

Napa River Steelhead and Salmon Monitoring Program 2018-19 Report



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Prepared by

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Executive Summary

2019 represented the 11th consecutive year of steelhead and salmon out-migrant monitoring using a rotary screw trap in the Napa River. The trap was in operation for 59 days; 33 potential sampling days between March 1 and May 31 were missed due to high flows. A total of 1,527 fish were captured, including 11 native and 10 non-native species. Native species comprised 91.3% of the total catch (n=1,394) and non-native fishes accounted for 8.7 % (n=133).

A total of 110 steelhead smolts were captured, equating to a catch rate of 1.9 fish per sampling day, which was similar to last year and slightly above the program's 11-year average. The higher numbers of steelhead captured in 2018 and 2019 suggest a modest population rebound from the severe drought conditions of 2013-2016. The median steelhead smolt length was 193 millimeters (7.6 inches), which was slightly greater than the previous 10-year average of 188 millimeters (7.4 inches). The average steelhead smolt size has remained relatively large and stable during the past 11 years, despite considerable variation in environmental conditions within that same period.

A total of 89 Chinook parr/smolts were captured, equating to a catch rate of 1.5 fish per sampling day, which was the lowest in the past four years. Chinook catch rates have exhibited a high degree of variability over the past 11 years, ranging from 0 - 101.5 smolts captured per sampling day. This suggests that the Napa River does not support a viable self-sustaining Chinook population, but some successful spawning has occurred in most years. 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 99 steelhead smolts were PIT tagged in 2019. During the past seven years (2013 - 2019) 522 steelhead smolts have been tagged. Of that total, four have been re-detected in subsequent years by the Napa River PIT tag antenna; two in 2018 and two in 2019. These tagging data represent the first known confirmation of steelhead returning to the Napa River.

A total of four Chinook salmon spawner surveys were completed between December 3, 2018 and January 4, 2019, covering approximately 22.9 kilometers (14.2 miles) of the mainstem Napa River between Zinfandel Lane and Oak Knoll Avenue. One live salmon, one salmon carcass, and 3 salmon redds 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 2019 (**Figure 1**). This represents the 11th 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 selected based on accessibility, landowner cooperation, and its location just above the extent 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

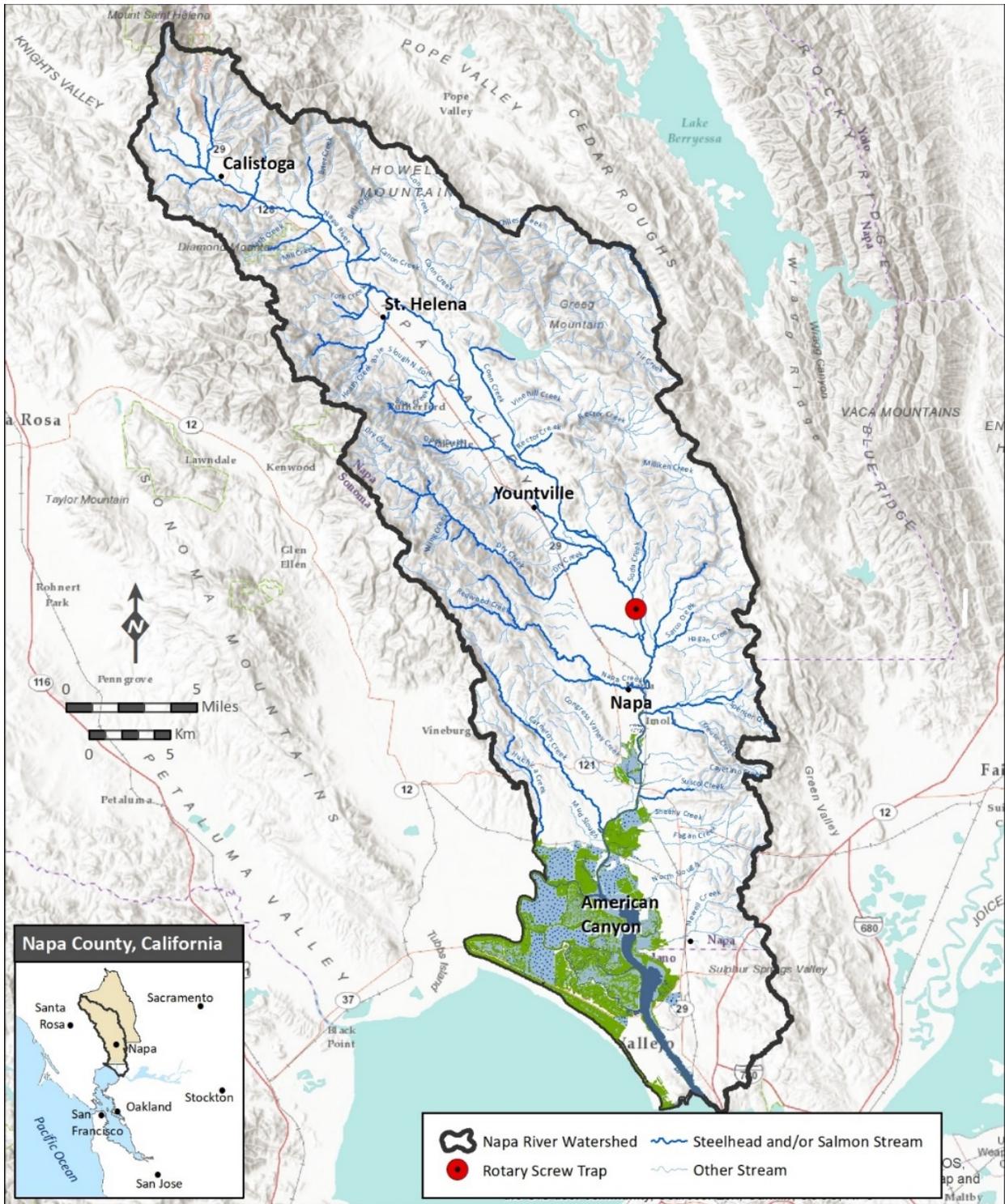


Figure 2. Napa River rotary screw trap location.

A hydrograph for water year 2018-19 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 high flow conditions in early March, we were not able to install and begin operating the trap until March 18. Several subsequent storms then occurred once the trap was installed, requiring temporary stoppages for several days at a time. A total of 33 potential sampling days were missed within the target period of March 1 - June 1 due to high flow conditions.

The RST was in operation for a total of 59 days between March 1 and May 31, 2019 (**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 outlined in Appendix B. During high-flow conditions, the trap was cleaned of debris multiple times per day to reduce the risk of injury or mortality to captured fish.

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.

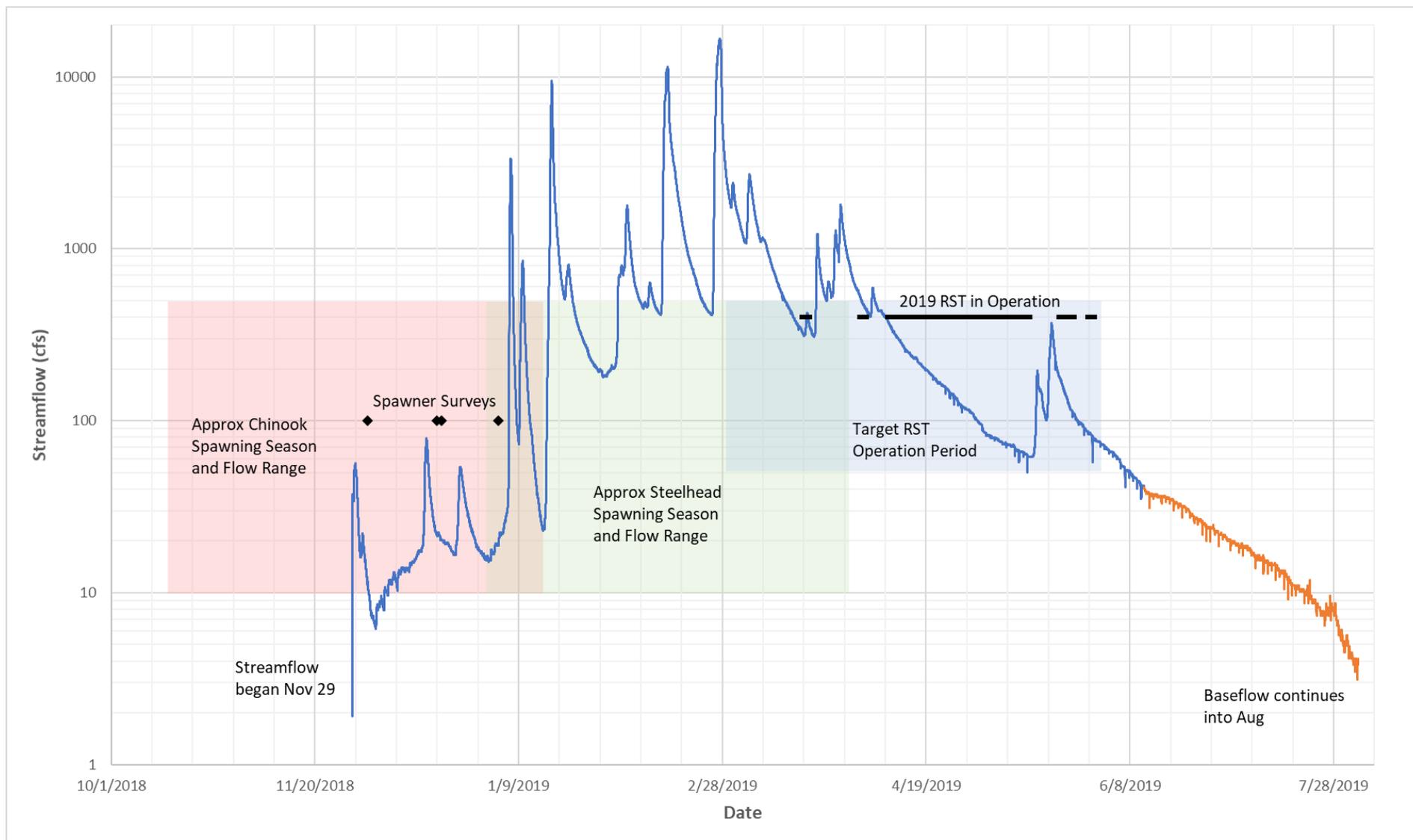


Figure 3. 2018-19 hydrograph for USGS streamgaging station 11458000 Napa River near Napa, California, showing storm timing and field work. The blue line represents “approved” data, and the orange line represents “provisional” data at time of reporting.

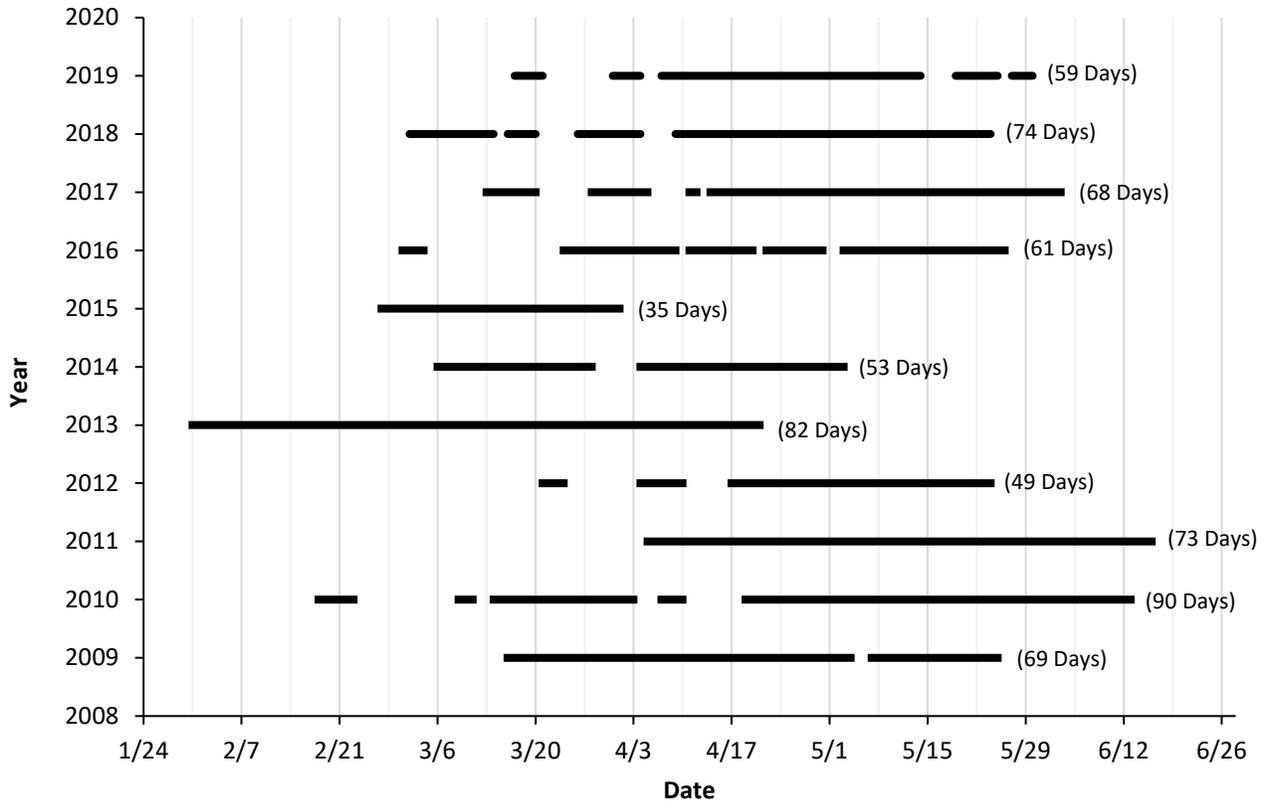


Figure 4. Dates of operation for the Napa River rotary screw trap from 2009-2019. Note: the total number of sampling days per year is shown in parentheses. Gaps within each sampling year represent periods when the trap was not operated due to high flows or other factors.

Results and Discussion

During the spring 2019 season, a total of 1,527 fish were captured in the RST, including 11 native and 10 non-native species (**Figure 5**). Native species comprised 91.3% of the total catch (n=1,394) and non-native fishes accounted for 8.7 % (n=133). 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 2009-2019.

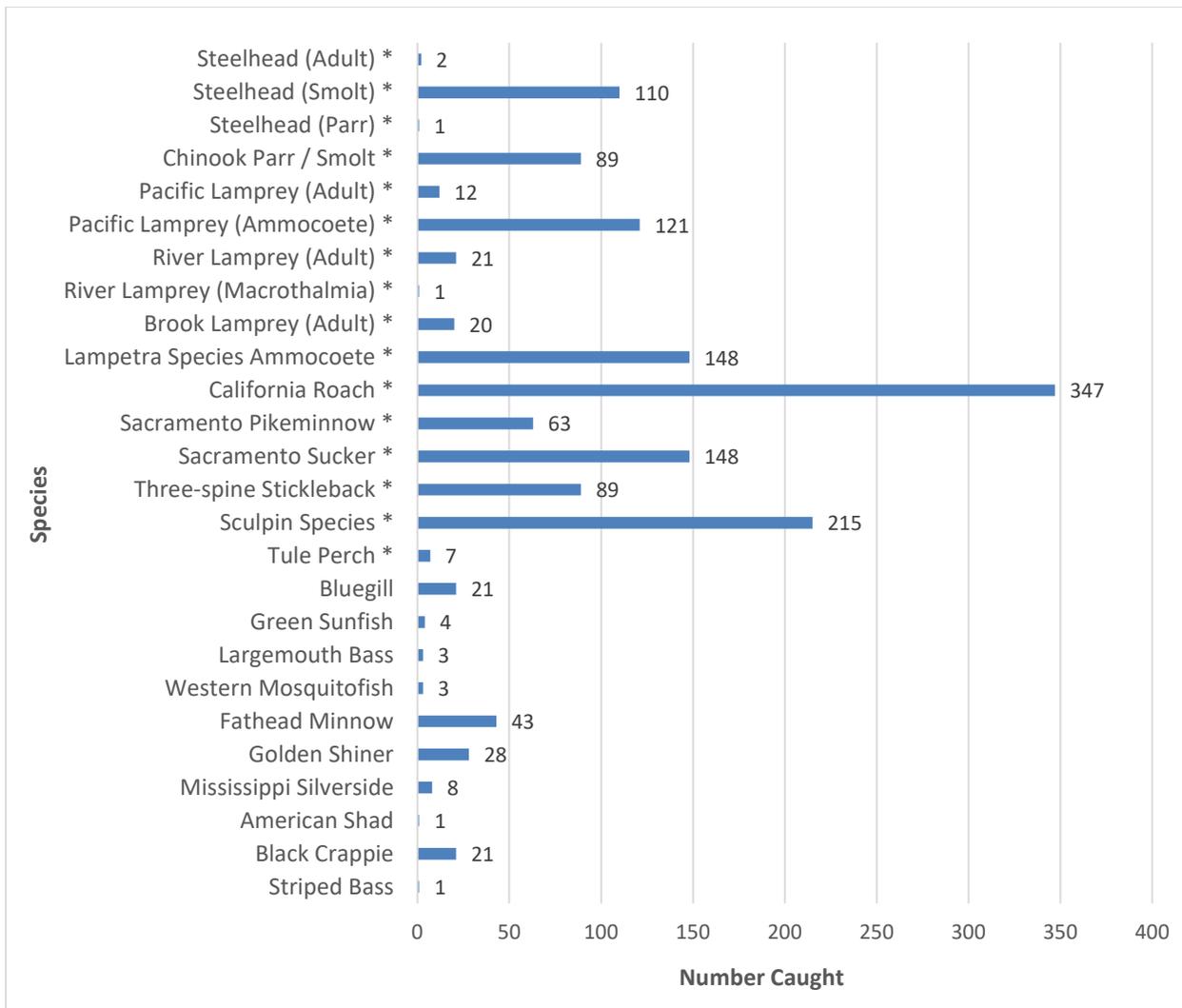


Figure 5. 2019 RST season catch totals, excluding larval specimens.

*Native species

Steelhead and Salmon Smolt Catch

A total of 110 steelhead smolts, 2 adults, 1 parr, and no fry were captured in 2019. The 2019 steelhead smolt CPUE was 1.9 fish per sampling day, which was approximately the same as the previous year and slightly above the 11-year average CPUE of 1.6 (**Figure 6**). Historically, steelhead CPUE exhibited a stable or slightly increasing trend from 2009 to 2012, followed by notably lower catch rates in 2013-2017. The increased catch rates observed in 2018 and 2019 suggest a modest population rebound from the severe drought conditions of 2013-2016.

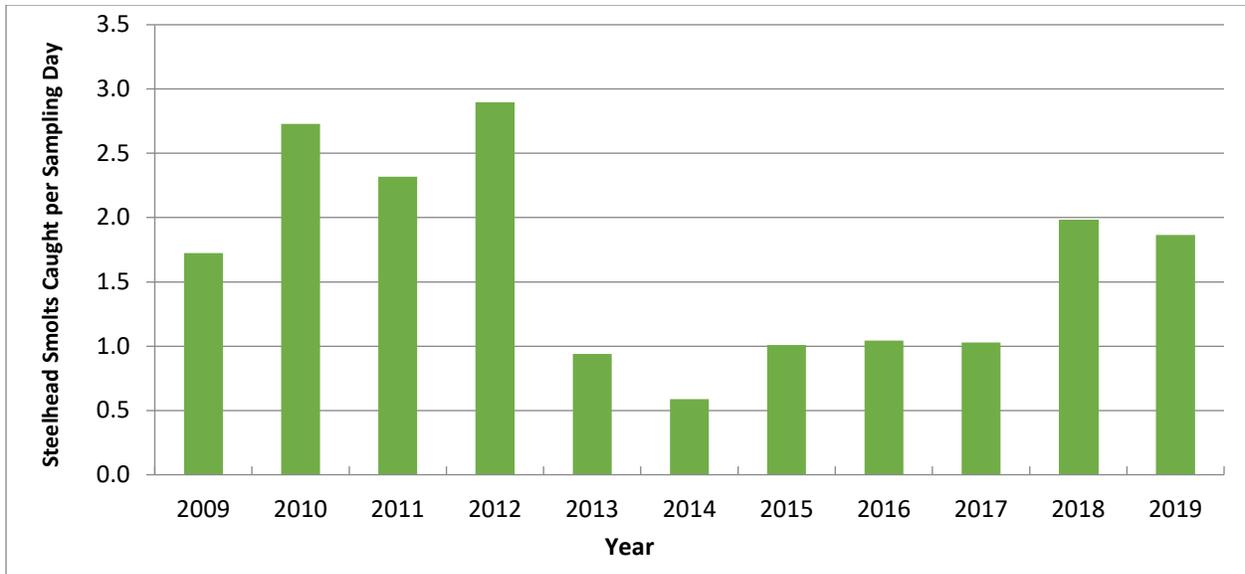


Figure 6. Steelhead smolt catch rates (CPUE) 2009-2019.

A total of 89 Chinook parr/smolts and 0 fry were captured in 2019. The 2019 Chinook smolt catch declined sharply from the previous two years, with a CPUE of 1.5 (Figure 7). Chinook salmon CPUE has exhibited a high degree of variability over the past 11 years, ranging from 0 - 101.5 smolts captured per sampling day. This suggests that the Napa River does not support a viable self-sustaining Chinook population, but some successful spawning has occurred in most years. 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.

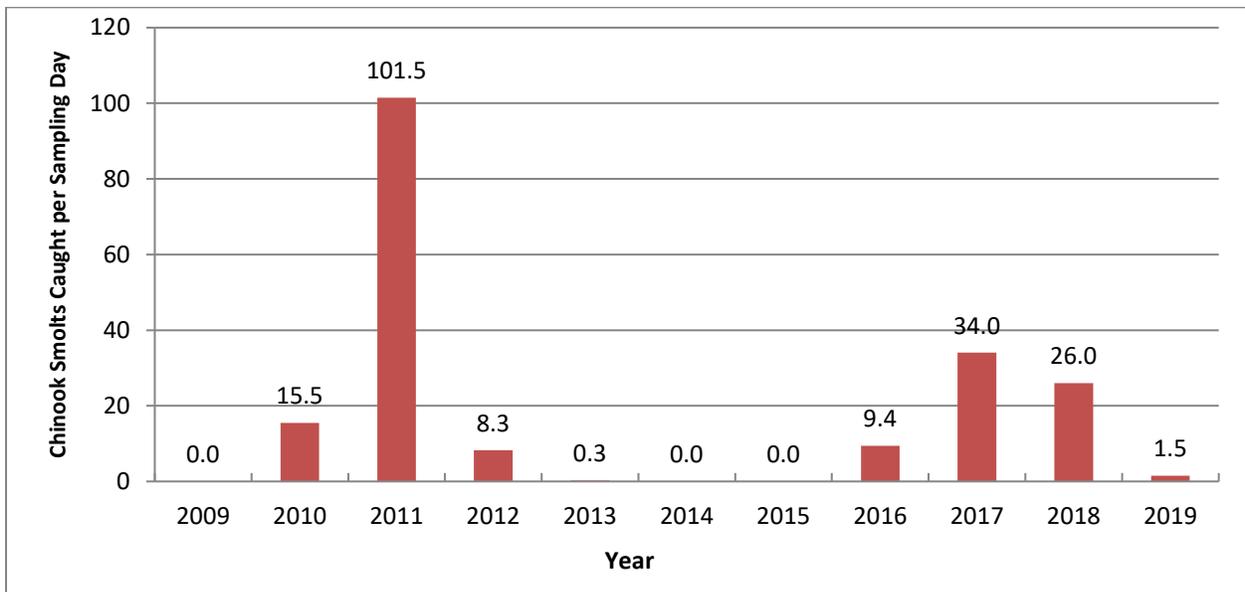


Figure 7. Chinook salmon smolt catch rates (CPUE) 2009-2019.

Steelhead Smolt Size

The median steelhead smolt fork length in 2019 was 193 millimeters (7.6 inches), which was slightly greater than the previous 10-year average of 188 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 8**).

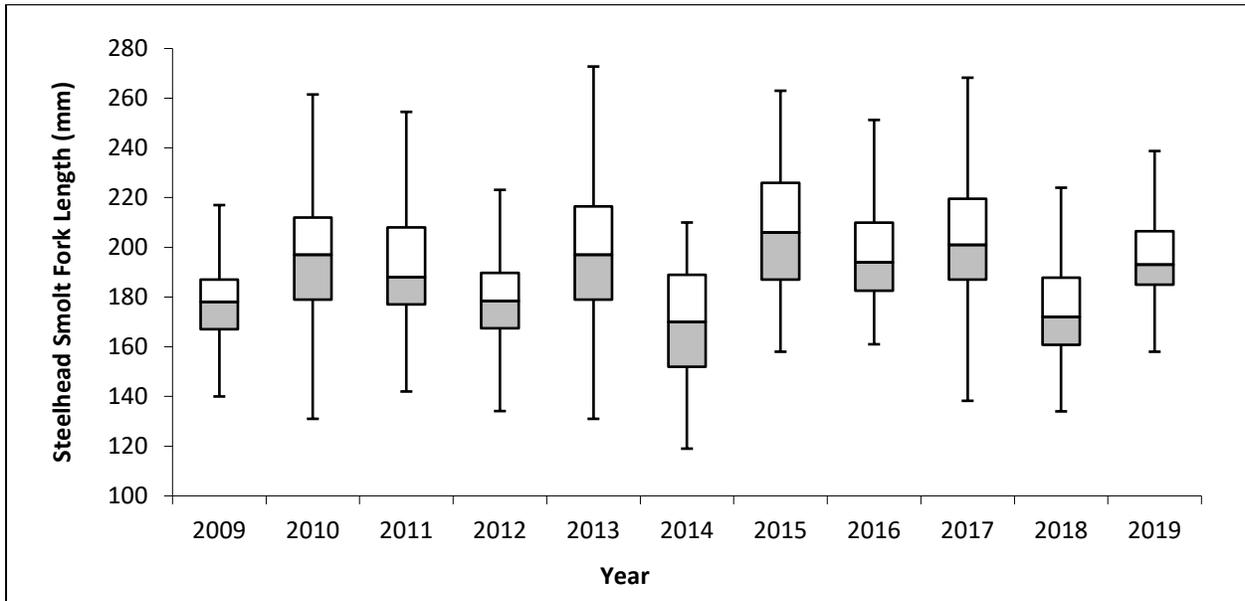


Figure 8. Steelhead smolt fork lengths from the Napa River rotary screw trap 2009-2019. The bottom and top of each box are the 25th and 75th percentiles respectively. The line near the middle of each box is the median, and the vertical lines (whiskers) represent the lowest and highest values within 1.5 times the inter-quartile range.

Trapping Efficiency

During the 2019 season, a total of 81 steelhead smolts and 56 Chinook salmon smolts were marked and released upstream to generate trapping efficiency estimates (**Table 1**). Of these marked fish, 9 steelhead and 30 Chinook were recaptured, yielding season-long trap efficiency estimates of 11% for steelhead and 54% for Chinook (**Figure 9**). The average trapping efficiency during the previous 9-year period was 13% for steelhead and approximately 25% for Chinook.

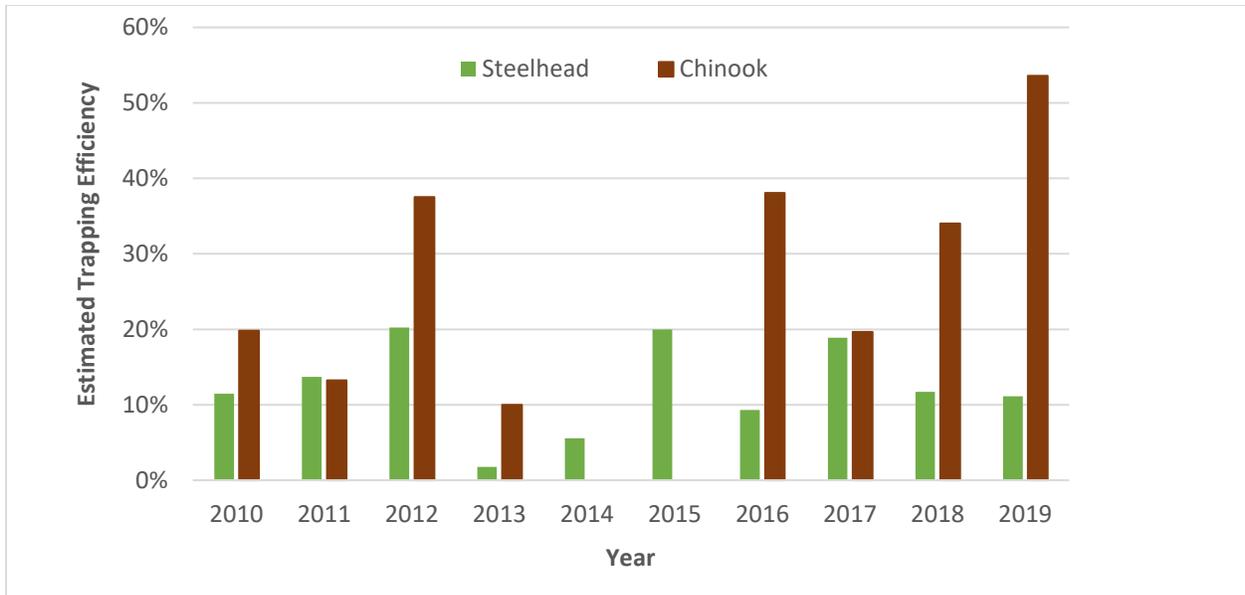


Figure 9. Rotary screw trap season-long trapping efficiency estimates for steelhead and Chinook salmon smolts 2010-2019. Note: efficiency releases were not conducted for the 2009 season.

Table 1. Total number of smolts captured, released upstream, and recaptured by the rotary screw trap 2010-2019. Note: efficiency releases were not conducted for the 2009 season.

Year	Steelhead				Chinook			
	Total smolts captured	Marked smolts released upstream	Smolts recaptured	Trapping efficiency estimate	Total smolts captured	Marked smolts released upstream	Smolts recaptured	Trapping efficiency estimate
2010	242	201	23	11%	1,371	702	139	20%
2011	166	95	13	14%	7,265	914	121	13%
2012	142	84	17	20%	406	272	102	38%
2013	77	56	1	2%	19	10	1	10%
2014	31	18	1	6%	0	0	0	-
2015	34	25	5	20%	0	0	0	-
2016	64	43	4	9%	580	289	110	38%
2017	70	53	10	19%	2,315	575	113	20%
2018	147	111	13	12%	1,922	623	216	34%
2019	110	81	9	12%	89	56	30	54%

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 from January 23 - July 12, 2019 (**Figure 10**). The antennas were powered by solar-charged batteries and remained in good operating condition continuously throughout the 2019 season.



Figure 10. Paired PIT tag antenna loops in the Napa River.

Results and Discussion

During the 2019 out-migrant trapping season, 99 steelhead smolts received PIT tags. During the past seven years (2013 - 2019) RCD has tagged a total of 522 steelhead smolts (**Figure 11**). Of that total, four have been re-detected in subsequent years by the Napa River PIT tag antenna; two in 2018 and two in 2019. These tagging data represent the first known confirmation of steelhead returning to the Napa River, although none of these fish were physically recaptured. **Table 2** provides tagging and return details on these four steelhead.

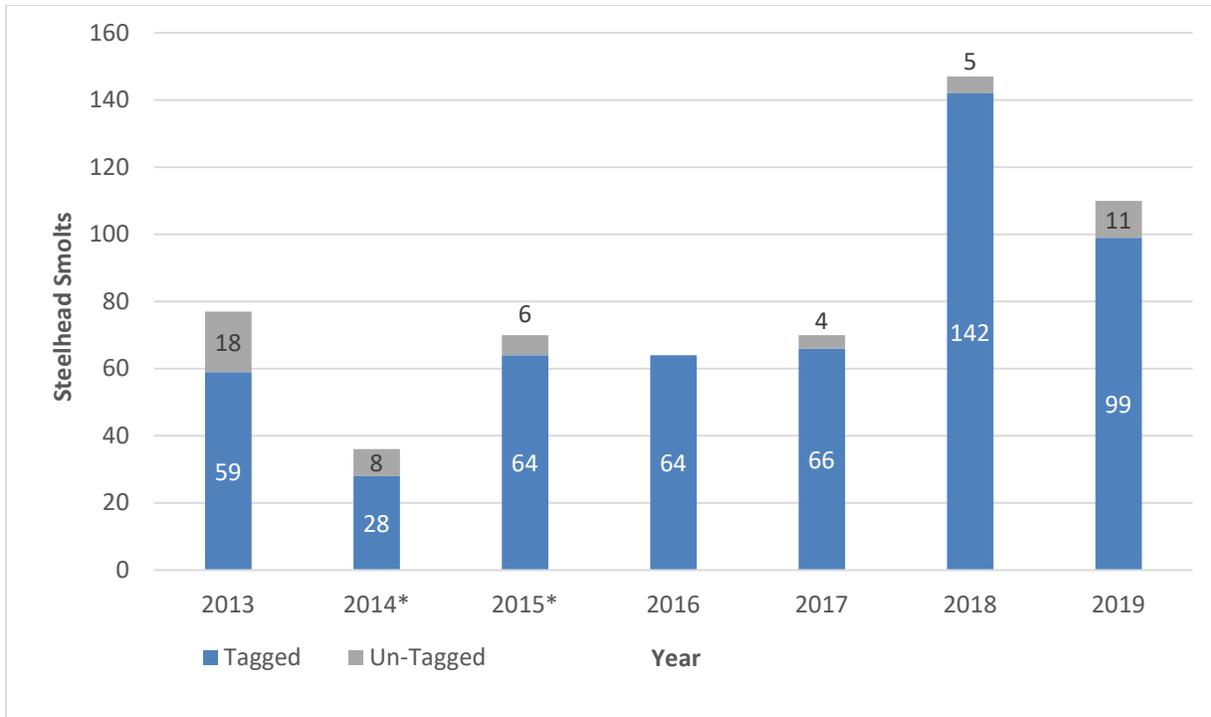


Figure 11. Number of PIT tagged steelhead smolts relative to the total catch 2013-2019.

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

Table 2. PIT tagged steelhead re-detected by the Napa River PIT tag antenna in subsequent years.

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

Spawner Surveys

Methods

Spawner surveys were conducted in fall 2019 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 using a field tablet computer:

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 four spawner surveys were completed between December 3, 2018 and January 4, 2019, covering approximately 22.9 kilometers (14.2 miles) of the mainstem Napa River between Zinfandel Lane and Oak Knoll Avenue (**Figure 12**). A total of one live salmon, one salmon carcass, and 3 salmon redds was found (**Table 3**). The carcass was comprised of a partial skin and tail only, so neither the head nor the otoliths could be collected; however, a tissue sample was collected for genetic analysis.

Table 3. 2018-19 Chinook salmon spawner survey details and results.

Date	December 3, 2018	December 20, 2018	December 21, 2018	January 4, 2019
Stream	Napa River	Napa River	Napa River	Napa River
Flow (cfs)	9	14	21	23
Flow source	USGS (Oak Knoll)	USGS (Pope St.)	USGS (Oak Knoll)	USGS (Oak Knoll)
Survey Extent	Oak Knoll Ave. Br. to Rotary Screw Trap site	Zinfandel Ln. Br. to Oakville X-Rd. Br.	Oakville X-Rd. Br. to Cooks Rd. Br.	Yountville Eco-Reserve to Oak Knoll Ave. Br.
Survey Length (mi)	2.3	4.7	2.2	5.1
Survey Length (km)	3.7	7.5	3.5	8.3
Live Chinook	0	1	0	0
Chinook carcasses	0	1	0	0
Redds	0	0	0	3

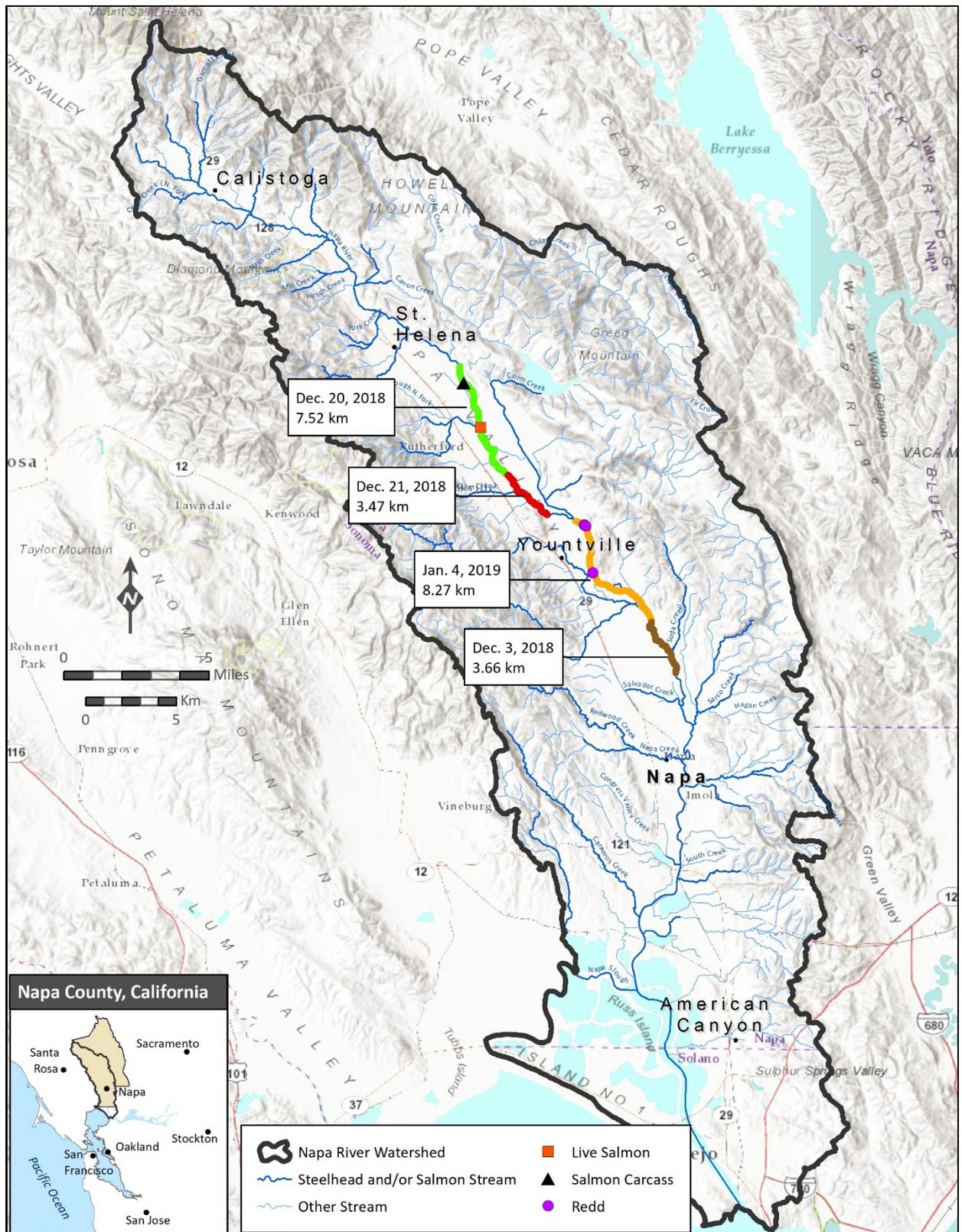


Figure 12. 2018-19 spawner survey reaches.

Anticipated Monitoring in 2019-20

At time of reporting, the RCD does not have funding secured to continue monitoring in 2019-20; however, we and our partners have submitted grant applications to continue the program. Additionally, monetary support from local non-profit organizations and groups is expected to allow for continued operation of the rotary screw trap at a minimum.

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 2009-2019

Appendix B: Smolt Trap Processing Procedure

Appendix A: Rotary Screw Trap Season Totals 2009-2019

Native Fishes

Common Name	Scientific Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Steelhead / Rainbow trout	<i>Oncorhynchus mykiss</i>												
Fry / Parr (<130 mm)		941	94	7	152	3,025	303	35	11	6	32	1	4,607
Smolt (>130mm)		119	251	175	160	77	31	34	64	70	147	110	1,238
Adult or Resident (>300 mm)		0	3	4	0	3	0	0	3	6	3	2	24
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>												
Parr / Smolt		1	1,520	7,377	488	19	0	0	580	2,315	1,922	89	14,311
Kokanee/ Sockeye Salmon	<i>Oncorhynchus nerka</i>												
Parr / Smolt		0	342	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	384
Macrothalmia ^{1,2}		-	-	-	-	1	0	0	3	0	7,203	0	7,207
Ammocete ¹		-	-	-	9	4	7	30	54	45	314	121	584
River Lamprey	<i>Lampetra ayresi</i>												
Adult ¹		-	2	21	9	3	0	0	86	46	1	21	189
Macrothalmia ¹		-	-	-	-	15	0	0	1	0	5	1	22
Brook Lamprey (Adult¹)	<i>Lampetra richardsoni</i>	-	0	64	7	174	120	87	77	38	63	20	650
Lampetra Sp. Ammocete¹	<i>Lampetra sp.</i>	-	-	-	19	108	46	40	136	70	74	148	641
Sacramento Splittail	<i>Pogonichthys macrolepidotus</i>	2	6	0	1	26	0	6	0	6	39	0	86
Hardhead	<i>Mylopharodon conocephalus</i>	0	0	1	0	0	1	1	0	0	0	0	3
Sacramento Pikeminnow	<i>Ptychocheilus grandis</i>	28	87	192	191	33	12	4	27	200	512	63	1,349
California Roach²	<i>Hesperoleucus symmetricus</i>	4,744	3,571	336	330	498	691	253	548	249	260	347	11,827
Sacramento Sucker	<i>Catostomus occidentalis</i>	82	419	207	33	78	42	61	166	284	1,060	148	2,580
Tule Perch	<i>Hysterocephalus traski</i>	6	28	30	20	17	8	6	78	51	27	7	278
Sculpin sp.	<i>Cottus sp.</i>	242	124	62	66	329	184	20	51	53	84	215	1,430
Three-spine Stickleback	<i>Gasterosteus aculeatus</i>	116	76	273	50	34	37	14	3,329	465	78	89	4,561

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	Total
Bluegill	<i>Lepomis macrochirus</i>	29	100	86	41	11	107	24	221	130	52	21	822
Redear Sunfish	<i>Lepomis microlophus</i>	0	8	0	0	0	1	9	8	2	1	0	29
Pumpkinseed	<i>Lepomis gibbosus</i>	0	0	1	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	66
Black Crappie	<i>Pomoxis nigromaculatus</i>	1	0	1	1	1	0	1	1	7	1	21	35
Largemouth Bass	<i>Micropterus salmoides</i>	2	1	4	3	0	0	1	1	2	47	3	64
Western Mosquitofish	<i>Gambusia affinis</i>	1	0	2	3	1	1	0	4	1	2	3	18
Wakasagi	<i>Hypomesus nipponensis</i>	0	9	0	0	0	0	0	0	0	1	0	10
Threadfin Shad	<i>Dorosoma petenense</i>	0	2	3	1	0	0	0	4	0	0	0	10
American Shad	<i>Alosa sapidissima</i>	0	0	0	0	0	0	0	0	6	6	1	13
Mississippi Silverside	<i>Menidia beryllina</i>	0	12	1	0	0	0	0	14	11	0	8	46
Fathead Minnow	<i>Pimephales promelas</i>	2	4	20	0	2	2	12	11	74	189	43	359
Common Carp	<i>Cyprinus carpio</i>	1	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	188
White Catfish	<i>Ameiurus catus</i>	0	1	0	1	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	19
Channel Catfish	<i>Ictalurus punctatus</i>	1	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	20

Non-Fish Taxa

Bullfrog	<i>Lithobates catesbeiana</i>												
Larvae		500	1,401	632	111	54	255	368	560	1,457	832	61	6231
Adult		1	2	5	2	0	1	9	9	3	7	1	40
Pacific Chorus Frog (Larvae)	<i>Pseudacris regilla</i>	0	32	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	41
Signal Crayfish	<i>Pacifastacus leniusculus</i>	3	103	79	128	123	307	41	64	44	129	47	1068
Red Swamp Crayfish	<i>Procambarus clarkii</i>	40	233	78	46	13	103	25	151	40	283	9	1021
Red-eared Slider Turtle	<i>Trachemys scripta elegans</i>	0	3	1	1	1	0	1	17	1	6	6	37
Western Pond Turtle	<i>Actinemys marmorata</i>	2	1	1	1	1	1	2	4	2	3	4	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