

Napa River Steelhead and Salmon Monitoring Program 2019-20 Report



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Prepared by

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Contents

Executive Summary.....	1
Introduction.....	2
Smolt Trapping	2
Methods	2
Results and Discussion.....	7
Steelhead and Salmon Smolt Catch.....	8
Steelhead Smolt Size.....	8
Trapping Efficiency.....	9
PIT Tagging.....	9
Methods	9
Results and Discussion.....	10
Spawner Surveys.....	12
Methods	12
Results and Discussion.....	12
Anticipated Monitoring in 2020 and 2021.....	14
References	14
List of Appendices.....	14

Executive Summary

2020 represented the 12th consecutive year of steelhead and salmon out-migrant monitoring using a rotary screw trap in the Napa River. Due to exceptionally low flow conditions throughout spring, the trap was only in operation for 11 days, and 81 potential sampling days between March 1 and May 31 were missed. A total of 1,457 fish were captured, including 11 native and 3 non-native species. Native species comprised 99.5% of the total catch (n=1,449) and non-native fishes accounted for 0.5% (n=8).

A total of 44 steelhead smolts were captured. The limited sampling period and relatively small sample size was deemed insufficient to calculate catch rates for comparisons to previous years. The median steelhead smolt length was 178 millimeters (7.0 inches), which was slightly smaller than the previous 11-year average of 189 millimeters (7.4 inches). The average steelhead smolt size has remained relatively large and stable during the past 12 years, despite considerable variation in environmental conditions within that same period.

A total of 33 Chinook parr/smolts were captured in spring 2020; however, the trap was not operational during the peak Chinook smolt outmigration period of May and early June. Chinook catch rates have exhibited a high degree of variability over the past 12 years, ranging from 0 - 101.5 smolts captured per sampling day. This suggests that the Napa River does not support a fully self-sustaining Chinook population, but some successful spawning has occurred in most years, including the 2019-2020 water year. Chinook abundance in any given year appears to be primarily dependent upon (1) natural variability in the amount and timing of rainfall, and (2) inputs of stray salmon from other river systems and/or Central Valley hatcheries that opportunistically spawn in the Napa River.

A total of 42 steelhead smolts were PIT tagged in 2020. During the past eight years (2013 - 2020) 564 steelhead smolts have been tagged. Of that total, six have been re-detected in subsequent years by the Napa River PIT tag antenna. These tagging data represent the first known confirmation of steelhead returning to the Napa River.

A total of five Chinook salmon spawner surveys were completed between December 11, 2019 and January 9, 2020. The surveys covered approximately 40.0 kilometers (24.9 miles) of the mainstem Napa River between Calistoga and Oak Knoll Avenue. In total, 60 salmon redds, 14 live salmon, and zero salmon carcasses were observed.

Introduction

In 2009, the Napa County Resource Conservation District (RCD) began the Napa River Watershed Steelhead and Salmon Monitoring Program with the goal of better understanding steelhead trout and Chinook salmon populations in the Napa River watershed. Since the program was initiated, the RCD has conducted annual monitoring of smolt abundance, adult returns, juvenile distribution, and genetic diversity, as funding and environmental conditions allowed.

This monitoring program is intended to provide science-based information to all stakeholders involved in steelhead and salmon management and recovery. In addition to generating data on steelhead and salmon, the monitoring program also provides information about other native fishes and tracks ecological responses to ongoing habitat restoration.

In this annual update, we provide results from our spring downstream migrant trapping (smolt trapping), fall and winter spawner surveys, and operation of our Passive Integrated Transponder (PIT) tag detection system located in the Napa River. Additional information and previous years' reports can be found at our website: www.naparcd.org/assessment-programs/fisheries-monitoring.

Smolt Trapping

Methods

An 8-foot diameter rotary screw trap (RST) was used to capture fish in the Napa River in spring 2020 (**Figure 1**). The full RST protocol is provided in Appendix B. 2020 represented the 12th consecutive year the RCD has operated the RST at the same location, approximately 3.2 kilometers (2 miles) downstream of the Oak Knoll Avenue Bridge (**Figure 2**). The RST site was originally selected based on accessibility, landowner cooperation, and its location just upstream of tidal influence. Approximately 67% (~188 stream kilometers) of the total anadromous salmonid spawning and rearing habitat in the Napa River watershed is located upstream of this site.



Figure 1. Napa River rotary screw trap

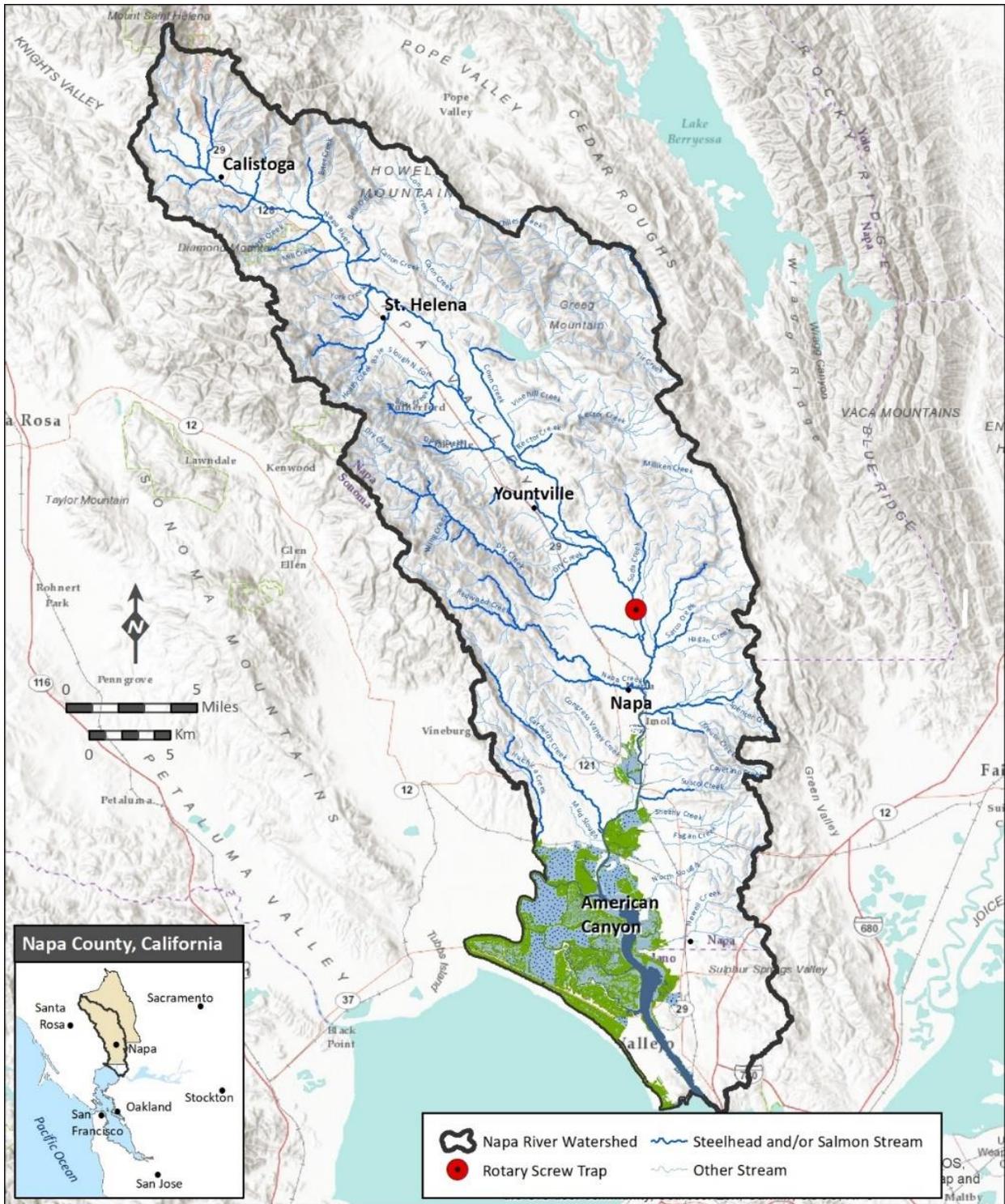


Figure 2. Napa River rotary screw trap location.

A hydrograph for water year 2019-20 in relation to RST operation and salmonid spawning seasons is provided as **Figure 3**. As a general rule, the target RST operating period begins on March 1 and extends through early June, or until catch and/or flows diminish. However, due to exceptionally low flow conditions in spring 2020, there was insufficient water velocity to spin the trap during much of the season. One small storm occurred on April 15, which resulted in sufficient flow to operate the trap for 10 consecutive days. No additional storms occurred during the spring, and flows diminished to a trickle by early June. A total of 81 potential sampling days were missed within the target period of March 1 - June 1 due to low flow conditions.

The RST was in operation for a total of 11 days during the 2020 season (**Figure 4**). While in operation, crews checked the trap at least once per day to process the catch and remove debris. Fish captured in the trap were processed according to the procedures described in Appendix B.

A sub-sample of steelhead and Chinook smolts captured each week was marked with a small fin clip, and a PIT tag in the case of steelhead, then transported in buckets upstream approximately 1 kilometer (0.6 miles) for release. The number of these marked fish that were subsequently recaptured was used to generate weekly and season-long trap efficiency estimates. Upstream releases were conducted on weekdays only. The number of fish that were marked and released each week was variable based on catch rates. Trap efficiency estimates were not able to be calculated during weeks with low or no catch.

Catch-per-unit-effort (CPUE) was calculated by dividing the total number of smolts captured by the total number of days sampled.

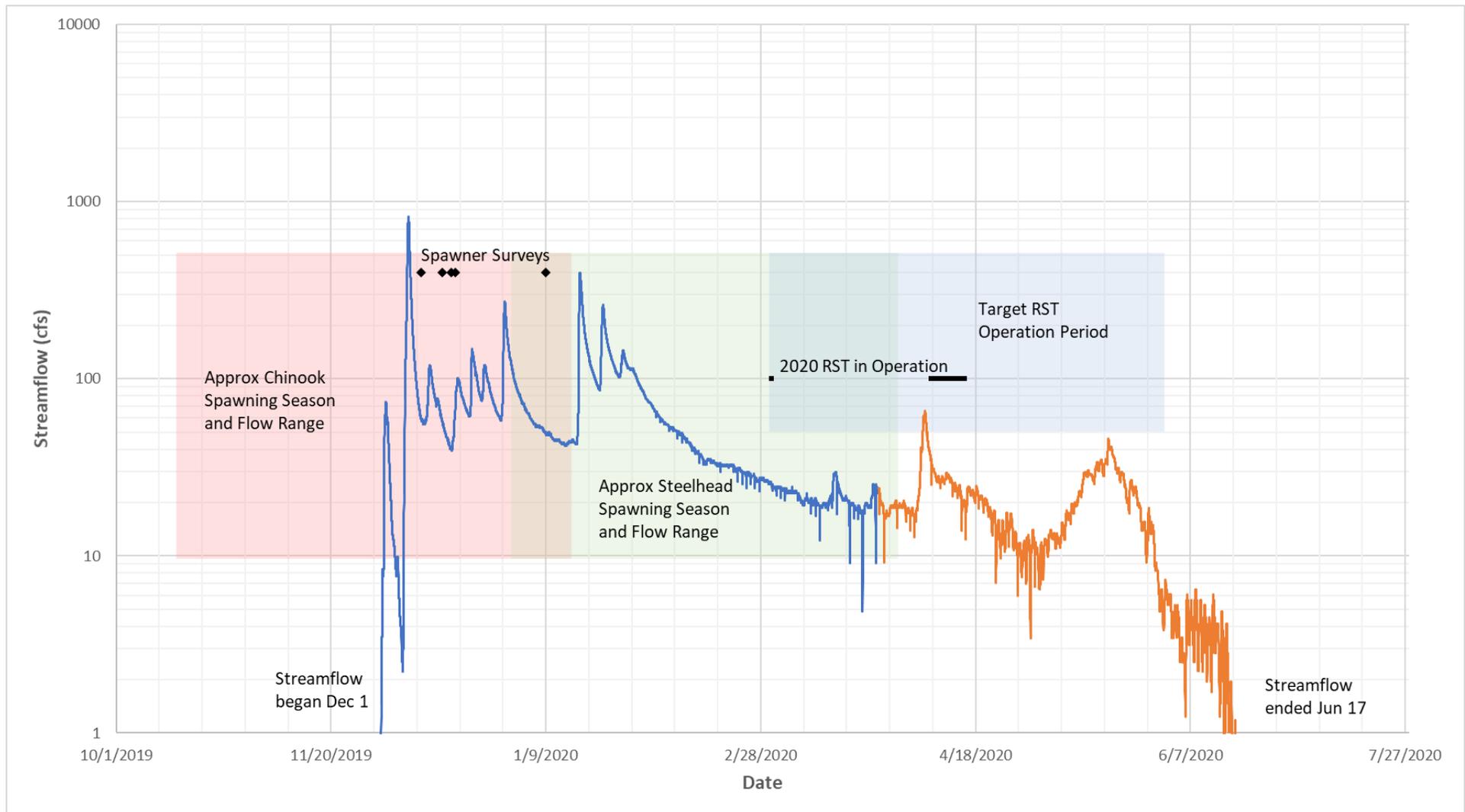


Figure 3. 2019-20 hydrograph for USGS streamgaging station 11458000 Napa River near Napa, California, showing storm timing and field work. The blue line represents “approved” data, and the orange line represents “provisional” data at time of reporting.

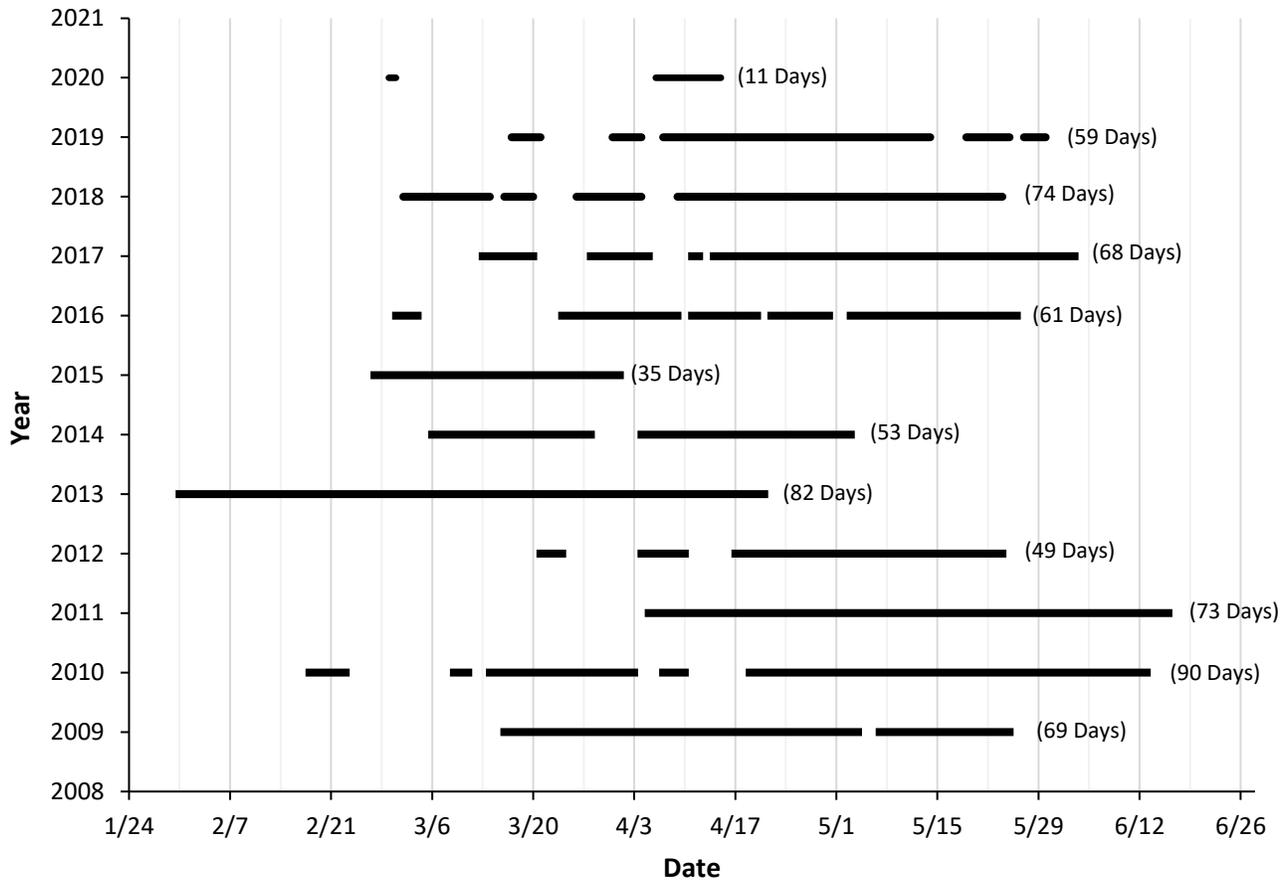


Figure 4. Dates of operation for the Napa River rotary screw trap from 2009-2020. Note: the total number of sampling days per year is shown in parentheses. Gaps within each sampling year represent periods when the trap was not operated due to high flows, low flows, or other factors.

Results and Discussion

During the spring 2020 rotary screw trap season, a total of 1,457 fish were captured, including 11 native and 3 non-native species (**Figure 5**). Native species comprised 99.5% of the total catch ($n=1,449$) and non-native fishes accounted for 0.5% ($n=8$). As in previous years, this total count did not include larval life stages of several species (Sacramento sucker, three-spine stickleback, California roach), which were frequently too abundant to accurately count.

Appendix A provides count totals for each fish species as well as incidentally captured non-fish taxa from 2009-2020.

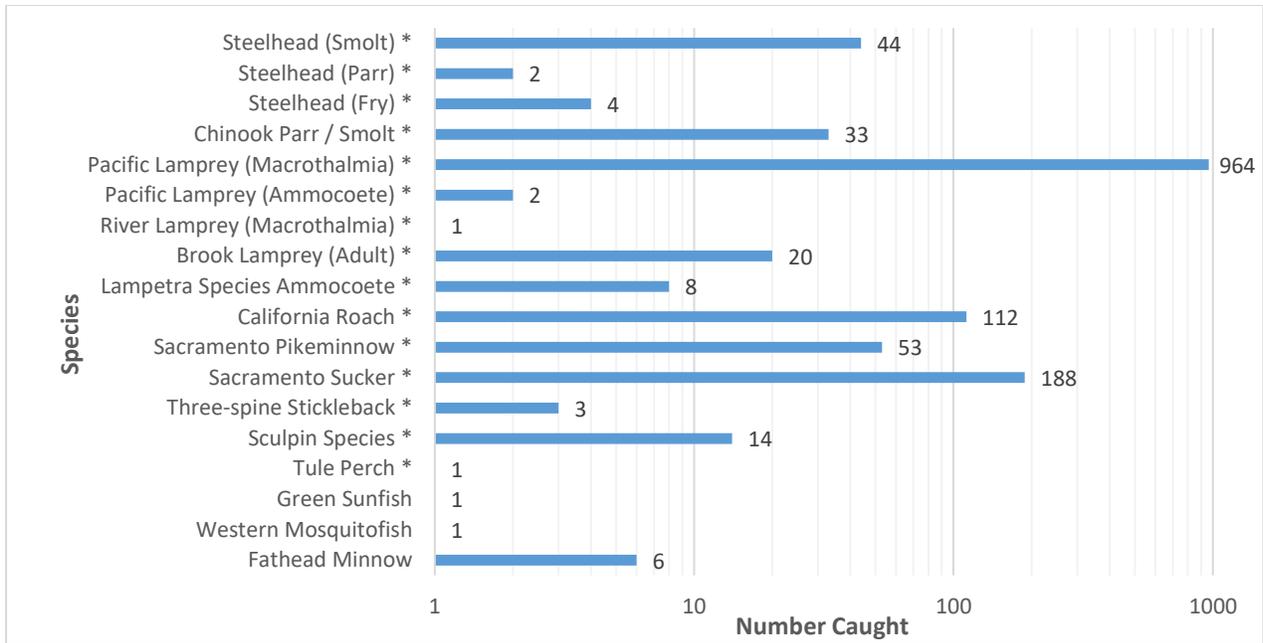


Figure 5. 2020 RST season catch totals, excluding larval specimens.

*Native species

Steelhead and Salmon Smolt Catch

A total of 44 steelhead smolts and 33 Chinook salmon smolts were captured during 2020 RST sampling season. Due to the extremely short sampling season and limited sample sizes, catch-per-unit-effort (CPUE) was not calculated for comparison to previous years. It is worth noting, that although we were unable to effectively sample salmonid smolts during the 2020 season due to low flow conditions, these limited data confirm that both steelhead and Chinook were able to carry out their life-cycles and outmigrate to the ocean successfully.

Steelhead Smolt Size

The median steelhead smolt size (i.e. fork length) in 2020 was 178 millimeters (7.0 inches), which was slightly smaller than the previous 11-year average of 189 millimeters (7.4 inches). Median steelhead smolt size has remained relatively stable during the monitoring program's 11-year history with a range of 170 - 206 millimeters (6.7 - 8.1 inches), despite considerable variation in environmental conditions within that same period (**Figure 6**).

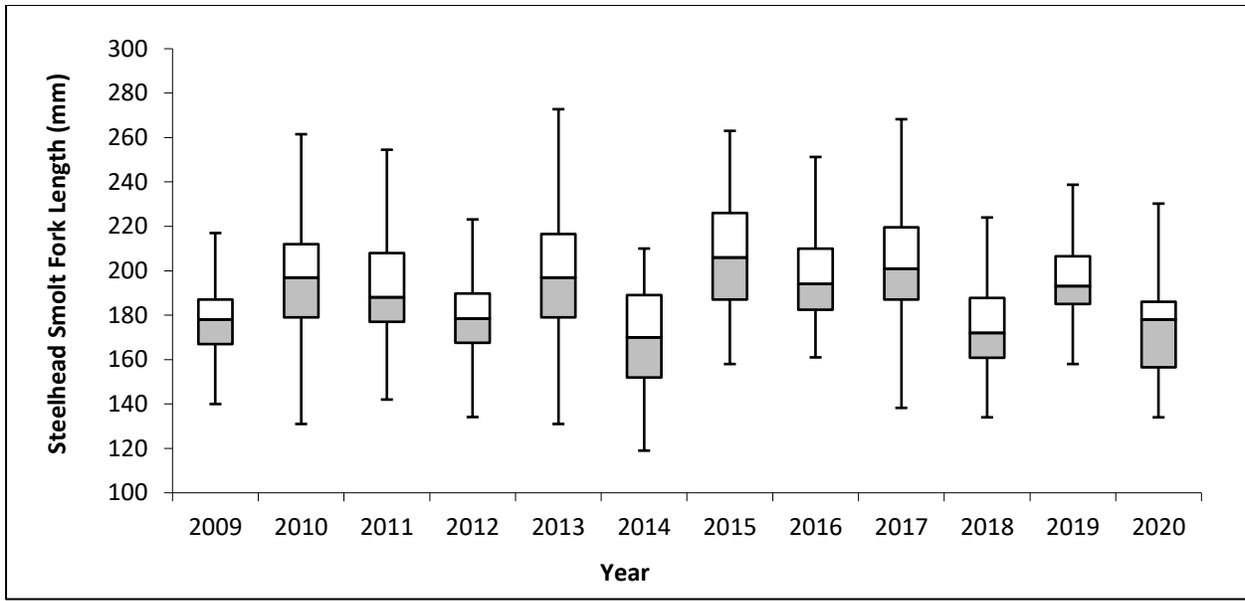


Figure 6. Steelhead smolt fork lengths from the Napa River rotary screw trap 2009-2020. The bottom and top of each box are the 25th and 75th percentiles respectively. The line near the middle of each box is the median, and the vertical lines (whiskers) represent the lowest and highest values within 1.5 times the inter-quartile range.

Trapping Efficiency

Trapping efficiency was not calculated for the 2020 smolt trapping season, due to the extremely limited sampling period and low overall catch. The trapping efficiency during the previous 11-year history of this monitoring program has been approximately 13% for steelhead and approximately 25% for Chinook. For further details and discussion on this topic, see reports from previous years.

PIT Tagging

Methods

Passive Integrated Transponder (PIT) tags were used to uniquely identify and track individual steelhead in the Napa River. Steelhead smolts larger than 130 mm fork length were anesthetized and implanted with 12 mm half-duplex (HDX) tags using a Biomark injection gun. Tagged fish were then scanned with a handheld tag reader and the unique tag code was recorded in the RCD’s database.

A pair of stationary PIT tag antenna loops located in the Napa River approximately 20 meters upstream of the RST were operated continuously throughout the winter/spring 2020 season (Figure 7).



Figure 7. Paired PIT tag antenna loops in the Napa River.

Results and Discussion

During the 2019 out-migrant trapping season, 42 steelhead smolts received PIT tags. During the past eight years (2013 - 2020) RCD has tagged a total of 564 steelhead smolts (**Figure 8**). Of that total, six individual steelhead have been re-detected in subsequent years by the Napa River PIT tag antenna (**Table 1**). These tagging data confirm steelhead reproduction and return spawning within the Napa River watershed.

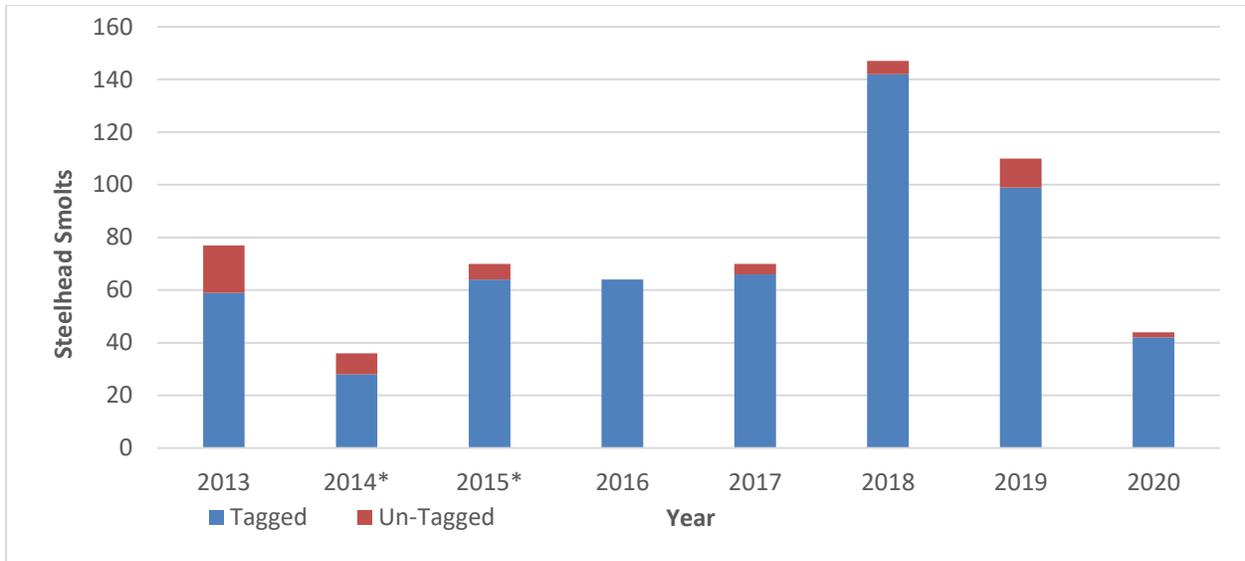


Figure 8. Number of PIT tagged steelhead smolts relative to the total catch 2013-2020.

*Note: 2014 and 2015 included steelhead captured in fyke nets in Sulphur and York Creeks in addition to the RST.

Table 1. PIT tagged steelhead re-detected by the Napa River PIT tag antenna in subsequent years.

Date Tagged	Tagging Location	Length (mm)	Weight (g)	Re-Detection Date	Days between tagging and re-detection
4/1/2016	Napa River RST	192	65.1	3/1/2018	699
4/2/2016	Napa River RST	201	85.1	3/1/2018	698
5/12/2017	Napa River RST	193	68.4	2/17/2019	646
3/18/2018	Napa River RST	190	63.5	3/11/2020	724
4/17/2018	Napa River RST	185	68.1	2/17/2020	671
4/23/2018	Napa River RST	185	65.1	3/19/2019	330

Spawner Surveys

Methods

Spawner surveys were conducted according to the RCD Spawner Survey Protocol, which is based on methodology described in the California Salmonid Stream Habitat Restoration Manual published by the California Department of Fish and Wildlife (CDFW 1998). Surveys were conducted once sufficient rainfall had occurred and continuous base-flow had been established.

Spawner surveys were conducted by kayak in the mainstem Napa River to document live fish, carcasses, and redds (spawning nests). During each survey, the crew continuously scanned areas likely to be used by spawning salmonids. Polarized sunglasses were used to improve visibility and detection of underwater features. The following data, along with geographic coordinates of each observation, were recorded:

Salmon (live) - total count, species, sex

Salmon (carcass) - total count, species, sex, length, presence/absence of adipose fin, condition

Redd - total count, species, area, habitat type, occupied/not occupied

Results and Discussion

A total of five spawner surveys were completed between December 11, 2019 and January 9, 2020, covering approximately 40.0 kilometers (24.9 miles) of the mainstem Napa River between Calistoga and Oak Knoll Avenue (**Figure 9**). During these surveys, 60 redds, 14 live salmon, and zero carcasses were observed (**Table 2**). The complete absence of carcasses was unusual, given the relatively high number of redds observed.

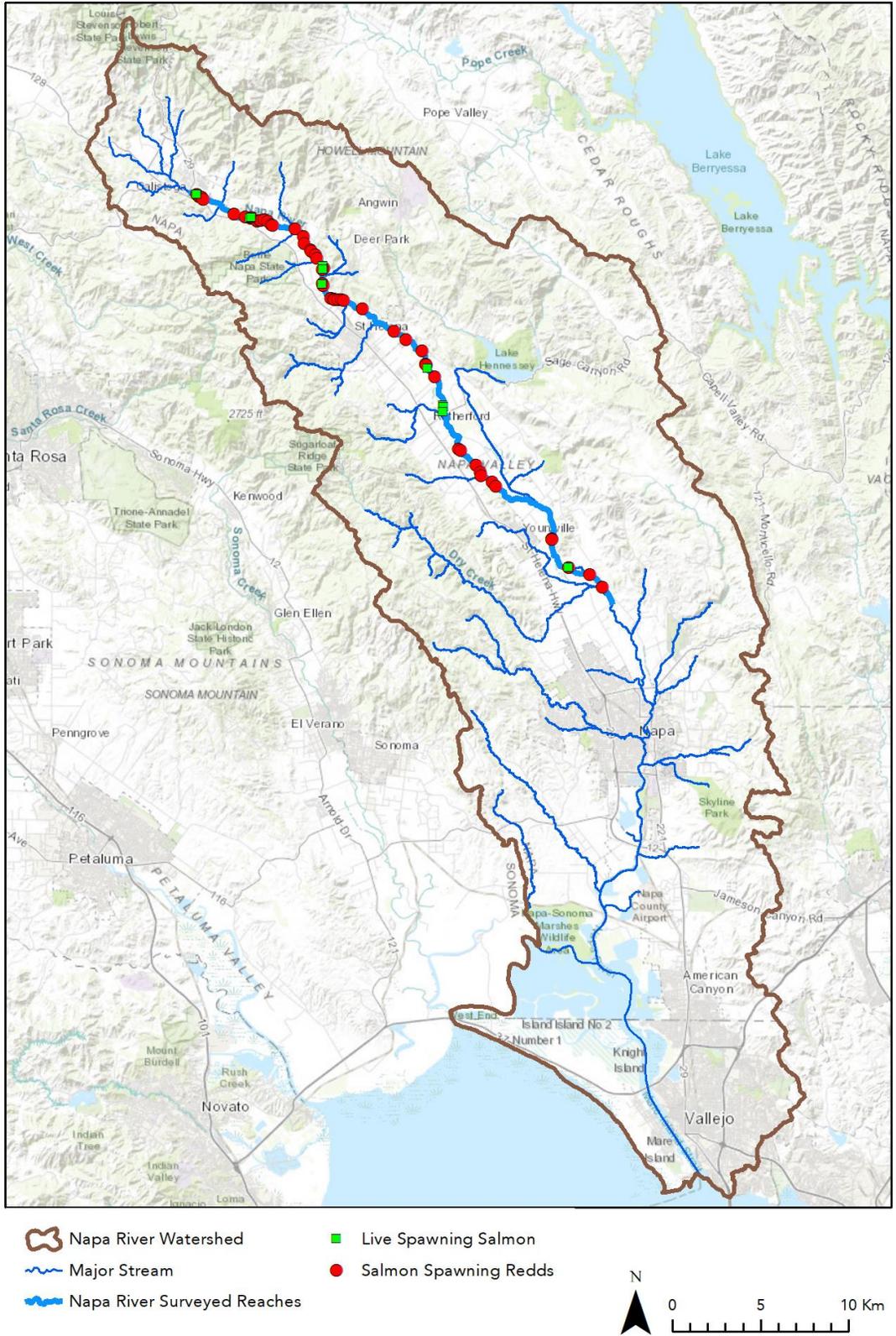


Figure 9. 2019-20 spawner survey results.

Table 2. 2019-20 Chinook salmon spawner survey details and results.

Date	12/11/2019	12/16/2019	12/18/2019	12/19/2019	1/9/2020
Stream	Napa River	Napa River	Napa River	Napa River	Napa River
Flow (cfs)	13	44	48	76	49
Flow source	Dunaweal Lane ALERT gage	Pope Street USGS gage	Pope Street USGS gage	Pope Street USGS gage	Oak Knoll Ave USGS gage
Survey Extent	Lincoln Ave Calistoga to Bale Lane	Bale Lane to Pope Street	Pope Street to Rutherford Road	Rutherford Road to bottom of OVOK Group C	Bottom of OVOK Group C to Oak Knoll Ave
Survey Length (mi)	4.77	4.95	4.57	6.02	4.55
Survey Length (km)	7.68	7.97	7.36	9.69	7.32
Live Chinook	5	4	4	0	1
Chinook carcasses	0	0	0	0	0
Redds	18	24	6	7	5

Anticipated Monitoring in 2020 and 2021

At time of reporting, the RCD has funding from the California State Coastal Conservancy and local partners to continue Napa River rotary screw trap monitoring and spawner surveys through 2022.

References

California Department of Fish and Wildlife (CDFW). 1998. California Salmonid Stream Habitat Restoration Manual. <http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp>.

List of Appendices

Appendix A: Rotary Screw Trap Season Totals 2009-2020

Appendix B: Smolt Trap Processing Procedure

Appendix A: Rotary Screw Trap Season Totals 2009-2020

Native Fishes

Common Name	Scientific Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Steelhead / Rainbow trout	<i>Oncorhynchus mykiss</i>													
Fry / Parr (<130 mm)		941	94	7	152	3,025	303	35	11	6	32	1	6	4,613
Smolt (>130mm)		119	251	175	160	77	31	34	64	70	147	110	44	1,282
Adult or Resident (>300 mm)		0	3	4	0	3	0	0	3	6	3	2	0	24
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>													
Parr / Smolt		1	1,520	7,377	488	19	0	0	580	2,315	1,922	89	33	14,344
Kokanee/ Sockeye Salmon	<i>Oncorhynchus nerka</i>													
Parr / Smolt		0	342	0	0	0	0	0	0	0	0	0	0	342
Pacific Lamprey	<i>Entosphenus tridentatus</i>													
Adult		25	11	38	64	9	14	11	143	31	26	12	0	384
Macrothalmia ^{1,2}		-	-	-	-	1	0	0	3	0	7,203	0	964	8,171
Ammocete ¹		-	-	-	9	4	7	30	54	45	314	121	2	586
River Lamprey	<i>Lampetra ayresi</i>													
Adult ¹		-	2	21	9	3	0	0	86	46	1	21	0	189
Macrothalmia ¹		-	-	-	-	15	0	0	1	0	5	1	1	23
Brook Lamprey (Adult¹)	<i>Lampetra richardsoni</i>													
		-	0	64	7	174	120	87	77	38	63	20	20	670
Lampetra Sp. Ammocete¹	<i>Lampetra sp.</i>													
		-	-	-	19	108	46	40	136	70	74	148	8	649
Sacramento Splittail	<i>Pogonichthys macrolepidotus</i>													
		2	6	0	1	26	0	6	0	6	39	0	0	86
Hardhead	<i>Mylopharodon conocephalus</i>													
		0	0	1	0	0	1	1	0	0	0	0	0	3
Sacramento Pikeminnow	<i>Ptychocheilus grandis</i>													
		28	87	192	191	33	12	4	27	200	512	63	53	1,402
California Roach²	<i>Hesperoleucus symmetricus</i>													
		4,744	3,571	336	330	498	691	253	548	249	260	347	112	11,939
Sacramento Sucker	<i>Catostomus occidentalis</i>													
		82	419	207	33	78	42	61	166	284	1,060	148	188	2,768
Tule Perch	<i>Hysterocarpus traski</i>													
		6	28	30	20	17	8	6	78	51	27	7	1	279
Sculpin sp.	<i>Cottus sp.</i>													
		242	124	62	66	329	184	20	51	53	84	215	14	1,444
Three-spine Stickleback	<i>Gasterosteus aculeatus</i>													
		116	76	273	50	34	37	14	3,329	465	78	89	3	4,564

¹ Juvenile and larval lamprey as well as adult river and brook lampreys were only differentiated consistently beginning with the 2012 season.

² Includes estimated numbers during periods of high abundance.

Non-Native Fishes

Common Name	Scientific Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Bluegill	<i>Lepomis macrochirus</i>	29	100	86	41	11	107	24	221	130	52	21	0	822
Redear Sunfish	<i>Lepomis microlophus</i>	0	8	0	0	0	1	9	8	2	1	0	0	29
Pumpkinseed	<i>Lepomis gibbosus</i>	0	0	1	0	0	0	0	0	0	0	0	0	1
Green Sunfish	<i>Lepomis cyanellus</i>	0	2	5	0	0	19	2	10	15	9	4	1	67
Black Crappie	<i>Pomoxis nigromaculatus</i>	1	0	1	1	1	0	1	1	7	1	21	0	35
Largemouth Bass	<i>Micropterus salmoides</i>	2	1	4	3	0	0	1	1	2	47	3	0	64
Western Mosquitofish	<i>Gambusia affinis</i>	1	0	2	3	1	1	0	4	1	2	3	1	19
Wakasagi	<i>Hypomesus nipponensis</i>	0	9	0	0	0	0	0	0	0	1	0	0	10
Threadfin Shad	<i>Dorosoma petenense</i>	0	2	3	1	0	0	0	4	0	0	0	0	10
American Shad	<i>Alosa sapidissima</i>	0	0	0	0	0	0	0	0	6	6	1	0	13
Mississippi Silverside	<i>Menidia beryllina</i>	0	12	1	0	0	0	0	14	11	0	8	0	46
Fathead Minnow	<i>Pimephales promelas</i>	2	4	20	0	2	2	12	11	74	189	43	6	365
Common Carp	<i>Cyprinus carpio</i>	1	0	0	0	0	0	0	0	0	0	0	0	1
Golden Shiner	<i>Notemigonus crysoleucas</i>	1	11	18	1	22	2	14	6	27	58	28	0	188
White Catfish	<i>Ameiurus catus</i>	0	1	0	1	0	0	0	0	0	0	0	0	2
Brown Bullhead	<i>Ameiurus nebulosus</i>	2	3	3	3	0	2	0	3	3	0	0	0	19
Channel Catfish	<i>Ictalurus punctatus</i>	1	0	0	0	0	0	0	0	0	0	0	0	1
Striped Bass	<i>Morone saxatilis</i>	3	2	0	1	0	0	0	8	3	2	1	0	20

Non-Fish Taxa

Bullfrog	<i>Lithobates catesbeiana</i>													
Larvae		500	1,401	632	111	54	255	368	560	1,457	832	61	12	6243
Adult		1	2	5	2	0	1	9	9	3	7	1	0	40
Pacific Chorus Frog (Larvae)	<i>Pseudacris regilla</i>	0	32	0	0	0	0	0	0	0	0	0	0	32
California Toad (Adult)	<i>Anaxyrus boreas</i>	0	0	0	0	0	0	0	6	11	21	3	0	41
Signal Crayfish	<i>Pacifastacus leniusculus</i>	3	103	79	128	123	307	41	64	44	129	47	3	1071
Red Swamp Crayfish	<i>Procambarus clarkii</i>	40	233	78	46	13	103	25	151	40	283	9	4	1025
Red-eared Slider Turtle	<i>Trachemys scripta elegans</i>	0	3	1	1	1	0	1	17	1	6	6	0	37
Western Pond Turtle	<i>Actinemys marmorata</i>	2	1	1	1	1	1	2	4	2	3	4	0	22

Appendix B: Smolt Trap Processing Procedure

Species	Life Stage	Mark/ Recapture	Number per day	Processing Procedure	Release location
Steelhead	FRY ≤ 40mm	-	All	Count and release	Downstream
	PARR 40 - 130 mm	-	All	Count and release	Downstream
	SMOLT ≥ 130 mm	NEW	First 30	1. Anesthetize and record length / weight 2. Apply pelvic fin clip and record unique genetics ID # 3. Insert PIT tag and record tag #	Upstream (Mon-Fri) Downstream (Sat, Sun)
			31+	Count and release	Downstream
		RECAP	All	1. Do not anesthetize 2. Scan for PIT tag and record tag # if detected 3. Record fin clip location, life stage, and notes on condition	Downstream
ADULT ≥ 300mm	-	All	1. Do not anesthetize 2. Scan for PIT tag and record tag # if detected 3. Record sex, estimated length, and any fin clips observed 4. Collect caudal fin clip and record unique genetics ID # 5. Take pictures of fish while holding in water	Downstream	
Chinook	FRY ≤ 40mm	-	All	Count and release	Downstream
	PARR / SMOLT ≥ 40 mm	NEW	First 20	1. Anesthetize and record length / weight 2. Apply upper caudal fin clip and record pooled genetics ID #	Upstream (Mon-Fri) Downstream (Sat, Sun)
			21+	Count and release	Downstream
		RECAP	All	Count and release	Downstream
River Lamprey	Adult	-	All	1. Anesthetize and record total length, sex, and maturity 2. Take photo on measuring tray	Downstream
Pacific Lamprey	Adult	-	All	Record maturity, sex, and notes on condition	Downstream
All other species	All	-	All	Count and release	Downstream