THE OREGON PLAN *for Salmon and Watersheds*

Assessment of Oregon Coastal Adult Winter Steelhead – Redd Surveys 2012

Report Number: OPSW-ODFW-2012-09

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SUMMARY

This report provides a summary of results from winter steelhead spawning ground surveys conducted in Oregon Coast and Lower Columbia basins in 2012. Sufficient surveys were conducted to meet the precision goal for the Oregon Coast Distinct Population Segment (DPS), but not the Klamath Mountains Province (KMP) DPS. Precision in the Lower Columbia River (LCR) and Southwest Washington (SWW) Evolutionarily Significant Units (ESU) also failed to meet the goal. Winter steelhead redd estimates for the 2012 spawning year were low compared to prior years for both the Oregon Coast and Klamath Mountains DPS. We do not have long-term data on winter steelhead redd abundance in the Lower Columbia, but 2012 appears to be below previously available estimates. Regional patterns are apparent for redd density, proportion of hatchery spawners, and spawn timing.

INTRODUCTION AND METHODS

As part of the Oregon Plan for Salmon and Watersheds, the Oregon Department of Fish and Wildlife (ODFW) initiated a project to monitor spawning winter steelhead (*Oncorhynchus mykiss*) in coastal Oregon streams in 2003. This project is designed to assess yearly status and trend, abundance, proportion of hatchery fish, and distribution of winter steelhead spawners in six coastal Monitoring Areas (MA) in two DPSs (Figure 1). In 2008 the project was modified to assess status only at the DPS level and in 2010 monitoring ceased in the Rogue MA, both due to budget constraints. Similar monitoring was conducted in 2004, in seven Oregon populations within two Lower Columbia ESUs. Additional winter steelhead monitoring occurred in the Sandy population in 2006, 2007, 2010 and 2011, and the Clackamas in all of these years except 2010. Monitoring across Oregon portions of the Lower Columbia ESUs was renewed in 2012.

A spatially balanced probabilistic sampling design (Stevens 2002) was used to select survey sites across a stream network of winter steelhead spawning habitat. The selection frame was developed using professional knowledge of biologists from a variety of private and governmental organizations. Monitoring of winter steelhead abundance is based on counts of redds instead of live or dead fish, in accordance with prior work conducted by ODFW in Oregon coastal streams (Susac and Jacobs 1999). Repeat visits to each site from February through May generated a total redd count for each survey. Redds were marked with colored rocks and flagging to prevent re-counting during subsequent surveys. The survey interval of once every fourteen days is based on prior ODFW research (Susac and Jacobs 1999). Specific descriptions of project protocols can be found in the annual survey procedures manual (ODFW 2012).

RESULTS AND DISCUSSION

This report contains monitoring area level summaries for each steelhead DPS along the Oregon Coast, as well population level summaries for areas within the LCR and SWW ESU's. The Lower Columbia population structure used in this report was defined by the National Oceanic and Atmospheric Administration (Myers et. al. 2006). Counts of lamprey redds and adults are recorded during steelhead surveys but are not reported here.

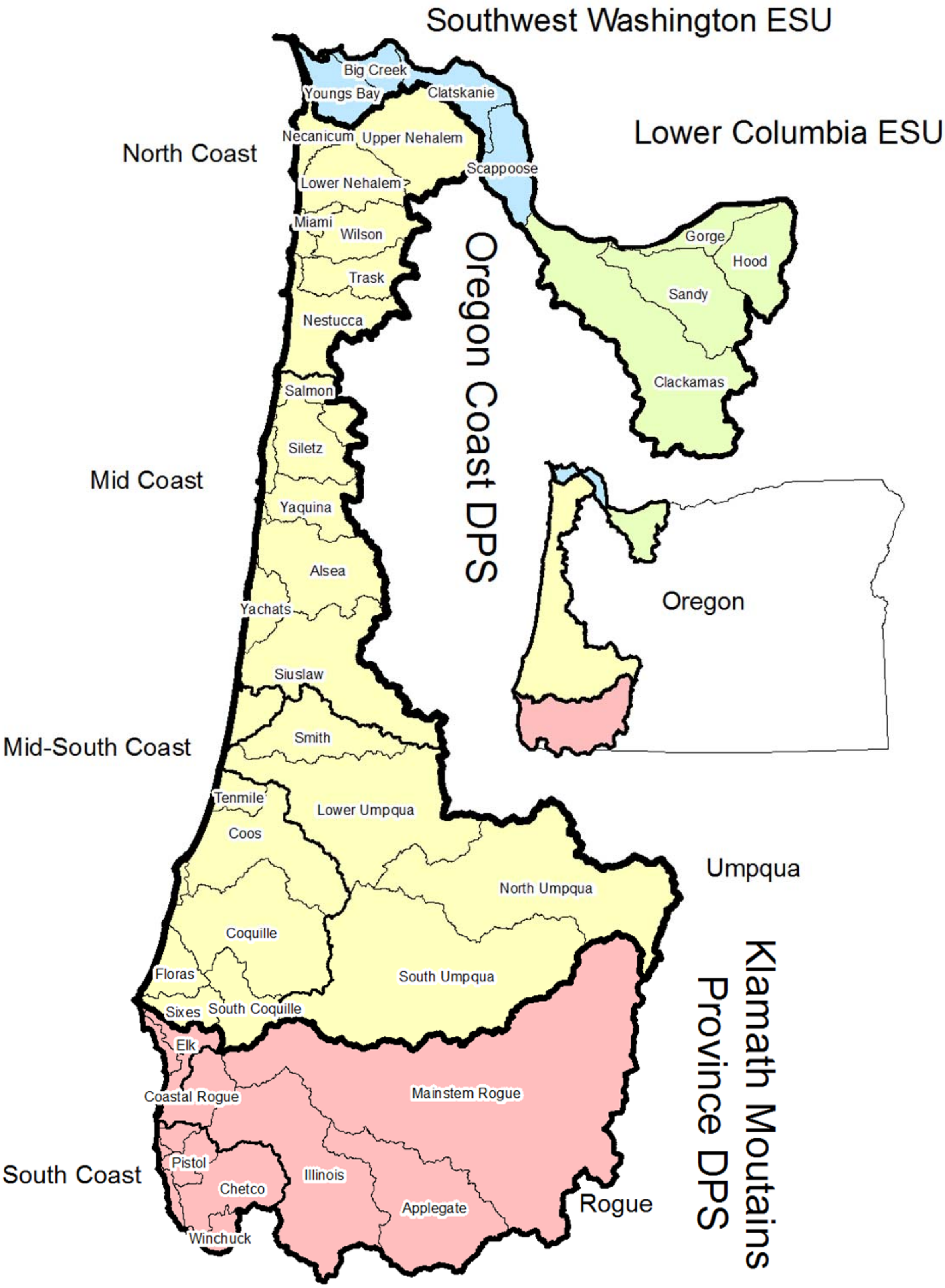

Figure 1. Steelhead monitoring study area showing the winter steelhead populations, monitoring areas, evolutionarily significant units and distinct population segments.

Table 1. Site status by monitoring area. Target sites fell within steelhead spawning habitat; response sites were successfully surveyed and non-response sites were not successfully surveyed because of issues such as; lack of landowner permission, site inaccessibility, or gaps in survey effort typically due to stream turbidity. Non-target sites are outside of steelhead spawning habitat.

DPS	Monitoring Area	Target Response	Target Non-response	Non-target
Oregon Coast	North Coast	31	10	2
	Mid Coast	33	15	4
	Mid South Coast	18	25	2
	Umpqua	17	34	5
	Total	**99**	**84**	**13**
Klamath Mountains Province	South Coast	2	16	0
	Rogue River			
	Total	**2**	**16**	**0**
Lower Columbia	Youngs Bay	17	3	5
	Big Cr	8	3	2
	Clatskanie	15	9	0
	Scappoose	15	11	2
	Clackamas	23	20	0
	Sandy	8	36	4
	Gorge	6	1	1
	Total	**92**	**83**	**14**

A total of 193 sites were successfully surveyed in 2012, split between Oregon Coast and Lower Columbia streams (Table 1), representing 48% of the total number of sites selected. Sites were selected at a rate of 1/32 miles of habitat in the Oregon Coast DPS, while selection densities were greater in the KMP DPS (1/19), the SWW ESU (1/2), and the LCR ESU (1/4). Three percent of sites coast-wide and eight percent in the Lower Columbia region were not surveyed because of landowner access restrictions. The SWW ESU had the highest proportion of access denials (12%). Thirty-six percent of sites in the Umpqua MA and 40% in both the Scappoose and Sandy populations were not used in final estimates due to turbidity and/or large gaps between survey dates. The percentage of sites falling outside of steelhead spawning habitat ranged from 0 to 20%, with an average across all areas of the Oregon Coast and Lower Columbia of 7%.

The target precision for steelhead redd estimates is a 95% confidence interval within ±30% of the point estimate. In 2012 this precision goal was achieved for only two estimates, the Oregon Coast DPS and the Mid South Coast MA (Table 2). Precision goals were exceeded in all other areas, often substantially (i.e. ±196% in the KMP DPS). Failure to reach precision goals were primarily due to poor surveying conditions during suspected periods of spawning.

Table 2. Oregon winter steelhead redd abundance estimates, 2012. Estimates are derived from counts in random GRTS spawning surveys.

		Survey Effort		Winter Steelhead Redd Abundance: Total		Wild[b]	
DPS/ESU	Monitoring Area or Population	Number of Surveys	Miles	Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast DPS	North Coast	31	30	16,376	6,480	15,864	6,278
	Mid Coast	33	24	22,607	9,453	19,074	7,976
	Mid South Coast	18	17	8,403	2,189	7,414	1,932
	Umpqua	17	12	11,416	6,192	11,416	6,192
	Total	99	84	58,801	13,209	53,769	12,045
Klamath Mountains Province DPS	South Coast	2	1	2,738	5,366	2,738	5,366
	Rogue River	-	-	-	-	-	-
	Total	2	1	2,738	5,366	2,738	5,366
Southwest Washington ESU	Youngs Bay	17	15	262	232	197	173
	Big Cr	8	6	115	97	0	0
	Clatskanie	15	15	242	100	242	100
	Scappoose	15	15	72	42	72	42
	Total	55	51	692	274	511	205
Lower Columbia River ESU	Clackamas	23	22	904	419	871	404
	Sandy	8	11	208	275	208	275
	Gorge	6	3	2	4	2	4
	Total	37	36	1,112	501	1,079	489

b *Estimates of wild spawners derived through application of live and carcass fin-mark recoveries in random surveys.*

Oregon Coast DPS

The 2012 estimate of wild winter steelhead redds in the Oregon Coast DPS is the third lowest, dating back to 2003 (Figure 2). The 53,769 wild redds in the Oregon Coast DPS were not distributed evenly across monitoring areas (Table 2). Density of redds (redds/mile of steelhead spawning habitat) varied, with the North and Mid Coast MA's having higher redd densities than those areas located further south (Figure 3). The Mid Coast MA had the highest wild redd density, 12.2 redds/mile, and the Umpqua MA had the lowest density, 6.4 redds/mile (Table 3). Redd density in the Mid-South Coast MA was relatively low (9.4 redds/mile), though the percentage of sites having at least one recorded redd was the highest among the four coastal MA's, with 94% of sites being occupied (Table 3). In monitoring areas outside of the Mid-South Coast, occupation and redd density were more closely correlated, with the lowest occupation rate being observed in the Umpqua (65%). The proportion of hatchery origin spawners (pHOS) in the naturally spawning steelhead population varied among the monitoring areas, ranging between 0% in the Umpqua MA to 16% in the Mid Coast MA (Table 4 and Figure 4). The proportion of hatchery spawners across the Oregon Coast DPS was 11%, which is among the lowest on record since 2003. Calculations of pHOS are based on spawning ground observations of adipose fin clips from both live and dead steelhead.

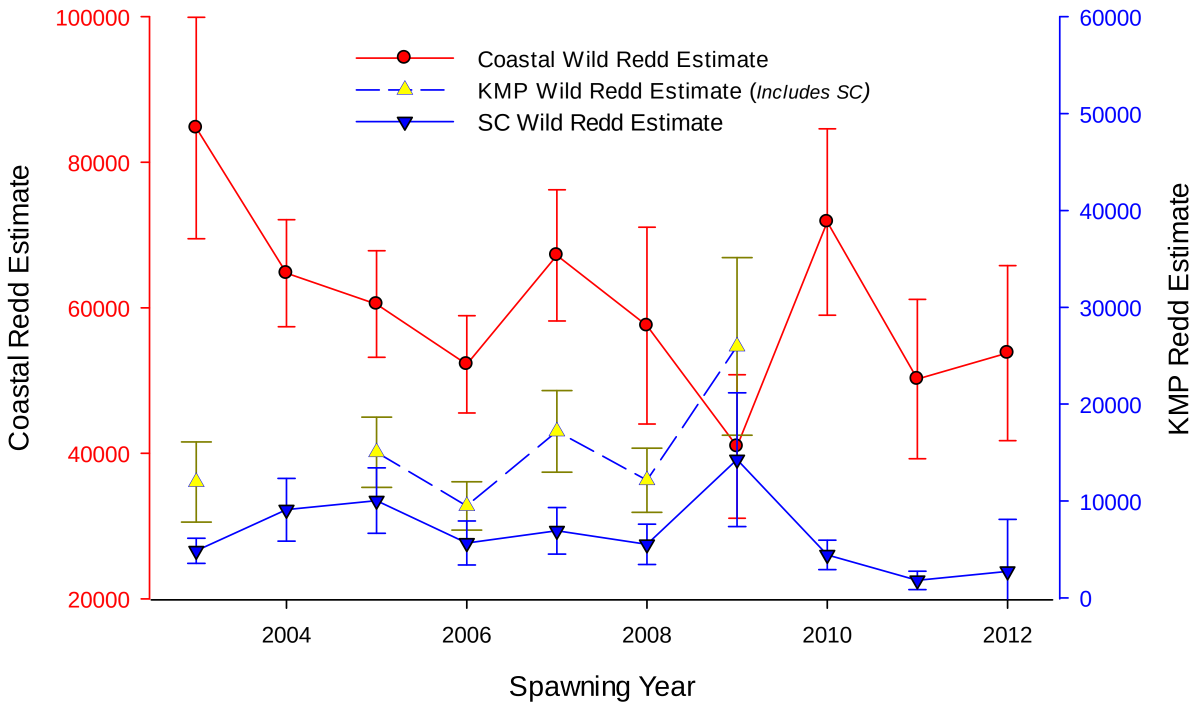

Figure 2. Winter steelhead wild redd estimates based on random surveys from 2003 to 2012. Error bars are 95% confidence intervals. The Rogue River is not included in the 2004, 2010-2012 KMP totals.

Oregon Coast DPS steelhead spawn timing in 2012 occurred relatively early when compared to previous years in the Mid South and Umpqua MAs (peak in late February), relatively late in the North Coast MA (peak in late April), with the Mid Coast MA having peaks in both time periods (Figure 5). The late April peak in spawning in the North Coast MA is about three weeks later than normal, but similar to timing in 2011 (Brown et. al. 2011). Stream discharge fluctuated greatly in 2012, with significant periods of high flows and turbidity both immediately before surveys began in February and throughout March and early April (Figure 6). This flow regime was problematic for survey schedules and may have influenced the relatively early spawn timing observed across most of the Oregon Coast DPS in two ways: Elevated flows may have attracted early fish into spawning areas, and reduced visibility may have reduced surveyors' abilities to observe redd deposition in the middle of the season (March-April). The apparent depression in spawning activity common during March across all Oregon Coast MA's is unusual, and suggests that survey conditions influenced spawning survey results during 2012.

Klamath Mountains Province DPS

No surveys were performed in the Rogue MA in 2012; therefore the estimate for the KMP DPS is incomplete. In the South Coast MA we estimate that there were 2,738 wild steelhead produced redds (Table 2); the lowest recorded since monitoring began in 2003. However, the estimate is severely hampered by the small number of successfully surveyed sites. Area river flows were generally higher than normal, and a series of very large storms between January and April resulted in both poor surveying conditions, and a large number of sites which were inaccessible do to road closures. As a result, only two sites were successfully surveyed throughout the 2012 spawning season. This small sample size is considered inadequate for the meaningful discussion of South Coast MA winter steelhead abundance and distribution, though results are shown in the tables and figures of this document.

Table 3. Oregon winter steelhead redd density and percent occupancy, 2012.

DPS / ESU	Monitoring Area	Redds/Mile	% Sites With Redds
Oregon Coast DPS	North Coast	12.1	90%
	Mid Coast	12.2	84%
	Mid South Coast	9.4	94%
	Umpqua	6.4	65%
	Total	**10.0**	**83%**
Klamath Mountains Province DPS	South Coast	8.1	100%
	Rogue River	--	--
	Total	**--**	**--**
Southwest Washington ESU	Youngs Bay	5.8	53%
	Big Cr	5.5	63%
	Clatskanie	4.1	60%
	Scappoose	1.2	50%
	ESU Total	**3.7**	**58%**
Lower Columbia River ESU	Clackamas	5.2	50%
	Sandy	0.2	25%
	Gorge	0.3	17%
	ESU Total	**1.9**	**38%**

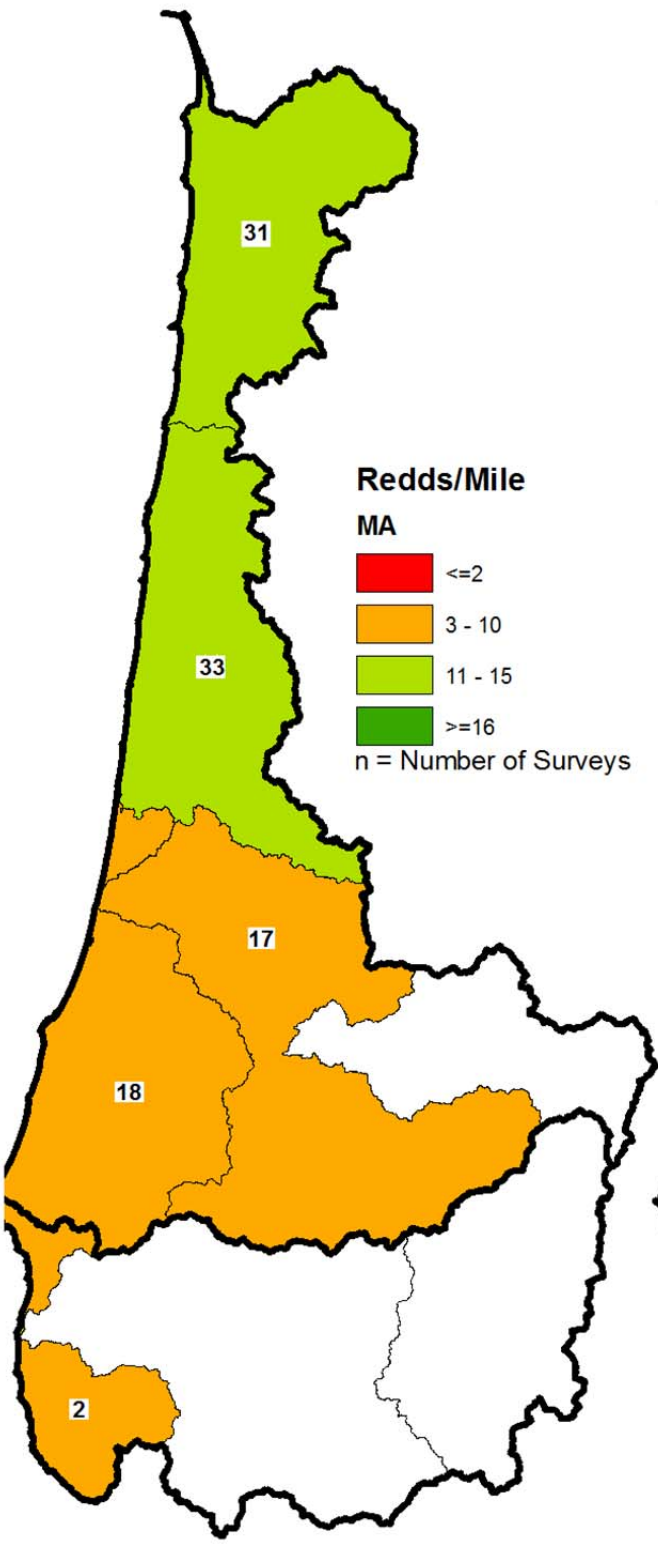

Figure 3. Total redds/mile in random surveys in 2012 by monitoring area in the Coastal and KMP DPSs, with the number of surveys in each monitoring area.

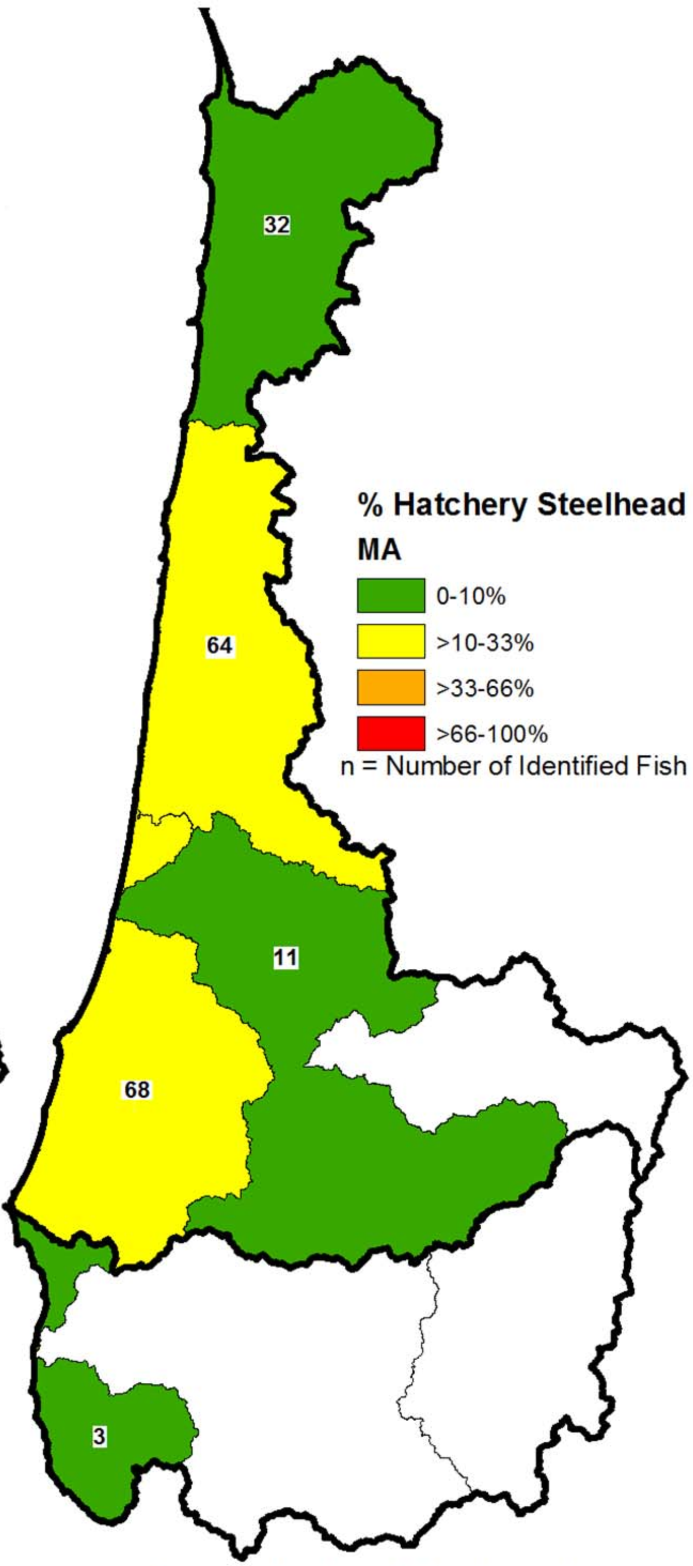

Figure 4. Percentage hatchery fish found on random surveys in each of the six Coastal and KMP monitoring areas in 2012 based on adipose fin clip observations of live and dead steelhead. Data in each monitoring area may be based on multiple surveys.

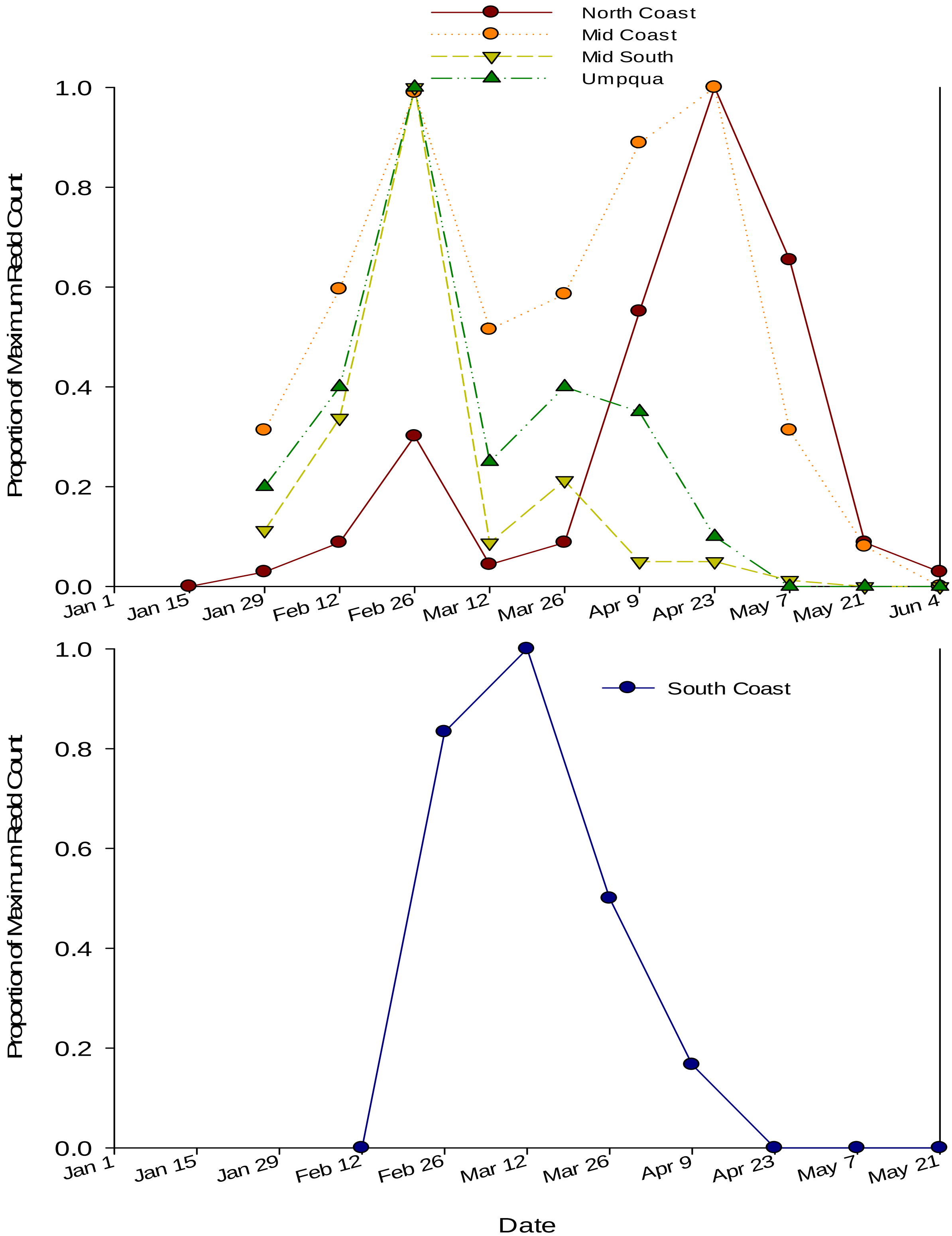

Figure 5. Proportions of the maximum winter steelhead redd count in each of the six Coastal and KMP monitoring areas by week, 2012.

Table 4. Percentage of hatchery winter steelhead found on spawning surveys in 2012 based on adipose fin clip observations of live and dead steelhead.

DPS	Monitoring Area	Known Fish	Hatchery Percentage
Oregon Coast DPS	North Coast	32	3%
	Mid Coast	64	16%
	Mid South Coast	68	12%
	Umpqua	11	0%
	Total	**175**	**11%**
Klamath Mountains Province DPS	South Coast	3	0%
	Rogue River		
	Total	**3**	**0%**
Southwest Washington ESU	Youngs Bay	4	25%
	Big Cr	5	100%
	Clatskanie	3	0%
	Scappoose	5	0%
	Total	**17**	**35%**
Lower Columbia River ESU	Clackamas	28	4%
	Sandy	3	0%
	Gorge	0	
	Total	**31**	**4%**

Southwest Washington ESU

The 2012 estimate of wild winter steelhead redds in the Oregon portion of the SWW ESU was 511, which is slightly lower than the 2004 estimate (Table 2 and Figure 7). In addition, two populations (Youngs Bay and Clatskanie) accounted for 86% of the 2012 wild winter steelhead redds in the SWW ESU. Density of redds was more evenly distributed with an average across the ESU of 3.7 redds per mile (Table 3). The exception to this pattern is the Scappoose population, where only 1.2 redds per mile was observed (Table 3 and Figure 8). The percentage of sites having at least one redd observation was also relatively consistent across the ESU, ranging from 50% in the Scappoose population to 63% in the Big Creek population (Table 3).

The distribution of hatchery steelhead in the SWW ESU naturally spawning populations was highly variable, ranging from 0% pHOS in the Clatskanie and Scappoose populations to 100% pHOS in the Big Creek population (Table 4 and Figure 9). The Youngs Bay population had a 25% pHOS, though the percentage in the Lewis and Clark basin (which is a significant component of this population) was zero. Of note in 2012 are the small sample sizes for many of the hatchery proportion calculations (Figure 9).

Spawn timing varied across SWW ESU populations, with late February or early March peaks recorded in the predominantly wild populations of the Scappoose and Clatskanie, and April peaks in the more hatchery influenced Youngs Bay and Big Creek populations (Figure 10).

An apparent mid-season lull in spawning activity occurring across the ESU may be the result of the unusually poor survey conditions encountered across Oregon during March. Timing information gathered in 2004 suggests that these populations may have relatively protracted spawning seasons, and a lack of recorded redd deposition in the center of this season suggests that poor survey conditions may have masked some aspects of the 2012 timing signature.

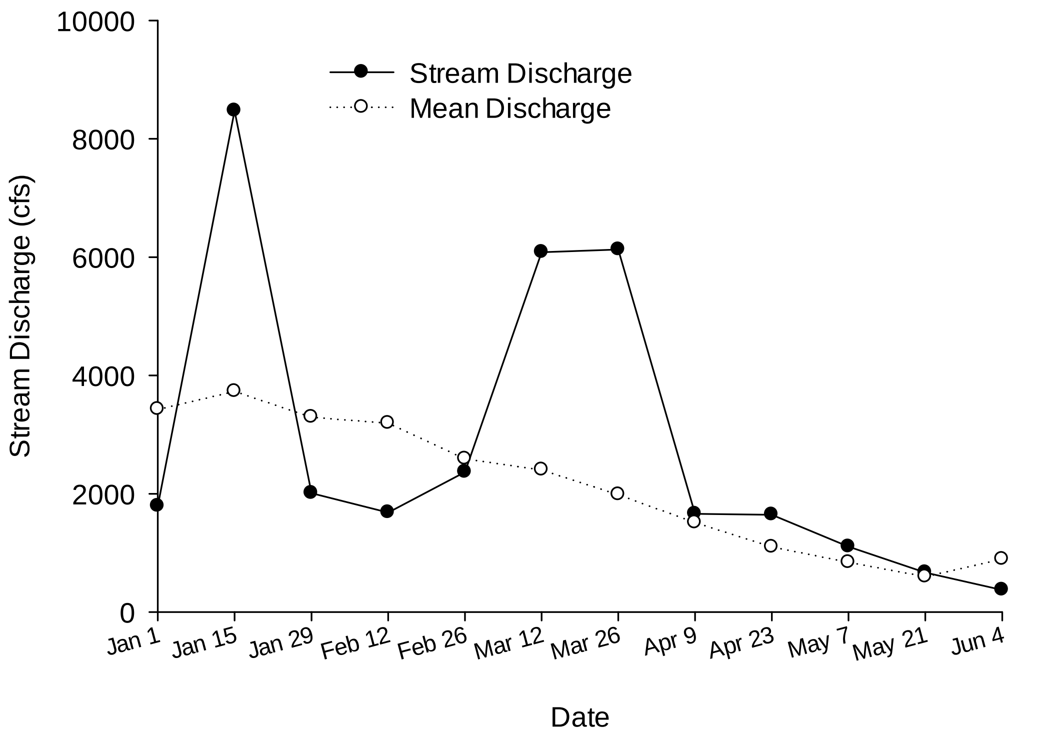

Figure 6. Stream discharge at Alsea River near Tidewater during 2012, compared to mean discharge from 1939 to 2006.

Lower Columbia ESU

The 2012 estimate of wild winter steelhead redds in the LCR ESU was 1,079, considerably lower than the 4,108 redds estimated for 2004 (Figure 7). Redd distribution across the ESU was uneven, with over 80% of the wild redd estimate occurring in the Clackamas population, and only 19% and 0.2% of wild redds occurring in the Sandy and Gorge populations, respectively. In addition to 2004, redd estimates are available for the Sandy and Clackamas populations in 2006 and 2007. The 2012 Clackamas estimate of 871 wild redds is similar to the 2006 and 2007 estimates, though much lower than the 2004 estimate (Figure 11).

The Sandy population estimate of 208 wild redds is roughly half of the previous low estimate, which occurred in 2004. Poor survey conditions across the ESU may have reduced the

2012 estimates to some degree, particularly in the Sandy population where 40% of surveyed sites were not eligible for use in calculations due to gaps in data caused by poor stream visibility. Poor survey conditions can negatively bias estimates in two ways: 1) redds may be quickly disguised by elevated flows, causing counts to miss a portion of redd deposition, and 2) poor visibility may halt survey efforts for an extended period of time causing data gaps. It is probable that both of these factors influenced estimates in the Sandy; particularly because several of the sites excluded from estimates were among the highest redd densities in the population. As a result it is likely that the Sandy population estimate contains a significant negative bias. An alternate estimate method using all random sites regardless of survey gaps resulted in an estimate of 320 redds in the Sandy population. This estimate may be more accurate than the official numbers reported here, but is not immune to the negative biases outlined above. It remains the lowest estimate on record for this population, despite being inclusive of all high density sites attempted in 2012.

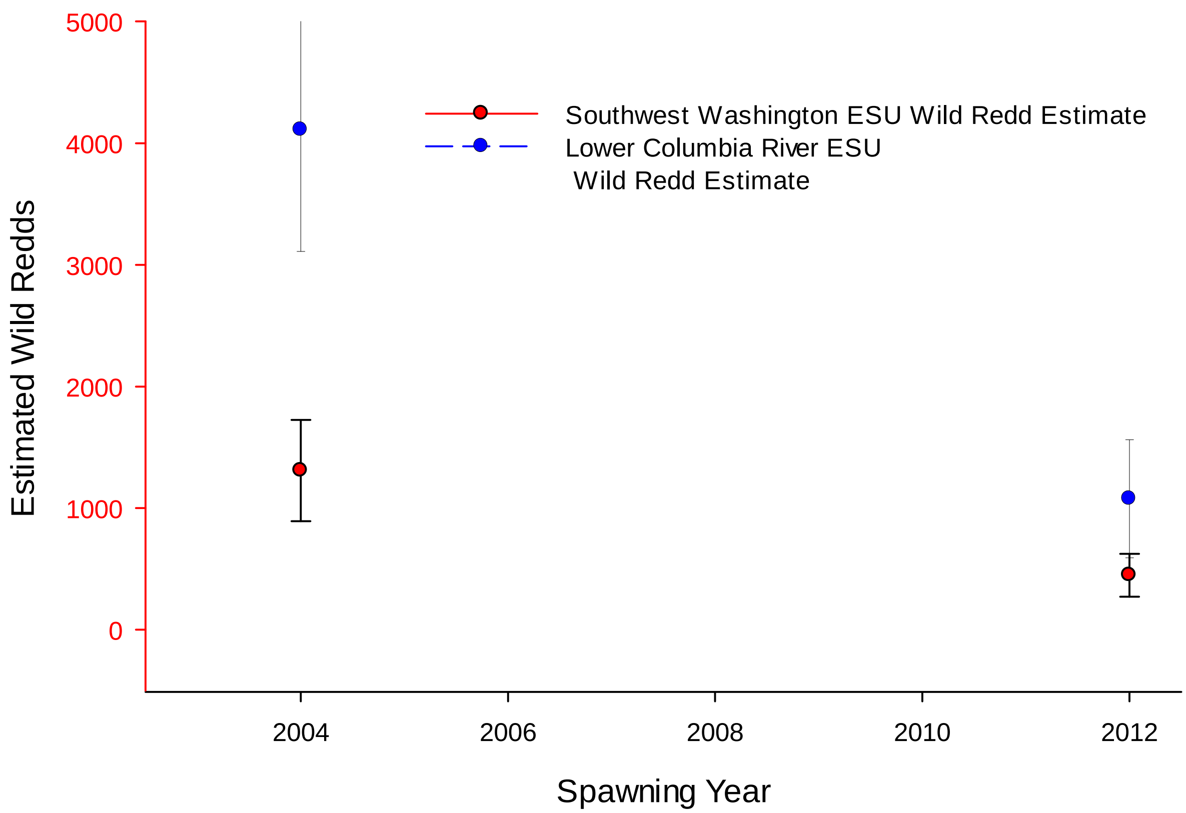

Figure 7. Winter steelhead wild redd estimates in the Oregon portions of the LCR and SWW ESUs based on random surveys in 2004 and 2012. Error bars are 95% confidence intervals.

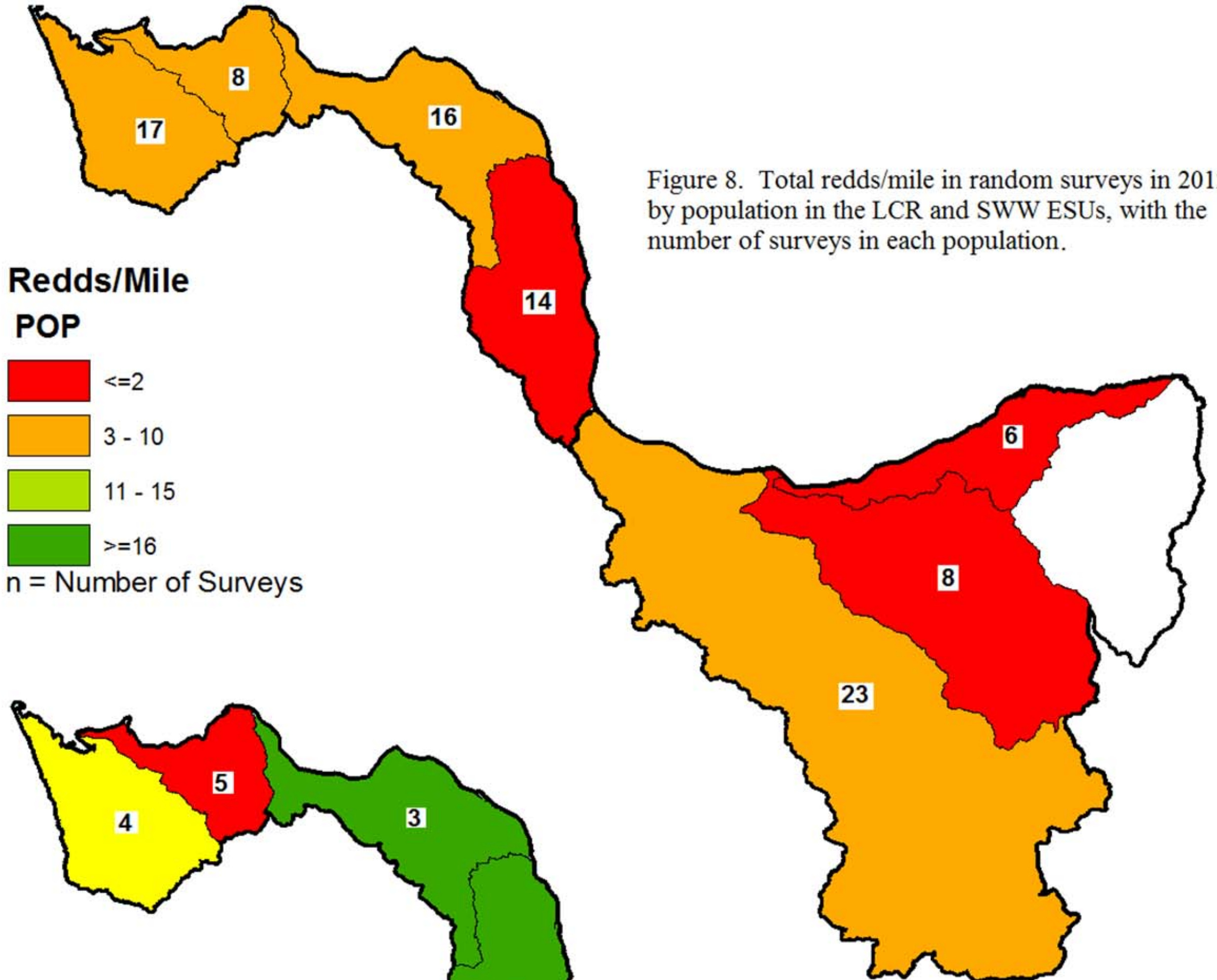

Figure 8. Total redds/mile in random surveys in 2012 by population in the LCR and SWW ESUs, with the number of surveys in each population.

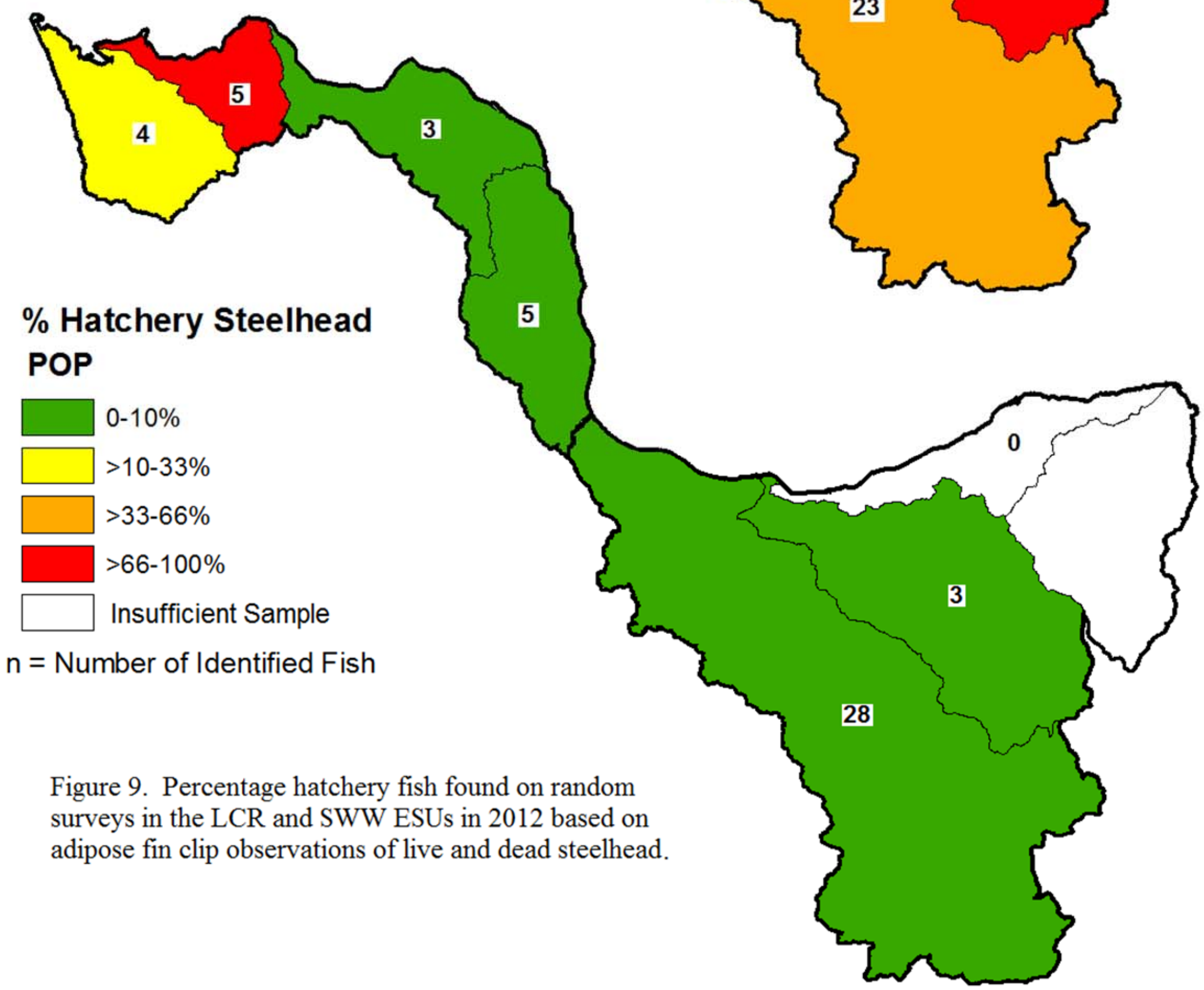

Figure 9. Percentage hatchery fish found on random surveys in the LCR and SWW ESUs in 2012 based on adipose fin clip observations of live and dead steelhead.

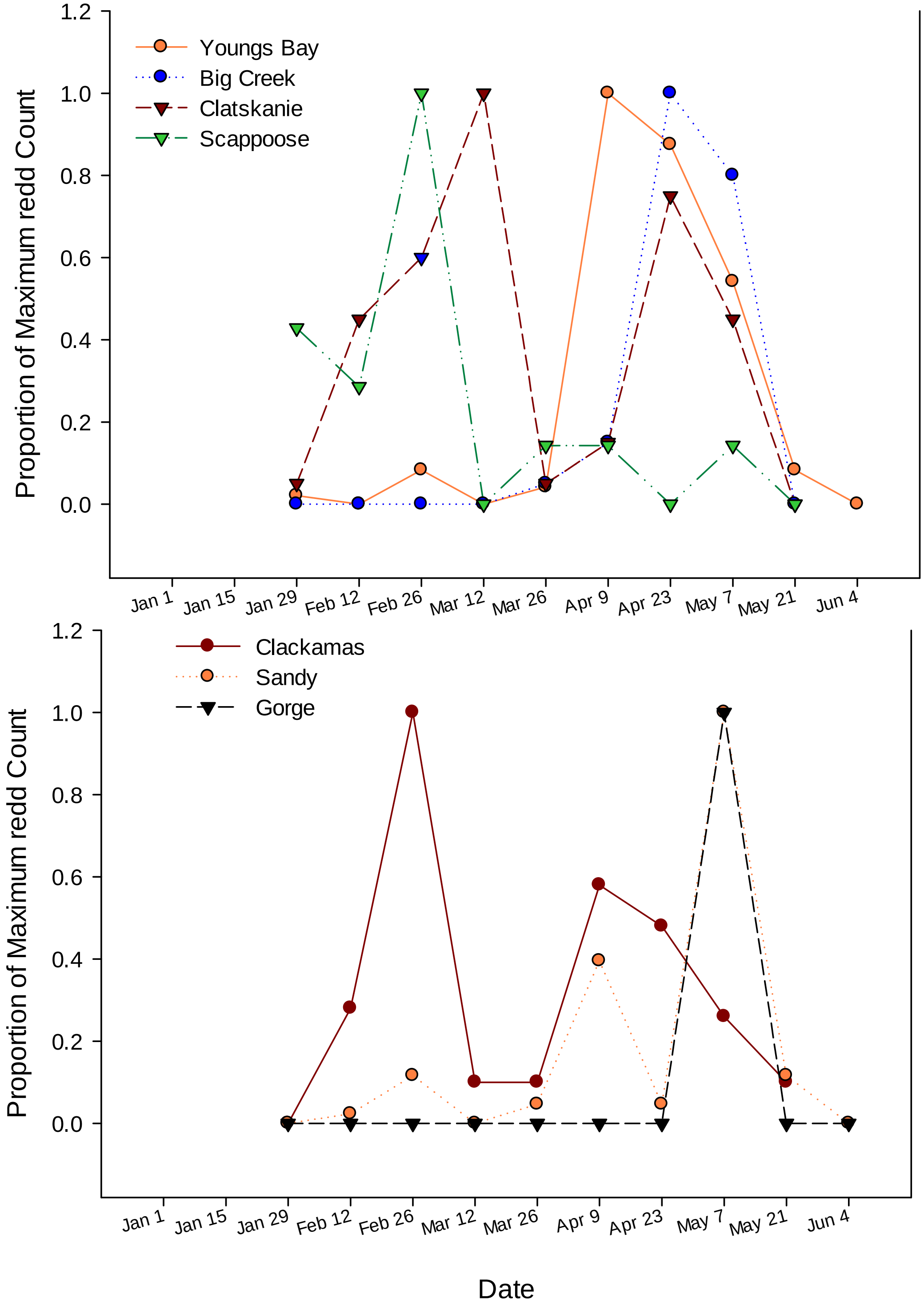

Figure 10. Proportions of the maximum winter steelhead redd count in each of the seven Lower Columbia populations by week of the year, 2012.

Redd density for the LCR ESU was 1.9 redds/ mile, ranging from 5.2 redds per mile in the Clackamas to an extremely low 0.2 redds per mile in the Sandy (Table 3 and Figure 8). The percentage of sites having at least one redd also varied, with 50% of sites occupied in the Clackamas, but only 25% in the Sandy and 17% in the Gorge populations (Table 3).

Very few hatchery steelhead were observed in the naturally spawning population across the LCR ESU; pHOS was 4% (Table 4). The only confirmed observations of hatchery fish on spawning grounds occurred in the Clackamas population (Table 4). Low sample sizes in the other two populations contained within this ESU make assessment of hatchery/wild interactions in those areas unreliable, with only three fin-mark confirmations on live or dead fish in the Sandy, and none in the Gorge populations. Beginning in 2013, the sampling design in the Sandy population will be modified to increase fin-mark observation sample size.

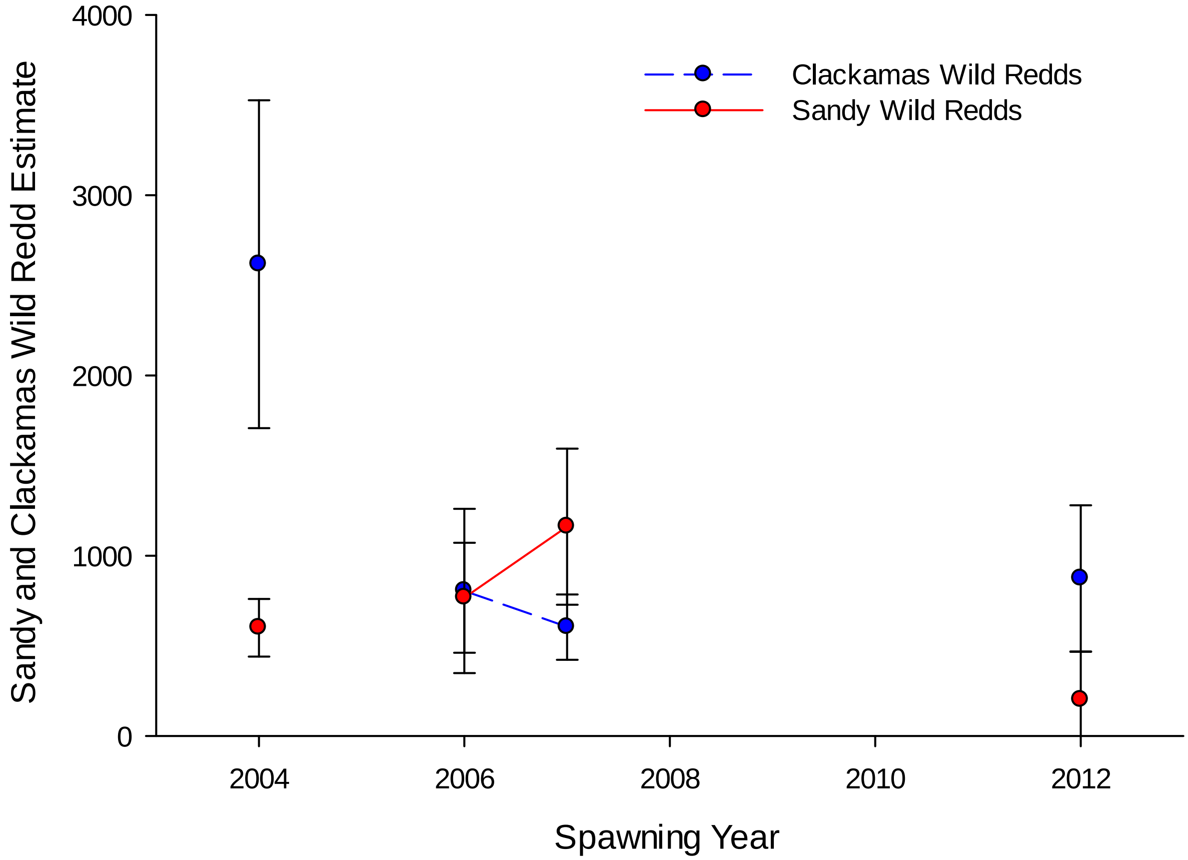

Figure 11. Winter steelhead wild redd estimates in the Clackamas and Sandy River populations based on random surveys from 2004 to 2012. Error bars are 95% confidence intervals. Estimates for these populations are not currently available for the years 2010-2011, but may be available in future reports.

Peak spawn timing varied across the three populations within this ESU, with the Clackamas peak occurring in mid to late February, and the Sandy and Gorge recording maximum redd deposition in May (Figure 10). A secondary peak was recorded in the Clackamas population in early April, and it is possible that poor survey conditions during much of March may have obscured some spawning activity between those times. This timing appears to have been earlier than recorded in previous years in the Clackamas, but appears to be relatively normal in the Sandy and Gorge populations. As was common across the state, a dip in spawning activity in the Sandy in early April may have resulted more from poor survey conditions than from the pattern of redd deposition this year.

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