THE OREGON PLAN *for Salmon and Watersheds*

Western Oregon Adult Winter Steelhead and Lamprey, 2021 Redd Survey Data Report

Report Number: OPSW-ODFW-2021-09

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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 2021. Also included is a brief summary of lamprey data collected from the same monitoring efforts. Total wild winter steelhead redd estimates in the Southwest Washington (SWW) Evolutionary Significant Unit (ESU) and in the Lower Columbia River (LCR) ESU were 34% and 80% of the prior 7-year average, respectively. Total wild winter steelhead redd estimates were 73% of the 7-year average for the Oregon Coast (OC) Distinct Population Segment (DPS). Estimate precision goals were met for steelhead redd estimates in the OC DPS. Precision goals were not met in the SWW ESU, the LCR ESU, nor any of the four OC Monitoring Areas (MA). 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 mixed in 2021 in the Lower Columbia and Oregon Coast, but overall, slightly higher 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 in 2003 to monitor spawning winter steelhead (*Oncorhynchus mykiss*) in coastal Oregon streams, this project is part of the Oregon Adult Salmonid Inventory and Sampling program. 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 2021 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. 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, these include: River Mill (Clackamas River) and Winchester (North Umpqua River) dams, and Big Creek Hatchery, Klaskanine Hatchery, Sandy Hatchery and NF Alsea Hatchery weirs. The Bonnie Falls Trap (Scappoose Basin) is no longer a counting station. Surveys above the former trap were not added to the survey frame in 2020. However, surveys will be selected above this point in future years. 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 are conducted, at least once every 14 days, from February through May to generate a total redd count for each survey. Post season each survey is evaluated, based on the number and timing of survey dates, to determine if it should be used in abundance estimates. Large gaps between survey dates (over 15 days), especially during the main period of steelhead spawning, could result in undercounting of redds. A majority of the random steelhead spawning surveys were also sampled as random coho spawning surveys, weekly surveys conducted from October through January. In these cases,

survey data from December on is included in the steelhead season dataset to ensure any steelhead and/or lamprey (fish & redds) observed during the salmon spawning season are included in the steelhead season analysis. Pacific lamprey standard surveys and any steelhead surveys that still have activity at the end of May are typically continued into June, or until the end of spawning activity, however in 2021 nearly all surveys were discontinued at the end of May. Specific descriptions of project protocols can be found in the annual survey procedures manual (ODFW 2021).

Steelhead redd abundance estimates are converted to fish abundance using a standard redd-to-fish conversion factor developed in the OC ESU (ODFW 2013). Wild steelhead abundance estimates (including both dam counts and spawning survey results) for the 2021 spawning season are reported in Table 2.

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 2016. 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 2021 are presented in Table 8 as a single estimate for the Oregon Coast DPS.

RESULTS

Survey Effort

SWW & LCR ESU's

- Budget constraints related to COVID-19 resulted in a reduction in effort within the SWW and LCR ESU's during the 2021 Winter Steelhead season (Table 1).
- Due to budget cuts in 2021, a number of surveys were dropped and are part of the non-response column of Table 1. The percentage of sites which were successfully surveyed in

2021 was 41% in the SWW ESU and 61% in the LCR ESU. The SWW ESU was below the 9-year average of 61% and the LCR ESU was above the 9-year average of 52%.

- Due to ongoing 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.
- Also due to budget restraints, trapping at Bonnie Falls (Scappoose population) was discontined after the 2019 season. To address this the area was included in spawning survey monitoring starting in 2021. However, due to denials and non-responsive landowners, no surveys were not conducted above Bonnie Falls in 2021.
- 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 2021. The greater challenges in 2021 were adjustments and logistical complications due to implementation of COVID-19 response measures. However field staff were successful in completing surveys throughout the season.

Oregon Coast DPS

- Survey effort in the OC DPS in 2021 was similar to recent years (Table 1).
- The percentage of sites successfully surveyed (54%) was above the 7-year average (51%).
- Survey conditions in the OC DPS were challenging early in the season (Jan-Feb), particularly in the Mid South Coast MA. For the remainder of the season survey conditions improved and remained good with lower-than-average rainfall and stream discharge. Given the challenging survey conditions in February paired with early spawn timing in the Mid South Coast MA, a number of sites had to be dropped from the Mid South Coast MA sample that did not meet survey rotation criteria.
- In the second half of the season, many small streams became too low for adult entry, and some streams even became fully dry. While most years this occurs to some degree, it was more pronounced in 2021 due to minimal rainfall after February.
- Overall, conditions were amenable to survey protocols in 2021 (Figure 11). Field staff were successful in completing surveys throughout the season despite the logistical complications associated with ongoing COVID-19 safety adjustments.

Redd Abundance

SWW & LCR ESU's

- Estimates for the Scappoose population for the 2021 season are not provided due to insufficient sample size. Contributors to this insufficient sample include denials, No AUC's and dropped sites due to budget cuts.
- The 2021 wild winter steelhead redd abundance estimate in the Clatskanie population (191 redds) was 38% of the 7-year average (Table 2).
- The 2021 wild redd abundance for the LCR ESU (2,464 redds) was 80% of the 7-year average (Table 2).

Oregon Coast DPS

- The 2021 wild winter steelhead redd abundance in the OC DPS (36,726 redds) was 73% of the 7-year average (Table 2).
- Wild estimates were below average in all four Oregon Coast MA's. The Mid Coast MA estimate (7,245 redds) was second lowest estimate since monitoring began in 2003 (49% of the 7-year average), and the North Coast MA estimate (13,751 redds) was the closest to average (95% of the 7-year average).

Hatchery Proportion

SWW & LCR ESU's

- In the Clatskanie population, the 2021 pHOS estimate was higher than the 7-year average, yet still below 10% in all populations (Figure 5 & Table 2).
- In the LCR ESU, pHOS estimates were generally below, or similar to, the prior 7-year averages (Figure 5 & Table 2). However, hatchery proportion for the Lower Clackamas spawning surveys was 21.7% in 2021 (Figure 5 & Table 2). When combined with the count of fish passed above the North Fork Clackamas Dam (100% wild), the basin total pHOS for the Clackamas in 2021 was 9.2%.
- In 2021, all populations had a sample size below the 10 live/dead fish-observation target, except for the Upper Sandy River surveys 12 steelhead observations with known clip status. (Figure 5).
- The 2021 pHOS estimate in the Sandy River Population did not exceed 5%, therefore a Summer Steelhead hatchery percentage is not required. The pHOS estimate for spawning ground surveys in the Clackamas population was 21.7%, so a calculation of February Summer Steelhead pHOS which is 0% for 2021.

Oregon Coast DPS

- In the OC DPS, the estimate of pHOS was 6.4%, which is below the 7-year average of 11.1% (Table 2), and the second lowest estimate since monitoring began in 2003.
- Estimates of pHOS were below the prior 7-year average in all four MAs.
- In 2021, only two of the four MAs had a sample size above the 10 live/dead fish-observation target (Figure 9). The Mid Coast MA and Umpqua MA were both below the observation target, and the 2021 reported pHOS estimate is the 5-year average.

Distribution and Timing

LCR & SWW ESU's

- Site occupancy (percentage of sites with at least one steelhead redd) was below the 7-year average in both the SWW ESU and the LCR ESU (Table 3). All populations had occupancy rates in 2021 that were below the prior 7-year average with the exception of the Sandy River population with an occupancy rate of 77% (Table 3).
- Winter steelhead redd timing for 2021 in the SWW ESU and the LCR ESU occurred in a in a pattern consistent with recent years (Figure 6).

Oregon Coast DPS

- The percentage of occupied sites in the OC DPS in 2021 was below the 7-year average, the same being true in each of the four MAs (Table 3).
- Winter steelhead spawn timing in 2021 was fairly typical for each MA (Figure 10). Spawn timing in the Mid South Coast MA began earlier than average in 2021, with the monitoring impacts described in the Survey Effort section of this report.

Pacific Lamprey Information

SWW & LCR ESU's

- In the LCR and SWW ESUs, Pacific Lamprey redd densities (peak redds per mile) appeared to be up from last year except in the Clatskanie population. the average for 2021 (Figure 12). The only populations that were above the 6-year average were in the Scappoose and the Clackamas.

Oregon Coast DPS

- In the OC DPS, 2021 Pacific Lamprey redd density on steelhead surveys was 120% of the 18-year average (Figure 14).
- Within Pacific Lamprey index surveys on the Oregon Coast, 2021 spawn timing began, peaked and tapered off earlier than is typical (Figure 15). Due to the early drop in lamprey spawning activity, and considering logistical complications, Pacific Lamprey standard surveys were ended earlier than typical (most surveys dropped at the end of May).
- Pacific Lamprey redd counts continue to track occupancy metrics in the OC DPS random sites. These results suggest that occupancy may provide an index of abundance (Figure 14).

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APPENDIX

Table 1. Site status in Oregon winter steelhead ESU/DPS's by monitoring area or population, 2021. 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]	17	9	0
	Scappoose	8	28	0
	Total	**25**	**37**	**0**
Lower Columbia River	Clackamas [b]	24	31	0
	Sandy [b]	18	34	1
	Gorge	ns	ns	ns
	Total	**42**	**65**	**1**
Oregon Coast [a]	North Coast	37	19	5
	Mid Coast	39	12	5
	Mid South Coast	27	39	7
	Umpqua	42	31	4
	Total	**145**	**101**	**21**
Klamath Mountains Province	South Coast	No random (GRTS) surveys conducted since 2016 spawning season.		
	Rogue River			
	Total			

a = Oregon Coast DPS does not include sites that were within hatchery hotspots.

b = Surveys in the Clatskanie, Clackamas and the Sandy River basin are shown here as the sum of all components.

Table 2. Western Oregon wild winter steelhead spawning abundance (fish and redds) and percent hatchery origin spawners (pHOS) for 2021, and prior year averages. Includes results from spawning ground surveys (SGS) and counting stations (areas without SGS). Wild proportions and pHOS estimates are derived from fin-mark observations on live and dead steelhead. ns = no surveys conducted. ne= no estimates for this season due to a low sample size.

ESU/DPS	Population or Monitoring Area	Data Source	Wild Winter Steelhead				pHOS	
			Redds		Fish			
			2021	7-Yr Avg	2021	7-Yr Avg	2021	7-Yr Avg
Southwest Washington	Youngs Bay	SGS	ns	ns	ns	ns	ns	ns
	Big Cr	SGS	ns	ns	ns	ns	ns	ns
	Clatskanie	SGS	191	514	328	878	4.7%	3.6%
	Scappoose	SGS	ne	49	ne	86	ne	0.0%
	Bonnie Falls	Count	-	-	-	9	-	0.0%
	Total	**All**	**191**	**563**	**328**	**973**	**-**	**3.3%**
Lower Columbia River	Clackamas	SGS	191	884	328	1,507	21.7%	13.4%
	N Fk Clackamas Dam	Count	-	-	662	1,400	0.0%	0.0%
	Sandy	SGS	2,273	2,186	3,868	3,720	0.9%	5.6%
	Gorge	SGS	ns	ns	ns	ns	ns	ns
	Total	**All**	**2,464**	**3,071**	**4,858**	**6,628**	**2.5%**	**6.1%**
Oregon Coast	North Coast	SGS	13,751	14,542	23,380	24,726	6.2%	11.0%
	Mid Coast	SGS	7,245	14,729	12,320	25,042	12.0%	14.9%
	Alsea Hatchery	Count	-	-	21	74	0.0%	0.0%
	Mid South Coast	SGS	7,276	10,280	12,373	17,480	8.0%	17.0%
	Umpqua	SGS	8,454	10,664	14,376	18,133	0.8%	4.3%
	Winchester Dam	Count	-	-	5,427	10,225	3.3%	4.6%
	Total	**All**	**36,726**	**50,215**	**67,876**	**95,679**	**6.4%**	**11.1%**
	Hatchery Hot-Spots [a]	*SGS*	*2,557*	*2,321*	*4,351*	*3,949*	*37.4%*	*39.7%*
Klamath Mountains Province	South Coast	SGS	No random (GRTS) surveys conducted since 2016 spawning season.					
	Rogue River	SGS						
	Total	**All**						

a = Surveying of hatchery hot-spots began with the 2016 season, average is 2016-2020.

Table 3. Oregon winter steelhead redd density and site occupancy, 2021. Sites must have at least one confirmed redd to be considered occupied. ns = no surveys conducted. ne= no estimates for this season due to a low sample size.

ESU/DPS	Population or Monitoring Area	Redds / Mile		% Sites With Redds	
		2021	7 -Yr Avg	2021	7 -Yr Avg
Southwest Washington	Young's Bay	ns	ns	ns	ns
	Big Creek	ns	ns	ns	ns
	Clatskanie	3.2	9.3	47%	65%
	Scappoose	ne	1.0	ne	22%
	Total	**-**	**5.1**	**-**	**42%**
Lower Columbia River	Clackamas	1.2	5.7	33%	57%
	Sandy	13.7	15.3	77%	75%
	Gorge	ns	ns	ns	ns
	Total	**6.8**	**10.1**	**54%**	**65%**
Oregon Coast	North Coast	11.7	14.4	64%	64%
	Mid Coast	5.0	10.8	62%	70%
	Mid South Coast	8.2	12.8	74%	76%
	Umpqua	4.9	6.7	50%	69%
	Total	**7.4**	**10.7**	**61%**	**70%**
	Hatchery Hot-Spots [a]	*17.4*	*19.8*	*67%*	*79%*
Klamath Mountains Province	South Coast	No random (GRTS) surveys conducted since 2016 spawning season.			
	Rogue River				
	Total				

a = Surveying of hatchery hot-spots began with the 2016 season, average is 2016-2020.

Table 4. Annual fish abundance estimates of naturally spawning wild steelhead by Monitoring Area (MA), in Oregon Coastal Steelhead DPSs, run years 2003 to 2021. Includes estimates for areas above counting stations where GRTS surveys are not conducted. n.a. = not available.

Year	Oregon Coast DPS					Klamath Mountains Province DPS	
	North Coast MA	Mid Coast MA	Mid South Coast MA	Umpqua MA	Hatchery Hot Spots [a]	South Coast MA	Rogue River MA
2003	48,838	30,760	20,154	52,754	n.a.	8,252	27,403
2004	48,622	23,877	17,335	33,159	n.a.	15,462	n.a.
2005	32,516	13,417	38,884	24,762	n.a.	17,063	16,445
2006	35,814	22,947	33,239	21,247	n.a.	9,638	18,990
2007	35,010	17,230	41,334	32,011	n.a.	11,763	19,157
2008	20,164	21,471	31,974	35,490	n.a.	9,388	13,844
2009	17,740	20,540	15,535	23,423	n.a.	24,259	21,002
2010	32,181	28,367	33,880	37,702	n.a.	7,535	n.a.
2011	16,937	32,894	16,161	28,563	n.a.	3,077	n.a.
2012	26,973	32,430	12,608	32,302	n.a.	4,658	n.a.
2013	49,934	47,480	26,223	48,847	n.a.	15,237	n.a.
2014	24,118	15,324	18,495	26,496	n.a.	7,567	n.a.
2015	41,893	26,347	19,635	29,513	n.a.	2,863	n.a.
2016	26,338	40,484	23,887	28,893	n.a.	n.a.	n.a.
2017	18,228	9,443	11,749	20,790	2,554	n.a.	n.a.
2018	15,481	32,371	18,503	35,495	810	n.a.	n.a.
2019	13,410	24,181	9,179	29,704	4,437	n.a.	n.a.
2020	33,611	27,640	20,909	27,612	7,994	n.a.	n.a.
2021	23,380	12,341	12,373	19,803	4,351	n.a.	n.a.

a = Stratification of Hatchery Hot-Spot areas began in 2016 per guidance in CMP (ODFW 2014). Oregon Coast MAs do not include sites that were within hatchery hot-spots after 2015.

Table 5. Annual fish abundance estimates of naturally spawning wild steelhead by Population, in Lower Columbia Steelhead ESUs, run years 2003 to 2021. n.a. = not available. TBD = Random surveys predate the current effort, and the data has not yet been included in this analysis.

	Southwest Washington ESU				Lower Columbia ESU	
Year	Youngs Bay	Big Creek	Clatskanie	Scappoose	Clackamas	Sandy
2003	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*
2005	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006	n.a.	n.a.	n.a.	n.a.	1,164	1,060
2007	n.a.	n.a.	n.a.	n.a.	1,208	1,140
2008	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2009	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2010	n.a.	n.a.	n.a.	n.a.	n.a.	TBD
2011	n.a.	n.a.	n.a.	n.a.	n.a.	TBD
2012 [a]	340	54	415	171	2,733	357
2013	164	53	1,530	375	2,427	3,509
2014	n.a.	n.a.	n.a.	n.a.	3,404	3,249
2015	n.a.	n.a.	1,950	198	3,740	4,670
2016	n.a.	n.a.	827	178	4,144	5,488
2017	n.a.	n.a.	293	35	2,531	2,125
2018	n.a.	n.a.	371	24	3,030	5,981
2019	n.a.	n.a.	422	5	1,500	1,896
2020	n.a.	n.a.	1,403	118	2,005	2,634
2021	n.a.	n.a.	328	n.a.	990	3,868

a = Current GRTS sampling effort began with the 2012 spawning season.

Table 6. Oregon winter steelhead redd abundance estimates, 2021. Estimates do not include areas above counting stations and are thus not complete population estimates in some areas. Estimates without a 95% Confidence Interval (CI) are based on alternative methods due to inadequate samples. ns = no surveys conducted. ne = no estimates for this season due to a low sample size.

		Winter Steelhead Redd Abundance			
		Total		Wild	
ESU/DPS	Population or Monitoring Area	Estimate	95% CI	Estimate	95% CI
Southwest Washington	Youngs Bay	ns	ns	ns	ns
	Big Cr	ns	ns	ns	ns
	Clatskanie [a]	200	437	191	-
	Scappoose	ne	-	ne	-
	Total	**-**	**-**	**-**	**-**
Lower Columbia River	Clackamas [a]	245	172	191	-
	Sandy [a]	2,293	1,354	2,273	-
	Gorge	ns	ns	ns	ns
	Total	**2,538**	**1,369**	2,464	**-**
Oregon Coast [b]	North Coast	14,667	5,106	13,751	4,787
	Mid Coast	8,238	3,152	7,245	-
	Mid South Coast	7,908	3,511	7,276	3,230
	Umpqua	8,522	2,959	8,454	-
	Total	**39,335**	**7,556**	**36,726**	**-**
Klamath Mountains Province	South Coast	No random (GRTS) surveys conducted since 2016 spawning season.			
	Rogue River				
	Total				

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

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

Table 7. Oregon Winter steelhead redd abundance estimates within stratified samples, 2021. Estimates without a 95% CI are based on alternative methods due to insufficient sample size.

ESU	Population and *Strata*	Survey Effort Number of Surveys	Survey Effort Miles	Approximate Spawning Miles	Winter Steelhead Redd Abundance Total Estimate	Total 95% CI	Wild Estimate	Wild 95% CI
Southwest Washington	*Clatskanie Strata*	15	11.9	57.0	182	96	177	-
	Plympton Cr. Strata	2	2.1	1.1	18	0	14	-
	Clatskanie Total	17	13.9	58.1	200	96	191	-
Lower Columbia River	*Clackamas Strata*	16	12.4	139.5	200	166	170	-
	Clackamas Migration Strata	4	6.5	31.5	5	8	4	-
	Eagle Cr. Hatchery	4	4.6	9.5	39	43	17	-
	Lower Clackamas Total	24	23.5	180.5	245	-	191	-
	Sandy Strata	12	12.2	133.6	2,182	1,351	2,182	1,351
	Sandy Migration Strata	6	10.4	22.0	111	140	91	-
	Cedar Cr. Hatchery Strata	ns	ns	0.6	ns	ns	ns	-
	Sandy Total	18	22.6	156.2	2,293	-	2,273	-
	Lower Columbia ESU Total	**59**	**60.0**	**394.8**	**2,738**	**-**	**2,655**	-

Table 8. Oregon Winter Steelhead redd abundance estimates within Oregon Coast Hotspots in 2021. Estimates are calculated at the DPS scale, due to insufficient sample size at the MA scale. Estimates without a 95% CI are based on alternative methods due to inadequate samples.

DPS	Monitoring Area	Survey Effort Number of Surveys	Survey Effort Miles	Spawning Miles within Hotspots	Winter Steelhead Redd Abundance Total Estimate	Total 95% CI	Wild Estimate	Wild 95% CI
Oregon Coast	North Coast Hotspots	2	1.6	49				
	Mid Coast Hotspots	5	3.9	89				
	Mid South Coast Hotspots	-	-	61	**4,085**	**2,527**	**2,557**	**-**
	Umpqua Hotspots	-	-	42				
	Total	**7**	**5.5**	**241**				

Table 9. Number of known adipose fin-mark status dead and live steelhead observed on spawning grounds, 2021. Calculation of pHOS based on a minimum sample size of 10. Preference order: 1-current year dead fish; 2-current year combined dead and live fish; 3-recent years combined sample. ns = no surveys conducted.

ESU/DPS	Population/Sub-Population or Monitoring Area	Number Dead Fish		Number Live Fish	
		2021	7-Yr Avg	2021	7-Yr Avg
Southwest Washington	Young's Bay	ns	ns	ns	ns
	Big Cr	ns	ns	ns	ns
	Clatskanie	0	1	3	21
	Clatskanie Exc. A	0	0	1	8
	A. Plympton Creek	0	1	2	14
	Scappoose	0	0	0	1
	Total	**0**	**1**	**3**	**21**
Lower Columbia River	Clackamas Population [a]	0	4	0	17
	Clackamas Exc. A & B	0	1	0	4
	A. Migration Corridor	0	1	0	3
	B. Eagle Creek	0	3	0	14
	Sandy Population	0	5	18	64
	Sandy Exc. A & B	0	1	12	14
	A. Migration Corridor	0	2	6	8
	B. Cedar Creek	ns	6	ns	75
	Gorge	ns	ns	ns	ns
	Total	**0**	**9**	**18**	**81**
Oregon Coast	North Coast	4	5	28	87
	Mid Coast	1	3	2	55
	Mid South Coast	0	1	25	57
	Umpqua	1	1	8	35
	Total [b]	**6**	**11**	**63**	**234**
	Hatchery Hot Spots	*0*	*0*	*6*	*29*
Klamath Mountains Province	South Coast	No random (GRTS) surveys conducted since 2016 spawning season.			
	Rogue River				
	Total				

a = Area below North Fork Clackamas Dam.

b = Oregon Coast DPS total does not include sites that were within hatchery hotspots.

Table 10. Annual estimates of steelhead per redd based on calibration survey areas, run years 2014 to 2021. n.a. = not available. Currently used conversion formula:
*Total Steelhead = (1.70 * Redds) + 3.74 (ODFW 2013).*

Year	Lower Col. ESU	Oregon Coast DPS				**Annual Average**
	Lewis & Clark River	N. Fk. Nehalem River	E. Fk. of S. Fk. Trask River	Fall Cr. (Alsea R.)	Mill Cr. (Yaquina R.)	
2014	2.08	n.a.	3.45	1.27	1.79	**2.15**
2015	1.06	n.a.	2.19	1.55	2.00	**1.70**
2016	1.23	1.98	1.21	0.49	1.02	**1.19**
2017	0.86	n.a.	n.a.	n.a.	2.69	**1.78**
2018	1.23	n.a.	n.a.	n.a.	0.76	**0.99**
2019	1.28	n.a.	n.a.	n.a.	1.11	**1.19**
2020	1.07	n.a.	n.a.	n.a.	0.93	**1.00**
2021	0.48	n.a.	n.a.	n.a.	1.94	**1.21**
Avg.	**1.16**	**1.98**	**2.28**	**1.10**	**1.53**	**1.40**

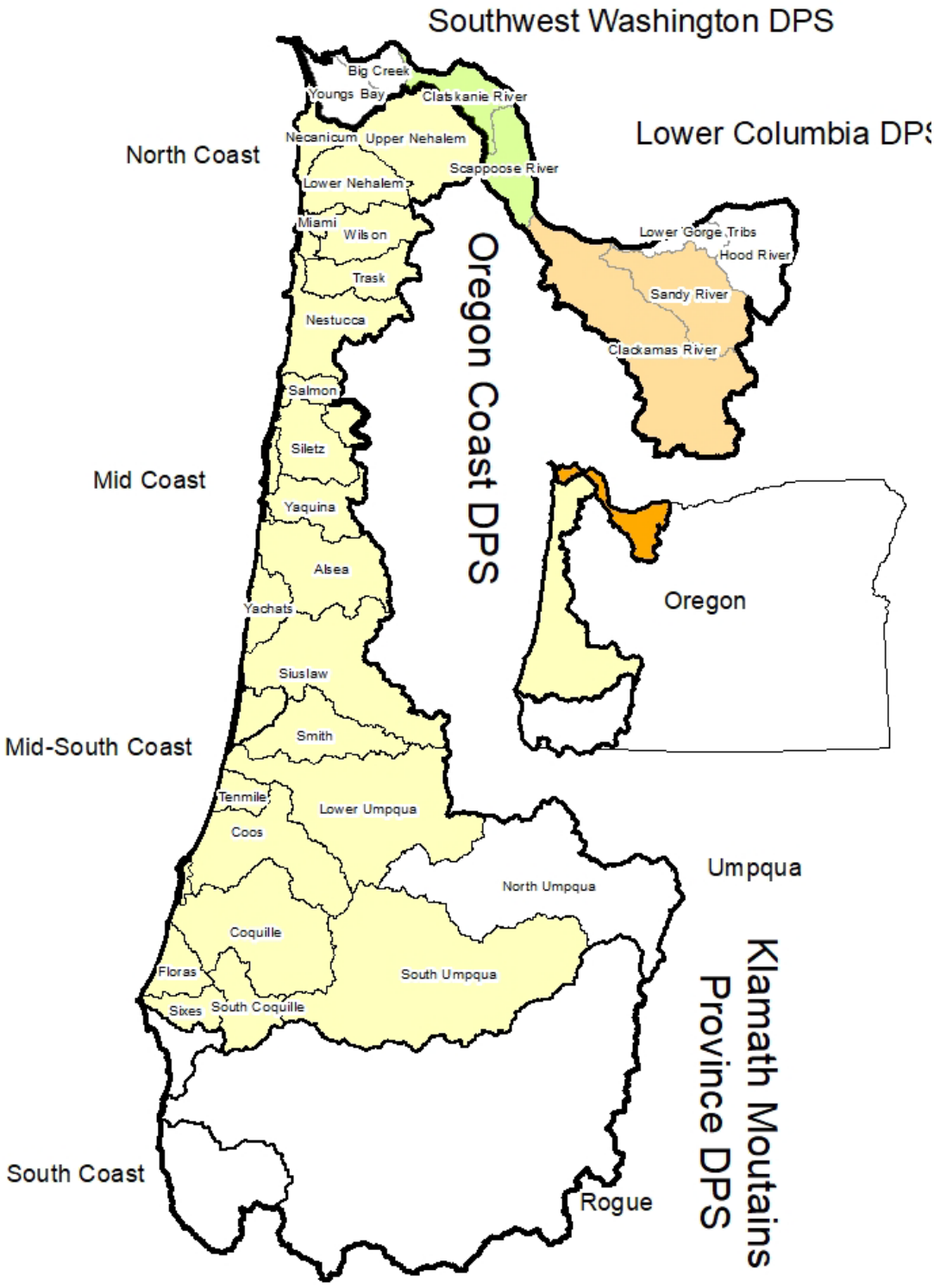

Figure 1. Geographic scope of winter steelhead monitoring, 2021. Monitoring scales include: Evolutionary Significant Unit (ESU), Dependent Population Segment (DPS), Monitoring Area (MA), and population. Areas without color shading were not monitored in 2021. Boundaries as defined by Busby et.al. (1996) 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.

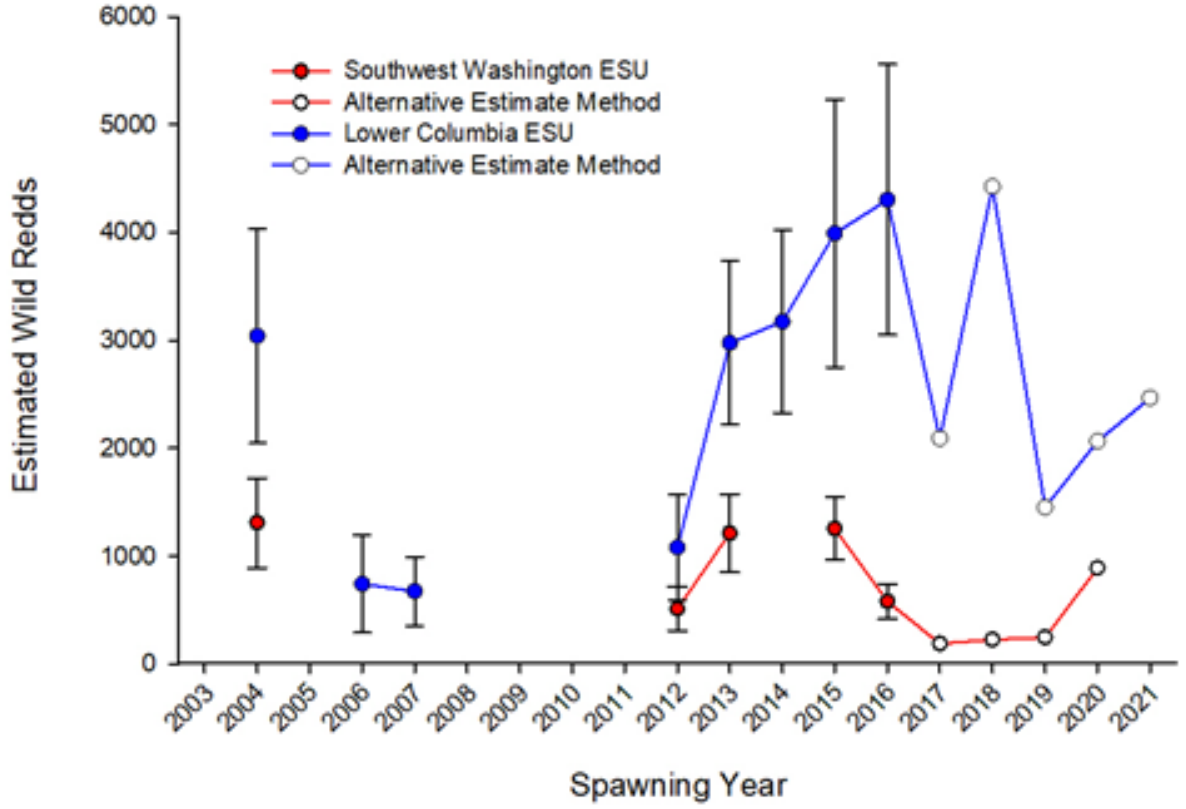

Figure 2. Wild winter steelhead redd estimates in the Oregon portions of the SWW and LCR ESUs based on random surveys, 2004 to 2021. Error bars represent 95% confidence intervals. Inclusion of survey data from specific populations has varied across years. Note: 2017 to 2021 error bars were not available because estimates were calculated with alternative methods. Also, an estimate at the strata level for the SWW ESU was not available for 2021 given that there was not enough of a sample size for an estimate in the Scappoose population.

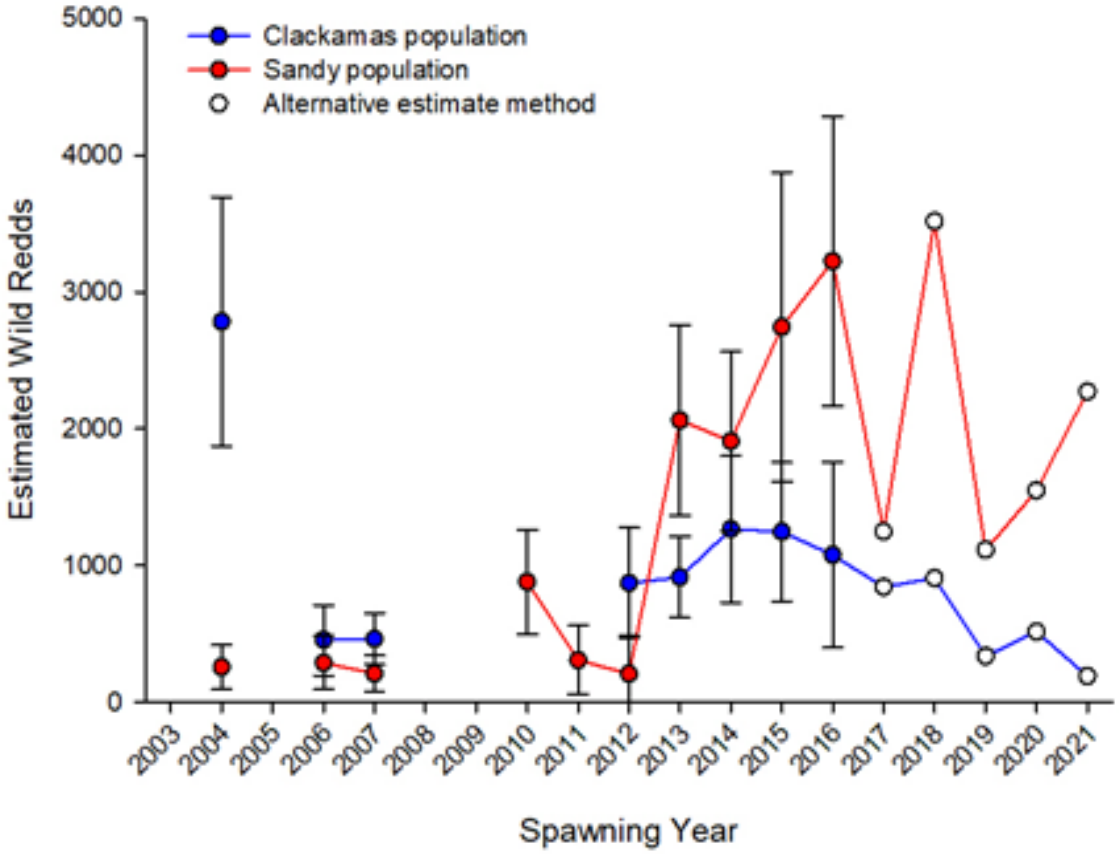

Figure 3. Wild winter steelhead redd estimates in the Clackamas and Sandy River populations based on random surveys, 2004 to 2021. Error bars represent 95% confidence intervals. Note: 2017 to 2021 error bars were not available because estimates were calculated with alternative methods.

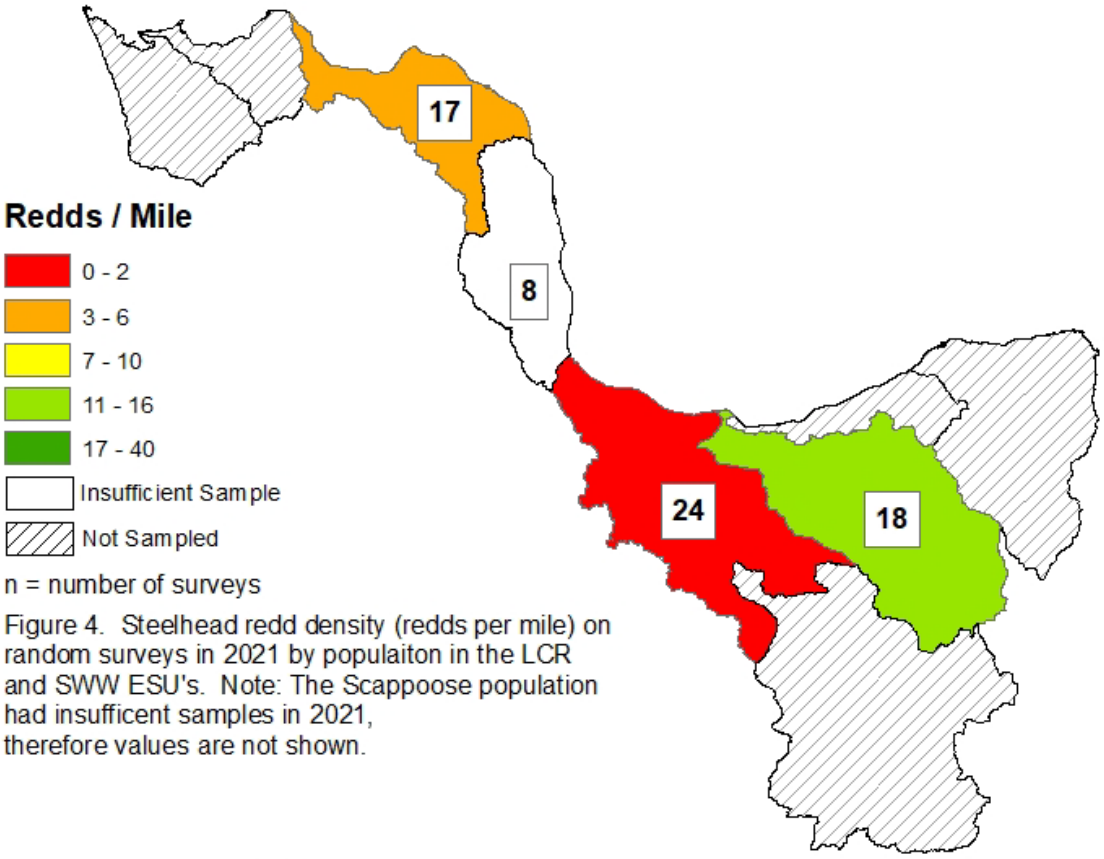

Figure 4. Steelhead redd density (redds per mile) on random surveys in 2021 by populaiton in the LCR and SWW ESU's. Note: The Scappoose population had insufficent samples in 2021, therefore values are not shown.

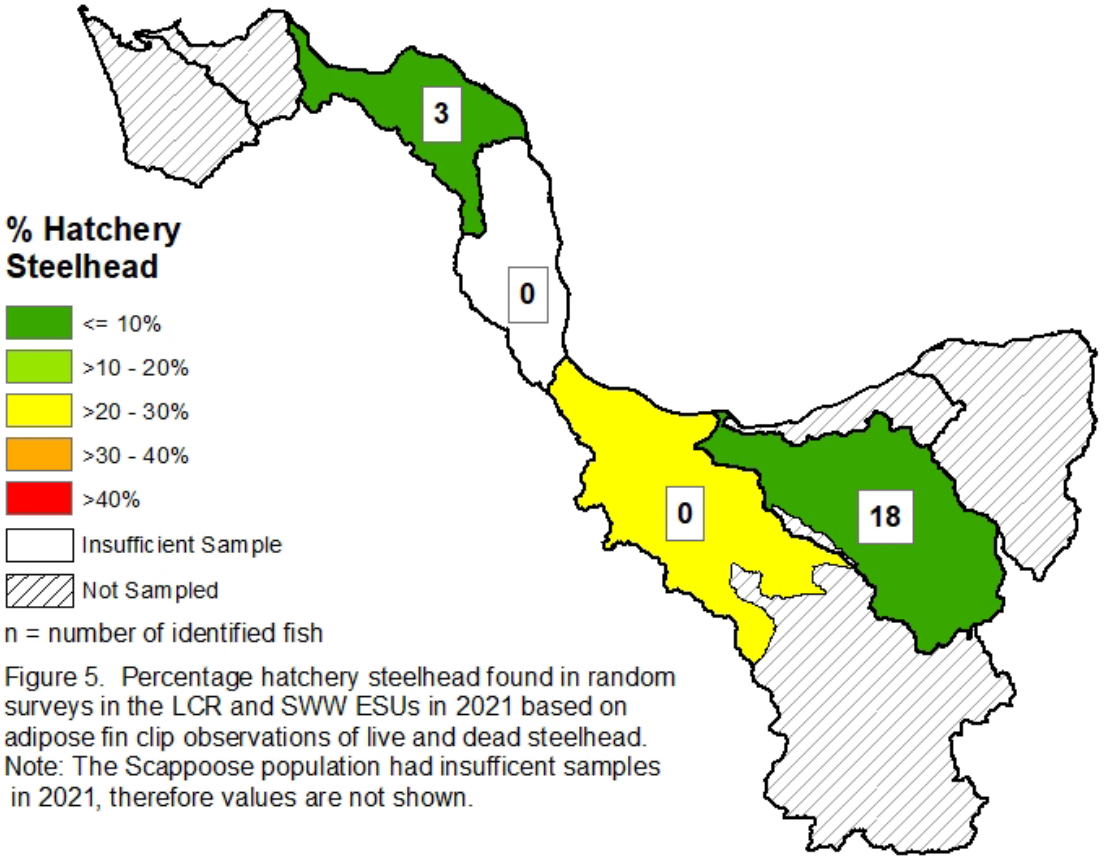

Figure 5. Percentage hatchery steelhead found in random surveys in the LCR and SWW ESUs in 2021 based on adipose fin clip observations of live and dead steelhead. Note: The Scappoose population had insufficent samples in 2021, therefore values are not shown.

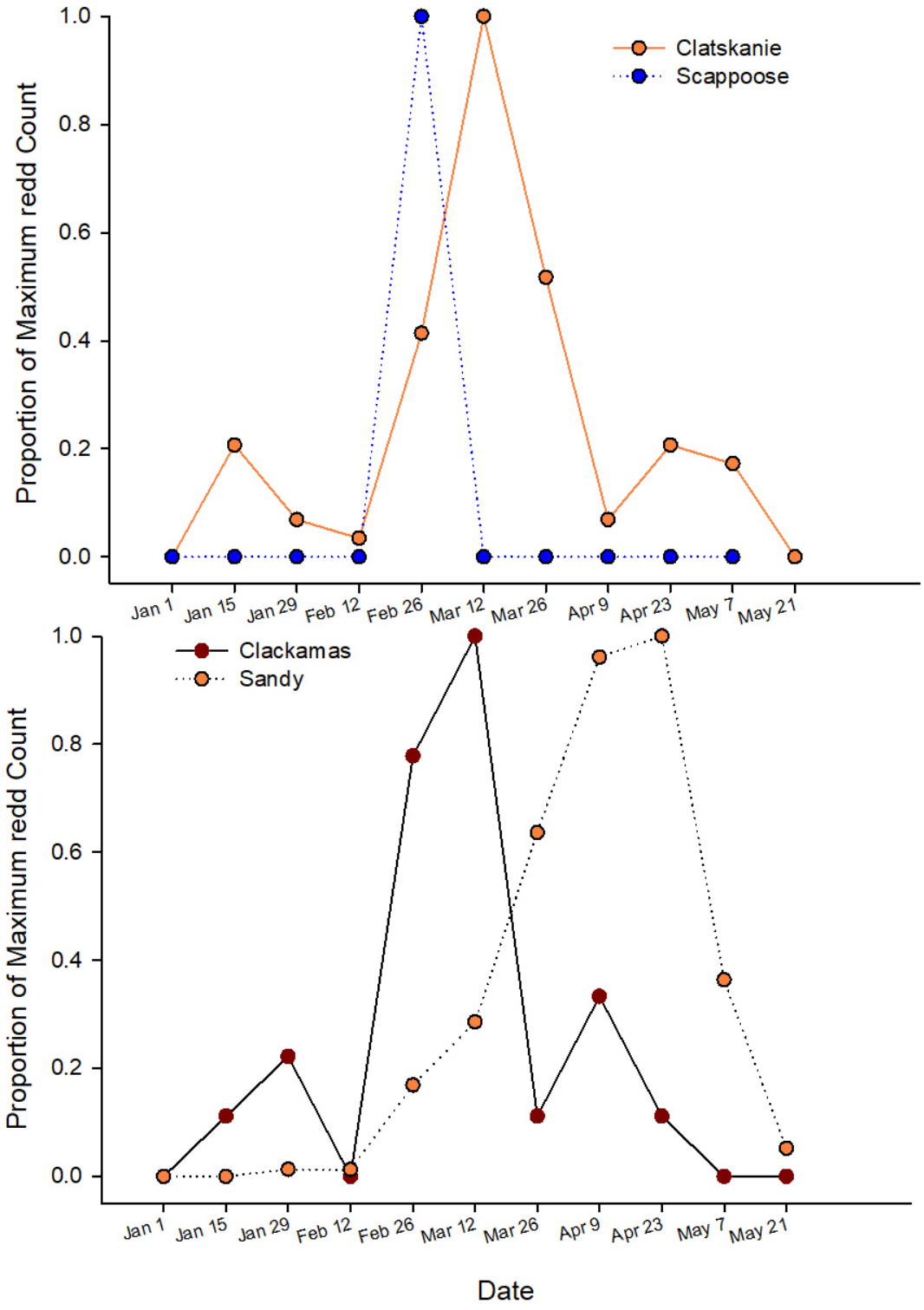

Figure 6. Winter steelhead spawn timing, represented by proportion of the maximum redd count in a) SWW ESU populations and b) LCR ESU populations, 2021.

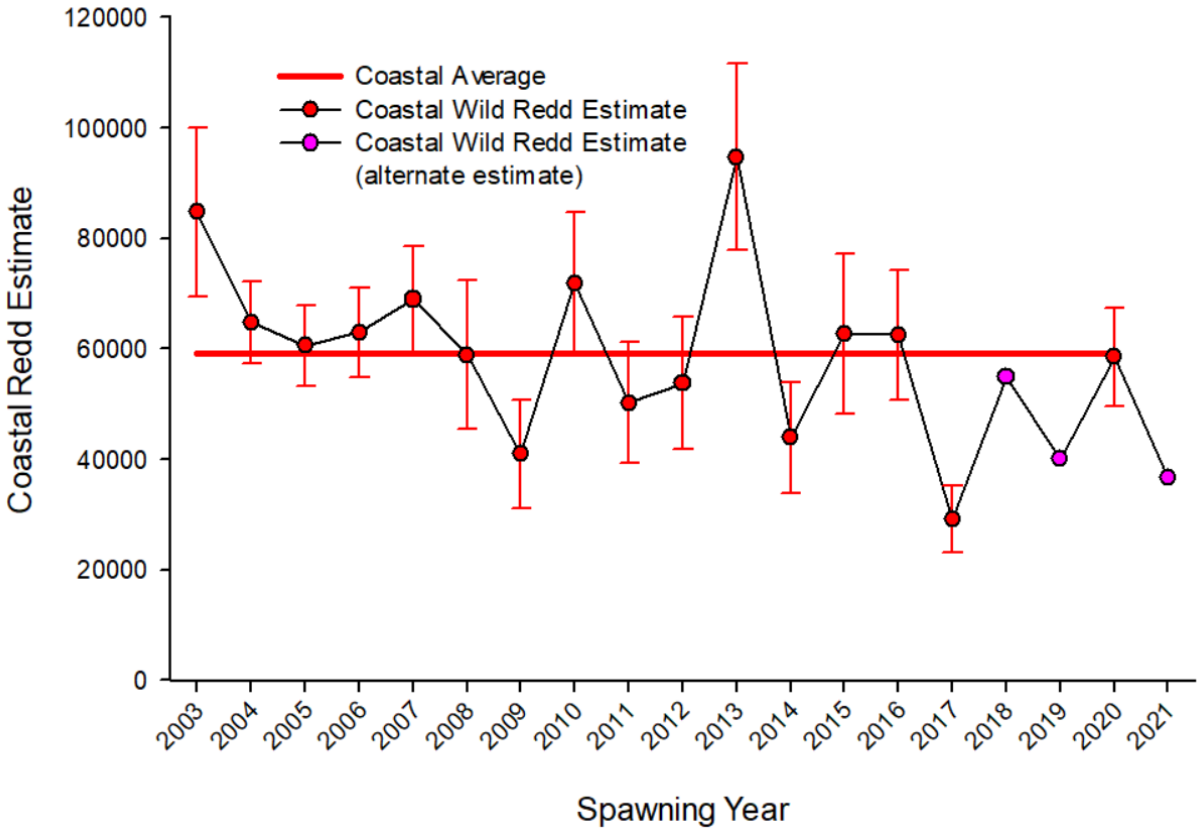

Figure 7. Estimated number of wild winter steelhead redds in the Oregon Coast DPS, 2003 to 2021. Error bars represent 95% confidence intervals. Note: 2018, 2019 and 2021 error bars were not available because estimates were calculated with alternative methods.

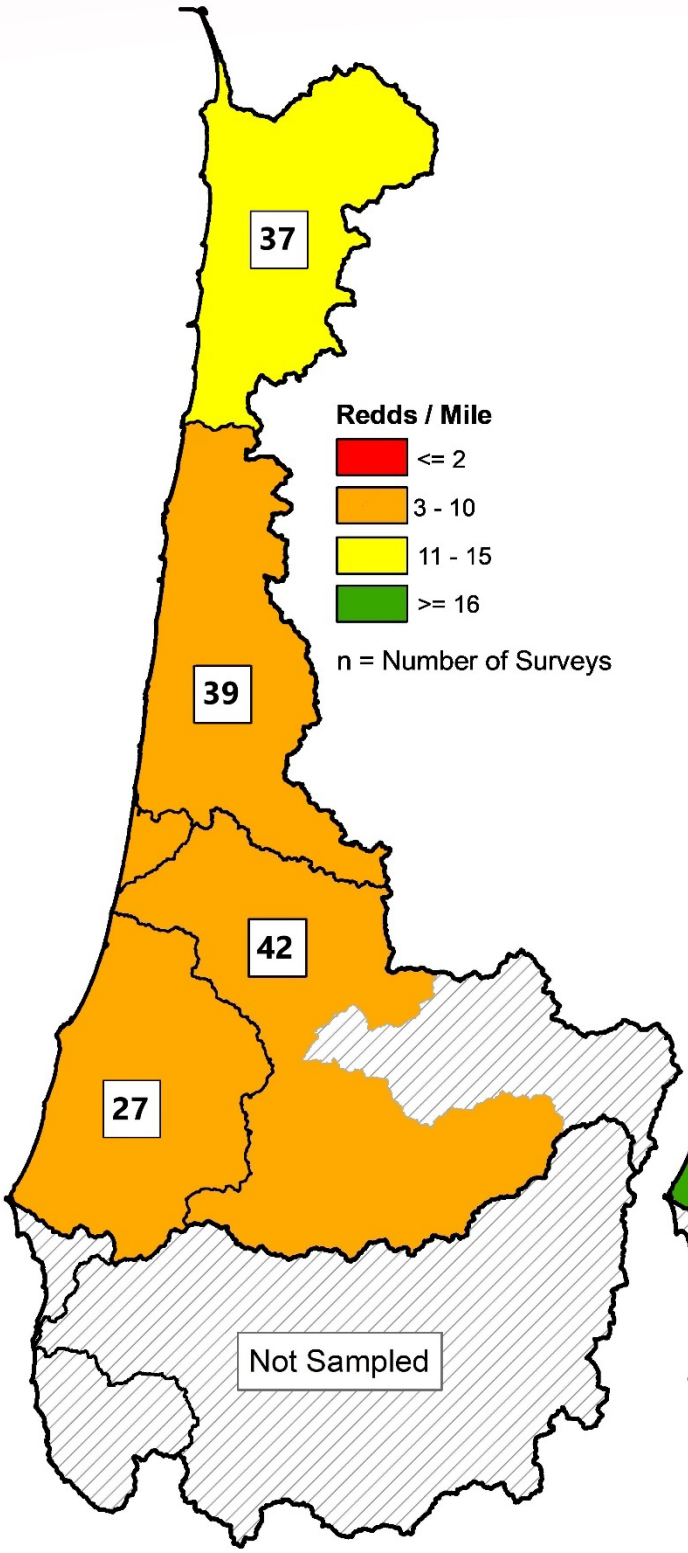

Figure 8. Steelhead redd density (redds per mile) in random surveys in 2021 by monitoring area in the Coastal and KMP DPS's.

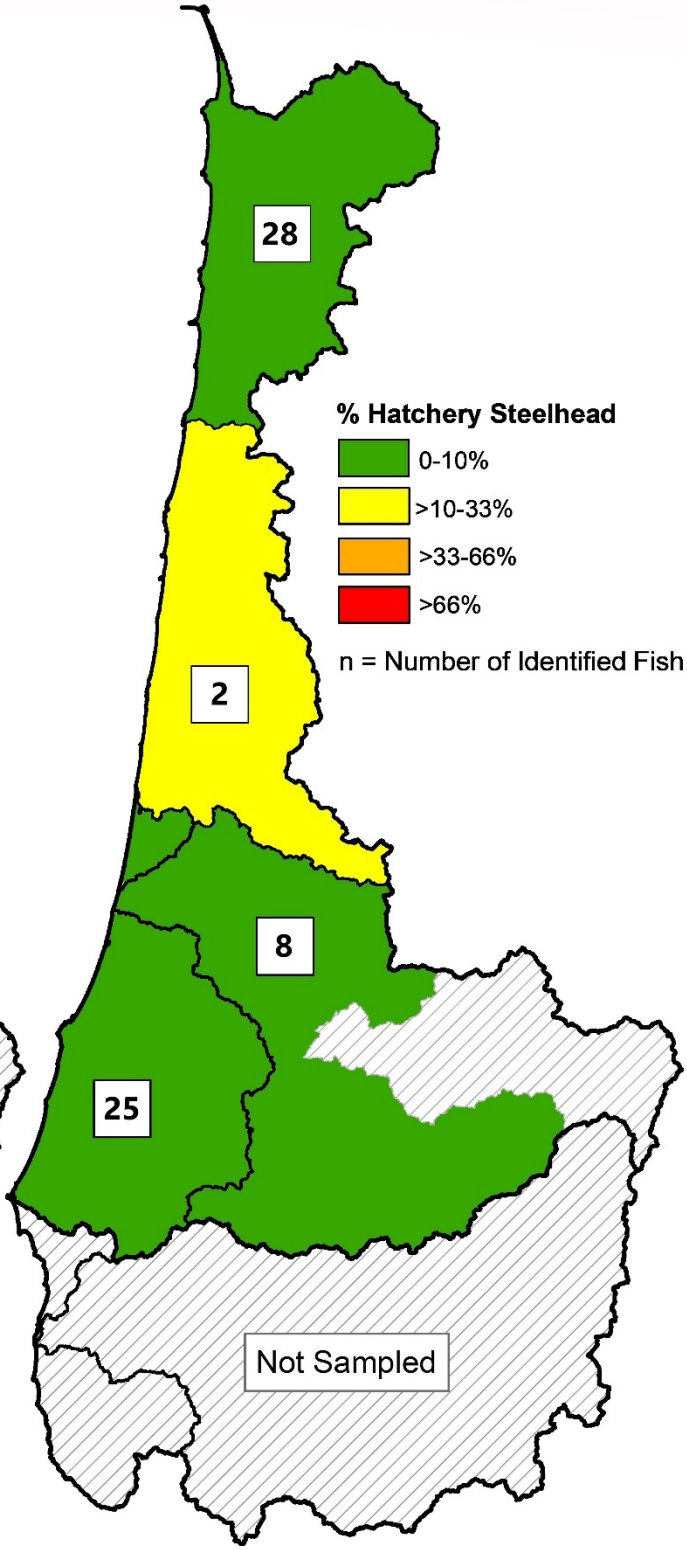

Figure 9. Percentage hatchery steelhead found in random surveys in each of the six Coastal and KMP monitoring areas in 2021 based on fin clip observations of live and dead steelhead.

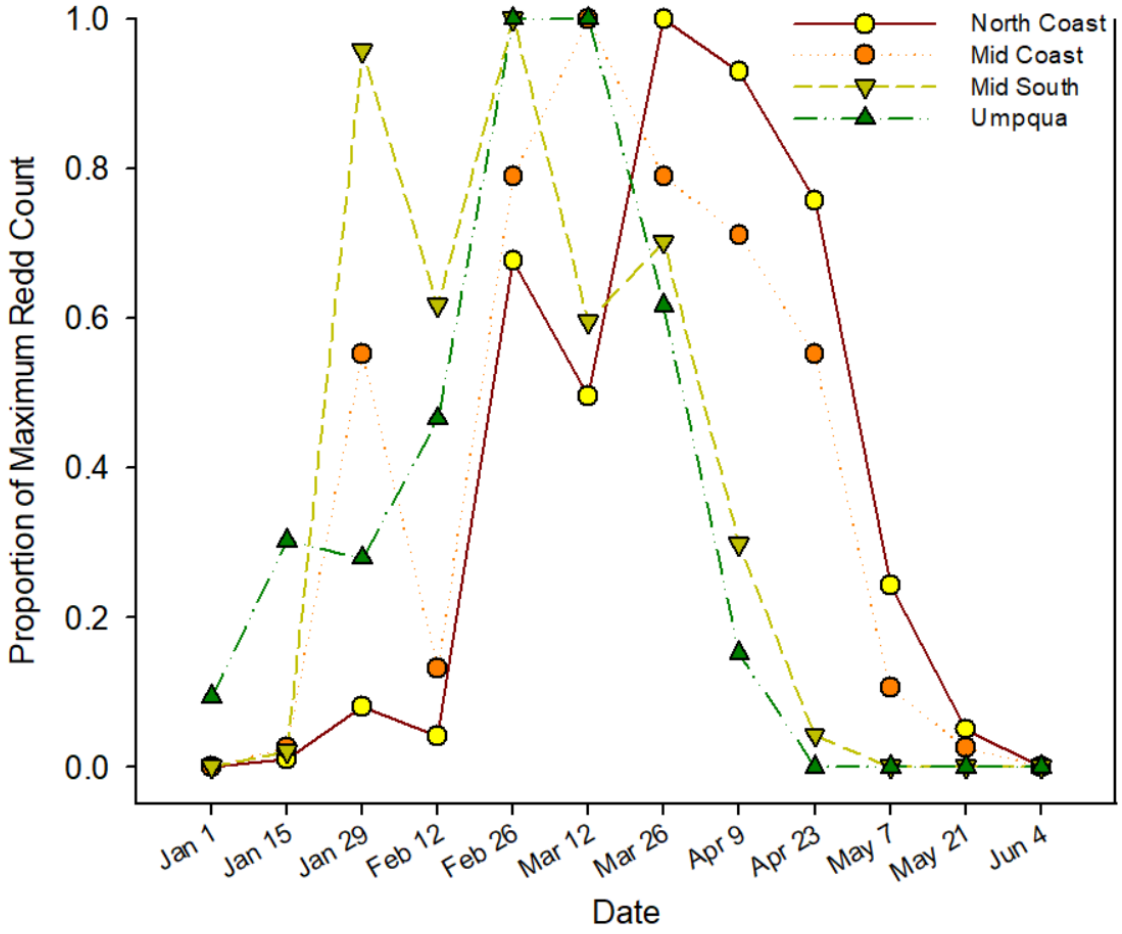

Figure 10. Winter steelhead spawn timing, represented by proportion of the maximum redd count in each of the four OC DPS monitoring areas, 2021.

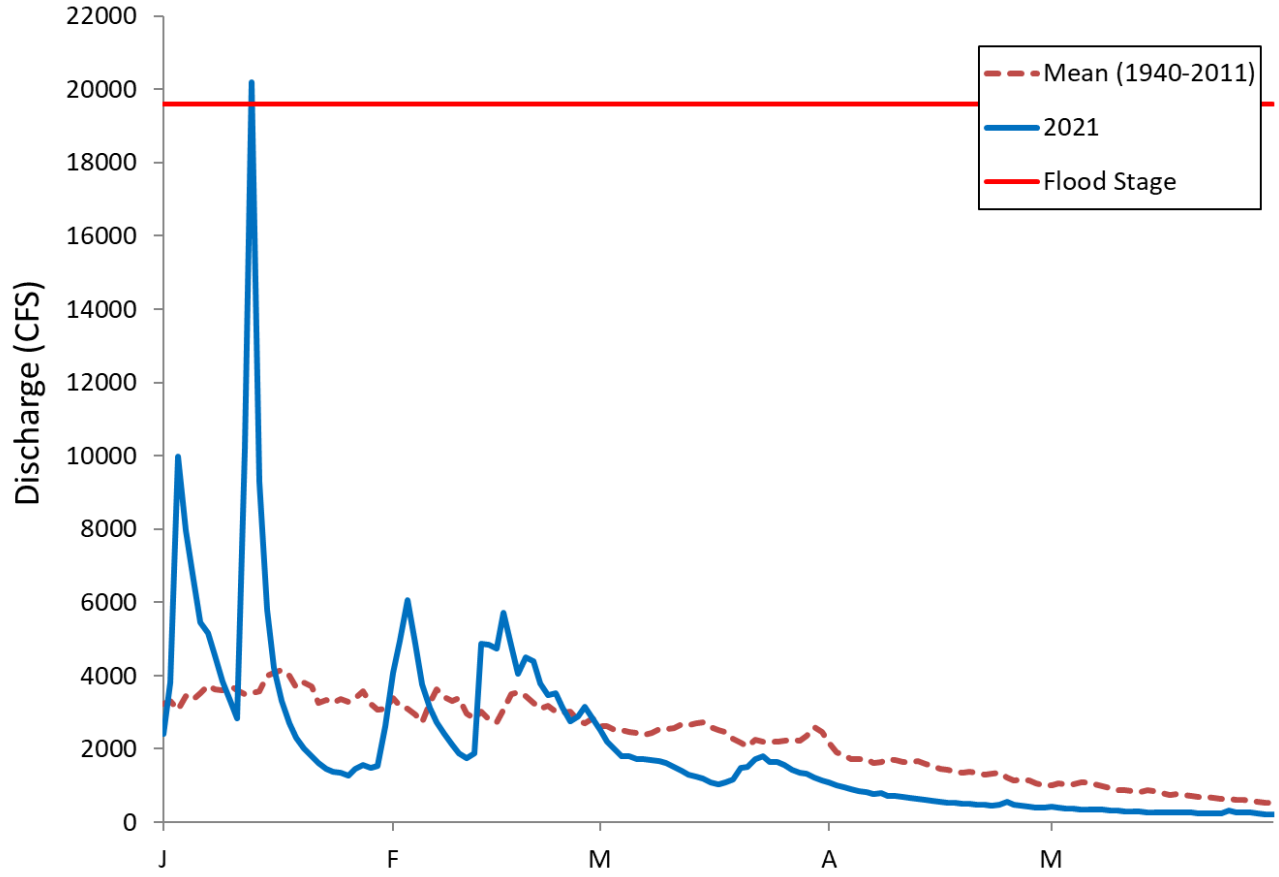

Figure 11. Stream discharge at Alsea River near Tidewater during 2021, compared to mean discharge from 1940 to 2011. (Flood stage = 19,500 CFS)

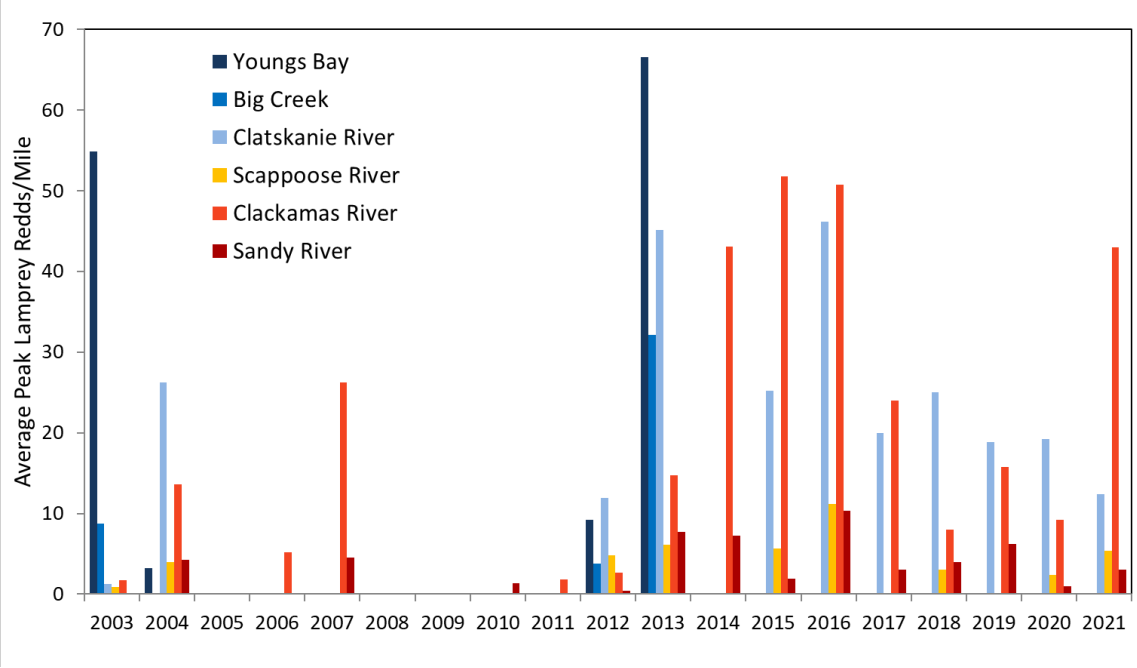

Figure 12. Lower Columbia Pacific Lamprey Peak Redd Density in random and supplemental Steelhead Spawning Surveys, 2003-2021. Note that not all populations were monitored in all years.

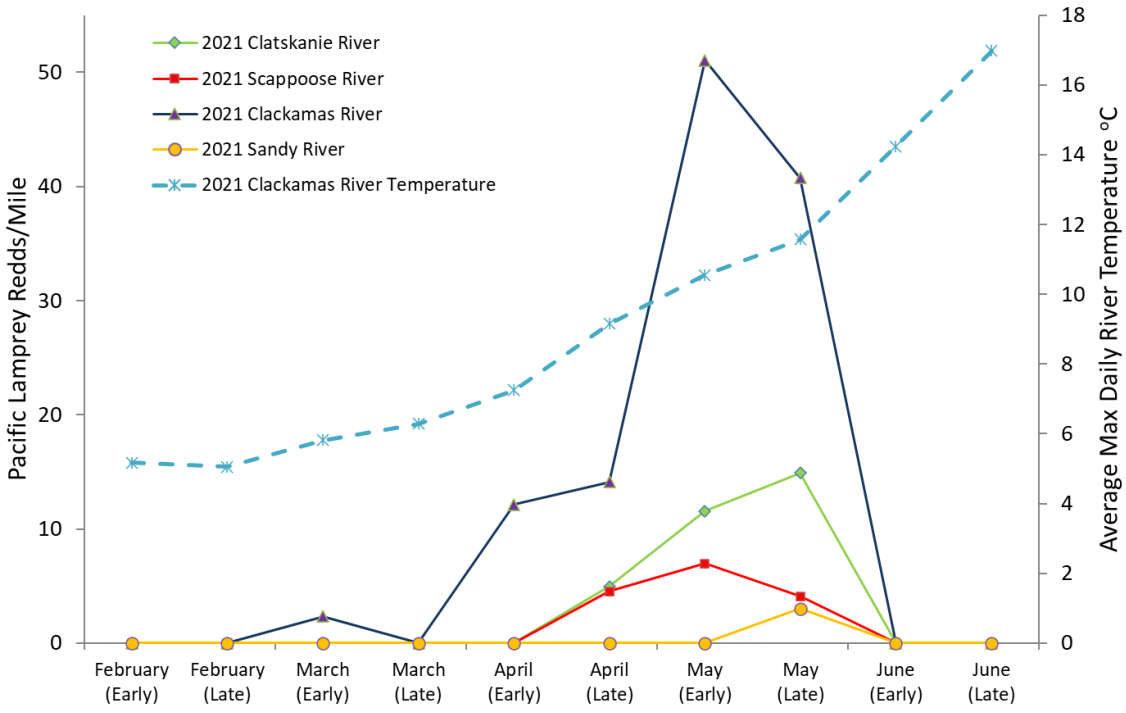

Figure 13. Lower Columbia Pacific Lamprey spawn timing in random and supplemental steelhead surveys in 2021 and average daily max water temperature in the Clackamas River.

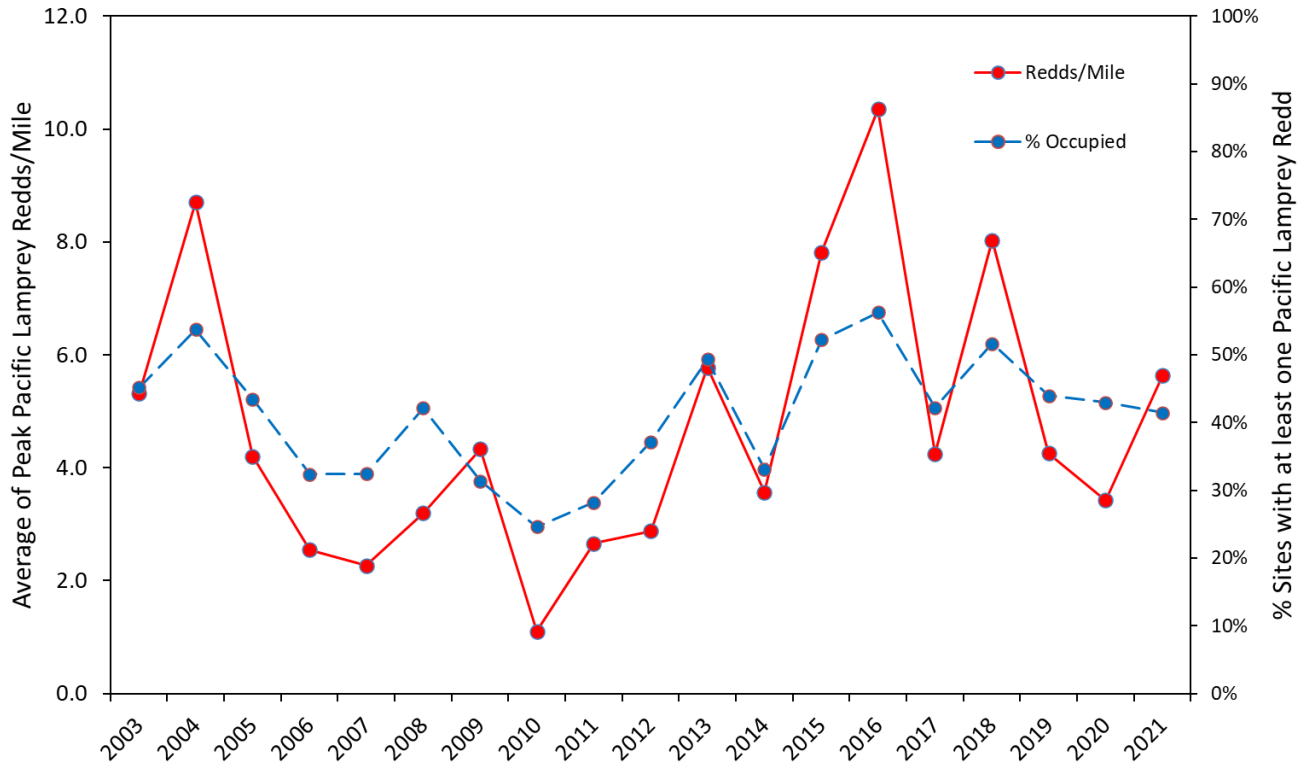

Figure 14. Oregon Coast Pacific Lamprey peak redd density and percent of sites occupied in random steelhead spawning surveys, 2003 to 2021.

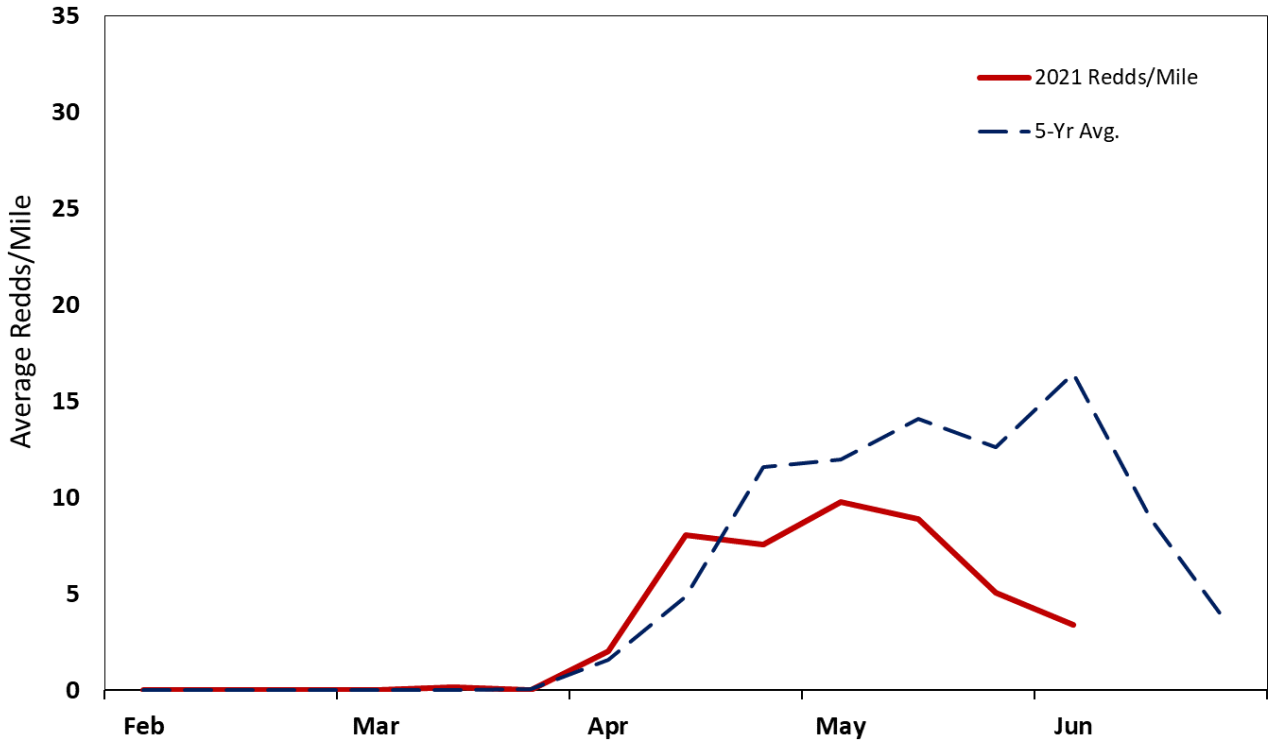

Figure 15. Oregon Coast Pacific Lamprey spawn timing in index surveys, 2021.

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