# Abundance Monitoring of Juvenile Salmonids in Oregon Coastal Streams, 2001

**Oregon Plan for Salmon and Watersheds**

**Monitoring Report No. OPSW-ODFW-2002-1**

**December 20, 2002**

Jeffrey D. Rodgers

Western Oregon Rearing Project
Oregon Department of Fish and Wildlife
28655 Highway 34
Corvallis, OR 97333

**Citation:** Rodgers, J.D. 2002. Abundance Monitoring of Juvenile Salmonids in Oregon Coastal Streams, 2001. Monitoring Program Report Number OPSW-ODFW-2002-1, Oregon Department of Fish and Wildlife, Portland.

**Table of Contents**

## List of Figures

## List of Tables

## Executive Summary


This report summarizes the results of two studies currently being conducted by the Western Oregon Rearing Project. The first study (Chapter 1) involves coast-wide sampling of the abundance of juvenile coho in coastal streams. In 2001, for the first time since the project began in 1998, the Mid-Coast replaced the Mid-South Coast as having highest mean density and frequency of occurrence of juvenile coho. Compared to data collected in 1998 for the same brood cycle, the frequency of occurrence of juvenile coho was higher in 2001 in the Mid-Coast and South Coast, while mean juvenile coho densities were higher in the North Coast, Mid-Coast, and South Coast. Based on the regression equation for each brood year, at an average adult escapement of 11 fish/mile, spawners in 1998 produced approximately half the number of juveniles (225/mile) compared to spawners in 1999 (525/mile) or 2000 (442/mile).

Chapter 2 describes the summer of 2001 results of a study in Smith River on the utility of electrofishing surveys in tributary streams and basin-wide snorkel surveys as a way of monitoring juvenile salmonid population trends. Compared to results obtained by electrofishing in the summer of 2000, juvenile coho increased and trout < 90 mm decreased, while ≥ 90mm steelhead and cutthroat did not change in abundance. As in the summer of 2000, electrofishing in tributary streams found trout < 90 mm and cutthroat ≥ 90 mm at over two-thirds of the sites sampled, while juvenile coho occurred at half of the sites. Steelhead ≥ 90 mm were the least widespread, occurring at slightly over one-third of the sites in Smith River tributaries.

Basin-wide snorkel surveys in Smith River found the highest density of all three species of salmonids in the tributary stream reaches. Almost twice the percentage of sites in wadeable stream reaches had juvenile steelhead compared to non-wadeable reaches. Juvenile coho, however, were found more frequently in non-wadeable stream reaches, probably due to the fact that some wadeable stream reaches were inaccessible to adult coho.

Of trout ≥ 90 mm that were classified by divers as either cutthroat or steelhead, 58.7% were identified as cutthroat and 41.3% as steelhead, similar to the proportions determined by electrofishing. For sites where both snorkel and electrofishing surveys were conducted, divers estimated 43% of the coho density and 67% of the cutthroat density estimated by electrofishing. Electrofishing density estimates for steelhead, however, were 78% of that estimated by snorkeling. For all three species, snorkel surveys observed at least one fish at more sites than electrofishing surveys.

# Chapter 1: Abundance of Juvenile Coho Salmon in Oregon Coastal Streams in the Summer of 2001.

## Introduction

In the summer of 1998, as part of the Oregon Plan for Salmon and Watersheds, the Oregon Department of Fish and Wildlife (ODFW) began a project to monitor juvenile coho in Oregon's coastal streams. This project is designed to monitor trends in abundance of juvenile coho salmon rearing in five coastal Monitoring Areas (Figure 1). This report summarizes the results obtained from data collected during the summer of 2001 and compares it to previously collected data.

## Methods

### Study Design

We have a target of surveying juvenile coho rearing at 50; one-kilometer long stream reaches in each Monitoring Area. Sites are randomly selected using Environmental Mapping and Assessment Program (EMAP) protocol (Stevens and Olsen 1999). This protocol involves the use of a Geographic Information System incorporating a 1:100,000 digital stream network of coho rearing distribution to insure an unbiased and spatially balanced selection of sample sites across each GCA. To maximize the usefulness of the data, we make provisions during the EMAP site selection process to incorporate as much overlap in sample sites as possible between the Western Oregon Rearing Project, ODFW's Aquatic Inventory Project, and ODFW's Coastal Salmonid Inventory Project. The total number of candidate sites for each year is divided equally into four visitation intervals: 1) sites that are visited annually; 2) sites that are visited every three years; 3) sites that are visited every nine years; and 4) sites that are visited once. The repeat visitation sites help to provide for better trend detection, while the single visitation sites enable us to incorporate changes in known fish distribution into our sampling universe.

Once completed, the EMAP site selection process provides the geographic coordinates (i.e. latitude and longitude) of each of the candidate sites. We then produce topographic maps showing the location of each sample point. Field crews use a handheld Geographic Positioning System to find the approximate location of the EMAP selected sample point, and then established 1 km long survey reaches that encompasses the sample point.

### Survey Methodology

A two-person snorkel crew counts the number of juvenile coho at each of the sample reaches. To reduce problems associated with snorkeling in shallow or fast water habitat, only pools $\geq$ 6 $m^2$ in surface area and $\geq$ 40 cm deep are snorkeled. Crewmembers either alternate the pools that they snorkel or one crewmember snorkels the entire reach. We measure the maximum pool depth and estimate the length and average width of all snorkeled pools.

Snorkel methodology involves a single upstream pass through each pool. Counts of the number of juvenile coho, cutthroat, steelhead, unknown trout, chinook, blackside dace, and redside shiner are recorded for each pool. Trout < 90 mm are not counted.

After snorkeling, the underwater visibility of each pool during the snorkel count is ranked on a scale of 0 to 3 where: 0 = not snorkelable due to extremely high hiding cover or zero water visibility; 1 = high amount of hiding cover or poor water clarity; 2 = moderate amount of hiding cover or moderate water clarity neither of which were thought to impede accurate fish counts; and 3 = little hiding cover and good water clarity. Only pools with a visibility rank of two or three are used in data analysis.

For sites in the North, Mid-Coast, Mid-South, and Umpqua where water poor water clarity prohibits snorkel surveys, electrofishing is used to provide information on the percentage of pools containing juvenile coho. Electrofishing is conducted using Smith-Root model 12-B backpack electrofishers following NMFS electrofishing guidelines (NMFS 2000). At poor water clarity sites, a single upstream electrofishing pass is made in each pool that meets the size and depth criteria for conducting snorkel surveys. If a juvenile coho is captured during electrofishing, the pass is terminated and coho are recorded as being present in the pool. No block nets are used for this sampling. Electrofishing is not conducted at any sites in the South Coast Monitoring area in order to comply directives from the National Marine Fisheries Service (NMFS).

To provide quality control of the snorkel data, and to information on temporal changes in abundance during the course of the sampling season, supervisory staff has a goal of resurveying a random sample of 10 to 20 percent of the sites surveyed in each Monitoring Area.

### Data Analysis

Two basic metrics were used to analyze the juvenile coho data: 1) the percentage of pools that contained at least one juvenile coho; and 2) the average density (fish/$m^2$) of juvenile coho. Methods outlined by Stevens (2002) were used to calculate sample variances from which Z-values (Snedecor and Cochran 1980) were obtained to compare means. Analysis of covariance (Neter and Wasserman 1974) was used to compare differences between years in the slope and intercept of the relationship between adults found on spawning surveys and juveniles observed the following summer.

## Results

### Site Visitation

The locations of candidate sample sites for the summer of 2001 are shown for each Monitoring Area in figures 2-6. In 2001, the most sites were sampled (snorkeled or electrofished) in the North Coast, and the fewest in the Mid-South Coast (Table 1). The South Coast had the highest number of sites that could not be sampled, primarily due to low water at some sites as a result of drought conditions. As in the summer of 2000 (Rodgers 2001), site access denial in 2001 was highest in the Mid-South and South Coast. However, site access denials appear to have been more randomly distributed and less spatially biased in 2001 compared to 2000, especially in the South Coast.

### Juvenile Coho Frequency of Occurrence

The percentage of pools at each sample site containing at least one juvenile coho is shown for each of the Monitoring Areas in Figures 7-11. In the summer of 2001, the Mid-Coast had the highest percentage of sites that contained at least one juvenile coho while the North Coast had the lowest. The Mid-Coast had the highest mean percentage of pools per site with juvenile coho, while the North Coast and South Coast had the lowest (Table 2). Table 3 shows the results of comparisons between Monitoring Areas of the mean percent of pools per site that contained juvenile coho where P $\leq$ 0.2.

Table 1. Status of sites in coastal Monitoring Areas that were candidates for random juvenile coho surveys, summer 2001.

| | Sampled | | Not Sampled | | | |
|---|---|---|---|---|---|---|
| **Monitoring Area** | **Snorkeled** | **Electrofished** | **Could Not Be Sampled** | **Above Barrier** | **Access Denied** | **Not Visited** |
| North Coast | 36 | 7 | 6 | 2 | 2 | 1 |
| Mid-Coast | 41 | 0 | 5 | 5 | 1 | 2 |
| Mid-South Coast | 23 | 7 | 8 | 2 | 10 | 0 |
| Umpqua | 23 | 9 | 11 | 6 | 4 | 2 |
| South Coast | 33 | 0 | 14 | 2 | 7 | 0 |

Table 2. The occurrence of juvenile coho as observed by snorkeling or electrofishing in coastal Monitoring Areas, 2001.

| Monitoring Area | Percentage of sites with at least one pool containing coho | Mean percentage (and standard error) of pools per site with coho | Median percentage of pools per site containing coho |
|---|---|---|---|
| North Coast | 52 | 41 (5.0) | 14 |
| Mid-Coast | 80 | 62 (5.4) | 85 |
| Mid-South Coast | 62 | 53 (6.9) | 58 |
| Umpqua | 60 | 44 (6.4) | 24 |
| South Coast | 58 | 41 (4.9) | 22 |

Table 3. Comparisons between coastal Monitoring Areas sampled in 2001 of the mean percentage of pools per site that contained juvenile coho. Only those comparisons with a P level $\leq$ 0.2 are shown.

| Comparison | P for difference |
|---|---|
| Mid-South Coast vs South Coast | 0.16 |
| Mid-Coast vs Umpqua | 0.01 |
| Mid-South Coast vs North Coast | 0.16 |
| North Coast vs Mid-Coast | 0.01 |
| Mid-Coast vs South Coast | <0.01 |

The mean percent of pools per site that contained juvenile coho for each sample year and the percentage of sites with at least one pool containing juvenile coho for each sample year are shown in Figures 12 and 13, respectively. Table 4 shows the results of tests for differences between the mean percentage of pools per site that contained juvenile coho in 1998 and 2001 (i.e. the same brood cycle). Both the Mid-Coast and South Coast had a higher frequency of occurrence of juvenile coho in 2001 compared to 1998 ($P \leq 0.14$)

Table 4. Differences between brood cycles within the same coastal Monitoring Area in the mean percentage of pools per site that contained juvenile coho.

| Comparison | P for difference |
|---|---|
| North Coast 98 vs North Coast 01 | 0.74 |
| Mid-Coast 98 vs Mid-Coast 01 | <0.01 |
| Mid-South Coast 98 vs Mid-South Coast 01 | 0.81 |
| South Coast 98 vs South Coast 01 | 0.14 |

**Juvenile Coho Density**

The average density of juvenile coho in pools at each sample site is shown for each Monitoring Area in Figures 14-18. In the summer of 2001, the percentage of sites that had juvenile coho densities $\geq$0.7 fish/$m^2$ ranged from a high of 35% in the Mid-South Coast to a low of 13% in the Umpqua (Table 5). The mean density of juvenile coho in the Umpqua was lower than in either the Mid-South Coast or Mid-Coast ($P \leq 0.10$) (Table 6). The yearly mean density and yearly percentage of sites with an average density $\geq$ 0.7 fish/$m^2$ in each Monitoring Area are shown in Figures 19 and 20. The results of Z-tests for differences in the mean density of juvenile coho observed for the 1998 and 2001 broods (same brood cycle) are shown in Table 7. Increases in juvenile coho rearing densities occurred in the North Coast, Mid-Coast, and South Coast ($P < 0.01$).

Table 5. Density (fish/$m^2$) of juvenile coho observed by snorkelers in coastal Monitoring Areas in 2001.

| Monitoring Area | Percent of sites with an average density $\geq$ 0.7 fish/$m^2$ | Mean density (standard error) | Median density |
|---|---|---|---|
| North Coast | 28 | 0.41(0.08) | 0.01 |
| Mid-Coast | 32 | 0.50(0.07) | 0.29 |
| Mid-South Coast | 35 | 0.47(0.10) | 0.05 |
| Umpqua | 13 | 0.27(0.07) | 0.01 |
| South Coast | 18 | 0.38(0.08) | 0.01 |

Table 6. Comparisons between coastal Monitoring Areas sampled in 2001 of the mean density of juvenile coho. Only those comparisons with a P level $\leq$ 0.2 are shown.

| Comparison | P for difference |
|---|---|
| Umpqua 01 vs Mid-South Coast 01 | 0.10 |
| Umpqua 01 vs Mid-Coast 01 | 0.02 |

Table 7. Differences between brood cycles within the same coastal Monitoring Area in the mean density of juvenile coho.

| Comparison | P for difference |
|---|---|
| North Coast 98 vs North Coast 01 | <0.01 |
| Mid-Coast 98 vs Mid-Coast 01 | <0.01 |
| Mid-South Coast 98 vs Mid-South Coast 01 | 0.37 |
| South Coast 98 vs South Coast 01 | <0.01 |

**Juvenile Recruitment**

Figure 21 shows the relationship between the estimated number of adult coho/mile that spawned in each Monitoring Area from 1998 through 2000 and the estimated number of juvenile coho/mile the following year. Differences in the slopes of the regression lines were the largest between the 1998 and 2000 brood years and the smallest between the 1998 and 1999 brood years (Table 11). Differences in the elevations of the regression lines were largest between the 1998 and 1999 brood years and the 1998 and 2000 brood years. Based on the regression equation for each brood year, at an average adult escapement of 11 fish/mile, spawners in 1998 produced approximately half the number of juveniles (225/mile) compared to spawners in 1999 (525/mile) or 2000 (442/mile).

Table 8. Comparison of variances, slopes, and elevations of regression lines fit to the relationship between adults/mile and juveniles/mile (data are depicted in Figure 21).

| Comparison (brood year) | Equality of Variances (Pvalue) | Comparison of Slopes (Pvalue) | Comparison of Elevations (Pvalue) |
|---|---|---|---|
| 1998 & 1999 | 0.015 | 0.810 | 0.003 |
| 1999 & 2000 | 0.193 | 0.164 | 0.625 |
| 1998 & 2000 | 0.070 | 0.019 | 0.015 |

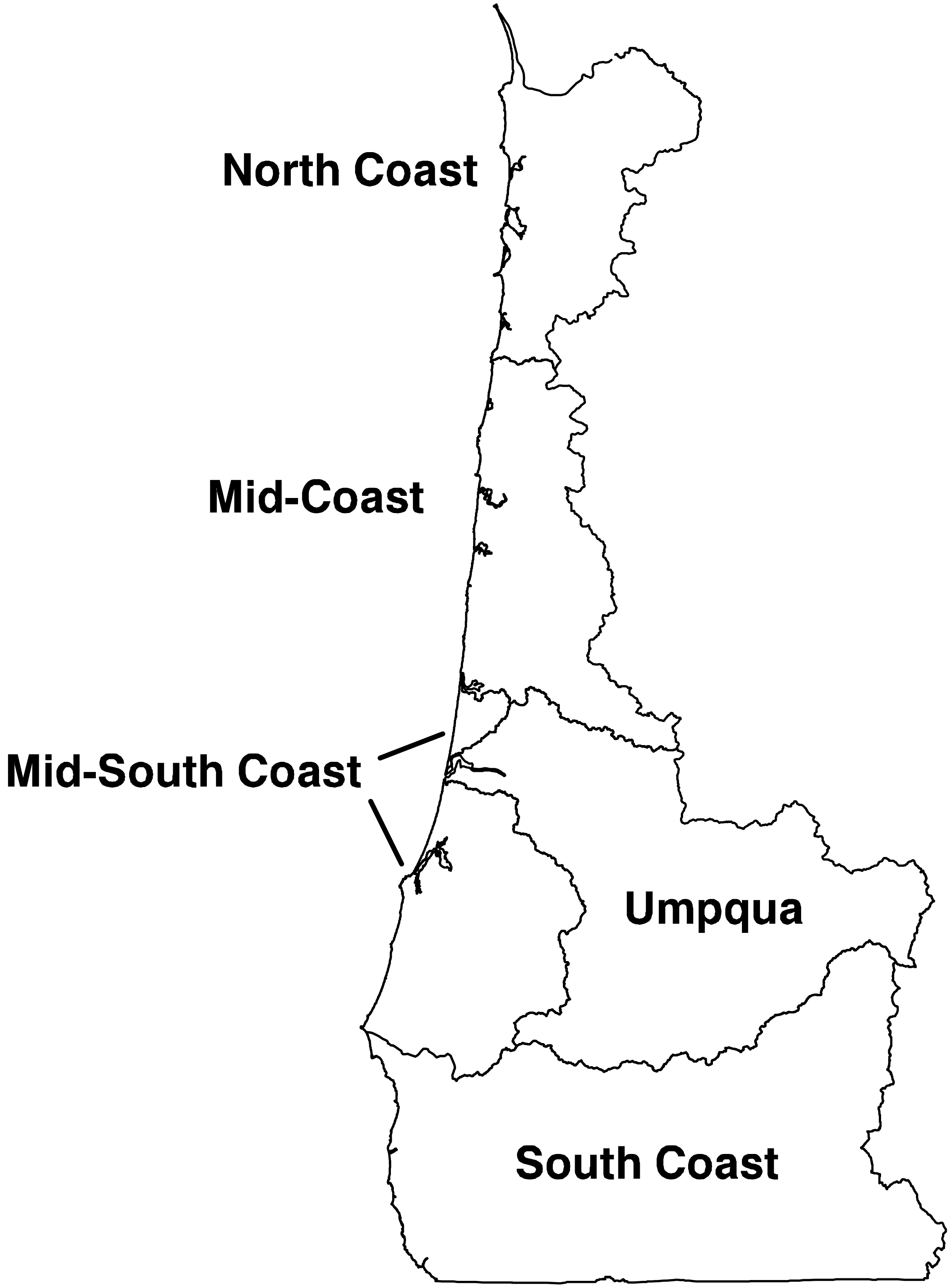



Figure 1. Location of five Monitoring Areas for coho salmon along the Oregon Coast.

| SITE | BASIN NAME | SUBBASIN NAME | REACH |
|---|---|---|---|
| 12 | TRASK RIVER | SOUTH FORK | Boundry Cr |
| 107 | NESTUCCA RIVER | MAIN STEM AND BAY | Testament Cr |
| 225 | NESTUCCA RIVER | MAIN STEM AND BAY | Clear Cr |
| 249 | NESTUCCA RIVER | MAIN STEM AND BAY | Sanders Cr (Smith Cr) |
| 258 | NESTUCCA RIVER | THREE RIVERS | Cedar Cr |
| 331 | NESTUCCA RIVER | THREE RIVERS | Crazy Cr |
| 400 | NESTUCCA RIVER | MAIN STEM AND BAY | Niagara Cr |
| 405 | NESTUCCA RIVER | MAIN STEM AND BAY | Pheasant Cr |
| 486 | NESTUCCA RIVER | LITTLE NESTUCCA | Austin Cr |
| 544 | TRASK RIVER | MAIN STEM | Hoquarten Slough |
| 584 | TRASK RIVER | MAIN STEM | Green Cr |
| 653 | NOT IDENTIFIED | NOT IDENTIFIED | |
| 714 | TILLAMOOK RIVER | MAIN STEM | Tillamook R |
| 718 | SAND LAKE | MAIN STEM | Sand Cr |
| 799 | TRASK RIVER | MAIN STEM | Mill Cr |
| 823 | TILLAMOOK RIVER | MAIN STEM | Killam Cr |
| 852 | TILLAMOOK RIVER | MAIN STEM | Simmons Cr |
| 896 | NESTUCCA RIVER | BEAVER CREEK | Bear Cr |
| 932 | NESTUCCA RIVER | MAIN STEM AND BAY | West Cr |
| 949 | NESKOWIN CREEK | MAIN STEM | Sloan Cr |
| 994 | OCEAN TRIB | MAIN STEM | Rice Cr |
| 1050 | NEHALEM RIVER | ROCK CREEK | Weed Cr |
| 1248 | NEHALEM RIVER | ROCK CREEK | Rock Cr, S Fk |
| 1377 | NECANICUM RIVER | SOUTH FORK | Brandis Cr |
| 1433 | NECANICUM RIVER | SOUTH FORK | Necanicum R, S Fk |
| 1452 | ROVER CREEK | MAIN STEM | Bergsvik Cr |
| 1481 | ROVER CREEK | MAIN STEM | Little Muddy Cr |
| 1496 | ROVER CREEK | MAIN STEM | Little Muddy Cr |
| 1591 | ROVER CREEK | MAIN STEM | Little Joe Cr |
| 1671 | NEHALEM RIVER | NORTH FORK | Nehalem R, N Fk |
| 1699 | NEHALEM RIVER | NORTH FORK | Rackheap Cr |
| 1904 | MIAMI RIVER | MAIN STEM | Miami R |
| 2004 | KILCHIS RIVER | MAIN STEM | Kilchis R, N Fk |
| 2050 | NEHALEM RIVER | MAIN STEM | Foley Cr |
| 2055 | NOT IDENTIFIED | NOT IDENTIFIED | |
| 2095 | NEHALEM RIVER | MAIN STEM | E Humbug Cr |
| 2160 | NEHALEM RIVER | MAIN STEM | Beneke Cr |
| 2188 | NEHALEM RIVER | MAIN STEM | Crawford Cr |
| 2210 | NEHALEM RIVER | MAIN STEM | Northrup Cr |
| 2244 | NEHALEM RIVER | MAIN STEM | Unnamed Trib Walker Cr |
| 2265 | NEHALEM RIVER | MAIN STEM | Hamilton Cr |
| 2291 | NEHALEM RIVER | MAIN STEM | Ford Cr |
| 2352 | NEHALEM RIVER | ROCK CREEK | Selder Cr, Trib B |
| 2451 | NEHALEM RIVER | MAIN STEM | Cedar Cr |
| 2506 | NEHALEM RIVER | MAIN STEM | Fishhawk Cr |
| 2546 | NEHALEM RIVER | MAIN STEM | Coal Cr |
| 2573 | NEHALEM RIVER | MAIN STEM | Dell Cr |
| 2651 | NEHALEM RIVER | MAIN STEM | Deer Cr |
| 2687 | NEHALEM RIVER | MAIN STEM | Oak Ranch Cr |
| 2864 | NOT IDENTIFIED | NOT IDENTIFIED | Laughlin Cr |
| 2912 | WILSON RIVER | MAIN STEM | Fall Cr |
| 2939 | WILSON RIVER | MAIN STEM | Ben Smith Cr |
| 3022 | WILSON RIVER | DEVIL'S LAKE FORK | Deo Cr |
| 3079 | WILSON RIVER | MAIN STEM | Jordan Cr |
| 3164 | NEHALEM RIVER | MAIN STEM | Beaver Cr |

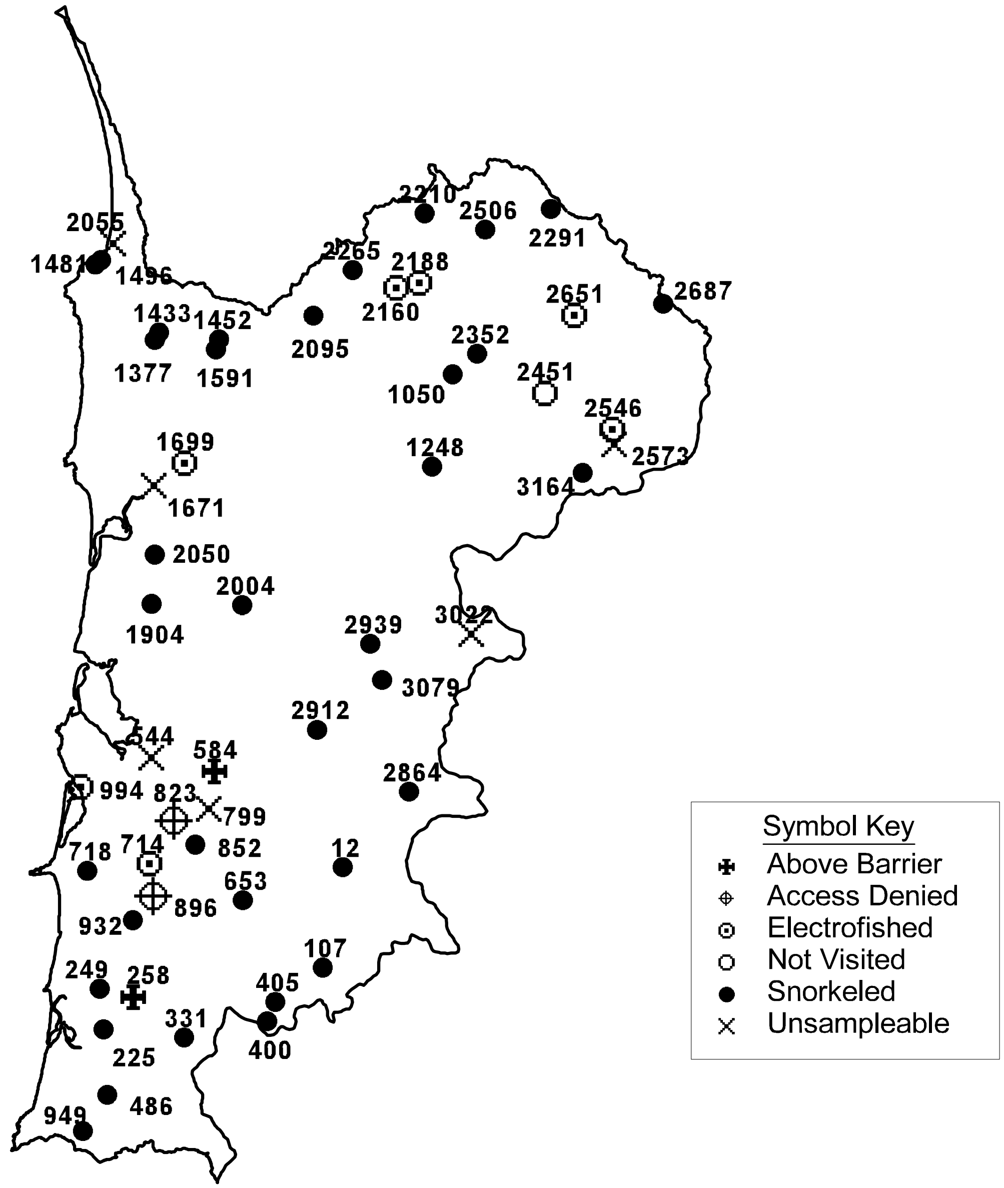



Figure 2. Location and status of candidate sites for juvenile coho sampling in the North Coast, summer 2001 (see Appendix A for geographic coordinates).

| SITE | BASIN NAME | SUBBASIN NAME | REACH |
|---|---|---|---|
| 34 | SIUSLAW RIVER | LAKE CREEK | Elk Cr |
| 73 | ALSEA RIVER | FIVE RIVERS | Lobster Cr |
| 96 | ALSEA RIVER | MAIN STEM AND BAY | Benner Cr |
| 127 | YACHATS RIVER | MAIN STEM | Stump Cr |
| 172 | SIUSLAW RIVER | LAKE CREEK | Indian Cr, N Fk, Trib D |
| 194 | SIUSLAW RIVER | LAKE CREEK | Indian Cr, N Fk |
| 209 | SIUSLAW RIVER | LAKE CREEK | Maria Cr |
| 220 | SIUSLAW RIVER | LAKE CREEK | Rogers Cr |
| 274 | SIUSLAW RIVER | LAKE CREEK | Fish Cr |
| 292 | ALSEA RIVER | FIVE RIVERS | Lobster Cr, E Fk |
| 321 | SIUSLAW RIVER | LAKE CREEK | Lake Cr |
| 369 | ALSEA RIVER | NORTH FORK | Alsea R, N Fk |
| 390 | ALSEA RIVER | MAIN STEM AND BAY | Narrows Cr |
| 411 | ALSEA RIVER | NORTH FORK | Crooked Cr |
| 451 | ALSEA RIVER | SOUTH FORK | Brown Cr |
| 549 | SIUSLAW RIVER | MAIN STEM | Haight Cr |
| 577 | SIUSLAW RIVER | MAIN STEM | Wildcat Cr, Trib Zh |
| 601 | SIUSLAW RIVER | MAIN STEM | Wildcat Cr |
| 609 | SIUSLAW RIVER | MAIN STEM | Clay Cr |
| 669 | SIUSLAW RIVER | MAIN STEM | Fawn Cr |
| 749 | SIUSLAW RIVER | NORTH FORK | Porter Cr |
| 773 | SIUSLAW RIVER | NORTH FORK | Condon Cr |
| 806 | BIG CREEK | MAIN STEM & SFK | Fryingpan Cr |
| 826 | TENMILE CREEK | MAIN STEM | Mill Cr |
| 861 | SIUSLAW RIVER | MAIN STEM | Barber Cr |
| 918 | SIUSLAW RIVER | MAIN STEM | Bounds Cr |
| 955 | SIUSLAW RIVER | LAKE CREEK | Hula Cr |
| 979 | SIUSLAW RIVER | MAIN STEM | Hanson Cr |
| 1001 | SIUSLAW RIVER | MAIN STEM | Knowles Cr |
| 1026 | YAQUINA RIVER | ELK CREEK | Spout Cr |
| 1076 | YAQUINA RIVER | LITTLE ELK CREEK | Oglesby Cr |
| 1086 | SILETZ RIVER | ROCK CREEK | Steere Cr |
| 1172 | SILETZ RIVER | NORTH FORK | Boulder Cr |
| 1207 | SILETZ RIVER | NORTH FORK | Warnicke Cr |
| 1247 | SILETZ RIVER | MAIN STEM | Mill Cr, N Fk |
| 1307 | SILETZ RIVER | MAIN STEM | Dewey Cr |
| 1400 | SILETZ RIVER | MAIN STEM | Bear Cr |
| 1432 | DEVIL'S LAKE | MAIN STEM | Rock Cr, Trib A |
| 1463 | CUMMINS CR | MAIN STEM | Cummins Cr |
| 1470 | ALSEA RIVER | MAIN STEM AND BAY | Darling Cr |
| 1491 | BIG CREEK | MAINSTEM,SFK,DICK'S | Big Cr, S Fk |
| 1531 | ALSEA RIVER | DRIFT CREEK | Flynn Cr |
| 1579 | YAQUINA RIVER | ELK CREEK | Deer Cr |
| 1606 | YAQUINA RIVER | MAIN STEM AND BAY | Mill Cr |
| 1653 | ALSEA RIVER | FIVE RIVERS | Camp Cr |
| 1665 | ALSEA RIVER | FIVE RIVERS | Five Rivers |
| 1709 | SIUSLAW RIVER | LAKE CREEK | Bear Cr, S Fk |
| 1712 | SIUSLAW RIVER | LAKE CREEK | Lake Cr |
| 1744 | ALSEA RIVER | NORTH FORK | Seeley Cr |
| 1797 | SIUSLAW RIVER | MAIN STEM | Siuslaw R |
| 1830 | SIUSLAW RIVER | MAIN STEM | Siuslaw R |
| 1847 | SIUSLAW RIVER | MAIN STEM | Munsel Cr |
| 1876 | BIG CREEK | MAIN STEM & SFK | Big Cr |
| 1888 | SIUSLAW RIVER | LAKE CREEK | Indian Cr |
| 1951 | YAQUINA RIVER | MAIN STEM AND BAY | Depot Cr |
| 2035 | ALSEA RIVER | DRIFT CREEK | Trout Cr |
| 2066 | ALSEA RIVER | MAIN STEM AND BAY | Carns Canyon |

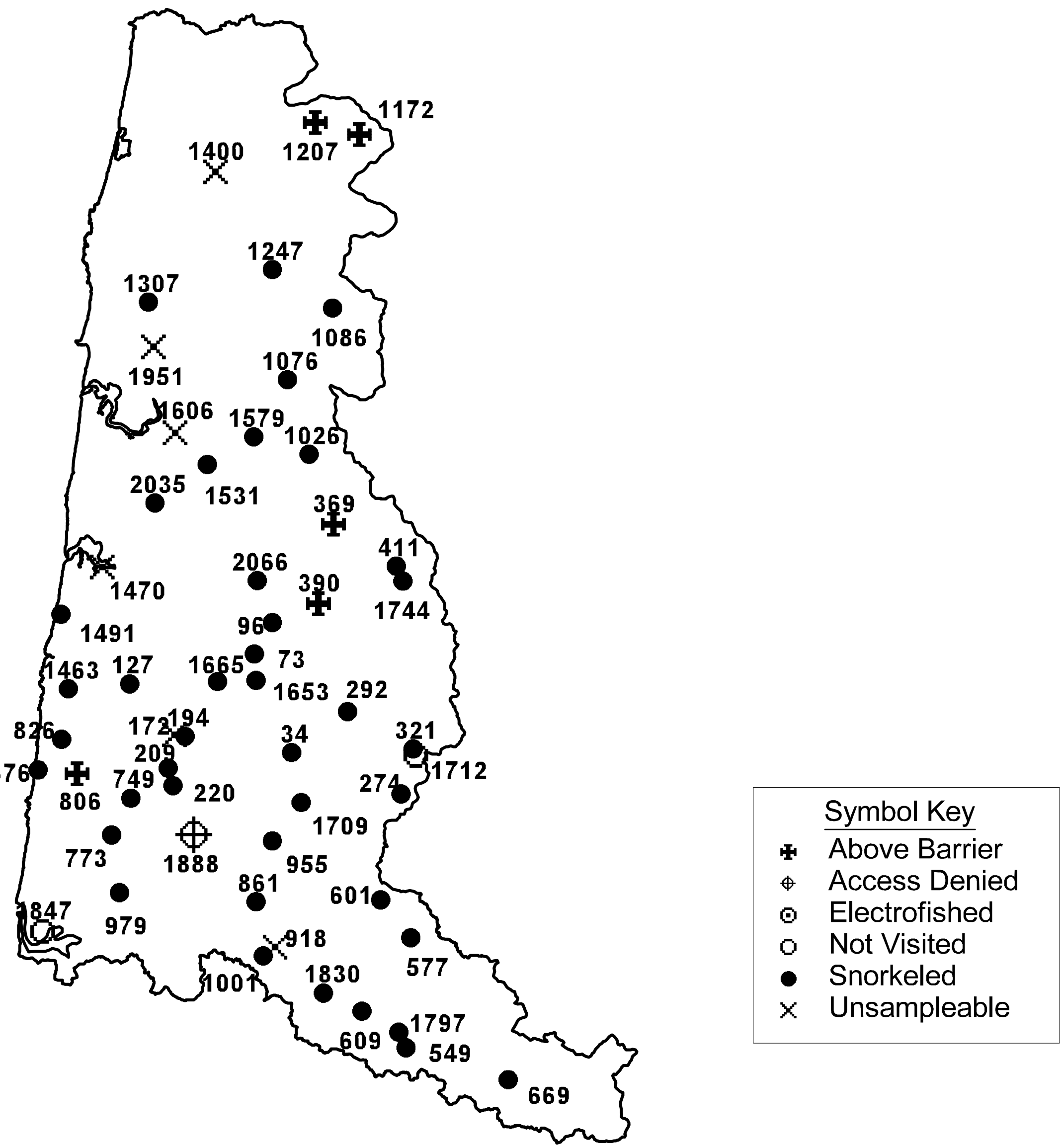



Figure 3. Location and status of candidate sites for juvenile coho sampling in the Mid-Coast, summer 2001 (see Appendix A for geographic coordinates).

| SITE | BASIN NAME | SUBBASIN NAME | REACH |
|---|---|---|---|
| 44 | COOS RIVER | SOUTH FORK | Little Cow Cr |
| 133 | COOS RIVER | SOUTH FORK | Bottom Cr |
| 149 | COQUILLE RIVER | MIDDLE FORK | Mcmullen Cr |
| 182 | COQUILLE RIVER | SOUTH FORK | Ward Cr |
| 220 | COQUILLE RIVER | SOUTH FORK | Rowland Cr |
| 231 | COQUILLE RIVER | SOUTH FORK | Baker Cr |
| 279 | COQUILLE RIVER | SOUTH FORK | Beaverdam Br |
| 311 | COQUILLE RIVER | SOUTH FORK | Dement Cr |
| 326 | FOURMILE CR | MAIN STEM | Fourmile Cr |
| 361 | COQUILLE RIVER | EAST FORK | Weekly Cr |
| 451 | COQUILLE RIVER | NORTH FORK | Middle Cr |
| 584 | COQUILLE RIVER | NORTH FORK | Coquille R, N Fk |
| 651 | COQUILLE RIVER | EAST FORK | Elk Cr |
| 665 | COQUILLE RIVER | MIDDLE FORK | Big Cr |
| 689 | COQUILLE RIVER | NORTH FORK | Johns Cr |
| 740 | COQUILLE RIVER | MIDDLE FORK | Rock Cr |
| 757 | COQUILLE RIVER | MIDDLE FORK | Little Rock Cr |
| 781 | COQUILLE RIVER | SOUTH FORK | Salmon Cr |
| 819 | SIXES RIVER | MAIN STEM | Sixes R |
| 858 | SIXES RIVER | MAIN STEM | Sixes R |
| 884 | FLORAS CREEK | MAIN STEM | Floras Cr |
| 961 | TENMILE CREEK | MAIN STEM | Tenmile Cr |
| 1096 | TENMILE CREEK | SOUTH TENMILE LAKE | Benson Cr |
| 1175 | COOS RIVER | MILLICOMA RIVER | Hendrickson Cr |
| 1200 | COOS RIVER | SOUTH FORK | Bessey Cr |
| 1260 | COQUILLE RIVER | NORTH FORK | Coquille R, Little N Fk |
| 1264 | COQUILLE RIVER | NORTH FORK | Coquille R, N Fk |
| 1319 | COOS RIVER | SOUTH FORK | Wren Smith Cr |
| 1342 | COOS RIVER | MILLICOMA RIVER | Millicoma R, E Fk |
| 1385 | COOS RIVER | MILLICOMA RIVER | Millicoma R, E Fk |
| 1403 | COOS RIVER | MILLICOMA RIVER | Schumacher Cr |
| 1506 | COOS RIVER | MAIN STEM | Catching Cr |
| 1610 | COOS RIVER | MAIN STEM | Winchester Cr |
| 1693 | COQUILLE RIVER | MAIN STEM AND BAY | Mack Cr |
| 1757 | TAHKENITCH CREEK | FIVEMILE CREEK | Fivemile Cr |
| 1769 | TAHKENITCH CREEK | FIVEMILE CREEK | Fivemile Cr |
| 1826 | SILTCOOS RIVER | MAPLE CREEK | Maple Cr |
| 1858 | SILTCOOS RIVER | WOAHINK LAKE | Miller Cr |
| 1905 | COOS RIVER | SOUTH FORK | Williams R |
| 1930 | COQUILLE RIVER | MAIN STEM AND BAY | Fishtrap Cr |
| 2019 | COQUILLE RIVER | NORTH FORK | Coquille R, N Fk |
| 2137 | COQUILLE RIVER | SOUTH FORK | Poverty Gulch |
| 2201 | SIXES RIVER | MAIN STEM | Sixes R |
| 2203 | SIXES RIVER | MAIN STEM | Sixes R |
| 2303 | NOT IDENTIFIED | NOT IDENTIFIED | |
| 2322 | TENMILE CREEK | EEL LAKE | Eel Cr |
| 2388 | COOS RIVER | MILLICOMA RIVER | Hendrickson Cr |
| 2438 | COOS RIVER | MILLICOMA RIVER | Packard Cr |
| 2460 | NOT IDENTIFIED | NOT IDENTIFIED | |
| 2530 | COOS RIVER | MAIN STEM | Talbott Cr |

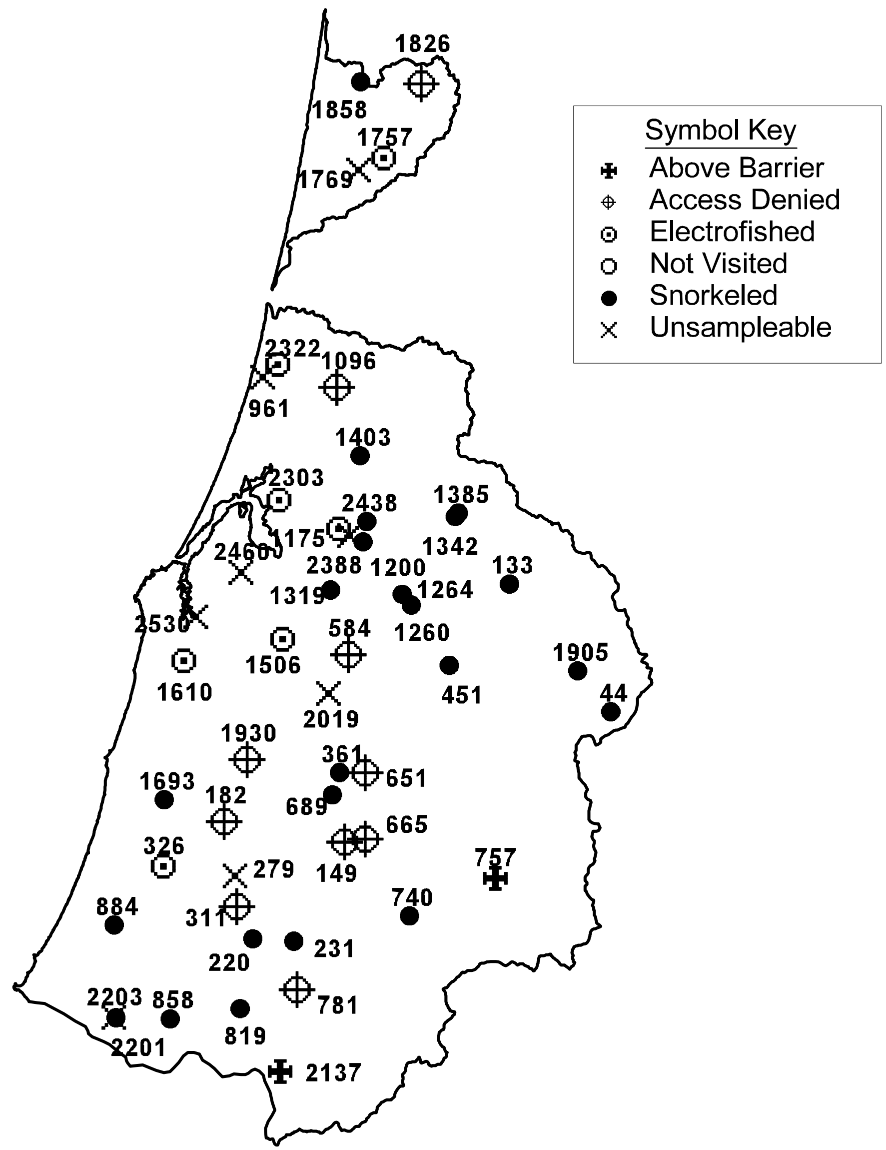



Figure 4. Location and status of candidate sites for juvenile coho sampling in the Mid-South Coast, summer 2001 (see Appendix A for geographic coordinates).

| SITE | BASIN NAME | SUBBASIN NAME | REACH |
|---|---|---|---|
| 29 | UMPQUA RIVER | ELK CREEK | Elk Cr |
| 63 | UMPQUA RIVER | ELK CREEK | Bennet Cr |
| 81 | UMPQUA RIVER | SOUTH UMPQUA | Roberts Cr |
| 127 | UMPQUA RIVER | MAIN STEM AND BAY | Turkey Cr |
| 915 | UMPQUA RIVER | SOUTH UMPQUA | Wood Cr |
| 925 | UMPQUA RIVER | SOUTH UMPQUA | Whitehorse Cr |
| 954 | UMPQUA RIVER | SOUTH UMPQUA | Blue Cr |
| 958 | UMPQUA RIVER | SOUTH UMPQUA | Clear Cr |
| 970 | UMPQUA RIVER | SOUTH UMPQUA | Quines Cr |
| 972 | UMPQUA RIVER | SOUTH UMPQUA | Bull Run Cr |
| 988 | UMPQUA RIVER | MAIN STEM AND BAY | Wind Cr |
| 1006 | UMPQUA RIVER | MAIN STEM AND BAY | Harvey Cr |
| 1026 | UMPQUA RIVER | MAIN STEM AND BAY | Scholfield Cr |
| 1034 | UMPQUA RIVER | MAIN STEM AND BAY | Dry Cr |
| 1047 | UMPQUA RIVER | MAIN STEM AND BAY | Camp Cr |
| 1061 | UMPQUA RIVER | SMITH RIVER | Otter Cr |
| 1069 | UMPQUA RIVER | MAIN STEM AND BAY | Oar Cr |
| 1100 | UMPQUA RIVER | MAIN STEM AND BAY | Case Knife Cr |
| 1113 | UMPQUA RIVER | MAIN STEM AND BAY | Wolf Cr |
| 1116 | UMPQUA RIVER | MAIN STEM AND BAY | Heddin Cr |
| 1146 | UMPQUA RIVER | MAIN STEM AND BAY | Lutsinger Cr |
| 1151 | UMPQUA RIVER | MAIN STEM AND BAY | Lutsinger Cr |
| 1158 | UMPQUA RIVER | MAIN STEM AND BAY | Camp Cr |
| 1169 | UMPQUA RIVER | MAIN STEM AND BAY | Mcgee Cr |
| 1186 | UMPQUA RIVER | MAIN STEM AND BAY | Mehl Cr |
| 1212 | UMPQUA RIVER | SMITH RIVER | Spencer Cr, W Fk, Trib A |
| 1256 | UMPQUA RIVER | SMITH RIVER | S Sister Cr |
| 1314 | UMPQUA RIVER | SMITH RIVER | Lower Johnson Cr |
| 1358 | UMPQUA RIVER | SMITH RIVER | Blackwell Cr |
| 1394 | UMPQUA RIVER | MAIN STEM AND BAY | Wells Cr |
| 1423 | UMPQUA RIVER | MAIN STEM AND BAY | Weatherly Cr |
| 2230 | UMPQUA RIVER | NOT IDENTIFIED | Umpqua River |
| 2233 | UMPQUA RIVER | MAIN STEM AND BAY | Umpqua R |
| 2241 | UMPQUA RIVER | CALAPOOYA CREEK | Coon Cr |
| 2246 | UMPQUA RIVER | SOUTH UMPQUA | Mcnabb Cr |
| 2267 | UMPQUA RIVER | SOUTH UMPQUA | Tenmile Cr |
| 2297 | UMPQUA RIVER | SOUTH UMPQUA | Tenmile Cr |
| 2300 | UMPQUA RIVER | SOUTH UMPQUA | Bear Cr |
| 2309 | UMPQUA RIVER | SOUTH UMPQUA | Falcon Cr |
| 2348 | UMPQUA RIVER | SOUTH UMPQUA | Stampede Cr |
| 2350 | UMPQUA RIVER | SOUTH UMPQUA | Beaver Cr |
| 2351 | UMPQUA RIVER | SOUTH UMPQUA | Burnt Cr |
| 2368 | UMPQUA RIVER | SOUTH UMPQUA | Boulder Cr |
| 2389 | UMPQUA RIVER | SOUTH UMPQUA | Squaw Cr |
| 2390 | UMPQUA RIVER | SOUTH UMPQUA | Crooked Cr |
| 2414 | UMPQUA RIVER | SOUTH UMPQUA | Black Canyon Cr |
| 2435 | UMPQUA RIVER | NORTH UMPQUA | Limpy Cr |
| 2437 | UMPQUA RIVER | NOT IDENTIFIED | Part Cr |
| 2442 | UMPQUA RIVER | NORTH UMPQUA | N Umpqua R |
| 2474 | UMPQUA RIVER | NORTH UMPQUA | Cavitt Cr |
| 2518 | UMPQUA RIVER | SOUTH UMPQUA | Shively Cr, E Fk |
| 2544 | UMPQUA RIVER | SOUTH UMPQUA | Salt Cr #2 |
| 2587 | UMPQUA RIVER | SOUTH UMPQUA | N Myrtle Cr |
| 2626 | UMPQUA RIVER | NOT IDENTIFIED | |
| 2672 | UMPQUA RIVER | MAIN STEM AND BAY | Providence Cr |
| 2719 | UMPQUA RIVER | NOT IDENTIFIED | Indian Cr |

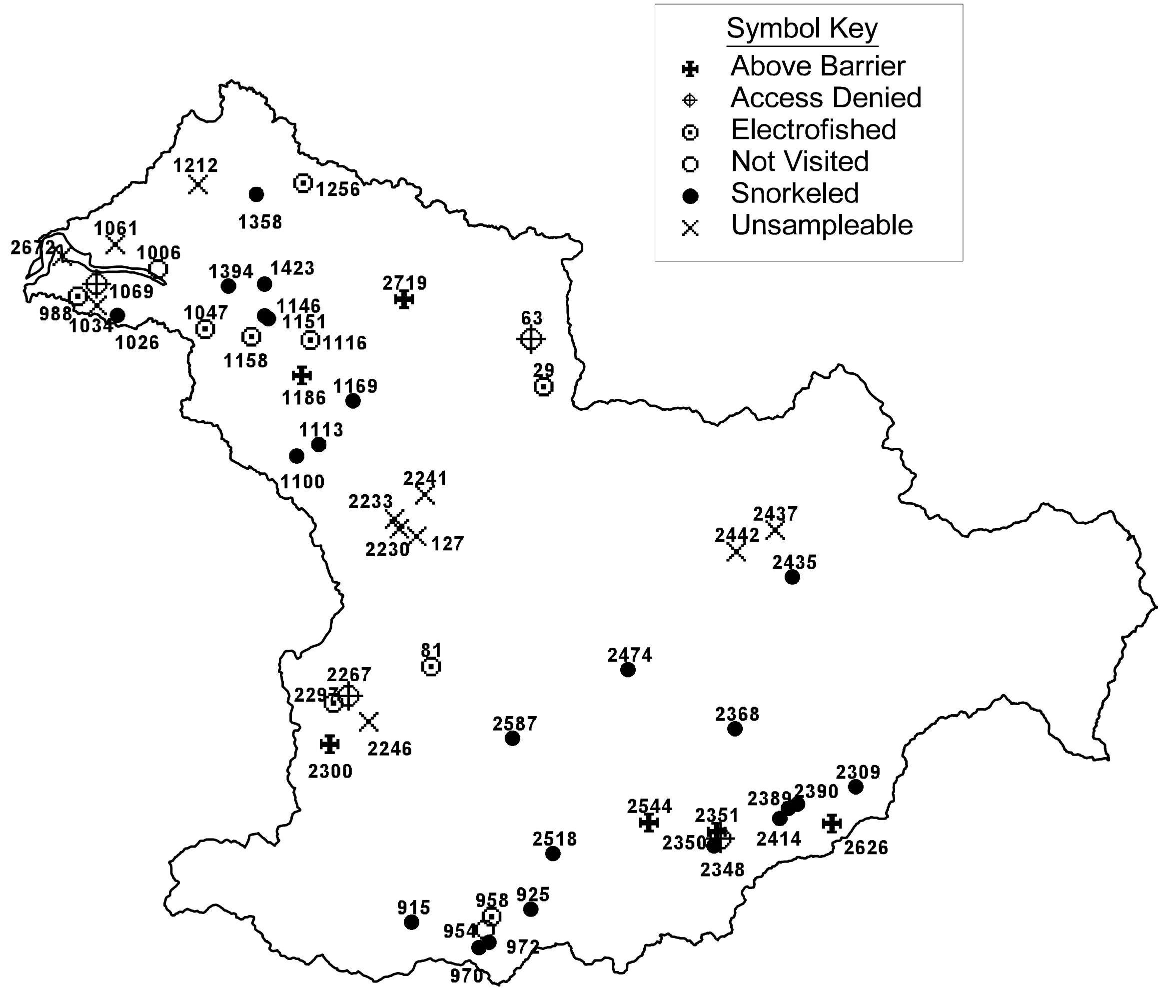



Figure 5. Location and status of candidate sites for juvenile coho sampling in the Umpqua, summer 2001 (see Appendix A for geographic coordinates).

| SITE | BASIN NAME | SUBBASIN NAME | REACH |
|---|---|---|---|
| 20 | ROGUE RIVER | MAIN STEM | Grave Cr |
| 36 | ROGUE RIVER | MAIN STEM | Grave Cr |
| 37 | ROGUE RIVER | MAIN STEM | Grave Cr |
| 53 | ROGUE RIVER | MAIN STEM | Sugarpine Cr |
| 74 | ROGUE RIVER | MAIN STEM | Flat Cr |
| 97 | ROGUE RIVER | BIG BUTTE CREEK | Mcneil Cr |
| 109 | ROGUE RIVER | MAIN STEM | Little Butte Cr, N Fk |
| 122 | ROGUE RIVER | BIG BUTTE CREEK | Big Butte Cr, N Fk |
| 134 | ROGUE RIVER | BIG BUTTE CREEK | Big Butte Cr, N Fk |
| 144 | ROGUE RIVER | MAIN STEM | Trail Cr, W Fk |
| 165 | ROGUE RIVER | MAIN STEM | Evans Cr |
| 195 | ROGUE RIVER | MAIN STEM | Sams Cr |
| 239 | ROGUE RIVER | MAIN STEM | Rock Cr |
| 240 | ROGUE RIVER | MAIN STEM | Salt Cr |
| 256 | ROGUE RIVER | MAIN STEM | Jumpoff Joe Cr |
| 257 | ROGUE RIVER | MAIN STEM | Jumpoff Joe Cr |
| 273 | ROGUE RIVER | MAIN STEM | Grave Cr |
| 288 | ROGUE RIVER | MAIN STEM | Wolf Cr |
| 309 | ROGUE RIVER | MAIN STEM | Jumpoff Joe Cr |
| 336 | ROGUE RIVER | MAIN STEM | Shasta Costa Cr |
| 338 | ROGUE RIVER | MAIN STEM | Shasta Costa Cr |
| 383 | ROGUE RIVER | MAIN STEM | Billings Cr |
| 397 | ROGUE RIVER | LOBSTER CREEK | Lobster Cr |
| 399 | ROGUE RIVER | LOBSTER CREEK | Lobster Cr |
| 410 | ROGUE RIVER | LOBSTER CREEK | Lobster Cr, N Fk |
| 415 | ROGUE RIVER | LOBSTER CREEK | Lobster Cr, N Fk |
| 453 | ROGUE RIVER | ILLINOIS RIVER | Fall Cr |
| 477 | ROGUE RIVER | ILLINOIS RIVER | Mendenhall Cr |
| 486 | ROGUE RIVER | APPLEGATE RIVER | Williams Cr, W Fk |
| 505 | ROGUE RIVER | ILLINOIS RIVER | Althouse Cr |
| 520 | ROGUE RIVER | ILLINOIS RIVER | Althouse Cr |
| 548 | ROGUE RIVER | ILLINOIS RIVER | Little Grayback Cr |
| 549 | ROGUE RIVER | ILLINOIS RIVER | Little Grayback Cr |
| 577 | ROGUE RIVER | ILLINOIS RIVER | Illinois R, W Fk |
| 594 | ROGUE RIVER | ILLINOIS RIVER | Illinois R, W Fk |
| 623 | ROGUE RIVER | MAIN STEM | Little Butte Cr, S Fk |
| 629 | ROGUE RIVER | MAIN STEM | Soda Cr |
| 631 | ROGUE RIVER | MAIN STEM | Little Butte Cr, S Fk |
| 657 | ROGUE RIVER | APPLEGATE RIVER | Little Applegate R |
| 668 | ROGUE RIVER | APPLEGATE RIVER | Applegate R |
| 685 | ROGUE RIVER | MAIN STEM | Pleasant Cr, Queens Br |
| 706 | ROGUE RIVER | MAIN STEM | Louse Cr |
| 722 | ROGUE RIVER | MAIN STEM | Louse Cr |
| 745 | ROGUE RIVER | APPLEGATE RIVER | Williams Cr |
| 758 | ROGUE RIVER | APPLEGATE RIVER | Forest Cr |
| 781 | ROGUE RIVER | APPLEGATE RIVER | Williams Cr, E Fk |
| 791 | ROGUE RIVER | APPLEGATE RIVER | Thompson Cr |
| 828 | ROGUE RIVER | APPLEGATE RIVER | Cedar Log Cr |
| 834 | ROGUE RIVER | MAIN STEM | Shan Cr |
| 866 | ROGUE RIVER | ILLINOIS RIVER | Draper Cr |
| 869 | ROGUE RIVER | APPLEGATE RIVER | Waters Cr |
| 875 | ROGUE RIVER | APPLEGATE RIVER | Slate Cr |
| 907 | ROGUE RIVER | ILLINOIS RIVER | Crooks Cr |
| 914 | ROGUE RIVER | ILLINOIS RIVER | Crooks Cr |
| 930 | ROGUE RIVER | ILLINOIS RIVER | Deer Cr |
| 959 | ROGUE RIVER | MAIN STEM | Coleman Cr |

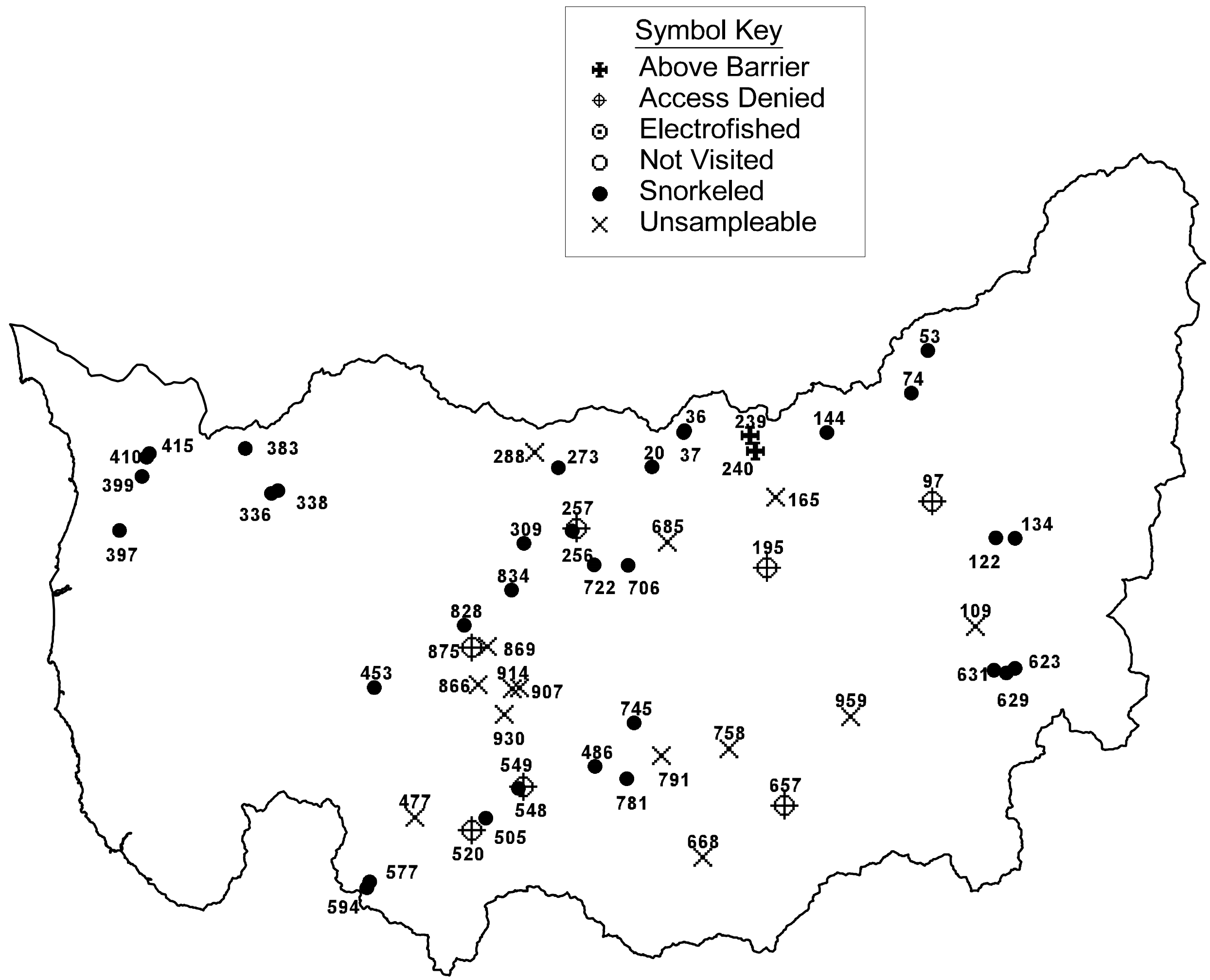



Figure 6. Location and status of candidate sites for juvenile coho sampling in the South Coast, summer 2001 (see Appendix A for geographic coordinates).

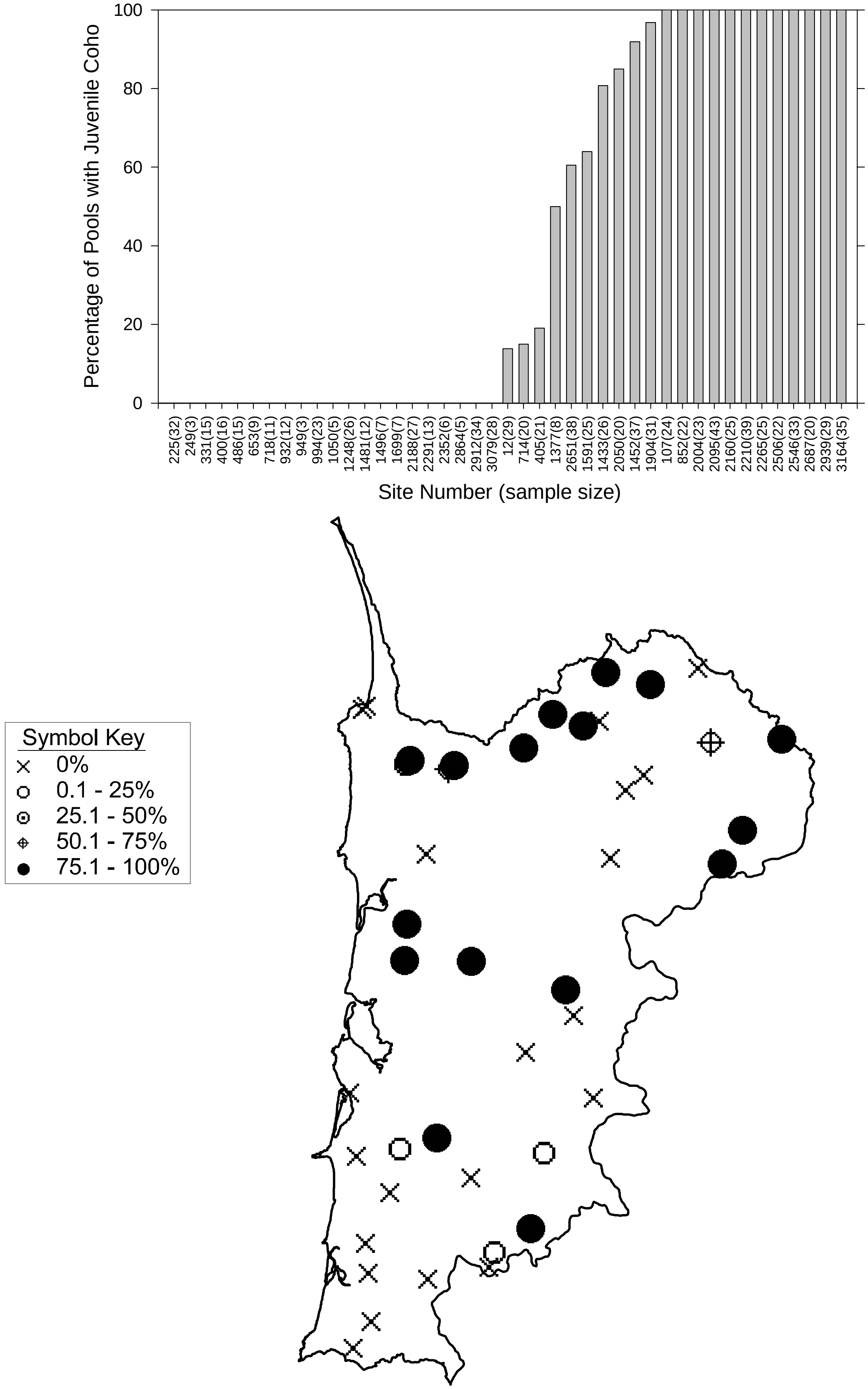



Figure 7. Percentage of pools that contained juvenile coho at each site snorkeled or electrofished in the summer of 2001 in the North Coast (see Appendix A for site data).

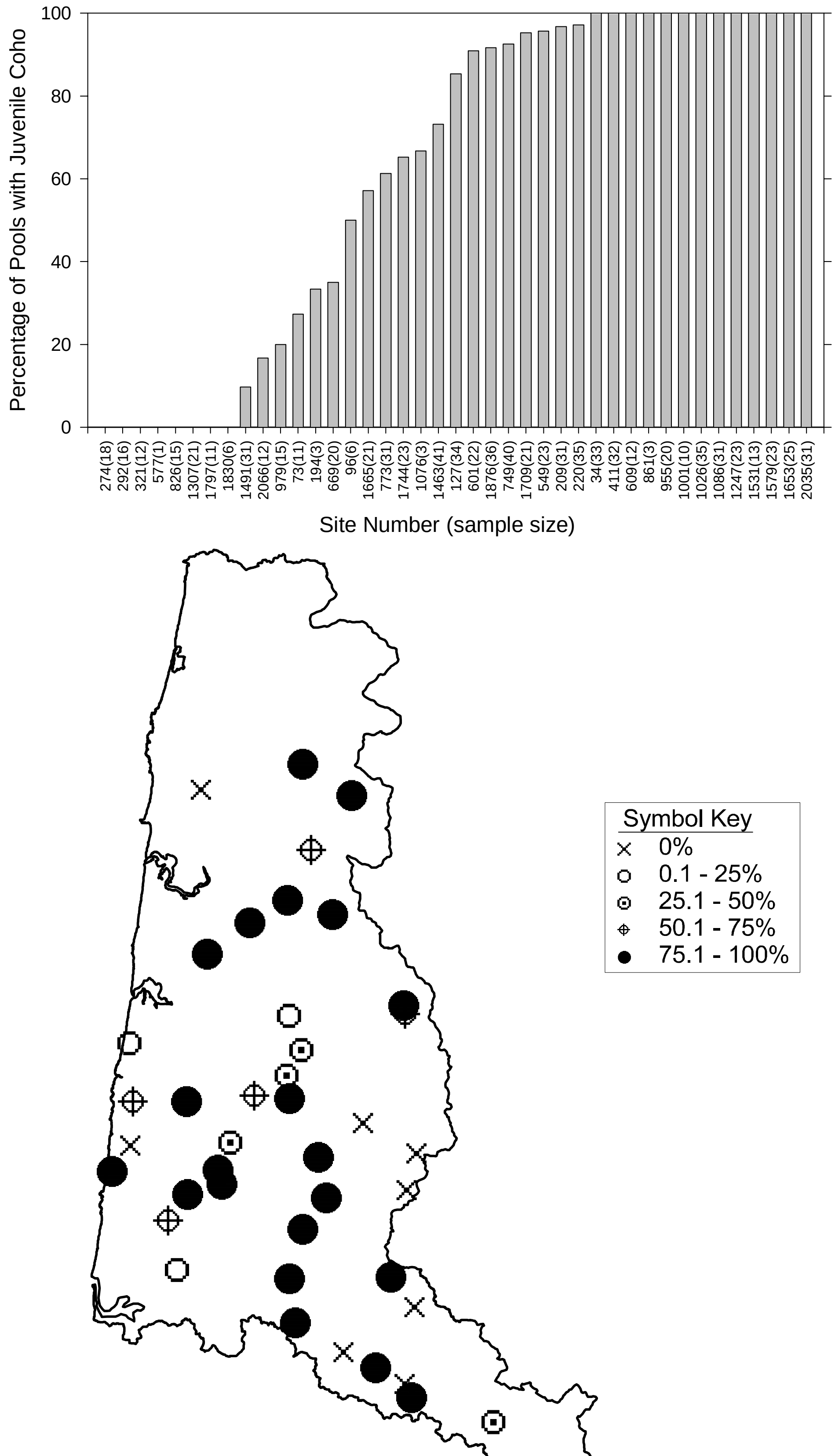



Figure 8. Percentage of pools that contained juvenile coho at each site snorkeled or electrofished in the summer of 2001 in the Mid-Coast (see Appendix A for site data).

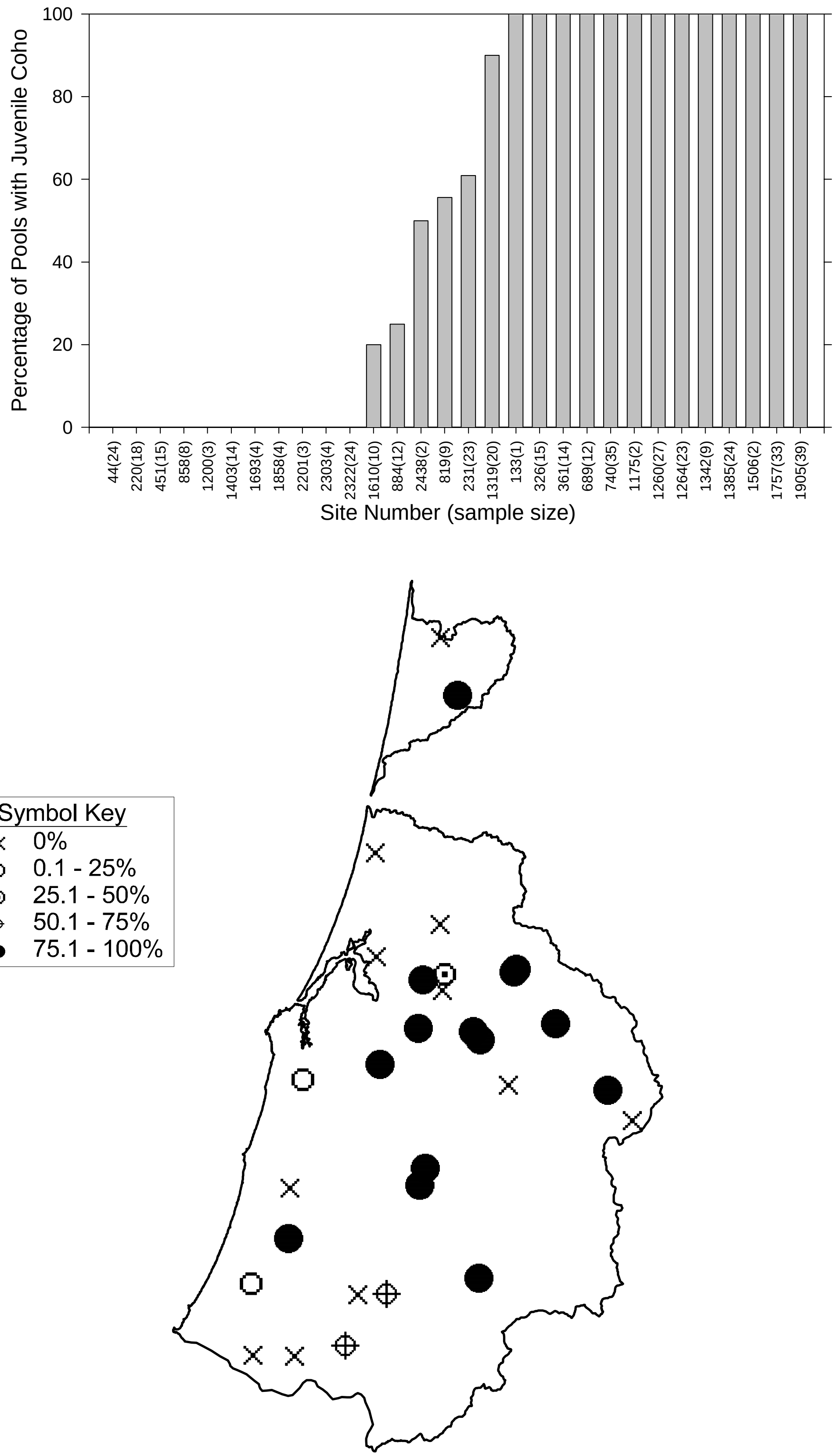



Figure 9. Percentage of pools that contained juvenile coho at each site snorkeled or electrofished in the summer of 2001 in the Mid-South Coast (see Appendix A for site data).

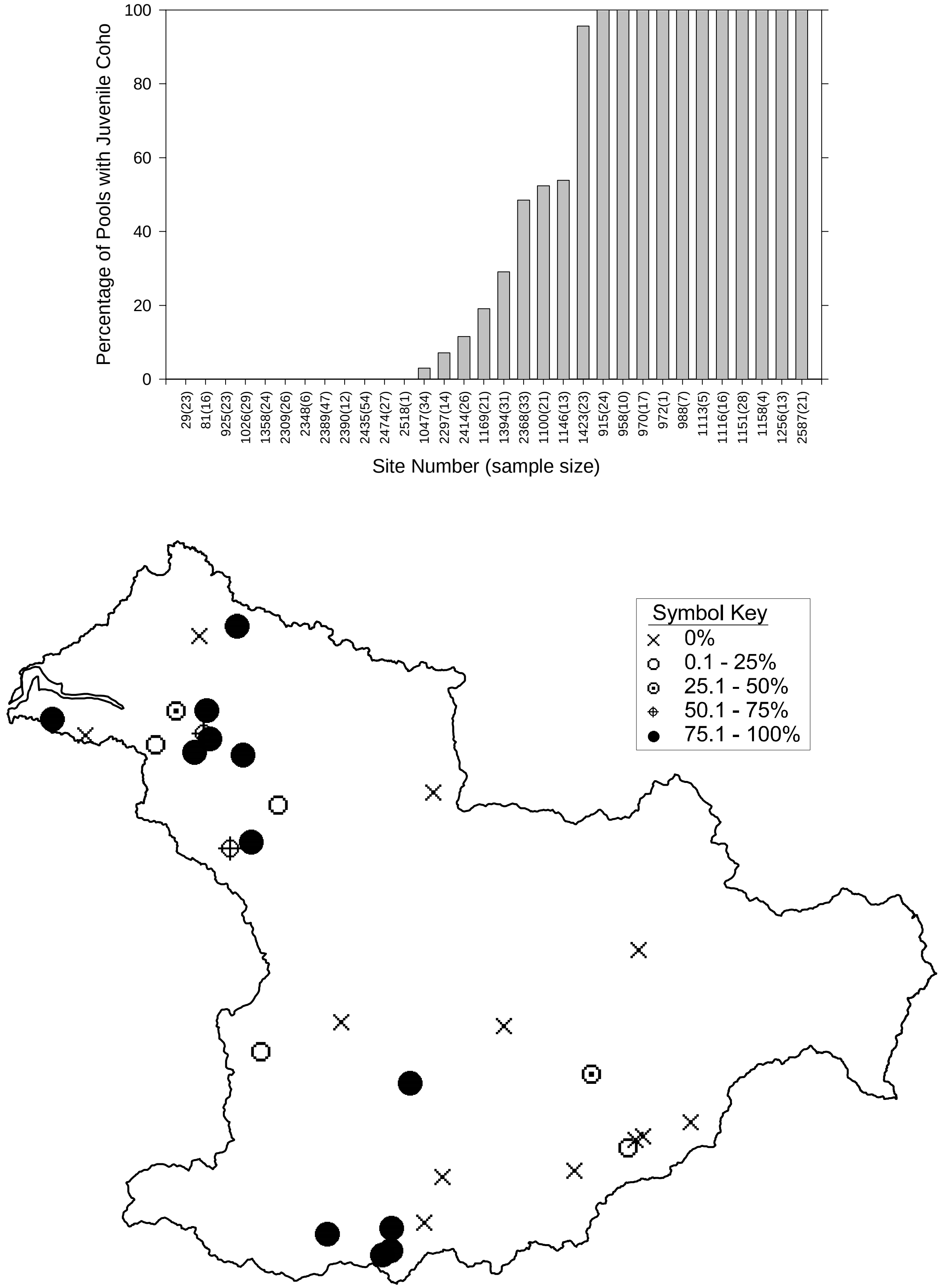
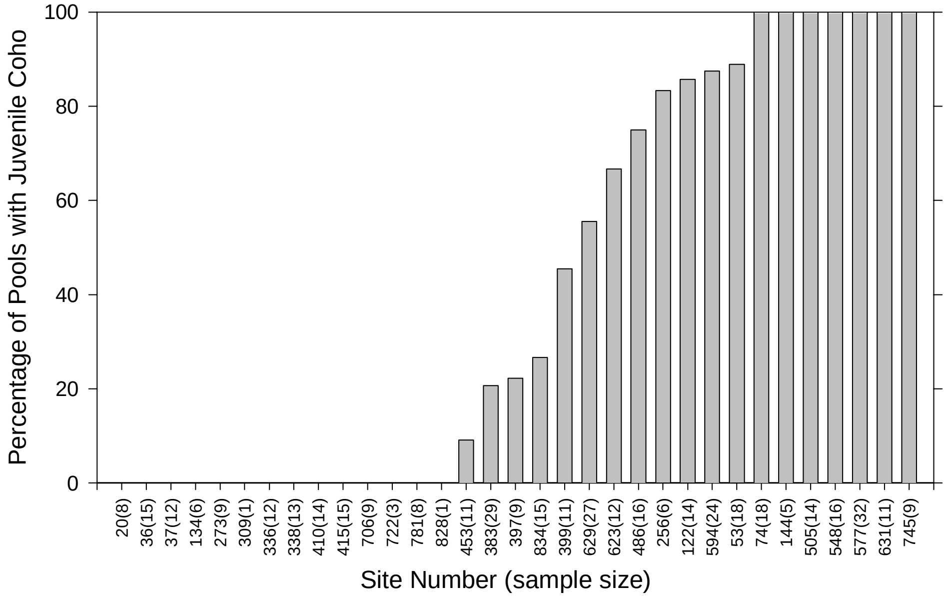



Figure 10. Percentage of pools that contained juvenile coho at each site snorkeled or electrofished in the summer of 2001 in the Umpqua (see Appendix A for site data).



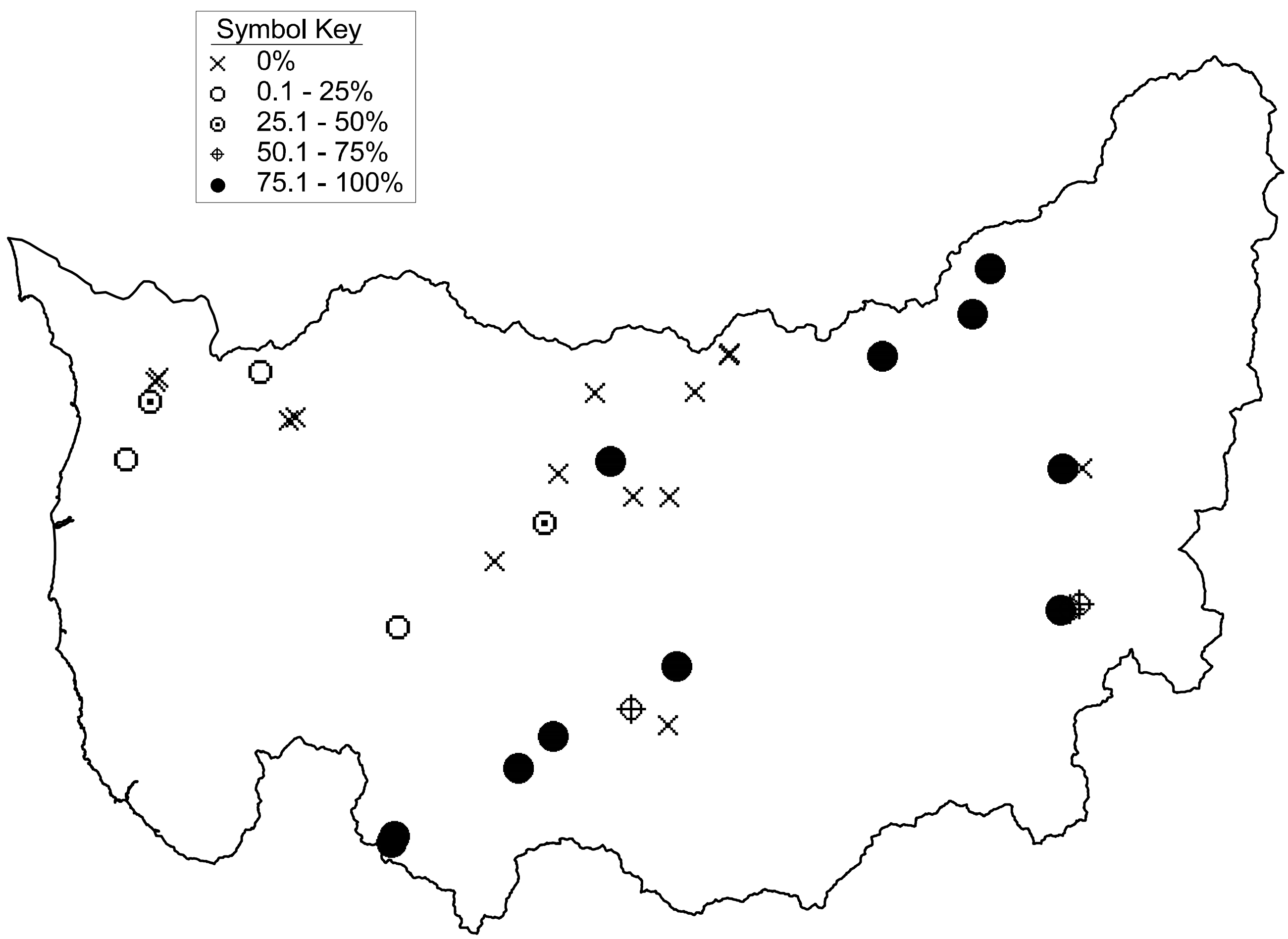




Figure 11. Percentage of pools that contained juvenile coho at each site snorkeled in the summer of 2001 in the South Coast (see Appendix A for site data).

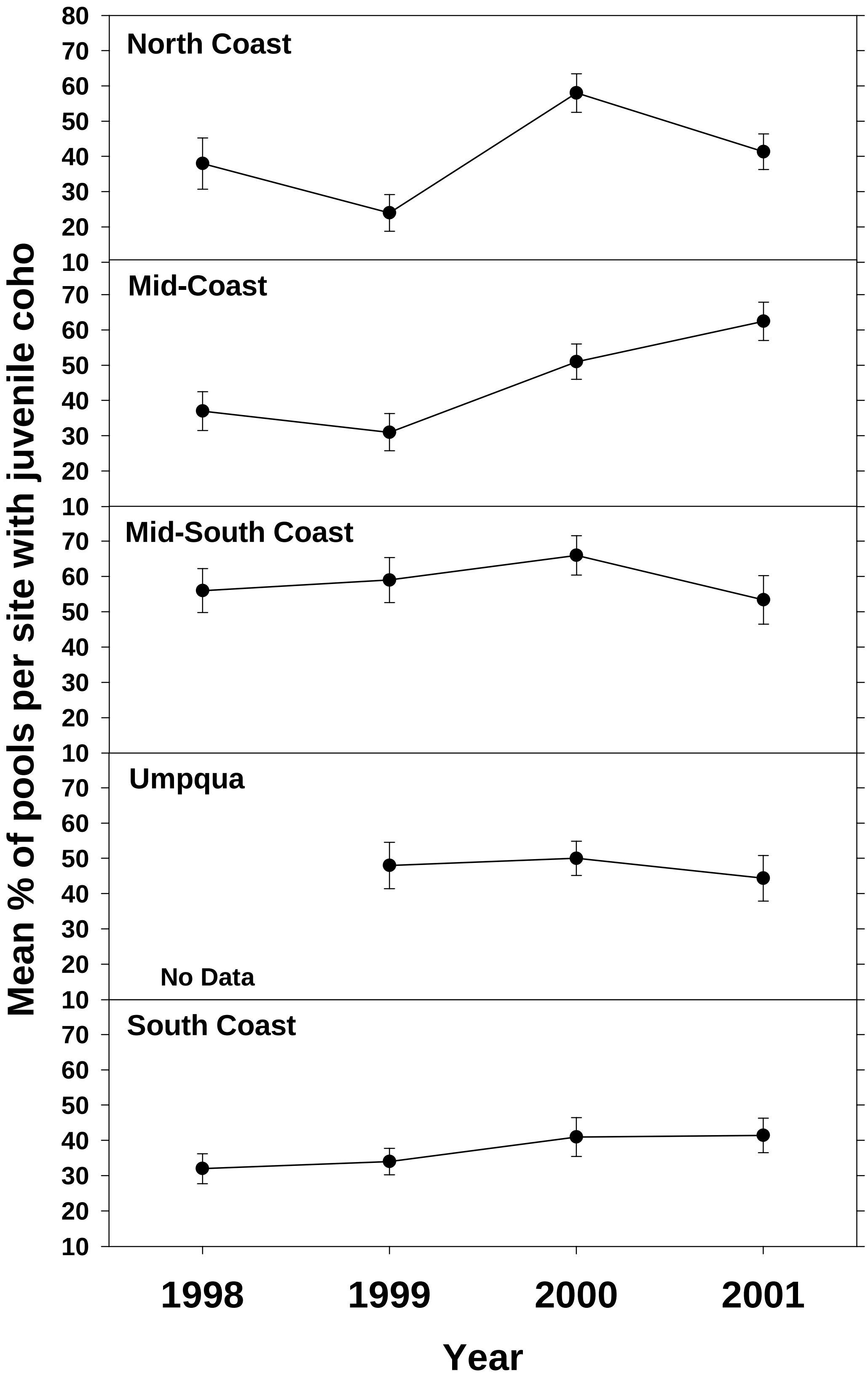



Figure 12. Percentage (mean and standard error) of pools per site that contained juvenile coho in each coastal Monitoring Area, 1998-2001. No sampling was conducted in the Umpqua in 1998.

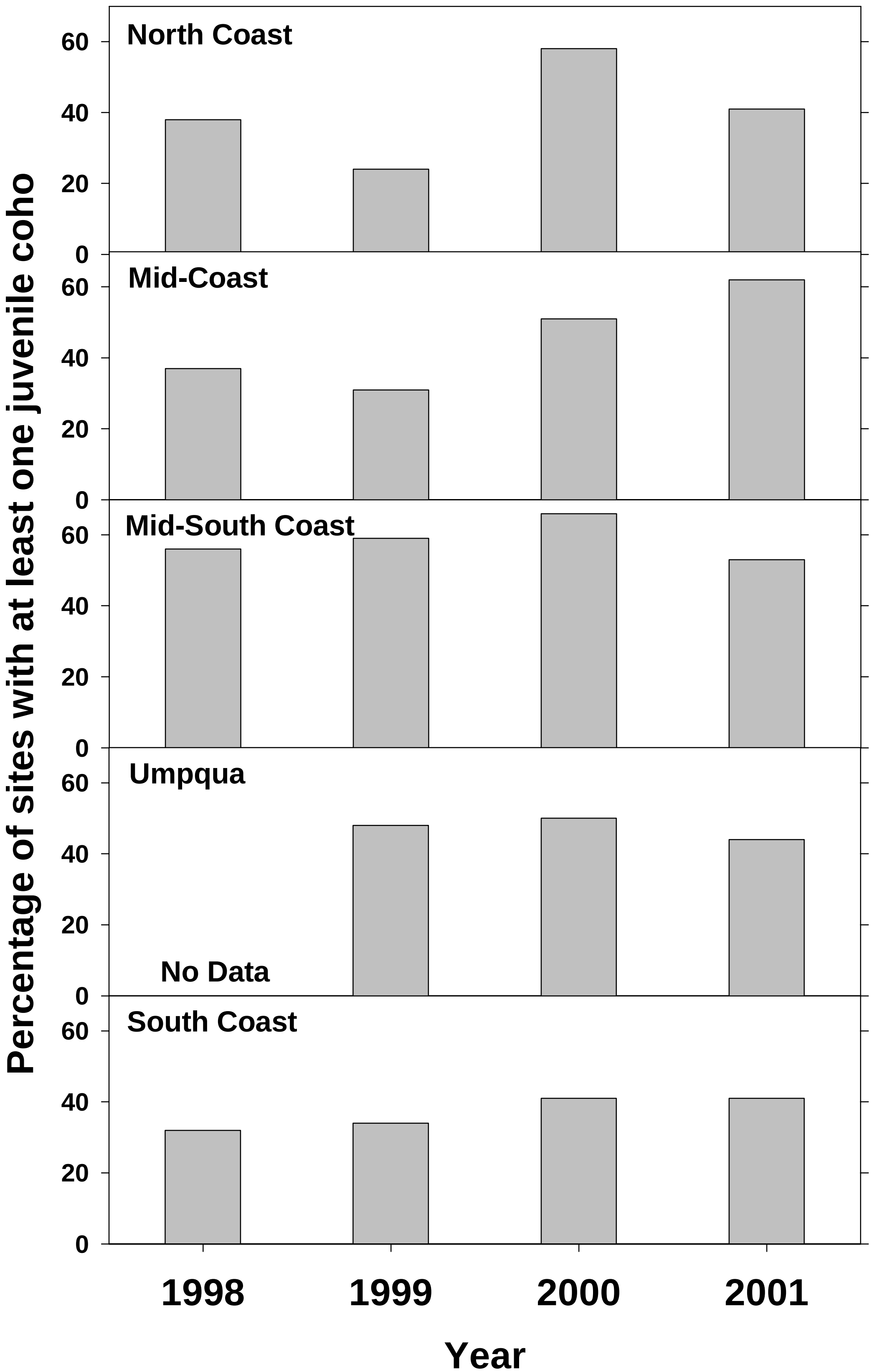



Figure 13. Percentage of sites with at least one pool containing juvenile coho in each coastal Monitoring Area, 1998-2001. No sampling was conducted in the Umpqua in 1998.

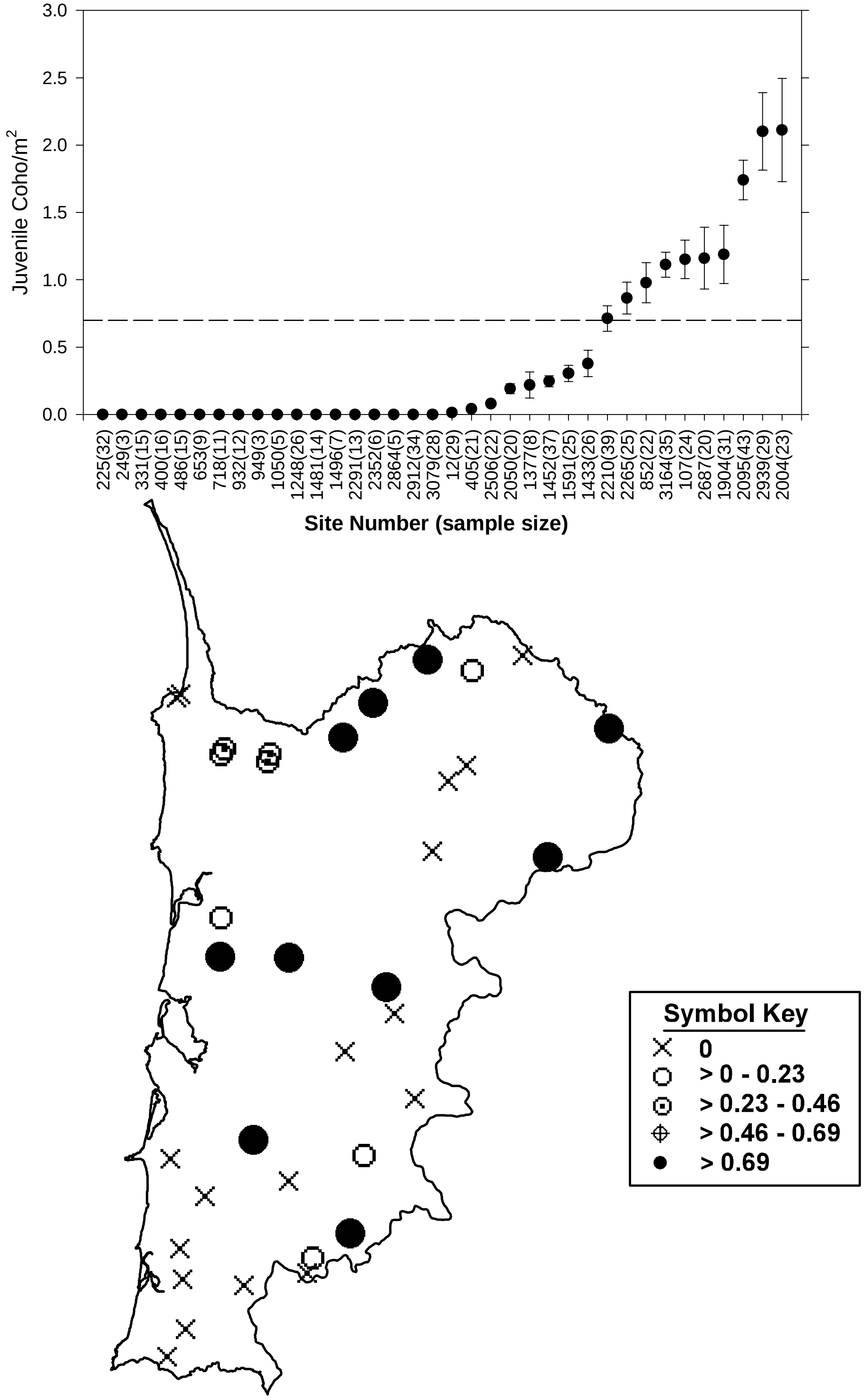



Figure 14. Density (mean and standard error) of juvenile coho at North Coast sites in 2001 (see Appendix A for site data). Dashed horizontal line at 0.7 fish/$m^2$ in graph indicates approximate full seeding level (see Rodgers 2000).

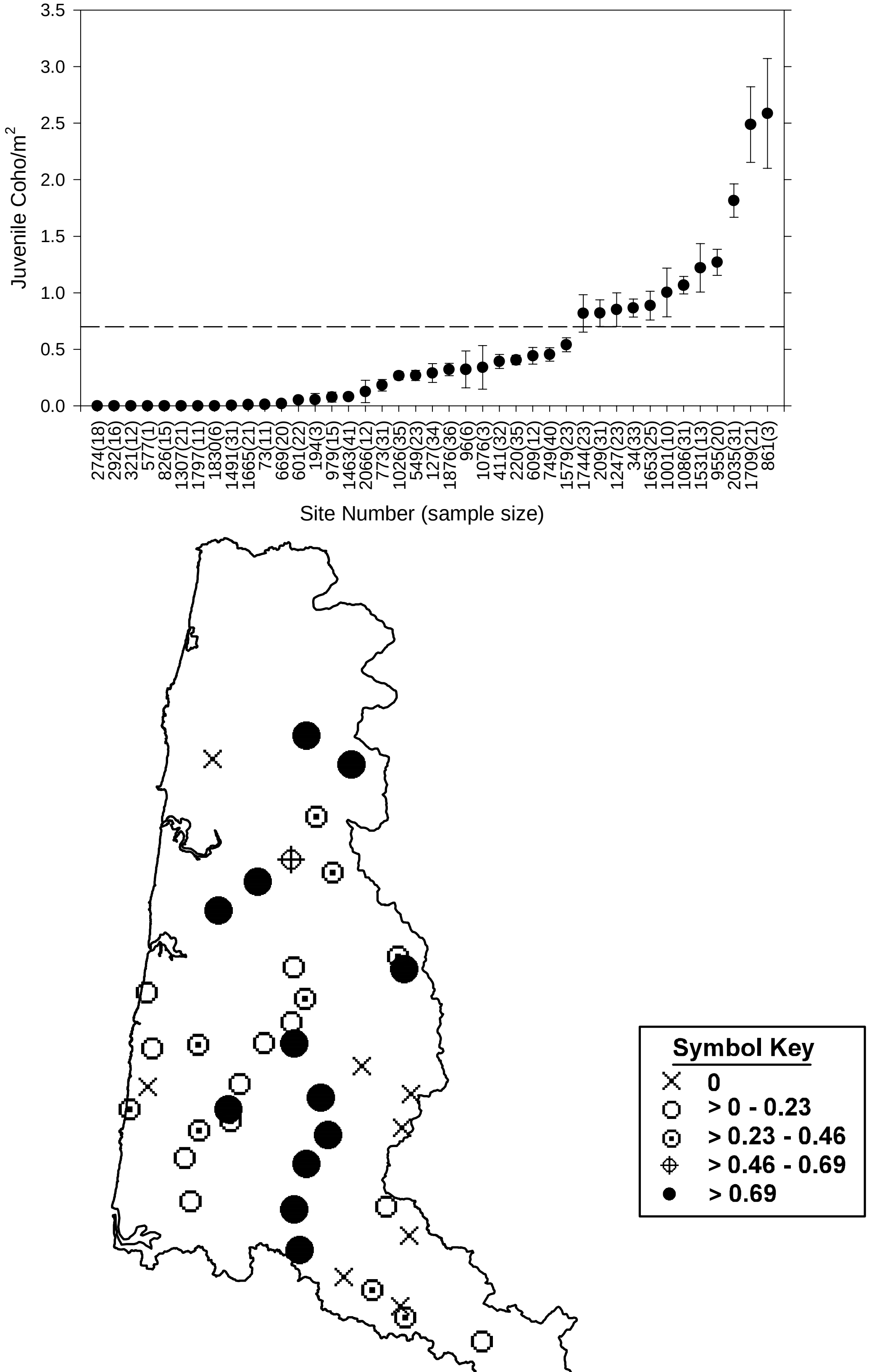



Figure 15. Density (mean and standard error) of juvenile coho at Mid-Coast sites in 2001 (see Appendix A for site data). Dashed horizontal line at 0.7 fish/$m^2$ in graph indicates approximate full seeding level (see Rodgers 2000).

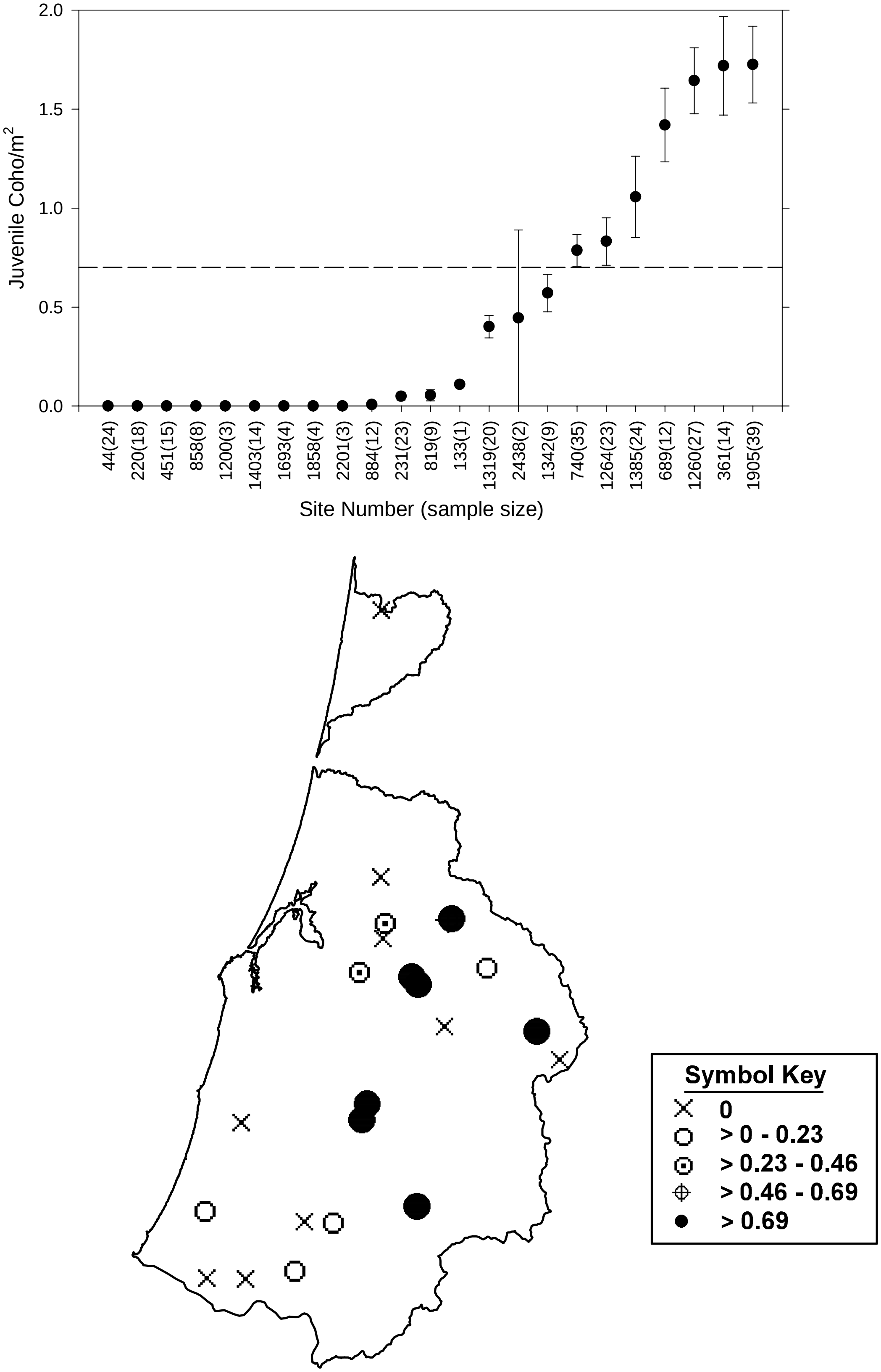
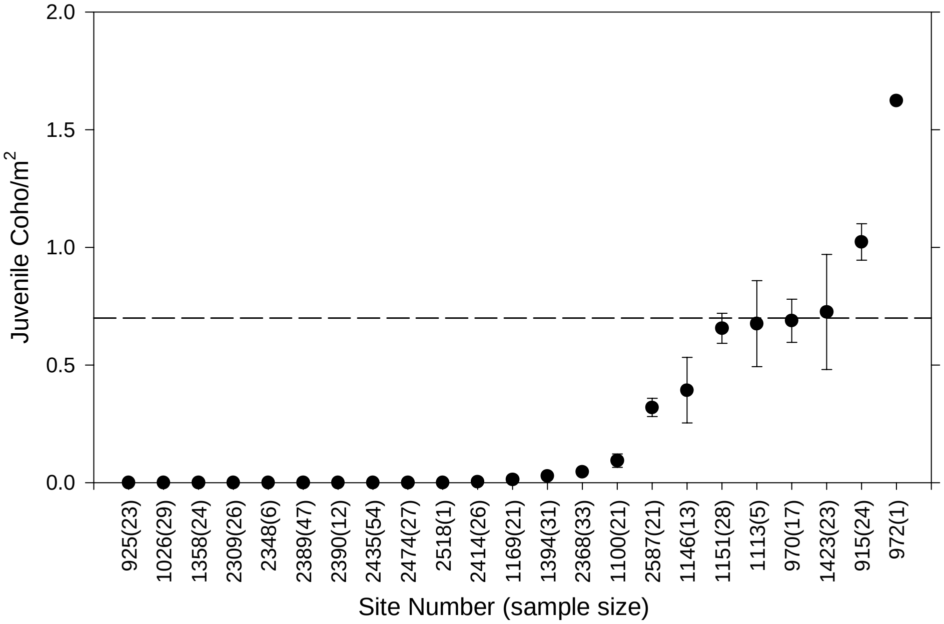



Figure 16. Density (mean and standard error) of juvenile coho at Mid-South Coast sites in 2001 (see Appendix A for site data). Dashed horizontal line at 0.7 fish/m$^2$ in graph indicates approximate full seeding level (see Rodgers 2000).



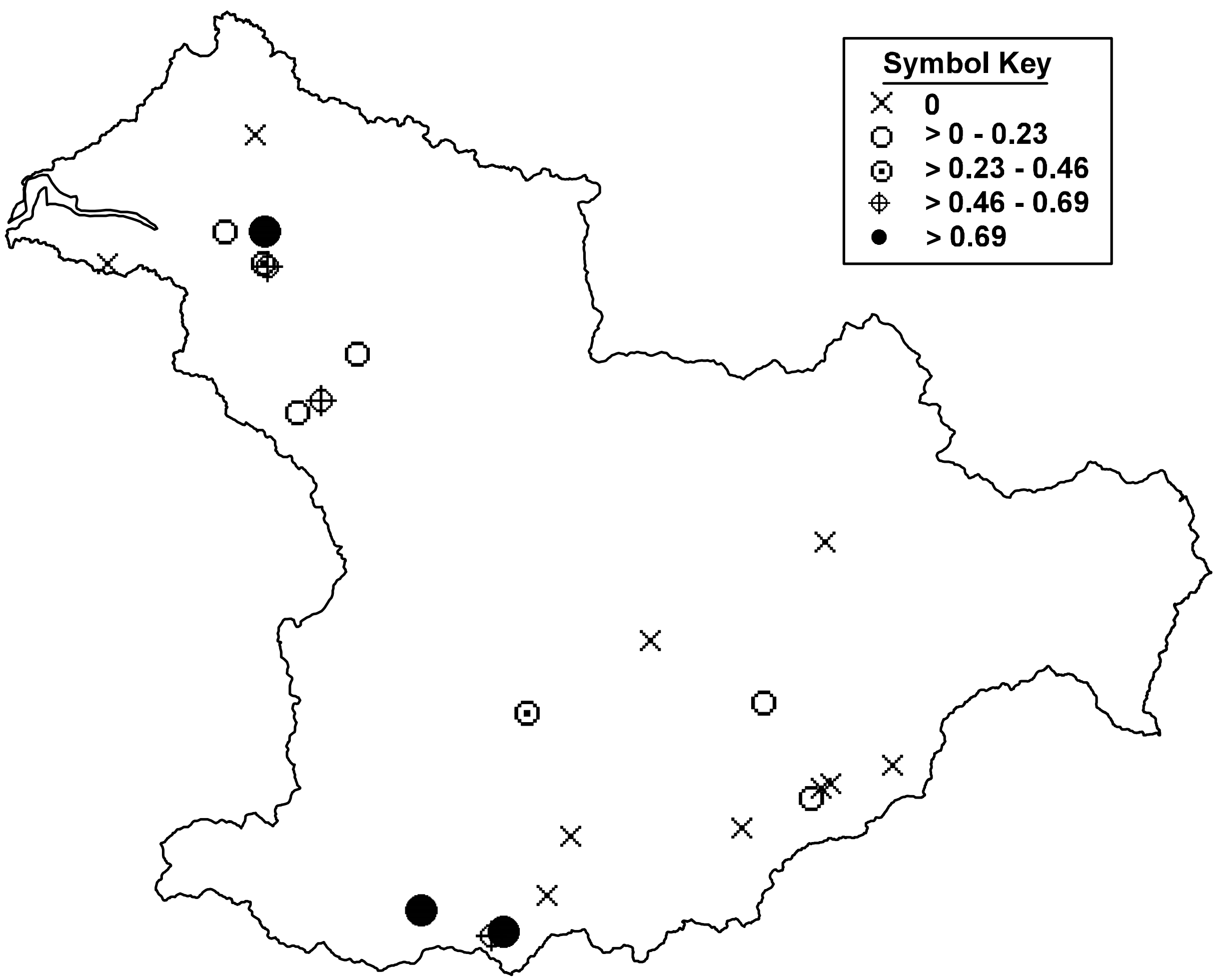
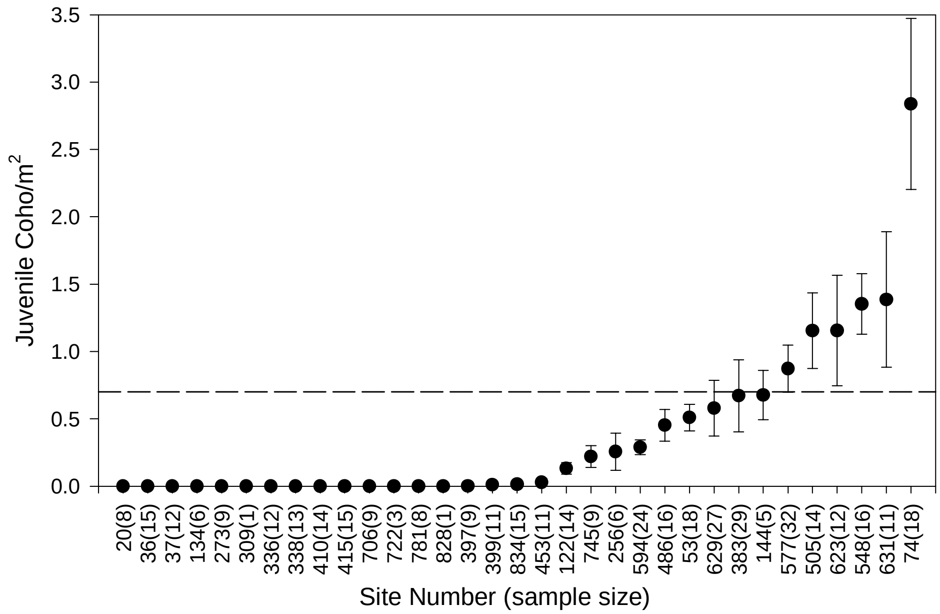




Figure 17. Density (mean and standard error) of juvenile coho salmon at Umpqua sites in 2001 (see Appendix A for site data). Dashed horizontal line at 0.7 fish/m$^2$ in graph indicates approximate full seeding level (see Rodgers 2000).



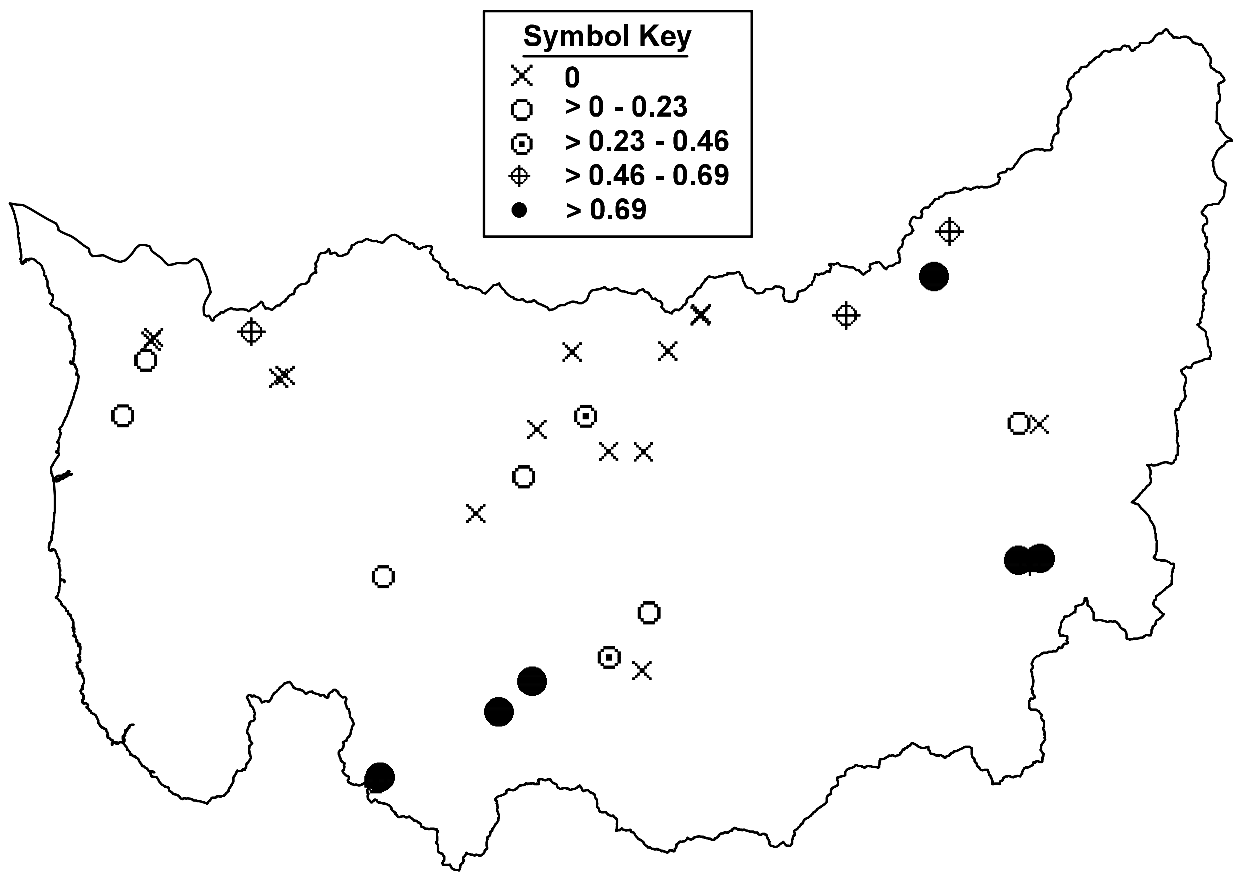




Figure 18. Density (mean and standard error) of juvenile coho salmon at South Coast sites in 2001 (see Appendix A for site data). Dashed horizontal line at 0.7 fish/m$^2$ in graph indicates approximate full seeding level (see Rodgers 2000).

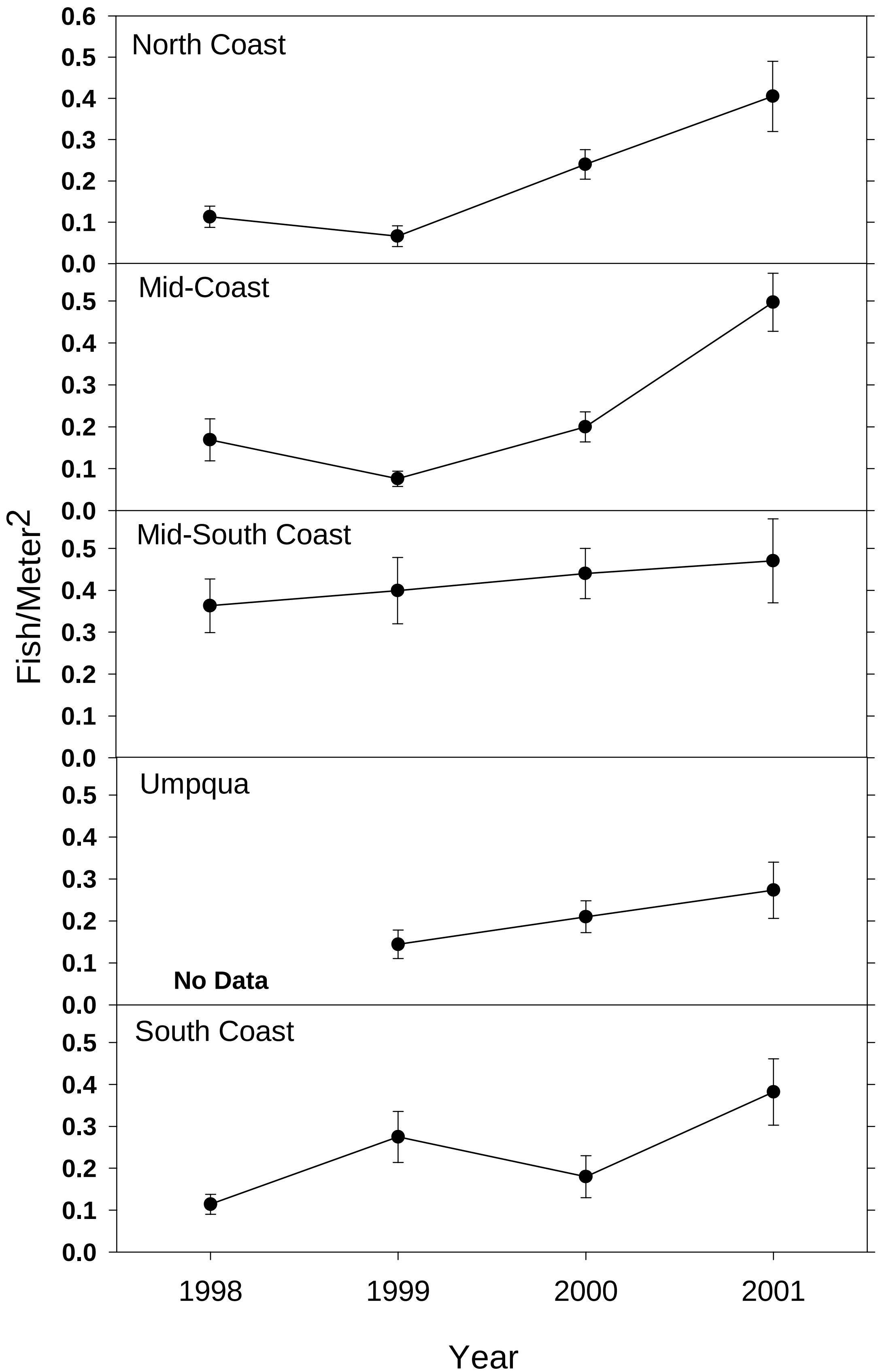



Figure 19. Density (mean and standard error) of juvenile coho in each coastal Monitoring Area, 1998-2001. No sampling was conducted in the Umpqua in 1998.

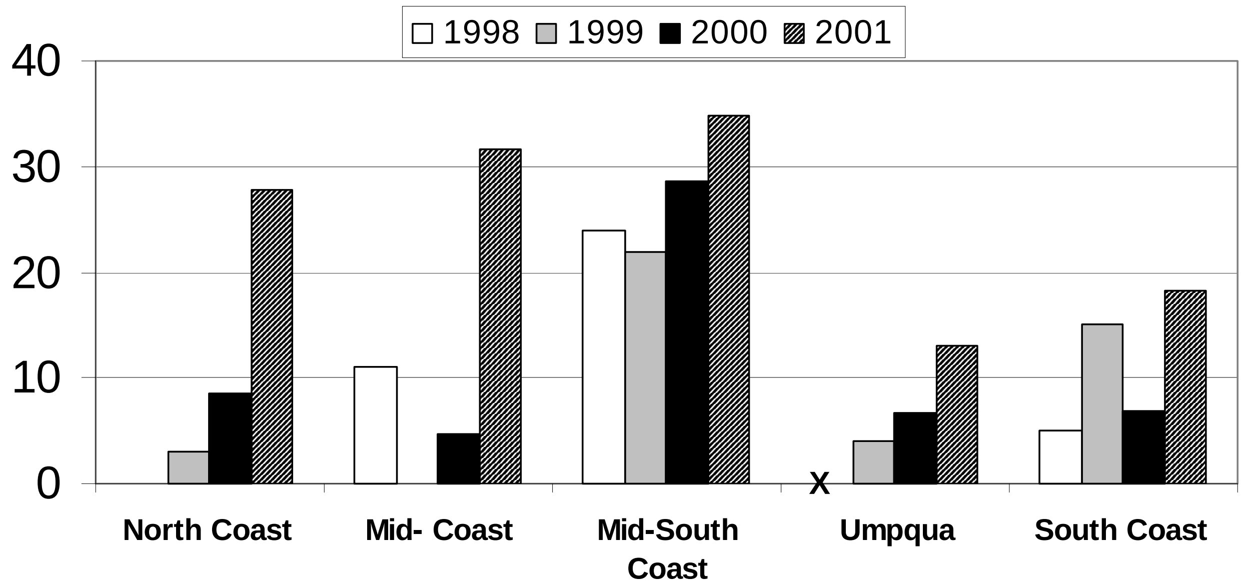


Figure 20. Percentage of sites with an average density ≥ 0.7 fish/m$^2$ in each coastal Monitoring Area, 1998-2001. No sampling was conducted in the Umpqua in 1998.

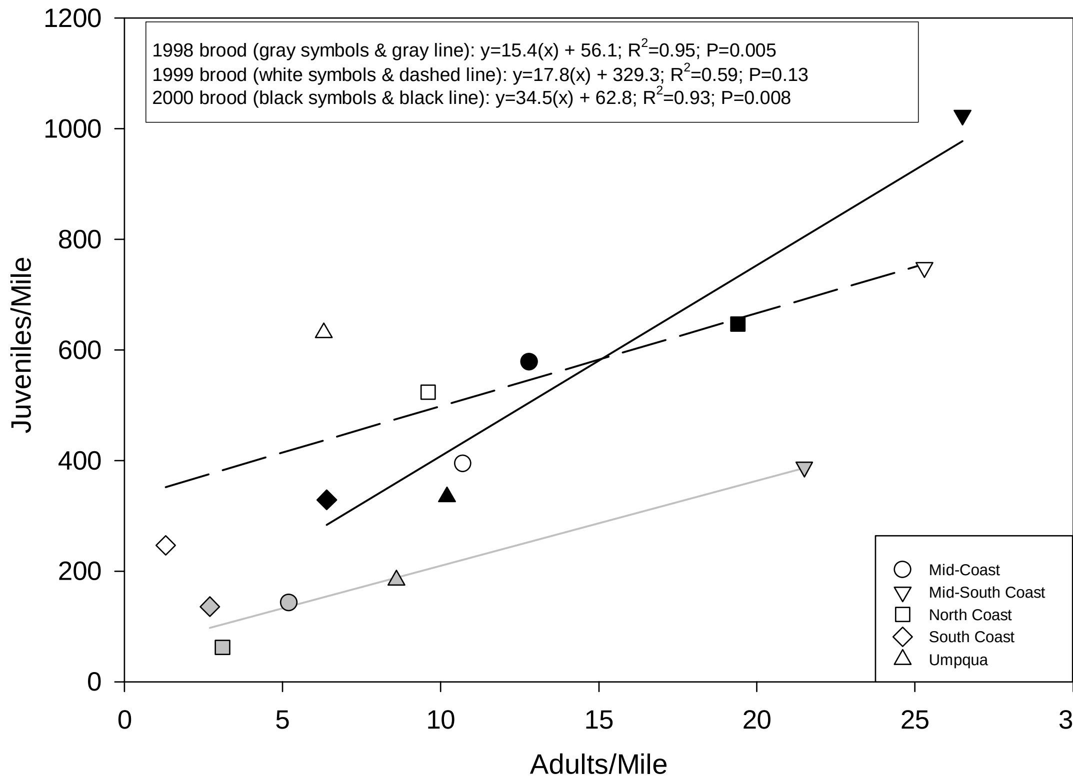


Figure 21. Relationship between number of adults/mile in each coastal Monitoring Area and the number of juveniles/mile the following year, 1998-2000.

# Chapter 2: Smith River Steelhead and Coho Monitoring Verification Study: Results of Juvenile Salmonid Sampling, Summer 2001

## Introduction

Monitoring the status of salmonids in Oregon coastal streams is an important component of the Oregon Department of Fish and Wildlife's (ODFW's) contribution to the Oregon Plan for Salmon and Watersheds. Since 1998, ODFW has had a program to monitor adult and juvenile coho in Oregon coastal streams (see Chapter 1 of this report). Beginning in 2002, ODFW is planning to expand its monitoring program to include steelhead.

The monitoring plans for both coho and steelhead rely on the Environmental Mapping and Assessment Protocol (EMAP) (Stevens and Olsen 1999) random site selection process to select survey sites. Although this monitoring is being implemented coastwide, no information is available at a large basin scale on the relationship of data collected to the actual population status of the fish being monitored. The goal of the Smith River Steelhead and Coho Monitoring Verification Study is to provide this information.

The purpose of this report is to summarize data collected on juvenile salmonids in Smith River during the summer of 2001. This summary is divided into three parts: 1) the results of electrofishing in "wadeable" stream reaches ($\leq$ 60 $km^2$ basin area); 2) the results of basin-wide snorkel surveys; and 3) comparison of electrofishing and snorkel surveys.

## Study Area

A map of the study area is shown in Figure 22. The study area begins above a waterfall approximately 48 km from the confluence of Smith River with the Umpqua River. The basin area above the falls is approximately 525 $km^2$ with approximately 463 km of mainstem and tributary streams at the 1:100,000 map scale.

The climate is Pacific Maritime with portions of the basin receiving up to 250 cm of rain annually, the majority of which falls in November through February. Red alder (*Alnus rubra*) with an understory of salal (*Gaultheria shallon*), sword fern (*Polystichum munitum*), and vine maple (*Acer circinatum*) dominate riparian vegetation.

## Methods

### Electrofishing

Sites electrofished for juvenile salmonids are restricted to wadeable sized streams ($\leq$ 60 $km^2$ basin area) that occur on a 1:100,000 digital map within the presumed rearing distribution of steelhead above Smith River Falls. The rearing distribution of juvenile steelhead was determined by combining three GIS databases: 1) ODFW's winter steelhead distribution database (Bowers, 2000); 2) ODFW's coho distribution database (Bowers, 2000); and 3) ODFW Salmonid Inventory Project's coho salmon distribution database (Steve Jacobs - ODFW, personal communication). Coho distribution databases were used in addition to the steelhead distribution database because there are a few instances were coho salmon were shown to have a farther upstream distribution than steelhead and I believe that steelhead should be able to access all areas accessible to coho. Two different coho distribution databases were used because there are slight differences between them, and there is no reason to assume that one database is more accurate than the other.

Once the sampling universe was identified, Environmental Monitoring and Assessment Program (EMAP) protocols (Diaz-Ramos et al. 1996) were used to randomly select 30-36 sites per year. To track individual brood years, a four-year rotating panel design (i.e. revisiting sites every four years) is used since the majority of Oregon coastal steelhead are four years old when they return to spawn.

The EMAP site selection process provides the geographic coordinates of each of the candidate sample sites. These points are printed onto topographic maps and loaded into a handheld Geographic Positioning System (GPS). The topo maps are then used to navigate to the approximate location of the sample point, while the GPS is used to find the precise location of the sample point.

Sampling begins at the sample point, and continues upstream on a habitat unit by habitat unit basis until a length of stream equal to approximately 20 active channel widths is sampled. Side channels entering the survey are not sampled. Independent population estimates are made of young of the year trout (< 90 mm fork length), juvenile steelhead ≥ 90 mm, cutthroat ≥ 90 mm, and juvenile coho. Block nets are used at the tail and head of all fast water and pool units so that estimates can be obtained for each habitat unit.

A pass-removal estimate (Armour, et al. 1983) using a minimum of two passes is conducted in all units. Decisions on whether additional passes were necessary are based on the number of fish captured and the reduction in catch from one pass to the next. When 10 or fewer fish are caught on a pass, the next pass needs to have a 50% reduction or another pass is made. When more than 10 fish are captured, the next pass needs to be reduced by 67%. These rules apply independently to all species/size classes. In complex pools, fish captured during the pass-removal estimates are given a small notch in their upper caudal fin and released for a mark-recapture estimate (Armour, et al 1983). Marked fish are distributed throughout the pool so that they can mix with the remaining unmarked fish. Marked fish are given a minimum of one hour to recover in the pool before recapture efforts begin. Recapture efforts continued until a minimum of 50% of the released marked fish are recovered.

Fish lengths are measured to the nearest millimeter. All captured trout are measured, as are 50 coho from each site. A species identification is made for all measured trout regardless of size, with the category "unknown trout" used for smaller trout that cannot be field identified to species.

Habitat type is classified using ODFW's Aquatic Inventory definitions for pools, glides, riffle/rapids, and dry stream channels (Moore et al. 1997). We measure the length (to nearest 0.1m) for all habitat units as well as the average width (to nearest 0.1m) and maximum depth (to nearest cm) of all wetted units. For all wetted habitat units, we also estimate substrate composition using the following categories: 1) silt and fine organic matter; 2) sand; 3) gravel (2-64mm); 4) cobble (64-256mm); 5) boulders (>256mm); and 6) bedrock, and counted the number of boulders ≥ one meter in diameter that are in or touching the wetted channel.

## Snorkel Surveys

Snorkel surveys were attempted at electrofishing sites prior to electrofishing. In addition, snorkel surveys were conducted at 16 randomly selected sites in the larger, non-wadeable (>60 $km^2$ basin area) mainstem portions of Smith River above Smith River Falls.

Snorkel surveys began at the EMAP sample point and ended 1,000 meters upstream. A two-person snorkel crew conducted surveys at the wadeable sites. Up to 4 people conducted snorkel surveys in the non-wadeable reaches. In wadeable reaches, crewmembers either alternated the pools they snorkeled or one crewmember snorkeled the entire reach. In the non-wadeable reaches, crewmembers snorkeled side-by-side and summed their individual counts. To reduce problems associated with snorkeling in shallow or fast water habitat, only pools $\geq$ 6 $m^2$ in surface area and $\geq$ 40 cm deep were snorkeled. We measured the maximum pool depth and estimated the length and average width of all snorkeled pools.

In all wadeable and most non-wadeable reaches, snorkel methodology involved a single upstream pass through each pool. In some of the larger, non-wadeable reaches, divers surveyed downstream. Counts of the number of juvenile coho, cutthroat, steelhead, unknown trout, chinook, blackside dace, and redside shiner were recorded for each pool. Trout < 90 mm were not counted. After snorkeling, the underwater visibility of each pool was ranked on a scale of 0 to 3 where: 0 = not snorkelable due to an extremely high amount of hiding cover or zero water visibility; 1 = high amount of hiding cover or poor water clarity; 2 = moderate amount of hiding cover or moderate water clarity neither of which were thought to impede accurate fish counts; and 3 = little hiding cover and good water clarity.

## Electrofishing Data Analysis

Length frequency histograms were generated for juvenile coho, cutthroat $\geq$ 90 mm, steelhead $\geq$ 90 mm, and trout < 90 mm. For trout 60-89 mm, the proportion of fish identified as cutthroat, steelhead, and unknown was plotted for each site. The percentage of sites with at least one fish was calculated for each of the four species/size classes. The total population of each species/size class present at a sample site was determined by summing the individual species/size class population estimates for all the habitat units sampled. This total estimated population was then divided by the sum of the lengths of all habitat units in the survey (both wet and dry) to obtain the number of fish per meter of stream channel. An estimate of the total population of fish in the wadeable streams above Smith River Falls was calculated by multiplying the average number of fish/meter for all electrofished sites by the total length of stream channels in the sampling universe (338.4 km). The 95% confidence interval around each species/size class population estimate was determined using the statistical analysis outlined by Stevens (2002).

## Snorkel Survey Data Analysis

Only pools with a visibility rank of two or three were used in data analysis. The proportion of trout $\geq$ 90 mm estimated by electrofishing that were cutthroat and steelhead was used to reclassify unknown trout $\geq$ 90 mm observed by divers. The reclassified fish were then added to the observed number of ≥ 90 mm cutthroat and steelhead prior to calculating metrics for the diver count data.

The percentage of snorkel sites and the percentage of pools at each site with at least one fish was calculated for juvenile coho, ≥ 90 mm steelhead, and ≥ 90 mm cutthroat. Fractions resulting from the reclassification of unknown trout were rounded to the nearest whole number.

For each snorkel site, the number of fish/$m^2$ of pool habitat was calculated for each of the three species/size classes by averaging the density estimates for each pool at that site. For this analysis, fractions resulting from the reclassification of unknown trout were not rounded to the nearest whole number. A basin-wide density for each of the three species/size classes was obtained by averaging the individual site densities. The 95% confidence interval around each species/size class population estimate was determined using the statistical analysis outlined by Stevens (2002).

### Electrofishing and Snorkel Survey Comparisons

Ultimately the two survey methods will be compared against trends in the actual population of adult steelhead and coho returning to Smith River. It is, however, too early in the project for such comparisons since two years of data do not allow for trend analysis. Comparisons can be made, however, between the yearly results of the two juvenile monitoring methods. To do this, only sites surveyed by both survey types were used. The same metrics used to analyze the larger snorkel site dataset were used to compare electrofishing and snorkel surveys.

## Results

### Electrofishing Surveys

A total of 32 sites were visited for electrofishing surveys in the summer of 2001 (Figure 23). The physical characteristics of the reaches electrofished in Smith River during the summer of 2001 are shown in Figures 24 – 28. A total of 2,958 meters of stream channel were sampled of which 243 meters were dry. Four sites were completely dry, 14 sites had greater than 50% pool habitat by length, and 11 sites had greater than 50% riffle/rapid habitat by length. Average wetted channel width at the 28 watered sites ranged from 0.7 m to 12.5 m. Two sites had maximum water depths ≥ 100 cm. Of the wetted sites, bedrock substrate dominated 4 sites, silt/sand 8 sites, and gravel/cobble/boulder 16 sites.

Figures 29 - 32 show the spatial pattern of abundance of juvenile salmonids in Smith River as determined by electrofishing during the summer of 2001. Trout < 90 mm and cutthroat ≥ 90 mm were the most widespread, occurring at 69% and 72% of the sites respectively. Juvenile coho were found at 50% of the sites. Steelhead ≥ 90 mm were the least widespread, occurring at only 38% of the sites. These results are similar to those obtained in the summer of 2000 (Rodgers 2001). Overall, juvenile coho were the most abundant, followed in order by trout < 90 mm, cutthroat ≥ 90 mm, and steelhead ≥ 90 mm (Table 9). Cutthroat represented 56.7% of and steelhead 43.3% of the trout ≥ 90 mm.

Table 9. Population estimates of juvenile steelhead ≥ 90 mm, juvenile coho, trout < 90 mm, and cutthroat trout ≥ 90 mm in the wadeable stream reaches above Smith River Falls based on data obtained by electrofishing.

| Species | ≥ 90 mm Steelhead | Coho | < 90 mmTrout | ≥ 90 mm Cutthroat |
|---|---|---|---|---|
| **Population Estimate** | 12,016 | 317,831 | 76,685 | 26,275 |
| **95% Confidence Interval** | 6,316 | 142117 | 29516 | 8075 |
| **Confidence Interval % of Estimate** | 53 | 45 | 38 | 31 |

Figure 33 compares the electrofishing population estimates for each species/size class obtained in 2000 and 2001. Juvenile coho increased (P = 0.10) and trout < 90 mm decreased (P = 0.08), while ≥ 90mm steelhead and cutthroat did not change in abundance from 2000 to 2001 (P > 0.20).

Length frequency histograms obtained by electrofishing for each species are shown in Figures 34 - 37. Juvenile coho averaged 60 mm, juvenile steelhead ≥ 90 mm averaged 115 mm, cutthroat ≥ 90 mm averaged 131 mm, and trout < 90 mm averaged 57 mm in fork length. For trout 60-89 mm, 82% were identified as steelhead, 13% as cutthroat, and 5% as unknown. The spatial pattern of the 60-89 mm trout speciation is shown in Figure 38.

## Snorkel Surveys

The snorkel crew visited fifty sites during the summer of 2001. Of these 50 sites, 10 had no pools meeting the minimum size and/or depth criteria, two sites had poor water clarity that made snorkeling impossible, and 38 were snorkeled (Figure 39). Of the 38 sites snorkeled, 21 were in common with electrofishing sites, one was an electrofishing candidate site not visited by the electrofishing crew, and 16 were in larger stream reaches outside the "wadeable" stream sampling universe for electrofishing surveys.

Of trout ≥ 90 mm that were classified by divers as either cutthroat or steelhead, 58.7% were identified as cutthroat and 41.3% as steelhead, similar to the proportions determined by electrofishing.

Divers observed the highest density of all three species in the wadeable stream reaches (Table 10). For cutthroat and steelhead ≥ 90 mm, the percentage of sites with at least one fish was highest in the wadeable stream reaches. Almost twice the percentage of sites in wadeable stream reaches had juvenile steelhead compared to non-wadeable reaches. Juvenile coho, however, were found more frequently in non-wadeable stream reaches, probably due to the fact that some wadeable stream reaches were inaccessible to adult coho. Figures 40 – 42 show the frequency of occurrence of fish observed by divers at each snorkeled site.

Table 10. The average fish density and percentage of sites with at least one fish in pools snorkeled at wadeable and non-wadeable sites in Smith River, summer 2001.

| | All snorkel sites | | | Snorkel sites in wadeable streams | | | Snorkel sites in non-wadeable streams | | |
|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Coho** | **≥ 90 mm Cutthroat** | **≥ 90 mm Steelhead** | **Coho** | **≥ 90 mm Cutthroat** | **≥ 90 mm Steelhead** | **Coho** | **≥ 90 mm Cutthroat** | **≥ 90 mm Steelhead** |
| **Fish/m$^2$** | 0.192 | 0.030 | 0.012 | 0.300 | 0.051 | 0.021 | 0.044 | 0.001 | <0.001 |
| **95% CI** | 0.005 | <0.001 | <0.001 | 0.014 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **% of sites with at least one fish** | 84 | 84 | 53 | 77 | 91 | 68 | 94 | 75 | 31 |

## Electrofishing and Snorkel Survey Comparisons

For sites where both snorkel and electrofishing surveys were conducted, divers observed 43% of the coho density and 67% of the cutthroat density estimated by electrofishing. Electrofishing density estimates for steelhead, however, were 78% of that observed by snorkeling. For all three species, snorkel surveys observed at least one fish at more sites than electrofishing surveys (Table 11).

Three factors probably contribute to differences between snorkel surveys and electrofishing surveys: 1) undercounting by divers of the actual number of fish present; 2) differences in abundance in the 1,000 meters of stream at each site surveyed by divers and the 20 – 299 meter stream reaches surveyed by electrofishing; and 3) differences in the size of pools sampled by snorkeling and electrofishing. Differences between the two methods do not, however, mean that one is better at monitoring the status of salmonids in Smith River. The question of how well the two methods of monitoring juvenile abundance track with trends in the actual abundance of salmonids as determined by adult population estimates can only be answered with additional years of data necessary for trend analysis.

Table 11. The average density and number of sites with at least one coho, cutthroat, or steelhead as determined by snorkel and electrofishing surveys at 21 sites sampled by both methods in Smith River, summer 2001.

| **Method** | **Snorkel** | | | **Electrofish** | | |
|---|---|---|---|---|---|---|
| **Species/size class** | **Coho** | **≥ 90 mm Cutthroat** | **≥ 90 mm Steelhead** | **Coho** | **≥ 90 mm Cutthroat** | **≥ 90 mm Steelhead** |
| **Average fish/m$^2$** | 0.276 | 0.051 | 0.021 | 0.636 | 0.077 | 0.017 |
| **95% Confidence Interval** | 0.013 | <0.001 | <0.001 | 0.072 | 0.001 | <0.001 |
| **Number of sites with at least one fish** | 16 | 19 | 15 | 15 | 16 | 12 |
| **% of sites with at least one fish** | 76 | 90 | 71 | 71 | 76 | 57 |

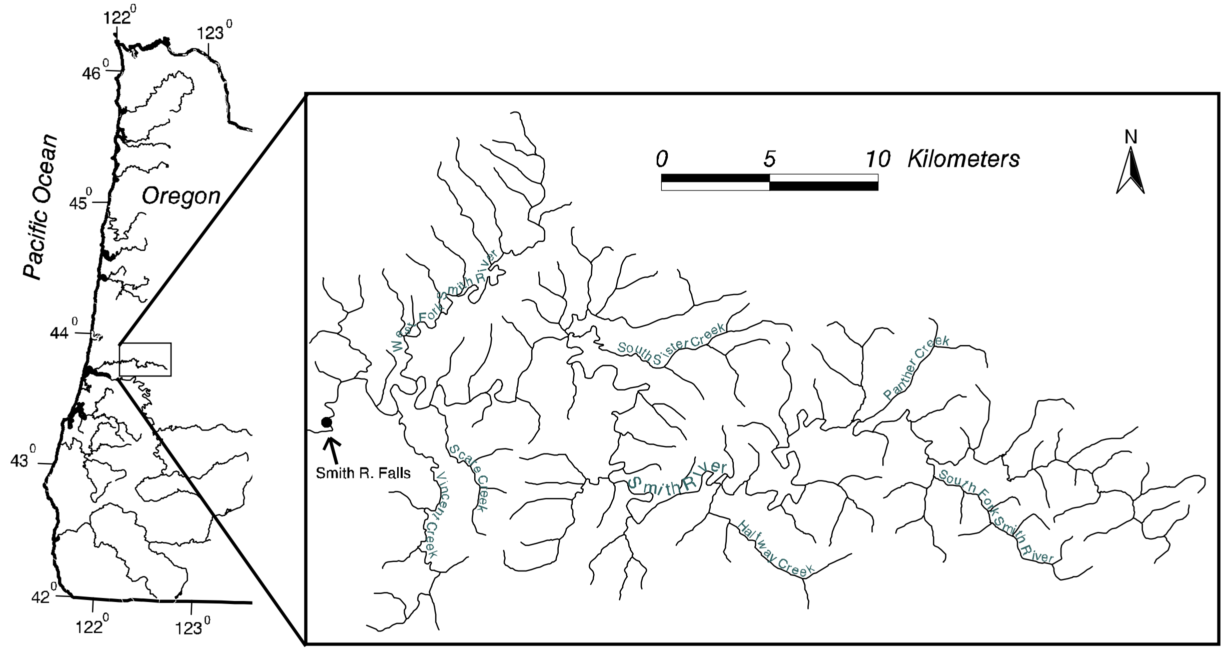



Figure 22. Location of Smith River study area.

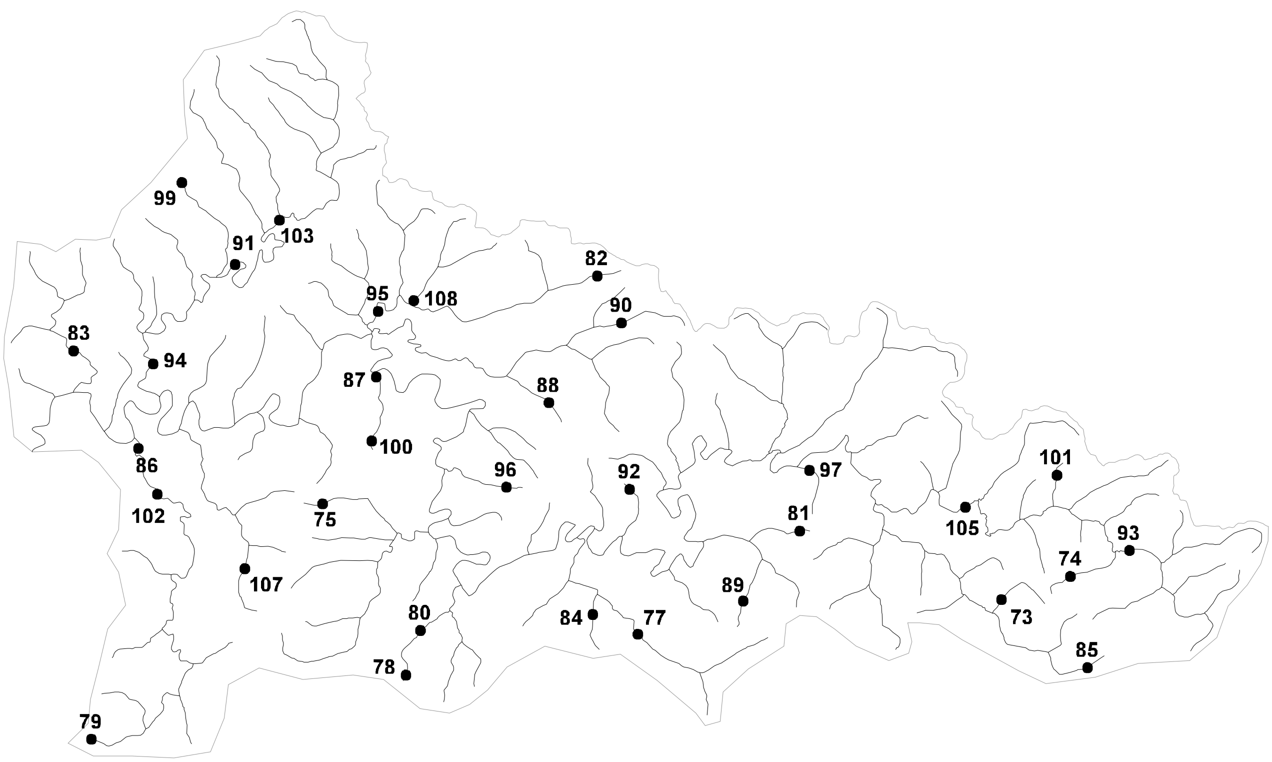



Figure 23. Location of sites electrofished for juvenile salmonid abundance in Smith River, summer 2001. The numbers above the sample points are the site numbers for referencing data in Appendix B.

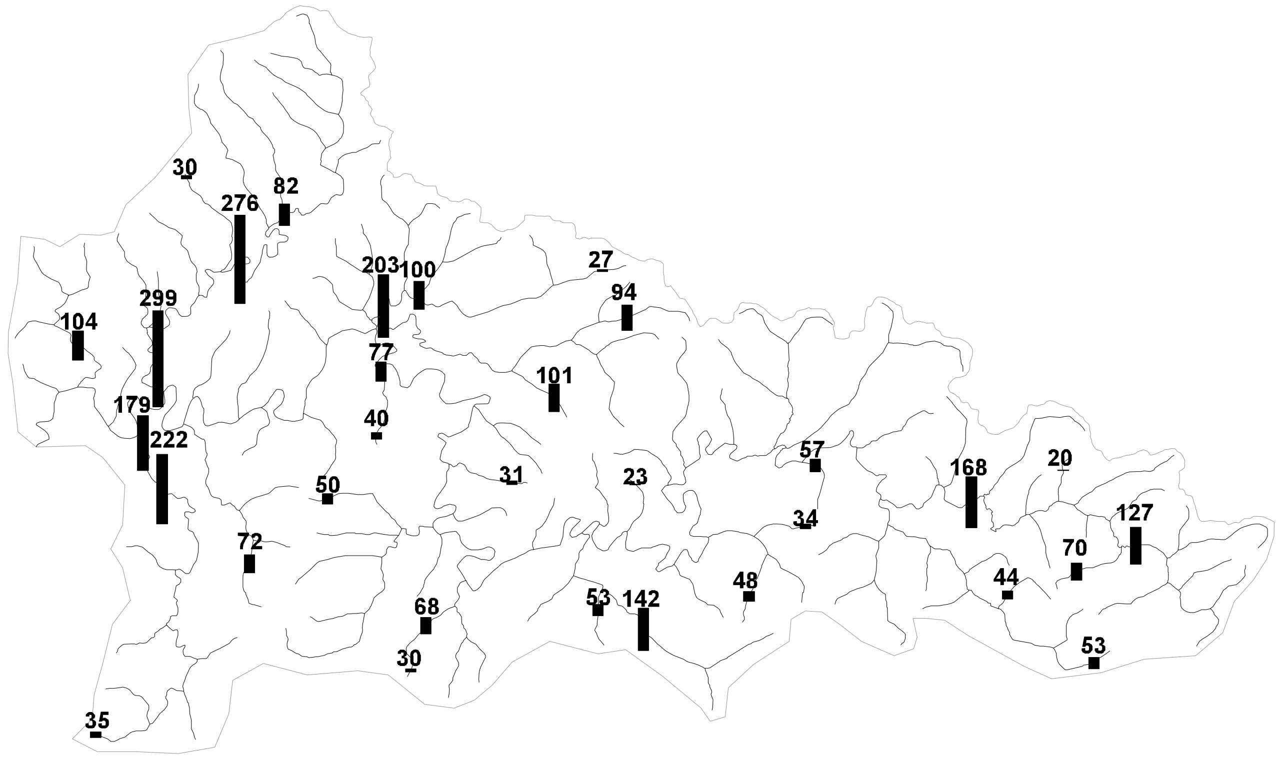



Figure 24. Length of sites sampled by electrofishing in Smith River, summer 2001. Bars indicate the length of the site relative to other sites. The numbers above each bar is the length of the site (in meters).

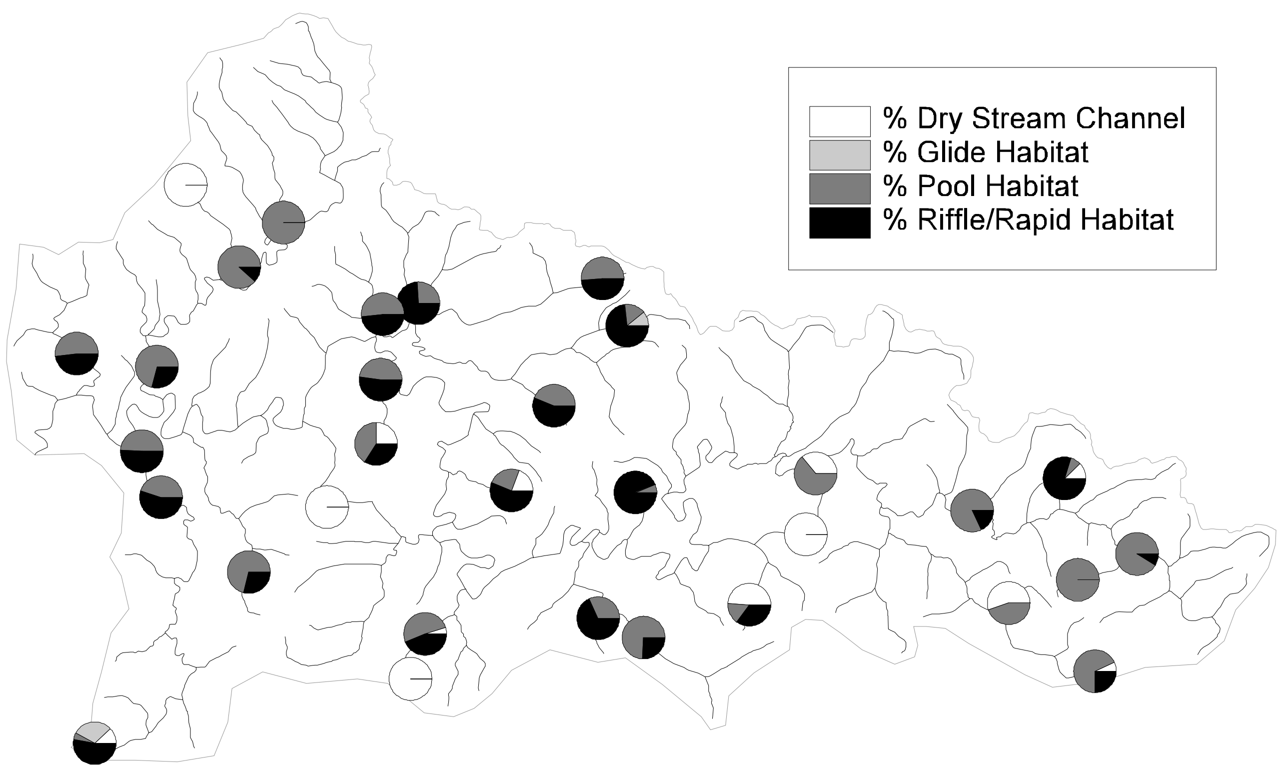



Figure 25. Percentage of the length of each site electrofished in Smith River during the summer of 2001 that was dry stream channel, glide, pool, or riffle/rapid habitat.

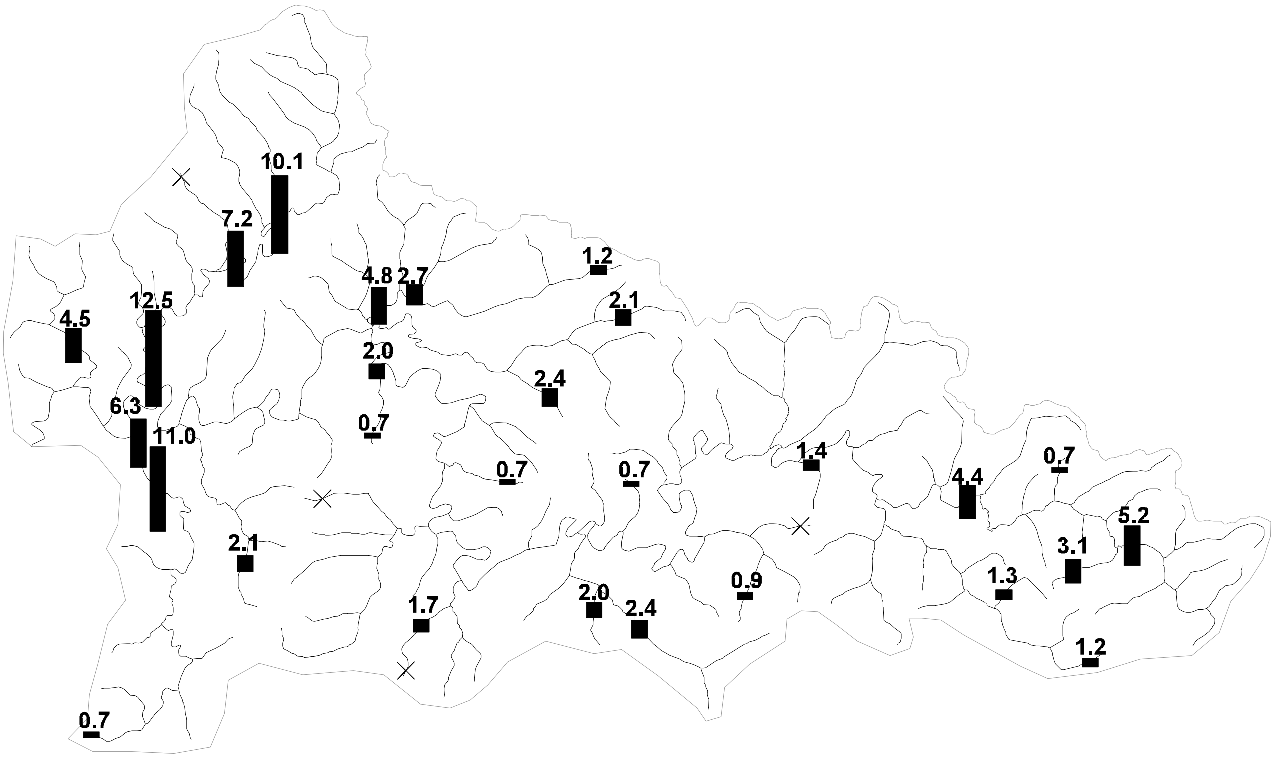



Figure 26. Average wetted width of sites electrofished in Smith River, summer 2001. Bars indicate the width of the site relative to other sites. Sites that were completely dry are indicated with an "X". The number above each bar is the average width of the site (in meters).


Figure 27. Maximum water depth of sites electrofished in Smith River, summer 2001. Bars indicate the maximum depth of the site relative to other sites. Sites that were completely dry are indicated with an "X". The number above each bar is the maximum depth of the site (in centimeters).

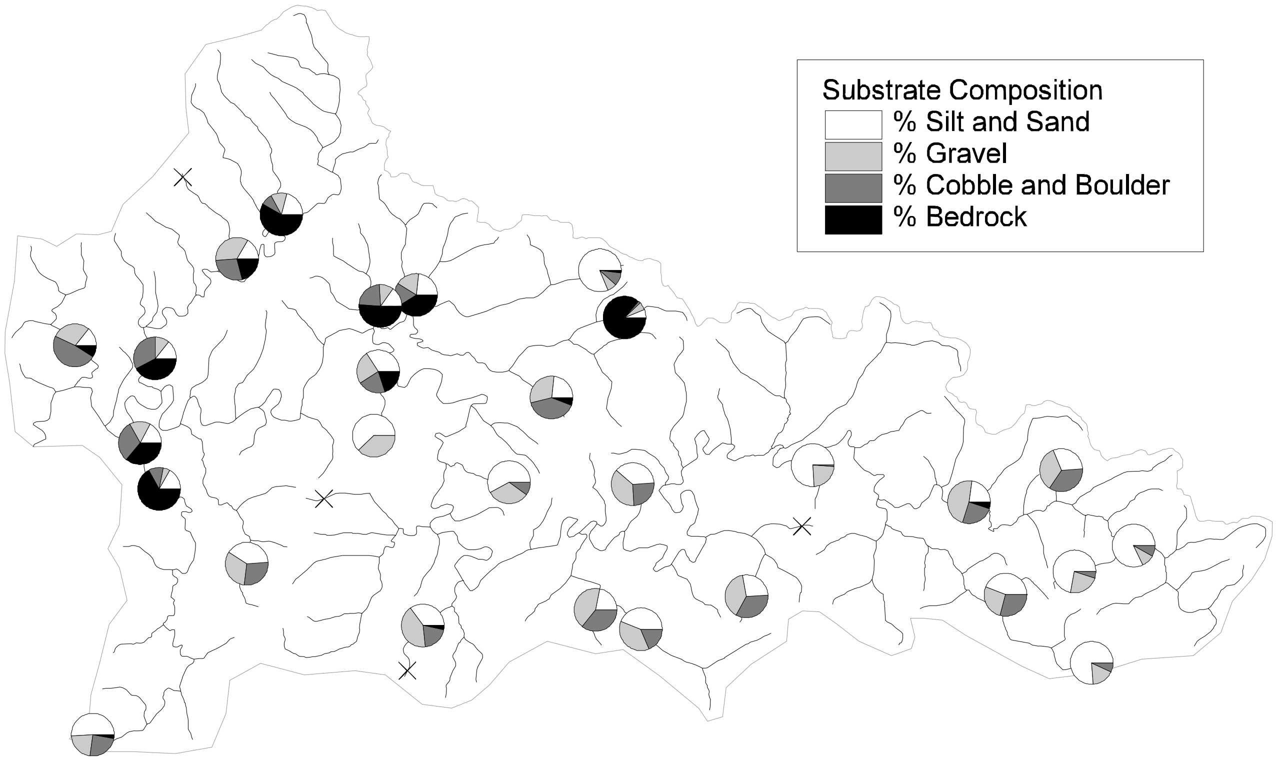



Figure 28. Substrate composition of wetted stream channels at sites electrofished in Smith River, summer 2001. Sites that were completely dry are indicated with an "X".


Figure 29. Number of juvenile steelhead (≥90mm fork length) per meter of stream as determined by electrofishing in Smith River, summer 2001.

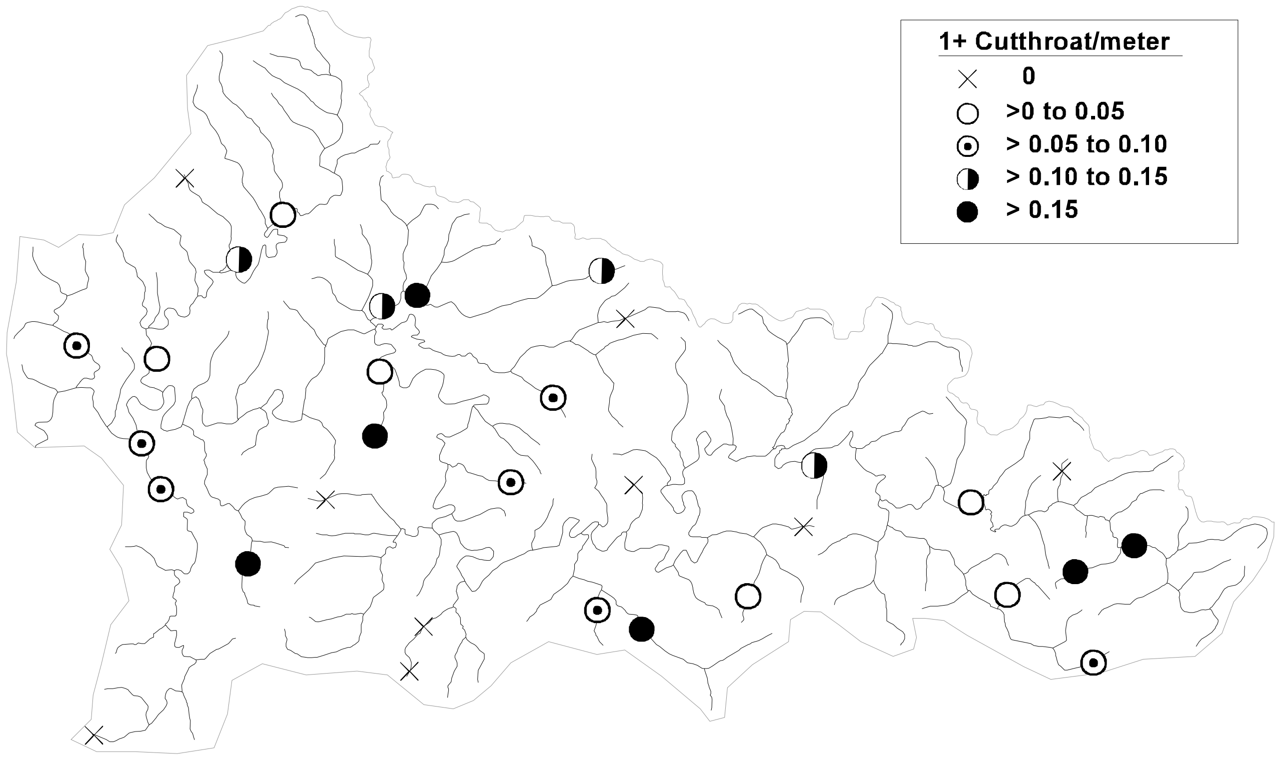



Figure 30. Number of cutthroat trout (>90mm fork length) per meter of stream as determined by electrofishing in Smith River, summer 2001.

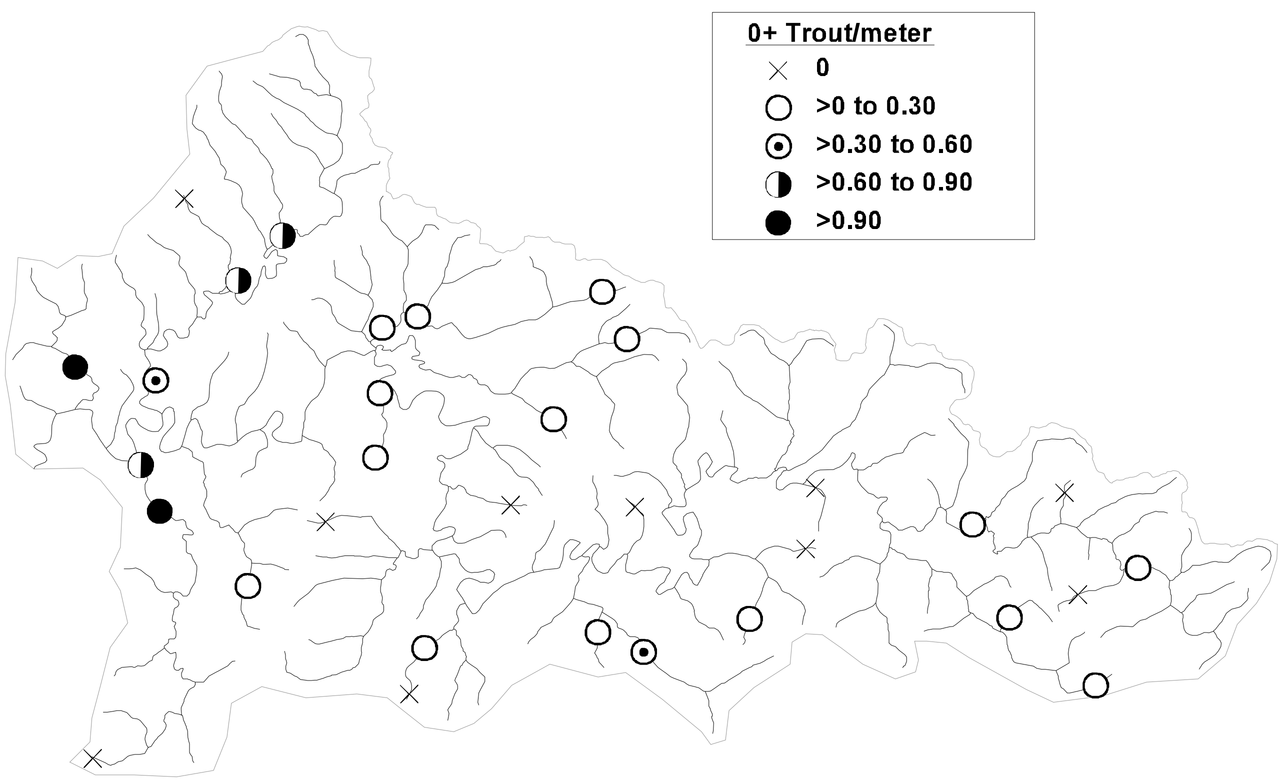



Figure 31. Number of 0+ trout (<90mm fork length) per meter of stream as determined by electrofishing in Smith River, summer 2001.

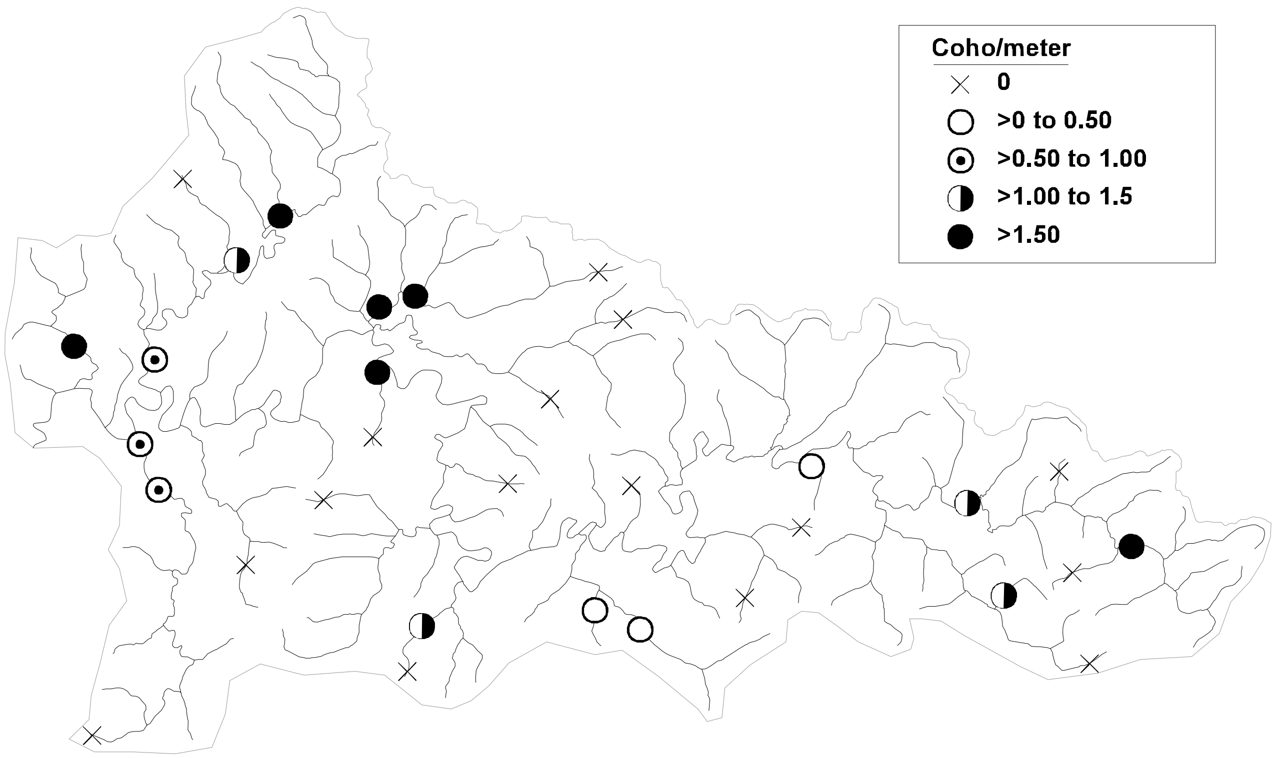



Figure 32. Number of juvenile coho per meter of stream as determined by electrofishing in Smith River, summer 2001.

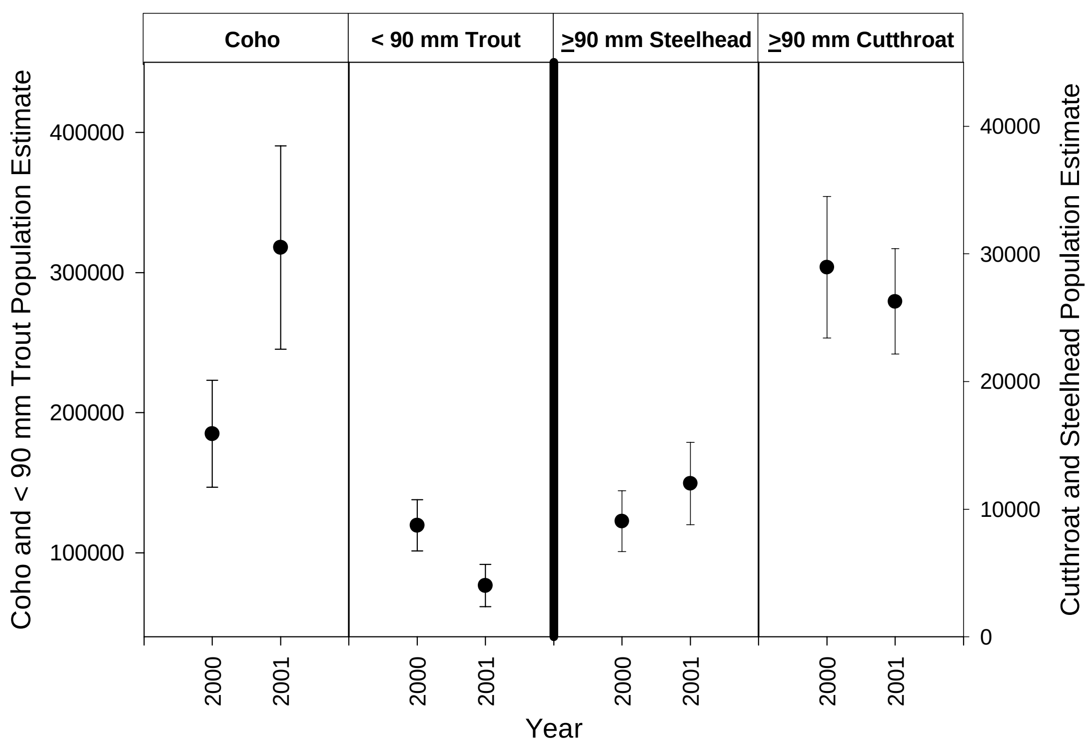



Figure 33. Estimated population (and standard error bars around estimate) of juvenile salmonids as based on electrofishing in Smith River tributary streams, 2000 and 2001.

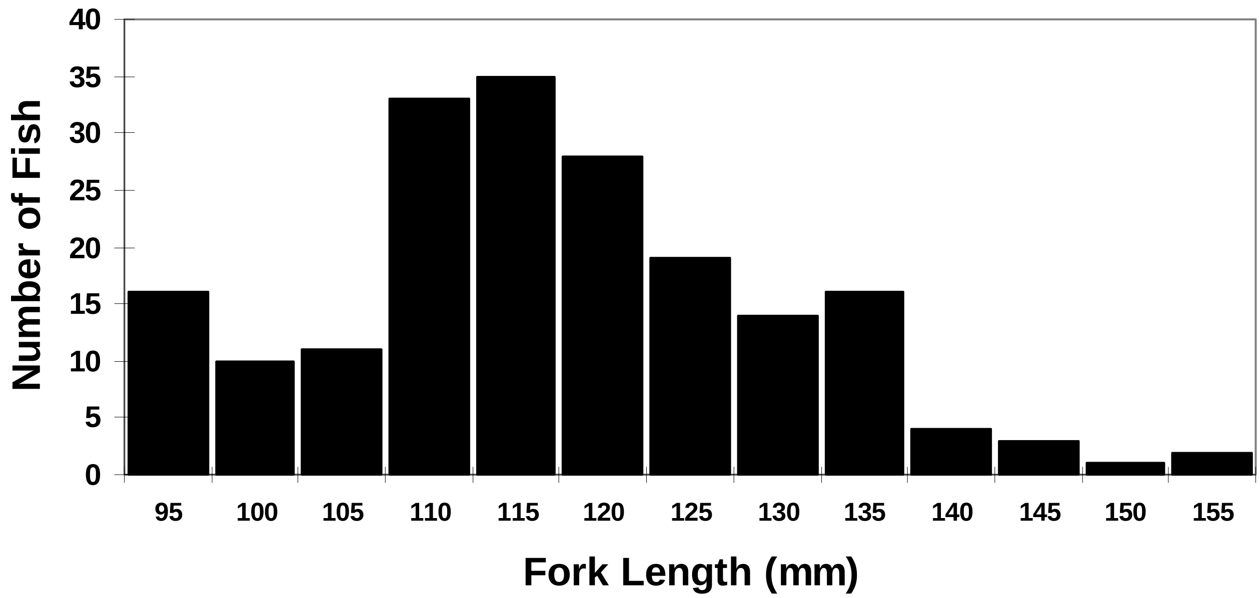



Figure 34. Length frequency (in 5 mm increments) of steelhead ≥ 90mm at sites electrofished in Smith River, summer 2001.

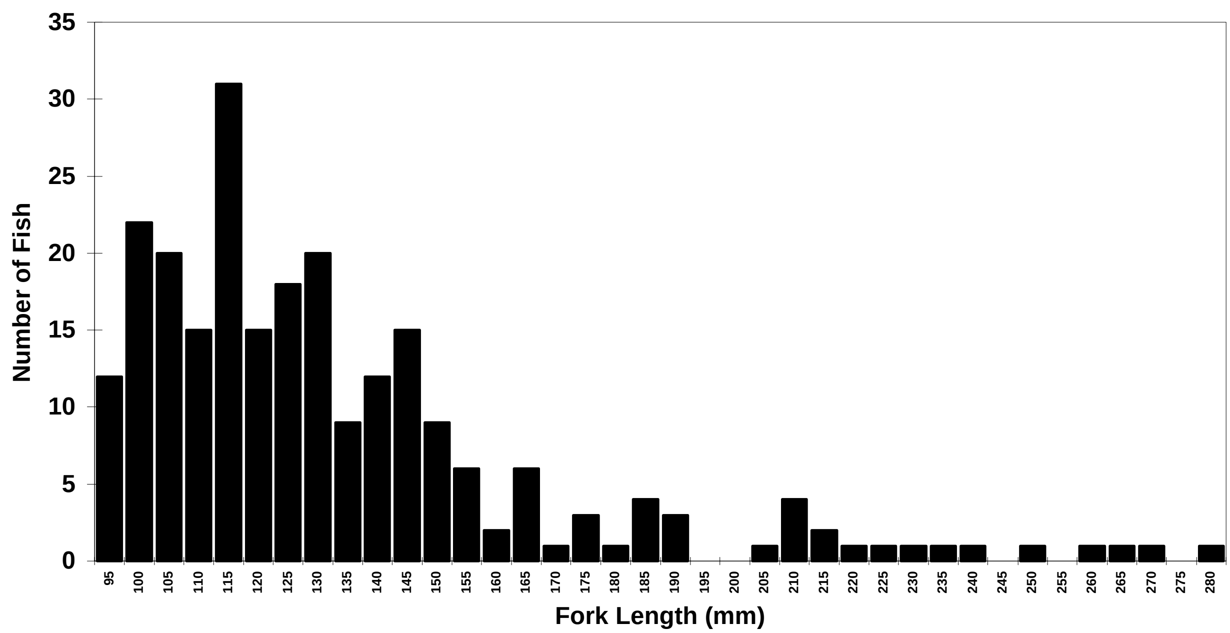



Figure 35. Length frequency (in 5 mm increments) of cutthroat ≥ 90mm at sites electrofished in Smith River, summer 2001.

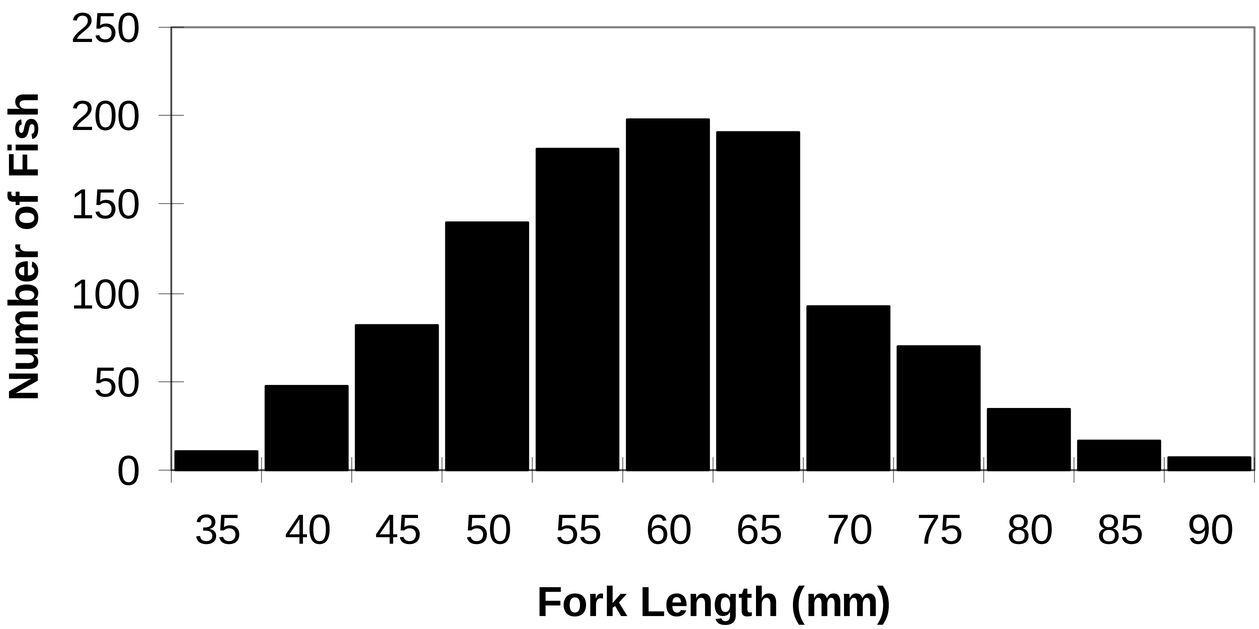



Figure 36. Length frequency (in 5 mm increments) of trout < 90 mm at sites electrofished in Smith River, summer 2001.

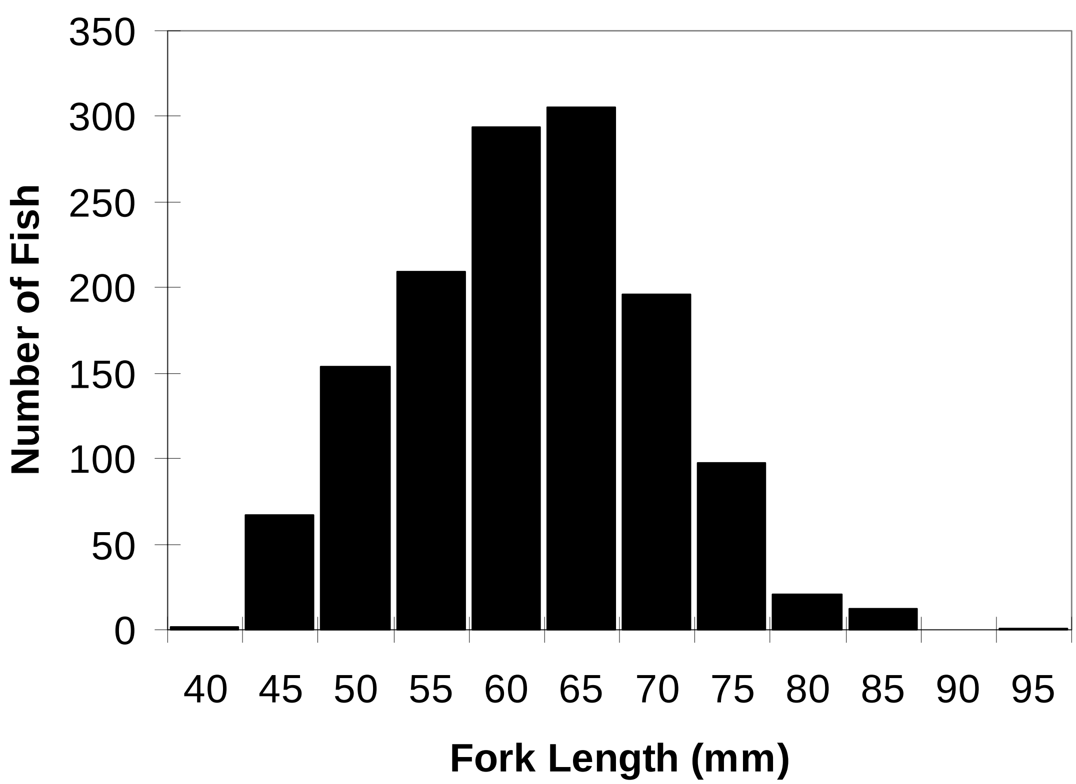



Figure 37. Length frequency (in 5 mm increments) of juvenile coho at sites electrofished in Smith River, summer 2001.

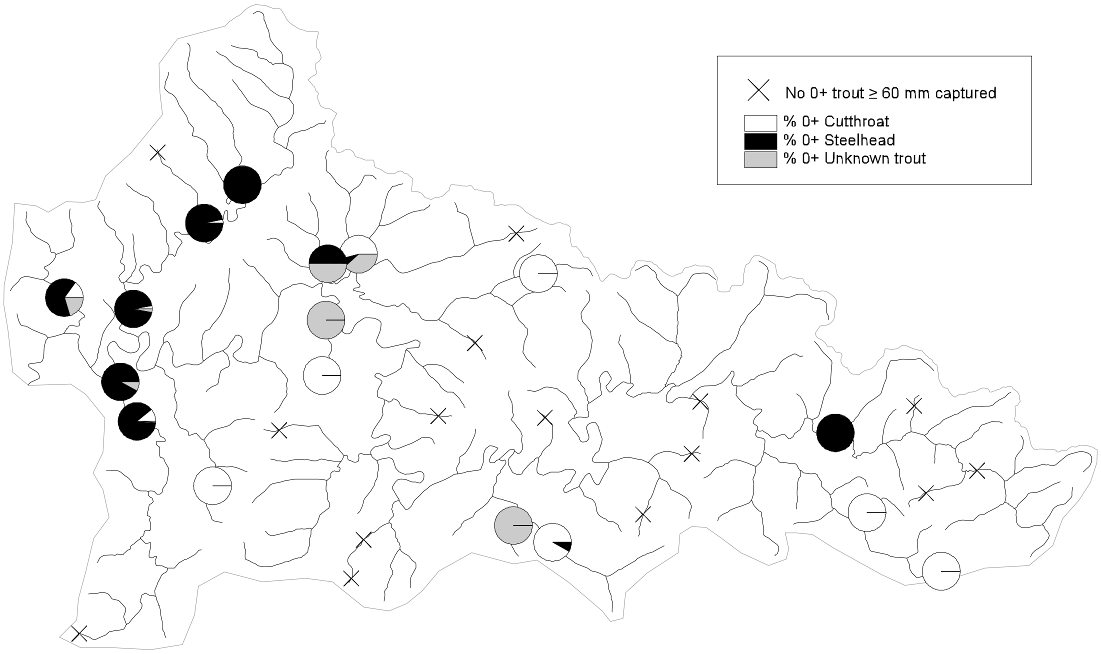



Figure 38. Species composition of 0+ trout $\geq$ 60 mm fork length at sites electrofished in Smith River, summer 2001.

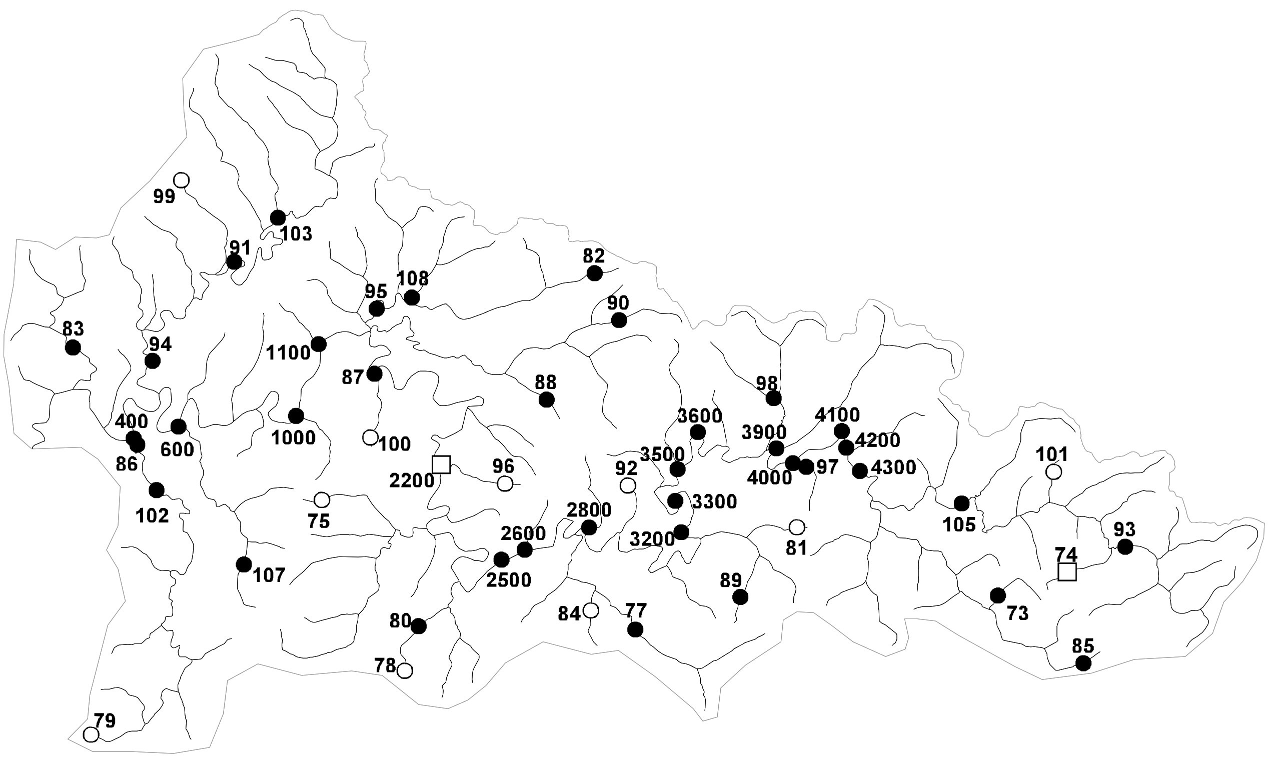
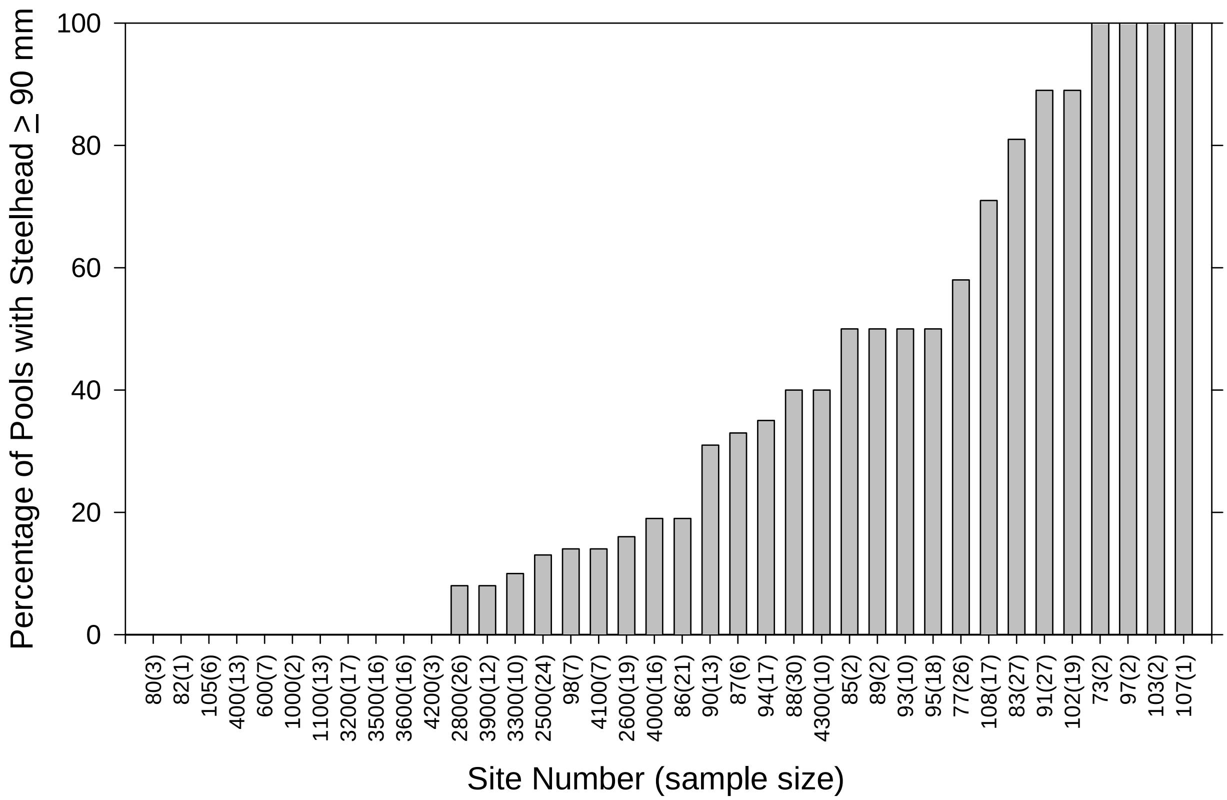



Figure 39. Location of Smith River sites visited by the snorkel crew during the summer of 2001. Solid circles are sites that were snorkeled, hollow circles are sites that had no pools meeting size or depth criteria for snorkel surveys, and hollow boxes are sites were poor water visibility precluded diver observations. The numbers above the sample points are the site numbers for referencing data in Appendix C. Site 98 and sites with numbers $\geq$ 400 were not in common with electrofishing sites.



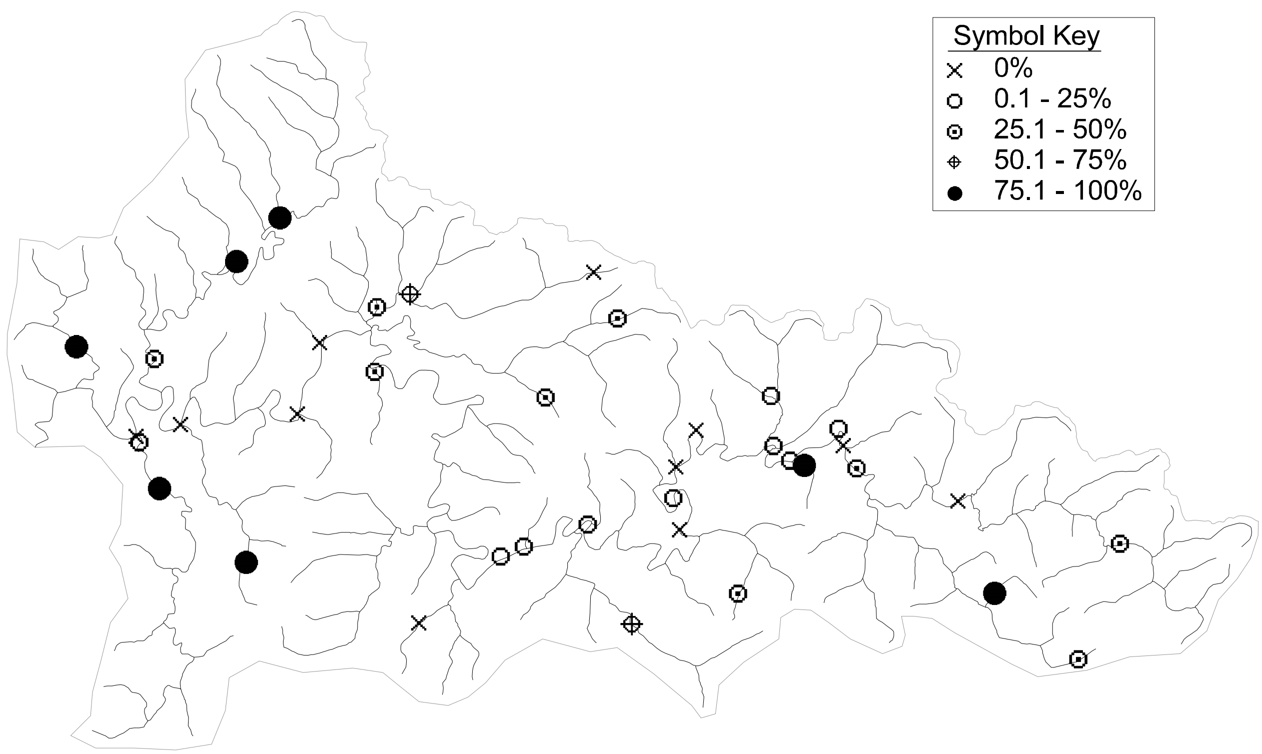




Figure 40. Percentage of pools at each site snorkeled in Smith River that contained at least one ≥ 90 mm juvenile steelhead in summer 2001.

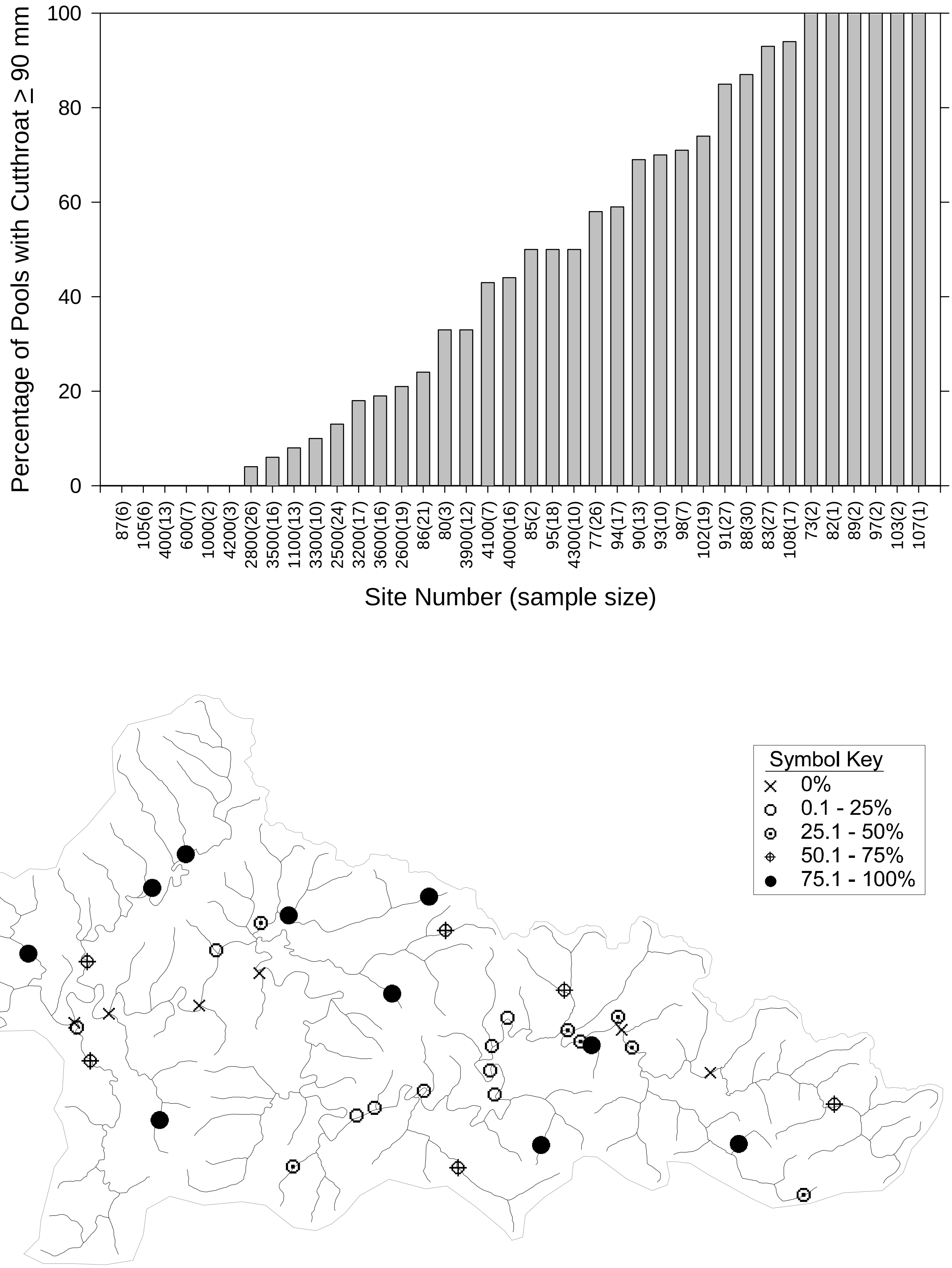
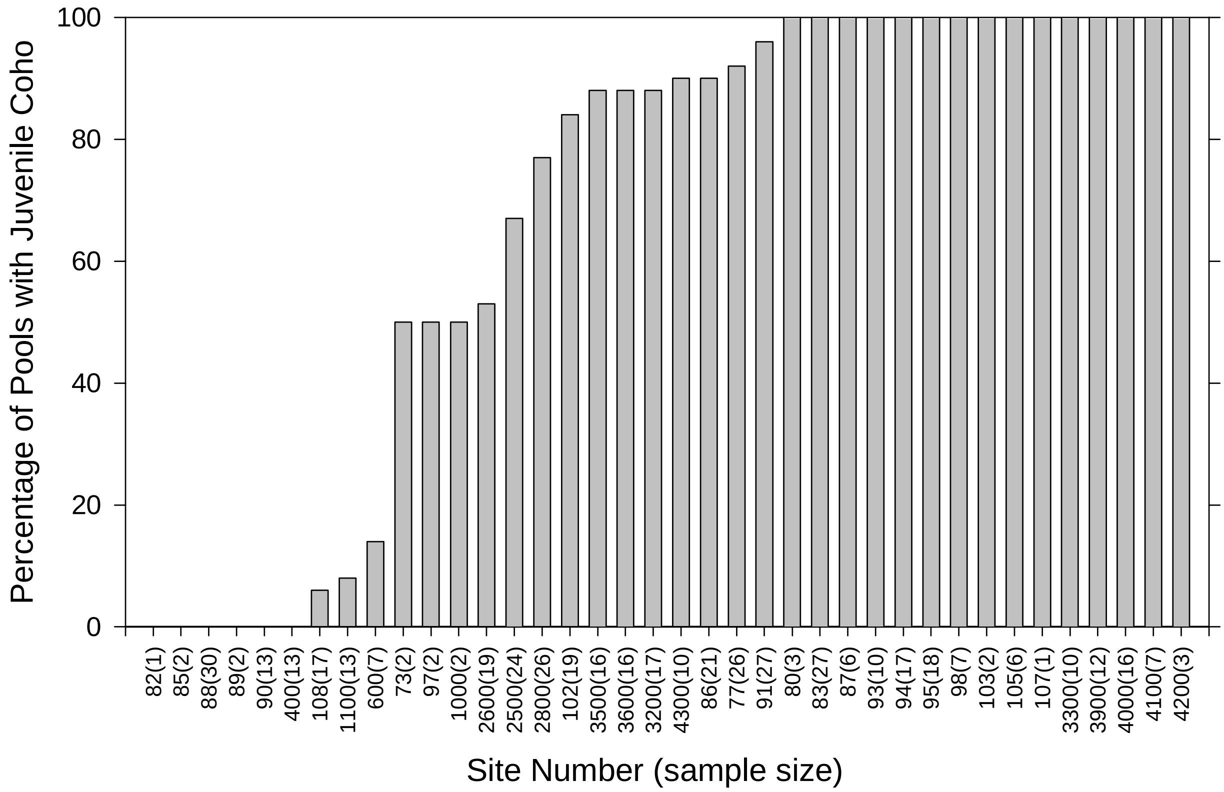



Figure 41. Percentage of pools at each site snorkeled in Smith River that contained at least one ≥ 90 mm cutthroat in the summer of 2001.



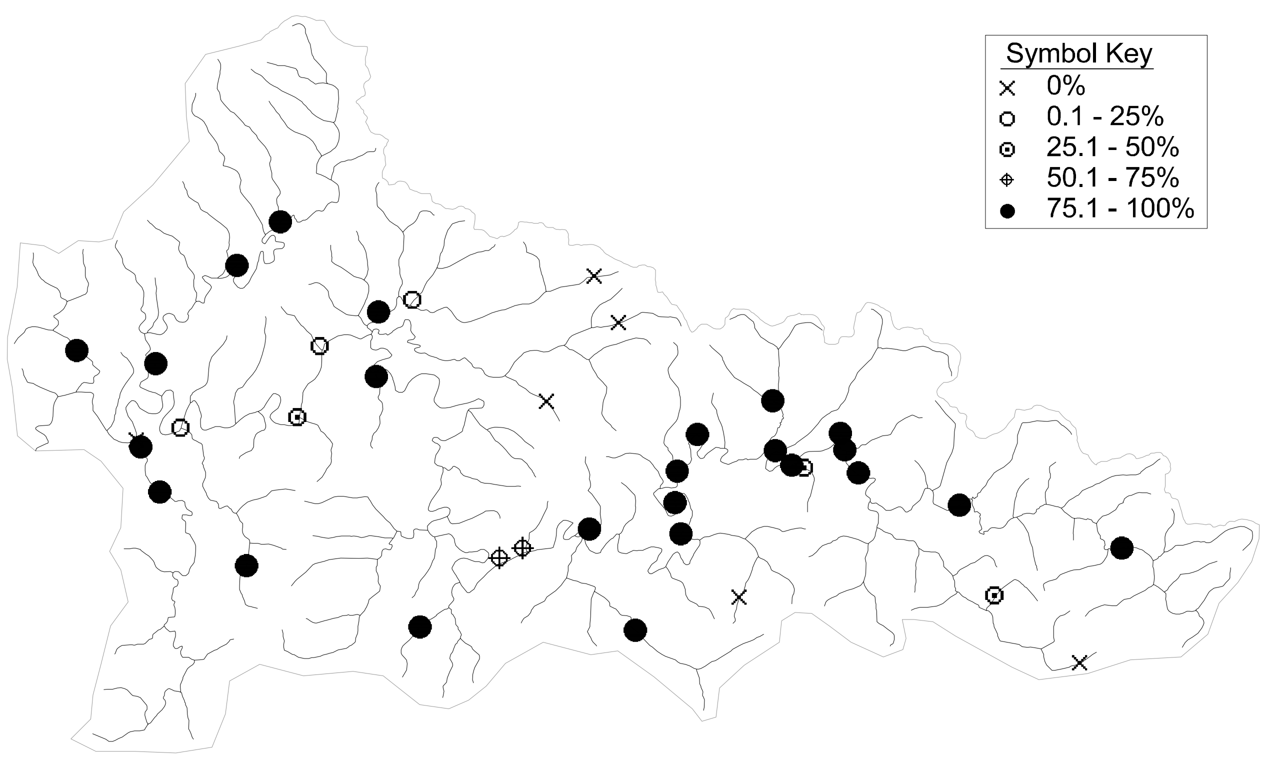




Figure 42. Percentage of pools at each site snorkeled in Smith River that contained at least one juvenile coho in the summer of 2001.

References

Armour, C.L., K.P. Burnham, and W.S. Platts. 1983. Field methods and statistical analysis for monitoring small salmonid streams. U.S. Fish and Wildlife Service, Washington, D.C.

Bowers, J. 2000. Oregon Department of Fish and Wildlife salmonid distribution data. Oregon Department of Fish and Wildlife, Portland.

Dias-Ramos, S., D.L. Stevens, Jr., and A.R. Olsen. 1996. EMAP Statistical Methods Manual. Environmental Monitoring and Assessment Program, National Health and Environmental Effects Research Laboratory, Office of Research and Development, Corvallis, Oregon.

Moore, K.M.S., K.K. Jones, and J.M. Dambacher. 1997. Methods for stream habitat surveys. Oregon Department of Fish and Wildlife, Information Report 97-4, Portland.

National Marine Fisheries Service. 2000. Backpack electrofishing guidelines. National Marine Fisheries Service, Portland, Oregon.

Neter, J., and W. Wasserman. 1974 Applied linear statistical models. Richard D. Irwin, Incorporated, Homewood, Illinois.

Rodgers, J.D. 2000. Abundance of juvenile coho salmon in Oregon coastal streams: 1998 and 1999. Monitoring Program Report Number OPSW-ODFW-2000-1. Oregon Department of Fish and Wildlife, Portland.

Rodgers, J.D. 2001. Monitoring abundance of juvenile salmonids in Oregon coastal streams, 2000. Monitoring Program Report Number OPSW-ODFW-2001-1, Oregon Department of Fish and Wildlife, Portland.

Snedecor, G.W., and W.G. Cochran. 1980. Statistical methods. Iowa State University Press, Ames.

Stevens, D.L., Jr. 2002. Sampling design and statistical analysis methods for the integrated biological and physical monitoring of Oregon streams. Monitoring Program Report Number OPSW-ODFW-2002-7, Oregon Department of Fish and Wildlife, Portland.

Stevens, D.L., Jr., and A.R. Olsen. 1999. Spatially restricted surveys over time for aquatic resources. Journal of Agriculture, Biological, and Environmental Statistics 4:415-428.

## Appendix A. Location, sample sizes, average density, and percentage of pools containing juvenile coho at coastal Monitoring Area sites sampled in 2001.

| Monitoring Area | Site | Basin Name, Subbasin Name | Reach | Longitude (decimal degrees) | Latitude (decimal degrees) | Number of Pools Sampled for Density | Juvenile Coho Density (fish/m2) | Number of Pools Sampled for Percent Occurrence | Percentage of Pools Containing Juvenile Coho |
|---|---|---|---|---|---|---|---|---|---|
| North Coast | 12 | TRASK RIVER , SOUTH FORK | Boundary Cr | -123.5445 | 45.3536 | 29 | 0.01 | 29 | 14 |
| North Coast | 107 | NESTUCCA RIVER , MAIN STEM AND BAY | Testament Cr | -123.5684 | 45.2491 | 24 | 1.15 | 24 | 100 |
| North Coast | 225 | NESTUCCA RIVER , MAIN STEM AND BAY | Clear Cr | -123.8850 | 45.1763 | 32 | 0.00 | 32 | 0 |
| North Coast | 249 | NESTUCCA RIVER , MAIN STEM AND BAY | Sanders Cr (Smith Cr) | -123.8927 | 45.2180 | 3 | 0.00 | 3 | 0 |
| North Coast | 331 | NESTUCCA RIVER, THREE RIVERS | Crazy Cr | -123.7673 | 45.1708 | 15 | 0.00 | 15 | 0 |
| North Coast | 400 | NESTUCCA RIVER , MAIN STEM AND BAY | Niagara Cr | -123.6459 | 45.1909 | 16 | 0.00 | 16 | 0 |
| North Coast | 405 | NESTUCCA RIVER , MAIN STEM AND BAY | Pheasant Cr | -123.6359 | 45.2118 | 21 | 0.04 | 21 | 19 |
| North Coast | 486 | NESTUCCA RIVER , LITTLE NESTUCCA | Austin Cr | -123.8761 | 45.1087 | 15 | 0.00 | 15 | 0 |
| North Coast | 653 | NOT IDENTIFIED, NOT IDENTIFIED | Unnamed | -123.6885 | 45.3158 | 9 | 0.00 | 9 | 0 |
| North Coast | 714 | TILLAMOOK RIVER, MAIN STEM | Tillamook R | -123.8309 | 45.3520 | 0 | - | 20 | 15 |
| North Coast | 718 | SAND LAKE, MAIN STEM | Sand Cr | -123.9182 | 45.3395 | 11 | 0.00 | 11 | 0 |
| North Coast | 852 | TILLAMOOK RIVER, MAIN STEM | Simmons Cr | -123.7619 | 45.3713 | 22 | 0.98 | 22 | 100 |
| North Coast | 932 | NESTUCCA RIVER , MAIN STEM AND BAY | West Cr | -123.8487 | 45.2903 | 12 | 0.00 | 12 | 0 |
| North Coast | 949 | NESKOWIN CREEK , MAIN STEM | Sloan Cr | -123.9092 | 45.0700 | 3 | 0.00 | 3 | 0 |
| North Coast | 994 | OCEAN TRIB, MAIN STEM | Rice Cr | -123.9363 | 45.4282 | 0 | - | 23 | 0 |
| North Coast | 1050 | NEHALEM RIVER , ROCK CREEK | Weed Cr | -123.4085 | 45.8686 | 5 | 0.00 | 5 | 0 |
| North Coast | 1248 | NEHALEM RIVER , ROCK CREEK | Rock Cr, S Fk | -123.4338 | 45.7717 | 26 | 0.00 | 26 | 0 |
| North Coast | 1377 | NECANICUM RIVER , SOUTH FORK | Brandis Cr | -123.8519 | 45.8918 | 8 | 0.22 | 8 | 50 |
| North Coast | 1433 | NECANICUM RIVER , SOUTH FORK | Necanicum R, S Fk | -123.8453 | 45.9002 | 26 | 0.38 | 26 | 81 |
| North Coast | 1452 | ROVER CREEK, MAIN STEM | Bergsvik Cr | -123.7562 | 45.8952 | 37 | 0.25 | 37 | 92 |
| North Coast | 1496 | ROVER CREEK, MAIN STEM | Little Muddy Cr | -123.9357 | 45.9725 | 7 | 0.00 | 7 | 0 |
| North Coast | 1591 | ROVER CREEK, MAIN STEM | Little Joe Cr | -123.7599 | 45.8846 | 25 | 0.30 | 25 | 64 |
| North Coast | 1699 | NEHALEM RIVER , NORTH FORK | Rackheap Cr | -123.8036 | 45.7676 | 0 | - | 7 | 0 |
| North Coast | 1904 | MIAMI RIVER , MAIN STEM | Miami R | -123.8405 | 45.6184 | 31 | 1.19 | 31 | 97 |
| North Coast | 2004 | KILCHIS RIVER , MAIN STEM | Kilchis R, N Fk | -123.7069 | 45.6208 | 23 | 2.11 | 23 | 100 |
| North Coast | 2050 | NEHALEM RIVER , MAIN STEM | Foley Cr | -123.8384 | 45.6699 | 20 | 0.19 | 20 | 85 |
| North Coast | 2095 | NEHALEM RIVER , MAIN STEM | E Humbug Cr | -123.6184 | 45.9235 | 43 | 1.74 | 43 | 100 |
| North Coast | 2160 | NEHALEM RIVER , MAIN STEM | Beneke Cr | -123.5002 | 45.9578 | 0 | - | 25 | 100 |
| North Coast | 2188 | NEHALEM RIVER , MAIN STEM | Crawford Cr | -123.4663 | 45.9636 | 0 | - | 27 | 0 |
| North Coast | 2210 | NEHALEM RIVER , MAIN STEM | Northrup Cr | -123.4585 | 46.0341 | 39 | 0.71 | 39 | 100 |
| North Coast | 2265 | NEHALEM RIVER , MAIN STEM | Hamilton Cr | -123.5621 | 45.9724 | 25 | 0.86 | 25 | 100 |
| North Coast | 2291 | NEHALEM RIVER , MAIN STEM | Ford Cr | -123.2718 | 46.0428 | 13 | 0.00 | 13 | 0 |
| North Coast | 2352 | NEHALEM RIVER , ROCK CREEK | Selder Cr, Trib B | -123.3734 | 45.8901 | 6 | 0.00 | 6 | 0 |
| North Coast | 2506 | NEHALEM RIVER , MAIN STEM | Fishhawk Cr | -123.3675 | 46.0194 | 22 | 0.08 | 22 | 100 |
| North Coast | 2546 | NEHALEM RIVER , MAIN STEM | Coal Cr | -123.1726 | 45.8186 | 0 | - | 33 | 100 |
| North Coast | 2651 | NEHALEM RIVER , MAIN STEM | Deer Cr | -123.2346 | 45.9360 | 0 | - | 38 | 61 |
| North Coast | 2687 | NEHALEM RIVER , MAIN STEM | Oak Ranch Cr | -123.1006 | 45.9484 | 20 | 1.16 | 20 | 100 |
| North Coast | 2864 | NOT IDENTIFIED, NOT IDENTIFIED | Laughlin Cr | -123.4509 | 45.4345 | 5 | 0.00 | 5 | 0 |
| North Coast | 2912 | WILSON RIVER, MAIN STEM | Fall Cr | -123.5889 | 45.4952 | 34 | 0.00 | 34 | 0 |
| North Coast | 2939 | WILSON RIVER, MAIN STEM | Ben Smith Cr | -123.5158 | 45.5858 | 29 | 2.10 | 29 | 100 |

Appendix A (continued).

| Monitoring Area | Site | Basin Name, Subbasin Name | Reach | Longitude (decimal degrees) | Latitude (decimal degrees) | Number of Pools Sampled for Density | Juvenile Coho Density (fish/m2) | Number of Pools Sampled for Percent Occurrence | Percentage of Pools Containing Juvenile Coho |
|---|---|---|---|---|---|---|---|---|---|
| North Coast | 3079 | WILSON RIVER, MAIN STEM | Jordan Cr | -123.4967 | 45.5492 | 28 | 0.00 | 28 | 0 |
| North Coast | 3164 | NEHALEM RIVER , MAIN STEM | Beaver Cr | -123.2114 | 45.7707 | 35 | 1.11 | 35 | 100 |
| Mid-Coast | 34 | SIUSLAW RIVER, LAKE CREEK | Elk Cr | -123.6955 | 44.2035 | 33 | 0.87 | 33 | 100 |
| Mid-Coast | 73 | ALSEA RIVER , FIVE RIVERS | Lobster Cr | -123.7623 | 44.3165 | 11 | 0.01 | 11 | 27 |
| Mid-Coast | 96 | ALSEA RIVER , MAIN STEM AND BAY | Benner Cr | -123.7354 | 44.3543 | 6 | 0.32 | 6 | 50 |
| Mid-Coast | 127 | YACHATS RIVER , MAIN STEM | Stump Cr | -123.9633 | 44.2759 | 34 | 0.29 | 34 | 85 |
| Mid-Coast | 194 | SIUSLAW RIVER, LAKE CREEK | Indian Cr, N Fk | -123.8697 | 44.2171 | 3 | 0.06 | 3 | 33 |
| Mid-Coast | 209 | SIUSLAW RIVER, LAKE CREEK | Maria Cr | -123.8946 | 44.1793 | 31 | 0.82 | 31 | 97 |
| Mid-Coast | 220 | SIUSLAW RIVER, LAKE CREEK | Rogers Cr | -123.8854 | 44.1593 | 35 | 0.41 | 35 | 97 |
| Mid-Coast | 274 | SIUSLAW RIVER, LAKE CREEK | Fish Cr | -123.5152 | 44.1599 | 18 | 0.00 | 18 | 0 |
| Mid-Coast | 292 | ALSEA RIVER , FIVE RIVERS | Lobster Cr, E Fk | -123.6073 | 44.2532 | 16 | 0.00 | 16 | 0 |
| Mid-Coast | 321 | SIUSLAW RIVER, LAKE CREEK | Lake Cr | -123.4986 | 44.2128 | 12 | 0.00 | 12 | 0 |
| Mid-Coast | 411 | ALSEA RIVER , NORTH FORK | Crooked Cr | -123.5371 | 44.4256 | 32 | 0.39 | 32 | 100 |
| Mid-Coast | 549 | SIUSLAW RIVER, MAIN STEM | Haight Cr | -123.4931 | 43.8631 | 23 | 0.27 | 23 | 96 |
| Mid-Coast | 577 | SIUSLAW RIVER, MAIN STEM | Wildcat Cr, Trib Zh | -123.4914 | 43.9920 | 1 | 0.00 | 1 | 0 |
| Mid-Coast | 601 | SIUSLAW RIVER, MAIN STEM | Wildcat Cr | -123.5427 | 44.0352 | 22 | 0.05 | 22 | 91 |
| Mid-Coast | 609 | SIUSLAW RIVER, MAIN STEM | Clay Cr | -123.5659 | 43.9041 | 12 | 0.44 | 12 | 100 |
| Mid-Coast | 669 | SIUSLAW RIVER, MAIN STEM | Fawn Cr | -123.3259 | 43.8301 | 20 | 0.02 | 20 | 35 |
| Mid-Coast | 749 | SIUSLAW RIVER, NORTH FORK | Porter Cr | -123.9528 | 44.1426 | 40 | 0.45 | 40 | 93 |
| Mid-Coast | 773 | SIUSLAW RIVER, NORTH FORK | Condon Cr | -123.9821 | 44.0985 | 31 | 0.18 | 31 | 61 |
| Mid-Coast | 826 | TENMILE CREEK, MAIN STEM | Mill Cr | -124.0691 | 44.2078 | 15 | 0.00 | 15 | 0 |
| Mid-Coast | 861 | SIUSLAW RIVER, MAIN STEM | Barber Cr | -123.7435 | 44.0272 | 3 | 2.59 | 3 | 100 |
| Mid-Coast | 955 | SIUSLAW RIVER, LAKE CREEK | Hula Cr | -123.7212 | 44.0990 | 20 | 1.27 | 20 | 100 |
| Mid-Coast | 979 | SIUSLAW RIVER, MAIN STEM | Hanson Cr | -123.9657 | 44.0316 | 15 | 0.08 | 15 | 20 |
| Mid-Coast | 1001 | SIUSLAW RIVER, MAIN STEM | Knowles Cr | -123.7282 | 43.9647 | 10 | 1.00 | 10 | 100 |
| Mid-Coast | 1026 | YAQUINA RIVER , ELK CREEK | Spout Cr | -123.6859 | 44.5520 | 35 | 0.27 | 35 | 100 |
| Mid-Coast | 1076 | YAQUINA RIVER , LITTLE ELK CREEK | Oglesby Cr | -123.7259 | 44.6381 | 3 | 0.34 | 3 | 67 |
| Mid-Coast | 1086 | SILETZ RIVER, ROCK CREEK | Steere Cr | -123.6574 | 44.7239 | 31 | 1.07 | 31 | 100 |
| Mid-Coast | 1247 | SILETZ RIVER, MAIN STEM | Mill Cr, N Fk | -123.7582 | 44.7663 | 23 | 0.85 | 23 | 100 |
| Mid-Coast | 1307 | SILETZ RIVER, MAIN STEM | Dewey Cr | -123.9592 | 44.7226 | 21 | 0.00 | 21 | 0 |
| Mid-Coast | 1463 | CUMMINS CR, MAIN STEM | Cummins Cr | -124.0623 | 44.2671 | 41 | 0.08 | 41 | 73 |
| Mid-Coast | 1491 | BIG CREEK, MAINSTEM, SFK, DICK'S FK | Big Cr, S Fk | -124.0794 | 44.3538 | 31 | 0.01 | 31 | 10 |
| Mid-Coast | 1531 | ALSEA RIVER , DRIFT CREEK | Flynn Cr | -123.8512 | 44.5359 | 13 | 1.22 | 13 | 100 |
| Mid-Coast | 1579 | YAQUINA RIVER , ELK CREEK | Deer Cr | -123.7778 | 44.5701 | 23 | 0.54 | 23 | 100 |
| Mid-Coast | 1653 | ALSEA RIVER , FIVE RIVERS | Camp Cr | -123.7581 | 44.2859 | 25 | 0.89 | 25 | 100 |
| Mid-Coast | 1665 | ALSEA RIVER , FIVE RIVERS | Five Rivers | -123.8205 | 44.2829 | 21 | 0.01 | 21 | 57 |
| Mid-Coast | 1709 | SIUSLAW RIVER, LAKE CREEK | Bear Cr, S Fk | -123.6772 | 44.1453 | 21 | 2.49 | 21 | 95 |
| Mid-Coast | 1744 | ALSEA RIVER , NORTH FORK | Seeley Cr | -123.5257 | 44.4080 | 23 | 0.82 | 23 | 65 |
| Mid-Coast | 1797 | SIUSLAW RIVER, MAIN STEM | Siuslaw R | -123.5055 | 43.8816 | 11 | 0.00 | 11 | 0 |
| Mid-Coast | 1830 | SIUSLAW RIVER, MAIN STEM | Siuslaw R | -123.6288 | 43.9241 | 6 | 0.00 | 6 | 0 |

Appendix A (continued).

| Monitoring Area | Site | Basin Name, Subbasin Name | Reach | Longitude (decimal degrees) | Latitude (decimal degrees) | Number of Pools Sampled for Density | Juvenile Coho Density (fish/m2) | Number of Pools Sampled for Percent Occurrence | Percentage of Pools Containing Juvenile Coho |
|---|---|---|---|---|---|---|---|---|---|
| Mid-Coast | 1876 | BIG CREEK, MAIN STEM & SFK | Big Cr | -124.1058 | 44.1707 | 36 | 0.32 | 36 | 92 |
| Mid-Coast | 2035 | ALSEA RIVER , DRIFT CREEK | Trout Cr | -123.9346 | 44.4883 | 31 | 1.82 | 31 | 100 |
| Mid-Coast | 2066 | ALSEA RIVER , MAIN STEM AND BAY | Carns Canyon | -123.7623 | 44.4024 | 12 | 0.13 | 12 | 17 |
| Mid-South Coast | 44 | COOS RIVER, SOUTH FORK | Little Cow Cr | -123.6141 | 43.1903 | 24 | 0.00 | 24 | 0 |
| Mid-South Coast | 133 | COOS RIVER, SOUTH FORK | Bottom Cr | -123.7869 | 43.3379 | 1 | 0.11 | 1 | 100 |
| Mid-South Coast | 220 | COQUILLE RIVER , SOUTH FORK | Rowland Cr | -124.1788 | 42.9035 | 18 | 0.00 | 18 | 0 |
| Mid-South Coast | 231 | COQUILLE RIVER , SOUTH FORK | Baker Cr | -124.1124 | 42.9025 | 23 | 0.05 | 23 | 61 |
| Mid-South Coast | 326 | FOURMILE CR, MAIN STEM | Fourmile Cr | -124.3316 | 42.9869 | 0 | - | 15 | 100 |
| Mid-South Coast | 361 | COQUILLE RIVER , EAST FORK | Weekly Cr | -124.0500 | 43.1053 | 14 | 1.72 | 14 | 100 |
| Mid-South Coast | 451 | COQUILLE RIVER , NORTH FORK | Middle Cr | -123.8790 | 43.2378 | 15 | 0.00 | 15 | 0 |
| Mid-South Coast | 689 | COQUILLE RIVER , NORTH FORK | Johns Cr | -124.0599 | 43.0782 | 12 | 1.42 | 12 | 100 |
| Mid-South Coast | 740 | COQUILLE RIVER , MIDDLE FORK | Rock Cr | -123.9270 | 42.9385 | 35 | 0.79 | 35 | 100 |
| Mid-South Coast | 819 | SIXES RIVER , MAIN STEM | Sixes R | -124.1933 | 42.8200 | 9 | 0.05 | 9 | 56 |
| Mid-South Coast | 858 | SIXES RIVER , MAIN STEM | Sixes R | -124.3052 | 42.8041 | 8 | 0.00 | 8 | 0 |
| Mid-South Coast | 884 | FLORAS CREEK, MAIN STEM | Floras Cr | -124.4029 | 42.9123 | 12 | 0.01 | 12 | 25 |
| Mid-South Coast | 1175 | COOS RIVER , MILLICOMA RIVER | Hendrickson Cr | -124.0721 | 43.3968 | 0 | - | 2 | 100 |
| Mid-South Coast | 1200 | COOS RIVER, SOUTH FORK | Bessey Cr | -124.0283 | 43.3807 | 3 | 0.00 | 3 | 0 |
| Mid-South Coast | 1260 | COQUILLE RIVER , NORTH FORK | Coquille R, Little N Fk | -123.9451 | 43.3079 | 27 | 1.64 | 27 | 100 |
| Mid-South Coast | 1264 | COQUILLE RIVER , NORTH FORK | Coquille R, N Fk | -123.9610 | 43.3204 | 23 | 0.83 | 23 | 100 |
| Mid-South Coast | 1319 | COOS RIVER, SOUTH FORK | Wren Smith Cr | -124.0770 | 43.3212 | 20 | 0.40 | 20 | 90 |
| Mid-South Coast | 1342 | COOS RIVER , MILLICOMA RIVER | Millicoma R, E Fk | -123.8800 | 43.4152 | 9 | 0.57 | 9 | 100 |
| Mid-South Coast | 1385 | COOS RIVER , MILLICOMA RIVER | Millicoma R, E Fk | -123.8746 | 43.4195 | 24 | 1.06 | 24 | 100 |
| Mid-South Coast | 1403 | COOS RIVER , MILLICOMA RIVER | Schumacher Cr | -124.0391 | 43.4829 | 14 | 0.00 | 14 | 0 |
| Mid-South Coast | 1506 | COOS RIVER, MAIN STEM | Catching Cr | -124.1554 | 43.2631 | 0 | - | 2 | 100 |
| Mid-South Coast | 1610 | COOS RIVER, MAIN STEM | Winchester Cr | -124.3145 | 43.2322 | 0 | - | 10 | 20 |
| Mid-South Coast | 1693 | COQUILLE RIVER , MAIN STEM AND BAY | Mack Cr | -124.3320 | 43.0638 | 4 | 0.00 | 4 | 0 |
| Mid-South Coast | 1757 | TAHKENITCH CREEK, FIVEMILE CREEK | Fivemile Cr | -124.0246 | 43.8398 | 0 | - | 33 | 100 |
| Mid-South Coast | 1858 | SILTCOOS RIVER, WOAHINK LAKE | Miller Cr | -124.0642 | 43.9268 | 4 | 0.00 | 4 | 0 |
| Mid-South Coast | 1905 | COOS RIVER, SOUTH FORK | Williams R | -123.6707 | 43.2377 | 39 | 1.72 | 39 | 100 |
| Mid-South Coast | 2201 | SIXES RIVER , MAIN STEM | Sixes R | -124.3930 | 42.8024 | 3 | 0.00 | 3 | 0 |
| Mid-South Coast | 2303 | NOT IDENTIFIED, NOT IDENTIFIED | Unnamed | -124.1709 | 43.4282 | 0 | - | 4 | 0 |
| Mid-South Coast | 2322 | TENMILE CREEK , EEL LAKE | Eel Cr | -124.1833 | 43.5888 | 0 | - | 24 | 0 |
| Mid-South Coast | 2438 | COOS RIVER , MILLICOMA RIVER | Packard Cr | -124.0236 | 43.4048 | 2 | 0.44 | 2 | 50 |
| Umpqua | 29 | UMPQUA RIVER, ELK CREEK | Elk Cr | -123.1784 | 43.5525 | 0 | - | 23 | 0 |
| Umpqua | 81 | UMPQUA RIVER , SOUTH UMPQUA | Roberts Cr | -123.3784 | 43.1483 | 0 | - | 16 | 0 |
| Umpqua | 915 | UMPQUA RIVER , SOUTH UMPQUA | Wood Cr | -123.3956 | 42.7817 | 24 | 1.02 | 24 | 100 |
| Umpqua | 925 | UMPQUA RIVER , SOUTH UMPQUA | Whitehorse Cr | -123.1660 | 42.8055 | 23 | 0.00 | 23 | 0 |
| Umpqua | 958 | UMPQUA RIVER , SOUTH UMPQUA | Clear Cr | -123.2445 | 42.7957 | 0 | - | 10 | 100 |
| Umpqua | 970 | UMPQUA RIVER , SOUTH UMPQUA | Quines Cr | -123.2642 | 42.7489 | 17 | 0.69 | 17 | 100 |
| Umpqua | 972 | UMPQUA RIVER , SOUTH UMPQUA | Bull Run Cr | -123.2451 | 42.7568 | 1 | 1.62 | 1 | 100 |

Appendix A (continued).

| Monitoring Area | Site | Basin Name, Subbasin Name | Reach | Longitude (decimal degrees) | Latitude (decimal degrees) | Number of Pools Sampled for Density | Juvenile Coho Density (fish/m2) | Number of Pools Sampled for Percent Occurrence | Percentage of Pools Containing Juvenile Coho |
|---|---|---|---|---|---|---|---|---|---|
| Umpqua | 988 | UMPQUA RIVER , MAIN STEM AND BAY | Wind Cr | -124.0957 | 43.6553 | 0 | - | 7 | 100 |
| Umpqua | 1026 | UMPQUA RIVER , MAIN STEM AND BAY | Scholfield Cr | -124.0131 | 43.6281 | 29 | 0.00 | 29 | 0 |
| Umpqua | 1047 | UMPQUA RIVER , MAIN STEM AND BAY | Camp Cr | -123.8434 | 43.6163 | 0 | - | 34 | 3 |
| Umpqua | 1100 | UMPQUA RIVER , MAIN STEM AND BAY | Case Knife Cr | -123.6512 | 43.4386 | 21 | 0.09 | 21 | 52 |
| Umpqua | 1113 | UMPQUA RIVER , MAIN STEM AND BAY | Wolf Cr | -123.6095 | 43.4565 | 5 | 0.68 | 5 | 100 |
| Umpqua | 1116 | UMPQUA RIVER , MAIN STEM AND BAY | Heddin Cr | -123.6365 | 43.6070 | 0 | - | 16 | 100 |
| Umpqua | 1146 | UMPQUA RIVER , MAIN STEM AND BAY | Lutsinger Cr | -123.7255 | 43.6363 | 13 | 0.39 | 13 | 54 |
| Umpqua | 1151 | UMPQUA RIVER , MAIN STEM AND BAY | Lutsinger Cr | -123.7177 | 43.6325 | 28 | 0.66 | 28 | 100 |
| Umpqua | 1158 | UMPQUA RIVER , MAIN STEM AND BAY | Camp Cr | -123.7527 | 43.6079 | 0 | - | 4 | 100 |
| Umpqua | 1169 | UMPQUA RIVER , MAIN STEM AND BAY | Mcgee Cr | -123.5460 | 43.5201 | 21 | 0.01 | 21 | 19 |
| Umpqua | 1256 | UMPQUA RIVER , SMITH RIVER | S Sister Cr | -123.6624 | 43.8298 | 0 | - | 13 | 100 |
| Umpqua | 1358 | UMPQUA RIVER , SMITH RIVER | Blackwell Cr | -123.7510 | 43.8084 | 24 | 0.00 | 24 | 0 |
| Umpqua | 1394 | UMPQUA RIVER , MAIN STEM AND BAY | Wells Cr | -123.7978 | 43.6766 | 31 | 0.03 | 31 | 29 |
| Umpqua | 1423 | UMPQUA RIVER , MAIN STEM AND BAY | Weatherly Cr | -123.7276 | 43.6811 | 23 | 0.72 | 23 | 96 |
| Umpqua | 2297 | UMPQUA RIVER , SOUTH UMPQUA | Tenmile Cr | -123.5657 | 43.0914 | 0 | - | 14 | 7 |
| Umpqua | 2309 | UMPQUA RIVER , SOUTH UMPQUA | Falcon Cr | -122.5452 | 42.9935 | 26 | 0.00 | 26 | 0 |
| Umpqua | 2348 | UMPQUA RIVER , SOUTH UMPQUA | Stampede Cr | -122.8163 | 42.9039 | 6 | 0.00 | 6 | 0 |
| Umpqua | 2368 | UMPQUA RIVER , SOUTH UMPQUA | Boulder Cr | -122.7816 | 43.0717 | 33 | 0.05 | 33 | 48 |
| Umpqua | 2389 | UMPQUA RIVER , SOUTH UMPQUA | Squaw Cr | -122.6745 | 42.9603 | 47 | 0.00 | 47 | 0 |
| Umpqua | 2390 | UMPQUA RIVER , SOUTH UMPQUA | Crooked Cr | -122.6564 | 42.9663 | 12 | 0.00 | 12 | 0 |
| Umpqua | 2414 | UMPQUA RIVER , SOUTH UMPQUA | Black Canyon Cr | -122.6907 | 42.9453 | 26 | 0.00 | 26 | 12 |
| Umpqua | 2435 | UMPQUA RIVER, NORTH UMPQUA | Limpy Cr | -122.6783 | 43.2892 | 54 | 0.00 | 54 | 0 |
| Umpqua | 2474 | UMPQUA RIVER, NORTH UMPQUA | Cavitt Cr | -122.9934 | 43.1511 | 27 | 0.00 | 27 | 0 |
| Umpqua | 2518 | UMPQUA RIVER , SOUTH UMPQUA | Shively Cr, E Fk | -123.1276 | 42.8858 | 1 | 0.00 | 1 | 0 |
| Umpqua | 2587 | UMPQUA RIVER , SOUTH UMPQUA | N Myrtle Cr | -123.2121 | 43.0483 | 21 | 0.32 | 21 | 100 |
| South Coast | 20 | ROGUE RIVER , MAIN STEM | Grave Cr | -123.2312 | 42.6438 | 8 | 0.00 | 8 | 0 |
| South Coast | 36 | ROGUE RIVER , MAIN STEM | Grave Cr | -123.1686 | 42.6994 | 15 | 0.00 | 15 | 0 |
| South Coast | 37 | ROGUE RIVER , MAIN STEM | Grave Cr | -123.1700 | 42.6962 | 12 | 0.00 | 12 | 0 |
| South Coast | 53 | ROGUE RIVER , MAIN STEM | Sugarpine Cr | -122.6829 | 42.8295 | 18 | 0.51 | 18 | 89 |
| South Coast | 74 | ROGUE RIVER , MAIN STEM | Flat Cr | -122.7145 | 42.7653 | 18 | 2.84 | 18 | 100 |
| South Coast | 122 | ROGUE RIVER, BIG BUTTE CREEK | Big Butte Cr, N Fk | -122.5363 | 42.5529 | 14 | 0.13 | 14 | 86 |
| South Coast | 134 | ROGUE RIVER, BIG BUTTE CREEK | Big Butte Cr, N Fk | -122.4976 | 42.5528 | 6 | 0.00 | 6 | 0 |
| South Coast | 144 | ROGUE RIVER , MAIN STEM | Trail Cr, W Fk | -122.8816 | 42.7031 | 5 | 0.68 | 5 | 100 |
| South Coast | 256 | ROGUE RIVER , MAIN STEM | Jumpoff Joe Cr | -123.3872 | 42.5441 | 6 | 0.26 | 6 | 83 |
| South Coast | 273 | ROGUE RIVER , MAIN STEM | Grave Cr | -123.4201 | 42.6377 | 9 | 0.00 | 9 | 0 |
| South Coast | 309 | ROGUE RIVER , MAIN STEM | Jumpoff Joe Cr | -123.4832 | 42.5235 | 1 | 0.00 | 1 | 0 |
| South Coast | 336 | ROGUE RIVER , MAIN STEM | Shasta Costa Cr | -123.9939 | 42.5830 | 12 | 0.00 | 12 | 0 |
| South Coast | 338 | ROGUE RIVER , MAIN STEM | Shasta Costa Cr | -123.9807 | 42.5875 | 13 | 0.00 | 13 | 0 |
| South Coast | 383 | ROGUE RIVER , MAIN STEM | Billings Cr | -124.0498 | 42.6478 | 29 | 0.67 | 29 | 21 |
| South Coast | 397 | ROGUE RIVER, LOBSTER CREEK | Lobster Cr | -124.2955 | 42.5175 | 9 | 0.00 | 9 | 22 |

Appendix A (continued).

| Monitoring Area | Site | Basin Name, Subbasin Name | Reach | Longitude (decimal degrees) | Latitude (decimal degrees) | Number of Pools Sampled for Density | Juvenile Coho Density (fish/m2) | Number of Pools Sampled for Percent Occurrence | Percentage of Pools Containing Juvenile Coho |
|---|---|---|---|---|---|---|---|---|---|
| South Coast | 399 | ROGUE RIVER, LOBSTER CREEK | Lobster Cr | -124.2551 | 42.5999 | 11 | 0.01 | 11 | 45 |
| South Coast | 410 | ROGUE RIVER, LOBSTER CREEK | Lobster Cr, N Fk | -124.2476 | 42.6285 | 14 | 0.00 | 14 | 0 |
| South Coast | 415 | ROGUE RIVER, LOBSTER CREEK | Lobster Cr, N Fk | -124.2422 | 42.6340 | 15 | 0.00 | 15 | 0 |
| South Coast | 453 | ROGUE RIVER, ILLINOIS RIVER | Fall Cr | -123.7722 | 42.3008 | 11 | 0.03 | 11 | 9 |
| South Coast | 486 | ROGUE RIVER, APPLEGATE RIVER | Williams Cr, W Fk | -123.3248 | 42.1953 | 16 | 0.45 | 16 | 75 |
| South Coast | 505 | ROGUE RIVER, ILLINOIS RIVER | Althouse Cr | -123.5397 | 42.1130 | 14 | 1.15 | 14 | 100 |
| South Coast | 548 | ROGUE RIVER, ILLINOIS RIVER | Little Grayback Cr | -123.4765 | 42.1592 | 16 | 1.35 | 16 | 100 |
| South Coast | 577 | ROGUE RIVER, ILLINOIS RIVER | Illinois R, W Fk | -123.7660 | 42.0118 | 32 | 0.87 | 32 | 100 |
| South Coast | 594 | ROGUE RIVER, ILLINOIS RIVER | Illinois R, W Fk | -123.7701 | 42.0024 | 24 | 0.29 | 24 | 88 |
| South Coast | 623 | ROGUE RIVER , MAIN STEM | Little Butte Cr, S Fk | -122.4914 | 42.3599 | 12 | 1.16 | 12 | 67 |
| South Coast | 629 | ROGUE RIVER , MAIN STEM | Soda Cr | -122.5085 | 42.3526 | 27 | 0.58 | 27 | 56 |
| South Coast | 631 | ROGUE RIVER , MAIN STEM | Little Butte Cr, S Fk | -122.5334 | 42.3561 | 11 | 1.39 | 11 | 100 |
| South Coast | 706 | ROGUE RIVER , MAIN STEM | Louse Cr | -123.2730 | 42.4963 | 9 | 0.00 | 9 | 0 |
| South Coast | 722 | ROGUE RIVER , MAIN STEM | Louse Cr | -123.3407 | 42.4949 | 3 | 0.00 | 3 | 0 |
| South Coast | 745 | ROGUE RIVER, APPLEGATE RIVER | Williams Cr | -123.2501 | 42.2620 | 9 | 0.22 | 9 | 100 |
| South Coast | 781 | ROGUE RIVER, APPLEGATE RIVER | Williams Cr, E Fk | -123.2606 | 42.1785 | 8 | 0.00 | 8 | 0 |
| South Coast | 828 | ROGUE RIVER, APPLEGATE RIVER | Cedar Log Cr | -123.5966 | 42.3981 | 1 | 0.00 | 1 | 0 |
| South Coast | 834 | ROGUE RIVER , MAIN STEM | Shan Cr | -123.5051 | 42.4535 | 15 | 0.01 | 15 | 27 |

Appendix B. Estimated number of juvenile salmonids and physical characteristics of sites sampled by electrofishing in Smith River, summer 2001. See Figure 23 for location of sample sites.

| Site | Number of Coho | Number of Cutthroat ≥90 mm | Number of Steelhead ≥90 mm | Number of trout <90 mm | Site Length (m) | Wetted Surface Area ($m^2$) | Average Wetted Width (m) | Maximum Depth (cm) | Dry Channel Length (m) | Glide Length (m) | Glide Surface Area ($m^2$) | Number of Glides | Pool Length (m) | Pool Surface Area (m2) | Number of Pools | Riffle/ Rapid Length (m) | Riffle/ Rapid Surface Area (m2) | Number of Riffles/ Rapids | % Silt/ Sand | % Gravel | % Cobble/ Boulder | % Bedrock |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 73 | 64 | 2 | 0 | 1 | 44.3 | 25.9 | 1.3 | 35 | 24.4 | 0.0 | 0.0 | 0 | 19.9 | 25.9 | 4 | 0.0 | 0 | 0 | 43.5 | 27.3 | 29.2 | 0.0 |
| 74 | 0 | 11 | 0 | 0 | 70.0 | 210.3 | 3.1 | 100 | 0.0 | 0.0 | 0.0 | 0 | 70 | 210.3 | 6 | 0.0 | 0.0 | 0 | 71.5 | 23.3 | 5.1 | 0.0 |
| 75 | 0 | 0 | 0 | 0 | 50.0 | 0.0 | 0.0 | 0 | 50.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 77 | 47 | 29 | 0 | 64 | 141.6 | 406.2 | 2.4 | 71 | 0.0 | 0.0 | 0.0 | 0 | 104.7 | 346.5 | 5 | 36.9 | 59.7 | 3 | 44.2 | 37.0 | 18.8 | 0.0 |
| 78 | 0 | 0 | 0 | 0 | 30.0 | 0.0 | 0.0 | 0 | 30.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 79 | 0 | 0 | 0 | 0 | 34.6 | 14.2 | 0.7 | 20 | 4.3 | 10.5 | 7.3 | 1 | 1.8 | 2.7 | 1 | 18.0 | 4.2 | 1 | 51.4 | 22.3 | 23.8 | 2.6 |
| 80 | 78 | 0 | 0 | 3 | 67.9 | 109.6 | 1.7 | 30 | 3.7 | 0.0 | 0.0 | 0 | 34.6 | 82.4 | 3 | 29.6 | 27.2 | 3 | 34.6 | 41.7 | 20.4 | 3.3 |
| 81 | 0 | 0 | 0 | 0 | 34.0 | 0.0 | 0.0 | 0 | 34.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 82 | 0 | 4 | 0 | 1 | 27.0 | 32.7 | 1.2 | 50 | 0.0 | 0.0 | 0.0 | 0 | 13.7 | 23.1 | 3 | 13.3 | 9.5 | 2 | 81.2 | 7.3 | 9.9 | 1.6 |
| 83 | 754 | 7 | 38 | 114 | 104.4 | 510.2 | 4.5 | 58 | 0.0 | 0.0 | 0.0 | 0 | 54.5 | 261.7 | 2 | 49.9 | 248.5 | 2 | 13.7 | 29.2 | 48.4 | 8.7 |
| 84 | 19 | 4 | 0 | 4 | 52.9 | 91.6 | 1.9 | 35 | 0.0 | 0.0 | 0.0 | 0 | 17 | 40.3 | 3 | 35.9 | 51.3 | 2 | 22.0 | 42.0 | 36.0 | 0.0 |
| 85 | 0 | 4 | 0 | 11 | 53.2 | 69.9 | 1.1 | 43 | 3.6 | 0.0 | 0.0 | 0 | 36 | 60.8 | 7 | 13.6 | 9.1 | 4 | 76.0 | 16.8 | 7.2 | 0.0 |
| 86 | 96 | 10 | 10 | 120 | 178.8 | 1155.3 | 6.3 | 73 | 0.0 | 0.0 | 0.0 | 0 | 88.4 | 533.6 | 6 | 90.4 | 621.8 | 5 | 17.4 | 15.7 | 30.8 | 36.0 |
| 87 | 177 | 2 | 0 | 1 | 77.1 | 147.3 | 2.0 | 23 | 0.0 | 0.0 | 0.0 | 0 | 37.2 | 87.8 | 3 | 39.9 | 59.5 | 2 | 34.0 | 24.7 | 20.7 | 20.6 |
| 88 | 0 | 10 | 1 | 4 | 101.3 | 236.5 | 2.4 | 50 | 0.0 | 0.0 | 0.0 | 0 | 44.6 | 102.1 | 6 | 56.7 | 134.4 | 4 | 22.7 | 30.9 | 39.9 | 6.6 |
| 89 | 0 | 2 | 0 | 2 | 47.8 | 21.5 | 0.9 | 60 | 23.6 | 0.0 | 0.0 | 0 | 7.5 | 9.4 | 3 | 16.7 | 12.1 | 3 | 27.5 | 38.7 | 33.8 | 0.0 |
| 90 | 0 | 0 | 0 | 2 | 94.0 | 160.4 | 2.1 | 45 | 0.0 | 10.1 | 24.9 | 1 | 15.4 | 43.5 | 2 | 68.5 | 92.0 | 2 | 5.7 | 6.1 | 1.8 | 86.5 |
| 91 | 413 | 29 | 55 | 214 | 275.7 | 2198.1 | 7.2 | 73 | 0.0 | 0.0 | 0.0 | 0 | 242.2 | 1923.2 | 8 | 33.5 | 274.9 | 2 | 17.2 | 33.9 | 28.5 | 20.5 |
| 92 | 0 | 0 | 0 | 0 | 22.6 | 14.5 | 0.7 | 15 | 0.0 | 0.0 | 0.0 | 0 | 1.4 | 1.1 | 1 | 21.2 | 13.4 | 1 | 38.5 | 36.9 | 24.6 | 0.0 |
| 93 | 288 | 23 | 2 | 6 | 126.8 | 703.7 | 5.2 | 62 | 0.0 | 0.0 | 0.0 | 0 | 115.8 | 664.1 | 6 | 11.0 | 39.6 | 1 | 81.8 | 10.0 | 8.2 | 0.0 |
| 94 | 226 | 11 | 23 | 111 | 299.1 | 3567.2 | 12.5 | 112 | 0.0 | 0.0 | 0.0 | 0 | 213.1 | 2395.7 | 5 | 86.0 | 1171.5 | 2 | 13.7 | 10.9 | 33.3 | 42.1 |
| 95 | 658 | 23 | 19 | 61 | 202.9 | 1002.3 | 4.8 | 46 | 0.0 | 0.0 | 0.0 | 0 | 105 | 538.3 | 8 | 97.9 | 464.0 | 7 | 14.8 | 11.1 | 22.6 | 51.5 |
| 96 | 0 | 3 | 0 | 0 | 31.1 | 16.2 | 0.7 | 25 | 6.0 | 0.0 | 0.0 | 0 | 7.9 | 8.8 | 4 | 17.2 | 7.4 | 4 | 57.8 | 31.9 | 10.3 | 0.0 |
| 97 | 14 | 6 | 0 | 0 | 57.0 | 52.8 | 1.4 | 43 | 20.7 | 0.0 | 0.0 | 0 | 36.3 | 52.8 | 5 | 0.0 | 0.0 | 0 | 76.3 | 22.8 | 0.9 | 0.0 |
| 99 | 0 | 0 | 0 | 0 | 30.0 | 0.0 | 0.0 | 0 | 30.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 100 | 0 | 9 | 0 | 8 | 40.4 | 21.4 | 0.7 | 37 | 9.9 | 0.0 | 0.0 | 0 | 16.6 | 15.0 | 3 | 13.9 | 6.4 | 2 | 61.6 | 38.4 | 0.0 | 0.0 |
| 101 | 0 | 0 | 0 | 0 | 19.5 | 10.7 | 0.7 | 6 | 2.4 | 0.0 | 0.0 | 0 | 1.6 | 1.4 | 1 | 15.5 | 9.3 | 1 | 30.7 | 34.6 | 34.6 | 0.0 |
| 102 | 153 | 23 | 30 | 307 | 222.4 | 2412.2 | 11.0 | 95 | 0.0 | 0.0 | 0.0 | 0 | 100.7 | 1071.9 | 5 | 121.7 | 1340.3 | 3 | 17.3 | 4.8 | 11.2 | 66.7 |
| 103 | 235 | 2 | 4 | 74 | 81.8 | 831.1 | 10.1 | 80 | 0.0 | 0.0 | 0.0 | 0 | 81.8 | 831.1 | 5 | 0.0 | 0.0 | 0 | 20.9 | 12.3 | 9.0 | 57.8 |
| 105 | 239 | 3 | 7 | 21 | 167.8 | 809.9 | 4.4 | 52 | 0.0 | 0.0 | 0.0 | 0 | 137.3 | 687.2 | 7 | 30.5 | 122.7 | 4 | 22.6 | 47.3 | 24.7 | 5.4 |
| 107 | 0 | 19 | 4 | 11 | 72.4 | 150.8 | 2.1 | 59 | 0.0 | 0.0 | 0.0 | 0 | 51.3 | 107.3 | 5 | 21.1 | 43.4 | 4 | 40.5 | 31.6 | 27.9 | 0.0 |
| 108 | 372 | 22 | 4 | 28 | 100.0 | 279.6 | 2.7 | 39 | 0 | 0.0 | 0.0 | 0 | 26.1 | 77.2 | 3 | 73.9 | 202.4 | 4 | 22.6 | 17.8 | 17.6 | 42.0 |

Appendix C. Number of pools snorkeled, fish observed, and density of juvenile coho, cutthroat and steelhead based on snorkel surveys in Smith River, summer 2001. See Figure 39 for location of sample sites.

| Site | Number of Pools Snorkeled | Number of Fish Observed | | | | Adjusted Counts | | Average Fish/m² | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Coho | Cutthroat ≥90 mm | Steelhead ≥90 mm | Unknown Trout ≥90 mm | Cutthroat[a] >90 mm | Steelhead[b] >90 mm | Coho | Cutthroat ≥90 mm | Steelhead[c] ≥90 mm |
| 73 | 2 | 7 | 1 | 0 | 4 | 3 | 2 | 0.2083 | 0.1265 | 0.0739 |
| 77 | 26 | 182 | 18 | 25 | 16 | 27 | 32 | 0.0966 | 0.0148 | 0.0166 |
| 80 | 3 | 21 | 1 | 0 | 0 | 1 | 0 | 0.3045 | 0.0119 | 0.0000 |
| 82 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0.0000 | 0.1111 | 0.0000 |
| 83 | 27 | 4171 | 68 | 88 | 31 | 86 | 101 | 1.9352 | 0.0388 | 0.0402 |
| 85 | 2 | 0 | 1 | 0 | 1 | 2 | 0 | 0.0000 | 0.0746 | 0.0206 |
| 86 | 21 | 225 | 1 | 0 | 5 | 4 | 2 | 0.0703 | 0.0013 | 0.0008 |
| 87 | 6 | 154 | 0 | 2 | 0 | 0 | 2 | 1.0990 | 0.0000 | 0.0113 |
| 88 | 30 | 0 | 76 | 0 | 16 | 85 | 7 | 0.0000 | 0.1249 | 0.0107 |
| 89 | 2 | 0 | 1 | 0 | 1 | 2 | 0 | 0.0000 | 0.1211 | 0.0289 |
| 90 | 13 | 0 | 13 | 2 | 4 | 15 | 4 | 0.0000 | 0.0862 | 0.0198 |
| 91 | 27 | 427 | 7 | 27 | 28 | 23 | 39 | 0.0824 | 0.0053 | 0.0123 |
| 93 | 10 | 196 | 4 | 2 | 6 | 7 | 5 | 0.2558 | 0.0068 | 0.0056 |
| 94 | 17 | 440 | 11 | 2 | 6 | 14 | 5 | 0.0953 | 0.0023 | 0.0014 |
| 95 | 18 | 1951 | 20 | 12 | 8 | 24 | 16 | 0.7963 | 0.0116 | 0.0092 |
| 97 | 2 | 1 | 2 | 0 | 2 | 3 | 1 | 0.0238 | 0.1084 | 0.0464 |
| 98 | 7 | 125 | 6 | 0 | 1 | 7 | 0 | 0.7947 | 0.0417 | 0.0019 |
| 102 | 19 | 220 | 2 | 50 | 32 | 20 | 64 | 0.1233 | 0.0100 | 0.0479 |
| 103 | 2 | 119 | 2 | 10 | 7 | 6 | 13 | 0.2646 | 0.0133 | 0.0290 |
| 105 | 6 | 64 | 0 | 0 | 0 | 0 | 0 | 0.0996 | 0.0000 | 0.0000 |
| 107 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0.0351 | 0.0199 | 0.0152 |
| 108 | 17 | 90 | 51 | 6 | 24 | 65 | 16 | 0.3151 | 0.1894 | 0.0596 |
| 400 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0000 | 0.0000 | 0.0000 |
| 600 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0.0010 | 0.0000 | 0.0000 |
| 1000 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.0001 | 0.0000 | 0.0000 |
| 1100 | 13 | 1 | 1 | 0 | 0 | 1 | 0 | 0.0003 | 0.0003 | 0.0000 |
| 2500 | 24 | 54 | 0 | 0 | 3 | 2 | 1 | 0.0157 | 0.0004 | 0.0003 |
| 2600 | 19 | 29 | 3 | 0 | 3 | 5 | 1 | 0.0266 | 0.0075 | 0.0005 |
| 2800 | 26 | 88 | 0 | 1 | 1 | 7 | 1 | 0.0129 | 0.0000 | 0.0003 |
| 3200 | 17 | 184 | 4 | 0 | 0 | 4 | 0 | 0.0244 | 0.0003 | 0.0000 |
| 3300 | 10 | 167 | 0 | 0 | 1 | 1 | 0 | 0.0354 | 0.0001 | 0.0001 |
| 3500 | 16 | 201 | 1 | 0 | 0 | 1 | 0 | 0.0494 | 0.0001 | 0.0000 |
| 3600 | 16 | 190 | 5 | 0 | 0 | 5 | 0 | 0.0377 | 0.0006 | 0.0000 |
| 3900 | 12 | 340 | 7 | 0 | 1 | 8 | 0 | 0.1042 | 0.0021 | 0.0003 |
| 4000 | 16 | 506 | 9 | 0 | 3 | 11 | 1 | 0.1171 | 0.0031 | 0.0005 |
| 4100 | 7 | 470 | 6 | 0 | 1 | 7 | 0 | 0.0959 | 0.0009 | 0.0001 |
| 4200 | 3 | 124 | 0 | 0 | 0 | 0 | 0 | 0.0498 | 0.0000 | 0.0000 |
| 4300 | 10 | 530 | 1 | 0 | 5 | 4 | 2 | 0.1346 | 0.0033 | 0.0024 |

[a]Adjusted cutthroat = observed cutthroat + (unknown trout x .567)
[b]Adjusted steelhead = observed steelhead + (unknown trout x .433)
[c]Some sites will show a density of steelhead > 0 even though no steelhead are recorded for under the adjusted steelhead count category. This is because the adjusted counts are rounded to the nearest whole number, while the density estimates where obtained averaging the non-rounded adjusted counts for each pool snorkeled.