THE OREGON PLAN *for Salmon and Watersheds*

Assessment of Western Oregon Adult Winter Steelhead – Redd Surveys 2013

Report Number: OPSW-ODFW-2013-09

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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 2013. Sufficient surveys were conducted to meet the precision goal (95% C.I. ± 30% of point estimate) 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) did meet the goal. Winter steelhead redd estimates for the 2013 spawning year were relatively high 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 2013 estimates are higher than those in 2012. Weather and flow conditions made for optimal survey conditions during the 2013 season. 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. The 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) across two DPSs (Figure 1). In 2008, the project was modified to assess status at the DPS level only, and in 2010 monitoring ceased in the Rogue MA. Both reductions in effort were 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 restarted in 2012.

A spatially balanced probabilistic sampling design (Stevens 2002) was used to randomly 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. In accordance with prior work conducted by ODFW in coastal streams, monitoring of winter steelhead abundance is based on counts of redds, with rearing origin determined from live and dead fish (Susac and Jacobs 1999). Repeat visits to each site from February through May generate a total redd count for each survey. Sites are visited at least once every fourteen days (Susac and Jacobs 1999). Redds are marked with colored rocks and flagging to prevent re-counting during subsequent surveys. Specific descriptions of project protocols can be found in the annual survey procedures manual (ODFW 2013a).

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.

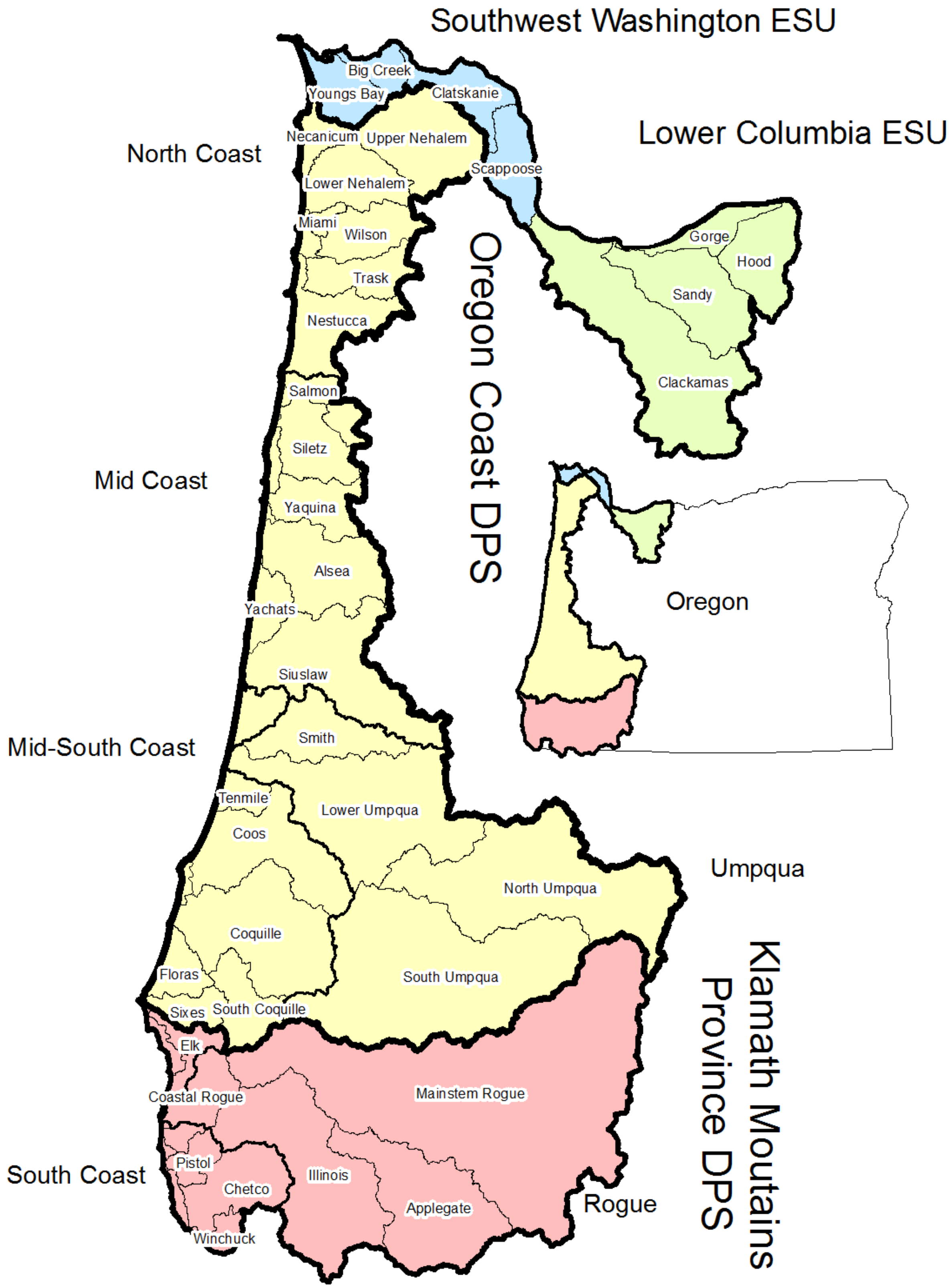

Figure 1. Steelhead monitoring study area showing the winter steelhead populations, monitoring areas, evolutionarily significant units and distinct population segments.

Table 1. Site status by monitoring area. Target sites are within and non-target sites are outside of 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.

DPS	Monitoring Area	Target Response	Target Non-response	Non-target
Oregon Coast	North Coast	31	10	2
	Mid Coast	39	7	4
	Mid-South Coast	35	8	2
	Umpqua	24	24	6
	Total	**129**	**49**	**14**
Klamath Mountains Province	South Coast	14	4	0
	Rogue River	-	-	-
	Total	**14**	**4**	**0**
Lower Columbia	Young's Bay	22	0	7
	Big Cr	10	1	1
	Clatskanie	25	1	0
	Scappoose	21	12	2
	Clackamas	33	14	2
	Sandy	33	15	4
	Gorge	-	-	-
	Total	**144**	**43**	**16**

A total of 287 sites were successfully surveyed in 2013, split between Oregon Coast, Klamath Mountains, and Lower Columbia streams (Table 1). Successful surveys represent 70% 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). Four percent of sites coast-wide and six percent in the Lower Columbia region were not surveyed because of landowner access restrictions. The SWW ESU had the highest proportion of access denials (8%). Fourteen percent of sites coast-wide and 5% in the Lower Columbia were not used in final estimates due to turbidity and/or large gaps between survey dates, with the highest proportion of these sites in the Umpqua MA (22%). The average percentage of sites across all areas of the Oregon Coast and Lower Columbia falling outside of steelhead spawning habitat was 7% (range: 0 to 24%).

The target level of precision for steelhead redd estimates is a 95% confidence interval within ±30% of the point estimate. In 2013, this goal was achieved for the Oregon Coast DPS, SWW and LCR ESUs, and in the North Coast and the Mid-South Coast MAs (Table 2). Precision goals were exceeded in each individual Lower Columbia population, and in the Mid Coast, Umpqua, and South Coast MAs. Steelhead spawning survey effort was dramatically reduced in 2008, resulting in not meeting precision goals at most spatial scales.

Table 2. Oregon winter steelhead redd abundance estimates, 2013. Estimates are derived from counts in randomly selected spawning surveys.

		Survey Effort		Winter Steelhead Redd Abundance			
				Total		Wild [a]	
DPS/ESU	Monitoring Area or Population	Number of Surveys	Miles	Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast	North Coast	31	29	30,144	8,958	29,371	8,728
	Mid Coast	39	31	31,030	11,209	27,927	10,088
	Mid-South Coast	35	35	19,476	5,152	15,423	4,080
	Umpqua	24	17	22,807	9,847	21,895	9,453
	Total	129	112	103,457	18,149	94,616	16,851
Klamath Mountains Province	South Coast	14	12	8,961	4,004	8,961	4,004
	Rogue River	-	-	-	-	-	-
	Total	14	12	8,961	4,004	8,961	4,004
Southwest Washington ESU	Young's Bay	22	20	283	121	94	40
	Big Cr	10	8	135	120	14	13
	Clatskanie	25	24	962	365	898	341
	Scappoose	21	18	205	120	205	120
	Total	78	70	1,585	420	1,211	363
Lower Columbia River ESU	Clackamas	33	39	1,075	350	914	297
	Sandy	33	41	2,202	747	2,062	699
	Gorge	-	-	-	-	-	-
	Total	66	80	3,277	825	2,976	760

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

Oregon Coast DPS

The 2013 estimate of wild winter steelhead redds in the Oregon Coast DPS is the highest since monitoring began in 2003 (Figure 2). The 94,616 estimated wild redds in the Oregon Coast DPS is 54% greater than the 2003-2012 average. One of the reasons the 2013 estimate is higher than previous years' estimates may be due in part to the ideal surveying conditions experienced during the season. Flows remained low and water clarity was optimal for much of the season causing a high rate of redd observations. Density of redds (total steelhead redds/mile of steelhead spawning habitat) varied across monitoring areas, ranging from the 22.2 redds/mile observed in the North Coast MA to the 15.6 redds/mile in the Umpqua MA (Table 3 and Figure 3). The Umpqua MA typically has the lowest redd density of all the Oregon Coast MA, whereas the MA with the highest redd density is more variable across years.

A lower than average rate of occupied sites (those with at least one recorded redd) was observed in 2013. This is likely in response to migration issues in smaller streams due to lower

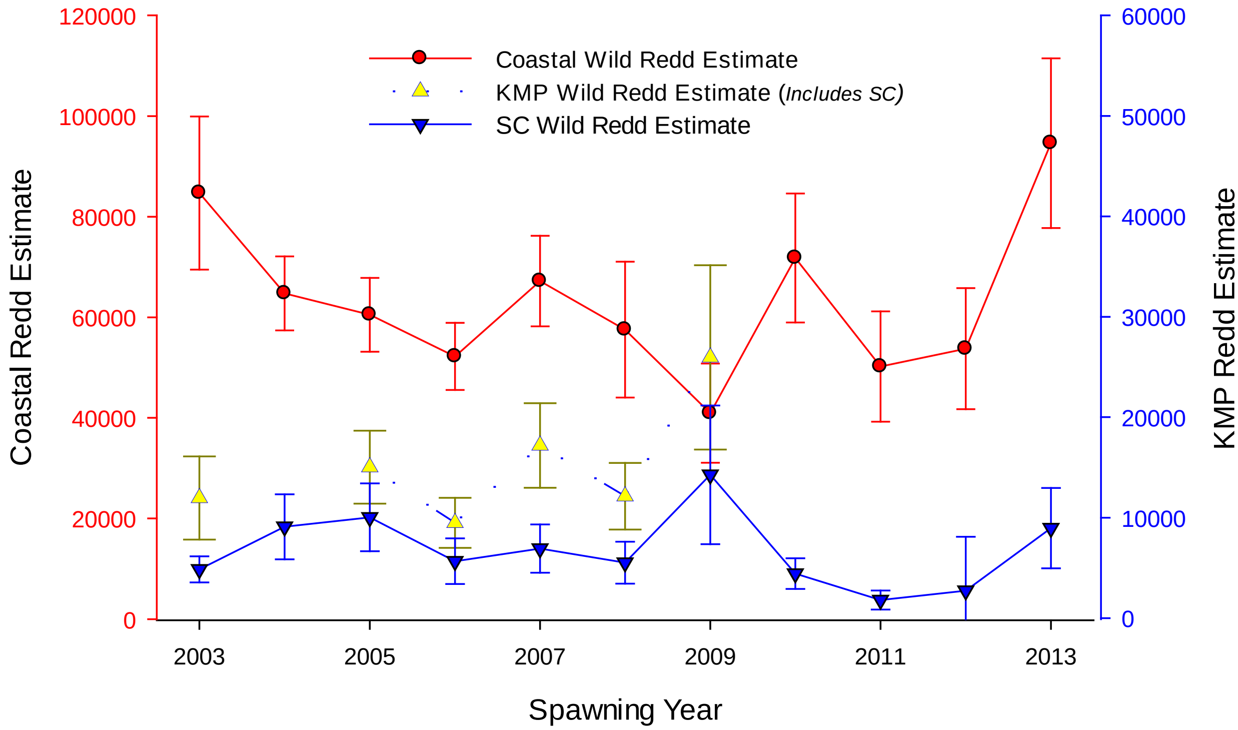

Figure 2. Winter steelhead wild redd estimates based on random surveys, 2003-2013. Error bars are 95% confidence intervals. Estimates for the KMP are incomplete for 2004 and 2010-2013, due to a lack of Rogue River MA data.

Table 3. Oregon total winter steelhead redd density and percent occupancy, 2013.

DPS		Monitoring Area	Redds/Mile	% Sites With Redds
Oregon Coast		North Coast	22.2	71%
		Mid Coast	16.9	76%
		Mid-South Coast	18.4	86%
		Umpqua	15.6	58%
		Total	**18.3**	**73%**
KMP		South Coast	26.4	100%
Lower Columbia	Southwest Washington ESU	Young's Bay	6.7	58%
		Big Cr	5.9	56%
		Clatskanie	16.3	65%
		Scappoose	3.4	33%
		ESU Total	**8.6**	**54%**
	Lower Columbia River ESU	Clackamas	5.9	57%
		Sandy	13.5	82%
		Gorge	-	-
		ESU Total	**9.5**	**69%**
		Total	**8.6**	**58%**

than average flows. In the Oregon Coast DPS, 73% of sites were occupied in 2013 compared to an average of 82% over the previous ten years. The Mid-South Coast MA had the highest rate of occupied sites (86%), despite a redd density that was slightly below average (Table 3). The lowest occupation rate was observed in the Umpqua MA (58%).

The proportion of hatchery origin spawners (pHOS) in naturally spawning steelhead populations varied among the monitoring areas, ranging between 3% in the North Coast MA to 21% in the Mid-South Coast MA (Table 4 and Figure 4). The proportion of hatchery origin spawners across the entire Oregon Coast DPS was 9%. This figure is nearly 6% lower than the 2003-2012 average of 15% pHOS. Over half of the known fish observations came from the Mid-South Coast where hatchery steelhead were most abundant. Sample size for determining pHOS was higher in 2013 than in 2012 in all four ESU/DPSs (Table 4 and Brown et.al. 2013).

Table 4. Number of known fin-mark status steelhead observed on spawning grounds, and resulting pHOS estimates in 2013. Based on adipose fin clip observations of live and dead steelhead in successfully conducted surveys.

DPS	Monitoring Area	Known Fish	Hatchery Percentage
Oregon Coast	North Coast	39	3%
	Mid Coast	50	10%
	Mid-South Coast	173	21%
	Umpqua	50	4%
	Total	**312**	**9%**
Klamath Mountains Province	South Coast	99	0%
	Rogue River	-	-
	Total	**99**	**0%**
Southwest Washington ESU	Young's Bay	18	67%
	Big Cr	19	89%
	Clatskanie	30	7%
	Scappoose	0	NA*
	Total	**67**	**24%**
Lower Columbia River ESU	Clackamas	20	15%
	Sandy	47	6%
	Gorge	-	-
	Total	**67**	**9%**

* = No hatchery percentage due to a sample size of zero in the Scappoose population.

Oregon Coast DPS steelhead spawn timing in 2013 occurred relatively early when compared to previous years in the North Coast and Umpqua MAs, and about average in the Mid Coast and Mid-South MAs (Figure 5 and Brown et.al. 2013). In general, though spawn timing

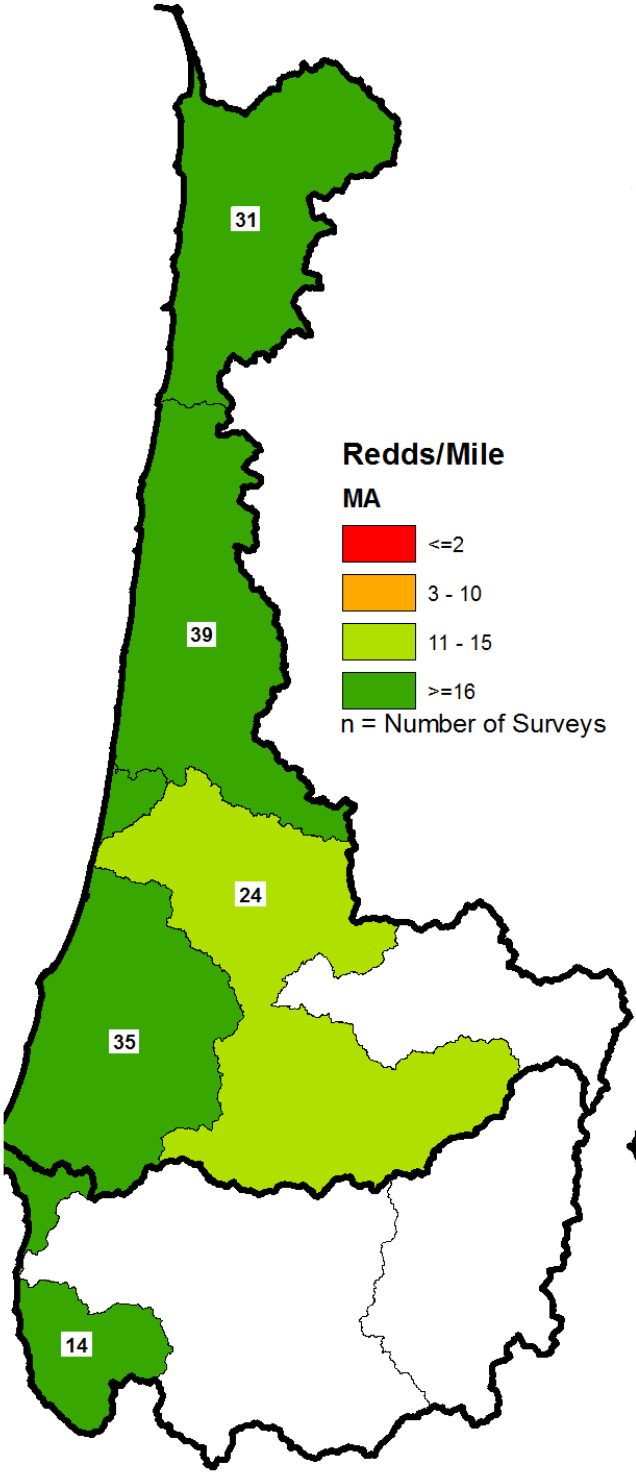

Figure 3. Total redds/mile in random surveys in 2013 by monitoring area in the Coastal and KMP DPSs, with the number of surveys in each monitoring area.

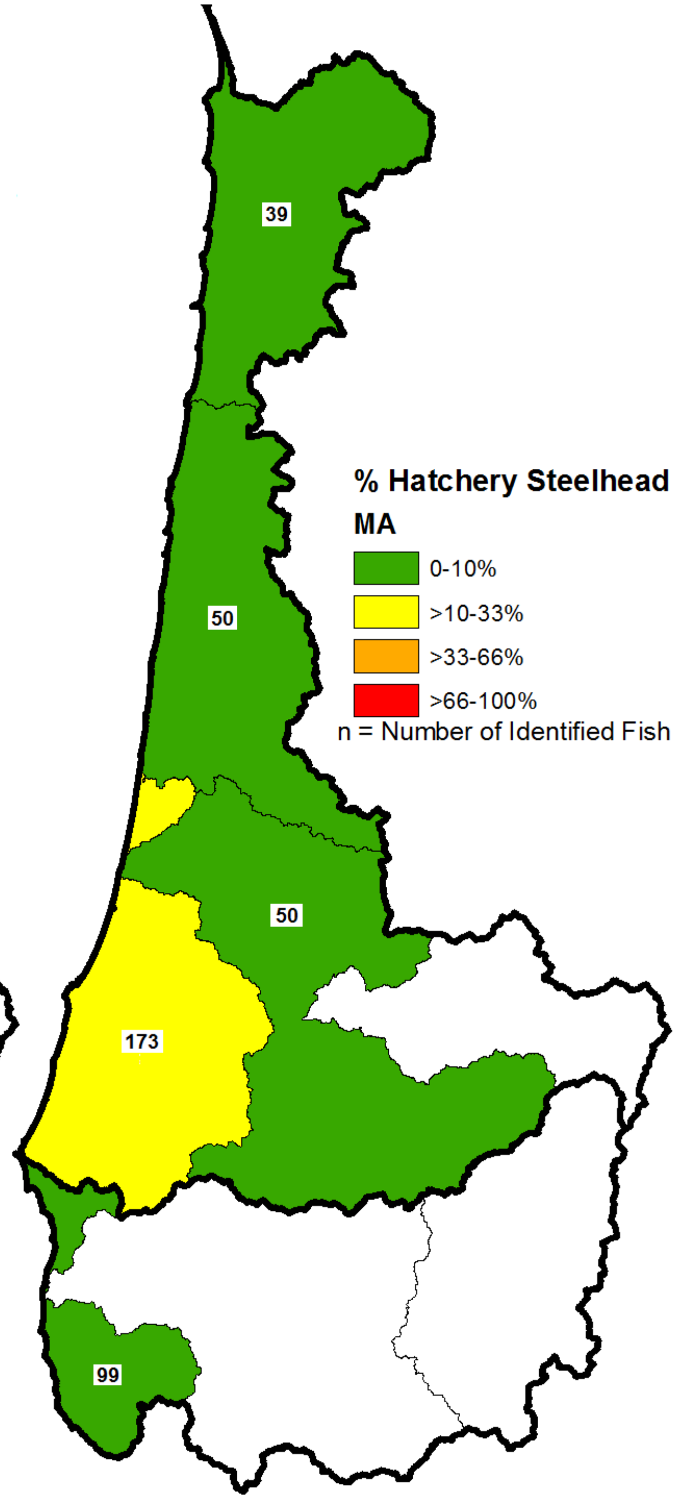

Figure 4. Percentage hatchery fish found on random surveys in each of the six Coastal and KMP monitoring areas in 2013 based on adipose fin clip observations of live and dead steelhead. Data in each monitoring area may be based on multiple surveys

peaked similarly to the 10 year average, but timing in 2013 was protracted across a longer time period in each coastal MA. This is most likely due to the lack of any high flow events in 2013. High flows typically influence both the intensity and duration of steelhead spawning activity and also inhibit our ability to count redds. Stream discharge was unusually steady in 2013, with no large peaks in flow. For example, in the Alsea basin the small peaks in stream discharge during the season only exceeded average a few times (Figure 6). Similar flows existed throughout the Oregon Coast and Lower Columbia. This flow regime was favorable for survey schedules and stream visibility; however, with such ideal conditions, it is possible that a higher proportion of steelhead redds were observed in 2013 when compared to a typical or "higher-flow" year.

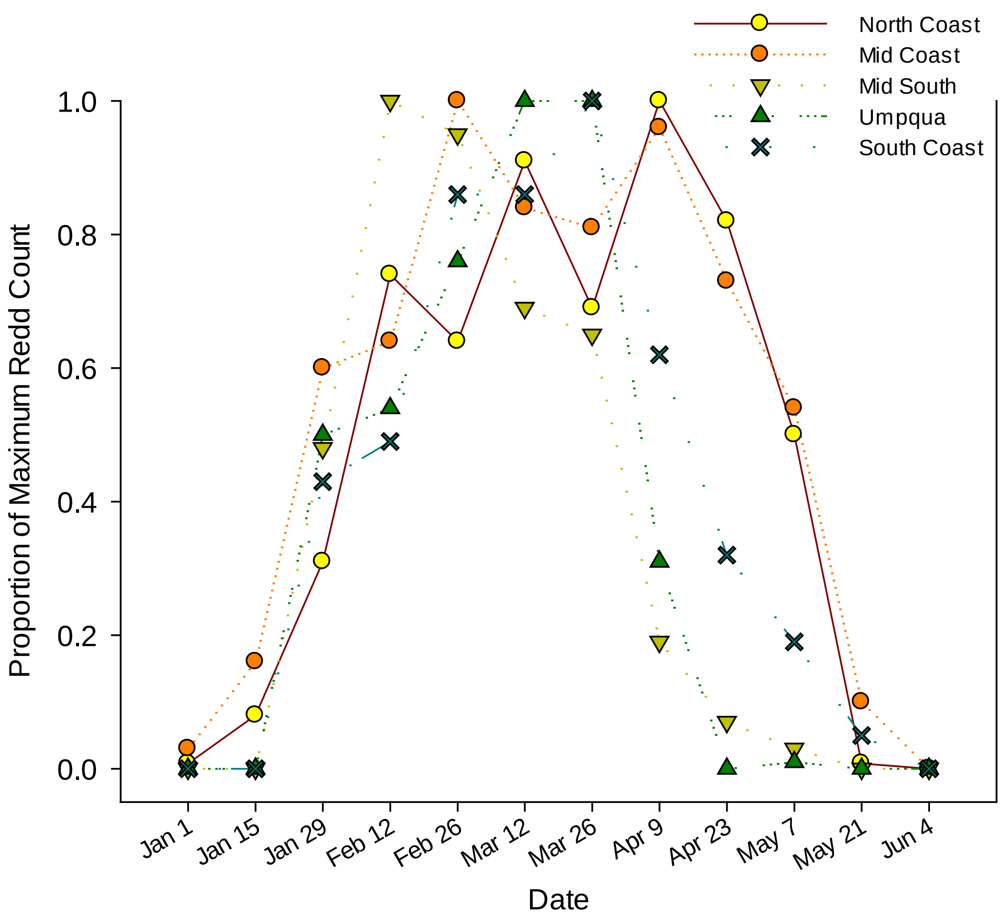

Figure 5. Proportion of the maximum winter steelhead redd count in each of the five Coastal and KMP monitoring areas by week of the year, 2013.

Klamath Mountains Province DPS

No surveys were performed in the Rogue MA in 2013 due to budget constraints. In the South Coast MA we estimate that there were 8,961 wild steelhead produced redds (Table 2). While this is not the highest estimate over the course of our monitoring, it is a large increase compared to the past three years (Figure 2). In 2011 and 2012, the small number of successfully

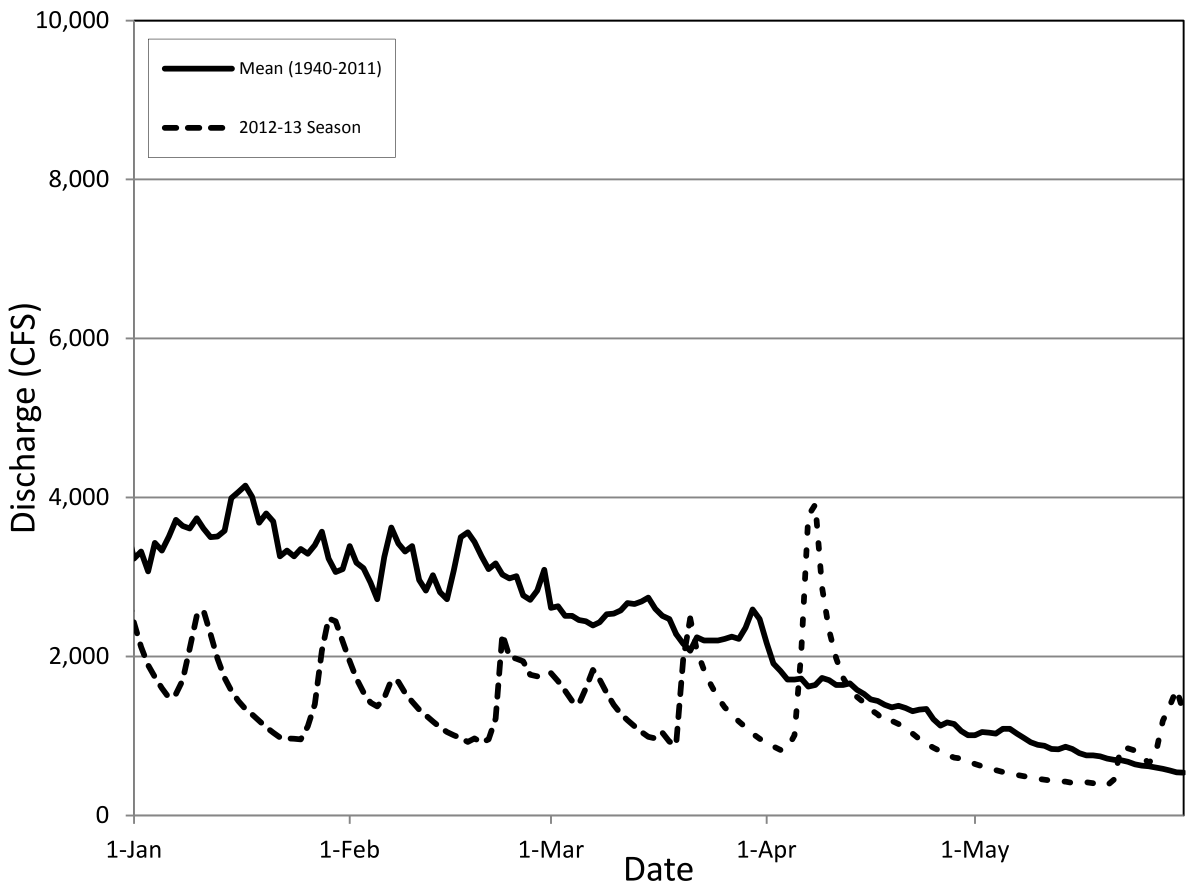

Figure 6. Stream discharge at Alsea River near Tidewater during 2013, compared to mean discharge from 1940 to 2011.

surveyed sites likely hampered the accuracy of these estimates, whereas in 2013 we had much better success, surveying 78% of our selected sites. This high proportion of successful surveys is largely due to the favorable survey conditions throughout the season. Conditions were similar to those experienced by the other Western Oregon monitoring areas. South Coast MA estimated pHOS in 2013 was 0%. This is the fifth year of estimating 100% wild steelhead spawners in this MA. Spawning timing in 2013 peaked in late March which is similar to prior years and slightly later than 2012 which peaked in mid-March (Brown et. al 2013).

Southwest Washington ESU

The 2013 estimate of wild winter steelhead redds in the Oregon portion of the SWW ESU was 1,211 (Table 2). This is an higher than the 2012 estimate and similar to the 2004 estimate (Figure 7). The Clatskanie population accounted for 74% of the 2013 wild winter steelhead redds within this ESU. Densities ranged from 3.4 redds per mile in the Scappoose population to 16.3 redds per mile in the Clatskanie population (Table 3 and Figure 8). Average density across the ESU was 8.6 redds per mile. Percentage of sites with at least one redd observed ranged from 33% in the Scappoose population to 65% in the Clatskanie population (Table 3).

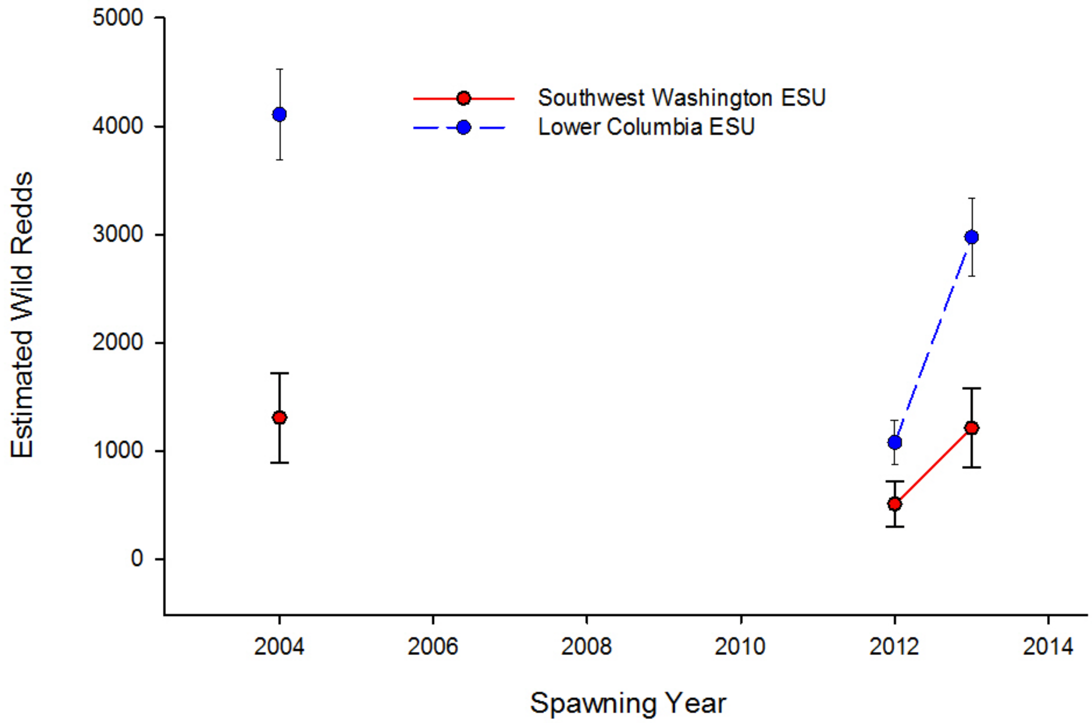

Figure 7. Winter steelhead wild redd estimates in the Oregon portions of the LCR and SWW ESUs based on random surveys in 2004, 2012 and 2013. Error bars are 95% confidence intervals. Lower Columbia ESU only includes data for the Sandy and Clackamas populations.

The distribution of naturally spawning hatchery steelhead in the SWW ESU varied across populations, ranging from 7% pHOS in the Clatskanie population to 89% pHOS in the Big Creek population (Table 4 and Figure 9). This pattern is consistent with previous years. The Youngs Bay population had a 67% pHOS, though the percentage in the Lewis and Clark sub-basin (which is a significant component of this population) was less than 1%. Sample sizes for hatchery proportion calculations within this ESU were better that previous years in all populations (Brown et. al 2013), excepting the Scappoose population where no known fin-marks were observed (Table 4 and Figure 9). Ideal stream conditions throughout the season likely contributed to the high sample size of known fish for the ESU.

Spawn timing was fairly consistent across the SWW ESU populations in 2013, with peaks ranging from early February in the Big Creek population to early March in the Scappoose and Youngs Bay populations (Figure 10). This is different than the patterns seen in 2012, when the Youngs Bay and Big Creek populations peaked in April, the Clatskanie population had a bi-modal timing (peaks in March and April) and the Scappoose population peaked in February (Brown et. al 2013). Consistently favorable survey conditions during the 2013 spawning season enhanced the ability to detect peaks in redd deposition. More years of data will be required to explore similarities and differences in winter steelhead spawning timing in these populations.

Lower Columbia ESU

The Oregon portion of the Lower Columbia Steelhead ESU includes four populations. However, due to budgetary and logistical issues, this spawning ground survey effort is only conducted in the Sandy, Gorge, and the portion of the Clackamas population below the North Fork Dam. The following results are for these areas only.

The 2013 estimate of wild winter steelhead redds in the LCR ESU was 2,976 (Table 2). With estimates for only three years there is no indication of trend. In both the LCR and SWW ESUs the 2013 wild winter steelhead redd estimate is less than the 2004 estimate and greater than the 2012 estimate (Figure 7). Redd distribution across the ESU was disproportionate, with over 69% in the Sandy population, and only 31% in the Clackamas population. In the Sandy and Clackamas populations spawning survey data is also available for the 2006, 2007, and 2010 through 2012 spawning seasons. The 2013 Clackamas estimate of 914 wild redds is similar to previous estimates, though much lower than the 2004 estimate (Figure 11). The 2013 Sandy population estimate of 2,062 wild redds is the highest estimate since 2004 when surveys were started for this population (Figure 11).

Effort in the Sandy population in 2013 differed from all other populations reported in that surveys were conducted weekly rather than the bi-weekly. This was done primarily to improve the sample size of observations of known fin-marked adults in this basin, but also in an attempt to maintain a higher number of successfully surveyed sites. In the Sandy population, 87% of sites surveyed met protocols for a viable survey, and were therefore eligible for use in calculations. Increased survey visits during the spawning season paired with ideal survey conditions were likely factors in the high proportion of valid surveys completed in 2013 compared to previous years. It is also important to note that surveying conditions were much better in 2013 than in any previous years, and historical estimates may be relatively lower in part due to a reduced rate of redd observation.

Redd density for the LCR ESU was 9.5 redds per mile, ranging from 5.9 redds per mile in the Clackamas to 13.5 redds per mile in the Sandy (Table 3 and Figure 8). The percentage of sites having at least one redd also varied between the two populations, with 57% of sites occupied in the Clackamas and 82% of sites occupied in the Sandy population (Table 3).

The proportion of naturally spawning steelhead of hatchery origin in the LCR ESU; was 9% in 2013 (Table 4). For the 2013 season, pHOS was 6% in the Sandy population and 15% in the Clackamas population (Table 4). Surveys were not conducted in the Columbia River Gorge population in 2013. Good survey conditions and increased survey frequency in the Sandy this season increased the number of steelhead of known fin-clip status from 3 in 2012 to 47 in 2013.

Peak spawn timing was similar across the two surveyed populations within this ESU, with the peak occurring during early April in both populations (Figure 10). There was also an initial peak recorded in the Clackamas population in late February. As with all other survey areas in 2013, survey conditions were ideal throughout the season in the LCR ESU, and it is unlikely that these timing signatures were the product of survey conditions or any other surveying affect.

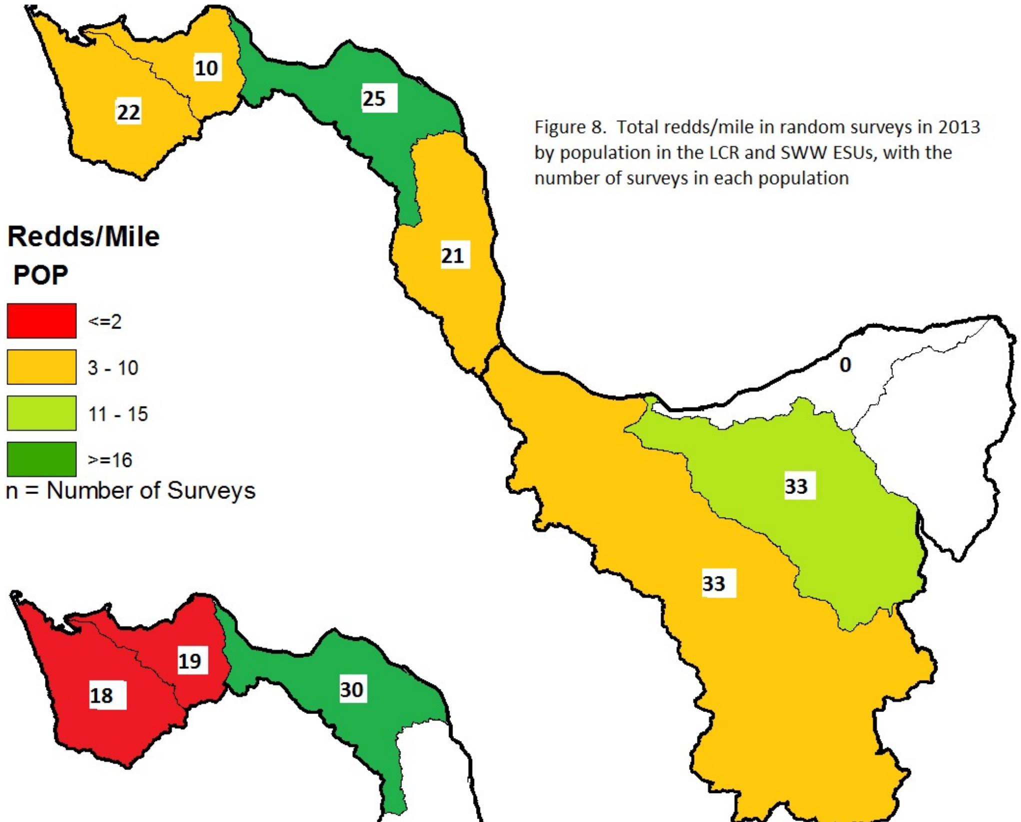

Figure 8. Total redds/mile in random surveys in 2013 by population in the LCR and SWW ESUs, with the number of surveys in each population

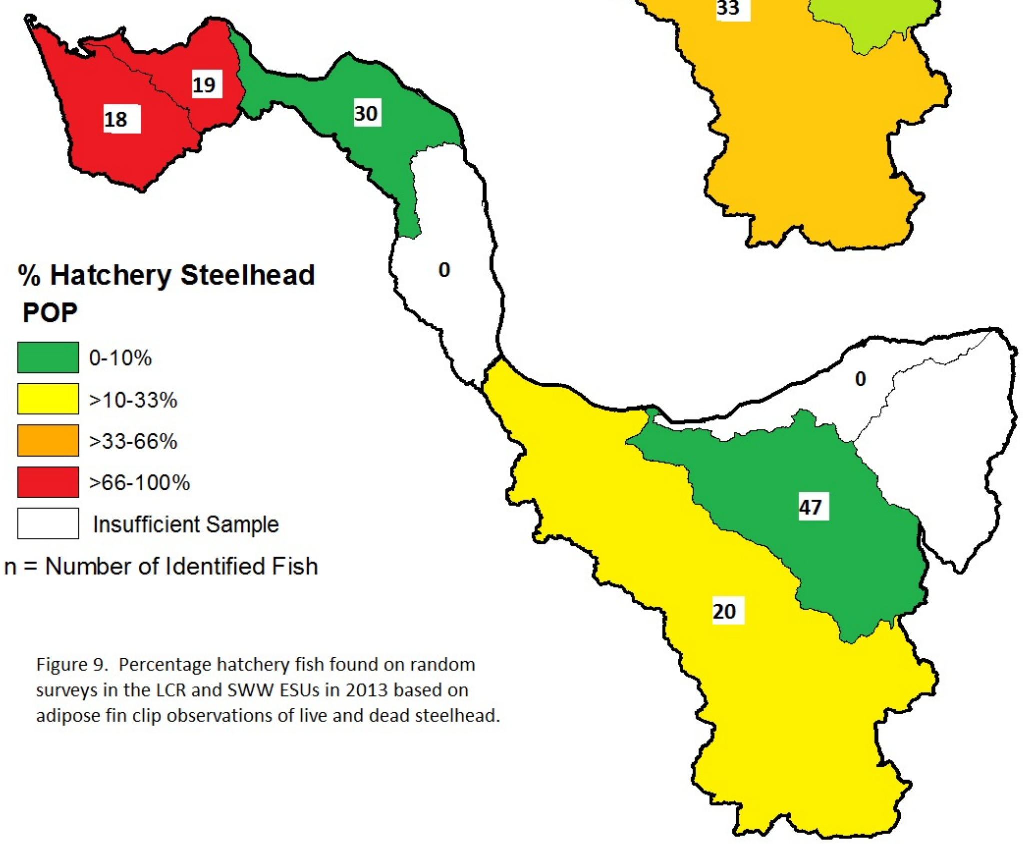

Figure 9. Percentage hatchery fish found on random surveys in the LCR and SWW ESUs in 2013 based on adipose fin clip observations of live and dead steelhead.

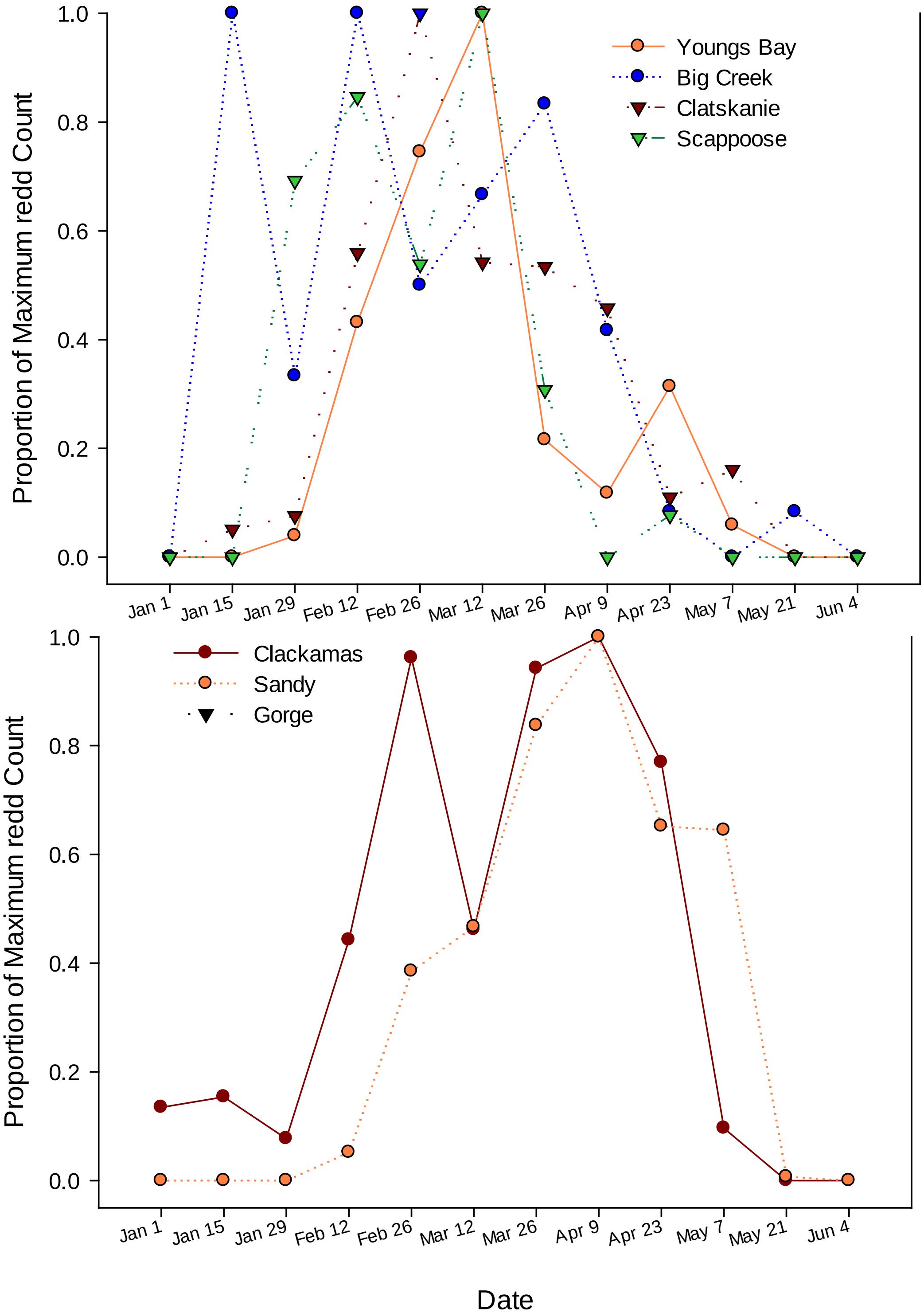

Figure 10. Proportion of the maximum winter steelhead redd count in each of the seven Lower Columbia populations by week of the year, 2013.

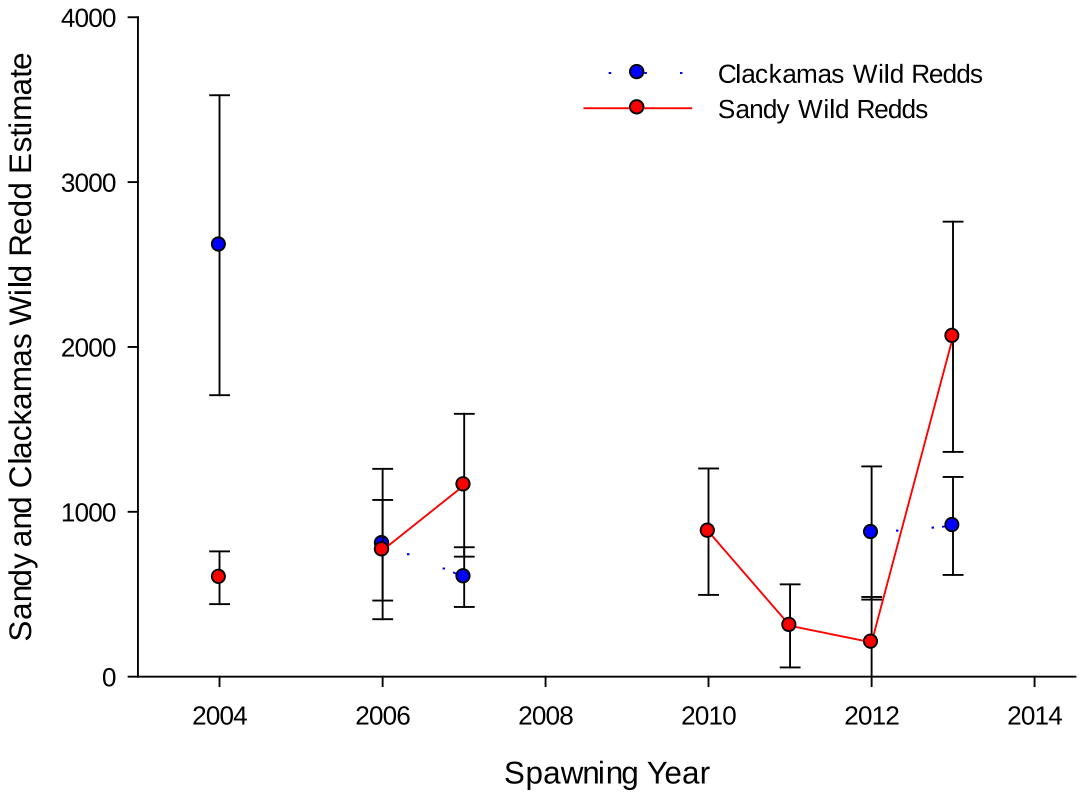

Figure 11. Winter steelhead wild redd estimates in the Clackamas and Sandy River populations based on random surveys from 2004 to 2013. Error bars are 95% confidence intervals.

Steelhead Escapement

In recent years there has been an increased emphasis on a redd-to-fish conversion factor so that estimates can be reported in terms of fish rather than redds. In 2013 we conducted a re-analysis of previous calibration efforts, based on four calibration sites over a five-year time span (1998-2002). This re-analysis resulted in an average conversion rate which is intended to be used across all of the monitoring areas and populations included in this report (ODFW 2013b).

Total steelhead = (1.70 * Redds) + 3.74

Estimates for winter steelhead escapement in 2013, derived from redd counts and then translated with this conversion factor are reported in Table 5. Planning for additional calibration efforts using similar methods and a mix of new and repeated calibration sites is in progress. This is intended to be an ongoing, and annual, component of these monitoring efforts. Some variation does exist between sites and between years, so the goal is to build on previous calibration work by exploring the feasibility of producing a redd-to-fish conversion on an annual basis.

The ideal surveying conditions found in the 2013 spawning season are extremely unusual. These “perfect” surveying conditions were not present during any of the previous year's calibration work. As a result, redd estimates for 2013 are likely to be among the most accurate produced for these monitoring areas since this work began in 2003, but the conversion from redds to fish may be positively biased since the conversion factor is likely based to a lower rate of redd observation on spawning ground surveys. As a result, the 2013 abundance estimates across all areas of western Oregon are likely to be somewhat higher than the actual number present in these populations.

Table 5. Oregon winter steelhead abundance estimates, 2013. Estimates are derived from redd counts in random spawning surveys. Clackamas estimate is for the area below the North Fork Clackamas Dam only. Dam counts are available on the Portland General Electric web page: http://www.portlandgeneral.com/community_environment/initiatives/protecting_fish/clackamas_river/default.aspx

		Winter Steelhead Abundance			
		Total		Wild [a]	
DPS/ESU	Monitoring Area or Population	Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast	North Coast	51,248	15,232	49,934	14,842
	Mid Coast	52,755	19,059	47,480	17,153
	Mid-South Coast	33,114	8,762	26,224	6,940
	Umpqua	38,776	16,743	37,225	16,073
	Total	175,881	30,857	160,851	28,650
Klamath Mountains Province	South Coast	15,237	6,810	15,237	6,810
	Rogue River	-	-	-	-
	Total	15,237	6,810	15,237	6,810
Southwest Washington ESU	Young's Bay	486	209	164	72
	Big Cr	234	207	28	25
	Clatskanie	1,639	624	1,530	583
	Scappoose	351	207	351	207
	Total	2,698	718	2,062	622
Lower Columbia River ESU	Clackamas [b]	1,831	598	1,557	509
	Sandy	3,748	1,273	3,509	1,192
	Gorge	-	-	-	-
	Total	5,575	1,406	5,062	1,295

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

b = *The Clackamas abundance estimate only includes the area below the North Fork Dam.*

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