THE OREGON PLAN *for Salmon and Watersheds*

Abundance Monitoring of Juvenile Salmonids In Oregon Coastal Streams, 2006.

Report Number: OPSW-ODFW-2007-1

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Oregon Plan for Salmon and Watersheds

Annual Monitoring Report No. OPSW-ODFW-2007-1

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SUMMARY

This report summarizes annual monitoring results of the abundance and distribution of juvenile salmonids in streams of western Oregon in 2006 by the Western Oregon Rearing Project, in support of the Oregon Plan for Salmon and Watersheds.

Tasks for 2006

1. Use the existing rearing distribution of juvenile salmonids as sampling frames and the Environmental Monitoring and Assessment Program (EMAP) site selection process to provide a random, spatially balanced set of sites for snorkel surveys sites. Monitor juvenile salmonids in three coho salmon evolutionarily significant units (ESU's) and three steelhead distinct population segments (DPS's), partitioned across several monitoring strata, defined as:

    - Four strata for the Oregon Coast Coho ESU frame (OCC), with a target of 40 (1^{st}-3^{rd} order stream reaches) sites per stratum. These same strata survey the tributary portion of Oregon Coast Steelhead DPS.

    - Four strata for the Oregon Coast Steelhead DPS frame, with a target of 10-15 (4^{th}-6^{th} order stream reaches) sites per stratum.

    - Five strata in southern coastal Oregon with one frame and stratum for 1^{st}-3^{rd} order stream reaches in the Southern Oregon Northern California Coho ESU (SONCC; South Coast strata), and one frames and four strata for the Klamath Mountain Province Steelhead DPS (KMPS; 1^{st}-3^{rd} order streams, 4^{th}-6^{th} order streams, Non-Rogue basins, Rogue basins). Sample size target for the SONCC stratum was 25-30 sites and for the KMPS >50 sites.

    - Two strata for the Lower Columbia River Coho ESU frame (Oregon basins), for stream reaches within the known rearing distribution of coho and steelhead. One stratum was comprised of 1^{st}-3^{rd} order stream reaches, and the other of 4^{th}-6^{th} order stream reaches. These strata also encompass the Lower Columbia River Steelhead DPS. The target number of sites for the frame was 80-100 sites.

    - Assess the quality of snorkel survey fish counts by conducting re-counts in the same pools at 10-20% of sites per stratum.

2. Based on fish counts from snorkel surveys, calculate abundance and distribution metrics for each ESU or DPS at the level of the strata. For the four OCC strata, test differences in these metrics across strata.

3. Incorporate annual survey data into a long-term record of trend for OCC juvenile fish density for each stratum by plotting the current year estimates in relation to previous years.

4. In cooperation with the Oregon Department of Environmental Quality (ODEQ), use the OCC sampling frame and the candidate sites to collect macroinvertebrate

samples that will be used by ODEQ to develop ESU-scale assessment of biological, chemical, thermal, and habitat conditions for the ESU.

5. Support OCC population-scale continuous water temperature monitoring by selecting one site each within 21 coho population units for subsequent temperature monitoring. In cooperation with ODEQ, deploy temperature loggers at each site in late spring and retrieve them in late summer or early fall. The loggers will be downloaded by ODEQ and resulting data summary submitted to the Western Oregon Rearing Project. The data will be used to assess the thermal conditions within each of the coho population units and to eventually relate them to macroinvertebrate samples collected at those same sites.

Accomplishments and Findings in 2006

Task 1. We successfully drew from each sampling frame a spatially-balanced set of candidate sites for each stratum. However, not all sites in all strata could be snorkeled, due mostly to landowner denials, insufficient water clarity, or lack of rearing habitat. We did not meet our goal of 80-100 sites for the Lower Columbia frame, nor for a target of 40 sites per strata in the OCC frame for tributary reaches in the Mid-South Coast and Umpqua strata. Effort in all other strata met pre-season goals. Table 1 in the Results section summarizes survey effort. We met our goal of re-surveying 15-20% of tributary sites (N= 41 sites), with high agreement between initial survey counts and resurveys (coho; r^2=0.99, steelhead; r^2=0.90).

Task 2. The number of surveys within strata was sufficient to obtain abundance and distribution metrics at the strata level for each ESU or DPS, and to calculate differences in these metrics between OCC tributary strata. For the OCC, all four of the 1st-3rd order stream strata had >20% of sites with juvenile coho densities $\geq$0.7 fish/m^2 (summer rearing full seeding level). There was no indication of density differences between these four strata. Text in the Results section and Tables 2 and 3 summarize these metrics for all strata.

Task 3. Annual juvenile coho abundance estimates in the OCC tributary strata were plotted into time series to visually show trends in this metric. Review of Figure 3 in Results section shows a consistent improvement in coho abundance in the North Coast, whereas other strata show cyclic patterns in abundance over the nine years of monitoring.

Task 4. We were able to collect macroinvertebrates samples from 175 of the OCC tributary sites. At time of this writing, these collections were still being processed by a contract laboratory, but data will be available from ODEQ in the future.

Task 5. A total of 21 temperature loggers were deployed in OCC tributary streams by ODFW survey crews. Nineteen were recovered in Aug-Sept. and submitted to ODEQ for downloading and summary analysis. One data logger was determined to be non-functioning, leaving continuous temperature data records for 18 sites. Table 4 in the Results section summarizes these data for one parameter, relative to juvenile salmonid abundance. Three sites had maximum 7-day mean temperatures >20º C.

Management Applications

These annual snorkel survey data continue to build on the long term record of summer juvenile salmonid abundance and distribution estimates for several western Oregon salmonid management units. They will be used with a suite of other metrics to evaluate the large scale and long term success of Oregon Plan objectives, including the next OC Coho Assessment and OCC conservation planning under the Native Fish Conservation Policy. More information about these programs can be found at: http://www.oregon-plan.org/OPSW/cohoproject/coho_proj.shtml

Not only do these juvenile fish surveys provide baseline summer rearing information at the ESU scale, they are appropriately stratified to scales that are relevant to district management needs. Although caution must be used in interpreting the estimates for any individual year, large declines in summer parr estimates may be considered a response variable that is influenced by among other things, poor spawning success, poor fry survival, or insufficient summer rearing habitat. Individual site information is available upon request by contacting David Jepsen at david.jepsen@oregonstate.edu, or visiting the project web site at: http://nrimp.dfw.state.or.us/crl/default.aspx?pn=WORP

INTRODUCTION

As part of the Oregon Plan for Salmon and Watersheds, the Oregon Department of Fish and Wildlife (ODFW) initiated a project in 1998 to monitor the trend in abundance and distribution of juvenile coho salmon (*Oncorhynchus kisutch*) rearing in Oregon coastal streams. Monitoring is currently designed to provide annual abundance and distribution information at the stratum-scale (described below) for each of several coho evolutionarily significant units (ESU's) and steelhead distinct population segments (DPS's), and to eventually use these annual data to provide long-term trend information. Ultimately these juvenile fish data will be used to investigate relationships between freshwater habitat characteristics, adult spawner abundance, and juvenile recruitment. This progress report summarizes abundance and distribution data collected in 2006 for each ESU and DPS, and for the Oregon Coast Coho ESU includes a time series for abundance data for all years of monitoring.

A fuller description of the OCC, OCS, SONCC and KMPS sampling frames, study design and survey methods, is found in Jepsen and Rodgers (2004). For the LCRC and LCRS, an interim frame was developed using the Streamnet 1:100K geodatabase (ftp://ftp.streamnet.org/pub/streamnet/gisdata/FishDistribution) of known rearing distribution of coho and steelhead. A description of the strata is provided below, and diagramed in Figure 1. In 1998 a sampling frame was developed that included four monitoring area strata for the Oregon Coast Coho ESU and one monitoring area strata for the Southern Oregon Northern California Coho ESU (hereafter SONCC). In 2002 monitoring was expanded by adding a sampling frame with four strata for juvenile steelhead (*Oncorhynchus mykiss*) in the Oregon Coast Steelhead DPS, and two strata for the Klamath Mountain Province Steelhead DPS. In 2006, juvenile salmonid monitoring was further expanded by adding a sampling frame with two strata for coho in the Lower Columbia River Coho ESU, with one of these strata encompassing the Lower Columbia River Steelhead DPS.

Monitoring Strata Designation

For each stratum, candidate sites were chosen randomly from the respective sampling frame to provide a spatially balanced set of EMAP sample points. Each point was assigned a 1,000 meter transect (site), and where transects overlapped, the EMAP points were aggregated into one sample site.

Oregon Coast Coho (OCC: 4 tributary strata, 4 larger water strata)

The OCC frame included four tributary strata (1st-3rd order stream reaches) within the known summer rearing distribution of OCC, designated in a north-south orientation as North Coast, Mid Coast, Mid-South Coast, and Umpqua basin (Figure 1). OC coho are also counted at sites in the OCS frame (below), which serves as a supplemental set of four strata for OCC in larger streams.

Oregon Coast Steelhead (OCS: 4 tributary strata, 4 larger water strata)

The OCS frame consisted of the OCC tributary frame and strata, plus a frame of 4th-6th order stream reaches with four strata.

Lower Columbia River Coho (LCRC: one tributary stratum, one larger water stratum)

The LCRC frame was divided into two strata. One stratum was comprised of 1^{st}-3^{rd} order stream reaches and the other of 4^{th}-6^{th} order stream reaches.

Lower Columbia River Steelhead (LCRS: one tributary stratum, one larger water stratum)

A portion of the LCRC encompasses stream reaches in the LCRS, thereby providing a sampling frame with two strata for this population complex.

Southern Oregon/Northern California Coho (SONCC: one tributary stratum)

The SONCC frame was comprised of 1^{st}-3^{rd} order stream reaches where coho were known to rear. The sampling frame for this ESU is not as comprehensive as other coho frames. It only includes basins that drain through Oregon, and does not include some reaches where we have observed juvenile coho when sampling sites in the KMPS frame.

Klamath Mountain Province Steelhead (KMPS: two tributary strata, two larger water strata)

The KMPS frame included both 1^{st}-3^{rd} order and 4^{th}-6^{th} order stream reaches of known steelhead distribution, with the number of sites in a Rogue basin stratum and Non-Rogue basin stratum proportioned by number of rearing miles in the strata. Each stratum is spatially balanced for the both 1^{st}-3^{rd} order reaches and 4^{th}-6^{th} order reaches.

Data Analysis

Data were summarized by strata for analyses (Table 1). Sites that could not be snorkeled were electrofished for frequency counts. The accuracy of snorkeled pool fish counts was assessed by re-snorkeling the same pools at 10-20% of sites per strata, and limited to those sites that contained juvenile coho. A resurvey generally occurred within 1-4 days of the original survey.

For the principle distribution and abundance metrics, a site value was calculated, and then all sites per stratum were averaged. Variance estimates were derived following the procedure reported in Stevens (2002). Juvenile fish distribution was evaluated by 1) % of sites per stratum where fish were present or absent, and 2) % of pools per site containing fish, averaged for each stratum. The principal abundance metric was density of fish in pools, averaged for each stratum.

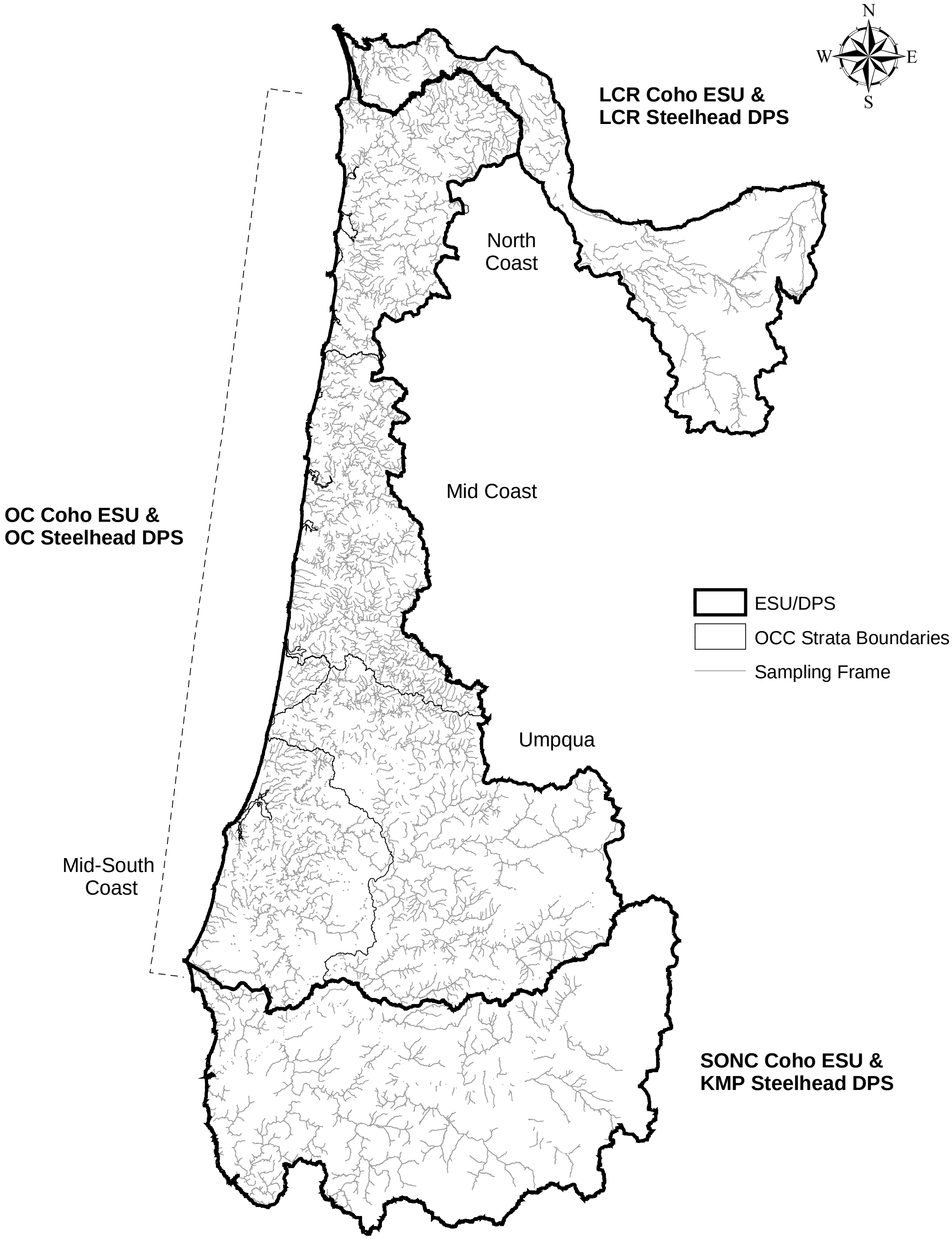

Figure 1. The spatial extent of juvenile salmonid rearing habitat within several salmonid management units (ESU, DPS) in western Oregon. The stream network of reaches with rearing habitat formed the sampling frame for selection of snorkel survey sites. Sample frames were stratified as described in the text.

RESULTS

In this report we provide stratum-level summaries for each coho ESU or steelhead DPS. Counts of cutthroat trout are recorded coincident with coho and steelhead counts, but are not reported here. Data on individual sample sites, UTM coordinates, and fish counts are available upon request by the Western Oregon Rearing Project.

Survey Effort and Resurveys

In total, we surveyed 6,168 pools (5,535 in 1st-3rd order reaches, 633 in 4th-6th order reaches), spread across 351 sites. In the Lower Columbia River frame, we were only able to survey 54 sites and therefore did not meet our target number of 80-100 sites (Table 1). As this was the first year for snorkel surveys in the LCRC ESU, many candidate sites were visited but were determined to be outside of coho rearing habitat or were otherwise not surveyable. These sites were subsequently removed from the sampling frame.   A revised sampling frame for 2007 monitoring should reduce this problem and allow more effort for surveyable sites. Within the OCC strata, we met our objective of surveying > 40 sites in the North Coast and Mid Coast strata, but only successfully surveyed 33 sites in each of the Mid South Coast and Umpqua strata. As in previous years, landowner denials were high in the Mid-South Coast. We met our objective to survey > 10 sites per strata in all of the OCS 4th-6th order reach strata. Likewise, we met our target number of sites in the KMPS strata (N=54 tributary sites, 15 large water sites) and the SONCC stratum (N=27 sites).

A total of 41 tributary sites (18% of tributary sites) that were snorkeled were revisited for fish counts by supervisory staff. When resurveys of juvenile salmonid counts from coho tributaries were compared to original surveys (Figure 2), the calculated slope of the relationships were 0.968x (coho; r^2=0.99), and 0.925x (steelhead; r^2=0.90), indicating high agreement between initial survey counts and resurveys.

Table 1. Summary of surveyed and non-surveyed candidate sites in 2006 for juvenile salmonid surveys in western Oregon streams, organized by species unit (ESU or DPS) and monitoring strata. Refer to Methods for description of ESU or DPS acronym and extent of strata.

		Surveyed			Not Surveyed			
ESU/DPS and Strata	Rearing Miles In Stratum	Snorkel	Electro-fish	% Stratum Sampled	Could Not Be Sampled	Above Barrier	Access Not Given	Not Visited
LCR Coho and LCR Steelhead								
Lower Columbia:								
1st-3rd order	1,678	35	13	1.8	6	0	1	0
4th-6th order	251	7	--	1.8	0	0	0	0
OC Coho and OC Steelhead								
North Coast:								
1st-3rd order	1,193	39	5	2.2	3	1	0	0
4th-6th order	190	12	--	4.2	6	0	0	0
Mid-Coast:								
1st-3rd order	1,708	45	1	1.7	3	1	2	2
4th-6th order	196	13	--	4.0	5	0	0	0
Mid-South Coast:								
1st-3rd order	1,123	27	6	2.3	0	2	16	0
4th-6th order	163	11	--	4.3	3	0	0	0
Umpqua								
1st-3rd order	1,647	30	3	1.2	3	2	3	0
4th-6th order	527	11	--	1.3	2	0	0	3
SONC Coho								
South Coast:								
1st-3rd order	469	27	0	3.5	0	0	5	0
KMP Steelhead								
Non-Rogue Basin:								
1st-3rd order	324	27	2	5.5	1	3	1	1
4th-6th order	43	5	--	7.4	1	0	0	1
Rogue Basin:								
1st-3rd order	987	23	2	1.5	3	0	5	2
4th-6th order	243	10	--	2.3	0	0	2	2

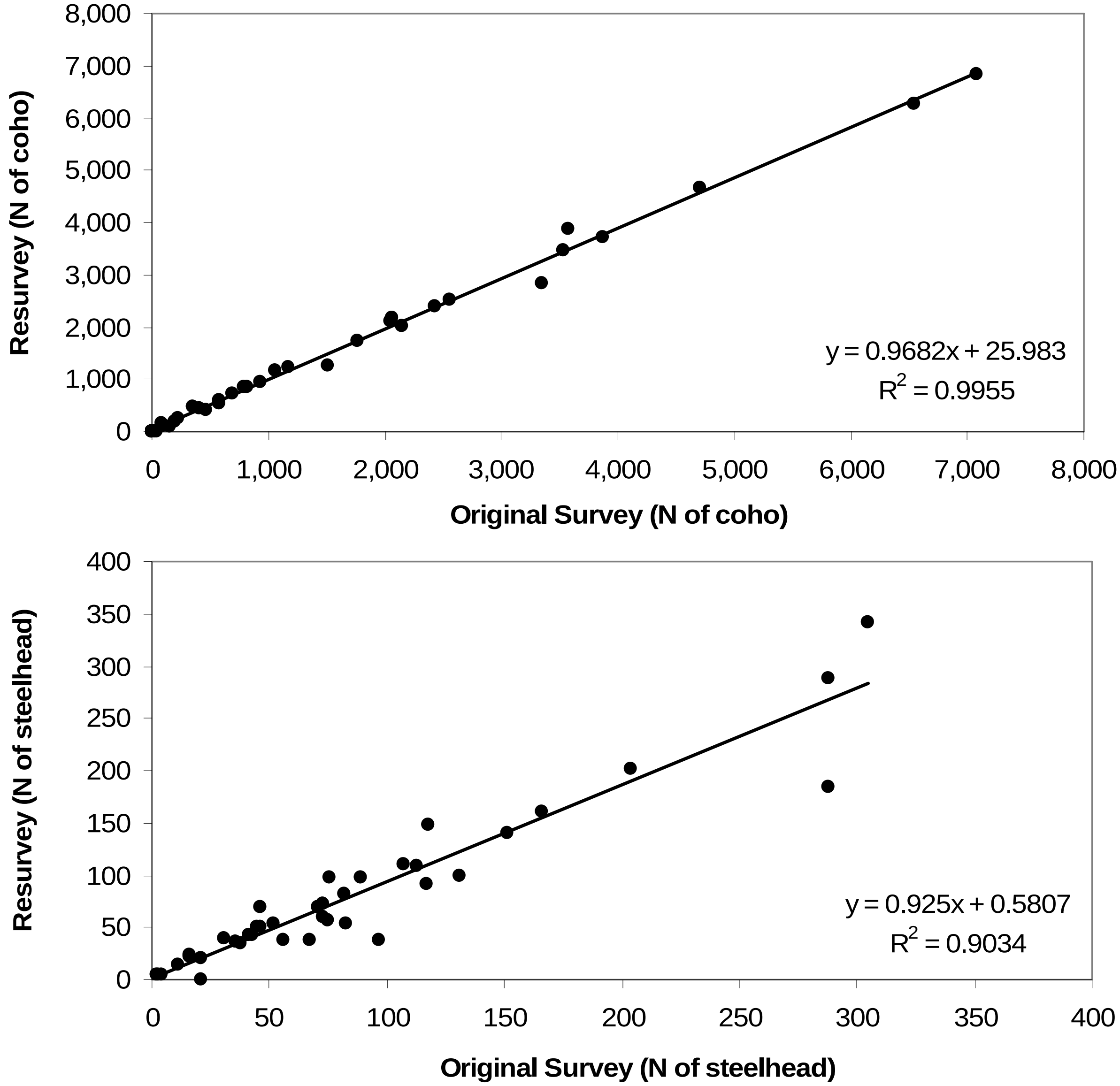

Figure 2. The linear relationship between original snorkel counts of the number of juvenile salmonids in pools and resurvey of the same pools in 2006. N = 41 sites and 2,067 pools

Annual Juvenile Fish Distribution and Abundance

Lower Columbia River Coho

Coho occurred at 43% of 1^{st}-3^{rd} order stream reaches, and at 100% of 4^{th}-6^{th} order stream reaches (Table 2). Average percent pool occupancy was 22% at tributary sites and 45% of 4^{th}-6^{th} order stream reaches. Average coho densities in pools was 0.10 fish/m^2 and 0.11 fish/m^2 for 1^{st}-3^{rd} order and 4^{th}-6^{th} order reaches, respectively (Table 3). Only one tributary site (3% of sites) had coho rearing densities > 0.7 fish/m^2 (Camp Creek, Lewis and Clark River basin).

Lower Columbia River Steelhead

Steelhead occurred at 64% of 1st-3rd order stream reaches, and at 100% of 4th-6th order stream reaches (Table 2). Average percent pool occupancy was 32% at tributary sites and 52% of 4th-6th order stream reaches. Average steelhead densities in pools was 0.04 fish/m2 and 0.02 fish/m2 for 1st-3rd order and 4th-6th order reaches, respectively (Table 3).

Oregon Coast Coho

Coho occurred in 73%-91% of the 1^{st}-3^{rd} order stream reaches, and were less widespread in the Umpqua basin than in other monitoring strata (Table 2). Within the 1^{st}-3^{rd} order stream strata, the average percent pool occupancy ranged from 53% (Umpqua basin) to 71% (North Coast). Results of z-tests (not reported here) and overlap of 95% confidence intervals for all strata indicated little evidence of differences in pool occupancy between strata. In 4^{th}-6^{th} order stream strata, coho occurred in 27%-92% of reaches, and were less widespread in the Mid-South Coast and Umpqua basin strata. Within the 4^{th}-6^{th} order stream sites of a stratum, the average percent pool occupancy ranged from 11% (Mid-South Coast) to 66% (North Coast).

Average coho densities in pools in the 1^{st}-3^{rd} order stream strata (Table 3) ranged from 0.38 fish/m^2 (Umpqua basin) to 0.68 fish/m^2 (North Coast). All four of the 1^{st}-3^{rd} order stream strata had > 20% of sites with juvenile coho densities $\geq$0.7 fish/m^2 (summer rearing full seeding level). Results of z-tests (not reported here) and overlap of 95% confidence intervals for all strata indicated little evidence of density differences between strata. As in past years, average coho densities were much lower in the 4^{th}-6^{th} order stream reach strata than in associated tributary strata, with no strata > 0.09 fish/m^2. Seeding levels were not achieved at any 4^{th}-6^{th} order stream reaches.

Oregon Coast Steelhead

Juvenile steelhead occurred in 65-86% of the 1^{st}-3^{rd} order stream sites, and were less widespread in the Mid- South Coast than in other monitoring strata. As in 2005, within the 1^{st}-3^{rd} order stream strata, the average percent pool occupancy by steelhead was lowest in the Umpqua basin (24%) and highest in the North Coast (42%). Steelheads occurred in 12%-54% of 4th-6th order stream reaches, and were less widespread in the Mid-South Coast and more widespread in the North Coast. In the

North Coast, steelhead were observed in greater proportion of pools of larger streams than tributary streams.

Average steelhead densities in pools in the 1^{st}-3^{rd} order stream strata (Table 3) ranged from 0.01 fish/m^2 (Umpqua basin) to 0.05 fish/m^2 (North Coast). As in past years, average steelhead densities were lower in the 4^{th}-6^{th} order stream reach strata than in associated tributary strata.

Southern Oregon/Northern California Coho

Coho occurred in 67% of the sites in the SONCC, and average percent pool occupancy was 48% (Table 2). The average coho density in pools was 0.17 fish/m^2 with only one site (4% of sites) achieving > 0.7 fish/m^2 (Crooks Creek, Illinois River basin).

Klamath Mountain Province Steelhead

Juvenile steelhead occurred in 90% and 71% of the 1^{st}-3^{rd} order stream reaches in the Non Rogue and Rogue basin strata, respectively (Table 2). They were observed in all of the 4^{th}-6^{th} order reaches in Non Rogue basin stratum, and 89% of reaches in the Rogue basin stratum. Average percent pool occupancies in 1^{st}-3^{rd} order reaches were greater in the Non Rogue reaches (73%) than in the Rogue reaches (50%). In larger streams of the Rogue basin the within site variability led to a large 95% confidence range (41%-81%), so differences in pool occupancies were not detectable. The average steelhead density in pools was similar between the two 1^{st}-3^{rd} order strata, and between the two 4^{th}-6^{th} order strata (Table 3).

Time Series Trend of OCC Juvenile Abundance

Review of time series data show no consistent increase or decrease in summer coho parr densities within the OCC ESU (Figure 3). One exception is the North Coast stratum where densities have generally increased since monitoring began, and it appears the estimate for 2006 was higher than previous monitoring years. Other strata are showing a cyclic pattern in coho abundance. For the Mid Coast, juvenile densities have remained < 0.4 fish/m^2, suggesting some limitation in fresh water rearing potential, relative to other strata. The Western Oregon Rearing Project is currently working with colleagues associated with the US-EPA and Oregon State University to develop a trend descriptor using sites in a panel design that are surveyed annually.

Table 2. The occurrence of juvenile coho and steelhead (Sthd; > 90 mm) from direct counts in snorkeling or electrofishing surveys in 2006 within monitoring strata of western Oregon streams. See Methods for description of strata.

ESU/DPS and Strata	N of Sites	% Of Sites with At Least One Juvenile Fish		Mean Percent Pool Occupancy And 95% Confidence Interval			
		Coho	Sthd	Coho	95% CI	Sthd	95% CI
LCR Coho and LCR Steelhead							
Lower Columbia:							
1st-3rd order	47	43	64	22	8	32	7
4th-6th order	7	100	100	45	19	52	15
OC Coho and OC Steelhead							
North Coast:							
1st-3rd order	44	91	86	71	10	42	8
4th-6th order	12	92	83	66	16	54	11
Mid-Coast:							
1st-3rd order	46	87	65	68	10	34	8
4th-6th order	12	67	50	29	15	12	6
Mid-South Coast:							
1st-3rd order	33	82	70	61	11	31	9
4th-6th order	11	27	64	11	10	27	16
Umpqua							
1st-3rd order	33	73	73	53	11	24	6
4th-6th order	11	36	64	28	20	32	15
SONC Coho							
South Coast:							
1st-3rd order	27	67	--	48	13	--	--
KMP Steelhead							
Non-Rogue Basin:							
1st-3rd order	29	--	90	--	--	73	11
4th-6th order	5	--	100	--	--	86	11
Rogue Basin:							
1st-3rd order	25	--	71	--	--	50	11
4th-6th order	9	--	89	--	--	61	20

Table 3. Density (fish/m^2) of juvenile coho and steelhead (Sthd: > 90 mm) in pools from snorkeler counts in 2006 within monitoring strata of western Oregon streams. See Methods for description of strata.

ESU/DPS and Strata	N of Sites	% Sites with Coho >0.7 fish/m^2	Mean Density of Fish in Pools and 95% Confidence Interval: Coho	95% CI	Sthd	95% CI
LCR Coho and LCR Steelhead						
Lower Columbia:						
1^{st}-3^{rd} order	33	3	0.10	0.06	0.04	0.01
4^{th}-6^{th} order	7	0	0.11	0.12	0.02	0.01
OC Coho and OC Steelhead						
North Coast:						
1^{st}-3^{rd} order	36	29	0.68	0.20	0.05	0.02
4^{th}-6^{th} order	12	0	0.09	0.05	0.02	0.01
Mid-Coast:						
1^{st}-3^{rd} order	45	27	0.44	0.12	0.03	0.01
4^{th}-6^{th} order	12	0	0.03	0.03	0.00	0.00
Mid-South Coast:						
1^{st}-3^{rd} order	27	30	0.47	0.13	0.02	0.01
4^{th}-6^{th} order	12	0	0.00	0.00	0.00	0.00
Umpqua						
1^{st}-3^{rd} order	30	23	0.38	0.12	0.01	0.01
4^{th}-6^{th} order	11	0	0.03	0.04	0.01	0.01
SONC Coho						
South Coast:						
1^{st}-3^{rd} order	27	4	0.17	0.10	--	--
KMP Steelhead						
Non-Rogue Basin:						
1^{st}-3^{rd} order	26	--	--	--	0.05	0.01
4^{th}-6^{th} order	5	--	--	--	0.02	0.01
Rogue Basin:						
1^{st}-3^{rd} order	22	--	--	--	0.07	0.03
4^{th}-6^{th} order	9	--	--	--	0.02	0.02

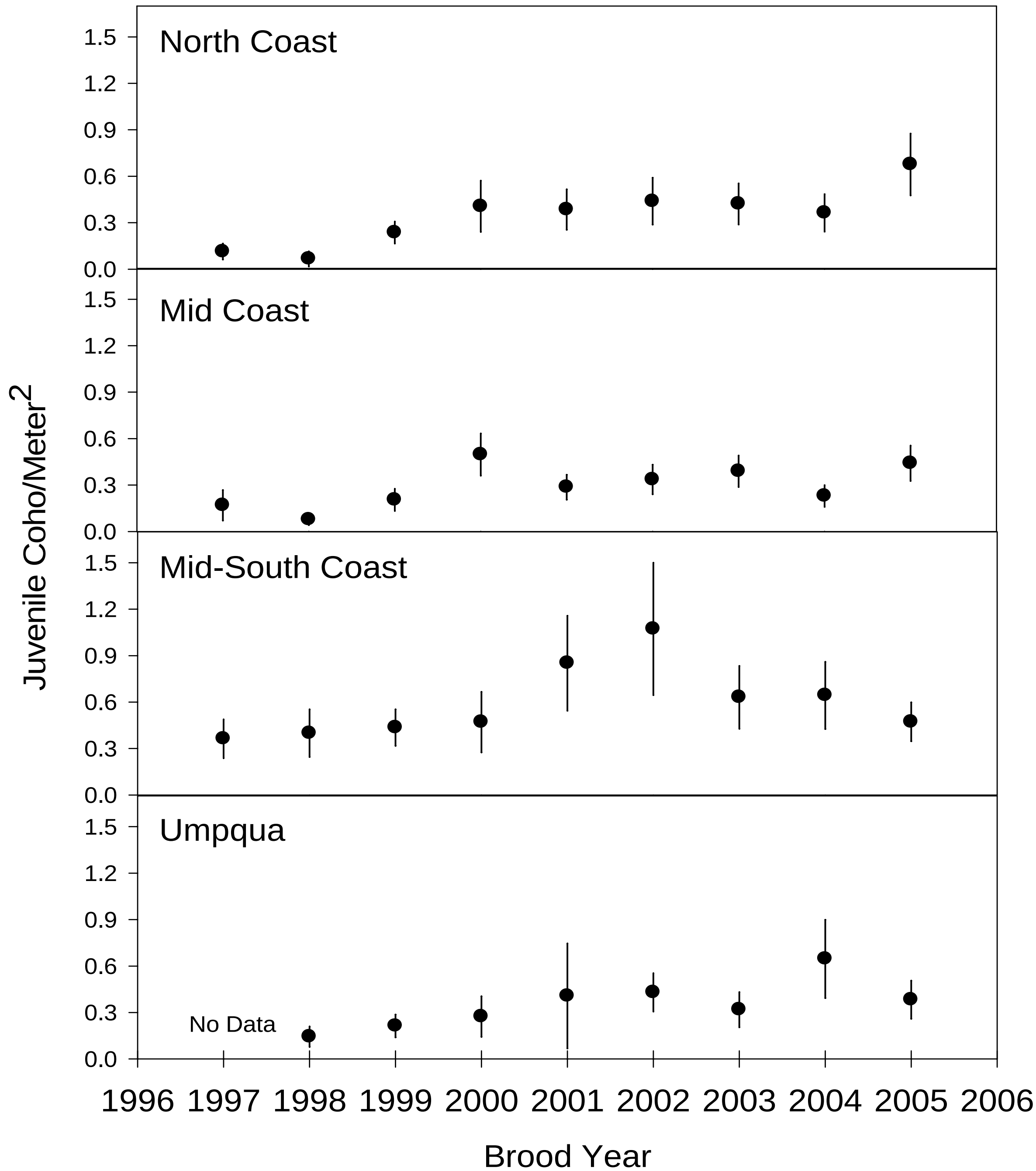

Figure 3. The annual trend in juvenile coho abundance in pools of 1^{st}-3^{rd} order stream reaches in the Oregon Coast Coho ESU, based on snorkel surveys. Plots are organized by monitoring strata. Brood year refers to the year adult coho spawned (Brood Year +1 = snorkel year).

Macroinvertebrate Collections

Survey crews were able to collect invertebrate kick samples at 175 tributary sites in the OCC ESU. These samples were given to ODEQ staff who submitted them to a contract lab for sample composition. At the time of this report sample analysis was not yet complete. Summary data from this macroinvertebrate sampling can be requested from the ODEQ Laboratory, Watershed Assessment Section. Contact Michael Mulvey at Mulvey.Michael@DEQ.state.or.us or 503-229-5348.

Population Scale Temperature Monitoring

Snorkel crews were able to deploy temperature loggers at 21 tributary sites in May, 2006. During recovery by snorkel crews in August and September two loggers were not found, and after downloading by ODEQ one data logger was determined to be non-functioning. This left temperature data records for 18 sites. These data are summarized in Table 4, and more detailed temperature data can be found at the DEQ LASAR data base on the DEQ web page at http://deq12.deq.state.or.us/lasar2/ or by contacting Michael Mulvey at Mulvey.Michael@DEQ.state.or.us or 503-229-5348.

DISCUSSION

Survey effort varied between strata in 2006, with strata in larger streams being surveyed at a higher relative level of effort than tributary strata. With the development of new sampling frames in 2007 for the OCC and LCRC, the targeted survey effort will be proportioned more evenly among strata. As we have continued to get very high agreement between initial snorkel surveys and resurveys, we will reduce the resurvey effort in 2007 and shift some crew leader effort to coordination of temperature monitoring and associated biota collections.

REFERENCES

Jepsen, D. B. and Rodgers, J. D. 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.

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.

Table 4. Summary of water temperature and juvenile salmonid data collected from stream sites representing twenty-one Oregon Coast Coho populations. MWAT = the maximum 7-day mean temperature. For fish data, one site (MC 1537) was on a 3-year revisit panel not surveyed for fish in 2006, and 3 sites had poor water visibility and were only electrofished for % pool occupancy. Sthd=Steelhead trout, Cutt= Cutthroat trout.

			Temperature Record Interval (ºC)			Juvenile Salmonid Surveys						
						Mean Pool Occupancy (%)			Mean Fish Density in Pools (fish/m^2)			
OCC Strata and Population	Site Number	Stream Name	Deploy Date	Retrieve Date	MWAT	Coho	Sthd	Cutt	Coho	Sthd	Cutt	Status
MC, Alsea R	1665	Five River	May 16	Sept 21	20.9	65	5	5	0.01	0.00	0.00	
MC, Beaver Cr	1537	Elkhorn Creek	May 16	Sept 26	14.4	--	--	--	--	--	--	Not surveyed
MC, Salmon R	1386	Crowley Creek	May 16	Aug 25	14.1	35	82	53	0.10	0.15	0.08	
MC, Siletz R	1247	Mill Creek, NF	May 9	Aug 3	16.2	100	57	73	0.87	0.05	0.04	
MC, Siuslaw R	220	Rogers Creek	May 9	Aug 15	17.4	100	50	65	0.63	0.01	0.02	
MC, Yaquina R	1026	Spout Creek	May 9	Sept 12	18.2	100	10	34	0.50	0.00	0.01	
MS, Coos Bay	2438	Packard Creek	May 19	Sept 5	16.5	46	8	62	0.328	0.01	0.14	
MS, Coquille R	689	Johns Creek	May 20	Aug 15	--	62	8	31	0.980	0.000	0.017	Malfunction
MS, Floras Cr	326	Fourmile Creek	May 26	Aug 29	17.9	17	0	17	0.078	0.000	0.036	
MS, Siltcoos R/L	1875	Billy Moore Cr	May 17	Sept 19	14.1	80	80	60	0.627	0.112	0.073	
MS, Sixes R	858	Sixes River	May 20	Sept 18	20.7	11	89	56	0.000	0.013	0.002	
MS, Tahkenitch L	1757	Fivemile Creek	May 25	Aug 21	17.5	100	0	38	--	--	--	Electrofished
MS, Tenmile L	2322	Eel Creek	May 12	Aug 22	15.2	0	0	38	--	--	--	Electrofished
NC, Necanicum R	1481	Little Muddy Cr	May 9	Sept 25	14.0	38	88	25	0.219	0.187	0.031	
NC, Nehalem R	2050	Foley Creek	May 9	--	--	84	84	58	0.364	0.094	0.037	Lost
NC, Nestucca R	377	Powder Creek	May 9	--	--	92	67	33	0.643	0.026	0.007	Lost
NC, Tillamook Bay	2939	Ben Smith Cr	May 9	Oct 2	14.6	100	56	8	1.987	0.059	0.004	
UM, N Umpqua R	2439	Rock Creek EF	May 25	Sept 5	16.8	36	64	14	0.251	0.042	0.004	
UM, S Umpqua R	958	Clear Creek	May 10	Sept 18	20.0	85	0	15	--	--	--	Electrofished
UM, L Umpqua R	1151	Lutsinger Creek	May 8	Aug 7	19.1	97	45	62	0.168	0.006	0.021	
UM, M Umpqua R	1113	Wolf Creek	May 17	Sept 13	20.5	57	22	39	0.018	0.007	0.004	