

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



**Abundance Monitoring of Juvenile Salmonids
In Coastal Oregon and Lower Columbia
Streams, 2008**

Report Number: OPSW-ODFW-2009-1



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**Juvenile Salmonid Monitoring in Coastal Oregon and Lower Columbia Streams,
2008**

Oregon Plan for Salmon and Watersheds

Annual Monitoring Report No. OPSW-ODFW-2009-1

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

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SUMMARY

This report provides a summary of results from summer juvenile salmonid surveys conducted on the Oregon coast and lower Columbia River in 2008. Density and occupancy metrics were comparable between the Oregon Coast Coho ESU and the Southern Oregon Northern California Coho ESU but the Lower Columbia Coho ESU estimates were lower for all metrics. Within the Oregon Coast Coho ESU the North Coast and Umpqua Monitoring Area densities were lower than the average since 1998, the Mid South was higher and the Mid Coast was average. 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 2008 and, for coho salmon, compares it to data previously collected.

The project originally surveyed only 1st-3rd order (tributary) streams but was expanded in 2002 to include juvenile steelhead (*Oncorhynchus mykiss*) and 4th-6th order (mainstem) 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).

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 four 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 were summarized by MA and stream order for analyses. Average pool density and percent pool occupancy for each site was 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 coho/m^2 is regarded as full seeding after Nickelson et al. (1992) who reported full seeding based on electrofishing as 1.0 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).

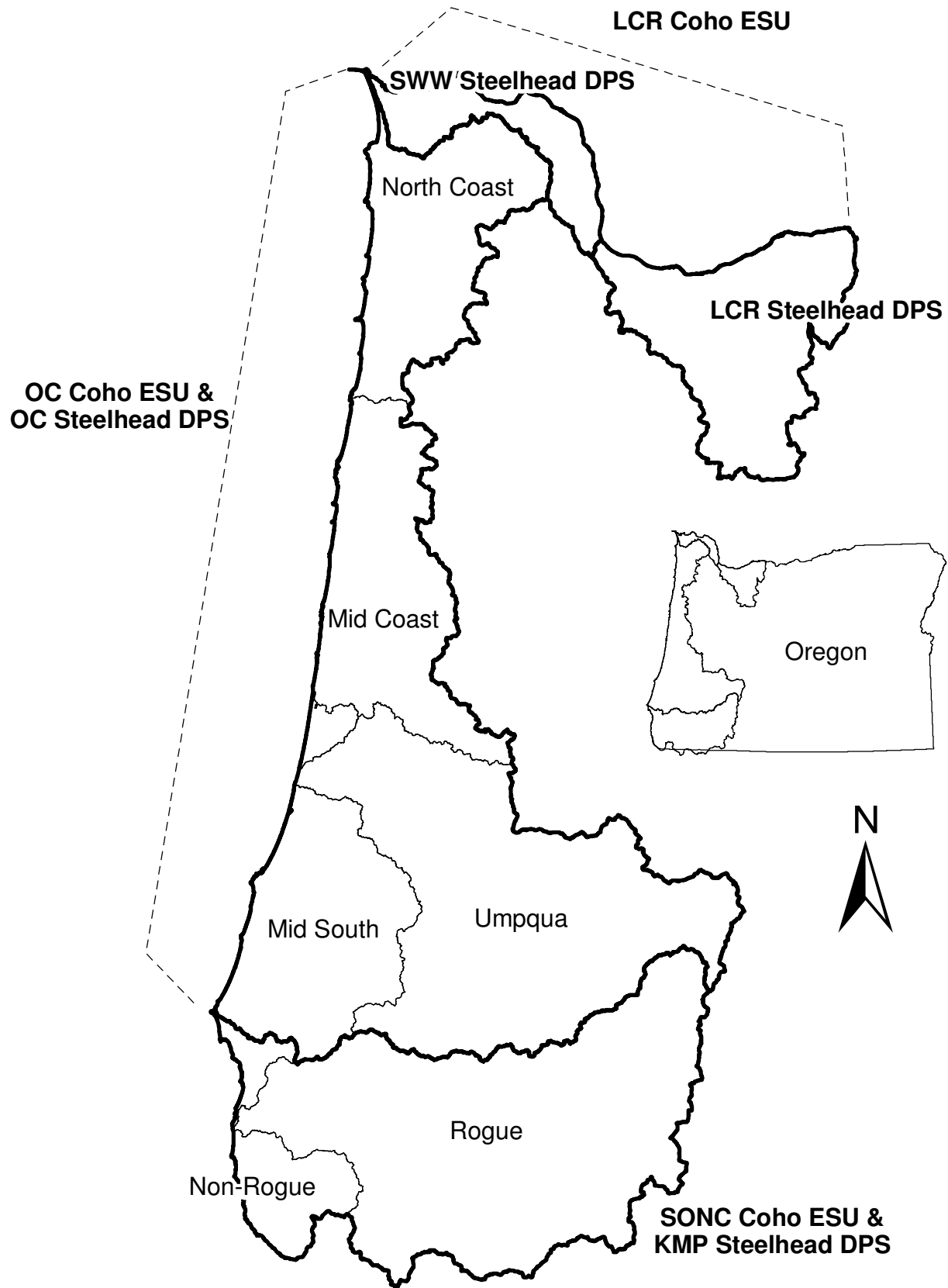


Figure 1. The spatial extent of the study area showing the Oregon portion of coho and steelhead ESU/DPSs as well as the monitoring areas in the Oregon Coast and KMP/SONC.

RESULTS

Survey Effort and Resurveys

We snorkeled 5,213 pools at 274 sites in 1st-3rd order reaches and 504 pools at 70 sites in 4th-6th order reaches. In addition, we electrofished 341 pools at 24 sites in 1st-3rd 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 except the North Coast 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 Non-Rogue MAs. Sixty two percent of the total selected sites were successfully surveyed (Table 1). Eight percent coast-wide were not surveyed because of landowner access restrictions with the Mid South Coast having the higher proportion of access denials. Six sites were dropped on the North Coast because of surveyor fish ID problems early in the season.

Thirty two (12%) of the snorkeled 1st-3rd order sites, comprising 628 pools, were resurveyed by crew leaders. The strong relationship between counts in the original surveys and resurveys (Figure 2, coho $R^2=0.99$, steelhead $R^2=0.94$) indicates the counts are precise and repeatable. Resurveying also helped identify fish ID problems with one crew at the start of the season.

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. *The Umpqua monitoring area includes snorkeled sites from the Smith River calibration study.

Monitoring Area	Stratum	Target		Target	
		Snorkeled	Electrofished	Non-response	Non-target
North Coast	1-3 Order	28	2	23	3
North Coast	4-6 Order	12	0	8	0
Mid Coast	1-3 Order	41	0	9	6
Mid Coast	4-6 Order	12	0	8	0
Mid South	1-3 Order	30	2	24	0
Mid South	4-6 Order	10	0	10	0
Umpqua*	1-3 Order	58	5	12	17
Umpqua*	4-6 Order	16	0	11	0
Lower Columbia	1-3 Order Coastal	17	9	21	5
Lower Columbia	1-3 Order Cascade	17	6	9	3
Lower Columbia	4-6 Order Cascade	7	0	9	0
South Coast Coho	1-3 Order	31	0	10	0
Rogue Steelhead	1-3 Order	18	0	9	8
Rogue Steelhead	4-6 Order	8	0	8	0
Non-Rogue Sthd	1-3 Order	34	0	9	1
Non-Rogue Sthd	4-6 Order	5	0	3	0

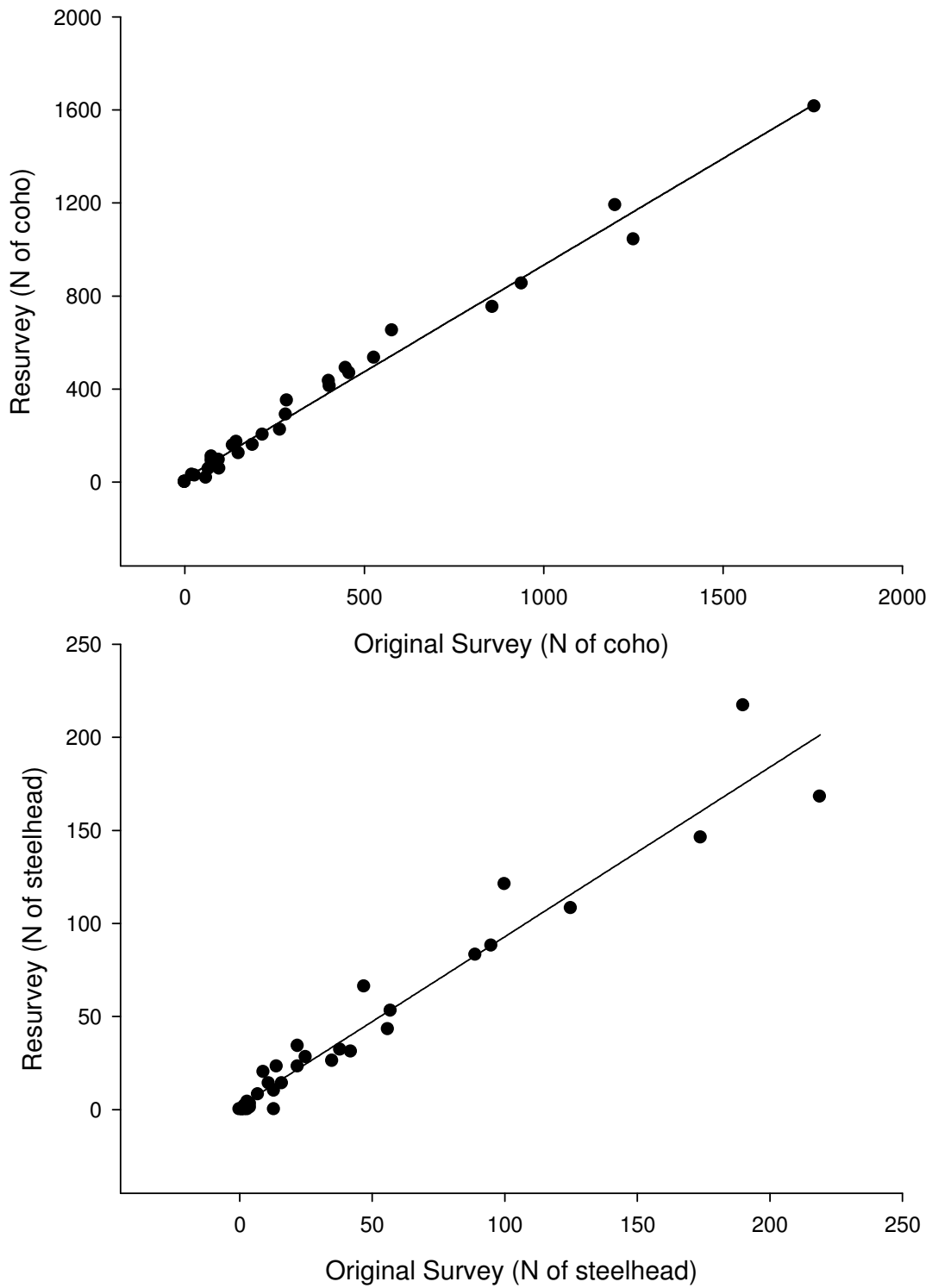


Figure 2. The relationship between original snorkel counts for juvenile coho and steelhead in pools and the resurvey of the same sites in 2008 (n=32).

Salmonid Distribution and Density

Oregon Coast Coho

Coho occurred in 75% of 1st-3rd 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 60% with the Umpqua and North Coast with the lowest occupancies. Mean average pool density was 0.34 coho/m² and 16% of sites had densities greater than 0.70 coho/m². Similar to the occupancy metrics the density estimates for the Umpqua and North Coast were lower than the other monitoring areas.

Coho distribution and density were lower in the North Coast and Umpqua, similar in the Mid Coast and greater in the Mid South compared to the average condition from 1998-2007 (Figure 3). There was an increasing trend in the North Coast until 2008 when all metrics registered a decline. Overall the Mid Coast shows an increasing trend however density has been flat for most of the monitoring. The Mid South Coast does not show a trend. Density in the Umpqua increased until 2005 and has decreased the last three years (Figure 4).

In 4th-6th order streams coho occurred in 55% of sites, only occurring in 2 of 12 sites in the Mid Coast. As in previous years all metrics were lower in mainstem sites compared to tributary sites.

Southern Oregon Northern California Coho

Coho occurred in 71% of the sites in the SONCC and mean pool occupancy was 60% (Table 2). The mean average pool density was high but had high variance. The sites with the highest densities were dry with isolated pools that concentrated coho to very high densities. Only 1st-3rd order streams were sampled in the SONCC.

Lower Columbia Coho

Coho occurred in 44% of 1st-3rd order stream reaches, mean pool occupancy was only 27%, and mean average density was low at 0.076 fish/m² (Table 2). As in 2007 only one site, in the Columbia River Gorge, exceeded an average density of 0.7 fish/m². 4th-6th order sites had higher occupancy metrics than the 1st-3rd order streams. While mainstem reaches had much lower average density than tributary reaches Lower Columbia mainstem densities were higher than coastal mainstem densities.

Table 2. Distribution and density estimates for juvenile coho salmon in western Oregon streams summer 2008. 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/m2	Mean Average Pool Density (coho/m2)	95% CI
<i>1-3 Order Streams</i>						
North Coast	70%	46%	± 14%	4%	0.156	± 0.082
Mid Coast	83%	69%	± 10%	17%	0.350	± 0.108
Mid South	88%	79%	± 10%	43%	0.698	± 0.179
Umpqua	63%	48%	± 11%	5%	0.223	± 0.073
South Coast Coho	71%	60%	± 11%	29%	0.811	± 0.446
Lower Columbia	44%	27%	± 9%	3%	0.076	± 0.056
<i>4-6 Order Streams</i>						
North Coast	75%	25%	± 14%	0%	0.002	± 0.001
Mid Coast	17%	3%	± 3%	0%	0.000	± 0.000
Mid South	90%	53%	± 18%	0%	0.005	± 0.005
Umpqua	52%	26%	± 16%	0%	0.002	± 0.002
Lower Columbia	57%	31%	± 24%	0%	0.006	± 0.009

Table 3. Distribution and density estimates for juvenile steelhead in western Oregon streams summer 2008. 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/m2)	95% CI
<i>1-3 Order Streams</i>					
North Coast	67%	31%	± 8%	0.027	± 0.009
Mid Coast	73%	41%	± 8%	0.053	± 0.019
Mid South	69%	33%	± 8%	0.032	± 0.013
Umpqua	63%	17%	± 4%	0.012	± 0.006
KMP Rogue	95%	62%	± 10%	0.085	± 0.024
KMP Non-Rogue	100%	73%	± 6%	0.060	± 0.014
Lower Columbia	61%	22%	± 10%	0.010	± 0.009
Southwest WA	62%	32%	± 11%	0.023	± 0.010
<i>4-6 Order Streams</i>					
North Coast	100%	57%	± 13%	0.005	± 0.002
Mid Coast	50%	22%	± 8%	0.000	± 0.000
Mid South	100%	52%	± 14%	0.008	± 0.007
Umpqua	83%	68%	± 14%	0.008	± 0.005
KMP Rogue	100%	72%	± 24%	0.009	± 0.004
KMP Non-Rogue	100%	96%	± 5%	0.058	± 0.052
Lower Columbia	100%	79%	± 13%	0.010	± 0.007

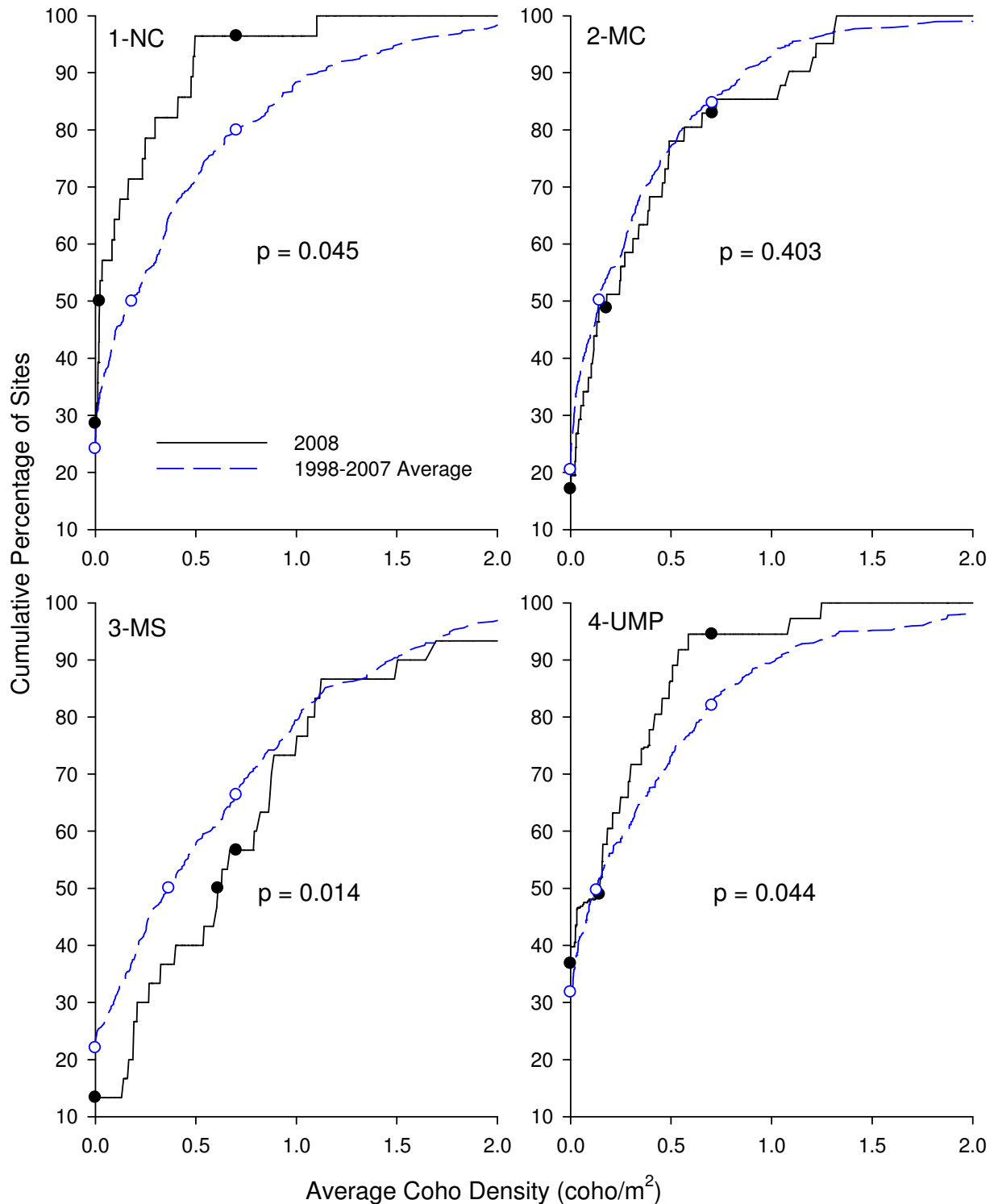


Figure 3. Average coho density CDFs from snorkeled tributary sites for the four monitoring areas of the Oregon Coast Coho ESU comparing 2008 with the average from 1998-2007. P values are for the comparison test of the two curves. The three points shown on the curves, from left to right, are the percentage of unoccupied sites, the median density, and the percentage of sites below 0.7 coho/m² (full seeding).

Oregon Coast Steelhead

Juvenile steelhead occurred in 68% of 1st-3rd order sites. As in 2005-2007 pool occupancy was lowest in the Umpqua. Steelhead occurred in 82% of 4th-6th order reaches. With the exception of the Mid Coast, site occupancy and mean pool occupancy were greater in 4th-6th order streams than 1st-3rd order streams (Table 3). Density was 0.030 fish/m² in 1st-3rd tributary streams compared to 0.006 fish/m² in mainstem streams.

2008 is the last year that 4th-6th order streams will be surveyed in the Oregon Coast DPS. Compared to the other western Oregon DPSs mainstem streams make up a smaller percentage of rearing habitat in the Oregon Coast (10.5%). Variation in 1st-3rd order streams explains nearly all variation in the density for all streams in a monitoring area ($R^2=0.988$, $p<0.001$).

Klamath Mountain Province Steelhead

Steelhead occurred in 97% of 1st-3rd order sites and 100% of 4th-6th sites of the Oregon portion of the Klamath Mountain Province steelhead DPS. Density averaged 0.075 fish/m² in tributary reaches and 0.019 fish/m² in mainstem reaches. There was no evidence for differences between the Rogue and South Coast monitoring areas in distribution or abundance. Average density in South Coast 4th-6th order sites was high but had high variance (Table 3).

Lower Columbia River/Southwest Washington Steelhead

The Oregon portion of the two steelhead DPSs had similar density and distribution metrics (Table 3). No 4th-6th streams were surveyed in the Southwest Washington DPS. The Lower Columbia River was the only DPS to have similar densities in the tributary and mainstem surveys.

ESU/DPS Comparisons

The Oregon Coast and Southern Oregon Northern California coho ESUs had similar distribution and density estimates. The Lower Columbia River ESU estimates were lower for all metrics.

The Klamath Mountain Province steelhead DPS had the highest distribution and density estimates. The Oregon Coast, Lower Columbia River, Southwest Washington DPSs had similar site and average pool occupancy estimates but the Lower Columbia River had the lowest density estimate.

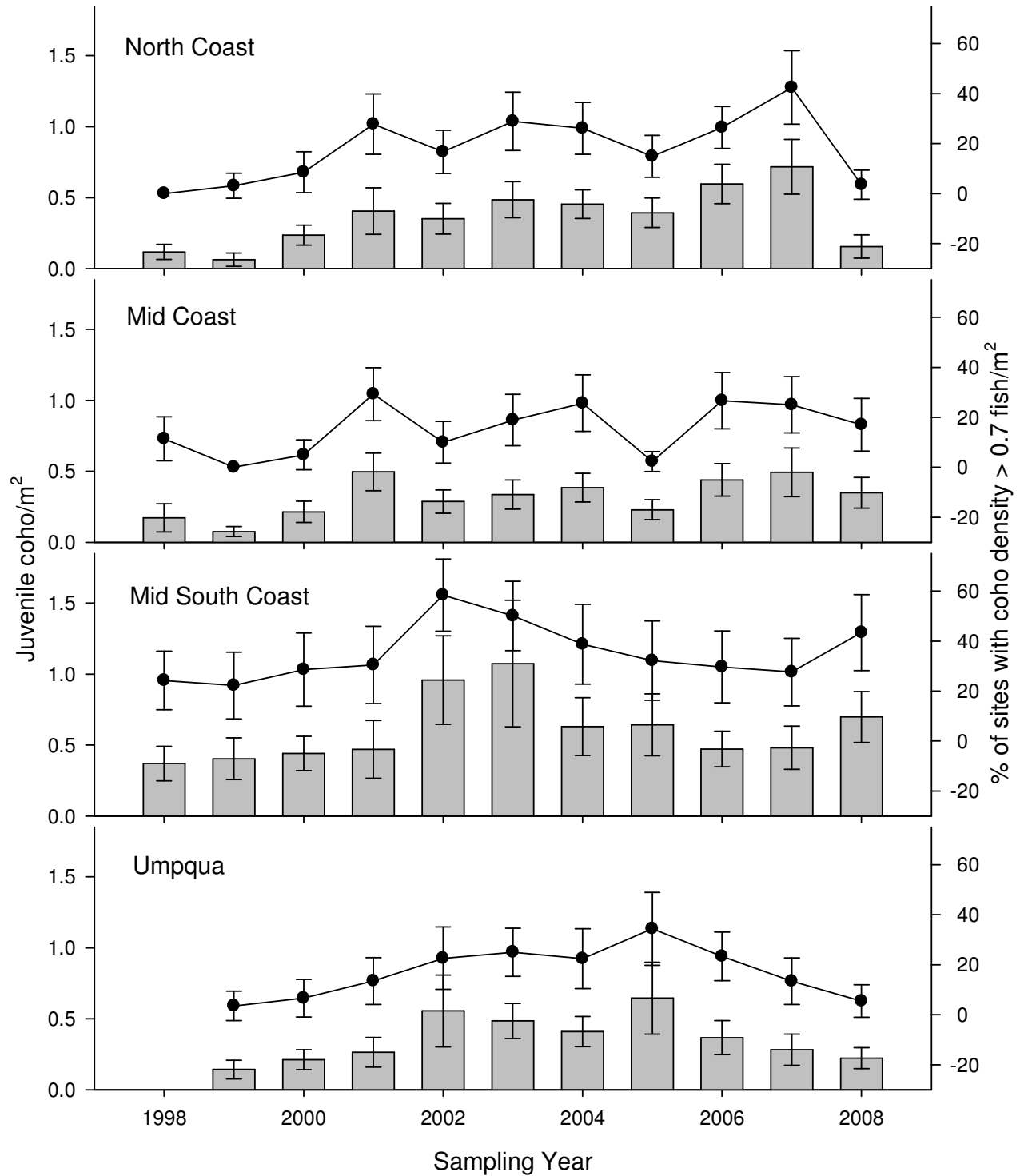


Figure 4. Annual trend in abundance and frequency metrics for juvenile coho salmon in the Oregon Coast Coho ESU, based on snorkel surveys in 1st-3rd order stream reaches. Panels are organized by monitoring strata. Gray bars are for mean density (coho/meter²) and black symbols are for % of sites with fish density > 0.7 fish/meter².

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