SRSP Science Webinar – Sacramento River Fish Trends
March 14, 2025

Winter-run Chinook Salmon in the Upper Sacramento River in 2024

Carcass and Redd Surveys
Methods, Analysis, and Results

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Winter-run Chinook past and present

- Originally existed only in the Sacramento River system that included the Little Sacramento, Fall, Pit and McCloud Rivers and Battle Creek.
- Require cold, clean fresh water over the summer months.
- Only exist in this area….no where else in world... genetically unique
- Livingston Stone was a federal biologist who developed the Baird Hatchery on the McCloud River and eggs from this hatchery were sent around the world.
- Currently only occur in the Sacramento River watershed below Keswick Dam. Shasta Dam blocks all access to winter-run habitat upstream. Winter-run spawners downstream of Keswick first noted in May of 1945 after completion of dam. Cool tailrace water substituted for headwater springs transferring habitat upstream of Shasta to the Redding area.
- Listed as Endangered in 1989 as drought, pollution, water diversions, and fishing pressure impacted their survival.

Big 8-Page Special: Where and How to Camp

MARCH 1970 50¢

Outdoor Life

March for the Kings
'New' Salmon Run

Raccoons Go West

Chug Up Lake Trout
Ice-Fishing Boom

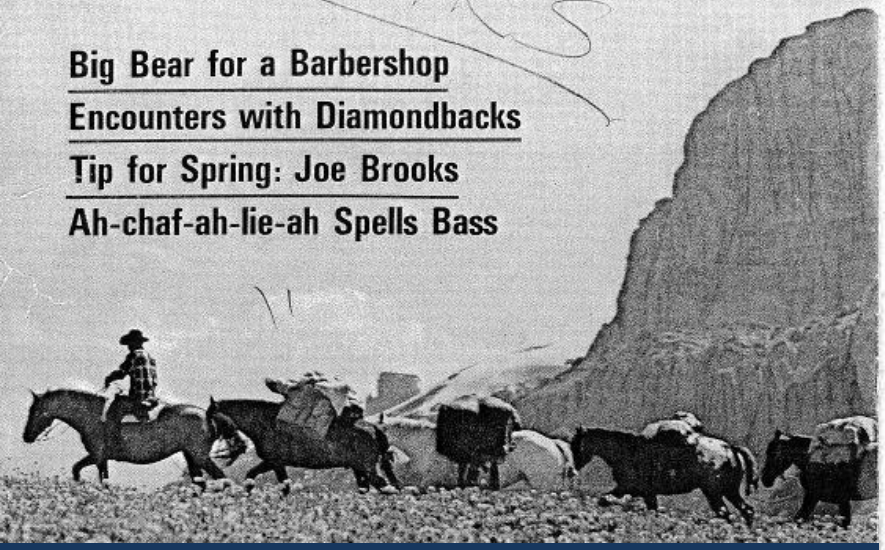
The Turkey Madness

Big Bear for a Barbershop

Encounters with Diamondbacks

Tip for Spring: Joe Brooks

Ah-chaf-ah-lie-ah Spells Bass



Walt Kauk grimaces as he nets John Reginato's king in replay, for camera, of action we got on upper Sacramento River, California

A key to success: plug sweetened with sardine

March with The Kings

By MIKE HAYDEN

Nobody is sure how this winter run started or why it's growing. But anchor-fishermen love these royal salmon

WITH COLD, numb fingers I flipped open the bail on my spinning reel and made my first cast from Walter Kauk's outboard-powered runabout. My lure was a large banana-shaped plug baited with a sliver of fresh sardine.

I remained on my feet long enough to watch the silver plug rocket a short distance through drifting tendrils of morning mist before it plunged and vanished in a glassy slick downstream. Then I planted myself in the stern beside John Reginato and gratefully accepted a cup of hot coffee from Walter Kauk, who sat up front at the wheel.

As I turned to take the steaming cup with my right hand, the cork butt of my seven-foot glass rod suddenly sprang skyward and threatened to catapult from the grasp of my left hand. For an instant I froze, caught with my arms crossed awkwardly. Then, in one uninterrupted motion,

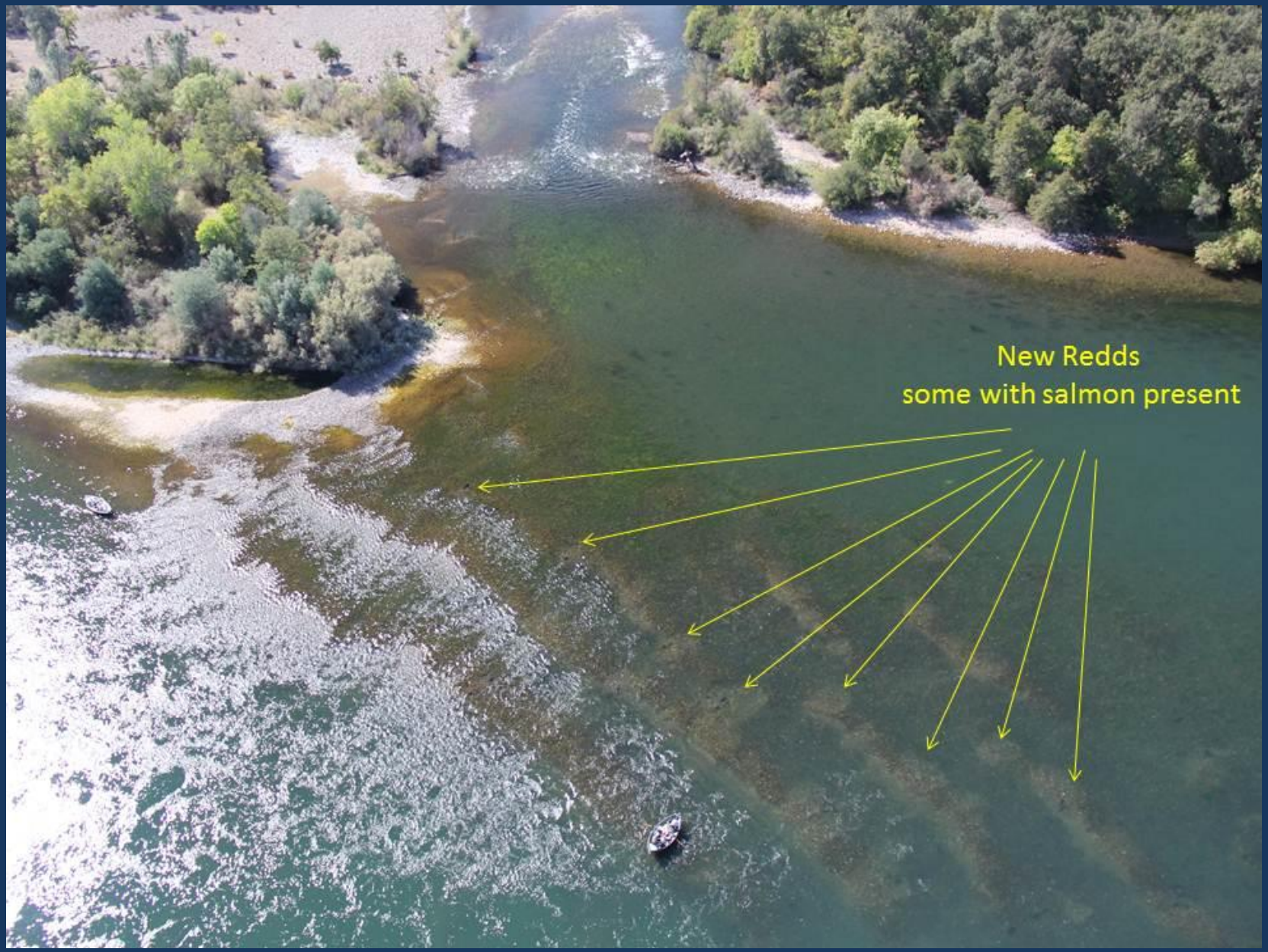
Mt. Shasta forms backdrop in this view of anchor-fishermen at Ball's Ferry

Monitoring of Winter-run: Adults

- No long-term monitoring prior to the 40 years of the Red Bluff Diversion Dam (RBDD) 1967-2008.
- Balls Ferry Weir (1940's) lasted only 3 years.
- **Carcass surveys begin in 1990's and become "official" for winter-run in 2001.**

- CURENT YEARS: 2003-2025
  - Boat based carcass surveys begin in late April and run into September.
  - Helicopter surveys to count salmon redds occur weekly- May to August.
  - Keswick trap removes adults for LSNFH from February through June.
  - Redd dewatering monitoring begins in June and goes into November- began 2013.
  - Colusa Basin Drain monitoring now regularly occurs on salmon straying into irrigation canals

Aerial Redd Survey: Used to determine the timing and extent of spawning in the river. The proportion of redds outside the carcass survey (if any) is used to expand the carcass survey numbers. Redd location and timing also inform water temperature management actions.



Winter-Run Aerial Redd and other data available to public in Excel spreadsheets at CALFISH.org

Year 2024 Aerial Redd Counts (New redds only)

NUMBER OF NEW REDDS VIEWED BY AERIAL OBSERVATIONS

DATE	5/6/2024	5/20/2024	6/4/2024	6/13/2024	6/26/2024	7/29/2024	8/5/2024	8/13/2024	8/28/2024	11/19/2024
Aircraft	helo	helo	helo	helo	helo	helo	helo	helo	helo	helo
Visibility	fair	good	good	excellent	fair	good	good	excellent	excellent	good
FLOW (noon) from Keswick (KWK)	6,301	6,302	9,018	9,899	12,565	13,254	12,657	12,115	10,023	3,953
Race	Winter	Winter	Winter	Winter	Winter	Winter	Winter	Winter	Winter	Fall
Keswick to A.C.I.D. Dam.	0	1	3	2	0	0	0	0	0	109
A.C.I.D. Dam to Highway 44 Bridge	0	2	1	1	4	4	0	3	0	40
Highway 44 Br. to Airport Rd. Br.	0	1	1	0	0	0	0	1	2	64
Airport Rd. Br. to Balls Ferry Br.	0	0	0	0	0	0	0	0	0	2
Balls Ferry Br. to Battle Creek.	0	0	0	0	0	0	0	0	0	0
Battle Creek to Jellys Ferry Br.	0	0	0	0	0	0	0	0	0	4
Jellys Ferry Br. to Bend Bridge	n/s	0	n/s	n/s	n/s	n/s	n/s	n/s	n/s	4
Bend Bridge to Red Bluff Diversion Dam	n/s	0	n/s	n/s	n/s	n/s	n/s	n/s	n/s	6
Red Bluff Diversion Dam to Tehama Br.	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	3
Tehama Br. To Woodson Bridge	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Woodson Bridge to Hamilton City Br.	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Hamilton City Bridge to Ord Ferry Br.	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Ord Ferry Br. To Princeton Ferry.	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
TOTALS	0	4	5	3	4	4	0	4	2	232
HELICOPTER HOUR ACCOUNTING-PSMFC only	1.2	1.8	0.9	1.1	1.2	1.2	1.3	1.2	1.2	
11.1						Note: no Helo available for one month period				no SR or e

2024	Late-Fall	% Dist	WINTER	% Dist.	SPRING	% Dist.	Fall	% Dist	ALL	% Dist.	
TOTALS											
Late-Fall-run redds in this box are from Early this year and Late in previous year.											
Keswick to A.C.I.D. Dam.	n/a	n/a	6	23.1%	n/a	n/a	109	47.0%	115	44.6%	Keswick to A.C.I.D. Dam.
A.C.I.D. Dam to Highway 44 Bridge	n/a	n/a	15	57.7%	n/a	n/a	40	17.2%	55	21.3%	A.C.I.D. Dam to Highway 44 Bridge
Highway 44 Br. to Airport Rd. Br.	n/a	n/a	5	19.2%	n/a	n/a	64	27.6%	69	26.7%	Highway 44 Br. to Airport Rd. Br.
Airport Rd. Br. to Balls Ferry Br.	n/a	n/a	0	0.0%	n/a	n/a	2	0.9%	2	0.8%	Airport Rd. Br. to Balls Ferry Br.
Balls Ferry Br. to Battle Creek.	n/a	n/a	0	0.0%	n/a	n/a	0	0.0%	0	0.0%	Balls Ferry Br. to Battle Creek.
Battle Creek to Jellys Ferry Br.	n/a	n/a	0	0.0%	n/a	n/a	4	1.7%	4	1.6%	Battle Creek to Jellys Ferry Br.
Jellys Ferry Br. to Bend Bridge	n/a	n/a	0	0.0%	n/a	n/a	4	1.7%	4	1.6%	Jellys Ferry Br. to Bend Bridge
Bend Bridge to Red Bluff Diversion Dam	n/a	n/a	0	0.0%	n/a	n/a	6	2.6%	6	2.3%	Bend Bridge to Red Bluff Diversion Dam
Red Bluff Diversion Dam to Tehama Br.	n/a	n/a	n/s	n/s	n/a	n/a	3	1.3%	3	1.2%	Red Bluff Diversion Dam to Tehama Br.
Tehama Br. To Woodson Bridge	n/a	n/a	n/s	n/s	n/a	n/a	n/a	n/a	n/a	n/s	Tehama Br. To Woodson Bridge
Woodson Bridge to Hamilton City Br.	n/a	n/a	n/s	n/s	n/a	n/a	n/a	n/a	n/a	n/s	Woodson Bridge to Hamilton City Br.
Hamilton City Bridge to Ord Ferry Br.	n/a	n/a	n/s	n/s	n/a	n/a	n/a	n/a	n/a	n/s	Hamilton City Bridge to Ord Ferry Br.
Ord Ferry Br. To Princeton Ferry.	n/a	n/a	n/s	n/s	n/a	n/a	n/a	n/a	n/a	n/s	Ord Ferry Br. To Princeton Ferry.
TOTALS	n/a	n/a	26	100.0%	n/a	n/a	232	100.0%	258	100.0%	

2024 CARCASS SURVEY CALCULATION	Within %	Downstream
Late fall carcass survey ended at Balls F	n/a	n/a
Winter run carcass survey end at Balls Ferry	100.0%	0.0%
Fall Run carcass survey ends at Balls Ferry	92.7%	7.3%

#Redds Above	# Redds Below	Split Above	Split Below
n/a	n/a	n/a	n/a
26	0	0	0
215	17	0	0

Split refers to the section the survey ended in
This data from raw data binders at Red Bluff
Redds is sum of sections without
need to divide section due to carcass survey
Downstream is below carcass survey area

2024 Summary of Aerial Redd Survey Data*

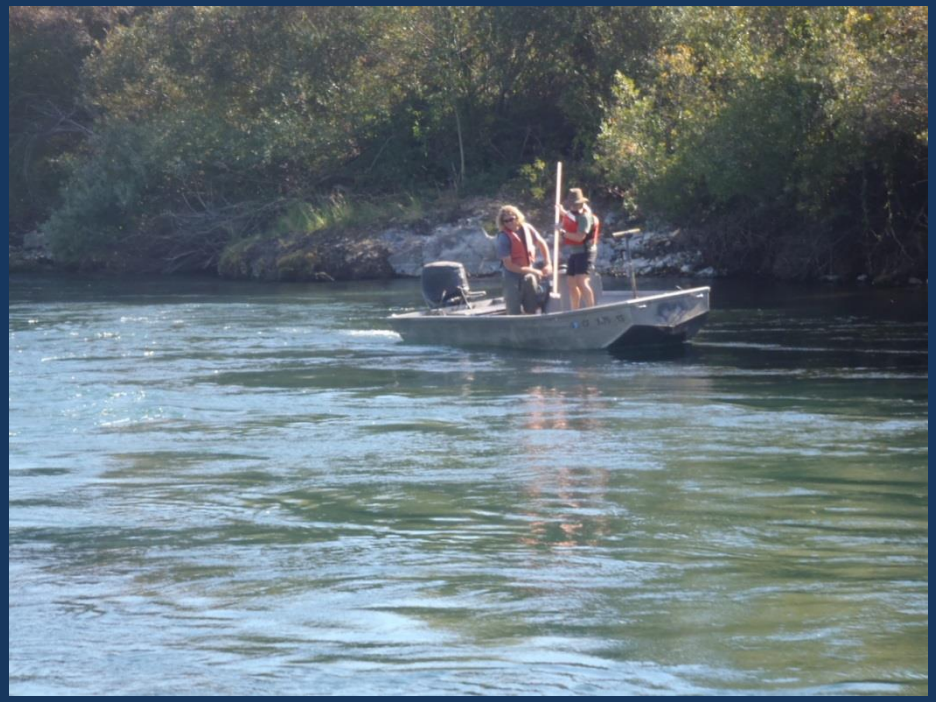
Late-Fall	% Dist.	Winter	% Dist.	Spring	% Dist.	Fall	% Dist	ALL	% Dist.	RIVER SECTIONS
n/a	n/a	6	23%	n/a	n/a	109	47%	115	45%	Keswick to A.C.I.D. Dam.
n/a	n/a	15	58%	n/a	n/a	40	17%	55	21%	A.C.I.D. Dam to Highway 44 Bridge
n/a	n/a	5	19%	n/a	n/a	64	28%	69	27%	Highway 44 Br. to Airport Rd. Br.
n/a	n/a	0	0%	n/a	n/a	2	1%	2	1%	Airport Rd. Br. to Balls Ferry Br.
n/a	n/a	0	0%	n/a	n/a	0	0%	0	0%	Balls Ferry Br. to Battle Creek.
n/a	n/a	0	0%	n/a	n/a	4	2%	4	2%	Battle Creek to Jellys Ferry Br.
n/a	n/a	0	0%	n/a	n/a	4	2%	4	2%	Jellys Ferry Br. to Bend Bridge
n/a	n/a	0	0%	n/a	n/a	6	3%	6	2%	Bend Bridge to RBDD
n/a	n/a	0	0%	n/a	n/a	3	1%	3	1%	RBDD to Tehama Br.
n/a	n/a	0	0%	n/a	n/a	n/a	n/a	n/a	n/s	Tehama Br. To Woodson Bridge
n/a	n/a	0	0%	n/a	n/a	n/a	n/a	n/a	n/s	Woodson Bridge to Hamilton City Br.
n/a	n/a	0	0%	n/a	n/a	n/a	n/a	n/a	n/s	Hamilton City Bridge to Ord Ferry Br.
n/a	n/a	0	0%	n/a	n/a	n/a	n/a	n/a	n/s	Ord Ferry Br. To Princeton Ferry.
n/a	**n/a**	**26**	**100%**	n/a	n/a	**232**	**100%**	**258**	**100%**	

* Summary of: 0 late-fall-run, 9 winter-run, 0 spring-run, and 1 fall-run Chinook Salmon redd counting flights.

In 2024, there were 26 winter-run redds observed over 9 helicopter flights

Carcass Surveys: are used to develop the annual population estimate for four runs of salmon each year in the Sacramento River. The winter-run survey occurs from late April to early September, using two boats, seven days per week. It is a collaborative effort between the CDFW, USFWS and PSMFC staff.

Crews spear salmon carcasses with long poles and collect samples and data from each fish and return many of them to the river with a numbered jaw tag. Subsequent recaptures of the tagged fish form the basis of the "mark-recapture" methodology used to estimate how many winter-run salmon were in the population. Other data is simultaneously collected on the carcasses such as sex, length, pre-spawn mortality, scales, otoliths, tissues, cwt tags, and other information as needed.



Carcass survey results create a female in-river estimate, additional information from LSNFH and aerial redd surveys are utilized to expand the carcass mark-recapture effort. Once combined, all sources of winter-run data are then used to characterize the population for various management and research needs.

TOTAL POPULATION ESTIMATE			ESTIMATE	Adjustments	
Cormack Jolly Seber Calculation for Females from R (CJS w.z.c.e)			392	392.0	See Image of R summary calculations imbedded in this file below for details:
Total FEMALES in-river after the Downstream Redd expansion			392	1.0000	No redds below carcass survey location. (26 redds observed during 13 WR surveys)
Number large Males (> 609 mm) in-river from Keswick Trap Data			457	1.1649	^ Based on the ratio of large WR males (>609) to total females at Keswick Trap: (N= 420, that includes 226 lg males to 194 females or 53.8% to 46.2%) vs. survey results fo
Number of small males (<609 mm) in-river from carcass survey data			176	0.3846	Based on number of total males to large males (>609 mm) from carcass survey fresh fish sample (65 total fresh: 25 small to 40 large or 38.5% to 61.5%). Includes no 0.555
Total MALES in-river adding in Jacks from Carcass survey data (Jills in			632		Sum of large and small males
Number of Fish Removed from Population by LSNFH			272	272	Updated10-29-24 USFWS Data from LSNFH Broodstock Collections 2024 = total of 732 WR: of these 460 RELEASED back into Sac. Leaving 272 REMOVED from Sac i
Final MAINSTEM Estimate is	1,296	=	1,296		This is expanded Mainstem Sacramento Spawner Escapement Estimate
Other Mainstem Winter-run Observed on other Survey Efforts (late fall, fall run,			1,296	0	0 WR carcasses found during LF carcass survey or in other creeks. This number will be updated by any WR determined to have spau
				64	DRAFT Battle Creek Jumpstart count as of 10-29-24 grandtab = 64 per RJ/jacie at USFWS. Note in 2024 the 6th year of adult Jumpstart Battle Creek WR, there were 17 tr

NOTE TABLES BELOW CONTAIN INFORMATION USED TO DETERMINE THE FINAL ESTIMATE: DO NOT MOVE OR DELETE

In-River totals	1,024	PERCENTS	In-River			PERCENT HATCHERY
Adult Females >2 yrs	325	31.8%	Total Adults	578	56.4%	OVERALL
Adult Males >2 yrs	253	24.7%	Total Grilse	446	43.6%	68.3%
Female Grilse-2yr Old	67	6.5%	[illegible]			
Male Grilse-1 and 2yr Old's	379	37.0%	[illegible]			
	1,024	100.0%	Note unmeasured fish originally measured as 0.5555 or 9999 for large and small purposes of mark recapture study may be included in Length Frequency proportions depending on final cut off chosen, but not in deciding cut off.			

Carcass Population Component Breakdown			Carcass Population Component Breakdown	HATCHERY FISH			NATURAL FISH			OVERALL		
Numbers from above	Fresh fish-clip value	Totals in-river clipped	CATEGORY	In-River	LSNFH	Total	In-River	LSNFH	Total	Total	%	
325	0.245	251	Number of Adult Females (>644 mm)	251	103	354	74	8	82	436	33.7%	Number of Adult Females (>644 mm)
253	0.113	116	Number of Adult Males (>714 mm)	116	78	194	137	5	142	336	25.9%	Number of Adult Males (>714 mm)
67	0.063	64	Number of Grilse Females (Jills)	64	20	84	2	0	2	87	6.7%	Number of Grilse Females (Jills <645 m
379	0.195	200	Number of Grilse Males (Jacks >300 and <715mm)	200	51	251	180	7	187	437	33.7%	Number of Grilse Males (Jacks) (from
1,024	See Data in Fresh Fish table [column Z-row 29]			631	252	883	393	20	413	1,296	100%	
Note the above and Breakdown Table is dependent on USFWS Hatchery annual			Note this Hatchery table does not include fish released without clips (see cell G:61)	631			393			1,296		

In 2024 there were an estimated 1,296 winter-run salmon in the Sacramento River

Following the creation of the annual population estimate the annual data is available in a summary table providing winter-run data for categories of interest for various users.

Winter-Run Chinook Salmon Data Table available for various categories for 1996-2024

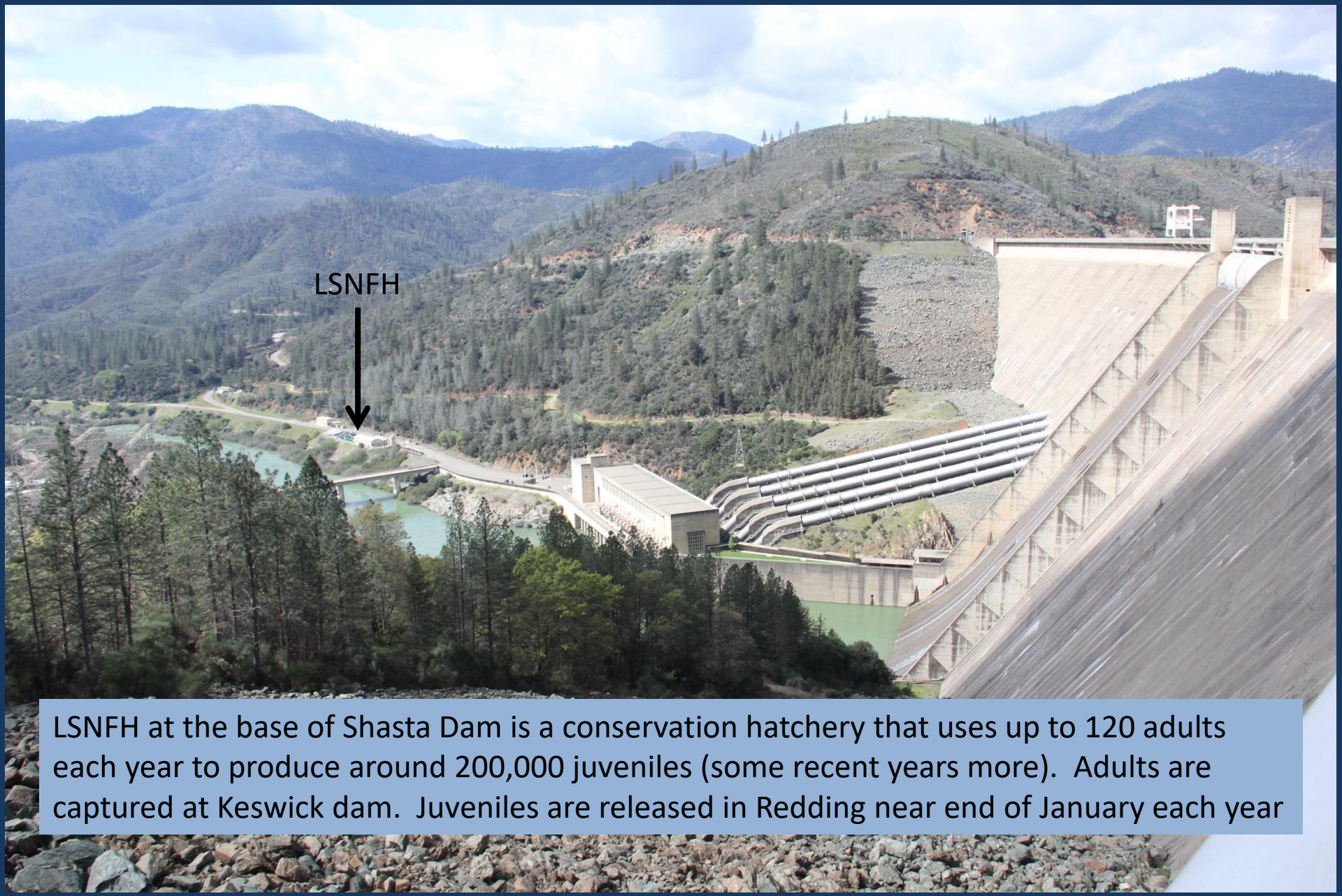
Category	Note*	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Official Total System Estimate	1	1,337	880	2,998	3,289	1,353	8,223	7,459	8,218	7,869	15,839	17,297	2,543	2,830	4,537	1,596	827	2,673	6,086	3,015	3,440	1,548	977	2,638	8,033	6,390	10,269	5,927	2,427	1,296
In-river spawner estimate	2	1,012	836	2,889	3,264	1,263	8,120	7,360	8,133	7,784	15,730	17,197	2,487	2,725	4,416	1,533	738	2,578	5,920	2,627	3,182	1,409	795	2,458	7,852	6,195	9,956	5,437	1,920	1,024
Into Hatchery (CNFH or LSNFH)	3	325	44	103	24	89	102	96	85	85	109	94	55	105	121	63	86	93	164	388	257	137	180	180	180	191	298	484	507	272
Other Winter-run (e.g. -Battle, LF survey)	4	237	226	6	1	1	1	3	0	0	0	6	1	0	0	0	3	2	2	0	1	2	2	0	1	4	15	6	0	0
Lower confidence interval (90%)	5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,449	5,343	2,741	3,042	329	109	2,235	7,213	5,958	9,280	5,009	2,084	1,022
Upper confidence interval (90%)	6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,894	6,732	3,290	3,836	2,763	1,888	3,029	8,852	6,821	11,258	6,889	2,767	1,571
Peterson standardized estimate	7	273	564	2,162	1,136	4,290	6,760	6,106	6,602	6,205	13,549	13,919	2,161	2,448	3,307	1,338	712	2,246	5,198	2,475	2,454	829	610	2,017	5,380	5,494	7,896	4,031	1,610	821
Reported Peterson estimate	8	820	2,053	5,501	2,262	6,670	11,502	10,541	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Jumpstart returns into Battle Creek (into Sac Riv)	9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	95 (0)	1038 (8)	240 (24)	109 (1)	55 (2)	64 (0)
RBDD estimate	10	1,337	880	2,992	3,288	1,352	5,523	9,169	9,757	7,192	5,299	7,436	6,144	3,635	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number adult females in-river- (no jills)	11	193	395	1,908	817	3,483	5,262	5,682	5,179	3,252	9,005	8,807	1,542	1,462	2,717	822	424	1,498	3,613	1,698	2,058	560	236	1,024	4,888	3,978	6,199	2,650	1,065	325
Number total females in-river	12	193	422	1,908	849	3,508	5,295	5,733	5,218	3,292	9,047	8,858	1,550	1,462	2,722	824	491	1,498	3,680	1,744	2,063	658	373	1,088	4,947	4,023	6,199	2,663	1,070	392
Total spawning females in-river (no unspawned)	13	182	407	1809	827	3508	5260	5654	5189	3256	8849	8664	1519	1439	2699	817	488	1481	3645	1727	2022	653	367	1080	4884	3904	5860	2607	1061	375
Carcasses encountered on survey	14	118	239	785	475	2,482	5,145	4,959	4,549	3,280	8,771	7,698	1,581	1,409	1,904	908	430	1,348	3,219	1,389	1,194	297	143	1,126	3,026	3,678	4,847	1,650	528	276
Percent of population observed on survey	15	43%	42%	36%	42%	58%	63%	66%	55%	42%	55%	45%	62%	50%	42%	57%	52%	50%	53%	46%	35%	19%	15%	43%	38%	58%	47%	28%	22%	21%
Date of peak carcasses encountered	16	15-July	11-July	01-July	22-June	02-July	08-July	15-July	11-July	15-July	23-July	14-July	14-July	5-July	5-July	4-July	21-July	22-July	19-July	6-July	17-July	21-July	29-July	31-July	9-July	8 + 17 July	10-July	12-July	17-July	2-July
Carcasses tagged (all fish)	17	86	191	575	313	2,000	4,364	3,770	3,457	2,072	4,758	4,121	1,063	841	1,146	582	253	881	1,734	731	721	223	93	857	1,883	2,508	2,906	1,000	329	188
Carcasses chopped (all-mark-recapture)	18	32	48	208	162	482	781	1,189	882	958	2,448	2,656	427	502	606	189	134	467	1,485	658	473	74	50	269	1,143	1,170	1,941	650	199	90
Carcasses chopped (clips years 2003-2011)	19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	210	250	1,565	921	91	66	152	137	43	388	183	211	213	83	112	906	954	1,527	1,220	109	110	155
Carcasses recaptured (all)	20	13	22	75	57	829	2,200	2,159	2,175	1,128	3,001	2,206	716	475	401	384	124	533	990	335	252	59	20	457	713	1,610	1,463	361	103	59
Percent recaptured (all)	21	15%	12%	13%	18%	41%	50%	57%	63%	54%	63%	54%	67%	56%	35%	66%	49%	60%	57%	46%	35%	26%	22%	53%	38%	64%	50%	36%	31%	31%
Carcasses showing hatchery origin	22	0	5	4	4	4	155	208	179	250	1,565	885	83	60	137	112	32	362	758	196	195	76	109	903	948	1,474	1,201	94	104	153
Number CWT's found (x) (= non-winter CWT	23	0	5 (0)	2 (0)	2 (1)	1 (1)	124 (0)	148 (8)	134 (0)	168 (1)	1269 (1)	776 (0)	66 (1)	46 (1)	116 (1)	100 (4)	21 (0)	312 (0)	133 (3)	168 (1)	161 (0)	71 (1)	106 (0)	879 (0)	888 (0)	1,404 (0)	1,135 (2)	74 (0)	95 (0)	148 (1)
Number of hatchery fish in population	24	0	12	11	10	7	429	566	423	636	3,056	2,386	143	170	467	199	80	810	399	705	770	466	824	2,177	2,989	2,907	3,271	641	707	883
Percent hatchery fish in population	25	0.0%	2.1%	0.5%	0.8%	0.2%	5.2%	7.6%	5.1%	8.1%	19.3%	13.8%	5.6%	6.0%	10.3%	12.5%	9.7%	30.3%	6.6%	23.4%	22.4%	30.1%	84.3%	82.5%	37.2%	45.5%	31.9%	10.8%	29.1%	68.2%
Number of hatchery fish in-river	26	n/a	n/a	n/a	n/a	n/a	n/a	413	628	3,048	2,379	134	161	461	197	79	808	399	454	638	358	655	2,023	2,873	2,781	3,030	318	433	631
Percent of hatchery fish in-river	27	n/a	n/a	n/a	n/a	n/a	n/a	5.1%	8.1%	19.4%	13.8%	5.4%	5.9%	10.4%	12.9%	10.7%	31.3%	6.7%	17.3%	20.1%	25.4%	82.4%	82.3%	36.6%	44.9%	30.4%	5.8%	22.6%	61.6%
Number of WR floy tags released	28	n/a	n/a	n/a	n/a	20	106	100	152	261	281	219	103	93	157	359	293	714	197	41	177	303	194	403	293	357	646	110	311	460
Number of WR floy tags recaptured	29	n/a	n/a	n/a	n/a	0	1	5	26	10	34	33	10	9	12	24	10	44	20	0	10	20	1	13	13	48	26	9	13	3
Percent of floy tags observed	30	n/a	n/a	n/a	n/a	0%	1%	5%	17%	4%	12%	15%	10%	10%	8%	7%	3%	6%	10%	0%	6%	7%	1%	3%	4%	13%	4%	8%	4%	1%
Percent males: survey and LSNFH (>2003)	31	29%	25%	12%	25%	18%	35%	22%	36%	58%	43%	48%	38%	46%	39%	46%	35%	42%	38%	35%	36%	54%	56%	57%	38%	36%	38%	52%	47%	60%
Percent adult males to all adults:	32	13%	24%	10%	11%	17%	29%	18%	32%	43%	38%	48%	35%	42%	38%	45%	28%	39%	34%	29%	35%	37%	40%	54%	35%	29%	37%	48%	47%	44%
Percent adult males to all fish:	33	11%	22%	10%	9%	16%	26%	17%	30%	32%	35%	47%	33%	39%	38%	44%	21%	37%	32%	26%	34%	22%	20%	30%	33%	26%	36%	44%	46%	26%
Percent jacks to all fish:	34	18%	4%	2%	17%	2%	9%	5%	22%	7%	2%	5%	7%	1%	1%	2%	13%	5%	7%	1%	1%	3%	35%	26%	5%	10%	3%	8%	3%	34%
Number of Jacks: survey and LSNFH (>2003)	35	50 + n/a	21 + n/a	40 + 0	189 + 12	90 + 17	738 + 22	360 + 15	496 + 8	2015 + 26	1110 + 4	327 + 0	129 + 2	203 + 4	48 + 1	39 + 0	87 + 22	142 + 2	393 + 2	183 + 88	43 + 6	420 + 67	302 + 44	665 + 23	391+14	613 + 12	245 + 15	315 + 531	28 + 27	380 + 58
Fork length cutoff for jacks (mm): survey	36	< 645	< 645	< 595	< 635	< 605	< 665	< 685	< 610	< 710	< 670	< 660	< 670	< 670	< 670	< 670	< 705	< 645	< 675	< 700	< 610	< 710	<720	<705	< 680	< 665	< 625	< 675	<610	<715
Percent females: survey and LSNFH	37	71%	75%	88%	75%	82%	65%	78%	64%	42%	57%	52%	62%	54%	61%	54%	65%	58%	62%	65%	64%	46%	44%	44%	62%	64%	62%	48%	52%	40%
Percent adult females to all adults:	38	87%	76%	90%	89%	83%	71%	82%	68%	57%	62%	52%	65%	58%	62%	55%	72%	61%	66%	71%	65%	63%	60%	57%	65%	71%	63%	52%	53%	57%
Percent adult females to all fish:	39	71%	70%	88%	72%	81%	64.30%	77%	64%	42%	57%	51%	62%	54%	61%	53%	56%	58%	61%	63%	64%	38%	30%	41%	62%	64%	62%	48%	52%	34%
Percent jills to all fish: survey and LSNFH	40	0%	5%	0%	3%	1%	0%	1%	0%	1%	0%	0%	0%	0%	0%	0%	9%	0%	1%	2%	0%	9%	14%	3%	1%	1%	0%	0%	0	0
Number of Jills: in-river and LSNFH (>2003)	41	0+n/a	27+n/a	0+3	32+0	25+0	33+0	51+0	39+0	40+1	42+0	51+0	8+0	0+0	5+0	2+0	66+12	0+0	67+0	46+11	5+2	98+37	137+3	64+2	59+0	45+1	0+0	13+7	5 + 0	66 + 20
Fork length cutoff for jills (mm): survey	42	< 645	< 645	< 595	< 595	< 585	< 605	< 545	< 610	< 610	< 600	< 590	< 600	< 600	< 600	< 580	< 645	< 540	< 626	< 610	< 575	< 630	<645	<620	< 610	< 590	<525	<610	<580	<645
Percent Adults vs Percent Grilse	43	82% - 18%	92% - 8%	98% - 2%	80% - 20%	97% - 3%	90% - 10%	94% - 6%	93% - 7%	74% - 26%	93% - 7%	98% - 2%	95% - 5%	92% - 8%	99% - 1%	97% - 3%	77% - 23%	95% - 5%	92% - 8%	89% - 11%	98% - 2%	60% - 40%	50% - 50%	70% - 30%	94% - 6%	90% - 10%	97% - 3%	92% - 8%	98% -2%	60% -40%
Number Adults vs Number Grilse	44	223 - 50	516 - 48	2122 - 40	915 - 221	4175- 115	7349- 771	6949- 411	7675- 543	5786- 2083	14883-1156	16918-378	2402- 139	2622-207	4483-54	1555-41	637-187	2527-144	5576-462	2688-328	3383-56	924-622	357-438	1739-729	7493-450	5715-671	9,994 - 260	5,433 -488	2368 + 59	772 -524
Percent female spawn success	45	94.5%	96.4%	94.8%	97.4%	100.0%	99.3%	98.6%	99.5%	99.0%	97.8%	97.8%	98.0%	98.4%	99.2%	99.2%	99.4%	98.8%	99.0%	99.0%	98.0%	99.2%	98.3%	99.3%	98.7%	97.0%	94.5%	97.9%	99.1%	95.7%
Percent females unspawned (prespawn morts)	46	5.5%	3.6%	5.2%	2.6%	0.0%	0.7%	1.4%	0.5%	1.0%	2.2%	2.2%	2.0%	1.6%	0.8%	0.8%	0.6%	1.2%	1.0%	1.0%	2.0%	0.8%	1.7%	0.7%	1.3%	3.0%	5.5%	2.1%	0.00885	0.043
Average fork length (mm) fresh females	47	n/a	n/a	n/a	n/a	n/a	n/a	n/a	739	760	757	756	770	766	752	748	732	715	806	748	721	691	674	738	763	726	744	761	802	719
Average Female Fecundity (# eggs)	48	5,019	5019	5019	5019	5019	5019	4,923	4,854	5,515	5,500	5,484	5,112	5,424	5,519	5,161	4,832	4,518	4,596	5,308	4,819	4,131	4,109	5,141	5,424	4,991	5,312	5,505	5,510	5,430
Estimated number of eggs layed in-river	49	915,831	2,042,375	9,078,404	4,148,253	17,606,652	26,398,139	27,833,461	25,189,698	17,968,910	48,671,423	47,514,506	7,766,556	7,806,944	14,895,046	4,217,615	2,358,220	6,889,267	16,750,495	9,168,354	9,742,267	2,696,962	1,507,113	5,552,179	26,490,089	19,484,965	31,125,828	14,351,535	5,846,110	2,636,250
Number hatchery juveniles released in-river	50	4,718	21,271	153,909	30,840	166,206	252,684	233,613	218,617	168,261	173,344	196,288	71,883	146,211	198,582	123,859	194,264	181,857	205,224	609,311	420,006	141,388	217,270	223,817	249,119	302,166	520,285	732,324	760,934	n/a yet
Number of Jumpstart (Battle Cr.) juvs released	51	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	215,047	185,000	182,415	214,000	137,358	174,550	132,931	
Juvenile Production Estimate (females)	52	550,872	1,386,346	4,676,143	1,490,249	4,946,418	5,643,635	6,964,626	6,181,925	2,786,832	12,109,474	11,818,005	1,864,521	1,952,614	3,728,444	1,049,385	512,192	1,809,584	4,431,054	2,409,171	2,630,547	166,189	201,409	433,176	854,941	330,130	125,038	49,924	234,896	
Juvenile Production Index (RST RBDD)	53	469,183	2,205,163	5,000,416	1,366,161	n/a	n/a	7,635,469	5,781,519	3,677,989	8,943,194	7,298,838	1,637,804	1,371,739	4,972,954	1,572,628	996,621	1,814,244	2,481,324	523,872	440,951	640,149	734,432	1,477,529	4,691,764	2,270,968	779,427	354,001	1,507,356	
Percent eggs to juvenile survival past RBDD	54	n/a	n/a	n/a	n/a	n/a	n/a	27.4%	23.0%	20.5%	18.4%	15.4%	21.1%	17.6%	33.4%	37.3%	42.3%	27.1%	14.8%	5.7%	4.5%	23.7%	48.7%	26.6%	17.7%	11.7%	2.5%	2.5%	25.8%	0.0%
Percent mortality of total eggs to juveniles past RBDD	55	n/a	n/a	n/a	n/a	n/a	n/a	72.6%	77.0%	79.5%	81.6%	84.6%	78.9%	82.4%	66.6%	62.7%	57.7%	72.9%	85.2%	94.3%	95.5%	76.3%	51.3%	73.4%	82.3%	88.3%	97.5%	97.5%	74.2%	100.0%
Estimated fry at RBDD for each female spawner	56	n/a	n/a	n/a	n/a	n/a	n/a	1,351	1,114	1,129	1,011	842	1,078	953	1,843	1,924	2,042	1,225	681	303	218	981	2,002	1,368	961	582	133	136	1,421	0
Cohort Replacement Rate	57	3.5	4.7	2.3	2.5	1.5	2.7	2.3	6.1	1.0	2.1	2.1	0.3	0.2	0.3	0.6	0.3	0.6	3.8	3.6	1.3	0.3	0.3	0.8	5.2	6.5	3.9	0.7	0.4	0.1
Total number of winter redds observed	58	43	30	141	1,146	572	1,396	610	878	621	1,968	717	286	441	86	223	18	261	569	127	196	18	26	198	515	491	578	406	64	26
Total number of WR redds dewatered	59	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5	1	0	0	0	2	5	26	2	4	3	1
Percent of redds within carcass survey area	60	100%	100%	94%	92.5%	72.1%	89.5%	95.9%	99.3%	100%	100%	99.7%	96.2%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%	100.0%	100.0%	100.0%	100.0%	100.0%
Percent of redds not observed by flights	61	76%	93%	92%	~39%	84%	73%	89%	83%	81%	78%	92%	81%	69%	97%	73%	96%	82%	84%	93%	90%	97%	93%	82%	89%	87%	90%	84%	94%	93%
Survey Date Start	62	4-Apr	30-Apr	5-May	5-May	3-May	2-May	1-May	30-Apr	30-Apr	28-Apr	1-May	1-May	1-May	4-May	3-May	2-May	30-Apr	30-Apr	29-Apr	28-Apr	2-May	1-May	30-Apr	29-Apr	4-May	3-May	2-May	1-May	1-May
Survey Date End	63	5-Sep	29-Aug	28-Aug	27-Aug	29-Aug	29-Aug	27-Aug	4-Sep	3-Sep	2-Sep	25-Aug	24-Aug	22-Aug	28-Aug	27-Aug	1-Sep	2-Sep	5-Sep	11-Sep	17-Sep	15-Sep	6-Sep	26-Sep	26-Sep	24-Sep	23-Sep	22-Sep	21-Sep	18-Sep
Number of Survey Periods	64	19	41	39	38	40	40	40	41	43	43	39	39	38	39	39	41	42	43	43	45	45	43	47	48	45	45	45	45	46
Survey River Mile Range	65	271 -301	288 -301	288 -301	288 -301	288 -301	288 -301	288 -301	286.5 -301	273.5-301	273.5-301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301
Flow range (cfs x 1000)	66	7 - 16	8 - 15	10 - 23	9 - 13	8 - 16	8 - 15	7 - 15	8 - 29	8 - 16	4 - 37	6 - 15	8 - 15	8 - 13	7 - 13	7 - 15	6 - 19	6 - 14	7 - 14	4 - 11	7 - 7.5	5 - 10.7	5 - 13	7 - 13	5 - 13	7 - 12.8	7- 10	4.6- 3.3	7 - 13.4	8 - 13.4
Water temp (°F) range	67	52 - 59	49 - 52	50 - 54	50 - 54	51 - 54	50 - 55	50 - 56	50 - 54	50 - 57	51 - 59	50 - 56	50 - 58	50 - 58	51 -58	49 - 54	50 - 57	50 - 55	50 - 58	50 - 59	53 - 60	51 - 56	49 - 57	51 - 55	51 - 56	51 - 60	52 - 61	51 - 60	49 - 53	50 - 53
Visibility range (ft)	68	n/a	3 - 10	4.5 - 11	6 - 11	9 - 21	14 - 21	17 - 22	8 - 15+	8.5 - 16	2 - 16+	5 - 13	2.5 - 20+	10.5 - 16+	2 - 11	4 - 16+	5 - 14	6 - 15+	8 - 15+	7 - 15+	7 - 15	5 - 10	2 - 9	10 - 16	1 - 12	4 - 16+	8 - 15	7 - 14	2 - 13	6 - 14
Tissue samples collected	69	0	0	0	0	0	0	0	1,584	870	2,201	2,138	787	548	836	782	347	1,045	1,867	845	791	254	132	1,078	2,323	2,941	2,530	1,126	380 (179)	227
Scale samples collected	70	0	0	0	0	0	0	0	0	72	219	1,807	758	537	832	639	277	894	962	754	718	216	113	869	885	2,636	1,816	606	346	206
Otolith samples collected	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	594	789	112	402	253	129	1,062	970	158	163	134	54	62
Eye samples collected	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	937	712	152	162	0	0	62
Sac Riv WR water temperature compliance location	73	BND	BND	BND	BND	BND	JLF	JLF	BND	JLF	JLF	BND	BSF	AND	AND	JLF	JLF	JLF	AND	CCR	CCR	BSF	BSF	BSF	BSF	CCR	SAC	SAC	CCR	CCR

Winter-Run Chinook Salmon Data Table available for various categories for 1996-2024

Category	Note *	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Official Total System Estimate	1	1,337	880	2,998	3,289	1,353	8,223	7,459	8,218	7,869	15,839	17,297	2,543	2,830	4,537	1,596	827	2,673	6,086	3,015	3,440	1,548	977	2,638	8,033	6,390	10,269	5,927	2,427	1,296
In-river spawner estimate	2	1,012	836	2,889	3,264	1,263	8,120	7,360	8,133	7,784	15,730	17,197	2,487	2,725	4,416	1,533	738	2,578	5,920	2,627	3,182	1,409	795	2,458	7,852	6,195	9,956	5,437	1,920	1,024
Into Hatchery (CNFH or LSNFH)	3	325	44	103	24	89	102	96	85	85	109	94	55	105	121	63	86	93	164	388	257	137	180	180	180	191	298	484	507	272
Other Winter-run (e.g. -Battle, LF survey)	4	237	226	6	1	1	1	3	0	0	0	6	1	0	0	0	3	2	2	0	1	2	2	0	1	4	15	6	0	0
Lower confidence interval (90%)	5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,449	5,343	2,741	3,042	329	109	2,235	7,213	5,958	9,280	5,009	2,084	1,022
Upper confidence interval (90%)	6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,894	6,732	3,290	3,836	2,763	1,888	3,029	8,852	6,821	11,258	6,889	2,767	1,571
Peterson standardized estimate	7	273	564	2,162	1,136	4,290	6,760	6,106	6,602	6,205	13,549	13,919	2,161	2,448	3,307	1,338	712	2,246	5,198	2,475	2,454	829	610	2,017	5,380	5,494	7,896	4,031	1,610	821
Reported Peterson estimate	8	820	2,053	5,501	2,262	6,670	11,502	10,541	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Jumpstart returns into Battle Creek (into Sac Riv)	9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	95 (0)	1038 (8)	240 (24)	109 (1)	55 (2)	64 (0)
RBDD estimate	10	1,337	880	2,992	3,288	1,352	5,523	9,169	9,757	7,192	5,299	7,436	6,144	3,635	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number adult females in-river- (no jills)	11	193	395	1,908	817	3,483	5,262	5,682	5,179	3,252	9,005	8,807	1,542	1,462	2,717	822	424	1,498	3,613	1,698	2,058	560	236	1,024	4,888	3,978	6,199	2,650	1,065	325
Number total females in-river	12	193	422	1,908	849	3,508	5,295	5,733	5,218	3,292	9,047	8,858	1,550	1,462	2,722	824	491	1,498	3,680	1,744	2,063	658	373	1,088	4,947	4,023	6,199	2,663	1,070	392
Total spawning females in-river (no unspawned)	13	182	407	1809	827	3508	5260	5654	5189	3258	8849	8664	1519	1439	2699	817	488	1481	3645	1727	2022	653	367	1080	4884	3904	5860	2607	1061	375
Carcasses encountered on survey	14	118	239	785	475	2,482	5,145	4,959	4,549	3,280	8,771	7,698	1,581	1,409	1,904	908	430	1,348	3,219	1,389	1,194	297	143	1,126	3,026	3,678	4,847	1,650	528	276
Percent of population observed on survey	15	43%	42%	36%	42%	58%	63%	66%	55%	42%	55%	45%	62%	50%	42%	57%	52%	50%	53%	46%	35%	19%	15%	43%	38%	58%	47%	28%	22%	21%
Date of peak carcasses encountered	16	15-July	11-July	01-July	22-June	02-July	08-July	15-July	11-July	15-July	23-July	14-July	14-July	5-July	5-July	4-July	21-July	22-July	19-July	6-July	17-July	21-July	29-July	31-July	9-July	8 + 17 July	10-July	12-July	17-July	2-July
Carcasses tagged (all fish)	17	86	191	575	313	2,000	4,364	3,770	3,457	2,072	4,758	4,121	1,063	841	1,146	582	253	881	1,734	731	721	223	93	857	1,883	2,508	2,906	1,000	329	188
Carcasses chopped (all-mark-recapture)	18	32	48	208	162	482	781	1,189	882	958	2,448	2,656	427	502	606	189	134	467	1,485	658	473	74	50	269	1,143	1,170	1,941	650	199	90
Carcasses chopped (clips years 2003-2011)	19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	210	250	1,565	921	91	66	152	137	43	388	183	211	213	83	112	906	954	1,527	1,220	109	110	155
Carcasses recaptured (all)	20	13	22	75	57	829	2,200	2,159	2,175	1,128	3,001	2,206	716	475	401	384	124	533	990	335	252	59	20	457	713	1,610	1,463	361	103	59
Percent recaptured (all)	21	15%	12%	13%	18%	41%	50%	57%	63%	54%	63%	54%	67%	56%	35%	66%	49%	60%	57%	46%	35%	26%	22%	53%	38%	64%	50%	36%	31%	31%
Carcasses showing hatchery origin	22	0	5	4	4	4	155	208	179	250	1,565	885	83	60	137	112	32	362	158	196	195	76	109	903	948	1,474	1,201	94	104	153
Number of CWT's found (x) = non-winter CWT	23	0	5 (0)	2 (0)	2 (1)	1 (1)	124 (0)	148 (8)	134 (0)	168 (1)	1269 (1)	776 (0)	66 (1)	46 (1)	116 (1)	100 (4)	21 (0)	312 (0)	133 (3)	168 (1)	161 (0)	71 (1)	106 (0)	879 (0)	888 (0)	1,404 (0)	1,135 (2)	74 (0)	95 (0)	148 (1)
Number of hatchery fish in population	24	0	12	11	10	7	429	566	423	636	3,056	2,386	143	170	467	199	80	810	399	705	770	466	824	2,177	2,989	2,907	3,271	641	707	883
Percent hatchery fish in population	25	0.0%	2.1%	0.5%	0.8%	0.2%	5.2%	7.6%	5.1%	8.1%	19.3%	13.8%	5.6%	6.0%	10.3%	12.5%	9.7%	30.3%	6.6%	23.4%	22.4%	30.1%	84.3%	82.5%	37.2%	45.5%	31.9%	10.8%	29.1%	68.2%
Number of hatchery fish in-river	26	n/a	n/a	n/a	n/a	n/a	n/a	n/a	413	628	3,048	2,379	134	161	461	197	79	808	399	454	638	358	655	2,023	2,873	2,781	3,030	318	433	631
Percent of hatchery fish in-river	27	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.1%	8.1%	19.4%	13.8%	5.4%	5.9%	10.4%	12.9%	10.7%	31.3%	6.7%	17.3%	20.1%	25.4%	82.4%	82.3%	36.6%	44.9%	30.4%	5.8%	22.6%	61.6%
Number of WR flay tags released	28	n/a	n/a	n/a	n/a	20	106	100	152	261	281	219	103	93	157	359	293	714	197	41	177	303	194	403	293	357	646	110	311	460
Number of WR flay tags recaptured	29	n/a	n/a	n/a	n/a	0	1	5	26	10	34	33	10	9	12	24	10	44	20	0	10	20	1	13	13	48	26	9	13	3
Percent of flay tags observed	30	n/a	n/a	n/a	n/a	0%	1%	5%	17%	4%	12%	15%	10%	10%	8%	7%	3%	6%	10%	0%	6%	7%	1%	3%	4%	13%	4%	8%	4%	1%
Percent males: survey and LSNFH (>2002)	31	29%	25%	12%	25%	18%	35%	22%	36%	58%	43%	48%	38%	46%	39%	46%	35%	42%	38%	35%	36%	54%	56%	57%	38%	36%	38%	52%	47%	60%
Percent adult males to all adults:	32	13%	24%	10%	11%	17%	29%	18%	32%	43%	38%	48%	35%	42%	38%	45%	28%	39%	34%	29%	35%	37%	40%	54%	35%	29%	37%	48%	47%	44%
Percent adult males to all fish:	33	11%	22%	10%	9%	16%	26%	17%	30%	32%	35%	47%	33%	39%	38%	44%	21%	37%	32%	26%	34%	22%	20%	30%	33%	26%	36%	44%	46%	26%
Percent jacks to all fish:	34	18%	4%	2%	17%	2%	9%	5%	6%	26%	7%	2%	5%	7%	1%	2%	13%	5%	7%	9%	1%	32%	35%	26%	5%	10%	3%	8%	2%	34%
Number of Jacks: survey and LSNFH (>2002)	35	50 + n/a	21 + n/a	40 + 0	189 + 12	90 + 17	738 + 22	360 + 15	496 + 8	2015 + 26	1110 + 4	327 + 0	129 + 2	203 + 4	48 + 1	39 + 0	87 + 22	142 + 2	393 + 2	183 + 88	43 + 6	420 + 67	302 + 44	665 + 23	391+14	613 + 12	245 + 15	315 + 531	28 + 27	380 + 58
Fork length cutoff for jacks (mm): survey	36	< 645	< 645	< 595	< 635	< 605	< 665	< 685	< 610	< 710	< 670	< 660	< 670	< 670	< 670	< 670	< 705	< 645	< 675	< 700	< 610	< 710	<720	<705	< 680	< 665	< 625	< 675	<610	<715
Percent females: survey and LSNFH	37	71%	75%	88%	75%	82%	65%	78%	64%	42%	57%	52%	62%	54%	61%	54%	65%	58%	62%	65%	64%	46%	44%	44%	62%	64%	62%	48%	52%	40%
Percent adult females to all adults:	38	87%	76%	90%	89%	83%	71%	82%	68%	57%	62%	52%	65%	58%	62%	55%	72%	61%	66%	71%	65%	63%	60%	57%	65%	71%	63%	52%	53%	57%
Percent adult females to all fish:	39	71%	70%	88%	72%	81%	64.30%	77%	64%	42%	57%	51%	62%	54%	61%	53%	56%	58%	61%	63%	64%	38%	30%	41%	62%	64%	62%	48%	52%	34%
Percent jills to all fish: survey and LSNFH	40	0%	5%	0%	3%	1%	0%	1%	0%	1%	0%	0%	0%	0%	0%	0%	9%	0%	1%	2%	0%	9%	14%	3%	1%	1%	0%	0%	0	0
Number of Jills: in-river and LSNFH (>2002)	41	0+n/a	27+n/a	0+3	32+0	25+0	33+0	51+0	39+0	40+1	42+0	51+0	8+0	0+0	5+0	2+0	66+12	0+0	67+0	46+11	5+2	98+37	137+3	64+2	59+0	45+1	0+0	13+7	5 + 0	66 + 20
Fork length cutoff for jills (mm): survey	42	< 645	< 645	< 595	< 595	< 585	< 605	< 545	< 610	< 610	< 600	< 590	< 600	< 600	< 600	< 580	< 645	< 540	< 626	< 610	< 575	< 630	<645	<620	< 610	< 590	<525	<610	<580	<645
Percent Adults vs Percent Grilse	43	82% - 18%	92% - 8%	98% - 2%	80% - 20%	97% - 3%	90% - 10%	94% - 6%	93% - 7%	74% - 26%	93% - 7%	98% - 2%	95% - 5%	92% - 8%	99% - 1%	97% - 3%	77% - 23%	95% - 5%	92% - 8%	89% - 11%	98% - 2%	60% - 40%	50% - 50%	70% - 30%	94% - 6%	90% - 10%	97% - 3%	92% - 8%	98% - 2%	60% -40%
Number Adults vs Number Grilse	44	223 - 50	516 - 48	2122 - 40	915 - 221	4175- 115	7349- 771	6949- 411	7675- 543	5786- 2083	14683-1156	16918-378	2402- 139	2622-207	4483-54	1555-41	637-187	2527-144	5576-462	2688-328	3383-56	924-622	357-438	1730-729	7403-450	5715-671	9,994 - 260	5,433 -488	2368 - 59	772 -524
Percent female spawn success	45	94.5%	96.4%	94.8%	97.4%	100.0%	99.3%	98.6%	99.5%	99.0%	97.8%	97.8%	98.0%	98.4%	99.2%	99.2%	99.4%	98.8%	99.0%	99.0%	98.0%	99.2%	98.3%	99.3%	98.7%	97.0%	94.5%	97.9%	99.1%	95.7%
Percent females unspawned (prespawn morts)	46	5.5%	3.6%	5.2%	2.6%	0.0%	0.7%	1.4%	0.5%	1.0%	2.2%	2.2%	2.0%	1.6%	0.8%	0.8%	0.6%	1.2%	1.0%	1.0%	2.0%	0.8%	1.7%	0.7%	1.3%	3.0%	5.5%	2.1%	0.00885	0.043
Average fork length (mm) fresh females	47	n/a	n/a	n/a	n/a	n/a	n/a	n/a	739	760	757	756	770	766	752	748	732	715	806	748	721	691	674	738	763	726	744	761	802	719
Average Female Fecundity (# eggs)	48	5,019	5019	5019	5019	5019	5019	4,923	4,854	5,515	5,500	5,484	5,112	5,424	5,519	5,161	4,832	4,518	4,596	5,308	4,819	4,131	4,109	5,141	5,424	4,991	5,312	5,505	5,510	5,430
Estimated number of eggs layed in-river	49	915,831	2,042,375	9,078,404	4,148,253	17,606,652	26,398,139	27,833,461	25,189,698	17,968,910	48,671,423	47,514,506	7,766,556	7,806,944	14,895,046	4,217,615	2,358,220	6,689,267	16,750,496	9,168,354	9,742,267	2,696,962	1,507,113	5,552,179	26,490,089	19,484,965	31,125,828	14,351,535	5,846,110	2,036,250
Number hatchery juveniles released in-river	50	4,718	21,271	153,909	30,840	166,206	252,684	233,613	218,617	168,261	173,344	196,288	71,883	146,211	198,582	123,859	194,264	181,857	205,224	609,311	420,006	141,388	217,270	223,817	249,119	302,166	520,285	732,324	760,934	n/a yet
Number of Jumpstart (Battle Cr.) juvs released	51	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	215,047	185,000	182,415	214,000	137,358	174,550	132,931	
Juvenile Production Estimate (females)	52	550,872	1,386,346	4,676,143	1,490,249	4,946,418	5,643,635	6,964,626	6,181,925	2,786,832	12,109,474	11,818,006	1,864,521	1,952,614	3,728,444	1,049,385	512,192	1,809,584	4,431,054	2,409,171	2,630,547	166,189	201,409	433,176	854,941	330,130	125,038	49,924	234,896		
Juvenile Production Index (RST RBDD)	53	469,183	2,205,163	5,000,416	1,366,161	n/a	n/a	7,635,469	5,781,519	3,677,989	8,943,194	7,298,838	1,637,804	1,371,739	4,972,954	1,572,628	996,621	1,814,244	2,481,324	523,872	440,951	640,149	734,432	1,477,529	4,691,764	2,270,968	779,427	354,001	1,507,356	
Percent eggs to juvenile survival past RBDD	54	n/a	n/a	n/a	n/a	n/a	n/a	27.4%	23.0%	20.5%	18.4%	15.4%	21.1%	17.6%	33.4%	37.3%	42.3%	27.1%	14.8%	5.7%	4.5%	23.7%	48.7%	26.6%	17.7%	11.7%	2.5%	2.5%	25.8%	0.0%
Percent mortality of total eggs to juveniles past RBDD	55	n/a	n/a	n/a	n/a	n/a	n/a	72.6%	77.0%	79.5%	81.6%	84.6%	78.9%	82.4%	66.6%	62.7%	57.7%	72.9%	85.2%	94.3%	95.5%	76.3%	51.3%	73.4%	82.3%	88.3%	97.5%	97.5%	74.2%	100.0%
Estimated fry at RBDD for each female spawner	56	n/a	n/a	n/a	n/a	n/a	n/a	1,351	1,114	1,129	1,011	842	1,078	953	1,843	1,924	2,042	1,225	681	303	218	981	2,002	1,368	961	582	133	136	1,421	0
Cohort Replacement Rate	57	3.5	4.7	2.3	2.5	1.5	2.7	2.3	6.1	1.0	2.1	2.1	0.3	0.2	0.3	0.6	0.3	0.6	3.8	3.6	1.3	0.3	0.3	0.8	5.2	6.5	3.9	0.7	0.4	0.1
Total number of winter redds observed	58	43	30	141	1,146	572	1,396	610	878	621	1,968	717	288	441	86	223	18	261	569	127	196	18	26	198	515	491	578	406	64	26
Total number of WR redds dewatered	59	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5	1	0	0	0	2	5	26	2	4	3	1
Percent of redds within carcass survey area	60	100%	100%	94%	92.5%	72.1%	89.5%	95.9%	99.3%	100%	100%	99.7%	96.2%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.8%	100.0%	100.0%	100.0%	100.0%	100.0%
Percent of redds not observed by flights	61	76%	93%	92%	-39%	84%	73%	89%	83%	81%	78%	92%	81%	69%	97%	73%	96%	82%	84%	93%	90%	97%	93%	82%	89%	87%	90%	84%	94%	93%
Survey Date Start	62	4-Apr	30-Apr	5-May	5-May	3-May	2-May	1-May	30-Apr	30-Apr	28-Apr	1-May	1-May	1-May	4-May	3-May	2-May	30-Apr	30-Apr	29-Apr	28-Apr	2-May	1-May	30-Apr	29-Apr	4-May	3-May	2-May	1-May	1-May
Survey Date End	63	5-Sep	29-Aug	28-Aug	27-Aug	29-Aug	29-Aug	27-Aug	4-Sep	3-Sep	2-Sep	25-Aug	24-Aug	22-Aug	28-Aug	27-Aug	1-Sep	2-Sep	5-Sep	11-Sep	17-Sep	15-Sep	6-Sep	26-Sep	26-Sep	24-Sep	23-Sep	22-Sep	21-Sep	18-Sep
Number of Survey Periods	64	19	41	39	38	40	40	40	41	43	43	39	39	38	39	39	41	42	43	43	45	45	43	47	48	45	45	45	45	46
Survey River Mile Range	65	271-301	288-301	288-301	288-301	288-301	288-301	288-301	288-301	286.5-301	273.5-301	273.5-301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301	276 - 301
Flow range (cfs x 1000)	66	7 - 16	8 - 15	10 - 23	9 - 13	8 - 16	8 - 15	7 - 15	8 - 29	8 - 16	4 - 37	6 - 15	8 - 15	8 - 13	7 - 13	7 - 15	6 - 19	6 - 14	7 - 14	4 - 11	7 - 7.5	5 - 10.7	5 - 13	7 - 13	5 - 13	7 - 12.8	7 - 10	4.6- 3.3	7 - 13.4	8 - 13.4
Water temp (°F) range	67	52 - 59	49 - 52	50 - 54	50 - 54	51 - 54	50 - 55	50 - 56	50 - 54	50 - 57	51 - 59	50 - 56	50 - 58	50 - 58	51 -58	49 - 54	50 - 57	50 - 55	50 - 58	50 - 59	53 - 60	51 - 56	49 - 57	51 - 55	51 - 56	51 - 60	52 - 61	51 - 60	49 - 53	50 - 53
Visibility range (ft)	68	n/a	3 - 10	4.5 - 11	6 - 11	9 - 21	14 - 21	17 - 22	8 -15+	8.5- 16	2 - 16+	5 - 13	2.5- 20+	10.5 - 16+	2 - 11	4 - 16+	5 - 14	6 - 15+	8 - 15+	7 - 15+	7 - 15	5 - 10	2 - 9	10 - 16	1 - 12	4 -16+	8 - 15	7 - 14	2 - 13	6 - 14
Tissue samples collected	69	0	0	0	0	0	0	0	1,584	870	2,201	2,138	787	548	836	782	347	1,045	1,867	845	791	254	132	1,078	2,323	2,941	2,530	1,126	380 (179)	227
Scale samples collected	70	0	0	0	0	0	0	0	0	72	219	1,807	758	537	832	639	277	894	982	754	718	216	113	869	885	2,636	1,816	606	346	206
Otolith samples collected	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	594	789	112	402	253	129	1,062	970	158	163	134	54	62
Eye samples collected	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	937	712	152	162	0	0	62
Sac Riv WR water temperature compliance location	73	BND	BND	BND	BND	BND	JLF	JLF	BND	JLF	JLF	BND	BSF	AND	AND	JLF	JLF	JLF	AND	CCR	CCR	BSF	BSF	BSF	BSF	CCR	SAC	SAC	CCR	CCR

* Footnote descriptions are available in a separate Word File upon request.

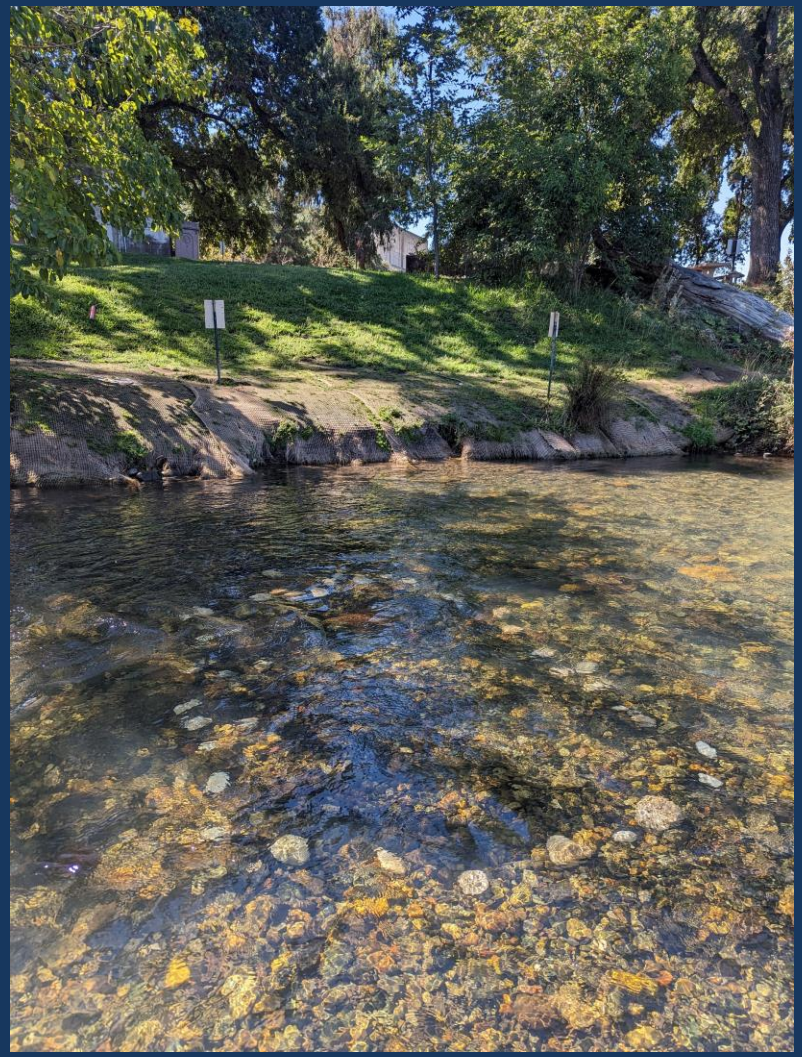
Other Winter-Run Data: Carcass survey data is combined with data from Livingston Stone National Fish Hatchery (LSNFH) to create the annual population estimate.



LSNFH at the base of Shasta Dam is a conservation hatchery that uses up to 120 adults each year to produce around 200,000 juveniles (some recent years more). Adults are captured at Keswick dam. Juveniles are released in Redding near end of January each year

Each year winter-run adults are collected by USFWS at the Keswick fish trap and trucked to the LSNFH where they are sorted and hatchery broodstock fish are selected and tanked until ready for spawning in the summer.

Shallow/Dewatered Redd Monitoring: In concert with the carcass surveys this effort monitors winter-run redd dewatering annually. Dewatered redd surveys begin in June for winter-run. They are designed to identify shallow water redds that may become dewatered if flows are lowered later in year. Depending on water temperatures Chinook redds can take between 70 and 100+ days for juvenile salmon to emerge from the gravel and start feeding.



- Shallow Winter-run redd monitoring was initiated in the 2013-14 season.
- Physical data collection includes: location, depth, photo, fish presence.

Data from the shallow/dewatered redd survey is used to inform flow management during and after the adult spawning takes place. In 2024, seventeen shallow redds were monitored and one was dewatered before juveniles had opportunity to emerge from that redd. In total, there were an estimated 375 winter-run Chinook redds in the river and 0.26% of these (1) were dewatered.

ID	Redd Number	Born on Date	Estimated Date of Emergence	Born on Depth	Status	Born on Flow (KWK)	Born on Flow (KES)	Actual or Estimated Dewater Flow (KES)	Location
1	4141-24-W	5/28/2024	8/25/2024	26	EMERGED	9,092	8,805	3,500	Sec 3, RL Golf Course
2	4142-24-W	6/5/2024	9/1/2024	27	EMERGED	9,077	8,485	3,500	Sec 3, RR Kutras Corner
3	4143-24-W	6/5/2024	9/5/2024	23	EMERGED	9,107	8,478	3,500	Sec 2, RR Kayak Ramp
4	4145-24-W	6/18/2024	9/17/2024	13	EMERGED	9,806	8,985	4,000	Sec 2, RR Kayak Ramp
5	4148-24-W	6/24/2024	9/23/2024	22	EMERGED	10,641	9,964	3,500	Sec 2, RR Below Sundial
6	4150-24-W	6/24/2024	9/23/2024	10	EMERGED	10,705	9,946	4,500	Sec 2, RR Kayak Ramp
7	4151-24-W	7/17/2024	10/15/2024	23	EMERGED	13,047	12,864	4,000	Sec 2, RR Below Sundial
8	4152-24-W	7/24/2024	10/22/2024	34	EMERGED	13,141	13,051	6,500	Sec 2, RR Below Sundial
9	4153-24-W	7/30/2024	10/28/2024	26	EMERGED	13,122	12,893	4,000	Sec 2, RR Below Sundial
10	4154-24-W	7/30/2024	10/28/2024	25	EMERGED	13,141	12,879	4,000	Sec 2, RR Kayak Ramp
11	4155-24-W	8/1/2024	10/30/2024	27	EMERGED	13,292	13,077	4,000	Sec 2, RR Kayak Ramp
12	4156-24-W	8/1/2024	10/30/2024	18	EMERGED	13,292	13,077	3,900	Sec 2, RR Kayak Ramp
13	4157-24-W	8/6/2024	11/4/2024	34	EMERGED	12,805	12,930	3,500	Sec 2, RR Market Street Gravel
14	4158-24-W	8/6/2024	11/4/2024	14	EMERGED	12,768	12,920	4,250	Sec 2, RR Kayak Ramp
15	4159-24-W	8/6/2024	11/4/2024	16	EMERGED	12,768	12,920	6,000	Sec 2, RR Kayak Ramp
16	4160-24-W	8/12/2024	11/10/2024	24	EMERGED	12,200	12,041	4,500	Sec 2, RR Kayak Ramp
17	4146-24-W	8/26/2024	11/22/2024	23	DEWATERED	11,095	10,980	4,600	Sec 3, RL Painter's Riffle

Questions?

Further information on winter-run data can be found on the Calfish website at the following link:
https://www.calfish.org/ProgramsData/ConservationandManagement/CentralValleyMonitoring/CDFWUpperSacRiverBasinSalmonidMonitoring.aspx

Or by contacting doug.Killam@wildlife.ca.gov