THE OREGON PLAN *for Salmon and Watersheds*

Western Oregon Adult Winter Steelhead and Lamprey, 2019 Redd Survey Data Report

Report Number: OPSW-ODFW-2019-09

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SUMMARY

This report provides a summary of results from winter steelhead spawning ground surveys conducted in Lower Columbia (Oregon side only) and Oregon Coast basins in 2019. Also included is a brief summary of lamprey data collected from the same monitoring efforts. Total winter steelhead redd estimates in the Southwest Washington (SWW) Evolutionary Significant Unit (ESU) and in the Lower Columbia River (LCR) ESU were 46% and 42% the prior 5-year average, respectively. Total winter steelhead redd estimates were 76% of the 5-year average for the Oregon Coast (OC) Distinct Population Segment (DPS). Estimate precision goals were met for steelhead redd estimates in the OC DPS, the North Coast Monitoring Area (MA) and the Nestucca River population. Precision goals were not met in the LCR ESU, the SWW ESU, nor the remaining three OC Monitoring Areas (Mid Coast, Umpqua and Mid-South Coast). Surveys were not conducted in the Klamath Mountains Province (KMP) DPS. Regional patterns are apparent for winter steelhead redd density, proportion of hatchery origin spawners and spawn timing. Indices for Pacific Lamprey were lower in 2019 in the Lower Columbia and Oregon Coast compared to recent years.

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 under the Oregon Adult Salmonid Inventory and Sampling project. The project is designed to assess yearly status and trend in abundance, proportion of hatchery origin spawners (pHOS), and distribution of winter steelhead spawners in four Oregon ESU/DPS units (Figure 1). The SWW and LCR ESU's are currently monitored at the population scale, though funding limited efforts in 2019 to only the Clatskanie, Scappoose, Clackamas, and Sandy populations. No monitoring occurred in the Youngs Bay, Big Creek, Gorge, or Hood populations. In the OC DPS, monitoring is evaluated at the monitoring area scale, and in 2019 at the population scale in the Nestucca River basin. No monitoring has occurred in the KMP DPS since 2015.

A spatially balanced, probabilistic sampling design (Stevens 2002) was used to randomly select survey sites across a stream network of winter steelhead spawning habitat. Areas above dams or fish traps where counts of winter steelhead are available are not sampled, and include: River Mill (Clackamas River), Cedar Creek Weir (Sandy River), and Winchester (North Umpqua River) dams, Bonnie Falls Trap (Scappoose River), and Big Creek Hatchery Weir. Counts of steelhead passed upstream of these sites are not included in this report. In accordance with prior work (Susac and Jacobs 1999) conducted by ODFW in coastal streams, monitoring of winter steelhead abundance is based on counts of redds; rearing origin is determined from live and dead fish observations. Repeat visits to each site, at least once every 14 days, from February through May generate a total redd count for each survey. Pacific lamprey standard surveys and any steelhead survey that still have activity at the end of May are continued into June, or until the end of spawning activity. Specific descriptions of project protocols can be found in the annual survey procedures manual (ODFW 2019).

Steelhead redd abundance estimates are converted to fish abundance using a standard redd-to-fish conversion factor developed in the OC ESU (ODFW 2013). Steelhead abundance estimates for the 2019 spawning season are reported in Table 5, but do not include data for areas where counts are available.

Standard procedures for pHOS estimation require at least 10 fish with known adipose fin status (clipped or not clipped). Preference is given to using data from dead fish. If the number of dead fish is less than 10, then live and dead fish samples are combined. If this still results in a sample of less than 10 fish, results from recent years are included.

Survey sites adjacent to hatcheries and/or their acclimation areas typically have a higher proportion of both hatchery fish and redd densities, and can therefore bias estimates of wild abundance. In order to reduce bias and increase accuracy of winter steelhead estimates, use of a stratified approach was initiated in 2017. These efforts differ slightly between the various monitoring units. In the SWW ESU the Clatskanie population is divided into two strata: Plympton Creek and the remaining Clatskanie basin. There are no hatchery steelhead releases in the Clatskanie population, but hatchery fish are abundant in Plympton Creek. In the LCR ESU, in each of the Sandy and Clackamas populations, strata are defined as: migration corridors, areas adjacent to hatchery releases, and the remaining portions of each population (i.e. areas outside of direct hatchery influence). In each case, individual strata estimates are calculated, then rolled up to final population estimates (Table 7). In the OC DPS, the ODFW Coastal Multi-Species Conservation and Management Plan allows for higher maximum pHOS rates in areas adjacent to acclimated hatchery release sites (ODFW 2014). These areas are known as hatchery Hot-Spots. Implementation of this stratification results in abundance and pHOS estimates for the areas of each MA that are outside of these Hot-Spots. Estimates within the Hot-Spots for 2019 are presented in Table 6 as a single estimate for the Oregon Coast DPS.

RESULTS

Survey Effort

SWW & LCR ESU's

- Survey effort in the SWW and LCR ESU's in 2019 was similar to recent years (Table 1).
- The percentage of sites which were successfully surveyed in the SWW ESU (58%) was close to the 5-year average (57%). Survey success in the LCR ESU (59%) was above the 5-year average (51%).
- Due to budget constraints, surveys in the Young's Bay and Big Creek populations have not been conducted since 2013 and surveys in the Gorge and Hood populations have not been conducted since 2012.
- Conditions in the SWW and LCR ESU's were average or better in terms of survey success rates, and flows were mostly agreeable to survey protocols in 2019.

Oregon Coast DPS

- Survey effort in the OC DPS in 2019 was similar to recent years (Table 1).
- The percentage of sites successfully surveyed (51%) was similar to the 5-year average (50%).
- Survey conditions in the OC DPS were generally challenging, particularly in February and early-April, but overall amenable to survey protocols in 2019 (Figure 11). An extended period of issues with survey access due to heavy snowfall and extensive downed timber contributed to the lower success rate in the Umpqua MA.

Redd Abundance

SWW & LCR ESU's

- The 2019 wild winter steelhead redd abundance in the SWW ESU (246 redds) was among the lowest recorded in the eight years of monitoring (Figure 2), and 49% of the 5-year average (Table 2).
- The 2019 wild redd abundance for the LCR ESU (1,450 redds) was also one of the lowest in that period (Figure 2), and 40% of the 5-year average (Table 2).

Oregon Coast DPS

- The 2019 wild winter steelhead redd abundance in the OC DPS (40,004 redds) was 79% of the 5-year average (Table 2).
- Wild estimates were below average in three of the four Oregon Coast MA's. The Mid-South Coast MA estimate was the lowest (50% of the 5-year average), and the Umpqua MA was the highest (121% of the 5-year average).

Hatchery Proportion

SWW & LCR ESU's

- In the SWW ESU, pHOS was comparable to that observed in recent years, and below 10% in all populations (Figure 5 & Table 2).
- In the LCR ESU, pHOS was higher than the prior 5-year average, was still below 10% in the Sandy population (Figure 5 & Table 2). Hatchery proportions for the Lower Clackamas spawning surveys were 26% in 2019 (Figure 5 & Table 2). However, when combined with the count of fish passed above the North Fork Clackamas Dam (100% wild), the basin total pHOS for the Clackamas was 11.9%.
- In 2019, all populations had a sample size below the 10 live/dead fish-observation target (Table 2).
- Given that the 2019 pHOS estimate exceeded 5% in the Sandy and Clackamas basins, an estimate of Summer Steelhead hatchery percentage is required. The February pHOS calculation for the Sandy and Clackamas River basins was 0% and 9% respectively.

Oregon Coast DPS

- In the OC DPS, the estimate of pHOS was 10.4%, which is slightly below the 5-year average of 14.0% (Table 2).
- Estimates of pHOS were above the prior 5-year average in the Mid-South Coast MA, and below average in the North Coast, Mid Coast and Umpqua MAs.
- In 2019, nearly all areas had a sample size above the 10 live/dead fish-observation target; only the Umpqua MA did not meet the threshold (Table 2).

Distribution and Timing

LCR & SWW ESU's

- SWW ESU site occupancy (percentage of sites with at least one steelhead redd) was below the 5-year average, while occupancy in the LCR ESU was very close to the 5-year average (Table 3).
- 2019 steelhead redd timing in the SWW ESU was later than normal, while LCR ESU redd timing was average compared to recent years (Figure 6).

Oregon Coast DPS

- The percentage of occupied sites in the OC DPS was slightly above the 5-year average, with some regional variability by MA (Table 3).
- Winter steelhead spawn timing peaked around mid-March, which is typical for the DPS. This timing is somewhat late for the Mid-South Coast and Umpqua MA's, and slightly early for the Mid Coast and North Coast MA's (Figure 10).

Pacific Lamprey Information

SWW & LCR ESU's

- In the LCR and SWW ESUs, Pacific Lamprey redd densities (peak redds per mile) appeared to be below average overall; however, the Clackamas and Sandy Populations showed a higher density compared to last year (Figure 12).

Oregon Coast DPS

- In the OC DPS, Pacific Lamprey redd densities were slightly below the 16-year average during the 2019 spawning season (Figure 14).
- Within Pacific Lamprey index surveys on the Oregon Coast, 2019 spawn timing had a typical peak in May, though spawning declined sooner than average as very few redds were observed in June (Figure 15). This compressed timing may be due to stream conditions and water temperature, as flows were very high in early April and below average in May (Figure 11).
- Pacific Lamprey redd counts continue to track occupancy metrics in the OC DPS random sites. These results suggest that occupancy may provide a valuable index of abundance (Figure 14).

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APPENDIX

Table 1. Site status in Oregon winter steelhead ESU/DPSs by monitoring area or population, 2019. Target sites were within and non-target sites were outside of steelhead spawning habitat. Response sites were successfully surveyed. 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. ns = no surveys conducted.

ESU/DPS	Population or Monitoring Area	Target Response	Target Non-response	Non-target
Southwest Washington	Youngs Bay	ns	ns	ns
	Big Cr	ns	ns	ns
	Clatskanie [b]	27	5	1
	Scappoose	13	23	0
	Total	**40**	**28**	**1**
Lower Columbia River	Clackamas [b]	33	15	0
	Sandy [b]	26	24	4
	Gorge	ns	ns	ns
	Total	**59**	**39**	**4**
Oregon Coast [a]	North Coast	70	32	21
	Nestucca [c]	*33*	*19*	*9*
	Mid Coast	45	16	6
	Mid South Coast	34	34	5
	Umpqua	20	40	9
	Total	**169**	**122**	**41**
Klamath Mountains Province	South Coast	ns	ns	ns
	Rogue River	ns	ns	ns
	Total	**ns**	**ns**	**ns**

Table 2. Spawning survey results for Oregon winter steelhead redd abundance estimates and percent hatchery origin spawning (pHOS) for 2019 and 5-year averages. Wild proportions and pHOS estimates are derived from fin-mark observations on live and dead steelhead. ns = no surveys conducted. Total abundance estimates for the Clackamas population do not include fish passage counts above the North Fork Clackamas Dam.

ESU/DPS	Population or Monitoring Area	Survey Effort		Winter Steelhead Redd Abundance				pHOS	
				Total		Wild			
		Number of Surveys	Miles	2019	5-Yr Avg	2019	5-Yr Avg	2019	5-Yr Avg
Southwest Washington	Youngs Bay	ns	ns	ns	ns	ns	ns	ns	ns
	Big Cr	ns	ns	ns	ns	ns	ns	ns	ns
	Clatskanie [ab]	27	25	260	514	246	504	5.4%	3.7%
	Scappoose	13	10	0	57	0	57	-	-
	Total	**40**	**34**	**260**	**571**	**246**	**685**	**-**	**-**
Lower Columbia River	Clackamas [ab]	33	35	455	1,196	336	1,068	26.0%	10.3%
	Sandy [ab]	26	29	1,193	2,707	1,113	2,529	6.7%	5.5%
	Gorge	ns	ns	ns	ns	ns	ns	ns	ns
	Total	**59**	**64**	**1,648**	**3,903**	**1,450**	**3,597**	**12.0%**	**6.7%**
Oregon Coast [c]	North Coast	70	61	8,617	16,666	7,886	14,828	8.5%	12.5%
	Nestucca [d]	*33*	*27*	*2,193*	*na*	*1,462*	*na*	*33.3%*	*na*
	Mid Coast	45	35	14,874	17,489	14,180	14,549	4.5%	19.9%
	Mid South Coast	34	31	8,535	13,424	5,397	10,853	36.8%	16.4%
	Umpqua [b]	20	14	12,625	11,091	12,541	10,366	0.7%	5.2%
	Total	**169**	**141**	**44,651**	**58,670**	**40,004**	**50,596**	**10.4%**	**14.0%**
Klamath Mountains Province	South Coast	ns	ns	ns	ns	ns	ns	ns	ns
	Rogue River	ns	ns	ns	ns	ns	ns	ns	ns
	Total	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**

a = Estimates for these populations are derived from stratified samples. See intro/method section for stratification

b = Not adequate sample, less than 10 known-fin-clip-status (live or dead) fish were observed. Therefore, an alternative method was used to estimate wild redds, which includes data from prior seasons. Numbers in orange are, or in part include, wild redd estimates based on an alternative method.

c = Oregon Coast DPS does not include sites that were within hatchery hot-spots.

d = Estimate obtained for the Nestucca population, which is included in the North Coast Monitoirng Area estimate.

Table 3. Oregon winter steelhead redd density and site occupancy, 2019. Sites must have at least one confirmed redd to be considered occupied. ns = no surveys conducted.

ESU/DPS	Population or Monitoring Area	Redds / Mile		% Sites With Redds	
		2019	5-Yr Avg	2019	5-Yr Avg
Southwest Washington	Young's Bay	ns	ns	ns	ns
	Big Creek	ns	ns	ns	ns
	Clatskanie	4.5	9.1	68%	64%
	Scappoose	0.0	0.9	0%	26%
	Total	**2.3**	**5.0**	**34%**	**48%**
Lower Columbia River	Clackamas	2.5	6.7	47%	60%
	Sandy	8.1	17.7	75%	74%
	Gorge	ns	ns	ns	ns
	Total	**5.3**	**11.9**	**61%**	**69%**
Oregon Coast	North Coast	7.8	15.0	65%	66%
	Mid Coast	9.5	11.2	77%	67%
	Mid-South Coast	8.7	13.6	69%	76%
	Umpqua	7.7	6.6	80%	68%
	Total	**8.4**	**11.4**	**73%**	**69%**
Klamath Mountians Province	South Coast	ns	ns	ns	ns
	Rogue River	ns	ns	ns	ns
	Total	**ns**	**ns**	**ns**	**ns**

Table 4. Oregon winter steelhead fish abundance estimates, 2019. Estimates do not include steelhead above counting stations and are thus not complete population estimates in all areas, see Appendix Tables 6 and 7. ns = no surveys conducted.

ESU/DPS	Population or Monitoring Area	Winter Steelhead Abundance			
		Total		Wild	
		Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Southwest Washington	Youngs Bay	ns	ns	ns	ns
	Big Cr	ns	ns	ns	ns
	Clatskanie [ab]	446	152	421	-
	Scappoose	-	-	-	-
	Total	**446**	**152**	**421**	-
Lower Columbia River	Clackamas [ab]	777	310	576	-
	Sandy [ab]	2,032	1,169	1,896	-
	Gorge	ns	ns	ns	ns
	Total	**2,809**	**1,476**	**2,472**	**-**
Oregon Coast [c]	North Coast	14,653	3,725	13,410	3,662
	Nestucca [d]	*3,732*	*923*	*2,489*	*617*
	Mid Coast	25,290	8,779	24,110	8,371
	Mid South Coast	14,513	5,235	9,179	3,312
	Umpqua [b]	21,466	10,882	21,323	-
	Total	**79,654**	**15,380**	**70,511**	-
Klamath Mountains Province	South Coast	ns	ns	ns	ns
	Rogue River	ns	ns	ns	ns
	Total	**ns**	**ns**	**ns**	**ns**

a = Estimates for these populations are derived from stratified samples. See intro/method section for stratification overview.

b = Not adequate sample, less than 10 known-fin-clip-status (live or dead) fish were observed. Therefore, an alternative method was used to estimate wild redds, which includes data from prior seasons. Numbers in orange are, or in part include, wild redd estimates based on an alternative method.

c = Oregon Coast DPS does not include sites that were within hatchery hot-spots.

d = Estimate obtained for the Nestucca population, which is included in the North Coast Monitoirng Area estimate.

Table 5. Annual redd abundance estimates of naturally spawning wild steelhead by Monitoring Area (MA), in Oregon Coast Steelhead DPSs, run years 2003 to 2019. n.a.= not available. Highlighted cells do not include estimates for areas above counting stations.

	Oregon Coast DPS				Klamath Mountains Province DPS	
Year	North Coast MA	Mid Coast MA	Mid-South Coast MA	Umpqua MA	South Coast MA	Rogue River MA
2003	28,726	18,092	11,853	26,044	4,852	7,105
2004	28,599	14,043	10,195	11,922	9,093	n.a.
2005	19,125	7,890	22,871	10,628	10,035	4,995
2006	21,065	13,496	19,550	8,786	5,667	7,372
2007	20,592	10,133	24,312	13,900	6,917	6,986
2008	11,859	12,628	18,806	15,556	5,520	5,822
2009	10,433	12,080	9,136	9,282	14,268	12,352
2010	18,928	16,684	19,927	16,266	4,430	n.a.
2011	9,961	19,347	9,504	11,394	1,808	n.a.
2012	15,864	19,074	7,414	11,416	2,738	n.a.
2013	29,371	27,927	15,423	21,895	8,961	n.a.
2014	14,185	9,012	10,877	9,791	4,449	n.a.
2015	24,641	15,443	11,548	10,975	1,682	n.a.
2016[a]	15,491	23,776	14,049	9,120	n.a.	n.a.
2017[a]	10,720	5,522	6,909	5,982	n.a.	n.a.
2018[a]	9,104	18,992	10,882	15,960	n.a.	n.a.
2019[a]	7,886	14,180	5,397	12,541	n.a.	n.a.

a = Oregon Coast DPS does not include sites that were within hatchery hot-spots after 2015.

Table 6. Oregon Winter Steelhead redd abundance estimates within Oregon Coast Hotspots in 2019. Estimates are calculated at the DPS scale, due to insufficient sample size at the MA scale.

DPS	Monitoring Area	Survey Effort		Spawning Miles within Hotspots	Winter Steelhead Redd Abundance			
					Total		Wild	
		Number of Surveys	Miles		Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast	North Coast Hotspots	2	1	49	-	-	-	-
	Mid Coast Hotspots	4	4	89	-	-	-	-
	Mid South Coast Hotspots	0	0	61	-	-	-	-
	Umpqua Hotspots	0	0	42	-	-	-	-
	Total	**6**	**4**	**241**	**2,608**	**1,912**	**2,608**	**1,912**

Table 7. Oregon Winter steelhead redd abundance estimates by stratified area, 2019. Due to small sample sizes in 2019, wild estimates in orange are derived from an alternate estimate method using a cumulative pHOS calculation from all years sampled.

ESU	Population	Survey Effort		Aproximate Spawning Miles	Winter Steelhead Redd Abundance			
					Total		Wild	
		Number of Surveys	Miles		Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Southwest Washington	*Clatskanie Strata*	24	22	53	238	87	229	-
	Plympton Cr.Strata	3	3	1	22	0	17	0
	Clatskanie Total	27	25	54	260	87	246	-
Lower Columbia River	*Clackamas Strata*	20	15	140	320	154	272	-
	Clackamas Migration Strata	7	13	32	14	12	11	-
	Eagle Cr. Hatchery	6	6	10	121	92	53	-
	Lower Clackamas Total	33	35	181	455	259	336	-
	Sandy Strata	17	15	124	1,005	668	965	-
	Sandy Migration Strata	9	14	22	188	156	149	-
	Cedar Cr. Hatchery Strata	ns	ns	1	ns	ns	ns	-
	Sandy Total	26	29	147	1193	825	1,113	-
	Lower Columbia ESU Total			**381**	**1,908**	**1,171**	**1,450**	-

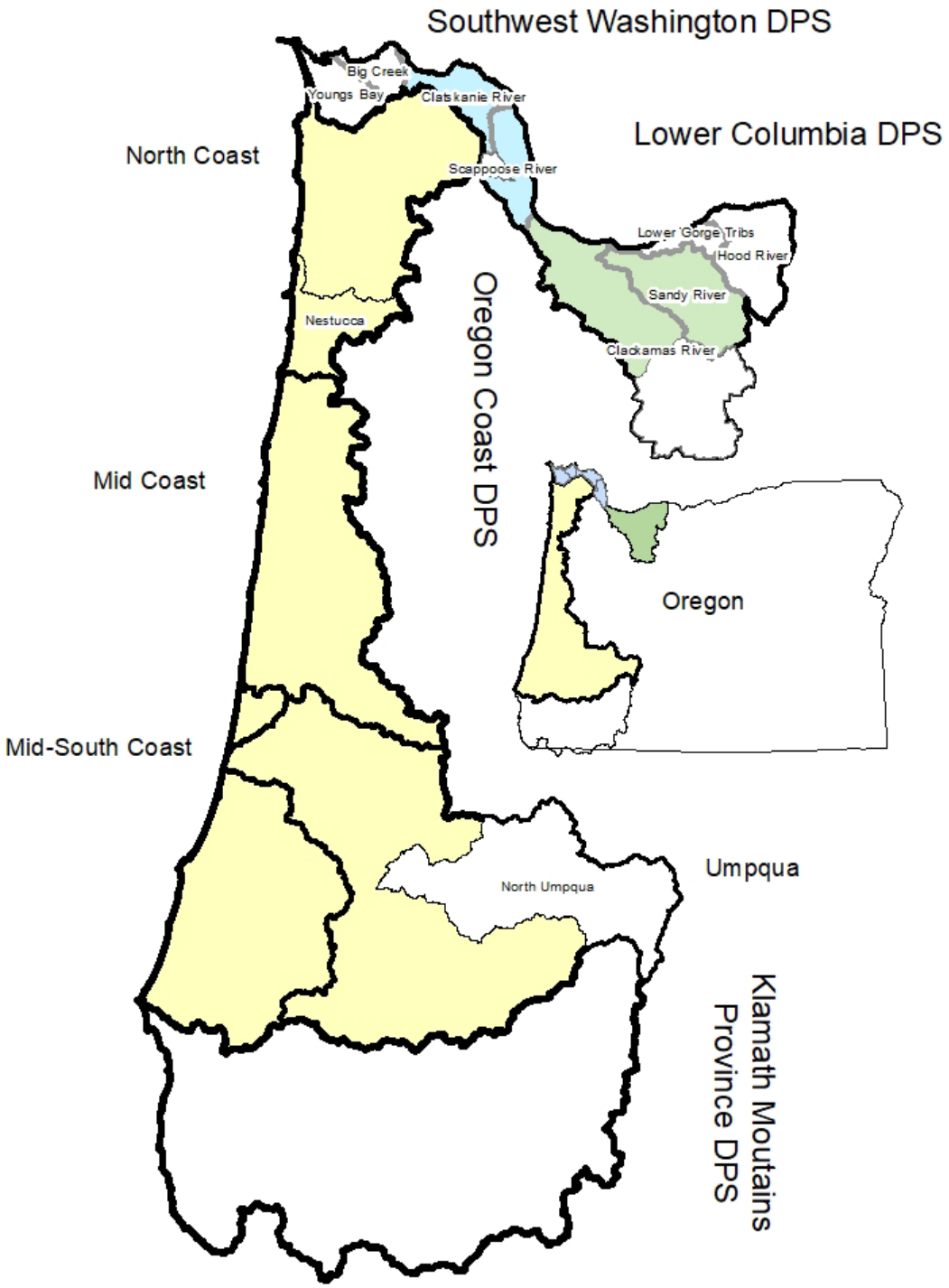

Figure 1. Geographic scope of winter steelhead monitoring, 2019. Monitoring scales include: Evolutionary Significant Unit (ESU), Dependent Population Segment (DPS), Monitoring Area (MA), and population. Areas without color were not monitored in 2019. Boundaries as defined by Busby et.al. (1996) for ESU/DPS, by Myers et al. (2006) for the LCR ESU populations, by the 2005 Oregon Native Fish Status Report (ODFW 2005) for other populations.

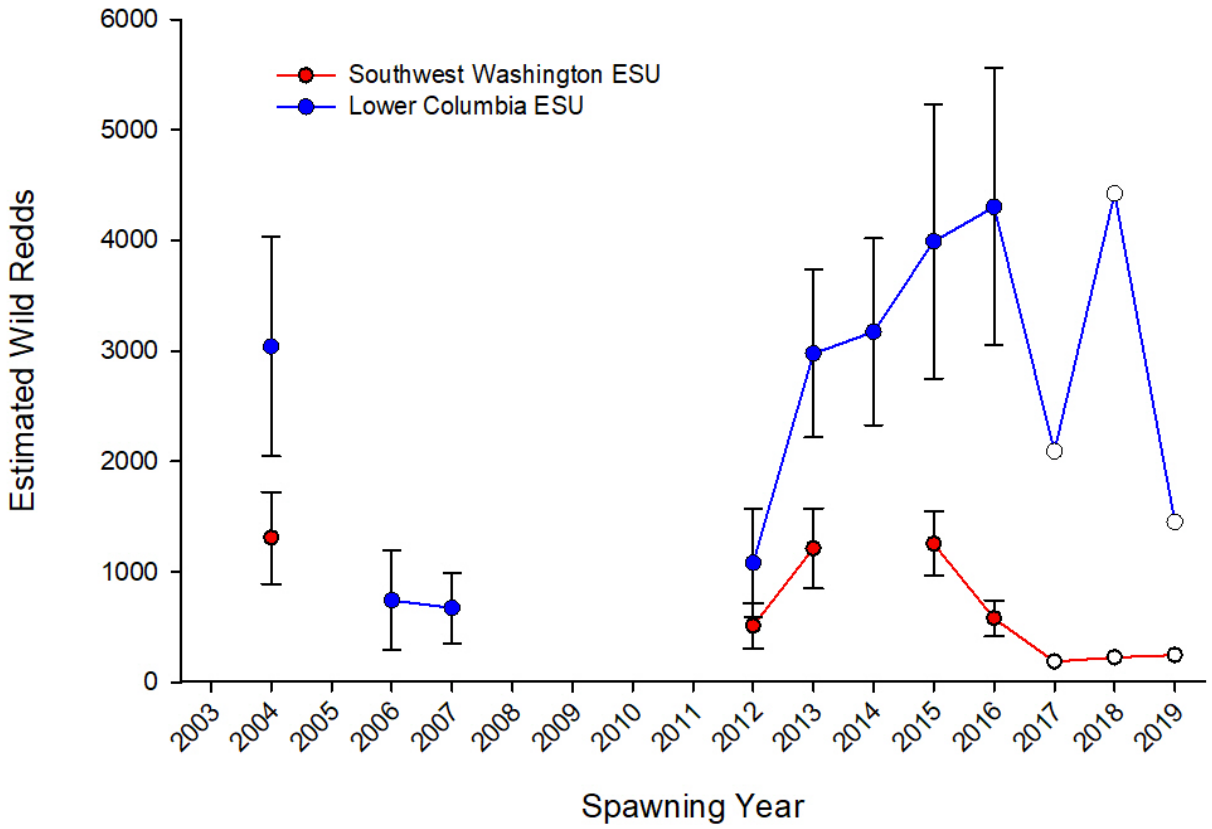

Figure 2. Wild winter steelhead redd estimates in the Oregon portions of the SWW and LCR ESUs based on random surveys, 2004 to 2019. Error bars represent 95% confidence intervals. Inclusion of survey data from specific populations and from above counting stations has varied across years. Note: 2017 to 2019 error bars were not available because estimates were calculated with alternative methods.

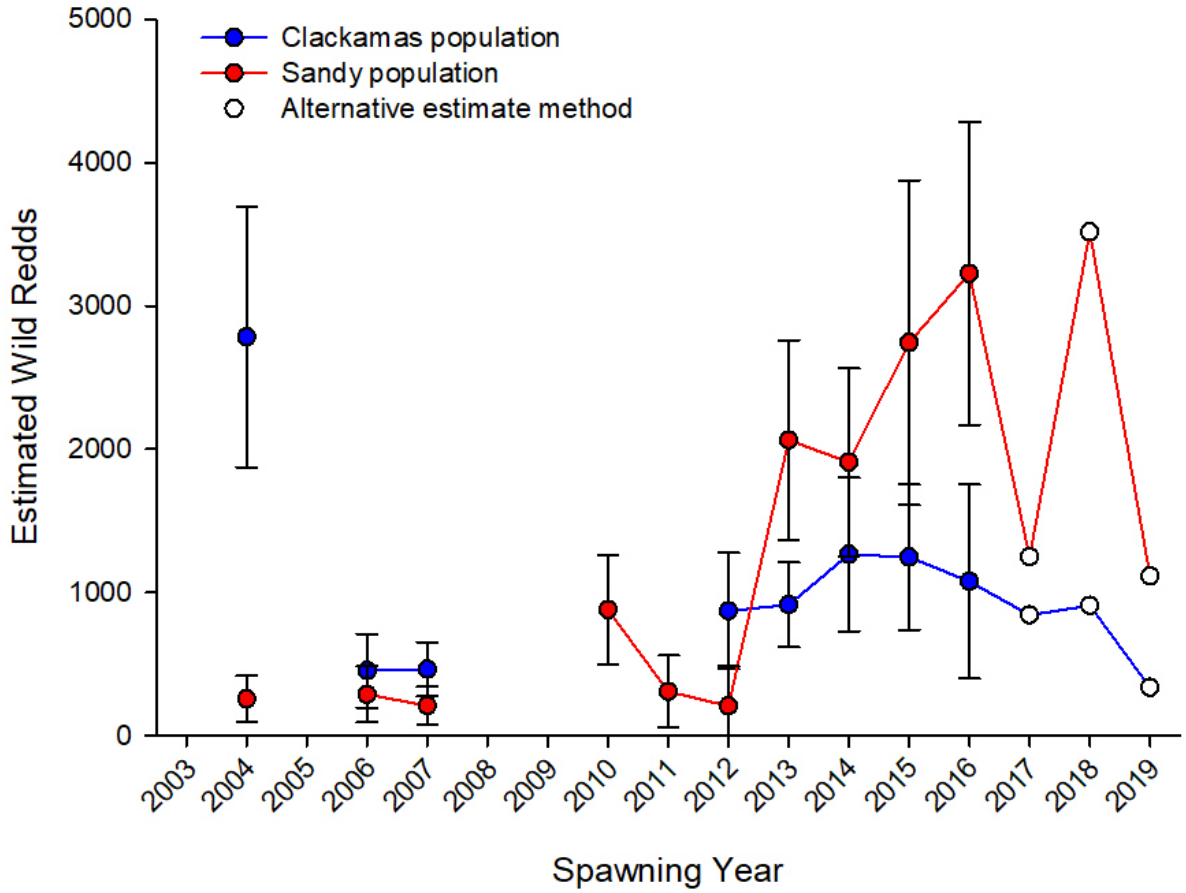

Figure 3. Wild winter steelhead redd estimates in the Clackamas and Sandy River populations based on random surveys, 2004 to 2019. Error bars represent 95% confidence intervals. Note: 2017 to 2019 error bars were not available because estimates were calculated with alternative methods.

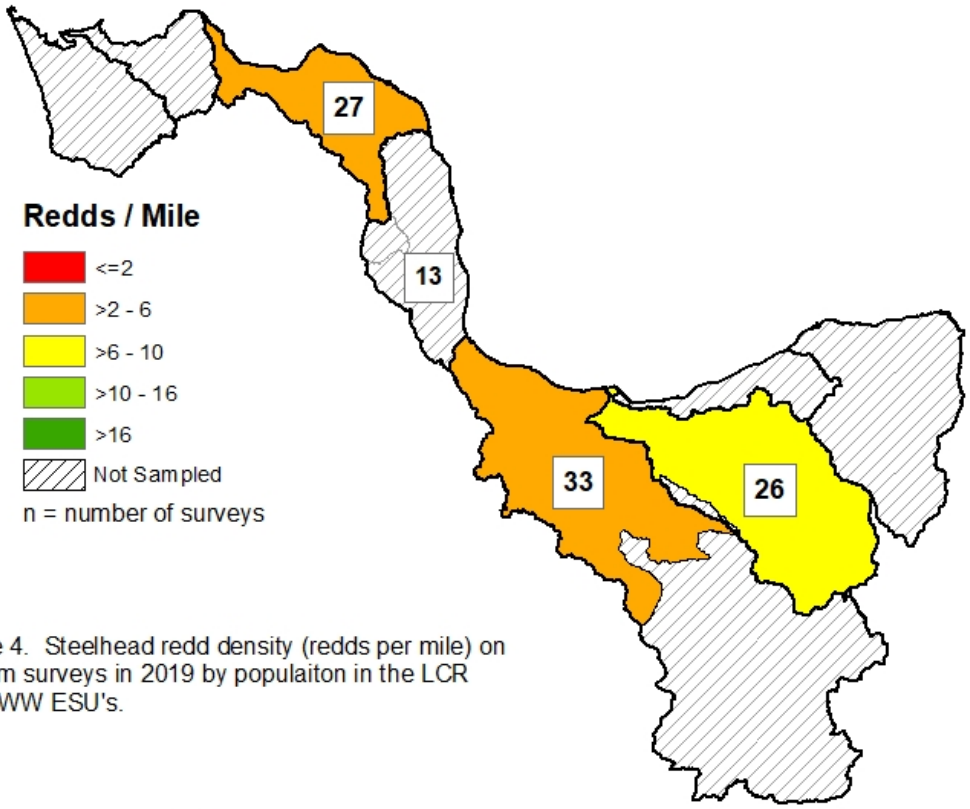

Figure 4. Steelhead redd density (redds per mile) on random surveys in 2019 by populaiton in the LCR and SWW ESU's.

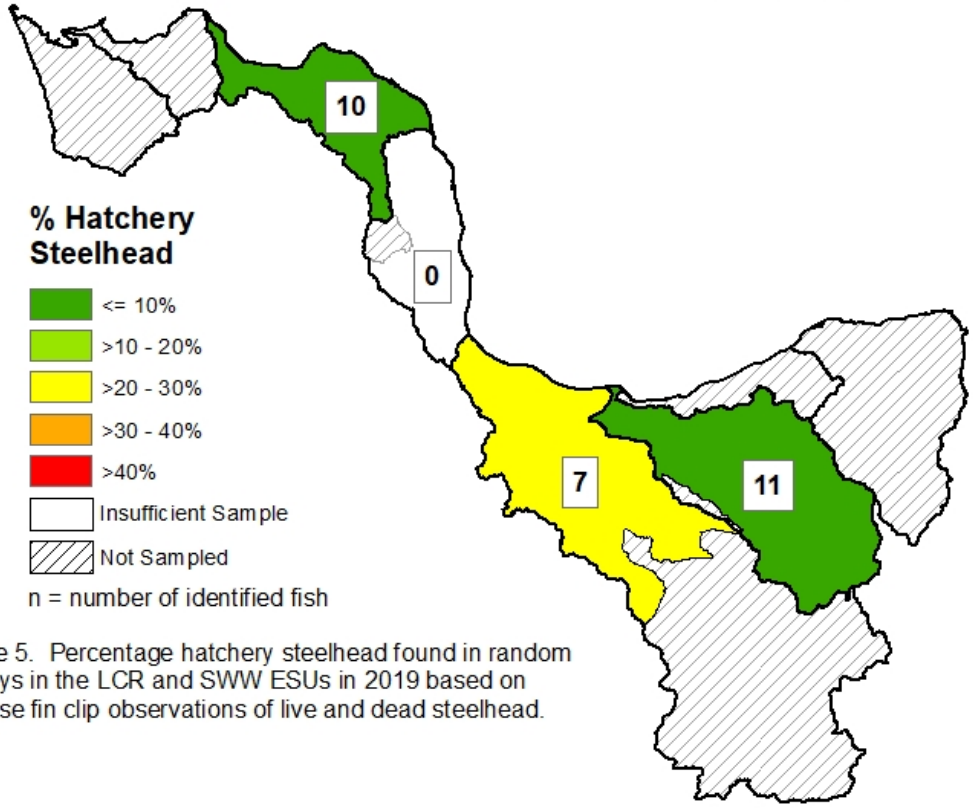

Figure 5. Percentage hatchery steelhead found in random surveys in the LCR and SWW ESUs in 2019 based on adipose fin clip observations of live and dead steelhead.

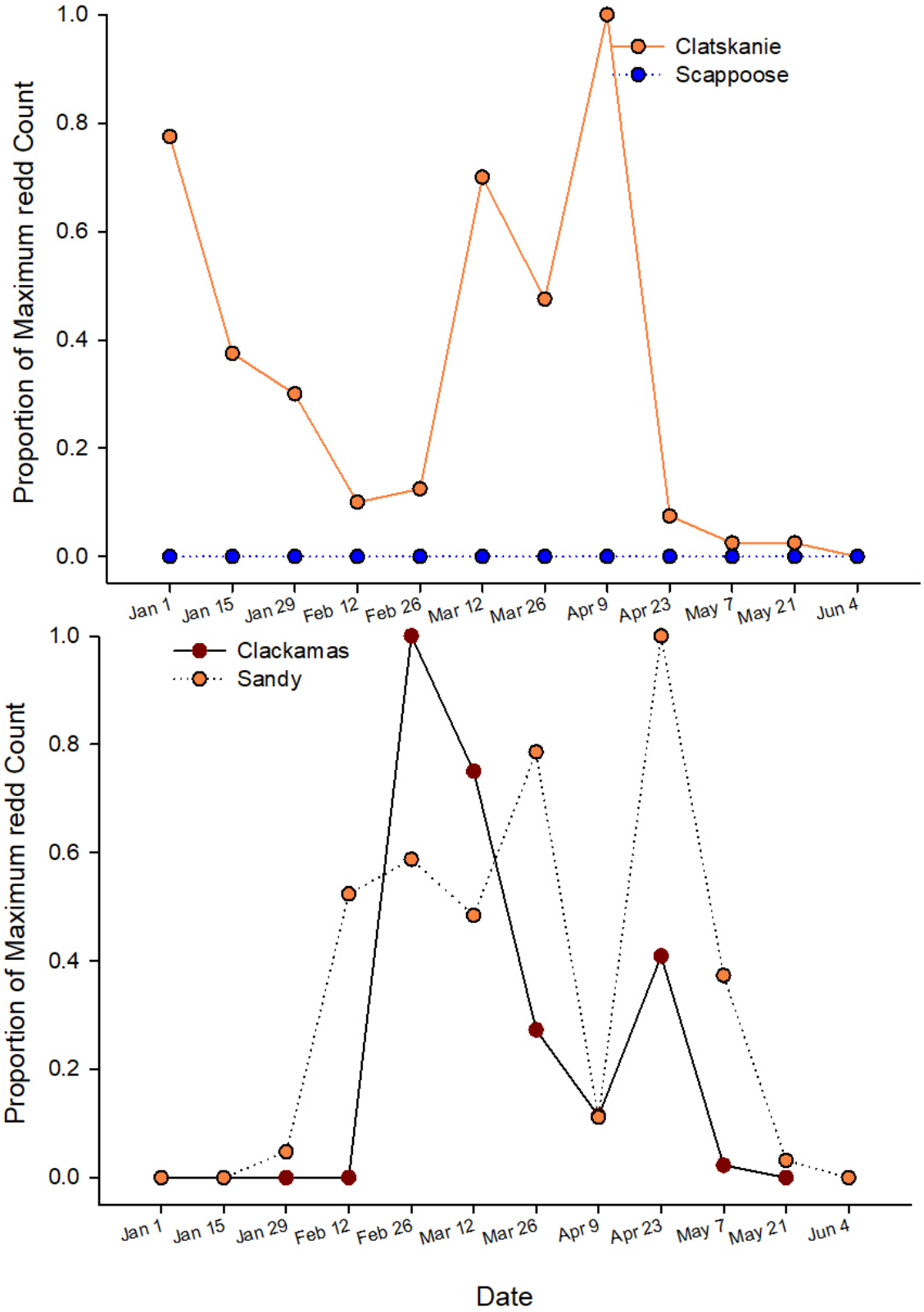

Figure 6. Winter steelhead spawn timing, represented by proportion of the maximum redd count in a) SWW ESU populations and b) LCR ESU populations, 2019.

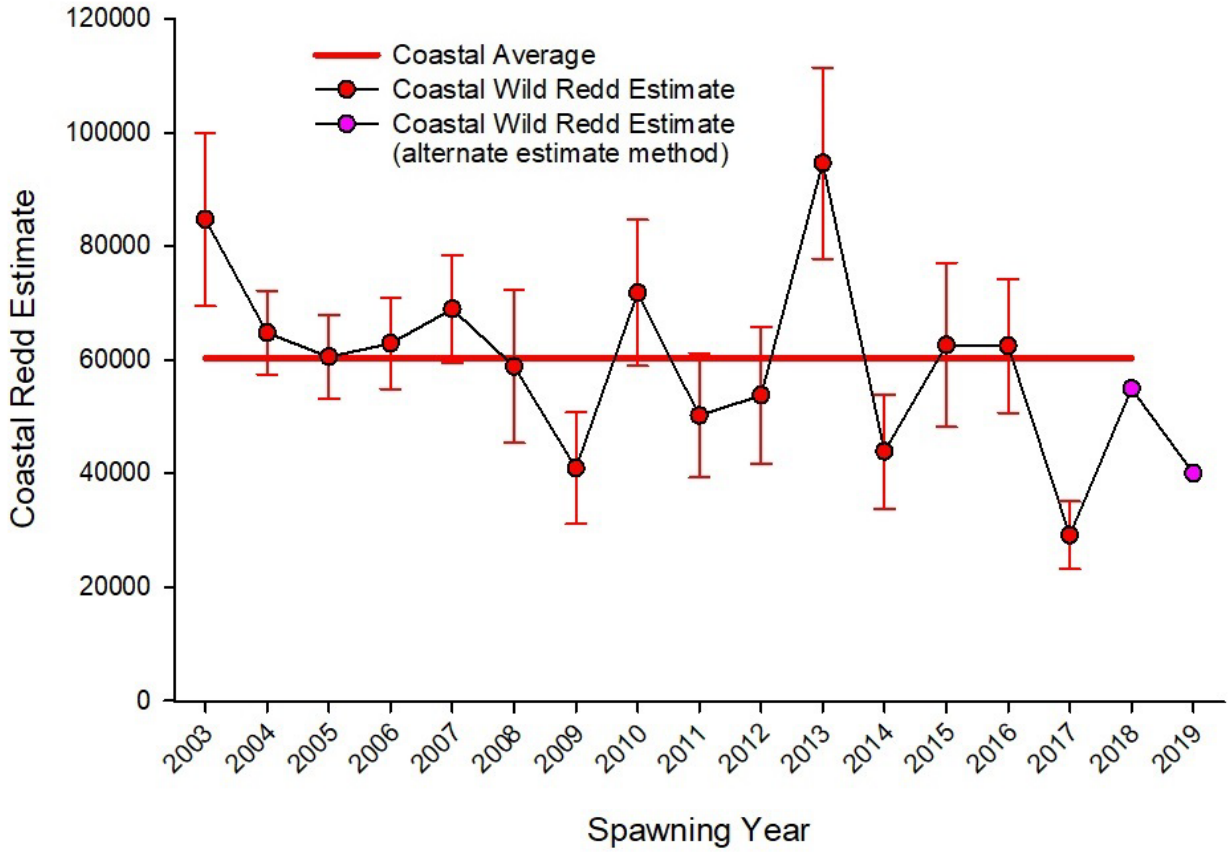

Figure 7. Estimated number of wild winter steelhead redds in the Oregon Coast DPS, 2003 to 2019. Error bars represent 95% confidence intervals. Note: 2018 and 2019 error bar were not available because estimates were calculated with alternative methods.

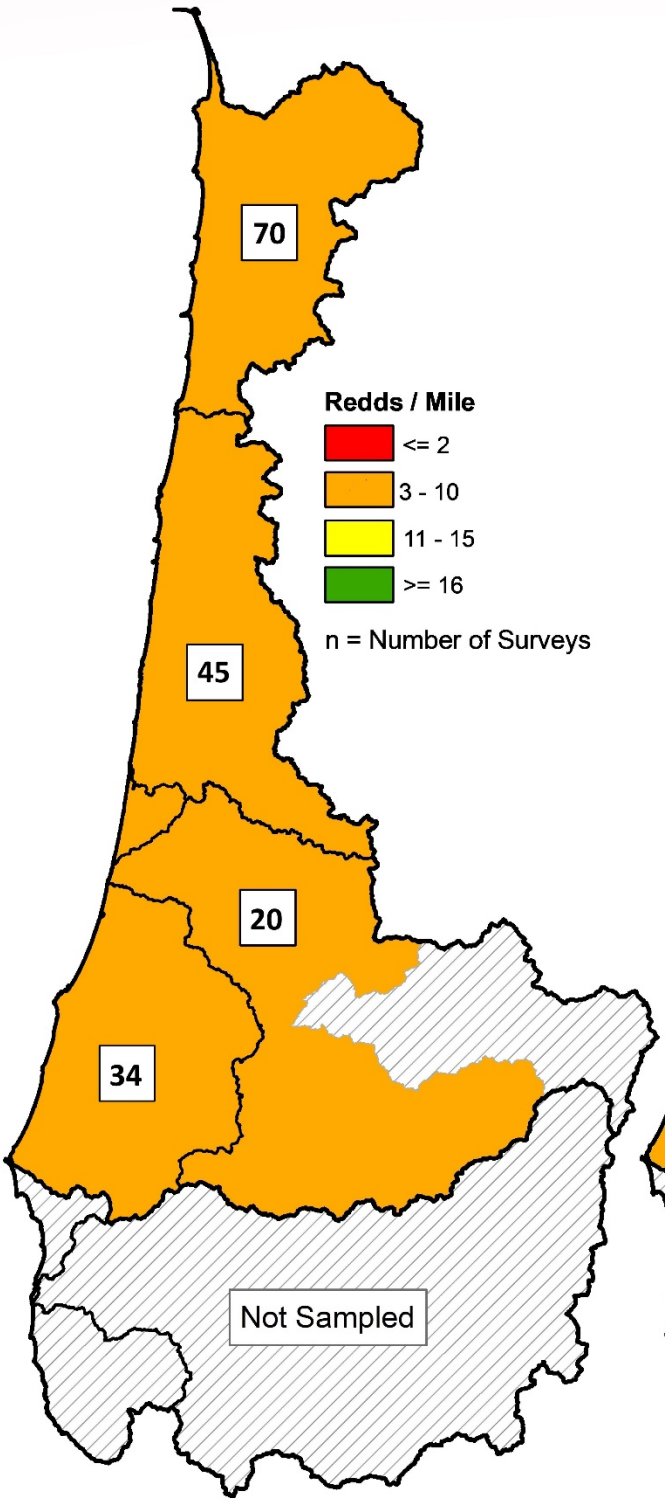

Figure 8. Steelhead redd density (redds per mile) in random surveys in 2019 by monitoring area in the Coastal and KMP DPS's.

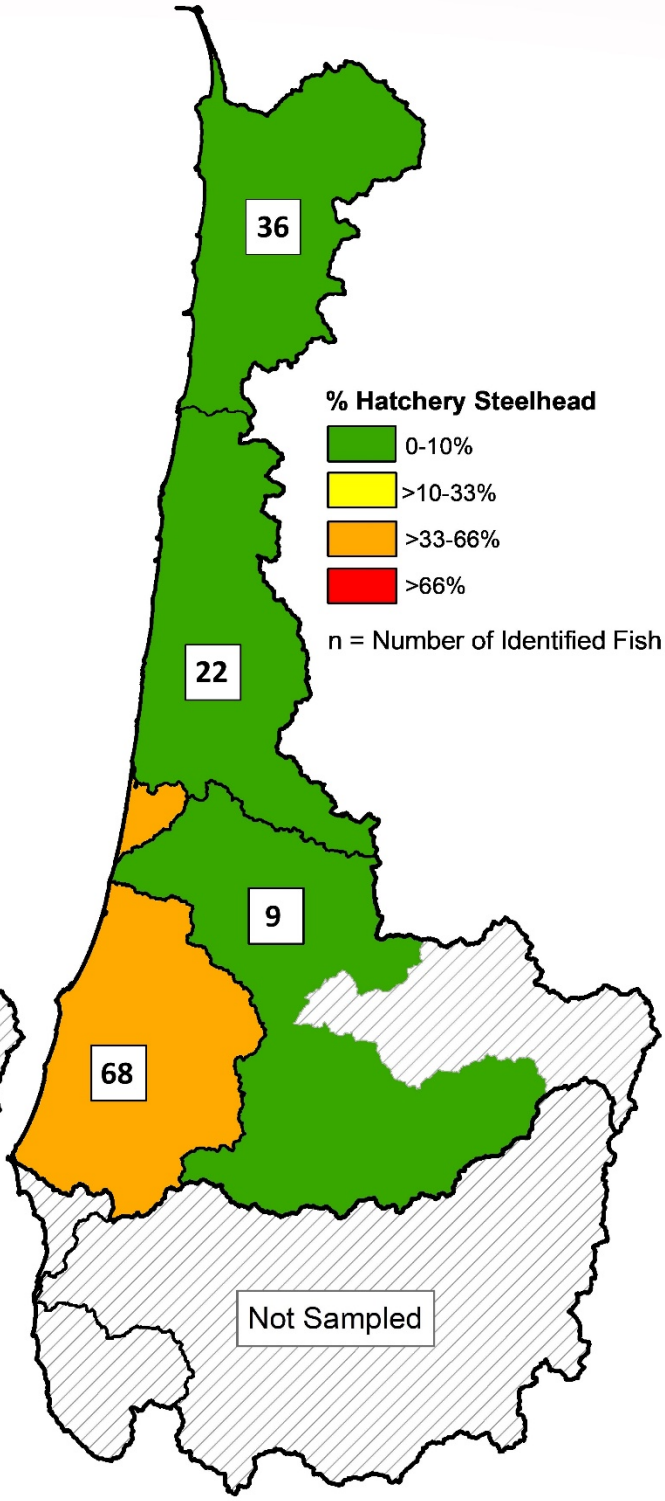

Figure 9. Percentage hatchery steelhead found in random surveys in each of the six Coastal and KMP monitoring areas in 2019 based on fin clip observations of live and dead steelhead.

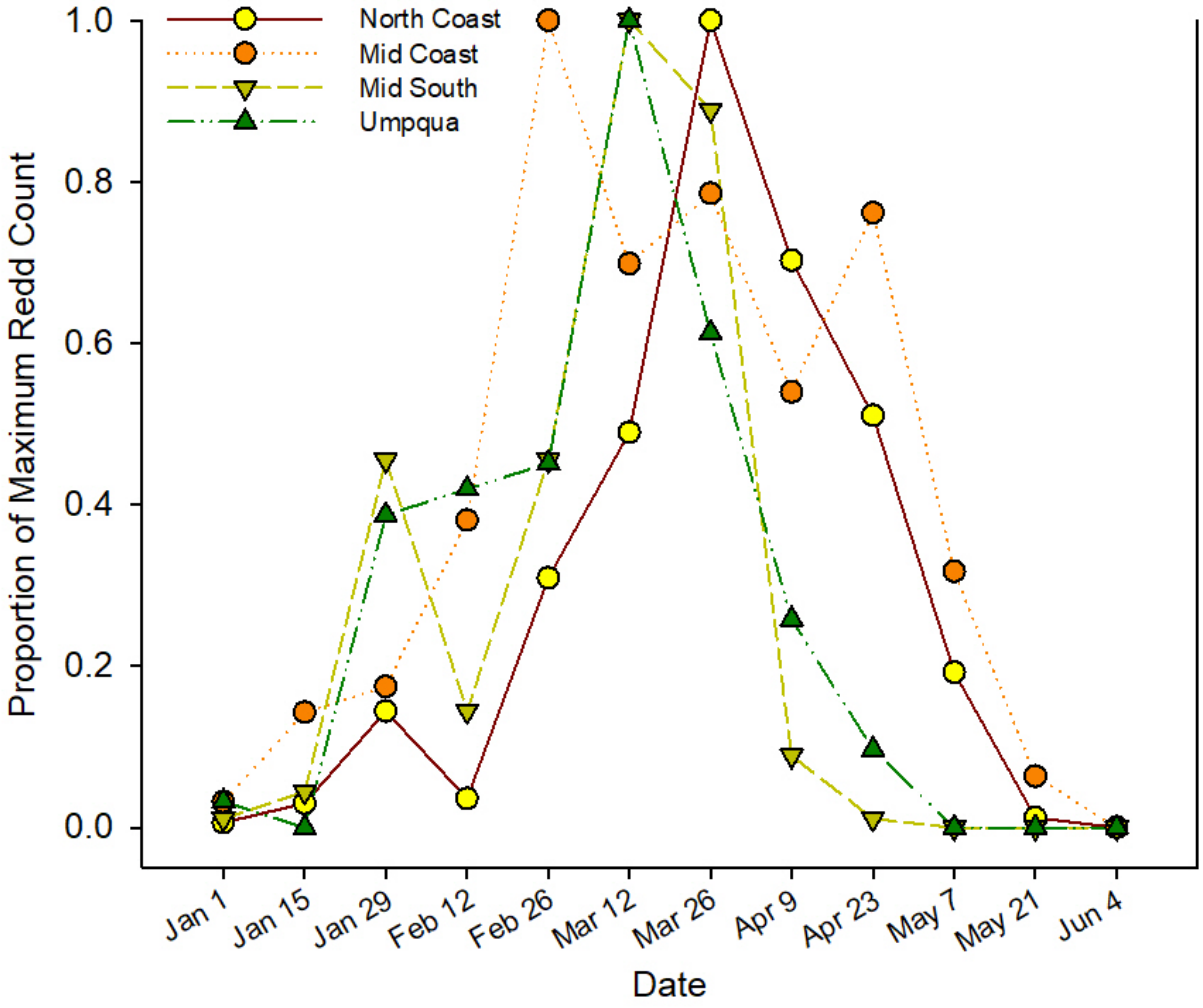

Figure 10. Winter steelhead spawn timing, represented by proportion of the maximum redd count in each of the four OC DPS monitoring areas, 2019.

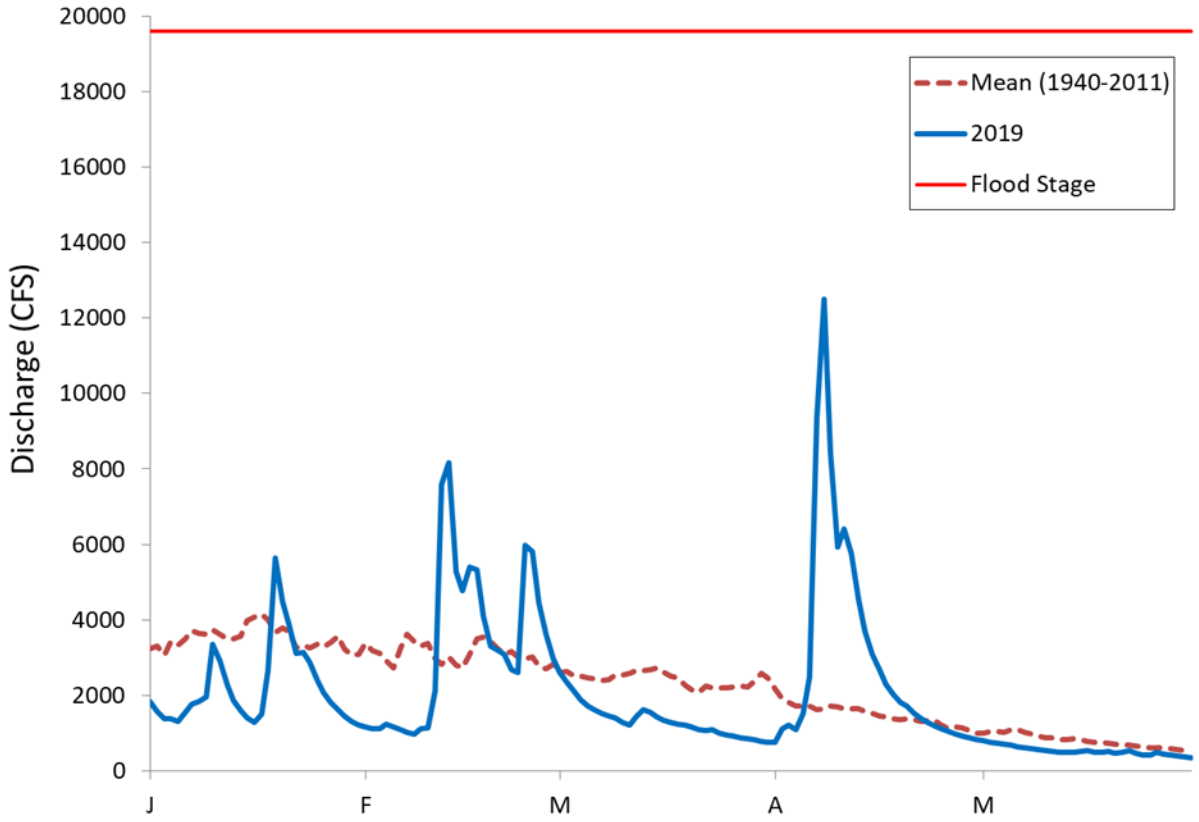

Figure 11. Stream discharge at Alsea River near Tidewater during 2019, compared to mean discharge from 1940 to 2011. (Flood stage = 19,500 CFS)

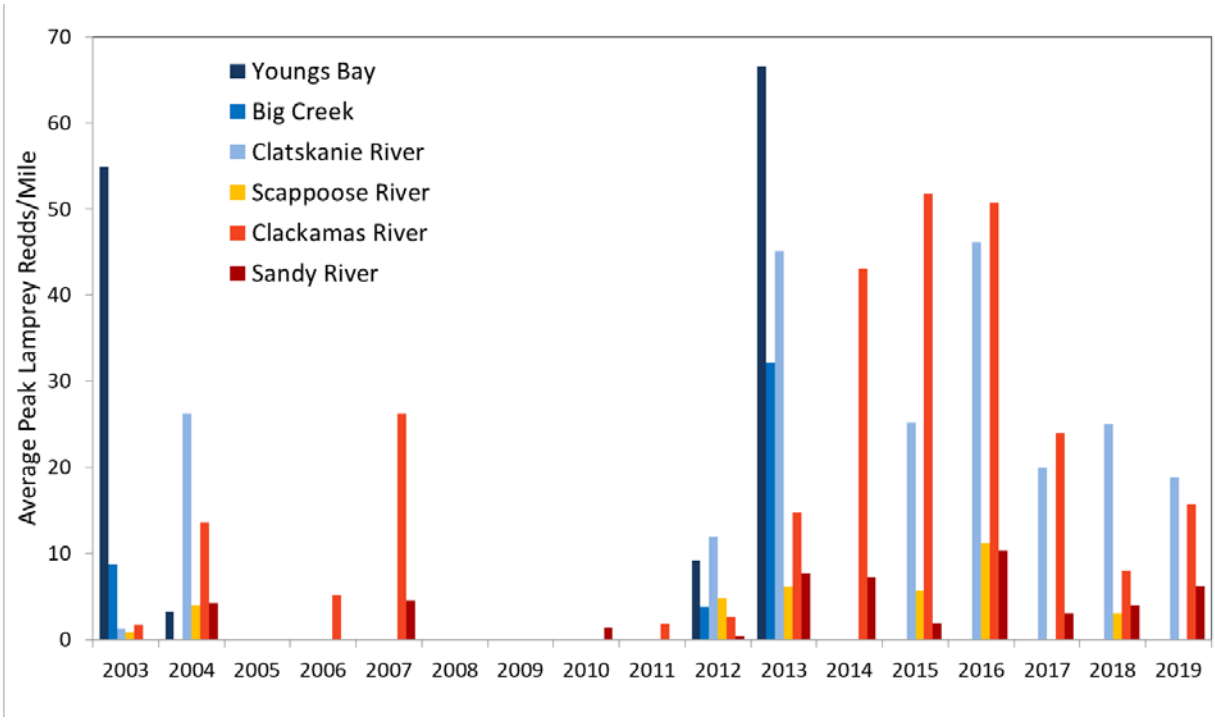

Figure 12. Lower Columbia Pacific Lamprey Peak Redd Density in Random Steelhead Spawning Surveys, 2003-2019. Note that not all populations were monitored in all years.

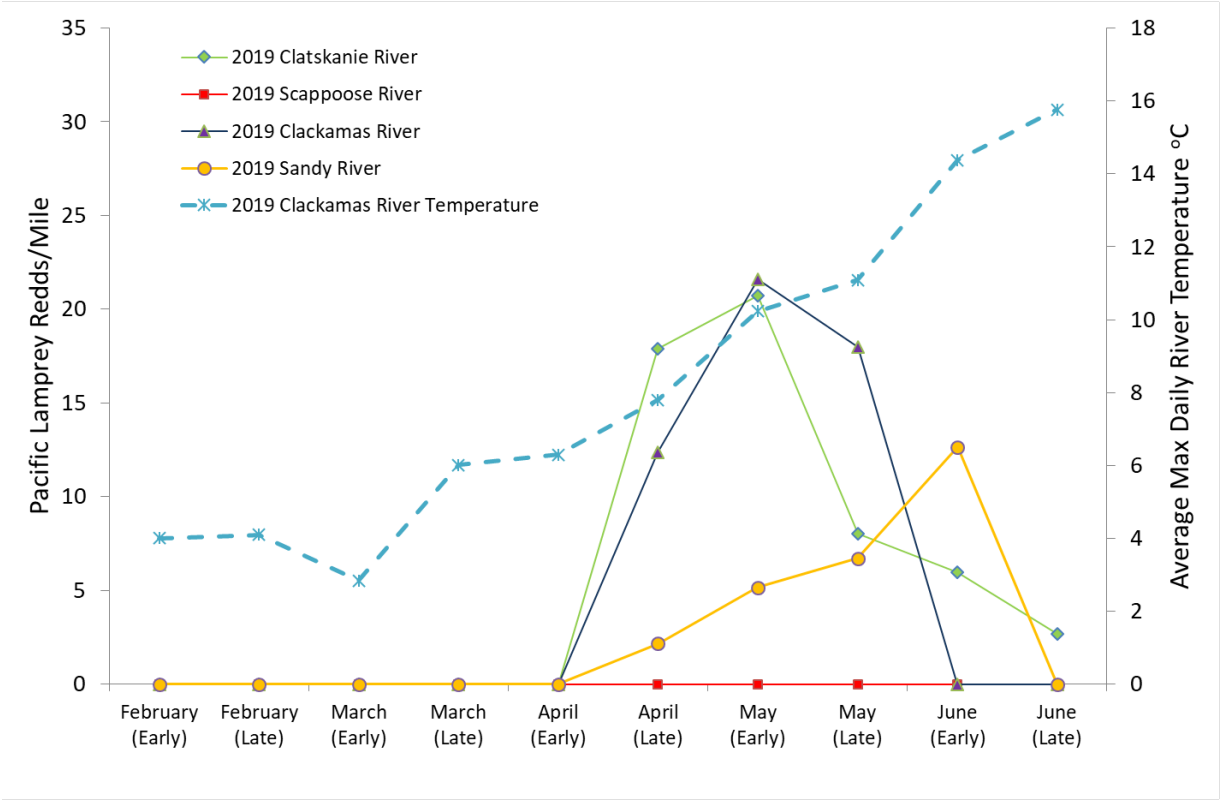

Figure 13. Lower Columbia Pacific Lamprey spawn timing in random steelhead surveys in 2019 and average daily max water temperature in the Clackamas River.

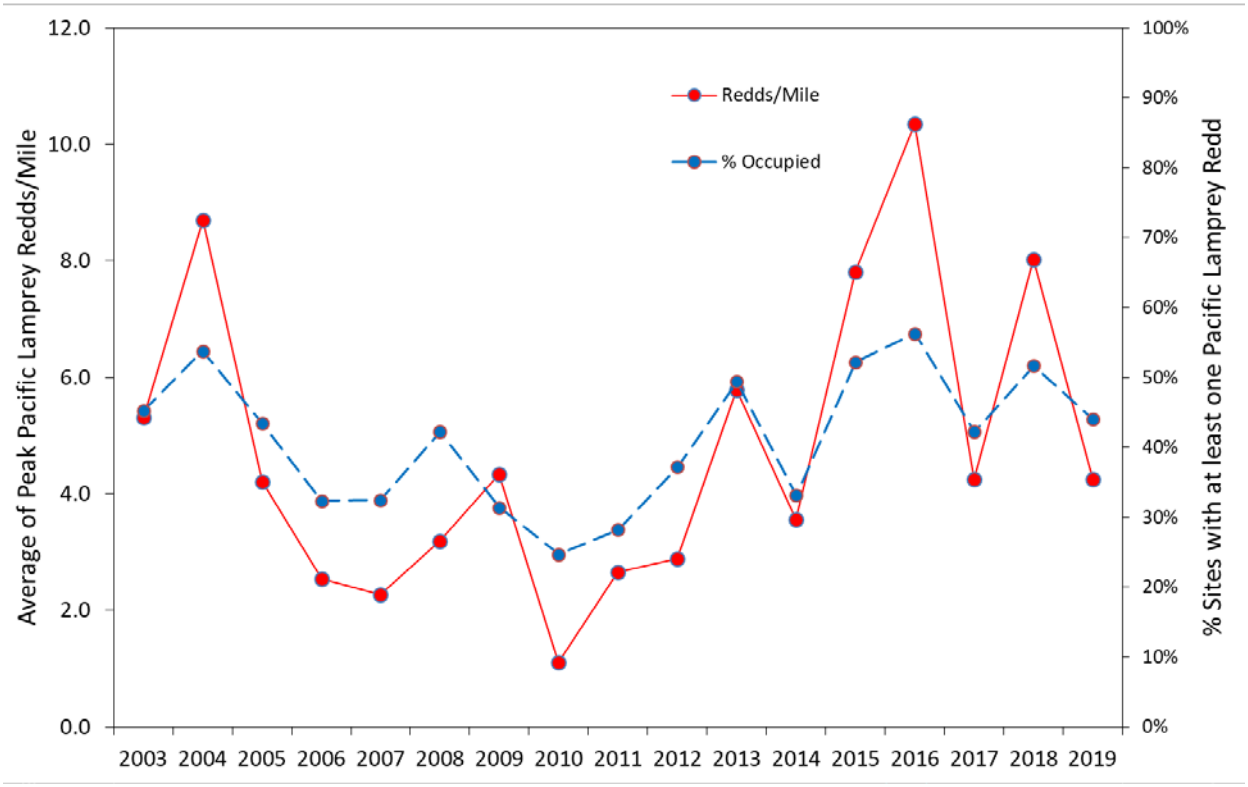

Figure 14. Oregon coast Pacific Lamprey peak redd density and percent of sites occupied in random steelhead spawning surveys, 2003 to 2019.

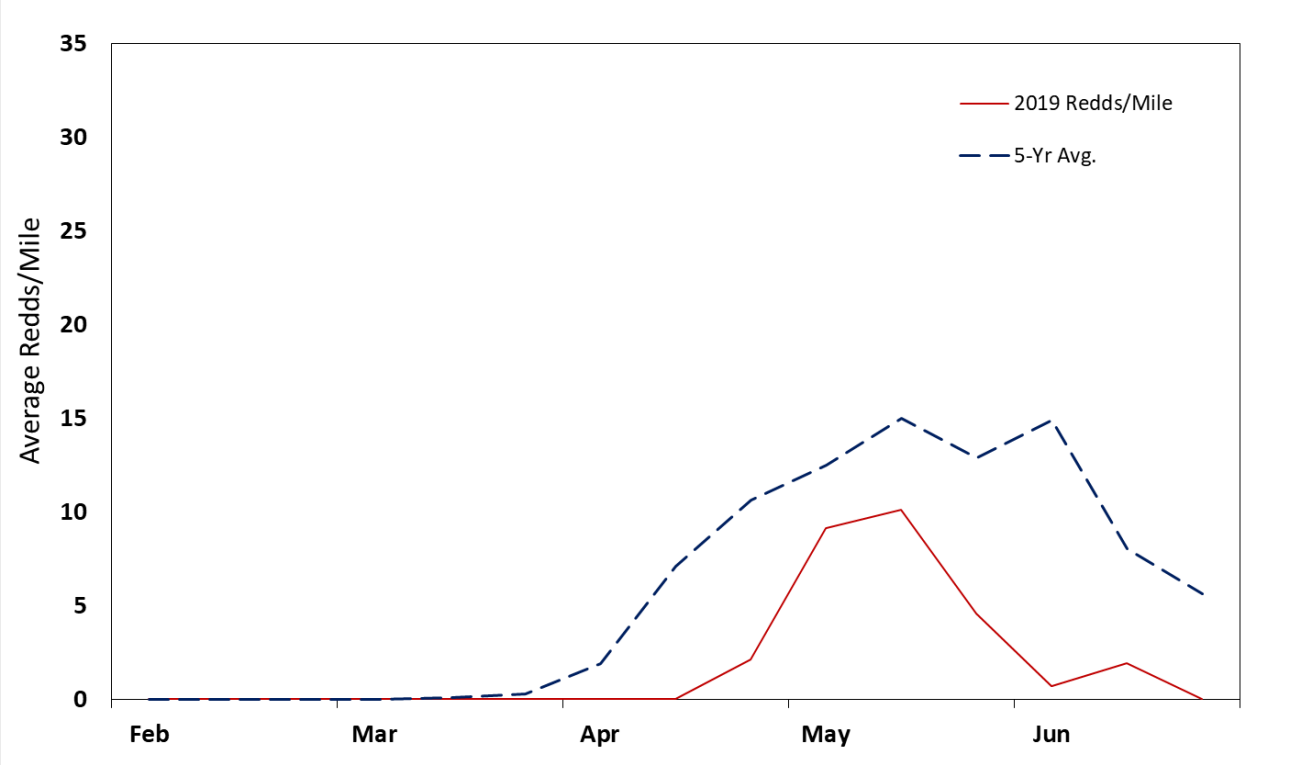

Figure 15. Oregon coast Pacific Lamprey spawn timing in index surveys, 2019.

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