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Summary of Abundance and Biological Data Collected During Juvenile Salmonid Monitoring in the Mainstem Klamath River Below Iron Gate Dam, California, 2021

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Abstract.— This report summarizes results from the 2021 season of juvenile salmonid outmigrant monitoring downstream of Iron Gate Dam on the mainstem Klamath River, California. Trapping occurred at four locations: below the confluence with Bogus Creek (river km 308), just upstream of the Interstate 5 bridge (river km 294), upstream of the confluence with the Scott River near Kinsman Creek (river km 238), and above the confluence with the Trinity River near Weitchpec, California (river km 65). Both frame nets and rotary screw traps were deployed at all sites in early March and operated until late June. Low river flows and high river temperatures prevented the continued operation of traps after June 18. Traps were operated four nights each week from Monday to Friday. All juvenile salmonids in the catch were counted and each day a subset was measured for length, weight, and external symptoms of disease. Non-salmonid fishes were also enumerated and sampled for length measurements. Mark-recapture studies were conducted periodically at the Kinsman and Weitchpec trap sites during the season to estimate trap efficiency. Efficiency estimates and catch data were used to estimate weekly and seasonal outmigration abundance of natural-origin age-0 juvenile Chinook Salmon migrating downstream past the Kinsman trap site using a Bayesian time-stratified population estimation method. Historic data was used to fit a model of discharge and proportion of a week sampled to predict weekly trap efficiencies at the I-5 site. For the periods that traps were operated, season-wide abundance estimates of natural-origin age-0 Chinook Salmon were 926,931 (CI=430,973-1,932,947) at the I-5 trap site, and 782,514 (CI=424,984) at the Kinsman trap site. Efficiency estimates and catch data were used to generate weekly estimates of natural-origin age-0 juvenile Chinook Salmon migrating downstream past the Weitchpec trap site, with an estimate of 1,237,533 (CI=672,202-2,123,426) for the sampling period which did not capture enough of the population to be considered a season-wide abundance estimate. Abundance estimates were not estimated for the Bogus trap site in 2021. The proportion of total juvenile Chinook Salmon that were captured dead was above average in 2021 at all trapping sites, which is consistent with high prevalence of infection by *Ceratonova shasta* in juvenile Chinook Salmon. Catch of dead juvenile Coho Salmon and steelhead were low and similar to long-term means. Dead fish were not included in abundance estimates.

Introduction

The Klamath River basin historically supported large runs of Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), steelhead (*O. mykiss*), and other anadromous fishes (KRBFTF 1991; NAS 2004; USDOJ and NMFS 2012). These species contribute to economically and culturally important subsistence, sport, and commercial fisheries. However, abundances of anadromous fish species have declined dramatically due to a variety of factors, including overfishing, logging, mining, road building, livestock grazing, water diversion, wetland conversion, and dam construction (KRBFTF 1991; NAS 2004; USDOJ and NMFS 2012).

The U.S. Fish and Wildlife Service (USFWS), in collaboration with the Karuk Tribe and U.S. Geological Survey (USGS), began trapping juvenile salmonids annually on the Klamath River between Iron Gate Dam and the Scott River confluence in 2000 to collect outmigration timing data and weekly catch of young-of-the-year (age-0) Chinook Salmon and to attempt to calibrate the production model SALMOD (Bartholow et al. 2002). Beginning in 2006, the objectives of this ongoing monitoring project shifted to generate weekly-stratified estimates of production (Gough et al. 2015) and disease monitoring (Nichols and True 2007; Nichols et al. 2009; True et al. 2010, 2011, 2013, 2016; Bolick et al. 2012, 2013). Additionally, these data have been used to develop and calibrate an improved salmon production model, the Stream Salmonid Simulator or S3 Model (Perry et al. 2018, 2019) that is being used as a decision-support tool to aid in water management (Plumb et al. 2019). Data generated by this project is also useful for assessing the status and trends of salmonid populations in the Klamath River. This report summarizes data collected during the 2021 trapping season.

Study Area

Juvenile salmon monitoring was conducted at four sites on the mainstem Klamath River (Figure 1) located between Iron Gate Dam [river kilometer (rkm) 310.0] and the Trinity River confluence (rkm 64.3). The upstream-most site (Bogus site; rkm 307.8) was 1.6 km downstream of the Bogus Creek confluence on Blue Heron RV Park property. The second site (I-5 site; rkm 293.5) was 0.2 km downstream of the Carson Creek confluence and 0.9 km upstream of where Interstate 5 crosses the Klamath River. The third downstream site (Kinsman site; rkm 237.5) was 0.5 km upstream of the Kinsman Creek confluence. The farthest downstream site (Weitchpec site; rkm 65) was 0.7 km upstream of the Trinity River confluence behind the Yurok Tribal office in Weitchpec, California.

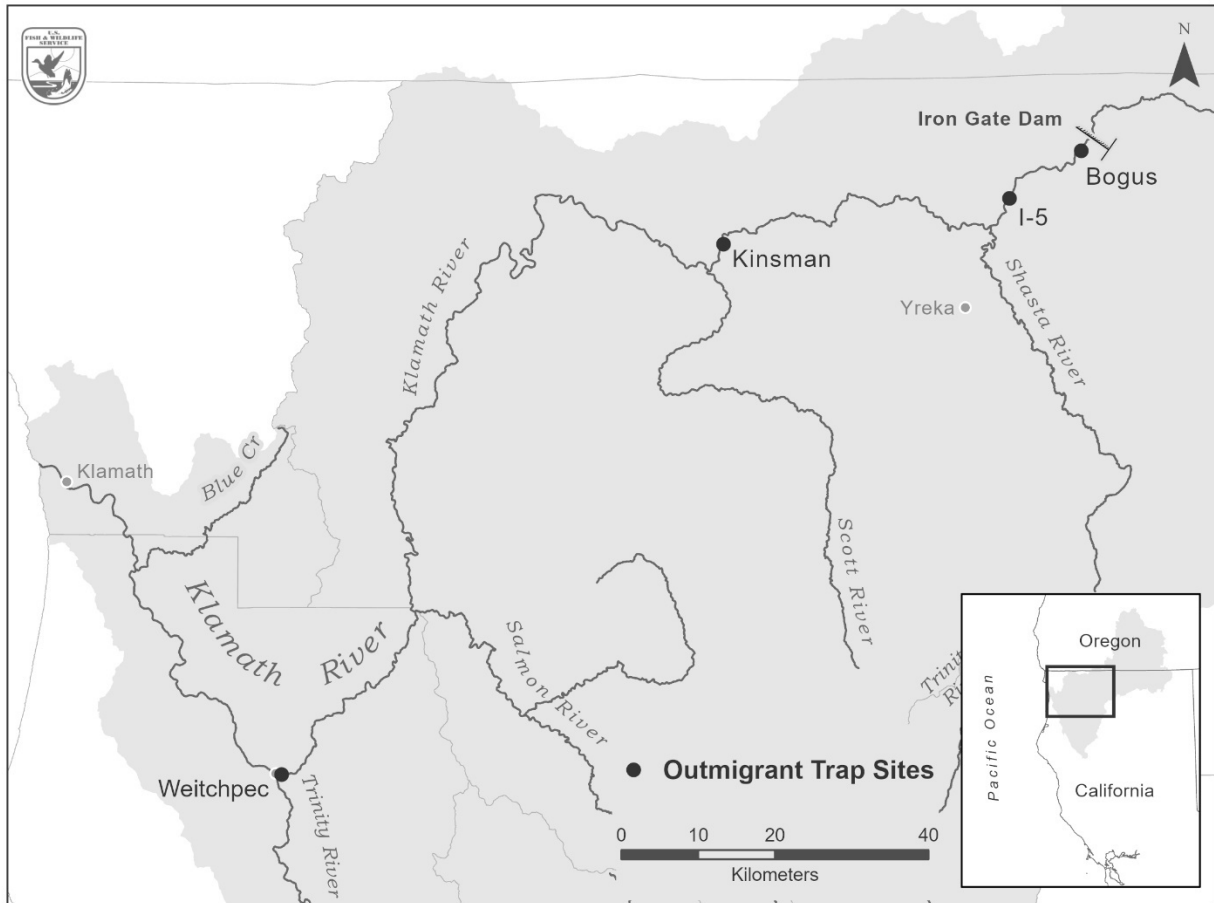


Figure 1. The middle Klamath River basin with juvenile salmon outmigration trap sites identified.

Methods

River Conditions

River discharge and water temperature were monitored throughout the trapping season. The USGS gaging station below Iron Gate Dam (#11516530) was used to represent discharge at the Bogus and I-5 trap sites since accretions from tributaries between the gaging station and these sites are minimal. Discharge at the Kinsman trap site was estimated by subtracting the discharge of the Scott River near Fort Jones (USGS gaging station #11519500) from the discharge of the Klamath River near Seiad Valley (USGS gaging station #11520500). Discharge at the Weitchpec Site was estimated using the USGS gaging station near Orleans, California (#11523000). Water temperature was monitored near each trap site using digital data loggers. For a more detailed description of the methods used to collect and process water temperature data, see David and Goodman (2017).

Trap Design and Operation

Rotary screw traps (RSTs) or frame nets or both gear types were deployed at each of the trap sites. Frame nets were placed closer to the bank in shallower, slower moving water as compared to RST placement, and are in general more efficient at capturing younger and smaller age-0 salmonids migrating along river margins (Gough et al. 2015). Rotary screw traps were set further from the bank in faster, deeper water to capture older and larger age-0 and age-1 salmonids than typically caught in frame nets (Gough et al. 2015). Frame nets were placed near the bank at a location such that water velocity was ideally between 1.0 and 1.2 m/s at the center of the net and water depth between 0.3 and 1.0 m, while RSTs were placed further from the bank such that the cone would spin between five and seven revolutions/min.

In 2021, one frame net (3 m by 1.5 m opening) was operated at the Bogus trap site, two 2.4-m (8-ft) diameter RSTs and one frame net were operated at the I-5 trap site, one 1.5-m (5-ft) diameter RST was operated at the Kinsman trap site and one 2.4-m (8-ft) diameter RST and two frame nets were operated at the Weitchpec site. The Bogus frame net, I-5 RSTs, and Kinsman RST were deployed on March 1. The Weitchpec RST and one frame net were deployed March 26 and April 2, respectively, and a second frame net was added in tandem downstream of the first on April 28. The Bogus frame net and Kinsman RST were operated until June 4, when water temperatures at these sites exceeded the threshold established in the project's scientific collection permit. The I-5 RSTs and frame net were operated until June 9 when the water temperature at this site also exceeded the allowable threshold. The RST and upstream frame net at the Weitchpec site were operated until June 18. Due to decreased flows and channel morphology, the downstream frame net became unsafe for staff to operate and was removed on June 10.

All traps were typically operated over four consecutive nights each week (Monday–Thursday nights) throughout the sampling period and checked a minimum of once per day. The following information was recorded for each trap on each day: date, site, trap type, crew members, air and water temperatures, trap check time, trap reset time, trap depth, and center velocity. Rotation rates at the times of checks and resets of RSTs were also measured as a count of complete cone revolutions in a minimum of 180 seconds. Air temperature was taken in the shade close to the river's edge. Water temperature was taken at the surface in the shade in moving water. Trap depth of RSTs was defined as the submerged depth of the cone, while trap depth of frame nets was measured as the water depth at the midpoint of the frame entrance. Center velocity was measured as the water velocity at 60% of the trap depth. If a trap was relocated, RST rotations, trap depth, and center velocity were re-measured.

All captured fish were identified and enumerated. A maximum daily biological sample ('biosample') for each trap type at each site of 30 fish from each salmonid species and 10 fish from each non-salmonid species, were measured and examined, including up to 10 lamprey ammocoetes from each genus and 10 eyed lamprey from each species. The following data were recorded for all salmonids in the biosample: age (0 or 1+), fork length (FL), weight, presence/absence of a hatchery mark, presence of any external abnormalities, and abdomen condition (normal or distended). Gill color (red, pale/pink, or white/gray/tan) and condition (normal or eroded/fungal) were recorded for salmonids ≥ 45 mm FL. The following data were recorded for non-salmonids in the biosample: species, development

stage [lampreys only (ammocoete, eyed juvenile, or adult)], FL (or total length for species with pointed or round caudal fins), and presence of any external abnormalities.

Chinook Salmon Production Estimates

Weekly and season totals of natural-origin age-0 Chinook Salmon outmigrating past the I-5, Kinsman, and Weitchpec trap sites were estimated using a Bayesian time-stratified population estimation method (Bonner et al. 2009; Payton and Som 2021), and using methods described in Payton et al. (in prep) to estimate capture efficiency at the I-5 site. This method requires the following weekly data: total age-0 Chinook Salmon with adipose fins, total adipose fin-clipped age-0 Chinook Salmon (and associated hatchery clip rate), trapping effort (weighted sample fraction, described below), and mark-recapture numbers (estimated for the I-5 site). The numbers of age-0 Chinook Salmon with and without adipose fins were summarized from the weekly trapping data and fin-clip rates were reported by IGH.

Traps were not operated a full seven days each week and due to operational logistics and disruptions (e.g., flawed sets due to debris), daily catches were not completed every day as originally planned. To account for variable and less than full effort, the number of days the site was operated within each j^{th} week was divided by seven, termed sampling fraction:

$$s_j = \frac{d_j}{7}$$

Mark-recapture trap efficiency tests for age-0 Chinook Salmon were conducted at Kinsman and Weitchpec. Hatchery-produced age-0 Chinook Salmon provided by Iron Gate Hatchery (IGH) were used for this process. Test fish were marked with Bismarck Brown stain (Rawson 1984) and released approximately 0.5–0.8 km upstream of the trap site to be tested. At least three meso-habitat units, including at least one riffle, were located between the release site and the trap site to allow the fish enough time and space to distribute across the river channel similarly to a natural population passing the trap site. Due to the length of the sampling week, two or three recapture days were available after the release of marked fish. These capture efficiency trials were essential data for estimating abundance via the Bayesian time-stratified model. Mark-recapture efficiency tests could not be conducted for Coho Salmon or steelhead due to the limited catch of these species, so production estimates were not generated for these species.

Results and Discussion

River Conditions

The 2021 monitoring season was characterized by generally low and stable flows from March through June (Figure 2). At the beginning of the sampling season, discharge below Iron Gate Dam was approximately 30 m³/s, discharge at the Kinsman trap site was approximately 45 m³/s, and discharge at the Weitchpec site was approximately 165 m³/s (Figure 2). Flows out of Iron Gate Dam increased in April peaking at approximately 39 m³/s, peaking at approximately 55 m³/s at the Kinsman trap site, and peaking at approximately 185 m³/s at the Weitchpec site (Figure 2).

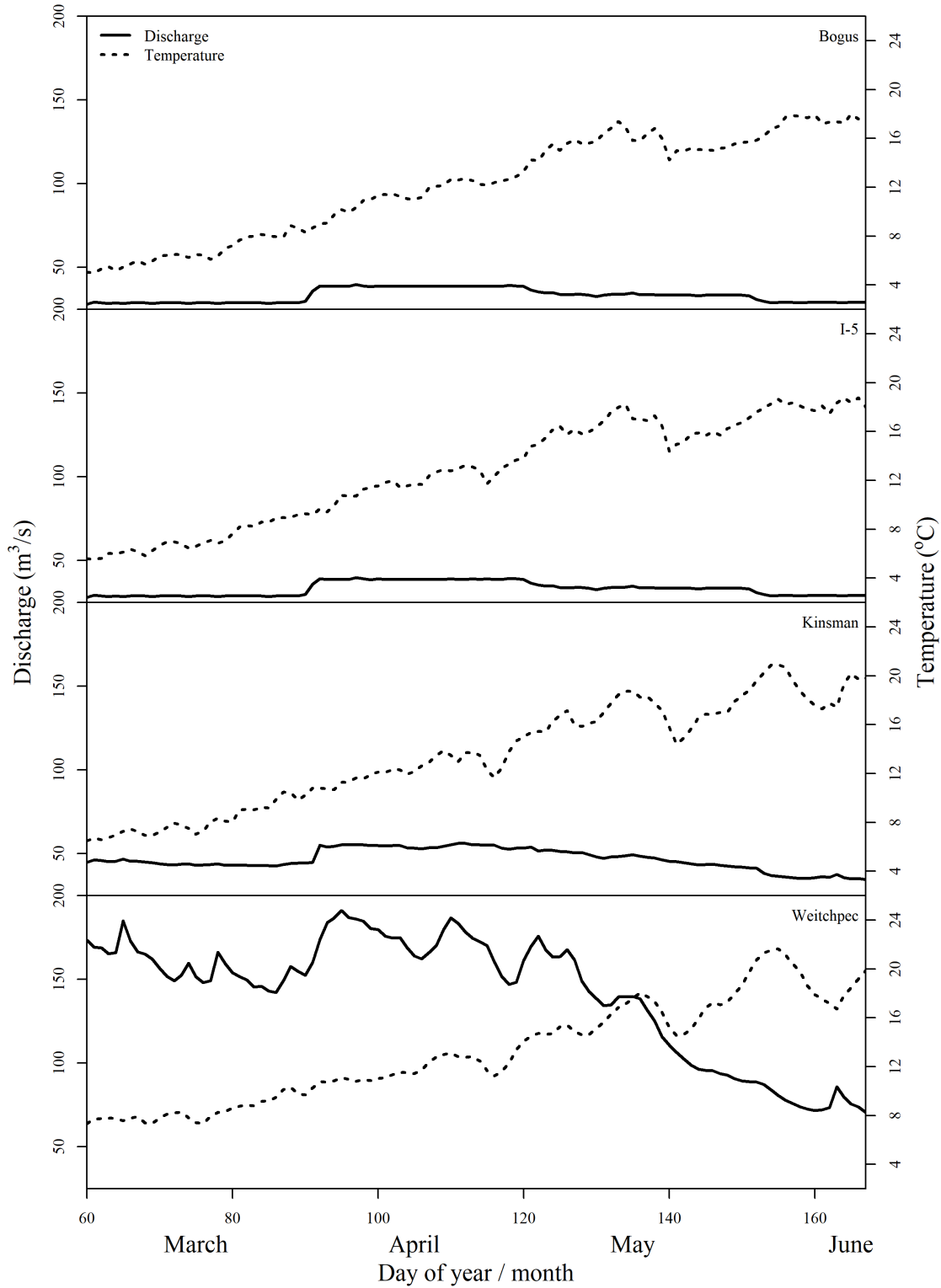


Figure 2. Klamath River mean daily discharge (m³/s) and mean daily temperature (°C) at the four trap sites for February through the end of June 2021.

Salmonid Abundance and Biological Data

Chinook Salmon

Natural-origin age-0 Chinook Salmon were captured at each of the three trap sites in all weeks that sampling occurred (Appendix A). Peak weekly catch of both live and dead natural-origin age-0 Chinook Salmon occurred during calendar week 15 (early April) at the Bogus trap site, and during calendar week 20 (early May) at the I-5 site. Peak weekly catch of live natural-origin age-0 Chinook Salmon occurred during calendar week 15 (early April) at Kinsman trap site while peak of dead fish occurred in calendar week 20 (Appendix A). Peak outmigration may have occurred before the Kinsman RST installation since fish were present in the catch in relatively high numbers at the onset of sampling. Five (5) age-1 Chinook Salmon were captured at the upriver (Bogus, I-5, and Kinsman) trap sites combined, while 113 age-1 Chinook Salmon were captured at the Weitchpec site (Appendix A). No hatchery-origin Chinook Salmon were captured at any of the trap sites as the California Department of Fish and Wildlife opted to not release any juvenile Chinook Salmon from Iron Gate Hatchery in Spring 2021 due to a very high prevalence of *C. shasta* spores in the water column and high infection rates in juvenile Chinook Salmon. All catch data for Chinook Salmon provided in Appendix A are raw catches and are not adjusted for effort or trap efficiency and do not encompass the entire outmigration period.

Estimates of the population of natural origin age-0 juvenile Chinook Salmon outmigrating past each of the trap sites during the spring 2021 season were 926,931 (CI=430,973-1,932,947) at the I-5 trap site, 782,514 (CI=424,984) at the Kinsman trap site, and 1,237,533 (CI=672,202-2,123,426) at the Weitchpec trap site (Table 1, Figure 3). The estimate at the I-5 site appears to have encompassed the entirety of the emigration period. However, the estimate at the Kinsman site did not include the entirety of the population because the highest weekly estimate occurred in week 11, the second week of sampling, which suggests that the early portion of the emigrating population was missed. Similarly, the weekly estimates for the Weitchpec site peaked the last week of sampling, which suggests that an unknown portion of the population was missed after sampling was suspended. Therefore, estimates at both Kinsman and Weitchpec should be considered minimum population estimates and comparison with data sets from previous years should be done with caution.

The 2021 sampling season was notable for the relatively high levels of juvenile Chinook Salmon with distended abdomens and pale gills in live fish (Table 2), clinical signs of disease, and catch of dead fish (Appendix A) at all sampling sites. The proportion of the catch with either clinical signs of disease or dead fish should not be assumed to be representative of the actual population level disease incidence, or mortality level. Abdomen and gill condition are useful real-time indicators of fish health and disease prevalence. However, prevalence of infection is better determined through genetic analysis and histological examination (e.g., True et al. 2016). To determine prevalence of infection more accurately for the juvenile Chinook Salmon population passing the Kinsman and Weitchpec trap sites, weekly-stratified random samples were collected, preserved, and delivered to the California–Nevada Fish Health Center (CA–NV FHC) to process using qPCR assays. The CA–NV FHC investigates infection rates of *C. shasta*, *Parvicapsula minibicornis*, and other pathogens in juvenile salmonids annually in the Klamath River below Iron Gate Dam and will publish a separate report compiling all analyses for 2021. In addition, the Arcata Fish

Table 1. Mainstem Klamath River weekly age-0 juvenile Chinook Salmon outmigrant abundance estimates and mark-recapture information, 2021.

Trap Site	Week	Week		Marks Released	Marks Recovered	Sampling Fraction	Mean population	0.025 bound	0.975 bound	
		Starting	Raw Catch							
I-5	10	3/2/2021	111	--	--	0.5714	11,877	1,450	45,083	
	11	3/9/2021	176	--	--	0.5714	18924	2298	74,888	
	12	3/16/2021	246	--	--	0.5238	34455	3,944	135,219	
	13	3/23/2021	265	--	--	0.5238	37043	4,315	146,770	
	14	3/30/2021	212	--	--	0.5238	31582	3,666	123,971	
	15	4/6/2021	671	--	--	0.5714	84444	9,979	327,728	
	16	4/13/2021	688	--	--	0.5238	109,467	13586	431,832	
	17	4/20/2021	853	--	--	0.5714	105,883	12474	418,620	
	18	4/27/2021	691	--	--	0.5238	110,865	12530	428,788	
	19	5/4/2021	754	--	--	0.5714	87940	10665	364,430	
	20	5/11/2021	1,184	--	--	0.5238	176,653	21110	682,488	
	21	5/18/2021	524	--	--	0.5238	78894	9,251	310,672	
	22	5/25/2021	149	--	--	0.5238	21969	2661	86,122	
	23	6/1/2021	102	--	--	0.5714	11415	1276	44,552	
	24	6/8/2021	5	--	--	0.2143	5,520	253	29,256	
	Total							926,931	430,973	1,932,947
	Kinsman	10	3/3/2021	90	--	--	0.5714	70,375	18,660	152,253
		11	3/9/2021	203	--	--	0.5714	93,327	25,303	210,196
		12	3/16/2021	133	--	--	0.5714	90,647	24,515	195,185
		13	3/23/2021	57	3,929	5	0.5714	76,374	30,855	137,613
		14	3/30/2021	97	--	--	0.4286	67,826	22,495	140,758
		15	4/6/2021	366	--	--	0.5714	54,638	16,955	113,005
		16	4/13/2021	210	3,950	19	0.5714	80,156	47,319	120,204
		17	4/20/2021	51	--	--	0.5714	54,591	15,267	114,054
18		4/27/2021	47	--	--	0.5714	47,430	14,263	106,543	
19		5/4/2021	172	--	--	0.5714	30,914	7,334	74,540	
20		5/11/2021	101	--	--	0.4286	25,189	5,446	64,187	
21		5/18/2021	23	--	--	0.5714	14,599	2,984	36,299	
22		5/25/2021	14	--	--	0.5714	13,590	2,112	37,009	
23	6/1/2021	10	--	--	0.4286	12,373	977	38,405		
Total							782,514	424,984	1,246,417	
Weitchpec	13	3/26/2021	5	--	--	0.1429	27,210	2,165	96,808	
	14	3/30/2021	37	--	--	0.3571	47,575	8,114	153,845	
	15	4/6/2021	146	--	--	0.5714	77,867	9,223	227,363	
	16	4/13/2021	109	--	--	0.5714	59,834	9,606	187,624	
	17	4/20/2021	18	--	--	0.5714	27,376	3,287	108,388	
	18	4/27/2021	6	--	--	0.4286	15,066	1,297	58,323	
	19	5/7/2021	35	--	--	0.5714	19,862	3,854	51,796	
	20	5/11/2021	46	3,424	9	0.5714	26,252	12,144	46,170	
	21	5/18/2021	83	--	--	0.5714	70,152	13,883	179,521	
	22	5/25/2021	54	--	--	0.5714	67,772	10,754	196,011	
	23	6/2/2021	302	--	--	0.4286	109,805	26,639	269,876	
	24	6/8/2021	174	--	--	0.4286	219,115	56,502	532,538	
25	6/15/2021	1,147	2,744	21	0.4286	374,371	237,903	564,179		
Total							1,237,533	672,202	2,123,426	

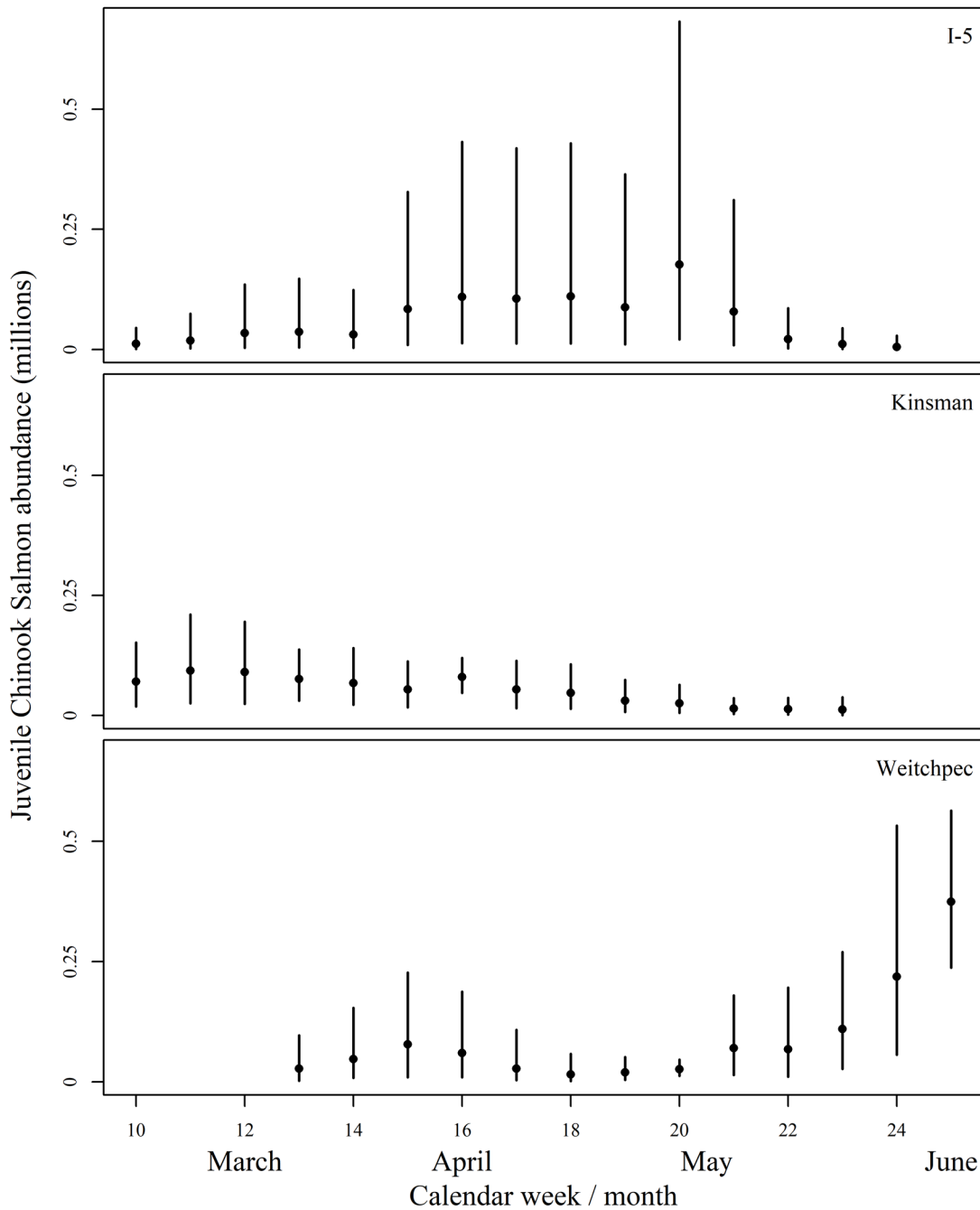


Figure 3. Weekly mean with lower (2.5% credible interval) and upper (97.5% credible interval) bound estimates for natural-origin, age-0 juvenile Chinook Salmon outmigrant abundance at three trap sites, 2021. Trapping did not occur before calendar week 13 at the Weitchpec site and did not occur after calendar weeks 23 and 24 at the Kinsman and I-5 trap sites, respectively.

Table 2. Mainstem Klamath River weekly natural-origin age-0 Chinook Salmon external symptoms of disease, 2021. Salmonid gills were classified as healthy if they were red in color and free of fungus and erosion. Gills were classified as unhealthy if they were pale/white/tan in color, fungal, or eroded. A distended abdomen is an indication of potential infection with the parasite *Ceratonova shasta*. These data were also collected for juvenile Coho Salmon and steelhead but are not reported here.

Trap site	Calendar week	Sampling dates	Abdomen condition			Gills				
			Number Examined	Distended		Number Examined	Color		Condition	
				Number Unhealthy	Percent Unhealthy		Number Unhealthy	Percent Unhealthy	Number Unhealthy	Percent Unhealthy
Bogus	10	Mar 3-4	36	0	0.0%	0	0	-- ^a	0	-- ^a
	11	Mar 9-10	46	0	0.0%	0	0	-- ^a	0	-- ^a
	12	Mar 16-18	45	0	0.0%	0	0	-- ^a	0	-- ^a
	13	Mar 23-25	62	0	0.0%	0	0	-- ^a	0	-- ^a
	14	Mar 30 - Apr 1	88	0	0.0%	0	0	-- ^a	0	-- ^a
	15	Apr 6 -8	90	0	0.0%	4	0	-- ^a	0	-- ^a
	16	Apr 13-15	90	0	0.0%	3	0	-- ^a	0	-- ^a
	17	Apr 20-22	88	0	0.0%	11	0	-- ^a	0	-- ^a
	18	Apr 27-29	89	1	1.1%	21	0	-- ^a	2	-- ^a
	19	May 4-6	86	1	1.2%	12	2	-- ^a	2	-- ^a
	20	May 11-13	55	14	25.5%	12	0	-- ^a	0	-- ^a
	21	May 18-20	11	0	-- ^a	3	0	-- ^a	0	-- ^a
	22	May 25-27	3	0	-- ^a	0	0	-- ^a	-	-- ^a
	23	Jun 1 - 3	3	0	-- ^a	0	0	-- ^a	-	-- ^a
	Total		792	16	2.0%	66	2	3.0%	4	6.1%
I-5	10	Mar 2-4	90	0	0.0%	1	0	-- ^a	0	-- ^a
	11	Mar 9-10	121	0	0.0%	0	0	-- ^a	-	-- ^a
	12	Mar 16-18	122	0	0.0%	2	0	-- ^a	0	-- ^a
	13	Mar 23-25	109	0	0.0%	2	0	-- ^a	0	-- ^a
	14	Mar 30 - Apr 1	115	0	0.0%	5	1	-- ^a	0	-- ^a
	15	Apr 6 -8	159	0	0.0%	13	1	-- ^a	0	-- ^a
	16	Apr 13-15	124	0	0.0%	19	0	-- ^a	0	-- ^a
	17	Apr 20-22	131	0	0.0%	70	0	0.0%	0	0.0%
	18	Apr 27-29	92	2	2.2%	52	0	0.0%	0	0.0%
	19	May 4-6	130	6	4.6%	86	5	5.8%	4	4.7%
	20	May 11-13	102	7	6.9%	65	2	3.1%	2	3.1%
	21	May 18-20	78	8	10.3%	70	7	10.0%	2	2.9%
	22	May 25-27	60	5	8.3%	54	0	0.0%	0	0.0%
	23	Jun 1 - 3	59	9	15.3%	54	1	1.9%	0	0.0%
24	Jun 8-9	4	1	-- ^a	4	0	-- ^a	0	-- ^a	
	Total		1496	38	2.5%	497	17	3.4%	8	1.6%

^a sample size too low for a reportable calculation

Table 2 continued. Mainstem Klamath River weekly natural-origin age-0 Chinook Salmon health information, 2021. Salmonid gills were classified as healthy if they were red in color and free of fungus and erosion. Gills were classified as unhealthy if they were pale/white/tan in color, fungal, or eroded. A distended abdomen is an indication of potential infection with the parasite *Ceratonova shasta*. These data are also collected for juvenile Coho Salmon and steelhead but are not reported here.

Trap site	Calendar week	Sampling dates	Abdomen condition			Gills					
			Number Examined	Distended		Number Examined	Color		Condition		
				Number Unhealthy	Percent Unhealthy		Pale or worse		Eroded or fungal		
						Number Unhealthy	Percent Unhealthy	Number Unhealthy	Percent Unhealthy		
Kinsman	10	Mar 3-4	90	0	0.0%	0	0	-- ^a	0	-- ^a	
	11	Mar 9-10	90	0	0.0%	11	0	-- ^a	0	-- ^a	
	12	Mar 16-18	88	0	0.0%	14	0	-- ^a	0	-- ^a	
	13	Mar 23-25	36	0	0.0%	11	0	-- ^a	0	-- ^a	
	14	Mar 30 - Apr 1	71	0	0.0%	25	0	-- ^a	0	-- ^a	
	15	Apr 6 -8	90	0	0.0%	52	0	0.0%	0	0.0%	
	16	Apr 13-15	90	0	0.0%	63	0	0.0%	0	0.0%	
	17	Apr 20-22	43	1	2.3%	39	1	2.6%	1	2.6%	
	18	Apr 27-29	33	0	0.0%	32	0	0.0%	0	0.0%	
	19	May 4-6	78	1	1.3%	65	2	3.1%	1	1.5%	
	20	May 11-13	64	3	4.7%	57	3	5.3%	0	0.0%	
	21	May 18-20	18	2	-- ^a	16	3	-- ^a	0	-- ^a	
	22	May 25-27	10	1	-- ^a	9	1	-- ^a	1	-- ^a	
	23	Jun 1 - 3	5	1	-- ^a	5	1	-- ^a	0	-- ^a	
	Total			806	9	1.1%	399	11	2.8%	3	0.8%
	Weitchpec	13	Mar 26	5	0	-- ^a	0	0	-- ^a	0	-- ^a
		14	Mar 30 - Apr 2	37	0	0.0%	0	0	-- ^a	0	-- ^a
		15	Apr 6-9	146	0	0.0%	0	0	-- ^a	0	-- ^a
		16	Apr 13-16	109	0	0.0%	1	0	-- ^a	0	-- ^a
		17	Apr 20-23	18	0	-- ^a	5	0	-- ^a	0	-- ^a
		18	Apr 27-30	12	0	-- ^a	6	0	-- ^a	0	-- ^a
		19	May 4-7	6	0	-- ^a	1	0	-- ^a	0	-- ^a
		20	May 11-15	37	1	2.7%	36	0	0.0%	0	0.0%
21		May 18-21	79	8	10.1%	72	0	0.0%	0	0.0%	
22		May 25-28	1	5	-- ^a	42	0	0.0%	0	0.0%	
23		Jun 2-4	67	13	19.4%	63	1	1.6%	1	1.6%	
24		Jun 8-11	69	12	17.4%	69	0	0.0%	0	0.0%	
25		Jun 15-18	120	0	0.0%	120	3	2.5%	3	2.5%	
Total				706	39	5.5%	415	4	1.0%	4	1.0%

^a sample size too low for a reportable calculation

and Wildlife Office intends to conduct technical analyses for the 2021 season to determine population level losses attributable to *C. shasta* and will report those findings in a future peer-reviewed technical report. Natural-origin age-0 Chinook Salmon mean weekly fork lengths were relatively stable or gradually increased throughout the sampling periods at the Bogus frame net while weekly mean fork lengths steadily increased throughout the sampling period at the I-5, Kinsman, and Weitchpec trap sites (Figures 4-9, Appendix B, Appendix C, Appendix E). Length–weight relationships for all Chinook Salmon pooled across trap sites are presented in Figure 10.

Coho Salmon

Natural-origin age-0 Coho Salmon were first captured mid- March at the Bogus and I-5 trap sites, were present the entire sampling season at the Kinsman site, and were first caught at the Weitchpec site in mid-May (Appendix A). Peak natural-origin age-0 Coho Salmon catches occurred during calendar week 16 (mid-April) at the Bogus trap site, calendar week 23 (early June) at the I-5 site, calendar week 16 at the Kinsman trap site, and calendar week 21 (late May) at the Weitchpec site (Appendix A). Iron Gate Hatchery releases age-1 Coho Salmon, 100% marked with a left maxillary clip, annually between mid-March and early April. In 2021, this release occurred on March 12 (calendar week 11). One natural-origin and zero hatchery-origin age-1 Coho Salmon were captured at the Bogus trap site (Appendix A). Nine natural-origin and forty-five hatchery-origin age-1 Coho Salmon were captured at the I-5 trap site (Appendix A). Seventeen natural-origin and eighteen hatchery-origin age-1 Coho Salmon were captured at the Kinsman trap site (Appendix A). Twenty-eight natural-origin and forty-five hatchery-origin age-1 Coho Salmon were captured at the Weitchpec trap site. All catch data for Coho Salmon provided in Appendix A are raw catches that have not been adjusted for effort or trap efficiency and do not encompass the entire outmigration period. Natural-origin age-0 Coho Salmon mean weekly fork lengths were generally stable throughout sampling periods at all three trap sites (Figures 4-9, Appendix B-G). Length–weight relationships for Coho Salmon are presented in Figure 10.

Steelhead

Natural-origin age-0 steelhead were first observed in late March and early April at the Bogus and I-5 trap sites, respectively (Appendix A). Natural-origin age-0 steelhead were captured throughout the sampling period at the Kinsman site with no clear peak in catch (Appendix A). Natural-origin age-0 steelhead were first captured at the Weitchpec site in mid-May (Appendix A). Natural-origin age-1+ steelhead were observed throughout most of the trapping season at most sites, with the lowest catch at the Bogus site and the highest catch at the Weitchpec site (Appendix A). Peak natural-origin age-1+ steelhead catch occurred during calendar week 19 (early May) at the I-5 trap site, calendar week 15 (mid-April) at the Kinsman trap site, and calendar week 20 (mid-May) at the Weitchpec trap site (Appendix A). All catch data for steelhead provided in Appendix A are raw catch and have not been adjusted for effort or trap efficiency and do not encompass the entire outmigration period. No clear patterns or trends were apparent in steelhead mean weekly fork lengths at any of the three trap sites (Figures 4-9, Appendix B-G). Length–weight relationships for steelhead are presented in Figure 10.

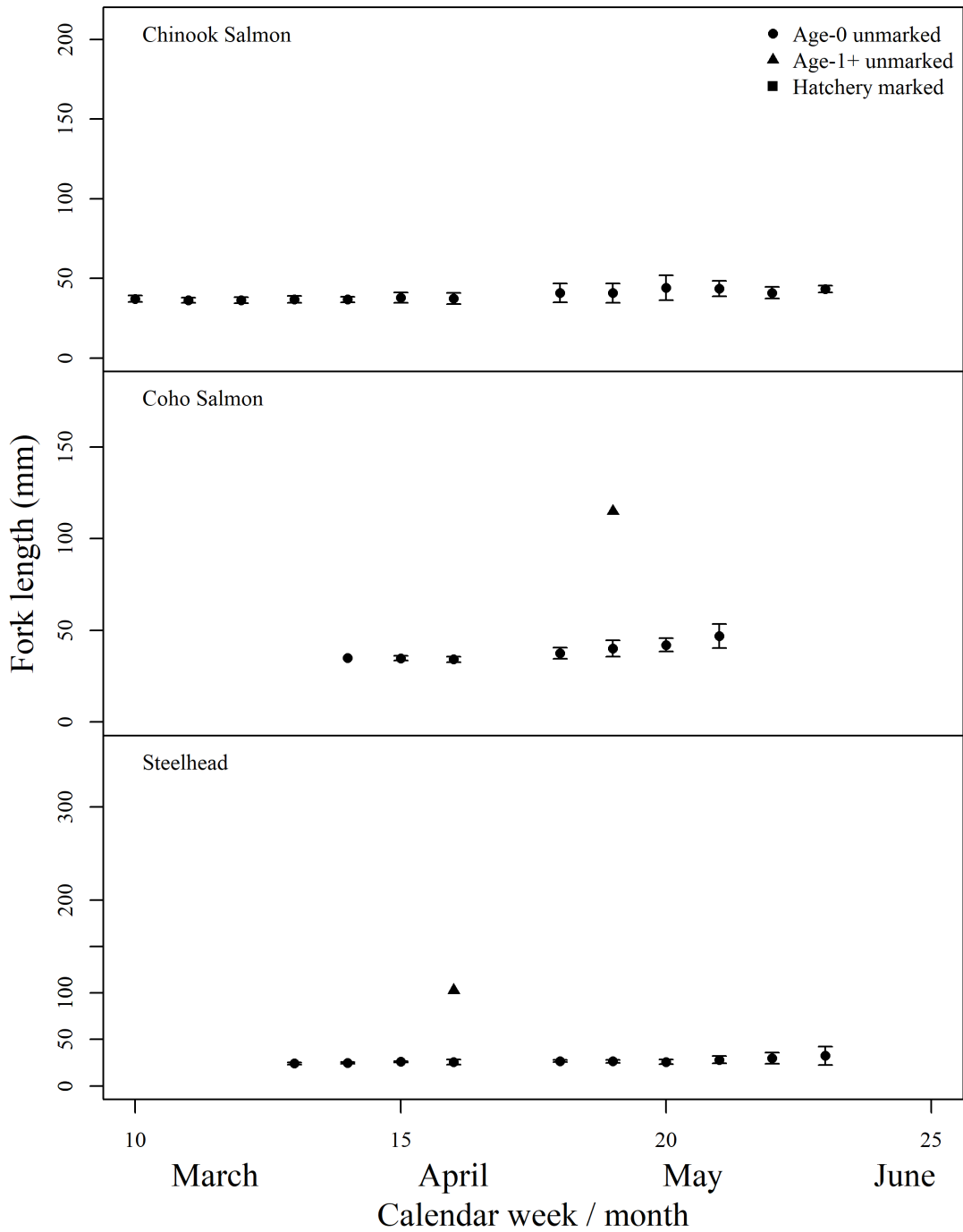


Figure 4. Weekly mean fork lengths (\pm one standard deviation) of unmarked age-0, unmarked age-1+, and hatchery-marked Chinook Salmon, Coho Salmon, and steelhead captured at the Klamath River Bogus frame net, 2021. Please note the difference in scale of the y-axes.

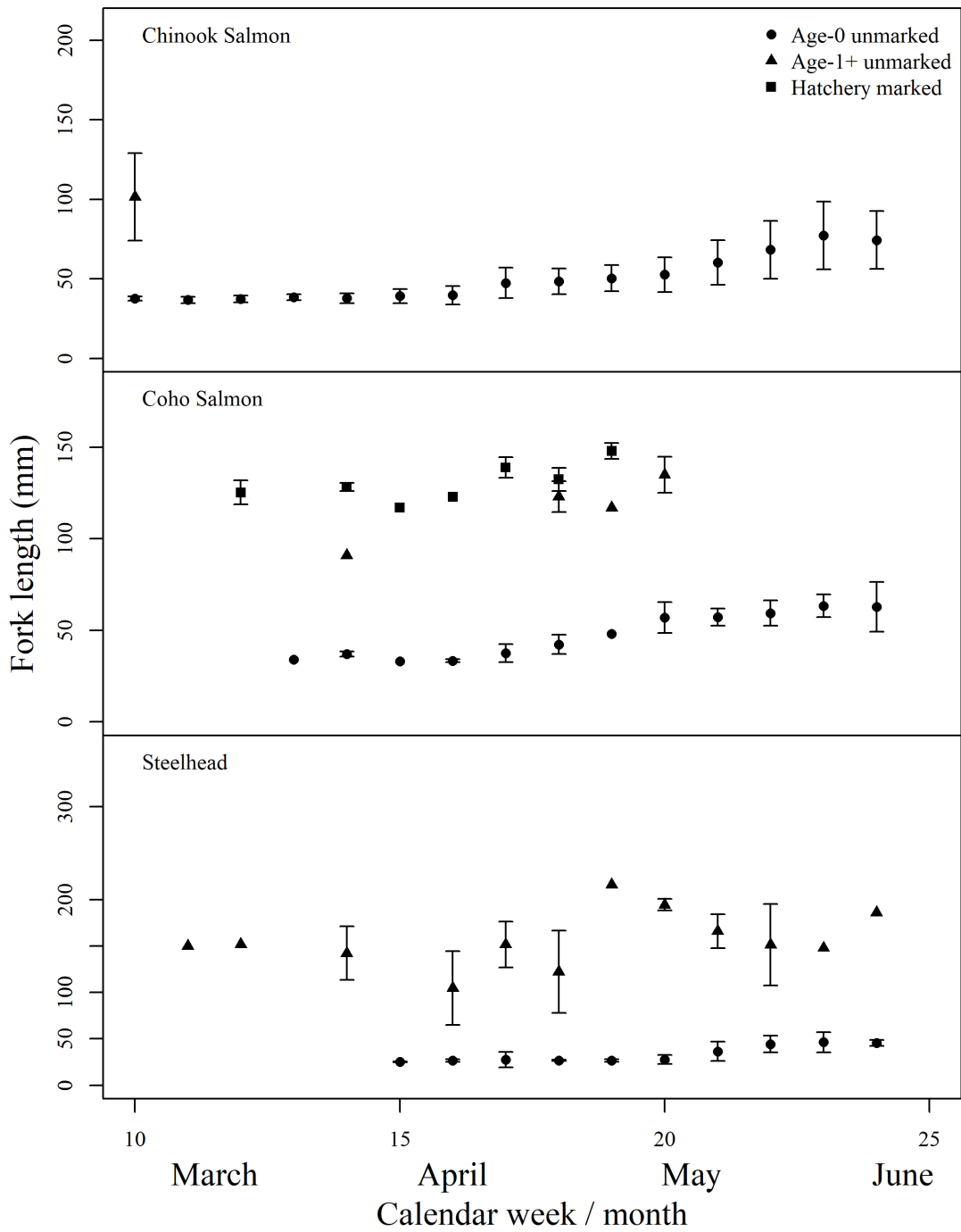


Figure 5. Weekly mean fork lengths (\pm one standard deviation) of unmarked age-0, unmarked age-1+, and hatchery-marked Chinook Salmon, Coho Salmon, and steelhead captured at the Klamath River I-5 RSTs, 2021. Please note the difference in scale of the y-axes.

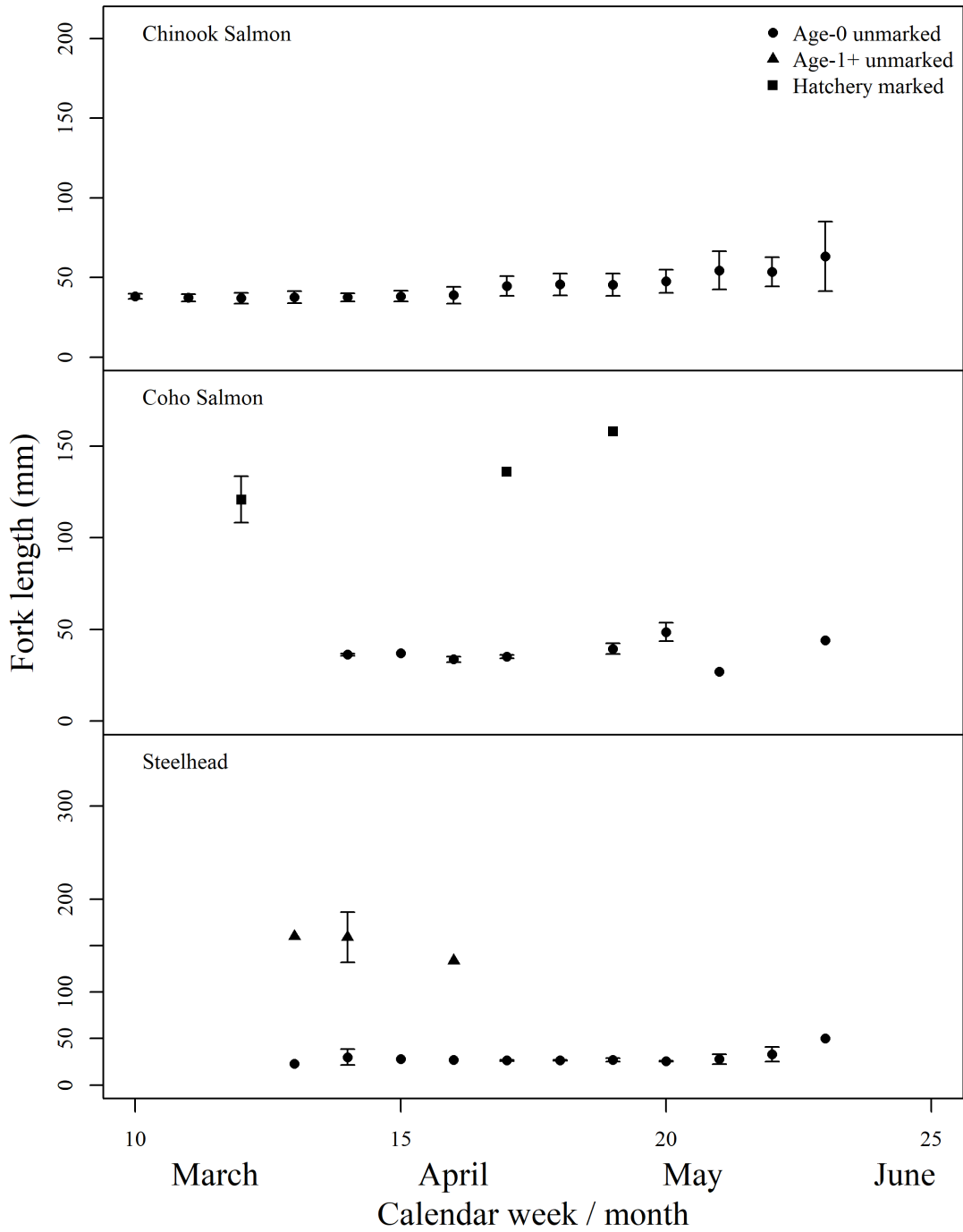


Figure 6. Weekly mean fork lengths (\pm one standard deviation) of unmarked age-0, unmarked age-1+, and hatchery-marked Chinook Salmon, Coho Salmon, and steelhead captured at the Klamath River I-5 frame net, 2021. Please note the difference in scale of the y-axes.

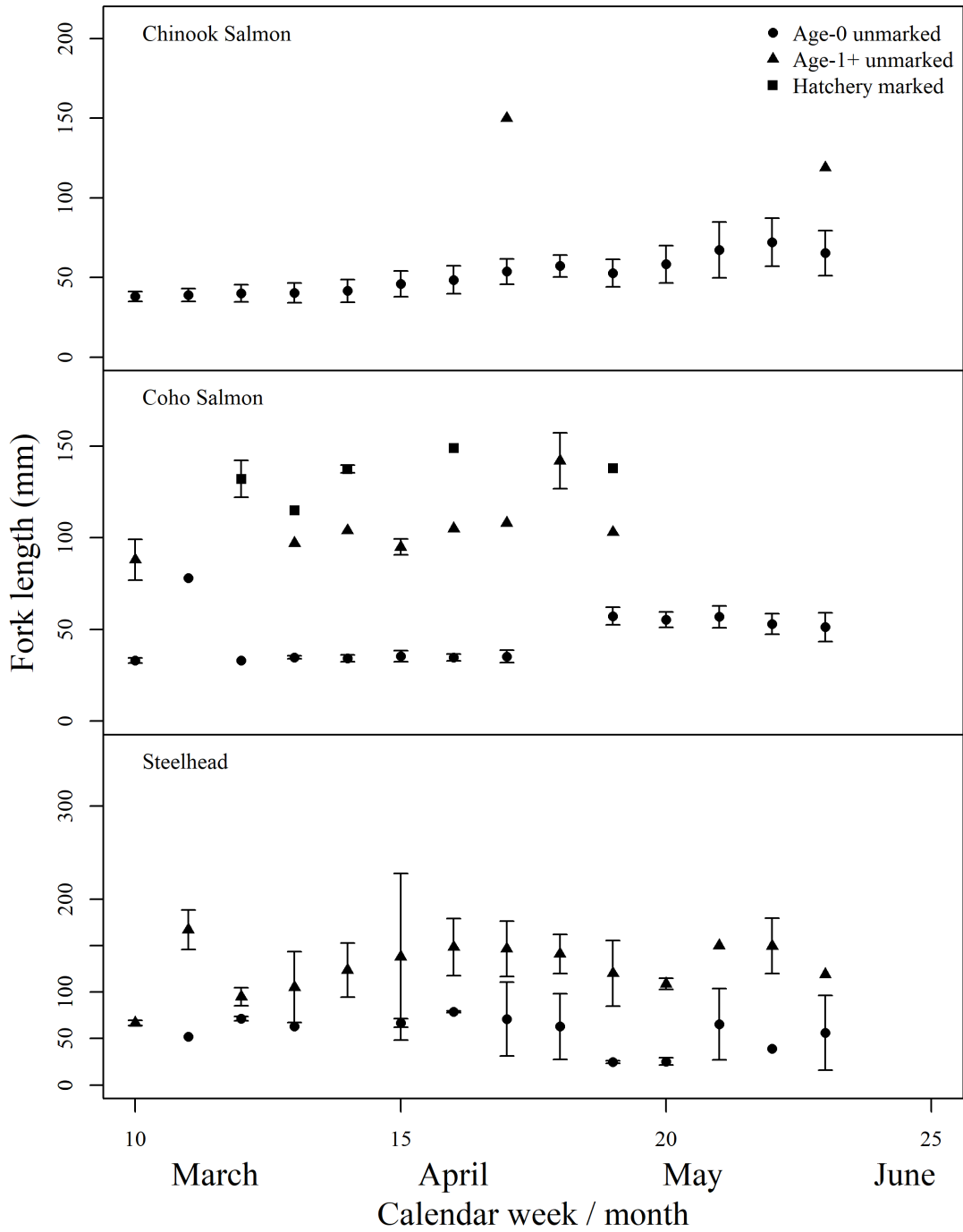


Figure 7. Weekly mean fork lengths (\pm one standard deviation) of unmarked age-0, unmarked age-1+, and hatchery-marked Chinook Salmon, Coho Salmon, and steelhead captured at the Klamath River Kinsman RST, 2021. Please note the difference in scale of the y-axes.

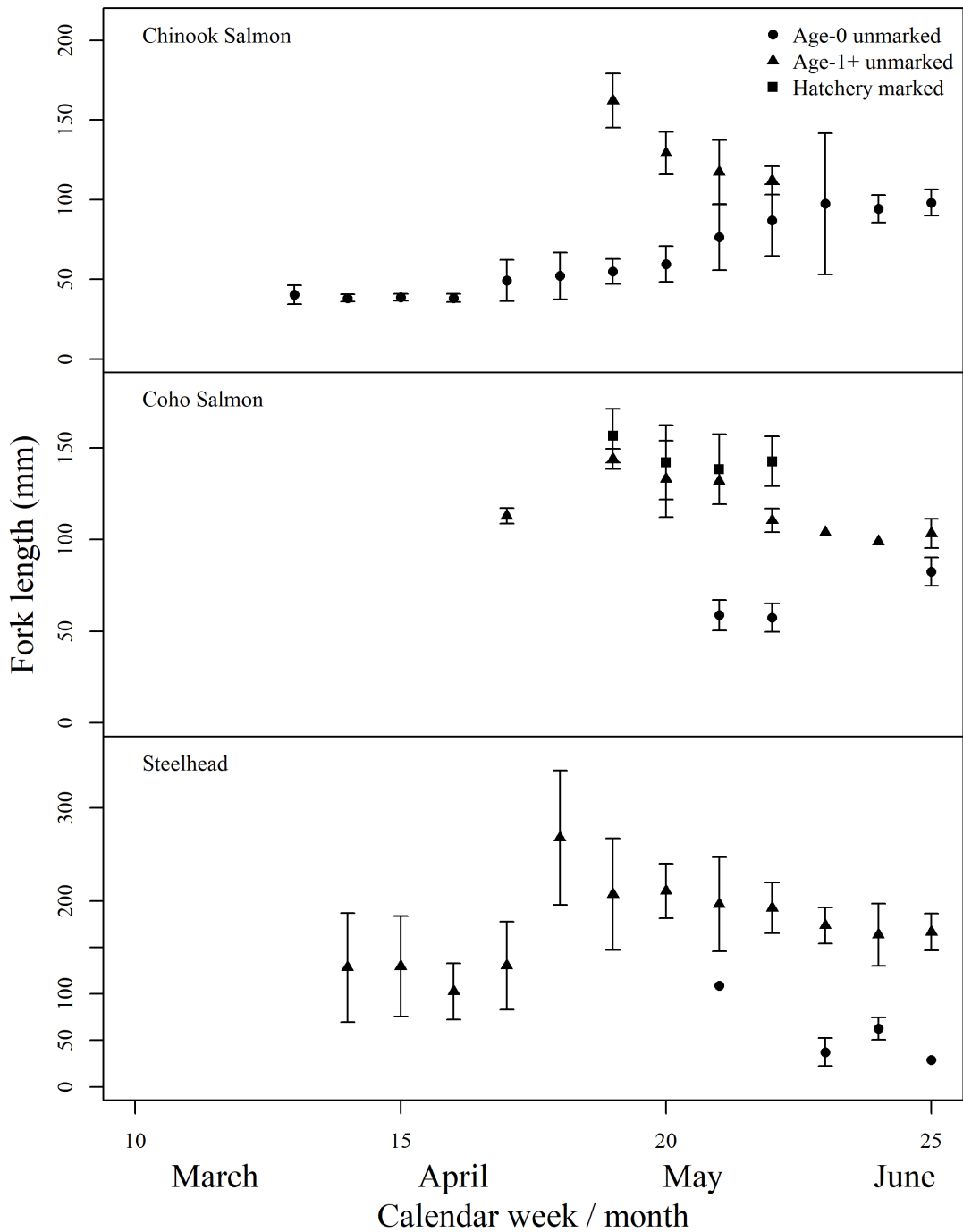


Figure 8. Weekly mean fork lengths (\pm one standard deviation) of unmarked age-0, unmarked age-1+, and hatchery-marked Chinook Salmon, Coho Salmon, and steelhead captured at the Klamath River Weitchpec RST, 2021. Please note the difference in scale of the y-axes.

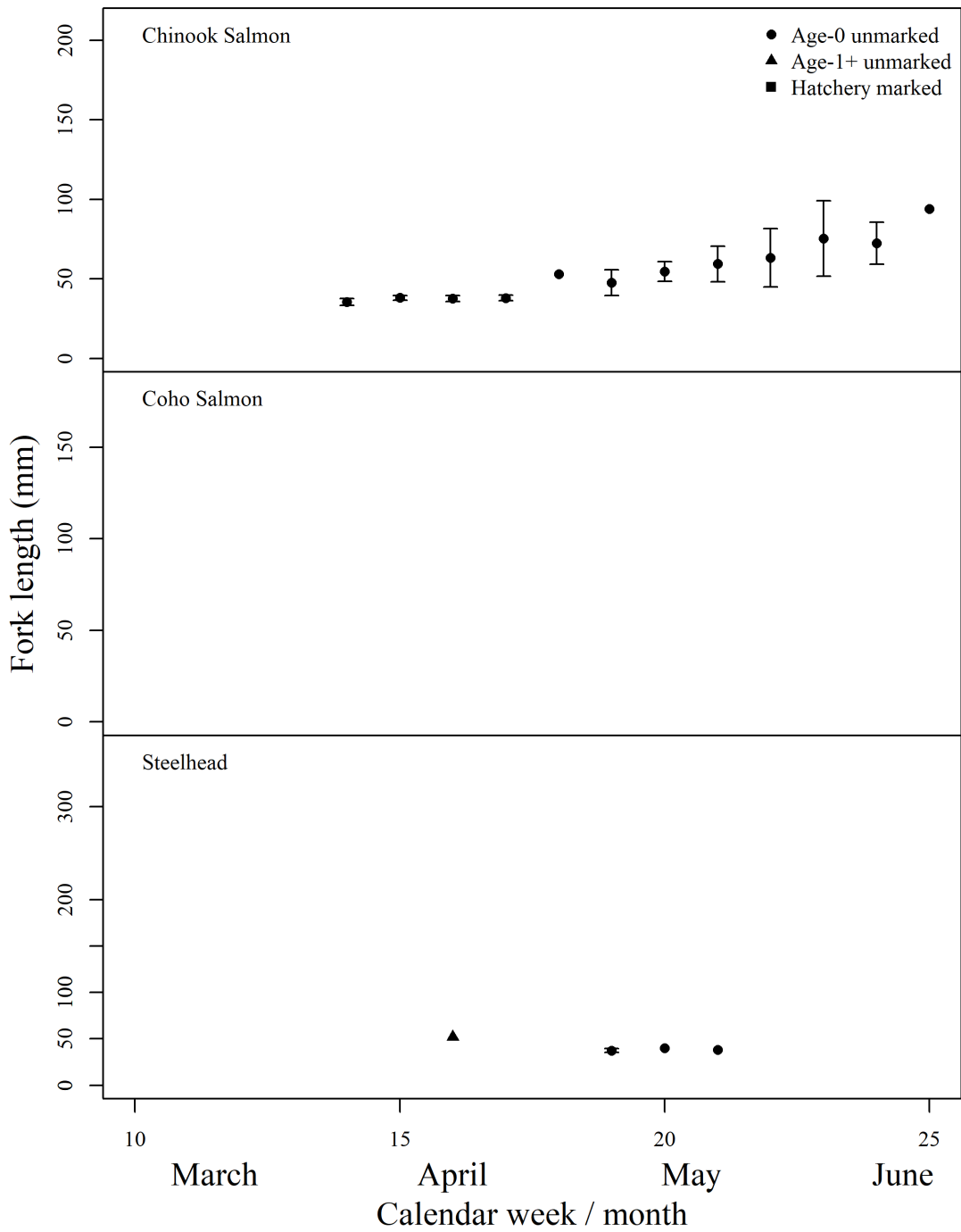


Figure 9. Weekly mean fork lengths (\pm one standard deviation) of unmarked age-0, unmarked age-1+, and hatchery-marked Chinook Salmon, Coho Salmon, and steelhead captured at the Klamath River Weitchpec frame nets, 2021. Please note the difference in scale of the y-axes. No Coho Salmon were captured.

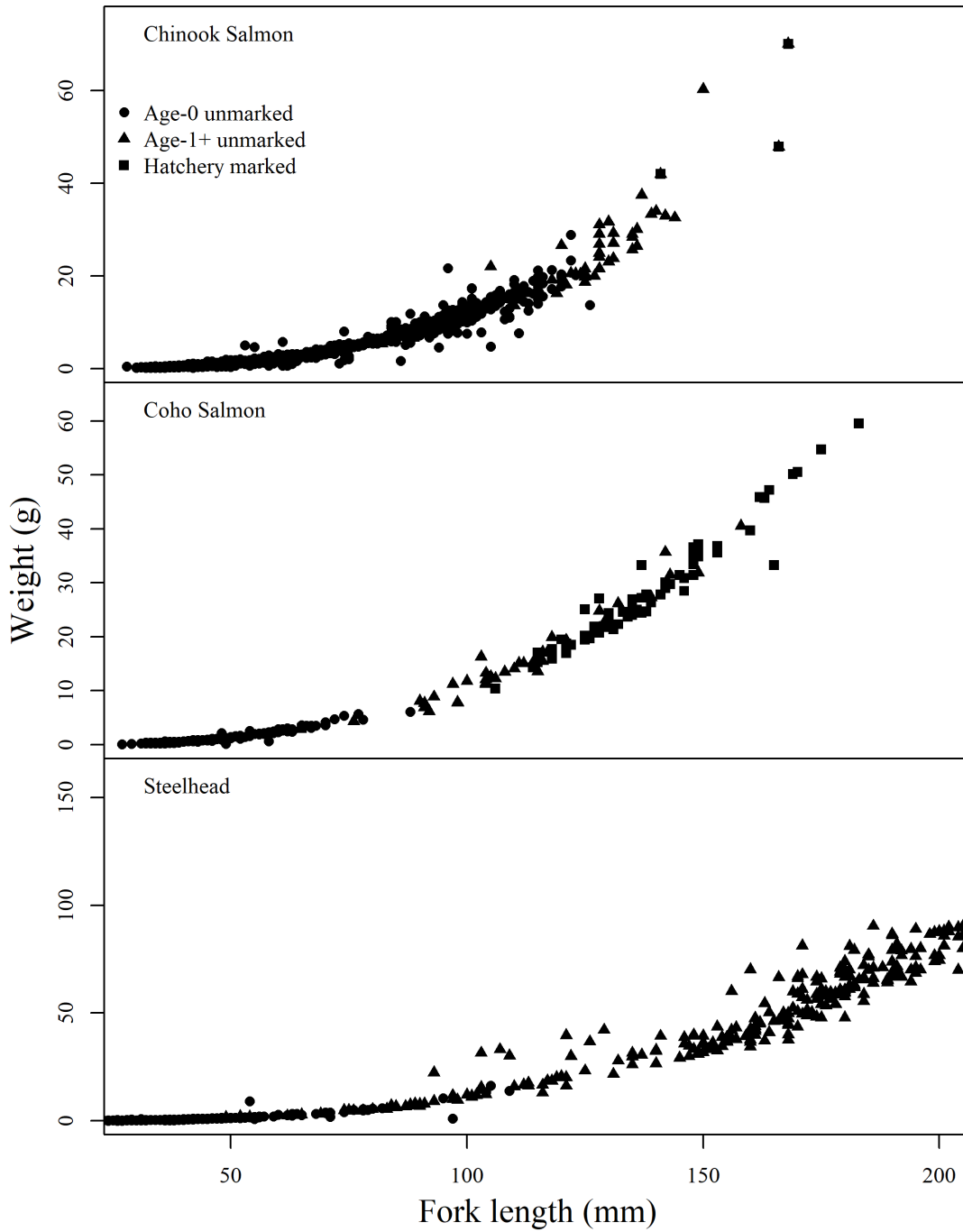


Figure 10. Weight plotted against fork length for individual juvenile Chinook Salmon, Coho Salmon, and steelhead, all trap sites combined, 2021. Please note the difference in scale of the y-axes.

Other Species

Sampling efforts were designed to target juvenile salmonids, but a variety of other fishes were also captured in the traps. In total, 16 non-target species were captured and identified. The most common non-target fishes captured at the Bogus trap site were non-native Yellow perch (*Perca flavescens*) and Crappie (*Pomoxis* spp.) (Table 3). The most common non-target fishes captured at the I-5 trap site was native Klamath River Lamprey (*Entosphenus similis*), native Marbled Sculpin (*Cottus klamathensis*), and non-native Bullhead (*Ameiurus* spp.) (Table 3). The most common non-target fishes captured and identified at the Kinsman site were native Speckled Dace (*Rhinichthys osculus*), Klamath River Lamprey, and Bullhead (Table 3). The most common non-target fishes captured and identified at the Weitchpec site were native Pacific Lamprey (*Entosphenus tridentatus*), Threespine Stickleback (*Gasterosteus aculeatus*), and Speckled Dace (*Rhinichthys osculus*) (Table 3).

Table 3. Catch totals of non-target fish species in the mainstem Klamath River at the three trap sites (all traps within each site combined), 2021.

Common name	Scientific name	Trap Site			
		Bogus	I-5	Kinsman	Weitchpec
Ammocete (Entosphenus)	<i>Entosphenus</i> spp.	26	31	152	55
Ammocete (Lampetra)	<i>Lampetra</i> spp.	0	1	1	0
Bullhead	<i>Ameiurus</i> spp.	7	55	37	20
Crappie	<i>Pomoxis</i> spp.	50	12	1	2
Fathead minnow	<i>Pimphales promelas</i>	0	3	0	2
Golden shiner	<i>Notemigonus crysoleucas</i>	8	9	1	8
Green sturgeon	<i>Acipenser medirostris</i>	0	0	0	10
Klamath River Lamprey	<i>Entosphenus similis</i>	25	137	81	2
Marbled sculpin	<i>Cottus klamathensis</i>	11	70	3	33
Pacific Lamprey	<i>Entosphenus tridentatus</i>	0	0	3	368
Prickly sculpin	<i>Cottus asper</i>	0	2	2	1
Speckled Dace	<i>Rhinichthys osculus</i>	0	40	171	223
Sucker spp.	<i>Catostomus</i> spp.	3	33	28	20
Sunfish	<i>Lepomis</i> spp.	4	0	0	0
Threespine stickleback	<i>Gasterosteus aculeatus</i>	0	0	0	243
Unidentified Lamprey Spp		0	0	0	9224
Western Brook Lamprey	<i>Lampetra 'richardsoni'</i>	0	0	0	1
Yellow perch	<i>Perca flavescens</i>	55	24	1	0
Other unidentified/misc		336	6	2	0

Acknowledgements

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We recognize that the Arcata Fish and Wildlife Office exists on the ancestral lands of the Wiyot people.

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Appendices

Appendix B. Klamath River at Bogus site (frame net) weekly unmarked and hatchery-marked Chinook and Coho salmon fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked Chinook Salmon										Unmarked Coho Salmon										Marked Coho Salmon				
		Age-0					Age-1+					Age-0					Age-1+					Age-1+				
		n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
10	Mar 02-04	36	37.2	32	41	2.0	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	Mar 09-11	47	36.3	32	41	1.6	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12	Mar 16-18	45	36.2	30	40	1.9	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	Mar 23-25	65	36.8	28	41	2.2	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
14	Mar 30-Apr 01	90	36.8	33	47	1.8	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
15	Apr 06-08	90	37.9	34	50	3.1	0	--	--	--	--	87	34.8	31	38	1.3	0	--	--	--	--	0	--	--	--	--
16	Apr 13-15	30	37.4	34	51	3.4	0	--	--	--	--	30	34.1	31	37	1.5	0	--	--	--	--	0	--	--	--	--
17	Apr 20-22	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
18	Apr 27-29	90	40.9	33	58	6.0	0	--	--	--	--	32	37.6	29	46	3.1	0	--	--	--	--	0	--	--	--	--
19	May 04-06	90	40.8	34	67	6.1	0	--	--	--	--	47	40.1	33	49	4.5	1	-- ^a	-- ^a	-- ^a	--	0	--	--	--	--
20	May 11-13	58	44.2	34	78	7.8	0	--	--	--	--	15	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
21	May 18-20	12	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	11	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
22	May 25-27	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
23	Jun 01-03	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix D. Klamath River at I-5 site (frame net) weekly unmarked and hatchery-marked Chinook and Coho salmon fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked Chinook Salmon										Unmarked Coho Salmon										Marked Coho Salmon				
		Age-0					Age-1+					Age-0					Age-1+					Age-1+				
		n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
10	Mar 02-04	19	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
11	Mar 09-11	18	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
12	Mar 16-18	33	37.09	27	46	3.36	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	8	-- ^a	-- ^a	-- ^a	-- ^a
13	Mar 23-25	35	37.66	32	55	3.67	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
14	Mar 30-Apr 01	27	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
15	Apr 06-08	68	38.26	34	49	3.37	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
16	Apr 13-15	36	38.89	34	58	5.19	0	--	--	--	--	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
17	Apr 20-22	45	44.64	33	61	6.23	0	--	--	--	--	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a
18	Apr 27-29	24	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
19	May 04-06	90	45.5	33	70	7.09	0	--	--	--	--	6	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a
20	May 11-13	69	47.65	34	69	7.35	0	--	--	--	--	7	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
21	May 18-20	22	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
22	May 25-27	13	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
23	Jun 01-03	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix E. Klamath River at Kinsman site (RST) weekly unmarked and hatchery-marked Chinook and Coho salmon fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked Chinook Salmon										Unmarked Coho Salmon					Marked Coho Salmon									
		Age-0					Age-1+					Age-0					Age-1+									
		n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd					
10	Mar 02-04	58	38.1	33	48	3.04	0	--	--	--	--	2	-- ^a	-- ^a	-- ^a	-- ^a	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
11	Mar 09-11	87	39.11	34	50	4.04	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
12	Mar 16-18	88	40.1	33	64	5.44	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	8	-- ^a	-- ^a	-- ^a	-- ^a
13	Mar 23-25	36	40.47	33	56	6.21	0	--	--	--	--	5	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
14	Mar 30-Apr 01	71	41.62	33	57	7.08	0	--	--	--	--	4	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a
15	Apr 06-08	90	46.13	33	64	8.09	0	--	--	--	--	12	-- ^a	-- ^a	-- ^a	-- ^a	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
16	Apr 13-15	90	48.49	33	73	8.71	0	--	--	--	--	50	34.7	32	46	2.0	1	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-22	44	53.7	36	70	8	1	-- ^a	-- ^a	-- ^a	-- ^a	37	35.3	33	49	3.4	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
18	Apr 27-29	34	57.24	43	74	6.91	0	--	--	--	--	0	--	--	--	--	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
19	May 04-06	87	52.7	33	82	8.71	0	--	--	--	--	4	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
20	May 11-13	82	58.34	38	84	11.76	0	--	--	--	--	10	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
21	May 18-20	35	67.31	37	101	17.44	0	--	--	--	--	7	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
22	May 25-27	16	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	5	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--
23	Jun 01-03	10	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix F. Klamath River at Weitchpec site (RST) weekly unmarked and hatchery-marked Chinook and Coho salmon fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked Chinook Salmon										Unmarked Coho Salmon					Marked Coho Salmon									
		Age-0					Age-1+					Age-0					Age-1+									
		n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
13	Mar 26-26	5	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
14	Mar 30-Apr 02	26	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
15	Apr 06-09	69	38.7	35	51	2.2	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
16	Apr 13-16	80	38.2	32	50	2.5	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
17	Apr 20-23	11	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	2	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
18	Apr 27-30	7	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
19	May 04-07	72	54.8	37	71	7.8	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	3	-- ^a	-- ^a	-- ^a	-- ^a	17	-- ^a	-- ^a	-- ^a	-- ^a
20	May 11-14	65	59.6	38	100	11.2	46	129.2	89	155	13.4	0	--	--	--	--	13	-- ^a	-- ^a	-- ^a	-- ^a	23	-- ^a	-- ^a	-- ^a	-- ^a
21	May 18-21	85	76.4	43	126	20.7	12	-- ^a	-- ^a	-- ^a	-- ^a	4	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a
22	May 25-28	80	87.1	44	123	22.5	9	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a	3	-- ^a	-- ^a	-- ^a	-- ^a
23	Jun 02-04	90	97.4	11	495	44.3	0	--	--	--	--	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
24	Jun 08-11	77	94.3	75	113	8.6	17	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
25	Jun 15-18	120	98.1	82	122	8.2	0	--	--	--	--	2	-- ^a	-- ^a	-- ^a	-- ^a	6	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix G. Klamath River at Weitchpec site (frame nets) weekly unmarked and hatchery-marked Chinook and Coho salmon fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked Chinook Salmon										Unmarked Coho Salmon					Marked Coho Salmon									
		Age-0					Age-1+					Age-0					Age-1+									
		n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd	n	mean	min	max	sd
14	Mar 30-Apr 02	11	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
15	Apr 06-09	78	38.08	35	42	1.55	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
16	Apr 13-16	29	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
17	Apr 20-23	7	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
18	Apr 27-30	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
19	May 04-07	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
20	May 11-14	38	54.58	44	72	6.25	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
21	May 18-21	43	59.37	40	88	11.22	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
22	May 25-28	17	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
23	Jun 02-04	12	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
24	Jun 08-11	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--
25	Jun 15-18	2	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix H. Klamath River at Bogus site (frame net) weekly unmarked steelhead fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked steelhead									
		Age-0					Age-1+				
		n	mean	min	max	sd	n	mean	min	max	sd
13	Mar 26-26	16	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
14	Mar 30-Apr 1	8	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
15	Apr 06-09	51	26.1	24	27	0.7	0	--	--	--	--
16	Apr 13-16	4	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-23	0	--	--	--	--	0	--	--	--	--
18	Apr 27-30	90	26.87	23	30	1.15	0	--	--	--	--
19	May 04-07	89	26.45	18	33	1.59	0	--	--	--	--
20	May 11-14	78	25.91	24	38	2.42	0	--	--	--	--
21	May 18-21	17	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
22	May 25-28	6	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
23	Jun 01-04	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix I. Klamath River at I-5 site (RST) weekly unmarked steelhead fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked steelhead									
		Age-0					Age-1+				
		n	mean	min	max	sd	n	mean	min	max	sd
10	Mar 02-04	0	--	--	--	--	0	--	--	--	--
11	Mar 09-11	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a
12	Mar 16-18	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a
13	Mar 23-25	0	--	--	--	--	0	--	--	--	--
14	Mar 30-Apr 1	0	--	--	--	--	3	-- ^a	-- ^a	-- ^a	-- ^a
15	Apr 06-08	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
16	Apr 13-15	13	-- ^a	-- ^a	-- ^a	-- ^a	4	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-22	39	27.7	23	78	8.4	3	-- ^a	-- ^a	-- ^a	-- ^a
18	Apr 27-29	22	-- ^a	-- ^a	-- ^a	-- ^a	3	-- ^a	-- ^a	-- ^a	-- ^a
19	May 04-06	89	26.6	23	35	1.51	1	-- ^a	-- ^a	-- ^a	-- ^a
20	May 11-13	88	27.81	24	50	4.85	2	-- ^a	-- ^a	-- ^a	-- ^a
21	May 18-20	52	36.48	24	63	10.5	2	-- ^a	-- ^a	-- ^a	-- ^a
22	May 25-27	35	44.37	26	65	9.06	3	-- ^a	-- ^a	-- ^a	-- ^a
23	Jun 01-03	98	46.38	24	97	10.8	1	-- ^a	-- ^a	-- ^a	-- ^a
24	Jun 8-9	3	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a

^a sample size too low for a reportable calculation

Appendix J. Klamath River at I-5 site (frame net) weekly unmarked steelhead fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked steelhead									
		Age-0				Age-1+					
		n	mean	min	max	sd	n	mean	min	max	sd
13	Mar 23-25	1	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
14	Mar 30-Apr 1	2	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a
15	Apr 06-08	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
16	Apr 13-15	2	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-22	10	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
18	Apr 27-29	8	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
19	May 04-06	67	27.01	25	38	1.81	0	--	--	--	--
20	May 11-13	10	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
21	May 18-20	3	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
22	May 25-27	4	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--
23	Jun 01-03	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--

^a sample size too low for a reportable calculation

Appendix K. Klamath River at Kinsman site (RST) weekly unmarked steelhead fork lengths (mm), 2021.

Calendar week	Sample dates	Unmarked steelhead									
		Age-0				Age-1+					
		n	mean	min	max	sd	n	mean	min	max	sd
10	Mar 02-04	0	--	--	--	--	2	-- ^a	-- ^a	-- ^a	-- ^a
11	Mar 09-11	1	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a
12	Mar 16-18	3	-- ^a	-- ^a	-- ^a	-- ^a	2	-- ^a	-- ^a	-- ^a	-- ^a
13	Mar 23-25	1	-- ^a	-- ^a	-- ^a	-- ^a	3	-- ^a	-- ^a	-- ^a	-- ^a
14	Mar 30-Apr 1	0	--	--	--	--	3	-- ^a	-- ^a	-- ^a	-- ^a
15	Apr 06-08	8	-- ^a	-- ^a	-- ^a	-- ^a	4	-- ^a	-- ^a	-- ^a	-- ^a
16	Apr 13-15	3	-- ^a	-- ^a	-- ^a	-- ^a	10	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-22	3	-- ^a	-- ^a	-- ^a	-- ^a	5	-- ^a	-- ^a	-- ^a	-- ^a
18	Apr 27-29	5	-- ^a	-- ^a	-- ^a	-- ^a	4	-- ^a	-- ^a	-- ^a	-- ^a
19	May 04-06	2	-- ^a	-- ^a	-- ^a	-- ^a	4	-- ^a	-- ^a	-- ^a	-- ^a
20	May 11-13	7	-- ^a	-- ^a	-- ^a	-- ^a	5	-- ^a	-- ^a	-- ^a	-- ^a
21	May 18-20	4	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a
22	May 25-27	1	-- ^a	-- ^a	-- ^a	-- ^a	7	-- ^a	-- ^a	-- ^a	-- ^a
23	Jun 01-03	5	-- ^a	-- ^a	-- ^a	-- ^a	1	-- ^a	-- ^a	-- ^a	-- ^a

^a sample size too low for a reportable calculation

Appendix L. Klamath River at Weitchpec site (RST) weekly unmarked steelhead fork lengths (mm), 2021.

Calendar	Sample	Unmarked steelhead										
		Age-0					Age-1+					
		week	dates	n	mean	min	max	sd	n	mean	min	max
14	Mar 30-Apr 6	0	--	--	--	--	2	-- ^a	-- ^a	-- ^a	-- ^a	-- ^a
15	Apr 06-09	0	--	--	--	--	6	-- ^a	-- ^a	-- ^a	-- ^a	-- ^a
16	Apr 13-16	0	--	--	--	--	5	-- ^a	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-23	0	--	--	--	--	12	-- ^a	-- ^a	-- ^a	-- ^a	-- ^a
18	Apr 27-30	0	--	--	--	--	39	268.1	97	420	72.1	
19	May 04-07	0	--	--	--	--	54	207.2	109	378	60	
20	May 11-14	0	--	--	--	--	120	210.8	110	330	29.1	
21	May 18-21	1	-- ^a	-- ^a	-- ^a	-- ^a	44	196.4	102	482	50.6	
22	May 25-28	0	--	--	--	--	103	192.6	49	295	27.2	
23	Jun 02-04	4	-- ^a	-- ^a	-- ^a	-- ^a	78	173.8	116	211	19.4	
24	Jun 08-11	2	-- ^a	-- ^a	-- ^a	-- ^a	31	158.5	84	282	37.8	
25	Jun 15-18	1	-- ^a	-- ^a	-- ^a	-- ^a	77	166.7	54	221	20	

^a sample size too low for a reportable calculation

Appendix M. Klamath River at Weitchpec site (frame nets) weekly unmarked steelhead fork lengths (mm), 2021.

Calendar	Sample	Unmarked steelhead										
		Age-0					Age-1+					
		week	dates	n	mean	min	max	sd	n	mean	min	max
16	Apr 13-16	0	--	--	--	--	1	-- ^a	-- ^a	-- ^a	-- ^a	-- ^a
17	Apr 20-23	0	--	--	--	--	0	--	--	--	--	--
18	Apr 27-30	0	--	--	--	--	0	--	--	--	--	--
19	May 04-07	2	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	--
20	May 11-14	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	--
21	May 18-21	1	-- ^a	-- ^a	-- ^a	-- ^a	0	--	--	--	--	--

^a sample size too low for a reportable calculation