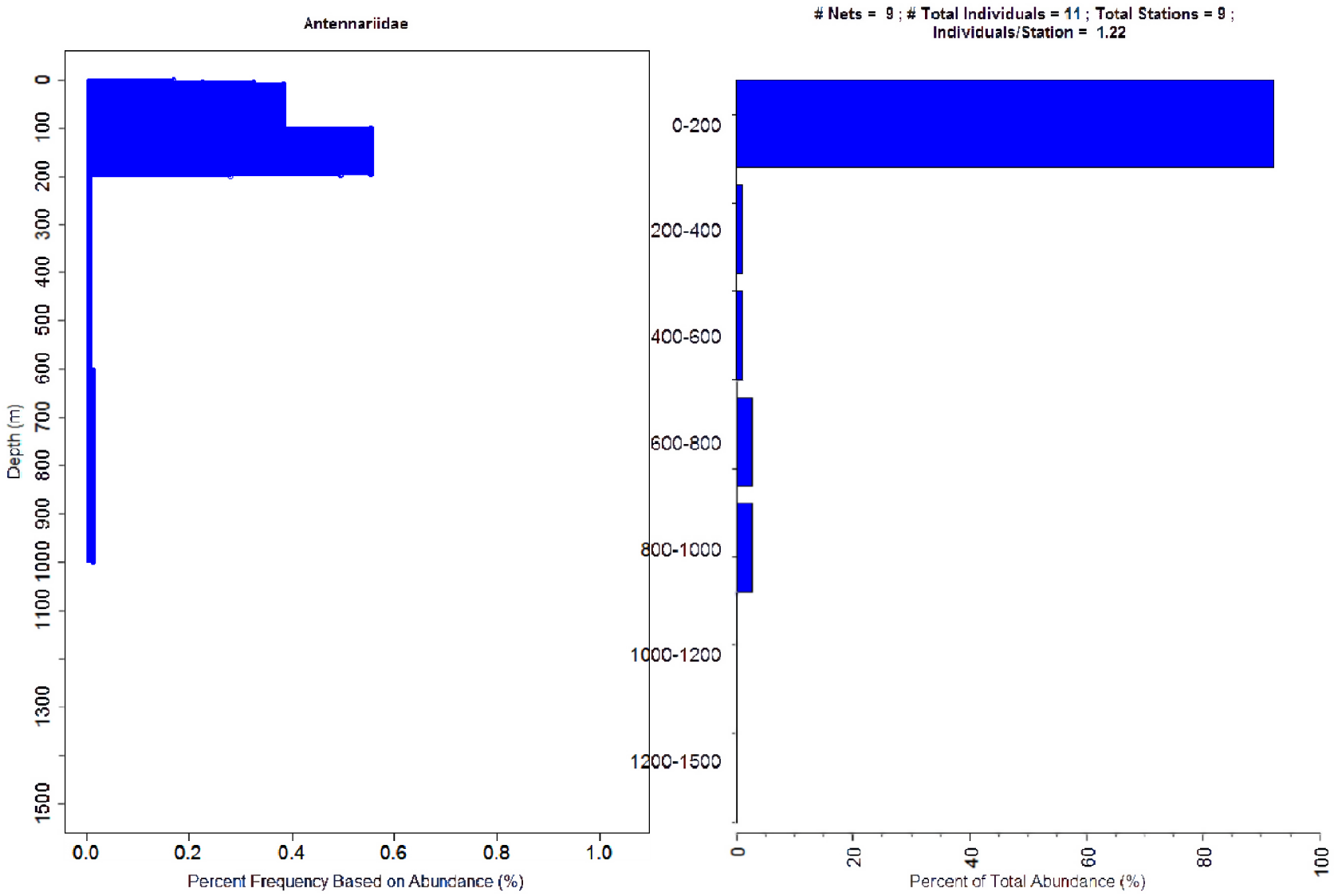
Anguillidae


Anomura
Nets = 13 ; # Total Individuals = 18 ; Total Stations = 12 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

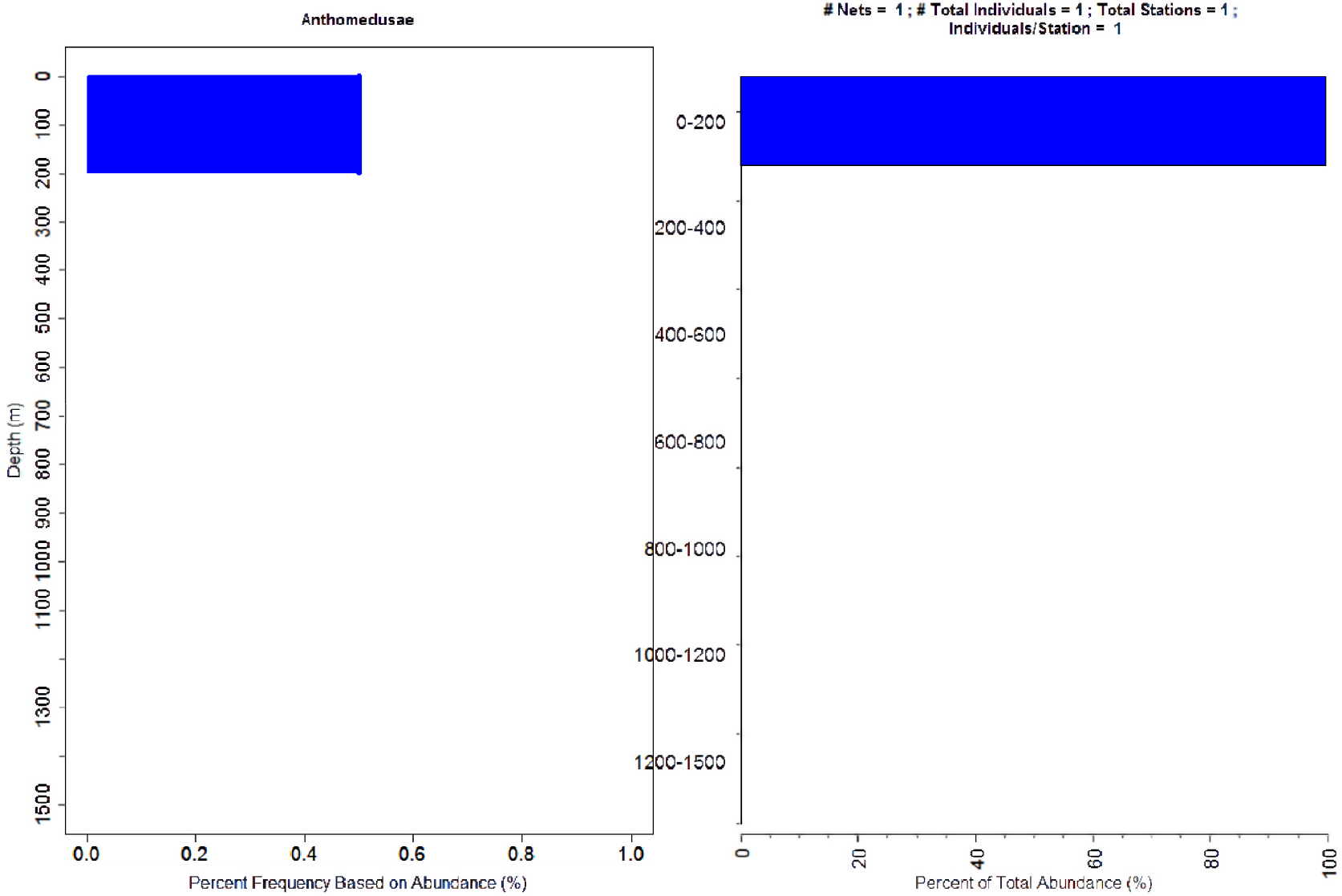
Anomura



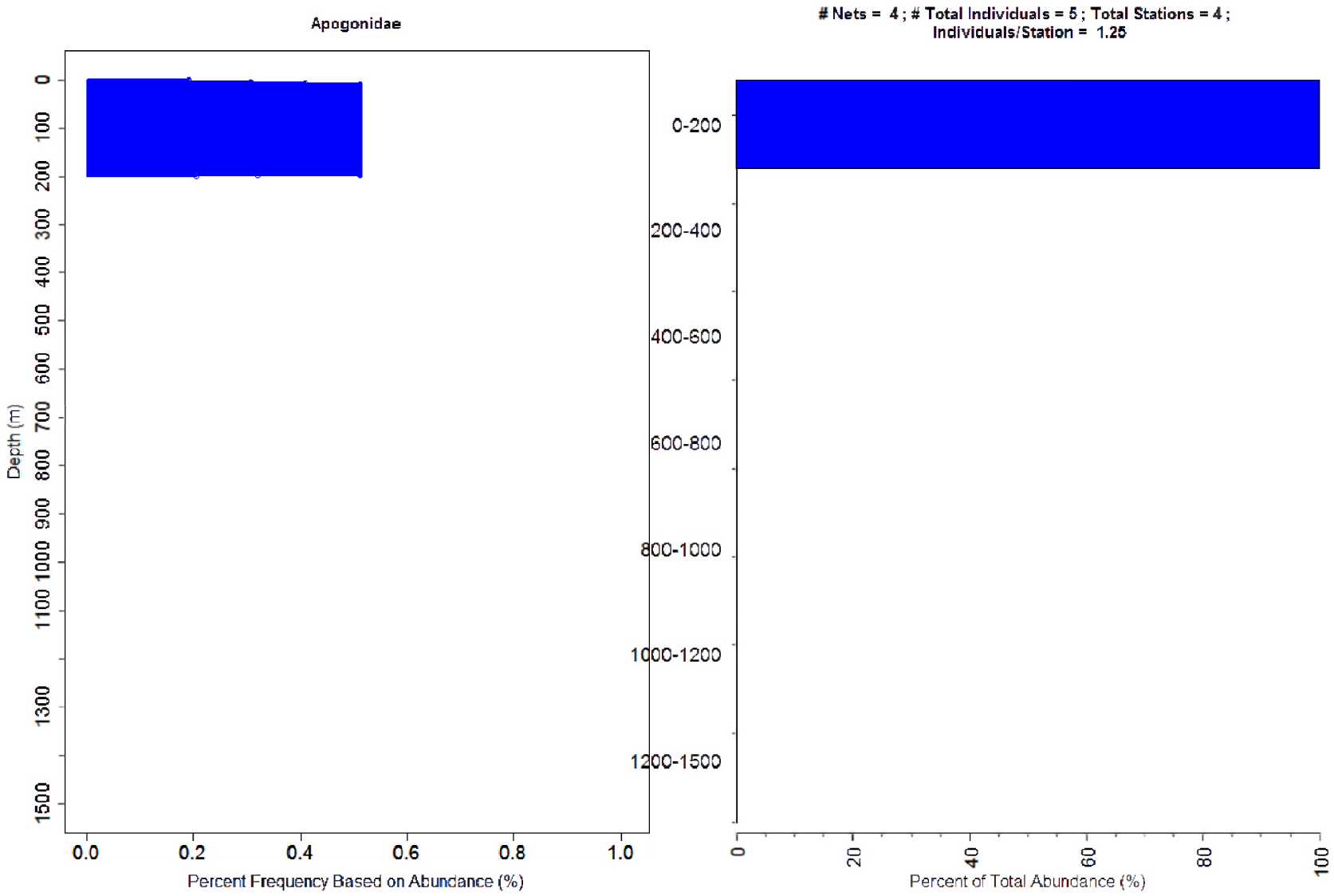
Anoplogaster_cornuta



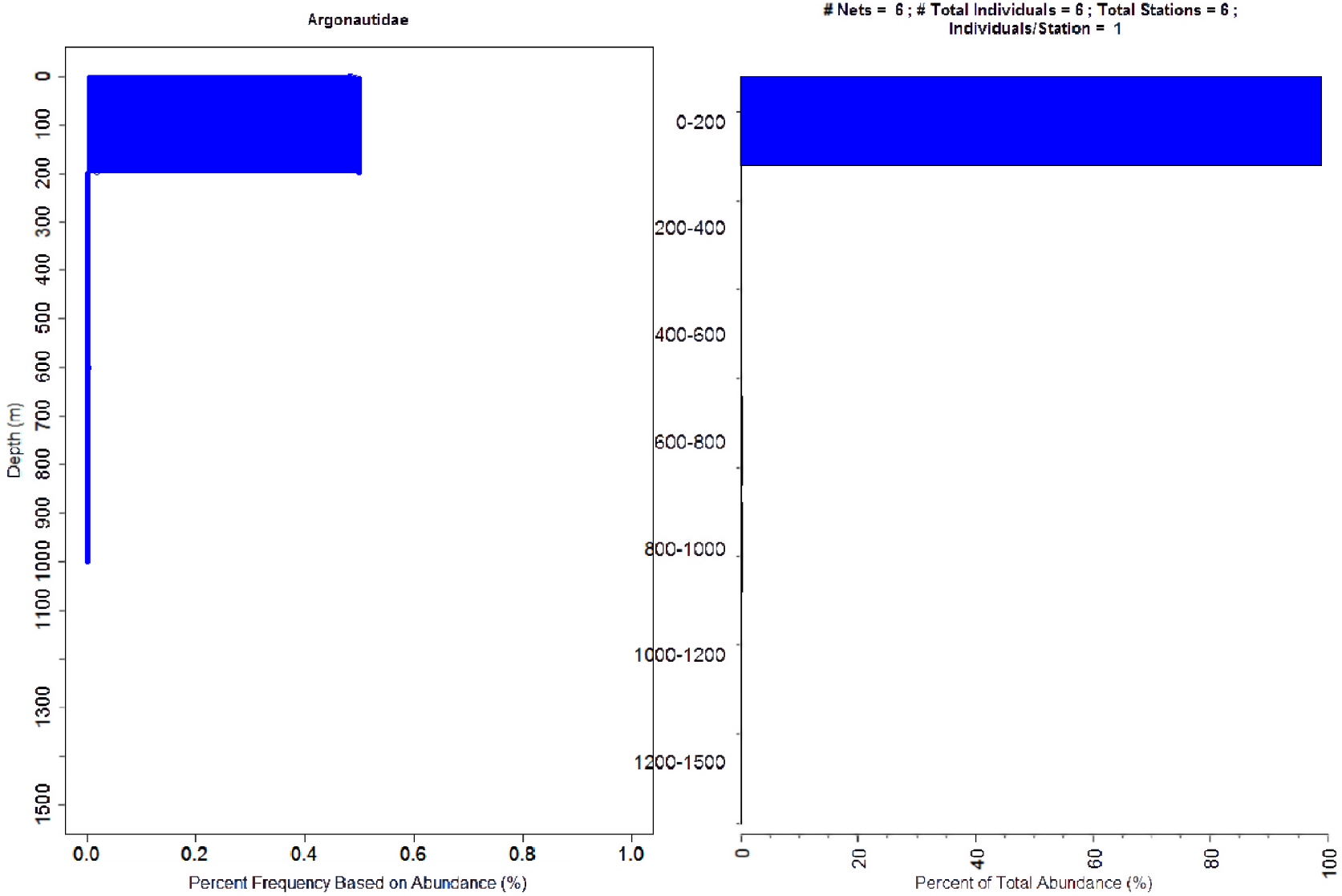
Antennariidae



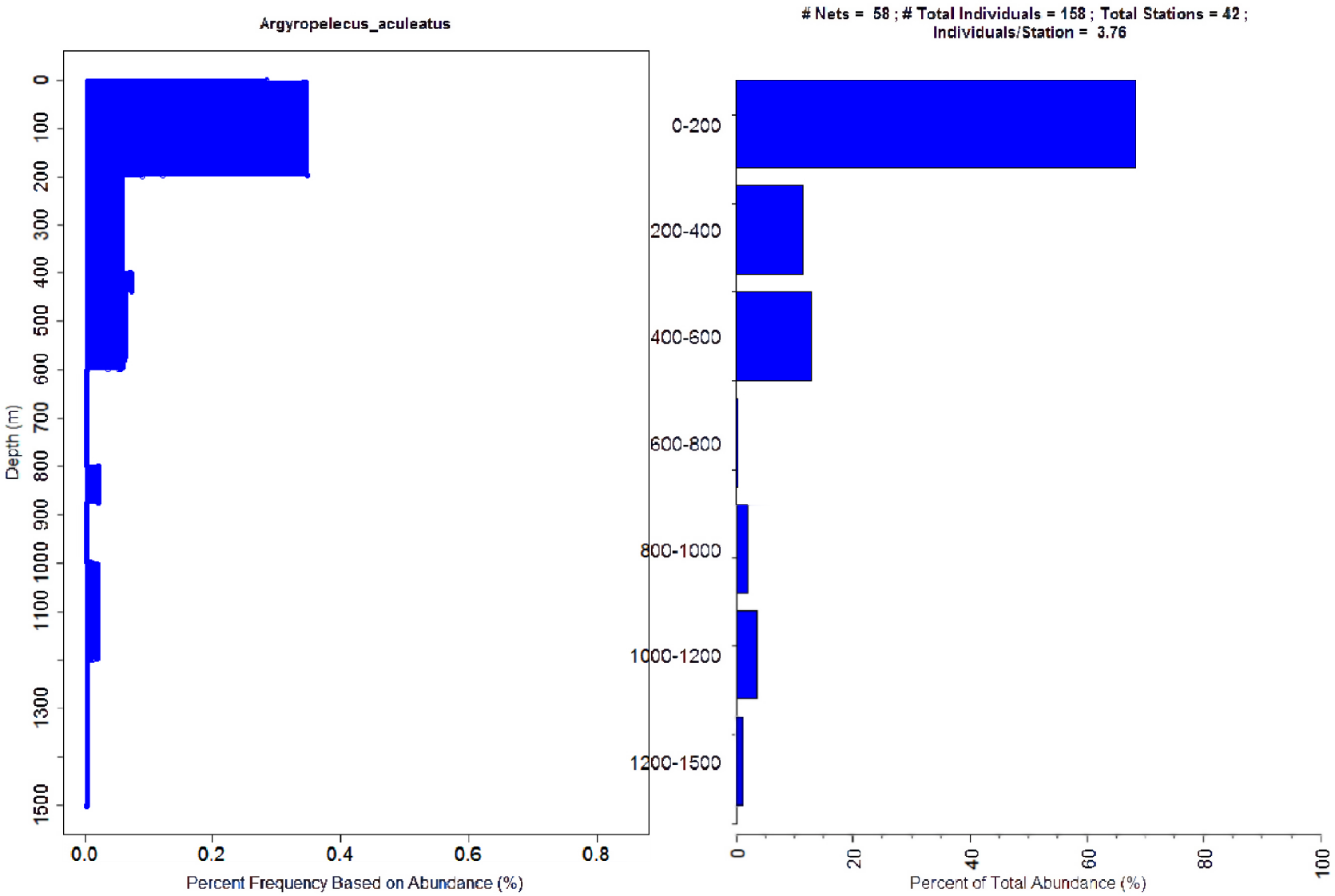
Anthomedusae


Apogonidae
Nets = 4 ; # Total Individuals = 5 ; Total Stations = 4 ;
Individuals/Station = 1.25
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

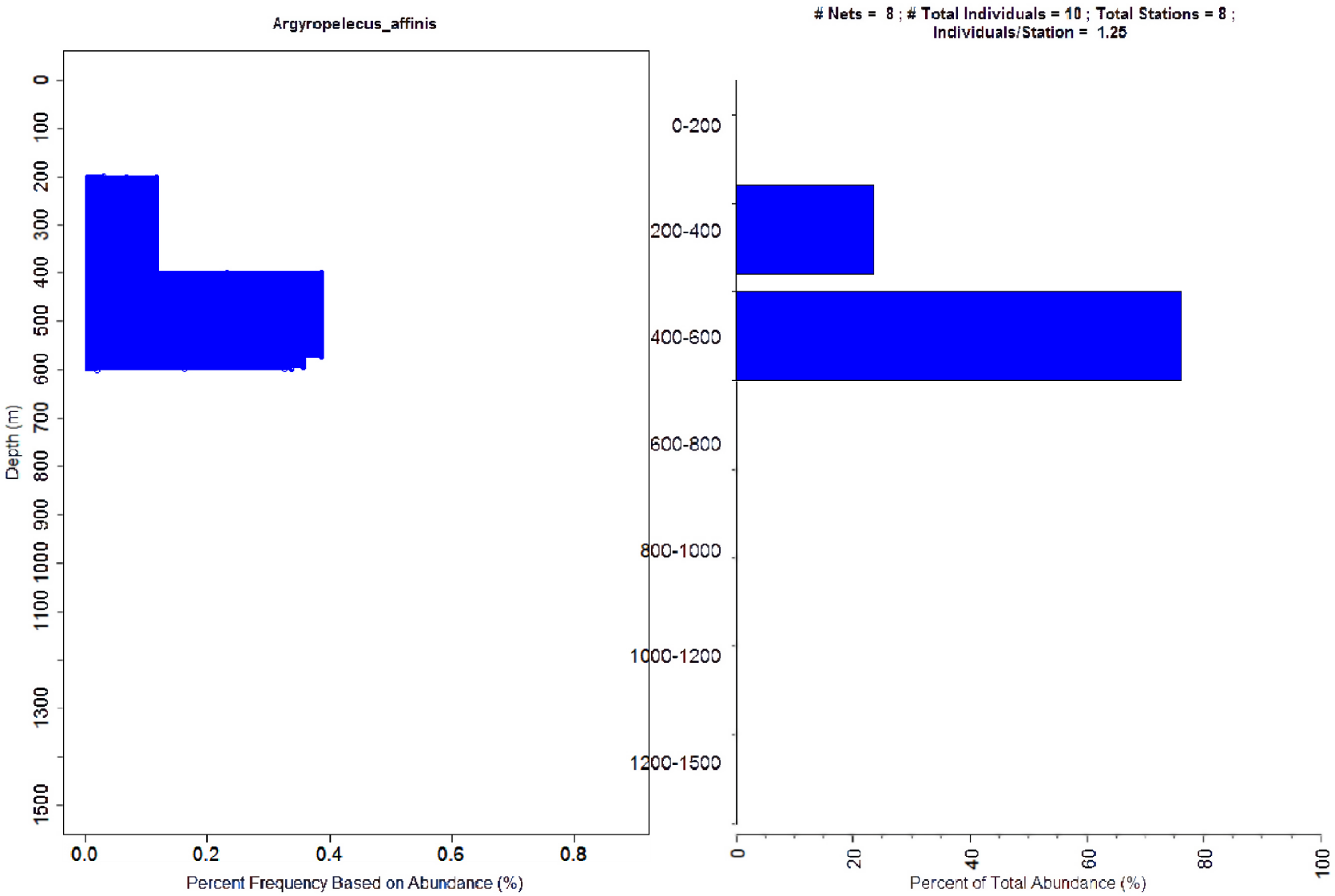
Apogonidae



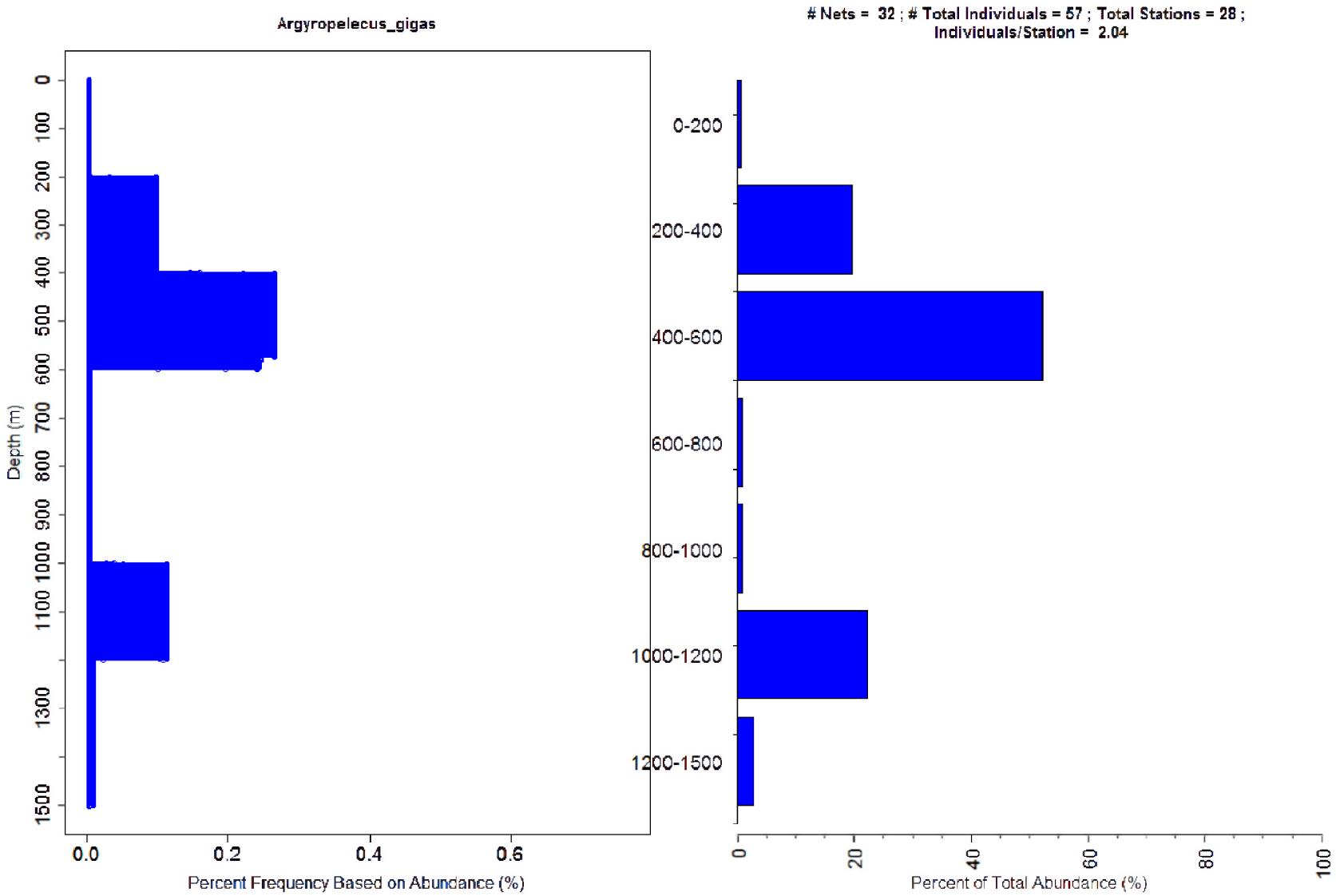
Argonautidae



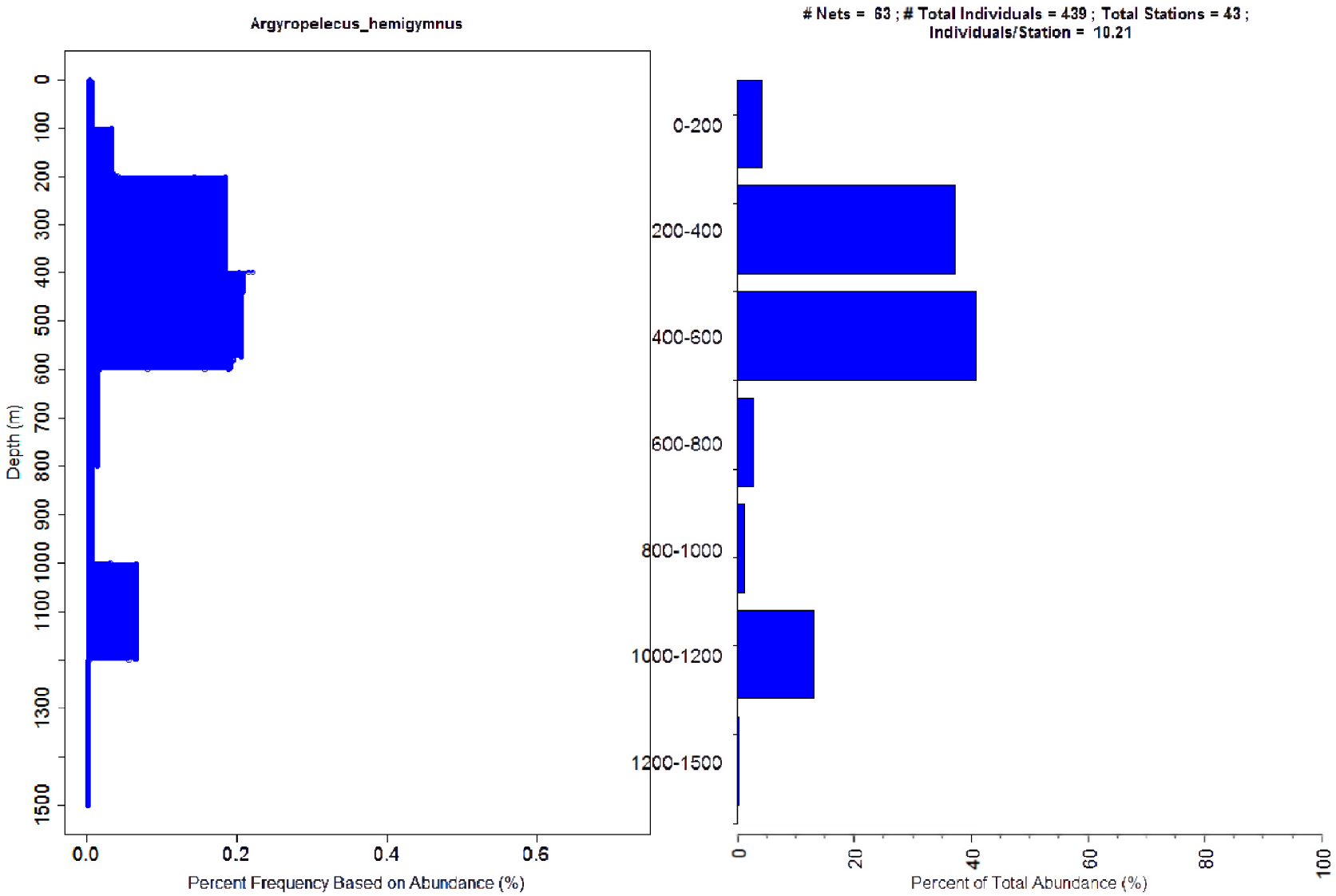
Argyropelecus_aculeatus



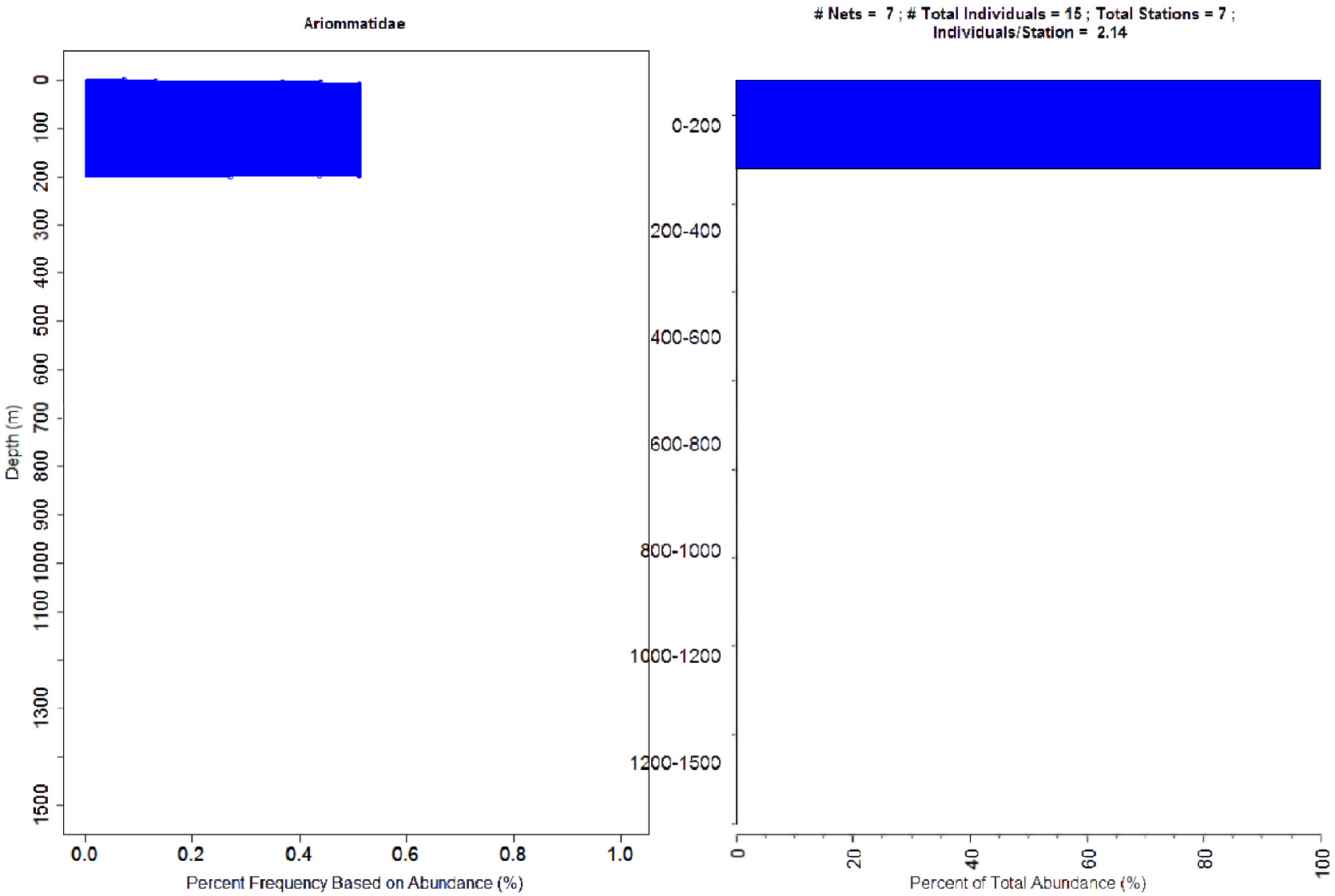
Argyropelecus_affinis



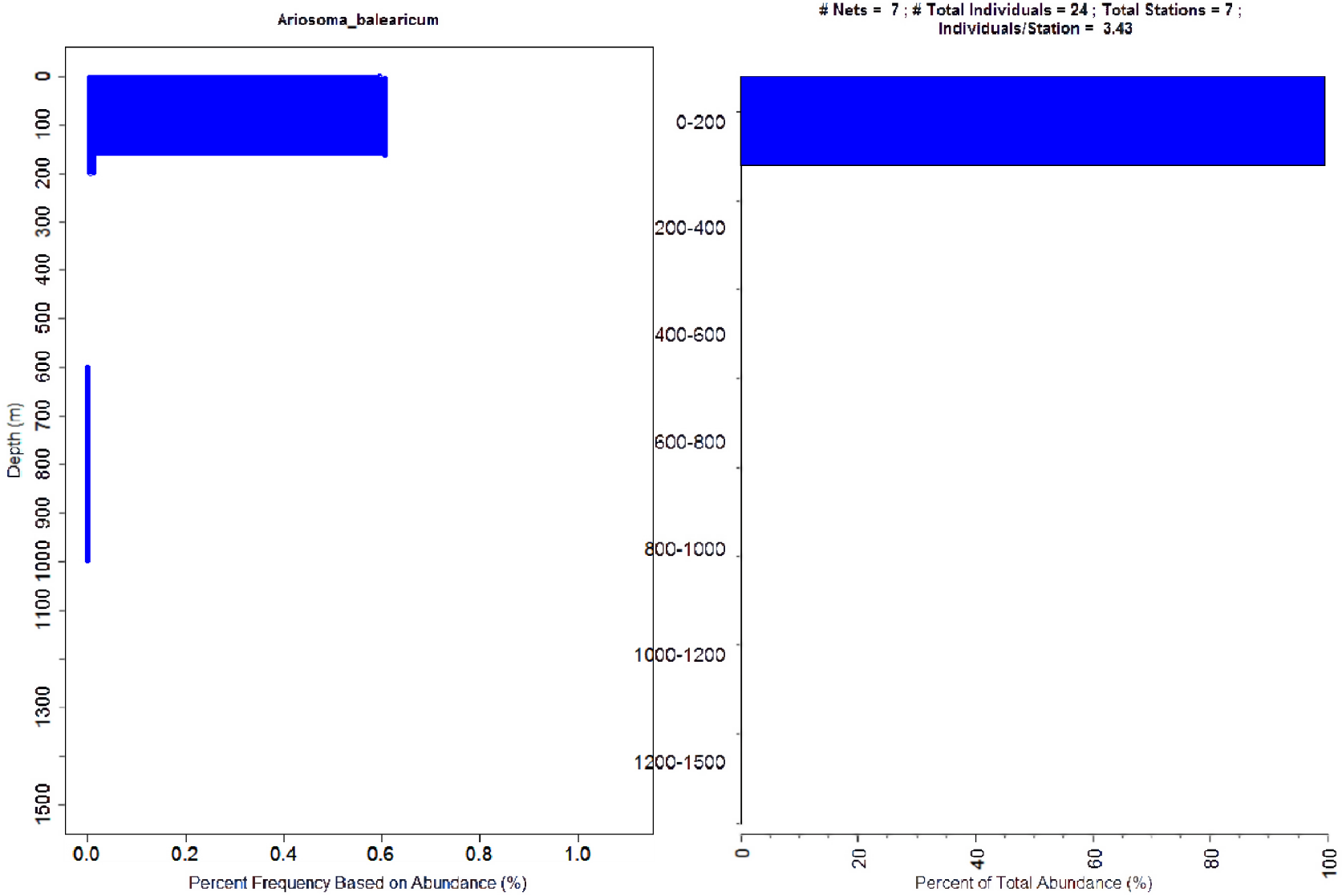
Argyropelecus_gigas



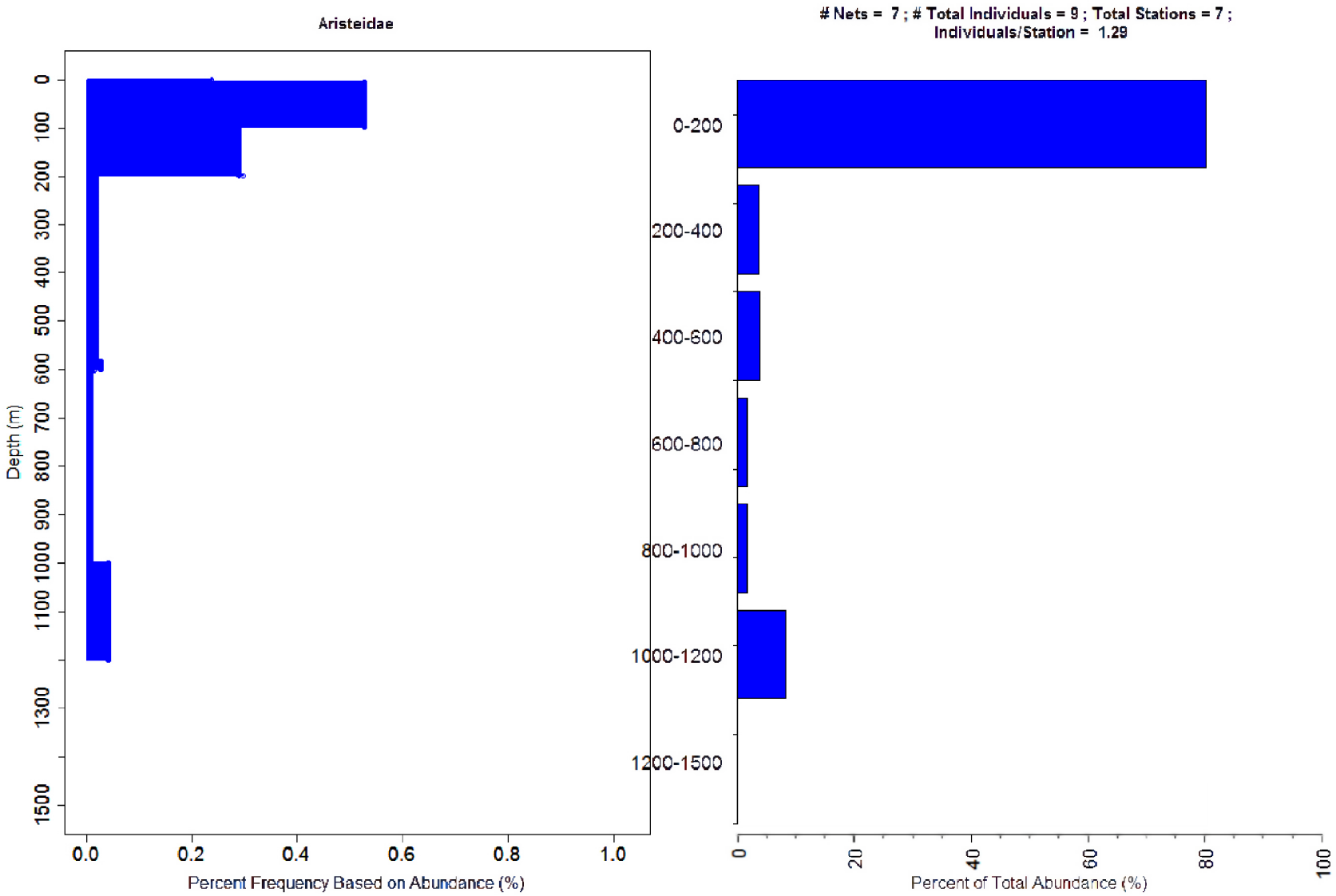
Argyropelecus_hemigymnus



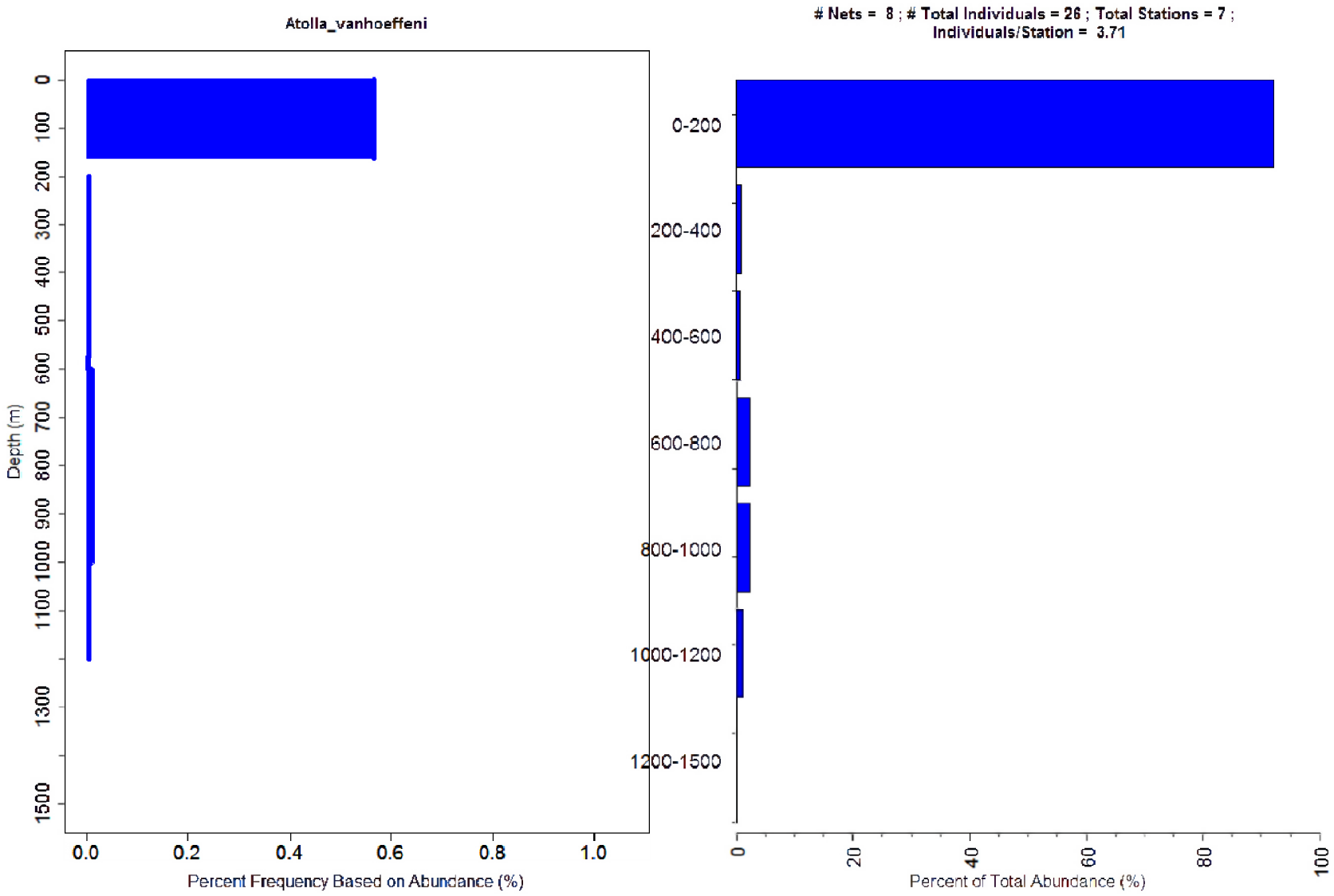
Ariommatidae



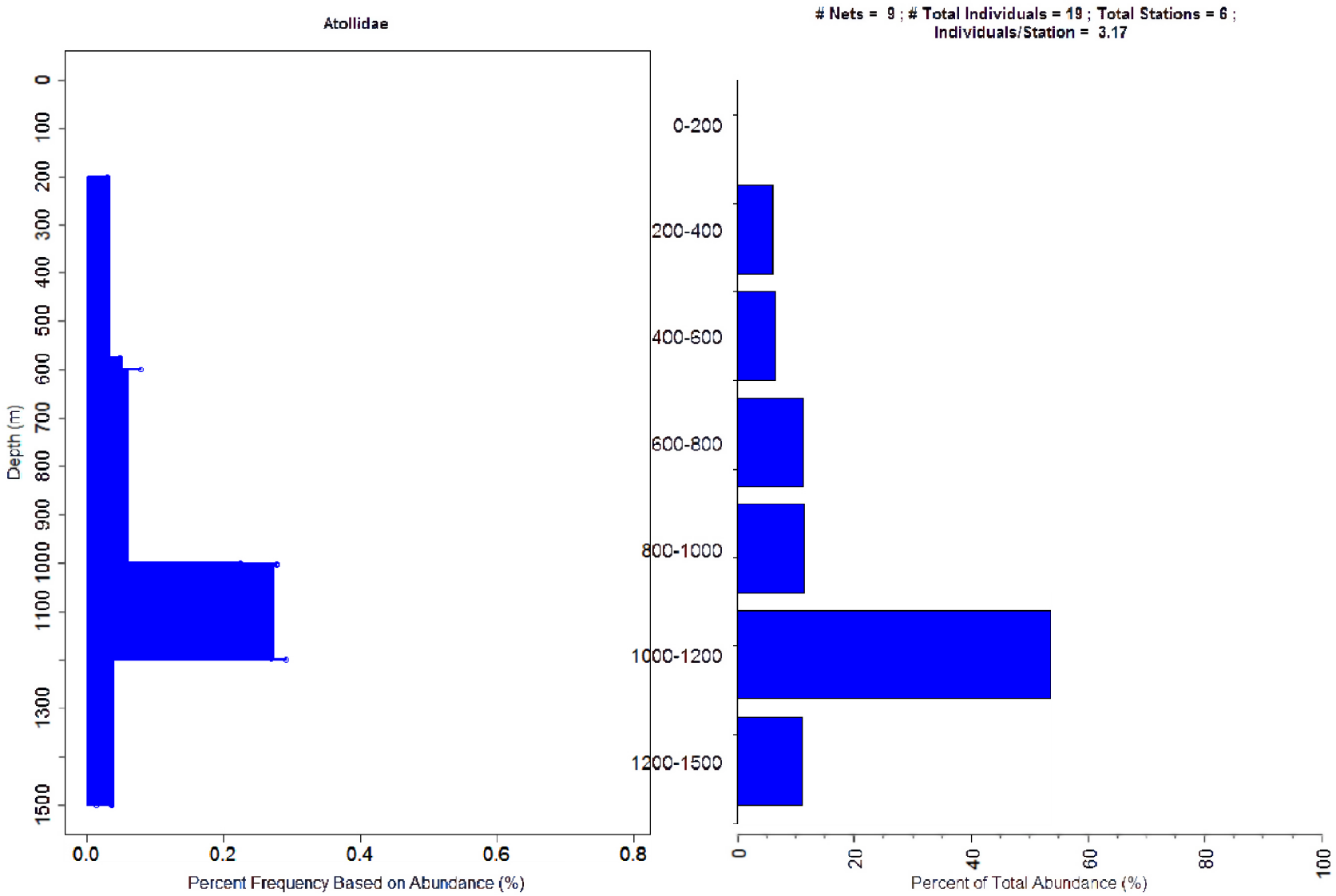
Ariosoma_balearicum


Aristeidae
Nets = 7 ; # Total Individuals = 9 ; Total Stations = 7 ;
Individuals/Station = 1.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

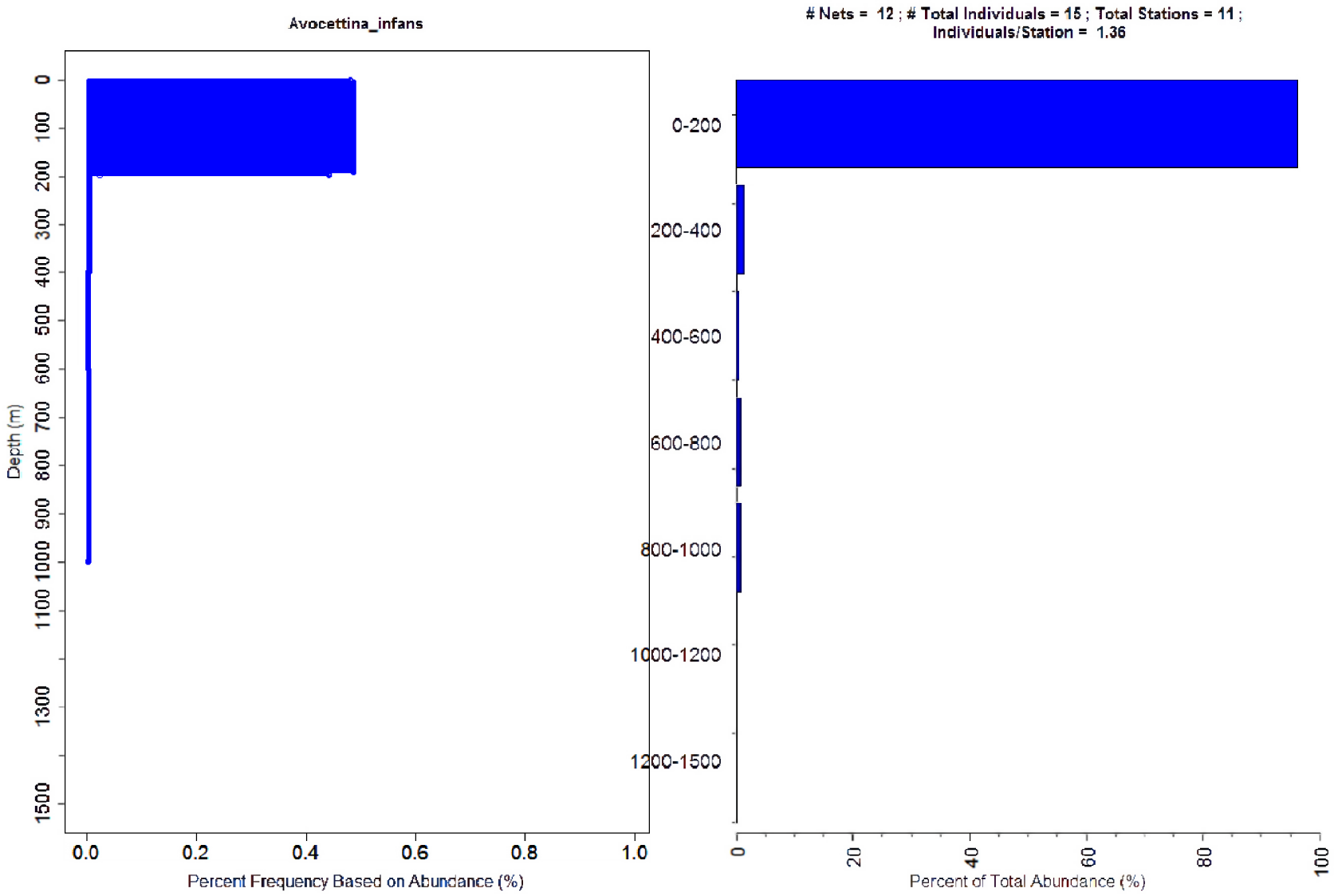
Aristeidae



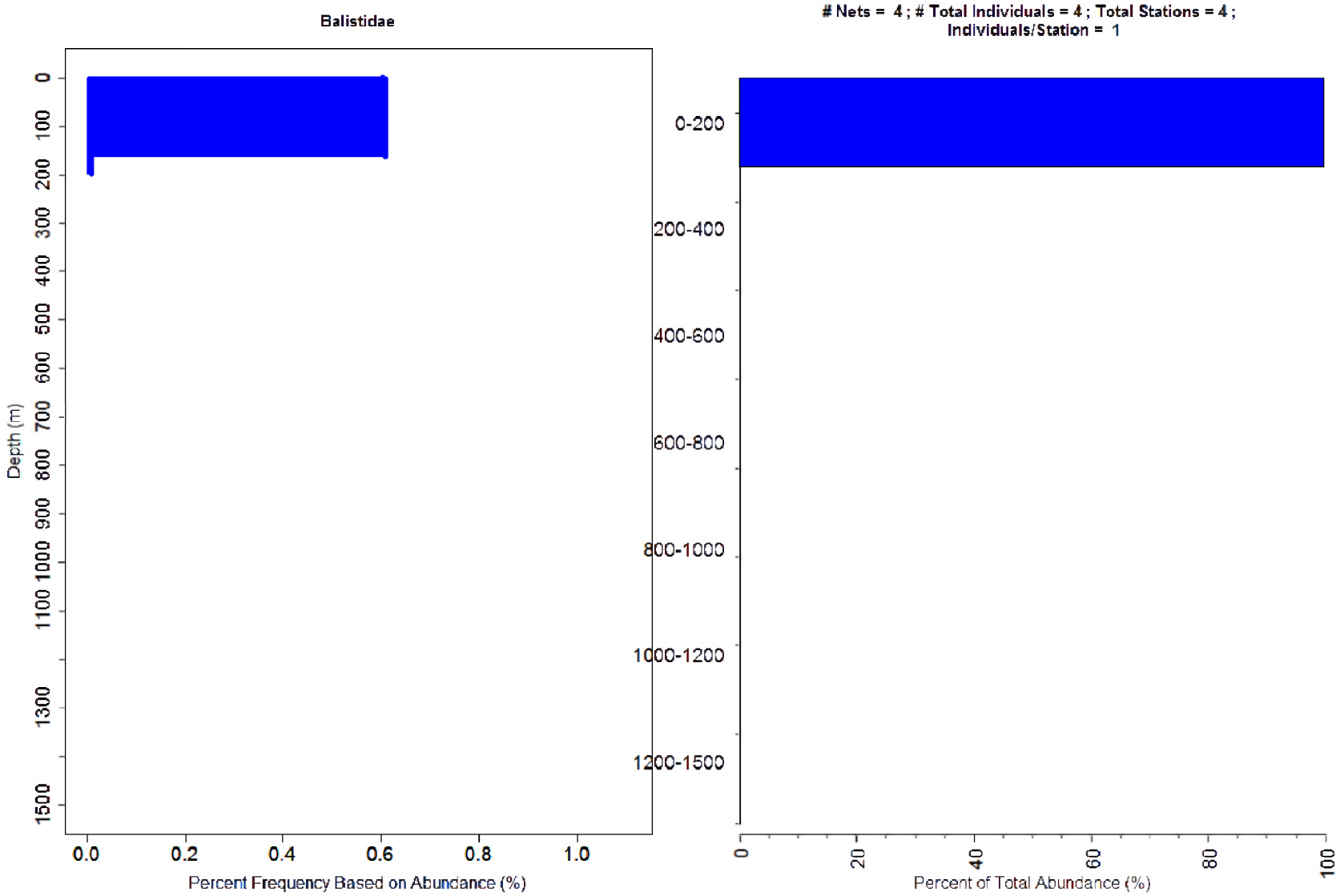
Atolla_vanhoeffeni


Atollidae
Nets = 9 ; # Total Individuals = 19 ; Total Stations = 6 ;
Individuals/Station = 3.17
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

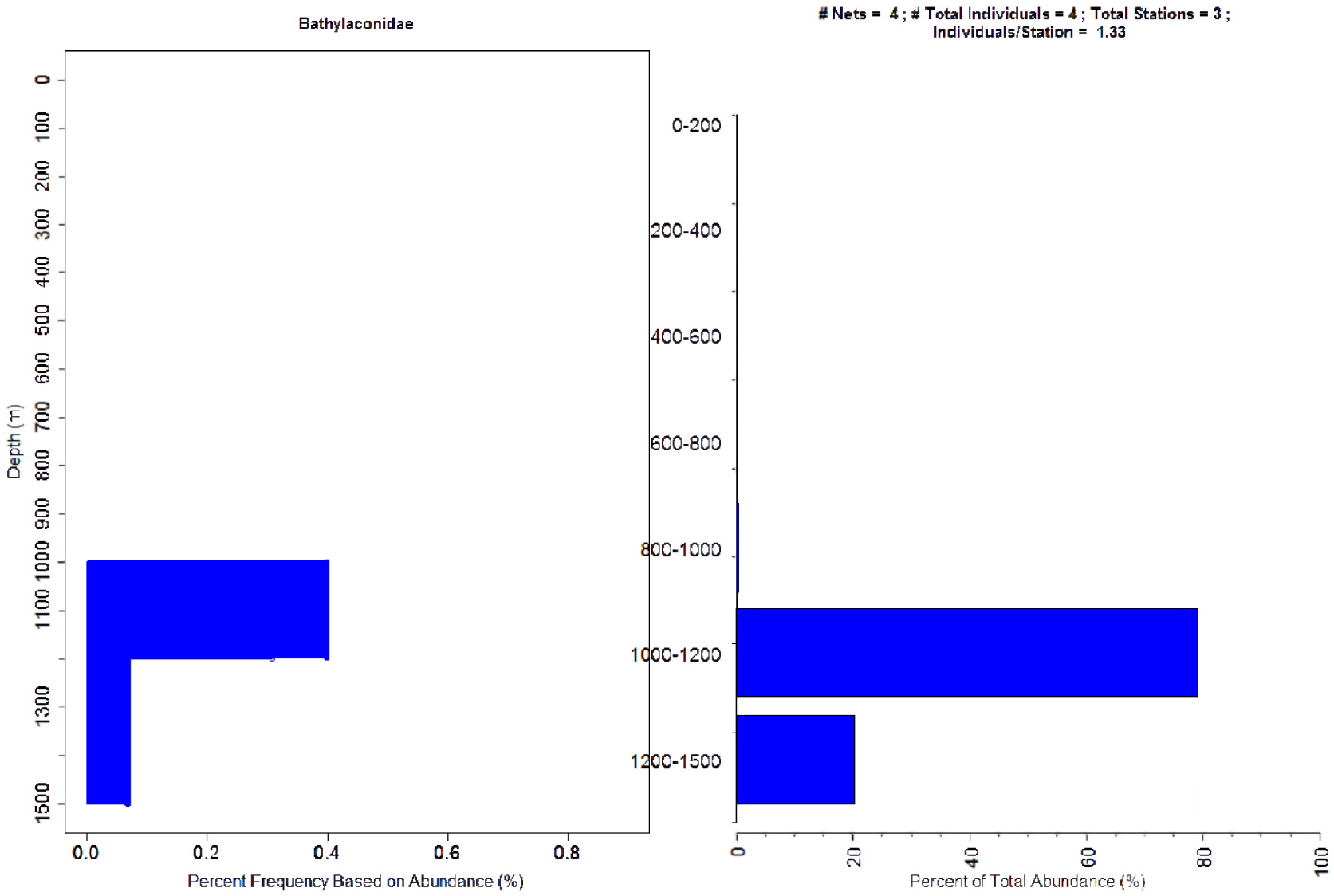
Atollidae



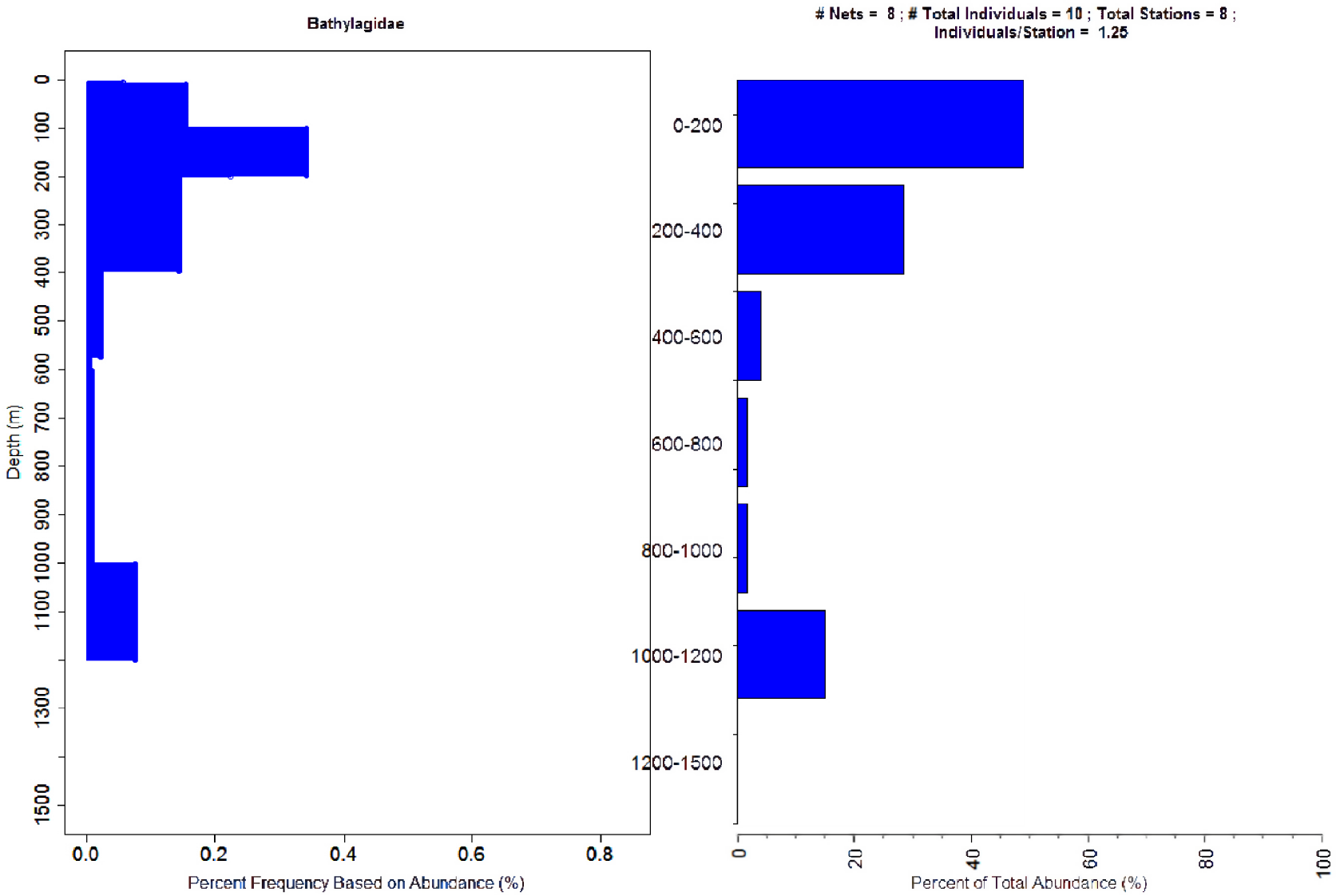
Avocettina_infans


Balistidae
Nets = 4 ; # Total Individuals = 4 ; Total Stations = 4 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

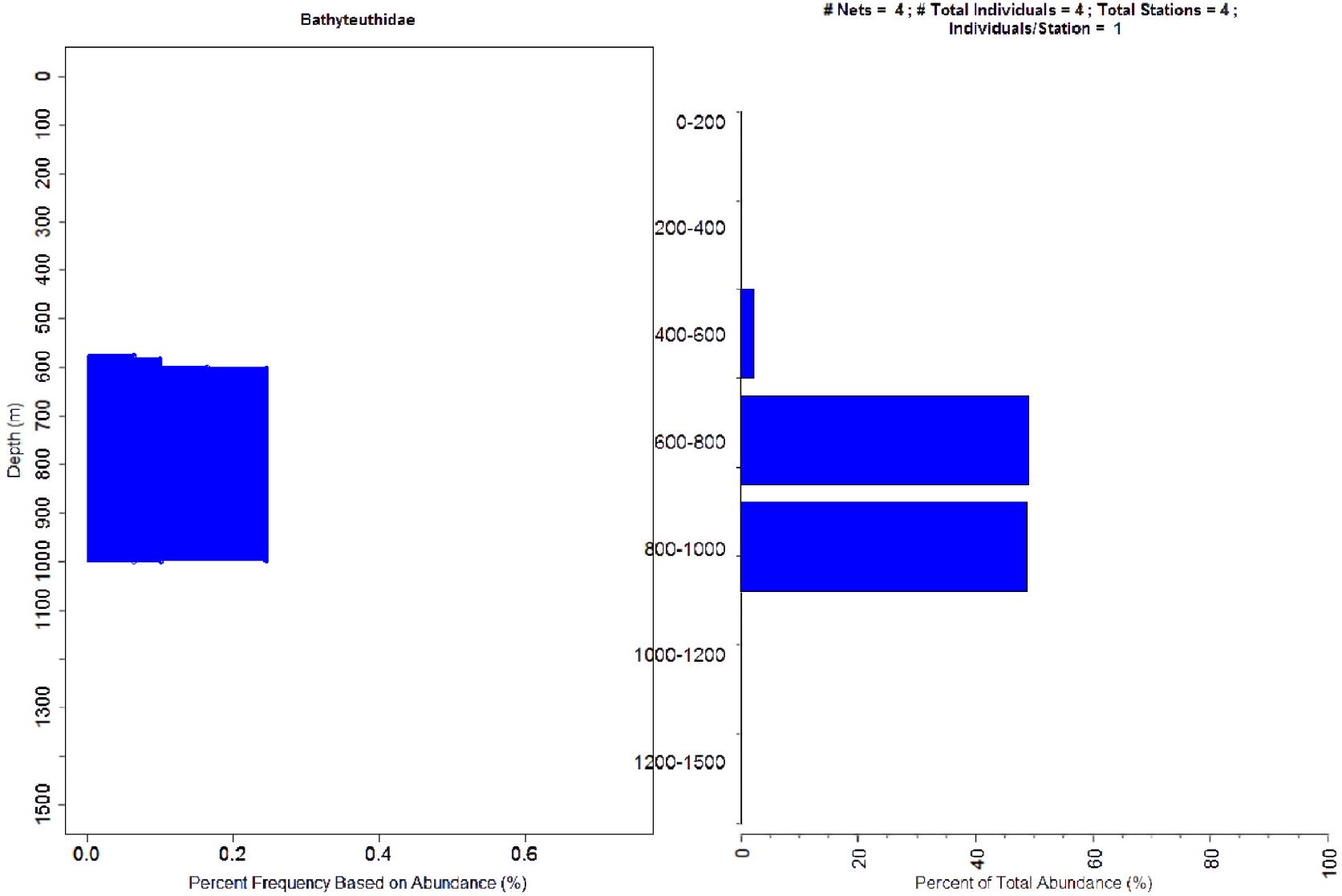
Balistidae



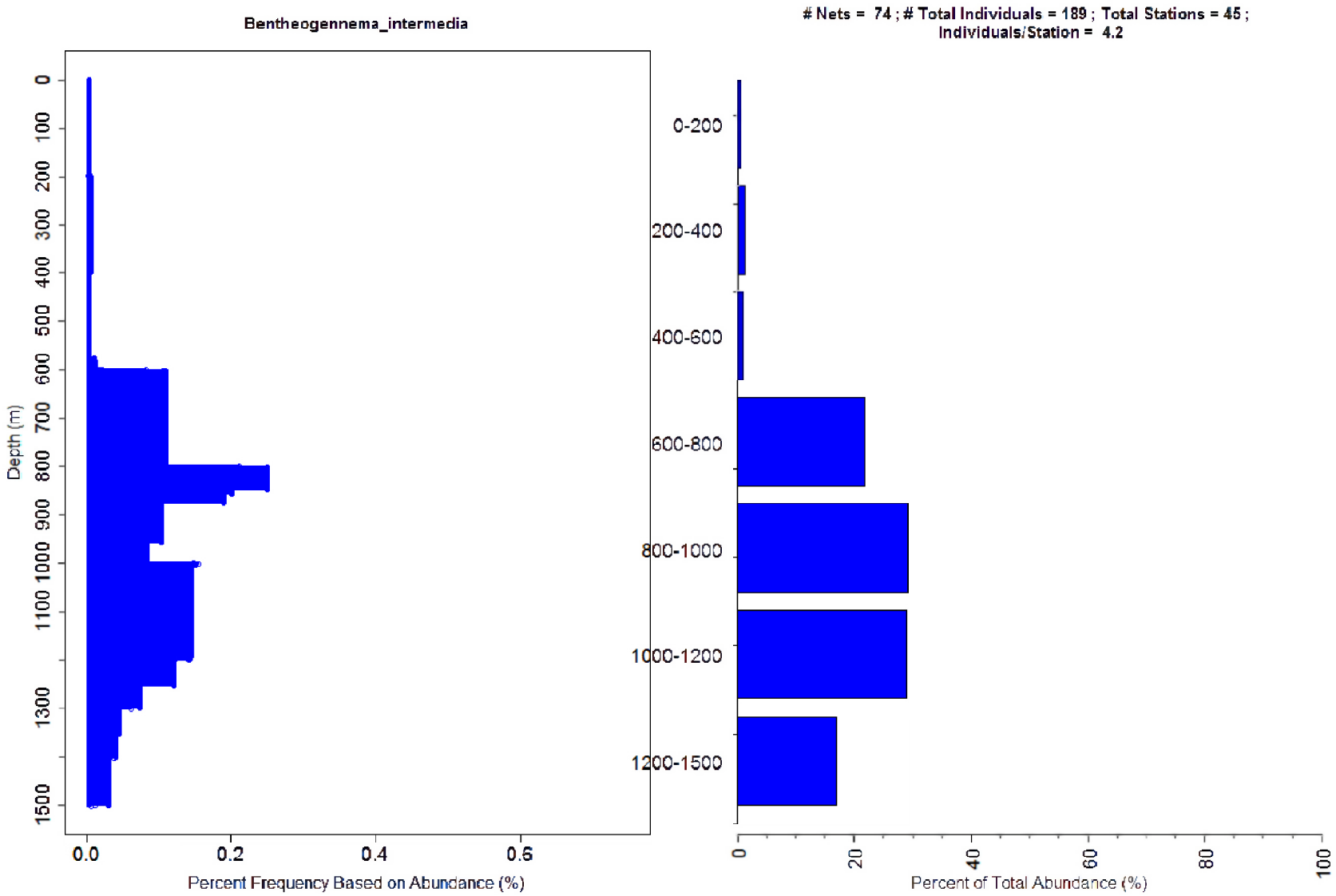
Bathylaconidae



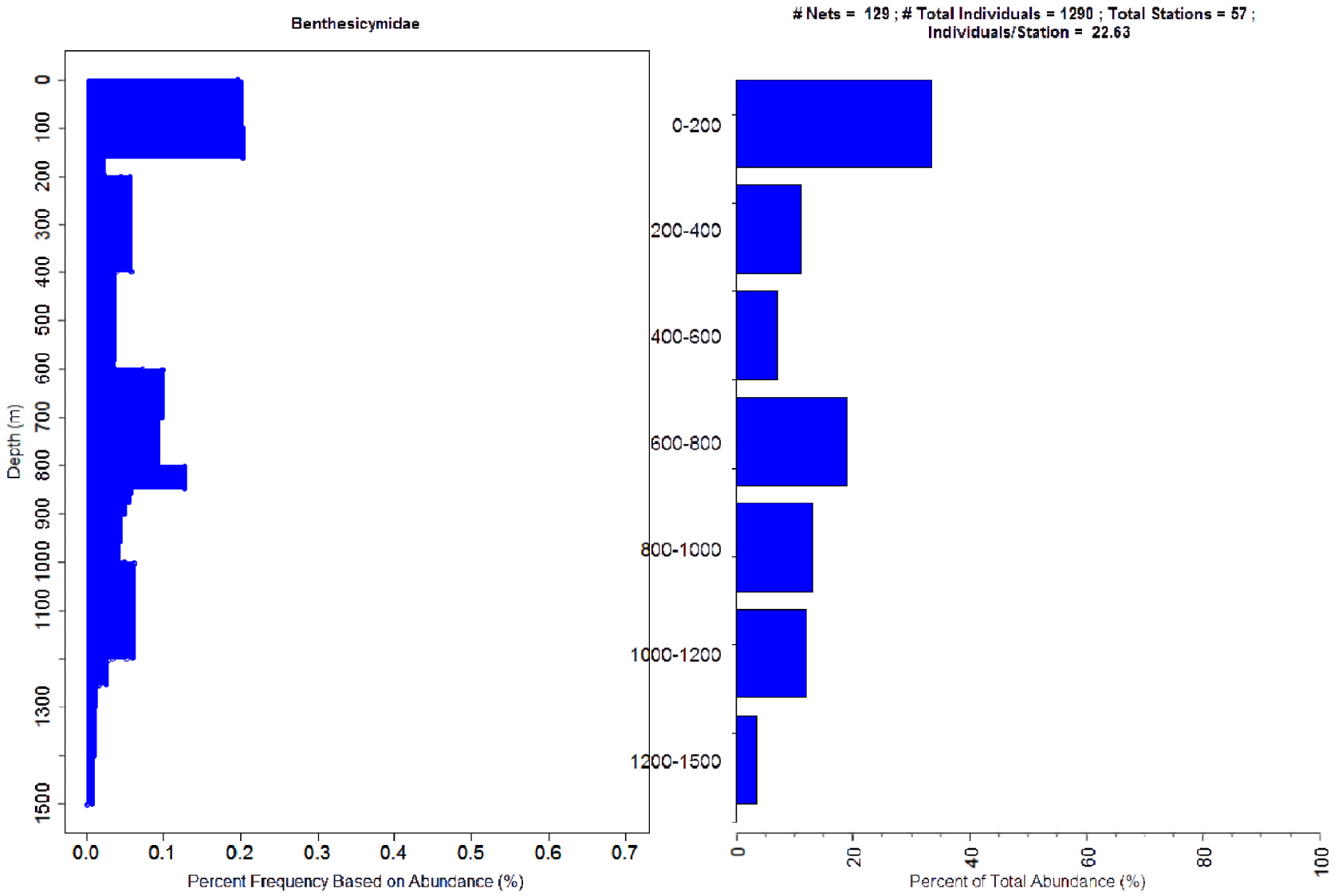
Bathylagidae



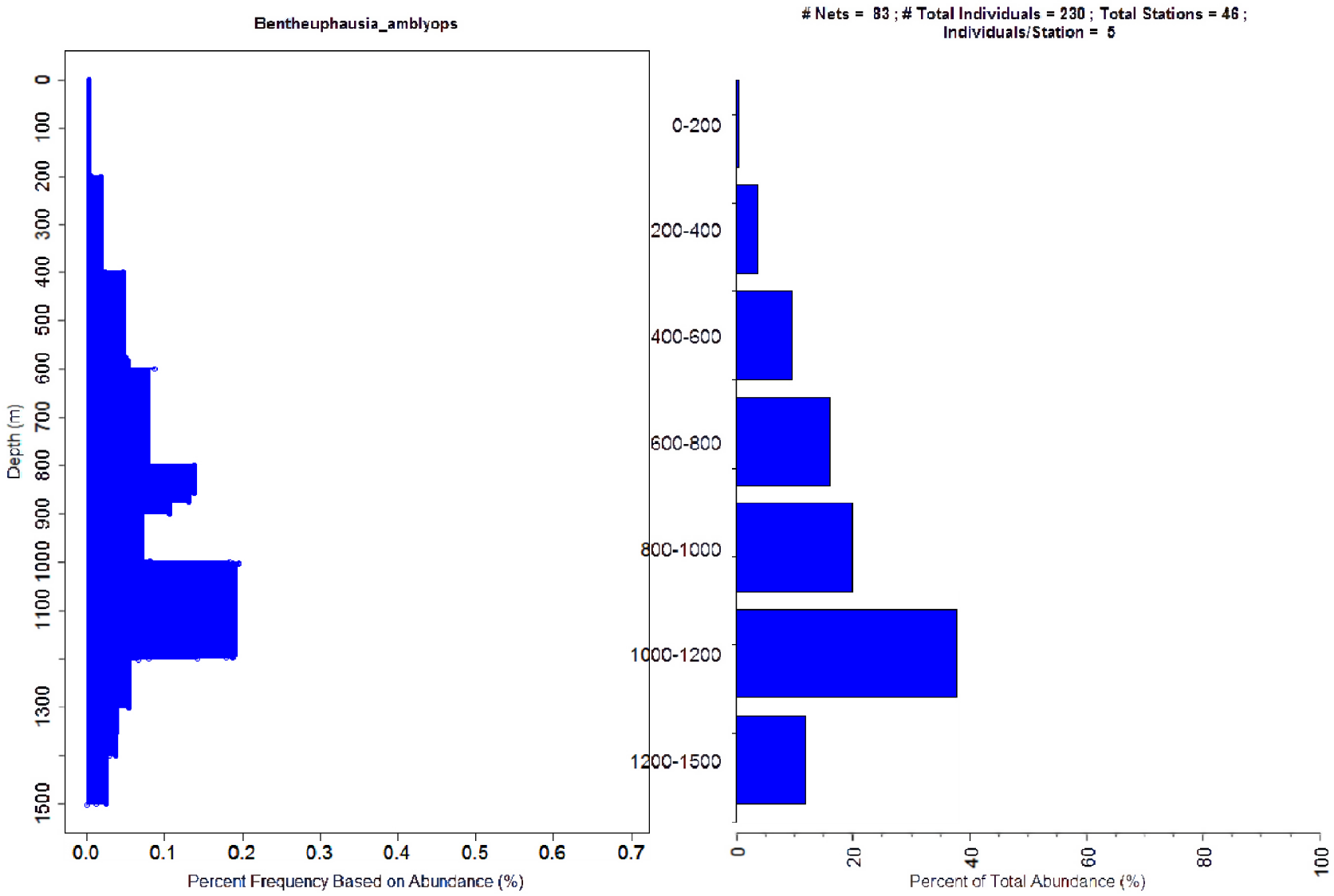
Bathyteuthidae



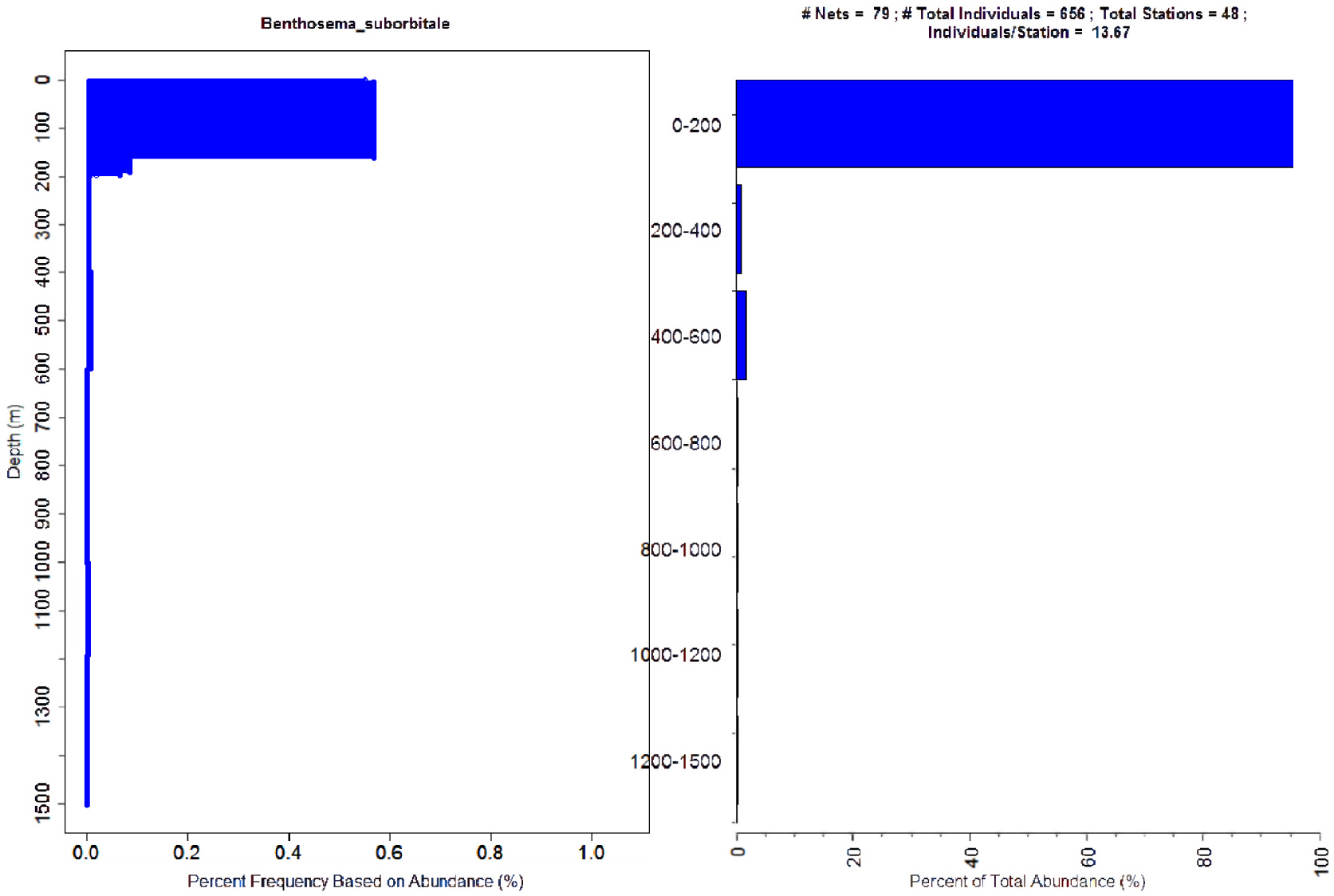
Bentheogennema_intermedia



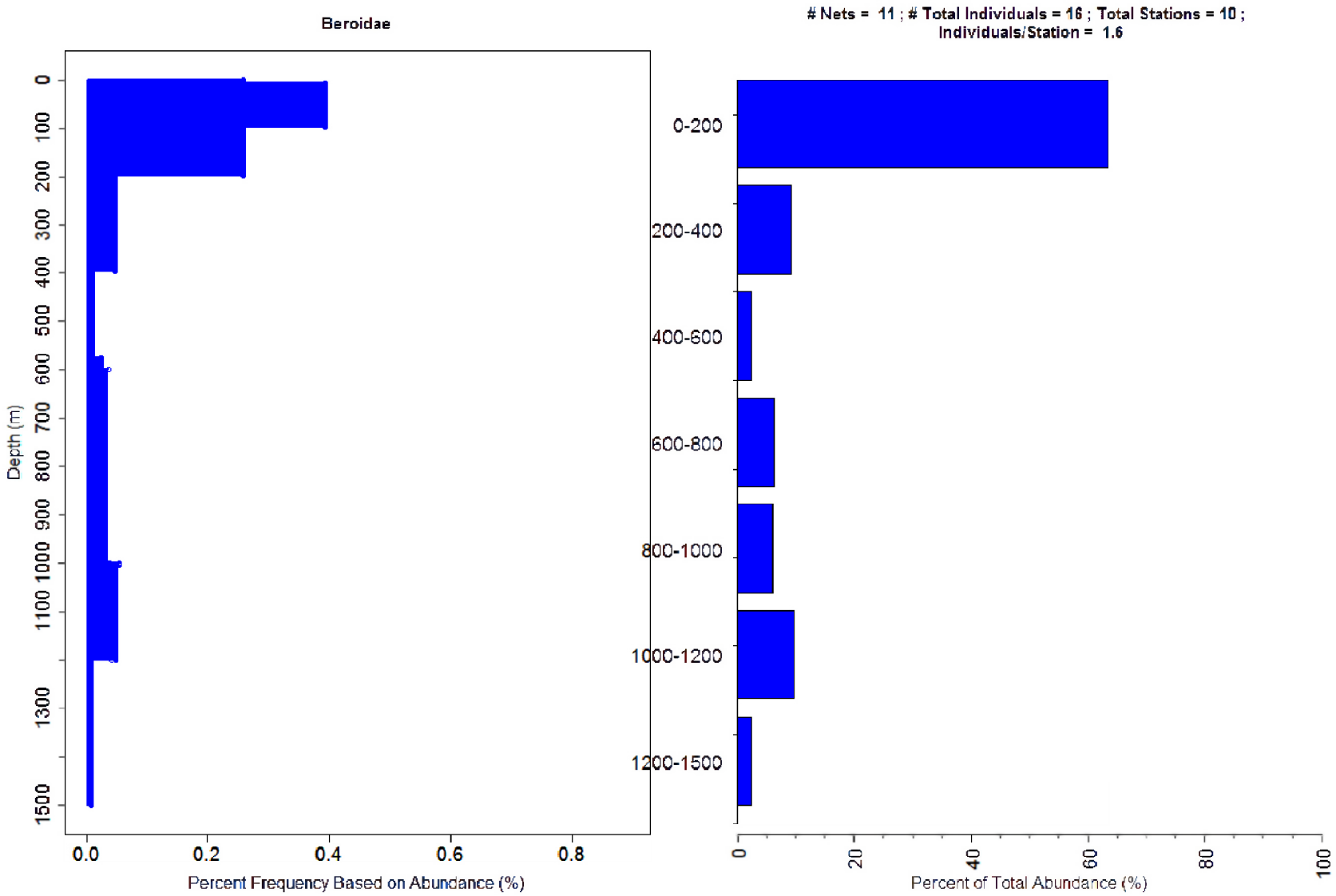
Benthesicymidae



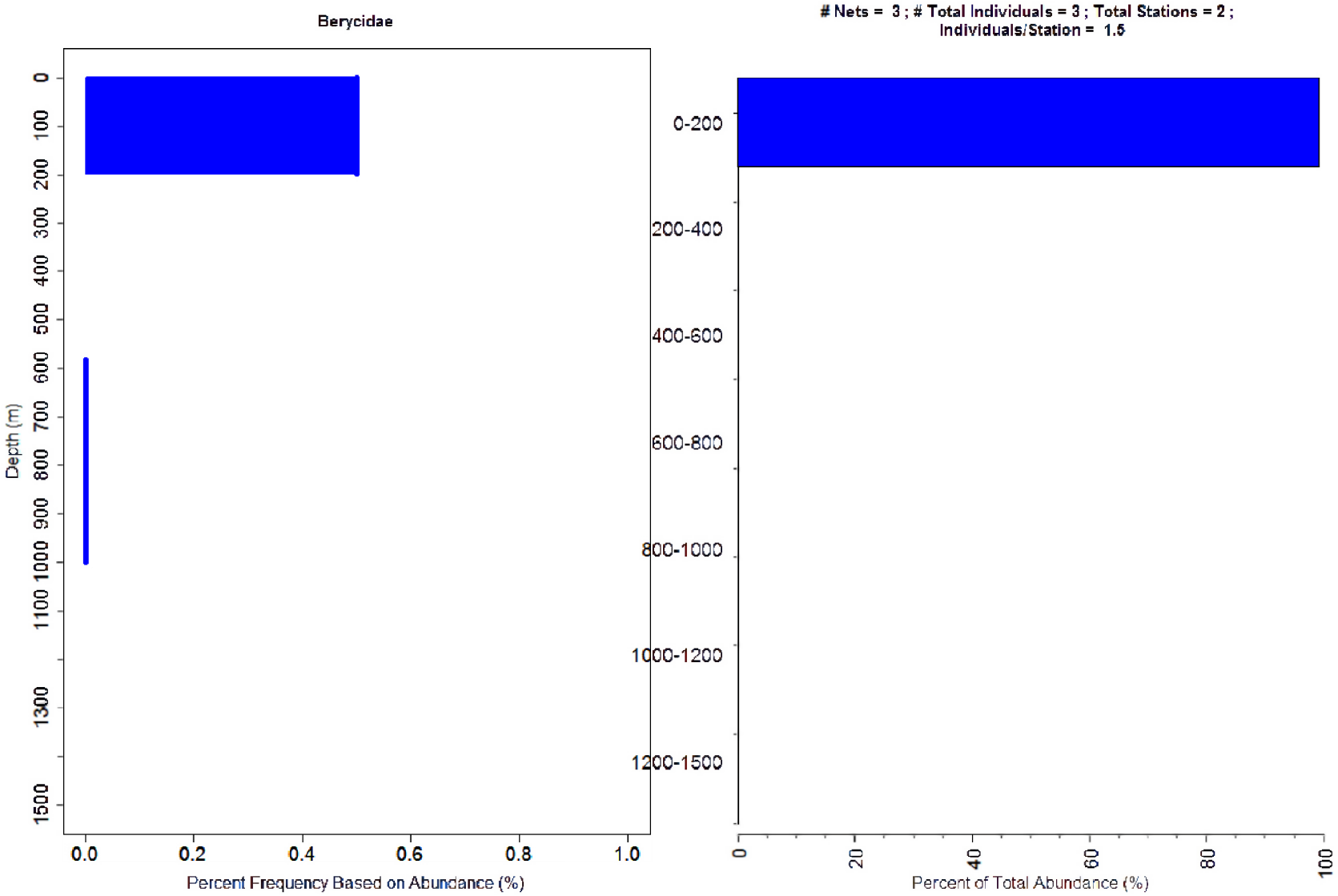
Bentheuphausia_amblyops



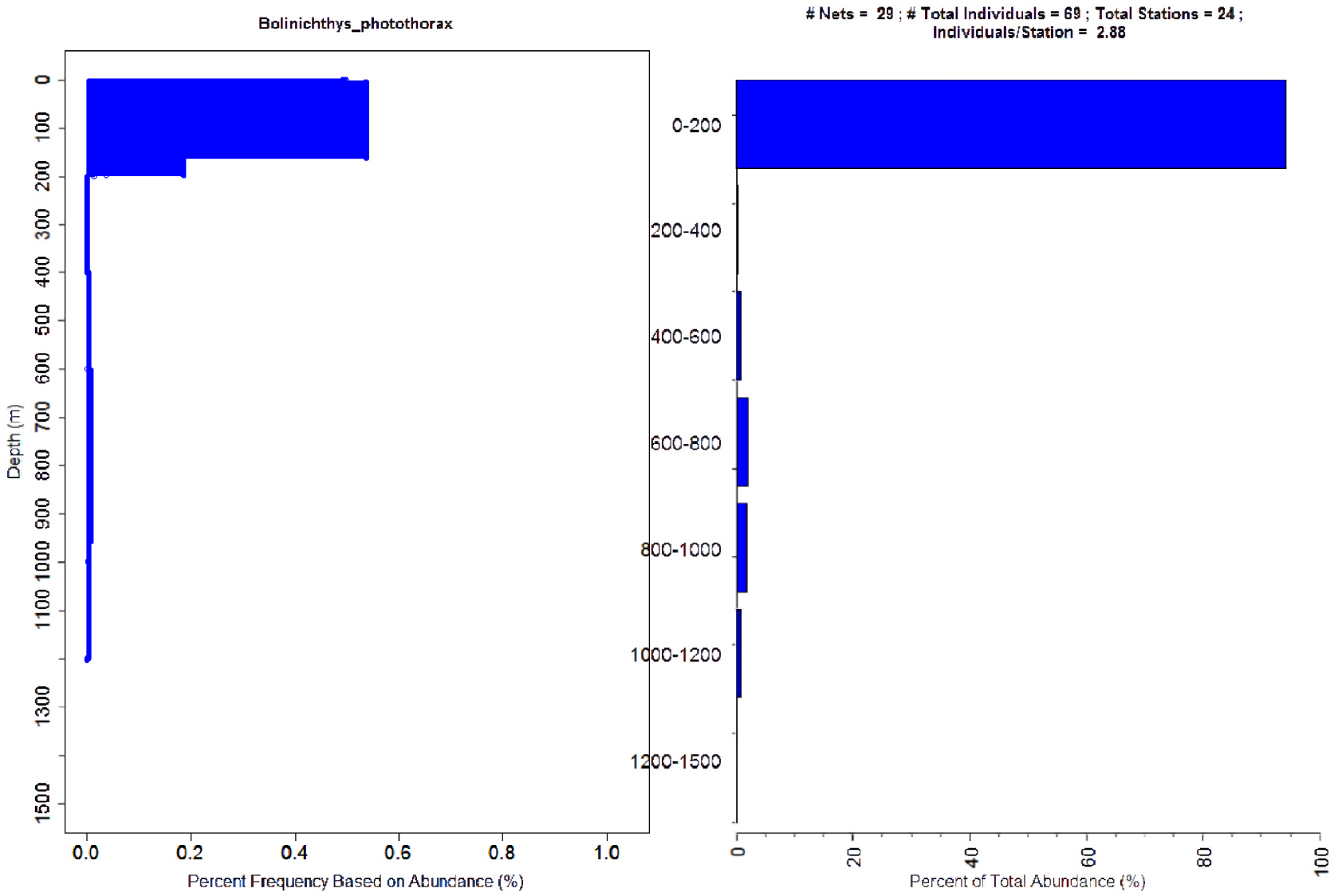
Benthosema_suborbitale


Beroidae
Nets = 11 ; # Total Individuals = 16 ; Total Stations = 10 ;
Individuals/Station = 1.6
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

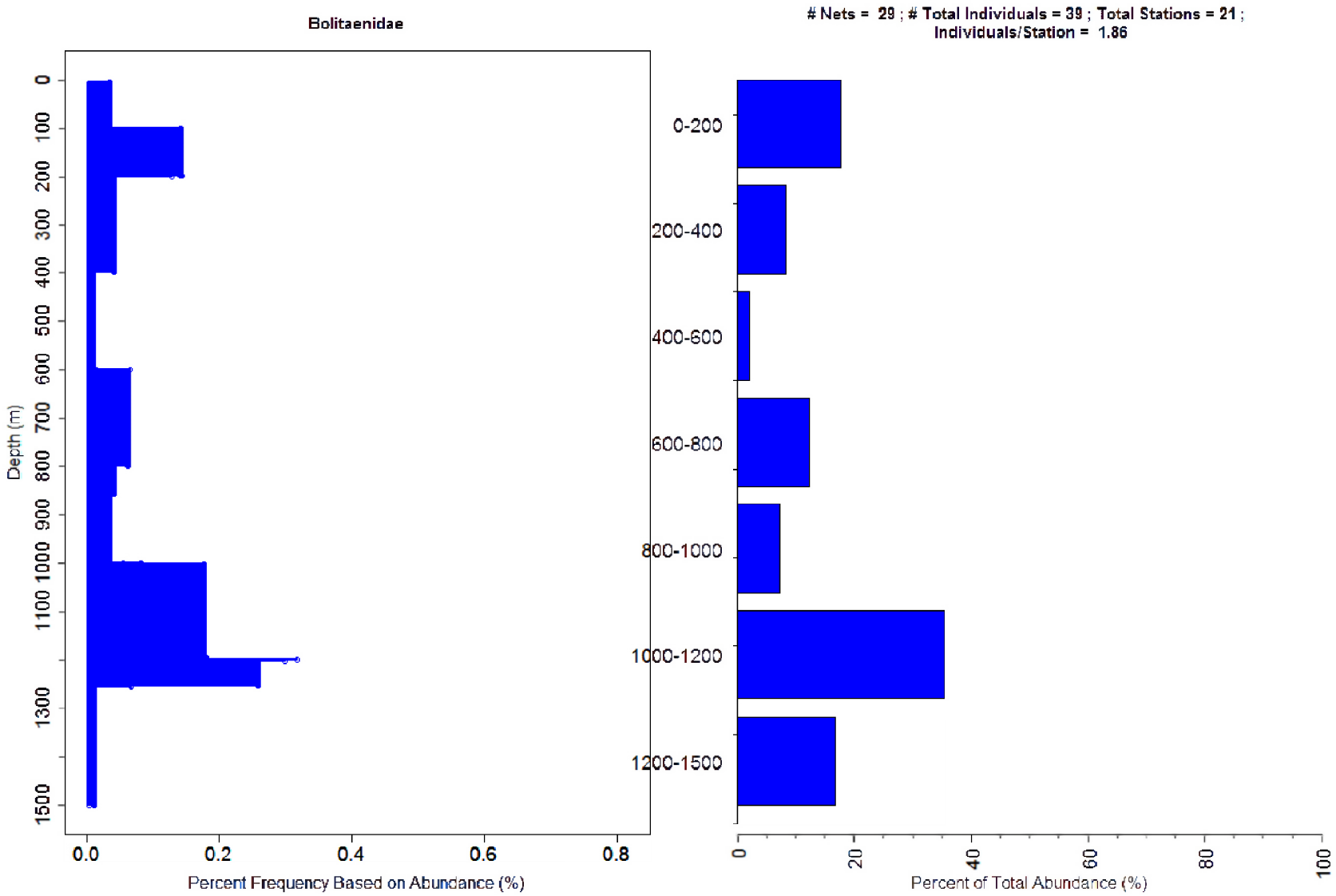
Beroidae


Berycidae
Nets = 3 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

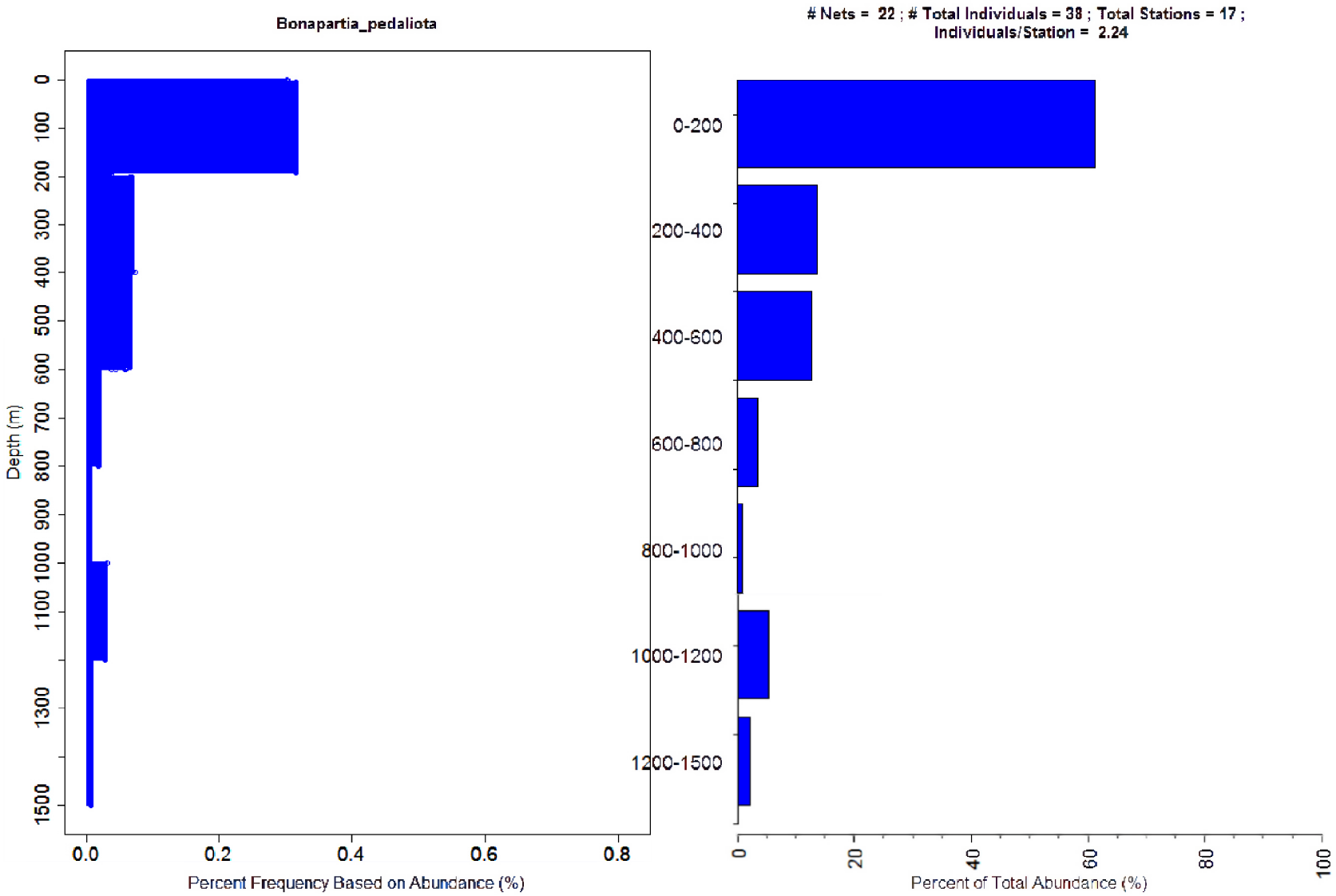
Berycidae



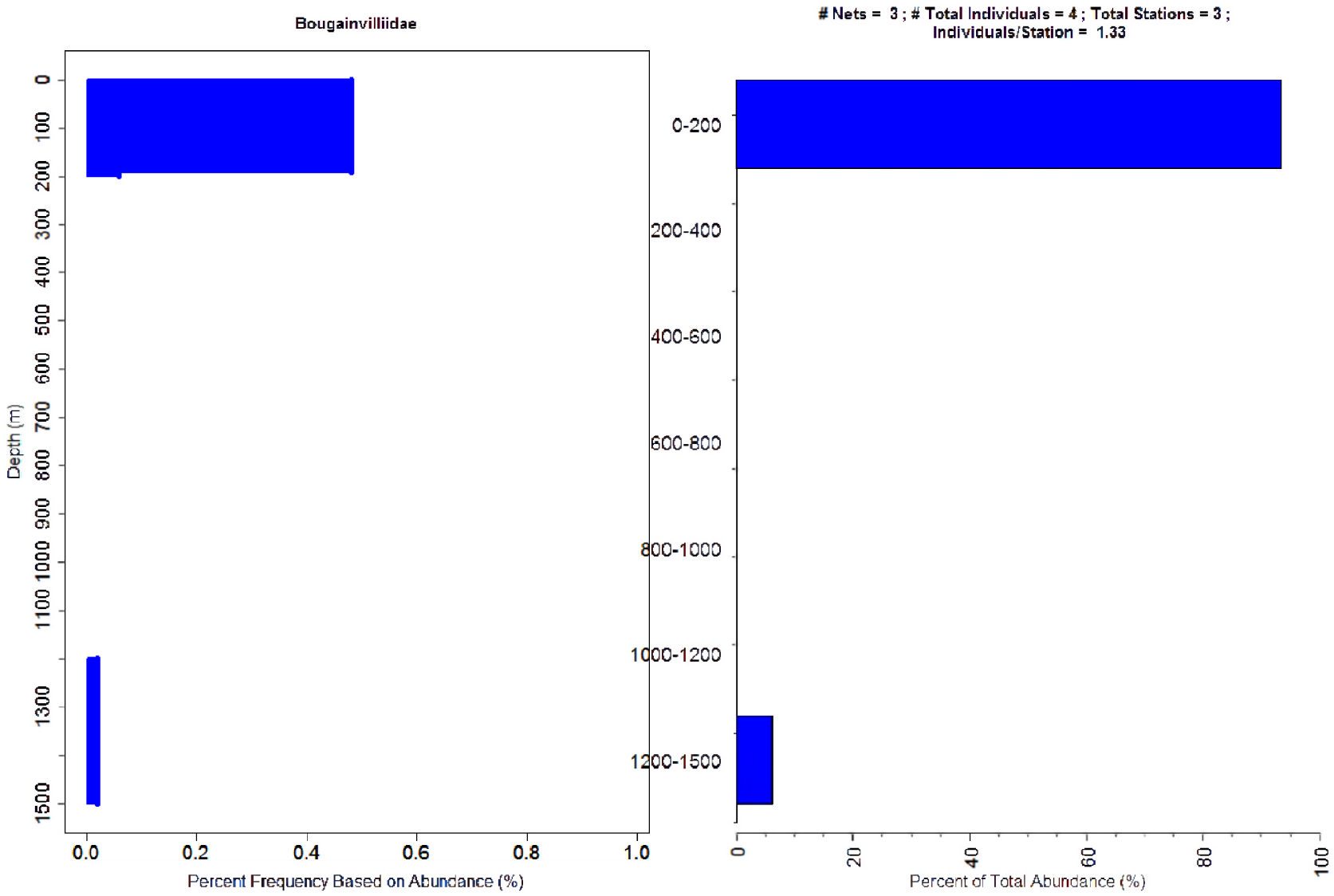
Bolinichthys_photothorax



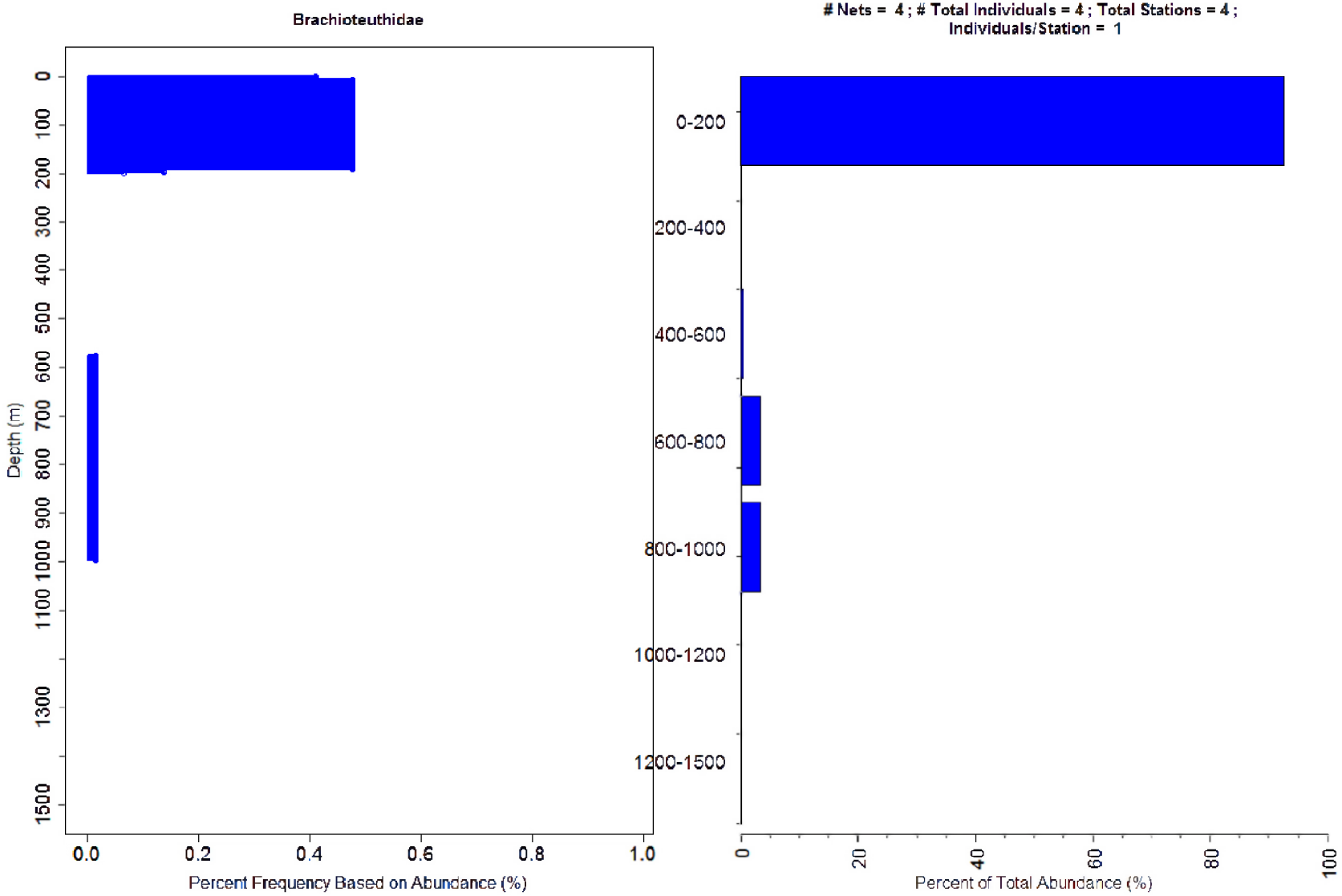
Bolitaenidae



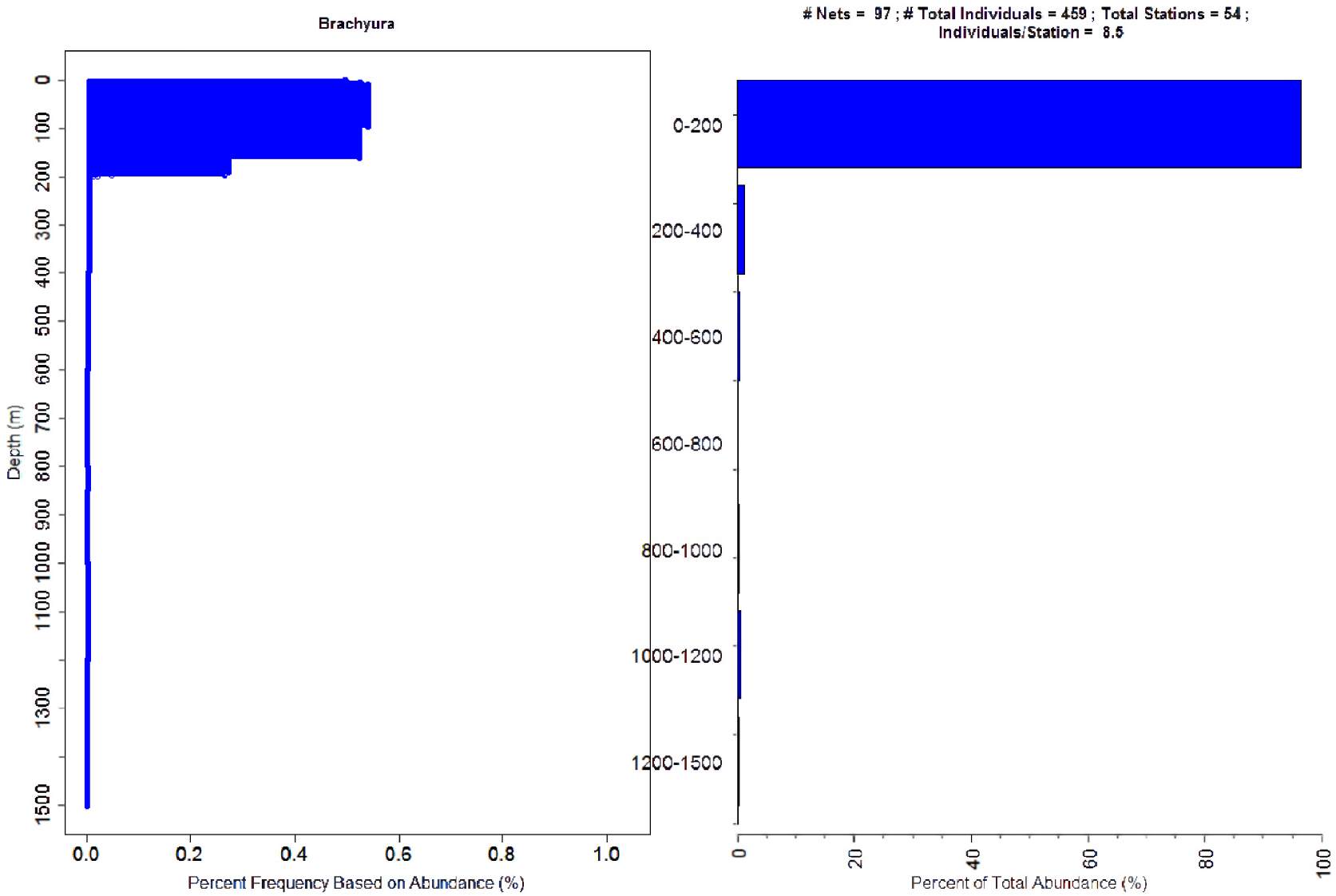
Bonapartia_pedaliota



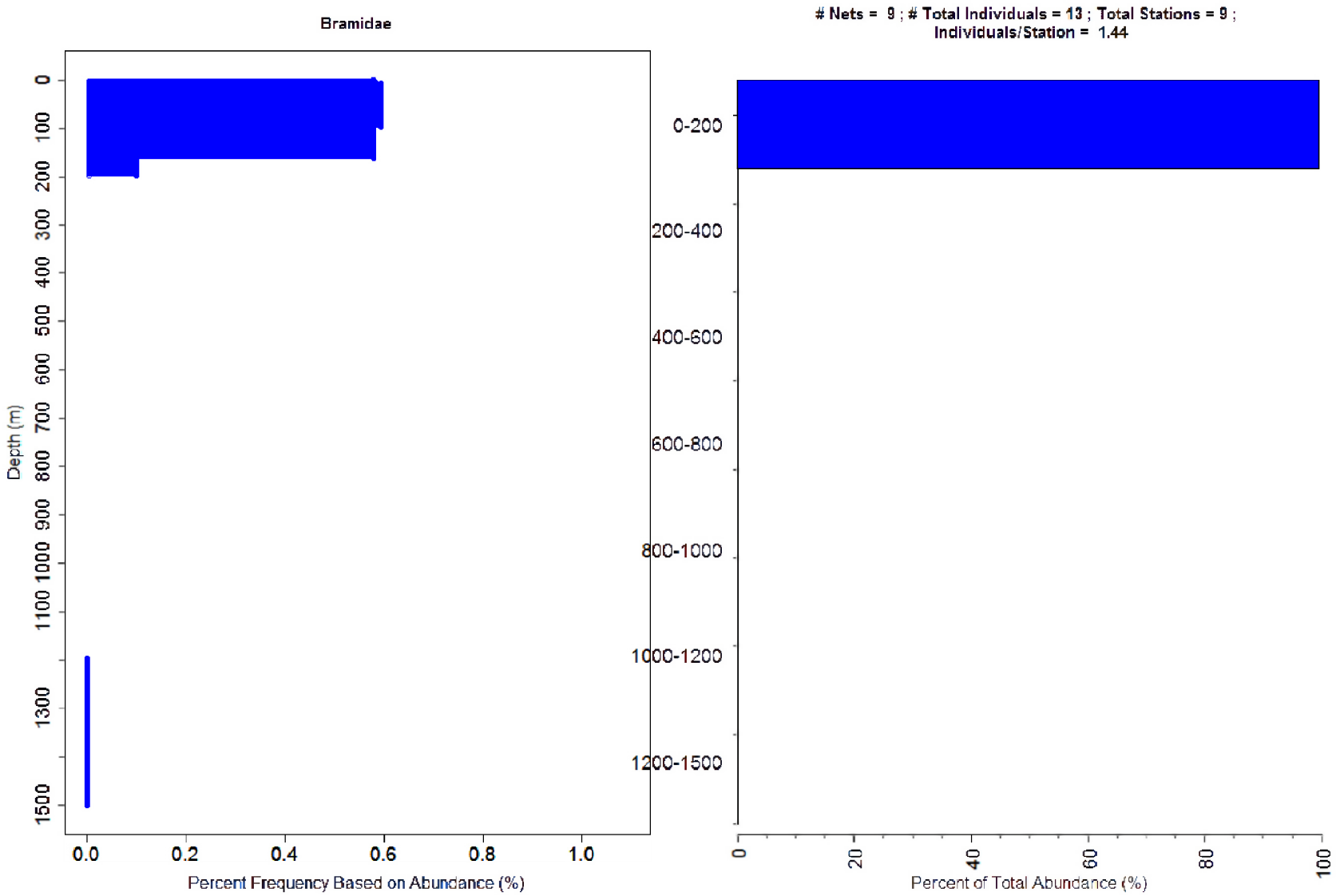
Bougainvilliidae



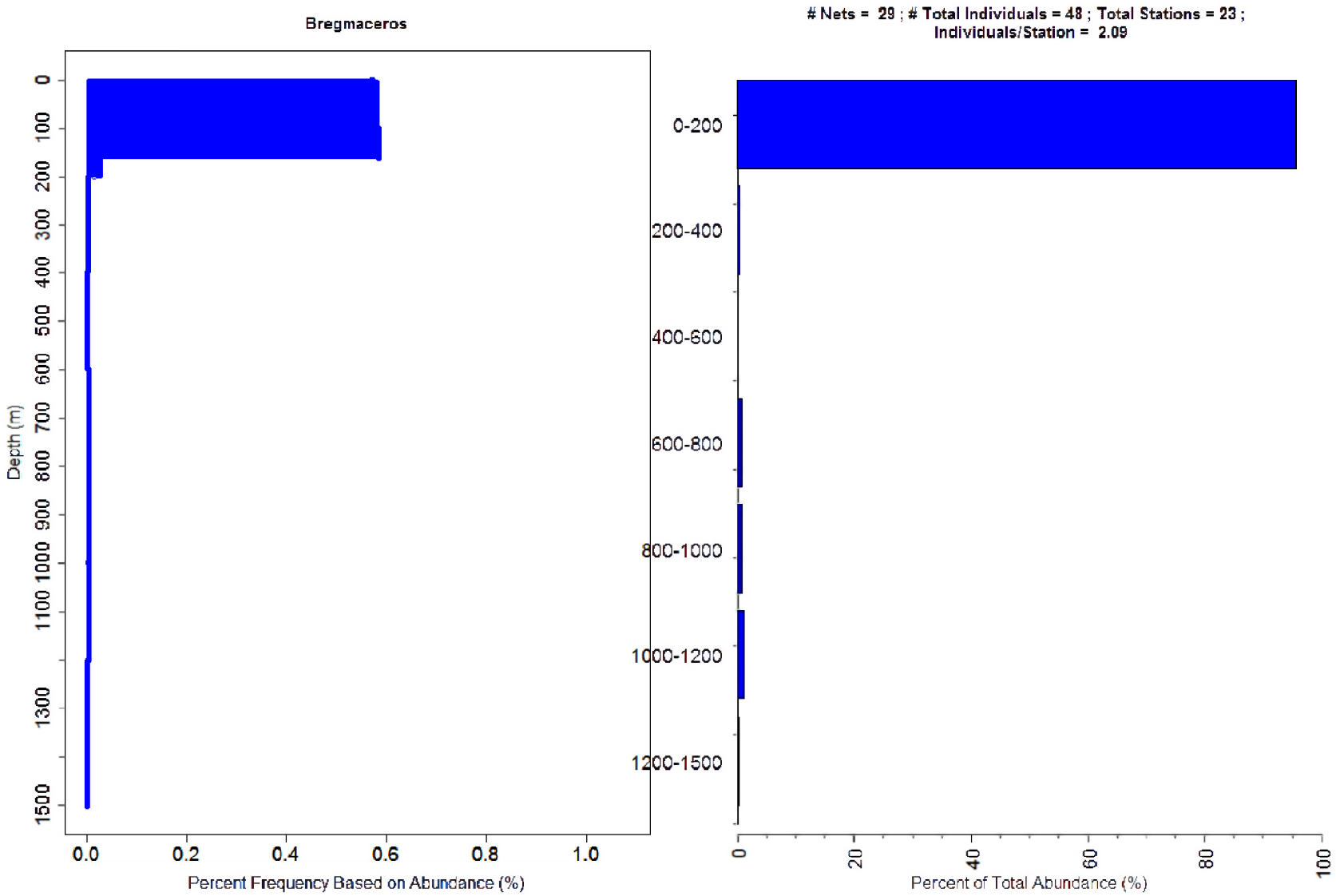
Brachioteuthidae


Brachyura
Nets = 97 ; # Total Individuals = 459 ; Total Stations = 54 ;
Individuals/Station = 8.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

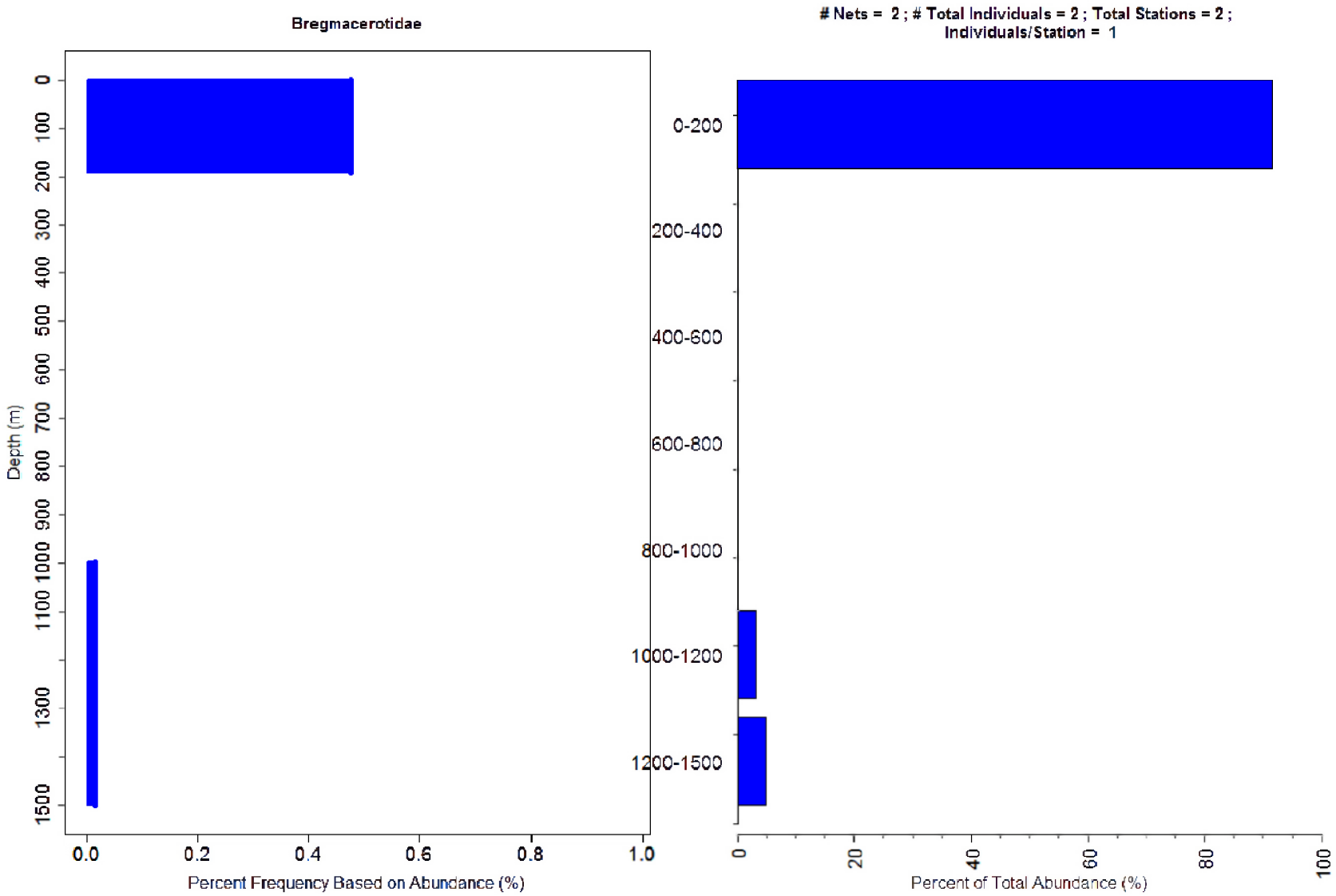
Brachyura


Bramidae
Nets = 9 ; # Total Individuals = 13 ; Total Stations = 9 ;
Individuals/Station = 1.44
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

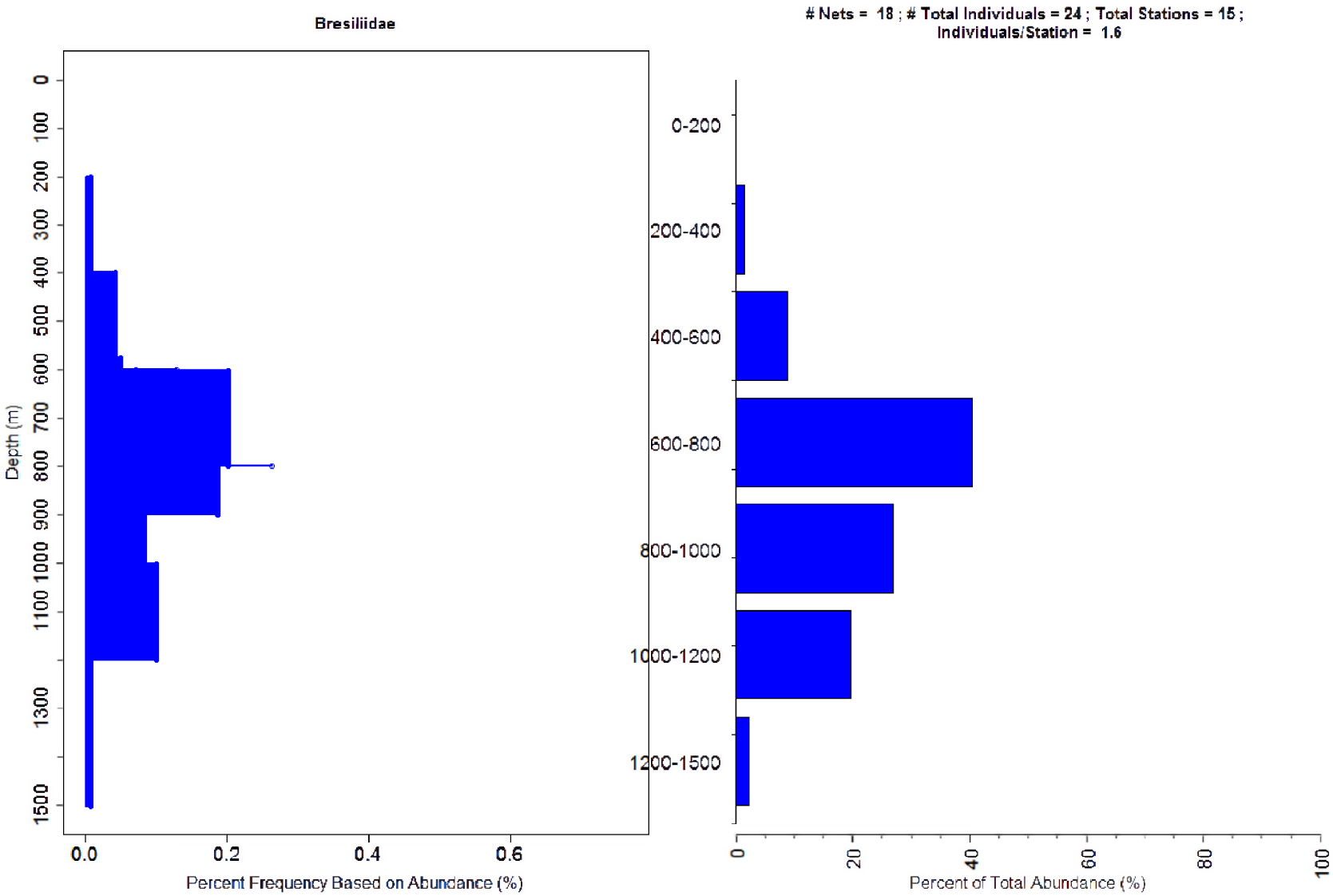
Bramidae



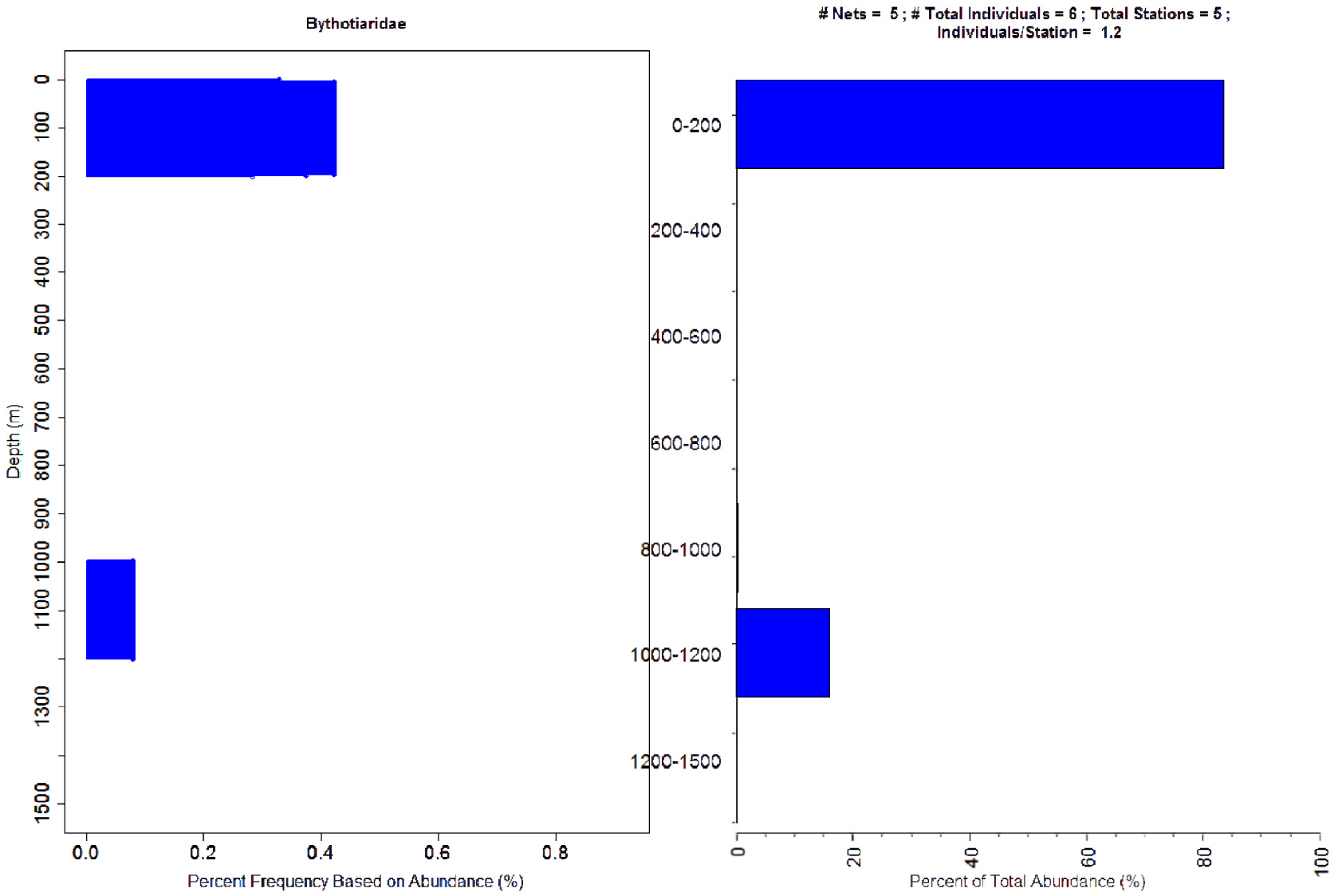
Bregmaceros



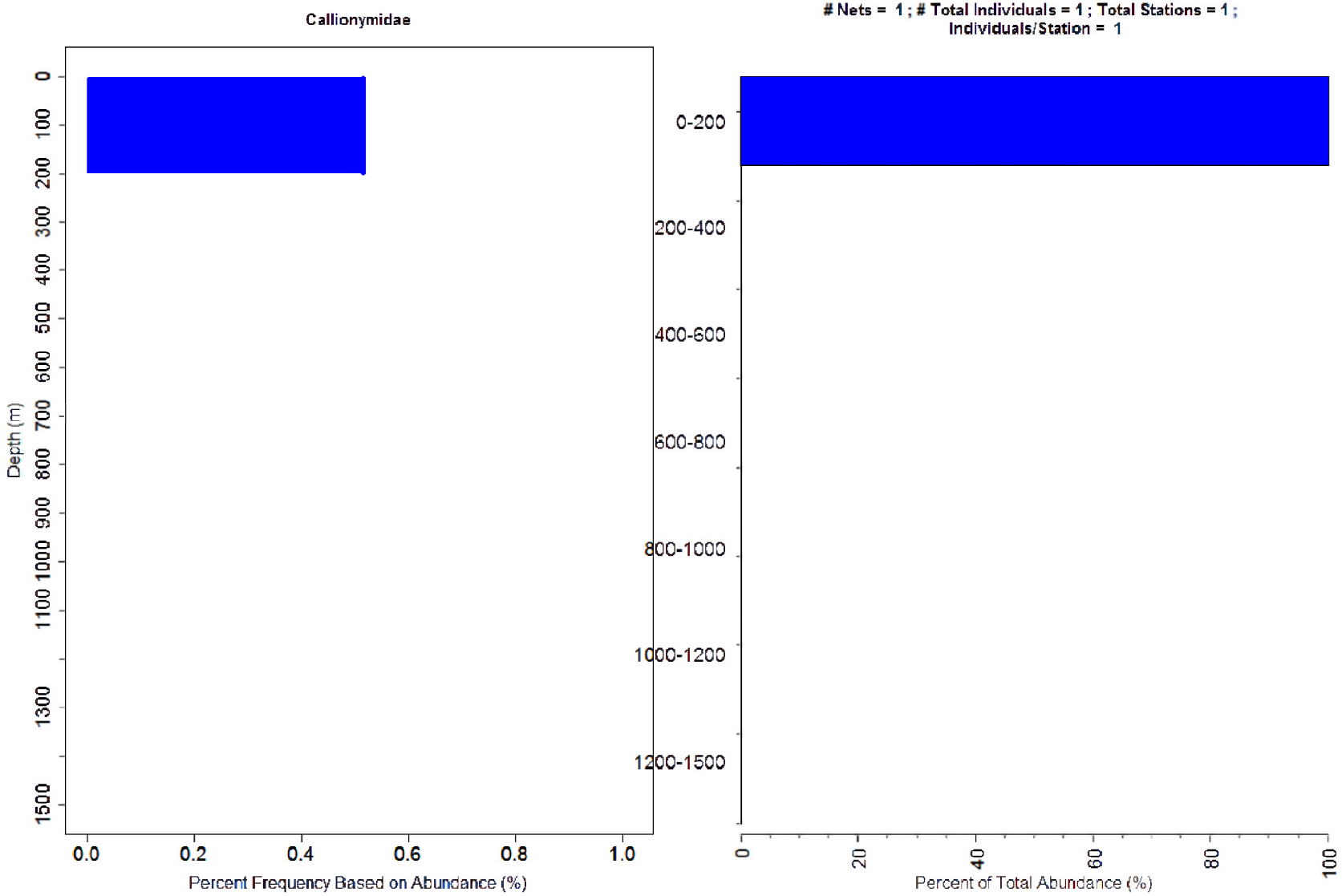
Bregmacerotidae



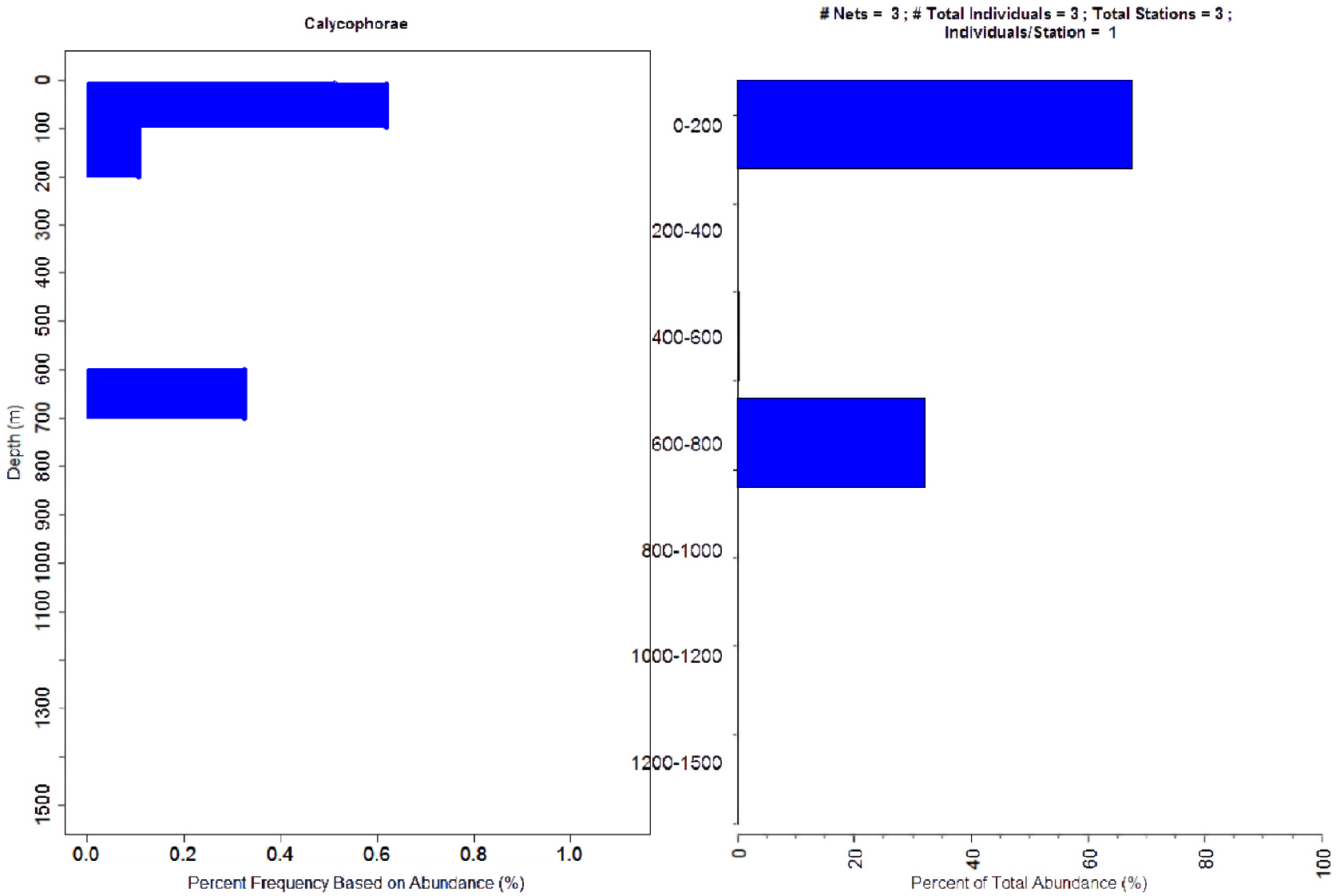
Bresiliidae



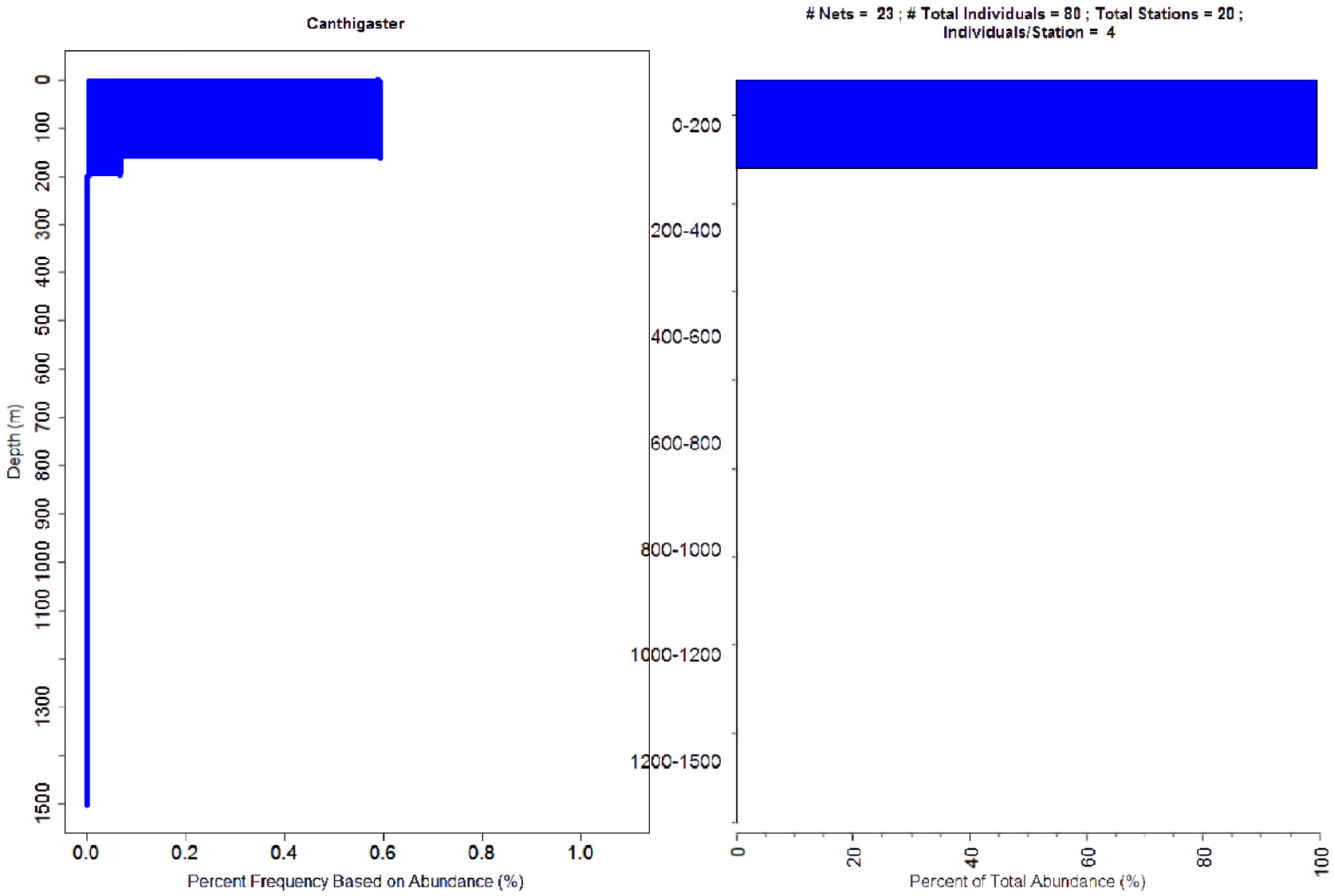
Bythotiaridae



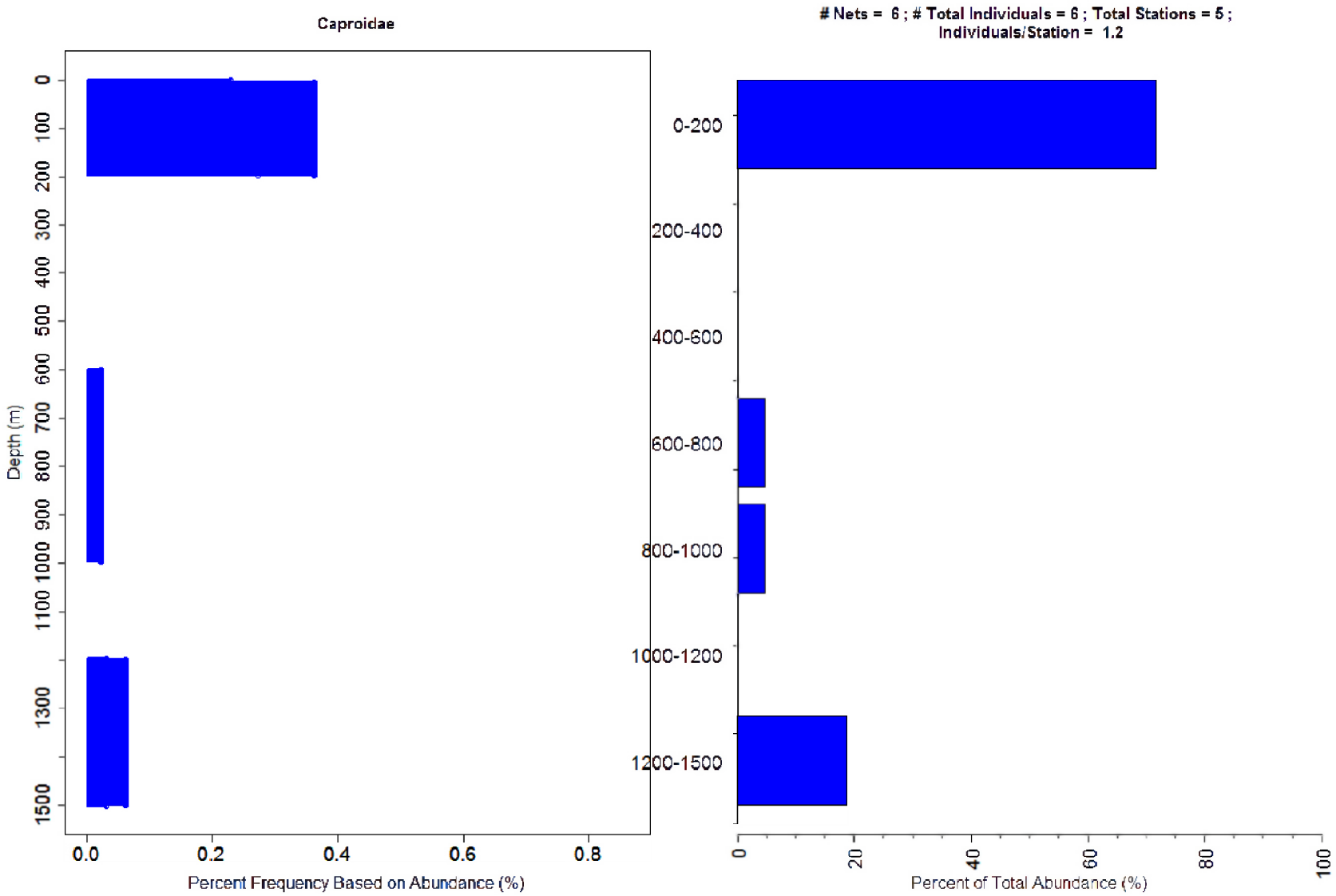
Callionymidae



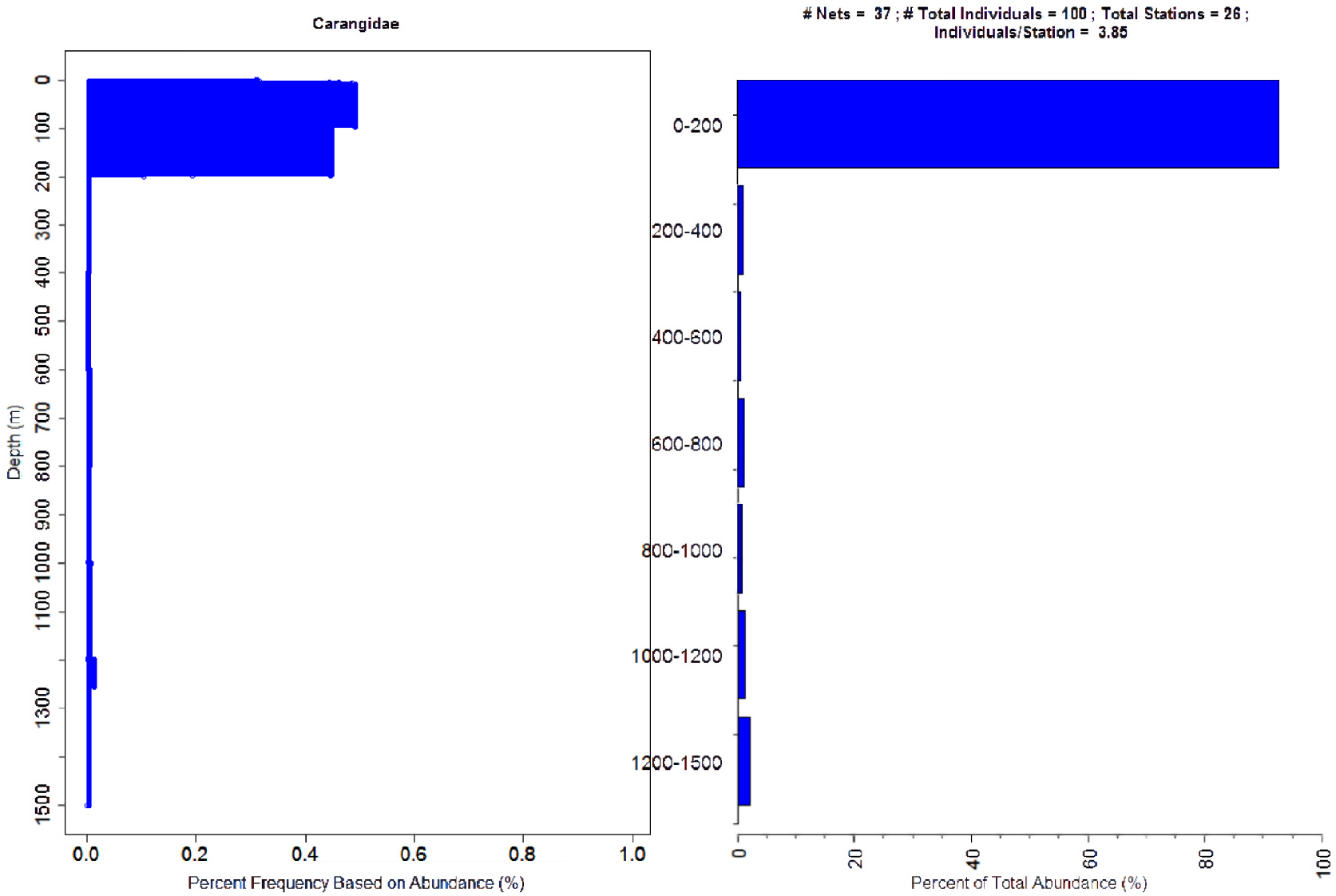
Calycophorae



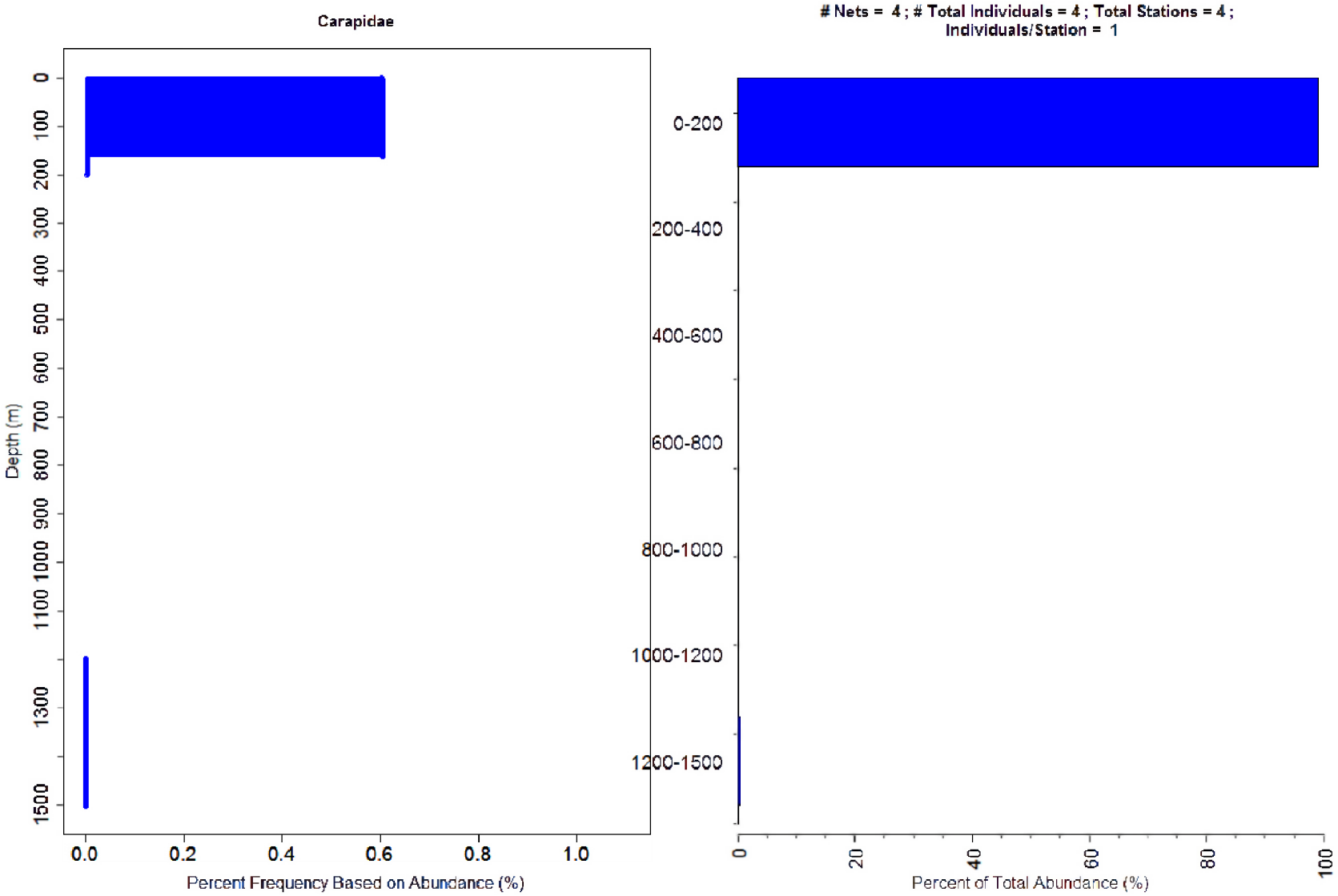
Canthigaster


Caproidae
Nets = 6 ; # Total Individuals = 6 ; Total Stations = 5 ;
Individuals/Station = 1.2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

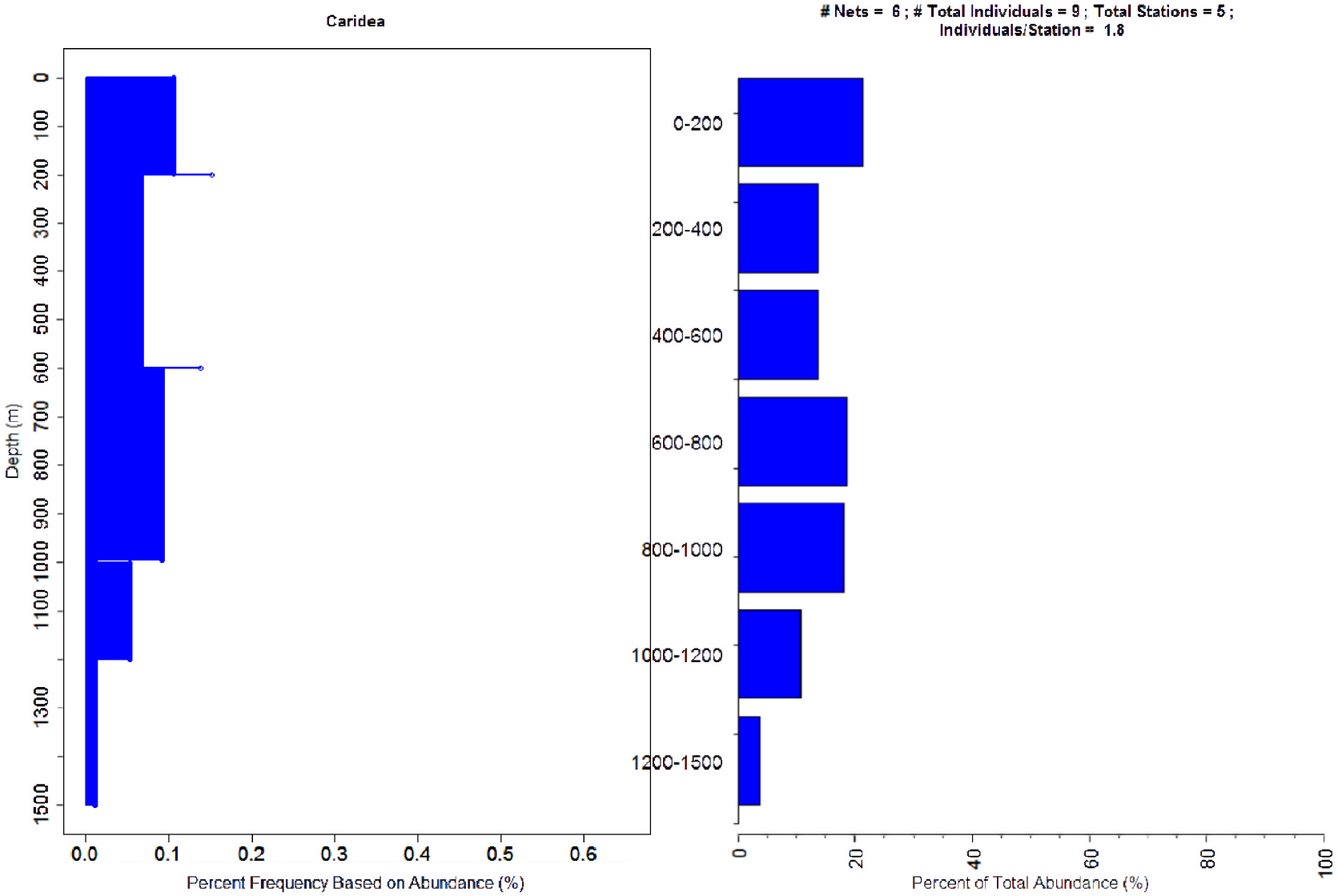
Caproidae


Carangidae
Nets = 37 ; # Total Individuals = 100 ; Total Stations = 26 ;
Individuals/Station = 3.85
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

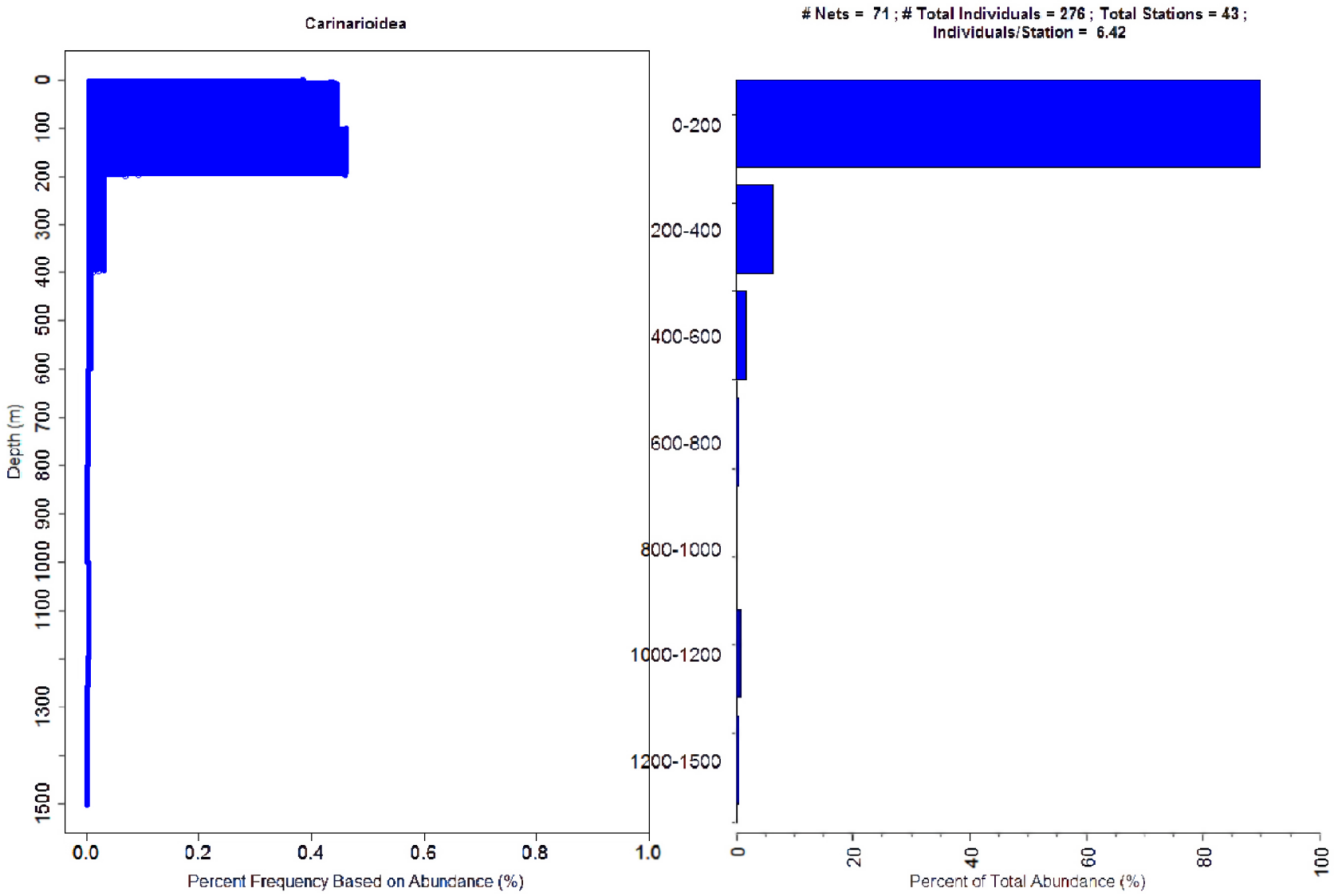
Carangidae


Carapidae
Nets = 4 ; # Total Individuals = 4 ; Total Stations = 4 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

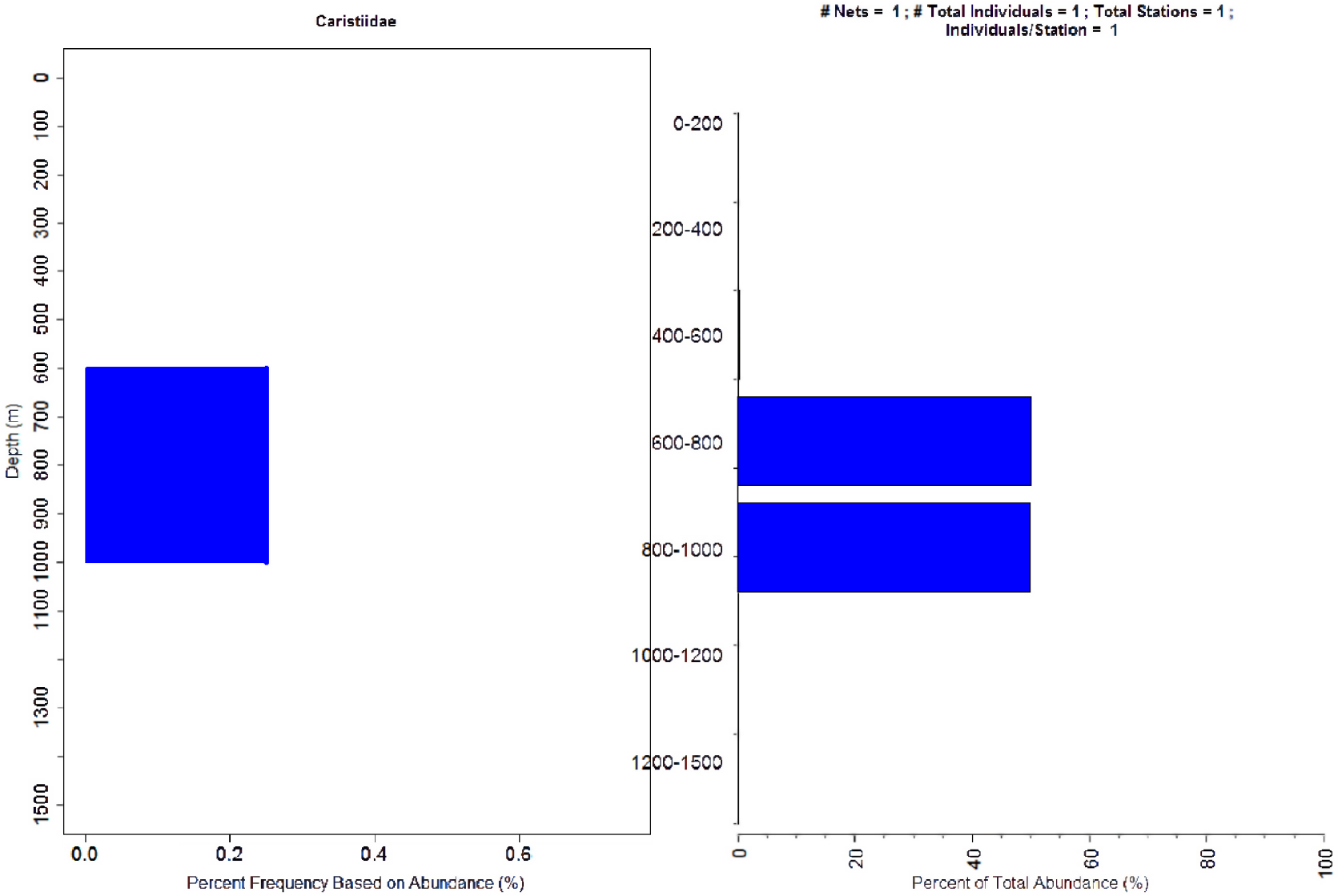
Carapidae


Caridea
Nets = 6 ; # Total Individuals = 9 ; Total Stations = 5 ;
Individuals/Station = 1.8
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

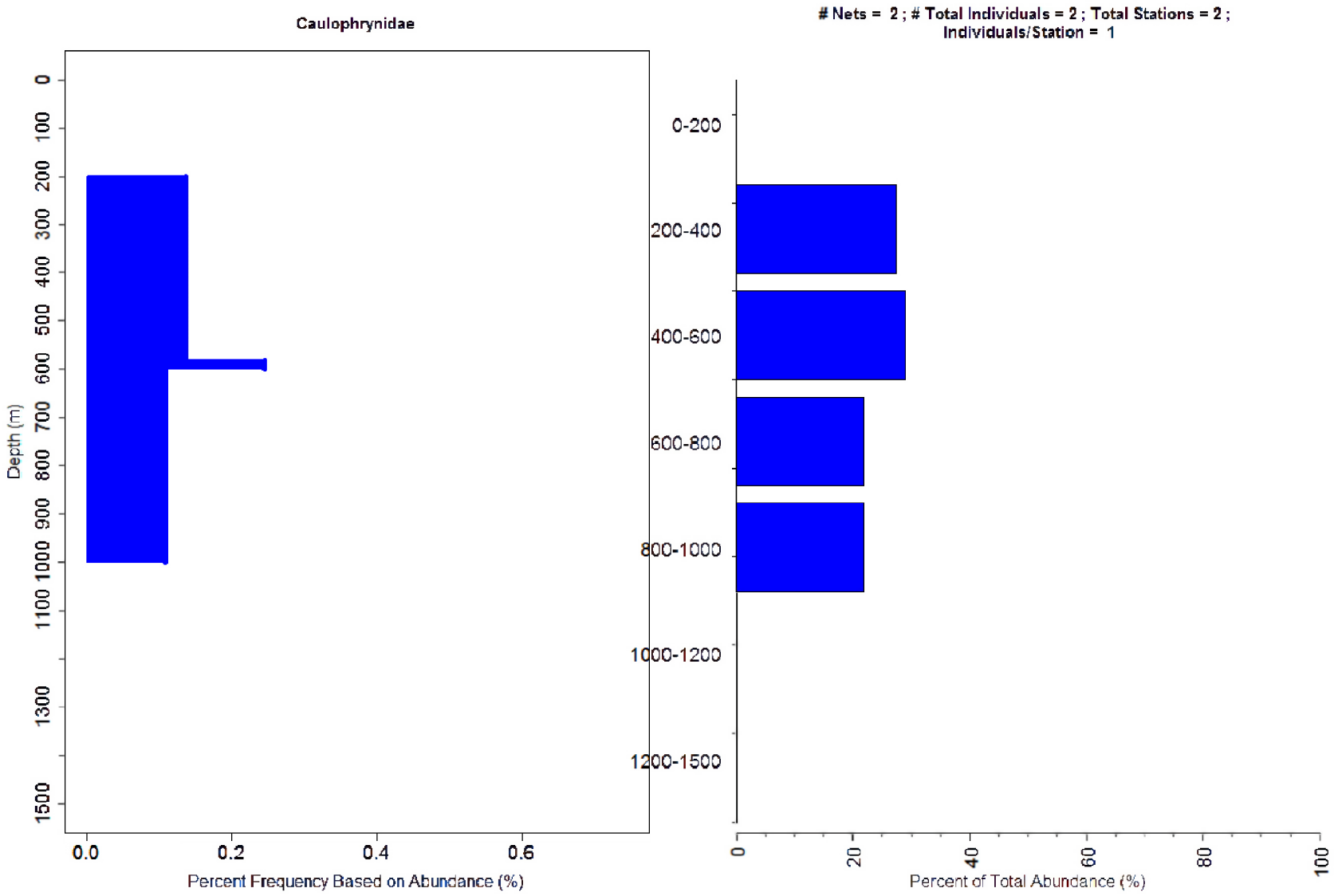
Caridea



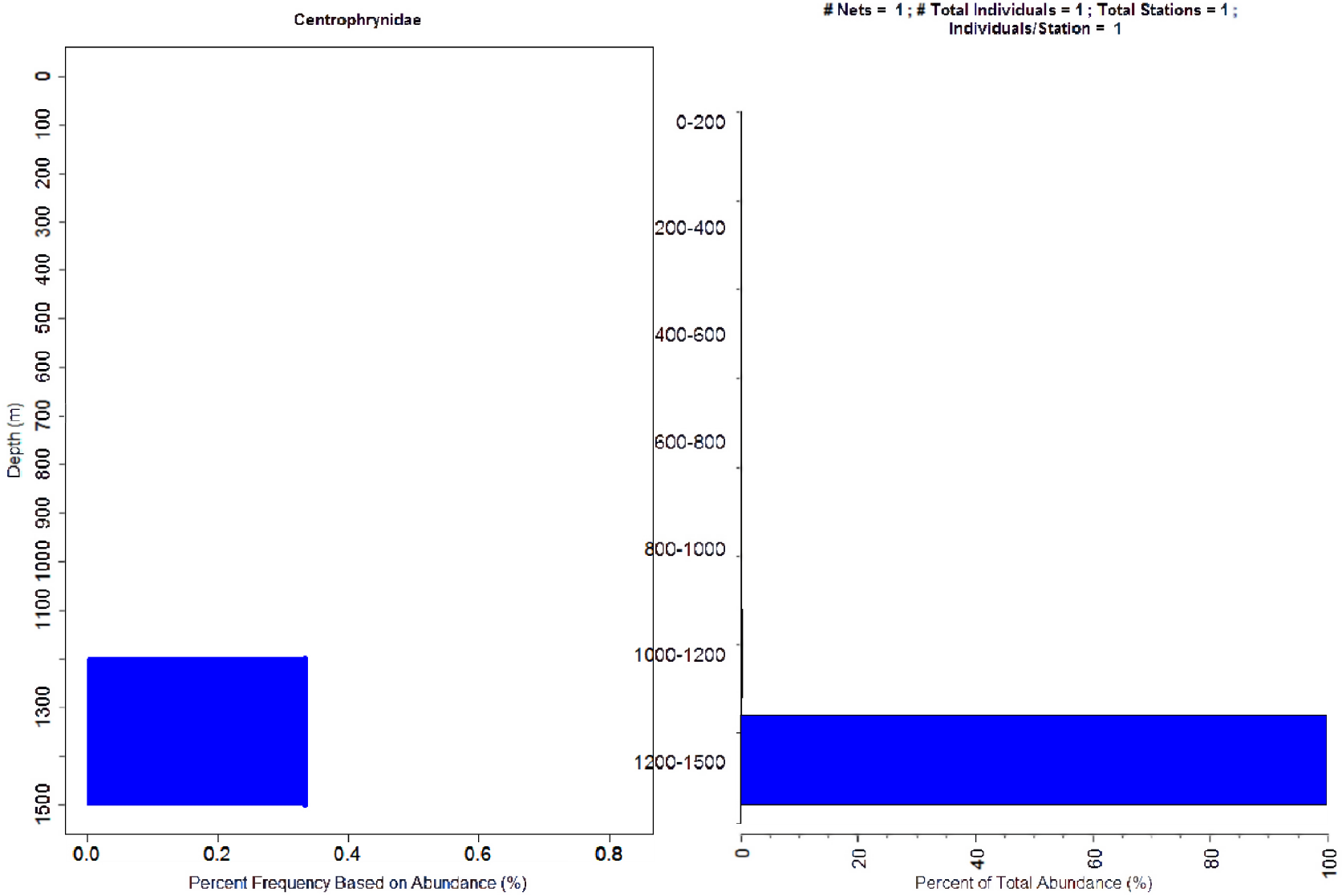
Carinarioidea



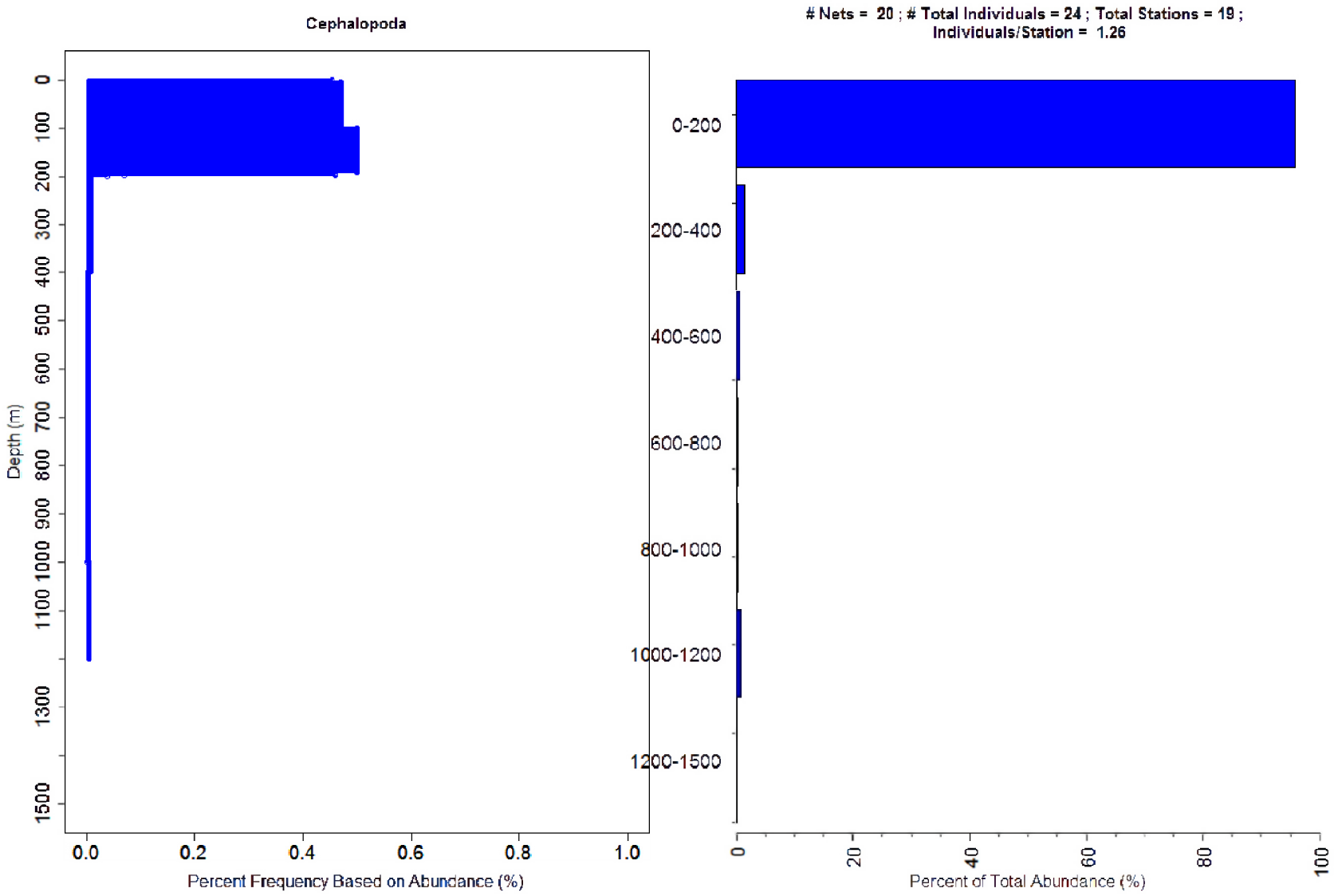
Caristiidae



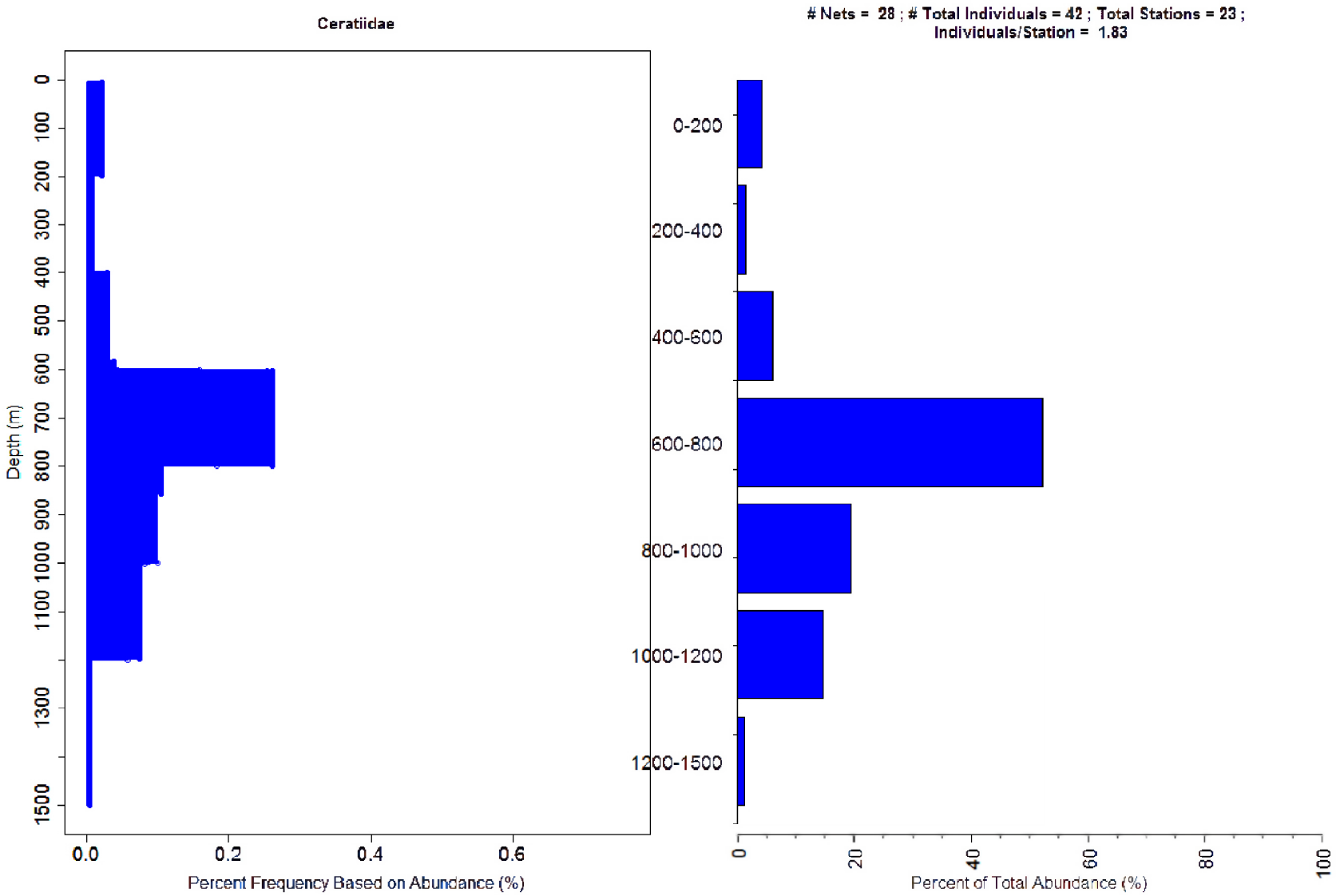
Caulophrynidae



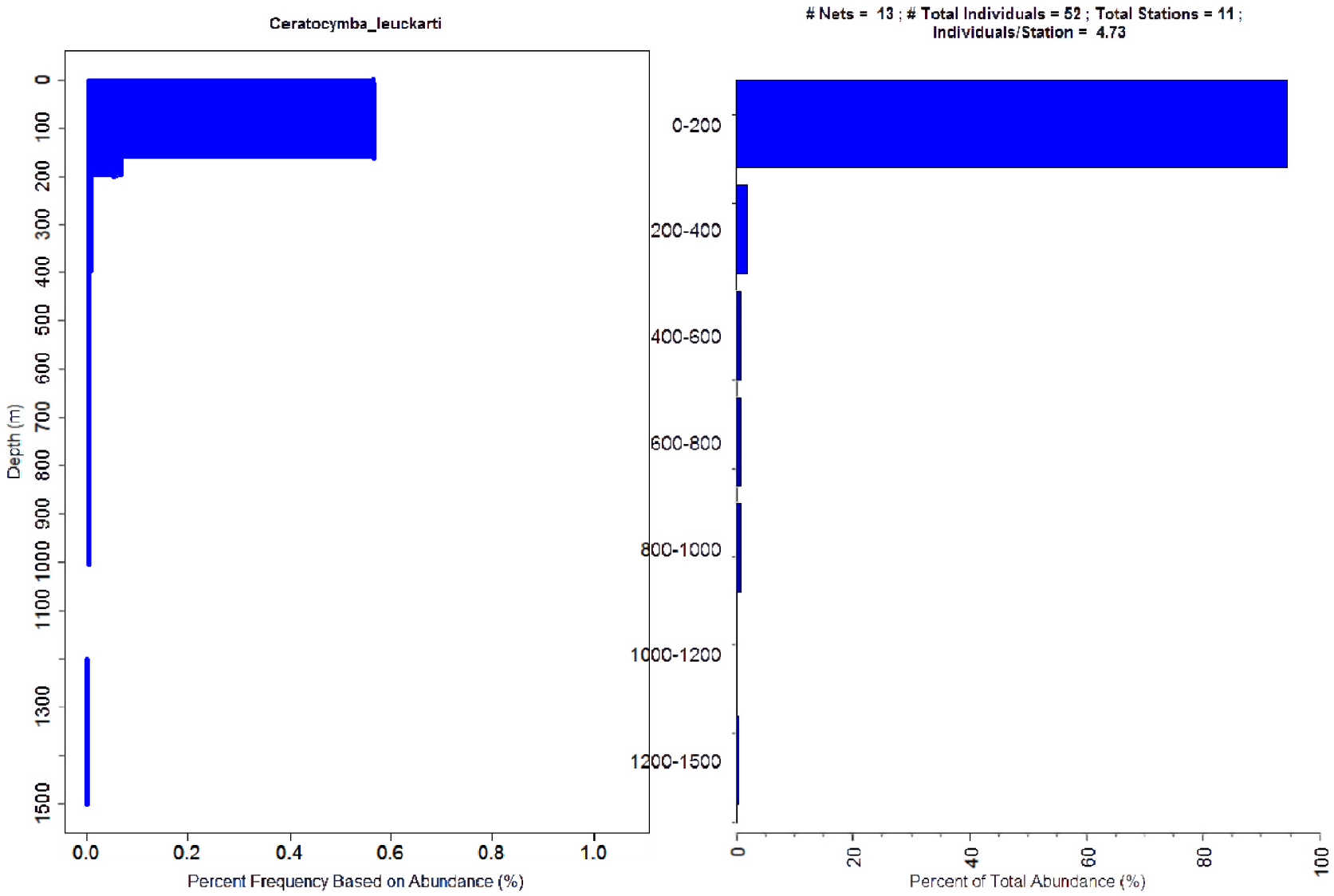
Centrophrynidae



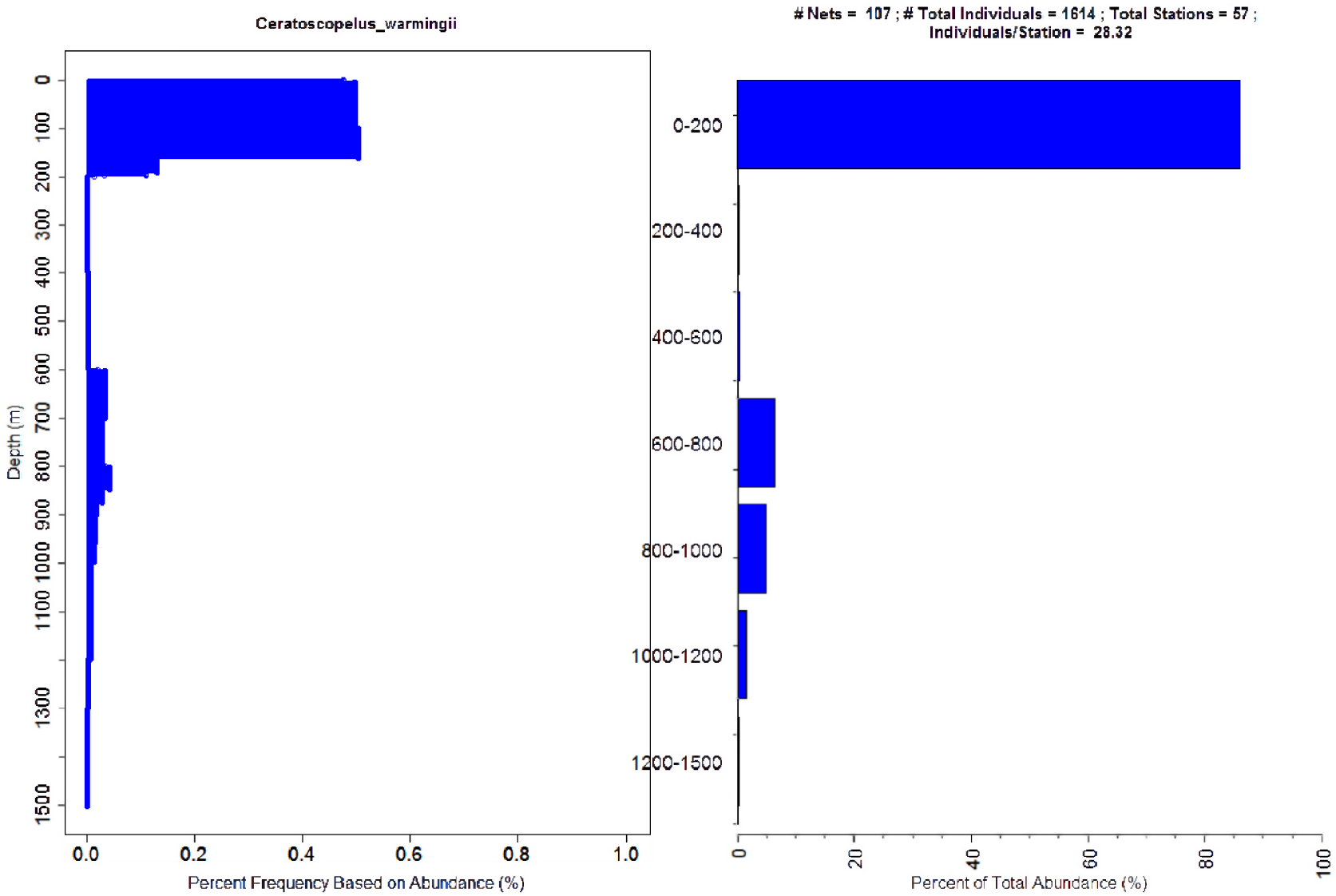
Cephalopoda


Ceratiidae
Nets = 28 ; # Total Individuals = 42 ; Total Stations = 23 ;
Individuals/Station = 1.83
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

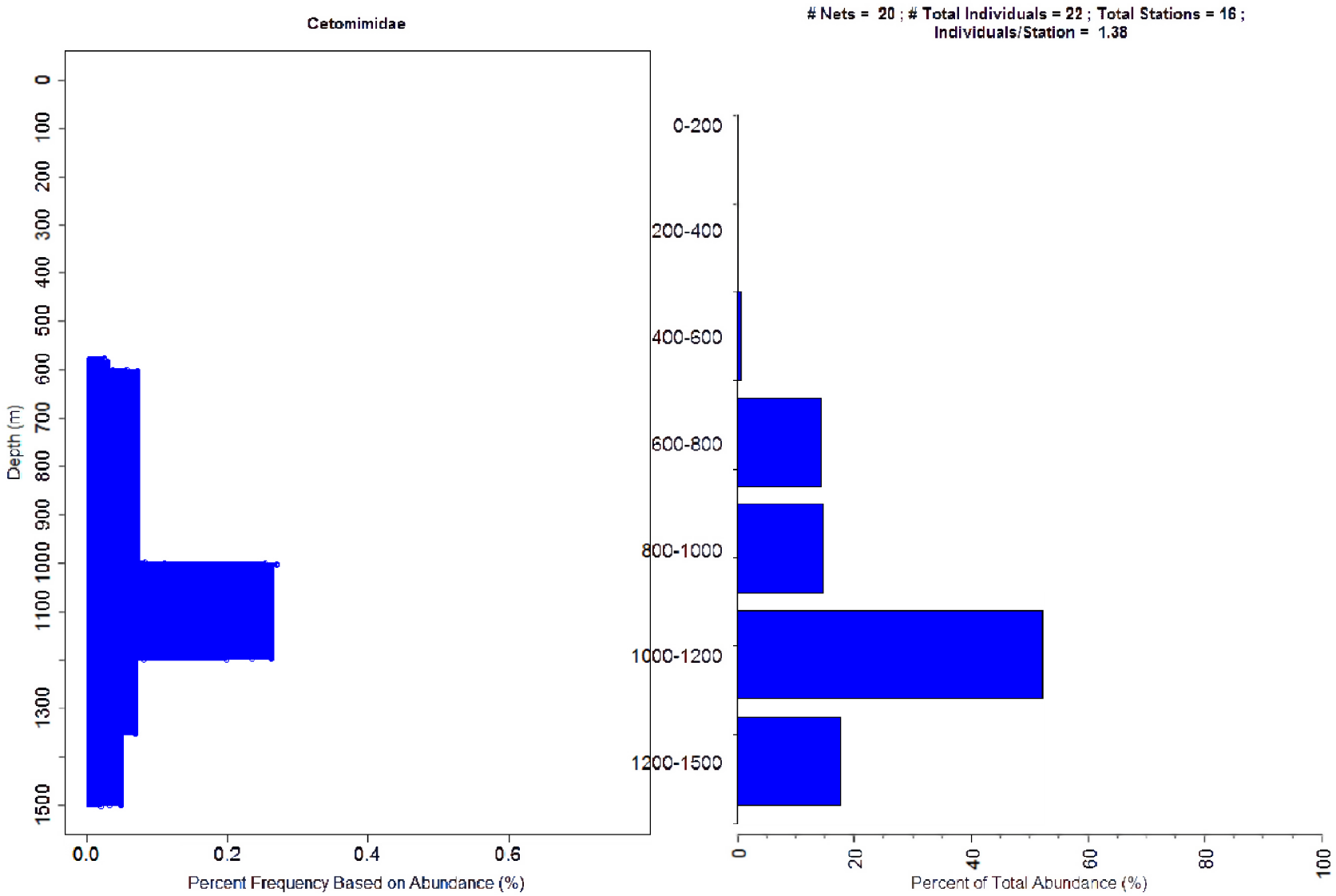
Ceratiidae



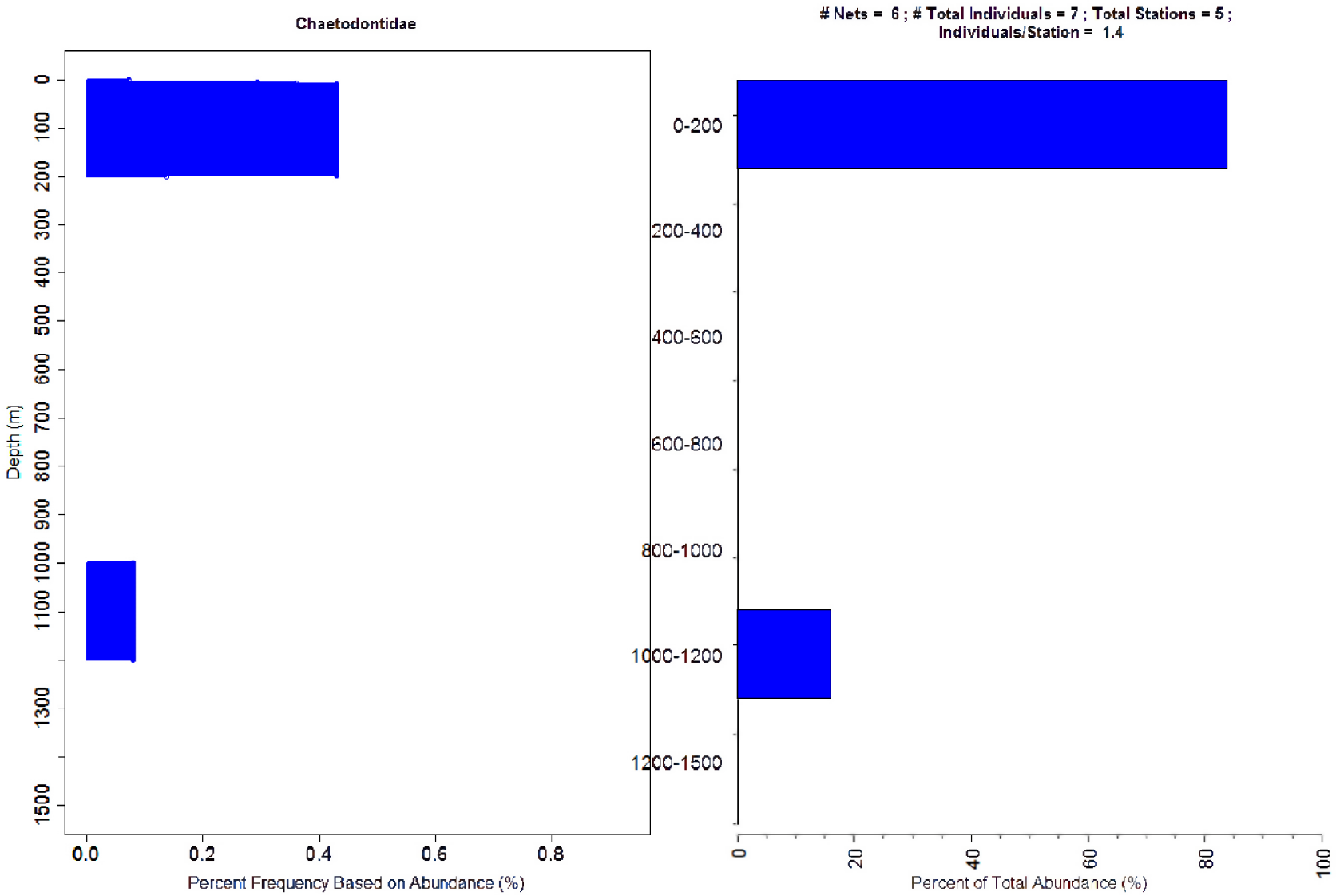
Ceratocymba_leuckarti



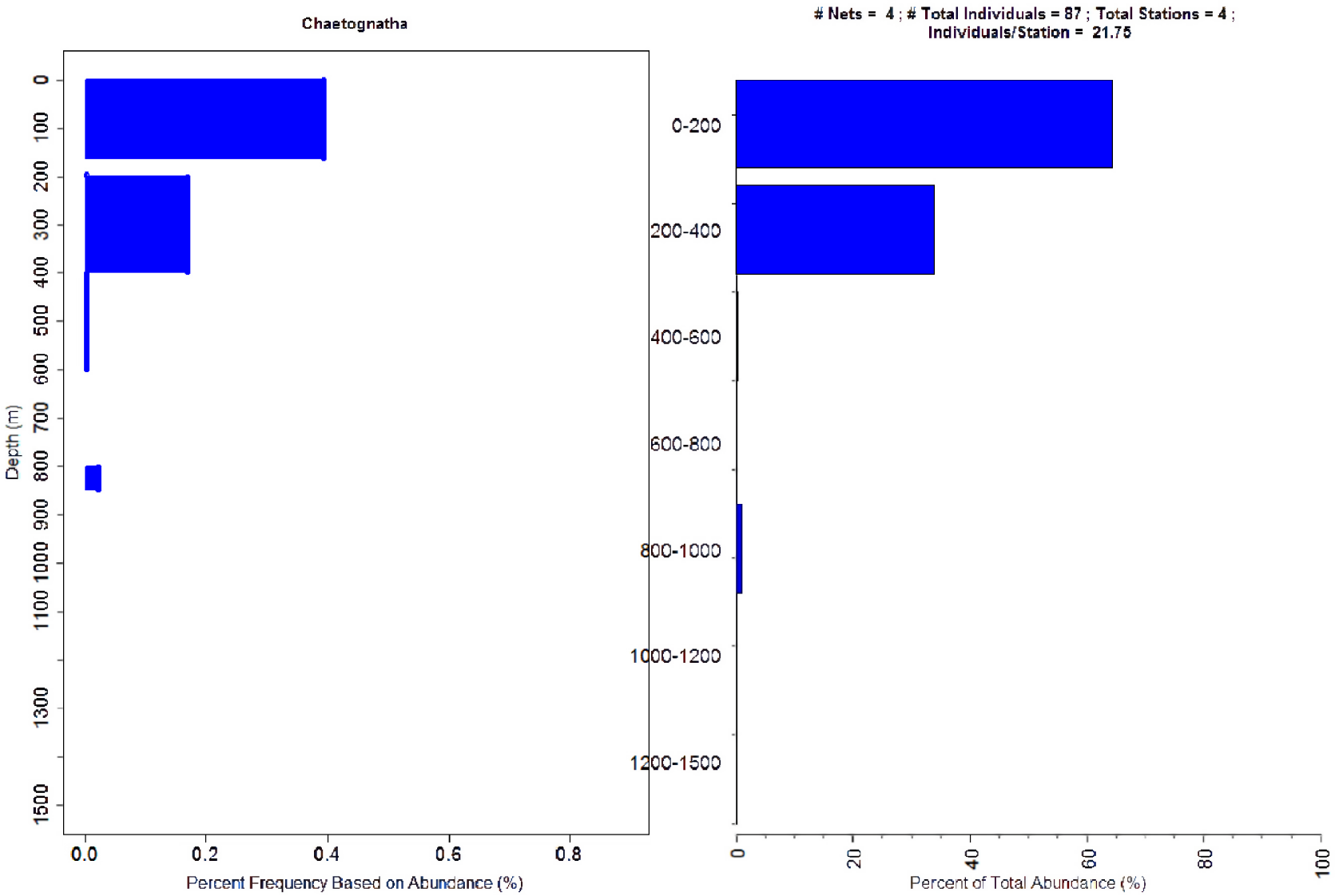
Ceratoscopelus_warmingii



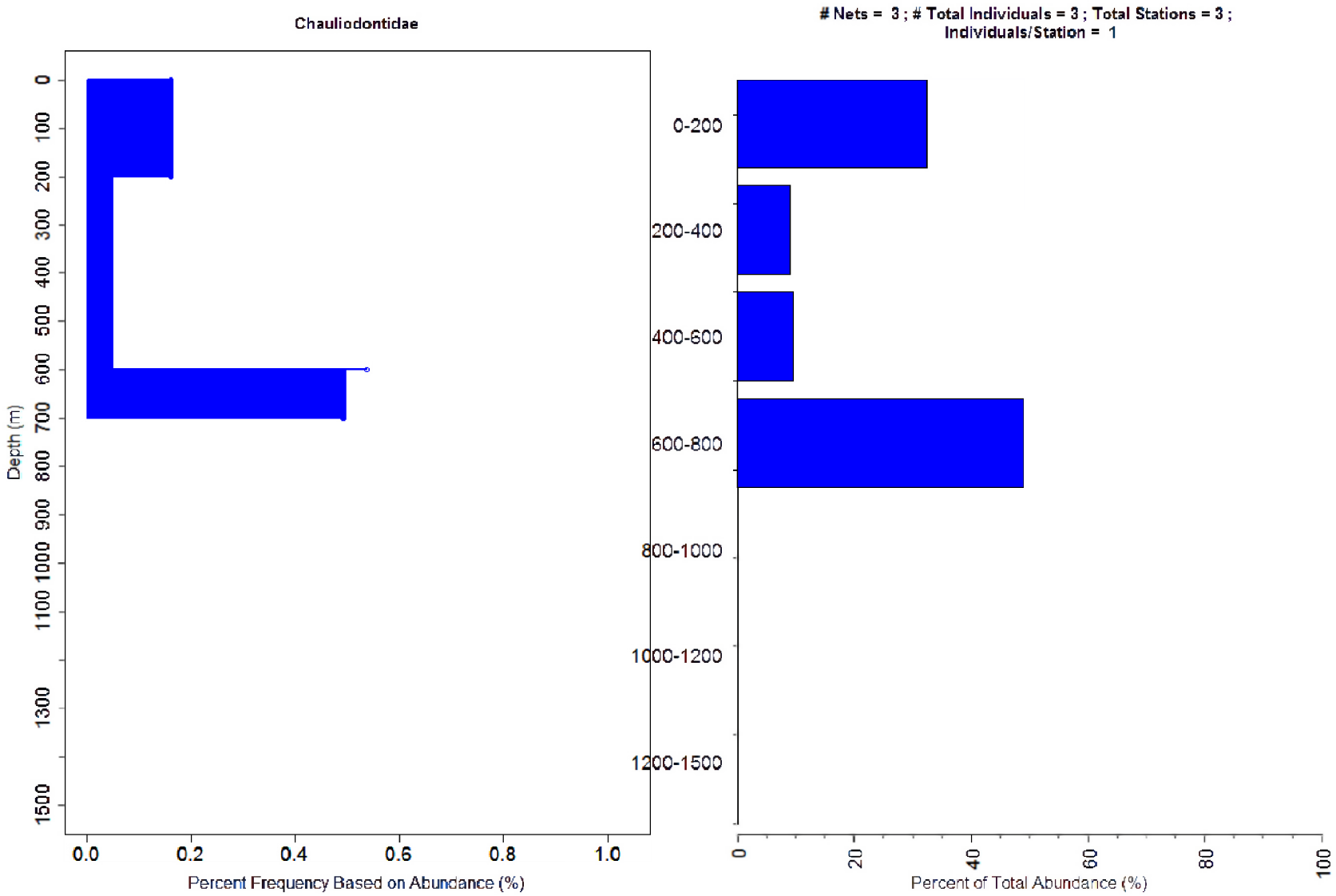
Cetomimidae



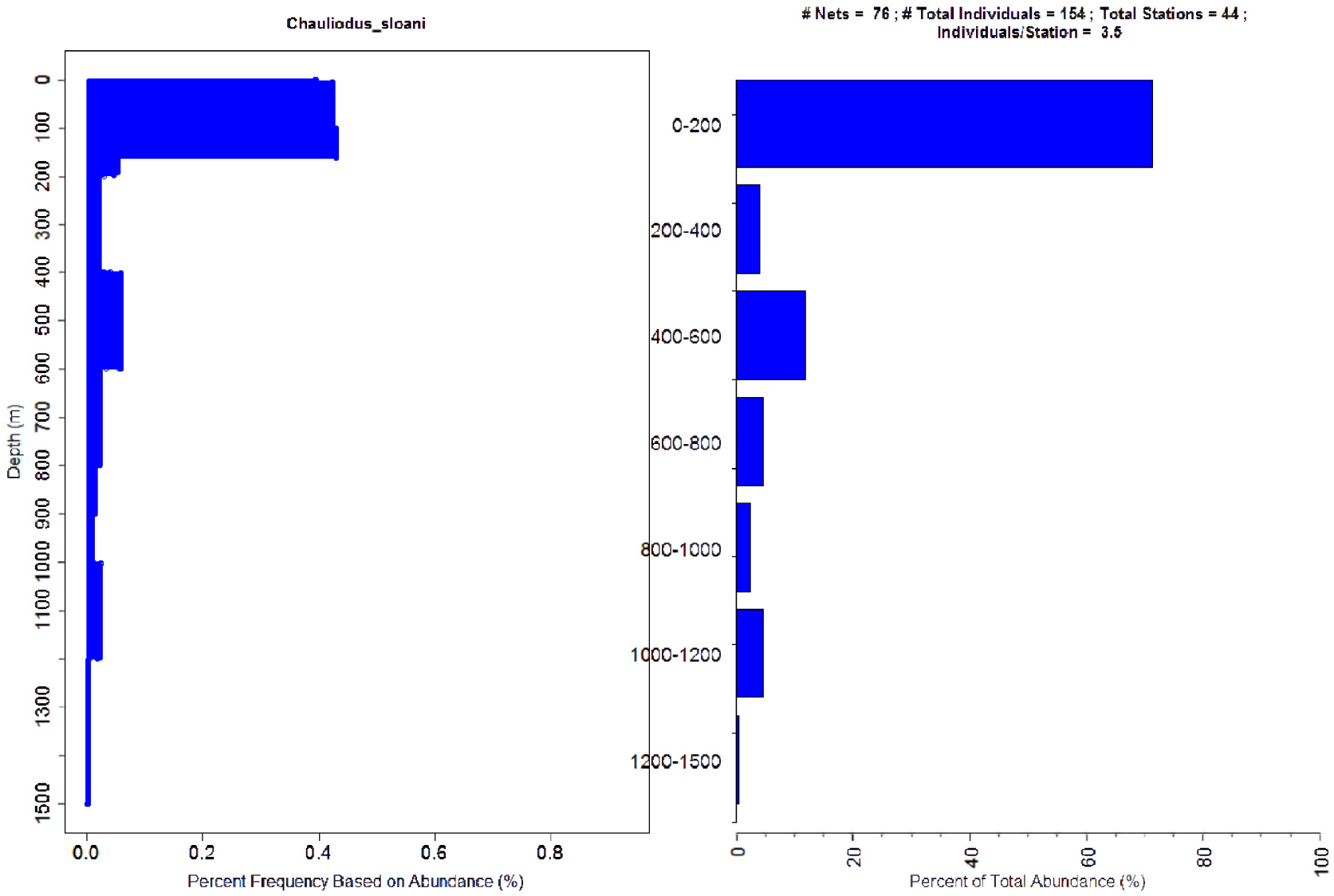
Chaetodontidae



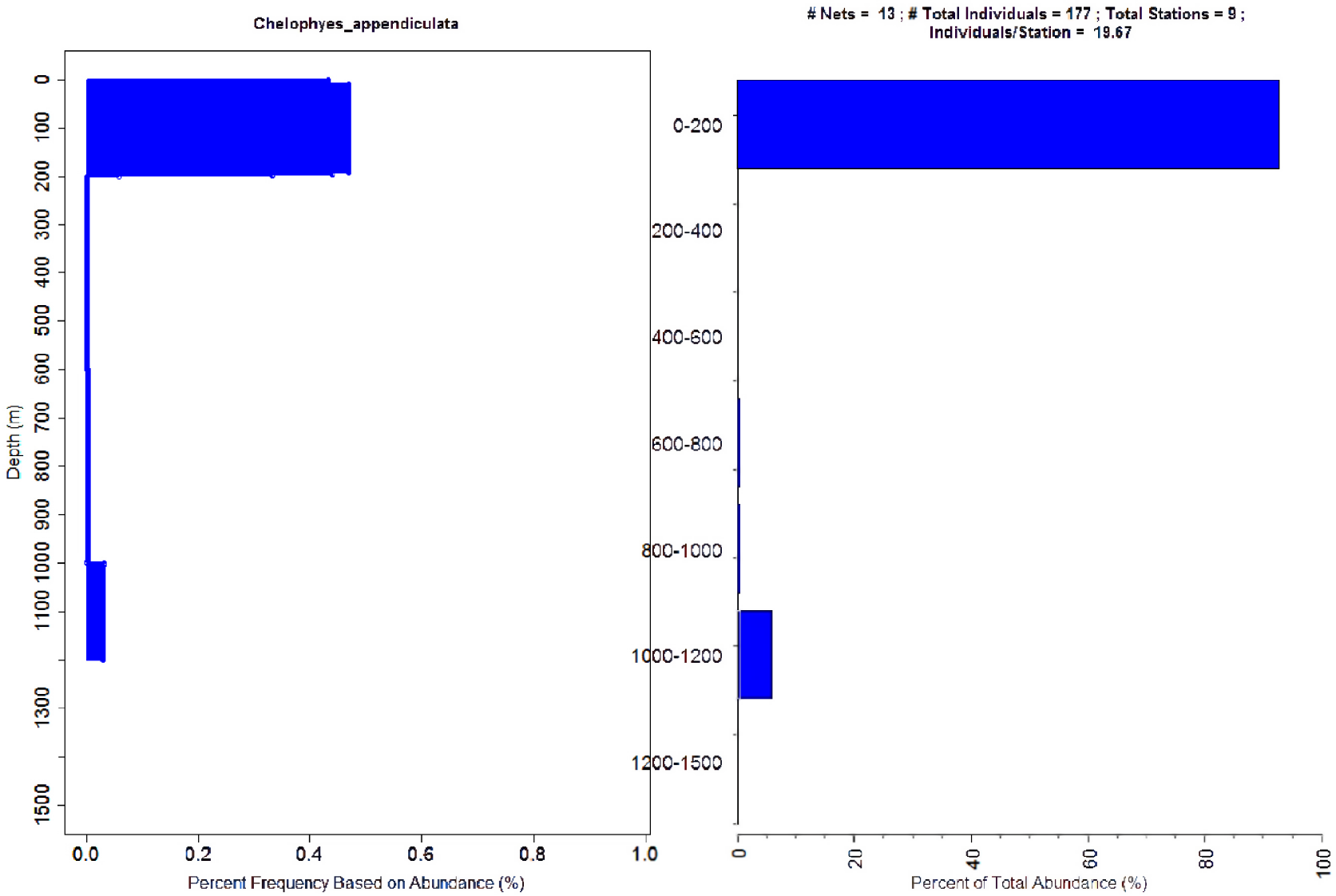
Chaetognatha



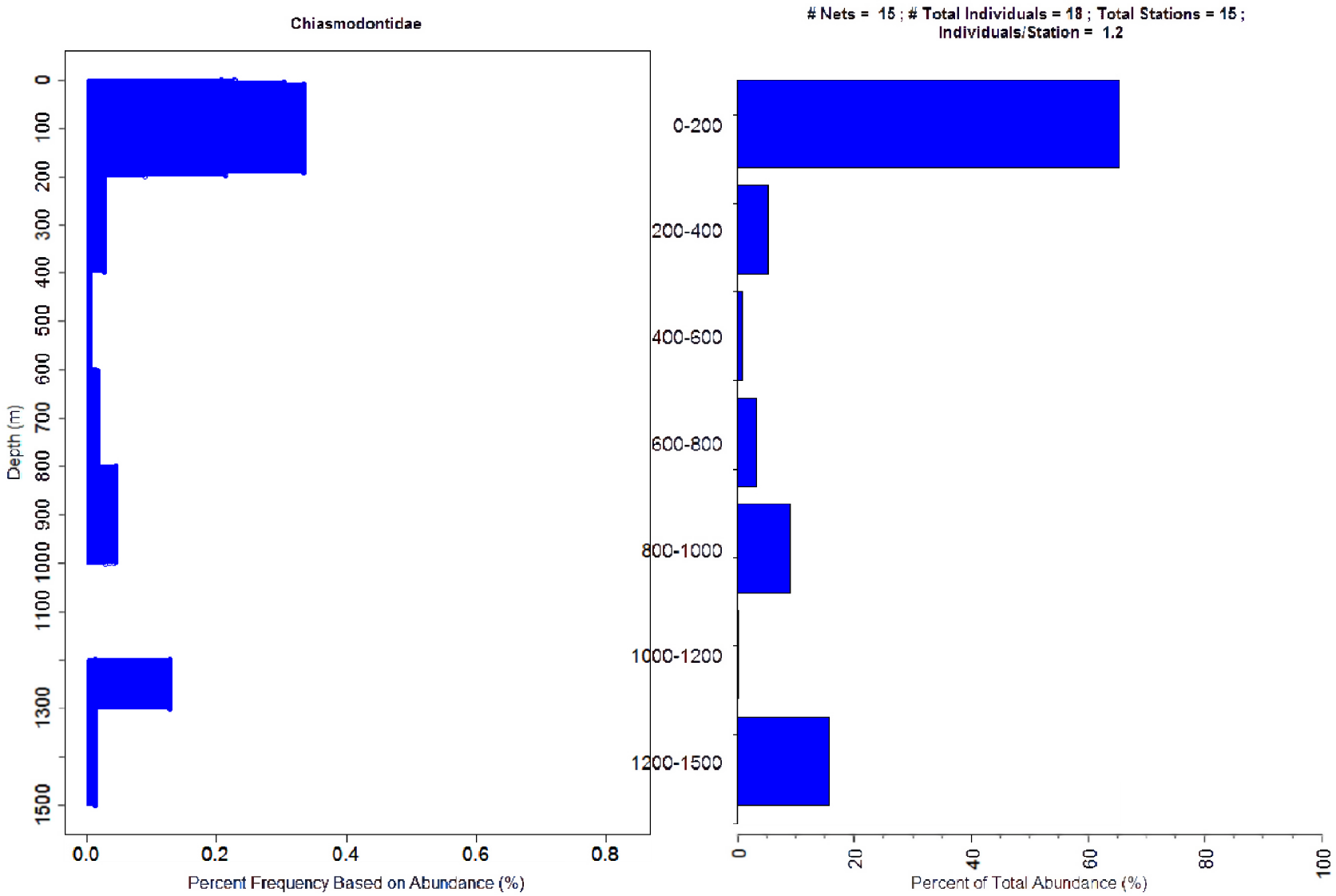
Chauliodontidae



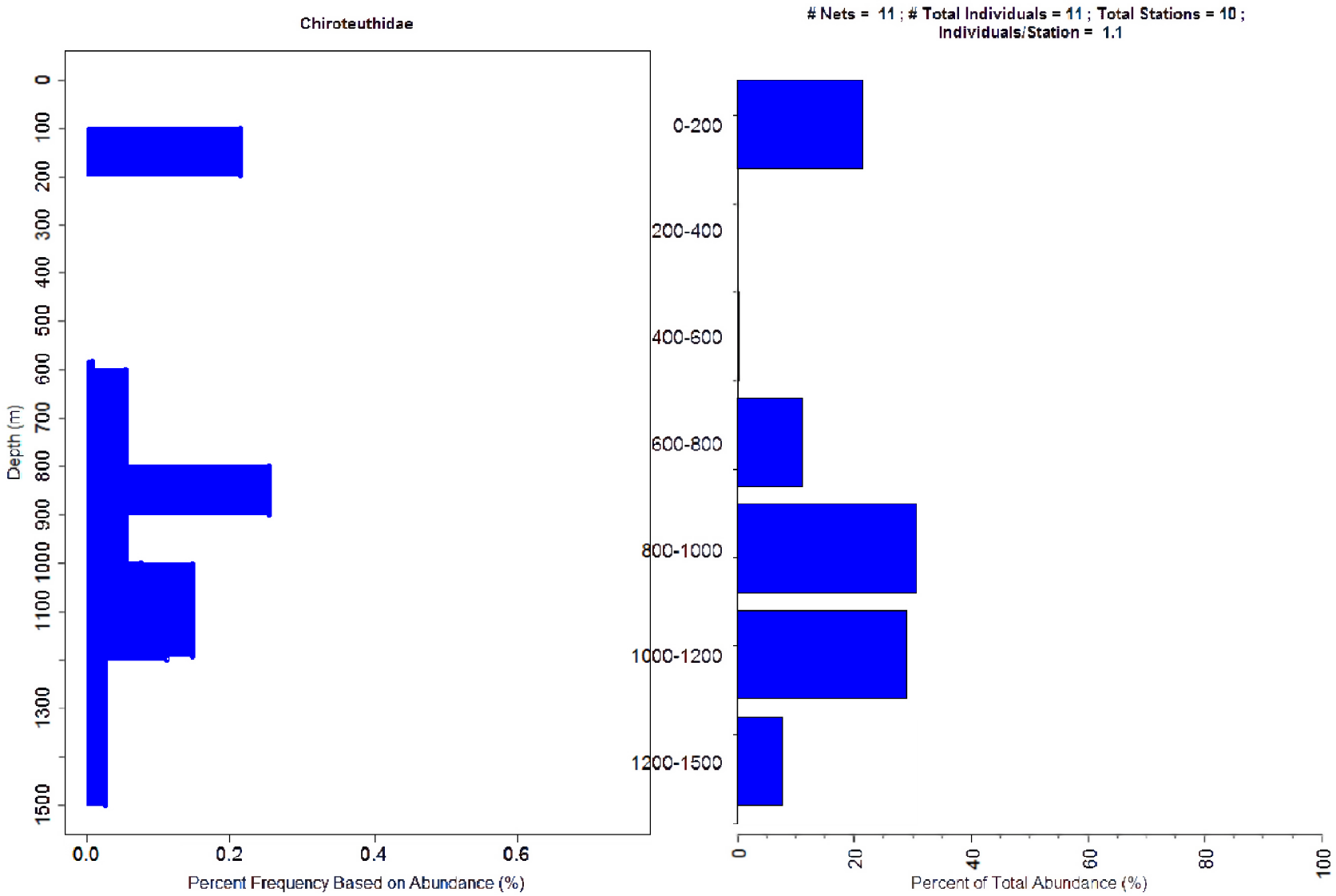
Chauliodus_sloani



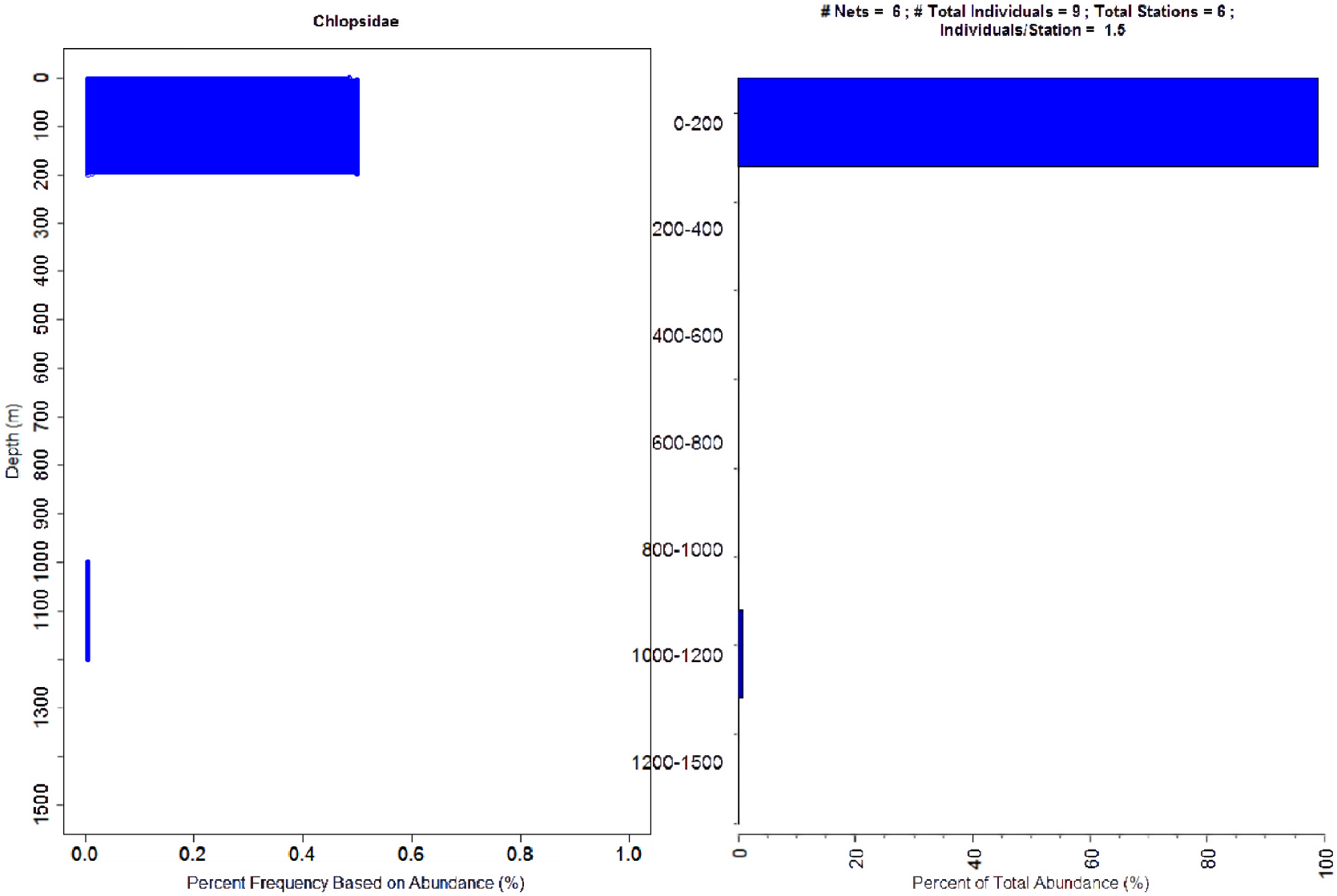
Chelophyes_appendiculata



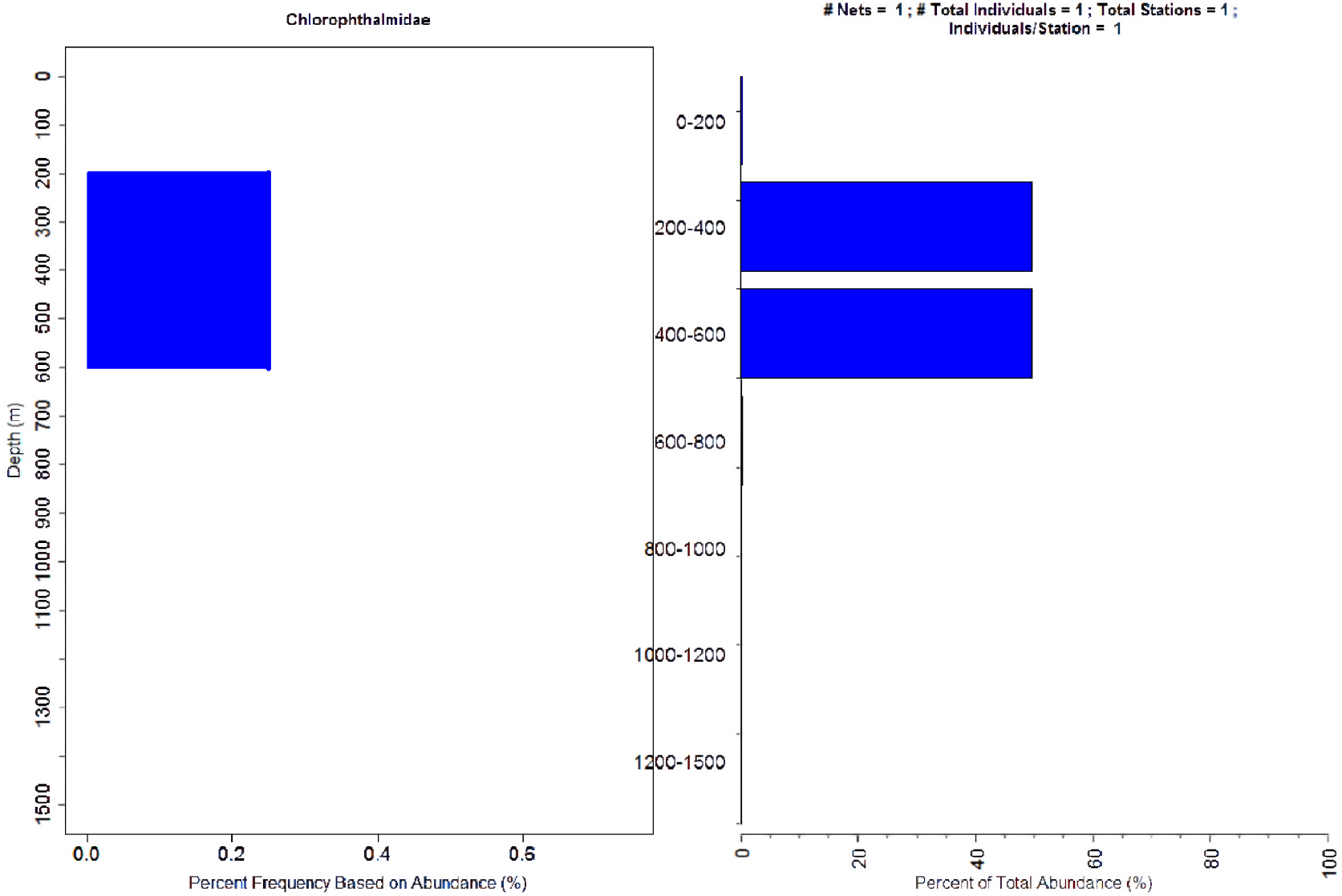
Chiasmodontidae



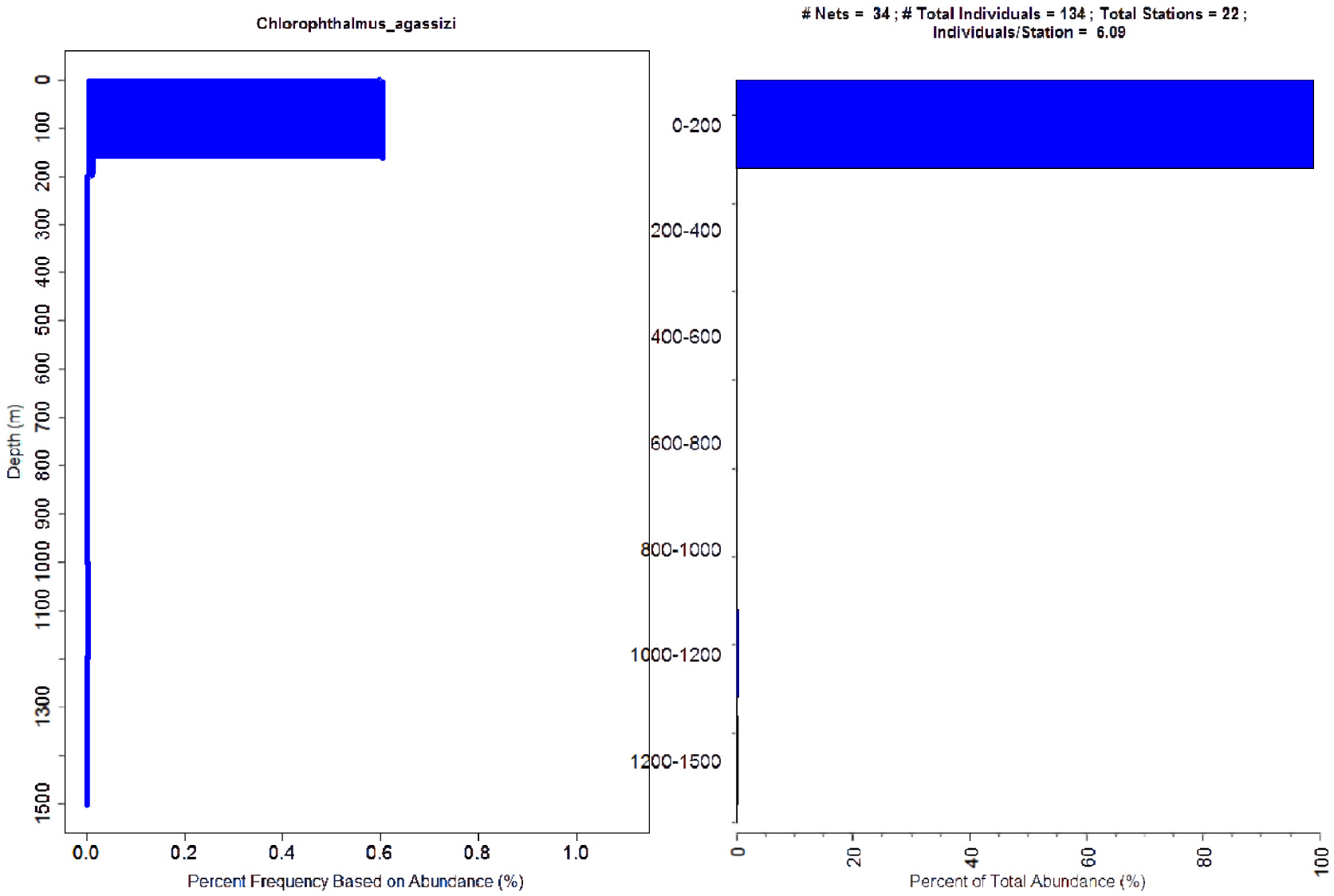
Chiroteuthidae


Chlopsidae
Nets = 6 ; # Total Individuals = 9 ; Total Stations = 6 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

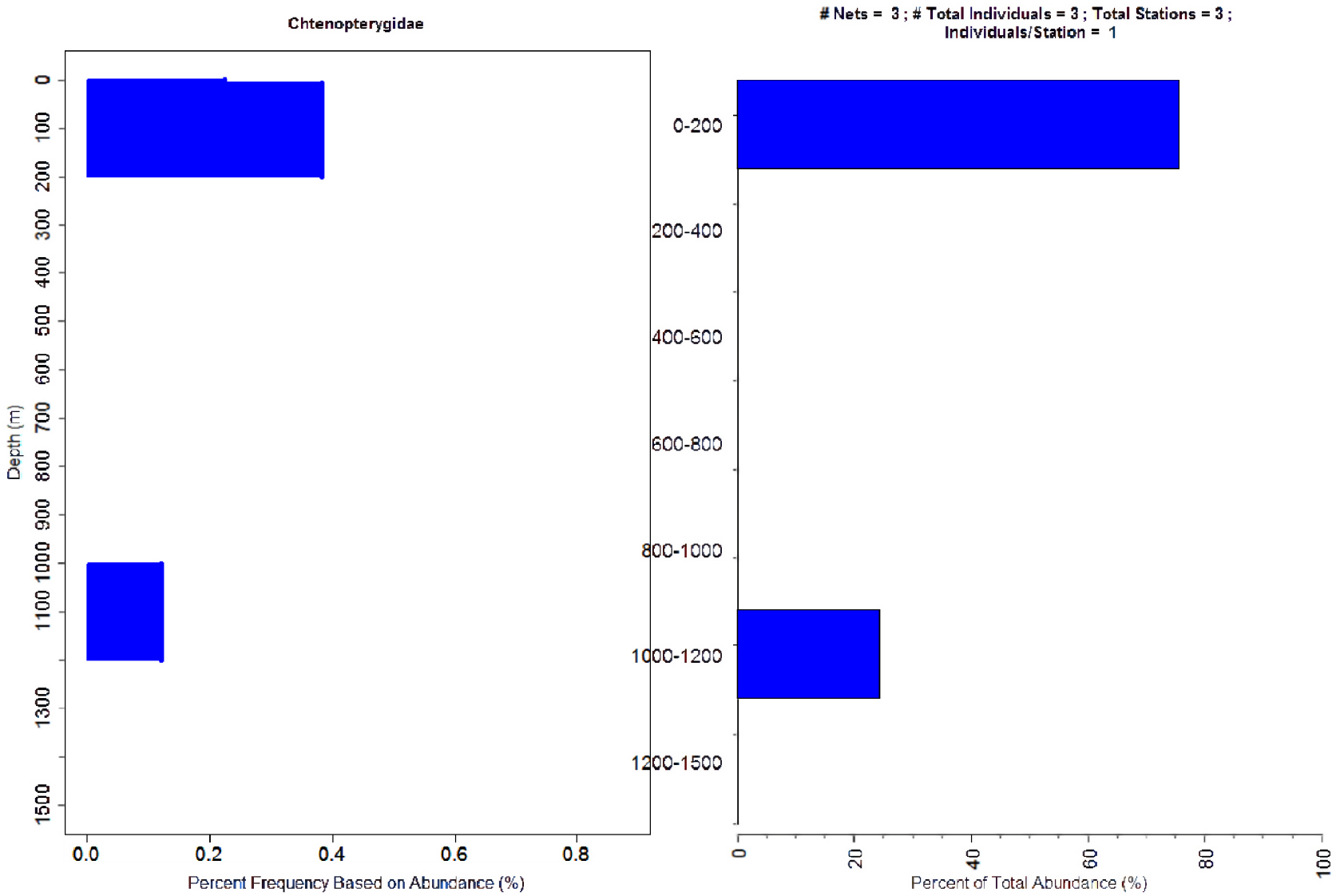
Chlopsidae



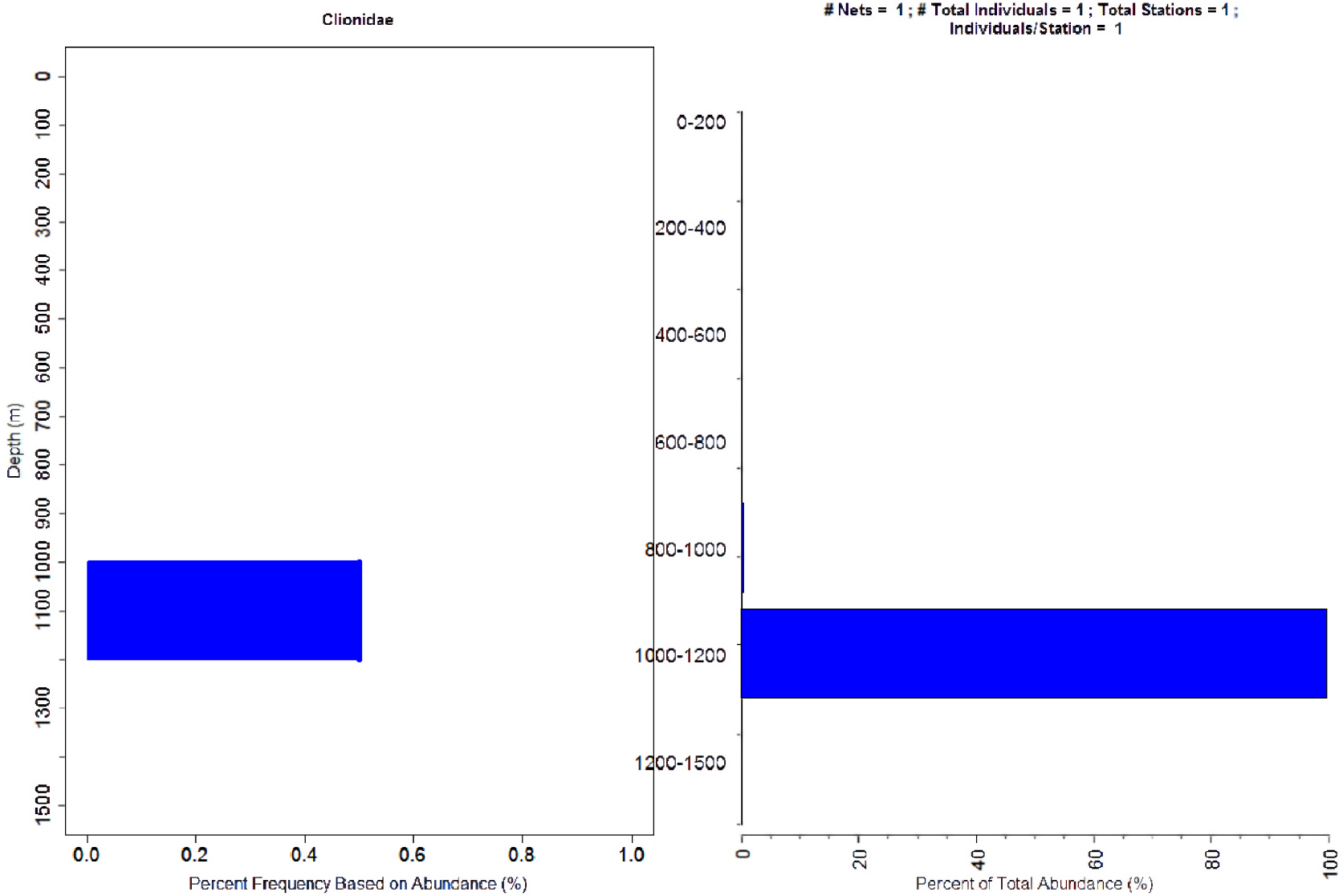
Chlorophthalmidae



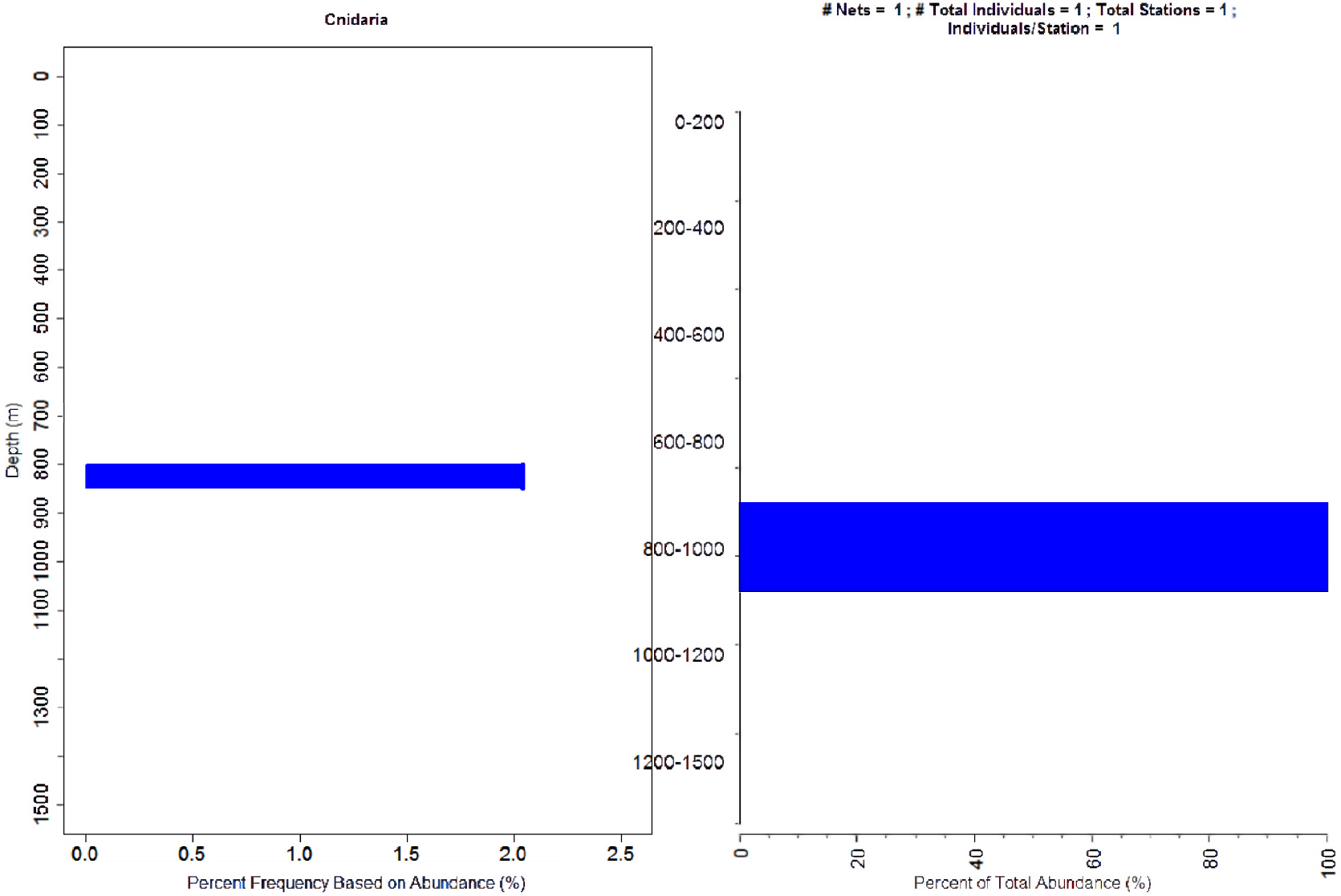
Chlorophthalmus_agassizi



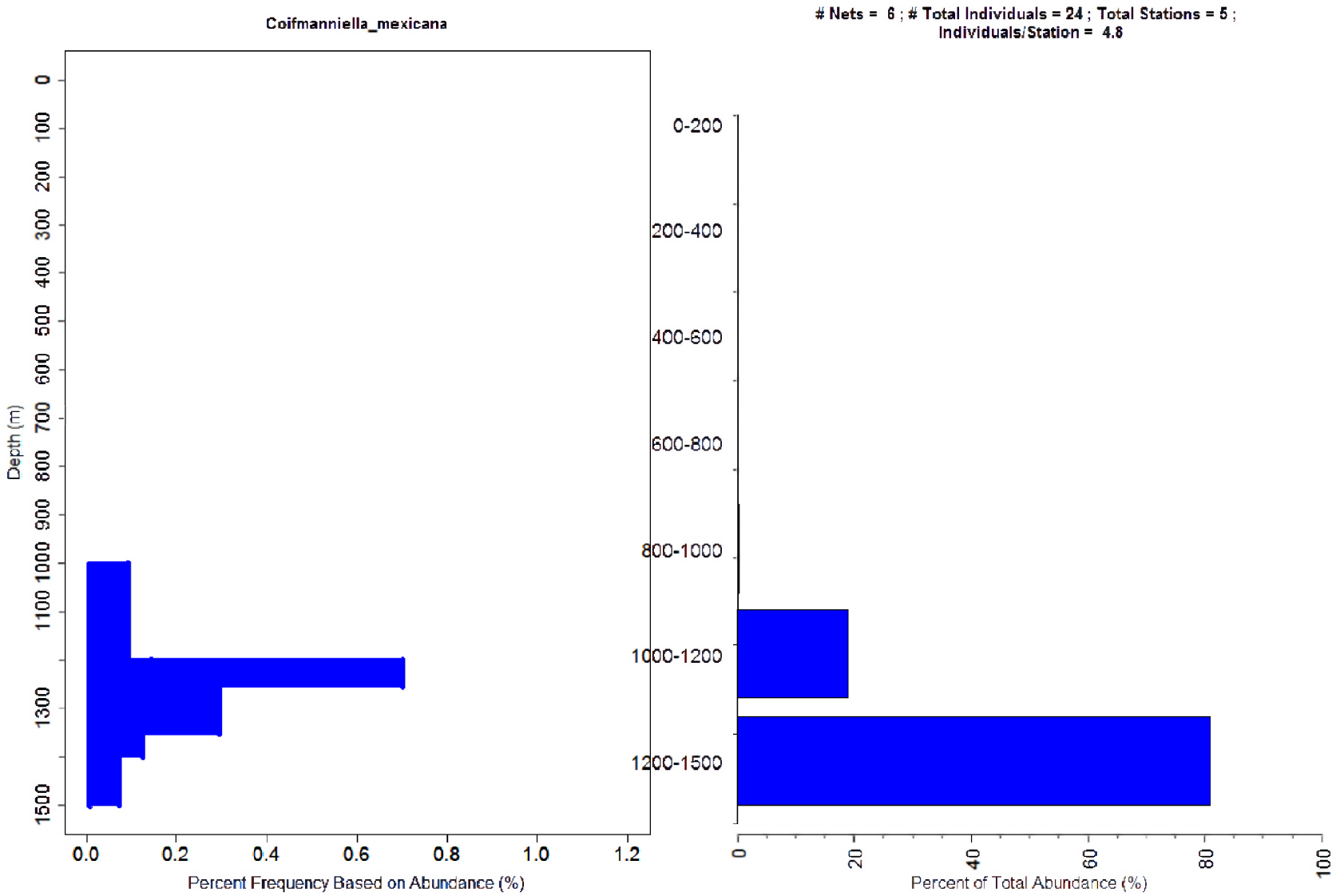
Chtenopterygidae


Clionidae
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

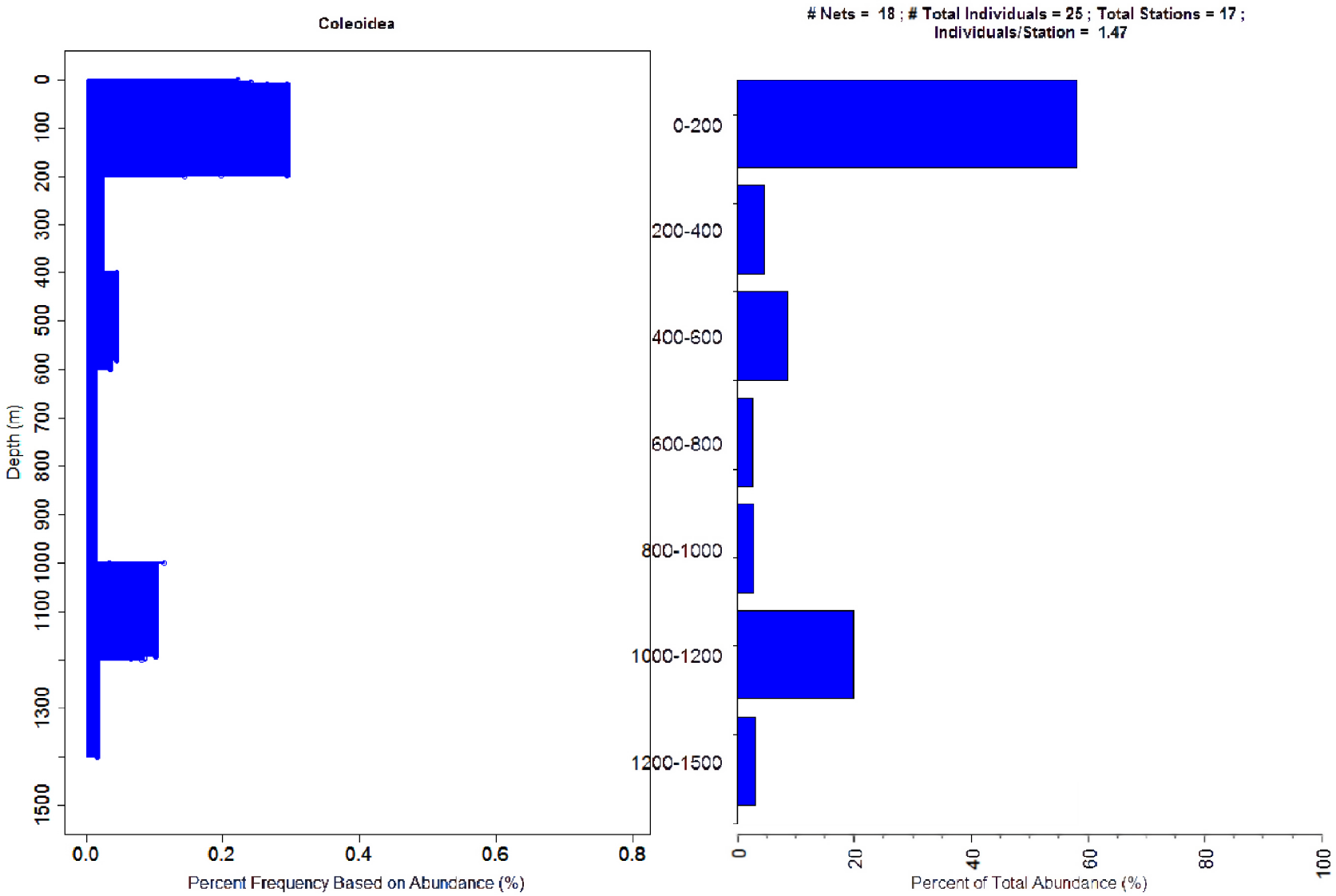
Clionidae


Cnidaria
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

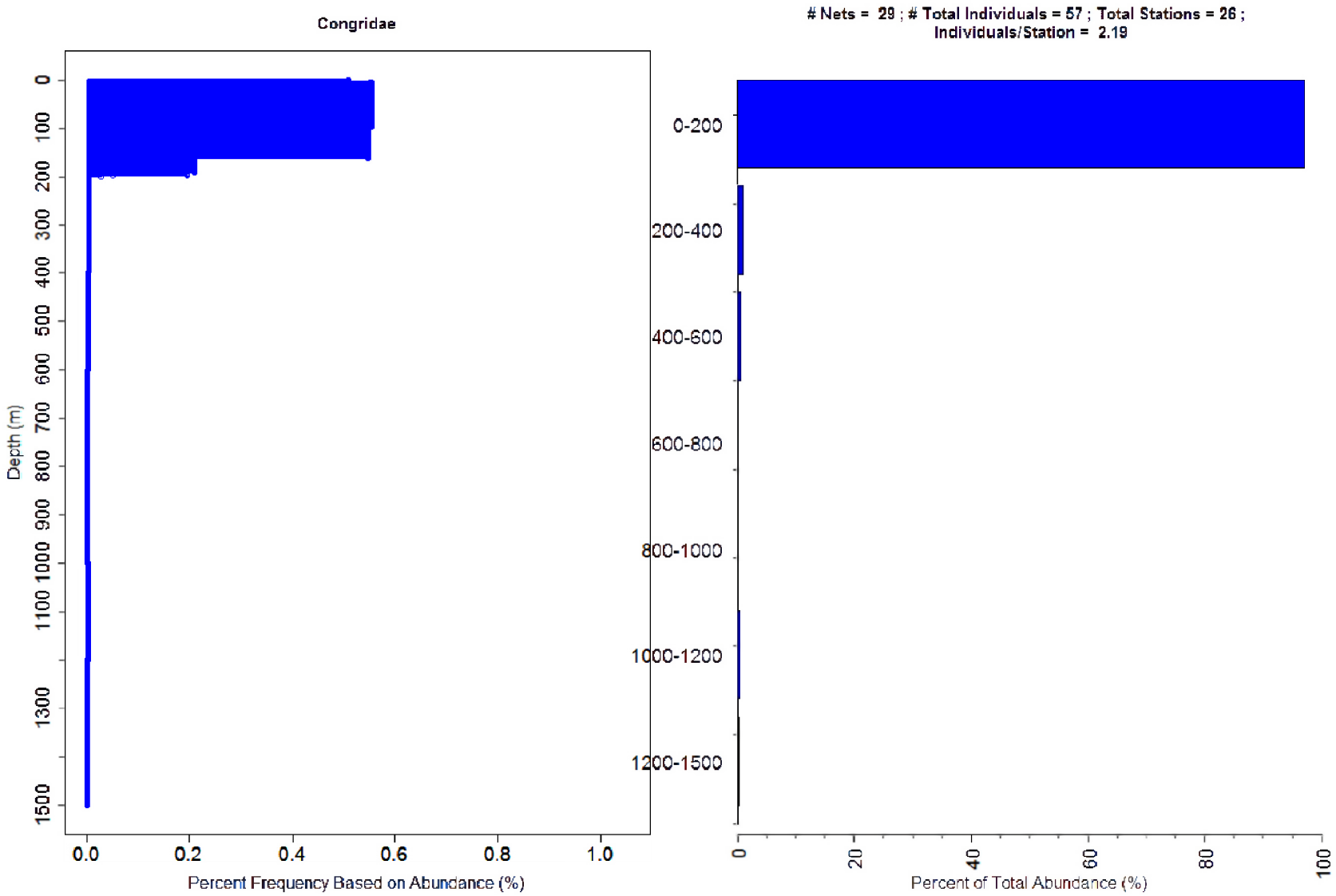
Cnidaria



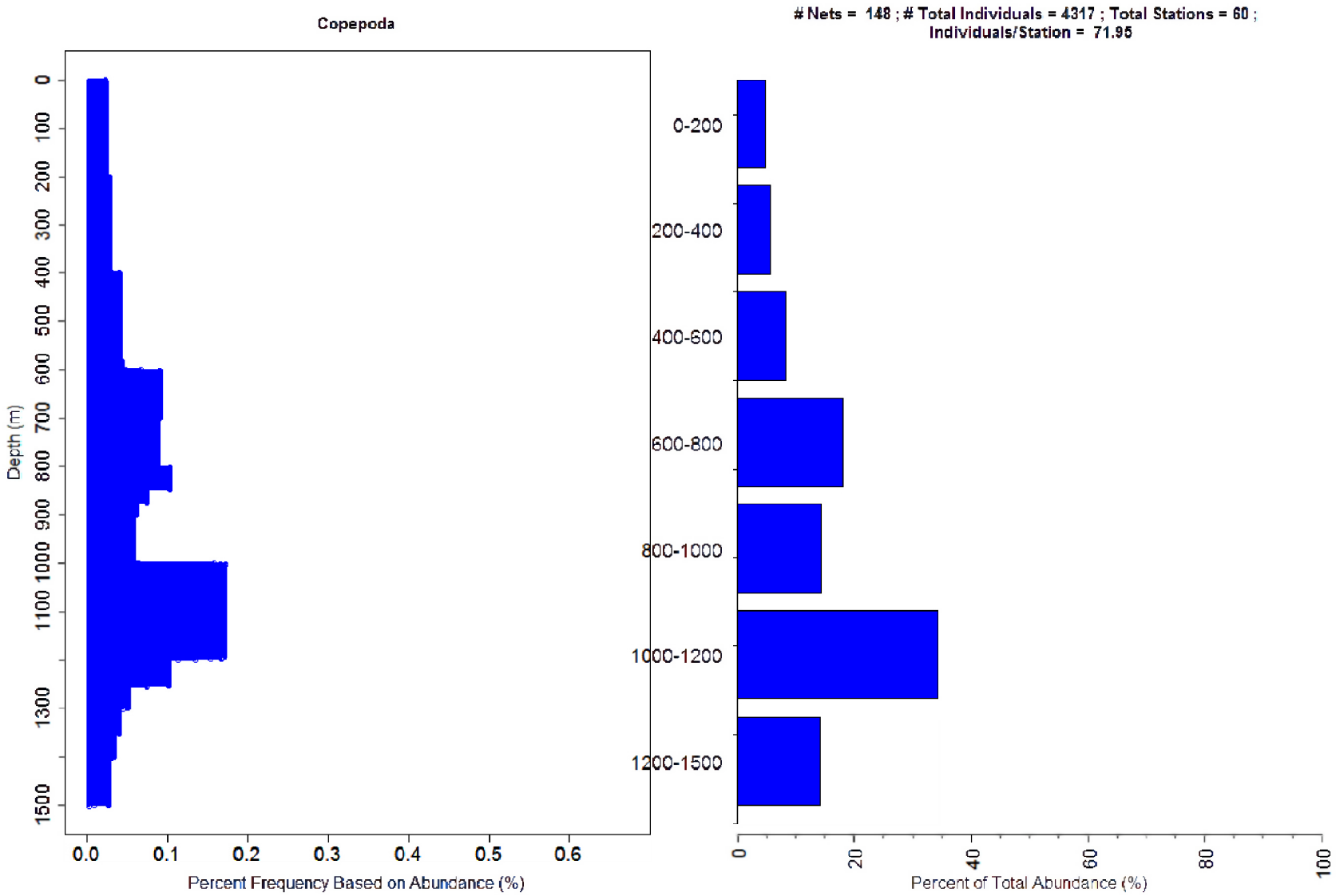
Coifmanniella_mexicana


Coleoidea
Nets = 18 ; # Total Individuals = 25 ; Total Stations = 17 ;
Individuals/Station = 1.47
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

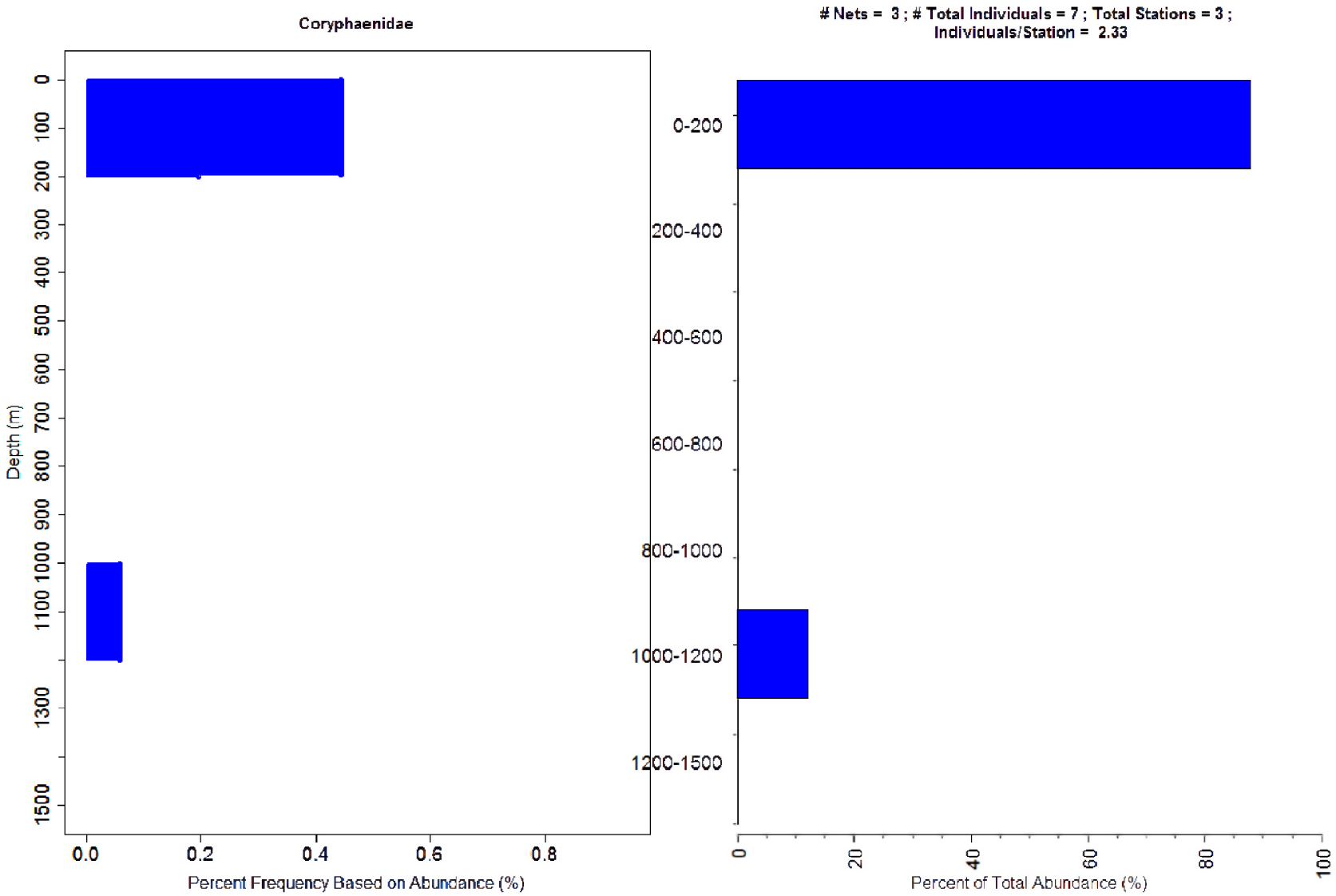
Coleoidea


Congridae
Nets = 29 ; # Total Individuals = 57 ; Total Stations = 26 ;
Individuals/Station = 2.19
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

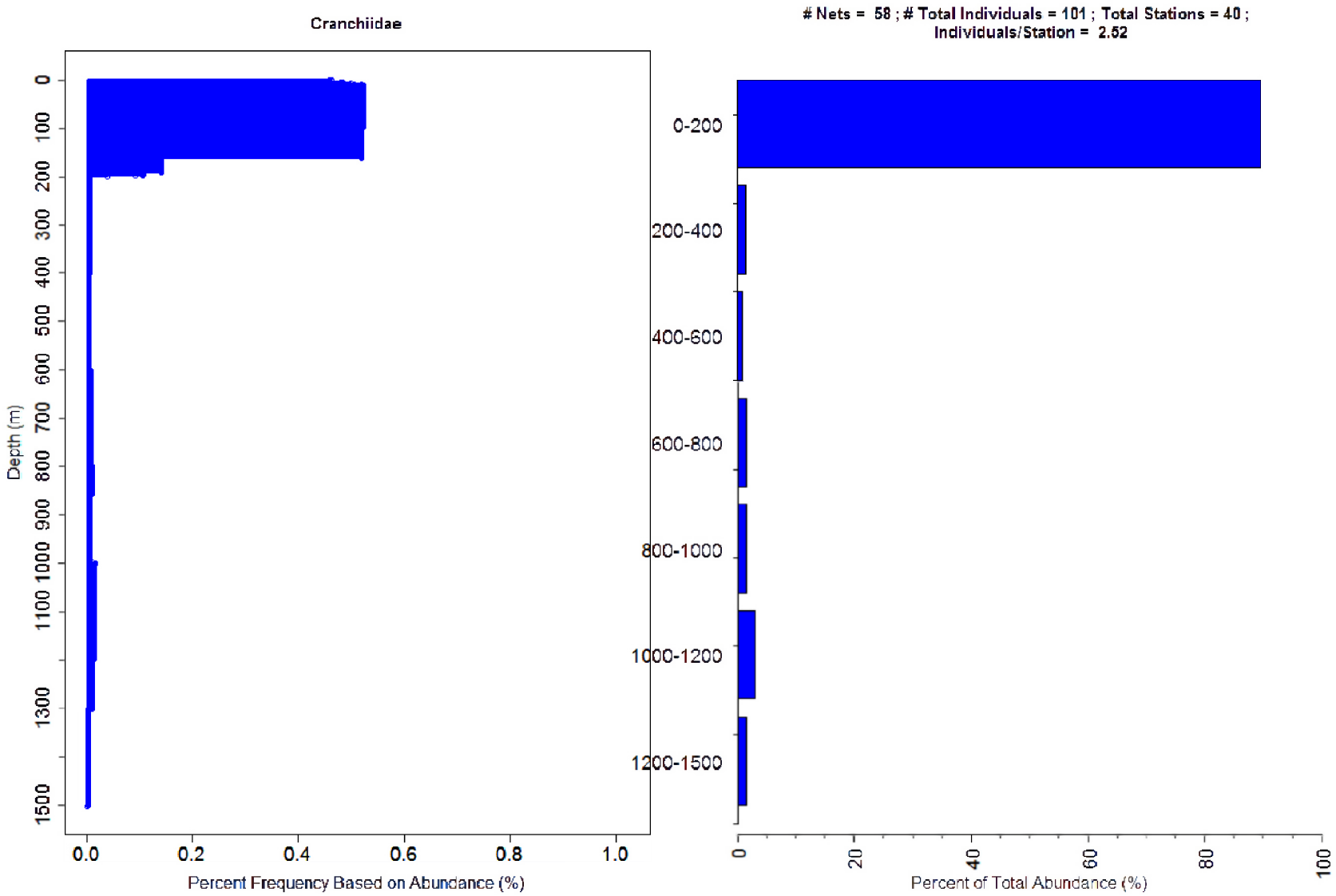
Congridae


Copepoda
Nets = 148 ; # Total Individuals = 4317 ; Total Stations = 60 ;
Individuals/Station = 71.95
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

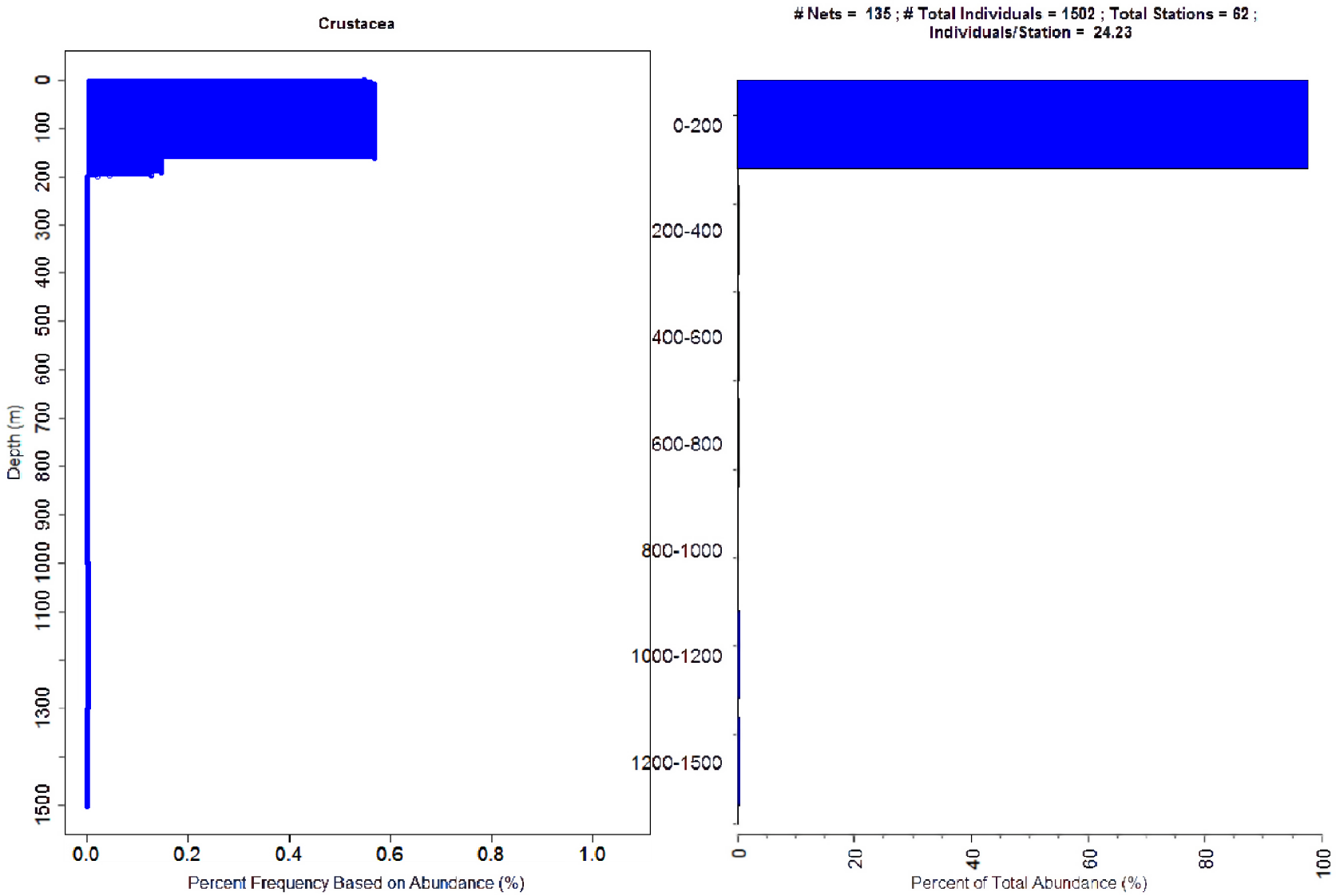
Copepoda



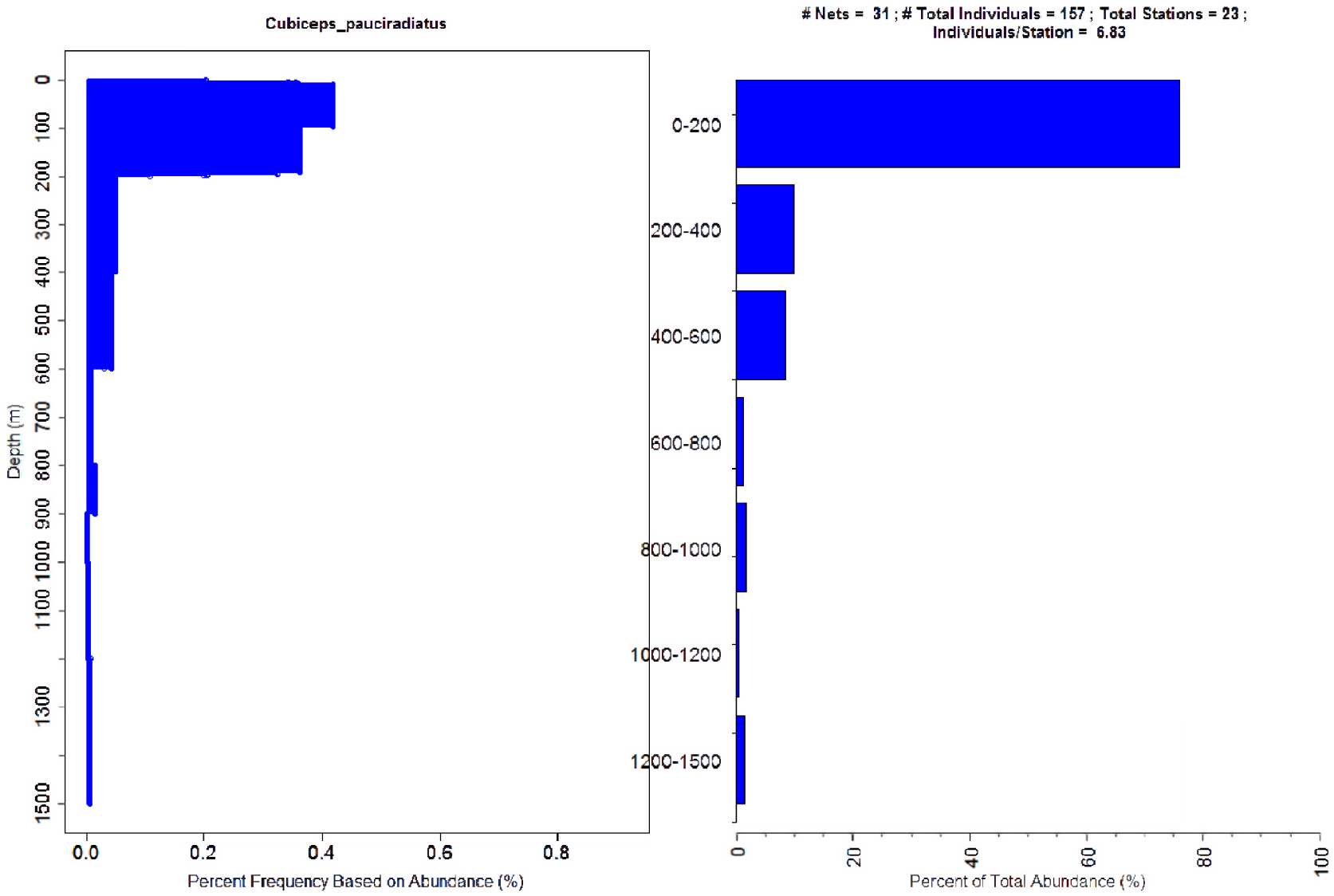
Coryphaenidae



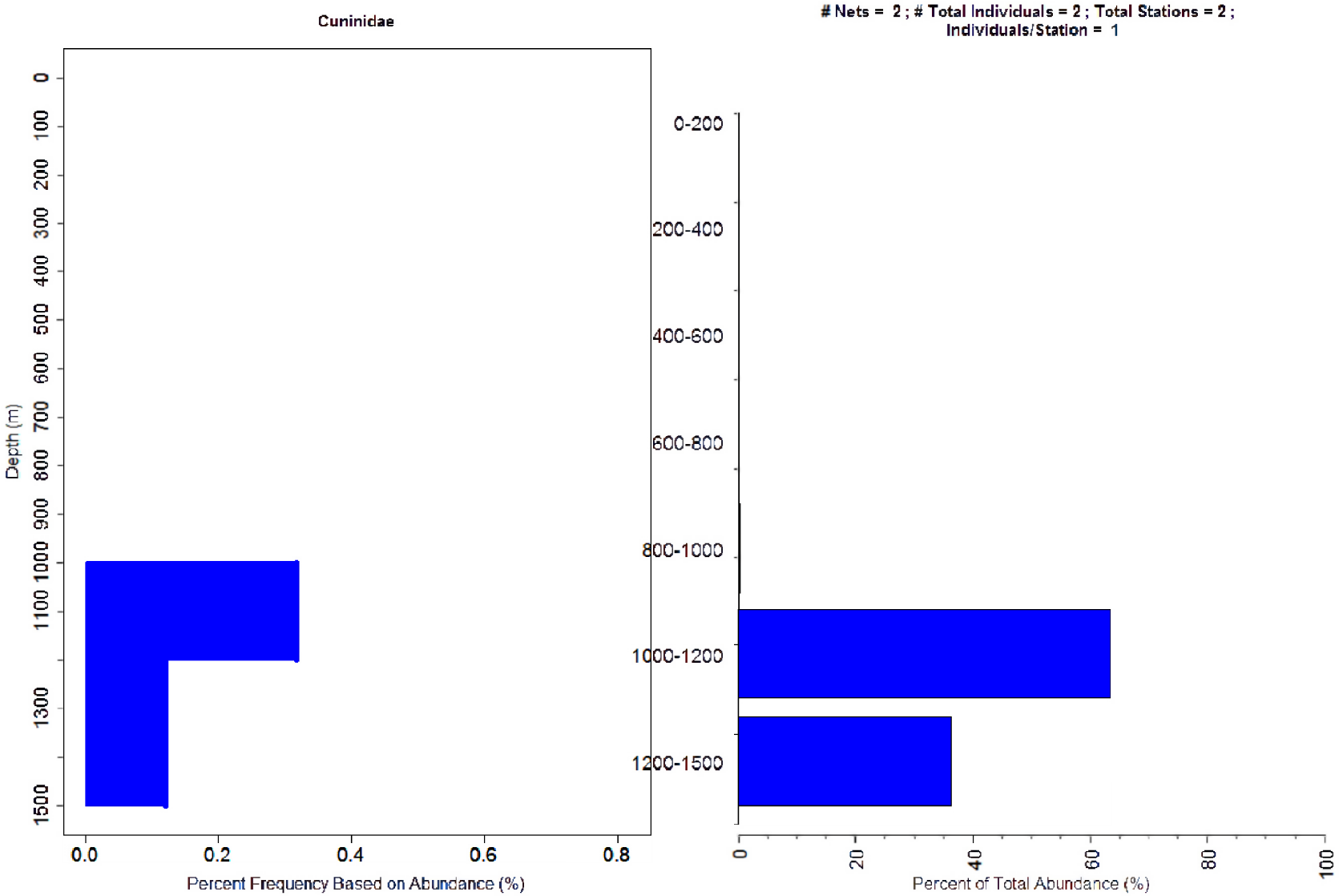
Cranchiidae


Crustacea
Nets = 135 ; # Total Individuals = 1502 ; Total Stations = 62 ;
Individuals/Station = 24.23
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

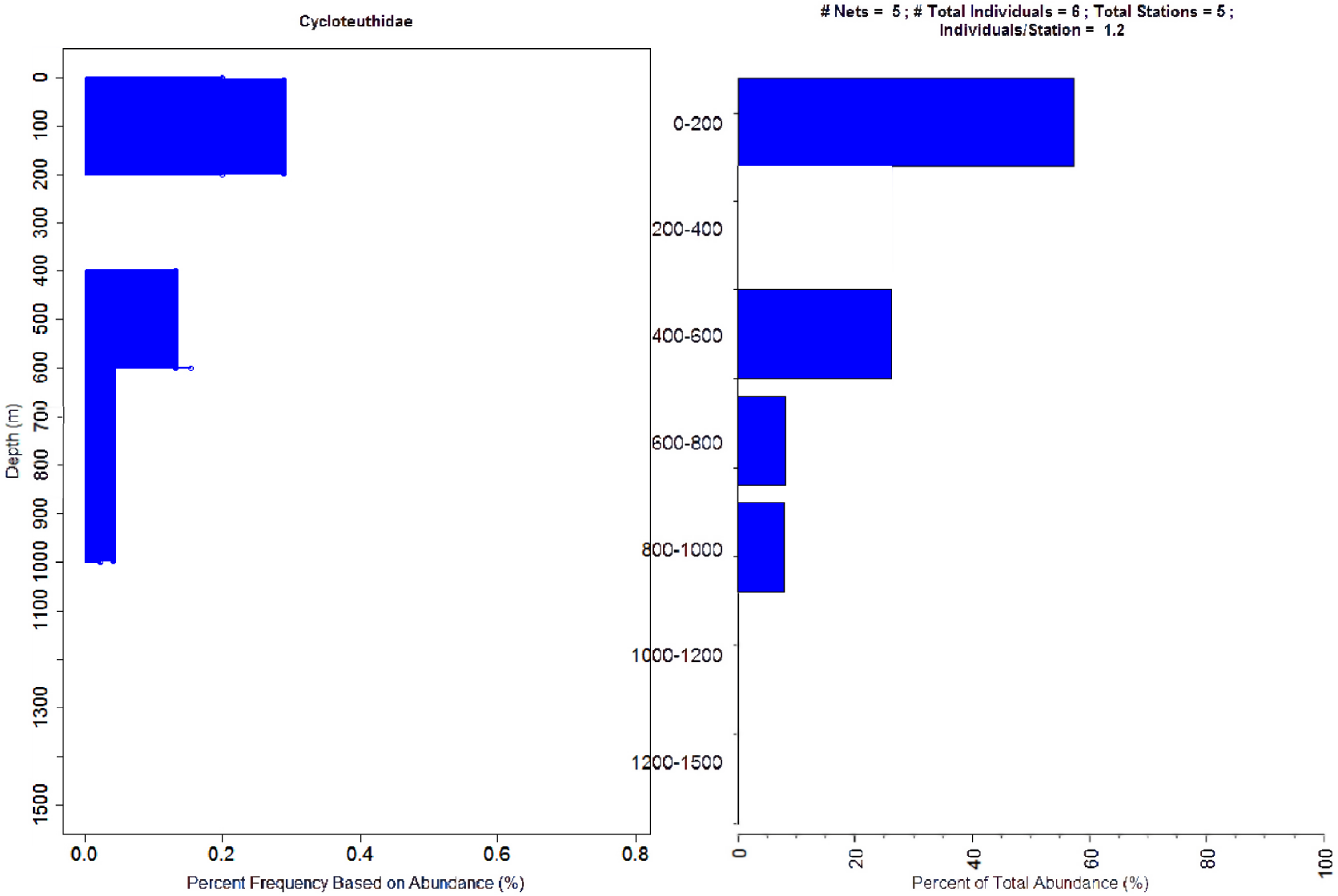
Crustacea



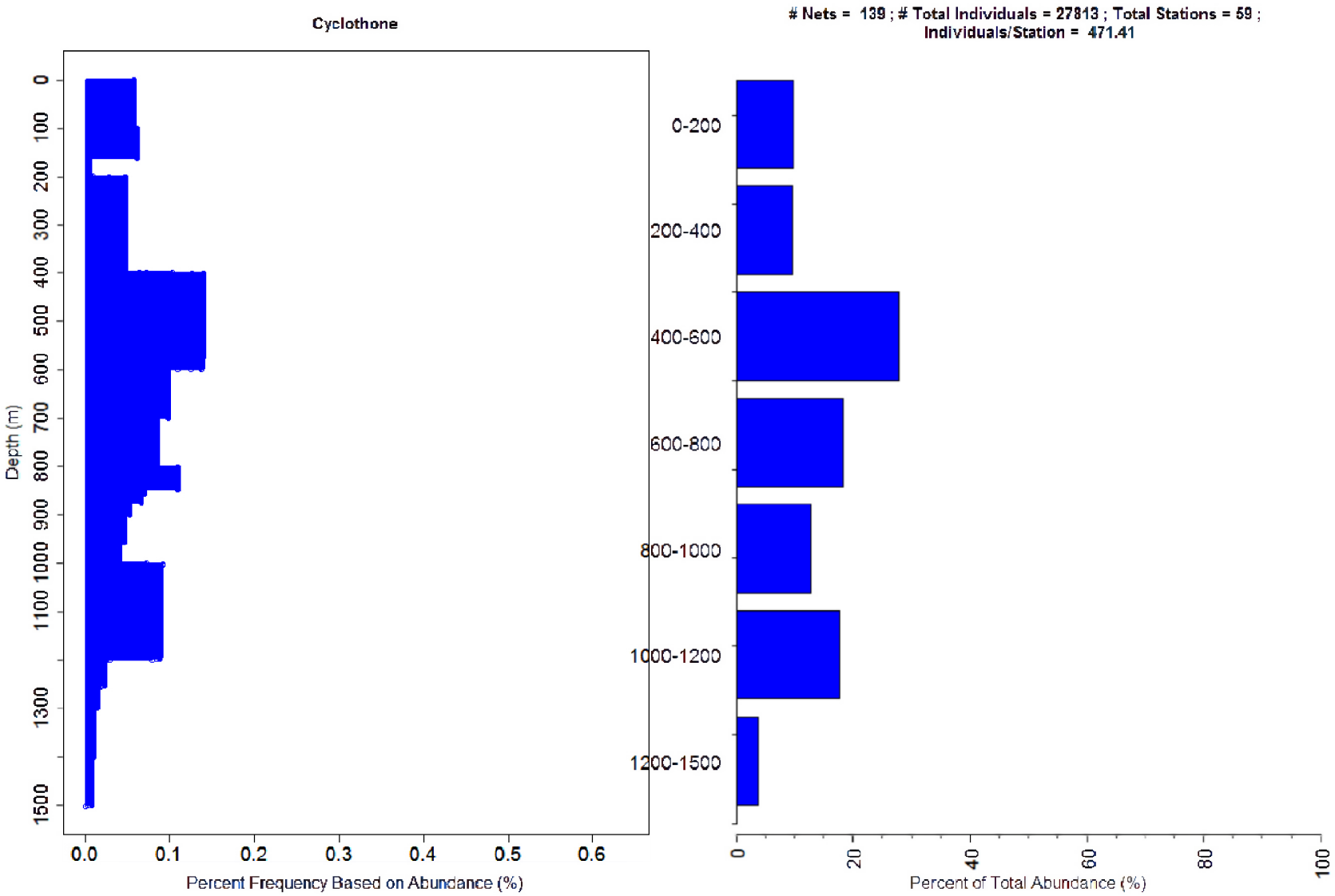
Cubiceps_pauciradiatus


Cuninidae
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

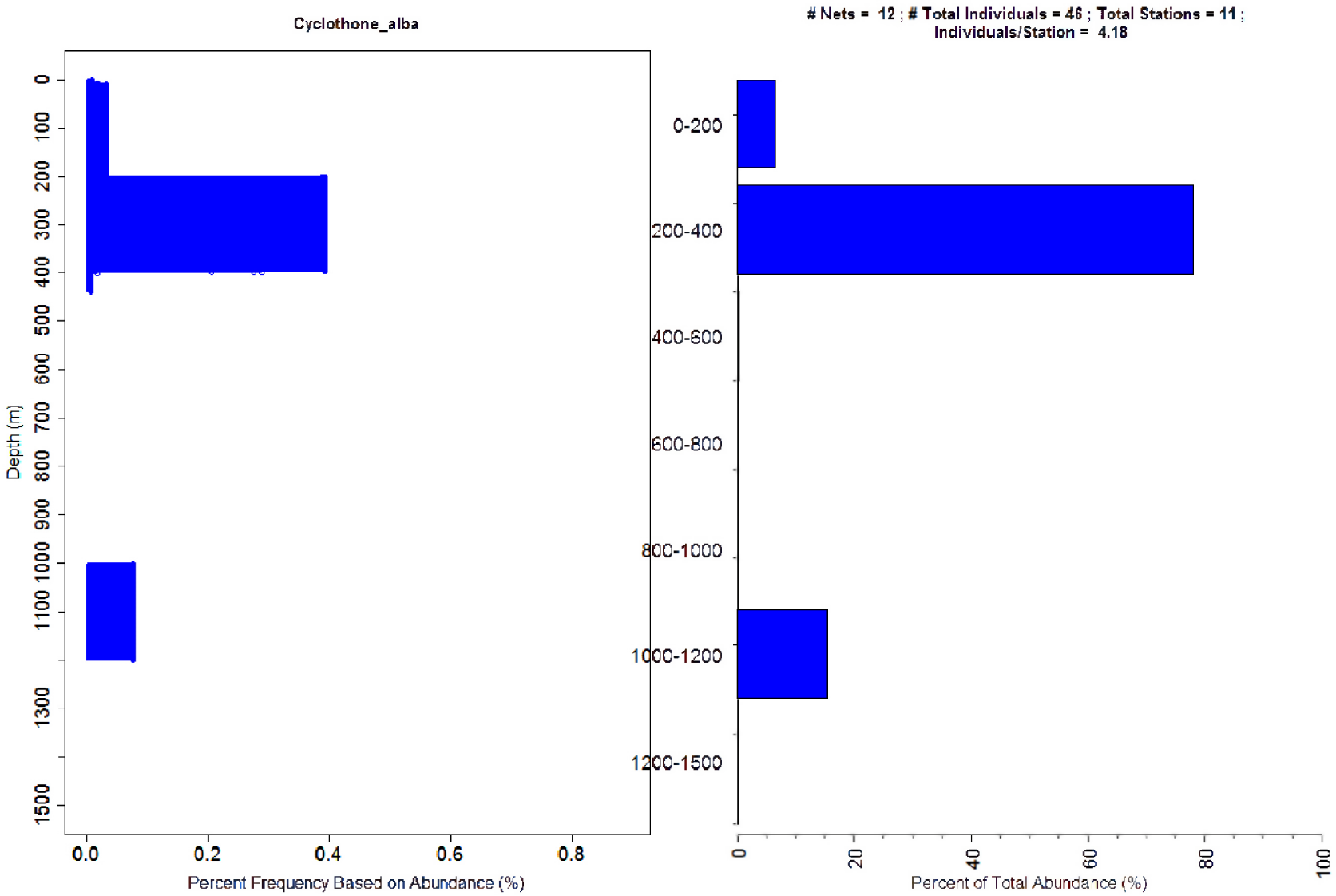
Cuninidae



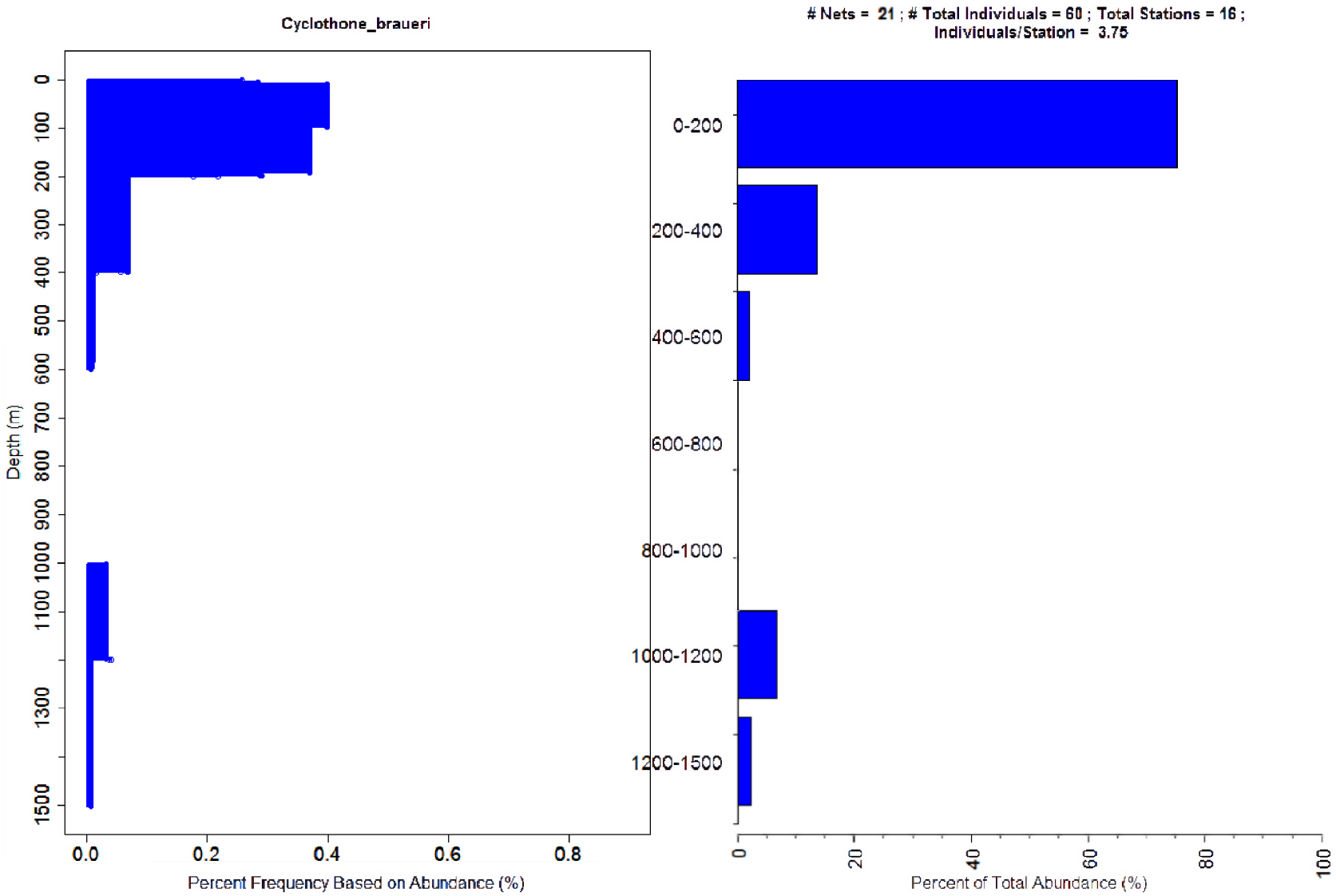
Cycloteuthidae


Cyclothone
Nets = 139 ; # Total Individuals = 27813 ; Total Stations = 59 ;
Individuals/Station = 471.41
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

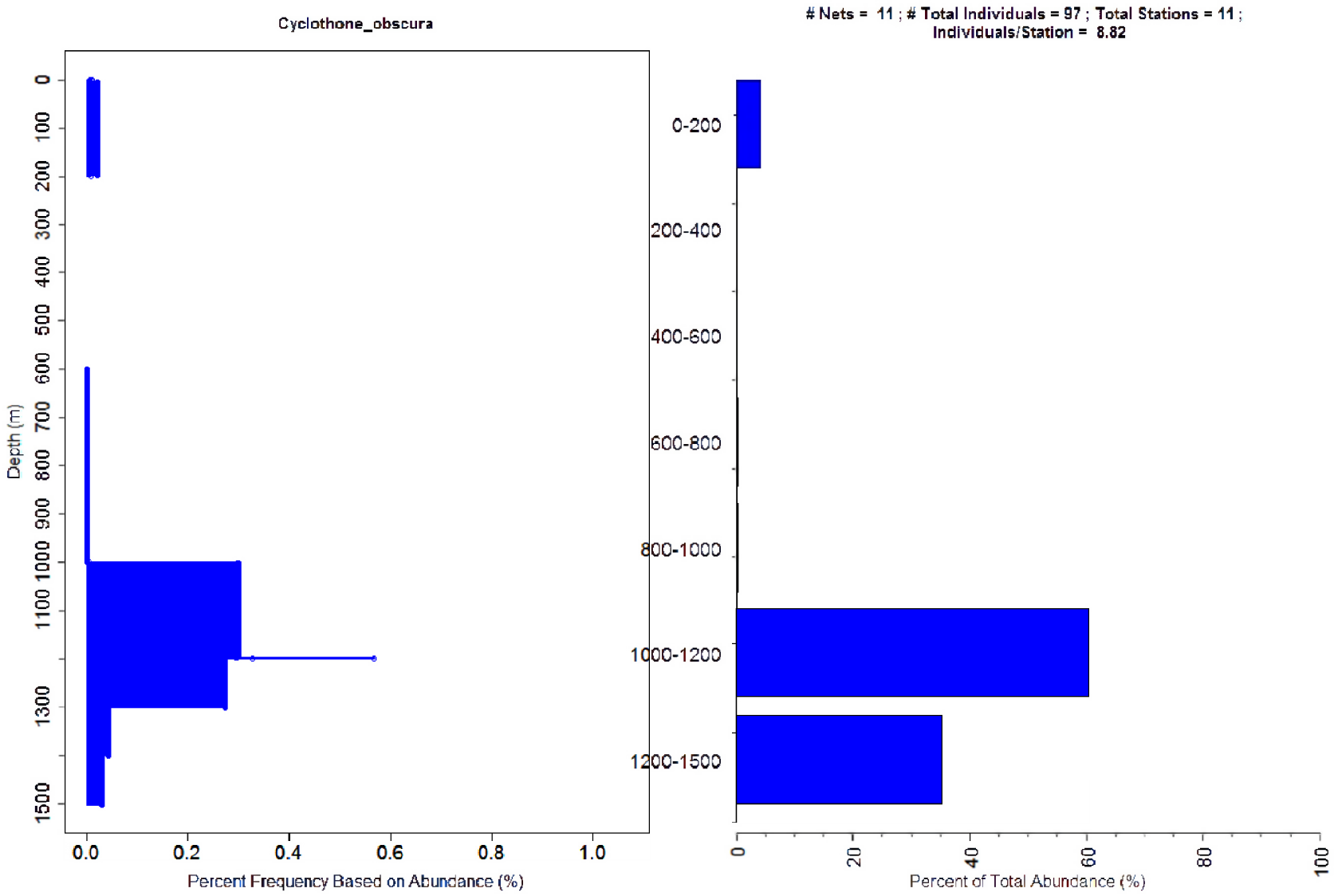
Cyclothone



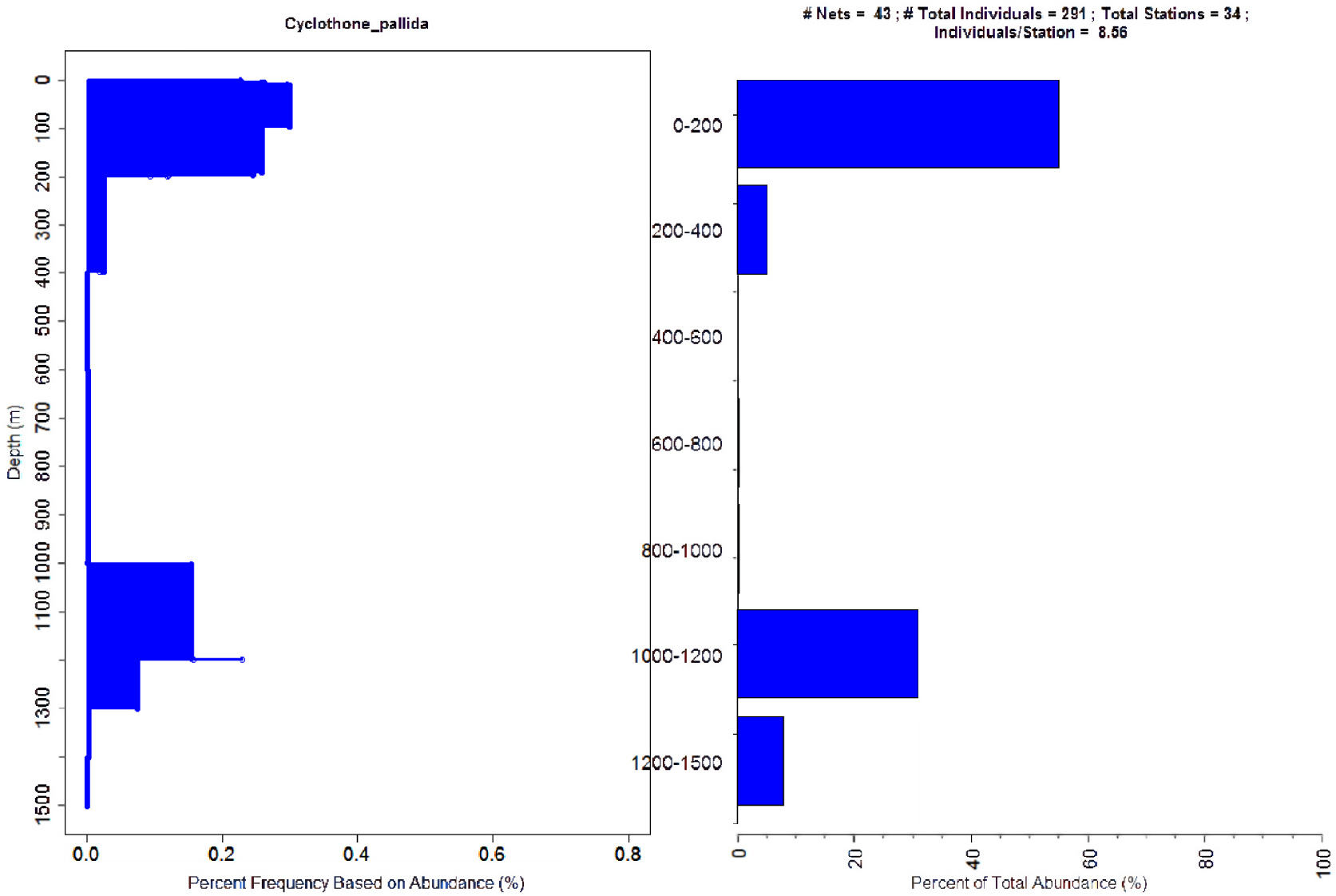
Cyclothone_alba



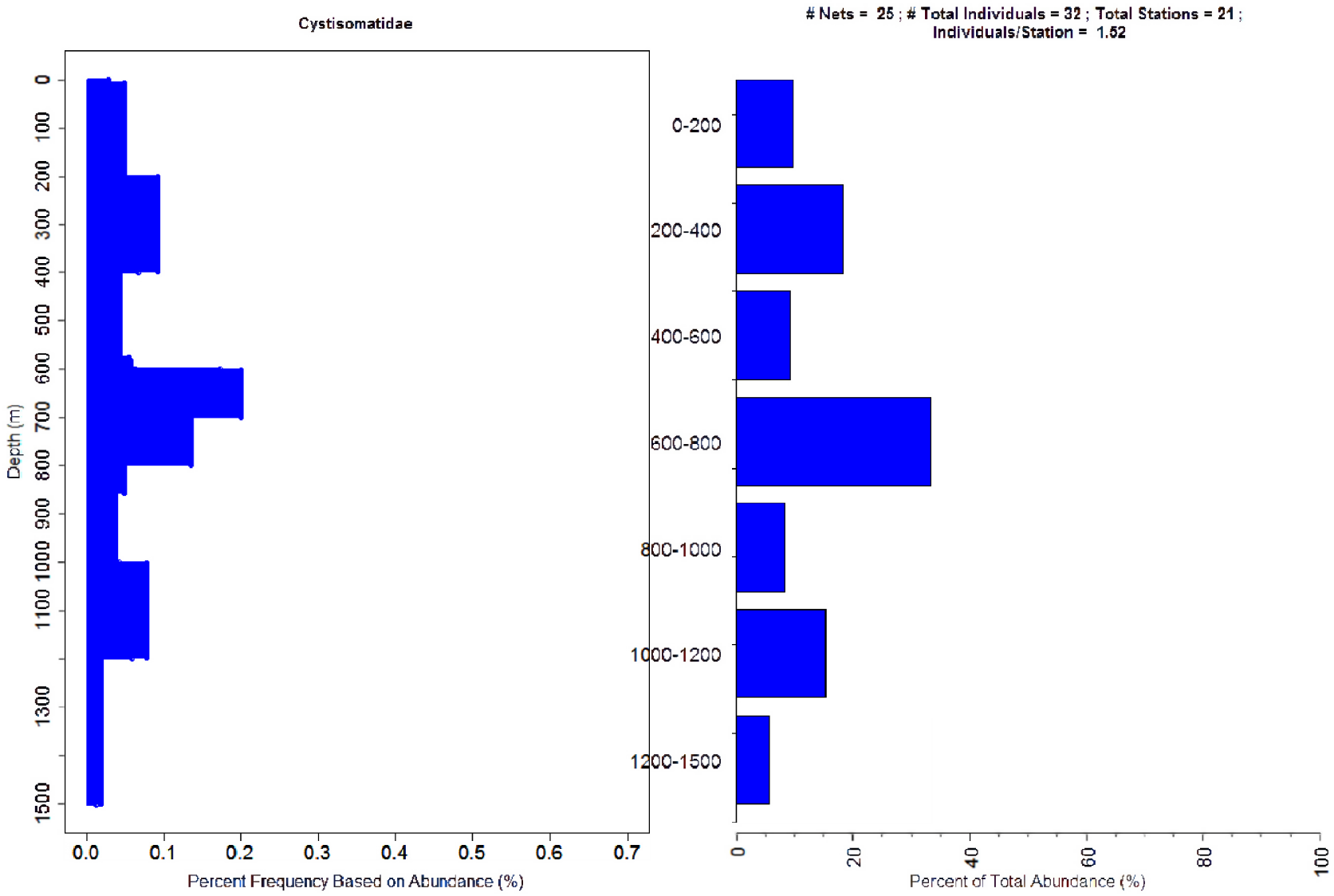
Cyclothone_braueri



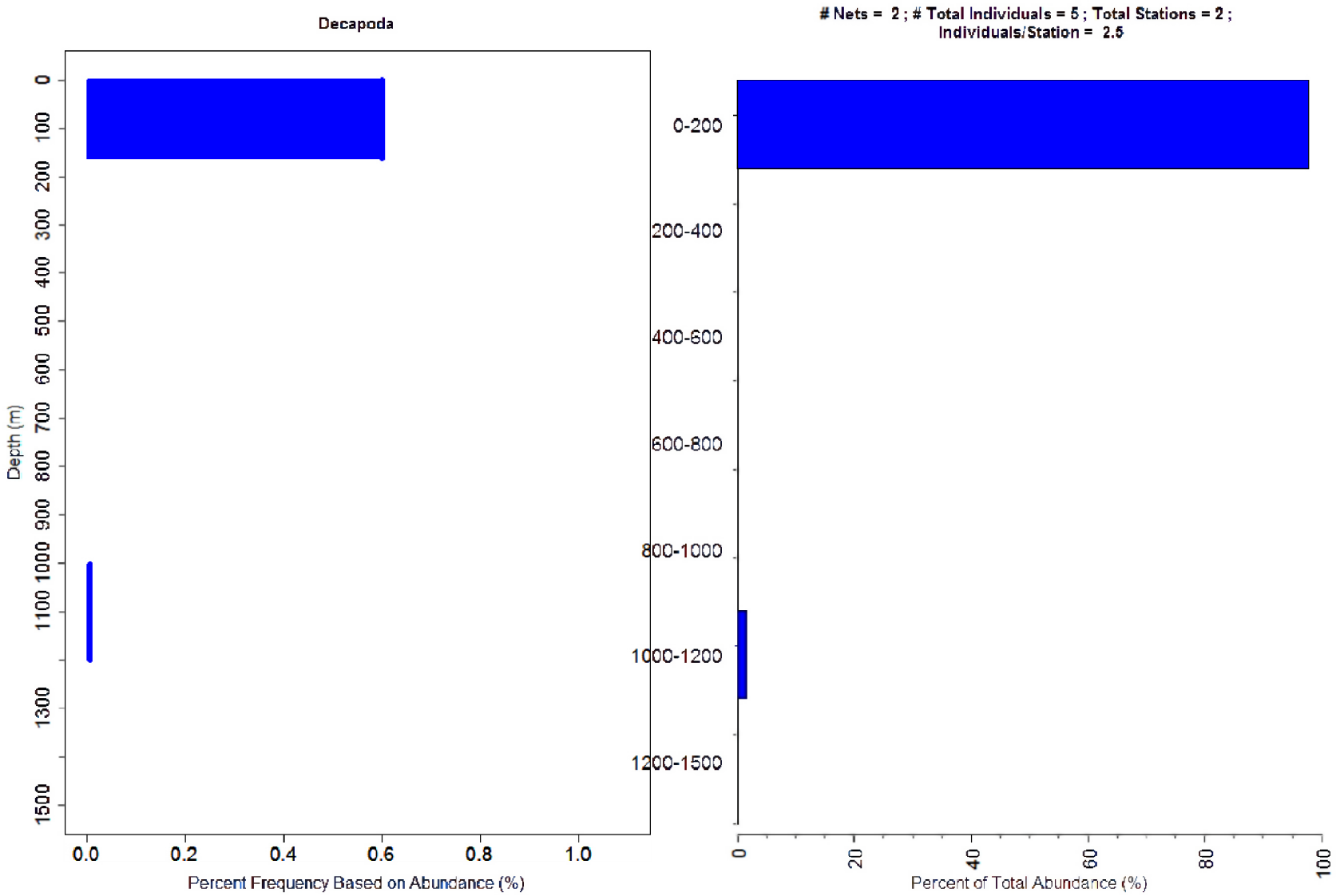
Cyclothone_obscura



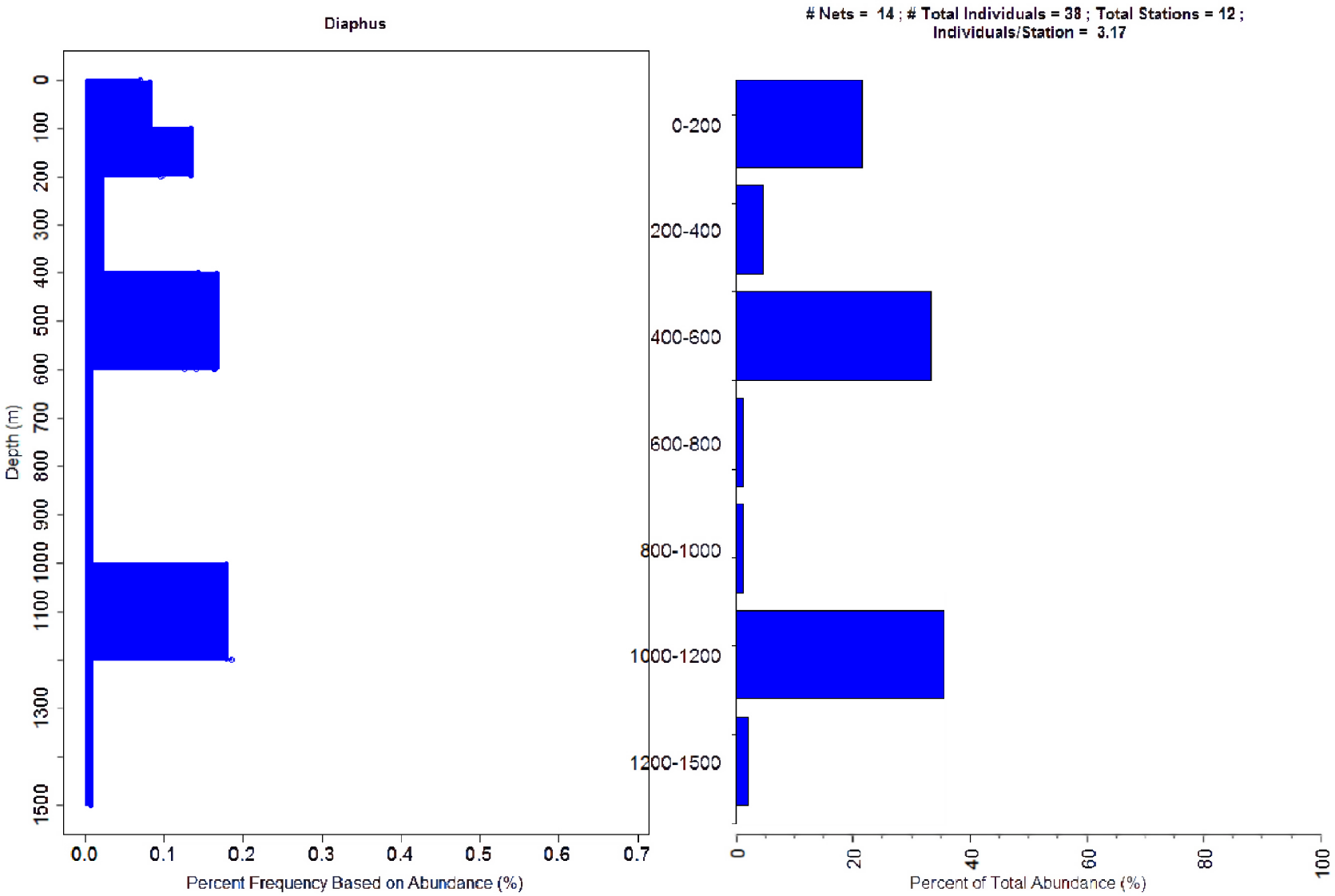
Cyclothone_pallida



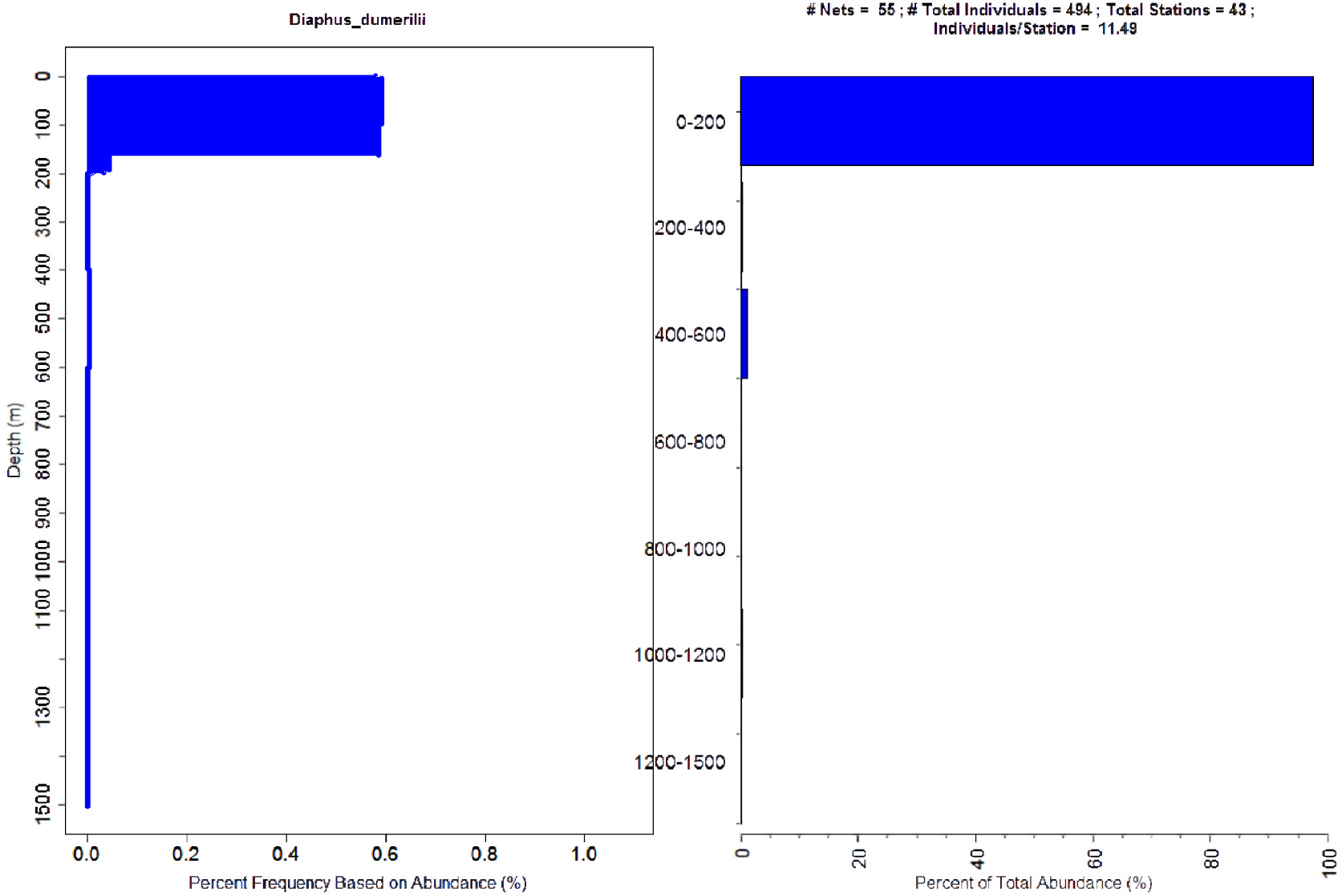
Cystisomatidae


Decapoda
Nets = 2 ; # Total Individuals = 5 ; Total Stations = 2 ;
Individuals/Station = 2.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

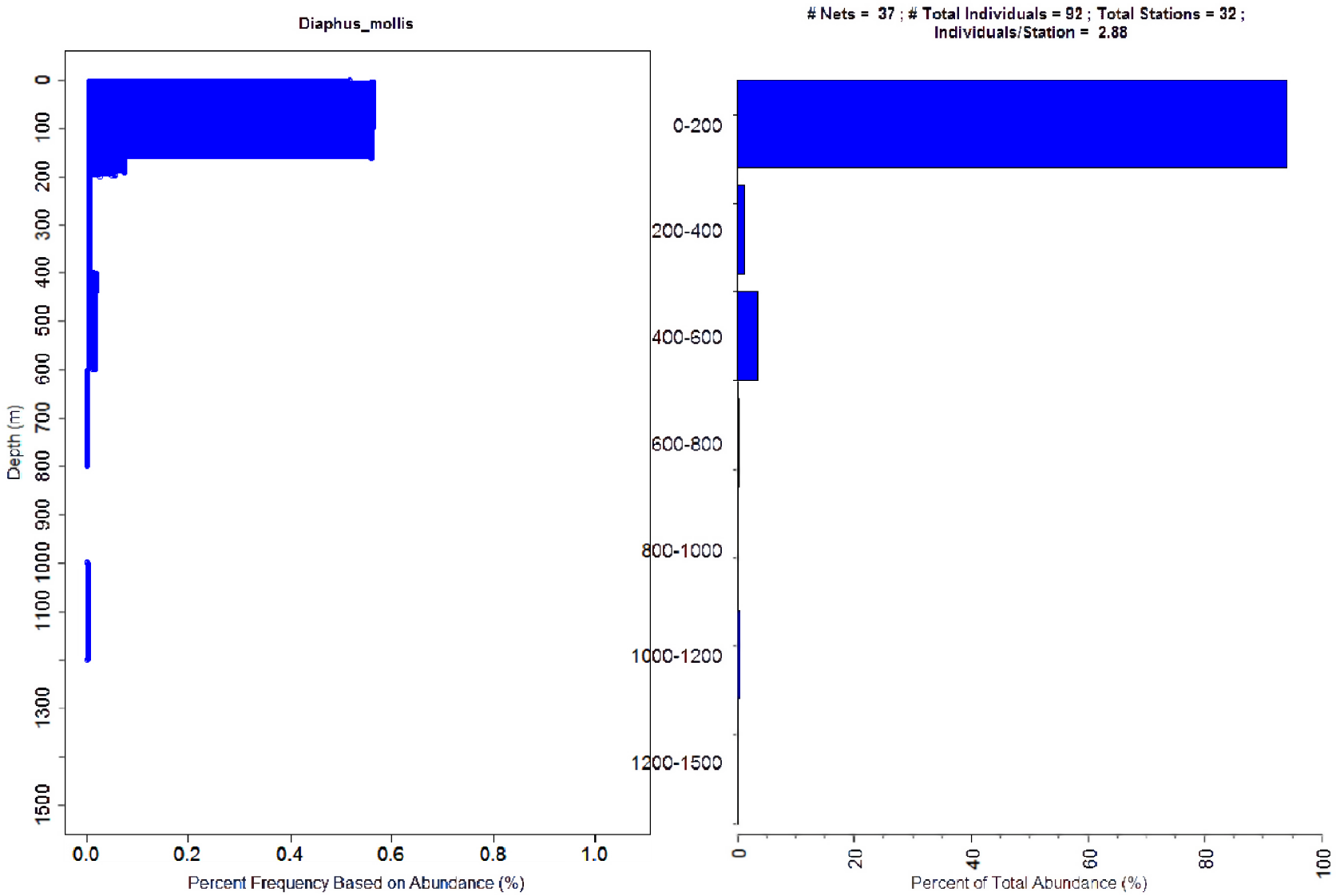
Decapoda


Diaphus
Nets = 14 ; # Total Individuals = 38 ; Total Stations = 12 ;
Individuals/Station = 3.17
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

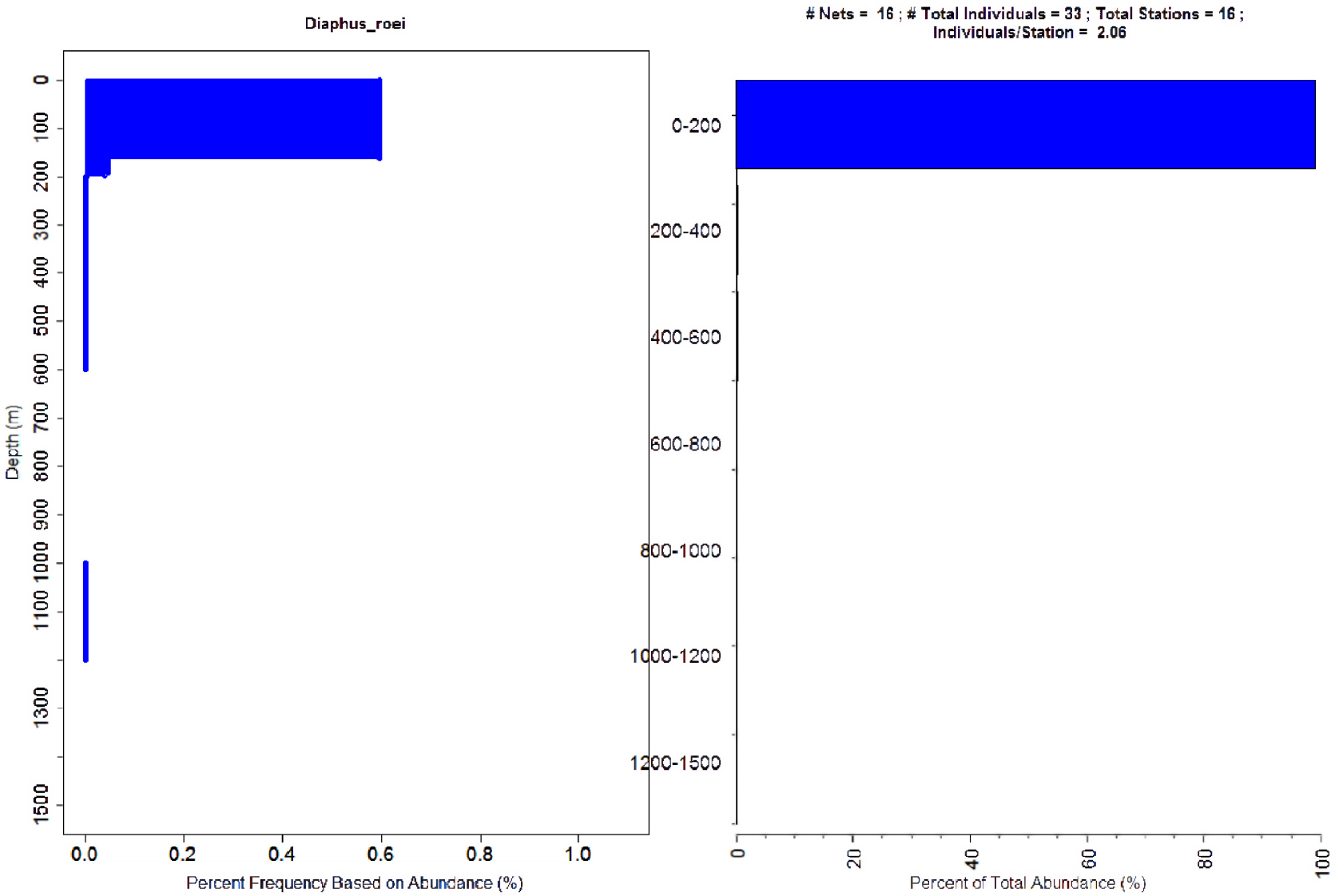
Diaphus



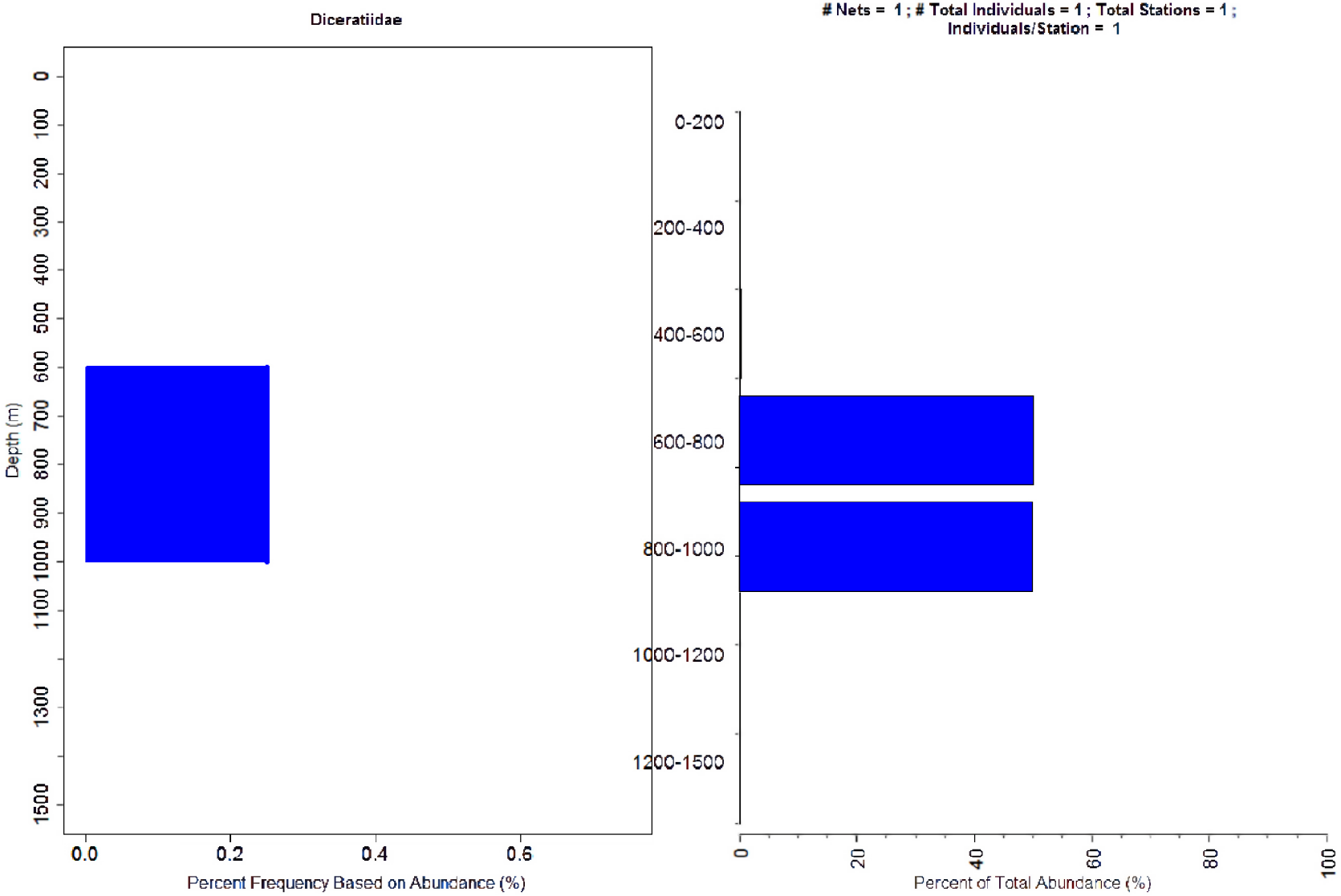
Diaphus_dumerilii



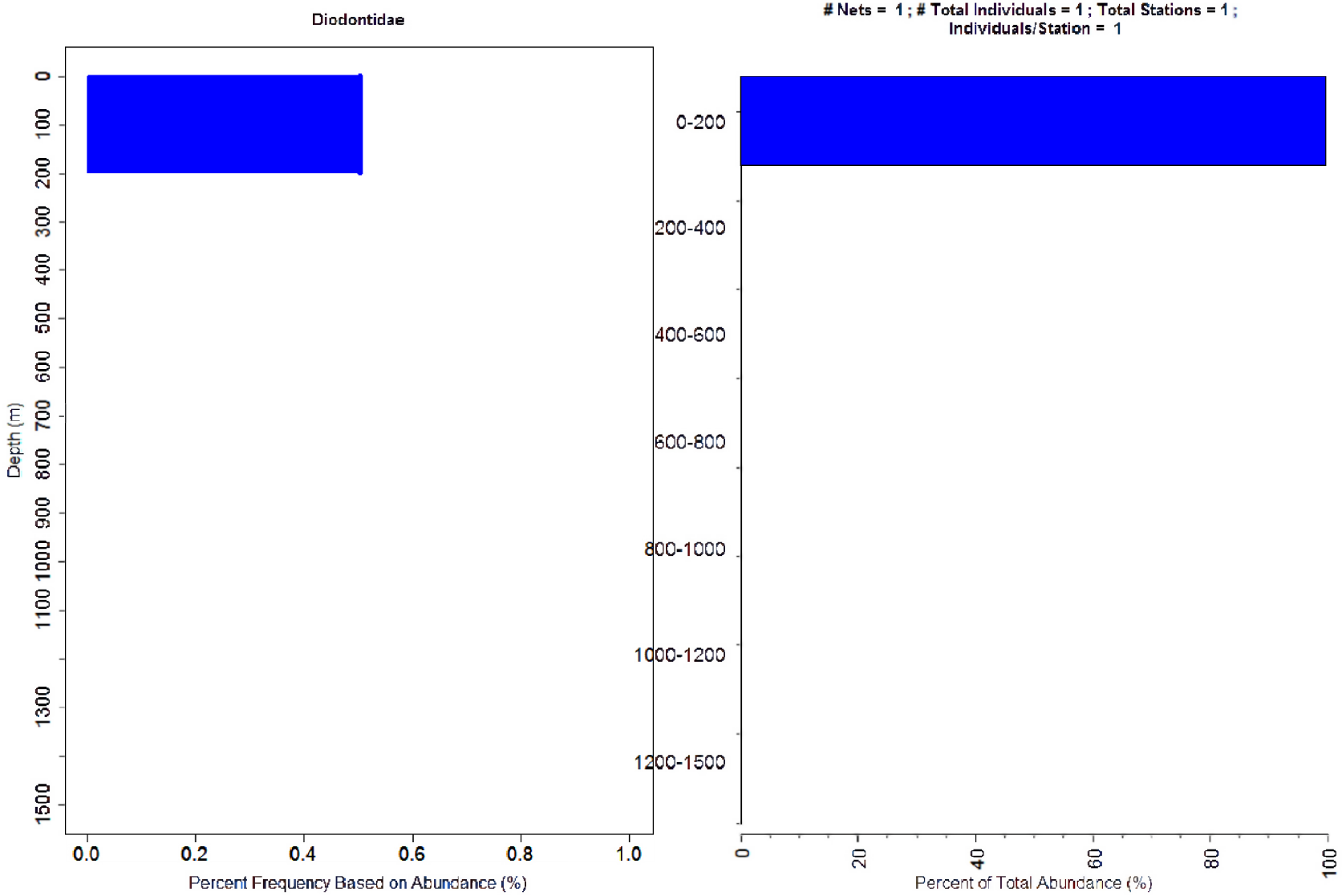
Diaphus_mollis



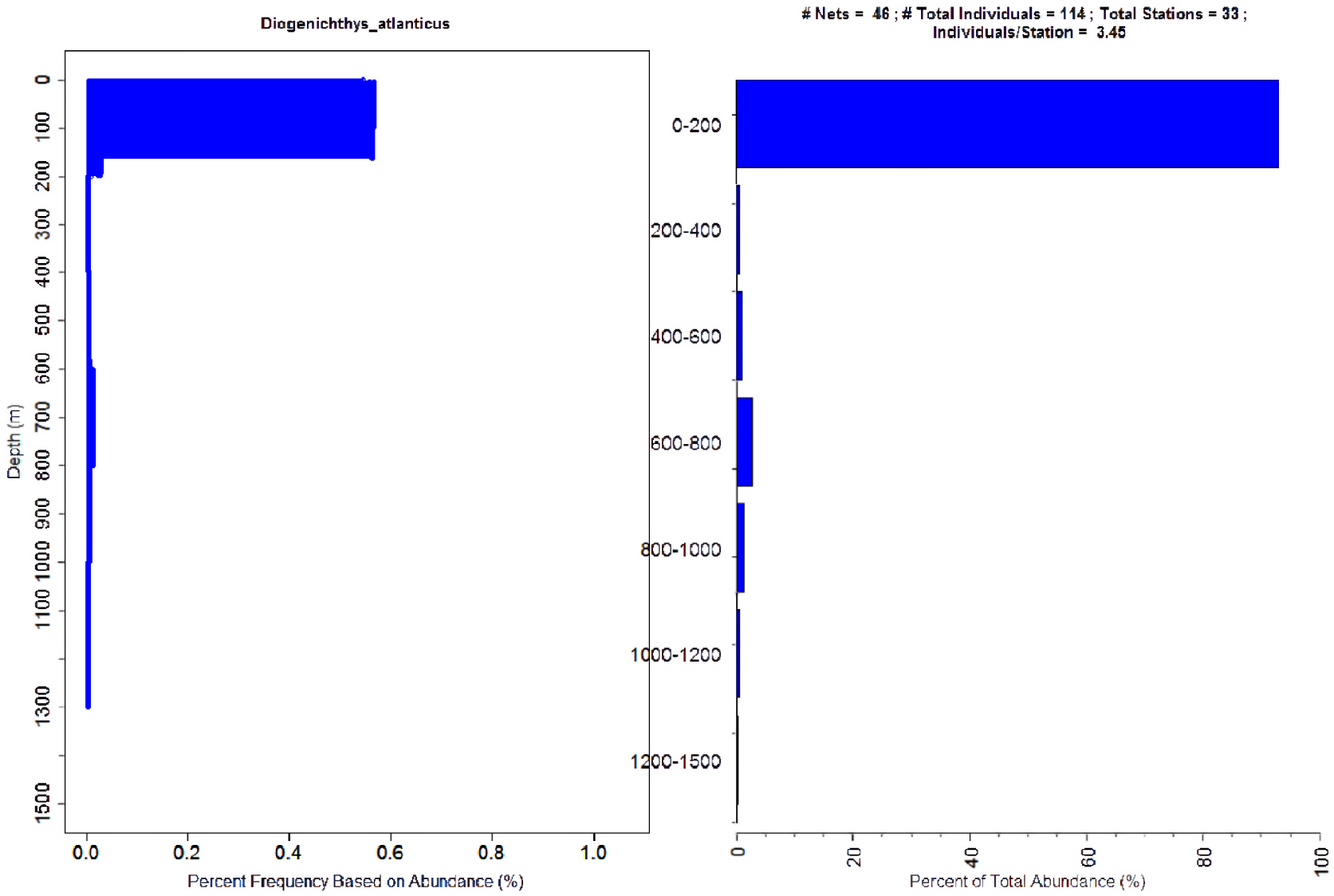
Diaphus_roei



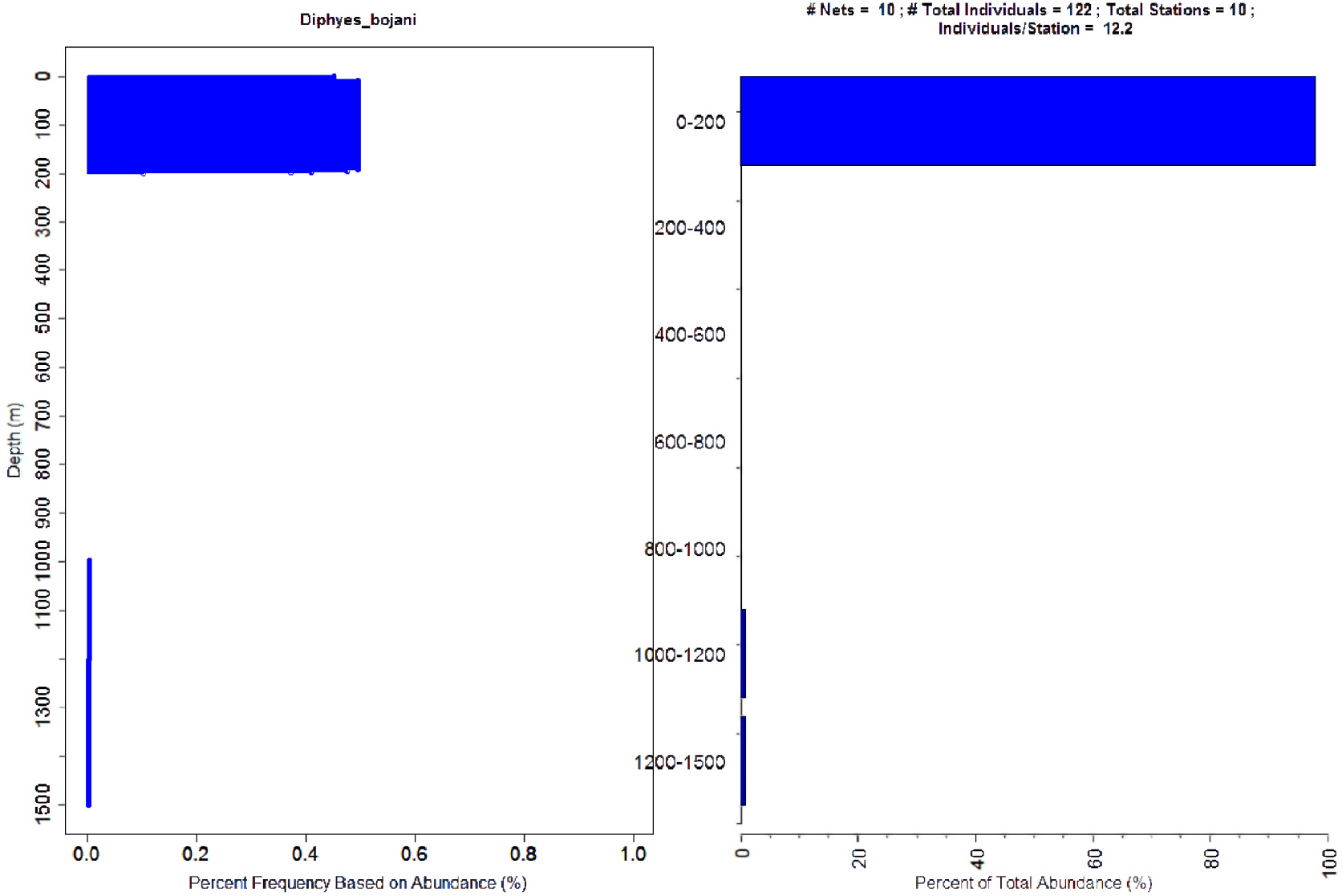
Diceratiidae



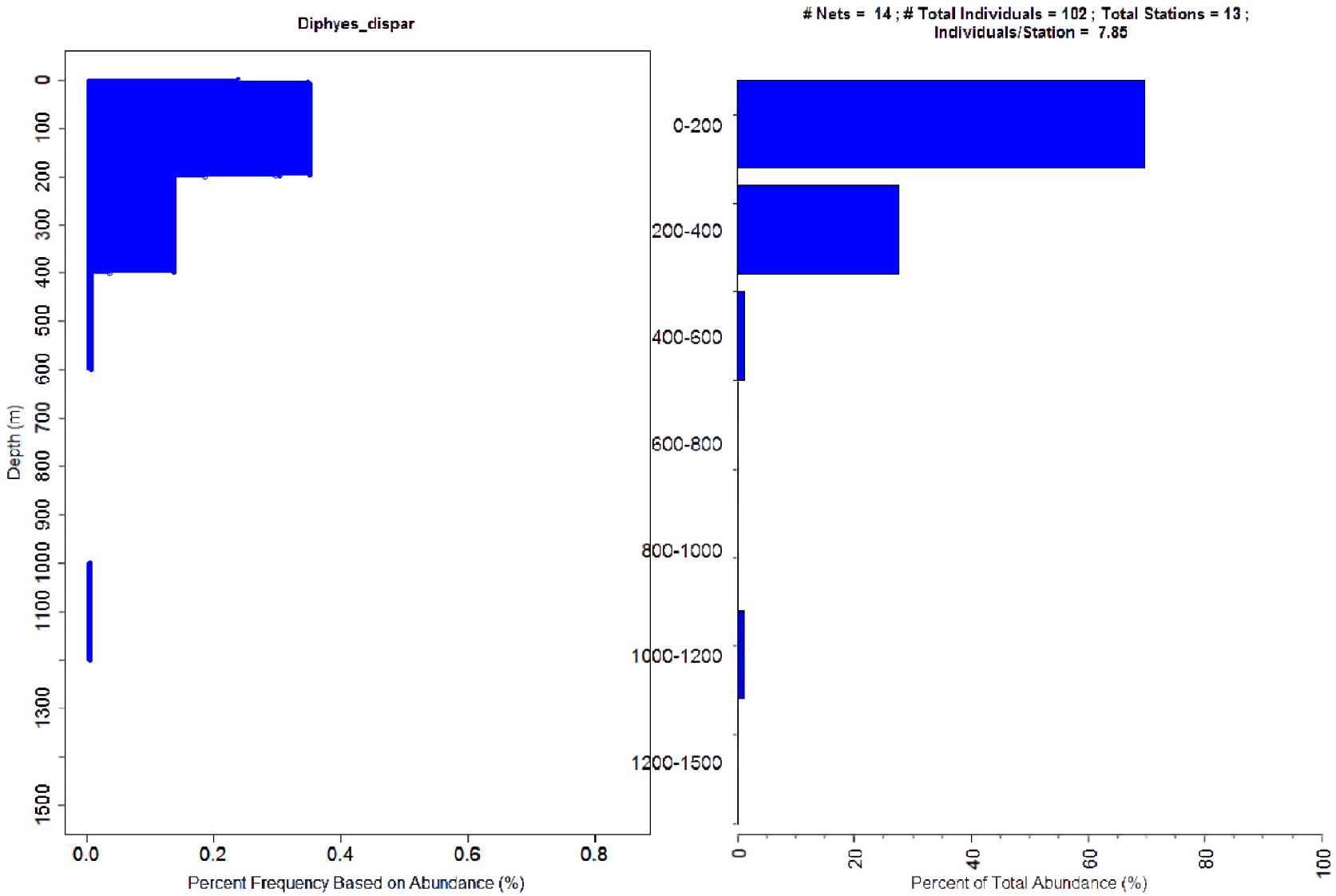
Diodontidae



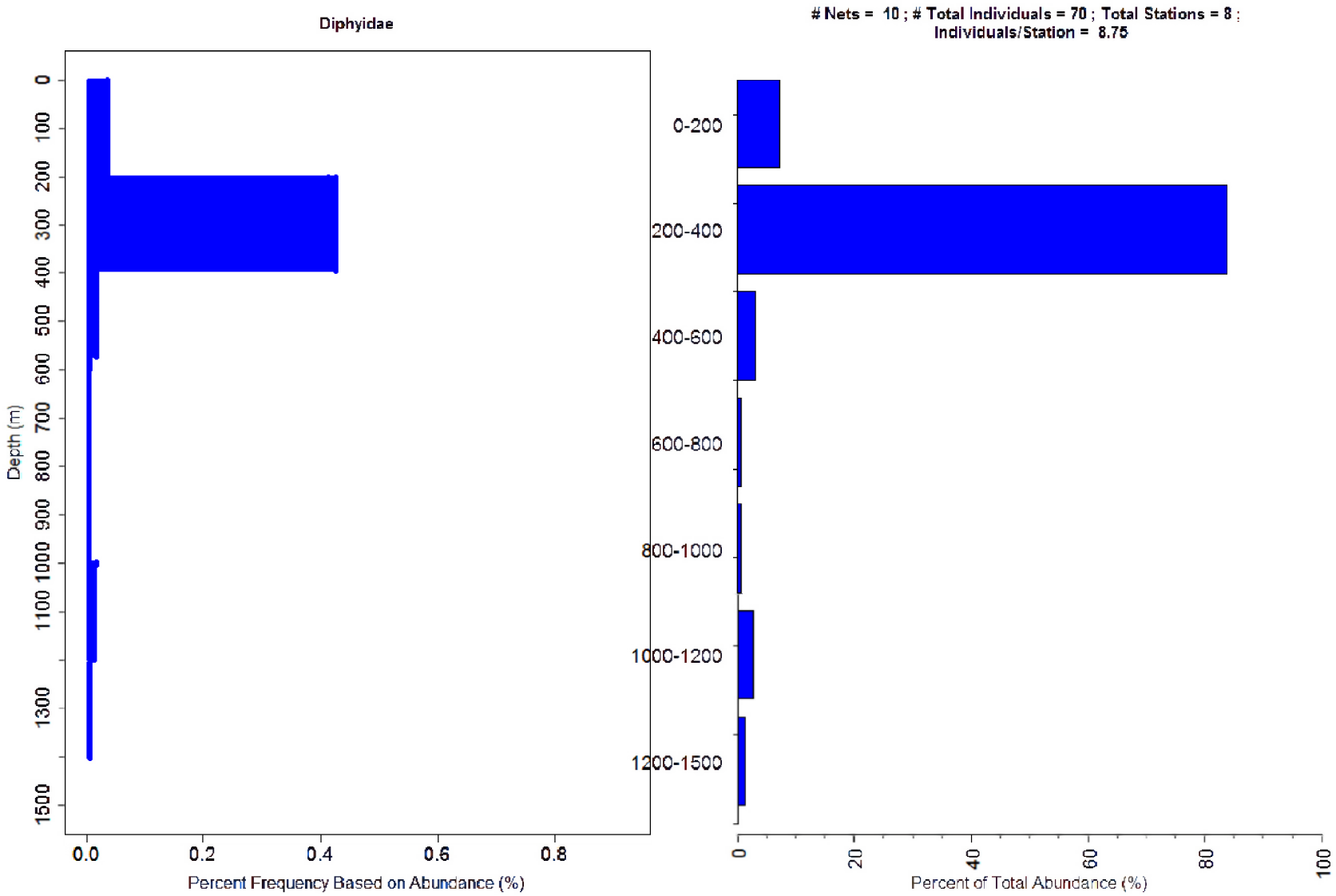
Diogenichthys_atlanticus



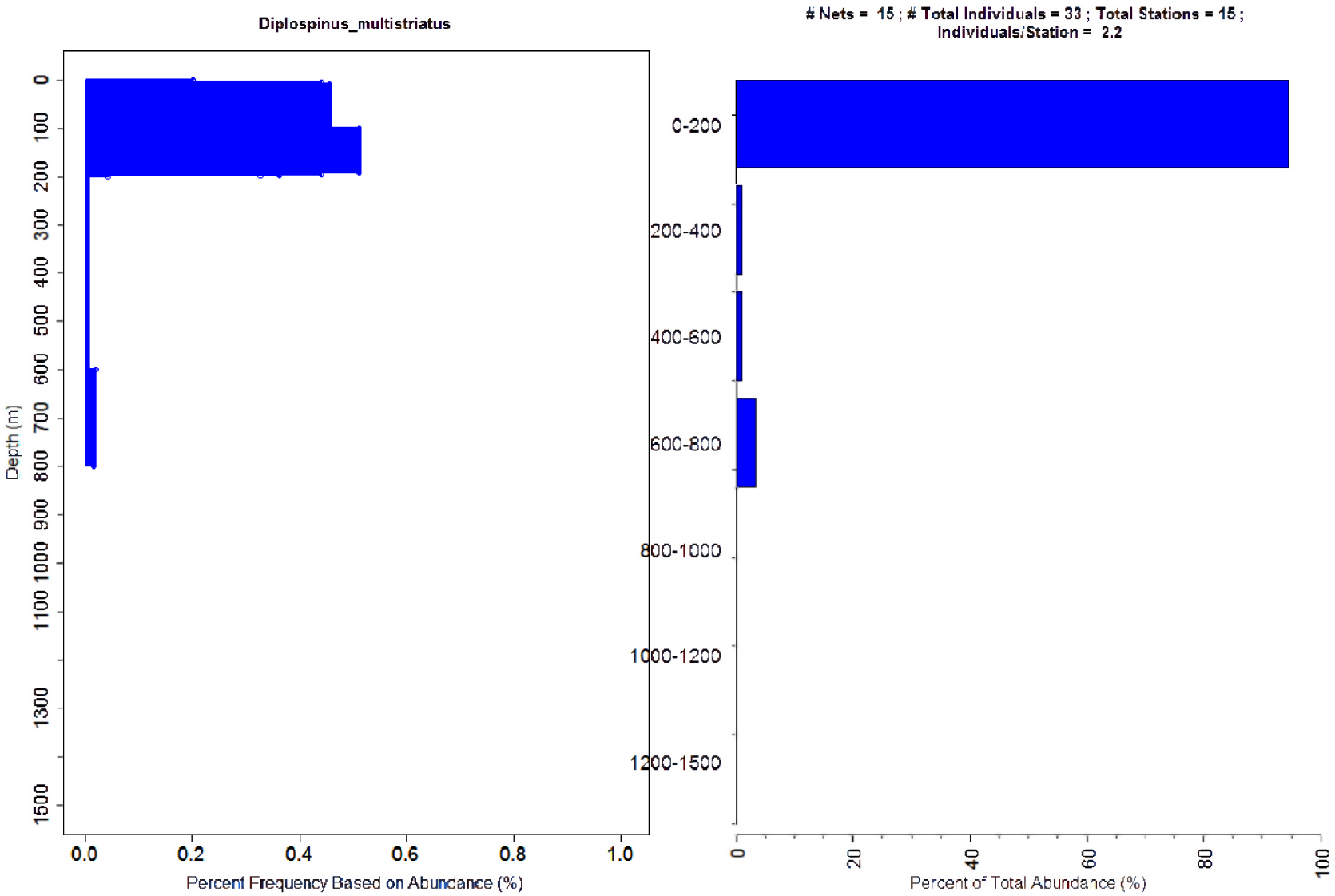
Diphyes_bojani



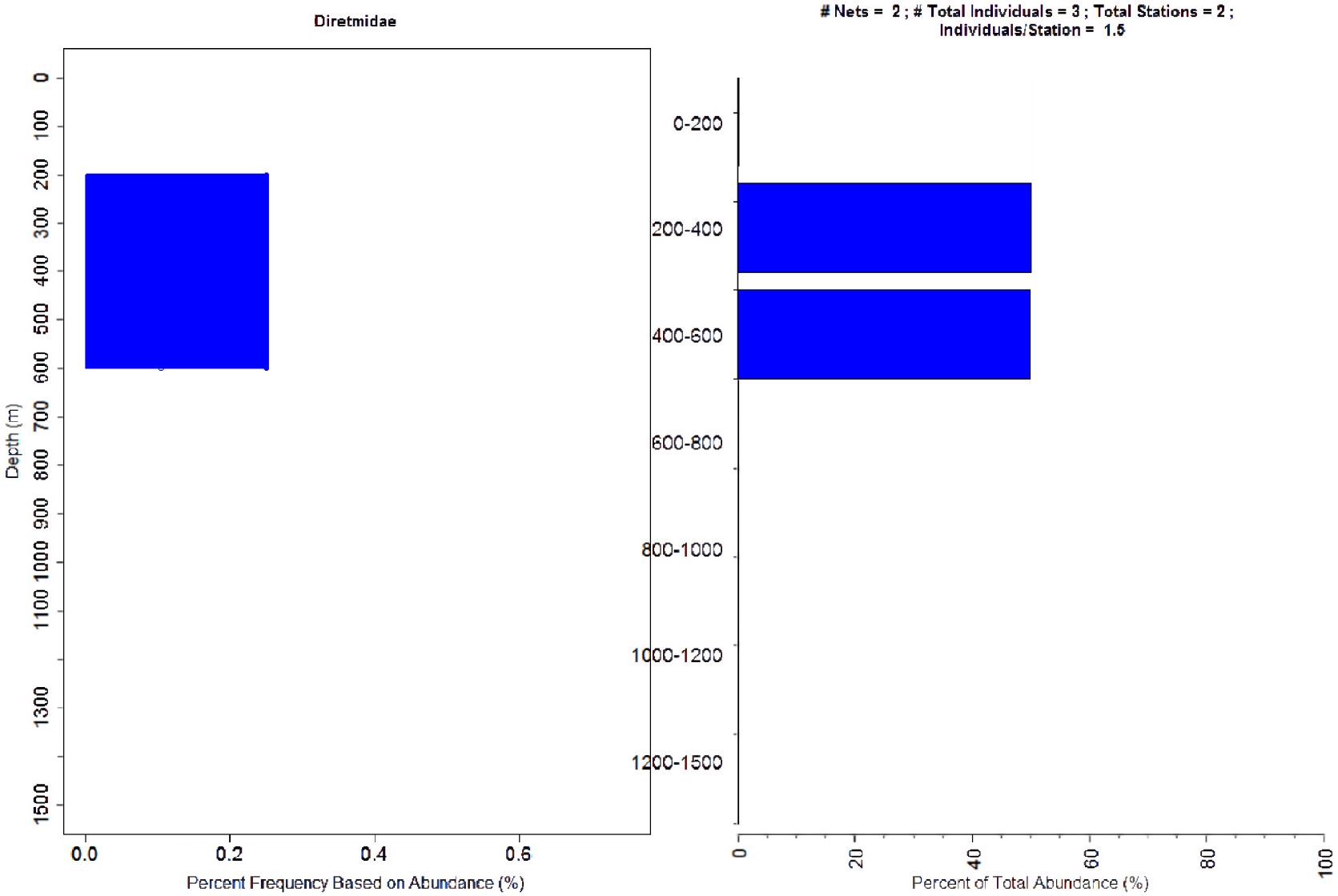
Diphyes_dispar


Diphyidae
Nets = 10 ; # Total Individuals = 70 ; Total Stations = 8 ;
Individuals/Station = 8.75
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

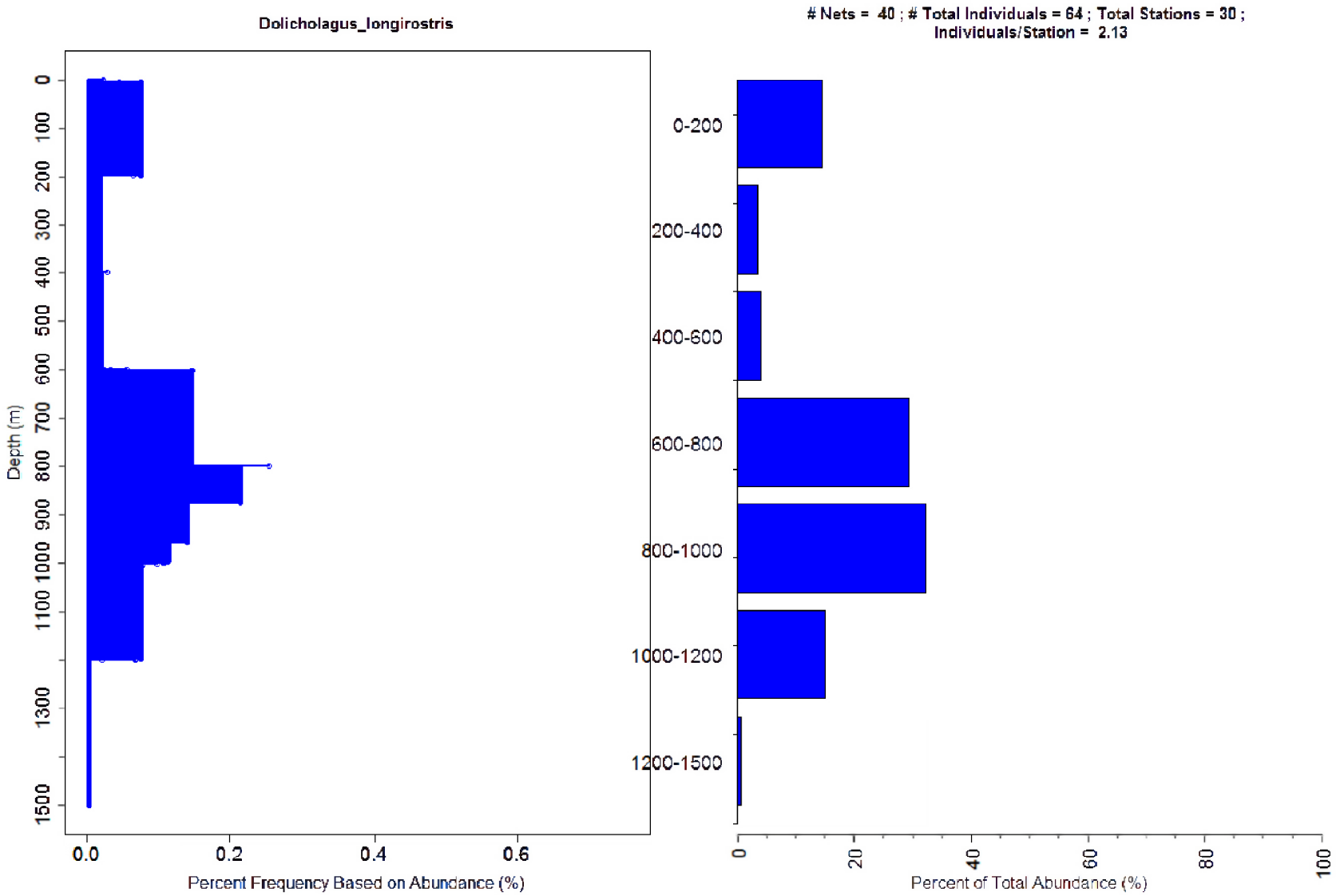
Diphyidae



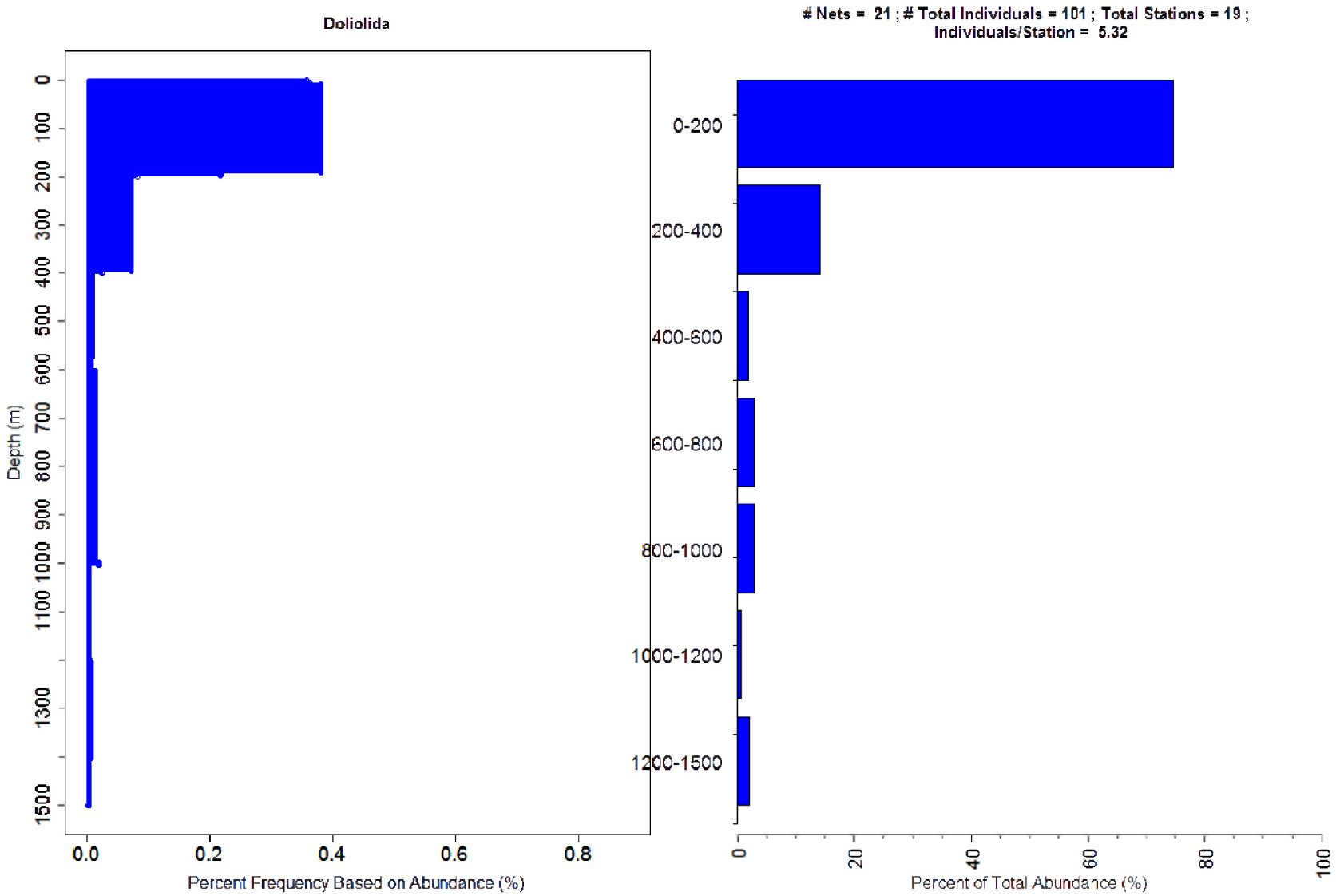
Diplospinus_multistriatus


Diretmidae
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

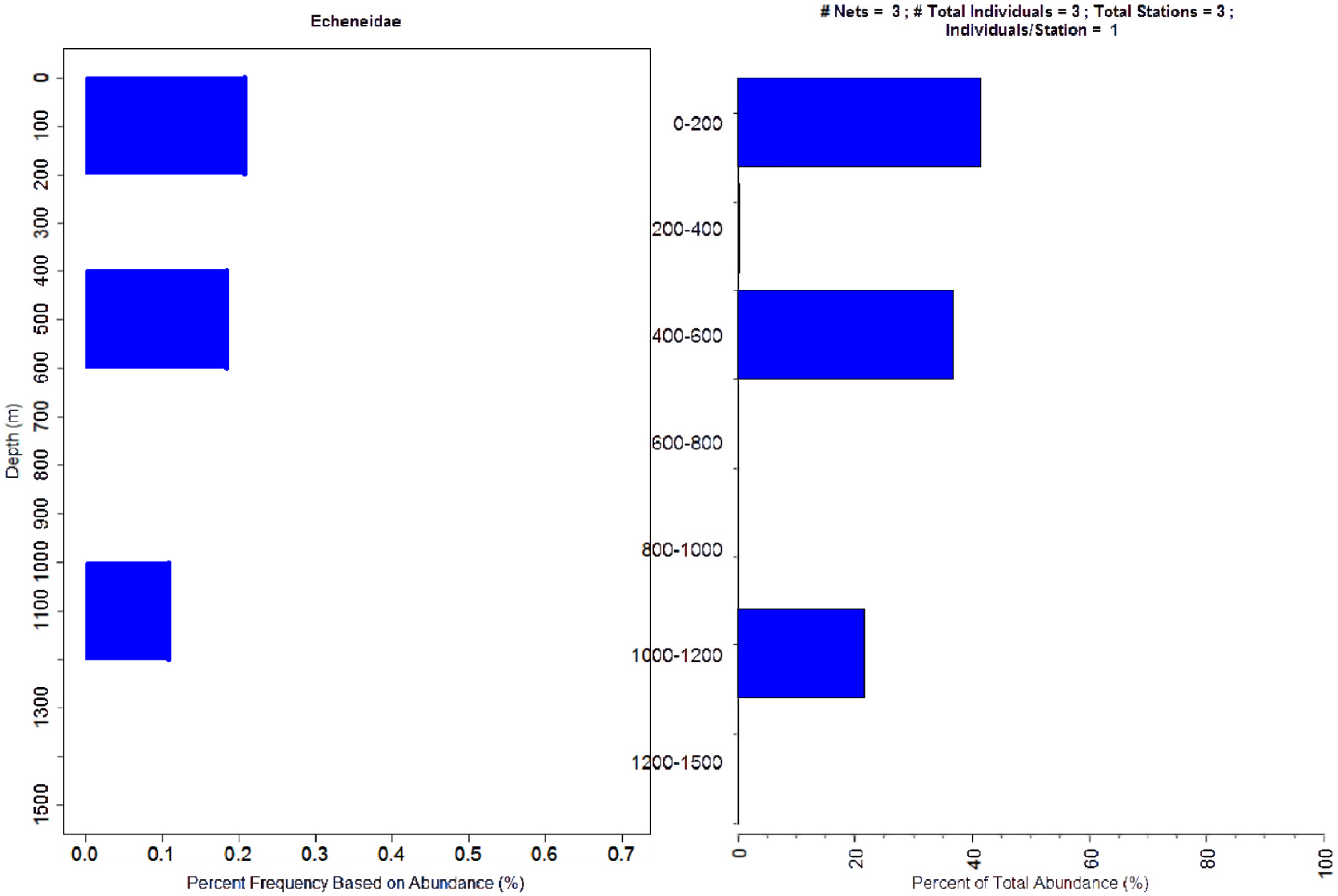
Diretmidae



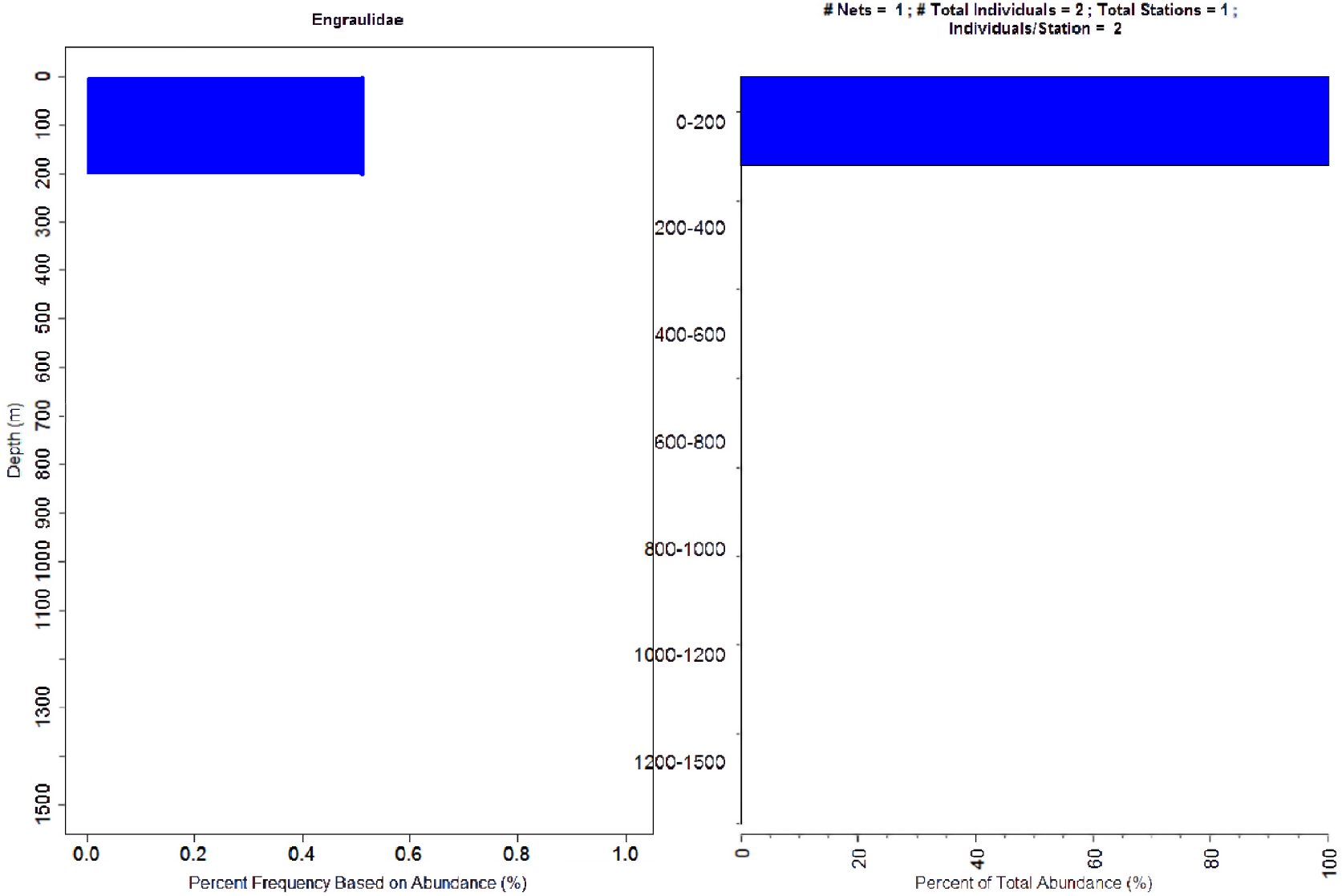
Dolicholagus_longirostris


Doliolida
Nets = 21 ; # Total Individuals = 101 ; Total Stations = 19 ;
Individuals/Station = 5.32
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

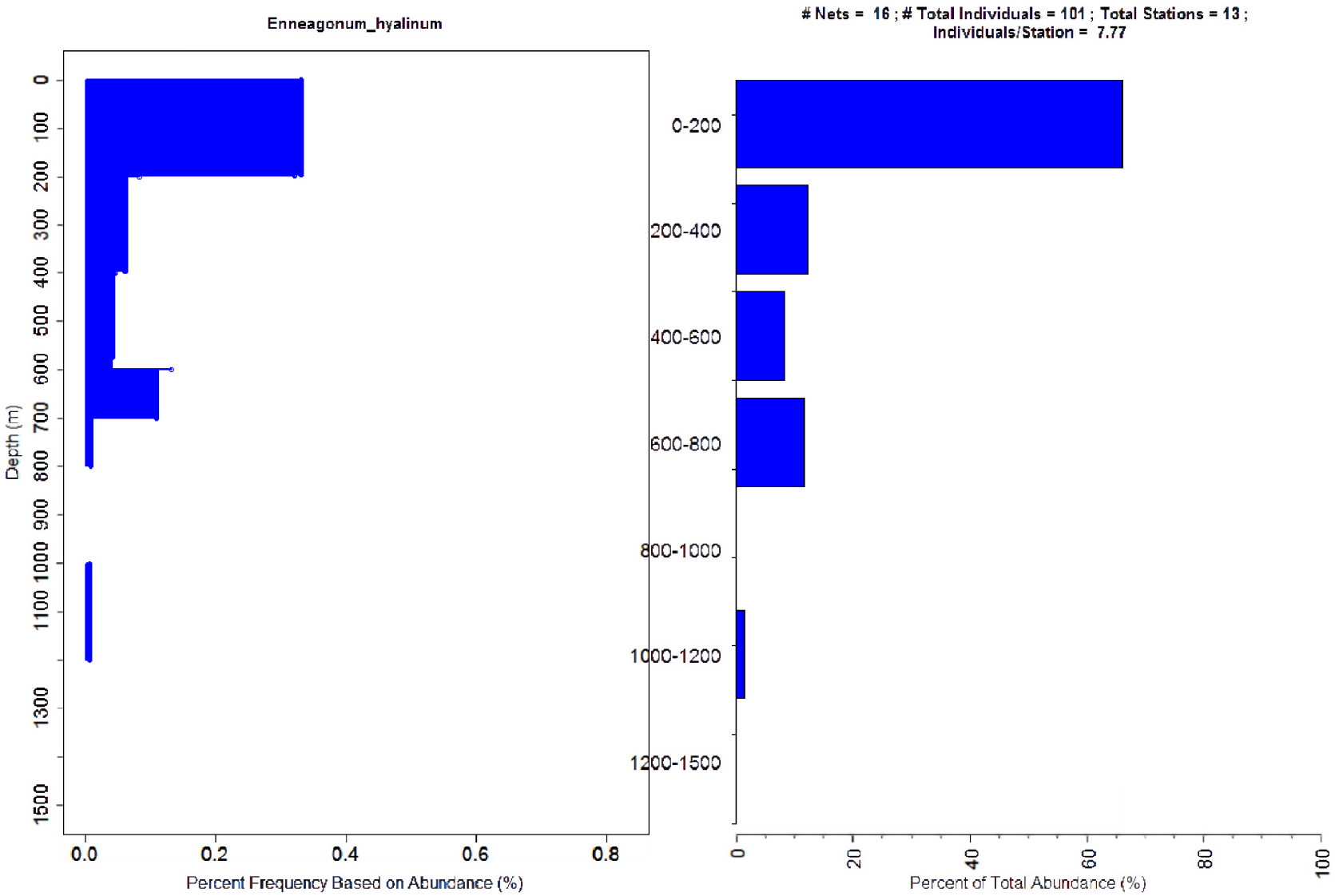
Doliolida


Echeneidae
Nets = 3 ; # Total Individuals = 3 ; Total Stations = 3 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

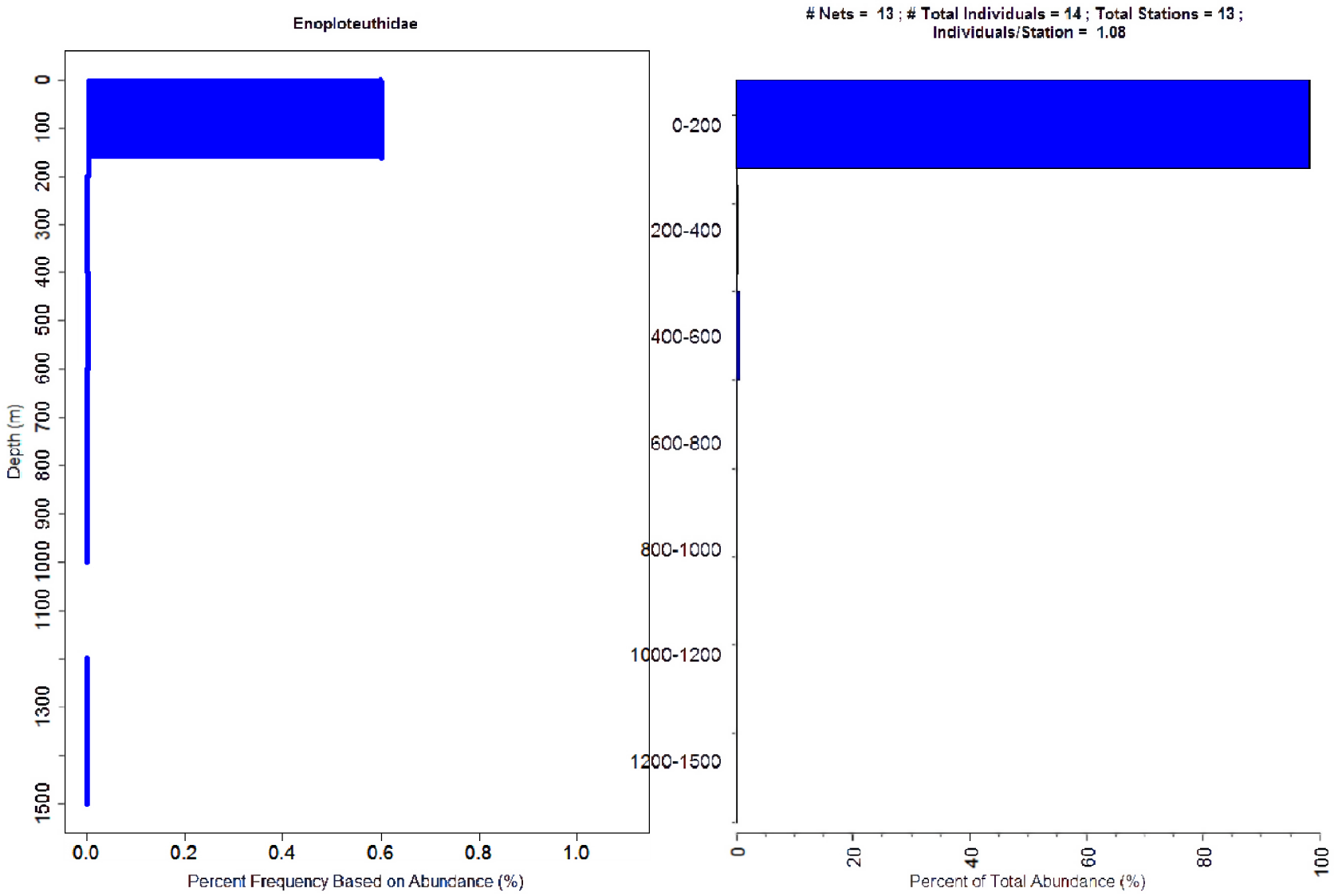
Echeneidae



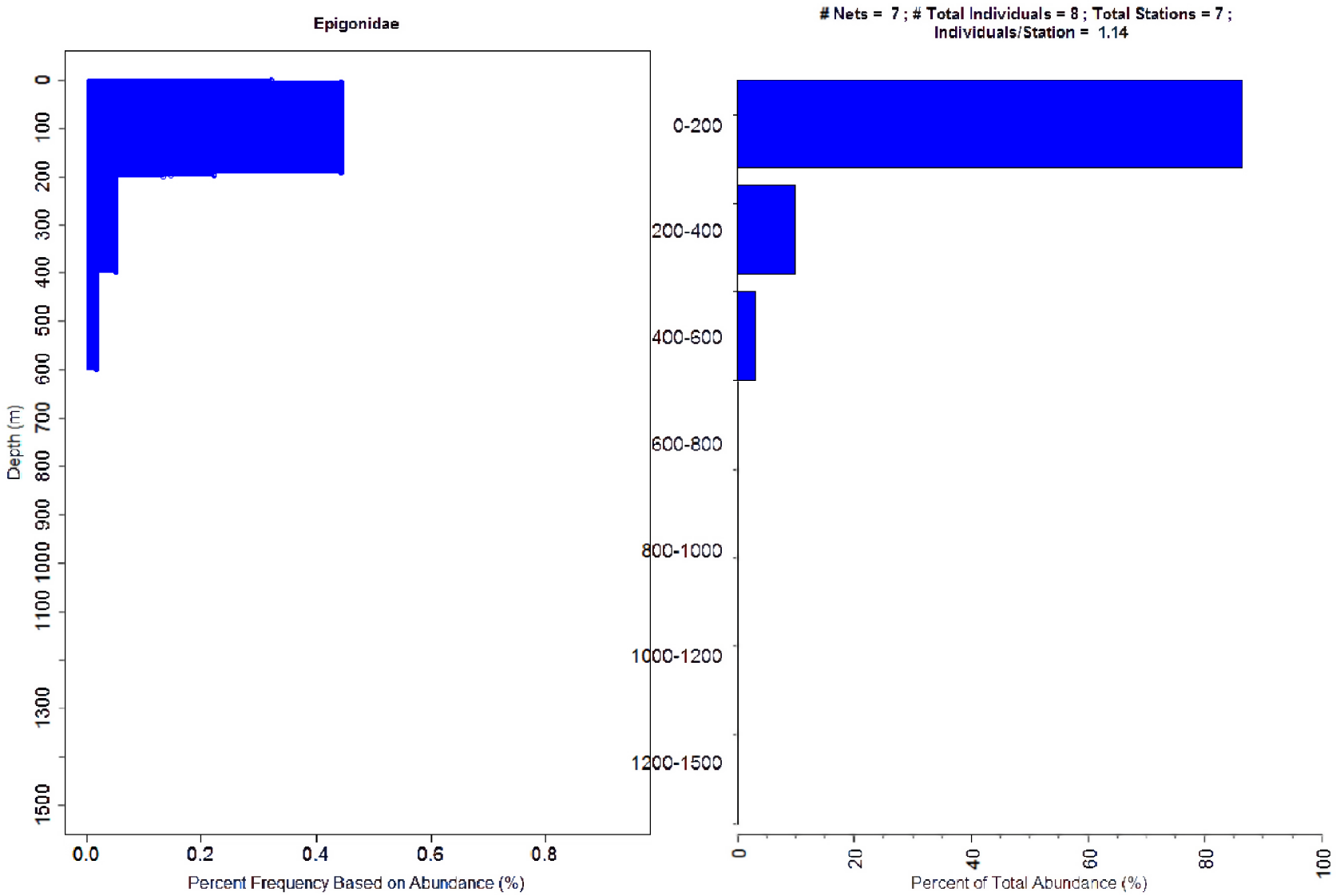
Engraulidae



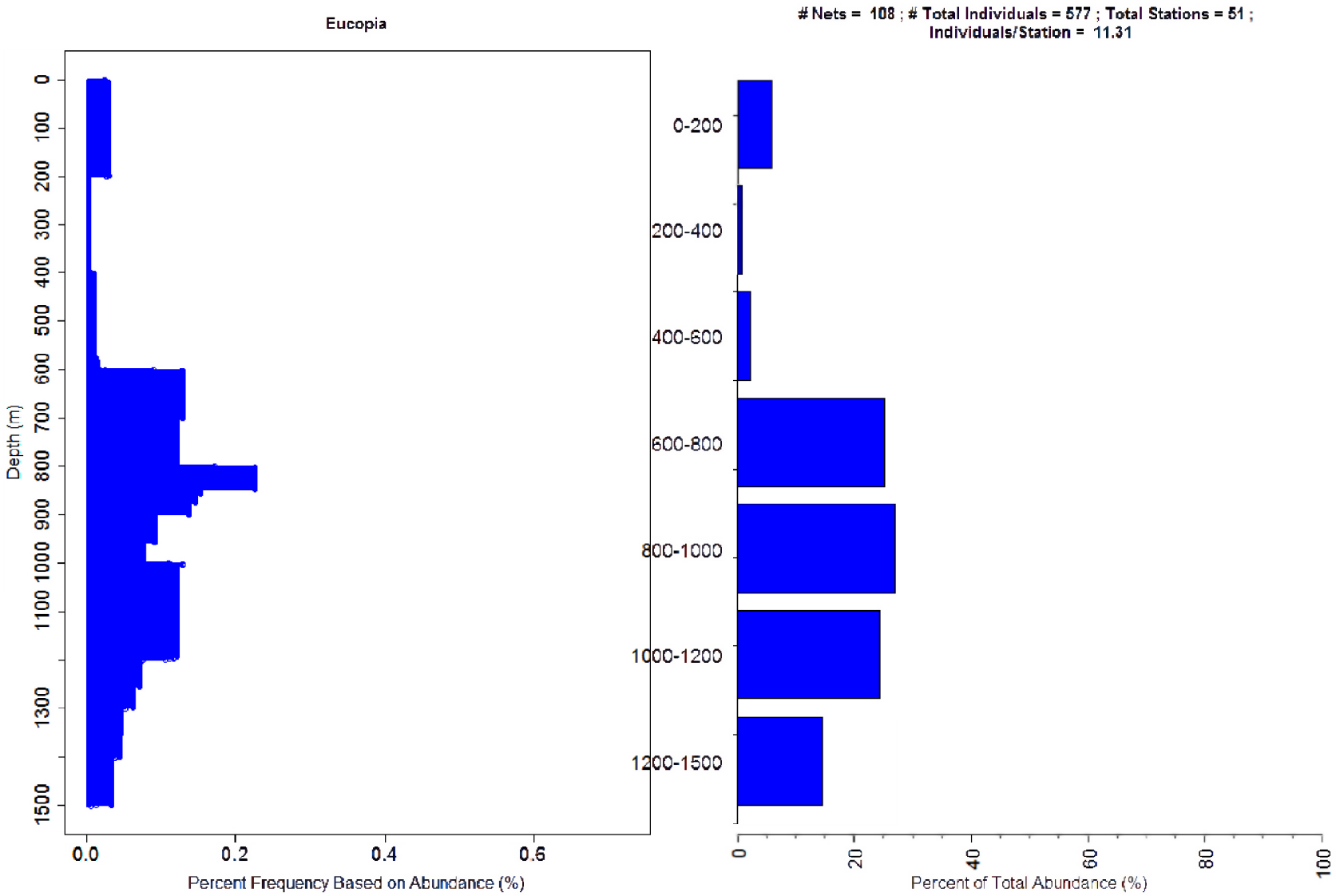
Enneagonum_hyalinum



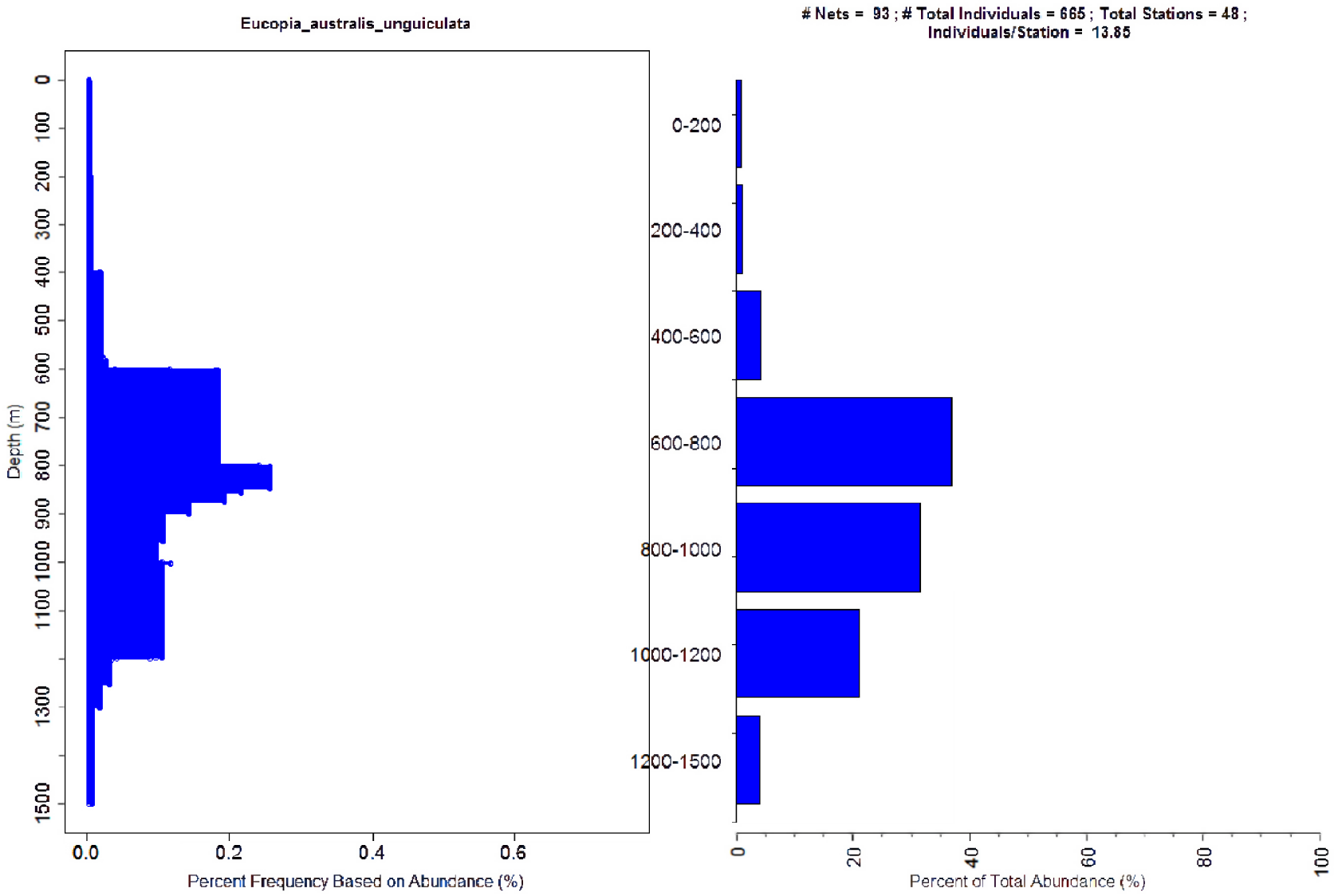
Enoploteuthidae


Epigonidae
Nets = 7 ; # Total Individuals = 8 ; Total Stations = 7 ;
Individuals/Station = 1.14
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

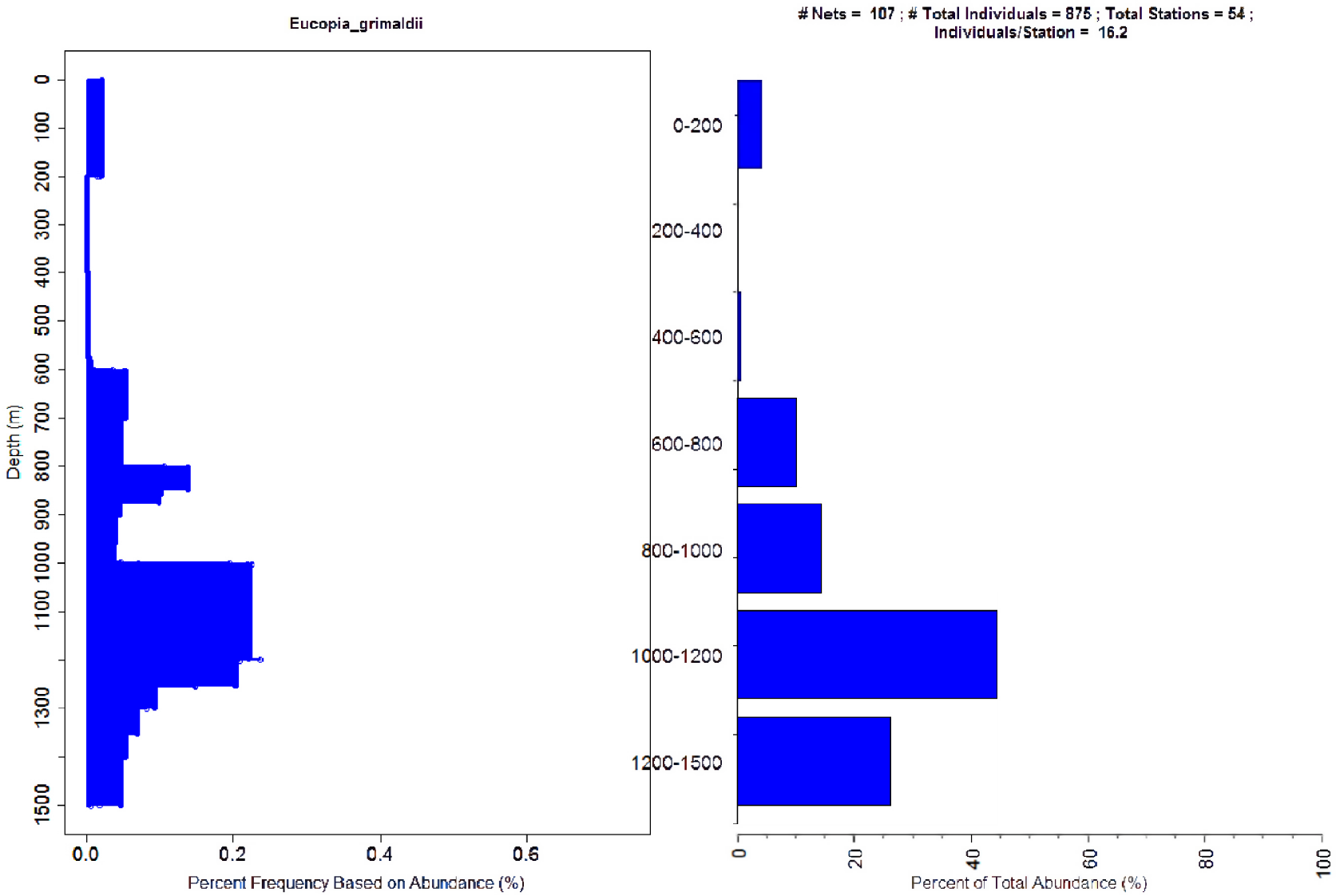
Epigonidae


Eucopia
Nets = 108 ; # Total Individuals = 577 ; Total Stations = 51 ;
Individuals/Station = 11.31
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

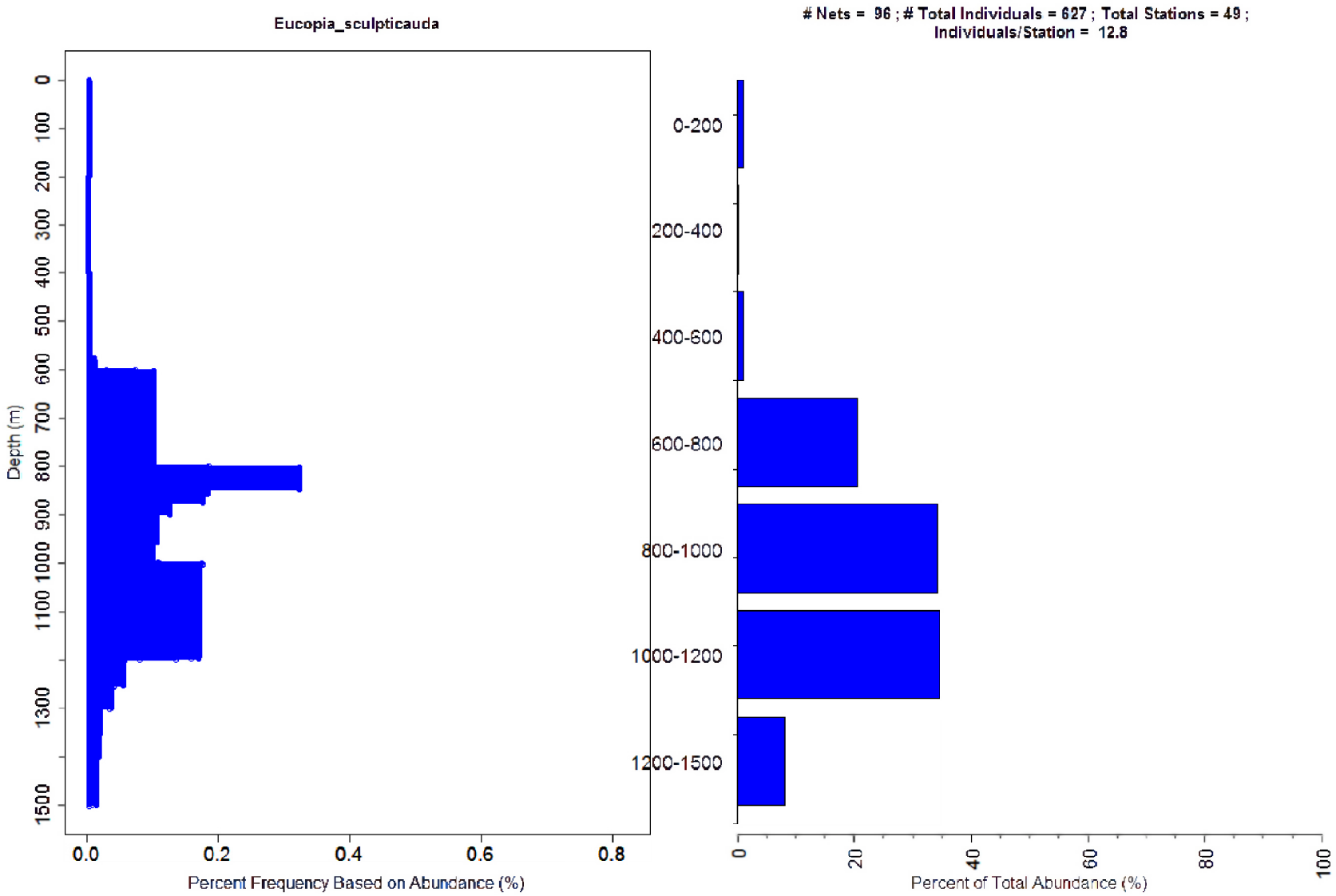
Eucopia



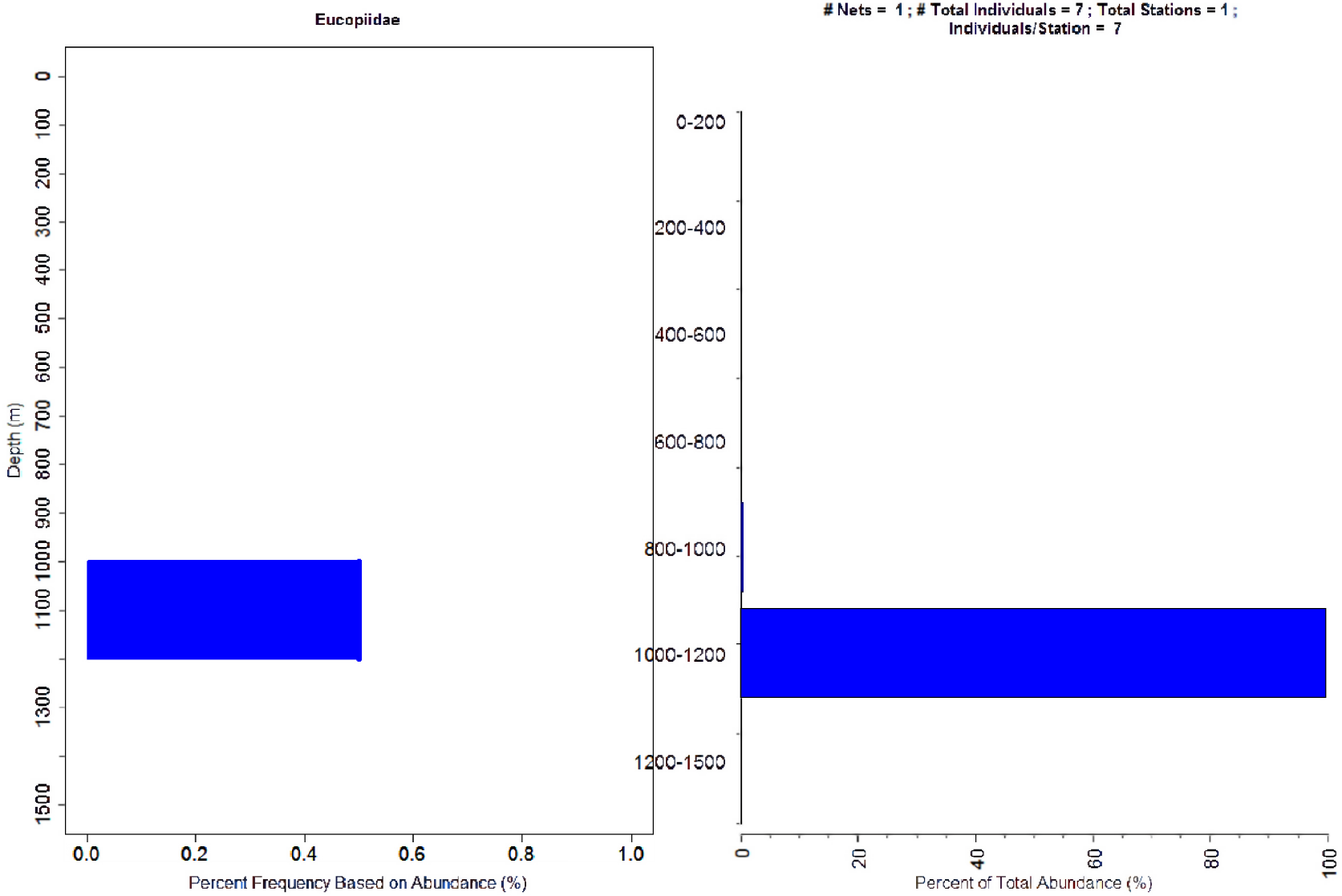
Eucopia_australis_unguiculata



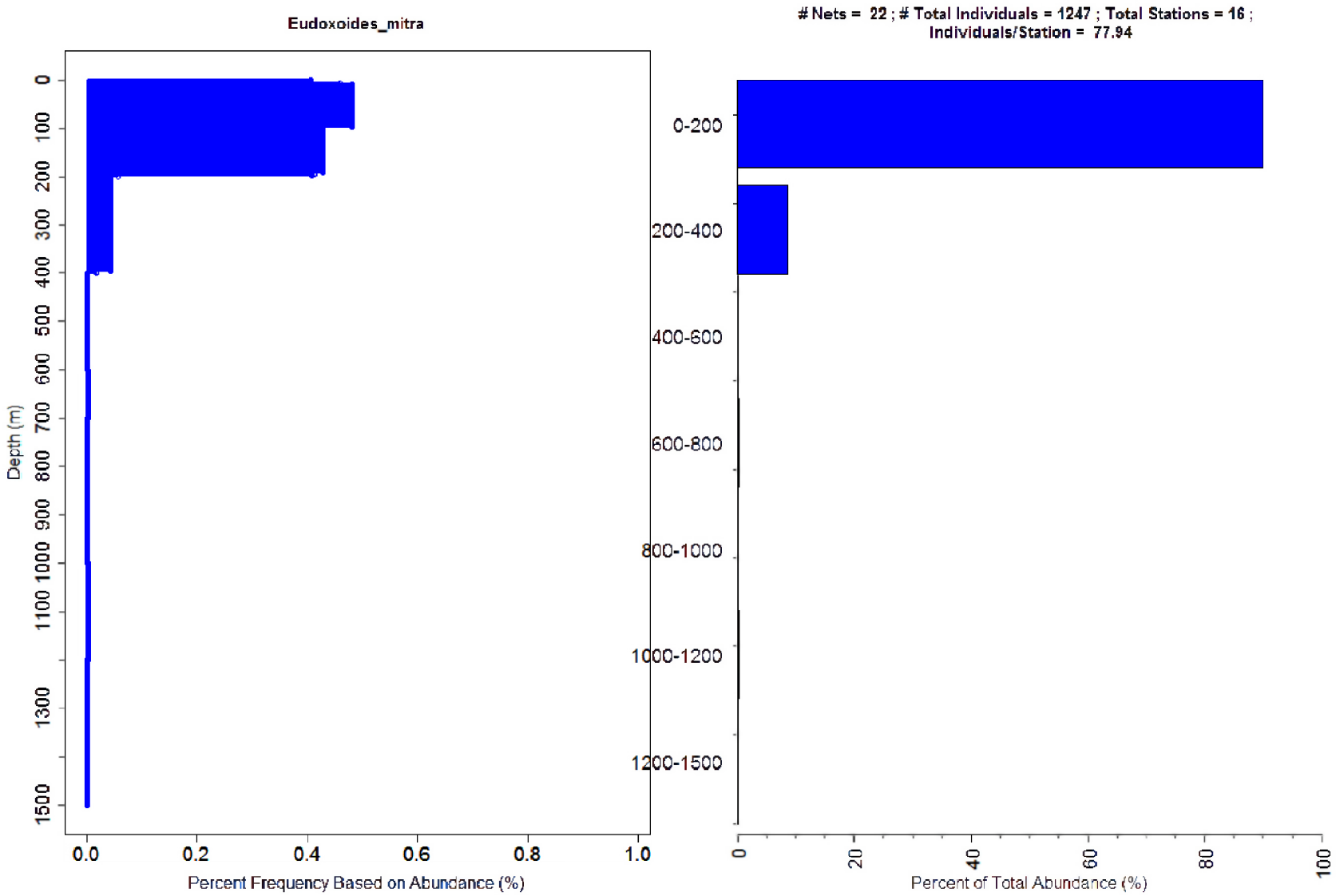
Eucopia_grimaldii



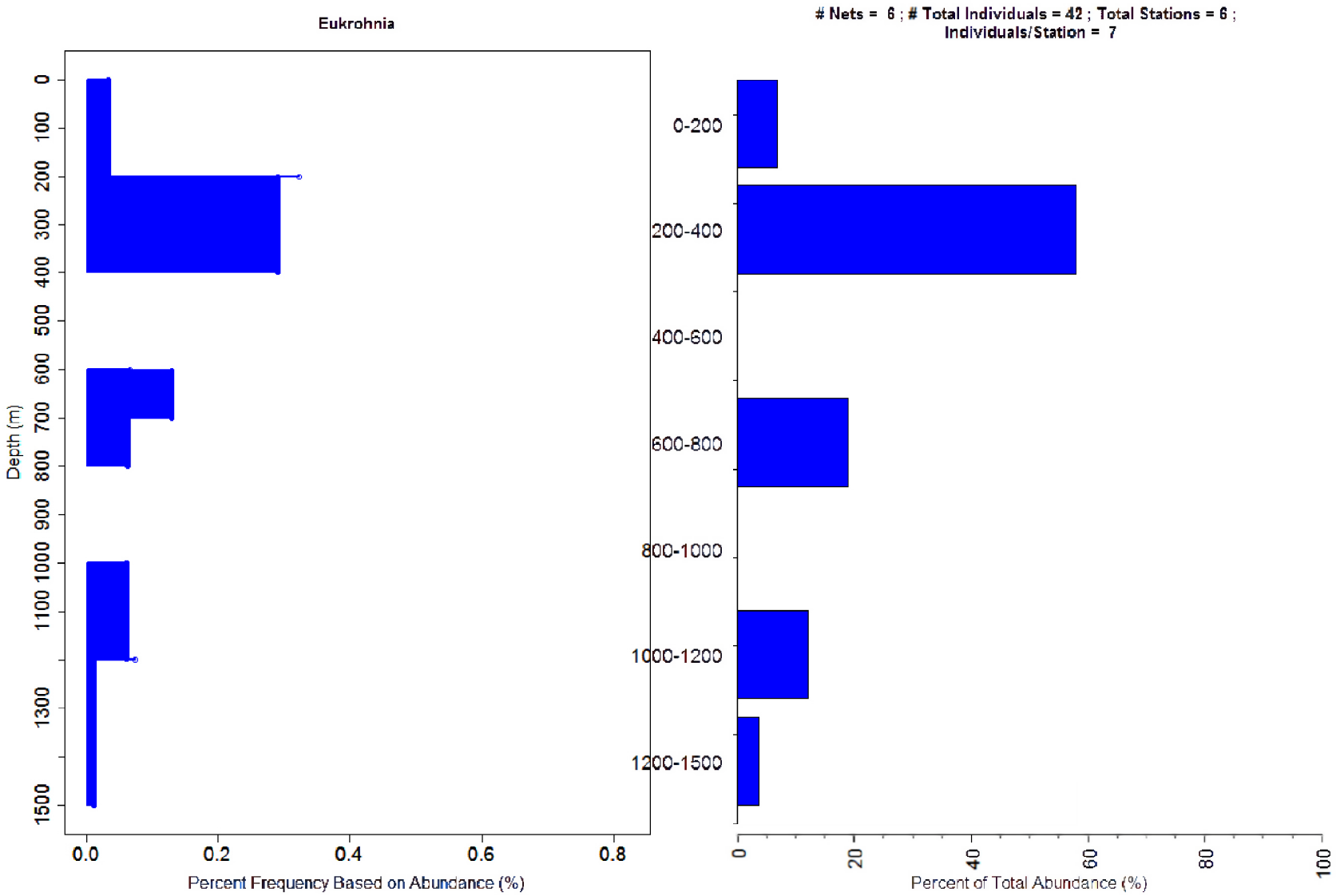
Eucopia_sculpticauda


Eucopiidae
Nets = 1 ; # Total Individuals = 7 ; Total Stations = 1 ;
Individuals/Station = 7
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

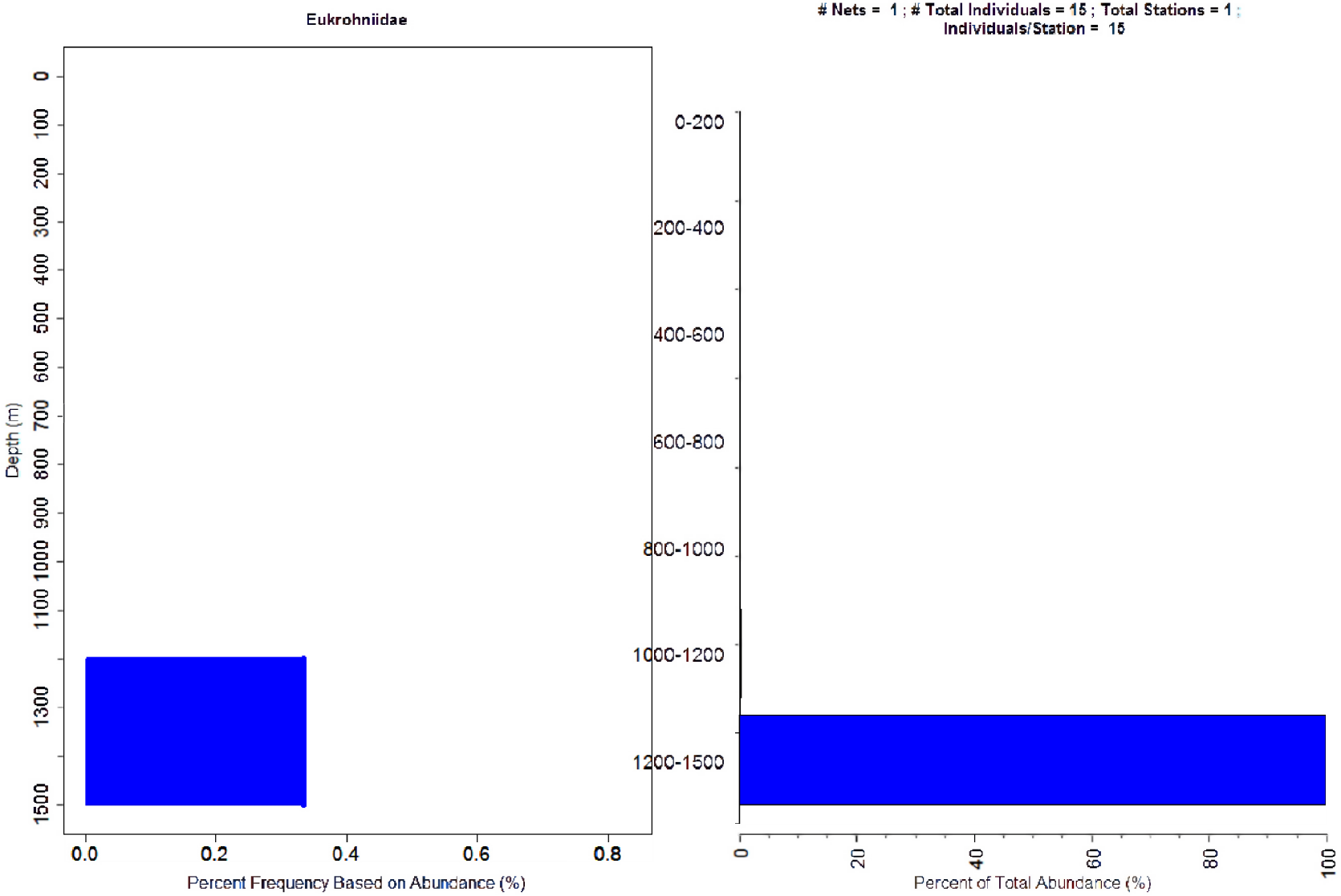
Eucopiidae



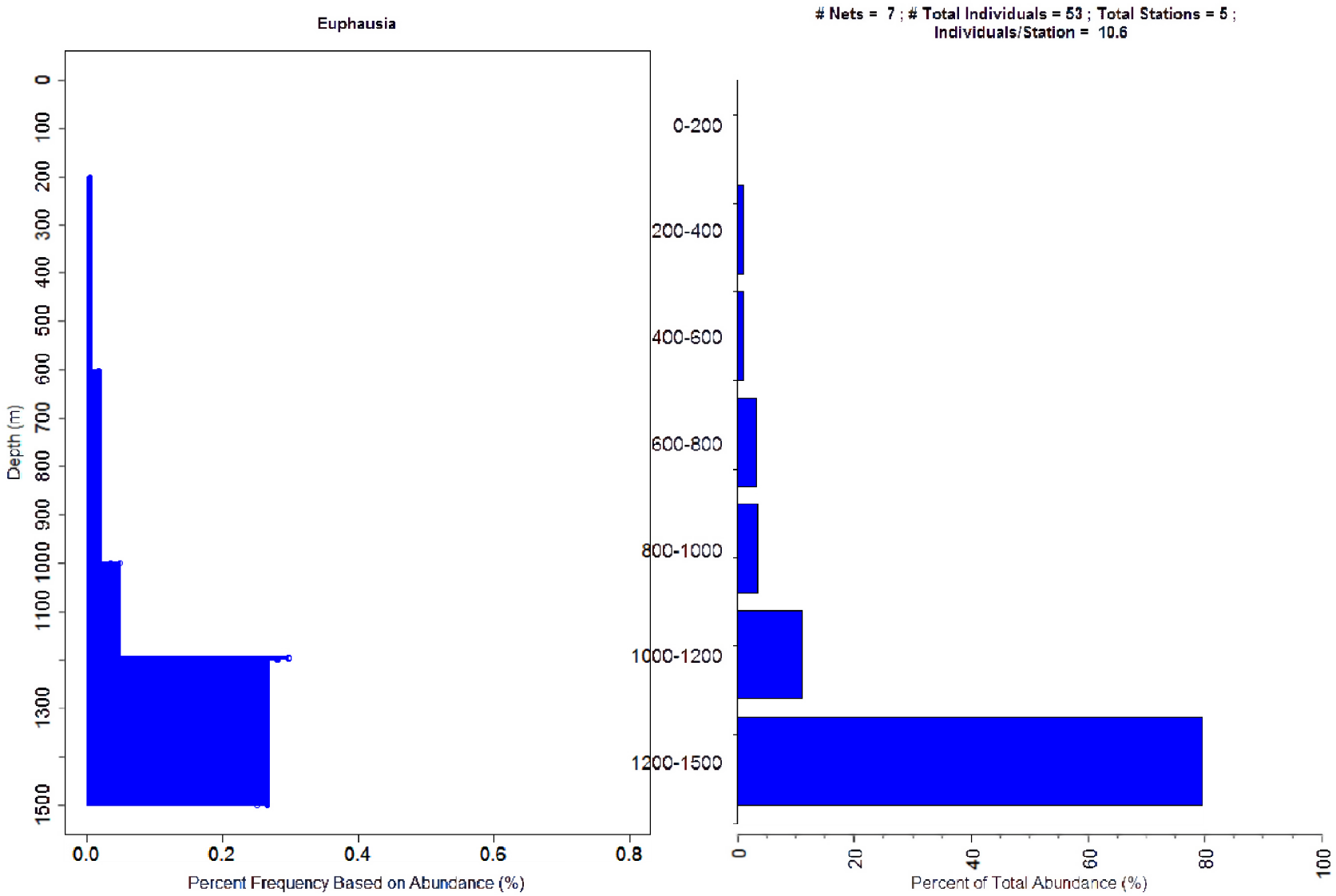
Eudoxoides_mitra


Eukrohnia
Nets = 6 ; # Total Individuals = 42 ; Total Stations = 6 ;
Individuals/Station = 7
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

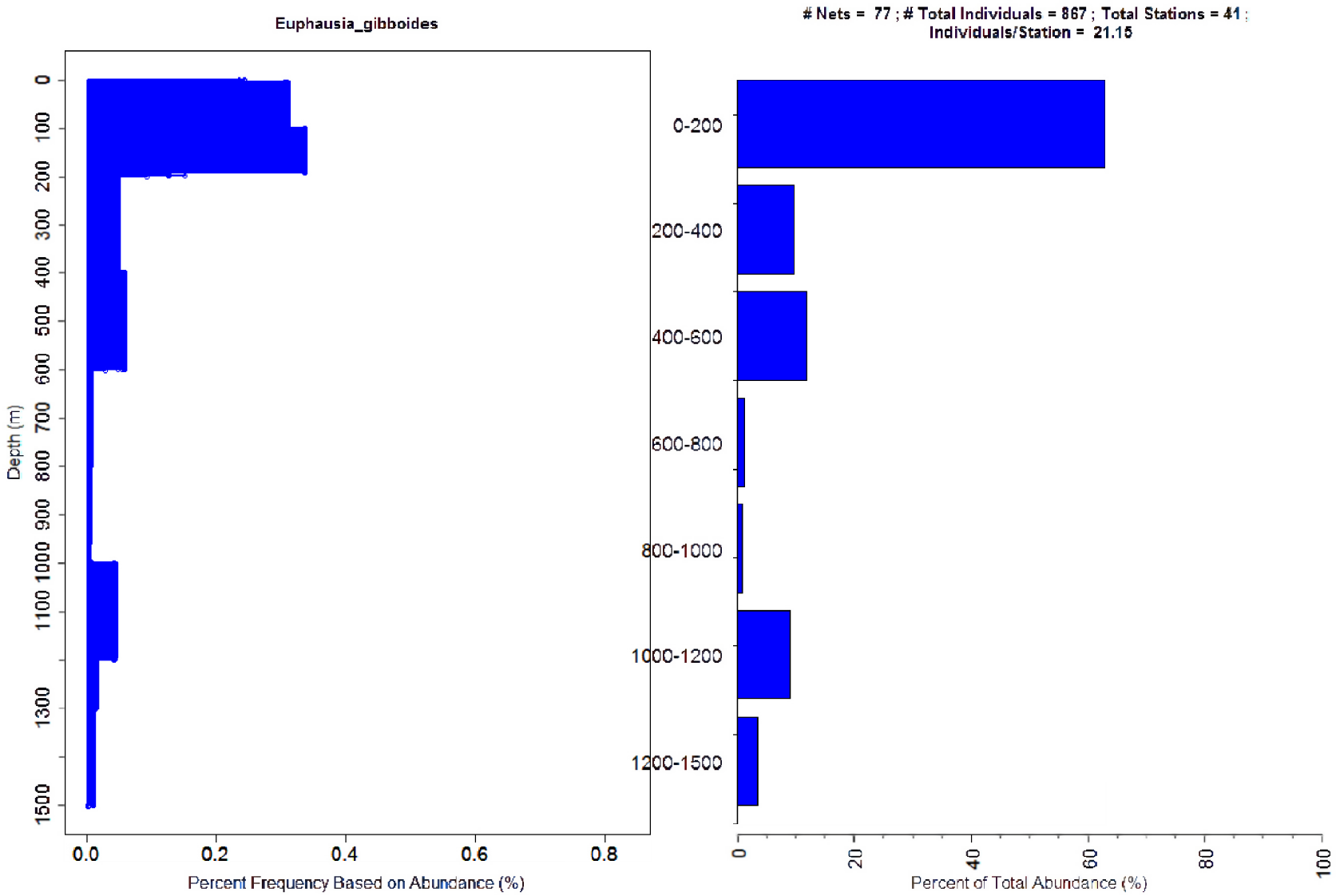
Eukrohnia



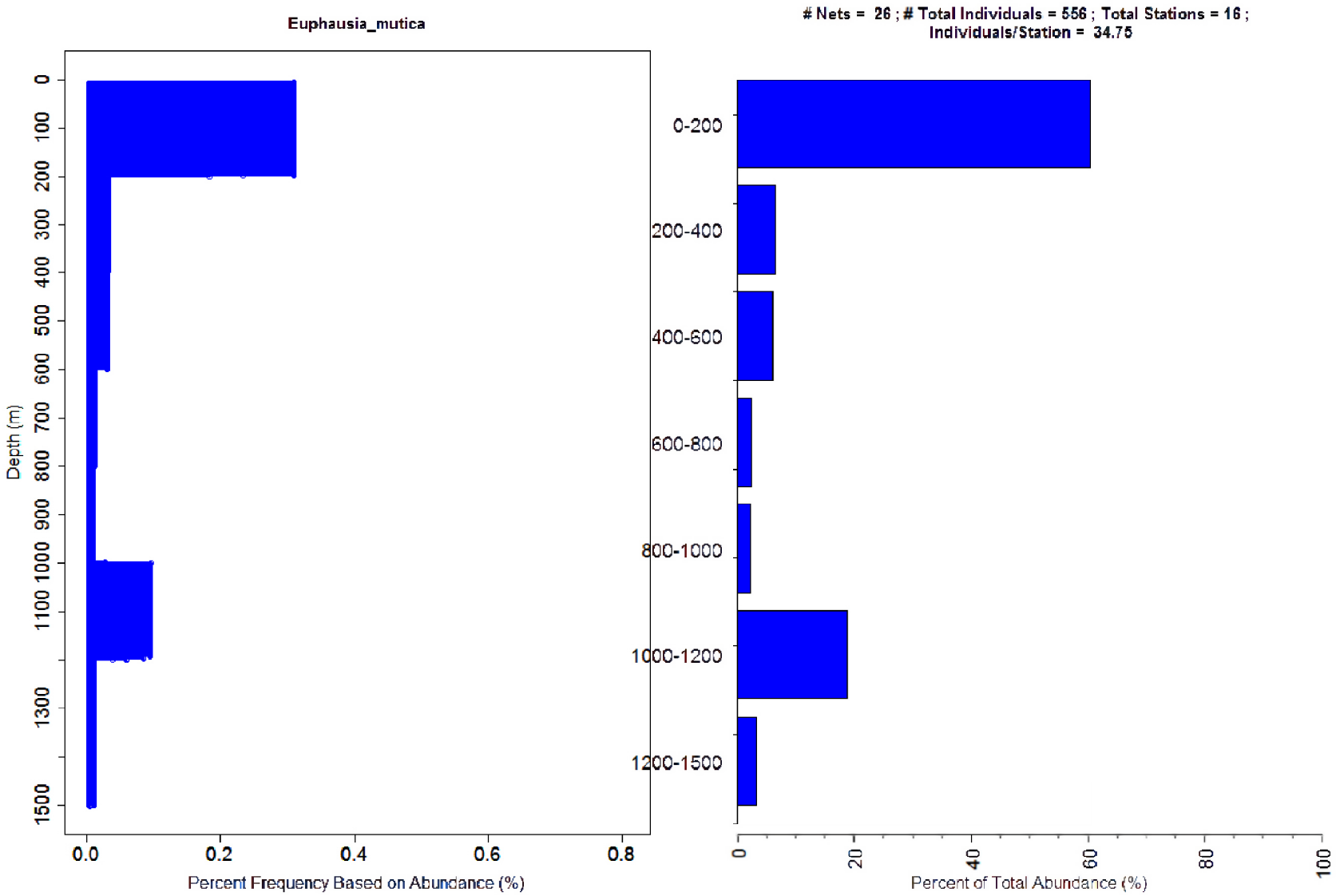
Eukrohniidae


Euphausia
Nets = 7 ; # Total Individuals = 53 ; Total Stations = 5 ;
Individuals/Station = 10.6
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

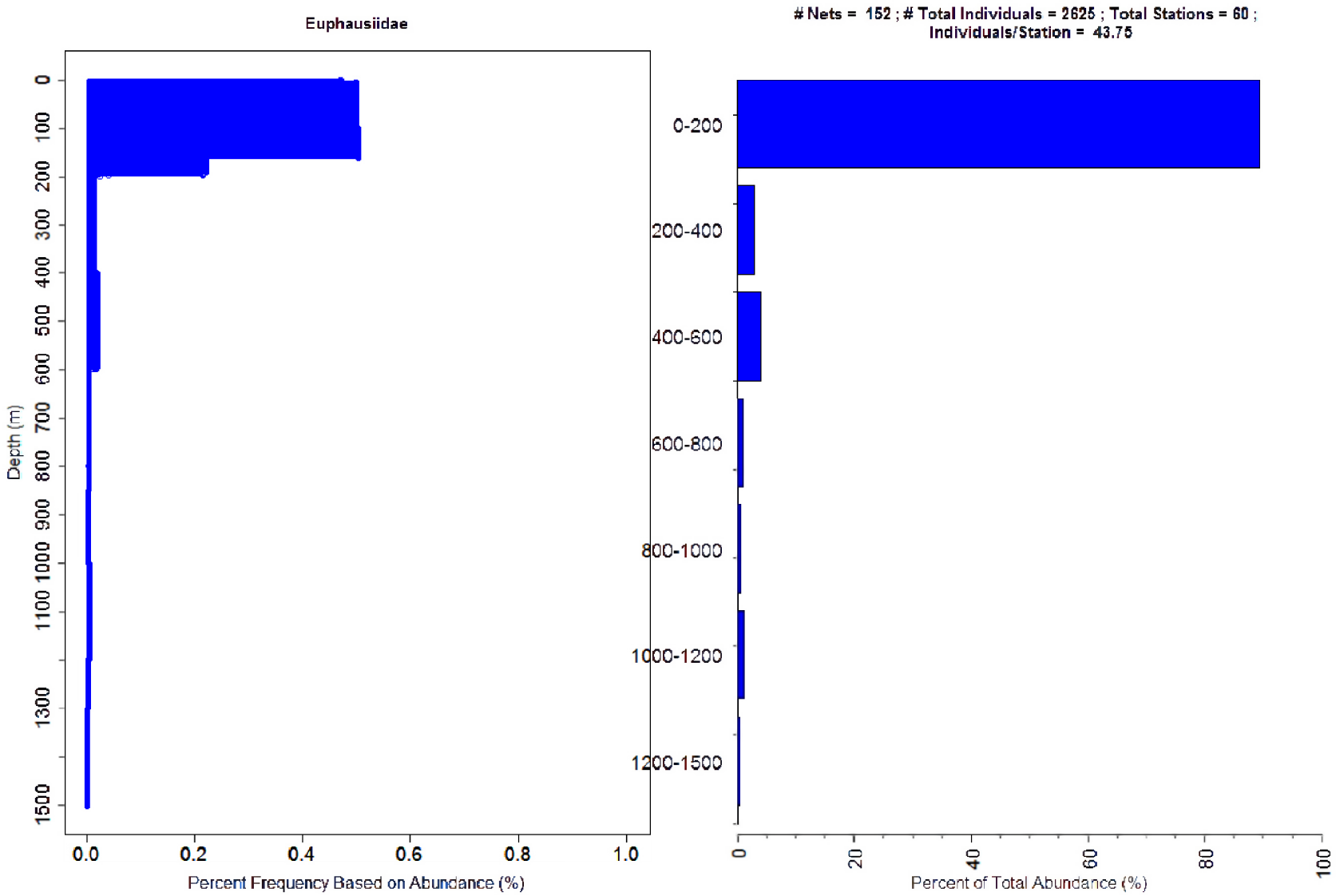
Euphausia



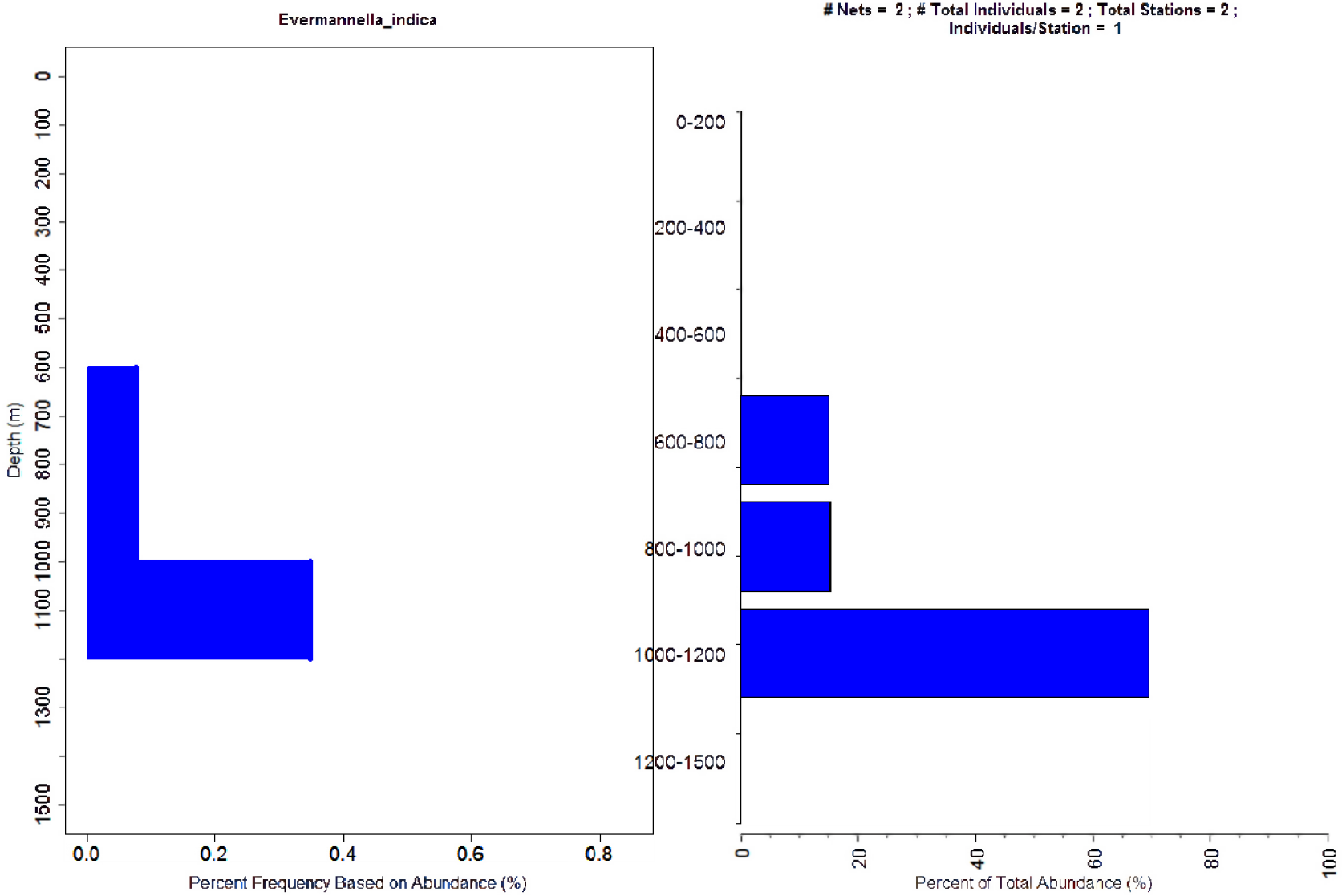
Euphausia_gibboides



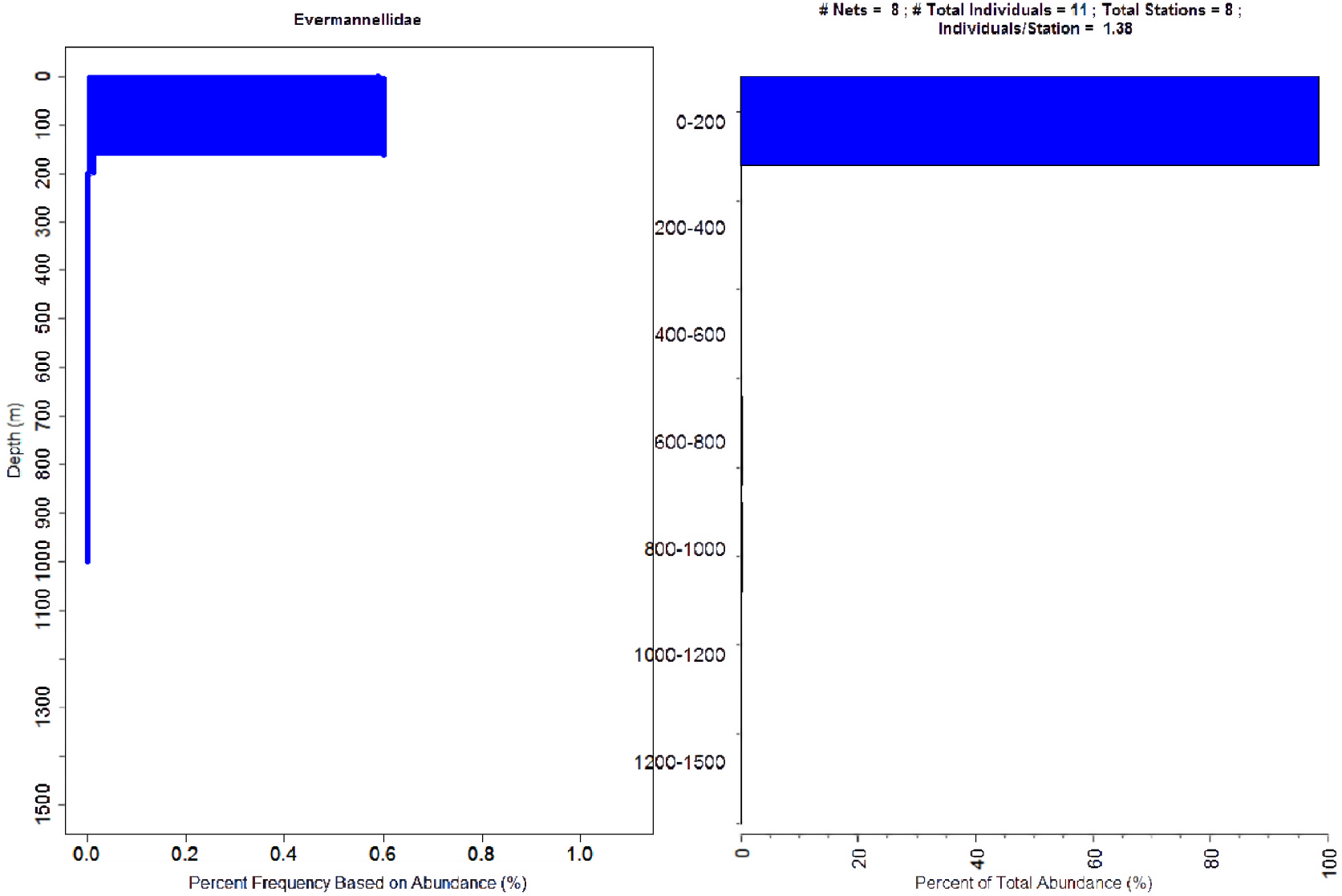
Euphausia_mutica



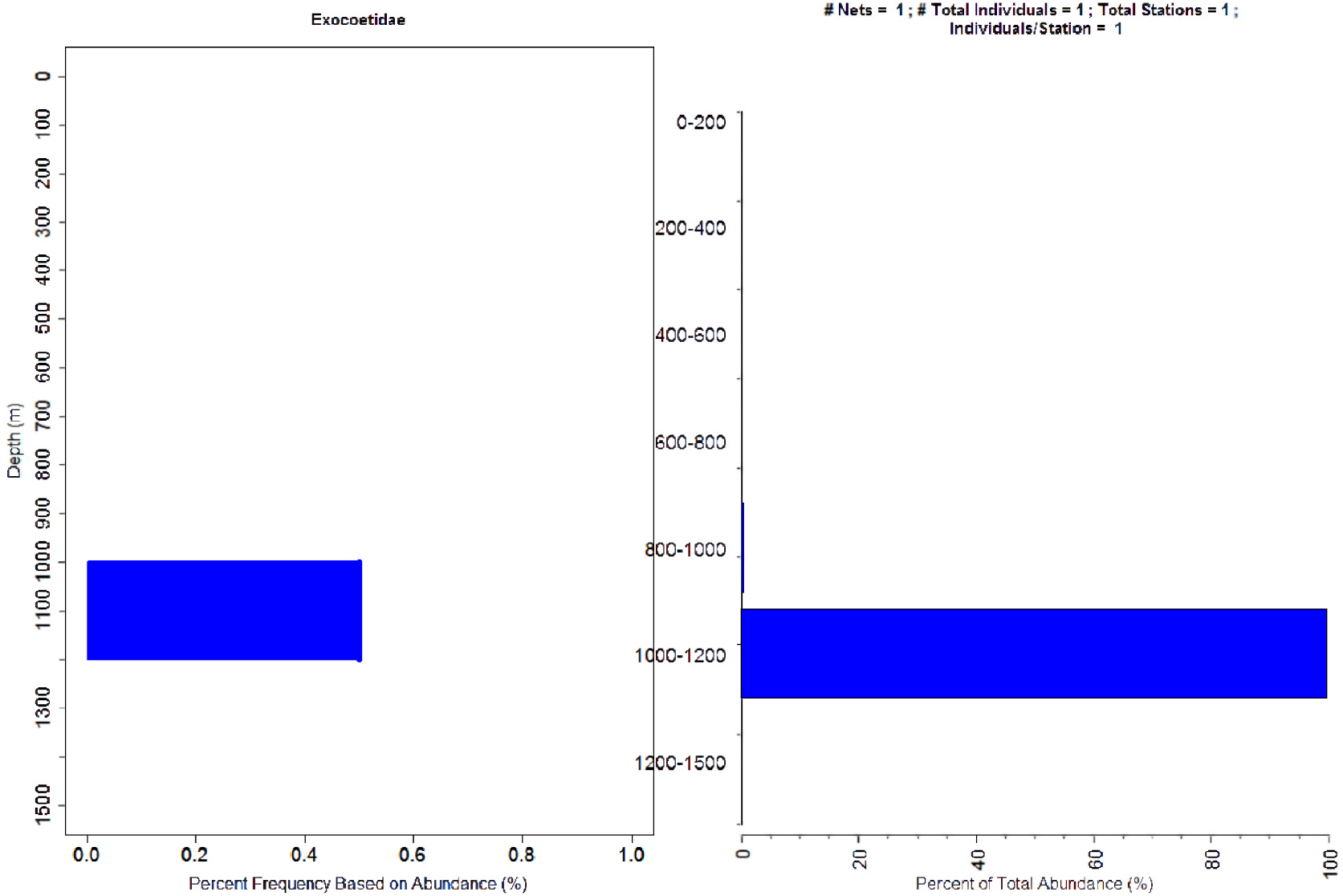
Euphausiidae



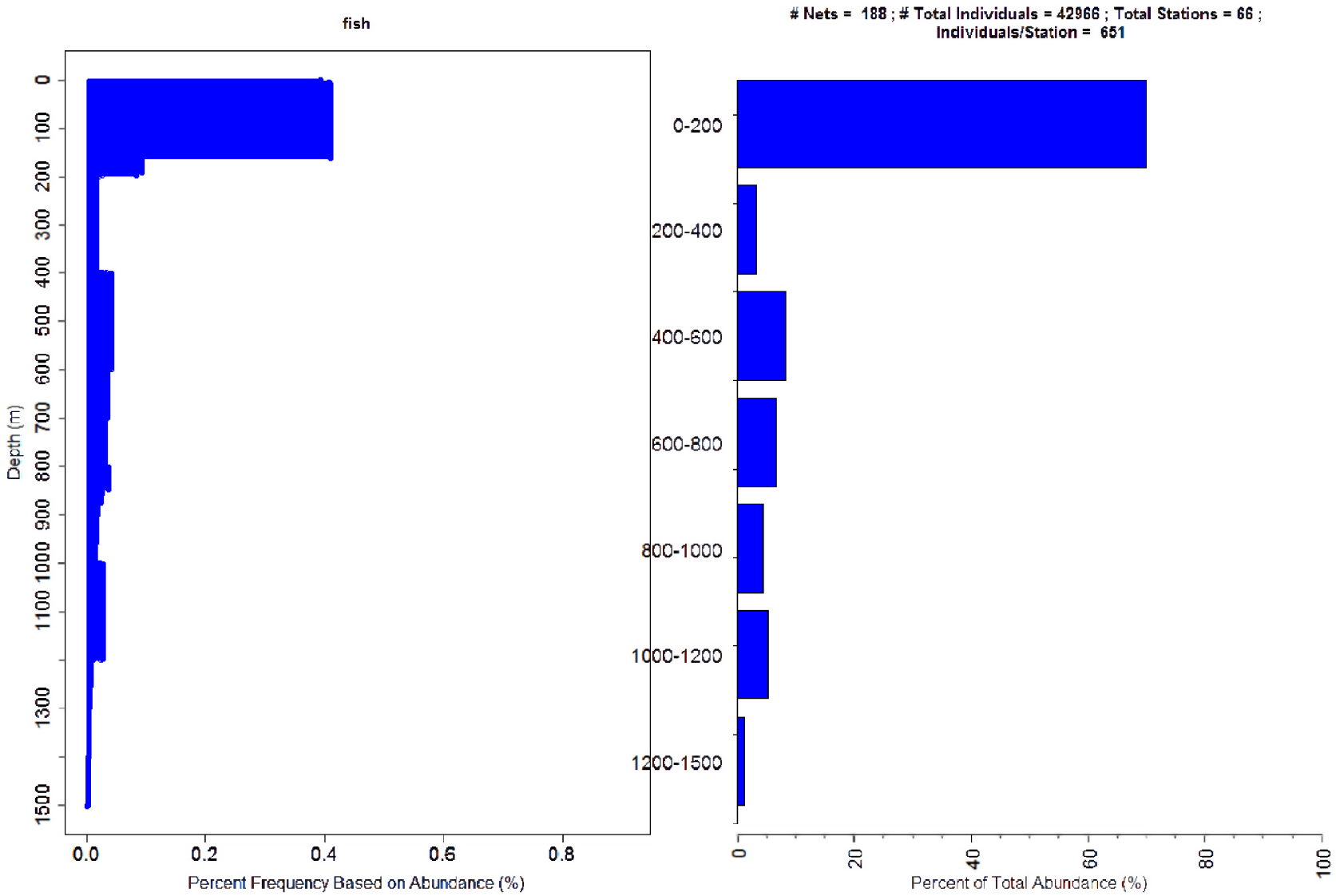
Evermannella_indica



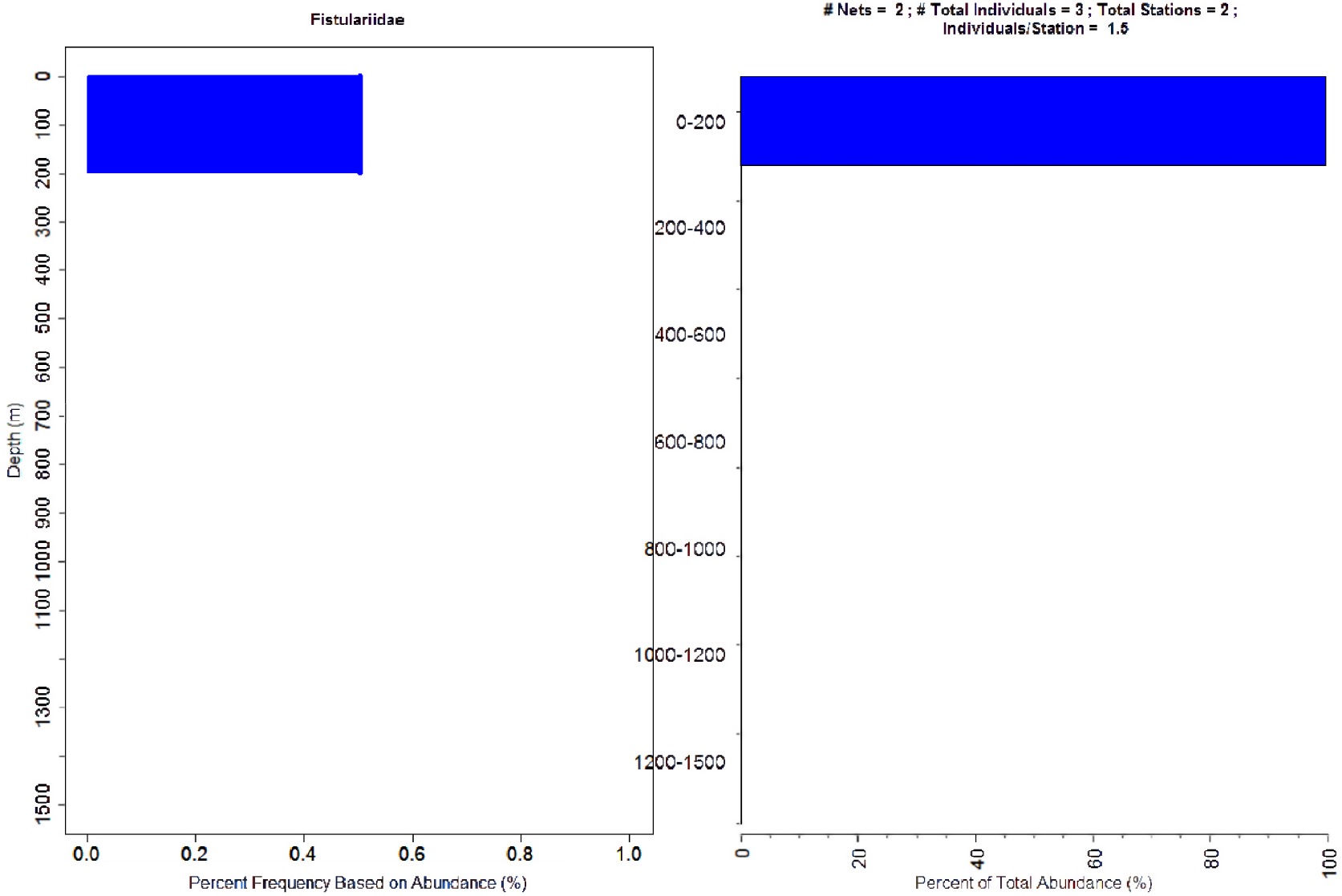
Evermannellidae



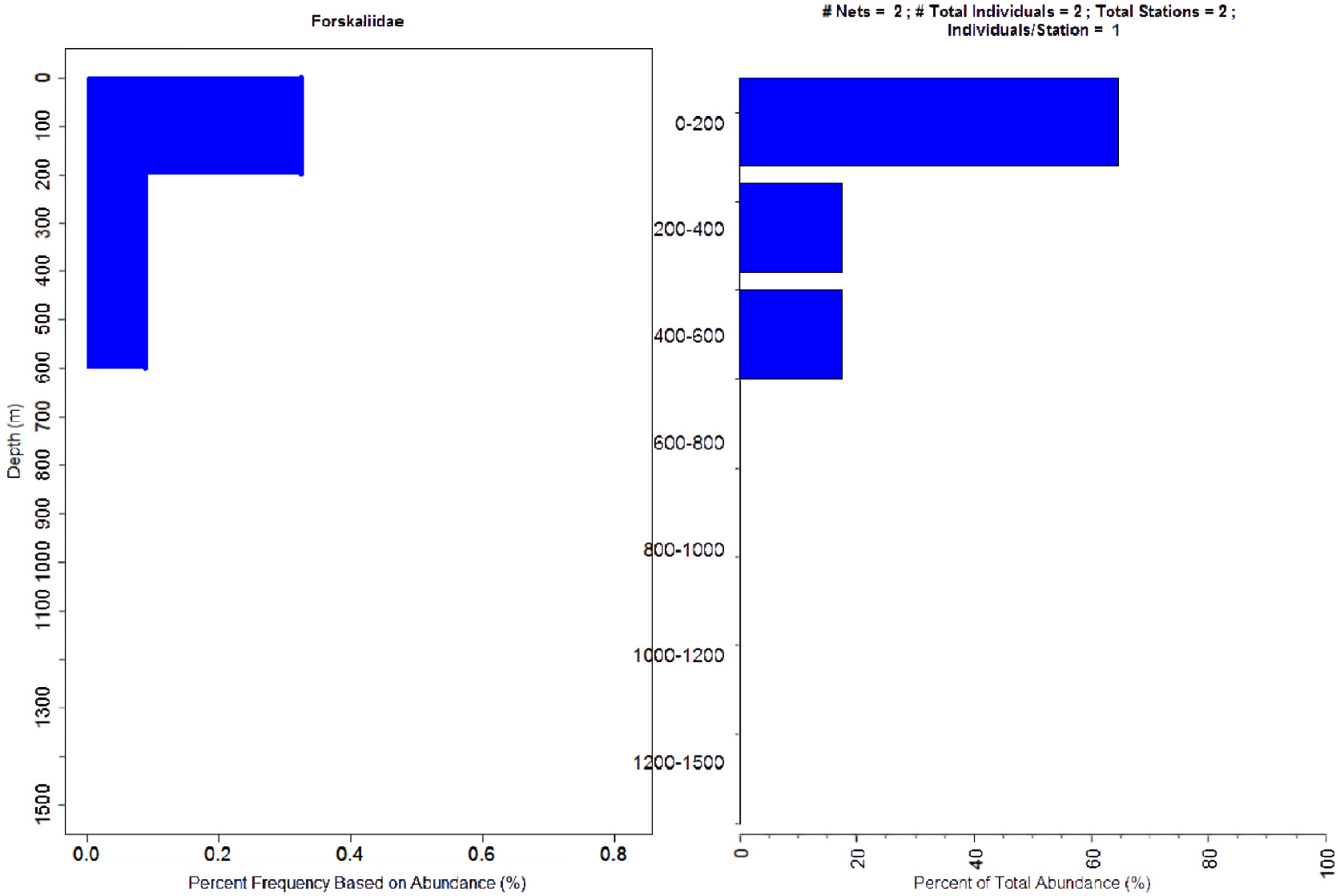
Exocoetidae


fish
Nets = 188 ; # Total Individuals = 42966 ; Total Stations = 66 ;
Individuals/Station = 651
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

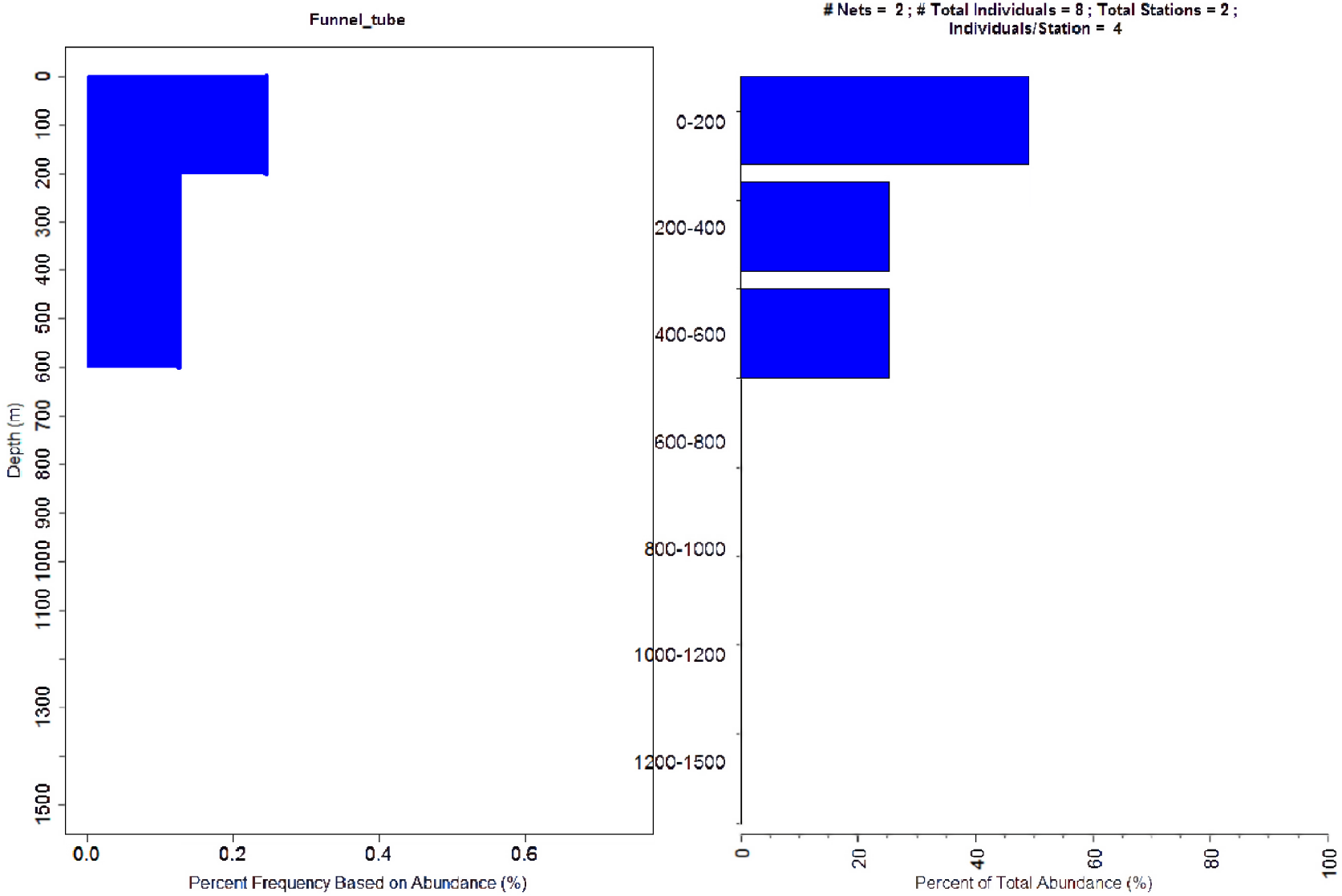
fish



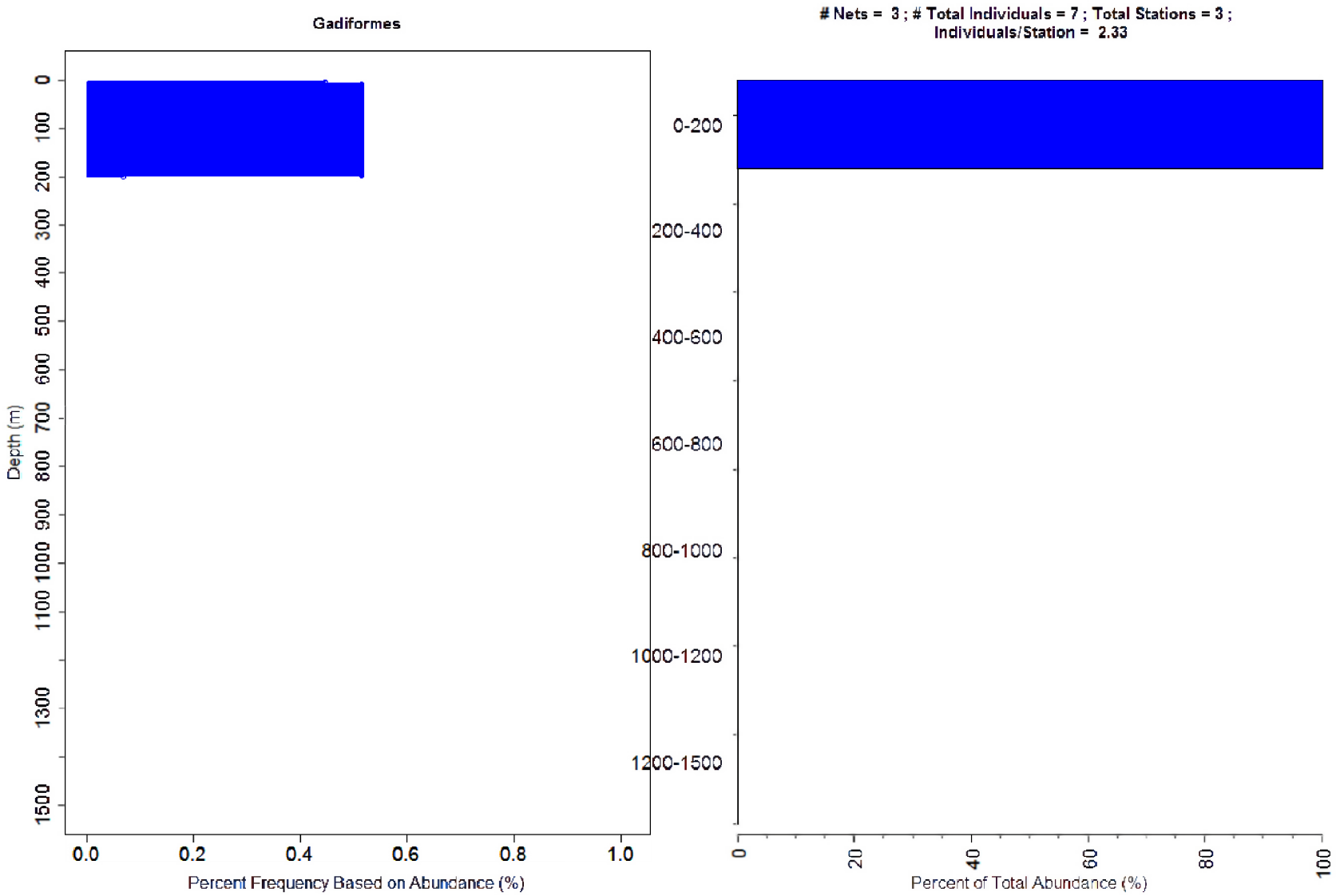
Fistulariidae



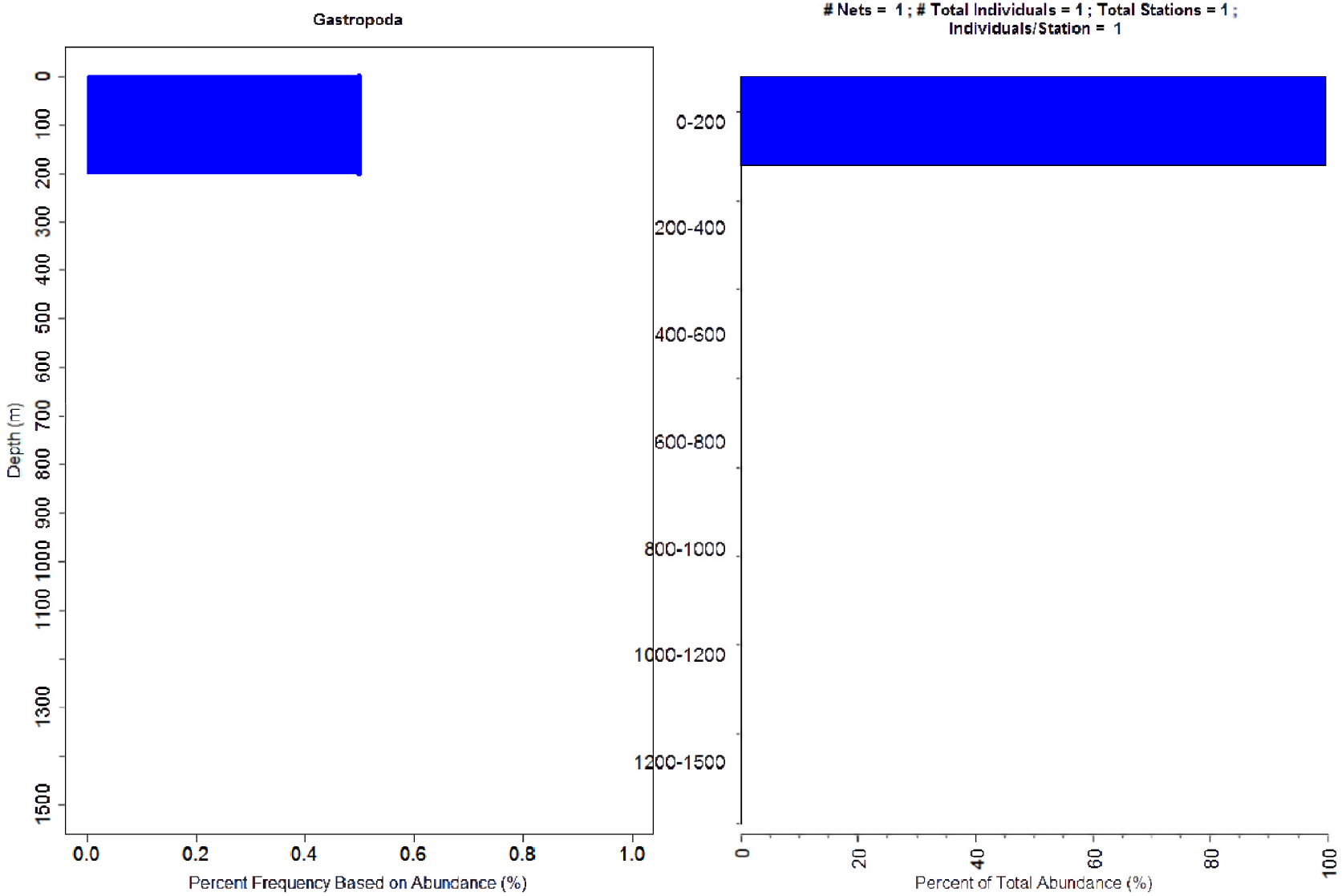
Forskaliidae


Funnel_tube
Nets = 2 ; # Total Individuals = 8 ; Total Stations = 2 ;
Individuals/Station = 4
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

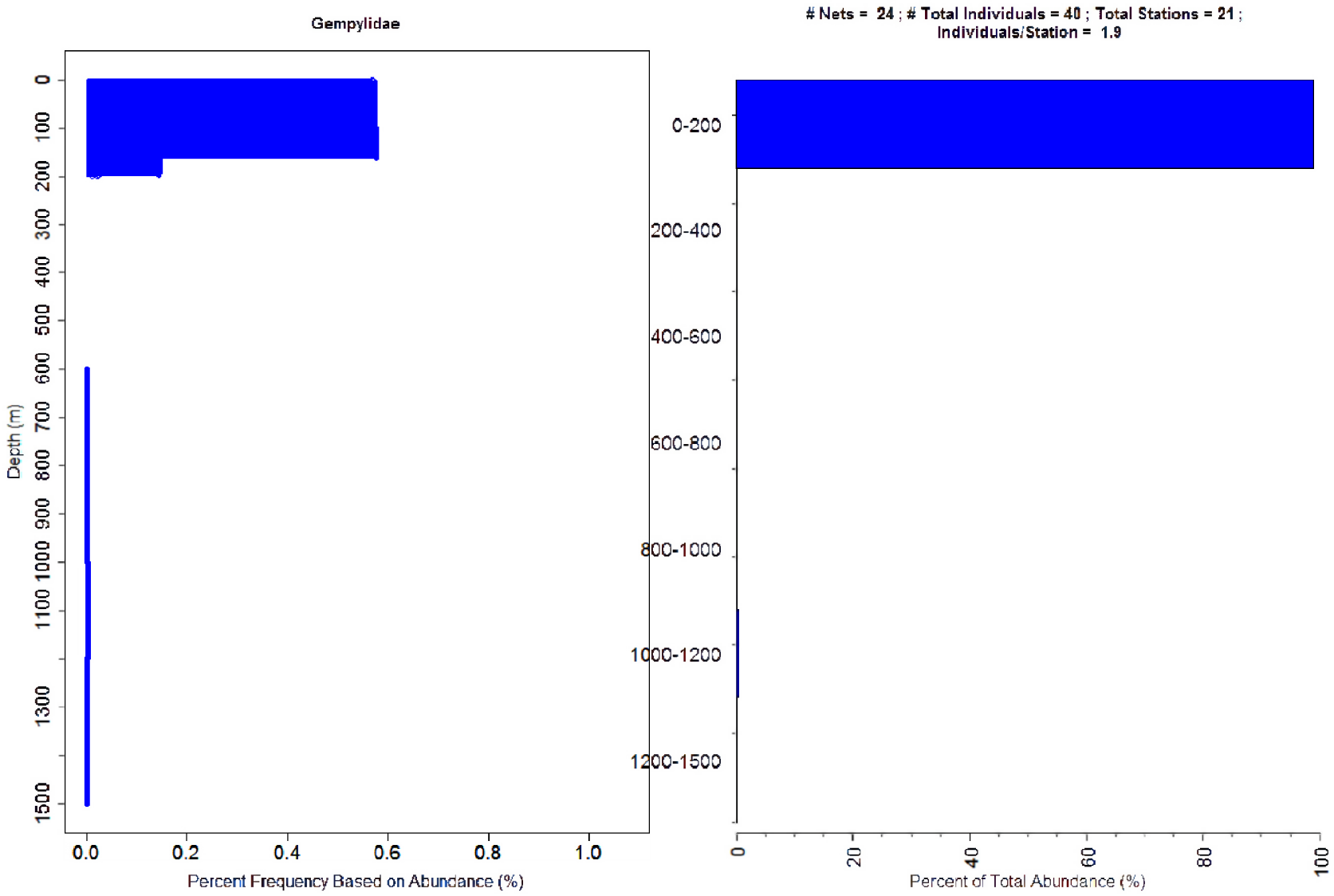
Funnel_tube


Gadiformes
Nets = 3 ; # Total Individuals = 7 ; Total Stations = 3 ;
Individuals/Station = 2.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

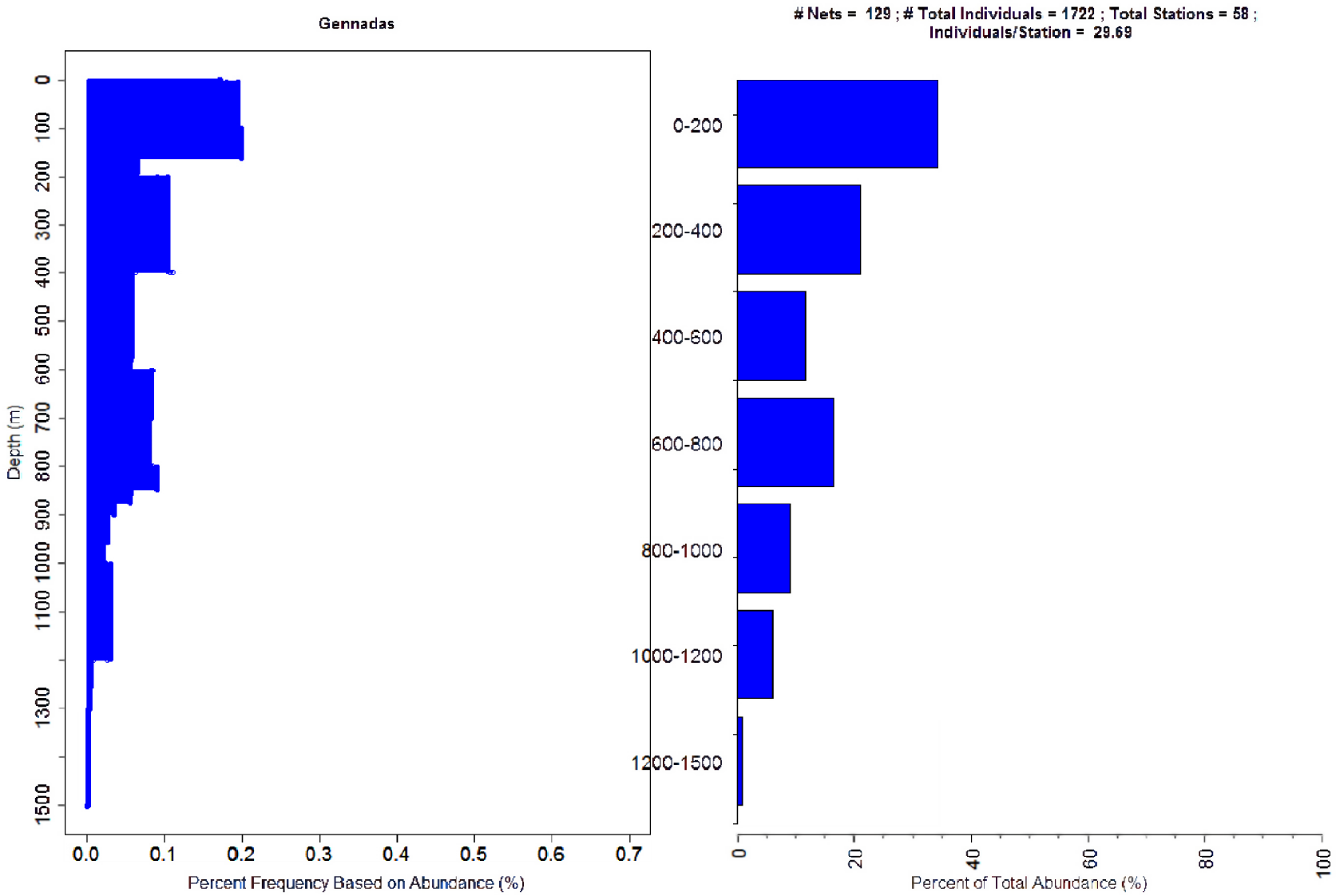
Gadiformes


Gastropoda
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

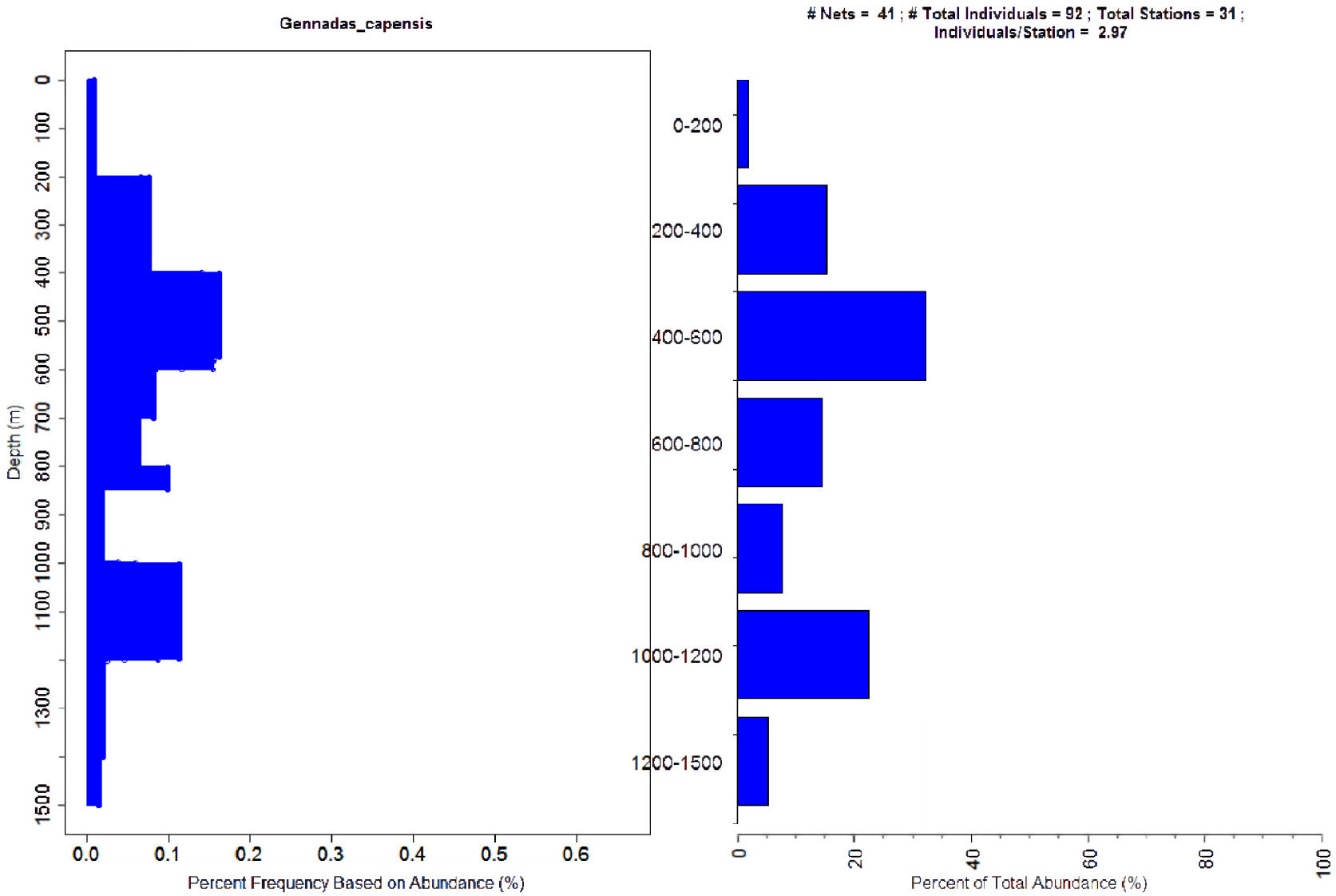
Gastropoda


Gempylidae
Nets = 24 ; # Total Individuals = 40 ; Total Stations = 21 ;
Individuals/Station = 1.9
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

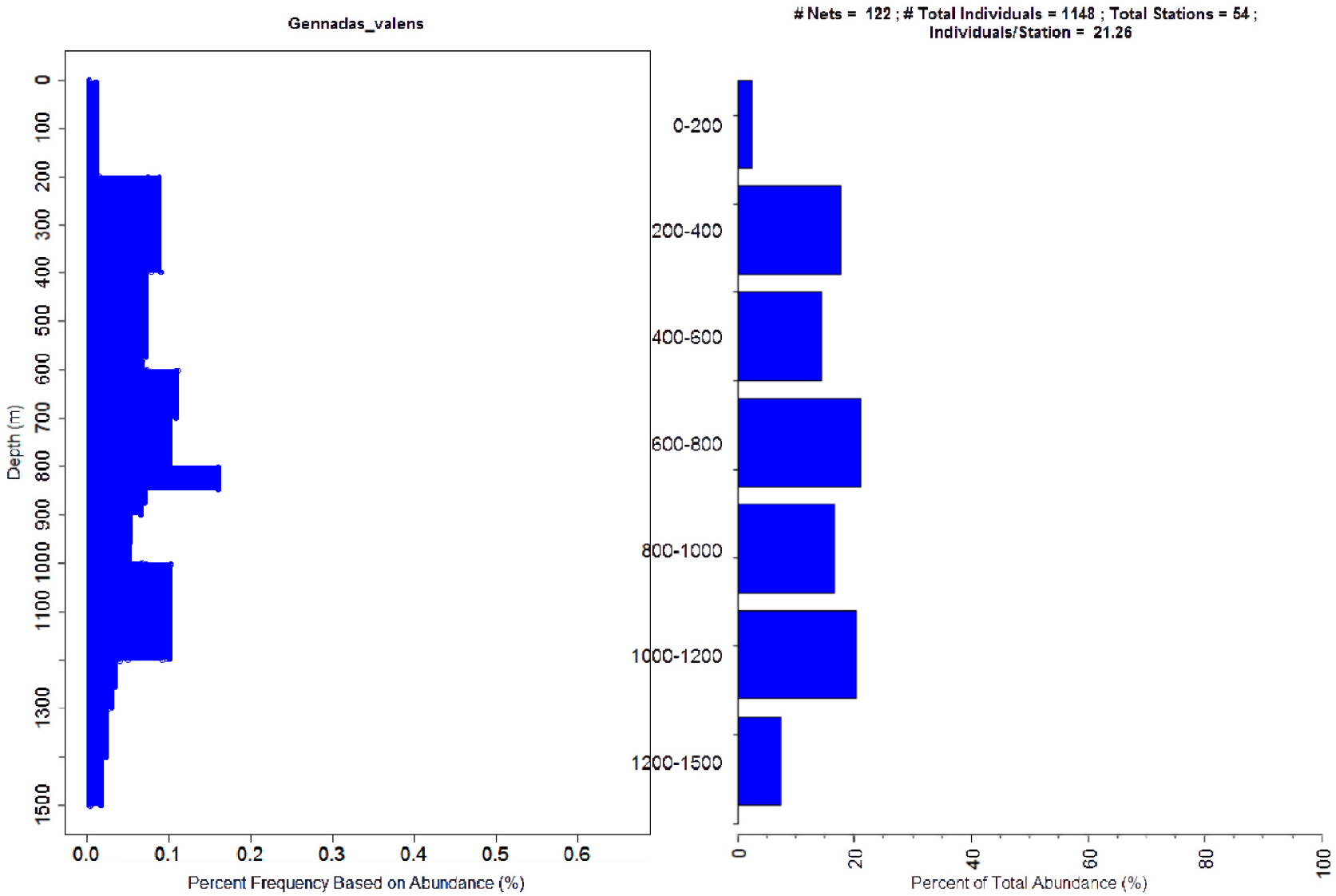
Gempylidae


Gennadas
Nets = 129 ; # Total Individuals = 1722 ; Total Stations = 58 ;
Individuals/Station = 29.69
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

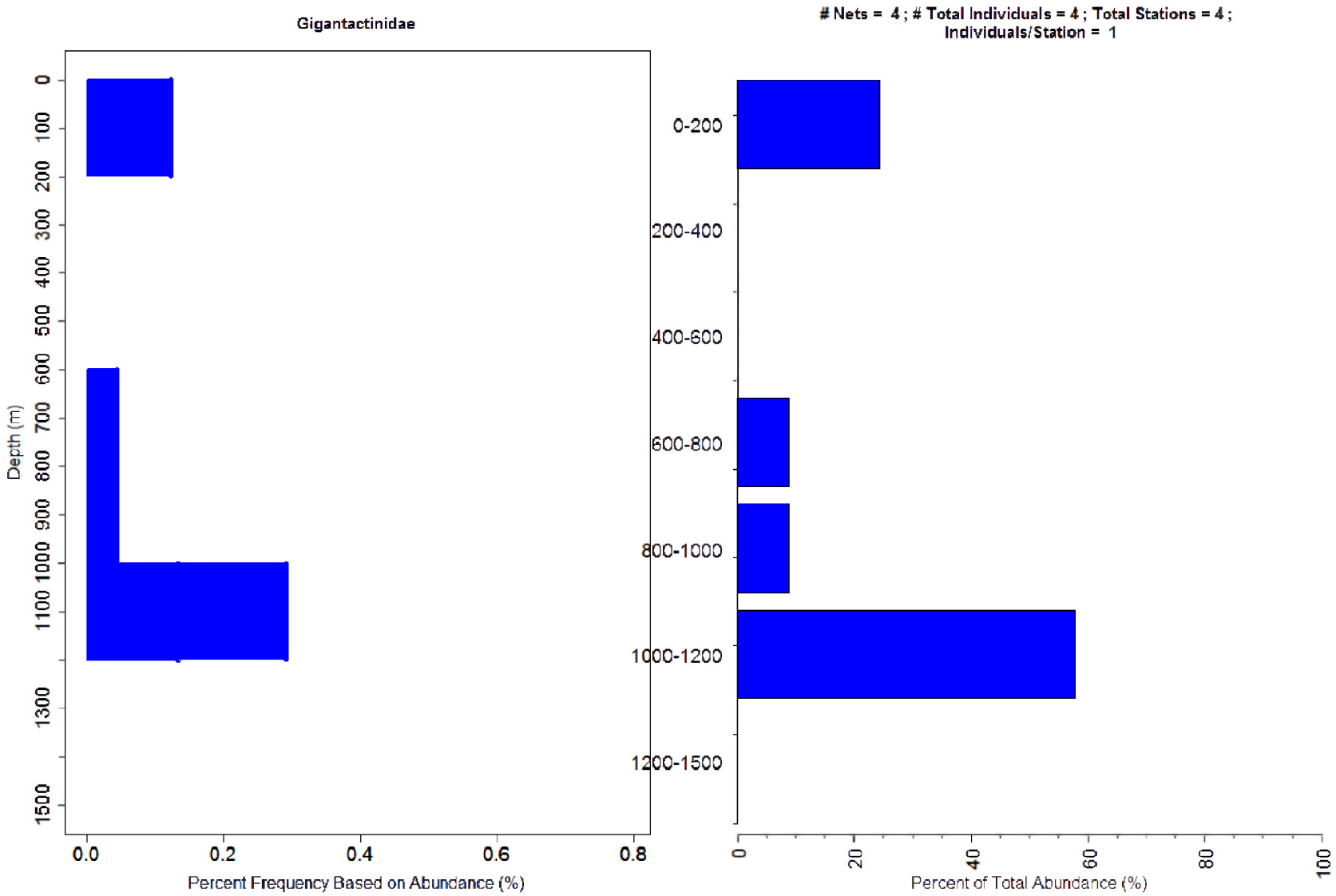
Gennadas



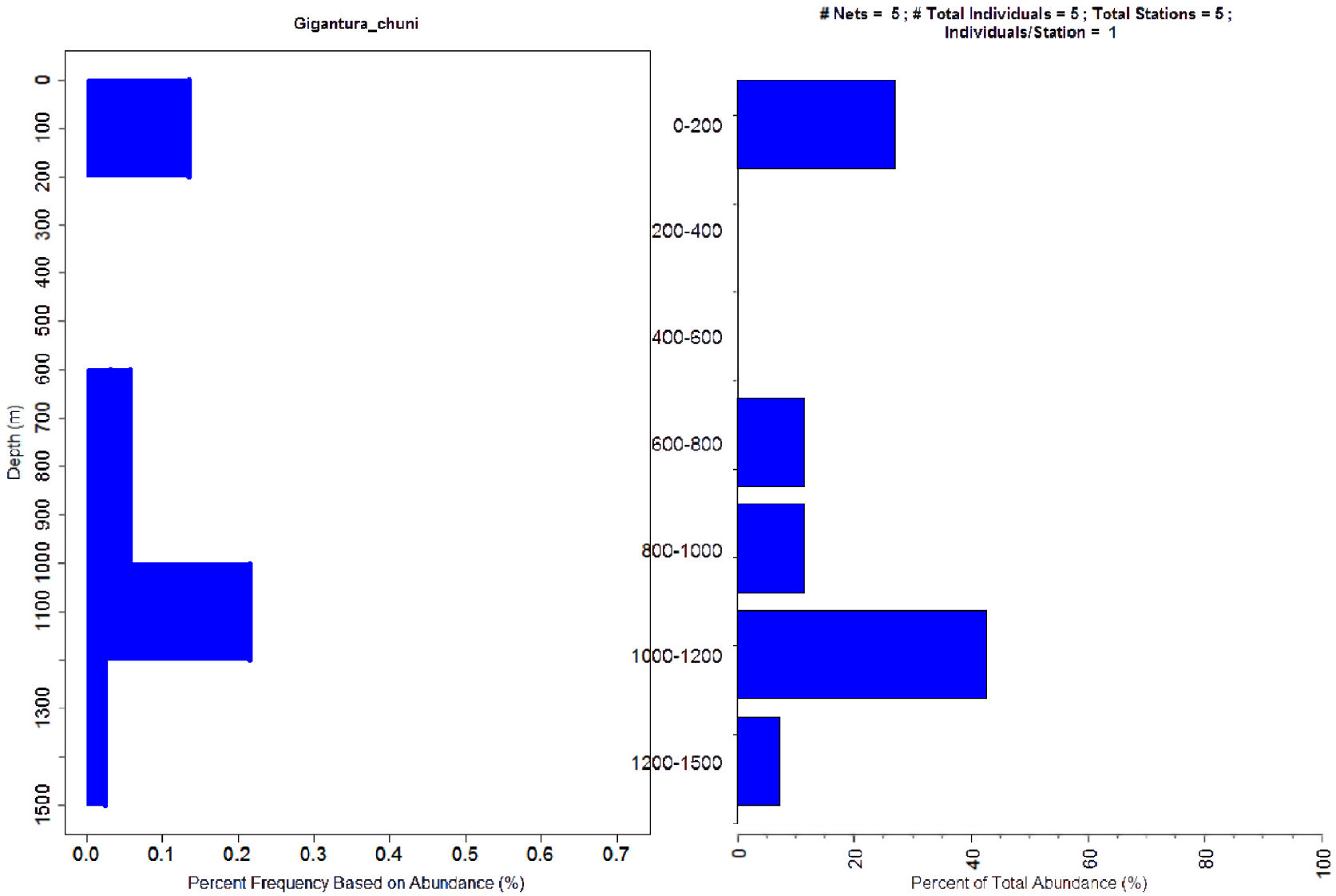
Gennadas_capensis



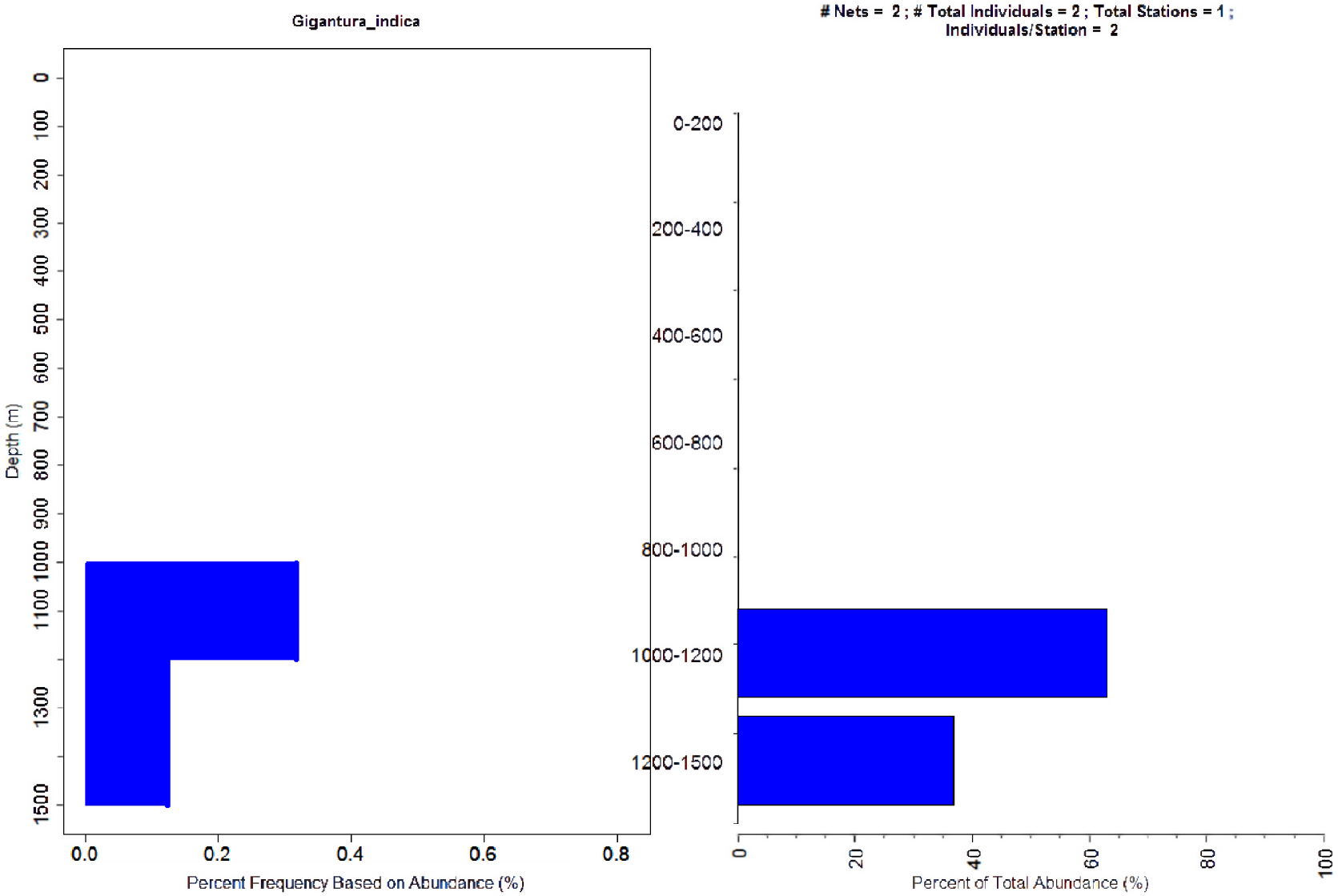
Gennadas_valens



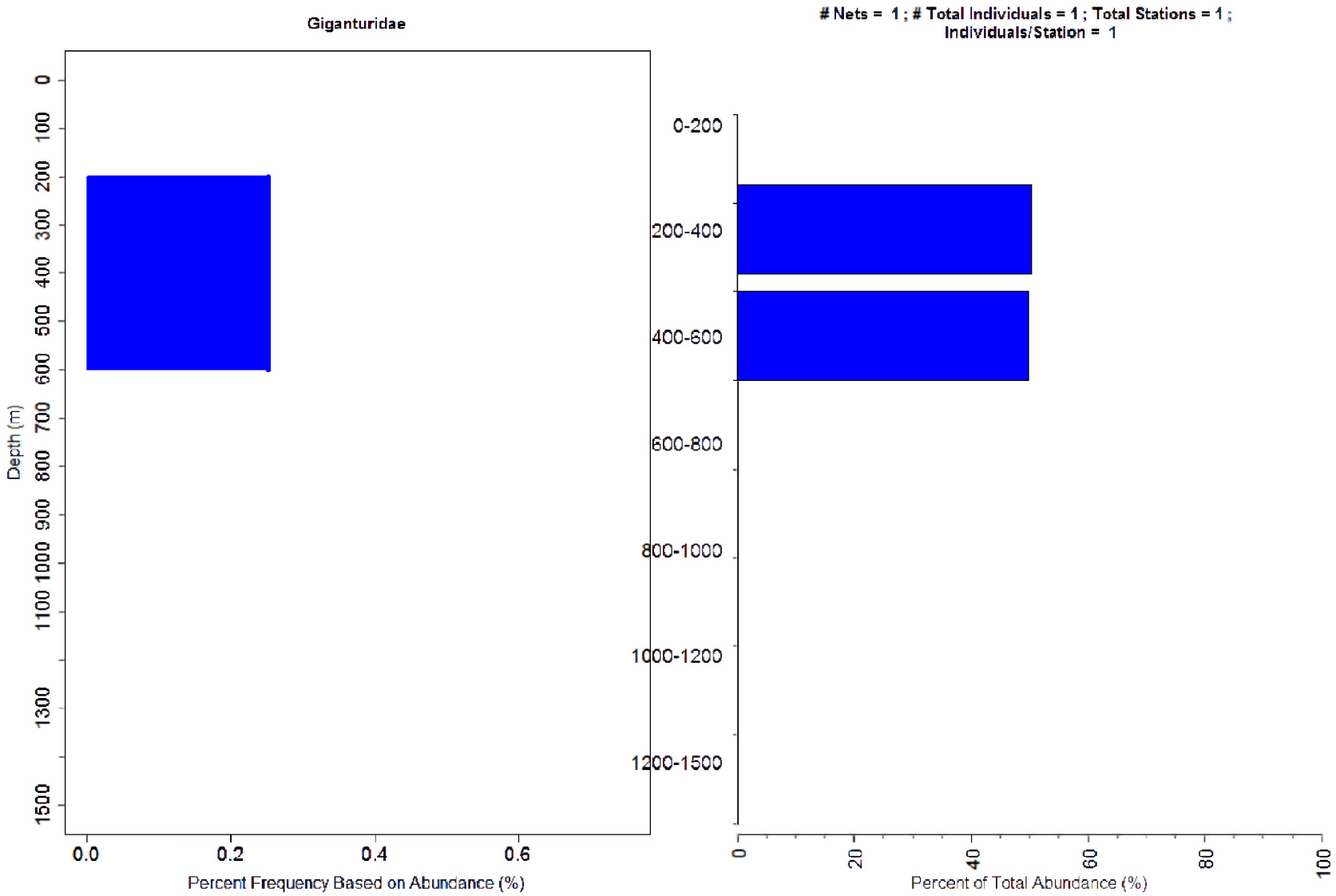
Gigantactinidae



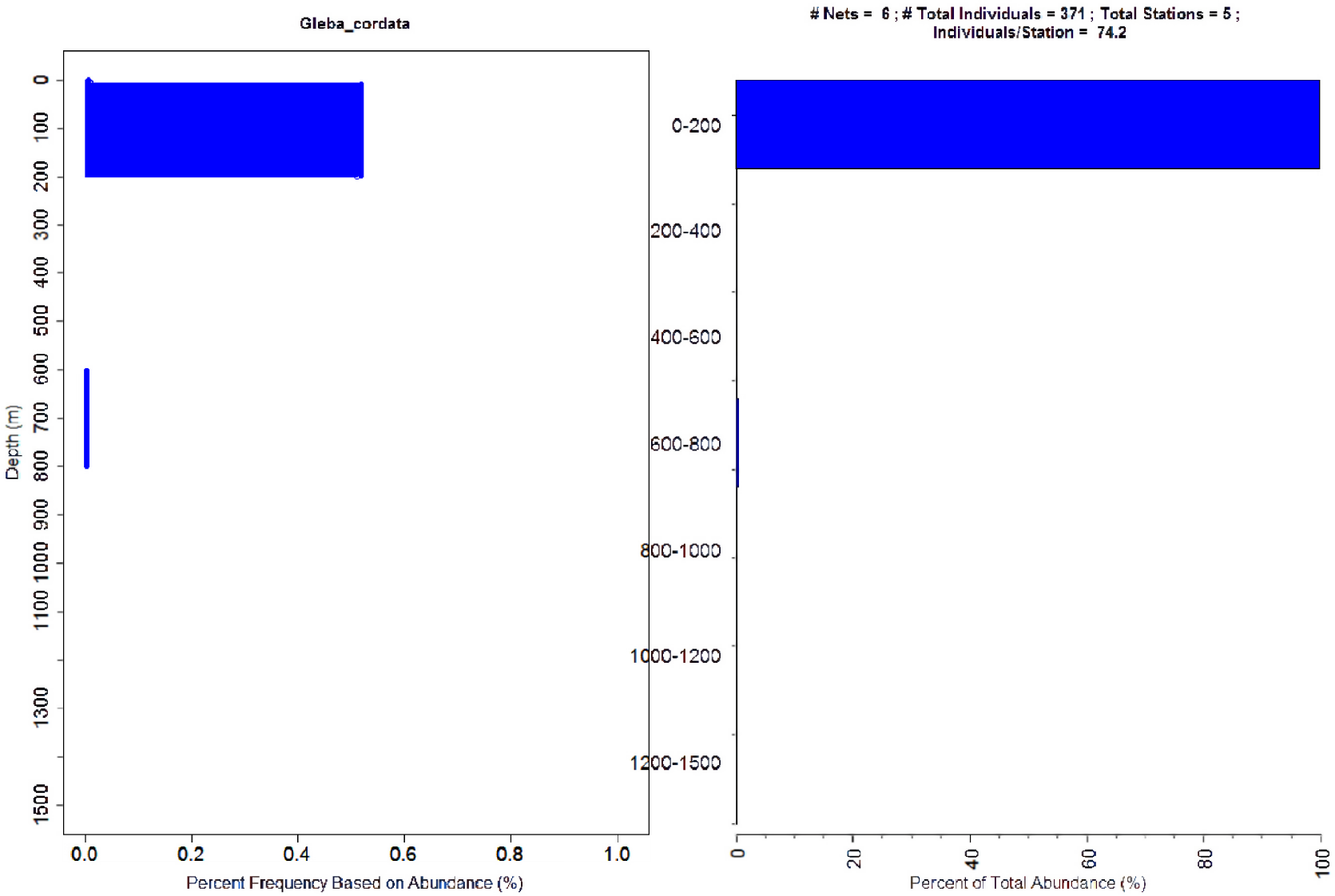
Gigantura_chuni



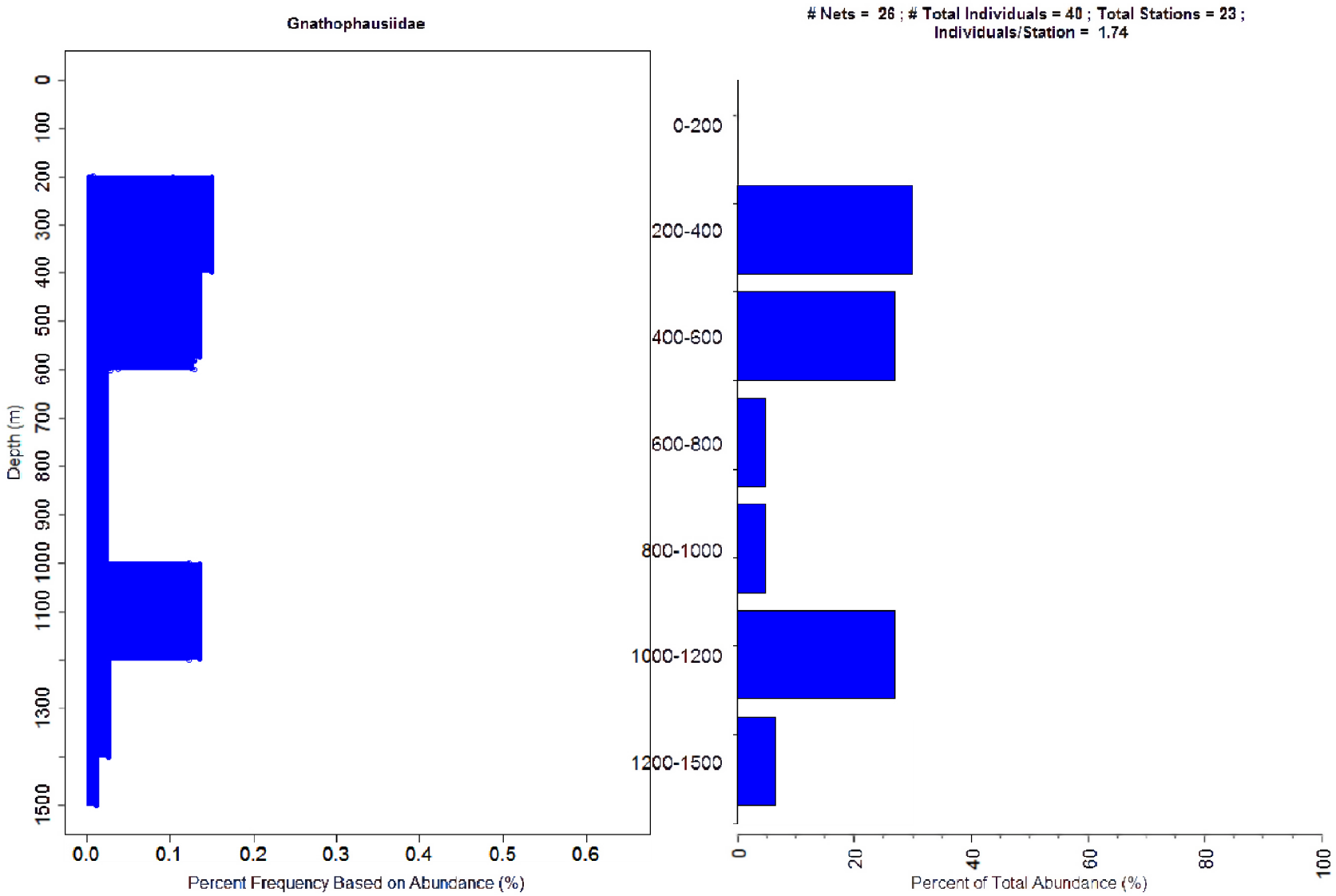
Gigantura_indica



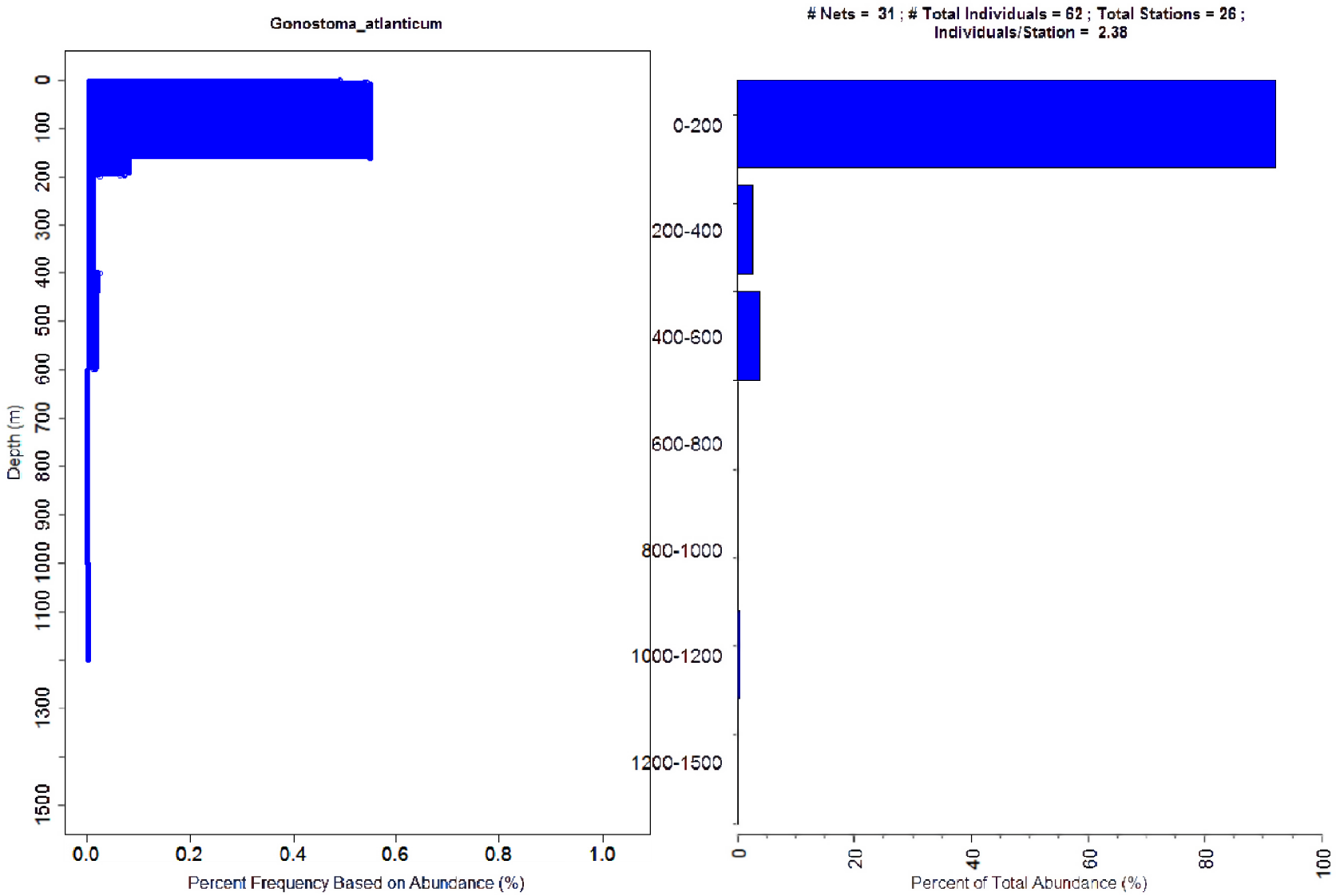
Giganturidae



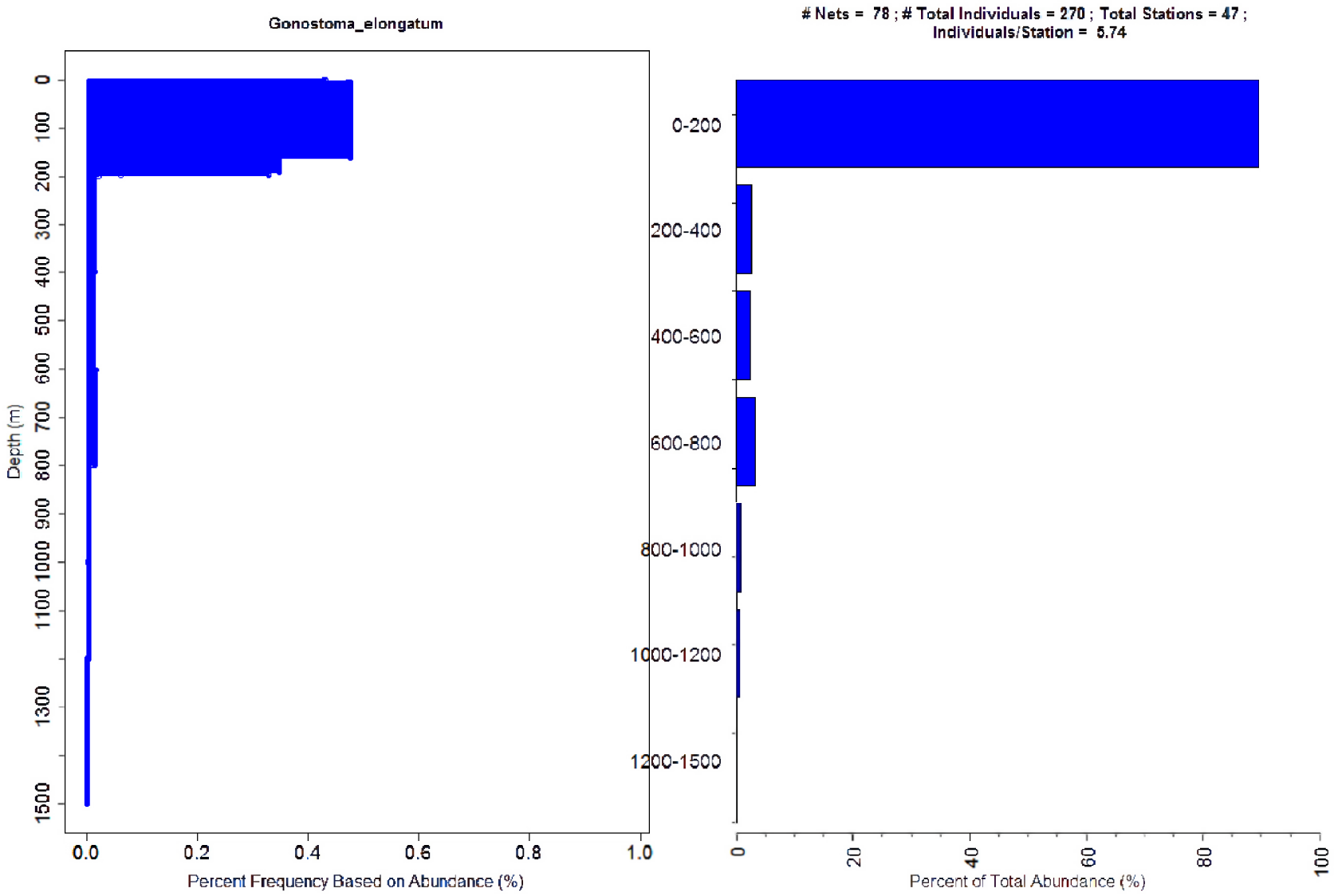
Gleba_cordata



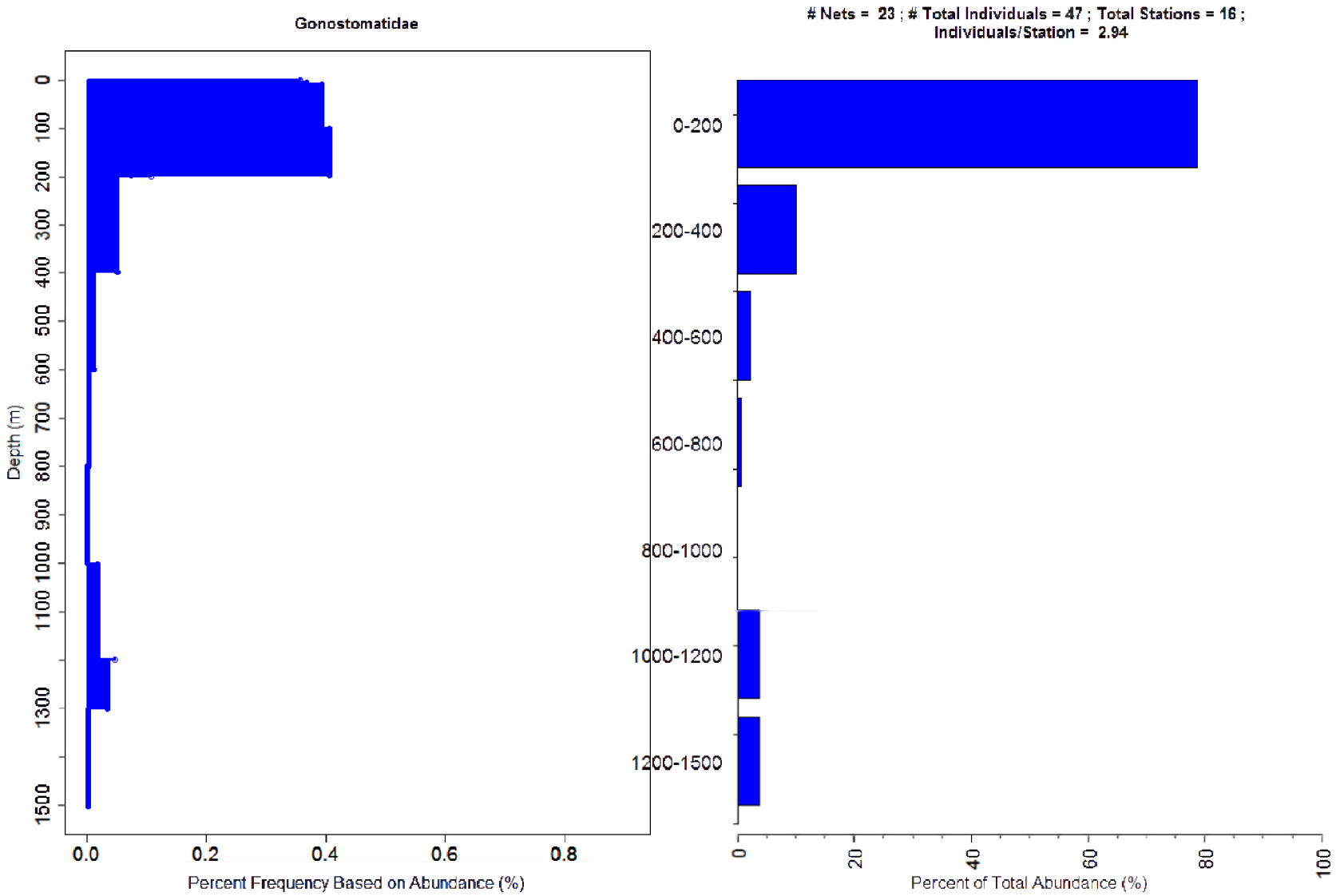
Gnathophausiidae



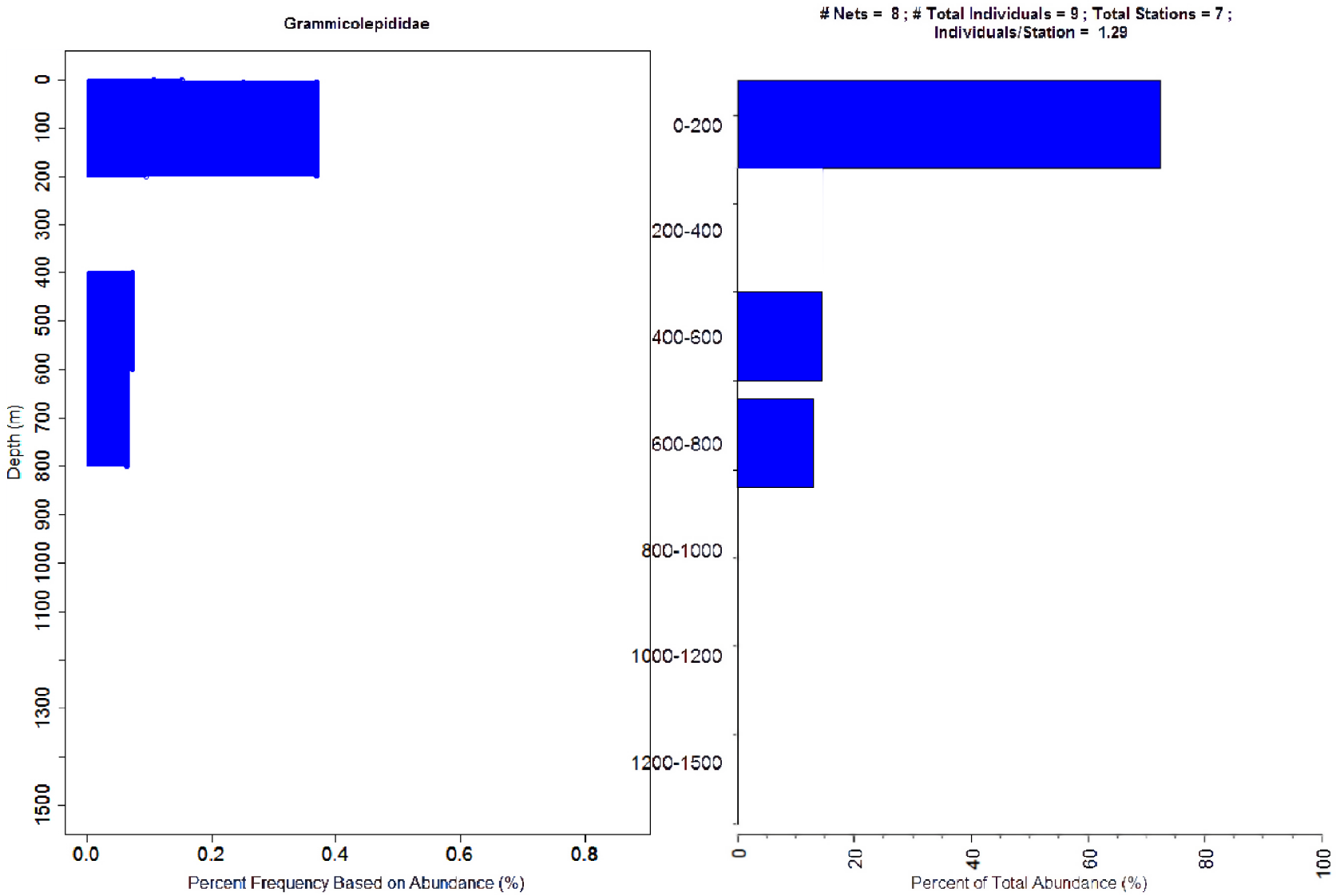
Gonostoma_atlanticum



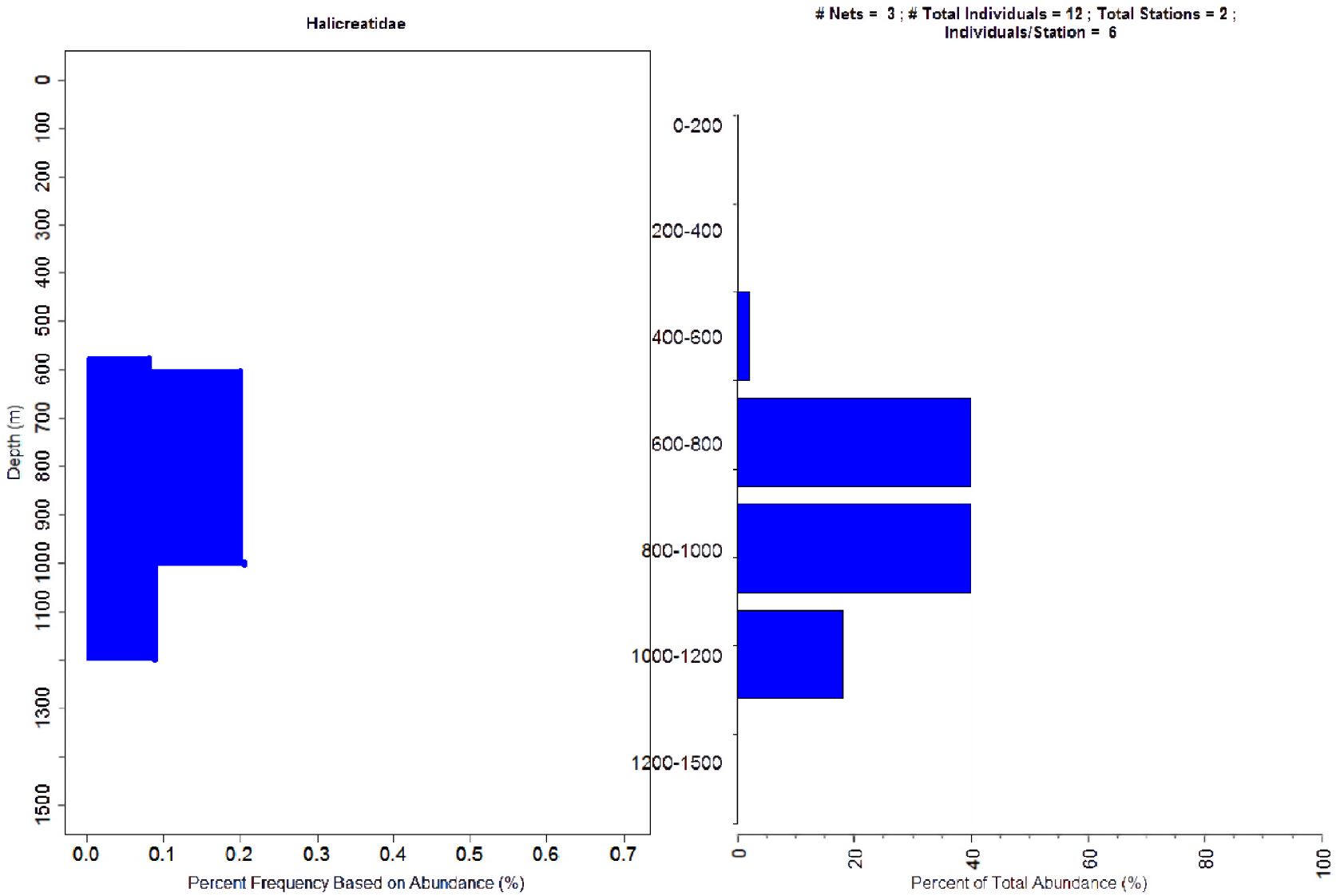
Gonostoma_elongatum



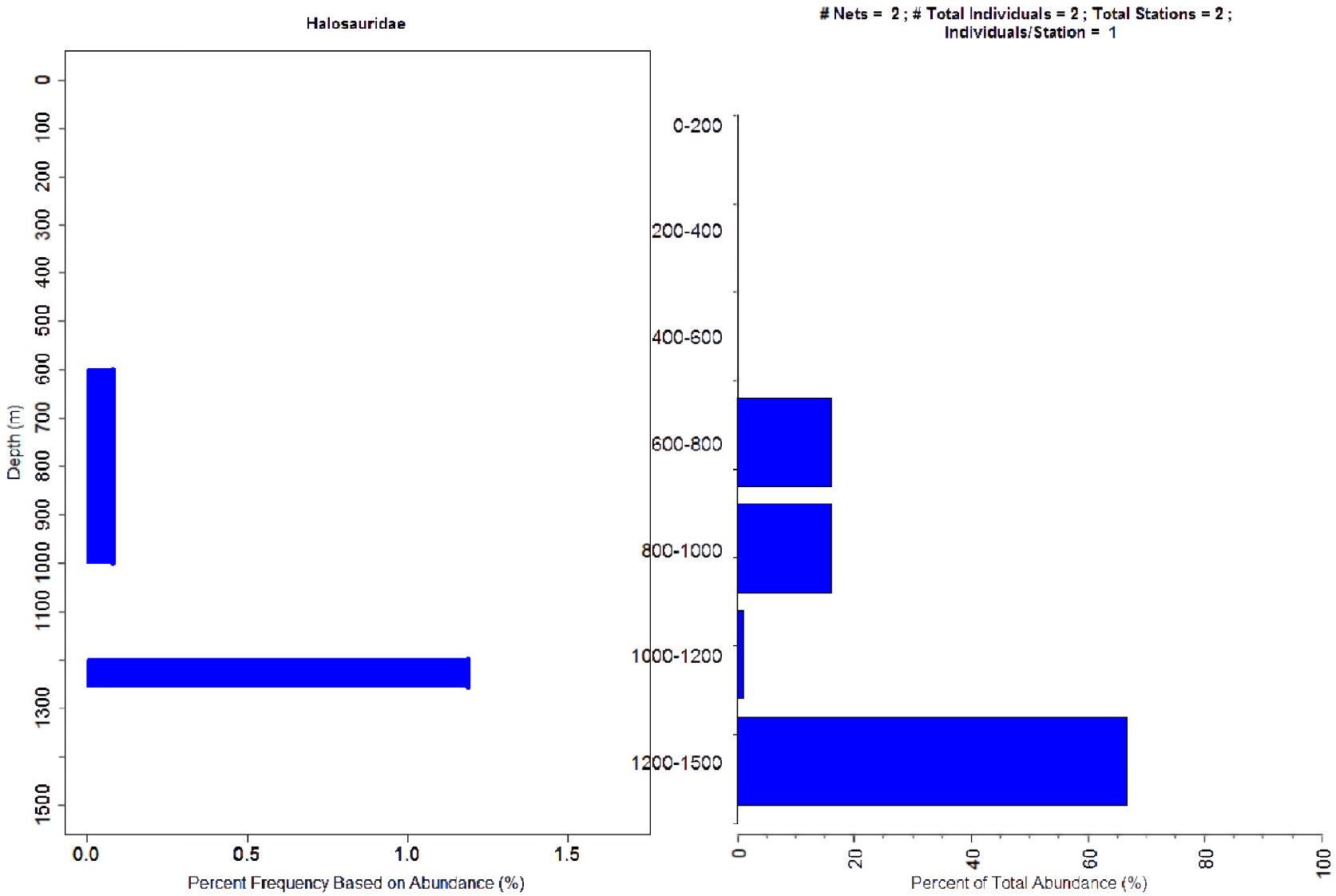
Gonostomatidae



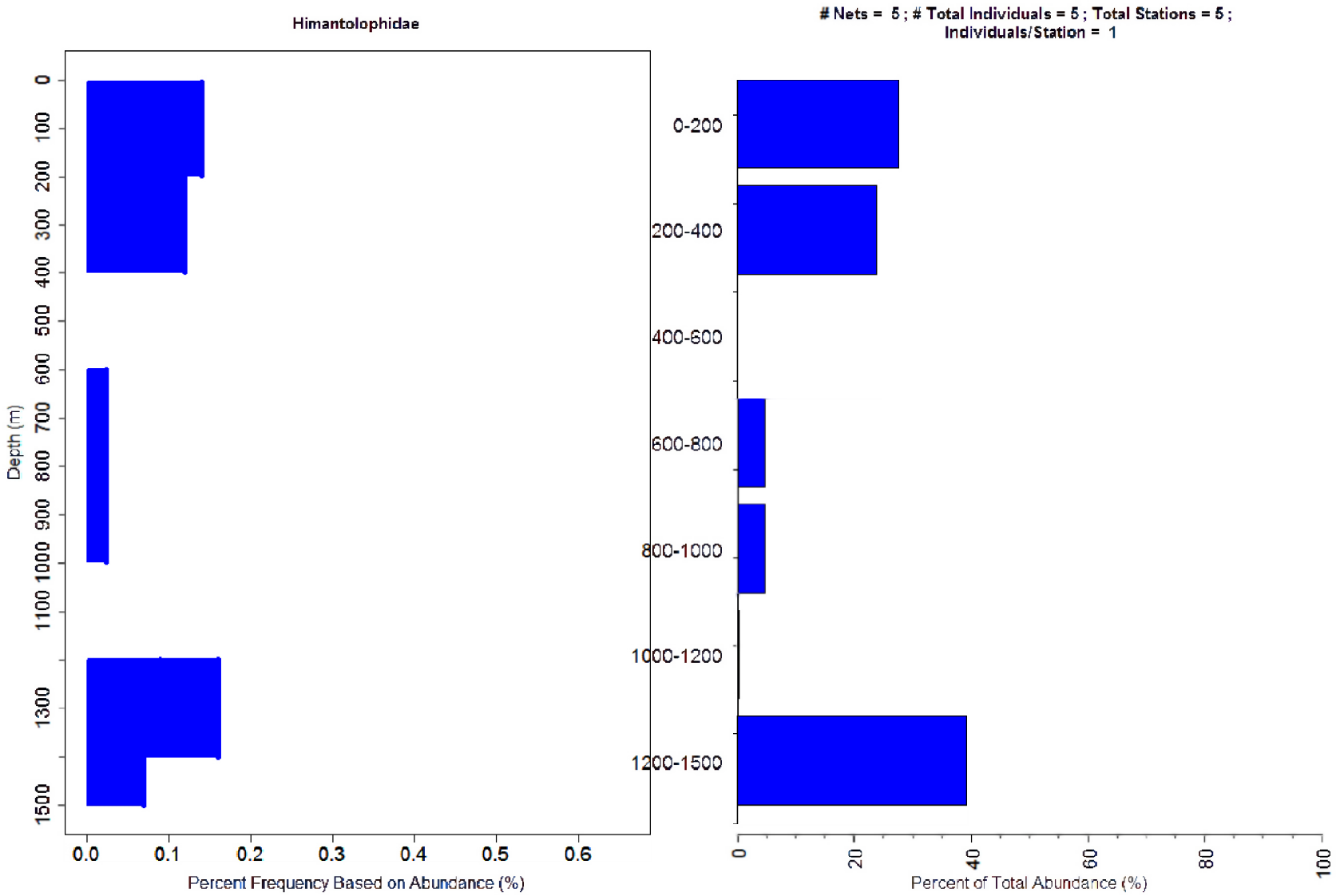
Grammicolepididae



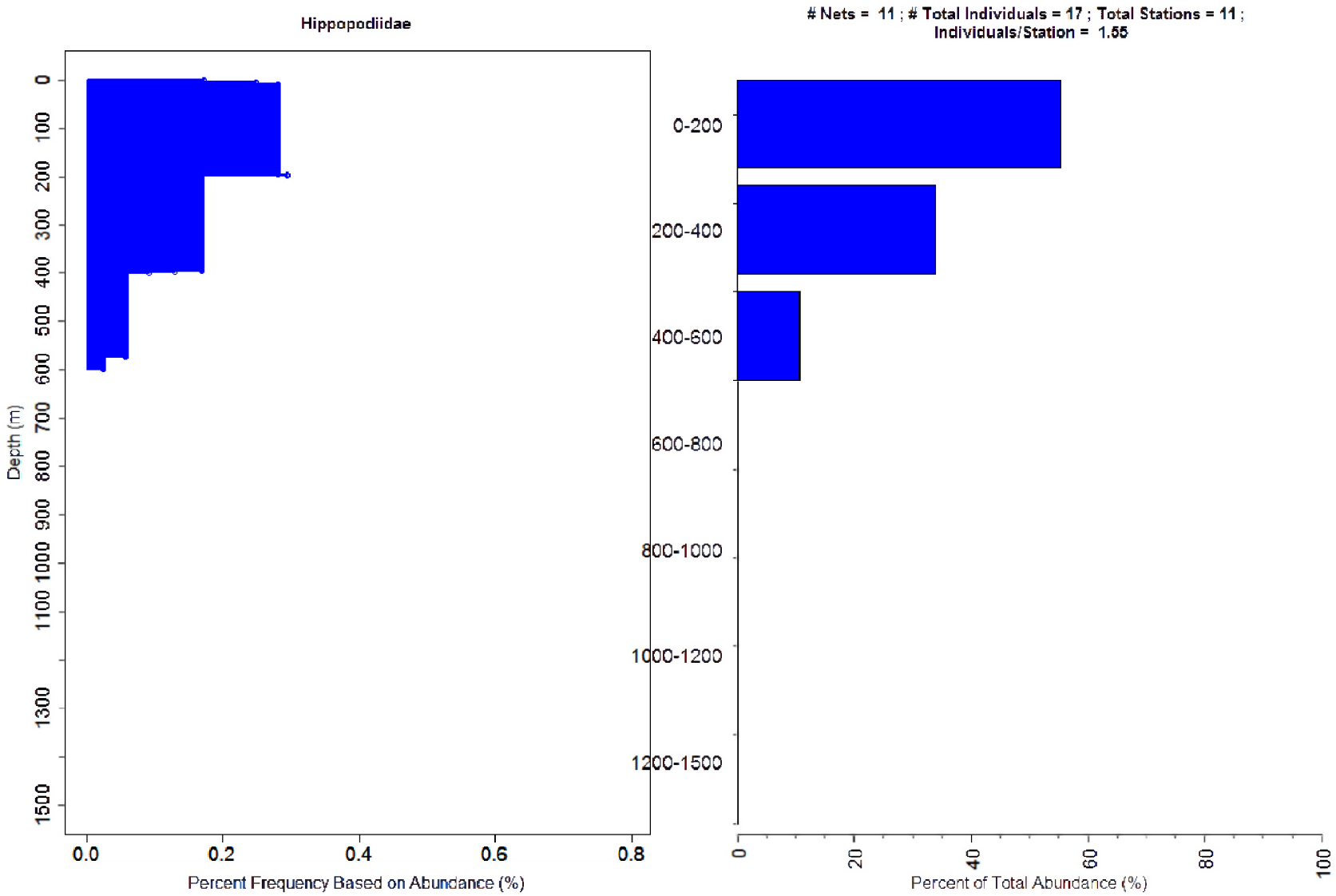
Halicreatidae



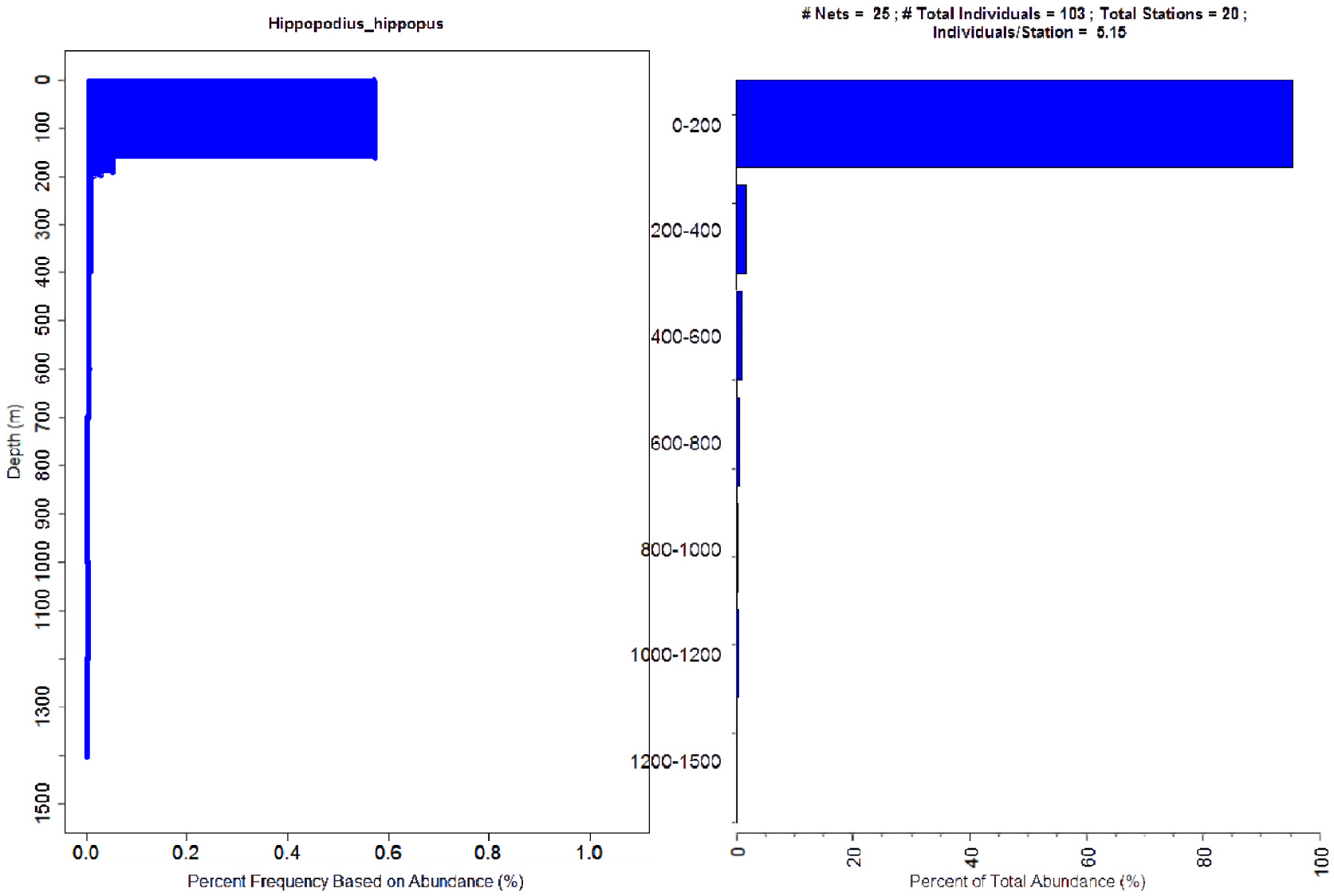
Halosauridae



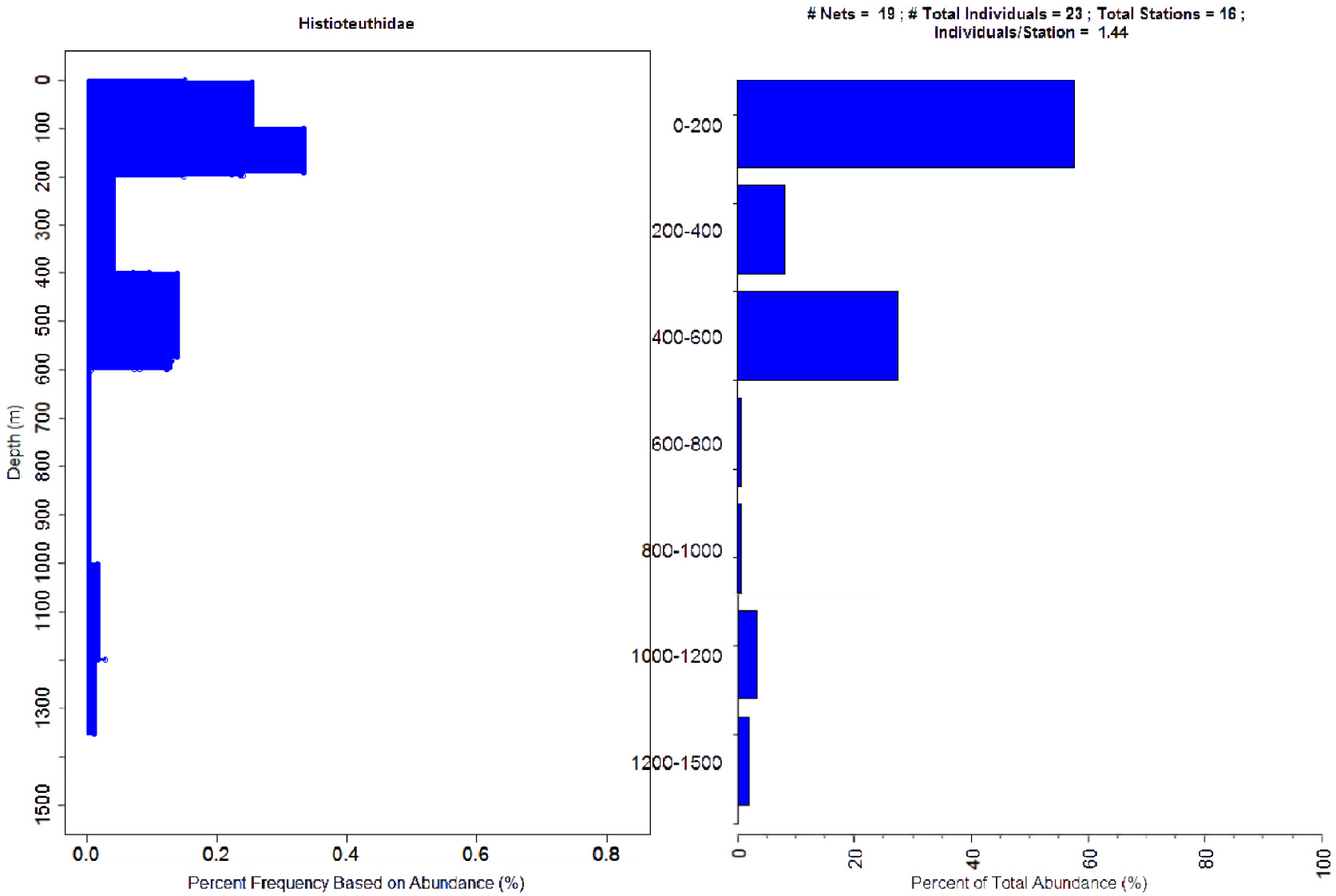
Himantolophidae



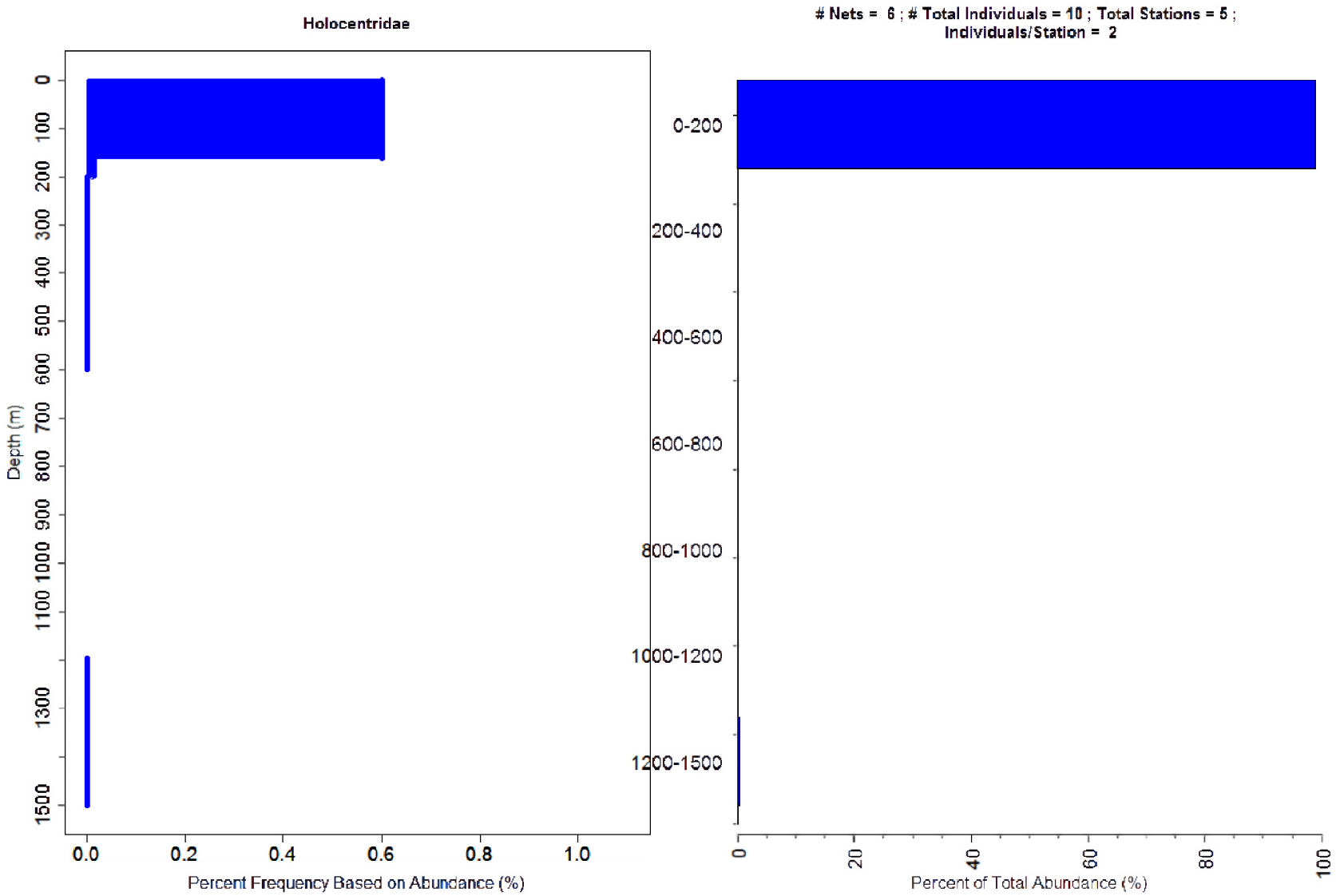
Hippopodiidae



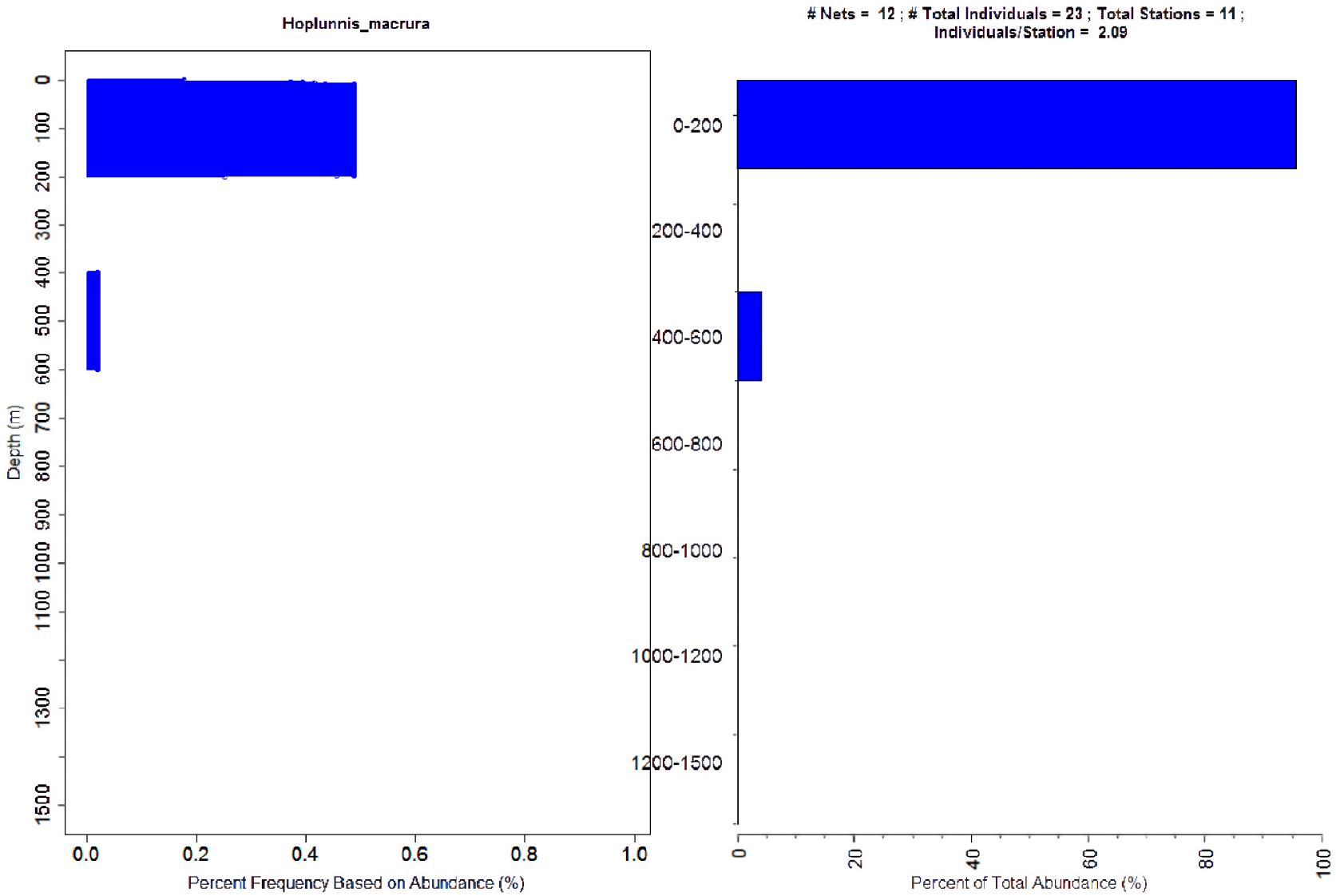
Hippopodius_hippopus



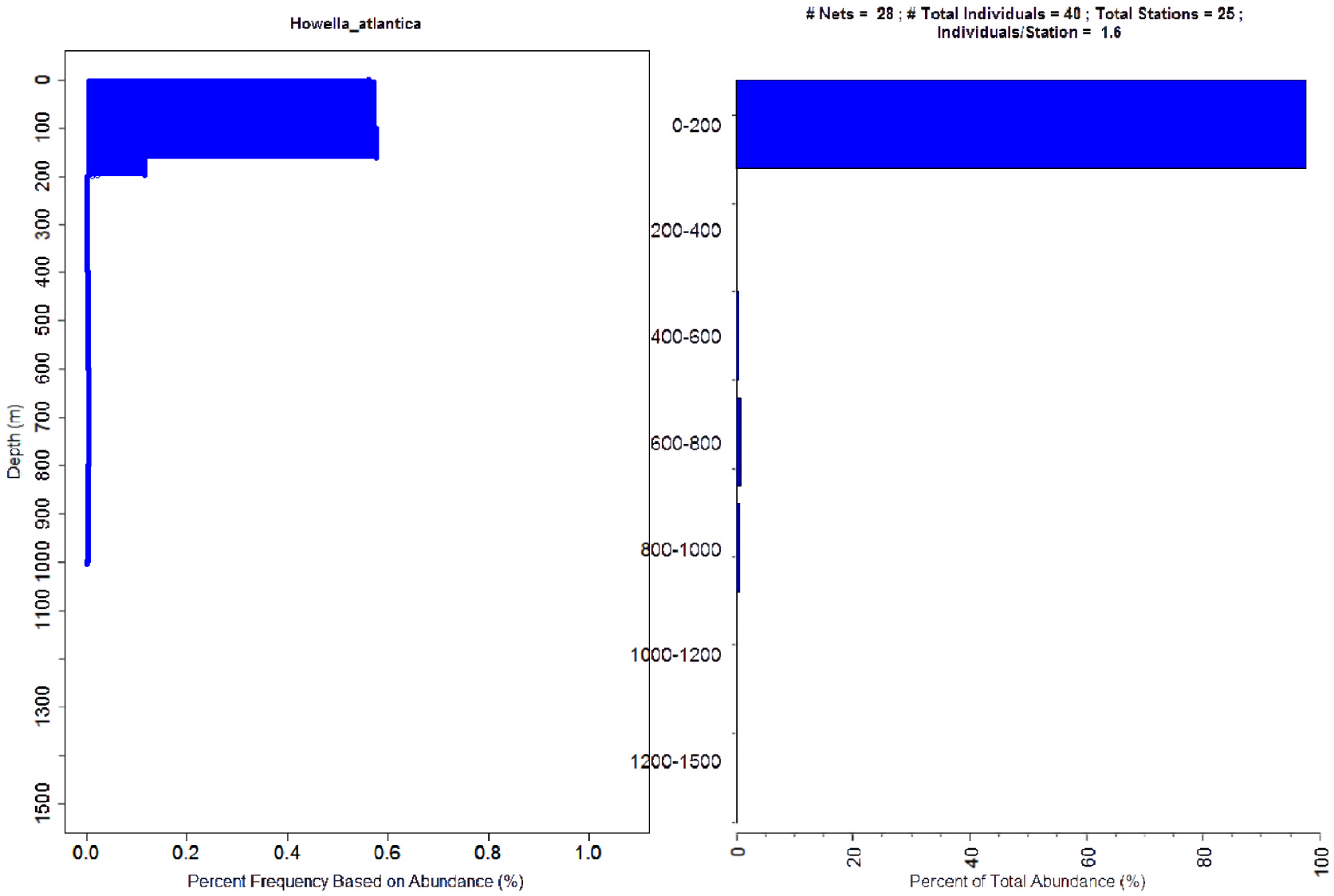
Histioteuthidae



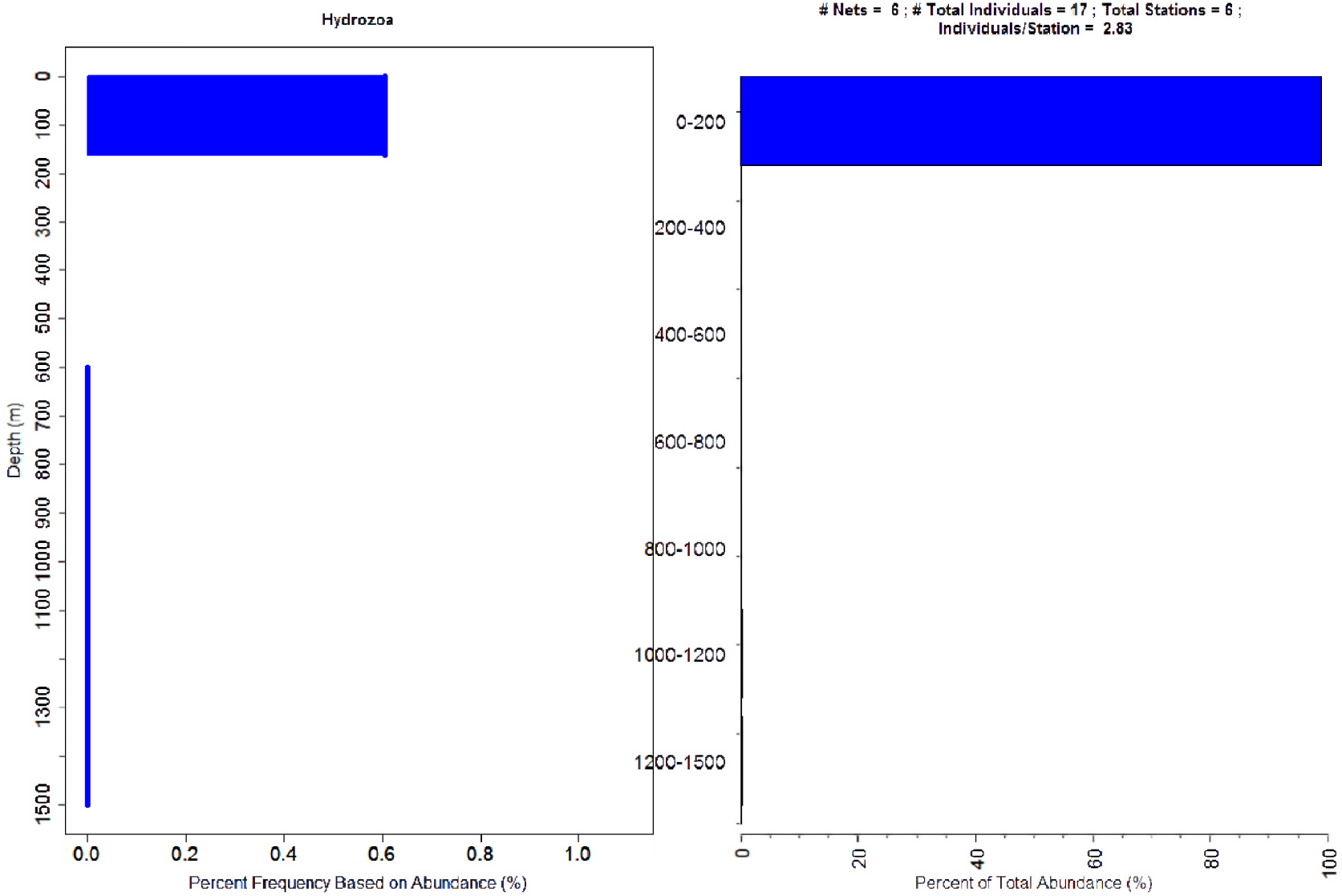
Holocentridae



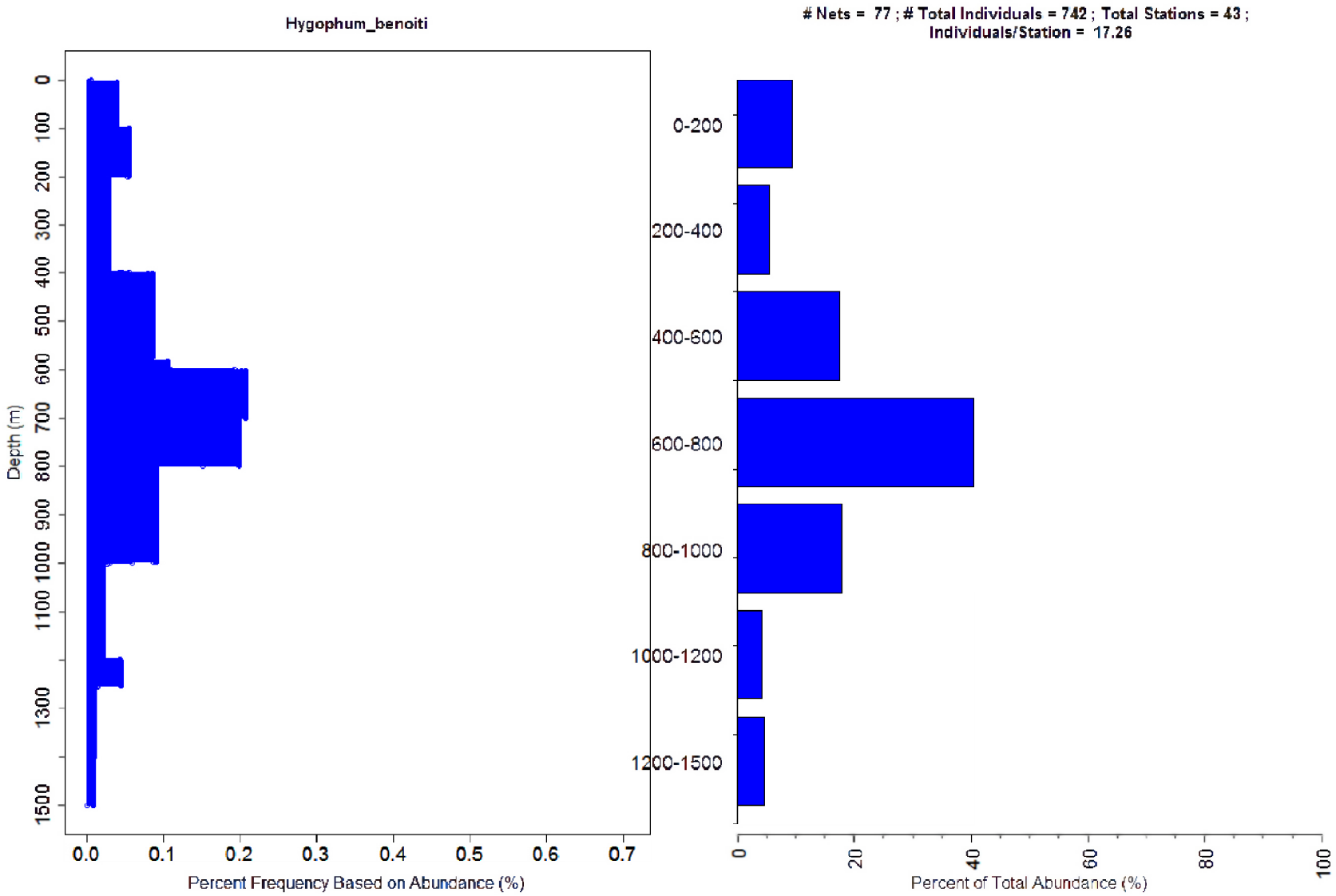
Hoplunnis_macrura



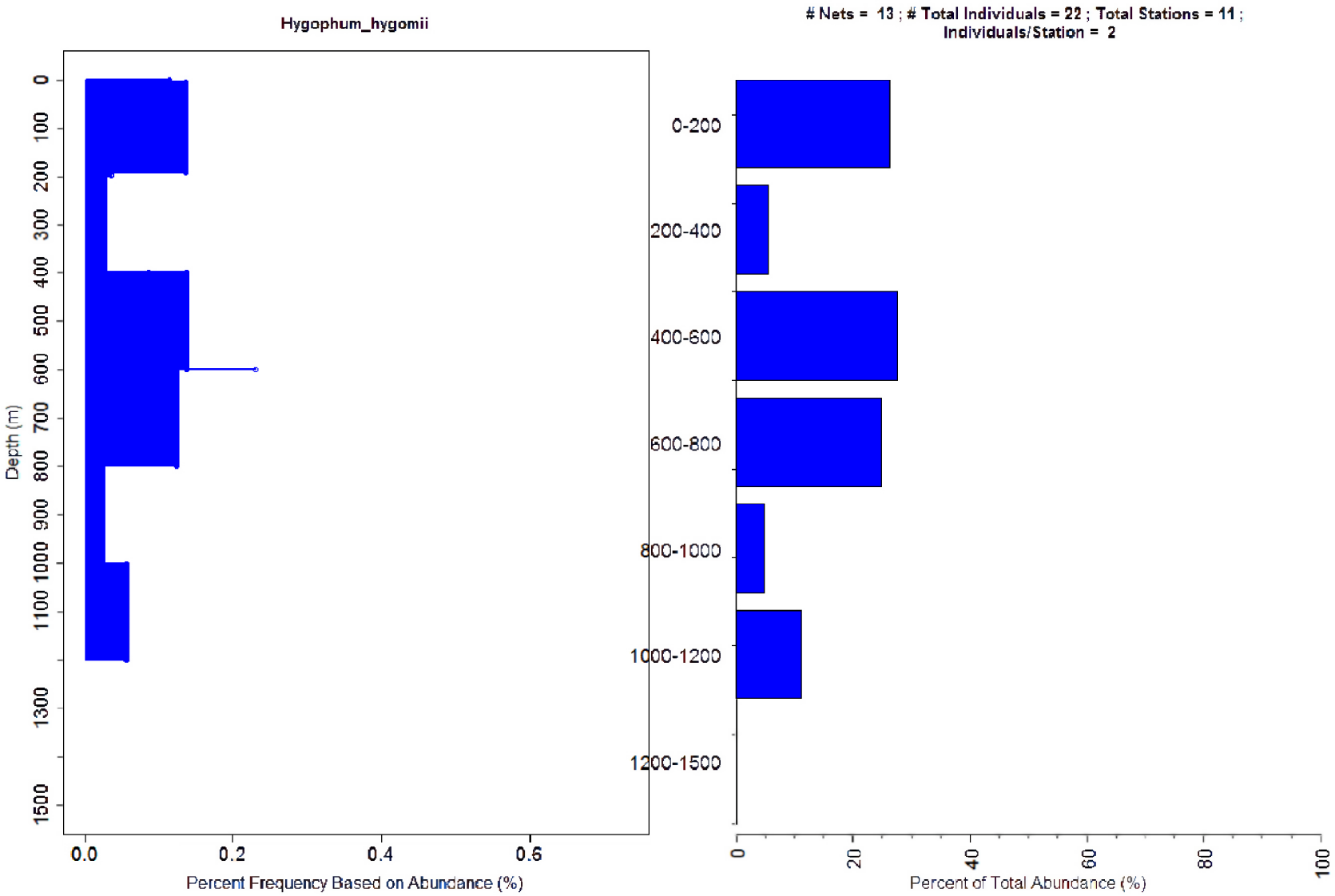
Howella_atlantica


Hydrozoa
Nets = 6 ; # Total Individuals = 17 ; Total Stations = 6 ;
Individuals/Station = 2.83
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

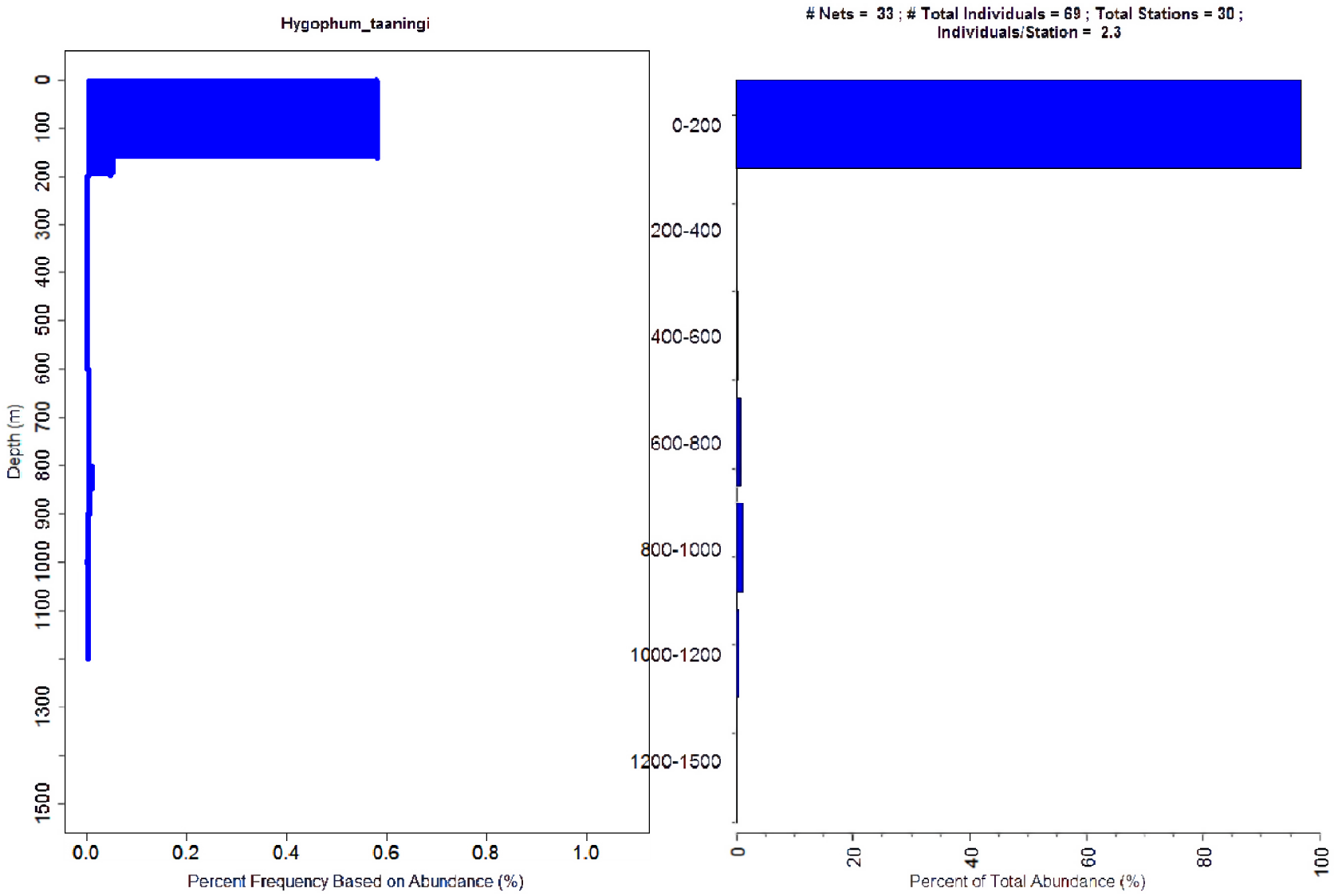
Hydrozoa



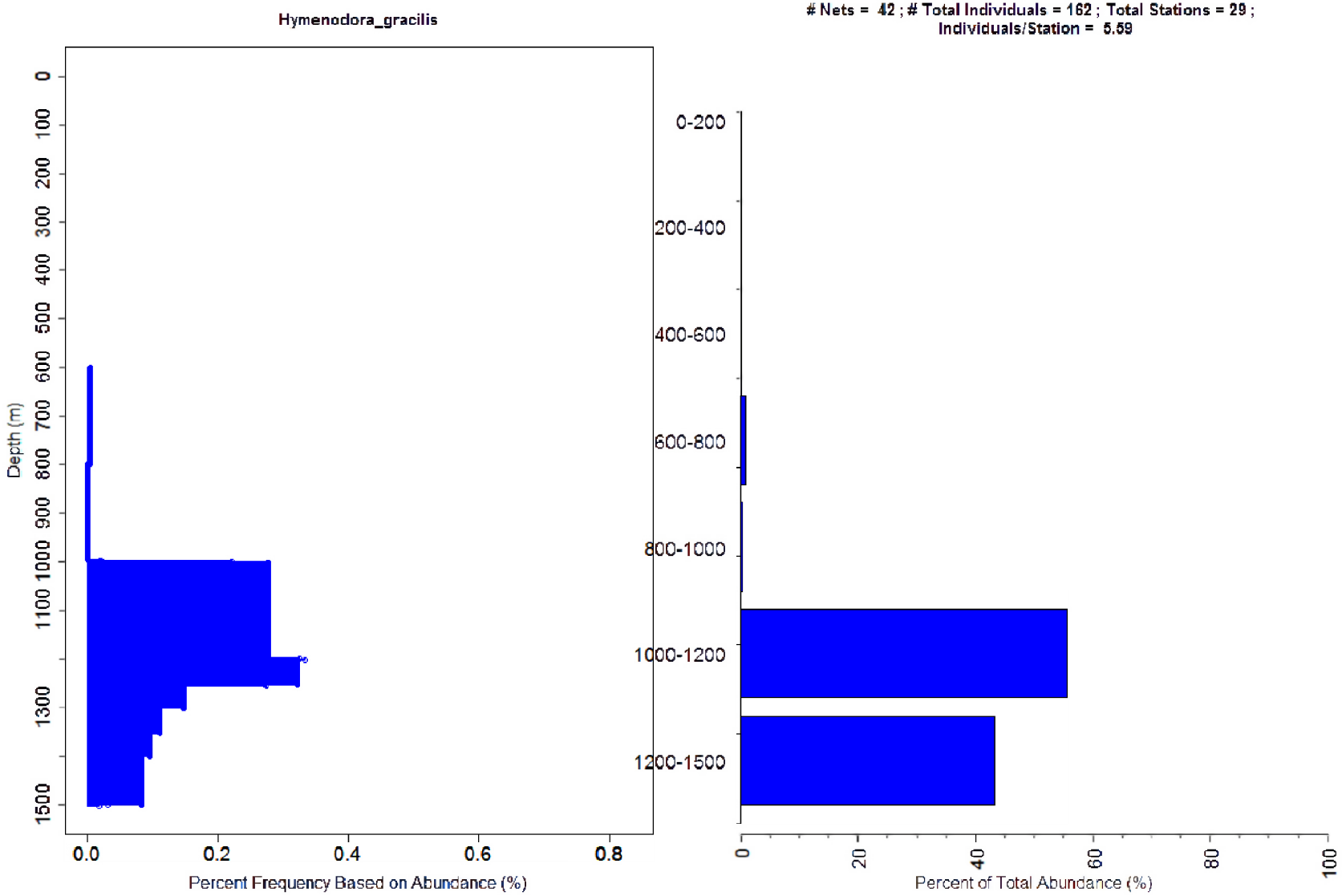
Hygophum_benoiti



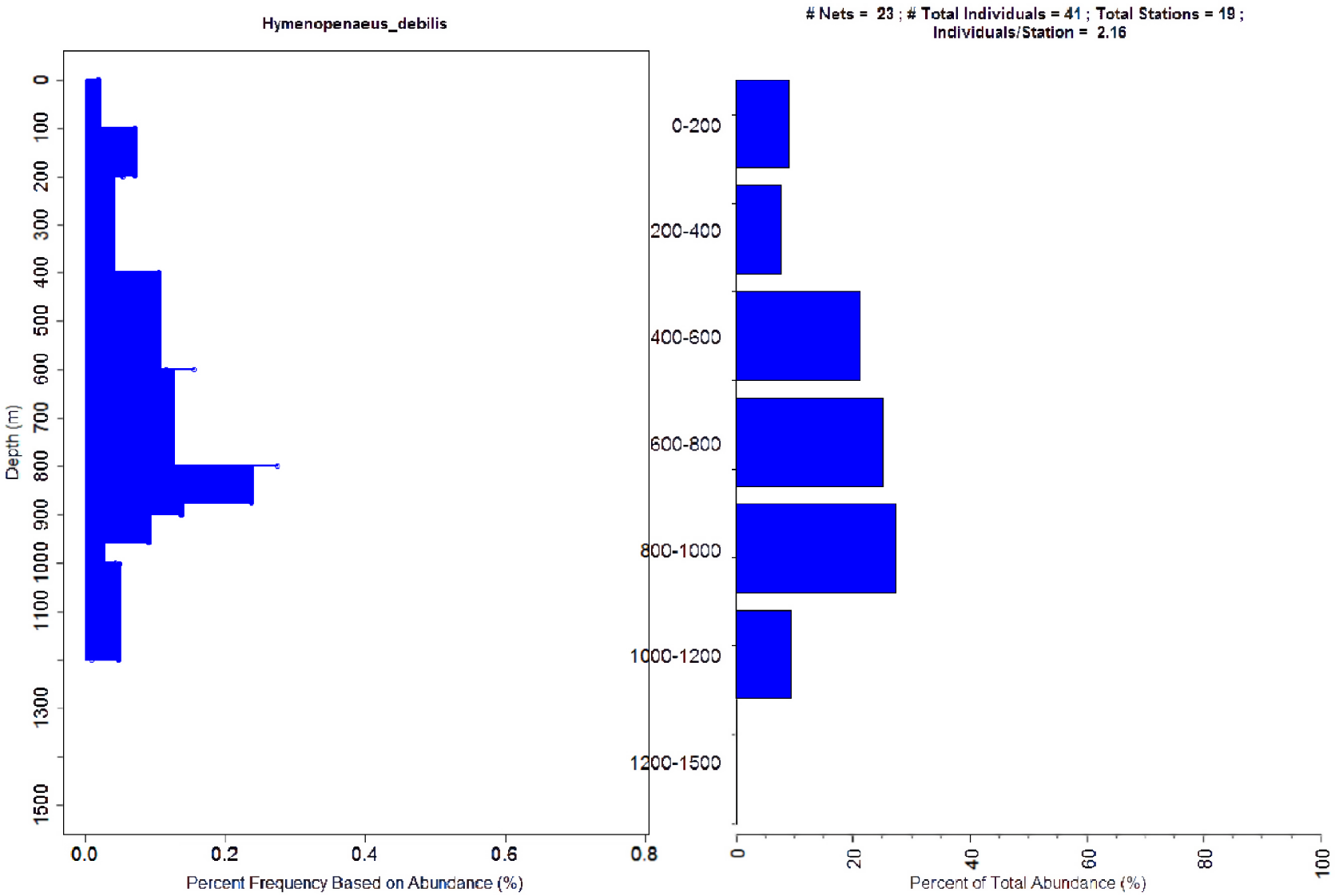
Hygophum_hygomii



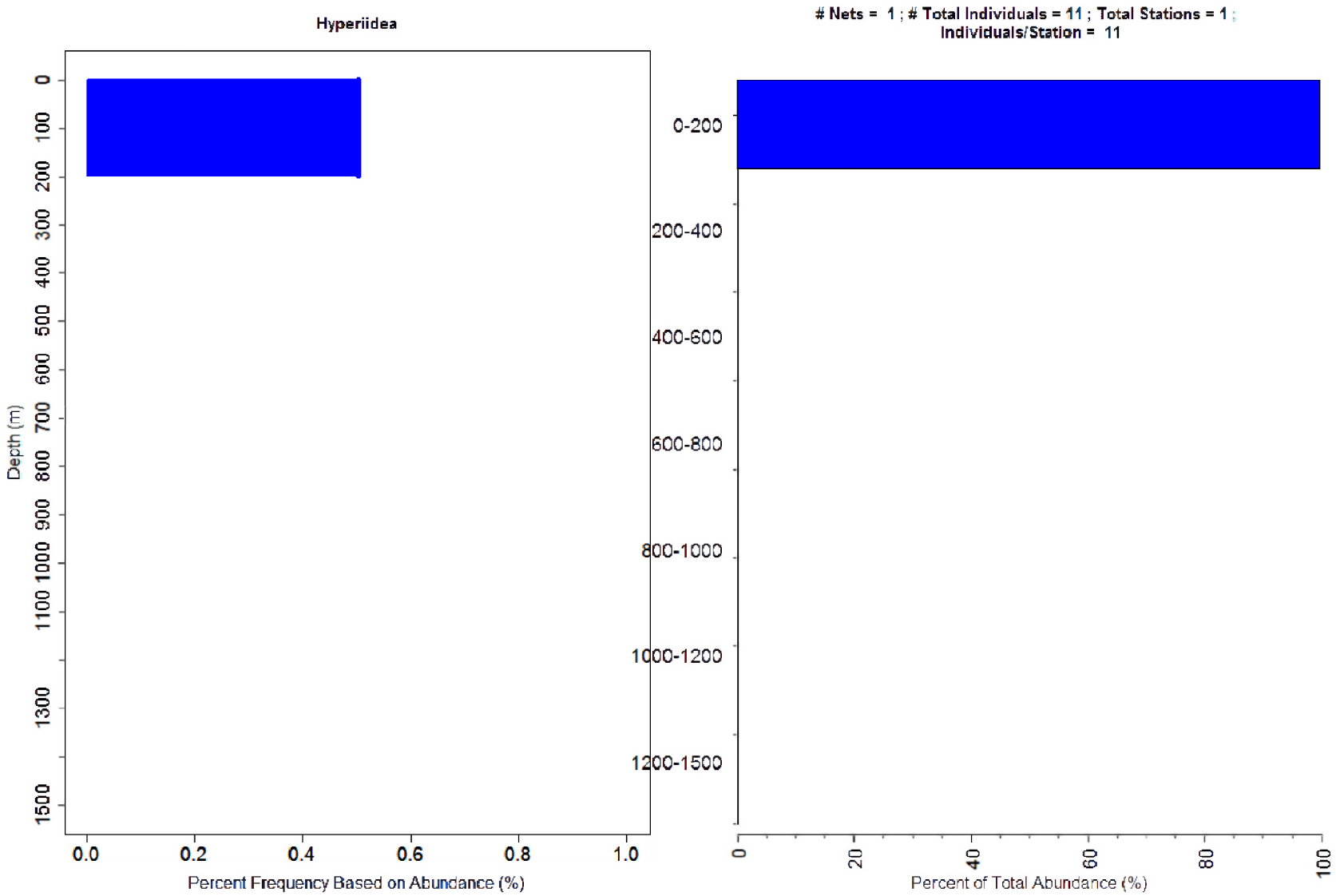
Hygophum_taaningi



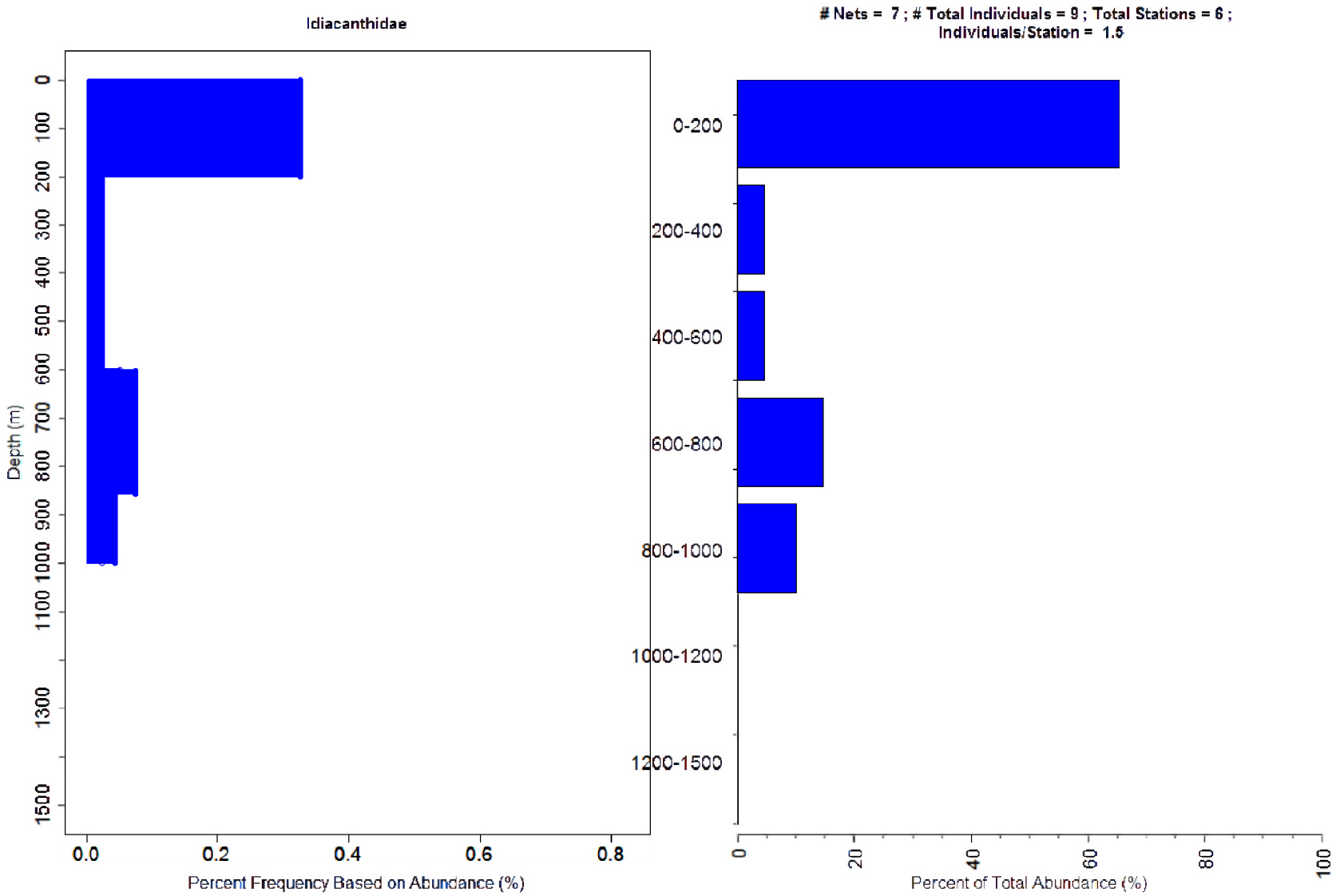
Hymenodora_gracilis



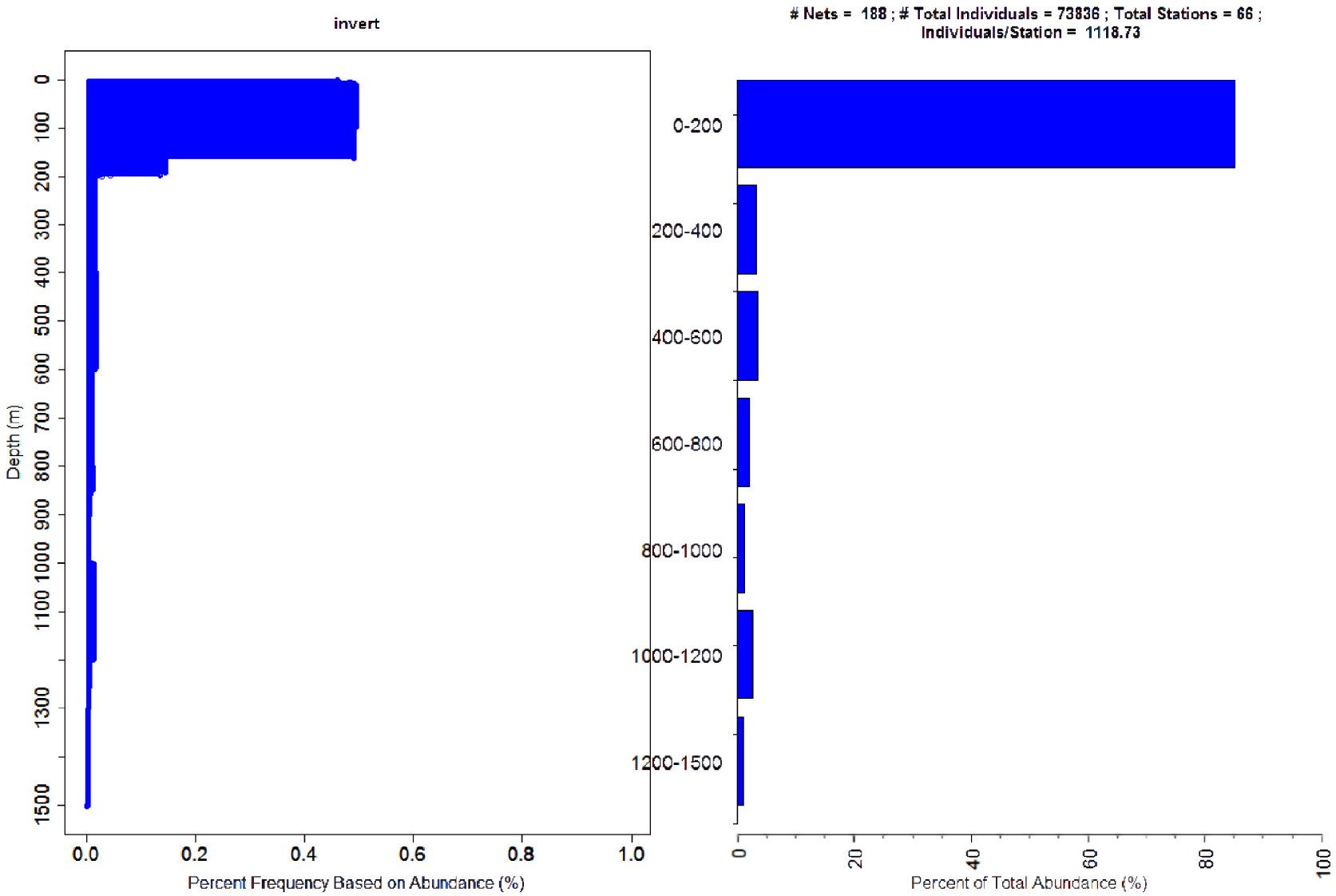
Hymenopenaeus_debilis


Hyperiidea
Nets = 1 ; # Total Individuals = 11 ; Total Stations = 1 ;
Individuals/Station = 11
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

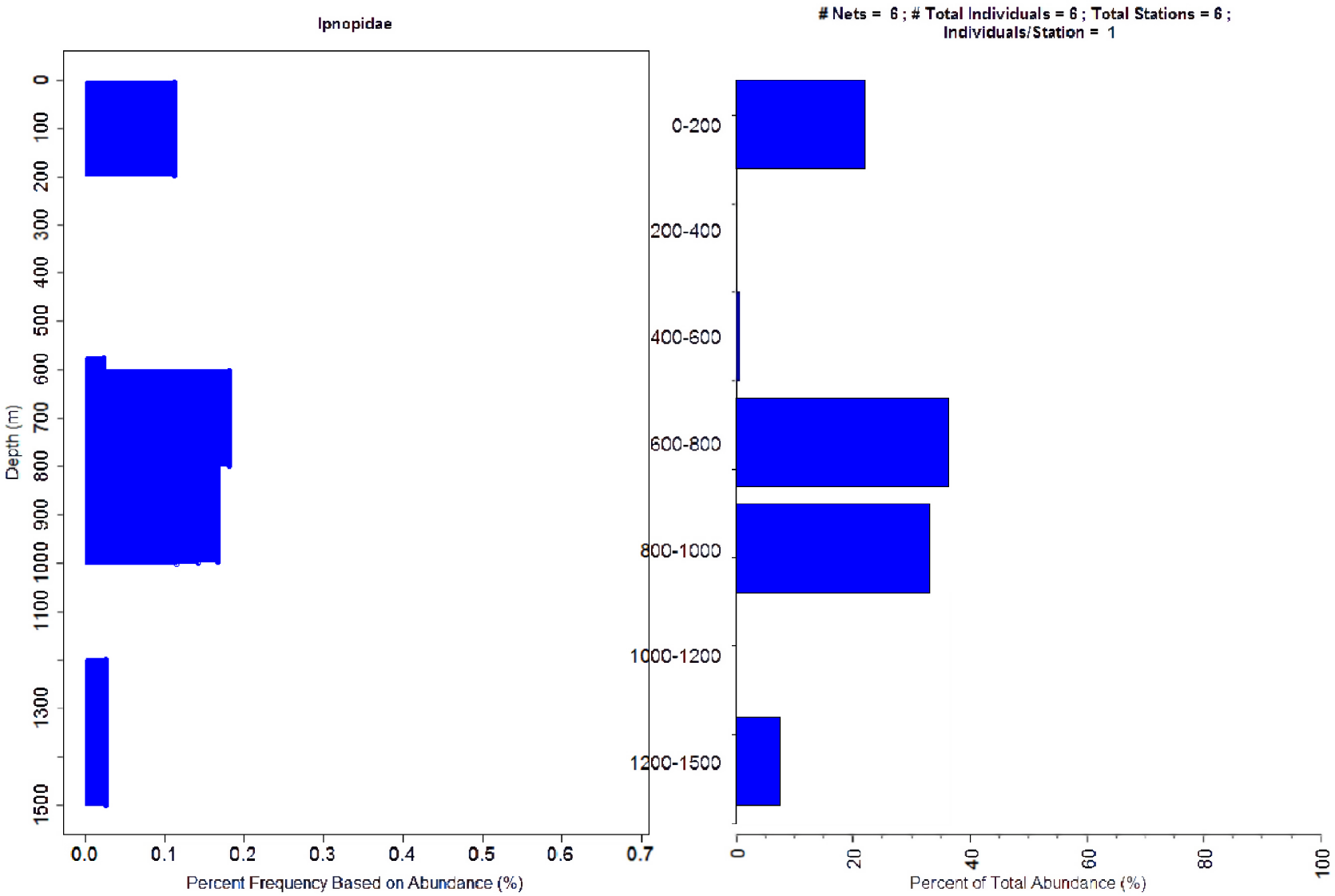
Hyperiidea



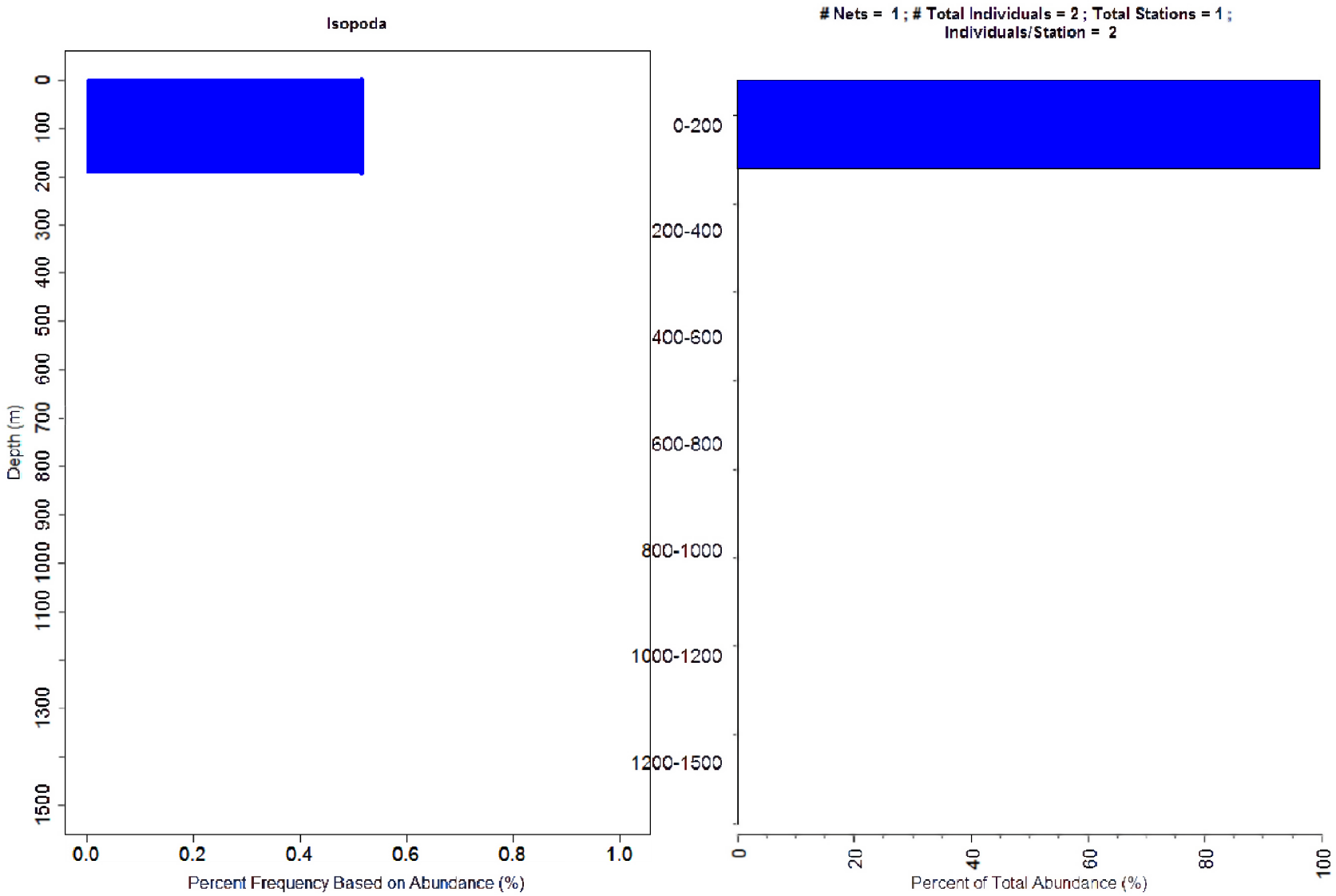
Idiacanthidae


invert
Nets = 188 ; # Total Individuals = 73836 ; Total Stations = 66 ;
Individuals/Station = 1118.73
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

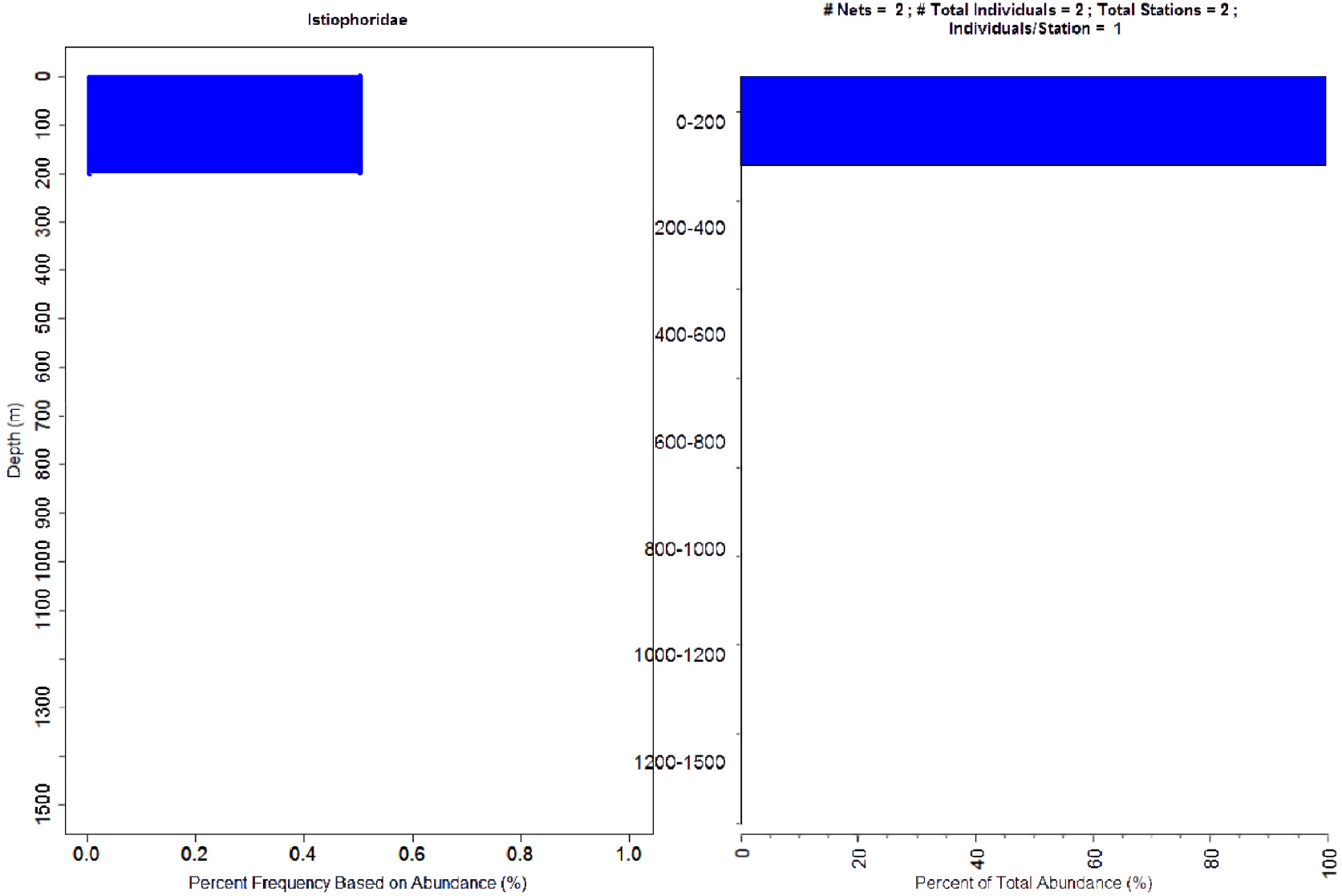
invert


Ipnopidae
Nets = 6 ; # Total Individuals = 6 ; Total Stations = 6 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

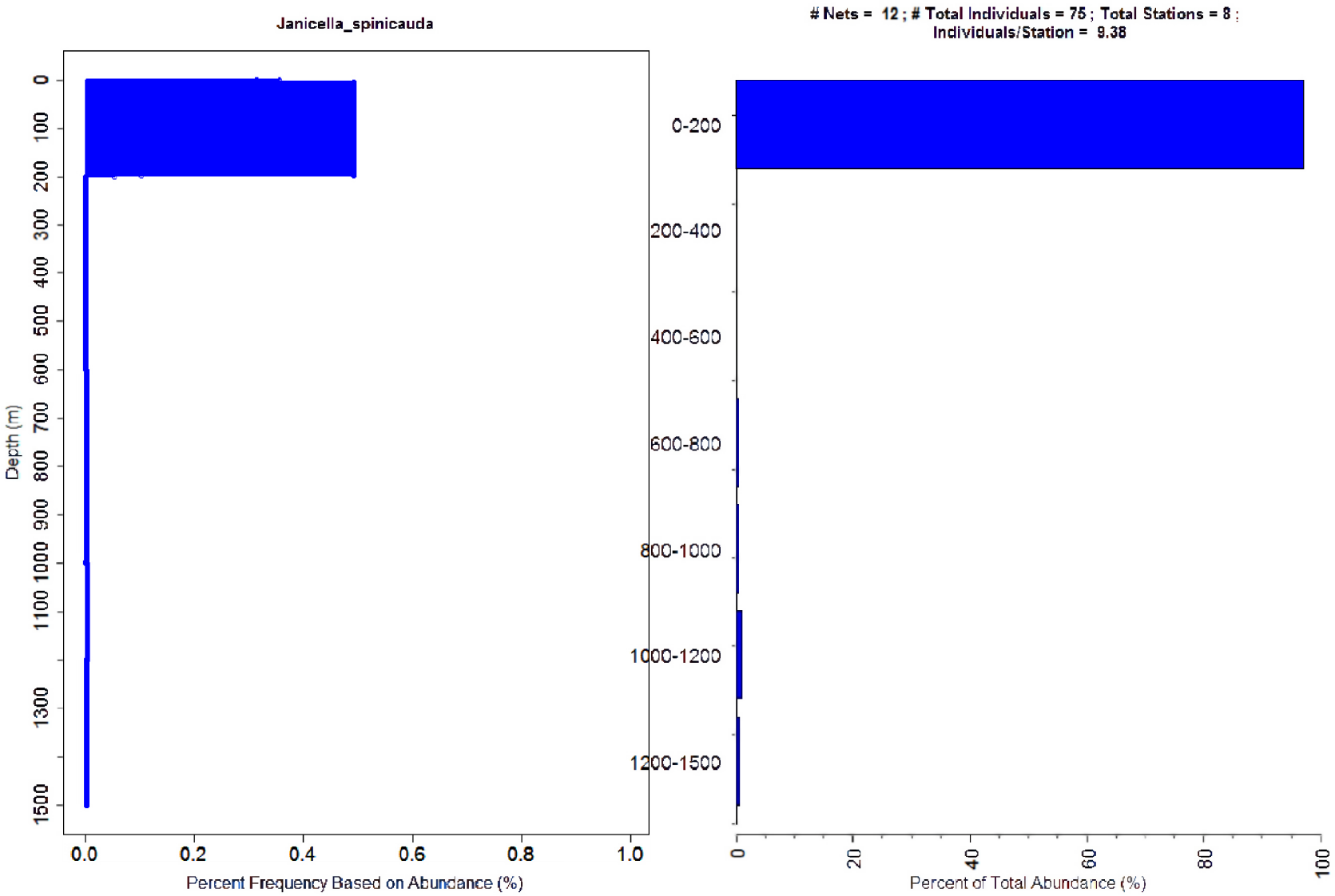
Ipnopidae


Isopoda
Nets = 1 ; # Total Individuals = 2 ; Total Stations = 1 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

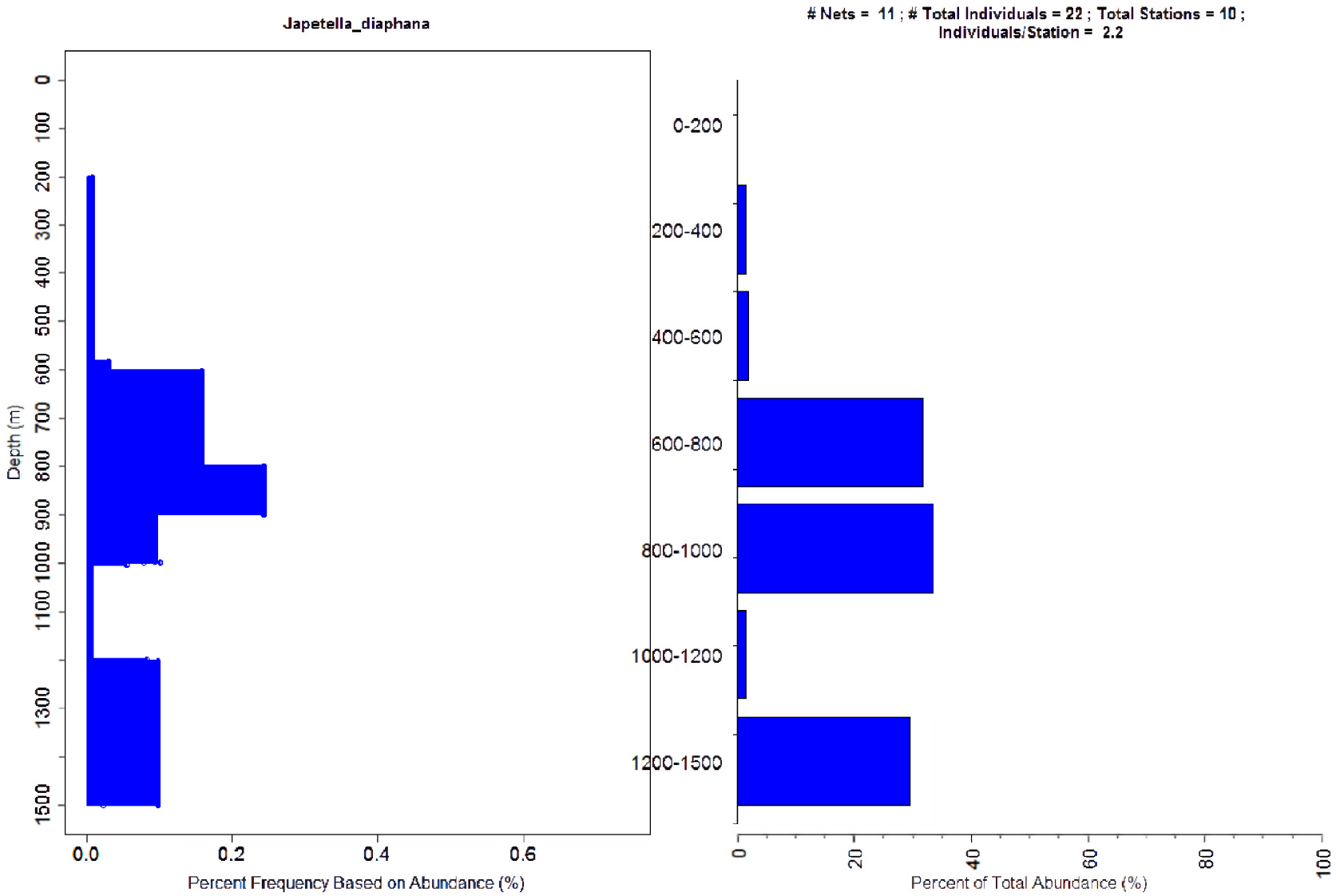
Isopoda



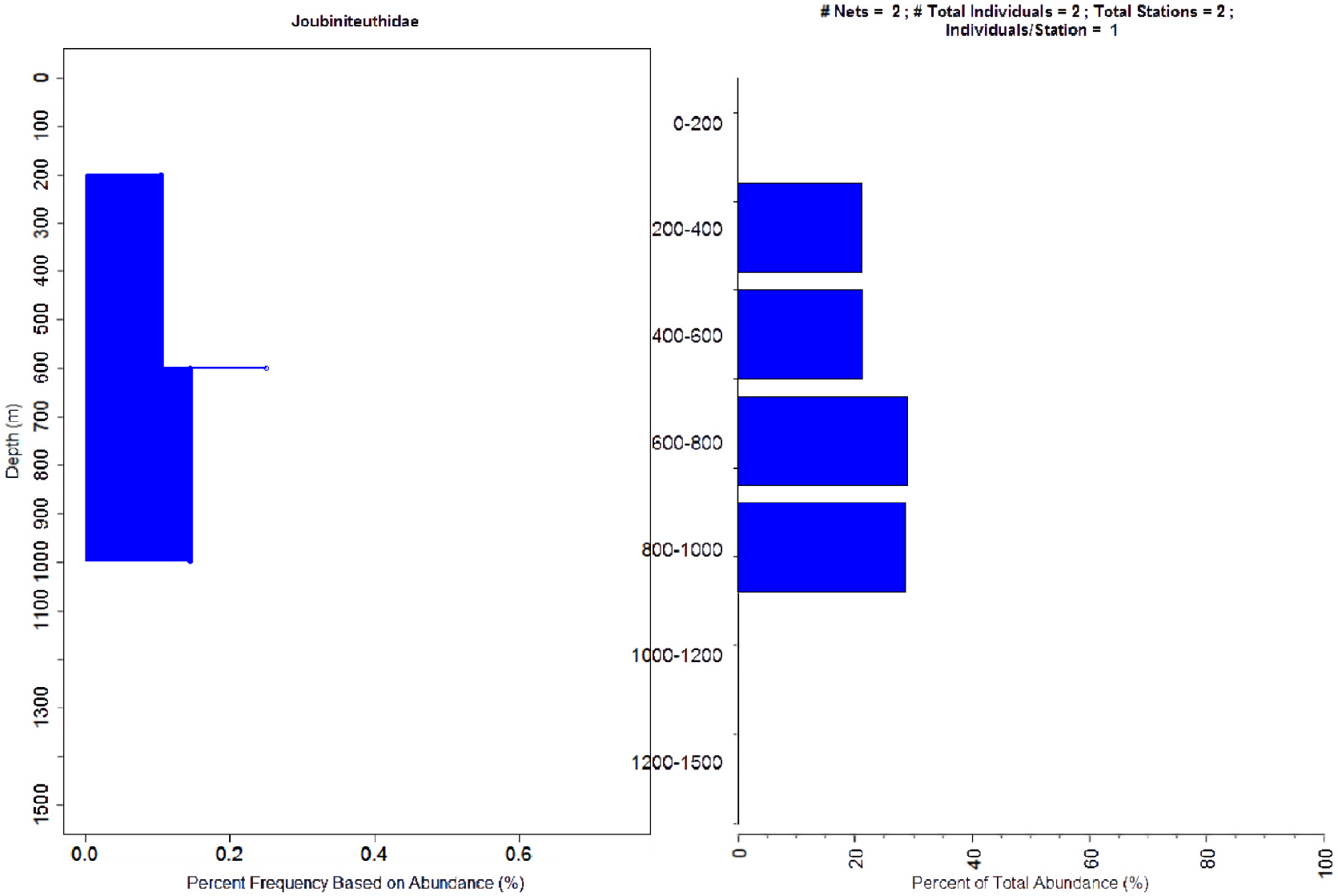
Istiophoridae



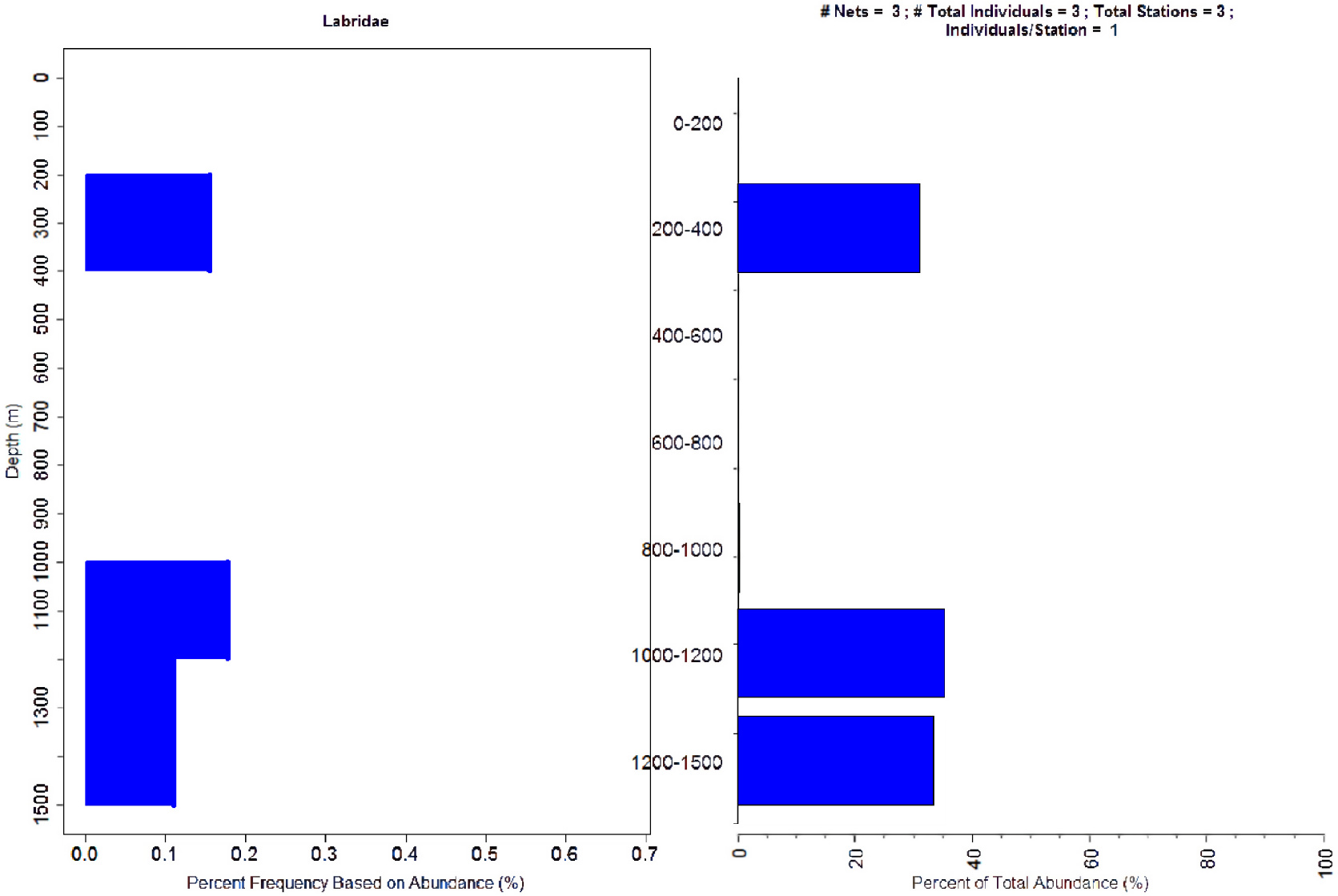
Janicella_spinicauda



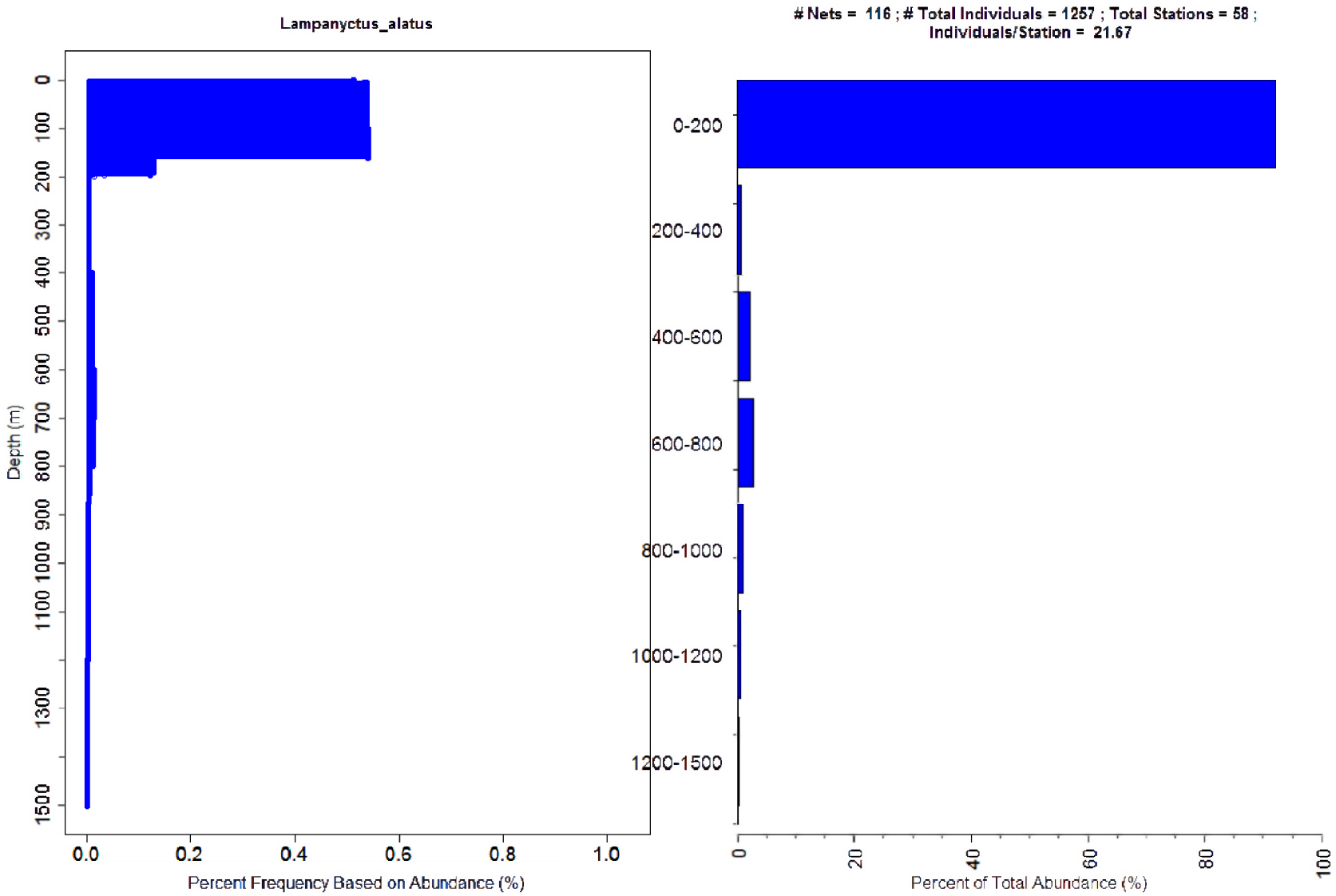
Japetella_diaphana



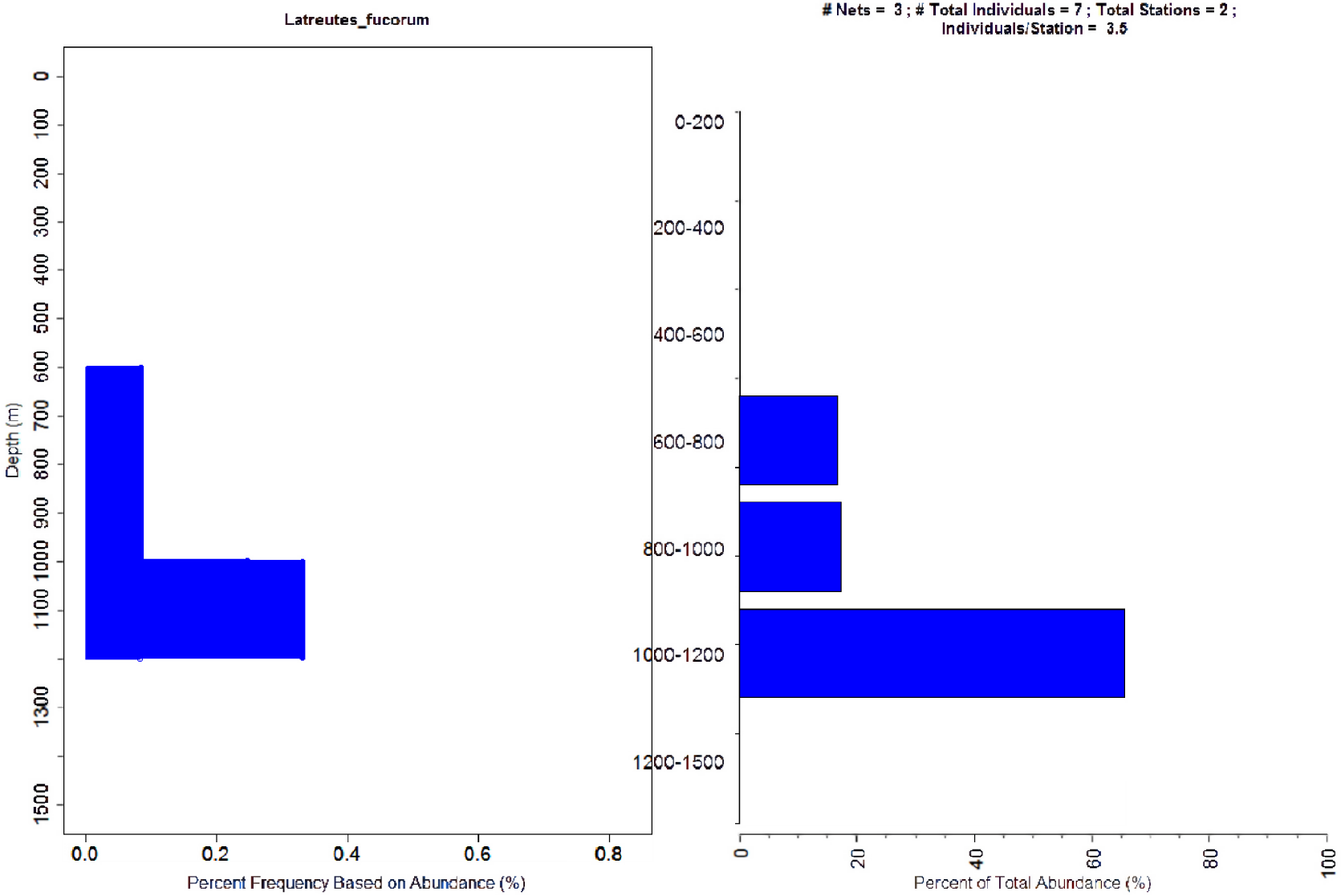
Joubiniteuthidae


Labridae
Nets = 3 ; # Total Individuals = 3 ; Total Stations = 3 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

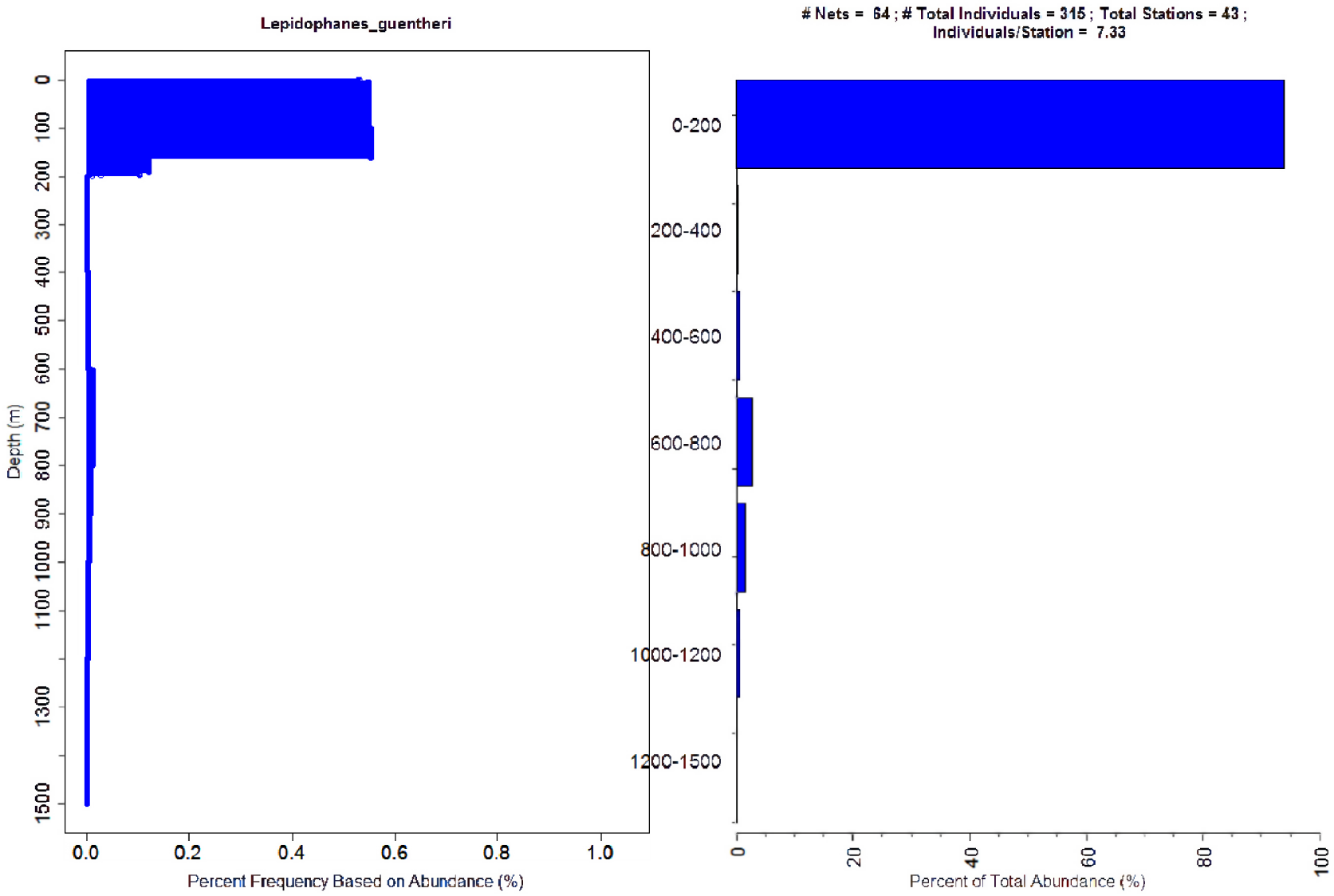
Labridae



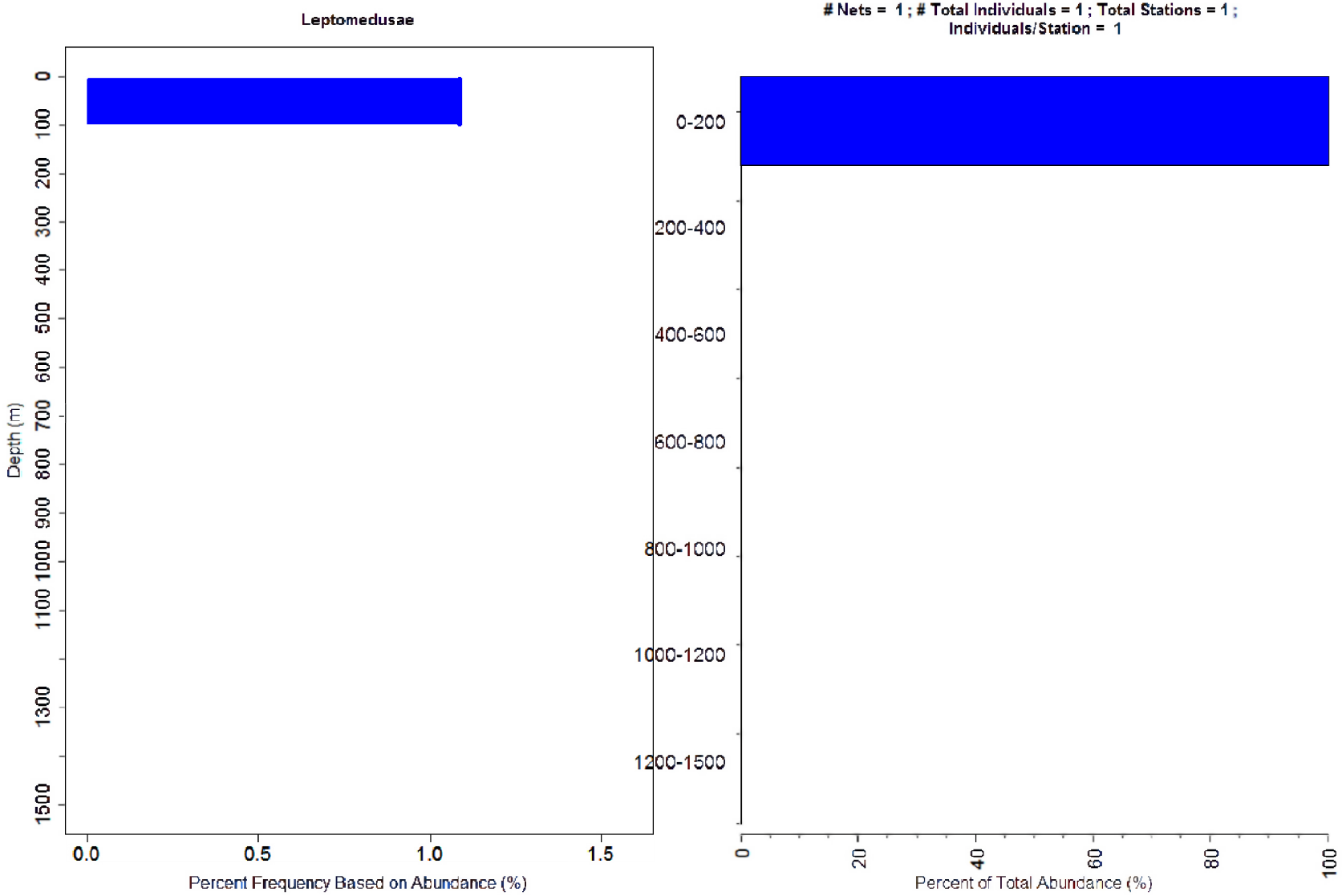
Lampanyctus_alatus



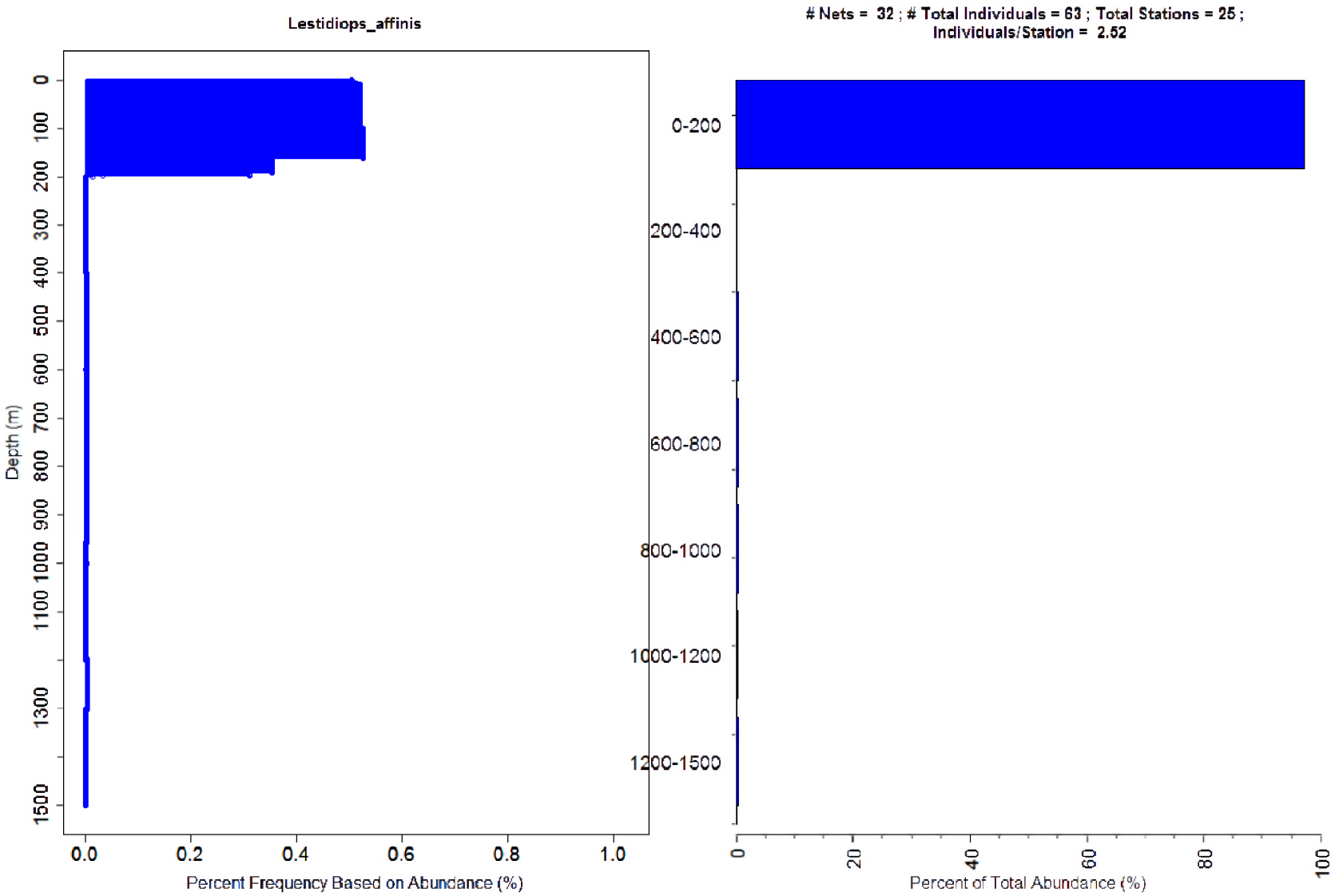
Latreutes_fucorum



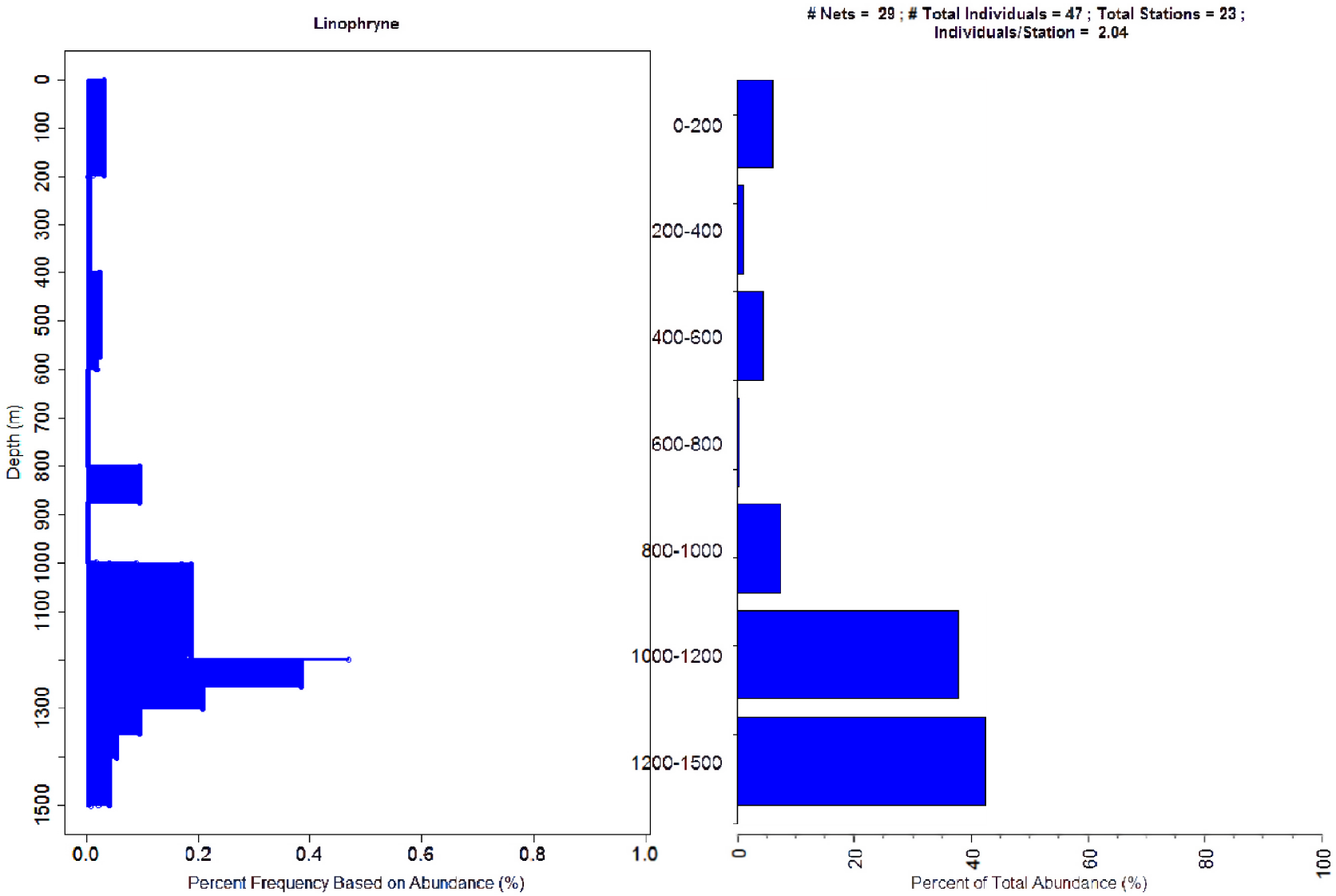
Lepidophanes_guentheri



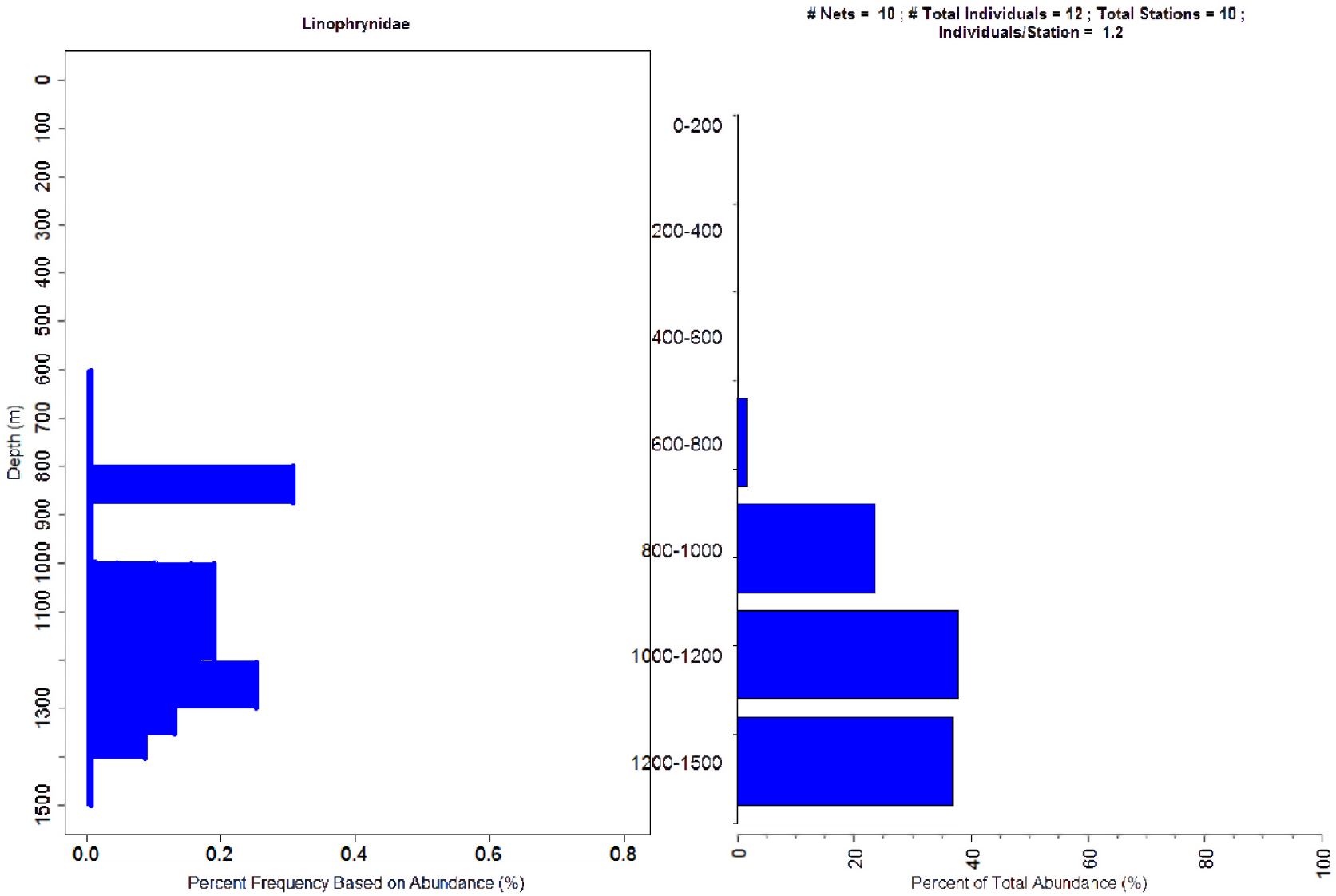
Leptomedusae



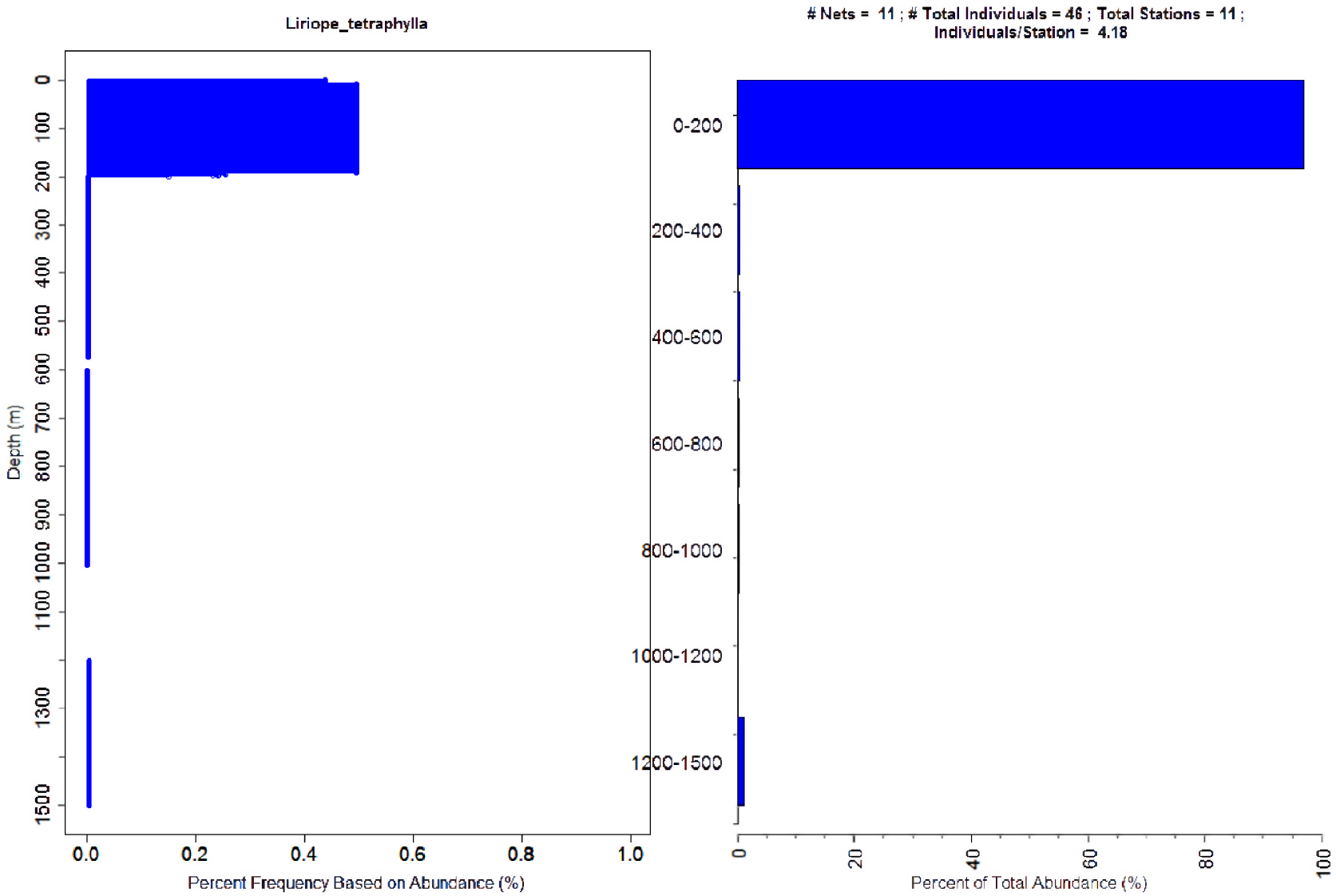
Lestidiops_affinis


Linophryne
Nets = 29 ; # Total Individuals = 47 ; Total Stations = 23 ;
Individuals/Station = 2.04
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

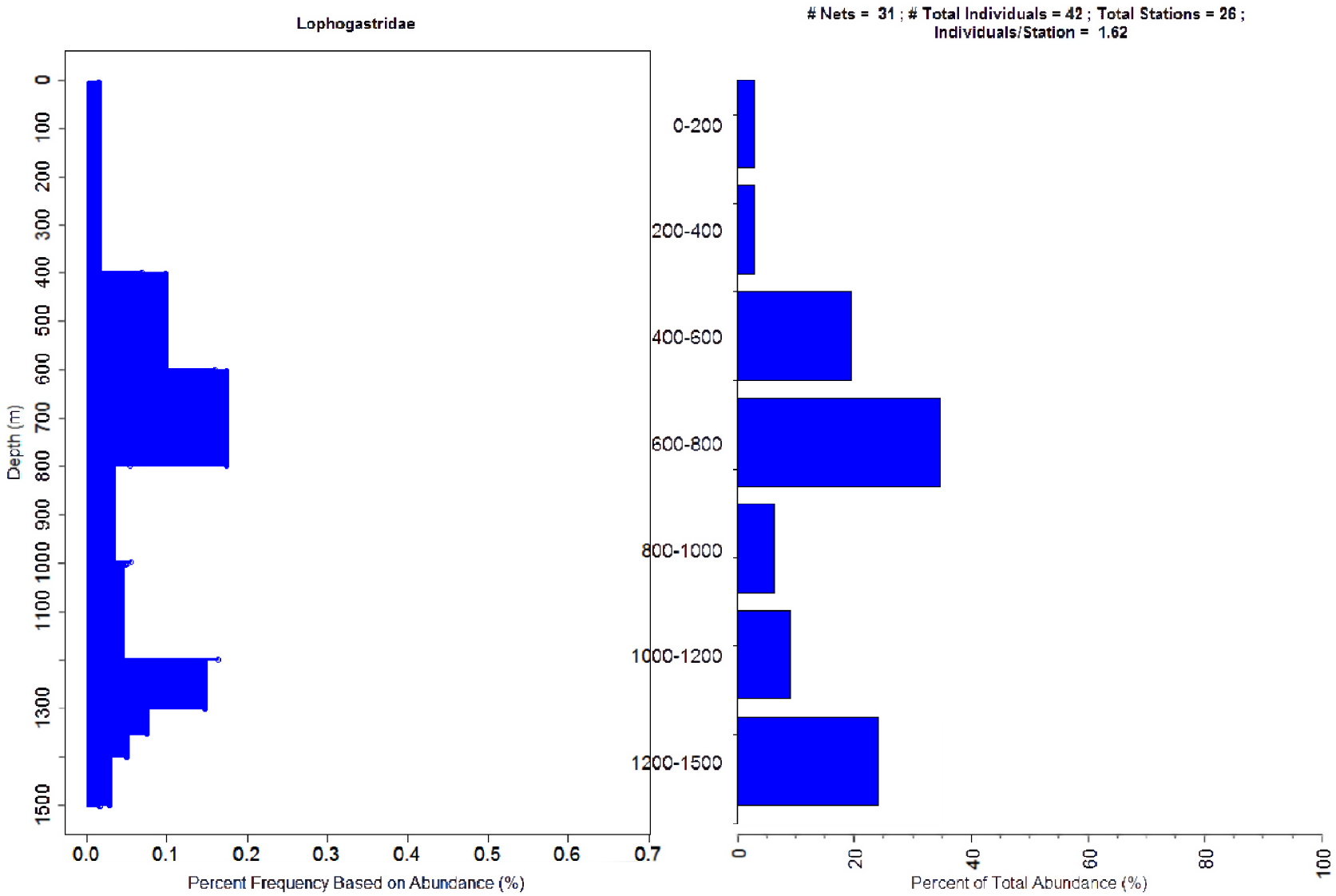
Linophryne



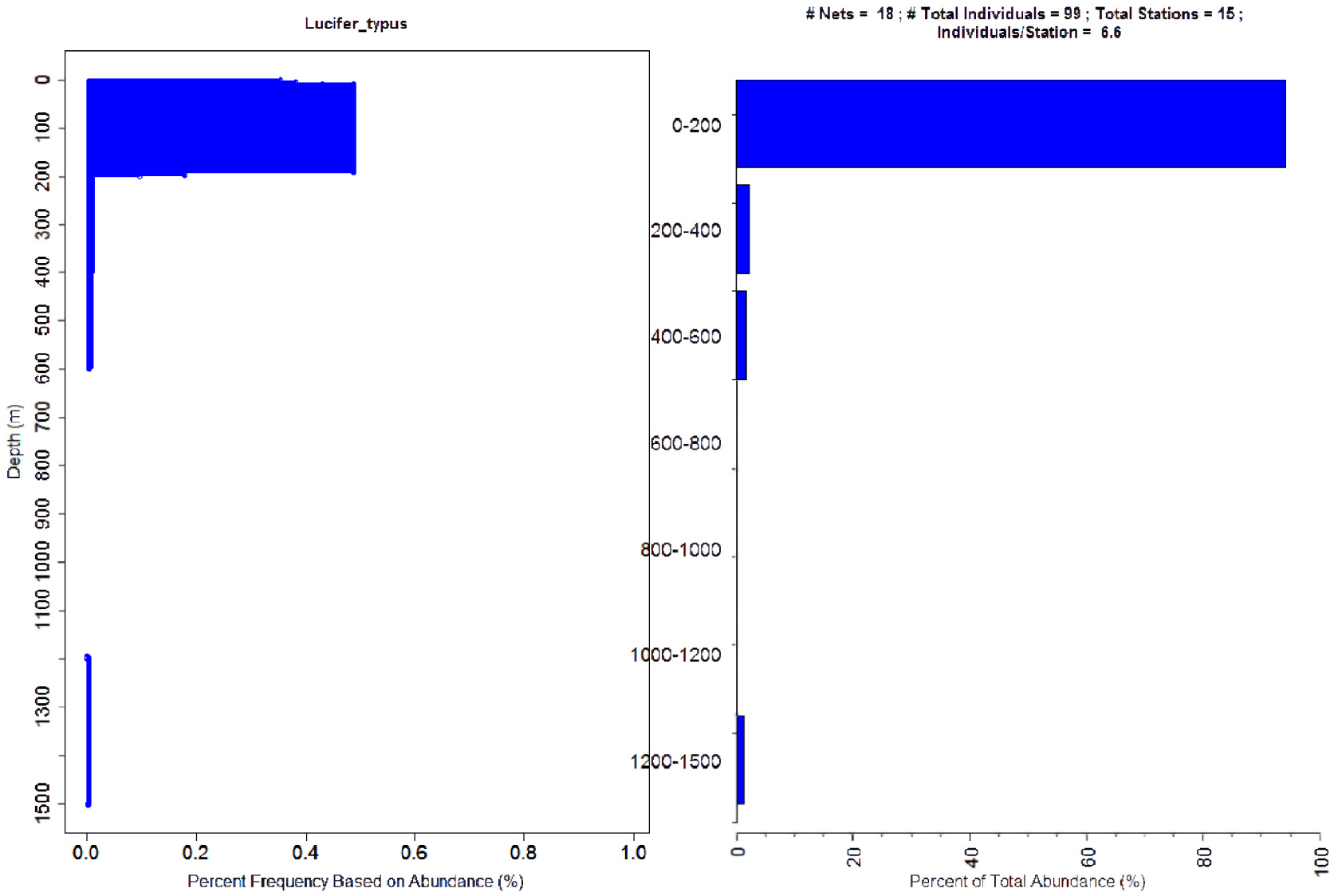
Linophrynidae



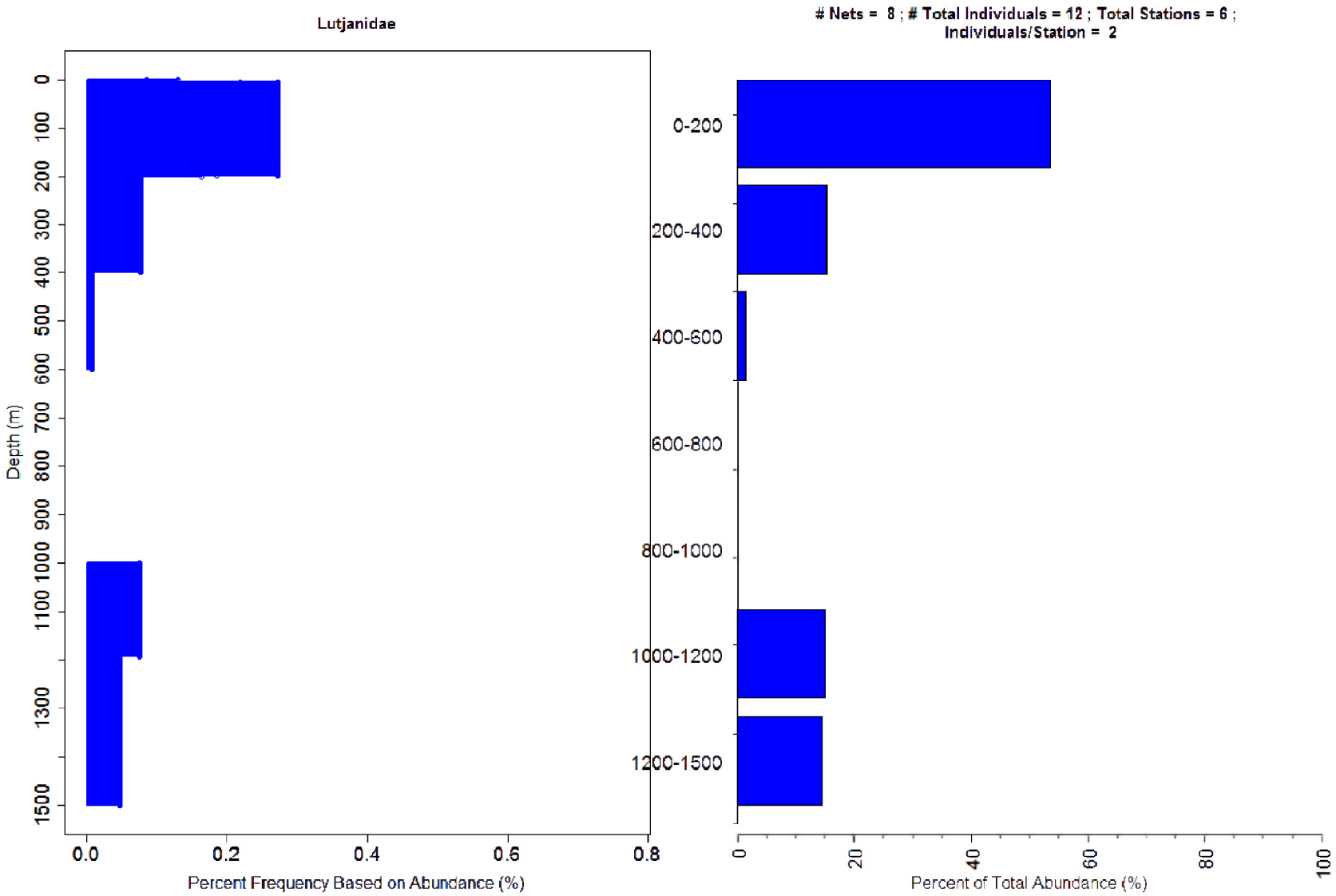
Liriope_tetraphylla



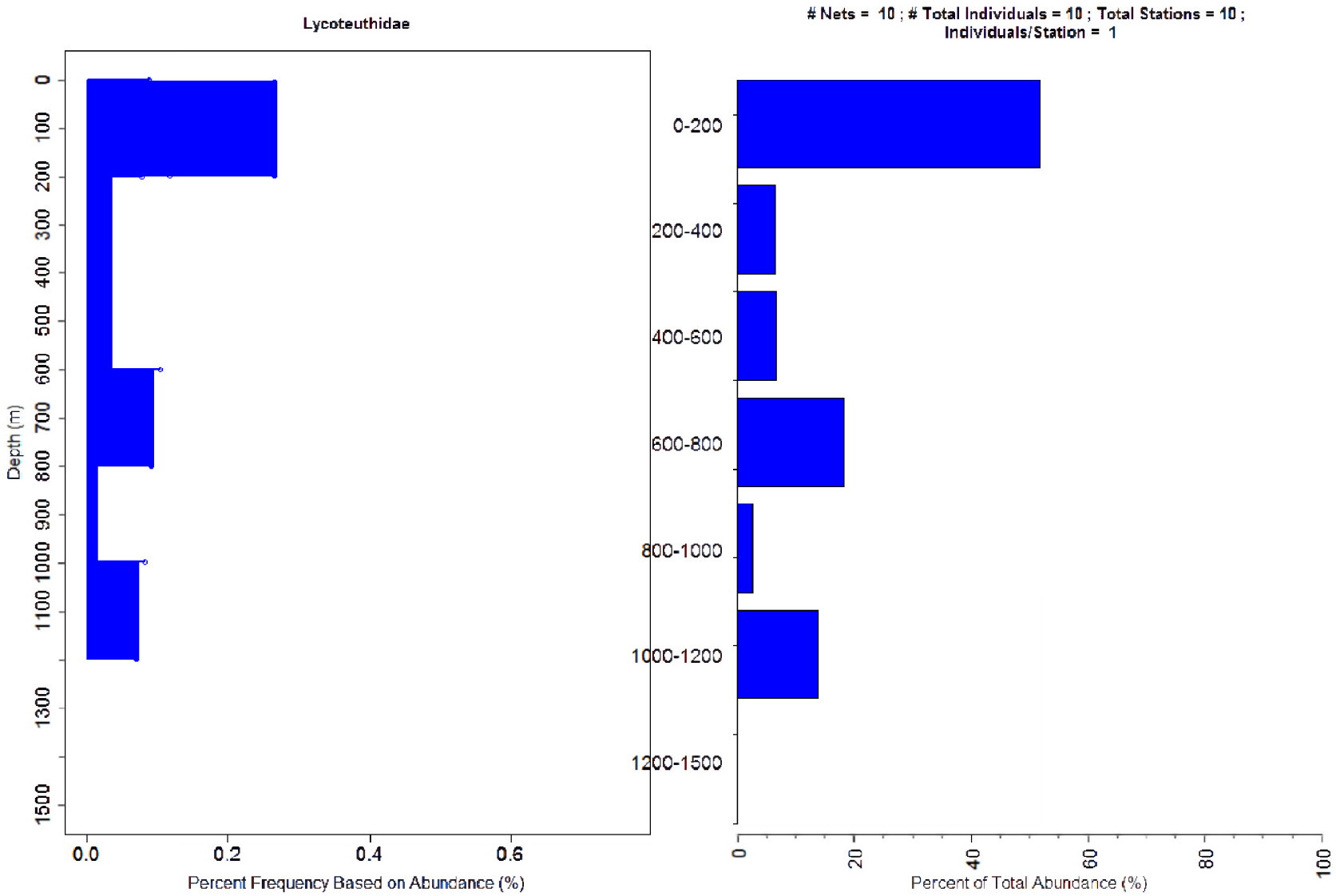
Lophogastridae



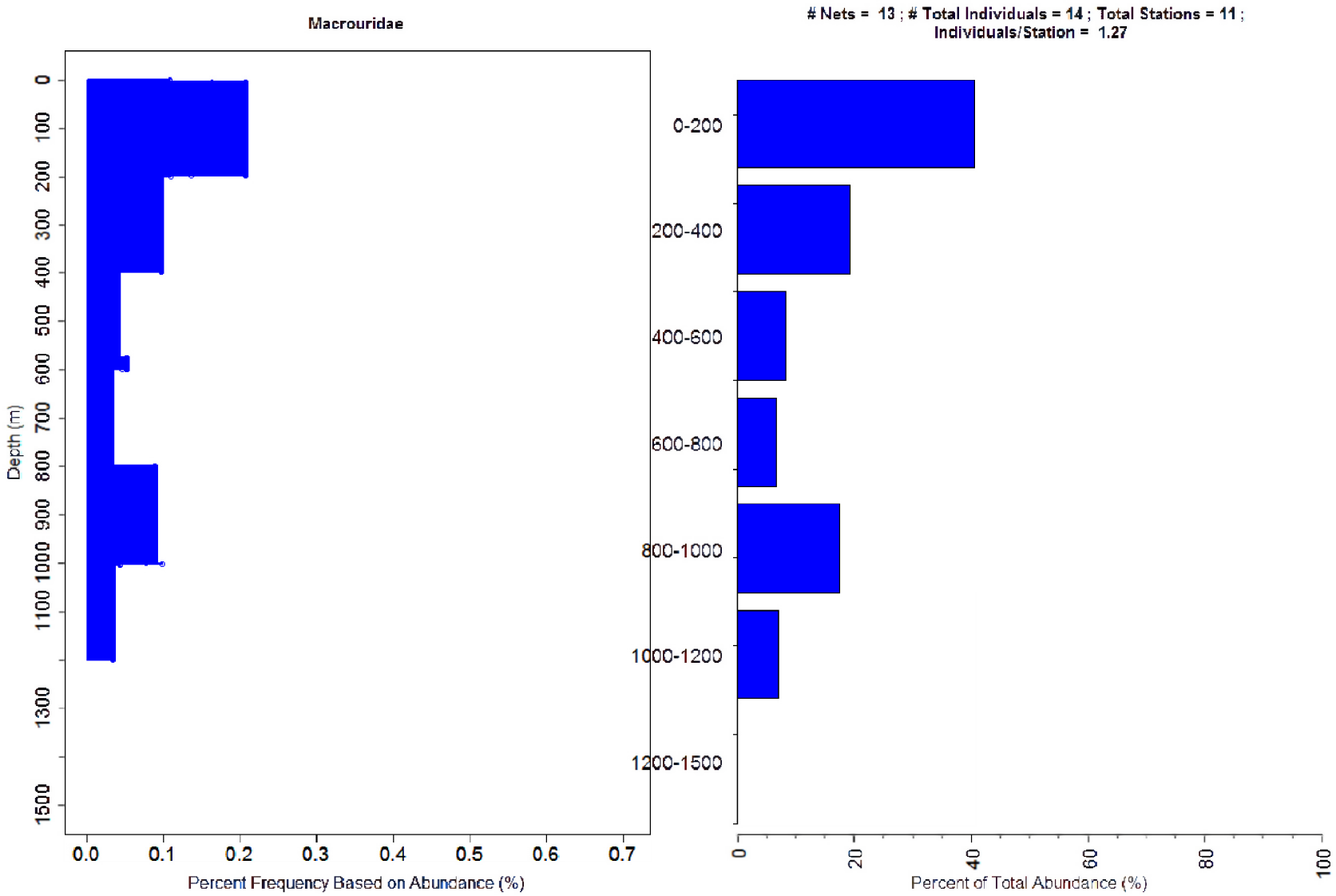
Lucifer_typus


Lutjanidae
Nets = 8 ; # Total Individuals = 12 ; Total Stations = 6 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

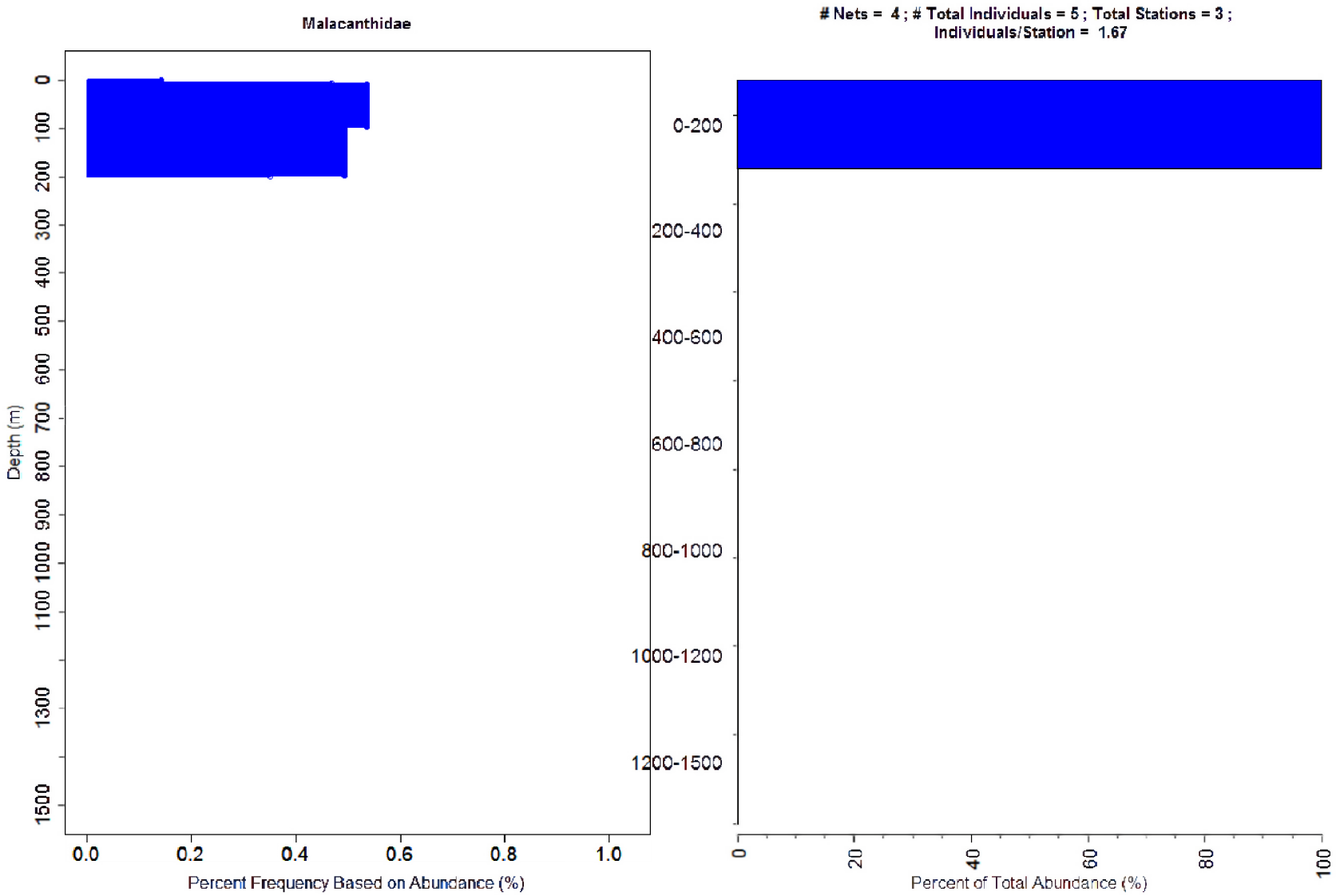
Lutjanidae



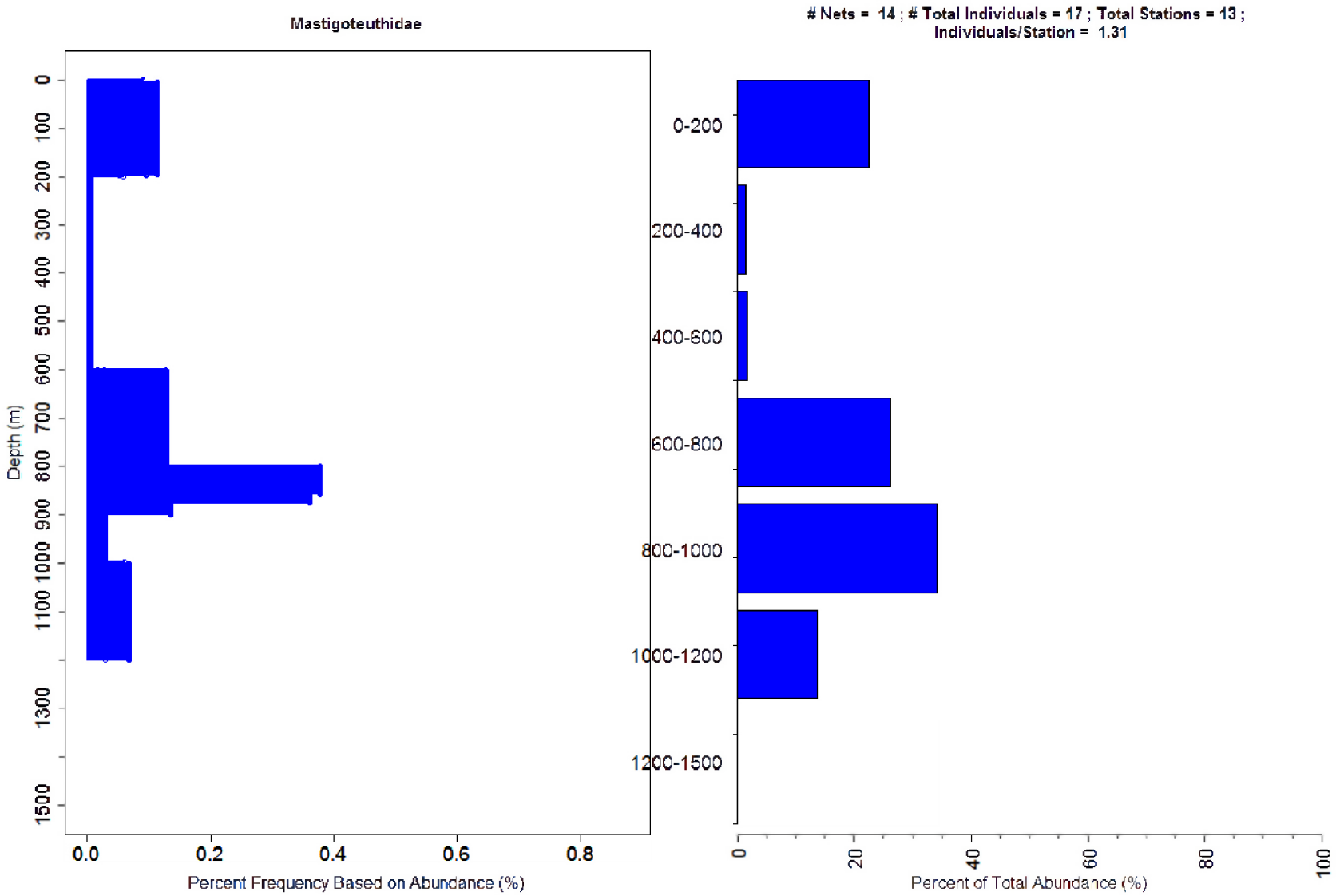
Lycoteuthidae



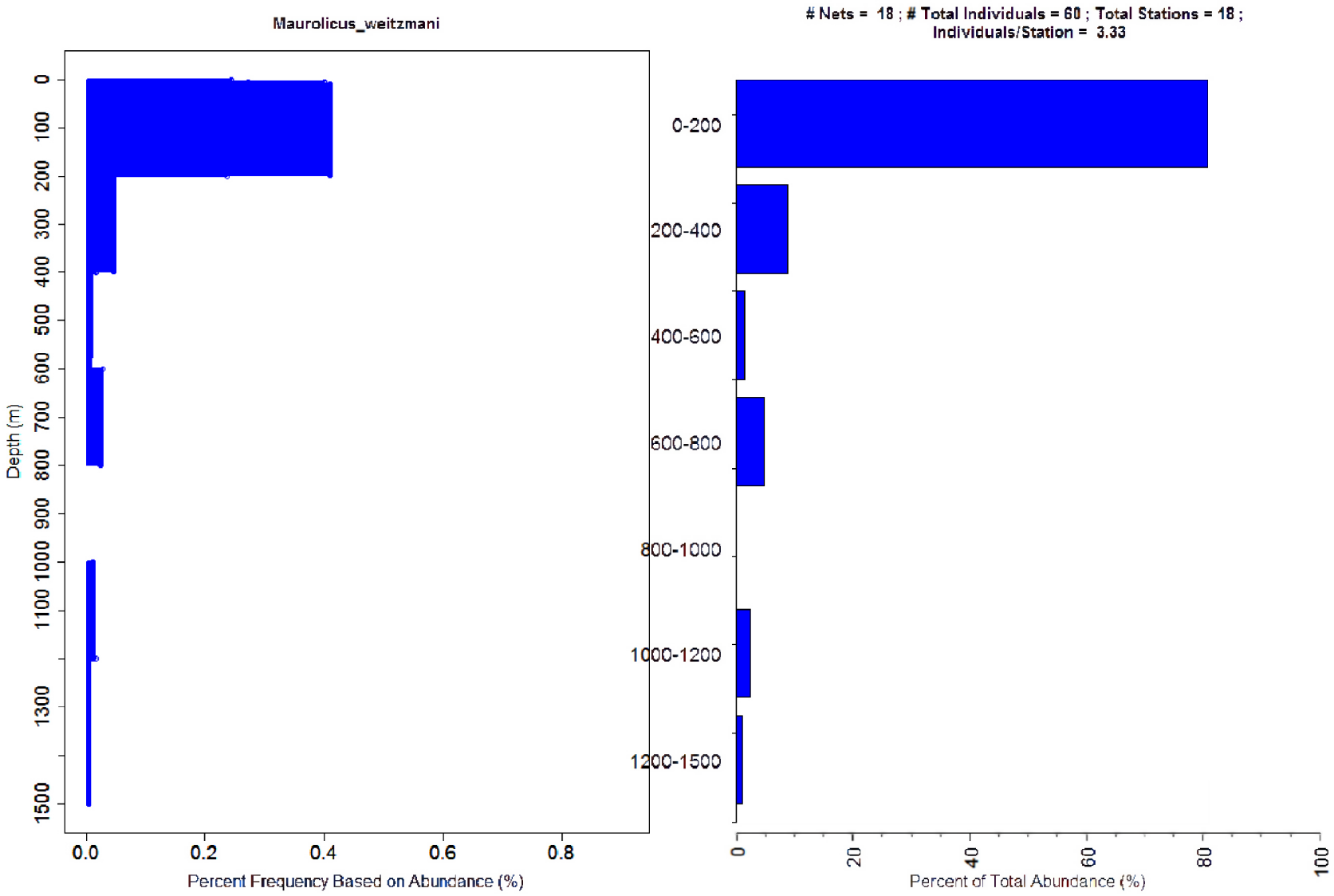
Macrouridae



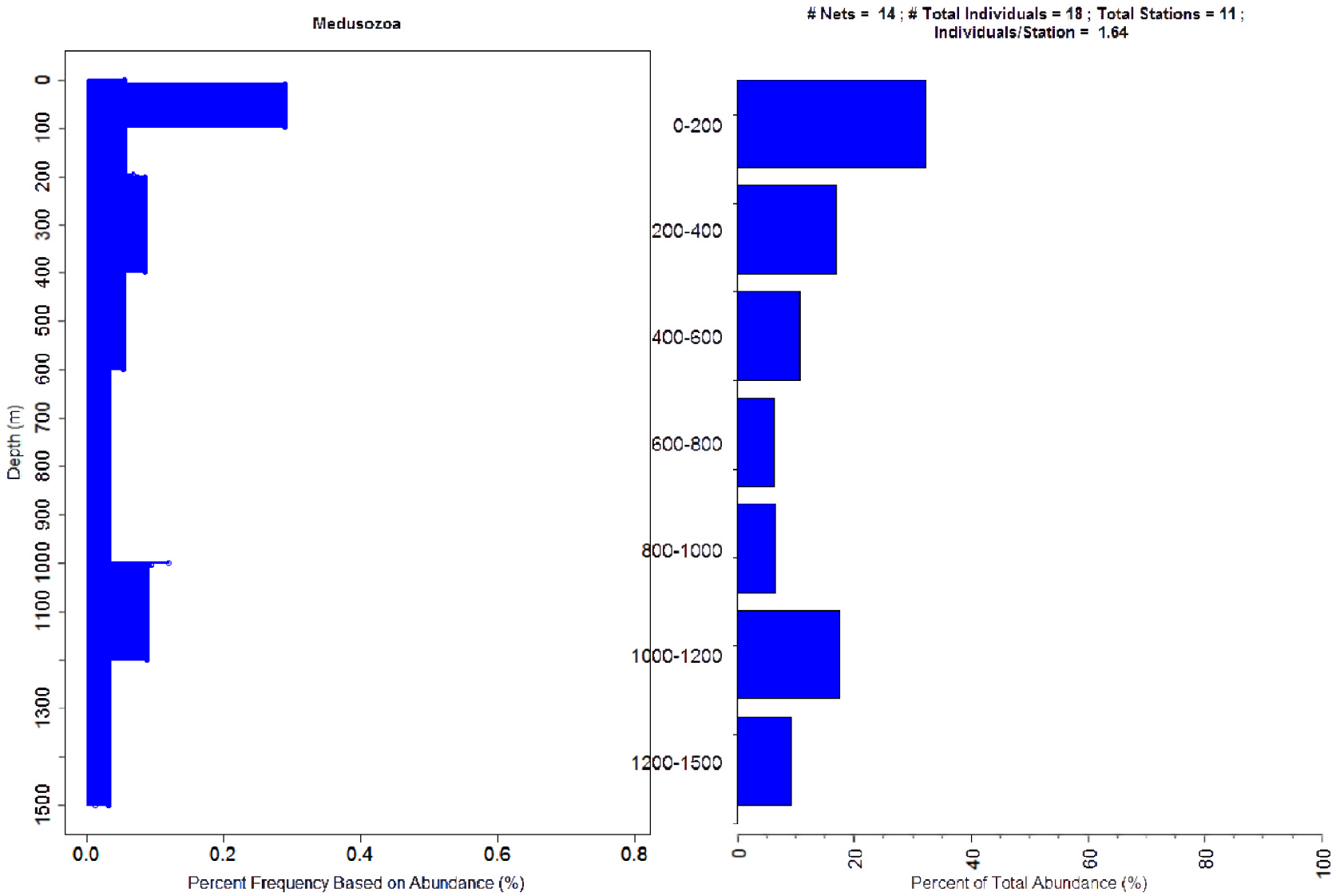
Malacanthidae



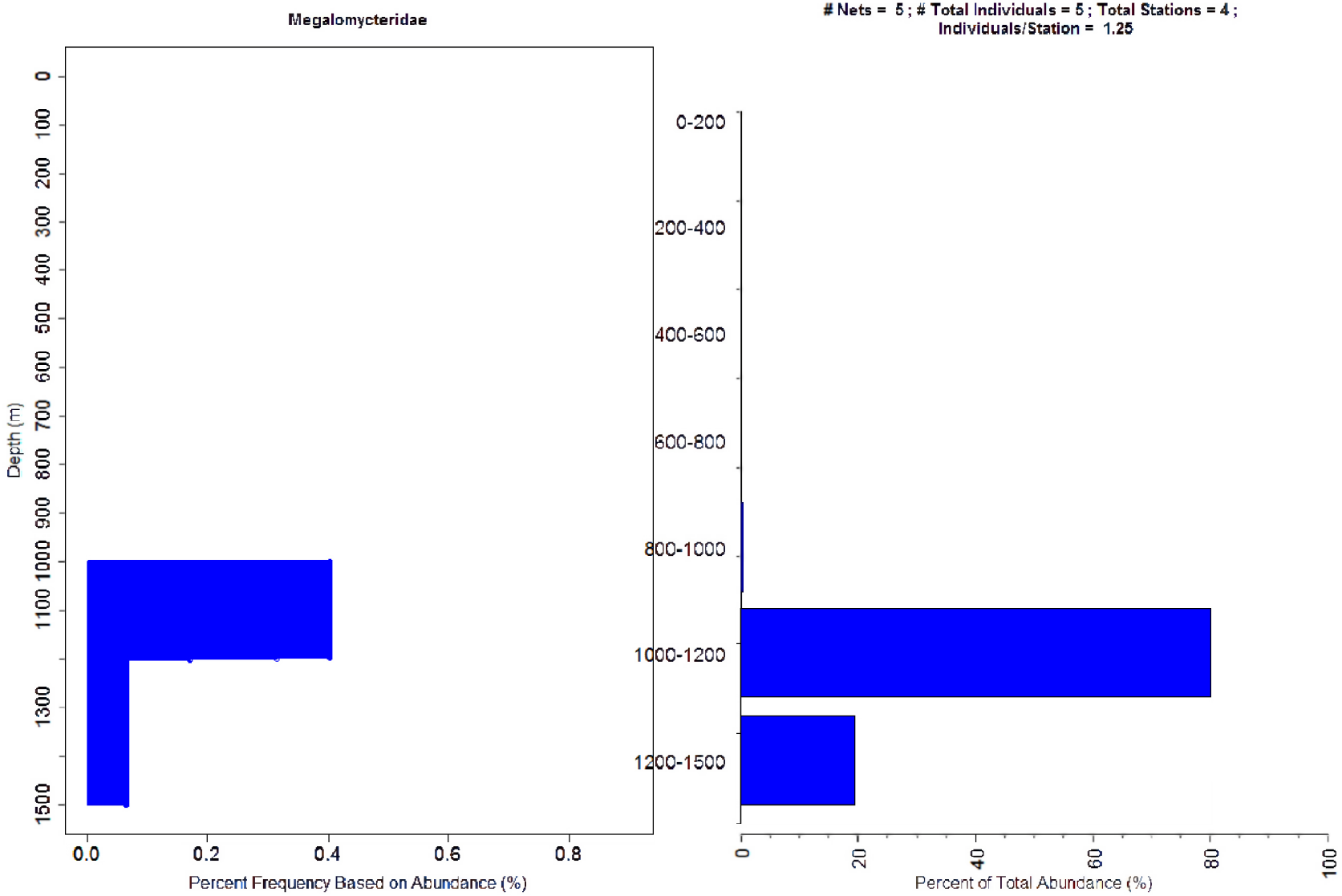
Mastigoteuthidae



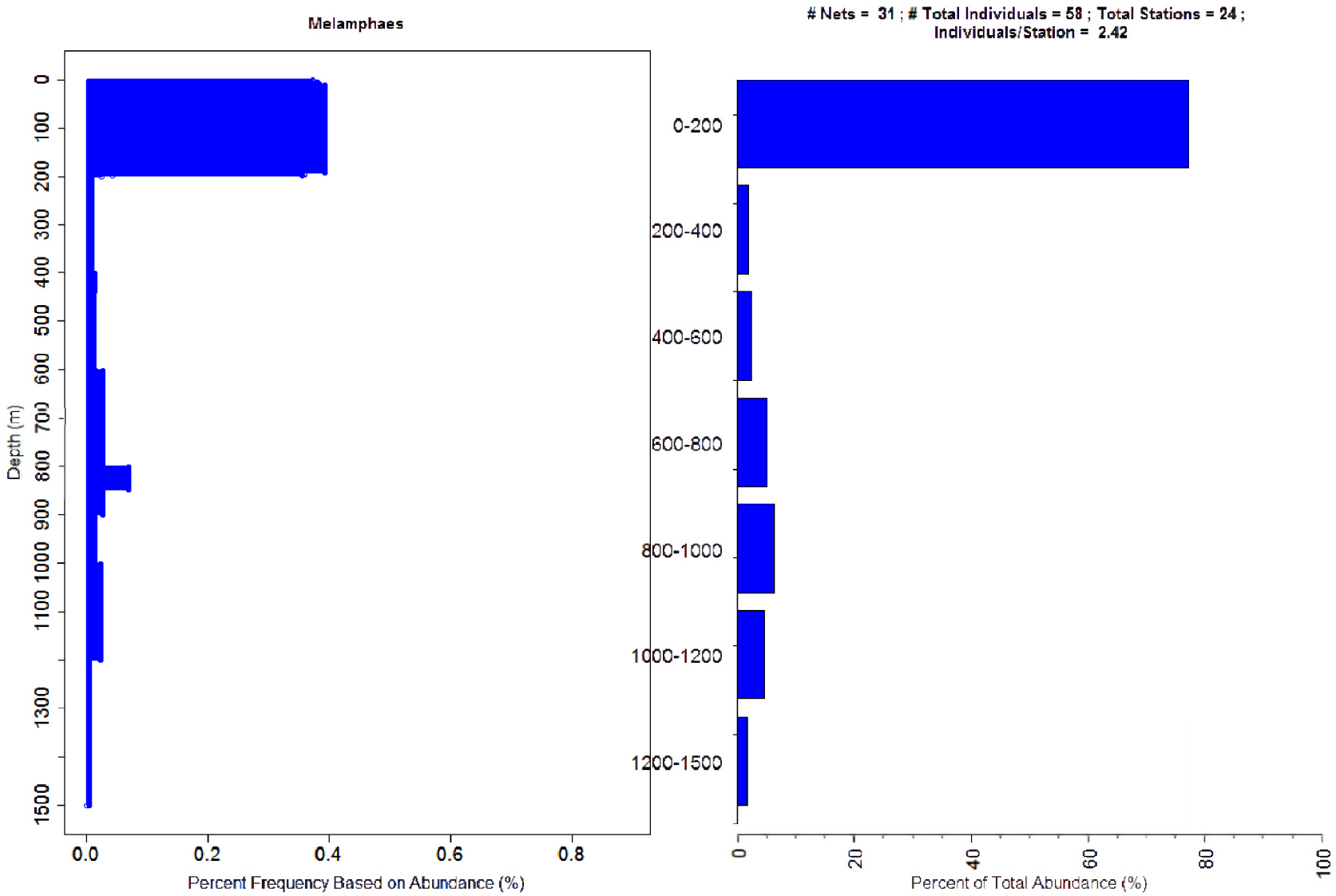
Maurolicus_weitzmani


Medusozoa
Nets = 14 ; # Total Individuals = 18 ; Total Stations = 11 ;
Individuals/Station = 1.64
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

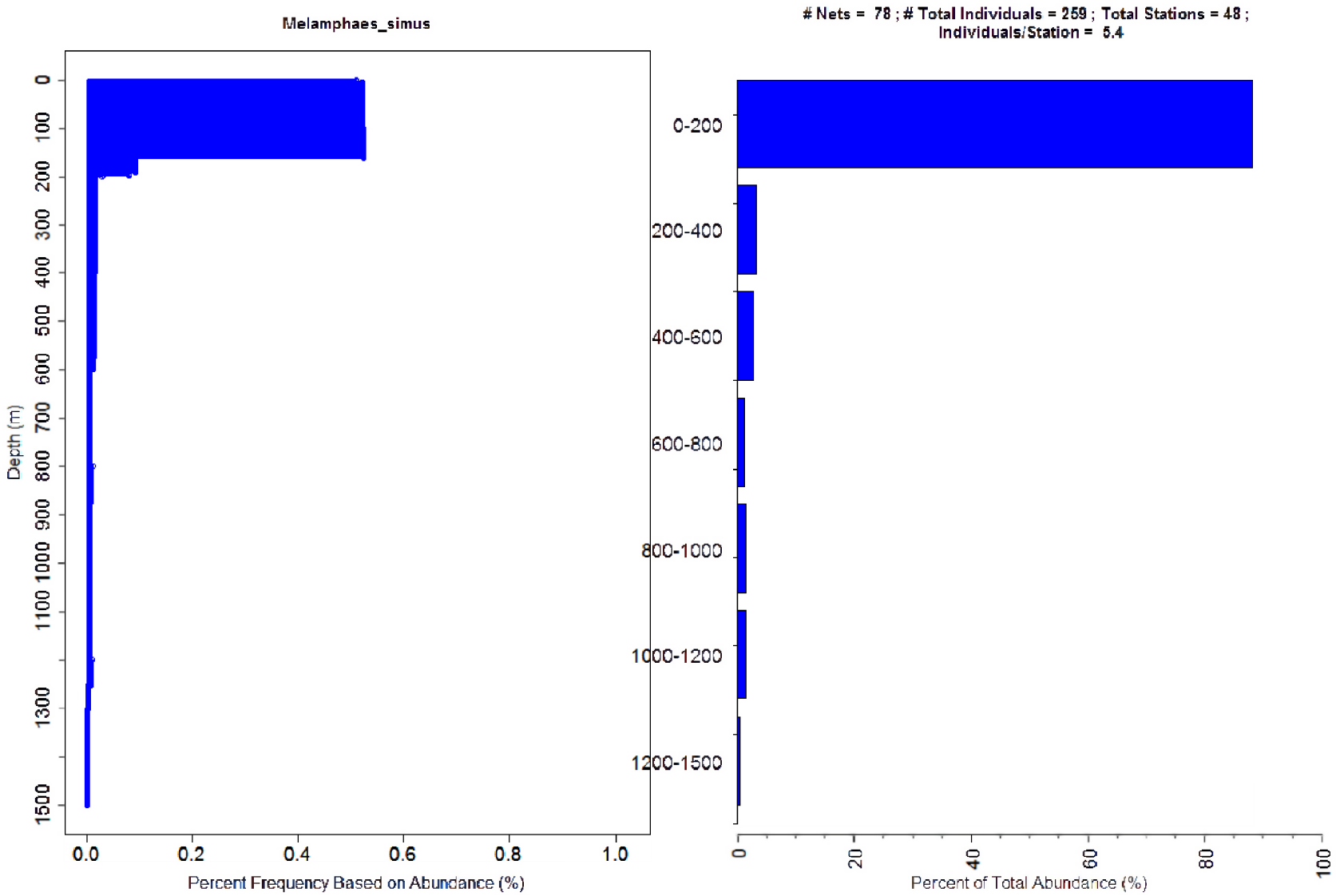
Medusozoa



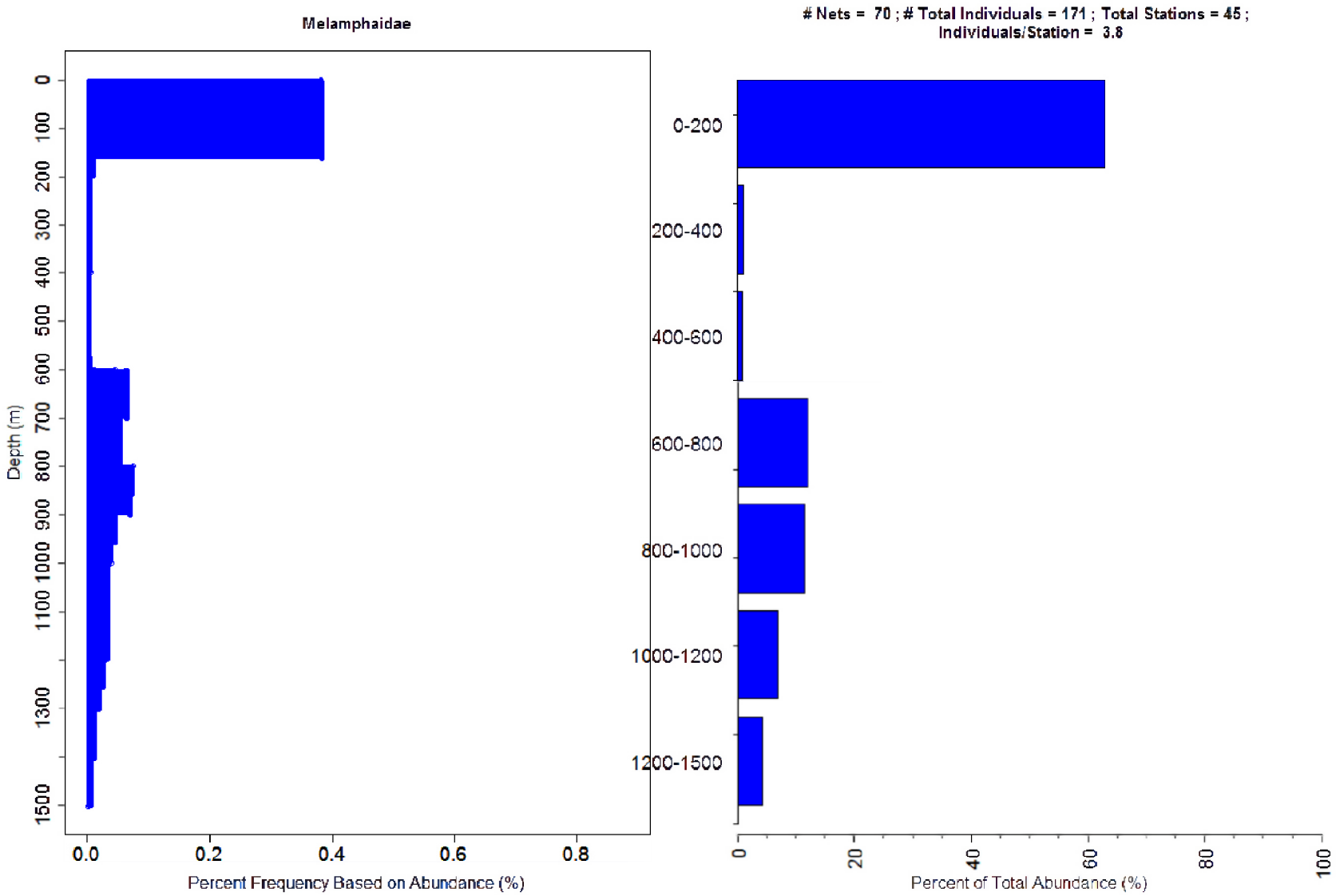
Megalomycteridae


Melamphaes
Nets = 31 ; # Total Individuals = 58 ; Total Stations = 24 ;
Individuals/Station = 2.42
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

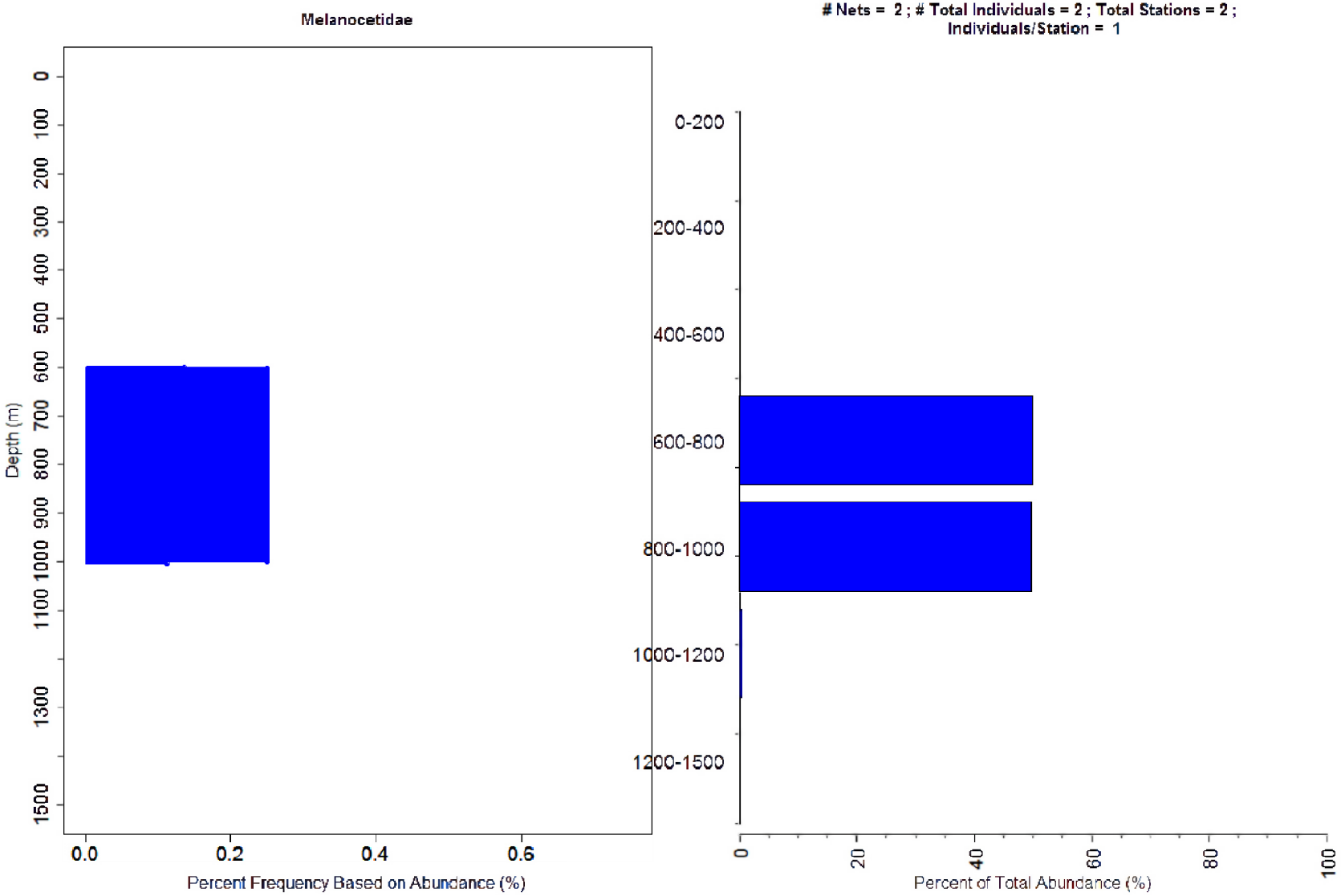
Melamphaes



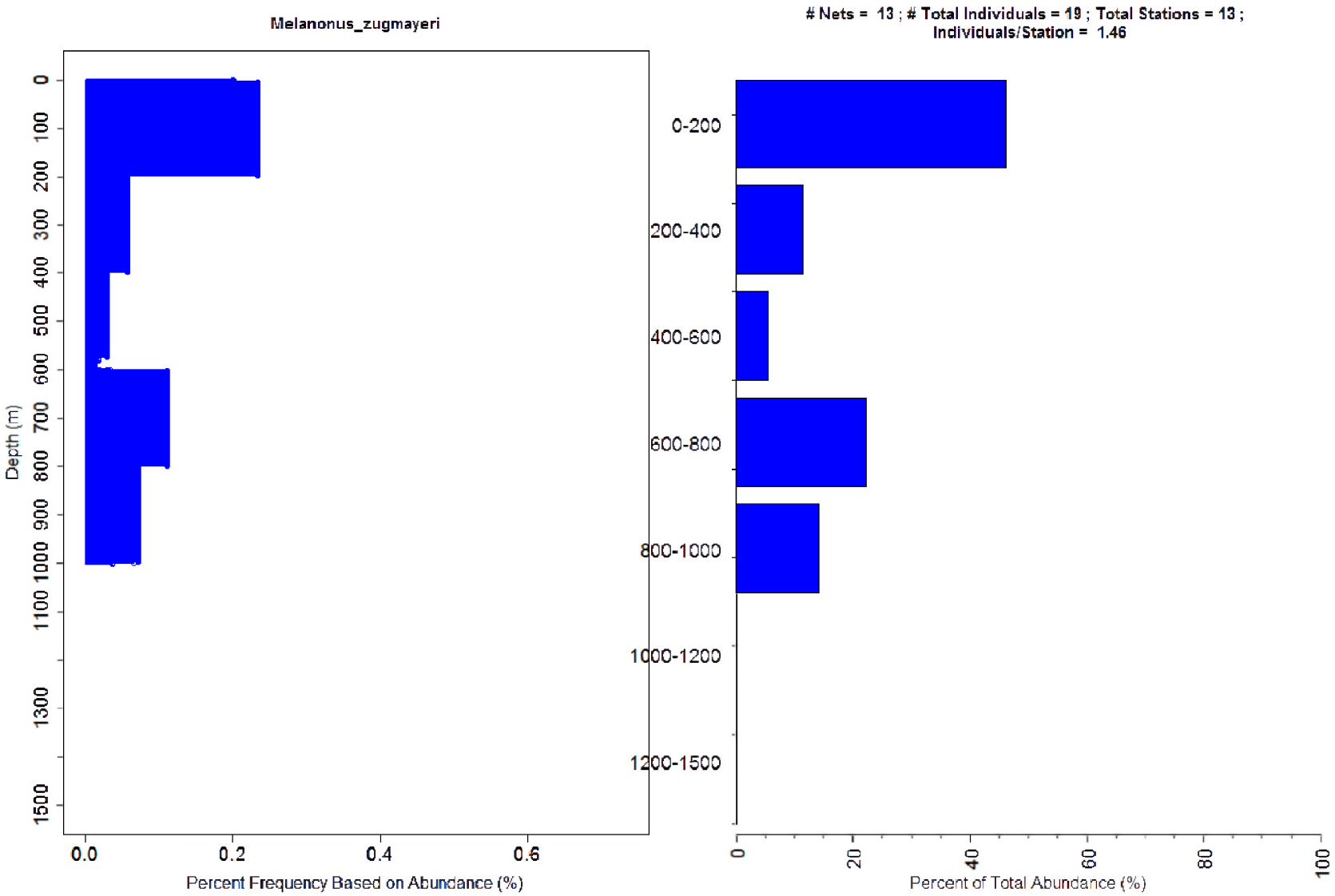
Melamphaes_simus



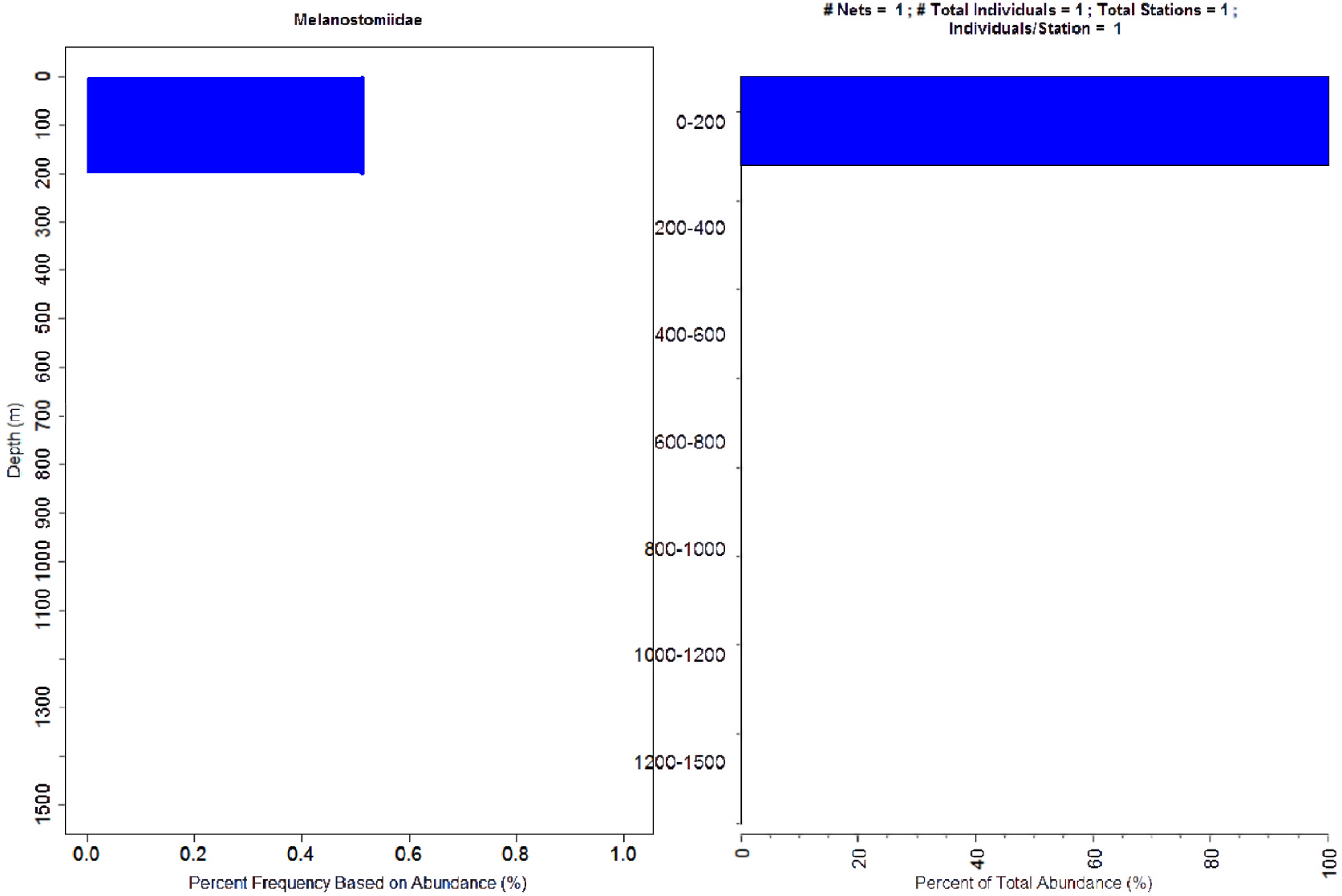
Melamphaidae



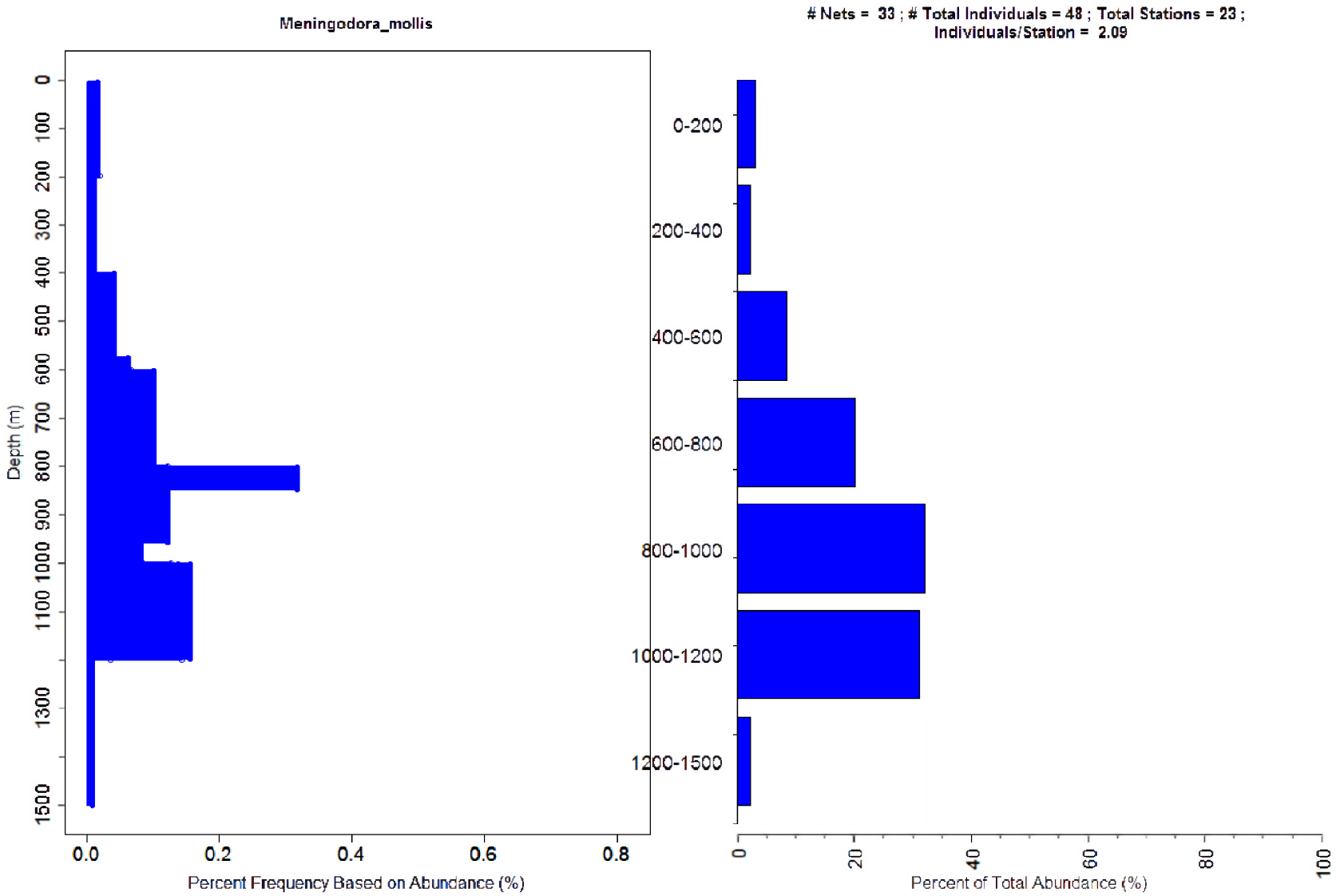
Melanocetidae



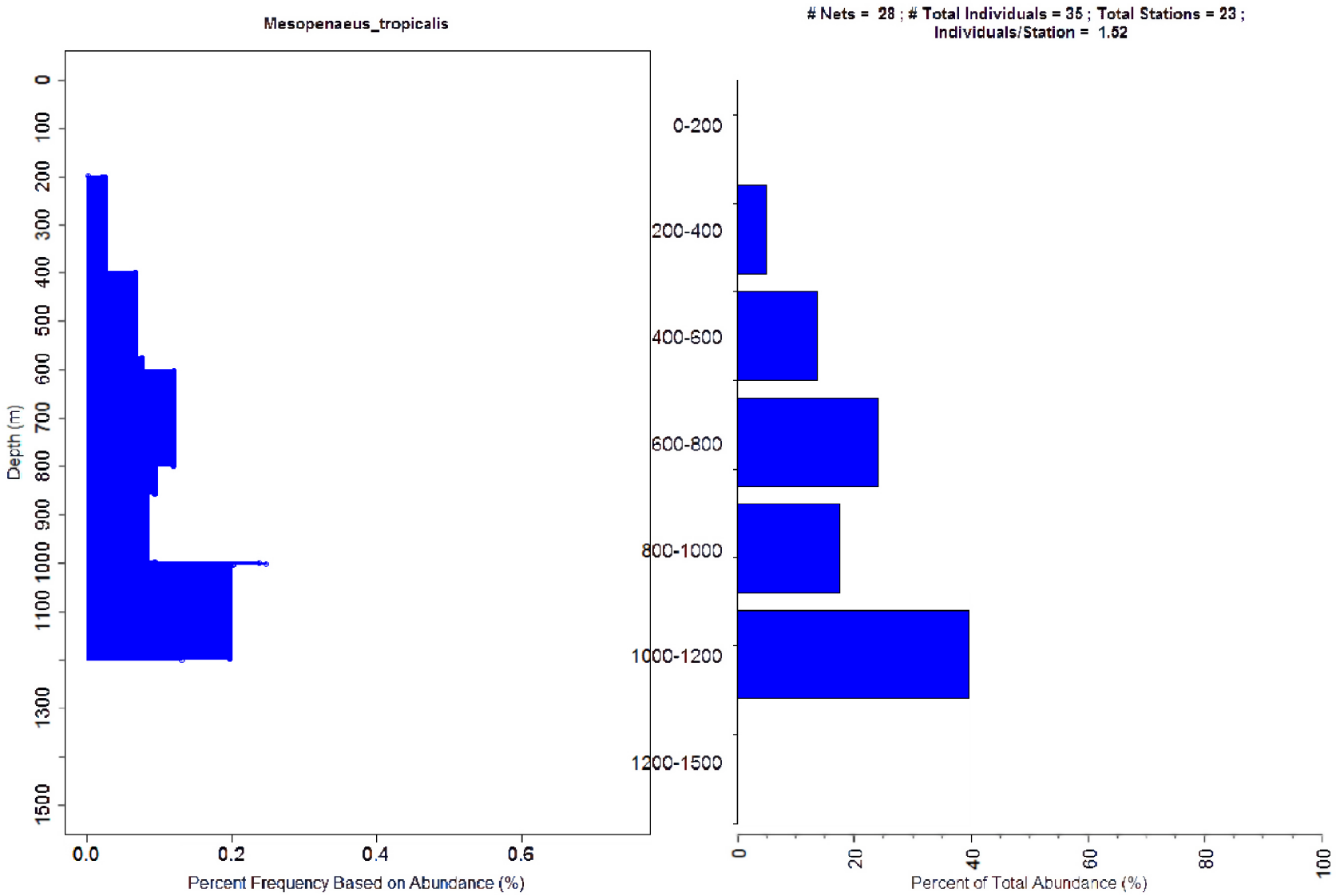
Melanonus_zugmayeri



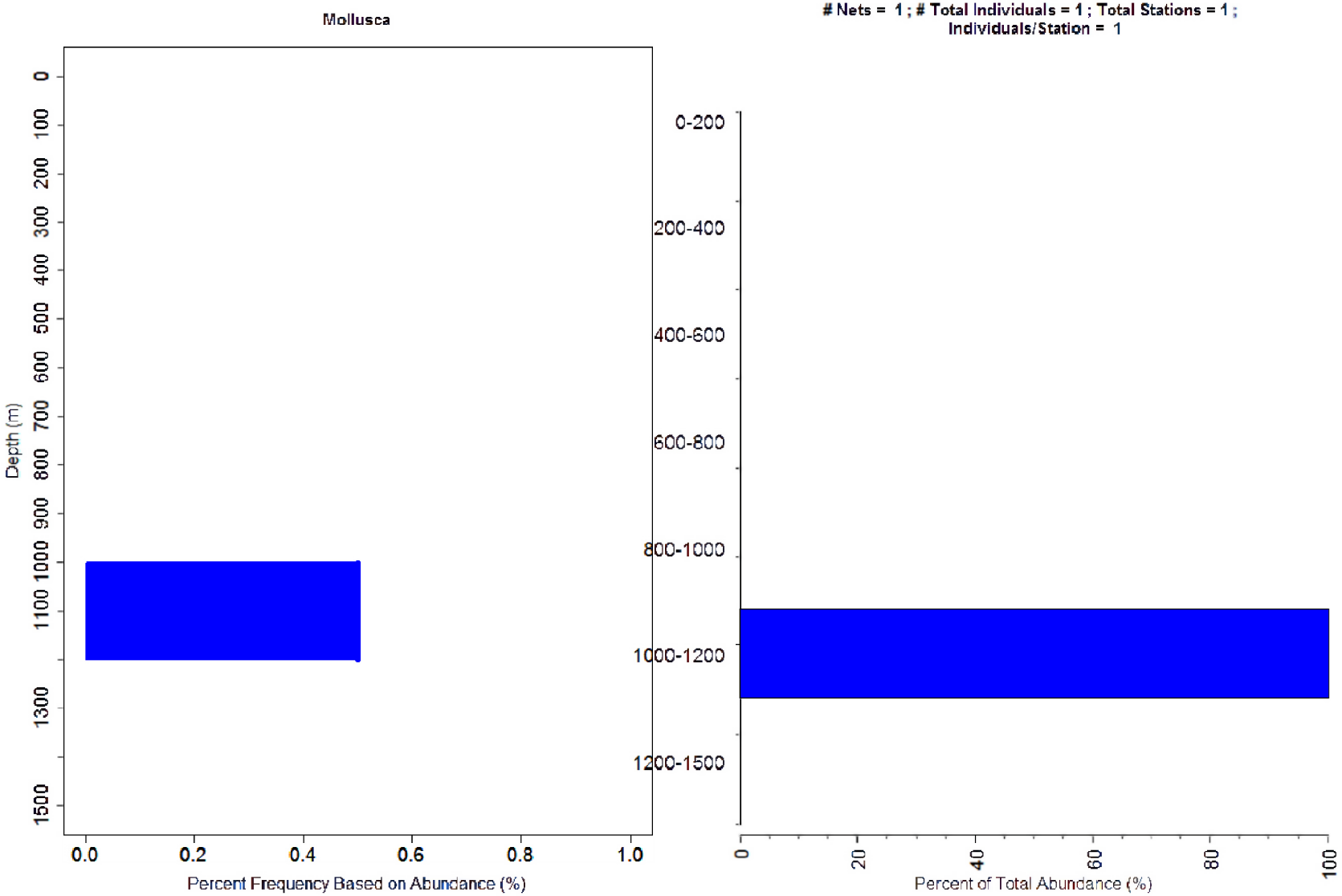
Melanostomiidae



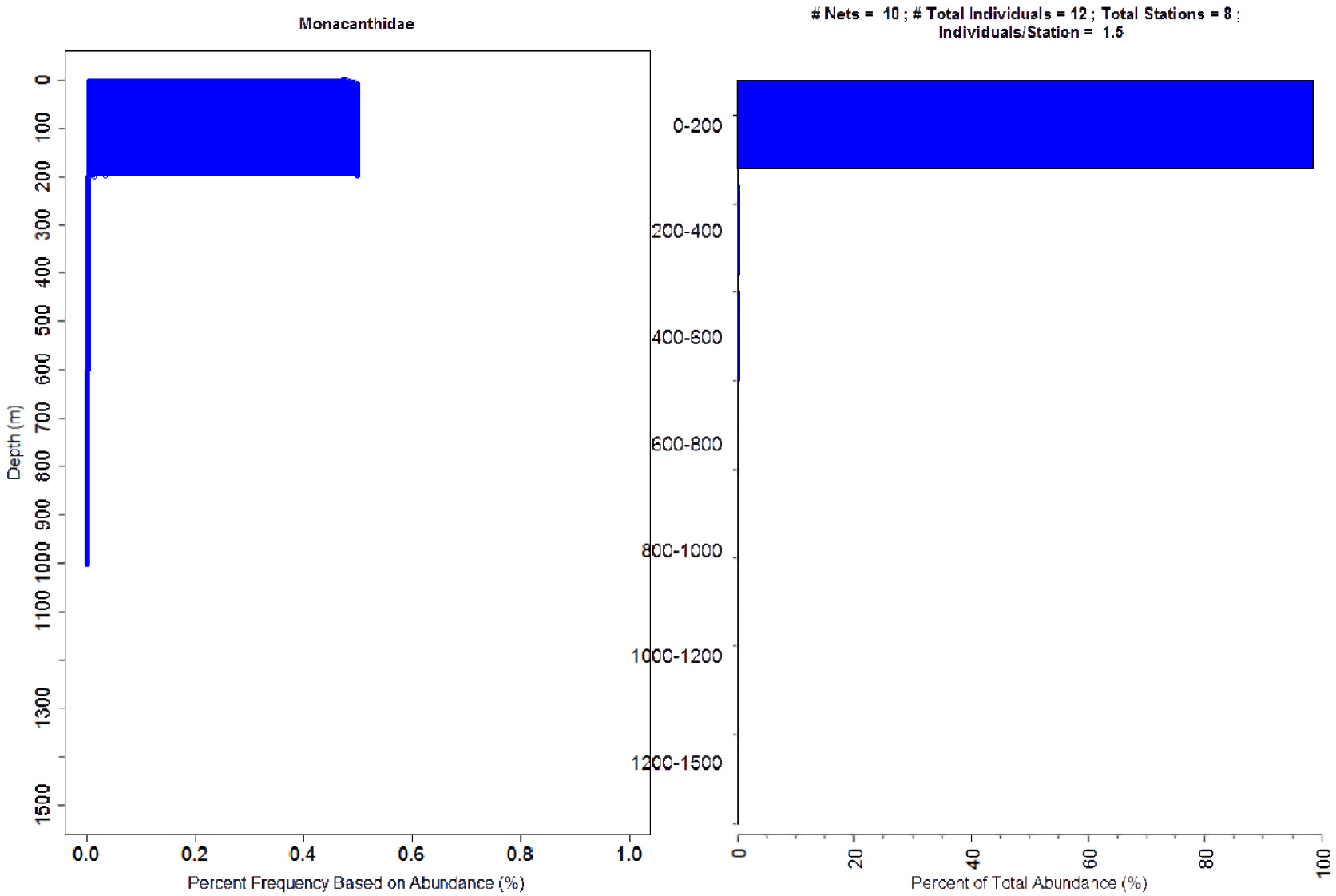
Meningodora_mollis



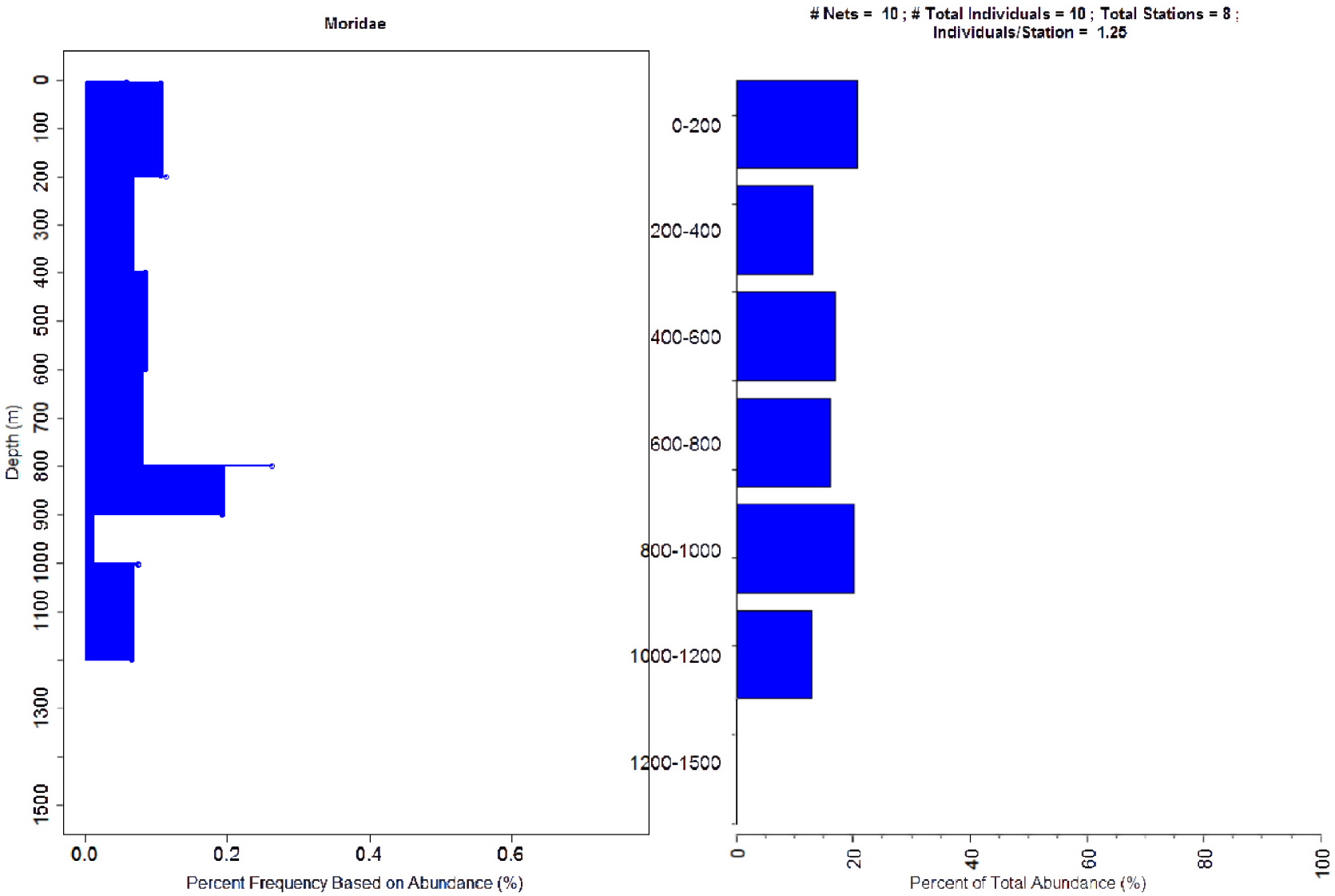
Mesopenaeus_tropicalis


Mollusca
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

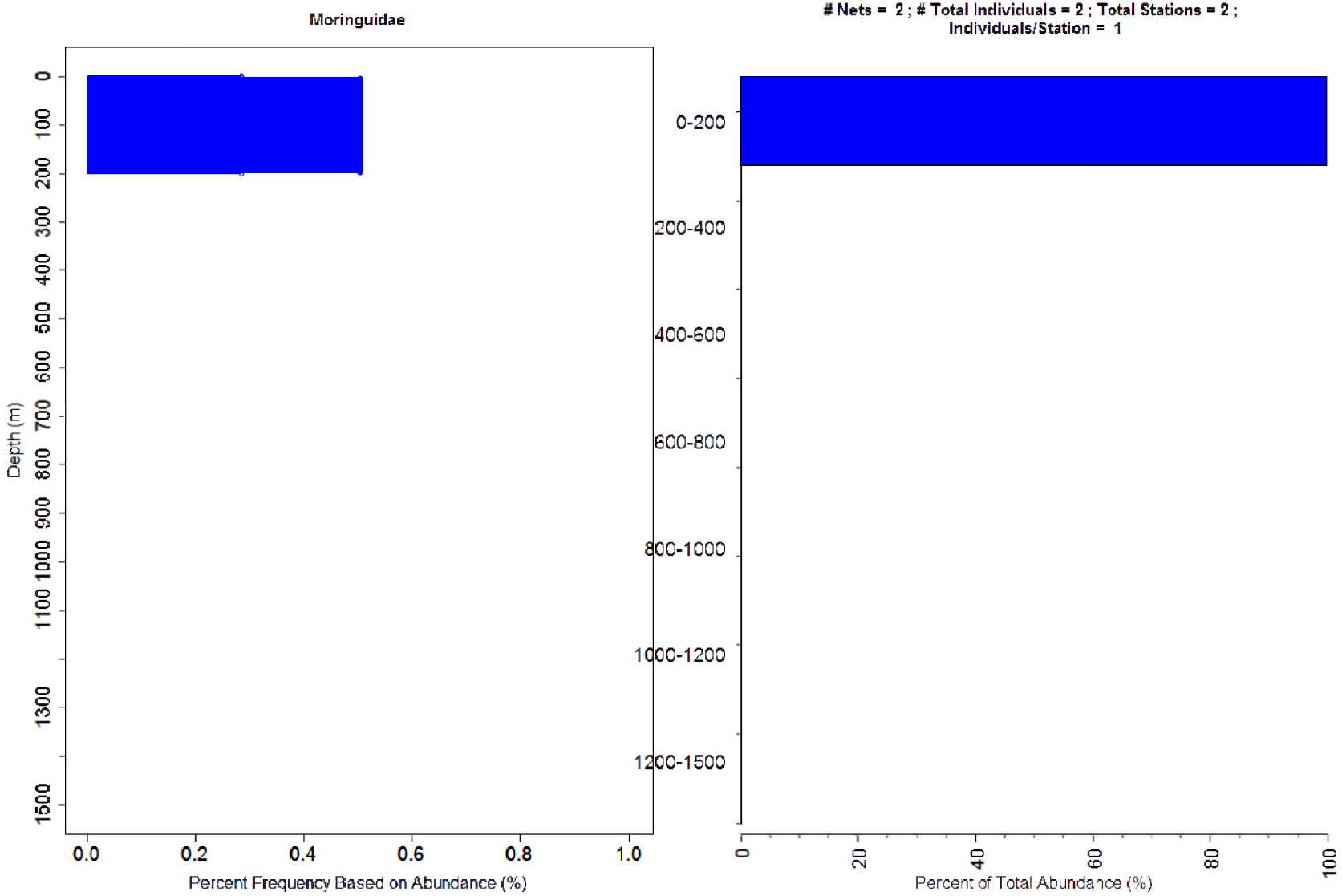
Mollusca



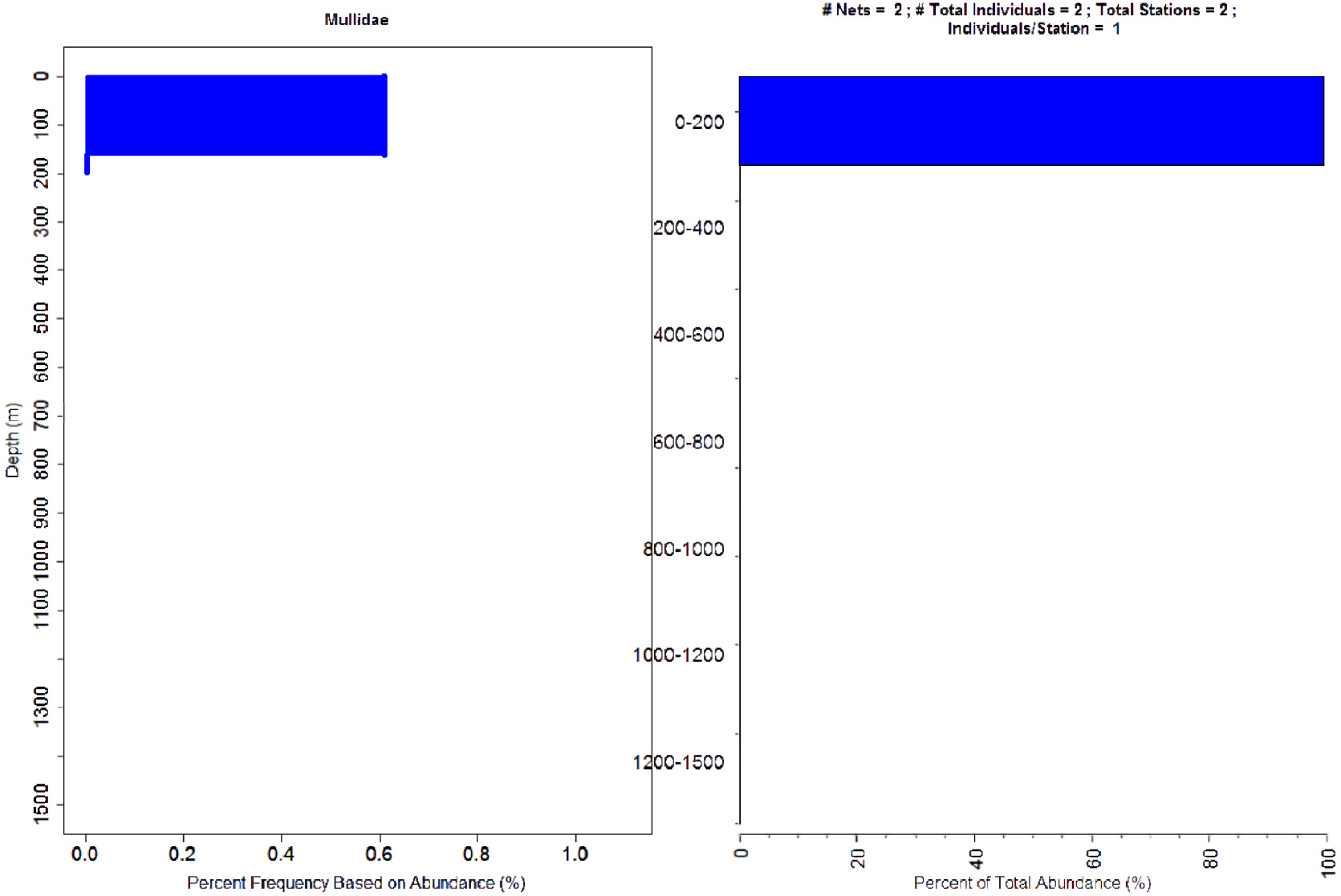
Monacanthidae


Moridae
Nets = 10 ; # Total Individuals = 10 ; Total Stations = 8 ;
Individuals/Station = 1.25
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

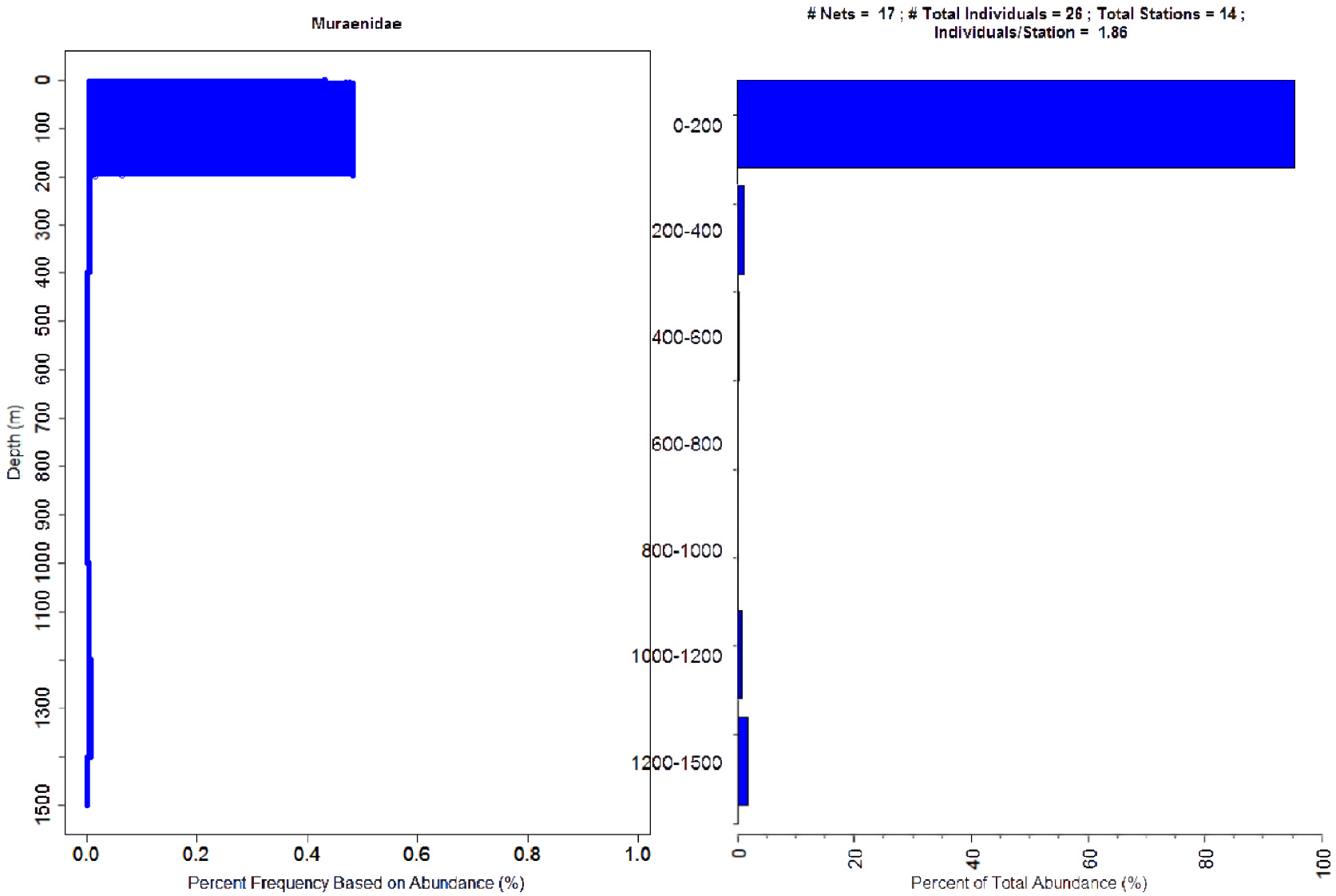
Moridae



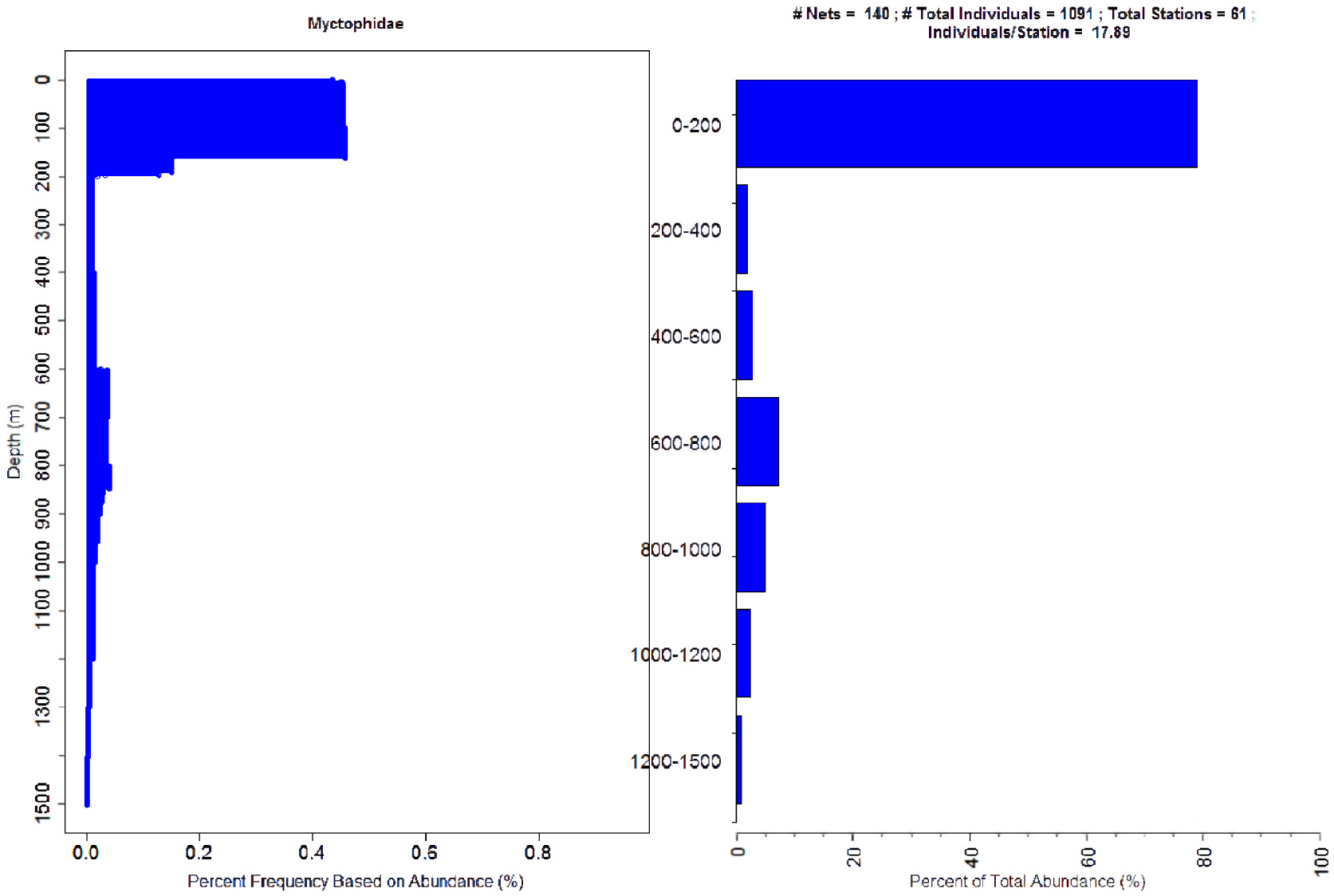
Moringuidae


Mullidae
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

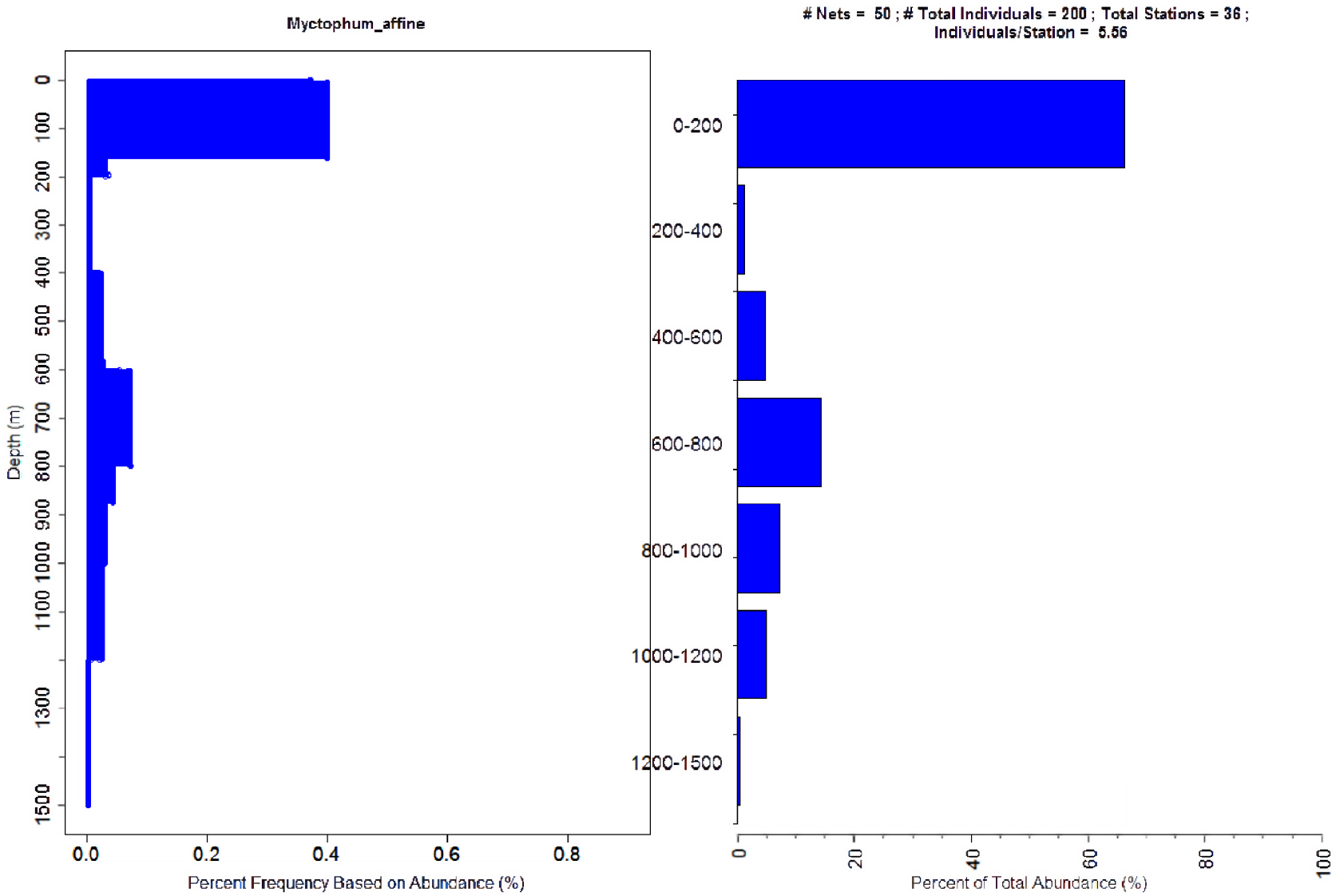
Mullidae


Muraenidae
Nets = 17 ; # Total Individuals = 26 ; Total Stations = 14 ;
Individuals/Station = 1.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

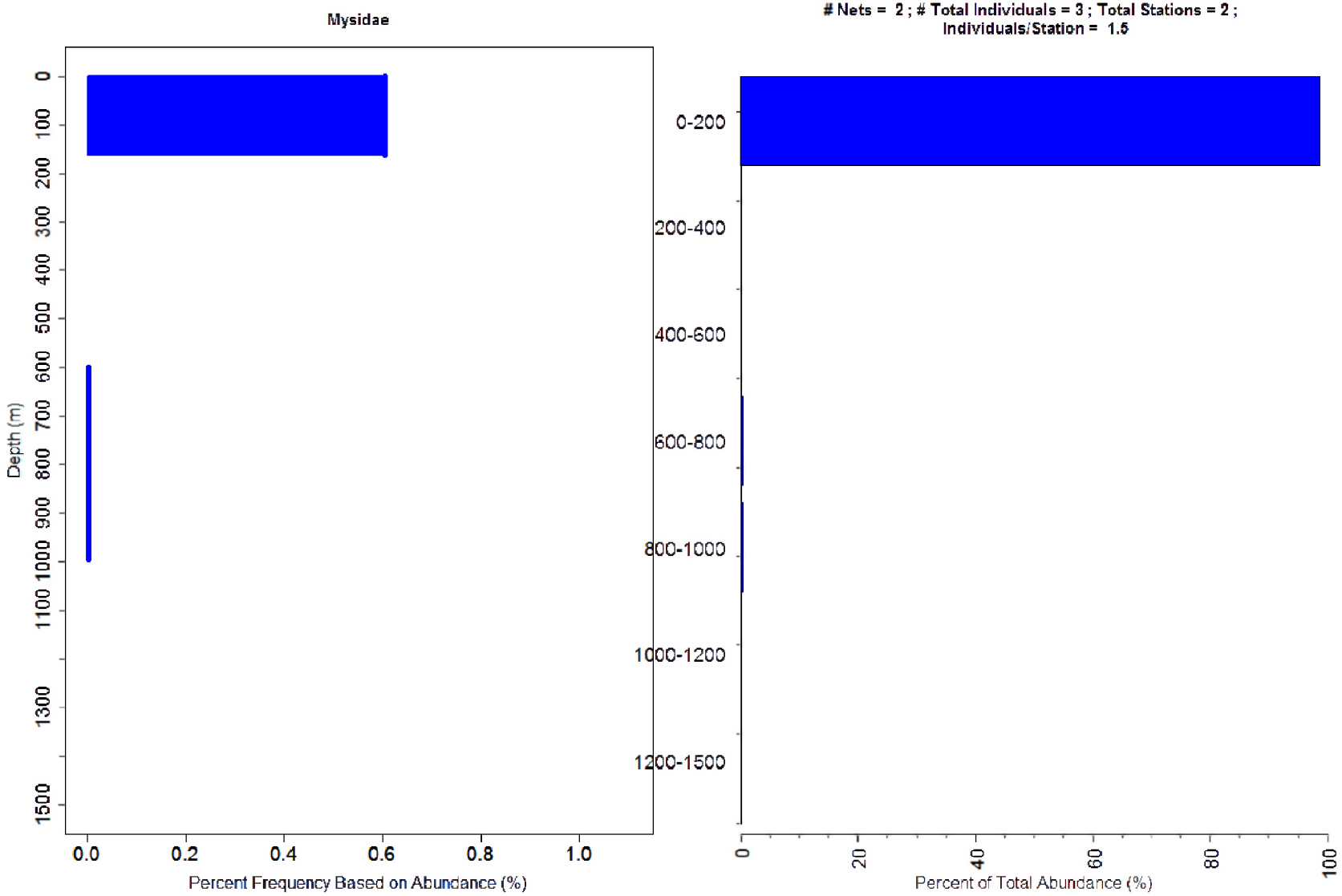
Muraenidae



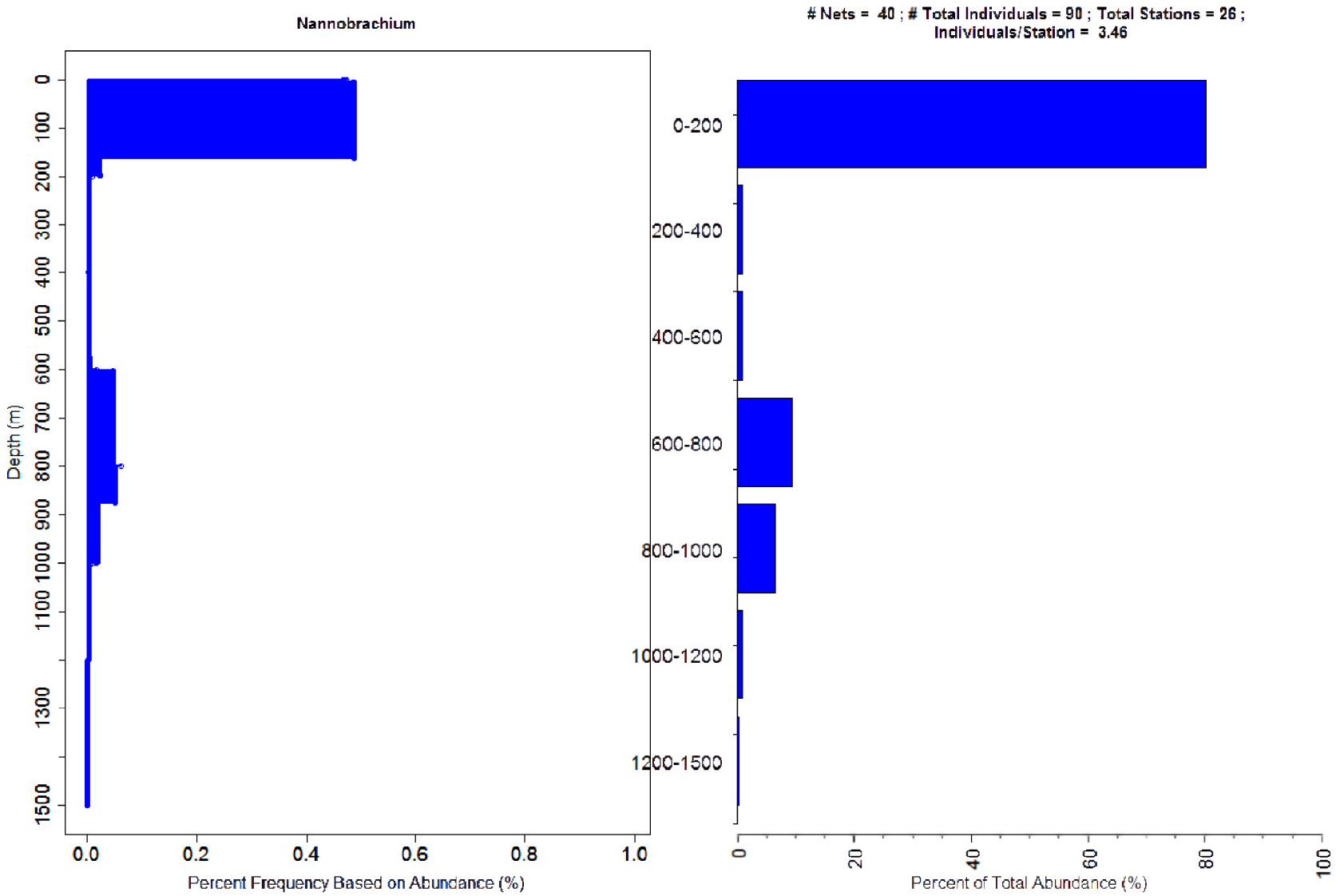
Myctophidae



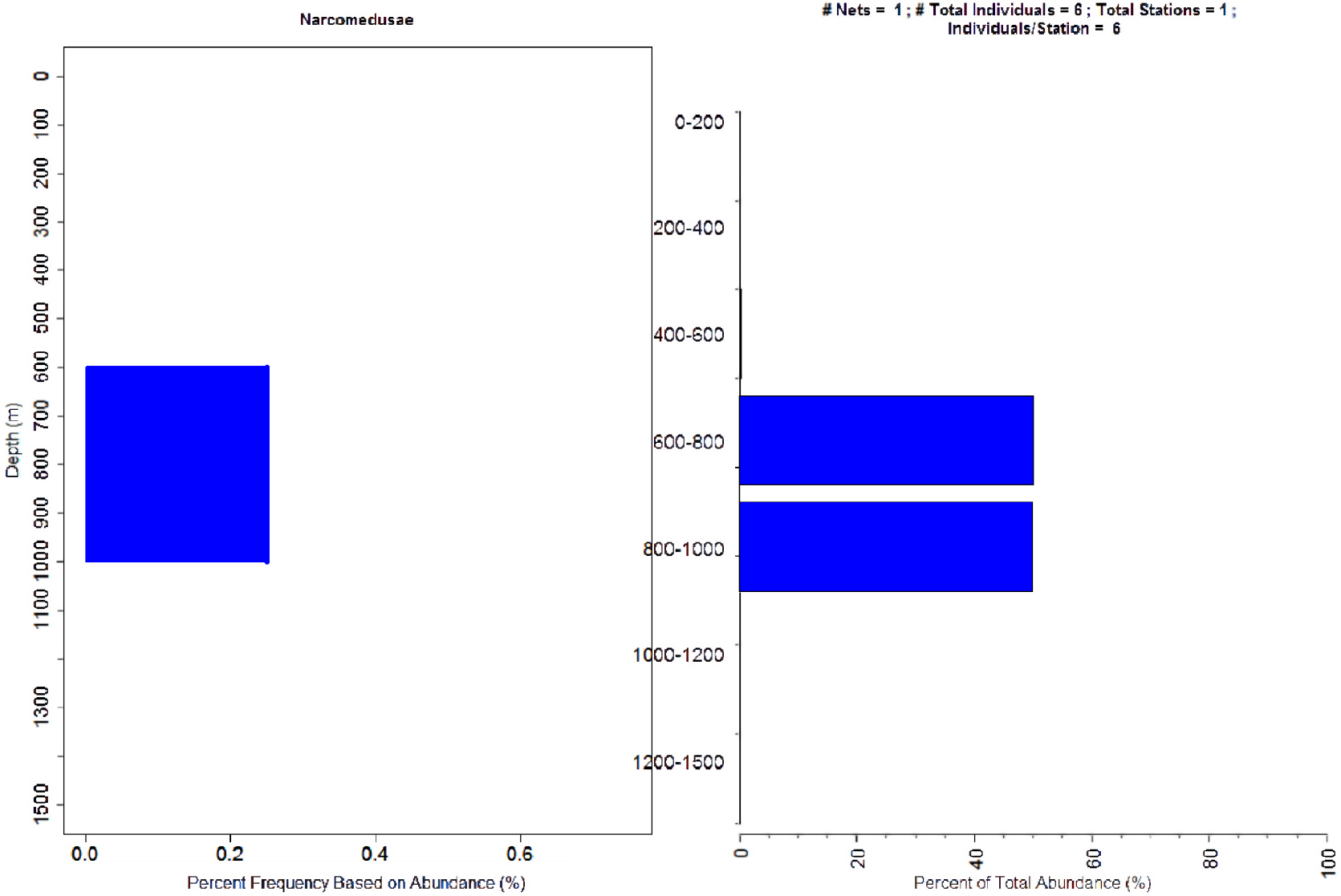
Myctophum_affine


Mysidae
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

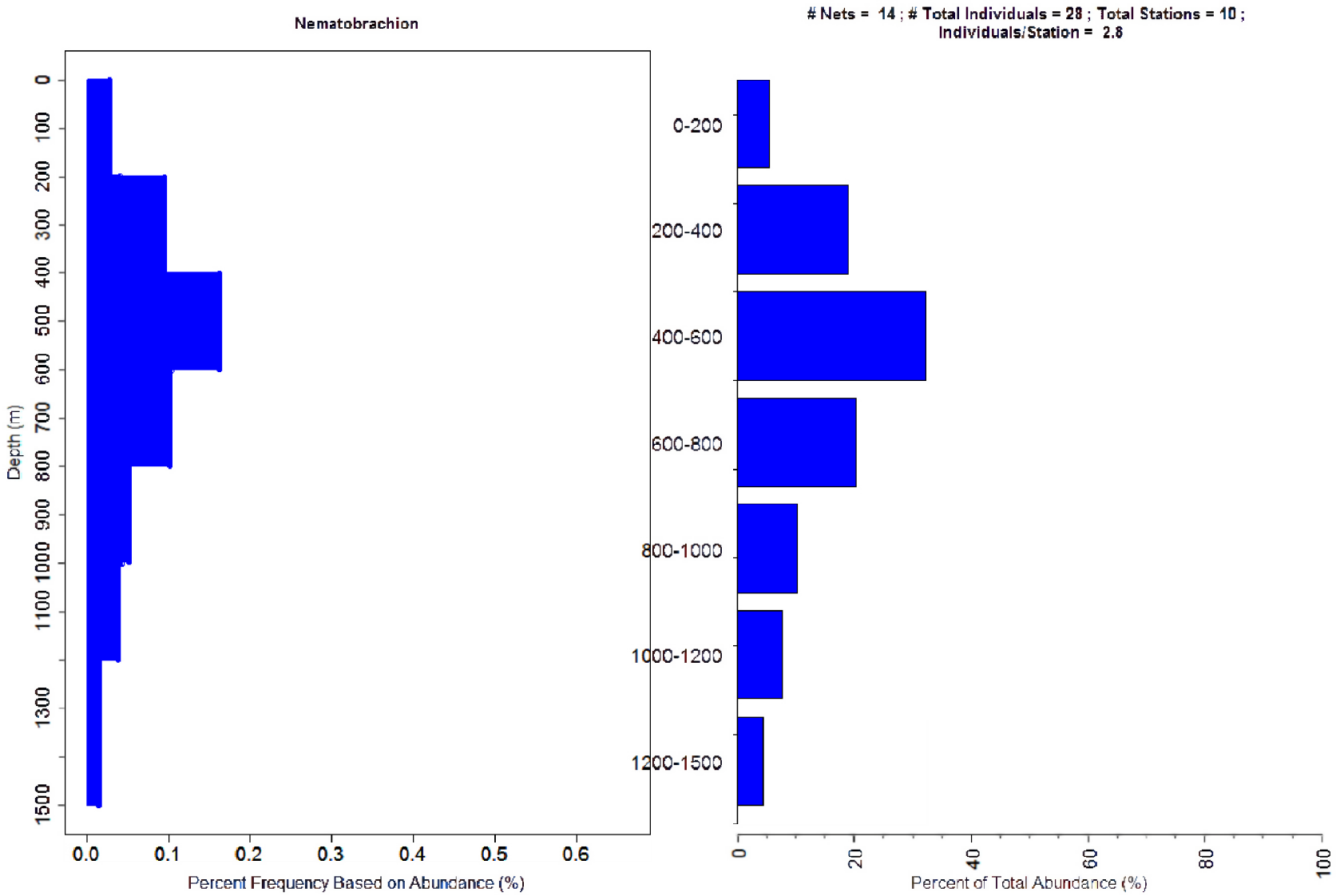
Mysidae



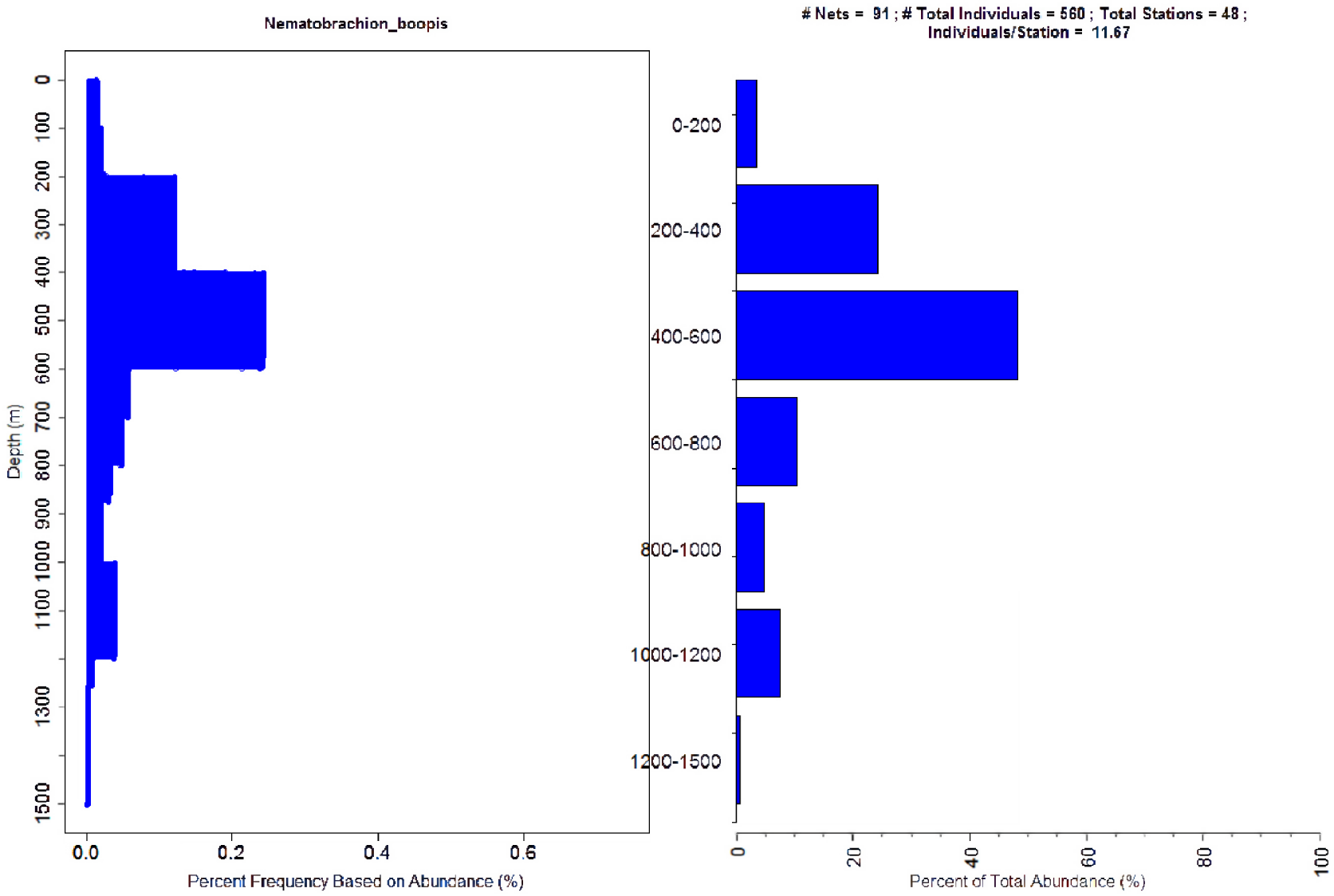
Nannobrachium



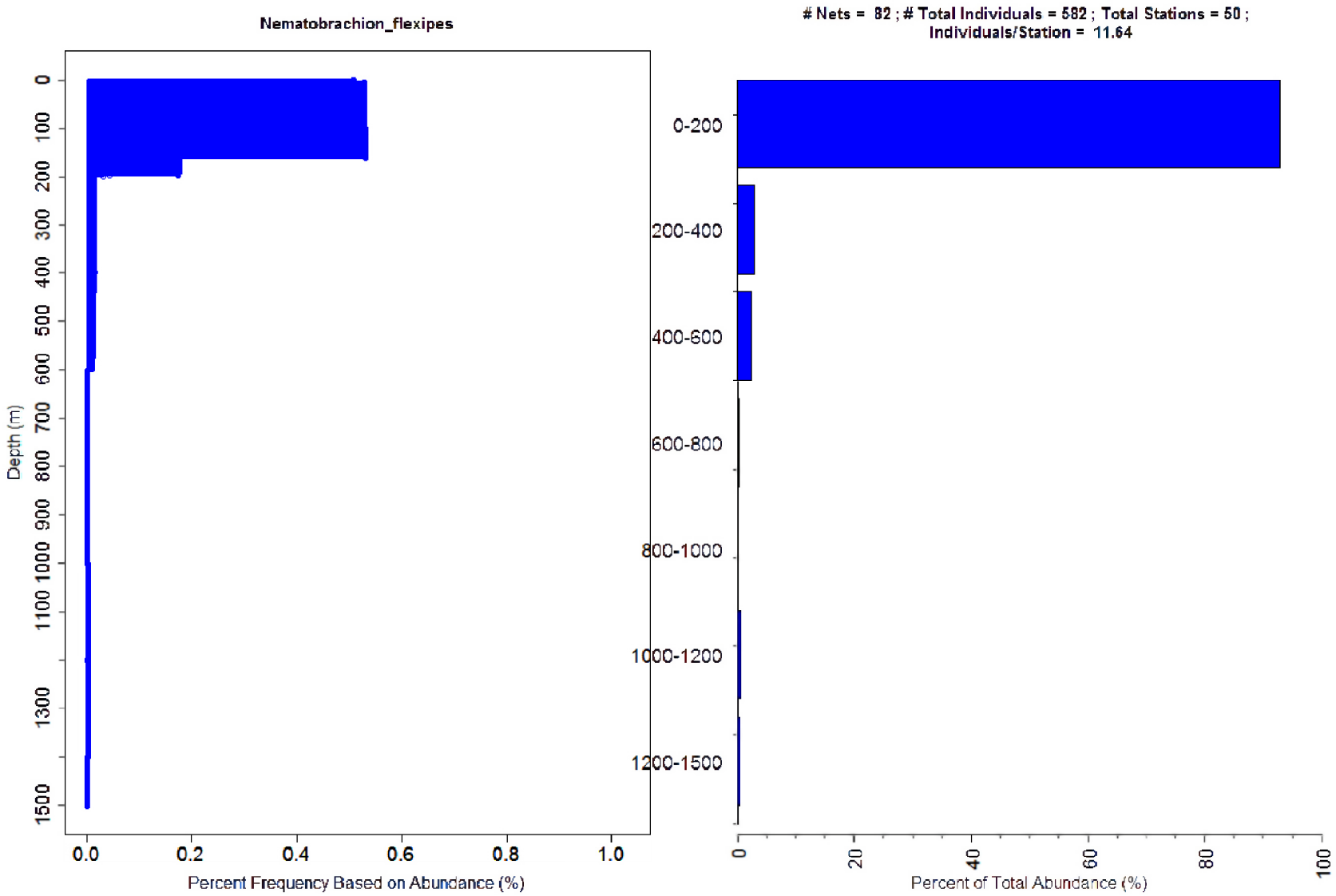
Narcomedusae



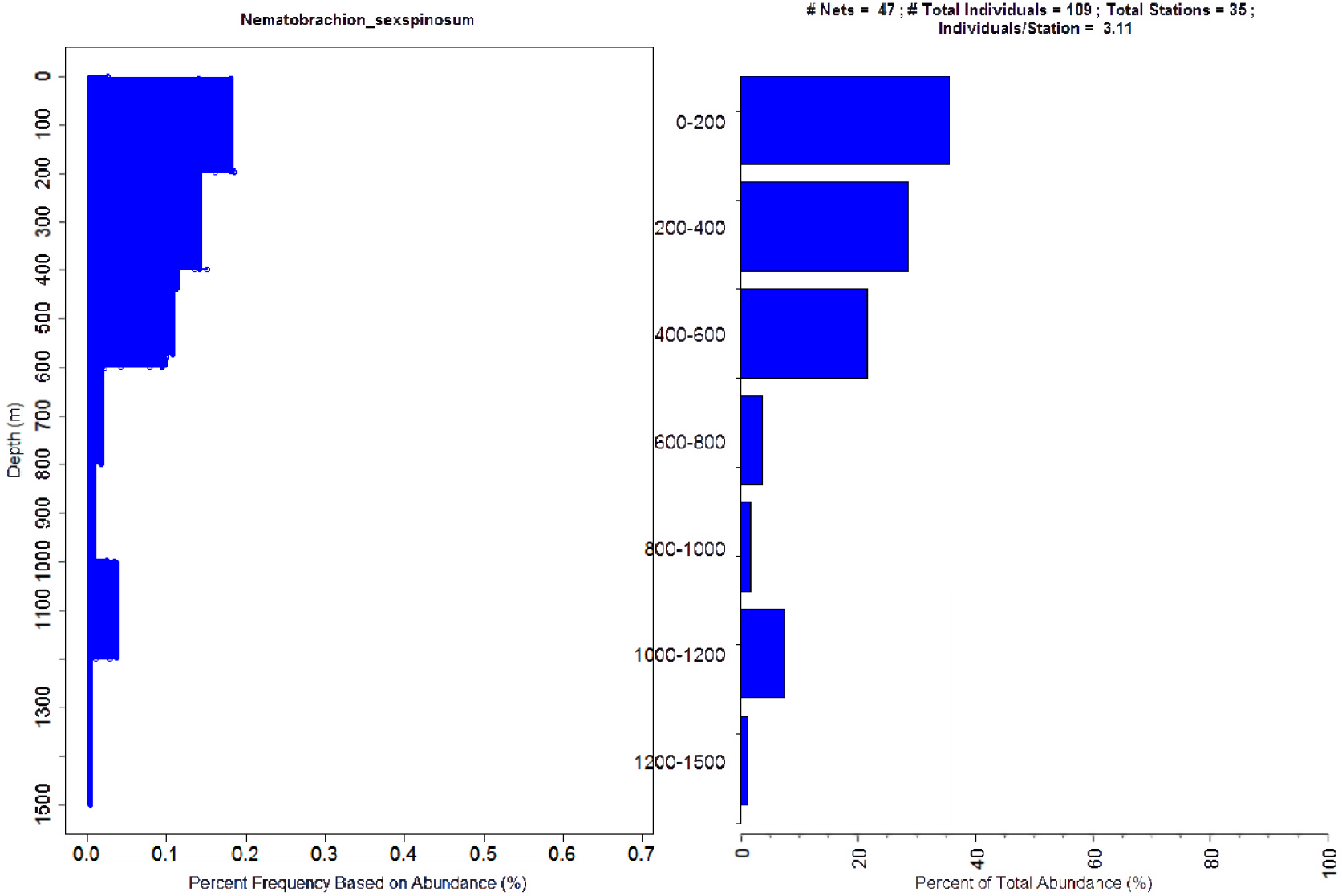
Nematobrachion



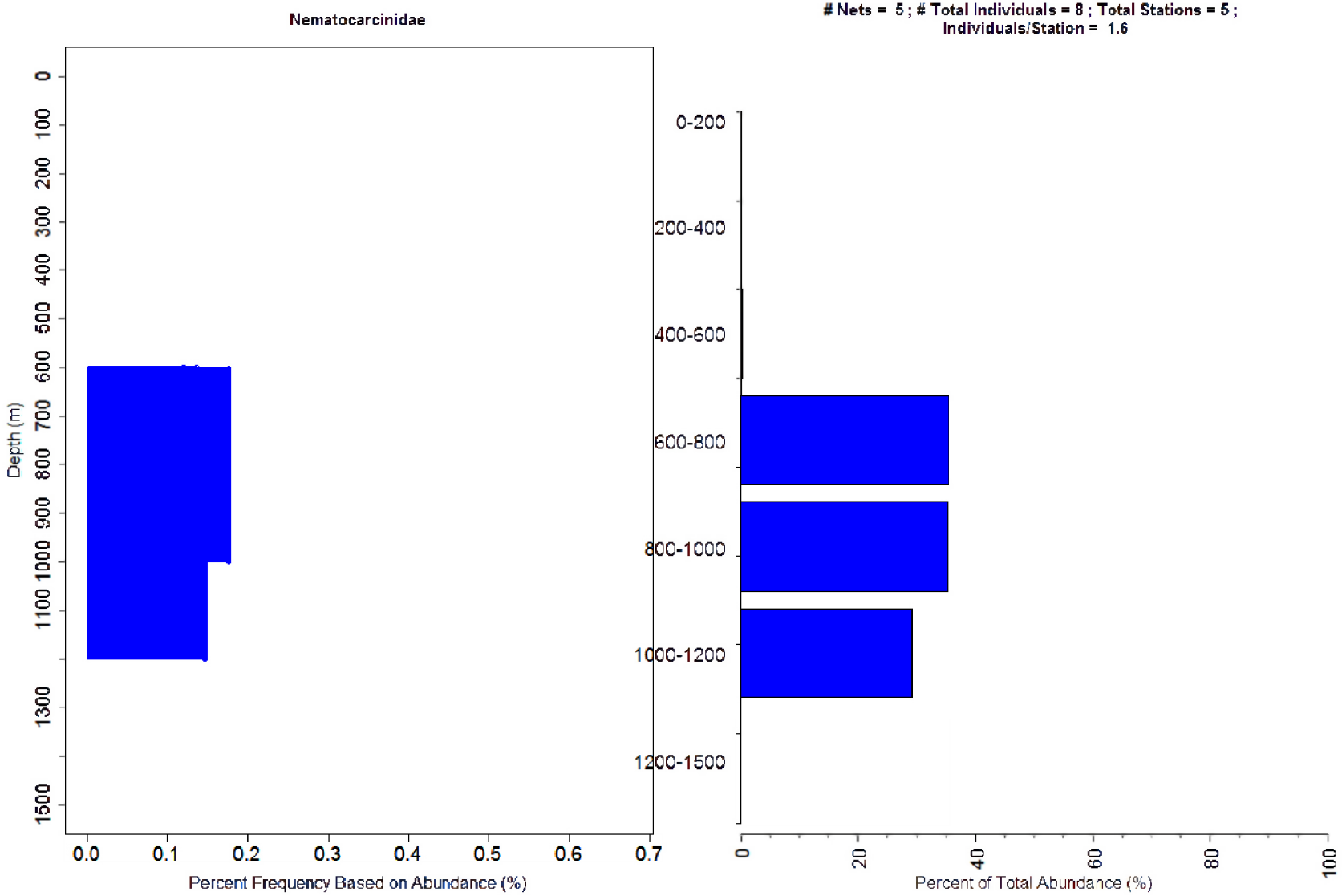
Nematobrachion_boopis



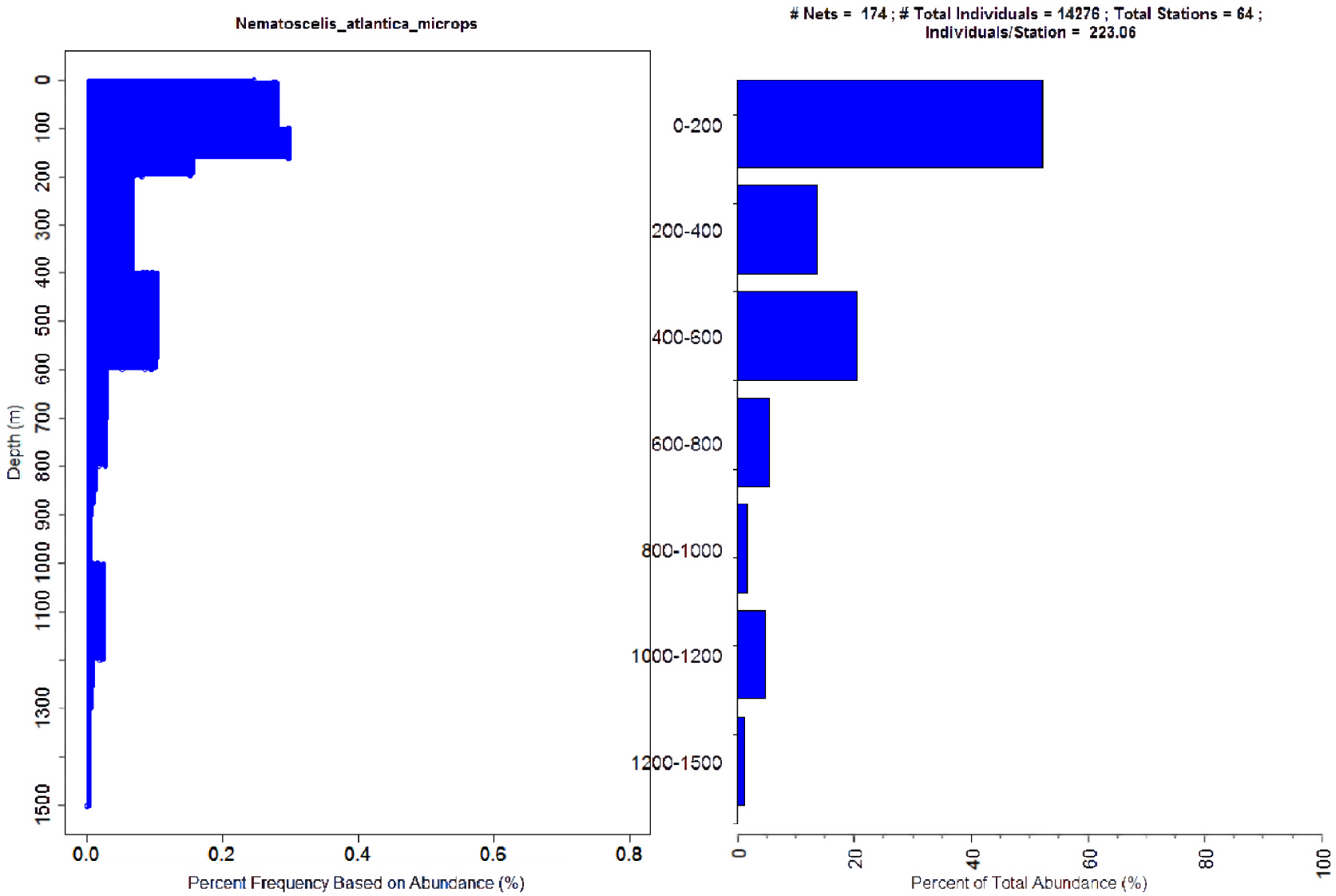
Nematobrachion_flexipes



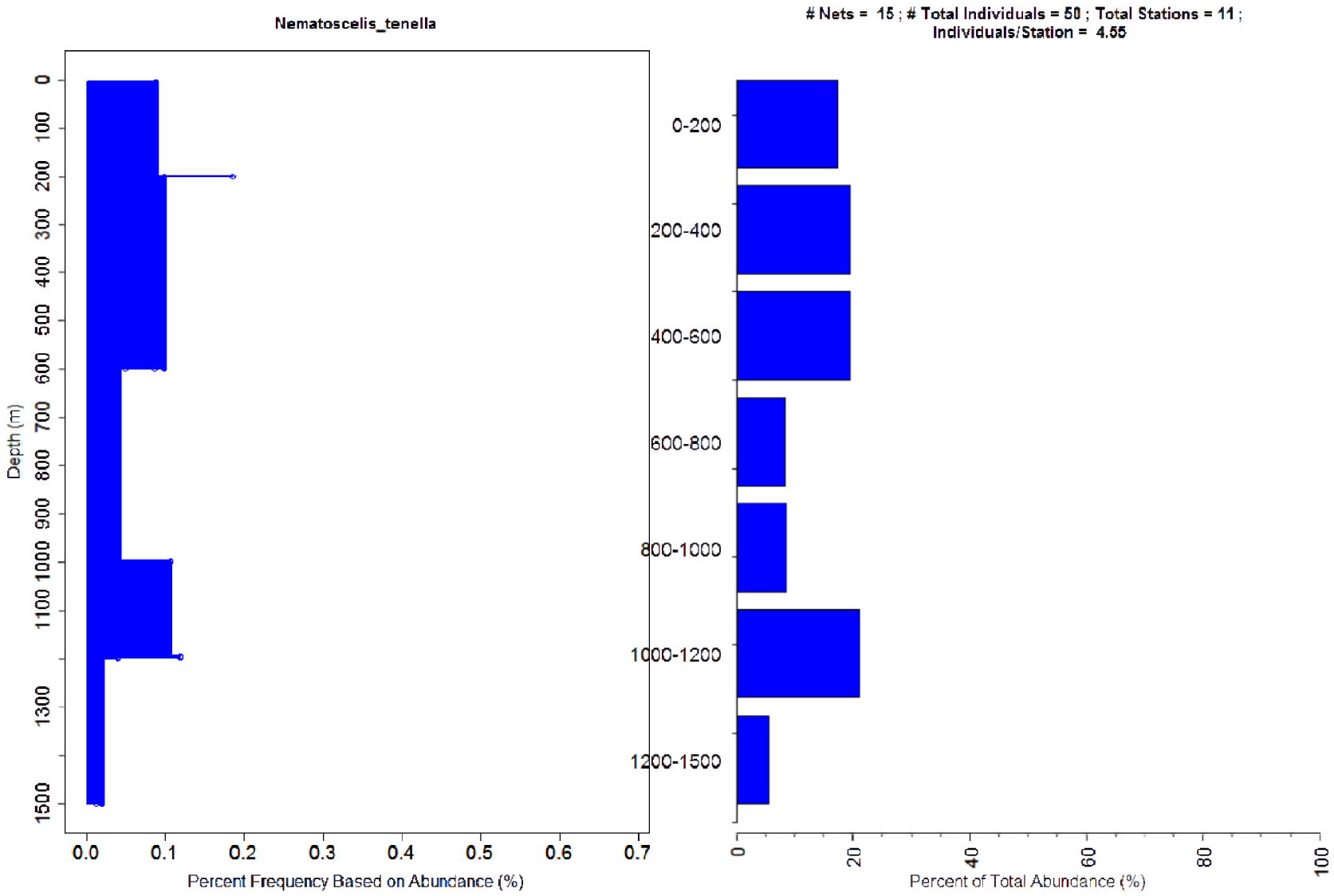
Nematobrachion_sexspinosum



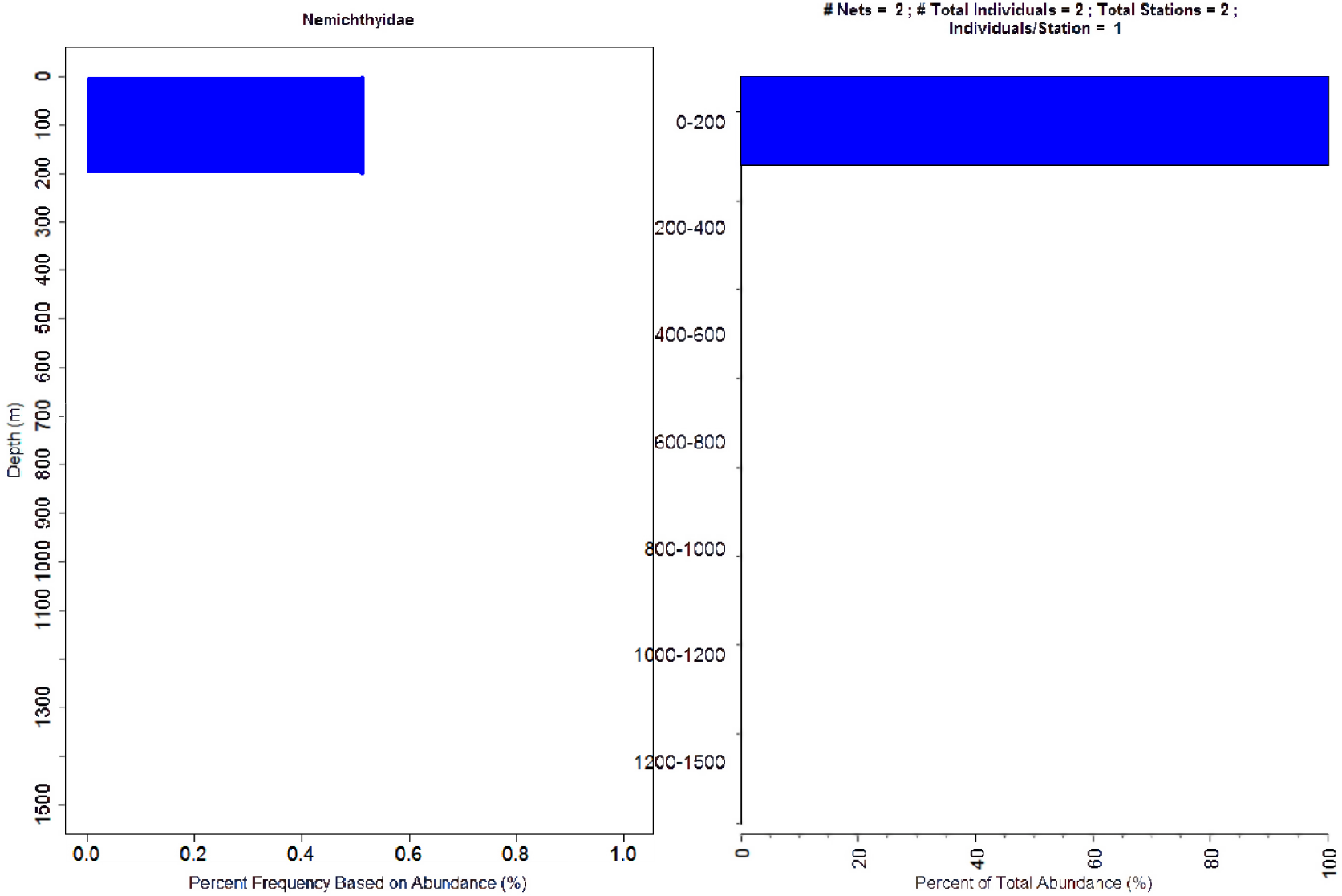
Nematocarcinidae



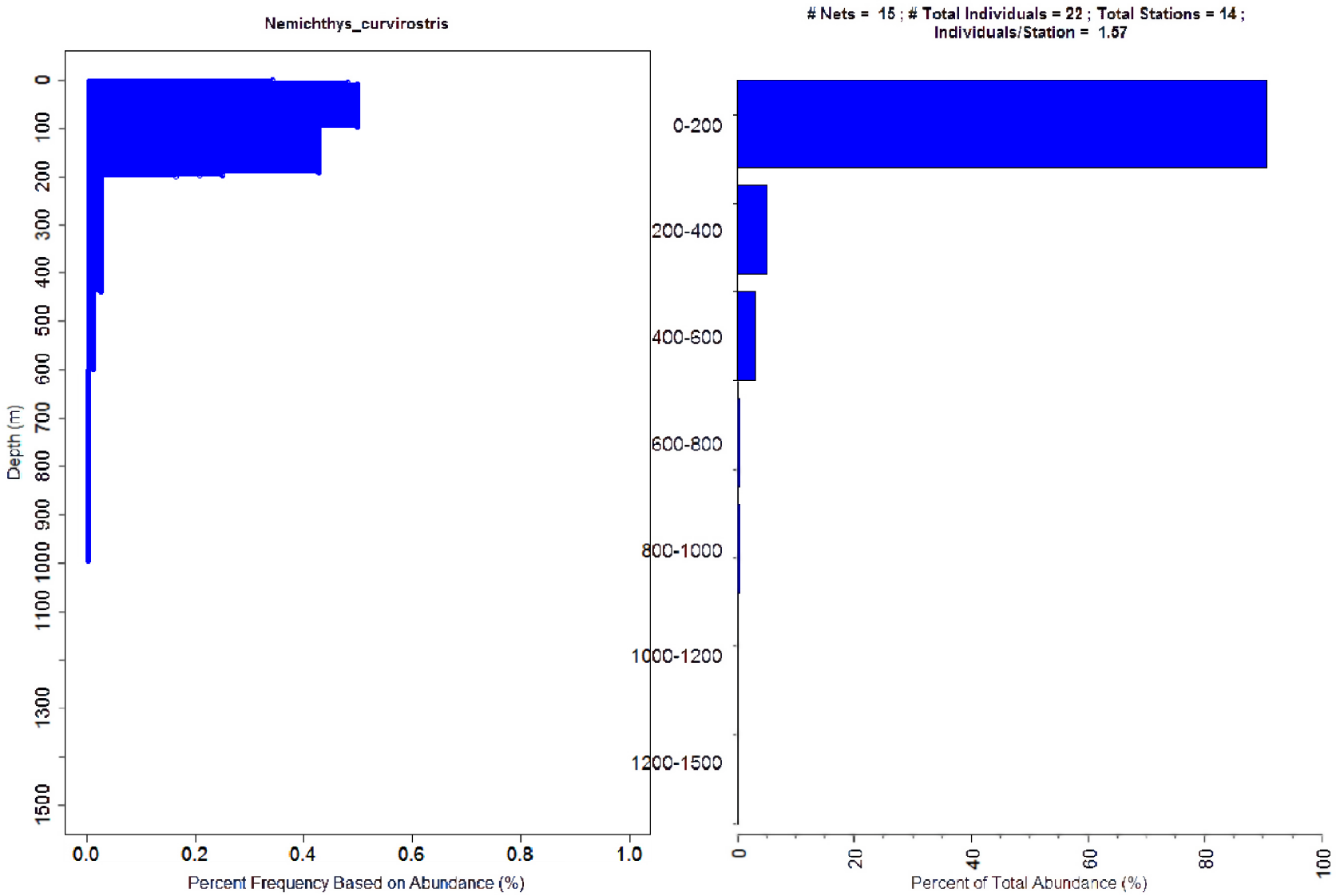
Nematoscelis_atlantica_microps



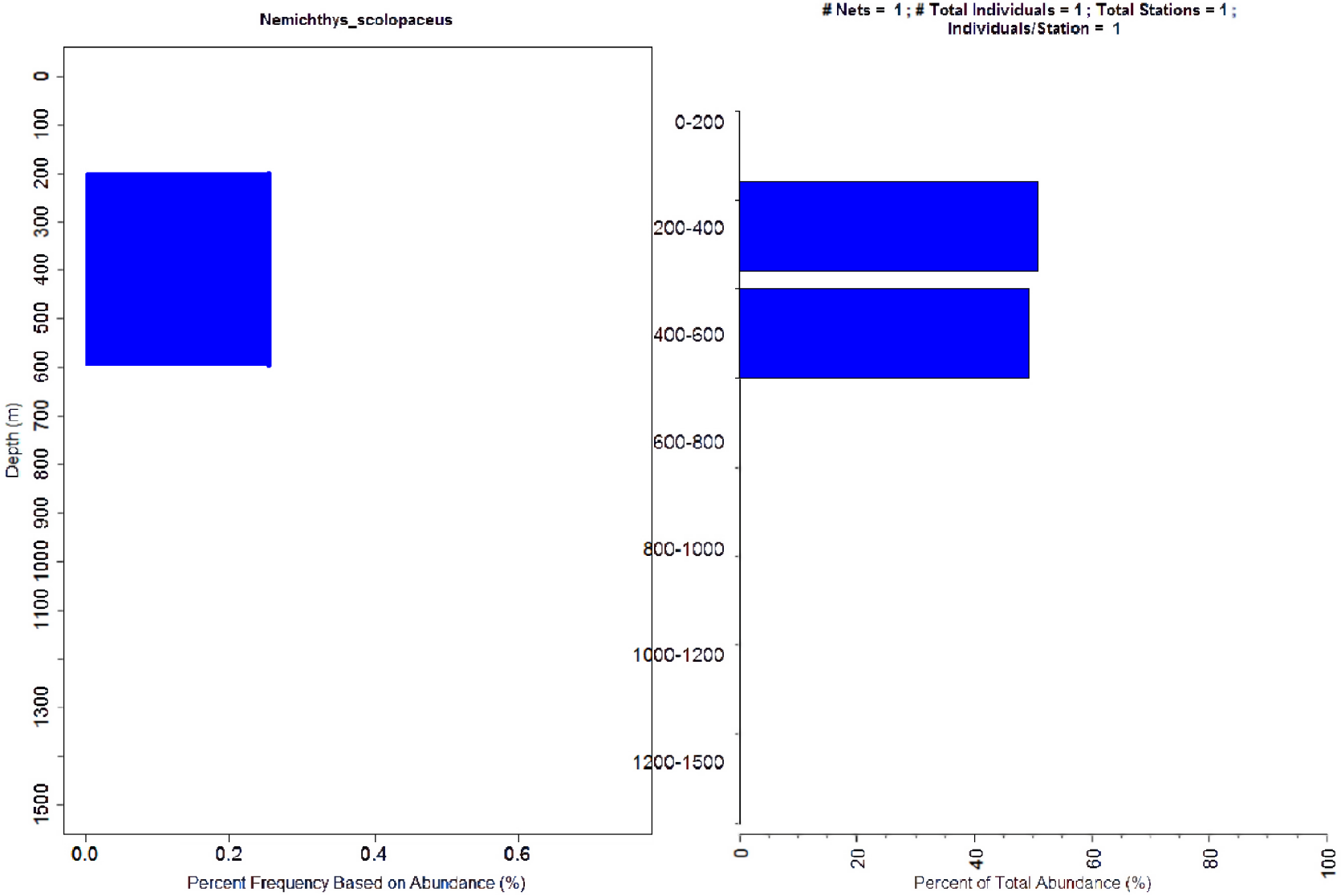
Nematoscelis_tenella



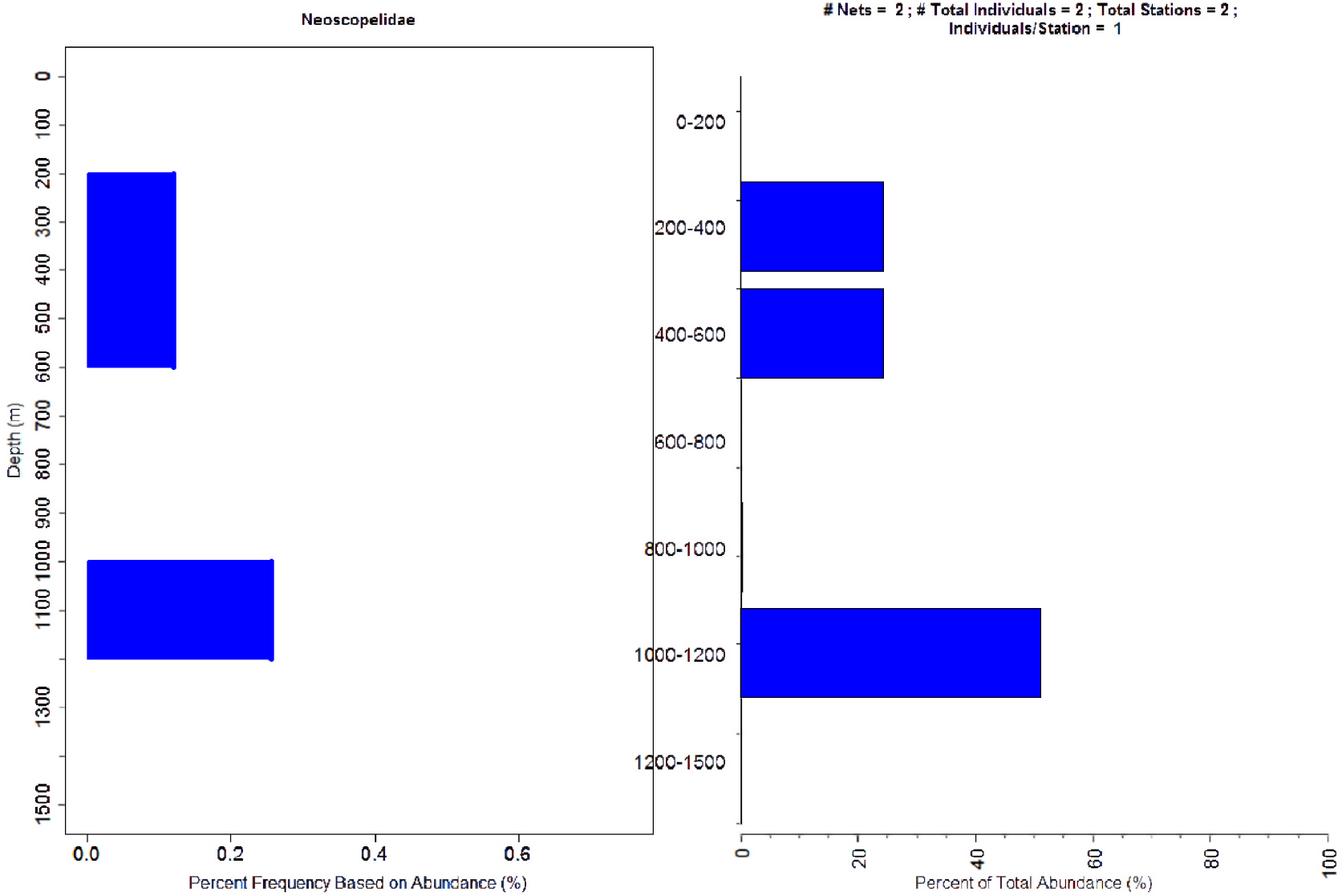
Nemichthyidae



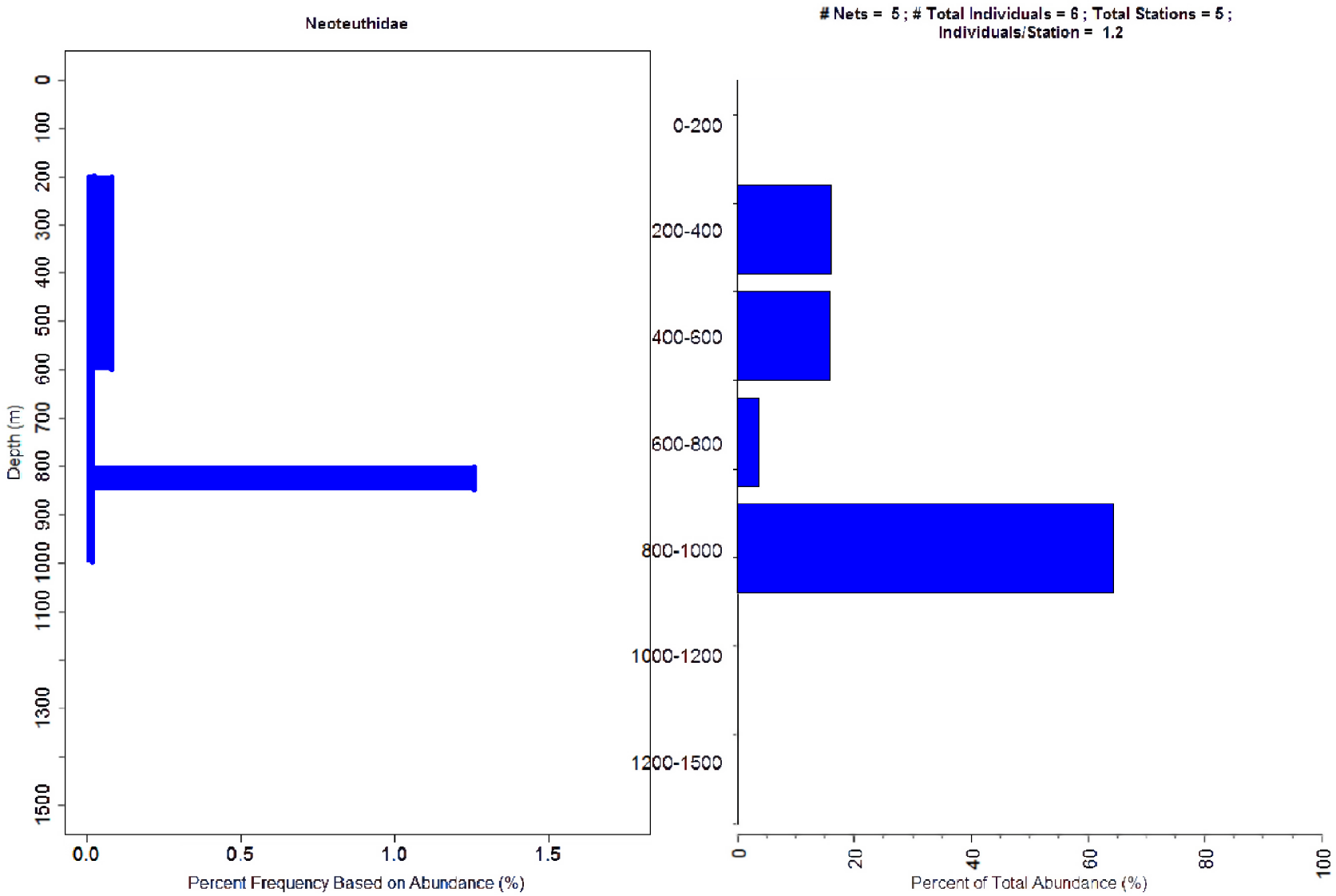
Nemichthys_curvirostris



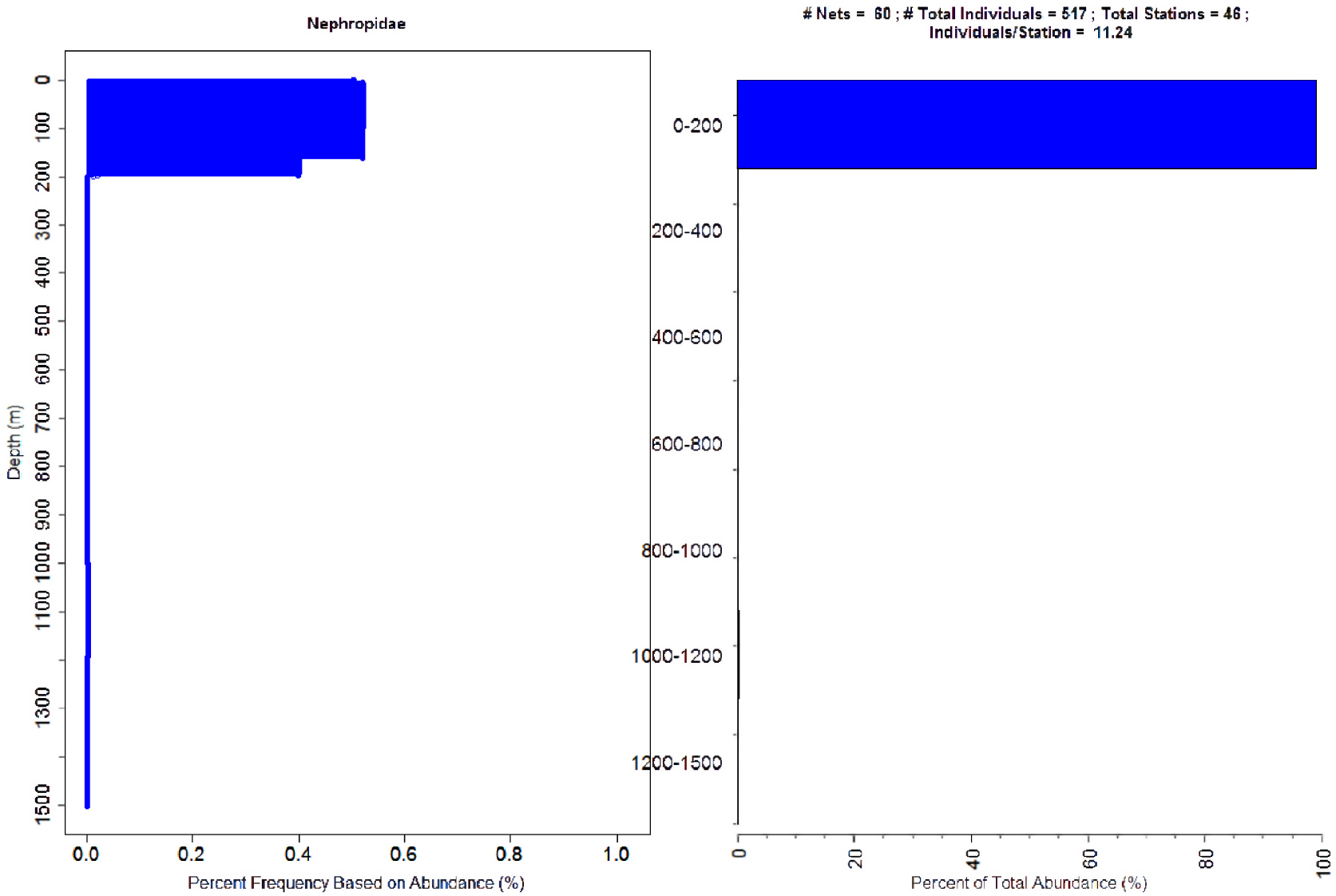
Nemichthys_scolopaceus



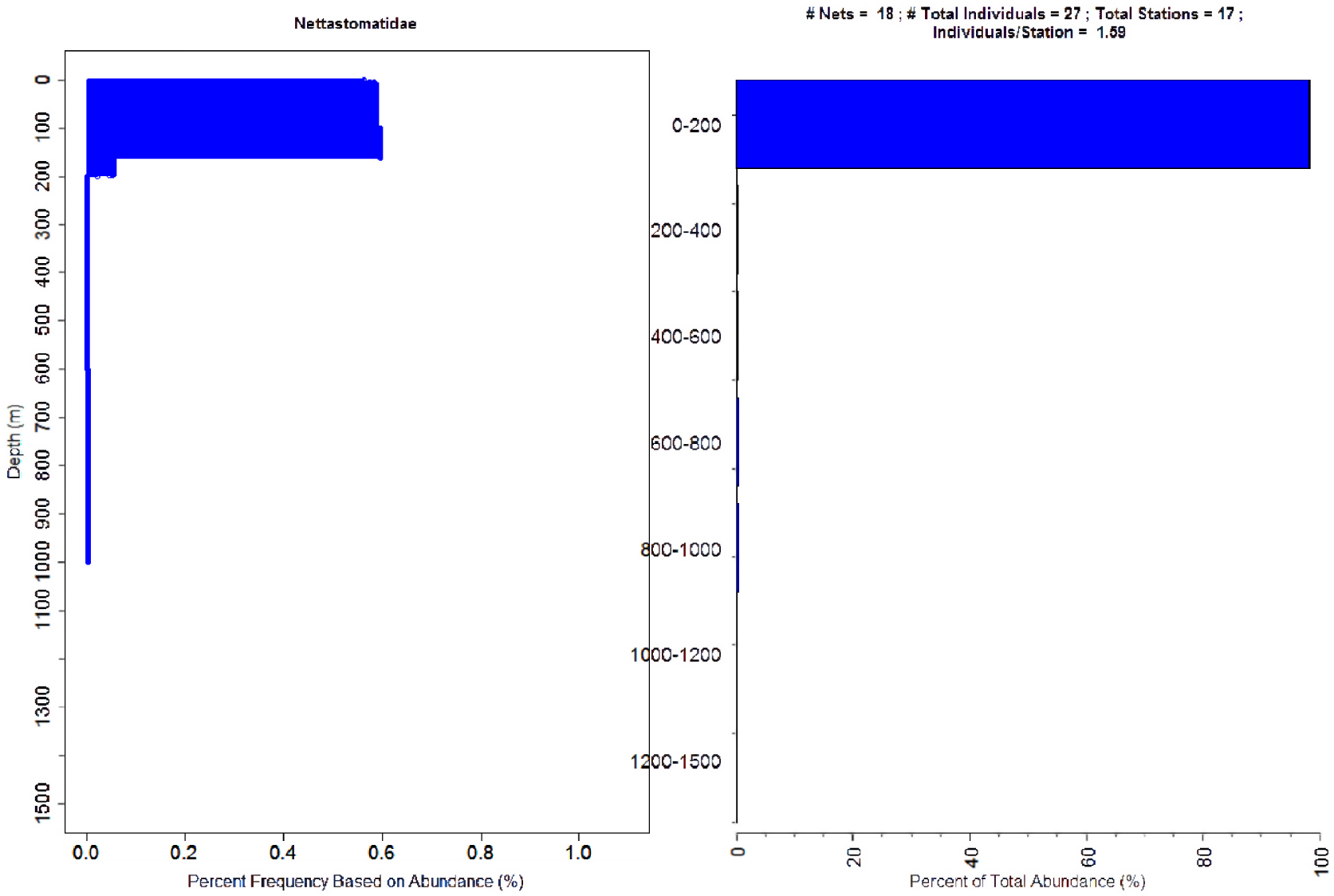
Neoscopelidae



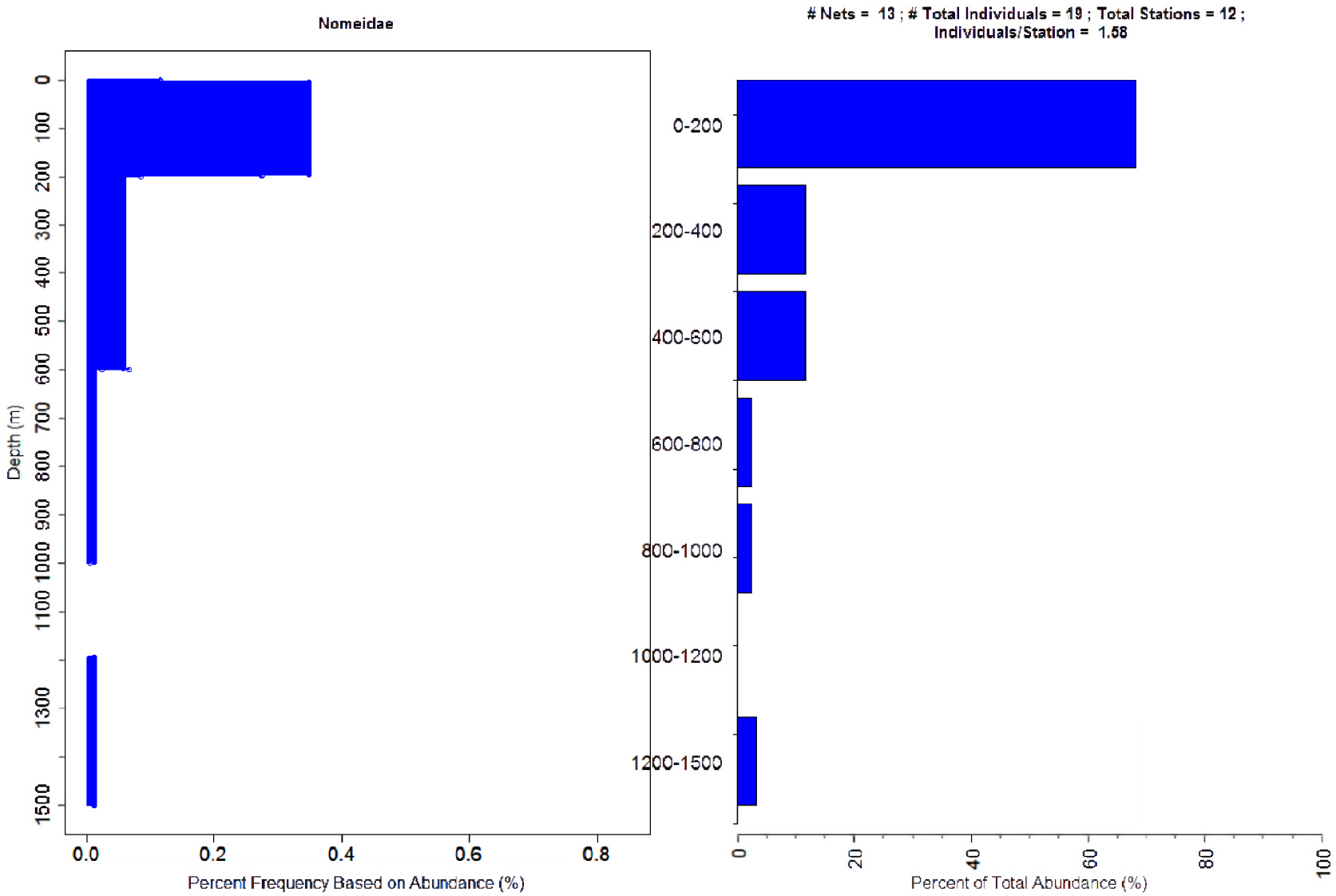
Neoteuthidae



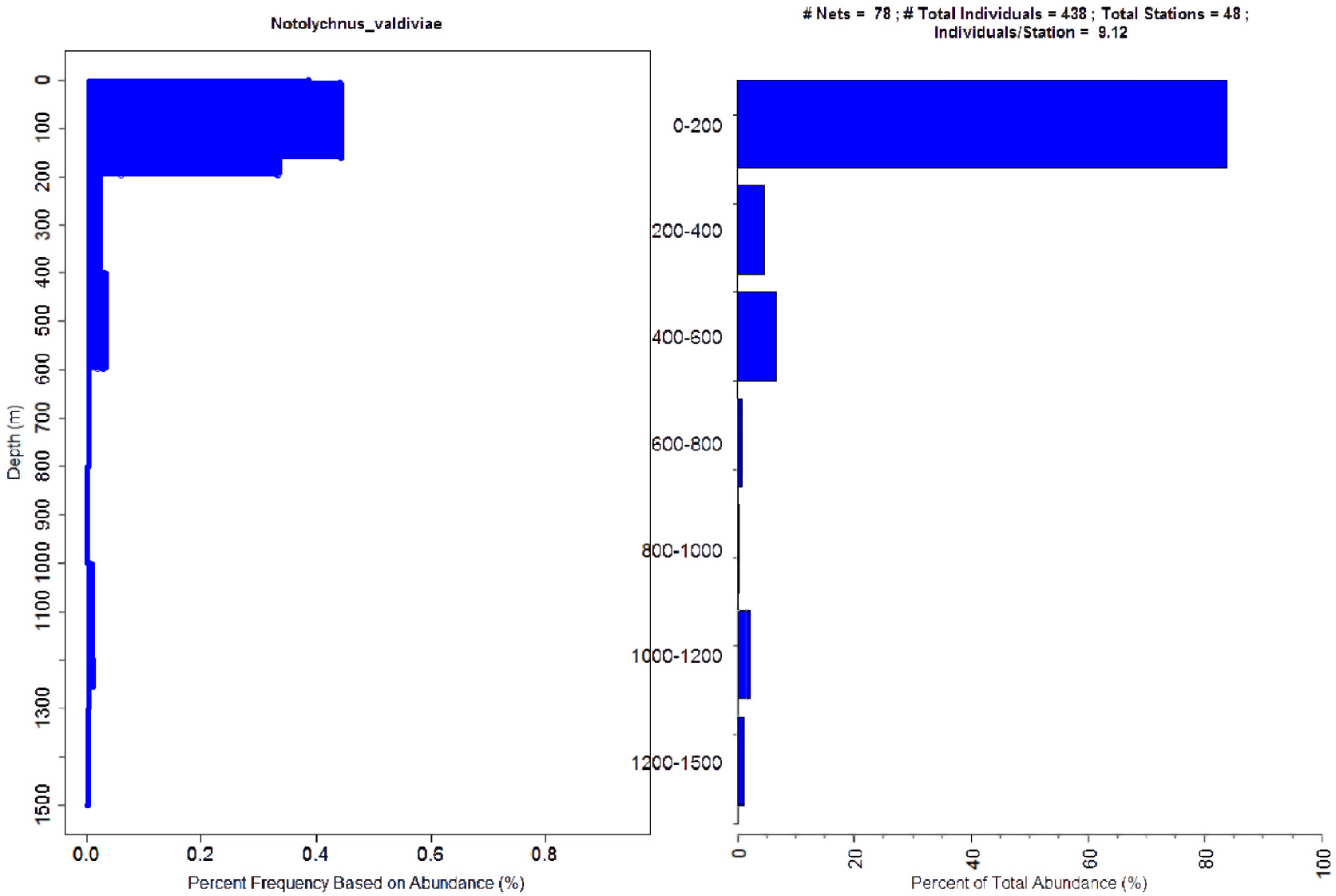
Nephropidae



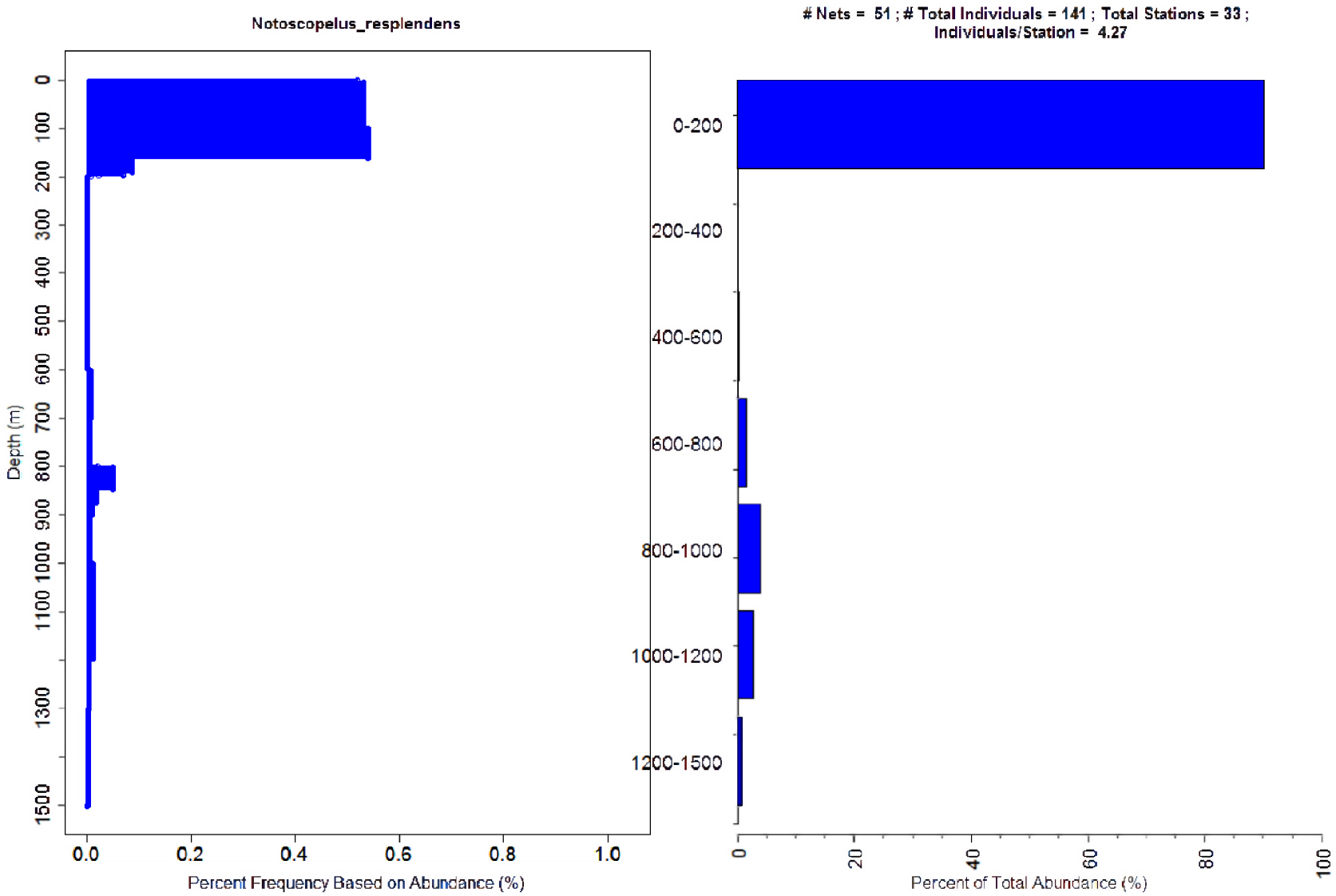
Nettastomatidae


Nomeidae
Nets = 13 ; # Total Individuals = 19 ; Total Stations = 12 ;
Individuals/Station = 1.58
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

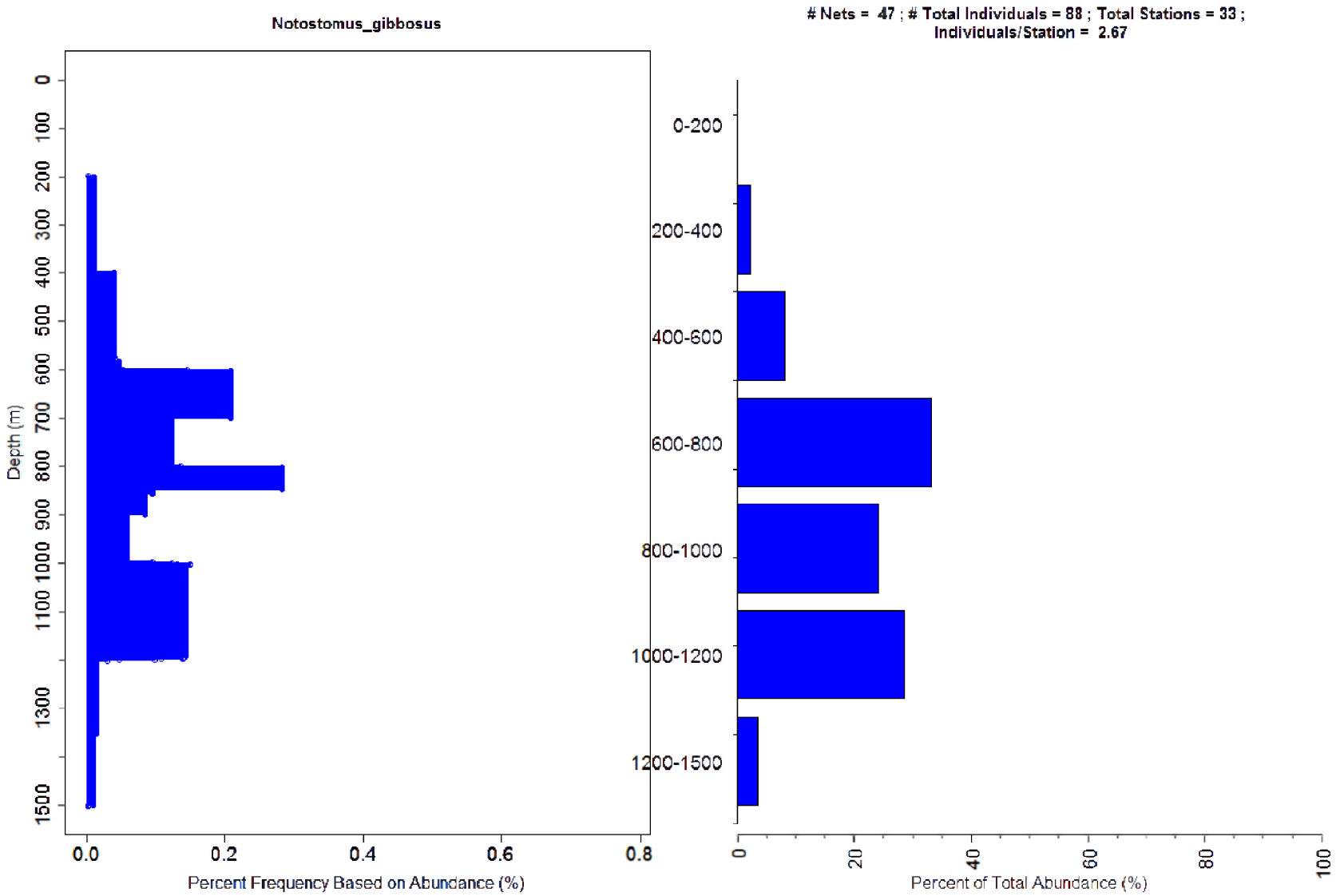
Nomeidae



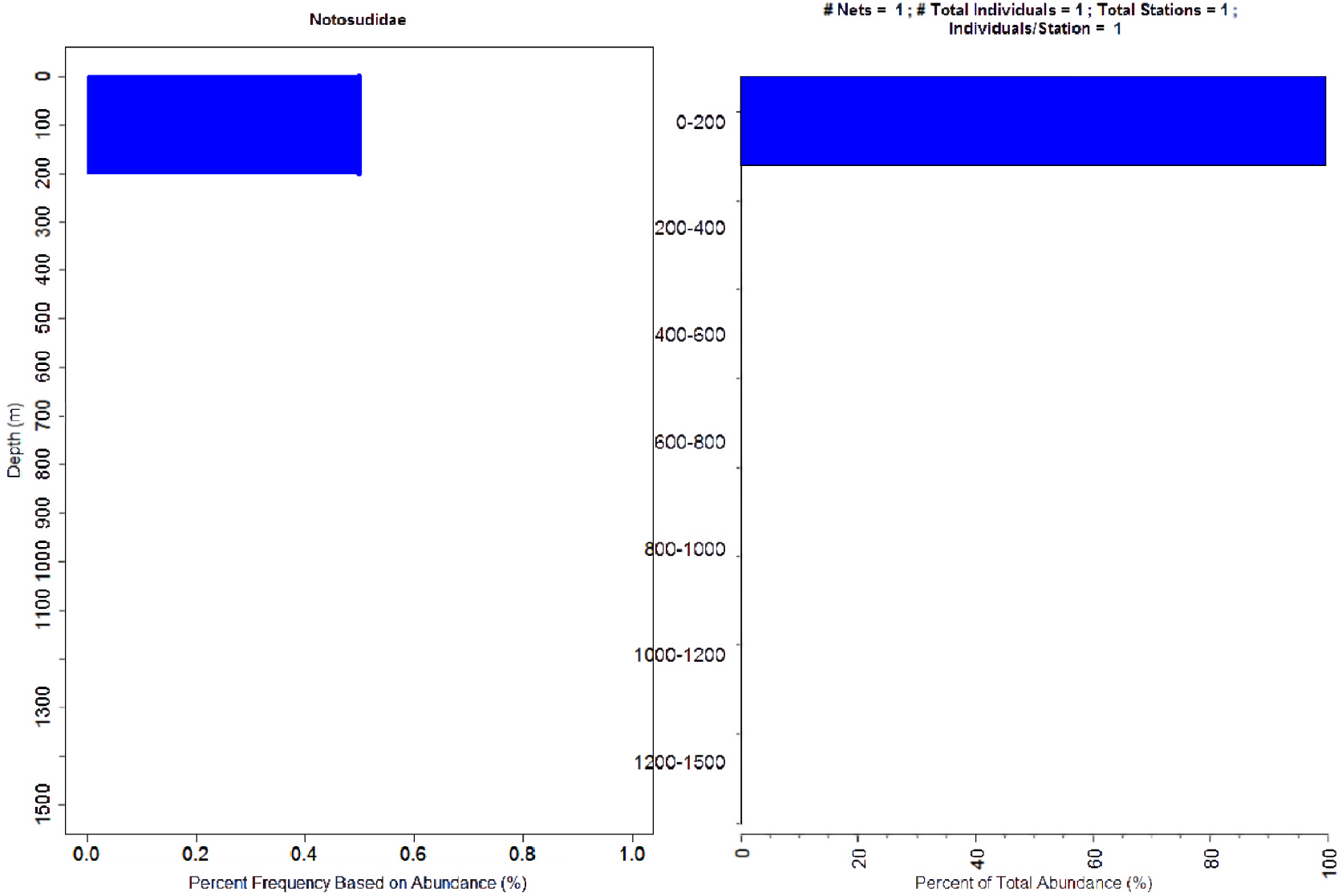
Notolychnus_valdiviae



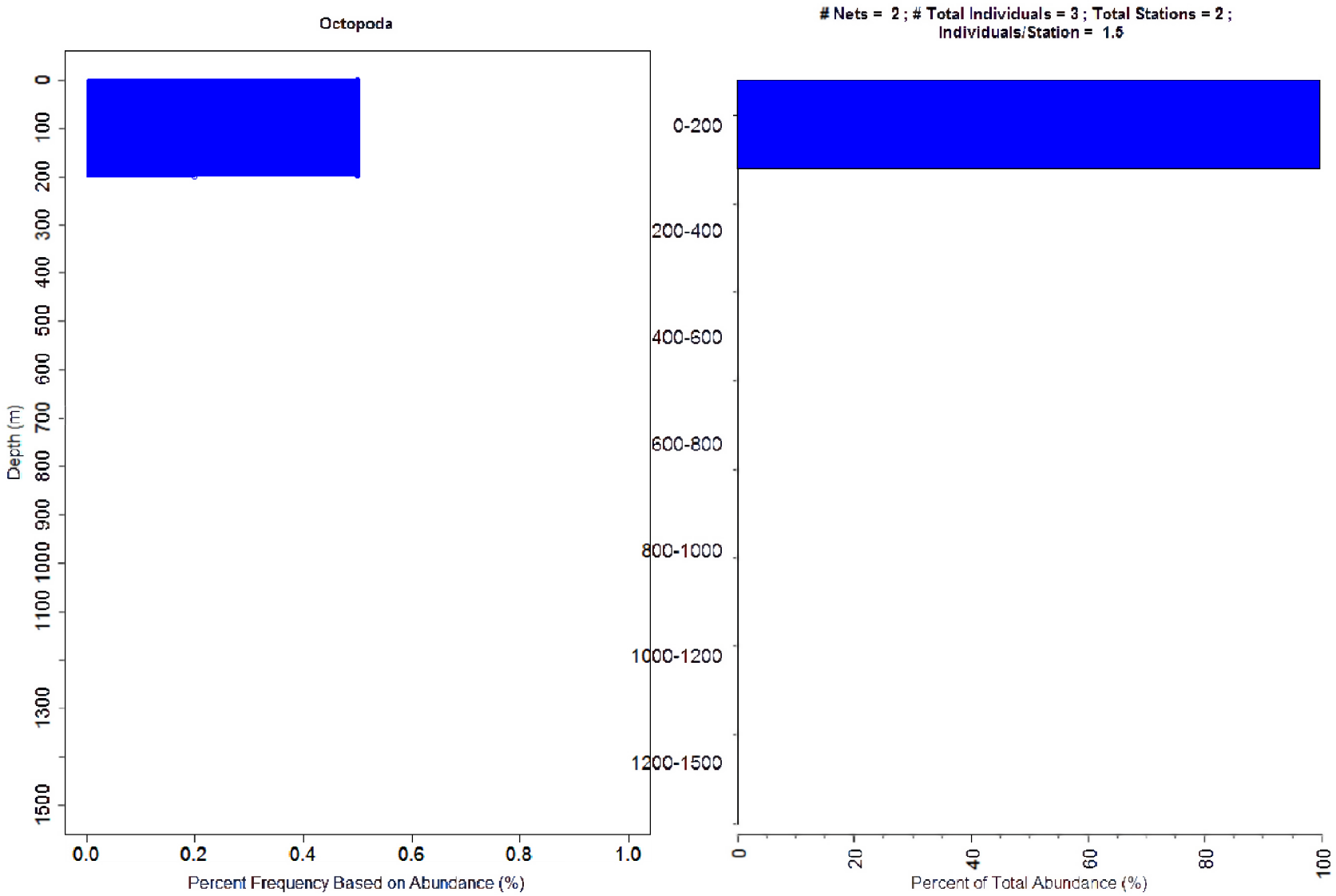
Notoscopelus_resplendens



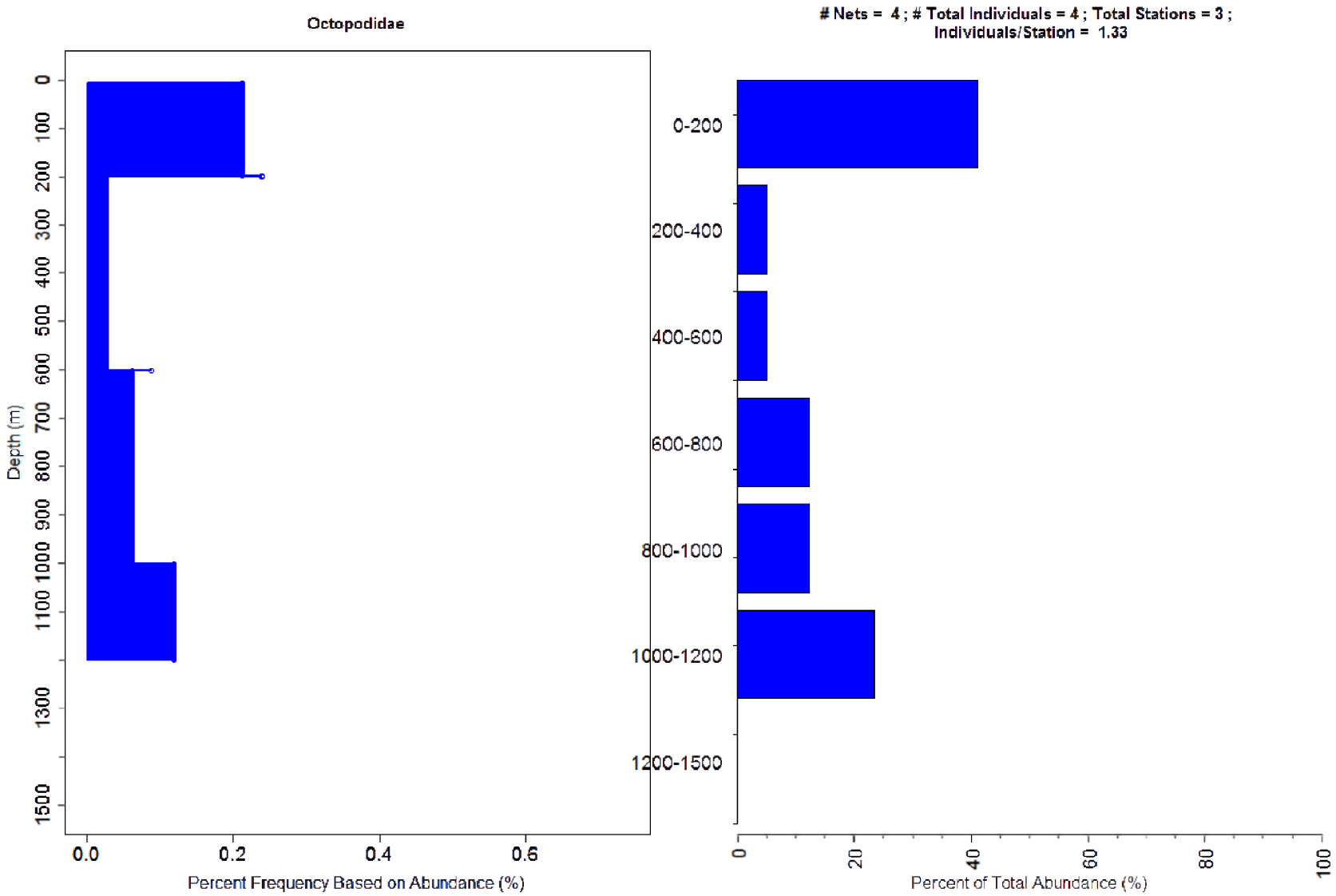
Notostomus_gibbosus



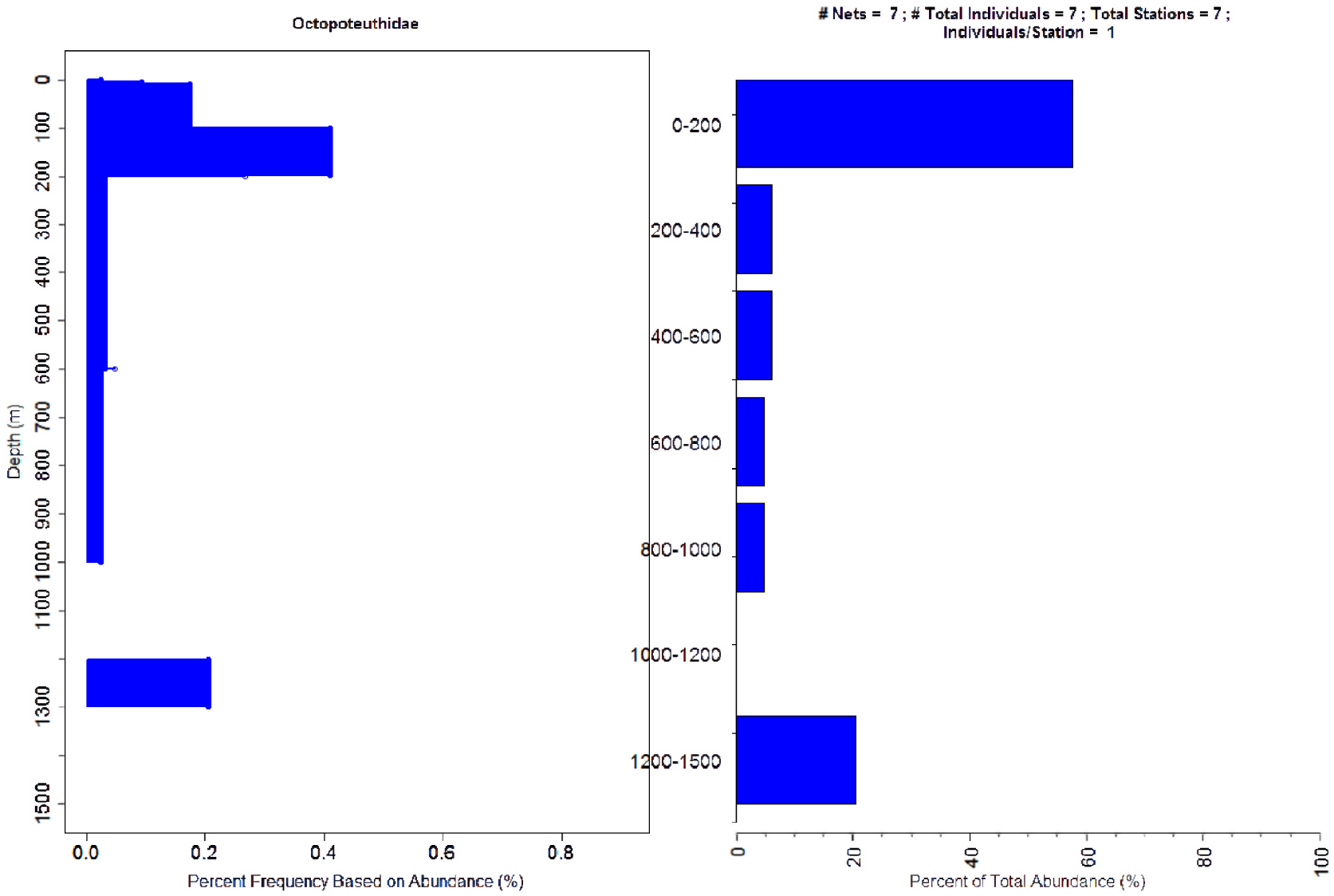
Notosudidae


Octopoda
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

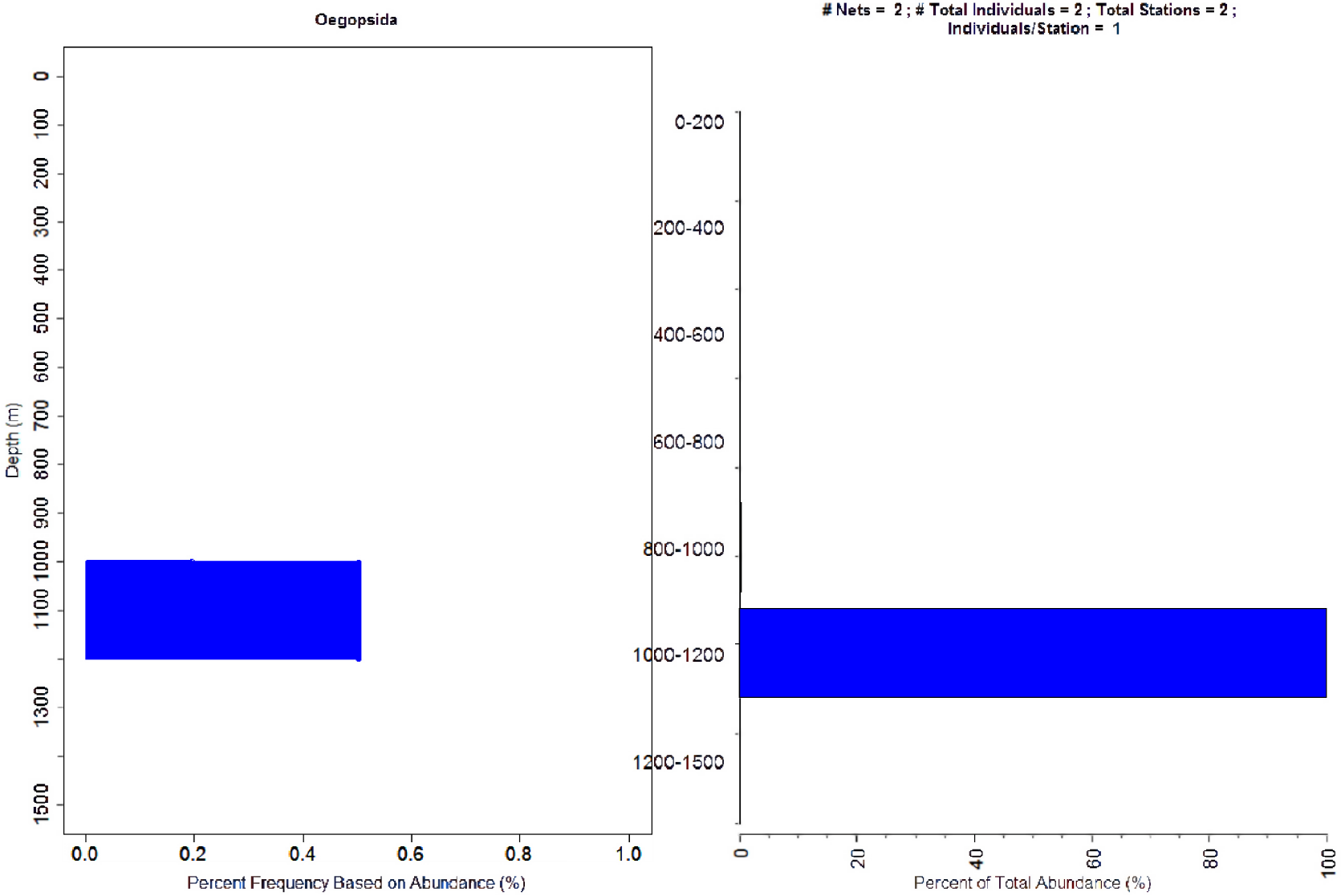
Octopoda



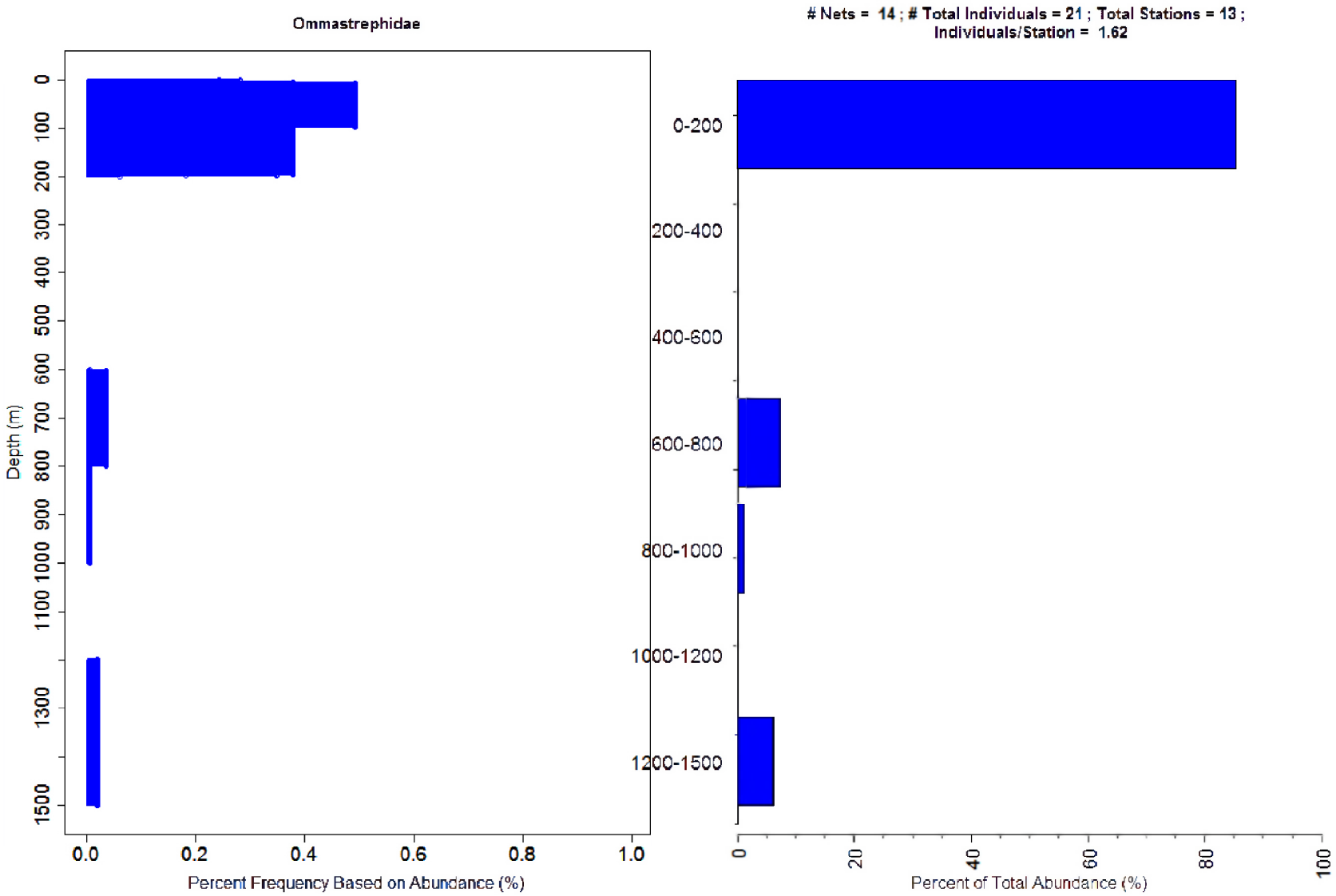
Octopodidae



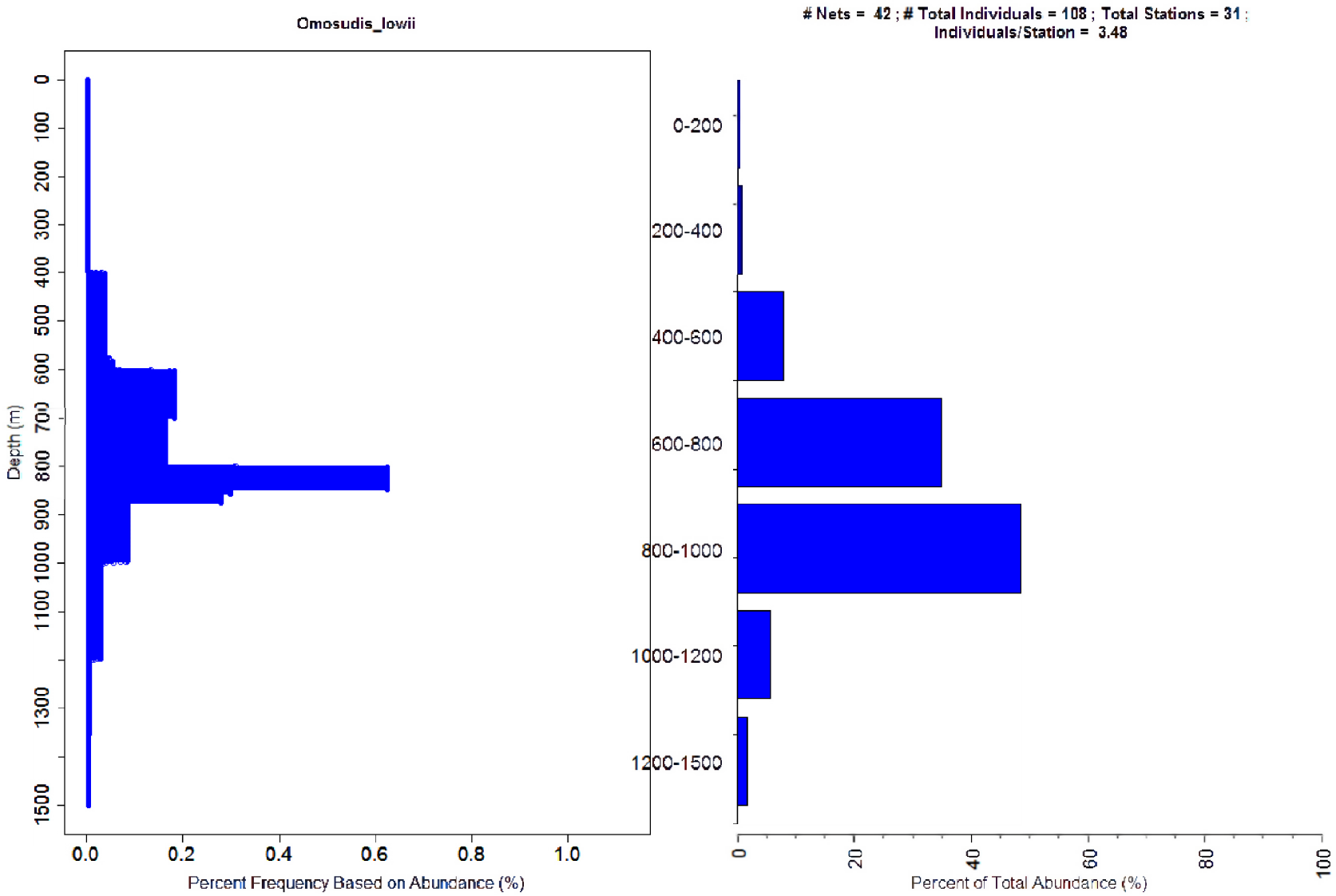
Octopoteuthidae


Oegopsida
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

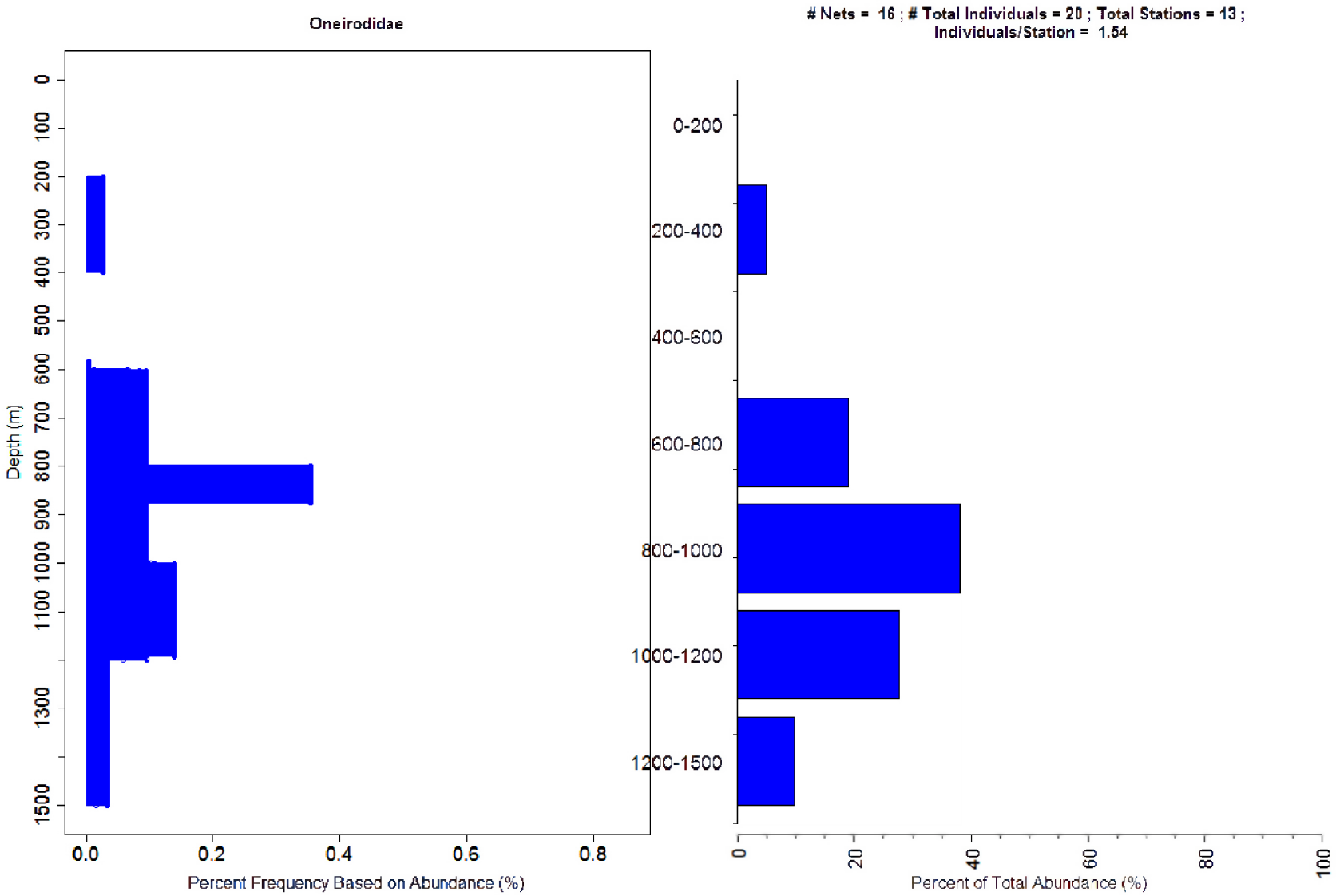
Oegopsida



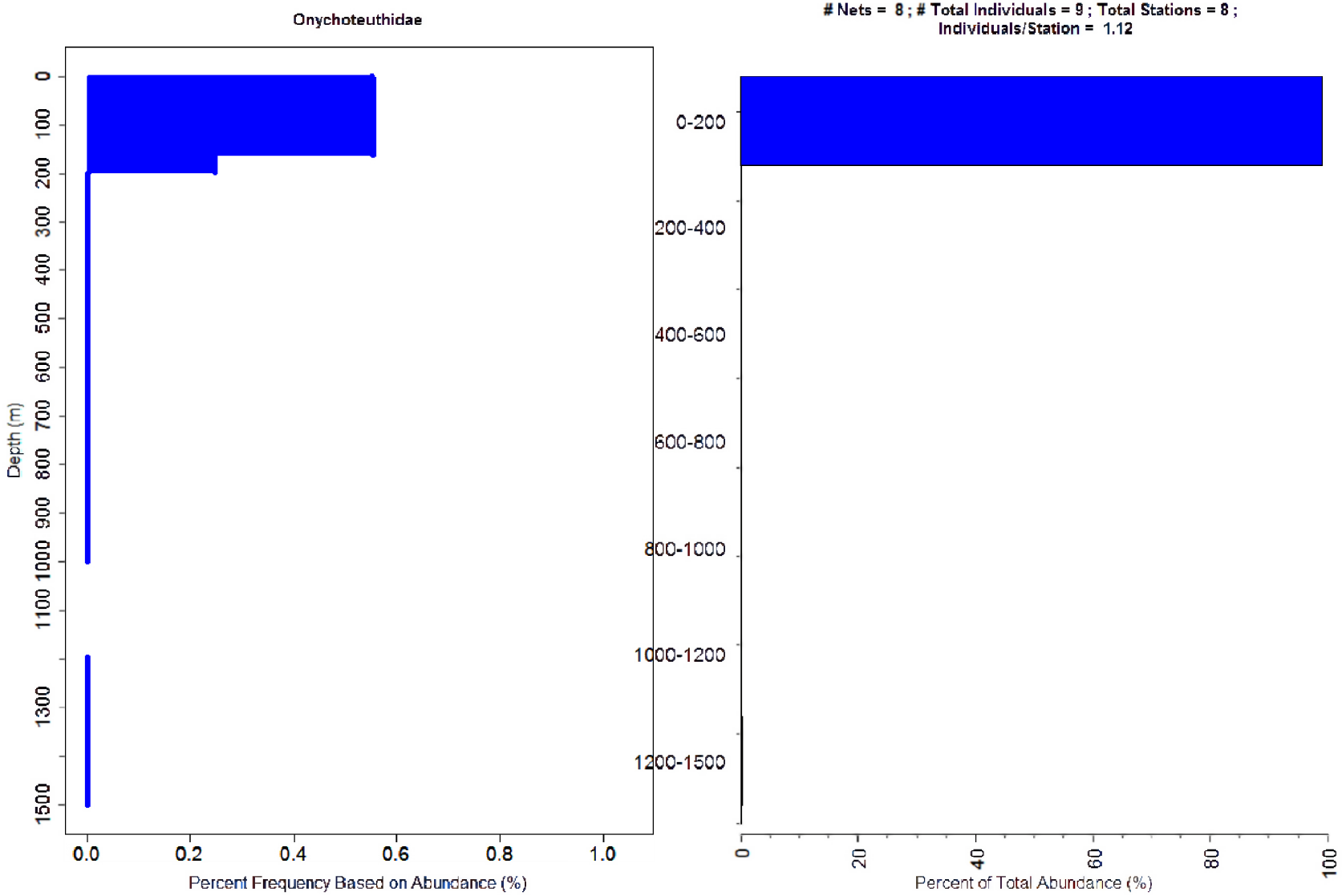
Ommastrephidae



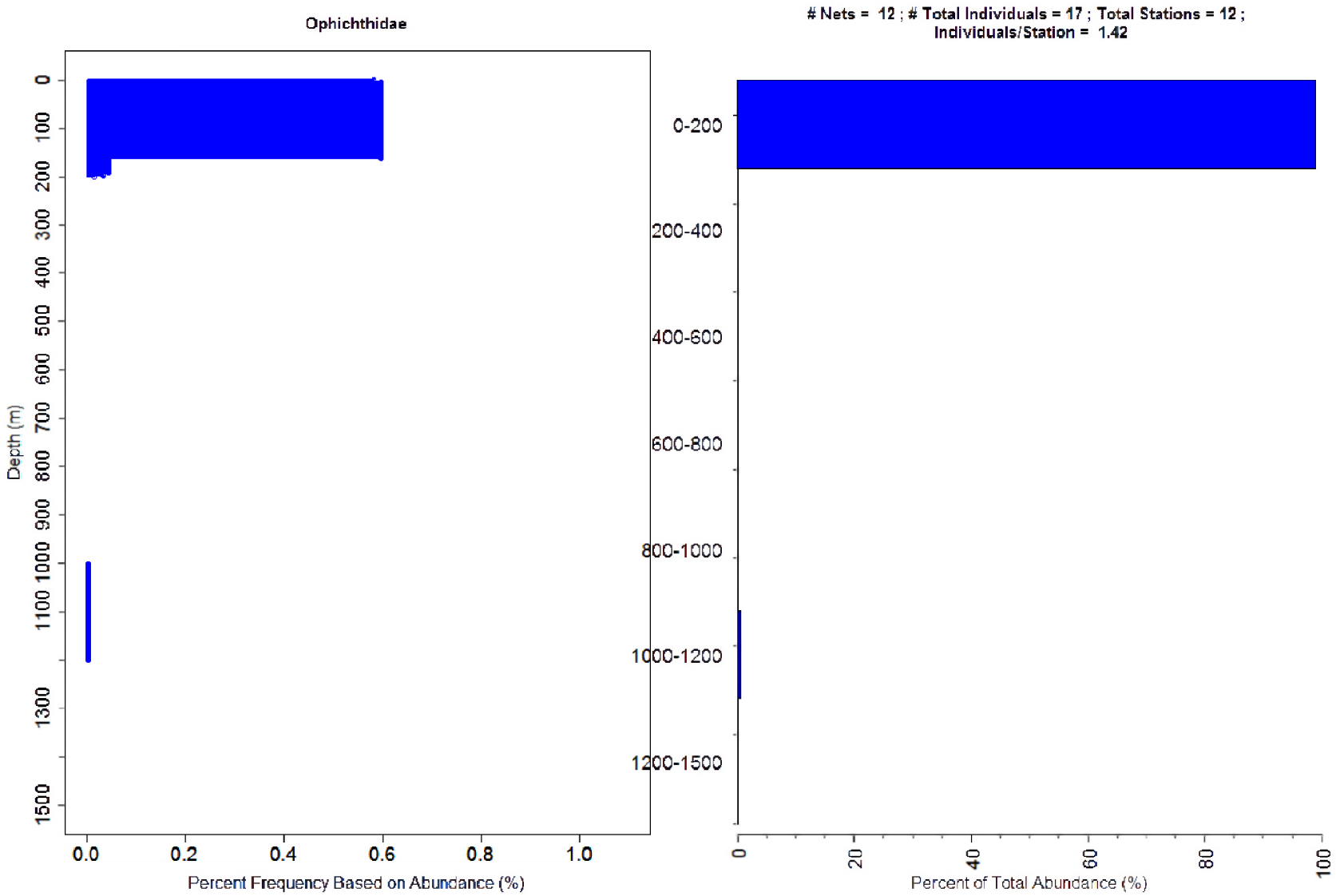
Omosudis_lowii



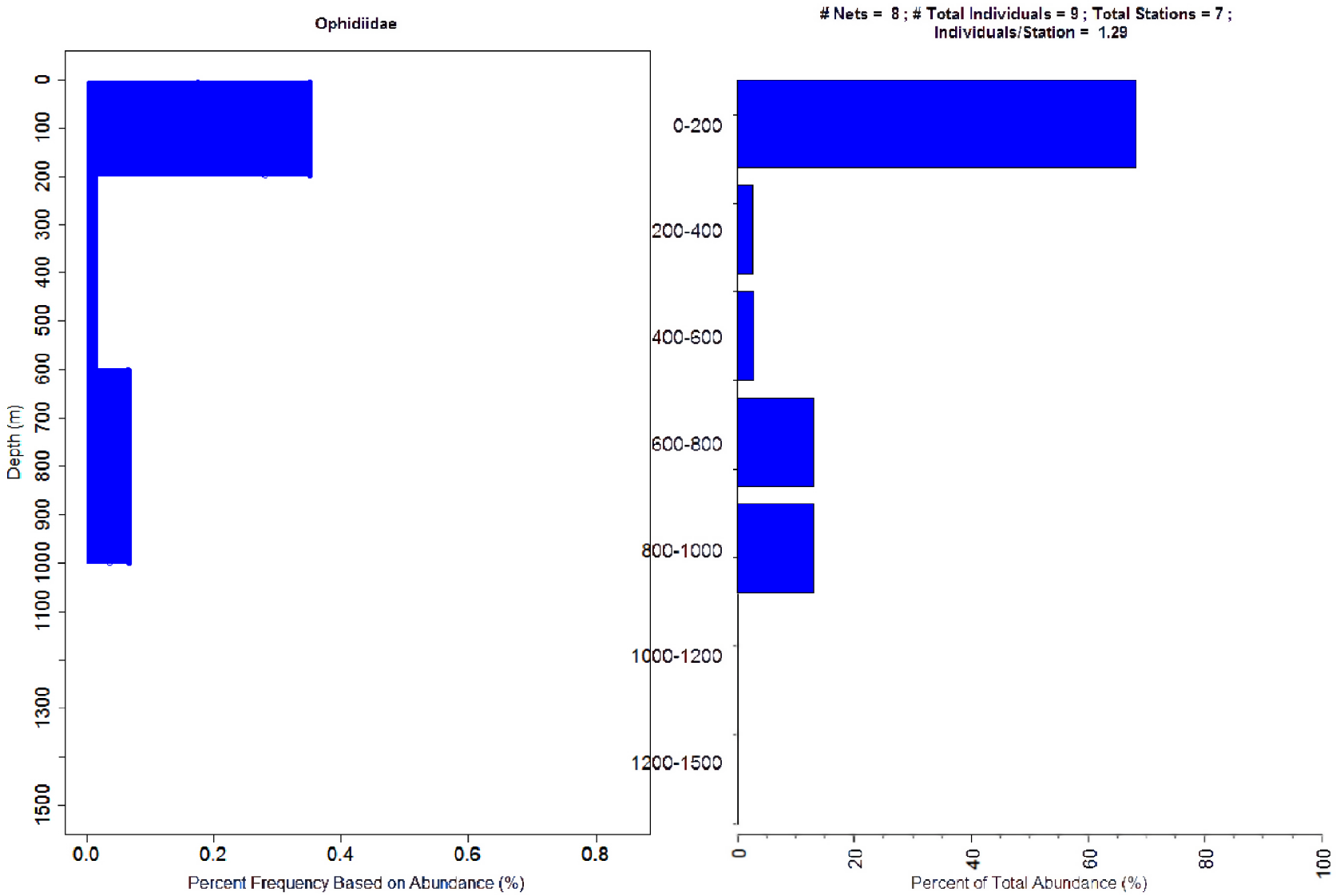
Oneirodidae



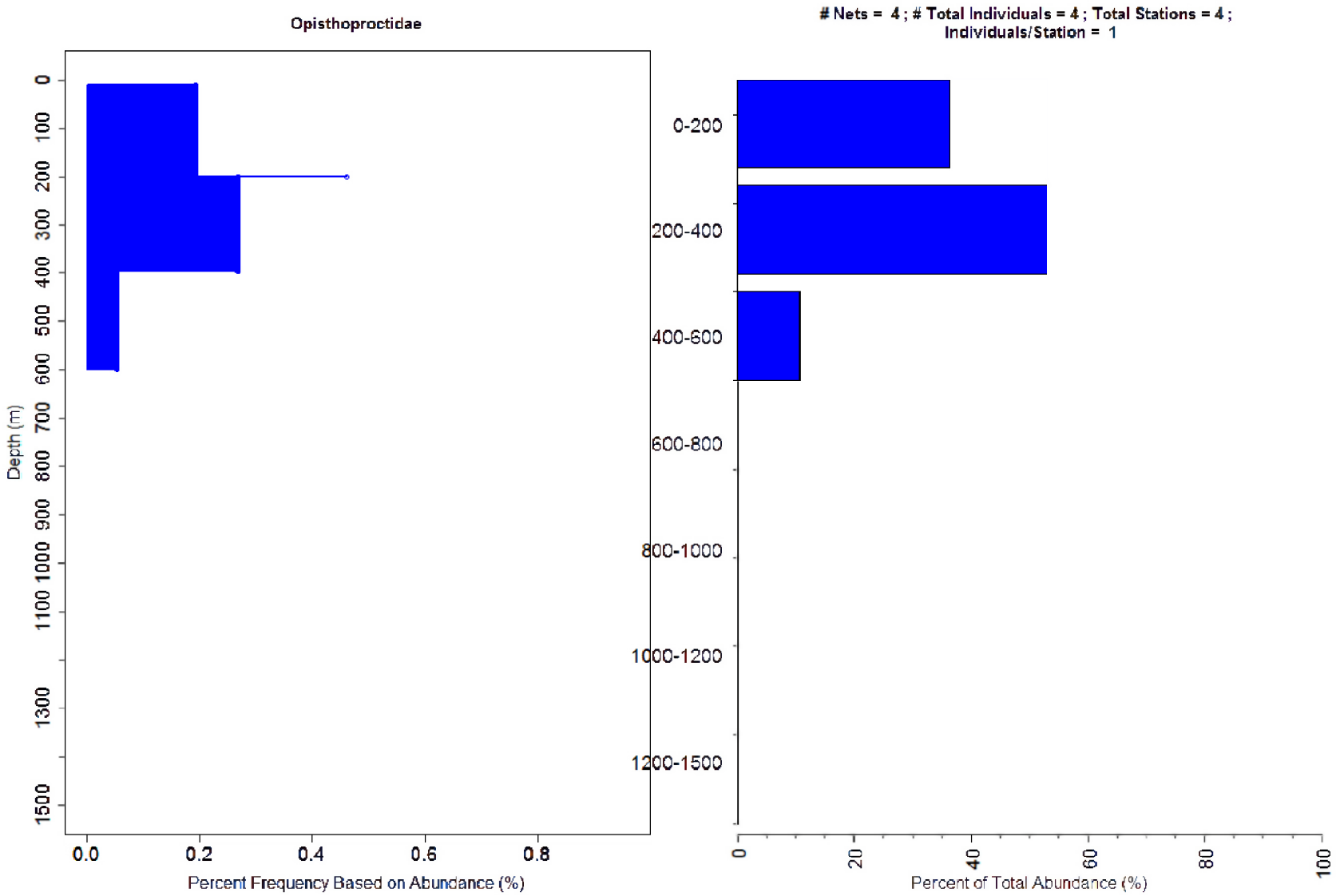
Onychoteuthidae



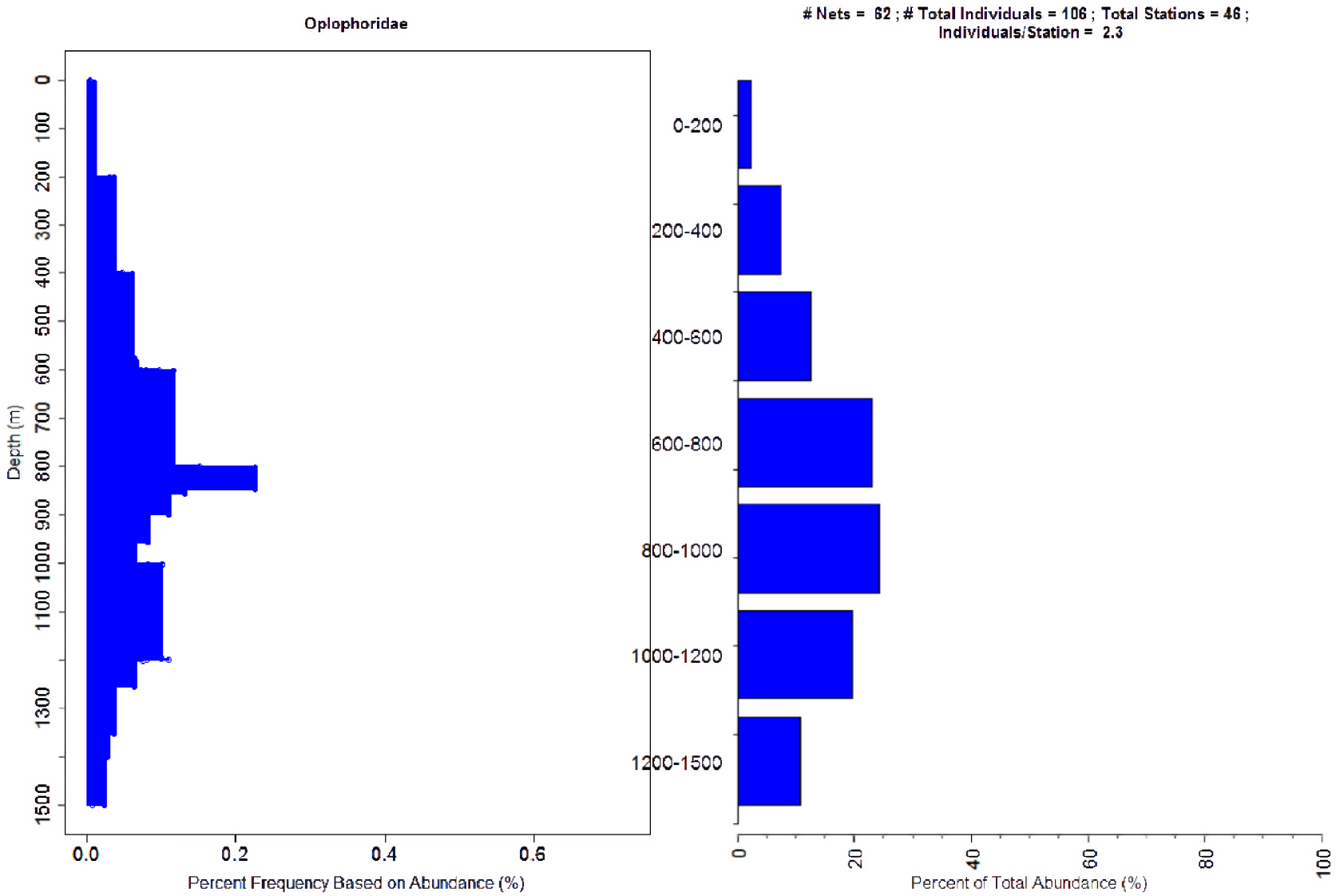
Ophichthidae


Ophidiidae
Nets = 8 ; # Total Individuals = 9 ; Total Stations = 7 ;
Individuals/Station = 1.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

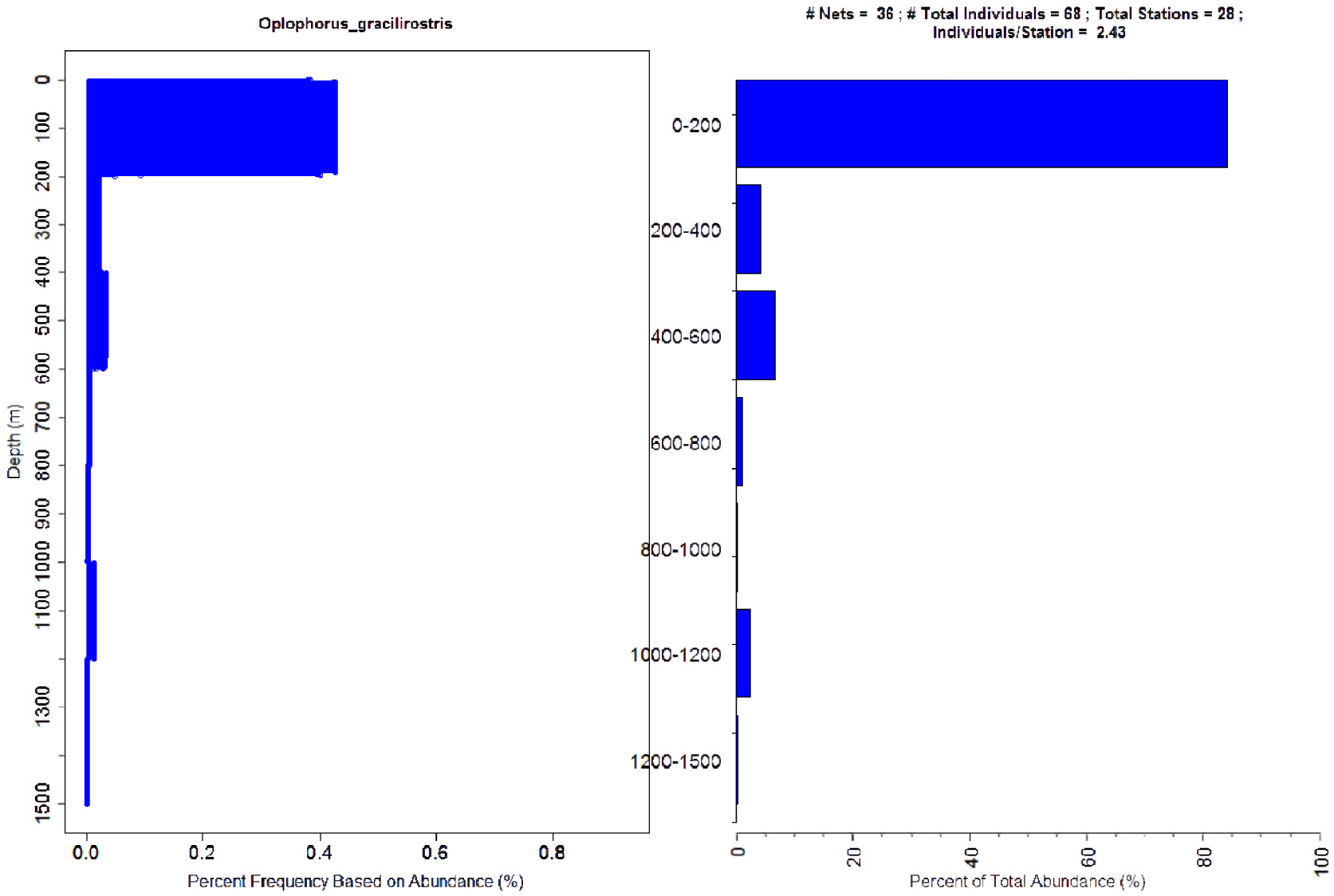
Ophidiidae



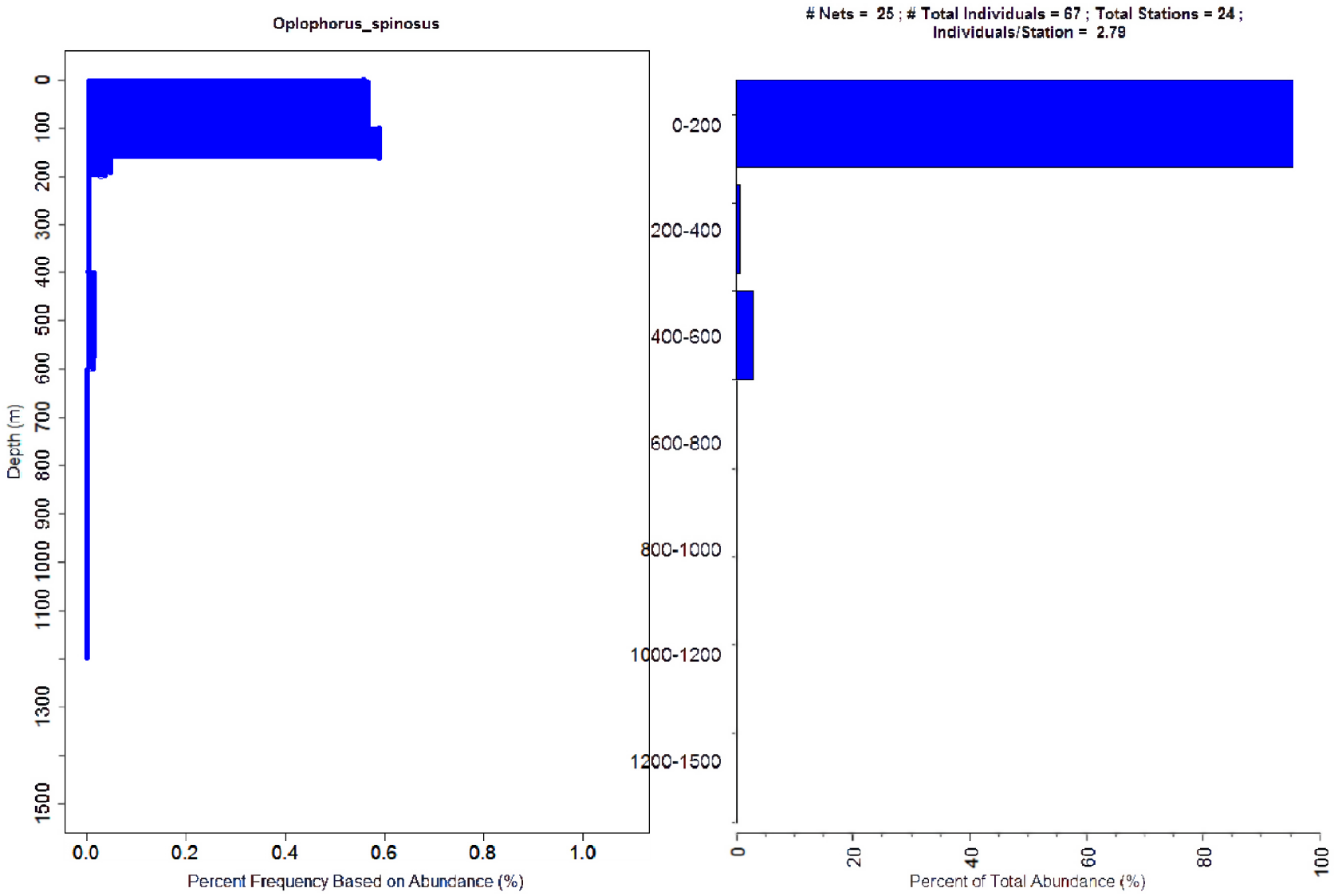
Opisthoproctidae



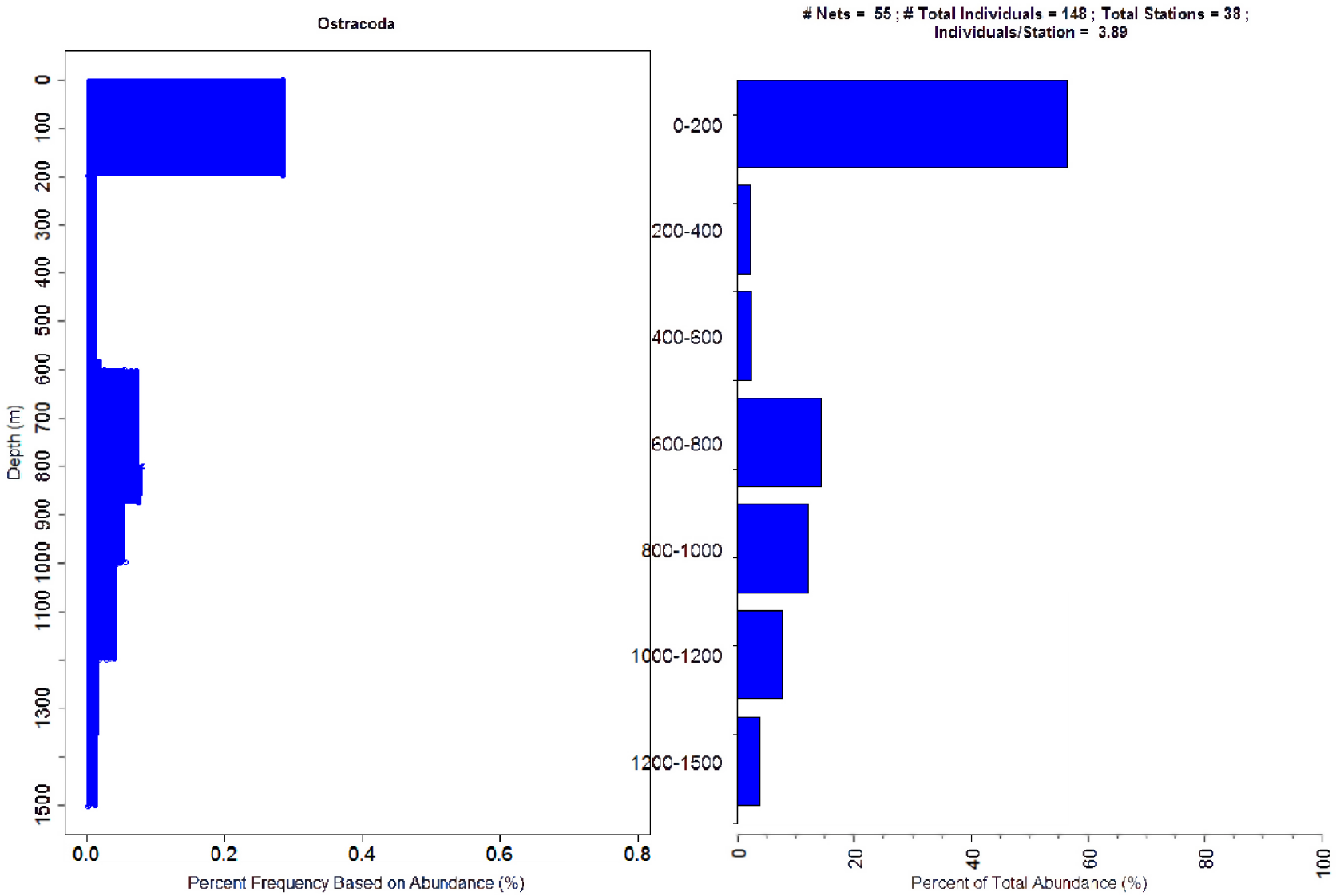
Oplophoridae



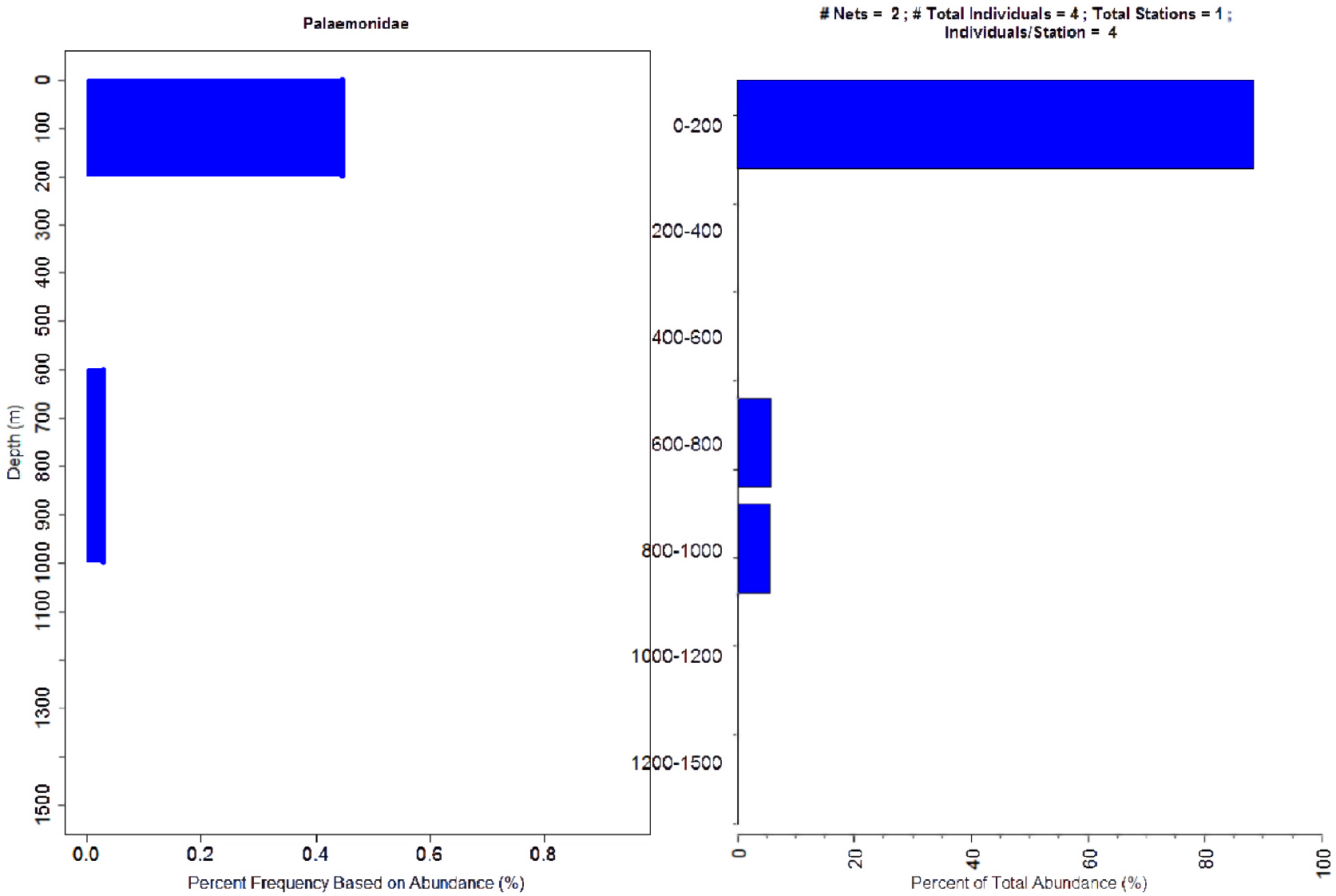
Oplophorus_gracilirostris



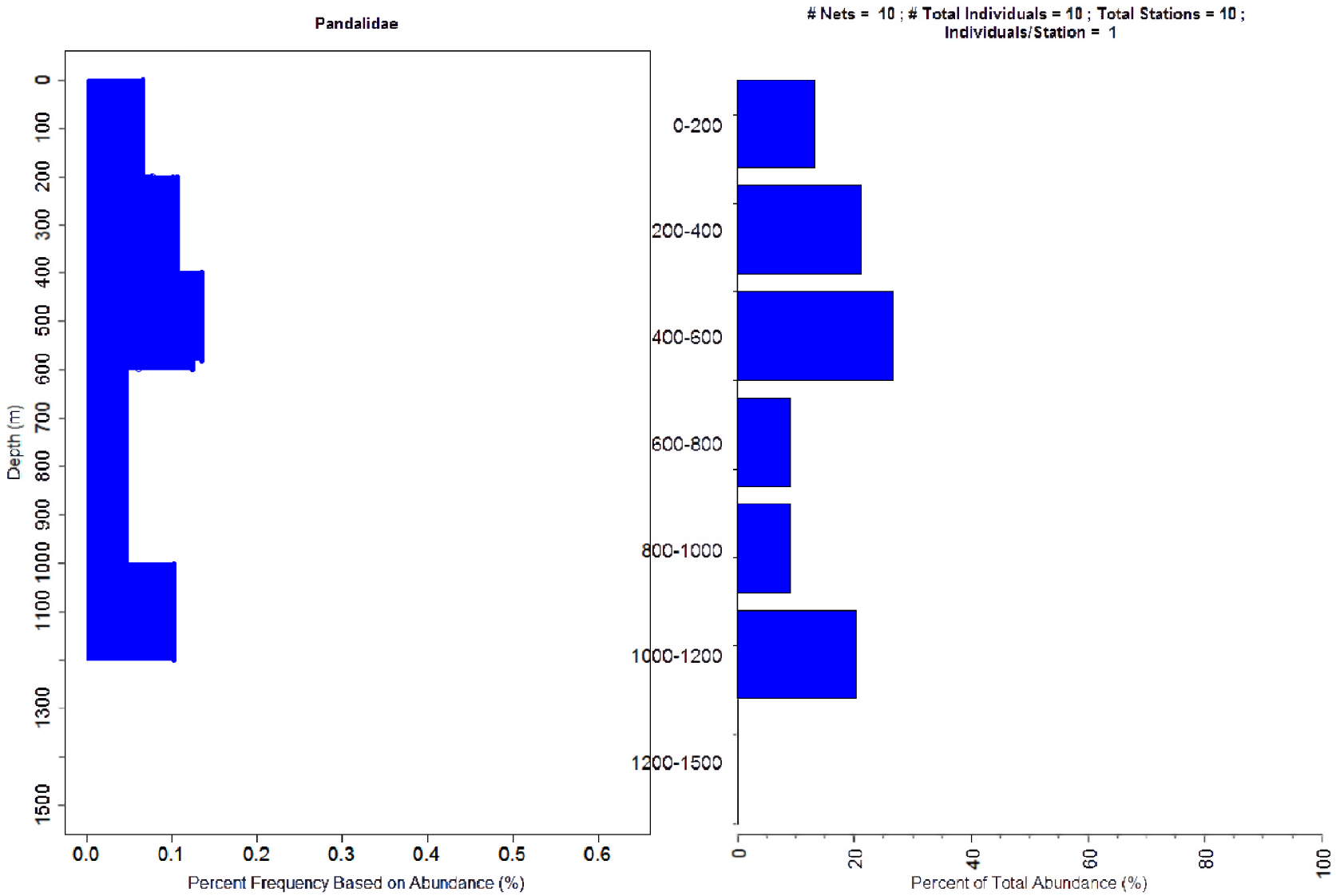
Oplophorus_spinosus


Ostracoda
Nets = 55 ; # Total Individuals = 148 ; Total Stations = 38 ;
Individuals/Station = 3.89
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

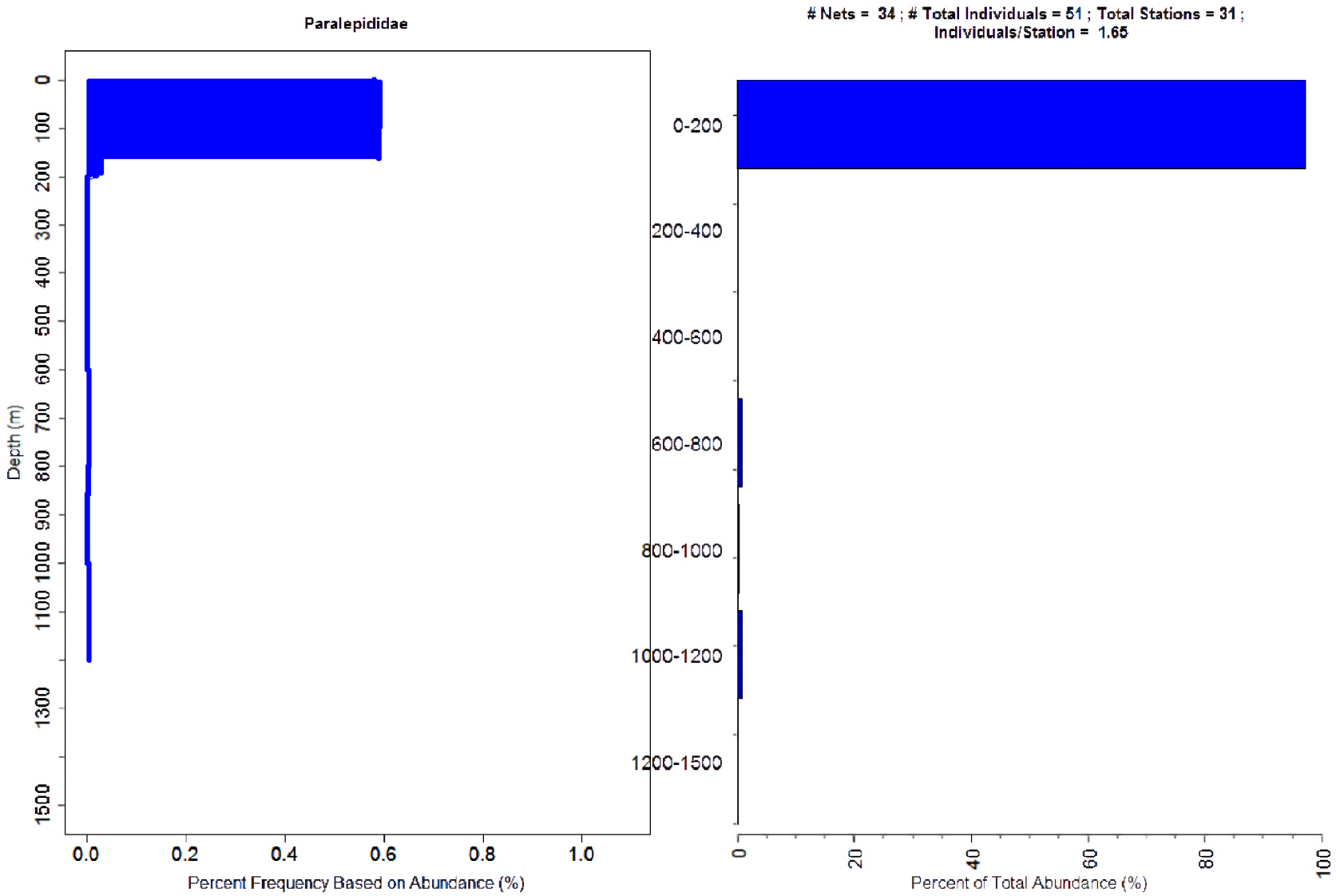
Ostracoda



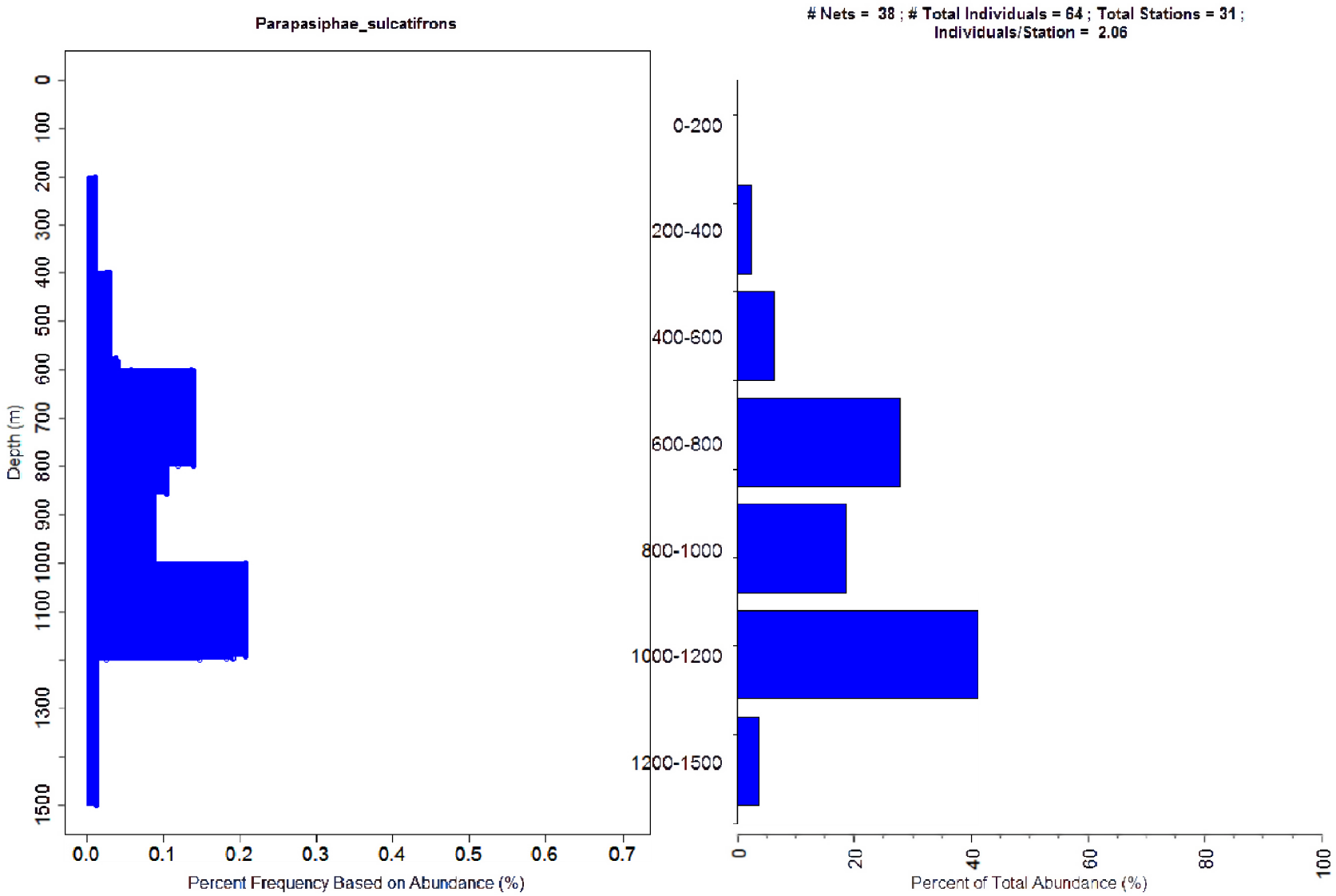
Palaemonidae


Pandalidae
Nets = 10 ; # Total Individuals = 10 ; Total Stations = 10 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

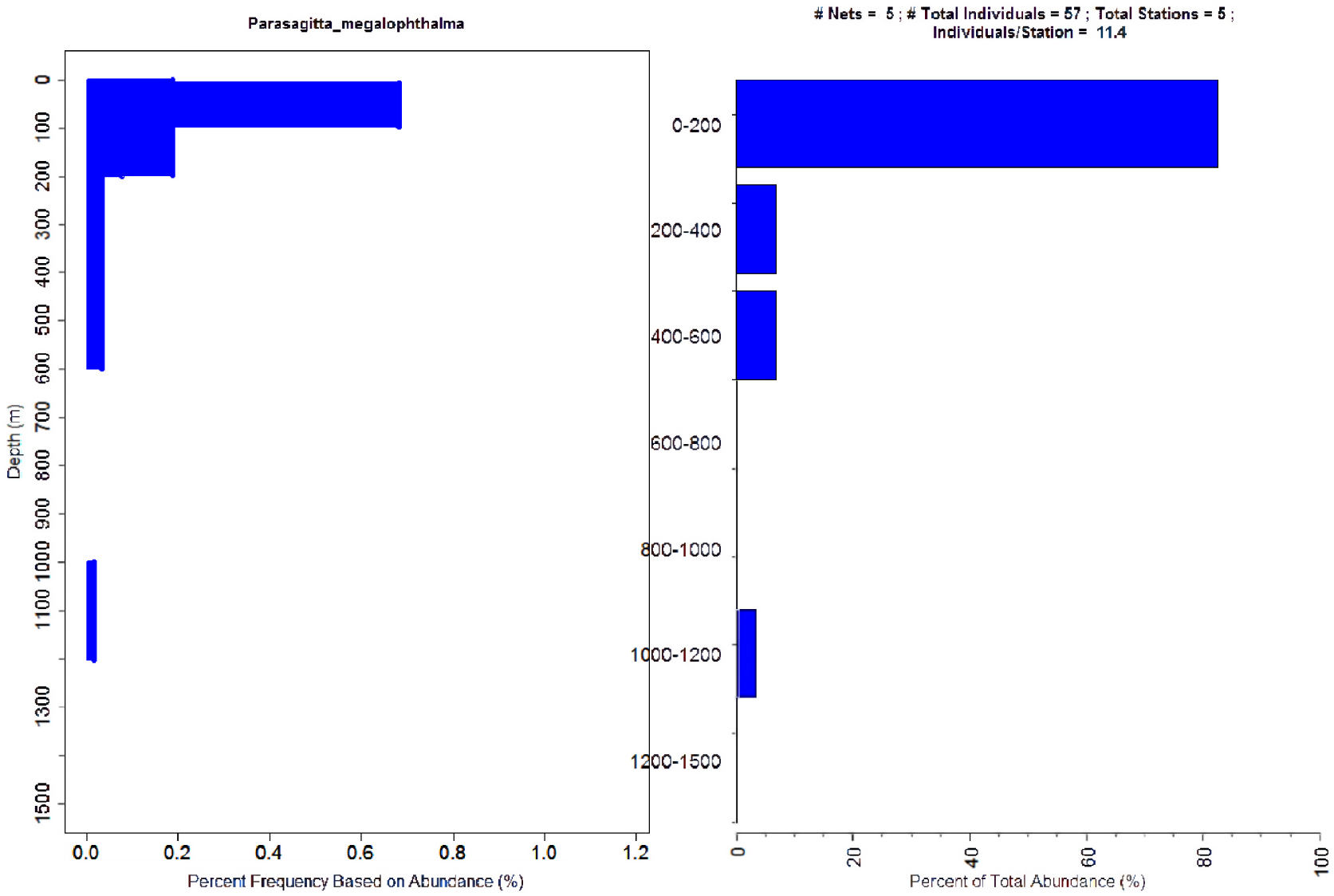
Pandalidae



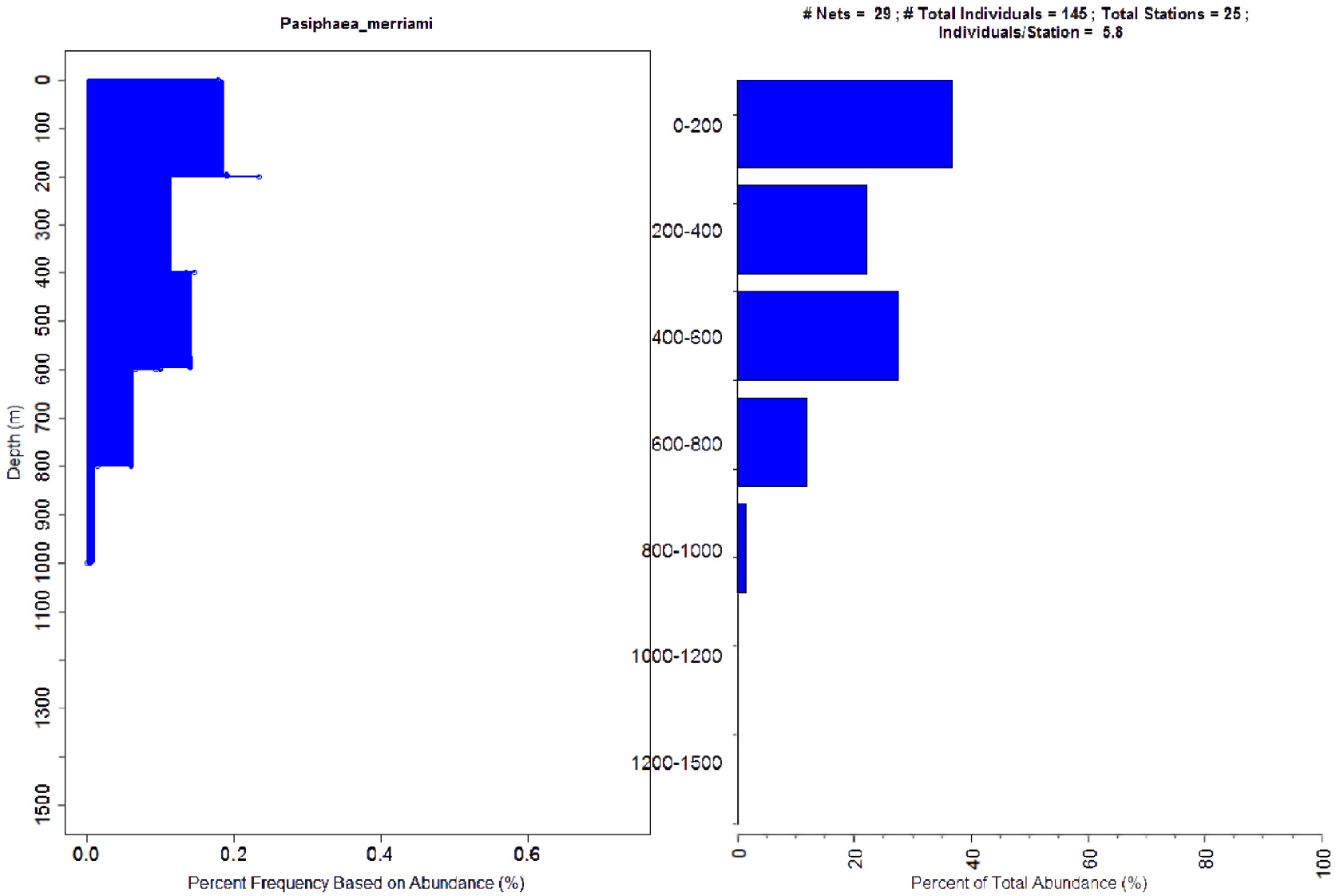
Paralepididae



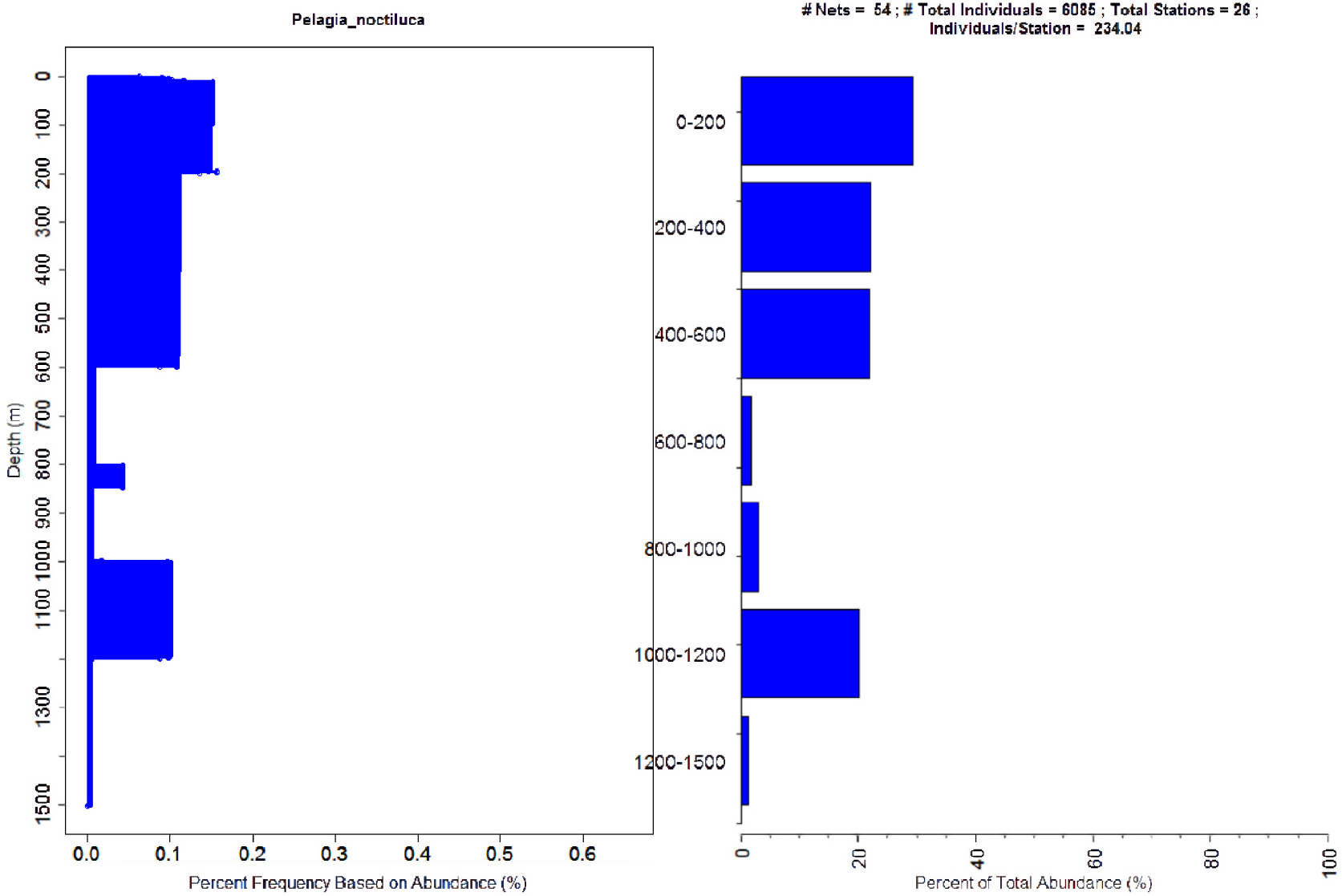
Parapasiphae_sulcatifrons



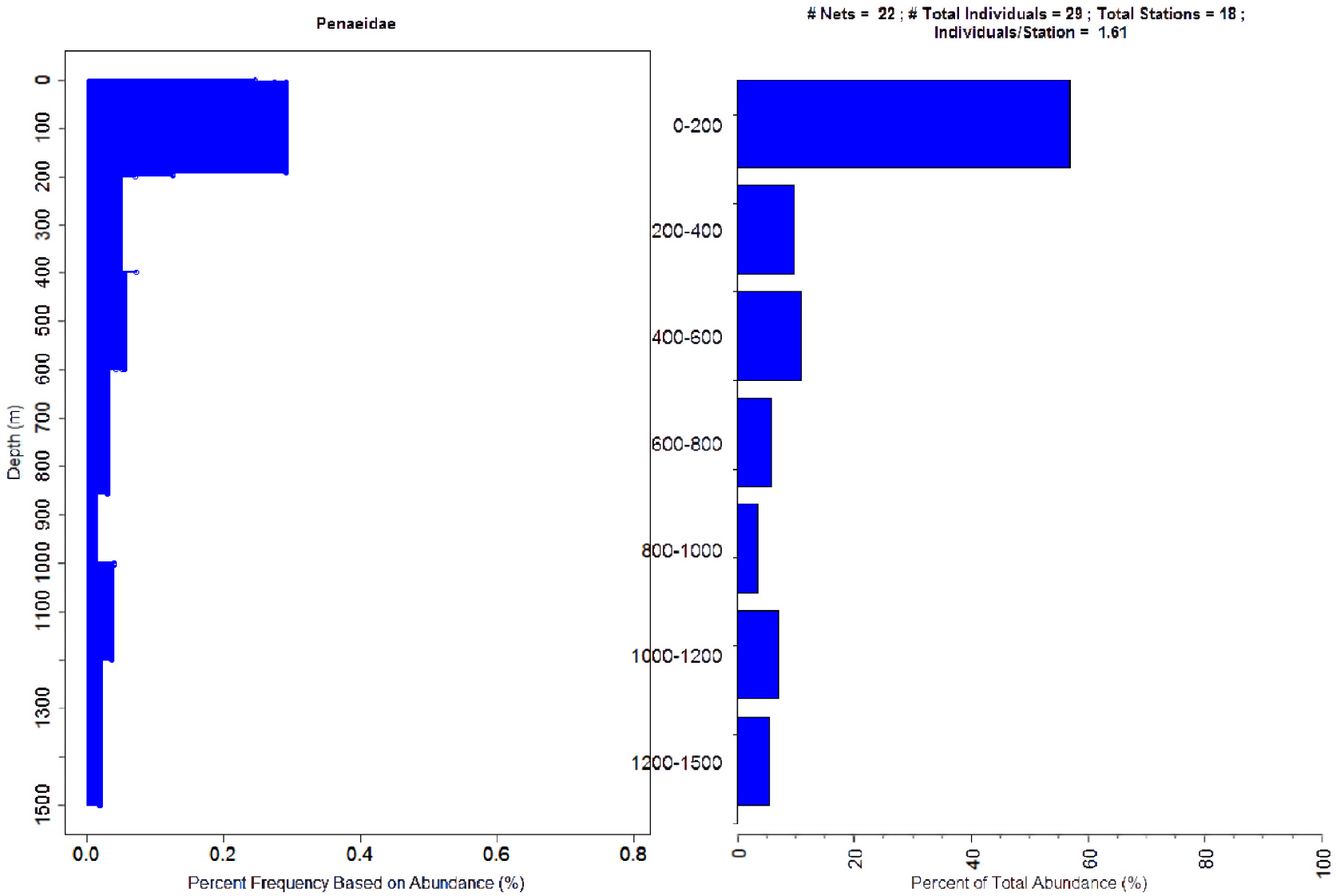
Parasagitta_megalophthalma



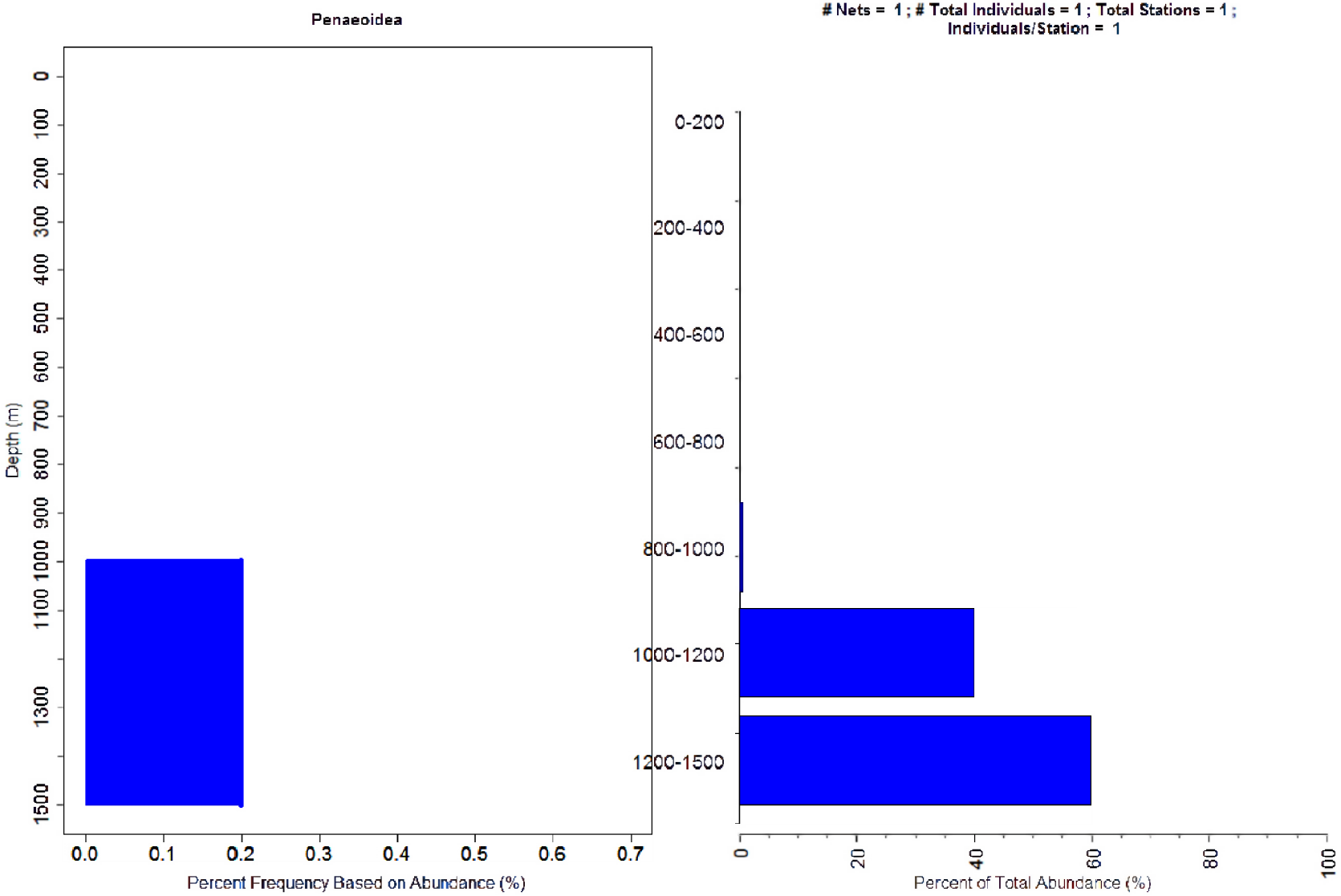
Pasiphaea_merriami



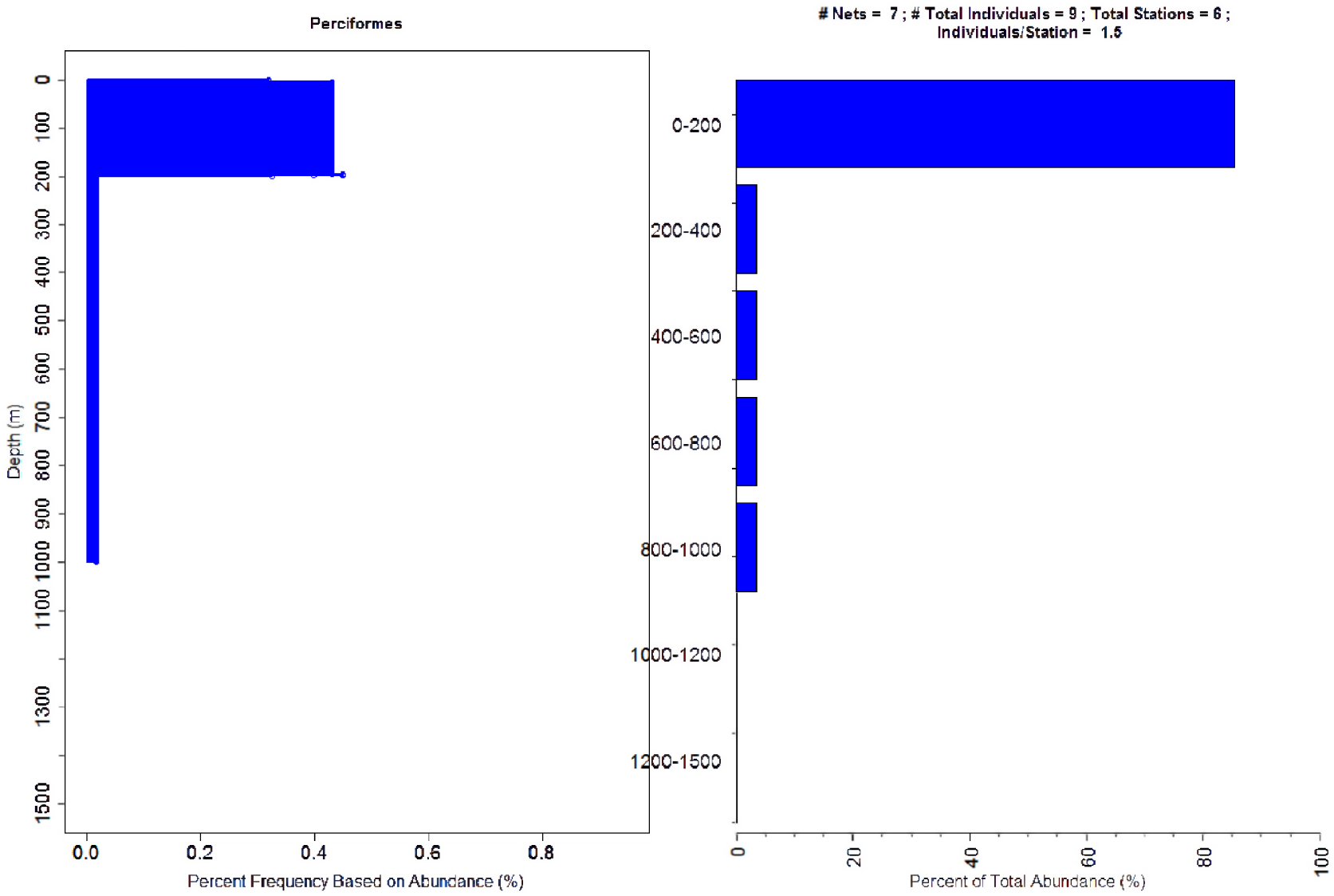
Pelagia_noctiluca


Penaeidae
Nets = 22 ; # Total Individuals = 29 ; Total Stations = 18 ;
Individuals/Station = 1.61
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

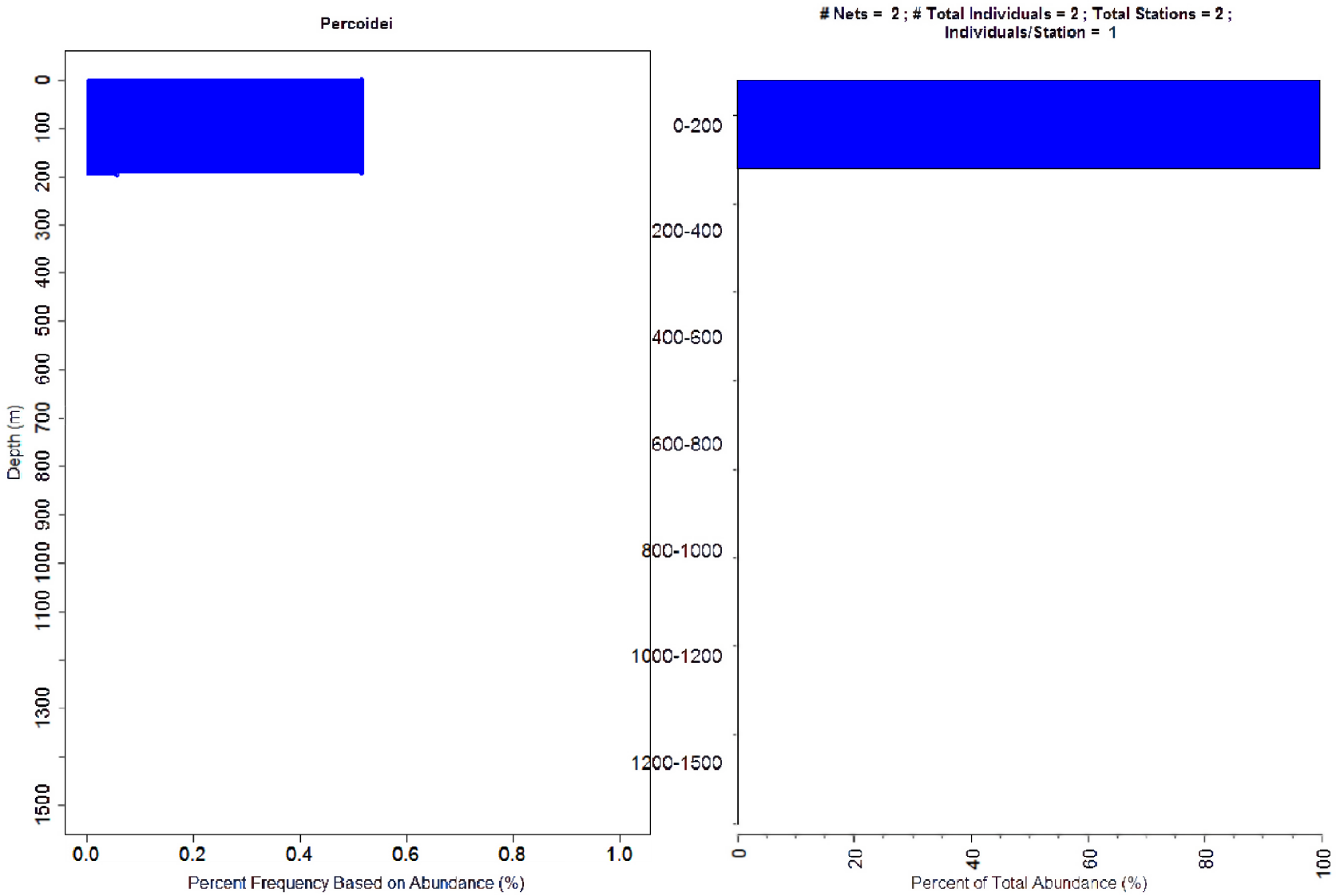
Penaeidae


Penaeoidea
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

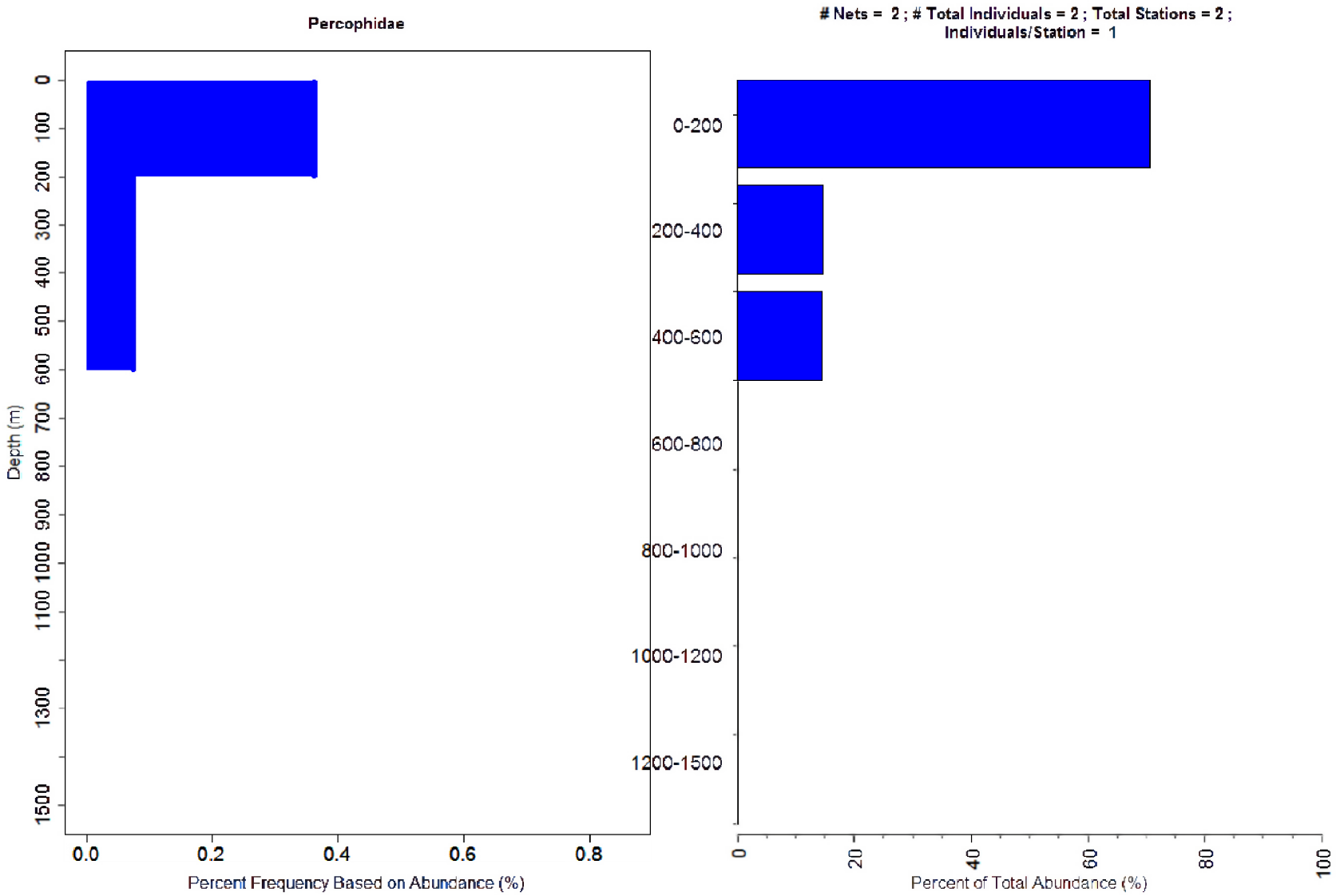
Penaeoidea



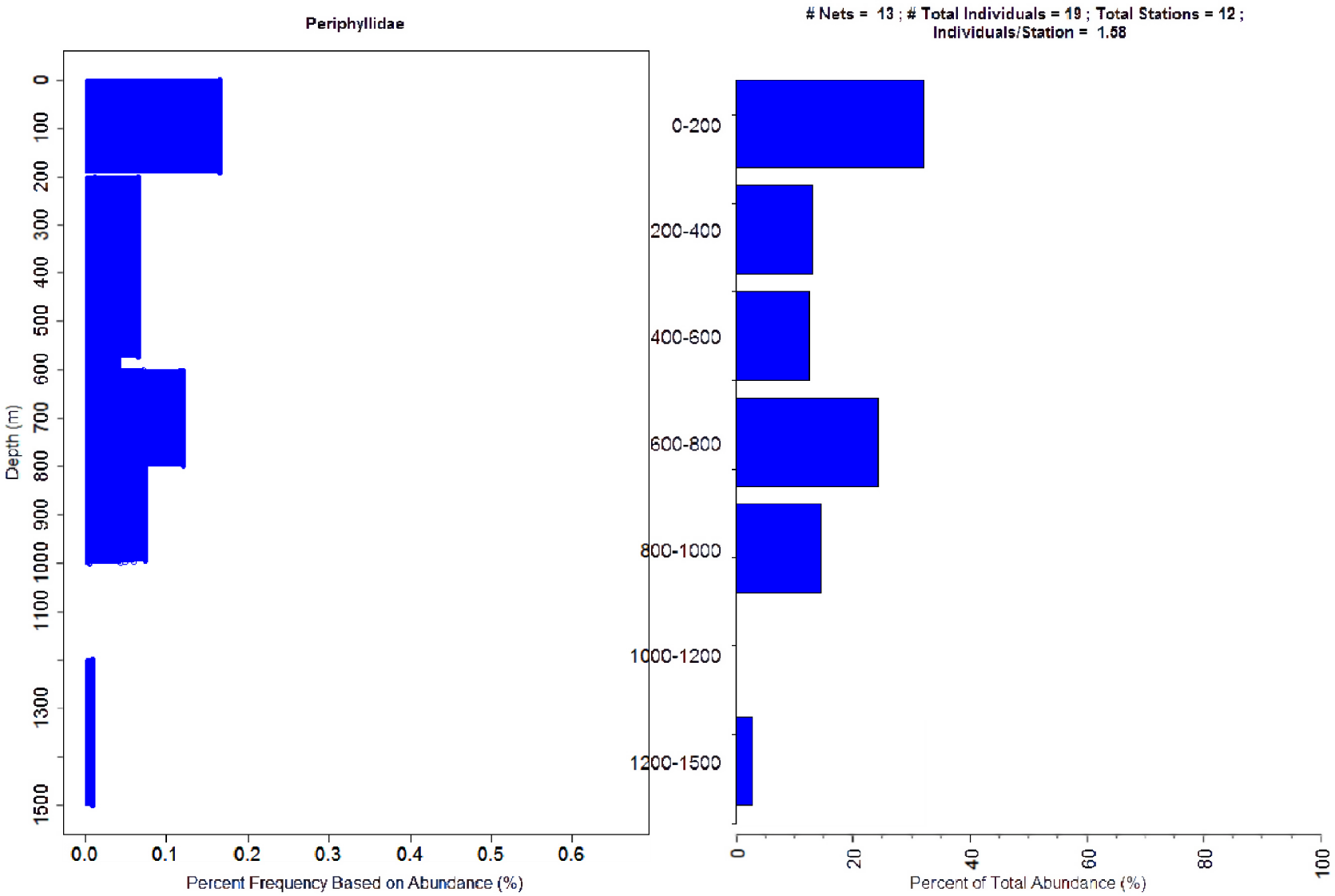
Perciformes


Percoidei
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

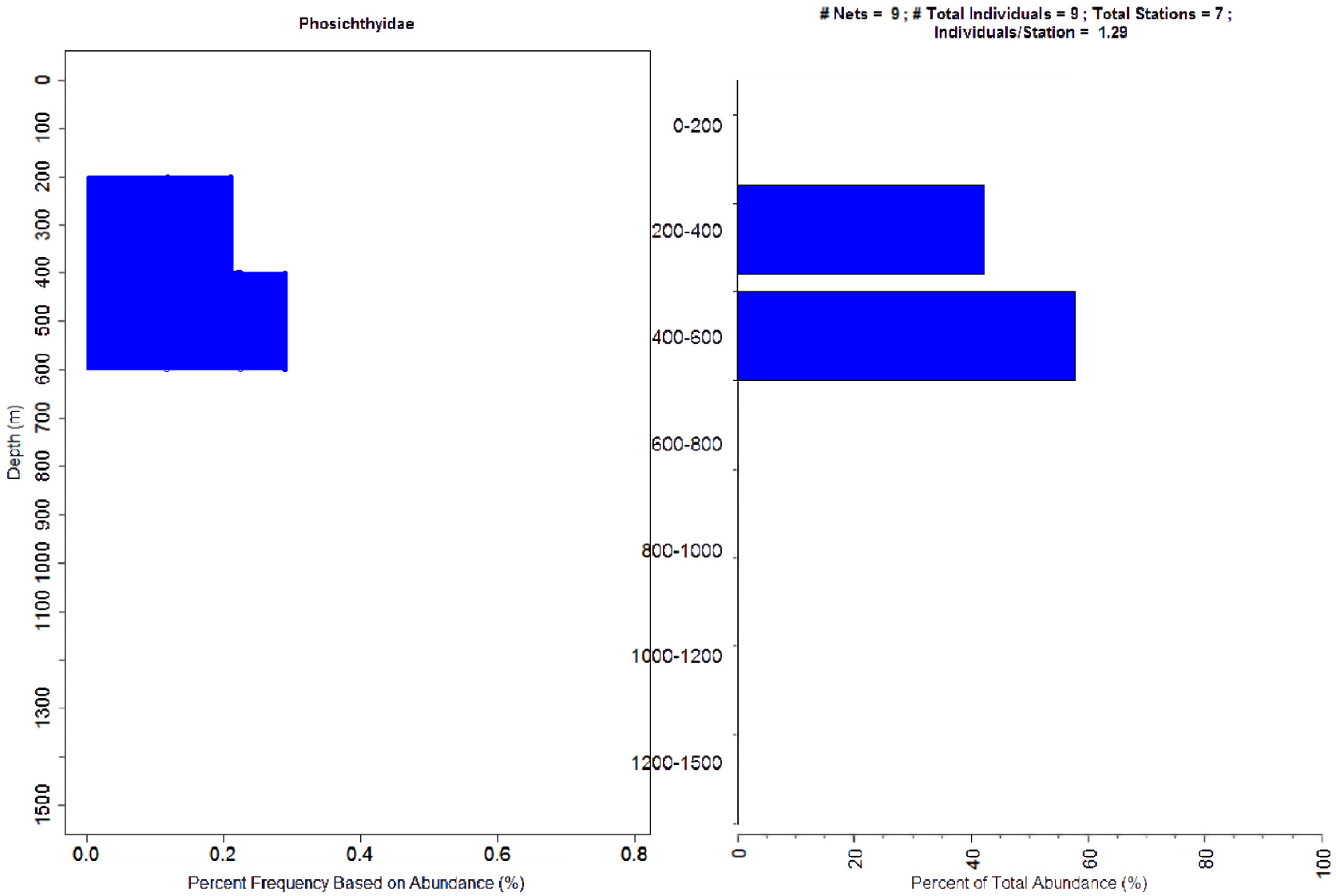
Percoidei



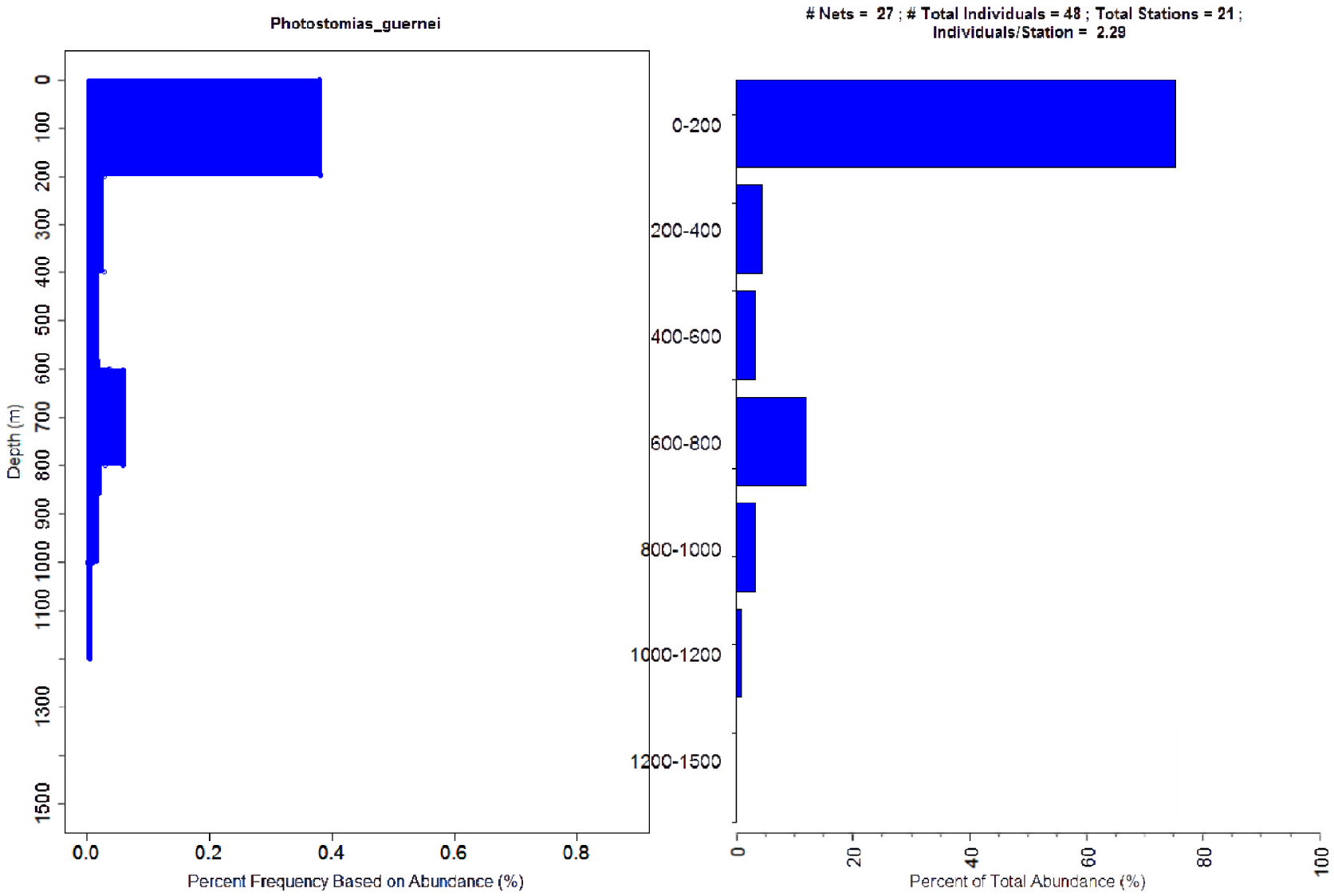
Percophidae



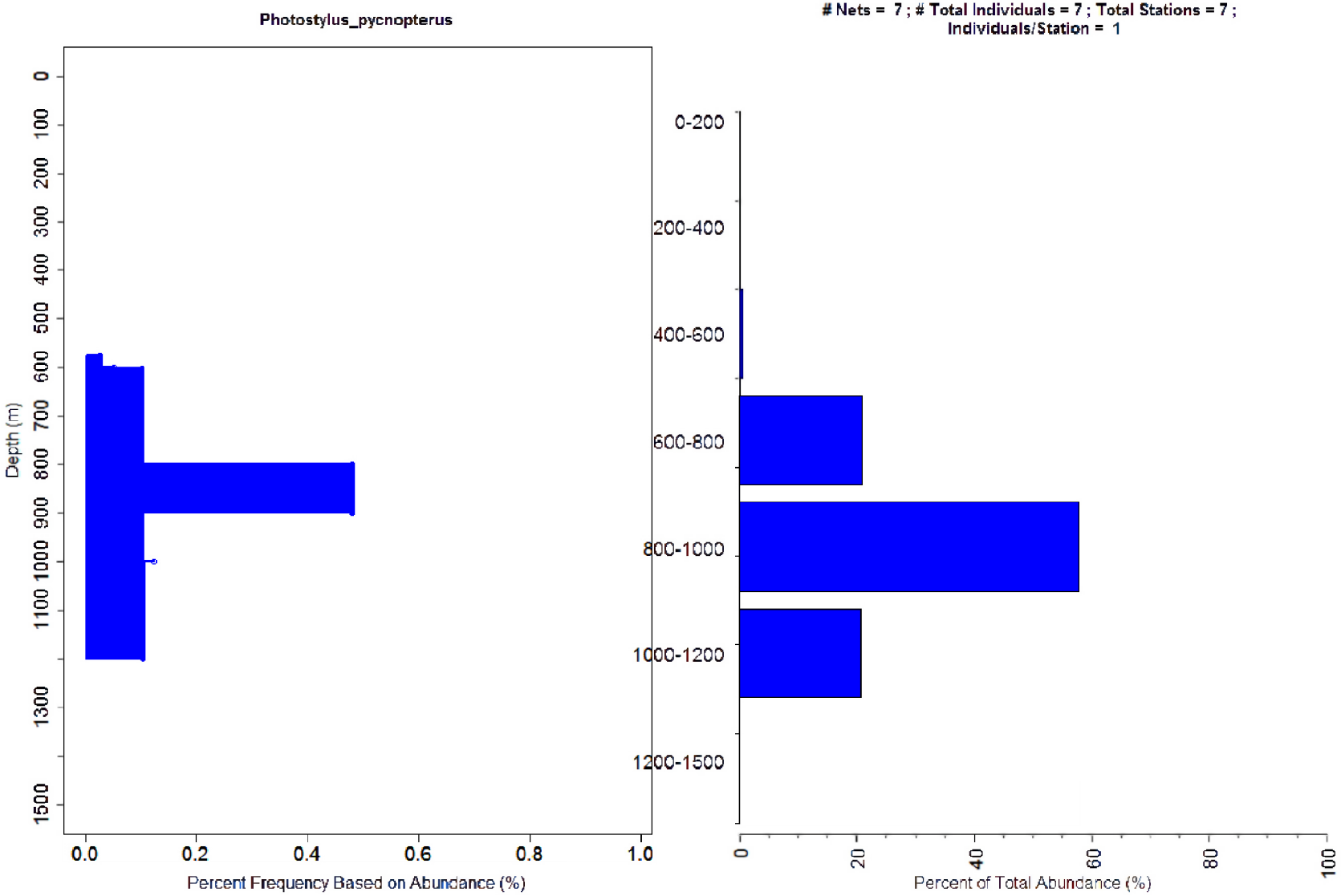
Periphyllidae



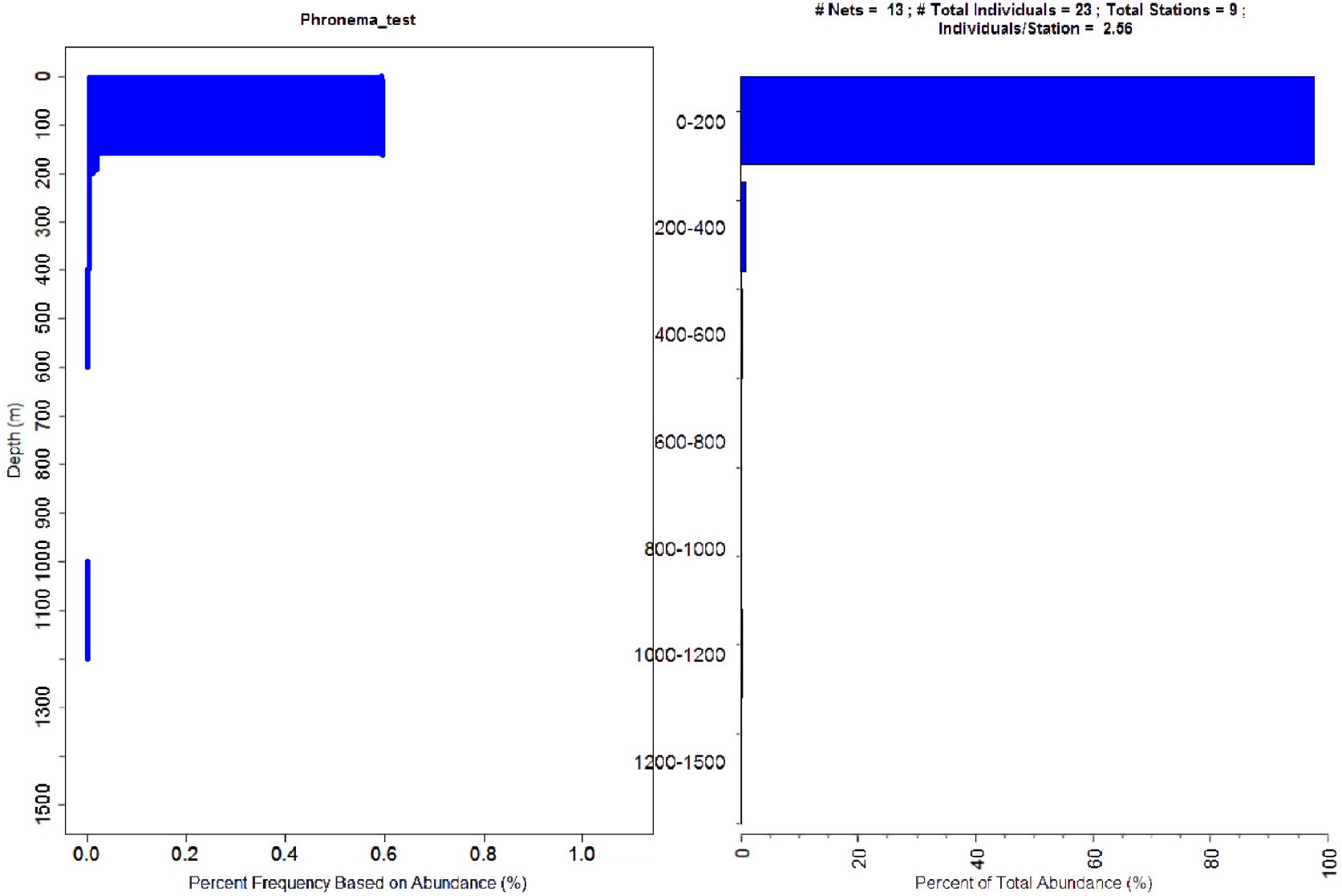
Phosichthyidae



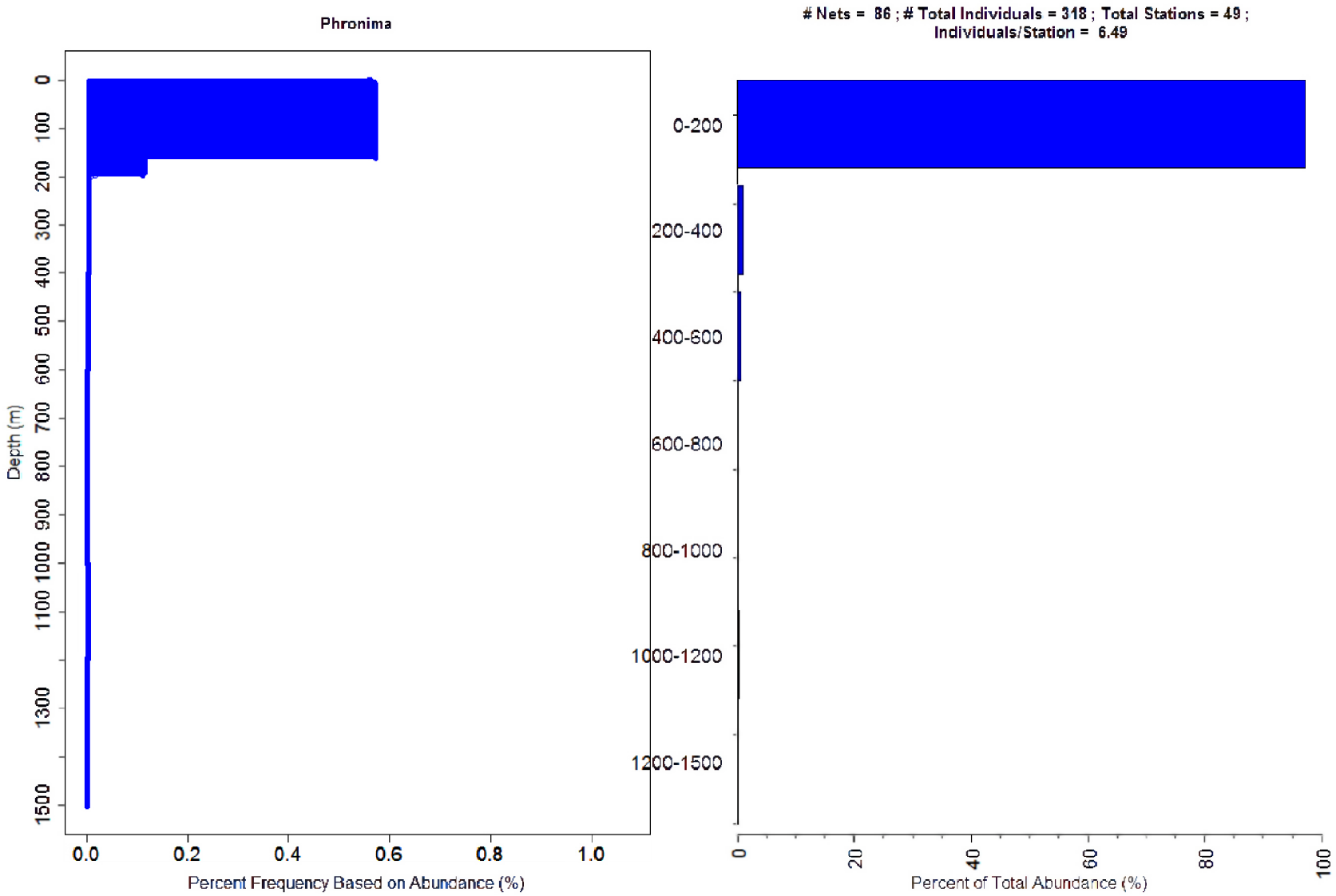
Photostomias_guernei



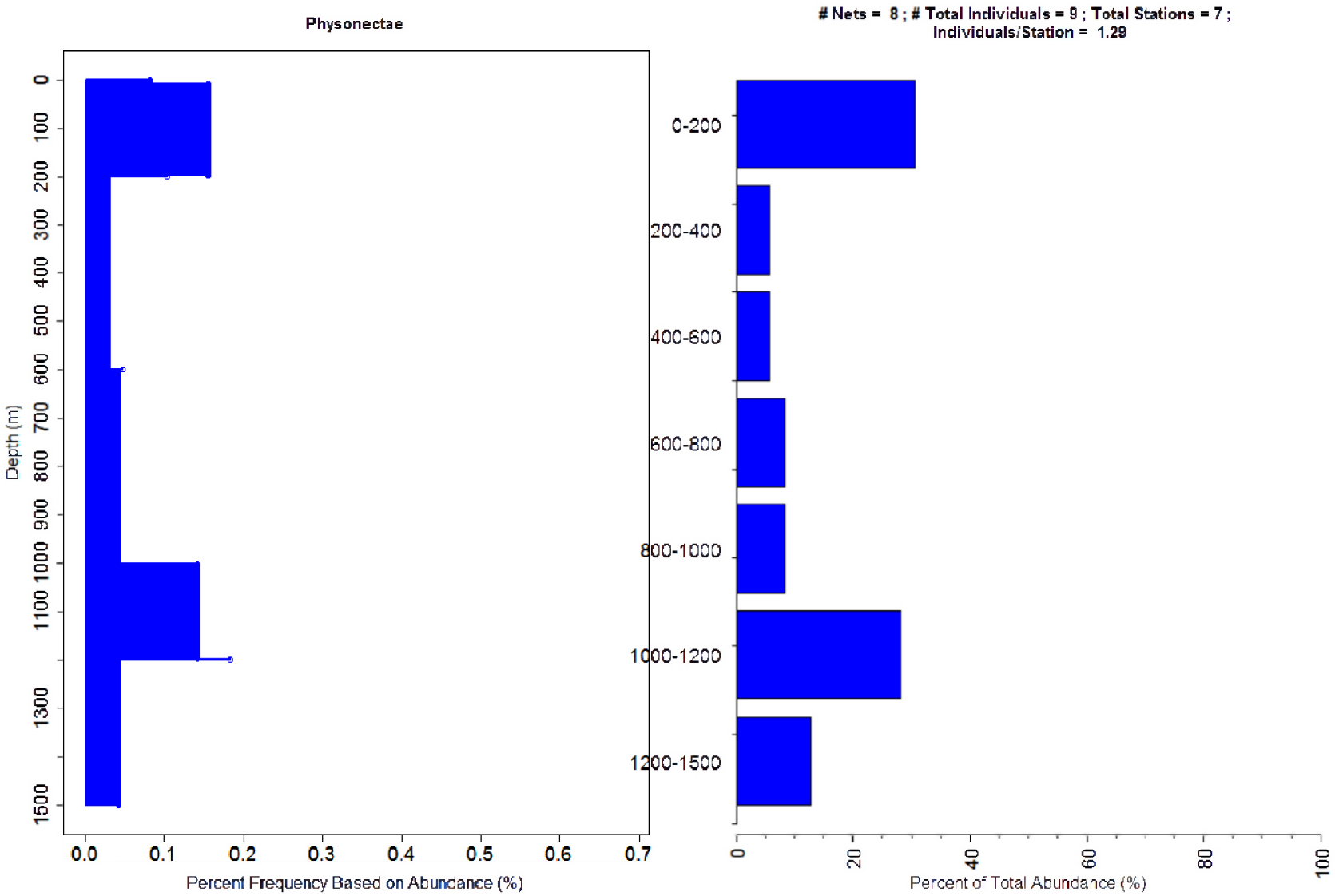
Photostylus_pycnopterus



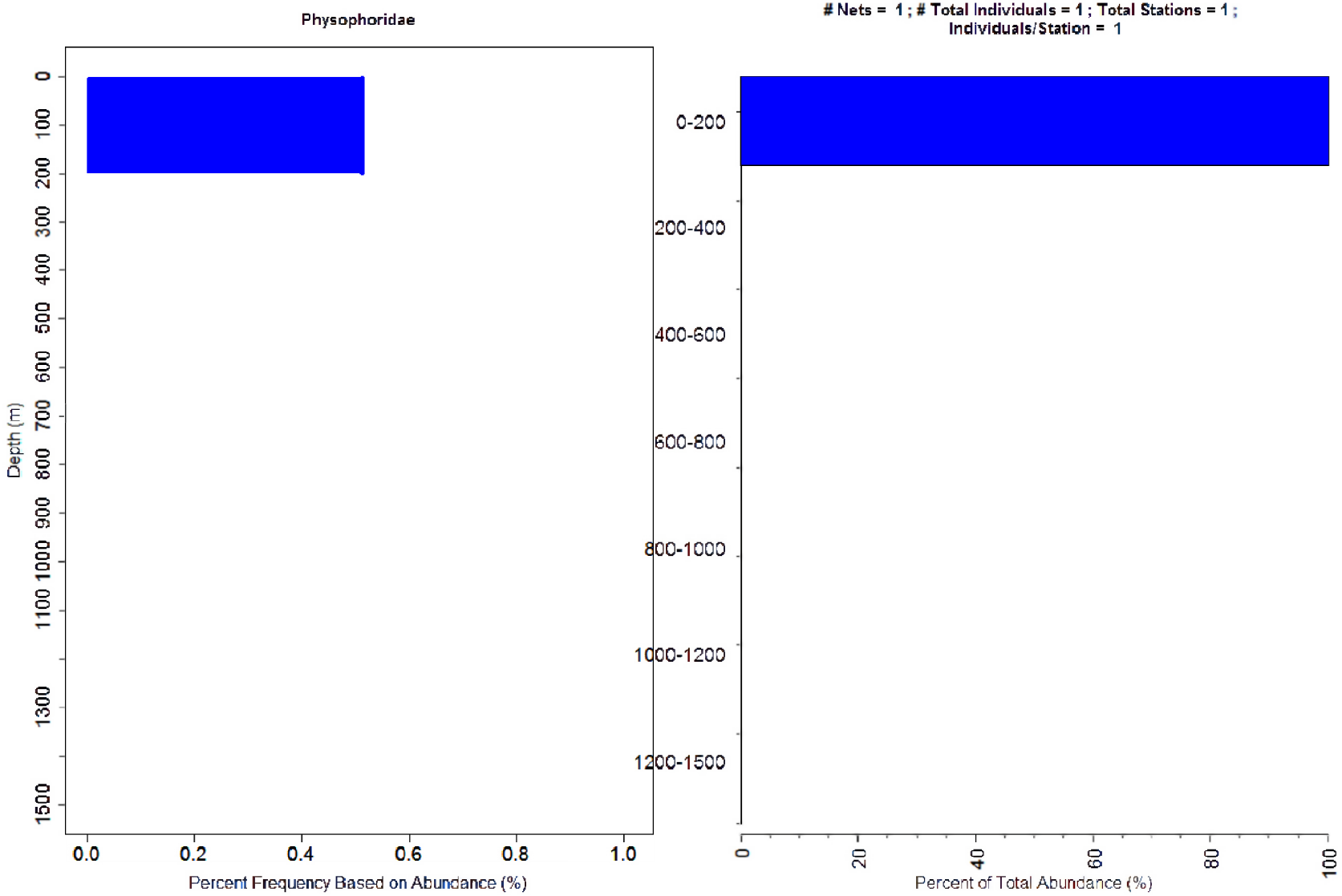
Phronema_test


Phronima
Nets = 86 ; # Total Individuals = 318 ; Total Stations = 49 ;
Individuals/Station = 6.49
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

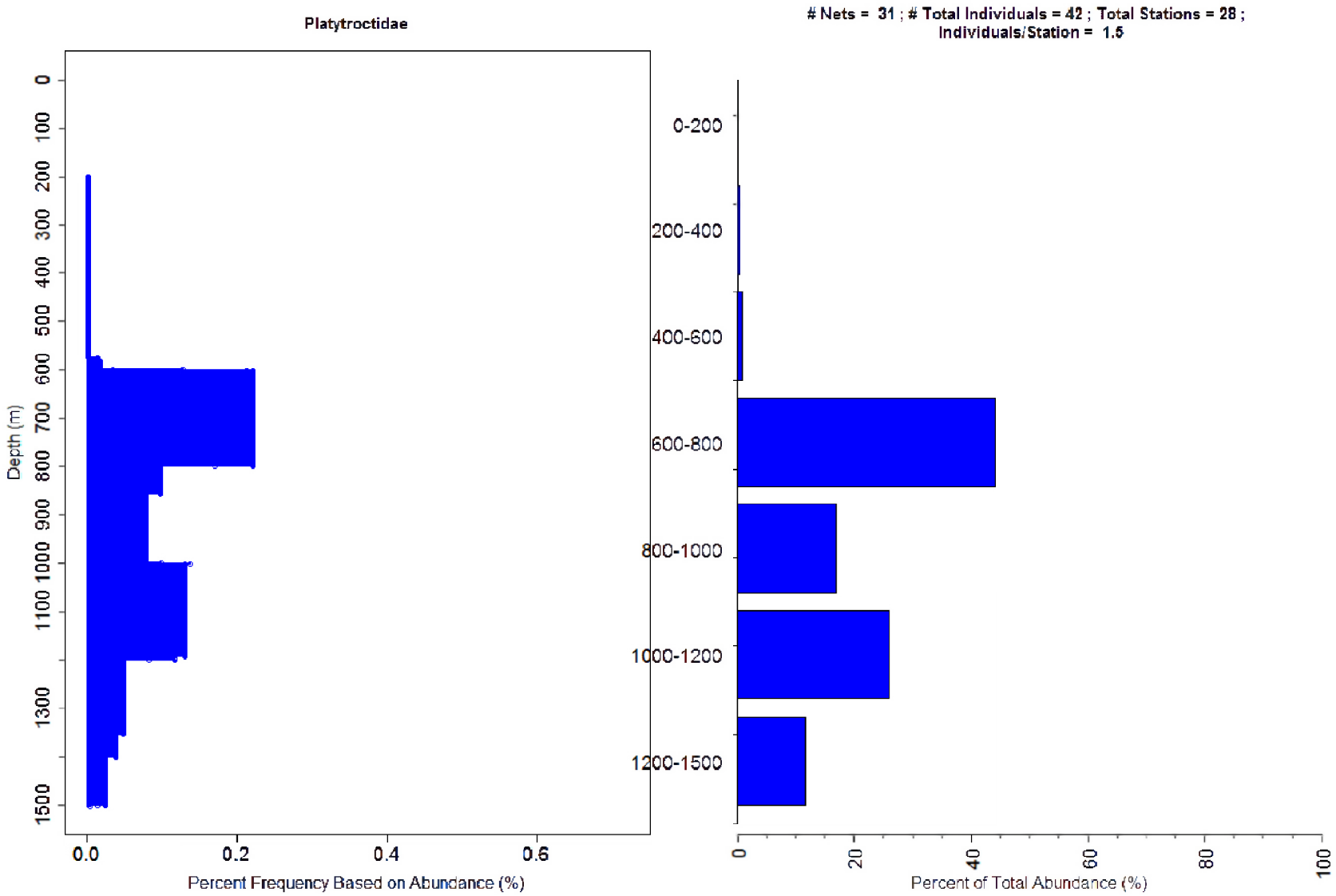
Phronima



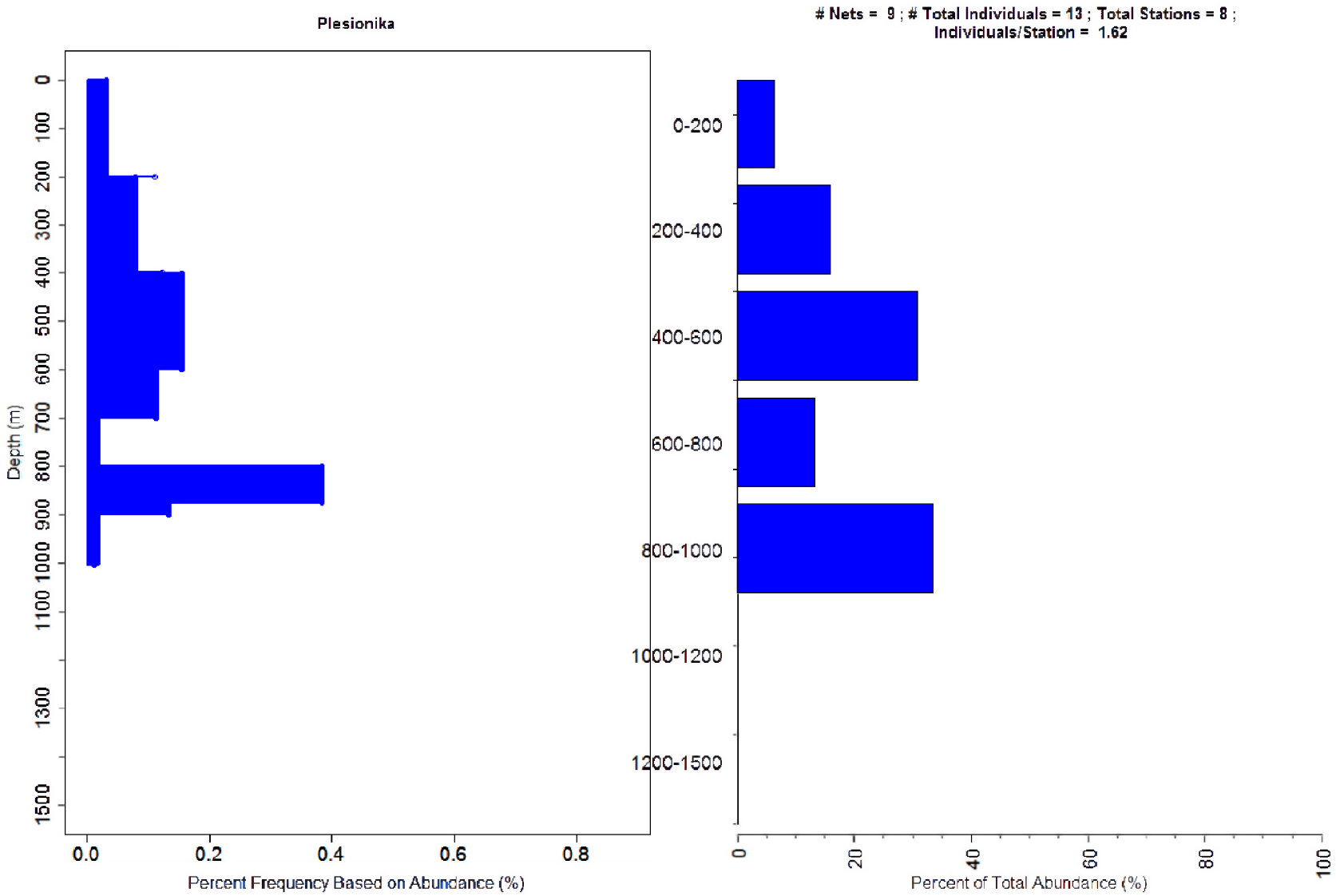
Physonectae



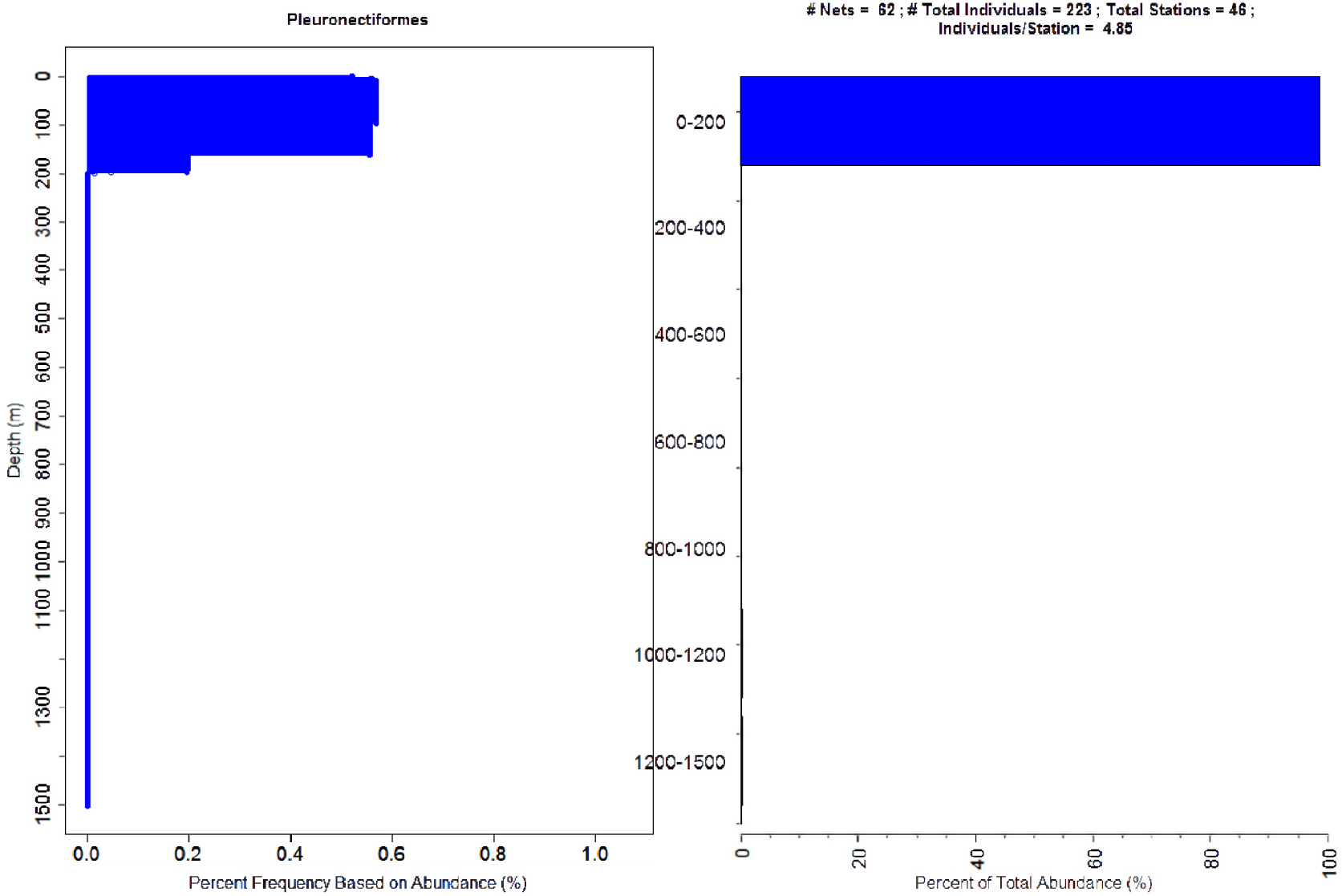
Physophoridae



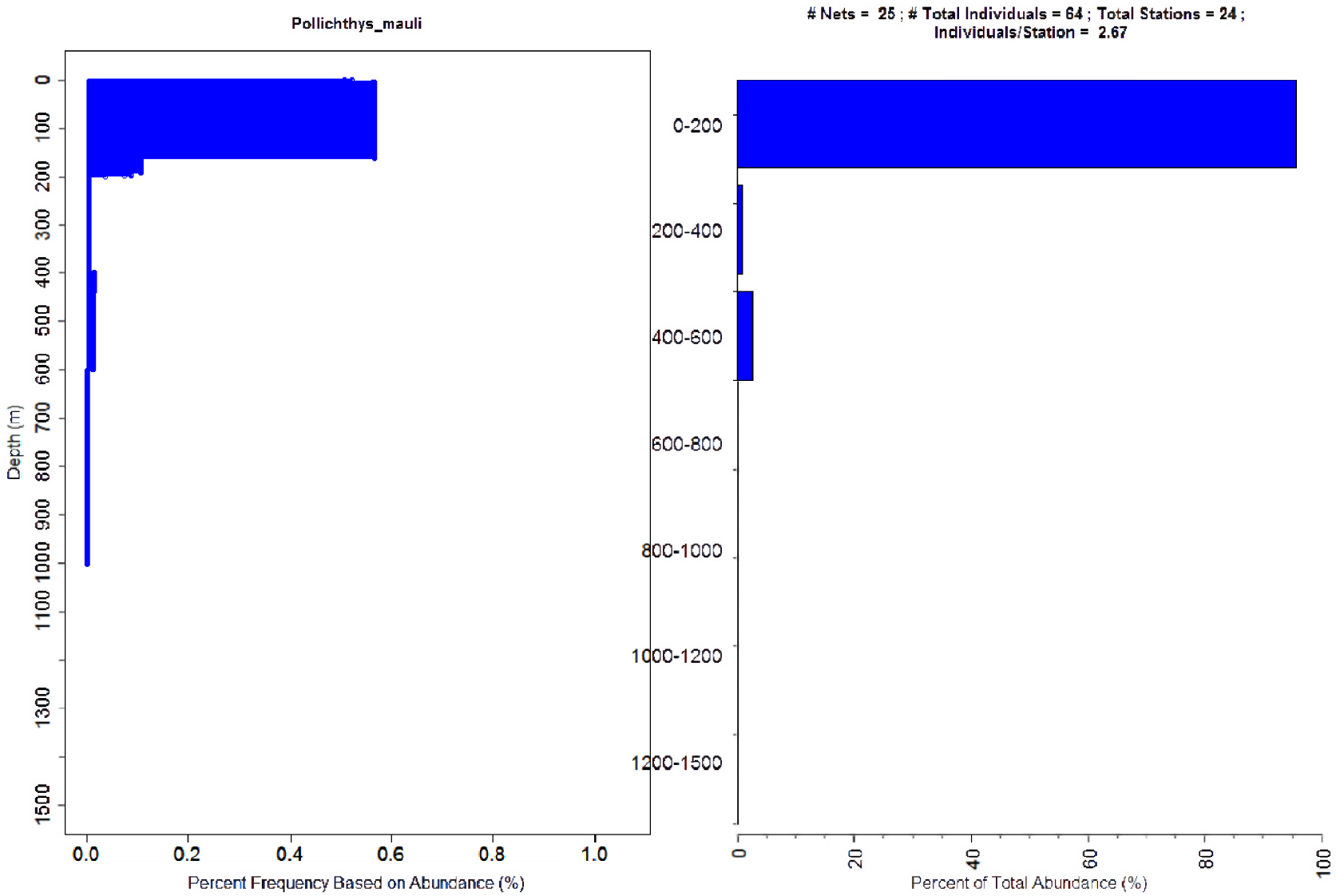
Platytroctidae


Plesionika
Nets = 9 ; # Total Individuals = 13 ; Total Stations = 8 ;
Individuals/Station = 1.62
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

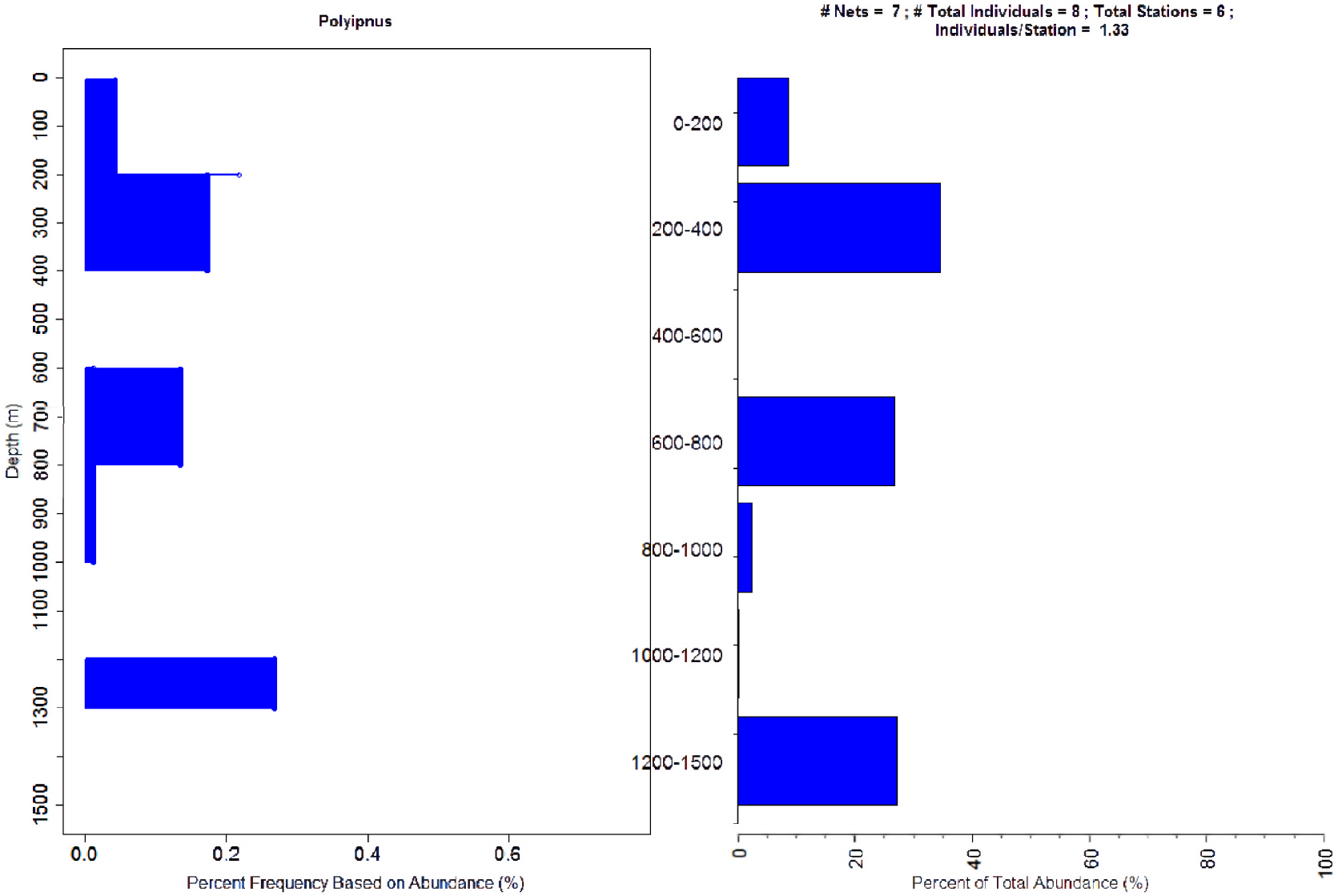
Plesionika



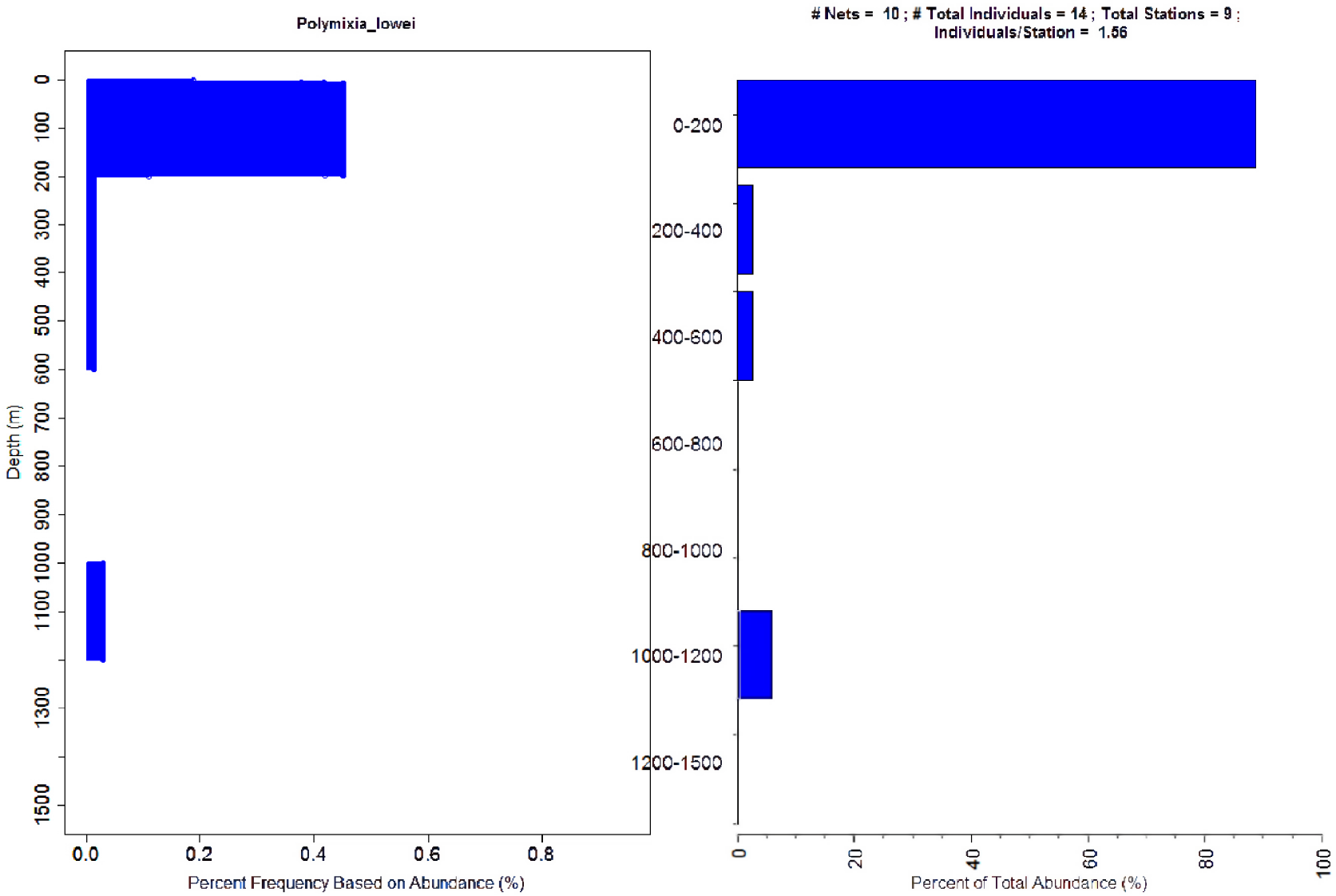
Pleuronectiformes



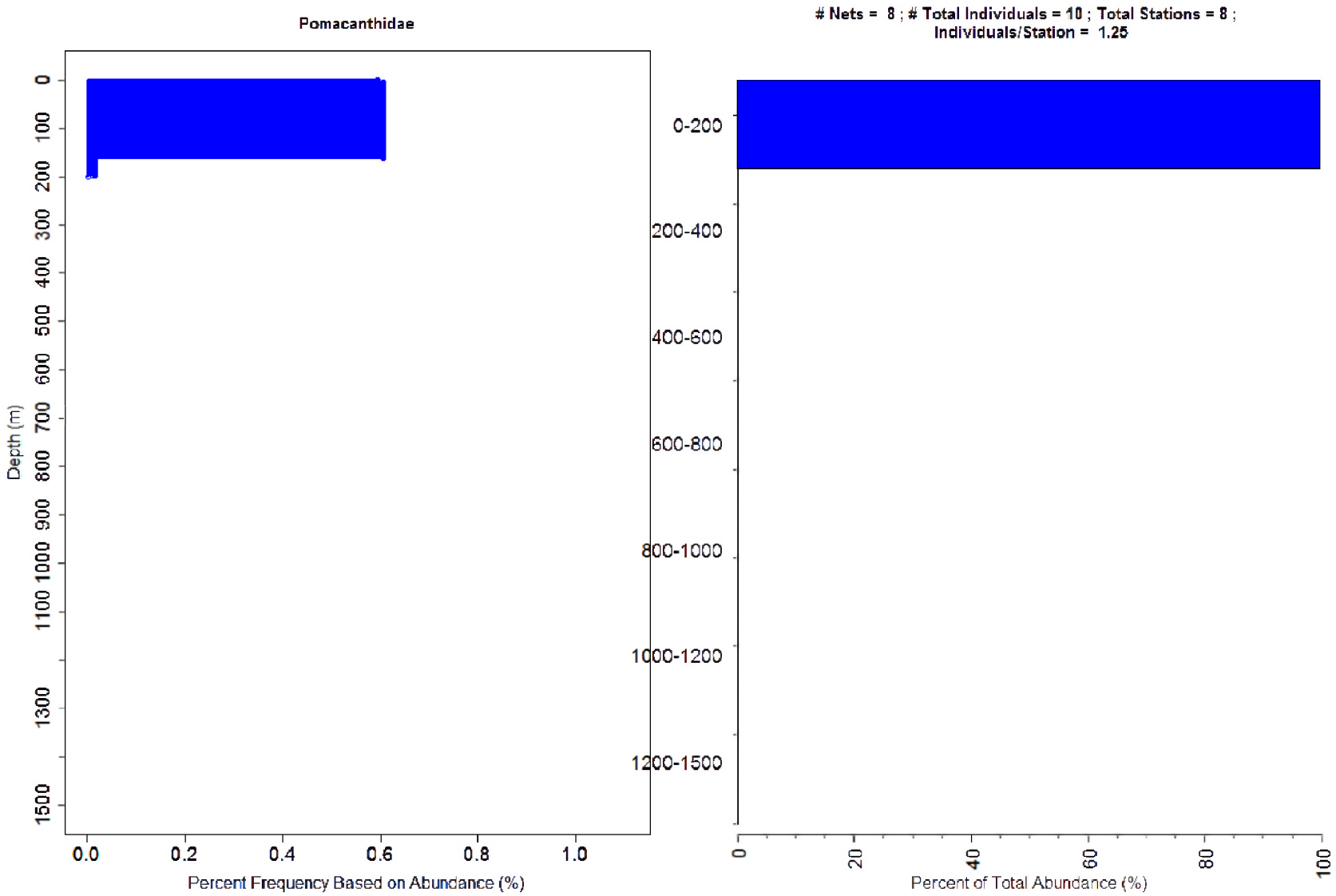
Pollichthys_mauli


Polyipnus
Nets = 7 ; # Total Individuals = 8 ; Total Stations = 6 ;
Individuals/Station = 1.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

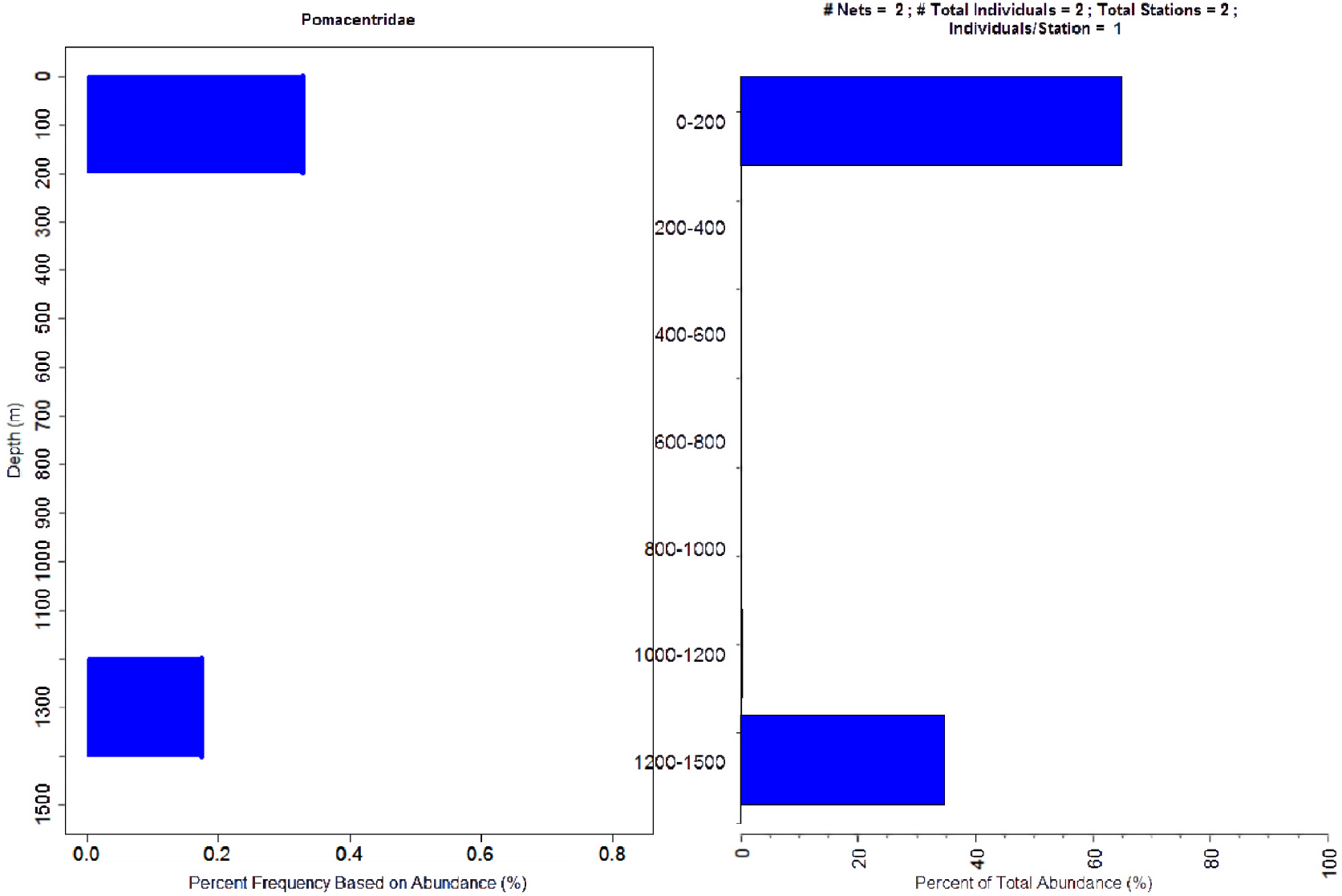
Polyipnus



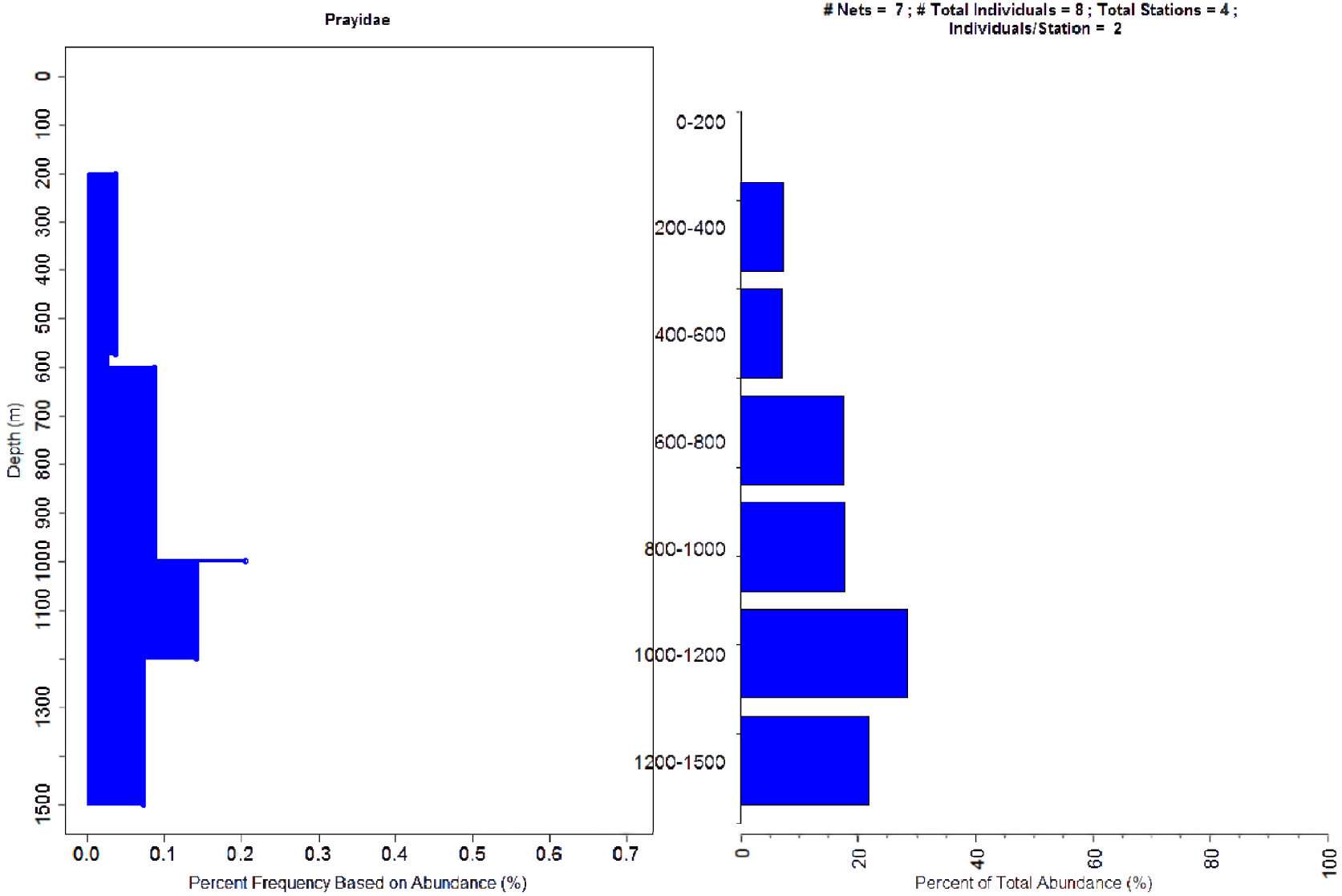
Polymixia_lowei



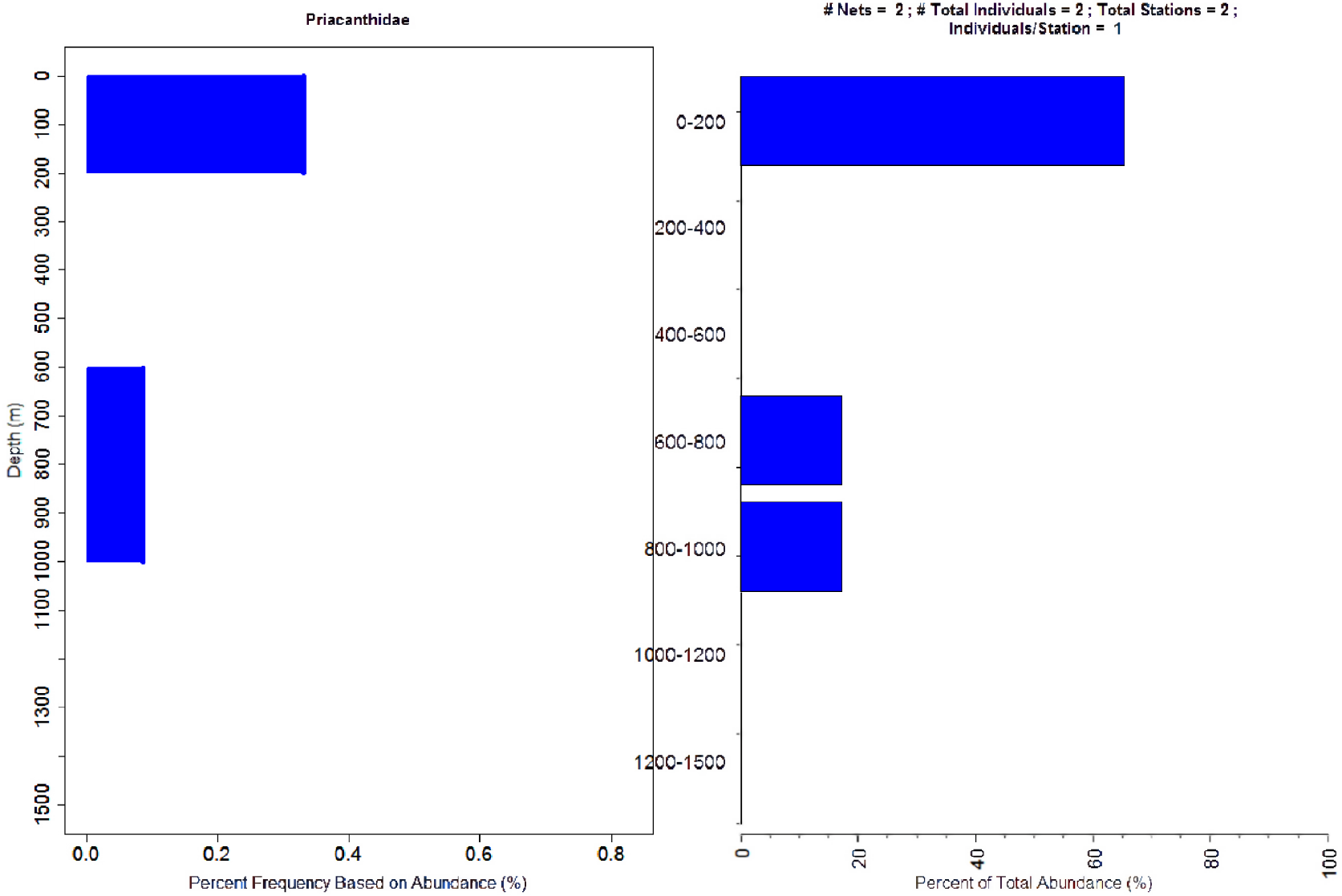
Pomacanthidae



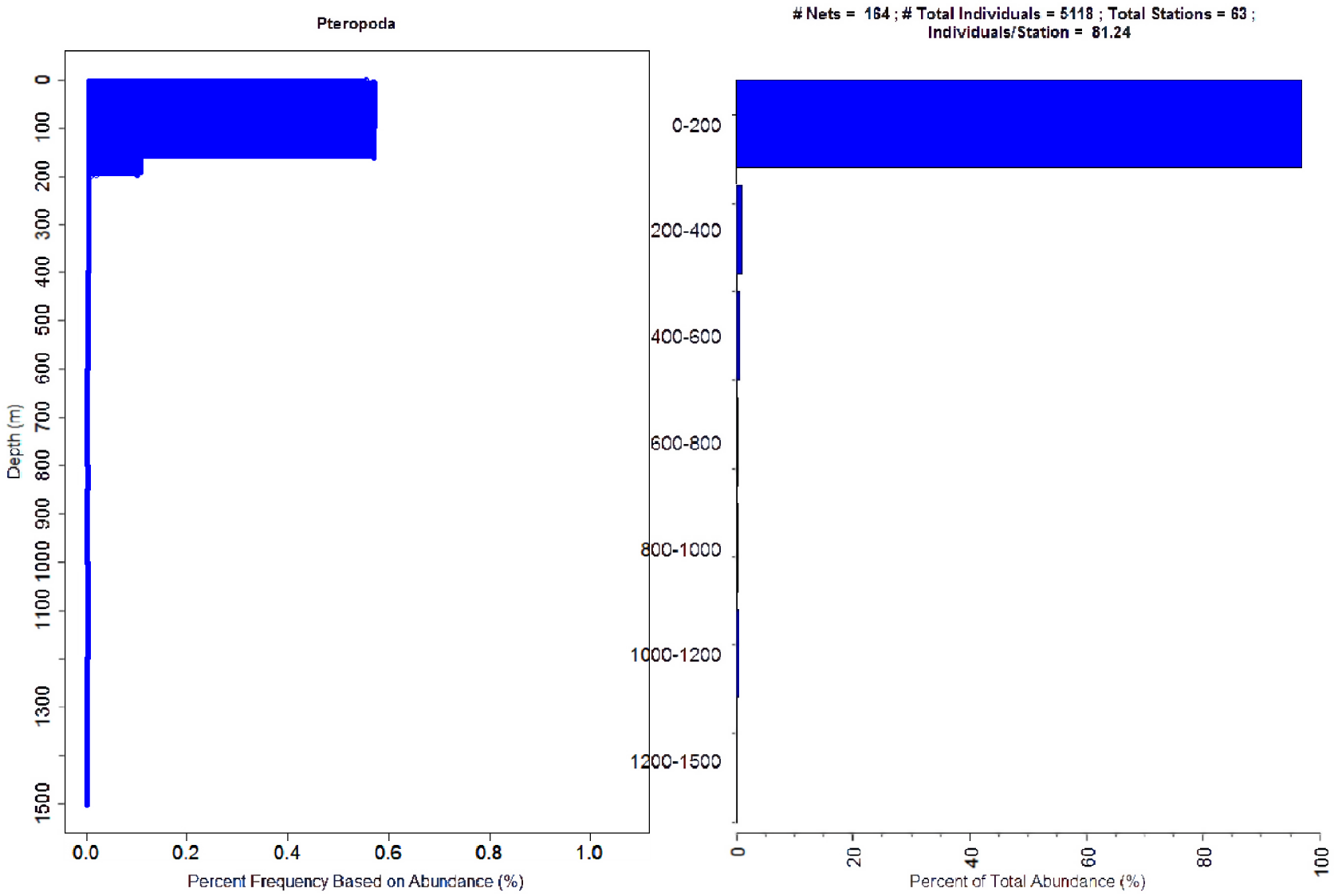
Pomacentridae


Prayidae
Nets = 7 ; # Total Individuals = 8 ; Total Stations = 4 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

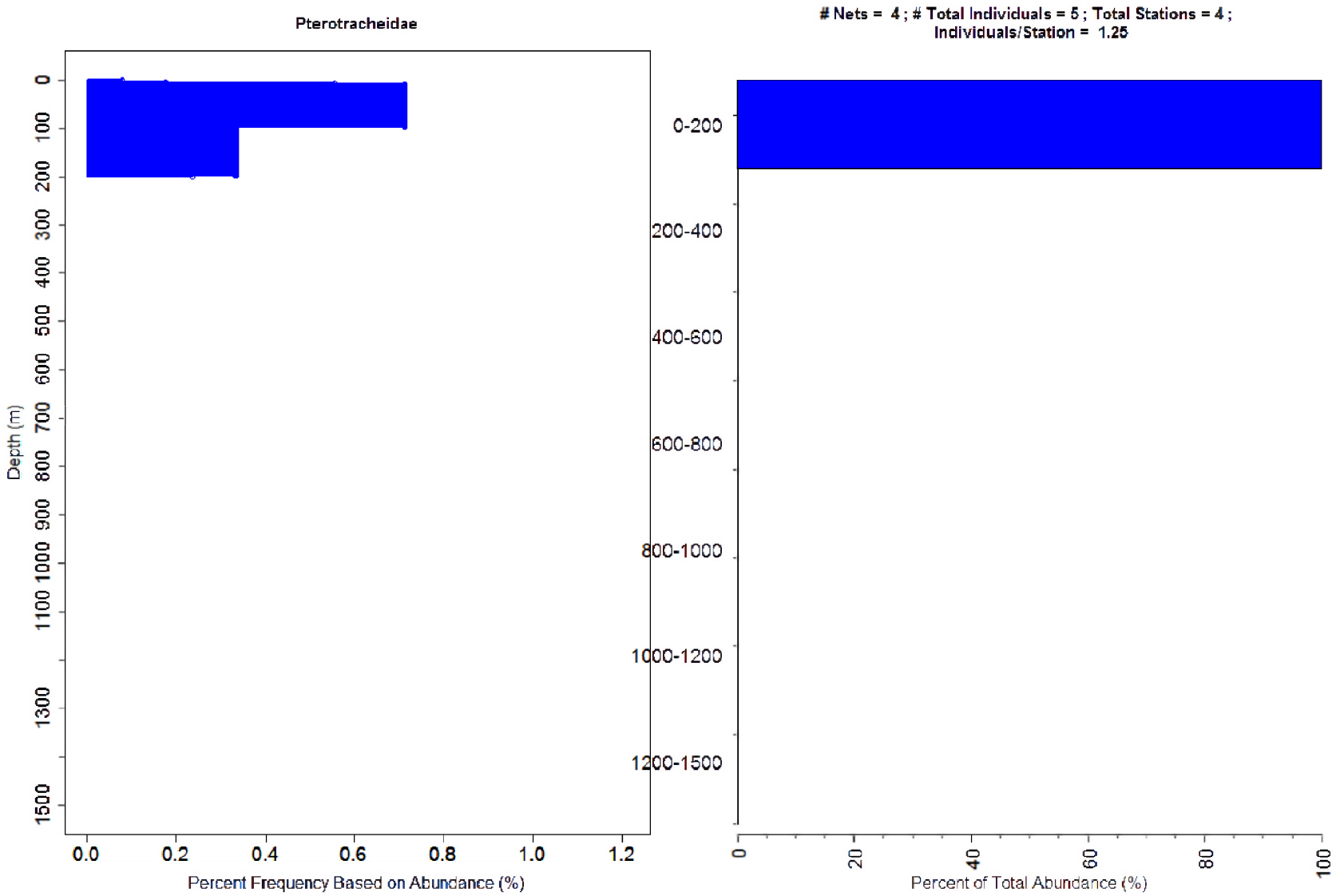
Prayidae



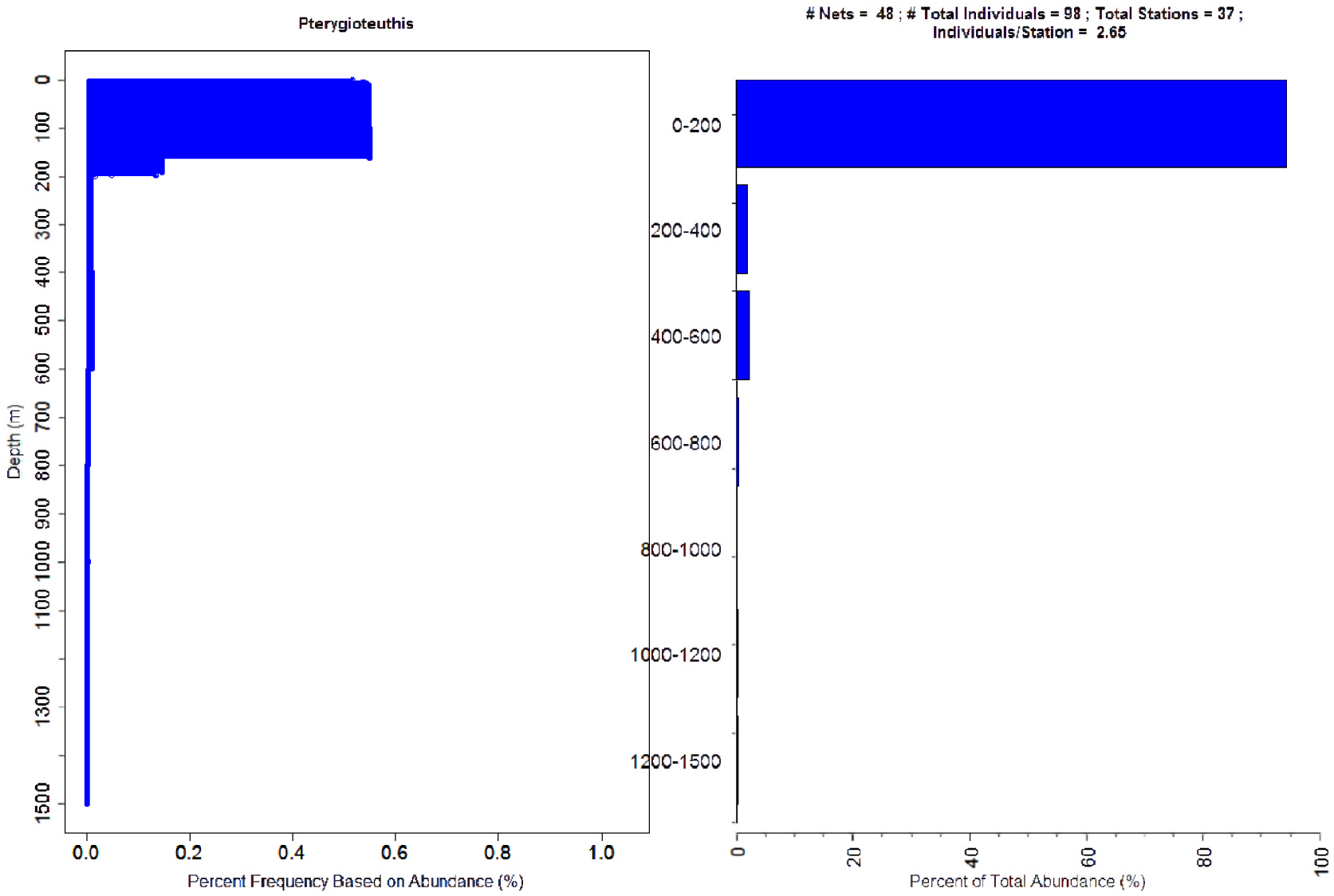
Priacanthidae


Pteropoda
Nets = 164 ; # Total Individuals = 5118 ; Total Stations = 63 ;
Individuals/Station = 81.24
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

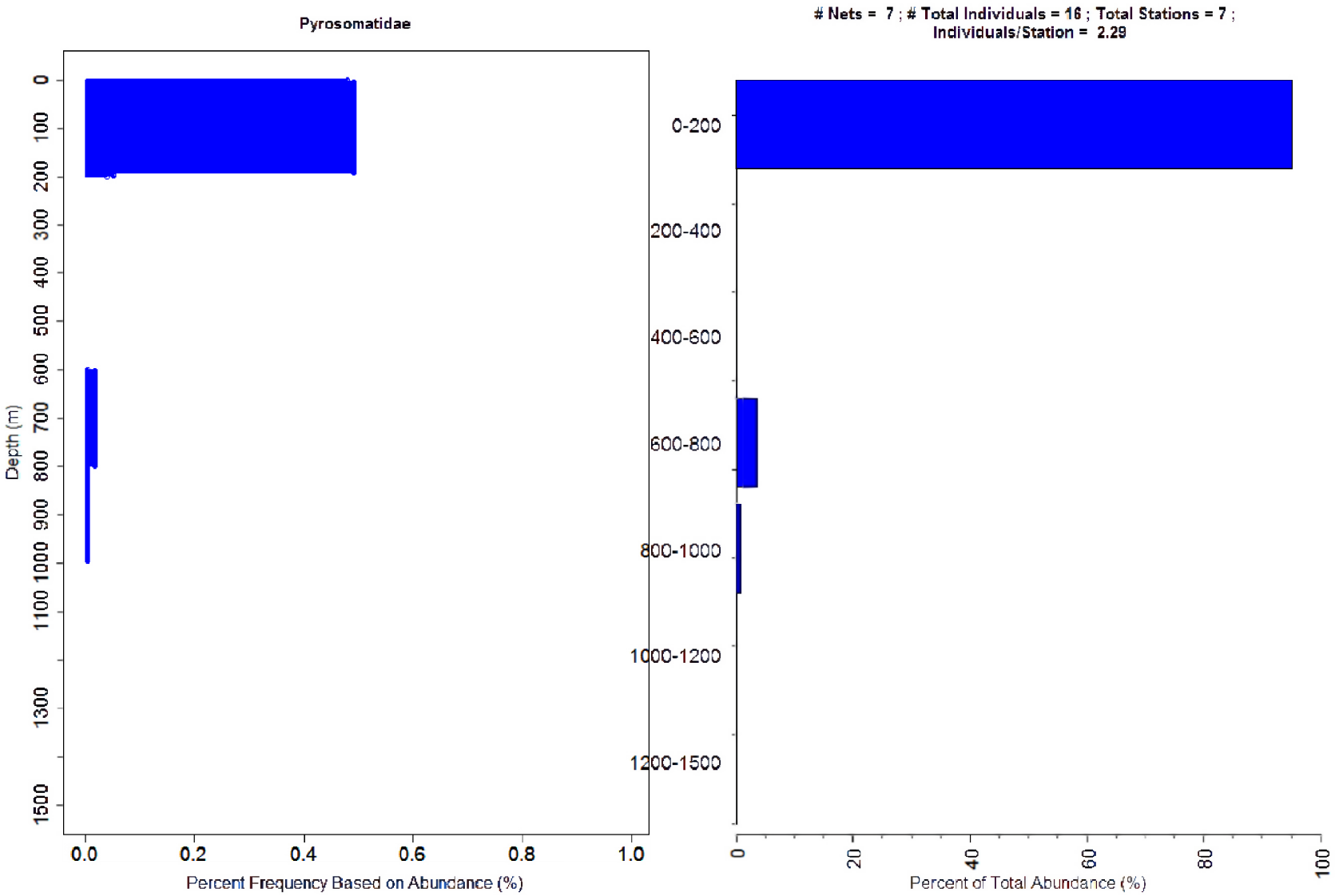
Pteropoda



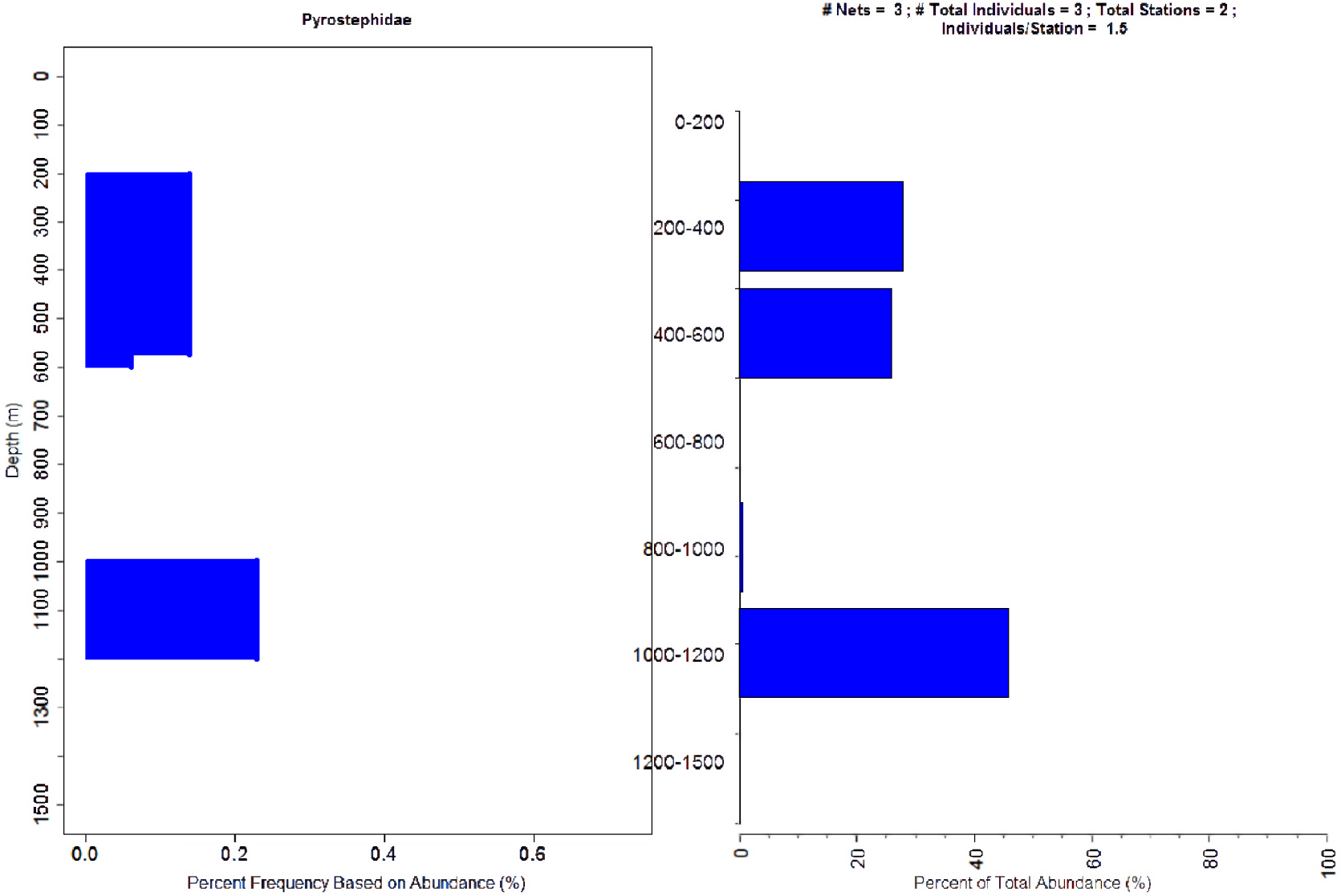
Pterotracheidae



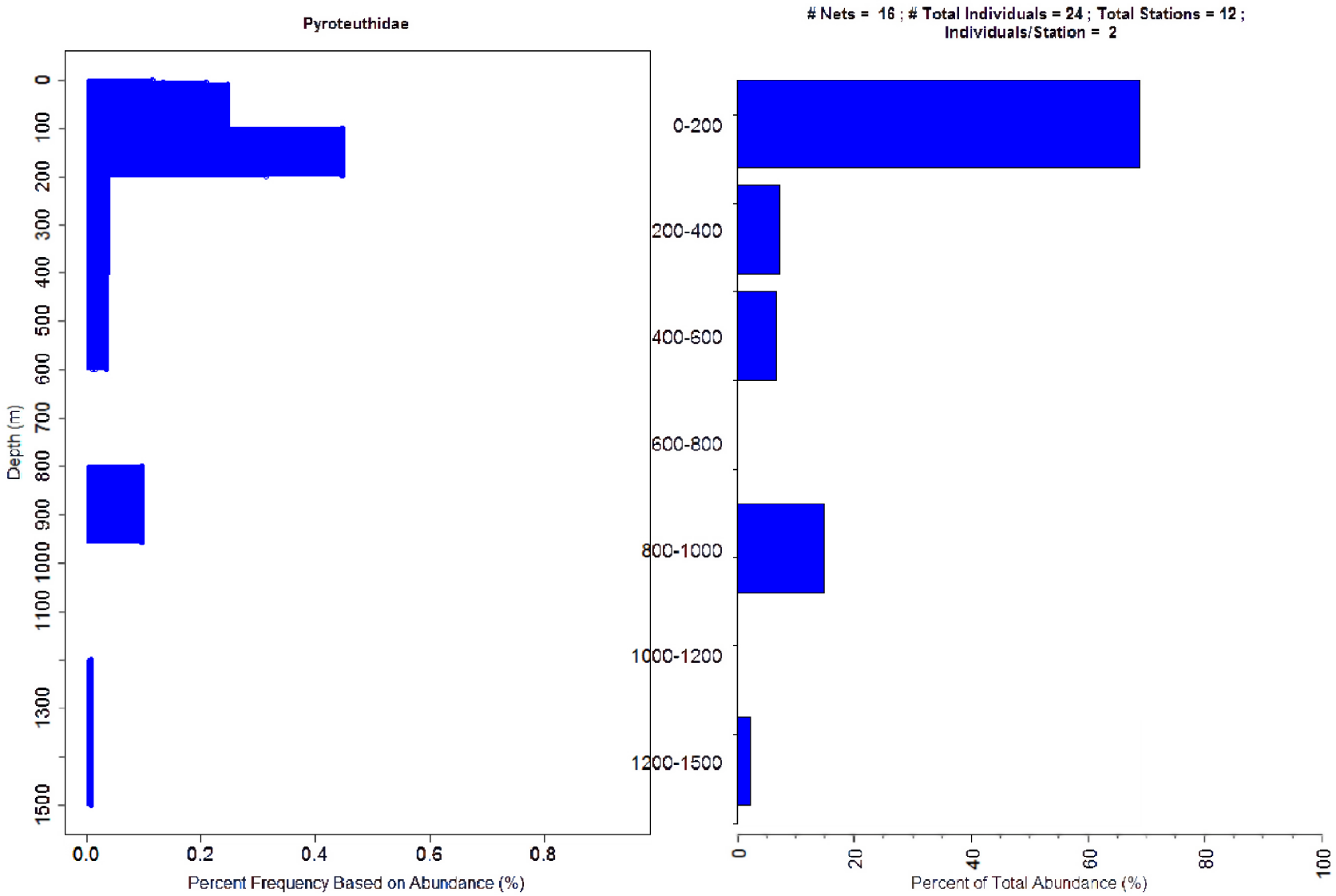
Pterygioteuthis



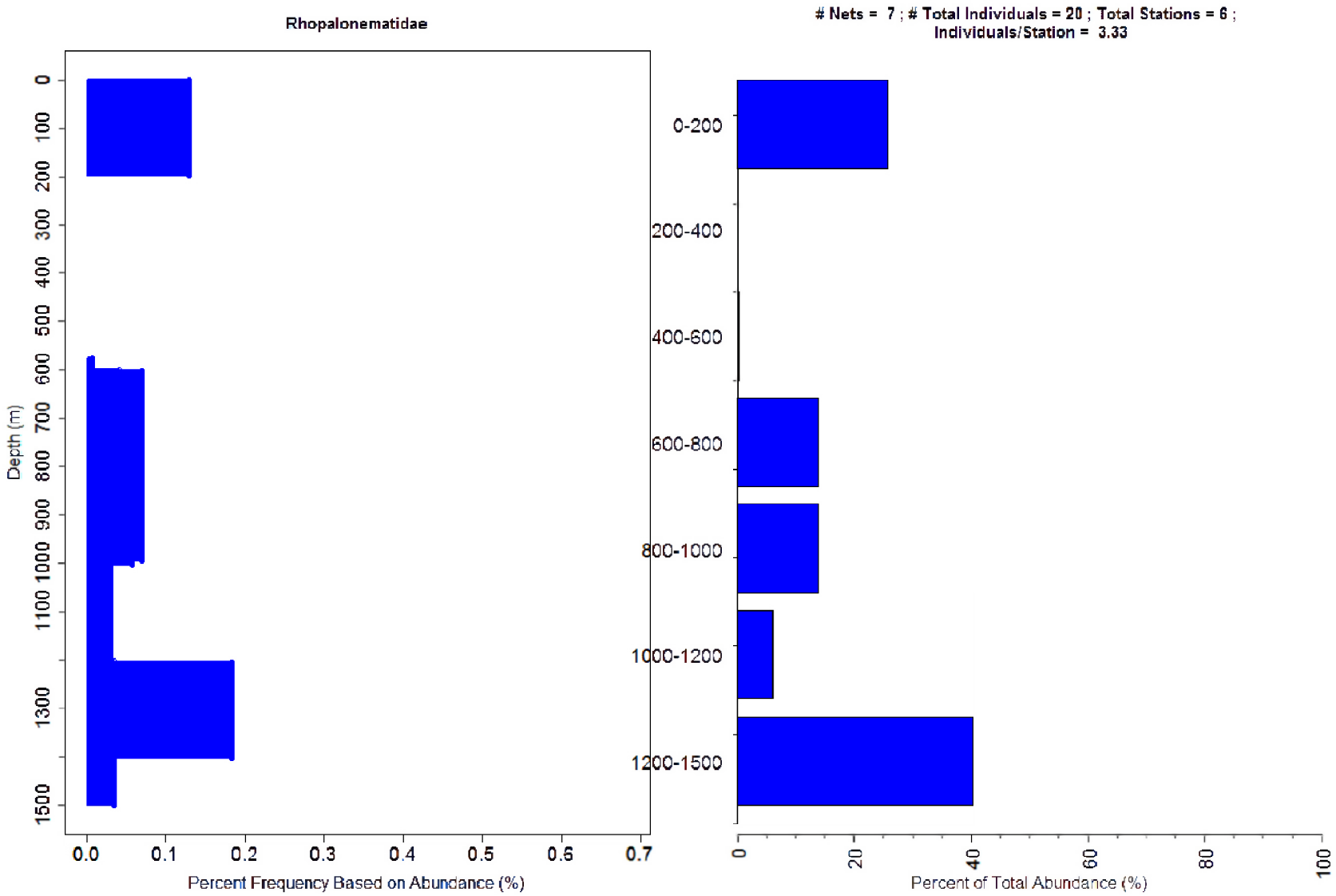
Pyrosomatidae



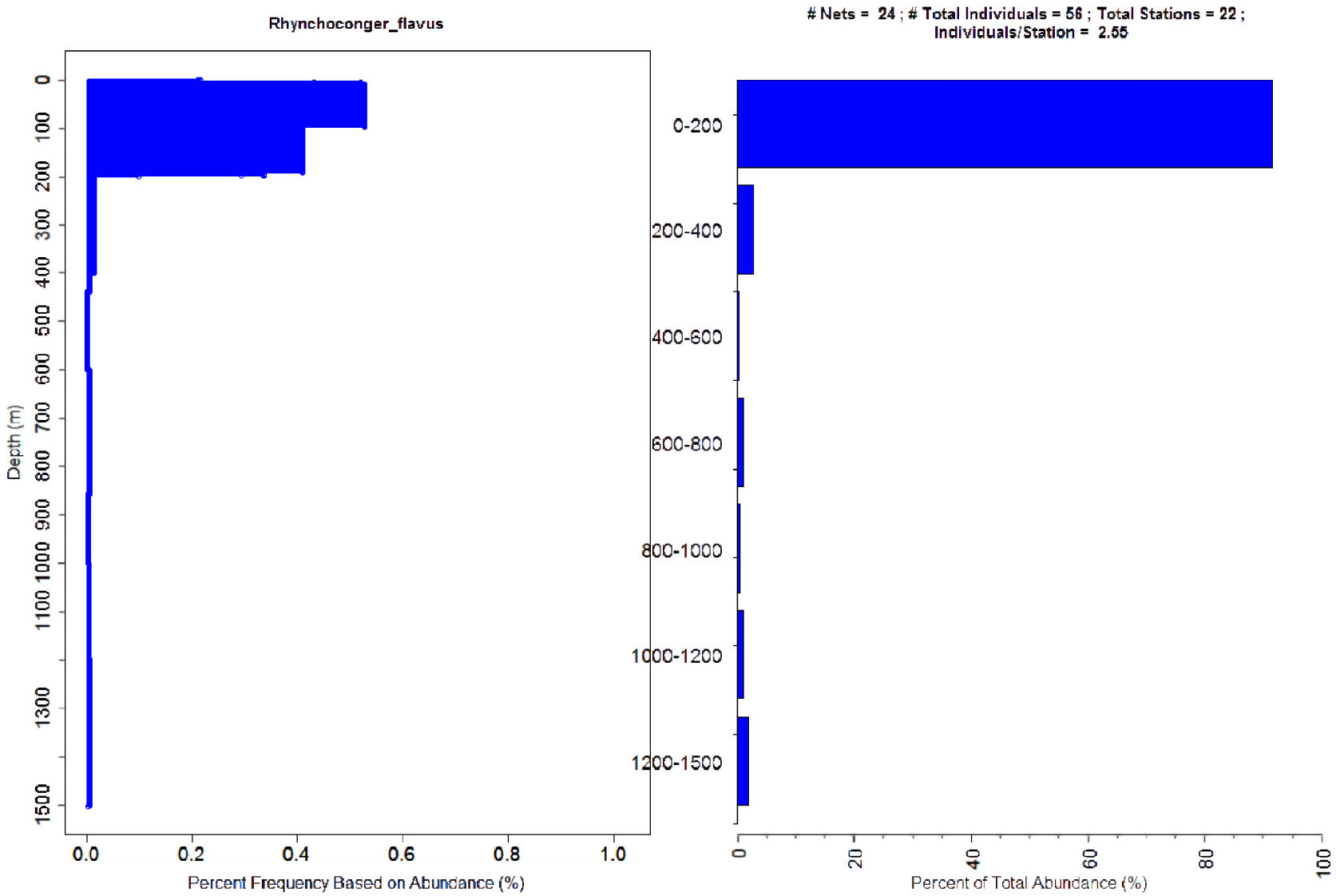
Pyrostephidae



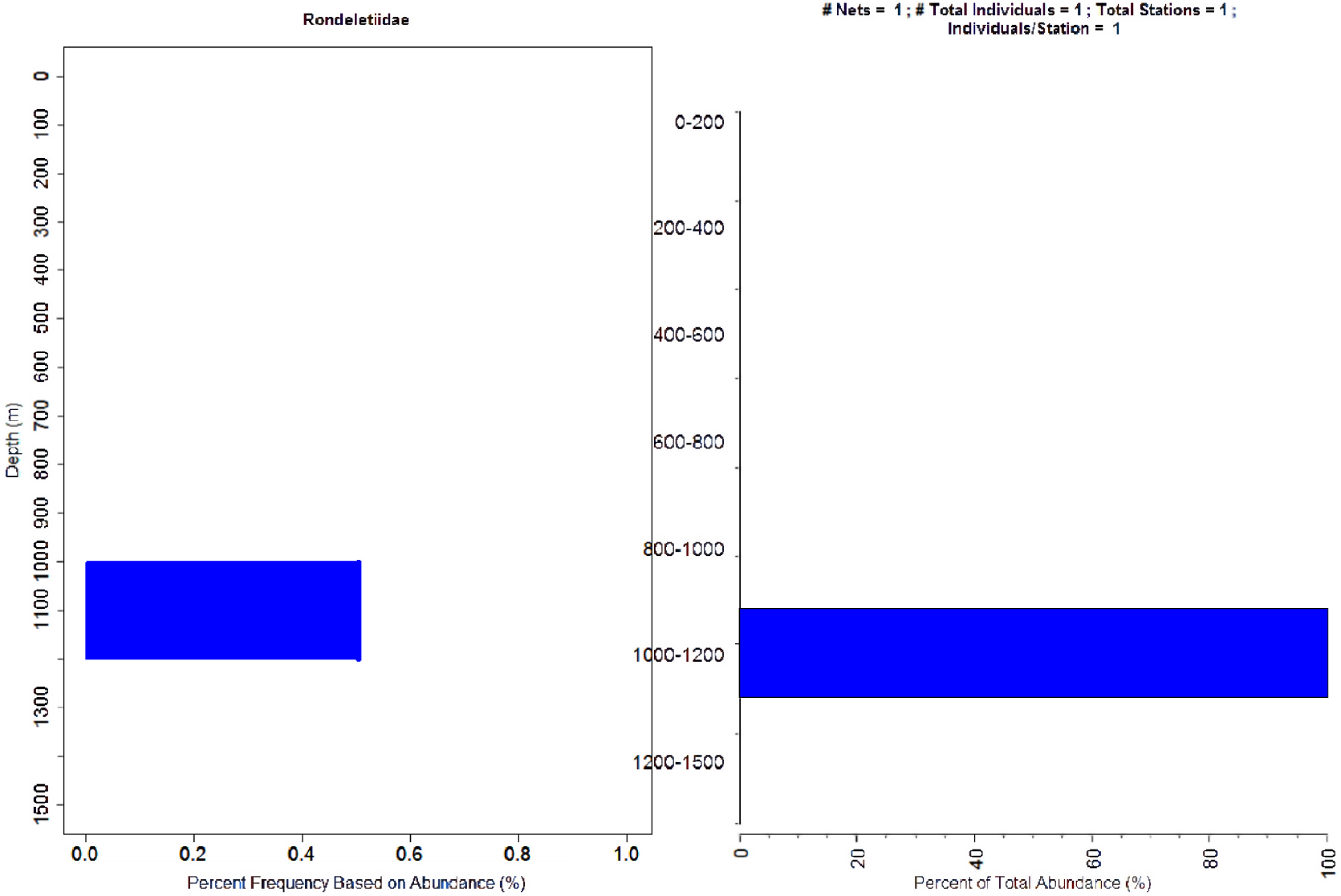
Pyroteuthidae



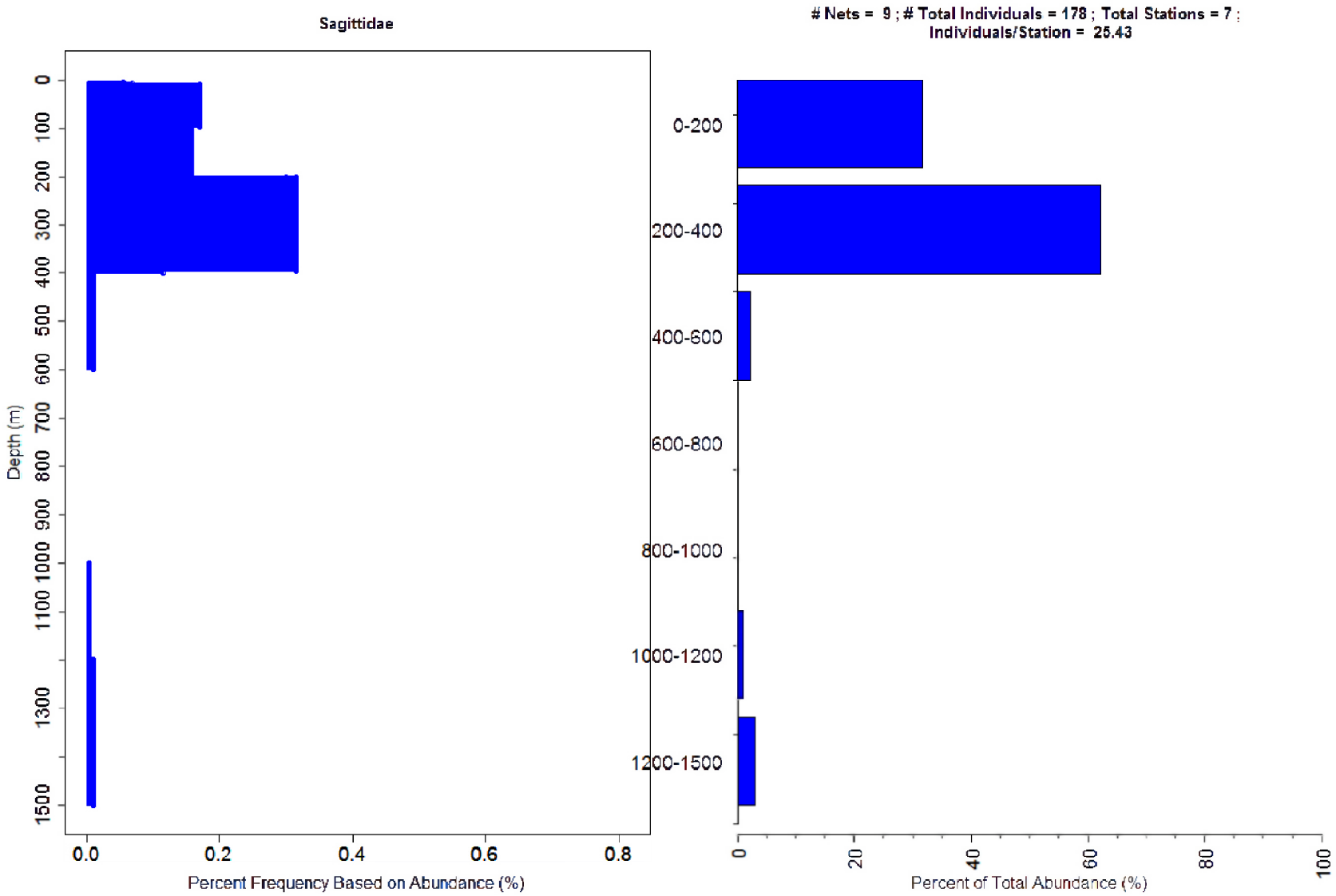
Rhopalonematidae



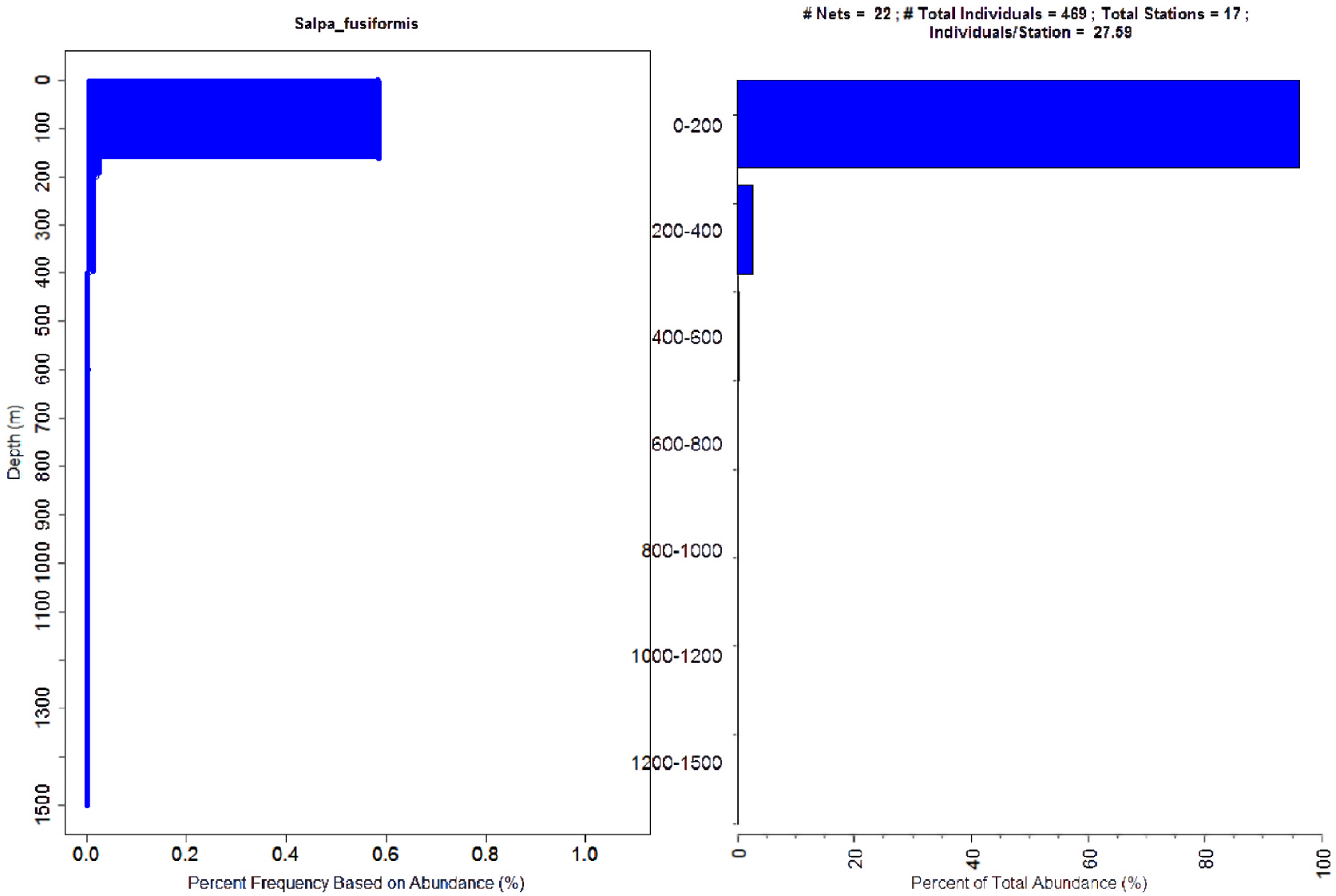
Rhynchoconger_flavus



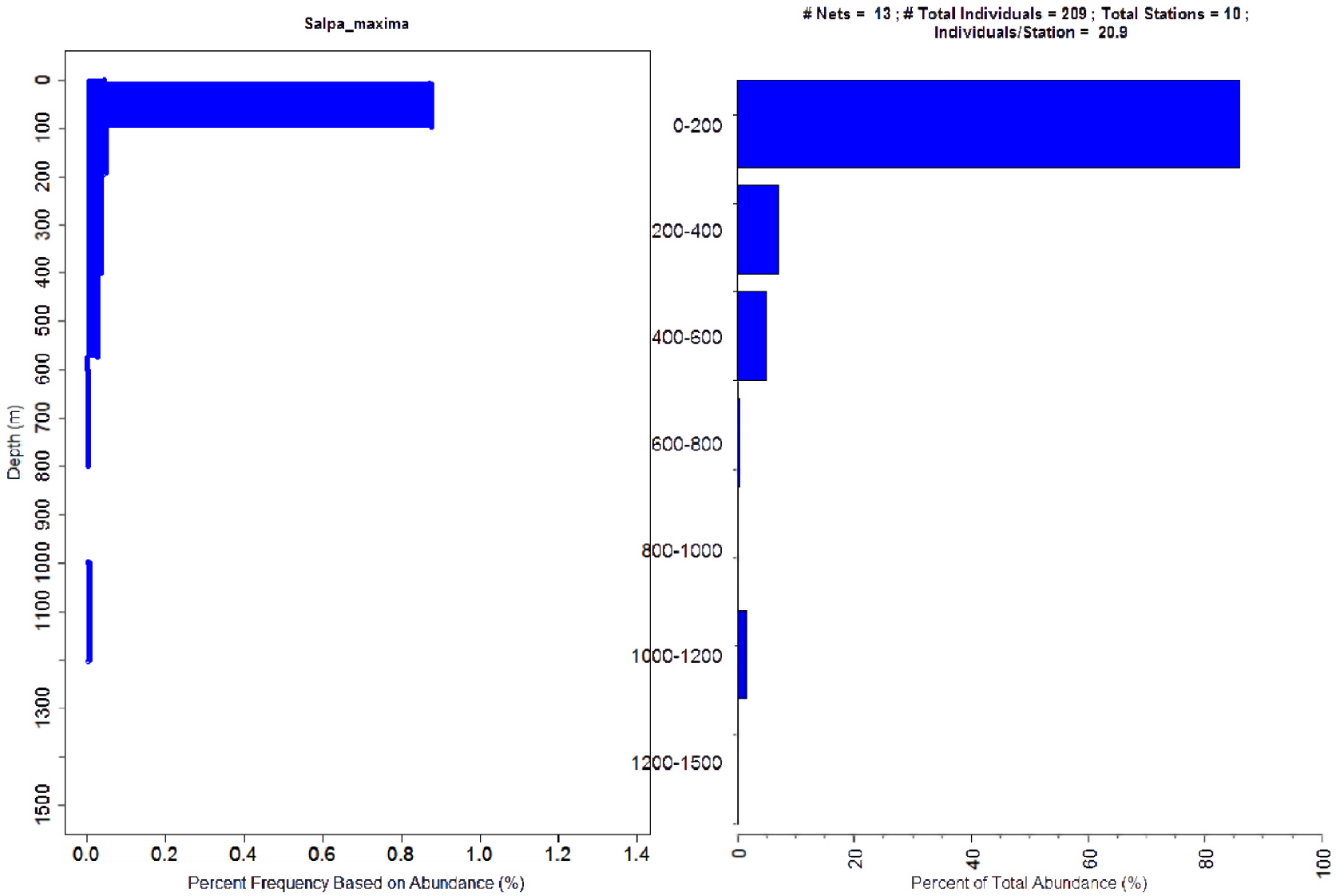
Rondeletiidae


Sagittidae
Nets = 9 ; # Total Individuals = 178 ; Total Stations = 7 ;
Individuals/Station = 25.43
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

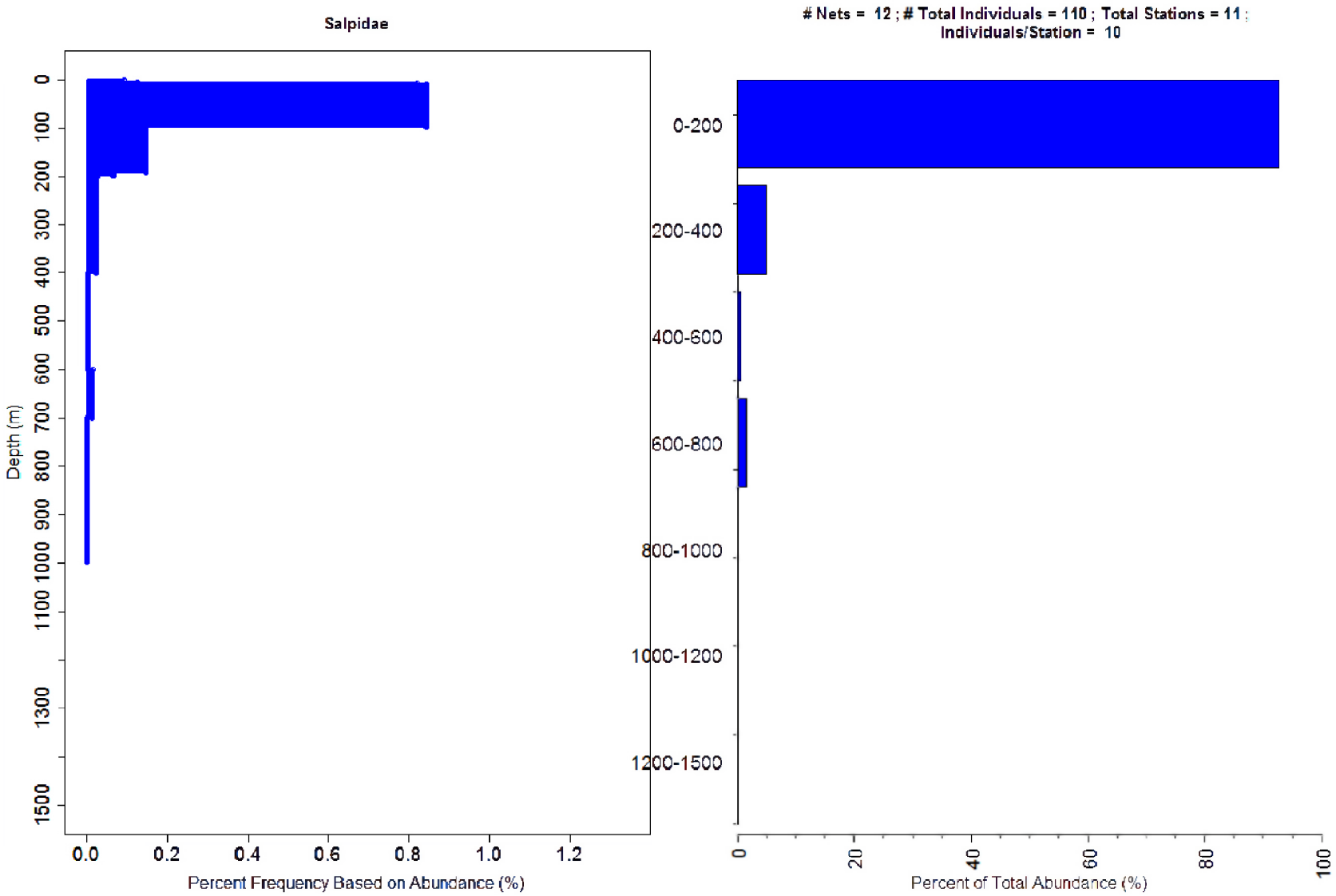
Sagittidae



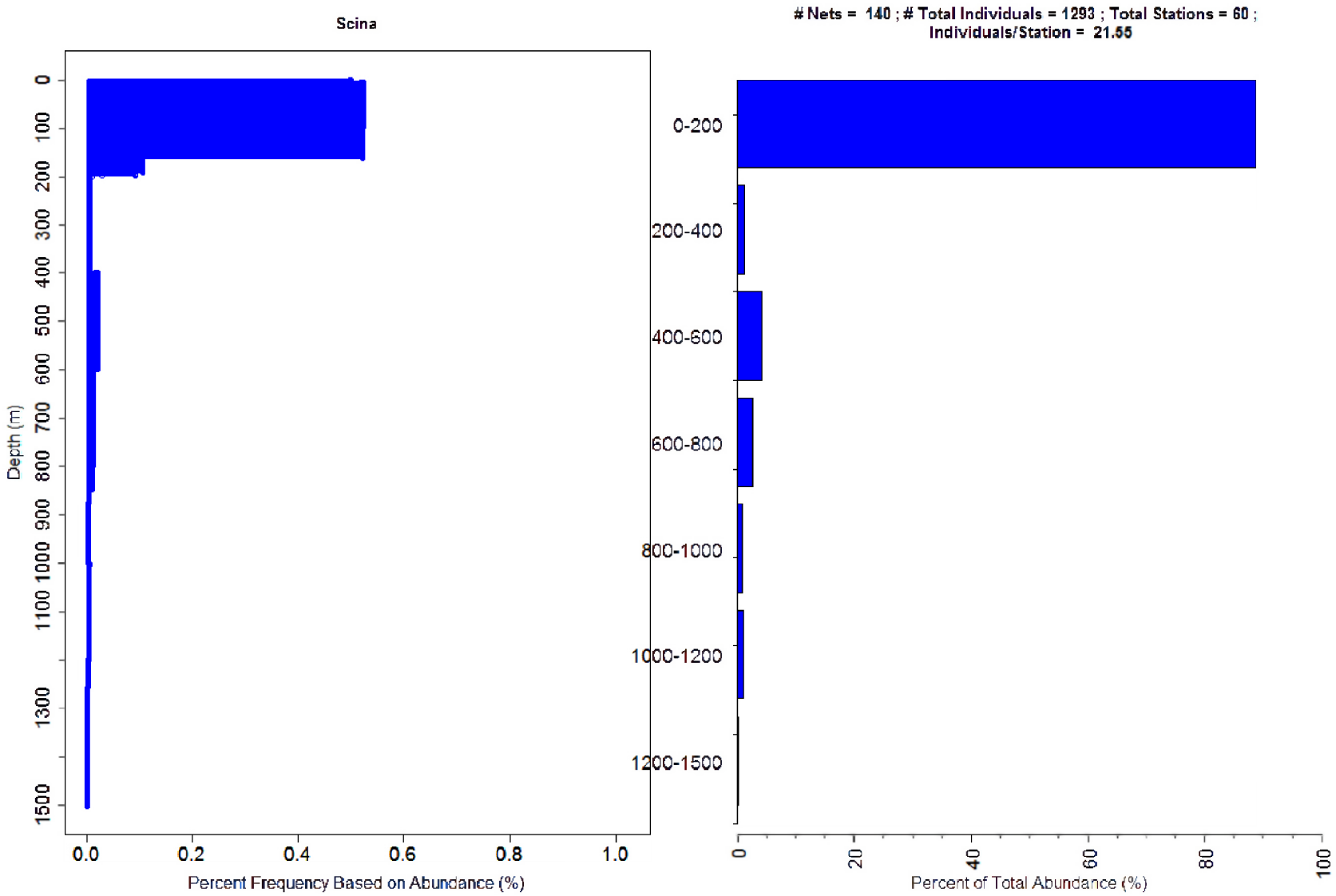
Salpa_fusiformis



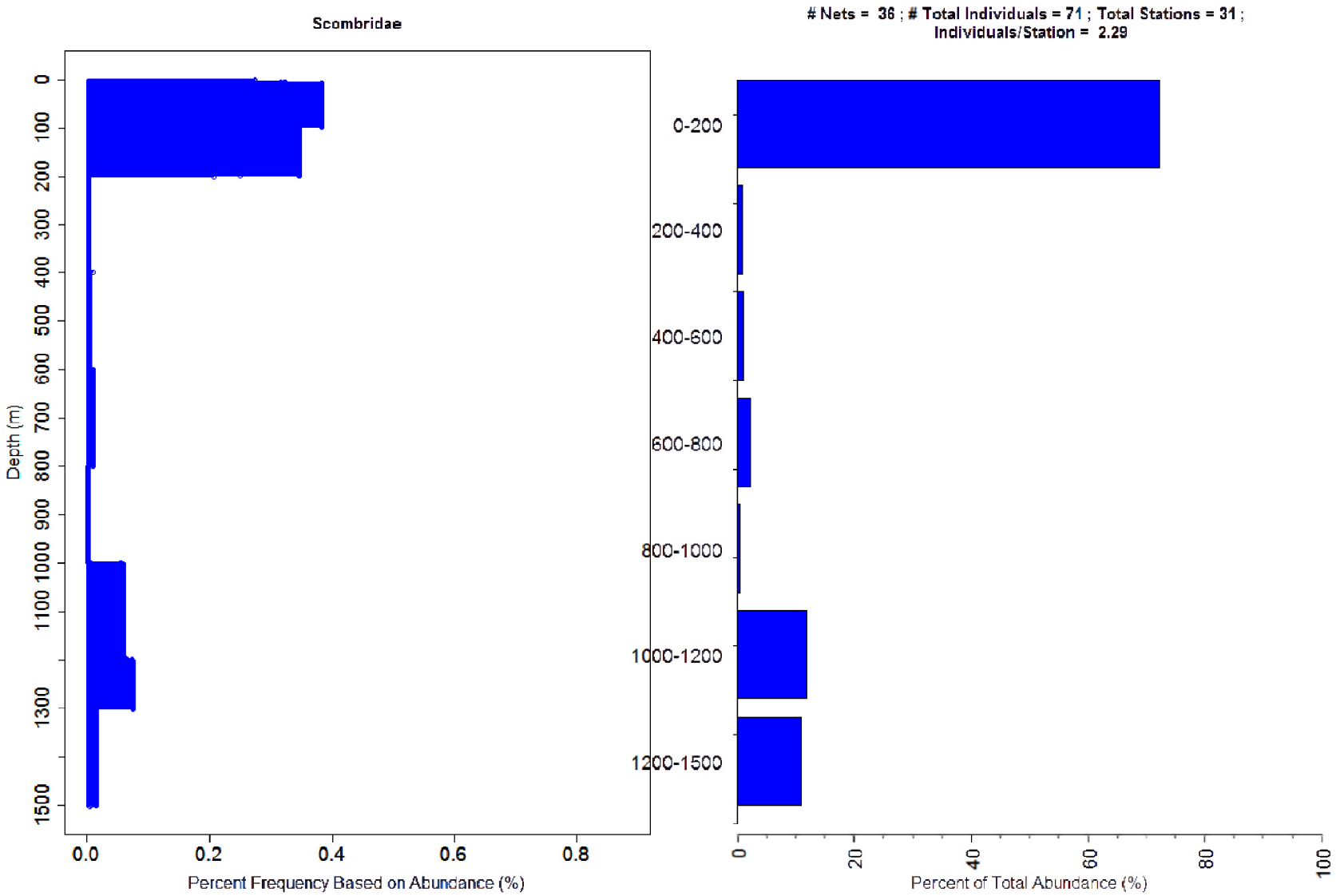
Salpa_maxima


Salpidae
Nets = 12 ; # Total Individuals = 110 ; Total Stations = 11 ;
Individuals/Station = 10
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

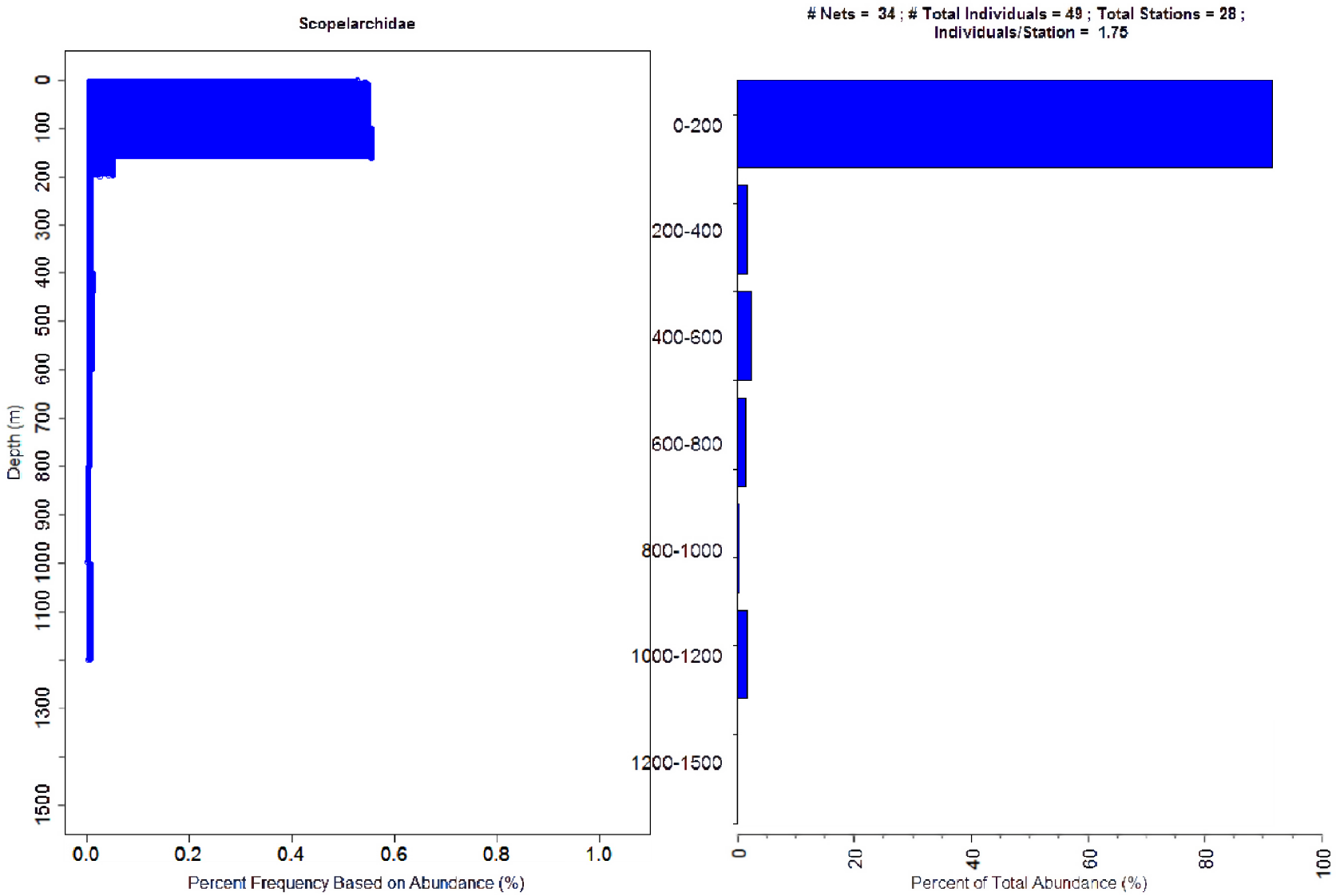
Salpidae


Scina
Nets = 140 ; # Total Individuals = 1293 ; Total Stations = 60 ;
Individuals/Station = 21.55
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

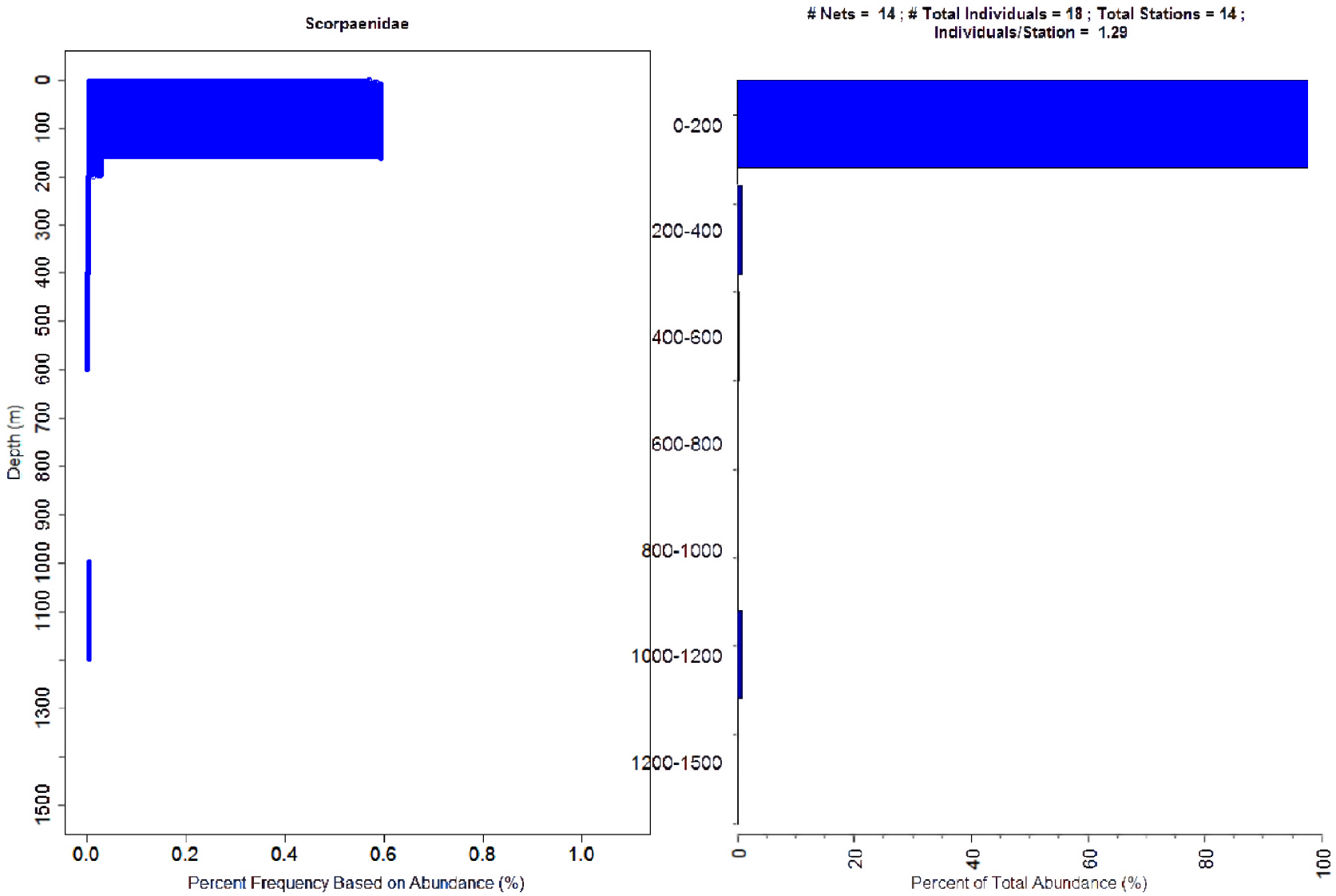
Scina


Scombridae
Nets = 36 ; # Total Individuals = 71 ; Total Stations = 31 ;
Individuals/Station = 2.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

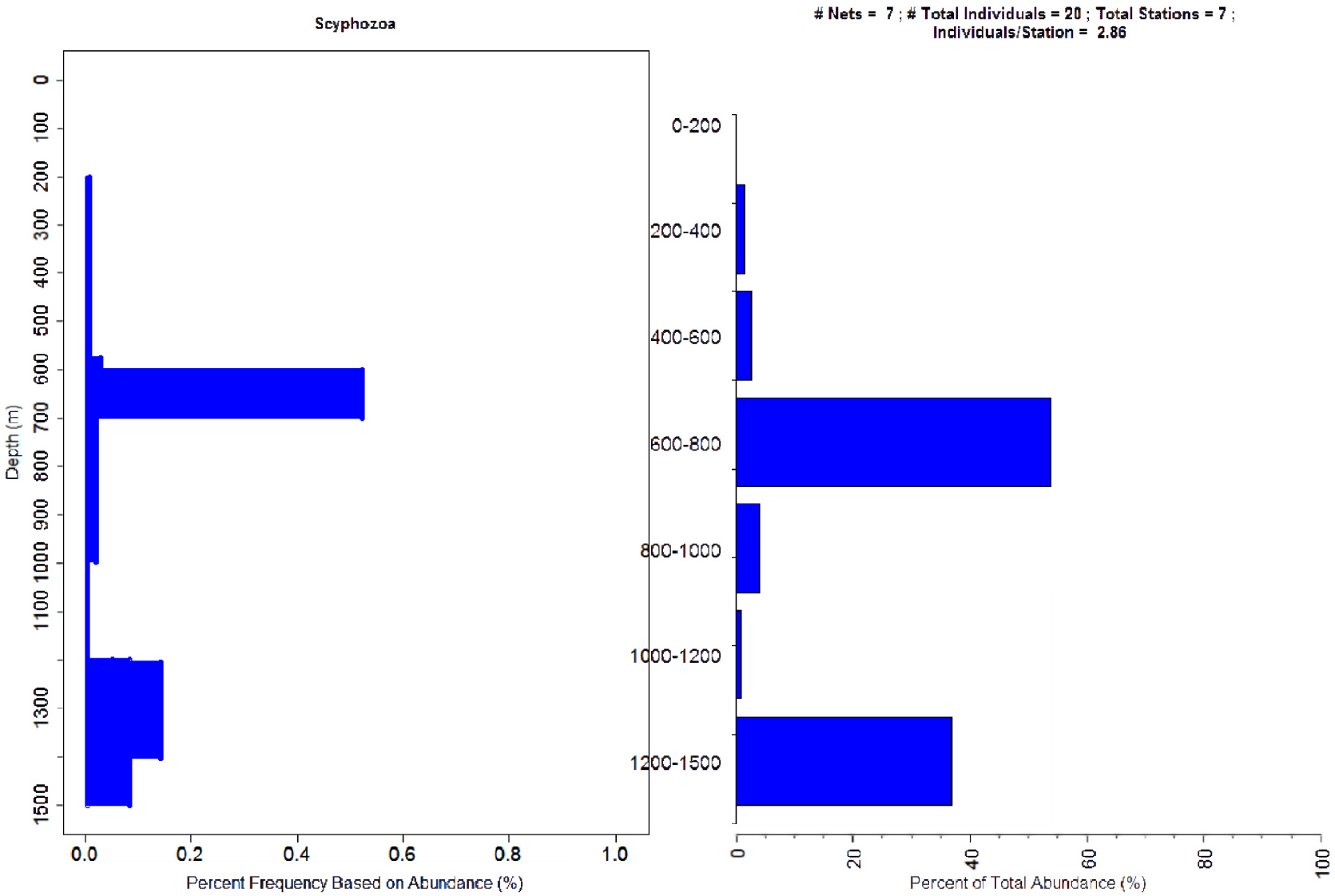
Scombridae



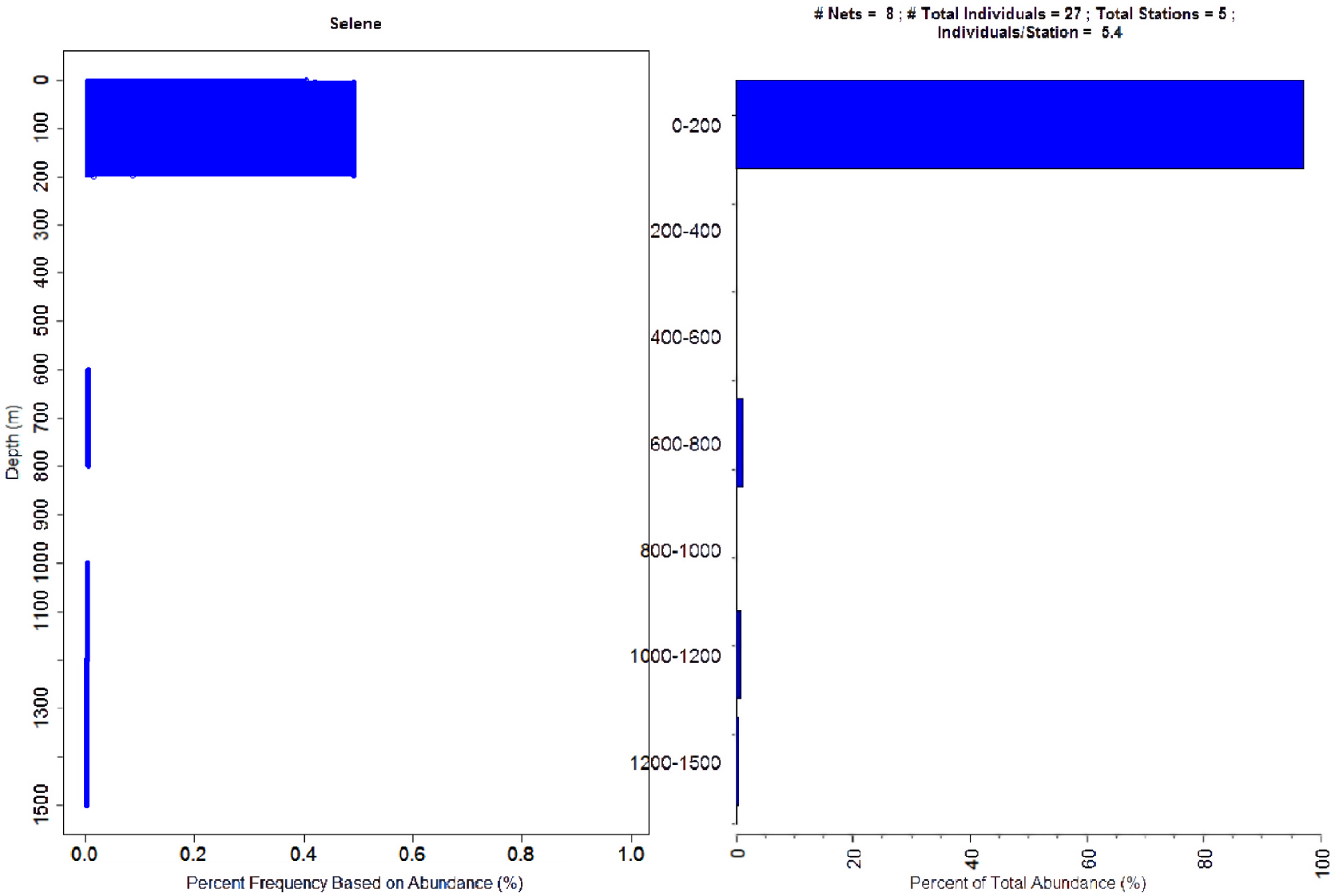
Scopelarchidae



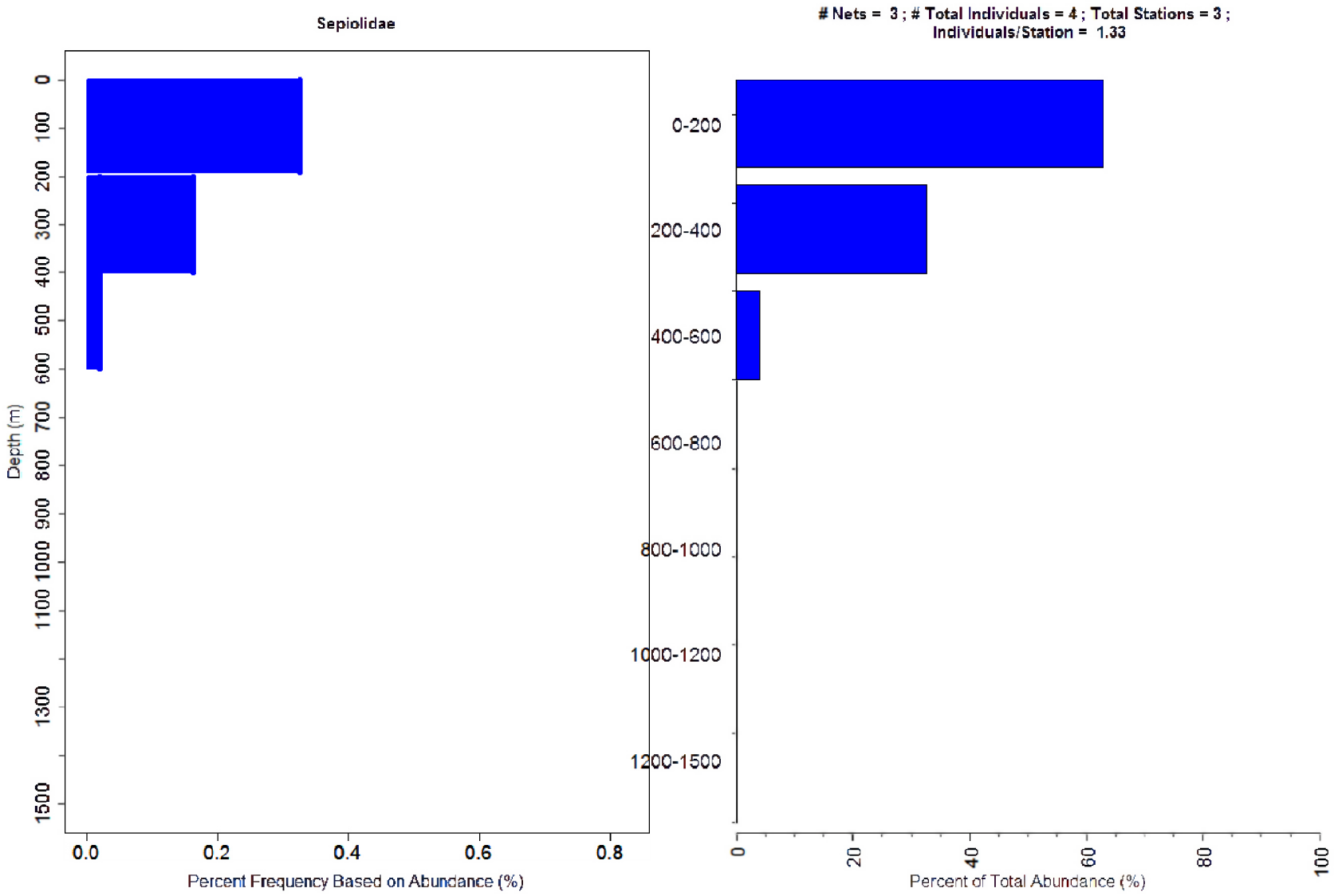
Scorpaenidae


Scyphozoa
Nets = 7 ; # Total Individuals = 20 ; Total Stations = 7 ;
Individuals/Station = 2.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

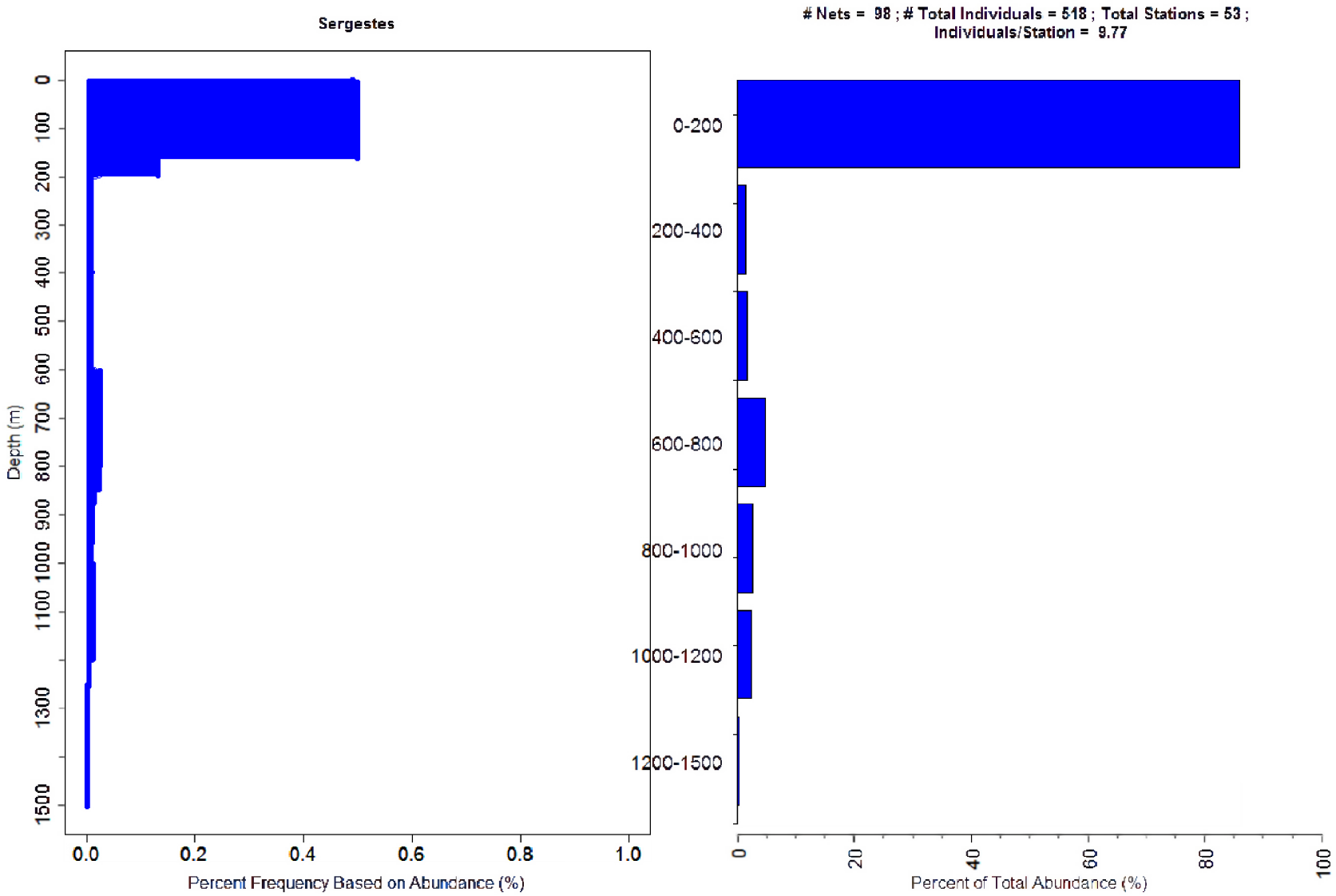
Scyphozoa


Selene
Nets = 8 ; # Total Individuals = 27 ; Total Stations = 5 ;
Individuals/Station = 5.4
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

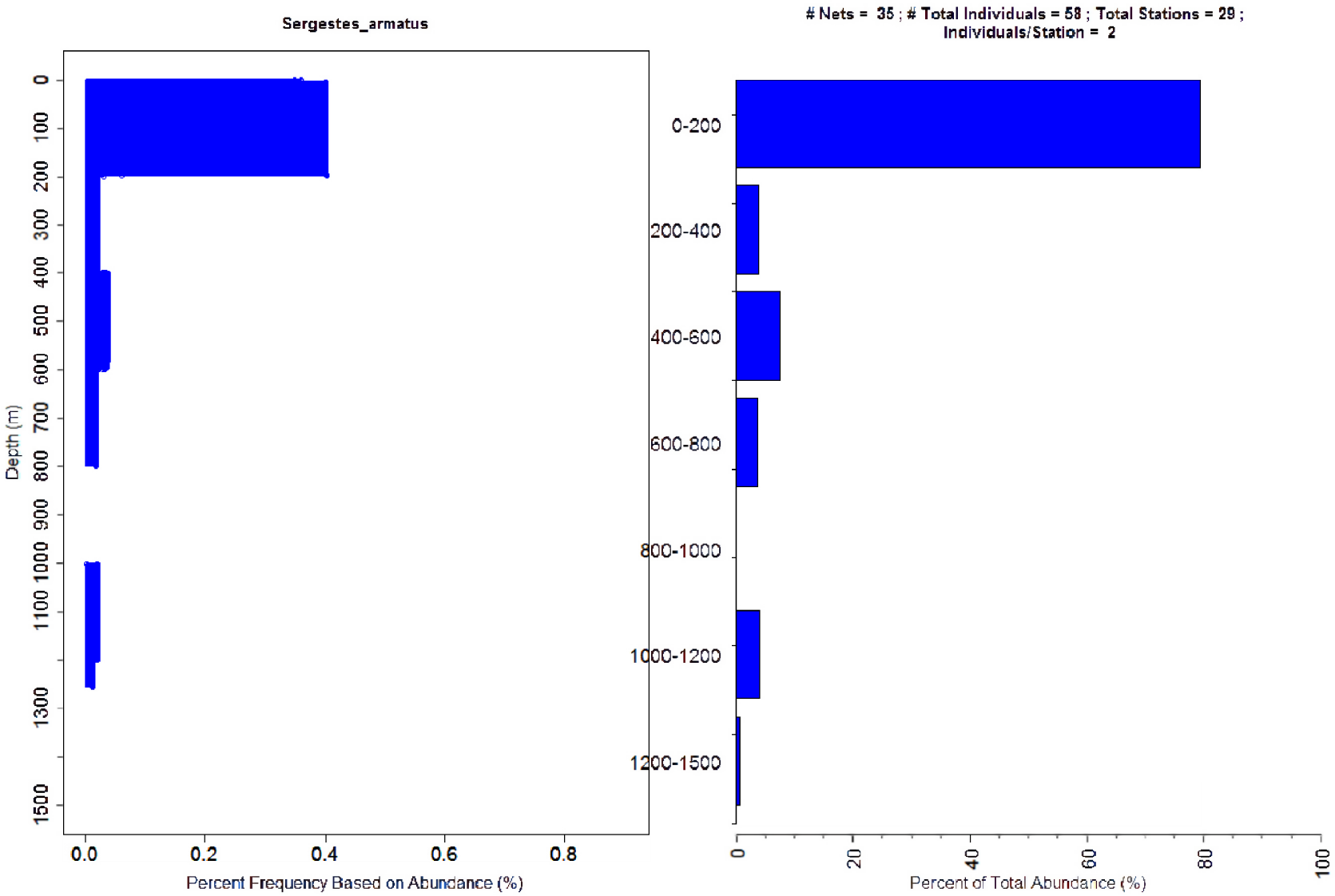
Selene


Sepiolidae
Nets = 3 ; # Total Individuals = 4 ; Total Stations = 3 ;
Individuals/Station = 1.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

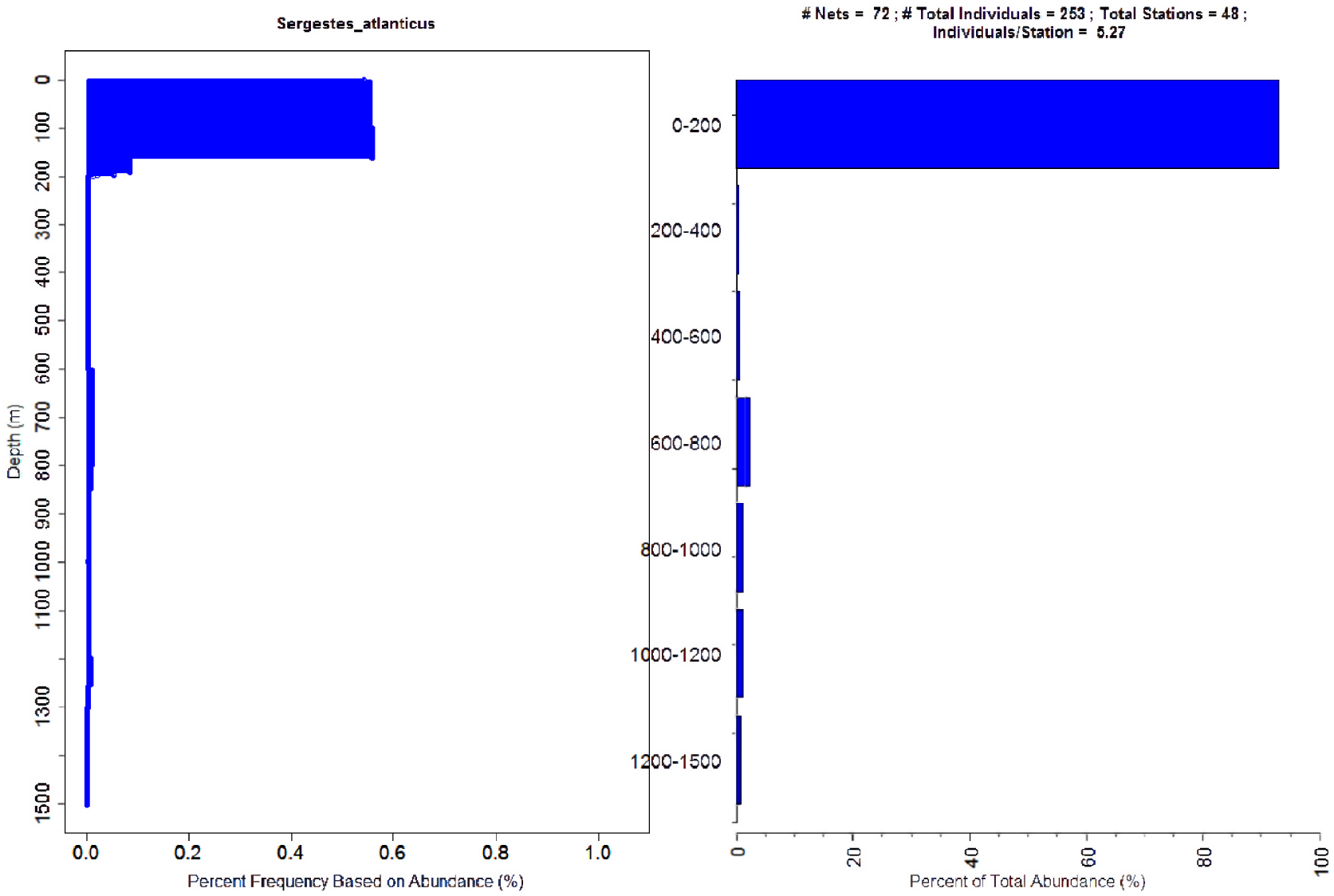
Sepiolidae


Sergestes
Nets = 98 ; # Total Individuals = 518 ; Total Stations = 53 ;
Individuals/Station = 9.77
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

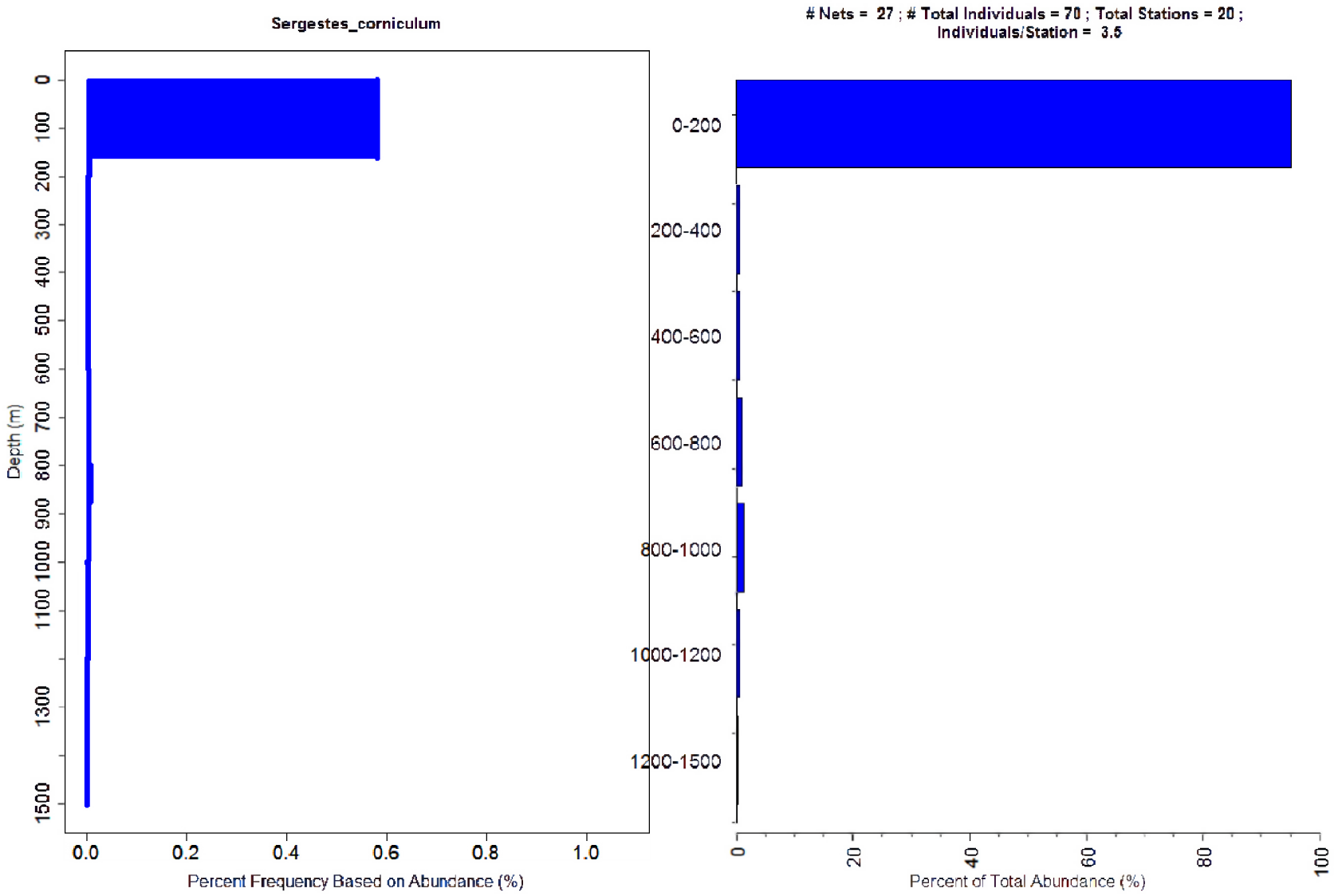
Sergestes



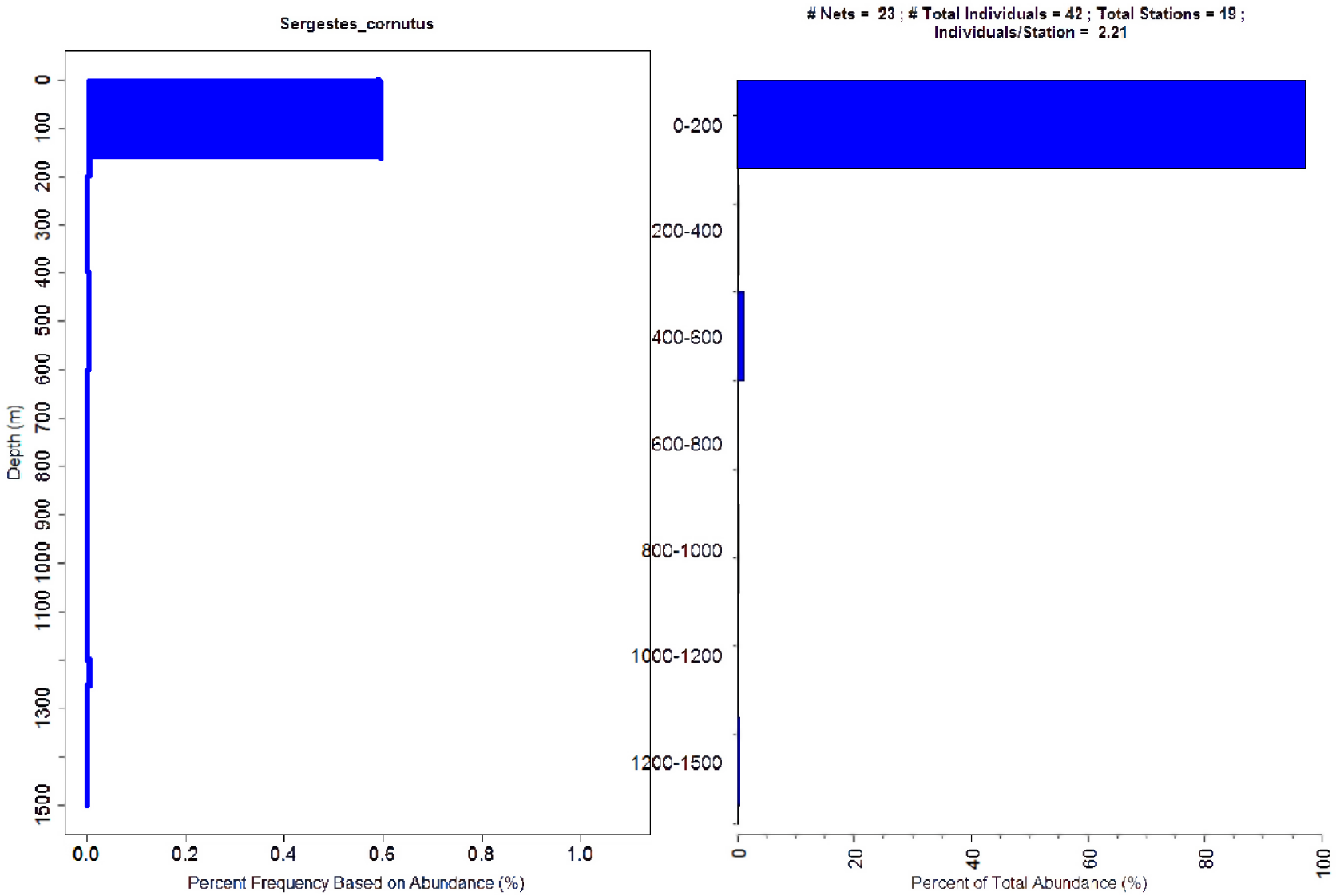
Sergestes_armatus



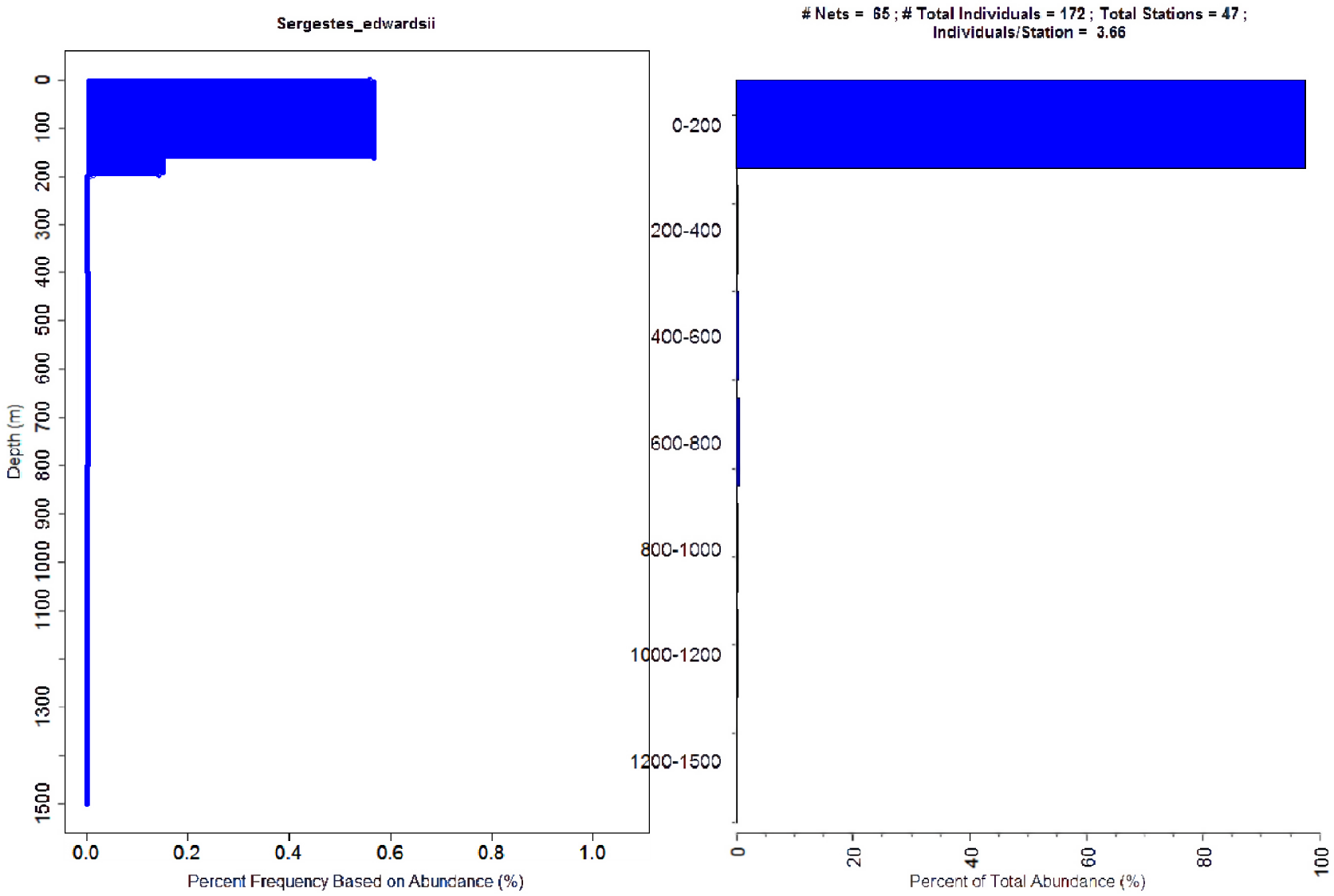
Sergestes_atlanticus



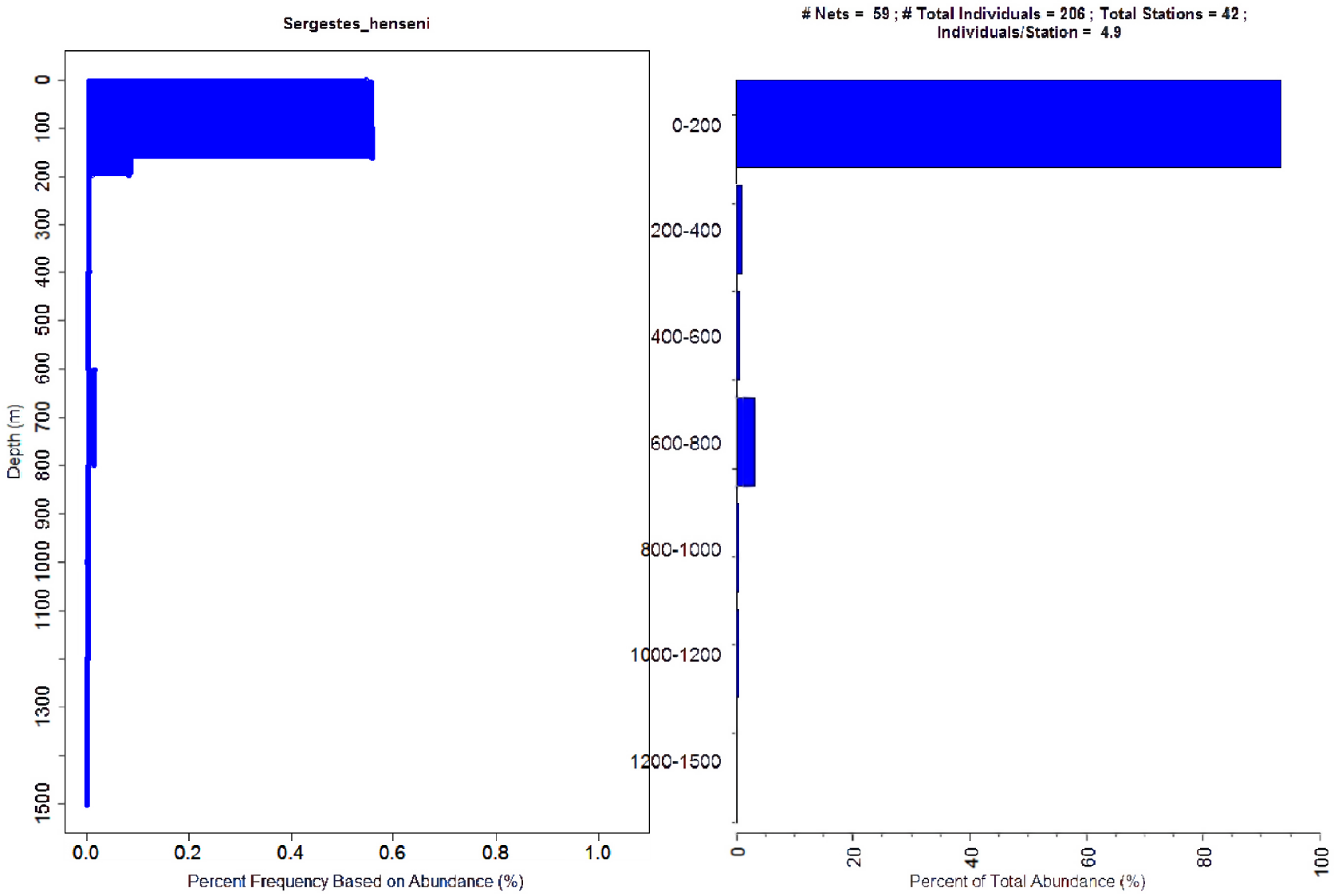
Sergestes_corniculum



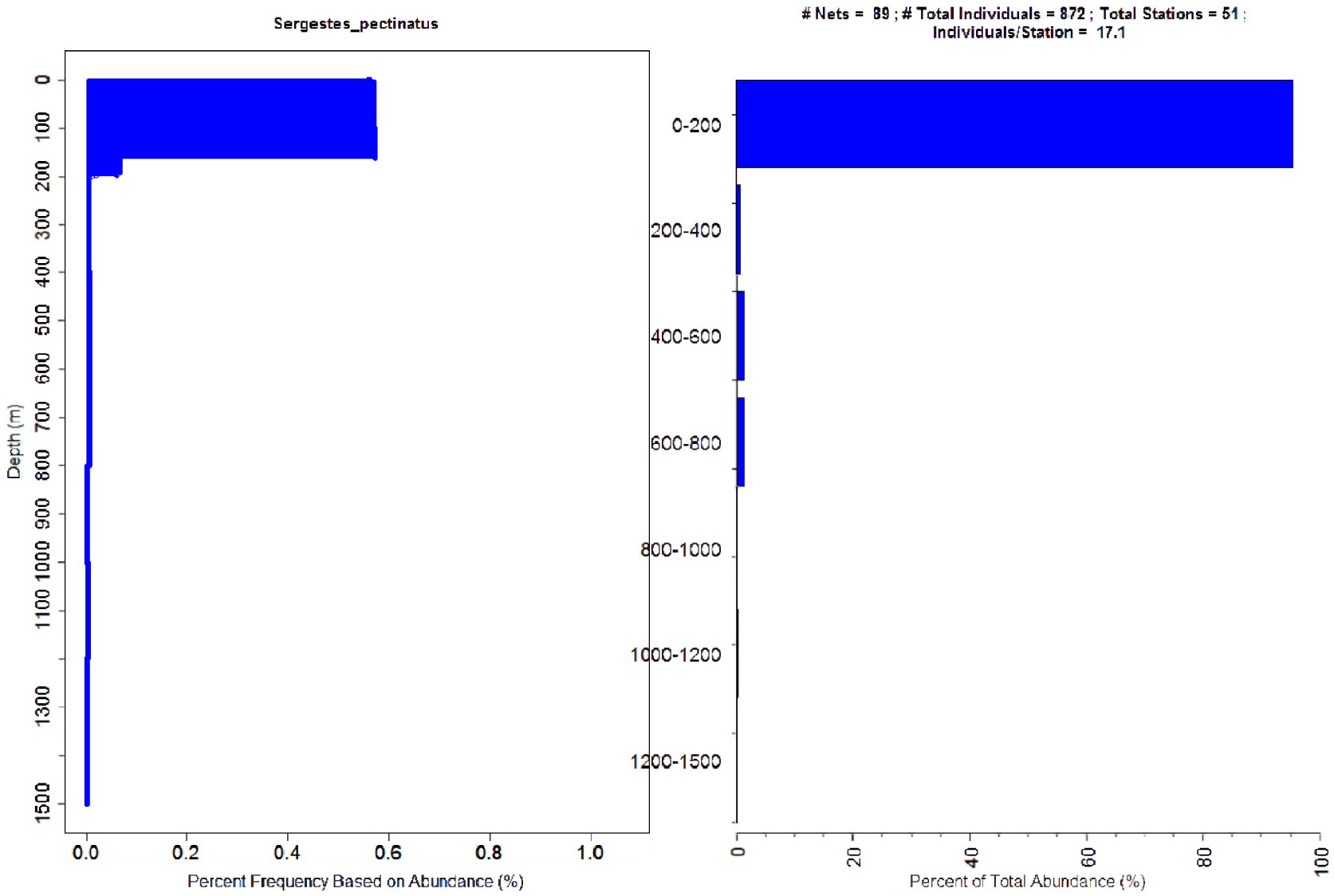
Sergestes_cornutus



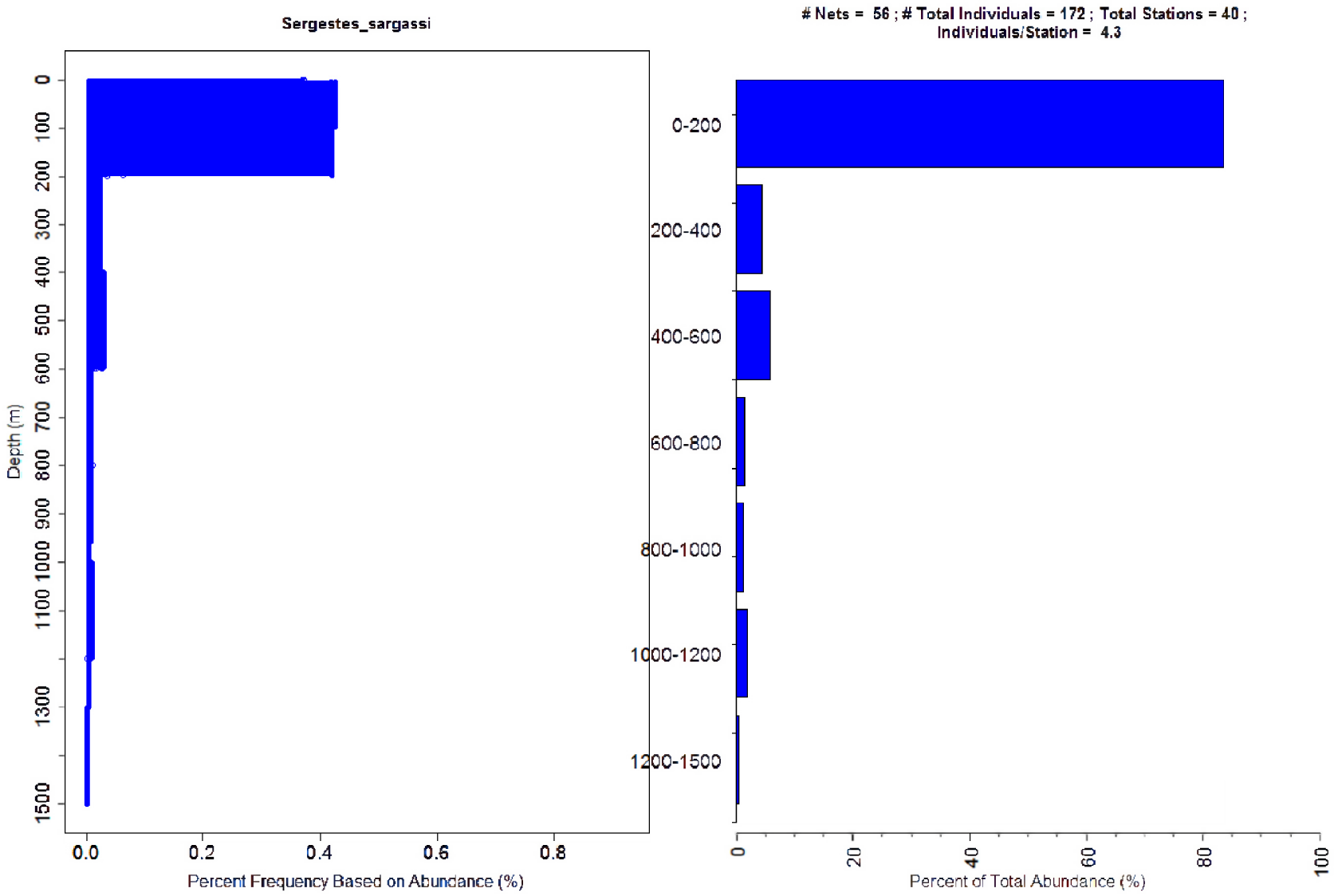
Sergestes_edwardsii



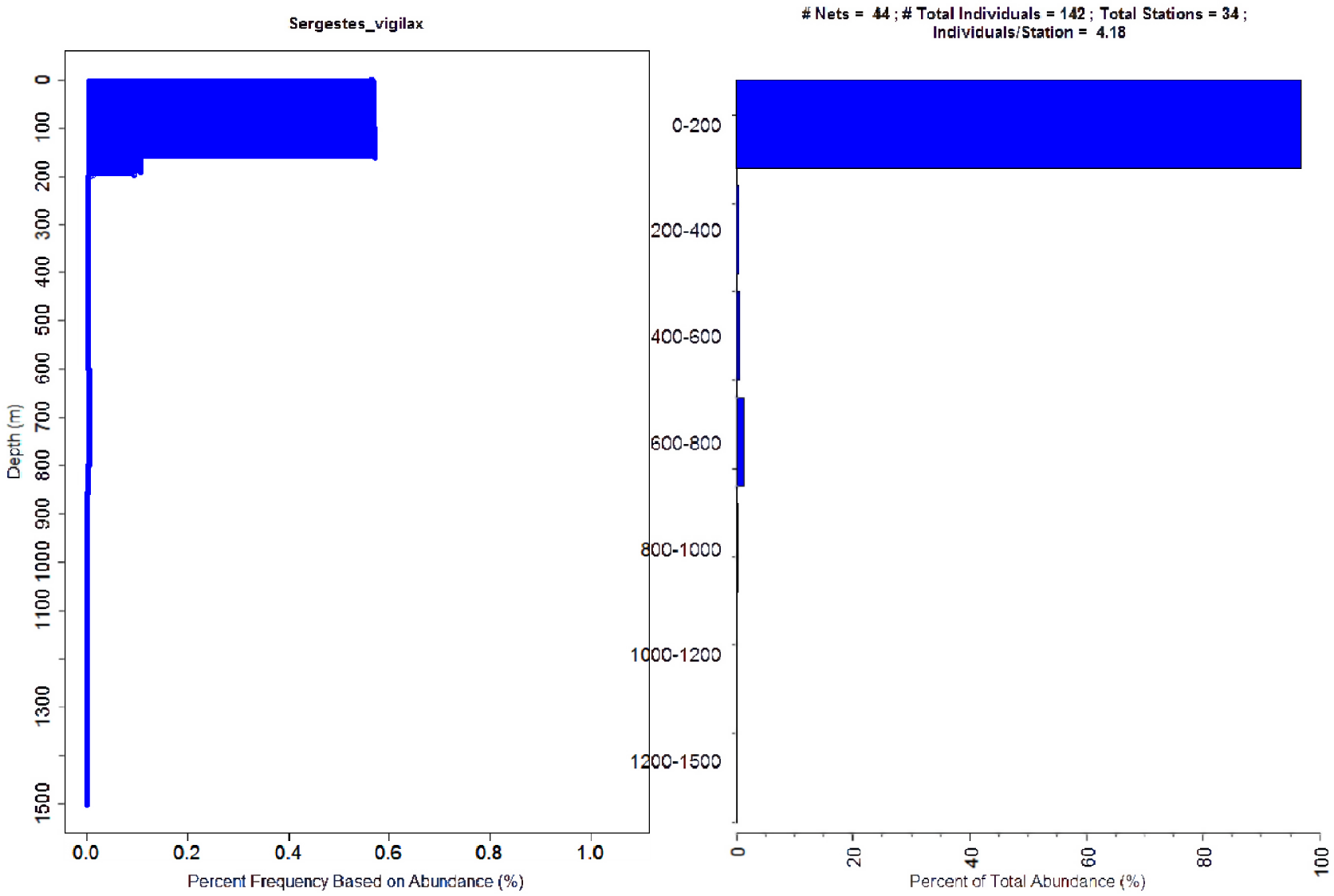
Sergestes_henseni



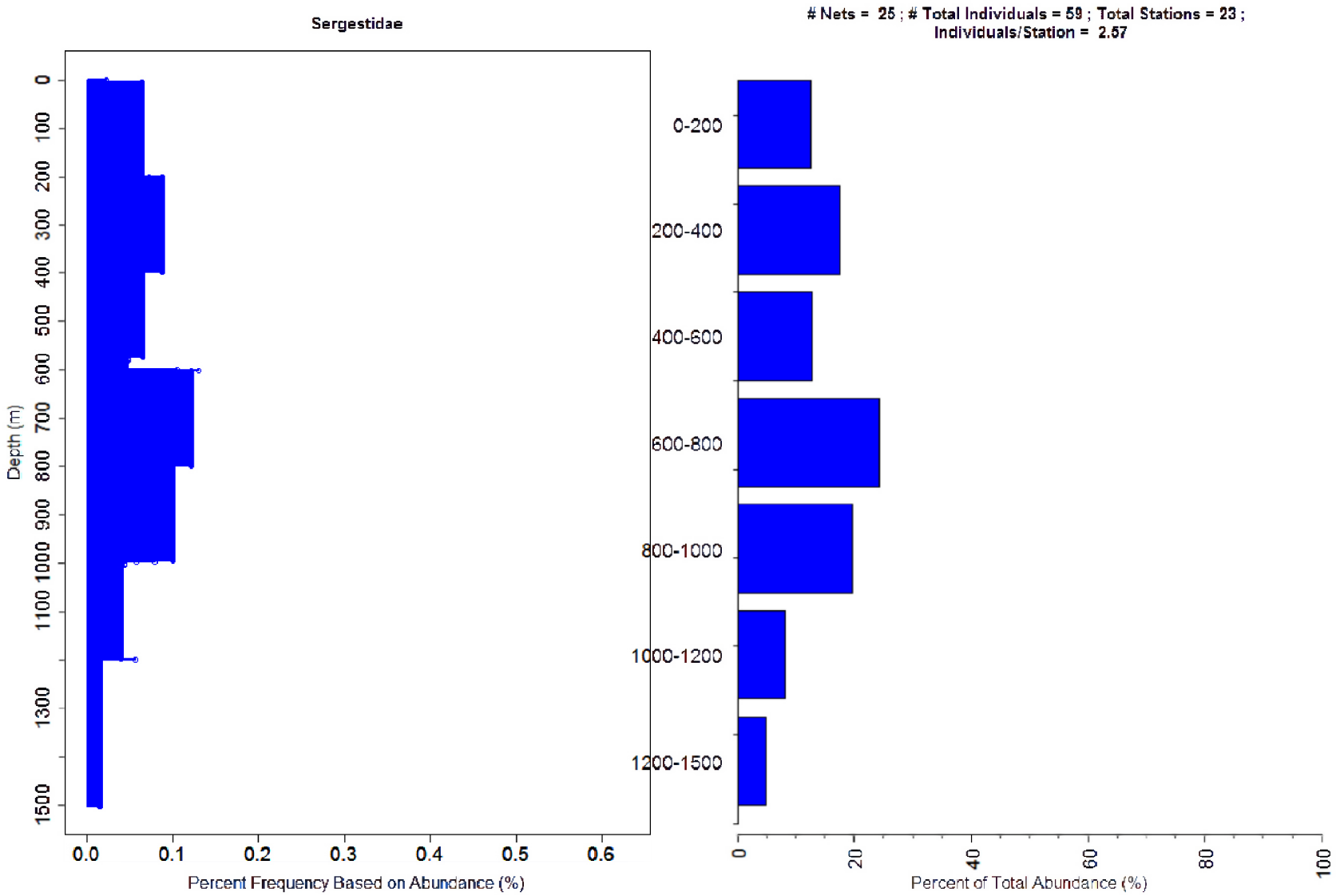
Sergestes_pectinatus



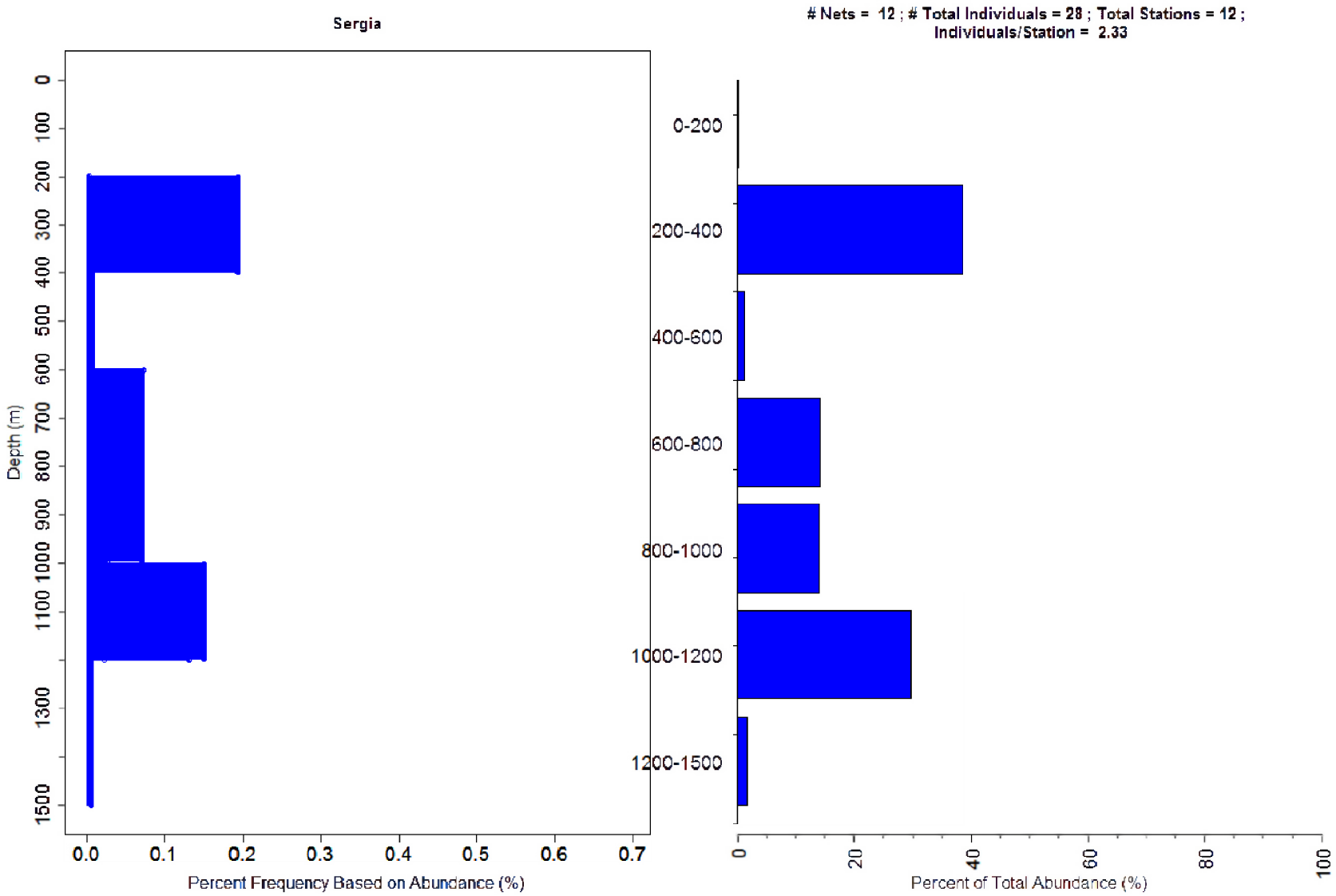
Sergestes_sargassi



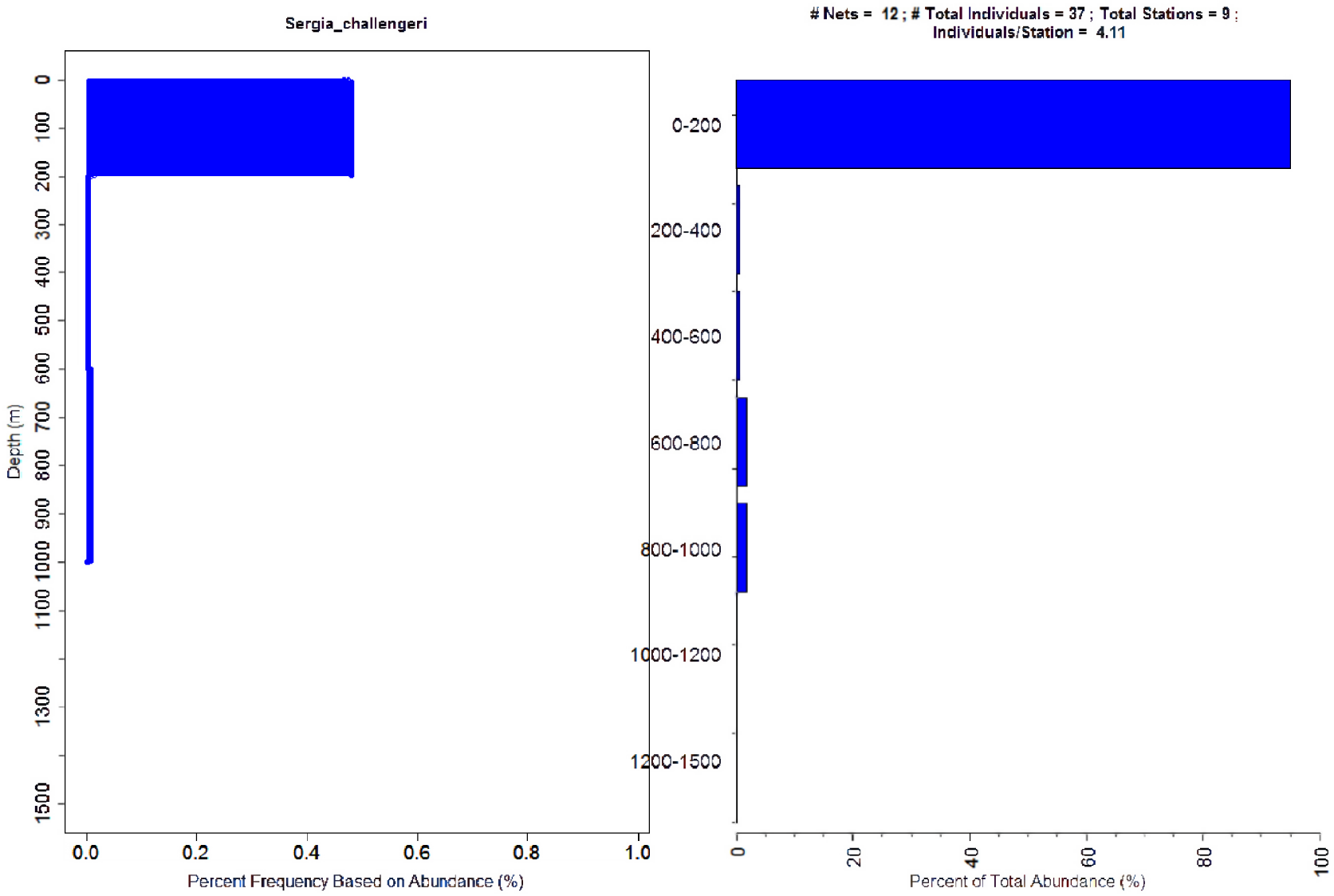
Sergestes_vigilax



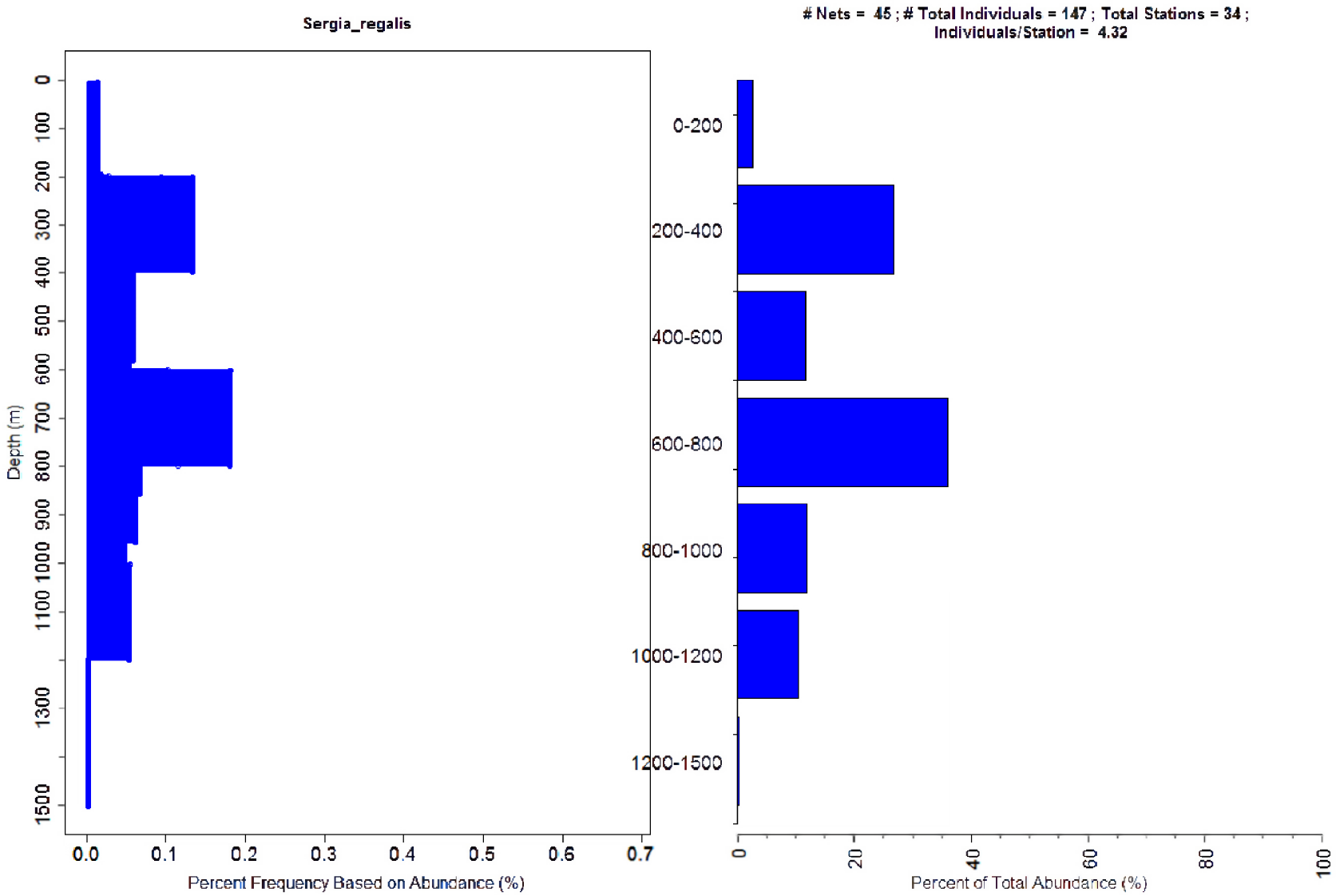
Sergestidae


Sergia
Nets = 12 ; # Total Individuals = 28 ; Total Stations = 12 ;
Individuals/Station = 2.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

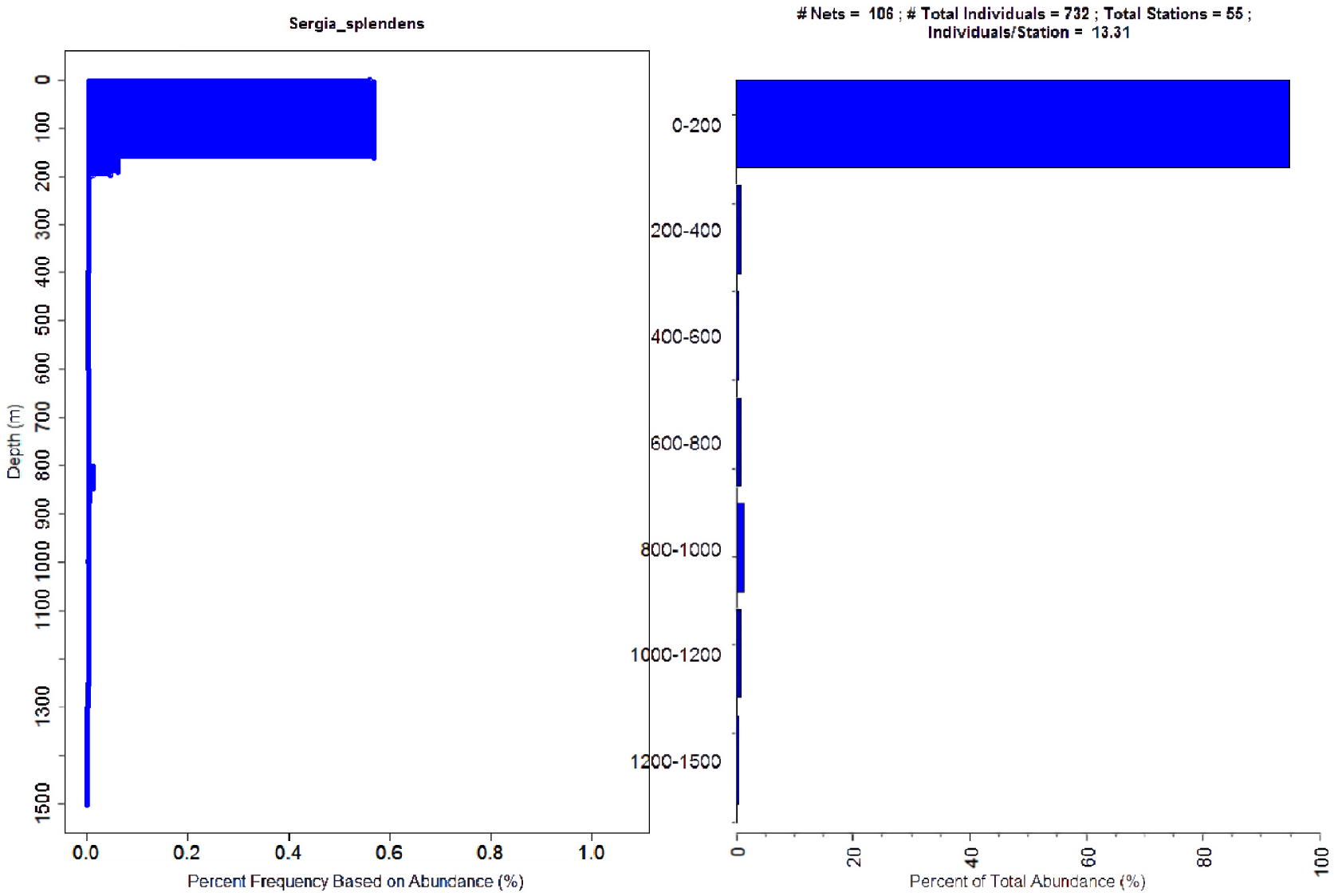
Sergia



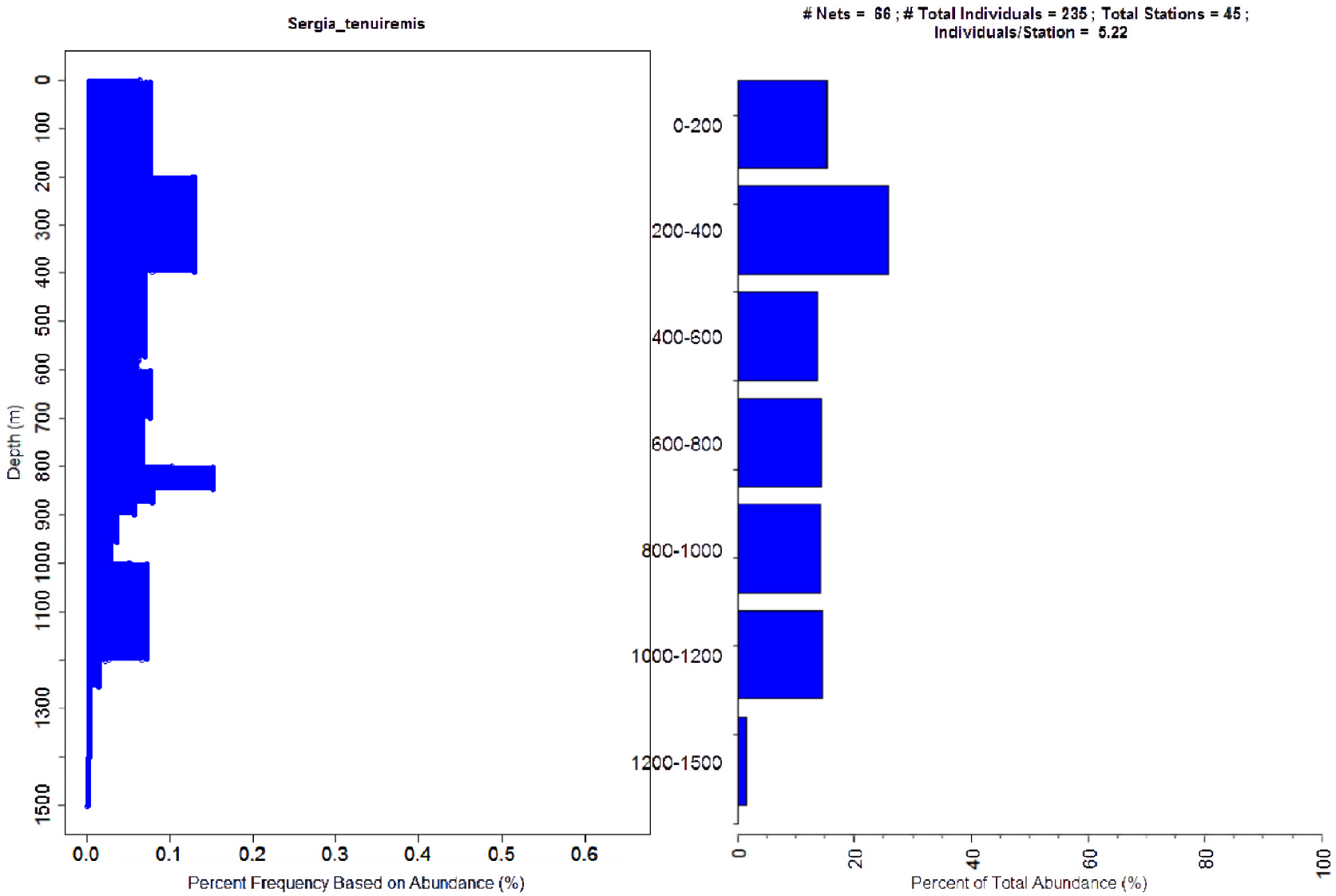
Sergia_challengeri



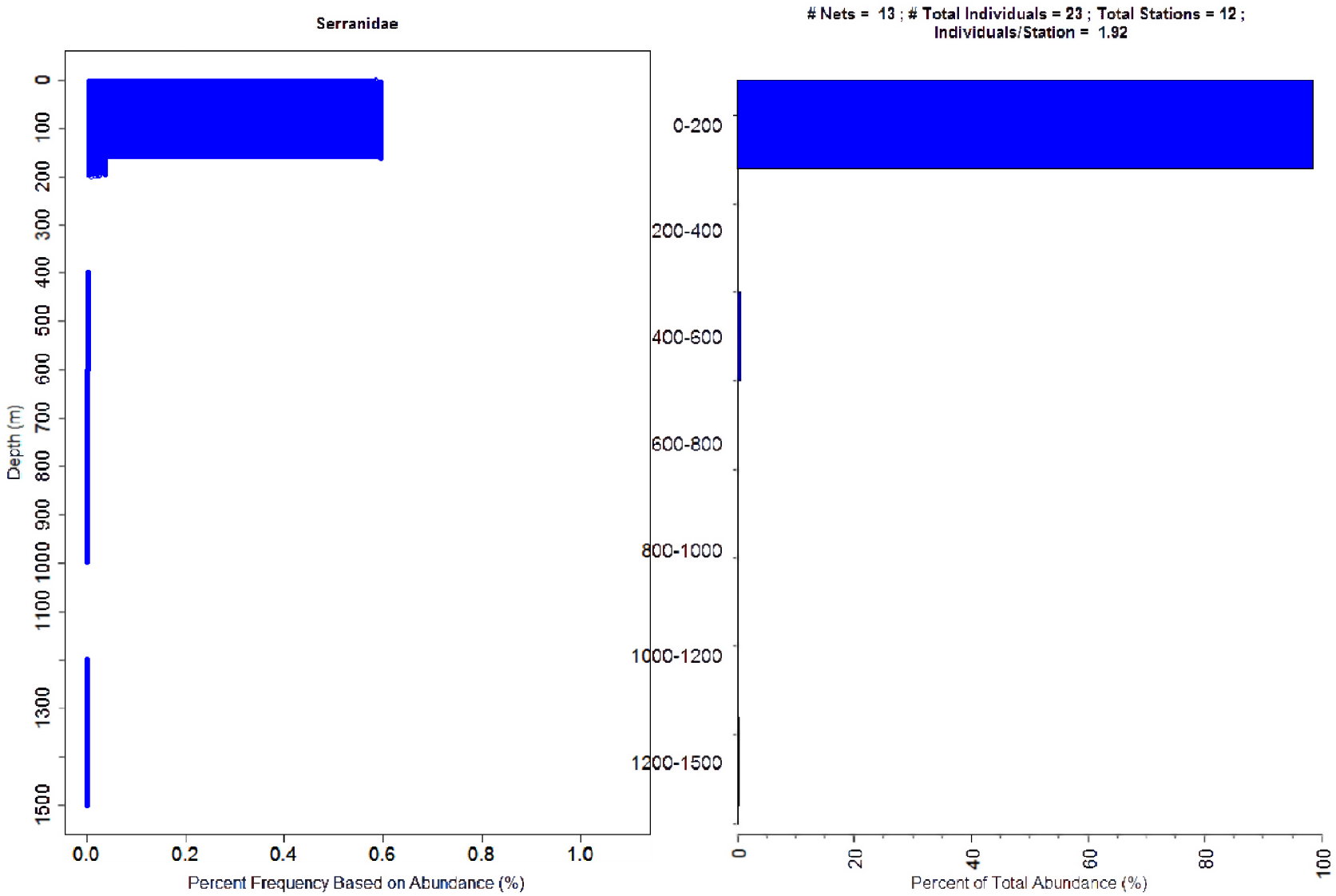
Sergia_regalis



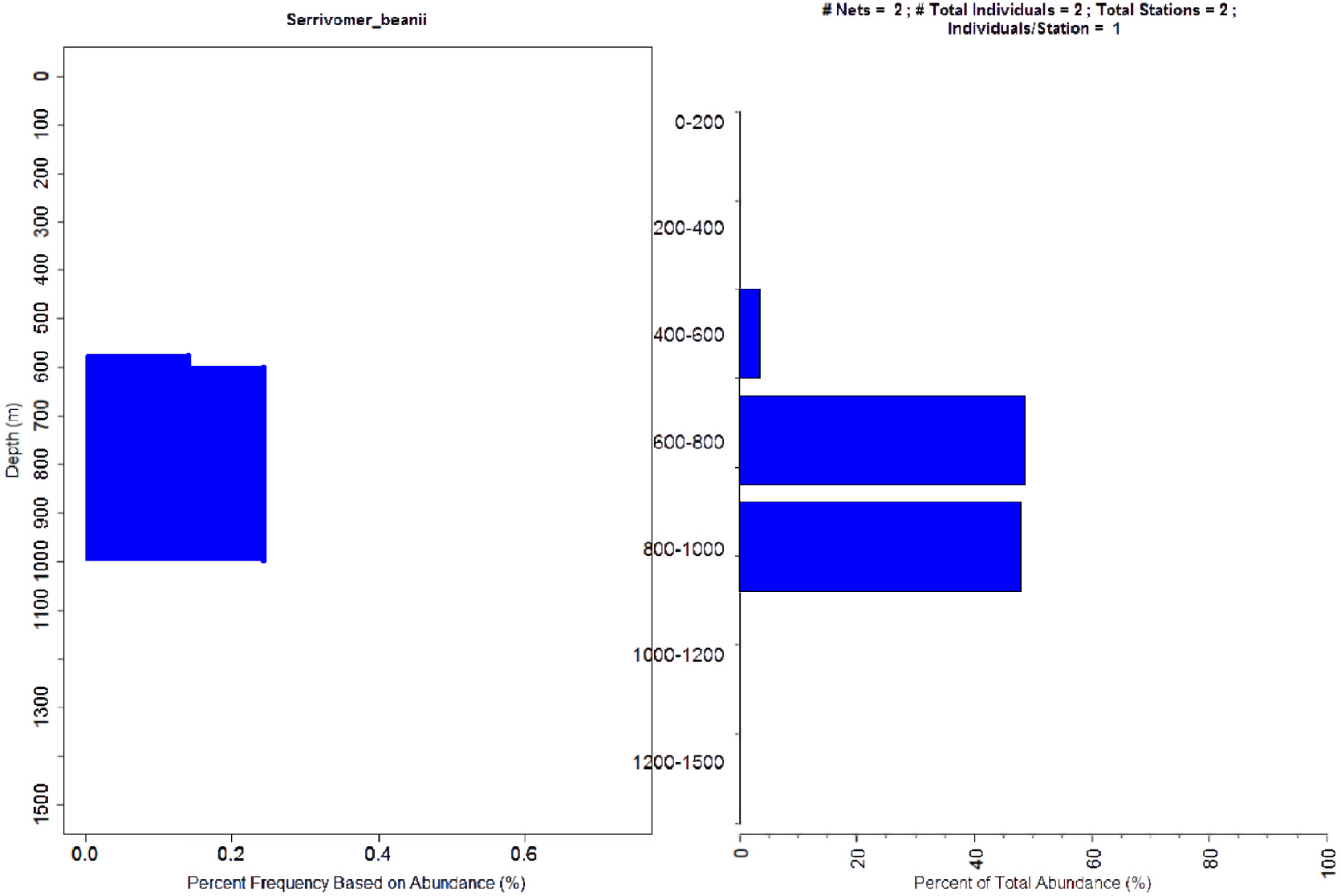
Sergia_splendens



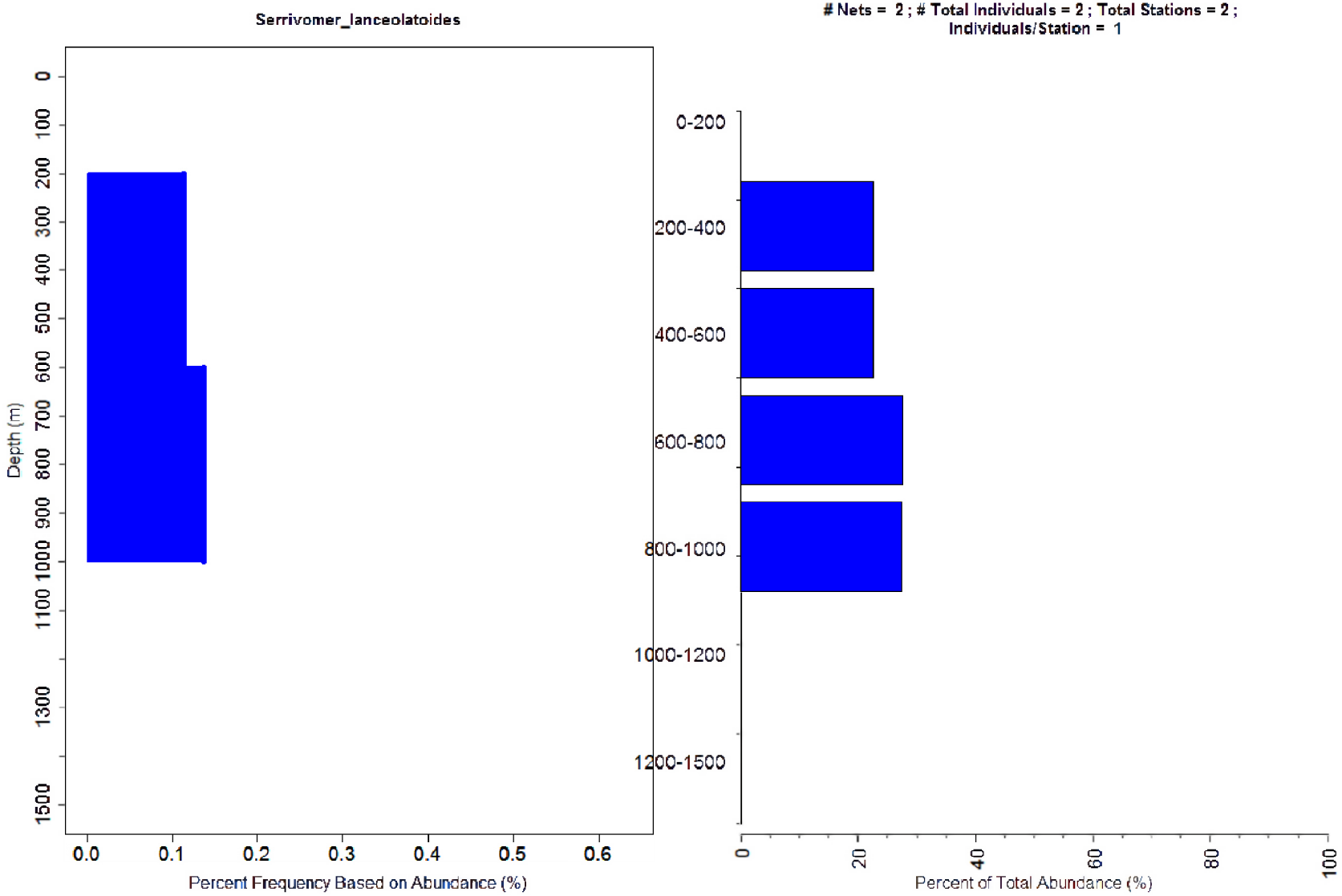
Sergia_tenuiremis


Serranidae
Nets = 13 ; # Total Individuals = 23 ; Total Stations = 12 ;
Individuals/Station = 1.92
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

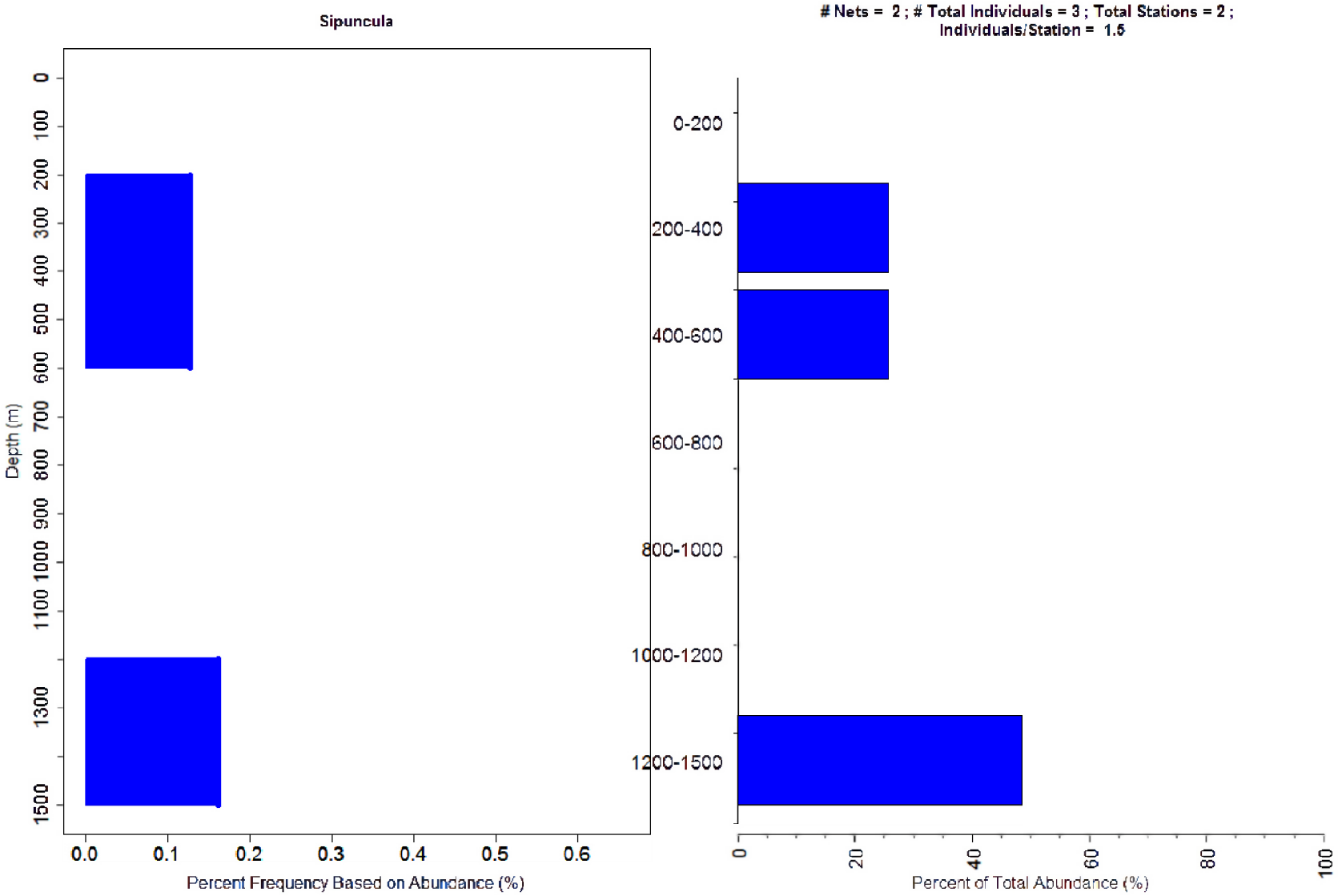
Serranidae



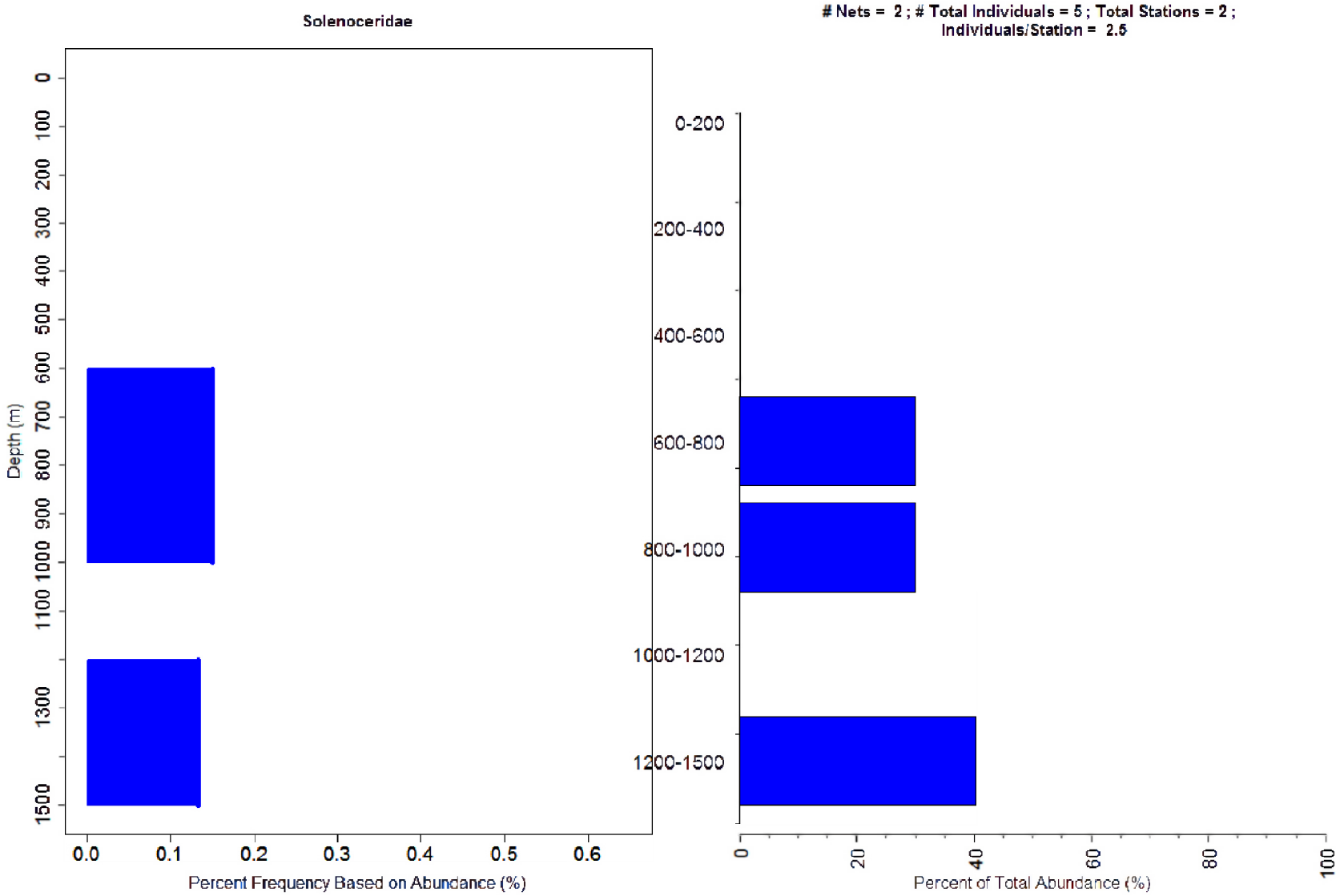
Serrivomer_beanii



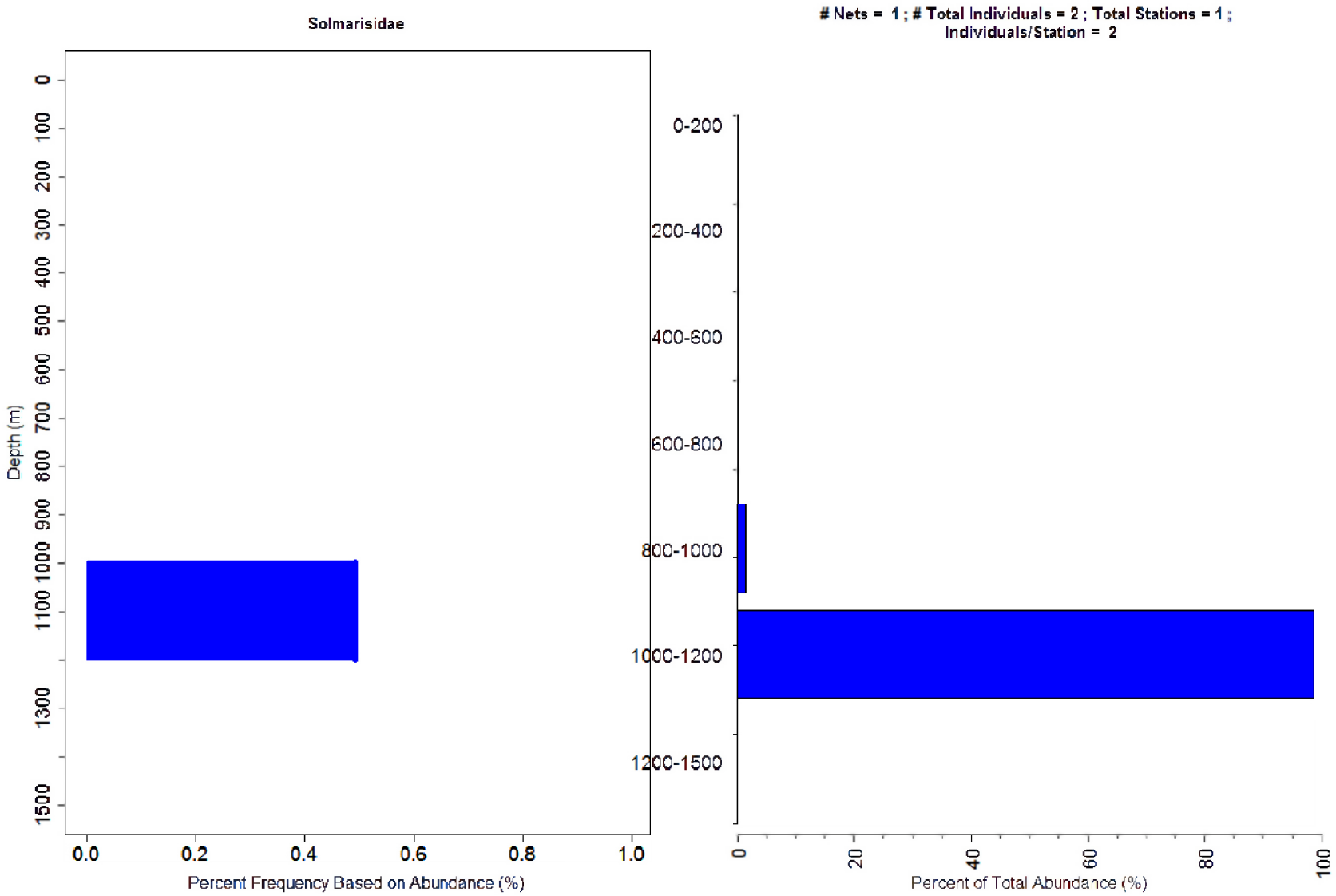
Serrivomer_lanceolatoides


Sipuncula
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

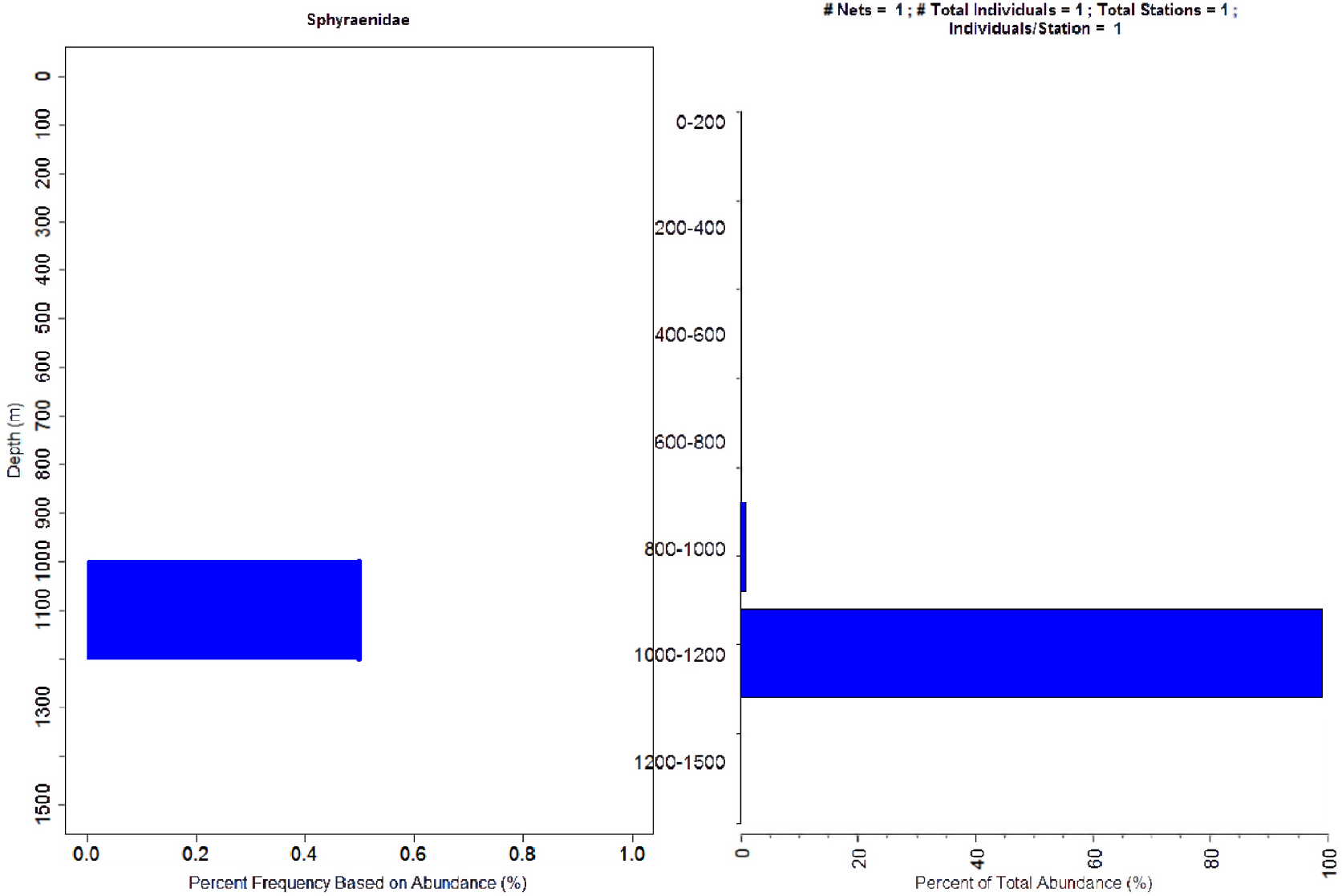
Sipuncula



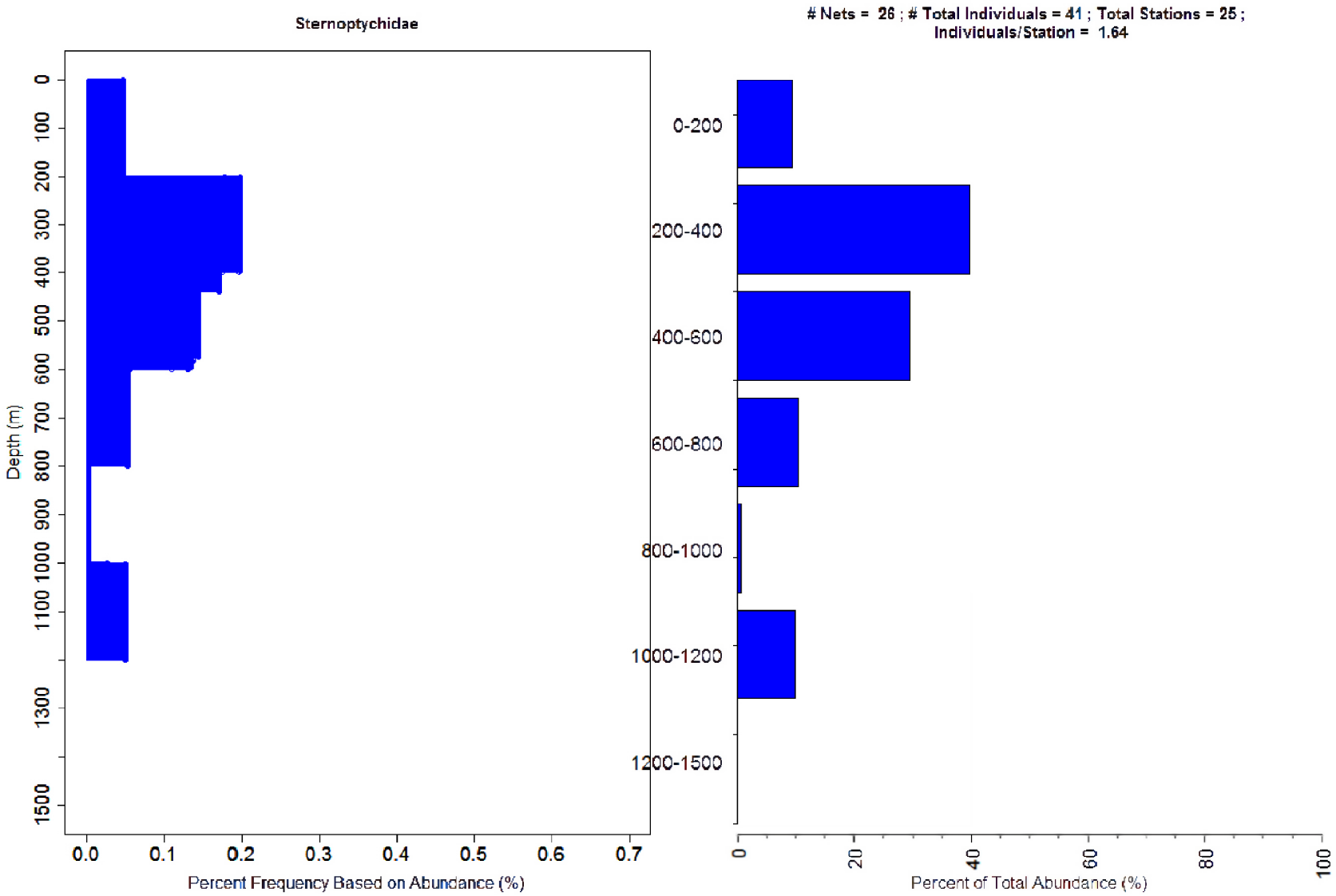
Solenoceridae



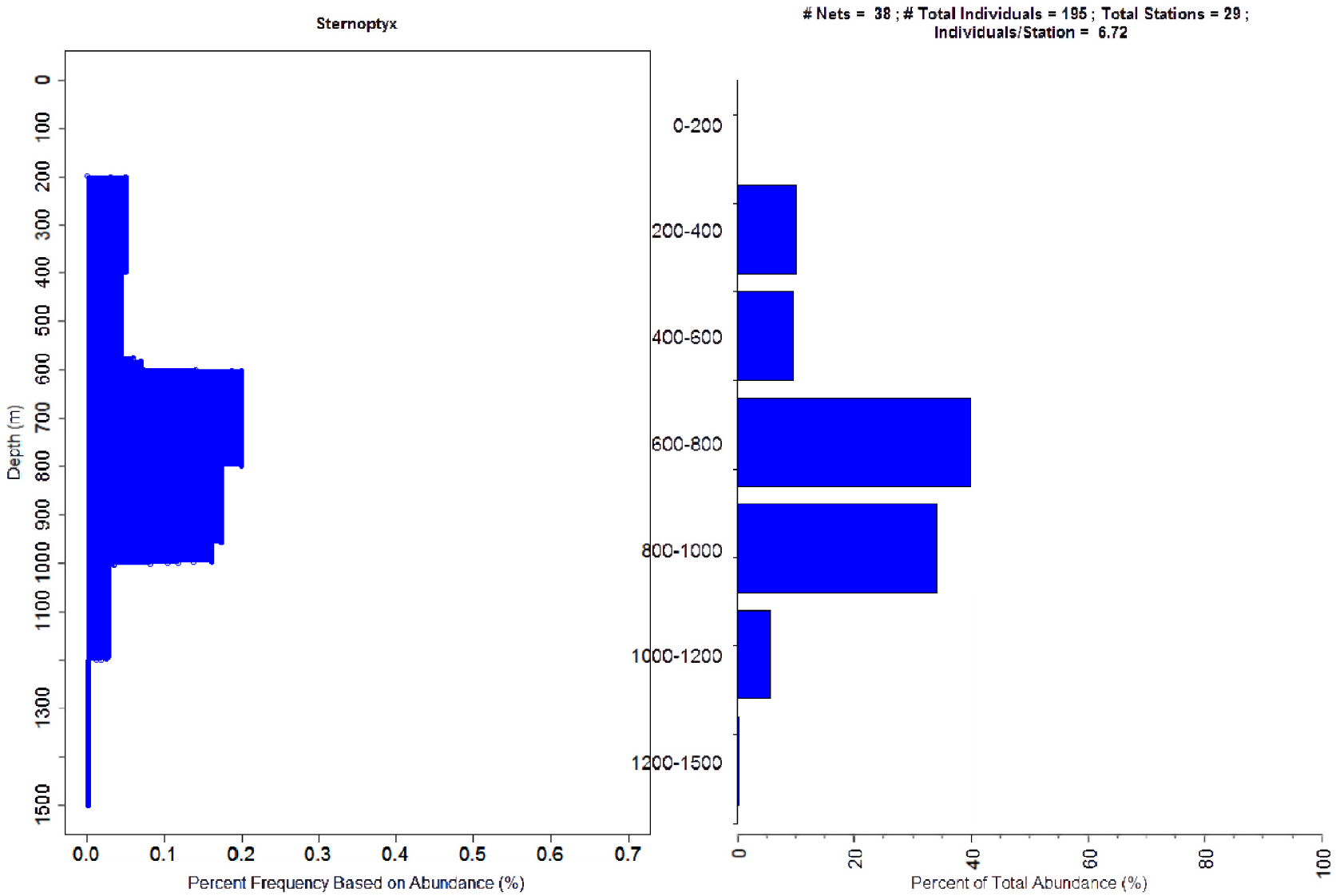
Solmarisidae



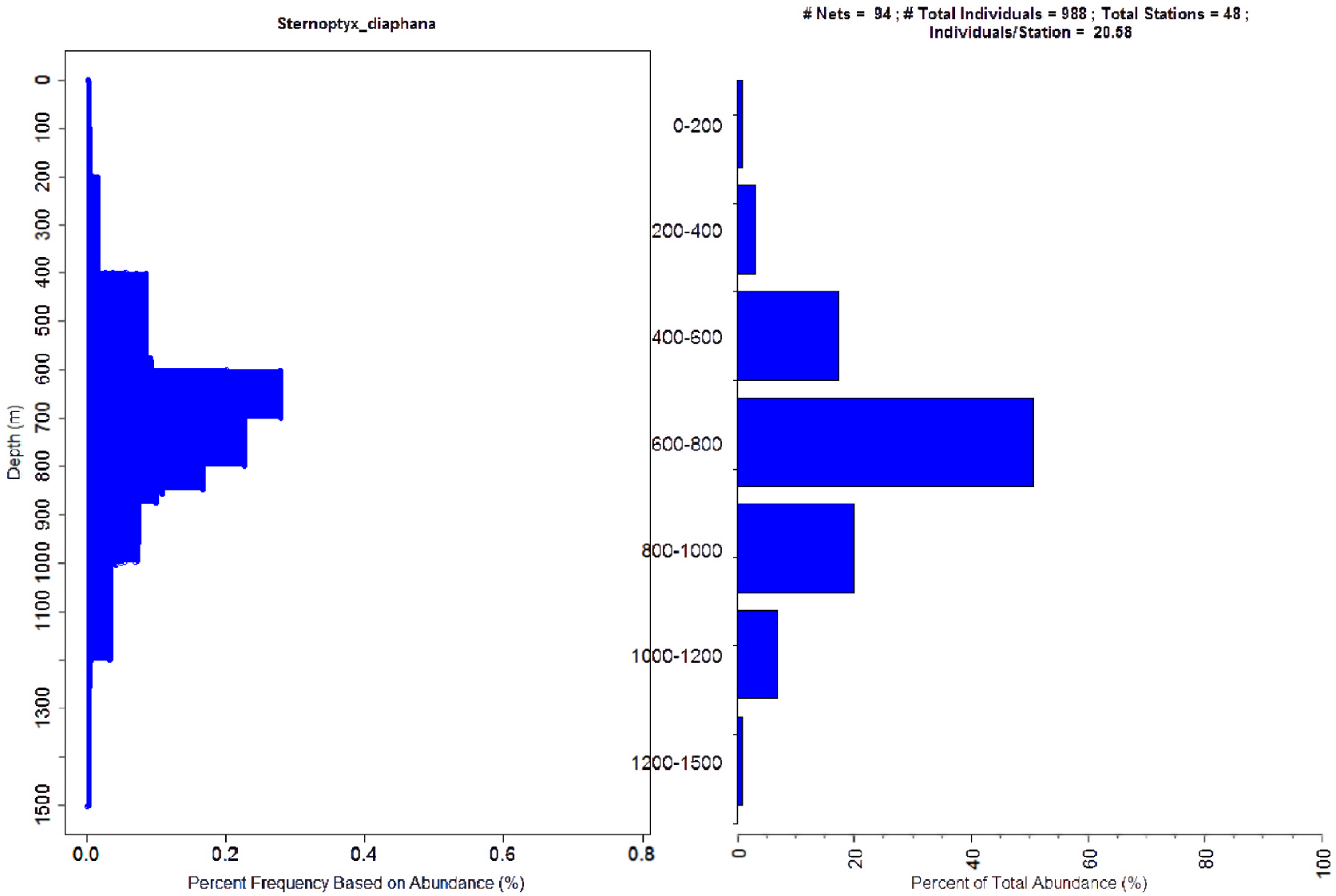
Sphyraenidae



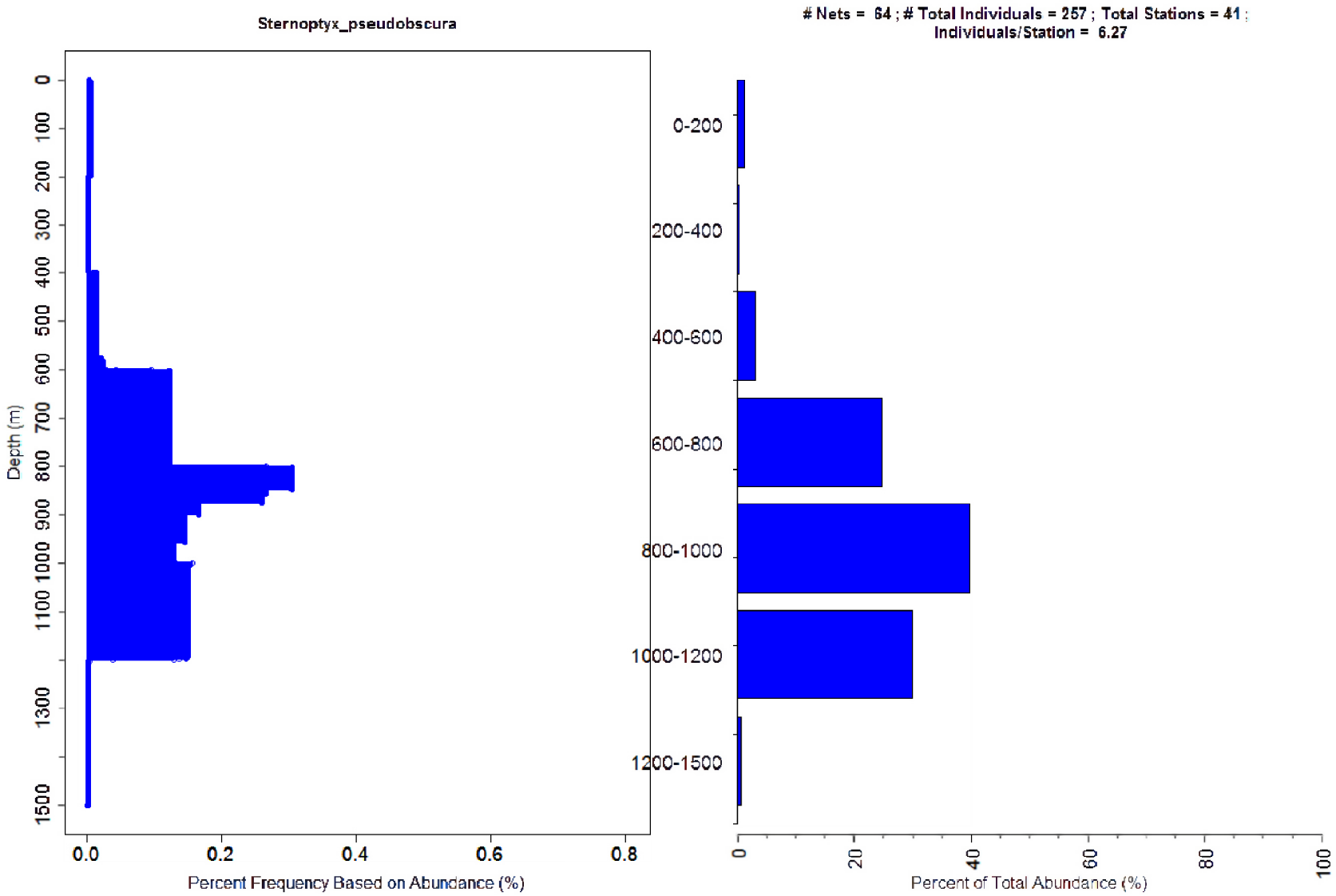
Sternoptychidae


Sternoptyx
Nets = 38 ; # Total Individuals = 195 ; Total Stations = 29 ;
Individuals/Station = 6.72
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

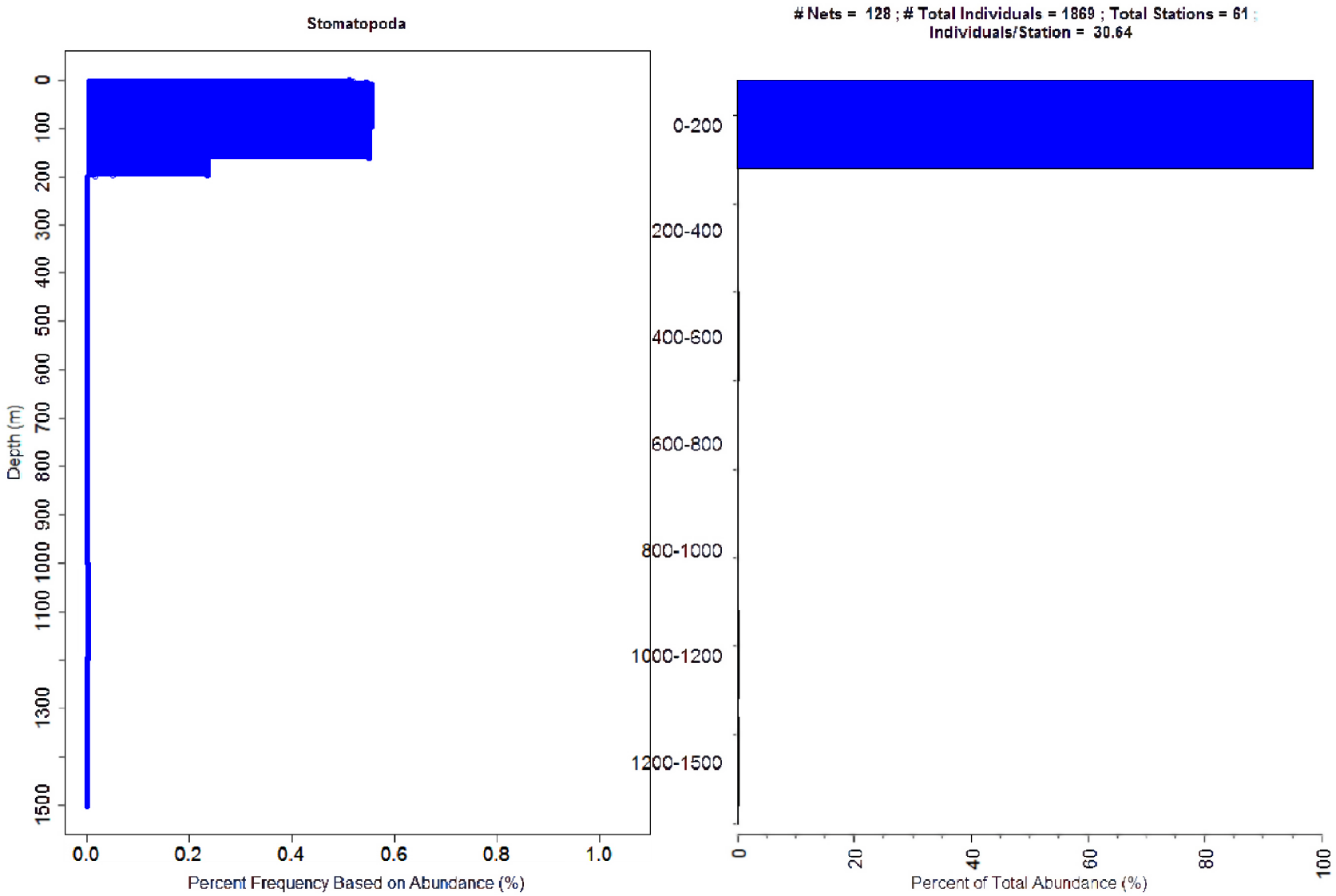
Sternoptyx



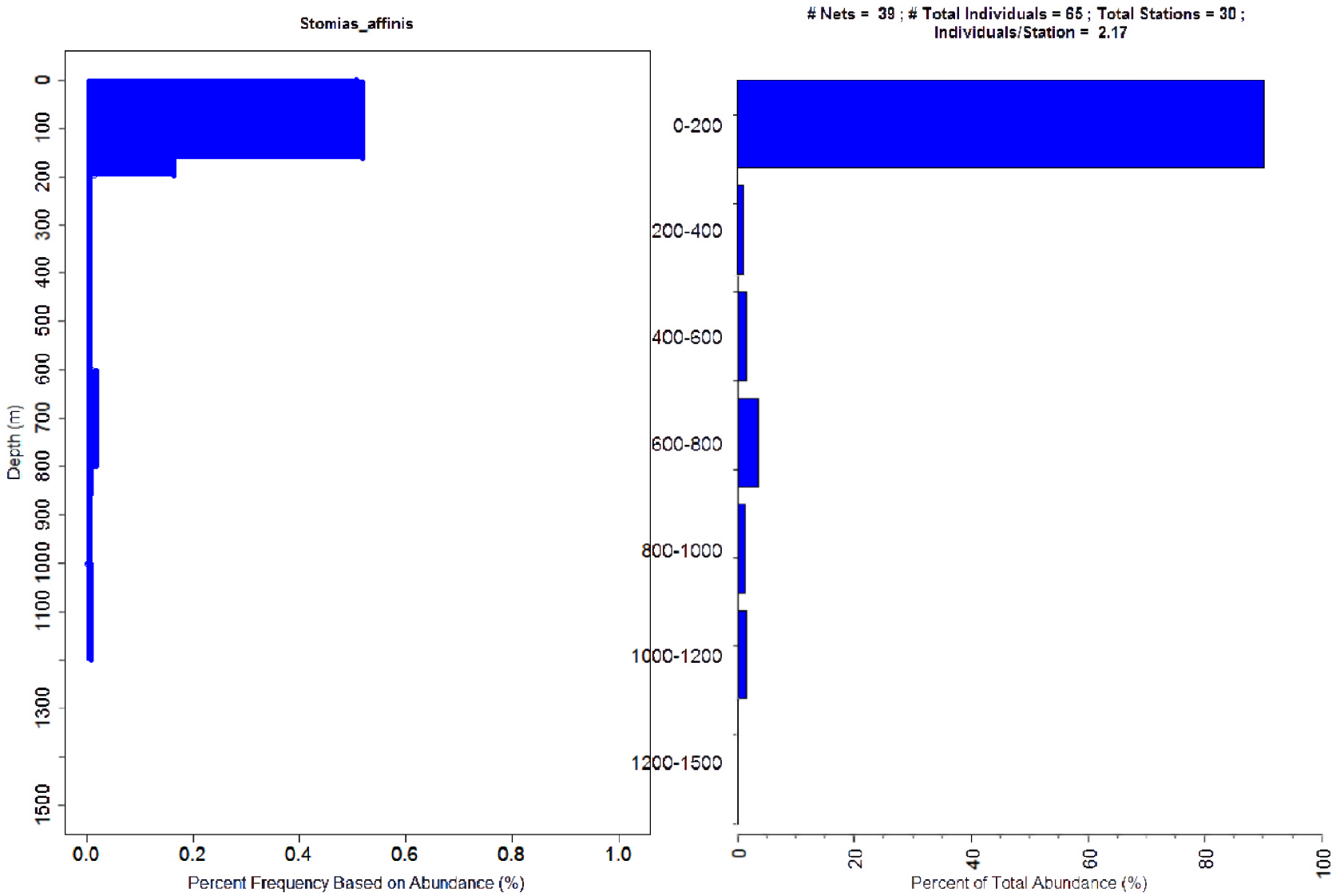
Sternoptyx_diaphana



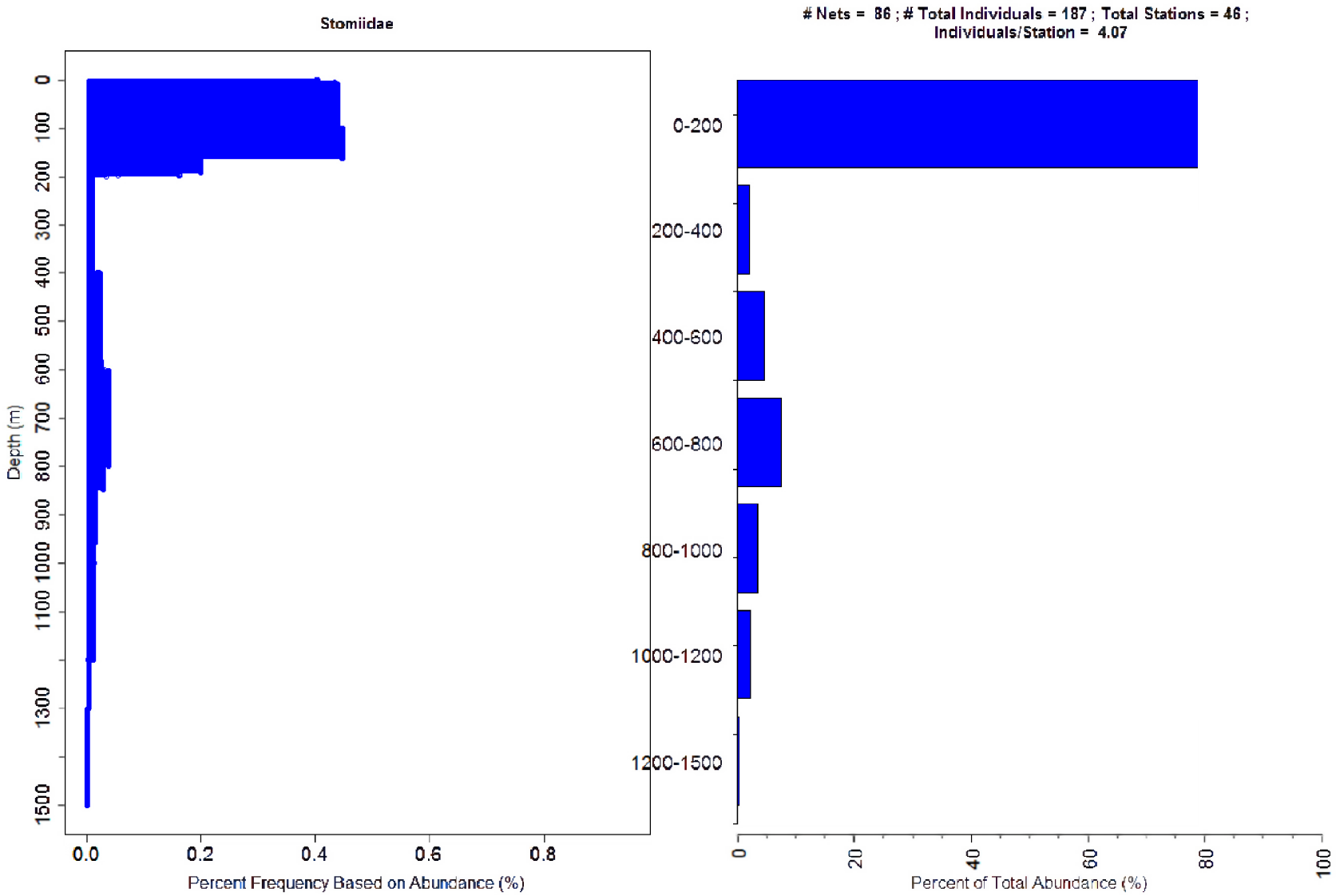
Sternoptyx_pseudobscura



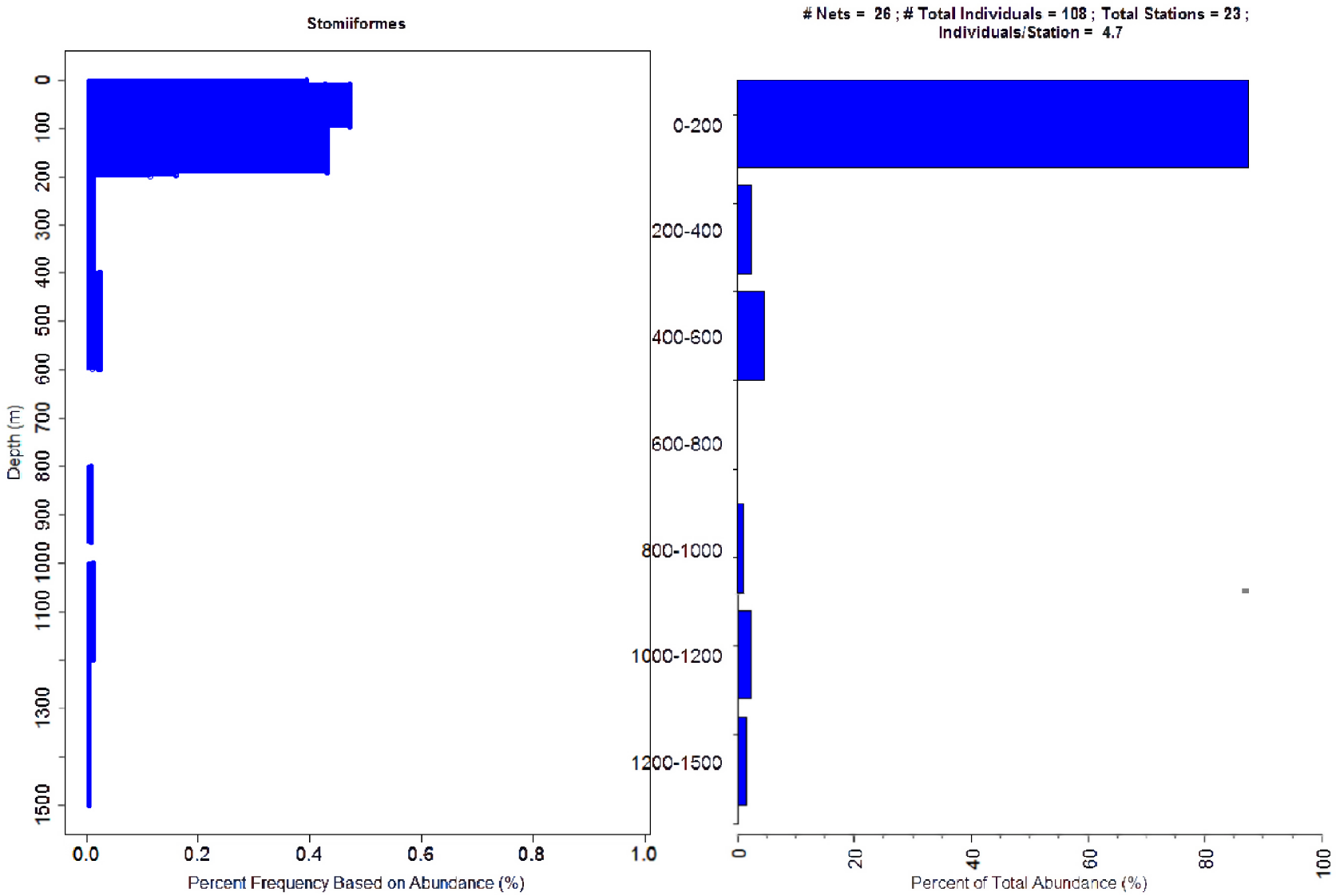
Stomatopoda



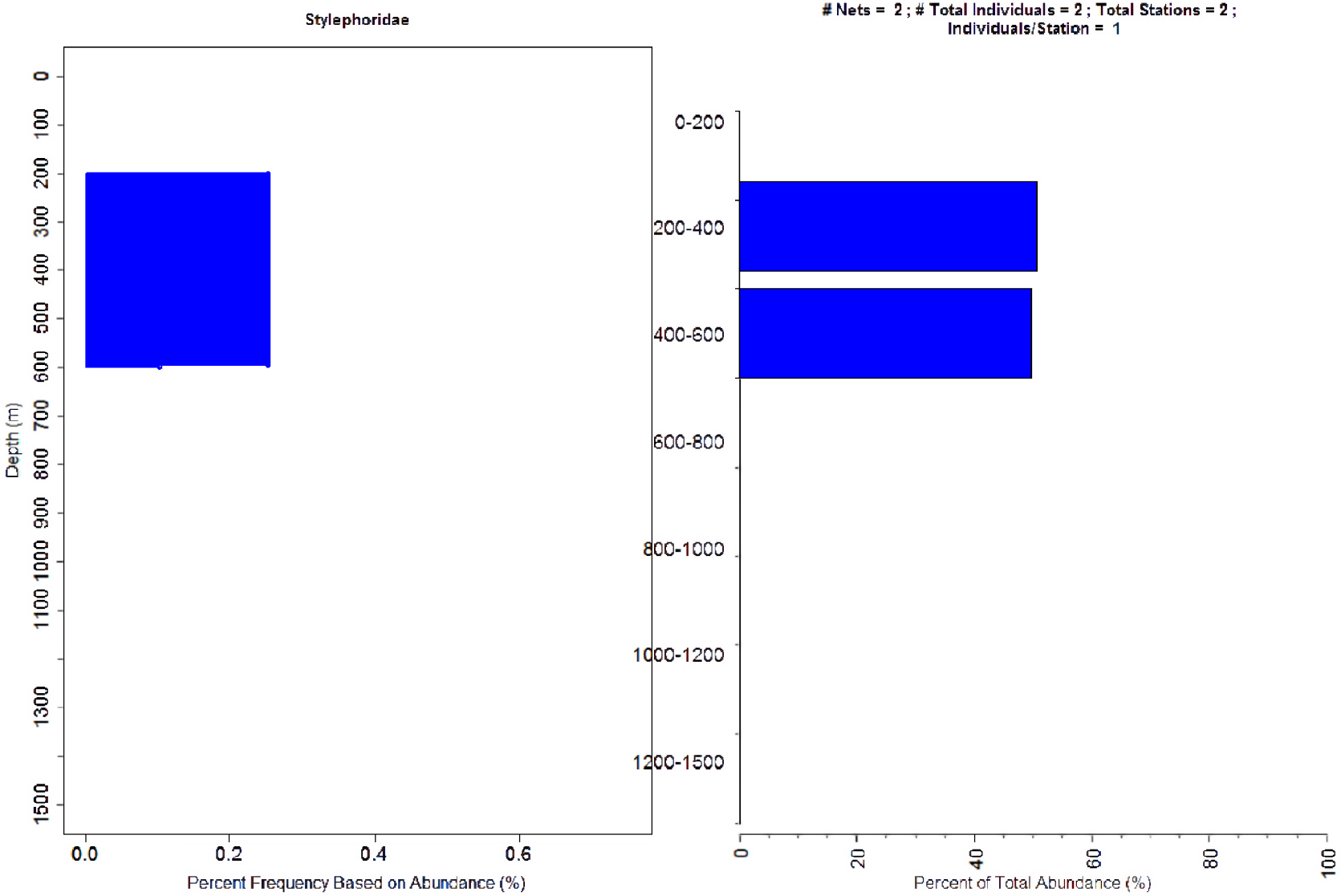
Stomias_affinis


Stomiidae
Nets = 86 ; # Total Individuals = 187 ; Total Stations = 46 ;
Individuals/Station = 4.07
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

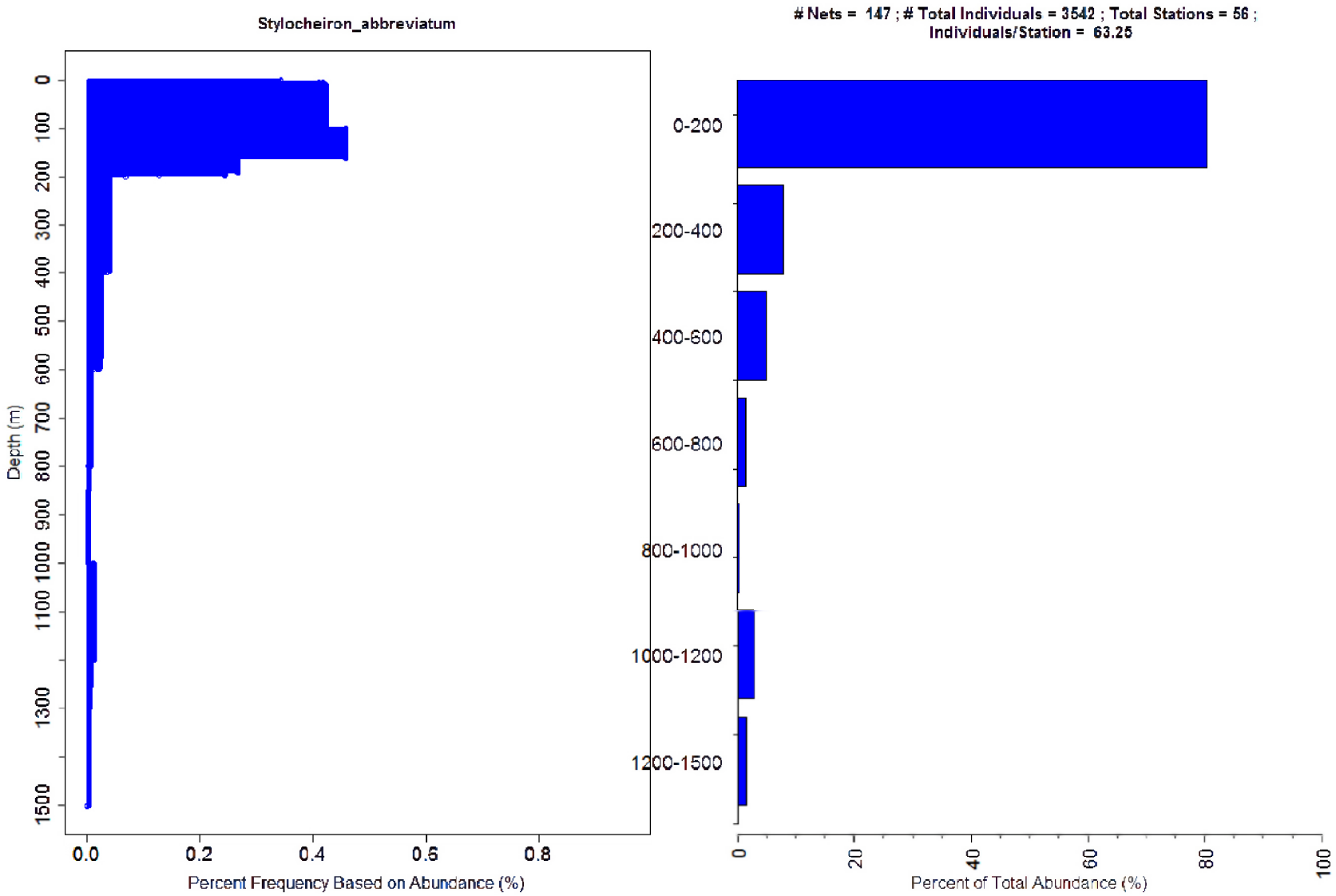
Stomiidae



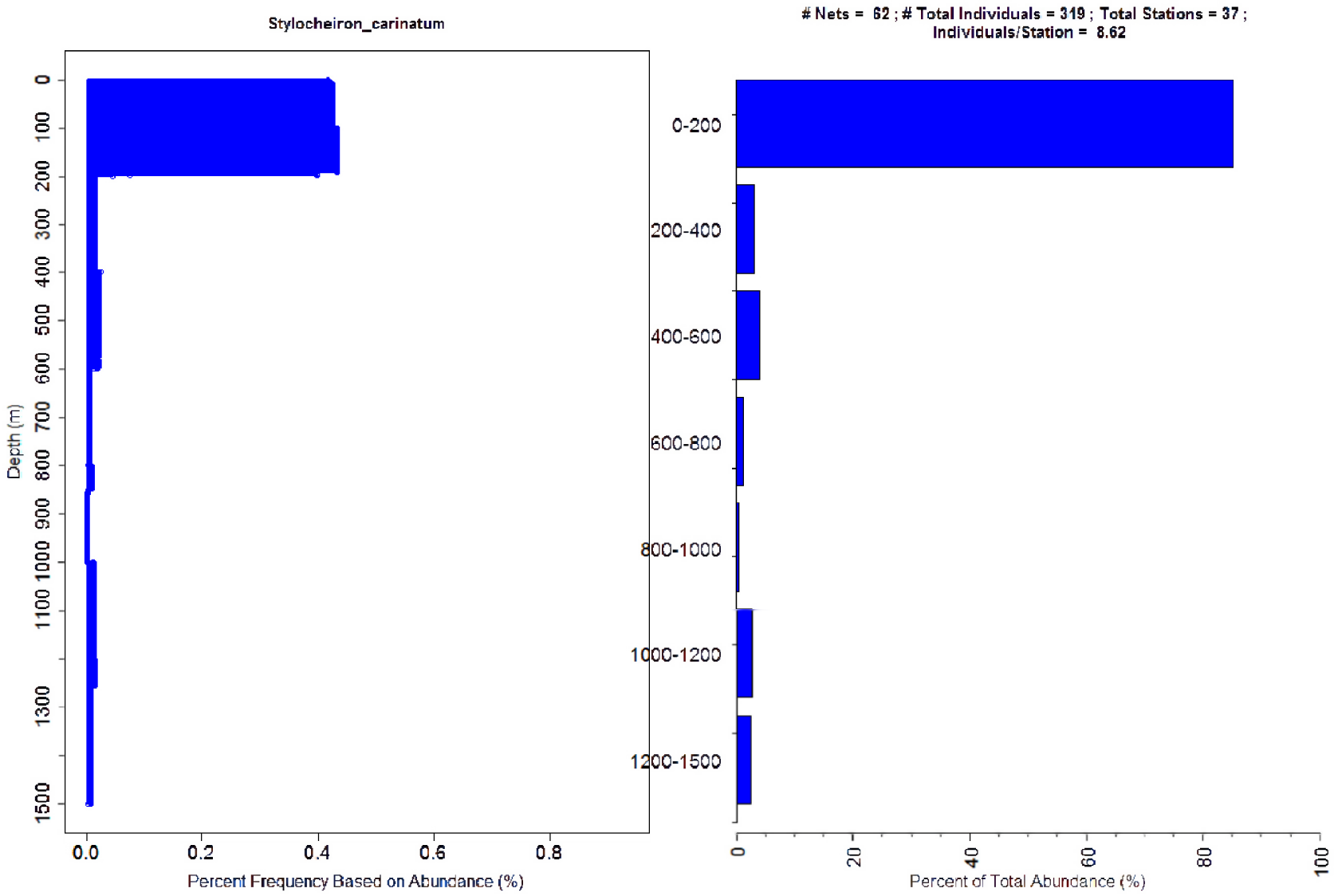
Stomiiformes



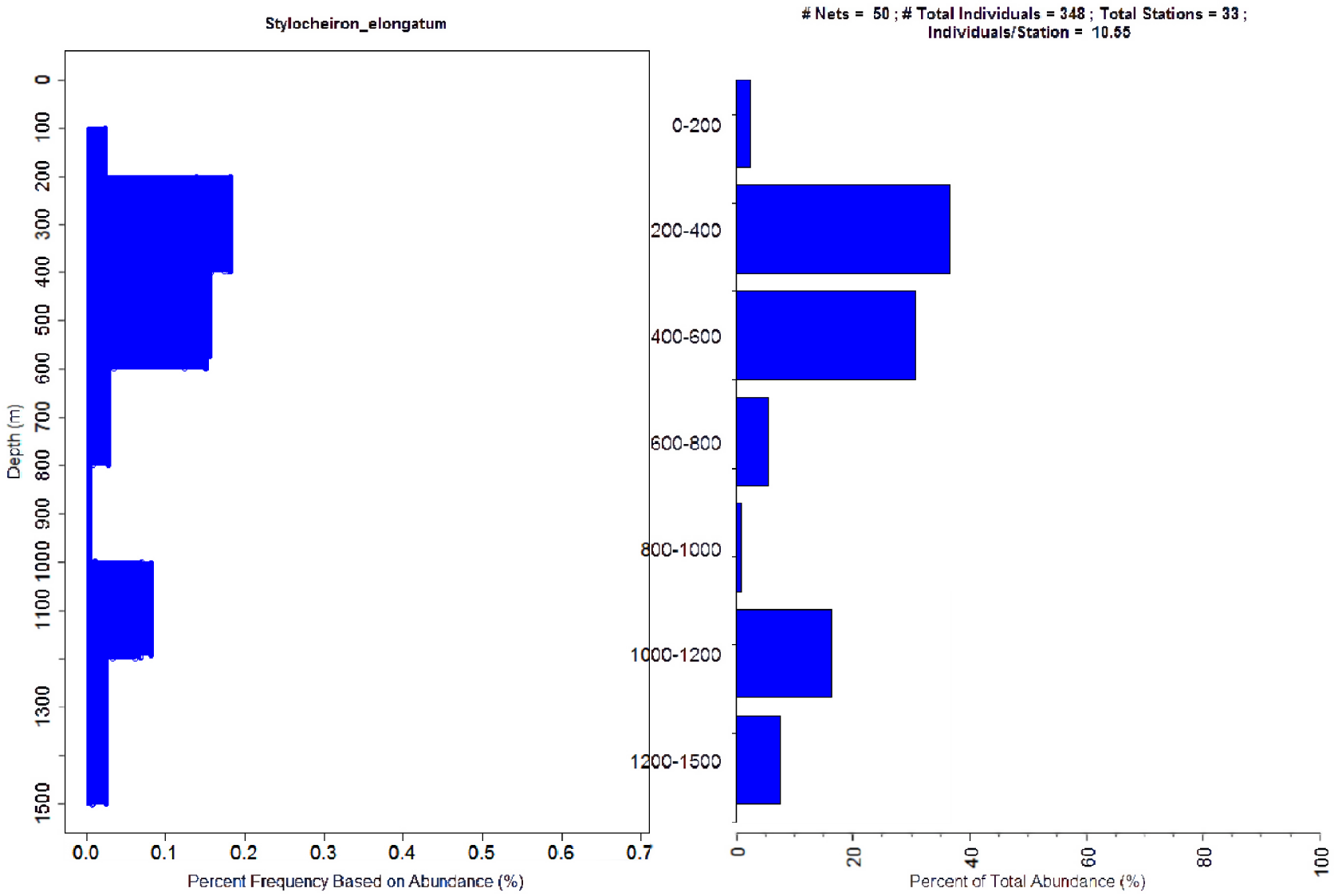
Stylephoridae



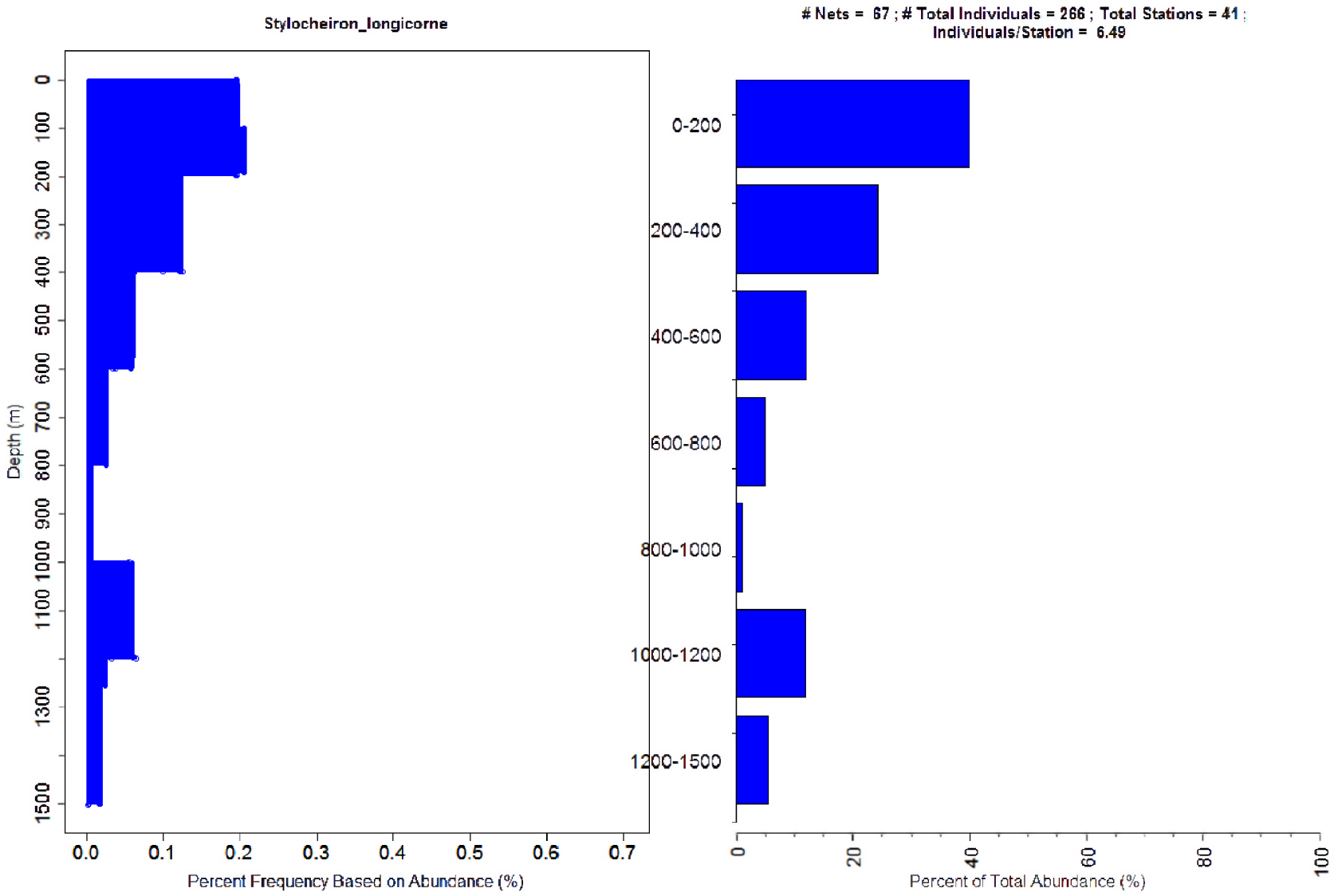
Stylocheiron_abbreviatum



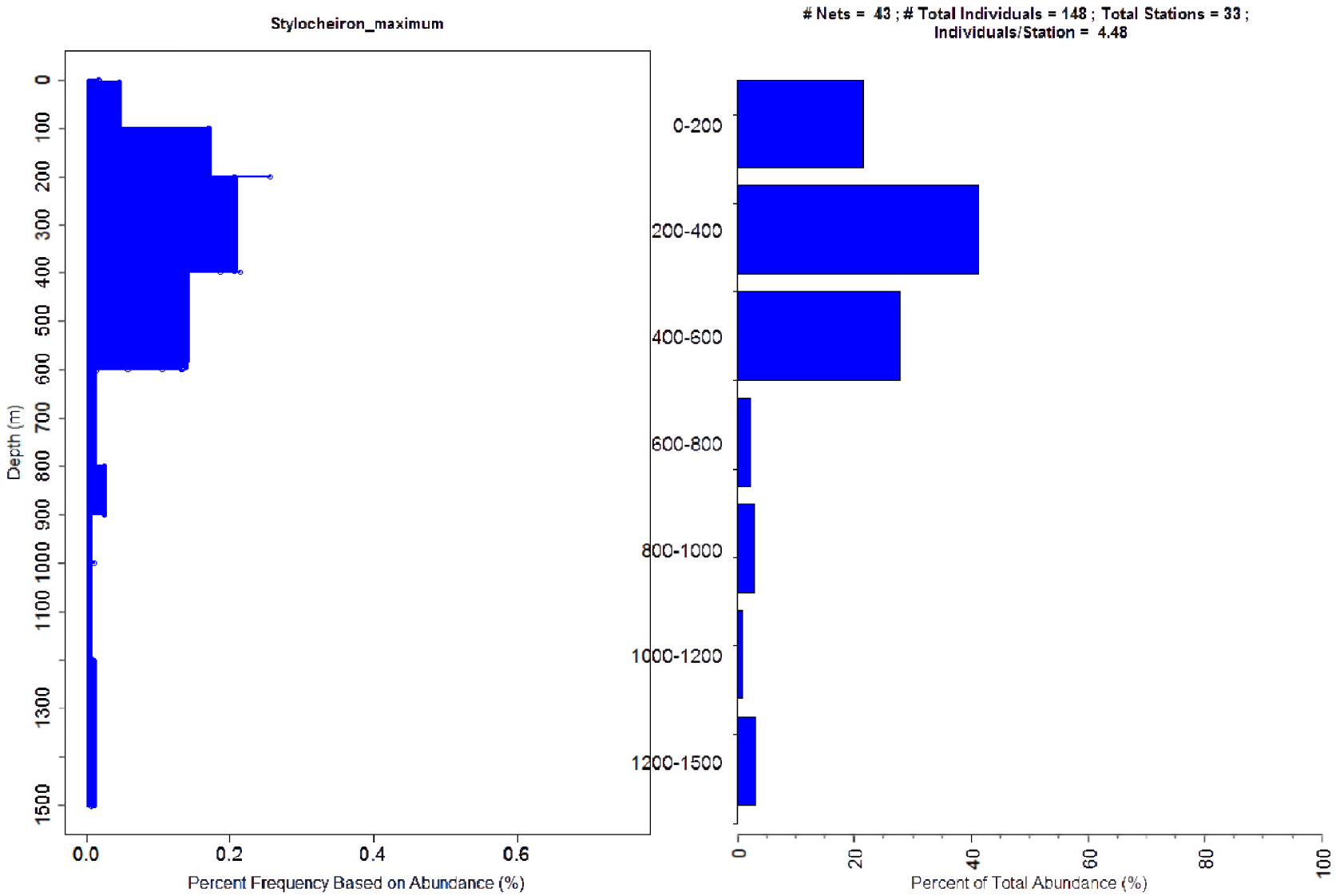
Stylocheiron_carinatum



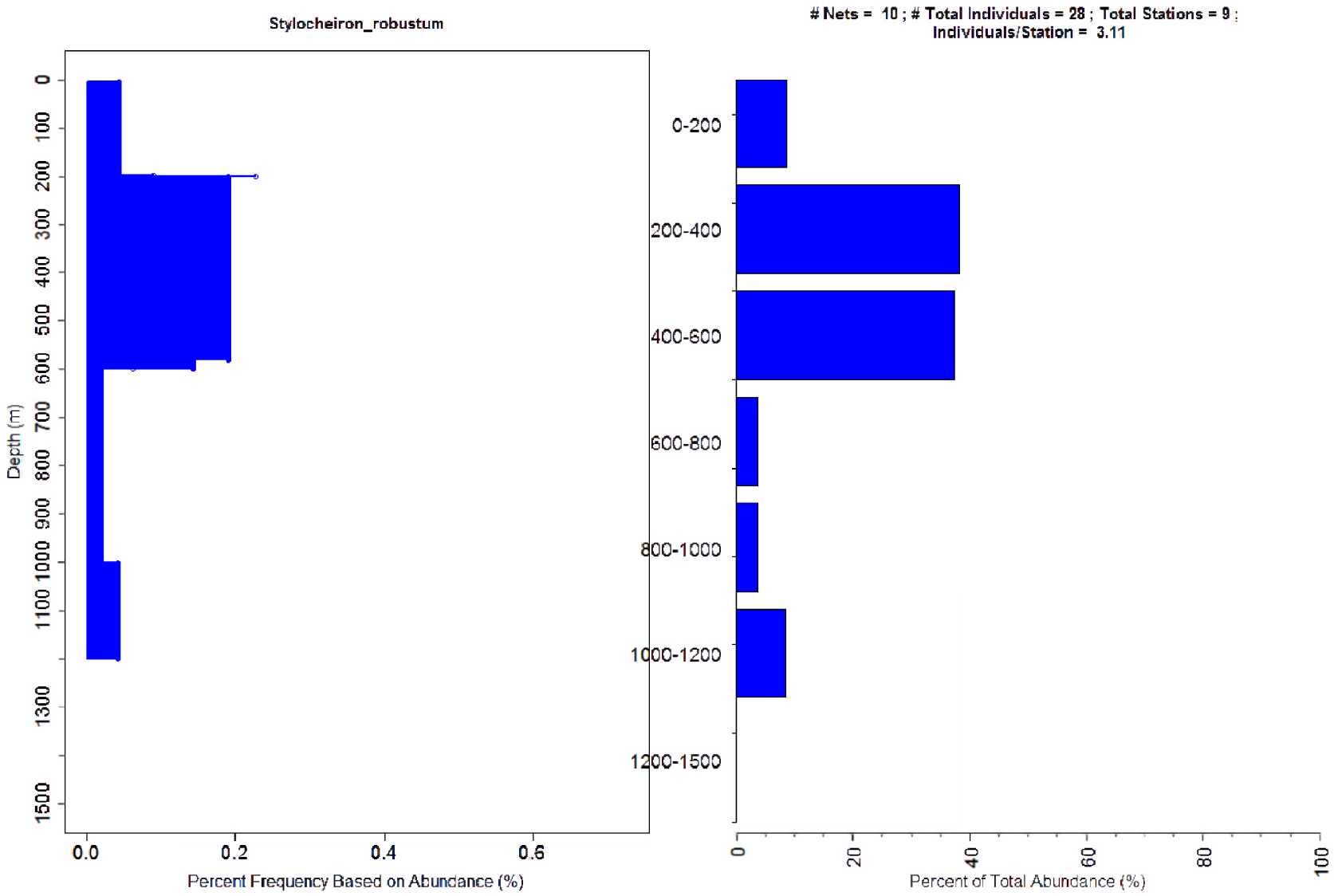
Stylocheiron_elongatum



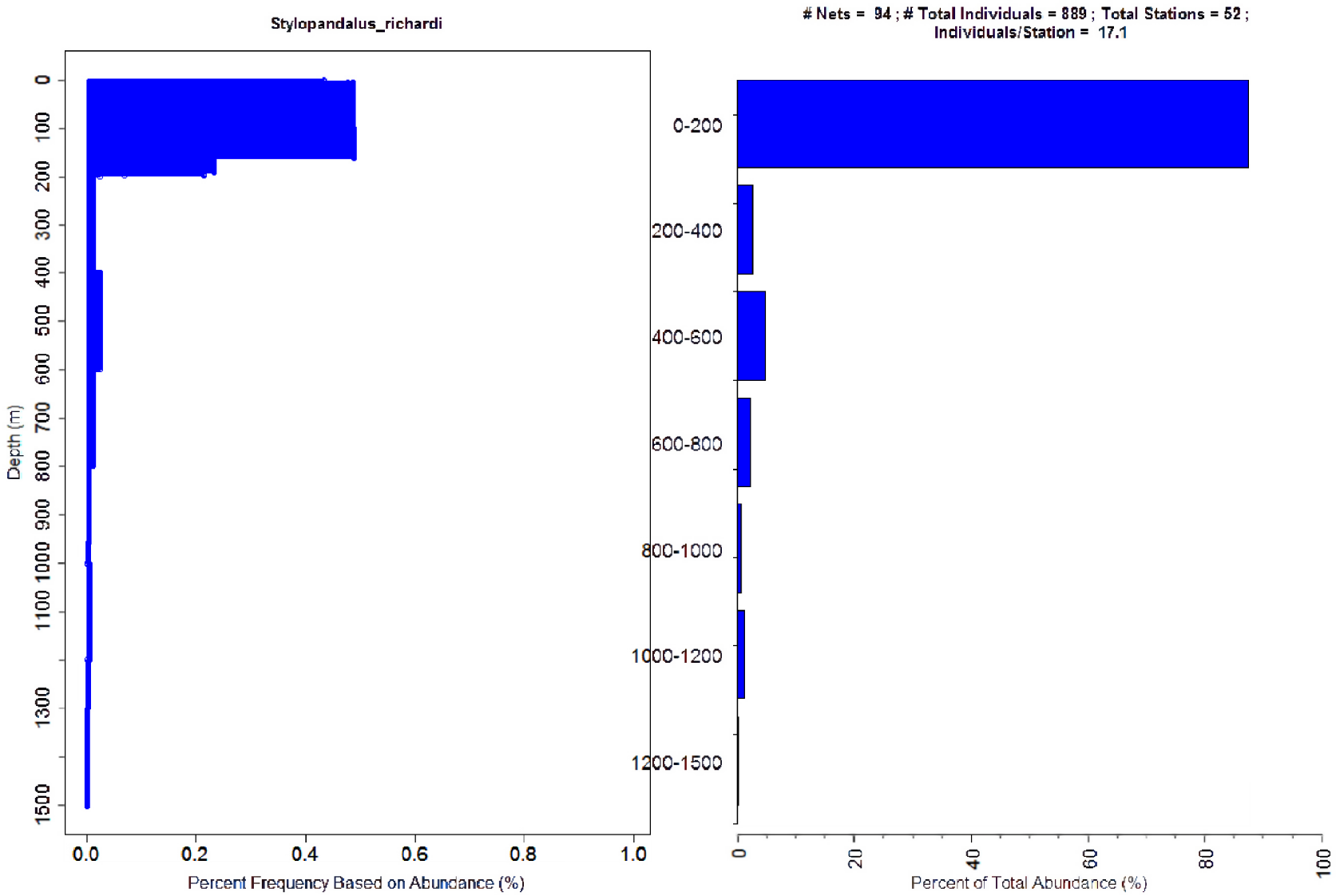
Stylocheiron_longicorne



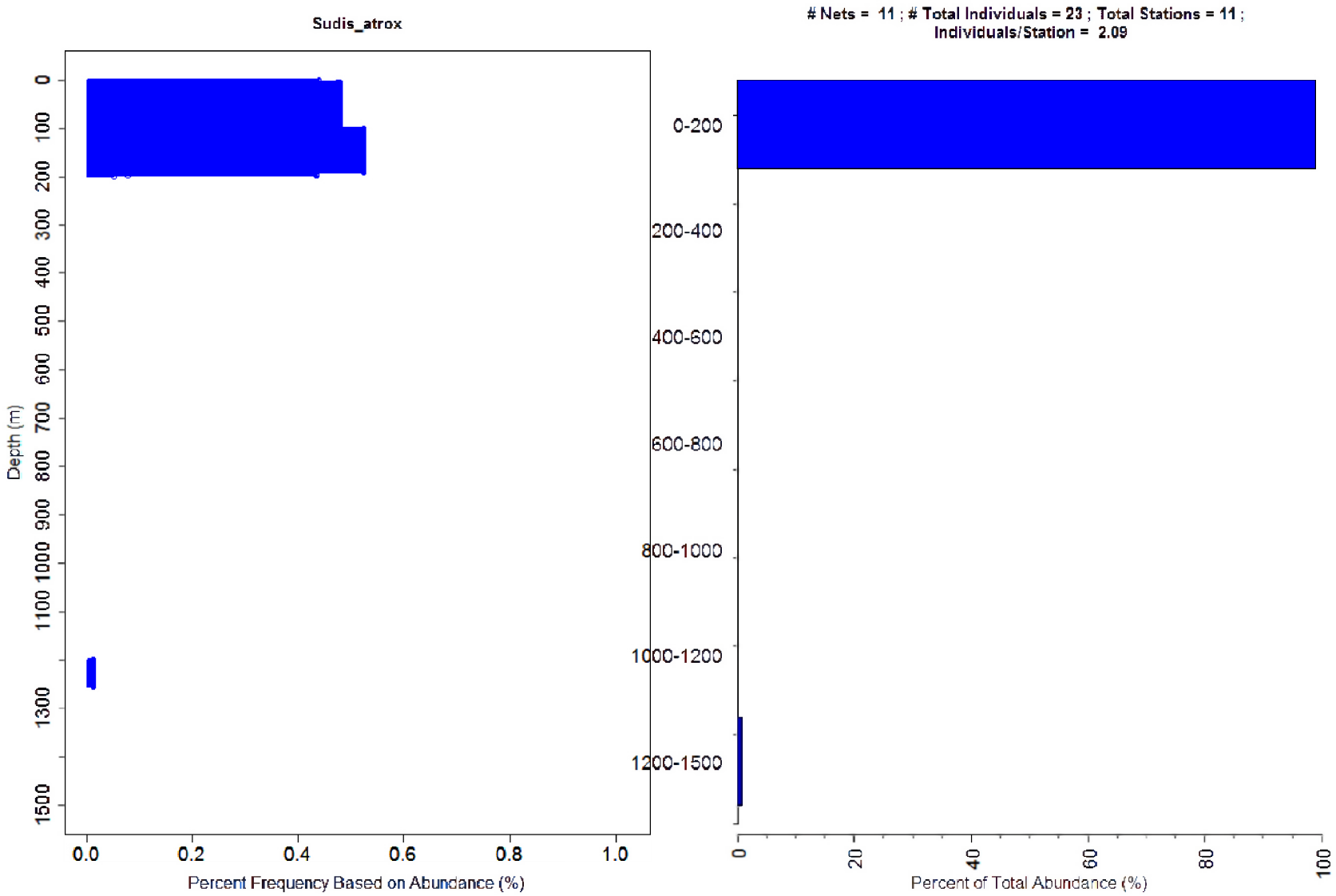
Stylocheiron_maximum



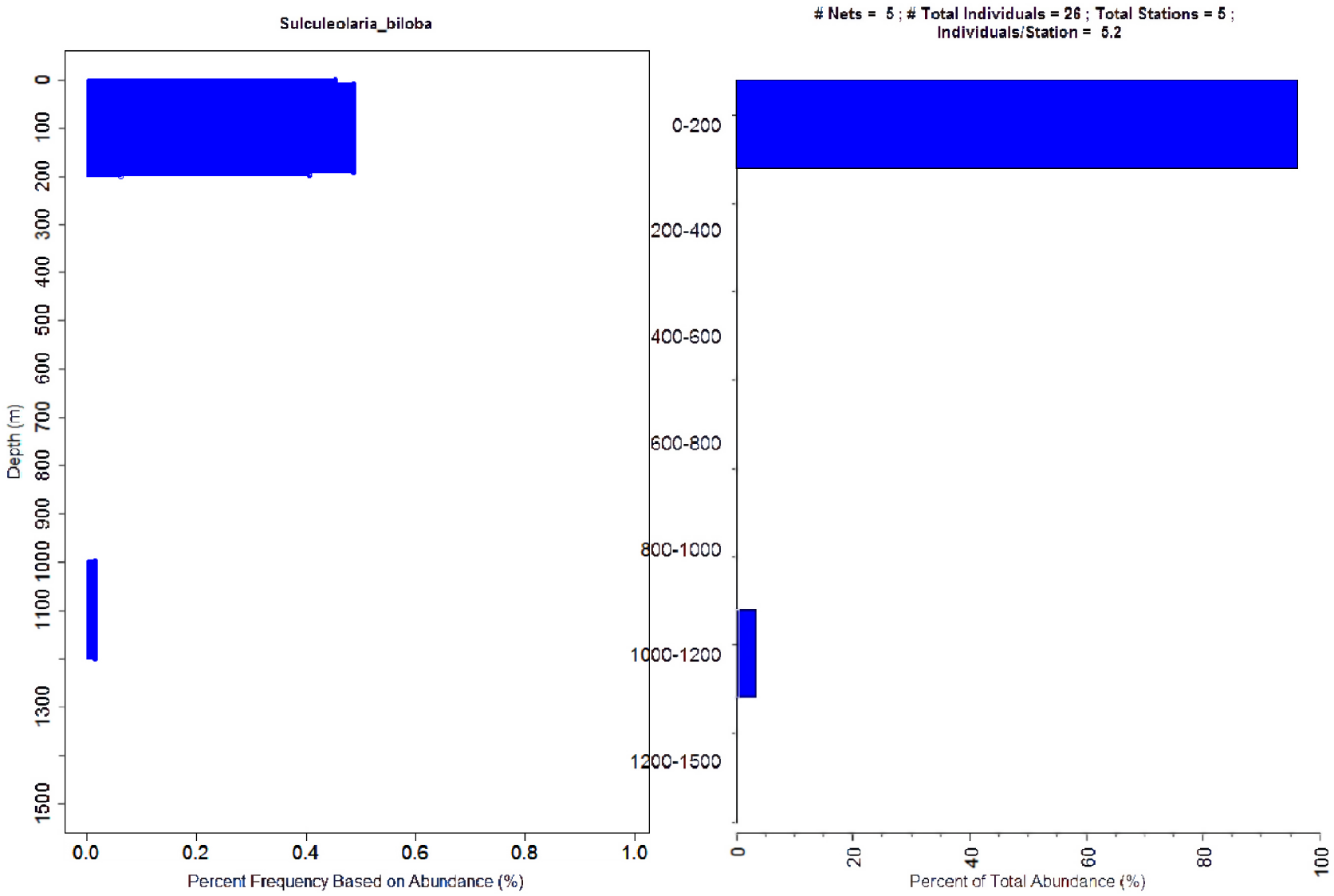
Stylocheiron_robustum



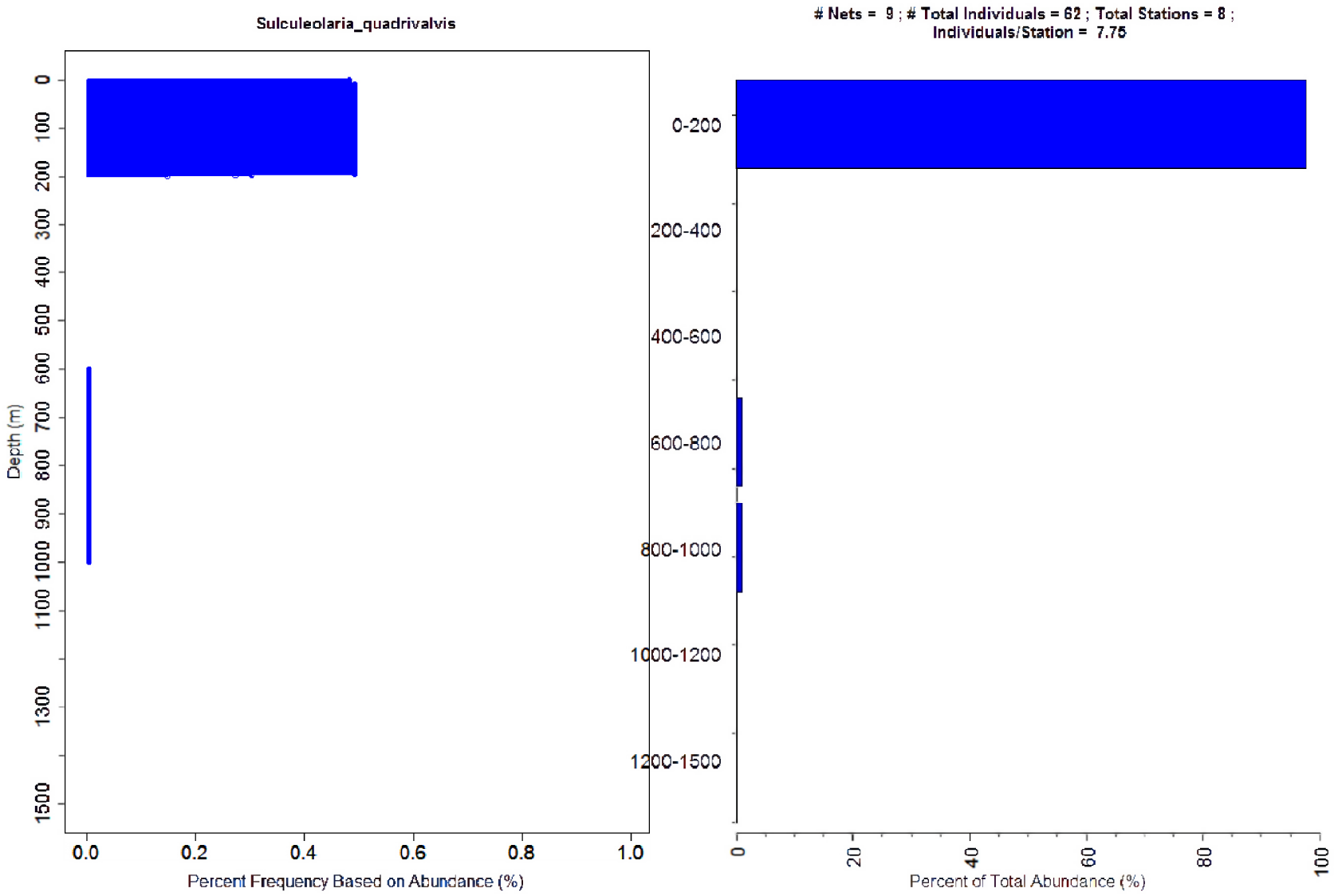
Stylopandalus_richardi


Sudis_atrox
Nets = 11 ; # Total Individuals = 23 ; Total Stations = 11 ;
Individuals/Station = 2.09
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

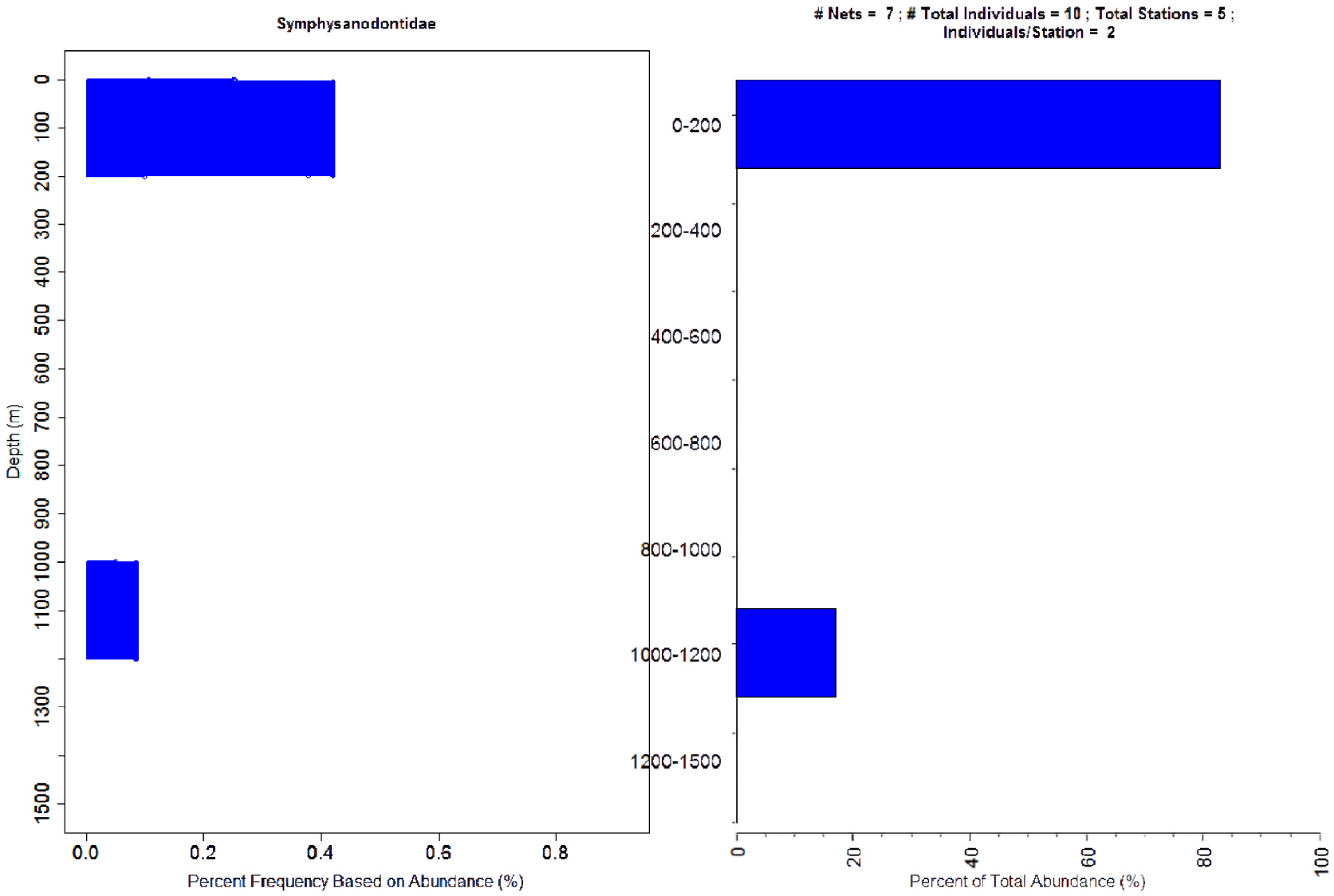
Sudis_atrox



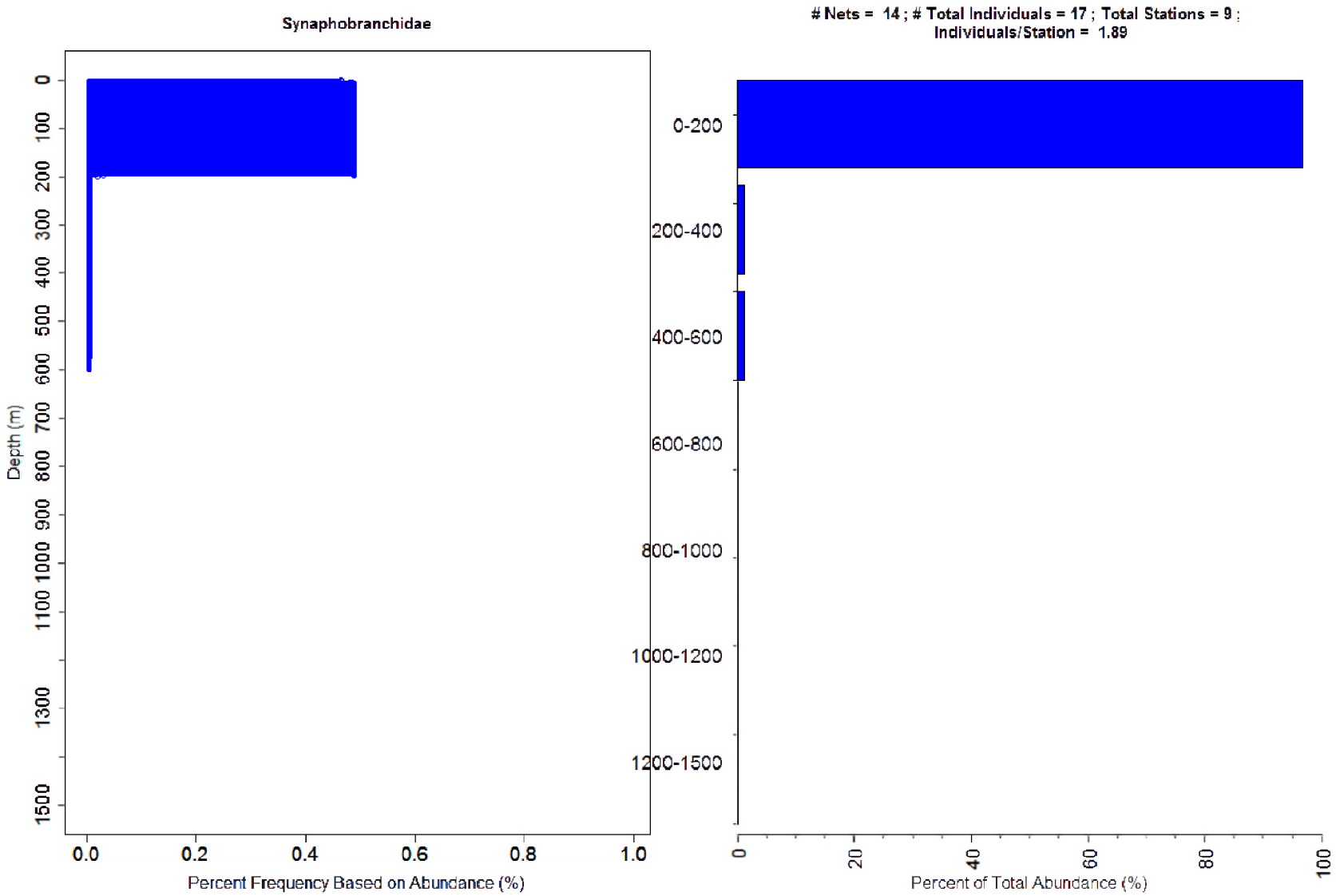
Sulculeolaria_biloba



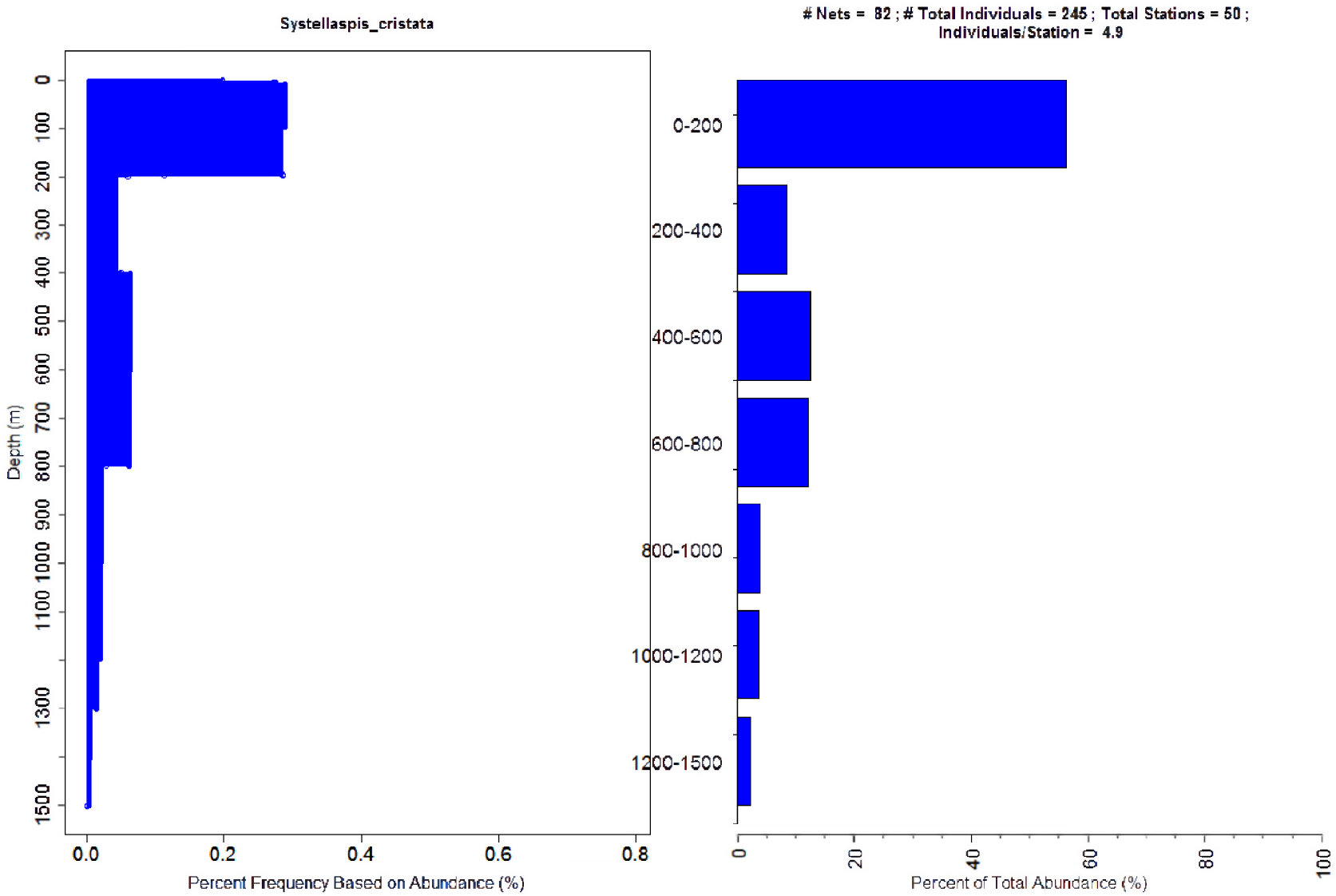
Sulculeolaria_quadrivalvis



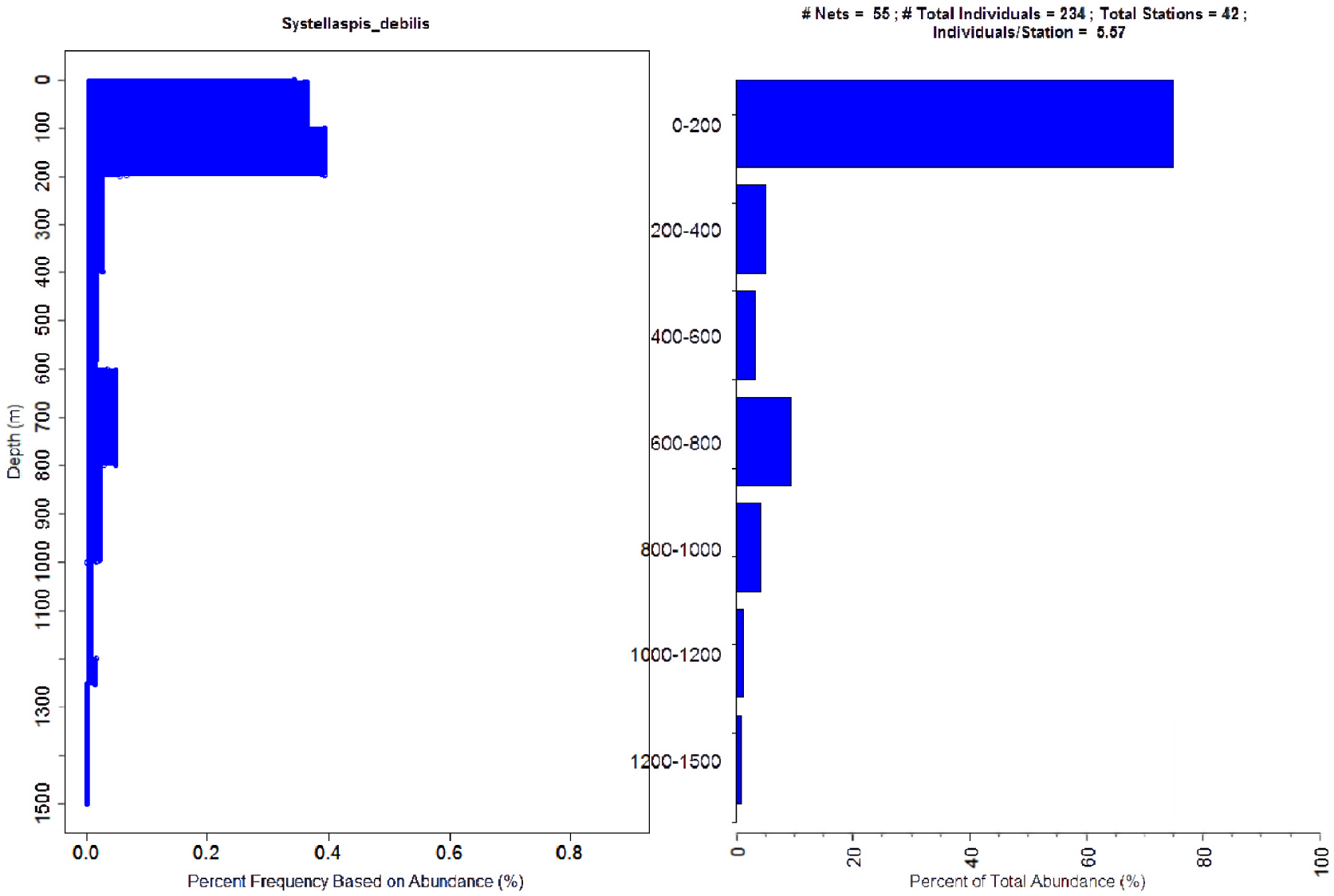
Symphysanodontidae



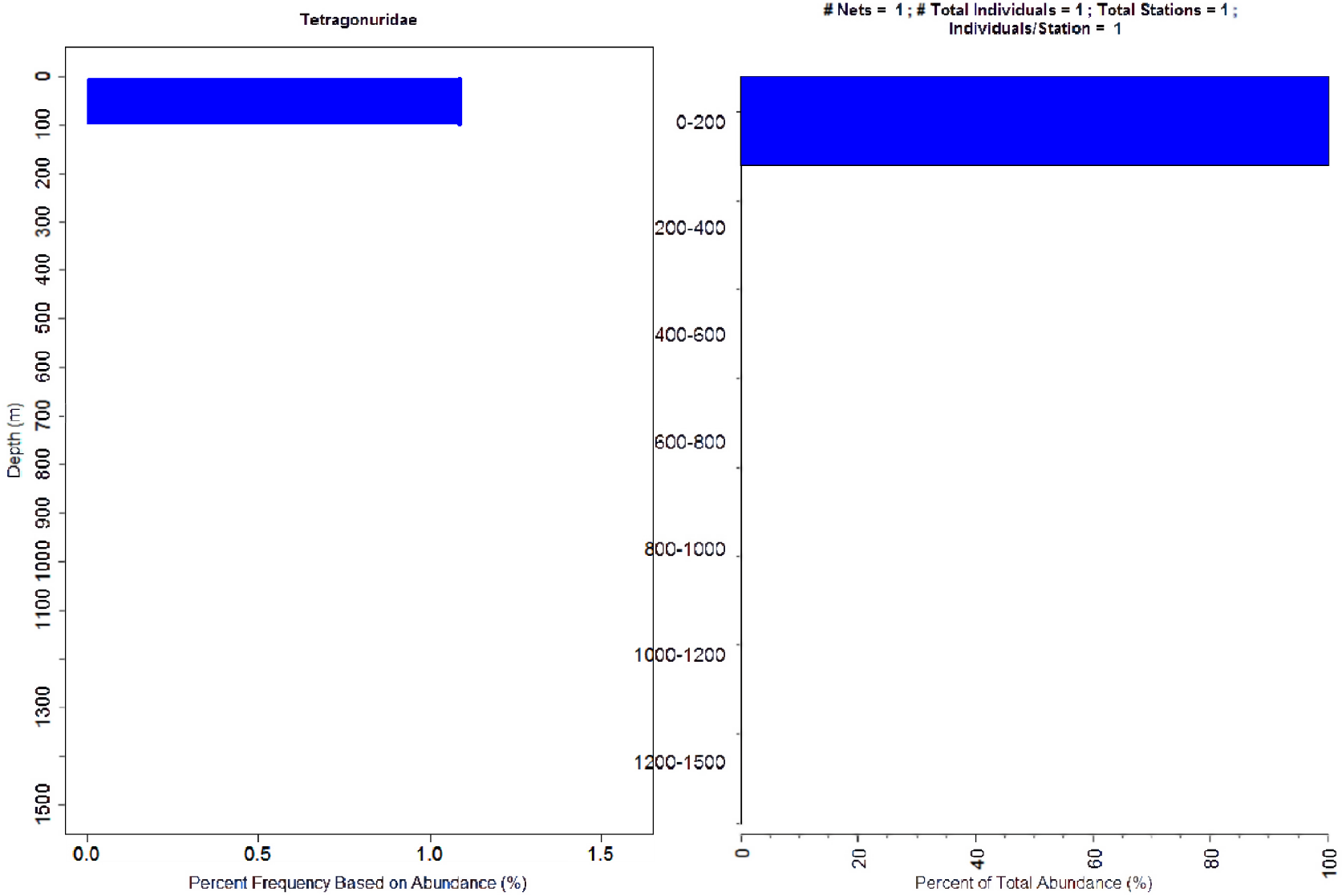
Synaphobranchidae



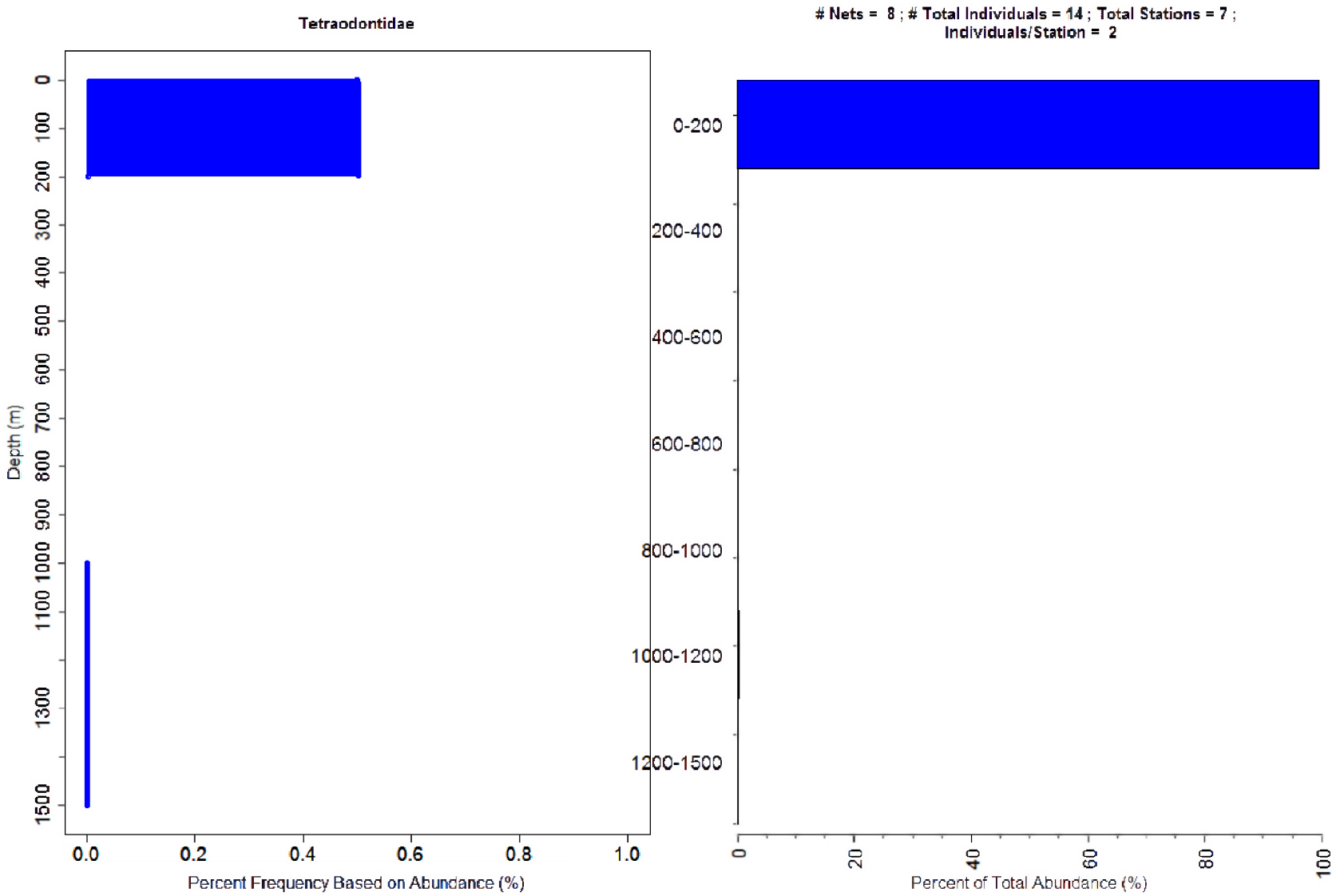
Systellaspis_cristata



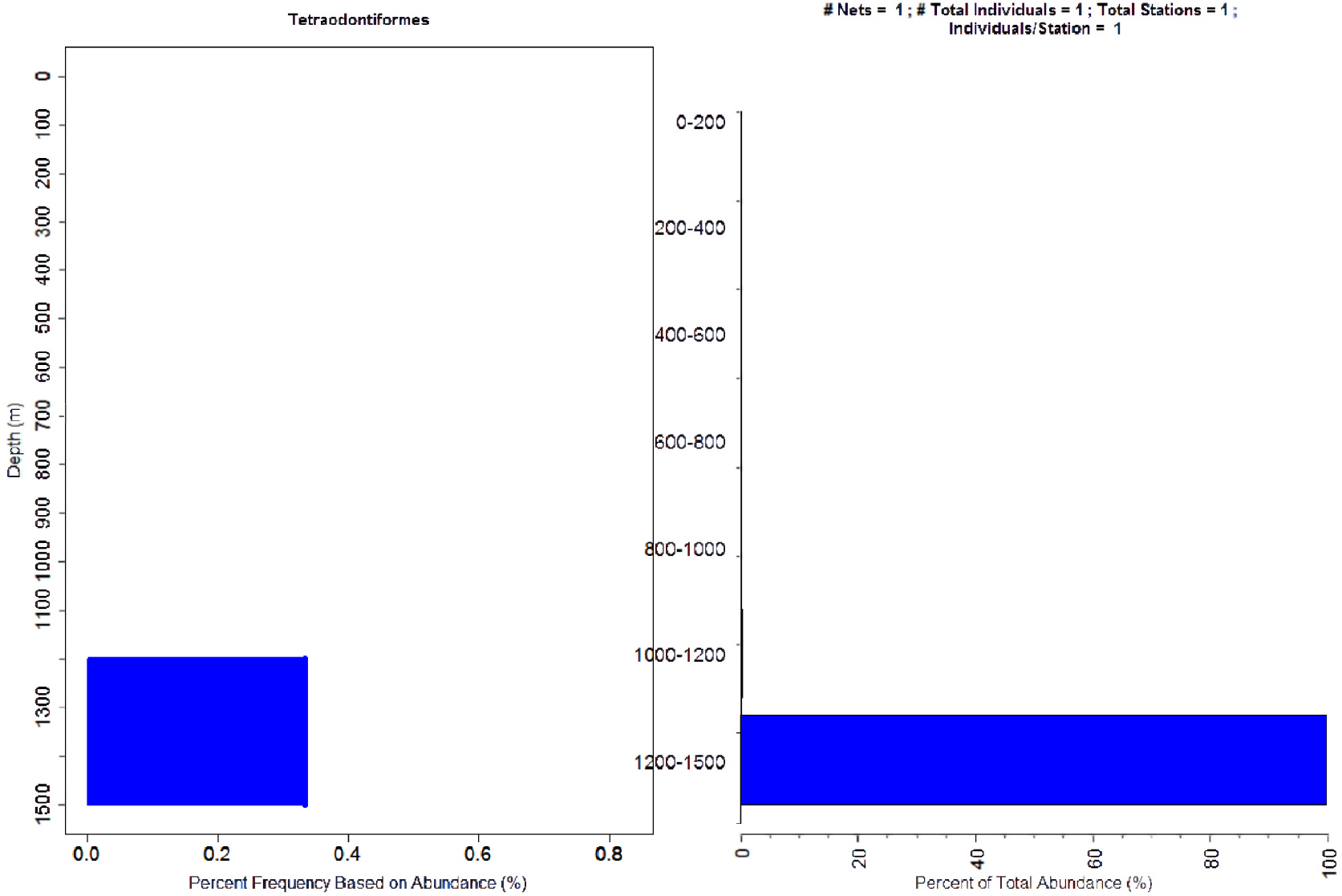
Systellaspis_debilis



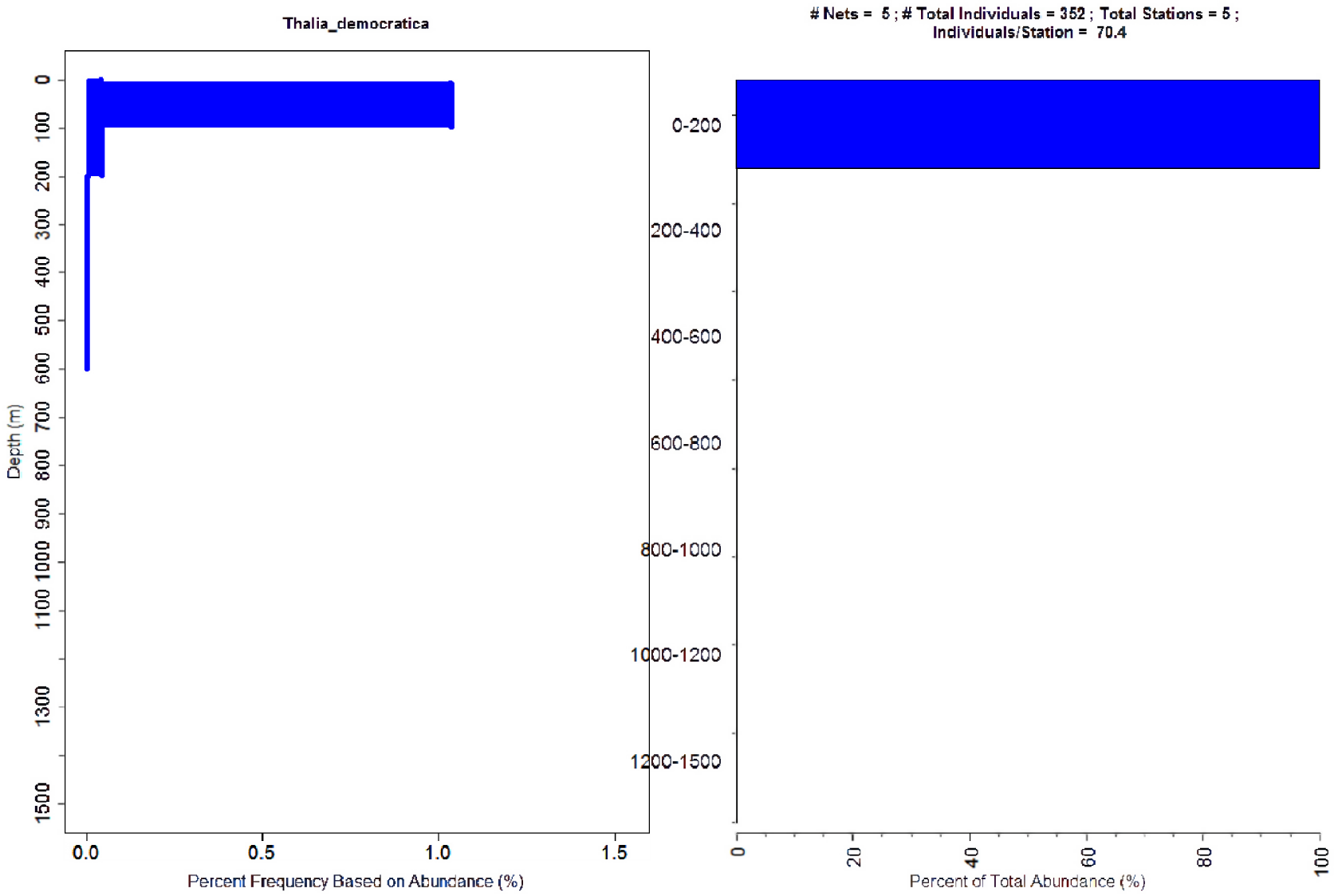
Tetragonuridae



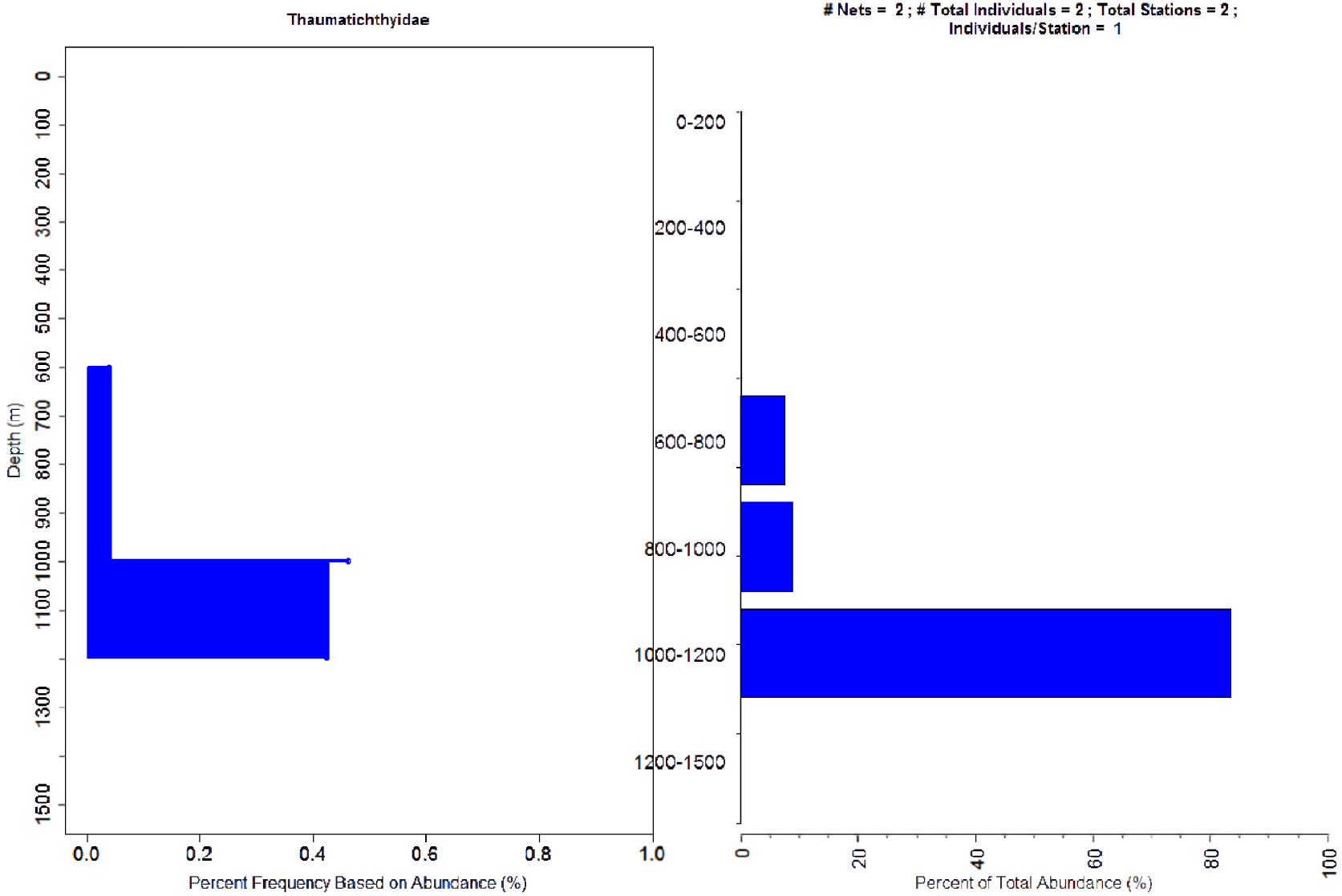
Tetraodontidae



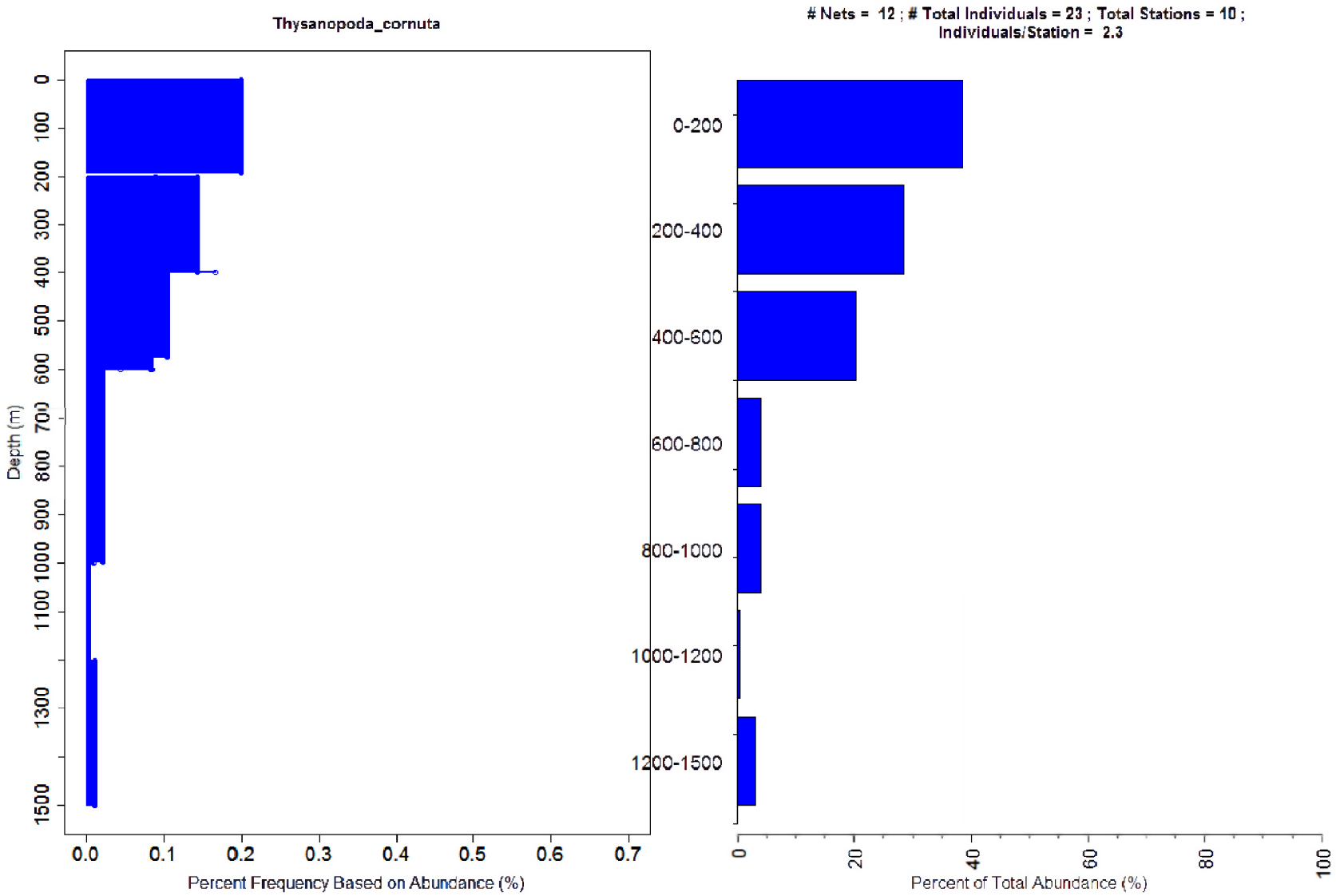
Tetraodontiformes



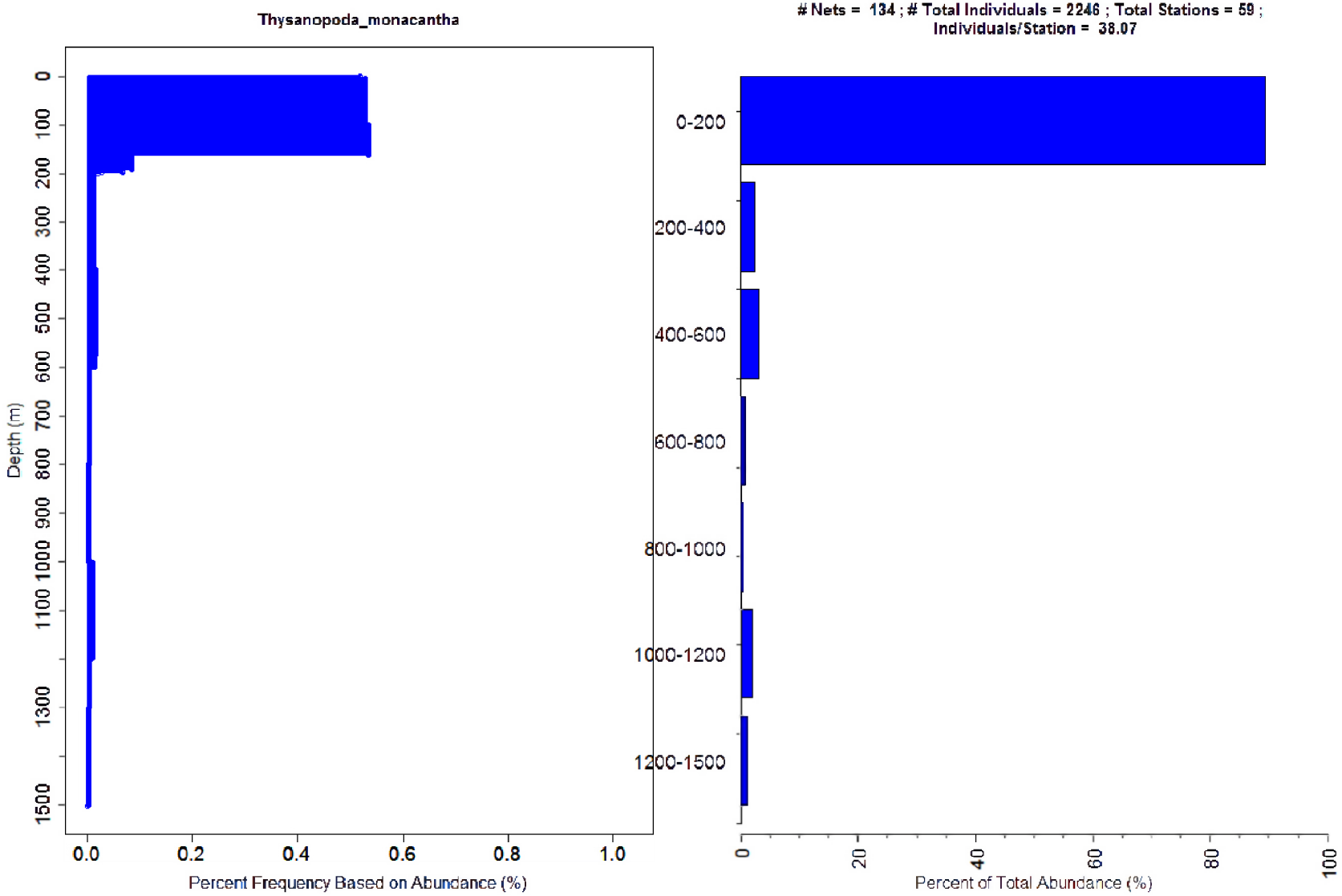
Thalia_democratica



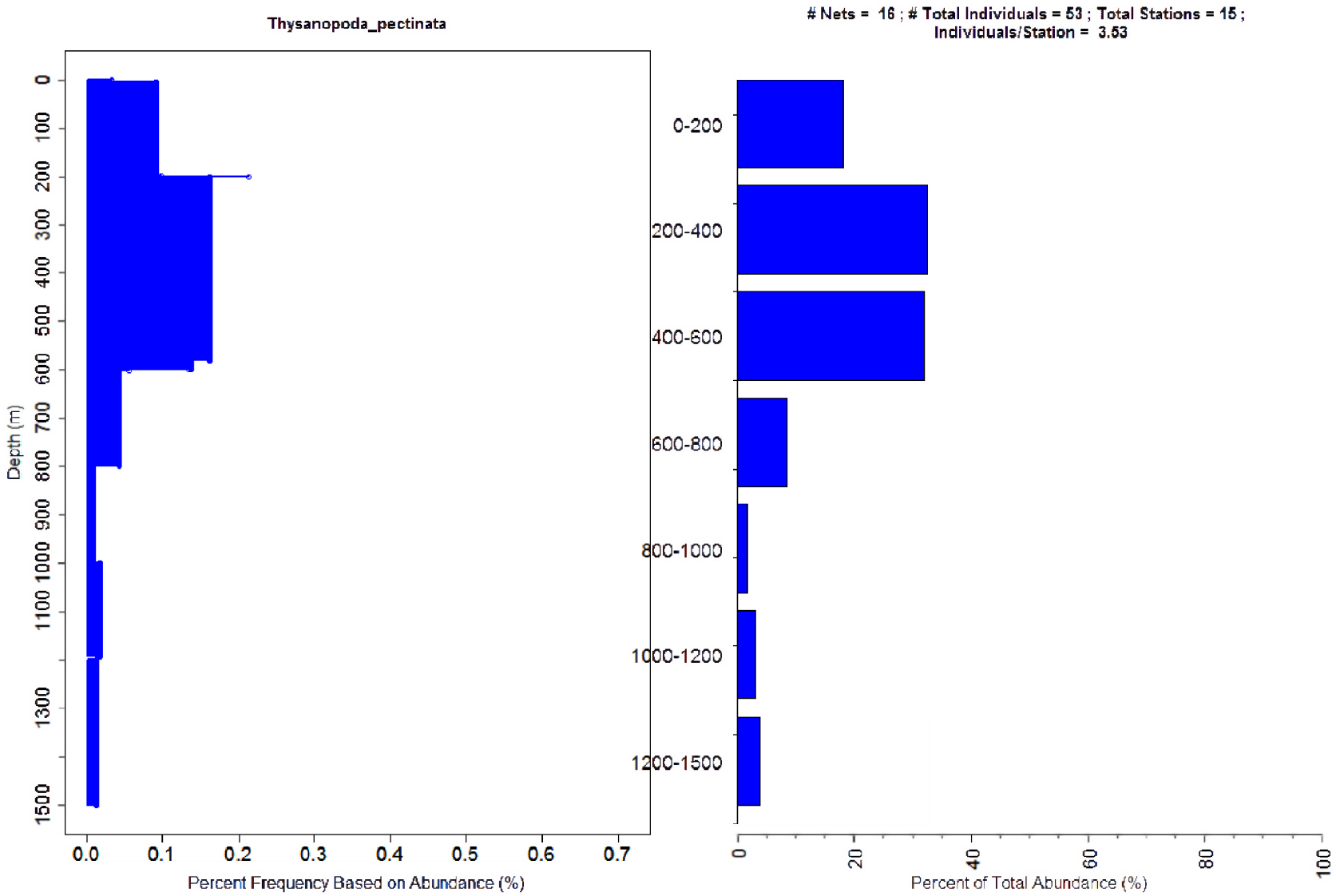
Thaumatichthyidae



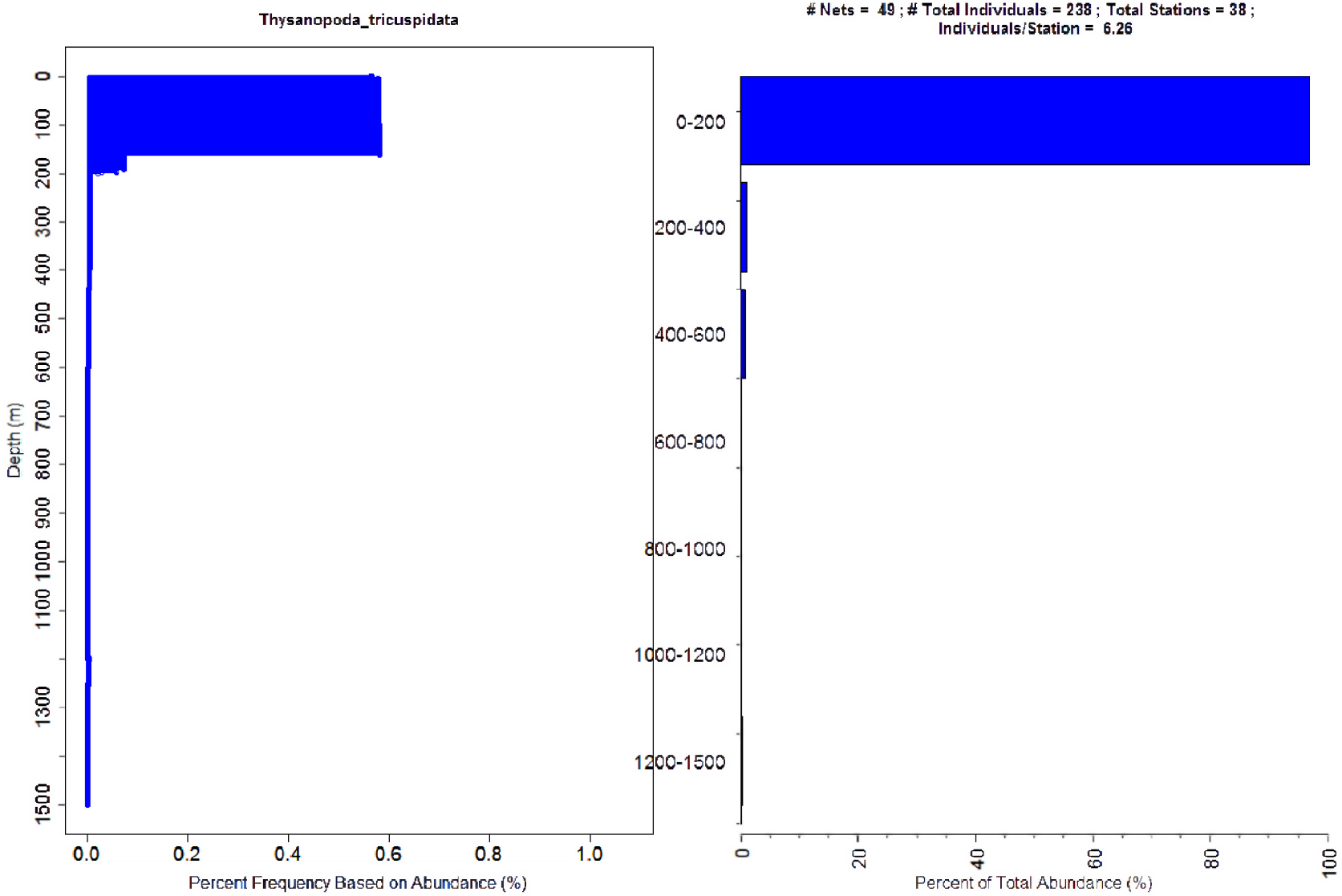
Thysanopoda_cornuta



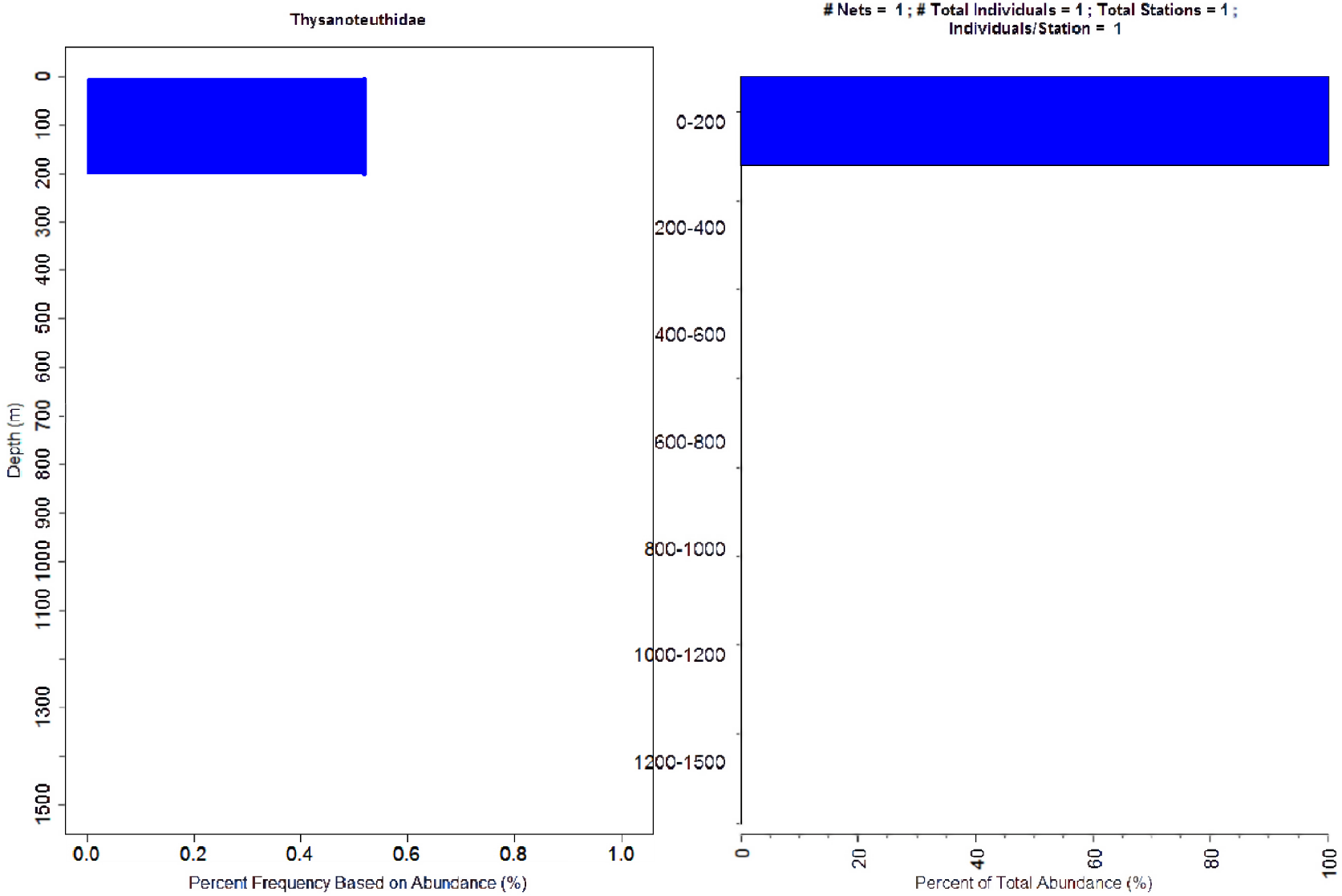
Thysanopoda_monacantha



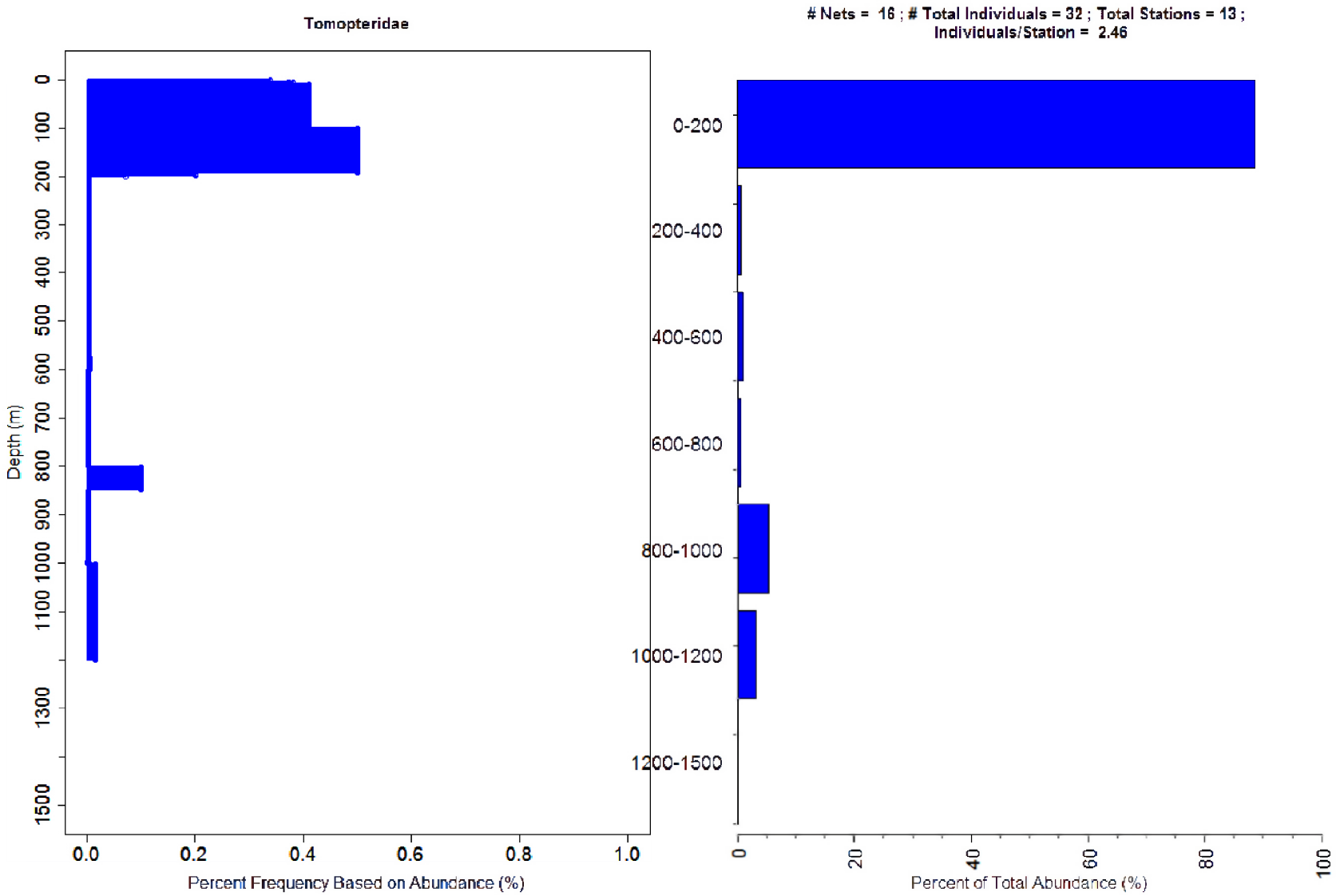
Thysanopoda_pectinata



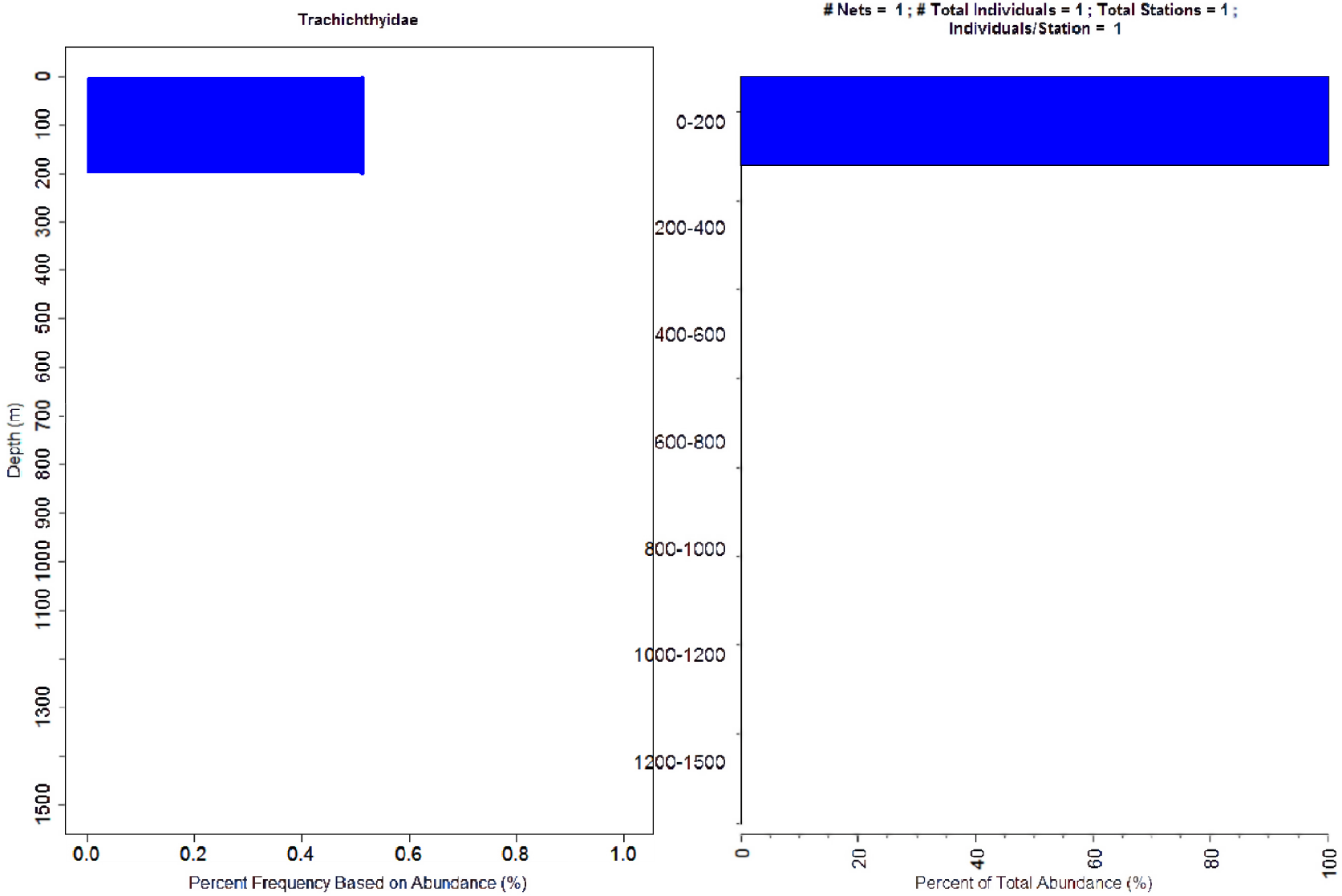
Thysanopoda_tricuspidata



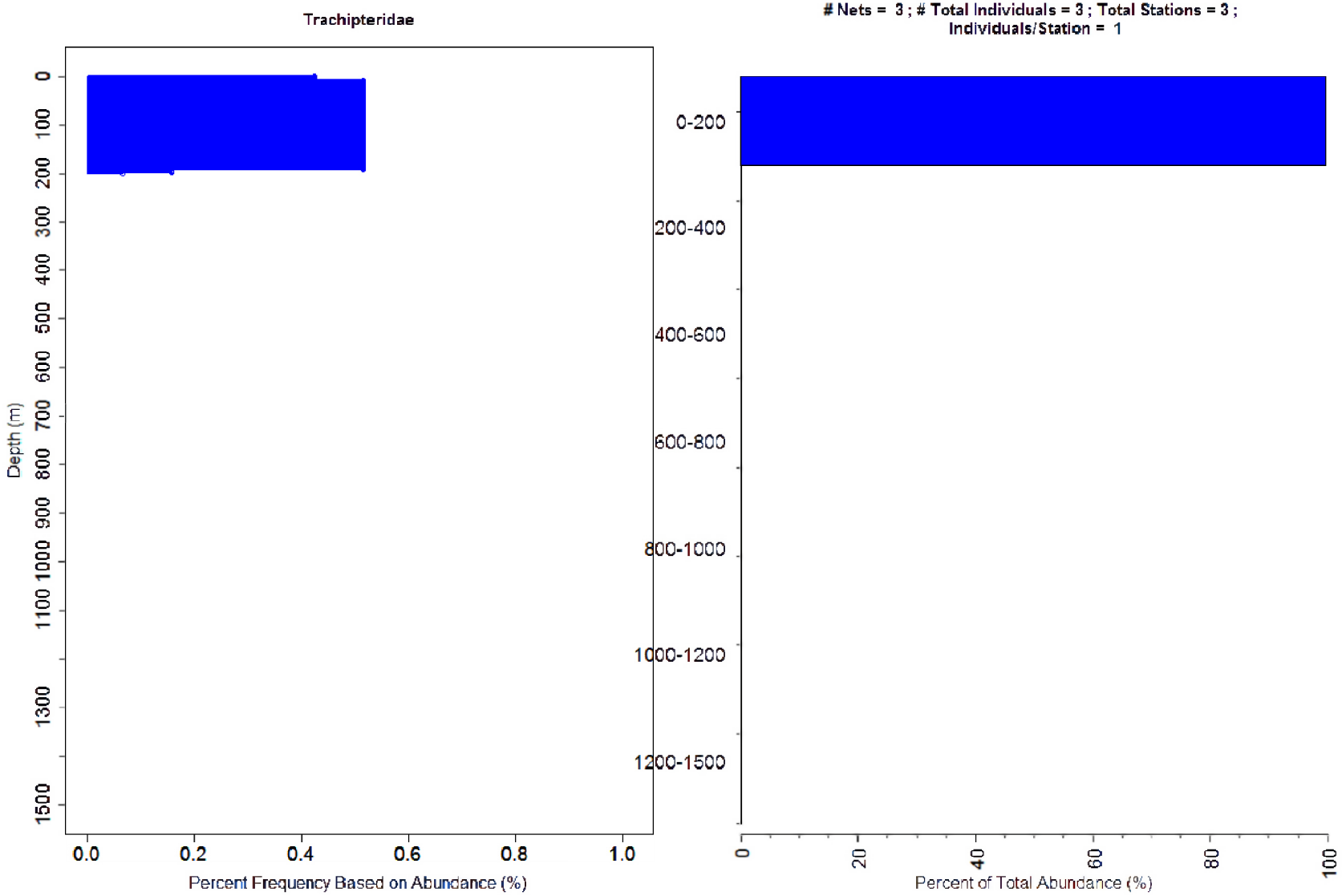
Thysanoteuthidae



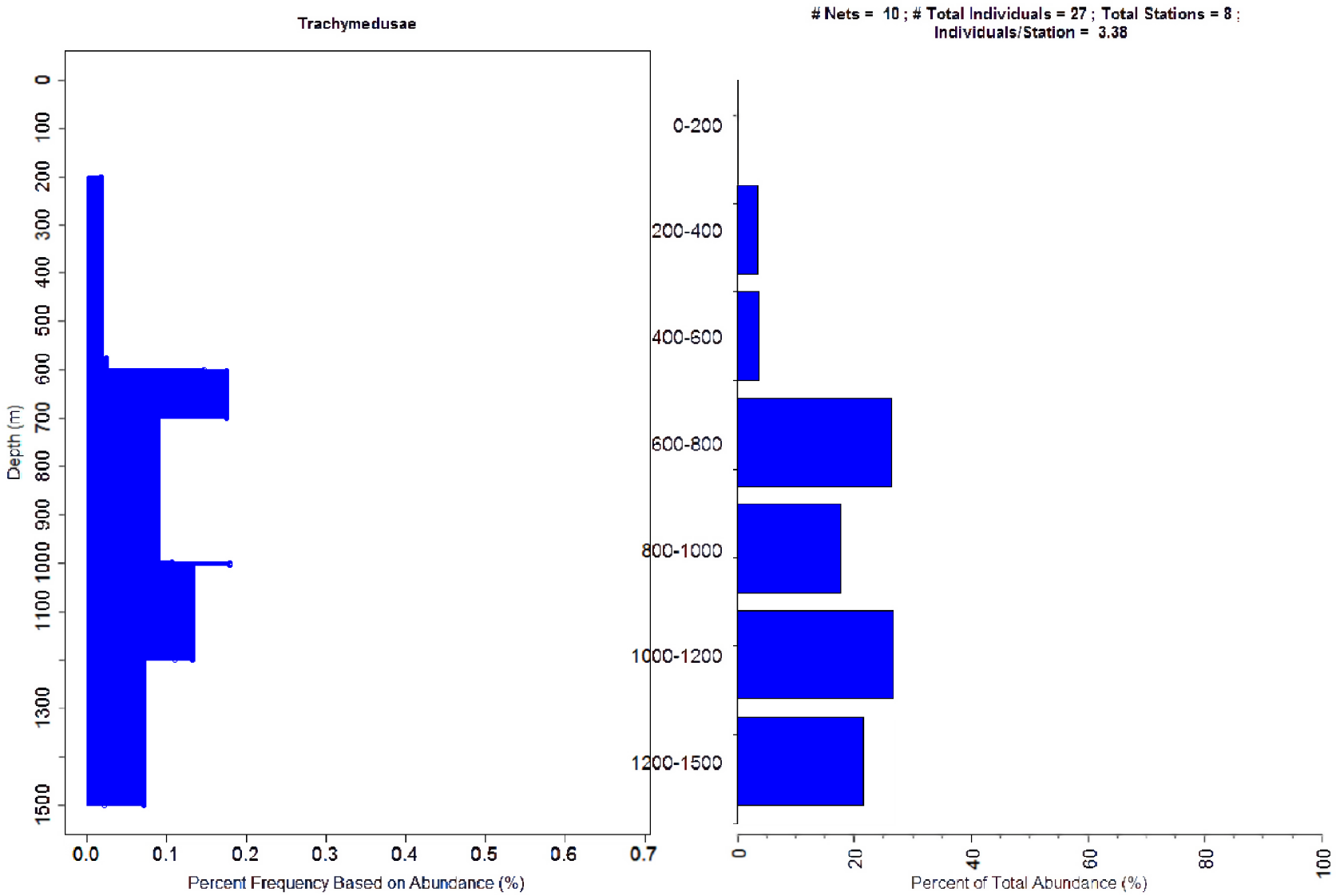
Tomopteridae



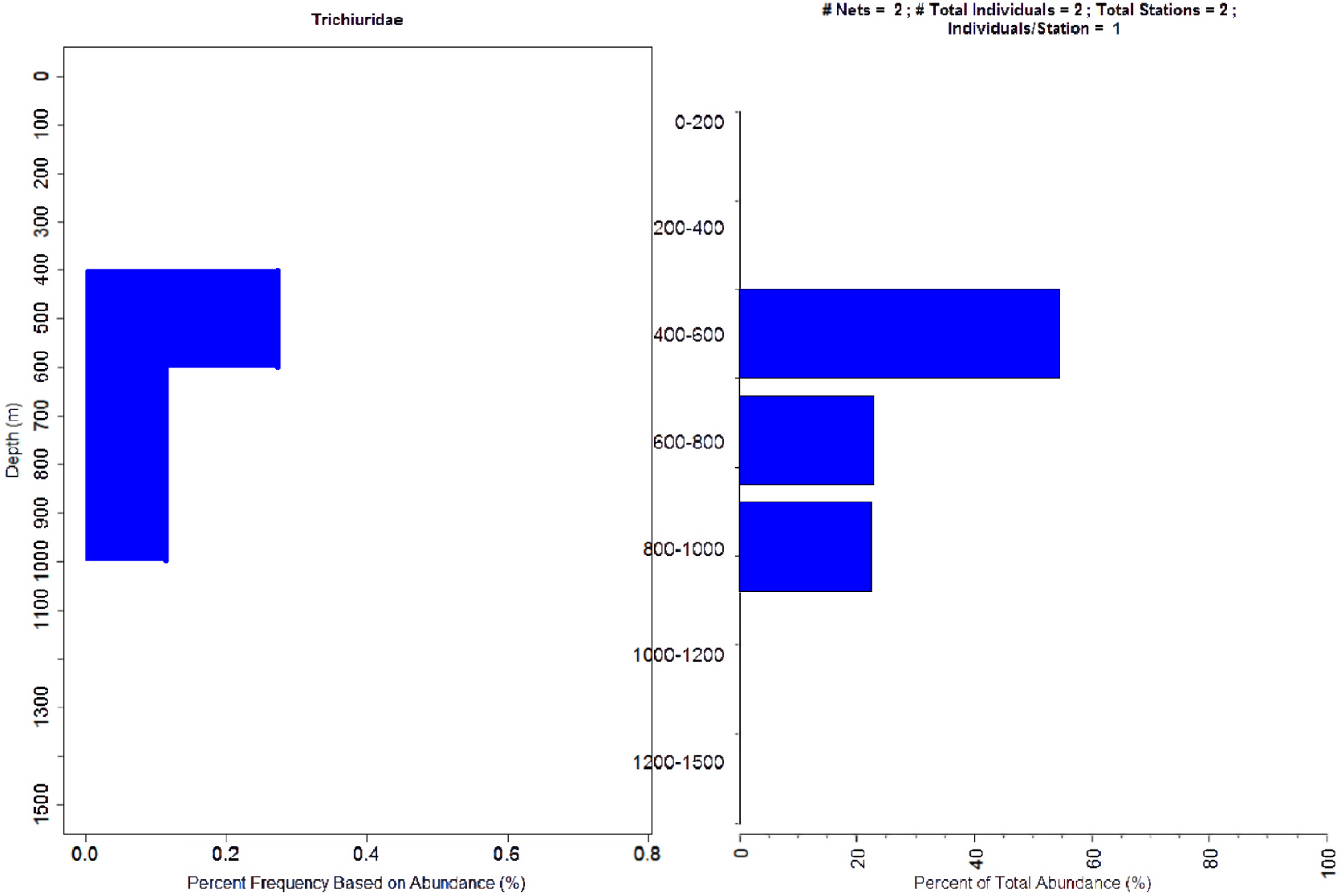
Trachichthyidae



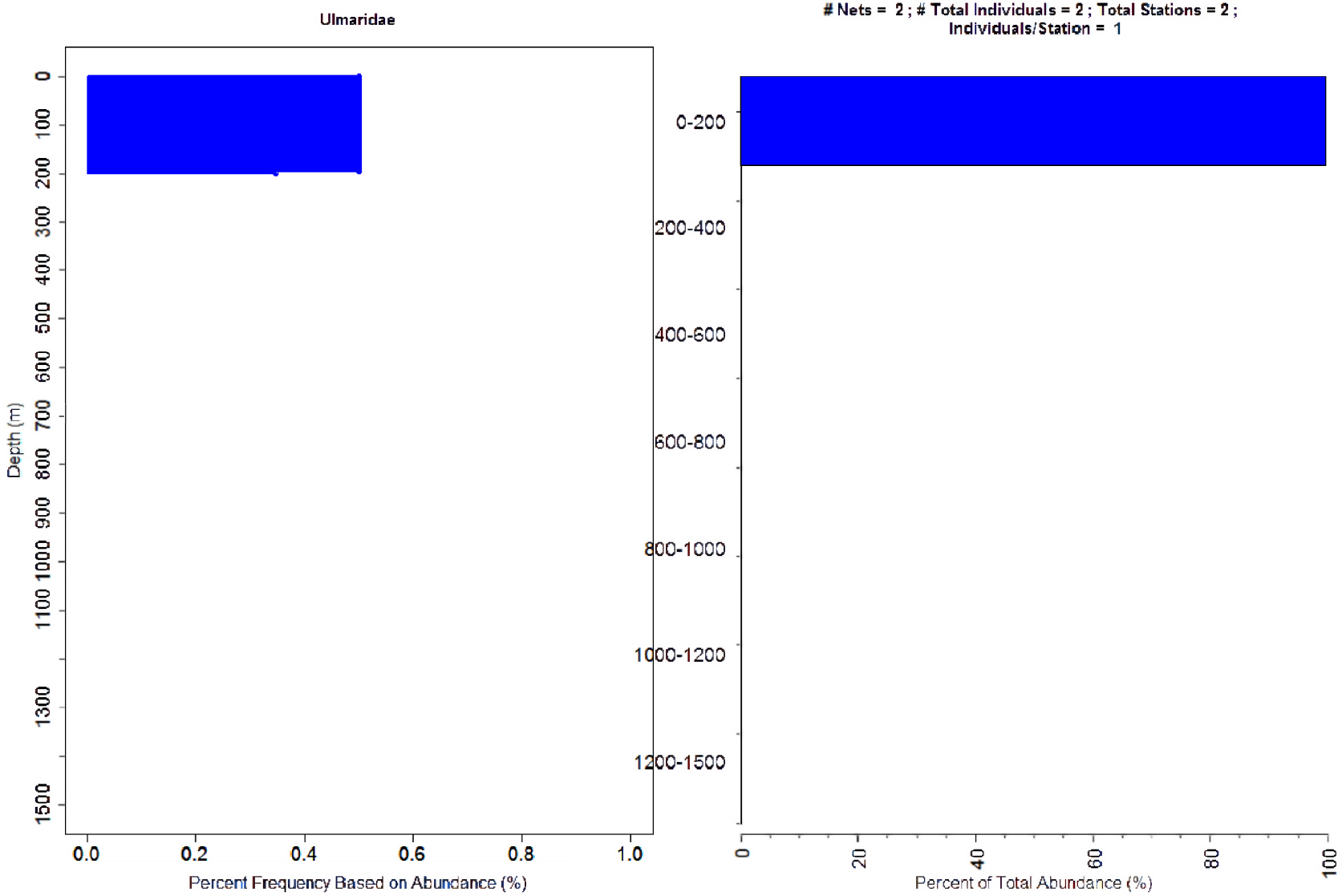
Trachipteridae



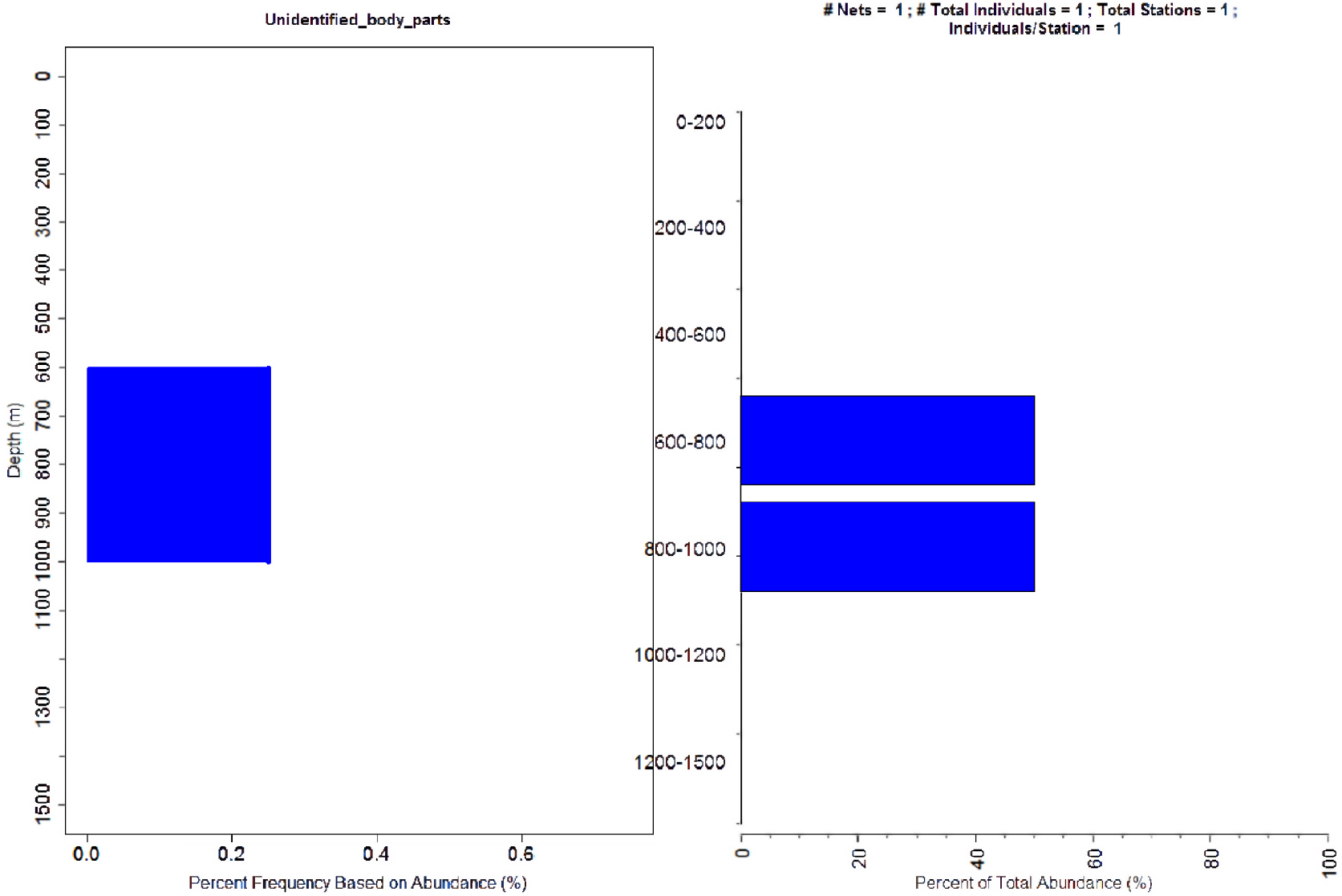
Trachymedusae



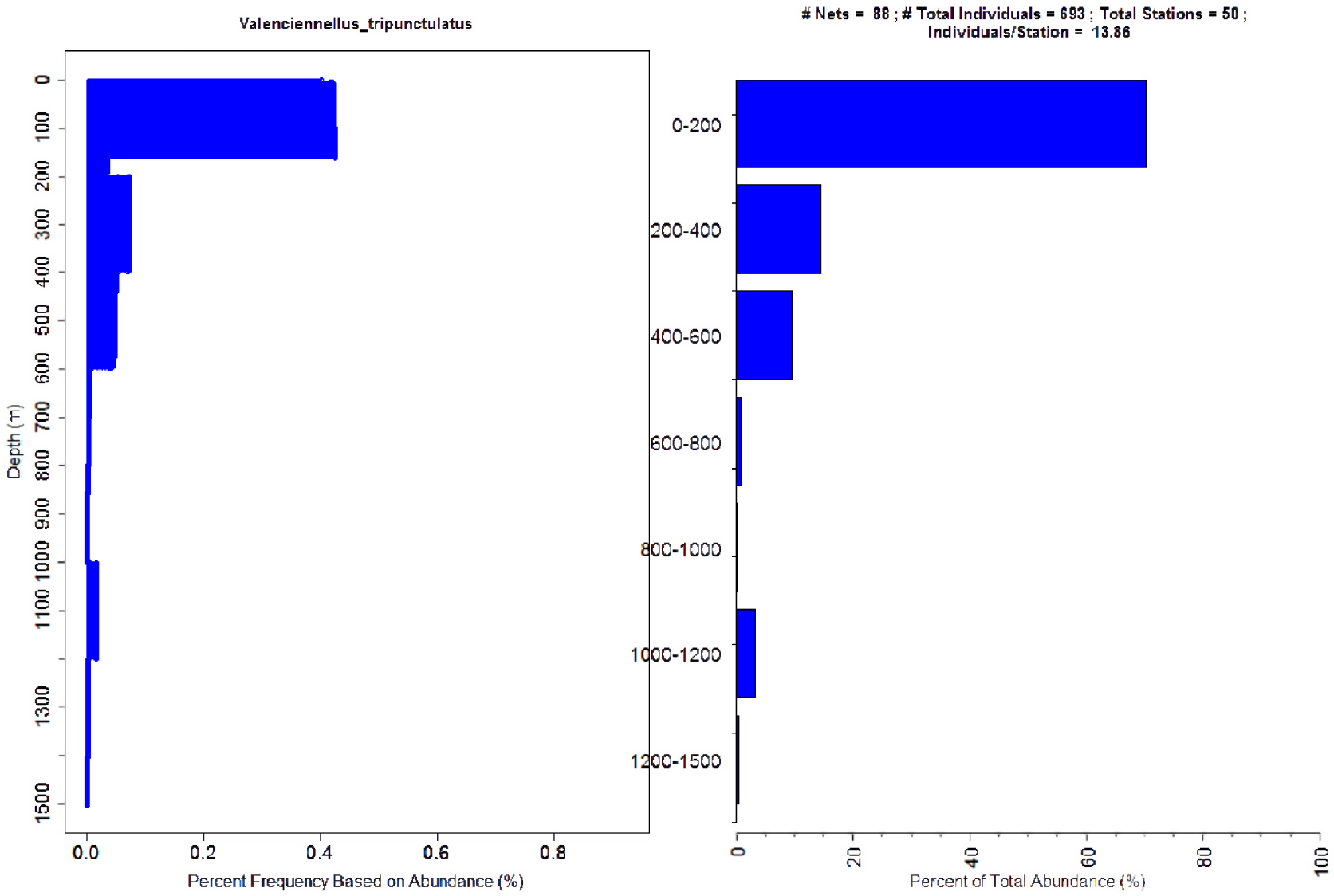
Trichiuridae


Ulmaridae
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

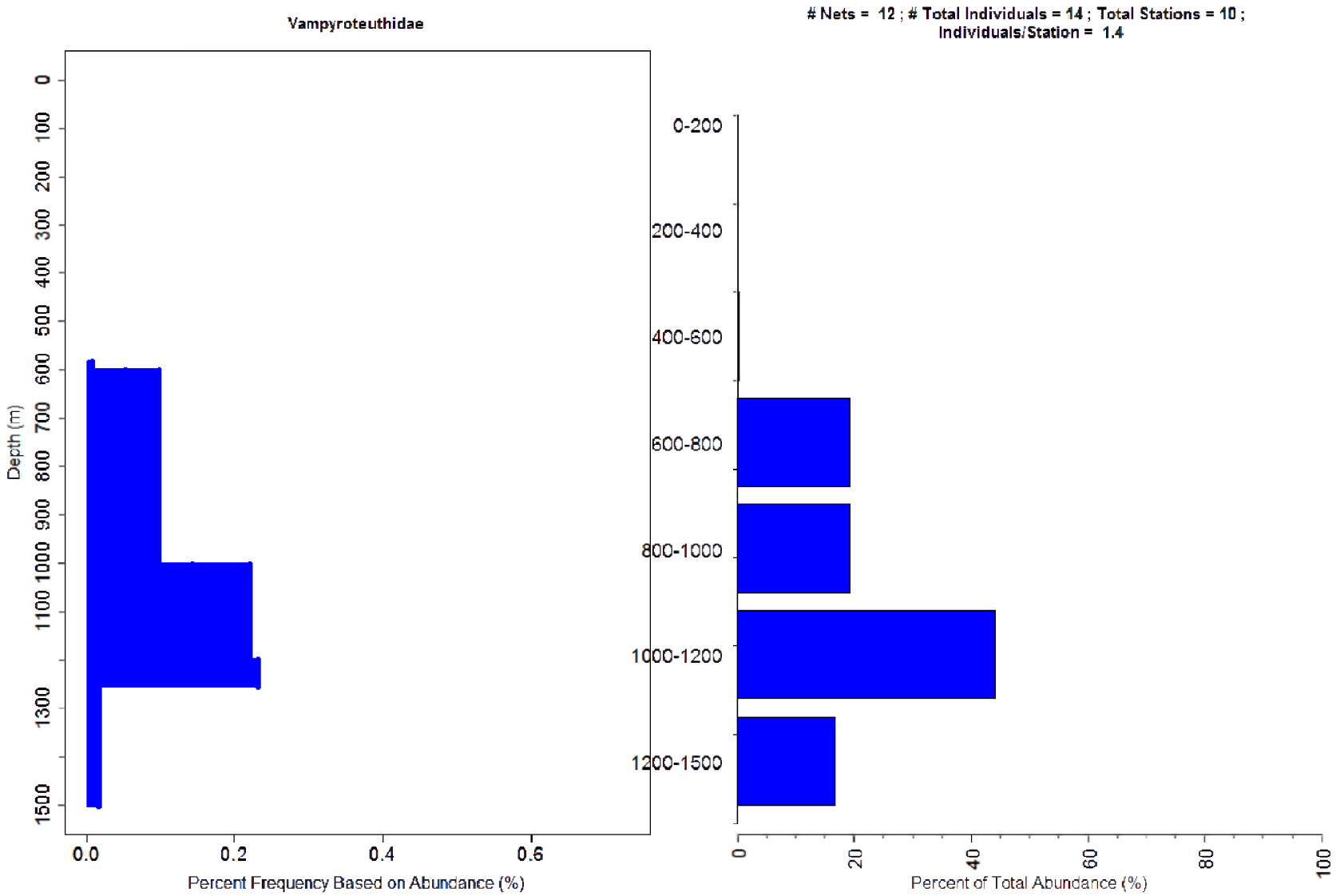
Ulmaridae



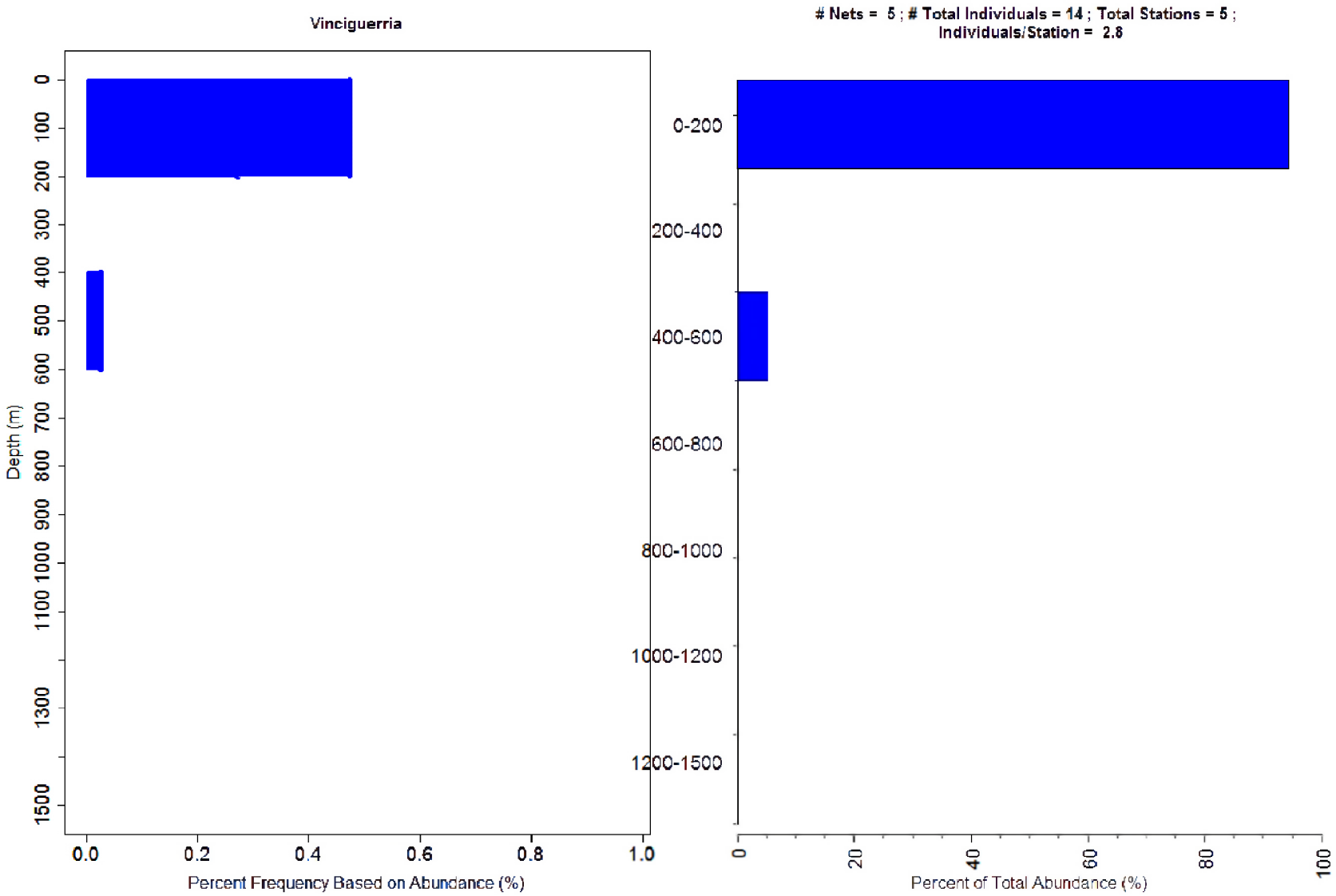
Unidentified_body_parts



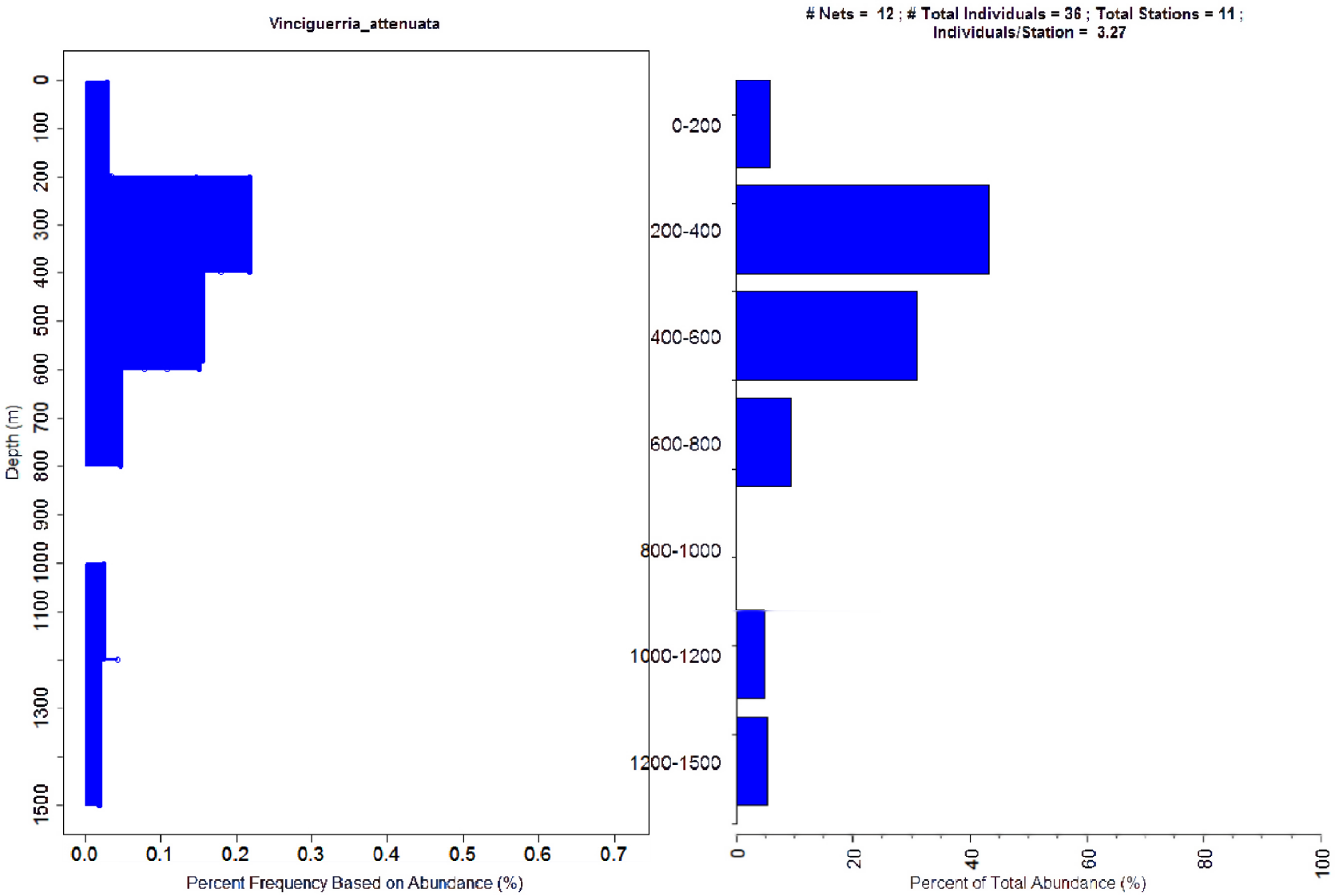
Valenciennellus_tripunctulatus



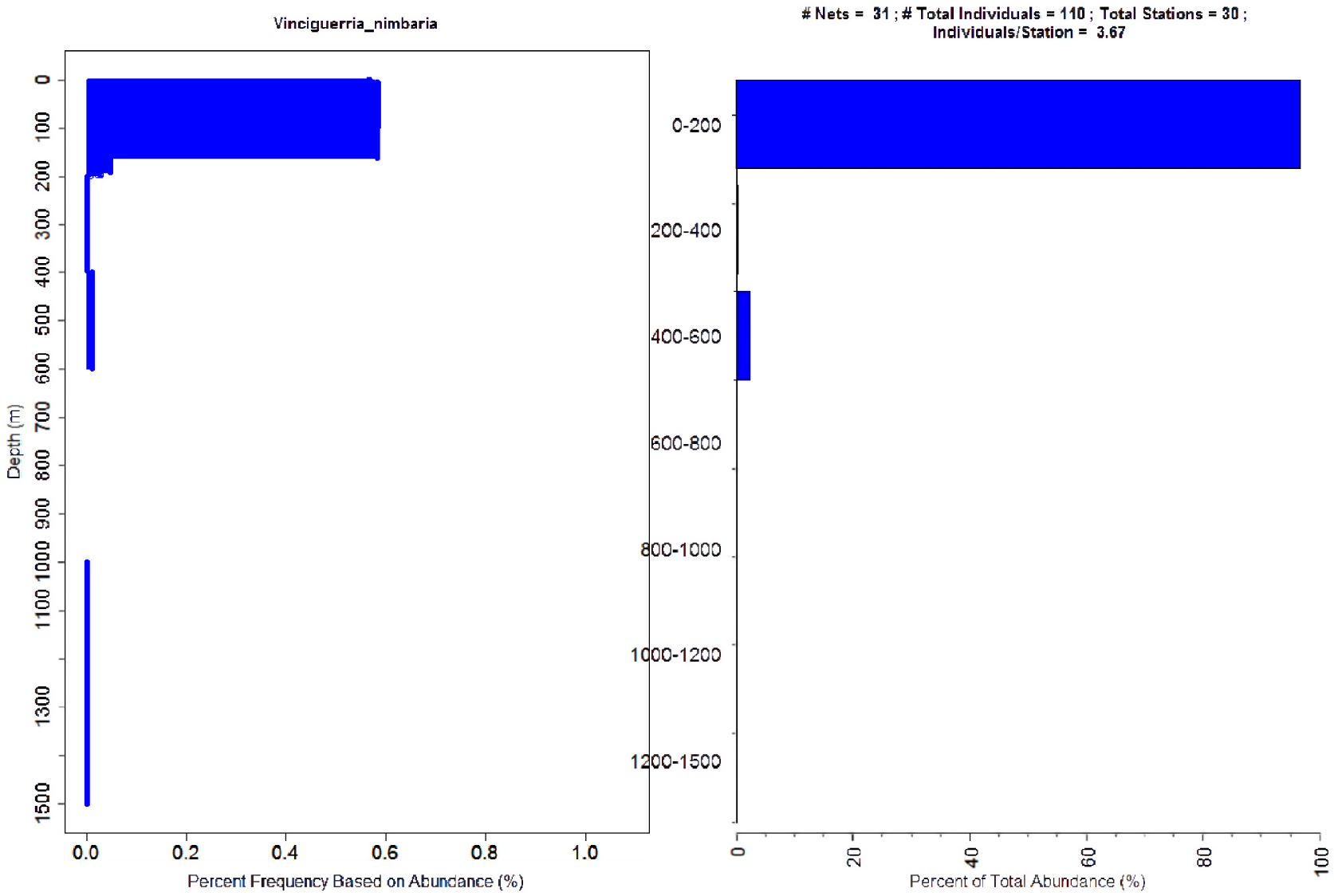
Vampyroteuthidae



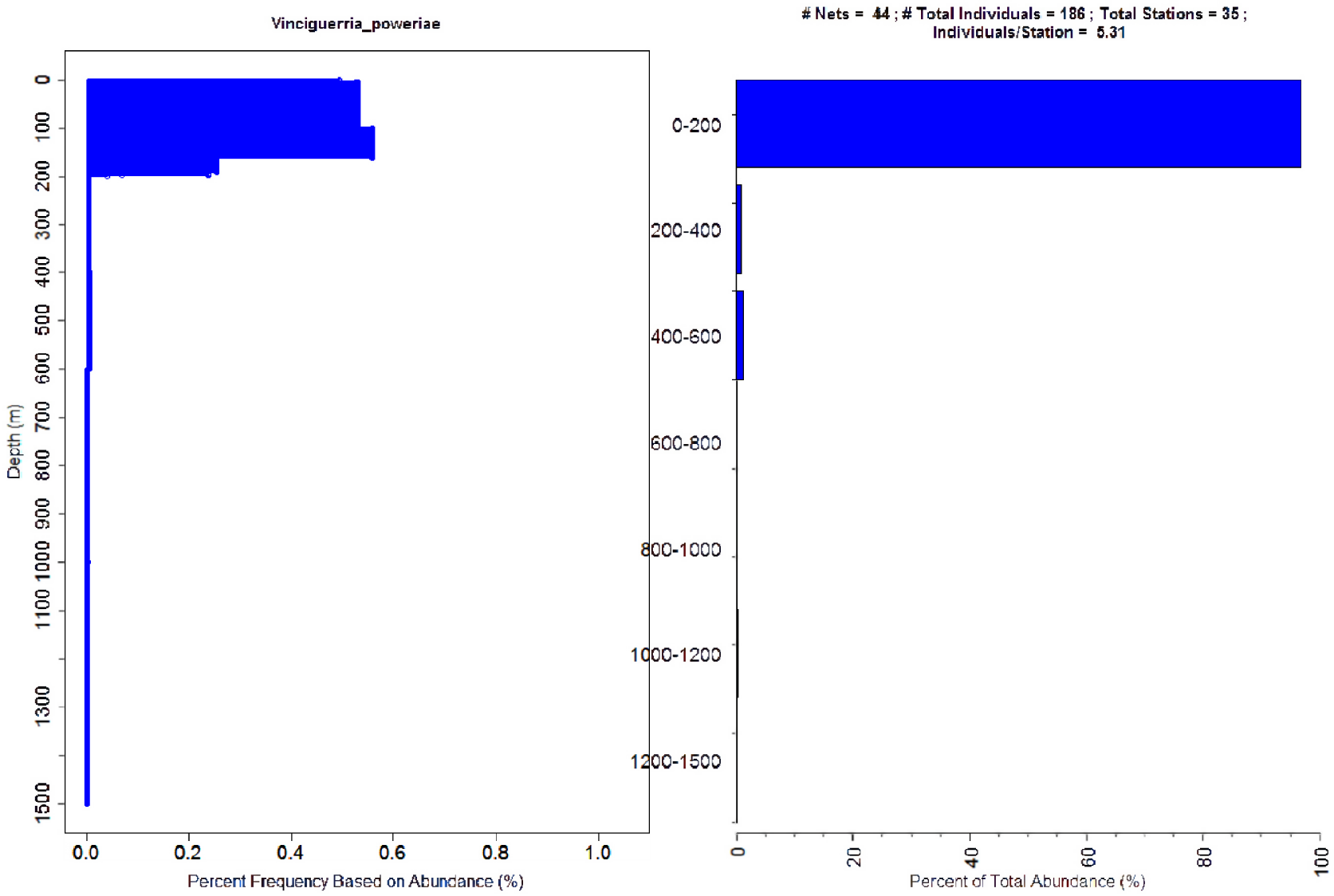
Vinciguerria



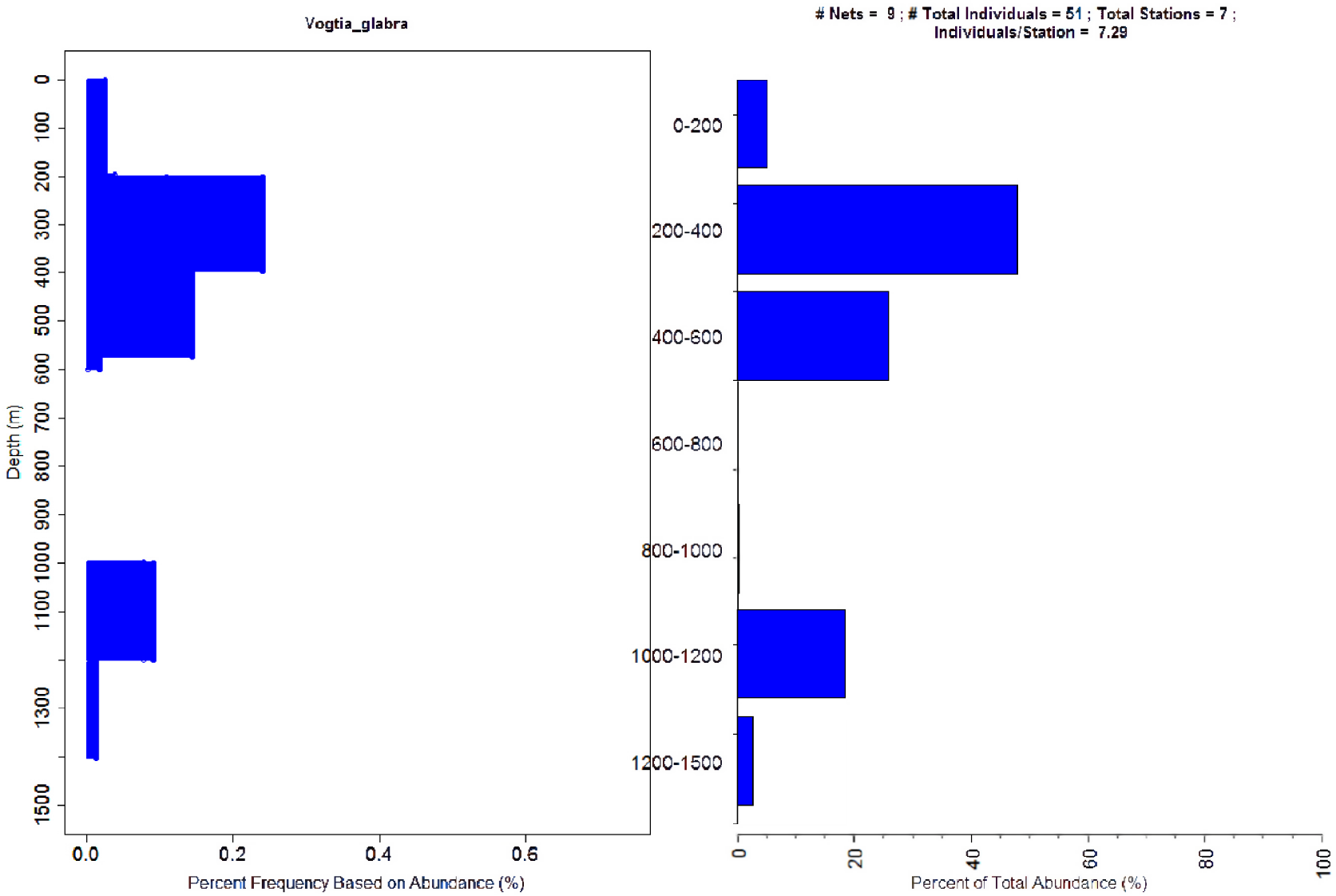
Vinciguerria_attenuata



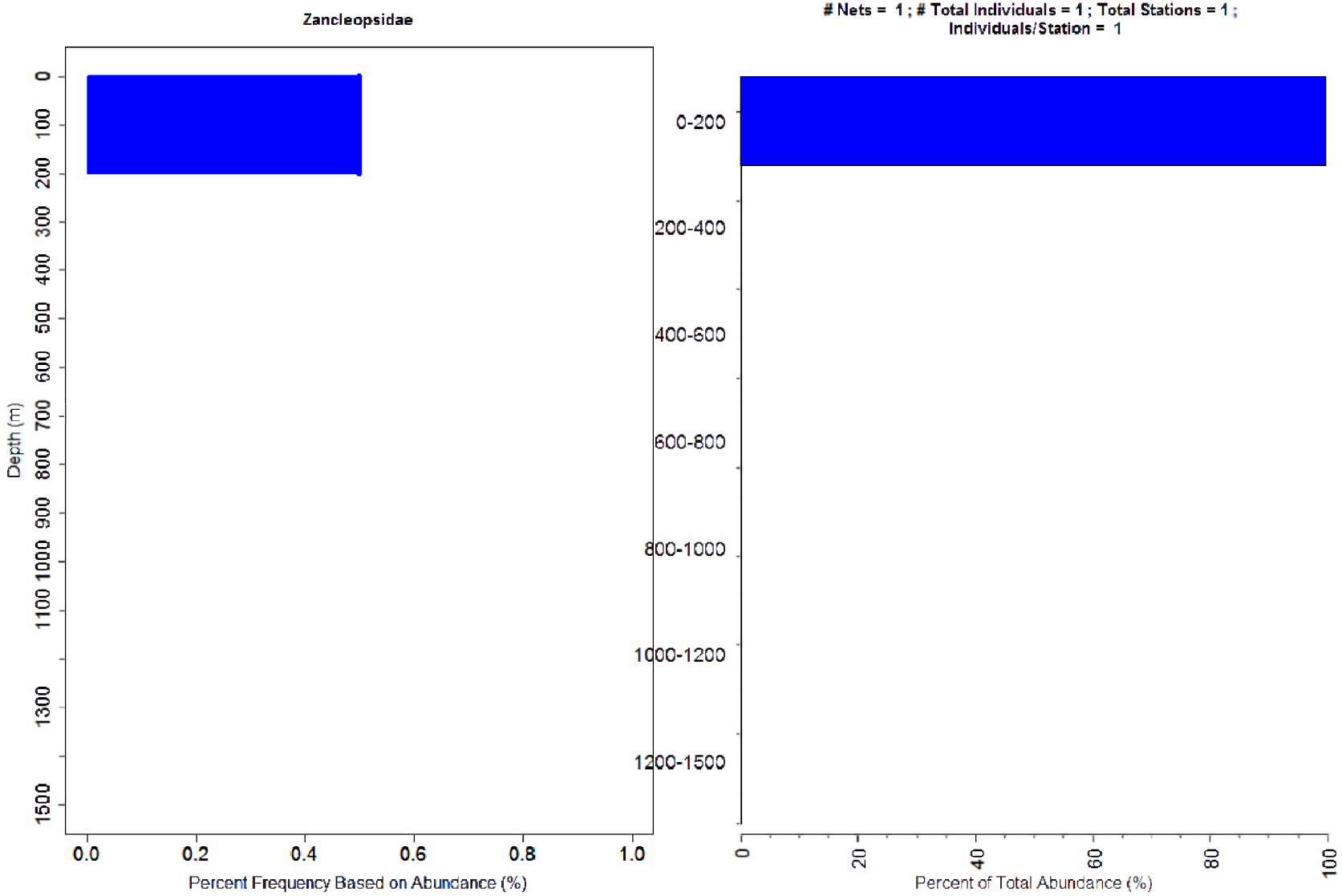
Vinciguerria_nimbaria



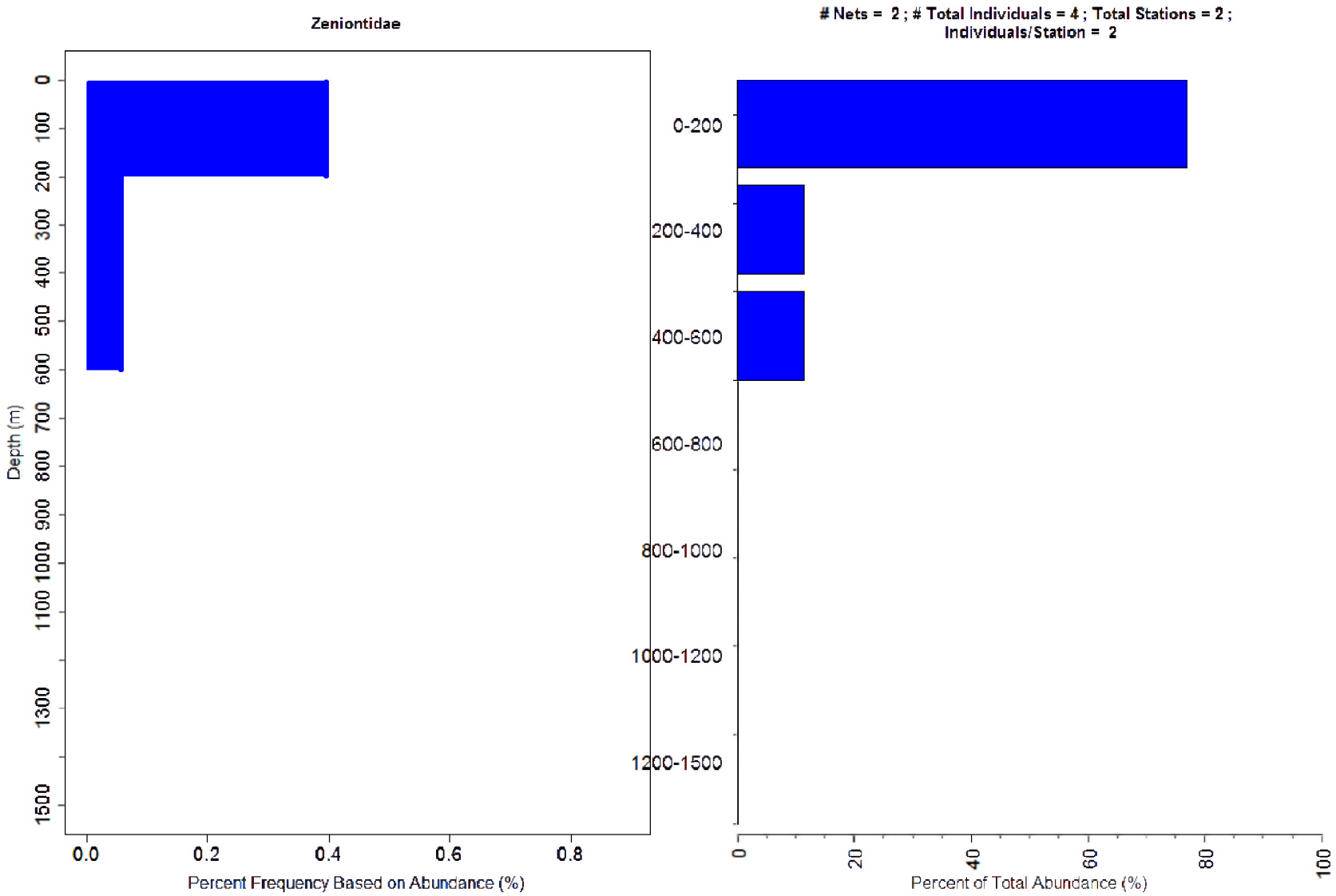
Vinciguerria_poweriae



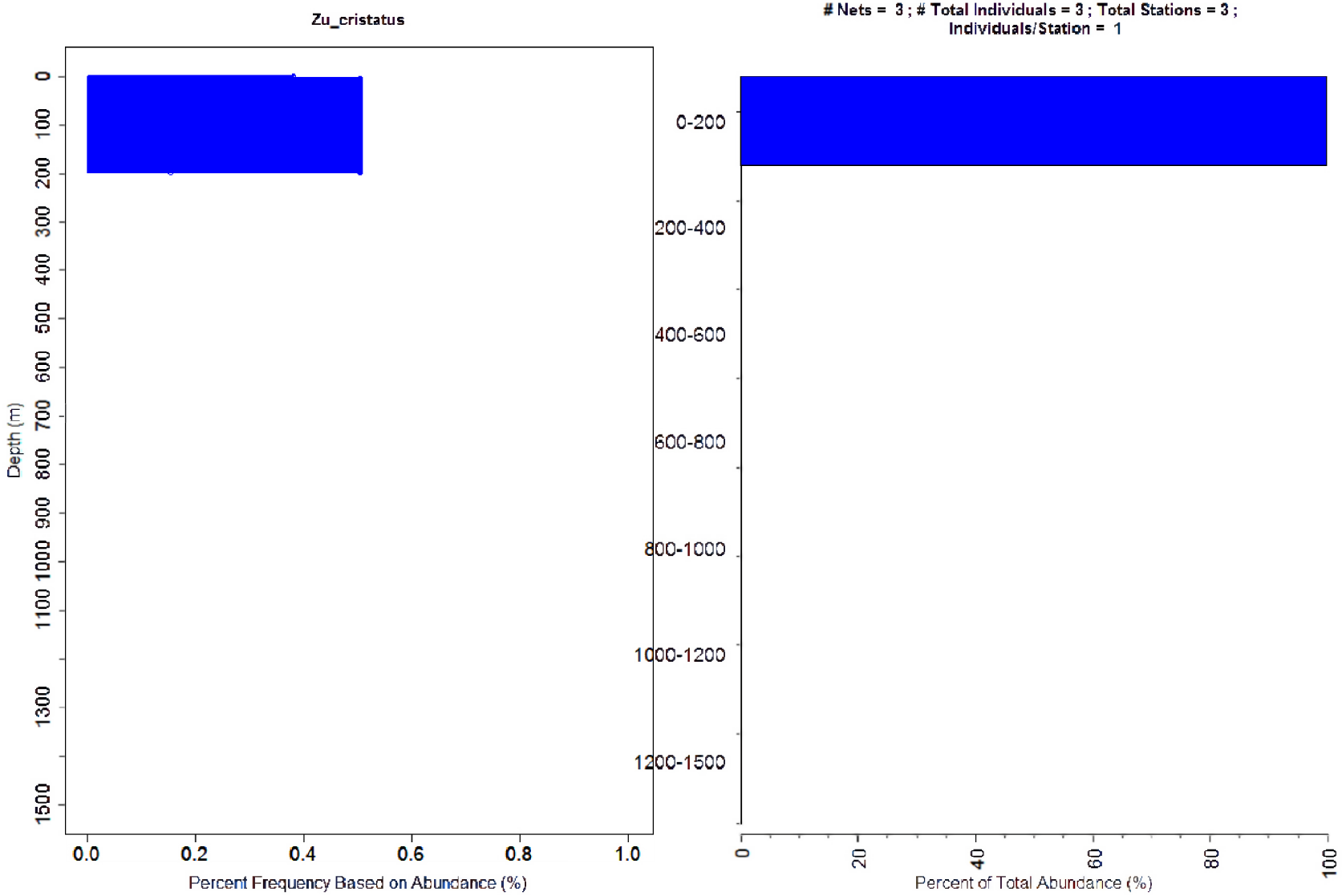
Vogtia_glabra



Zancleopsidae



Zeniontidae



Zu_cristatus

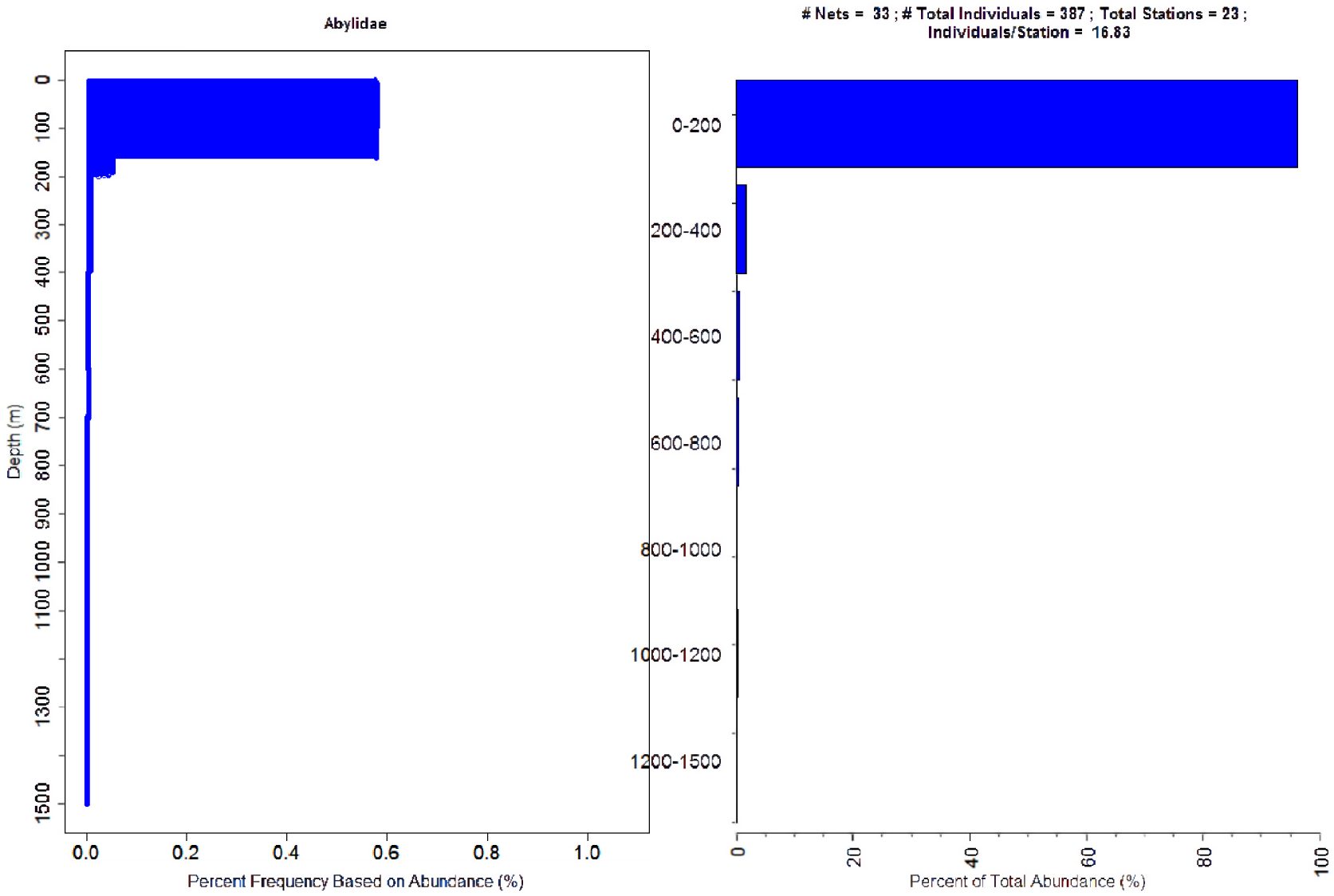
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

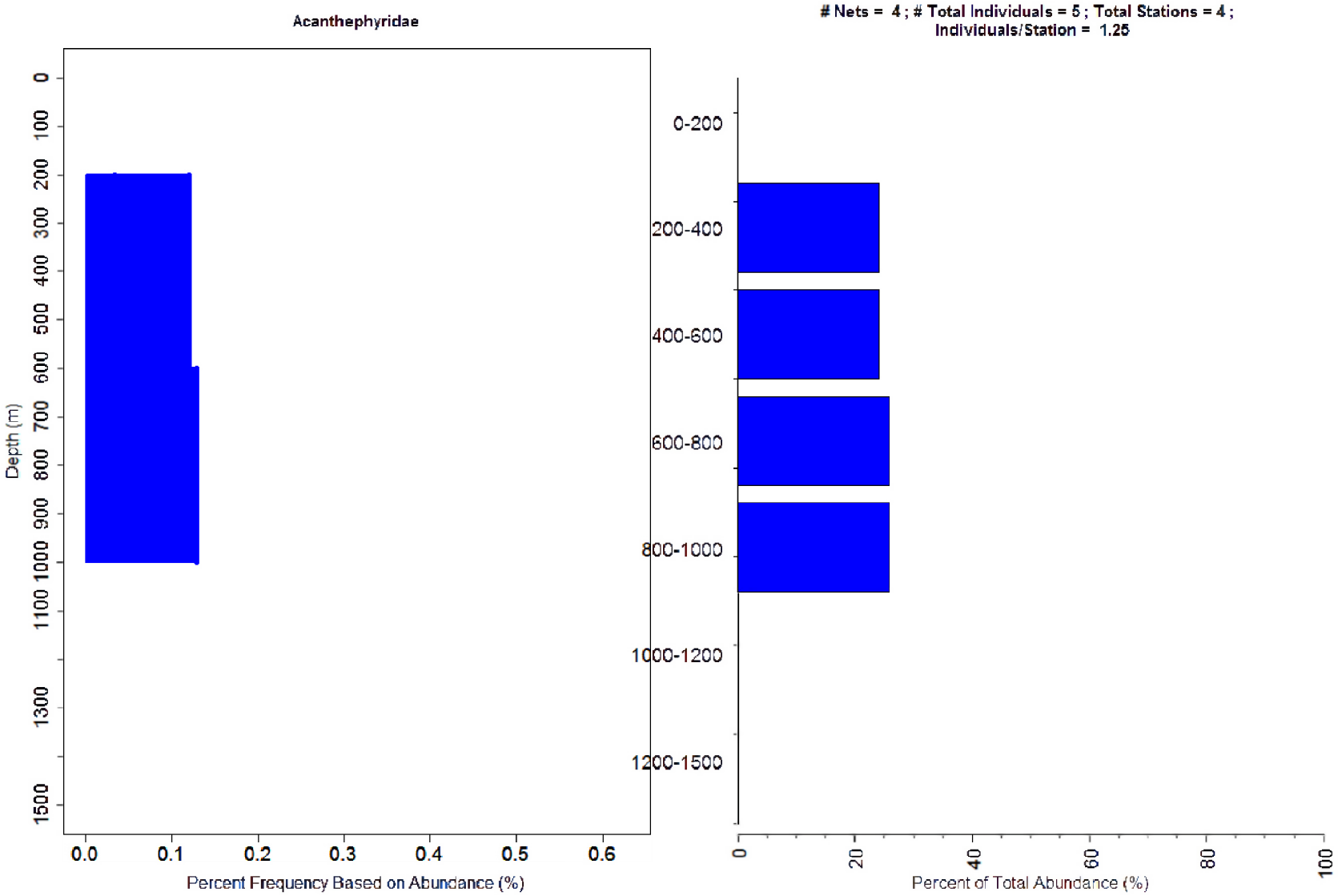
Appendix F2 – NRDA MOC10 Plots
Family Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

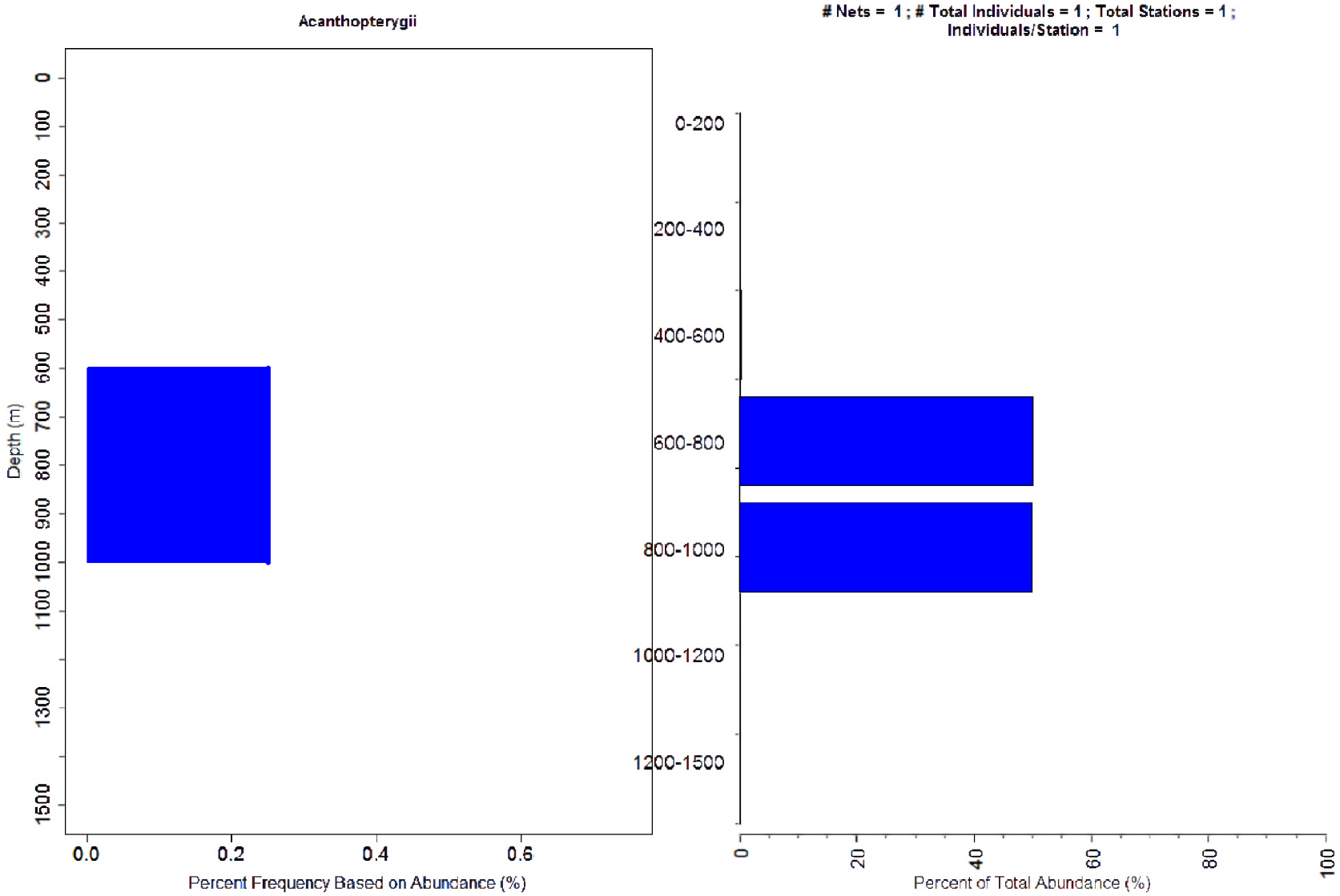
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879


Abylidae
Nets = 33 ; # Total Individuals = 387 ; Total Stations = 23 ;
Individuals/Station = 16.83
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

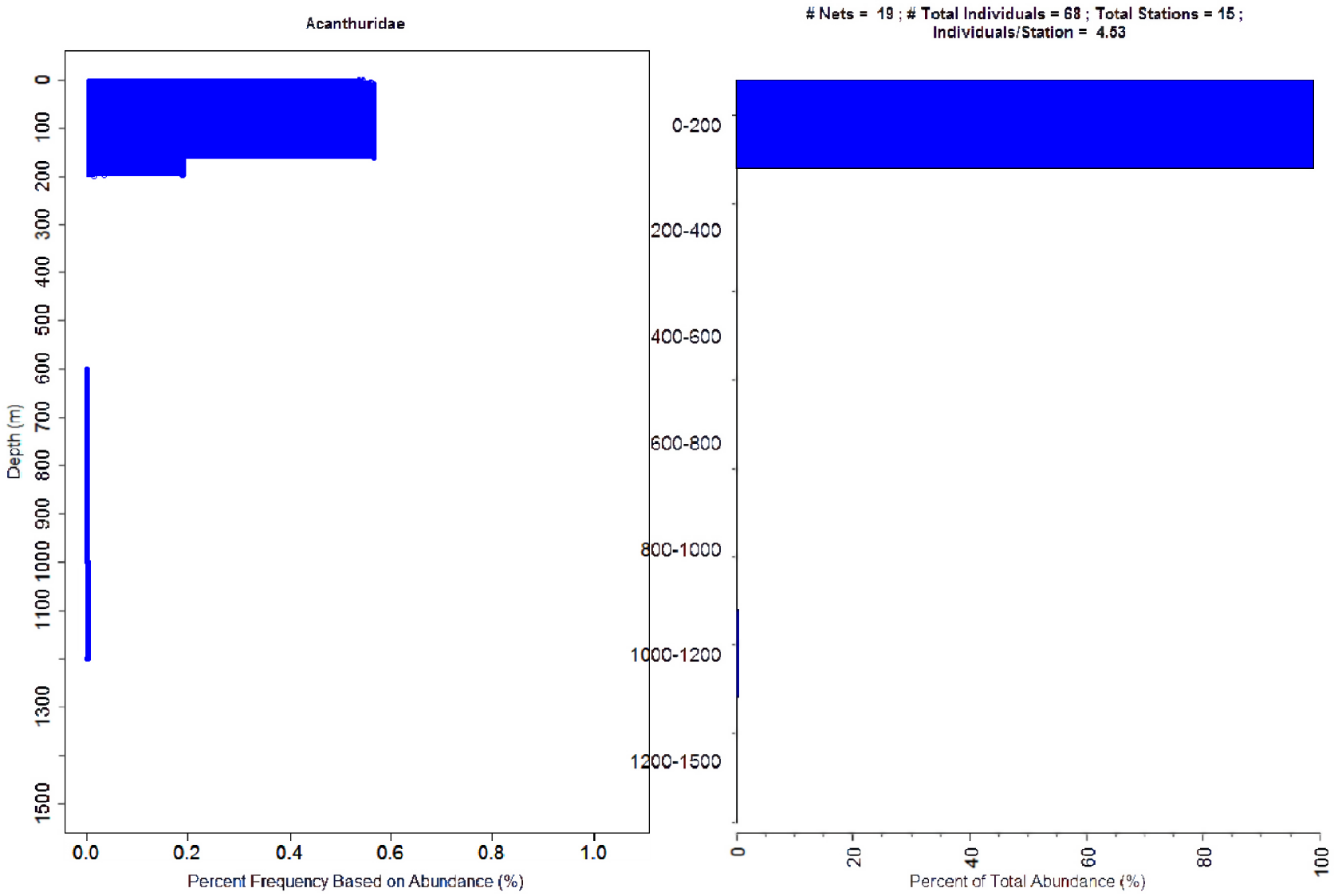
Abylidae



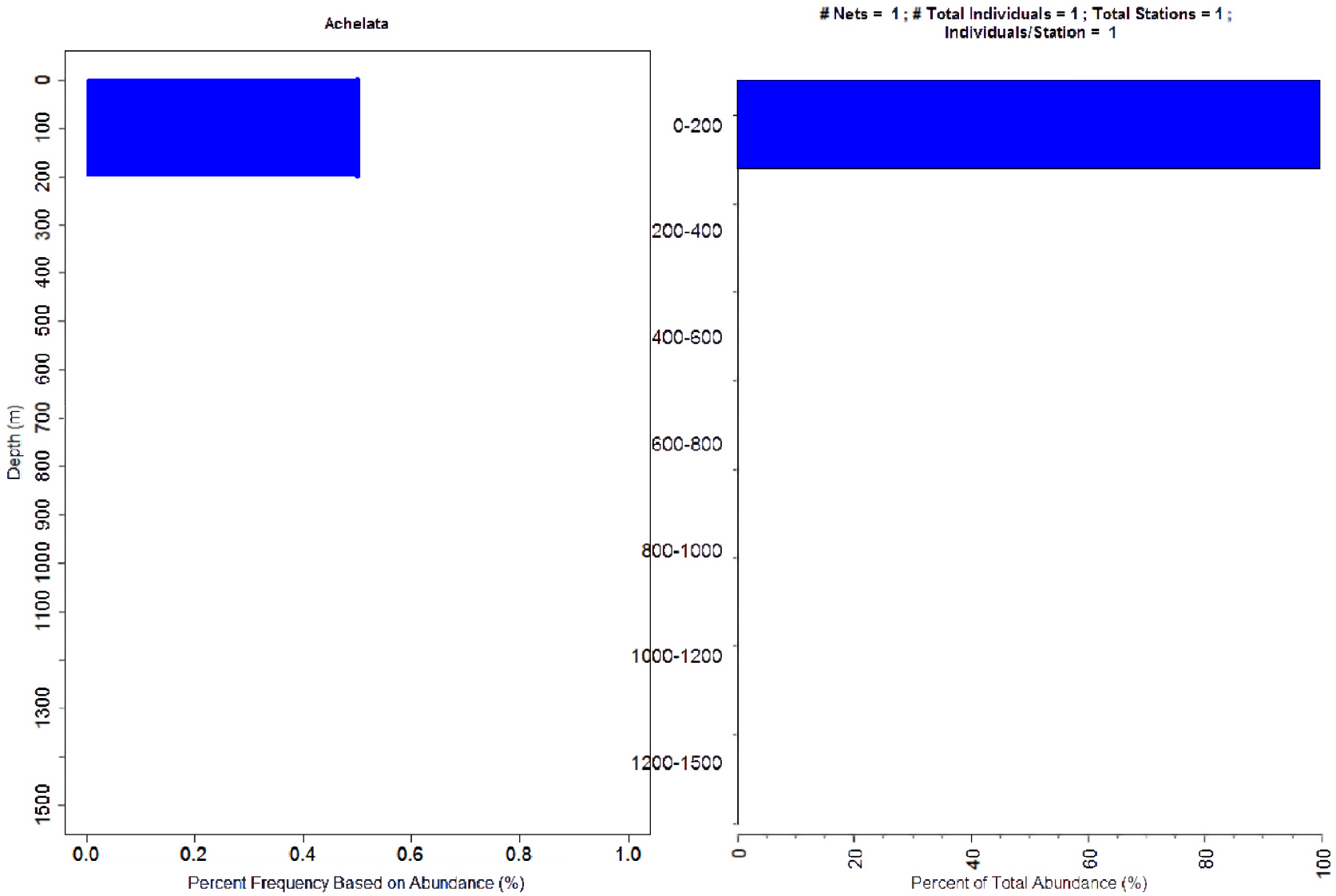
Acanthephyridae



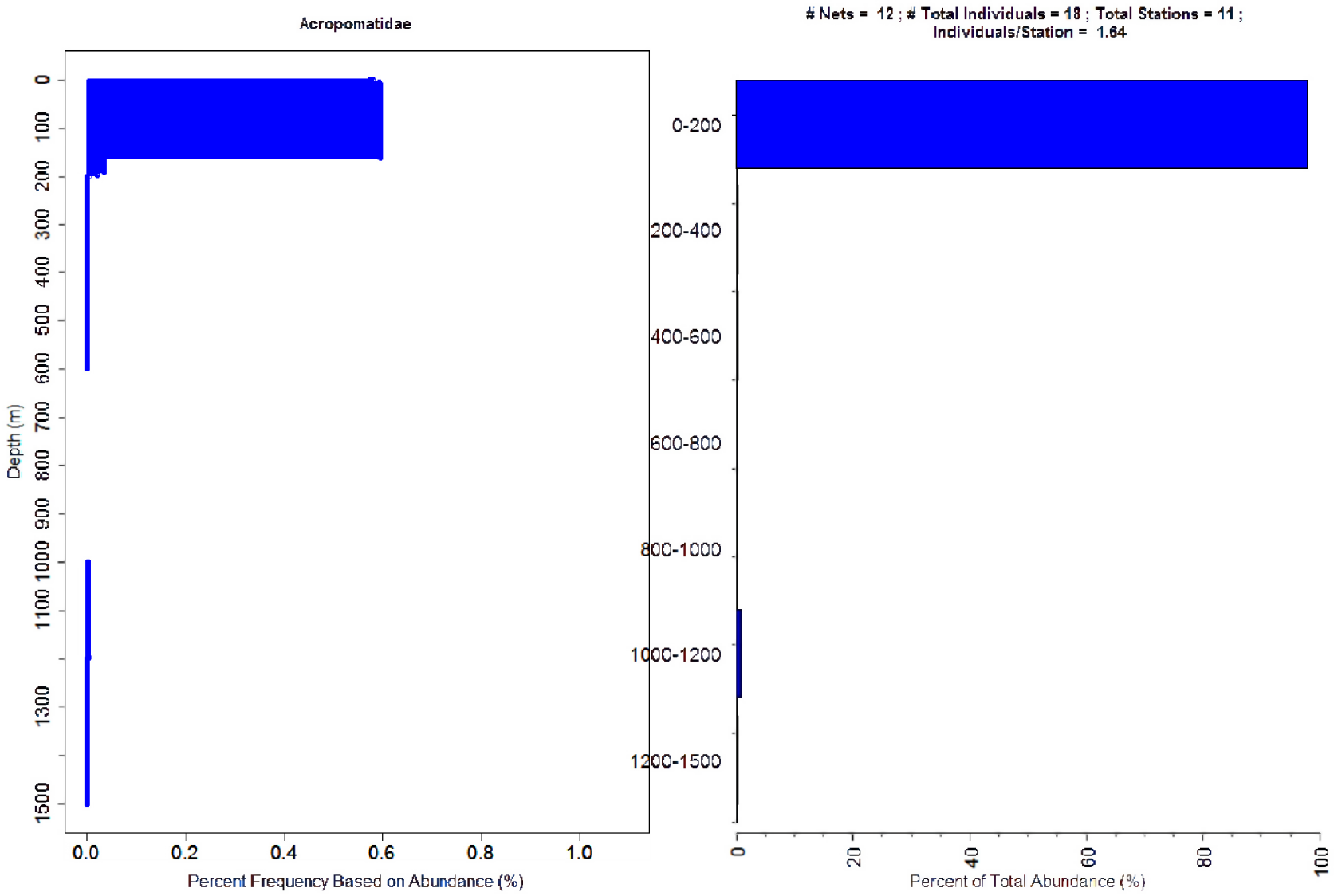
Acanthopterygii



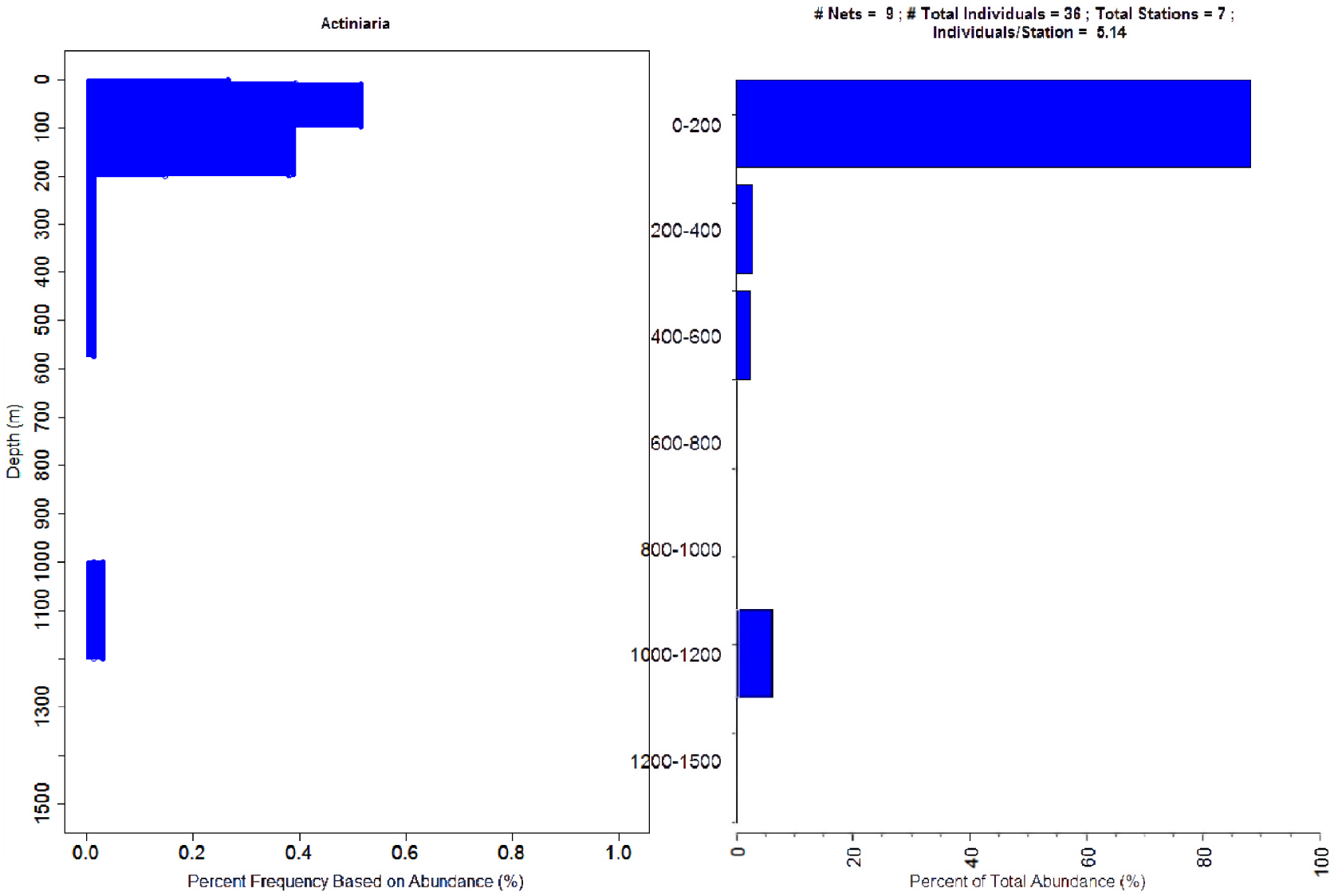
Acanthuridae


Achelata
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

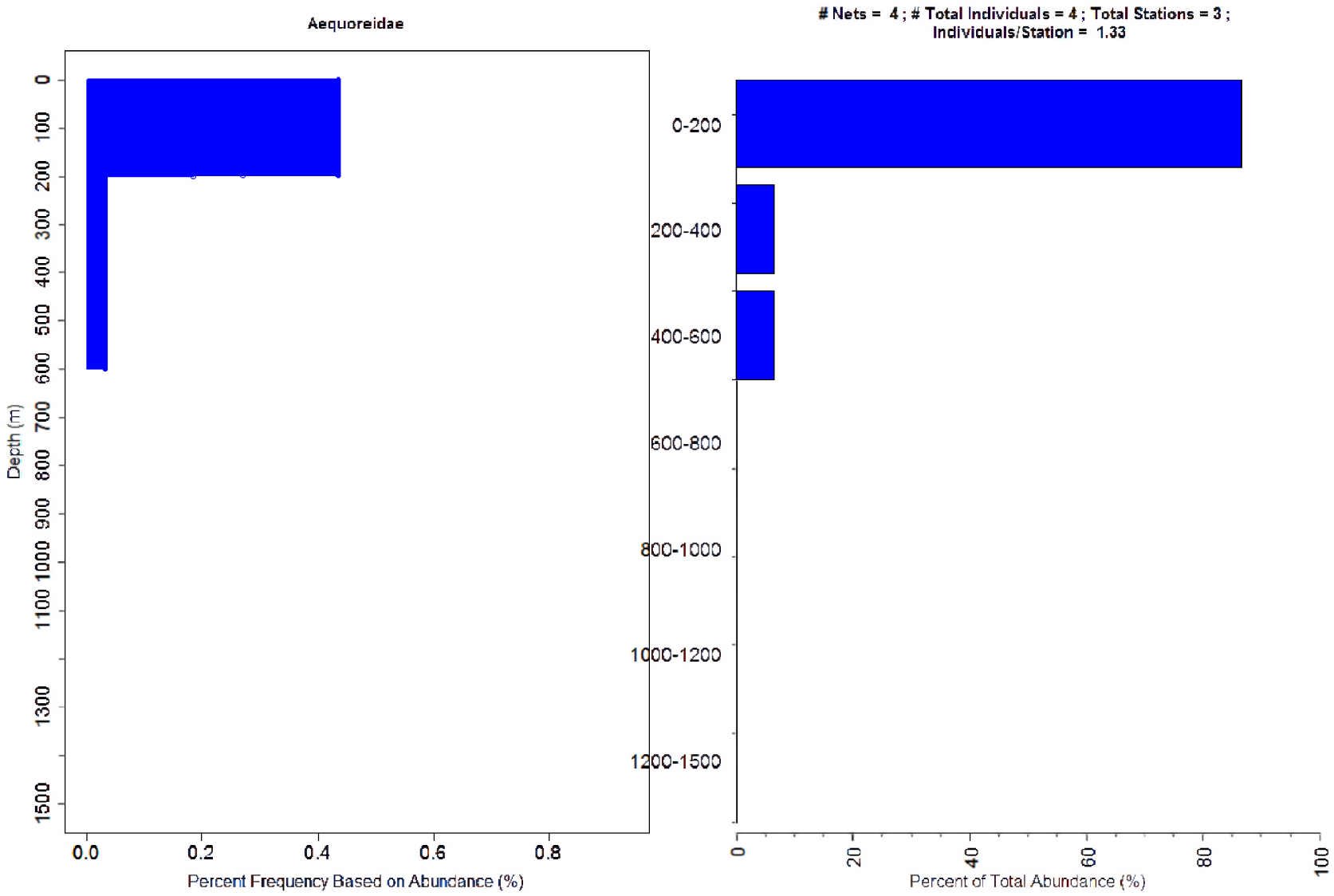
Achelata



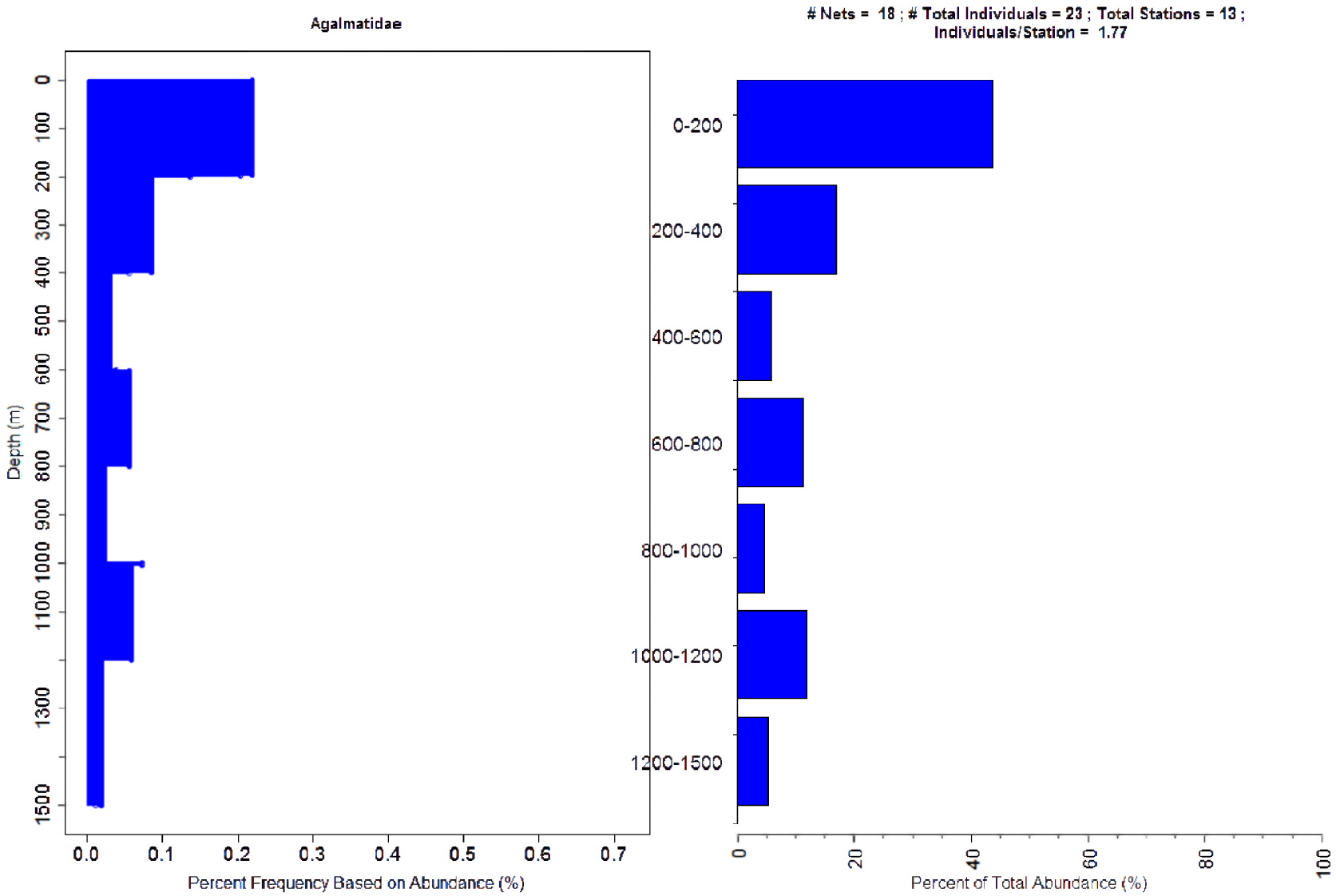
Acropomatidae


Actiniaria
Nets = 9 ; # Total Individuals = 36 ; Total Stations = 7 ;
Individuals/Station = 5.14
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

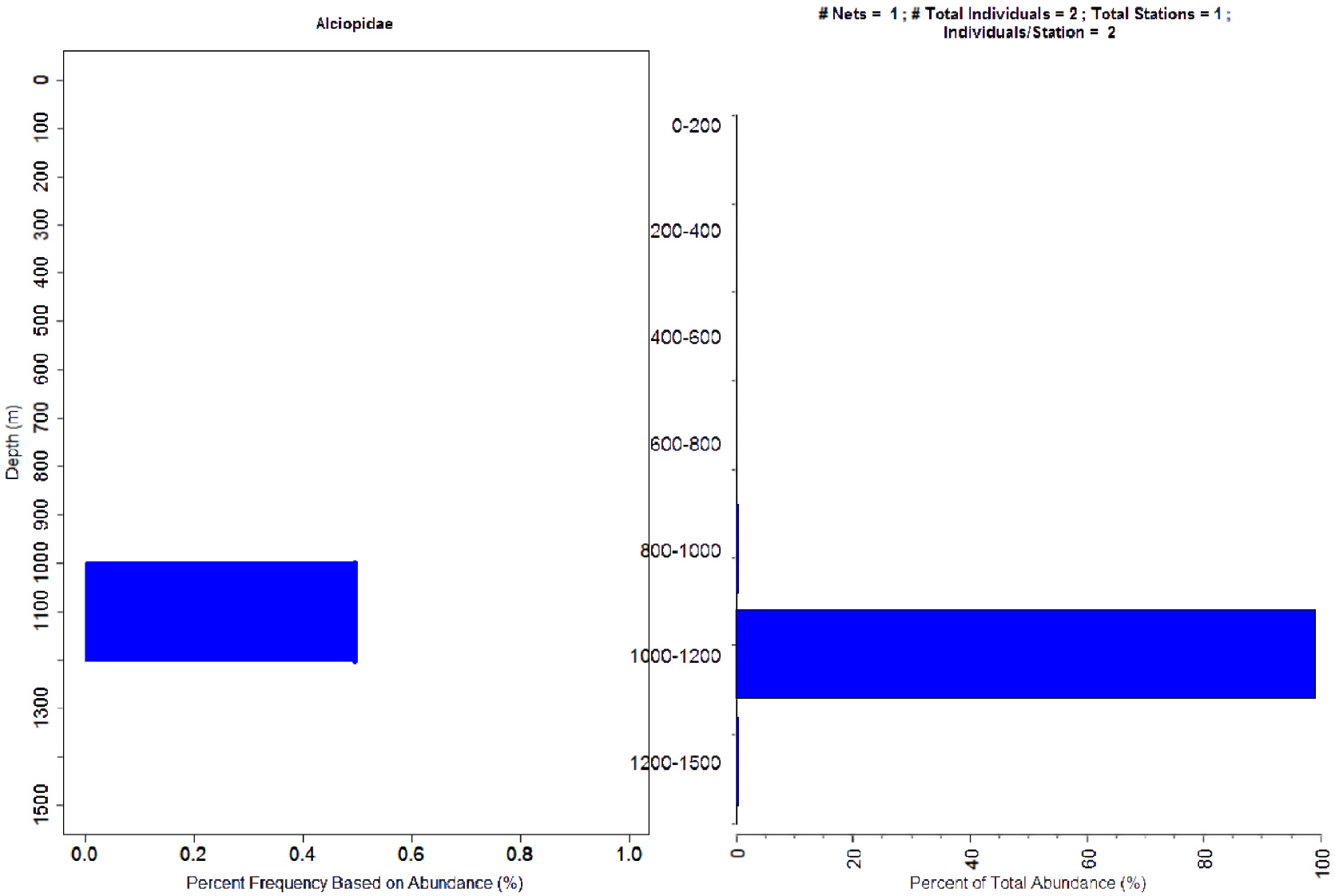
Actiniaria



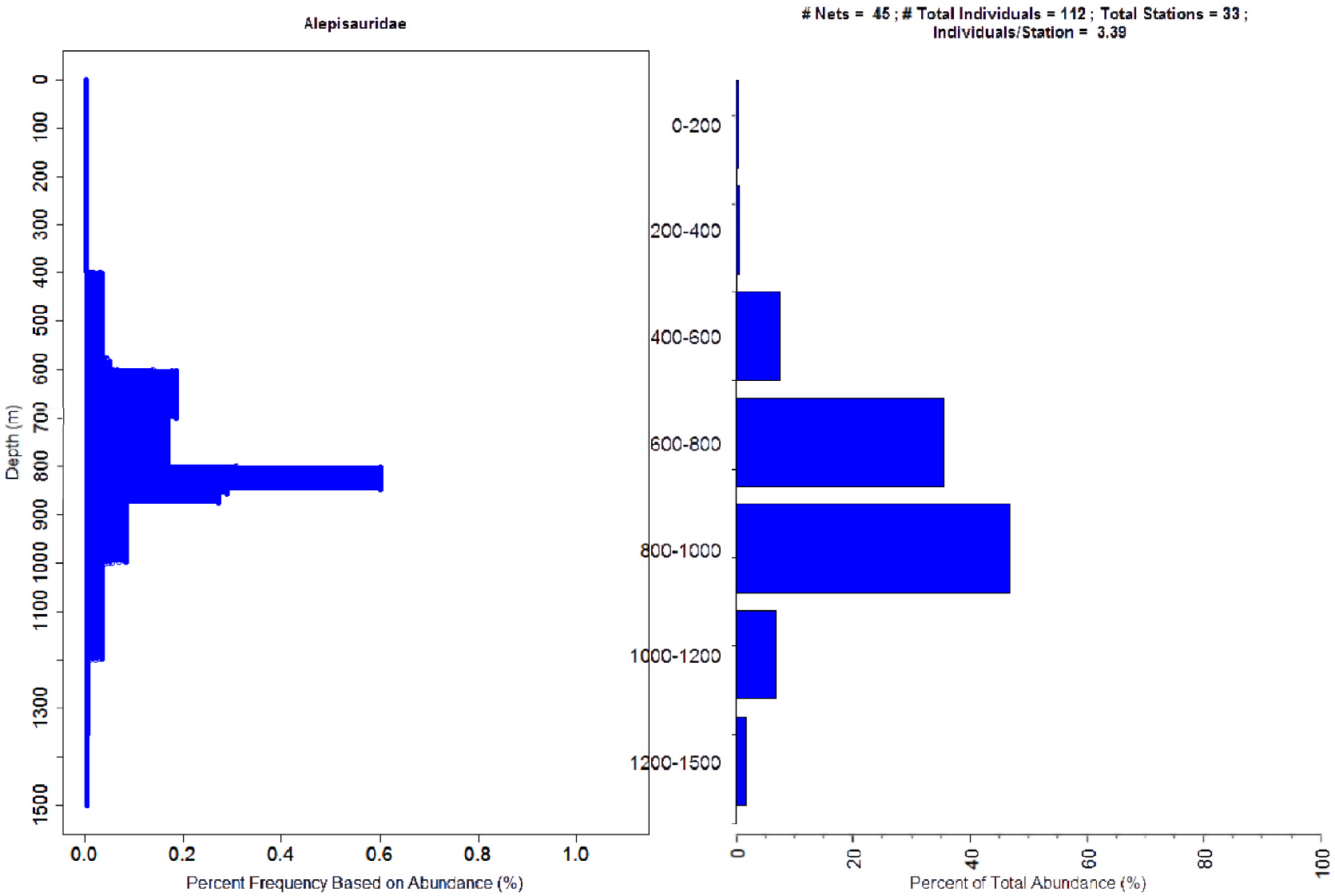
Aequoreidae



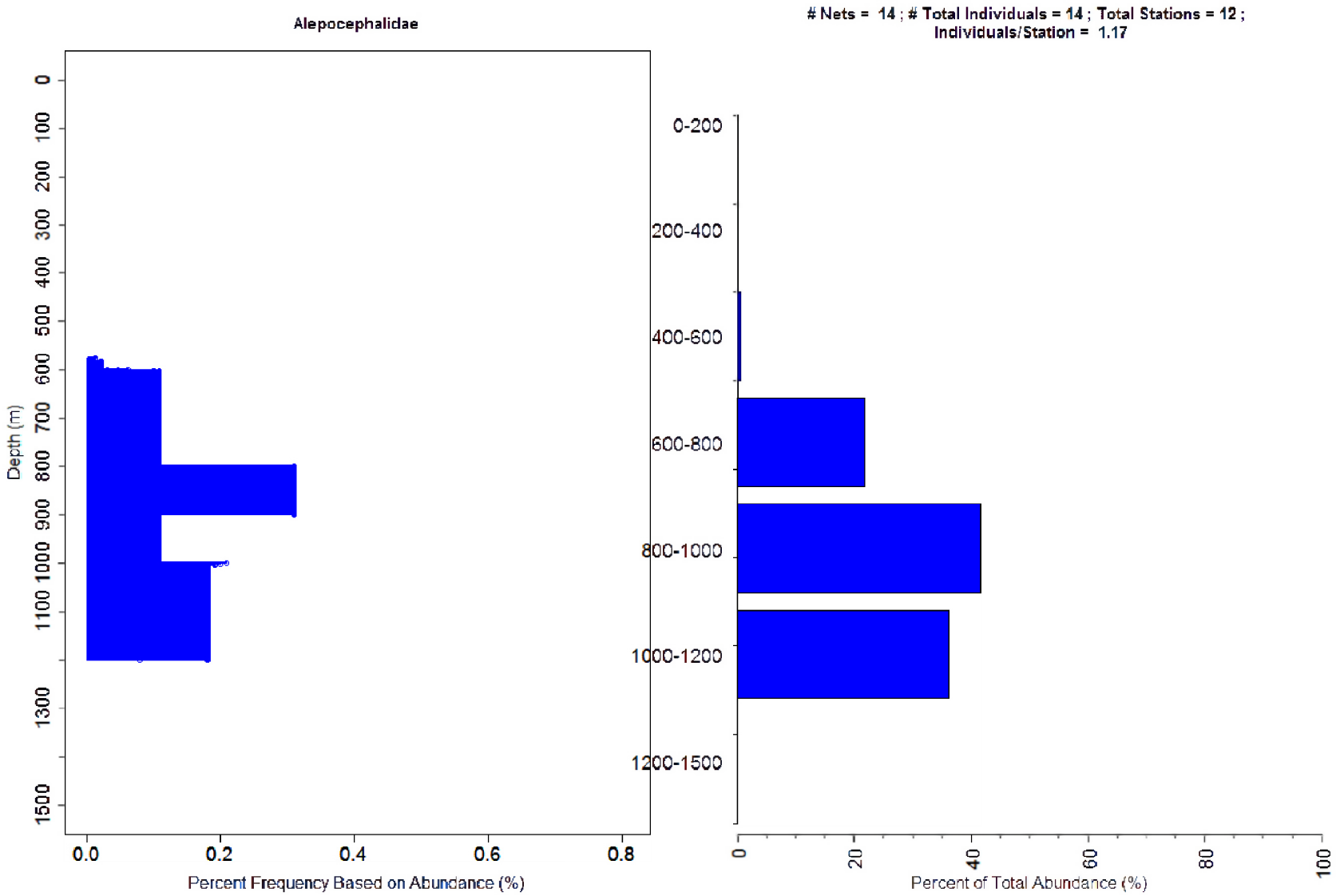
Agalmatidae


Alciopidae
Nets = 1 ; # Total Individuals = 2 ; Total Stations = 1 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

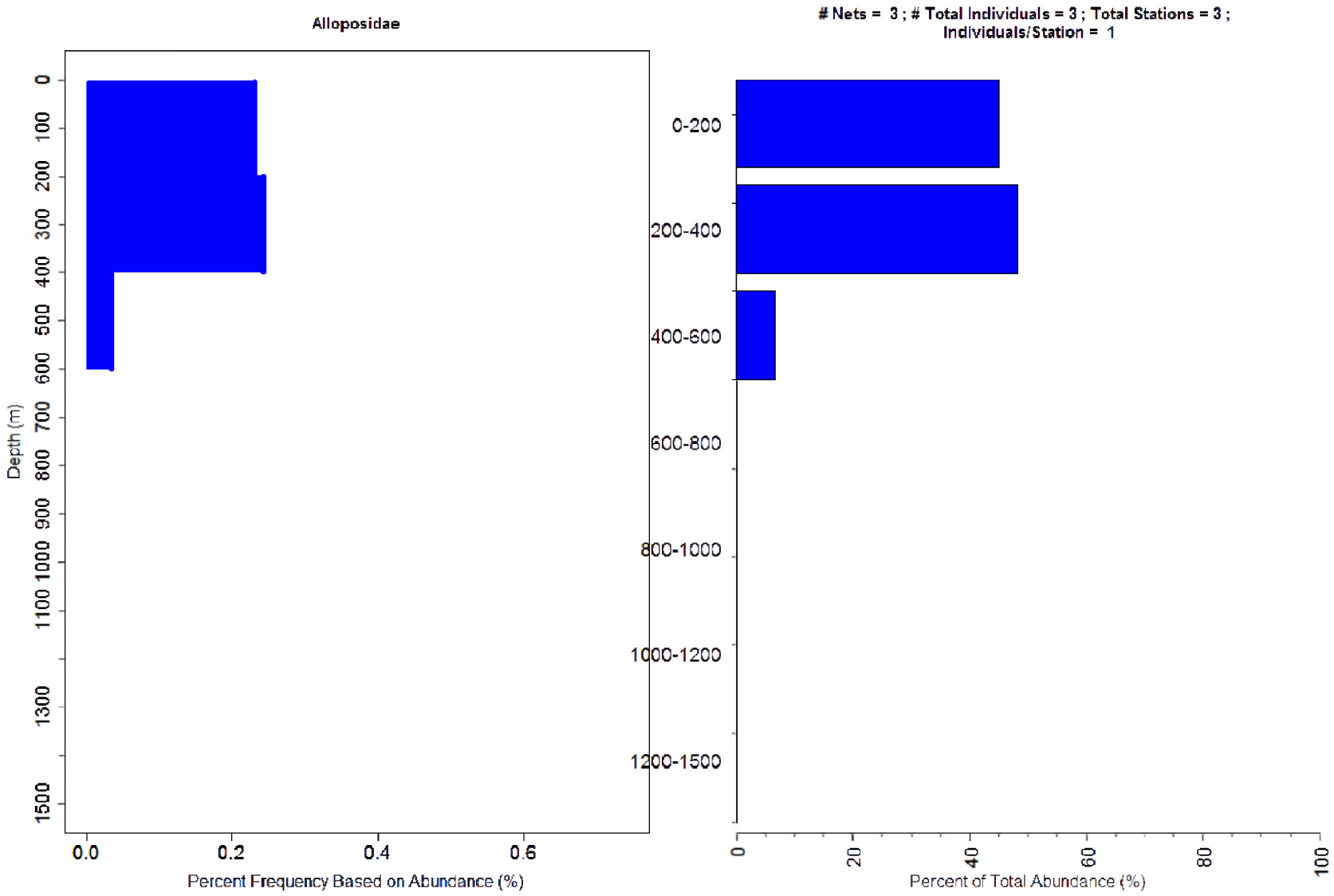
Alciopidae



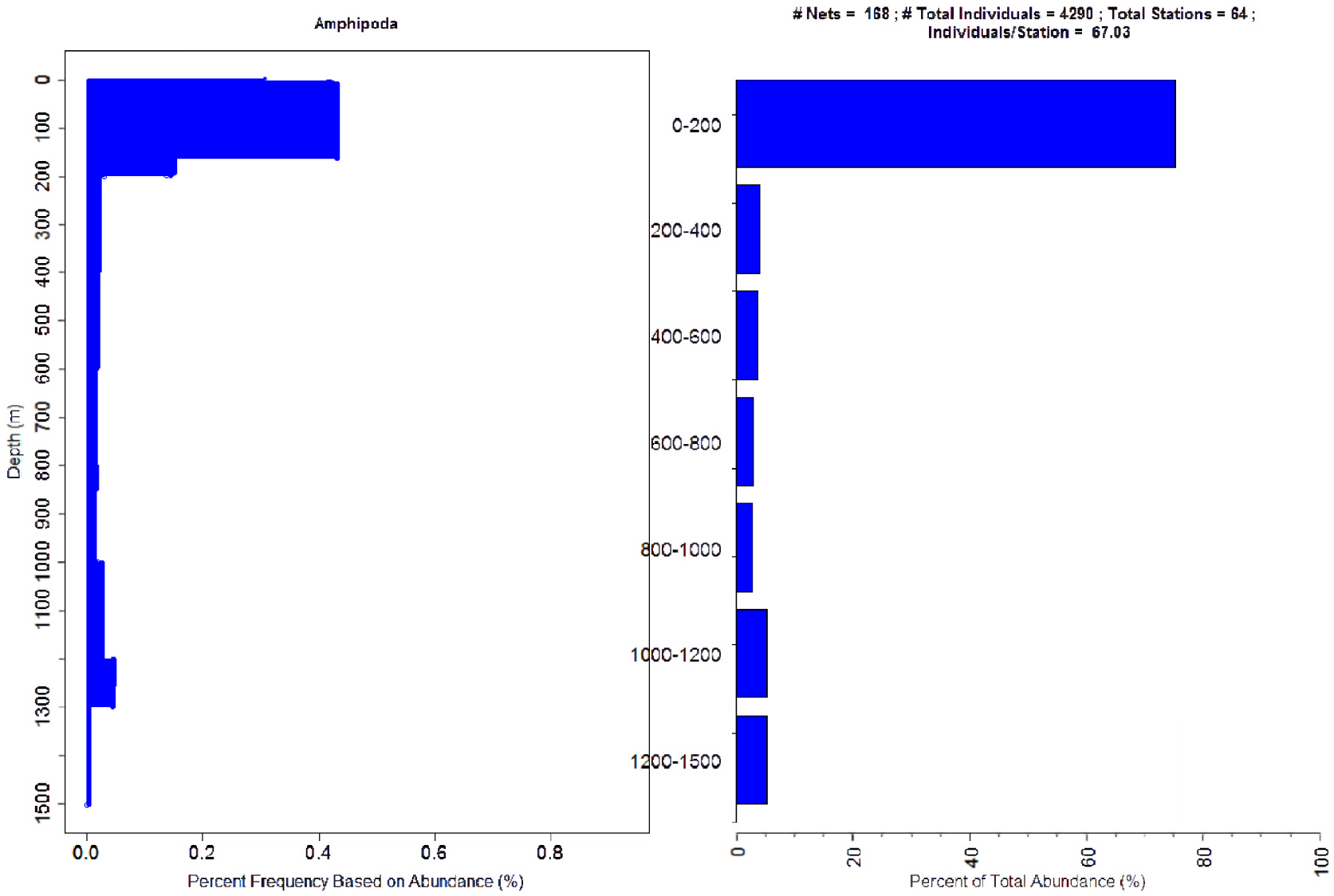
Alepisauridae



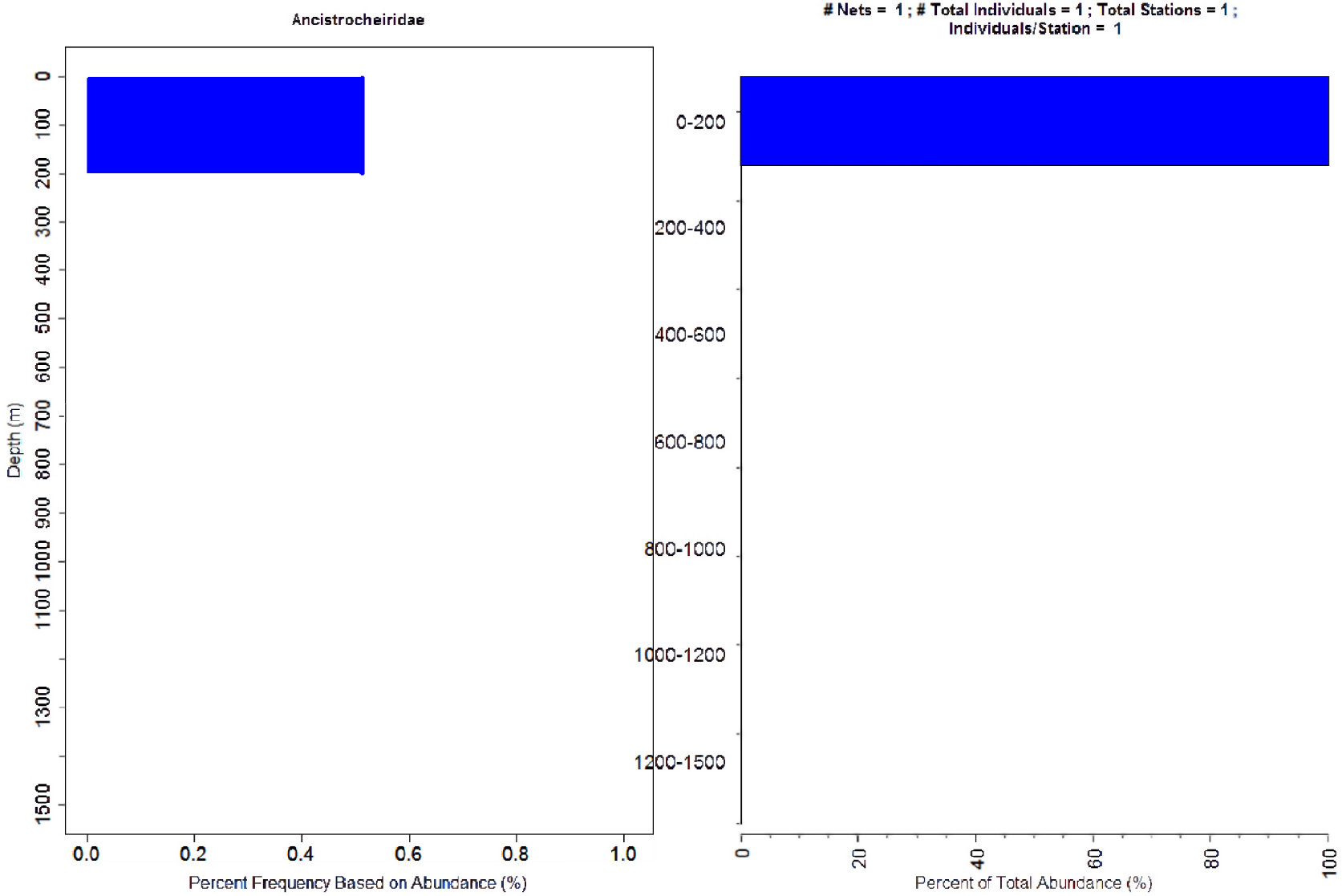
Alepocephalidae



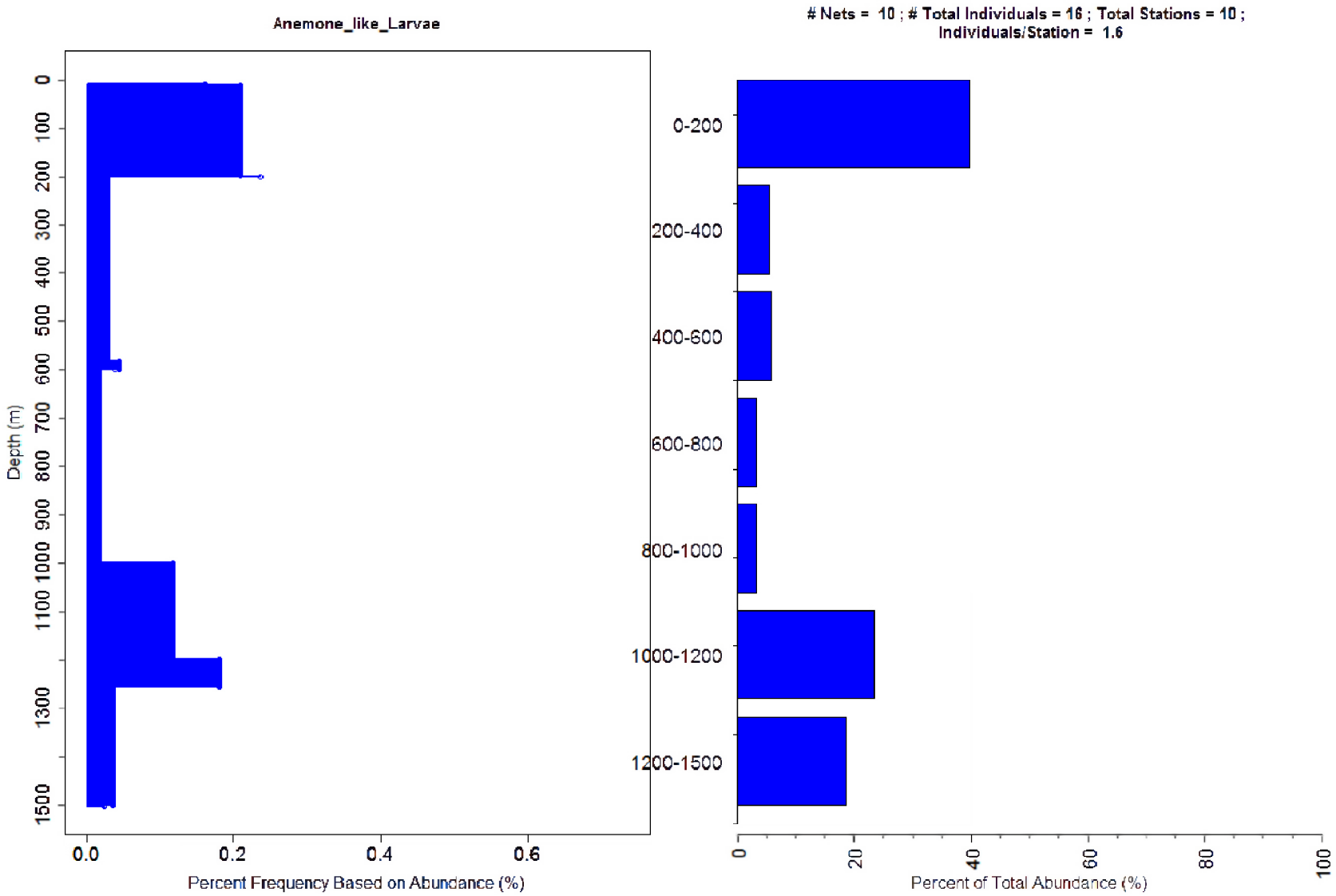
Alloposidae


Amphipoda
Nets = 168 ; # Total Individuals = 4290 ; Total Stations = 64 ;
Individuals/Station = 67.03
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

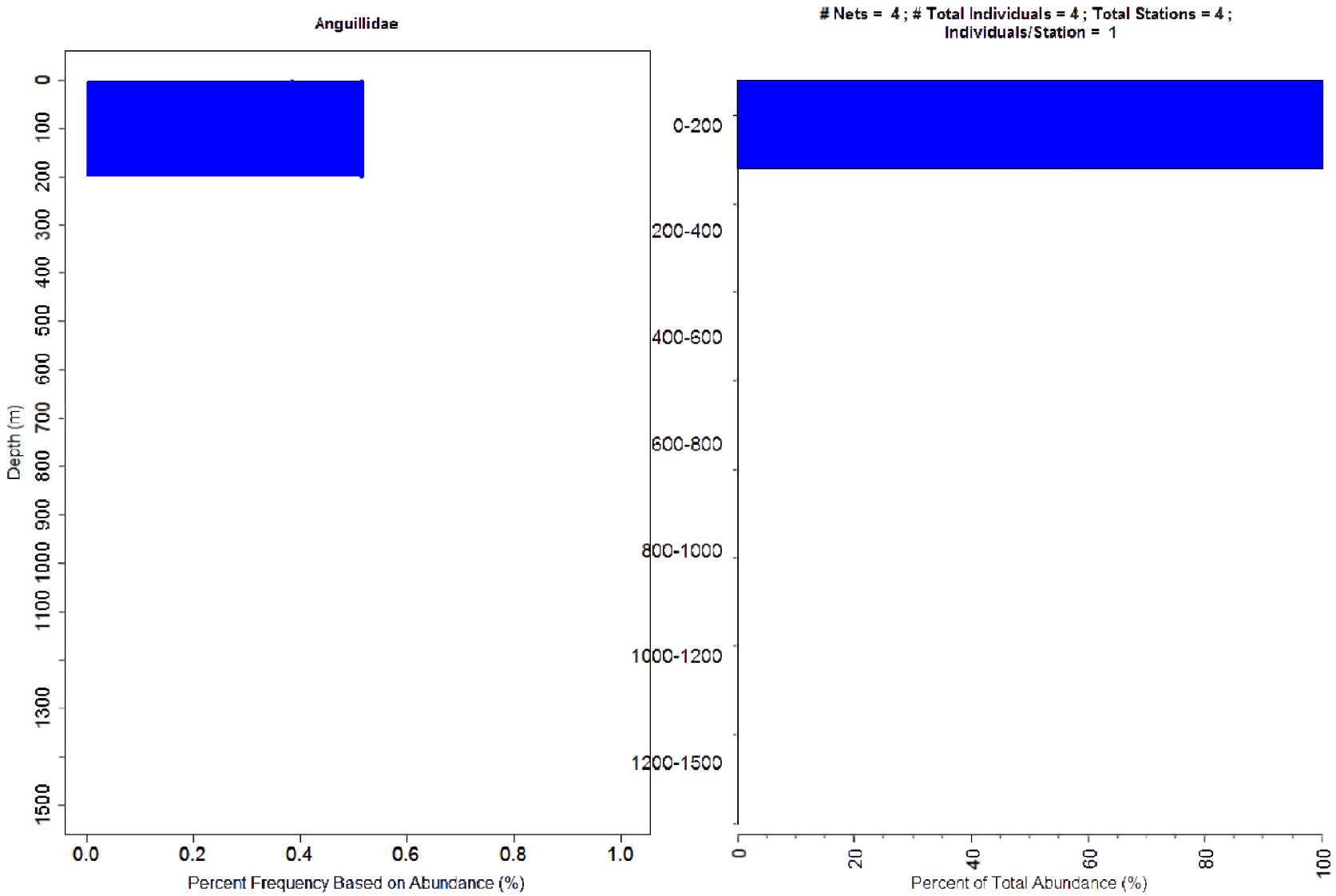
Amphipoda



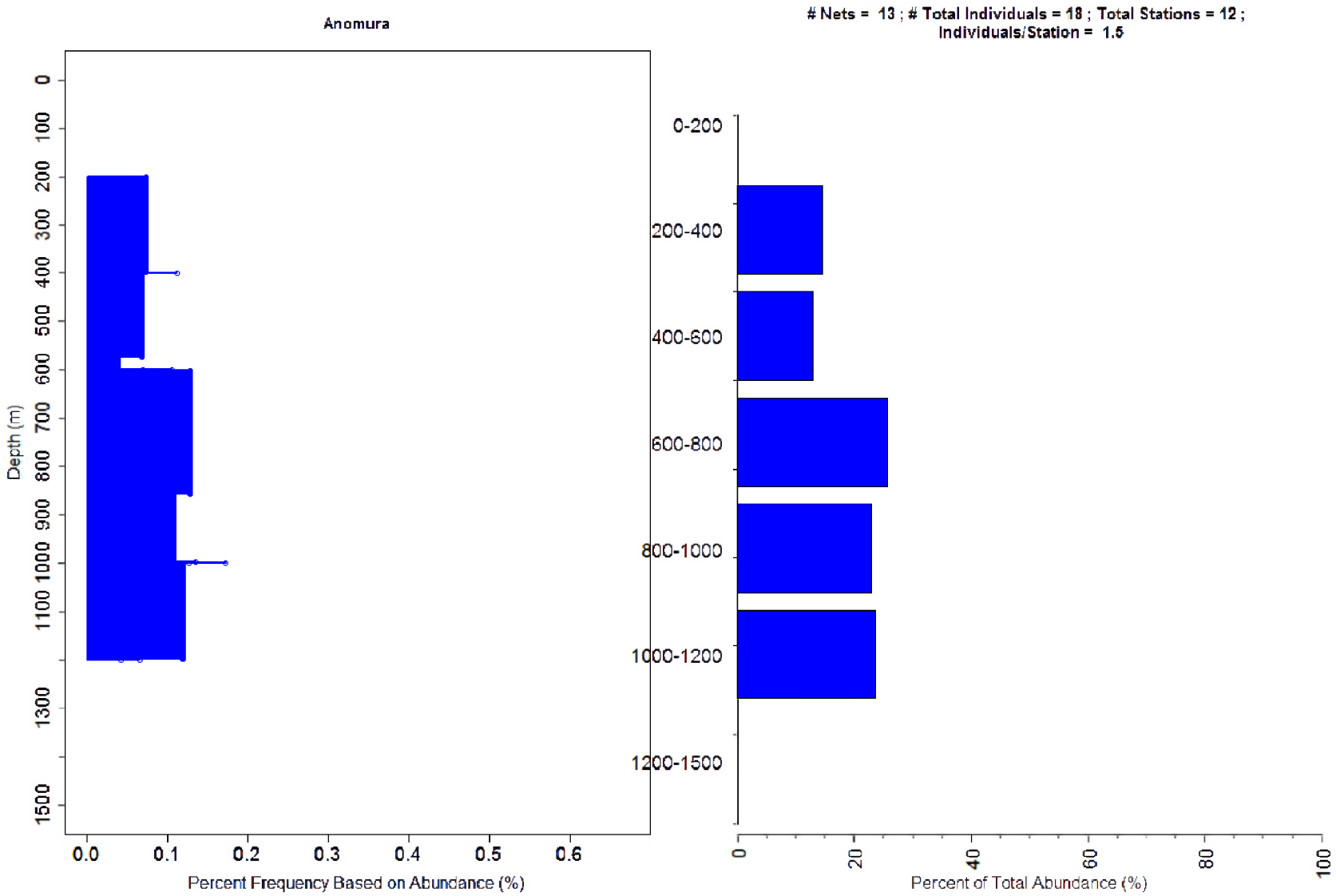
Ancistrocheiridae



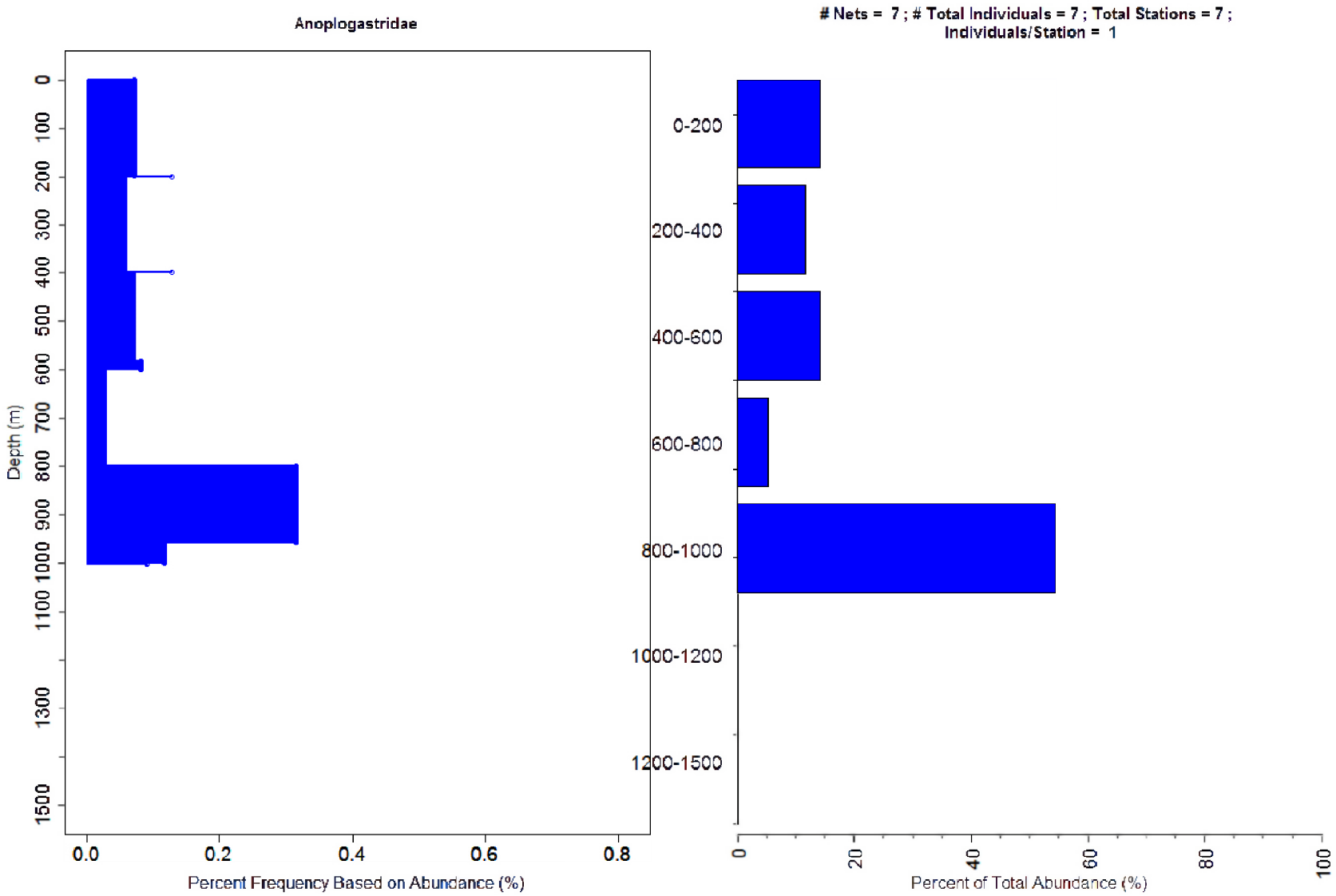
Anemone_like_Larvae



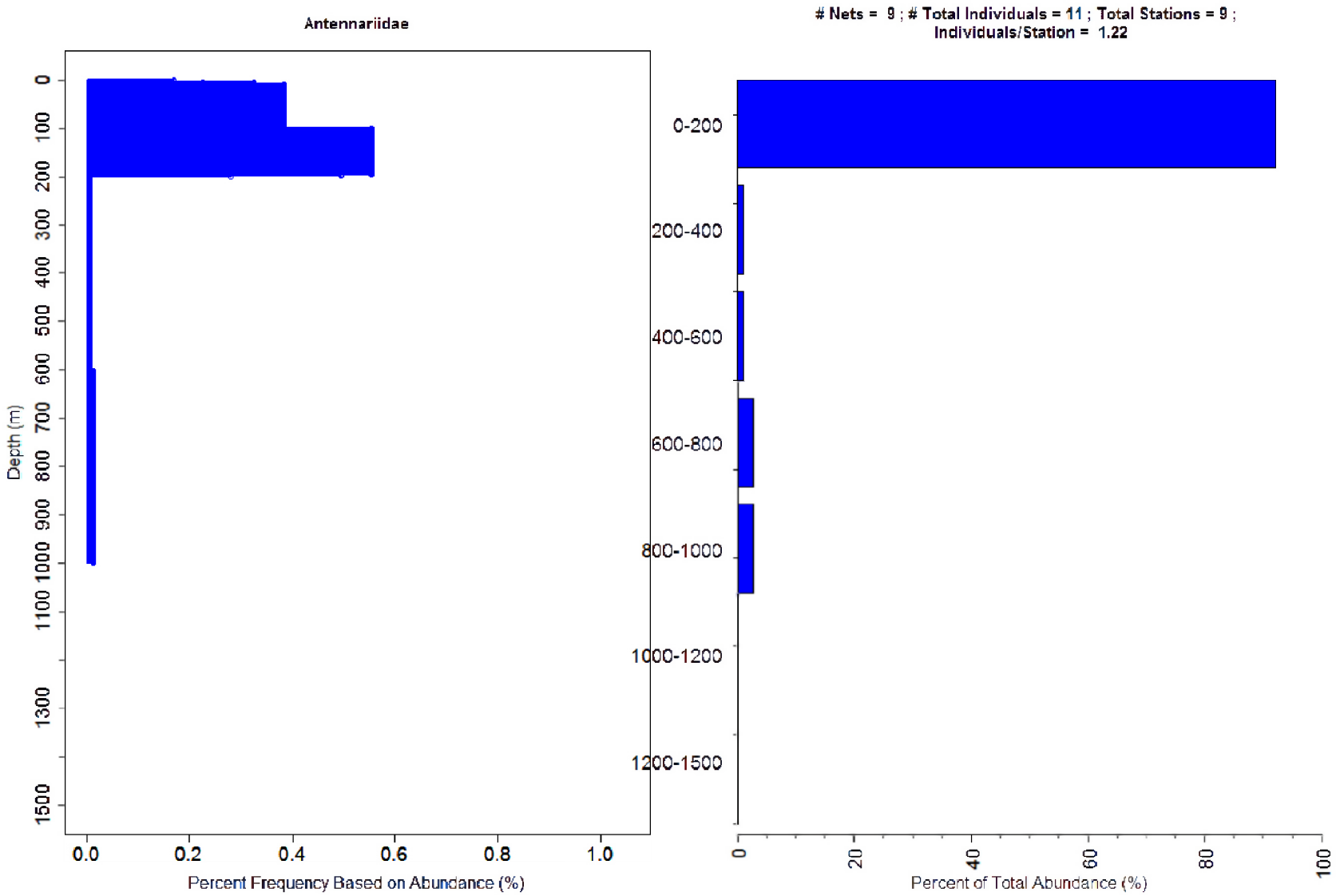
Anguillidae


Anomura
Nets = 13 ; # Total Individuals = 18 ; Total Stations = 12 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

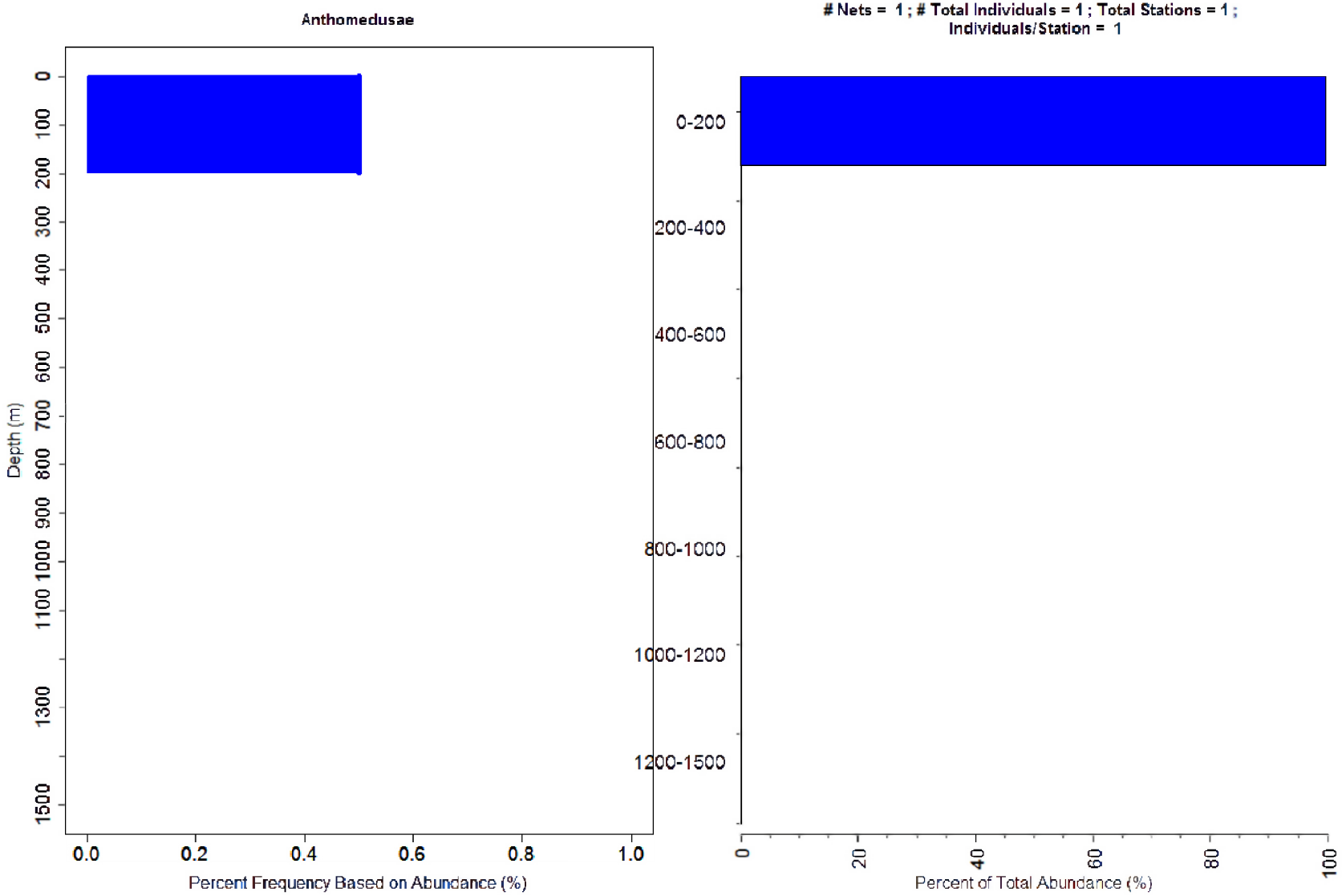
Anomura



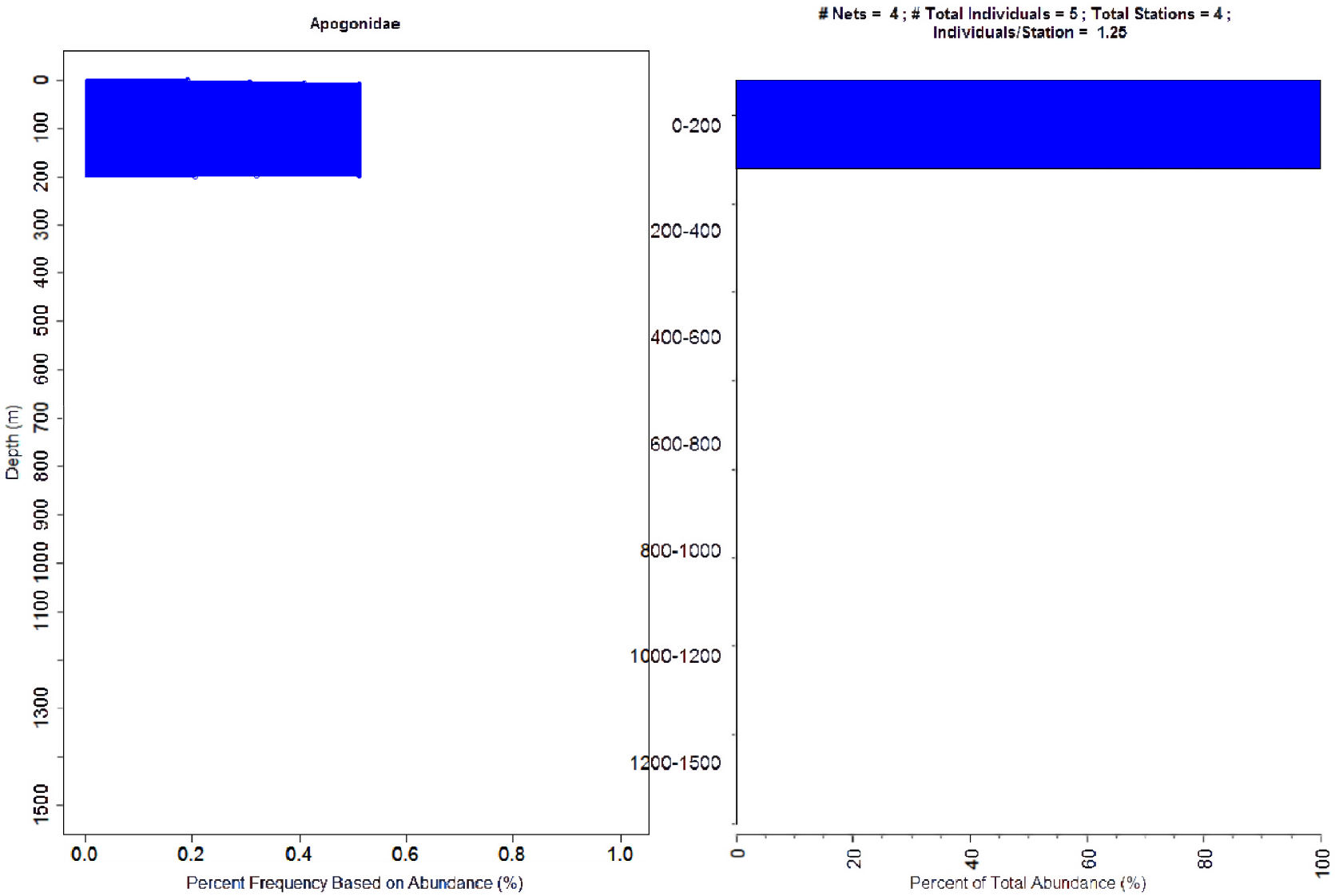
Anoplogastridae



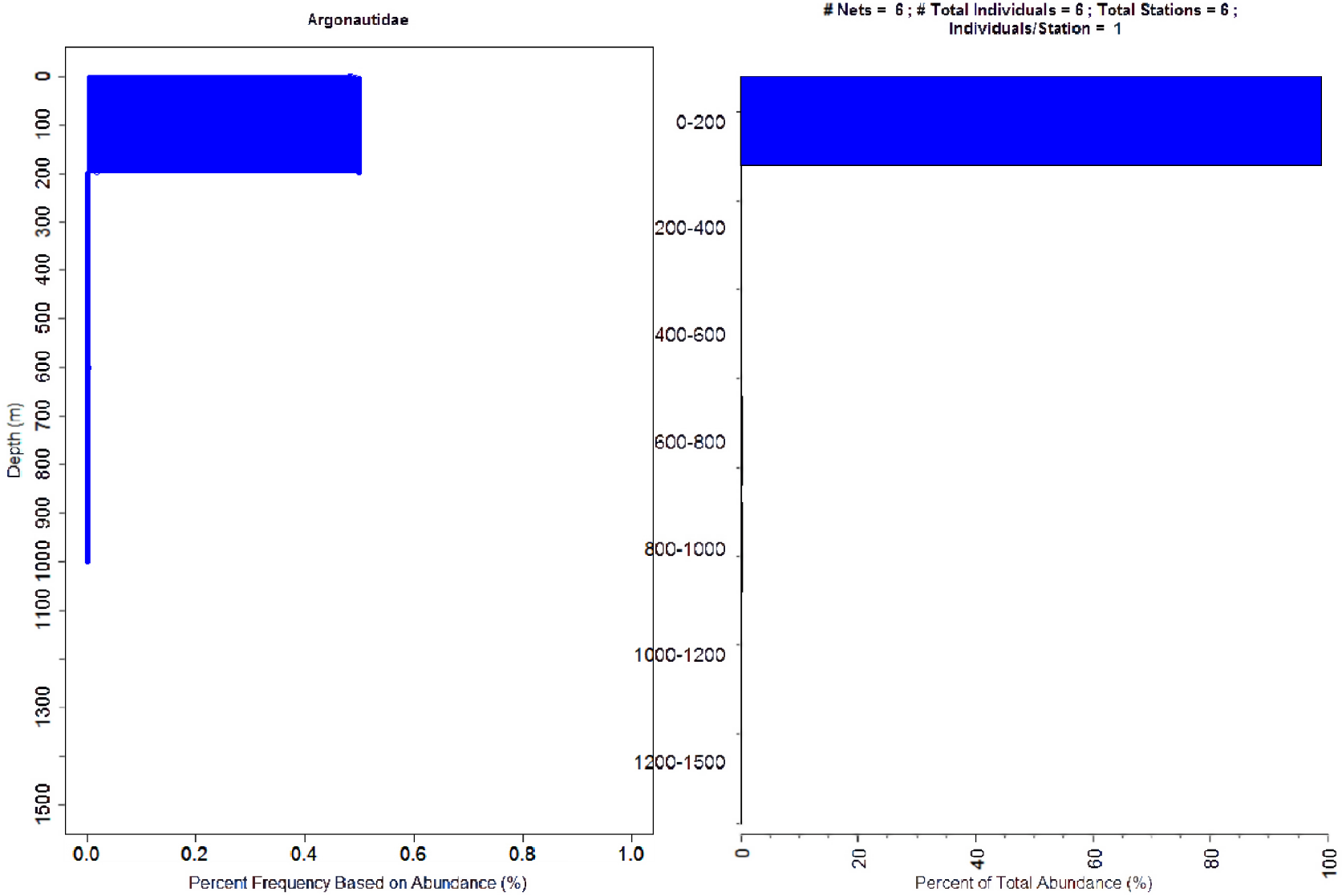
Antennariidae



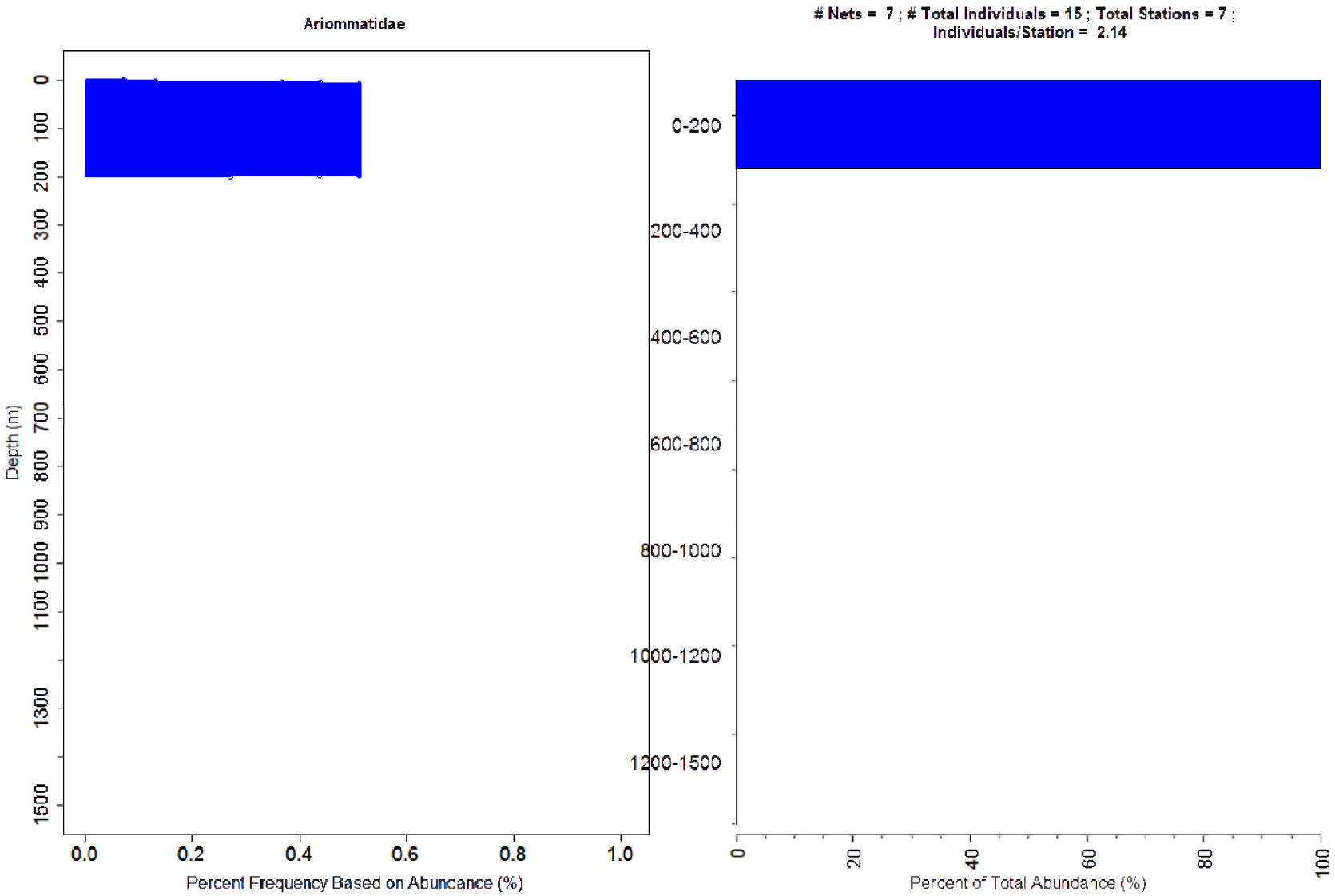
Anthomedusae


Apogonidae
Nets = 4 ; # Total Individuals = 5 ; Total Stations = 4 ;
Individuals/Station = 1.25
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

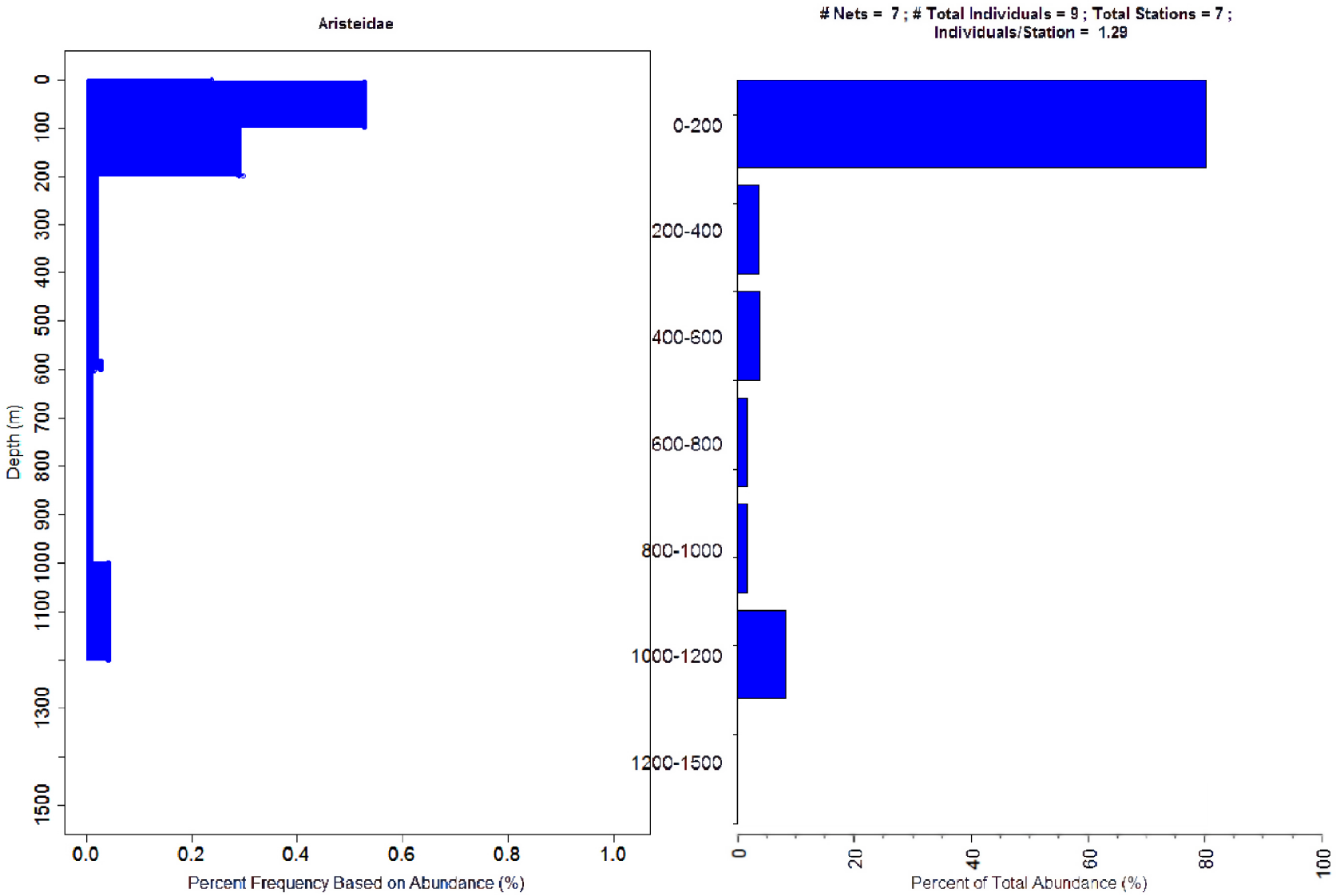
Apogonidae



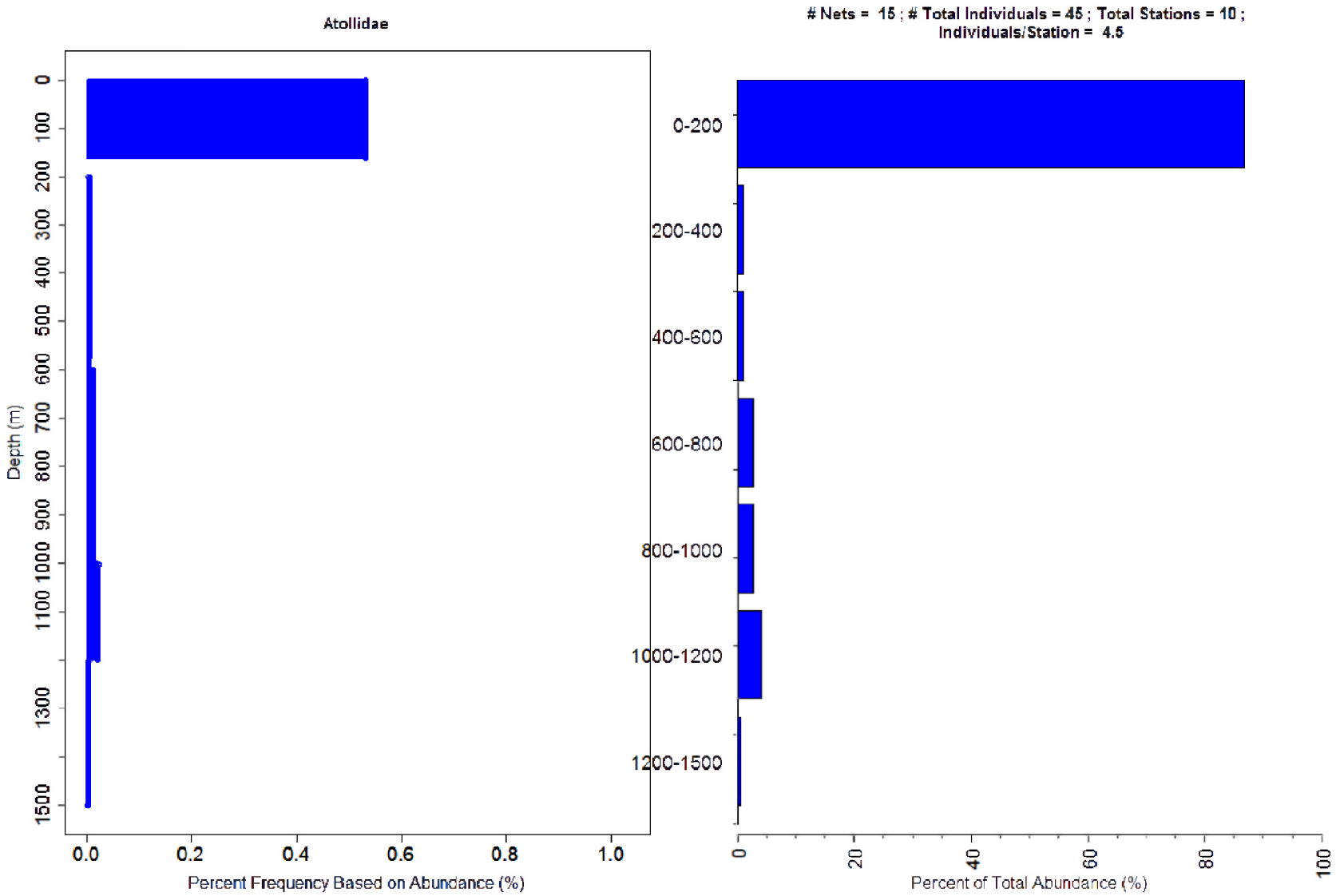
Argonautidae



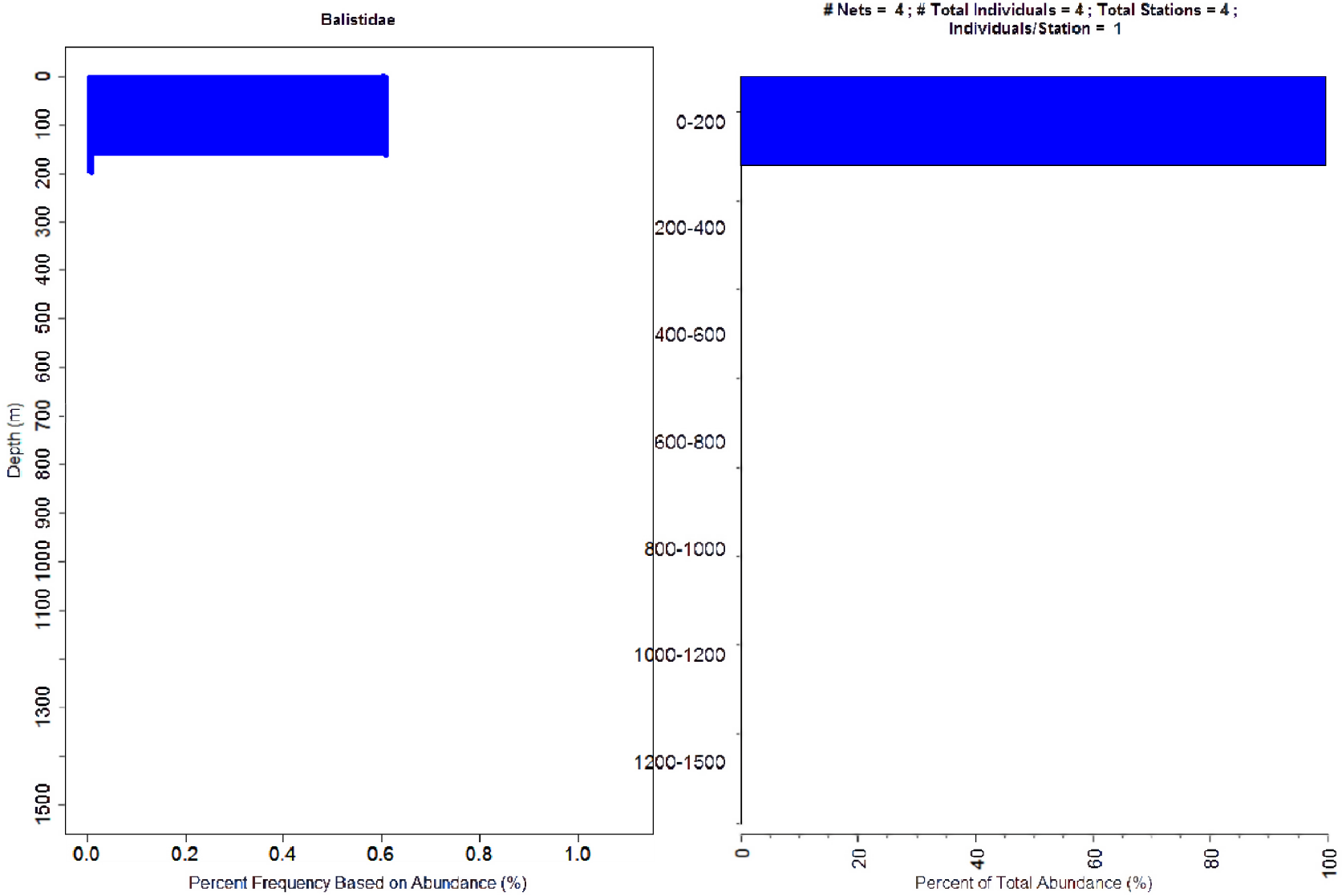
Ariommatidae


Aristeidae
Nets = 7 ; # Total Individuals = 9 ; Total Stations = 7 ;
Individuals/Station = 1.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

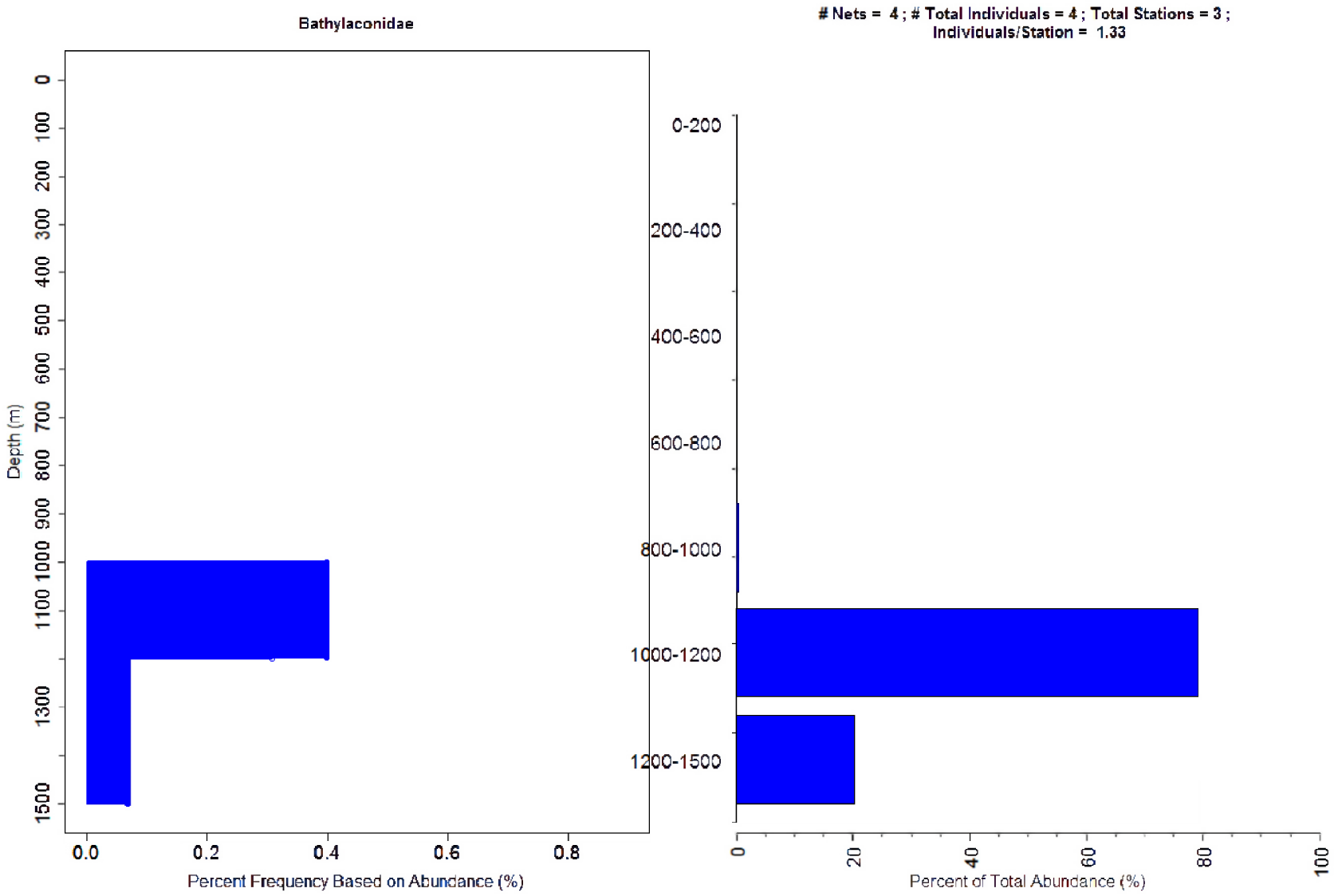
Aristeidae


Atollidae
Nets = 15 ; # Total Individuals = 45 ; Total Stations = 10 ;
Individuals/Station = 4.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

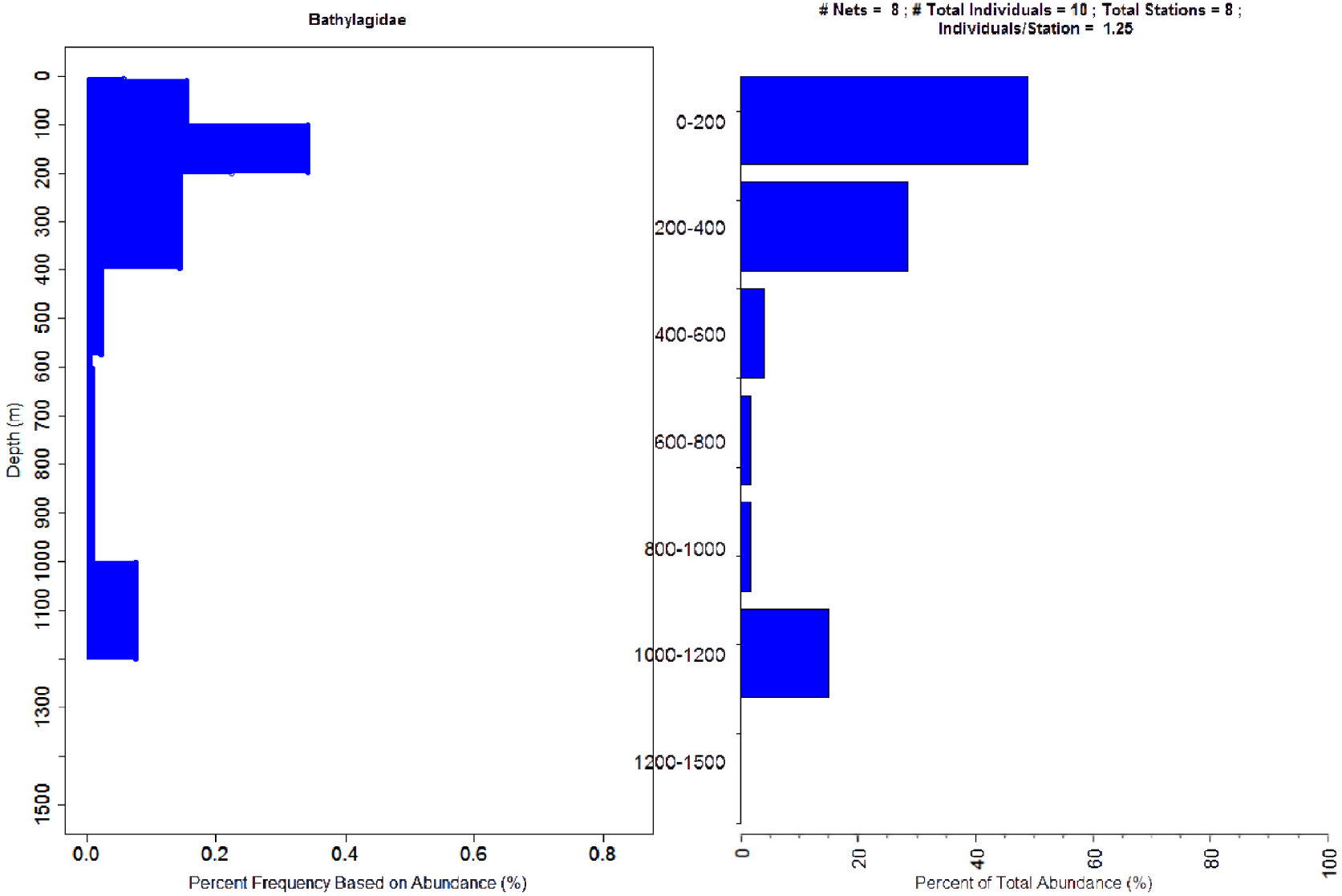
Atollidae


Balistidae
Nets = 4 ; # Total Individuals = 4 ; Total Stations = 4 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

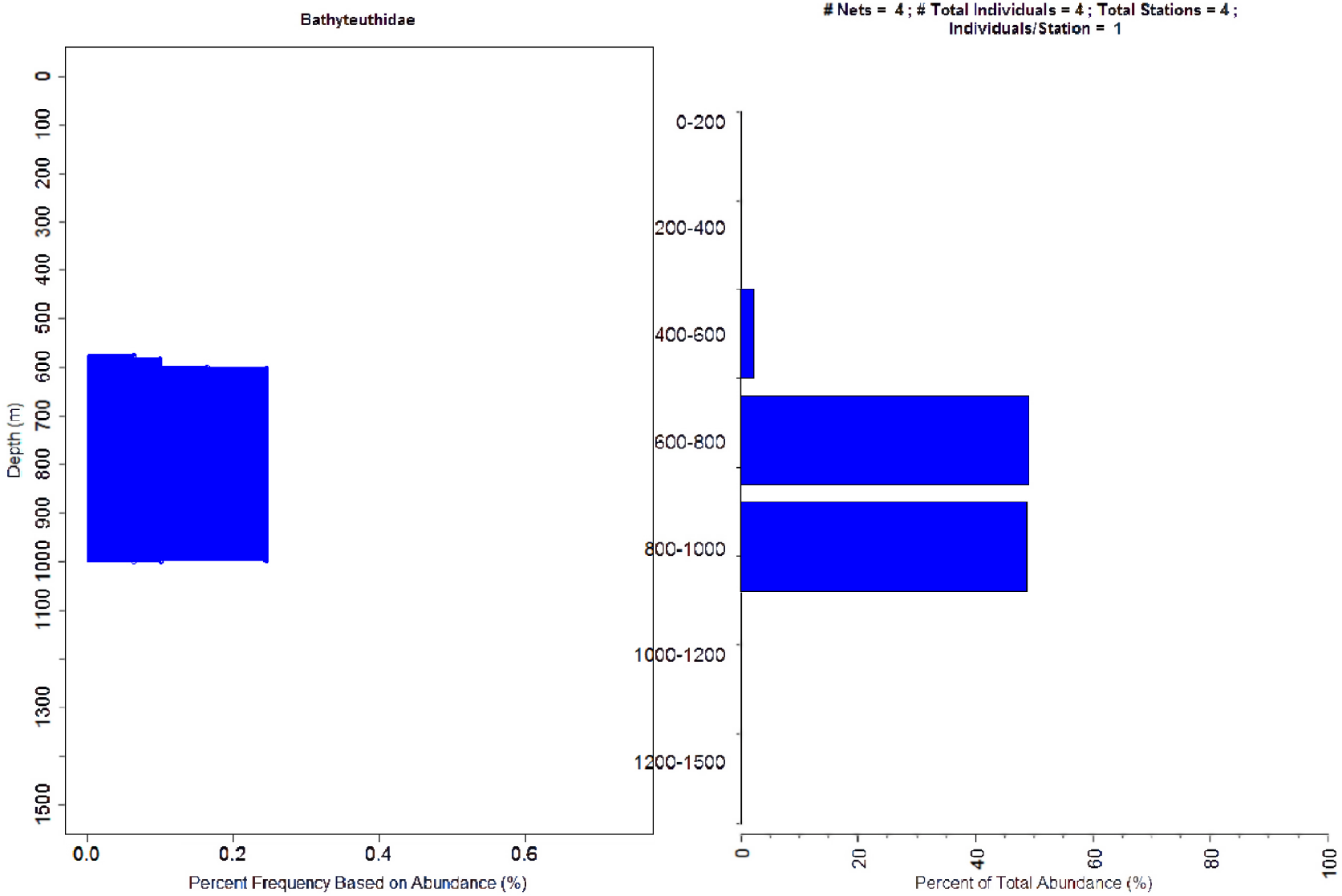
Balistidae



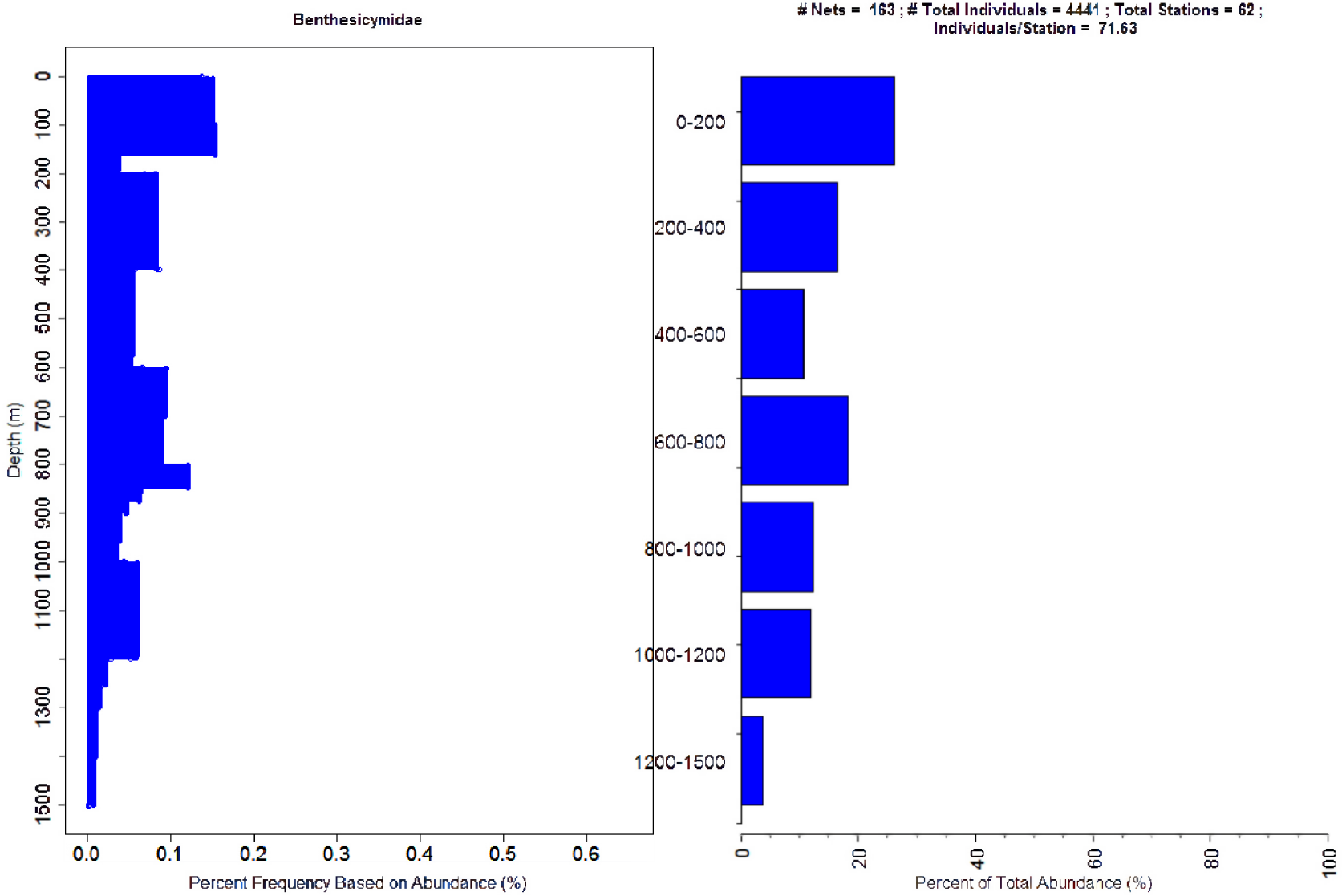
Bathylaconidae



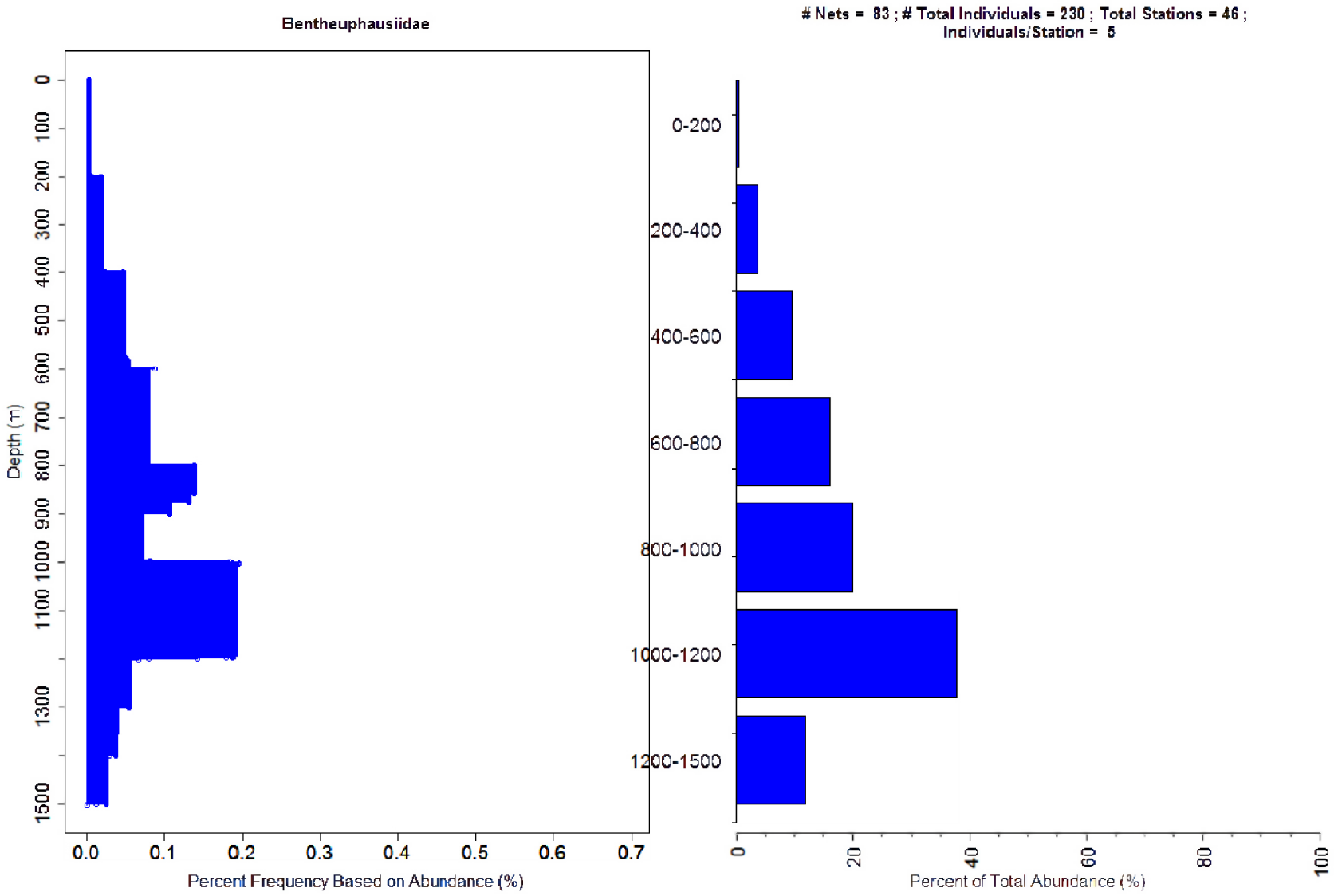
Bathylagidae



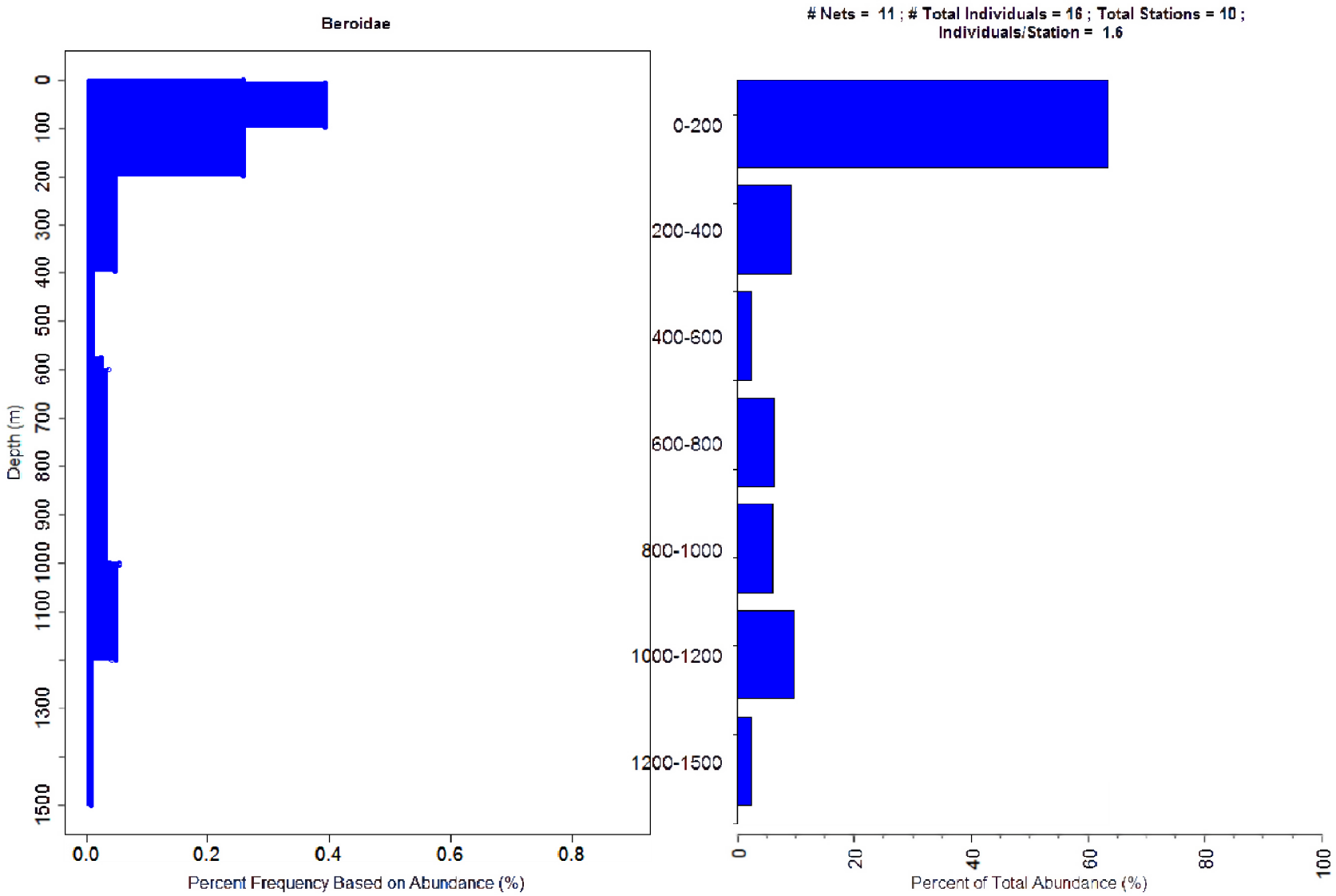
Bathyteuthidae



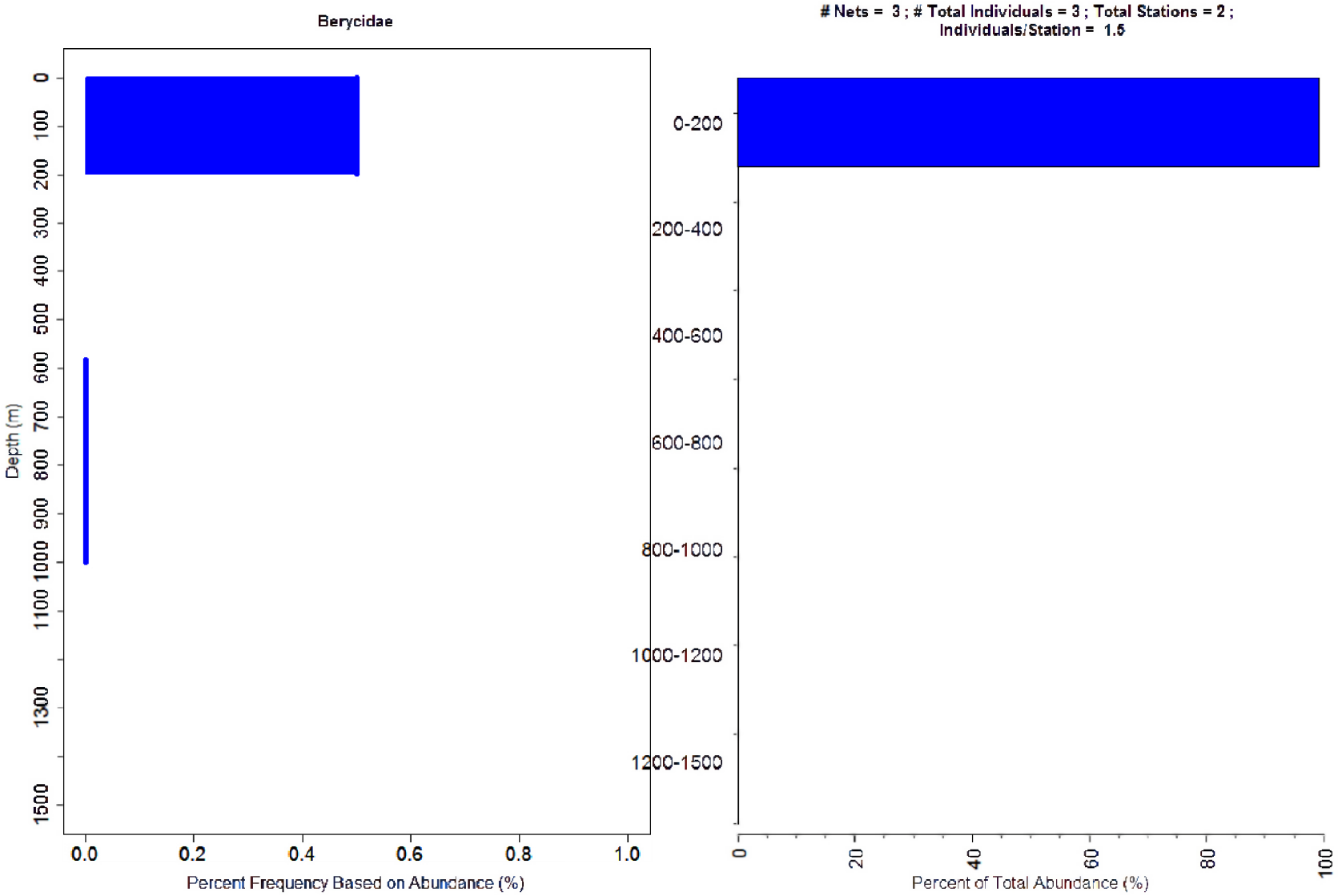
Benthesicymidae



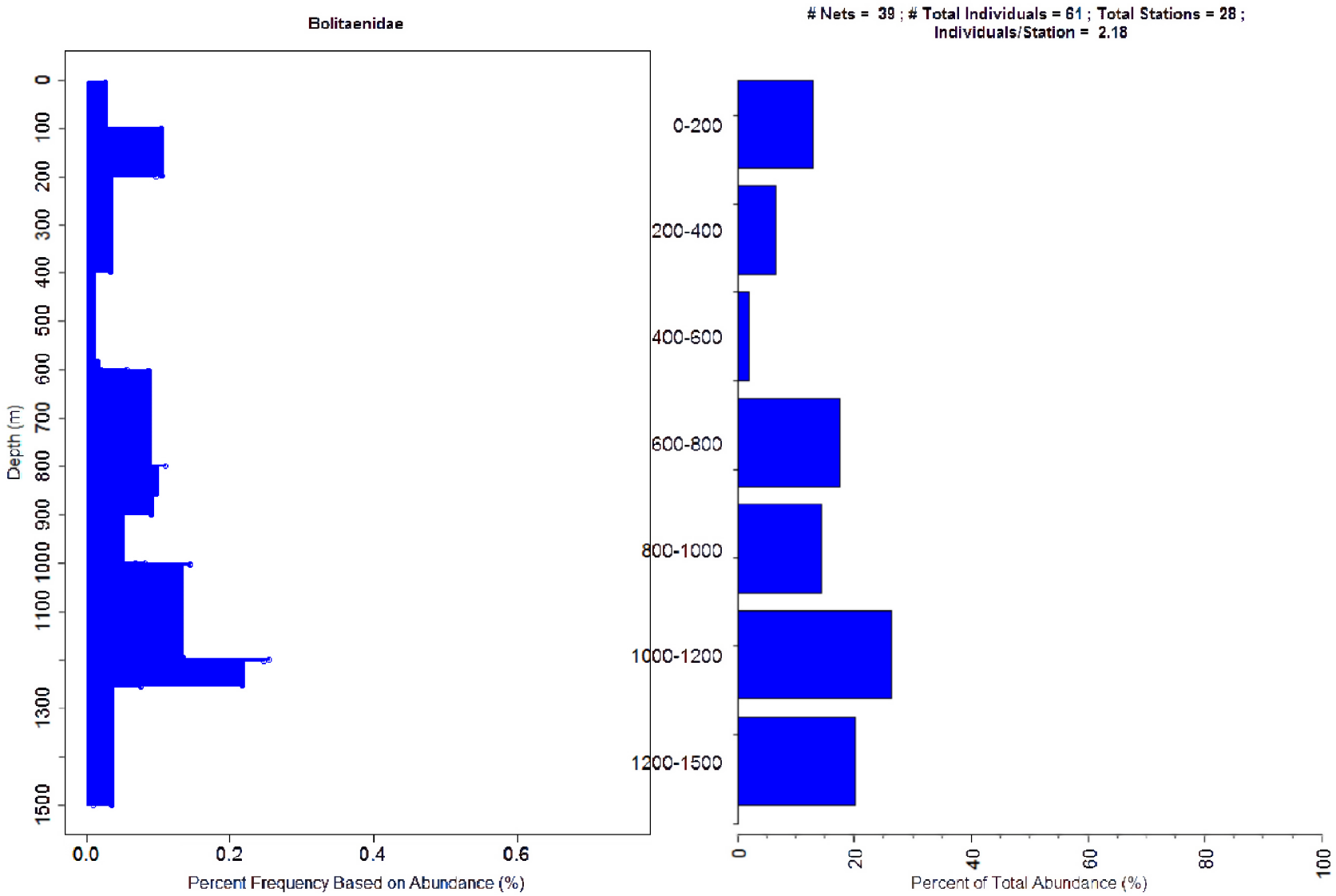
Bentheuphausiidae


Beroidae
Nets = 11 ; # Total Individuals = 16 ; Total Stations = 10 ;
Individuals/Station = 1.6
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

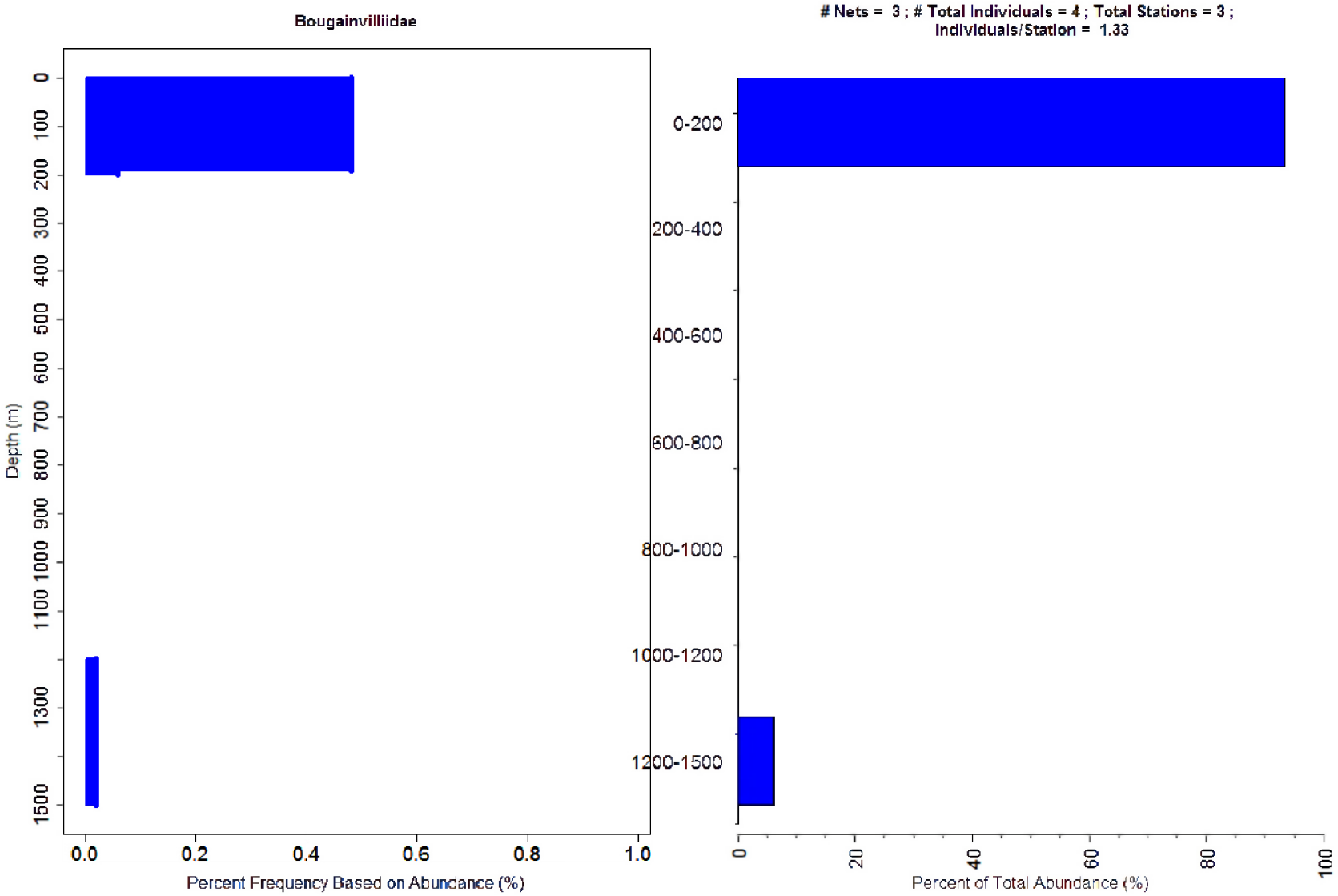
Beroidae


Berycidae
Nets = 3 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

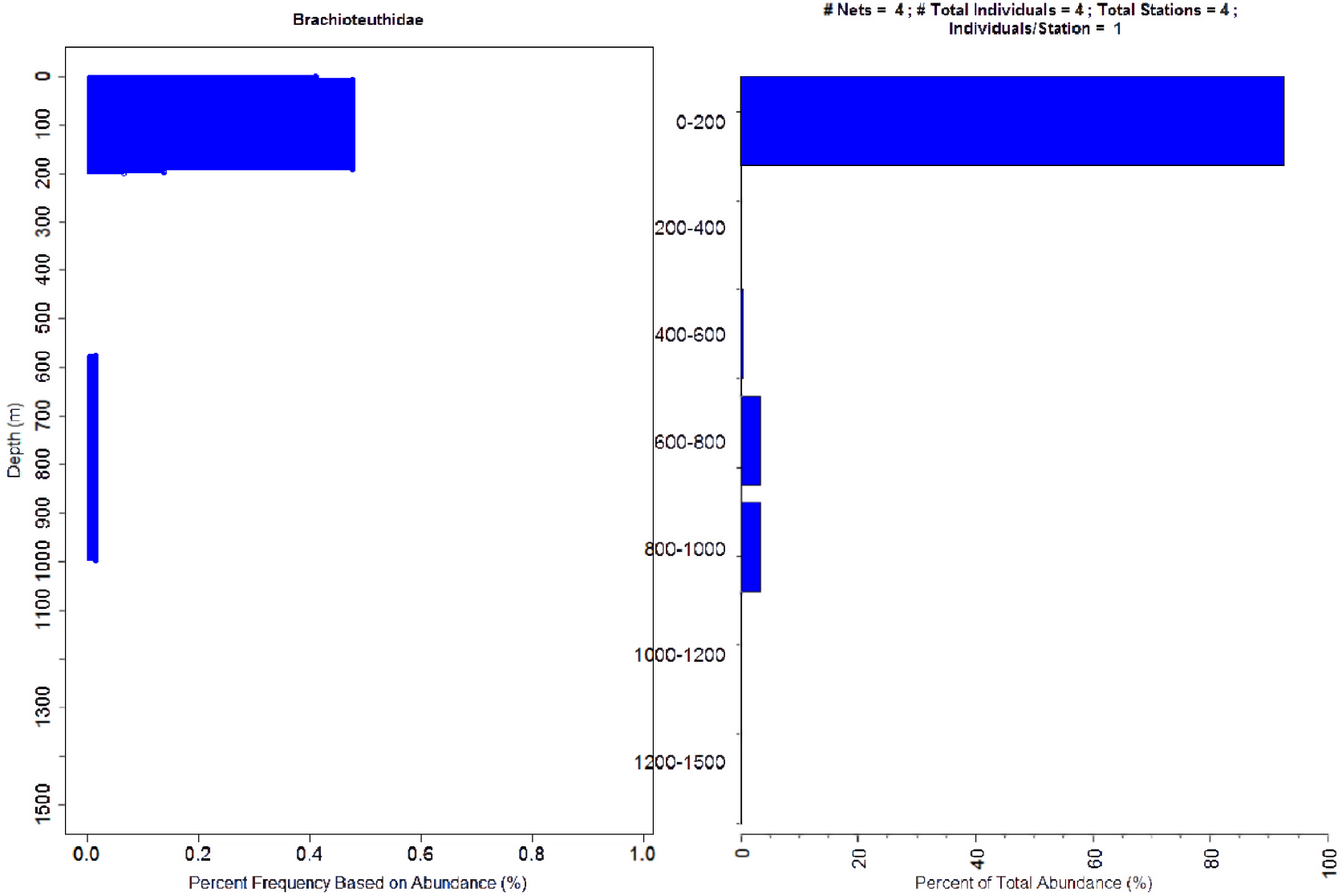
Berycidae



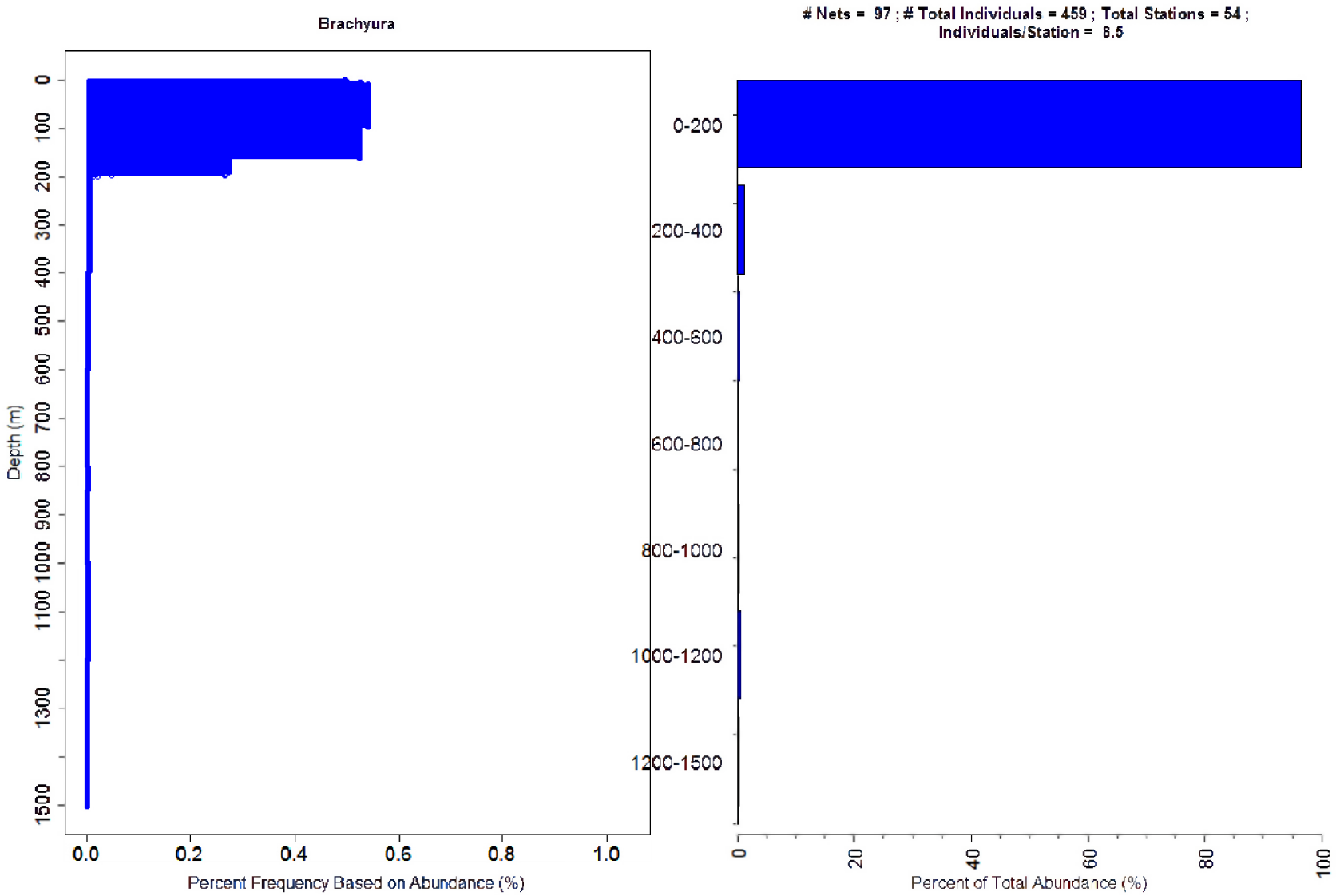
Bolitaenidae



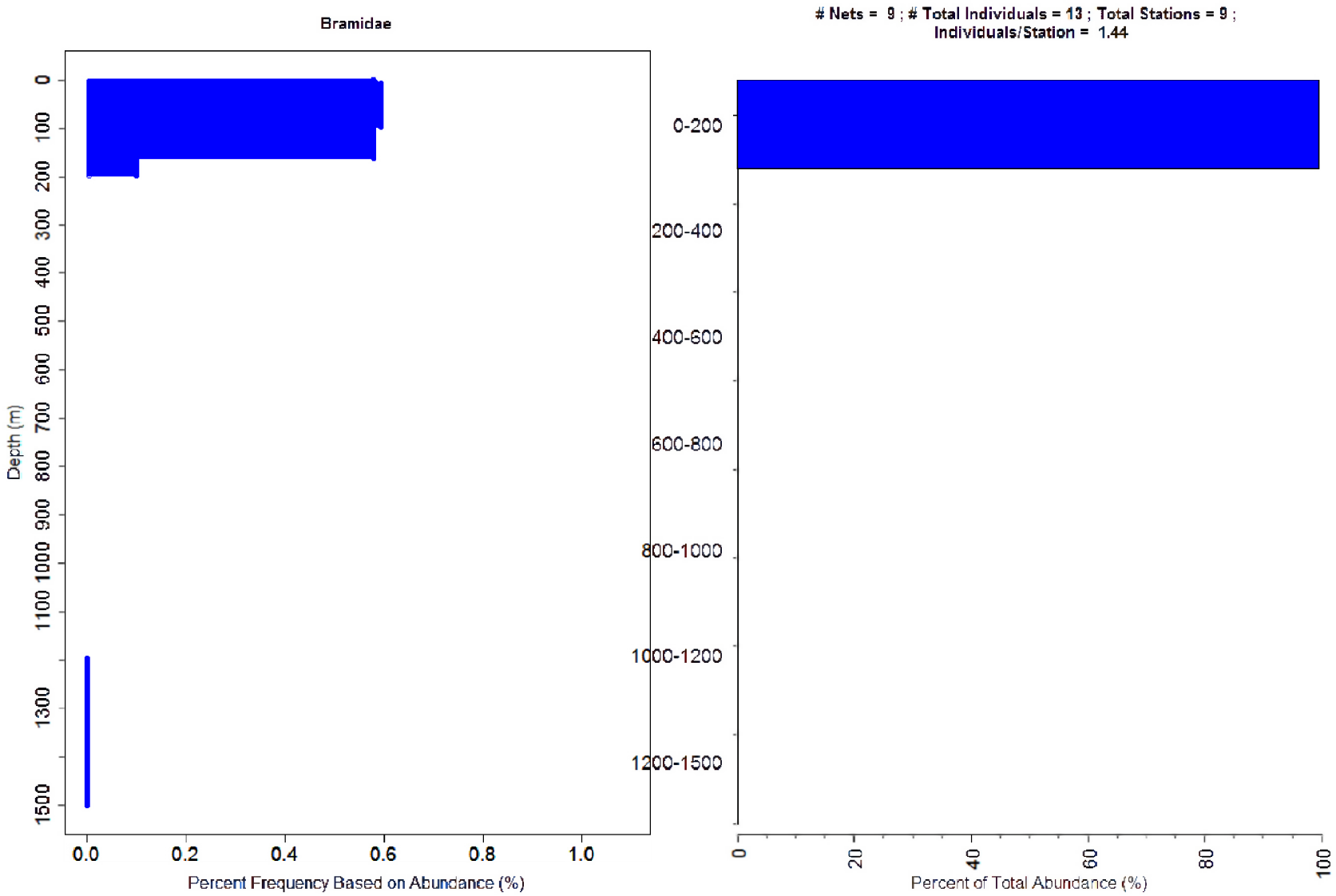
Bougainvilliidae



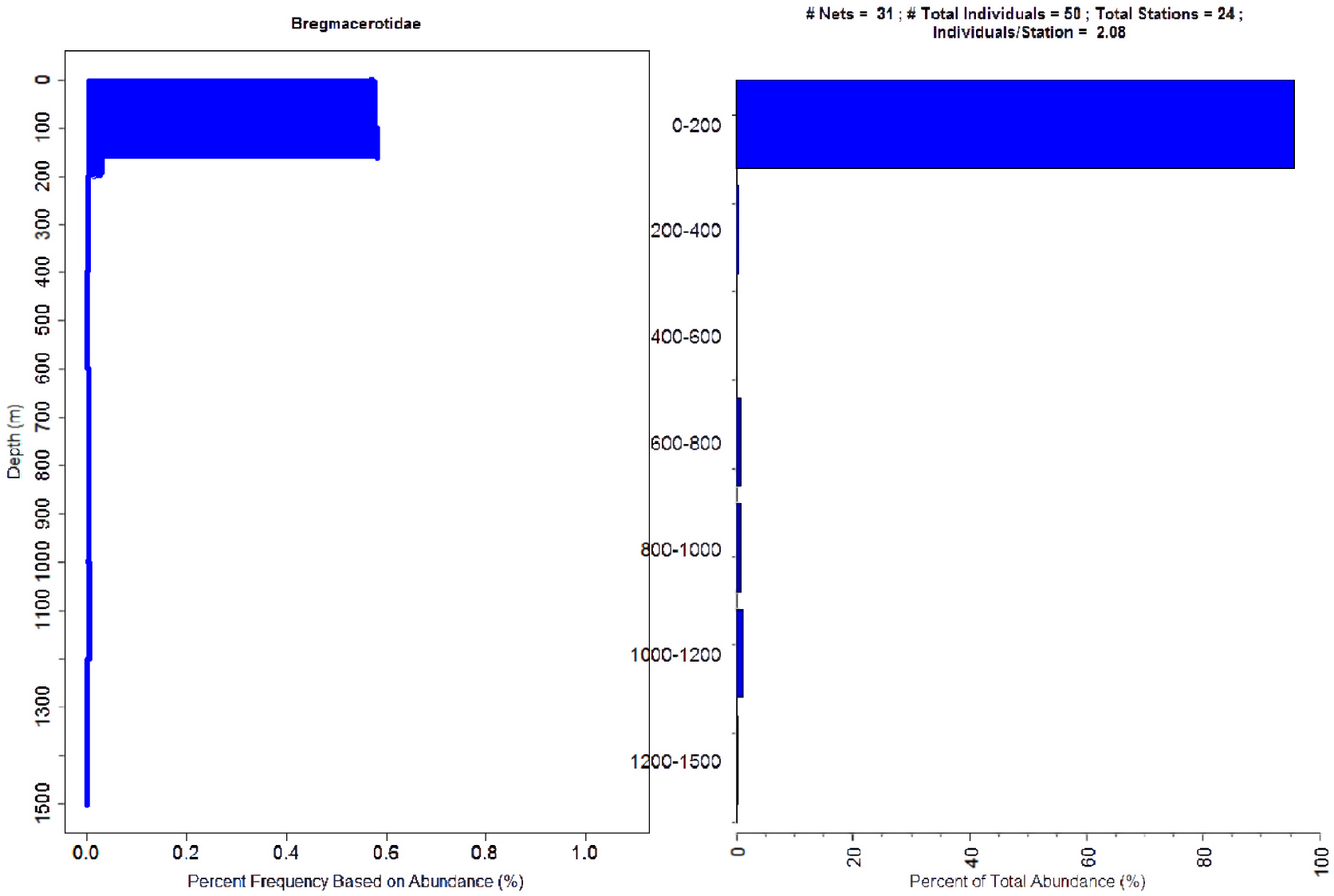
Brachioteuthidae


Brachyura
Nets = 97 ; # Total Individuals = 459 ; Total Stations = 54 ;
Individuals/Station = 8.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

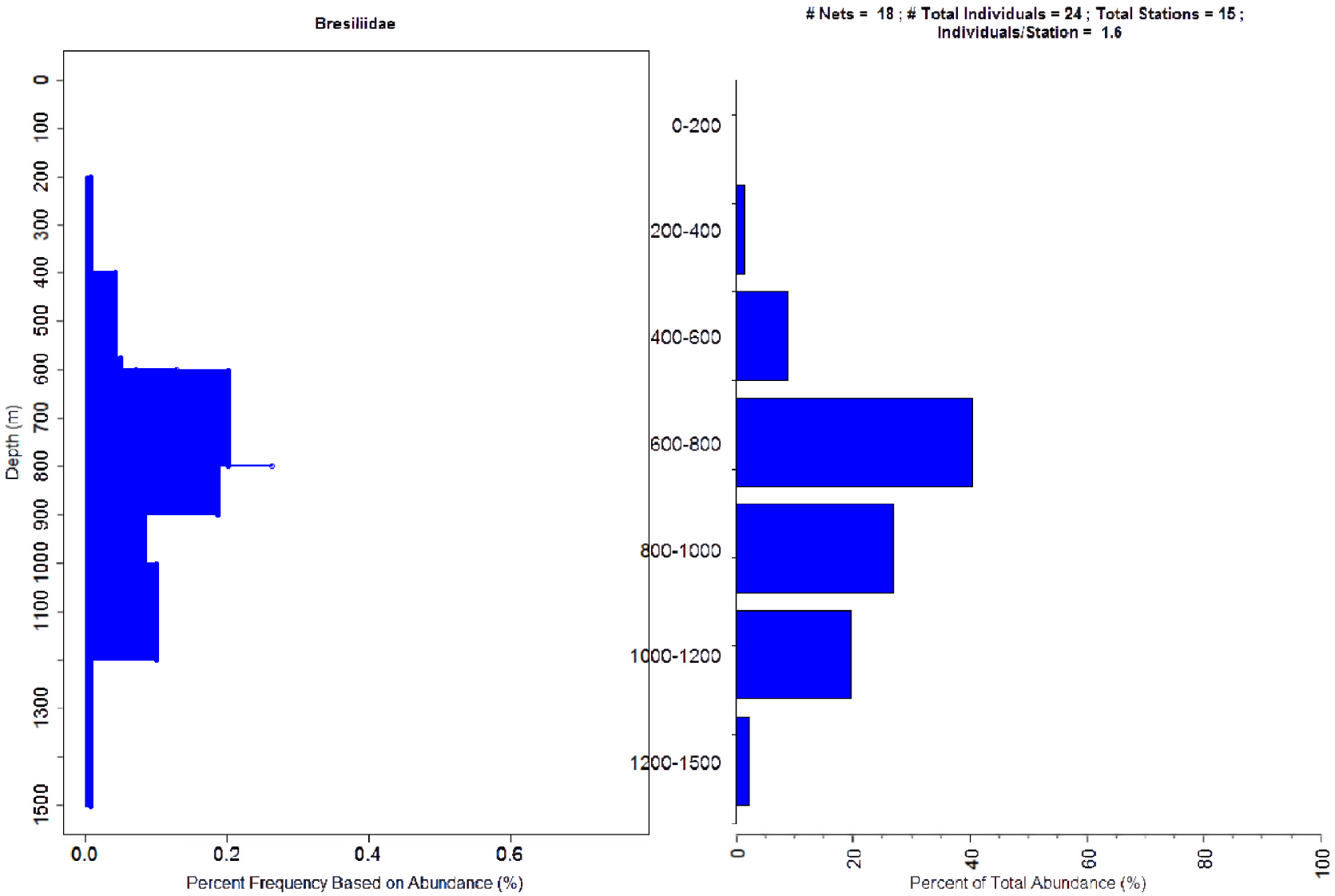
Brachyura


Bramidae
Nets = 9 ; # Total Individuals = 13 ; Total Stations = 9 ;
Individuals/Station = 1.44
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

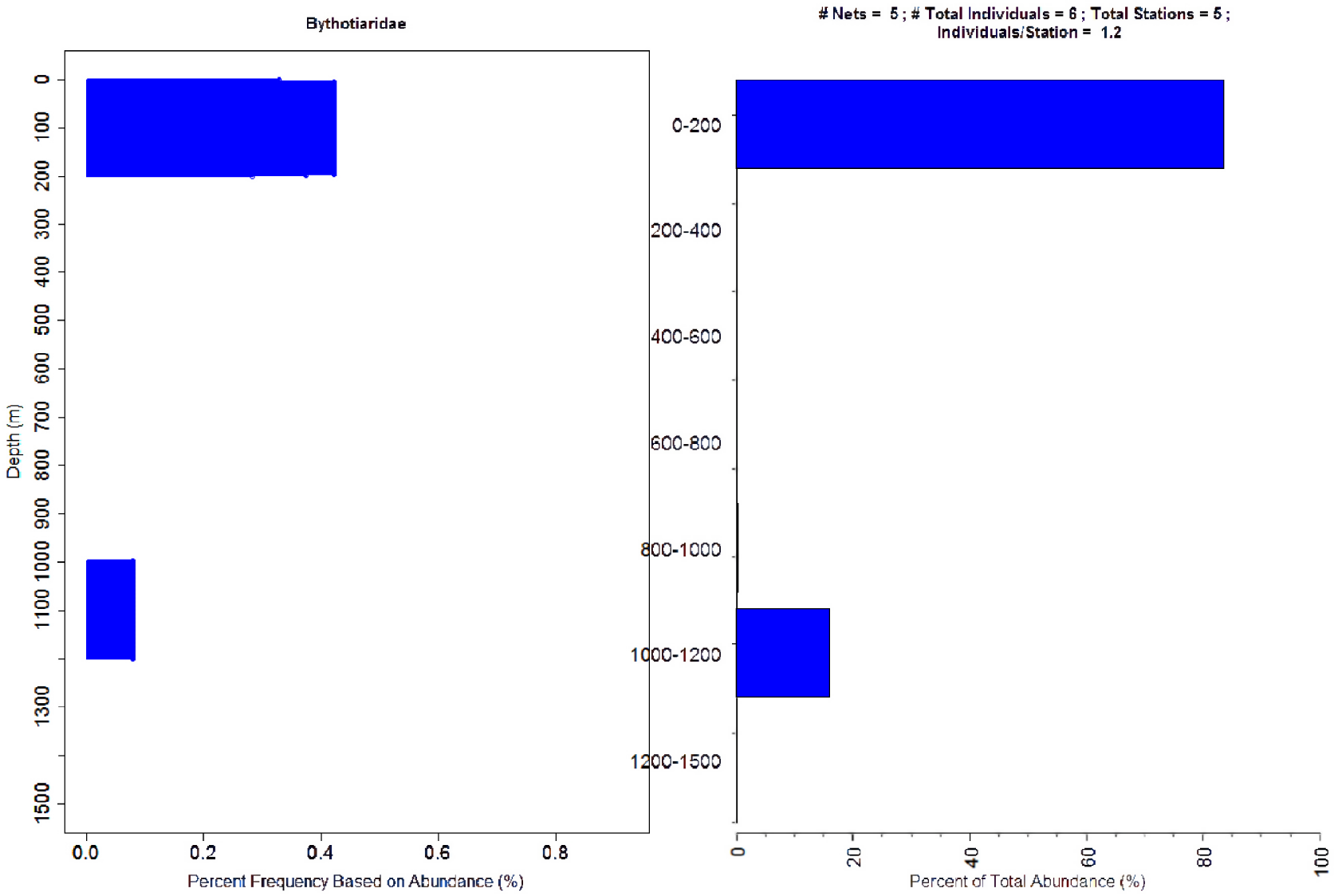
Bramidae



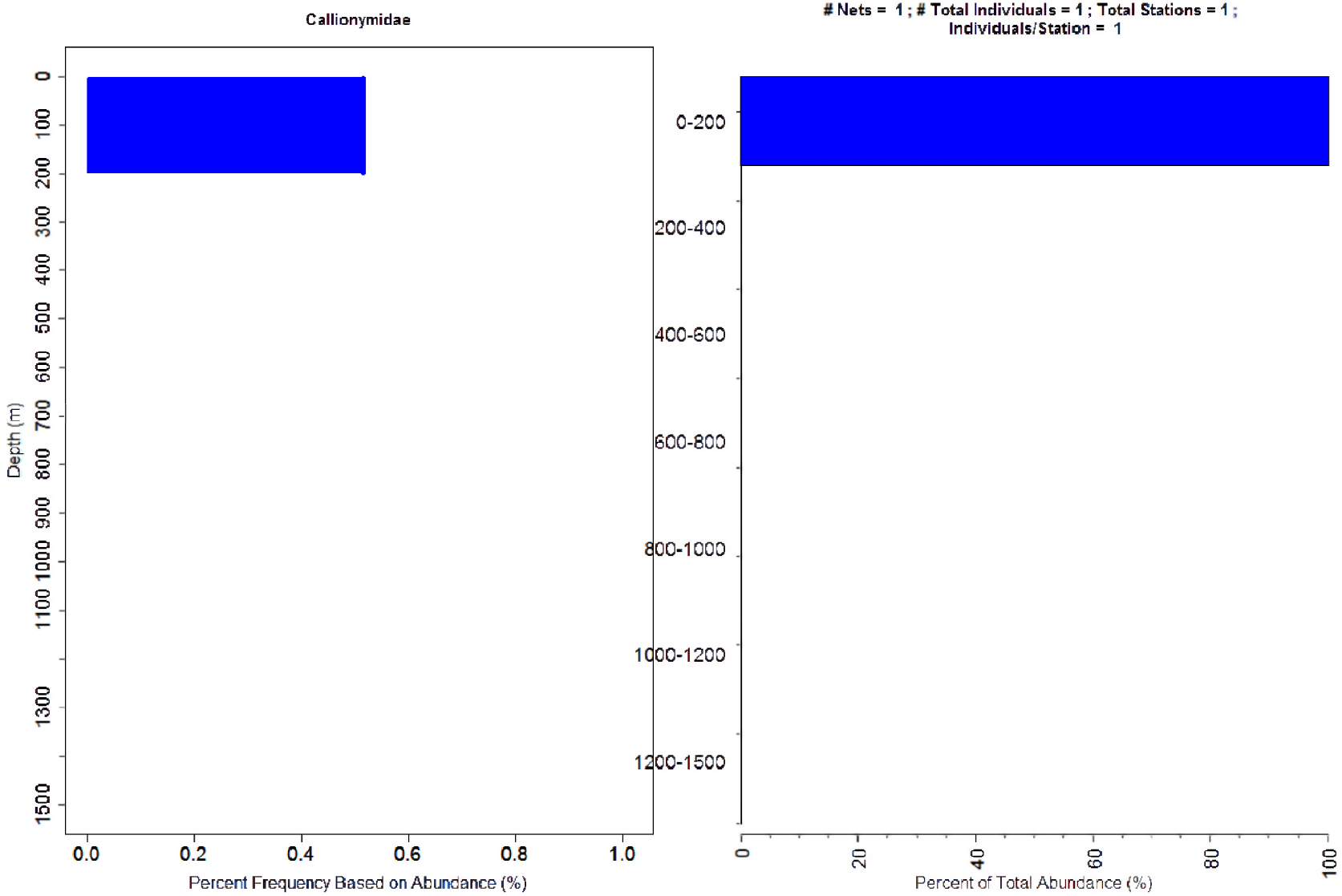
Bregmacerotidae



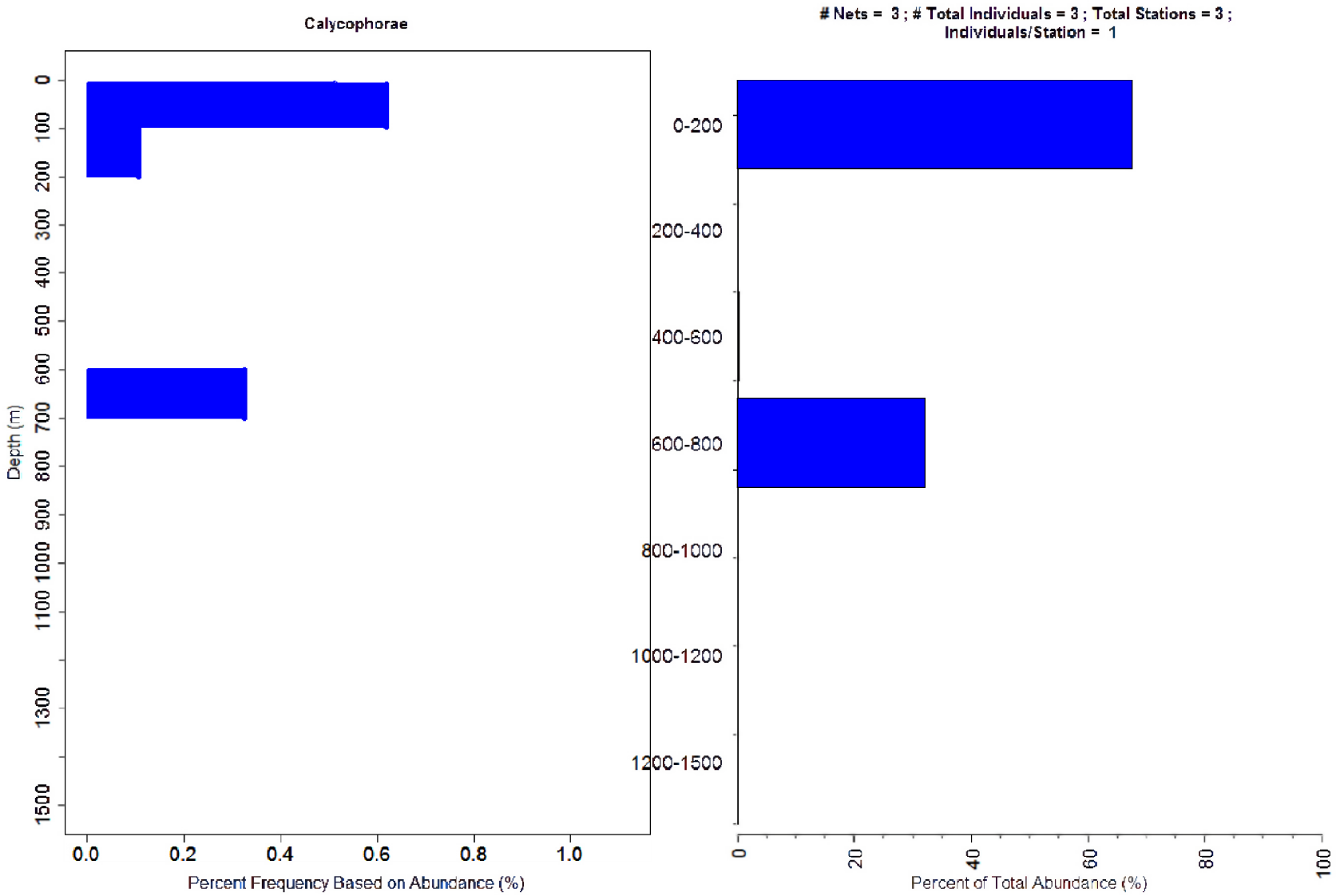
Bresiliidae



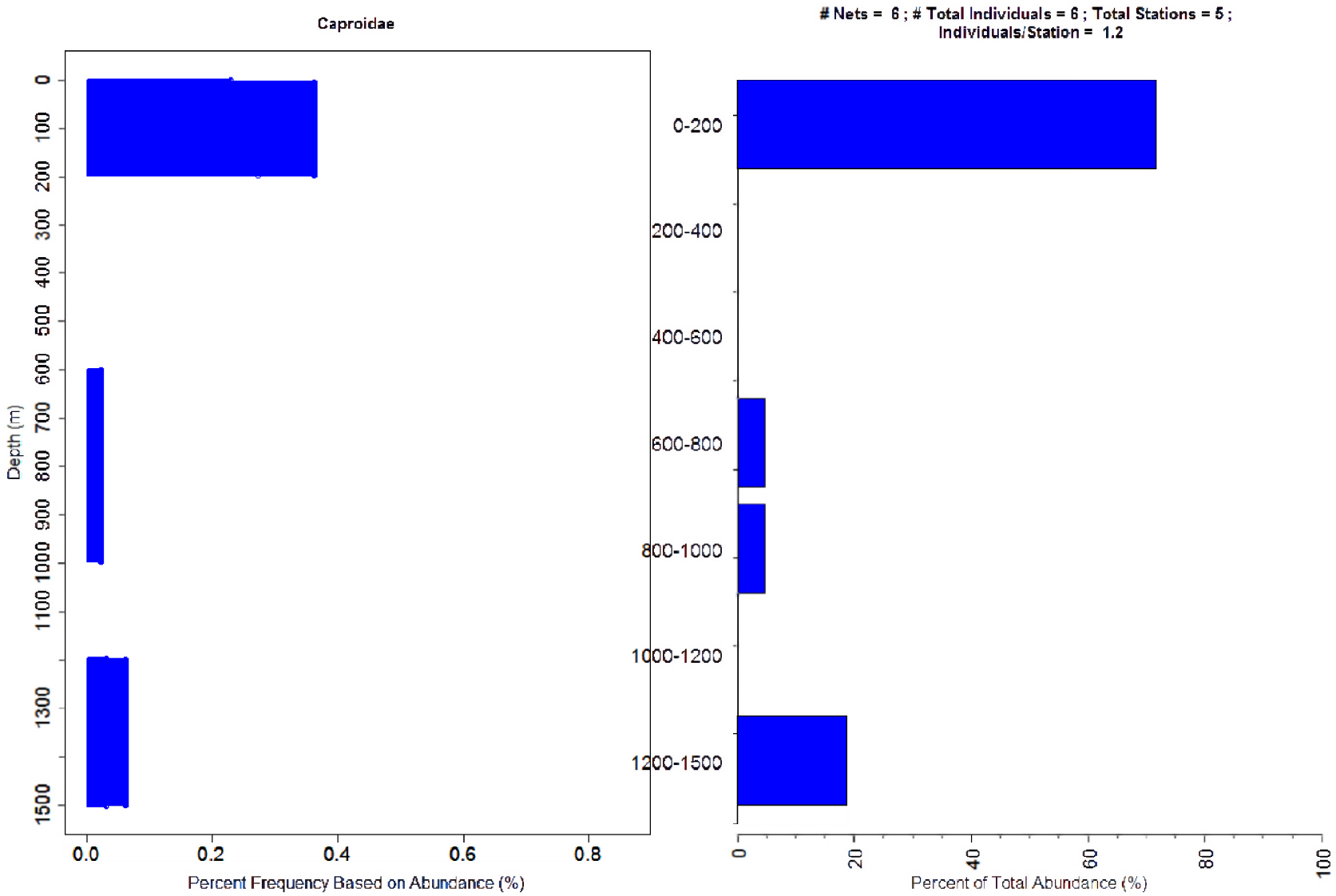
Bythotiaridae



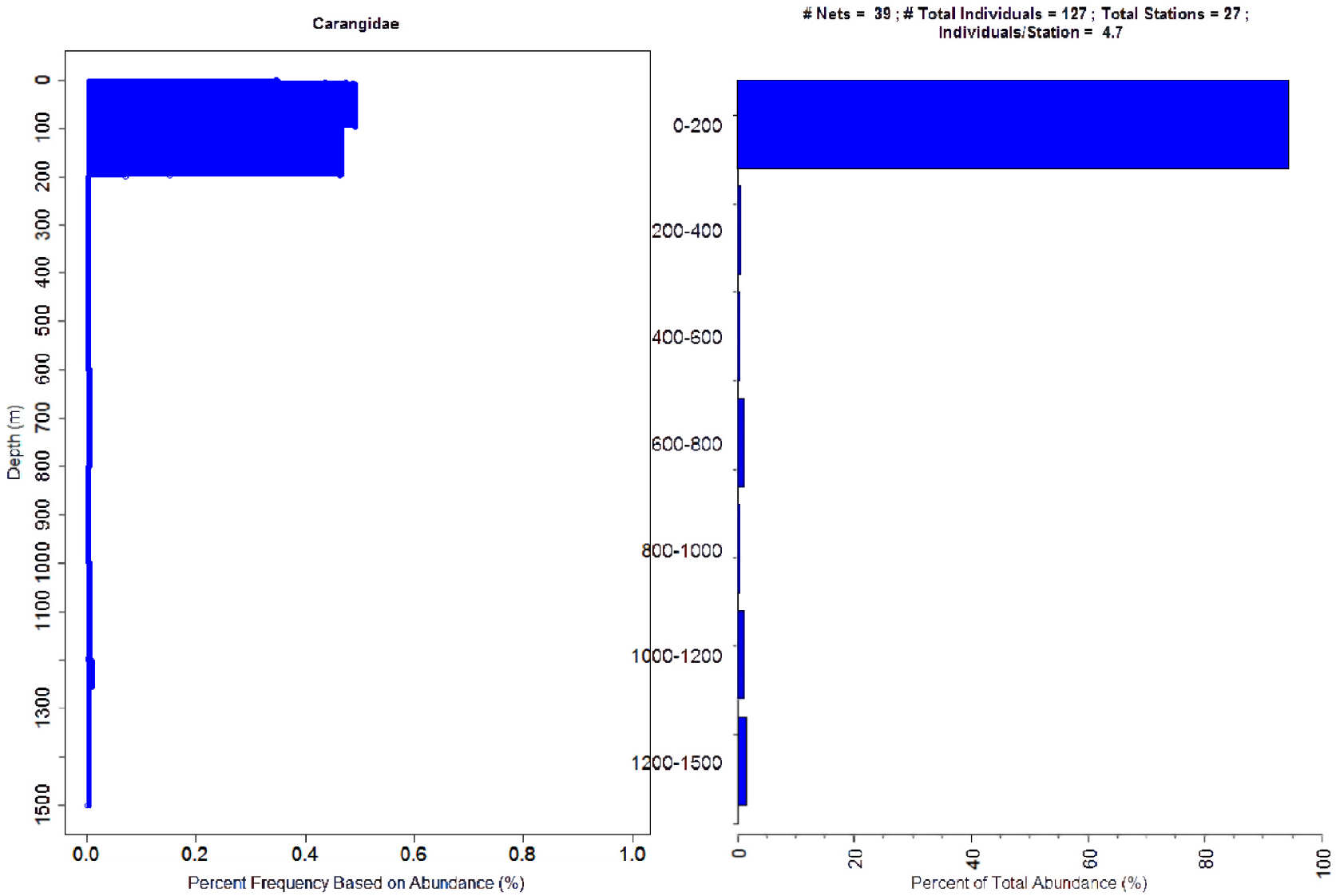
Callionymidae



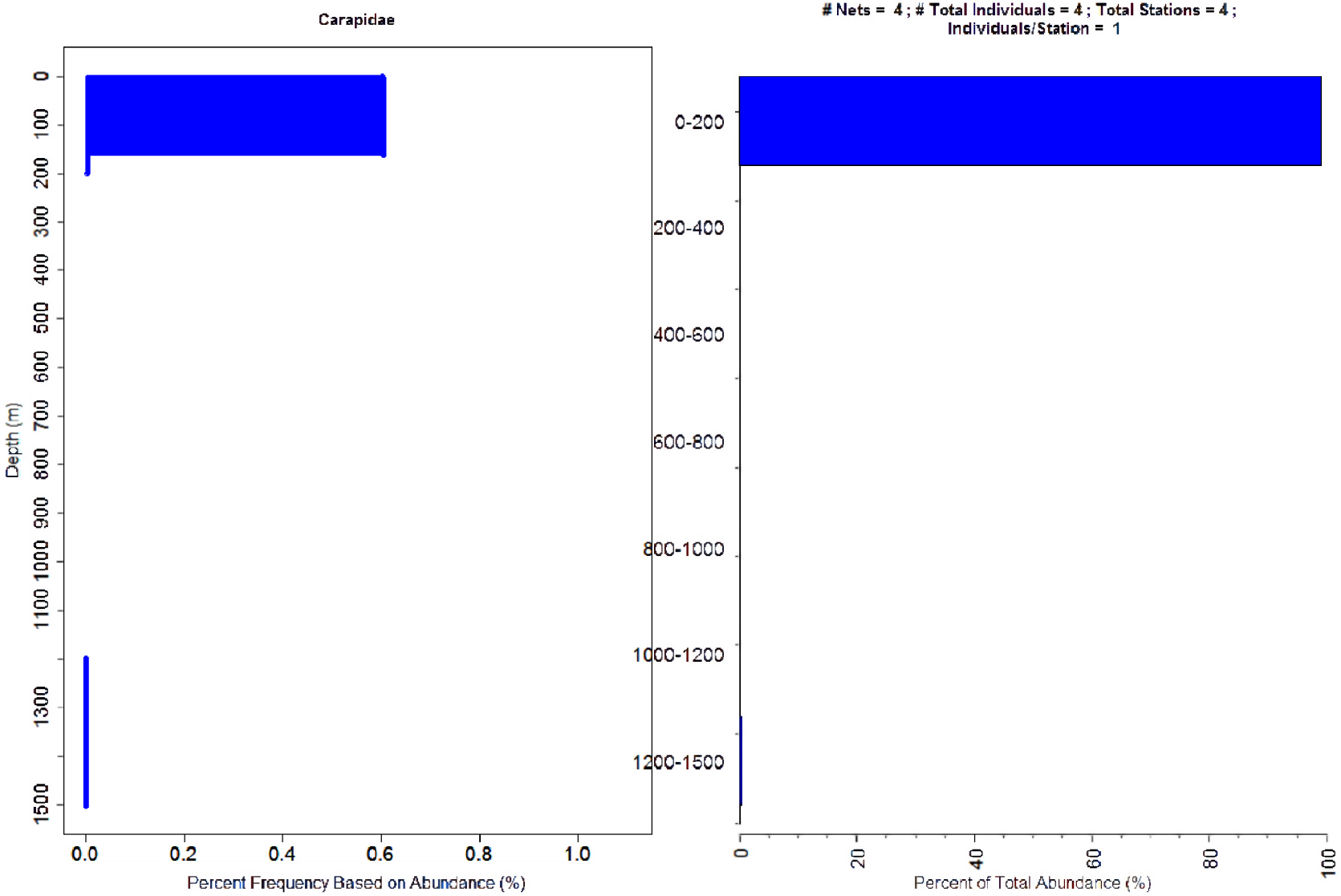
Calycophorae


Caproidae
Nets = 6 ; # Total Individuals = 6 ; Total Stations = 5 ;
Individuals/Station = 1.2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

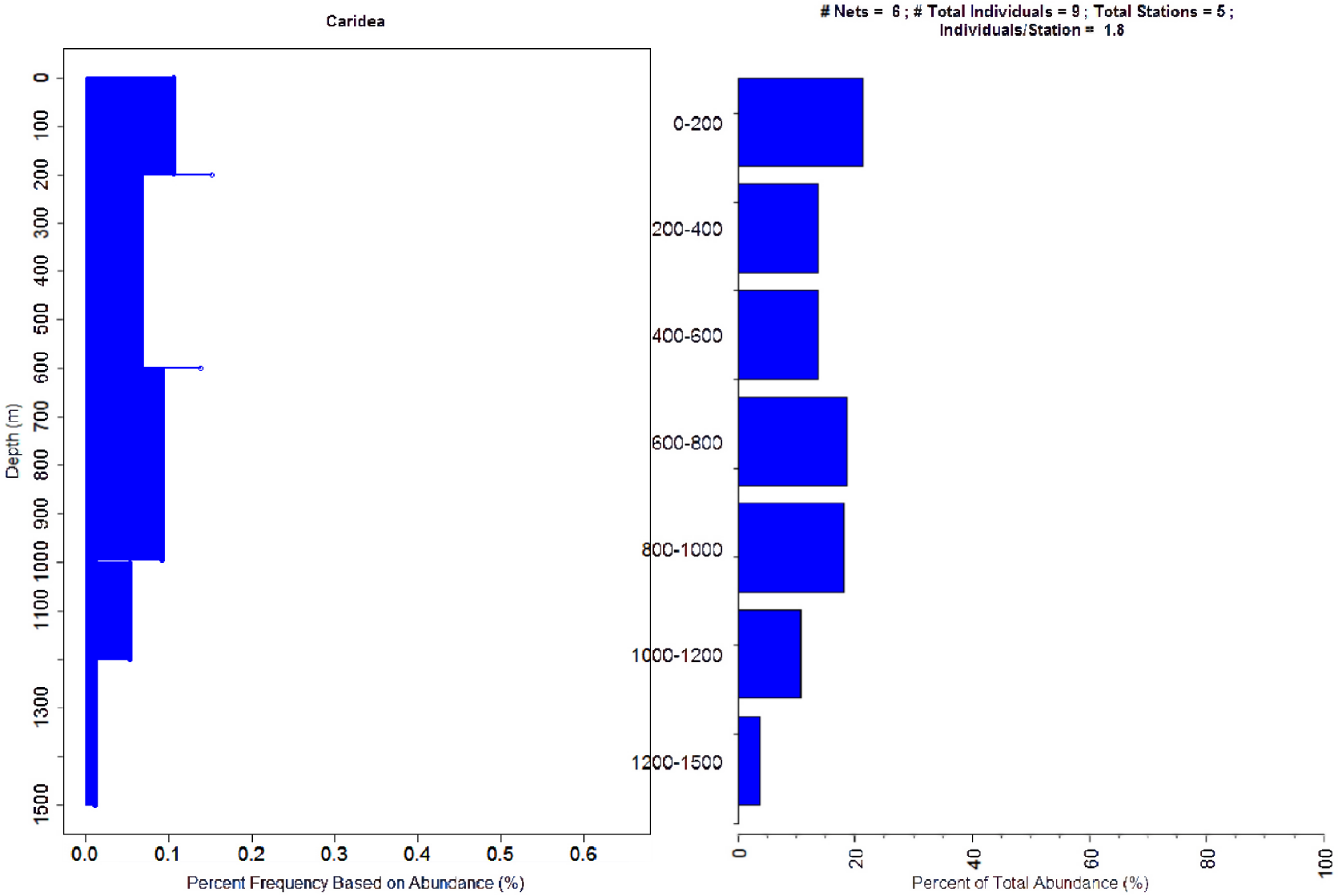
Caproidae


Carangidae
Nets = 39 ; # Total Individuals = 127 ; Total Stations = 27 ;
Individuals/Station = 4.7
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

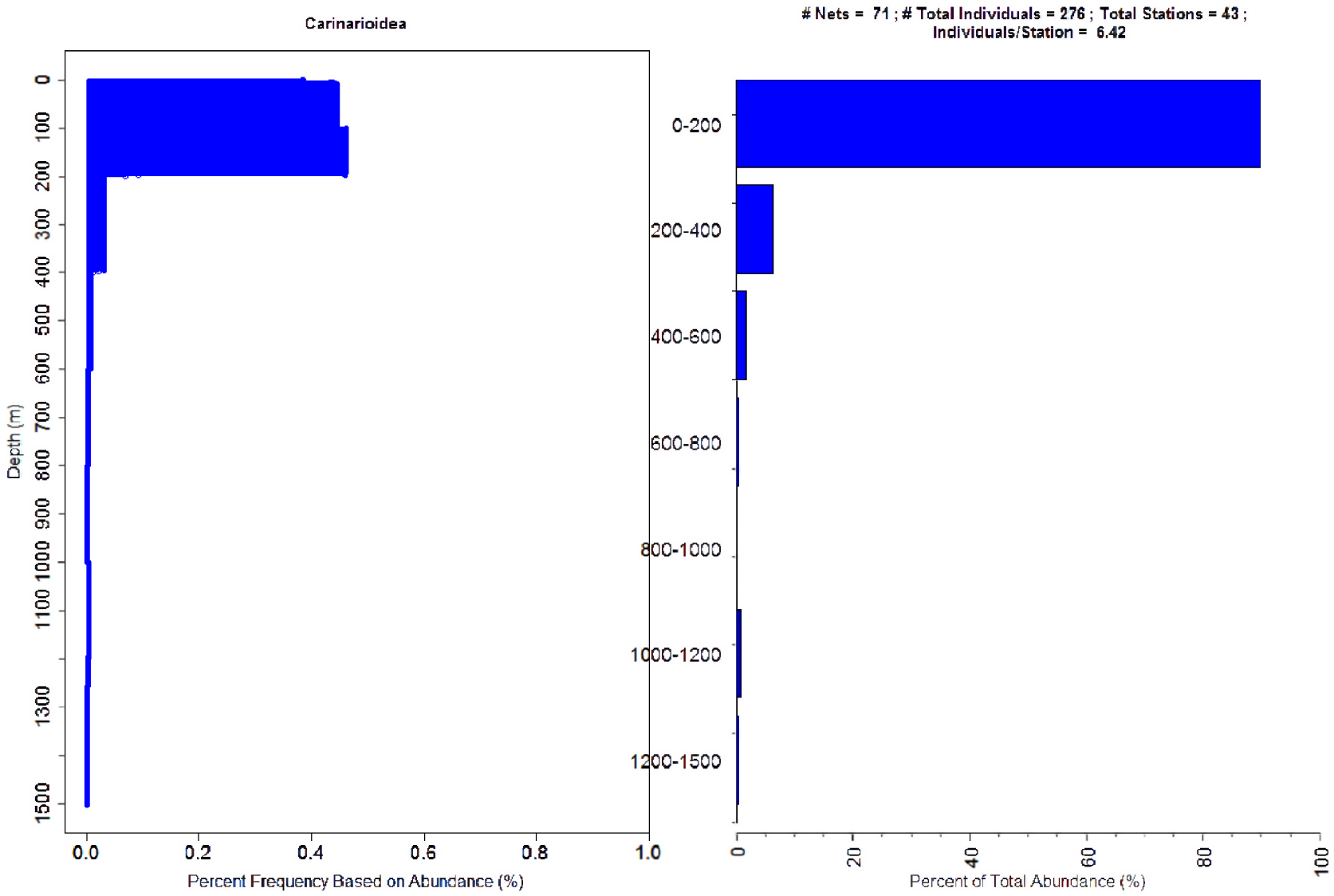
Carangidae


Carapidae
Nets = 4 ; # Total Individuals = 4 ; Total Stations = 4 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

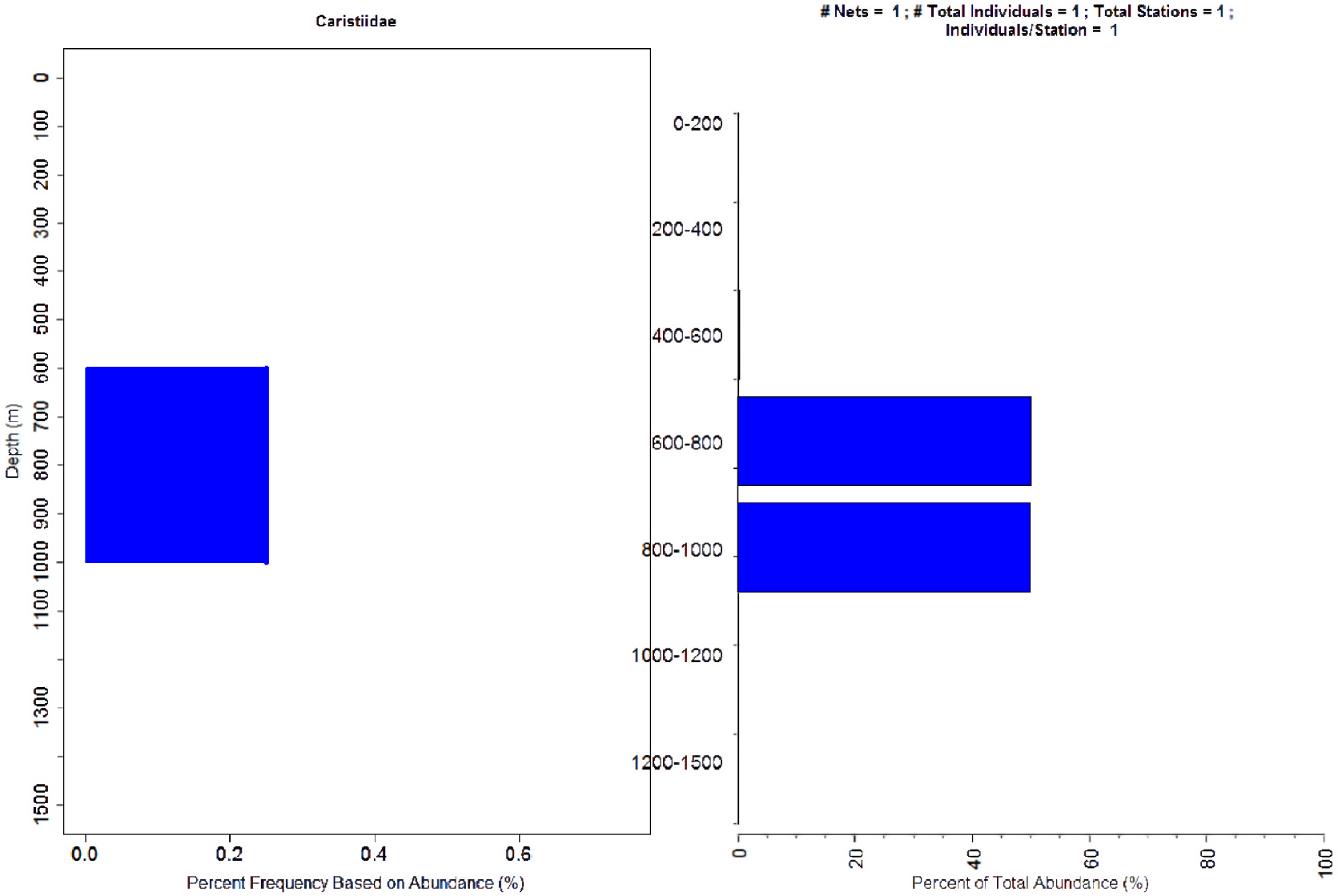
Carapidae


Caridea
Nets = 6 ; # Total Individuals = 9 ; Total Stations = 5 ;
Individuals/Station = 1.8
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

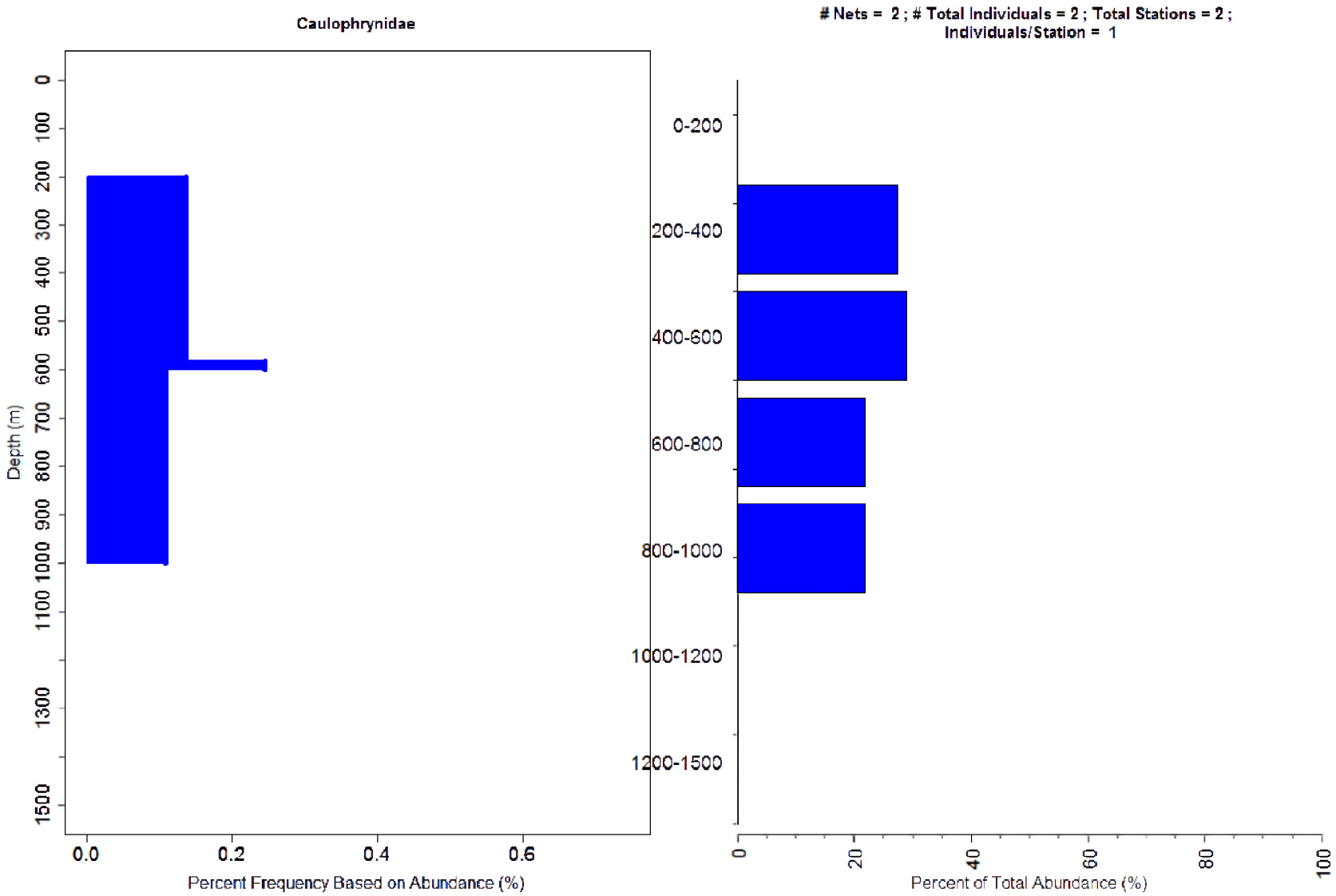
Caridea



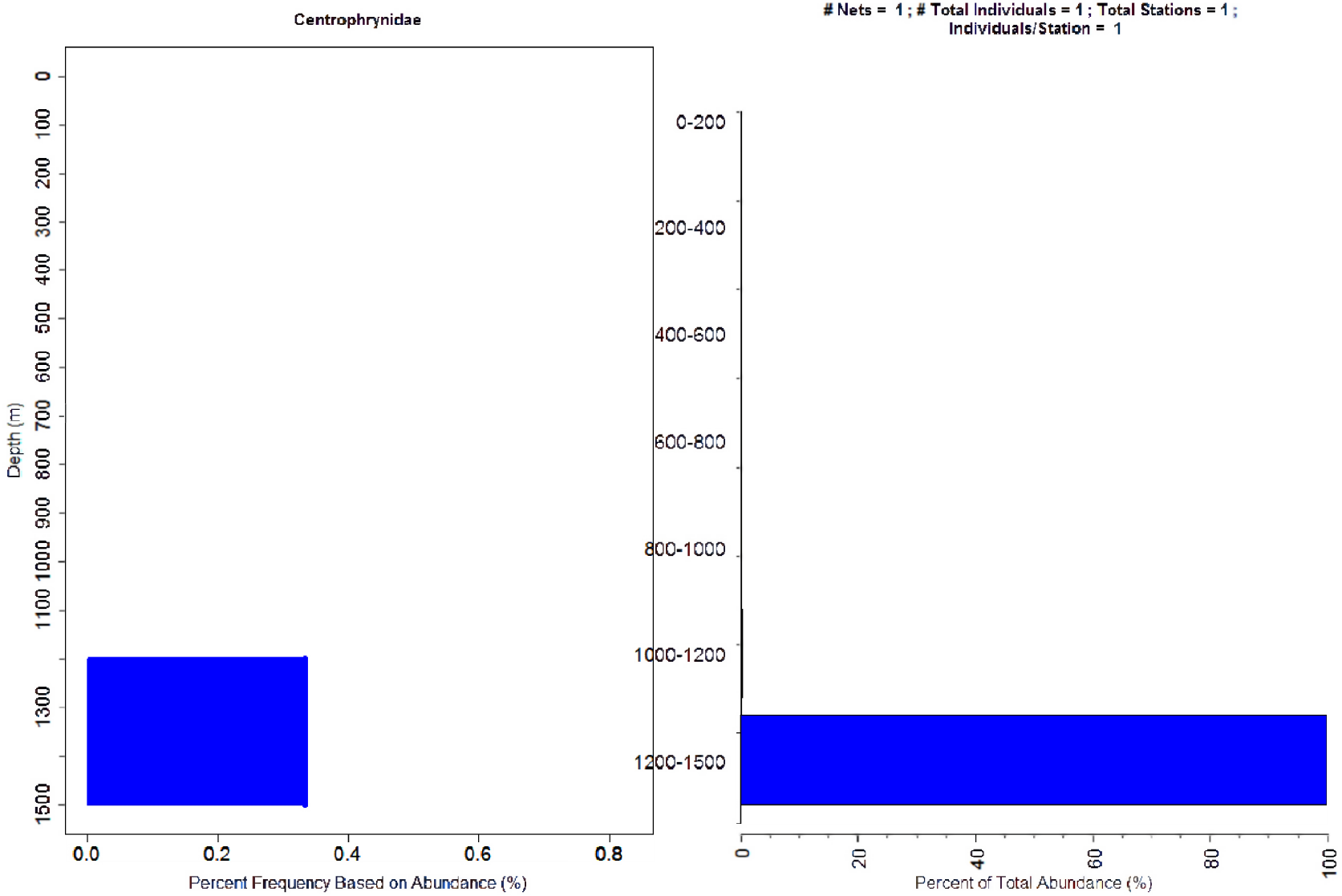
Carinarioidea



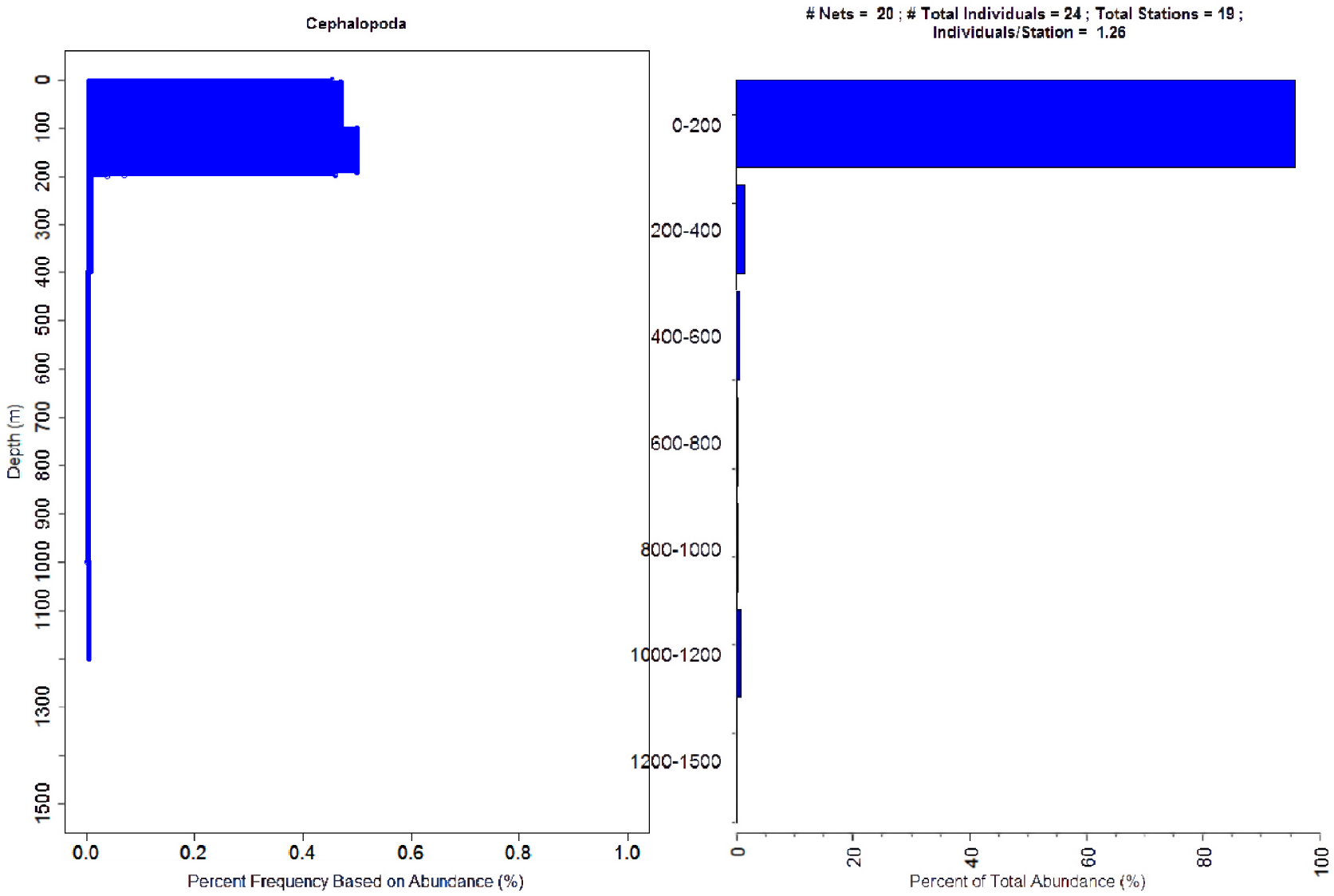
Caristiidae



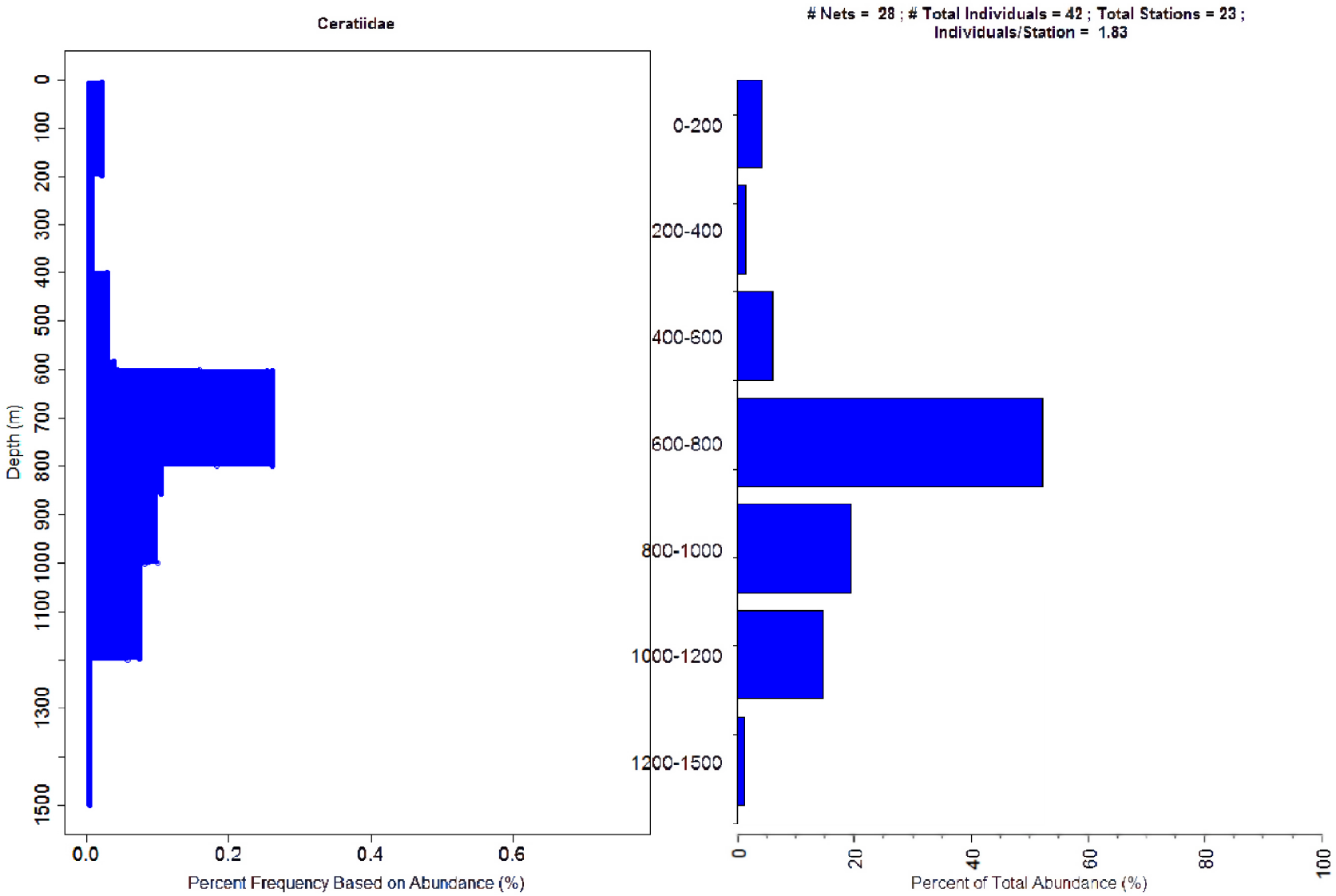
Caulophrynidae



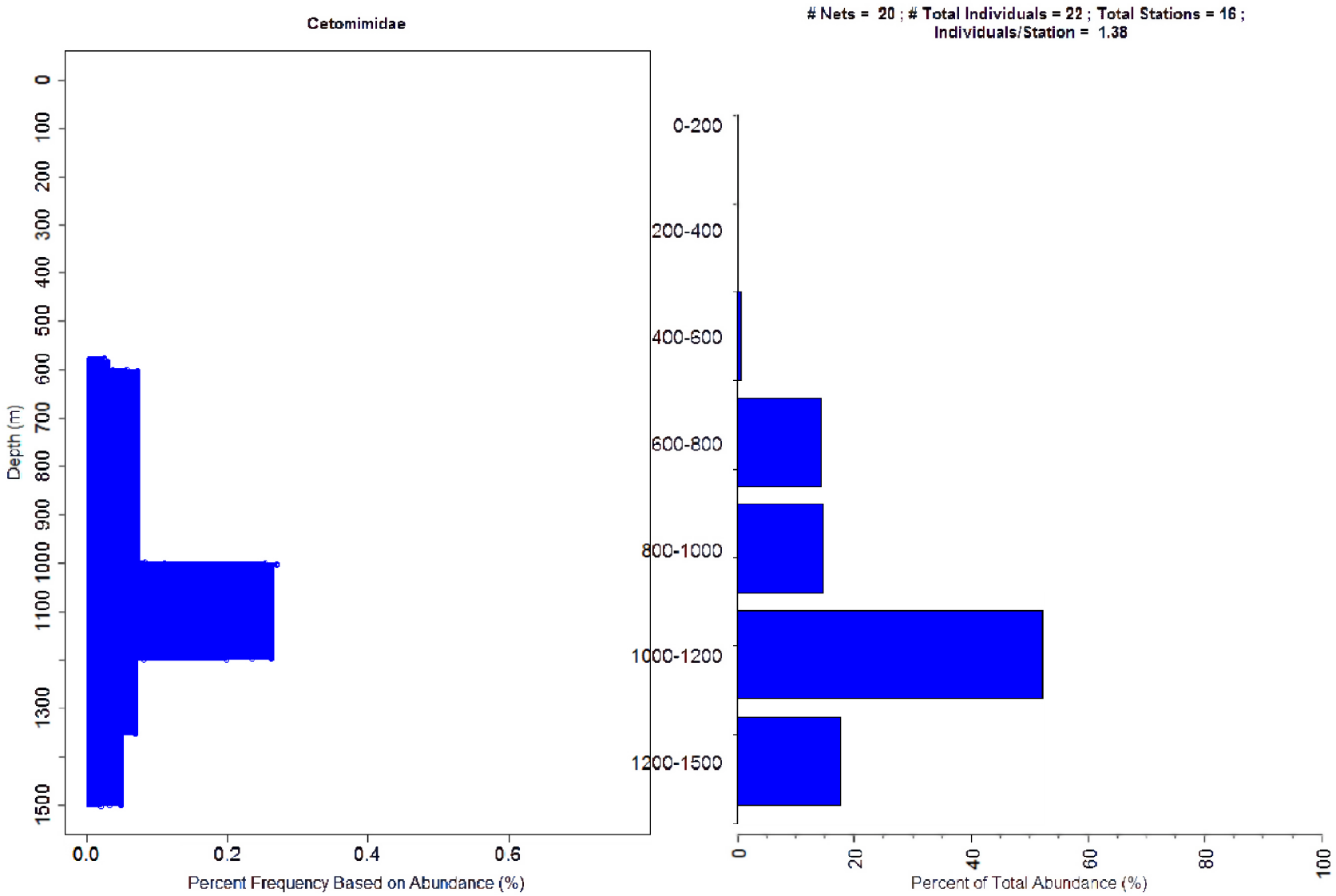
Centrophrynidae



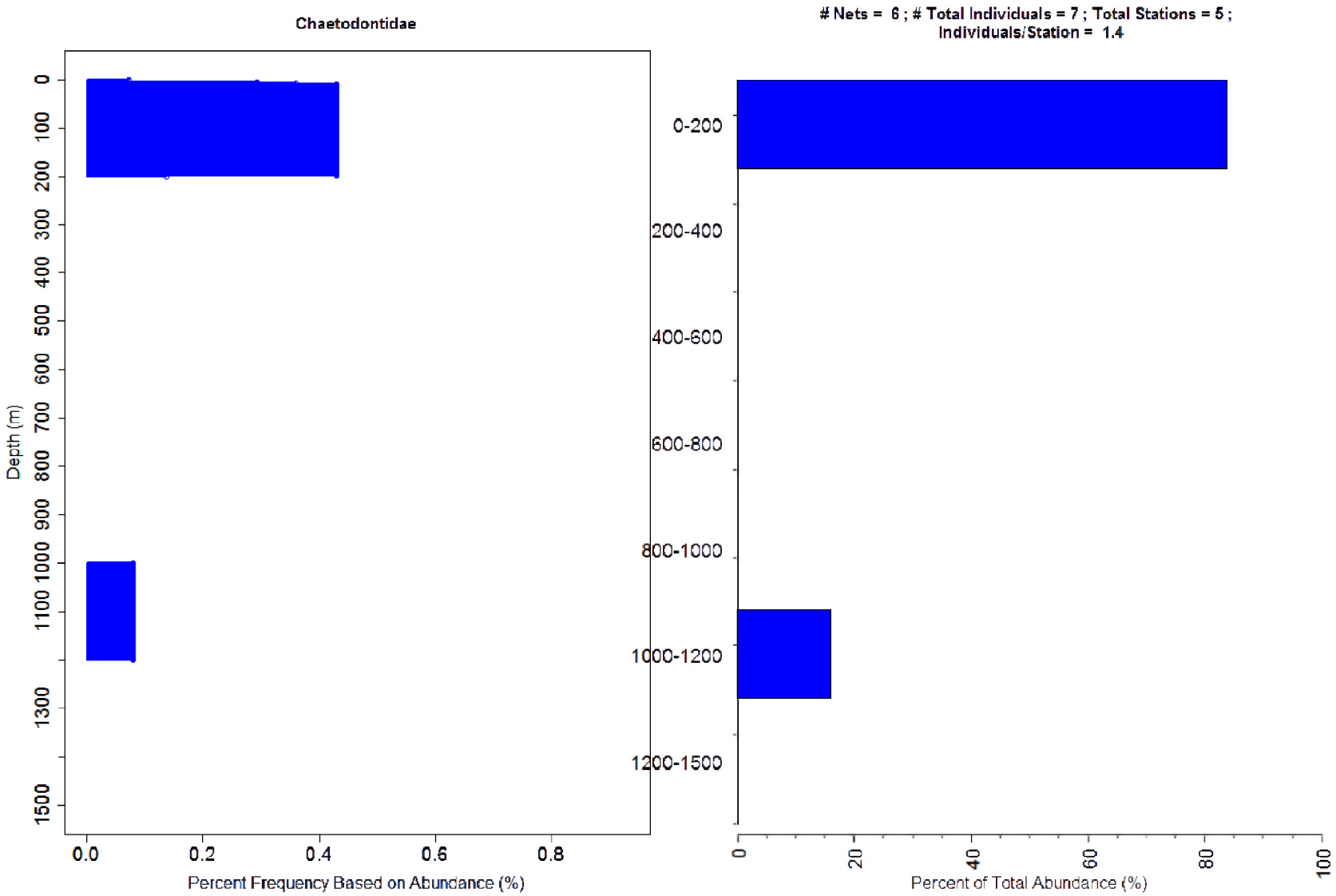
Cephalopoda


Ceratiidae
Nets = 28 ; # Total Individuals = 42 ; Total Stations = 23 ;
Individuals/Station = 1.83
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

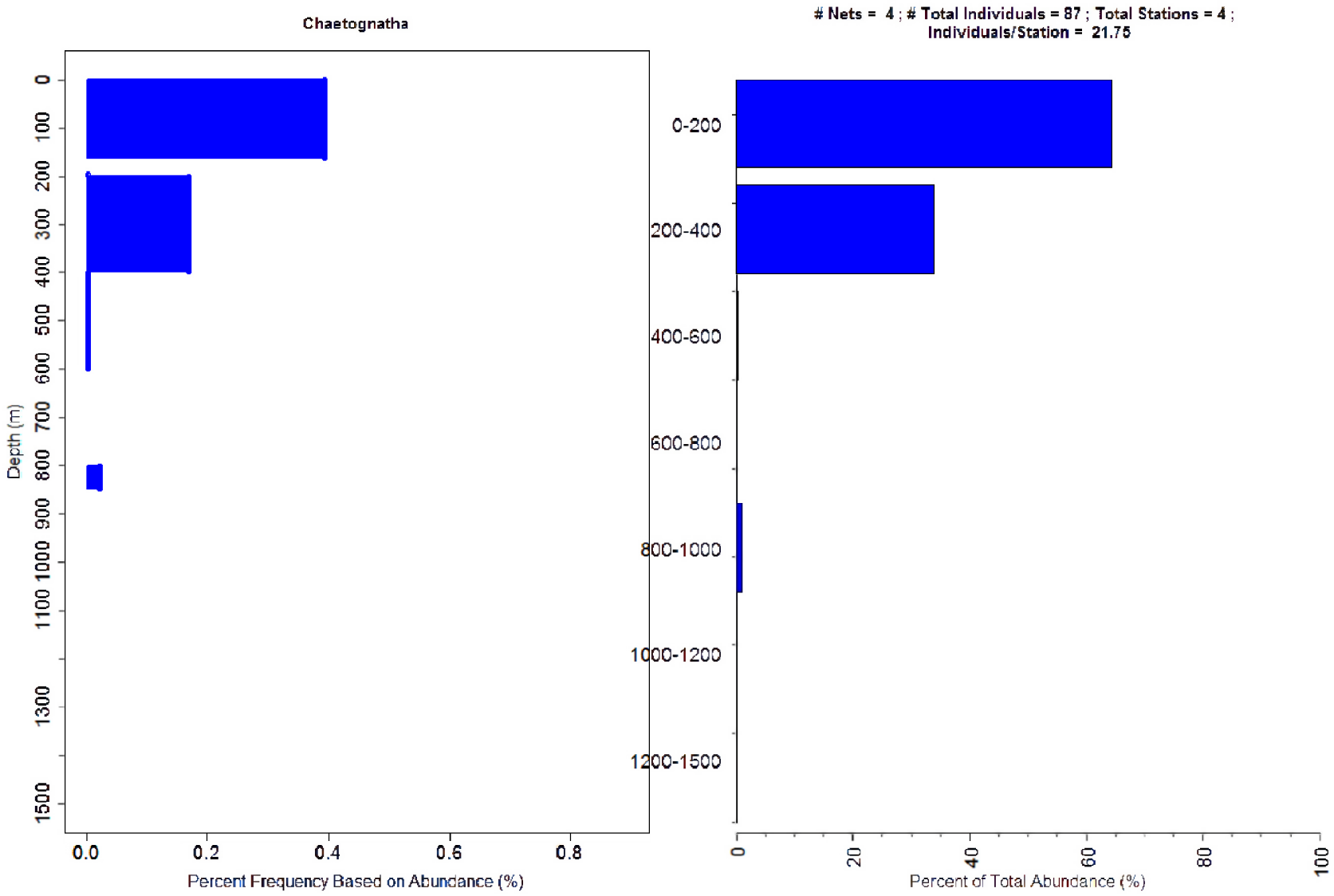
Ceratiidae



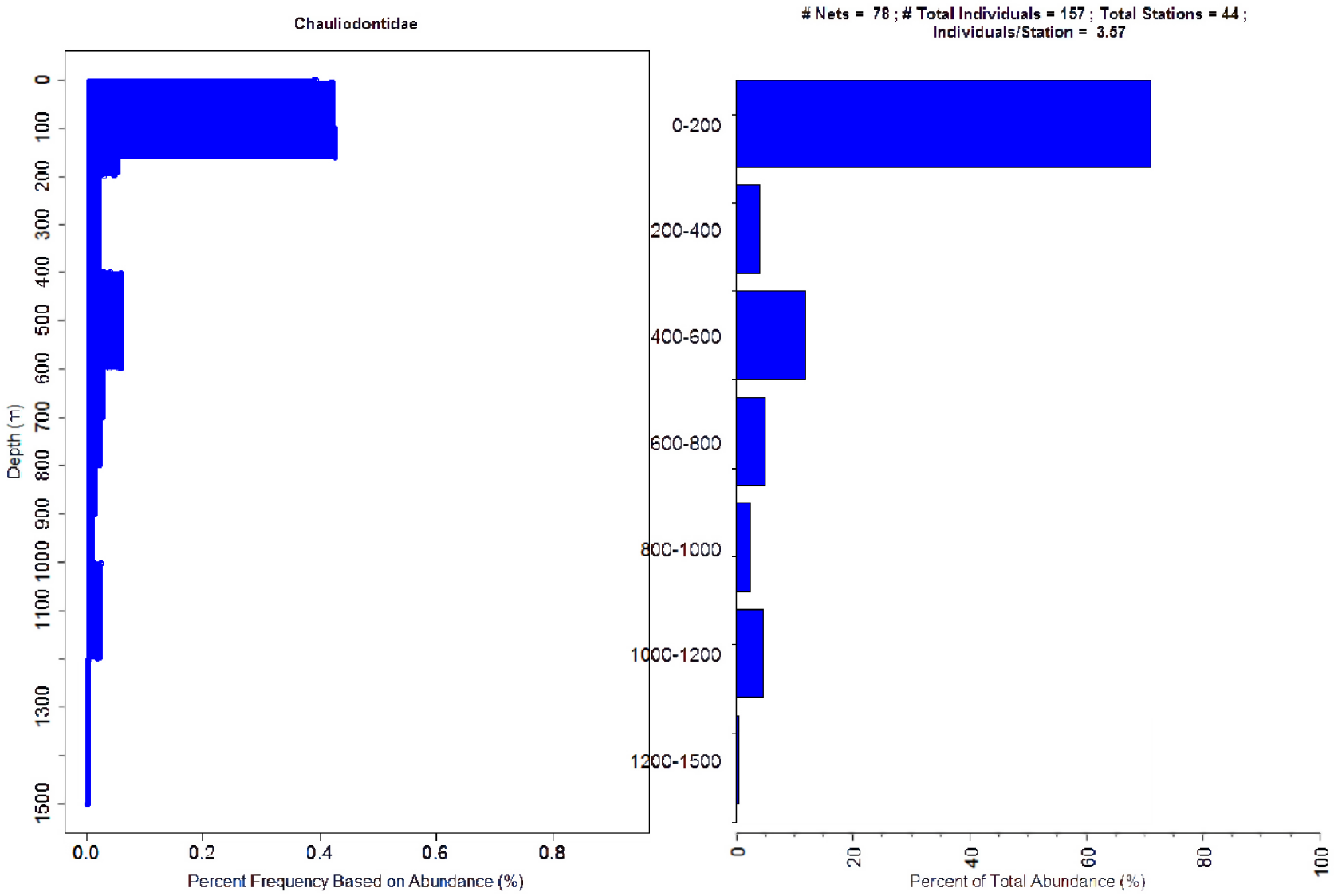
Cetomimidae



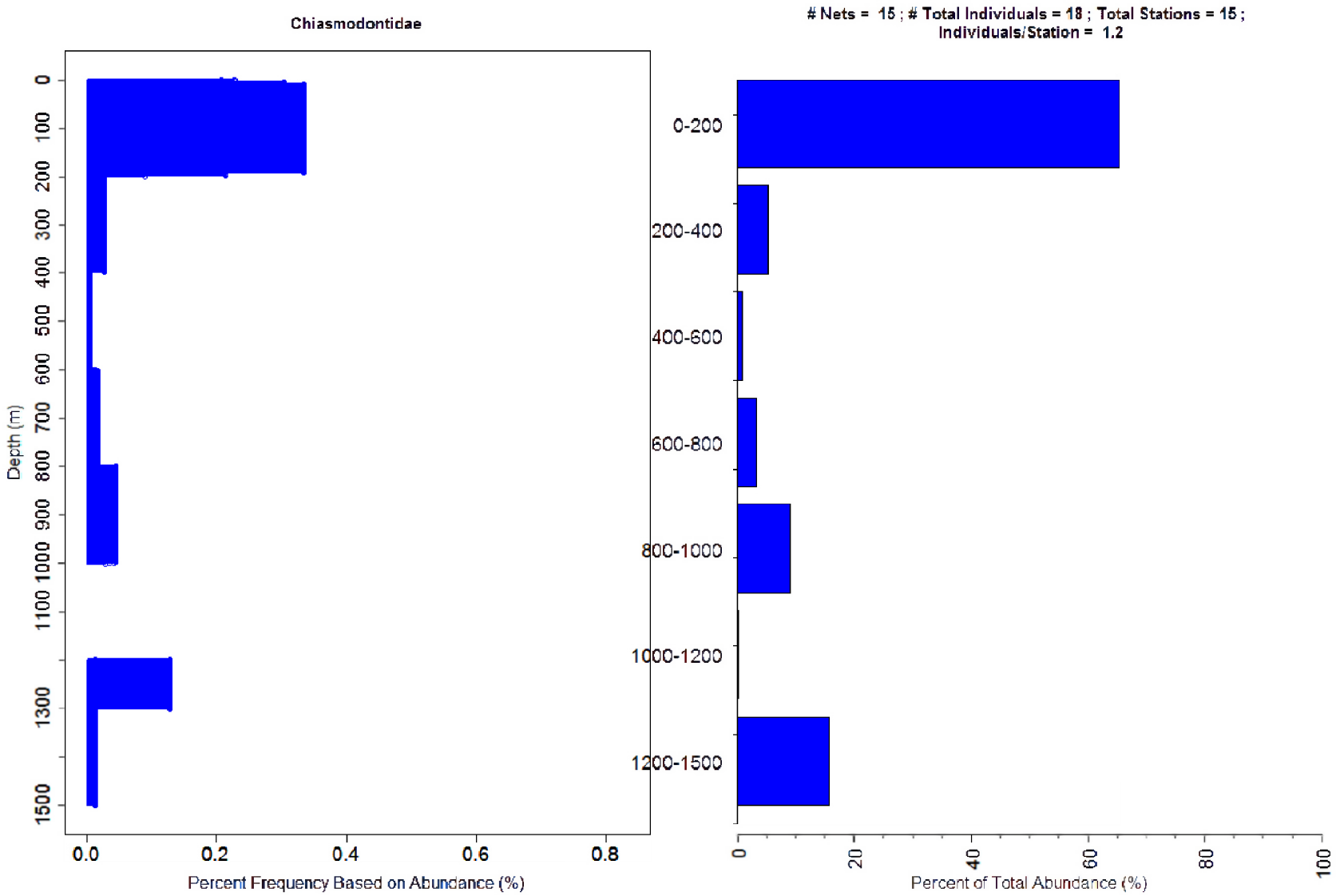
Chaetodontidae



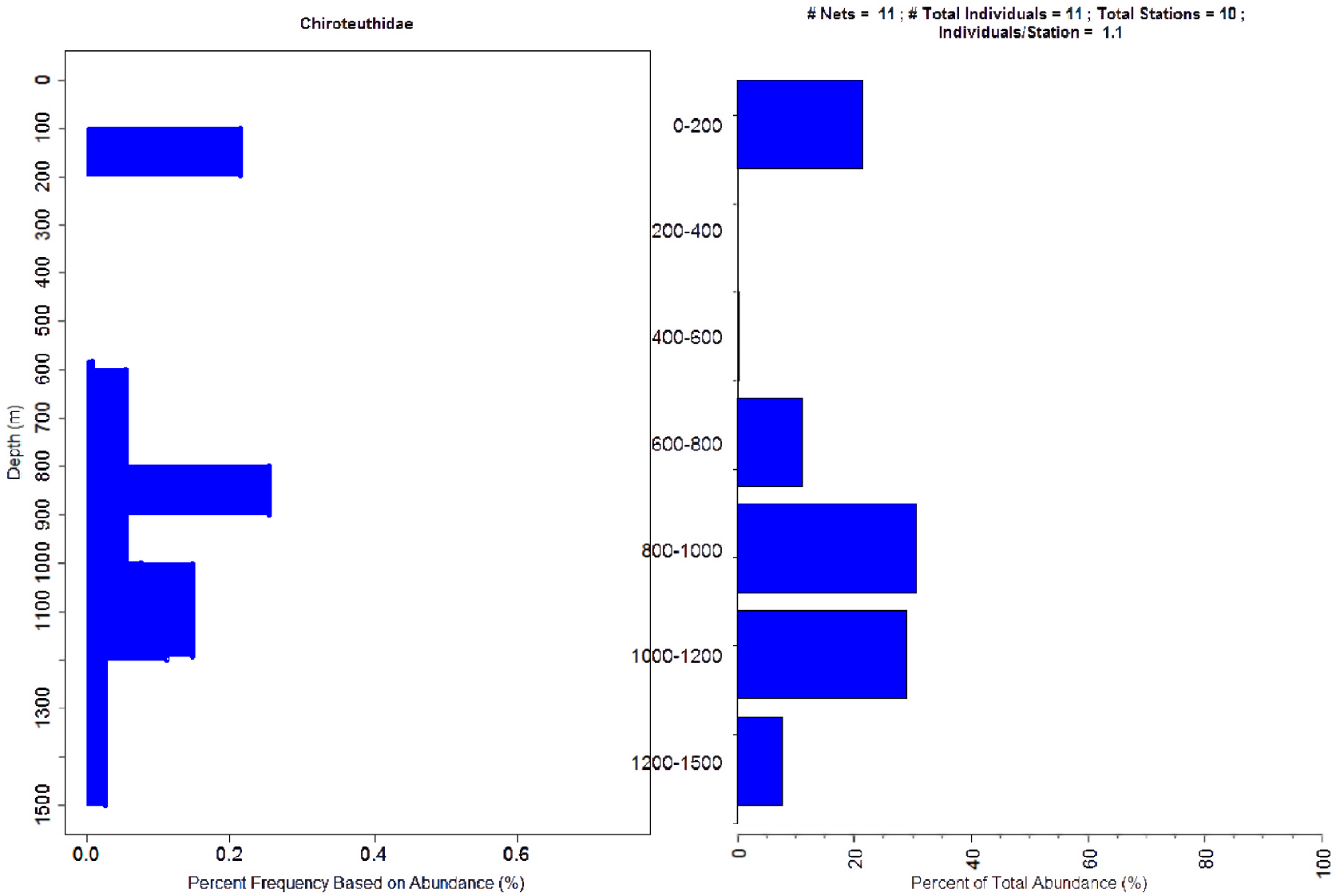
Chaetognatha



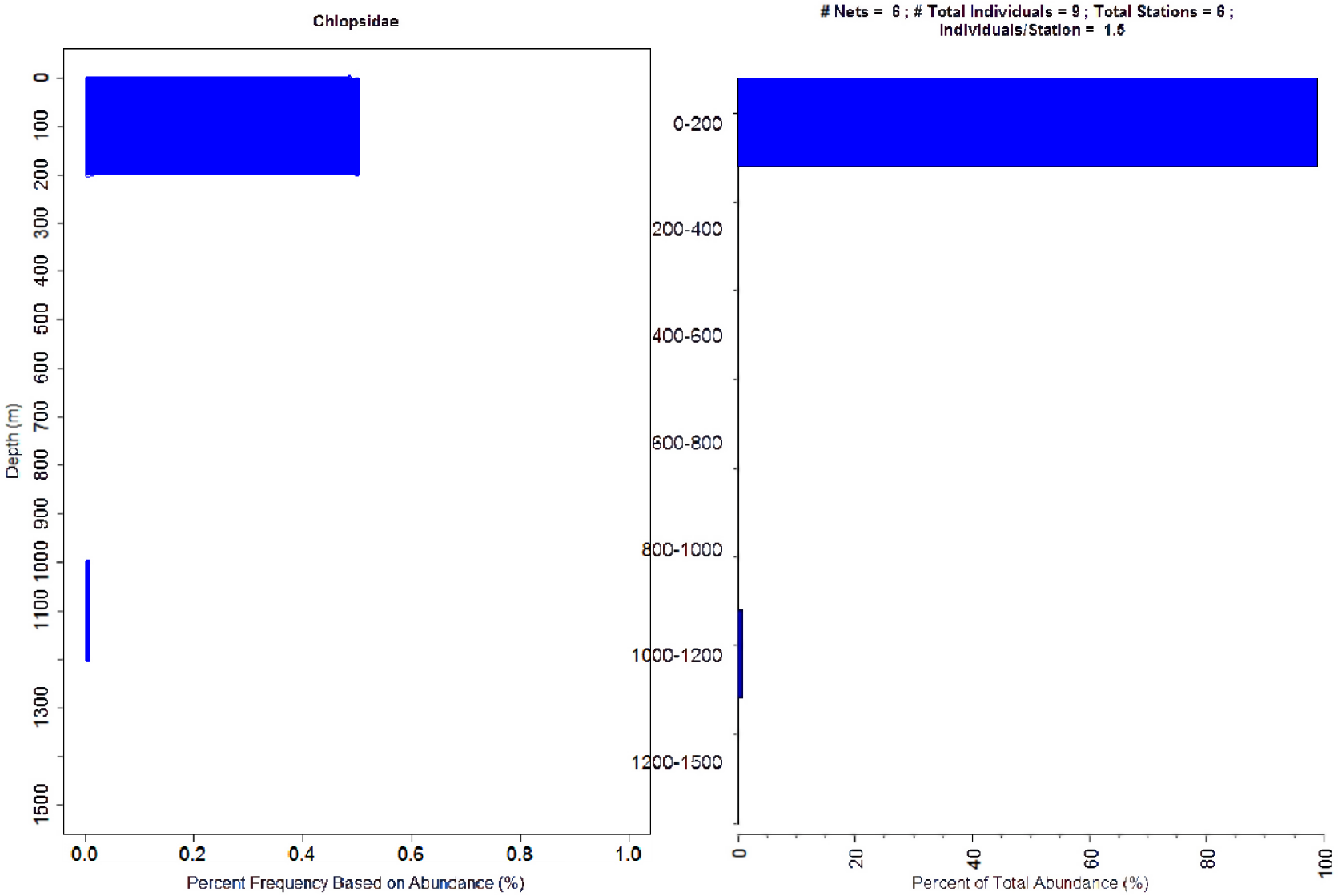
Chauliodontidae



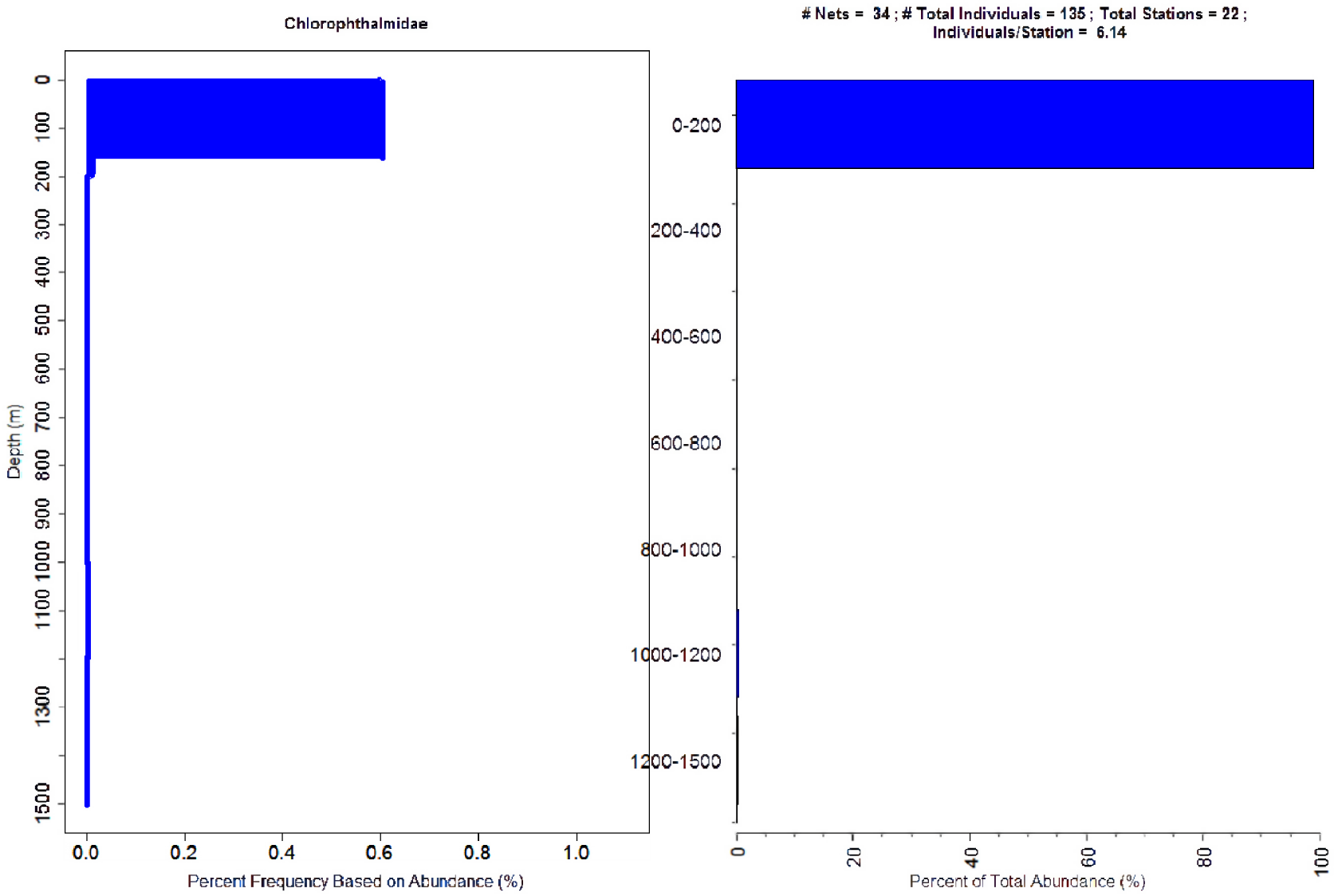
Chiasmodontidae



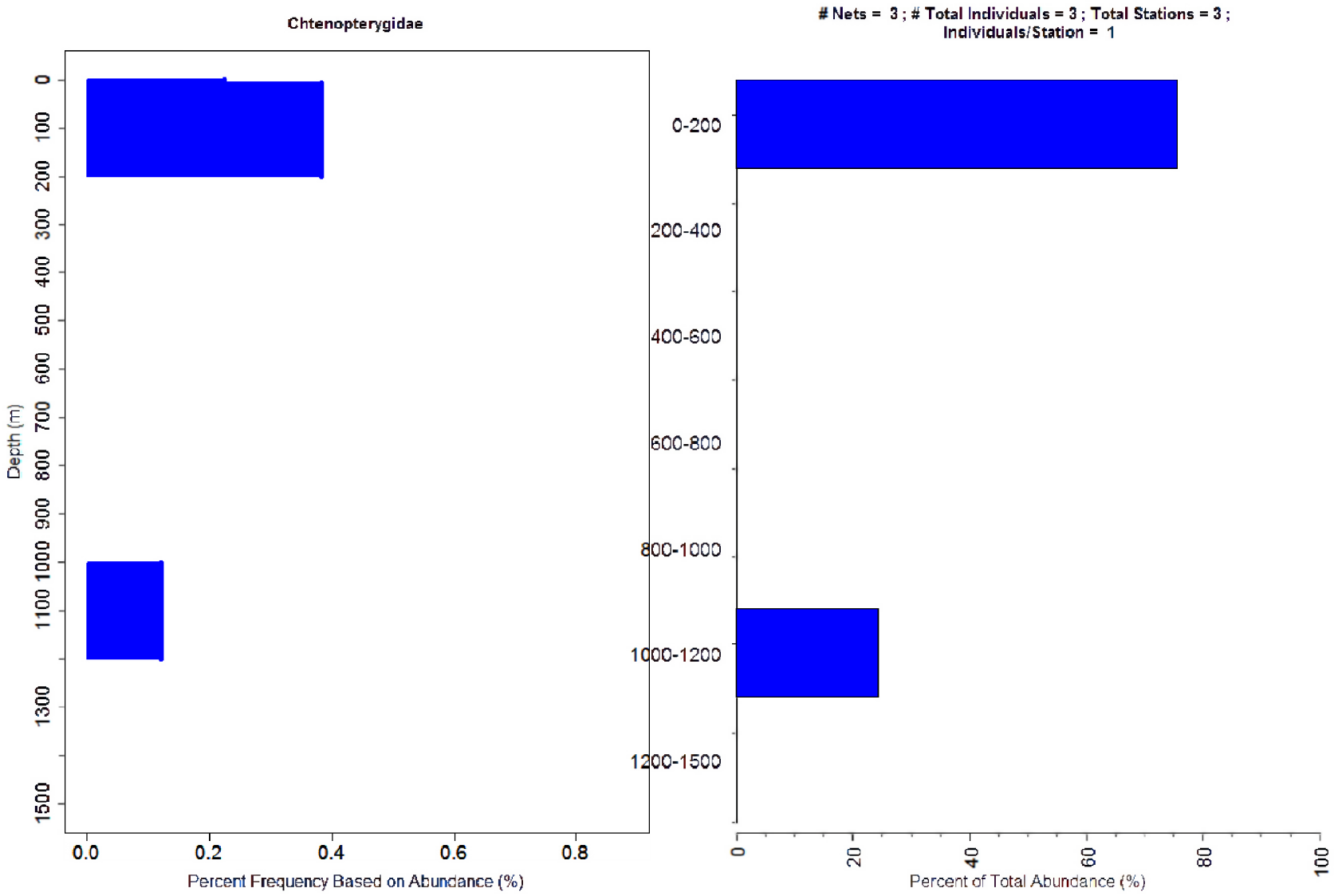
Chiroteuthidae


Chlopsidae
Nets = 6 ; # Total Individuals = 9 ; Total Stations = 6 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

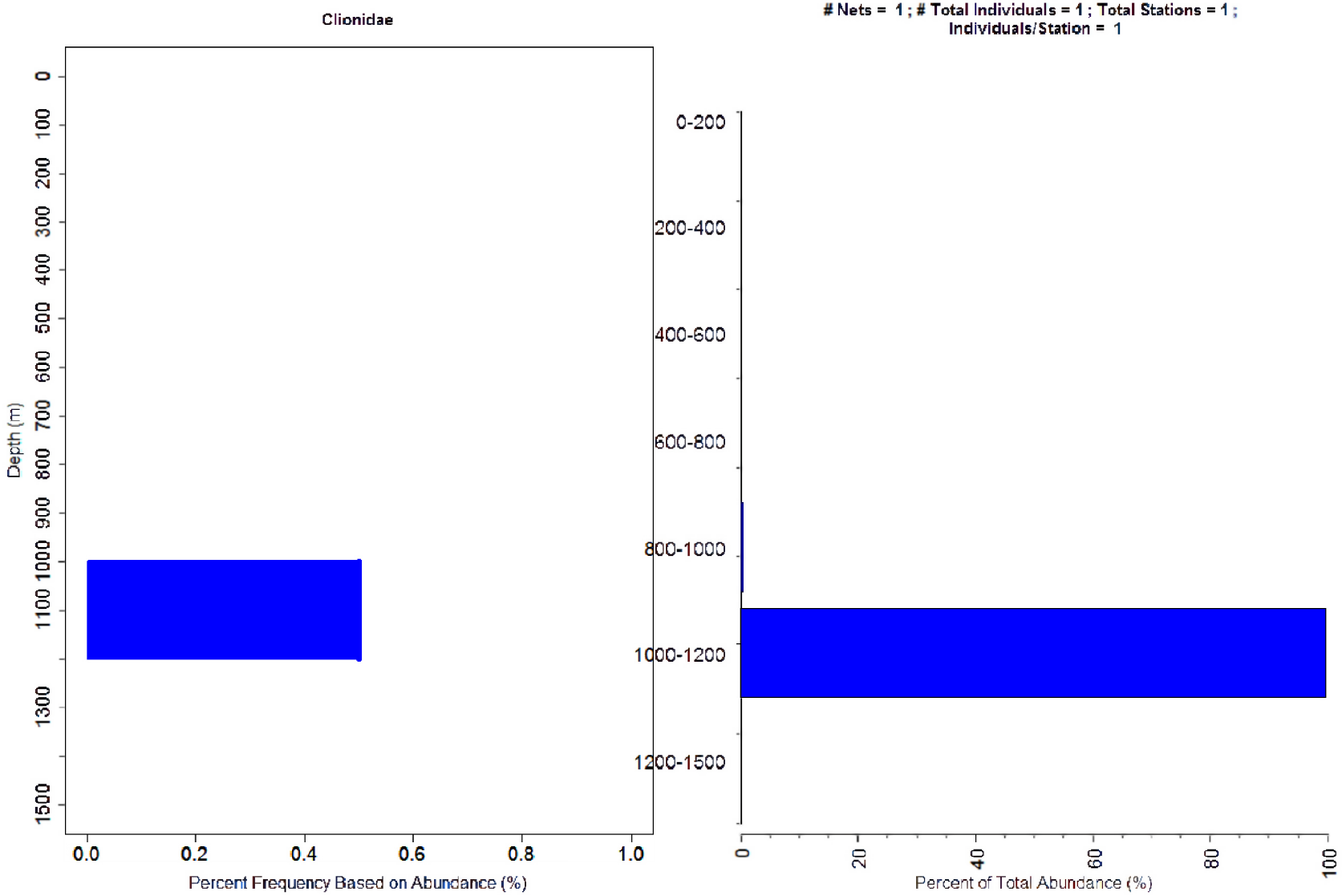
Chlopsidae



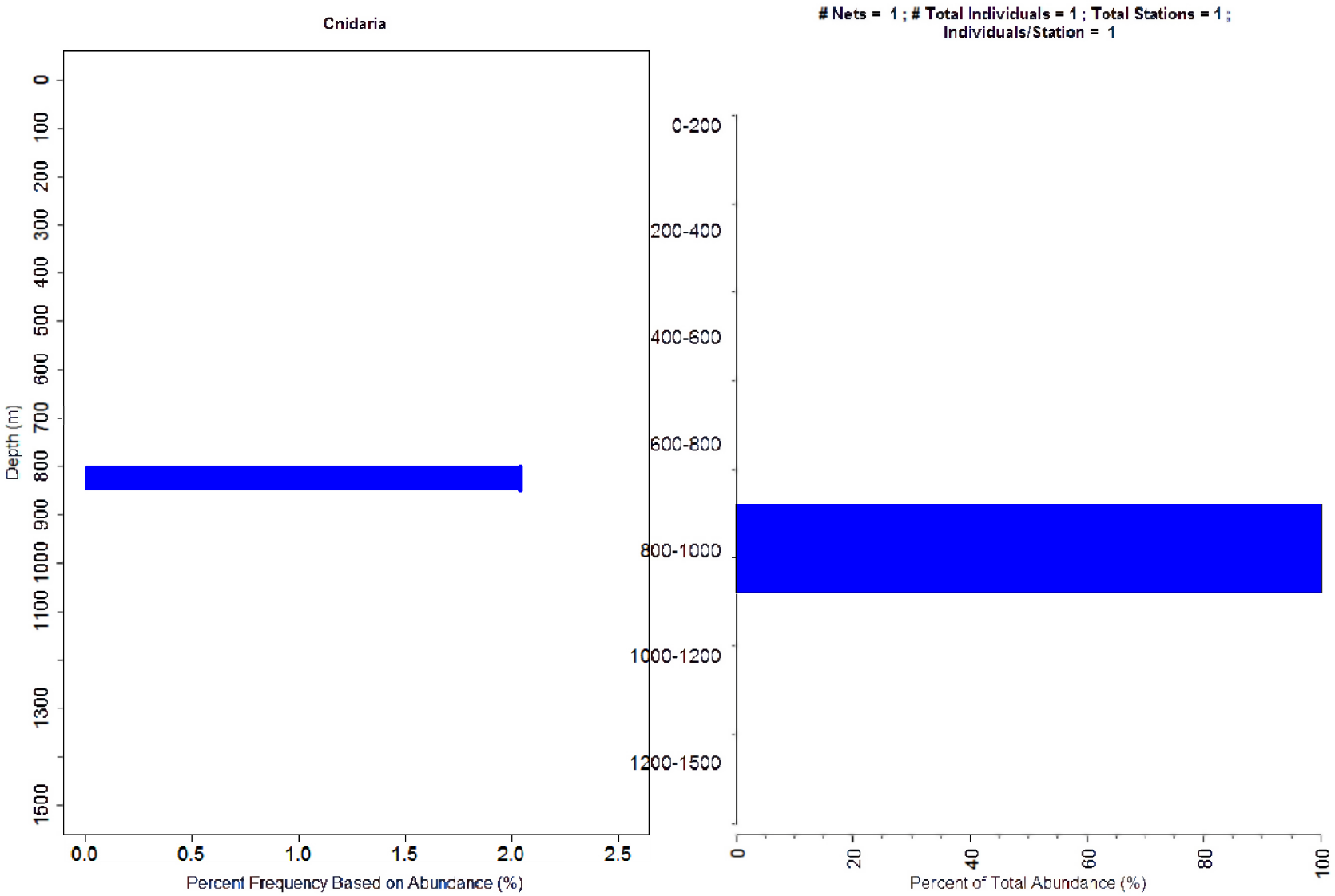
Chlorophthalmidae



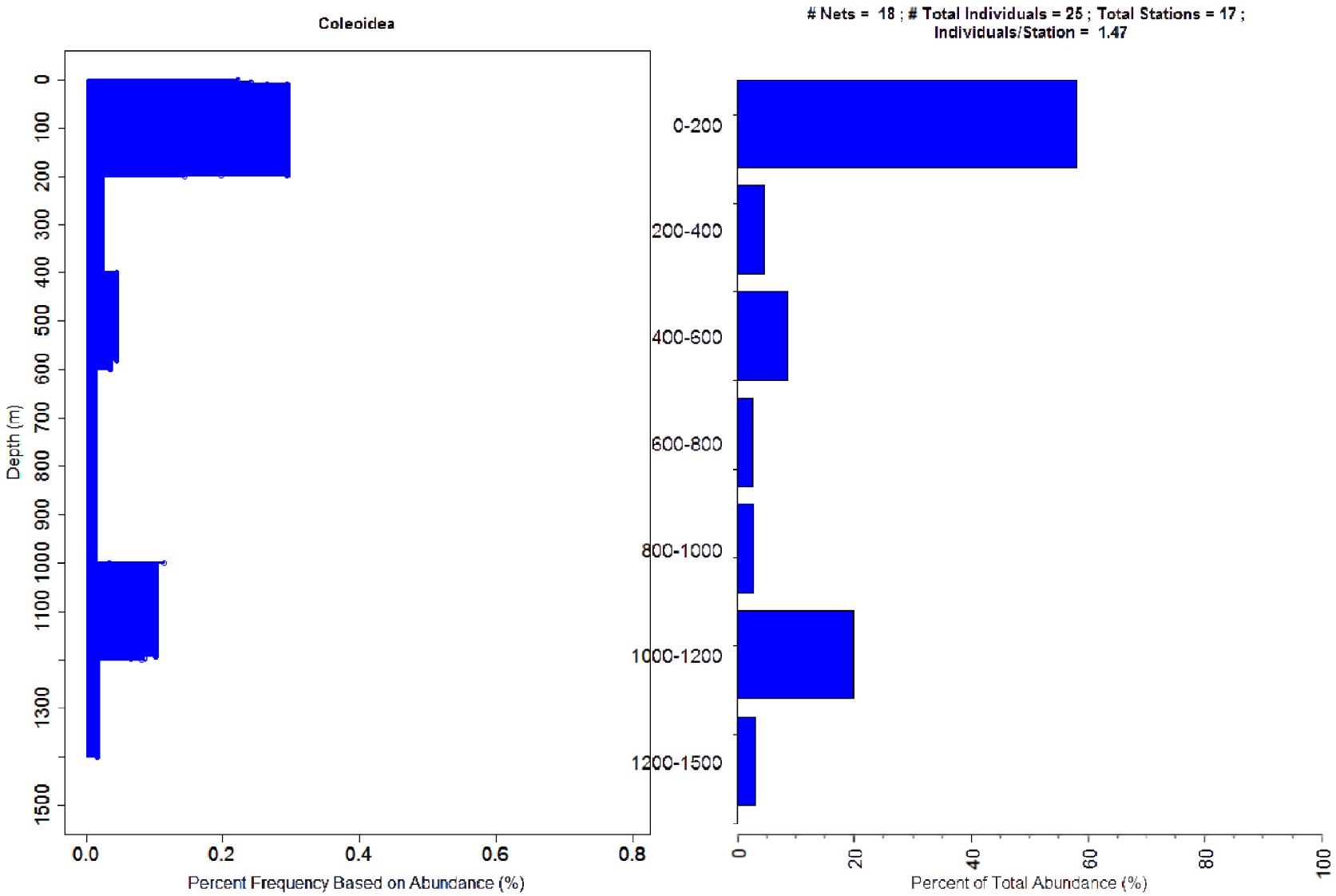
Chtenopterygidae


Clionidae
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

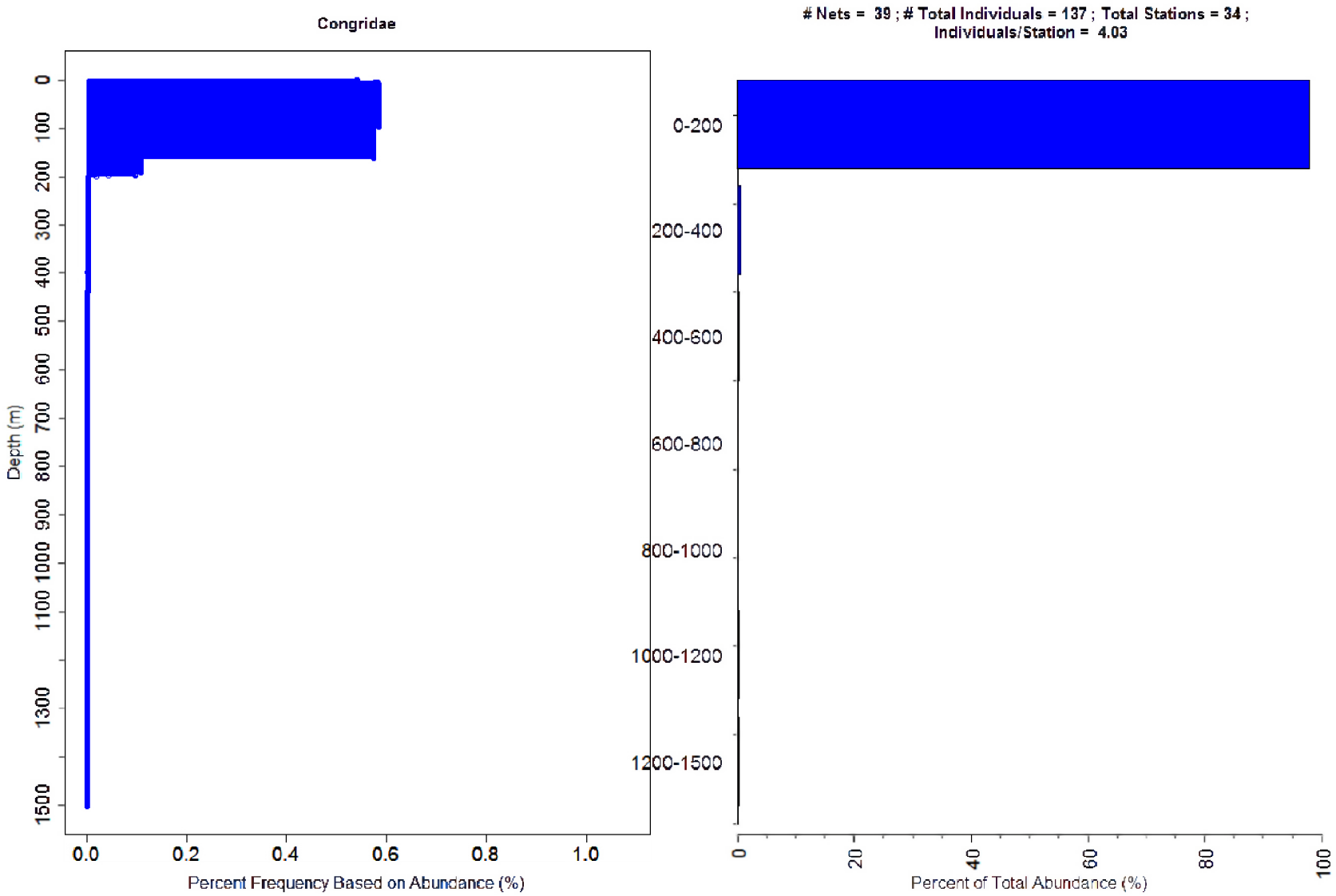
Clionidae


Cnidaria
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

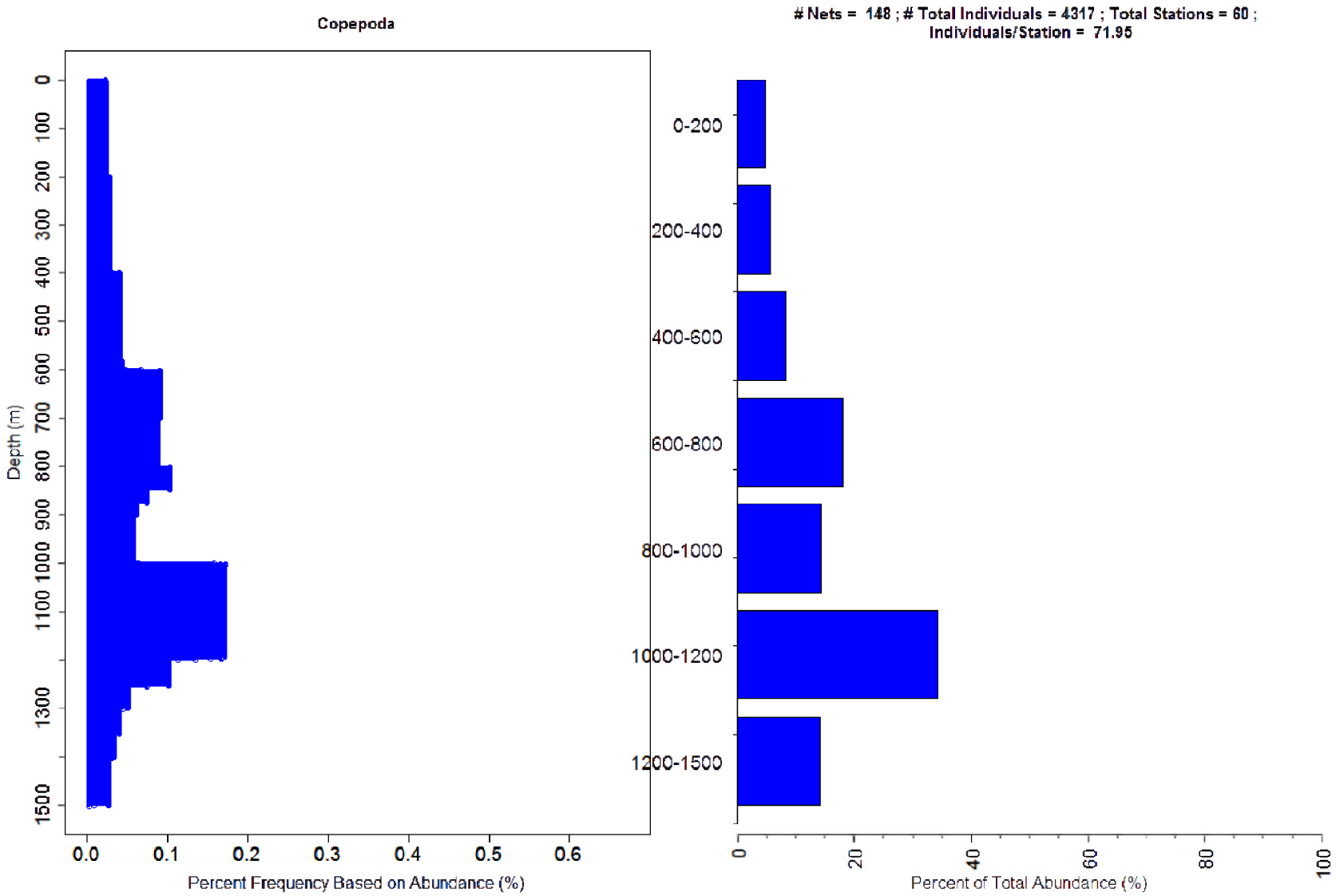
Cnidaria


Coleoidea
Nets = 18 ; # Total Individuals = 25 ; Total Stations = 17 ;
Individuals/Station = 1.47
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

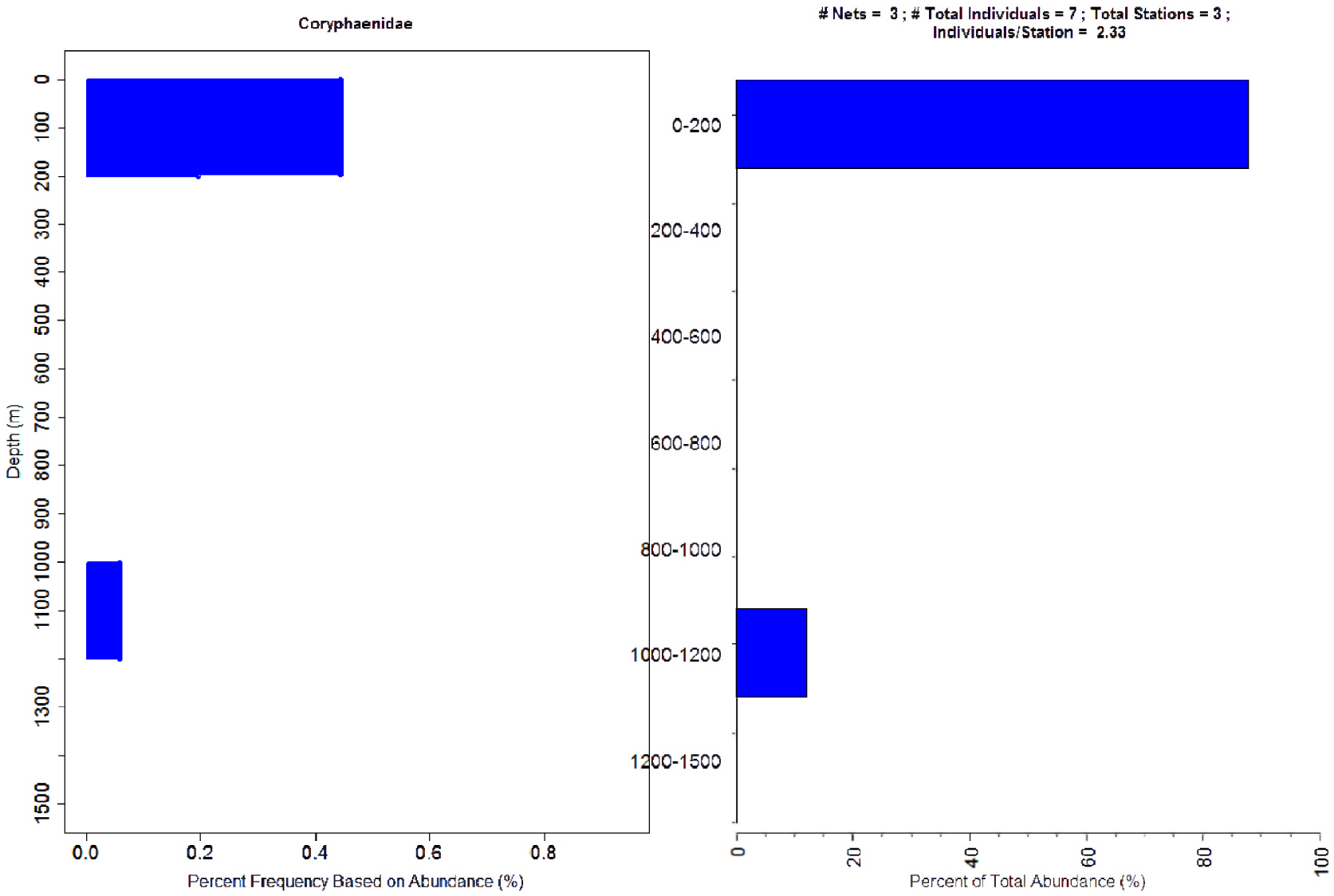
Coleoidea


Congridae
Nets = 39 ; # Total Individuals = 137 ; Total Stations = 34 ;
Individuals/Station = 4.03
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

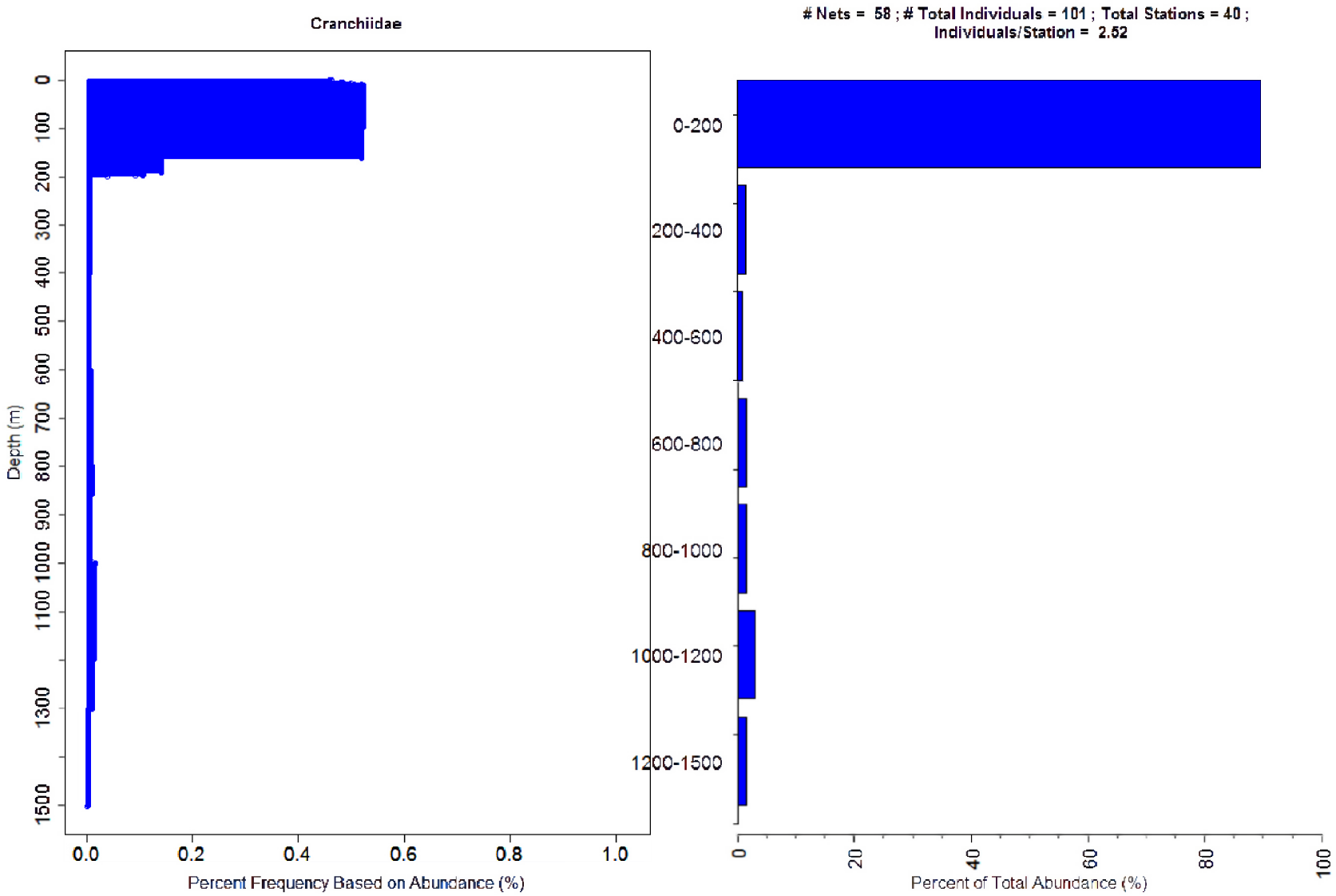
Congridae


Copepoda
Nets = 148 ; # Total Individuals = 4317 ; Total Stations = 60 ;
Individuals/Station = 71.95
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

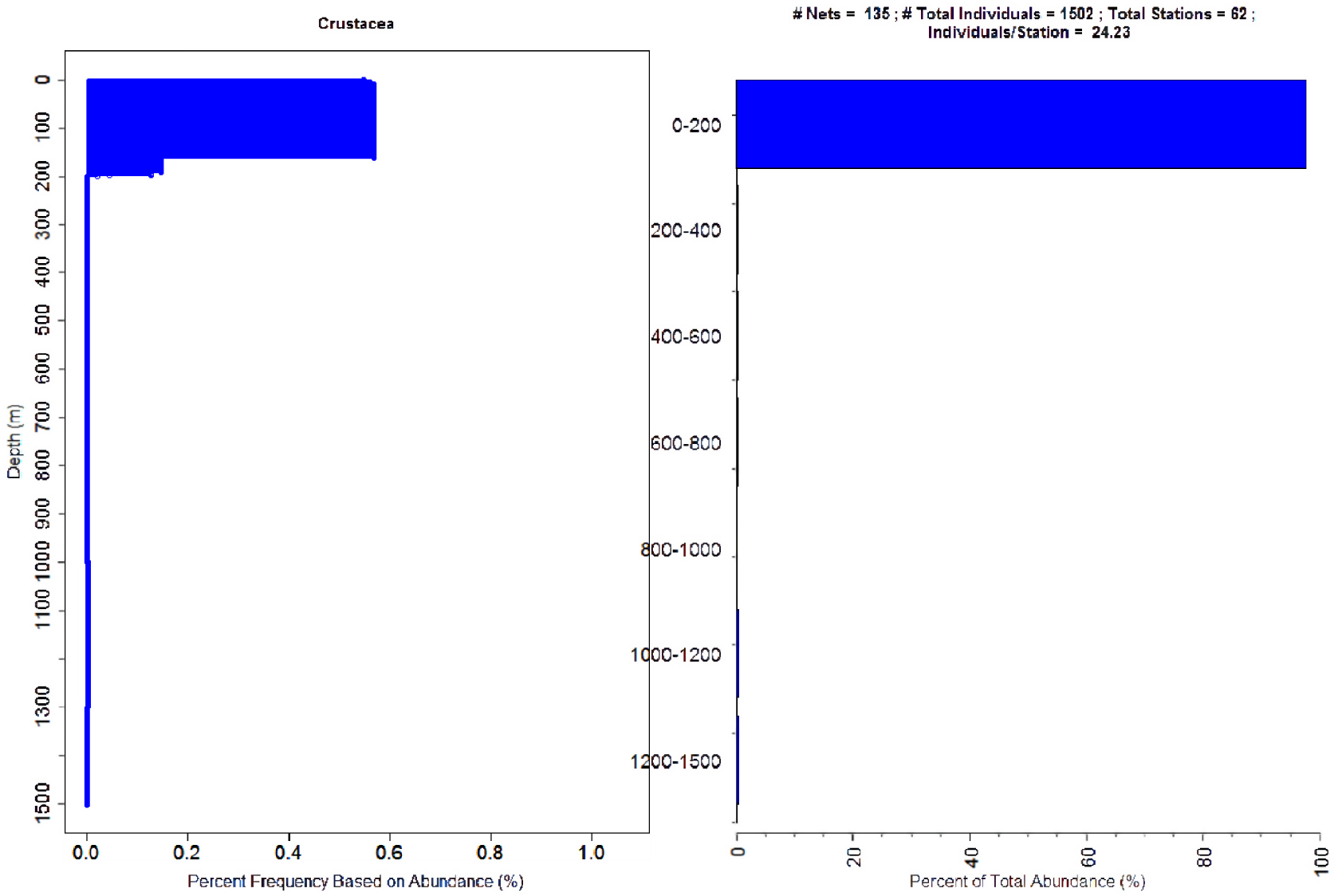
Copepoda



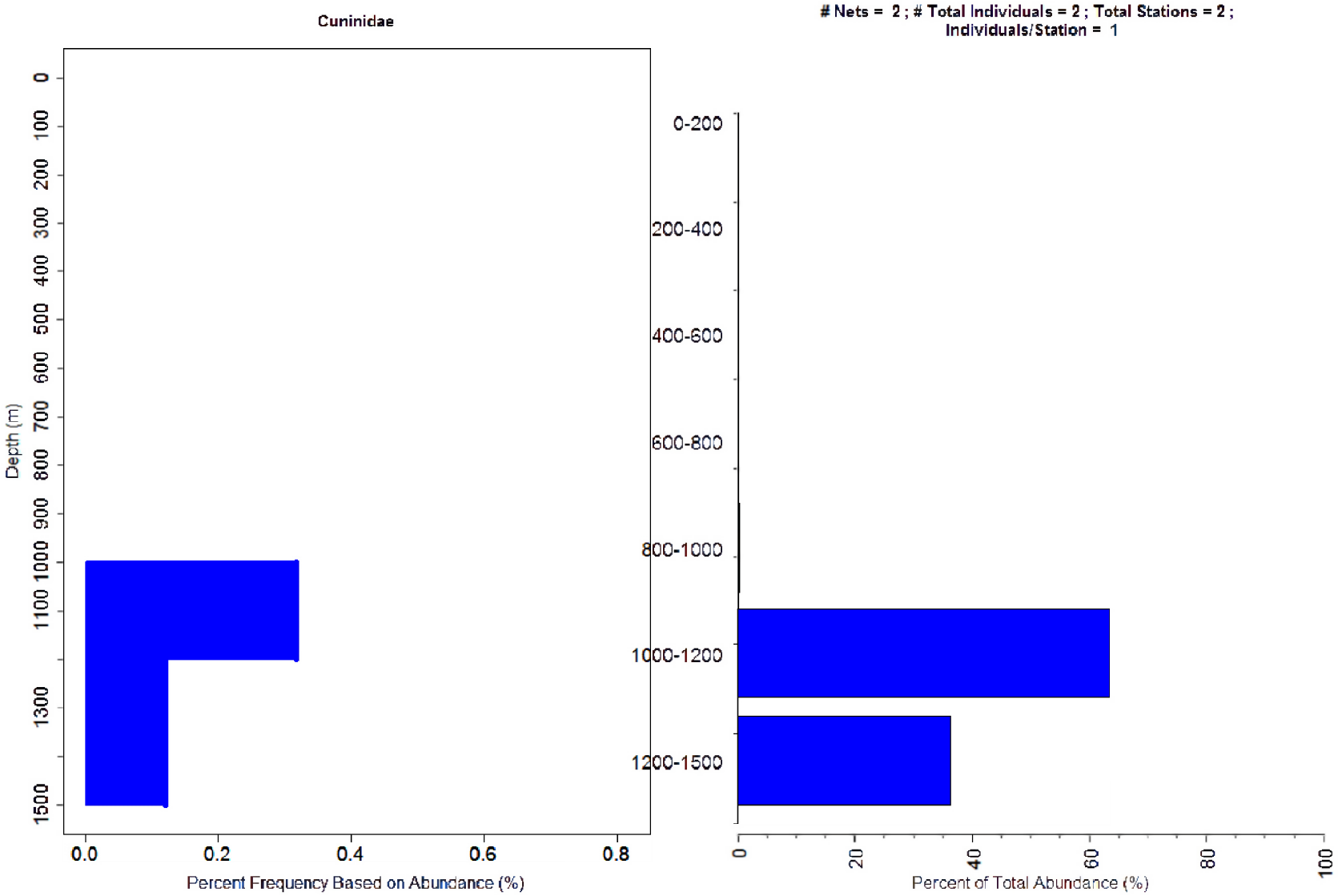
Coryphaenidae



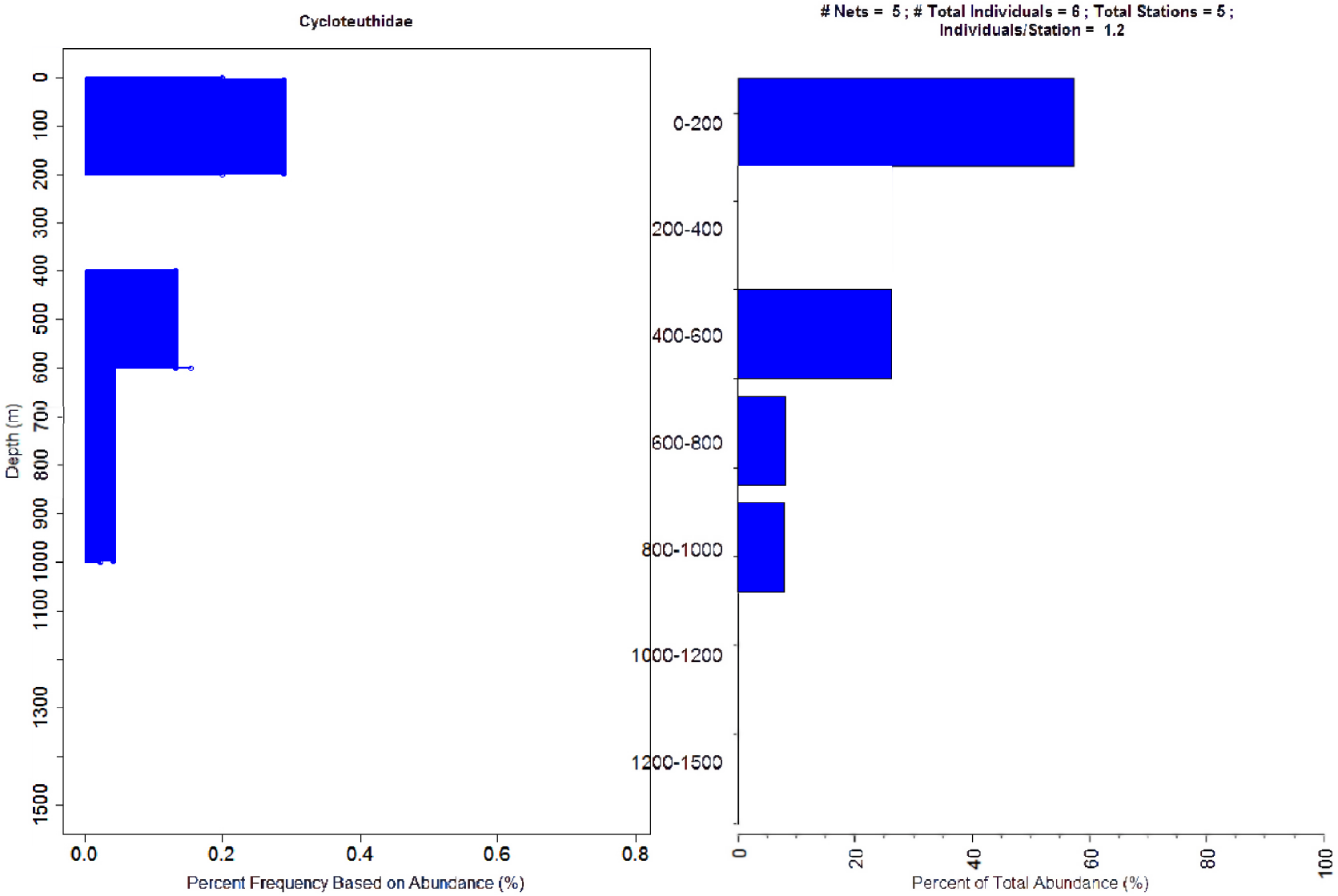
Cranchiidae


Crustacea
Nets = 135 ; # Total Individuals = 1502 ; Total Stations = 62 ;
Individuals/Station = 24.23
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

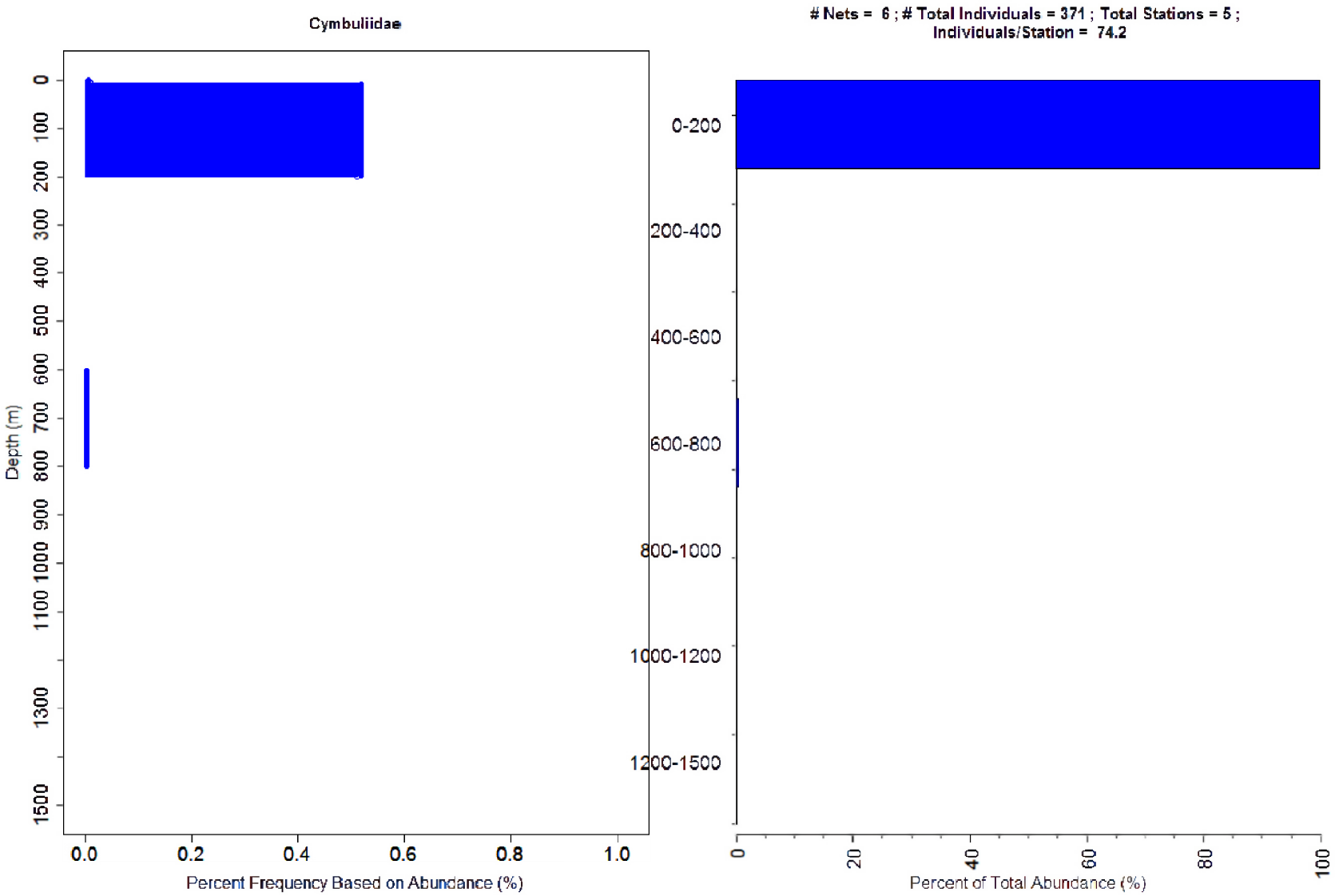
Crustacea


Cuninidae
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

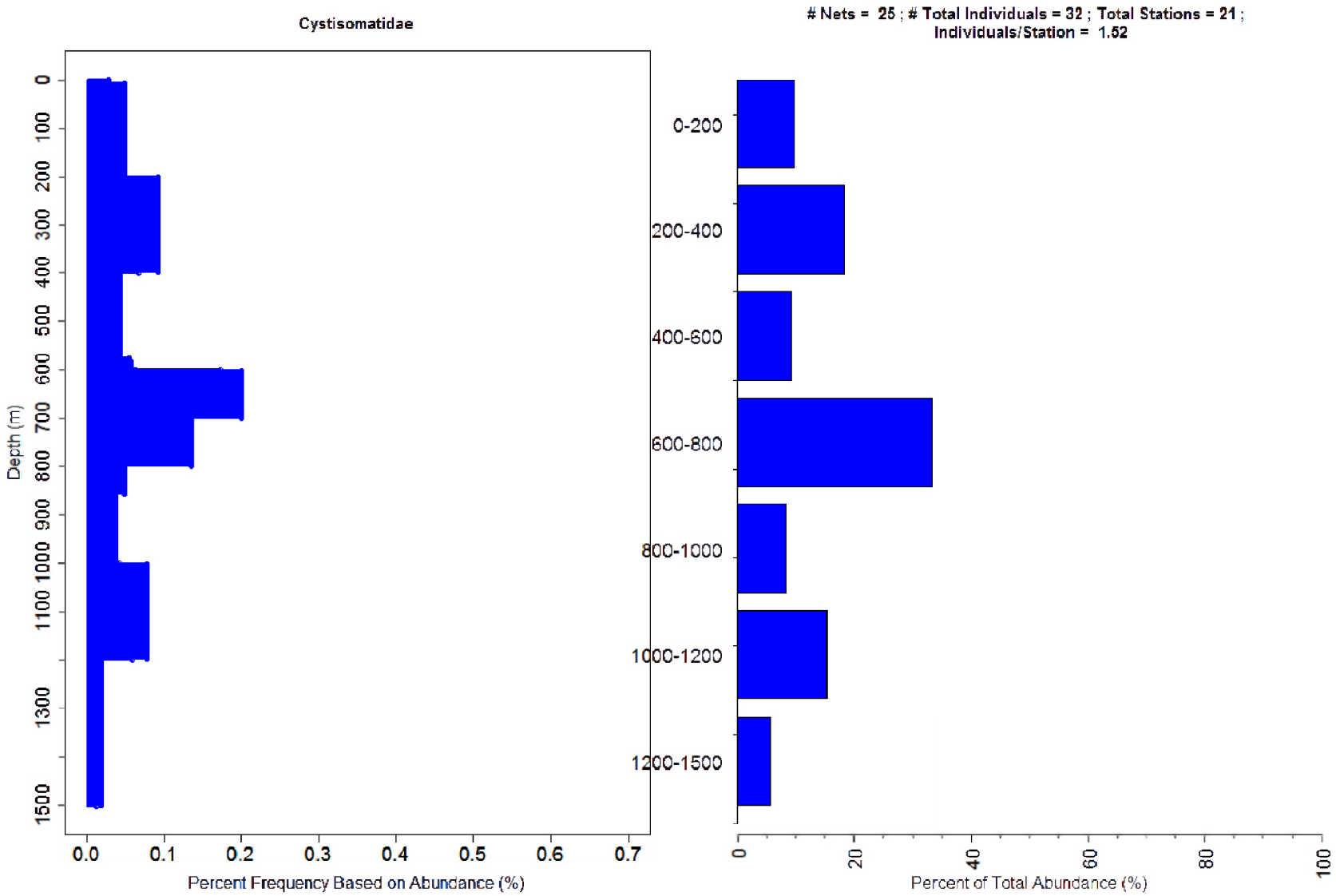
Cuninidae



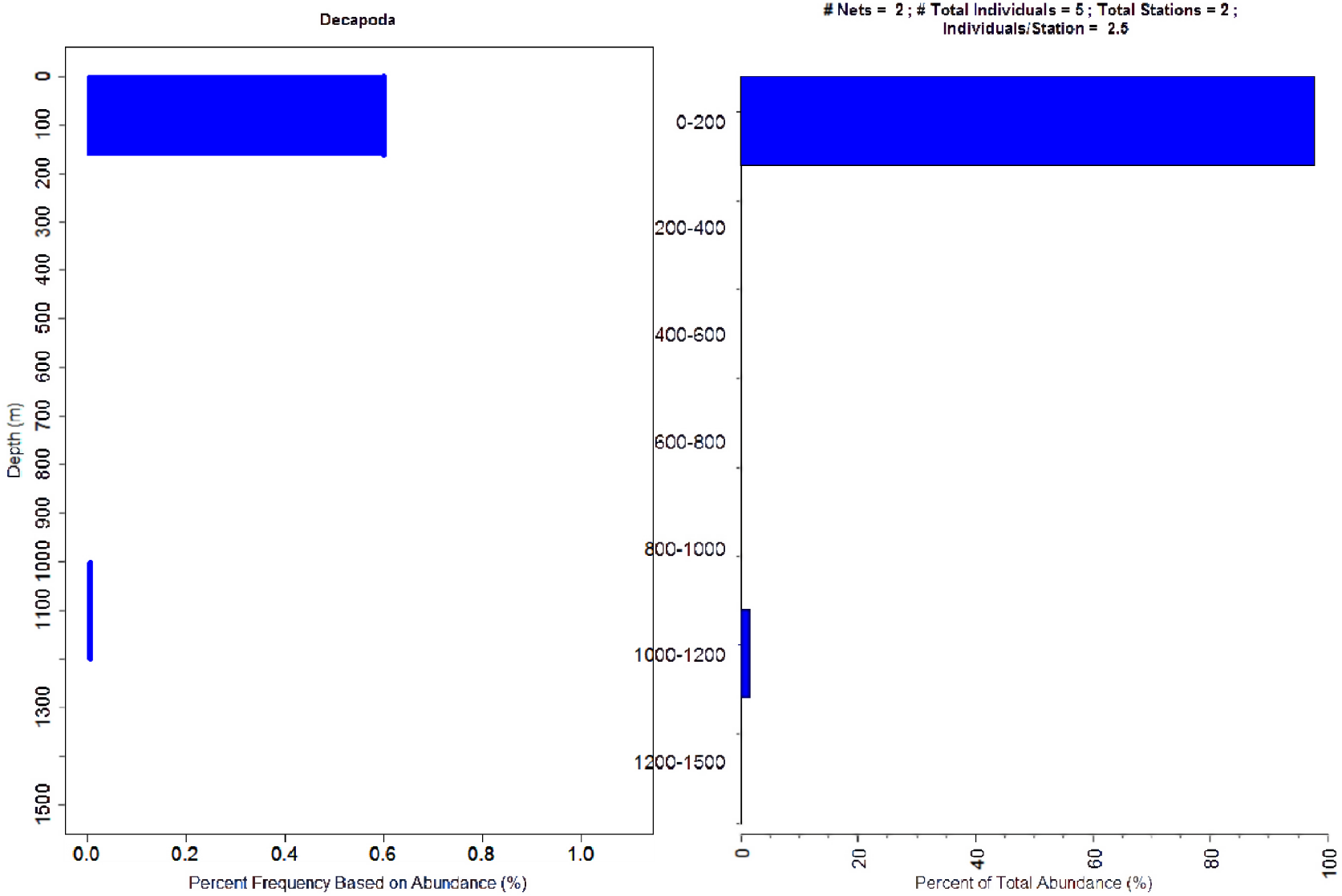
Cycloteuthidae



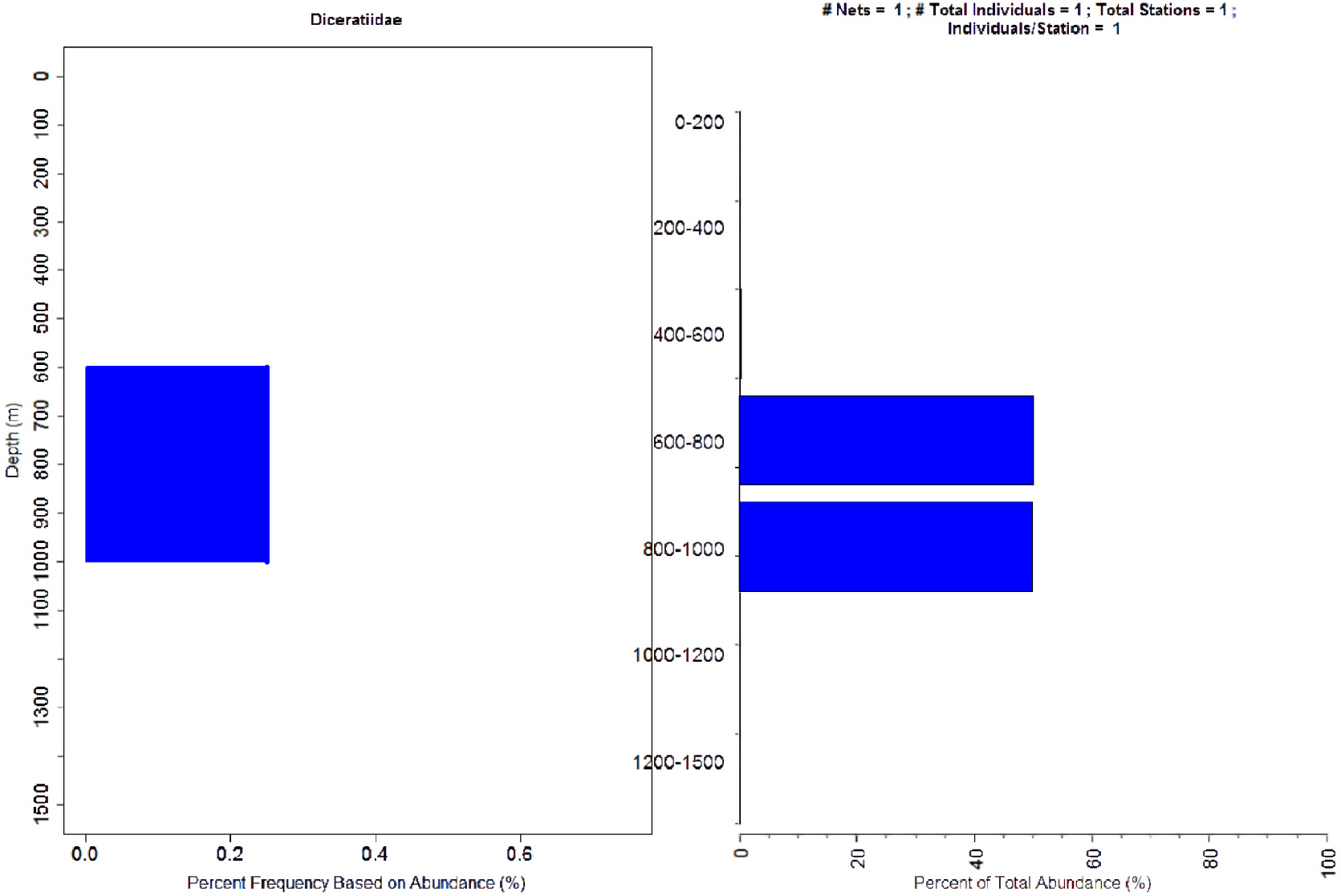
Cymbuliidae



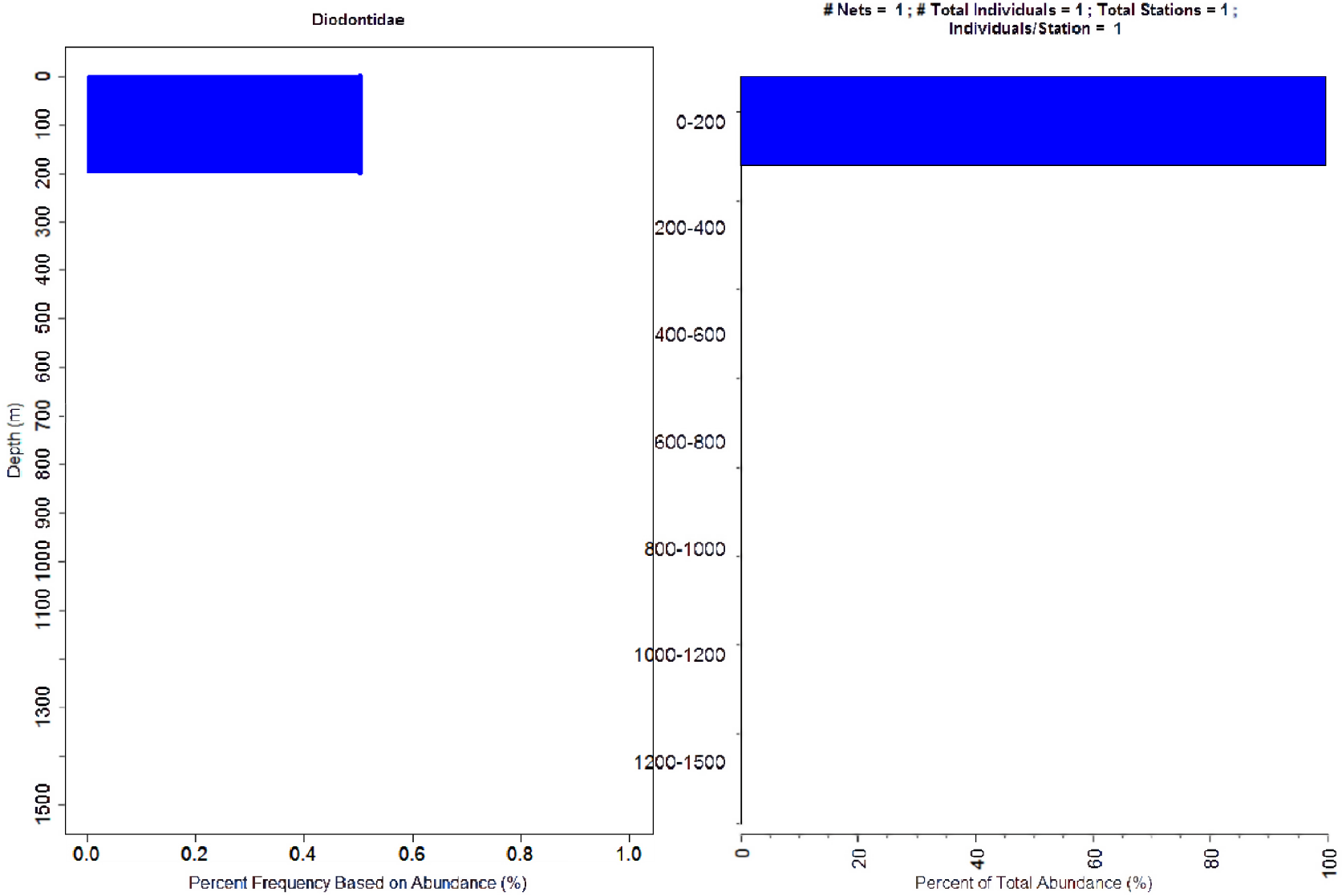
Cystisomatidae


Decapoda
Nets = 2 ; # Total Individuals = 5 ; Total Stations = 2 ;
Individuals/Station = 2.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

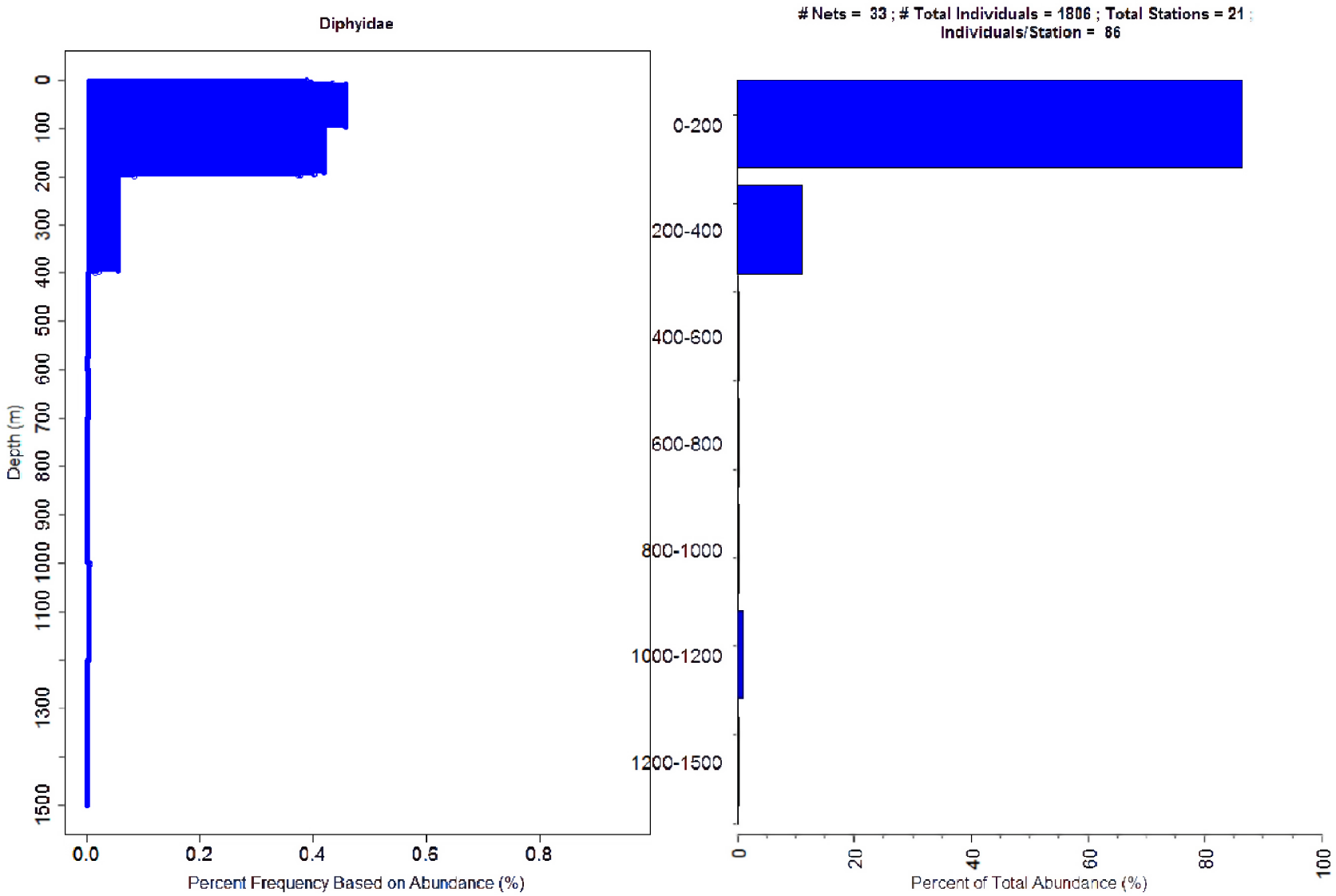
Decapoda



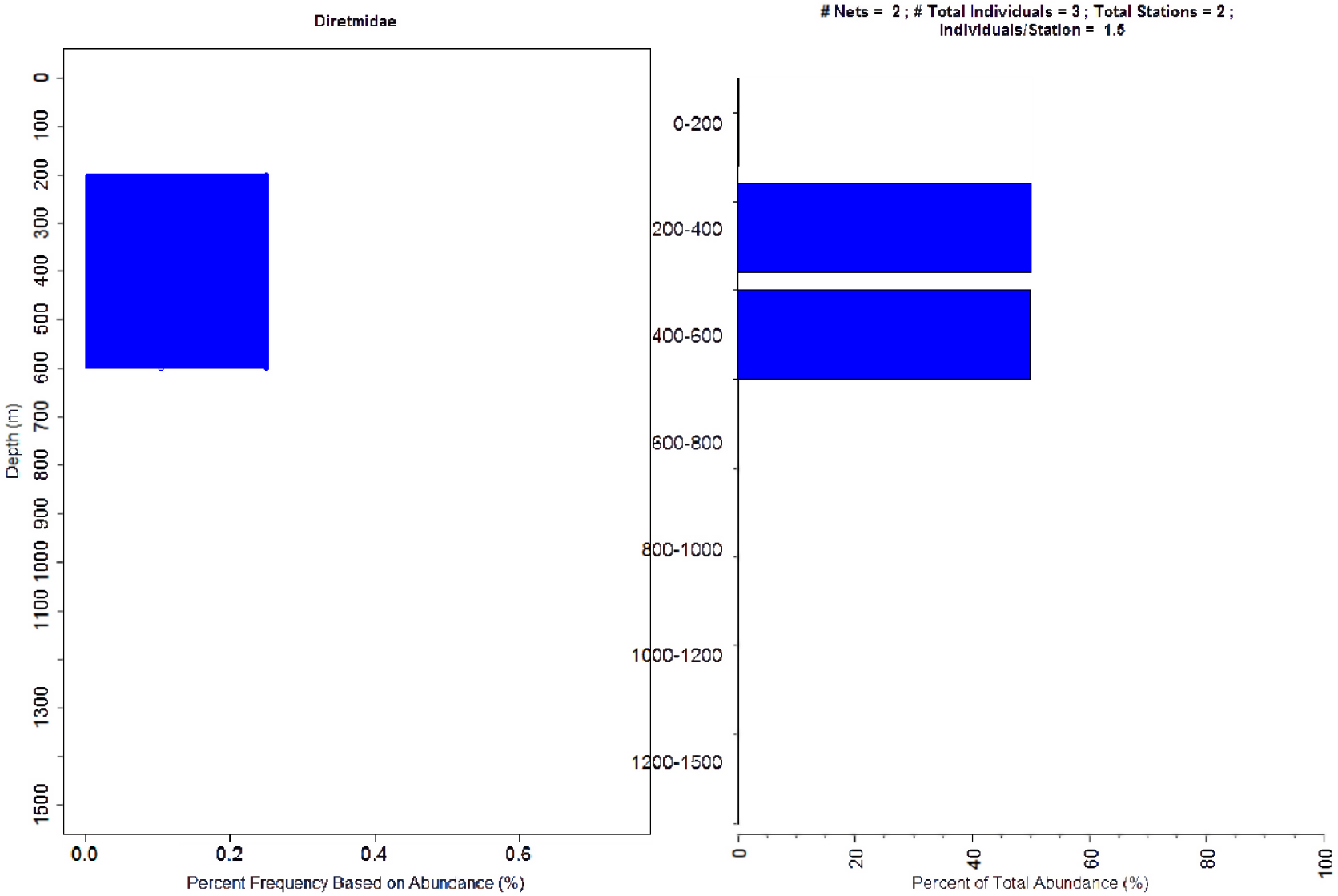
Diceratiidae



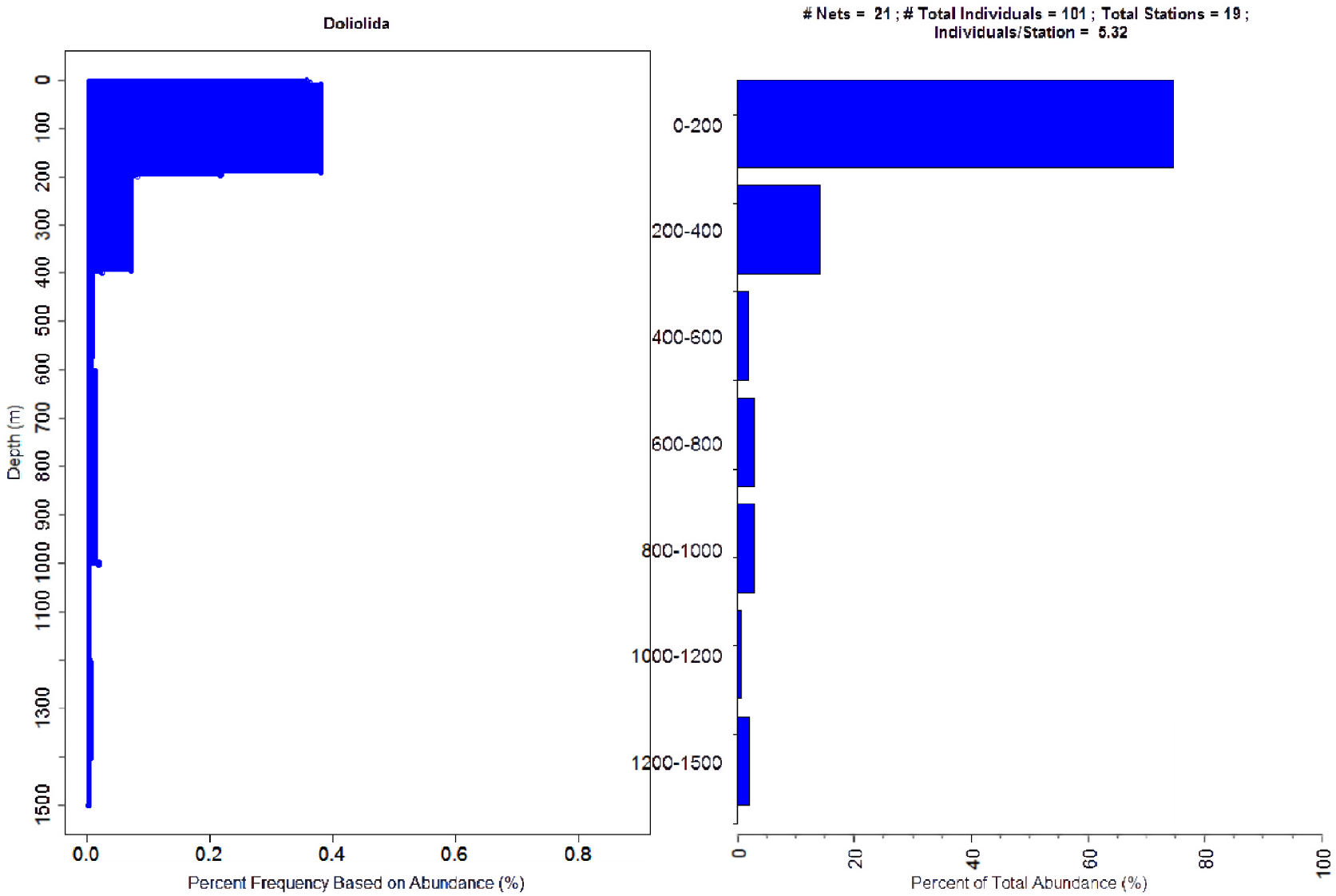
Diodontidae


Diphyidae
Nets = 33 ; # Total Individuals = 1806 ; Total Stations = 21 ;
Individuals/Station = 86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

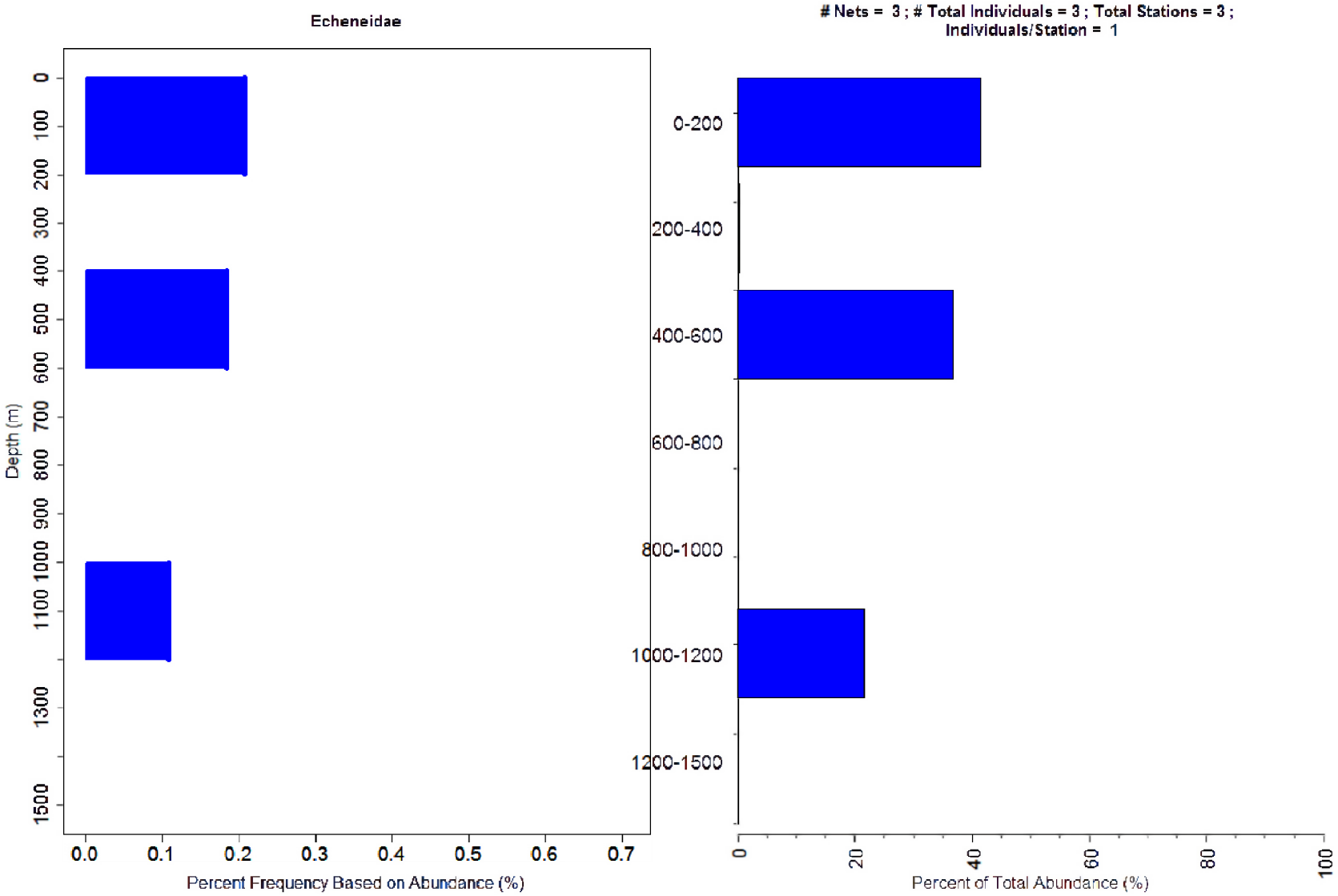
Diphyidae


Diretmidae
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

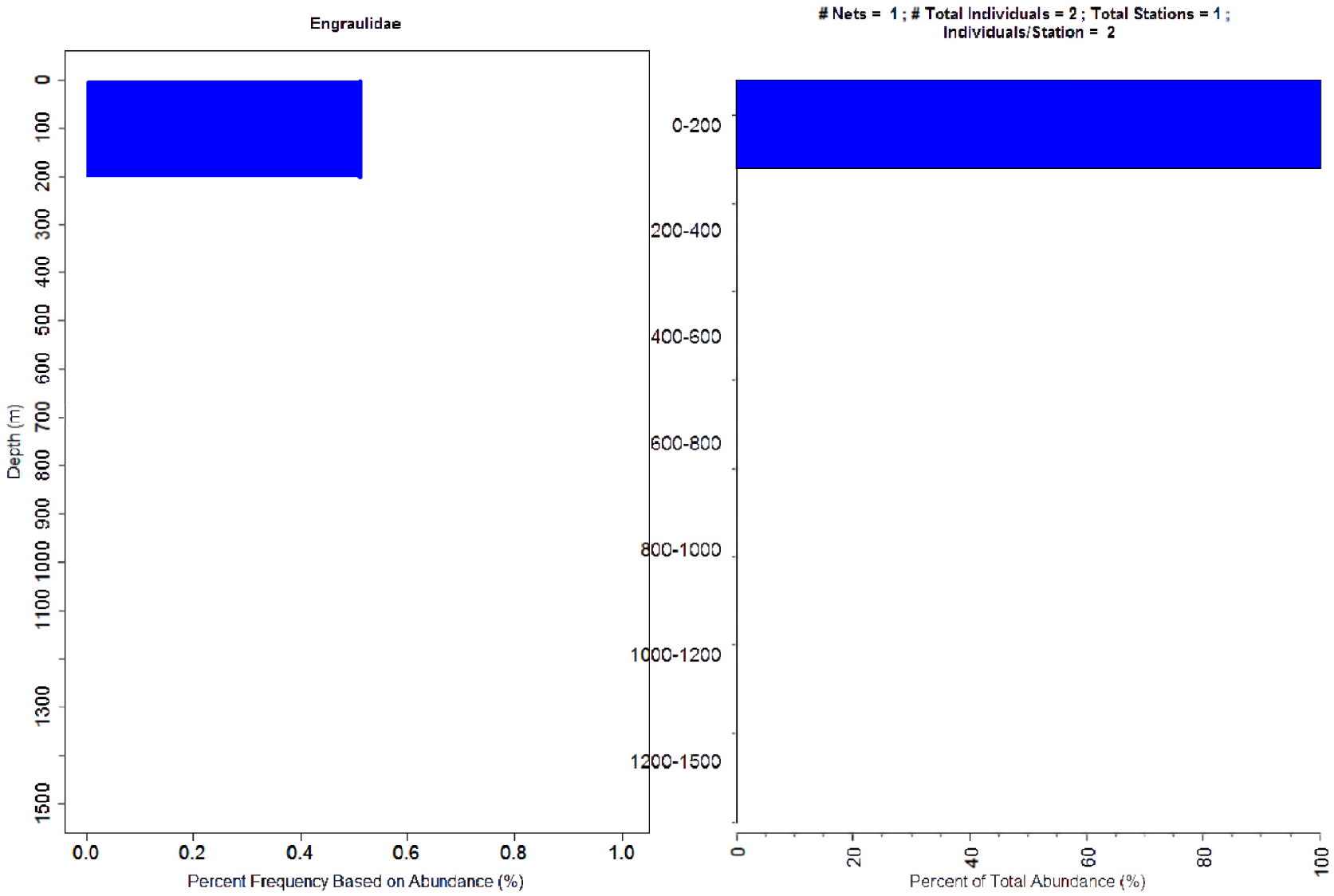
Diretmidae


Doliolida
Nets = 21 ; # Total Individuals = 101 ; Total Stations = 19 ;
Individuals/Station = 5.32
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

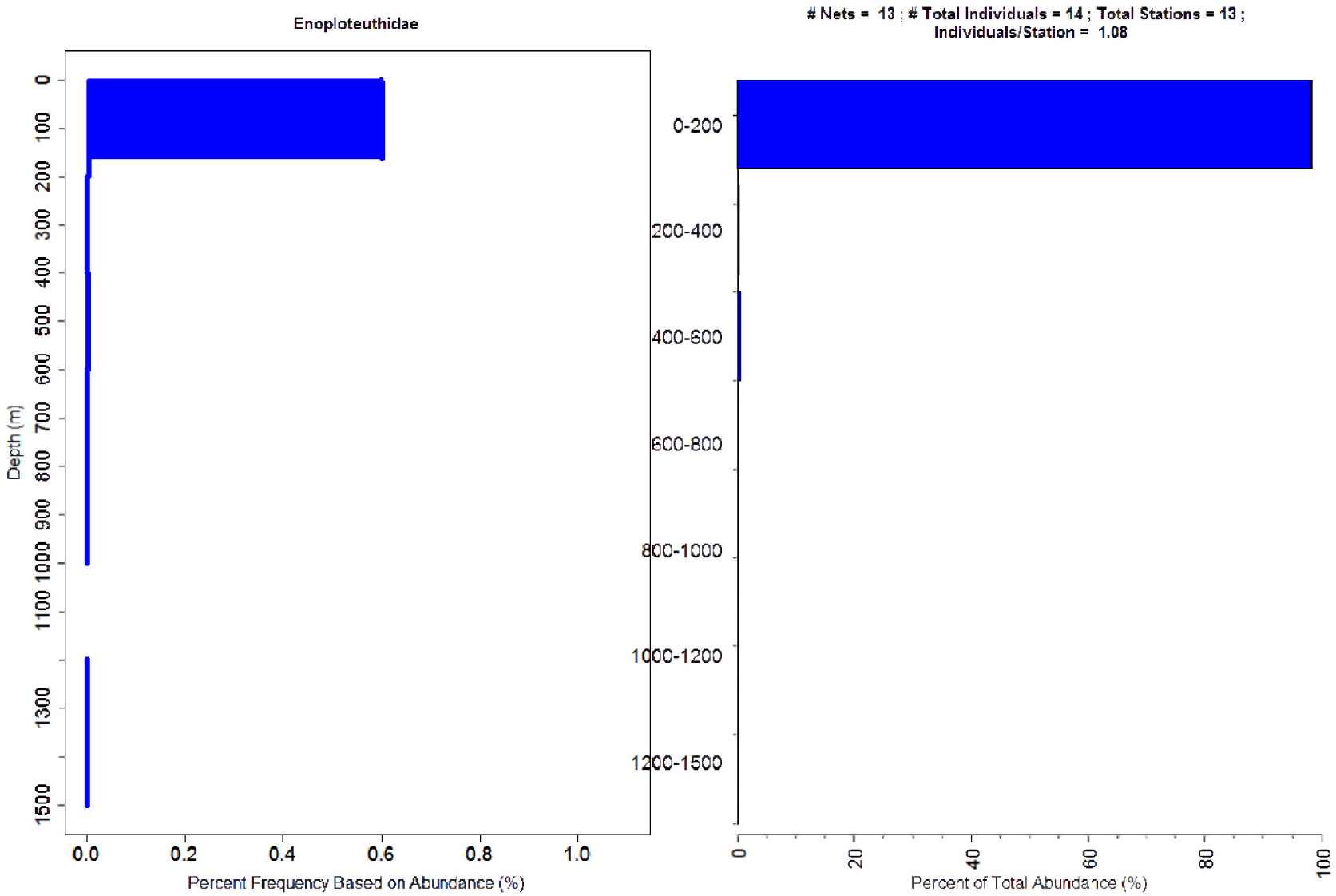
Doliolida


Echeneidae
Nets = 3 ; # Total Individuals = 3 ; Total Stations = 3 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

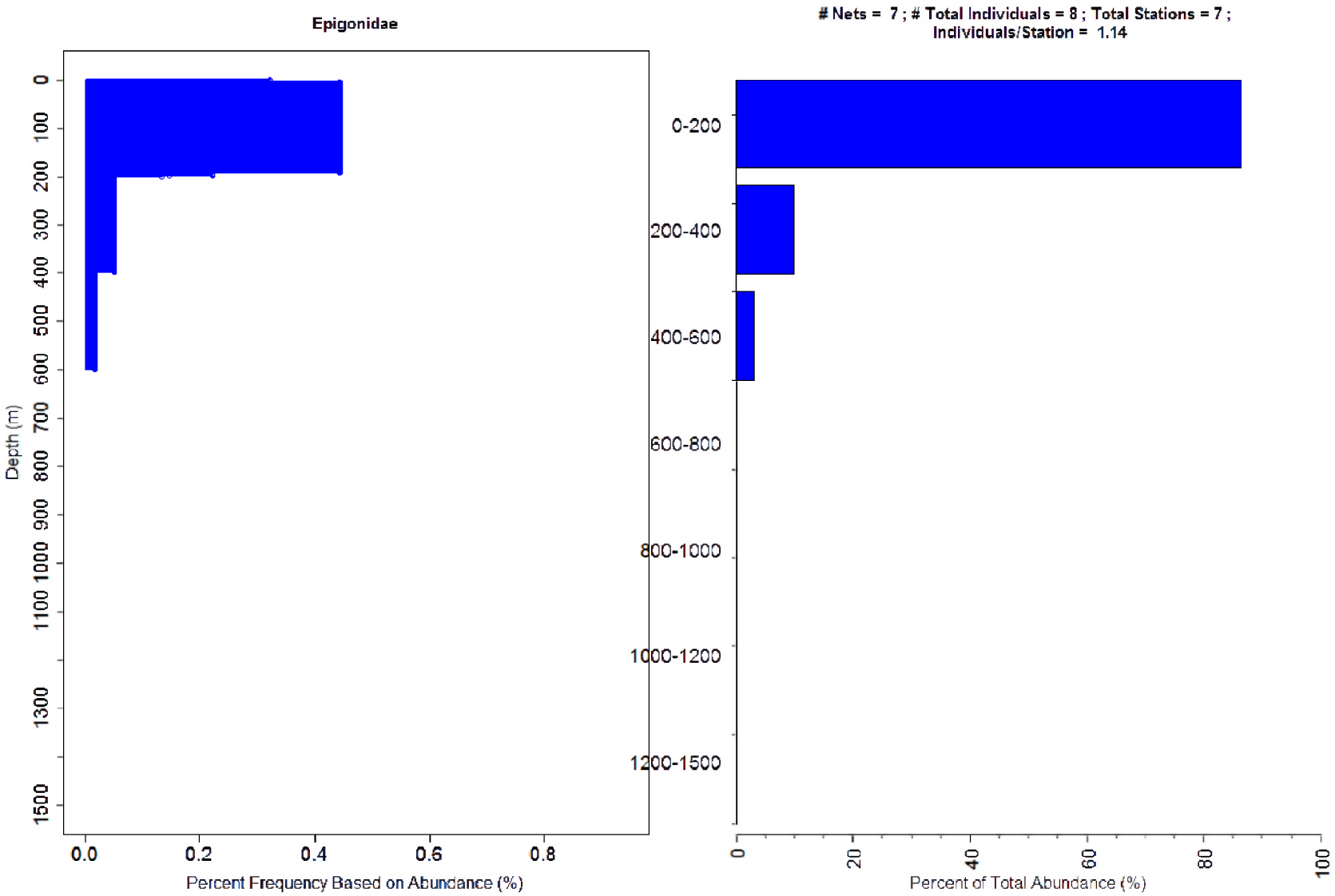
Echeneidae



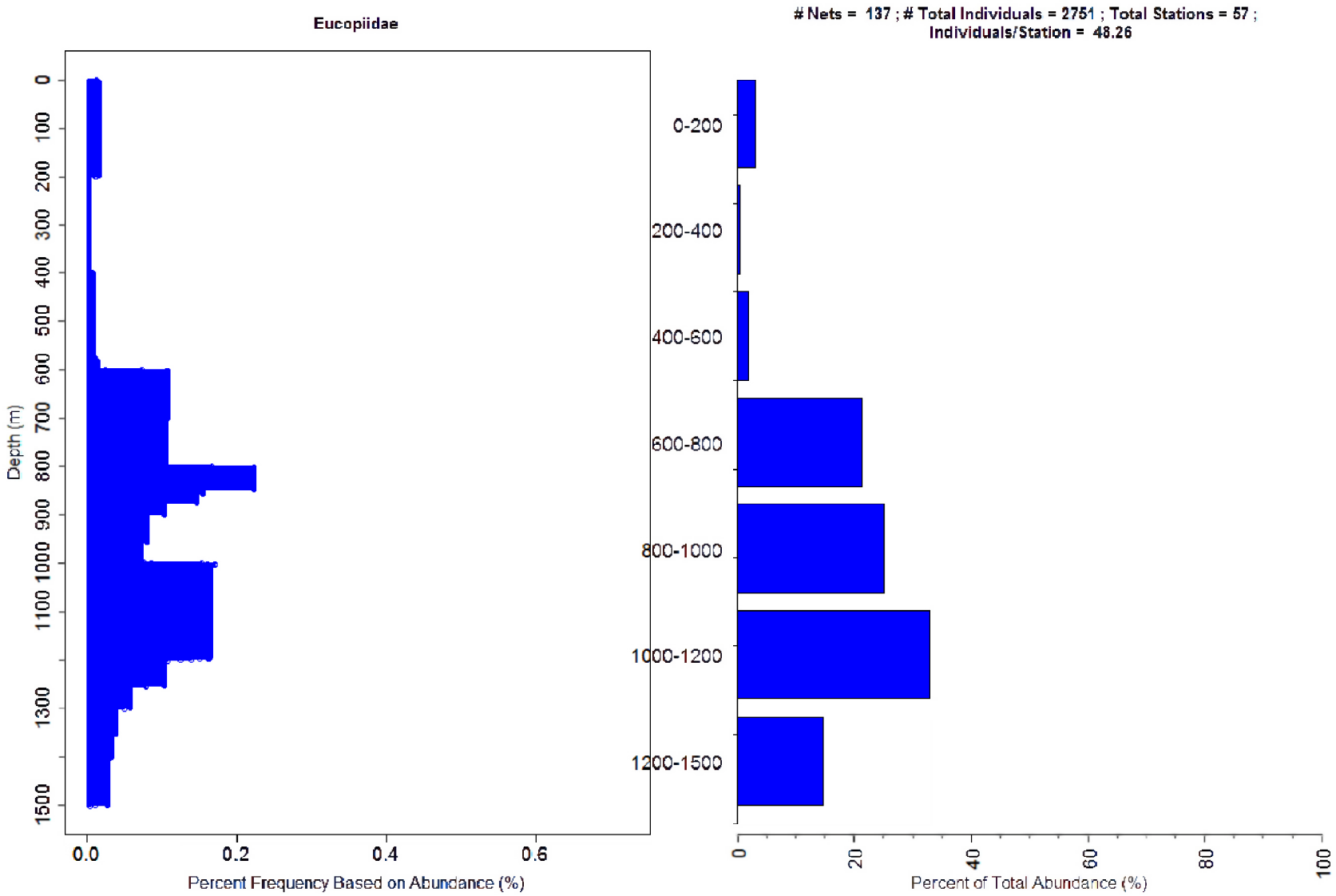
Engraulidae



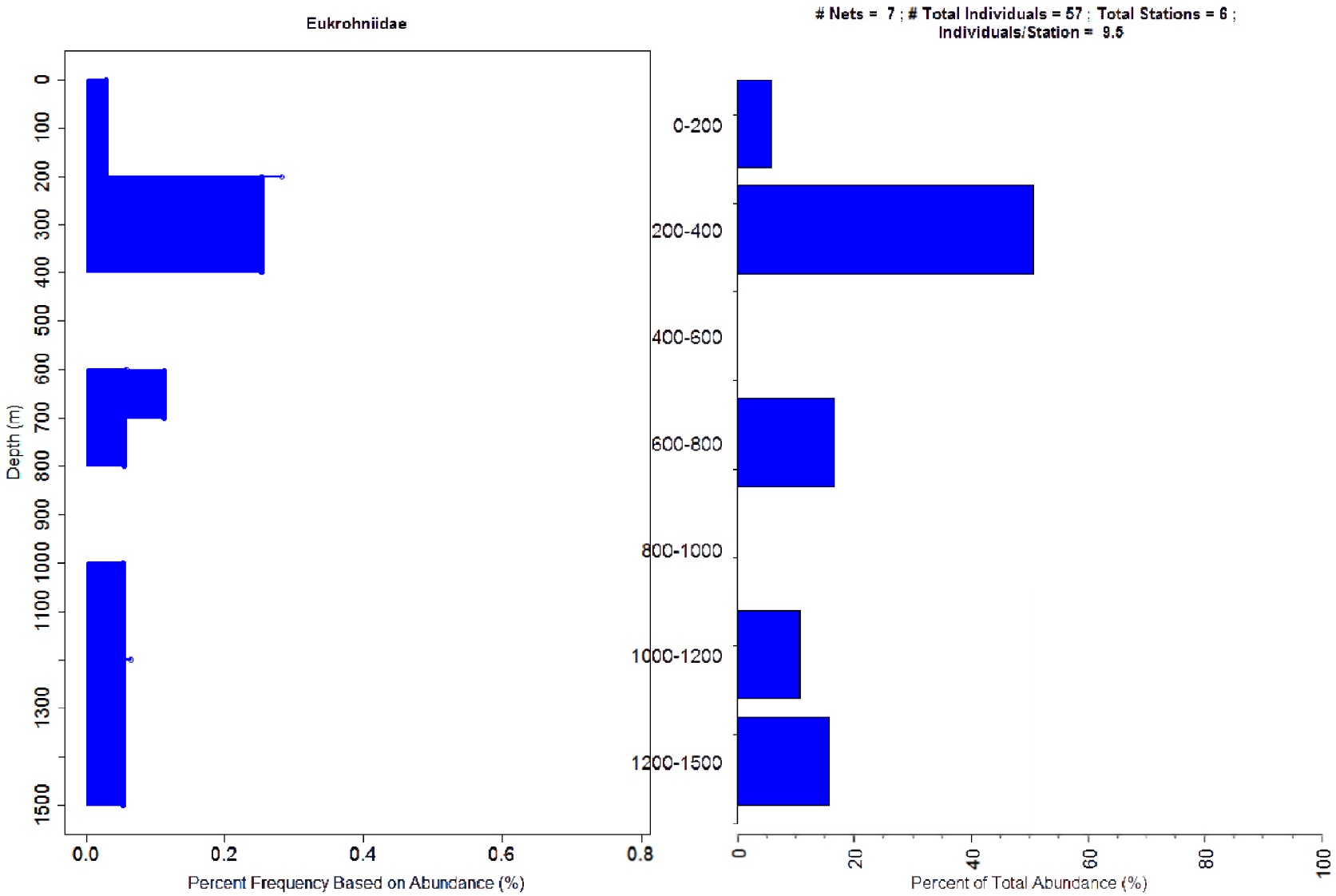
Enoploteuthidae


Epigonidae
Nets = 7 ; # Total Individuals = 8 ; Total Stations = 7 ;
Individuals/Station = 1.14
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

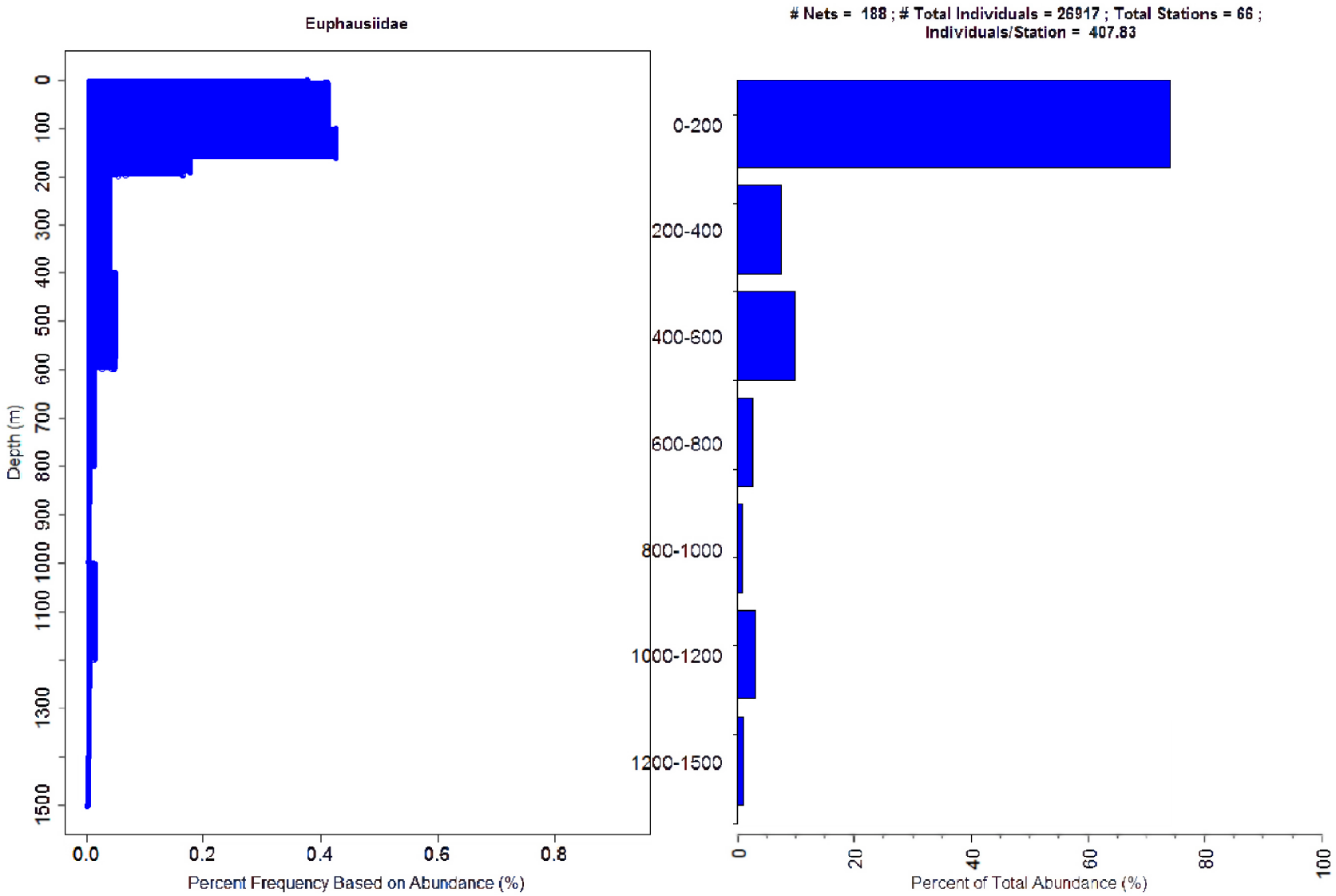
Epigonidae


Eucopiidae
Nets = 137 ; # Total Individuals = 2751 ; Total Stations = 57 ;
Individuals/Station = 48.26
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

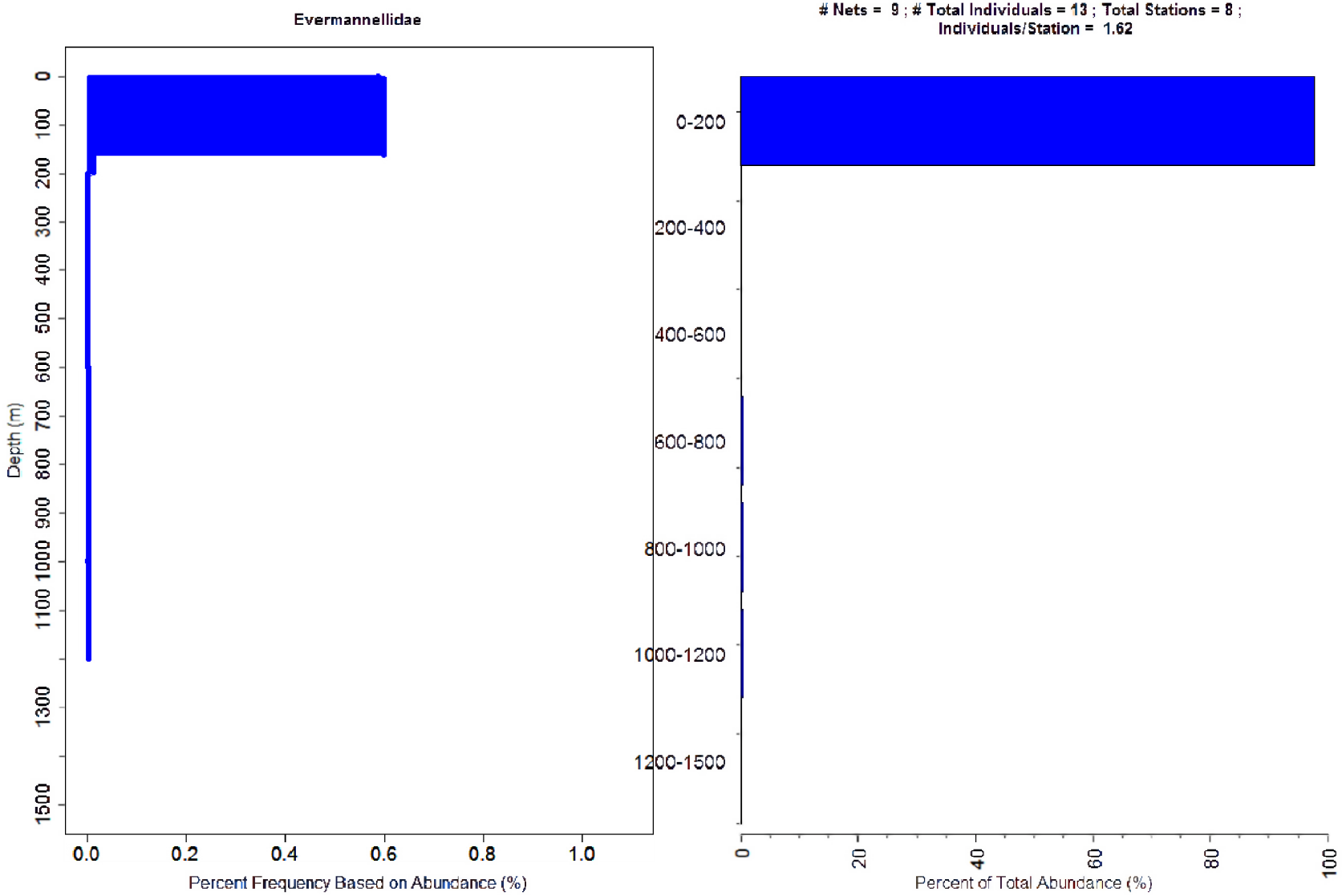
Eucopiidae



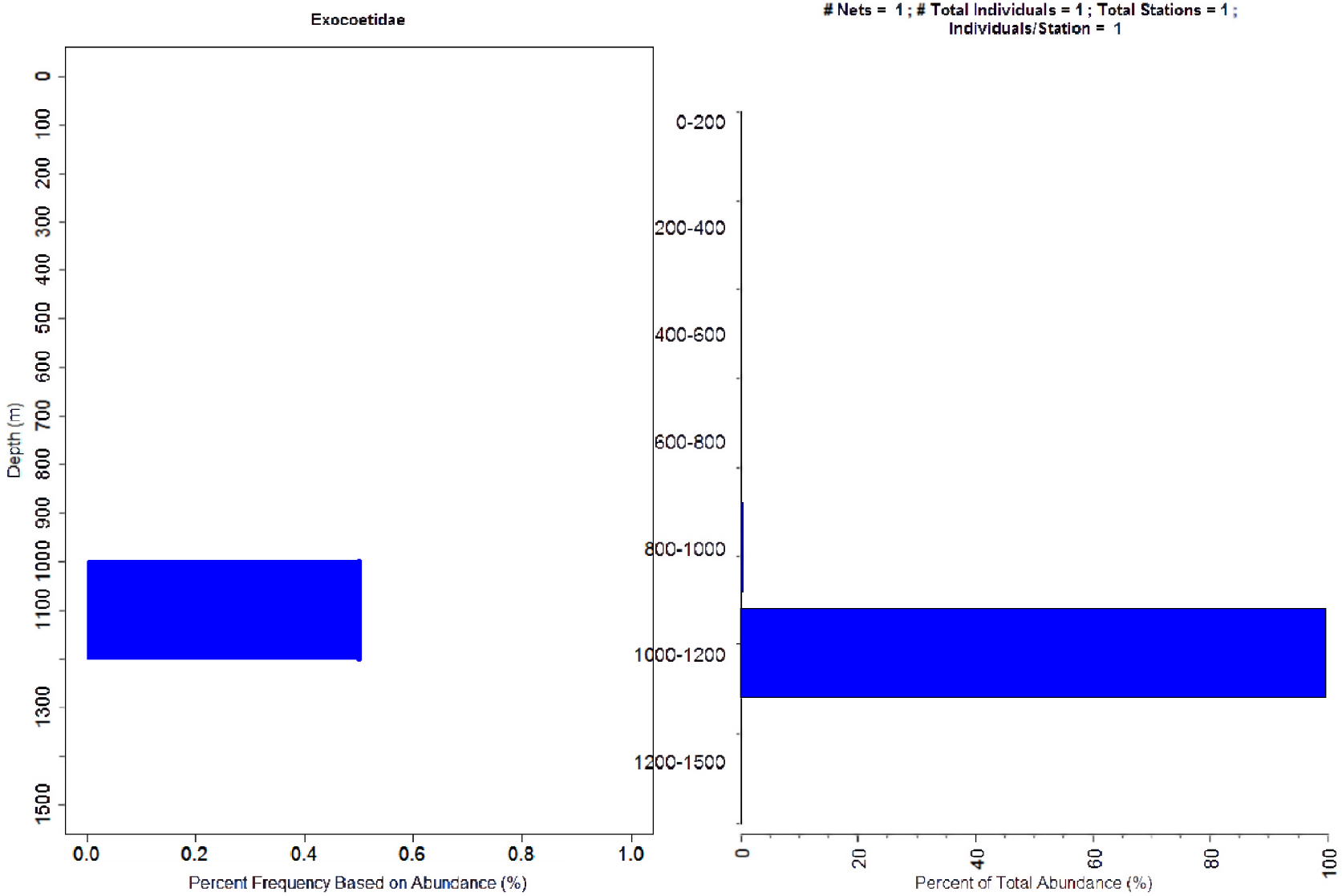
Eukrohniidae



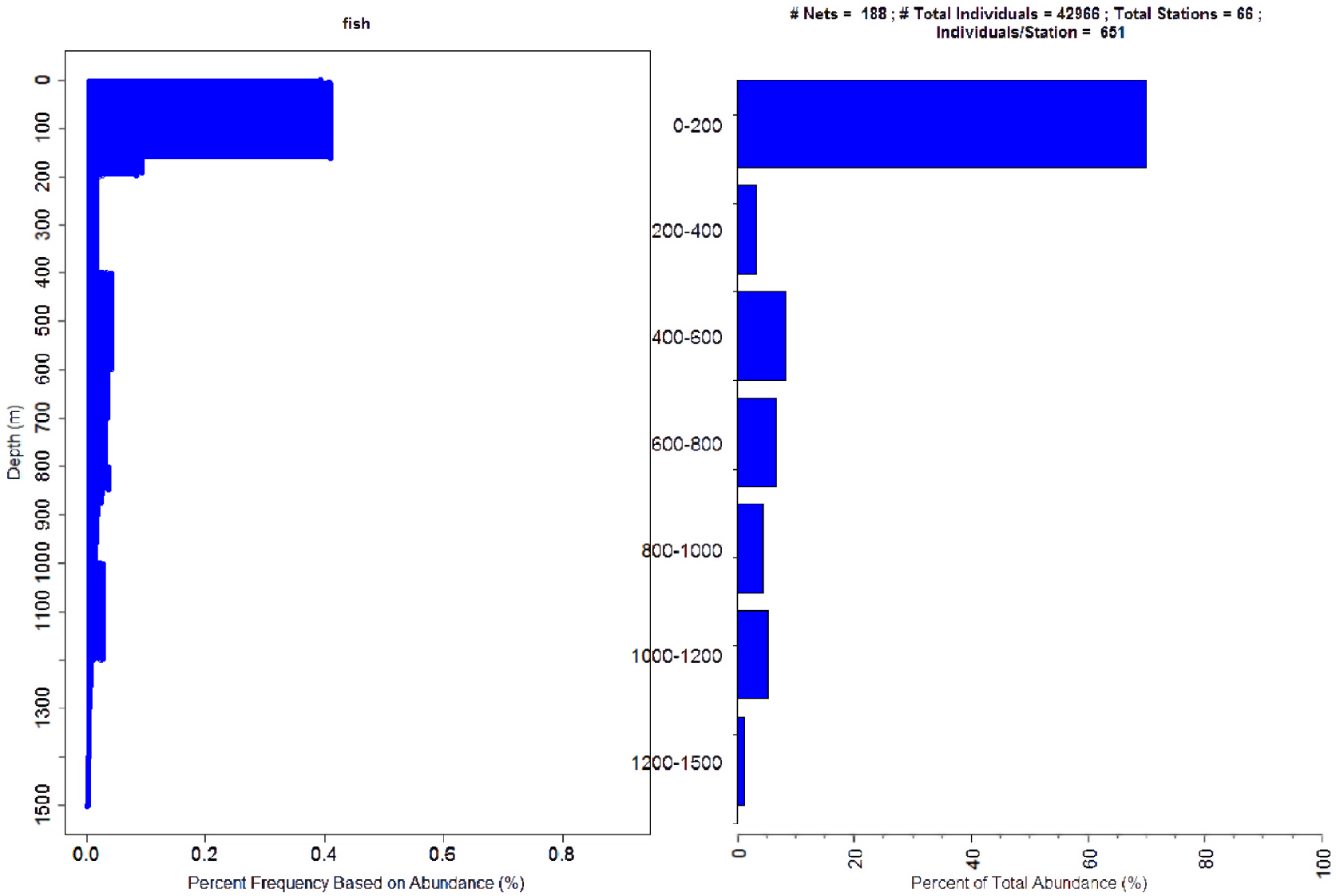
Euphausiidae



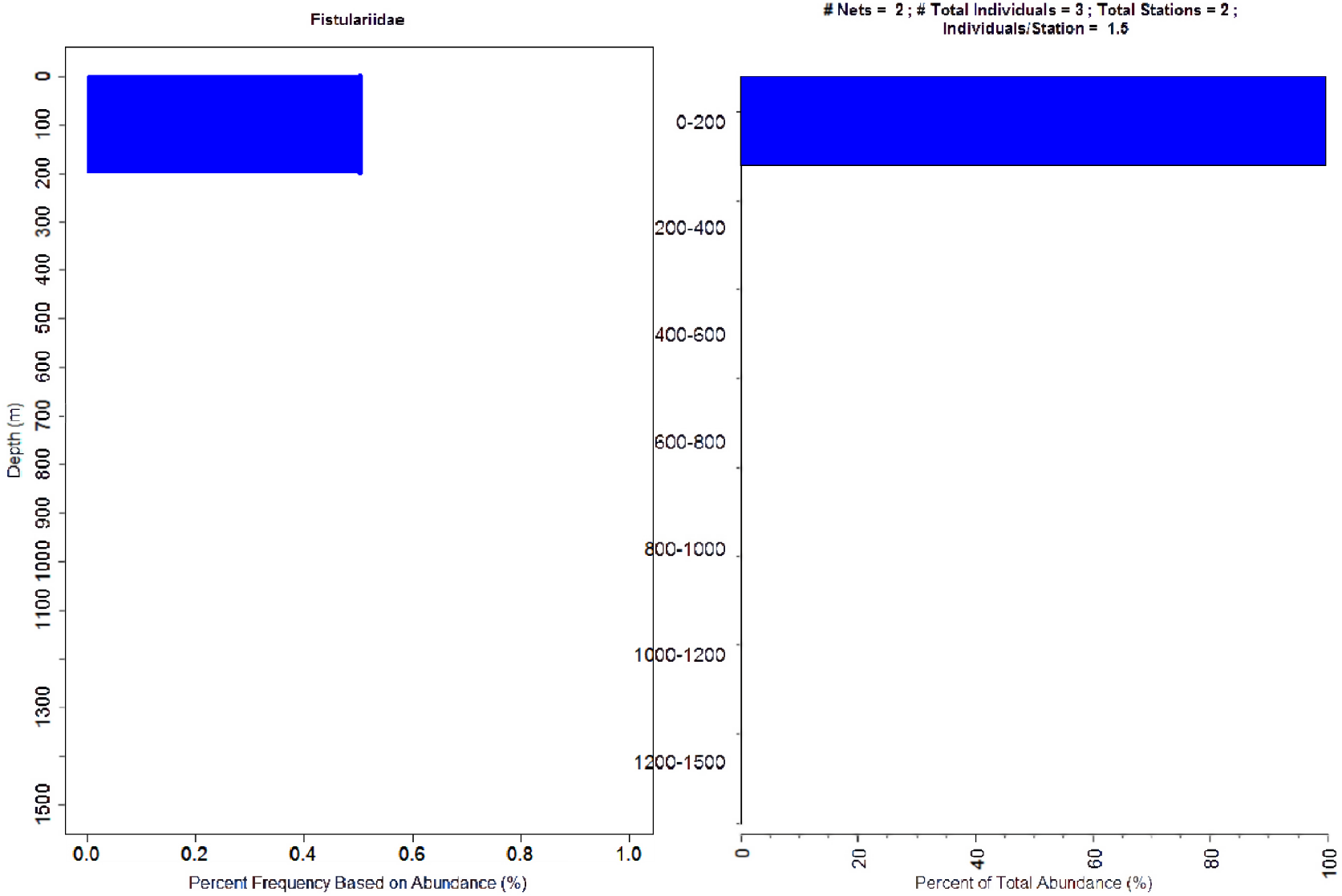
Evermannellidae



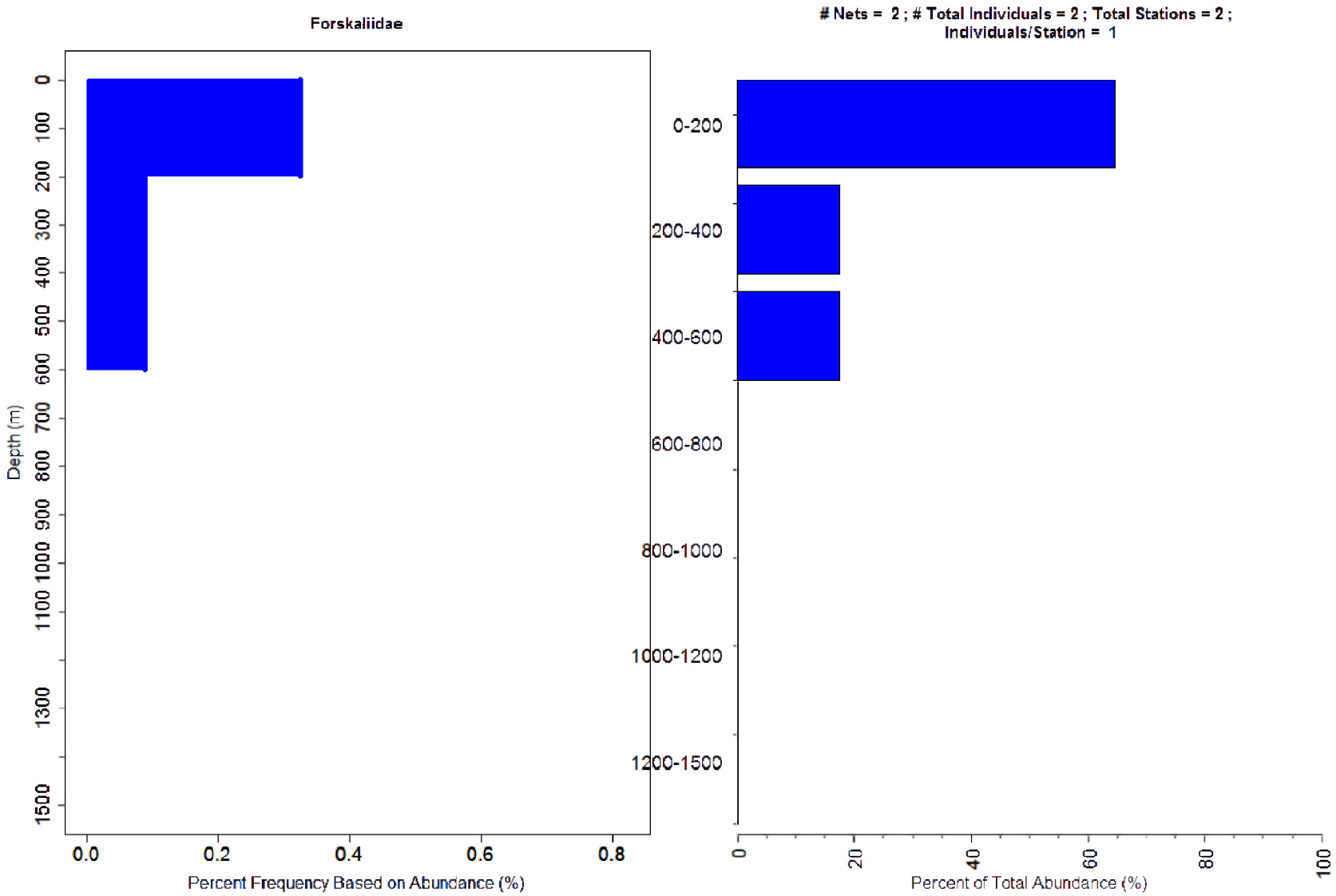
Exocoetidae


fish
Nets = 188 ; # Total Individuals = 42966 ; Total Stations = 66 ;
Individuals/Station = 651
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

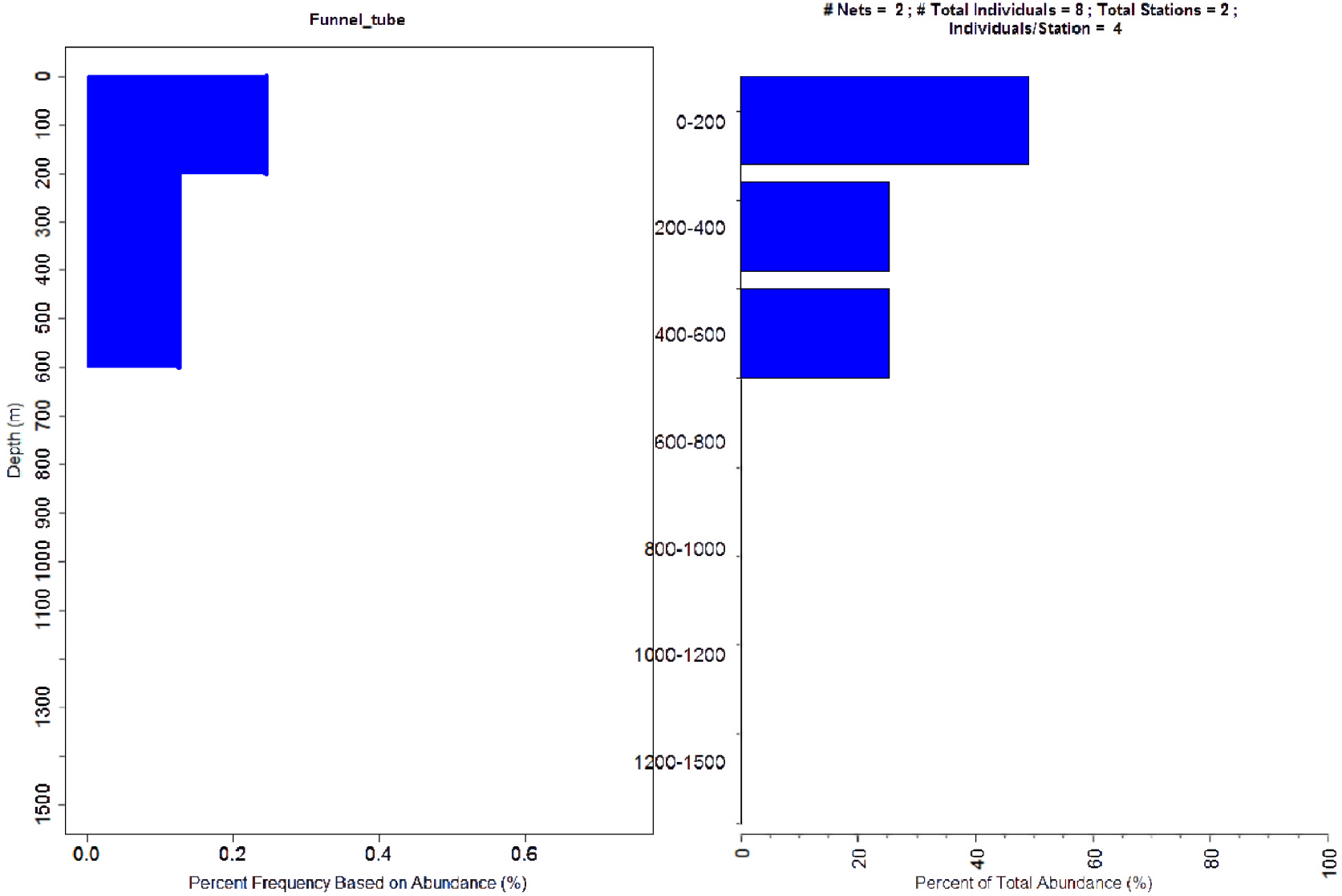
fish



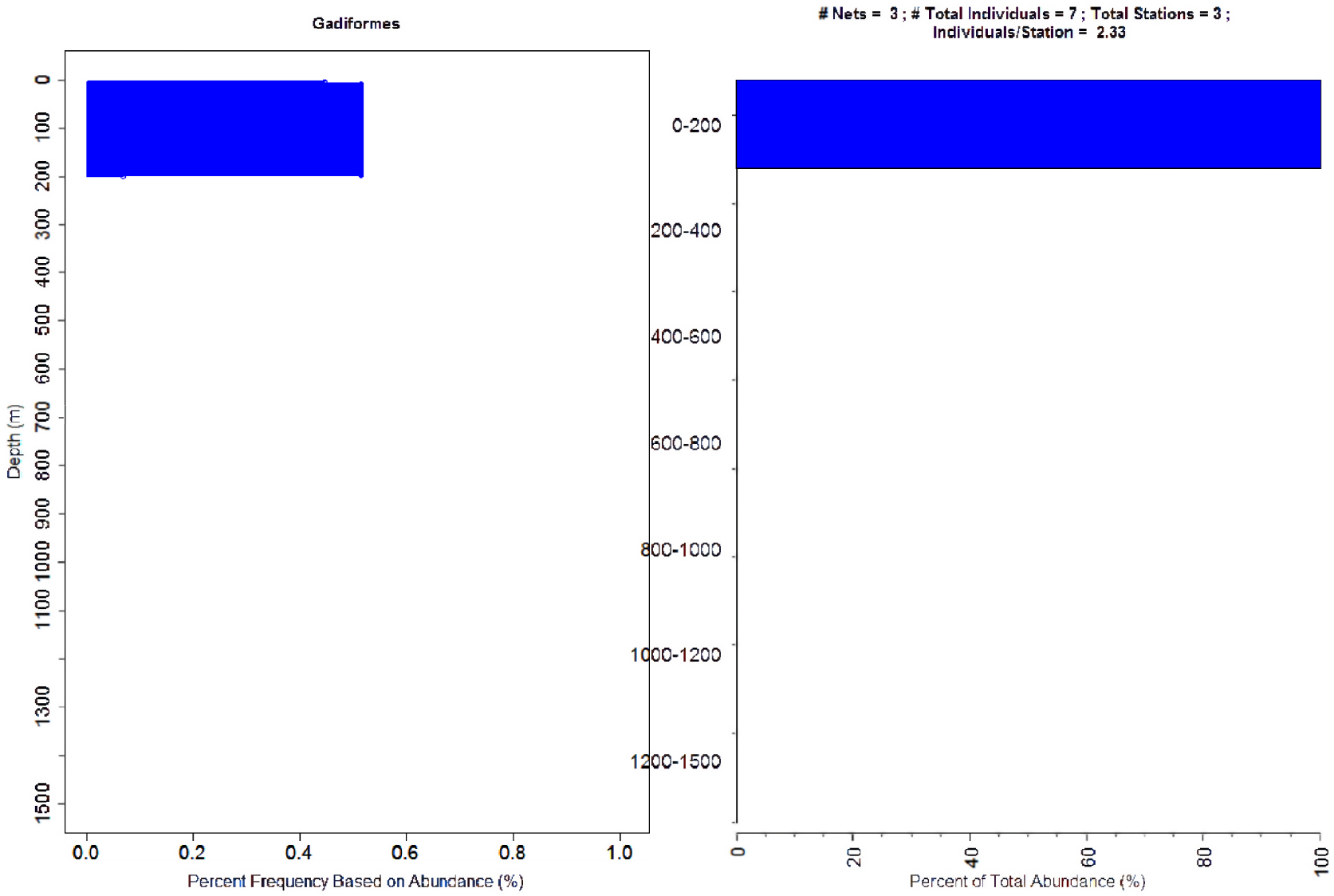
Fistulariidae



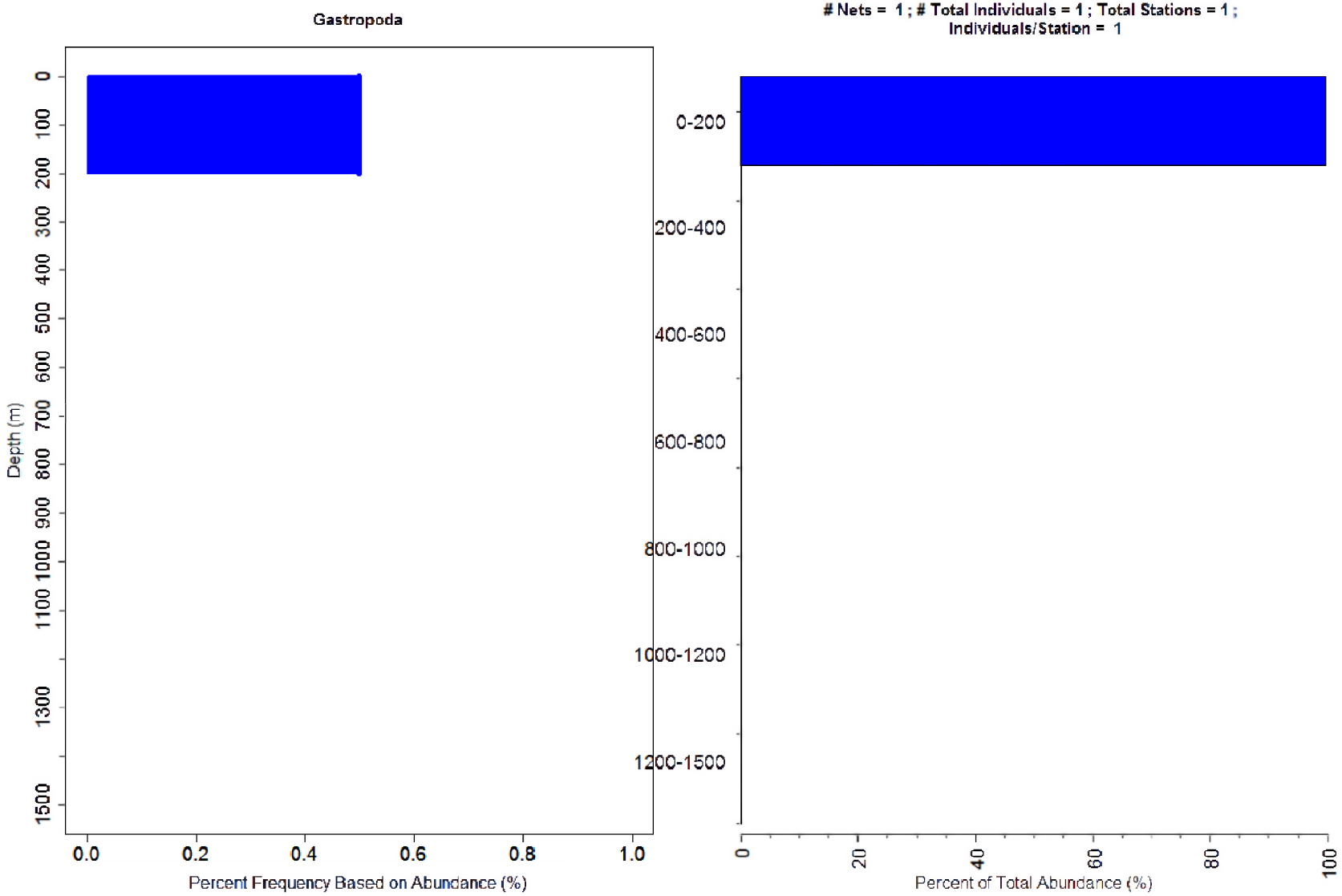
Forskaliidae


Funnel_tube
Nets = 2 ; # Total Individuals = 8 ; Total Stations = 2 ;
Individuals/Station = 4
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

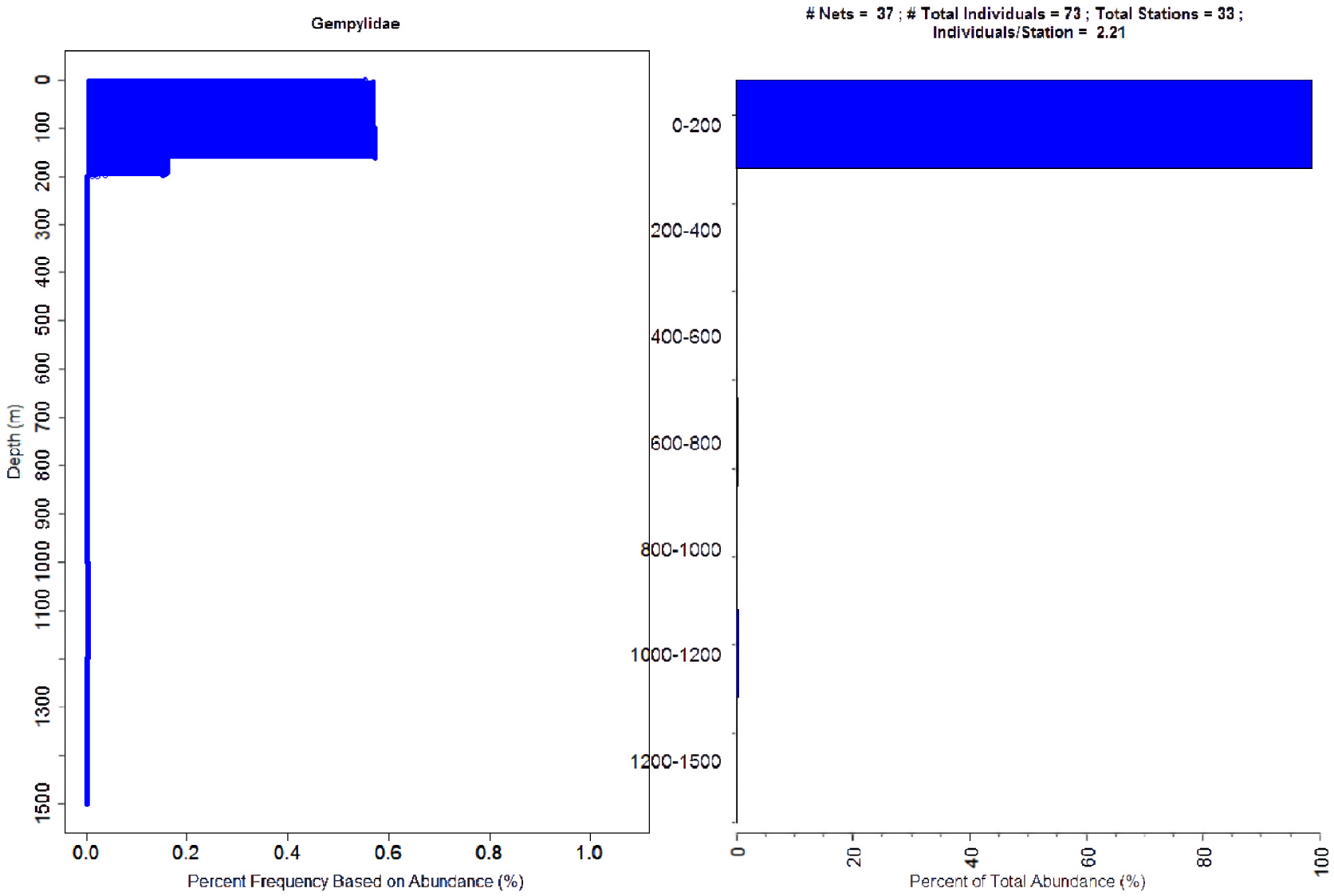
Funnel_tube


Gadiformes
Nets = 3 ; # Total Individuals = 7 ; Total Stations = 3 ;
Individuals/Station = 2.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

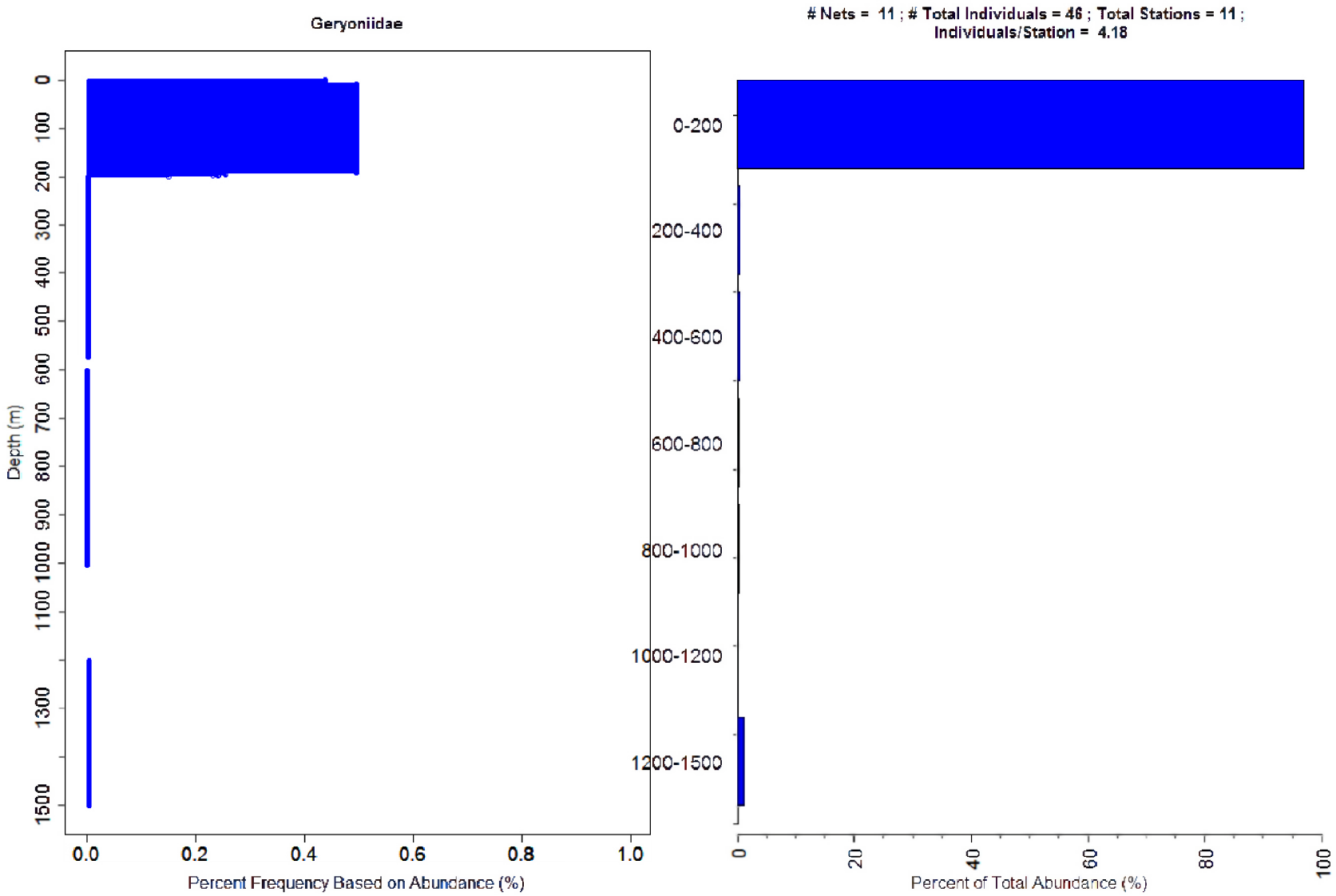
Gadiformes


Gastropoda
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

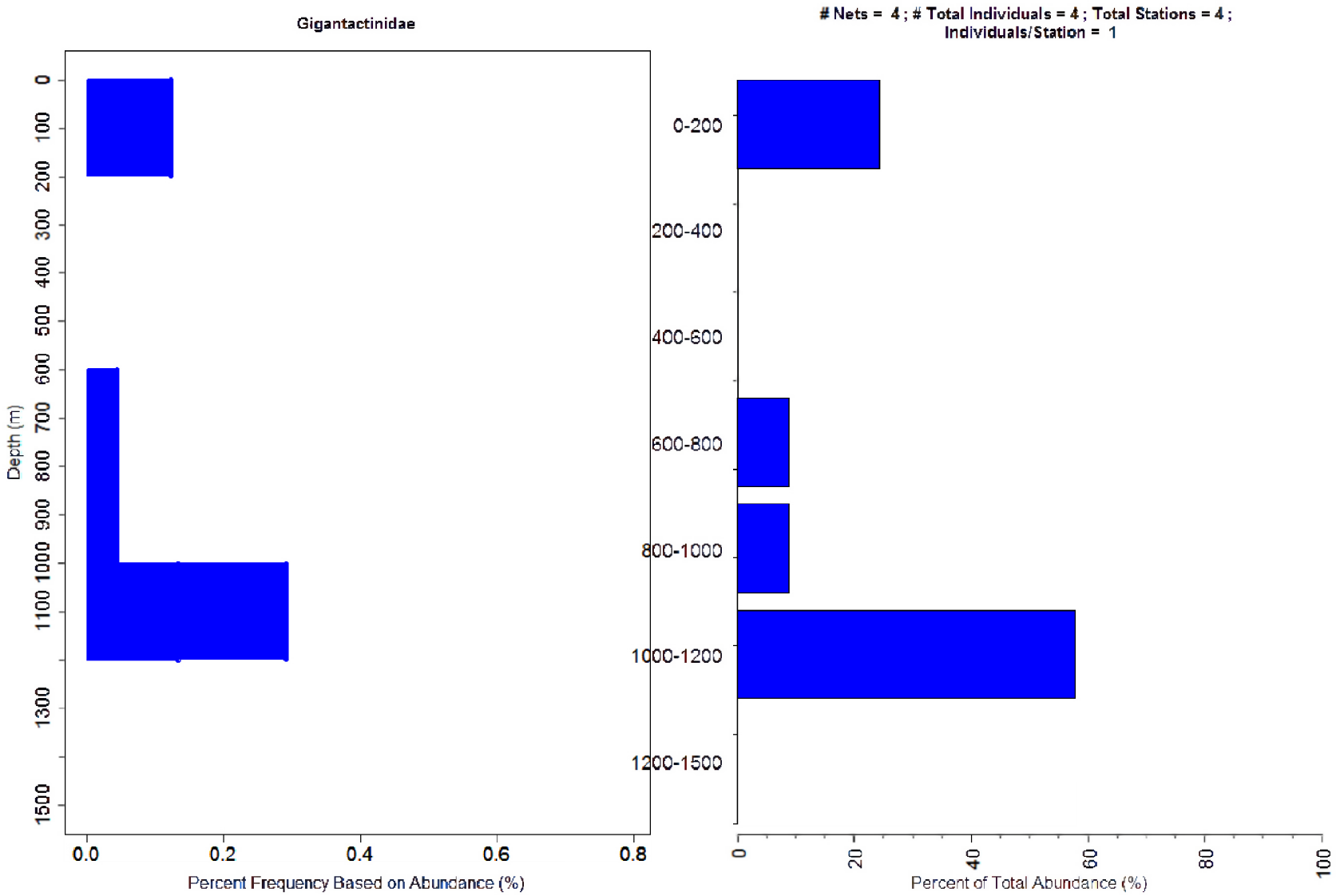
Gastropoda


Gempylidae
Nets = 37 ; # Total Individuals = 73 ; Total Stations = 33 ;
Individuals/Station = 2.21
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

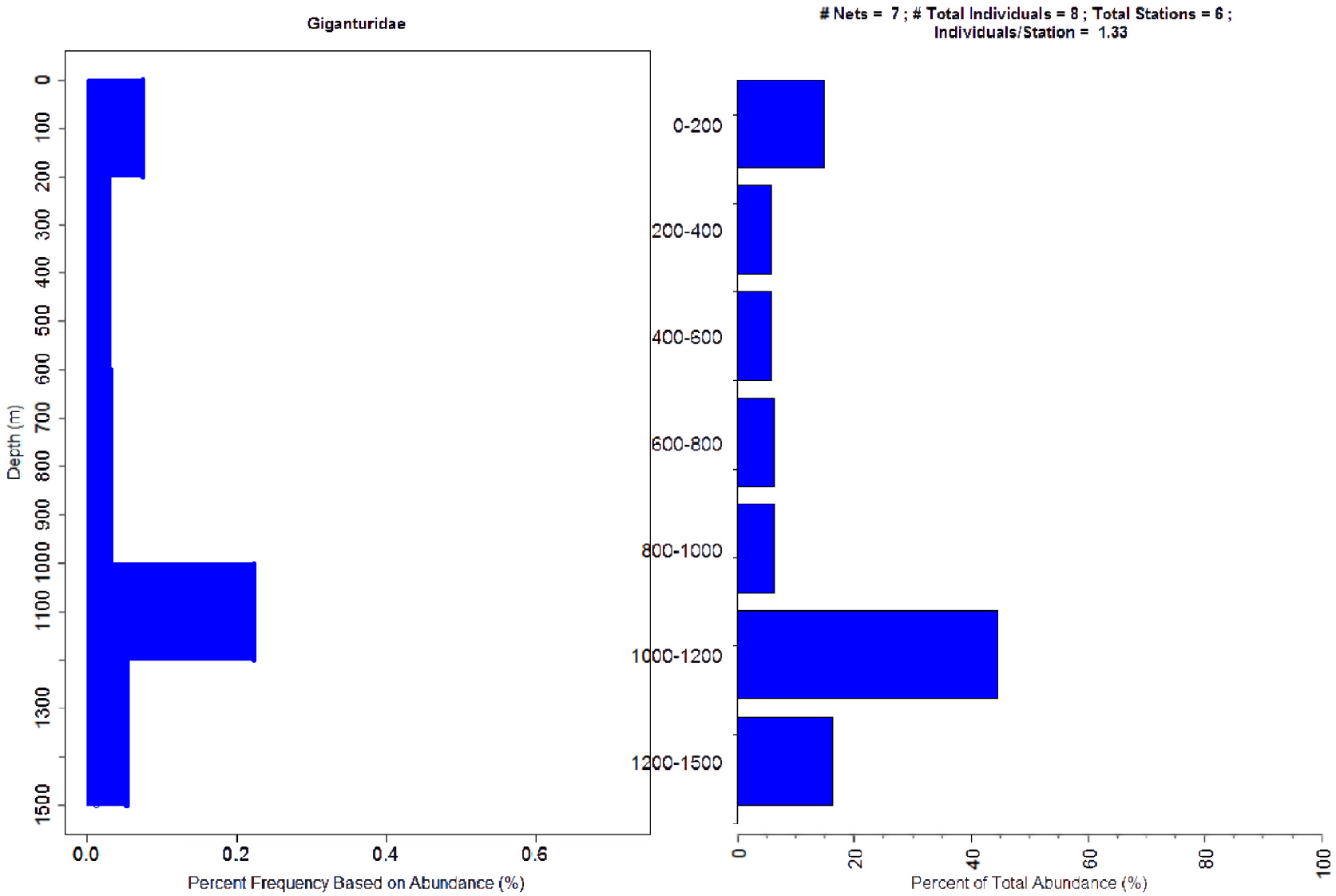
Gempylidae



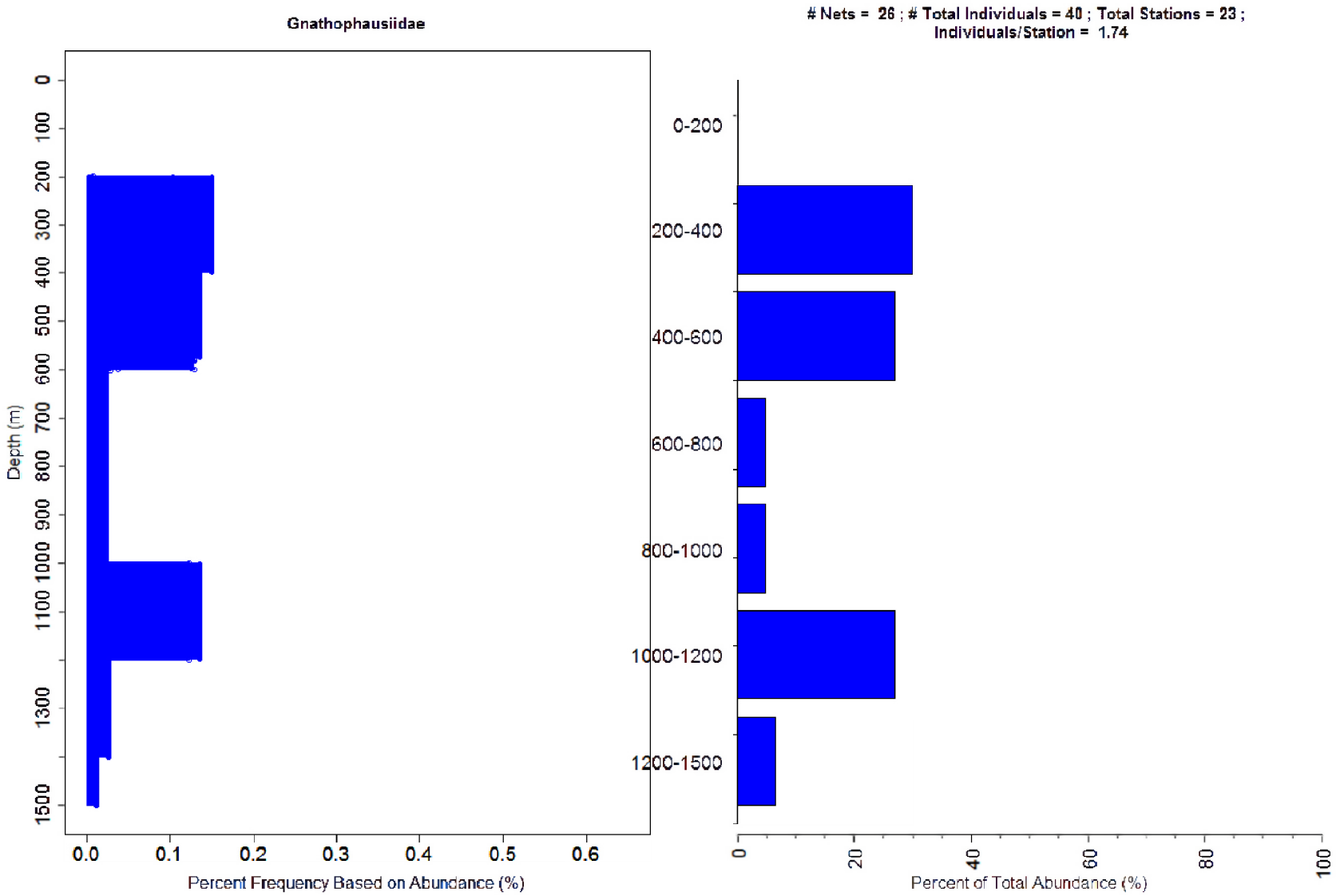
Geryoniidae



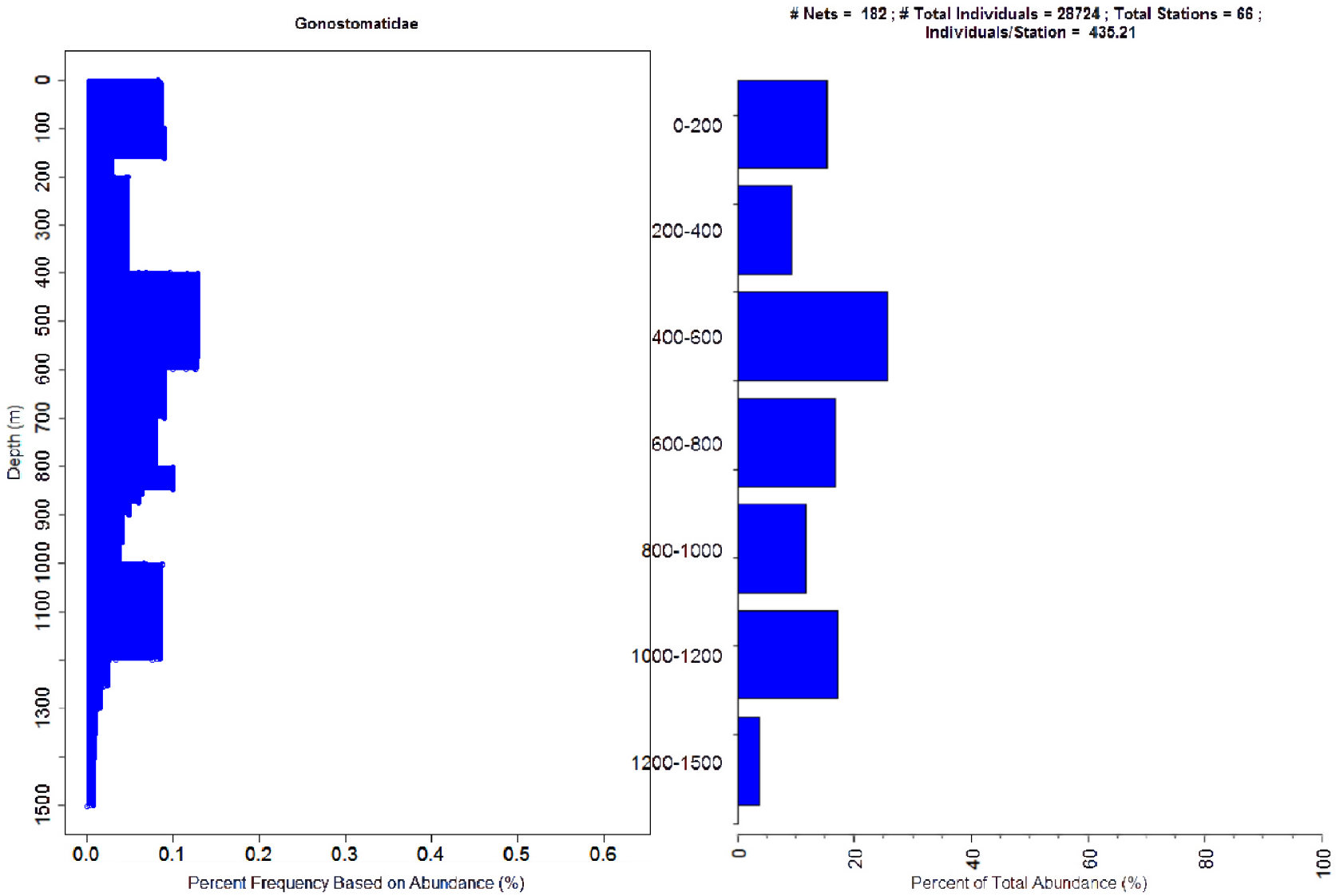
Gigantactinidae



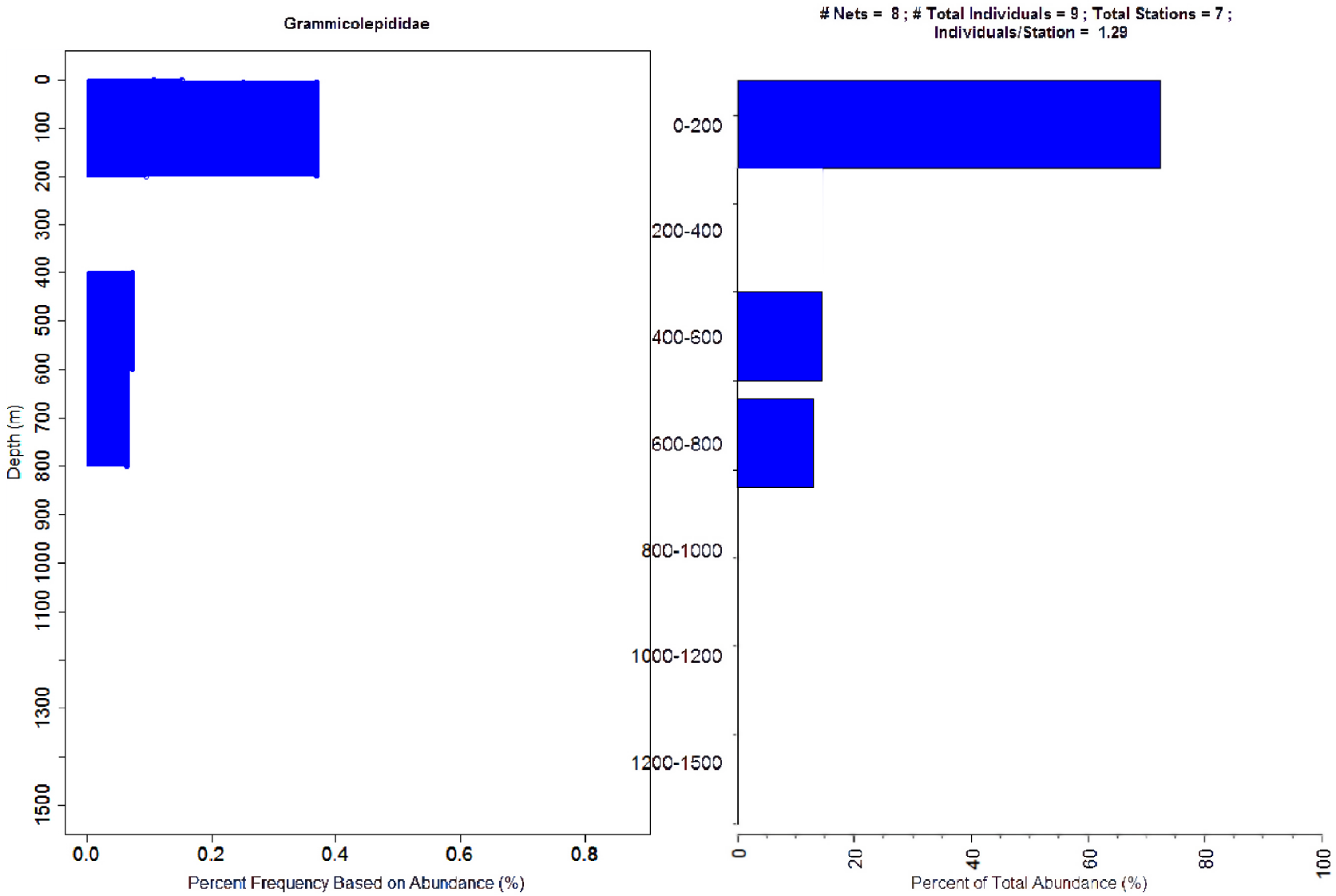
Giganturidae



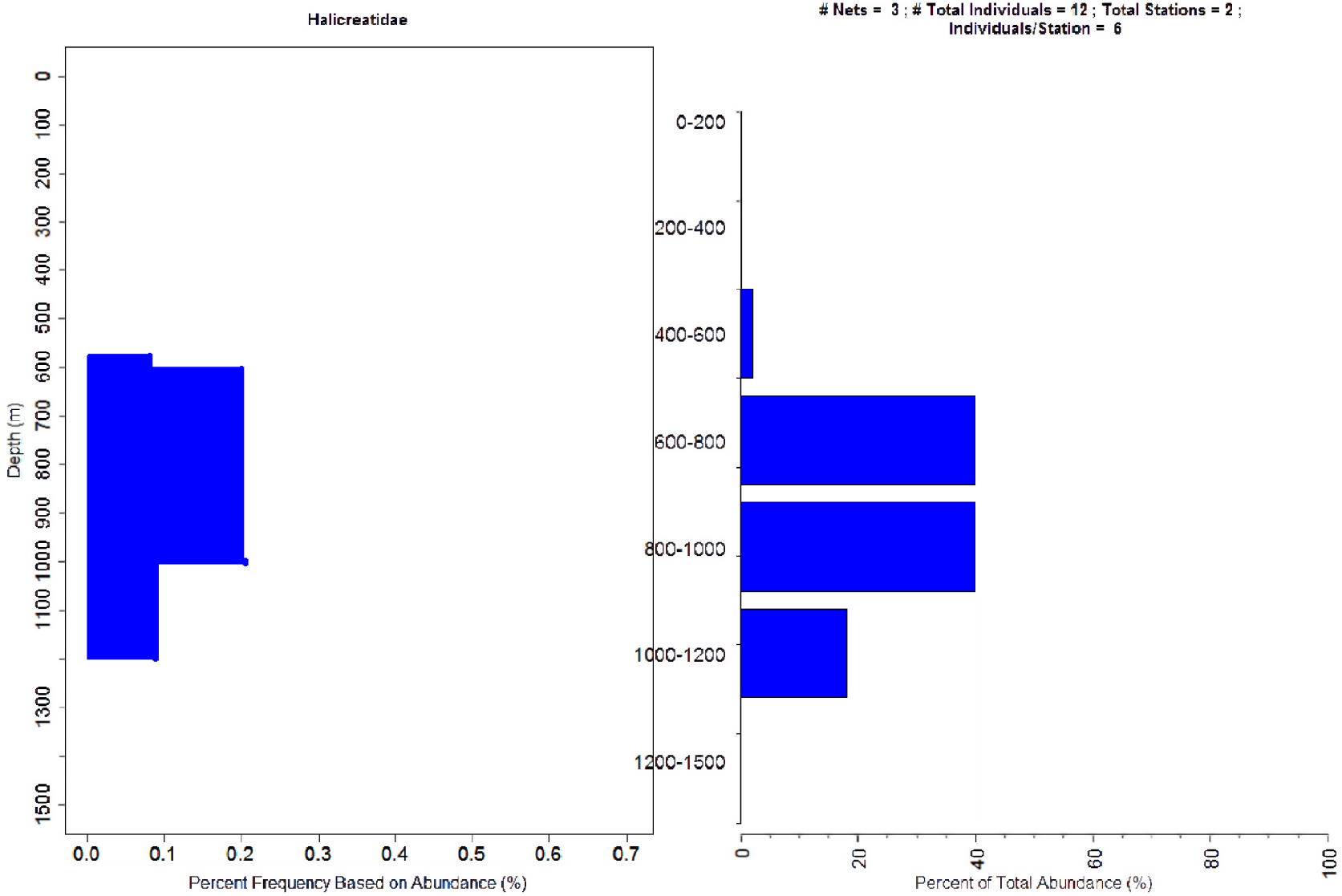
Gnathophausiidae



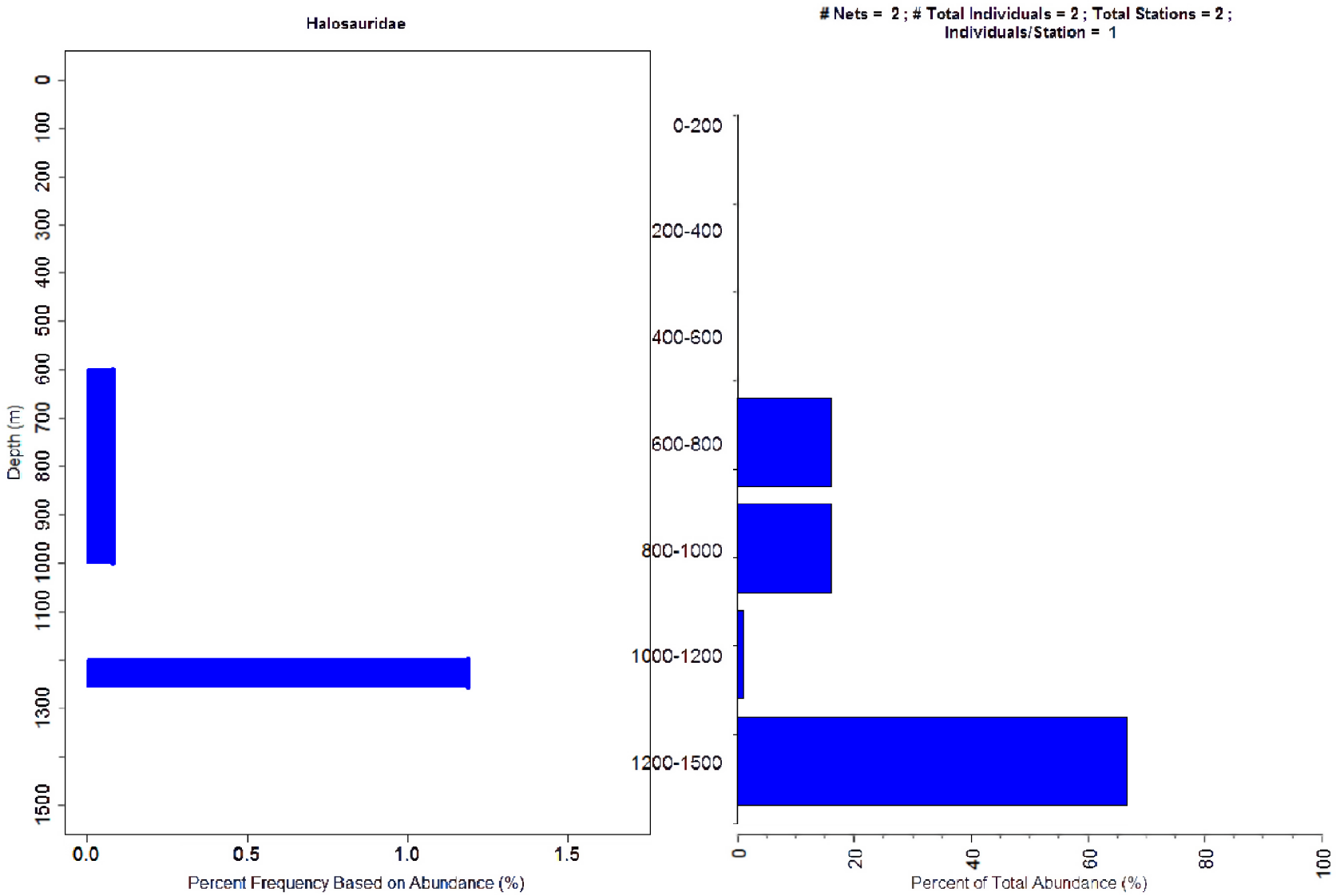
Gonostomatidae



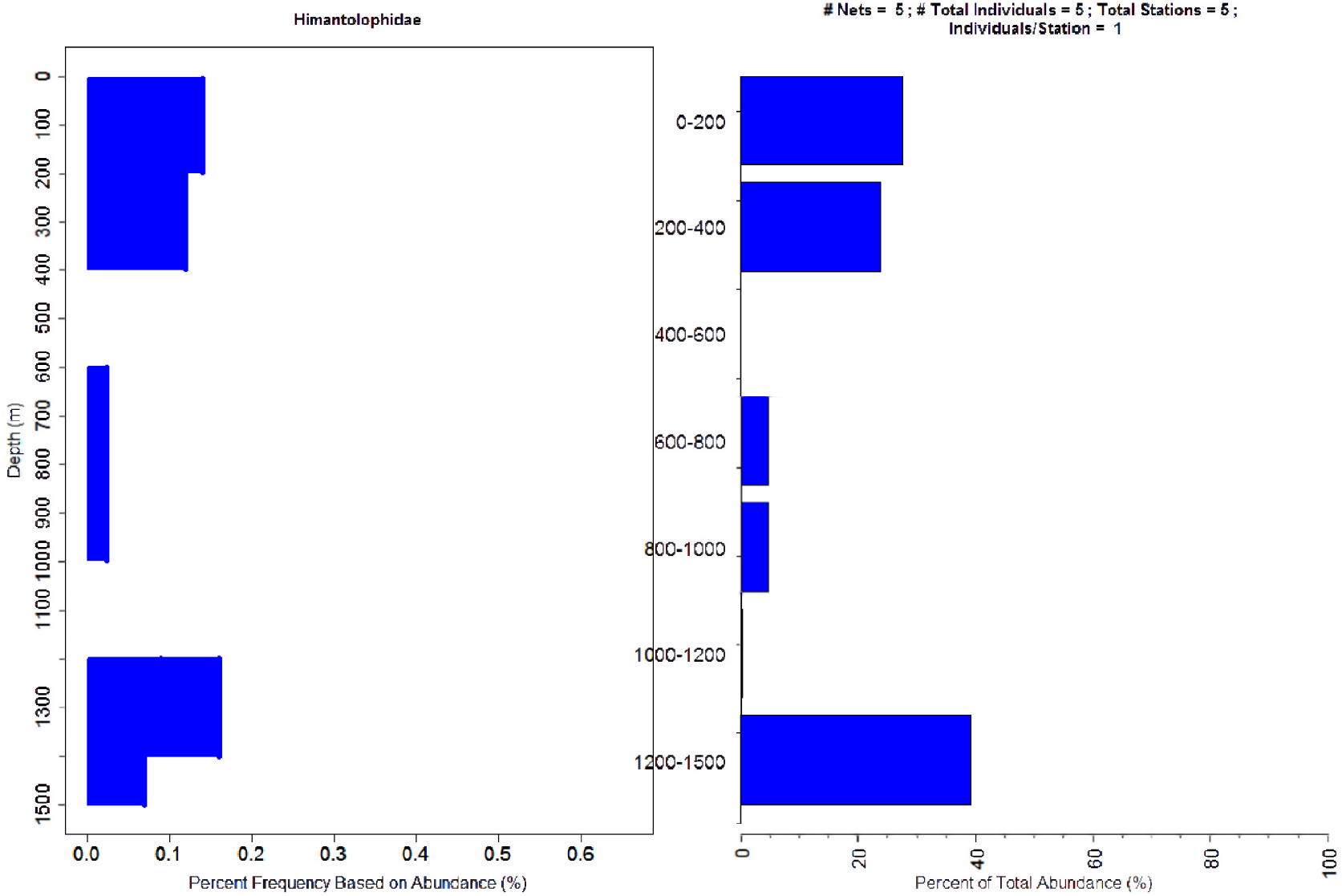
Grammicolepididae



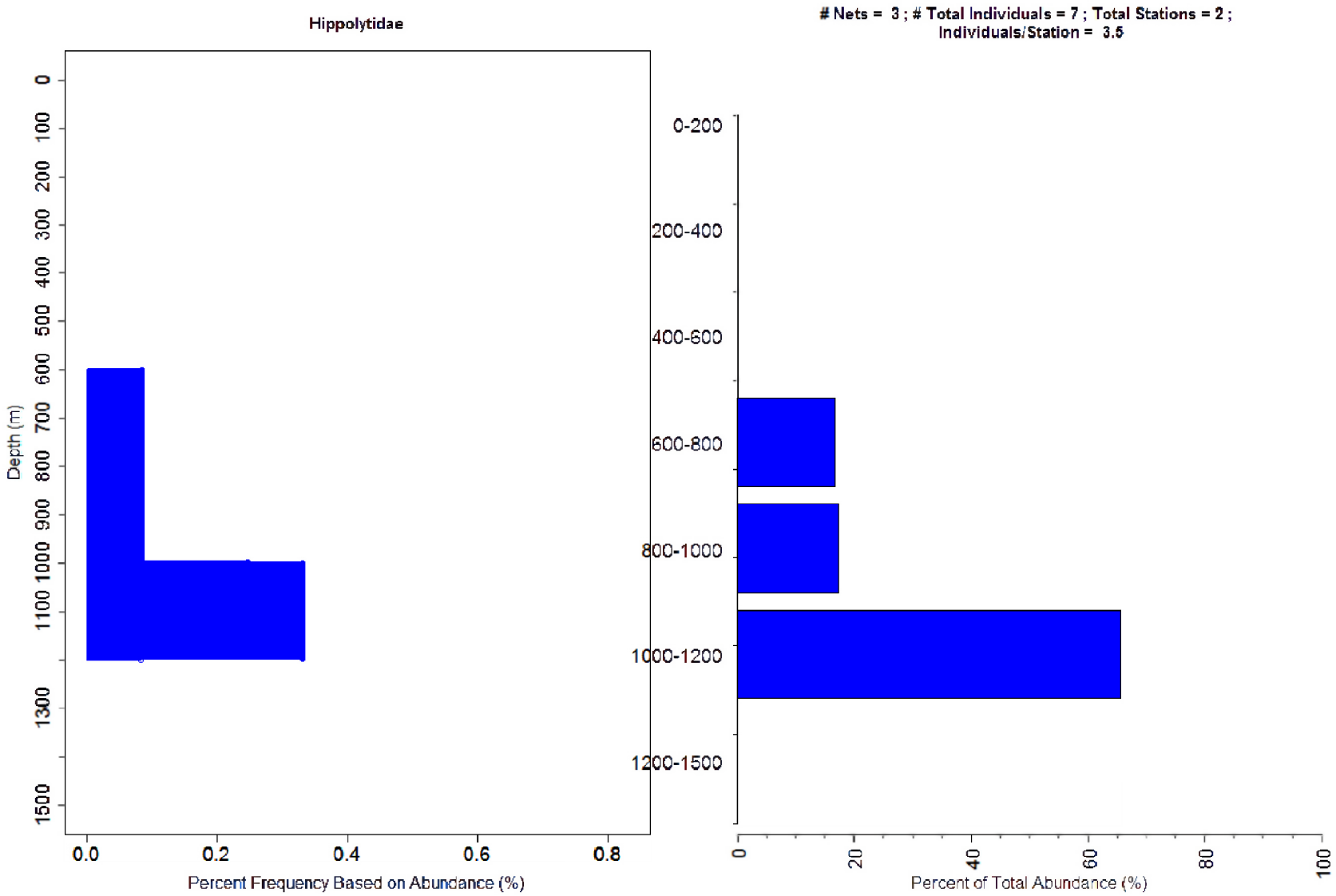
Halicreatidae



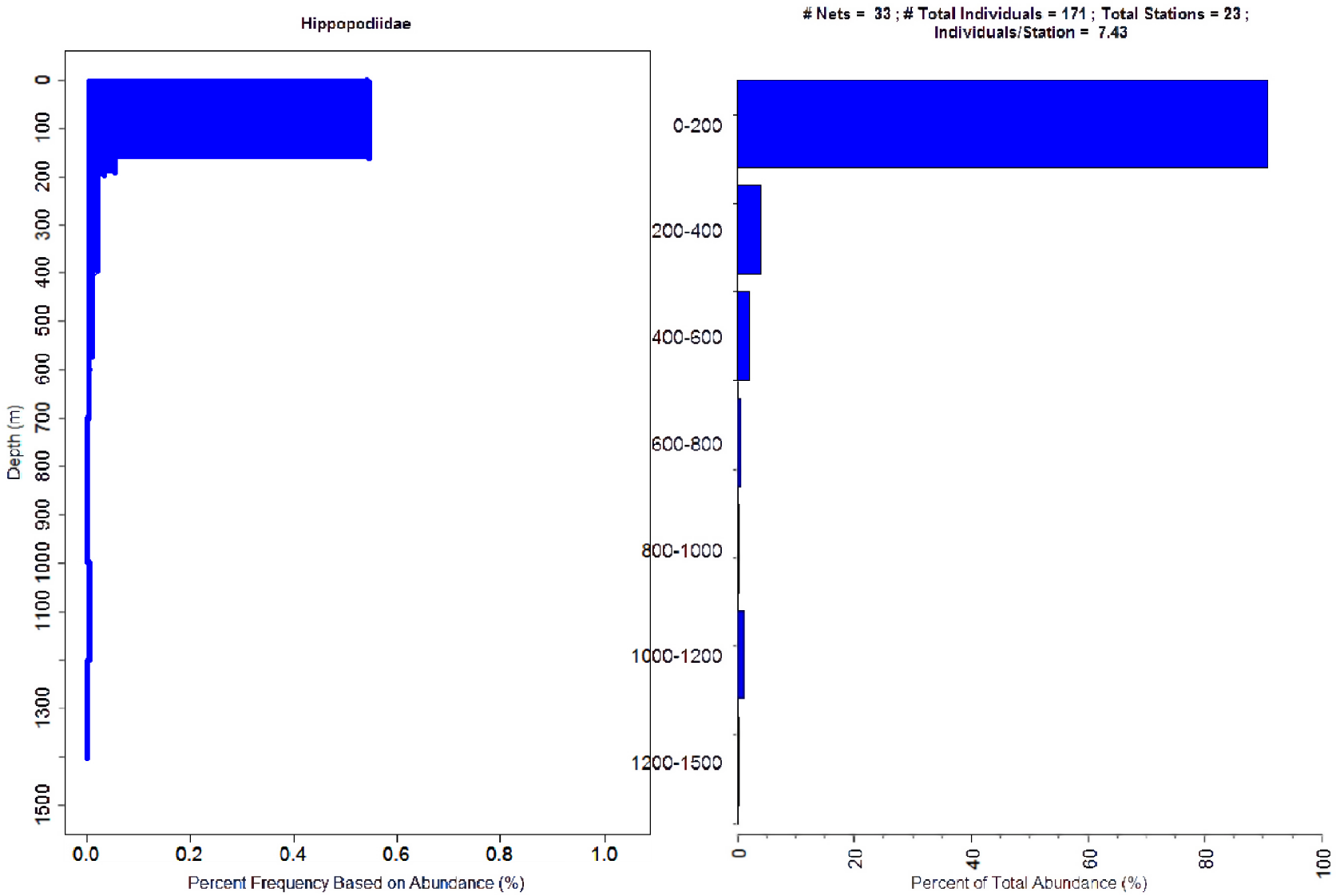
Halosauridae



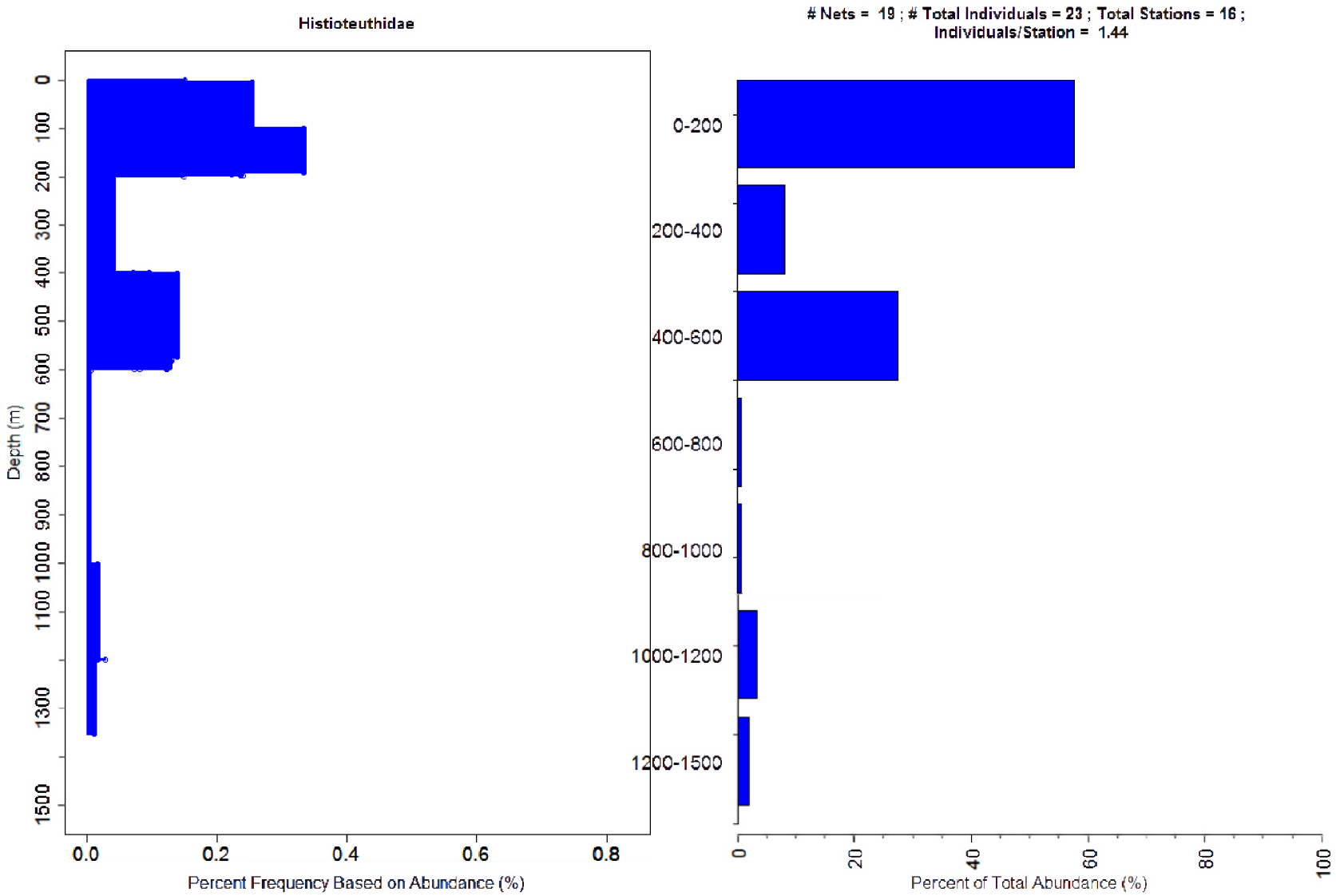
Himantolophidae



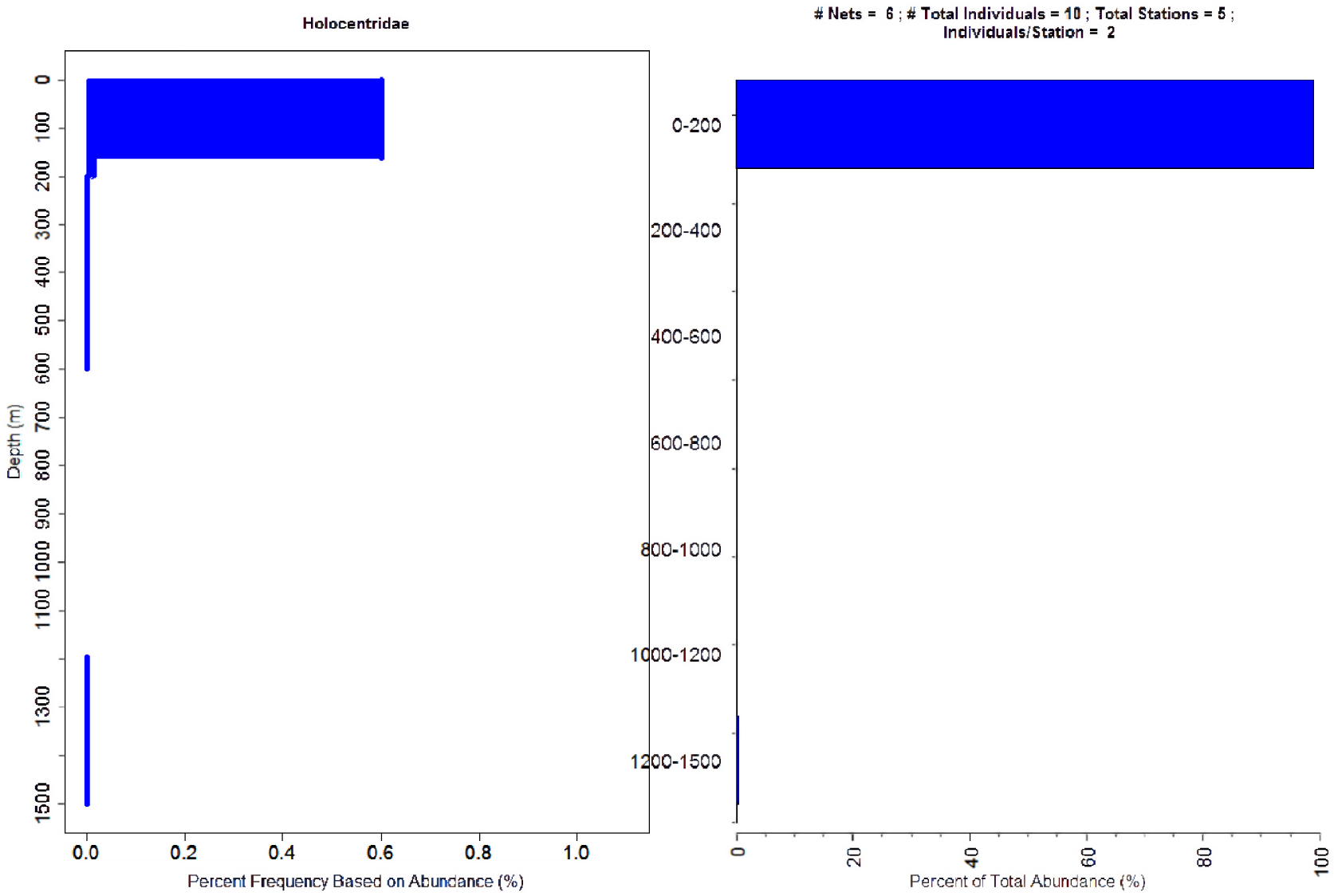
Hippolytidae



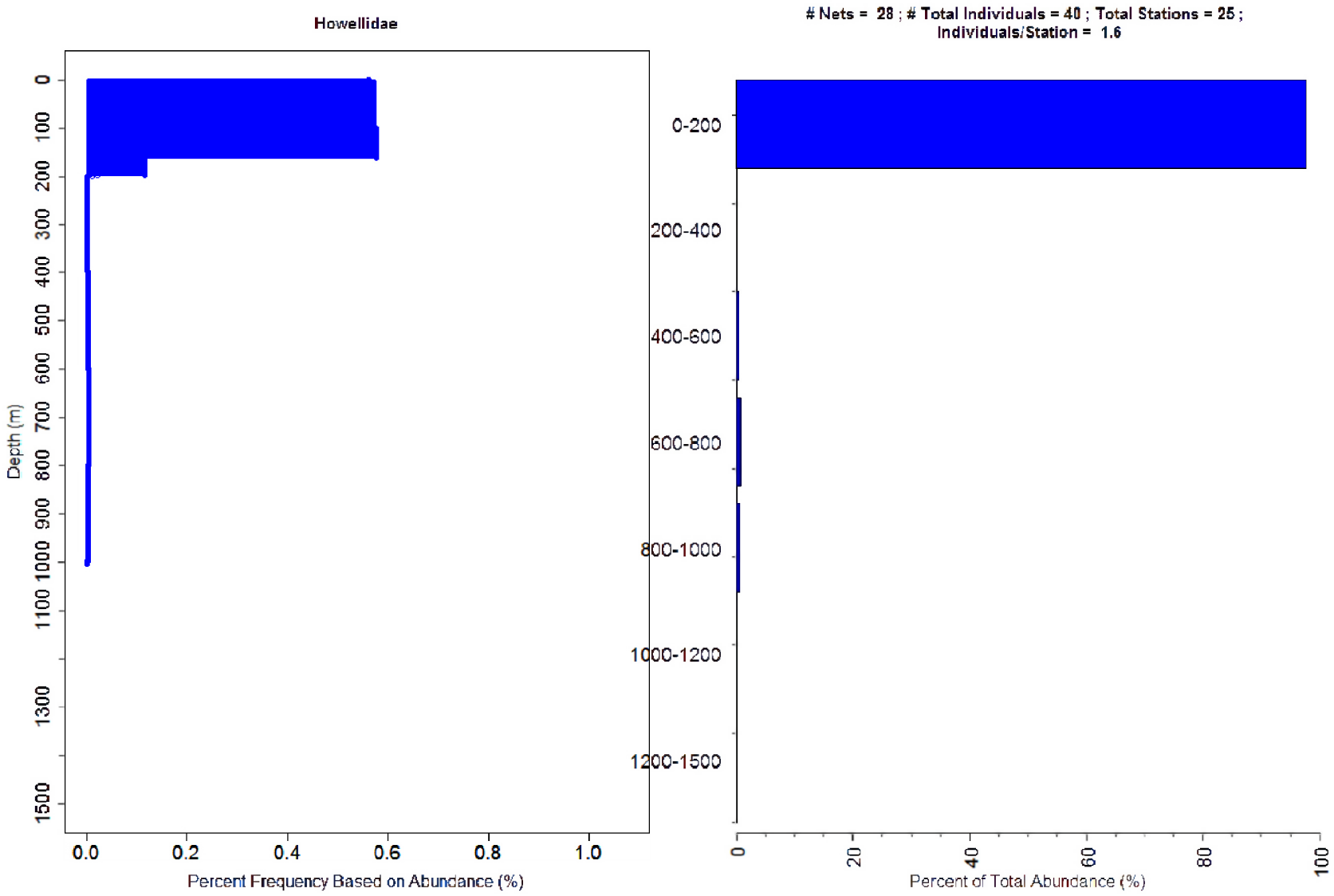
Hippopodiidae



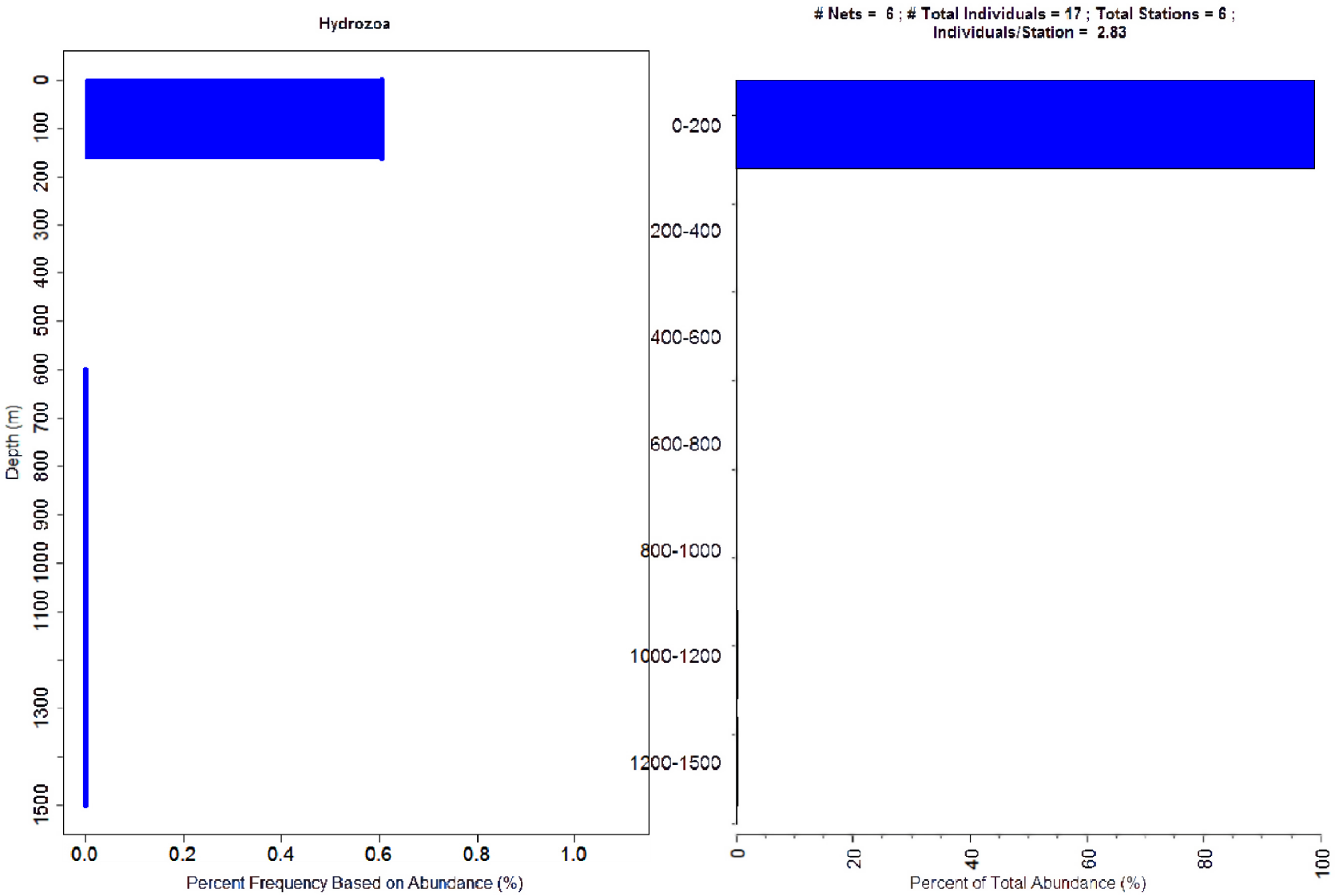
Histioteuthidae



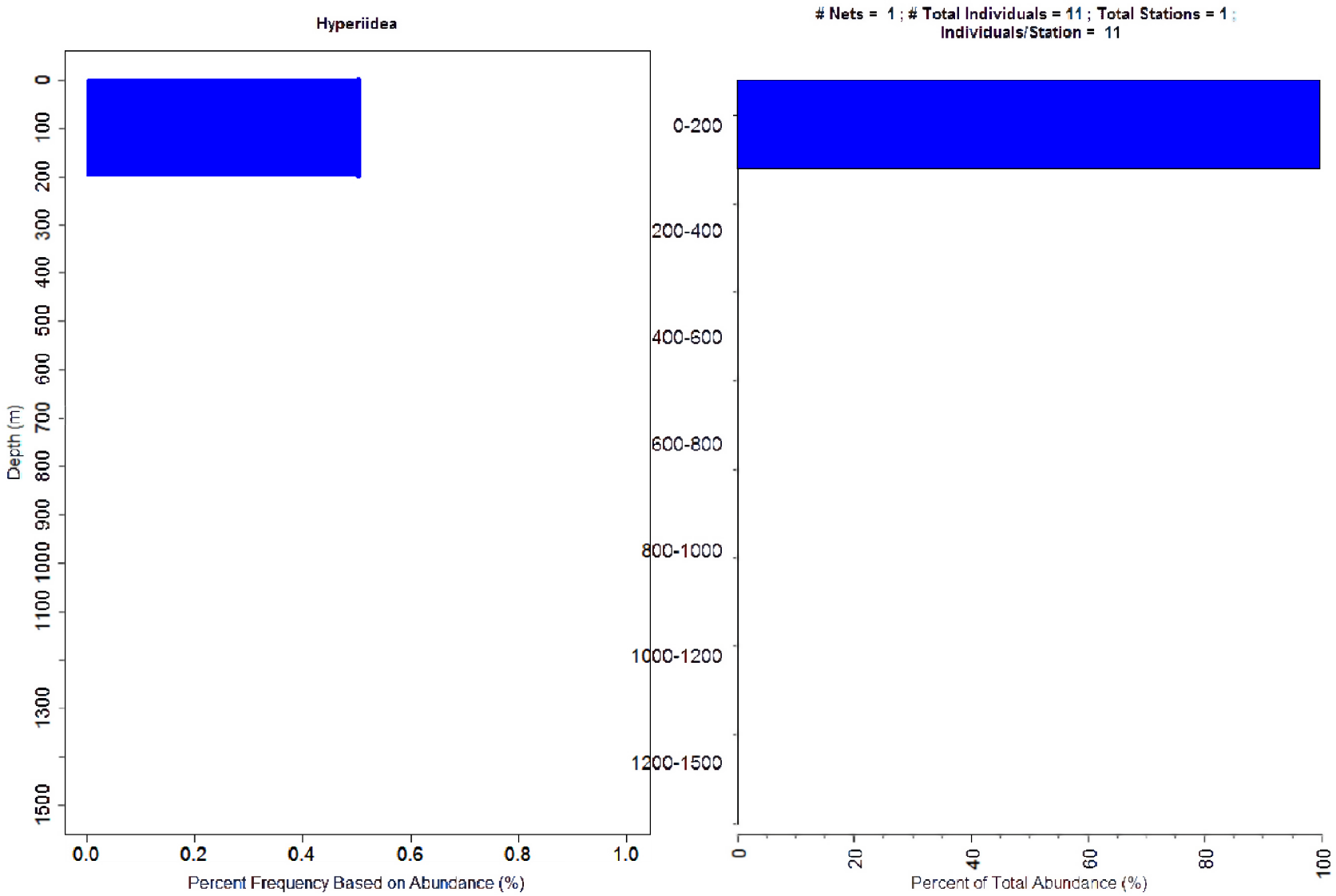
Holocentridae


Howellidae
Nets = 28 ; # Total Individuals = 40 ; Total Stations = 25 ;
Individuals/Station = 1.6
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

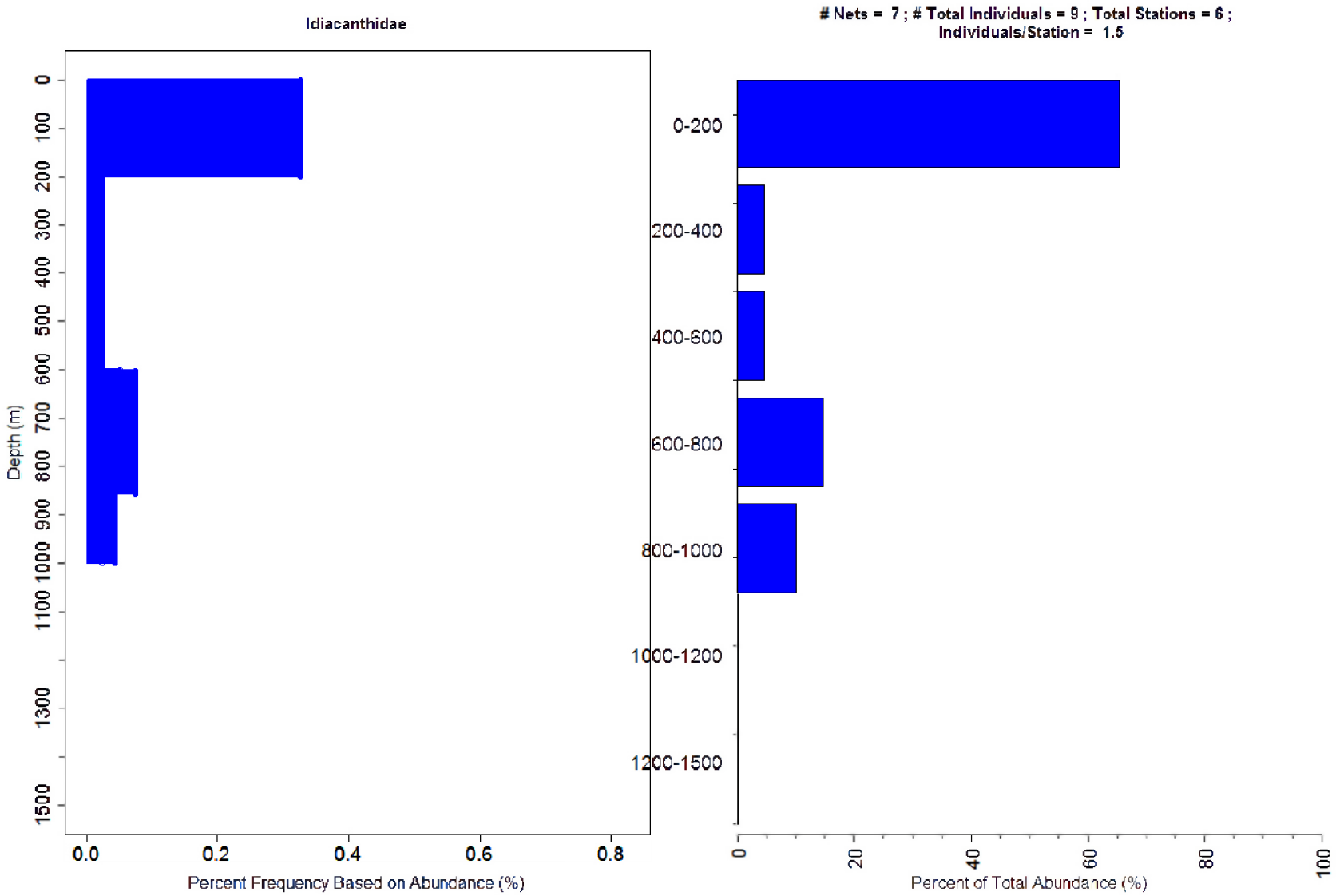
Howellidae


Hydrozoa
Nets = 6 ; # Total Individuals = 17 ; Total Stations = 6 ;
Individuals/Station = 2.83
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

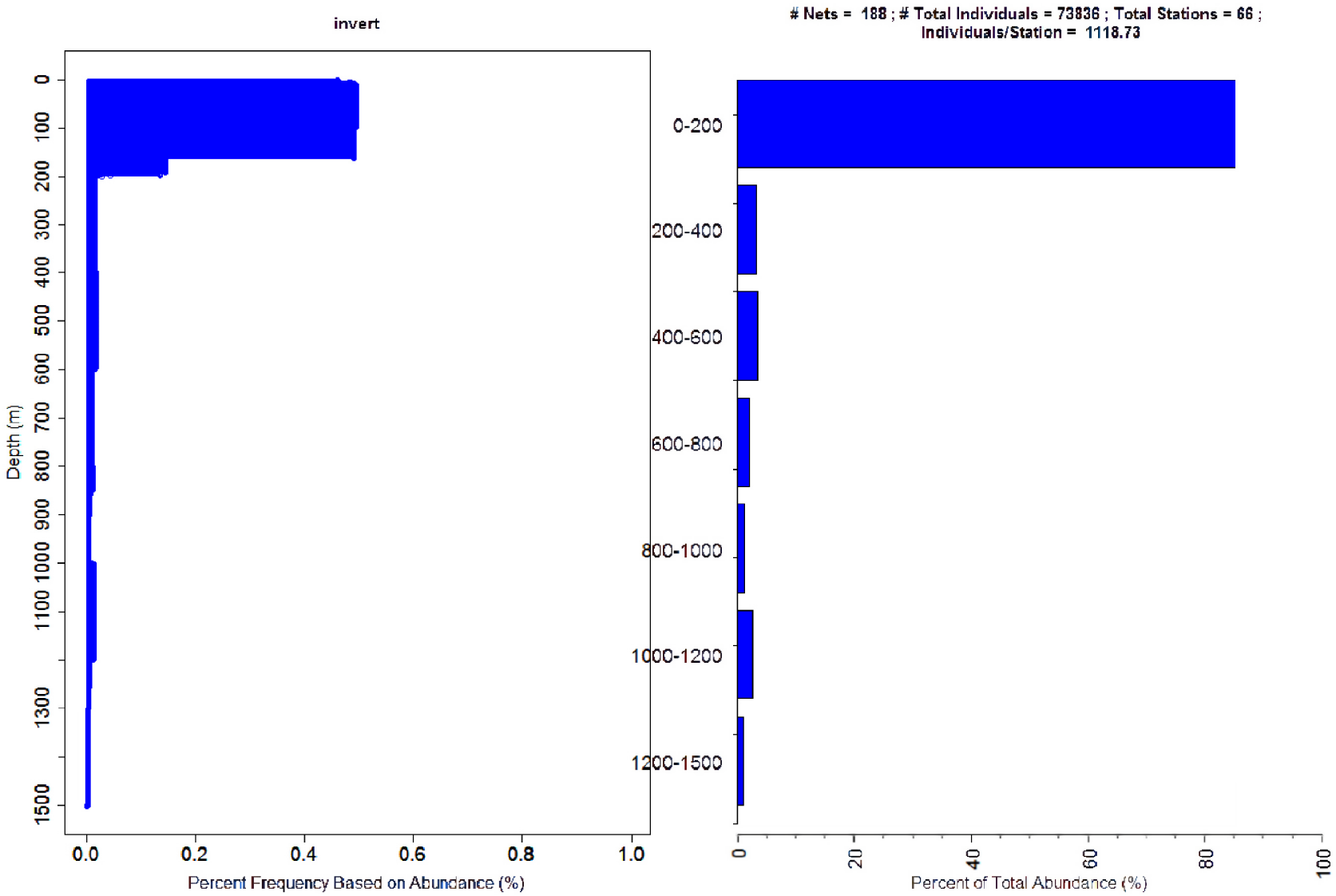
Hydrozoa


Hyperiidea
Nets = 1 ; # Total Individuals = 11 ; Total Stations = 1 ;
Individuals/Station = 11
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

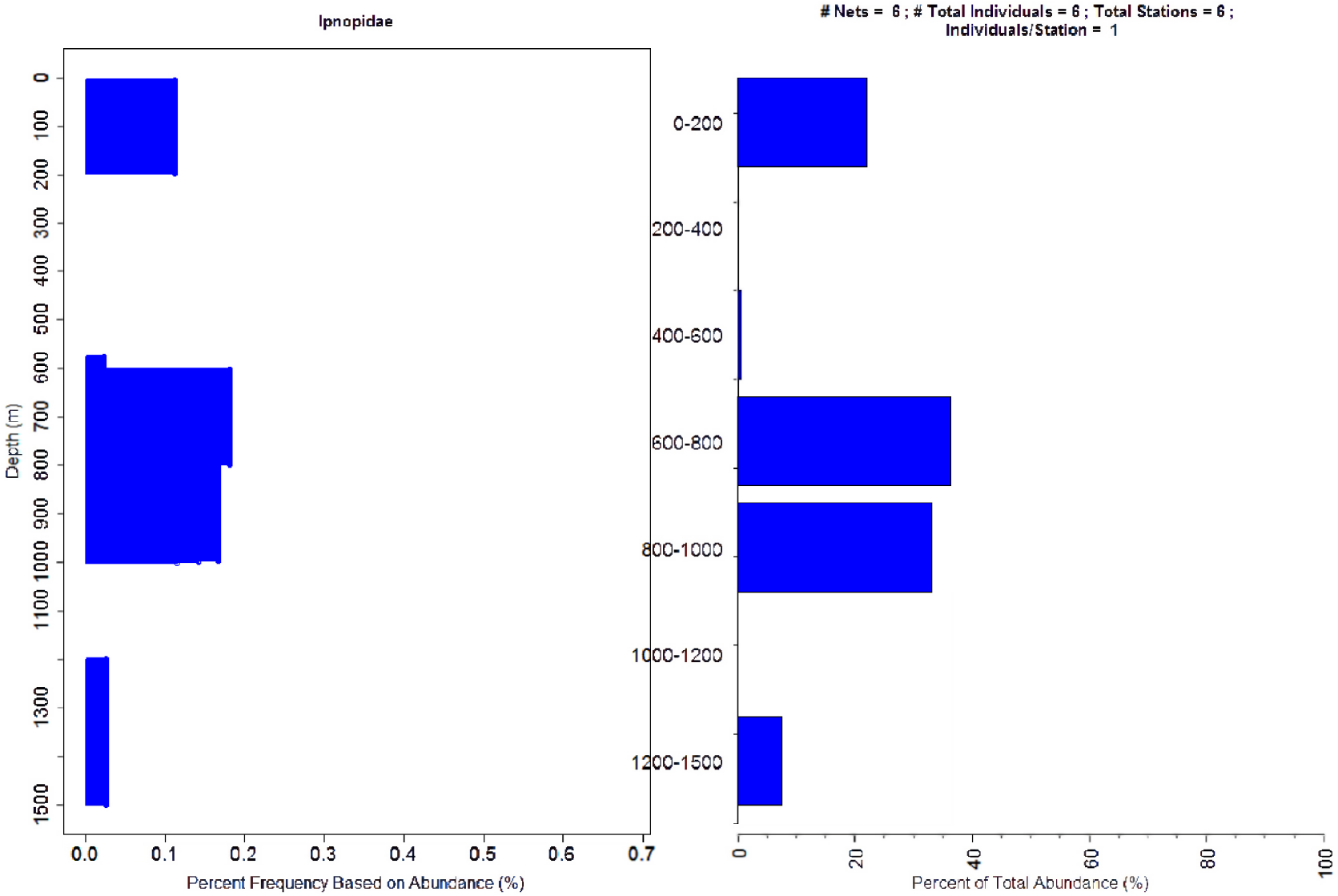
Hyperiidea



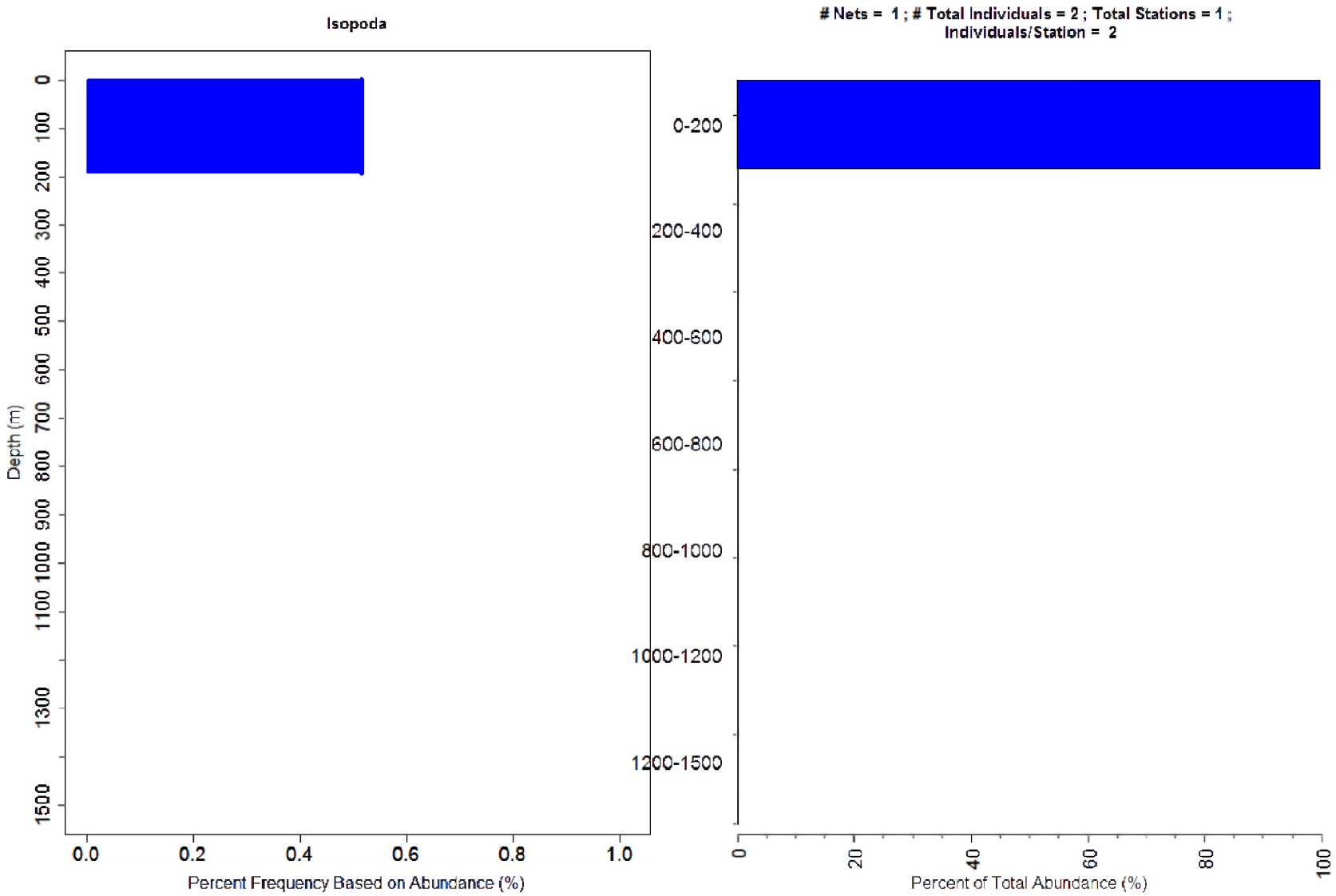
Idiacanthidae


invert
Nets = 188 ; # Total Individuals = 73836 ; Total Stations = 66 ;
Individuals/Station = 1118.73
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

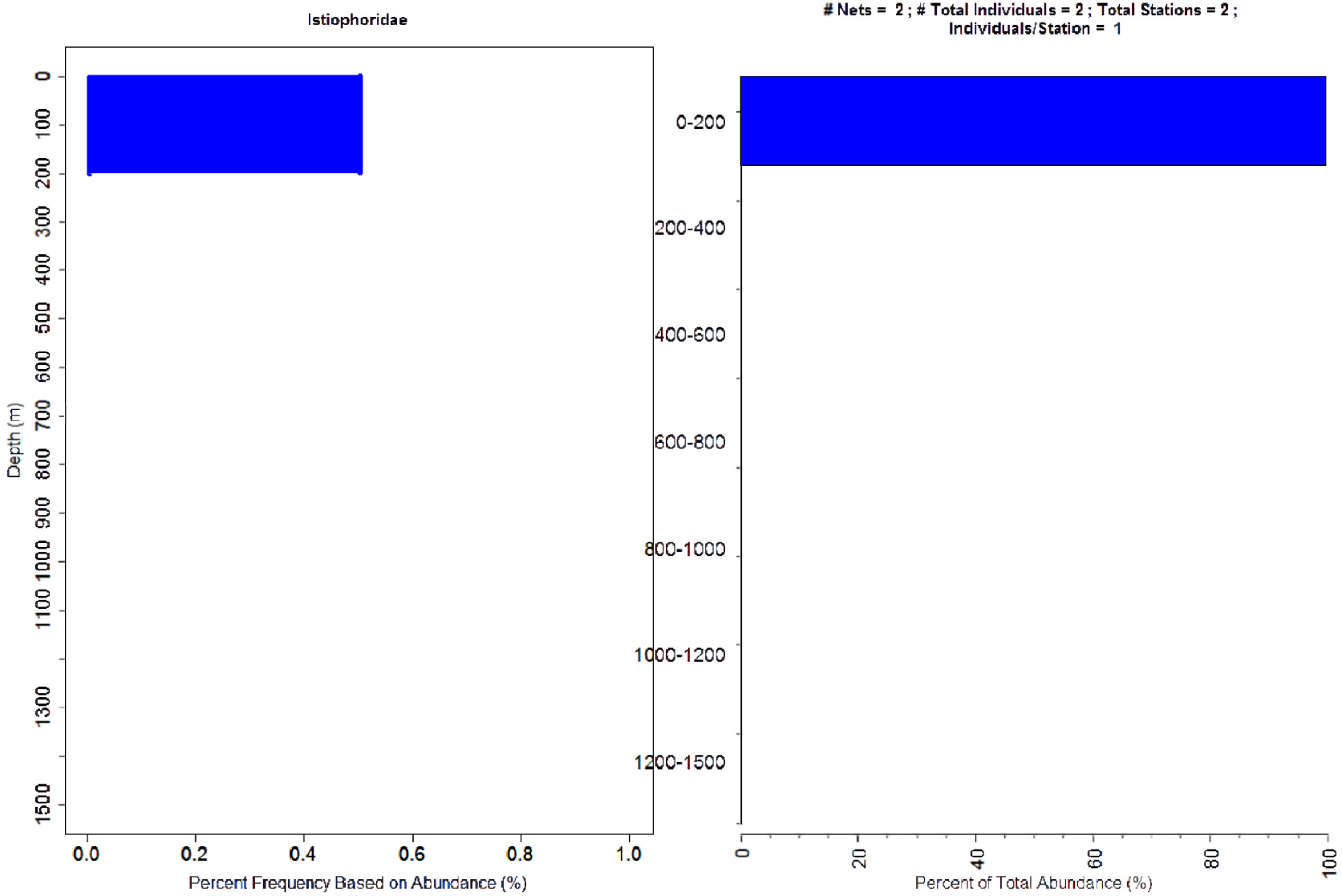
invert


Ipnopidae
Nets = 6 ; # Total Individuals = 6 ; Total Stations = 6 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

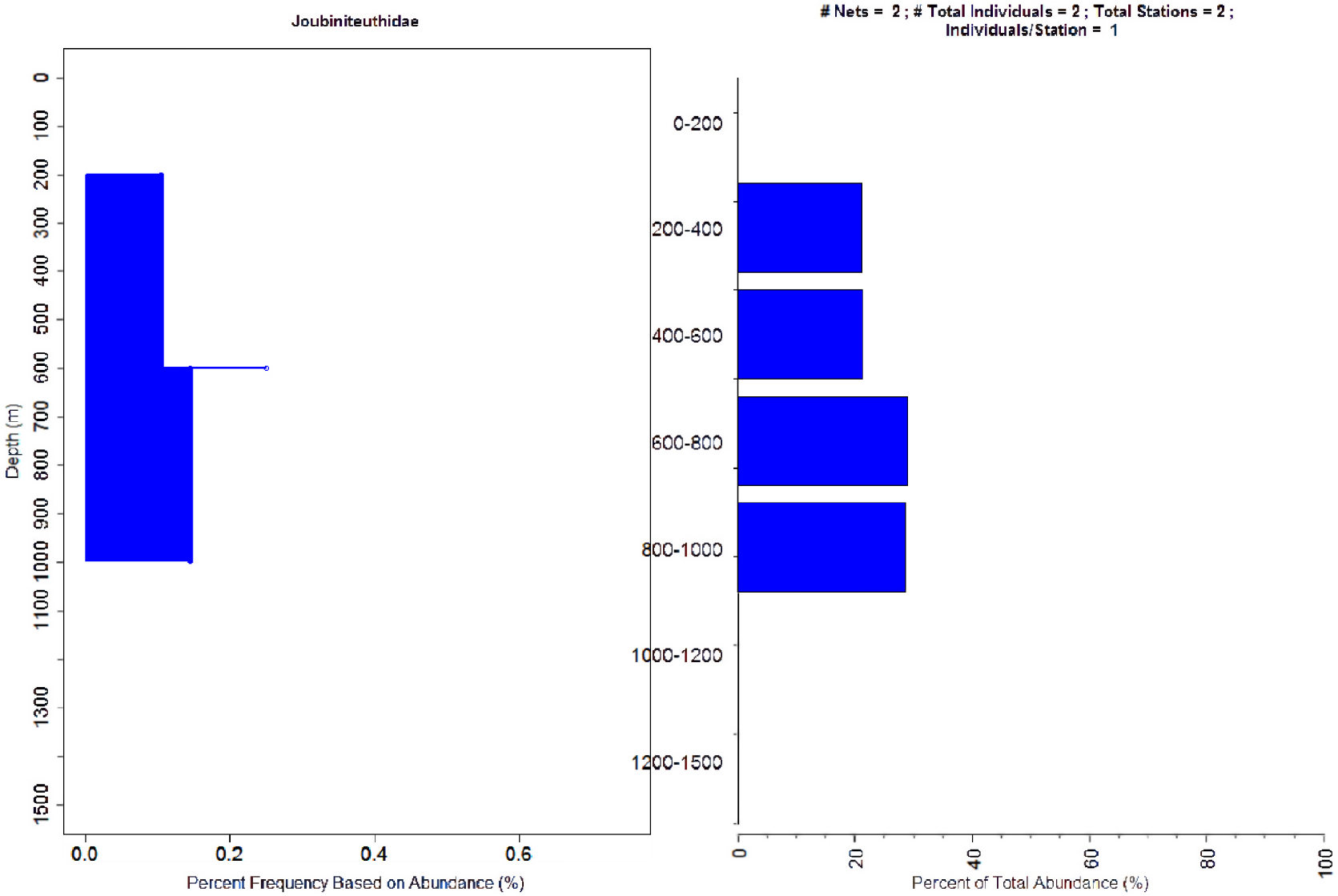
Ipnopidae


Isopoda
Nets = 1 ; # Total Individuals = 2 ; Total Stations = 1 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

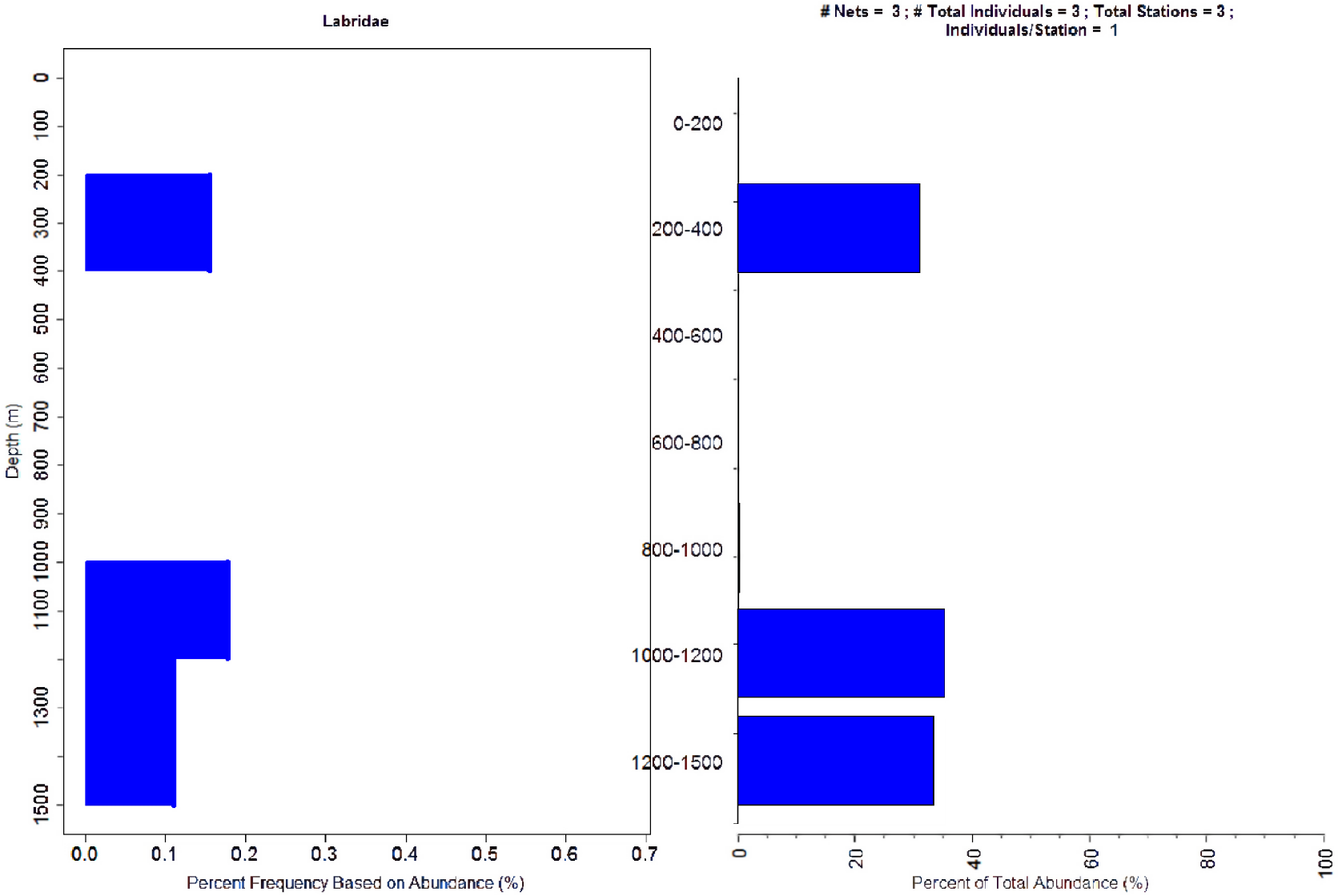
Isopoda



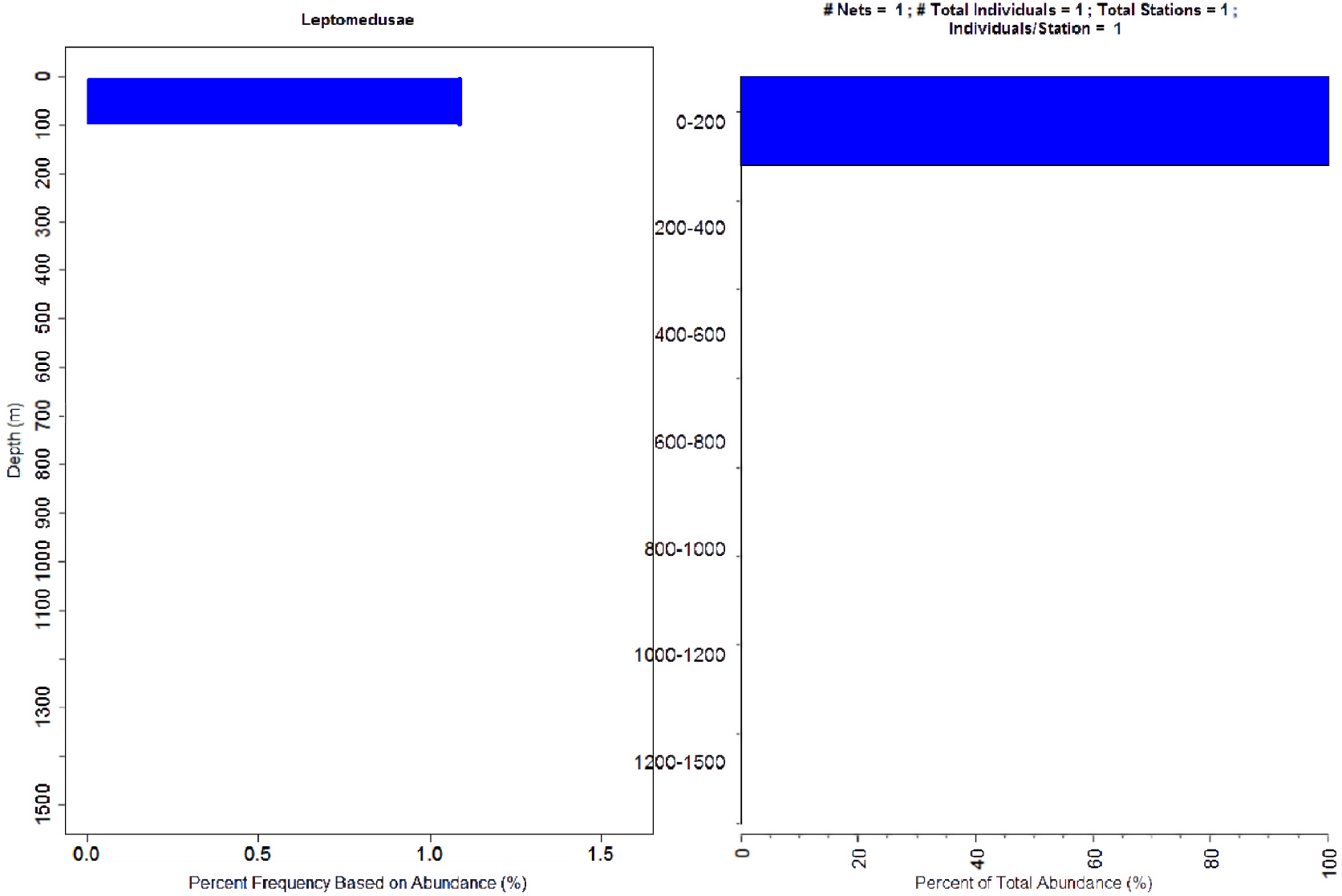
Istiophoridae



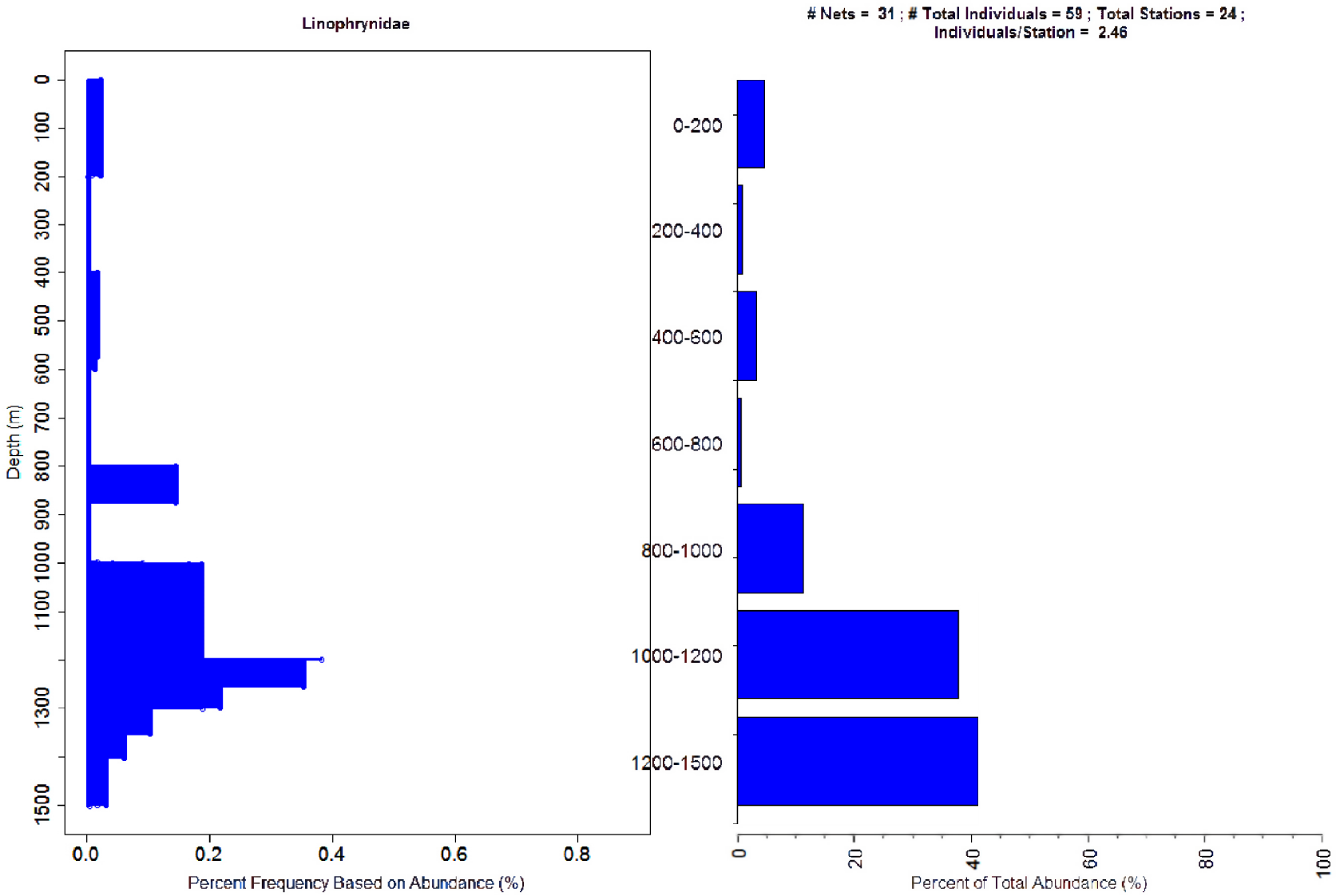
Joubiniteuthidae


Labridae
Nets = 3 ; # Total Individuals = 3 ; Total Stations = 3 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

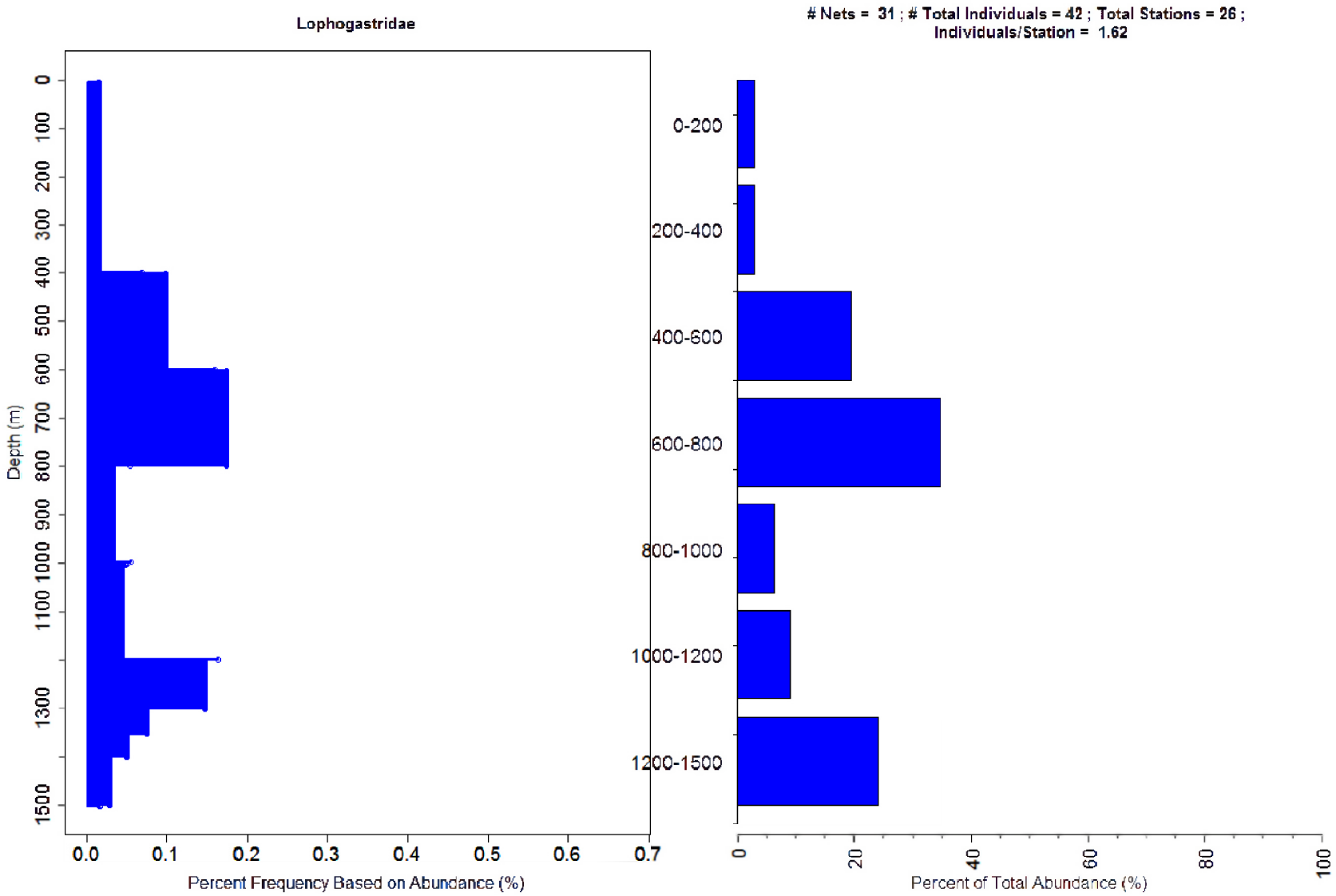
Labridae



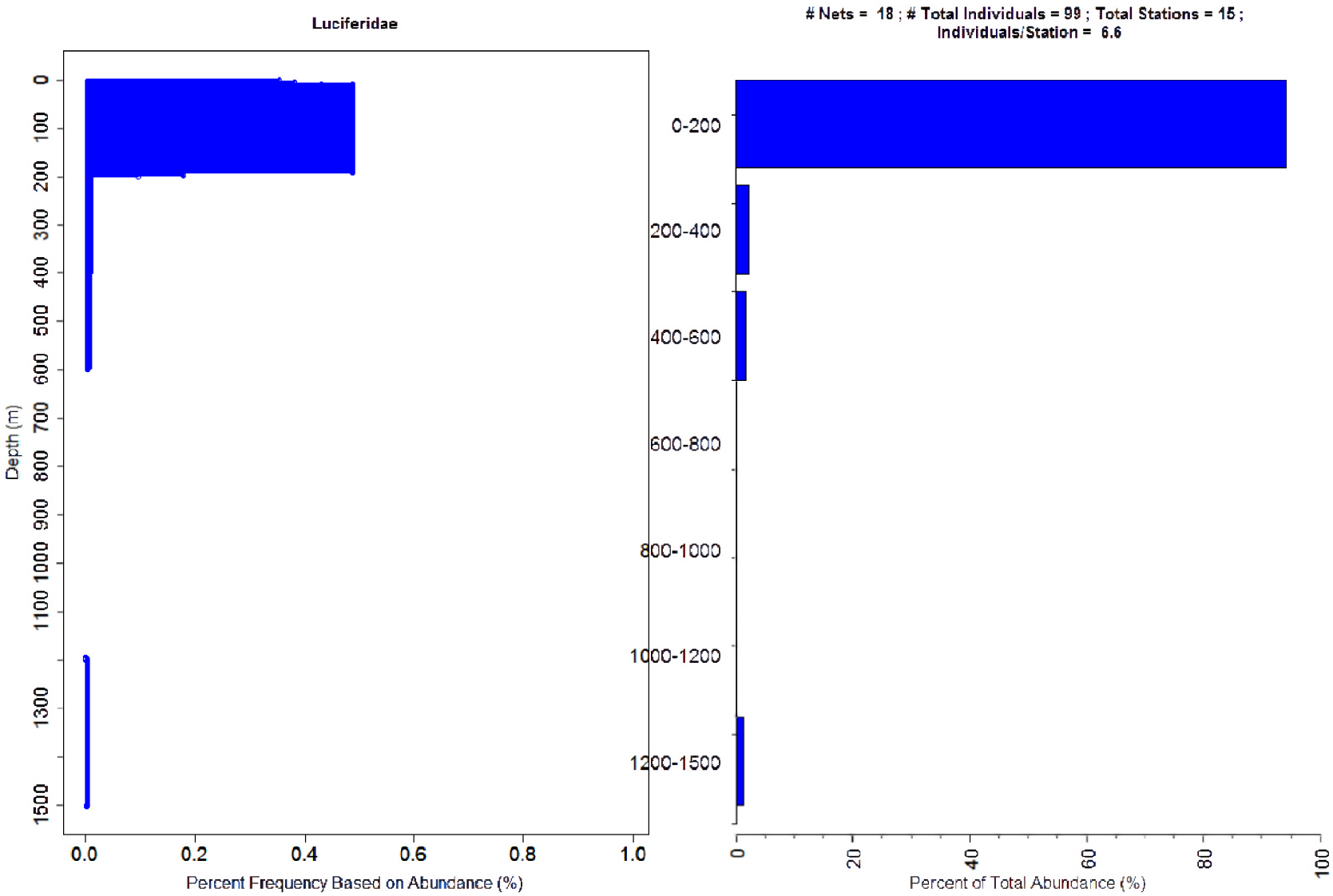
Leptomedusae



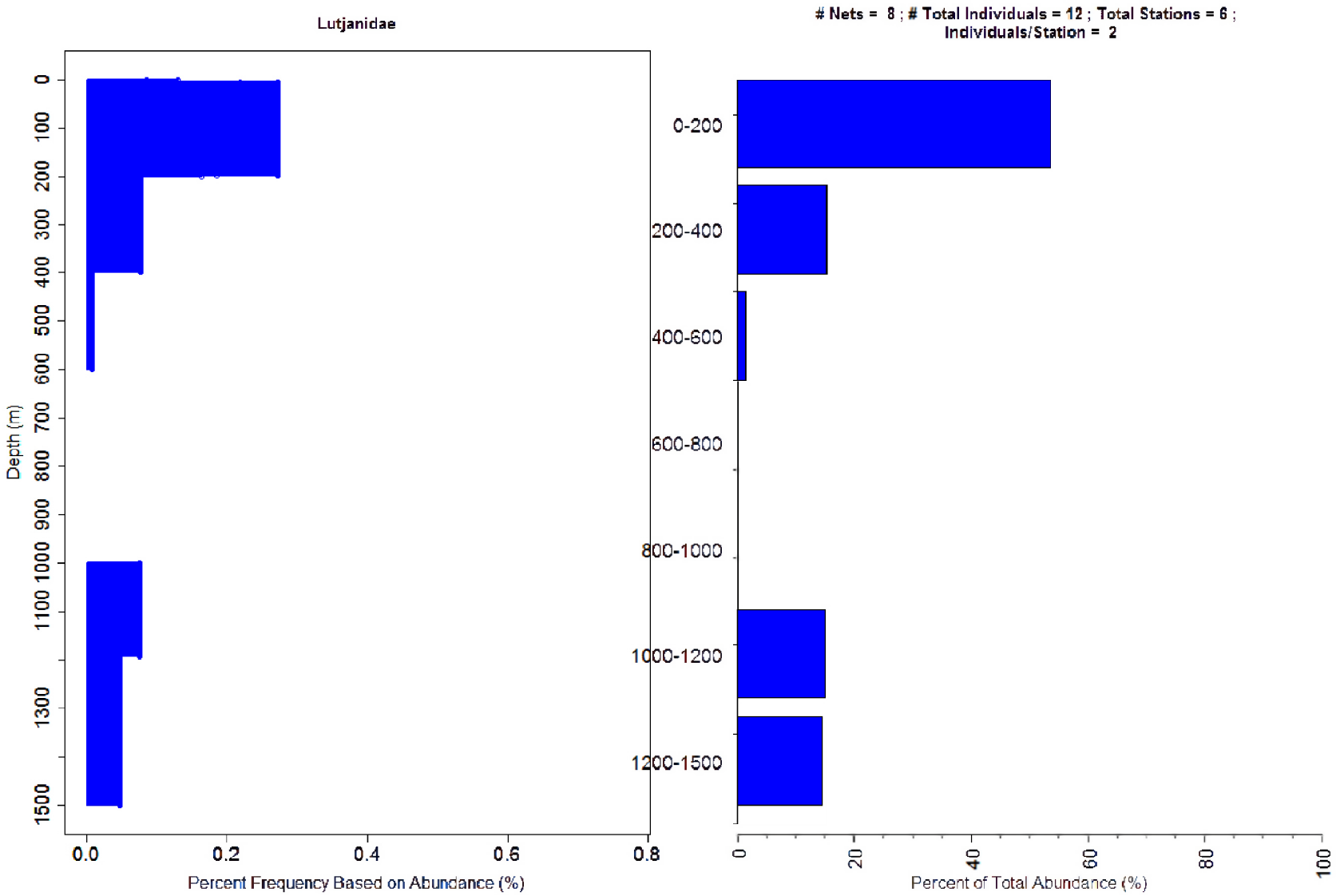
Linophrynidae



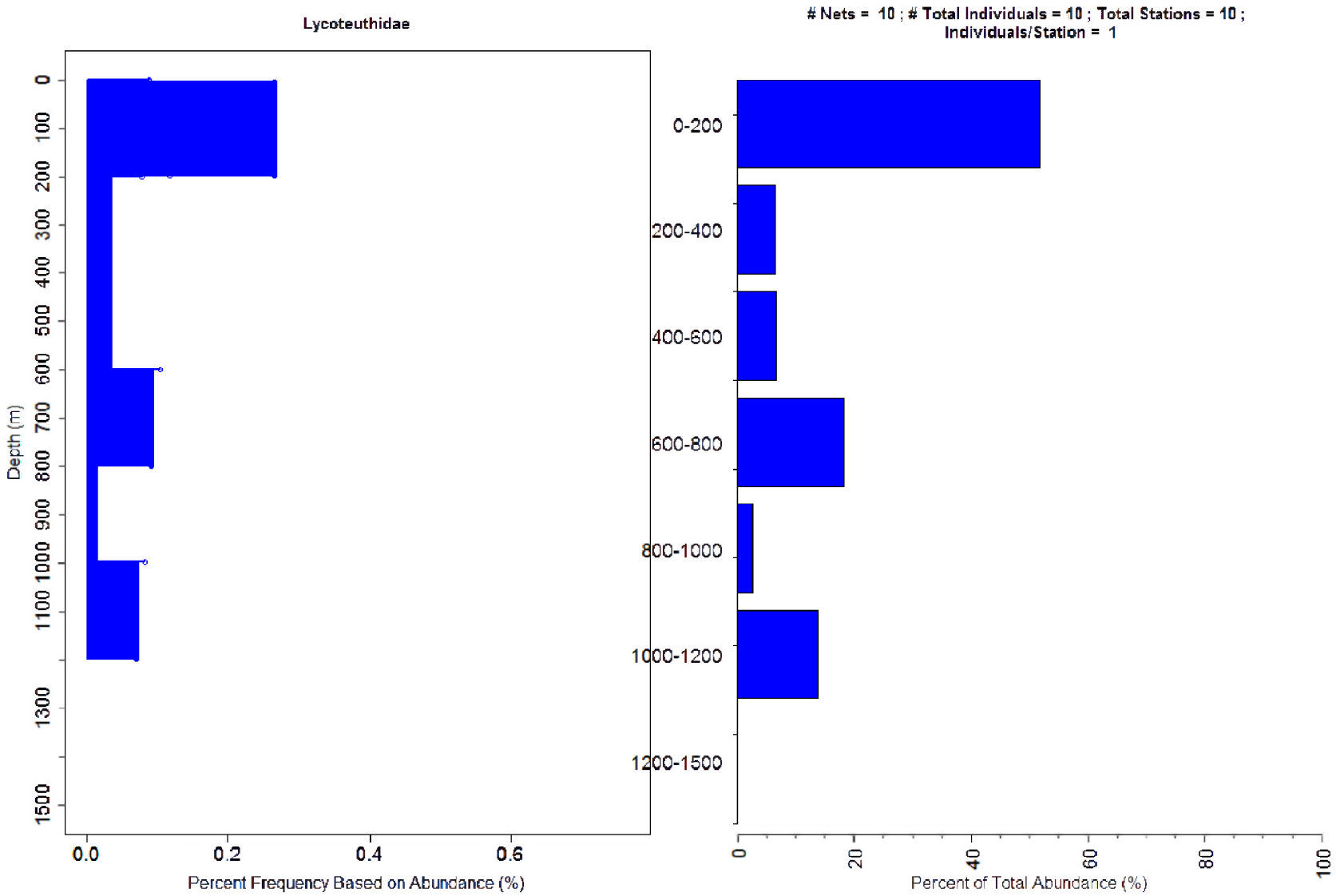
Lophogastridae



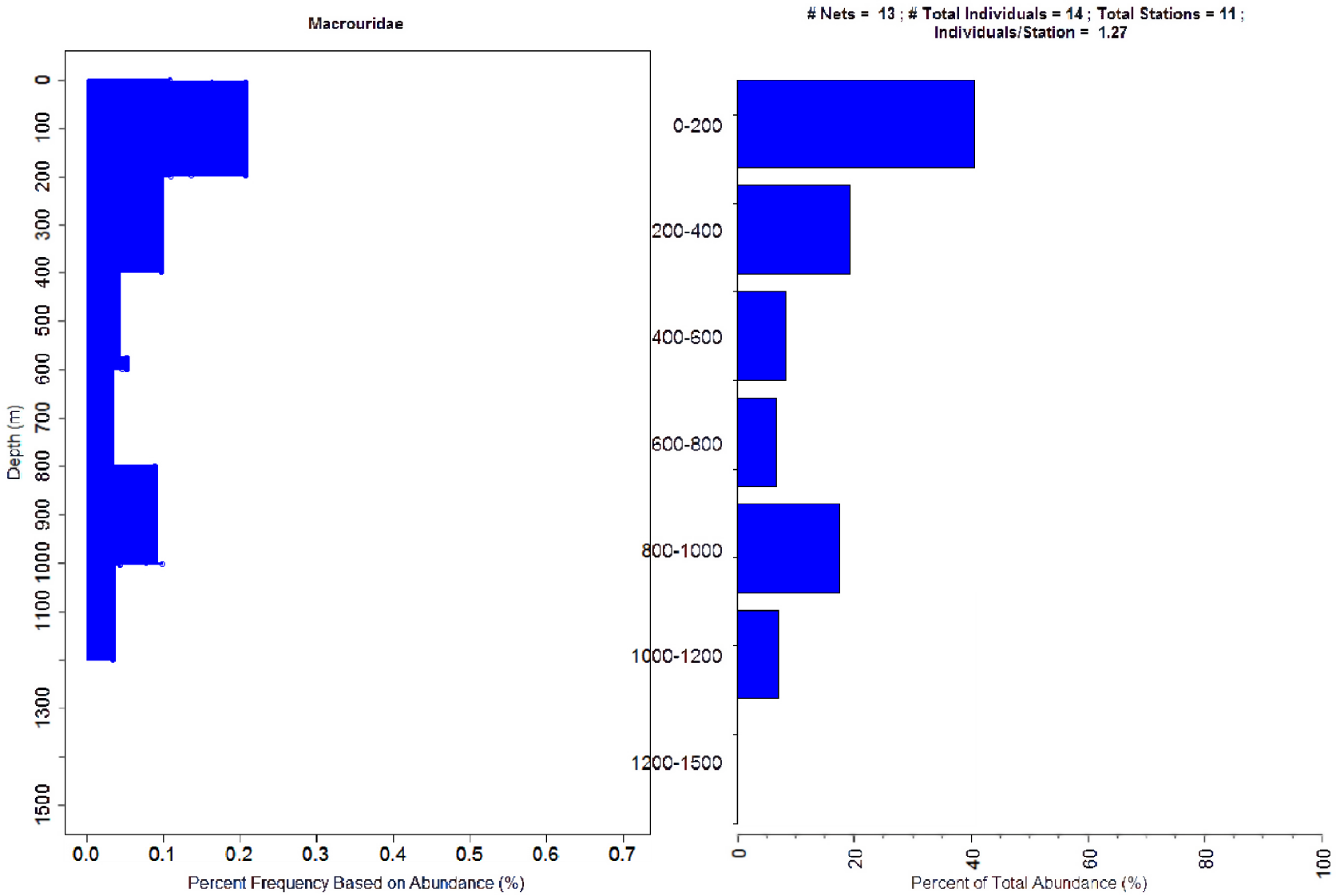
Luciferidae


Lutjanidae
Nets = 8 ; # Total Individuals = 12 ; Total Stations = 6 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

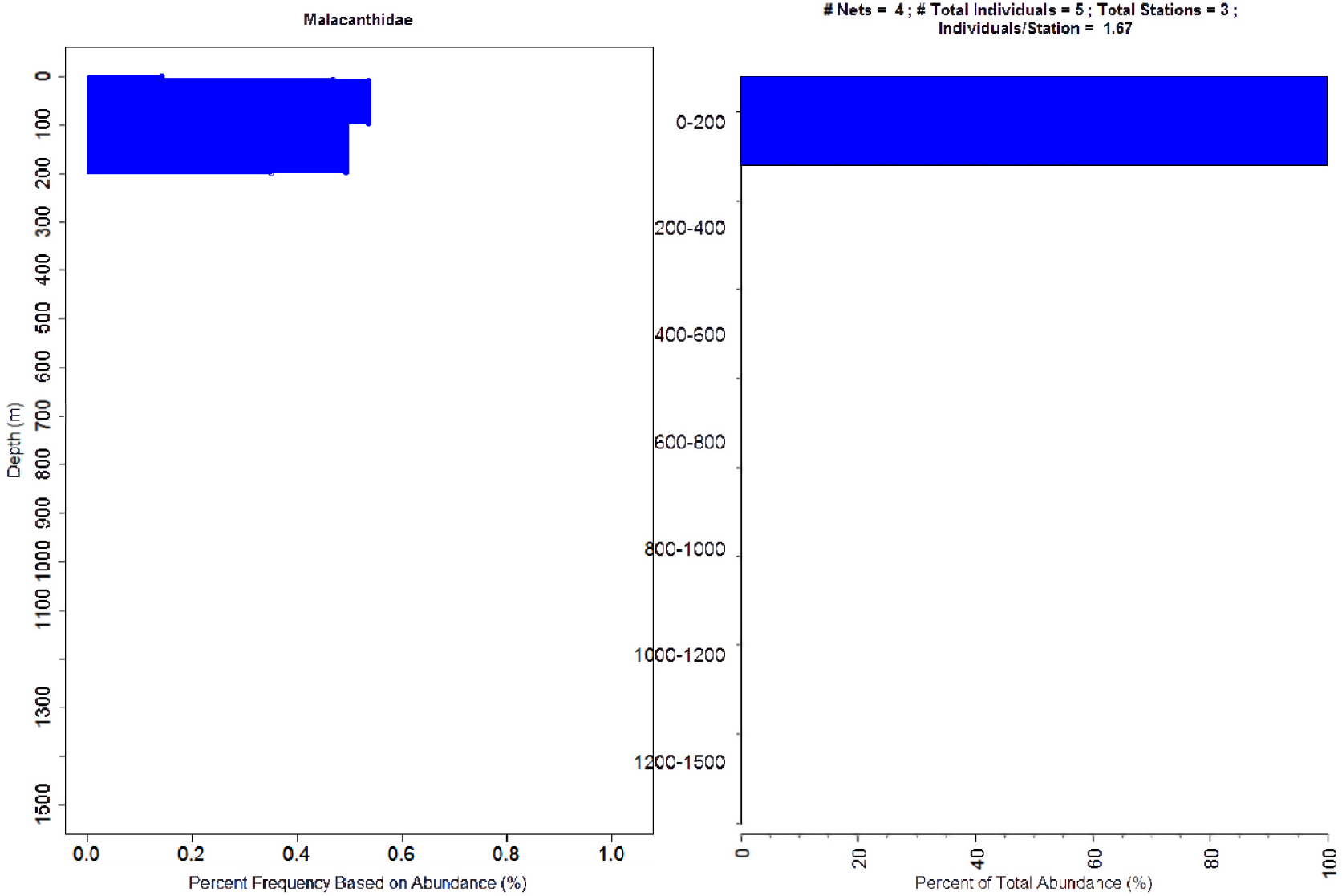
Lutjanidae



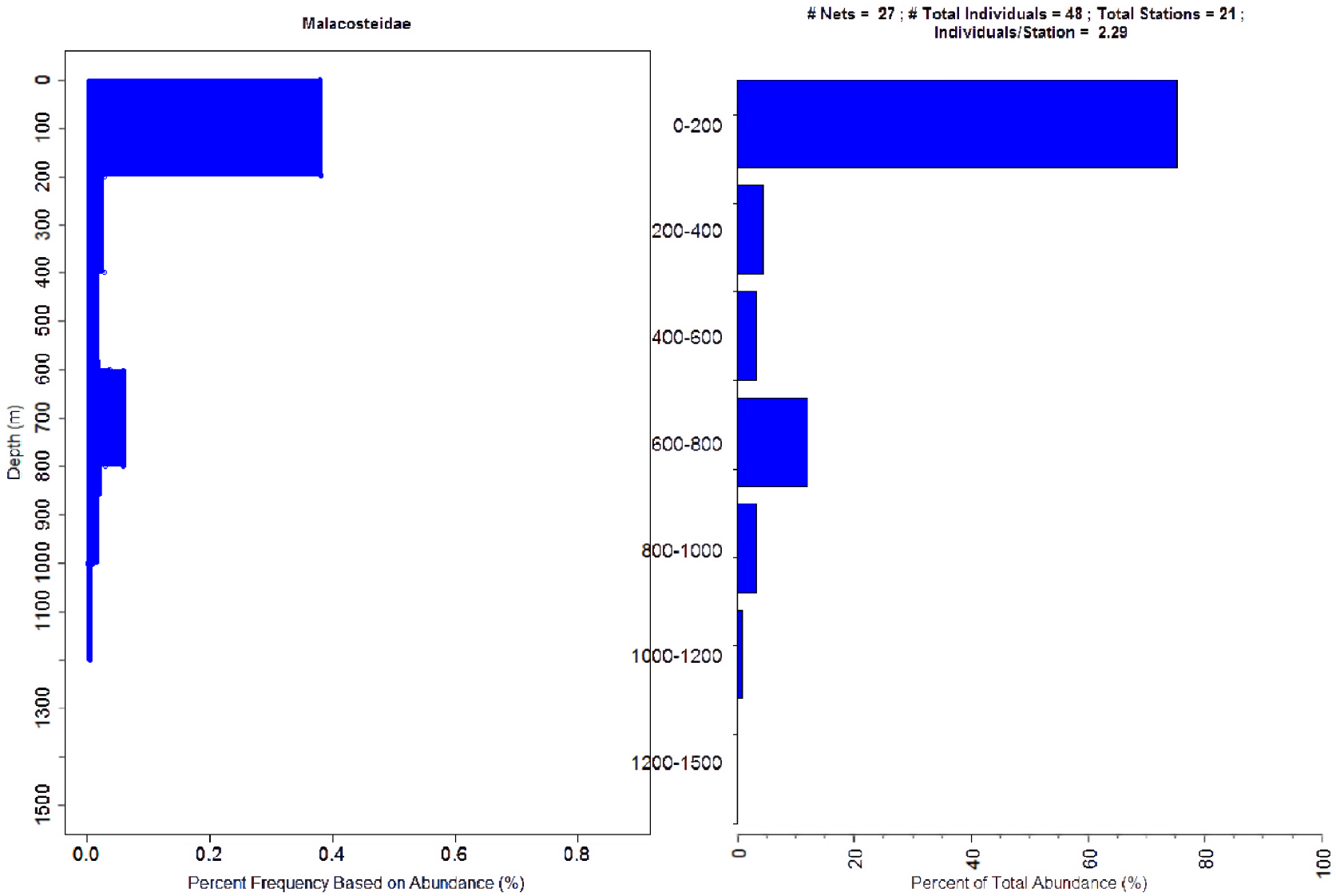
Lycoteuthidae



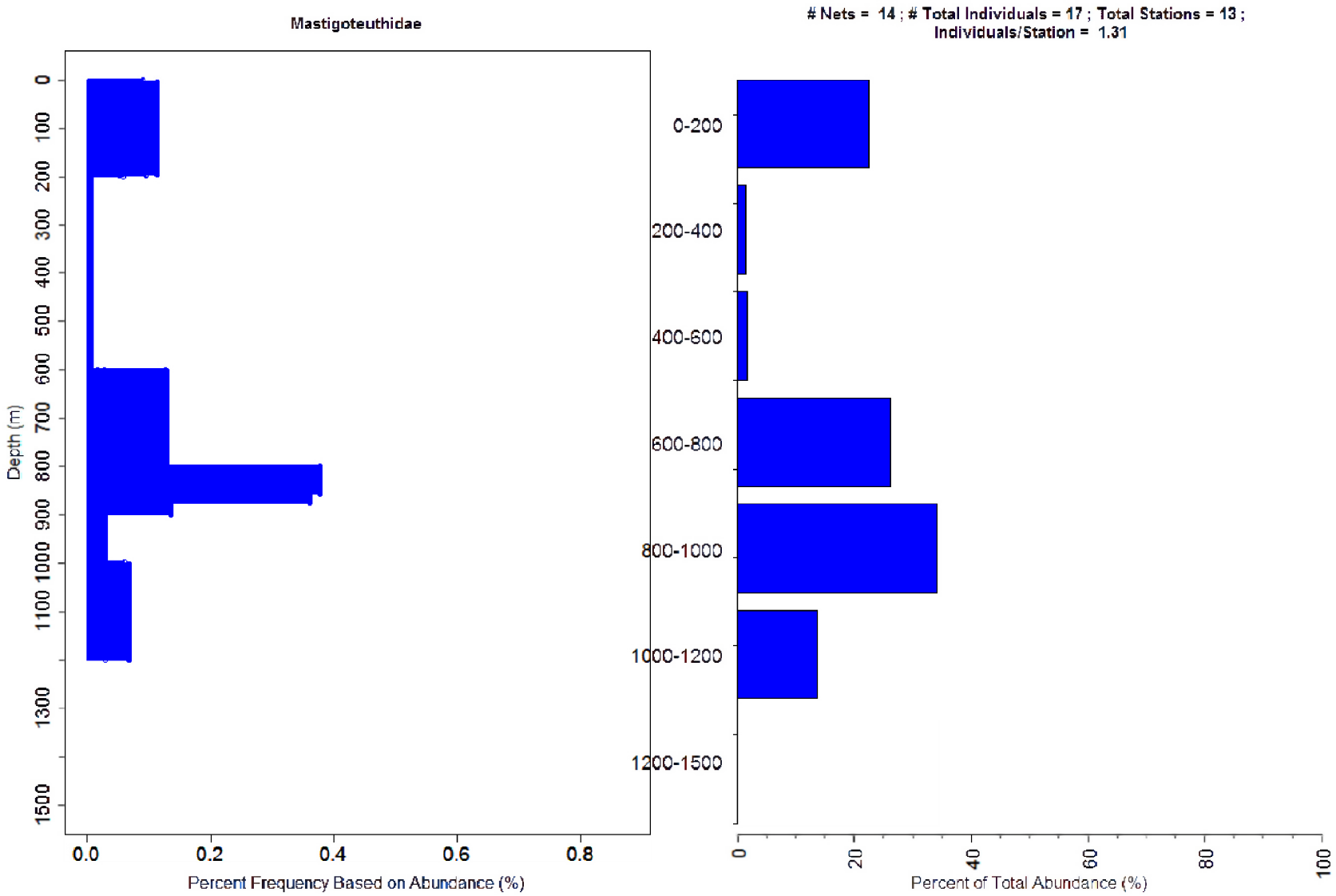
Macrouridae



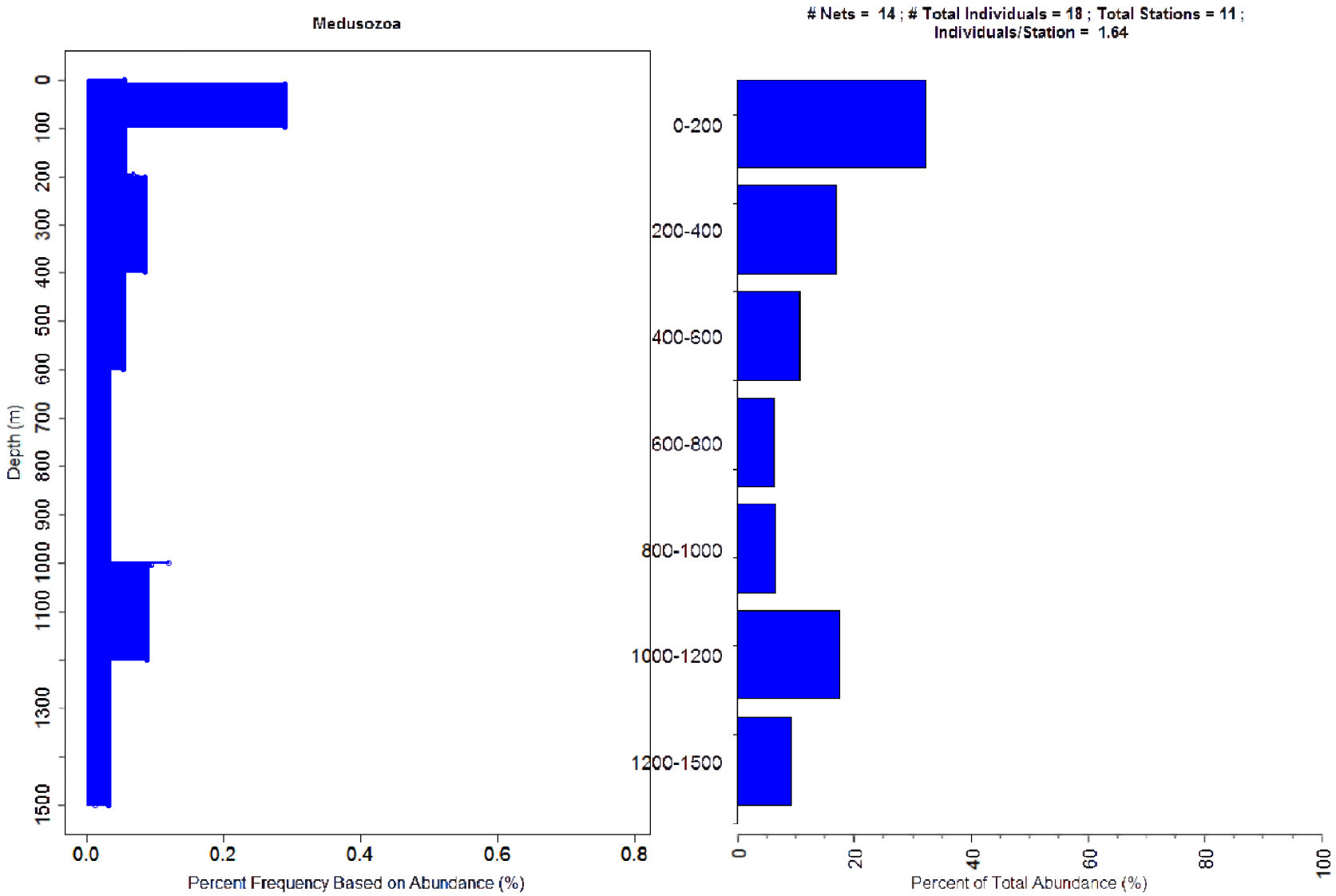
Malacanthidae



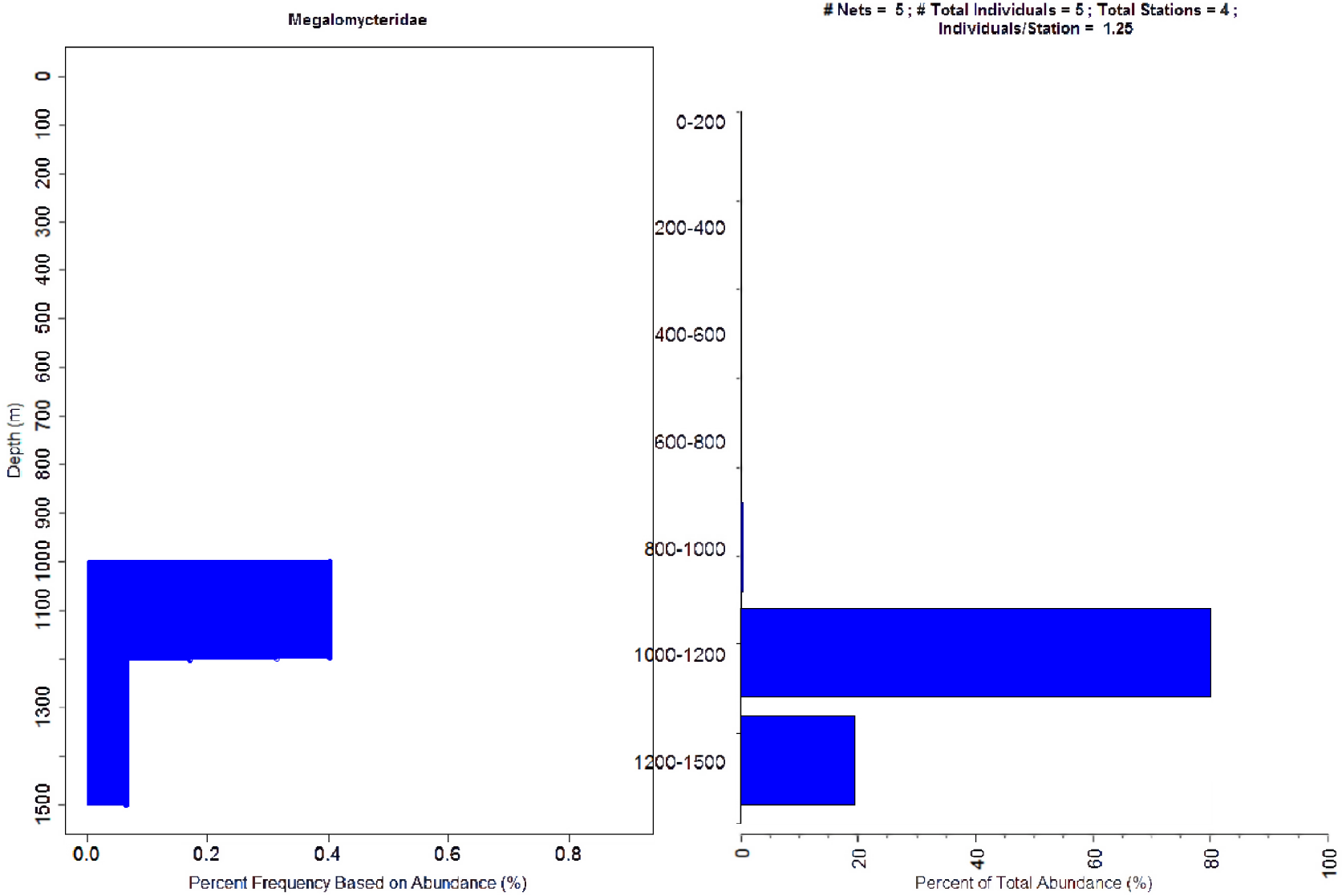
Malacosteidae



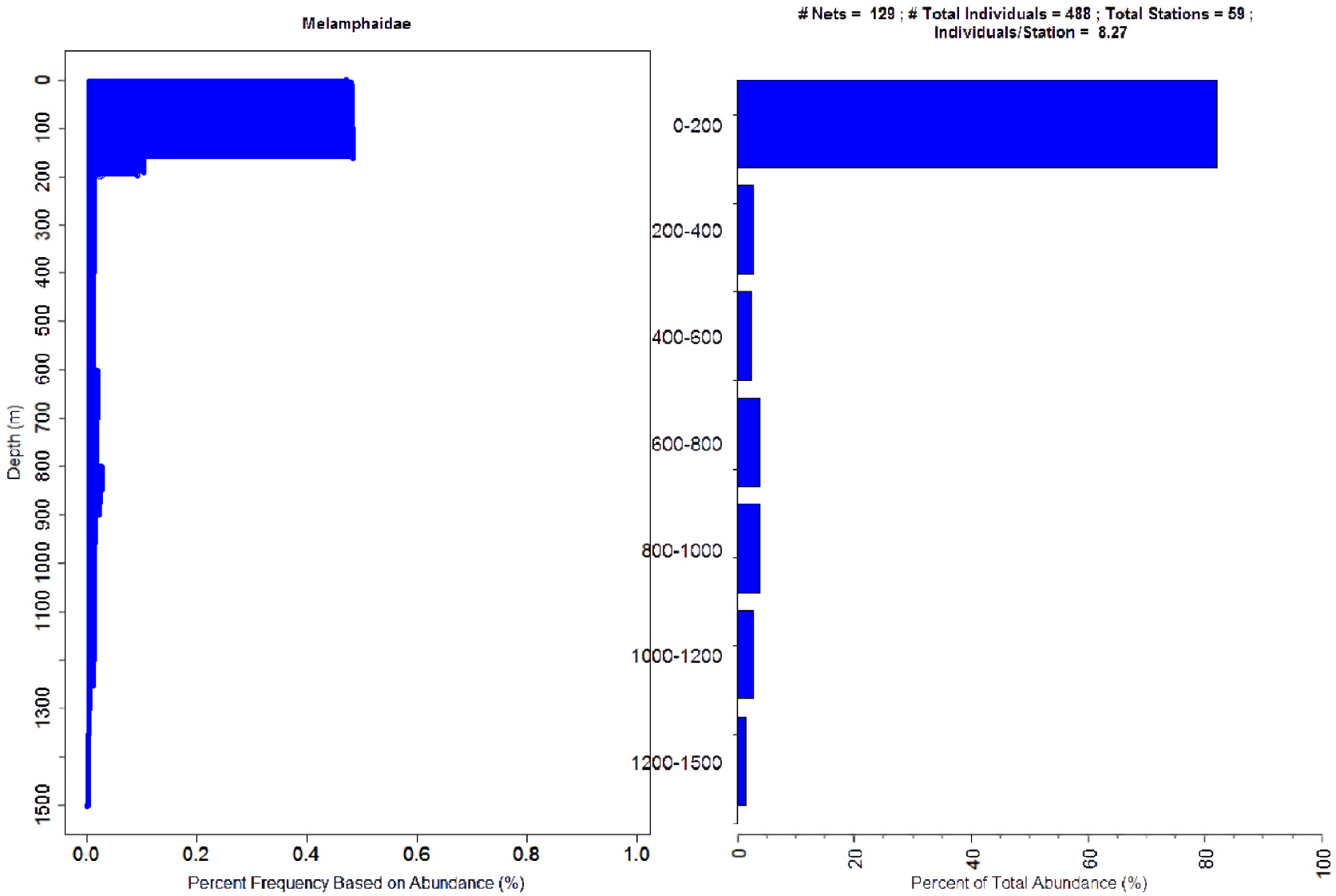
Mastigoteuthidae


Medusozoa
Nets = 14 ; # Total Individuals = 18 ; Total Stations = 11 ;
Individuals/Station = 1.64
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

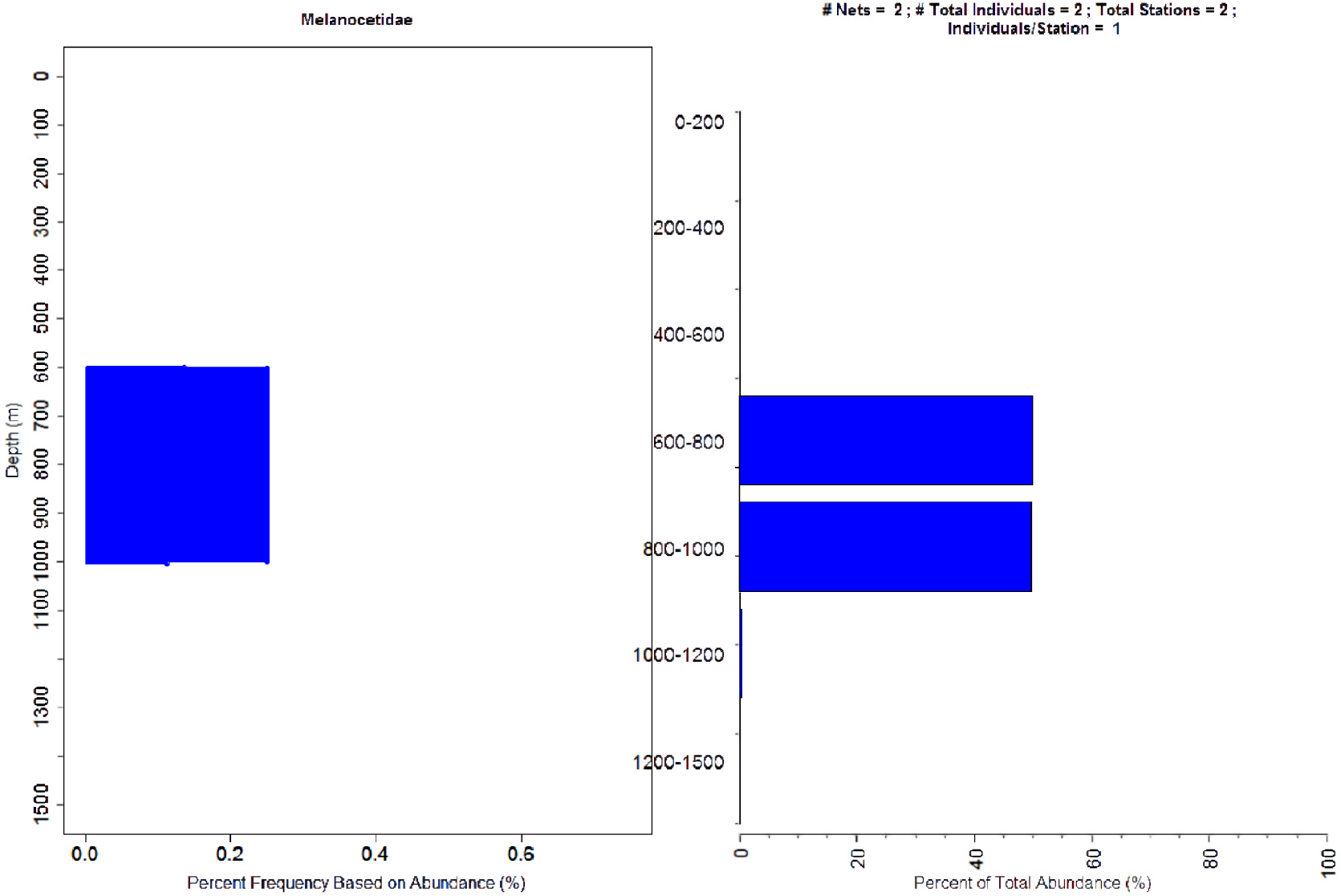
Medusozoa



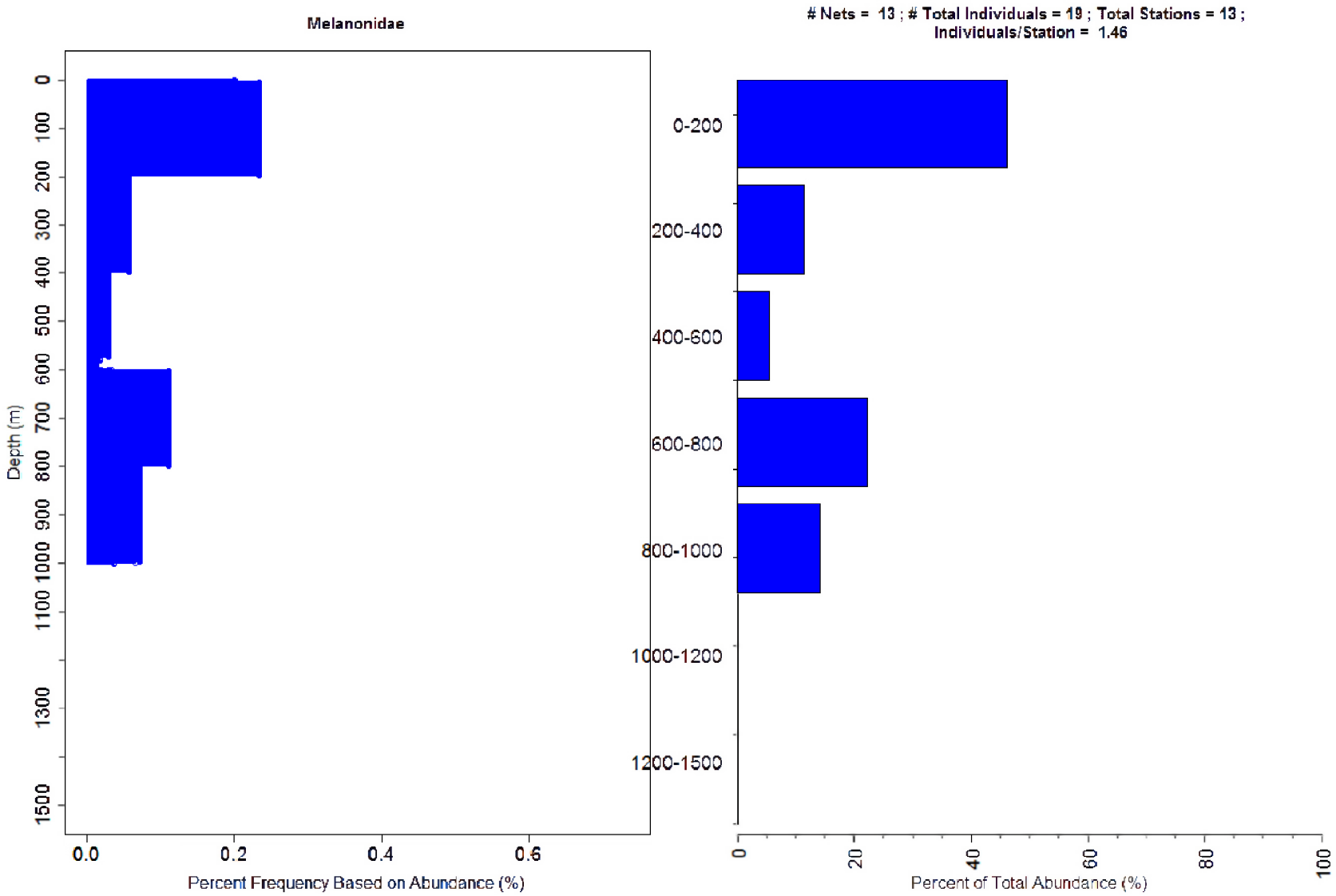
Megalomycteridae



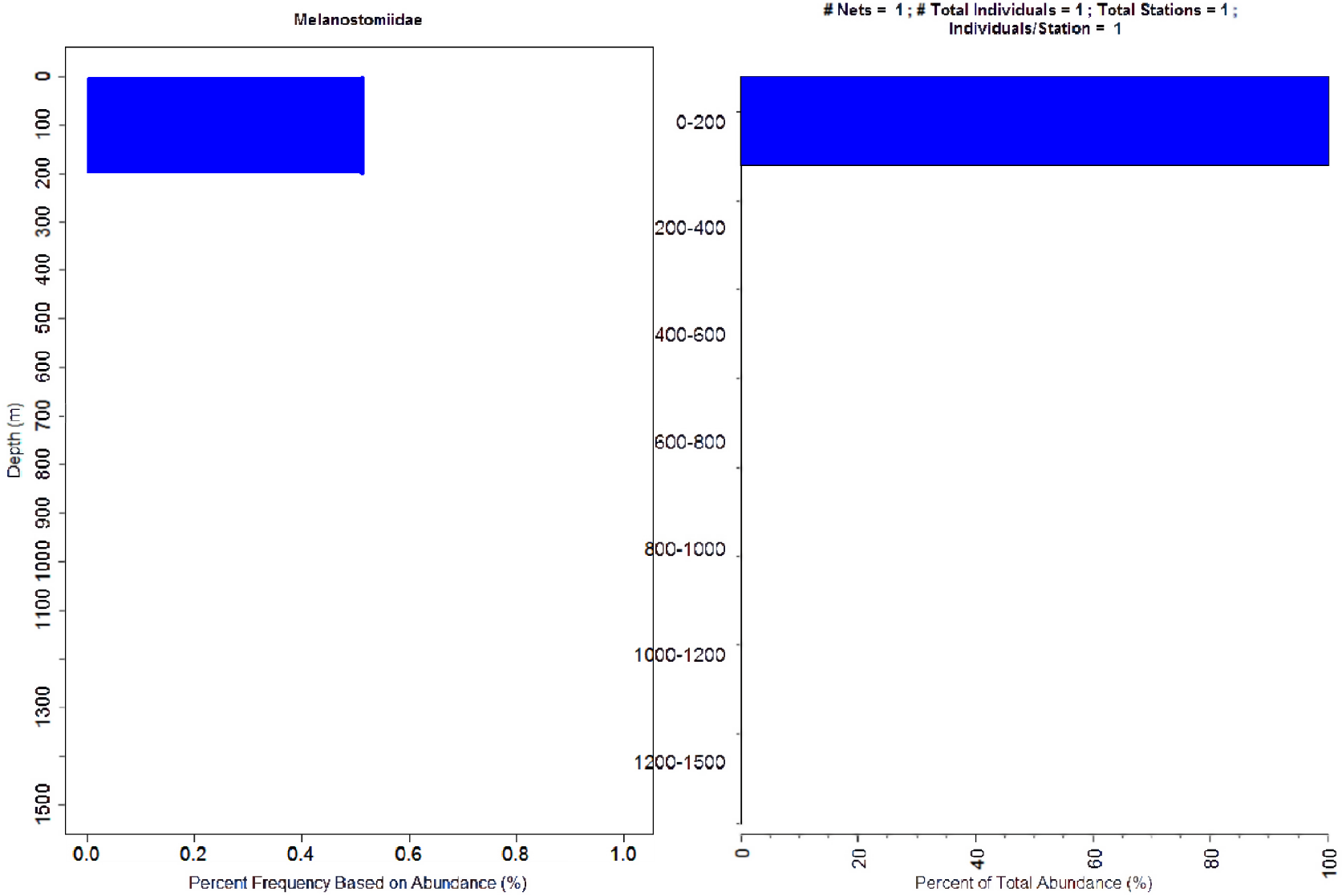
Melamphaidae



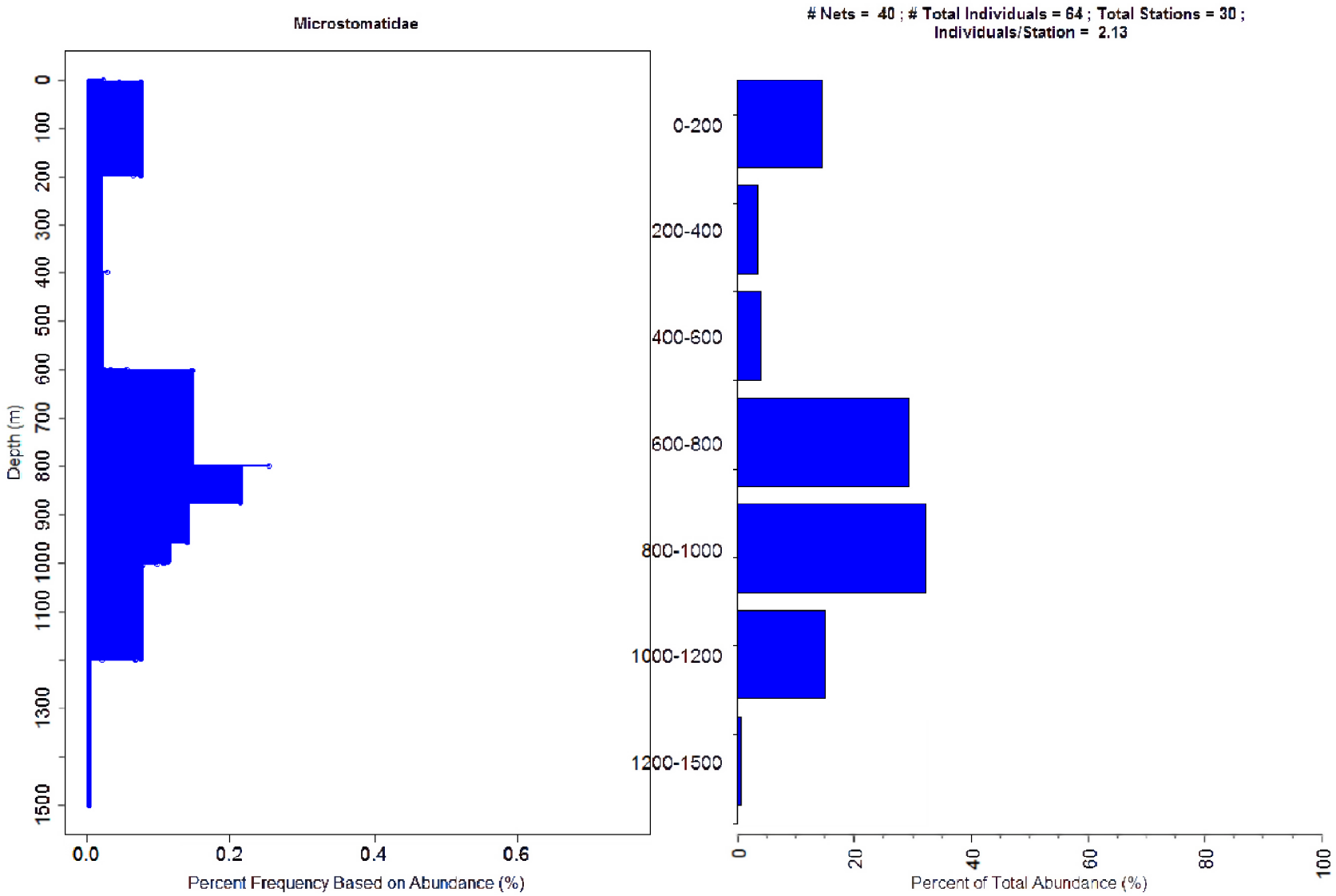
Melanocetidae



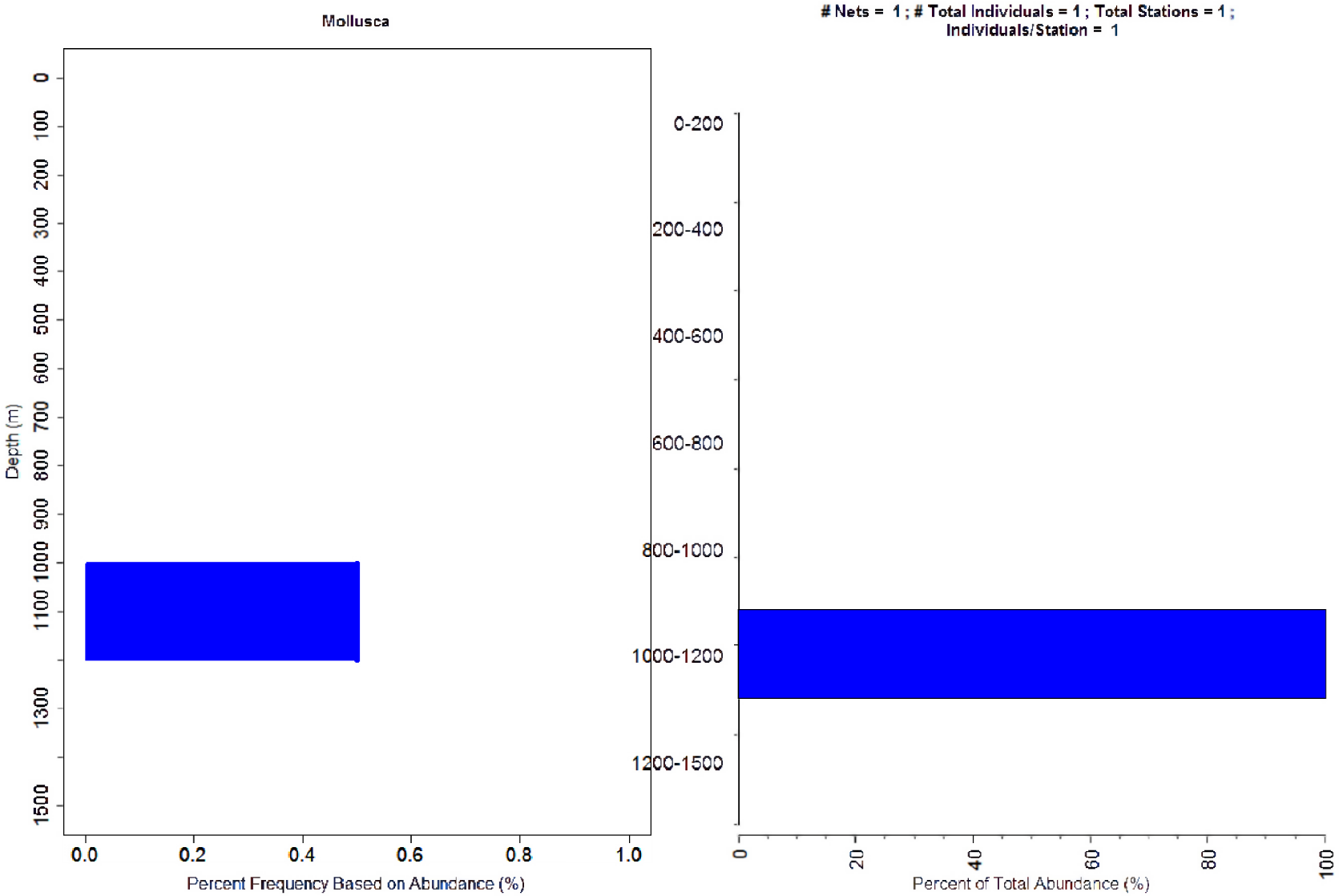
Melanonidae



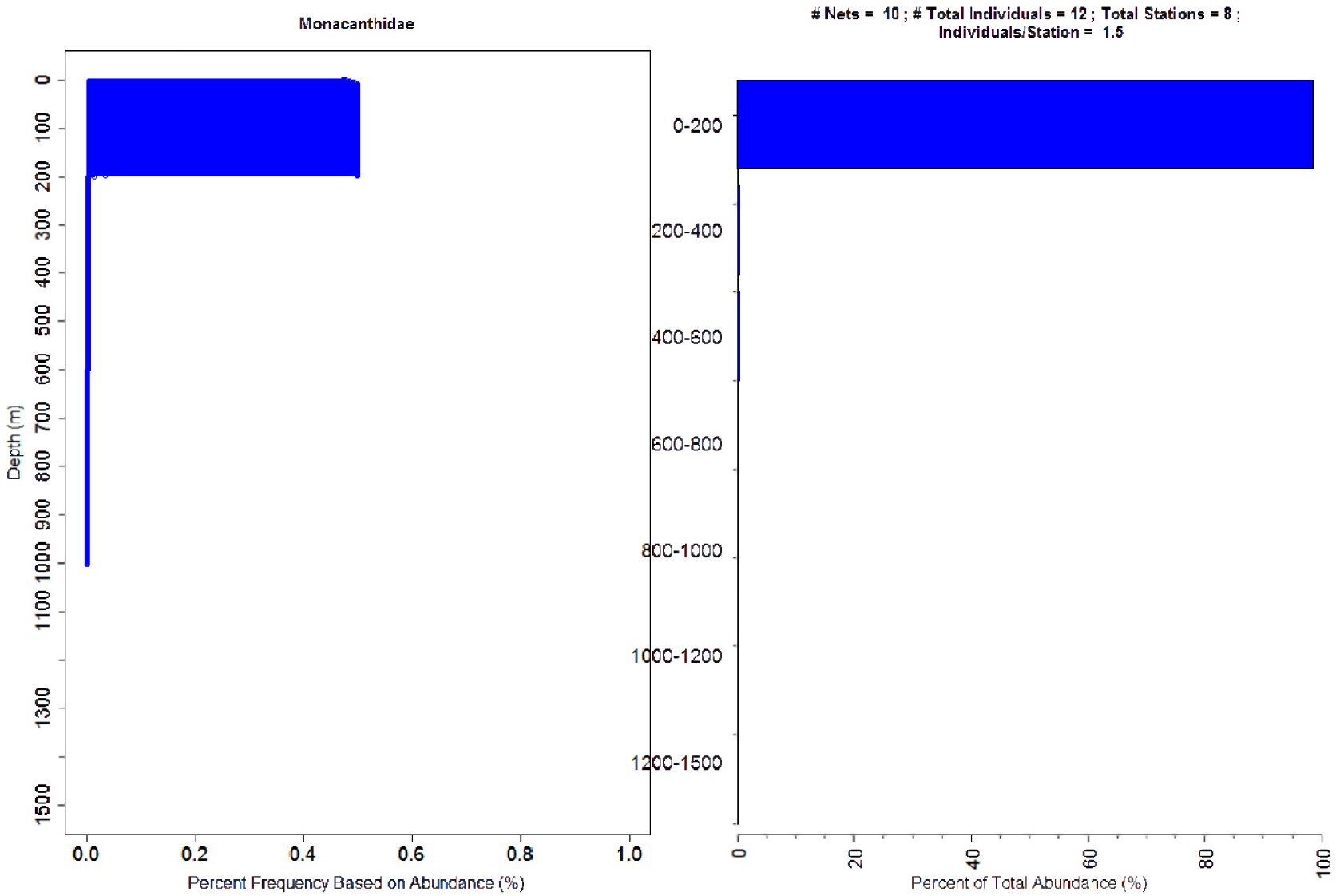
Melanostomiidae



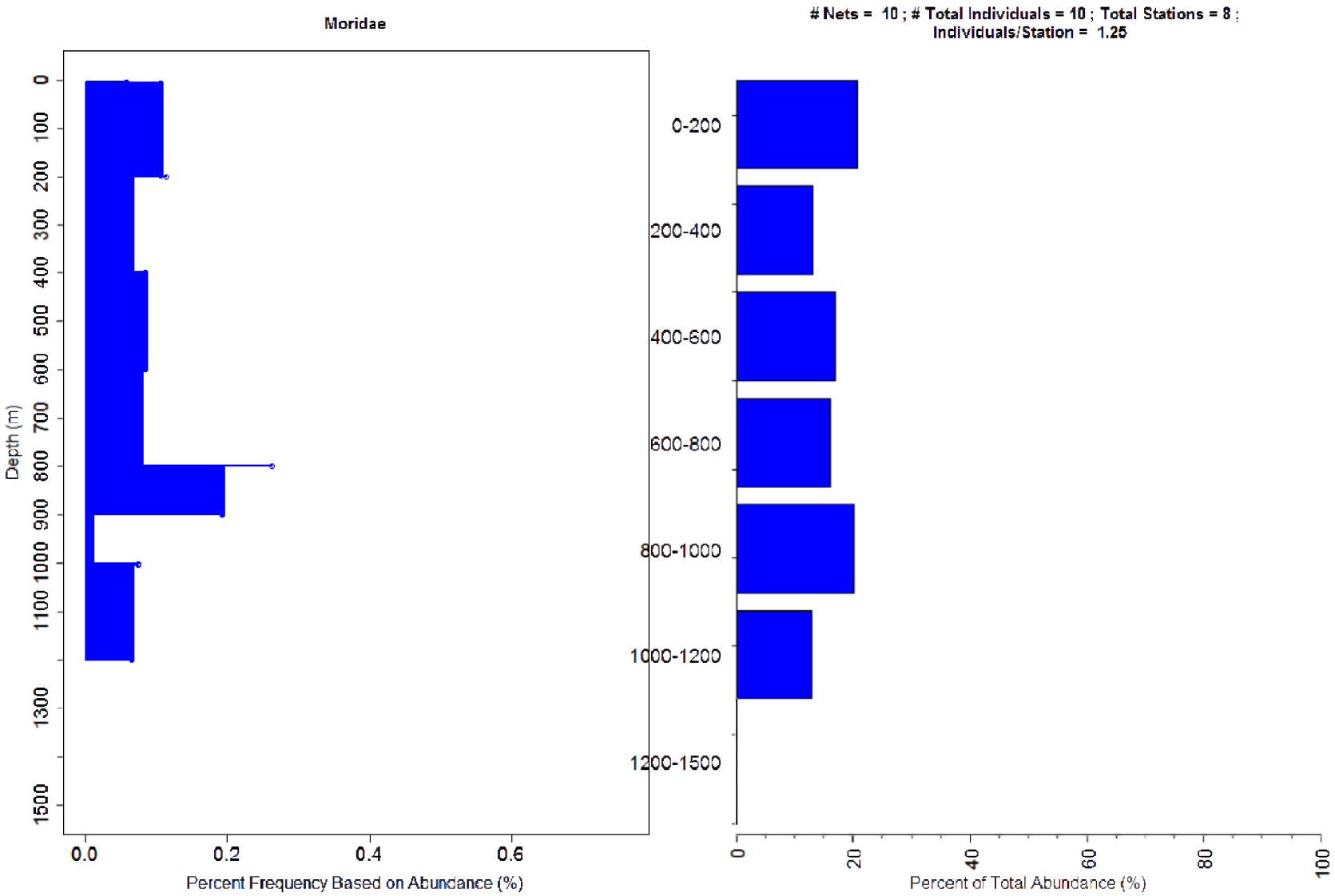
Microstomatidae


Mollusca
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

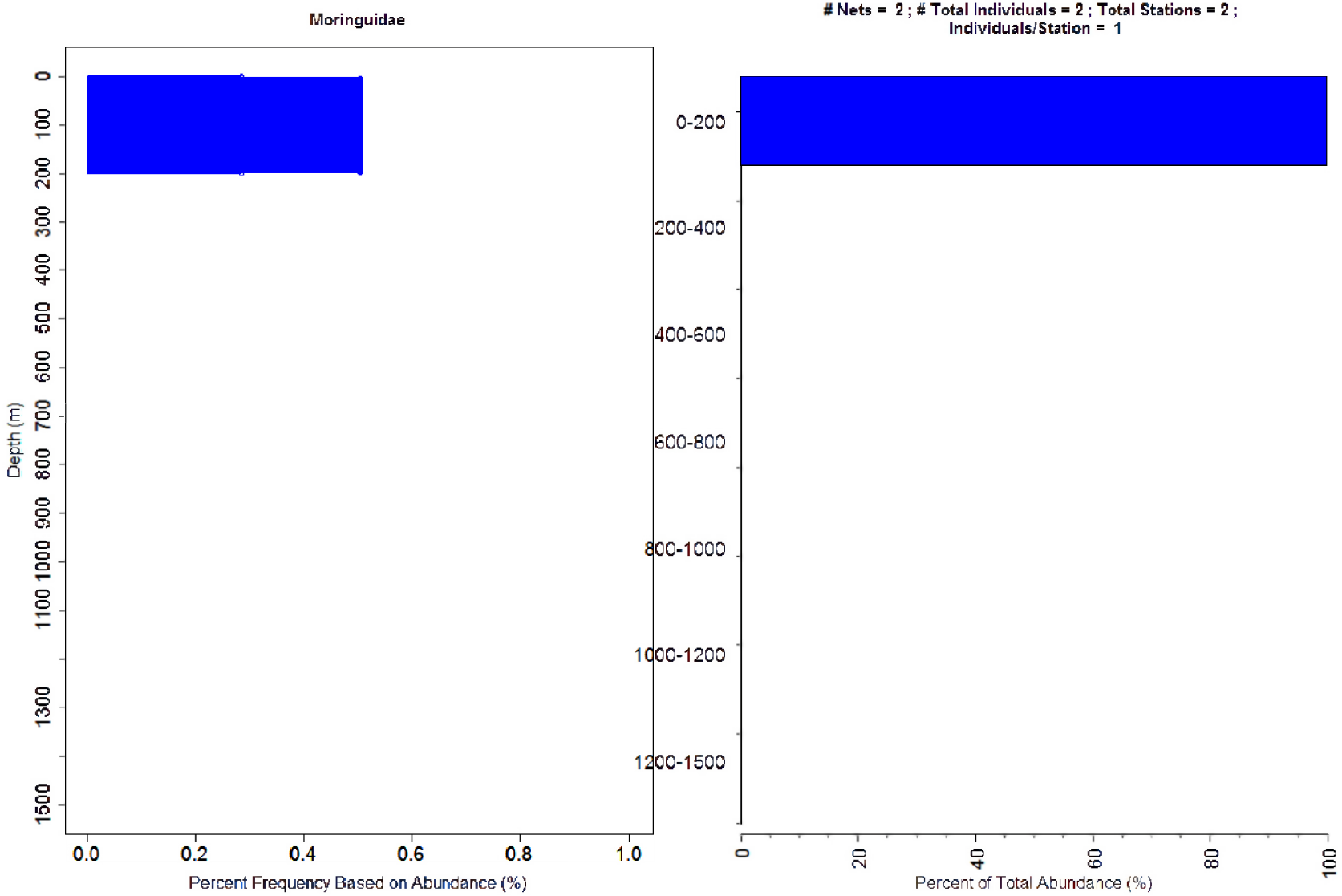
Mollusca



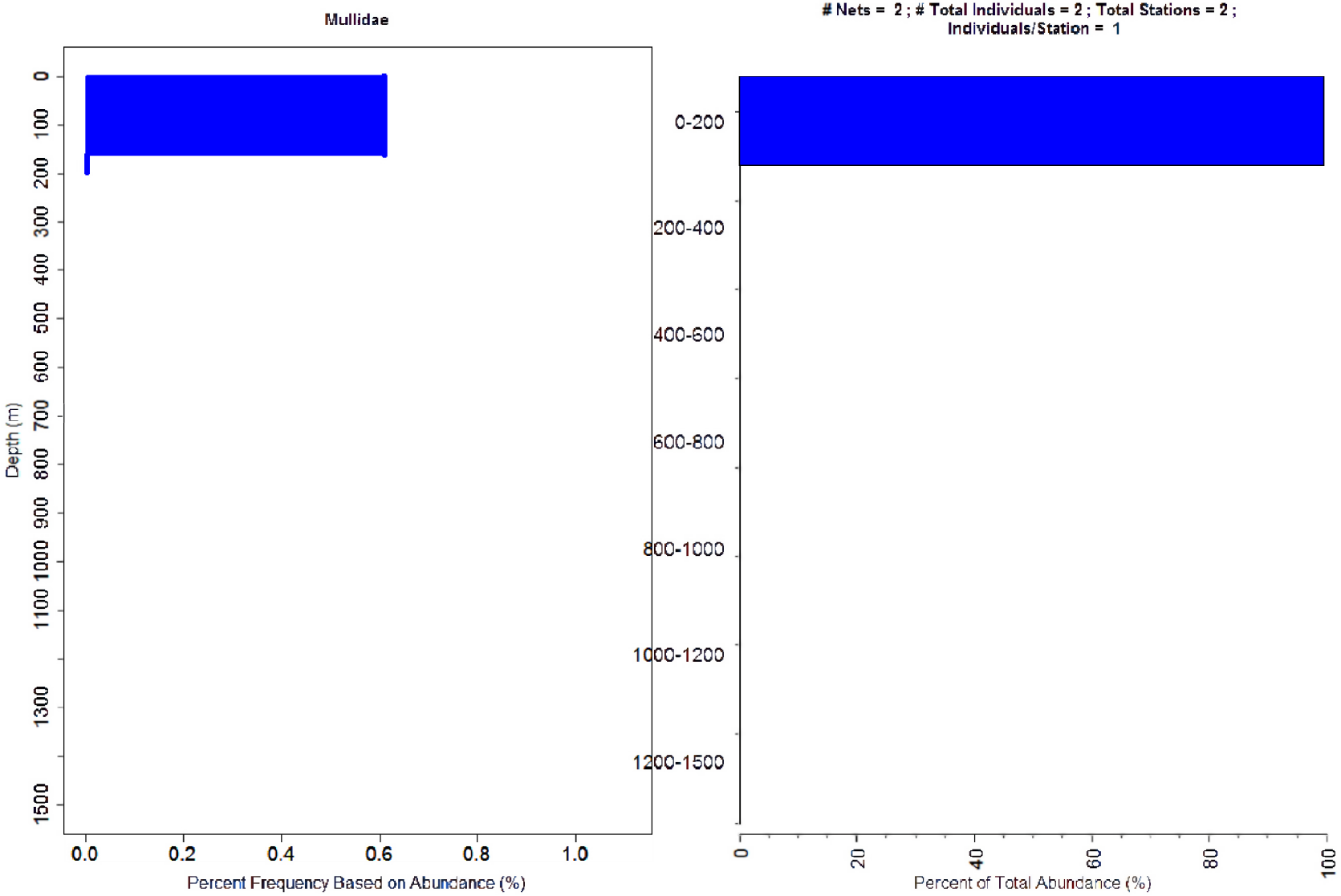
Monacanthidae


Moridae
Nets = 10 ; # Total Individuals = 10 ; Total Stations = 8 ;
Individuals/Station = 1.25
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

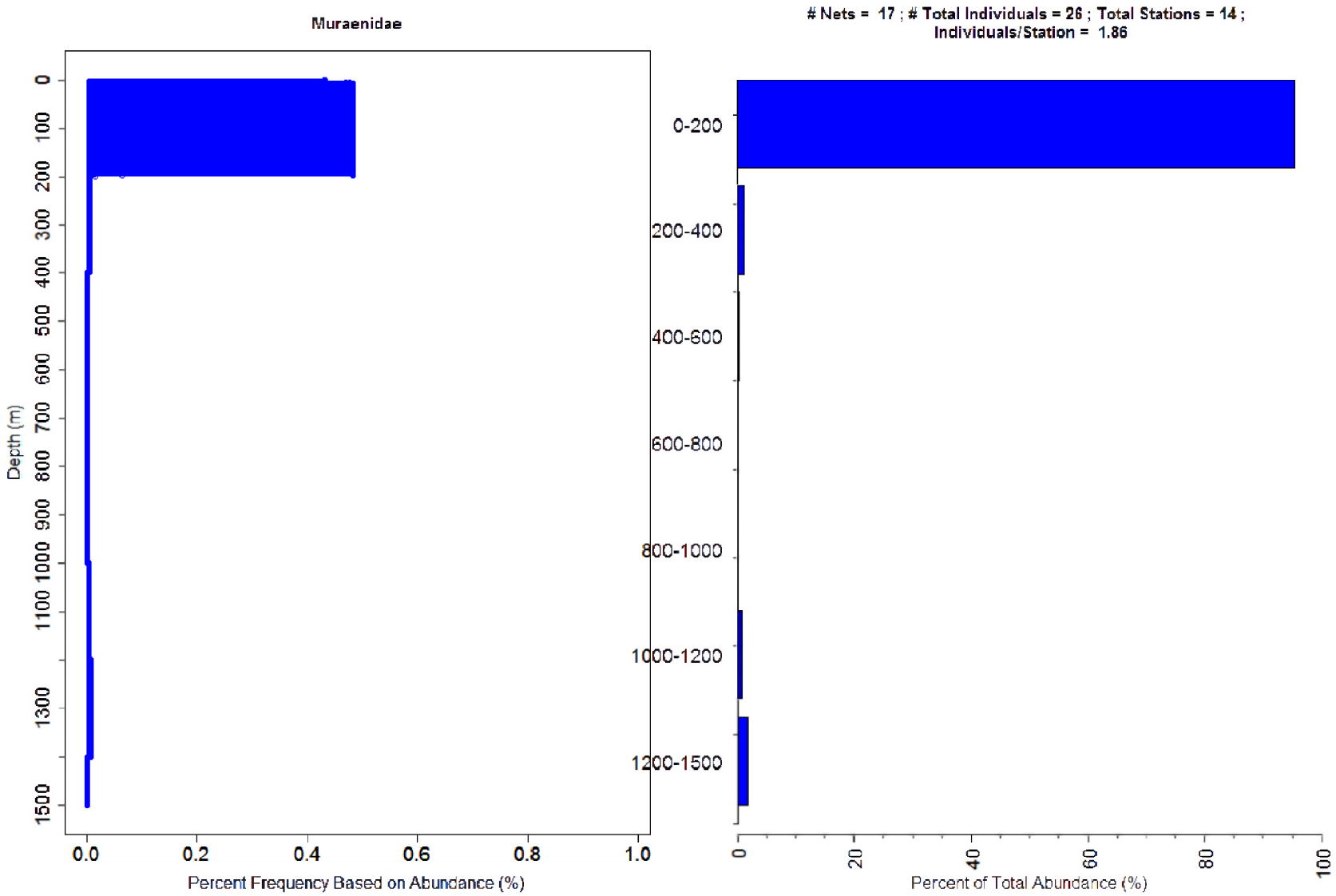
Moridae



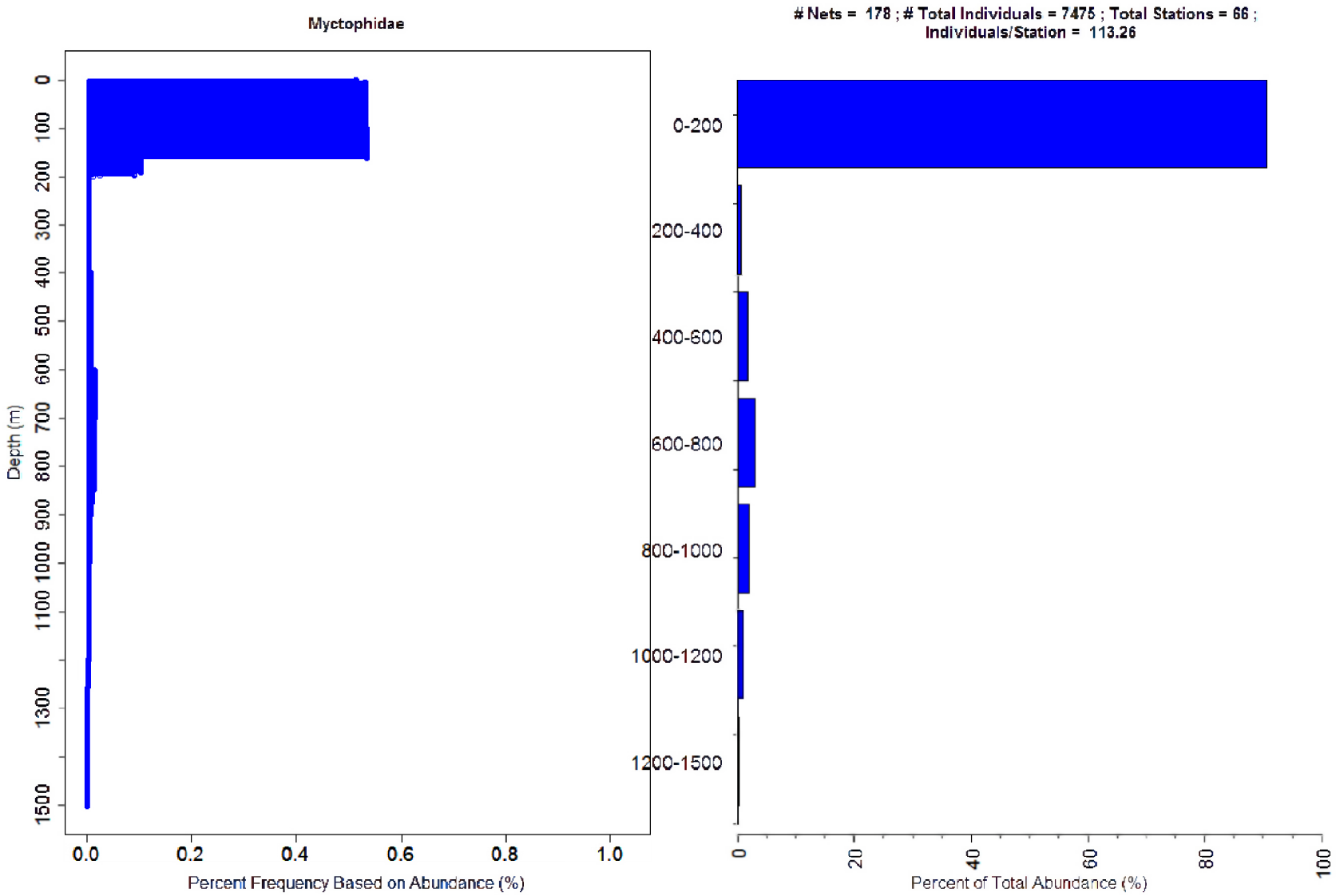
Moringuidae


Mullidae
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

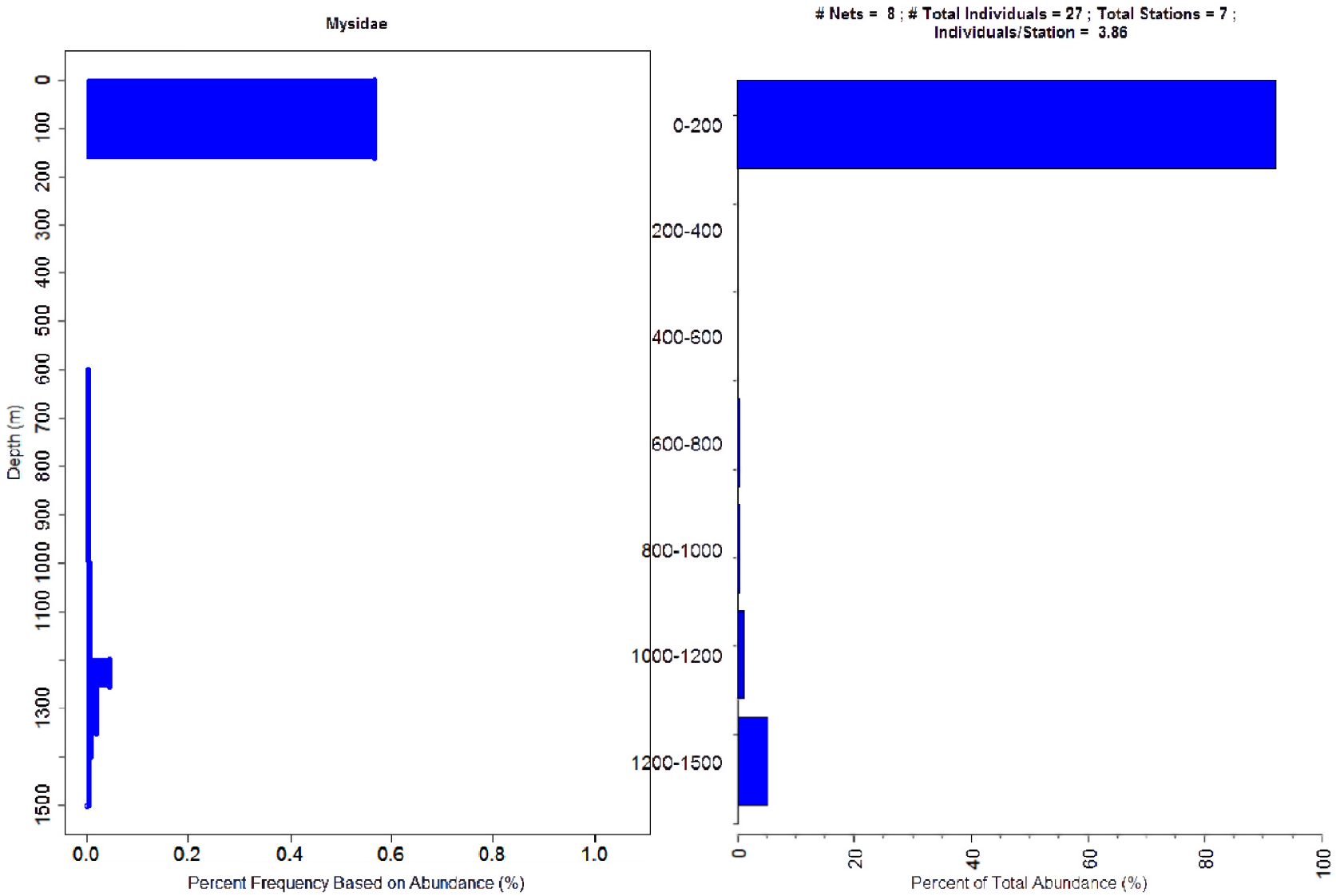
Mullidae


Muraenidae
Nets = 17 ; # Total Individuals = 26 ; Total Stations = 14 ;
Individuals/Station = 1.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

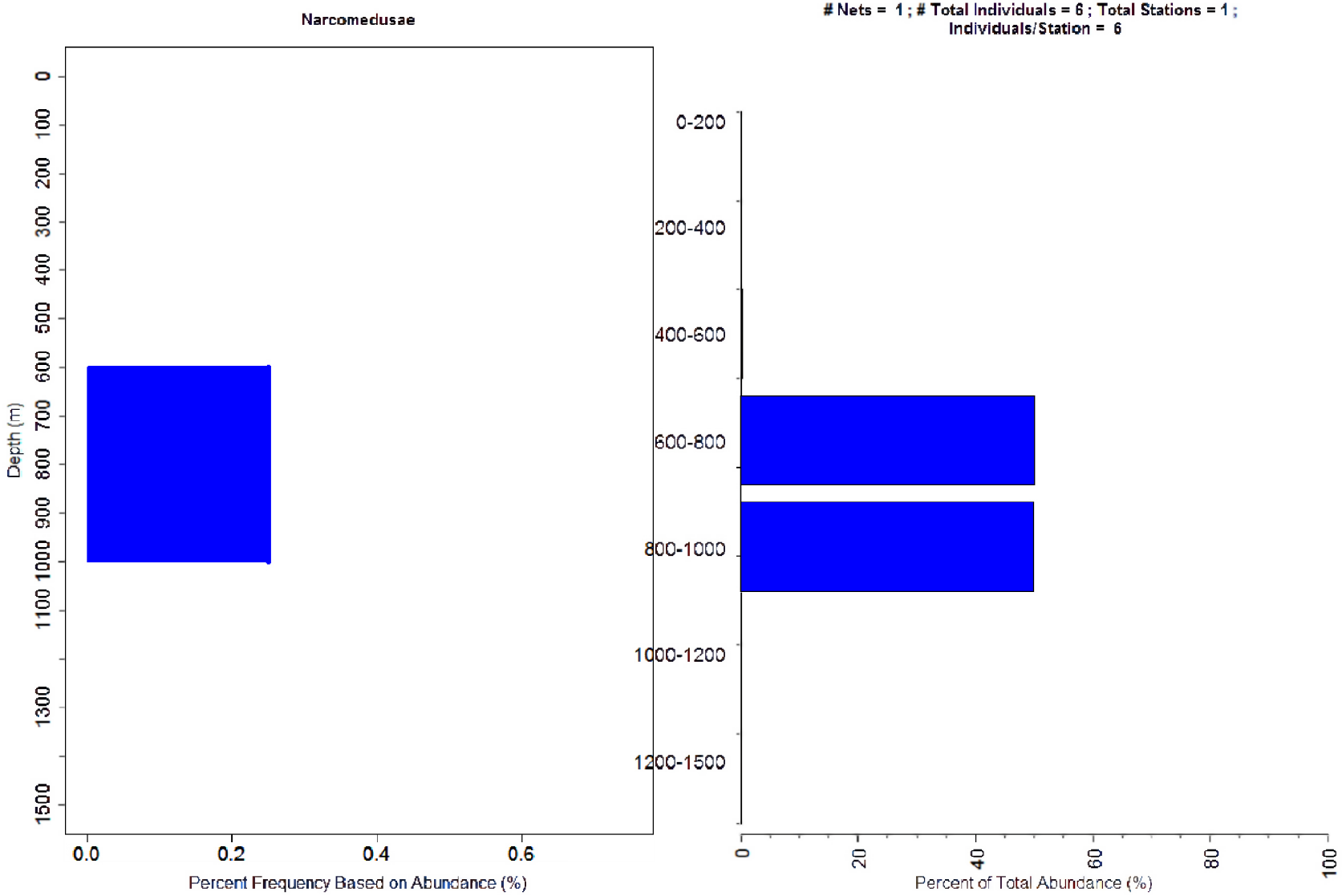
Muraenidae



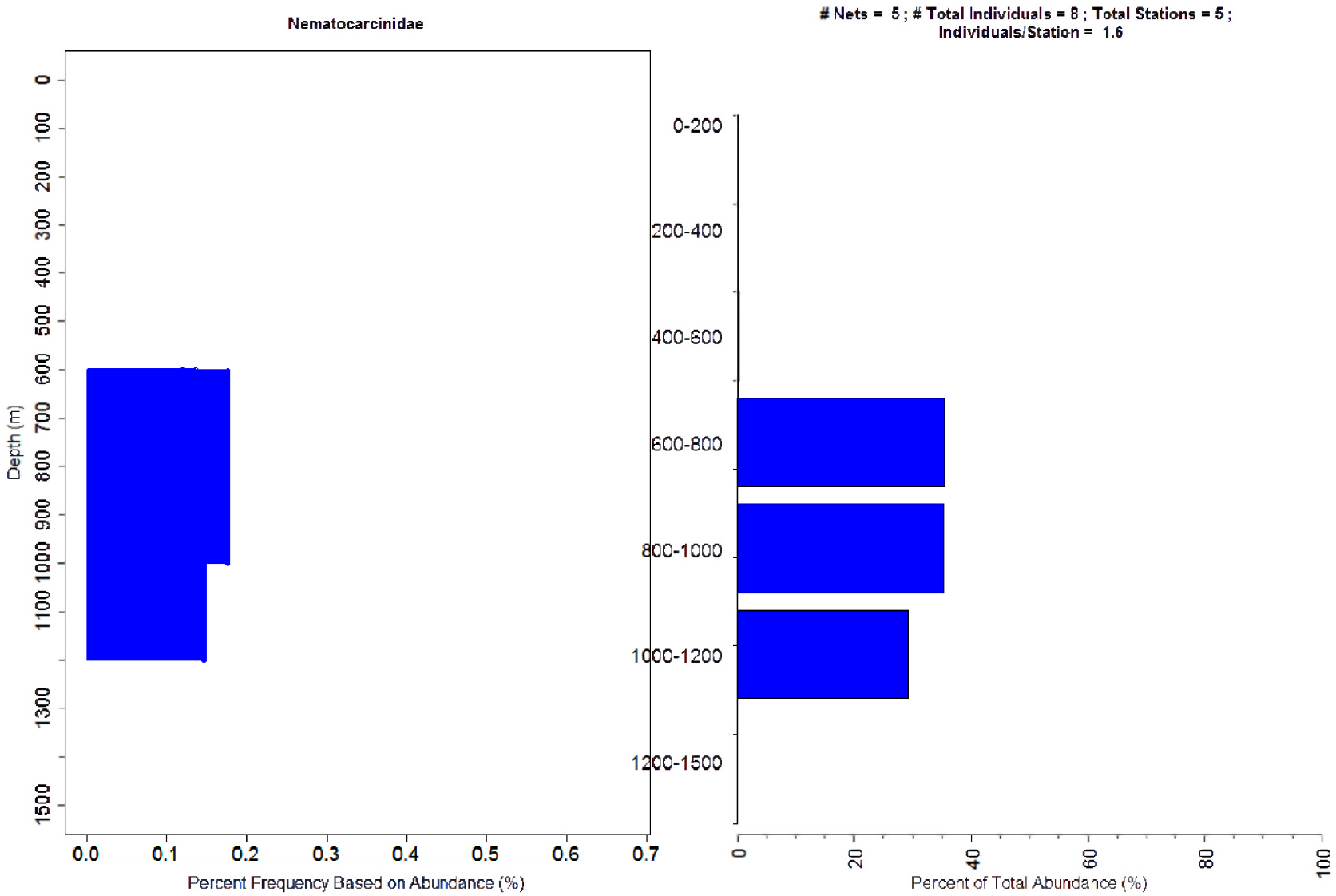
Myctophidae


Mysidae
Nets = 8 ; # Total Individuals = 27 ; Total Stations = 7 ;
Individuals/Station = 3.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

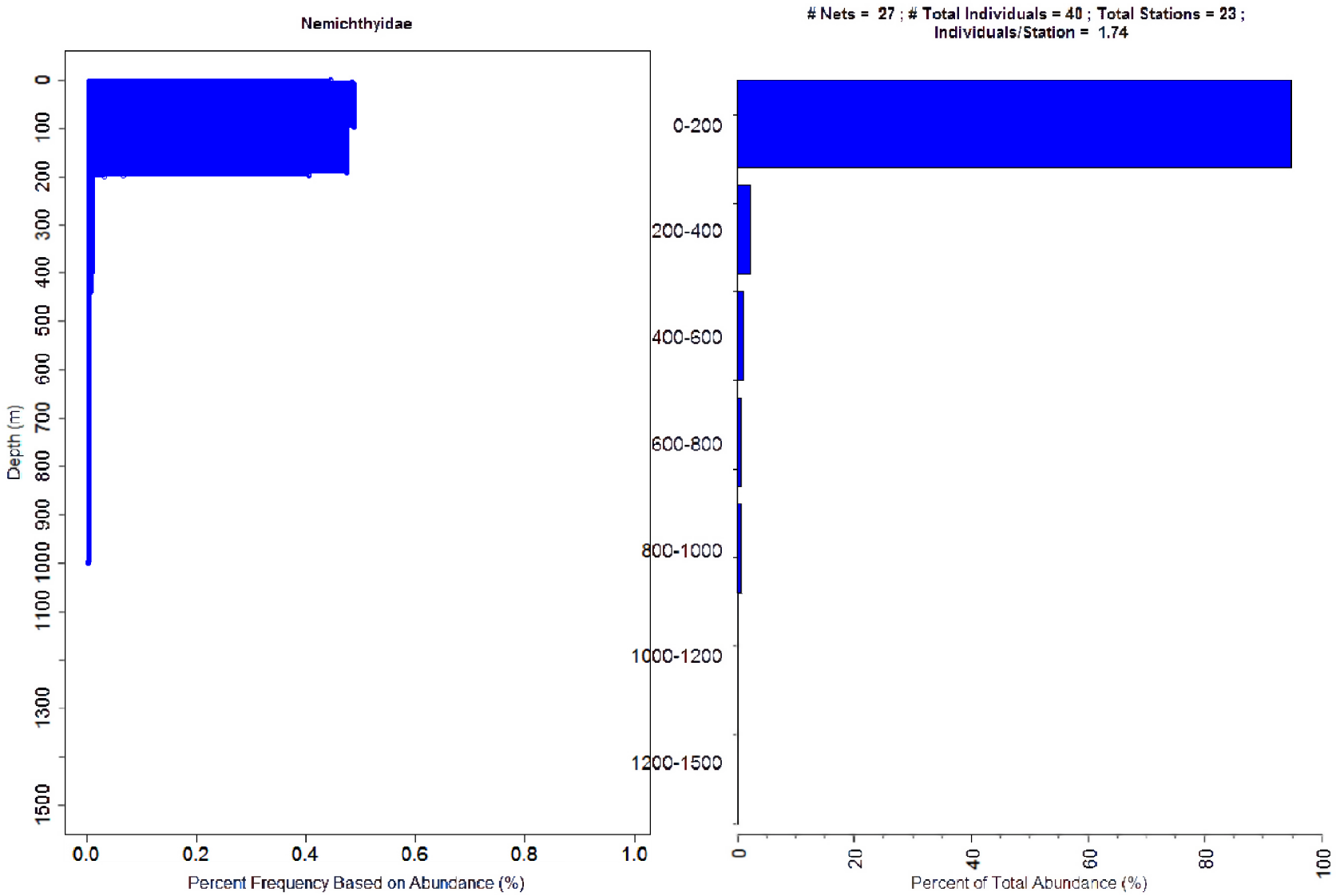
Mysidae



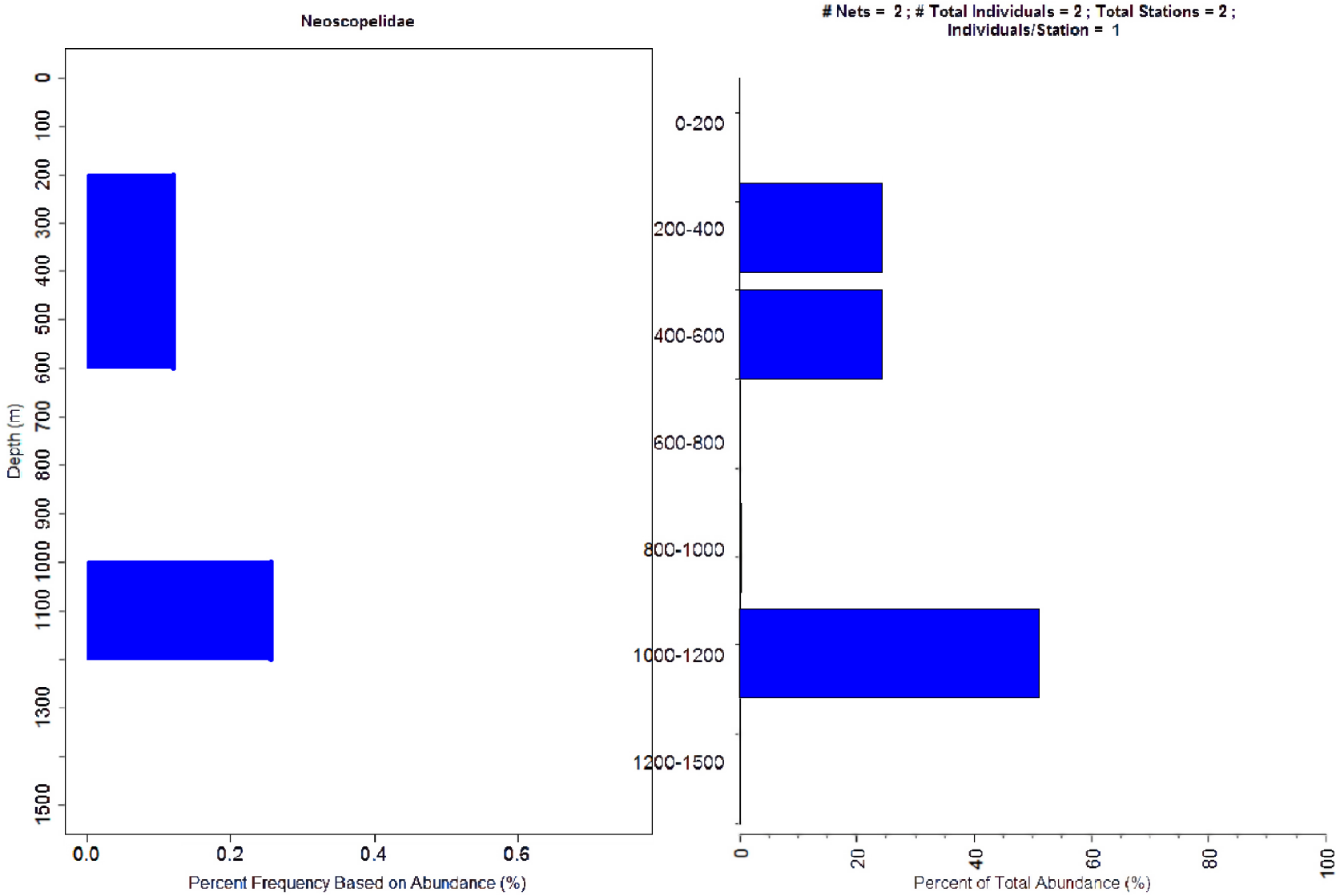
Narcomedusae



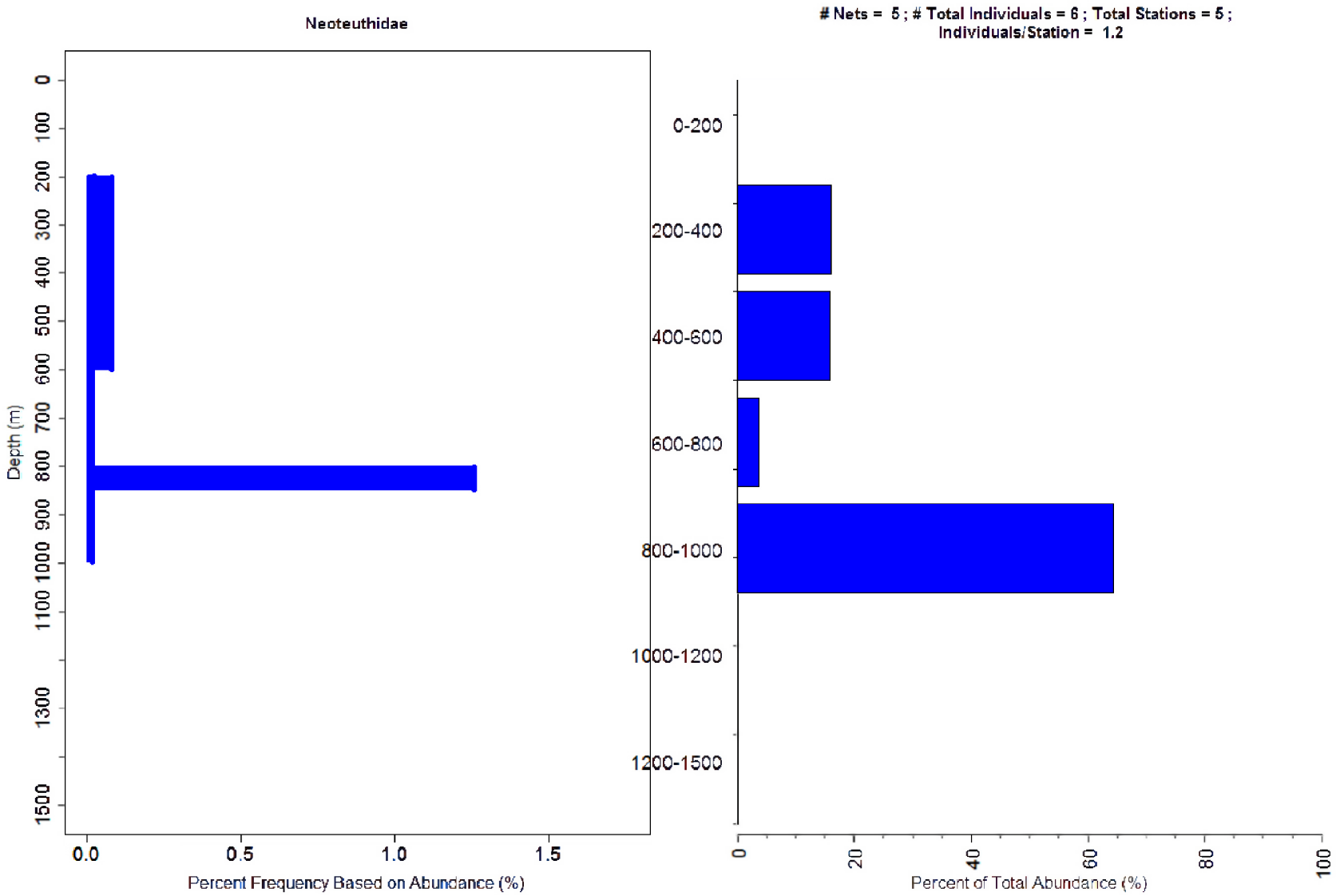
Nematocarcinidae



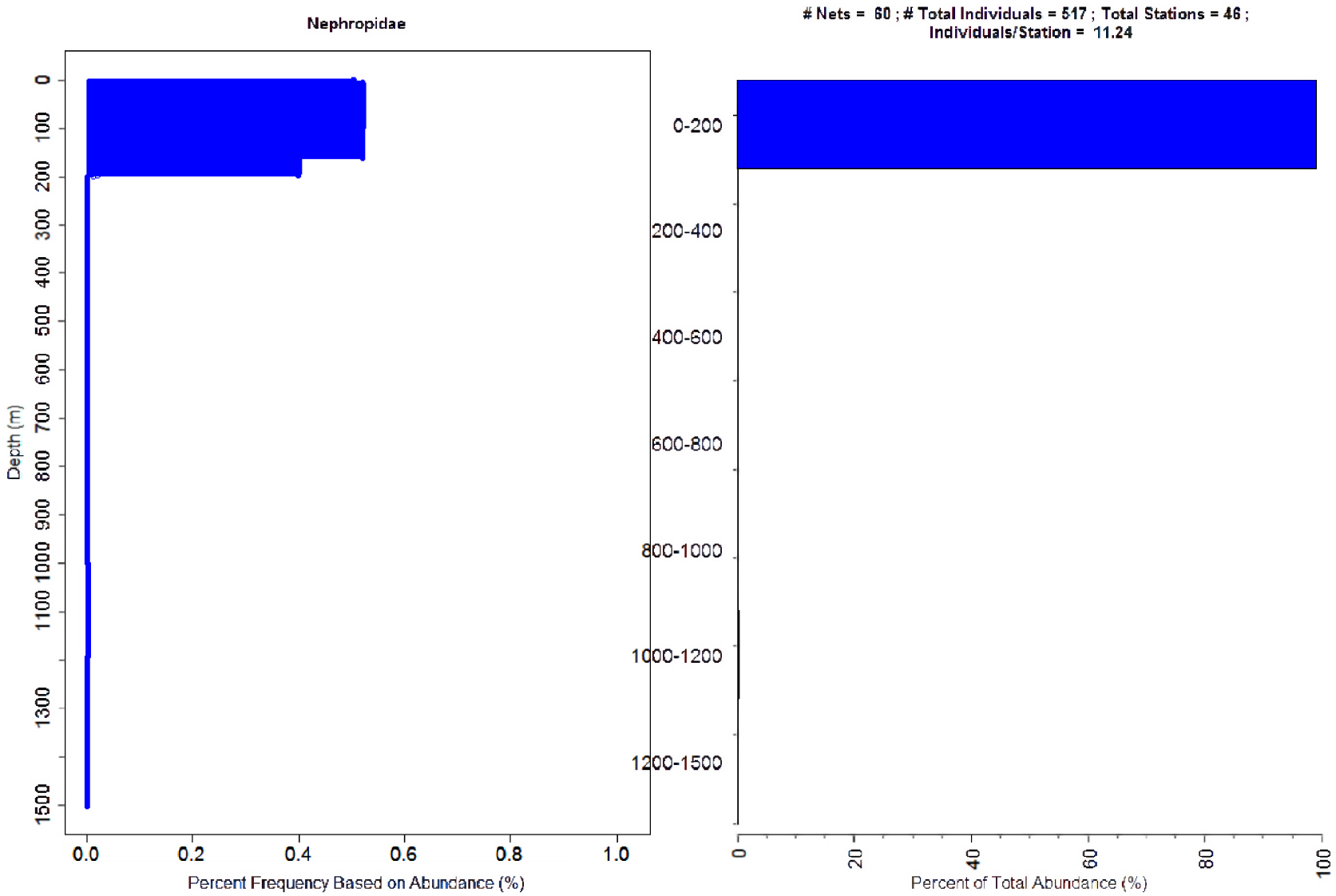
Nemichthyidae



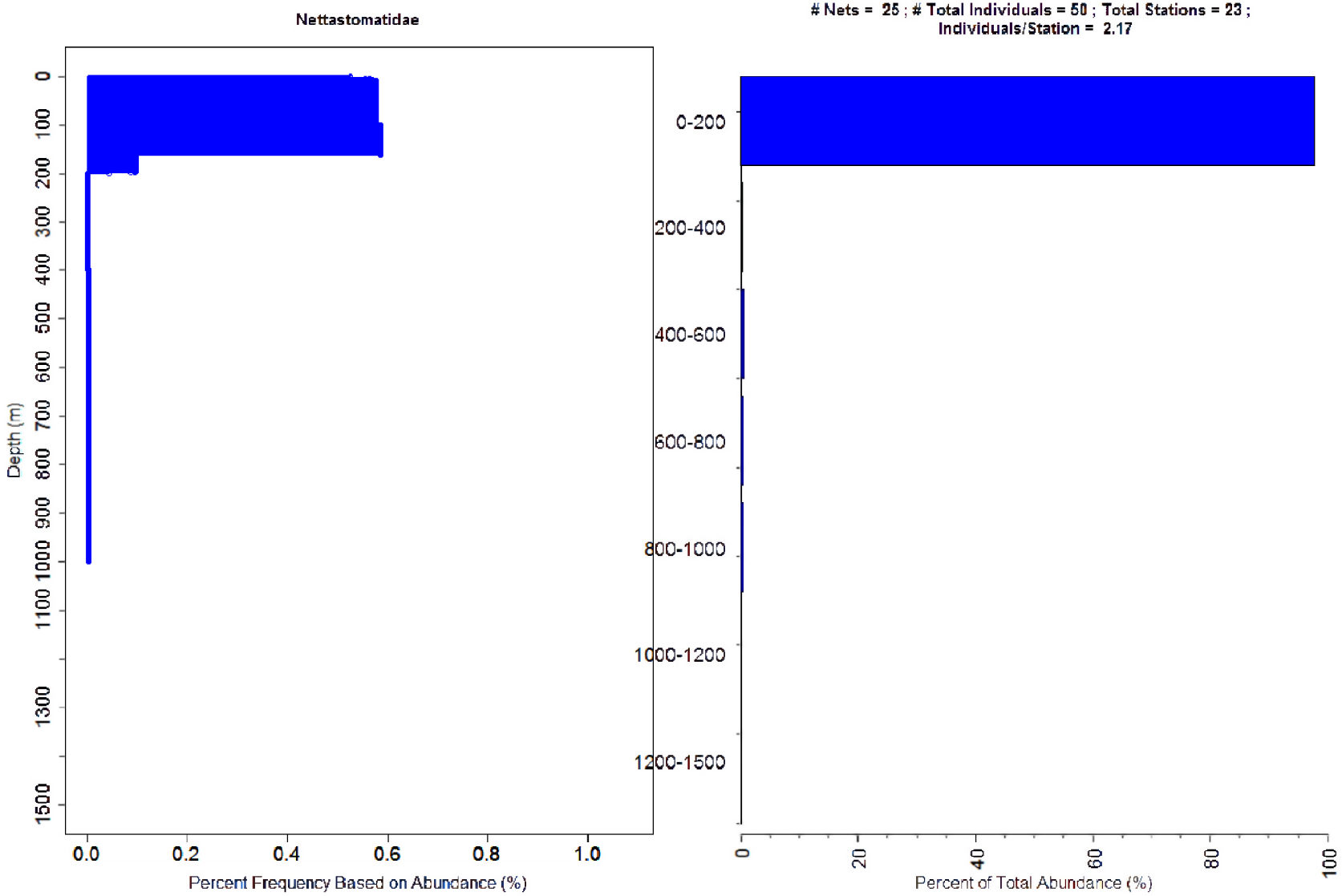
Neoscopelidae



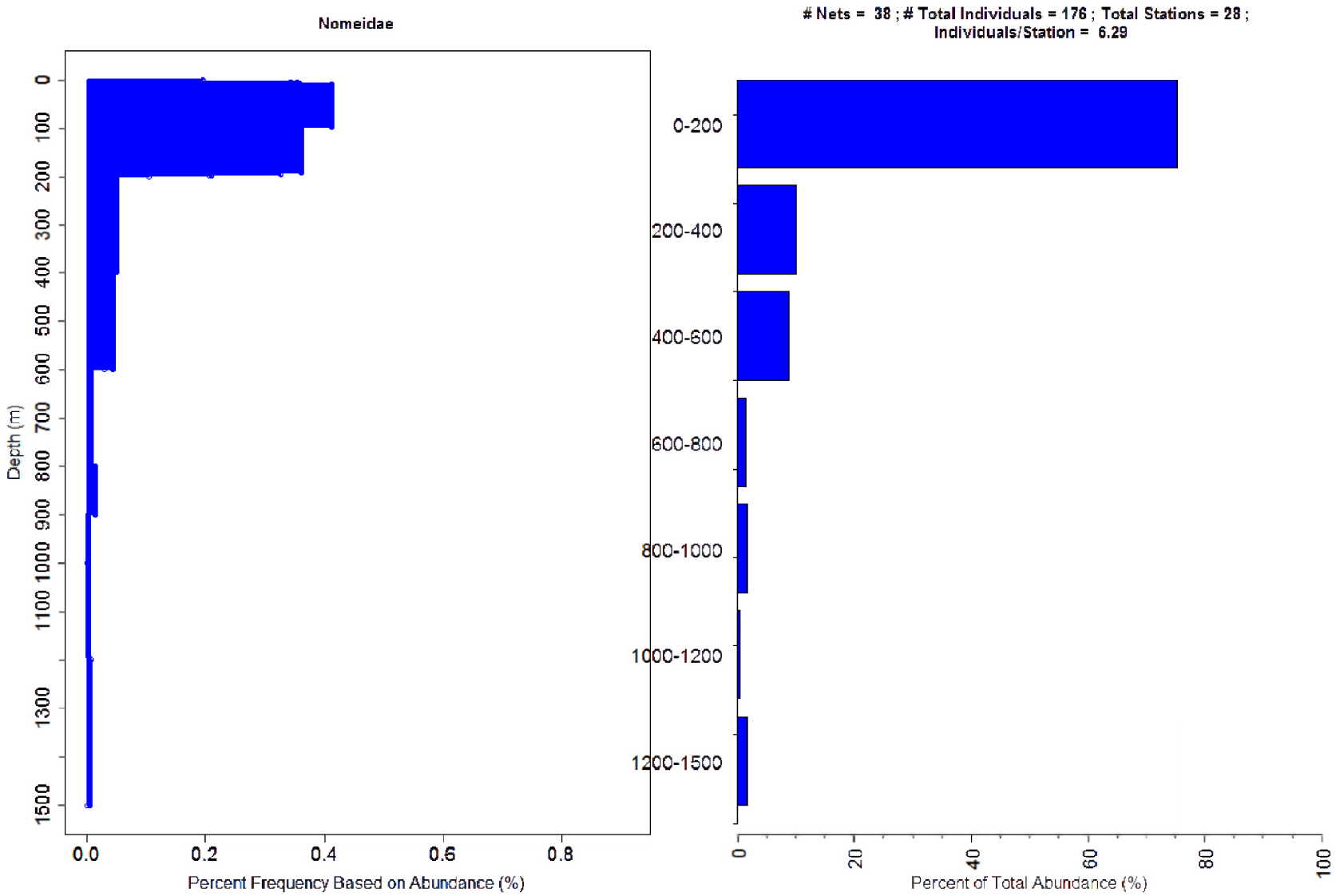
Neoteuthidae



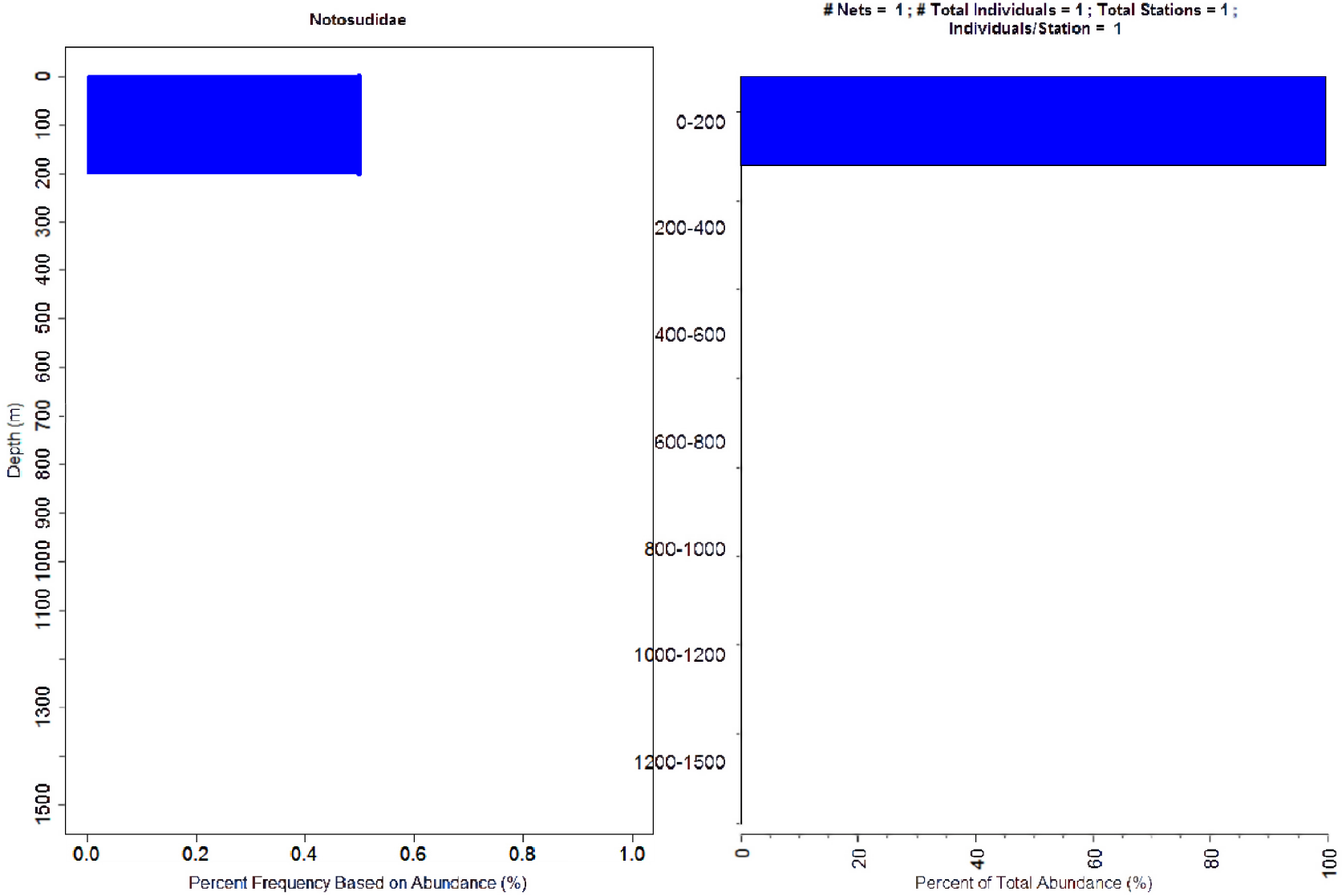
Nephropidae



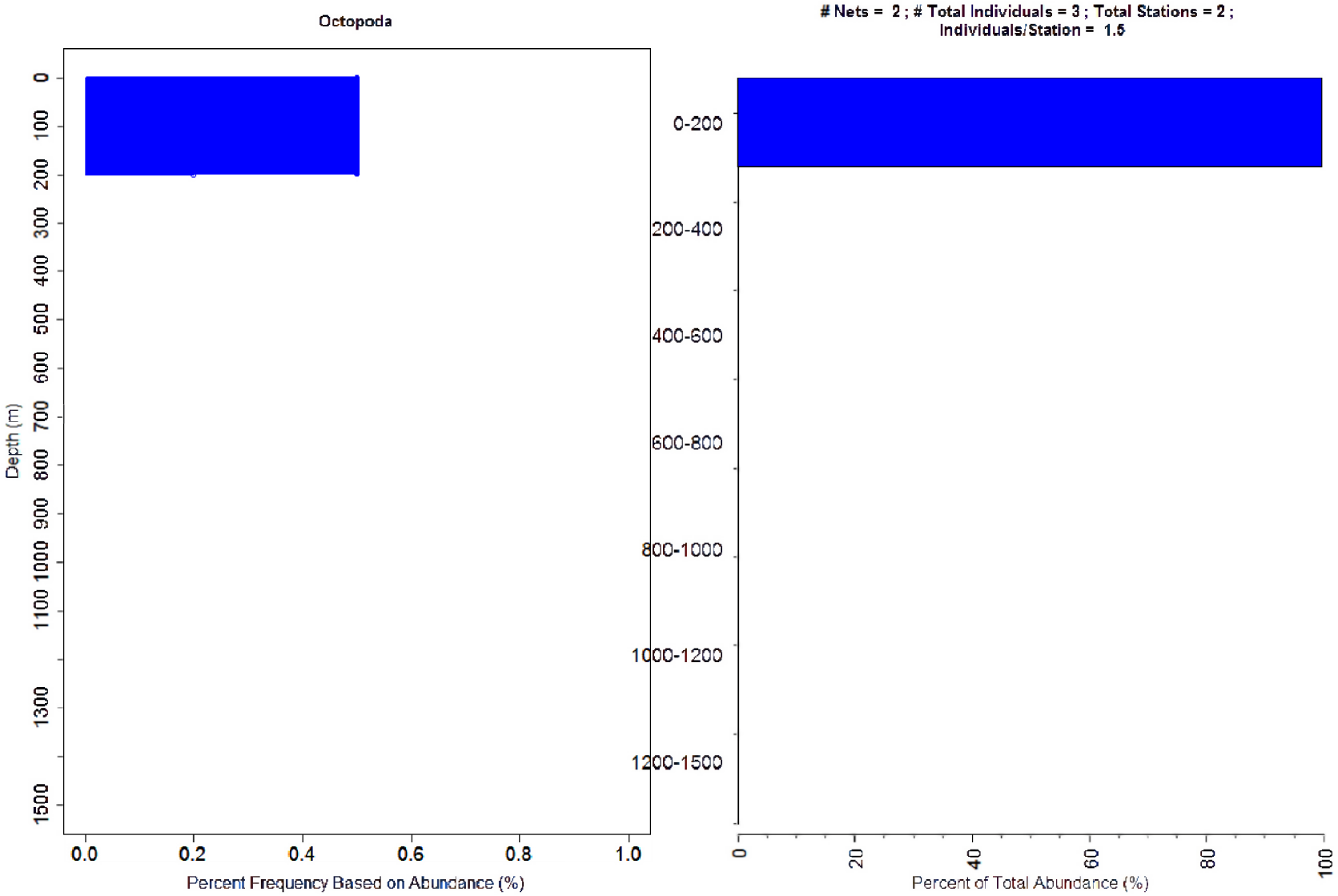
Nettastomatidae


Nomeidae
Nets = 38 ; # Total Individuals = 176 ; Total Stations = 28 ;
Individuals/Station = 6.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

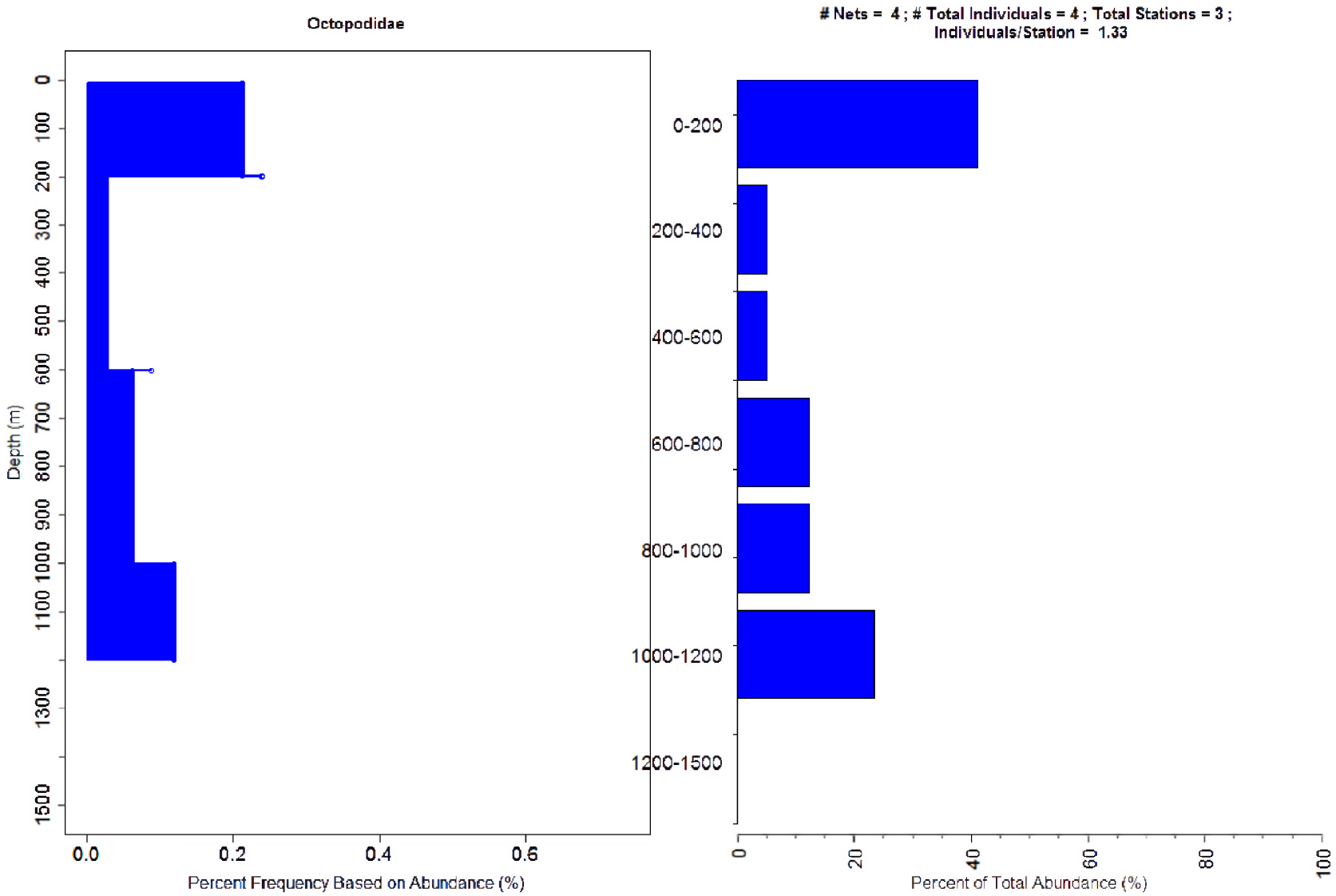
Nomeidae



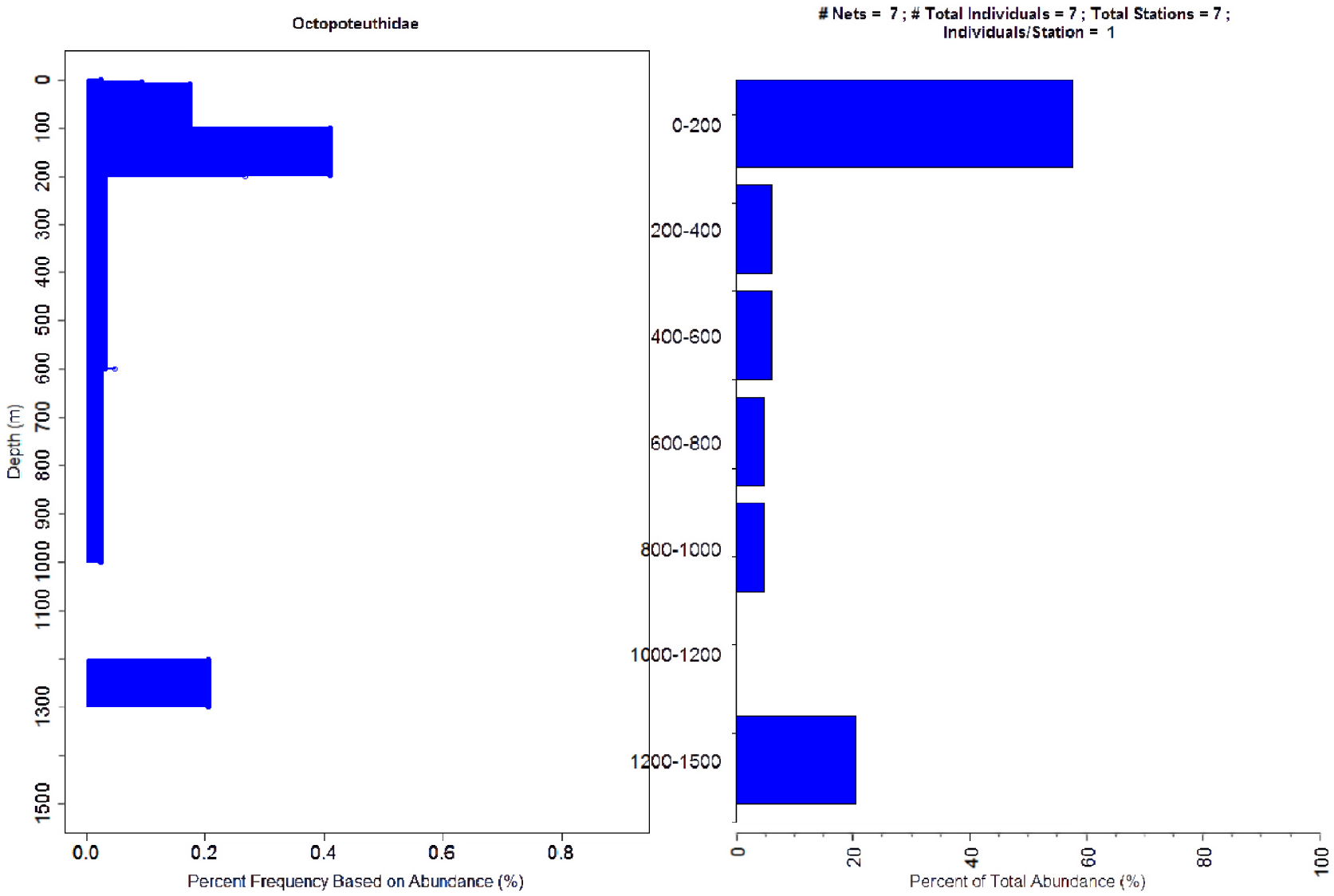
Notosudidae


Octopoda
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

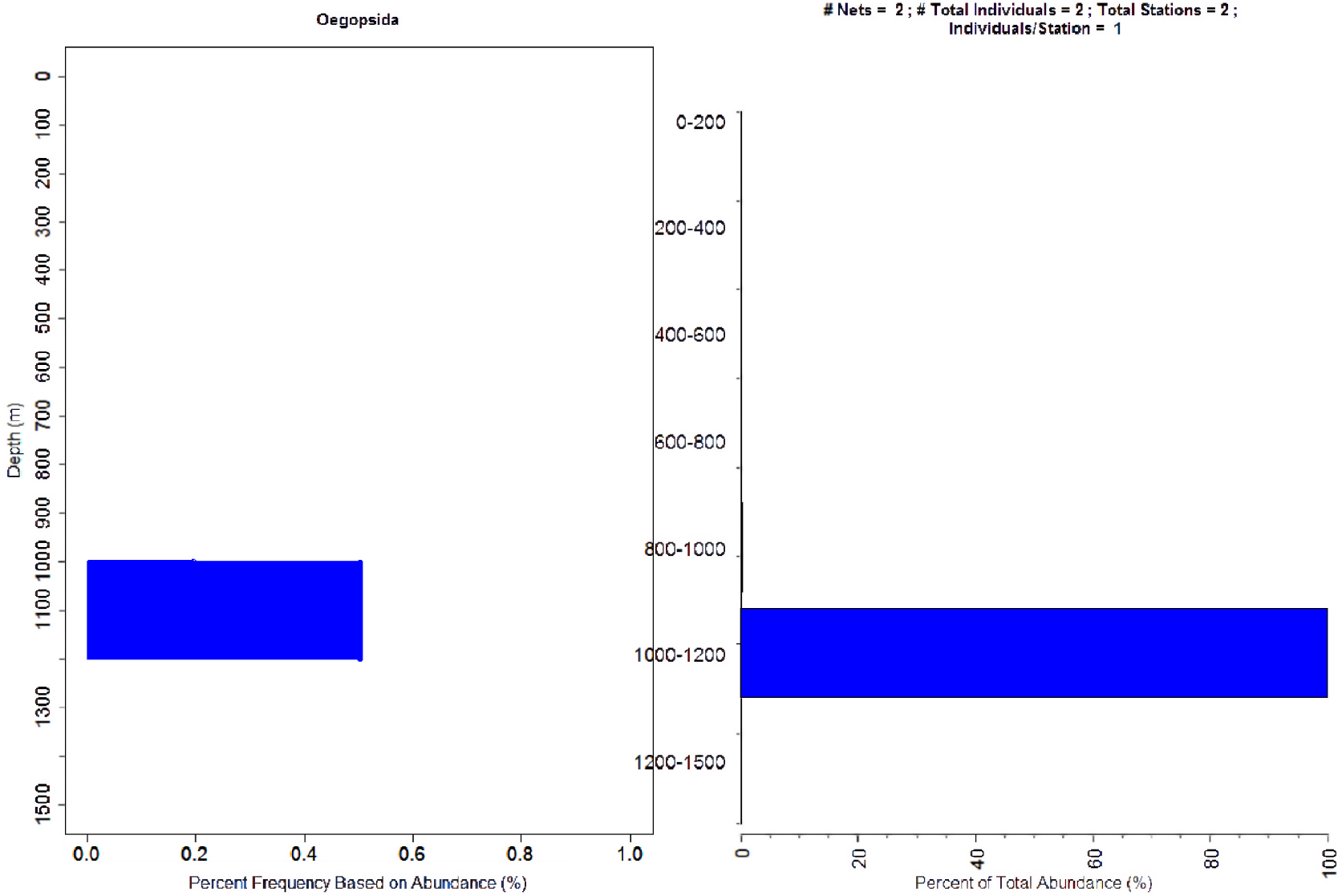
Octopoda



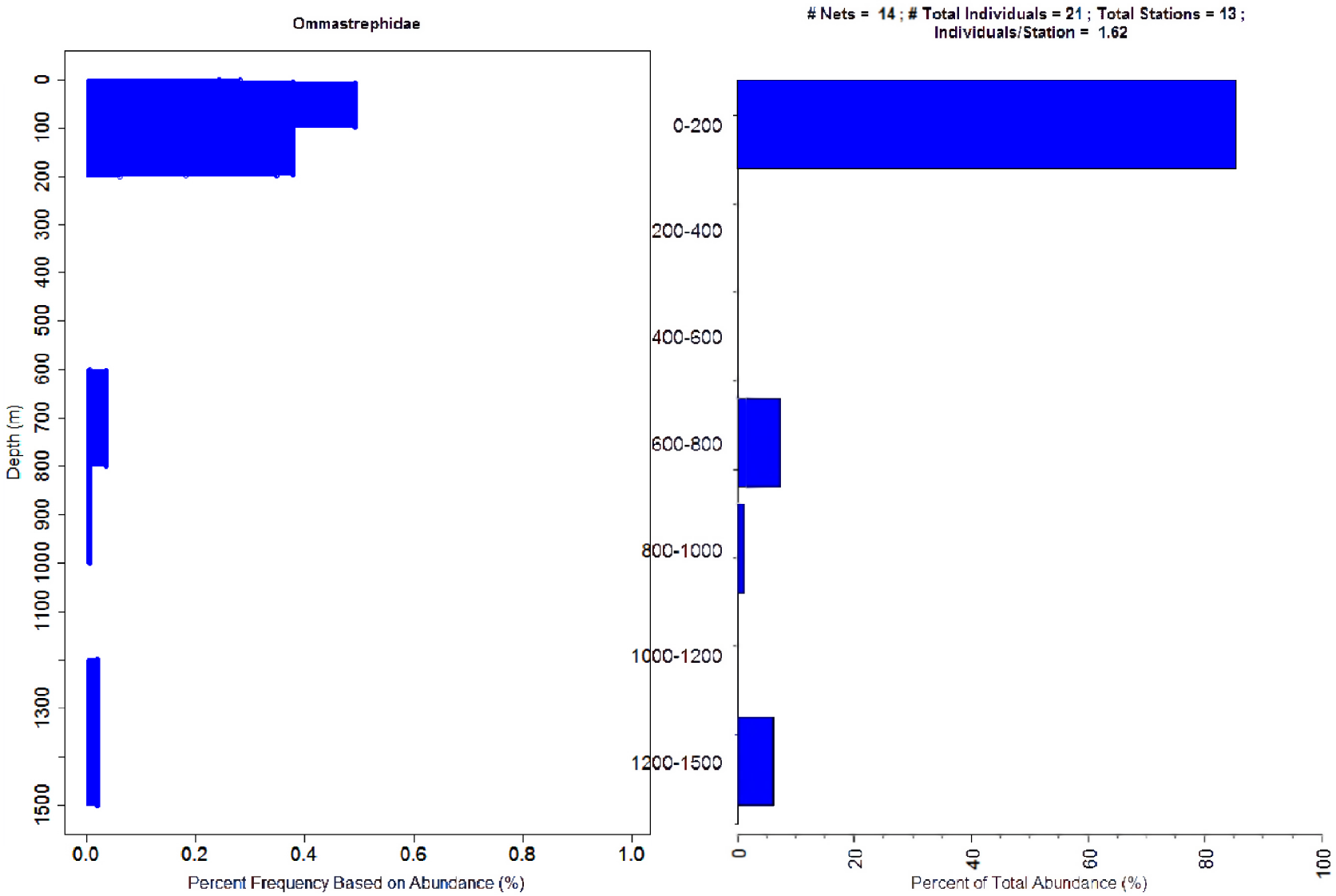
Octopodidae



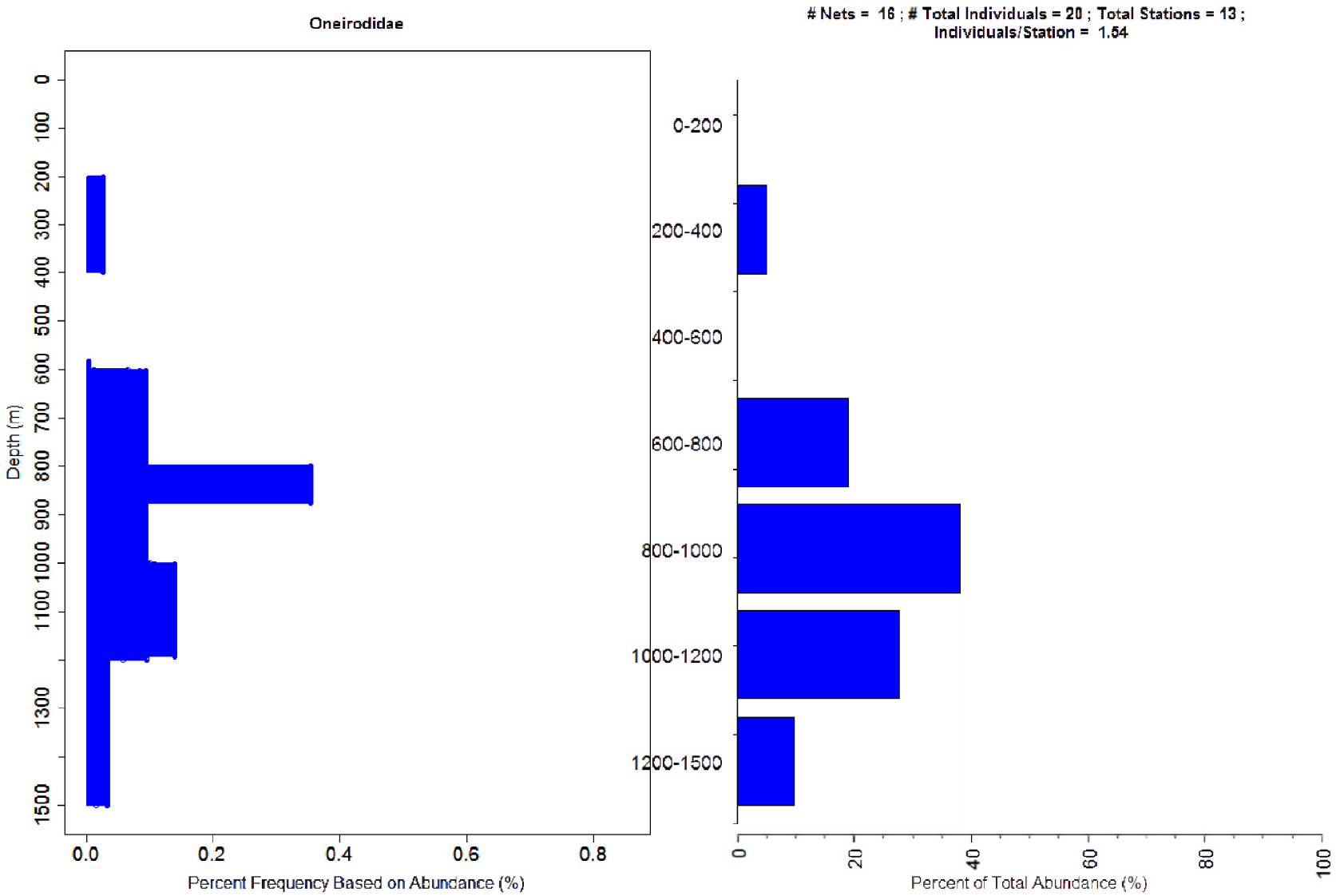
Octopoteuthidae


Oegopsida
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

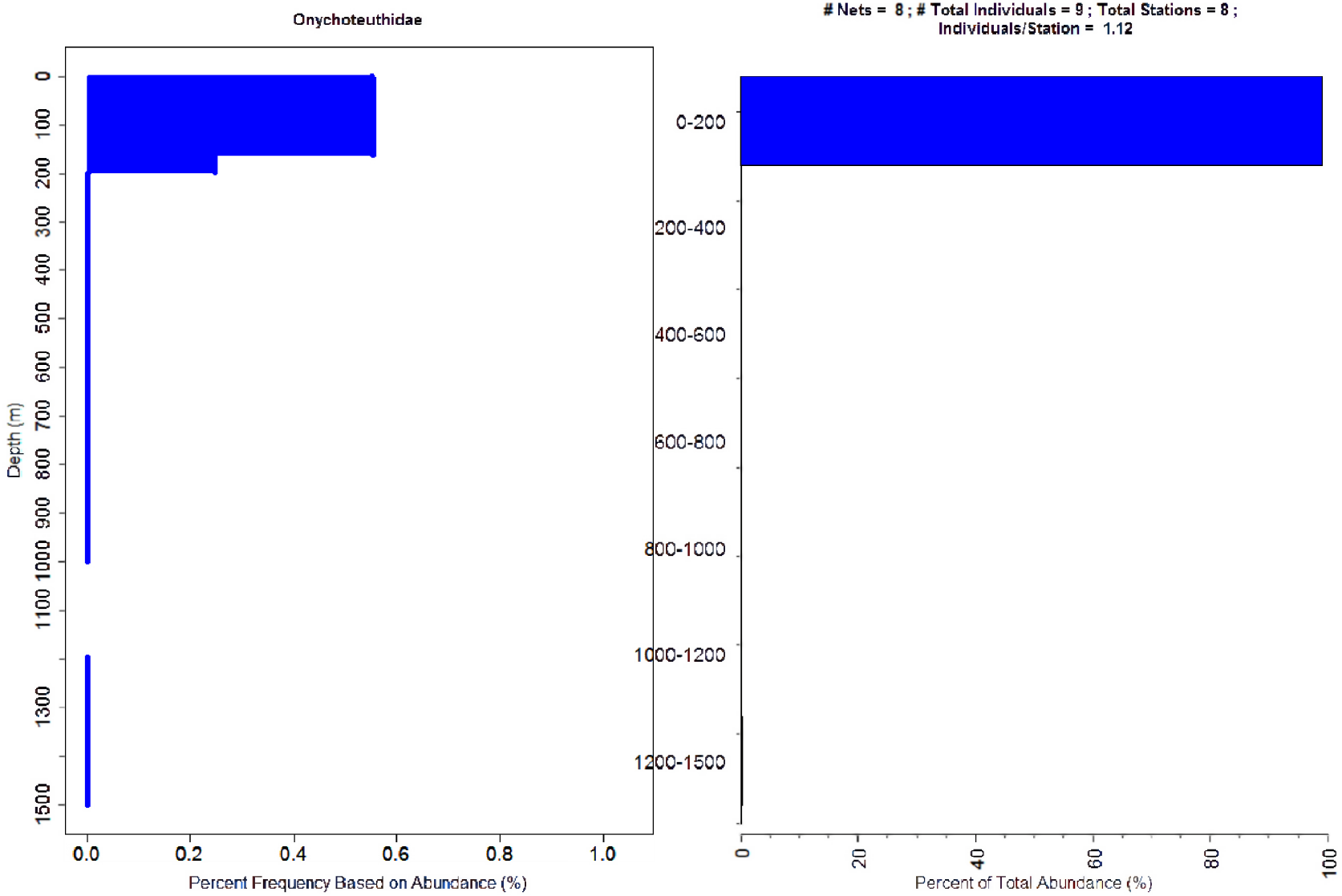
Oegopsida



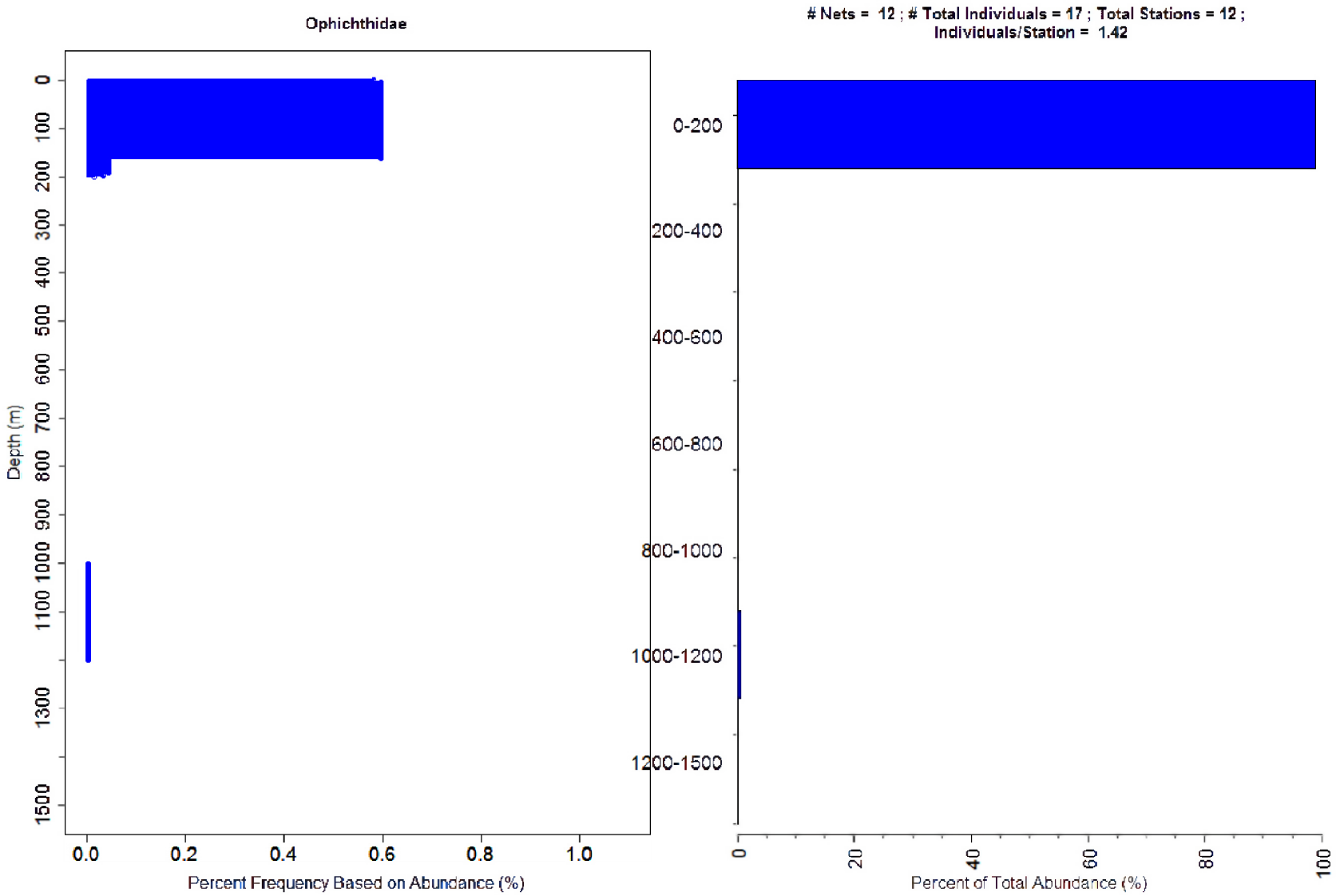
Ommastrephidae



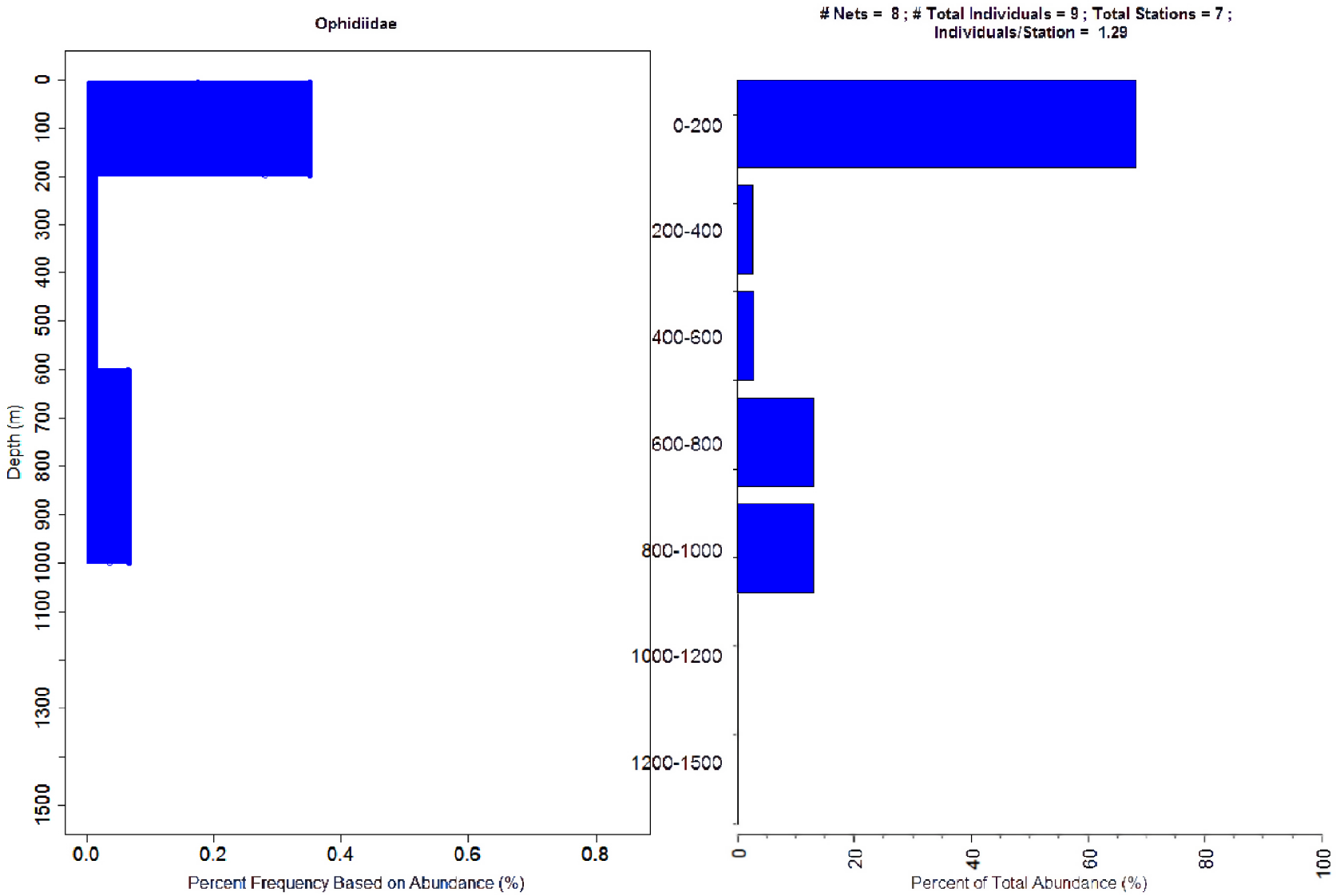
Oneirodidae



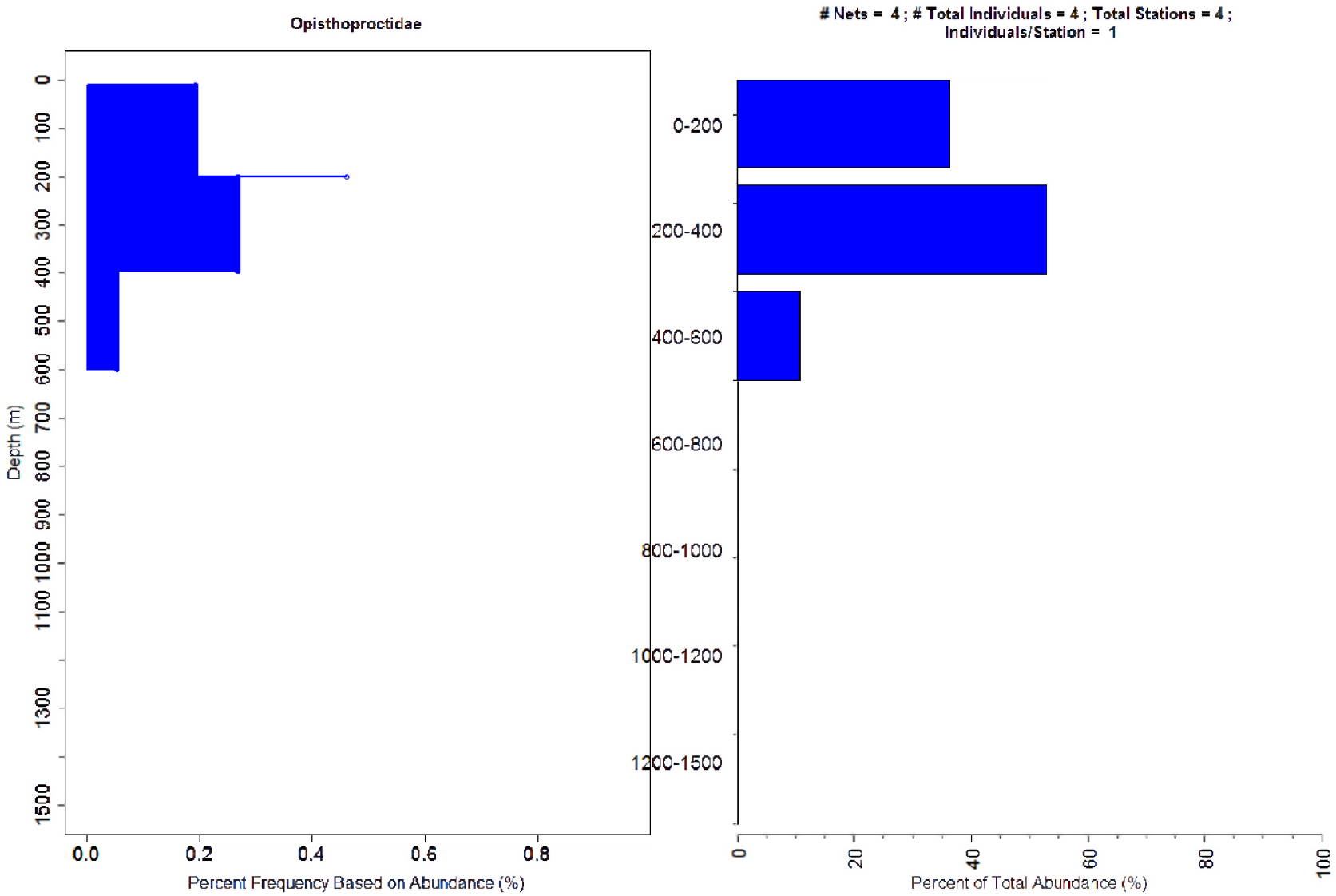
Onychoteuthidae



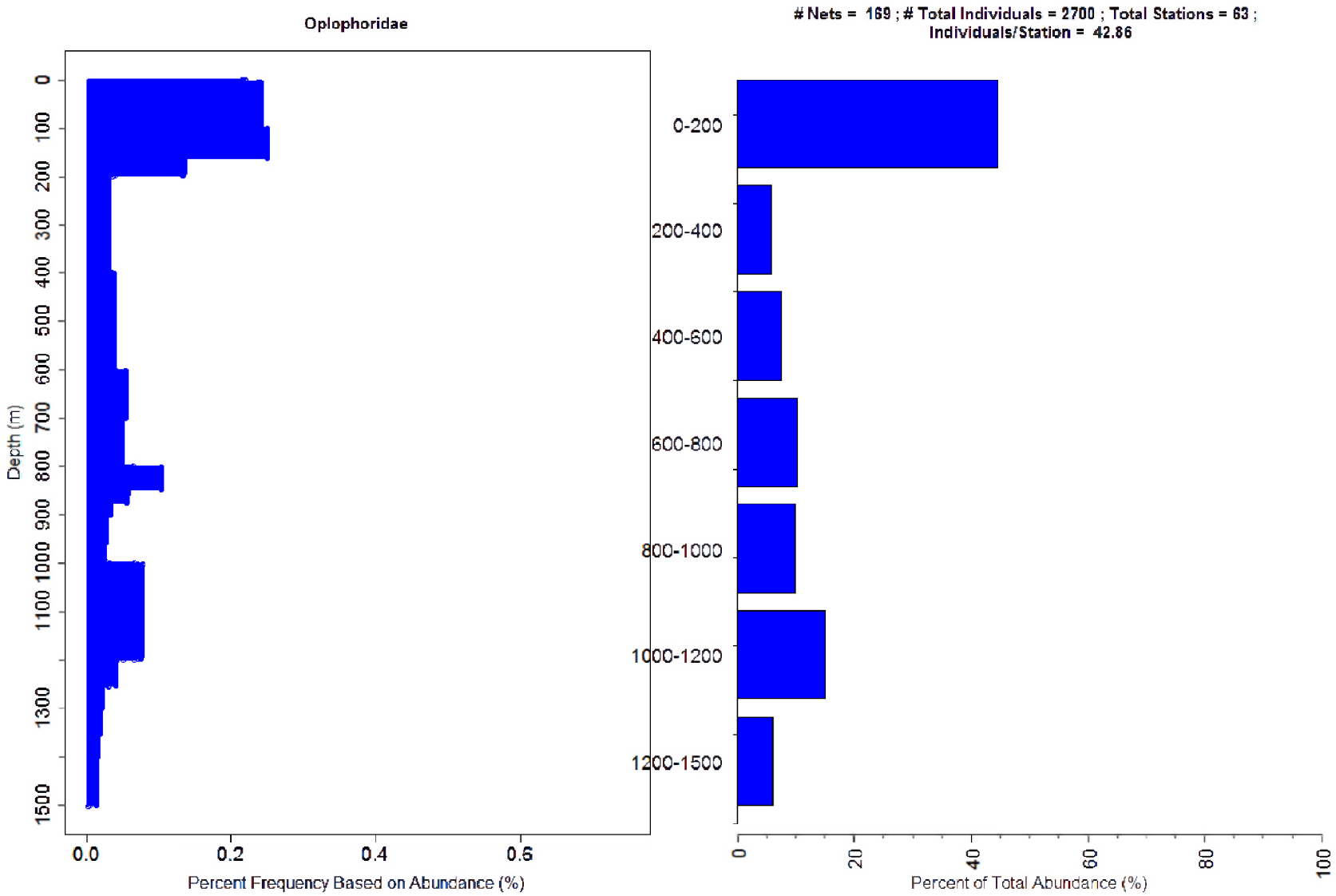
Ophichthidae


Ophidiidae
Nets = 8 ; # Total Individuals = 9 ; Total Stations = 7 ;
Individuals/Station = 1.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

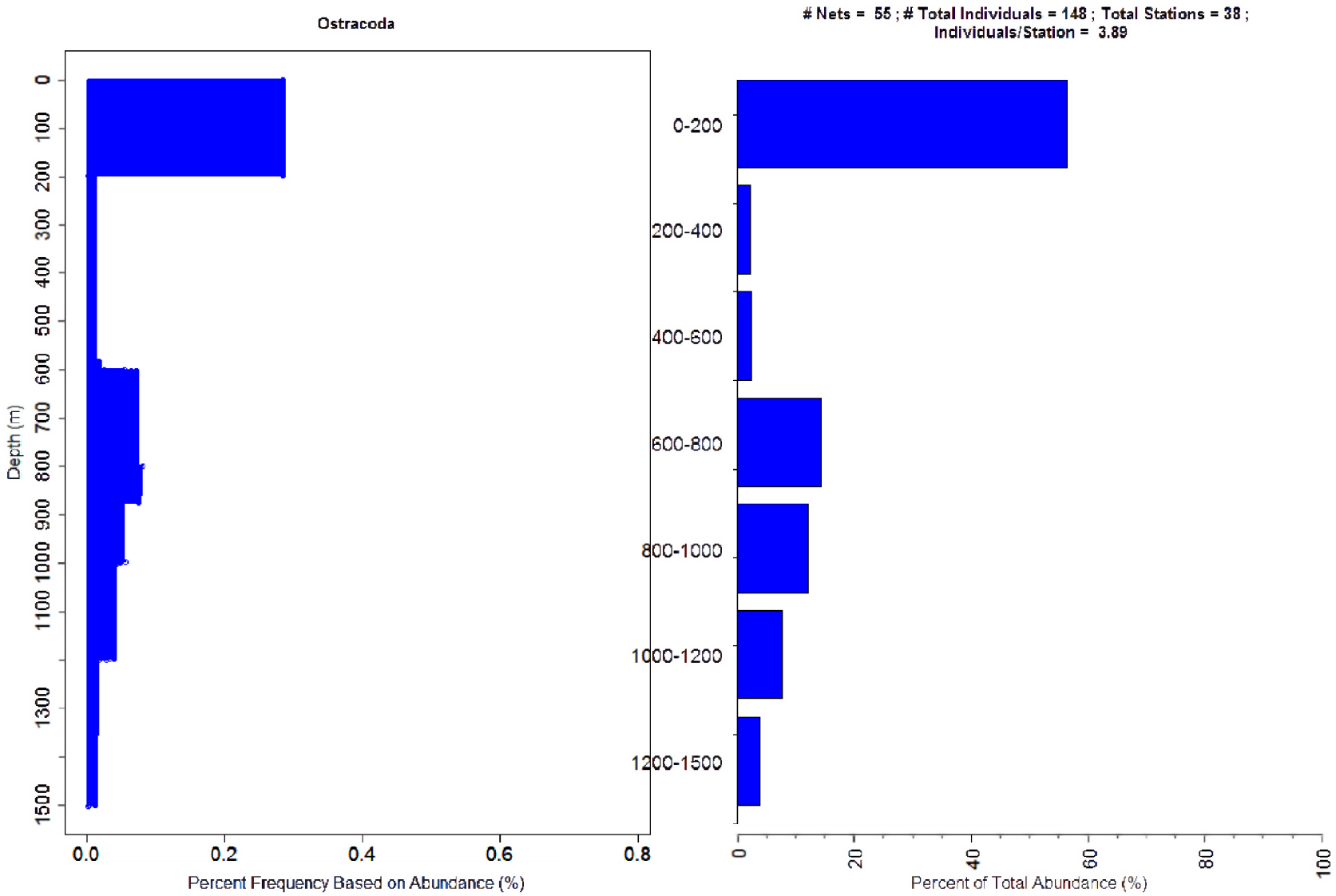
Ophidiidae



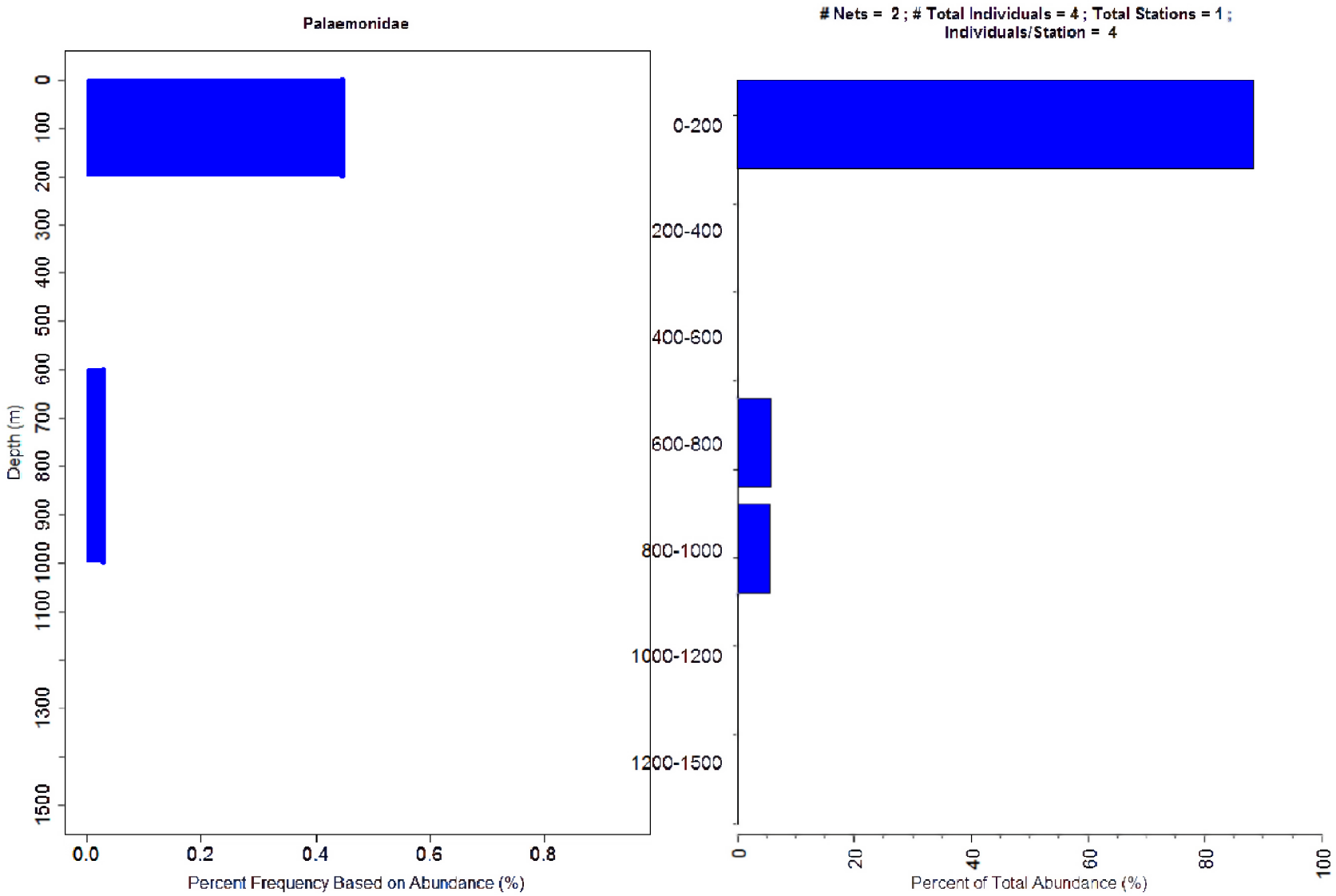
Opisthoproctidae



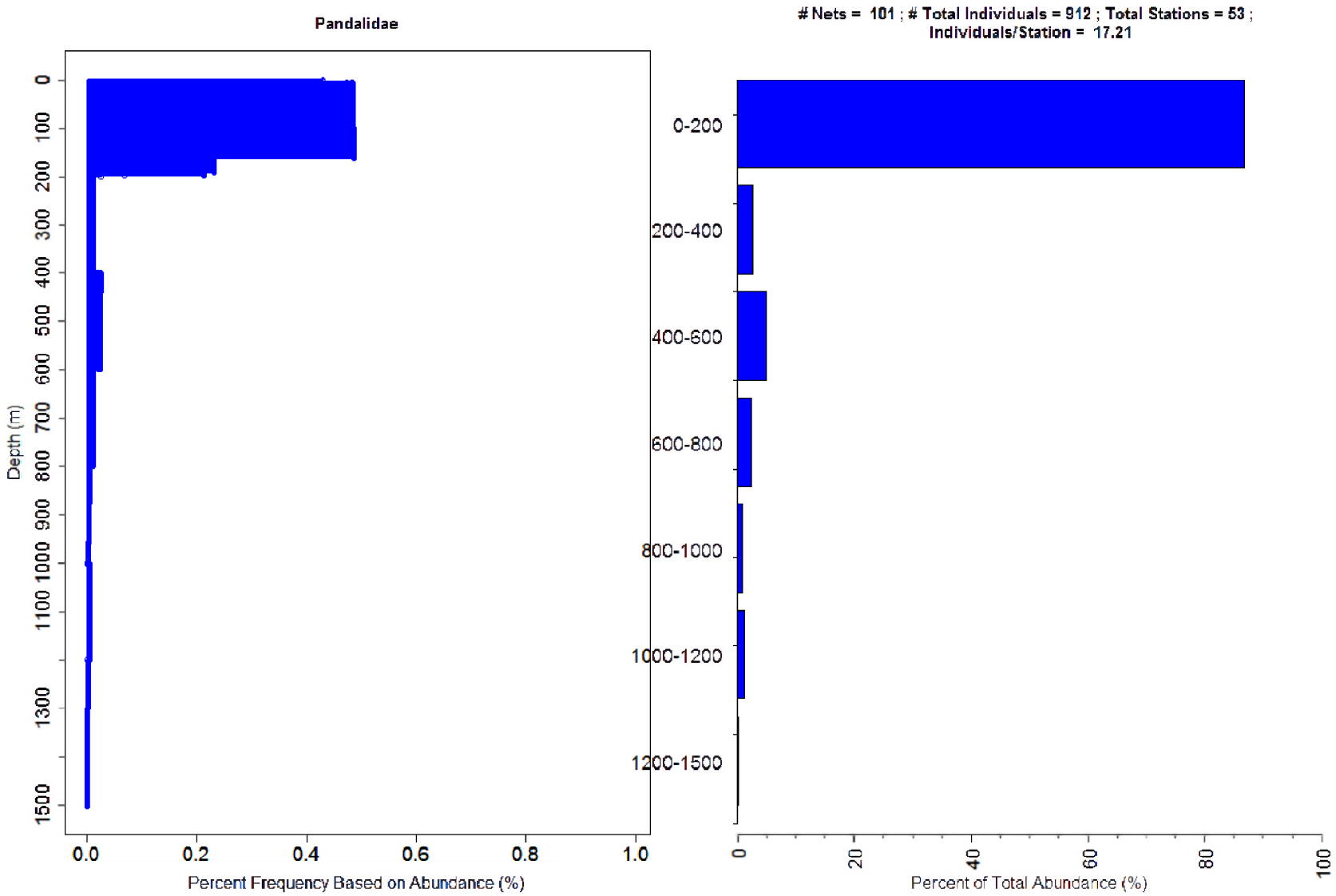
Oplophoridae


Ostracoda
Nets = 55 ; # Total Individuals = 148 ; Total Stations = 38 ;
Individuals/Station = 3.89
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

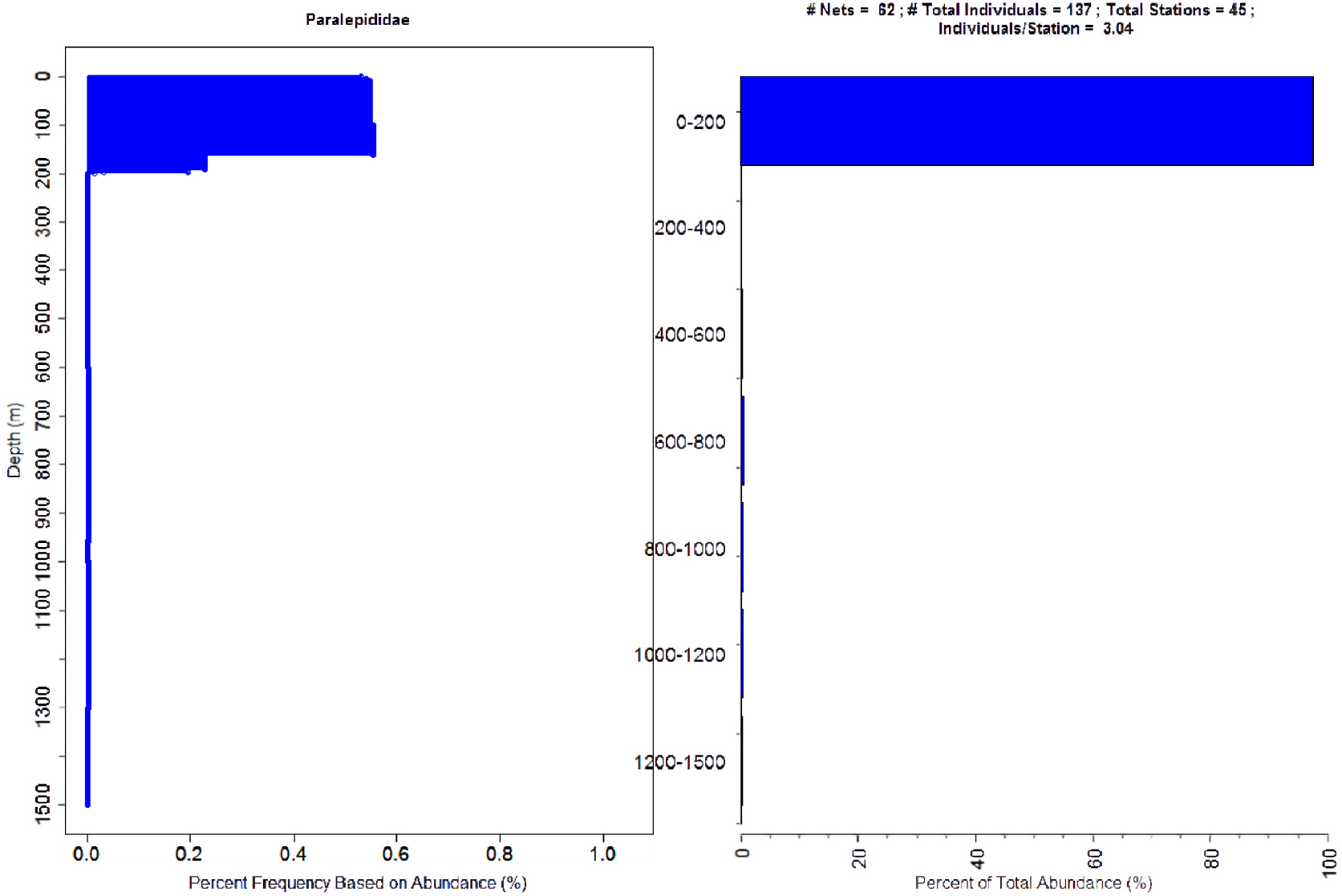
Ostracoda



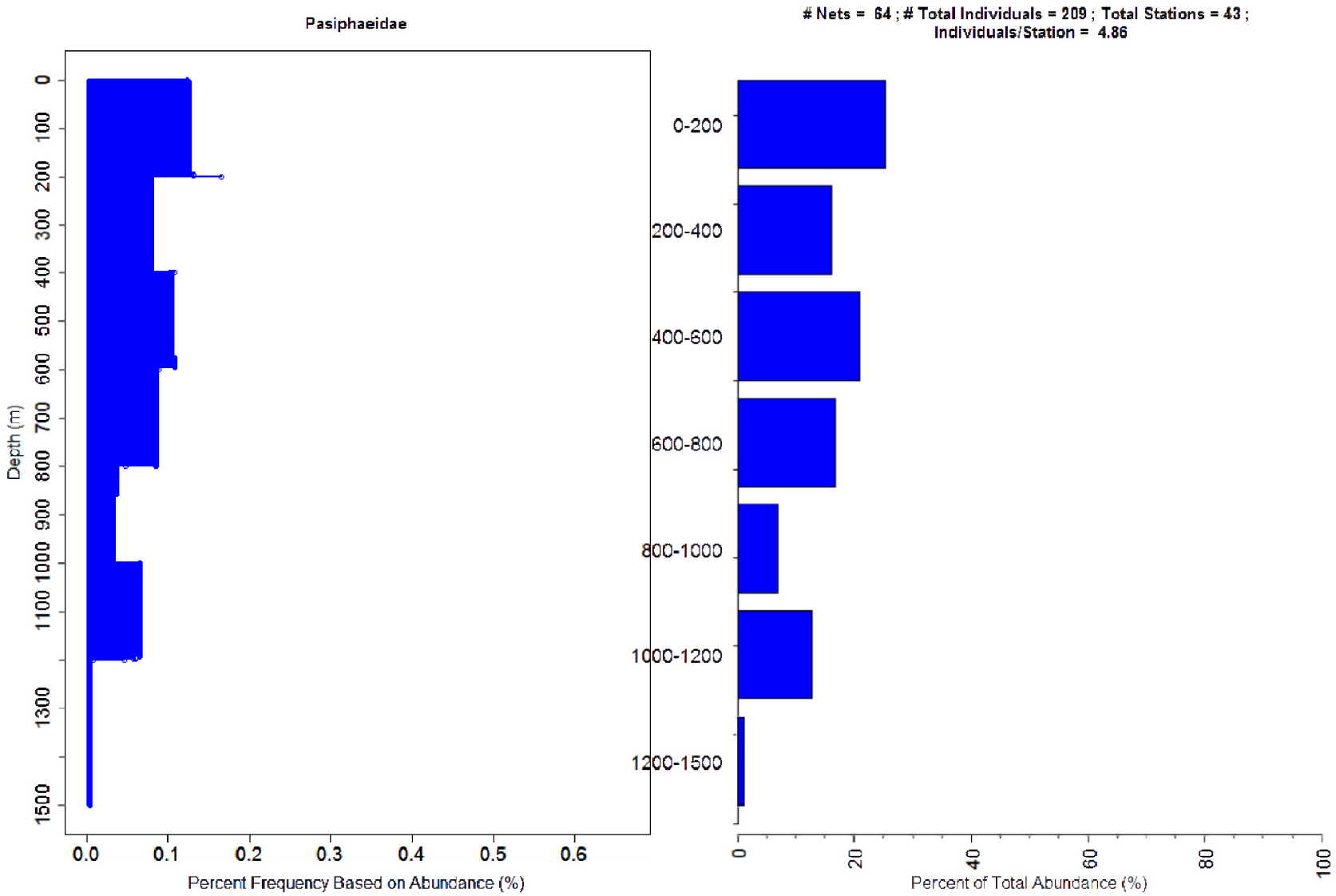
Palaemonidae


Pandalidae
Nets = 101 ; # Total Individuals = 912 ; Total Stations = 53 ;
Individuals/Station = 17.21
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

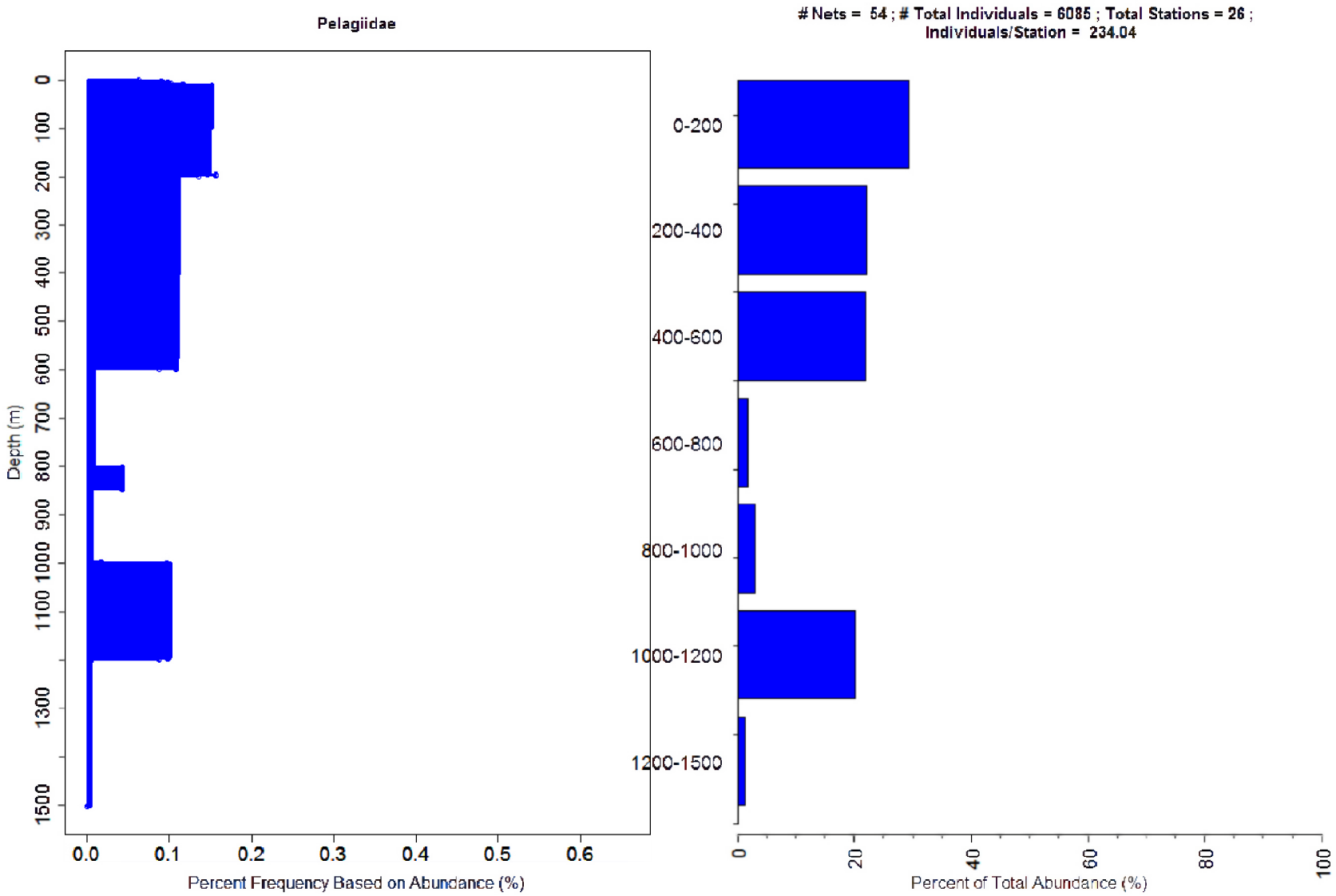
Pandalidae



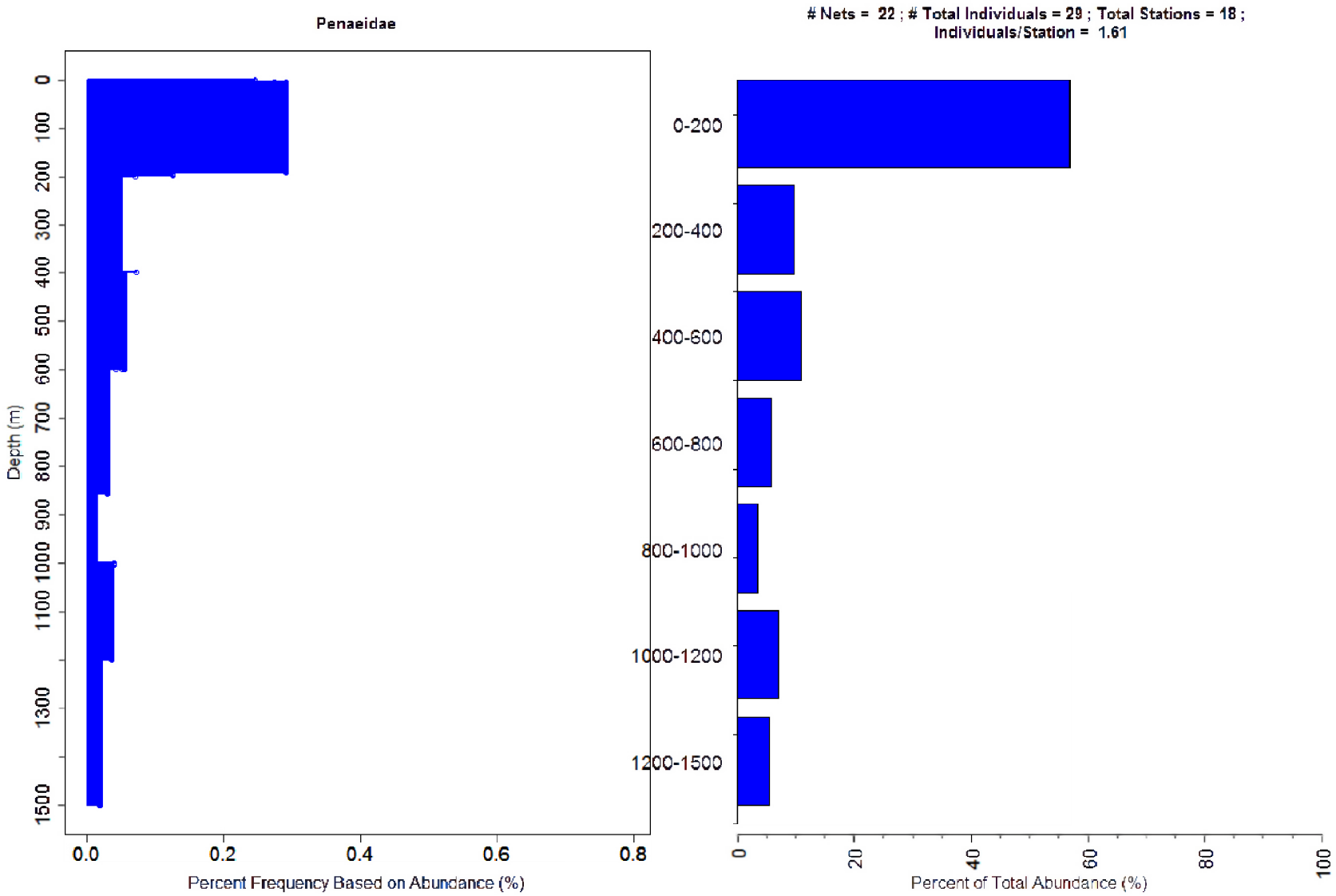
Paralepididae



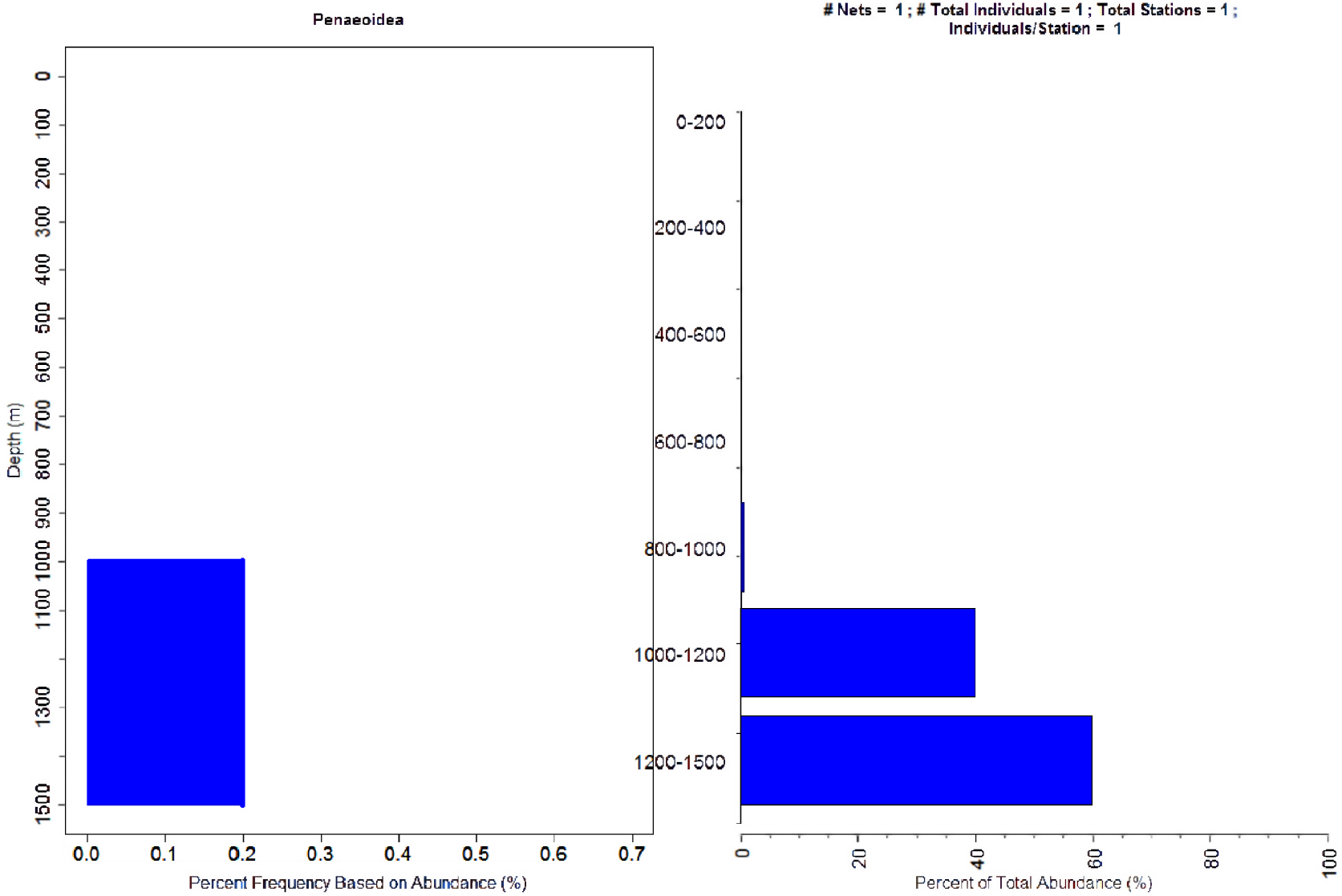
Pasiphaeidae


Pelagiidae
Nets = 54 ; # Total Individuals = 6085 ; Total Stations = 26 ;
Individuals/Station = 234.04
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

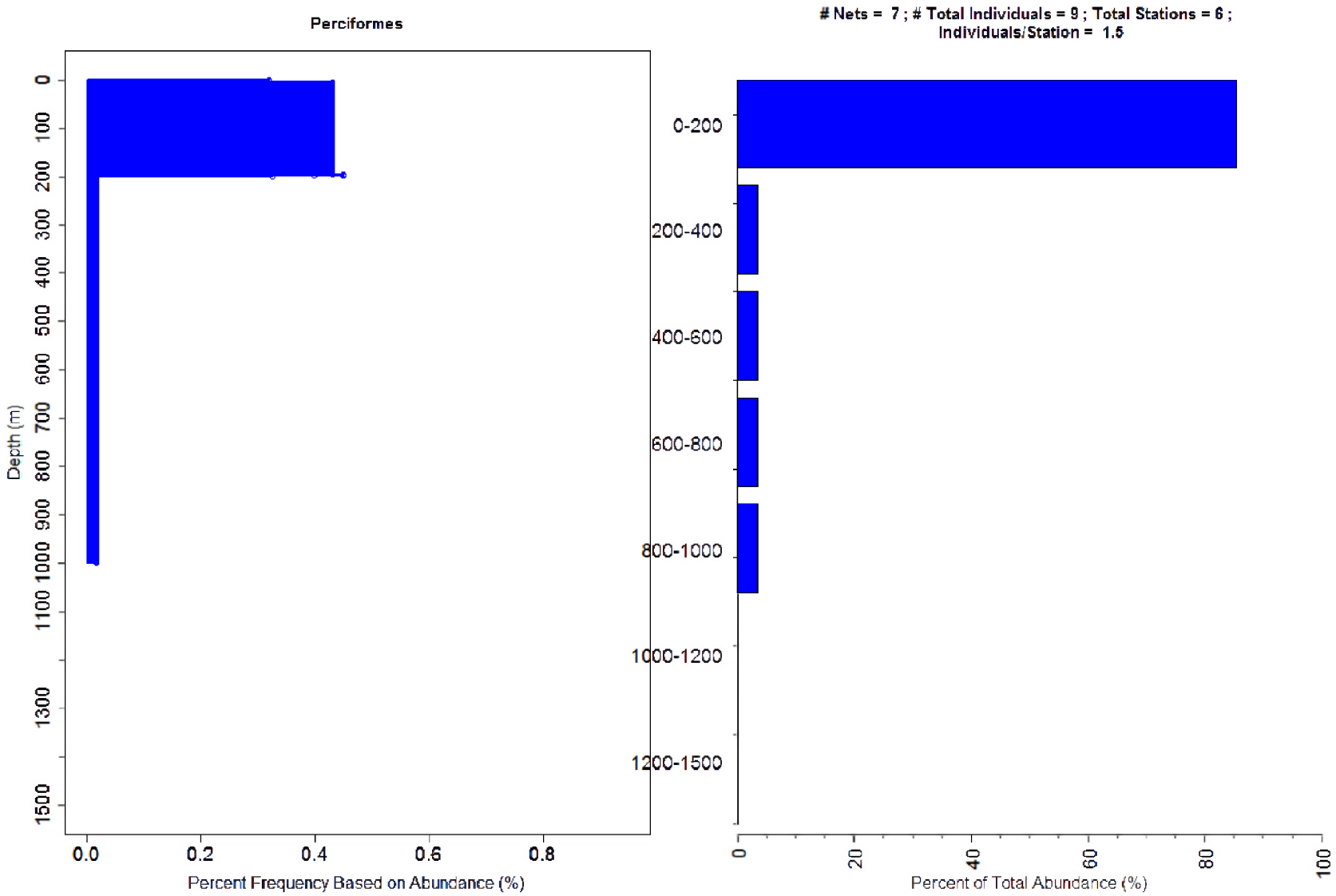
Pelagiidae


Penaeidae
Nets = 22 ; # Total Individuals = 29 ; Total Stations = 18 ;
Individuals/Station = 1.61
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

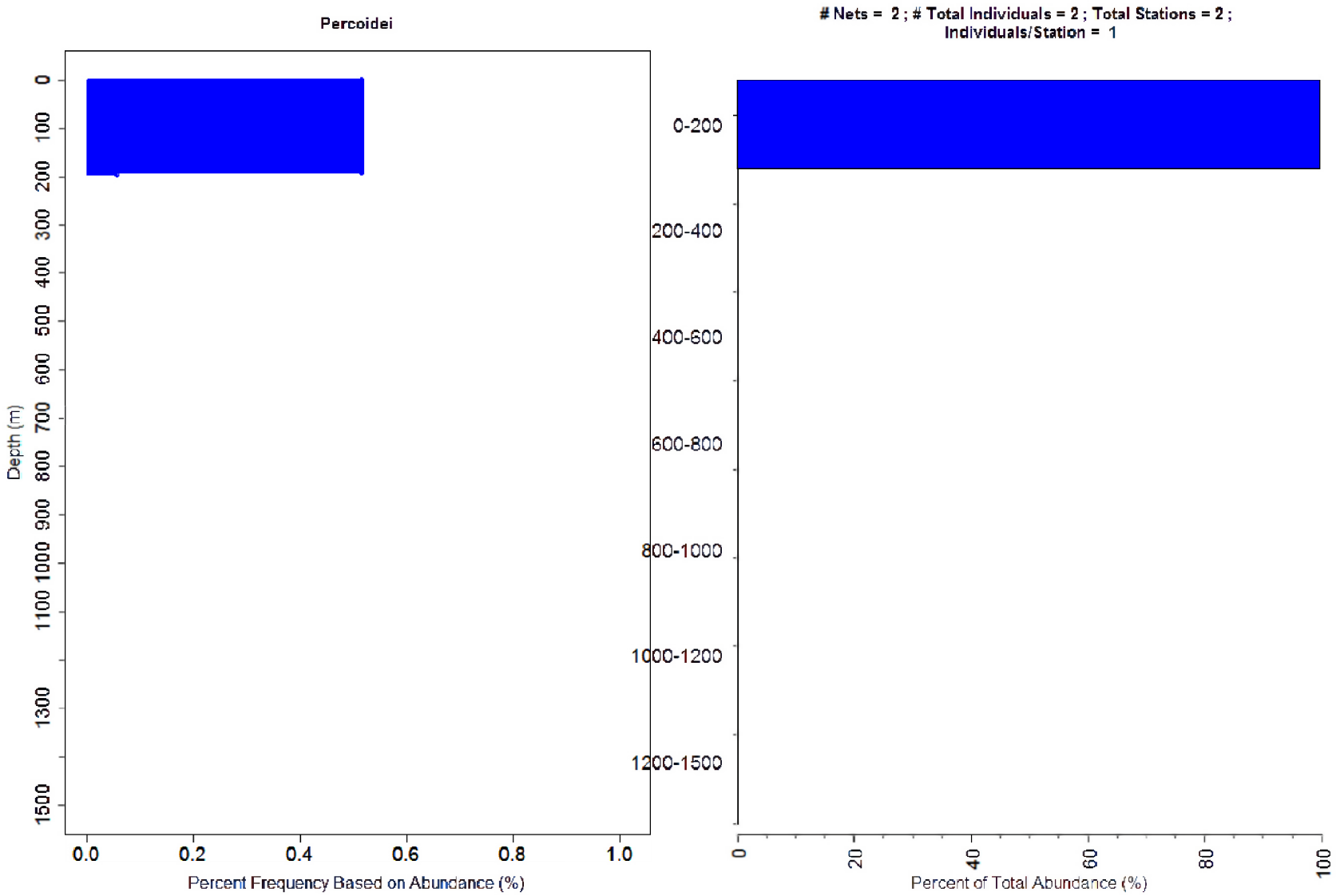
Penaeidae


Penaeoidea
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

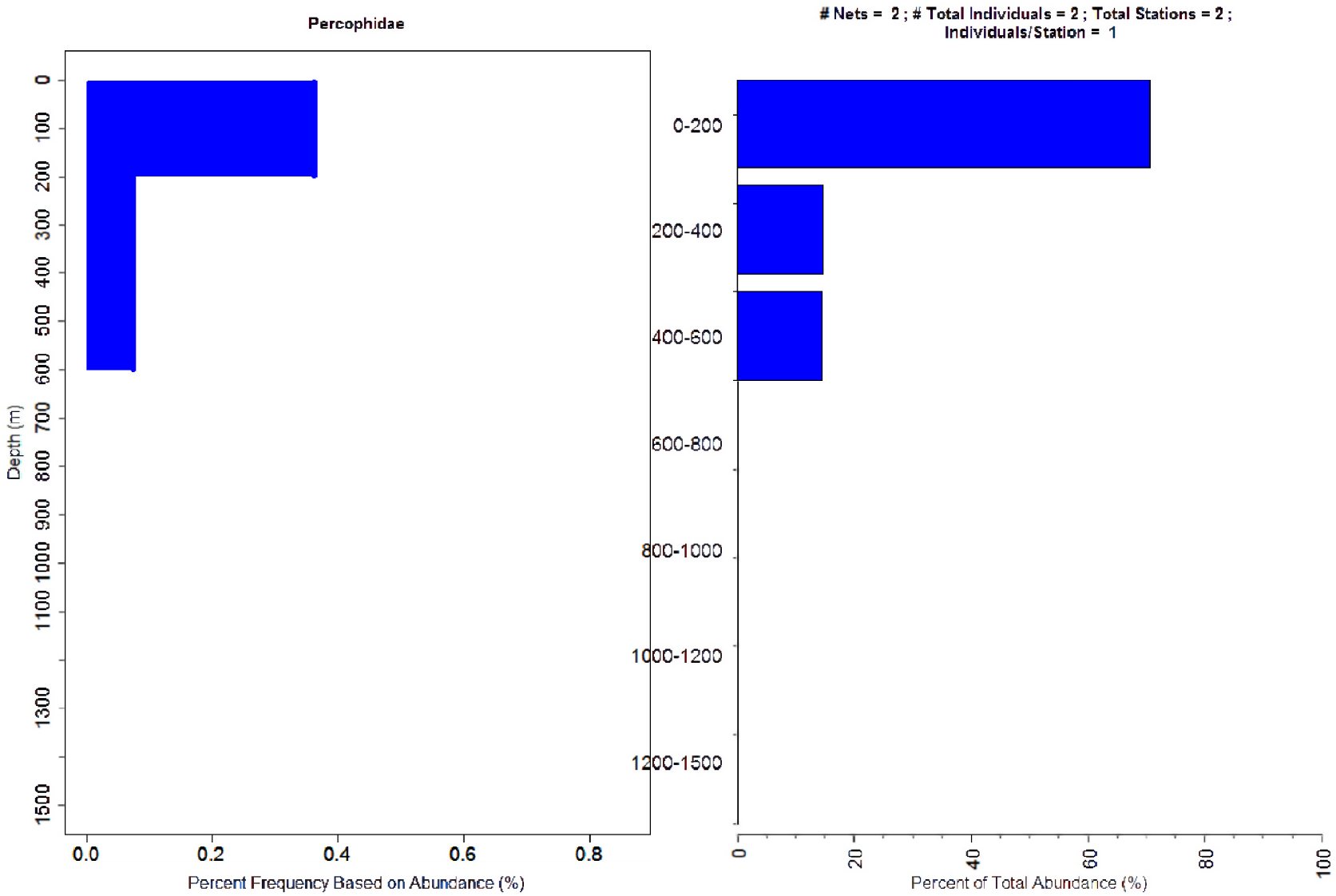
Penaeoidea



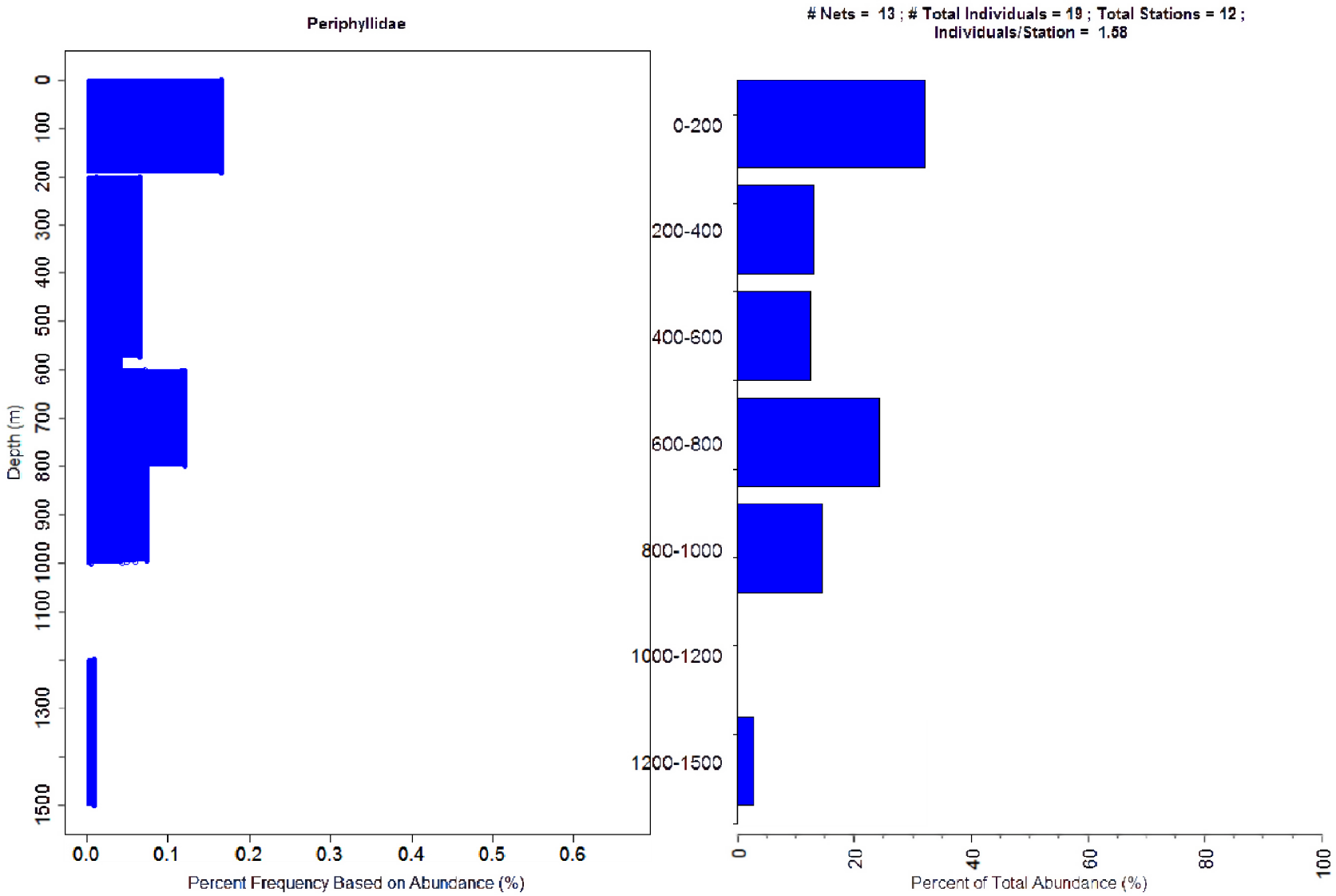
Perciformes


Percoidei
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

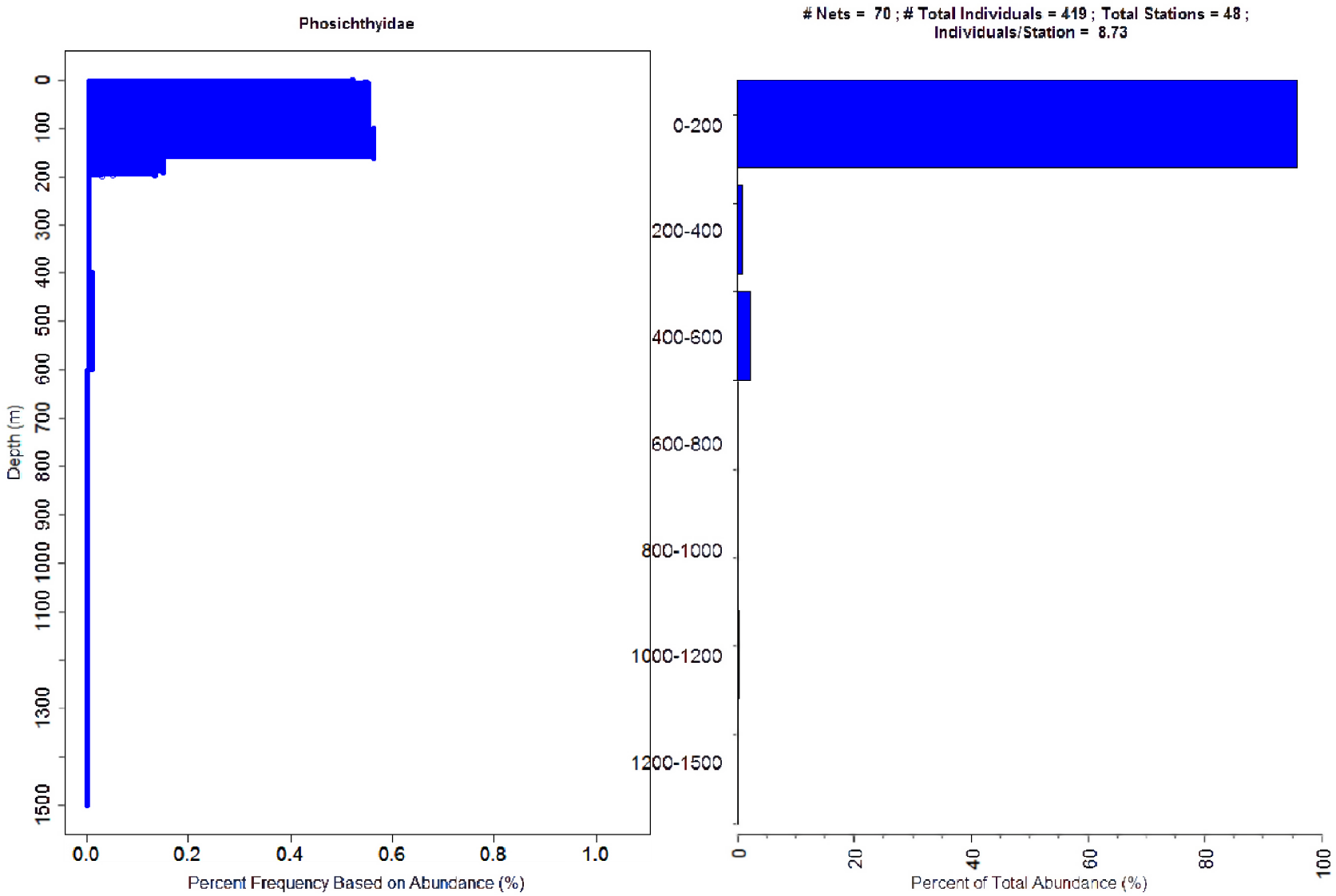
Percoidei



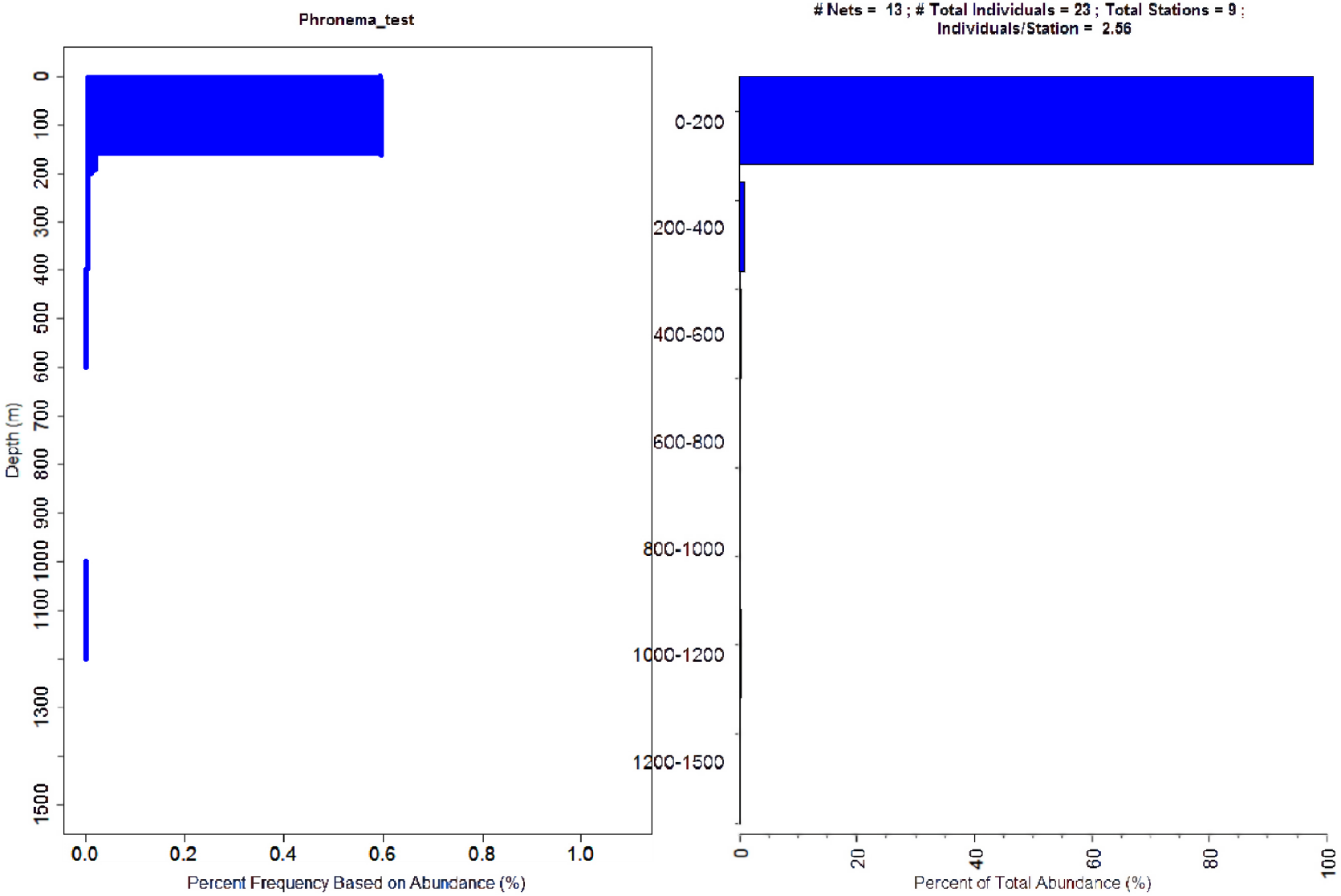
Percophidae



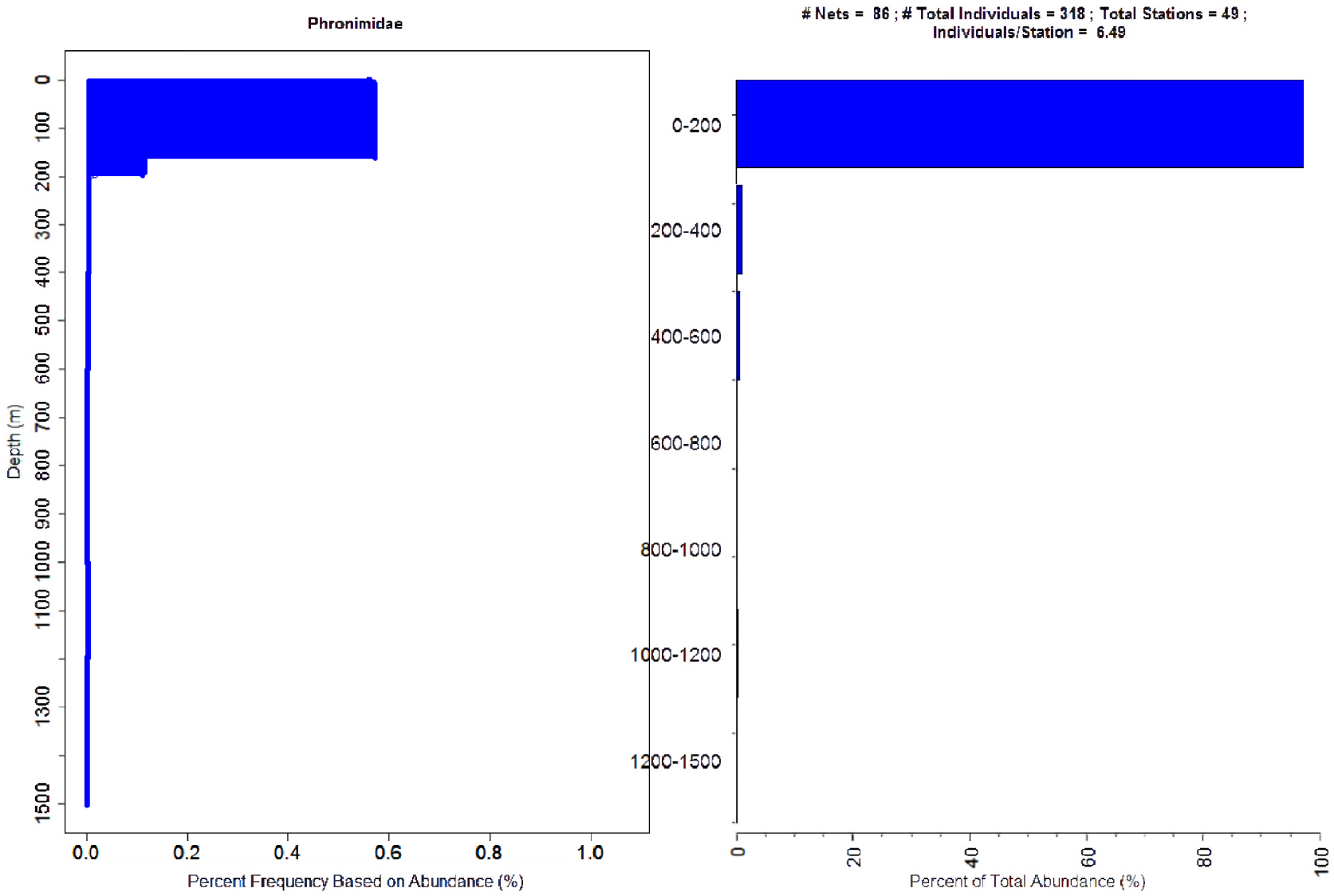
Periphyllidae



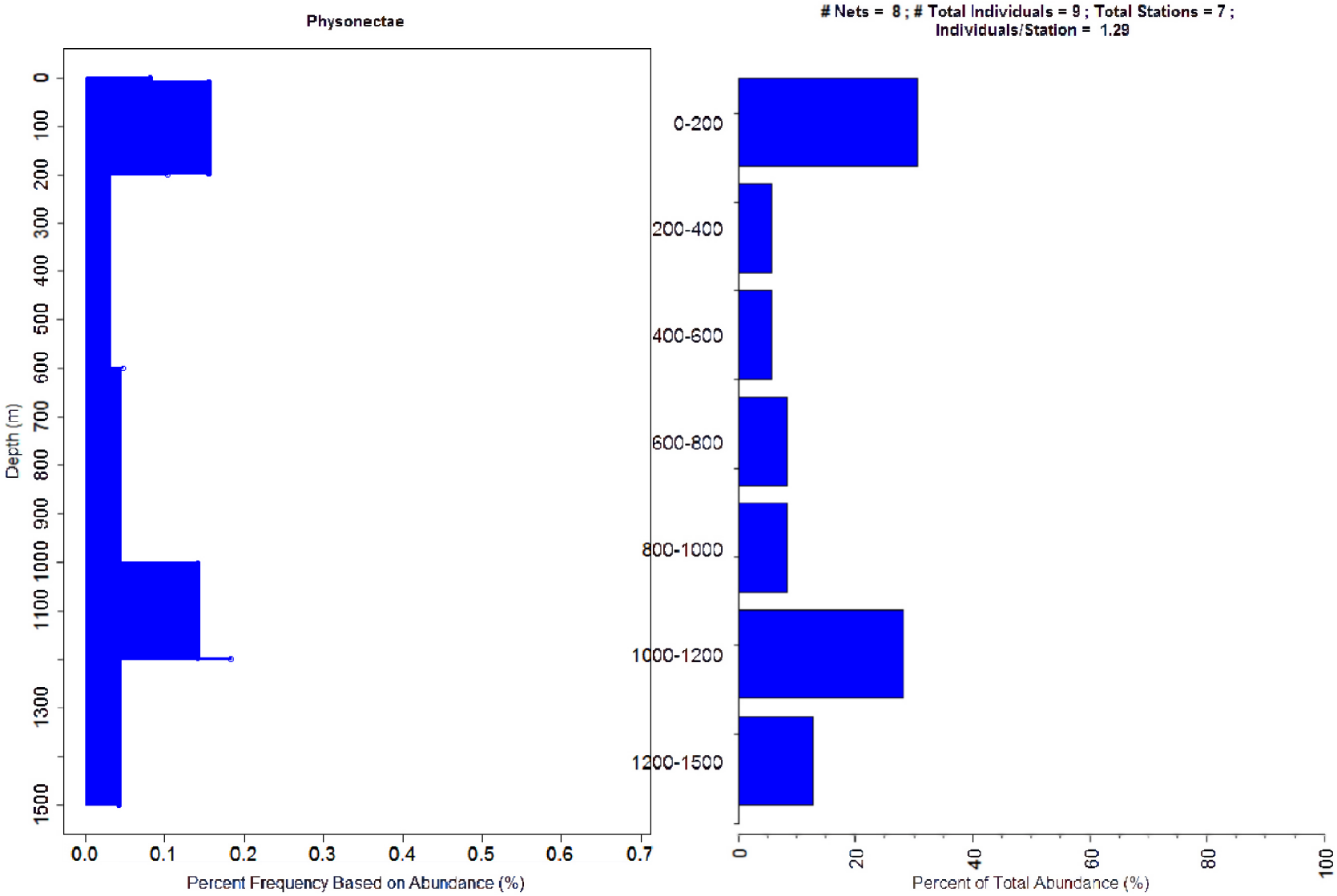
Phosichthyidae



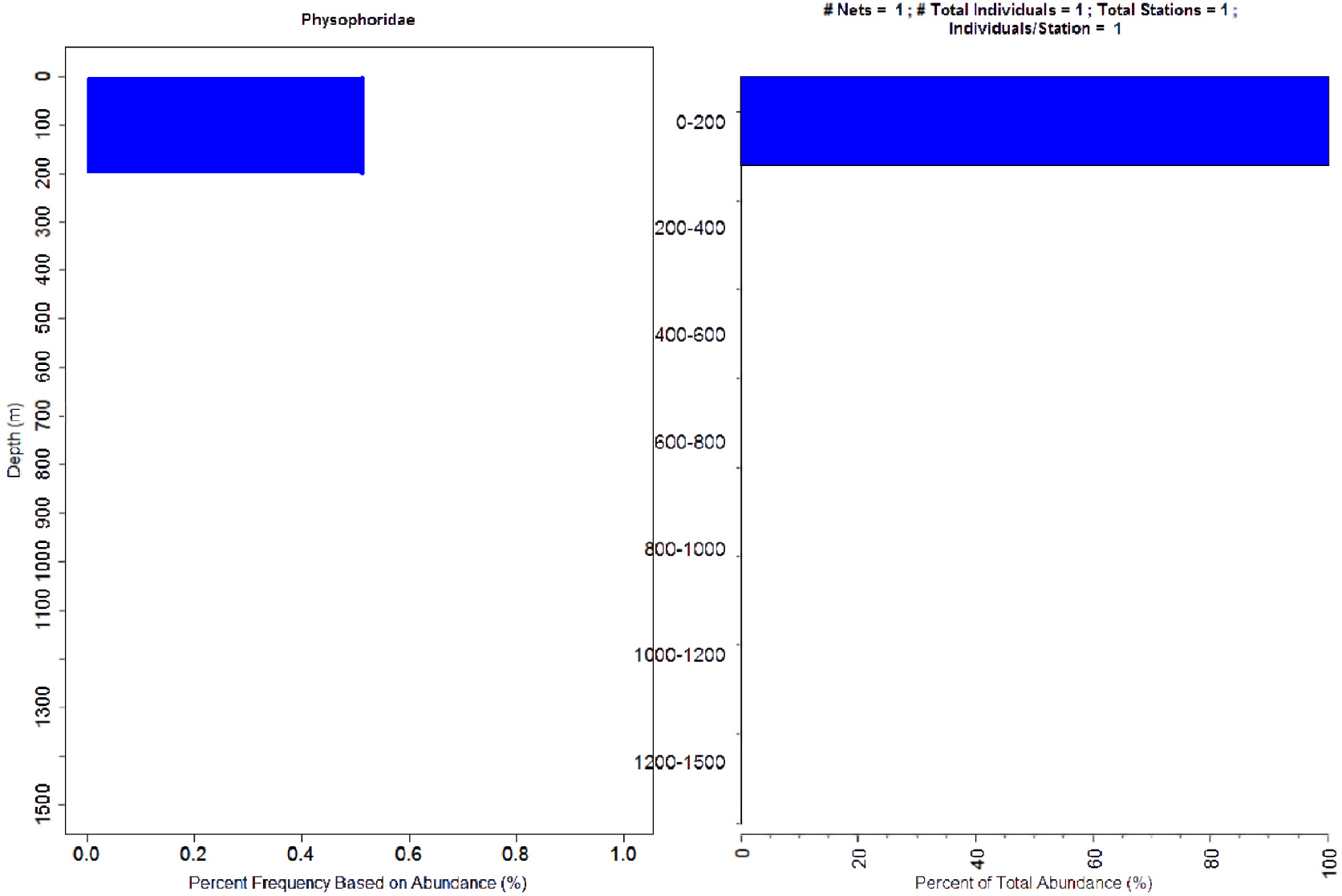
Phronema_test



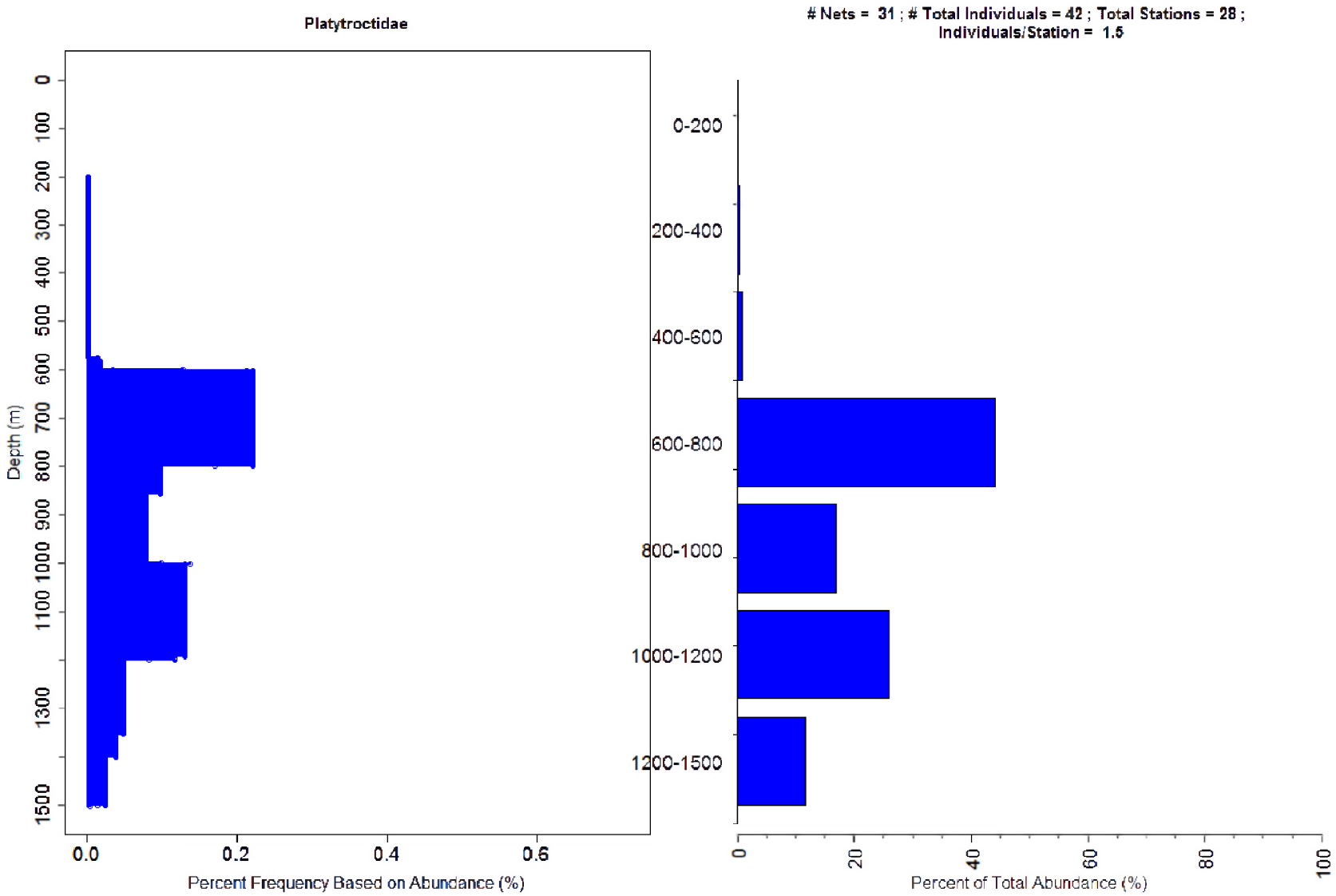
Phronimidae



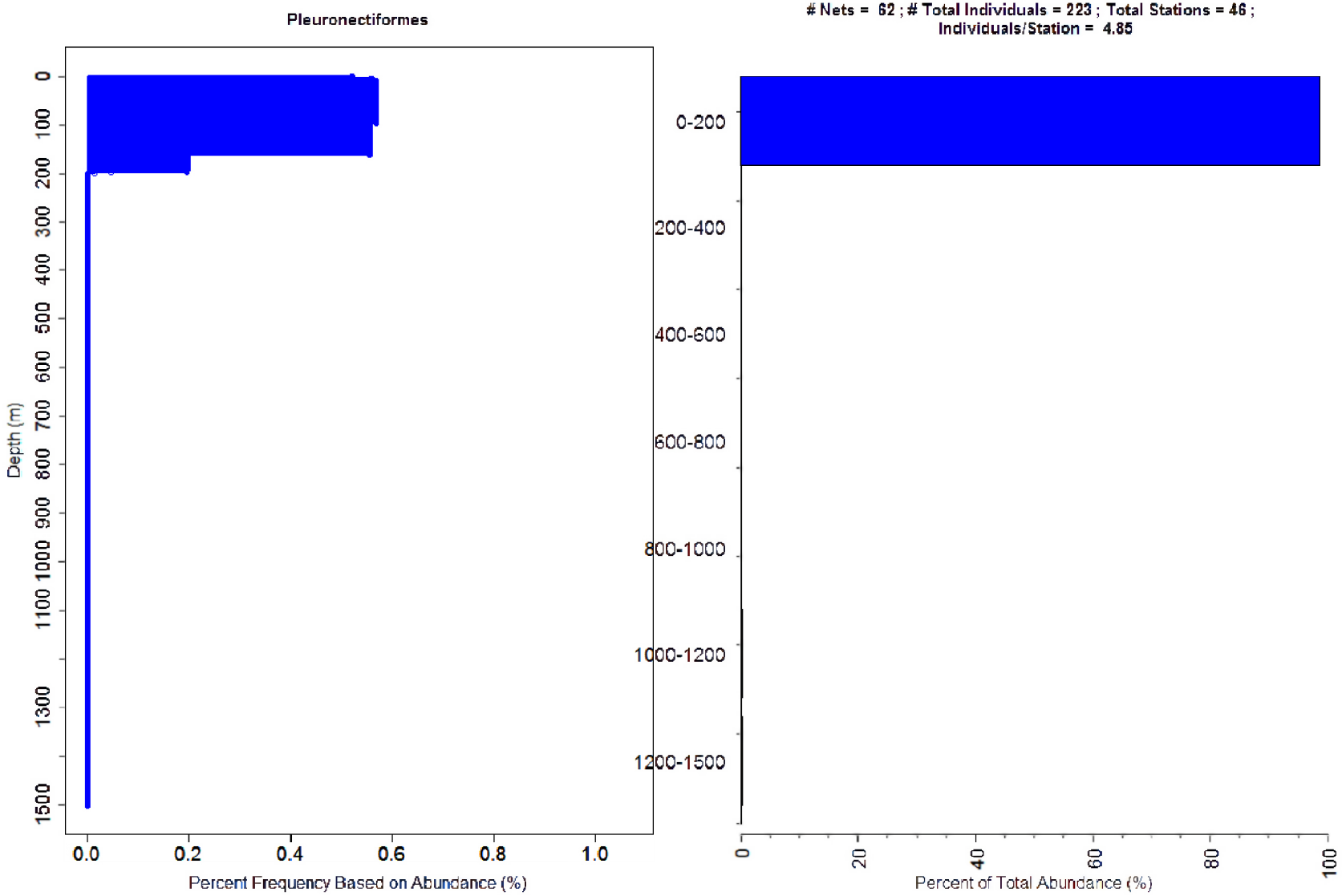
Physonectae



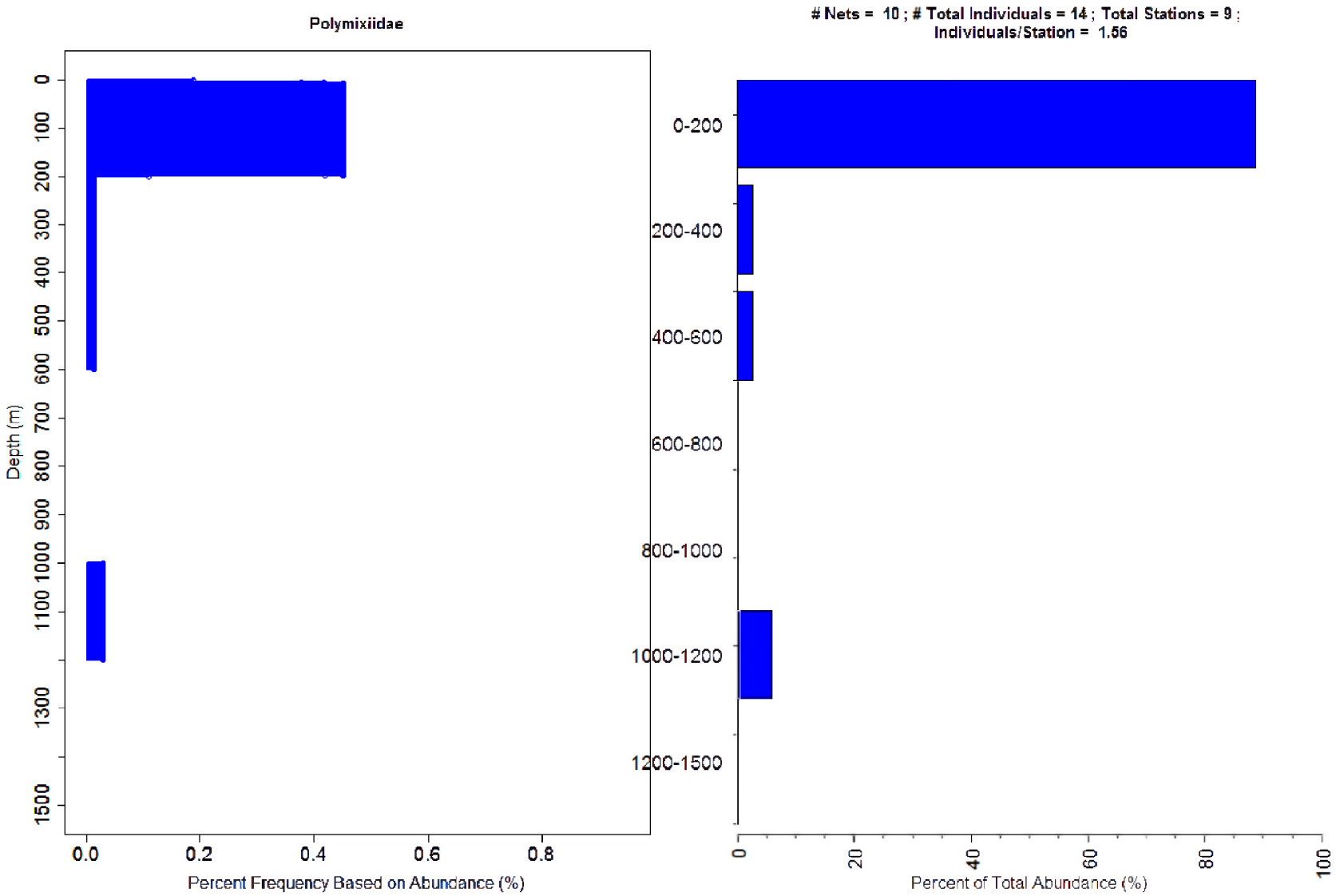
Physophoridae



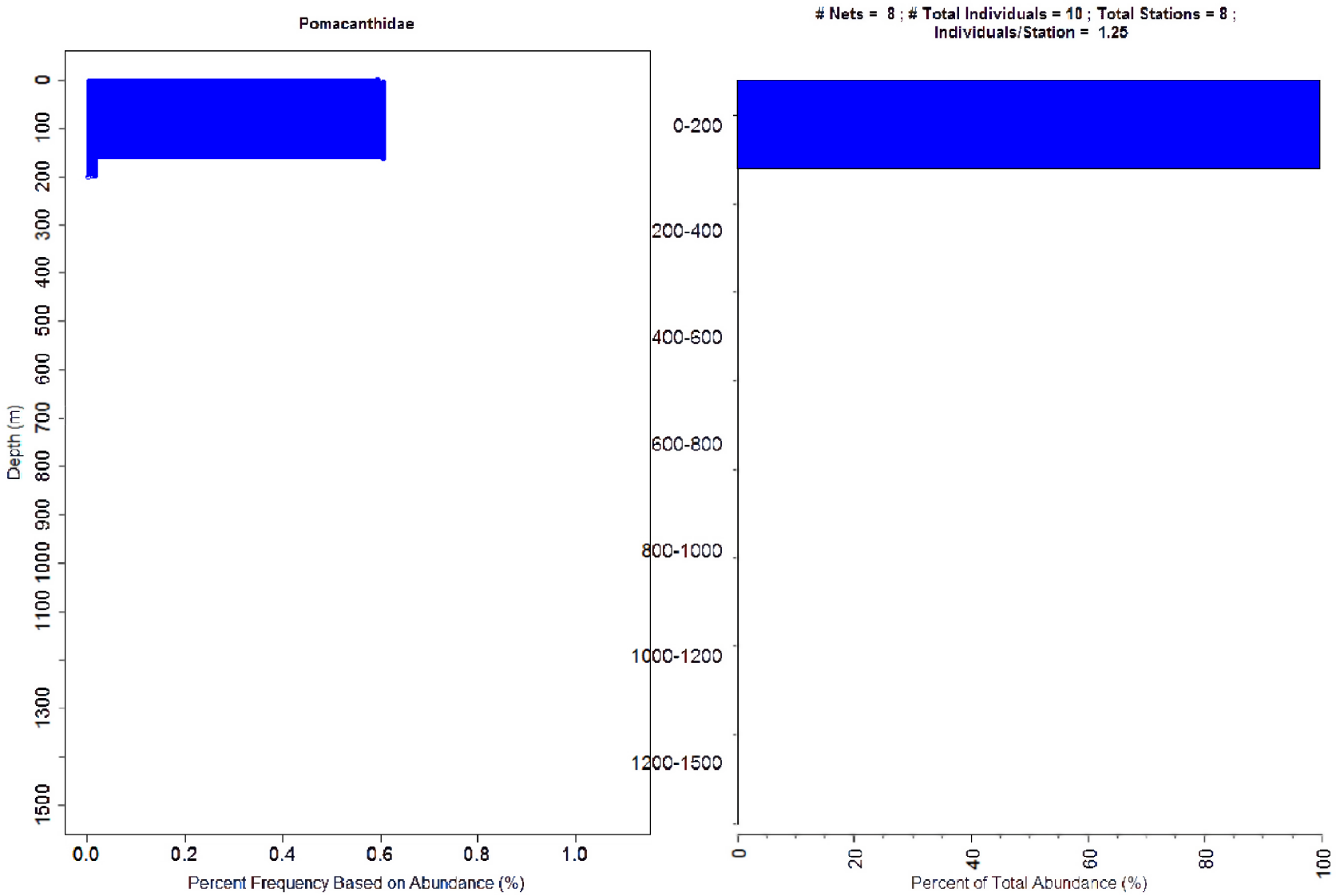
Platytroctidae



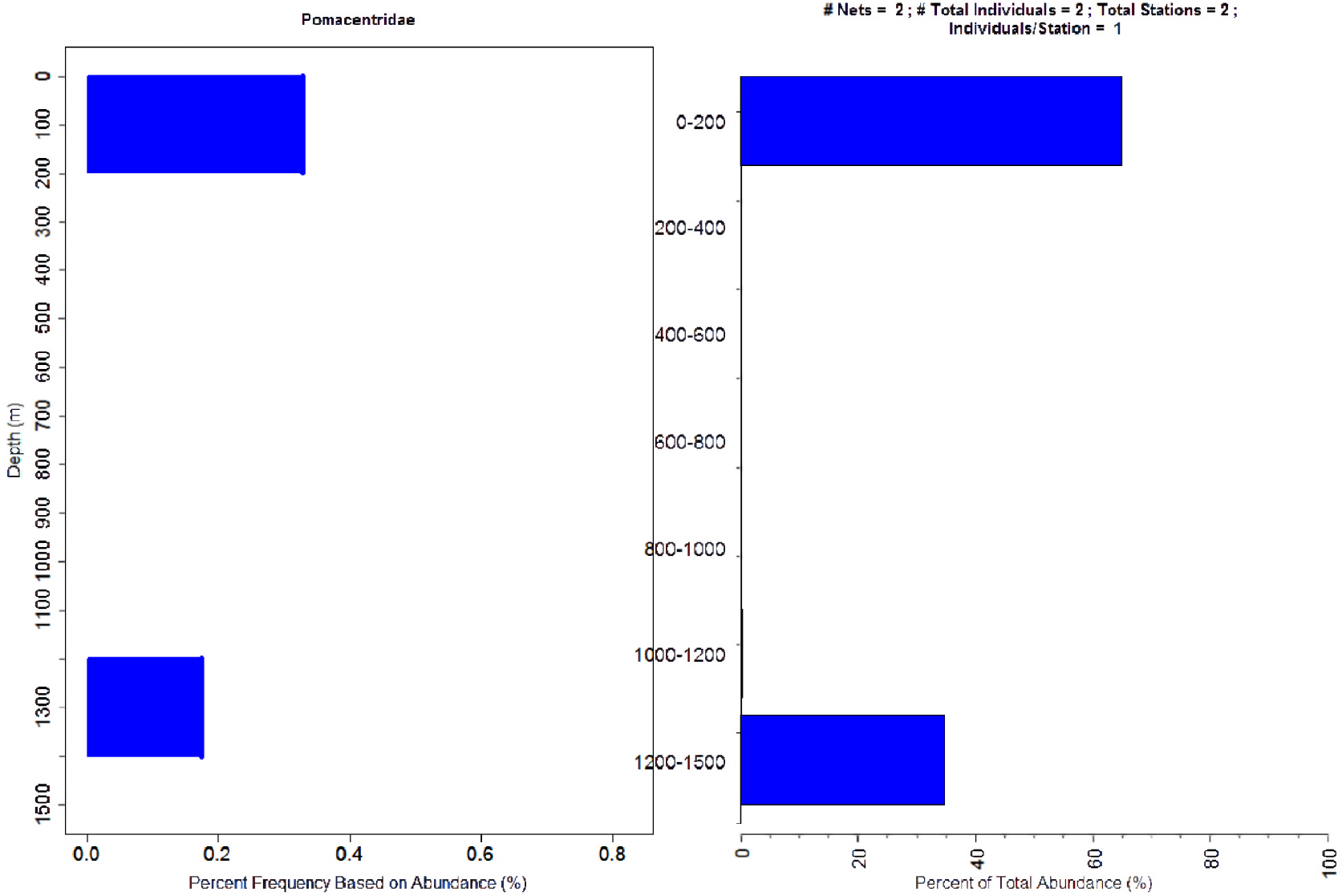
Pleuronectiformes



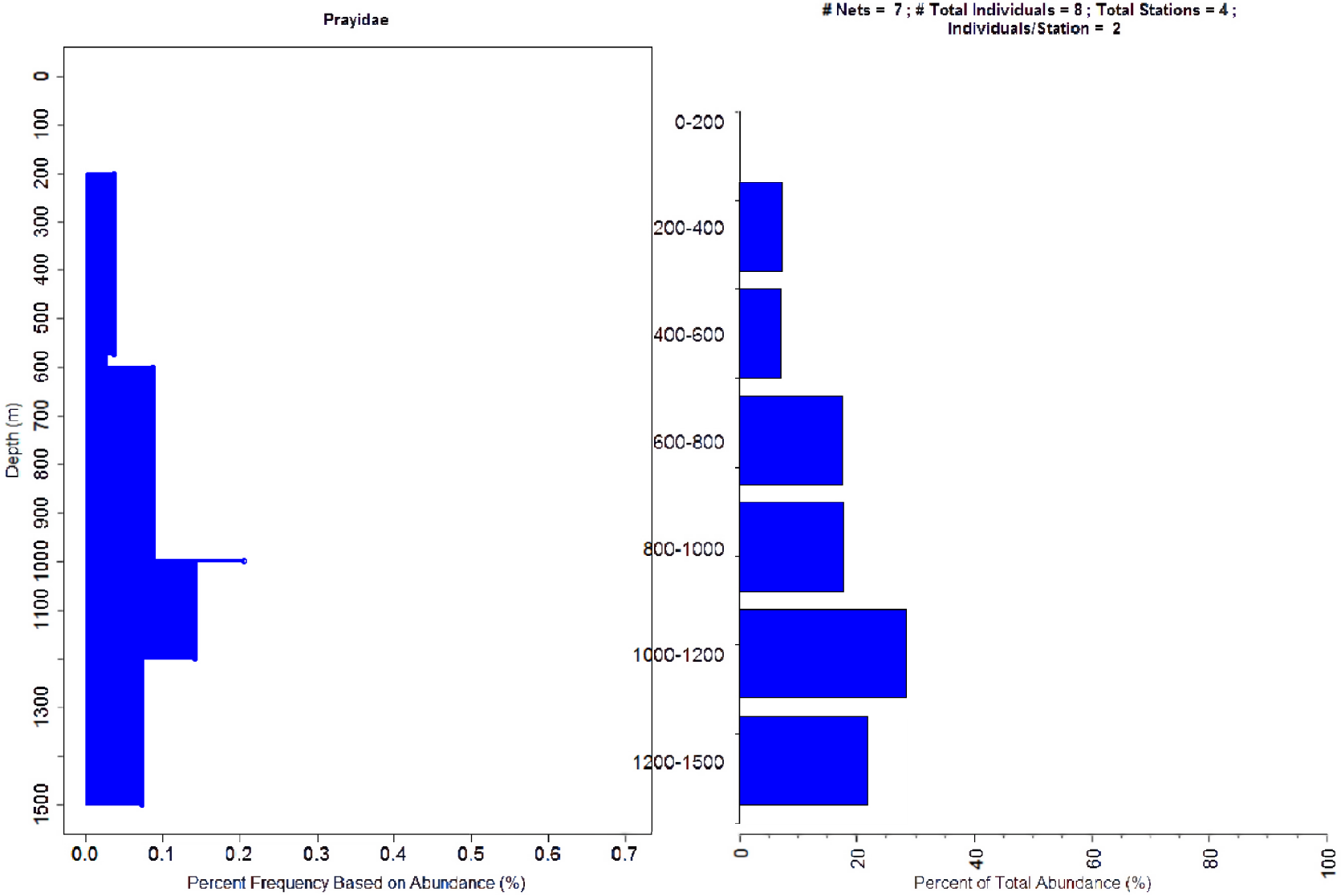
Polymixiidae



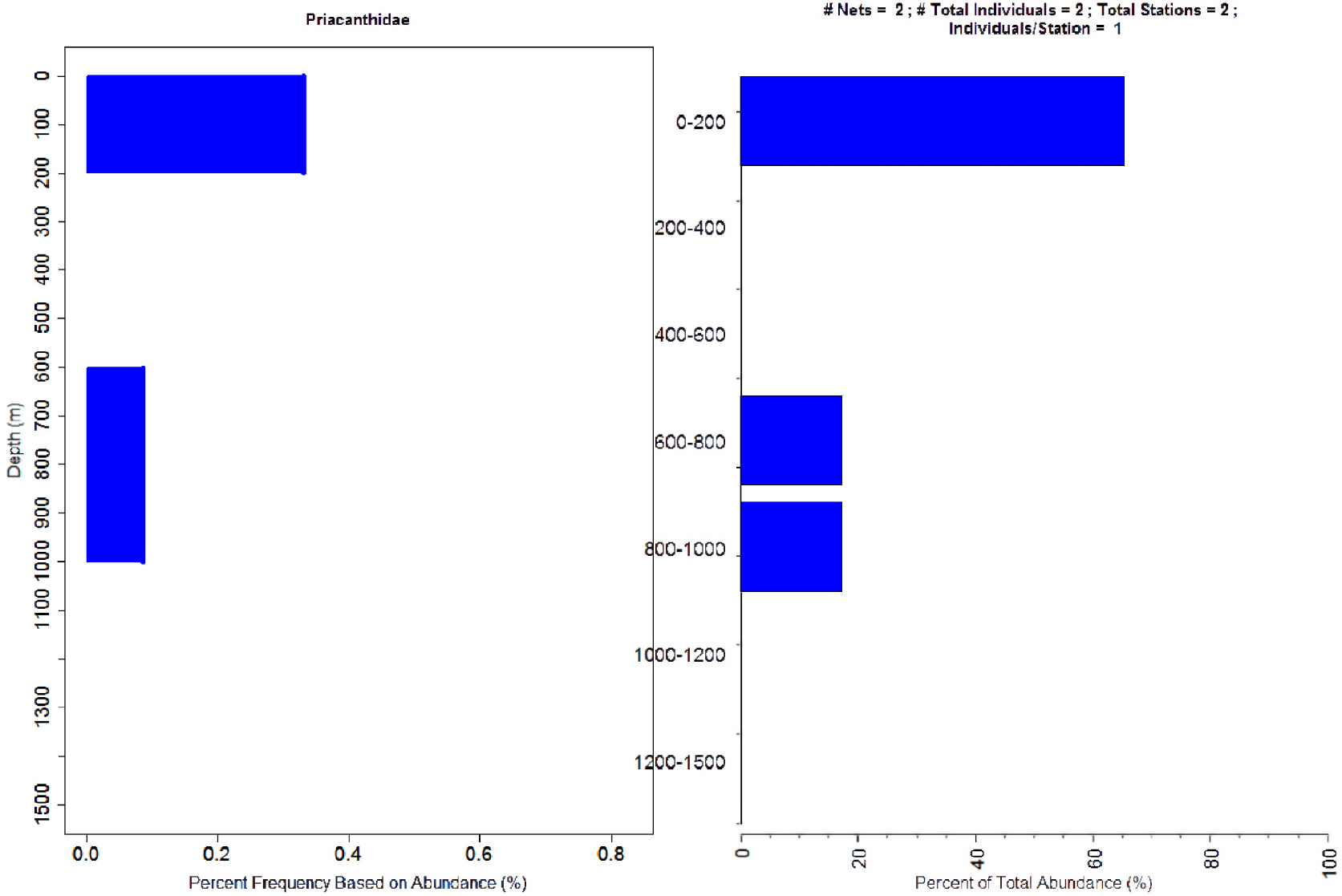
Pomacanthidae



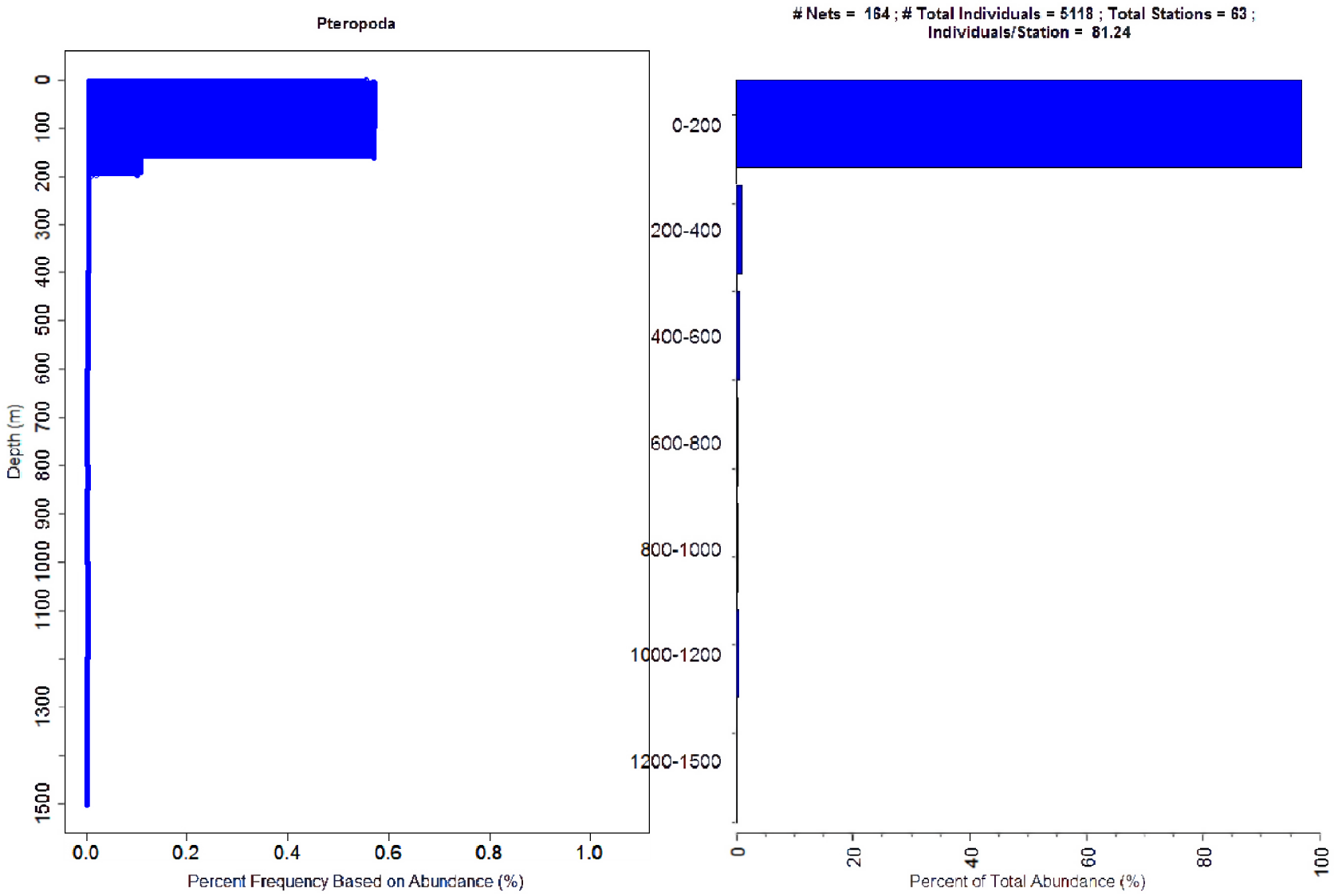
Pomacentridae


Prayidae
Nets = 7 ; # Total Individuals = 8 ; Total Stations = 4 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

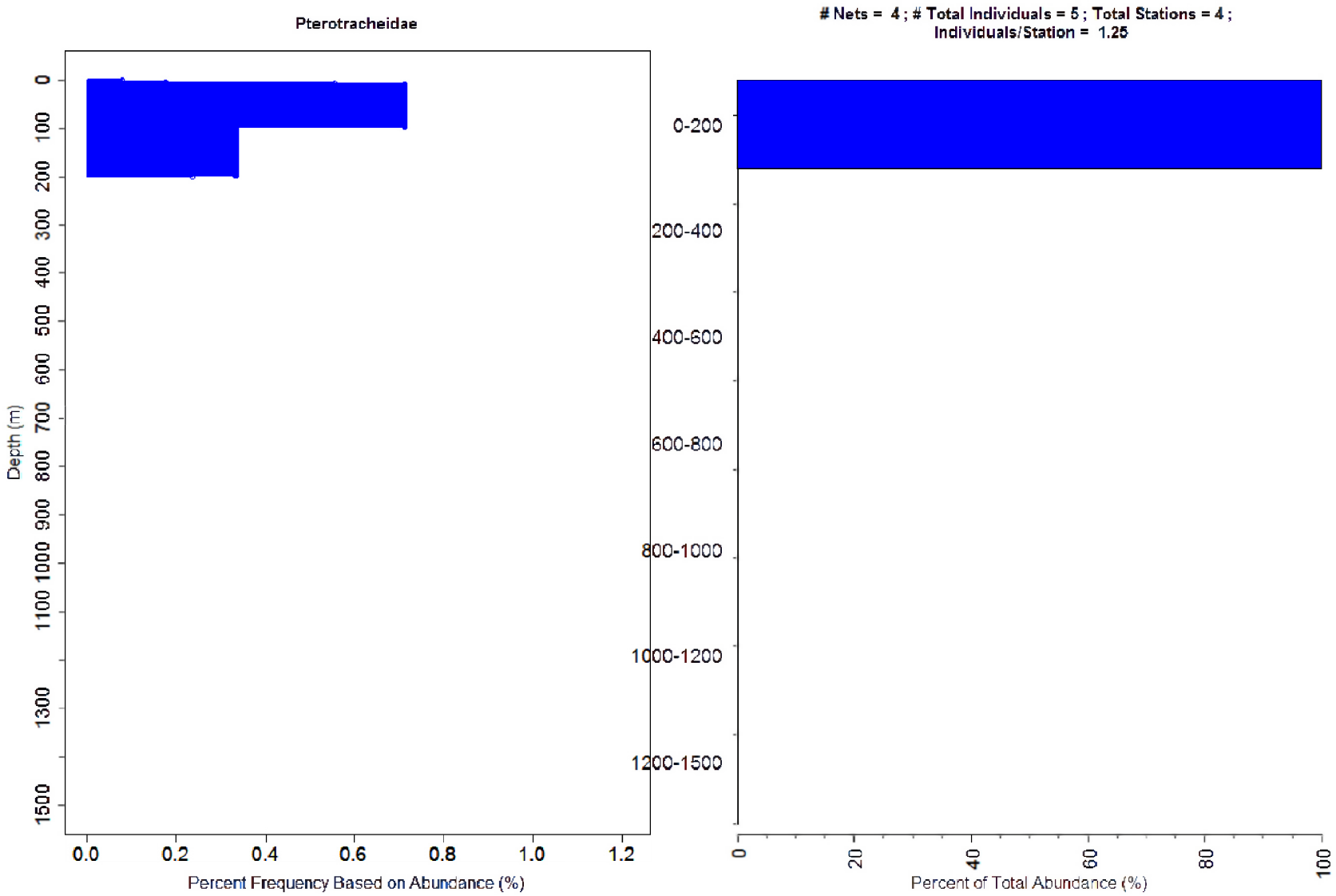
Prayidae



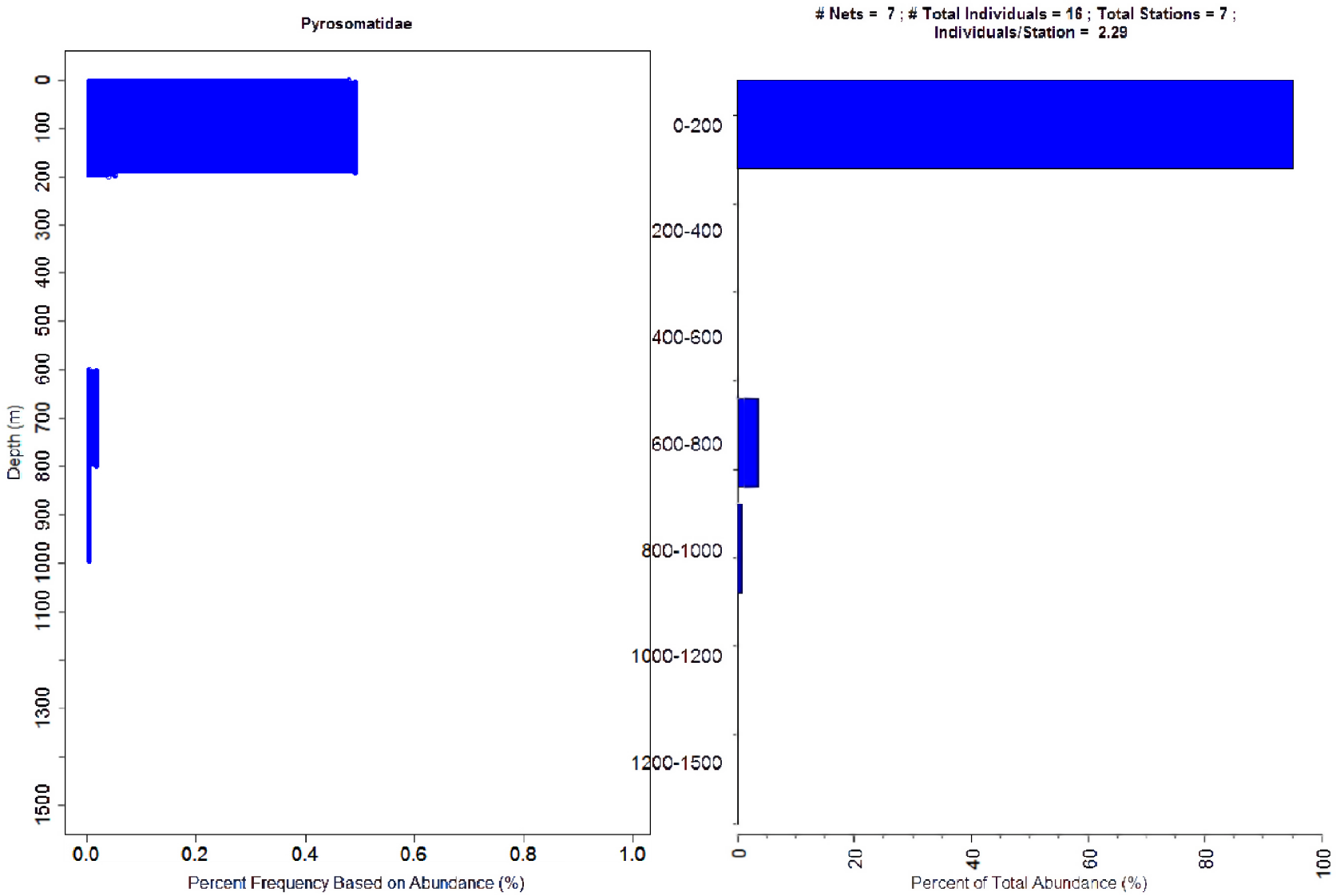
Priacanthidae


Pteropoda
Nets = 164 ; # Total Individuals = 5118 ; Total Stations = 63 ;
Individuals/Station = 81.24
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

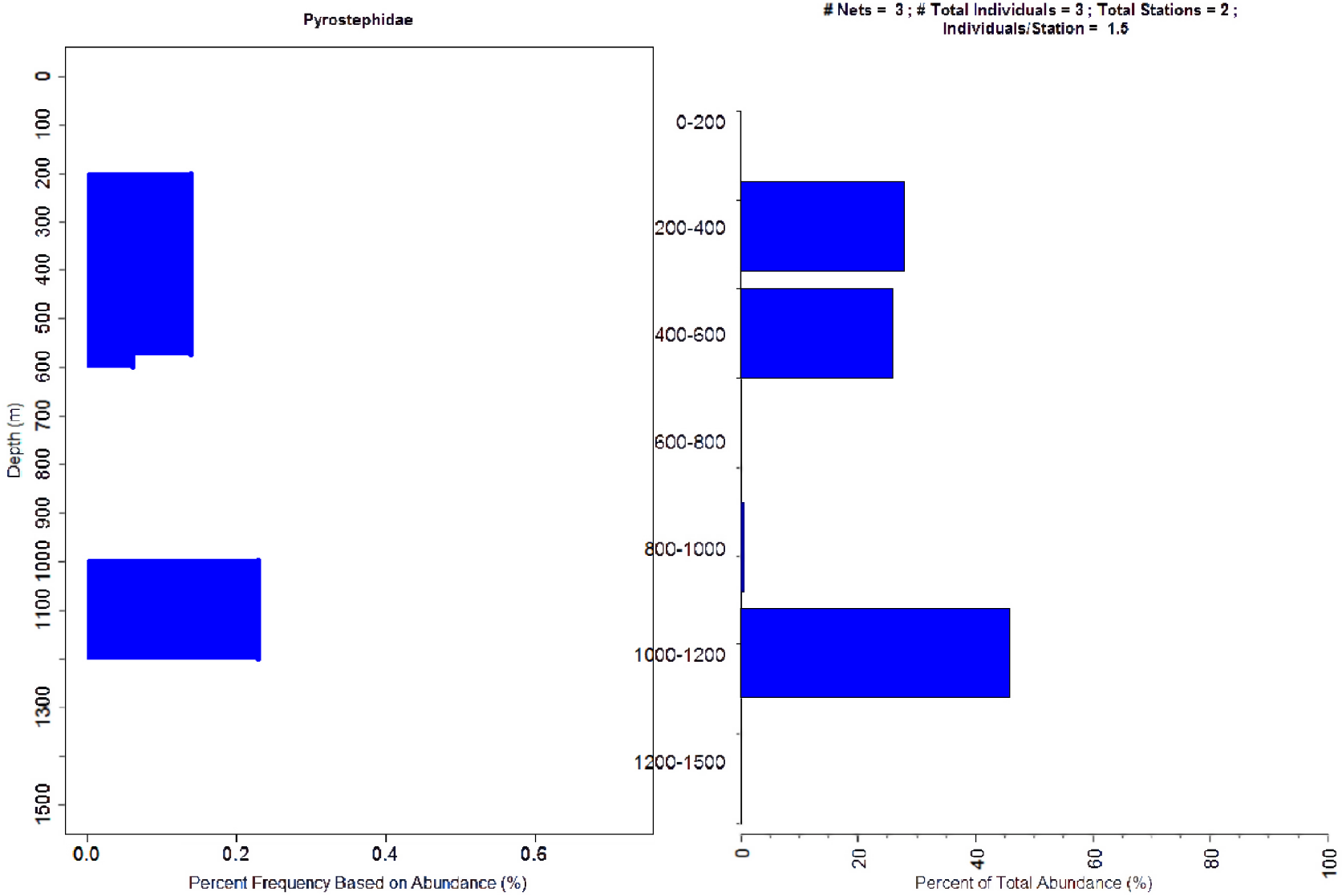
Pteropoda



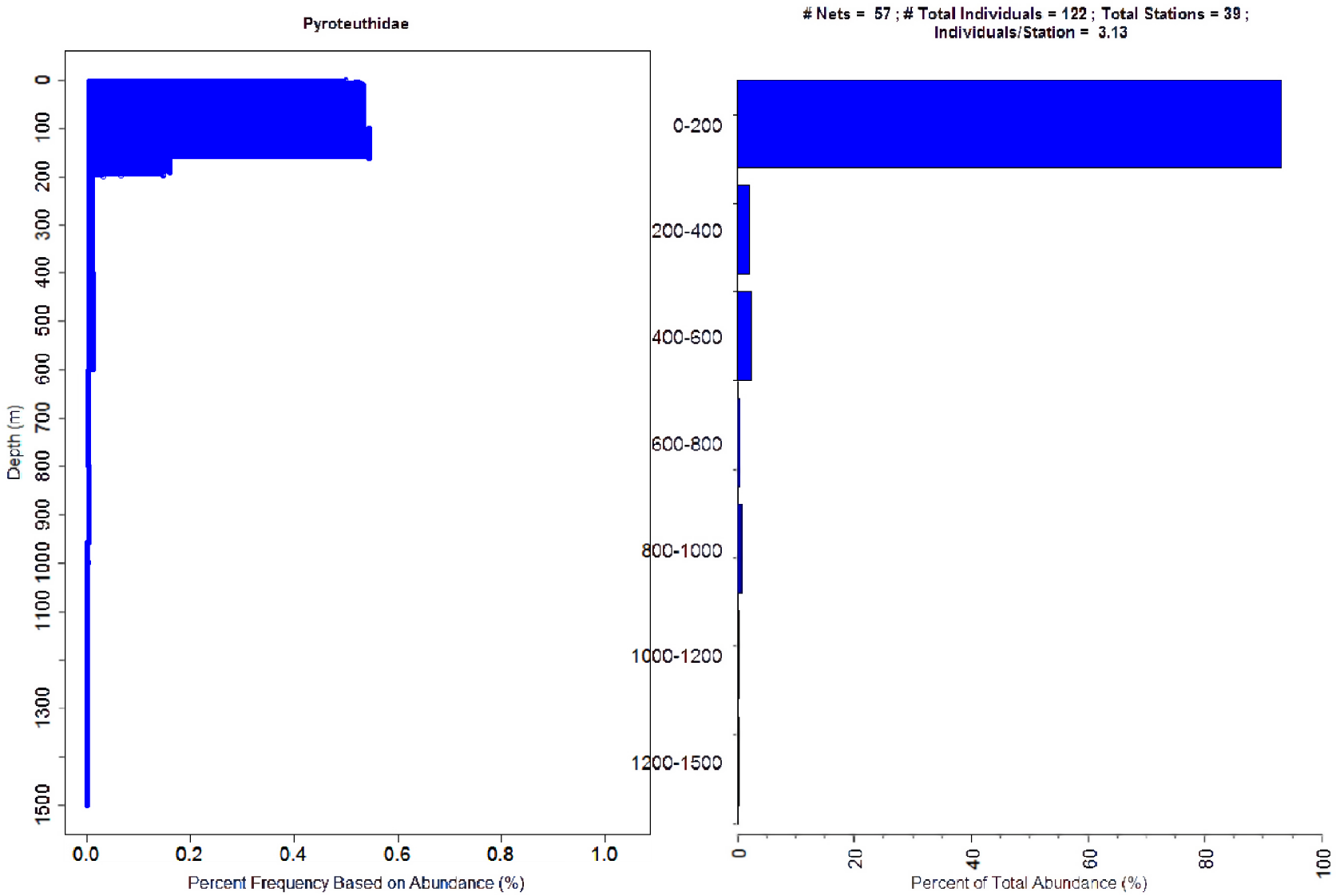
Pterotracheidae



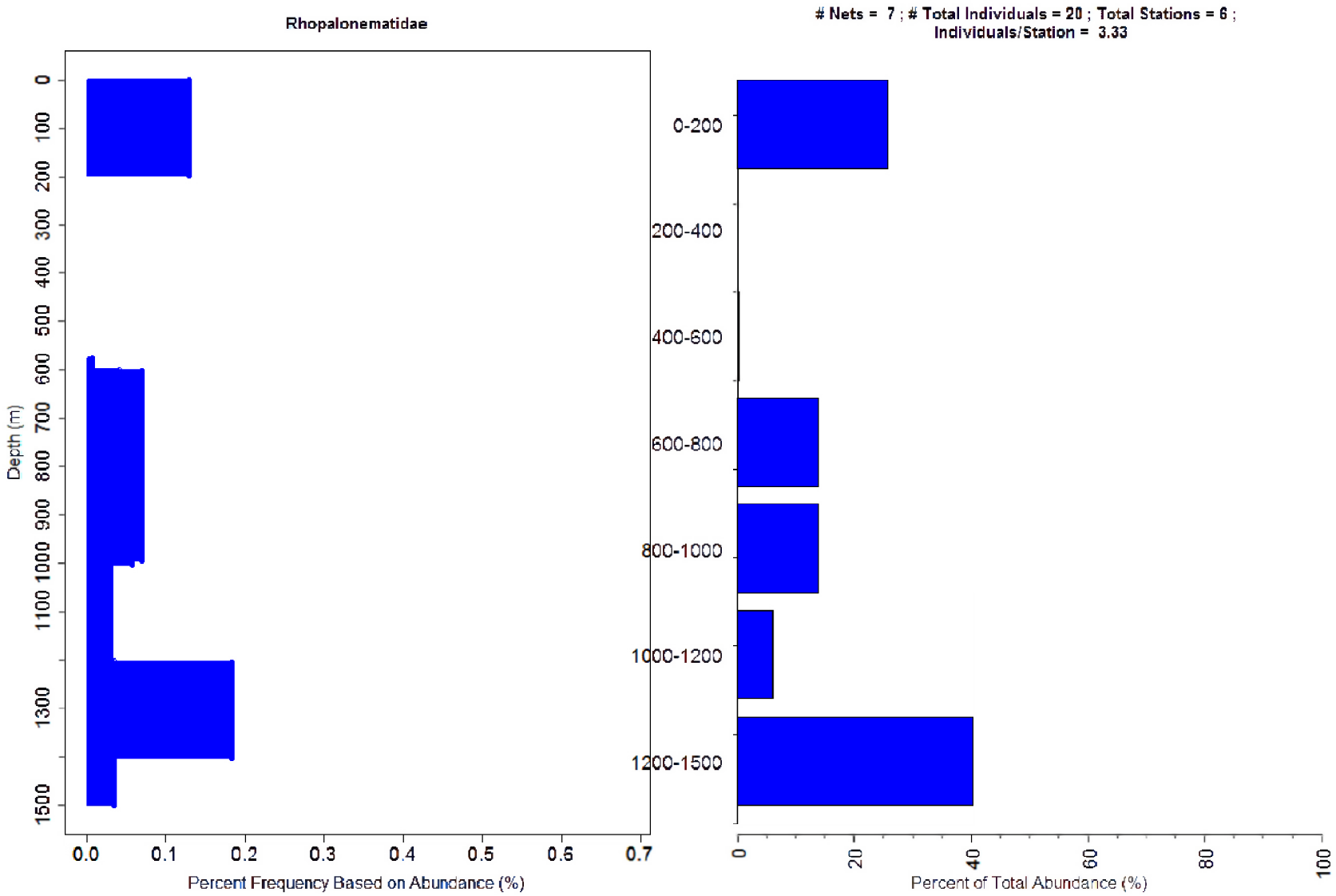
Pyrosomatidae



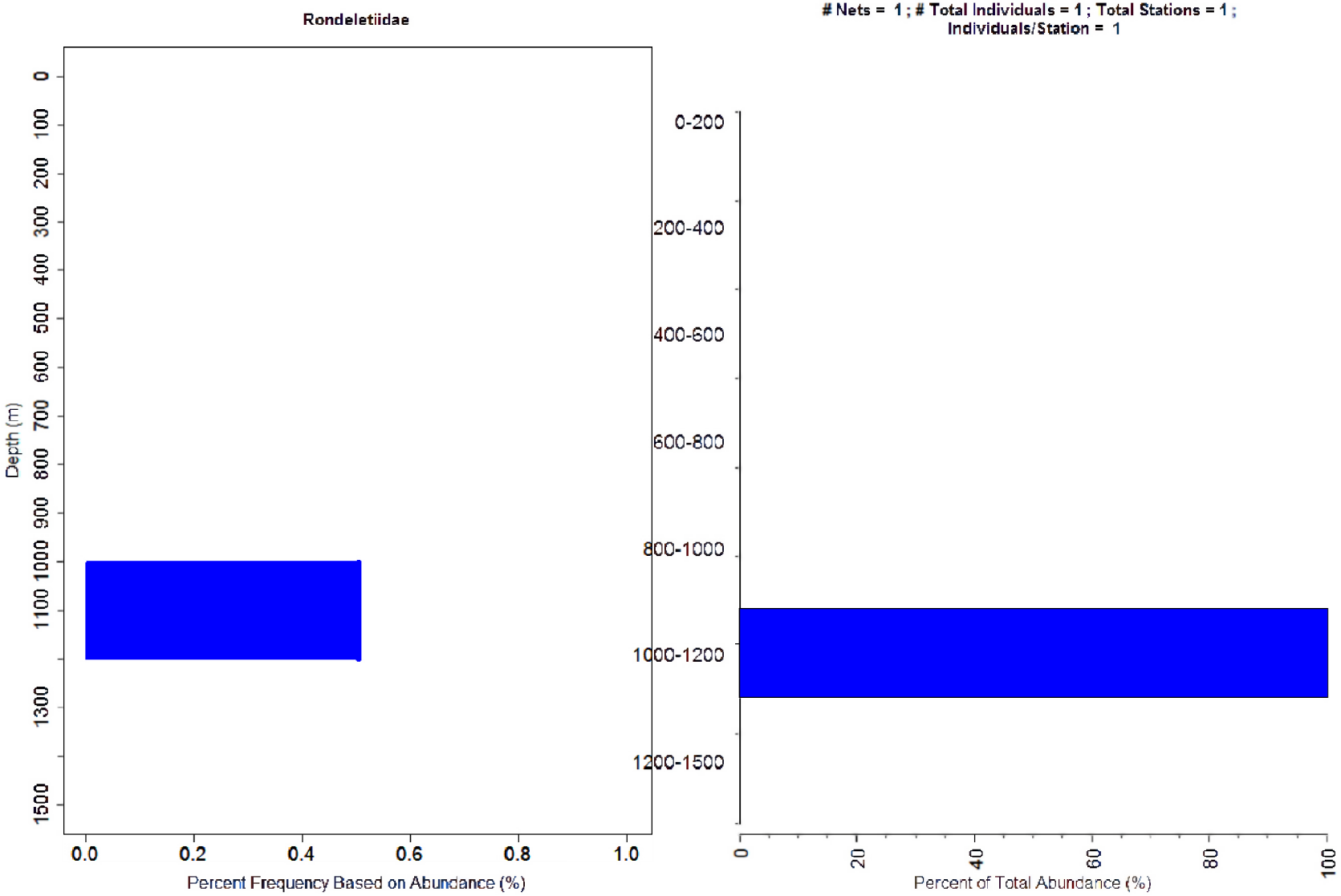
Pyrostephidae



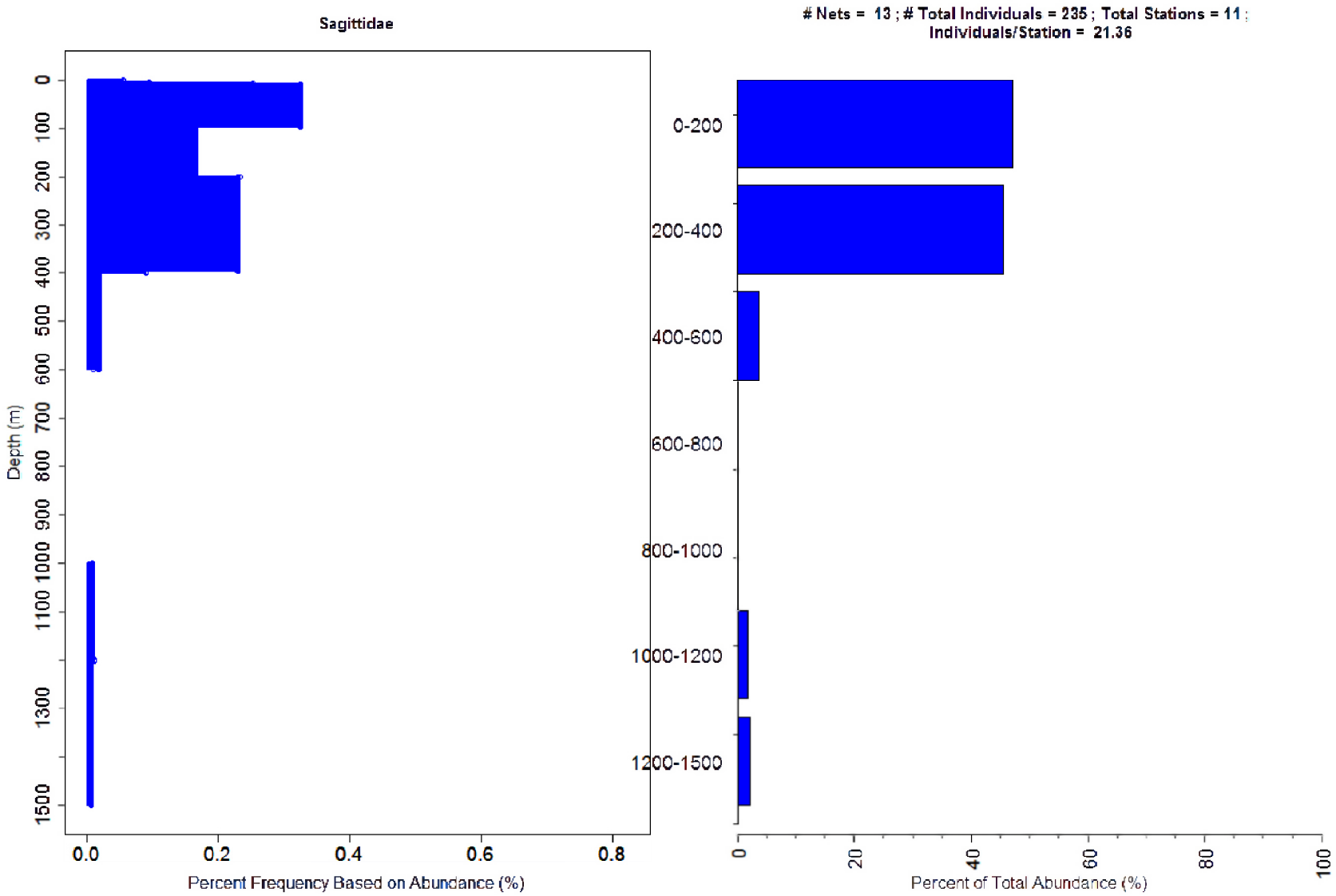
Pyroteuthidae



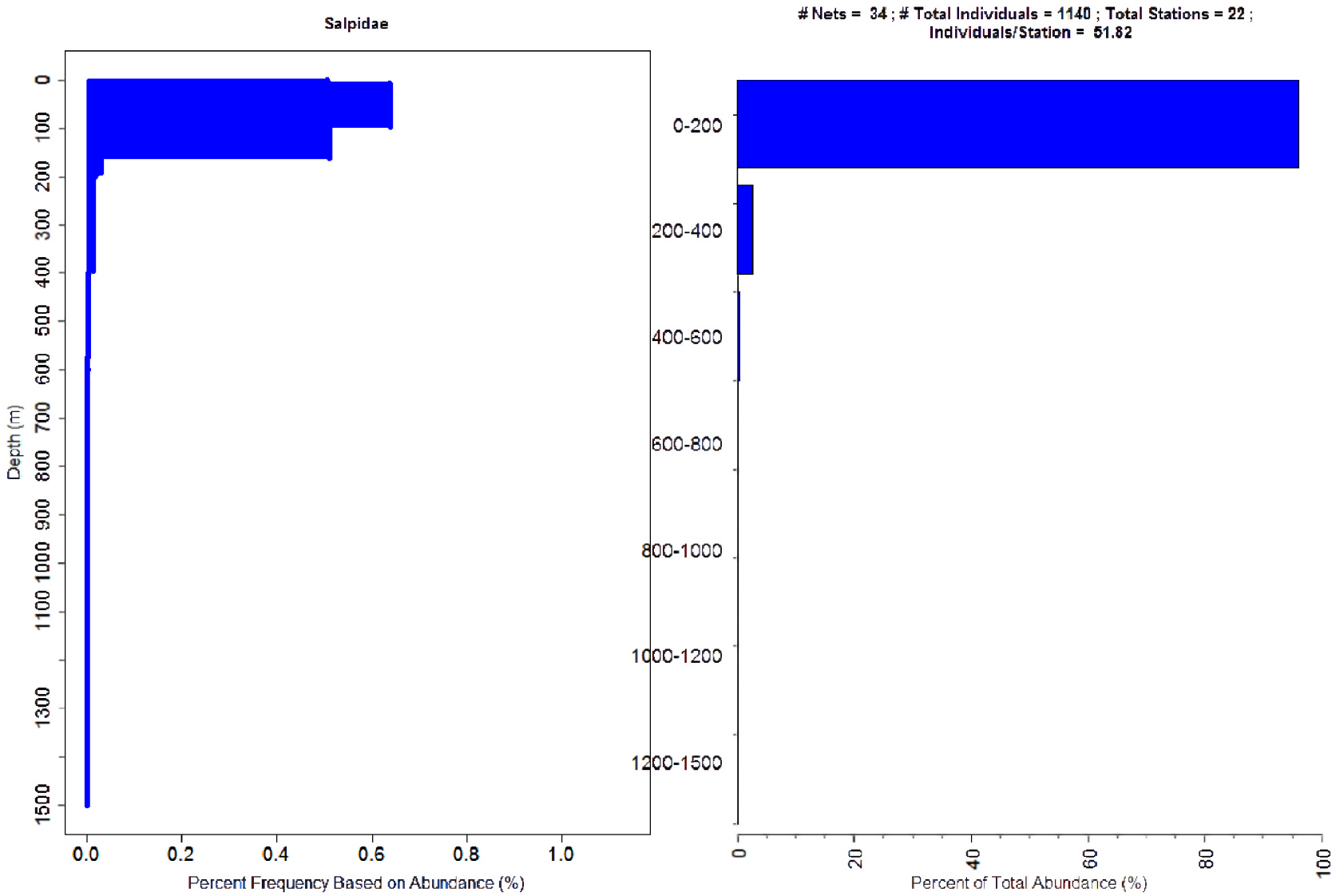
Rhopalonematidae



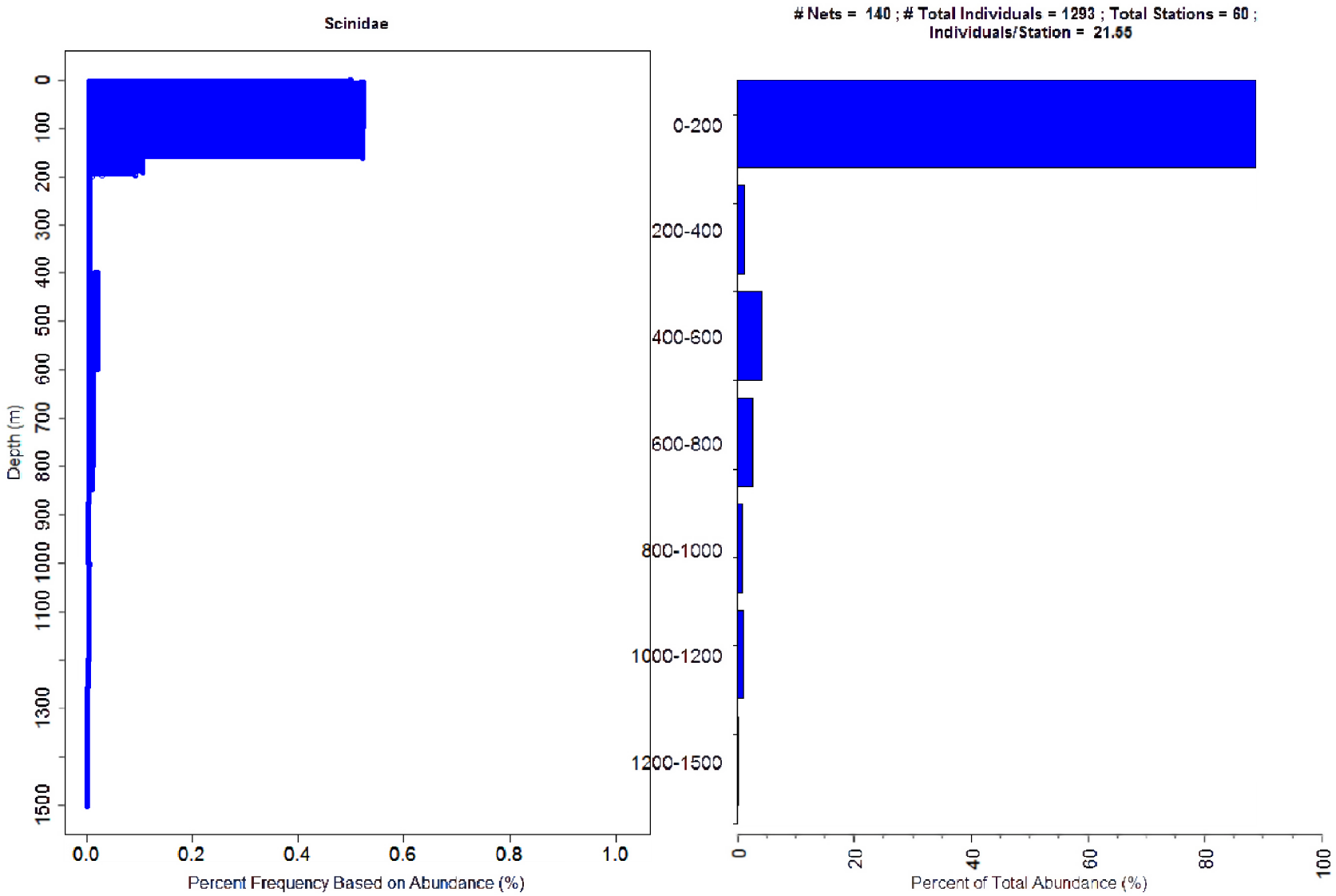
Rondeletiidae


Sagittidae
Nets = 13 ; # Total Individuals = 235 ; Total Stations = 11 ;
Individuals/Station = 21.36
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

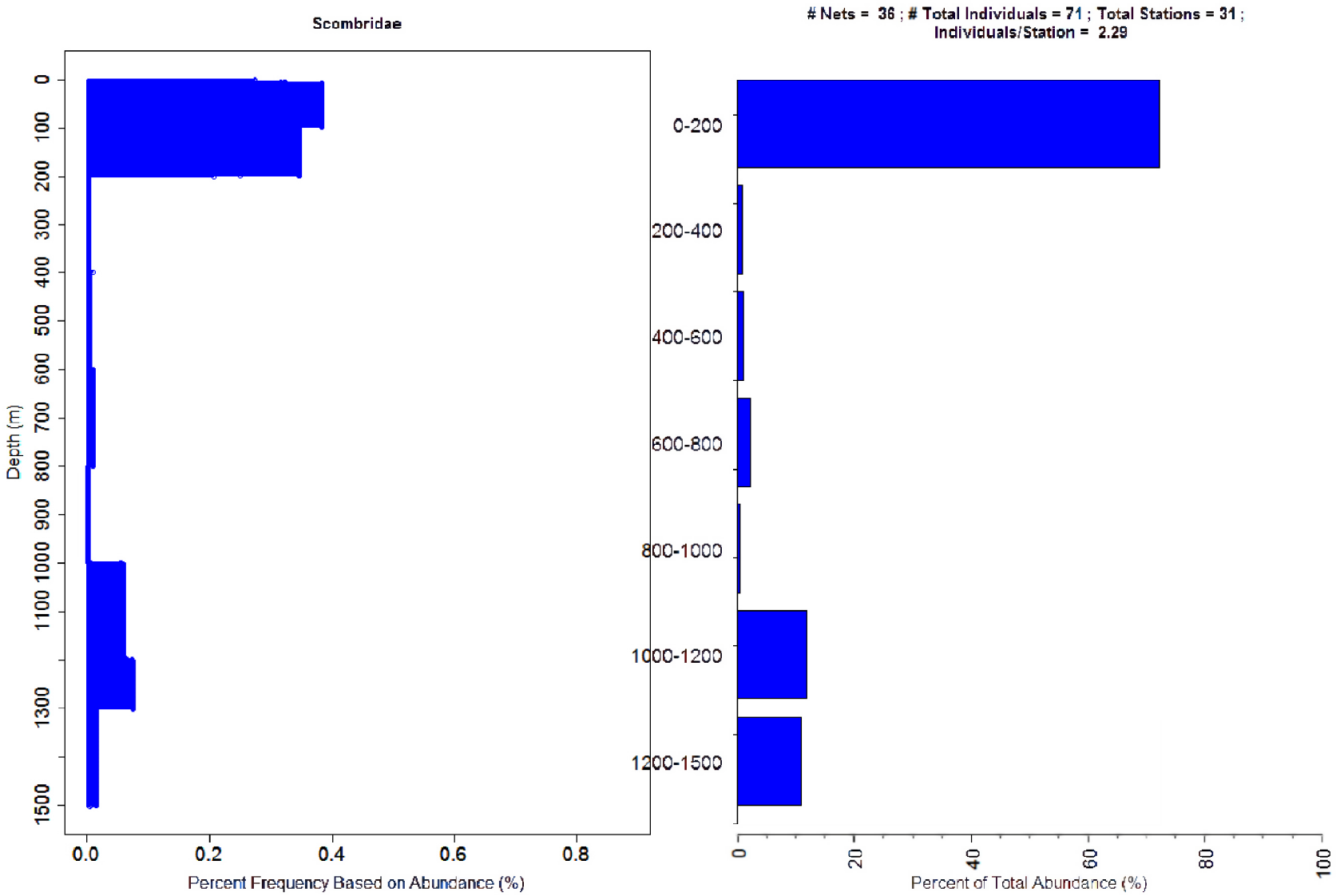
Sagittidae


Salpidae
Nets = 34 ; # Total Individuals = 1140 ; Total Stations = 22 ;
Individuals/Station = 51.82
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

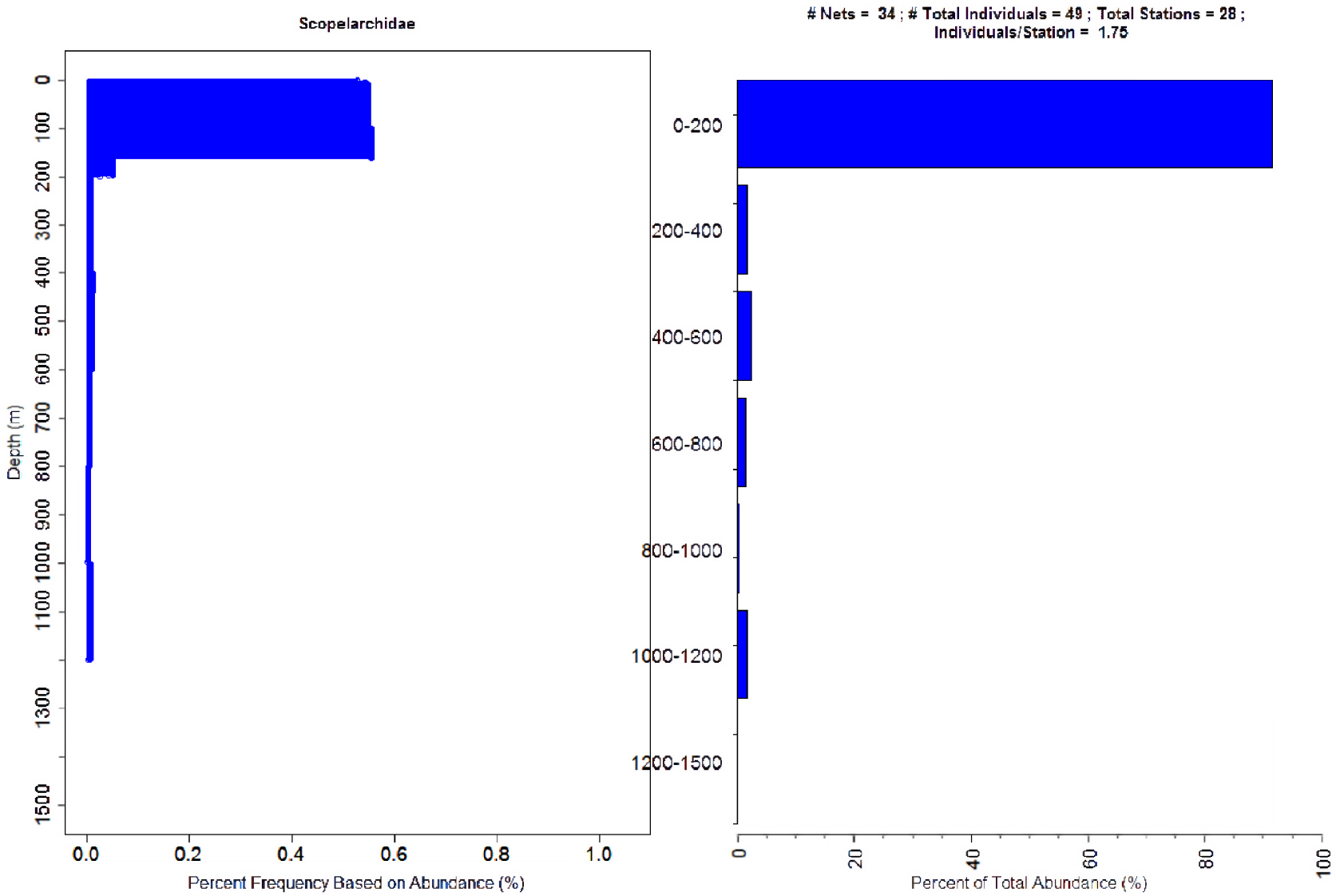
Salpidae


Scinidae
Nets = 140 ; # Total Individuals = 1293 ; Total Stations = 60 ;
Individuals/Station = 21.55
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

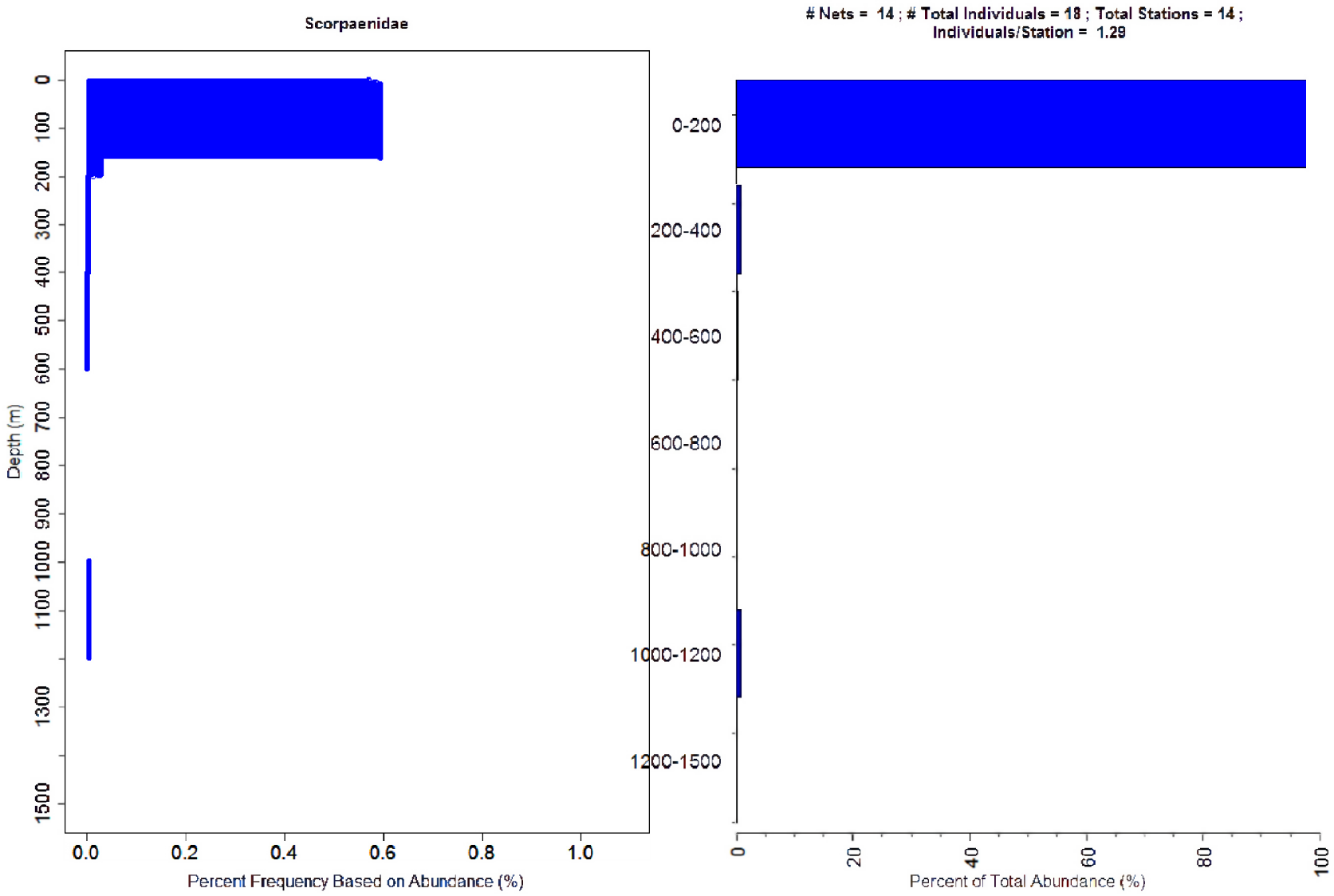
Scinidae


Scombridae
Nets = 36 ; # Total Individuals = 71 ; Total Stations = 31 ;
Individuals/Station = 2.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

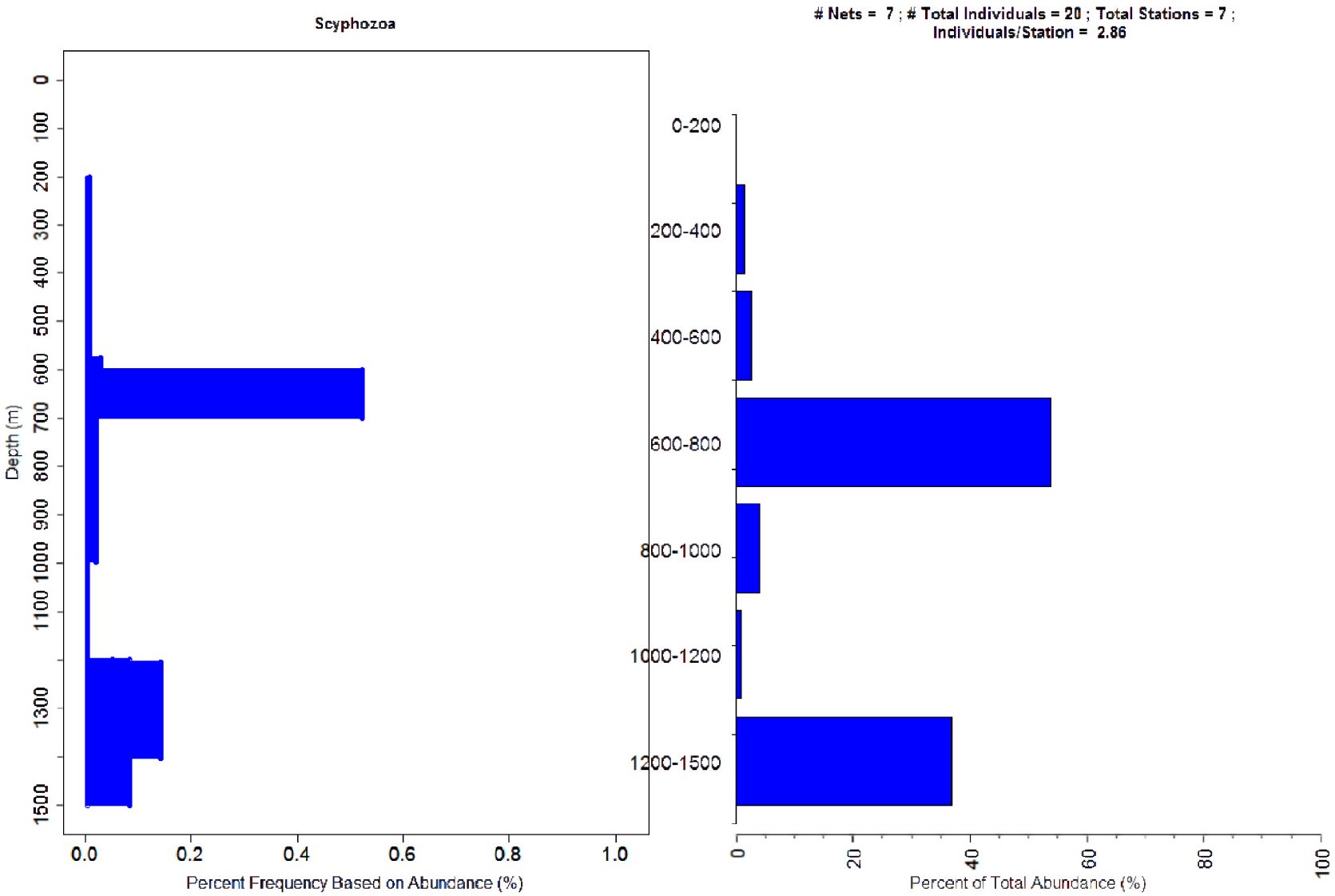
Scombridae



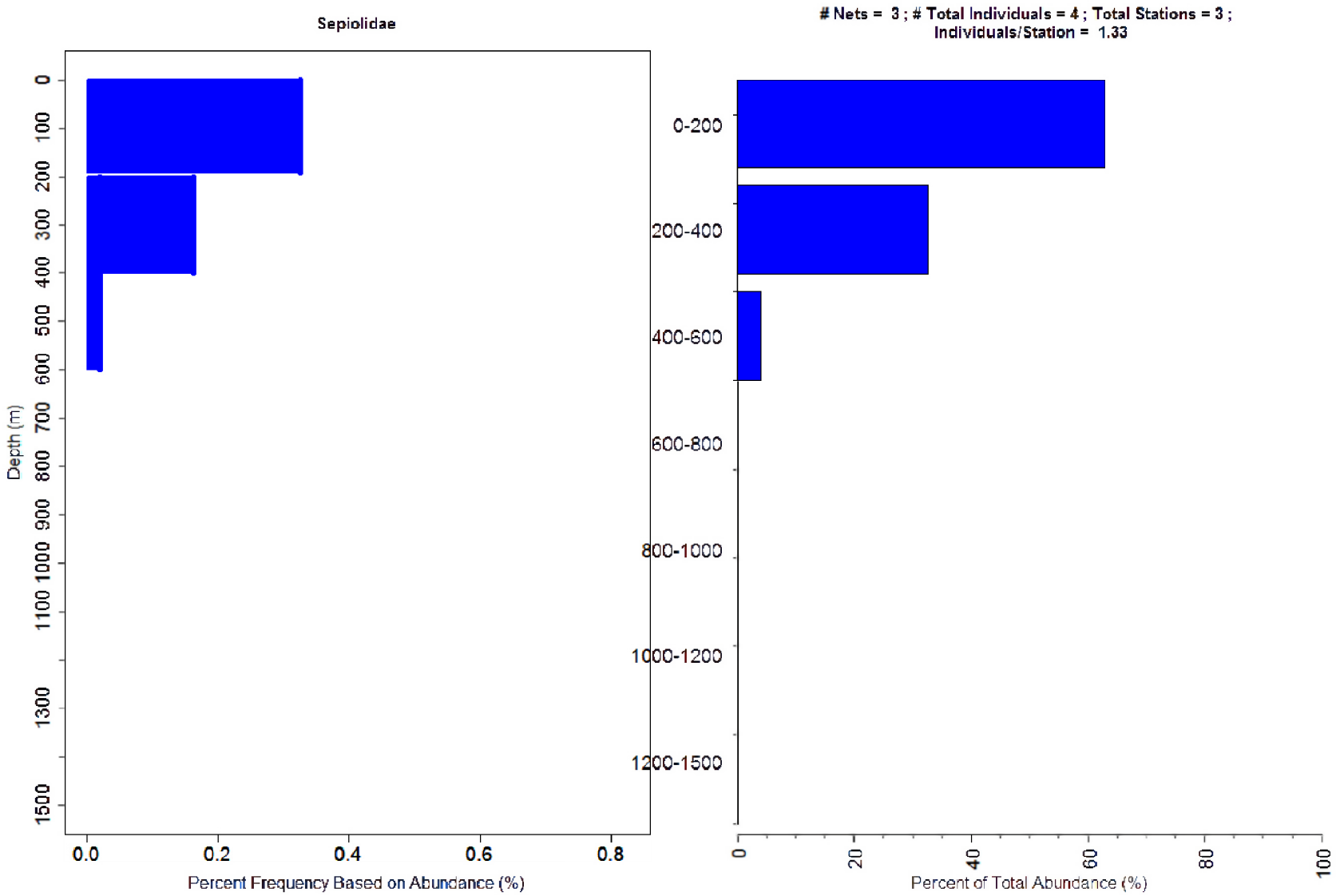
Scopelarchidae



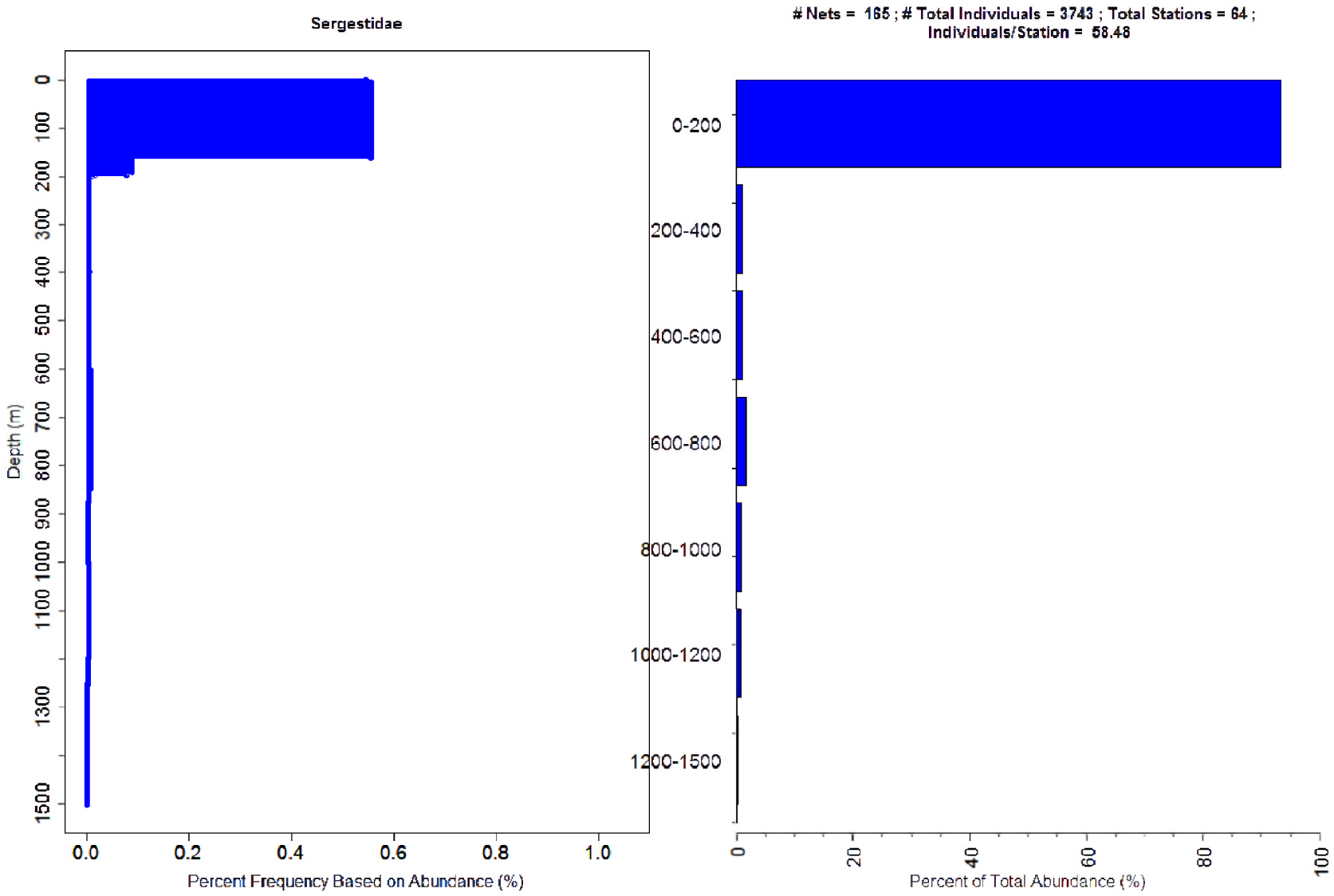
Scorpaenidae


Scyphozoa
Nets = 7 ; # Total Individuals = 20 ; Total Stations = 7 ;
Individuals/Station = 2.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

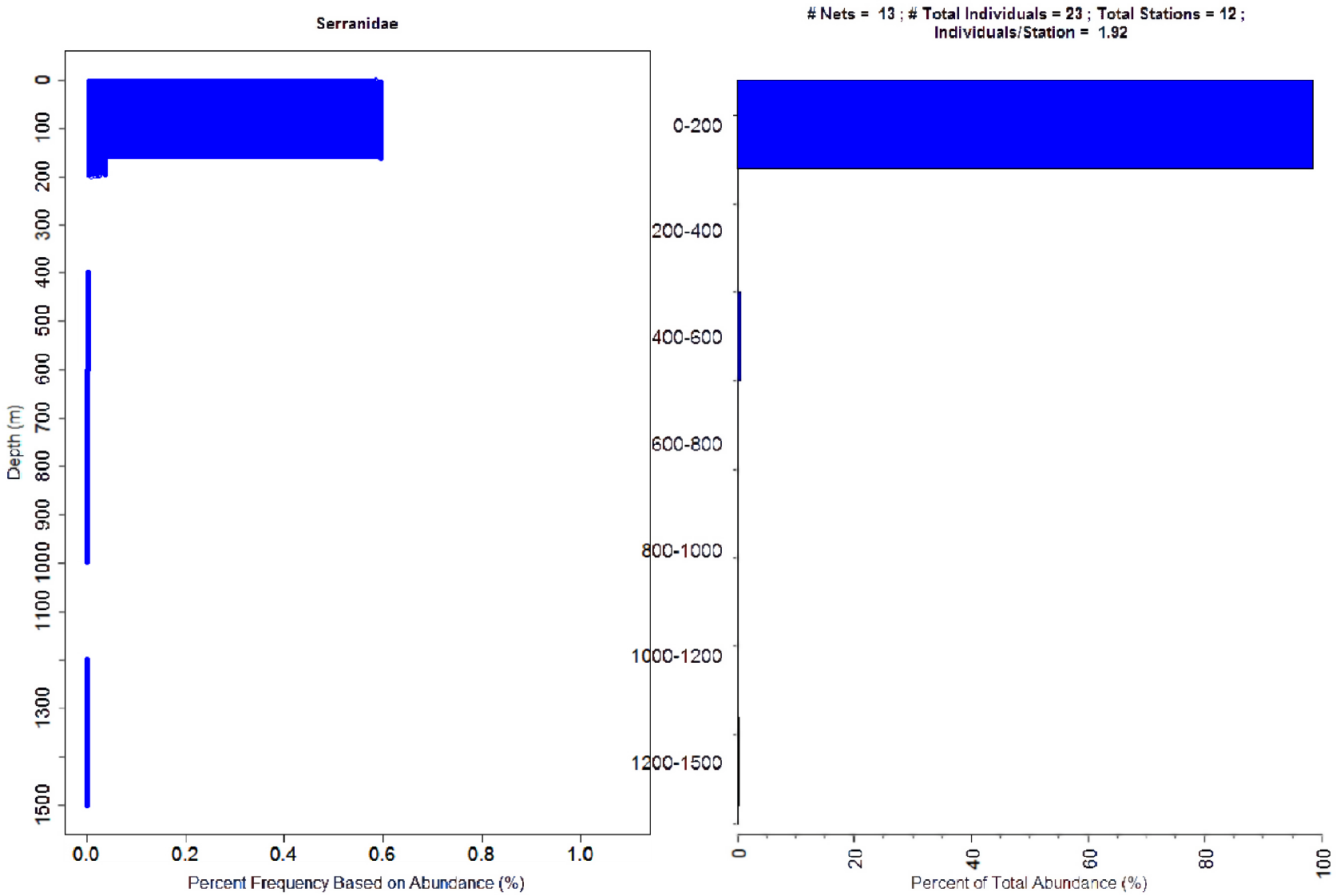
Scyphozoa


Sepiolidae
Nets = 3 ; # Total Individuals = 4 ; Total Stations = 3 ;
Individuals/Station = 1.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

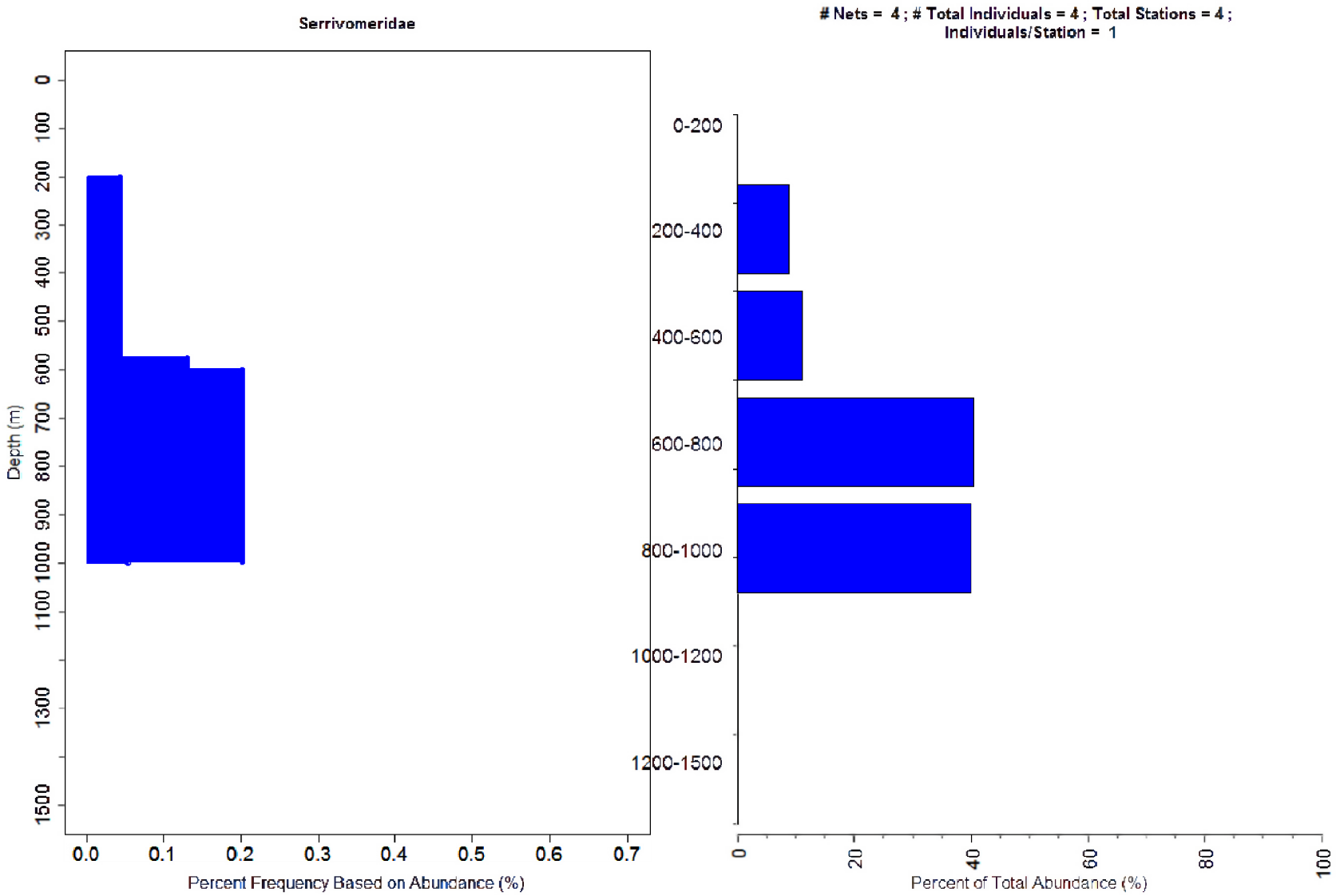
Sepiolidae



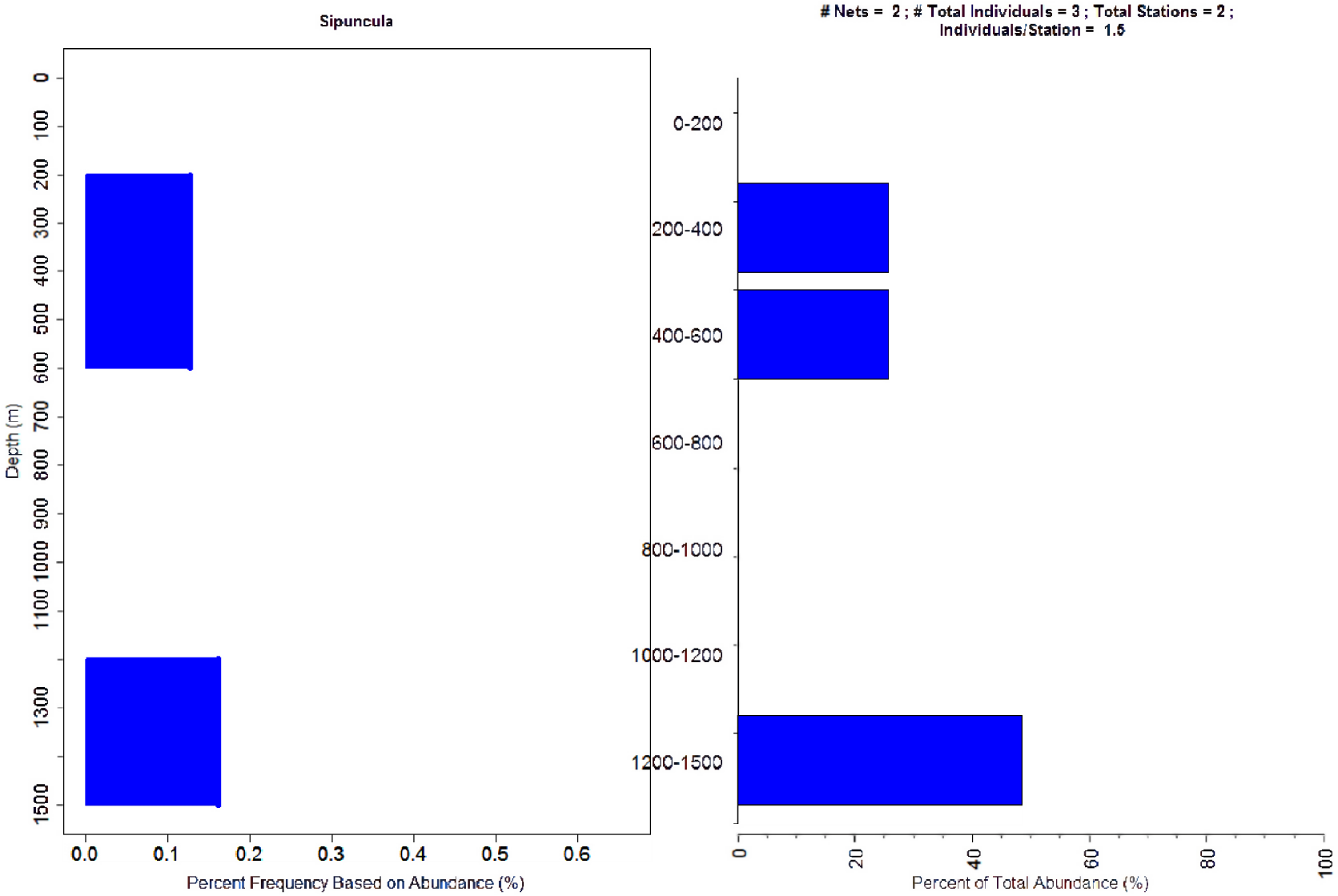
Sergestidae


Serranidae
Nets = 13 ; # Total Individuals = 23 ; Total Stations = 12 ;
Individuals/Station = 1.92
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

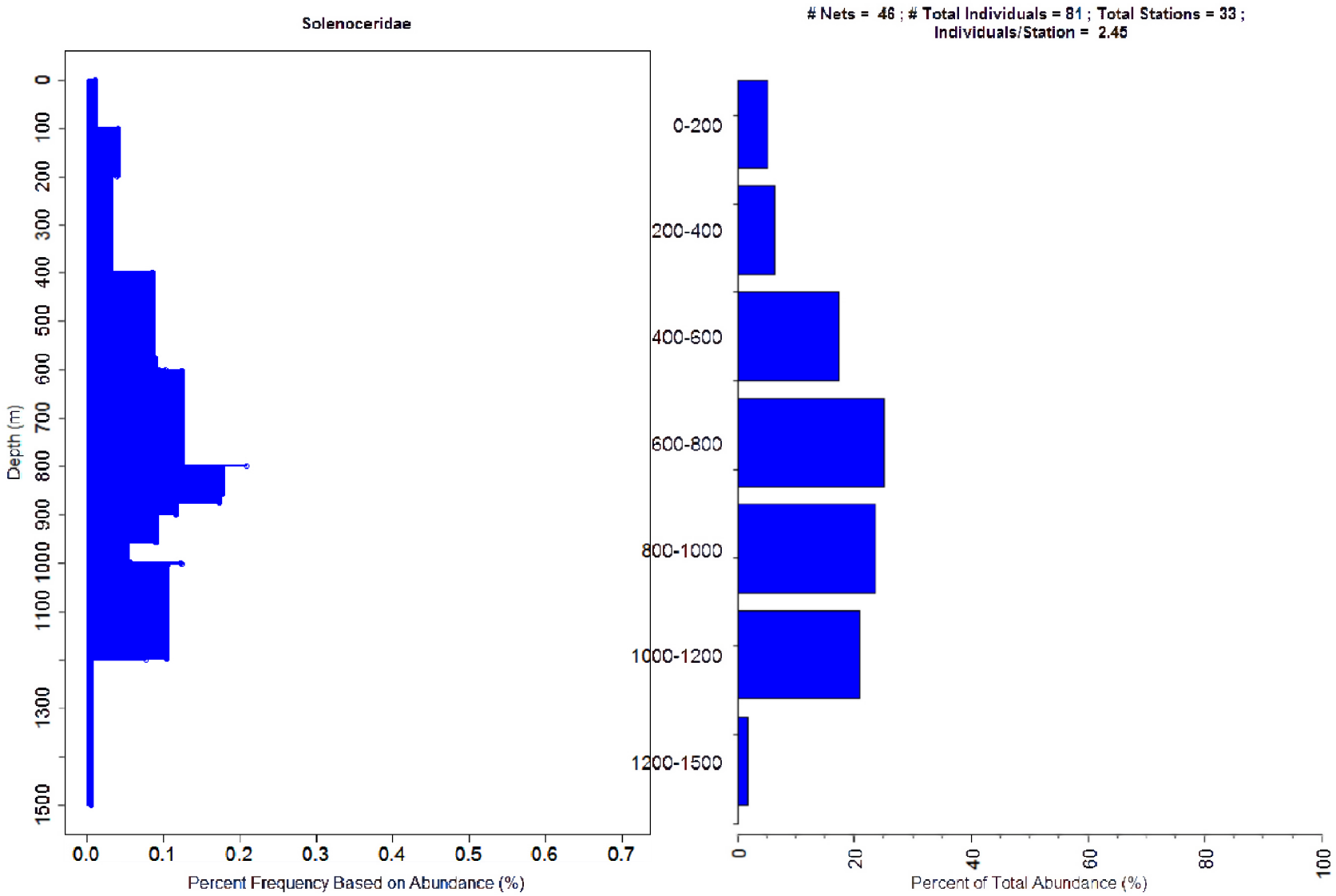
Serranidae



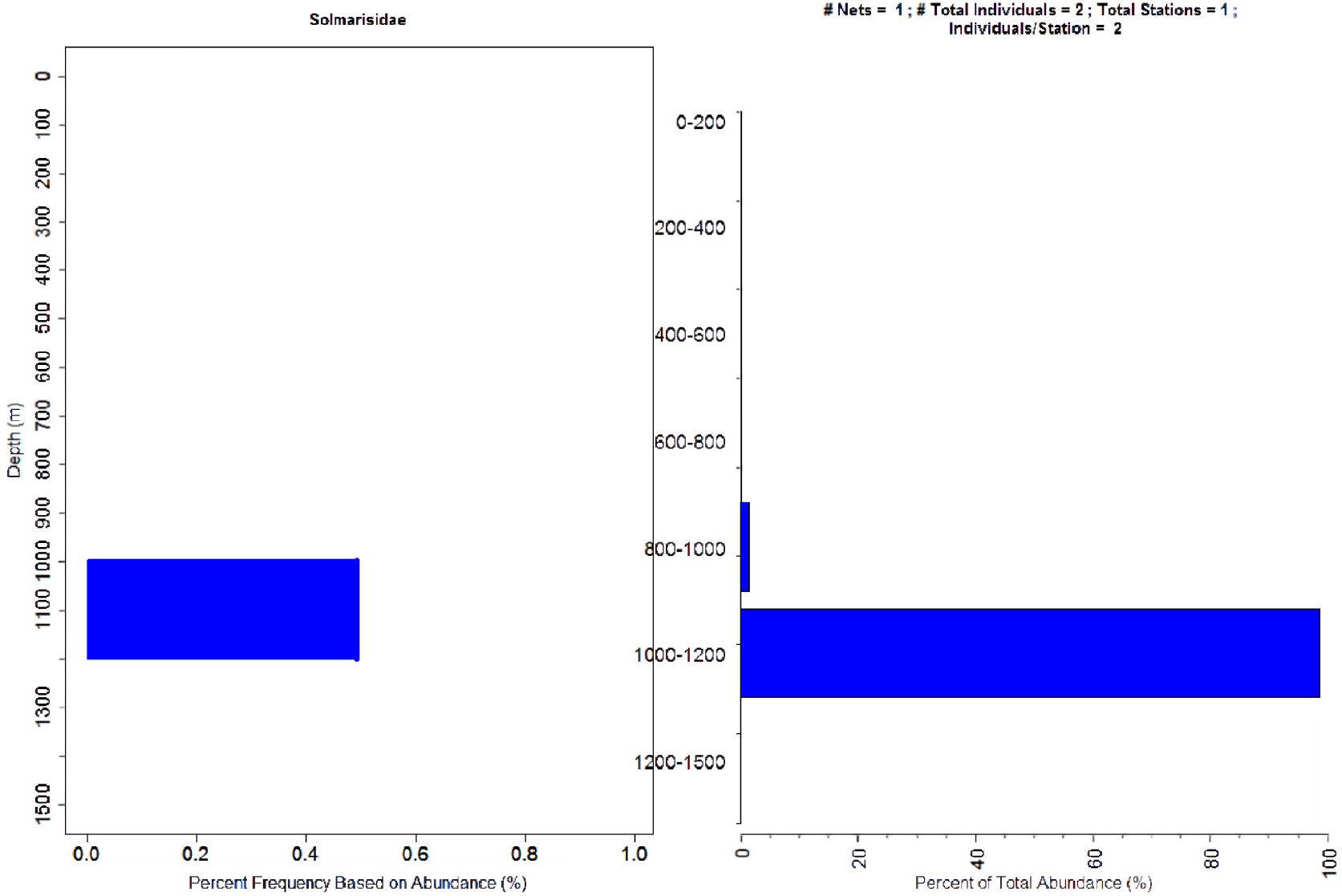
Serrivomeridae


Sipuncula
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

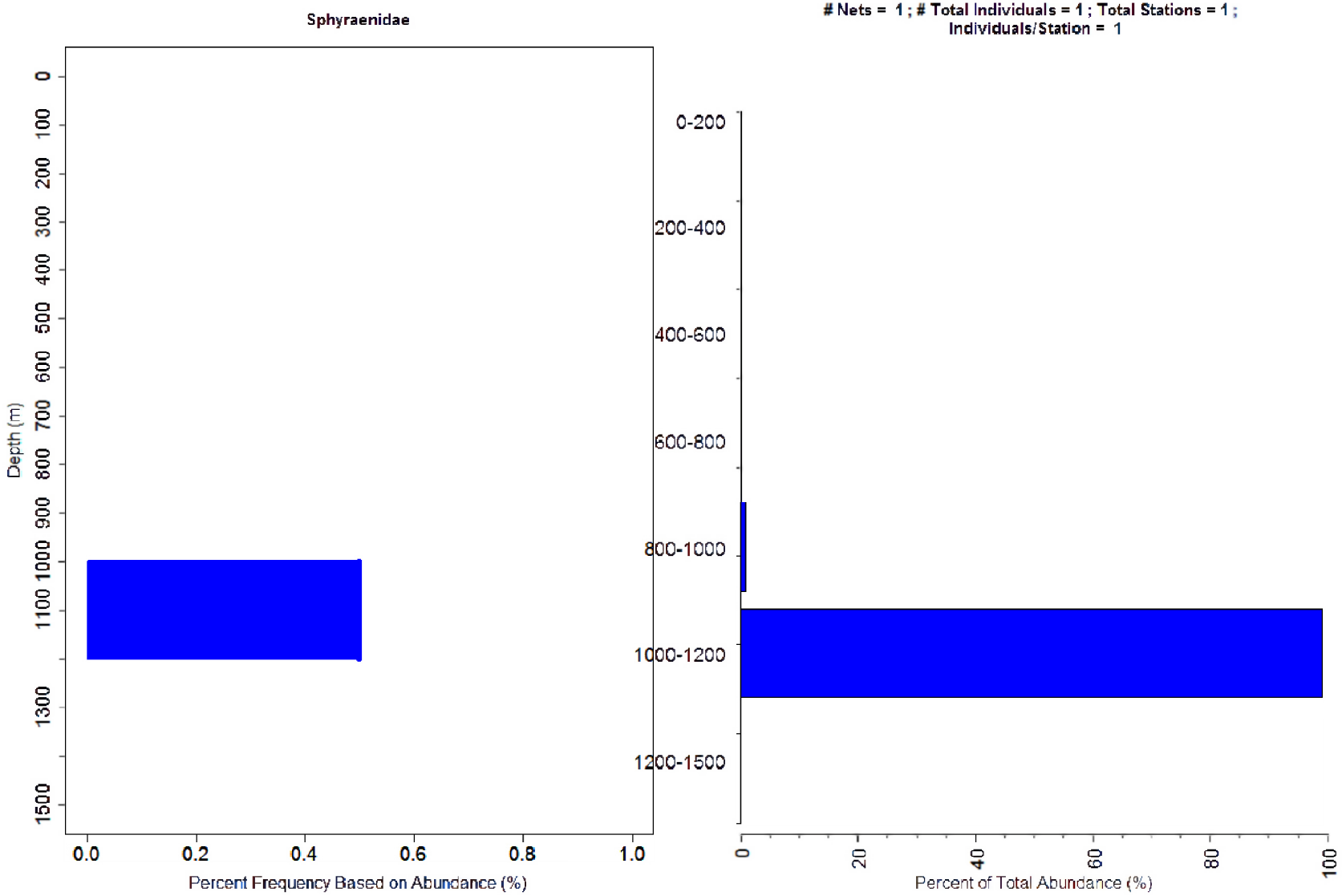
Sipuncula



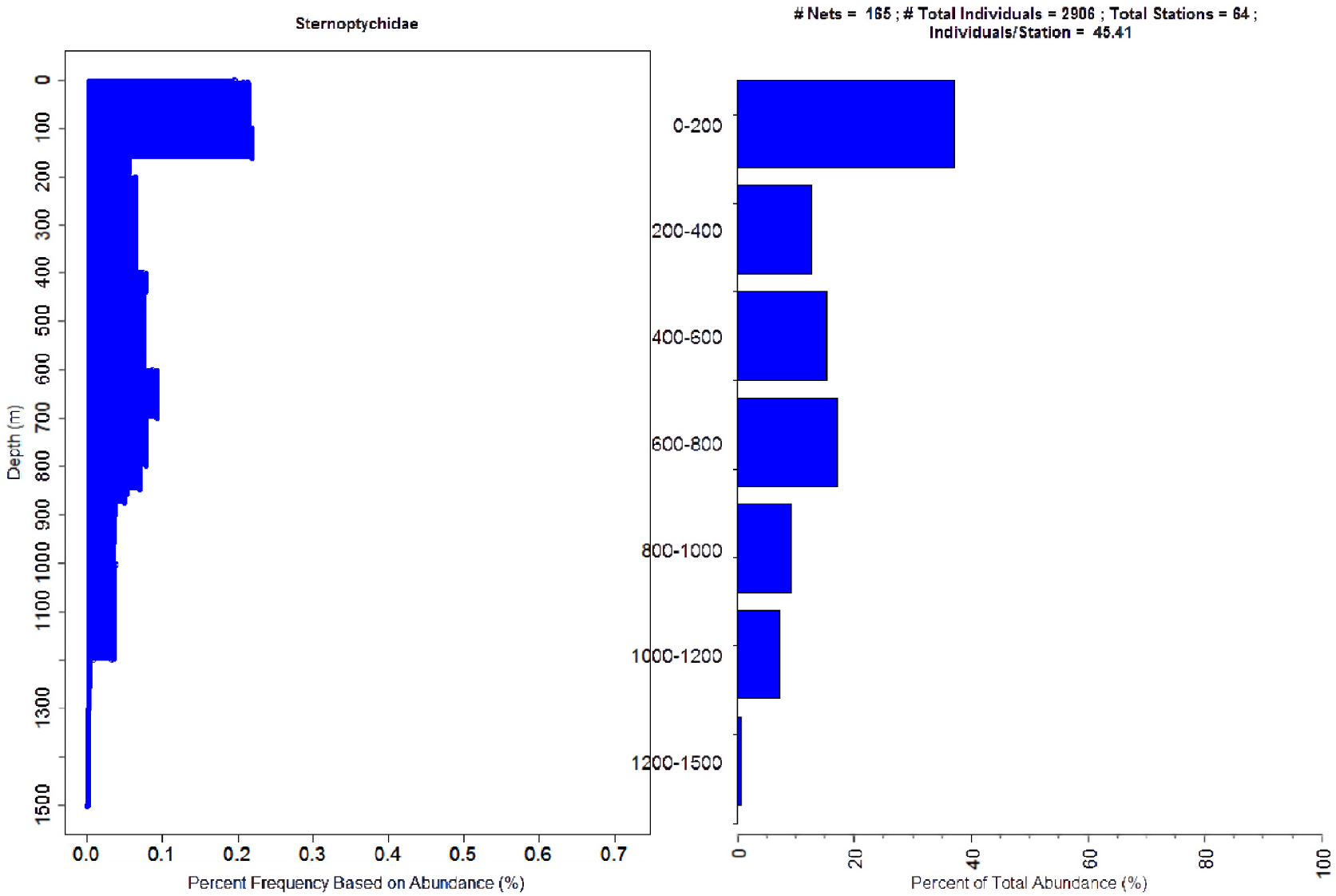
Solenoceridae



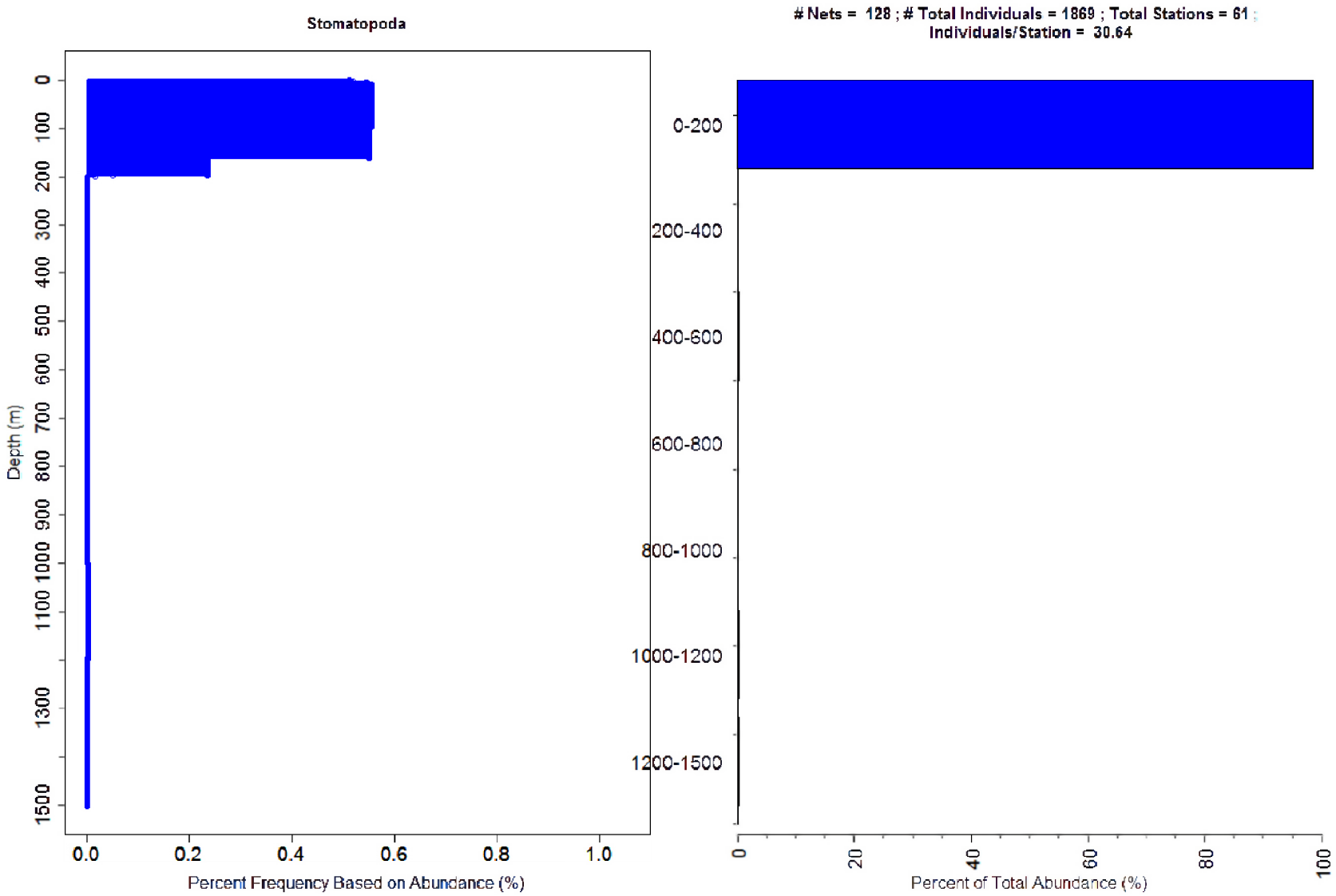
Solmarisidae



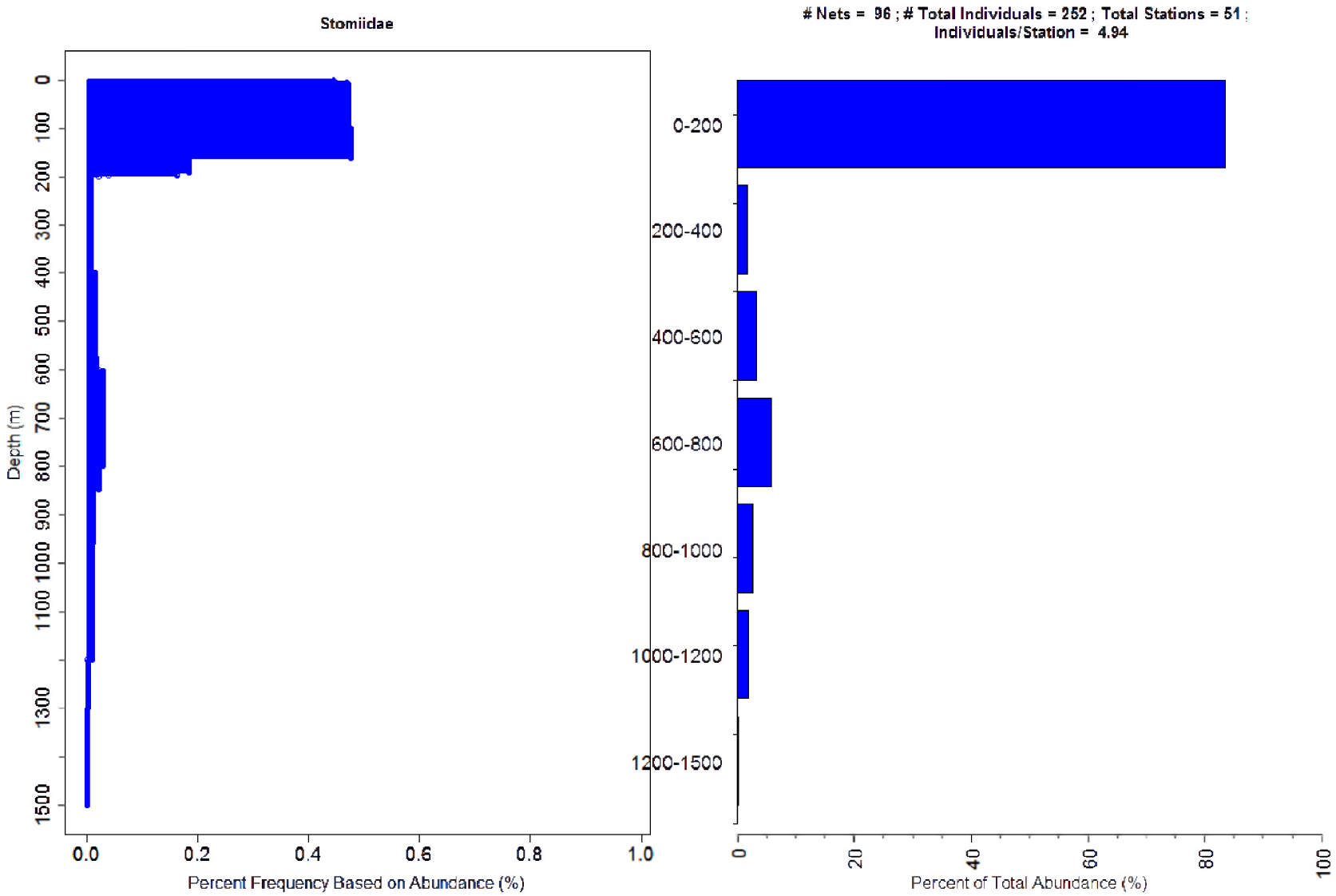
Sphyraenidae



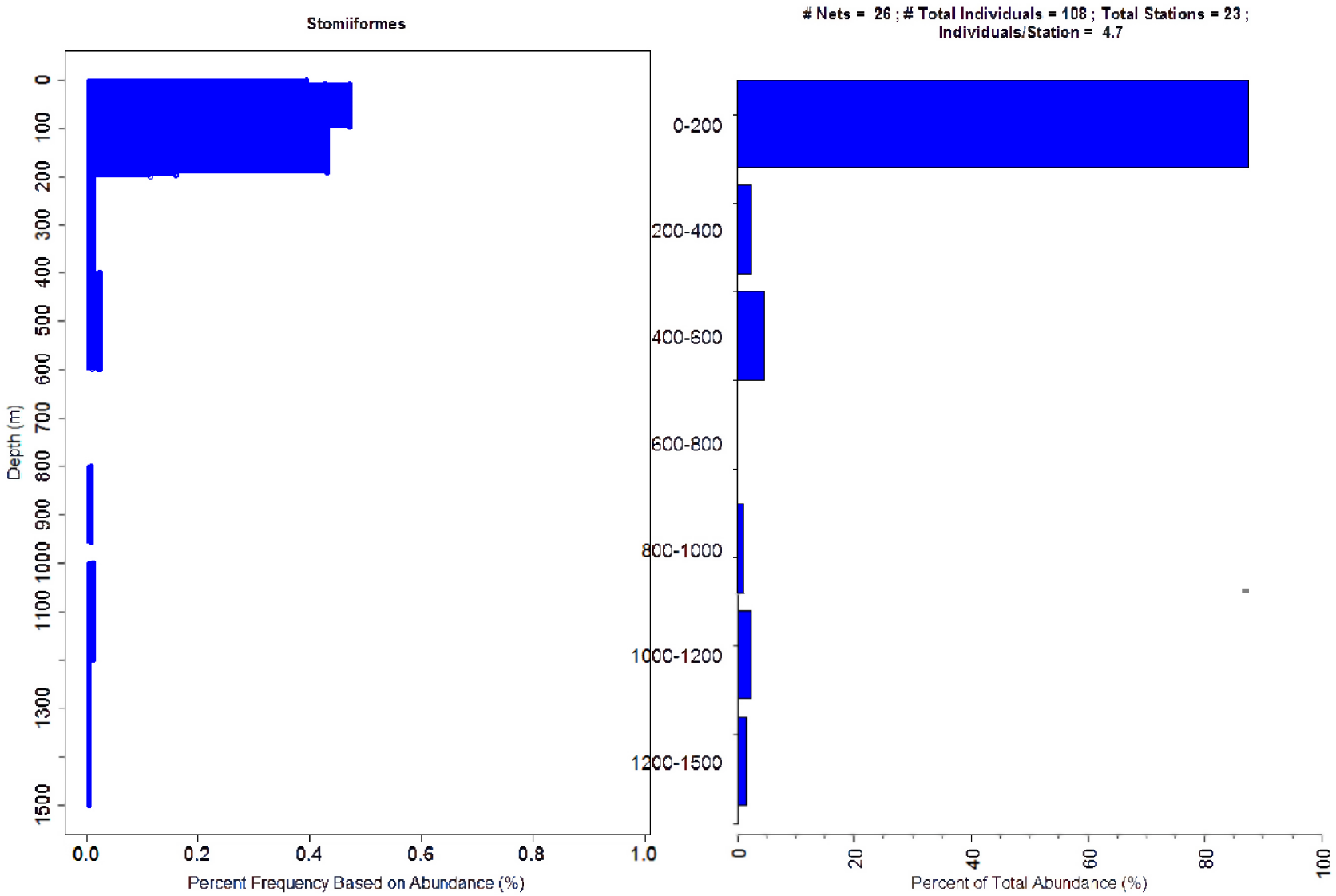
Sternoptychidae



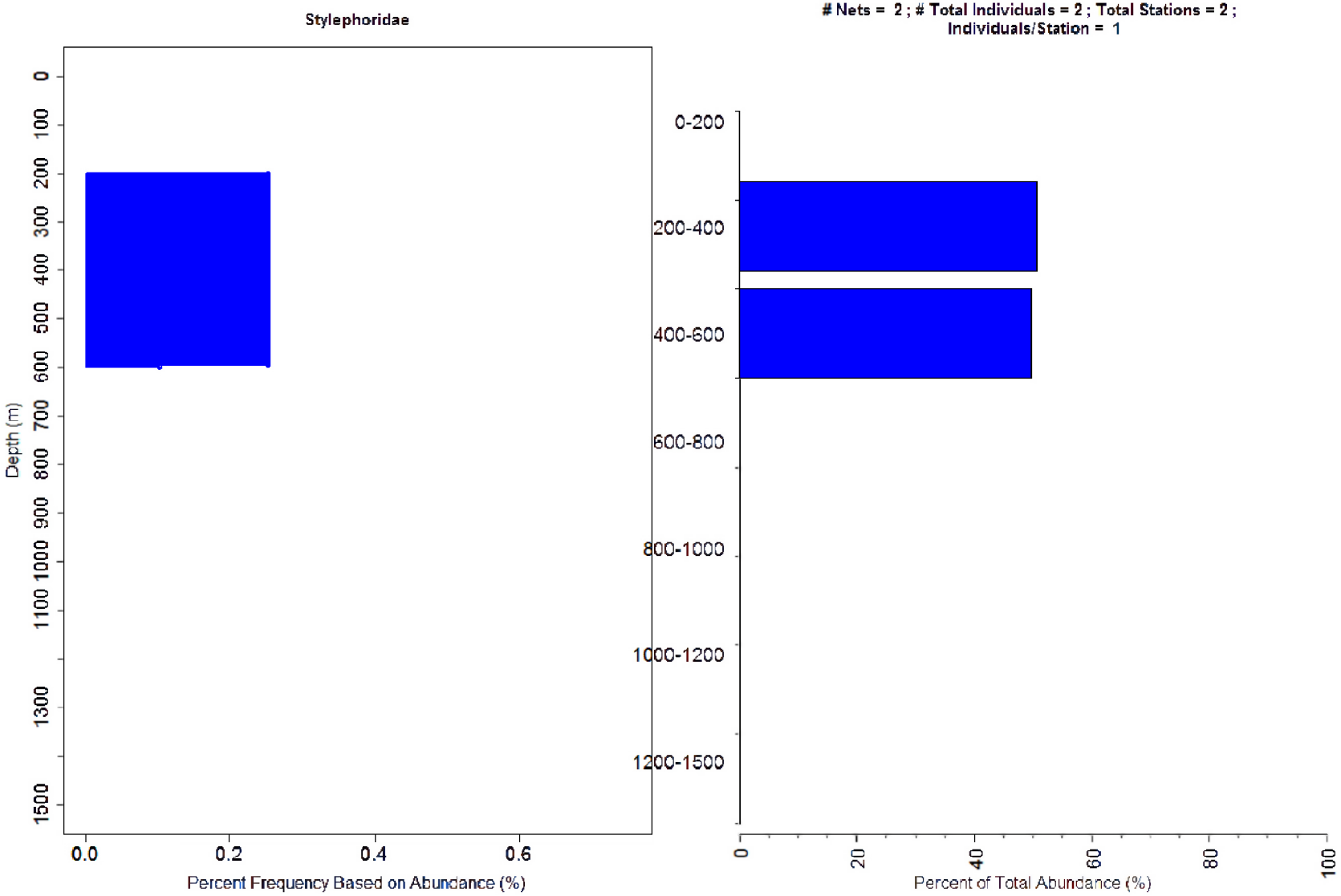
Stomatopoda


Stomiidae
Nets = 96 ; # Total Individuals = 252 ; Total Stations = 51 ;
Individuals/Station = 4.94
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

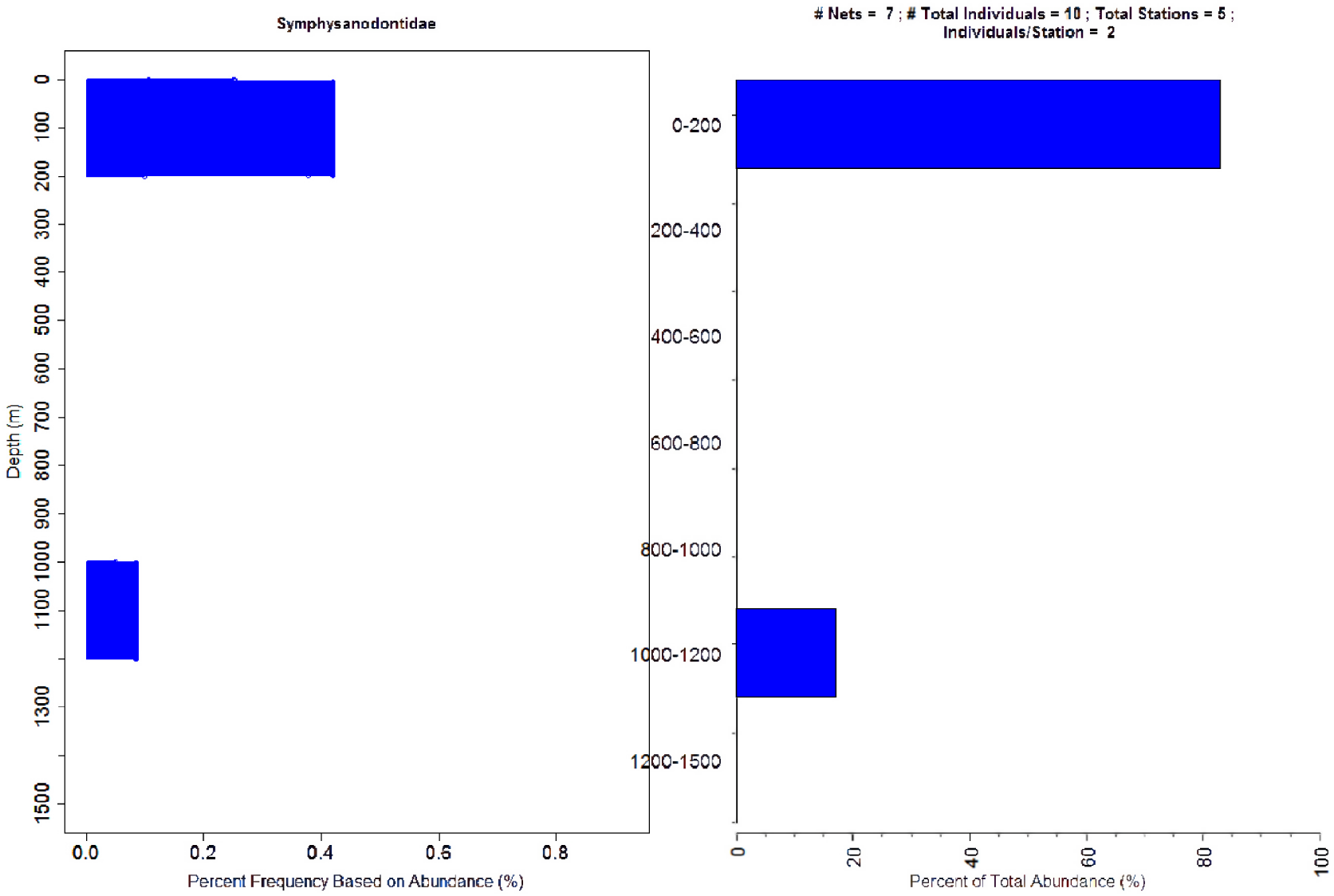
Stomiidae



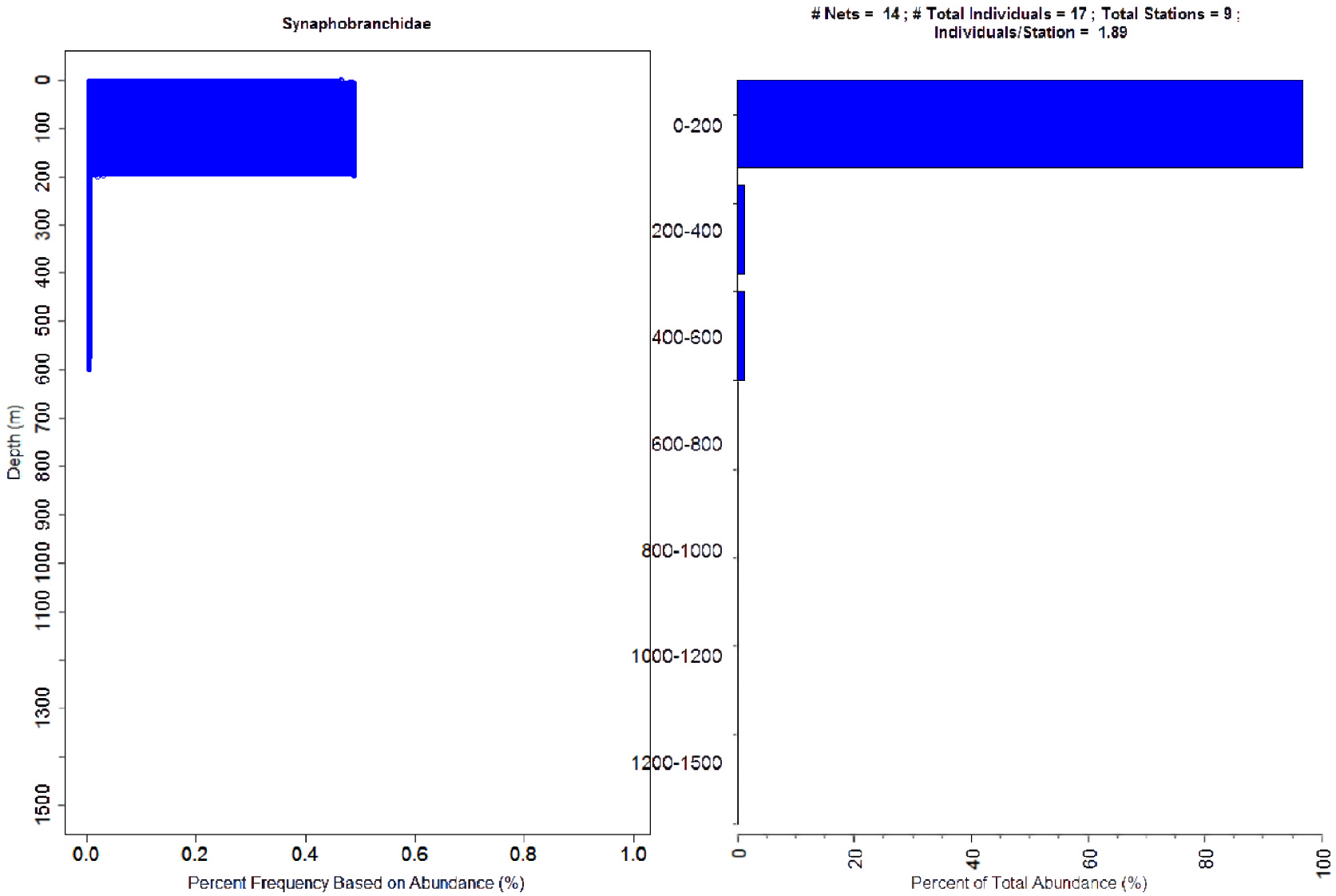
Stomiiformes



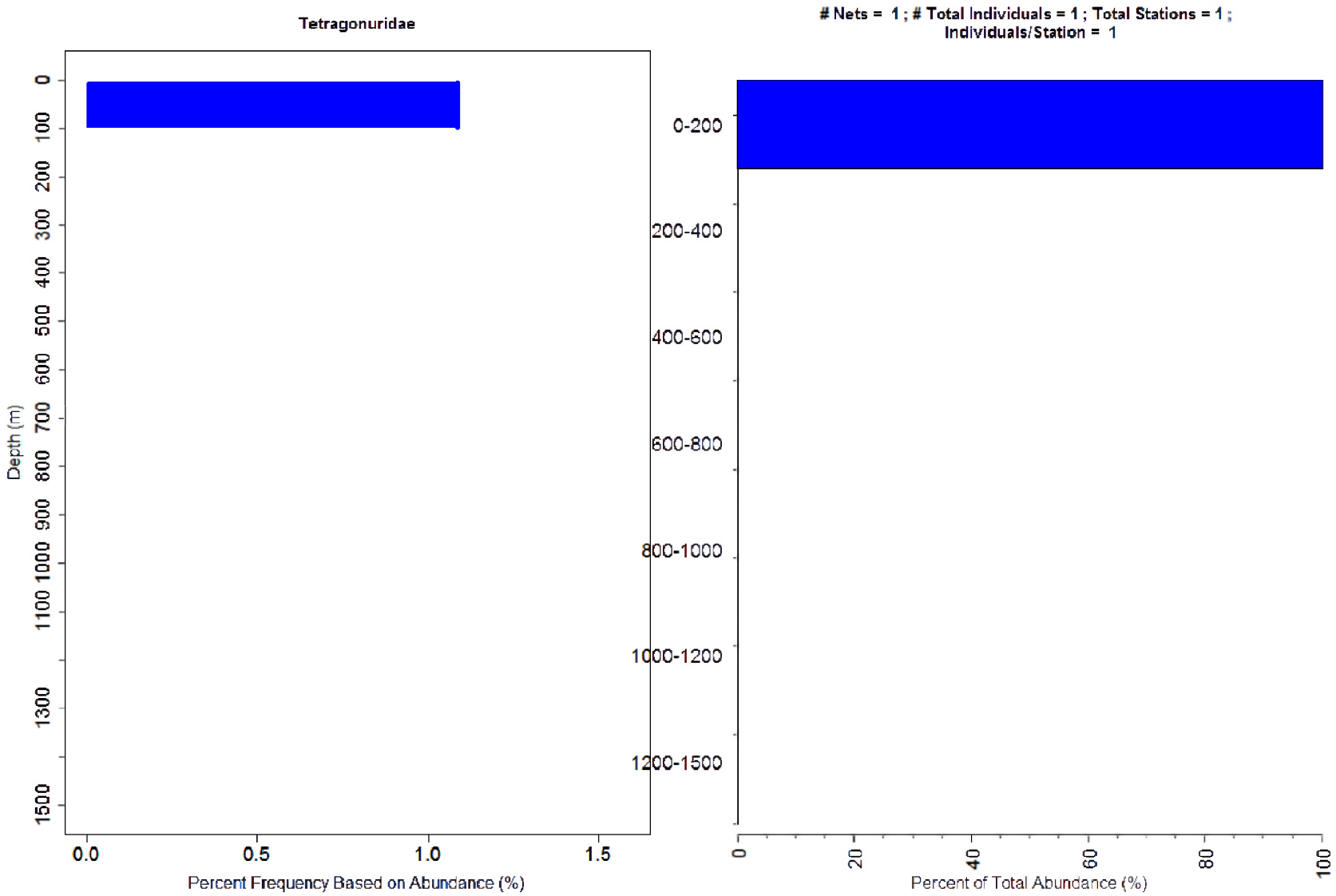
Stylephoridae



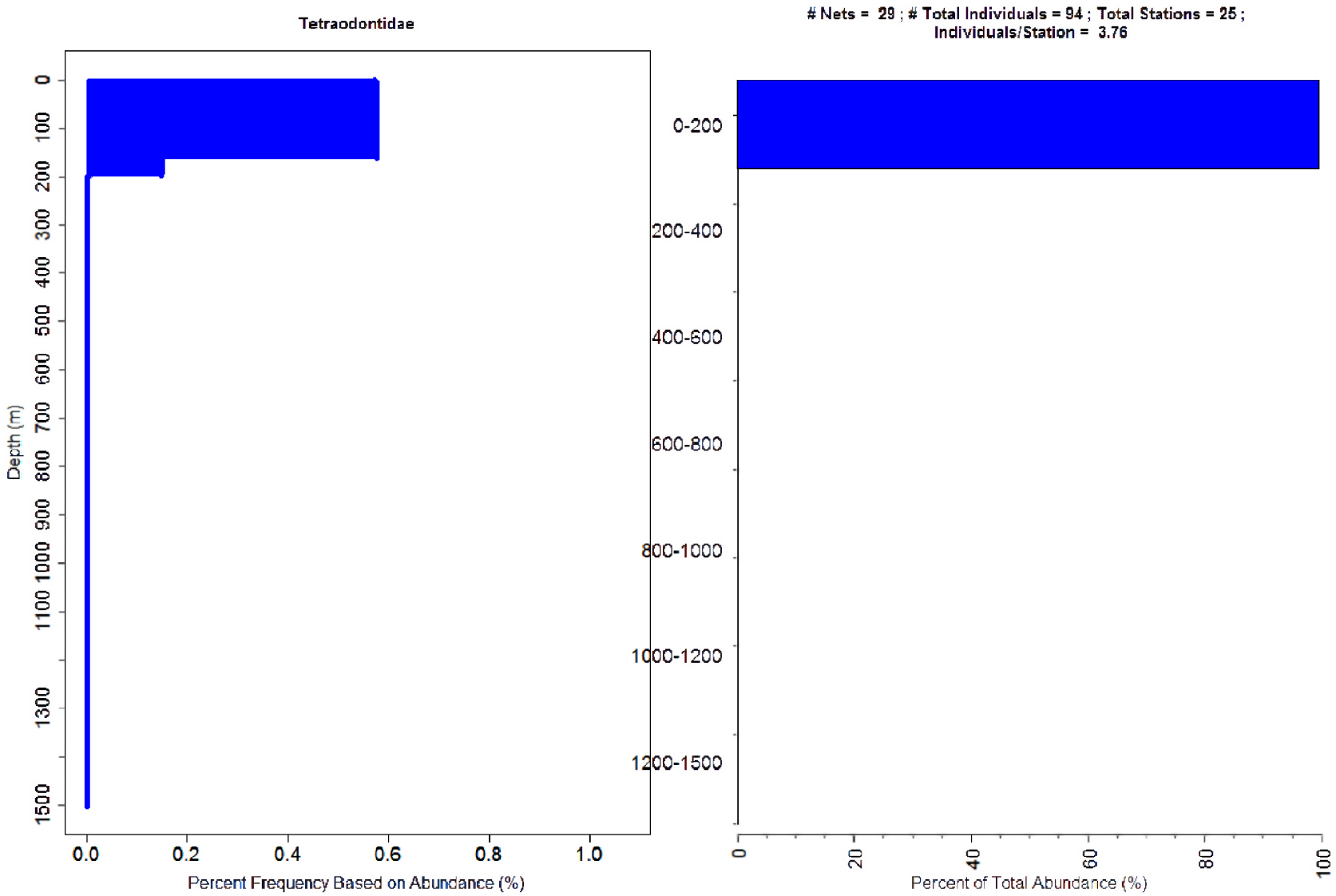
Symphysanodontidae



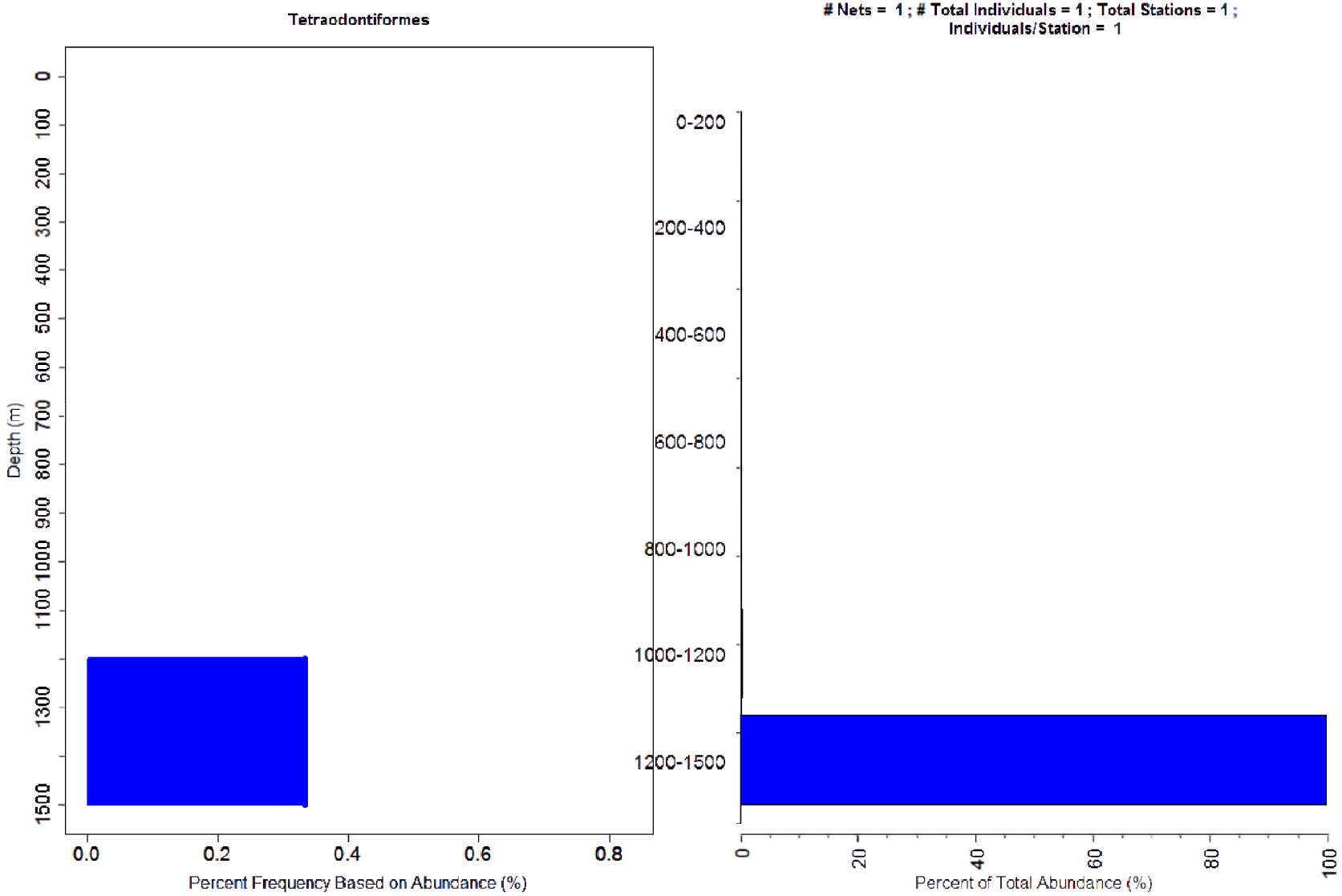
Synaphobranchidae



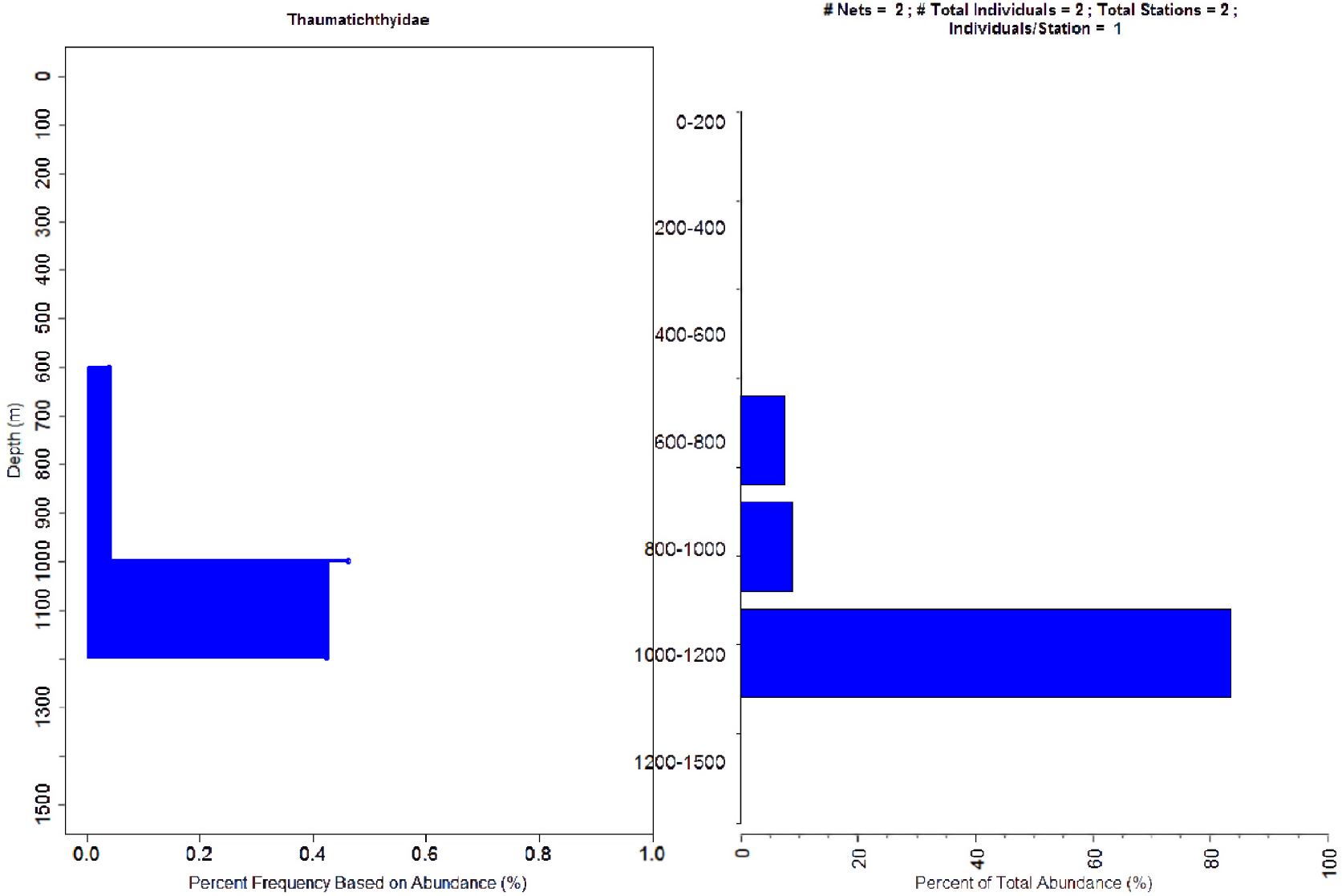
Tetragonuridae



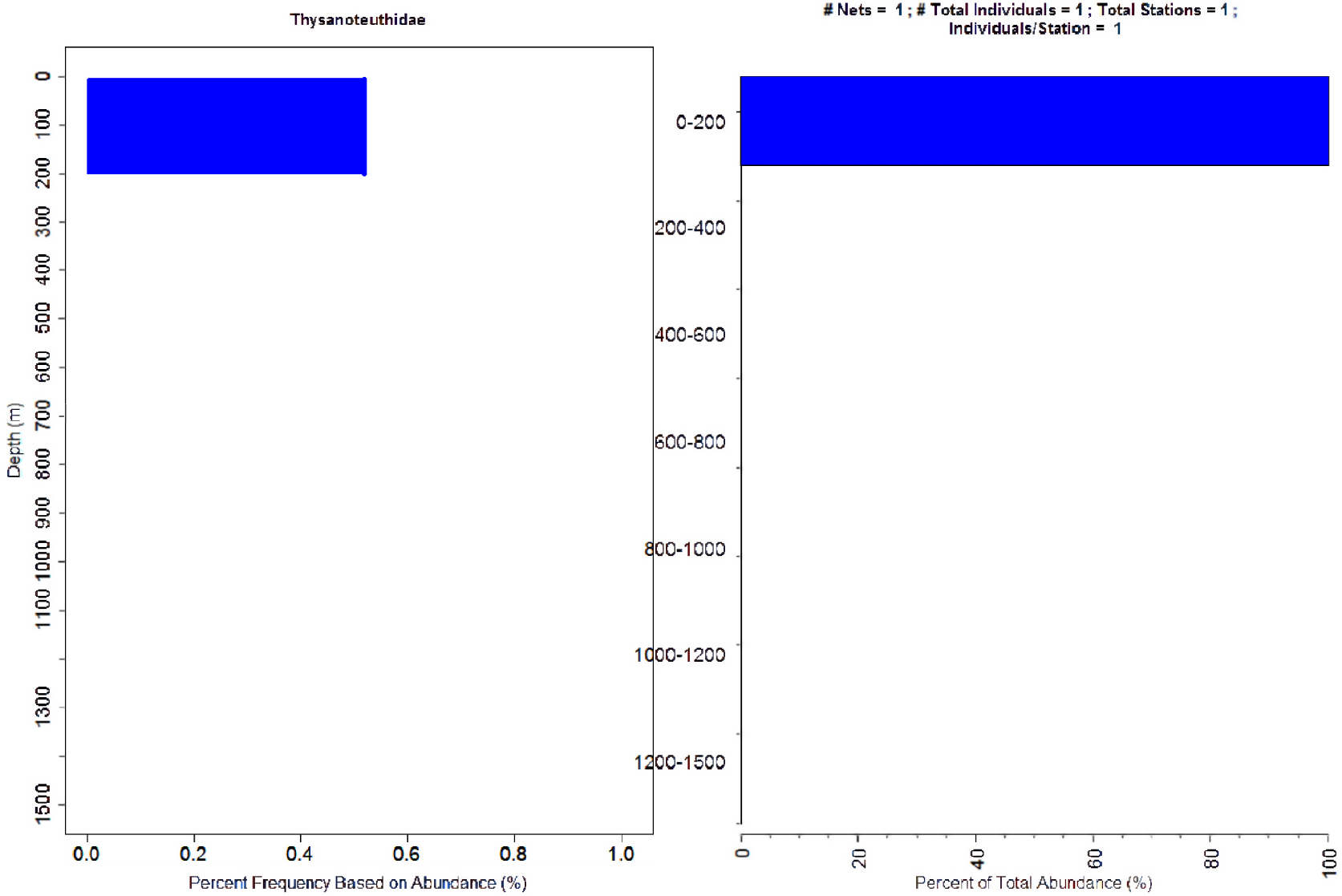
Tetraodontidae



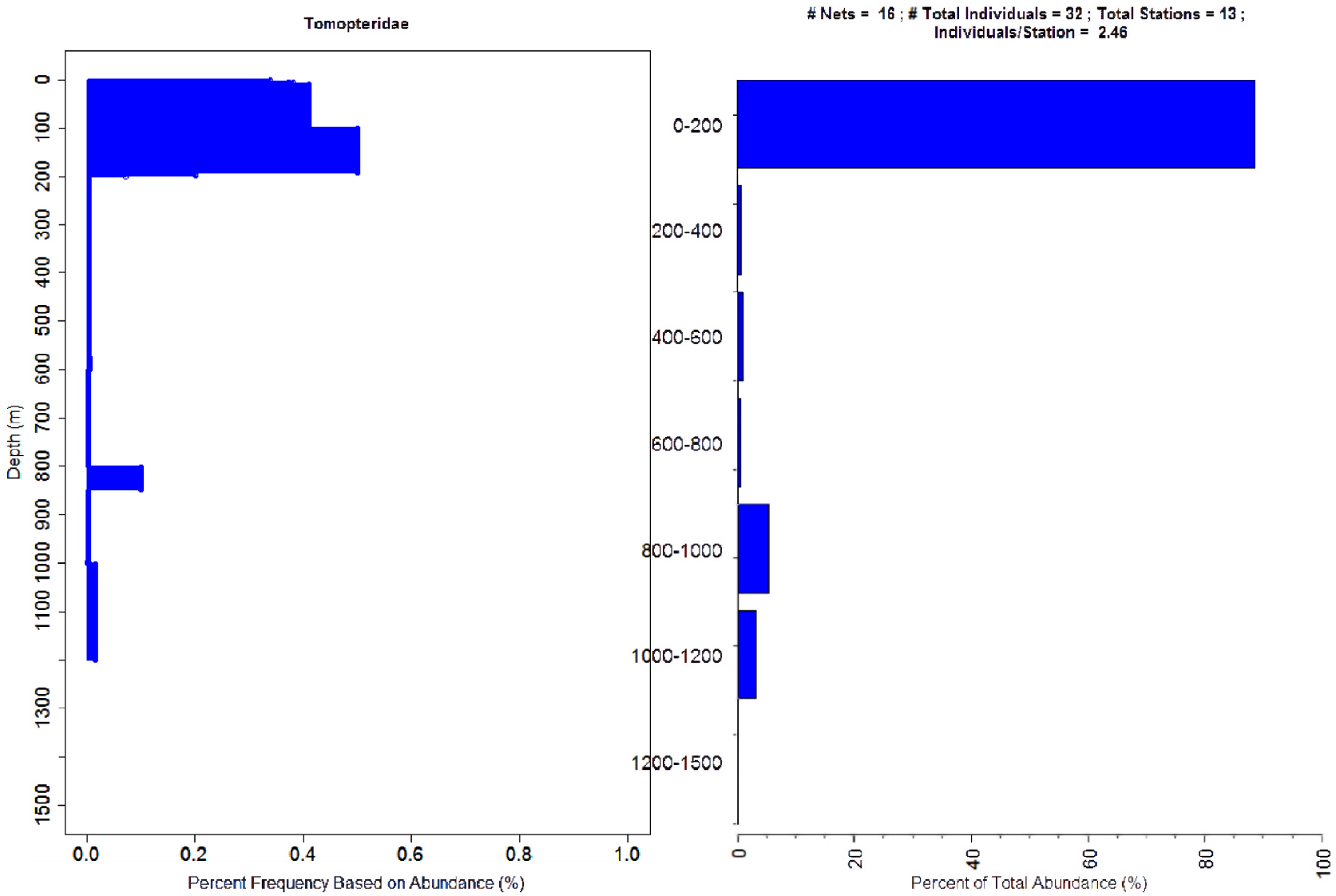
Tetraodontiformes



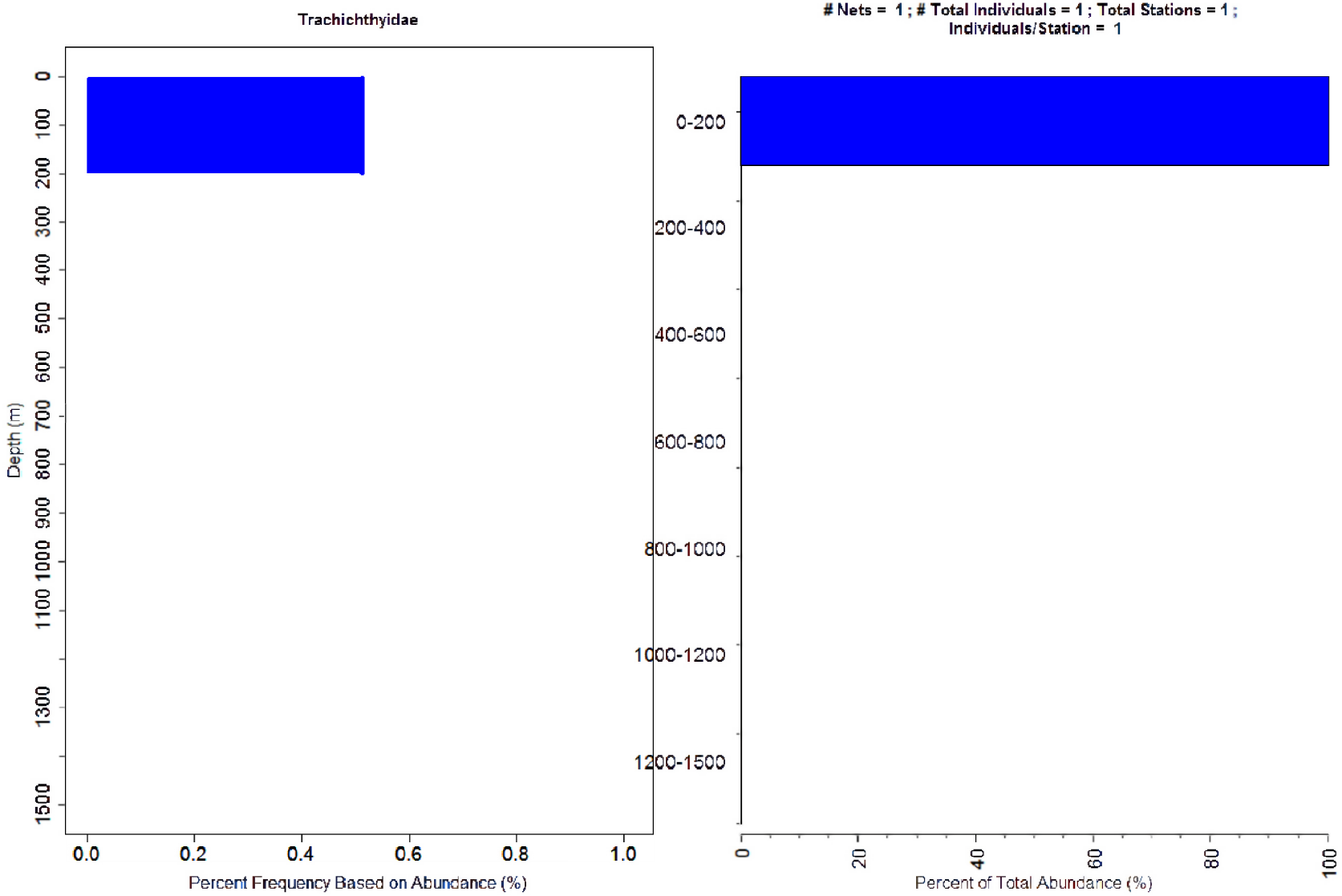
Thaumatichthyidae



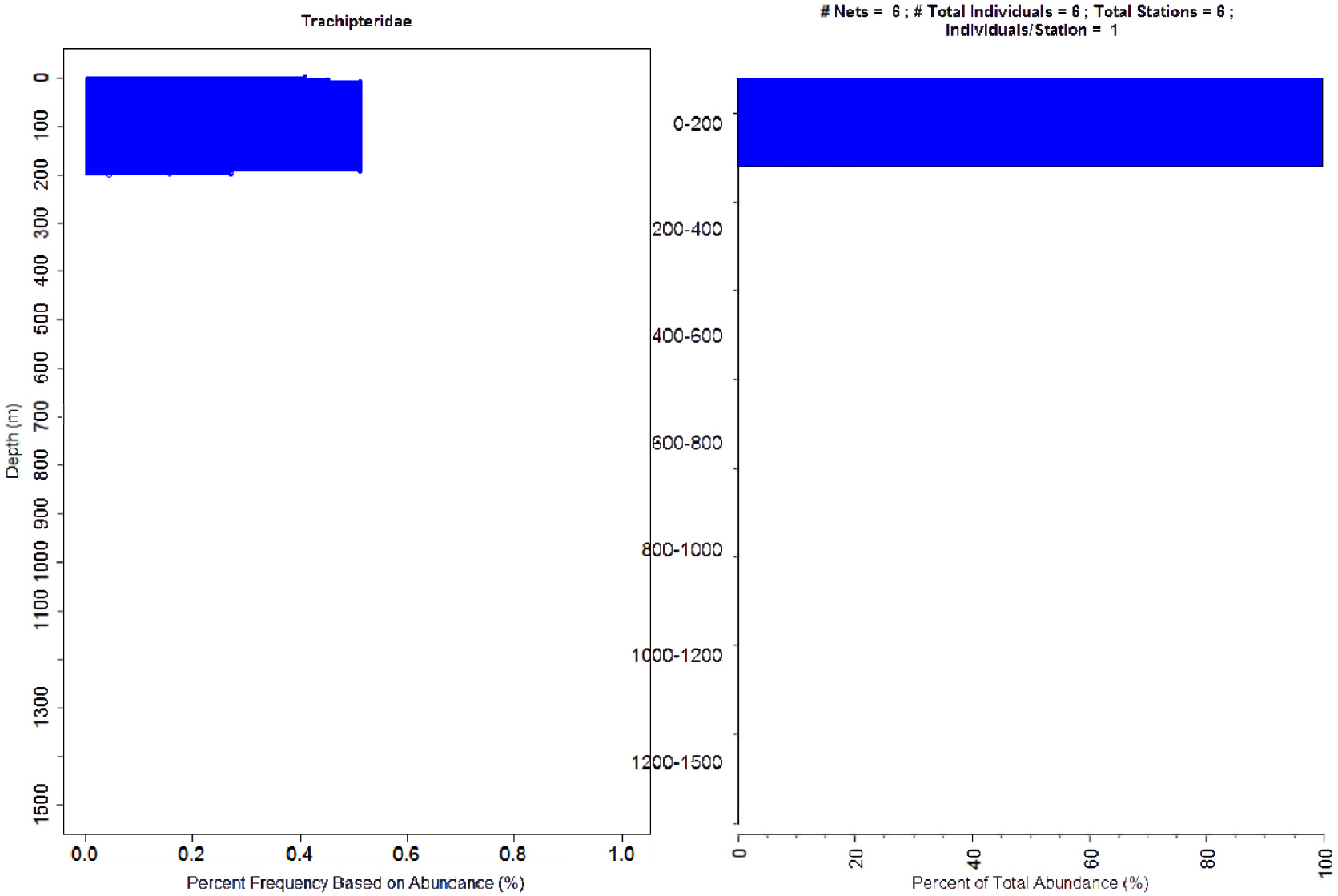
Thysanoteuthidae



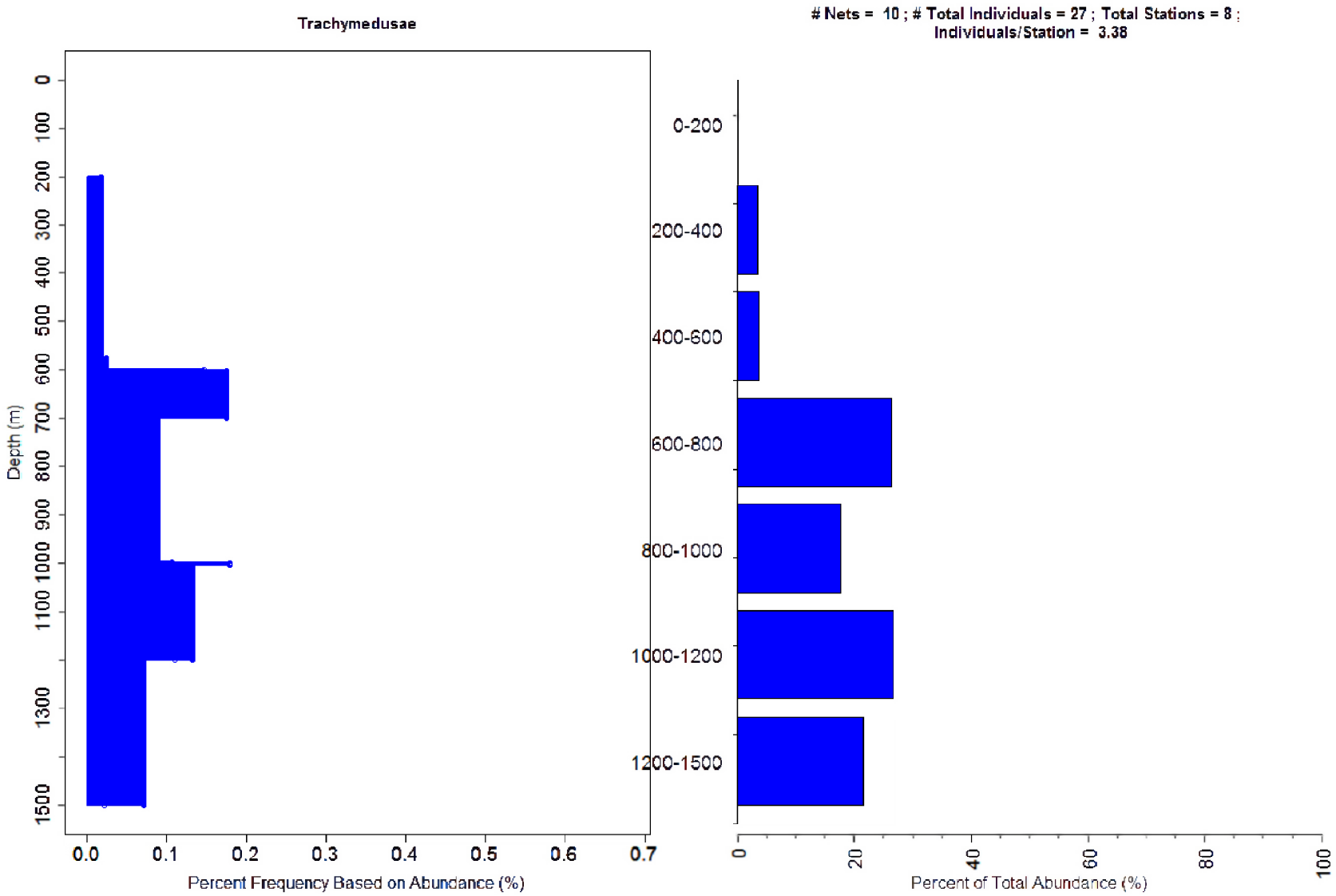
Tomopteridae



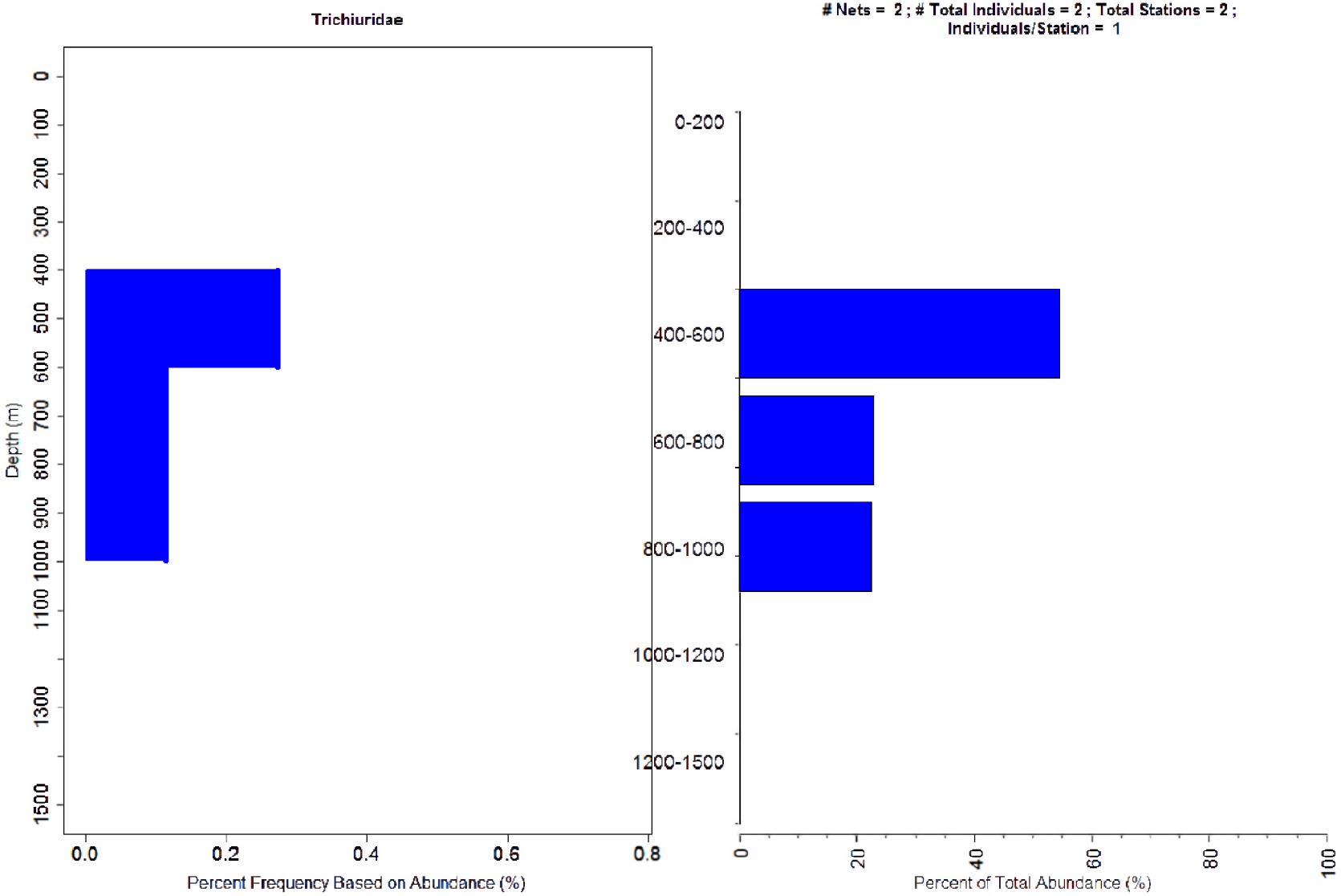
Trachichthyidae



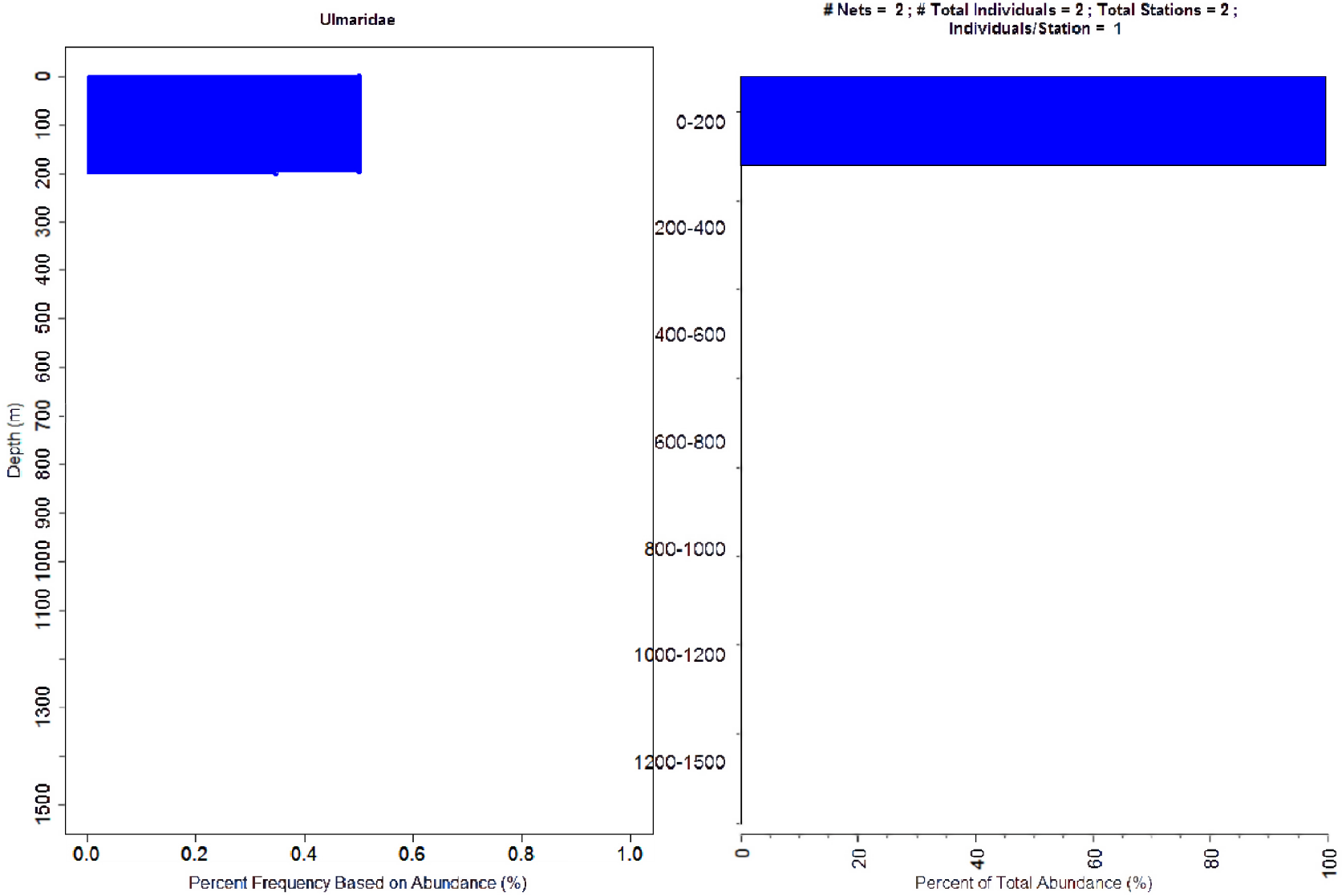
Trachipteridae



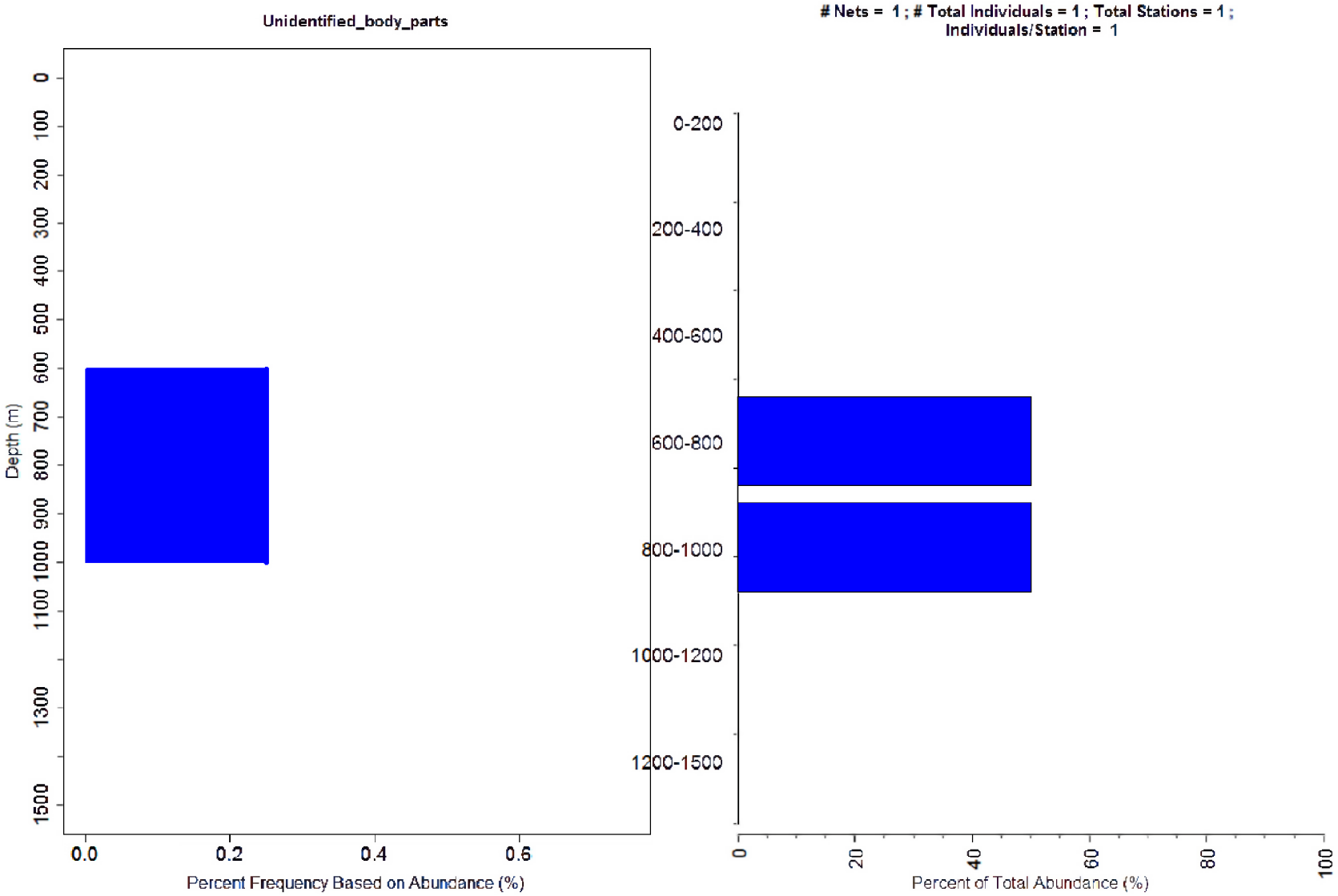
Trachymedusae



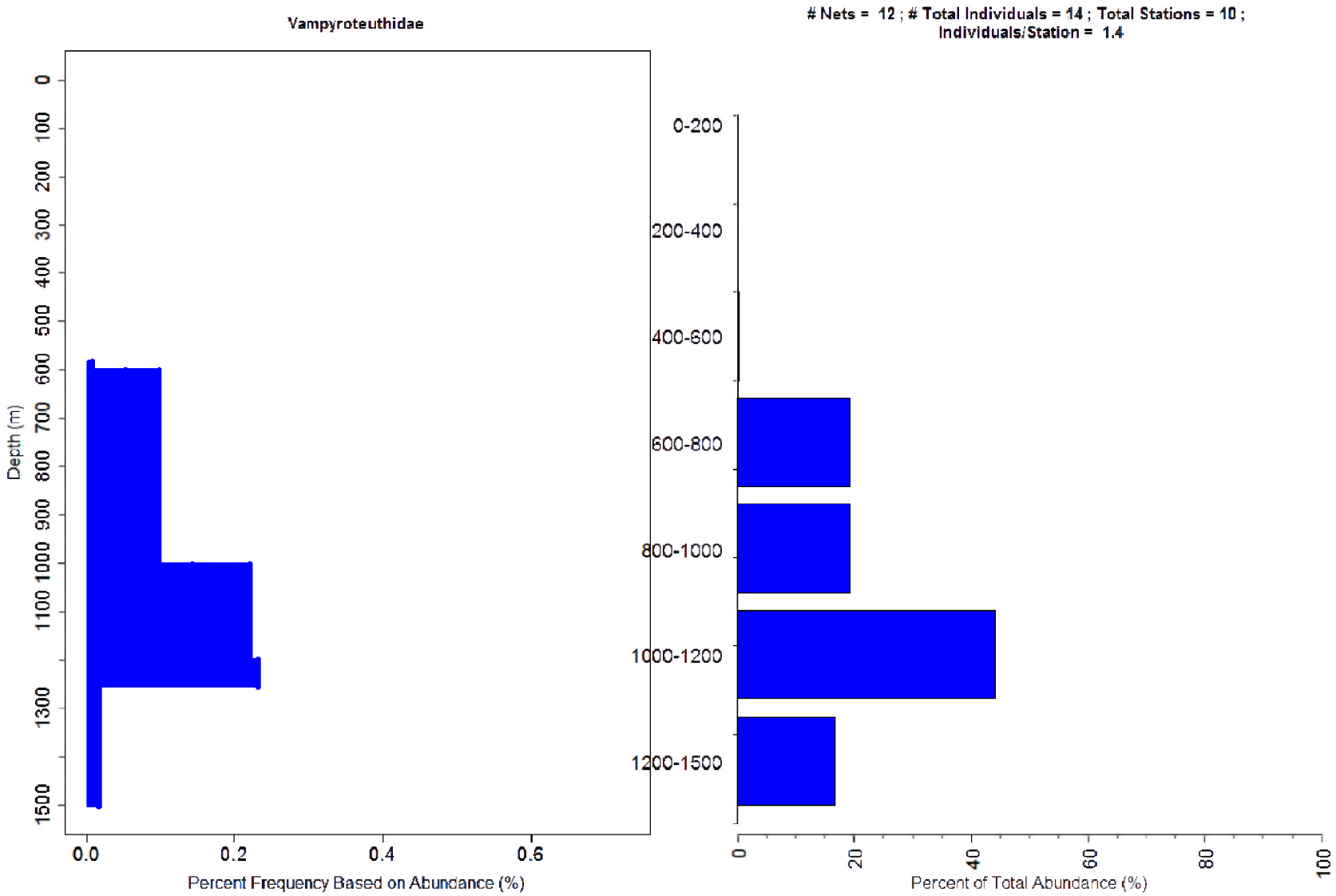
Trichiuridae


Ulmaridae
Nets = 2 ; # Total Individuals = 2 ; Total Stations = 2 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

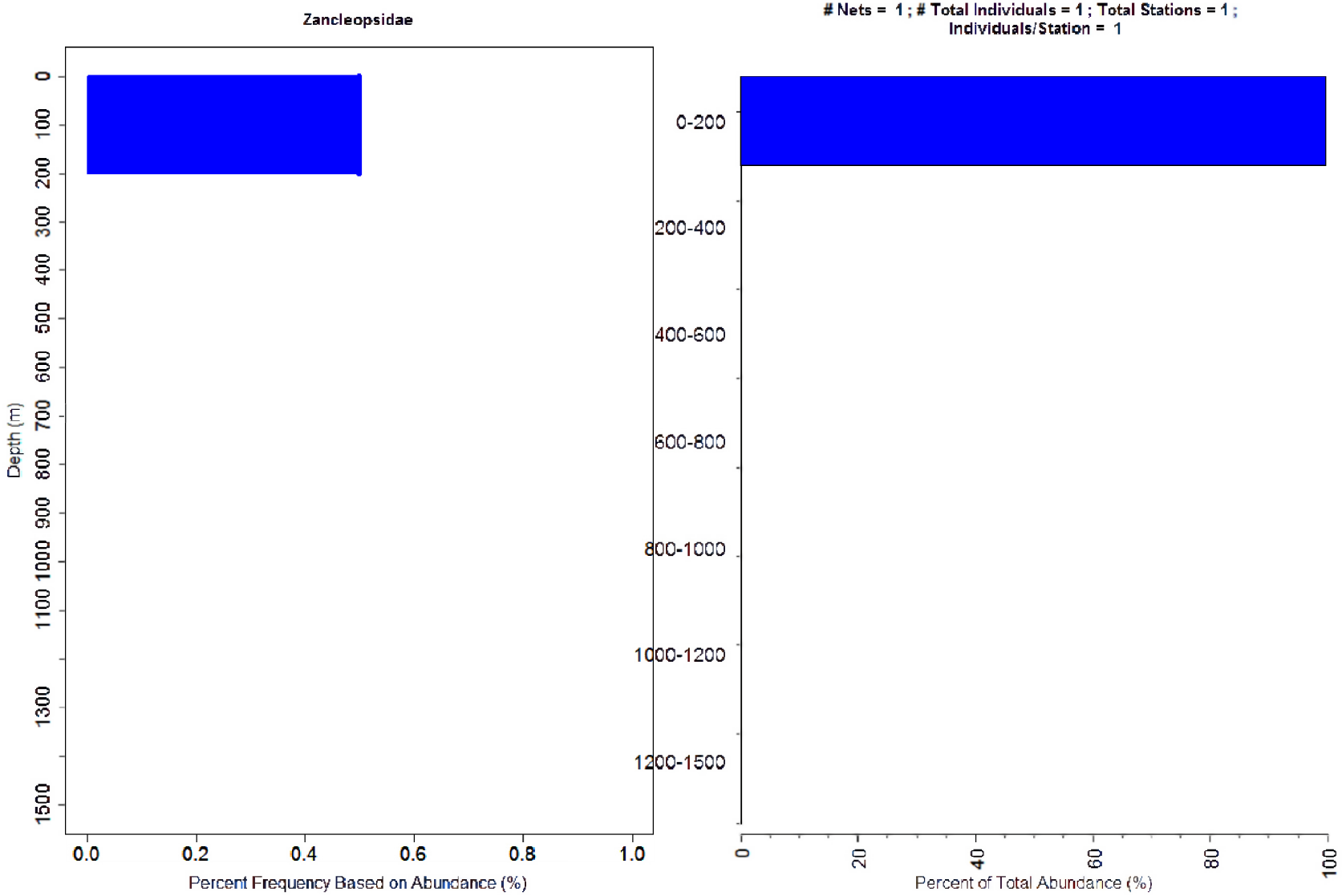
Ulmaridae



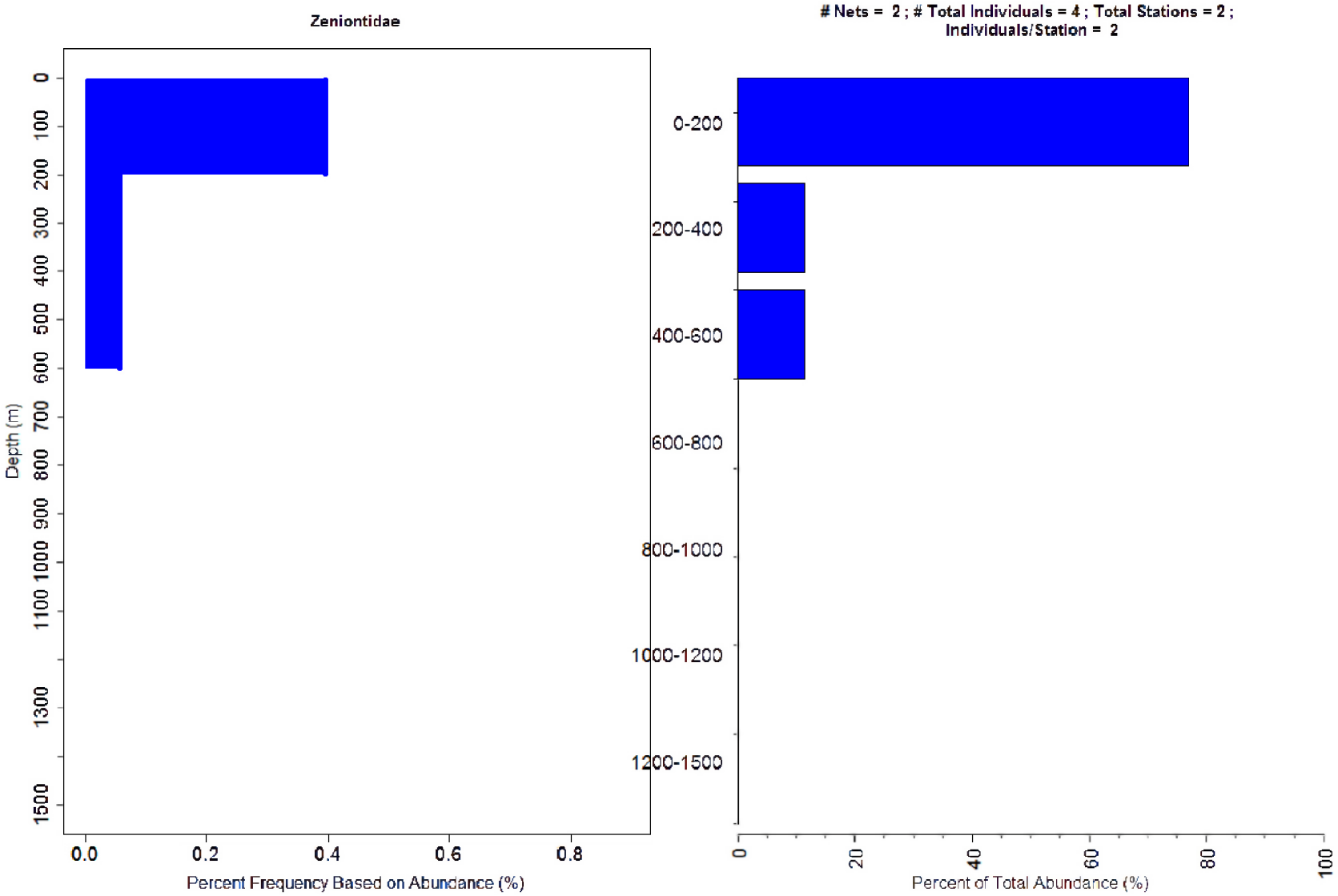
Unidentified_body_parts



Vampyroteuthidae



Zancleopsidae



Zeniontidae

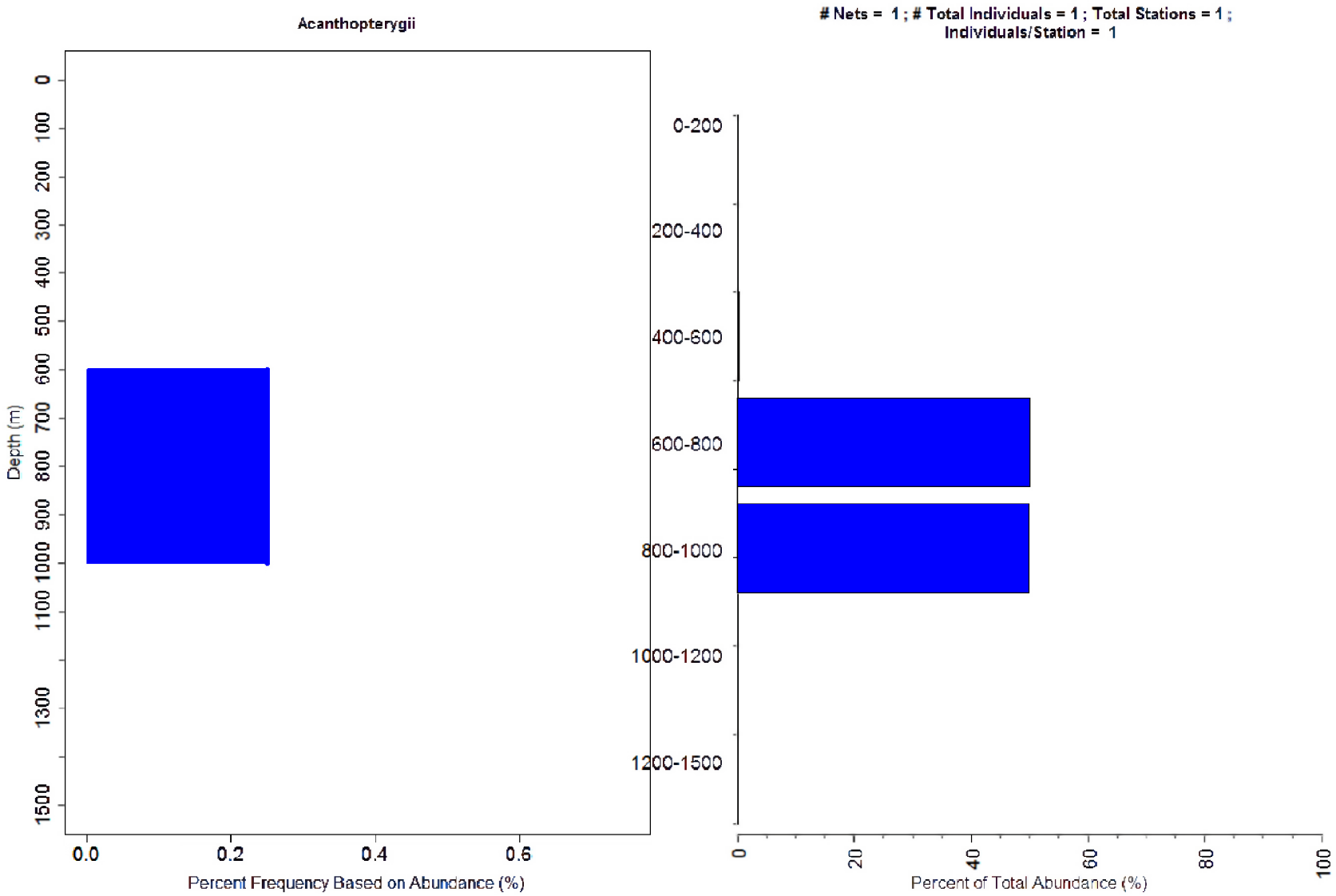
Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

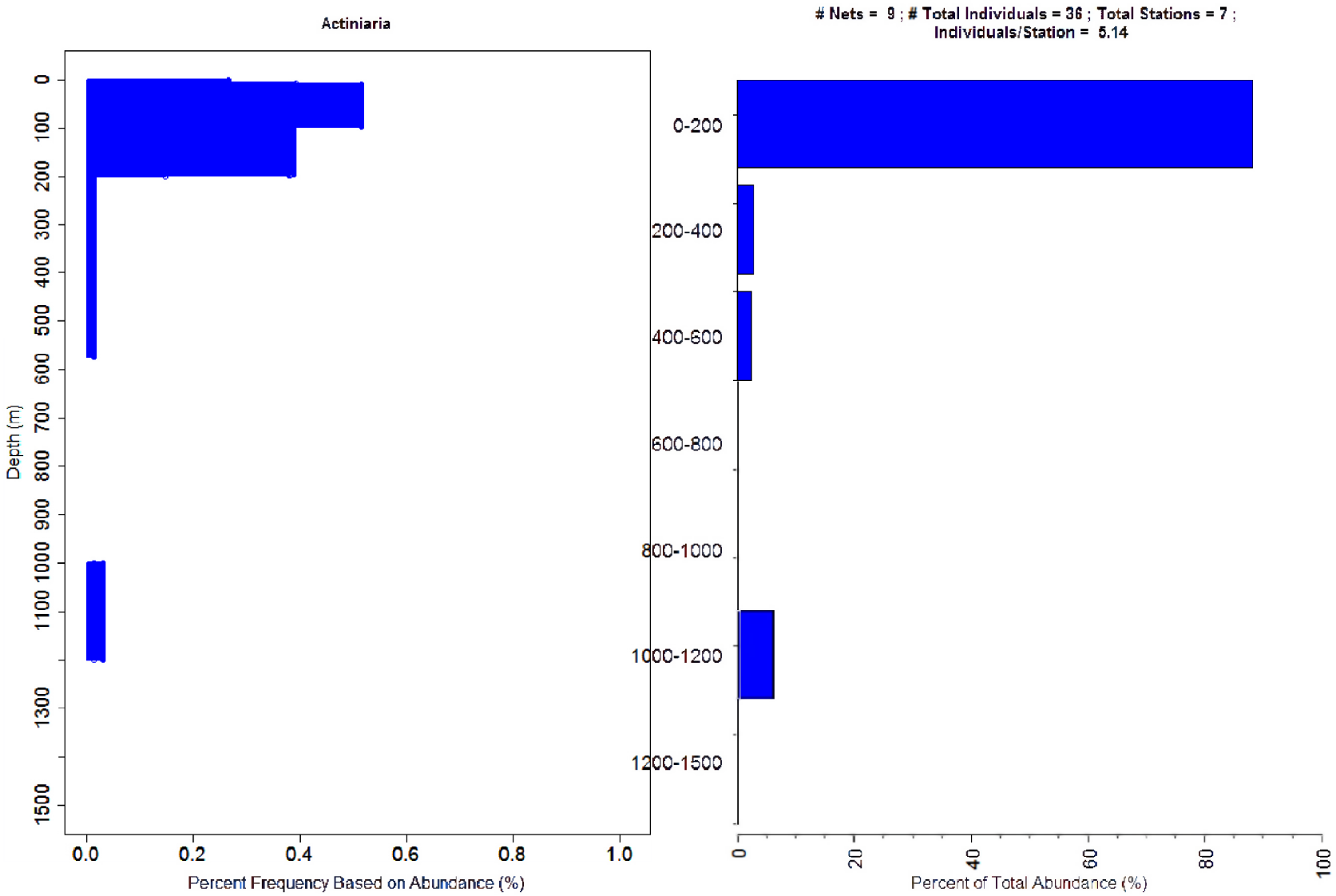
Appendix F3 – NRDA MOC10 Plots
Order Level Distributions

Authors: Deborah French McCay, M. Conor McManus, Alicia Morandi, Melanie Schroeder, Katharine Jayko, and Jill Rowe

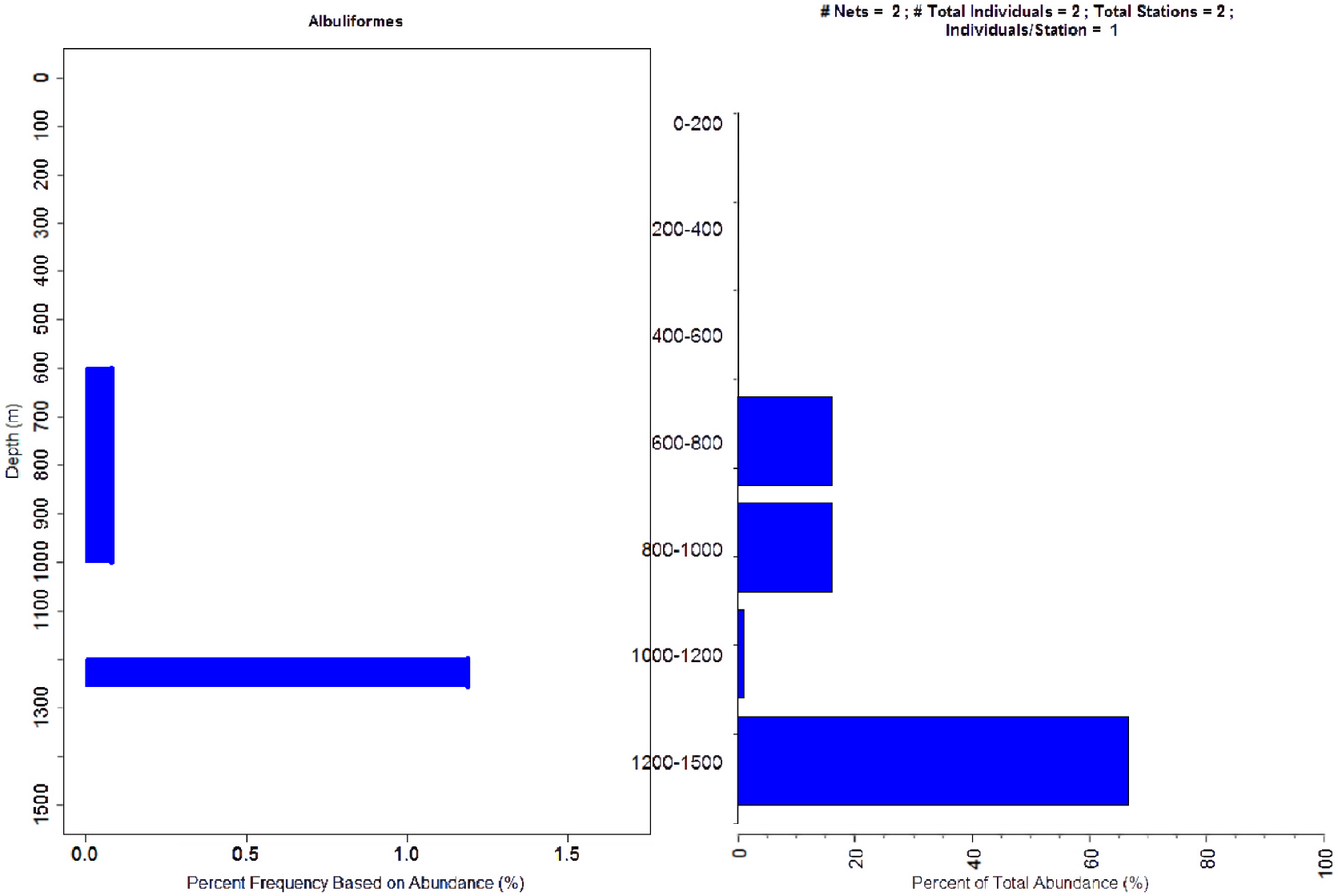
Date of Draft: August 30, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879



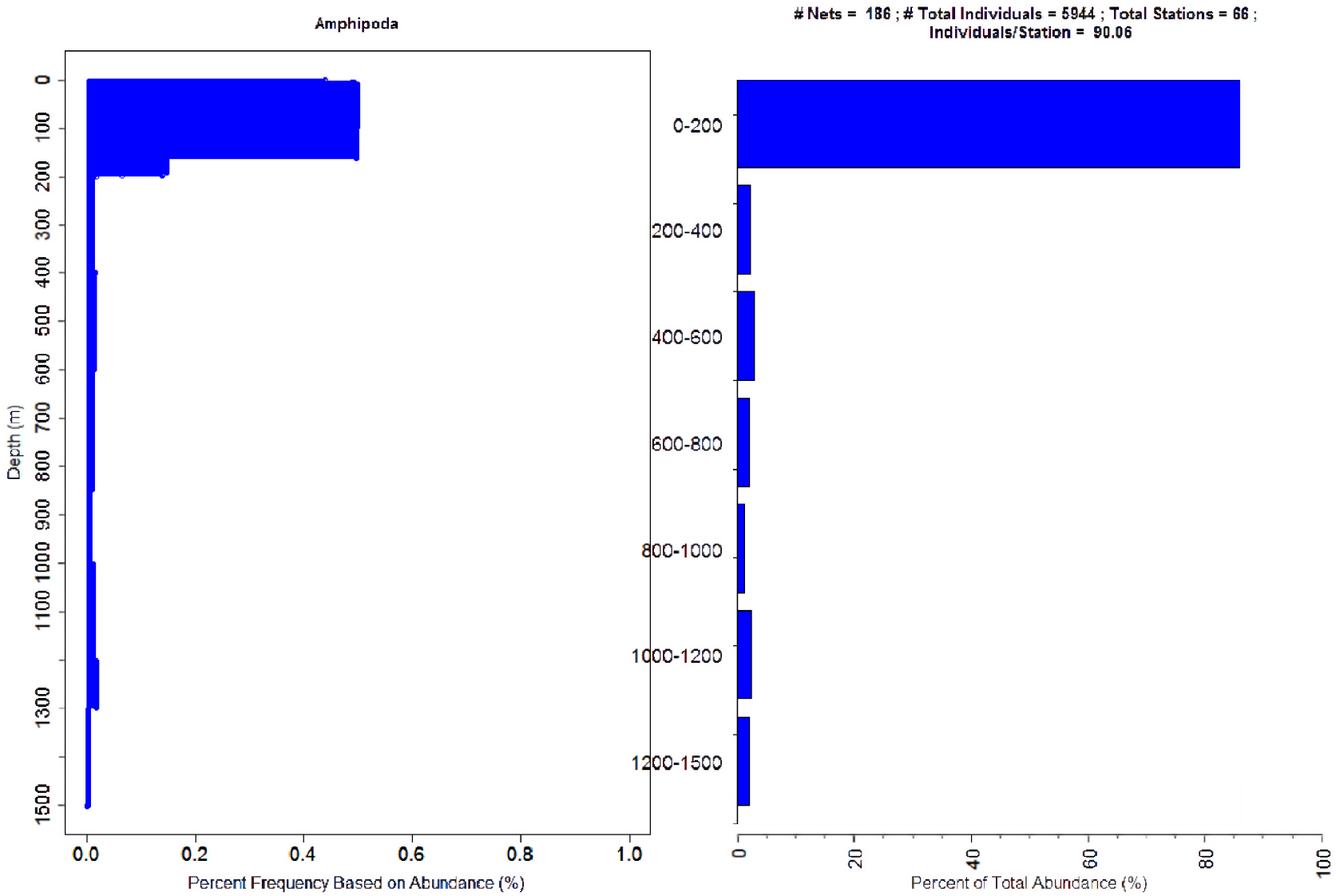
Acanthopterygii


Actiniaria
Nets = 9 ; # Total Individuals = 36 ; Total Stations = 7 ;
Individuals/Station = 5.14
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

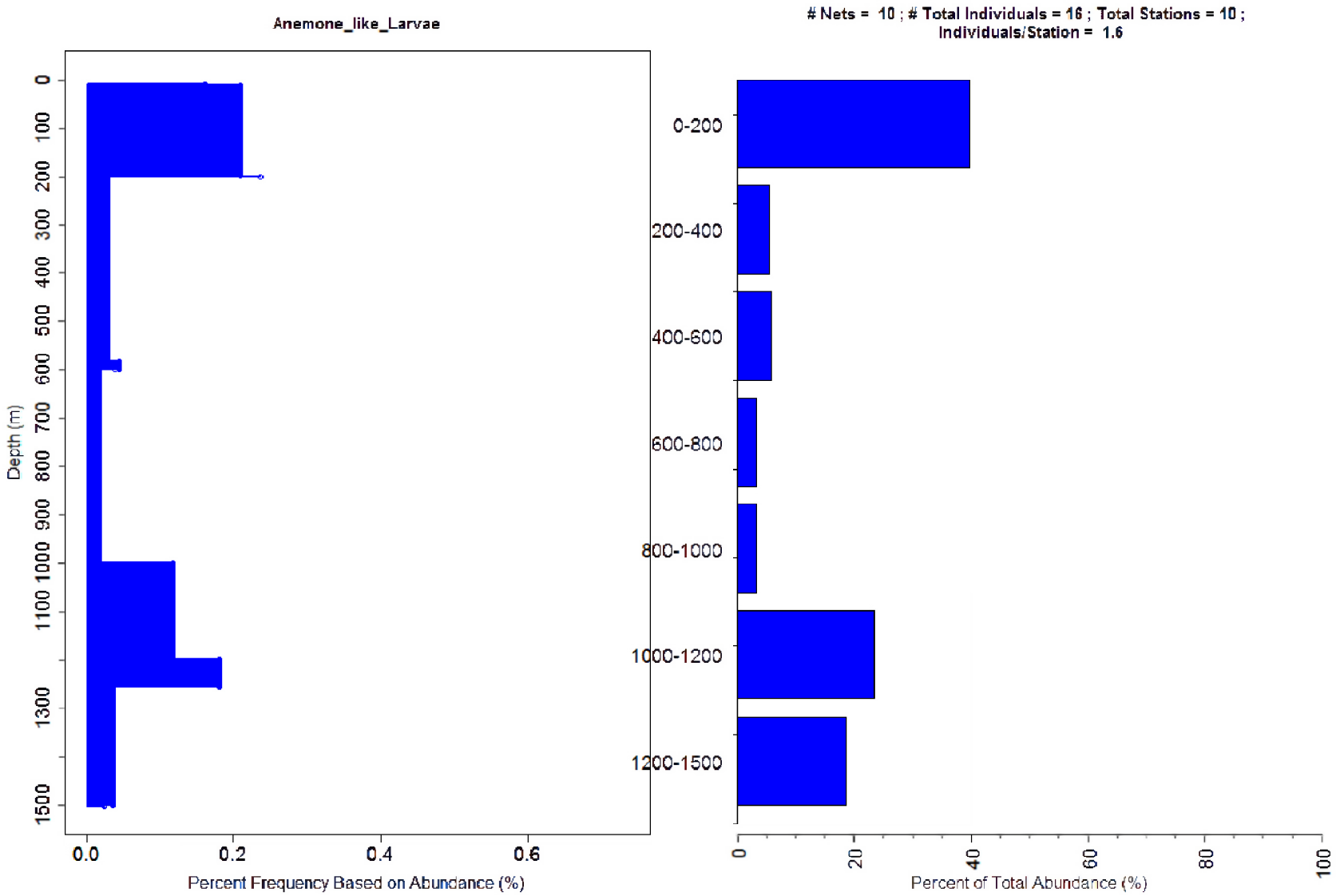
Actiniaria



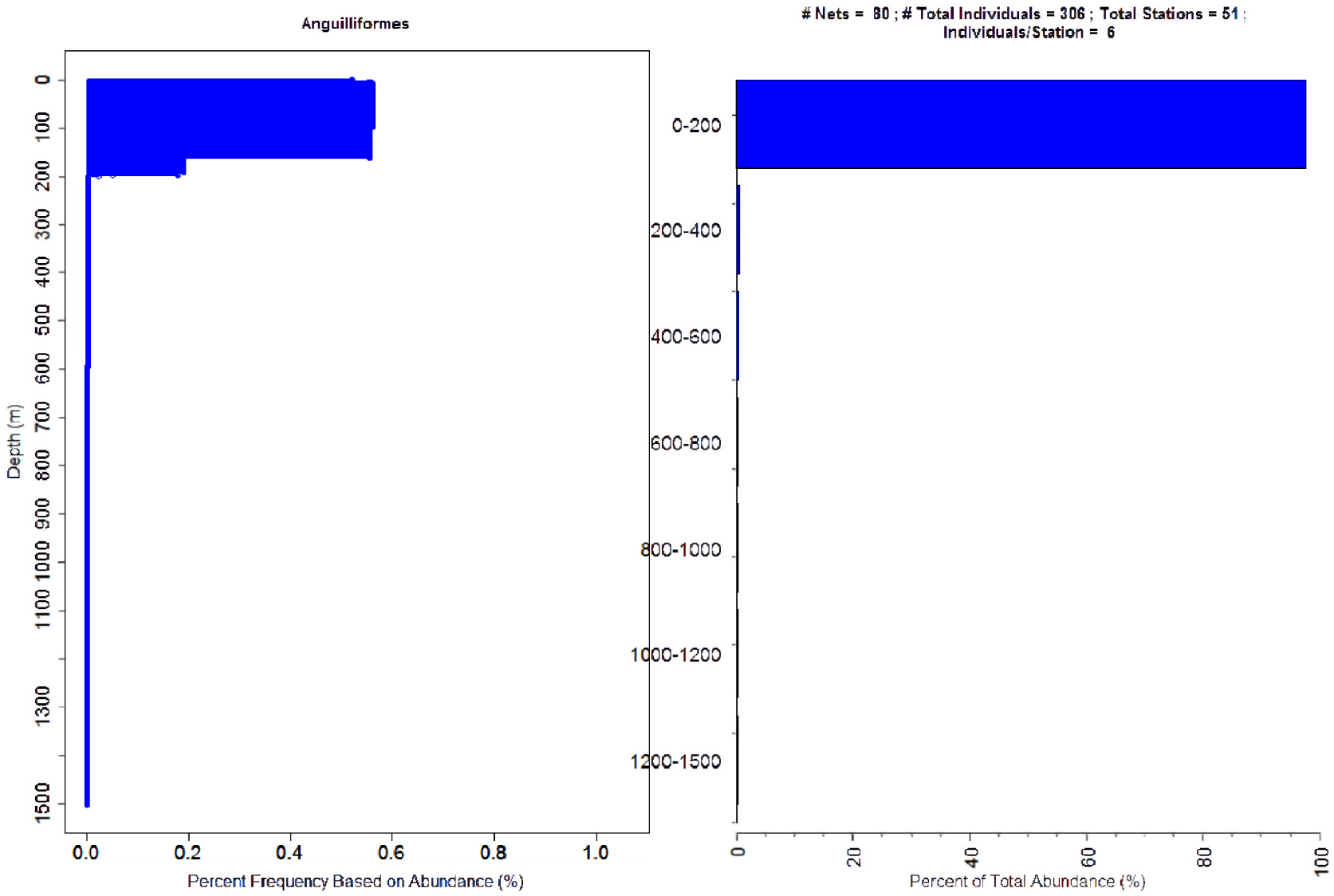
Albuliformes


Amphipoda
Nets = 186 ; # Total Individuals = 5944 ; Total Stations = 66 ;
Individuals/Station = 90.06
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

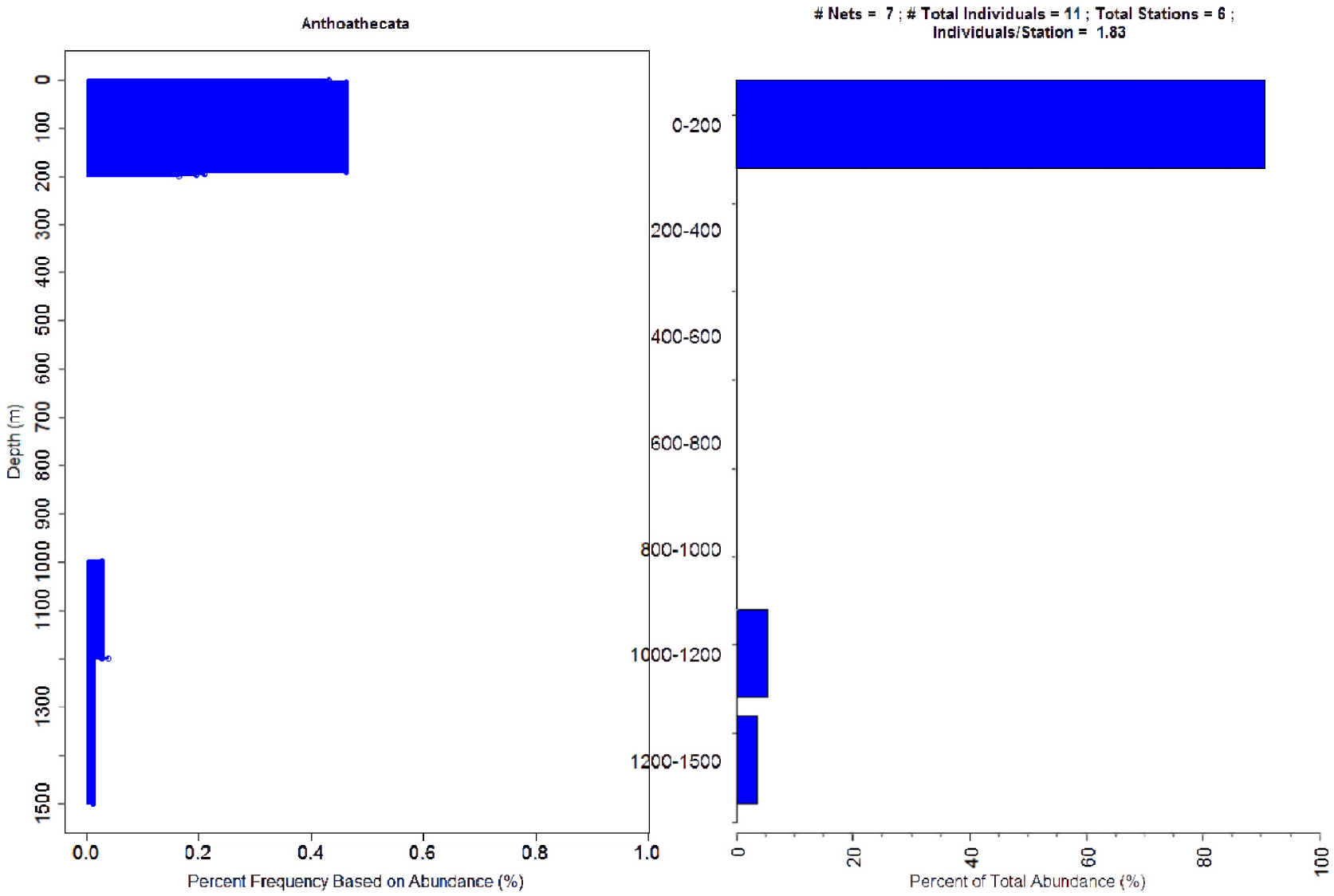
Amphipoda



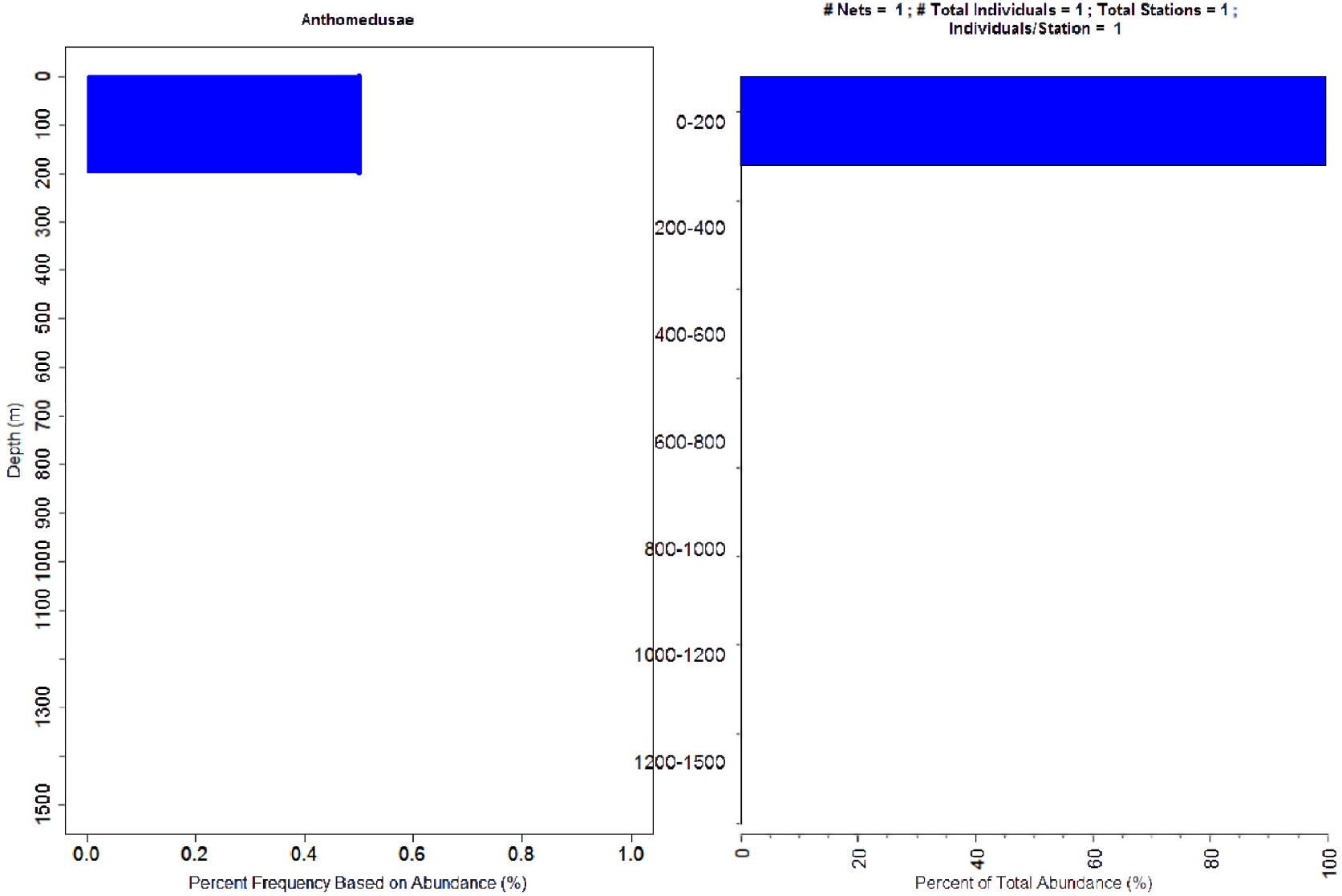
Anemone_like_Larvae



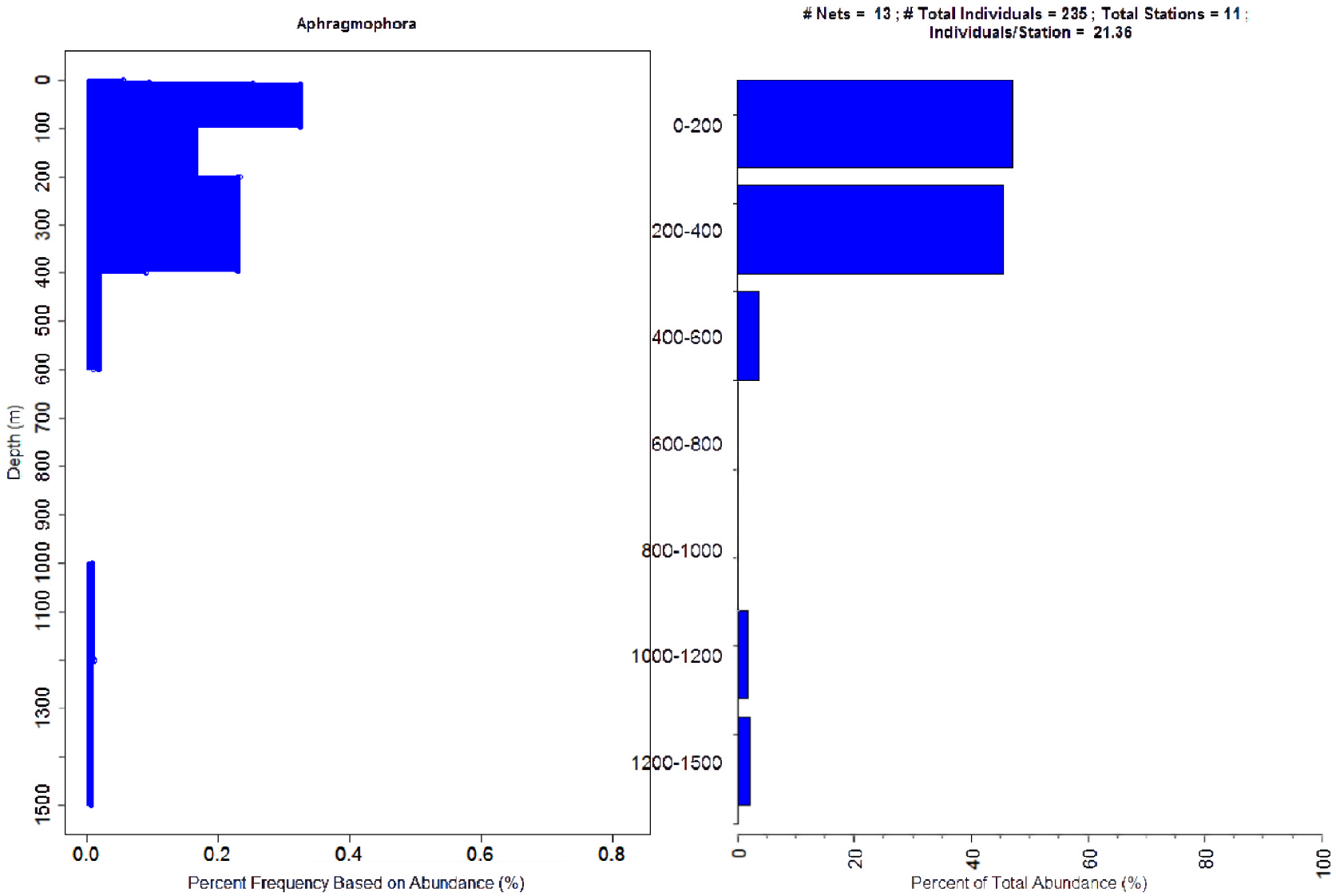
Anguilliformes



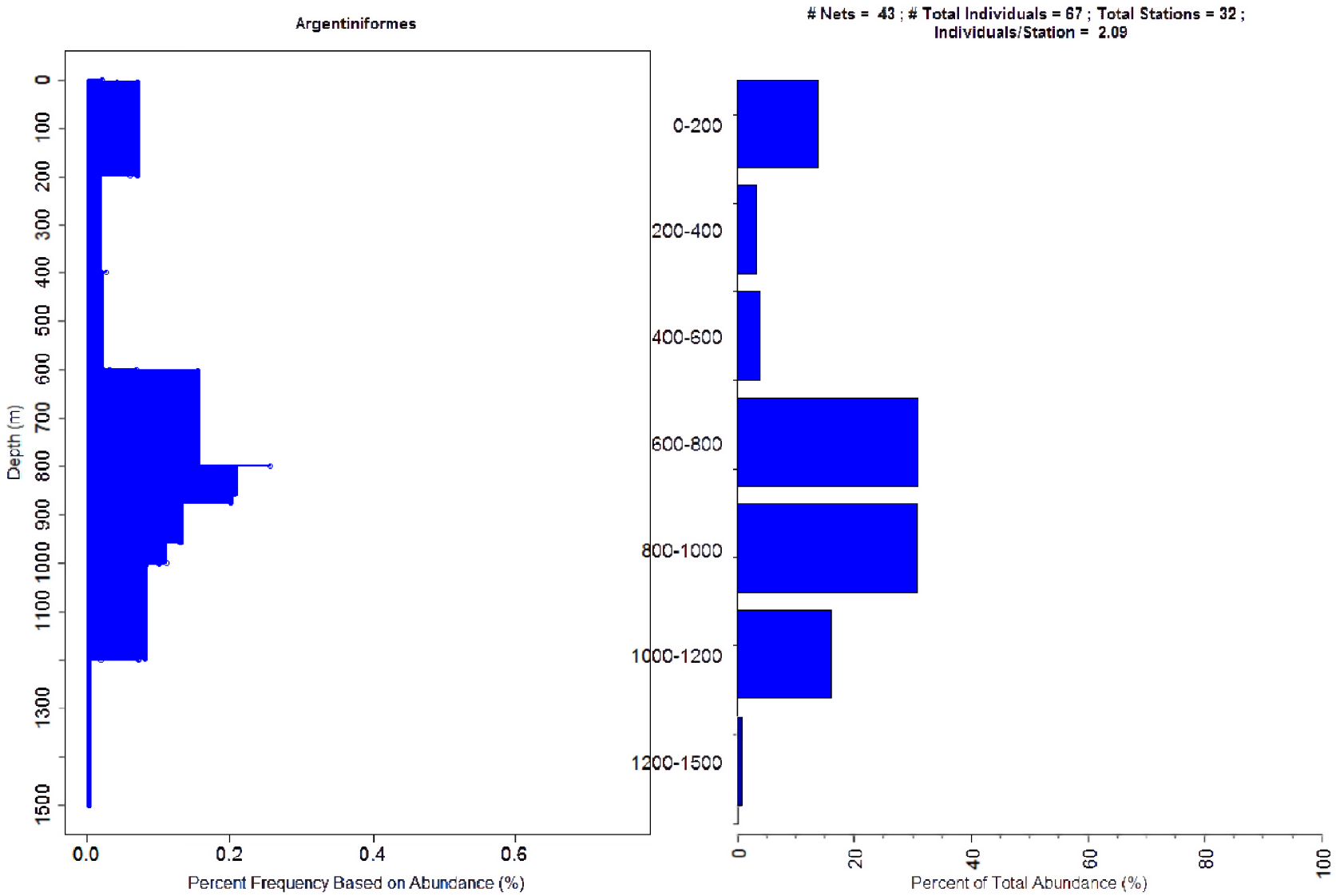
Anthoathecata



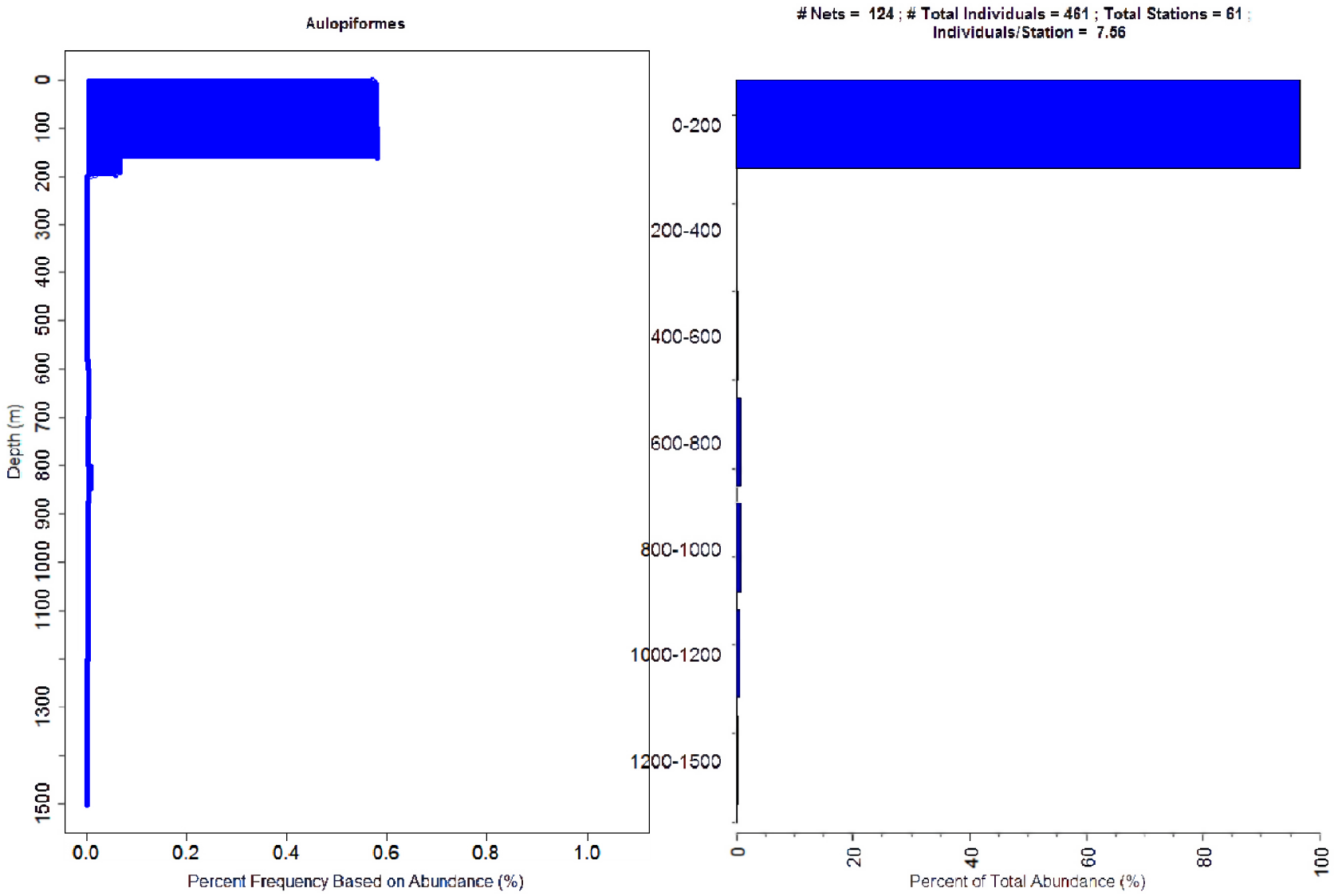
Anthomedusae



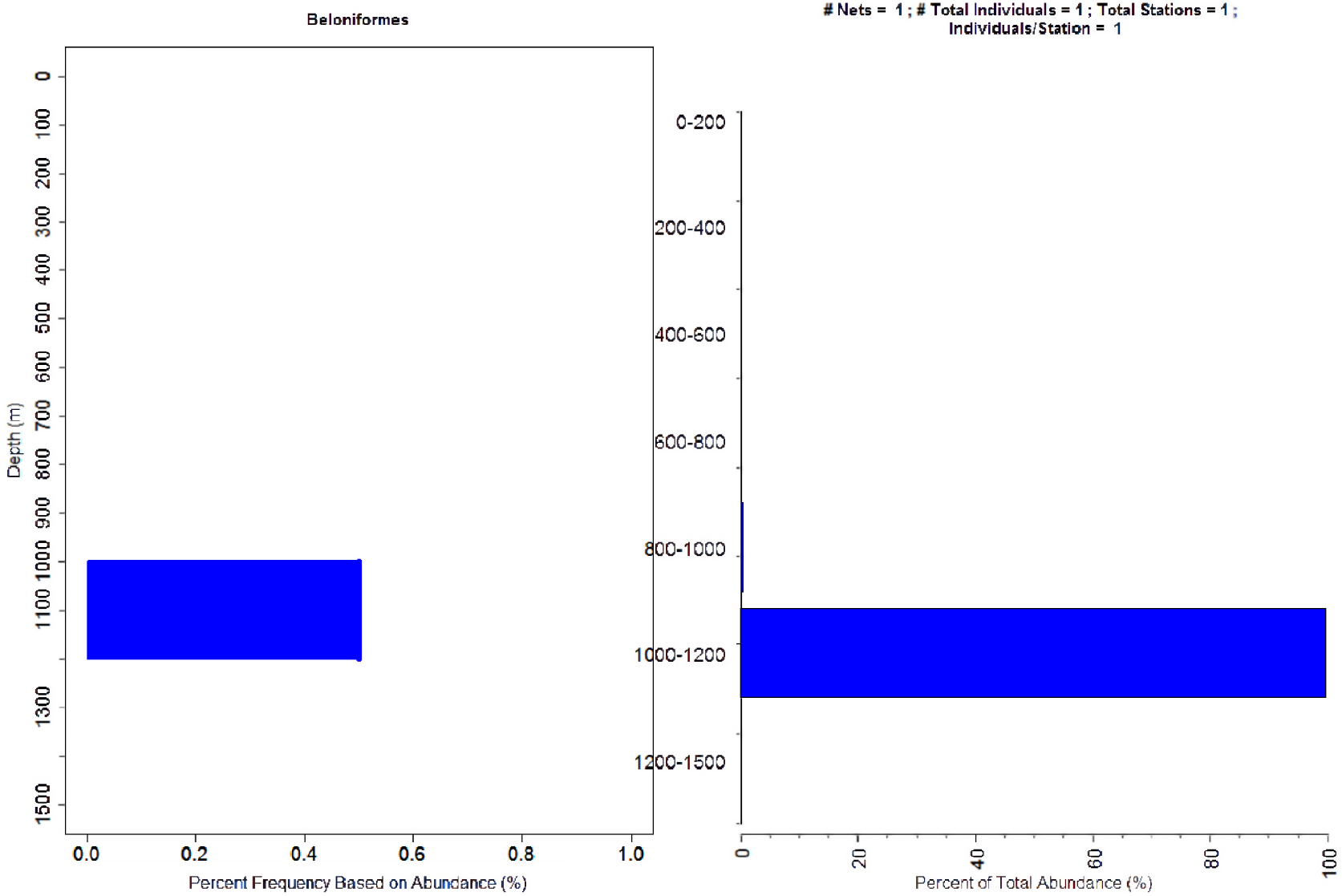
Aphragmophora



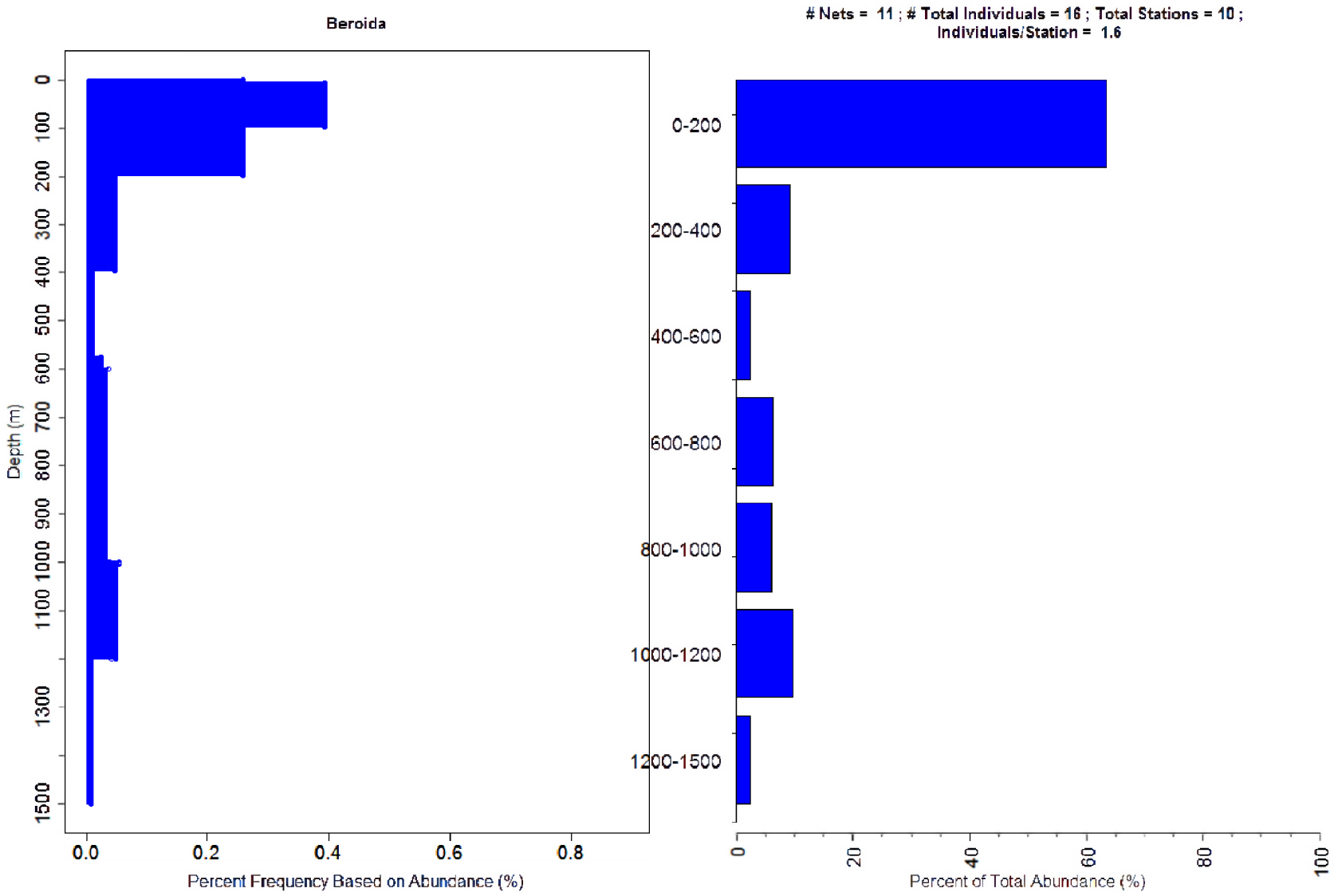
Argentiniformes



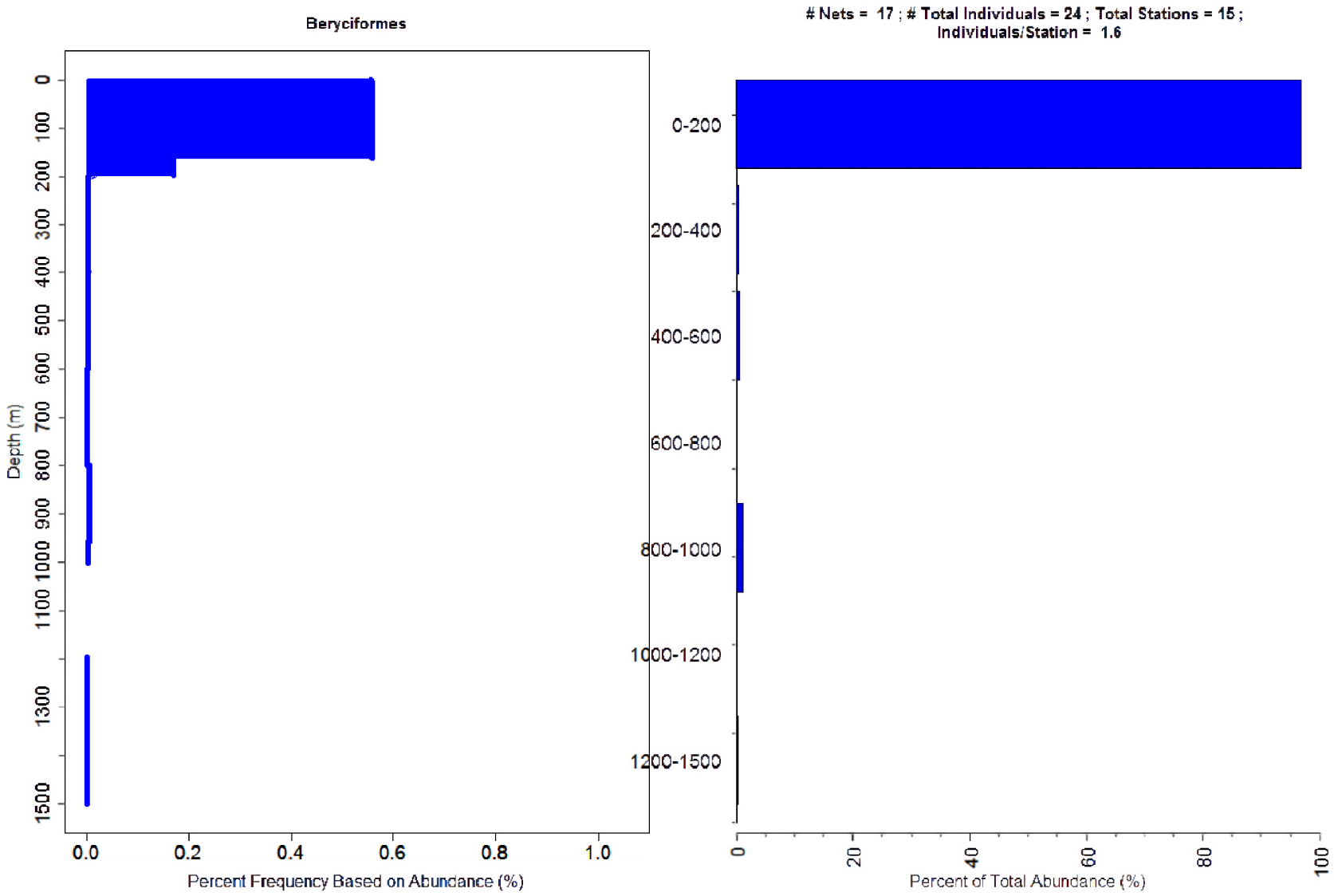
Aulopiformes



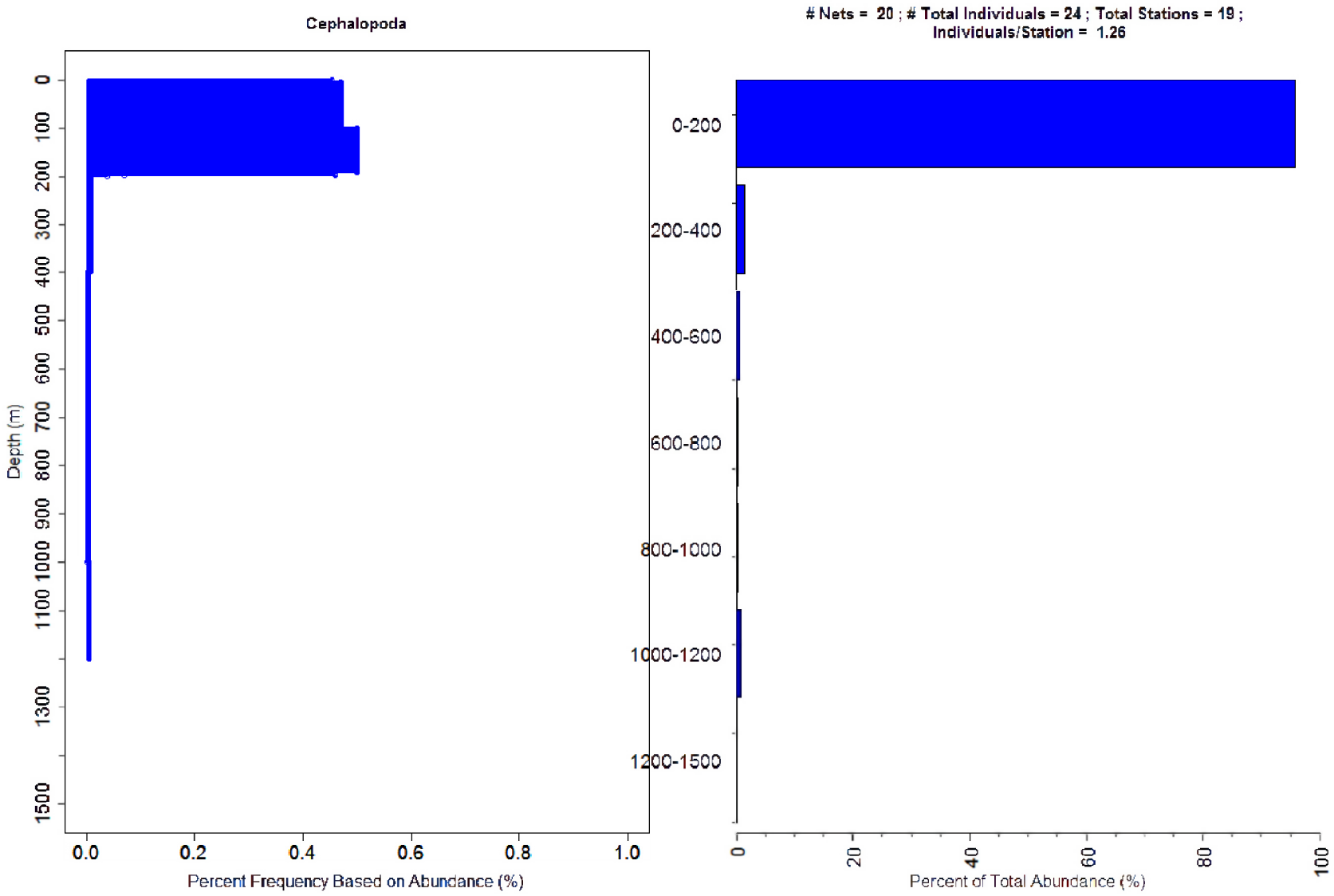
Beloniformes


Beroida
Nets = 11 ; # Total Individuals = 16 ; Total Stations = 10 ;
Individuals/Station = 1.6
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

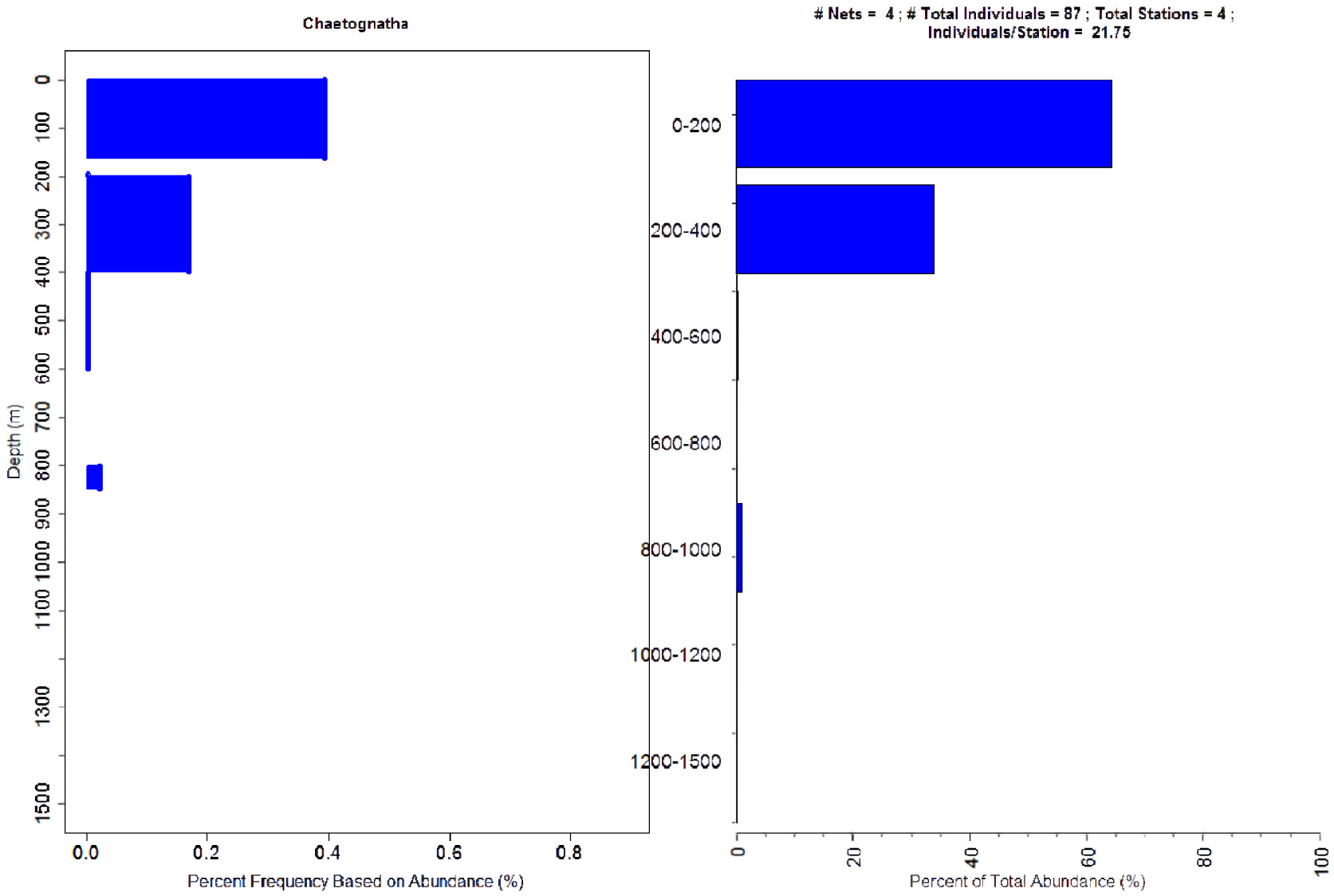
Beroida



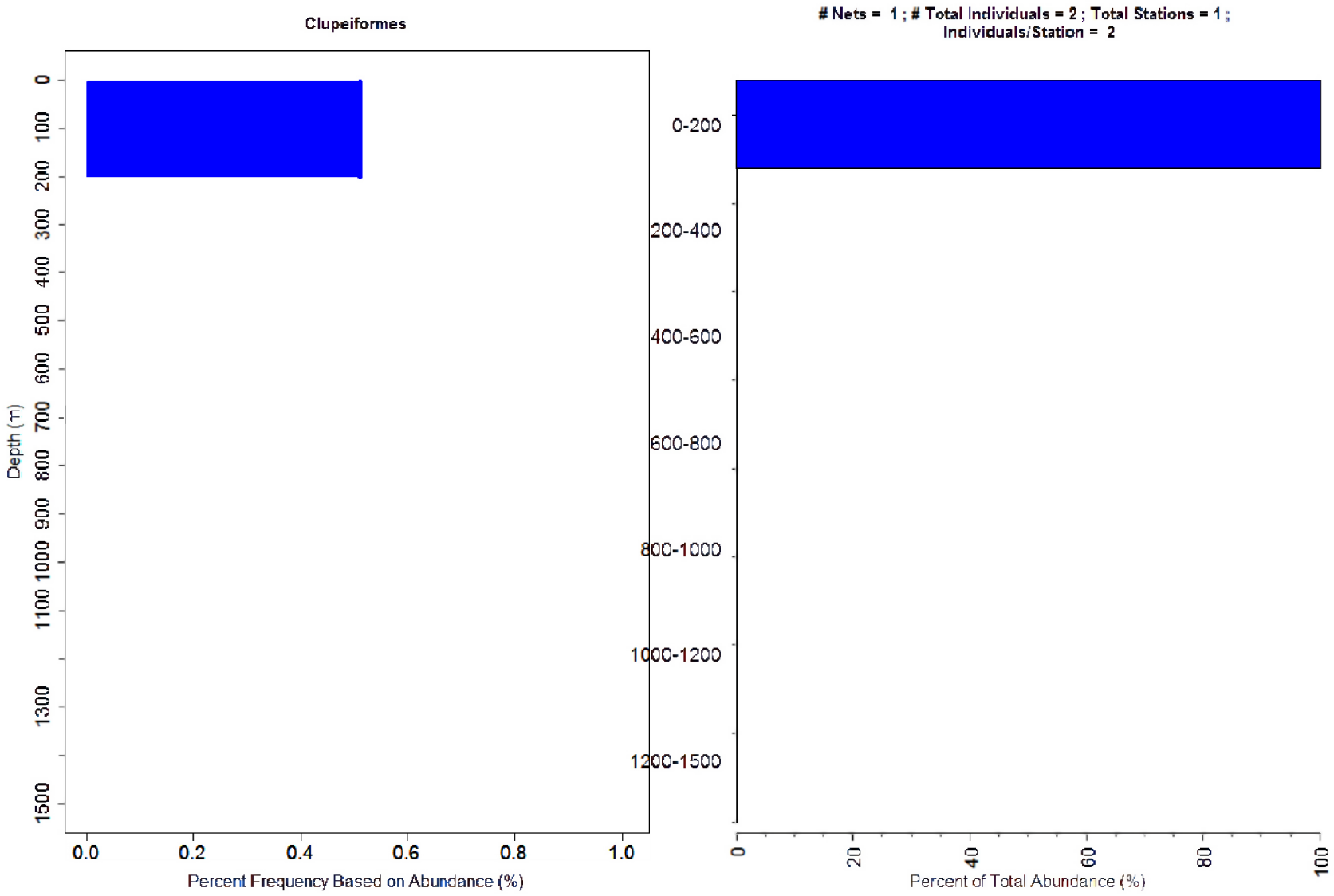
Beryciformes



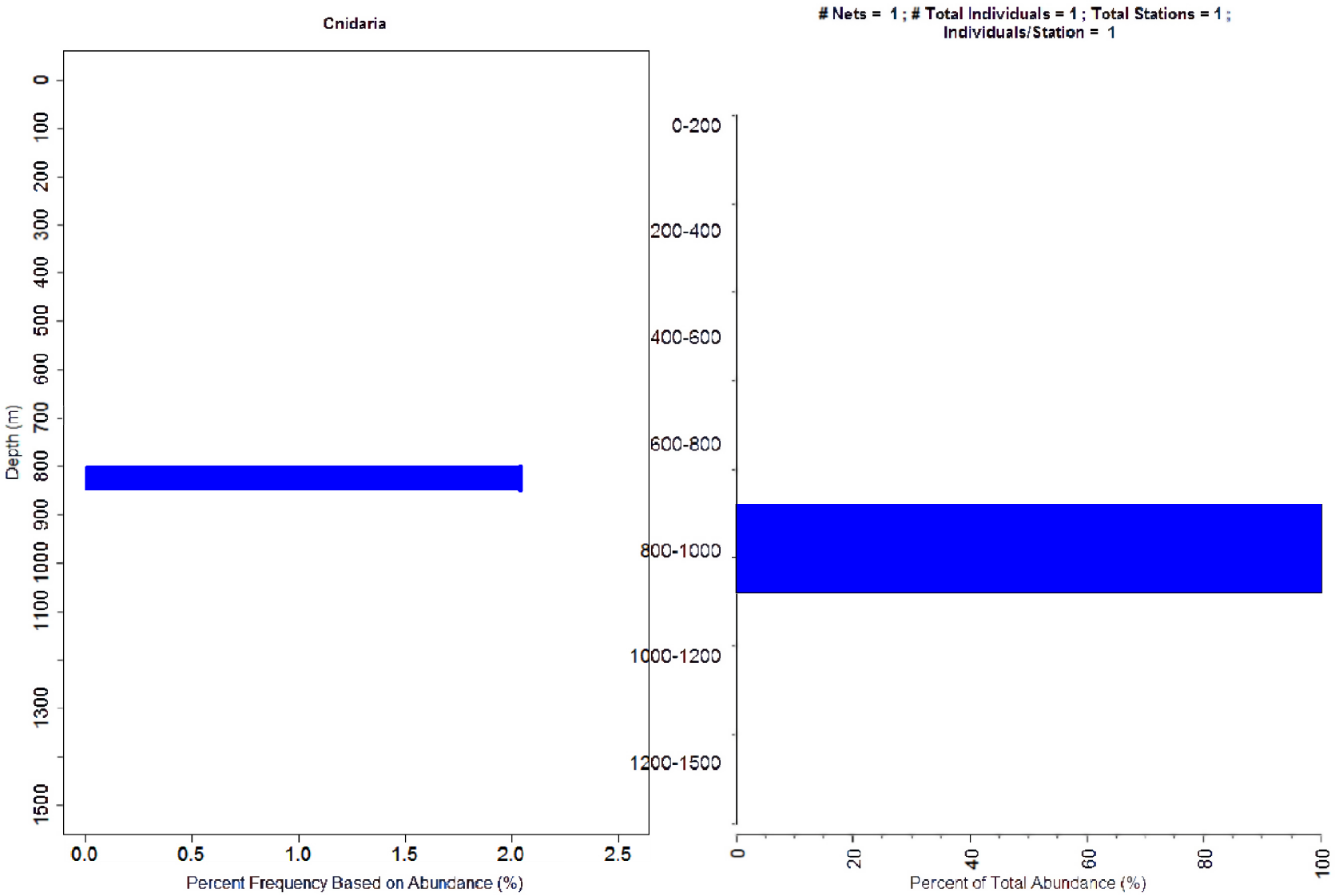
Cephalopoda



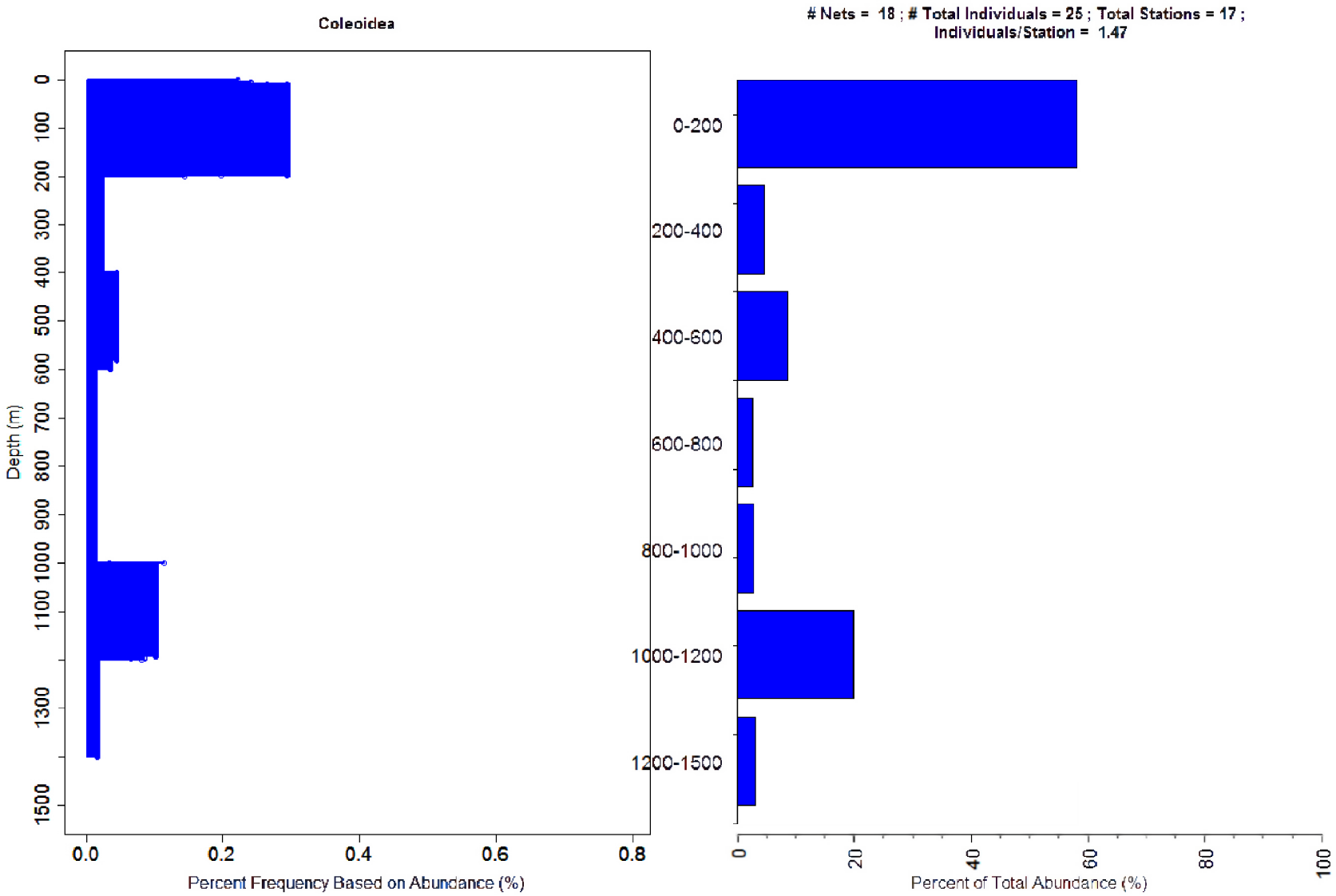
Chaetognatha



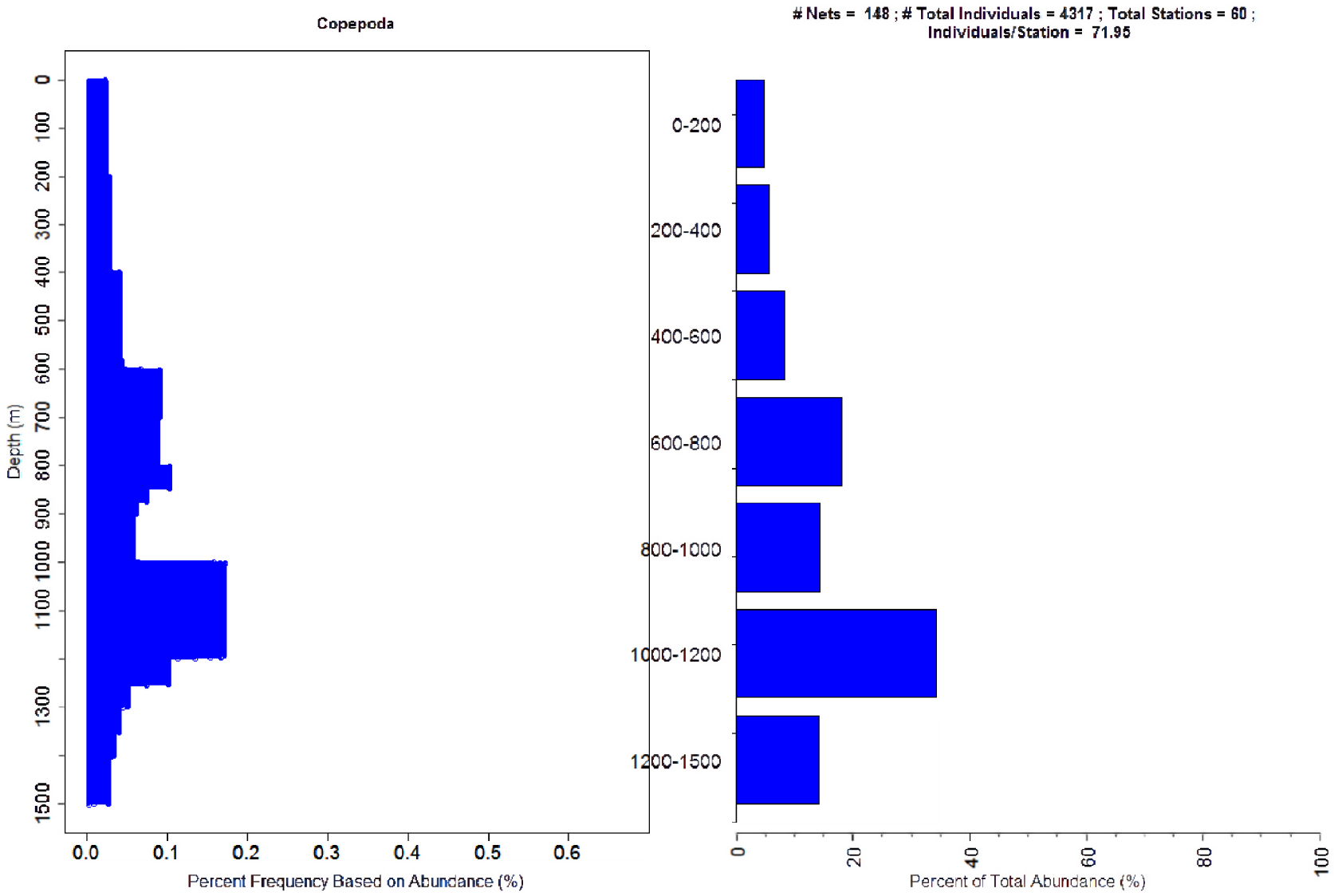
Clupeiformes


Cnidaria
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.5
1.0
1.5
2.0
2.5
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

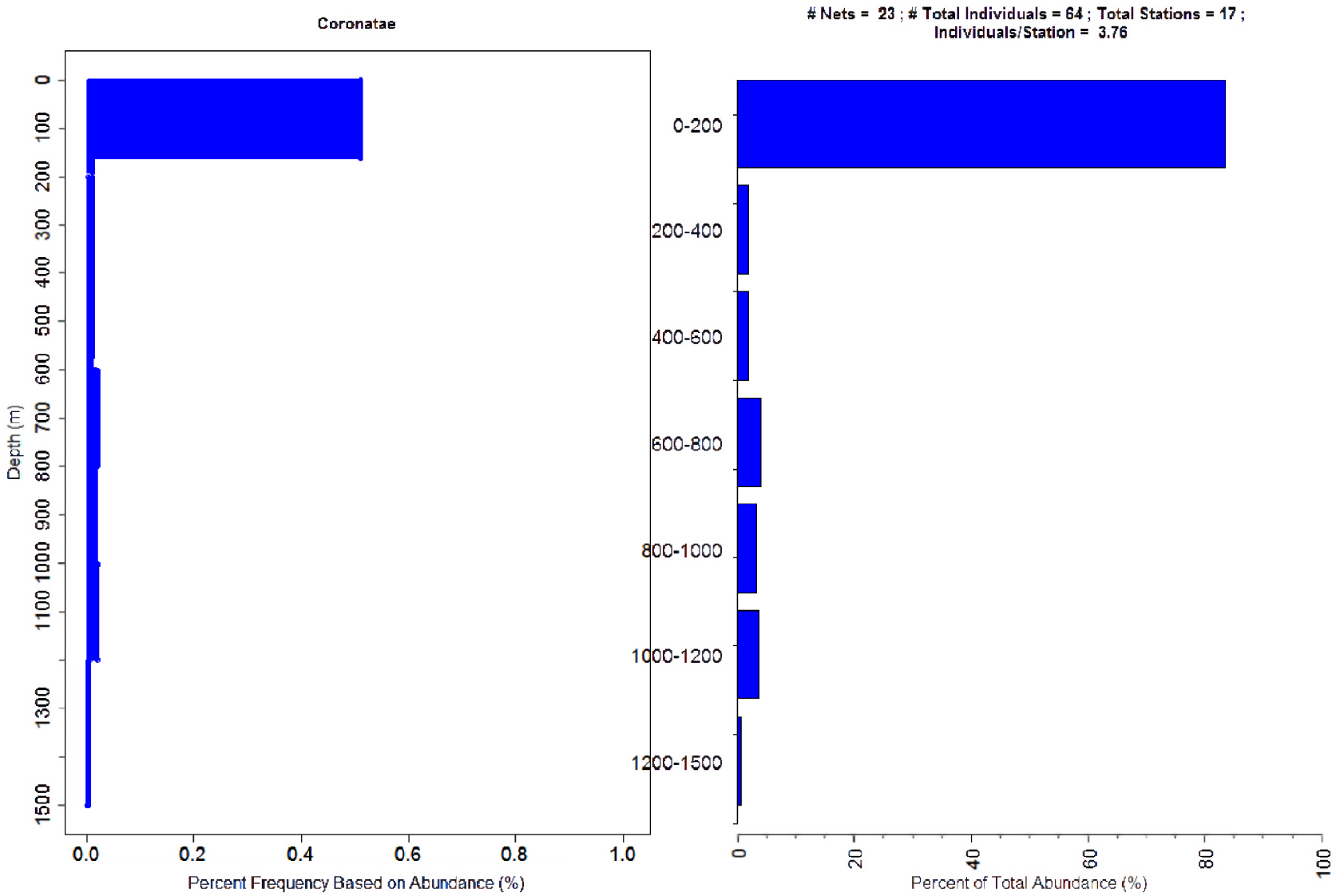
Cnidaria


Coleoidea
Nets = 18 ; # Total Individuals = 25 ; Total Stations = 17 ;
Individuals/Station = 1.47
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

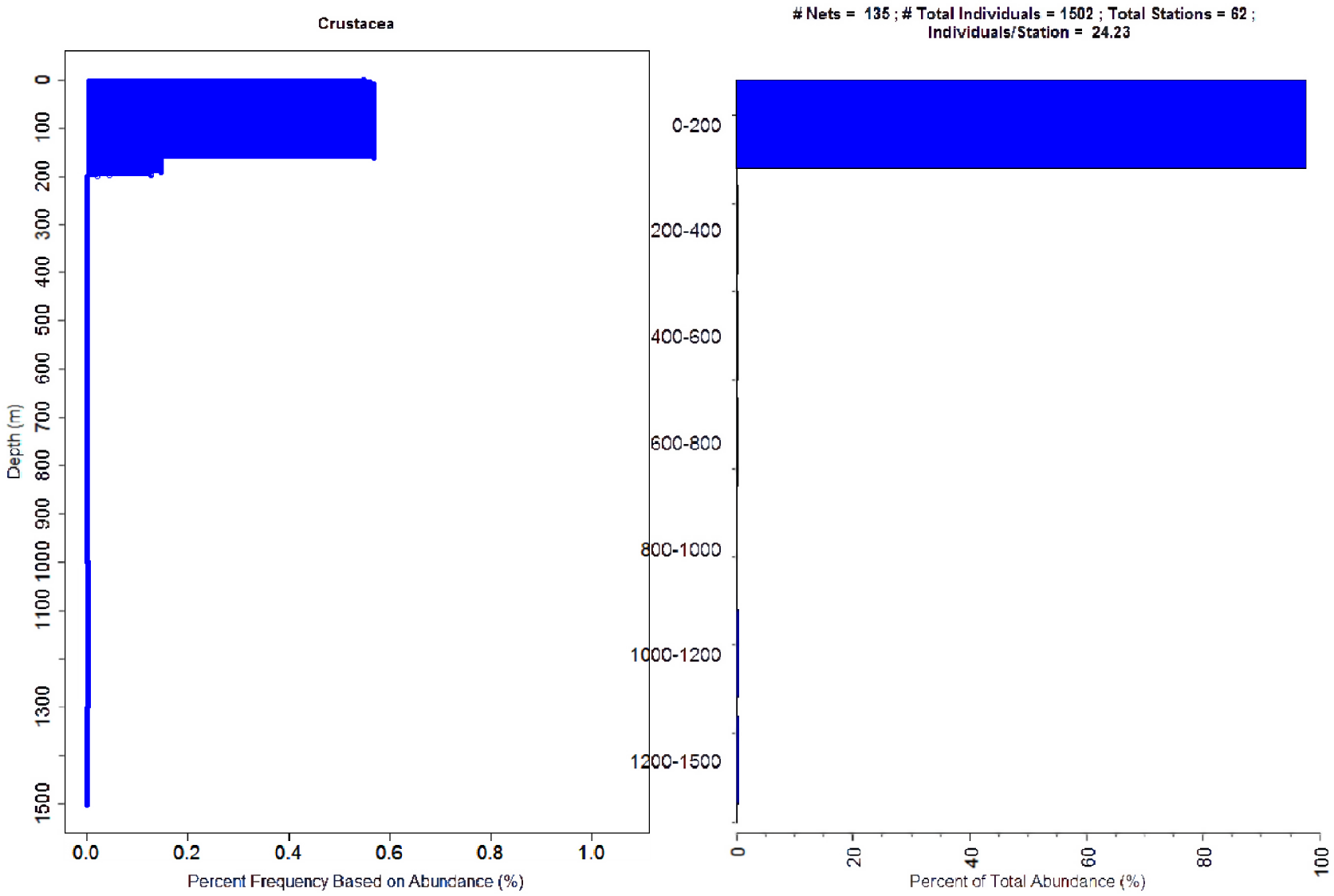
Coleoidea


Copepoda
Nets = 148 ; # Total Individuals = 4317 ; Total Stations = 60 ;
Individuals/Station = 71.95
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

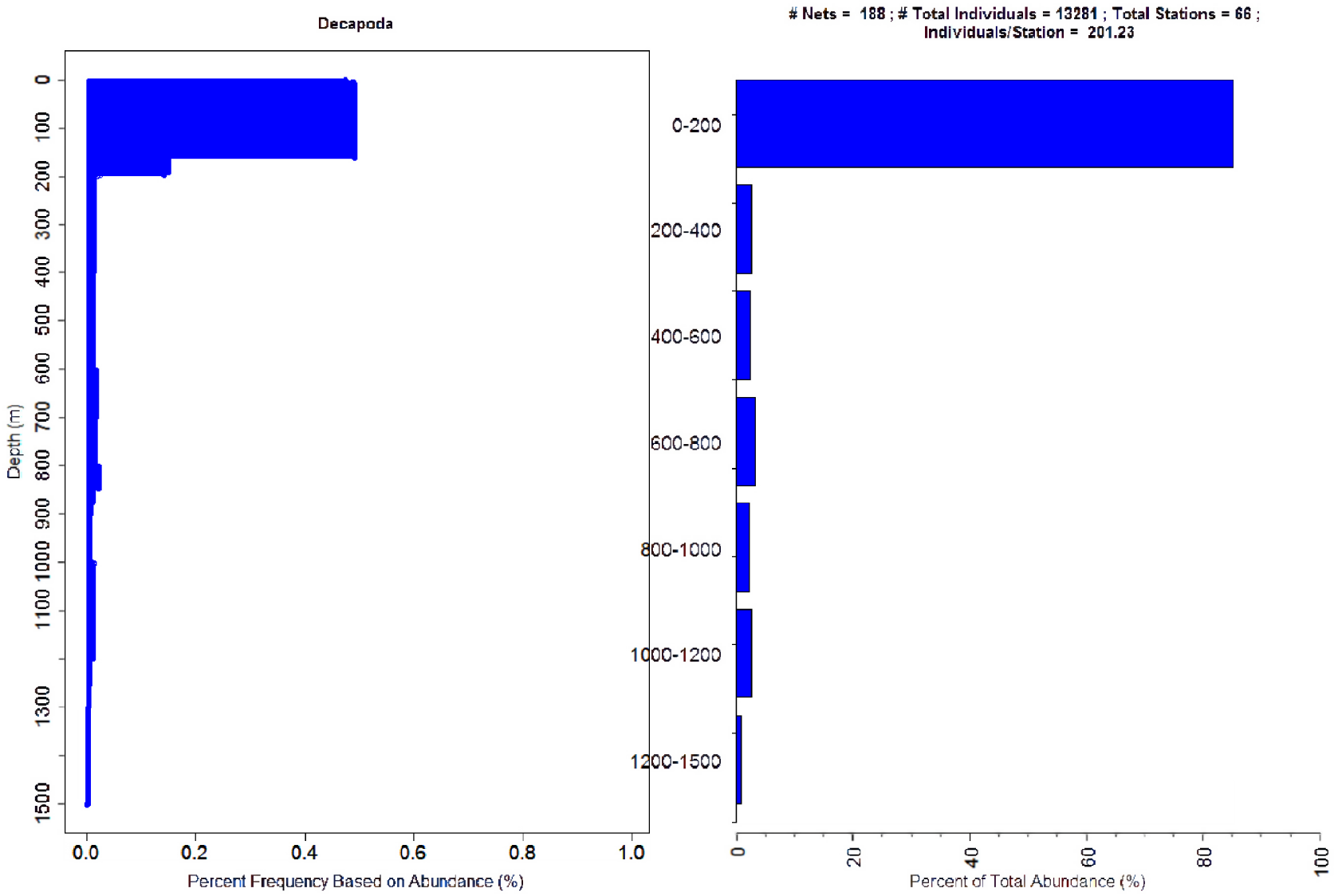
Copepoda


Coronatae
Nets = 23 ; # Total Individuals = 64 ; Total Stations = 17 ;
Individuals/Station = 3.76
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

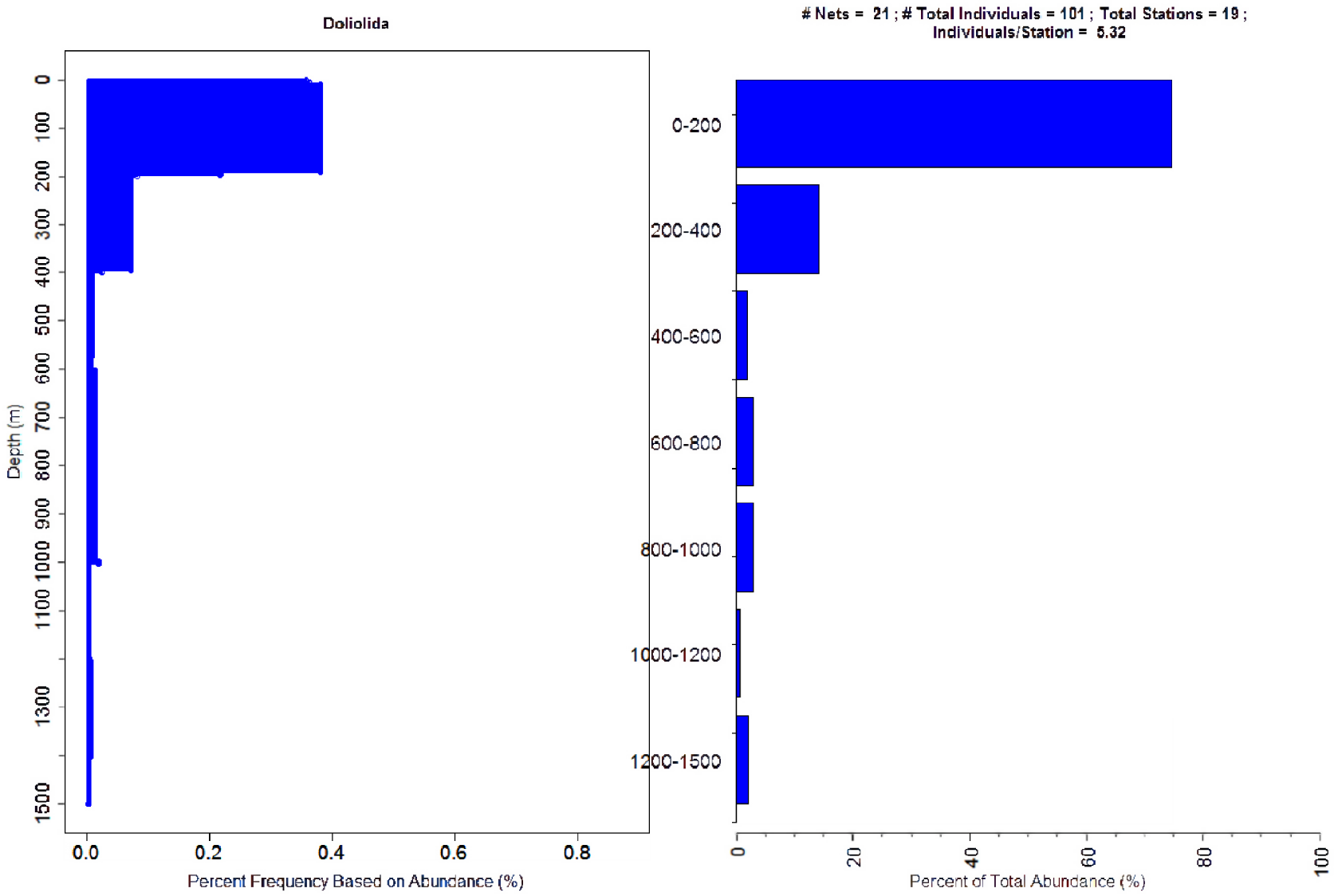
Coronatae


Crustacea
Nets = 135 ; # Total Individuals = 1502 ; Total Stations = 62 ;
Individuals/Station = 24.23
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

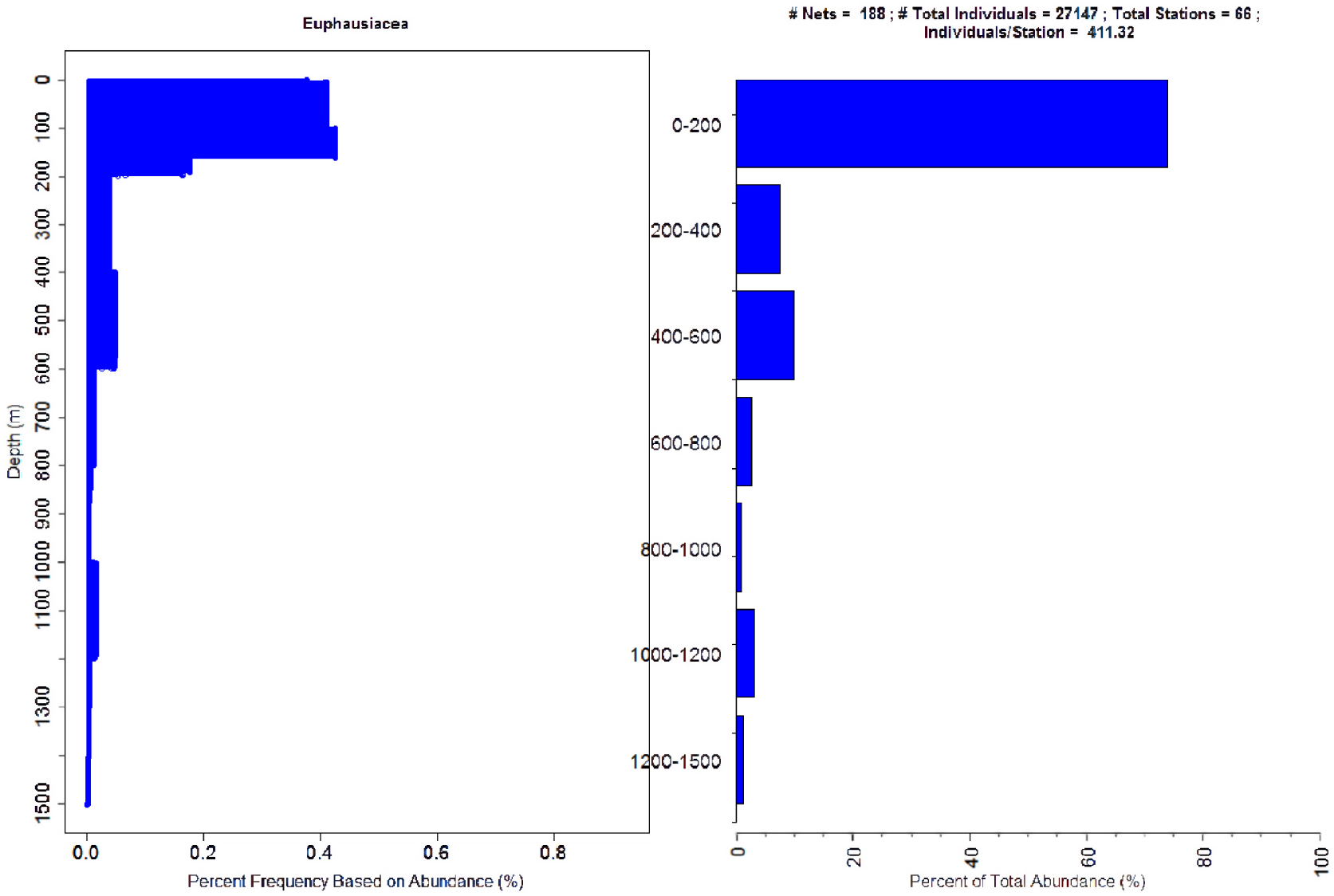
Crustacea


Decapoda
Nets = 188 ; # Total Individuals = 13281 ; Total Stations = 66 ;
Individuals/Station = 201.23
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

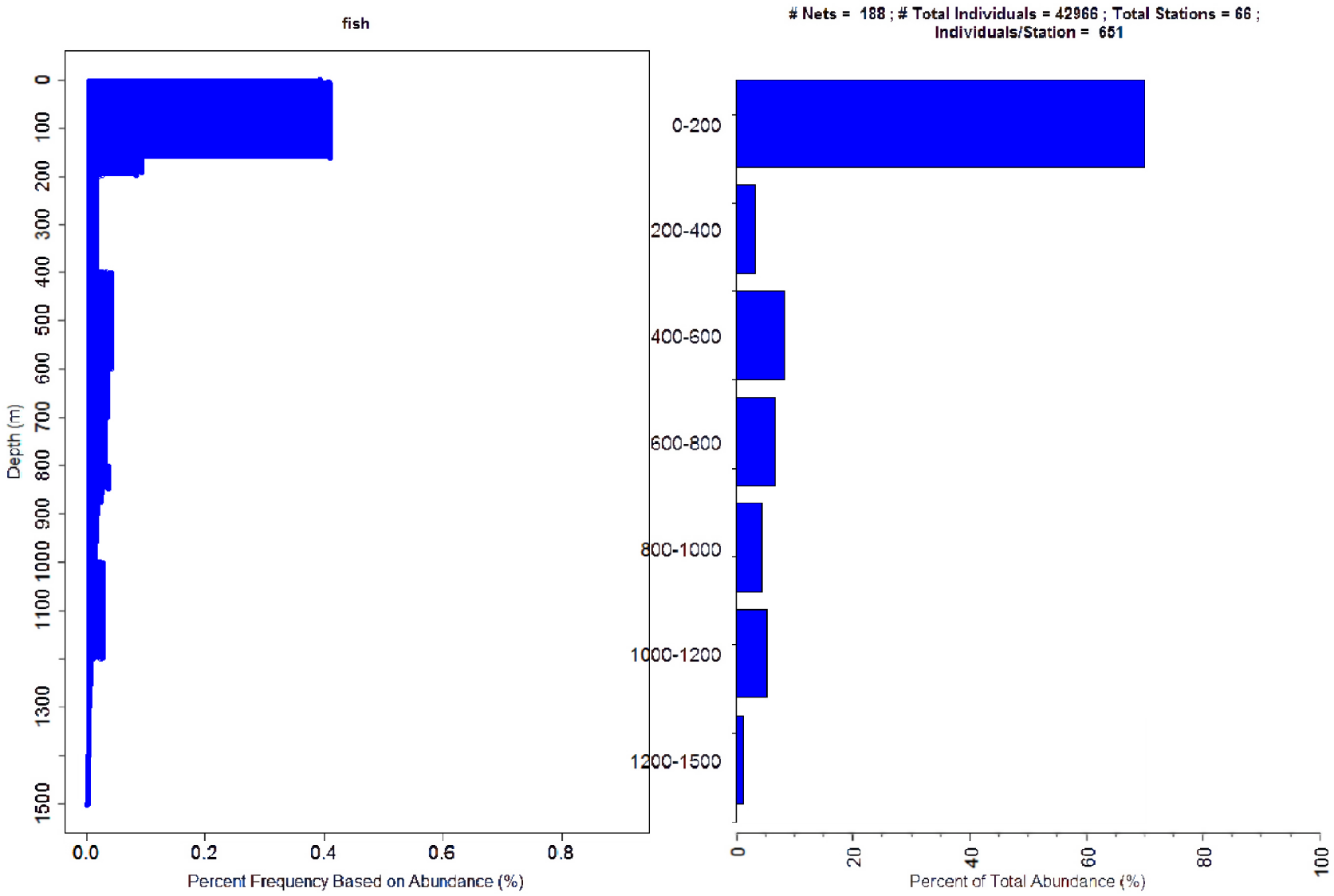
Decapoda


Doliolida
Nets = 21 ; # Total Individuals = 101 ; Total Stations = 19 ;
Individuals/Station = 5.32
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

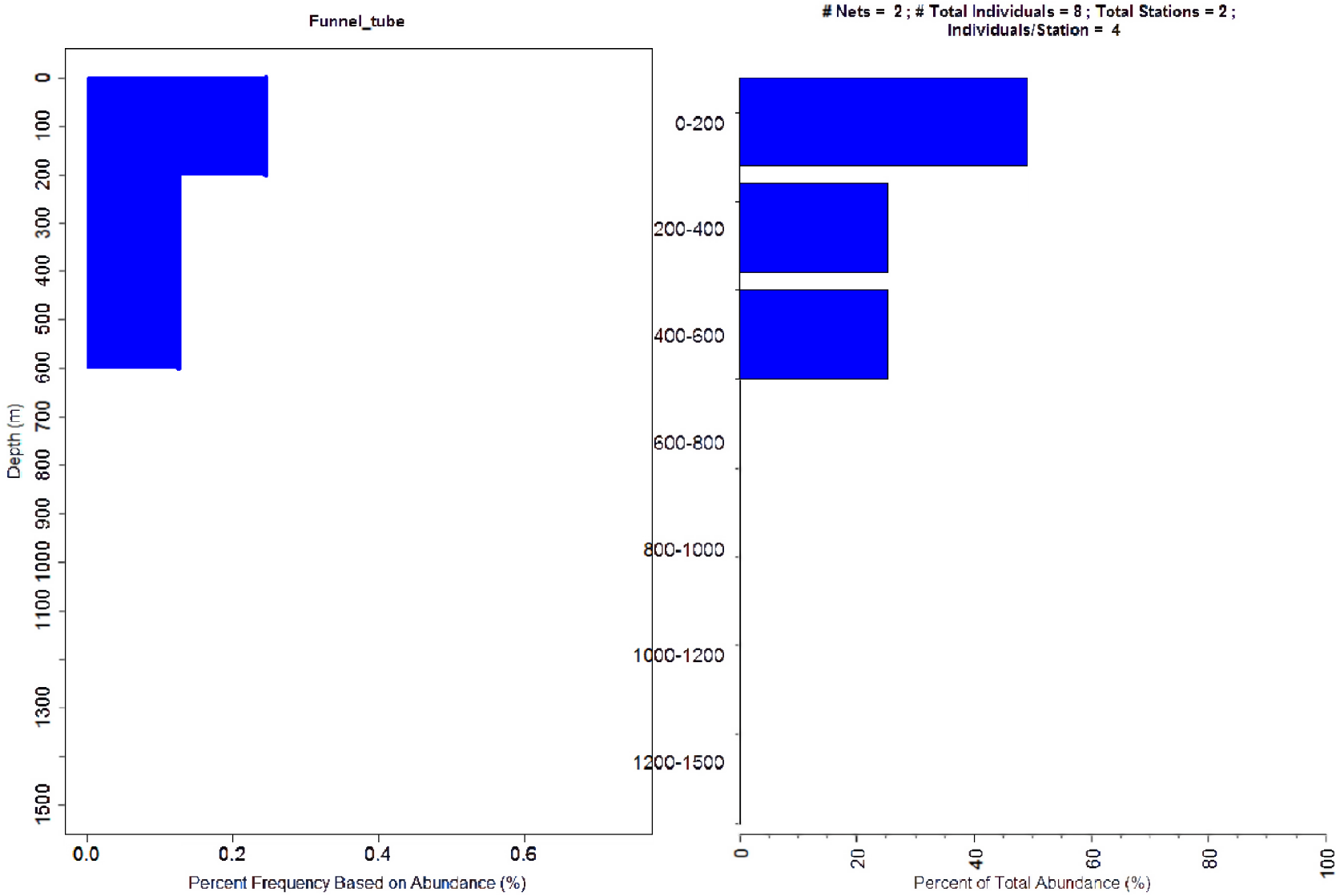
Doliolida



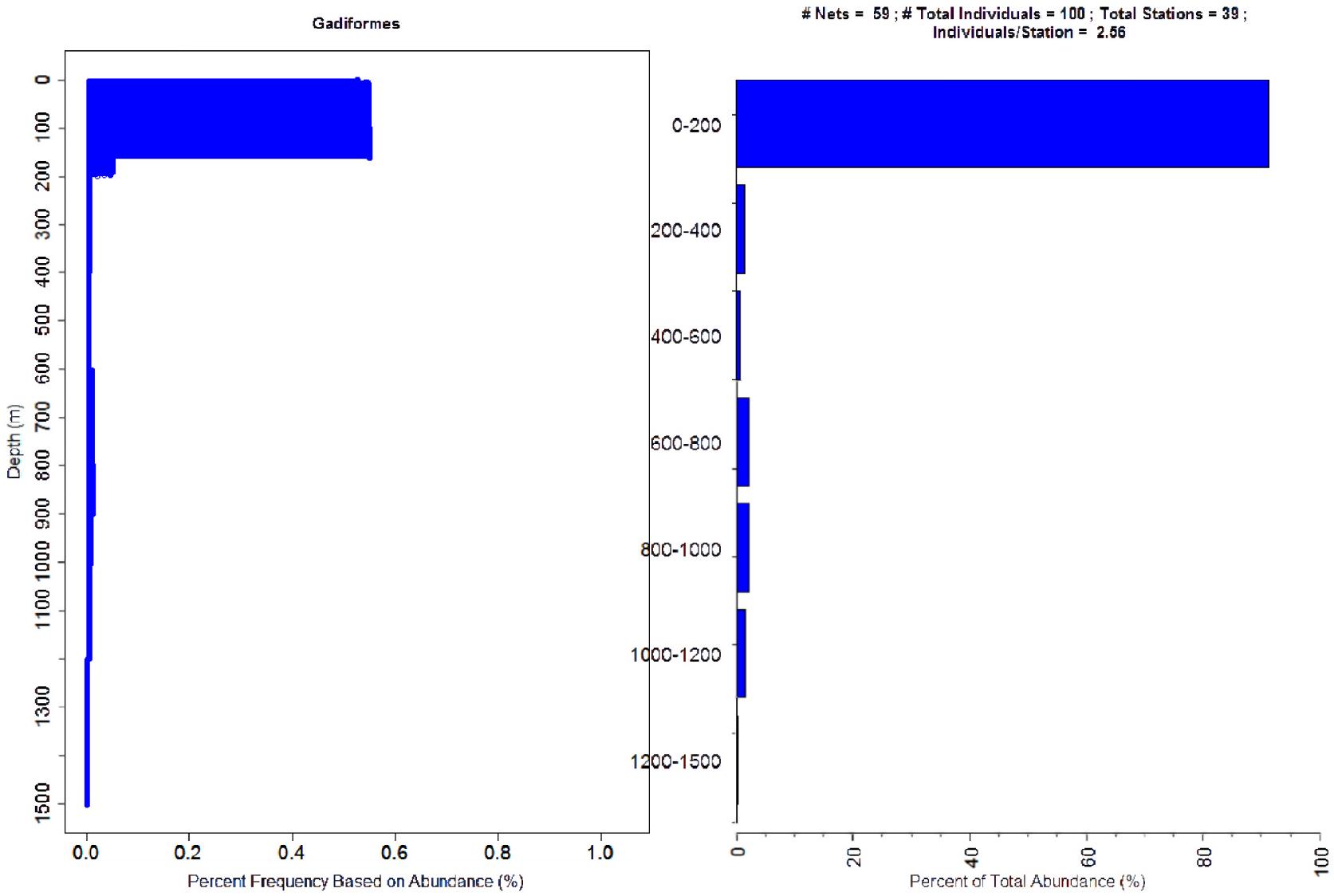
Euphausiacea


fish
Nets = 188 ; # Total Individuals = 42966 ; Total Stations = 66 ;
Individuals/Station = 651
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

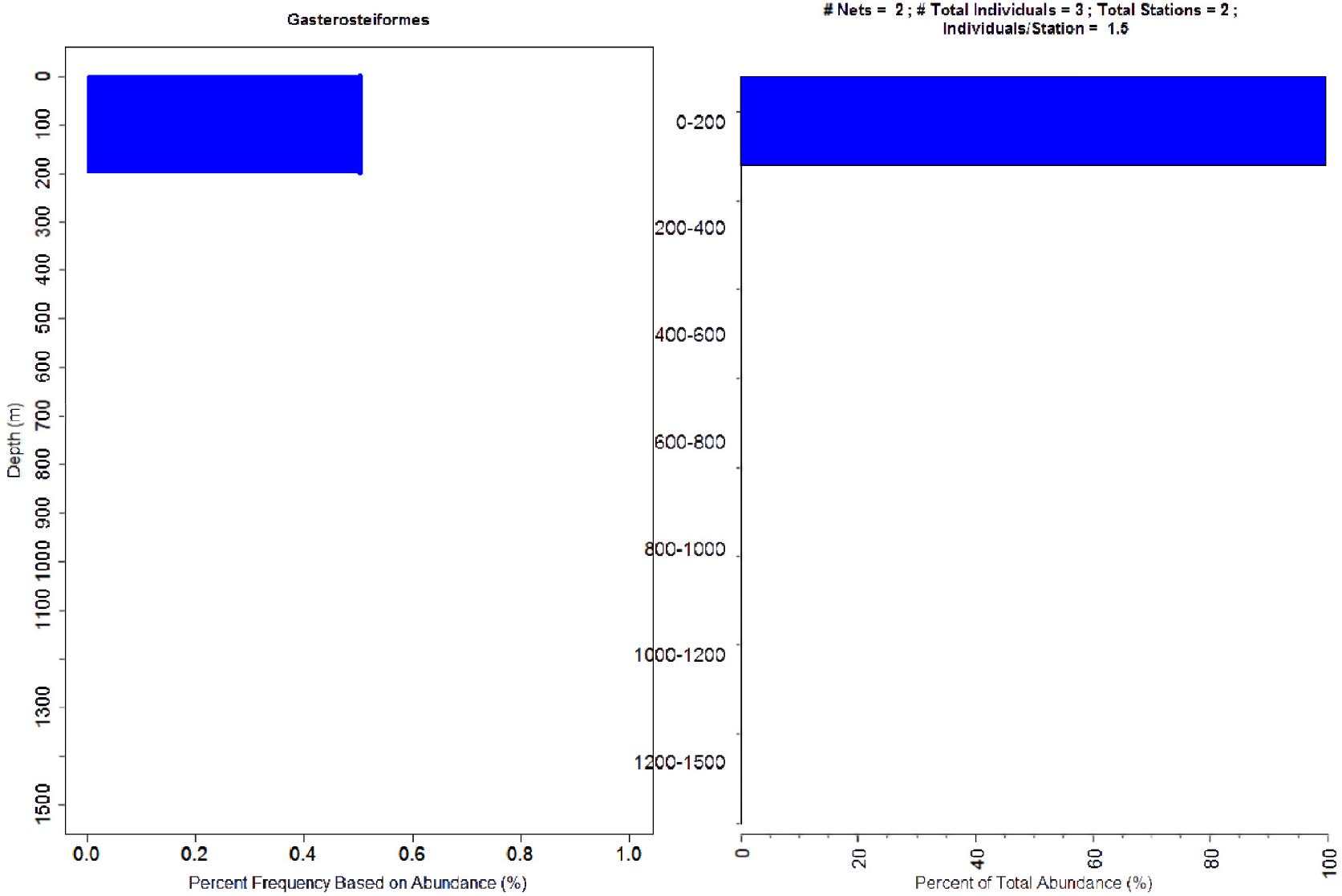
fish


Funnel_tube
Nets = 2 ; # Total Individuals = 8 ; Total Stations = 2 ;
Individuals/Station = 4
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

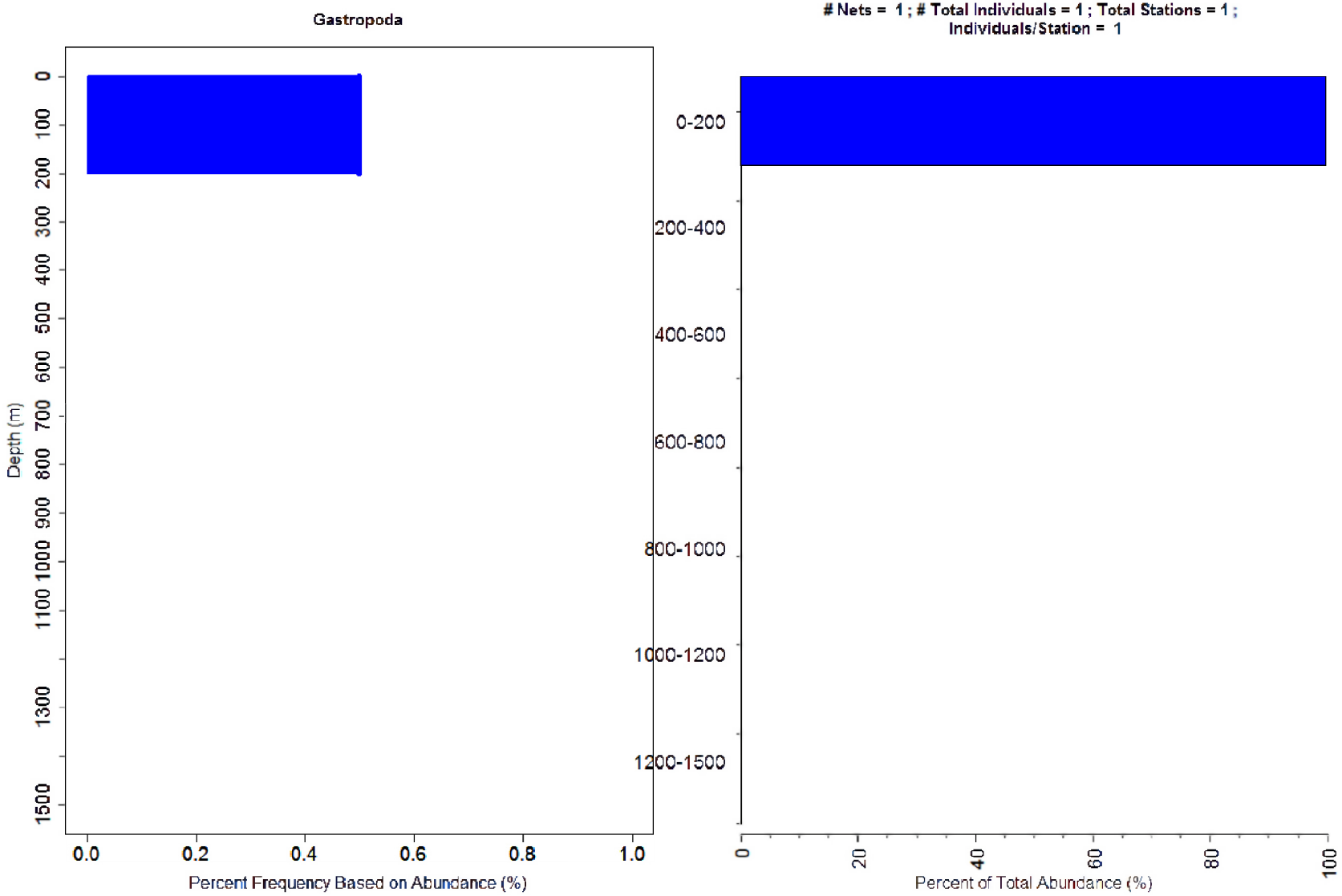
Funnel_tube


Gadiformes
Nets = 59 ; # Total Individuals = 100 ; Total Stations = 39 ;
Individuals/Station = 2.56
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

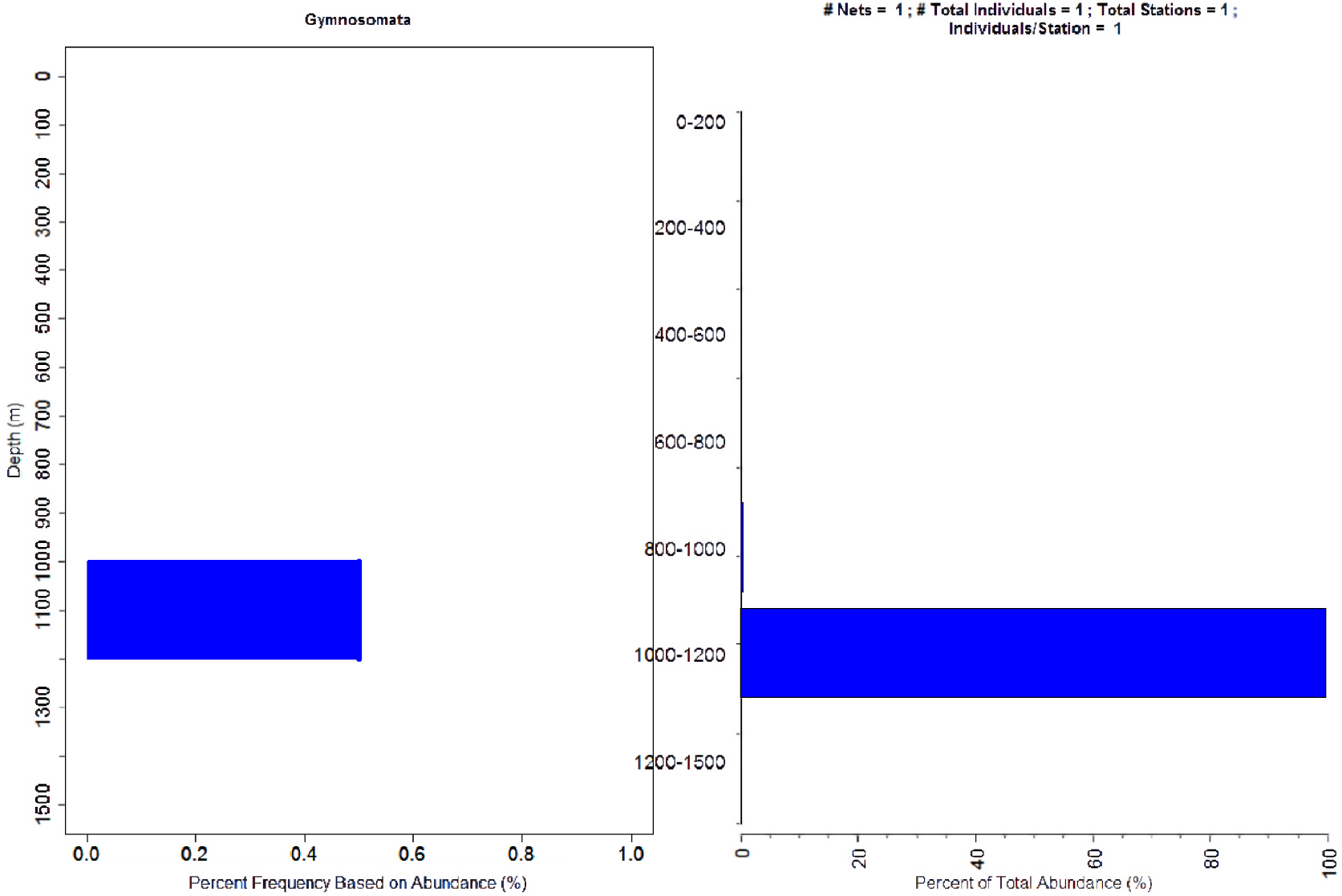
Gadiformes



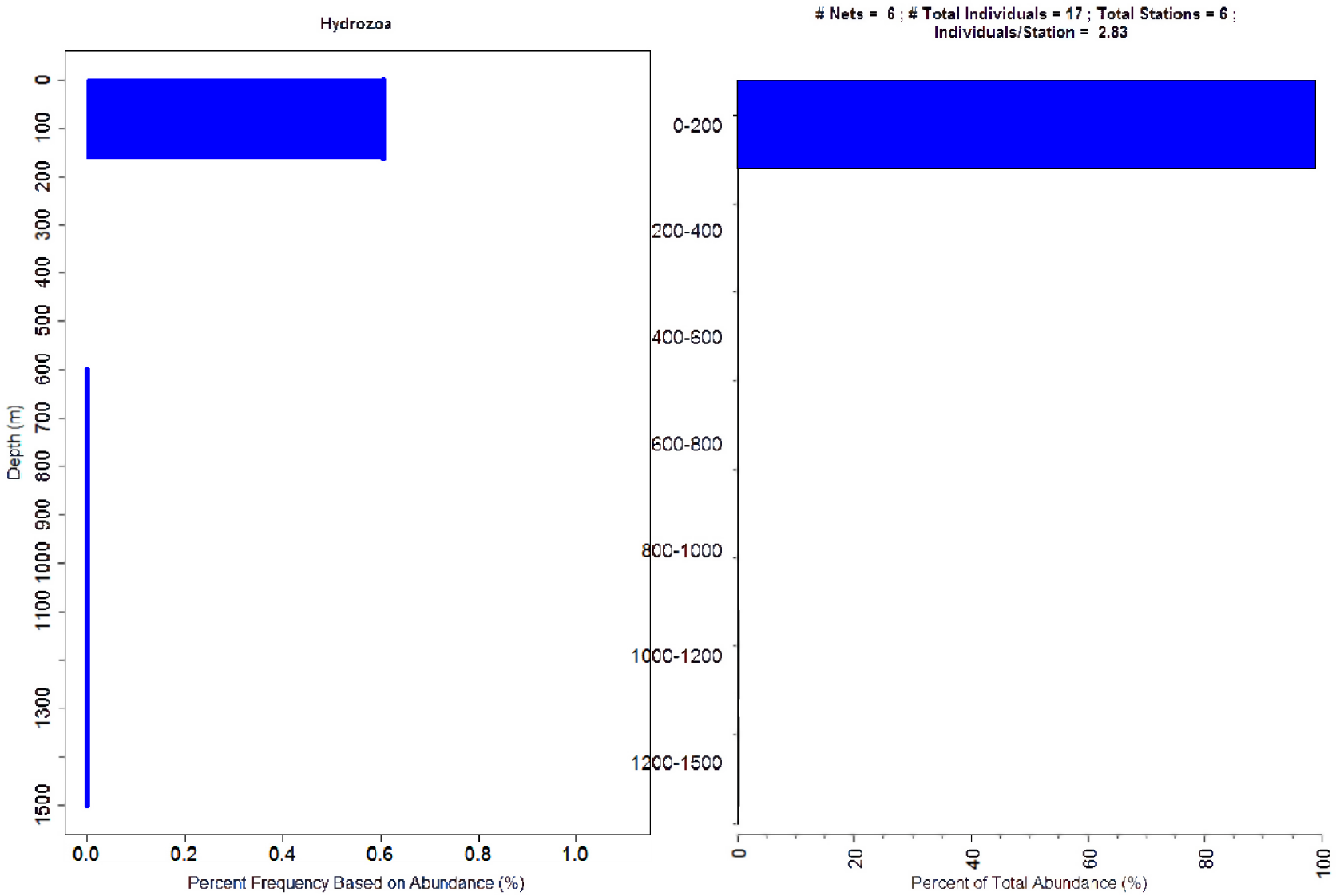
Gasterosteiformes


Gastropoda
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

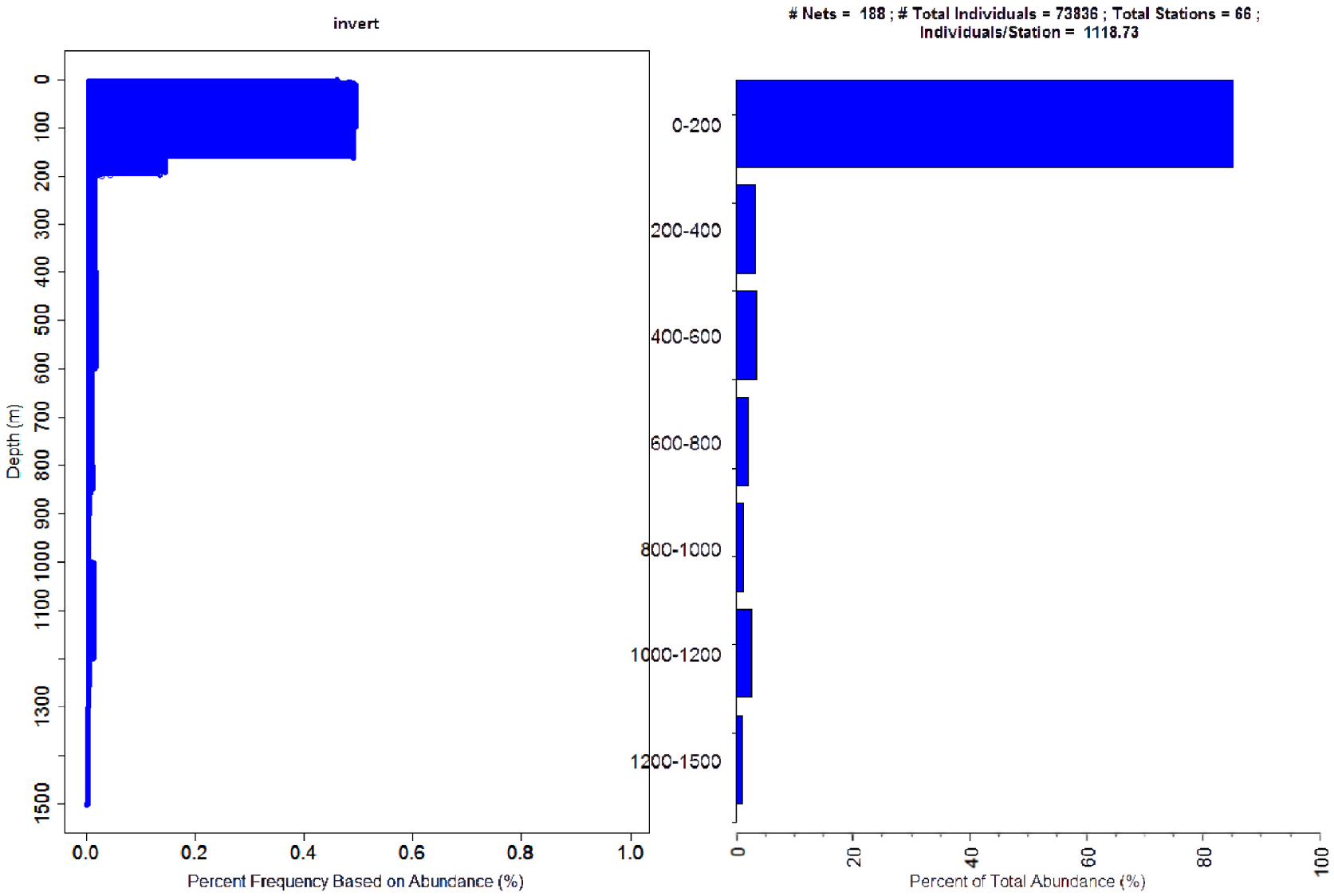
Gastropoda



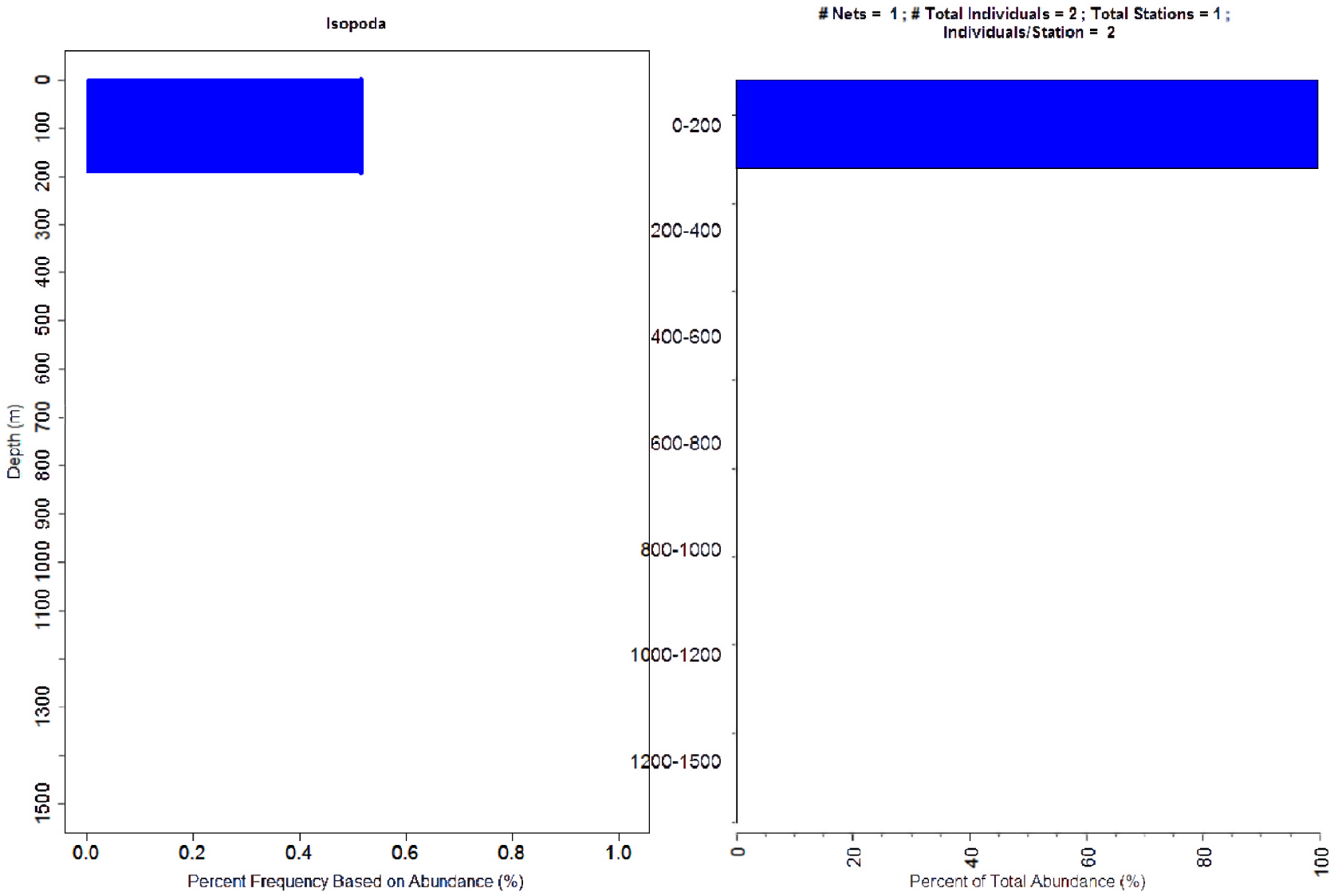
Gymnosomata


Hydrozoa
Nets = 6 ; # Total Individuals = 17 ; Total Stations = 6 ;
Individuals/Station = 2.83
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

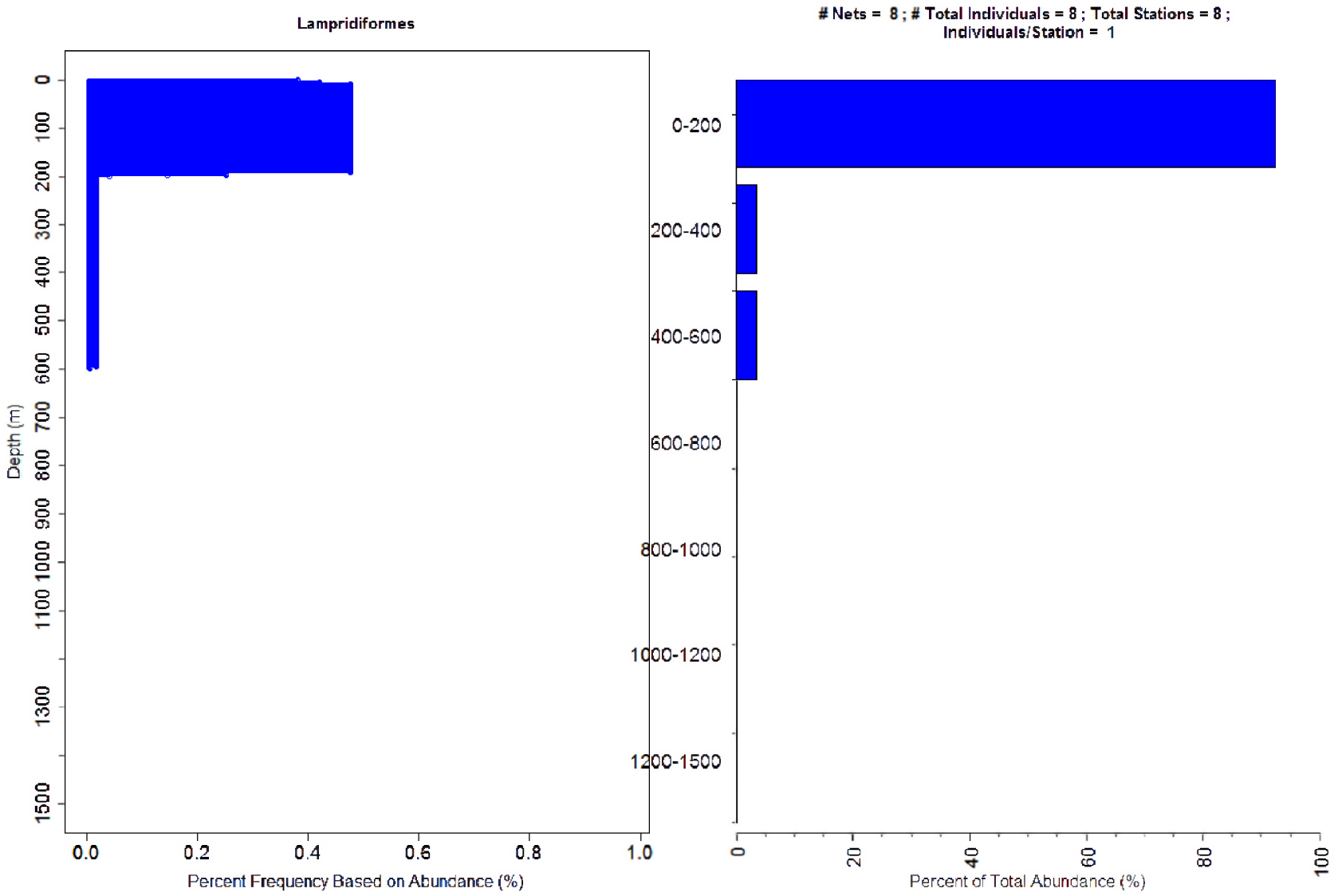
Hydrozoa


invert
Nets = 188 ; # Total Individuals = 73836 ; Total Stations = 66 ;
Individuals/Station = 1118.73
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

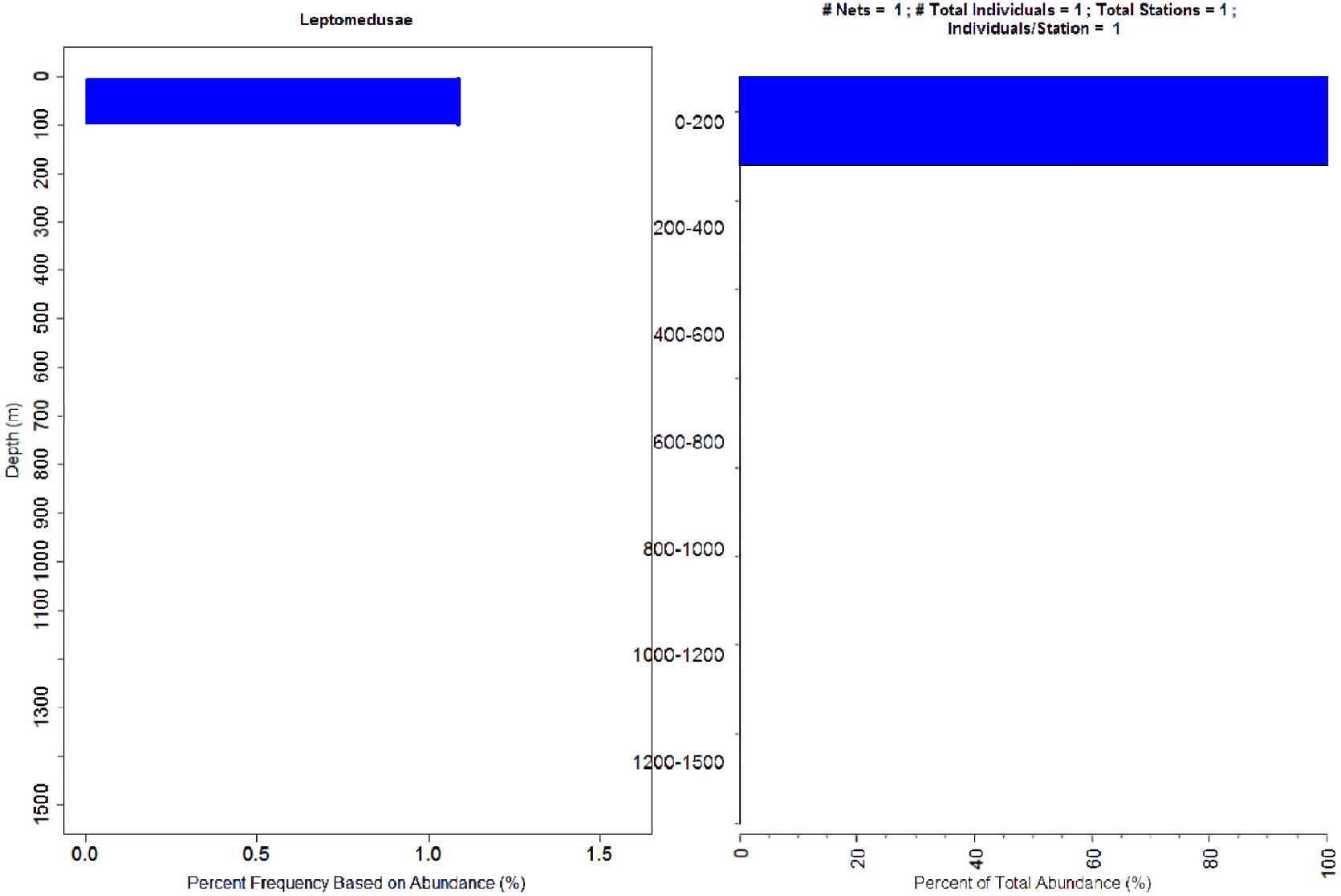
invert


Isopoda
Nets = 1 ; # Total Individuals = 2 ; Total Stations = 1 ;
Individuals/Station = 2
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

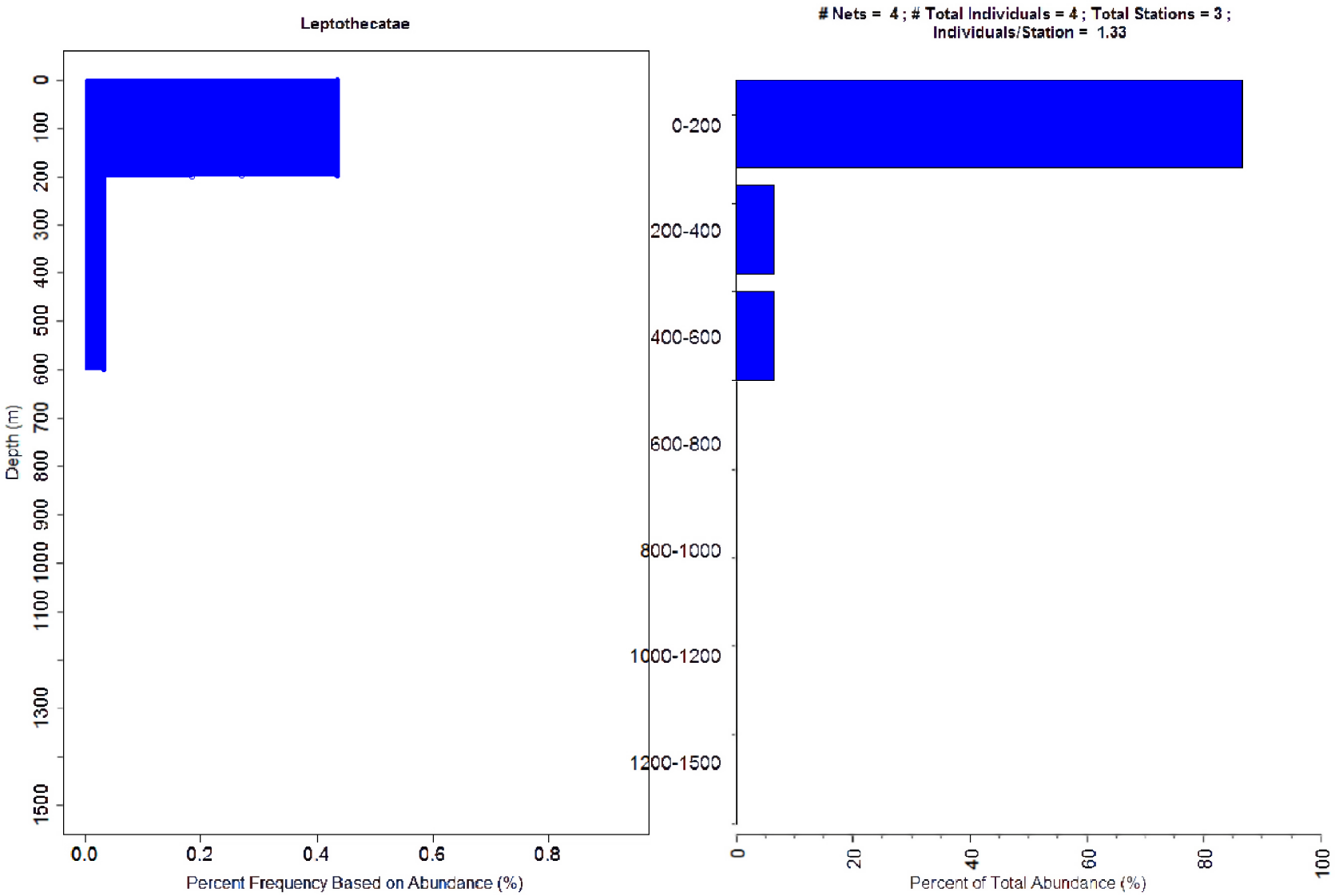
Isopoda



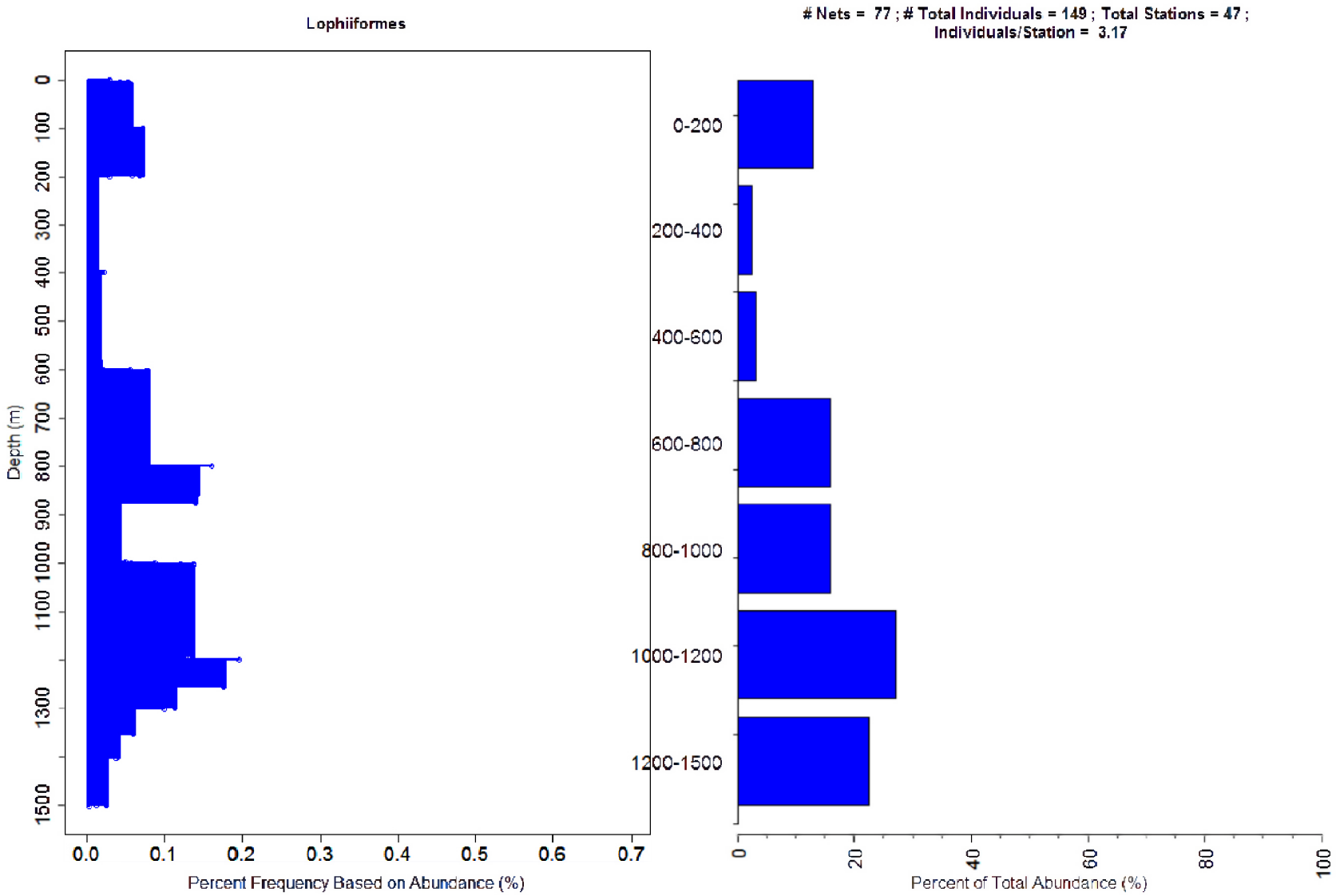
Lampridiformes



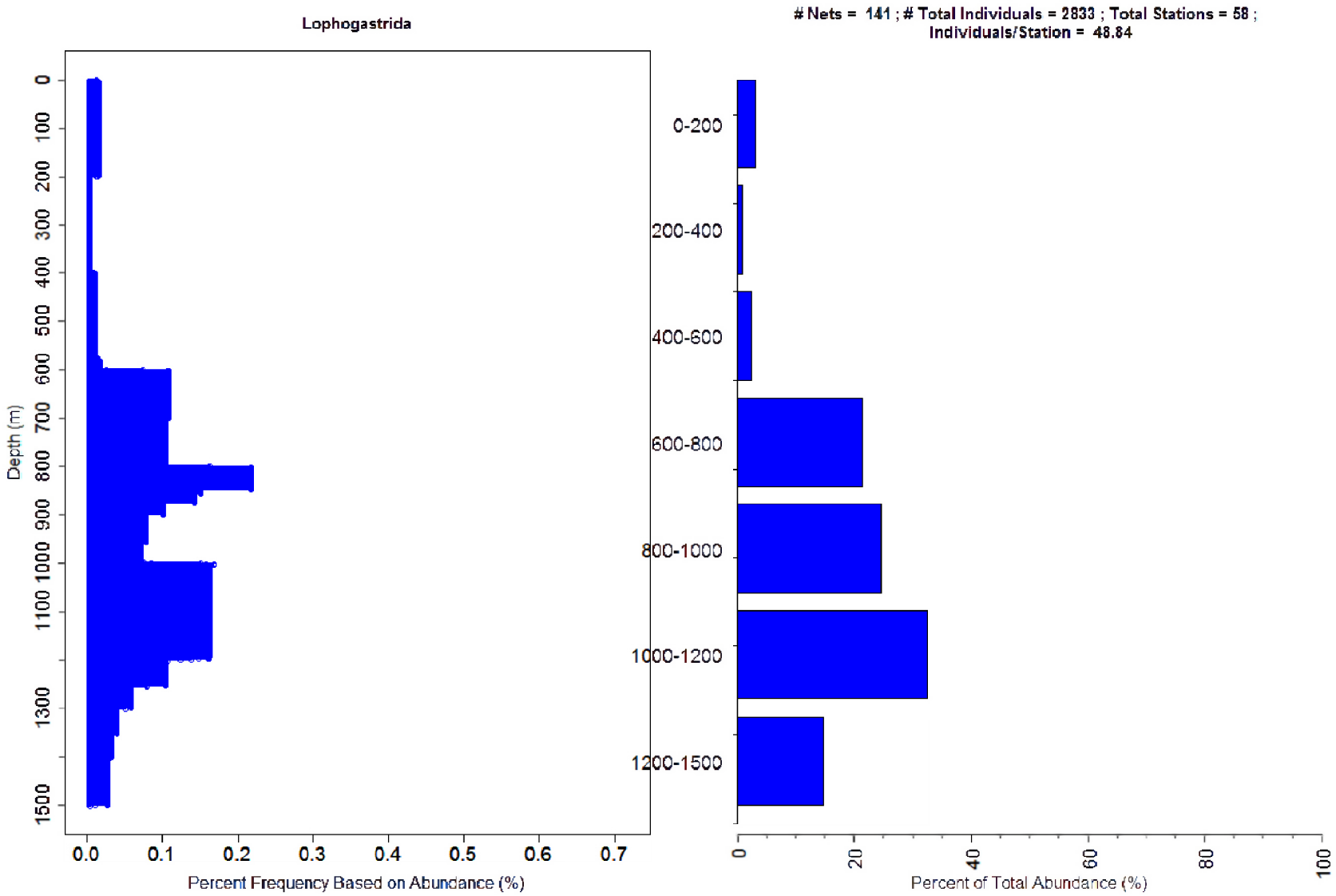
Leptomedusae



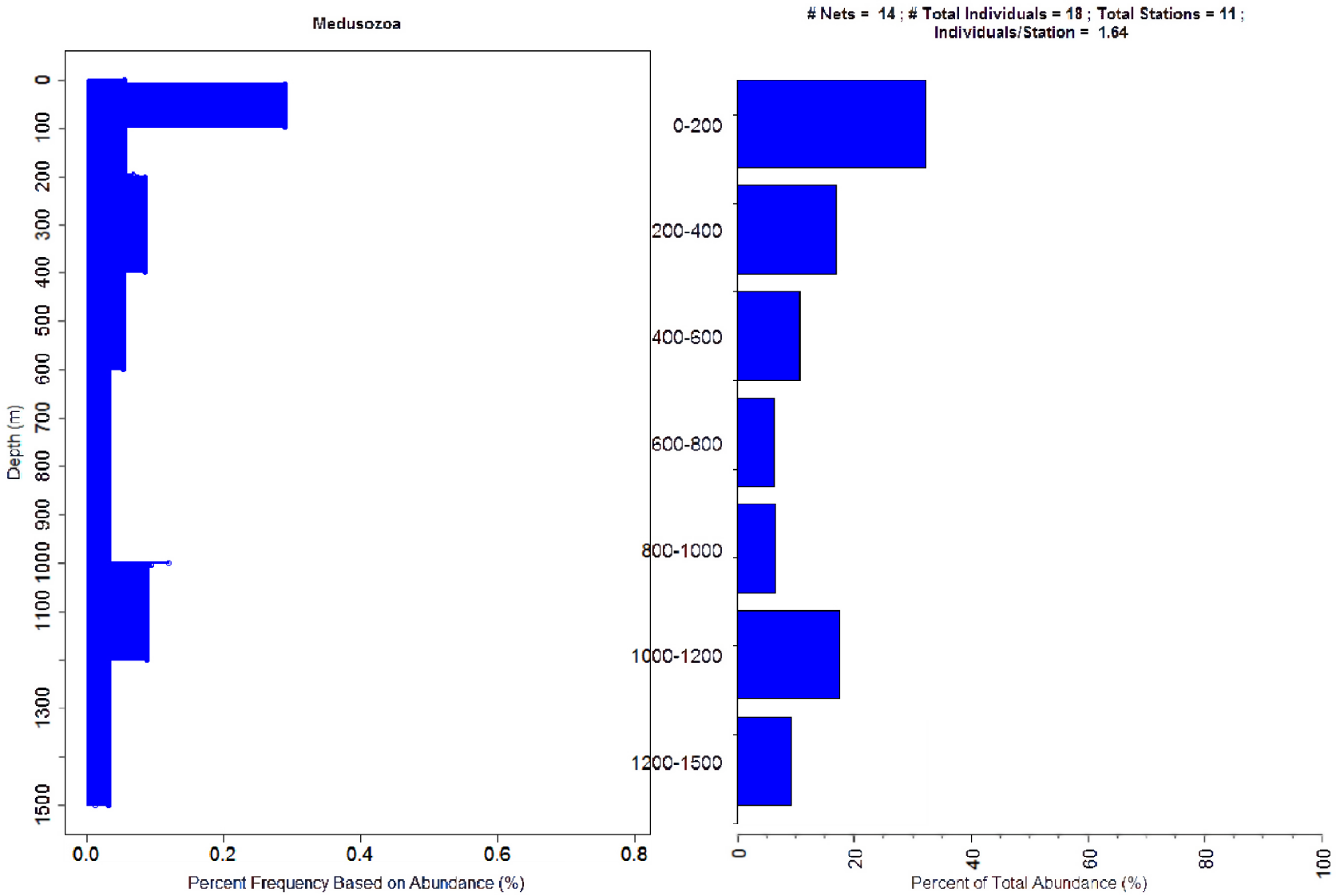
Leptothecatae



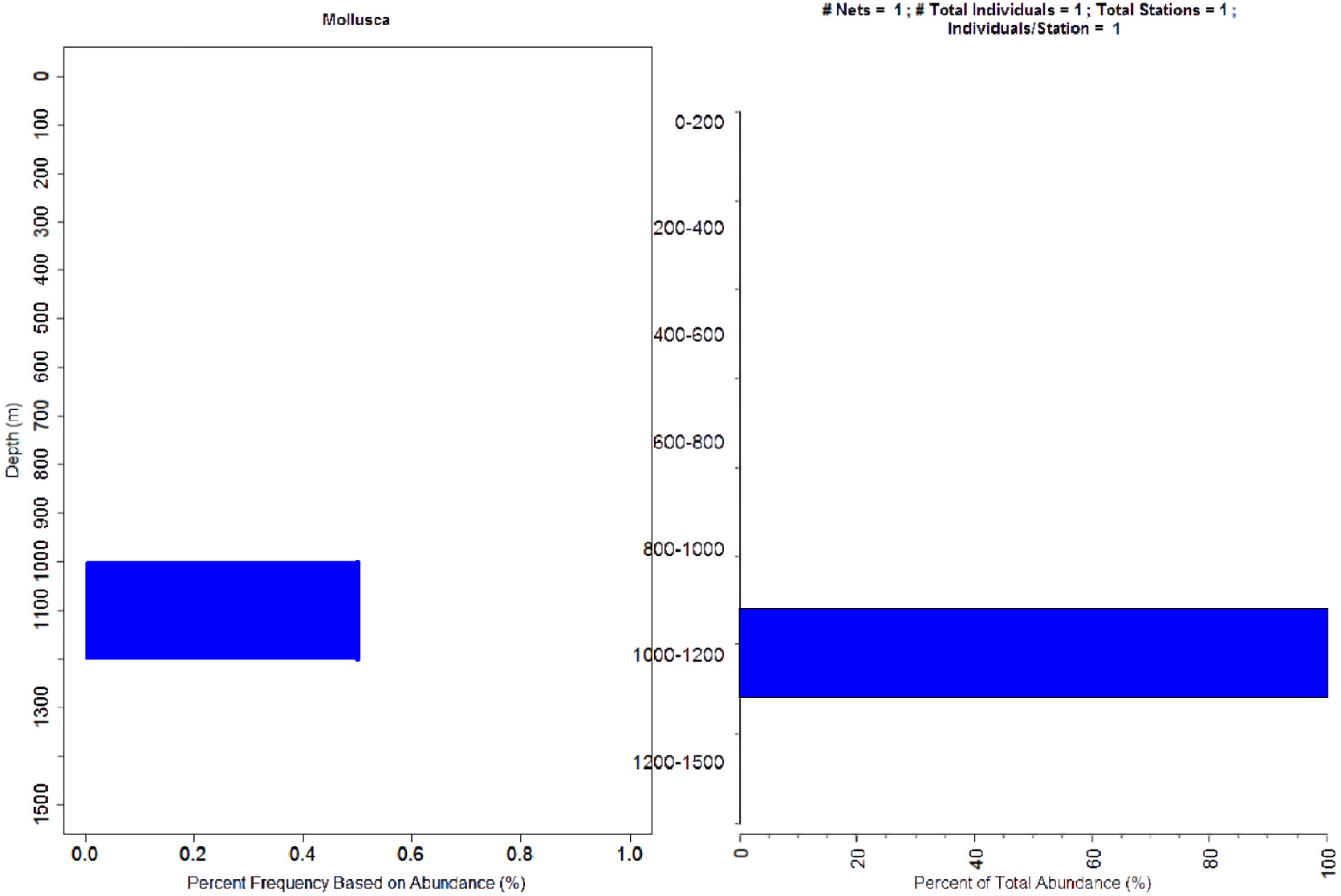
Lophiiformes



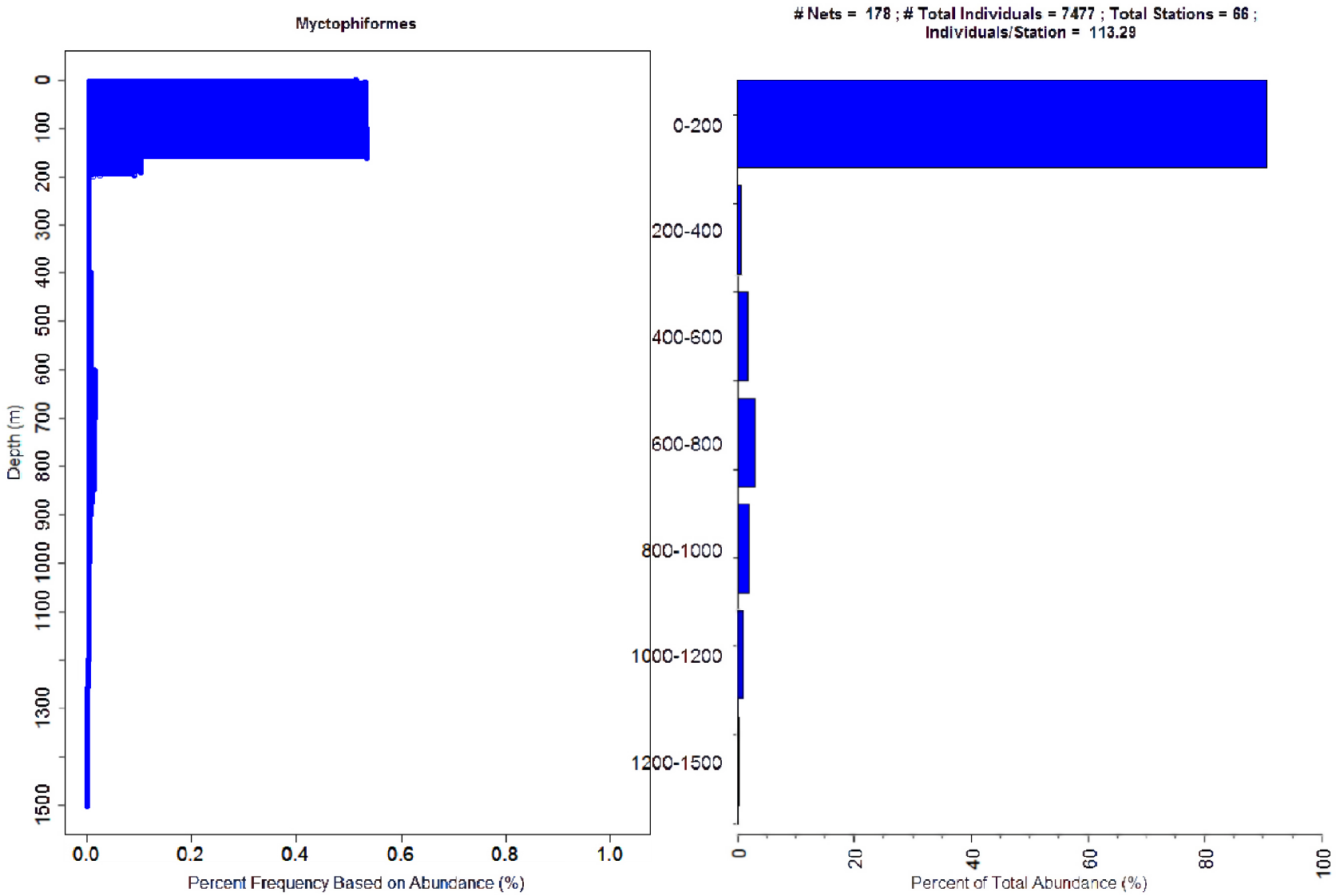
Lophogastrida


Medusozoa
Nets = 14 ; # Total Individuals = 18 ; Total Stations = 11 ;
Individuals/Station = 1.64
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

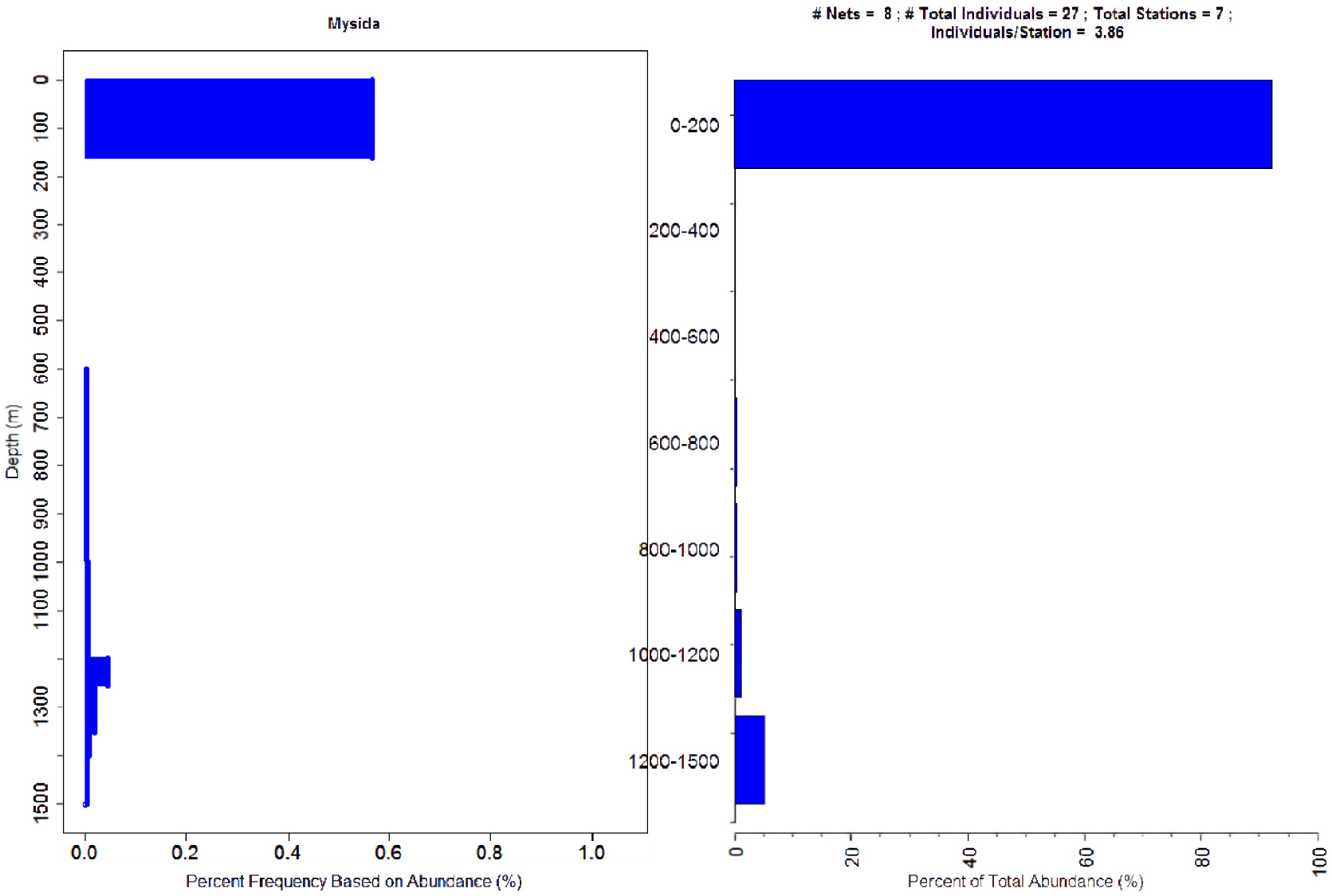
Medusozoa


Mollusca
Nets = 1 ; # Total Individuals = 1 ; Total Stations = 1 ;
Individuals/Station = 1
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

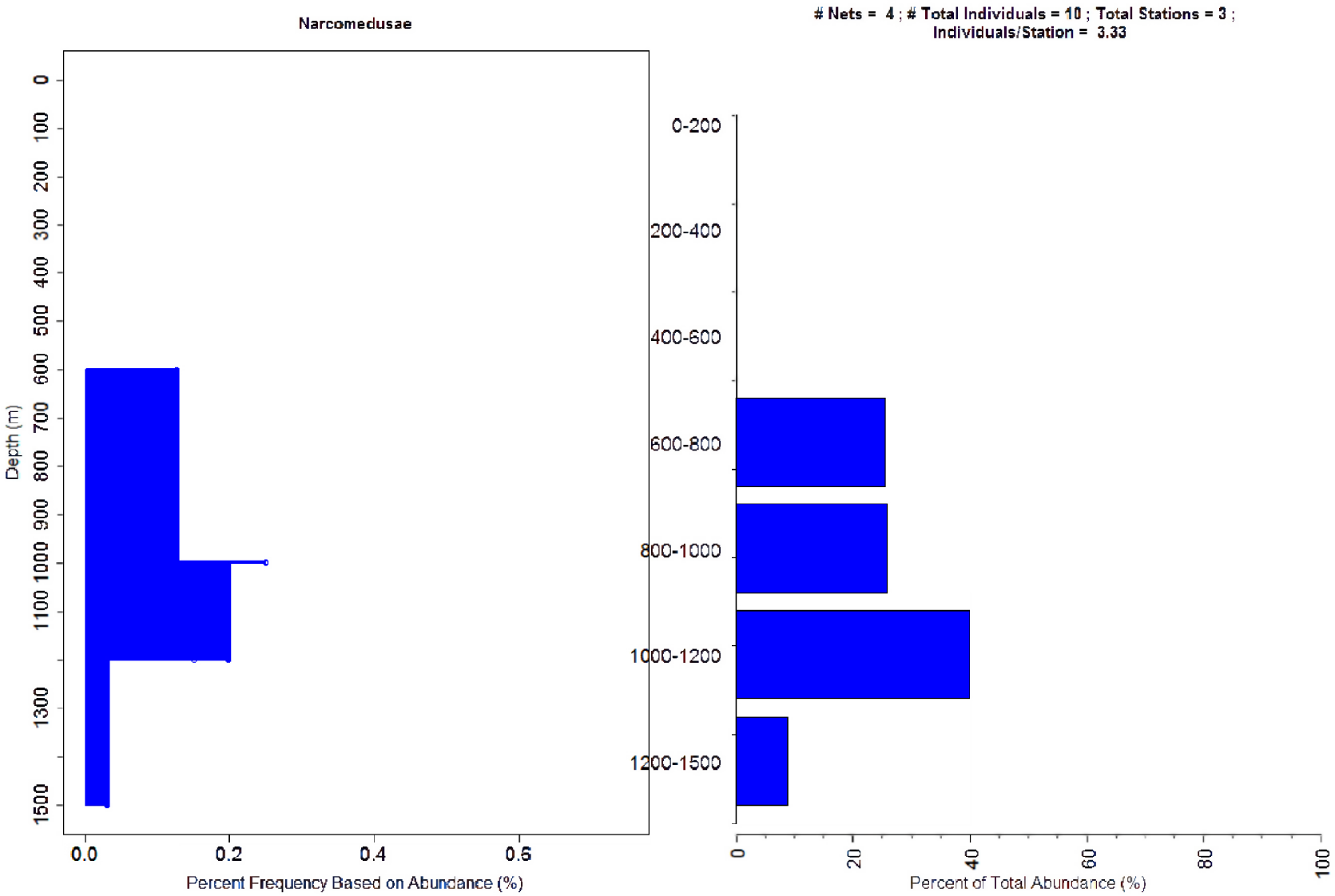
Mollusca



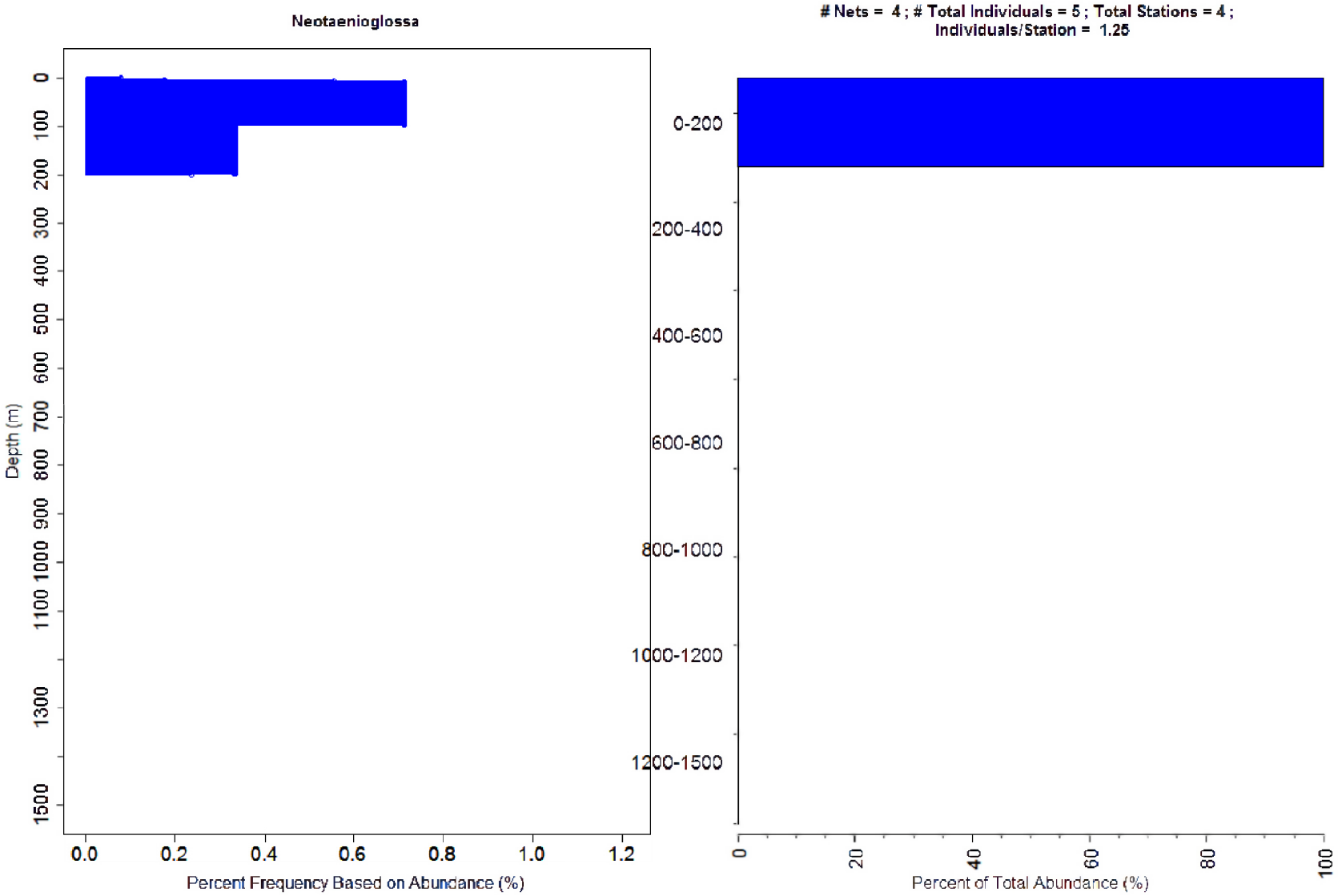
Myctophiformes


Mysida
Nets = 8 ; # Total Individuals = 27 ; Total Stations = 7 ;
Individuals/Station = 3.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

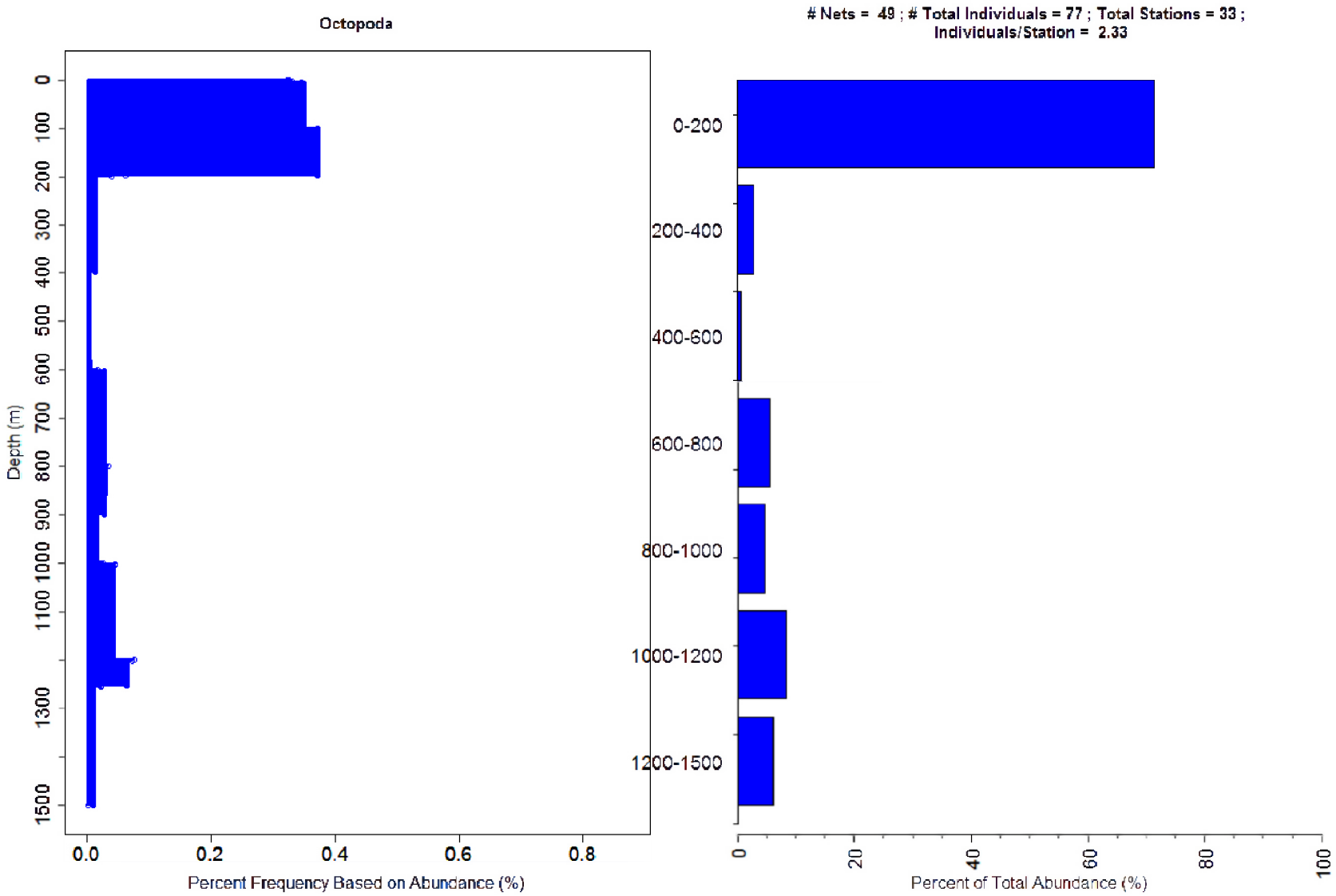
Mysida



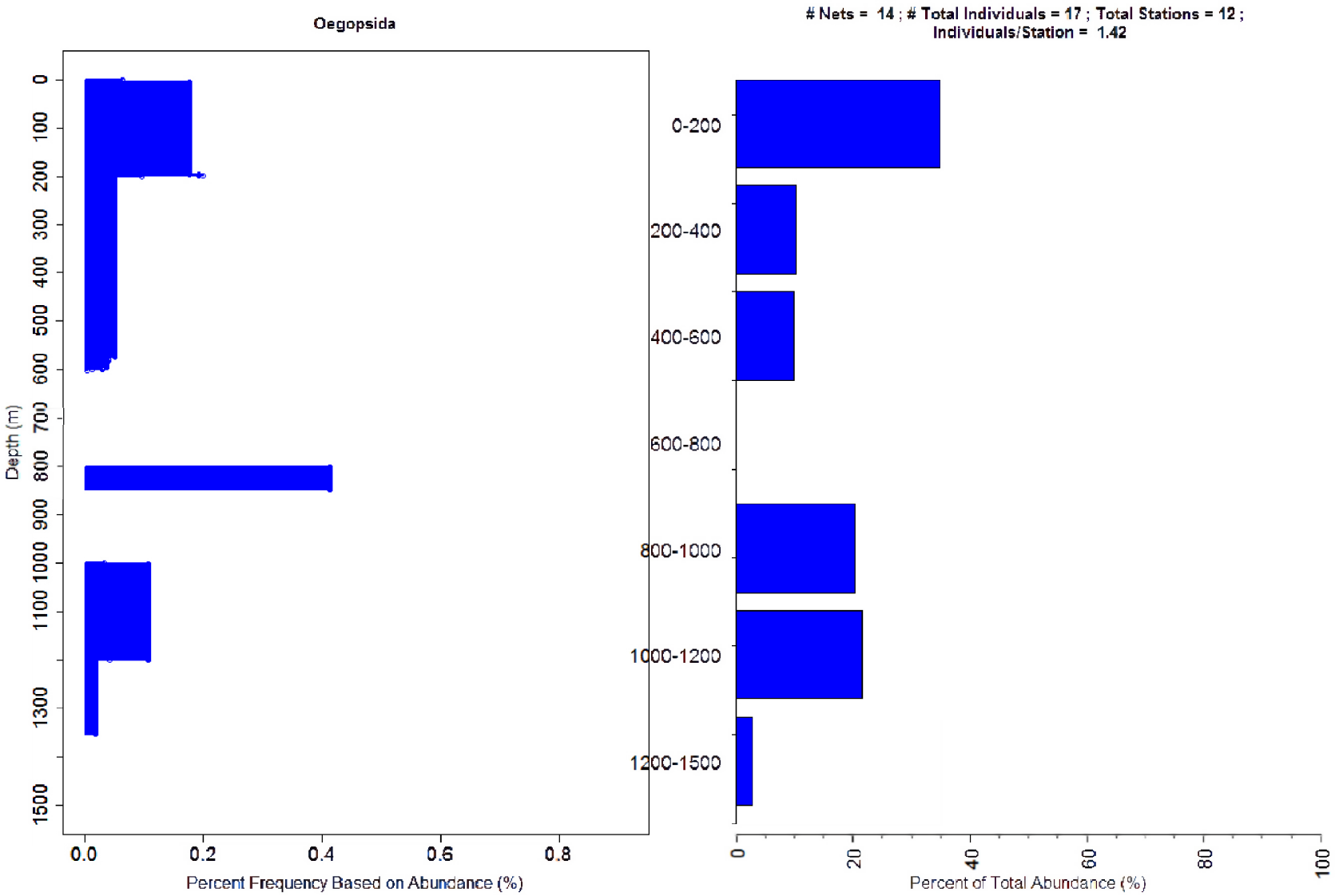
Narcomedusae



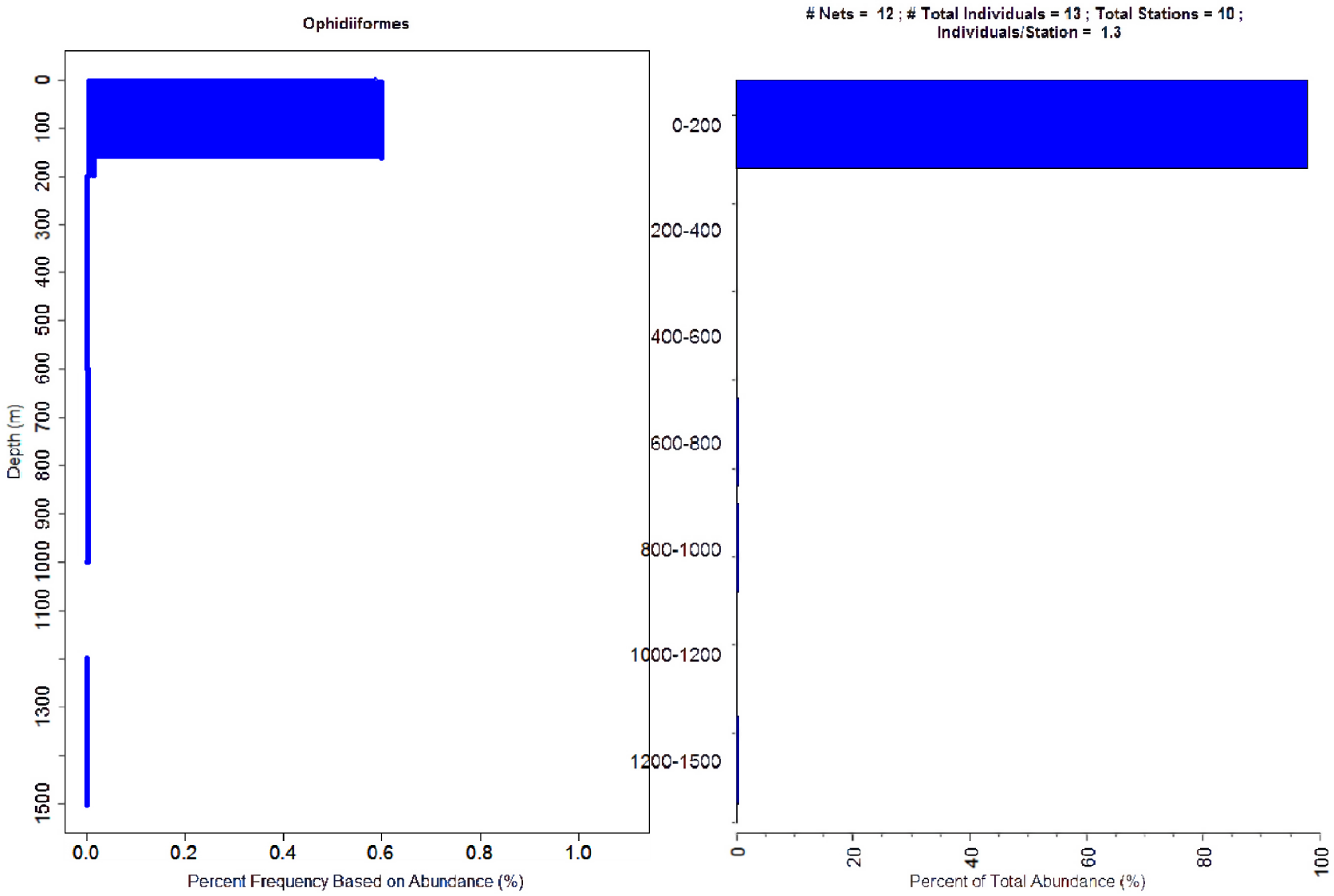
Neotaenioglossa


Octopoda
Nets = 49 ; # Total Individuals = 77 ; Total Stations = 33 ;
Individuals/Station = 2.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

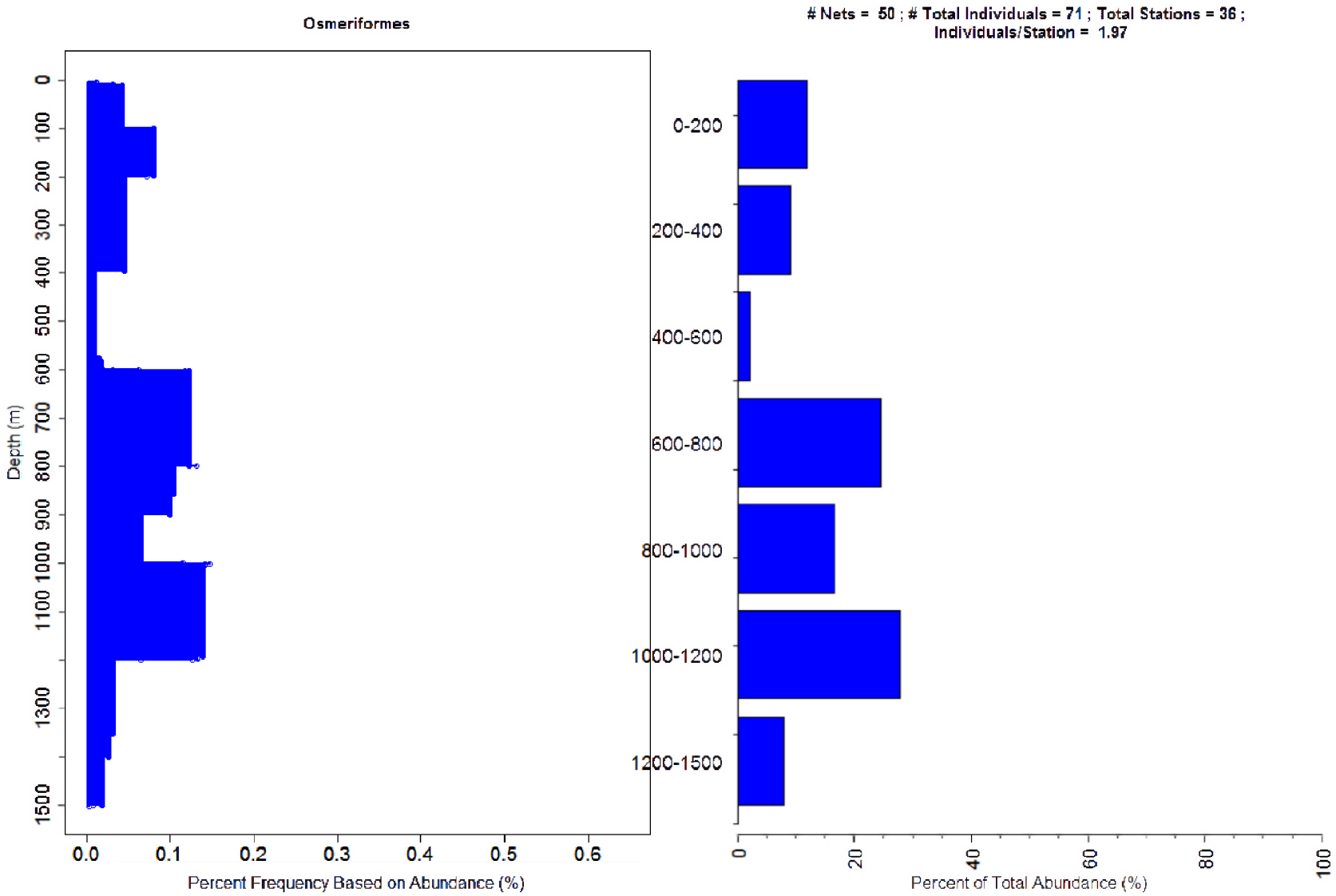
Octopoda


Oegopsida
Nets = 14 ; # Total Individuals = 17 ; Total Stations = 12 ;
Individuals/Station = 1.42
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

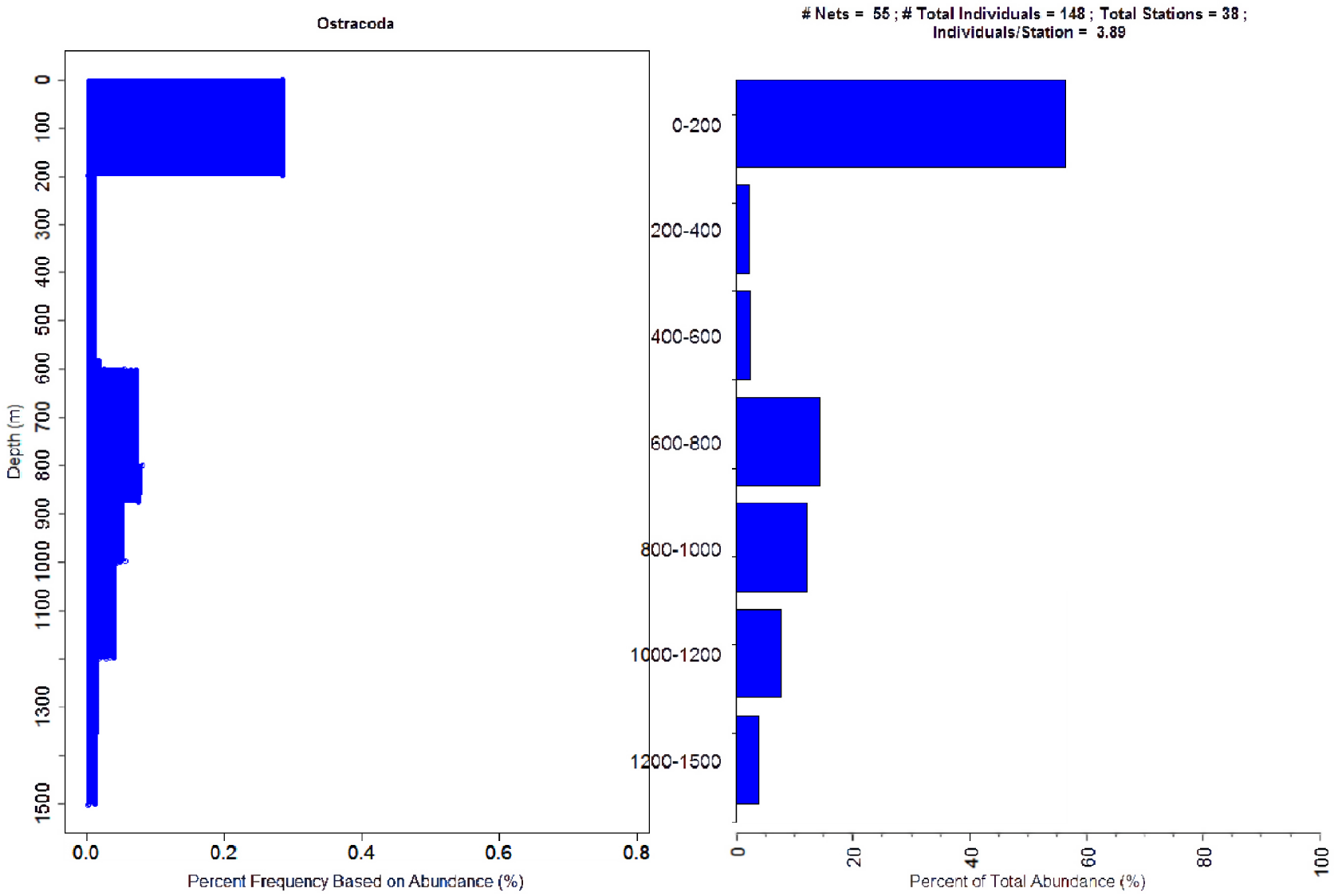
Oegopsida



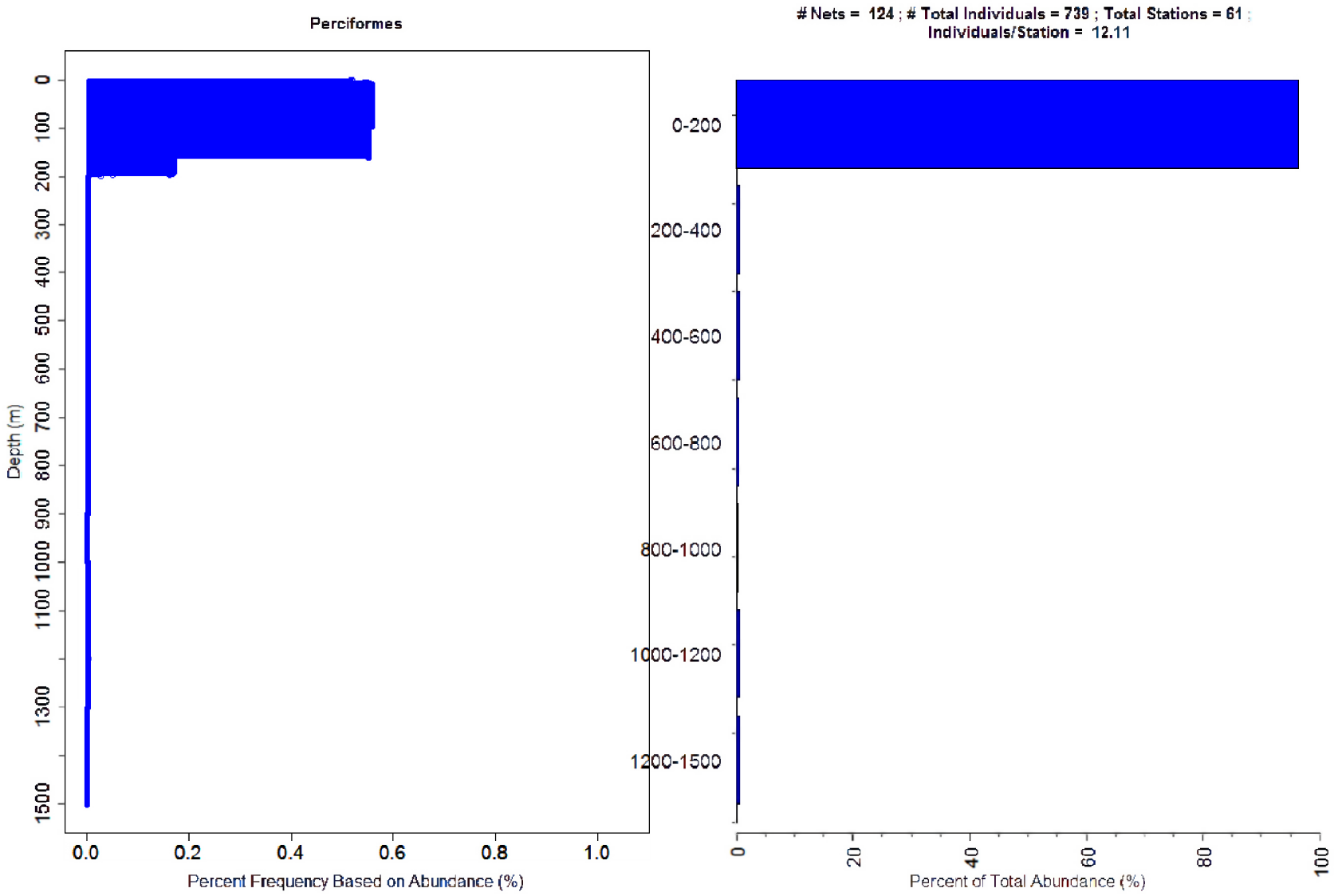
Ophidiiformes



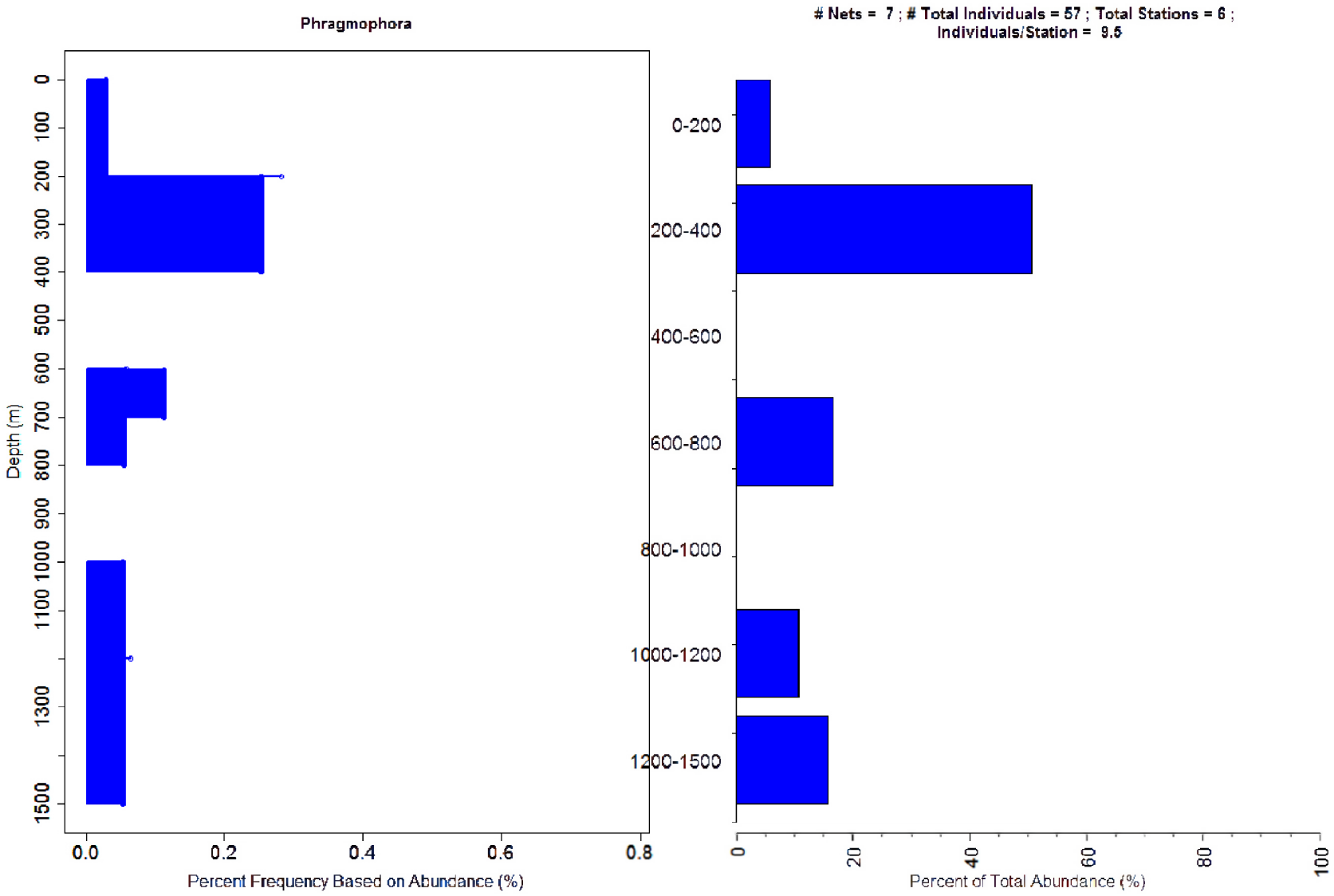
Osmeriformes


Ostracoda
Nets = 55 ; # Total Individuals = 148 ; Total Stations = 38 ;
Individuals/Station = 3.89
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

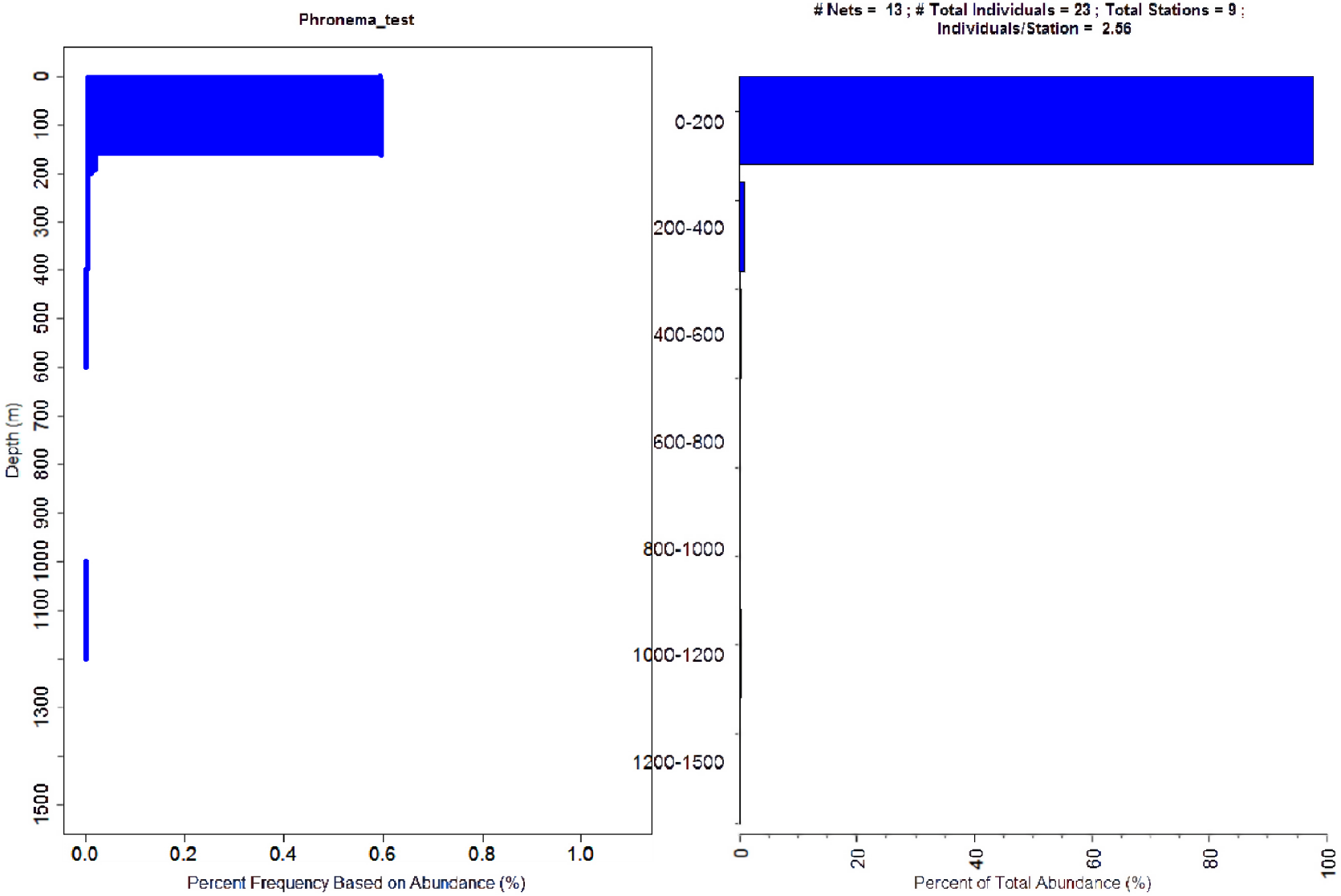
Ostracoda



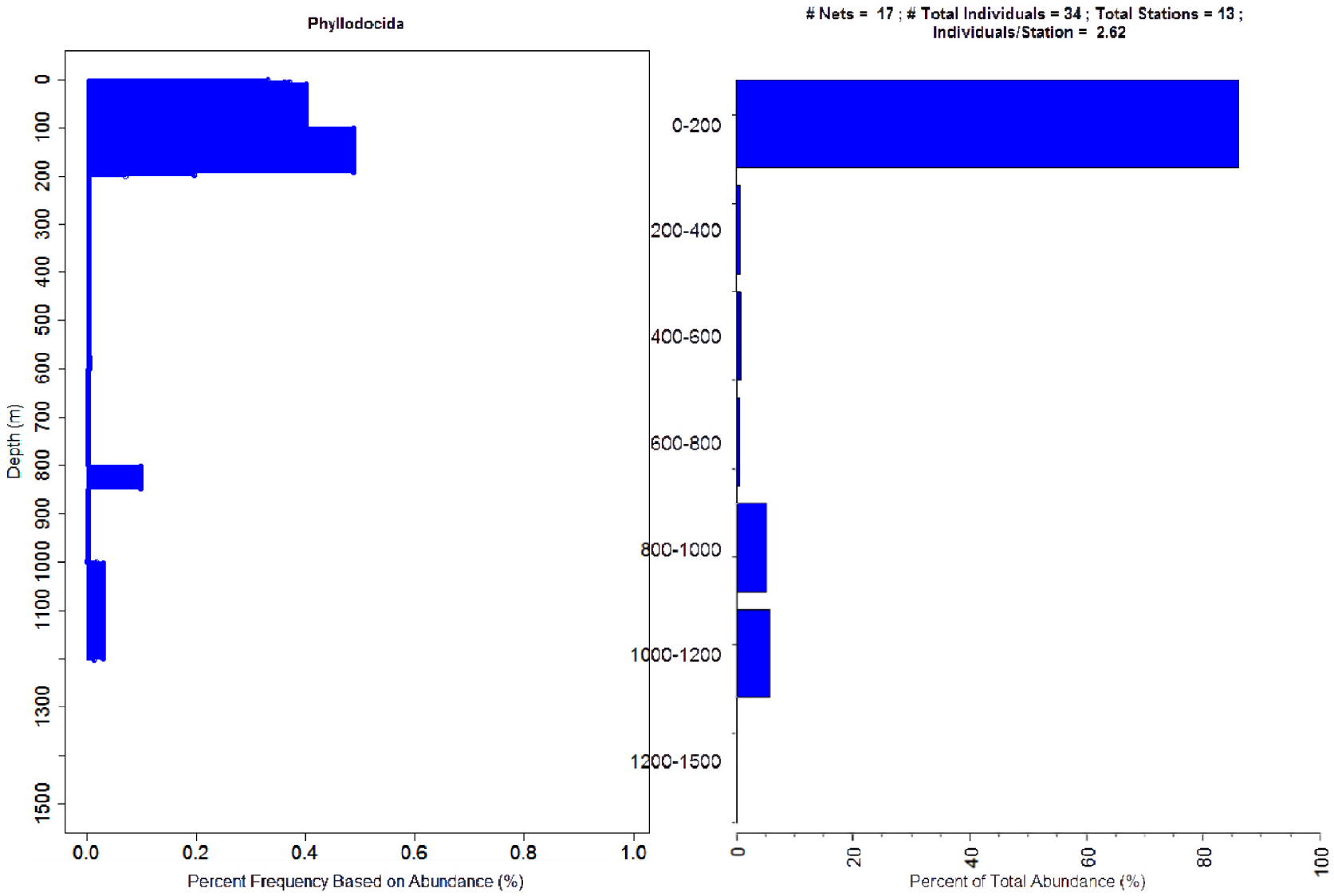
Perciformes



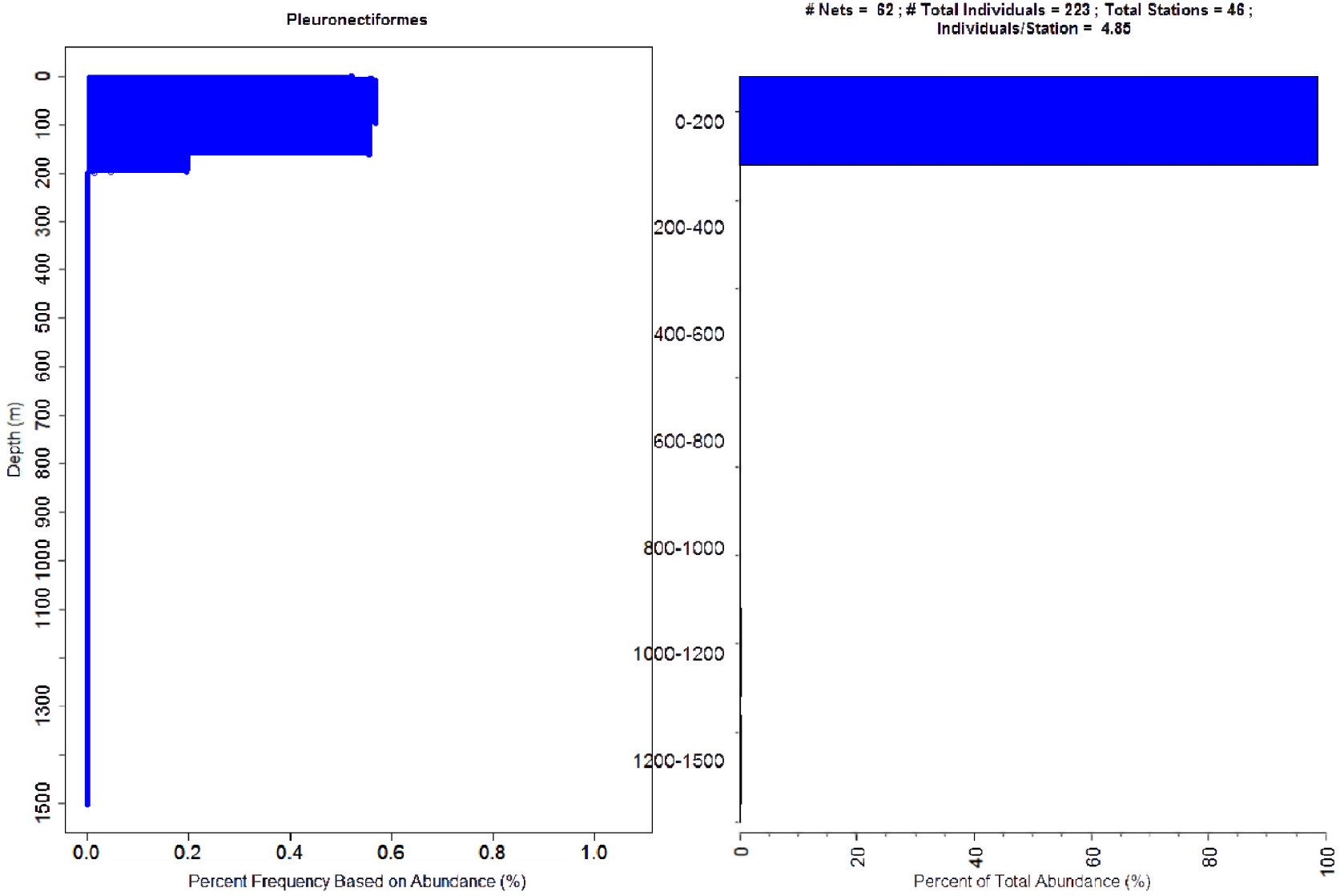
Phragmophora



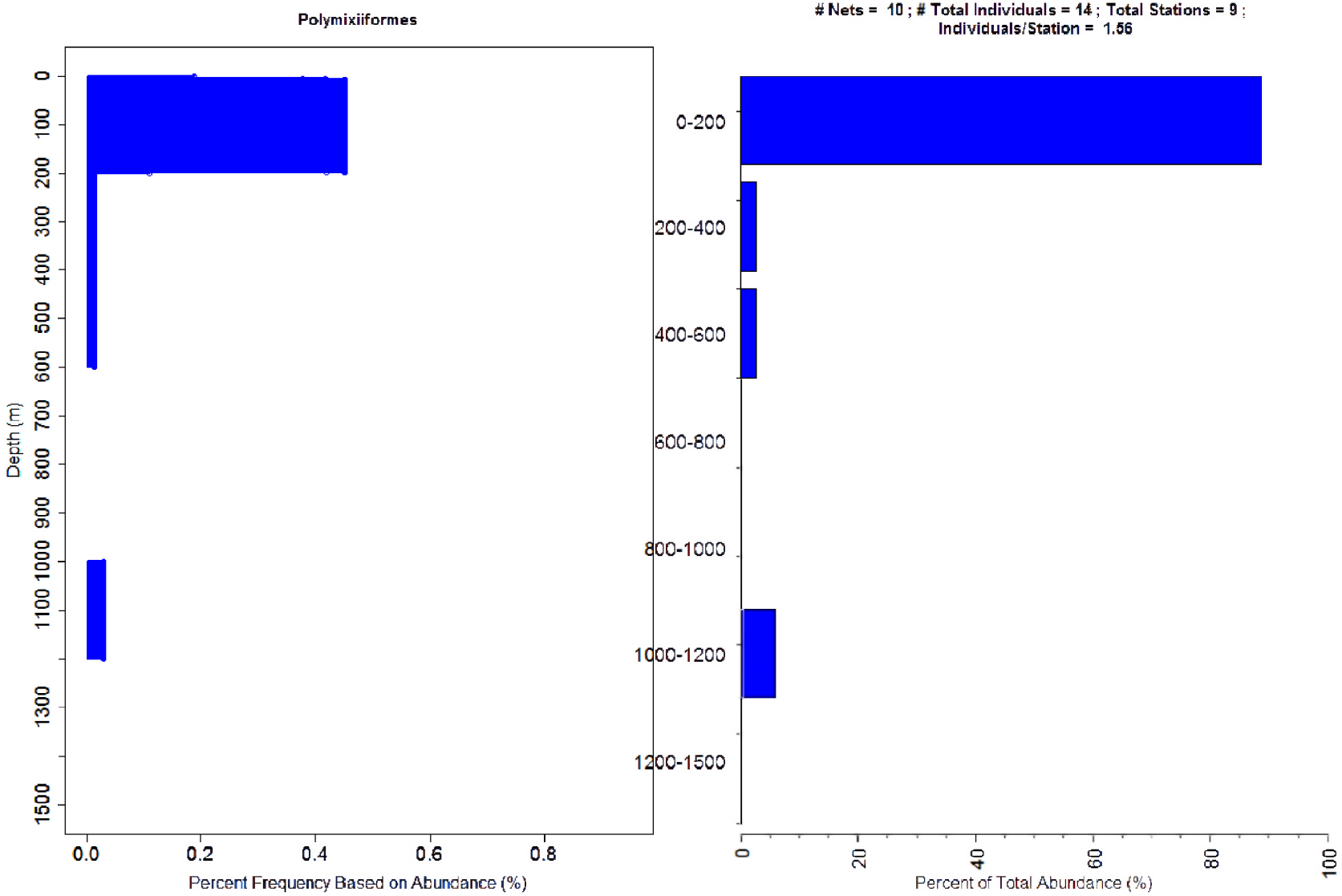
Phronema_test



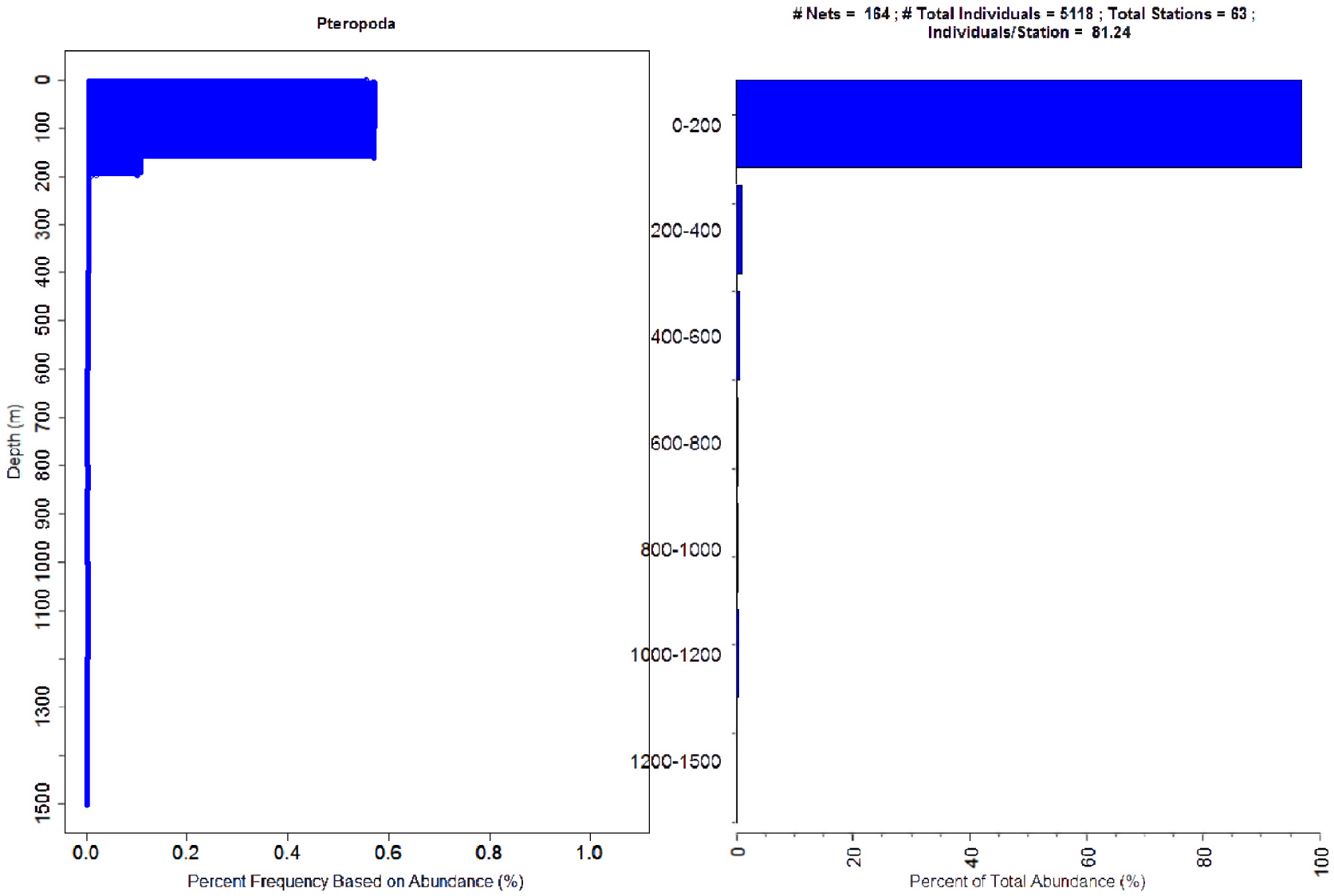
Phyllodocida



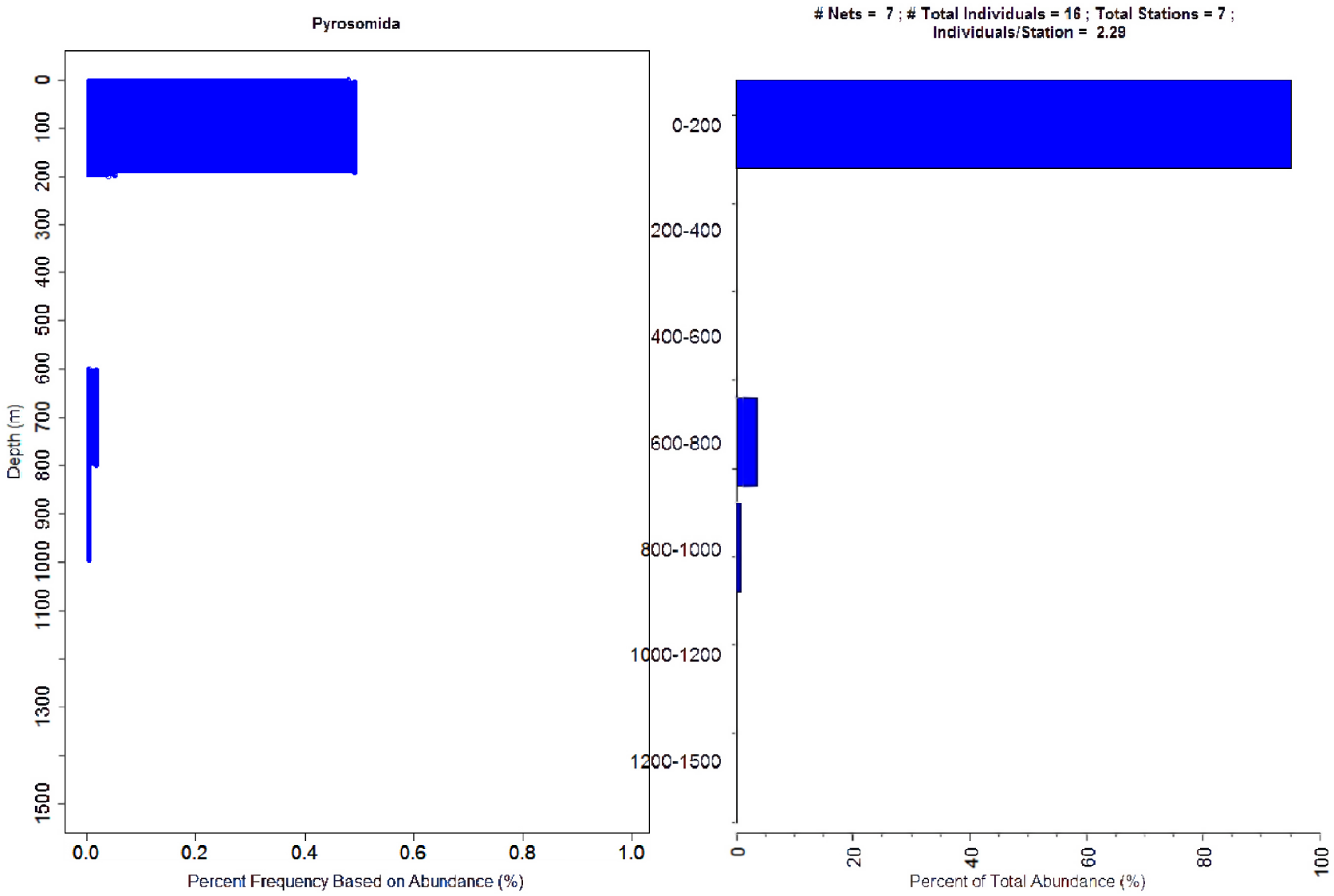
Pleuronectiformes



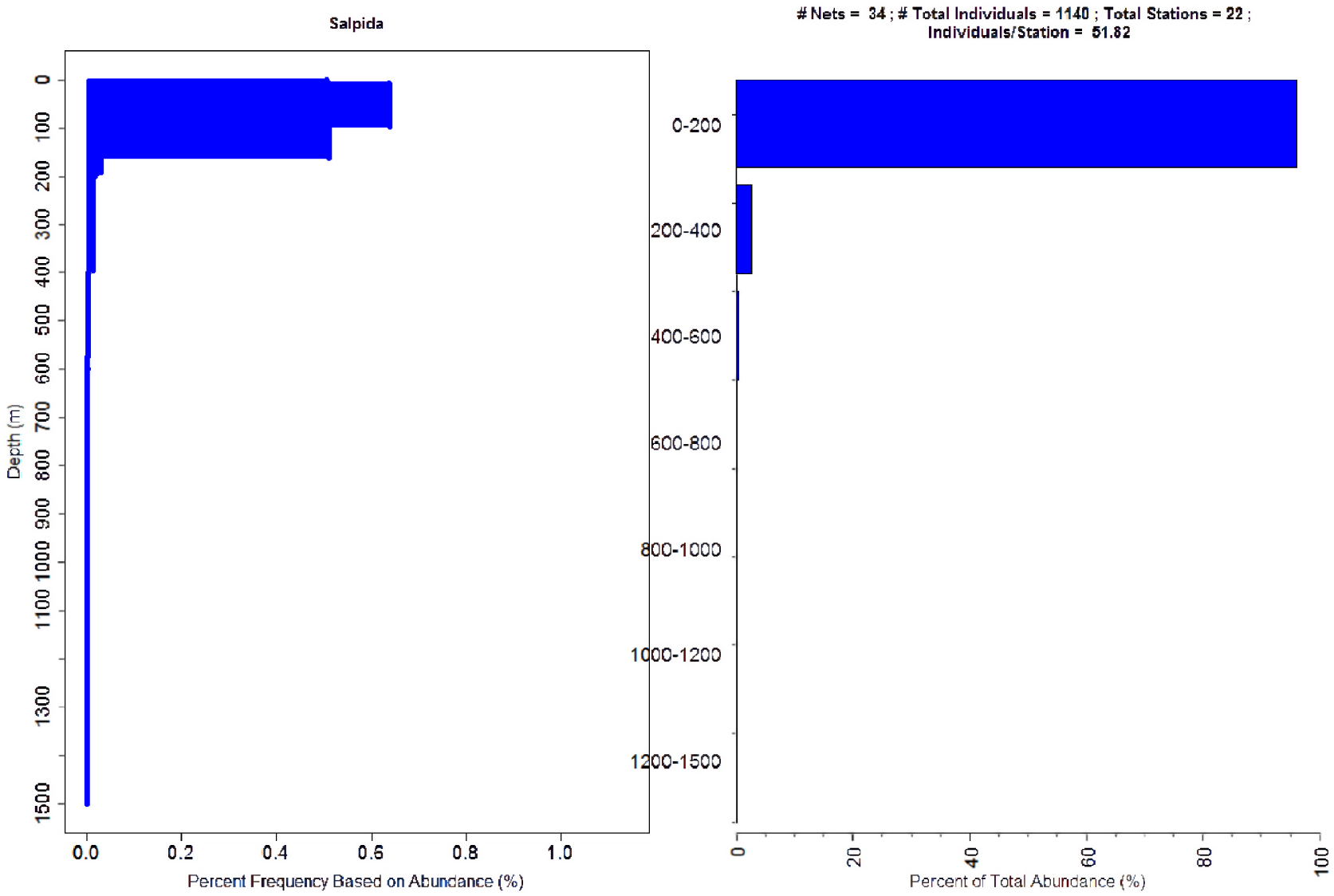
Polymixiiformes


Pteropoda
Nets = 164 ; # Total Individuals = 5118 ; Total Stations = 63 ;
Individuals/Station = 81.24
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

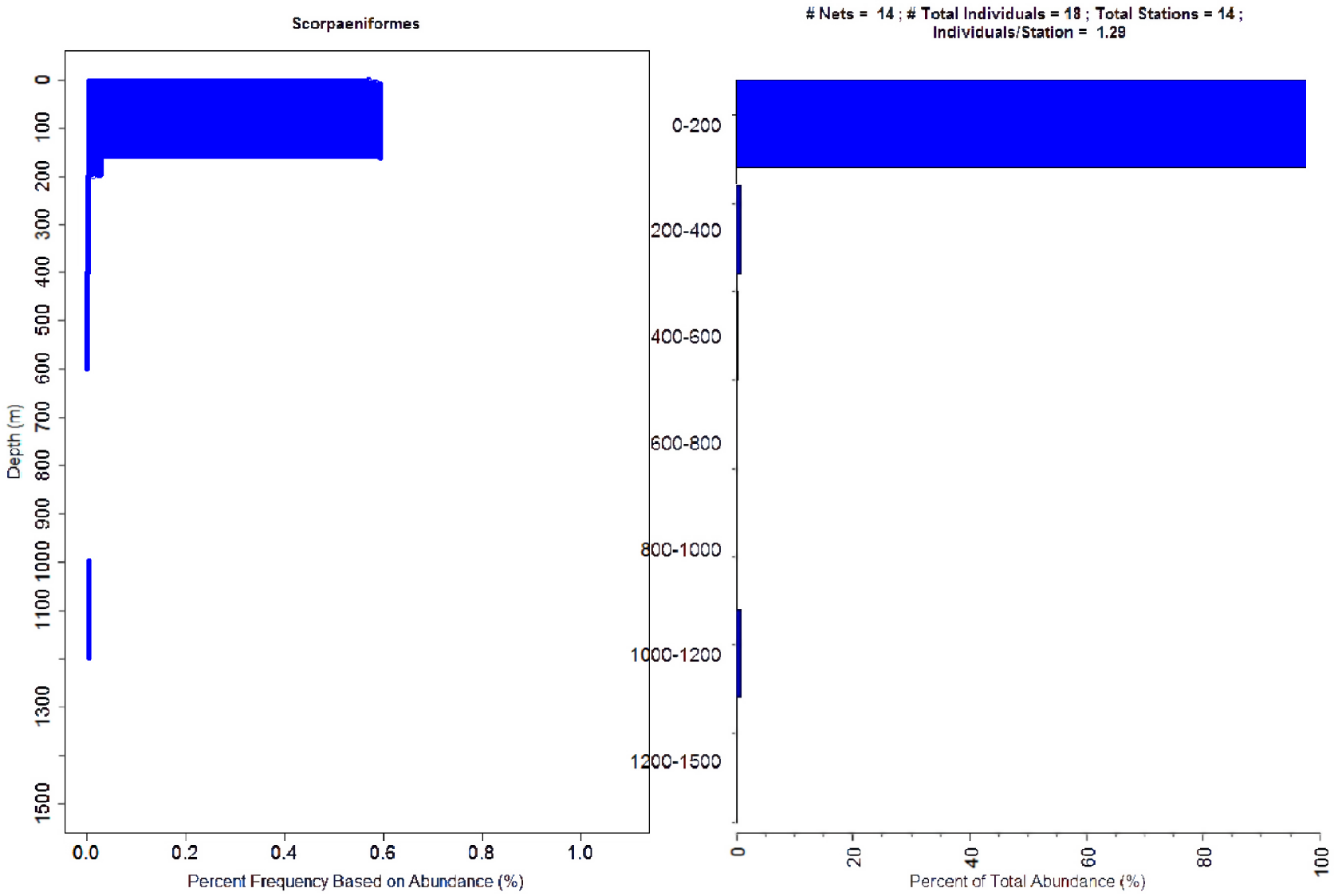
Pteropoda


Pyrosomida
Nets = 7 ; # Total Individuals = 16 ; Total Stations = 7 ;
Individuals/Station = 2.29
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

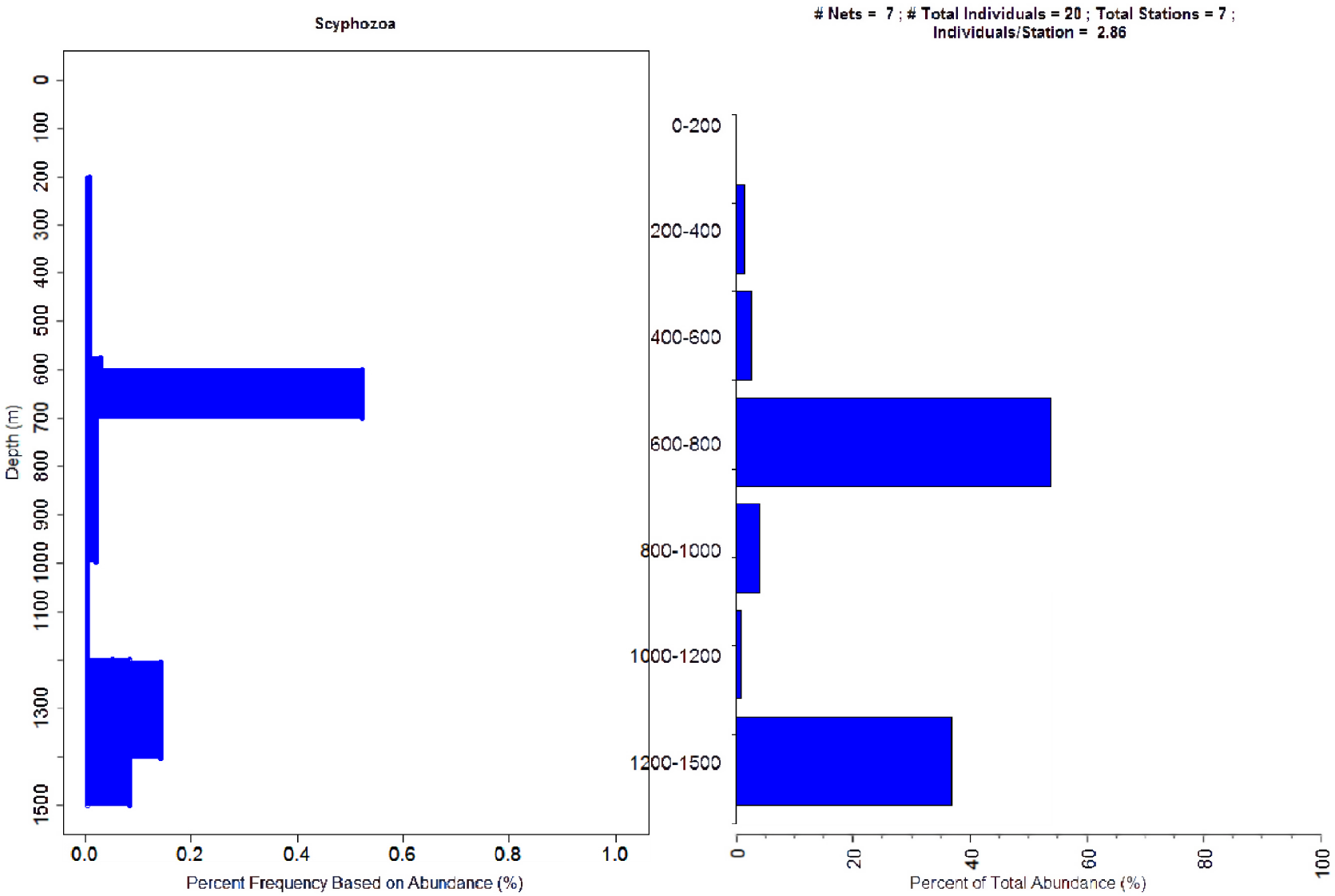
Pyrosomida


Salpida
Nets = 34 ; # Total Individuals = 1140 ; Total Stations = 22 ;
Individuals/Station = 51.82
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

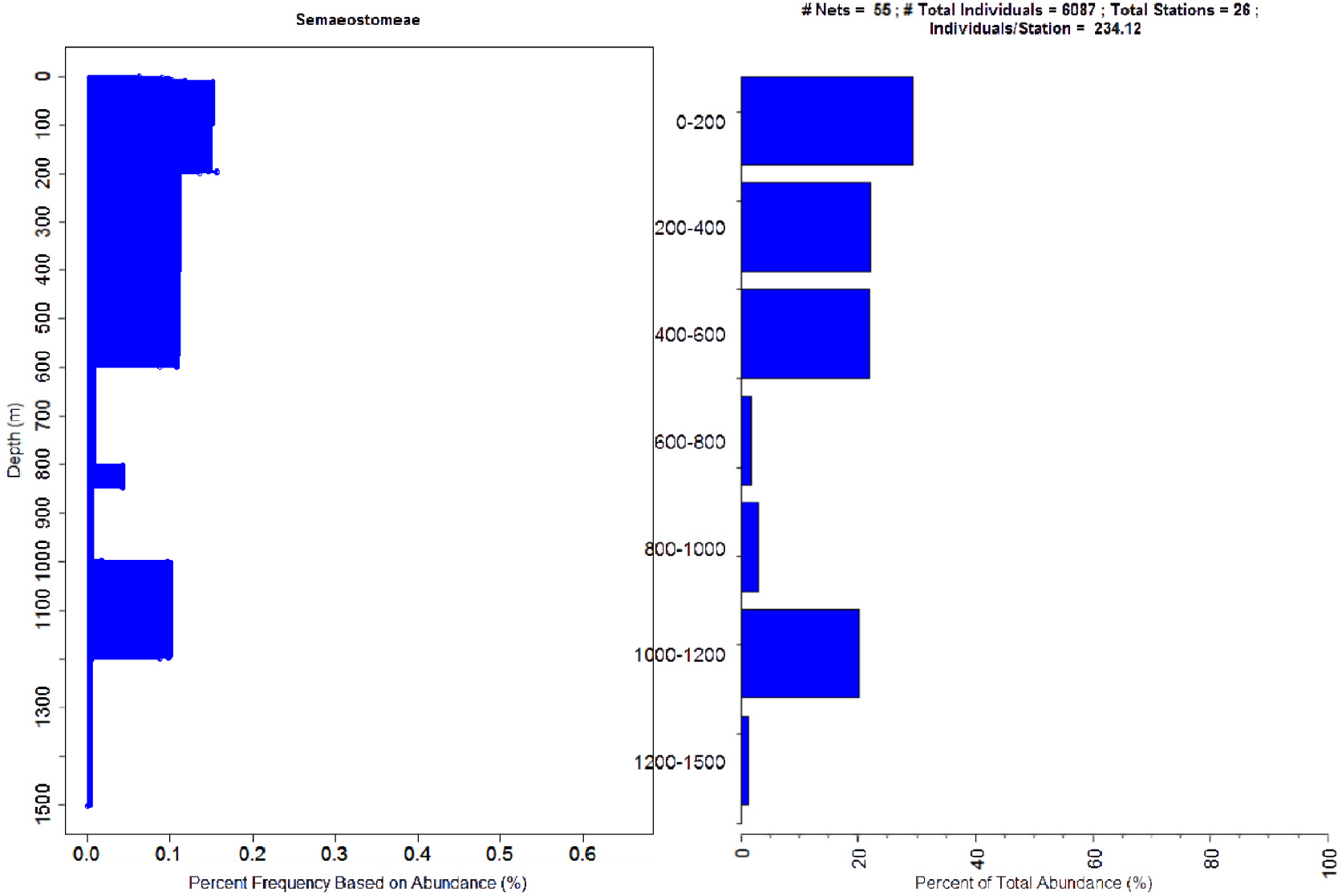
Salpida



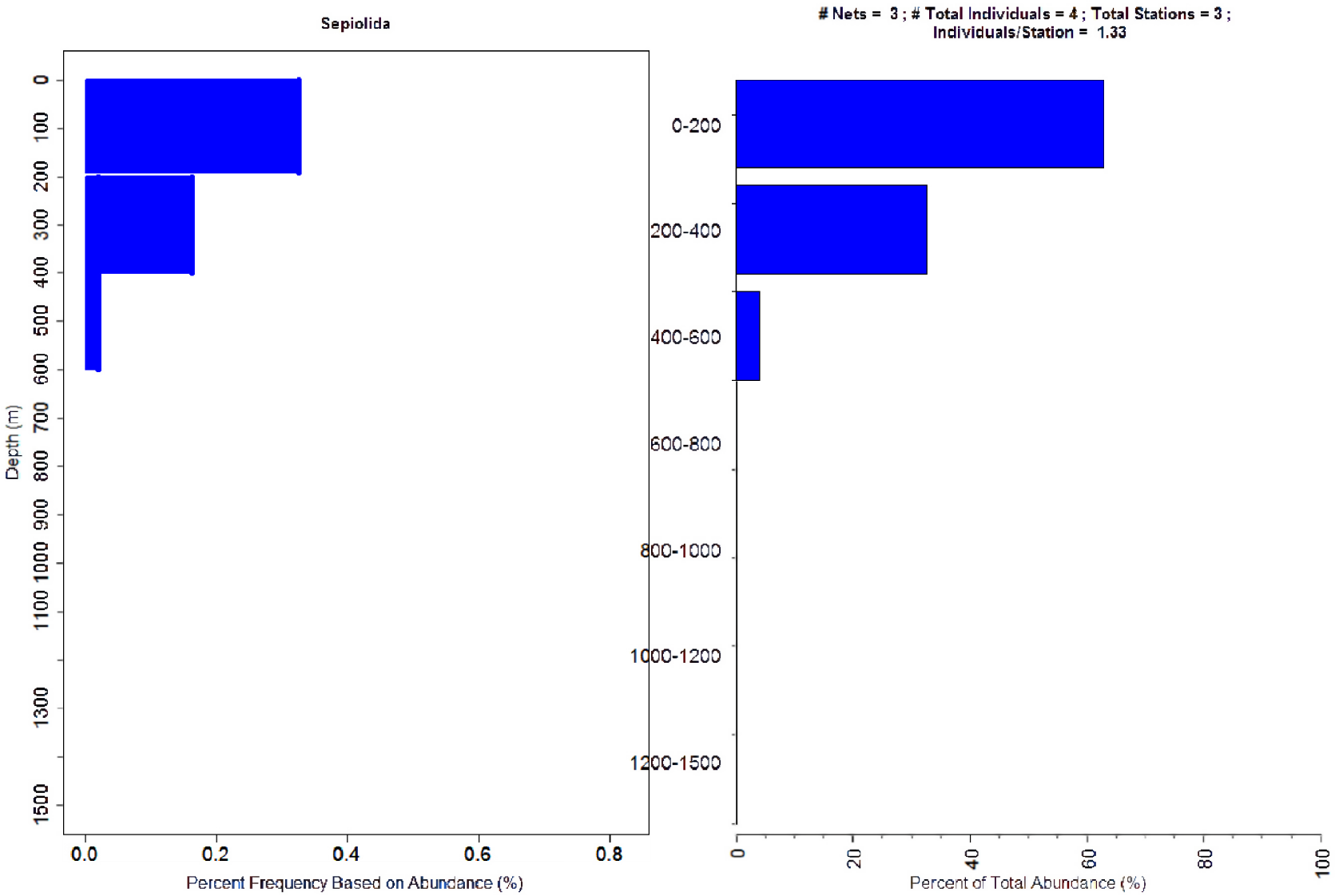
Scorpaeniformes


Scyphozoa
Nets = 7 ; # Total Individuals = 20 ; Total Stations = 7 ;
Individuals/Station = 2.86
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

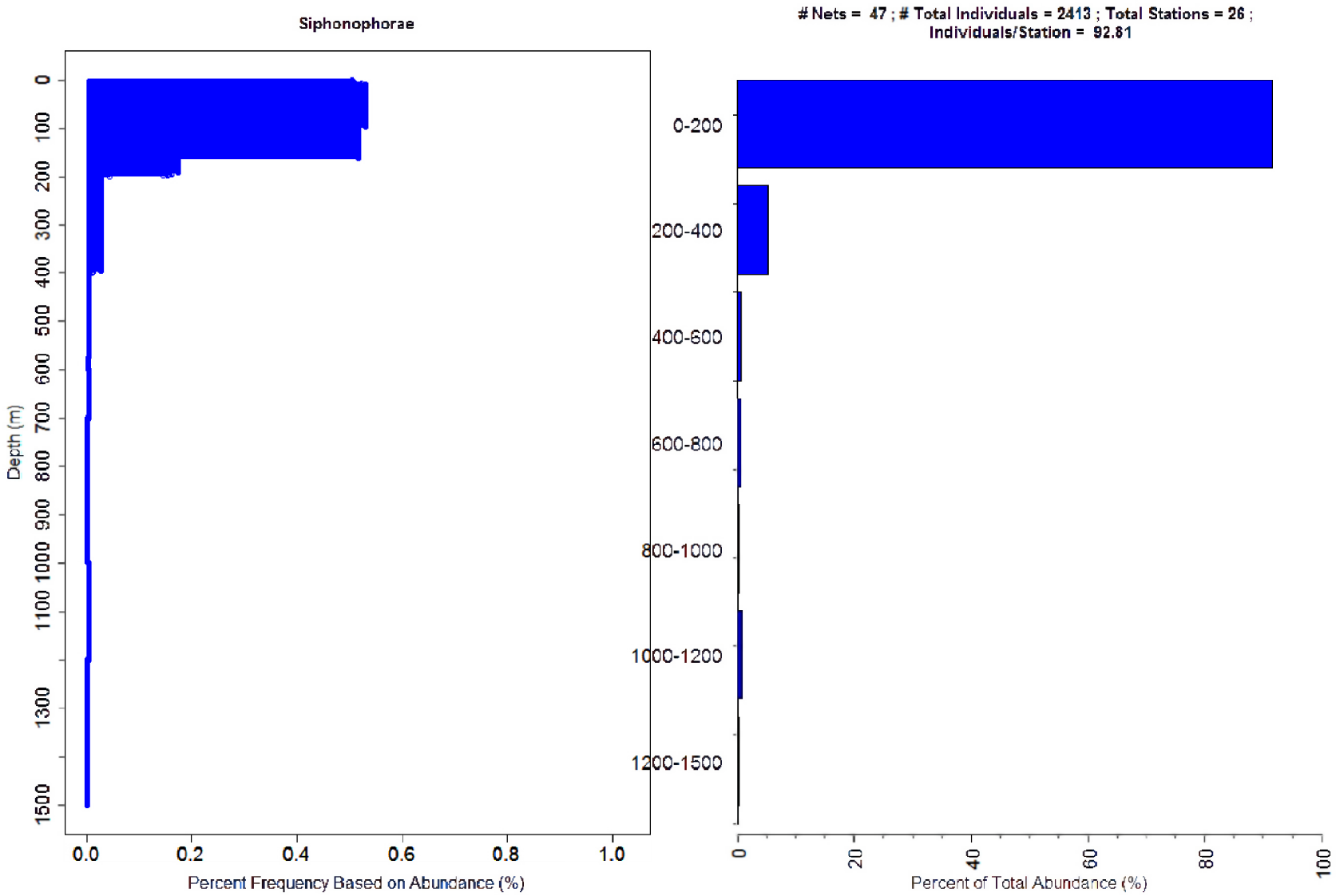
Scyphozoa



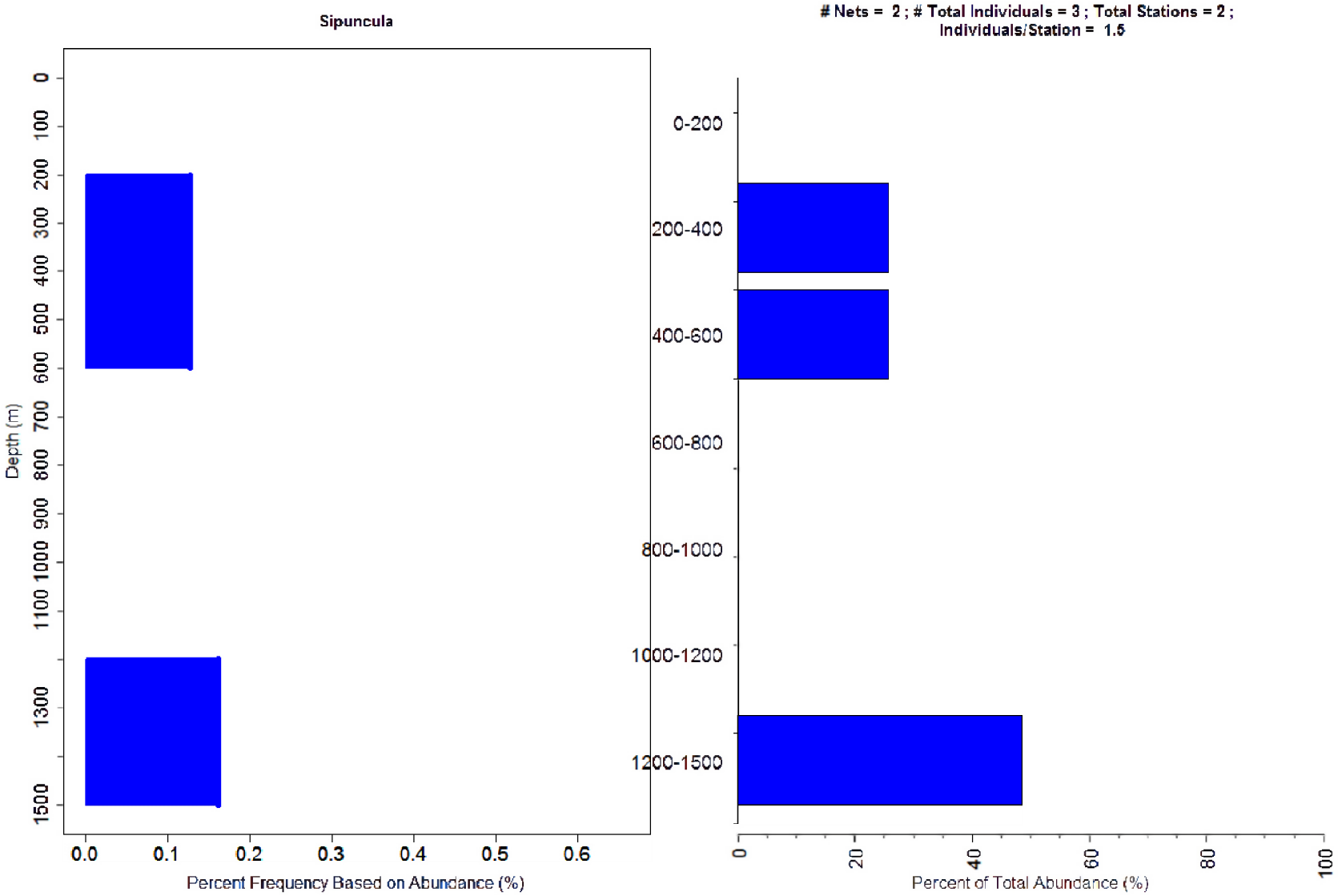
Semaeostomeae


Sepiolida
Nets = 3 ; # Total Individuals = 4 ; Total Stations = 3 ;
Individuals/Station = 1.33
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

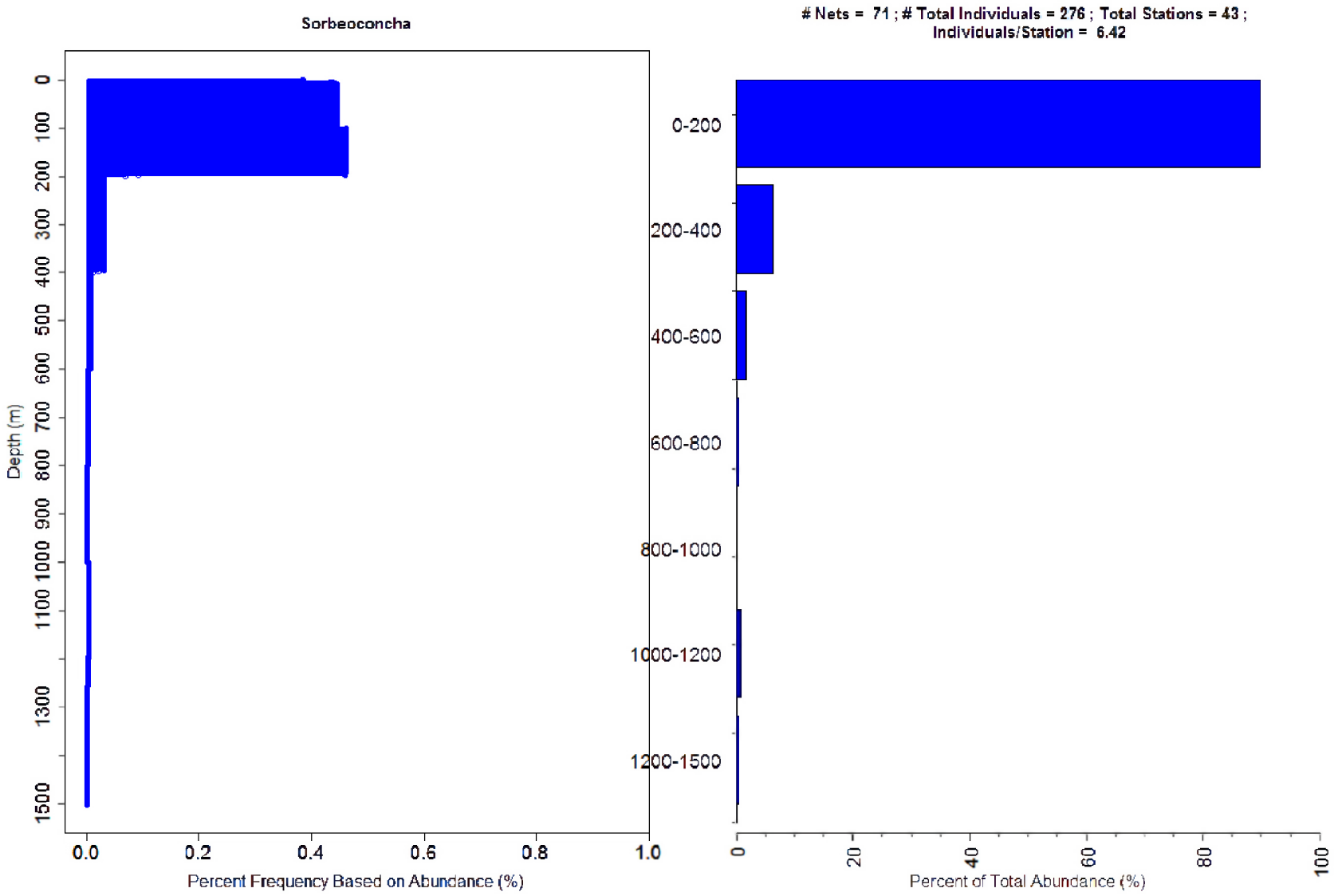
Sepiolida



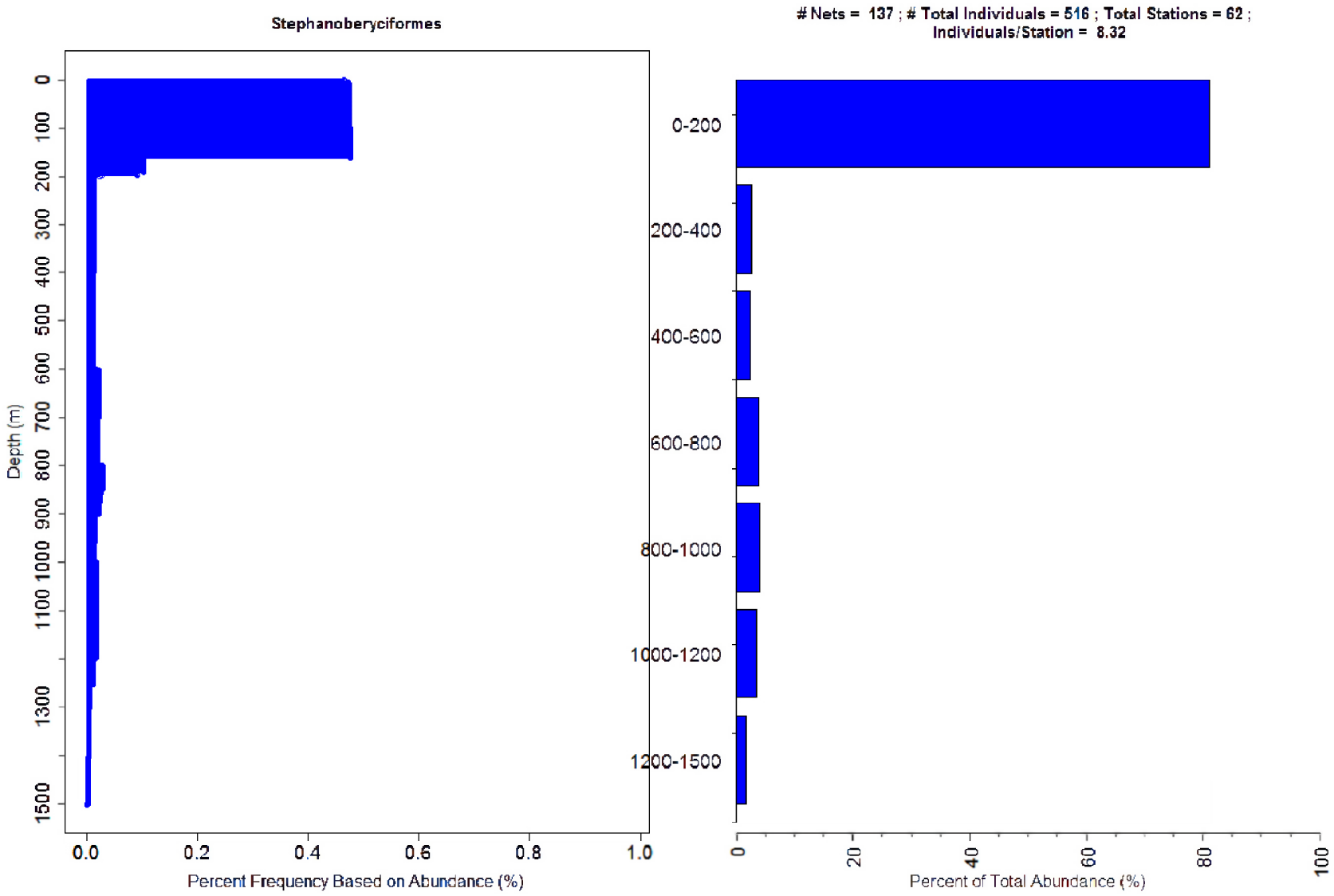
Siphonophorae


Sipuncula
Nets = 2 ; # Total Individuals = 3 ; Total Stations = 2 ;
Individuals/Station = 1.5
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

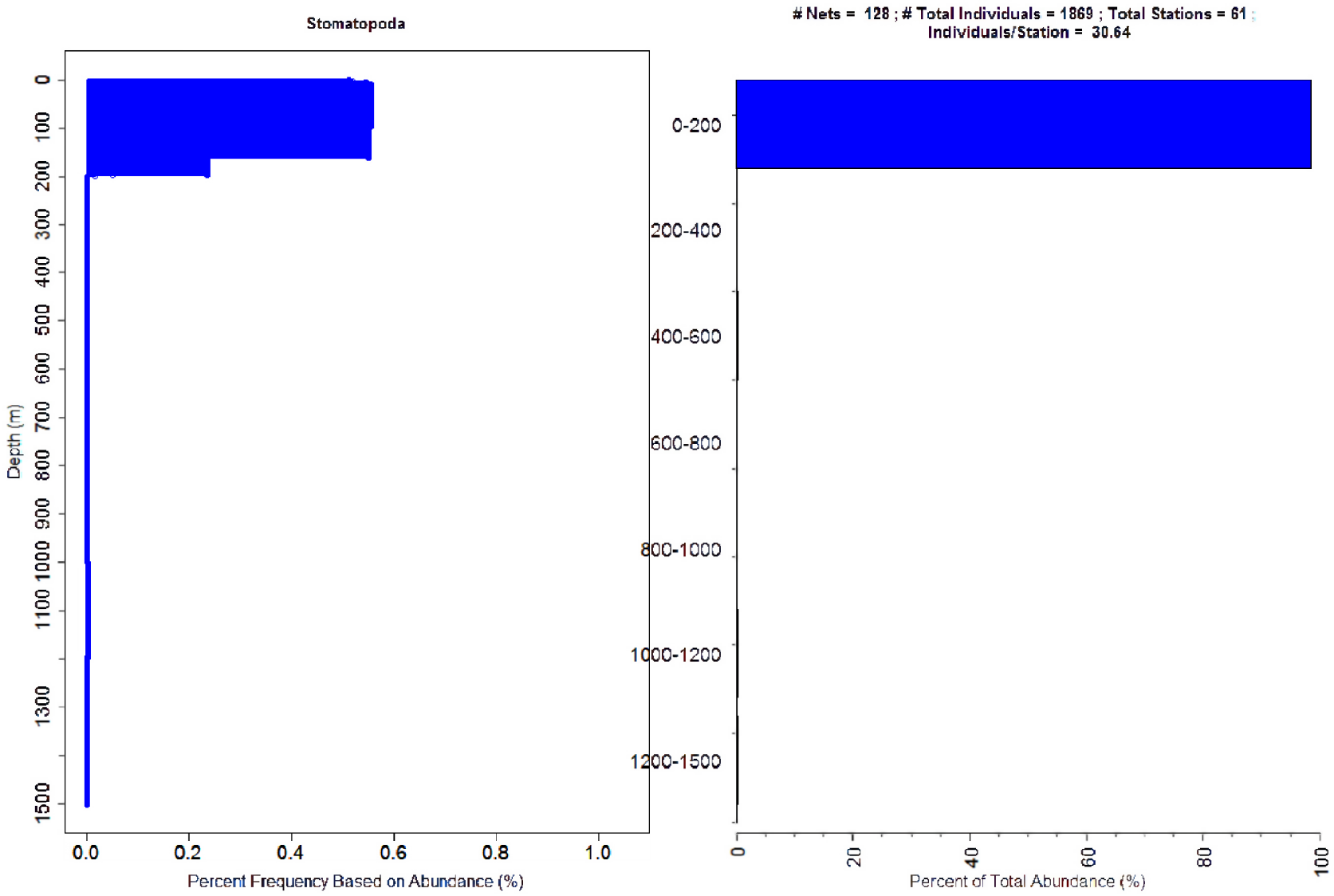
Sipuncula



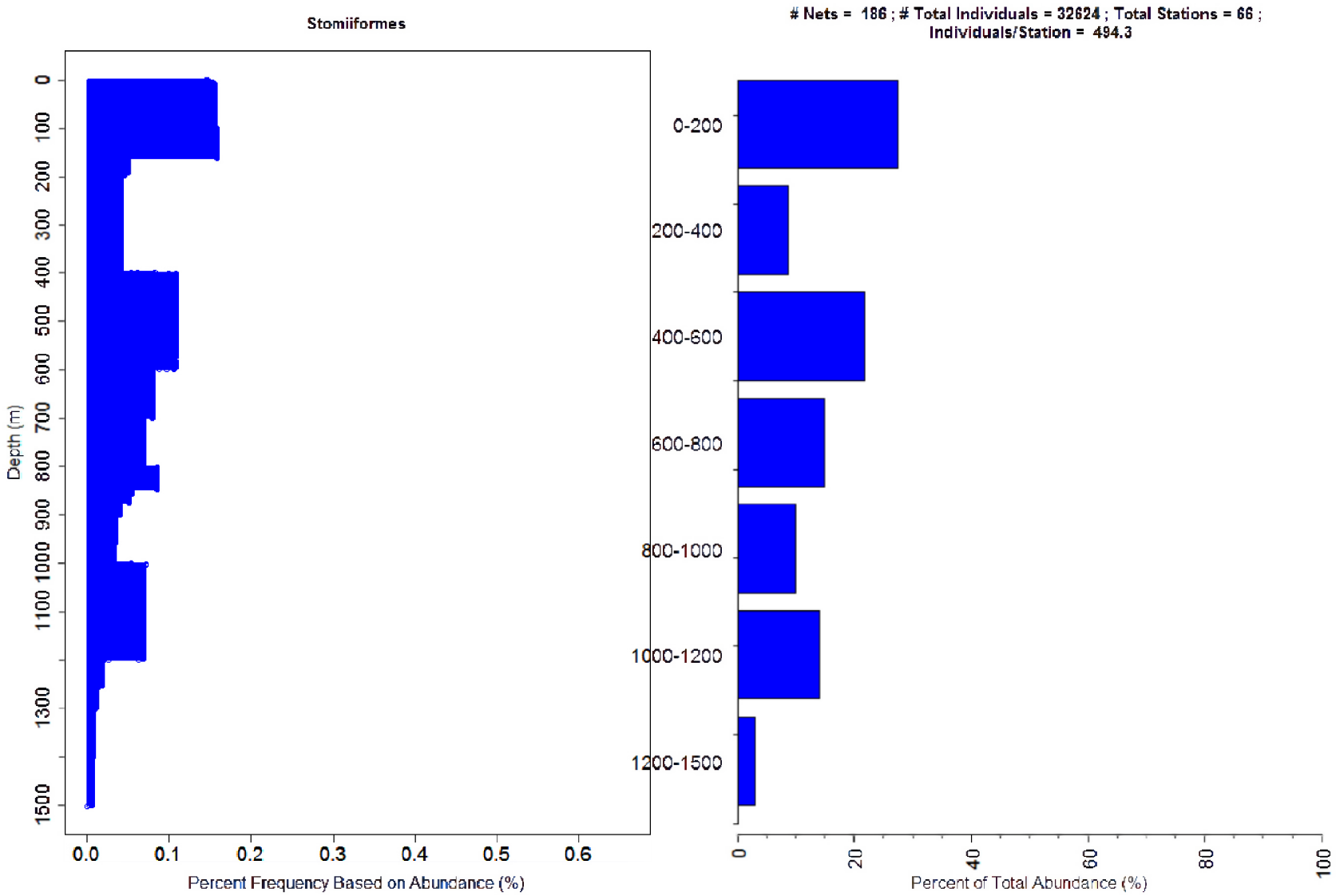
Sorbeoconcha



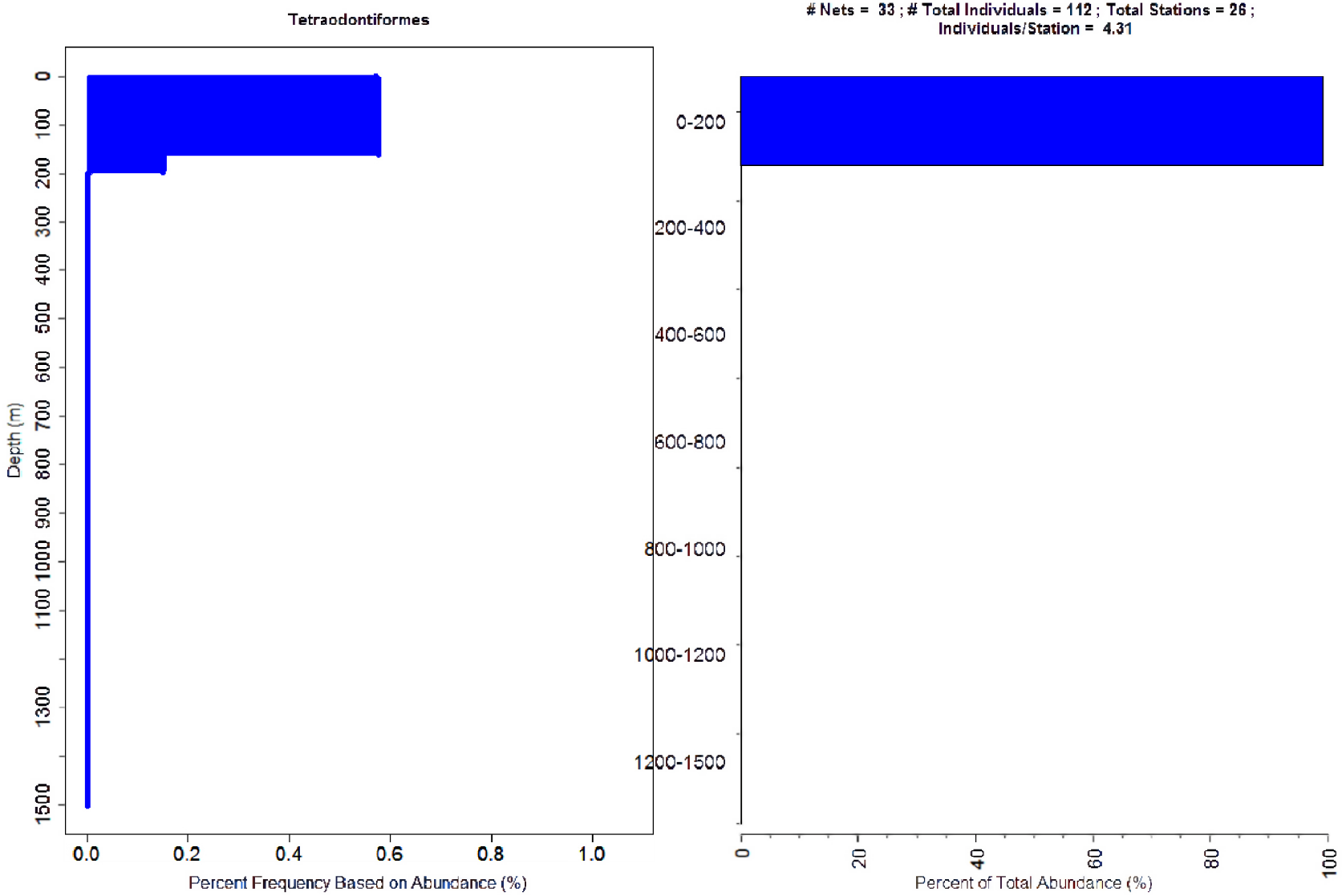
Stephanoberyciformes



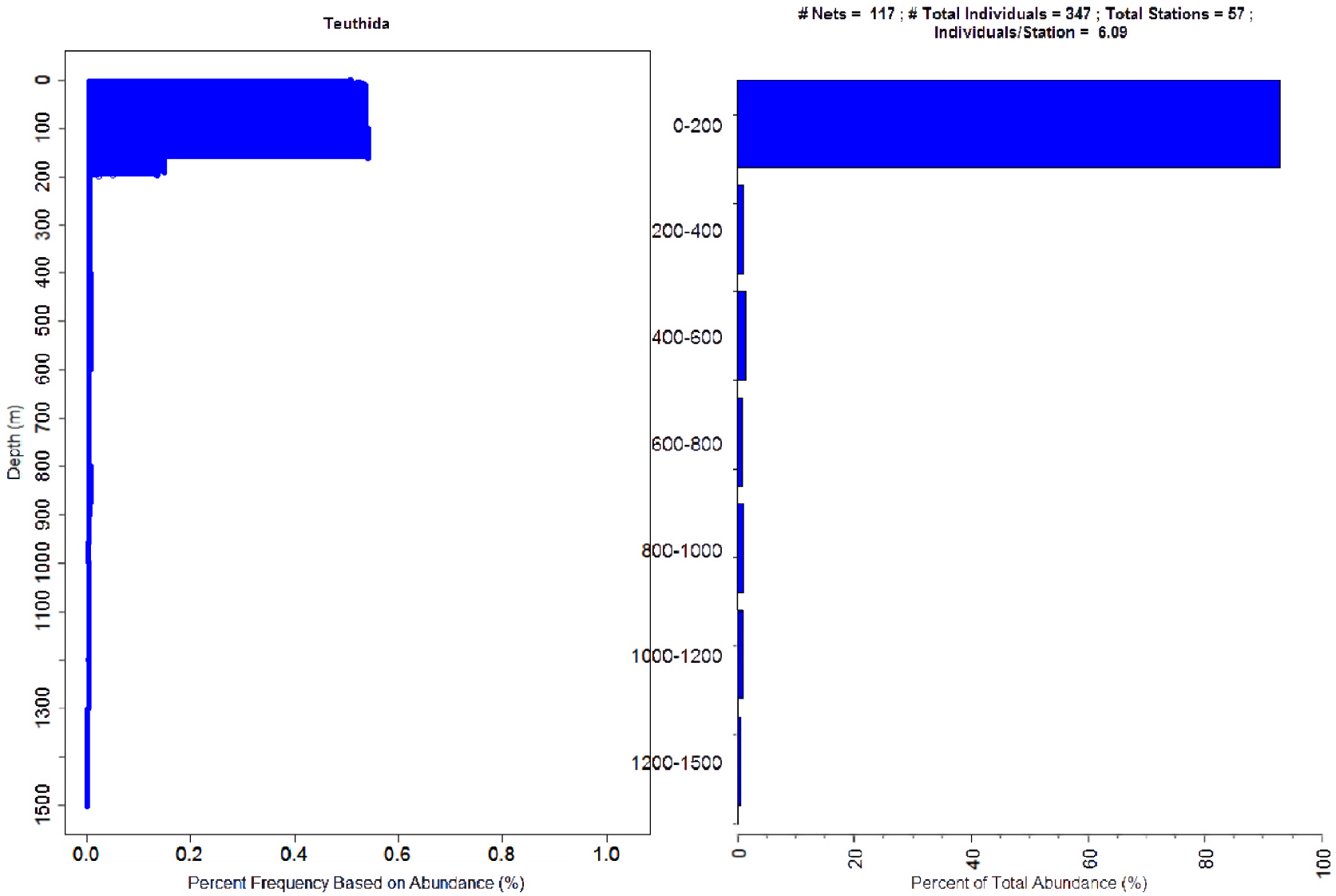
Stomatopoda



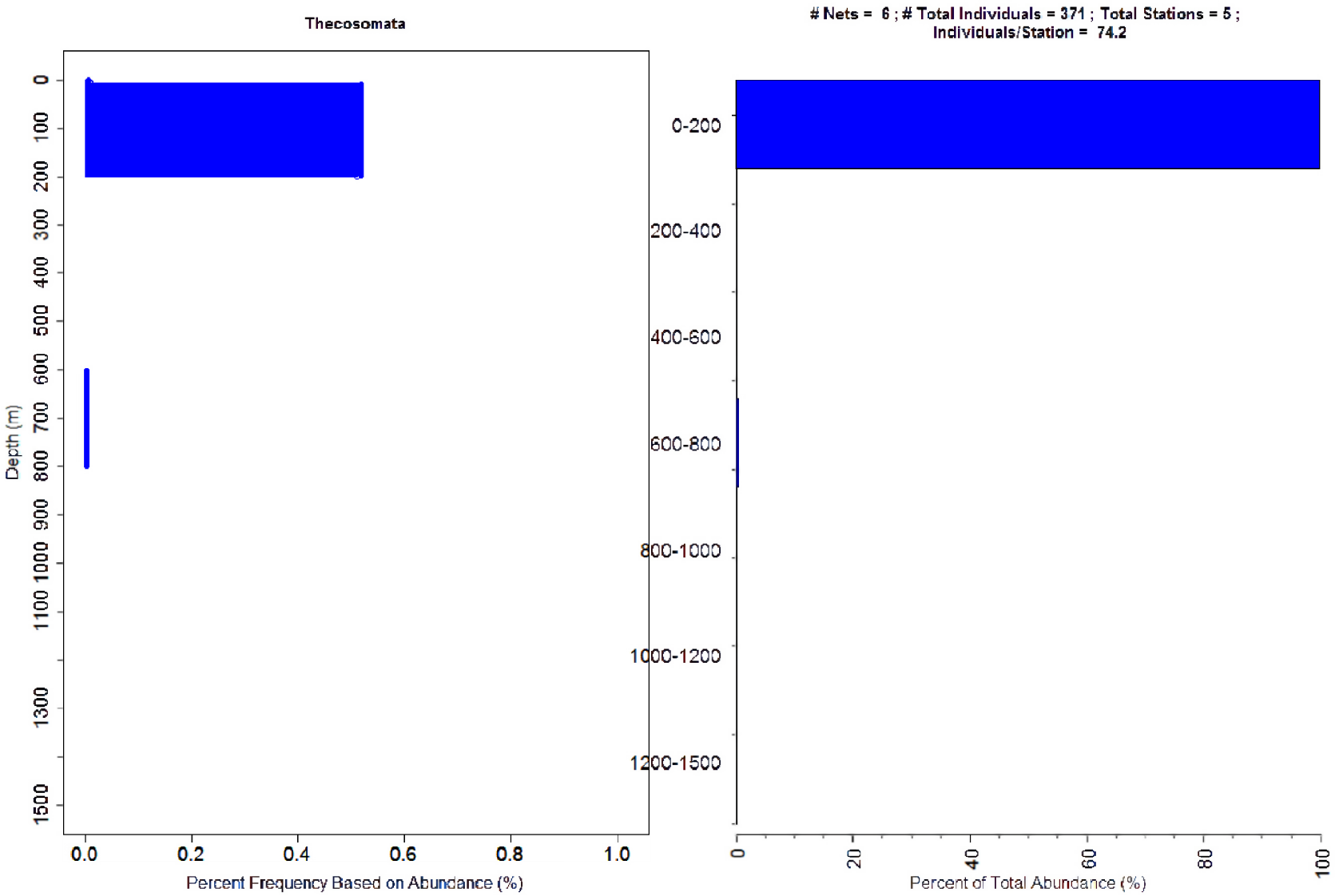
Stomiiformes



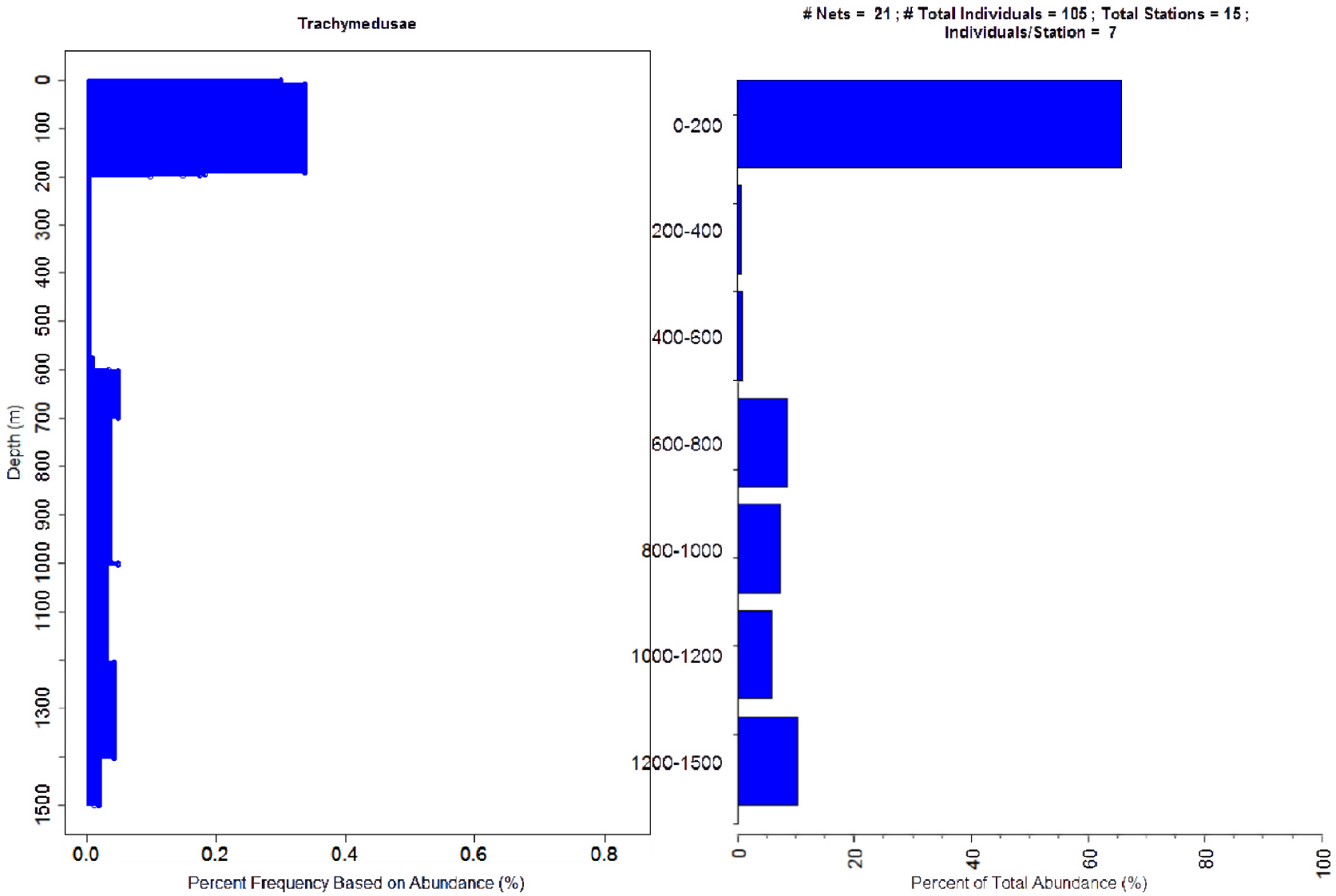
Tetraodontiformes


Teuthida
Nets = 117 ; # Total Individuals = 347 ; Total Stations = 57 ;
Individuals/Station = 6.09
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
1.0
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

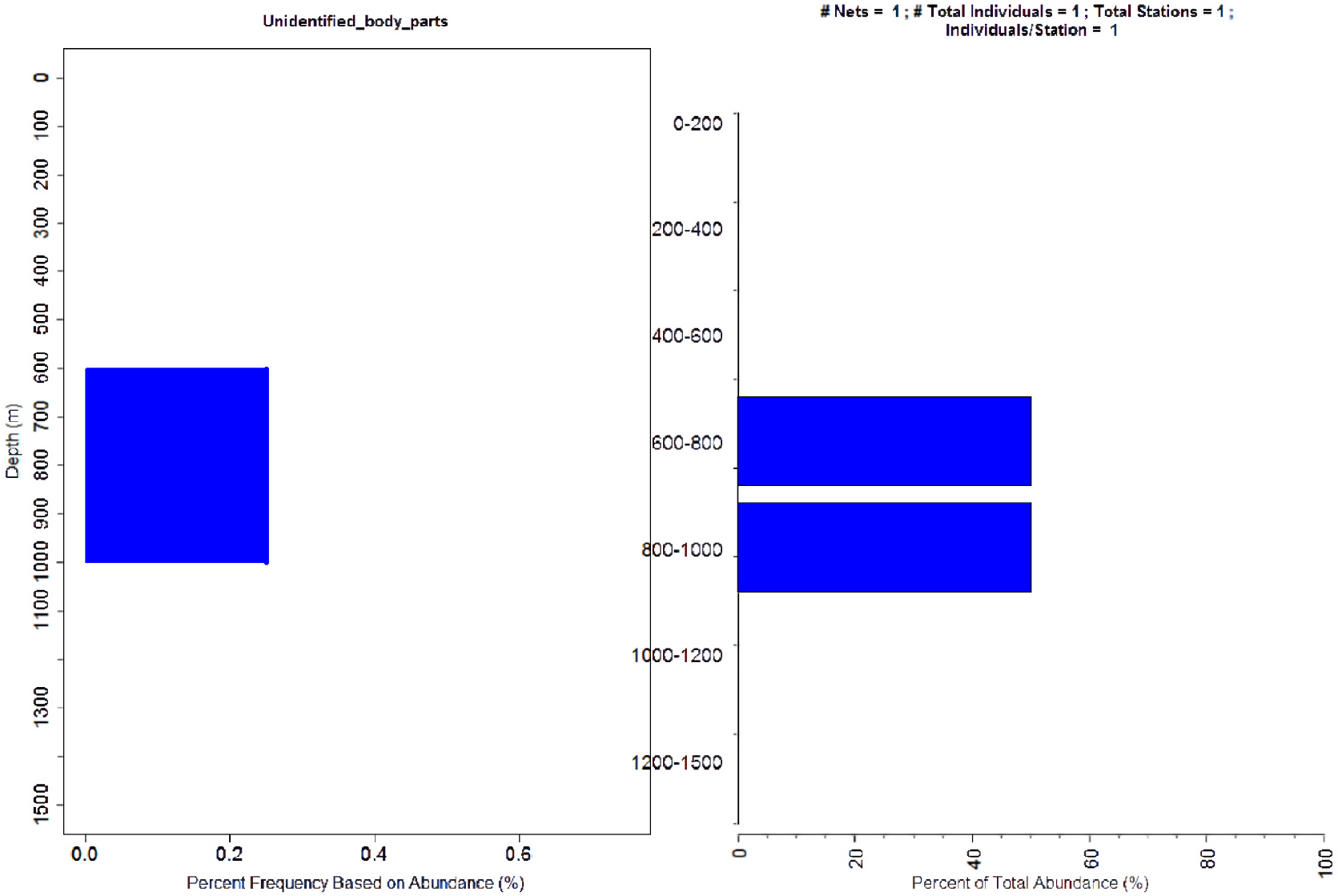
Teuthida



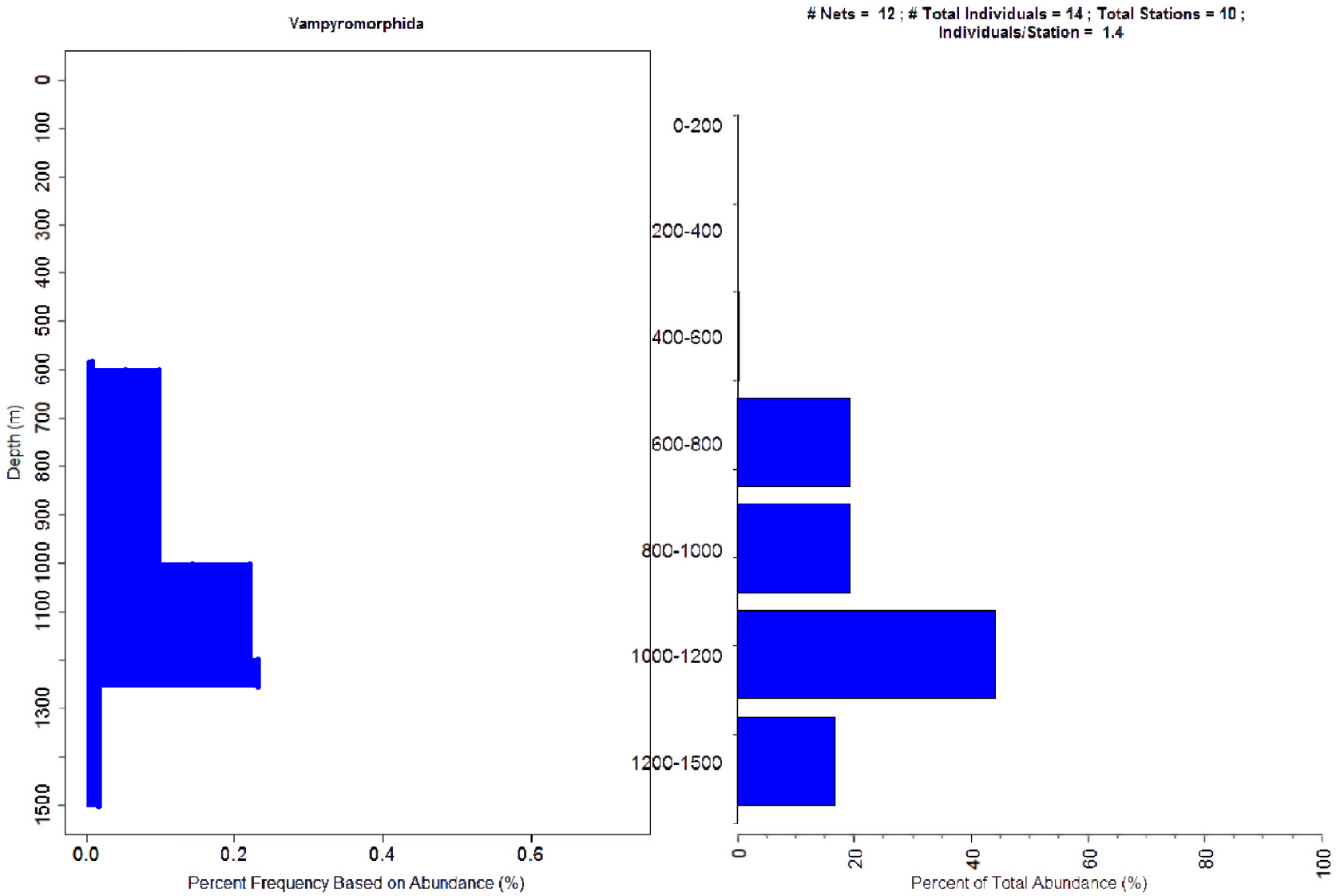
Thecosomata



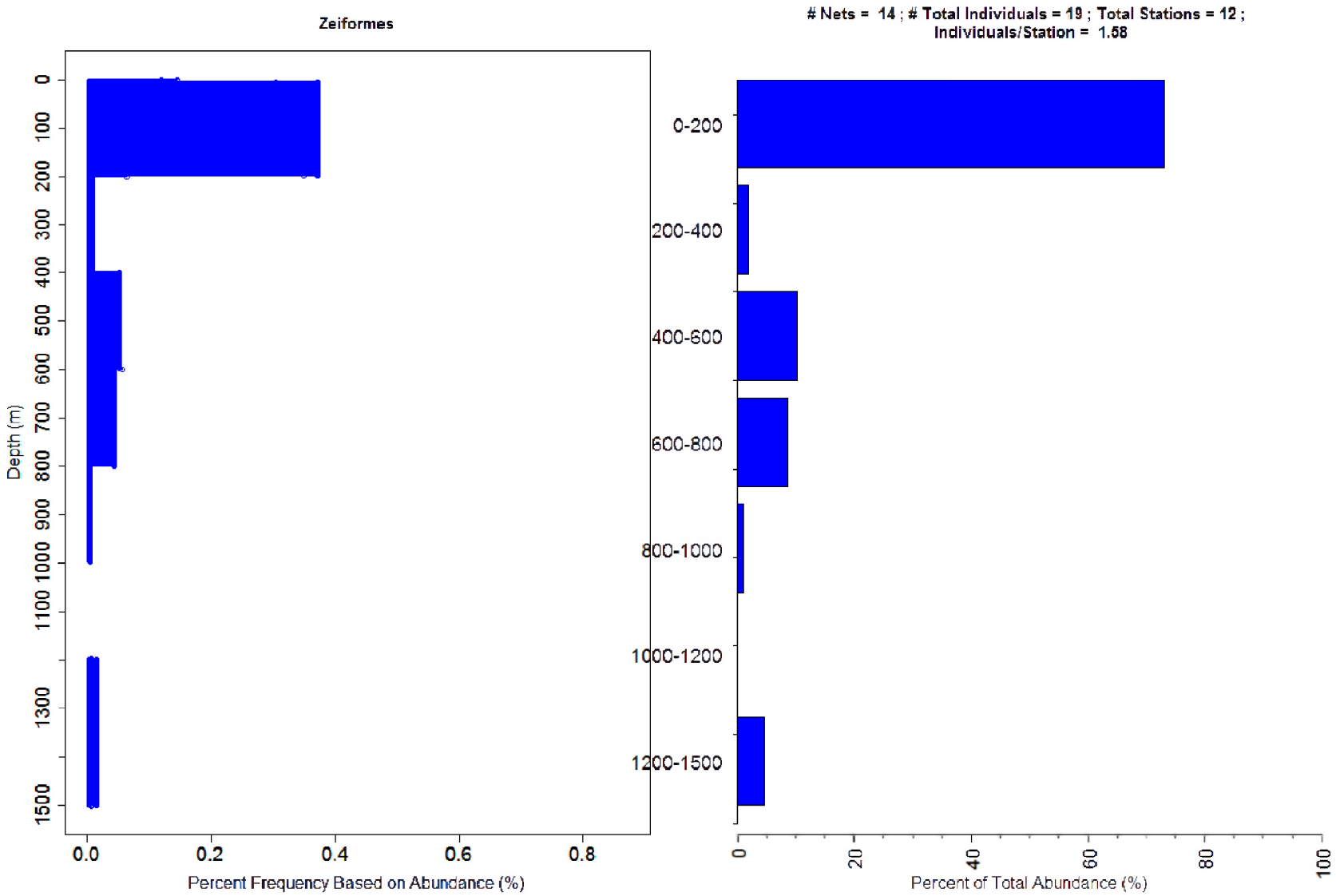
Trachymedusae



Unidentified_body_parts



Vampyromorphida


Zeiformes
Nets = 14 ; # Total Individuals = 19 ; Total Stations = 12 ;
Individuals/Station = 1.58
Depth (m)
0
100
200
300
400
500
600
700
800
900
1000
1100
1300
1500
0.0
0.2
0.4
0.6
0.8
Percent Frequency Based on Abundance (%)
0-200
200-400
400-600
600-800
800-1000
1000-1200
1200-1500
0
20
40
60
80
100
Percent of Total Abundance (%)

Zeiformes

Technical Reports for Deepwater Horizon Water Column Injury Assessment

WC_TR.09: Vertical Distribution Analysis of Plankton

Appendix G. Vertical Distribution of Plankton at the Analysis Taxa Level

Authors: Deborah French McCay, Alicia Morandi, M. Conor McManus, Melanie Schroeder, Katharine Jayko, and Jill Rowe

Date of Report: August 31, 2015
Project Number: 2011-144
RPS ASA 55 Village Square Drive, South Kingstown, RI 02879

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G.1 Introduction

This document contains a brief description of the data inputs and methods used to assign vertical distribution ranges to plankton taxa in the Gulf of Mexico. It also includes a guide and explanation for the Appendix G Excel spreadsheet containing plankton input data derived from SEAMAP Historical 1-m^2 MOCNESS and Bongo, SEAMAP Zooplankton Bongo, NRDA Tier 1A Shallow and Deep 1-m^2 MOCNESS, and NRDA 10-m^2 MOCNESS surveys, as well as the resulting water column depth ranges assigned for each taxon.

The vertical depth ranges in this appendix were calculated *at the analysis taxa level*, which is the lowest taxonomic level to which the specimens were identified (unless otherwise indicated). To facilitate ease of interpretation and reduce the need for default ranges assigned due to lack of adequate sample size, an additional appendix (Appendix H) contains vertical distribution data summarized at higher taxonomic levels (i.e., family, order, or higher level). However, this appendix includes the input data in their entirety and at the most detailed taxonomic level.

G.2 Dataset Summaries

G.2.1 Ichthyoplankton Data Sources

- SEAMAP Historical 1-m^2 MOCNESS (histmoc1):
  - Depth-discrete dataset where only ichthyoplankton were identified.
  - Sampled from the surface to 136 m where water depth allowed, in roughly 20-m depth bins.
  - Total of 97 stations (a.k.a. deployments), of which 55 were sampled during the day and 42 at night.

- NRDA Tier1A Shallow 1-m^2 MOCNESS (T1Ashallow):
  - Depth-discrete survey where ichthyoplankton and decapod zooplankton were identified and counted.
  - Sampled from the surface to 160 m where water depth allowed, in roughly 20-m depth bins.
  - Total of 8 stations sampled.

- NRDA Tier1A Deep 1-m^2 MOCNESS (T1Adeep):
  - Depth-discrete survey where ichthyoplankton and decapod zooplankton were identified and counted.
  - Sampled from the surface to 2,200 m where water depth allowed, in roughly 200-m depth bins.
  - Total of 20 stations sampled.

- SEAMAP Historical Bongo (Ichthyo (SEAMAP)):
  - Continuous survey of ichthyoplankton from the surface to 200 m with a bongo net.

- All taxa collected that were not accounted for in one of the depth-discrete datasets were assigned a 0 – 100 m default depth range (See Section 3.2.2 of the main report).

G.2.2 Zooplankton Data Sources

- NRDA 10-m^2 MOCNESS (MOC10):
  - Depth-discrete survey where fish and invertebrates were identified and counted.
  - Sampled from the surface to 1,500 m where water depth allowed, in roughly 200-m depth bins.
  - Total of 66 stations from Meg Skansi Cruise 7 were used in the vertical depth analysis.
  - Taxa were grouped to the family level unless species or genera were found in other datasets. Only invertebrate taxa were considered planktonic, the fish were considered nekton based on size.

- NRDA Tier1A Shallow 1-m^2 MOCNESS (T1Ashallow):
  - Depth-discrete survey where ichthyoplankton and decapod zooplankton were identified and counted.
  - Sampled from the surface to 160 m where water depth allowed, in roughly 20-m depth bins.
  - Total of 8 stations sampled.

- NRDA Tier1A Deep 1-m^2 MOCNESS (T1Adeep):
  - Depth-discrete survey where ichthyoplankton and decapod zooplankton were identified and counted.
  - Sampled from the surface to 2,200 m where water depth allowed, in roughly 200-m depth bins.
  - Total of 20 stations sampled.

- SEAMAP Zooplankton (Zoop):
  - Continuous survey of invertebrate zooplankton from the surface to 200 m (where water depth allowed) with a bongo net.
  - All taxa were assigned 0 – 200 m default depth range.
  - Broad decapod groups removed from dataset to defer to more detailed vertical data for decapods in the depth-discrete NRDA Tier 1A datasets.

G.3 Vertical Distribution Methods

G.3.1 Methods Overview

All depth-discrete MOCNESS datasets (Historical MOC1, Tier1A Shallow, Tier1A Deep, MOC10) were analyzed similarly: for each analysis taxa, a plot of vertical density distribution was generated along with several statistics, including the number of stations at which the taxon occurred, the total number of individuals caught at all stations, the average number of individuals caught per station (ind/loc), and abundance distributed across each vertical depth bin (as percent of individuals in each depth bin).

The cumulative percentage of total abundance was calculated for each 20-m or 200-m depth bin from the surface down and, again (separately), from the deepest point up to the surface. The minimum 95th percentile depth range was the upper bound of the shallowest depth bin that contained 5% of the abundance (from the surface downwards) and the maximum 95th percentile depth range was the lower bound of the deepest depth bin that contained 5% of the abundance (from the deepest point upwards). Criteria were developed to determine if there was insufficient data to derive a depth range for an analysis taxon, at which point a default depth range was applied instead. The development of these criteria is described in detail in Appendix B. The methods for application of these criteria to each dataset are described in Section 3.2.2 of the main report.

G.4 Appendix G Spreadsheet Navigation

G.4.1 Navigation Overview

The Appendix G workbook named: (WC_TR.09 Vertical Distributions Plankton_AppG_AnalysisTaxa_2015Aug31.xlsx)

contains tabs with input data from the four depth-discrete MOCNESS datasets: SEAMAP Historical MOC1 (histmoc1), Tier1A Shallow (T1Ash), Tier1A Deep (T1Adp), and NRDA MOC10 (MOC10). The tabs illustrate multiple steps of the vertical distribution assignment process and are described in the following subsections.

G.4.2 Raw Counts by Net

To the far right of the spreadsheet, there are two tabs containing the counts per analysis taxon for each net of the deeper MOC surveys: MOC10 data is on the **MOC10_rawcounts** tab and Tier1A Deep data is on the **T1adp_rawcounts** tab. Both contain sample and cruise information, upper and lower depths of each net sample, and the number of individuals caught in each sample for different analysis taxa (listed across the columns). These tabs were used to investigate whether or not a taxon that did not meet the inclusion criteria had more than 5 individuals caught in nets that sampled below 200 m, to help decide whether a deep (>200 m) default depth range should be applied.

G.4.3 95th Percentile Depth Ranges

The cumulative percent distributions of abundance were calculated from the raw counts by net by taxon using SAS and then imported to the Excel file for analysis. This procedure is described in separate documentation.

In the Excel workbook, there are ten tabs containing the cumulative percent distributions of abundance over depth: Historical MOC1 data is on the **histmoc1_pooled**, **histmoc1_day**, and **histmoc1_night** tabs; Tier1A Shallow data is on the **T1Ash_pooled**, **T1Ash_day**, and **T1Ash_night** tabs; Tier1A Deep data is on the **T1Adp_pooled**, **T1Adp_day**, and **T1Adp_night** tabs; and MOC10 data is on the **MOC10_pooled** tab. These tabs are where the 95th percentile minimum and maximum depths were calculated for each subset of data: day samples, night samples, or both day and night samples pooled. These tabs contain the analysis taxa listed across the columns, with some basic statistics in the first few rows.

The next section (separated by grey bars) contains the percent abundance of each taxa within either 10-m, 20-m, or 200-m depth bins. The cumulative percent abundance was calculated in

the third section by summing the percent abundance in different bins together from the surface downwards and from the deepest depth upwards. The final section calculates min and max depths using if statements that detect the upper limit of the shallowest bin and lower limit of the deepest bin that contain 5% of the abundance. These min and max depths comprise the 95th percentile depth ranges and are carried over into the summary tabs. The **histmoc1** tabs are slightly more complicated with additional sections because this tab is where different methods were tried out (e.g., summing in 10 m bins vs. 20 m bins, using 10th percentile vs. 5th percentile) but the depth ranges that were ultimately used are highlighted in yellow.

G.4.4 Summary of Statistics

There are four tabs that summarize the sample statistics and 95th percentile depth ranges calculated for each dataset: **histmoc1_sum**, **tier1Ashallow_sum**, **tier1Adeep_sum**, and **MOC10_sum**. These tabs contain some taxonomic information as well as basic survey statistics per analysis taxon (mean density, number of locations or stations (i.e., deployments) at which it was caught, total number of individuals caught, average number of individuals per location) for pooled, day, and night datasets where applicable. These statistics were calculated from the raw data in SAS. The tabs also contain the min and max 5th percentile depths, as calculated on the tabs described in **Section G.4.3**.

Kolmogrov-Smirnov analyses were used to determine significant differences in abundance between day and night distributions over depth for ichthyoplankton in the Historical MOC1 dataset. The p-value results can be found on the **histmoc1_sum** tab. Taxa with p-values ≤ 0.10 displayed significantly different diurnal density distributions and if their 95th percentile depth ranges differed by 20 m (the size of one bin) they were assigned unique day and night ranges in addition to a pooled range, for modeling diel vertical migration (DVM).

The **MOC10_sum** tab contains a few additional columns (O through U) within which vertical depth range assignments were made (this occurs on the **histmoc_tier1A_combined** tab for the other datasets). These columns include whether or not the taxa crossed the 200 m line, the shallow, deep, and combined depth ranges, whether or not the depth ranges were default (i.e., did not meet inclusion criteria in Section 3.2.2 of the main report), and the justification or notes about the depth range assignment. There is also a column that indicates whether the taxa was plankton or nekton, as the dataset contains both fish and invertebrates but only the invertebrates were considered planktonic and reported on the compiled tabs.

G.4.5 Ichthyoplankton Comparisons

Like the additional columns on the **MOC10_sum** tab, the **histmoc_tier1A_combined** tab is where the vertical depth ranges were assigned and justifications noted. Because there were some overlapping ichthyoplankton between the Historical MOC1 and Tier1A datasets, final depth ranges were assigned by taking the 95th percentile depths and sample criteria from all three datasets into account, as described in Section 3.2.2 of the main report. This tab contains columns that note whether or not the depth range for a taxon extended below 200 m, whether it was default, the min and max depths of the shallow and deep ranges as well as the dataset or default source of those depths, and notes on the justification for the depth range assignment.

For the majority of taxa, the cumulative abundance distributions over depth described in **Section G.4.3** were one-tailed and either began at the surface or ended at the deepest sampled

depth. However, when the abundance distributions were two-tailed and 5% was 'cut off' at both the surface and at depth during the 95th percentile depth range calculations, either the min or the max depth was manually adjusted so that the range represented 95% of the distribution (rather than covering only 90%). These adjustments were noted in the distribution check column of the **histmoc_tier1A_combined** tab.

G.4.6 Compiled Data by Organism Type

The highest level summary data is in the **Plankton-Fish** and **Plankton-Invert** tabs. These tabs are where one should look for a concise view of the results, with the remaining tabs providing additional detail. Both tabs are structured similarly, with all of the ichthyoplankton (from Historical MOC1, Tier1A Shallow, and Tier1A Deep) on the fish tab and the zooplankton (from MOC10, Tier1A Shallow, Tier1A Deep, SEAMAP Zoop, Pisces, and Shrimp Trawl) on the invertebrate tab. The columns are described in detail below.

- Concatenated ID: Concatenates the name of the source dataset with the analysis taxon as a unique identifier.
- Source Dataset: The dataset from which the data for the analysis taxon was compiled.
- Analysis Taxon: Lowest taxonomic level at which the depth range analyses were conducted.
- Has density data?: Indicates whether or not the analysis taxon was present in the density datasets that were used for injury quantification during modeling.
- concat tax(for sorting): A concatenated text string of all of the taxonomic information compiled from either source datasets or itis.gov that is entered in columns T through AC. Useful for quickly sorting all data taxonomically.
- Lowest Summary Taxonomic Group: When analysis taxa occurred in multiple datasets, spelling and/or capitalization differed (i.e. BATHYLAGIDAE vs. Bathylagidae spp.) so this column contains a standardized spelling of the lowest analysis taxon, for summarizing injury across datasets if needed.
- Lowest Summary Rank: The taxonomic rank of the lowest summary grouping.
- Summary life stage: The life stage of the lowest summary grouping.
- Benthic, demersal, or pelagic: The movement behavior assigned to the analysis taxon. All plankton are pelagic, this column is more relevant for nekton datasets.
- Depth range below 200 m?: Whether or not the range crosses the 200 m mark.
- Default range? (YES/no/partial): Whether part or all of the depth range was defaulted (i.e., the statistics for the analysis taxon did not meet inclusion criteria).
- Combined (overall) Depth Range (m): The overall depth range that combines the shallow assigned range with the deep assigned range to provide a complete picture of where the taxon as found across datasets.
- Vertical Range Order: An approximate order of the vertical depth ranges listed from the surface downwards (with overlaps). Useful for sorting taxa from the shallowest to the deepest depth ranges.
- Vertical Range Code: A unique code assigned to each vertical depth range.
- Vertical Range Description: A detailed description of the vertical depth range.
- General Depth Zone: A more general description of the depth zones encompassed by the vertical depth range: surface (0 - 40 m), epipelagic (0 – 200 m), mesopelagic (0 – 1,000 m), and bathypelagic (>1,000 m).

- If DVM plankton – Day Depth Range (m): Day vertical depth range of taxa that had KS p-values ≤ 0.10 and ranges that differed at least 20 m. Only applied to taxa from the Historical MOC1 dataset.
- If DVM plankton – Night Depth Range (m) Night vertical depth range of taxa that had KS p-values ≤ 0.10 and ranges that differed at least 20 m. Only applied to taxa from the Historical MOC1 dataset.
- Taxonomic Information: Columns T through AC contain taxonomic information of type (fish vs. invert), phylum, subphylum, class, order, infraorder or suborder, superfamily, family, genus, and species compiled from either source datasets or itis.gov.
- Taxa Common Name: (incomplete)

G.4.7 Miscellaneous

The **VerticalRanges** tab contains a table of all of the vertical depth ranges assigned to either plankton or nekton with codes, descriptions of the depth range, and the general depth zone listed in order from the surface downwards. Finally, the **ReadMe** tab contains spreadsheet metadata.

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Appendix H. Vertical Distribution of Plankton Taxa at Higher Taxonomic Levels

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H.1 Introduction

This document contains a guide and explanation for the Appendix H Excel spreadsheet containing ichthyoplankton and zooplankton input data derived from SEAMAP Historical 1-m^2 MOCNESS, NRDA Tier 1A Shallow and Deep 1-m^2 MOCNESS, and NRDA 10-m^2 MOCNESS, summarized to higher taxonomic levels (order or family, where possible). This generalized the depth ranges over broader taxonomic categories, and reduced the need for default ranges assigned to those taxa that lacked adequate data at the lowest taxonomic level. Refer to Section 3.2 of the main report for information on the methods used to assign depth ranges and Appendix G for information on the datasets used as well as results for the vertical distribution analysis conducted at the lowest possible taxonomic level.

H.2 Appendix H Spreadsheet Navigation

H.2.1 Navigation Overview

The Appendix H workbook named: (WC_TR.09 Vertical Distributions Plankton_AppH_OrderFamily_2015Aug31.xlsx) contains tabs with input data from the four depth-discrete MOCNESS datasets: SEAMAP Historical MOC1 (histmoc1), Tier1A Shallow (T1Ash), Tier1A Deep (T1Adp), and NRDA MOC10 (MOC10). The tabs illustrate multiple steps of the vertical distribution assignment process and are described in the following subsections.

H.2.2 95th Percentile Depth Ranges

The cumulative percent distributions of abundance were calculated from the raw counts by net by taxon using SAS and then imported to the Excel file for analysis. This procedure is described in the main report.

In the Excel workbook, there are eight tabs containing the cumulative percent distributions of abundance over depth. These tabs are where the 95th percentile minimum and maximum depths were calculated for each dataset at either the order level (tab name preceeded with **O-**) or the family level (tab name preceeded with **F-**). Historical MOC1 data at the order level is on the **O_histmoc_depths** tab while Historical MOC1 data summarized to the family level (used for fish in the Perciformes order) is on the **F_histmoc_depths** tab; Tier1A Shallow data is on the **O-t1ash_depths** and **F-t1ash_depths** tabs; Tier1A Deep data is on the **O-t1adp_depths** and **F-t1adp_depths** tabs; and MOC10 data is on the **O-MOC10_depths** and **F-MOC10_depths** tabs. For invertebrates, family level summaries were only used for taxa within the order Decapoda.

These depth tabs contain the analysis taxa listed across the columns, with some basic statistics in the first few rows. The next section (separated by grey bars) contains the percent abundance of each taxa within either 10-m, 20-m, or 200-m depth bins. The cumulative percent abundance was calculated in the third section by summing the percent abundance in different bins together from the surface downwards and from the deepest depth upwards. The final section calculates min and max depths using if statements that detect the upper limit of the shallowest bin and lower limit of the deepest bin that contain 5% of the abundance. These min and max depths comprise the 95th percentile depth ranges and are carried over into the summary tabs.

H.2.3 Summary of Statistics

There are eight tabs that summarize the sample statistics and 95th percentile depth ranges calculated for each dataset and higher taxonomic level: **O-histmoc_statsum**, **F-histmoc_statsum, O-t1ash_statsum**, **F-t1ash_statsum O-t1adp_statsum**, **F-t1adp_statsum**, **O-MOC10_statsum**, and **F-MOC10_statsum**. These tabs contain some taxonomic information as well as basic survey statistics per analysis taxon (mean density, number of locations or stations (i.e., deployments) at which it was caught, total number of individuals caught, average number of individuals per location) for pooled, day, and night datasets where applicable. These statistics were calculated from the raw data in SAS. The tabs also contain the min and max 5th percentile depths, as calculated on the tabs described in Section H.2.2.

H.2.4 Comparisons between Datasets

The **histmoc_tier1A_ichthyo** tab is where the vertical depth ranges were finally assigned and justification notes are located for ichthyoplankton taxa. Because there were some overlapping ichthyoplankton between the Historical MOC1 and Tier1A datasets, final depth ranges were assigned by taking the 95th percentile depths and sample criteria from all three datasets into account. This tab contains columns that note whether or not the depth range for a taxon extended below 200 m, whether it was default, the min and max depths of the shallow and deep ranges as well as the dataset or default source of those depths, and notes on the justification for the depth range assignment.

The same procedure was applied to zooplankton taxa from the MOC10 and Tier1A datasets on the **tier1A_MOC10_inverts** tab.

H.2.5 Compiled Data by Organism Type

The highest level summary data is in the **OrderFamily_Ichthyoplankton** and **OrderFamily_Inverts** tabs. These tabs are where one should look for a concise view of the results, with the remaining tabs providing additional detail. Both tabs are structured similarly. All of the ichthyoplankton (from Historical MOC1, Tier1A Shallow, and Tier1A Deep) were summarized at the order level except Perciformes taxa, which were summarized at the family level. All zooplankton (from MOC10, Tier1A Shallow, and Tier1A Deep) were summarized at the order level except Decapoda taxa, which were summarized at the family level. The columns are described in detail below.

- Concatenated ID: Concatenates the name of the source dataset with the analysis taxon as a unique identifier.
- Higher Level Analysis Taxa: Either the family, order, or higher taxonomic summary level.
- Taxonomic Rank: Indicates the taxonomic rank of the summary level as order, family, other level, or unspecified (for unidentified species and parts).
- Default range? (YES/no): Whether part or all of the depth range was defaulted (i.e., the statistics for the analysis taxon did not meet inclusion criteria).
- Below 200 m? (YES/no): Whether part or all of the depth range extended below the 200 m depth.

- Combined (overall) Depth Range (m): The overall depth range that combines the shallow assigned range with the deep assigned range to provide a complete picture of where the taxon as found across datasets.
- Vertical Range Order: An approximate order of the vertical depth ranges listed from the surface downwards (with overlaps). Useful for sorting taxa from the shallowest to the deepest depth ranges.
- Vertical Range Code: A unique code assigned to each vertical depth range.
- Vertical Range Description: A detailed description of the vertical depth range.
- General Depth Zone: A more general description of the depth zones encompassed by the vertical depth range: surface (0 - 40 m), epipelagic (0 – 200 m), mesopelagic (0 – 1,000 m), and bathypelagic (>1,000 m).
- concat_tax(for sorting): A concatenated text string of all of the taxonomic information compiled from either source datasets or itis.gov that is entered in columns L through Q. Useful for quickly sorting all data taxonomically.
- Taxonomic Information: Columns L through Q contain taxonomic information of type (fish vs. invert), phylum, subphylum, class, order, and family compiled from either source datasets or itis.gov.