Microhabitat Selection of Juvenile *Oncorhynchus mykiss*, Juvenile Chinook Salmon (*O. tshawytscha*), and Bull Trout (*Salvelinus confluentus*) Within Shitike Creek, Oregon at Varying Fish Densities.

Progress Report Fiscal Year 2003
And 2004 Work Plan

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Introduction

In 2002, the Service and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) received funding to evaluate the outplanting program in Shitike Creek and provide information on ecological interactions between spring Chinook and other fish species (FONS Project Number 1999-010). One aspect of the evaluation is to determine habitat use and ecological interactions between juvenile spring Chinook salmon (*Oncorhynchus tshawytscha*), juvenile summer steelhead or rainbow trout (*O. mykiss*), and bull trout (*Salvelinus confluentus*) in Shitike Creek. In 2003, the Service and the CTWSRO implemented a summer snorkel survey to specifically evaluate microhabitat selection of juvenile salmonids and investigate ecological interactions from the Chinook salmon outplanting program. The results of the evaluation will be used by Service personnel, and managers of natural resources, to mitigate and reduce ecological interactions between hatchery and wild fish. The following project objectives were proposed for fiscal year 2003 and 2004.

Objectives:

1) Identify microhabitat selection (depth, water velocity, species association, cover use, temperature) juvenile Chinook salmon, juvenile *O. mykiss* and Bull trout within Shitike Creek at varying densities.

2) Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water habitat units.

<u>Potential Management Action:</u> Adjust or manipulate the number or location of adult Chinook outplantings to maximize number of Chinook produced but minimize any density effects on microhabitat selection of juvenile *O. mykiss* or bull trout.

Input from project cooperators, the CTWSRO Fish and Wildlife Committee and biometric specialists may slightly alter or change the methodologies and actions proposed within this document.

Methods

Objective 1: Identify microhabitat selection of juvenile Chinook salmon, juvenile O. mykiss and Bull trout within Shitike Creek at varying densities.

A snorkel survey was instituted during summer 2003 that had two purposes; identify microhabitat selection of juvenile Chinook salmon, juvenile *O. mykiss*, and bull trout within Shitike Creek and to estimating abundance of these species. The snorkel survey conducted in 2003 was similar to a previous abundance survey conducted by Oregon Department of Fish and Wildlife (ODFW, Dambacher 2001) for purposes of comparison.

The microhabitat survey consisted of a three or four person snorkel crew performing visual observation and enumeration of juvenile Chinook salmon, juvenile *O. mykiss* and Bull trout. Slow-water habitat units, such as a pool or large backwater area, were randomly selected

for snorkel observation in three of the five identified reaches from the 2001 snorkel survey (Dambacher 2001). Juvenile *O. mykiss* and juvenile Chinook salmon encountered by a snorkeler were systematically selected (using a random start) for collection of microhabitat data. The microhabitat survey measured similar variables as Underwood et al. (1995) to determine microhabitat preference (Table 1). Only fish undisturbed by the snorkeler were selected for microhabitat observation. Snorkelers collected a minimum of 10 microhabitat observations on juvenile *O. mykiss* and juvenile Chinook salmon within a slow-water habitat unit.

A bounded count was performed by snorkelers within a habitat unit after collection of microhabitat data and a 15 minute period of inactivity. The methodology of the bounded counts was performed by snorkelers during the 2001 ODFW survey. In this previous juvenile salmonid abundance survey, a number of fast and slow water habitats were identified, snorkeled, and abundance estimates generated for each sampled habitat unit throughout the distribution of juvenile Chinook salmon in Shitike Creek (Table 2 and Figure 1). Based on results of the 2001 abundance survey, a large amount of the juvenile Chinook and juvenile *O. mykiss* populations occur in slow-water habitat rather than fast-water habitat (Figures 2 and 3). For FY 2003, only slow-water habitat units were sampled during the microhabitat and abundance survey (Table 2).

A change to the past survey abundance methodology used in Shitike Creek by ODFW (Dambacher 2001) involved a modification to the bounded counts estimator used to estimate juvenile fish abundance when performing snorkel counts (Robson and Whitlock 1954; Routledge 1982). The bounded counts estimator is

$$\hat{Y} = X_m + (X_m - X_{m-1})$$

where,

$\hat{Y}$ = abundance estimate for unit

X_m = highest count

X_{m-1} = next highest count

Dambacher (2001) found that in most units sampled for juvenile abundance, only counts made by divers during the first 3 of 4 passes were used in the bounded counts estimator therefore, only 3 passes were required for snorkelers during the bounded counts performed in slow-water habitat units.

Traditionally, validation of a bounded count estimate on a habitat unit is conducted using multiple pass electrofishing (Hankin and Reeves 1988). In an effort to calibrate snorkel counts, reduce stress on juvenile fish and conserve man-hours, a new snorkel count calibration method was attempted using a mark-resight methodology (Table 3). The mark-resight estimate calculated from that snorkel count would have been considered the "true" number of juvenile *O. mykiss* and Chinook salmon within the slow-water unit. Unfortunately, water temperatures in the slow-water habitat units selected for mark-resight calibration increased beyond 19°C, a threshold temperature for reduced stress and mortality from handling. A decision to postpone the mark-resight calibration was made until water temperatures decreased, which did not occur until the completion of the snorkel survey. None of the slow-water habitat units snorkeled in FY 2003 were calibrated using the mark-resight methodology.

Table 1. Microhabitat variables (Underwood et al. 1995) to be collected on randomly selected juvenile *O. mykiss*, juvenile Chinook salmon, and Bull Trout within Shitike Creek, OR. Variables measured relate to the selected fish or the immediate area the fish inhabits at the time of observation.

Variable	Unit or Category(s)	Description
Species	SST SCS BLT	Steelhead or Rainbow Trout (*Oncorhynchus mykiss*) Spring Chinook Salmon Bull Trout
Age	0+ Post age 0+	SCS – Age 0+ ≤ 115 mm SST – Age 0+ ≤ 90 mm Post age 0+ >90 mm BLT – Age 0+ ≤ 90 mm Post age 0+ >90 mm
Distance from Streambed	Meters (0.1)	Distance from streambed at the time of snorkel observation.
Most Prevalent Substrate Type	Silt or Fines (<2.0 mm) Small Gravel (2.0 – 15 mm) Large Gravel (>15mm – 60mm) Small Cobble (60-130 mm) Large Cobble (120-250 mm) Boulder (>250 mm)NA	From Platts et al. (1984). Estimated from snorkel observation. The snorkel observation crew will be calibrated at start of microhabitat survey on their identification and classification of these substrate categories
Total Depth	Meters (0.1)	Measured at point of fish location from streambed to surface of water.
Nearest Cover Type	Boulders Undercut Banks Turbulence (Bubble Curtain) Overhead Vegetation Small Woody Debris Large Wood Debris	From Wesche et al. (1987). Cover type will be determined by snorkel observation of fish for a time of at least one minute.
Distance to Nearest Cover Type	Meters (0.1)	Visually estimated from snorkel observation.
Nearest fish Species	SST SCS BLT Other	Steelhead or Rainbow trout Spring Chinook Salmon Bull Trout Other species present within Shitike Creek
Distance of nearest fish Species	Meters (0.1)	Visually estimated from snorkel observation.
Grouped or Ungrouped	G or U	In a group of other fish (within 30cm) or not grouped with other fish (> 30cm away from another fish. If grouped with other fish an estimate of the number of fish will be made by the snorkeler and the species composition of that group.
Water Velocity	Meters per second (MPS)	Measured using Global Water Velocimeter at end of snorkel observation. In an effort not to disturb observed fish, a marker will be placed below the fish and velocity will be measured at the end of snorkel observation and at the conclusion of microhabitat survey in the selected unit.

Figure 1. Shitike Creek basin, tributary of the Deschutes River, in the Confederated Tribes of the Warm Springs Reservation, Oregon. Number of boundaries of each reach used in juvenile Chinook salmon abundance surveys (Dambacher 2001) are denoted. Reach 1 includes the area from the Community Center to Thompson's Bridge. Reach 2 includes Thompson's Bridge to Headworks. Reach 3 includes the area from Headworks to Bennetts. Reach 4 includes the area known as Upper Crossing. Reach 5 is the area from Peters Pasture upstream. The thin arrow denotes observed downstream limit of juvenile bull trout at "Upper Crossing" from Electrofishing conducted by CTWSRO and ODFW personnel in 2000. The thick arrow denotes lower boundary of regular bull trout observations in snorkel-dive counts during 2001. Reproduced from Dambacher

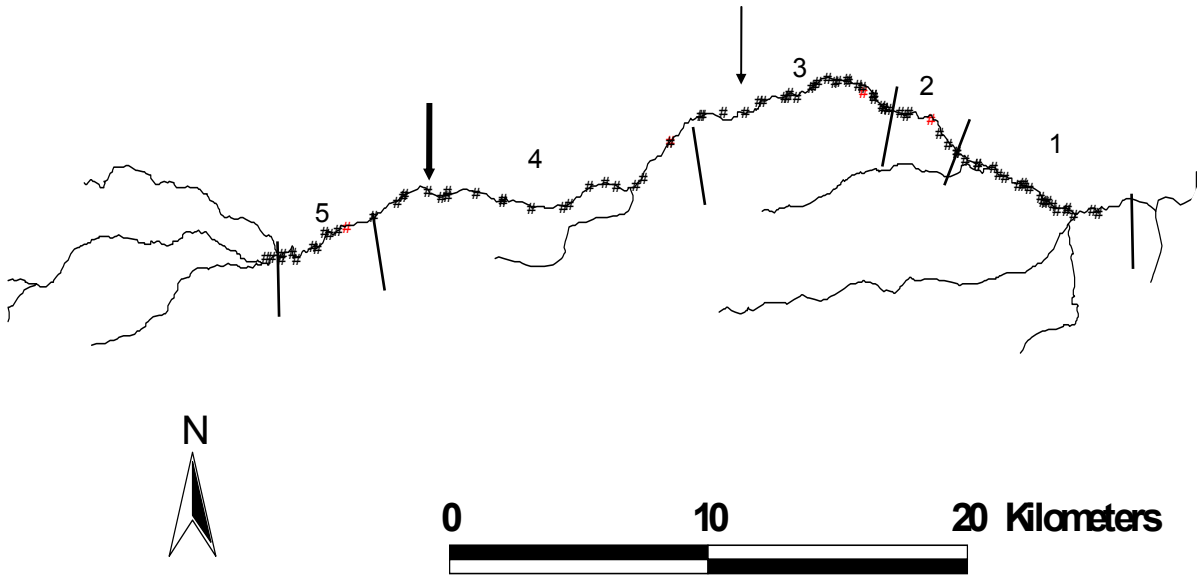

Table 2. Total fast water (FW) and slow water habitat units in Shitike Creek, OR during 2001 juvenile abundance survey for reaches 1-5 (Dambacher 2001). Percent composition of each habitat unit, for each reach is provided in parentheses. The number of units in each reach for 2001 sampling and 2003 proposed sampling scenarios is also provided.

	Habitat		Total habitat		2001 Sampling (variable %)	Proposed 2003 SW=15%	Sampled 2003 SW=15%
Reach	type	N	length (m)	Area (m^2)	n	n	N
1	FW	92	7,429 (74%)	110,695 (78%)	9		
	SW	81	2,642 (26%)	30,940 (22%)	16	13	10*
2	FW	23	2,420 (90%)	30,949 (90%)	2		
	SW	9	277 (10%)	3,297 (10%)	9	2	
3†	FW	75	6,147 (78%)	63,792 (78%)	10		
	SW	54	1,756 (22%)	17,666 (22%)	11	9	9
4	FW	102	14,390 (91%)	162,648 (91%)	13		
	SW	45	1,376 (9%)	15,410 (9%)	8	7	
5	FW	32	2,976 (64%)	35,088 (65%)	4		
	SW	37	1,669 (36%)	19,068 (35%)	8	6	7*
Total	FW	324	33,362 (81%)	403,172 (82%)	38		
Total	SW	226	7,720 (19%)	86,381 (18%)	52	37	26
Overall		550	41,082	489,553	90	37	26

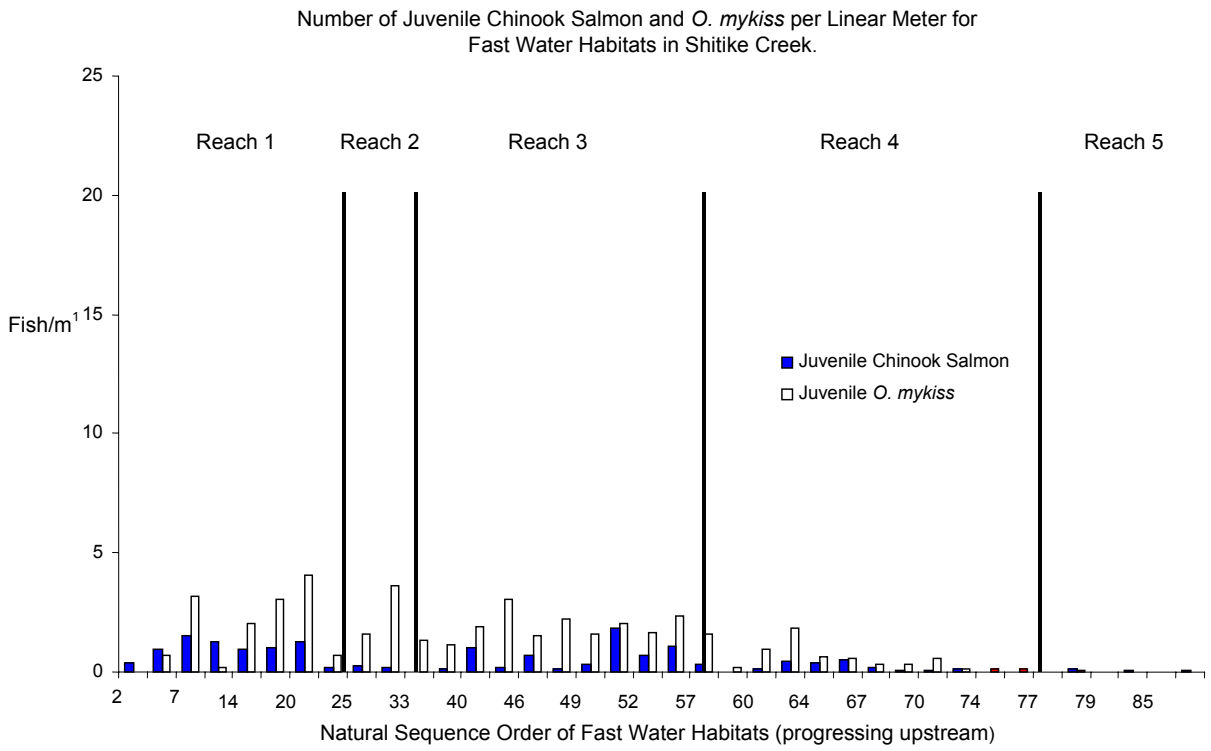

Figure 2. Number of juvenile Chinook salmon and *O. mykiss* per linear meter of fast water hatchery units in Shitike Creek, OR 2001. Reach 1 includes the area from the Community Center to Thompson's Bridge. Reach 2 includes Thompson's Bridge to Headworks. Reach 3 includes the area from Headworks to Bennetts. Reach 4 includes the area known as Upper Crossing. Reach 5 is the area from Peters Pasture upstream. Data presented is from Dambacher (2001).

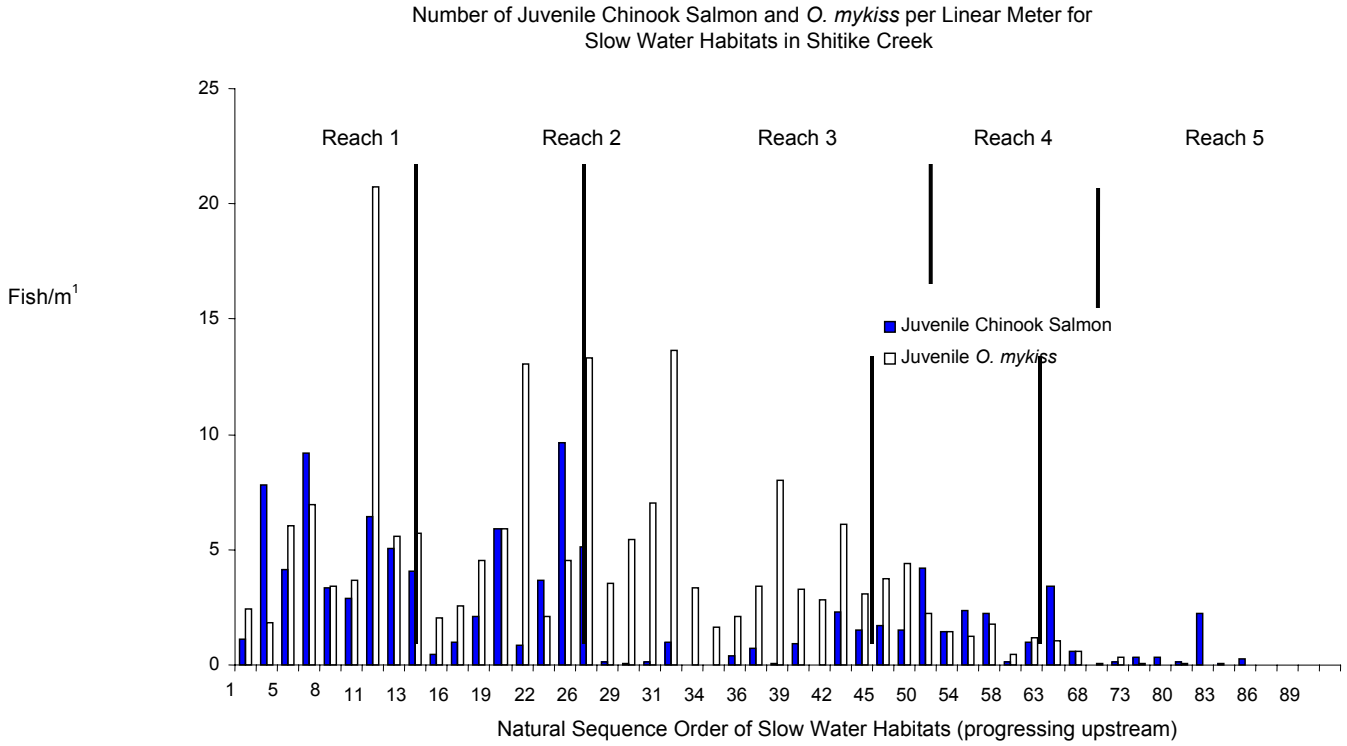

Figure 3. Number of juvenile Chinook salmon and *O. mykiss* per linear meter of slow water habitat units in Shitike Creek, OR during 2001. Reach 1 includes the area from the Community Center to Thompson's Bridge. Reach 2 includes Thompson's Bridge to Headworks. Reach 3 includes the area from Headworks to Bennetts. Reach 4 includes the area known as Upper Crossing. Reach 5 is the area from Peters Pasture upstream. Data presented is from Dambacher (2001).

Table 3. Proposed mark-resight methodology to be conducted on three randomly selected slow-water habitat units within Shitike Creek, OR. This methodology did not occur due to high water temperatures at the time of snorkel surveys in FY2003 but is proposed for FY2004.

Step Number	Procedure	Description
1	Block net unit on up and downstream sections.	Will ensure no immigration or emigration from selected slow-water unit during marking procedure or after marked fish are released back into unit
2	Multiple seine pulls through unit.	At least two pulls of a seine will be attempted in each selected unit to maximize catch for marking.
3	Collected fish will be anesthetized; fork length (mm) and weight (g) of individual fish will be recorded.	Collected fish will be held in perforated buckets within Shitike Creek to maintain adequate flow. Water temperature will also be monitored. Fish will not be marked, measured, or captured in water temperatures that are in excess of 18C, or on days that water temperature could exceed 18C for more than a 2 hour period.
4	Fish will be marked with a solution of Bismarck Brown Y and released.	After fish are anesthetized, measured, and weighed they will be placed in a tub of stream water and Bismarck Brown Y solution. Stream water and Bismarck Brown Y will be mixed to form a 0.007% solution. Fish will be placed in the solution for 10 minutes then released back into the slow-water unit. The proposed concentration of Bismarck Brown Y solution and immersion time will illicit a mark retention of approximately 2 days, dependent on water quality. Further trials of mark retention and underwater observation of marked fish is planned at Eagle Creek NFH during late June 2003 and will involve both USFWS and CTWSRO personnel.
5	A three (3) hour block of time will allow marked fish to acclimate.	To meet assumptions of a mark-resight procedure, marked fish must exhibit normal behavior and mix with unmarked fish within the unit.
6	Mark-resight snorkel count will be performed.	Three (3) snorkel observers will conduct an enumeration of marked and unmarked individuals within the slow-water unit to calculate the "true" number of juvenile *O. mykiss* and Chinook salmon within the unit.
7	Block nets will be removed and correction factor on abundance estimates will be calculated.	Block nets will be removed from the upstream and downstream sections of the slow-water unit to allow immigration and emigration of juvenile salmonids. A correction factor will be calculated using a linear regression of bounded count estimates against mark-resight estimates ("true" number of fish within a unit).

When microhabitat observation and bounded counts were completed in a slow-water habitat unit, the total length of the unit down the thalweg and three width measurements, systematically spaced through the unit, were recorded. Maximum depth at each width measurement was also noted. Unit dimensions (length and average width) were used to calculate the total area of the slow-water habitat unit (m^2).

Abundance estimates for juvenile Chinook salmon and juvenile *O. mykiss* in each slow-water unit were calculated using the bounded counts estimator previously mentioned. An average slow-water habitat unit abundance estimate was calculated for each species, in each reach and applied to units not snorkeled. Abundance estimates were not calculated on the reaches of Shitike Creek not snorkeled in 2003. Confidence intervals were estimated using only the error between pool abundance estimates and did not account for error in snorkel observation.

Objective 2: Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water habitat *units.*

Several regression analyses were performed to determine relationships between microhabitat preference, fish density and water temperature (Table 4). A reach specific, slow-water population estimate for juvenile *O. mykiss* and juvenile Chinook salmon was calculated from bounded counts performed in slow-water habitat units. This estimate does not have two stages of variance associated with most bounded count estimates due to difficulties performing the mark-resight estimates.

Additional statistical analyses (logistic regression analyses) have been performed but have not been reviewed by Service biometric professionals. Those analyses will be included in subsequent progress reports.

Table 4. Hypotheses to be tested, statistical test to be used and alpha level for microhabitat and fish density data collected within Shitike Creek 2003. Analyses may change dependent on review from USFWS biometricians.

Null Hypothesis	Test	Statistic or Alpha level
Steelhead microhabitat selection is not correlated with density of juvenile spring Chinook salmon	Regression Analysis	r^2
Steelhead density is not correlated with presence/density of other species.	Regression Analysis and Logistic Regression	$\alpha = 0.05$ or r^2
Steelhead density is not correlated with grouping of species.	Regression Analysis	r^2
Steelhead microhabitat selection is not correlated with grouping of species.	Regression Analysis	r^2
Steelhead or Chinook density is not correlated with presence/absence of bull trout.	Logistic Regression Analysis	$\alpha = 0.05$ or r^2

Results

Objective 1: Identify microhabitat selection of juvenile Chinook salmon, juvenile O. mykiss and Bull trout within Shitike Creek at varying densities.

A total of 26 pools were sampled resulting in 300 individual fish observations in 2003 (Table 5). Observations between juvenile spring Chinook salmon and juvenile *O. mykiss* were nearly identical as were the number of grouped observations. Nearly twice as many juvenile *O. mykiss* (n=32) than juvenile spring Chinook salmon (n=17) were observed not grouped with any other fish.

Three cover types were the most prevalent with the 300 recorded fish observations; Boulder, Large Wood (>15 cm diameter, 2 m length), and Small Wood (<15 cm diam. and 2 m in length, Figure 4). Over 81% of all juvenile Chinook salmon or *O. mykiss* fish observations had boulder, large wood, or small wood as being used as cover. Distance to these three covers by the species varied slightly, except for small wood where juvenile Chinook salmon remained much closer to than juvenile *O. mykiss* (Figure 5). Focal point velocity of observed fish did not vary significantly between reaches or between species except in reach 3 between age 0+ and 1+ O. mykiss (Figure 6).

Streambed depth of juvenile Chinook salmon and age classes of juvenile *O. mykiss* were similar between reaches (Figure 7). Total depth of water where observation of juvenile Chinook salmon and age classes of juvenile *O. mykiss* occurred were similar between reaches (Figure 8).

Table 5. Number of juvenile Chinook salmon, juvenile *O. mykiss*, bull trout and brook trout/hybrids observed and by grouping category (same species, unlike species, not grouped) by snorkelers in Shitike Creek during 2003. Same species grouping is defined as ≤ 30 cm from another fish of the same species, Unlike species grouping is ≤ 30 cm from an unlike species of fish and not grouped is > 30 cm from another fish. Brook trout and brook trout/bull trout hybrids are grouped together.

	Species Grouping Category			
Species/Category	Same	Unlike	Not Grouped	Total
Brook trout/hybrids	1	1	6	8
Bull Trout (> 50 cm)	1	3	10	14
Juvenile Chinook salmon	59	65	17	141
Juvenile *O. mykiss*	64	41	32	137
Total Observations	125	110	65	300

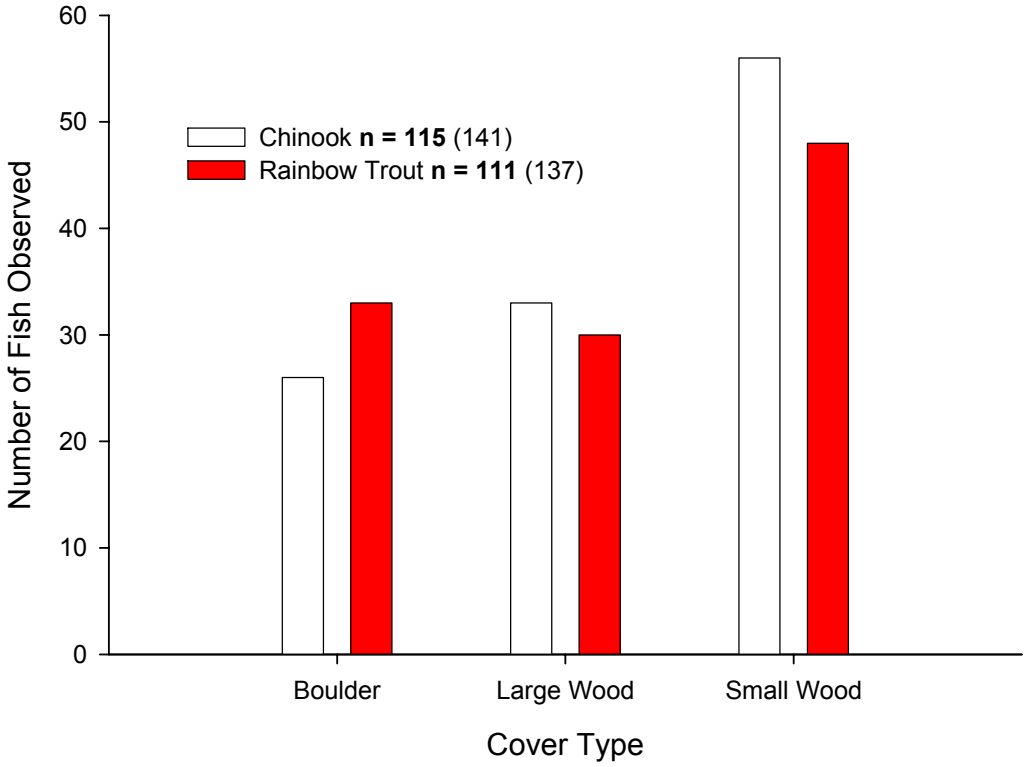

Figure 4. Number of observations with boulder, large wood, or small wood identified as cover used by juvenile Chinook salmon or juvenile *O. mykiss*. Over 81% of all juvenile Chinook salmon or juvenile *O. mykiss* fish observations had boulder, large wood, or small wood as being used as cover.

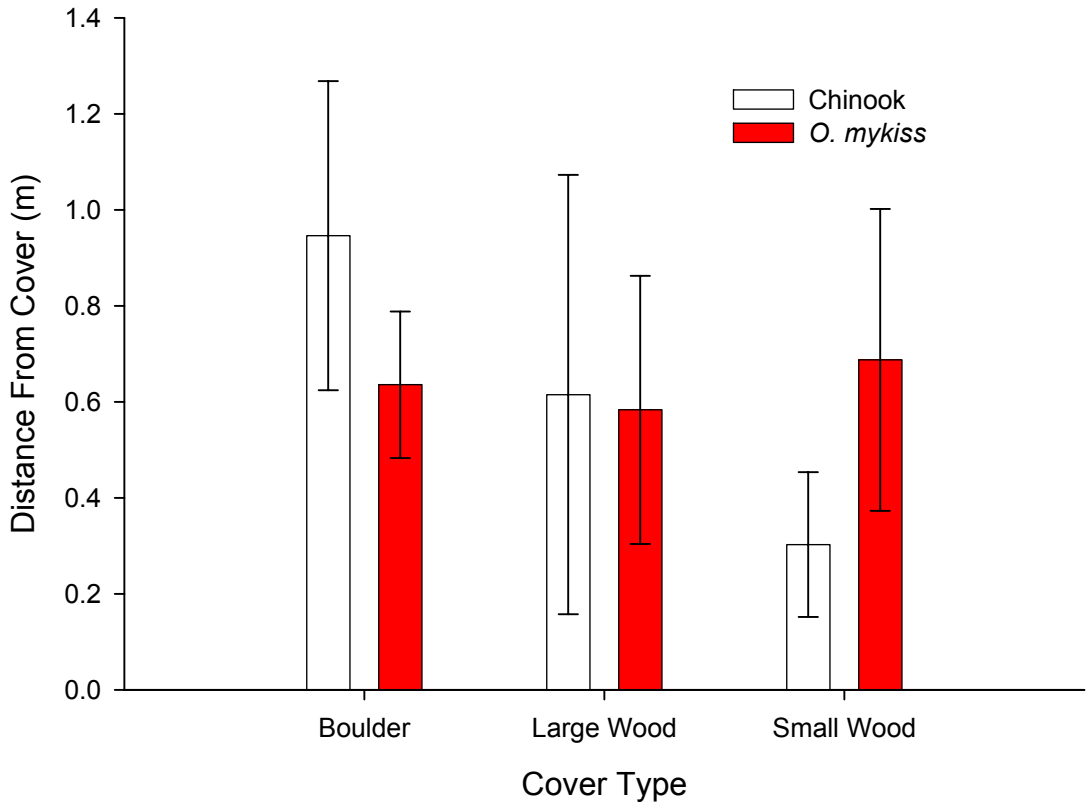

Figure 5. Average distance (m) from boulders, large wood, and small wood cover types for juvenile Chinook salmon and juvenile *O. mykiss* in Shitike Creek, OR during 2003. Error bars represent 95% confidence intervals.

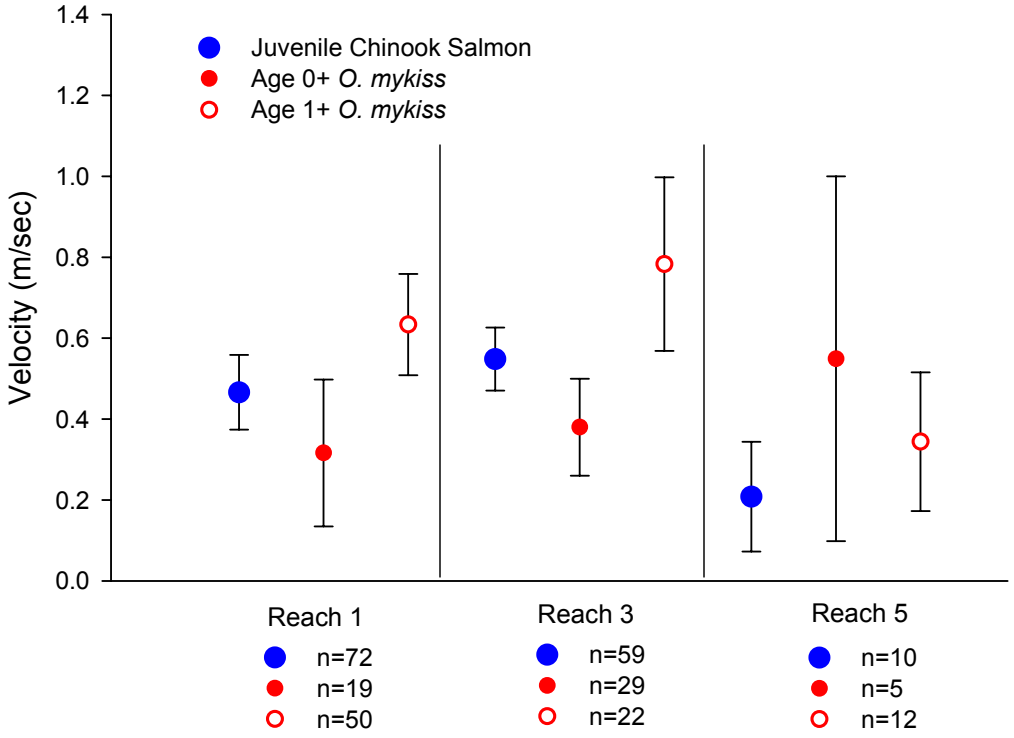

Figure 6. Focal point velocities for juvenile Chinook salmon and tow stages of juvenile *O. mykiss* in reaches 1, 3, and 5 of Shitike Creek, OR during 2003.

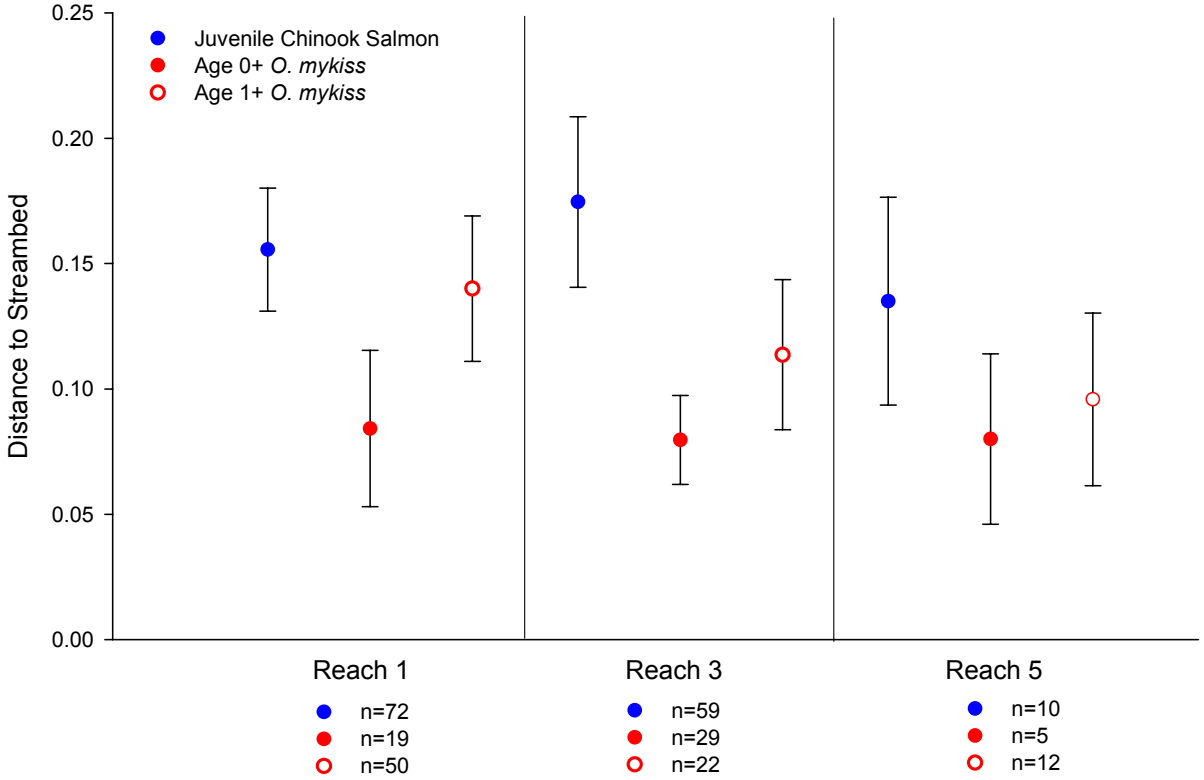

Figure 7. Streambed depth for observed juvenile Chinook salmon and two age classes of *O. mykiss* in Shitike Creek during 2000. Sample size for each species for each reach is given. Error bars represent 95% confidence limits.

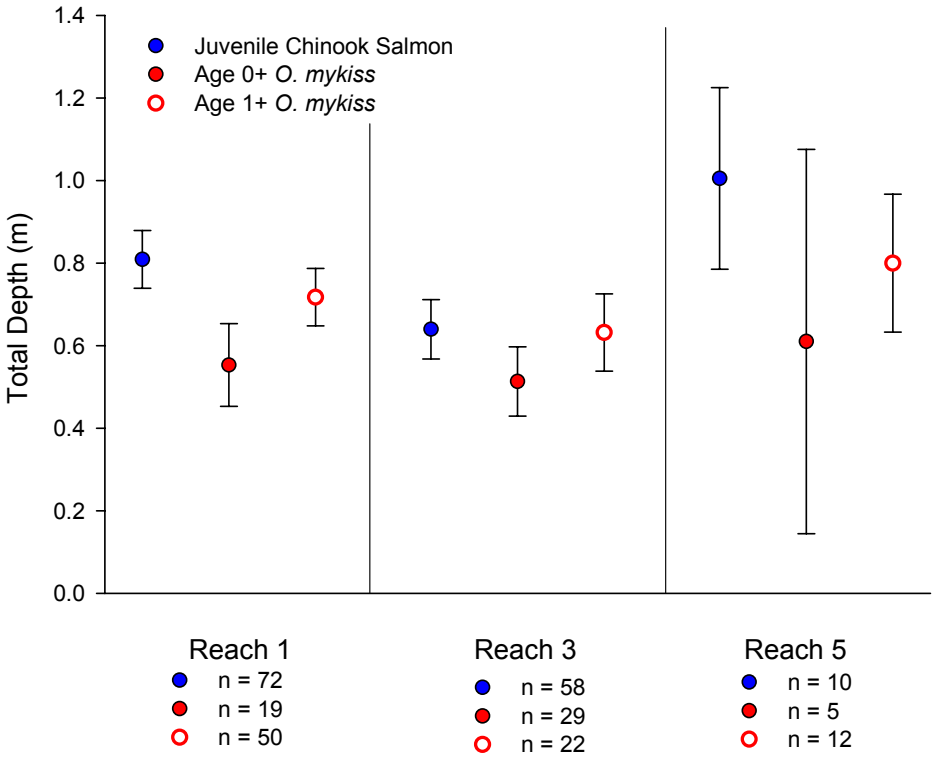

Figure 8. Depth of water for observed juvenile Chinook salmon and two age classes of juvenile *O. mykiss* in Shitike Creek during 2003. Sample size for each species, for each reach is given. Error bars represent 95% confidence intervals.

A total of 26 pools were sampled over the three reaches on Shitike Creek during 2003. Abundance of juvenile Chinook salmon and juvenile *O. mykiss* were largest in reach 1 and followed closely by reach 3 for both species but estimates overlap considerably when error is considered (Table 6). Densities of juvenile Chinook salmon and juvenile *O. mykiss* are highly correlated (r^2=0.88) for slow-water habitat units in Shitike Creek during 2003 but not in 2001 (r^2=0.26, Figure 9).

Table 6. Slow water population estimates for juvenile *O. mykiss* and juvenile Chinook salmon in sampled reaches of Shitike creek during 2003. Number of total slow water habitat units (N), number sampled (n), and the fraction in each reach are given. The juvenile Chinook salmon population estimate conducted by ODFW in 2001 is also presented for comparison.

Reach	N	n	Sampling Fraction (n/N x 100)	Juvenile *O. mykiss* Estimate 2003	Juvenile Chinook Salmon Estimate 2003	Juvenile Chinook Salmon Estimate 2001
1	50	10	20%	2240 (±710)	2,435 (±908)	10,991 (±3,322)
3	33	9	27%	1474 (±476)	2,075 (±650)	2,968 (±1,474)
5	21	7	33%	180 (±87)	66 (±650)	1,158 (±1,362)

Objective 2: Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water habitat *units.*

Relationships between microhabitat selection and fish density were explored using linear regression with the composition of juvenile Chinook salmon compared with either the composition or density of juvenile *O. mykiss* at a specific microhabitat variable. These analyses should be considered preliminary. Additional versions of these analyses, and new analyses, will be presented in future progress reports.

The composition of juvenile Chinook in slow-water habitat units did not have a relationship with depth of juvenile *O. mykiss* from the stream bed (Figure 10). A slight relationship (r^2=0.43) was found between composition of juvenile Chinook in slow-water habitats and use of cobble substrate by juvenile *O. mykiss* (Figure 11). As juvenile Chinook salmon composition increased, the observation of juvenile *O. mykiss* grouped among other juvenile O.mykiss decreased (r^2=0.56, Figure 12). Focal point velocity of juvenile *O. mykiss* did not have a relationship with either density or composition of juvenile Chinook salmon (Figure 13 and 14 respectively).

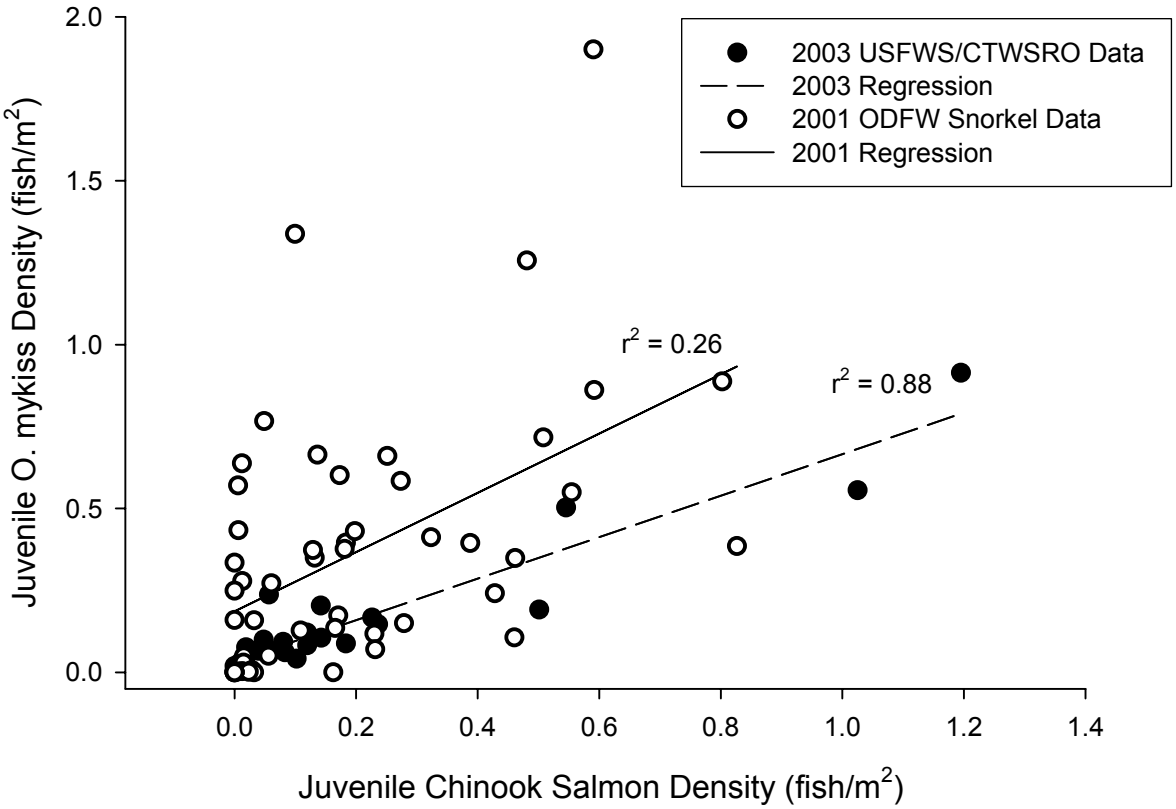

Figure 9. Juvenile Chinook salmon densities vs. juvenile *O. mykiss* densities in 2001 and 2003. The densities plotted for 2001 were collected during a survey conducted by ODFW (Dambacher 2001).

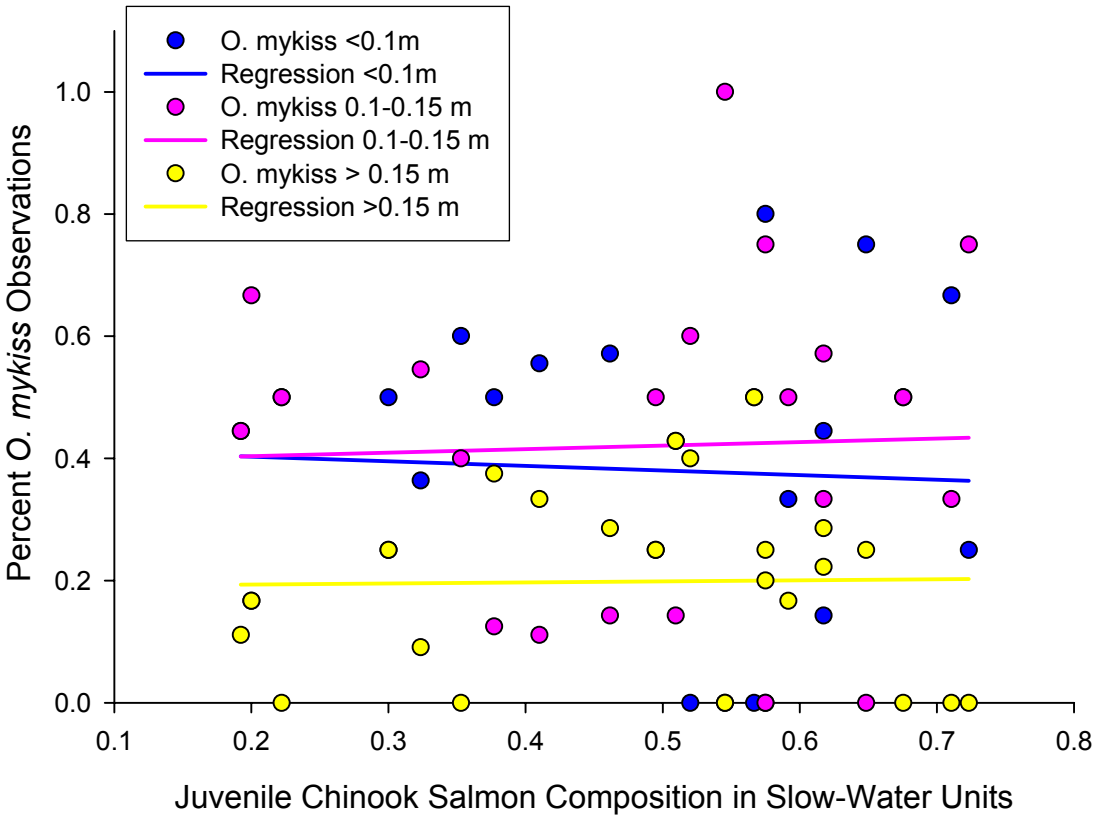

Figure 10. Percent (%) juvenile Chinook salmon composition in slow-water habitat units vs. percent of juvenile *O. mykiss* observations at three bed depth categories. Data collected during 2003 in Shitike Creek, OR.

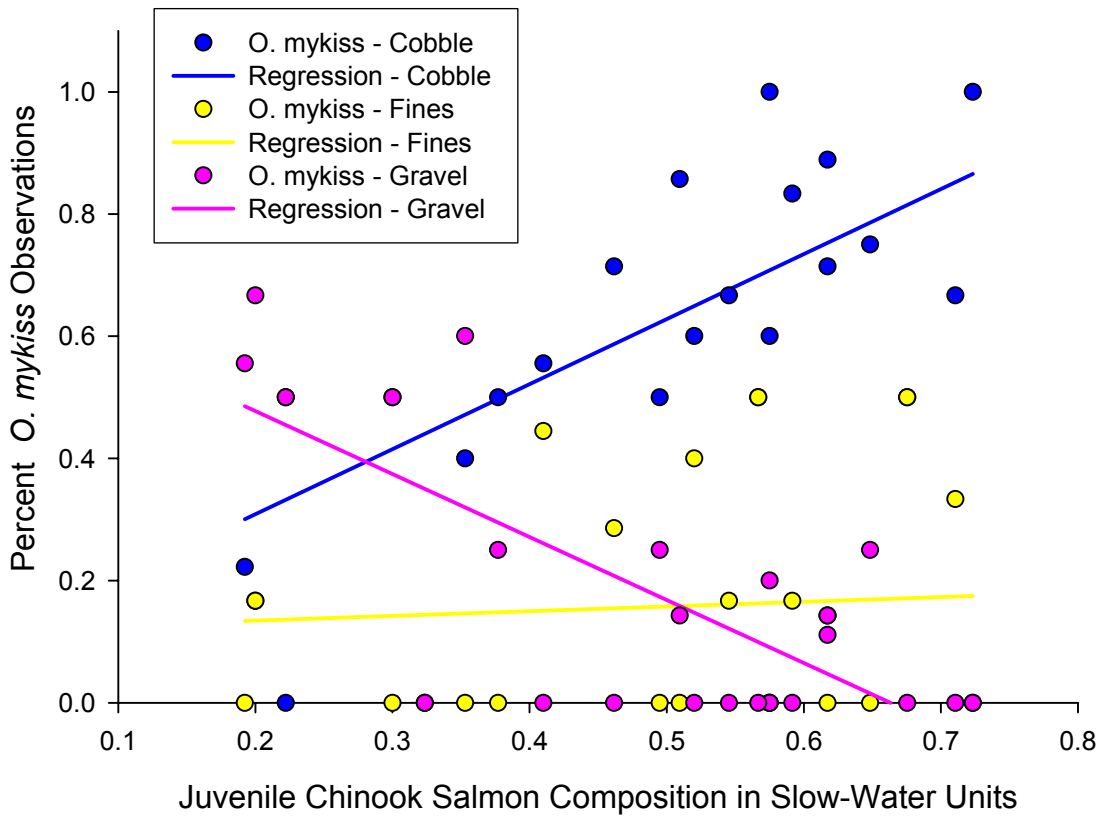

Figure 11. Percent (%) juvenile Chinook salmon composition in slow-water habitat units vs. percent of juvenile *O. mykiss* observations at three substrate categories. Data collected during 2003 in Shitike Creek, OR.

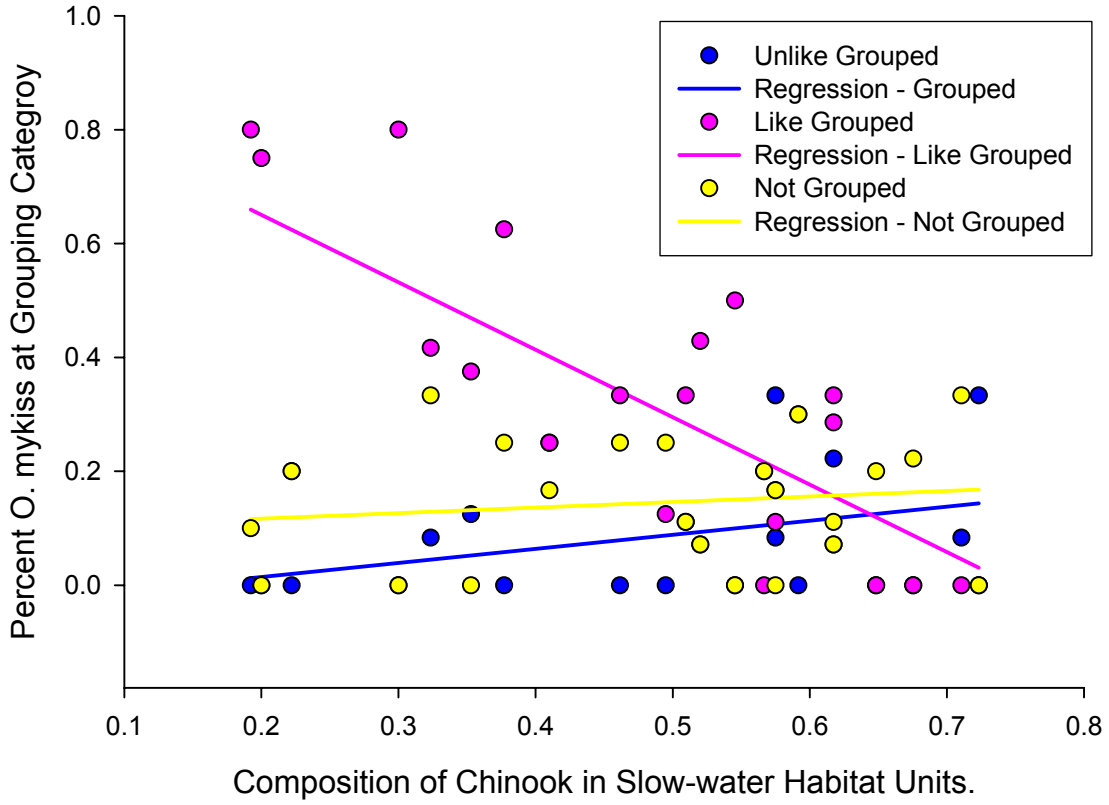

Figure 12. Percent of juvenile Chinook salmon composition in slow-water habitat units vs. the percent *O. mykiss* at three grouping categories. Data collected in Shitike Creek, OR during 2003.

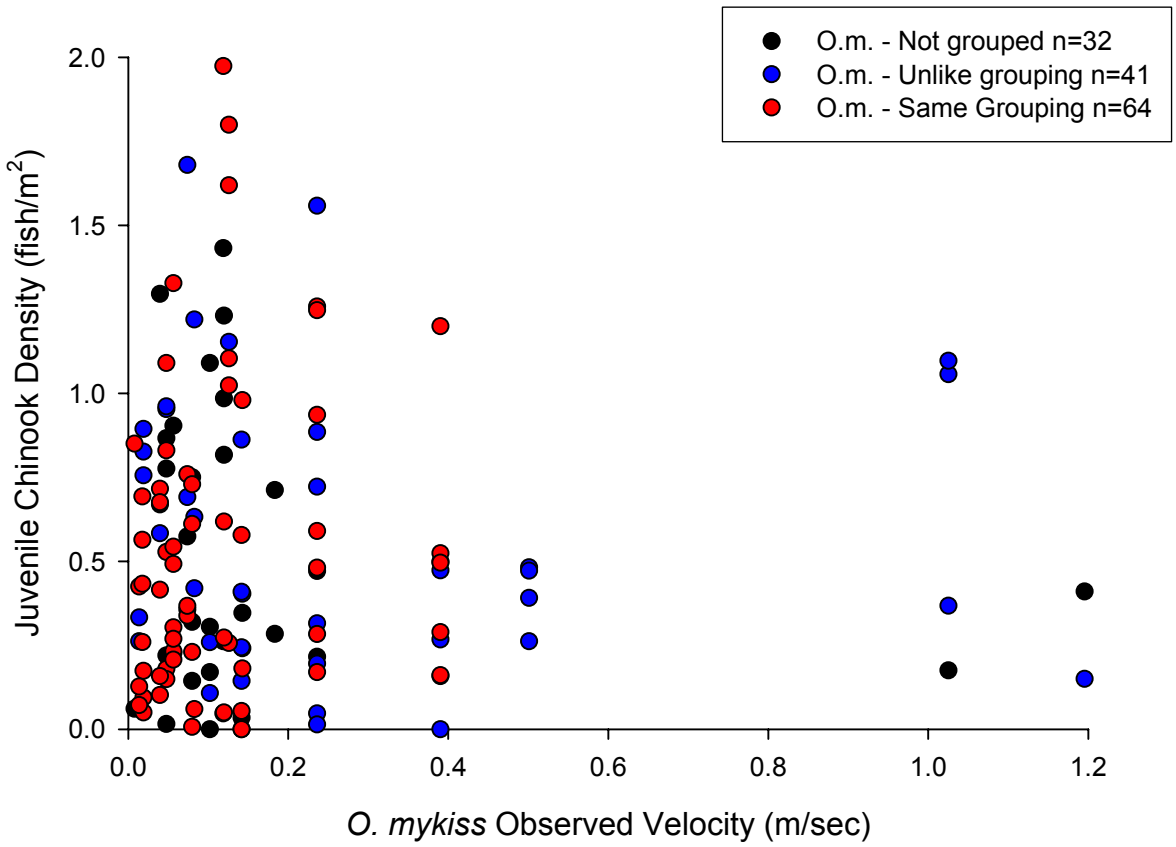

Figure 13. Observed velocity (m/sec) of not grouped, unlike grouped or same grouped juvenile *O. mykiss* plotted against density (fish/m^2) of juvenile Chinook salmon in slow-water units.

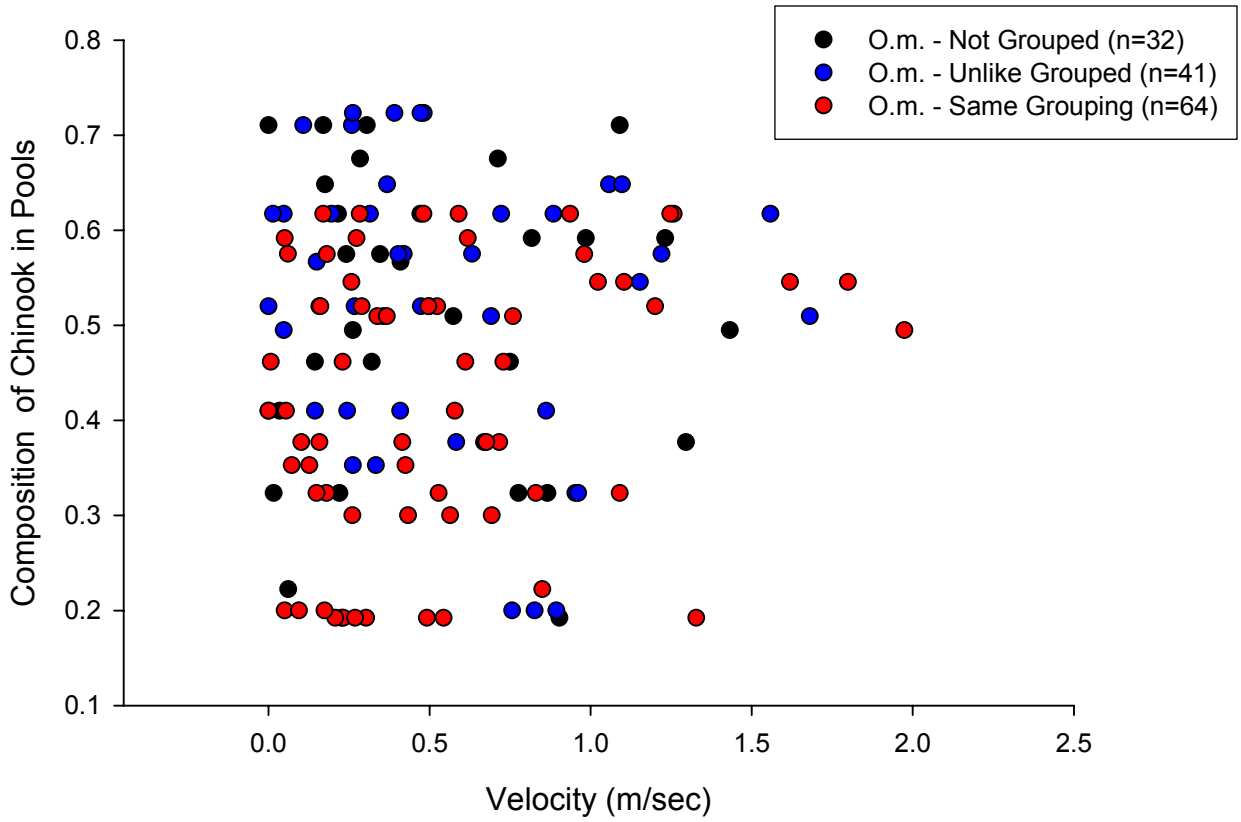

Figure 14. Observed velocity (m/sec) of not grouped, unlike grouped or same grouped juvenile *O. mykiss* plotted against the composition of juvenile Chinook salmon in slow-water units.

FY2004 Work Plan Objectives

In 2003, the Service and the CTWSRO implemented a summer snorkel survey to specifically evaluate microhabitat selection of juvenile salmonids and investigate ecological interactions from the Chinook salmon outplanting program. The evaluation of the outplanting program in Shitike Creek and identification of ecological interactions between spring Chinook and other fish species (FONS Project Number 1999-010) will continue in FY 2004 with identical objectives as FY 2003. The results of the FY2003 and FY2004 evaluations will be used by Service personnel, and managers of natural resources, to mitigate and reduce ecological interactions between hatchery and wild fish. The following project objectives were proposed for fiscal year 2003 and will be continued in 2004.

Objectives:

1) Identify microhabitat selection (depth, water velocity, species association, cover use, temperature) juvenile Chinook salmon, juvenile *O. mykiss* and Bull trout within Shitike Creek at varying densities.

2) Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water habitat units.

Potential Management Action: Adjust or manipulate the number or location of adult Chinook outplantings to maximize number of Chinook produced but minimize any density effects on microhabitat selection of juvenile *O. mykiss* or bull trout.

Input from project cooperators, the CTWSRO Fish and Wildlife Committee and biometric specialists may slightly alter or change the methodologies and actions proposed for FY2004.

Methods and Data Collection

Objective 1: Identify microhabitat selection of juvenile Chinook salmon, juvenile O. mykiss and Bull trout within Shitike Creek at varying densities.

The snorkel survey instituted during summer 2003 to identify microhabitat selection of juvenile Chinook salmon, juvenile *O. mykiss*, and bull trout within Shitike Creek will be continued in FY2004 (Table 1). Identical snorkeling techniques and data collection methods will be used to collect microhabitat data and abundance estimates of juvenile *O. mykiss*, juvenile Chinook salmon and Bull Trout. Slow-water habitat units will again be randomly selected and sampled in reaches 1, 3, and 5 to maintain consistency within the existing Shitike Creek snorkel survey data set. Reach 2, which was not sampled in FY2003, may also be added for reaches to sample in FY2004 depending on consultations with tribal biologists and the Fish and Wildlife Committee, if desired. FY2003 Sampling fractions to select slow-water habitat units will be slightly increased in FY2004 to increase the overall number of slow-water habitats sampled and decrease 2nd stage error for abundance estimates. A sample size goal of 33 slow-water habitats in reaches 1,3, and 5 will be attempted in FY2004 (increased from 26 slow-water habitats in 2003).

Calibration of abundance estimates gathered from bounded counts will be conducted on three slow-water habitat units in FY2004. These units will be selected in reaches 1 and 3 (due to results of Section 7 Bull Trout consultation), and will be as dissimilar as possible to mimic random selection and different abundance snorkeling scenarios (suggested during internal FWS project review). A mark-recapture abundance estimate will be calculated using protocol outlined in Table 3 and from that estimate a correction factor will be applied to snorkeling abundance estimates.

Objective 2: Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water habitat *units.*

Each successive year of the assessment yields potentially drastic differences in juvenile densities of Chinook salmon, *O. mykiss*, and Bull Trout from the previous year. Relationships between density and particular microhabitat selection of a species of interest could be apparent or not apparent from year to year. Similar regression analyses to FY 2003 will be performed with data collected in FY2004 to determine relationships between microhabitat preference, fish density and water temperature. Additional statistical analyses will be performed on potential relationships that may appear that were not apparent in FY2003. Service Biometric specialists will be consulted and ultimately approve any statistical analyses proposed or used.

Proposed Sampling Schedule and Completion Timeline FY 2004

Objective	Activity	FY 2004					
		July 11-17	July 18-24	July 25-31	Aug.1-7	Aug. 8-14	Aug 14 – March 31, 2005
Identify microhabitat selection of juvenile Chinook salmon, juvenile *O. mykiss* and Bull trout within Shitike Creek at varying fish densities.	Selection of slow-water units for microhabitat sampling.	July 12-14					
Identify microhabitat selection of juvenile Chinook salmon, juvenile *O. mykiss* and Bull trout within Shitike Creek at varying dish densities.	Start of microhabitat surveys.	July 15-16					
Identify microhabitat selection of juvenile Chinook salmon, juvenile *O. mykiss* and Bull trout within Shitike Creek at varying fish densities.	Microhabitat surveys in slow and fast-water units.		All Week	All Week	All Week	Partial Week	
Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water habitat units.							In addition to other assigned duties.

Literature Cited

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