THE OREGON PLAN *for Salmon and Watersheds*

Assessment of Western Oregon Adult Winter Steelhead – Redd Surveys 2014

Report Number: OPSW-ODFW-2014-09

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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 2014, and also includes a brief summary of lamprey data collected from the same monitoring efforts. Sufficient surveys were conducted to meet the precision goal (95% C.I. ± 30% of point estimate) for steelhead estimates in the Oregon Coast Distinct Population Segment (DPS) and Lower Columbia River (LCR) Evolutionarily Significant Units (ESU), but not the Klamath Mountains Province (KMP) DPS. Funding was not available in 2014 for monitoring the Southwest Washington (SWW) ESU. Winter steelhead redd estimates for the 2014 spawning year were relatively 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 2014 estimates in the LCR ESU are higher than those in 2012 and 2013. Weather and flow conditions made for challenging survey conditions during the 2014 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 (Figure 1). 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. From 2010 through 2013, the same set of random sites was conducted annually. Starting in 2014 in the Oregon Coast ESU, random sites were selected from a rotating panel design with equal proportions of sites from annual, 3-year, and one-time only panels. This change in site selection maintains many of the same annual sites monitored for trend analysis, while also providing additional geographical and distribution information. In the Lower Columbia, sites have been selected using the rotating panel design for the past several years. 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 2014).

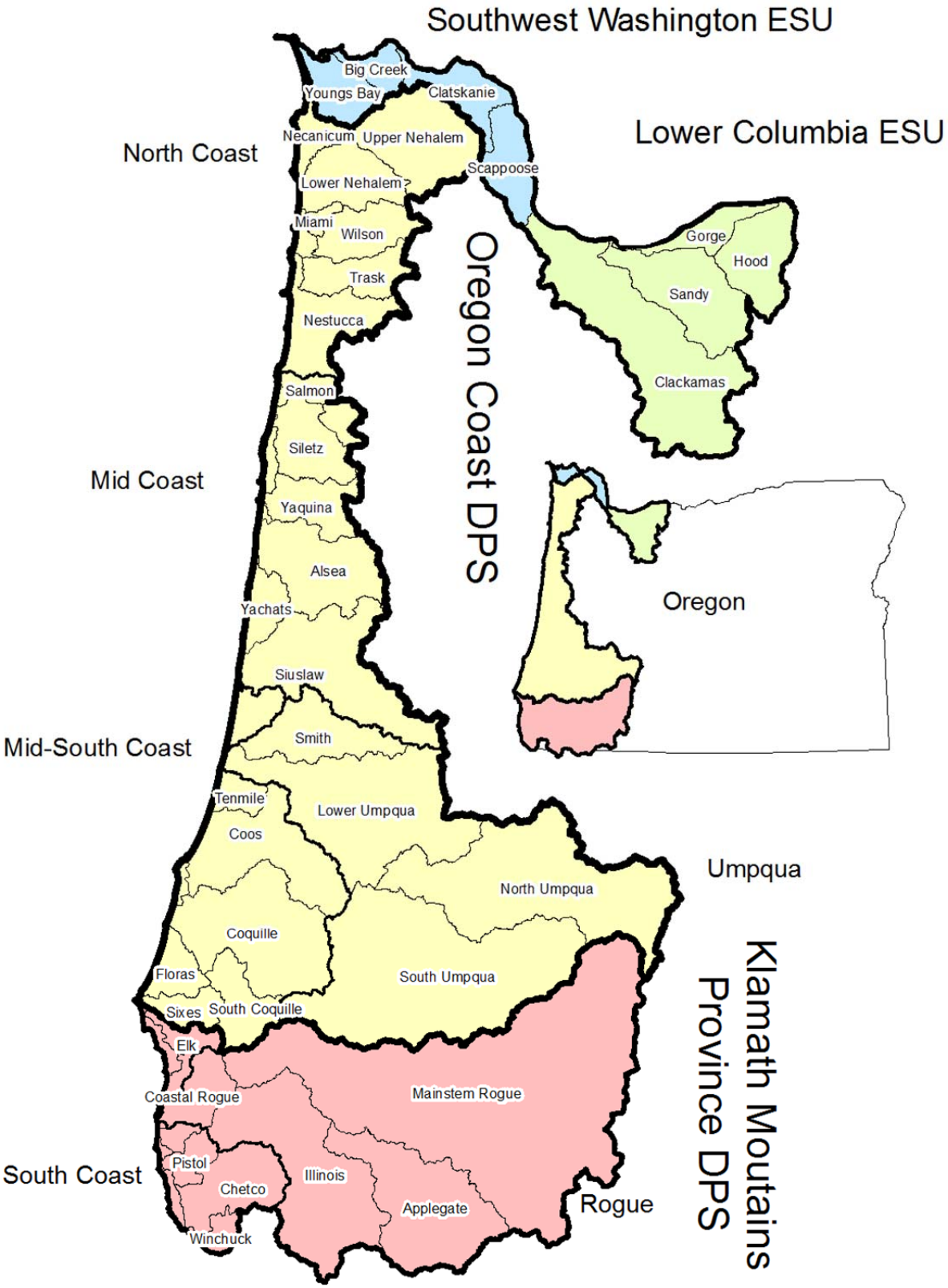

Figure 1. Steelhead monitoring study area showing the winter steelhead populations, monitoring areas, evolutionarily significant units and distinct population segments.

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 and results from this effort are included in a brief summary at the end of this report.

Table 1. Site status by monitoring area in 2014. 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 Nonresponse	Nontarget
Oregon Coast	North Coast	44	11	14
	Mid Coast	43	12	19
	Mid South Coast	24	38	6
	Umpqua	28	29	11
	Total	**139**	**90**	**50**
Klamath Mountains Province	South Coast	10	8	0
	Rogue River[a]	-	-	-
	Total	**10**	**8**	**0**
Southwest Washington ESU[a]	Young's Bay	-	-	-
	Big Cr	-	-	-
	Clatskanie	-	-	-
	Scappoose	-	-	-
	Total	-	-	-
Lower Columbia River ESU	Clackamas	43	24	1
	Sandy	37	13	7
	Gorge	-	-	-
	Total	**80**	**37**	**8**

a = *Surveys in the Rogue River MA and Southwest Washington ESU were not conducted in the 2014 season due to budget constraints.*

A total of 229 sites were successfully surveyed in 2014, split between Oregon Coast, Klamath Mountains, and Lower Columbia streams (Table 1). Successful surveys represent 54% of the total number of sites selected. Sites were selected at a rate of 1/23 miles of habitat in the

Oregon Coast DPS, while selection densities were greater in the KMP DPS (1/19) and the LCR ESU (1/4). Thirteen percent of sites coast-wide and seven percent in the Lower Columbia region were not surveyed because of landowner access restrictions. Fourteen percent of sites coast-wide and 7% 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 Mid-South MA (28%). The average percentage of sites across all areas of the Oregon Coast and Lower Columbia falling outside of steelhead spawning habitat was 14% (range: 0 to 23%).

The target level of precision for steelhead redd estimates is a 95% confidence interval within ±30% of the point estimate. In 2014, this goal was achieved for the Oregon Coast DPS and LCR ESUs, and in the North Coast MA (Table 2). Precision goals were exceeded in each individual Lower Columbia populations, and in the Mid Coast, Umpqua, Mid-South and South Coast MAs. Steelhead spawning survey effort has been dramatically reduced in the Oregon Coast since 2008, resulting in not meeting precision goals at most MA and population scales.

Table 2. Oregon winter steelhead redd abundance estimates in 2014. Estimates are derived from counts in randomly selected 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	North Coast	44	36	14,753	4,381	14,185	4,212
	Mid Coast	43	32	11,546	6,236	9,012	4,867
	Mid South Coast	24	21	13,767	8,104	10,877	6,403
	Umpqua	28	20	13,247	5,764	9,791	4,260
	Total	**139**	**110**	**53,312**	**12,529**	**43,865**	**10,029**
Klamath Mountains Province	South Coast	10	8	4,449	1,929	4,449	1,929
	Rogue River	-	-	-	-	-	-
	Total	**10**	**8**	**4,449**	**1,929**	**4,449**	**1,929**
Southwest Washington ESU[a]	Young's Bay	-	-	-	-	-	-
	Big Cr	-	-	-	-	-	-
	Clatskanie	-	-	-	-	-	-
	Scappoose	-	-	-	-	-	-
	Total	**-**	**-**	**-**	**-**	**-**	**-**
Lower Columbia River ESU	Clackamas	43	52	1,275	537	1,265	537
	Sandy	37	45	1,965	674	1,909	655
	Gorge	-	-	-	-	-	-
	Total	**80**	**97**	**3,241**	**862**	**3,174**	**847**

a = *Surveys in the Rogue River MA and Southwest Washington ESU were not conducted in the 2014 season due to budget constraints.*

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

Oregon Coast DPS

The 2014 estimate of wild winter steelhead redds in the Oregon Coast DPS is the second lowest since monitoring began in 2003 (Figure 2). The 43,865 estimated wild redds in the Oregon Coast DPS is only 46% of the 2013 estimate and 68% of average since 2003. Density of redds (total steelhead redds/mile of steelhead spawning habitat) varied across monitoring areas, ranging from the 7.8 redds/mile observed in the Mid Coast and Umpqua MAs to the 13.8 redds/mile in the Mid-South MA (Table 3).

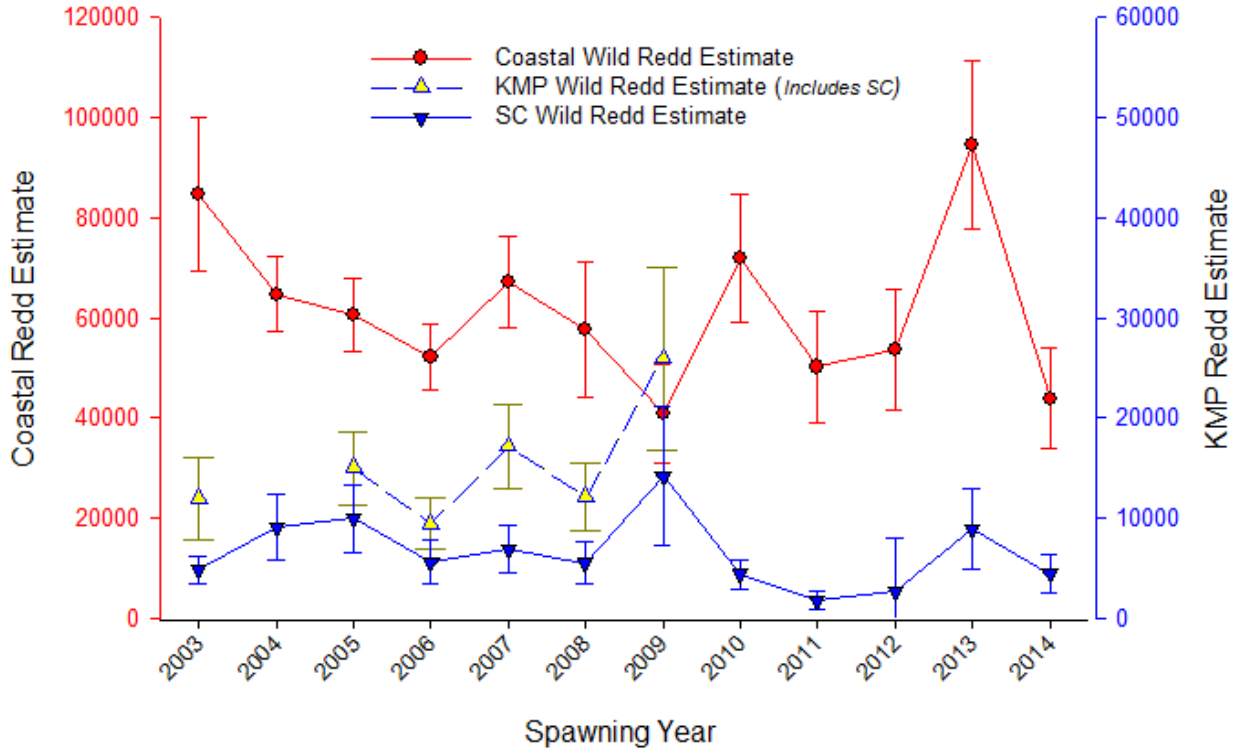

Figure 2. Winter steelhead wild redd estimates based on random surveys for 2003-2014. Error bars are 95% confidence intervals. Estimates for the KMP are incomplete for 2004 and 2010-2014, due to a lack of Rogue River MA data.

The rate of occupied sites (those with at least one recorded redd) was lower in the Oregon Coast for 2014 than in any of the previous seasons since this monitoring began in 2003. The exception to this pattern occurred in the Umpqua MA, where the rate of occupied sites was higher than the previous two years. The percent of sites occupied across the Oregon Coast has ranged from 73% to 85% during 2010 to 2013 while surveying the same selection of annual surveys. However, with our new site selection in 2014 (two-thirds of the sites selected were different from the past four years' static selection), occupancy varied to a greater degree with 68% of sites occupied in 2014 (Table 3). This variation is likely a combination of both temporal and spatial variables, though it is unclear which variable has greater influence.

The proportion of hatchery origin spawners (pHOS) in naturally spawning steelhead populations varied among the monitoring areas, ranging between 4% in the North Coast MA to 26% in the Umpqua MA (Table 4 and Figure 4). The proportion of hatchery origin spawners across the entire Oregon Coast DPS was 18%. This Oregon Coast pHOS figure is the highest we have seen since 2008 and greater than the 2003-2013 average of 14% pHOS. It is important to point out that all hatchery steelhead observed in the Umpqua MA were in a single Canyon Creek survey, which encompasses a steelhead acclimation site. Thus, it is expected that high numbers of hatchery steelhead would be observed in that survey. Without these Canyon Creek observations, the Umpqua MA would pHOS would be 0%, and the Oregon Coast DPS would be 12%. The new ODFW Coastal Multi-Species Conservation and Management Plan now allows for higher pHOS in areas directly adjacent to acclimation sites, and in the future steelhead spawner abundance estimates are likely to be stratified to account for these areas with different allowable pHOS rates.

Table 3. Oregon total winter steelhead redd density and percent occupancy in 2014.

DPS		Monitoring Area	Redds/Mile	% Sites With Redds
Oregon Coast		North Coast	13.0	57%
		Mid Coast	7.8	69%
		Mid-South Coast	13.8	75%
		Umpqua	7.8	71%
	Total	**Total**	**10.6**	**68%**
KMP	South Coast	5-SC	13.1	100%
Lower Columbia	Southwest Washington ESU	Young's Bay	-	-
		Big Cr	-	-
		Clatskanie	-	-
		Scappoose	-	-
		ESU Total	**-**	**-**
	Lower Columbia River ESU	Clackamas	6.6	66%
		Sandy	12.6	75%
		Gorge	-	-
		ESU Total	**9.2**	**70%**
		Total	**-**	**-**

Oregon Coast DPS steelhead spawn timing in 2014 started relatively late compared to previous years, but peaked similar to the 10-year average in each MA (Figure 5). River discharge in most areas remained low until mid-February which may have delayed steelhead migration to some degree. In all Oregon Coast MAs, spawn timing peaked similarly to the 10 year average, but a larger portion of spawning in the North Coast and Mid Coast occurred during those peaks while the Umpqua and Mid-South had more protracted spawning across the season (Figure 5). While no extreme flows occurred during the 2014 season, stream discharge was variable and high flows made for poor survey conditions several times during the season. For example, in the Alsea basin peaks in flows were common across the season, though flows neither

approached flood stage nor lasted for extended periods (Figure 6). Similar flow patterns to the Alsea basin existed throughout the Oregon Coast and Lower Columbia. It is unclear to what extent, if any, these survey conditions may have contributed to the generally low winter steelhead redd abundance estimates for the 2014 spawning season.

Table 4. Number of known fin-mark status steelhead observed on spawning grounds, and resulting pHOS estimates in 2014. 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	52	4%
	Mid Coast	41	22%
	Mid South Coast	73	21%
	Umpqua	47	26%[b]
	Total	**213**	**18%[b]**
Klamath Mountains Province	South Coast	34	0%
	Rogue River[a]	-	-
	Total	**34**	**0%**
Southwest Washington ESU[a]	Young's Bay	-	-
	Big Cr	-	-
	Clatskanie	-	-
	Scappoose	-	-
	Total	**-**	**-**
Lower Columbia River ESU	Clackamas	39	1%
	Sandy	35	3%
	Gorge	-	-
	Total	**74**	**2%**

a = *Surveys in the Rogue River MA and Southwest Washington ESU were not conducted in the 2014 season due to budget constraints.*

b = *All hatchery steelhead observed in Umpqua MA were in Canyon Creek, which encompasses a hatchery steelhead accilimation site. 13 out of 15 steelhead observed in this survey were of hatchery origin.*

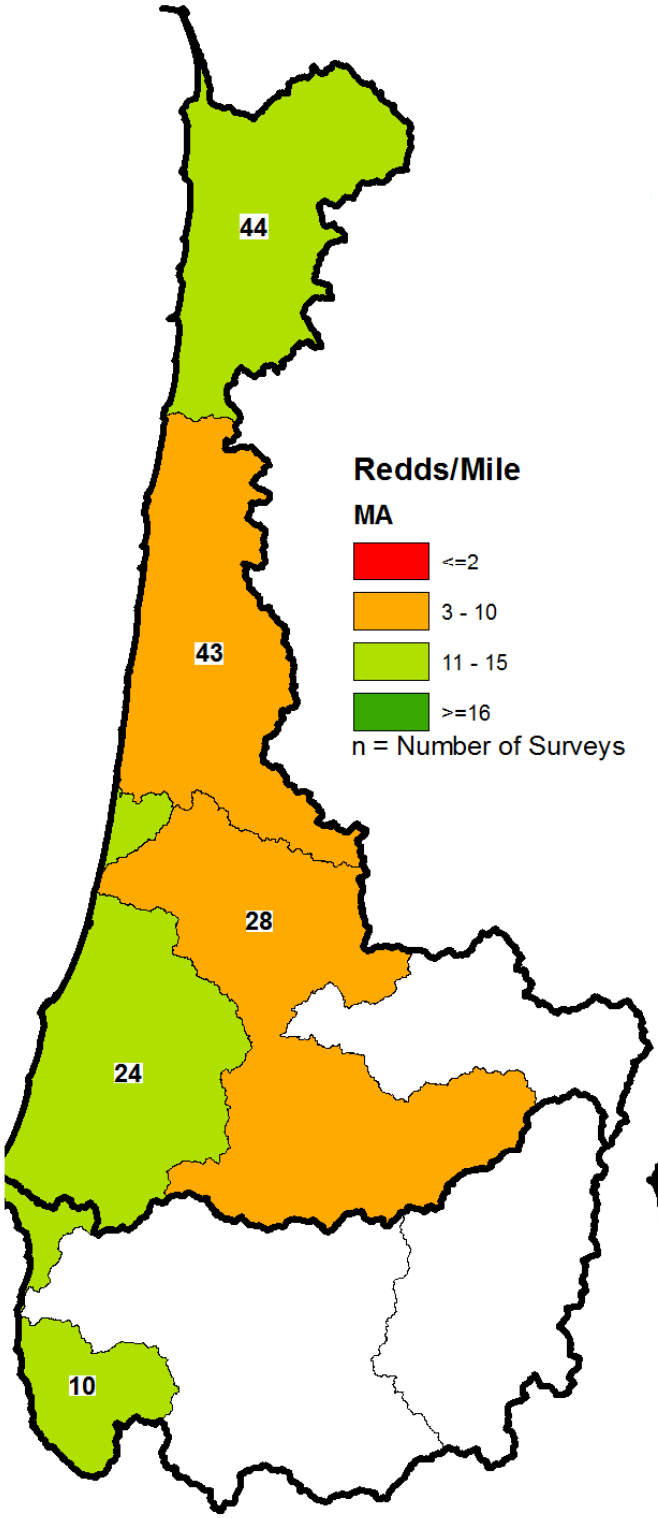

Figure 3. Total redds/mile in random surveys in 2014 by monitoring area in the Coastal and KMP DPSs, with the number of surveys in each monitoring area.

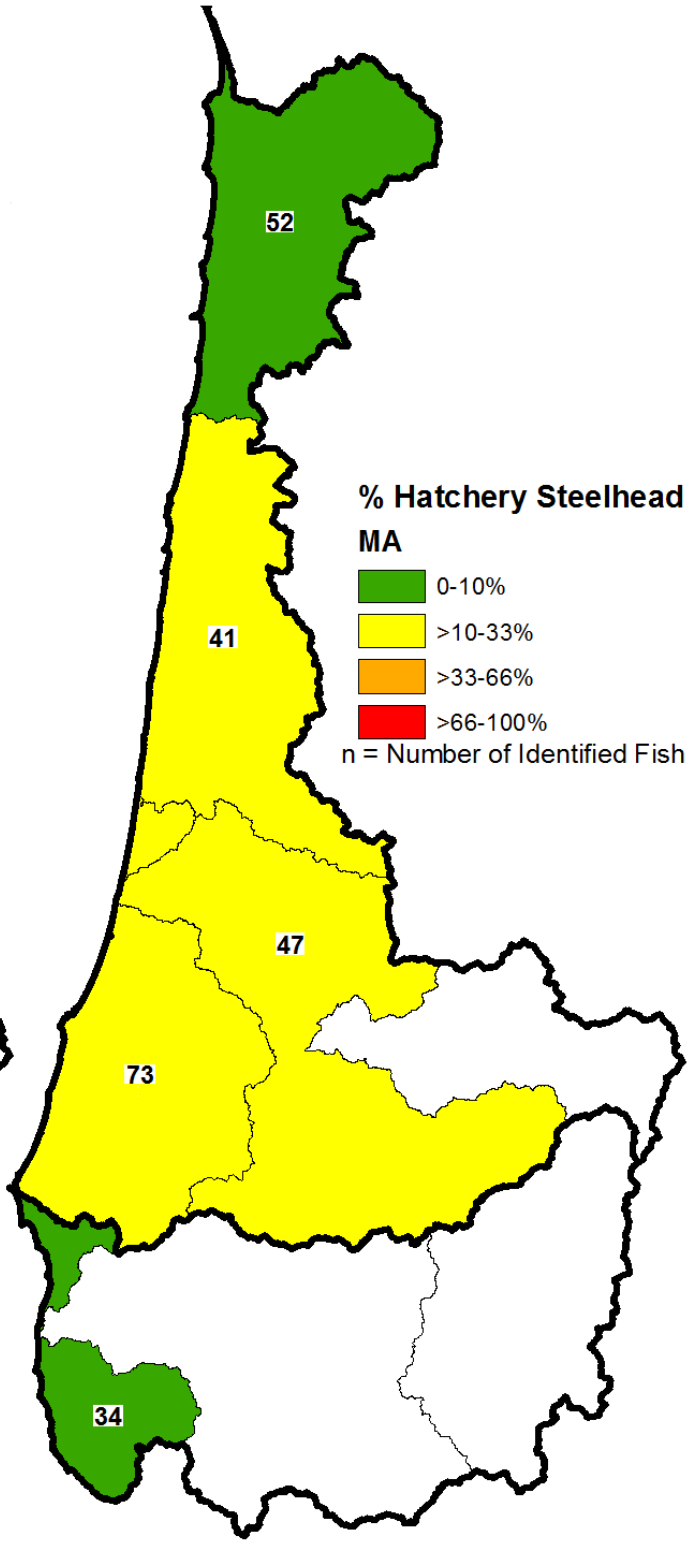

Figure 4. Percentage hatchery fish found on random surveys in each of the six Coastal and KMP monitoring areas in 2014 based on adipose fin clip observations of live and dead steelhead. Data in each monitoring area may be based on multiple surveys.

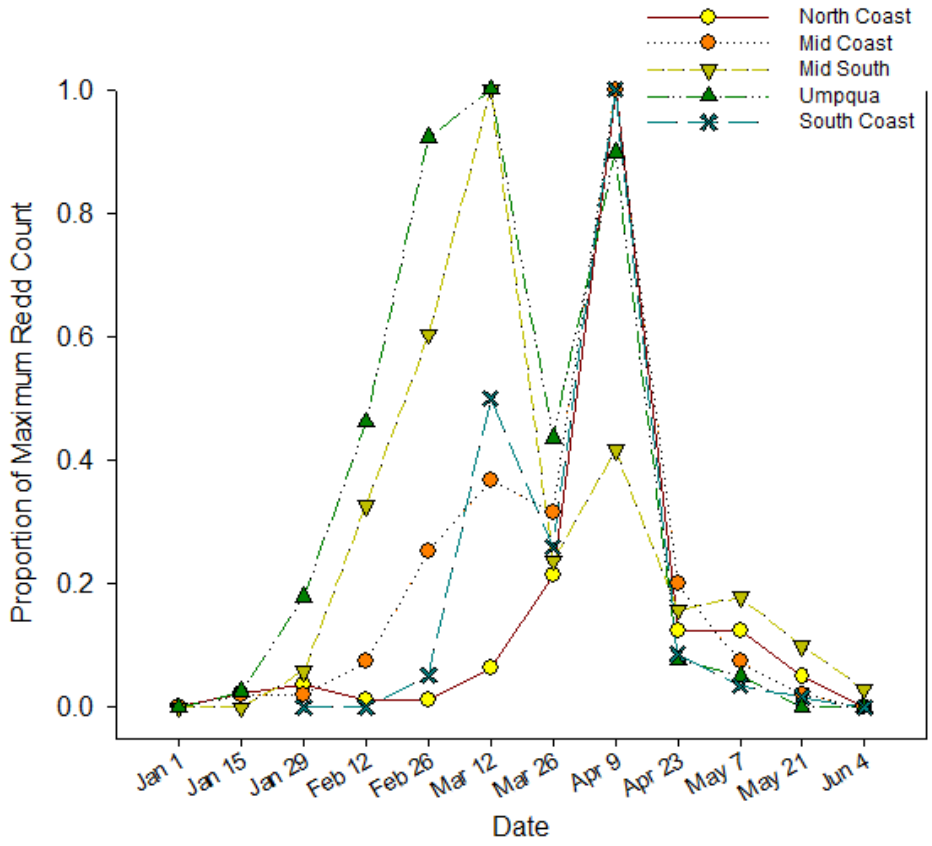

Figure 5. Proportion of the maximum winter steelhead redd count in each of the five Coastal and KMP monitoring areas by two-week period in 2014.

Klamath Mountains Province DPS

No surveys have been conducted in the Rogue MA since 2009 due to budget constraints. In the South Coast MA we estimate that there were 4,449 wild steelhead produced redds (Table 2). This estimate is a down 50% from the 2013 estimate, and is 35% less than the average estimate since monitoring began in 2003 (Figure 2). Only 56% of our 18 selected sites were successfully surveyed in the South Coast MA in 2014, and this small sample size may have contributed to this relatively low estimate. Survey conditions in the South Coast MA were similar to those experienced in other Western Oregon winter steelhead spawning survey areas in 2014, with fairly persistent precipitation most of the season. The small number of winter steelhead spawning survey sites attempted, and successfully surveyed, in 2014 is a combination of weather and that survey crews in this area were responsible for work other than spawning surveys. South Coast MA estimated pHOS in 2014 was 0% (Table 4). This is the sixth year of estimating 100% wild steelhead spawners in this MA. Spawning timing in 2014 peaked in early April which is later than last year (Jacobsen et. al. 2013) and the average (early March) and is the latest peak we have observed in our 12 years of monitoring.

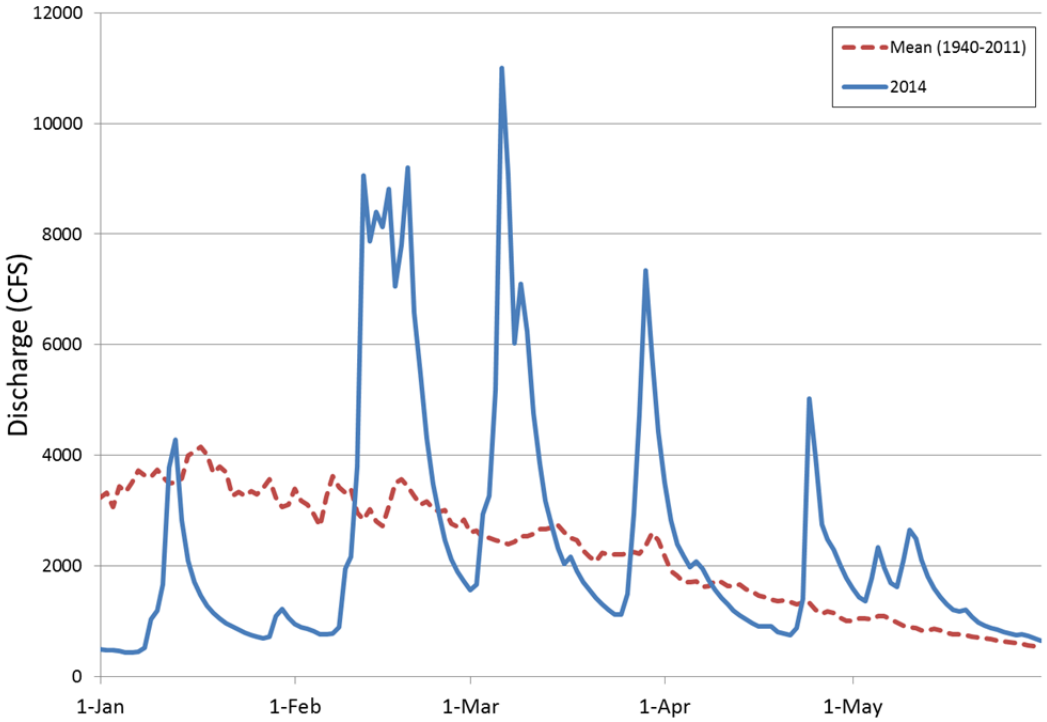

Figure 6. Stream discharge at Alsea River near Tidewater during 2014, compared to mean discharge from 1940 to 2011. (Flood stage = 19,500 CFS)

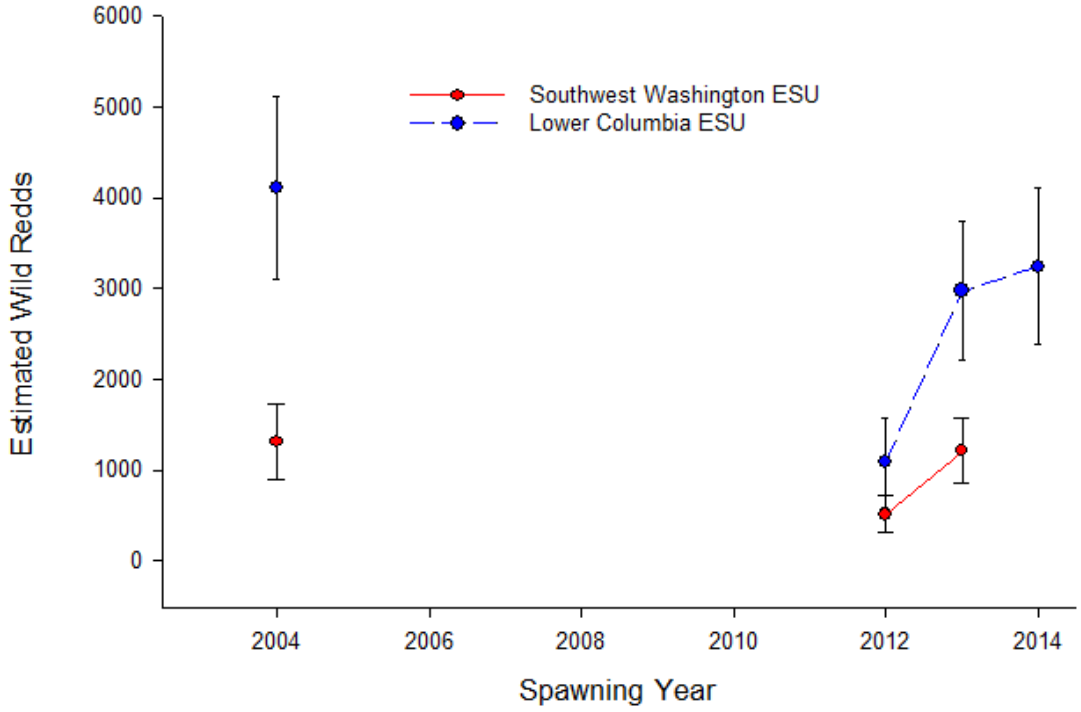

Figure 7. Winter steelhead wild redd estimates in the Oregon portions of the LCR and SWW ESUs based on random surveys in 2004, 2012, 2013 and 2014. Error bars are 95% confidence intervals. Lower Columbia ESU only includes data for the Sandy and Clackamas populations.

Southwest Washington ESU

Due to budget constraints no winter steelhead spawning surveys were conducted this season in the SWW ESU. Winter steelhead spawning surveys are planned to re-commence, starting in the 2015 season, in the Clatskanie and Scappoose populations.

Lower Columbia ESU

The Oregon portion of the Lower Columbia Steelhead ESU includes four populations. However, due to budgetary and logistical issues the 2014 spawning ground survey effort was limited to the Sandy and the portion of the Clackamas population located below the North Fork Dam. The following results are for these areas only.

The 2014 estimate of wild winter steelhead redds in the LCR ESU was 3,174 (Table 2). Though this is the second highest redd estimate in this ESU over the four years of record, trend analysis is not possible, considering the limited available time series (Figure 7). Redd distribution across the ESU was relatively even with 60% and 40% of estimated redds located in the Sandy and Clackamas populations, respectively. In the Sandy and Clackamas populations spawning survey data is also available for the 2006, 2007, and 2010 through 2013 spawning seasons. The 2014 Clackamas estimate of 1,265 wild redds is higher than recent estimates, though much lower than the 2004 estimate (Figure 11). The 2014 Sandy population estimate of 1,909 wild redds is slightly lower than in 2013 but is still the second highest observation since 2004 (Figure 11).

The winter steelhead estimate process in the Clackamas population differed this year from the traditional estimate process used in other populations of the Lower Columbia and Oregon Coast. The Clackamas population estimate combines two groups of random sites selected at different densities; one group in the Clear Creek sub-basin, and the other in the remaining areas of the lower Clackamas River. Random surveys from both sites pulls have been assigned separate weights to account for the different sampling densities. This method was developed to allow the ODFW Clackamas district office higher resolution information on the patterns and abundance of winter steelhead within Clear Creek, and also provides a larger sample size of surveys and live steelhead observations across the Clackamas survey area.

Effort in the Sandy population in 2013 and 2014 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, 97% of sites actually surveyed in 2014 met protocols for a viable survey, and were therefore eligible for use in calculations. Increased survey visits during the spawning season were likely factors in the high proportion of valid surveys completed in 2014 compared to previous years. The combination of this increased survey effort and excellent survey conditions imply that historical estimates may be relatively lower in part due to a reduced rate of redd observation.

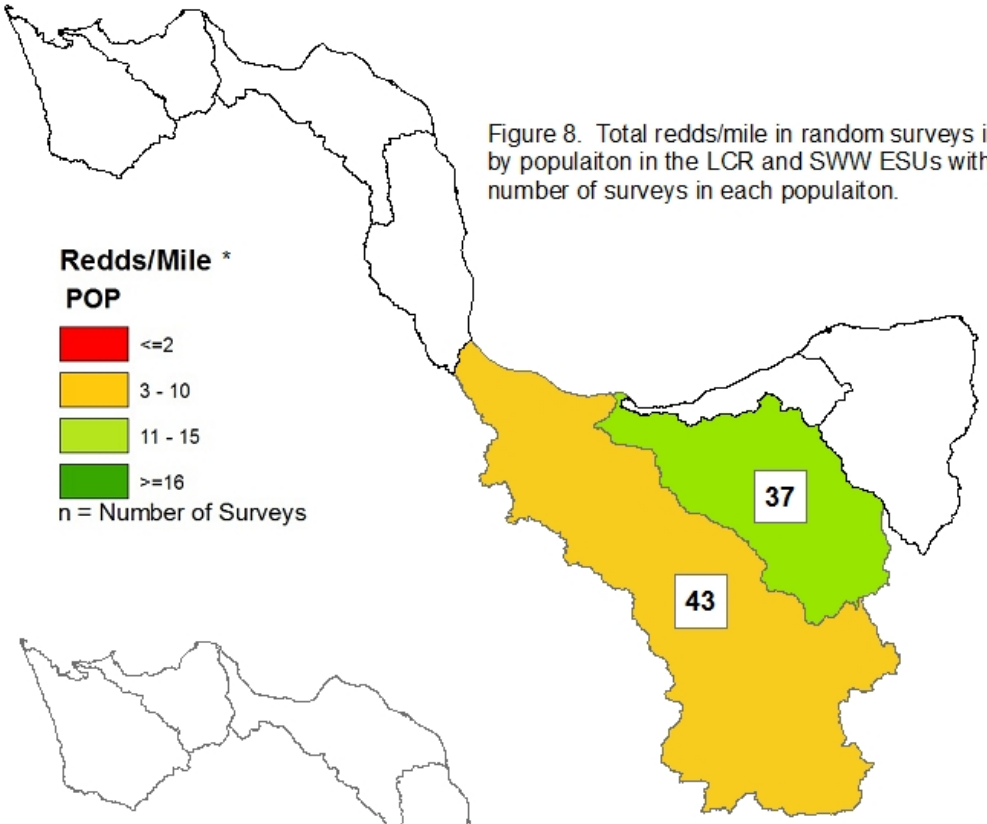

Figure 8. Total redds/mile in random surveys in 2014 by populaiton in the LCR and SWW ESUs with the number of surveys in each populaiton.

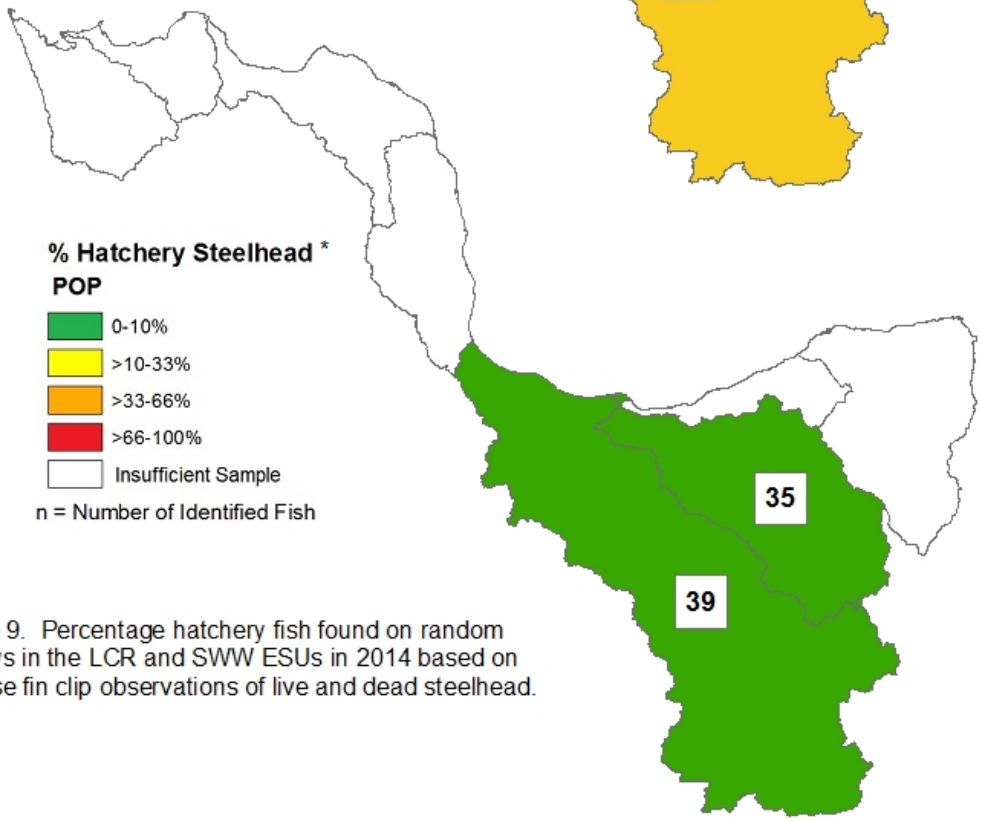

Figure 9. Percentage hatchery fish found on random surveys in the LCR and SWW ESUs in 2014 based on adipose fin clip observations of live and dead steelhead.

* Surveys in the Southwest Washington ESU were not conducted in 2014 due to budget constraints.

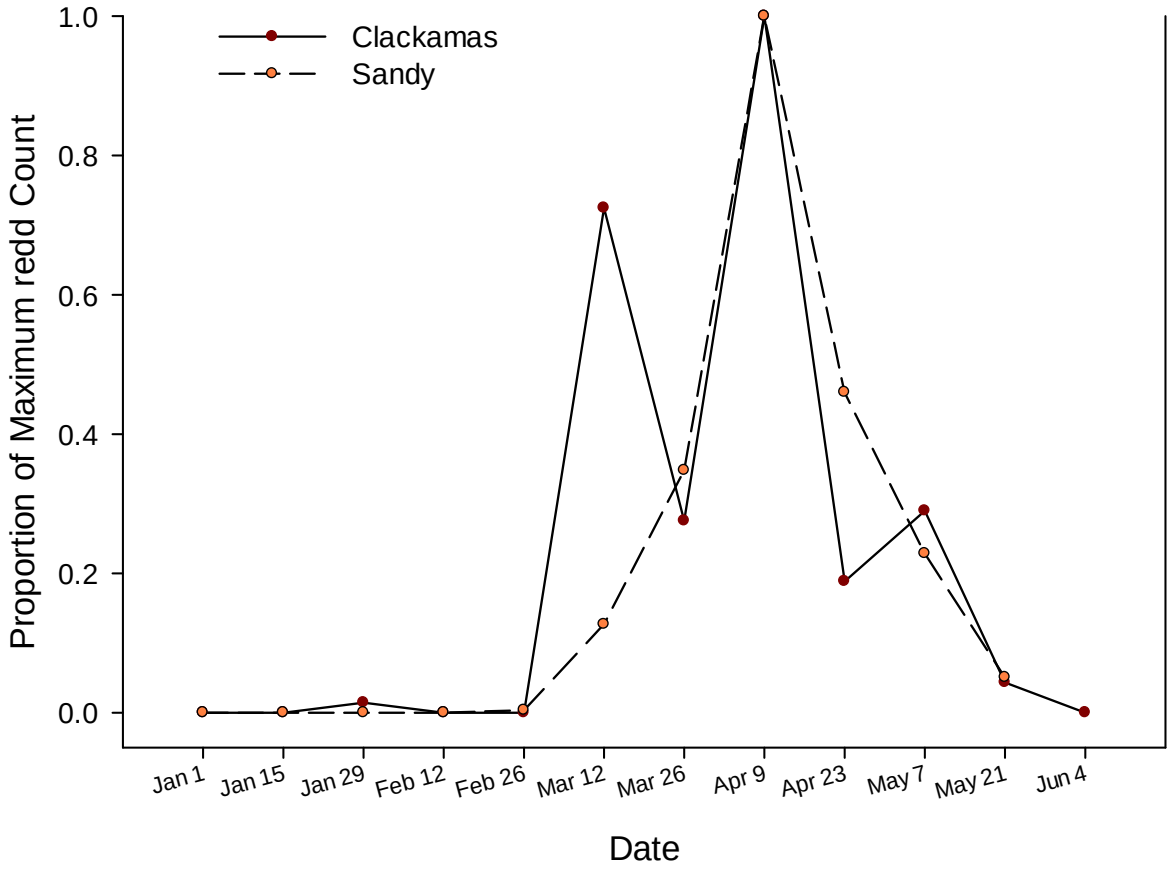

Figure 10. Proportion of the maximum winter steelhead redd count in each of the Lower Columbia populations by week of the year in 2014.

Redd density for the LCR ESU was 9.2 redds per mile, ranging from 6.6 redds per mile in the Clackamas to 12.6 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 66% of sites occupied in the Clackamas and 75% of sites occupied in the Sandy population (Table 3).

The proportion of naturally spawning steelhead of hatchery origin in the LCR ESU; was 2% in 2014 (Table 4). For the 2014 season, pHOS was 3% in the Sandy population and 1% in the Clackamas population (Table 4). Surveys were not conducted in the Columbia River Gorge population in 2014. Increased survey frequency in the Sandy this season improved the number of steelhead of known fin-clip status from 3 in 2012 to 35 in 2014.

The Sandy River contains a population of summer steelhead, which are difficult to differentiate from winter steelhead on the spawning ground. The two runs differ somewhat in spawn timing, with most summer-run fish spawning from late December into February, and winter runs spawning February through May. ODFW has agreed to provide an estimate of pHOS for the period of spawning overlap between these populations (February) in cases where the estimate for the winter run is higher than 5%. This is to provide information on the potential

for introgression between hatchery and wild stocks during this period. The estimated pHOS in the Sandy population this year was 3%, since this is below the 5% threshold to trigger the summer steelhead pHOS analysis, it is not needed for 2014.

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). Survey conditions were challenging but consistent in the LCR ESU, and there was no indication that these timing signatures were the product of survey conditions or any other surveying affect.

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 2013).

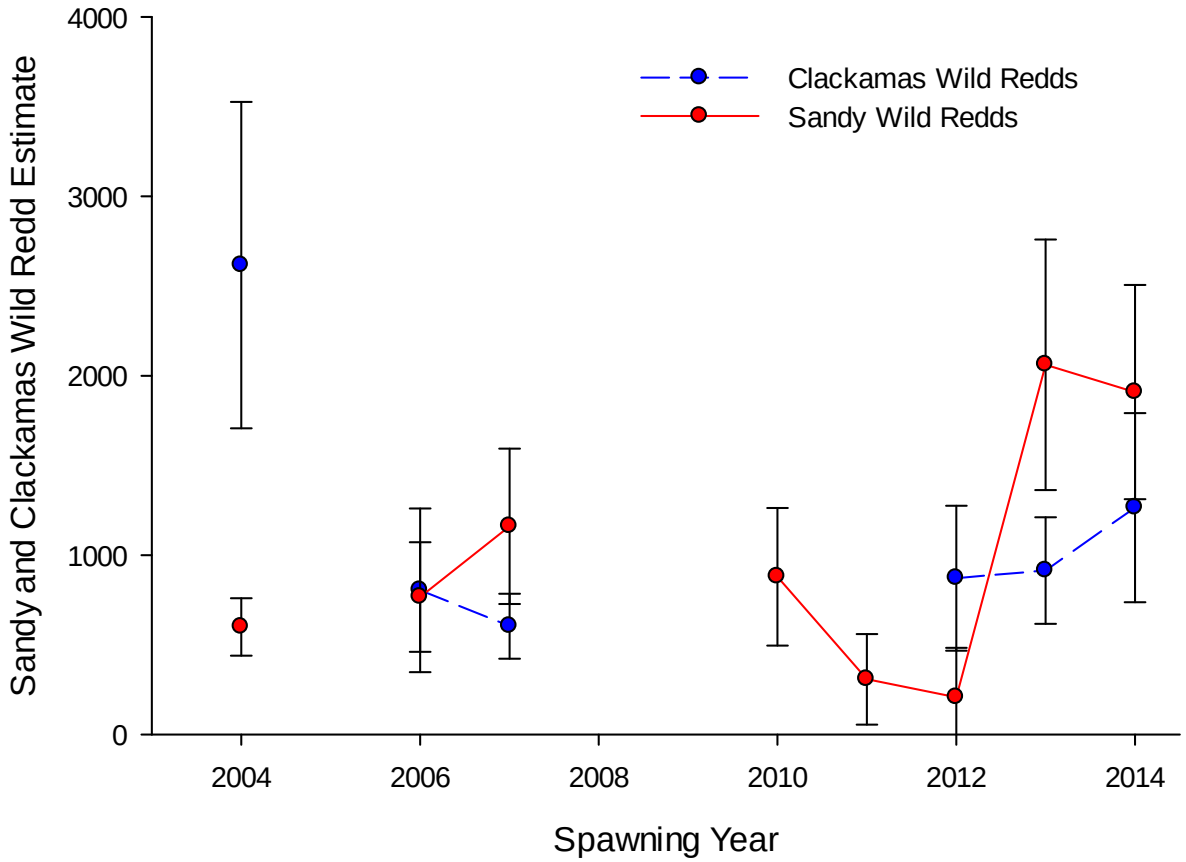

Figure 11. Winter steelhead wild redd estimates in the Clackamas and Sandy River populations based on random surveys from 2004 to 2014. Error bars are 95% confidence intervals.

Total steelhead = (1.70 * Redds) + 3.74

Estimates for winter steelhead escapement in 2014, derived from redd counts and then translated with this conversion factor are reported in Table 5. Starting in 2014, we began exploring additional calibration sites using similar methods and a mix of new and repeated calibration sites; however, those results are not yet reported nor used for conversions. These calibration efforts are intended to be an ongoing, 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.

Table 5. Oregon winter steelhead abundance estimates in 2014. Estimates are derived from redd counts in random spawning surveys. These estimates do not include counts of winter steelhead passed above the Winchester Dam (Umpqua MA) or the North Fork Clackamas Dam (Clackamas Population). These dam counts are available on-line.

		Winter Steelhead Abundance			
		Total		Wild[b]	
DPS/ESU	Monitoring Area or Population	Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast	North Coast	25,083	7,451	24,119	7,165
	Mid Coast	19,633	10,605	15,324	8,278
	Mid South Coast	23,407	13,780	18,495	10,889
	Umpqua	22,523	9,803	16,649	7,247
	Total	**90,635**	**21,303**	**74,575**	**17,053**
Klamath Mountains Province	South Coast	7,568	3,283	7,568	3,283
	Rogue River	-	-	-	-
	Total	**7,568**	**3,283**	**7,568**	**3,283**
Southwest Washington ESU[a]	Young's Bay	-		-	-
	Big Cr	-	-	-	-
	Clatskanie	-	-	-	-
	Scappoose		-	-	-
	Total	-	-	-	-
Lower Columbia River ESU	Clackamas	2,171	917	2,154	917
	Sandy	3,344	1,150	3,249	1,117
	Gorge	-	-	-	-
	Total	**5,513**	**1,469**	**5,400**	**1,444**

a = *Surveys in the Rogue River MA and Southwest Washington ESU were not conducted in the 2014 season due to budget constraints.*

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

LAMPREY MONITORING

Oregon Coast Pacific Lamprey

Over the course of steelhead monitoring, ancillary data recorded on each survey include the counts of Pacific Lamprey (*Entosphenus tridentatus*) redds. While these data do provide information for lamprey coast-wide, it is worth noting that all surveys are selected from the known distribution of steelhead spawning habitat, which does not fully cover lamprey spawning distribution. Furthermore, while live lamprey are observed spawning on surveys, we do not survey often enough nor when lamprey are most active (at night) to use live lamprey counts for abundance estimates. As a result, lamprey density on spawning surveys is summarized in this report by peak redds per mile. The peak redd count is the highest number of lamprey redds visible during any one survey date within a given spawning season. This peak redd count is then divided by the number of miles surveyed for peak redds per mile. Abundance estimates for lamprey are not available because the cumulative number of redds deposited over a spawning season is not accounted for, and because there currently is no reliable information on the ratio of redds to fish. However, peak redd counts do provide information on the distribution and timing of lamprey spawning activity, as well as some indication of relative density (and by proxy, relative abundance).

Over the past 12 years on the Oregon Coast, Pacific Lamprey peak redd density has fluctuated from roughly 1 to 9 redds/mile in random steelhead surveys, while averaging about 3.8 redds/mile (Figure 12). The proportion of sites occupied by Pacific Lamprey (sites with at least one Pacific Lamprey redd) has ranged from about 25% to 55% (avg. 38%); with increases and decreases in occupancy often tracking similar increases and decreases in peak redd density (Figure 12).

Beginning in 2010, thirteen of our annual random steelhead surveys across the Oregon Coast were selected to be index surveys for monitoring of Pacific Lamprey through their full spawn timing. These index surveys were picked with consideration of: (a) the consistent presence of lamprey spawning activity across years; (b) a mix of smaller and larger streams in each steelhead monitoring area; and (c) the feasibility of conducting these surveys with limited staff availability. Index surveys are visited during each steelhead spawning season (February-May) and continued through late June, some years even into early July, in an attempt to capture the full lamprey spawning season. The average spawn timing among index sites over the past five years peaked in mid-May, with the earliest peak occurring in April (2014), and the latest occurring in early-June (2011) (Figure 13). Peak spawn timing in 2014 in the Oregon Coast coincided with receding stream flows and a rise in average daily stream temperatures to 9-10°C on the Wilson River in the North Coast (Figure 13).

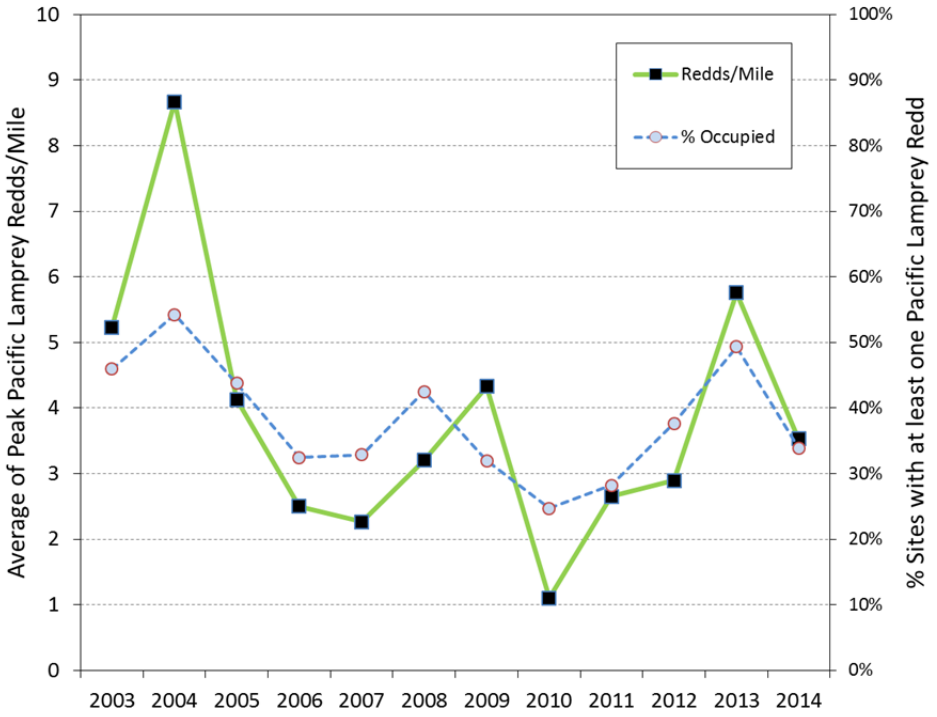

Figure 12. Oregon Coast Pacific Lamprey Peak Redd Density and Percent of Sites Occupied in Random Steelhead Spawning Surveys, 2003-2014.

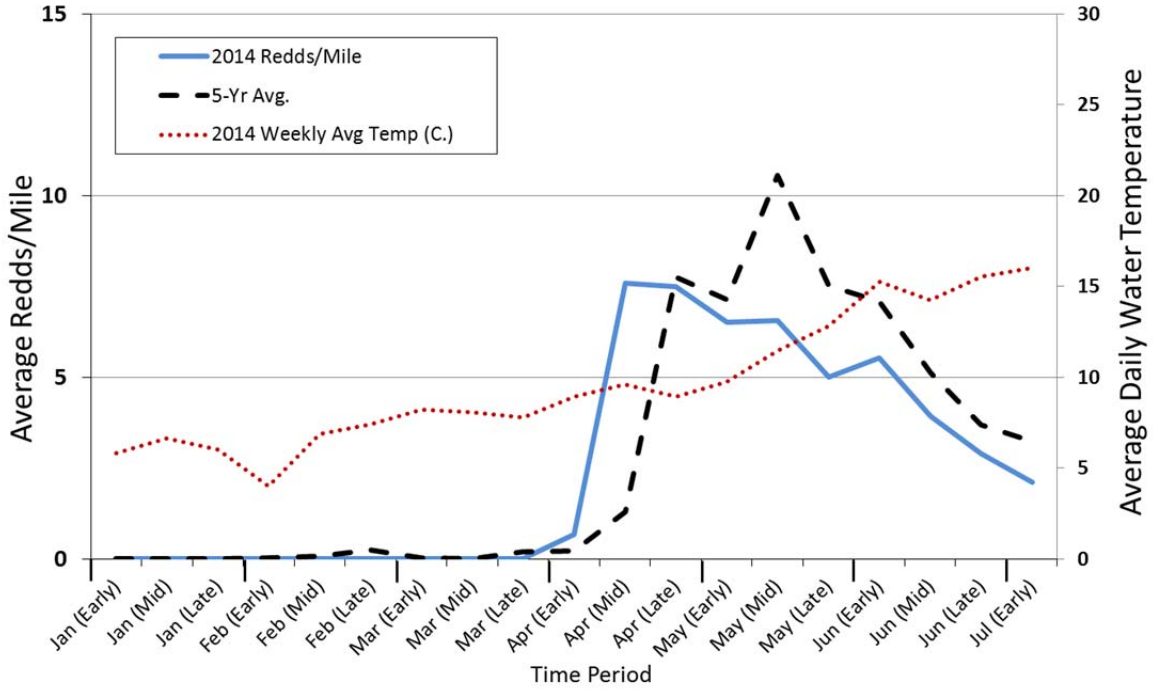

Figure 13. Oregon Coast Pacific Lamprey Spawn Timing in Index Surveys, 2010 – 2014 compared to the 5-year Average. Also shown is the 2014 weekly average stream temperatures in the Wilson River (North Coast).

Lower Columbia Pacific Lamprey

During the 2014 monitoring season, Pacific Lamprey densities in the Clackamas and Sandy populations were similar to the five year averages. (Figure 14). Pacific Lamprey redds were identified in 34% of sites sampled in the Lower Columbia River ESU. Pacific Lamprey redd occupancy was 55% for the Clackamas and 22% for the Sandy in 2014. Spawn timing occurred between early April and the end of May in the Clackamas, and during the month of May in the Sandy, while both basins peaked in mid-May (Figure 15). The tail end of spawn timing is likely biased by the lack of survey effort past the last week of May. While it was clear that there was a peak in mid-May, there may have been additional spawning in June which would not have been detected.

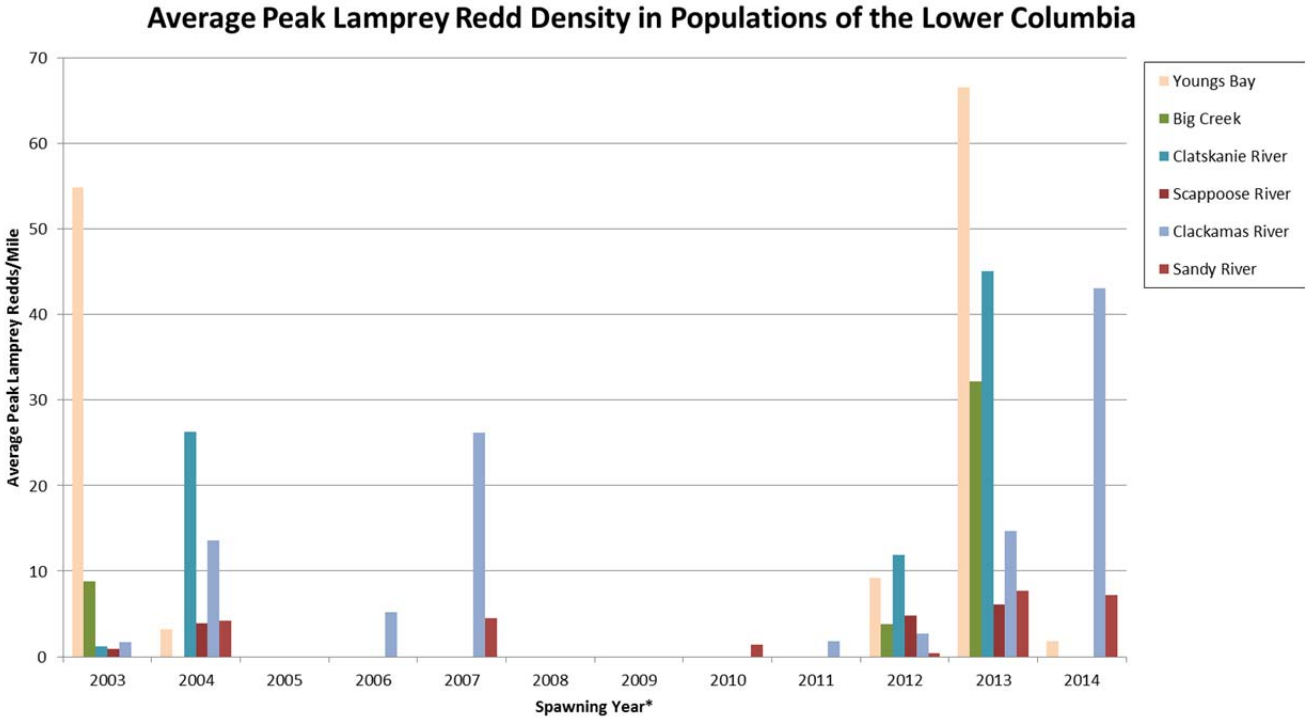

Figure 14. Lower Columbia Pacific Lamprey Peak Redd Density in Random Steelhead Spawning Surveys, 2003-2014. Note that not all populations were monitored in all years.

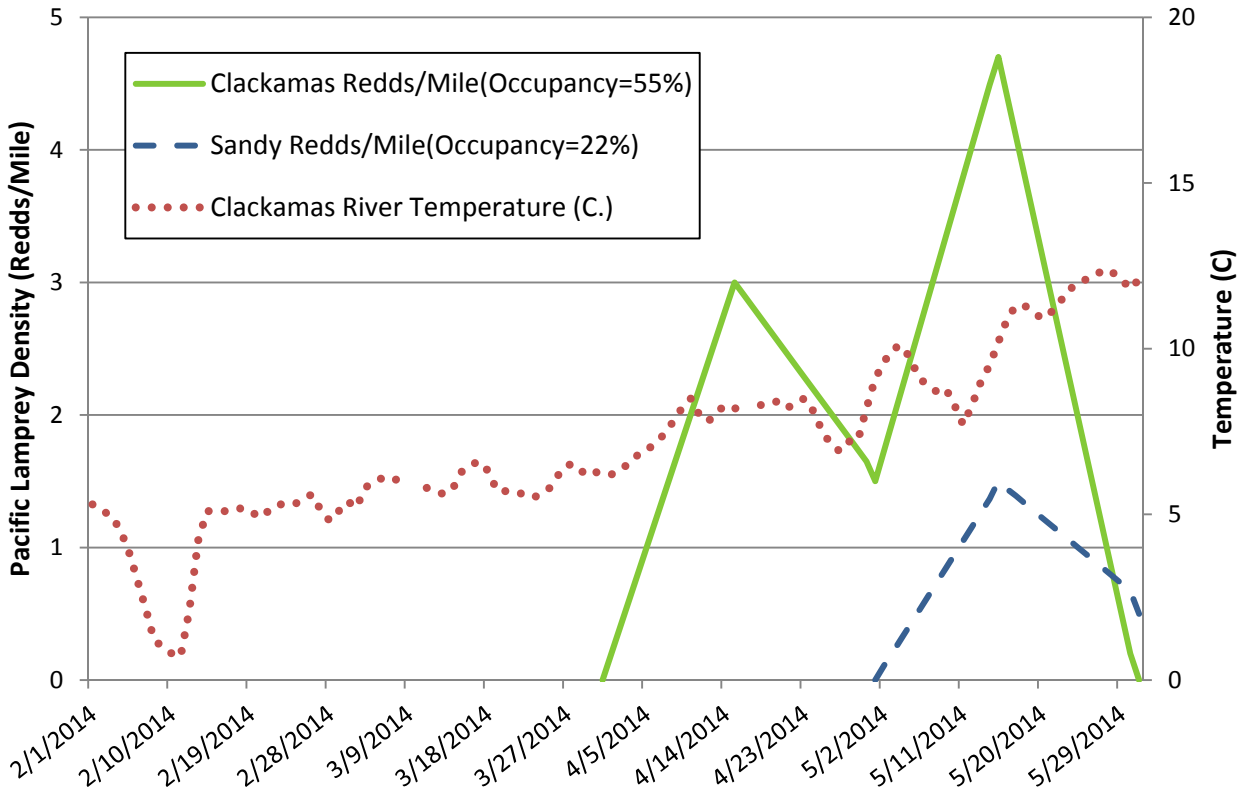

Figure 15. Lower Columbia Pacific Lamprey spawn timing in random steelhead surveys in 2014 and Average Daily Water Temperature in the Clackamas River.

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