# Results of the 2023 Survey of the Sea Otter Population in Washington State


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## Introduction

Northern sea otters, *Enhydra lutris kenyoni* (hereafter sea otter or otter), historically ranged throughout much of the coastal North Pacific. In the western North Pacific Ocean, sea otters could be found from the northern islands of Japan through the Commander and Aleutian Islands, including areas as far north as the Pribilof Islands. In the eastern North Pacific Ocean, sea otters ranged from the Alaska Peninsula south along the coast to Oregon (Wilson et al. 1991). In Washington, areas of sea otter concentration were reported from the Columbia River north along the coast of the Olympic Peninsula (Scheffer 1940). Washington's sea otter population was extirpated through hunting by the early 1900s. In an effort to reintroduce otters to Washington, sea otters were captured at Amchitka Island, Alaska, in 1969 and 1970 and translocated to states/provinces where they had been extirpated, including locations in Alaska, British Columbia, Washington, and Oregon. In Washington, a total of 59 sea otters were translocated to the outer coast of the Olympic Peninsula, with 29 individuals released near Point Grenville in 1969 and an additional 30 otters released near La Push in 1970 (Jameson et al. 1982; Jameson et al. 1986). In 2004, Washington State published a recovery plan for sea otters (Lance et al. 2004), and the status of the Washington sea otter population is reviewed by the WDFW every five years (for the most recent status review see Sato et al. 2018). Sea otters are currently listed as a Threatened species in the State of Washington and are protected under the Marine Mammal Protection Act of 1972.

Since 1989, aerial and ground surveys have been conducted by WDFW and USFWS/USGS to monitor Washington's sea otter population. Only three years of counts are missing from this time series – 2009 due to poor weather conditions, 2018 due to lack of funding, and 2020 due to the COVID-19 pandemic. In 1989, the population was estimated to be 208 sea otters, living primarily in the rocky habitats north of La Push, but with a small number counted as far south as Destruction Island. By 2019, the population had grown to at least 2,785 otters (Jeffries et al. 2019). During this time, sea otters have continued to occupy the primary range between Point Grenville and Cape Flattery, with population growth occurring within this range. Extralimital reports of sea

otters, which most likely originated from this coastal Washington population, include detections as far south as Cape Arago, Oregon, along the coast and detections in the Strait of Juan de Fuca, San Juan Islands, Admiralty Inlet, Bellingham Bay, and southern Puget Sound. A translocated population of sea otters also occurs along the outer Vancouver Island coast from Barkley Sound to Cape Scott.

## Methods

Washington sea otter surveys are a collaborative effort between biologists and volunteers from the Washington Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Olympic Coast National Marine Sanctuary, Olympic National Park, The Seattle Aquarium, Oregon Coast Aquarium, and the Quinault Indian Nation.

### *Survey Protocol*

Sea otter aerial surveys were flown in WDFW's Partenavia P-68C-TC (N 357 PN) or in a contracted Cessna 206 and cover coastal waters within the historical range of sea otters in Washington. A reconnaissance flight from Tillamook Rock, OR (45.3852° N −124.0184° W), north to Cape Flattery, WA (48.3861° N; −124.7261° W), then east into the Strait of Juan de Fuca to Freshwater Bay (48.1432° N; −123.6089 °W), WA, is typically conducted the day prior to beginning surveys to establish sea otter distribution and investigate the possibility of range expansion. This reconnaissance flight is then followed by three consecutive days of surveys covering coastal waters from just north of Grays Harbor, WA, at Copalis Rocks (47.2952° N; −124.2610° W) to Cape Flattery, and then east in the Strait of Juan de Fuca to Freshwater Bay. For discussion purposes, this survey area is broken up into a southern segment (from La Push south) and northern segment (from La Push north and into the Strait of Juan de Fuca).

Surveys were flown at approximately 800–1000' Above Ground Level (AGL) following a trackline along the coast about 0.5 mile from shore, allowing observation of a strip from the shoreline to ~2 miles offshore. This trackline covered all kelp beds and nearshore rocks and reefs along the outer Washington coast from Copalis Rocks north into the Strait of Juan de Fuca. The flight crew consisted of the pilot and three observers – a primary observer, secondary observer/data recorder, and a tertiary observer. The primary observer sat in the right front seat and was responsible for locating otters and directing the pilot; photographing otters with a digital camera (Canon EOS 7D Mark II equipped with a 100–400 mm lens); and counting (groups < 25 otters) or estimating (groups >25 otters) group size. The secondary observer in the right rear seat looked for otters, especially individuals or small groups near to but not part of large groups, and recorded times, counts, locations, and photo numbers on a flight log. The tertiary observer sat in the rear left seat, focusing on locating offshore groups and otters that the primary and secondary observers may have missed while focusing on the right side of the plane. For larger groups of sea otters, the aircraft circled clockwise to enable the primary observer to estimate numbers of otters and take digital photos without glare from the sun. For safety purposes, Automatic Flight Following (AFF) was used to track real-time locations for the aircraft. A Garmin GPSmap76Cx was used to record track lines. In 2024, the ArcGIS Survey Maps app was run on a tablet and used as additional tool

to help orient observers. This app was not used to record data but provided the plane's position in real time displayed on a map of the Washington coast.

In 2022, two offshore survey legs were added to each sea otter survey to investigate an apparent shift towards increased offshore habitat use by Washington's sea otters. These offshore survey legs indicated substantial, if inconsistent, use of the area surveyed 2 – 4 miles offshore between Split and Willoughby rocks and Destruction Island in the 2022 surveys (Clark et al. 2023). In 2023, however, mechanical issues with WDFW's Partenavia meant that surveys were flown in a contracted Cessna 206, which is a single engine plane, thus did not meet WDFW's safety requirements for flying offshore. As such, this new offshore survey transects could not be conducted in 2023.

*Ground-based Surveys*

Teams of ground observers conducted shore-based, visual surveys of nearshore sea otter habitat at five locations on the Washington Coast using binoculars and spotting scopes. From north to south, these locations included Duk Point/Seafield Creek, Sand Point, Norwegian Memorial, Giants Graveyard, and on the Quinault Indian Nation inshore of Split and Willoughby rocks. A full count of the viewable area was conducted by ground observers within approximately 30 minutes of the aerial observations of the same location. Observations of adults (independent) and large or small pups (dependent) were recorded on a topo or aerial photo delineated with the viewable area during each count (noting visual obstructions and environmental conditions that limit visibility during the count). Ground observers also recorded weather conditions, otter behaviors, their assessment of the accuracy of the count and any potential disturbance (boats, kayaks, response to aircraft, predators, etc.) that occurred during the count.

*Photo Counts and Analyses*

All digital images of groups of otters taken during the aerial surveys were reviewed and the best photo of each group was identified for use in counting. The best photos are those that are in focus, at an appropriate zoom, have minimal sun glare, and ideally capture the otters rafted at the surface, not swimming directionally or diving. Authors counted adults and pups in the digital images using Image J 1.5i (http://imagej.nih.gov/ij) and collectively agreed on the number of otters in each photo. Photo counts only included otters that were distinguishable (e.g., submerged objects that could not be confidently identified as otters were not counted). Pups identified within digital images were distinguished from adults and classified as dependent based on their small size, wooly light brown pelage, and close association/orientation (generally resting on the chest) with an adult.

Counts of adults and pups from the digital images were then added to the counts of otters observed during the survey but not photographed (groups smaller than ~25 individuals) to obtain the full count of sea otters from the aerial surveys. The final estimate consists of the most accurate aerial count of larger groups and estimates of small groups or individuals made during the aerial survey.

Once a total count was calculated for each flight, the flight with the highest total count was selected as the annual estimate. The resulting estimates represent the minimum Washington population count, because there is no correction factor to account for individual animals or small groups off the flight path, outside of the survey area, animals not detected or underwater when the plane flew over. Variance and/or confidence limits for these estimates cannot be calculated because annual estimates are based on the single highest count.

The average rate of population change (% increase or decrease) was calculated from annual counts from 1989 to 2023, and an exponential curve was fit to the count data. This approach provides an estimate of sea otter population growth based on all years in the time series, but also allows prediction across gaps in the dataset (i.e., 2009, 2018, 2020) and assessment of model fit using the $R^2$ value. A 3-year moving average is included in the Appendix for comparison with previous reports (Supplementary Figure 1).

## Results

### *2023 Survey Details*

The 2023 sea otter aerial survey flights were attempted during the week of June 26 – 30, 2023; however, persistent fog on the coast during this window meant that no complete surveys could be flown. A single complete aerial survey was instead flown on July 18, 2023. The 2023 survey crew consisted of J. Well (pilot), C. Clark (primary observer, right front seat), S. Ament (secondary observer/data recorder, right rear seat), and C. Pasi (tertiary observer, left rear seat).

### *Photo Counts*

Only the photos from July 18, 2023, were counted due to the lack of complete surveys during the week of June 26 – 30. The July 18 flight included a survey of the entire Washington sea otter range, from Copalis Rocks to Cape Flattery, then east into the Strait of Juan de Fuca ending at Freshwater Bay (Figure 1). The survey covered the nearshore waters, reefs, and kelp beds, as well as offshore rocks and islands. Observation conditions were very good, with the exception of a small patch of fog that interfered with counts at Bluff Point.

The number of sea otters observed during the survey conducted on July 18, 2023, was 1,343. All otters were observed from the traditional nearshore flight path, as the new offshore legs introduced in 2022 could not be flown in 2023. Of the 1,343 otters observed in 2023, 752 (56%) were observed in the area south of La Push and 591 (44%) in the area north of La Push (Figures 2 A and B, Table 1). The July 28, 2023, survey included 32 pups, with 12 pups observed south of La Push and 20 pups seen in the northern portion of the range. The exponential fit for the minimum abundance of sea otters in Washington from 1989 – 2023 continued a decline seen in the previous year ($R^2 = 0.807$), reflecting ongoing large fluctuations in estimates near the end of the time series (Figure 3).

In 2023, ground observers conducted 13 separate counts of sea otters at five locations on the Washington Coast (Table 2). Sea otter pups were documented from Split and Willoughby rocks in the south to Duk Point in the north. Poor visibility due to low clouds and fog resulted in incomplete aerial surveys during the week of June 25 – July 1, making a comparison to ground based survey results challenging. In past years ground counts typically counted more pups than observed from the plane and were able to classify dependent sea otters as large pups or small pups, which could not be reliably accomplished from aerial photographs or observations. The 2023 ground-based survey does provide insight into sea otter behavior, areas of pup occupancy, and their overall nearshore distribution along approximately 65 miles of Washington's outer coast that would not otherwise have been documented.

## Discussion

Only a single complete survey of the Washington sea otter population was flown in 2023 after several incomplete and unsuccessful surveys during the week of June 20–26, when low clouds and fog obscured much of the Washington outer coast. The total number of otters observed during the complete survey flown on July 18, 2023, was 1,343, less than half of the 2,916 otters counted in 2022, and lower even than the count of 1,811 otters that spurred questions about a possible population decline in 2021. Given the highly variable counts in recent years, as well as an apparent shift in habitat use by Washington's sea otters to include more offshore areas not typically covered by WDFW's sea otter surveys (Clark et al. 2023), the low count in 2023 should be interpreted with caution and should not on its own be considered an indication that the population is in decline.

The use of offshore habitat remains the most likely explanation for the variability in counts since 2019, when large rafts of otters were first spotted outside the traditional inshore survey route in the Kalaloch area. Since that time, aerial observations of sea otters have seesawed between high and low counts, with the high counts in 2019 and the partial survey in 2021 including large groups of otters using offshore habitat and the low counts in 2021 and 2023 occurring in years when offshore habitat was not surveyed. In 2019, more than 1,000 otters were seen in the area near Kalaloch, with many of these occurring in offshore rafts there were only spotted from the inshore transect line due to favorable weather and their large size. Removing these animals from that year's counts would have produced similar results to the 2021 survey. The results of the last four sea otter surveys thus indicate that surveying offshore habitat is critical to capturing the majority of Washington's sea otter population. The offshore area between Destruction Island and Split and Willoughby rocks appears to be commonly used by otters; however, there is no reason to believe this is the only portion of offshore habitat on the Washington coast used by sea otters, as evidenced by surveys conducted in 2022 where relatively few or not otters were seen in this offshore habitat, but total counts were still substantially lower than the high count of that year which included more than 1,100 animals in that area.

Between 1989 and 2002, most of the Washington sea otter population was located north of La Push, with that trend reversing following rapid population growth in the southern segment which outpaced increases in abundance in the northern end of the range (Figures 4 and 5). Examining counts of sea otters in the southern and northern segments of the range individually demonstrates that the large fluctuations in sea otter counts in recent years have occurred primarily

in the southern portion of the range. In contrast, observations of otters in the northern portion of the range have remained stable in recent years. These results may indicated differences in offshore habitat use by otters north and south of La Push, which may be an important factor for guiding the design of future surveys aimed at better capturing the distribution and abundance of sea otters in Washington.

During the 2023 survey, the southernmost sighting was a single individual observed near Point Grenville. The northernmost otter was another single individual observed at Tatoosh Island, and one animals was seen in the Strait of Juan de Fuca at Waadah Island adjacent to Neah Bay. In 2023, a credible sighting was received of a small group of sea otters including a pup at Race Rocks, on the British Columbia side of the Strait of Juan de Fuca, a relatively uncommon occurrence that far east into the Salish Sea. Three dead sea otters were reported on Oregon beaches in 2023, and multiple mortalities occurred there in past years.

The 2023 survey of the Washington sea otter population continued the recent trend of producing highly variable counts that make it challenging to determine population status and trends in abundance. Several logistical, mechanical, and weather-related issues resulted in only a single survey in 2023 that did not align in time with ground-based counts. Past sea otter surveys included several replicate surveys within a week and selected the highest count as a minimum population estimate for sea otters in Washington. In addition to the need to better survey offshore habitat, the 2023 results highlight the importance of conducting replicate surveys to account for variability of otter presence in space and time. An example of this variability is exemplified by incidental observations made by ground observers away from the five survey locations which included a group of ~400 otters near Destruction Island, as well as sightings of ~10 animals at Clallam Bay County Park near Sekiu, where otters were not seen during the aerial survey flights. Perhaps a better solution would be to adopt a sampling-based survey design aimed at generating an abundance estimate for Washington's sea otters, rather than attempting a census of a population that has grown substantially since the introduction of these surveys.

## Acknowledgements

Funding for this survey was provided by U.S. Fish and Wildlife Service under Cooperative Agreement No. F23AC01106. Special thanks to Rite Bros. Aviation pilot Jeff Well who safely flew the 2023 aerial survey and provided pre-flight support and weather guidance. WDFW and USFWS also thank the following ground surveyors: Brittany Blades, Ed Bowlby, Mary Sue Brancato, Ashley Griffin-Stence, Shawn Larson, Deanna Lynch, Anita McMillan, Katie Shellady, Aubrey Theiss, and Terre Zorman. Overflights of the Olympic Coast National Marine Sanctuary below 2000' AGL were conducted under NOAA permits OCNMS-2021-001 issued to WDFW and USFWS. Research activities in Olympic National Park were conducted under Scientific Research and Collecting Permit OLYM-2023-SCI-0020. Cover photograph of ground observers Brittany Blades, Aubrey Theiss, Ashley Griffin-Stence, and Anne Heron taken by Brittany Blades with The Oregon Coast Aquarium.

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**Tables**

Table 1. Results of the complete survey of the Washington sea otter population conducted on 6/23/2022. Independent = Adults; Dependent = Large or Small Pups. The "In/Offshore" column indicates whether the counts at a location were part of the traditional inshore survey of the coast or sighted during the ~2 or ~4 mile offshore legs added to the survey in 2022.

| *Location* | *In/Offshore* | *Independent* | *Dependent* | *Total* |
|---|---|---|---|---|
| **SOUTH SURVEY SEGMENT** | | | | |
| Point Grenville Area | Inshore | 1 | 0 | 1 |
| Flat Rock | Inshore | 1 | 0 | 1 |
| Willoughby Rock | Inshore | 222 | 8 | 228 |
| Queets River Area | Inshore | 3 | 0 | 3 |
| Kalaloch Area | Inshore | 1 | 0 | 1 |
| Destruction Island | Inshore | 356 | 0 | 356 |
| Diamond Rock Area | Inshore | 27 | 0 | 27 |
| Alexander Island | Inshore | 12 | 1 | 13 |
| Goodman Creek | Inshore | 1 | 0 | 1 |
| Toleak Point Area | Inshore | 1 | 0 | 1 |
| Giants Graveyard | Inshore | 114 | 3 | 117 |
| Quillayute Needles | Inshore | 1 | 0 | 1 |
| **NORTH SURVEY SEGMENT** | | | | |
| Cape Johnson Area | Inshore | 2 | 0 | 2 |
| Sandy Island Area | Inshore | 11 | 0 | 11 |
| Norwegian Memorial Area | Inshore | 58 | 5 | 63 |
| Yellow Banks Area | Inshore | 319 | 5 | 324 |
| Sand Point | Inshore | 53 | 4 | 57 |
| White Rock Area | Inshore | 12 | 2 | 14 |
| Tskawahyah/Cannonball Island | Inshore | 7 | 0 | 7 |
| Duk Point | Inshore | 101 | 2 | 103 |
| Father and Son Islands Area | Inshore | 3 | 1 | 4 |
| Point of Arches | Inshore | 2 | 1 | 3 |
| Hobuck Area | Inshore | 1 | 0 | 1 |
| Tatoosh Island | Inshore | 1 | 0 | 1 |
| Waadah Island | Inshore | 1 | 0 | 1 |
| Survey Total | | 1311 | 32 | 1343 |

Table 2. Shore-based counts of sea otters conducted by ground (unshaded columns, 6/27/2023 – 6/30/2023) and aerial (gray column, 7/18/2023) at five locations in the Washington sea otter range in 2023, including site name, date, and maximum number of otters counted.

| | Max otters/site observed daily | | | | |
|---|---|---|---|---|---|
| | **6/27/2023** | **6/28/2023** | **6/29/2023** | **6/30/2023** | **7/18/2023** |
| **Duk Point/Seafield Creek** | 86 | 62 | 64 | 50 | 103 |
| **Sand Point** | 87 | 65 | 108 | - | 57 |
| **Norwegian Memorial** | 93 | - | 81 | - | 63 |
| **Giants Graveyard** | 124 | 80 | - | - | 117 |
| **Split and Willoughby Rocks** | 98 | - | 185 | - | 228 |
| *Daily max observed* | 488 | 218 | 448 | 50 | 568 |


Figure 1. Garmin GPSmap76Cx mapping GPS track line from Washington sea otter aerial survey on July 18, 2023.

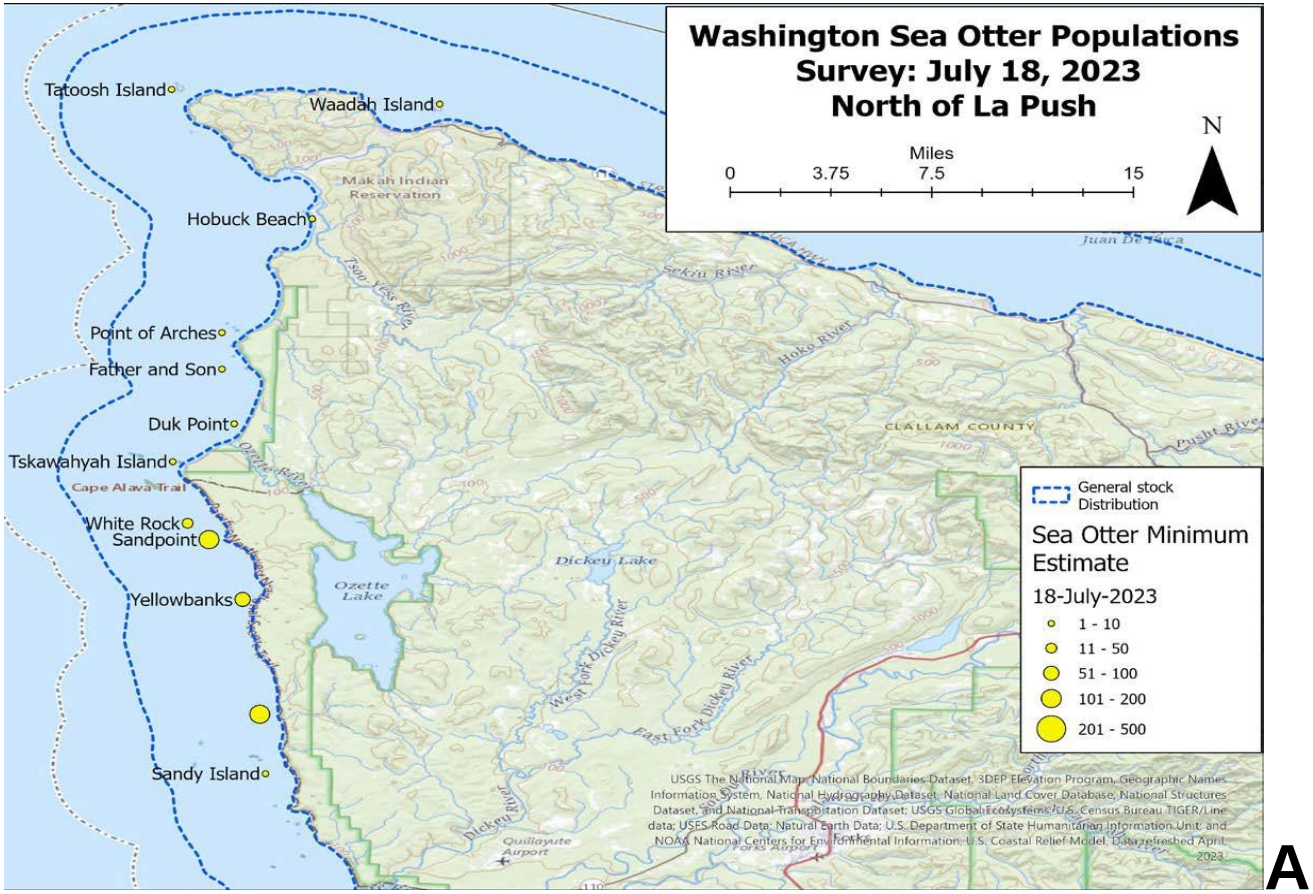



Figure 2A. Washington sea otter population distribution in the northern segment of the range during the survey on July 18, 2023. Sizes of circles correspond to the number of otters counted at that location.

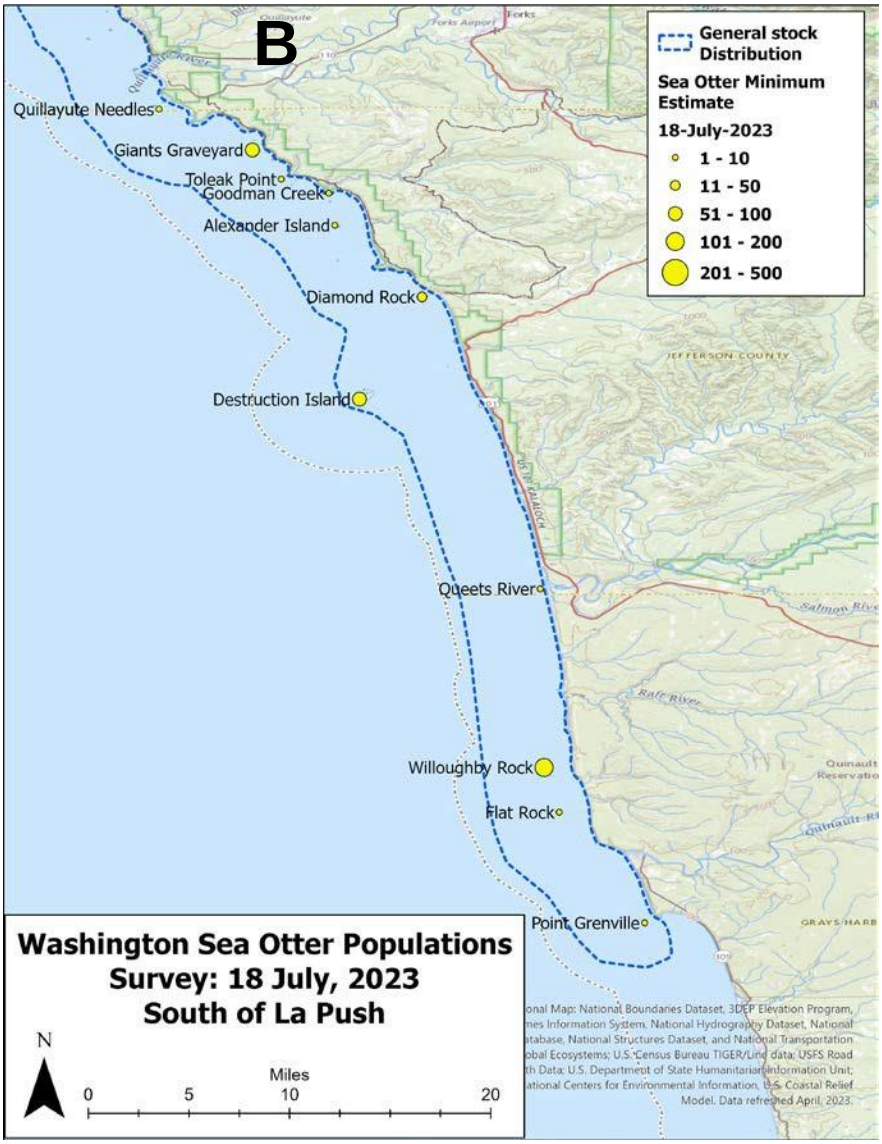



Figure 2B. Washington sea otter population distribution in the southern segment of the range during the surveys on July 18, 2023. Sizes of circles correspond to the number of otters counted at that location.

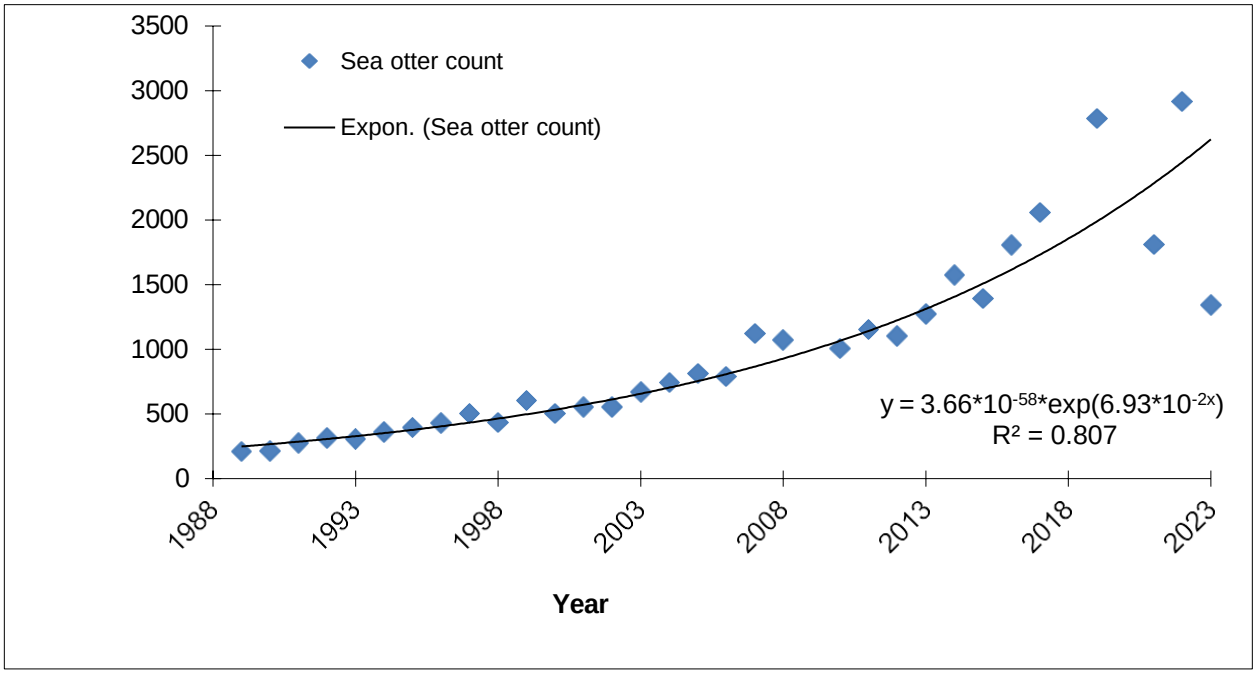



Figure 3. Sea otter counts for Washington State 1989-2022. The solid line depicts an exponential fit for all data 1989 – 2023. The 2022 counts include data from the two offshore transects flown at ~2 and ~4 miles from the coast between Destruction Island and Split/Willoughby Rocks that were not surveyed in previous years and could not be surveyed in 2023. The equation and goodness of fit ($R^2$) for this model is in the bottom right corner.

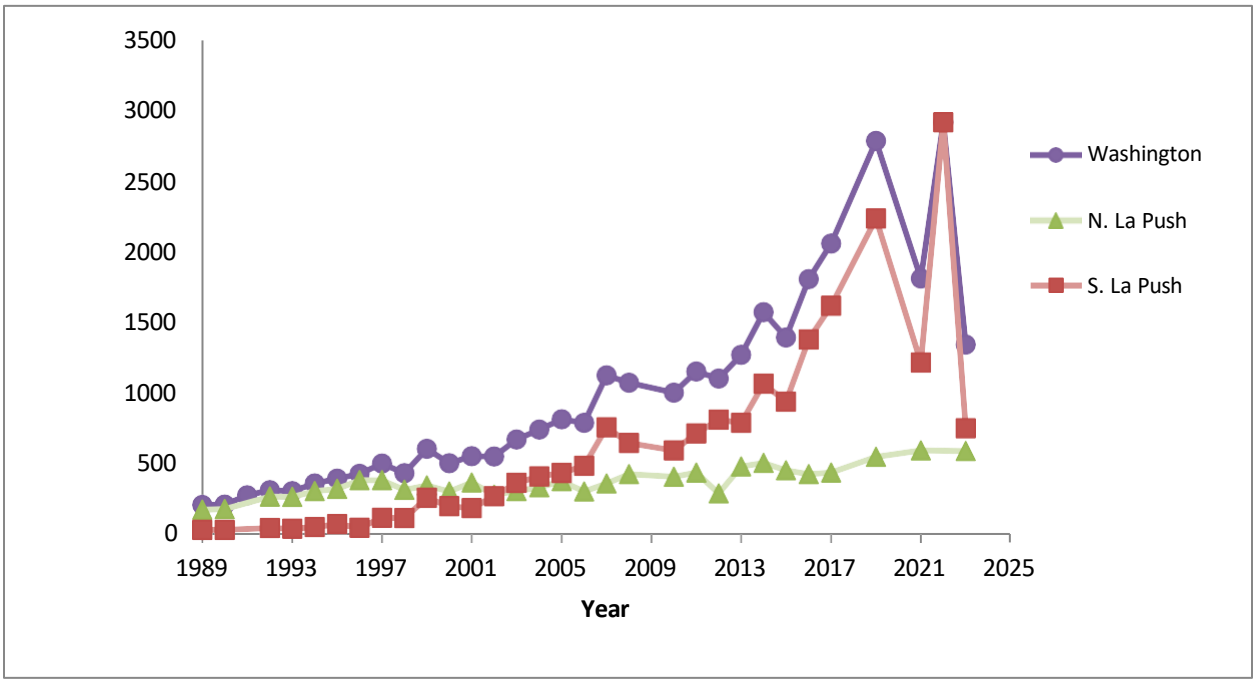



Figure 4. Growth patterns for Washington's sea otter population from 1989 and 2023. Purple circles depict the overall count for Washington State. Red squares represent counts for the southern segment (south of La Push) and green triangles depict counts for the northern segment (north of La Push).

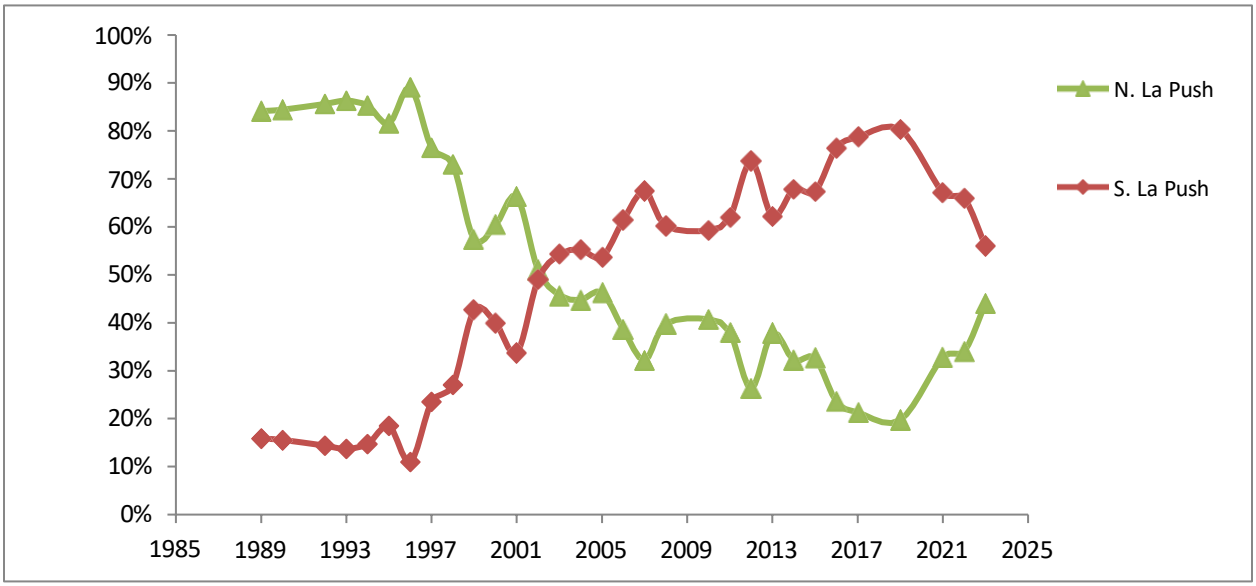
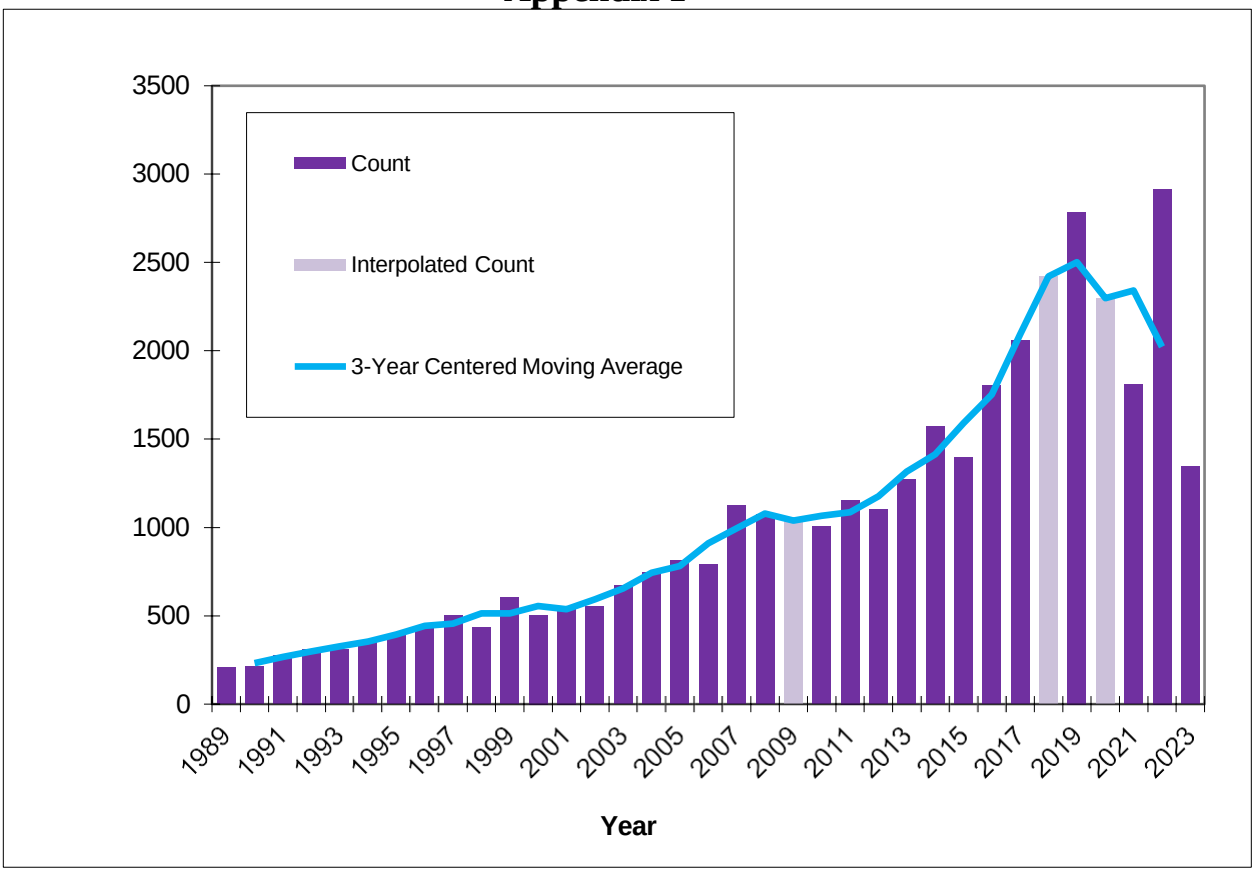


Figure 5. Comparative percentage of Washington sea otter population between the north and south (of La Push, WA) survey segments from 1989 – 2023.

# Appendix 1




Supplemental Figure 1. Three year centered moving average of sea otter counts from 1989 to 2023. The moving average is calculated using interpolated data for the years without counts (2009, 2018, 2020). Actual counts of sea otters are represented by the dark purple. Interpolated counts are presented as a lighter shade of purple.