

# THE OREGON PLAN *for* *Salmon and* *Watersheds*



**Abundance Monitoring of Juvenile Salmonids  
In Coastal Oregon and Lower Columbia  
Streams, 2009**

**Report Number: OPSW-ODFW-2010-1**



The Oregon Department of Fish and Wildlife prohibits discrimination in all of its programs and services on the basis of race, color, national origin, age, sex or disability. If you believe that you have been discriminated against as described above in any program, activity, or facility, please contact the ADA Coordinator, 3406 Cherry Avenue NE, Salem, OR 97303, 503-947-6000.

This material will be furnished in alternate format for people with disabilities if needed. Please call (541) 757-4263 to request.

**Juvenile Salmonid Monitoring in Coastal Oregon and Lower Columbia Streams,  
2009**

**Oregon Plan for Salmon and Watersheds**

**Annual Monitoring Report No. OPSW-ODFW-2010-1**

Erik Suring and Ronald J. Constable, Jr.  
Western Oregon Rearing Project  
Oregon Department of Fish and Wildlife  
28655 Highway 34  
Corvallis, OR 97333

**Citation:** Suring, E., and R. J. Constable, Jr. 2010. Abundance Monitoring of Juvenile Salmonids in Coastal Oregon and Lower Columbia Streams, 2009. Monitoring Program Report Number OPSW-ODFW-2010-1, Oregon Department of Fish and Wildlife, Salem.



## CONTENTS

Figures .....	i
Tables .....	i
Summary .....	1
Introduction and Methods .....	1
Results .....	3
Survey Effort and Resurveys.....	3
Salmonid Distribution and Density .....	5
References.....	10

## FIGURES

Figure 1. The spatial extent of the study area showing the Oregon portion of coho and steelhead ESU/DPSs as well as the monitoring areas in the Oregon Coast and KMP/SONC. ....	2
Figure 2. The relationship between original snorkel counts for juvenile coho and steelhead in pools and the resurvey of the same sites in 2009 (n=32). The dotted line indicates a 1:1 relationship. Data are log transformed to satisfy regression assumptions. ....	4
Figure 3. Average coho density CDFs from snorkeled tributary sites for the four monitoring areas of the Oregon Coast Coho ESU comparing 2009 with the average from 1998-2008. P values are for the comparison test of the two curves. The three points shown on the curves, from left to right, are the percentage of unoccupied sites, the median density, and the percentage of sites below 0.7 coho/m <sup>2</sup> (full seeding). ....	6
Figure 4. Annual trend in abundance and frequency metrics for juvenile coho salmon in the Oregon Coast Coho ESU, based on snorkel surveys in 1 <sup>st</sup> -3 <sup>rd</sup> order stream reaches. Panels are organized by monitoring strata. Gray bars are for mean density (coho/meter <sup>2</sup> ) and black symbols are for % of sites with fish density >0.7 fish/meter <sup>2</sup> . ....	9

## TABLES

Table 1. Site status by monitoring area and stream order. Target sites fell within rearing habitat; snorkeled and electrofished sites were successfully surveyed and non-response sites were not surveyed because of issues such as lack of landowner permission, site inaccessibility, or turbidity. Non-target sites are outside of coho and steelhead rearing habitat.....	3
Table 2. Distribution and density estimates for juvenile coho salmon in western Oregon streams summer 2009. Distribution metrics are calculated from snorkeled and electrofished sites whereas density metrics are calculated from only snorkeled sites.....	5
Table 3. Distribution and density estimates for juvenile steelhead in western Oregon streams summer 2009. Distribution metrics are calculated from snorkeled and electrofished sites whereas density metrics are calculated from only snorkeled sites.....	7

## SUMMARY

This report provides a summary of results from summer juvenile salmonid surveys conducted on the Oregon coast and lower Columbia River in 2009. Coho density and occupancy metrics were highest Oregon Coast coho ESU intermediate in the Southern Oregon Northern California coho ESU and lowest in the Lower Columbia coho ESU. Within the Oregon Coast Coho ESU the North Coast and Umpqua Monitoring Area metrics were similar to the average since 1998, while the Mid South and Mid Coast were higher. Juvenile steelhead estimates were comparable to previous years in all DPSs, with steelhead the most abundant and widespread in the Klamath Mountains Province.

## INTRODUCTION AND METHODS

As part of the Oregon Plan for Salmon and Watersheds, the Oregon Department of Fish and Wildlife (ODFW) initiated this project in 1998 to monitor the status and trend in abundance and distribution of juvenile coho salmon (*Oncorhynchus kisutch*) in coastal Oregon streams. This report summarizes the data collected during the summer of 2009 and, for coho salmon, compares it to data previously collected.

The project originally surveyed only 1<sup>st</sup>-3<sup>rd</sup> order (tributary) streams but was expanded in 2002 to include juvenile steelhead (*Oncorhynchus mykiss*) rearing areas and in 2006 to the Oregon portion of the Lower Columbia River coho evolutionarily significant unit (ESU) (Figure 1). The sampling frame is intended to encompass all non-tidal coho and steelhead rearing habitat. The original 100k stream layer frame was replaced by a 24k frame in 2007. A Generalized Random Tessellation Stratified design (GRTS) (Stevens 2002) was used to create a spatially balanced, random point distribution. Sites were stratified by Monitoring Area (MA) and stream order (Table 1). A detailed description of the sampling frames and survey designs are found in Jepsen and Rodgers (2004) and Jepsen and Leader (2007). 4<sup>th</sup>-6<sup>th</sup> order (mainstem) streams are no longer being surveyed in the Oregon Coast coho ESU.

Field crews snorkeled all pools meeting the size criteria ( $\geq 6 \text{ m}^2$  in surface area and  $\geq 40 \text{ cm}$  in maximum depth) in one kilometer of stream encompassing the GRTS point. Snorkeling was conducted during the minimum flow period from July to September using a single pass of one to six snorkelers, depending on stream width. In each pool counts were made of juvenile coho, Chinook, steelhead  $\geq 90 \text{ mm}$ , and cutthroat  $\geq 90 \text{ mm}$ . Presence was noted for dace, shiners, and trout  $< 90 \text{ mm}$ . Sites with poor water clarity or quality were electrofished using a single pass without block nets to determine presence for coho, steelhead and cutthroat in each pool. To assess repeatability and quality control supervisory staff resurveyed  $\geq 10\%$  of tributary sites in each MA.

Data are summarized by MA and stream order for analysis. Average pool density and percent pool occupancy for each site is averaged by MA. The percent of sites with at least one fish and with  $>0.7 \text{ coho/m}^2$  are reported for each MA.  $0.7 \text{ coho/m}^2$  is regarded as full seeding after Nickelson et al. (1992) who reported full seeding based on electrofishing as  $1.0 \text{ coho/m}^2$  and Rodgers et al. (1992) who found that snorkelers observed 70% of the coho counted by electrofishing. CDFs, variances, and confidence intervals were created using tools developed by the EMAP Design and Analysis Team (EPA 2009).

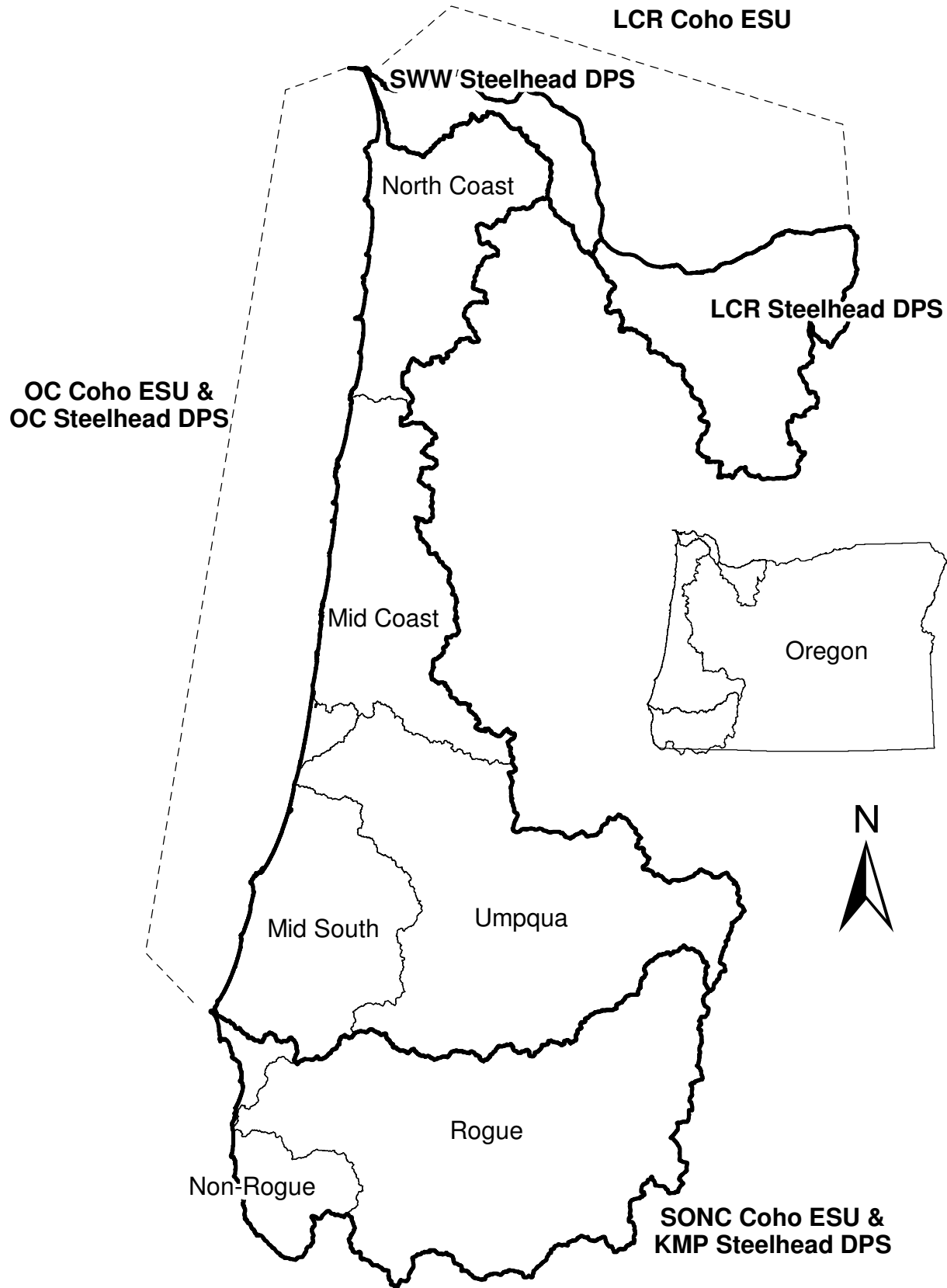


Figure 1. The spatial extent of the study area showing the Oregon portion of coho and steelhead ESU/DPSs as well as the monitoring areas in the Oregon Coast and KMP/SONC.

## RESULTS

### Survey Effort and Resurveys

We snorkeled 5,040 pools at 278 sites in 1<sup>st</sup>-3<sup>rd</sup> order reaches and 192 pools at 30 sites in 4<sup>th</sup>-6<sup>th</sup> order reaches. In addition, we electrofished 340 pools at 28 sites in 1<sup>st</sup>-3<sup>rd</sup> order reaches. The 95% confidence interval for monitoring area density estimates for coho was below or near the target of  $\pm 30\%$  for all Oregon Coast MA but not for the Lower Columbia or South Coast. Steelhead survey variance was higher than coho and the goal of  $\pm 30\%$  for the density estimate 95% confidence interval was only met in the North Coast and Rogue MAs. Sixty four percent of the total selected sites were successfully surveyed (Table 1). Ten percent coast-wide were not surveyed because of landowner access restrictions with the Mid South Coast having the highest proportion of access denials.

Thirty two (12%) of the snorkeled 1<sup>st</sup>-3<sup>rd</sup> order sites, comprising 730 pools, were resurveyed by crew leaders. The strong relationship between counts in the original surveys and resurveys (Figure 2, coho  $R^2=0.99$ ) indicates the counts are precise and repeatable. Steelhead counts were more variable ( $R^2=0.68$ ). Resurveying was also an important part of the training process, identifying fish ID or counting problems.

Table 1. Site status by monitoring area and stream order. Target sites fell within rearing habitat; snorkeled and electrofished sites were successfully surveyed and non-response sites were not surveyed because of issues such as lack of landowner permission, site inaccessibility, or turbidity. Non-target sites are outside of coho and steelhead rearing habitat.

Monitoring Area	Stratum	Snorkeled	Electrofished	Target	
				Non-response	Non-target
North Coast	1-3 Order	34	4	17	3
Mid Coast	1-3 Order	44	1	7	4
Mid South	1-3 Order	34	4	18	5
Umpqua	1-3 Order	35	5	10	9
Lower Columbia	1-3 Order Coastal	26	10	16	3
Lower Columbia	1-3 Order Cascade	21	3	18	8
Lower Columbia	4-6 Order Cascade	8	0	11	0
South Coast Coho	1-3 Order	30	0	8	2
Rogue Steelhead	1-3 Order	23	0	8	4
Rogue Steelhead	4-6 Order	13	0	4	0
Non-Rogue Sthd	1-3 Order	31	1	9	2
Non-Rogue Sthd	4-6 Order	7	0	1	0



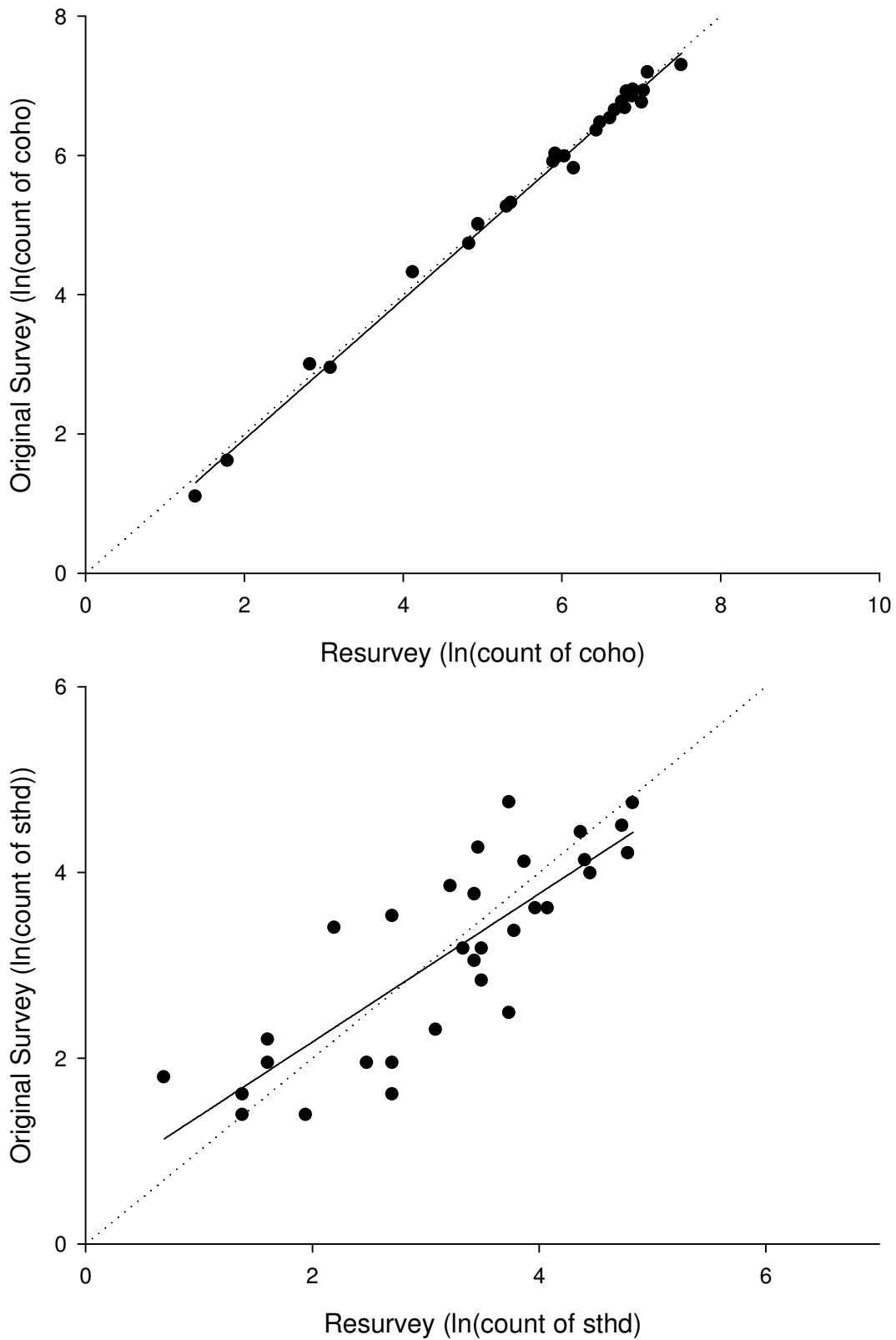


Figure 2. The relationship between original snorkel counts for juvenile coho and steelhead in pools and the resurvey of the same sites in 2009 (n=32). The dotted line indicates a 1:1 relationship. Data are log transformed to satisfy regression assumptions.

## Salmonid Distribution and Density

### ***Oregon Coast Coho***

Coho occurred in 76% of 1<sup>st</sup>-3<sup>rd</sup> order stream sites and, as in previous years, were less widespread in the Umpqua and North Coast than in other MAs (Table 2). Average pool occupancy was 65% and the Mid Coast had the highest occupancy rate. Mean average pool density was 0.60 coho/m<sup>2</sup> and 32% of sites had densities greater than 0.70 coho/m<sup>2</sup>. Densities at the MA level were similar except the Mid South was higher than the Umpqua.

Coho distribution and density were similar in the North Coast and Umpqua and greater in the Mid Coast and Mid South compared to the average condition from 1998-2008 (Figure 3). The North Coast and Mid Coast show an increasing trend since the beginning of monitoring whereas there is no trend apparent in the Mid South or Umpqua. The appearance of trend is linked to the increase in parental spawner abundance over this period. When the first four years of low spawner abundance are removed there is no trend in any MA (Figure 4).

### ***Southern Oregon Northern California Coho***

Coho occurred in 70% of the sites in the SONCC and mean pool occupancy was 44% (Table 2). The average coho density in pools was 0.37 fish/m<sup>2</sup> with four sites (13%) supporting > 0.7 fish/m<sup>2</sup>.

### ***Lower Columbia Coho***

Coho occurred in 33% of 1<sup>st</sup>-3<sup>rd</sup> order stream reaches, mean pool occupancy was only 22%, and mean average density was low at 0.068 fish/m<sup>2</sup> (Table 2). No sites exceeded an average density of 0.7 fish/m<sup>2</sup>. Very few coho were observed in 4<sup>th</sup>-6<sup>th</sup> order sites.

Table 2. Distribution and density estimates for juvenile coho salmon in western Oregon streams summer 2009. Distribution metrics are calculated from snorkeled and electrofished sites whereas density metrics are calculated from only snorkeled sites.

Monitoring Area	Distribution			Density		
	Site Occupancy	Mean Pool Occupancy	95% CI	Percent Sites > 0.7 coho/m <sup>2</sup>	Mean Average Pool Density (coho/m <sup>2</sup> )	95% CI
<i>1-3 Order Streams</i>						
North Coast	71%	59%	± 13%	32%	0.627	± 0.184
Mid Coast	91%	81%	± 8%	34%	0.578	± 0.162
Mid South	79%	69%	± 9%	44%	0.843	± 0.216
Umpqua	63%	51%	± 11%	26%	0.453	± 0.137
South Coast Coho	70%	44%	± 9%	13%	0.370	± 0.17
Lower Columbia	33%	22%	± 7%	0%	0.068	± 0.033
<i>4-6 Order Streams</i>						
Lower Columbia	25%	11%	± 14%	0%	0.000	± 0

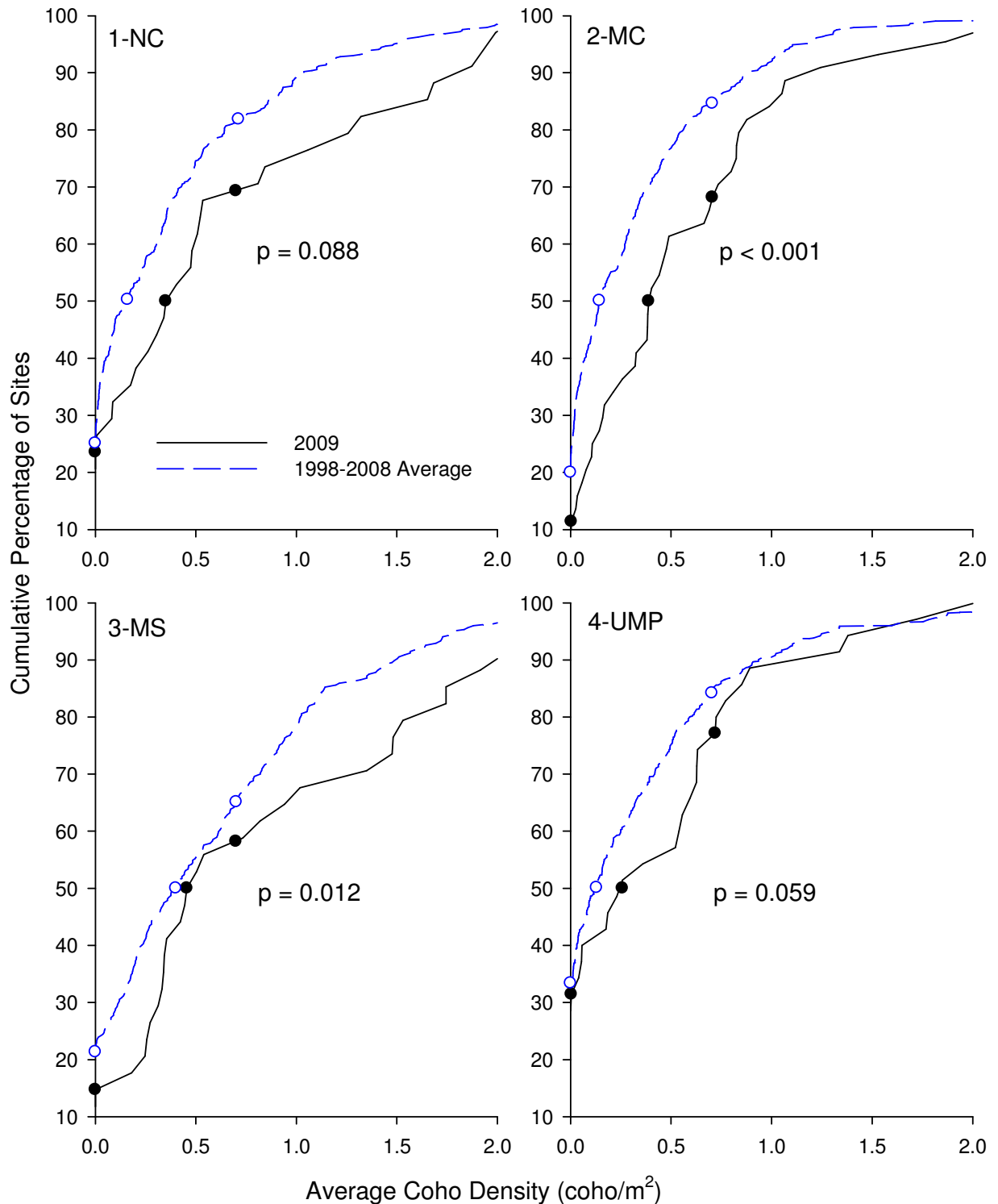


Figure 3. Average coho density CDFs from snorkeled tributary sites for the four monitoring areas of the Oregon Coast Coho ESU comparing 2009 with the average from 1998-2008. P values are for the comparison test of the two curves. The three points shown on the curves, from left to right, are the percentage of unoccupied sites, the median density, and the percentage of sites below 0.7 coho/m<sup>2</sup> (full seeding).

Table 3. Distribution and density estimates for juvenile steelhead in western Oregon streams summer 2009. Distribution metrics are calculated from snorkeled and electrofished sites whereas density metrics are calculated from only snorkeled sites.

Monitoring Area	Distribution			Density	
	Site Occupancy	Mean Pool Occupancy	95% CI	Mean Average Pool Density (sthd/m <sup>2</sup> )	95% CI
<i>1-3 Order Streams</i>					
North Coast	87%	61%	± 8%	0.093	± 0.024
Mid Coast	76%	34%	± 8%	0.044	± 0.018
Mid South	76%	35%	± 7%	0.029	± 0.011
Umpqua	53%	23%	± 7%	0.016	± 0.007
KMP Rogue	92%	60%	± 12%	0.086	± 0.028
KMP South Coast	94%	66%	± 10%	0.043	± 0.015
Lower Columbia	50%	21%	± 8%	0.015	± 0.009
Southwest WA	64%	35%	± 10%	0.027	± 0.012
<i>4-6 Order Streams</i>					
KMP Rogue	85%	66%	± 16%	0.021	± 0.014
KMP South Coast	100%	91%	± 5%	0.042	± 0.024
Lower Columbia	63%	36%	± 22%	0.000	± 0

### ***Oregon Coast Steelhead***

Juvenile steelhead occurred in 71% of 1<sup>st</sup>-3<sup>rd</sup> order sites. As in 2005-2008 pool occupancy was lowest in the Umpqua. Density was 0.043 fish/m<sup>2</sup> in 1<sup>st</sup>-3<sup>rd</sup> tributary streams. 4<sup>th</sup>-6<sup>th</sup> order mainstem streams were not surveyed in the Oregon Coast DPS.

### ***Klamath Mountain Province Steelhead***

Steelhead occurred in 93% of 1<sup>st</sup>-3<sup>rd</sup> order sites and 88% of 4<sup>th</sup>-6<sup>th</sup> sites of the Oregon portion of the Klamath Mountain Province steelhead DPS. Density averaged 0.069 fish/m<sup>2</sup> in tributary reaches and 0.025 fish/m<sup>2</sup> in mainstem reaches. The Rogue had higher tributary densities than the South Coast MA.

### ***Lower Columbia River/Southwest Washington Steelhead***

The Oregon portion of the two steelhead DPSs had similar density and distribution metrics (Table 3). No 4<sup>th</sup>-6<sup>th</sup> streams were surveyed in the Southwest Washington DPS. Very few steelhead were observed in the Lower Columbia River mainstem sites.

### ***ESU/DPS Comparisons***

The Oregon Coast coho ESU had the highest distribution and density estimates with the Southern Oregon Northern California ESU intermediate between the OCC and LCR ESUs. The Lower Columbia River ESU estimates were much lower for all metrics.

The Klamath Mountain Province steelhead DPS had the highest distribution and density estimates. The Oregon Coast and Southwest Washington DPSs had similar average pool occupancy and density estimates. The Lower Columbia River, while not statistically different from SWW, had lower estimates than the Oregon Coast.

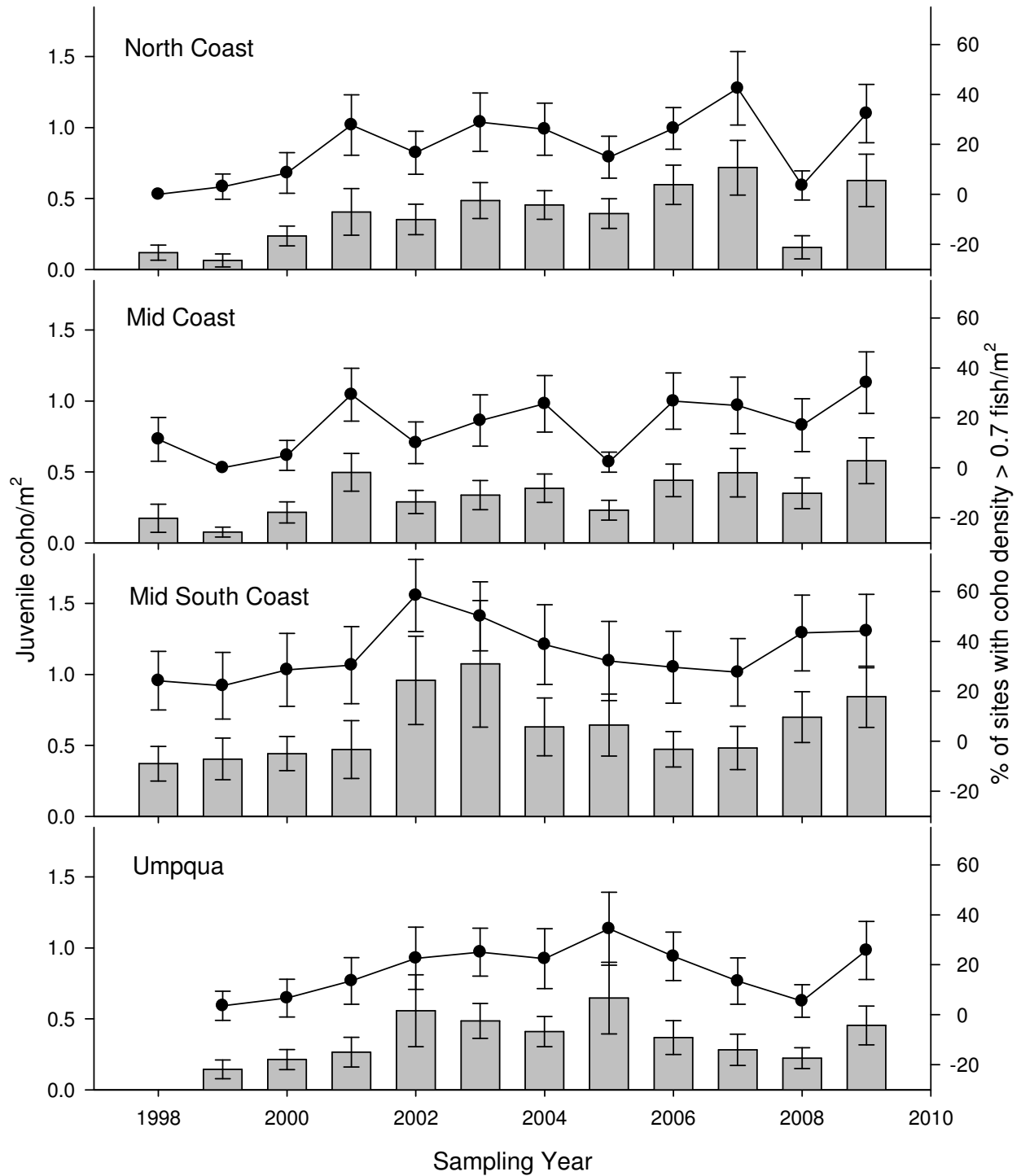


Figure 4. Annual trend in abundance and frequency metrics for juvenile coho salmon in the Oregon Coast Coho ESU, based on snorkel surveys in 1<sup>st</sup>-3<sup>rd</sup> order stream reaches. Panels are organized by monitoring strata. Gray bars are for mean density (coho/meter<sup>2</sup>) and black symbols are for % of sites with fish density > 0.7 fish/meter<sup>2</sup>.

## REFERENCES

- EPA. 2009. Aquatic Resource Monitoring. <http://www.epa.gov/nheerl/arm/>
- Jepsen, D. B. and K. Leader. 2007. Abundance monitoring of juvenile salmonids in Oregon coastal streams, 2006. Monitoring Program Report Number OPSW-ODFW-2007-1, Oregon Department of Fish and Wildlife, Salem.
- Jepsen, D. B. and J. D. Rodgers. 2004. Abundance monitoring of juvenile salmonids in Oregon coastal streams, 2002-2003. Monitoring Program Report Number OPSW-ODFW-2003-1, Oregon Department of Fish and Wildlife, Salem.
- Nickelson, T. E., J. D. Rodgers, S. L. Johnson, M. F. Solazzi. 1992. Seasonal changes in habitat use by juvenile coho salmon *Oncorhynchus kisutch* in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 49:783-789.
- Rodgers, J. D., M. F. Solazzi, S. L. Johnson, and M. A. Buckman. 1992. Comparison of three techniques to estimate juvenile coho salmon populations in small streams. North American Journal of Fisheries Management 12:79-86.
- 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.

