2023 Fall Chinook Salmon Spawning Ground Survey

Salmon-Scott Rivers Ranger District
Klamath National Forest

Prepared by
Maija Meneks
Salmon-Scott Rivers District Fish Biologist

May 1, 2024

Salmon-Scott Rivers Ranger District
Klamath National Forest
11263 N. State Hwy 3
Fort Jones, CA 96032

Table of Contents

Title page photo: The California Department of Fish and Wildlife fish weir on the Scott River at the Reach 6/7 break; November 2023.

ABSTRACT

Cooperative Fall Chinook spawning ground surveys between the U.S. Forest Service, California Department of Fish and Wildlife, Yurok Tribe, Karuk Tribe, Quartz Valley Indian Reservation, Salmon River Restoration Council, and local schools and volunteers have occurred on the Klamath National Forest since 1992. In addition to providing information to land managers in regard to where these fish spawn, these surveys are used to estimate the total in-river spawner escapement of fall-run Chinook salmon (*Oncorhynchus tshawytscha*) by the Klamath River Technical Team and the Pacific Fisheries Management Council for determination of harvest allocations for the subsequent year.

The Salmon River and Scott River are surveyed on an annual basis using both carcass mark-recapture and redd count techniques. Mark-recapture of carcasses (and in some cases, redd counts) are used for population estimations. Redd counts are utilized on the rivers' tributaries, which may not be regularly visited during the spawning season. The 2023 cooperative survey began October 9th and ended December 14th. Overall discharge for both drainages was close to long-term average. As usual, the Salmon River was more responsive to fall precipitation events compared to the Scott River, the former exhibiting two flow pulses which temporarily pushed conditions above those considered safe for surveyors. The first large storms of the season in December did not occur until after spawning was considered to be concluded. Surveys in both drainages also included tributary visits.

Approximately 1,619 fish returned to the Salmon River and 1,906 fish returned to the Scott River. Fall Chinook run estimates, made by California Department of Fish and Wildlife, are compiled through a combination of redd count and mark-recapture carcass surveys. The Scott River also employs weir videography. Using data collected since initiation of organized surveys in 1978, year 2023 returns were well below average for Salmon River [ranked 29th (of 46 years)] and well below average for Scott River [ranked 38th (of 46 years)].

INTRODUCTION

Since 1978, the California Department of Fish and Wildlife (CDFW) has determined fall-run Chinook salmon spawner escapement in the Klamath River watershed using a combination of weirs, mark-recapture surveys, redd surveys, and hatchery return information. This data is used in the determination of stock size projections for the management of Klamath River Fall Chinook salmon stocks by the Klamath River Technical Team and the Pacific Fisheries Management Council.

The CDFW, Klamath National Forest (KNF), and Six Rivers National Forest (SRNF) (the Forests are hereafter collectively referred to as USFS) have conducted Chinook spawner surveys for many years. Since missions differ among agencies, the objectives for these surveys were always slightly different. The USFS traditionally counted redds and live fish in order to estimate number and distribution of spawning Chinook salmon. Beginning in 1992, CDFW and USFS joined to accomplish spawner escapement surveys, partially due to shrinking budgets in both State and Federal programs, but also in desire to increase cooperative operations between agencies. These surveys now include collaboration with the Karuk Tribal Government, Quartz Valley Tribal Government, Salmon River Restoration Council, Siskiyou Resource Conservation District, Mid-Klamath Watershed Council, Northern California Resource Center, and local volunteers and public schools. The cooperative effort has improved the accuracy of CDFW estimates by enabling surveys that are more extensive and frequent in nature.

In fall 2023, a combination of redd and mark-recapture counts were completed in the Salmon River and Scott River drainages, including mainstems and tributaries, in order to determine fall Chinook spawner escapement and distribution (**Table 1**). This report summarizes redd count surveys conducted from October 9th through December 14th on the KNF portion of the Salmon and Scott Rivers (i.e., within the Salmon-Scott Rivers Ranger District [SSRD]). The exception is Wooley Creek and the Salmon River below Nordheimer Creek, which were surveyed by SRNF and/or CDFW personnel. Data from these latter locations is covered in other documents.

A separate report is prepared by CDFW biologists for the escapement estimates to be used by the fisheries management councils. A portion of the Fall Chinook MegaTable as compiled by the CDFW has been included in **Appendix A** (CDFW 2024a).

Table 1. The 2023 survey schedule for KNF personnel for the Salmon River and Scott River. Cooperators may have surveyed on dates during and after the primary survey period when KNF personnel were not present.

Survey Week	Scott River (Monday)	Salmon River (Tuesday)		Scott River (Thursday)	Salmon River (Friday)
1	Oct-9 (ns - holiday)	Oct-10	No surveys on Wednesday	Oct-12	Oct-13
2	Oct-16	Oct-17		Oct-19	Oct-20
3	Oct-23	Oct-24		Oct-26	Oct-27
4	Oct-30	Oct-31		Nov-02	Nov-03
5	Nov-06	Nov-07 (ns - high water)		Nov-09	Nov-10 (ns - holiday)
6	Nov-13	Nov-14		Nov-16	Nov-17
7	Nov-20	Nov-21		Nov-23 (ns - holiday)	Nov-24 (ns - holiday)
8	Nov-27	Nov-28		Nov-30	Dec-01 (Last day Salmon)
9	Dec-04			Dec-07	
10	Dec-11			Dec-14 (Last day Scott)	

*ns - no survey

METHODS

In 2023, redd surveys were conducted on the Salmon River and Scott River, as well as various tributaries. **Table 2** summarizes each reach for 2023, including reach designation and length, number of times surveyed, and total number of redds counted over the course of the survey season.

- Salmon River survey focus is from mile marker 12 on the North Fork (NF) to the confluence with the South Fork (SF); Matthews Creek campground on the SF to the confluence with the NF; and the mainstem Salmon River from the confluences to Nordheimer Creek.
    - Tributaries surveyed in 2023 include East Fork, West Fork, and mainstem Knownothing Creeks; Little NF Salmon River; Methodist Creek; Nordheimer Creek; and Plummer Creek.
    - Wooley Creek and the mainstem below Nordheimer Creek are surveyed on a different schedule by SRNF and/or CDFW personnel, and are detailed in a separate report.
- Scott River is surveyed from Callahan in the upper Scott Valley to the confluence of the Klamath River. Reaches below Shackleford Creek were led by a CDFW/KNF agency cooperative; and surveys upstream of Shackleford Creek were conducted by the Siskiyou

Resource Conservation District (RCD). Lack of access across or through private property excluded some segments or portions within reaches from survey, particularly in the valley.

- Tributaries surveyed in 2023 include Canyon Creek, Kelsey Creek, and Tompkins Creek.

The USFS and CDFW held two training sessions for agency employees, Tribal employees, non-governmental entities, and volunteers. On October 2nd, redd survey/carcass mark-recapture training was held at Indian Scotty group campground on the Scott River. Similar training was held at Oak Bottom Campground on the lower mainstem Salmon River on Oct 3rd. Topics discussed at the trainings included redd and fish identification; carcass marking and explanation of mark-recapture estimates; scale and otolith sampling; data collection; and survey safety procedures.

Table 2. Fall Chinook spawning survey reach descriptions for Salmon River and Scott Rivers in 2023. Salmon River reaches surveyed by Six Rivers National Forest not included.

Stream Name	Reach Name	Reach Number	Miles	Number of Times Surveyed[1]	Total Number of Redds Surveyed…
Salmon River					
Mainstem	Otter Bar to Nordheimer Ck	4A	1.6	8	60
	Forks of Salmon to Otter Bar	4B	2.4	9	86
North Fork	Mile 2 to Forks of Salmon	9A	2.0	6	33
	Mile 4 to Mile 2	9B	2.0	6	24
	Mile 6 to Mile 4	10A	2.0	4	23
	Mile 8 to Mile 6	10B	2.0	5	32
	Mile 10 to Mile 8	11A	2.0	5	29
	Mile 12 to Mile 10	11B	2.0	7	18
South Fork	Henry Bell to Forks of Salmon	5A	3.0	5	91
	O'Farrill Gulch to Henry Bell	5B	2.0	8	68
	Indian Ck to O'Farrill Gulch	6A	3.0	5	48
	Matthews Ck to Indian Ck	6B	2.2	5	39
Tributaries	Knownothing Creek	-	2.5	1	7
	Knownothing Creek (EF)	-	1.5	1	0
	Knownothing Creek (WF)	-	1.7	1	0
	Little NF Salmon River	A (lower)	2.3	1	0
	Methodist Creek	1	2.4	1	0
	Nordheimer Creek (A)	A (lower)	1.8	3	9
	Plummer Creek	-	1.5	1	0

Scott River					
	Midpoint to Confluence	1	2.5	11	91
	"Cabin Hole" to Midpoint	2	2.5	13	61
	George Allen to "Cabin Hole"[2]	3	3.0	10	38 (9)
	Tompkins Creek to George Allen	4	2.5	8	30
	Bridge Flat to Tompkins Creek	5	4.0	5	17
	CDFW Weir to Bridge Flat	6	3.8	4	18
	USGS Gauge to CDFW Weir	7	3.5	4	52
	Shackleford Creek to USGS Gauge	8	2.9	4	42
	Oro Fino to Quartz Valley Bridge[3]	9	4.2	4	4
	Hwy 3 to Oro Fino[3]	10	7.0	-	Not surveyed
	Eller Lane to Hwy 3[3]	11	5.5	-	Not surveyed
	Etna Creek to Eller Lane[3]	12	3.6	-	Not surveyed
	Horn Lane to Etna Creek[3]	13	1.8	-	Not surveyed
	Young's Point to Horn Lane[4]	14	2.1	5	32
	Fay Lane to Young's Point[3]	15	3.6	3	2
	Callahan to Fay Lane[3]	16	6.9	-	Not surveyed
Tributaries (Canyon)	Canyon Creek	-	1.3	2	0
	Kelsey Creek	-	0.6	2	0
	Tompkins Creek	-	2.5	1	0

[1]Flagging marking redds may have been removed prior to end of carcass surveys. "Times Surveyed" includes ALL surveys, including those performed end-of-season when redds may have been no longer counted.
[2]Portions of private property in Reach 3 of Scott River not flagged, although property was still traversed. Number in parenthesis is the maximum number of unflagged redds.
[3]Scott River reaches 9 through 16 and valley tributaries are surveyed by RCD.

On the Salmon and Scott Rivers, crews conduct two concurrent protocols on survey reaches, using redd counts and carcass counts (CDFW 2023). A typical crew consists of two people. Each crew walks and/or snorkel dives two to four miles of river each survey day unless health or safety concerns limit ability to survey. The number of times a reach is surveyed is directly related to the number of people available on the survey dates. When insufficient surveyors are present to cover all reaches, reach assignment is determined by the level of activity observed on the prior survey date and personnel knowledge of the system. To reduce estimator bias, crews are assigned a different reach each survey date. For Scott River, an additional limiting factor is access across private land (Reach 8).

On both rivers, all redds are counted, GPSed, flagged, and location marked on a topographic map, with total number of redds tallied at the end of each reach. Reaches where redds were not marked due to safety or landowner preference regarding flagging on their property are listed below. Additionally, flagged redds are characterized as to size (width/length) and habitat type in

which they are observed. Original field maps of redd locations are available at the Salmon-Scott Rivers Ranger District office in Fort Jones, CA.

- Salmon River, not flagged – canyon segment of 6A
    - Flags used when crews are able to access the Reach 6A canyon segment safely.
- Scott River, not flagged – portion of Reach 3 in front of a landowner's house

RESULTS

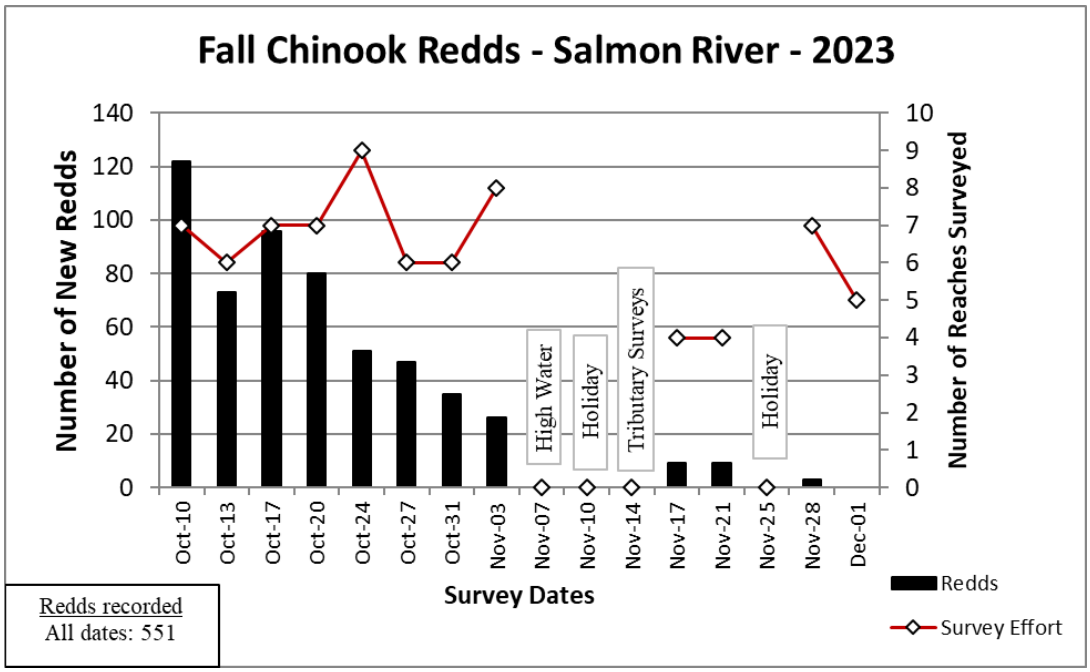
Salmon River

Overall effort on the Salmon River was good. Normal flow conditions were present through much of the spawning season, although it did edge higher towards the end (see **Appendix B**). Precipitation in early-November caused one survey day to be cancelled. Another post-storm spike about a week later coincided with planned tributary surveys, but no cancellation was necessary. While subsequent flows were considered safe for crews, there was sufficient increase to make it more difficult to view fish, redds, and carcasses. The South Fork and mainstem exhibited occasional light to moderate turbidity as a remnant effect to post-fire debris flows in 2022 and 2023, but not to the degree experienced the previous year. Surveys concluded in early-December ahead of incoming winter storms.

The date of peak spawning on the Salmon River was mid-October (**Figure 1**). In most years since 2010 when detailed reporting of survey efforts upon the SSRD began, the temporal pattern for Salmon River spawning is to be heavy at the survey start, especially as crews capture redds completed since spawning initiation (i.e., early-October); and there is often a subsequent decline in new redds thereafter, except when a freshet may trigger an uptick. This pattern appears valid for 2023. Overall survey effort was affected by number of surveyors available, weather, and flows. See **Appendix C** for a table of redd numbers organized by reach and date.

A total of 551 redds were observed. This number compares to an average of ~640 redds for surveys conducted between 2011 and 2022 (disregarding 2016 and 2021 due to confounding effects of high water). For 2023, no reaches recorded over 100 redds, with Reach 5A (SF Salmon River) having the most spawning documented at 91 redds. See **Appendix D** for redd spatial distribution and location information.

Figure 1. Fall Chinook redds observed and survey effort on the Salmon River in 2023. Surveys include mainstem, North Fork, and South Fork (see text for reach descriptions).



Specific areas of the Salmon River display a greater preference for use by spawning Fall Chinook. The GPS mapping of redds since 2011 is revealing patterns. There are areas which show annual use at low densities, as well as scattered redds which likely represent opportunistic use of habitat which may be locally limited in extent or transient. There are also sites that have demonstrated heavy use only once (and light or no use otherwise), and which may indicate exploitation only when certain conditions are met, such as water flow or fish return numbers.

Focus for the concentrated use area dataset is upon locales which exhibit multiple years of use at moderate or greater density of redds. Specifically, "concentrated use areas" are defined as redd groups which possess a minimum density of 6 redds within an approximate 100 meter linear distance in at least 25% of years since 2011. Exceptions for dataset inclusion are 2016 and 2021, when persistent high flows confounded the survey effort.

The regular use area dataset identifies well-defined clusters of redds which occur in the same location most years. While redds should be recorded as present within five years of the most recent dataset, exceptions may made regarding sites within river segments difficult for fish to access during persistent low-flow conditions. The concentrated use area dataset is a subset of the larger regular use area dataset, the latter of which includes sites that do not meet the linear density requirement of the former. Locales often represent pool tail-outs or lower gradient riffle/glide areas.

A longer dataset has permitted greater nuance: sites originally mapped as concentrated use areas have been reassigned to regular use; regular use sites have been promoted to concentrated use; and new regular and concentrated use sites have been added. Site tracking also suggests that elevated use at some locales is activated by specific water discharge and/or run size conditions, although more years of information gained under a wider range of scenarios is required for quantitative conclusions. For instance, five (of thirteen) years have included the below/very-

below average run size with lower discharge conditions. A long-term goal is to refine the definition of "concentrated use area" to include the triggers which elevate or depress use.

Regular use and concentrated use areas include:

- Mainstem Salmon River (Nordheimer Creek to Forks of Salmon – ~4.0 miles)
    - 22 regular use areas
    - 11 concentrated use areas (subset of regular use areas)
- North Fork Salmon River (Forks of Salmon to Kelly Gulch – ~12.0 miles)
    - 35 regular use areas
    - 12 concentrated use areas (subset of regular use areas)
- South Fork Salmon River (Forks of Salmon to Matthews Creek – ~10.2 miles)
    - 46 regular use areas
    - 15 concentrated use areas (subset of regular use areas)

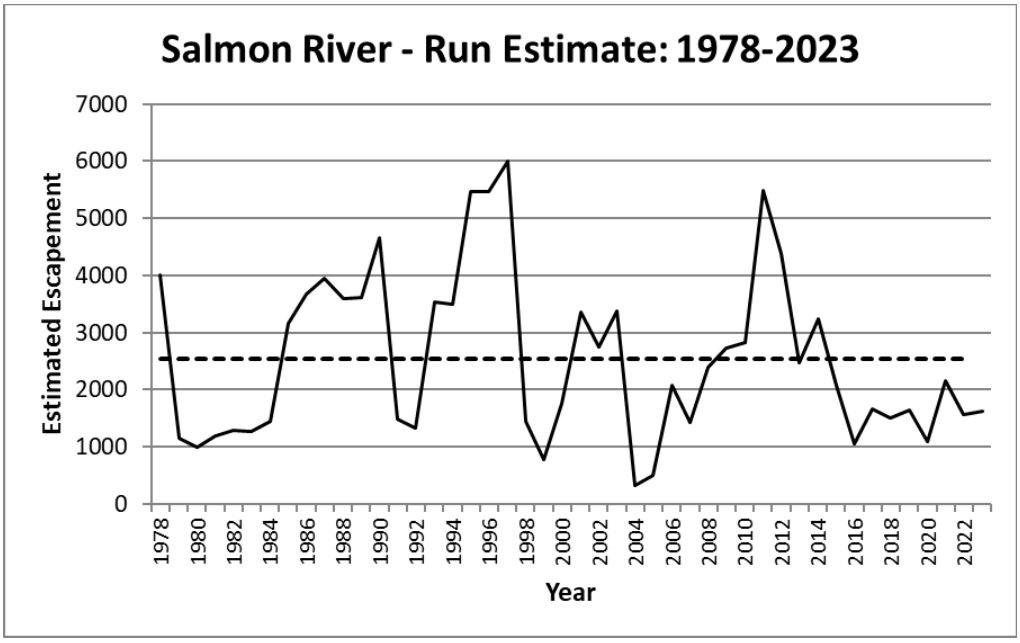
Notable areas with elevated use most years include downstream of Crapo Creek, Horn Field, Forks of Salmon bridge (North Fork), Pollock's Gulch, and Red Bank engine access.

The GoogleEarth spawning use area overlay was last updated in 2023 and a new overlay will be released in conjunction with this report. While there are no significant changes in overall fish distribution, a longer dataset has permitted continued refinement of the concentrated use area and regular use area datasets. Following annual review, multiple concentrated use areas were downgraded to regular use areas over the last several years, and some regular use areas have been removed from the dataset. In the same time period a handful of new regular use areas were identified, and several regular use areas were promoted to concentrated use area designation.

The amount of temporal and spatial overlap between spring- and fall-run Chinook is not well understood. Since 2018, surveys to identify (and flag) potential Spring Chinook redds have occurred in late-September and early-October within the traditional Fall Chinook spawning survey reaches. Many of these redds would have been counted as "Fall Chinook" in prior years. Because fall-run fish may be present in the Salmon River when spring-run fish are actively spawning, the exact origination of individual redds in locations which regularly support overlap of the runs can be unclear. The gain of the expanded Spring Chinook spawning survey effort is a greater understanding of when fall-run fish are entering the spawning grounds and commencement of spawning activity. By early-October fall-run spawning is typically underway within traditional Fall Chinook reaches; and while surveyors may still inadvertently capture Spring Chinook redds within the dataset, the expectation it is to be less than in the past. A new campaign of genetics sampling began in 2023, which is briefly introduced in the "Discussion" section.

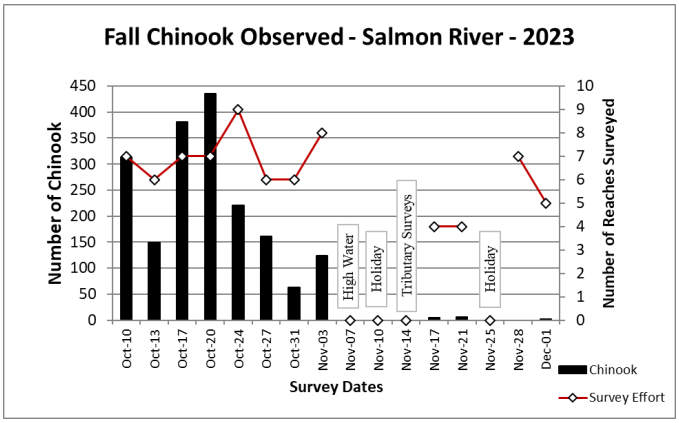
Using survey data, the Salmon River is estimated to have had 1,619 fall-run Chinook salmon return in the fall of 2023 (**Figure 2**; **Appendix A**). Based on long-term tracking data compiled by CDFW, 2023 was well below average, ranking 29th (of 46 years) for run size.

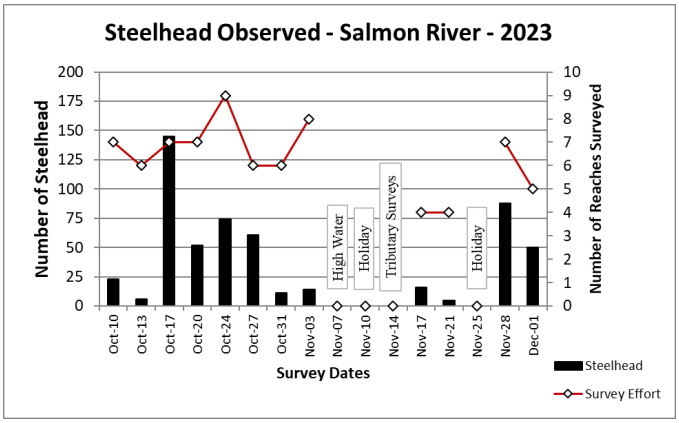
Figure 2. Salmon River fall-run escapement estimates for 1978 to 2023. Dashed line is average over long-term survey period.



Live Chinook and steelhead were tallied during surveys (**Figure 3**). As with redds, fish observation is influenced by number of surveyors, weather, discharge conditions, and surveyor experience. Because fish are more visible and easier to count when viewed underwater, teams which include at least one snorkeler tend to count more fish compared to the same reaches with walkers only. Peak live Chinook was observed on October 20th. The date generally corresponds with maximum new redds, a timeframe when the most fish are expected to be present prior to expected decline. Steelhead, as usual, were variable, with peak fish numbers reported for October 17th. Steelhead are often observed to be more active following precipitation events, which may be represented by some small freshets in early- to mid-October. However, dates which reported fish were also often dominated by one or two reaches; and those reaches included a snorkeler. See **Appendix C** for a table of fish numbers organized by species, reach, and date.

Figure 3. Observation of Fall Chinook and steelhead during the 2023 Salmon River surveys.





No coho salmon were incidentally observed during Fall Chinook surveys.

Salmon River tributary surveys occurred in October and November (**Appendix C**). Chinook redds and/or live Chinook were observed mainstem Knownothing Creeks and lower Nordheimer Creek. Neither fish nor redds were reported on East Fork/West Fork Knownothing Creeks, Little North Fork Salmon River, Methodist Creek, or Plummer Creek.

Scott River

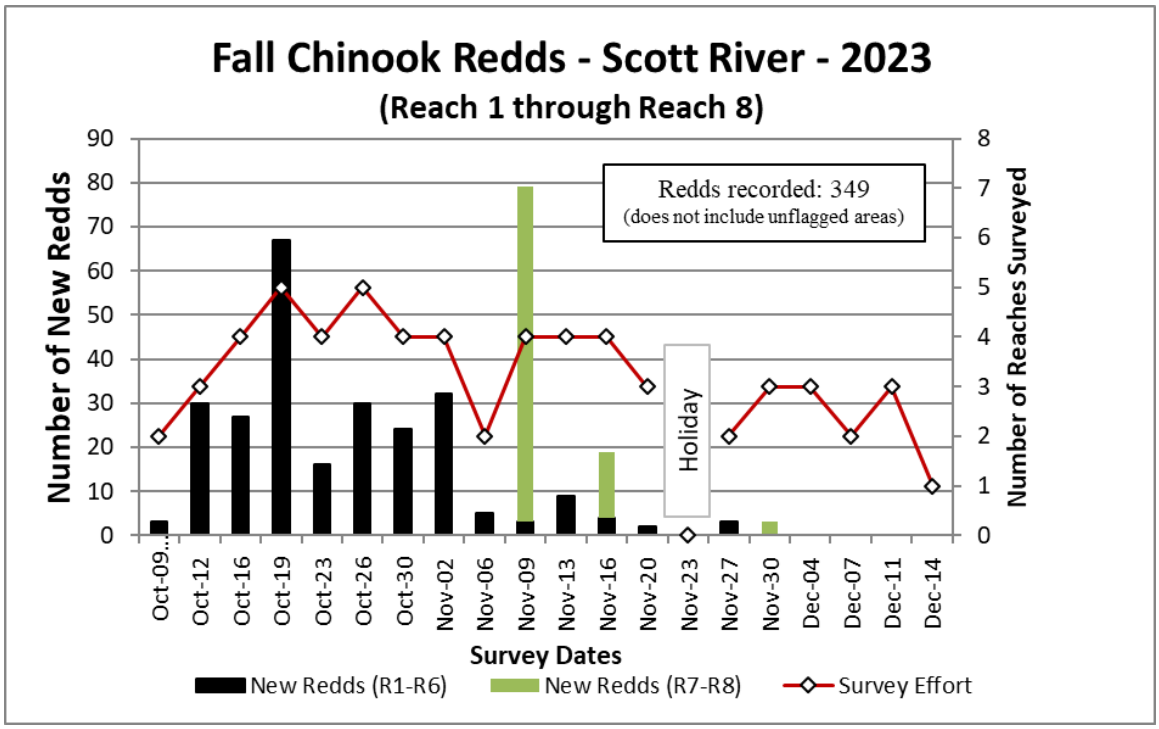
Overall effort for the Scott River was decent, albeit perhaps not as good as some previous years. Normal to low discharge conditions allowed safe access to all reaches throughout the season (**Appendix B**); and all scheduled surveys were able to be accomplished. However, access to Reach 8 was curtailed to the upper "B" subsection due to restricted permission to cross private property. Furthermore, starting the latter half of November, reduced crew availability meant less reaches completed on a given survey day compared to the start of the spawning season. On the other hand, within the same time period the low number of live fish and new redds reported suggests the spawning season to have been complete except for a few late season stragglers, so the loss in effort is unlikely to have appreciably affected the final numbers.

Based on available data, the Scott River in the survey area (Reach 1 through 6) likely reached its spawning peak just after mid-October (**Figure 4**). The first visit to Reach 7 and 8, above the video weir, was delayed until November 9th to maintain availability of CDFW crew(s) for lower Scott River surveys (because only CDFW personnel are allowed on Reach 8). Based upon fish passage timing through the weir (**Figure 7**), spawning peak in these upper reaches was likely in the latter portion of October, slightly later compared to downriver reaches. This timing would be similar to observations made in years with greater crew availability allowing fuller temporal coverage. See **Appendix C** for a table of redd numbers organized by reach and date.

Survey protocol includes marking redds with flagging when first encountered. The intent is for surveyors to discern new redds as they are constructed, and thereby allow for more accurate enumeration of redd numbers (and estimated escapement) over the course of the spawning season. The only exception is Reach 3 within the riverfront viewscape of the Trabucco residence, where no flags are hung at the request of the landowner. In this location, all redds are counted each time. The maximum number of unflagged redds observed during Reach 3 surveys was nine.

There were 358 redds observed in the survey area for 2023. This number compares to an average of ~585 redds for surveys conducted between 2011 and 2022 (disregarding 2016 due to confounding effects of high water). The return in 2023 was well below average, continuing the trend of local run depression which began in 2015. Overall spatial distribution was broadly similar to established patterns in regard to concentrated use and regular use areas. See **Appendix D** for redd spatial distribution and location information.

Figure 4. Fall Chinook redds observed and survey effort on the Scott River in 2023 (Reach 1 through Reach 8 only).



The Siskiyou Resource Conservation District (RCD) performs redd and carcass surveys upon private property from Reach 9 through Reach 16, as well as several Scott Valley tributaries. No Chinook surveys were conducted upon tributary systems this year, focus on mainstem reaches. Redds and fish were observed (**Table 3**; **Appendix C**). For additional information concerning the Scott Valley effort, contact RCD for a copy of their spawning survey report.

Table 3. Total number of redds observed for Reach 8 through Reach 16 for Scott River in 2023.

	Reach 9	Reach 10	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Total
Total Redds	4	-	-	-	-	32	2	-	38

Specific areas of the Scott River display a greater preference for use by spawning Fall Chinook. The GPS mapping of redds since 2011 is revealing patterns. There are areas which show annual use at both high and low densities, as well as scattered redds which likely represent opportunistic use of habitat which may be locally limited in extent or transient. There are also sites that have demonstrated heavy use only once (and light or no use otherwise), and which may indicate exploitation only when certain conditions are met, such as water flow or fish return numbers.

Focus for the concentrated use area dataset is upon locales which exhibit multiple years of use at moderate or greater density of redds. Defined the same as for the Salmon River, "concentrated use areas" are sites which possess a minimum density of 6 redds within an approximate 100 meter linear distance in at least 25% of years since 2011. An exception for inclusion in the dataset is 2016, when persistent high flows confounded the survey effort.

The regular use area dataset identifies well-defined clusters of redds which occur in the same location most years. While redds should be recorded as present within five years of the most recent dataset, exceptions may made regarding sites within river segments difficult for fish to access during persistent low-flow conditions. The concentrated use area dataset is a subset of the larger regular use area dataset, the latter of which includes sites that do not meet the linear density requirement of the former. Locales often represent pool tail-outs or lower gradient riffle/glide areas.

A longer dataset has permitted greater nuance: sites originally mapped as concentrated use areas have been reassigned to regular use; regular use sites have been promoted to concentrated use; and new regular and concentrated use sites have been added. Site tracking also suggests that elevated use at some locales is activated by specific water discharge, although more years of information is required for quantitative conclusions. A long-term goal is to refine the definition of "concentrated use area" to include the triggers which elevate or depress use.

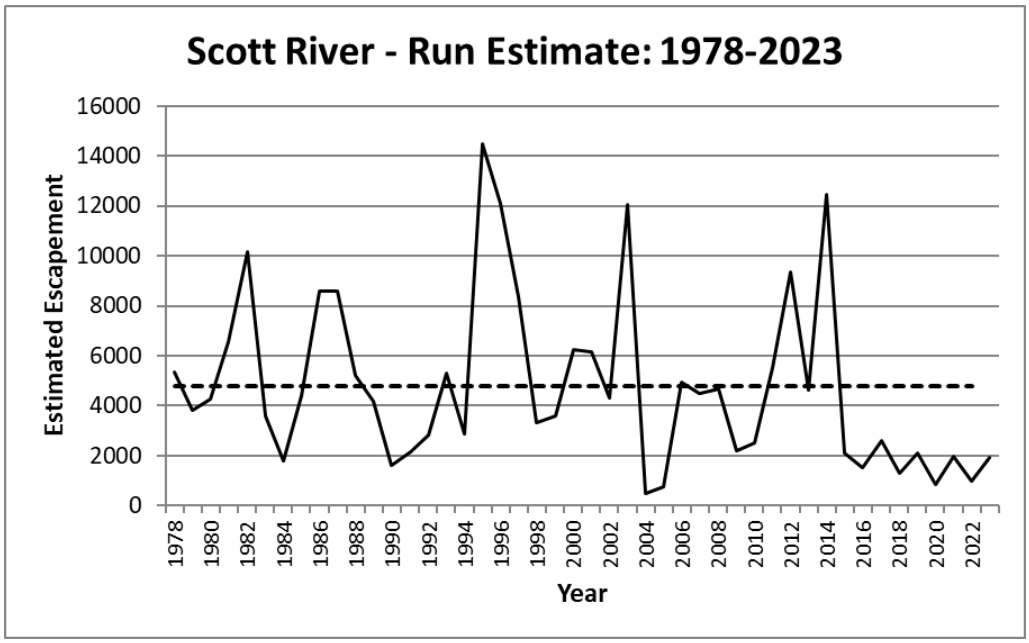
Regular use and concentrated use areas include:

- Scott River (Reach 1 through Reach 8 – ~24.5 miles)
    - 86 regular use areas
    - 43 concentrated use areas (subset of regular use areas)
        - The following sites have demonstrated elevated use most years: Johnson Bar River Access; County Road 7F01 (Scott River Road) bridge above Johnson Bar; many locales in Reach 8 when flows allow fish access.

The GoogleEarth spawning use area overlay was last updated in 2023; and a new overlay will be released in conjunction with this report. While there are no significant changes in overall fish distribution, a longer dataset has permitted continued refinement of the concentrated use area and regular use area datasets. Multiple concentrated use areas are candidates for demotion to regular use area or removal, a decision which will be made after the 2024 spawning season.

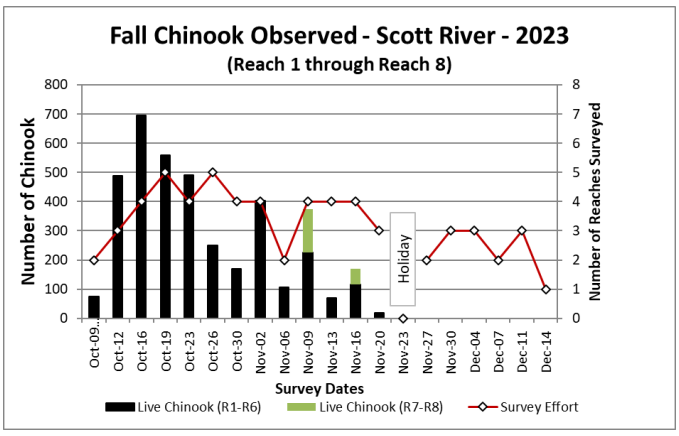
Using survey data and video weir observation, the Scott River is estimated to have had 1,906 fall-run Chinook salmon return in 2023 (**Figure 5**; **Appendix A**). Based on long-term tracking data compiled by CDFW, 2023 was well below average, ranking 38th (of 46 years) for run size.

Figure 5. Scott River fall-run escapement estimates for 1978 to 2023. Dashed line is average over long-term survey period.



Live Chinook and steelhead were tallied during surveys (**Figure 6**). As with redds, fish observation is influenced by number of surveyors, weather, discharge conditions, and surveyor experience. Additionally, the inclusion of a diver in the crew affects ability to identify fish, especially in deeper pools. Peak live Chinook was observed on October 16th. The uptick in live Chinook on November 2nd, 9th, and 16th is questionable as to identification; and many fish reported were likely coho salmon. See the "Discussion" section for further consideration of late-season fish misidentification on the Scott River. Steelhead were much more readily identified during surveys with snorklers, especially when within mixed schools of Chinook. Most steelhead were reported during the middle portion of October; and there was no obvious response to precipitation events regarding their activity. See **Appendix C** for a table of fish numbers organized by species, reach, and date.

Figure 6. Observation of Fall Chinook and steelhead during the 2023 Scott River surveys (Reach 1 through Reach 8 only).



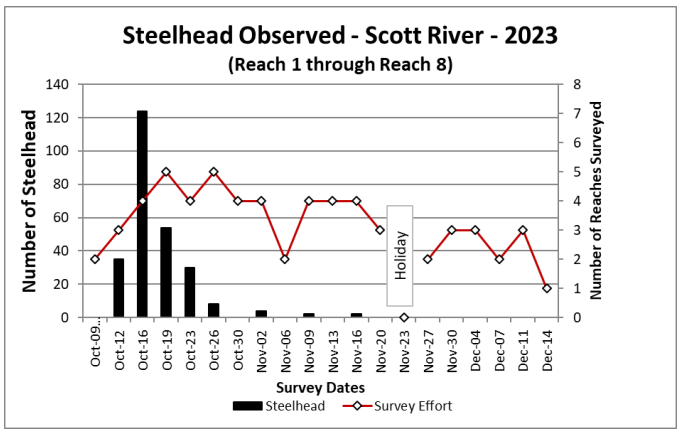
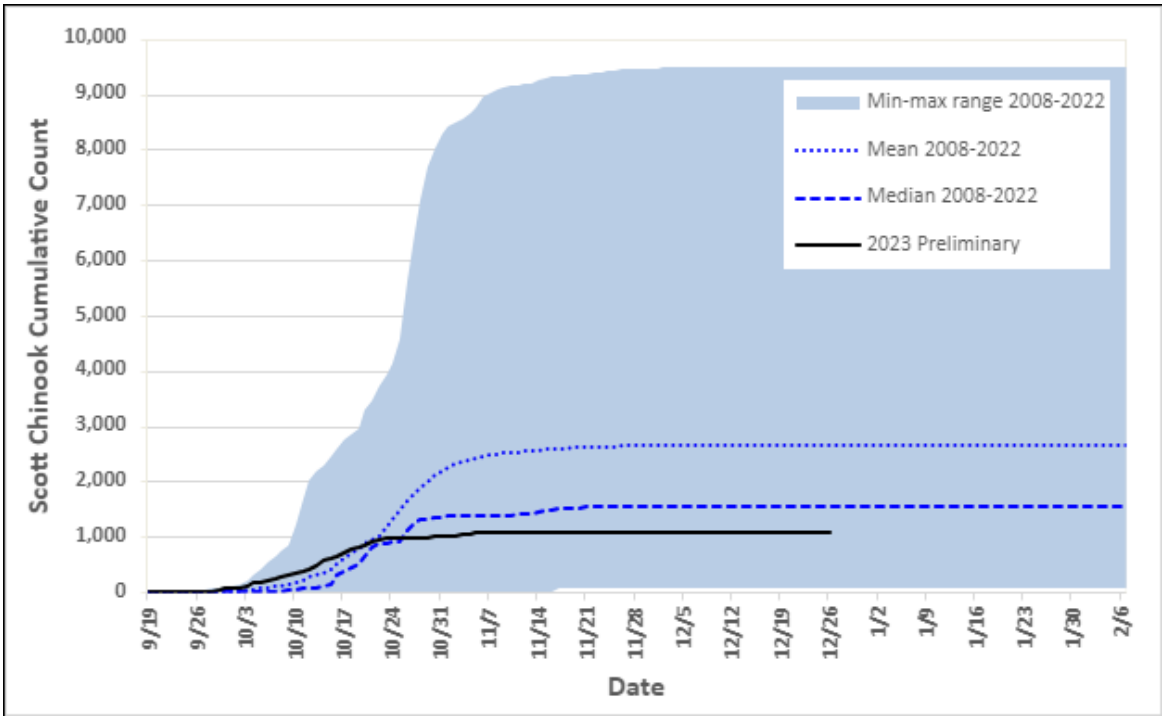


Figure 7. 2023 video weir observations (Reach 6/7 break). A total of 1,064 Chinook were recorded at the weir during its time of operation. (Figure from CDFW 2024b)



Coho salmon were incidentally observed during the Fall Chinook surveys:

- November 16th
  - 74 coho observed in Reach 6
- November 27th
  - 1 coho observed in Reach 2
- November 30th
  - 236 coho and 1 redd observed in Reach 6
- December 13th
  - 1 possible redd-in-progress observed in Tompkins Creek

Scott River tributary surveys occurred during November and December (**Appendix C**).

- Canyon Reaches: neither live Chinook, redds, nor carcasses were seen in Canyon Creek, Kelsey Creek, or Tompkins Creek.
- Valley Reaches (RCD): surveys were not completed, focus of available resources upon mainstem reaches.

DISCUSSION

The 2023 estimate of Fall Chinook population by CDFW indicates run size throughout the Klamath Basin to remain depressed compared to long-term averages (CDFW 2024a). This was the ninth consecutive year of reduced fish numbers for the Scott River; and the eighth for the Salmon River.

The use of GPS technology, starting 2011, to accurately document redd locations has been a significant upgrade from solely relying upon paper maps marked by individuals with varying degrees of geographical acumen. Via application of the GPS dataset, year-to-year fluctuation in spawning use can be tracked at the site and reach level. In turn, patterns can be correlated with factors such as discharge, flow timing, and storm events, as well as run size and other potential influences. As is common when considering natural systems, the dataset is complex and discerning true trends within the noise difficult. For both Salmon and Scott Rivers, a dataset dominated by lower-than-average flows and depressed run sizes means the full range of possible variability has yet to be seen.

Past annual reports have discussed many subjects, including the effects of low discharge, identification of barriers, and potential implications concerning climate change. For the most part, the continuation in 2023 of reduced run size, albeit with instream flow conditions more "normal" in comparison to long-term averages, does not substantially add to prior conversation; and, therefore, little can be added to those discussions (**Table 4**). A stand-alone review is planned to examine in-depth different facets of data gathered since 2011.

For 2023, the following items are highlighted: (1) genetics of spring-run and fall-run Chinook of the Salmon River; (2) large-scale patterns of shifting use by Salmon River Fall Chinook; and (3) live fish misidentification, with a focus upon the Scott River.

Salmon River – Spring-run vs. Fall-run Genetics

Chinook salmon have multiple recognized ecotypes. These ecotypes, colloquially called "runs", are described in terms of migration timing. By having a life history that includes a subset of individuals entering a river system at different times, overall species fitness may be enhanced. Not all salmonids incorporate distinct migratory ecotypes, the evolutionary impetus to develop such not well understood. Broad categories, not mutually exclusive, which may drive or sustain ecotypes include ability of early migrating fish to utilize suitable habitat less accessible to later arriving fish; and energetic and predation tradeoffs of ocean versus freshwater (Quinn, *et al.* 2016). Chinook salmon appear to be an example of the former, with spring-run Chinook taking advantage of the elevated flows of late spring and early summer to reach spawning and rearing habitat that is otherwise largely inaccessible due to thermal or low-water barriers during fall.

Assumptions have been made in the recent past concerning the genetics of salmonid ecotypes (Waples, *et al*. 2022). One assumption was that some salmonid species, such as Chinook salmon, exhibit a relatively high degree of genetic plasticity in regard to run timing, with ecotypes such as "spring-run" emerging repeatedly from the "fall-run" base type within different basins when and where conditions allowed. Supporting evidence indicated intra-basin genetics of the differing runs to be more similar than inter-basin genetics. A second assumption, potentially at odds with the first, was that the genetic basis of phenotype expression was complex, especially given variances in fat content, gonadal maturation, immunological response, and behavior which are perceived to be the primary differentiators between the various runs. Advances in the past decade

in the ability to resolve whole-genome sequences at increasingly finer scales across multiple samples in an economic and expedient manner has challenged the aforementioned assumptions.

Genetic analysis provides strong evidence that Chinook salmon "spring" and "fall" runs are genetically distinct from each other, likely the result of a single evolutionary event which then spread throughout the species' range (Thompson, *et al*. 2020; Prince, et al. 2017). Furthermore, expression of the two ecotypes appears to be controlled by a small, highly conserved region of the genome focused upon two genes and ancillary controlling factors (Horn and Narum 2022; Thompson, *et al*. 2020). This relatively simple genetic architecture, in turn, is expressed through the generations as a simple Mendelian trait (Waples, *et al*. 2022; Thompson, *et al*. 2020; Thompson, *et al*. 2019). Therefore, fish homozygous for the "spring" or "fall" haplotype exhibit their characteristic timing in leaving saltwater to begin migration, with heterozygous fish showing an intermediate timing (e.g., "late spring" or "early fall"). Other genetic modifiers or locally evolved variants fine-tune timing for local conditions (Horn and Narum 2022; Thompson, *et al*. 2020). In general, most populations, including the Salmon River, are a mix of homozygous and heterozygous haplotypes, with individual spring or fall runs exhibiting dominance of the associated genetics (Thompson, *et al*. 2020). Population haplotype persistence and frequency distribution is influenced by natural conditions, as well as anthropogenic impacts (i.e., dams, hatcheries, commercial fisheries) (Waples, *et al*. 2022; Thompson, *et al*. 2020; Thompson, *et al*. 2019).

The belief that many genes form the basis of run-type physiological and behavioral expression may be incorrect. Instead, only a few genes, as previously mentioned, appear crucial in the differentiation of spring and fall ecotypes. The specific mechanism is still under debate, with the cascading sequence of genetic interactions leading to phenotype expression proposed to be controlled primarily in response to photoperiod (Thompson, *et al*. 2020) or regulation of a key metabolic-associated hormone or other factor (Waples, *et al*. 2022; Prince, *et al*. 2016). The final agreed upon mechanism will likely be a combination of processes, but still initiate within only a handful of genes.

More recently, evidence suggests that that at least one element perceived to differentiate between the ecotypes – gonadal maturation – is a consequence of fish behavior and not directly impacted by spring/fall genetics. Thompson, *et al*. (2020) surveyed adult Chinook caught in the Klamath estuary, finding that all individuals, regardless of haplotype, had a relatively immature gonadal condition. The authors propose the reproductive maturation process to be tied to water temperature and independent of spring/fall genetics. Because spring-run Chinook holding in rivers are exposed to warmer temperatures sooner than their later up-migrating conspecifics, the subsequent acceleration of gonadal maturation results in the spring haplotype initiating spawning before fall haplotypes in the same system (although temporal overlap is still common). The implication of the gonadal maturation hypothesis is that other spring versus fall phenotypical differences may also be controlled by mechanisms common to the species' genetics, but are triggered in alternate ways based upon behavior tied back to haplotype.

Starting in 2023, Amy Fingerle (University of California, Berkley) began collecting genetic samples from juvenile and adult Chinook salmon of the Salmon River as a component of a doctoral thesis. This sampling is expected to continue for multiple years and will provide a fine-scale snapshot of current Chinook genetics throughout the basin. While genotyping for 2023 samples has been completed, the outputs are very preliminary and require additional collection years before meaningful conclusions may be made. Additional information is expected as the

project progresses. The final product will be used by federal, state, and non-governmental entities to inform run-type and genetics conservation, habitat enhancement development, fall- and spring-run spawning survey planning and interpretation, and other projects.

Salmon River – Large-Scale Patterns of Shifting Use

Data gathered through surveys suggests a recent large-scale pattern of shifting fish use for the Salmon River. The Fall Chinook spawning survey is only one source, with the hypothesis supported via data acquired from Spring Chinook spawning survey and Spring Chinook summer holding census events. Confirmation of this proposition requires a more in-depth analysis than is expected for an annual report and, as such, is provided as a general discussion point.

In the historic context, South Fork appears to support a greater proportion of Chinook use compared to the North Fork or upper mainstem. This situation seems to have shifted beginning in 2017 to favor the North Fork and mainstem; and may be in the process of returning to the original pattern.

- Fall Chinook spawning[1] – after favoring North Fork and/or mainstem 2017 through 2020, proportion of spawning use amid the upper mainstem and forks was more equal in 2022; and in 2023, South Fork returned to a use proportion similar to pre-2016.
- Spring Chinook holding census – South Fork counts of adult Spring Chinook 2017 through 2023 persist to be less than or similar to North Fork fish numbers.
- Spring Chinook spawning – redd counts 2017 through 2021 favor North Fork, with a possible shift to similar use allocation in 2022 and greater South Fork use in 2023. A caveat with interpretation of 2023 Spring Chinook spawning data is a strong possibility that Fall Chinook in the South Fork likely migrated upriver into the lower segment of the traditional Spring Chinook use area due to appropriate flow conditions allowing passage of low-water barriers. As spring, fall, and heterozygous genotypes cannot be visually differentiated, the redds resultant from the intrusion would have augmented Spring Chinook counts. While North Fork may have also experienced access of fall-run fish into spring-run reaches, it is not overtly obvious within the dataset.

The above dataset observations suggest an alteration in the river system that affects Chinook spatial distribution and spawning use by both Spring and Fall runs. The cause for a shift away from the South Fork (or, alternately, attraction towards North Fork) by Chinook is unknown. Equally, the reason behind a possible return to the established longer-term pattern of fish use is also unknown. Notable events which may have contributed to fish response include:

- Summer 2015 – debris flow, originating from Music Creek drainage, transported finer sediment into North Fork. Fall Chinook spawning use of the North Fork was noticeably depressed in 2015. Impacted pools and substrate had visually returned to conditions similar to pre-event by 2017.
- Fall 2016 – persistent elevated discharge during fall spawning season and into winter.
- Fall 2021 – persistent elevated discharge during fall spawning season.
- Summer 2022 – post-wildfire debris flows (Blind Horse Creek; unnamed Taylor Creek tributary), transported finer sediment into South Fork (and mainstem Salmon River). Heavy turbidity did not significantly decrease until October; subsequent fall and winter

[1] The years of 2016 and 2021 are excluded due to persistent high-water impacting Fall Chinook surveys, including an elevated number of survey cancellations and poor data quality when surveys could be completed.

precipitation reinitiated turbidity, albeit less severe in regard to intensity and duration. Visual sediment impact to substrate and significant infilling of some pools persisted through 2023.
    - Turbidity which affected SF Salmon River and mainstem Salmon River in 2022 lingered in 2023, but was not nearly as impactive to surveys.
- Late spring 2023 – post-wildfire debris flow (Rush Creek) transported sediment into South Fork. Smaller input than 2022 event, but event did augment fine sediment already present and is expected to extend substrate/pool recovery time.

The referenced events are not uncommon for the Salmon River system and similar have occurred during the longer Chinook dataset which is available. However, except for Spring Chinook holding census data, a sufficiently compiled dataset from which to examine nuances of spatial (re)distribution by Chinook, including spawning Fall Chinook, is not available at this time. It is likely other events have also precipitated an alteration in fish use, either short- or long-term, but discussion herein will be restricted to the time period 2011 to present. That said, it is unlikely that any of these items represent a singular "cause" or "trigger" for change but may be one of a suite of contributing factors.

Persistent high water in 2016 may have resulted in physical channel alteration at some localities. There are no habitat surveys to confirm the hypothesis; and even if there were, minimal pre-event data is available and locally utilized protocols are not sufficiently detailed to reveal what may be subtle changes. Potential evidence of localized channel modification is found in the annual tracking of Fall Chinook concentrated and regular use areas. Multi-year changes in fish utilization at some sites could indicate physical rearrangement to favor (or discourage) Chinook activity. Examples include South Fork concentrated use areas #10 and #15, both of which exhibit decreased spawning after 2016. Conversely, mainstem regular use area #18 was upgraded to a concentrated use area after review of 2023 spawning season data due to an increased amount of use on a consistent basis. However, it must always be kept in mind the possibility of other factors which might cause site-level changes in fish use, such as depressed run size starting 2016 and generally lower flow conditions in fall (excepting 2016 and 2021). Finally, even if there was channel modifications due to the 2016 event, the question then becomes if such was thence sufficient to alter Chinook spatial distribution and use patterns on a larger scale beyond that represented by specific spawning locations.

The longer-term response of fish populations or specifics of habitat following debris flows is not well covered in available literature. Such lack is due to the need to consider complex ecological processes, including anthropogenic effects, and the difficulty in isolating individual habitat or biological components. It has been argued that post-fire debris flows, which introduce woody debris and sediment, ultimately improve habitat availability and spawning conditions, even if short-term impacts are detrimental (Jacobs, *et al*. 2021; Flitcroft, *et al*. 2016). Of note, where post-fire debris flows are suggested to potentially be an important source of salmonid spawning material, existent and legacy anthropogenic impacts, inclusive of the receiving waters, can affect ultimate effectiveness (Smith, *et al*. 2021). Recovery of fish populations from debris-flows (and related catastrophic events, such as flood) can be quick – within five years (Howell 2006; Lamberti, *et al.* 1991). However, there are many interlinked factors which can affect the nuance and speed of recovery, including post-disturbance substrate stabilization, riparian vegetation regrowth, trophic response, connectivity, and recolonization potential of aquatic organisms (Flitcroft, *et al*. 2016; Howell 2006; Lamberti, *et al*. 1991).

The final take-away lesson is one of river/stream dynamism and the ability of Chinook salmon, and other aquatic fauna, to respond and adapt. It is less important to know the ultimate trigger for the observation of shifting spatial distribution and use by Chinook in the Salmon River – e.g., physical alteration from flood event; debris flows inputting new spawning gravels; changes in river temperature or chemical composition of which recent events are coincidental – than it is to know that the fish are reacting. However, the cautionary portion of the story is that human impacts, direct and indirect, can detrimentally affect that underlying natural resiliency given the complexity of ecological processes. Continuing to track patterns of Chinook habitat use, as well as major events which may cause an impact thereof, is a useful component to a long-term dataset to better understand local fish response.

Scott River - Late Season Live Fish Misidentification

The subject of live fish misidentification was discussed in the 2022 report as a subcomponent of observed mismatch between the number of "Chinook" reported, especially late season, versus number of redds. The accuracy of species identification is dependent upon factors such as viewing conditions, wading versus snorkeling, and surveyor experience. Local fisheries managers have never taken the Chinook numbers at face-value, instead using them as a window as to when fish are present, and guide decisions such as where to focus survey effort and how long to continue surveys at the end of the spawning season. That said, it would be advantageous to encourage a greater snorkeling effort, especially upon the Scott River, because management of steelhead and coho would benefit by having a greater accuracy of their presence and numbers, instead of being confounded as "Chinook".

Upon the Scott River, there was an uptick in live Chinook reported for November 2nd, 9th, and 16th. It is strongly suspected that many of these fish were coho in origination. For each of the survey days, there is one reach that stands out in regard to fish numbers. The video weir first records coho passing through the Reach 6/7 break around November 7th, which is coincident with a fall precipitation event that slightly increased Scott River flows. Shortly thereafter, the first incidental observations of coho by surveyors occurred in Reach 6 on November 16th. The video weir records the next significant upmigration of coho in late-November, timed with another storm event, whereupon over 500 fish were counted within a few days; and, at the same time, over 200 coho were counted in Reach 6 on November 30th. Of note, the video weir also records Chinook to have largely completed migration through the site by the end of October, which matches with a gradual decrease of live Chinook and new redd observations throughout the survey area.

The November 2nd outlier for live Chinook occurred upon Reach 1. The first several pools above the Klamath River confluence are known to occasionally support large numbers of fish. While some of these fish will stay in the Scott River, others are temporarily resting before heading to final destinations further upstream the Klamath River. The November 2nd survey ended about 0.5 mile upcanyon from the mouth due to time constraints, which is well above the pools where transient fish are expected to be holding. Therefore, it is very likely fish observed during the survey were committed to Scott River; and because there was no subsequent increase in Chinook redds matching the number of fish reported, many of these fish may actually represent coho beginning their Scott River upmigration.

The November 9th and 16th outliers for Chinook both originate from Reach 6. As mentioned previously, there was also confirmed observation of coho for Reach 6 on the November 16th date (as well as November 30th). Location information for fish seen by surveyors on the dates was not

recorded, but the reach does have several known impediments to upmigration during lower flow conditions – i.e., boulder cascades; beaver dam (some years). While discharge was suitable for Chinook to pass obstacles in 2023, perhaps coho were delayed, causing fish to generally hold in Reach 6 and, thereby, fostering increased "Chinook" reports. These fish later continued upstream, through the video weir, in late-November.

Of note, obvious live "Chinook" outliers were not present in the 2023 Salmon River dataset. Outliers do sometimes occur, although inaccuracies are typically due to steelhead misidentification, not coho. Coho are present in the Salmon River, but, unlike the Scott River, are a small component of the anadromous fish population. Some occurrences of reaches reporting larger than expected numbers of live Chinook later in the season have been confirmed via snorkel observation, which lends support to thoughts by some local fisheries managers that a small subpopulation of late-migrating Fall Chinook may be present within the Salmon River system in some years.

Table 4. Summary 2011 to 2023 of discharge conditions, fall storm occurrence, and run size for Salmon River and Scott River.

	Year												
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Salmon River													
Water Yr[1]	Normal	Normal	Normal to Low	Normal	Low to Very Low	High to Very High	Normal to High	Low	Normal to Low	Very Low to Low	Very High to Normal	Low	Normal
Fall Storms[2]	Early Late	Mid-Late Late	Early Late	Mid-Early Mid-Late Late	None	Mid-Early Mid-Late Late	Mid-Late Late	Late	Mid-Early Late	Late	Mid-Early Mid-Late	Mid-Late Late	Mid-Late Late
Run Size[3]	Well Above	Well Above	Average to Below	Above	Below	Well Below	Well Below	Well Below	Well Below	Well Below	Below	Below	Well Below
Scott River													
Water Yr	Normal	Low	Very Low to Low	Low to Normal	Very Low	Very High to High	Normal	Very Low	Low to Normal	Very Low	High to Normal	Very Low	Normal to Low
Fall Storms	None	Late	None	Mid-Early Late	None	Mid-Early Mid-Late Late	Late	Late	Late	None	Mid-Early Mid-Late	None	Late
Run Size	Average to Above	Well Above	Below	Well Above	Well Below	Well Below	Well Below	Well Below	Well Below	Well Below	Well Below	Well Below	Well Below

[1]Water Year – defined using the same daily discharge percentile cut-offs as the USGS gage dataset. Only considered for the active survey period.
*Very low - majority of daily discharge is below 10th percentile of daily means
*Low - majority of daily discharge is between 10th and 25th percentile of daily means
*Normal - majority of daily discharge is between 25th and 75th percentile of daily means
*High - majority of daily discharge is between 75th and 90th percentile of daily means
*Very high - majority of daily discharge is above 90th percentile of daily means
If there is no definite top rank, then top two ranks are included, with first descriptor the majority rank

[2]Fall Storms – fall freshet/storm timing defined as:
*None - no appreciable change in discharge (on gages) due to storms
*Early (before Oct 15)
*Middle-Early (Oct 15 to Oct 31)
*Middle-Late (Nov 1 to Nov 15)
*Late (after Nov 16)

[3]Run size – run size defined as:
*Average (to above/below) - within 10% of long-term average (as of the survey year)
*Above/below average - within 10% to 50% of long-term average
*Well above/below average - more than 50% deviation from long-term average

Survey Observations and Recommendations

The desired result for spawning (redd) surveys conducted in the Salmon River and Scott River watersheds is to create a dataset applicable in guiding locally informed management decisions (i.e., Forest Service, Watershed Councils, private individuals/organizations) in regard to projects, ongoing/proposed upland and riparian land use activities, and response to climate change. Products, such as the GoogleEarth overlay of redd regular use and concentrated use areas, are one result, and others may occur as needs are defined.

Many issues and problems encountered each year during the Fall Chinook surveys are observed on an annual basis. Most concerns are of the type which are addressed by agency managers early, with individual crews or as a survey whole, and then not adequately followed up upon during the remainder of the spawning season. This laxity allows undesirable crew habits to re-emerge later in the season and persist if not effectively corrected from the start. Other problems may not be seen during cursory in-season QA/QC, only showing up when data is closely examined and compiled in the post-season.

To address common reoccurring issues, it is the responsibility of the agency survey manager, or their representative, to ensure crews fully understand survey protocol. Although pre-season training introduces (or re-introduces) the protocol to crew, the information imparted may not be fully understood by a new crewmember, or yearly adjustments in protocol might not be wholly absorbed by a multi-season surveyor. Therefore, it is highly recommended that survey managers begin each survey day by reminding crew of the expected protocol. This activity should occur prior to acquisition of datasheet/map packets, before crews have begun to scatter to their assigned survey reach and it becomes difficult to capture the attention of the group. This daily announcement may include proper dictation of carcass and/or redd numbers, GPS protocols, reminder to fill in summary sheets, and any other issue of concern. Where reaches have special instructions, like flag/no-flag segments or no-access private property areas, conversation should also be undertaken with individual crews.

Communication between KNF and CDFW survey managers is paramount. In addition to attending the normal pre-season multi-agency meeting, survey managers for Salmon River and Scott River should communicate with each other prior to the survey season. The goal is to exchange recommendations on how to better administer the upcoming spawning surveys, which may include suggestions for minor changes in datasheets, protocol, and so forth. Furthermore, and of particular importance during the survey season, managers which observe the emergence or persistence of an issue during their survey day should convey such to other manager(s) to ensure the problem is specifically and immediately addressed the next survey day, not the following week, or later.

Since 2011, gains have been made in respect to datasheet return and data quality. Changes from pre-2011 practices and repeated verbal reminders over many years have altered habit – for example, datasheets/maps are now regularly returned at the end of the survey day. Of note, data quality continues to start to slip by the end of the season, especially as survey fatigue sets in during November. Problems which persist, or concerns which have a history of developing into problems if due diligence is not kept, along with recommended mitigations, are highlighted below:

- Recommendation #1: continue to provide data packets (carcass sheets, redd/map sheets) to each crew individually. Packets may be handed out by the survey administrator or a delegate.
    - This point of interaction is a good time to provide reminders to individuals and/or crew as to protocol or reach-specific instructions.
- Recommendation #2: crews check-in with administrative lead or delegate at end of survey day. Early returning crews may be required to wait if administrator or delegate is not present. If administrator/delegate cannot be present or crews must leave early due to travel distance, then a QA/QC checkbox should be utilized. This action verifies datasheets are complete AND an appropriate level of data quality exists.
    - A reminder checkbox was introduced to summary sheets in 2018. Training and morning briefings need to emphasize checkbox existence and what it signifies.
    - For the Scott River: the Scott River CDFW survey administrator continues to ensure that agency crewmembers understand it is their responsibility, when on-site and waiting for crews to return, to double-check datasheets for completeness.

There are multiple commonly observed crew-associated issues for agency managers to address during training and daily survey announcements. Starred entries denote subjects which are chronic problems:

- Correctly fill out all datasheets.
    - Complete header information as appropriate – start/end time, weather, streamflow, temperature (when available), **crew names (not initials), etc.
    - For redds, always use the data/map sheet. Only use the continuation sheet as the primary datasheet when no data/map sheet is available.
    - Count all live fish. Record total live Chinook seen during a survey on both the carcass and redd datasheets. The redd sheet also includes areas for coho and steelhead. If there are no fish, write a "0". This action confirms to the administrator that a count was undertaken.
    - **"Live fish" on the summary sheet is Chinook only (includes adults and jacks). If other species are to be reported, they should be written in the comment section.
    - **Redd dimensions should be measured to the nearest 0.1 meter, or as close as possible given equipment limitations. **Do not** use feet. **Do not** use the nearest meter or half meter. **Do not** estimate. **Do not** assume all redds are the same size and thereby report the same dimensions repeatedly.
    - **Always fill out the hardcopy maps, even if no redds were observed! They are used for post-season QA/QC, as well as a back-up should GPS data be lost or not collected.
        - This is especially important in years with low fish numbers, numerous cancelled surveys, and/or overall poor effort due to high water. Some reaches may only undergo one or two surveys, compared to the normal regime of six to ten (or more).
    - Be aware of and properly respond to alterations to datasheets, maps, summary sheets, and envelopes – e.g., data review box; redds-in-progress count.
- Perform the GPS protocol correctly.
    - Input the correct redd number label. An example is provided on the redd datasheet.

    - When a crew is GPSing, they should capture **all flags** which have not already been mapped, not just the new ones recorded that survey day. Do not assume that a redd has already been GPSed – check flagging for knots.
    - Use information on flagging – date and redd number – to build a redd GPS point. Do not sequentially number all redds on the day that the GPS is used, regardless of original date of discovery.
- Other issues
    - Older versions of datasheets and maps may be used for surveys. While still valid for data collection, any recent updates are not included and, thus, crew will find them different from examples used during training. Minor inconsistencies and errors in filling out documents are observed.
        - Due to the cost of water-resistant paper, unless a major update has occurred, older versions will remain available until all are used. The recommendation is to utilize older versions over newer when passing out data packets, ensuring crew members are aware when items are different.
    - Completely fill out the CDFW summary sheet, ensuring information is entered on the correct date.
    - Where reaches are split into "A" and "B", survey administrators should ensure crews are aware of which sub-reach they are surveying. Sub-reaches primarily occur on the Salmon River, although, depending upon fish numbers and landowner access, they may also be used for Reach 8 of the Scott River.
    - If a reach is ended early due to injury, weather, or other reason, mark on the map where the survey stopped.
    - Redd flagging should always include survey date and redd number to avoid double-counting.
    - To avoid multiple measurements of the same redd within "Unflagged Segments", as well as maintain survey speed, there is no need to take redd dimensions within these areas. Mapping and GPSing will still occur.
    - Ensure crews know any "special instructions" for a reach, such as flag/no-flag segments and entry/exits to avoid private property or natural hazards.
    - **Some individuals/crews present at the pre-season trainings are not fully engaged. These individuals/crew are often same ones who have built habits, sometimes undesirable, through years of surveying; and even when reminded during the season to make adjustments, will return to their old practices within a survey or two. Additionally…
        - Trainers do not always have the opportunity to traverse stations, and therefore may not be exposed to protocol adjustments that have occurred since the previous spawning season.

The following recommendations are aimed specifically at KNF and CDFW:

- The KNF administrator should ensure redd/map datasheets are always available.
- The Forest Service should continue incorporation of GPS-centric items into the annual pre-season survey training "Redd Station", including -
    - How to title redd GPS points.
    - Presentation of a visual on how multiple years of GPS data have led to delineation of spawning concentration areas.

    - Visual comparison of accuracy of GPSing versus potential inaccuracy of hardcopy maps: even the best map reader can be several hundred feet off, which in turn will affect precision of the map product produced for management and monitoring purposes.
    - Emphasize importance of hardcopy maps as a back-up to GPS data.
- (**NEW**) Forest Service, CDFW, or other interested entity should research advances in GPS/tablet use and determine if such is applicable for local incorporation, data management requirements, and cost.
- Pre-season training at all data collection stations should emphasize crew QA/QC prior to turning in datasheets, including correct header information and numbering for redds, carcasses, and scale/tissue envelopes.
- As necessary, flagging should be placed on the river and the road to demark entry/exit points to reaches, private property, flagged/unflagged segments, and similar.
- Require crews to carry at least one gaff or walking stick with measure marks (meters and tenth-meters).
- Encourage use of snorkeling, with the goal to field at least one diver per reach.
- (**NEW**) Review identification of live Chinook versus coho in early-November. Experienced surveyors should provide input for strategies to distinguish the species, especially when viewed from the shoreline.
- Discuss between USFS and CDFW survey administrators about how to manage *consistently* those individuals/crews who have been identified as exhibiting undesirable habits.
- Coordinate with CDFW to investigate the possibility of minor modifications to daily summary sheets.
    - Scott River only:
        - Alter the "Live Fish" field to specify "Live Fish – Chinook" to specify only Chinook are to be enumerated. Also include separate spaces to report adults and jacks.
        - Consider addition of "Live Fish – Steelhead" and "Live Fish – Coho" fields.
        - Include a checkbox with each reach for the survey manager to mark when a reach is not surveyed. The manager should comment why the reach was omitted (e.g., high water, insufficient crew, safety concerns).
- (**NEW**) When the USFS draft annual report is sent to CDFW for review, also include a copy of the datasheet/mapping errors recorded during end-of-season QA/QC to ensure CDWF administrators better understand general errors encountered the previous year.

Successes

Since 2011, there have been multiple successes in achieving higher quality and more consistent data:

Administration

- Protocol consistency between Salmon River and Scott River watersheds (on SSRD).
- When data packets are handed out by a survey administer or representative to crews, it is more likely that everything will be returned at the end of the day. Additionally, the morning rush is much more restrained.

Datasheets

- Most crews turn in the entirety of the datasheet/map packets, even when no redds, fish, and/or carcasses are found.
- KNF more often checks on-site stock of redd/map datasheets to ensure sufficient supplies are available for survey use.
- CDFW summary sheet modifications –
    - Provision of separate entries for "A" and "B" sub-reaches, as appropriate. This change eliminated the need for crews to manually draw a divider under the reach number and increased likelihood for data to be reported in the correct location.
    - Addition of prompts for crew to QA/QC all datasheets and envelopes.
    - Salmon River (2019) – addition of "Chinook" and adult/jack split to increase live fish reporting accuracy.
    - Salmon River (2019) – incorporation of "Reach Not Surveyed" checkbox.
    - Salmon River (2023) – modification to fish report field to enumerate by species.
- Forest Service redd datasheet modifications –
    - Incorporation of a map on the back of the main datasheet.
    - Inclusion of an example of a redd GPS point.
    - Addition of instructions for when to use "unflagged segments" portion of the datasheet (2019).
        - "Unflagged Redd Segment" removed from all datasheets EXCEPT Scott River Reach 3 (2022).
    - Space added to report "redds in progress", as per request by CDFW (2022).
    - Addition of prompt for crew to QA/QC datasheet (2022).
- Forest Service map modifications –
    - Survey area along river segment highlighted.
    - Inclusion of a special instruction box for reaches, or portions thereof, that are not flagged.
    - Unnecessary header box items removed (2019).
    - Checkbox added for "no new redds" (2022).

GPS

- Evolution of GPSing, such as incorporation of knotting flags to show that mapping has already occurred.
- Individual redds within multi-redd groupings are GPSed as individual points, thereby retaining mapping resolution of spawning areas for management and monitoring purposes.
- More GPS units are available to map redds. Between KNF, CDFW, watershed councils, tribal crews, and other entities, there is sufficient equipment to GPS every reach every day for both Salmon River and Scott River drainages.
- More regular downloading of GPS units. The KNF administrator brings a computer once a week to surveys to capture GPS data and tracks the downloaded data files.

Other

- Training (2021) – Inclusion of a slide/poster for "Redd Station" that illustrates the six habitat types.

- Salmon River (2019) – Reach 5A protocol adjusted to align with rest of survey area in regard to hanging flags and GPSing new redds as encountered. There will no longer be a complete redd count each survey date.
- Increased compliance to concurrently utilize GPS units and hardcopy maps to record redds.

LITERATURE CITED

California Department of Fish and Wildlife (CDFW). 2024a. Klamath River Basin Fall Chinook salmon spawner escapement, in-river harvest and run-size estimates – 1978-2023.

_____. 2024b. Klamath River project adult fish counting facility in-season update – January 5, 2024. California Department of Fish and Wildlife (Yreka Field Office), Yreka, CA. 4 p.

_____. 2023. Klamath Basin cooperative spawning ground survey – 2023 training manual. 65 p.

Flitcroft, R., J. Falke, G. Reeves, P. Hessburg, K. McNyset, and L. Benda. 2016. Wildfire may increase habitat quality for spring Chinook salmon in the Wenatchee River Subbasin, WA, USA. *Forest Ecology and Management* 359: 126–140. doi: 10.1016/j.foreco.2015.09.049

Horn, R.L., and S.R. Narum. 2023. Genomic variation across Chinook salmon populations reveals effects of a duplication on migration alleles and supports fine scale structure. *Molecular Ecology*, 32, 2818–2834. doi: 10.1111/mec.16895

Howell, P. 2006. Effects of wildfire and subsequent hydrologic events on fish distribution and abundance in tributaries of North Fork John Day River. *North American Journal of Fisheries Management* 26: 983-994. doi: 10.1577/M05-114.1

Jacobs, G., R. Thurow, J. Buffington, D. Isaak, and S. Wenger. 2021. Climate, fire regime, geomorphology, and conspecifics influence the spatial distribution of Chinook salmon redds. *Transactions of the American Fisheries Society* 150: 8–23. doi: 10.1002/tafs.10270

Lamberti, G., S. Gregory, L. Ashkenas, R. Wildman, and K. Moore. 1991. Stream ecosystem recovery following a catastrophic debris flow. *Canadian Journal of Fisheries and Aquatic Sciences* 48: 196-208. doi: 10.1139/f91-027

Prince, D.J., S.M. O'Rourke, T.Q. Thompson, O.A. Ali, M. Archiniega, H.S. Lyman, I.K. Saglam, A.J. Clemento, T.J. Hotaling, A.P. Kinziger, A.P. Spidle, J.C. Garza, D.E. Perse, and M.R. Miller. 2017. The evolutionary basis of premature migration in Pacific salmon highlights the utility of genomics for informing conservation. *Science Advances* 3: e1603198. doi: 10.1126/sciadv.1603198

Quinn, T.P, McGinnity, P., and T.E. Reed. 2016. The paradox of "premature migration" by anadromous salmonid fishes: patterns and hypotheses. *Canadian Journal of Fish and Aquatic Science* 73: 1015-1030. doi: 10.1139/cjfas-2015-0345

Smith, D., J. Schnieders, L. Marshall, K. Melchor, S. Wolfe, D. Campbell, A. French, J. Randolph, M. Whitaker, J. Klein, C. Steinmetz, and R. Kwan. 2021. Influence of a post-dam sediment pulse and post-fire debris flows on steelhead spawning gravel in the Carmel River, California. *Frontiers in Earth Science* 9:802825. doi: 10.3389/feart.2021.802825

Thompson, N.F., E.C. Anderson, A.J. Clemento, M.A. Campbell, D.E. Pearse, J.W. Hearsey, A.P. Kinzigen, and J.C. Garza. 2020. A complex phenotype in salmon controlled by a simple change in migratory timing. *Science* 370: 609-613. doi: 10.1126/science.aba9059

Thompson, T.Q., M.R. Bellinger, S.M. O'Rourke, D.J. Prince, A.E. Stevenson, A.T. Rodrigues, M.R. Sloat, C.F. Speller, D.Y. Yang, V.L. Butler, M.A. Banks, and M.R. Miller. 2019. Anthropogenic habitat alteration leads to rapid loss of adaptive variation and restoration potential in wild salmon populations. *Proceedings of the National Academy of Sciences* 1: 117-186. doi: 10.1073/pnas.1811559115

Waples, R.S., M.J. Ford, K. Nichols, M. Kardos, J. Myers, T.Q. Thompson, E.C. Anderson, I.J. Koch, G. McKinney, M.R. Miller, K. Naish, S.R. Narum, K.G. O'Malley, D. Pearse, G.R. Pess, T.P. Quinn, T.R. Seamons, A. Spidle, K. Warheit, and S.C Willis. 2022. Implications of large-effect loci for conservation: A review and case study with Pacific salmon. *Journal of Heredity* 113: 121–144. doi: 10.1093/jhered/esab069Waples

Appendix A – California Department Fish and Wildlife "MegaTable"

Due to large size of the Klamath River Fall Chinook "MegaTable" (1978 to 2023), only the most recent years and summary tables are provided in this Forest Service document. See the original California Department of Fish and Wildlife document for the full MegaTable, including footnotes and acronyms.

Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, 1978-2023 a/

SPAWNER ESCAPEMENT

	2020			2021			2022		
Hatchery Spawners	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Iron Gate Hatchery (IGH)	413	4,042	4,455	494	7,012	7,506	206	9,269	9,475
Trinity River Hatchery (TRH)	2,815	4,289	7,104	129	5,838	5,967	973	3,965	4,938
Hatchery Spawner Subtotals:	**3,228**	**8,331**	**11,559**	**623**	**12,850**	**13,473**	**1,179**	**13,234**	**14,413**
Natural Spawners									
Main Stem Klamath River n/ (excluding IGH)	150	3,028	3,178	860	4,400	5,260	111	4,930	5,041
Salmon River basin	122	972 hh/	1,094	263	1,890	2,153	291	1,274	1,565
Scott River basin	43	812	855	655	1,306	1,961	67	927	994
Shasta River basin	393	3,775	4,168	927	5,972	6,899	106	4,403	4,509
Bogus Creek basin	88	2,233	2,321	423	2,253	2,676	42	1,721	1,763
Misc. Klamath tributaries o/ (above Yurok Reservation)	34	874	908	179	1,003	1,182	224	1,286	1,510
Yurok Reservation tribs. (Klamath River) p/	99	124	223	25	119	144	148	228	376
Klamath Natural Spawner Subtotals:	**929**	**11,818**	**12,747**	**3,332**	**16,943**	**20,275**	**989**	**14,769**	**15,758**
Main Stem Trinity River dd/ (excluding TRH)	3,885	14,071	17,956	3,238	12,859	16,097 ll/	3,017	6,929	9,946
Misc. Trinity tributaries o/ (above Hoopa Reservation)	97	214	311	33	130	163	51	117	168
Hoopa Reservation tribs. (Trinity River) p/	37	82	119	32	124	156	60	141	201
Trinity Natural Spawner Subtotals:	**4,019**	**14,367**	**18,386**	**3,303**	**13,113**	**16,416**	**3,128**	**7,187**	**10,315**
Natural Spawner Subtotals	**4,948**	**26,185**	**31,133**	**6,635**	**30,056**	**36,691**	**4,117**	**21,956**	**26,073**
Total Spawner Escapement	**8,176**	**34,516**	**42,692**	**7,258**	**42,906**	**50,164**	**5,296**	**35,190**	**40,486**

IN-RIVER HARVEST

	2020			2021			2022		
Angler Harvest	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Klamath River (below Hwy 101 bridge)	39	206	245	138	249	387	104	381	485
Klamath River (Hwy 101 to Weitchpec)	343	2,946	3,289	2,161	900	3,061	1,614	1,092	2,706
Klamath River (Weitchpec to IGH)	134	1,589	1,723	74	579	653	26	742	768
Trinity River basin above Weitchpec aa/	17	382	399	26	692	718	126	246	372
Angler Harvest Subtotals:	**533**	**5,123**	**5,656**	**2,399**	**2,420**	**4,819**	**1,870**	**2,461**	**4,331**
Tribal Harvest e/									
Klamath River (below Hwy 101 bridge)	85	1,730	1,815	17	2,598	2,615	0	4,393	4,393
Klamath River (Hwy 101 to Trinity mouth)	156	2,503	2,659	144	2,842	2,986	41	1,864	1,905
Trinity River (Hoopa Reservation)	87	979	1,066	451	2,626	3,077	293	1,778	2,071
Tribal Harvest Subtotals:	**328**	**5,212**	**5,540**	**612**	**8,066**	**8,678**	**334**	**8,035**	**8,369**
Total In-river Harvest	**861**	**10,335**	**11,196**	**3,011**	**10,486**	**13,497**	**2,204**	**10,496**	**12,700**

IN-RIVER RUN

	2020			2021			2022		
Totals	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
In-river Harvest and Escapement	9,037	44,851	53,888	10,269	53,392	63,661	7,500	45,686	53,186
Angling Mortality (2.04% of harvest) f/	11	105	116	49	49	98	38	50	88
Net Mortality (8.70% of harvest) f/	29	453	482	26	671	697	10	694	704
Klamath Basin disease testing jj/	0	0	0	6	113	119	0	164	164
Total In-river Run	**9,077**	**45,409**	**54,486**	**10,350**	**54,225**	**64,575**	**7,548**	**46,594**	**54,142**

(continued next page)

Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, 1978-2023 a/

SPAWNER ESCAPEMENT

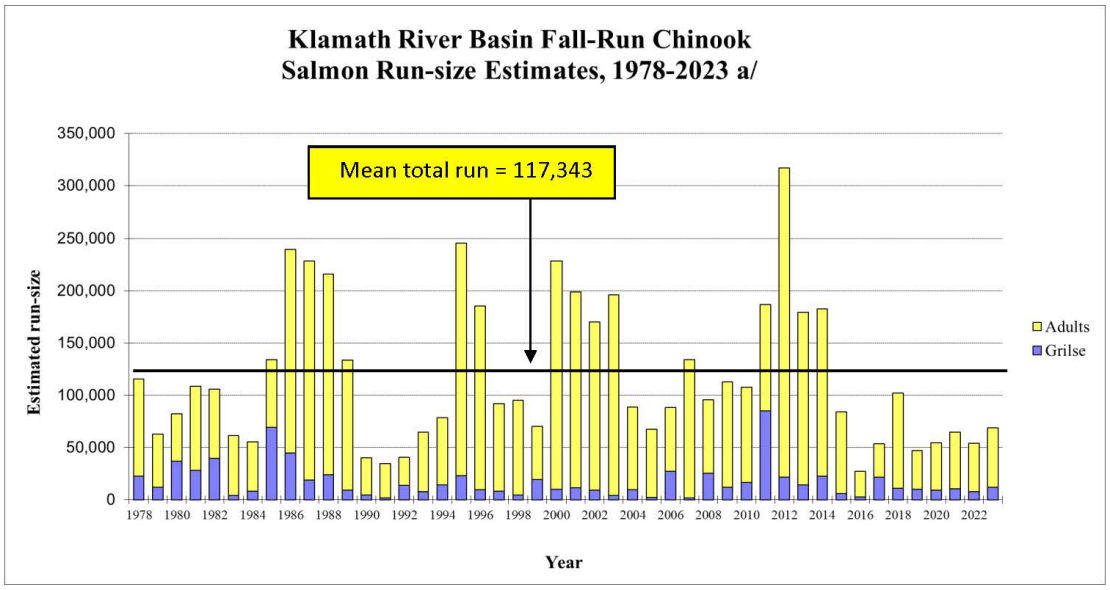
	2023			2024			2025		
Hatchery Spawners	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Iron Gate Hatchery (IGH)	200	10,145	10,345			0			0
Trinity River Hatchery (TRH)	848	11,819	12,667			0			0
Hatchery Spawner Subtotals:	**1,048**	**21,964**	**23,012**	**0**	**0**	**0**	**0**	**0**	**0**
Natural Spawners									
Main Stem Klamath River n/									
(excluding IGH)	375	6,105	6,480			0			0
Salmon River basin	264	1,355	1,619			0			0
Scott River basin	243	1,663	1,906			0			0
Shasta River basin	156	4,747	4,903			0			0
Bogus Creek basin	196	3,179	3,375			0			0
Misc. Klamath tributaries o/									
(above Yurok Reservation)	242	2,190	2,432			0			0
Yurok Reservation tribs. (Klamath River) p/	83	237	320			0			0
Klamath Natural Spawner Subtotals:	**1,559**	**19,476**	**21,035**	**0**	**0**	**0**	**0**	**0**	**0**
Main Stem Trinity River dd/									
(excluding TRH)	7,865	13,161	21,026			0			0
Misc. Trinity tributaries o/									
(above Hoopa Reservation)	16	67	83			0			0
Hoopa Reservation tribs. (Trinity River) p/	30	129	159			0			0
Trinity Natural Spawner Subtotals:	**7,911**	**13,357**	**21,268**	**0**	**0**	**0**	**0**	**0**	**0**
Natural Spawner Subtotals	**9,470**	**32,833**	**42,303**	**0**	**0**	**0**	**0**	**0**	**0**
Total Spawner Escapement	**10,518**	**54,797**	**65,315**	**0**	**0**	**0**	**0**	**0**	**0**

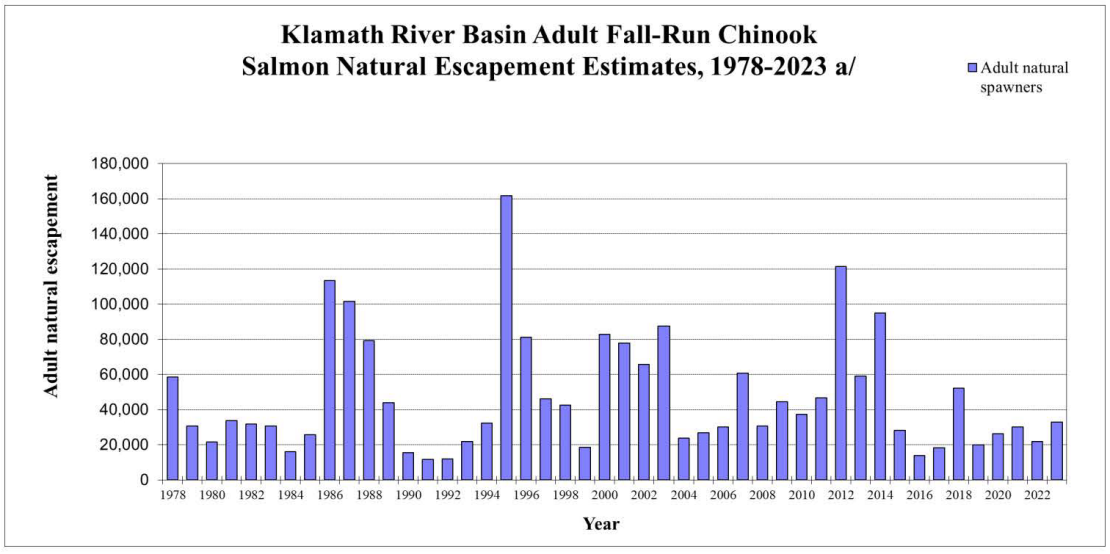
IN-RIVER HARVEST

	2023			2024			2025		
Angler Harvest	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Klamath River (below Hwy 101 bridge)	0	0	0			0			0
Klamath River (Hwy 101 to Weitchpec)	0	0	0			0			0
Klamath River (Weitchpec to IGH)	0	0	0			0			0
Trinity River basin above Weitchpec aa/	9	53	62			0			0
Angler Harvest Subtotals:	**9**	**53**	**62**	**0**	**0**	**0**	**0**	**0**	**0**
Tribal Harvest e/									
Klamath River (below Hwy 101 bridge)	5	12	17			0			0
Klamath River (Hwy 101 to Trinity mouth)	13	411	424			0			0
Trinity River (Hoopa Reservation)	1,118	1,668	2,786			0			0
Tribal Harvest Subtotals:	**1,136**	**2,091**	**3,227**	**0**	**0**	**0**	**0**	**0**	**0**
Total In-river Harvest	**1,145**	**2,144**	**3,289**	**0**	**0**	**0**	**0**	**0**	**0**

IN-RIVER RUN

	2023			2024			2025		
Totals	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
In-river Harvest and Escapement	11,663	56,941	68,604	0	0	0	0	0	0
Angling Mortality (2.04% of harvest) f/	0	1	1	0	0	0	0	0	0
Net Mortality (8.70% of harvest) f/	11	171	182			0			0
Klamath Basin disease testing jj/			0			0			0
Total In-river Run	**11,674**	**57,113**	**68,787**	**0**	**0**	**0**	**0**	**0**	**0**





a/ 2023 data are preliminary

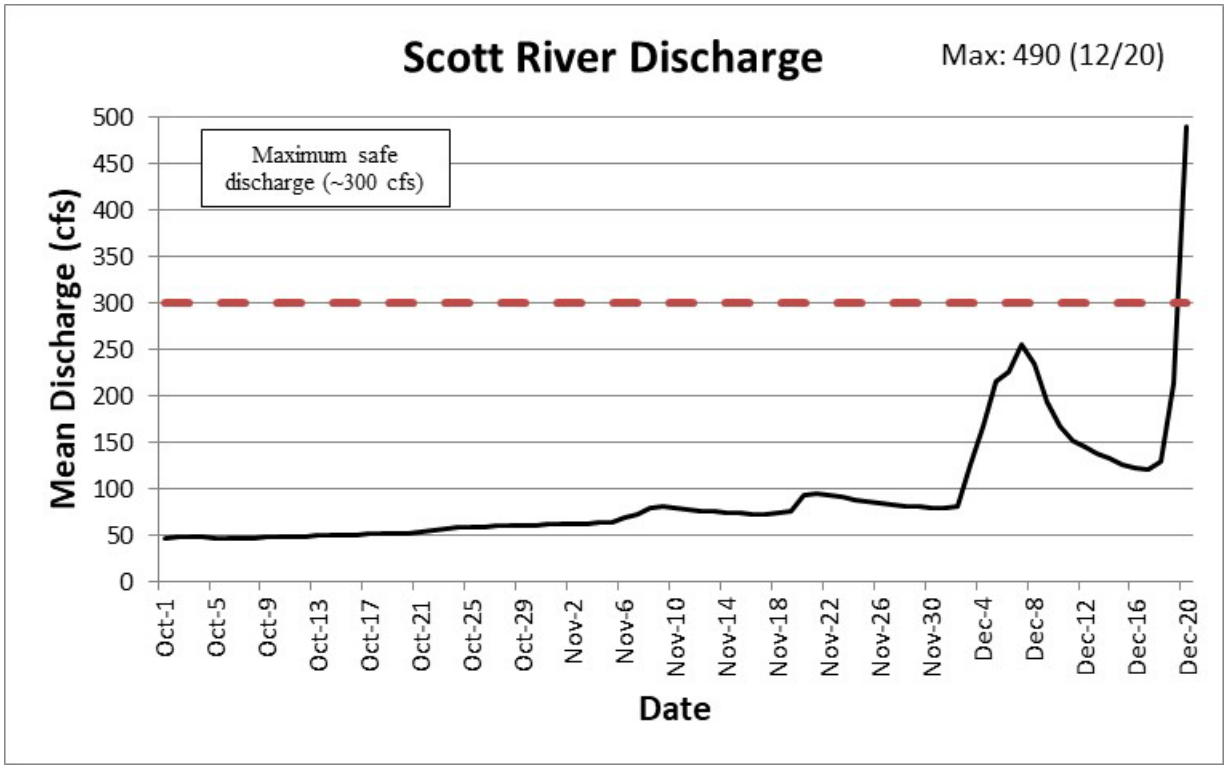
Appendix B – USGS Discharge Charts

Scott River

The Scott River gauge (11519500) is located 10.8 miles downstream from Fort Jones, CA.

- Legal location T.44N., R.10W., Sec. 29 (Mount Diablo Meridian); or
- Lat. 41°38'27" by Long. 123°00'50" (referenced NAD 1927)

The graph shown provides a daily mean of discharge at the gauge and includes October 1st through December 20th, 2023, which encompasses the redd/carcass survey dates and is inclusive effort by CDFW and/or other cooperators which may have continued after KNF had ended the survey season. Instantaneous discharges measured at the gauge can be higher or lower than that pictured. Variability in flow or on-site assessment of conditions of a specific reach during an actual survey day may have provided a window of safe discharge not reflected in the figure.

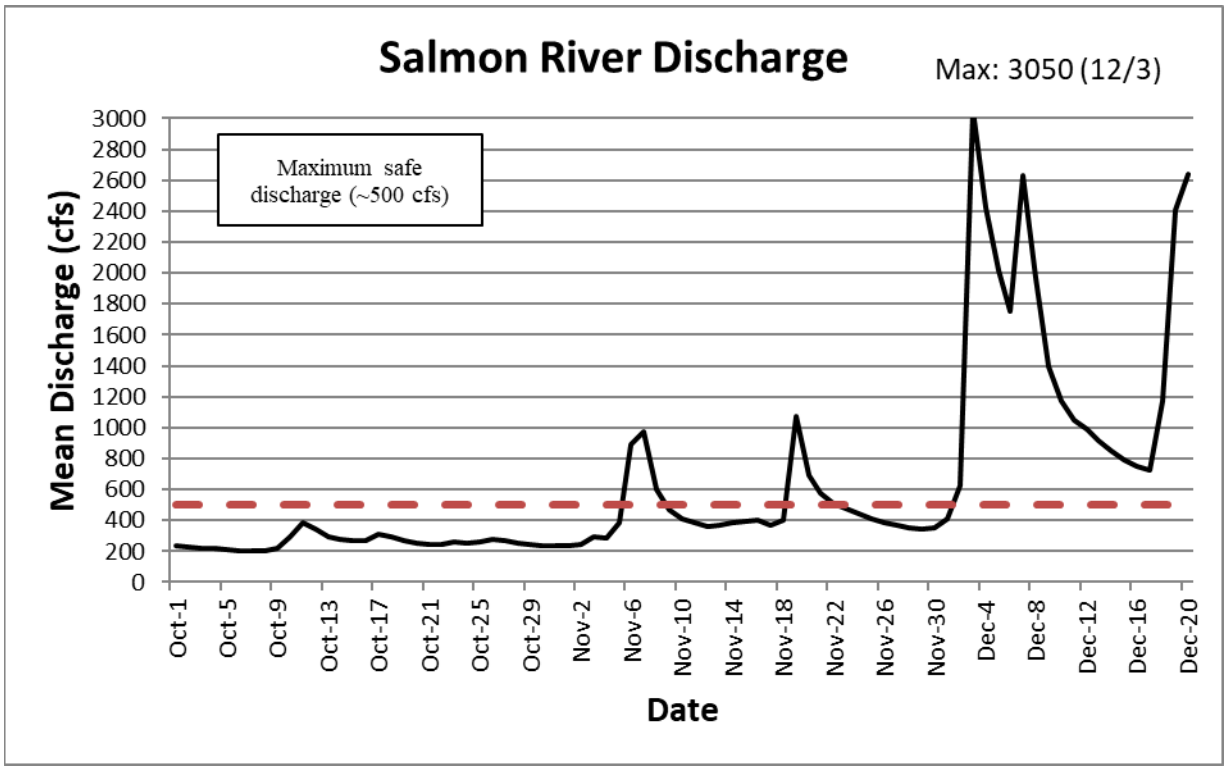


Salmon River

The Salmon River gauge (11522500) is located 1.0 miles upstream from Somes Bar, CA, at the confluence with the Klamath River.

- Legal location T.11N., R.6E., Sec. 3 (Humboldt Meridian); or
- Lat. 41°22'36" by Long. 123°28'33" (referenced NAD 1927)

The graph shown provides a daily mean of discharge at the gauge and includes October 1st through December 20th, 2023, which encompasses the redd/carcass survey dates and is inclusive effort by CDFW and/or other cooperators which may have continued after KNF had ended the survey season. Instantaneous discharges measured at the gauge can be higher or lower than that pictured. Variability in flow or on-site assessment of conditions of a specific reach during an actual survey day may have provided a window of safe discharge not reflected in the figure.



Appendix C – Redd and Fish Survey Tables (2023)

Salmon River Redds

Reach	Date															
	Oct-10	**Oct-13**	**Oct-17**	**Oct-20**	**Oct-24**	**Oct-27**	**Oct-31**	**Nov-03**	**Nov-07**	**Nov-10**	**Nov-14**	**Nov-17**	**Nov-21**	**Nov-25**	**Nov-28**	**Dec-01**
Mainstem																
4A - Otter Bar to Nordheimer Ck	30		9	2	2[1]	6	7	1	----	----	----	3		----		0
4B - Forks to Otter Bar	1		42	26	0	3		0				5	9			0
North Fork																
9A - Mile 2 to Forks	13		1		14		4		High Water	Holiday	Trib Surveys	1		Holiday	0	
9B - Mile 4 to Mile 2	6		9		7		0					0			2	
10A - Mile 6 to Mile 4		6			9			8							0	
10B - Mile 8 to Mile 6		10		10	0			12							0	
11A - Mile 10 to Mile 8		14		12		1		2							0	
11B - Mile 12 to Mile 10		7		4		0	6	1					0			0
South Fork																
5A - Henry Bell to Forks	42[1]	10[1]		7		30		2	-----	-----	-----		0	-----		0
5B - O'Farrill Gulch to Henry Bell	13		19	19	10	7		0					0			0
6A - Indian Ck to O'Farrill Gulch	17		10		3		17								1	
6B - Matthews Ck to Indian Ck		26	6		6		1								0	

*nd = no data (surveys performed, but redd count not reported) / Underline = days which included pulling flagging

[1]Incomplete survey - not completed due to injury, time constraint, or gear issue; partial reach survey to finish a prior day incomplete survey.

Salmon River Tributary Surveys

Tributary	Date	Redds	Chinook	Steelhead
Knownothing Creek	Nov-17	7	0	0
Knownothing Creek (EF)	Nov-14	0	0	0
Knownothing Creek (WF)	Nov-14	0	0	0
Little NF Salmon River	Nov-14	0	0	0
Methodist Creek	Nov-14	0	0	0
Nordheimer Creek (A)	Oct-27	7	4	0
	Nov-14	0	0	0
	Nov-17	2	0	0
Plummer Creek	Nov-14	0	0	0

*An attempt was made to visit Nordheimer Creek (B), but the trail was too overgrown to allow access and survey in a timely manner

Salmon River (Live) Chinook Observation

Reach	Date															
	Oct-10	**Oct-13**	**Oct-17**	**Oct-20**	**Oct-24**	**Oct-27**	**Oct-31**	**Nov-03**	**Nov-07**	**Nov-10**	**Nov-14**	**Nov-17**	**Nov-21**	**Nov-25**	**Nov-28**	**Dec-01**
Mainstem																
4A - Otter Bar to Nordheimer Ck	42		119	161	12	67	45	66	----	----	----	1		----		1
4B - Forks to Otter Bar	17		35	45	0	22		15				4	5			0
North Fork																
9A - Mile 2 to Forks	38		74		21		2		High Water	Holiday	Trib Surveys	0		Holiday	0	
9B - Mile 4 to Mile 2	37		37		36		3					0			0	
10A - Mile 6 to Mile 4		30			14			3							0	
10B - Mile 8 to Mile 6		11		18	18			8							0	
11A - Mile 10 to Mile 8		19		25		5		2							0	
11B - Mile 12 to Mile 10		8		15		4	1	1					0			0
South Fork																
5A - Henry Bell to Forks	90	49		90		36		18	|-----	|-----	|-----		0	|-----		1
5B - O'Farrill Gulch to Henry Bell	44		59	81	70	27		11					1			0
6A - Indian Ck to O'Farrill Gulch	33		30		26		10								0	
6B - Matthews Ck to Indian Ck		32	27		24		2								0	

*nd = no data (surveys performed, but datasheets or data missing; number likely 0)

Salmon River (Live) Steelhead Observation

Reach	Date															
	Oct-10	**Oct-13**	**Oct-17**	**Oct-20**	**Oct-24**	**Oct-27**	**Oct-31**	**Nov-03**	**Nov-07**	**Nov-10**	**Nov-14**	**Nov-17**	**Nov-21**	**Nov-25**	**Nov-28**	**Dec-01**
Mainstem																
4A - Otter Bar to Nordheimer Ck	14		125	18	28	61	10	11	----	----	----	0		----		0
4B - Forks to Otter Bar	4		1	0	0	0		0				6	3			1
North Fork																
9A - Mile 2 to Forks	2		11		0		0		High Water	Holiday	Trib Surveys	0		Holiday	0	
9B - Mile 4 to Mile 2	0		7		45		0					10			0	
10A - Mile 6 to Mile 4		5			1			0							88	
10B - Mile 8 to Mile 6		0		0	0			2							0	
11A - Mile 10 to Mile 8		0		0		0		1							0	
11B - Mile 12 to Mile 10		0		15		0	0	0					2			0
South Fork																
5A - Henry Bell to Forks	2	1		0		0		nd	-----	-----	-----		0	-----		49
5B - O'Farrill Gulch to Henry Bell	0		nd	19	0	0		0					0			0
6A - Indian Ck to O'Farrill Gulch	1		1		0		1								0	
6B - Matthews Ck to Indian Ck		0	0		0		0								0	

*nd = no data (surveys performed, but datasheets or data missing; number likely 0)

Scott River Redds

Reach	Date																			
	Oct-09	**Oct-12**	**Oct-16**	**Oct-19**	**Oct-23**	**Oct-26**	**Oct-30**	**Nov-02**	**Nov-06**	**Nov-09**	**Nov-13**	**Nov-16**	**Nov-20**	**Nov-23**	**Nov-27**	**Nov-30**	**Dec-04**	**Dec-07**	**Dec-11**	**Dec-14**
R1 - Midpoint to Confluence	3	11	17	22	2	3		19[2]	5		7		2	Holiday	0			0		
R2 - "Cabin Hole" to Midpoint	0	18	4	21	3	9		3	0		0		0		3			0		
R3 - George Allen to "Cabin Hole"[1]		1	6	7	11	2	0	9			2		0				0			
R4 - Townsend Gulch to George Allen			0	10	0	8	11	1			0						0			
R5 - Bridge Flat to Townsend Gulch				7		8	1			0		1					0[2]		0[2]	
R6 - CDFW Weir to Bridge Flat							12			3		3				0				nd
R7 - USGS Gauge to CDFW Weir										44		8[2]				0			0	
R8 - Blw Meamber Bridge to USGS Gauge[3]										32		7				3			0	
R9 - Oro Fino to Quartz Valley Bridge[4]			1				3		0			0								
R11 - Eller Lane to Hwy 3[4]																				
R12 - Etna Creek to Eller Lane[4]																				
R13 - Horn Lane to Etna Creek[4]																				
R14 - Young's Point to Horn Lane[4]						13		12		5	2		0							
R15 - Fay Lane to Young's Point[4]									2	0	0									
R16 - Callahan to Fay Lane[4]																				

*nd = no data (surveys performed, but redd count not reported) / Underline = days which included pulling flagging

[1]Reach 3 - Does not include unflagged redds (9) counted in front of house on private property (Trabucco)

[2]Incomplete survey - not completed due to injury, time constraint, or gear issue; partial reach survey to finish a prior day incomplete survey.

[3]Reach 8 only surveyed between Shackleford Creek and Graveyard Gulch due to lack of permission to cross private property

[4]Survey for RCD (valley) reaches may not occur on the same schedule as lower reaches. RCD data is placed in dates as close as possible to canyon survey days.

Scott River Tributary Surveys

Scott Canyon (Agency-Cooperative)

Tributary	Date	Redds	Chinook	Steelhead
Canyon Creek	Nov-30	0	0	0
	Dec-14	0	nd	nd
Kelsey Creek	Nov-30	0	0	0
	Dec-14	0	nd	nd
Tompkins Creek	Dec-13	0[1]	0	0

*nd = no data (surveys performed, but fish count not reported)

[1]Redd in progress reported for Tompkins Creek was most likely a coho, given time of year and presence of coho in mainstem Scott River

Scott Valley (Siskiyou Resource Conservation District)

No Valley tributary surveys for Chinook in 2023 – survey focus on mainstem

Scott River (Live) Chinook Observations

Reach	Date																			
	Oct-09	Oct-12	Oct-16	Oct-19	Oct-23	Oct-26	Oct-30	Nov-02	Nov-06	Nov-09	Nov-13	Nov-16	Nov-20	Nov-23	Nov-27	Nov-30	Dec-04	Dec-07	Dec-11	Dec-14
R1 - Midpoint to Confluence	22	96	322	239	277	26		301	98		19		13	Holiday	0			0		
R2 - "Cabin Hole" to Midpoint	52	316	292	139	47	94		11	8		6		1		0			0		
R3 - George Allen to "Cabin Hole"		77	61	87	104	65	5	37			24		5				0			
R4 - Townsend Gulch to George Allen			20	37	63	49	37	54			22						0			
R5 - Bridge Flat to Townsend Gulch				57		15	58			10		6					0		0	
R6 - CDFW Weir to Bridge Flat							69			215		109				0				nd
R7 - USGS Gauge to CDFW Weir										30		23				0			0	
R8 - Blw Meamber Bridge to USGS Gauge[1]										120		32				0			0	
R9 - Oro Fino to Quartz Valley Bridge[2]			5				5		nd			2								
R11 - Eller Lane to Hwy 3[2]																				
R12 - Etna Creek to Eller Lane[2]																				
R13 - Horn Lane to Etna Creek[2]																				
R14 - Young's Point to Horn Lane[2]						12		5		nd	nd		3							
R15 - Fay Lane to Young's Point[2]									nd	nd	nd									
R16 - Callahan to Fay Lane[2]																				

*nd = no data (surveys performed, but Chinook count not reported)

[1]Reach 8 only surveyed between Shackleford Creek and Graveyard Gulch due to lack of permission to cross private property

[2]Survey for RCD (valley) reaches may not occur on the same schedule as lower reaches. RCD data is placed in dates as close as possible to canyon survey days. Chinook not consistently reported; and even when observations are recorded, they may not include all fish seen on that date.

Scott River (Live) Steelhead Observations

Reach	Date																			
	Oct-09	**Oct-12**	**Oct-16**	**Oct-19**	**Oct-23**	**Oct-26**	**Oct-30**	**Nov-02**	**Nov-06**	**Nov-09**	**Nov-13**	**Nov-16**	**Nov-20**	**Nov-23**	**Nov-27**	**Nov-30**	**Dec-04**	**Dec-07**	**Dec-11**	**Dec-14**
R1 - Midpoint to Confluence	0	0	113	0	30	nd		0	0		0		0	Holiday	0			0		
R2 - "Cabin Hole" to Midpoint	0	24	11	0	0	0		0	0		nd		0		0			0		
R3 - George Allen to "Cabin Hole"		11	0	13	0	7	0	0			0		0				0			
R4 - Townsend Gulch to George Allen			0	15	0	1	0	4			0						0			
R5 - Bridge Flat to Townsend Gulch				26		0	0			2		0					0		0	
R6 - CDFW Weir to Bridge Flat							0			0		2				0				nd
R7 - USGS Gauge to CDFW Weir										0		0				0			0	
R8 - Blw Meamber Bridge to USGS Gauge[1]										0		0				0			0	
R9 - Oro Fino to Quartz Valley Bridge[2]			nd				nd		nd			nd								
R11 - Eller Lane to Hwy 3[2]												-								
R12 - Etna Creek to Eller Lane[2]																				
R13 - Horn Lane to Etna Creek[2]																				
R14 - Young's Point to Horn Lane[2]						nd		nd		nd	nd		nd							
R15 - Fay Lane to Young's Point[2]									nd	nd	nd									
R16 - Callahan to Fay Lane[2]																				

*nd = no data (surveys performed, but steelhead count not reported)

[1]Reach 8 only surveyed between Shackleford Creek and Graveyard Gulch due to lack of permission to cross private property

[2]Survey for RCD (valley) reaches may not occur on the same schedule as lower reaches. RCD data is placed in dates as close as possible to canyon survey days. No steelhead counts are made by RCD.

Appendix D – Redd Spatial Distribution and Location

Redd density on maps is displayed as number of redds observed (as GPSed or mapped) per approximate 100 meter of survey. Where tributaries were surveyed, only those which recorded redds are included in this appendix.

Salmon River Data

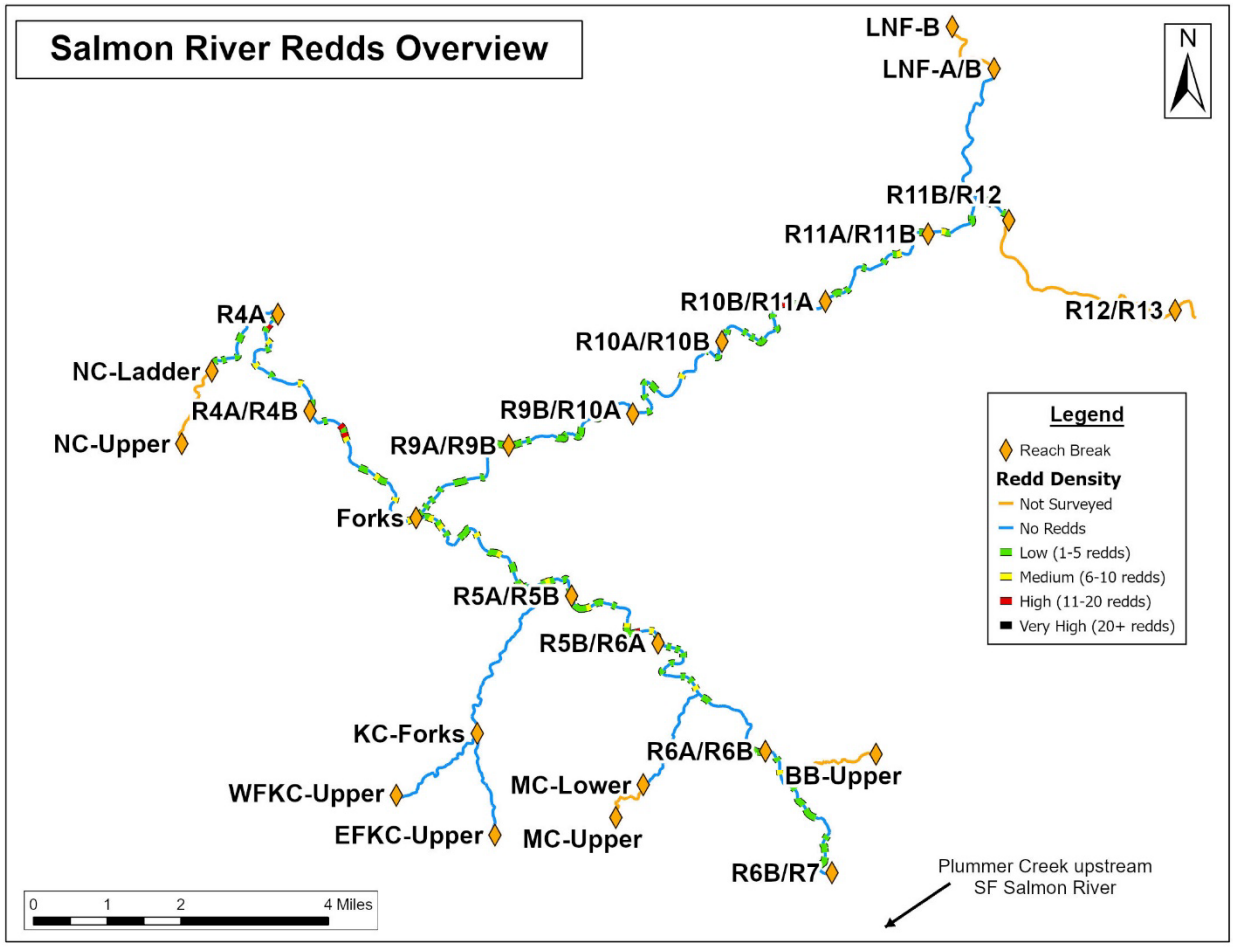


Figure D-SA1. General overview of redd distribution and density for Salmon River surveys. Map is of survey area only and does not include roads, hillslopes, or other landmarks.

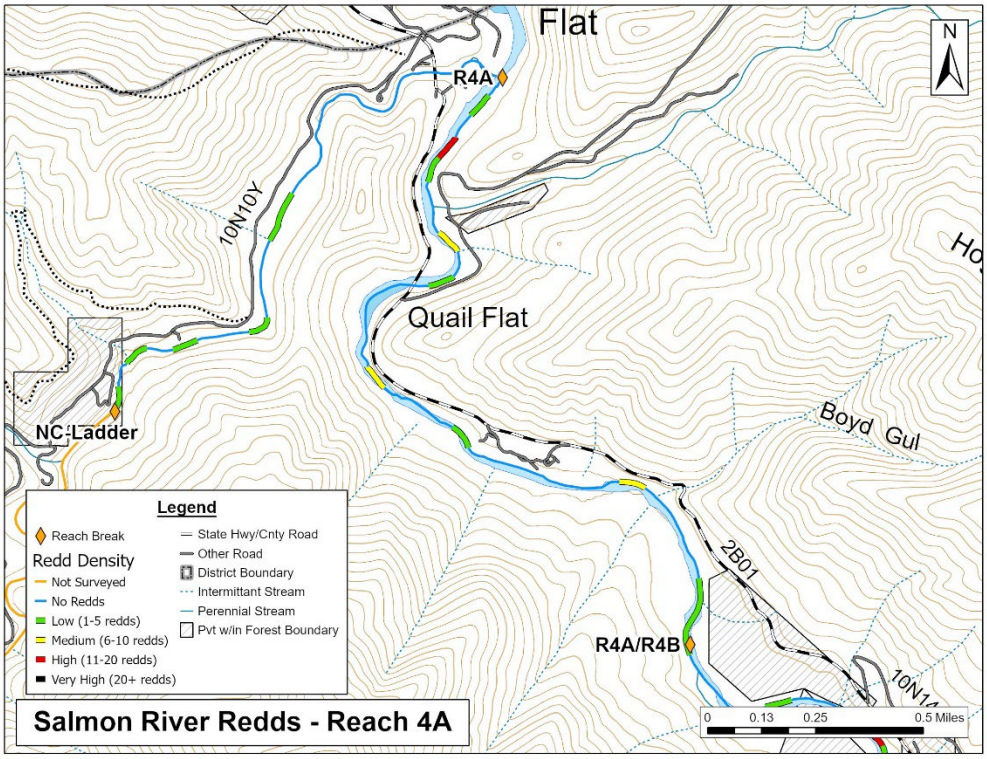


Figure D-SA2. Redd distribution and density for mainstem Salmon River, Reach 4A.

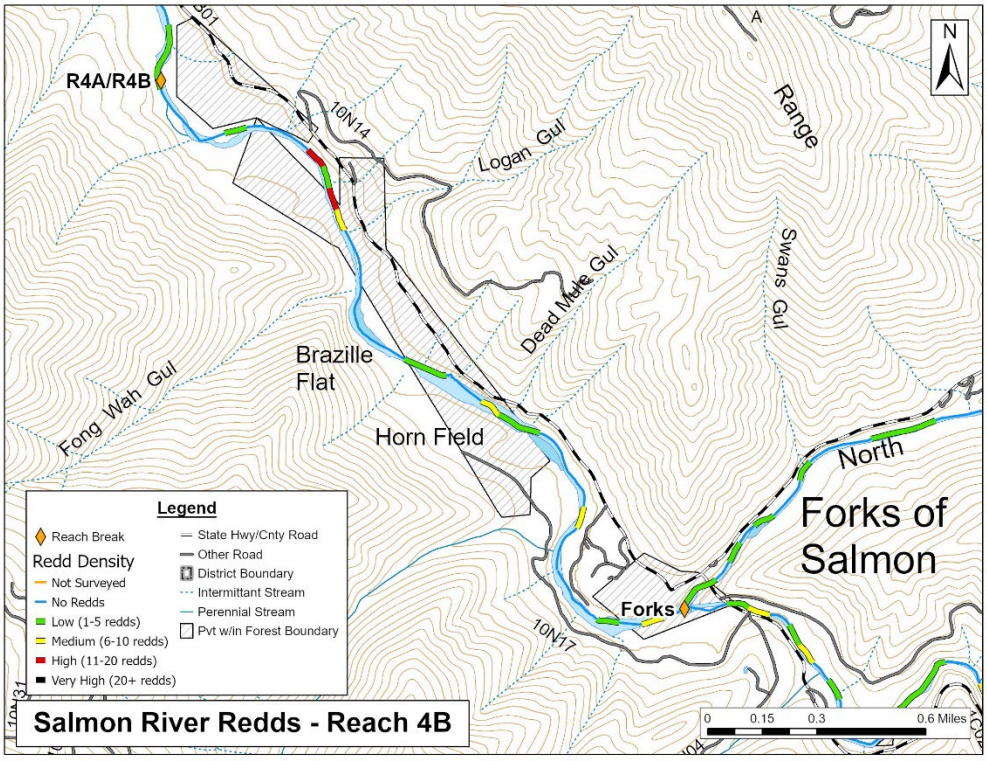


Figure D-SA3. Redd distribution and density for mainstem Salmon River, Reach 4B.

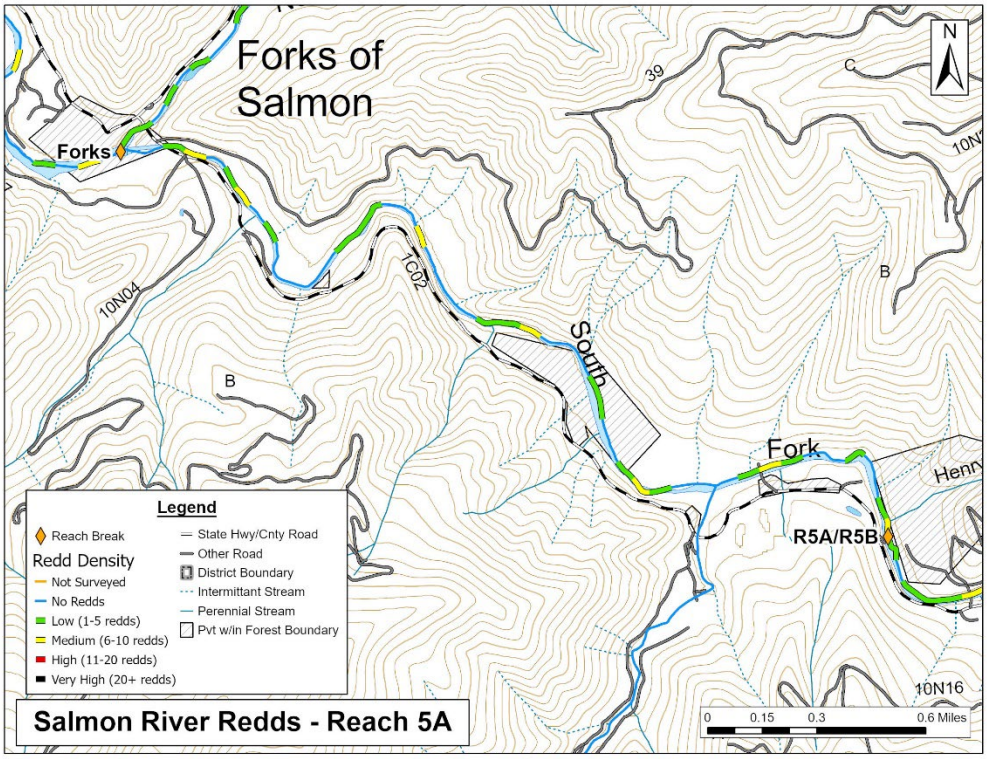


Figure D-SA4. Redd distribution and density for SF Salmon River, Reach 5A.

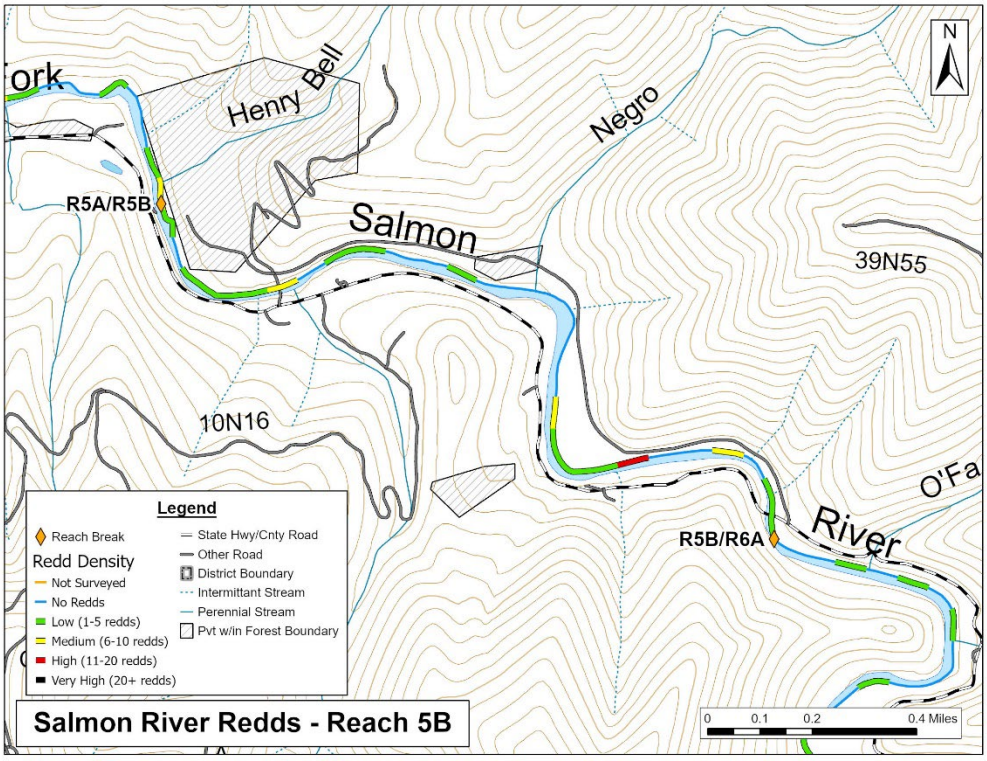


Figure D-SA5. Redd distribution and density for SF Salmon River, Reach 5B.

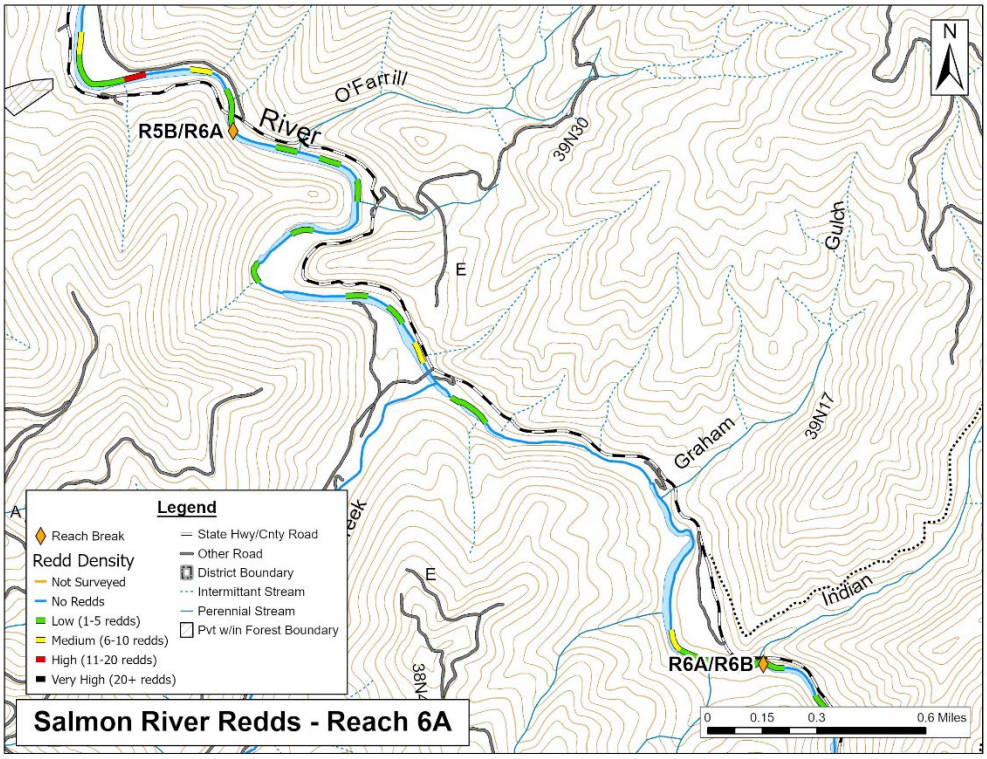


Figure D-SA6. Redd distribution and density for SF Salmon River, Reach 6A.

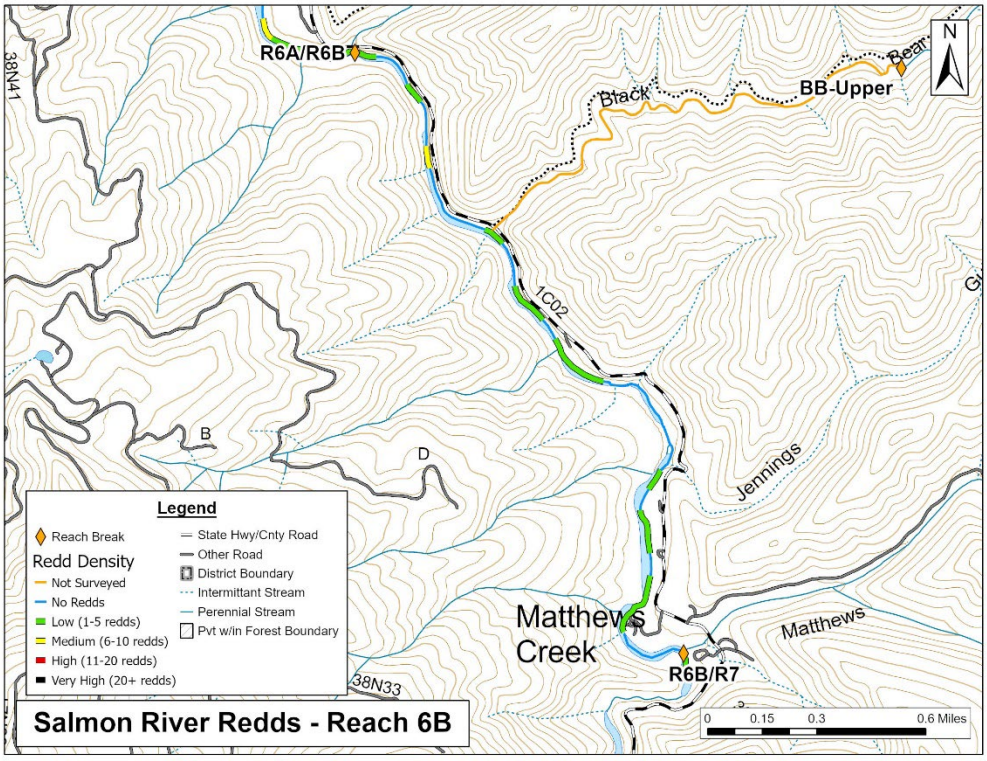


Figure D-SA7. Redd distribution and density for SF Salmon River, Reach 6B.

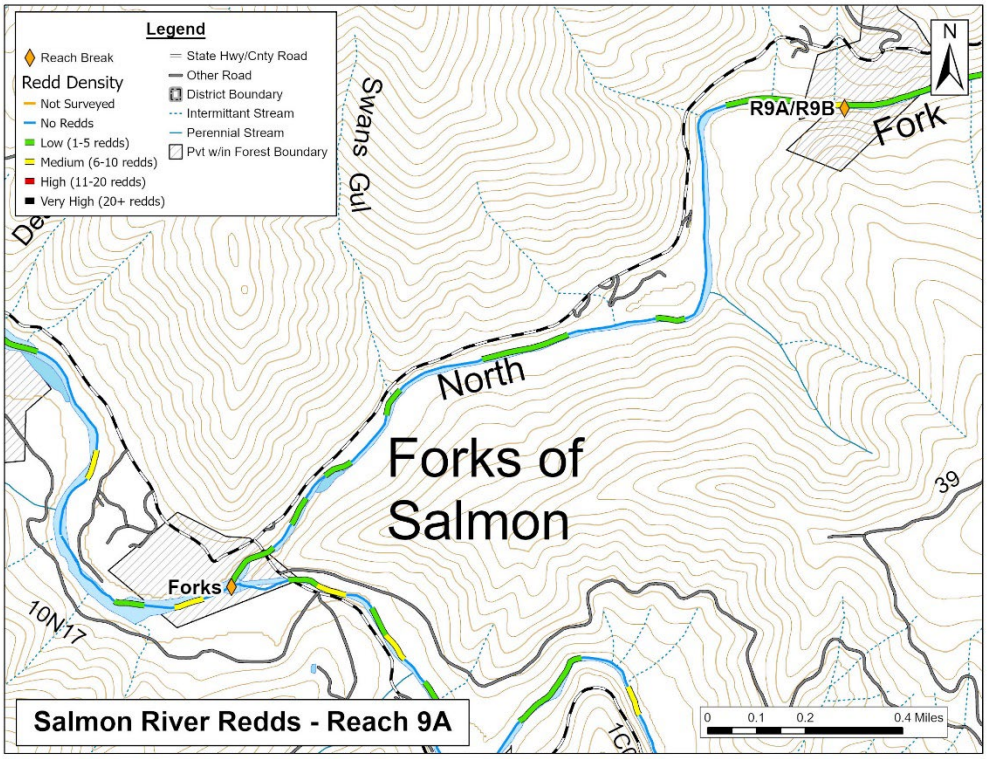


Figure D-SA8. Redd distribution and density for NF Salmon River, Reach 9A.

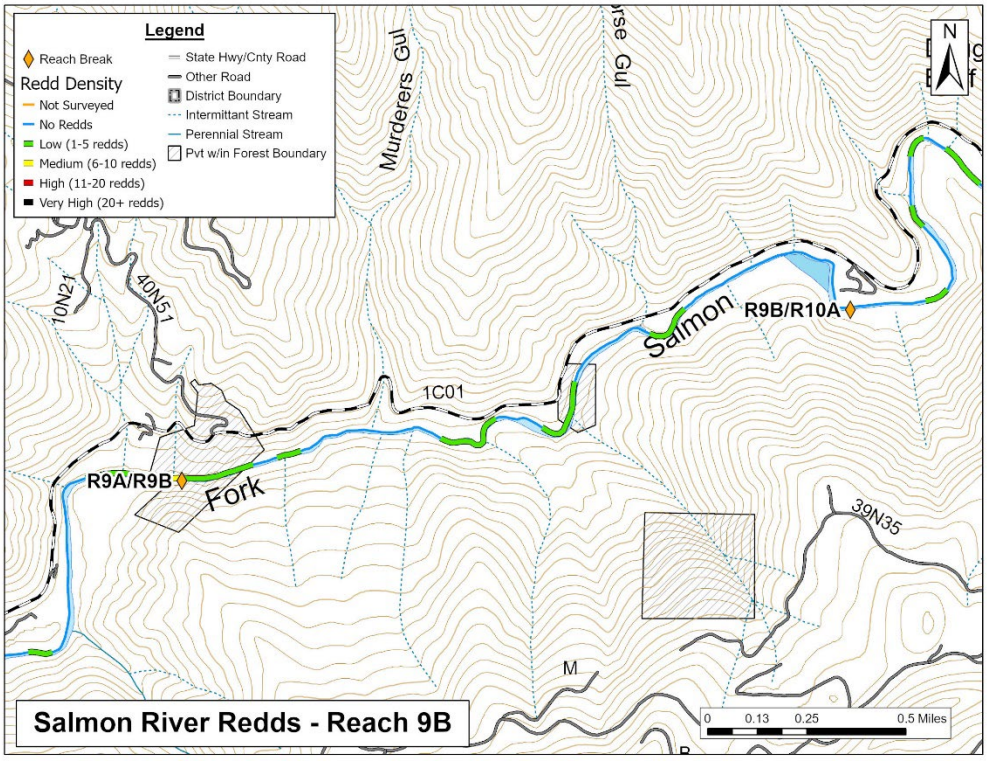


Figure D-SA9. Redd distribution and density for NF Salmon River, Reach 9B.

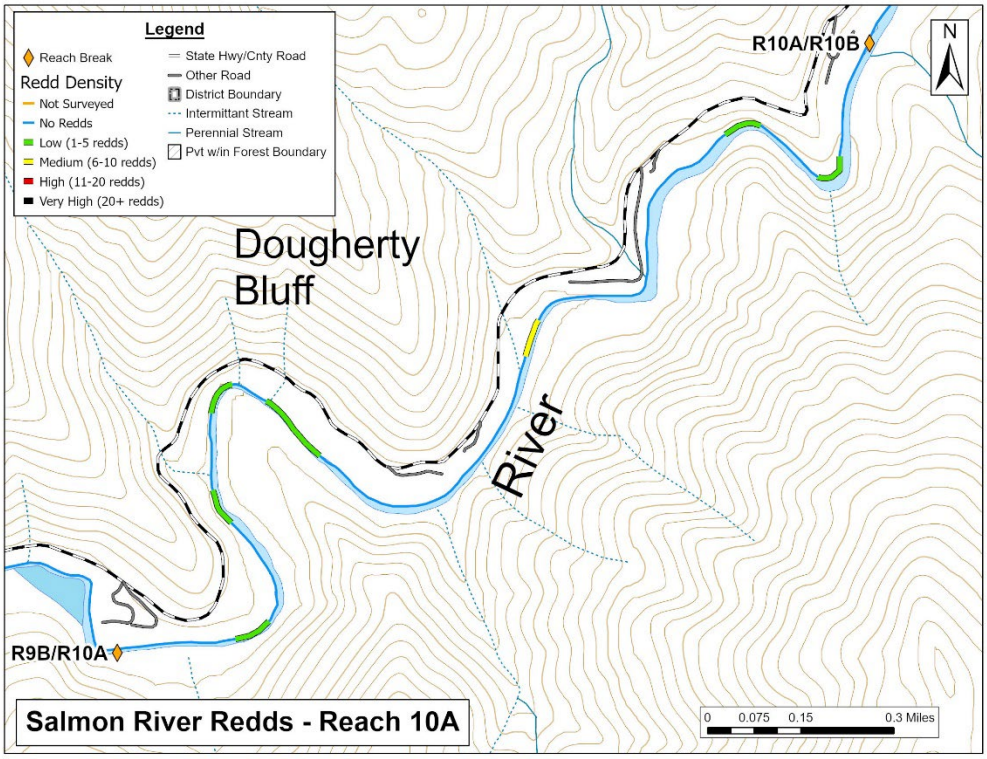


Figure D-SA10. Redd distribution and density for NF Salmon River, Reach 10A.

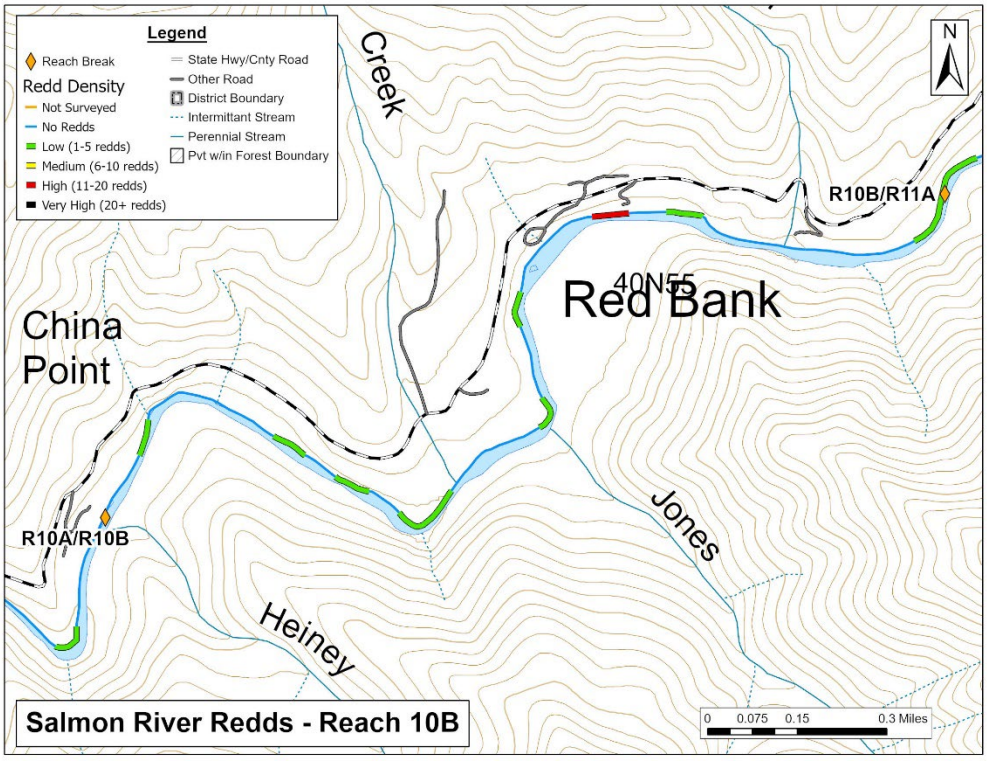


Figure D-SA11. Redd distribution and density for NF Salmon River, Reach 10B.

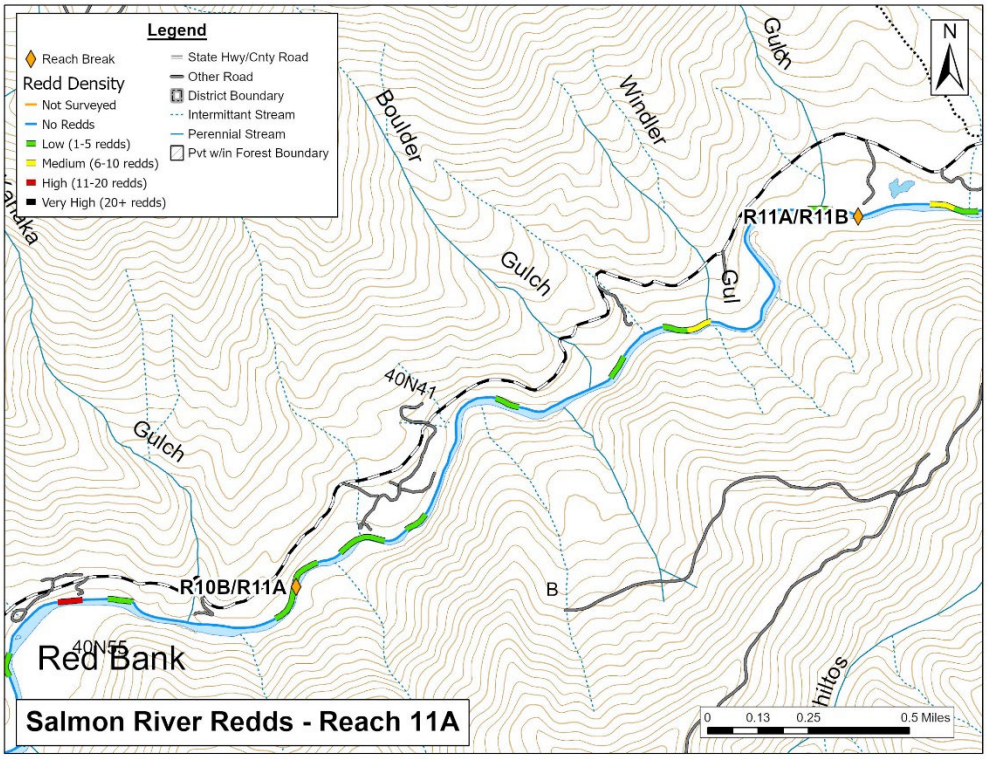


Figure D-SA12. Redd distribution and density for NF Salmon River, Reach 11A.

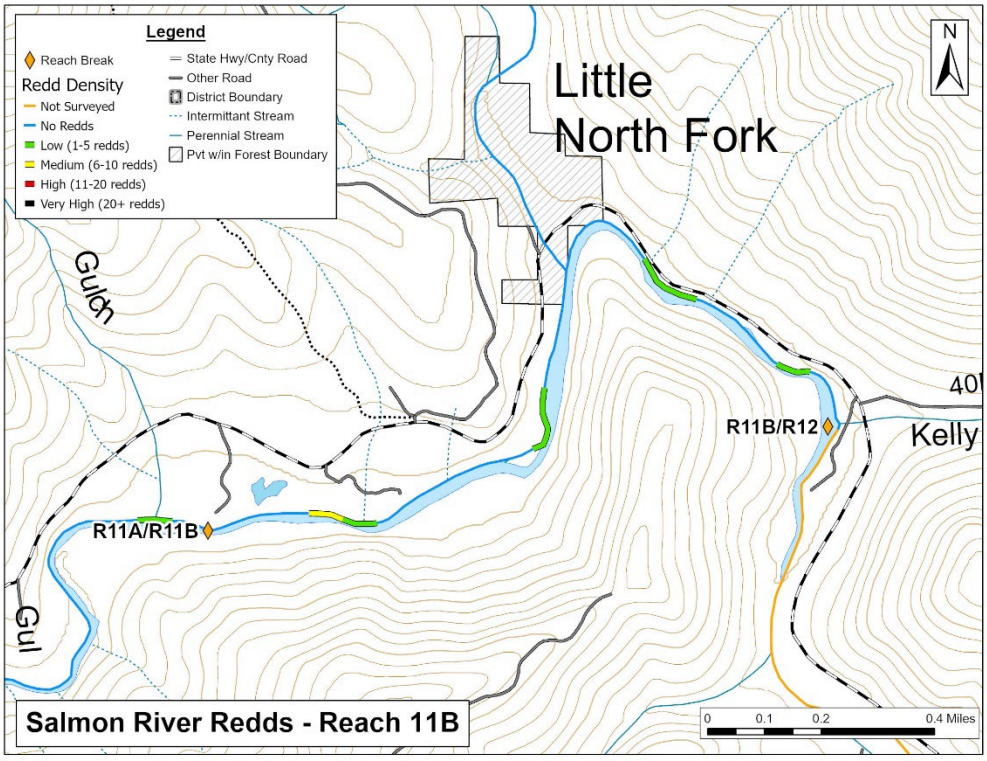
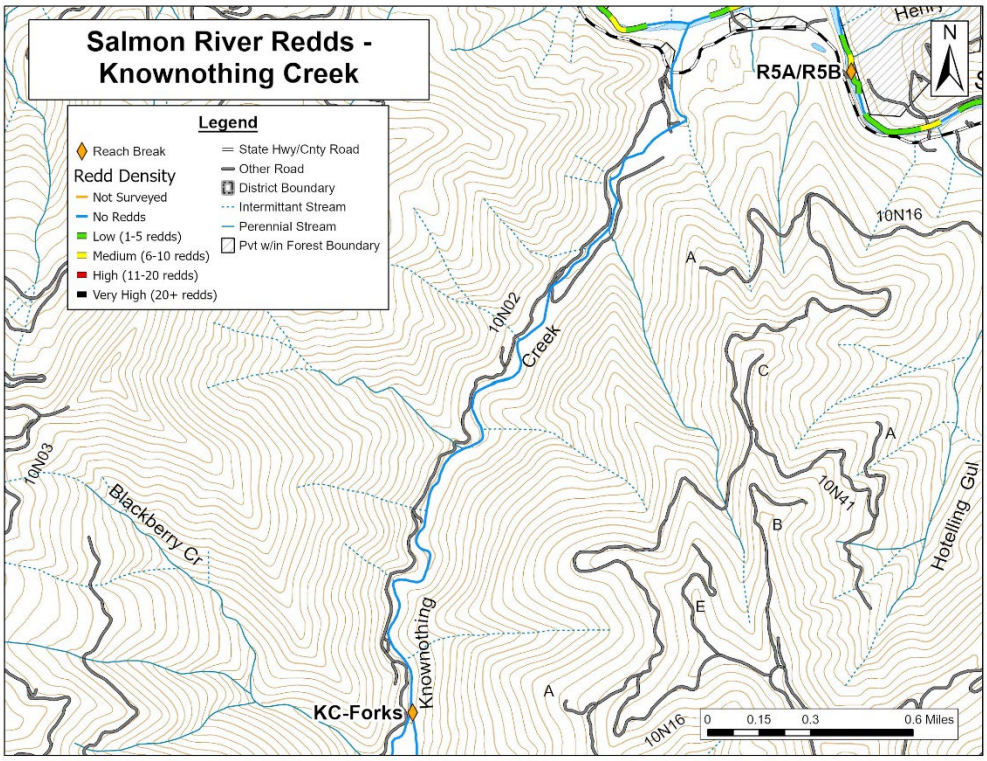


Figure D-SA13. Redd distribution and density for NF Salmon River, Reach 11B



--7 redds reported for Knownothing Creek, but they were neither GPSed nor located via hardcopy map--

Figure D-SA14. Redd distribution and density for mainstem Knownothing Creek.

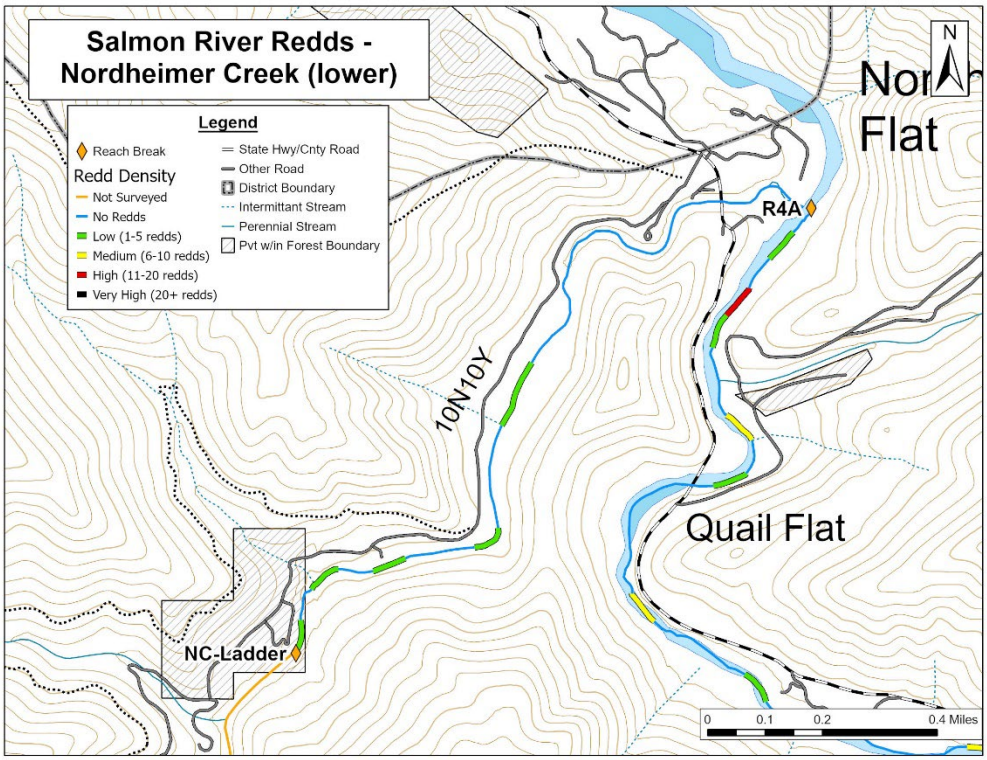


Figure D-SA15. Redd distribution and density for Nordheimer Creek (lower).

Scott River Data

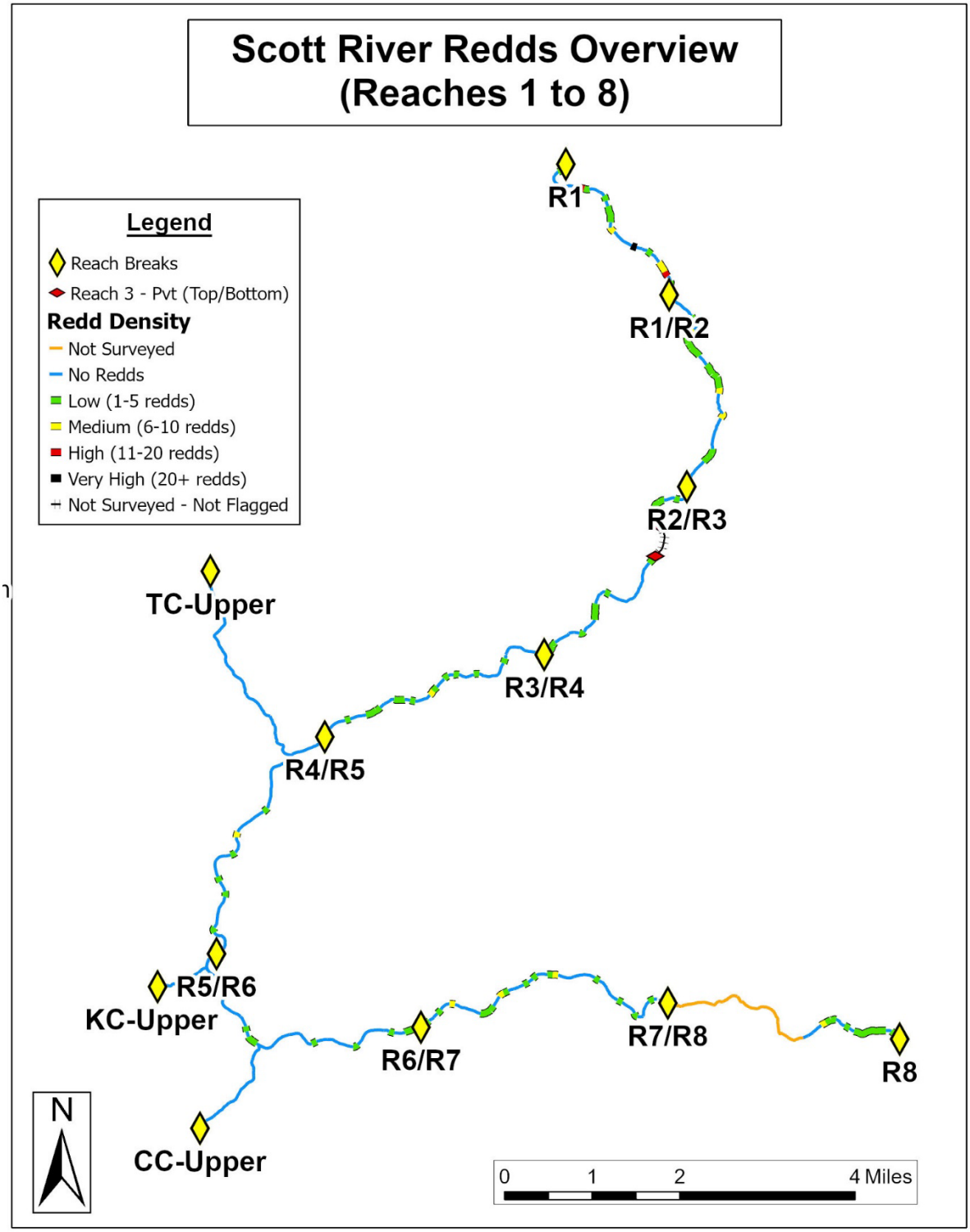


Figure D-SC1. General overview of redd distribution and density for Scott River surveys, Reach 1 through Reach 8. Map is of survey area only and does not include roads, hillslopes, or other landmarks.

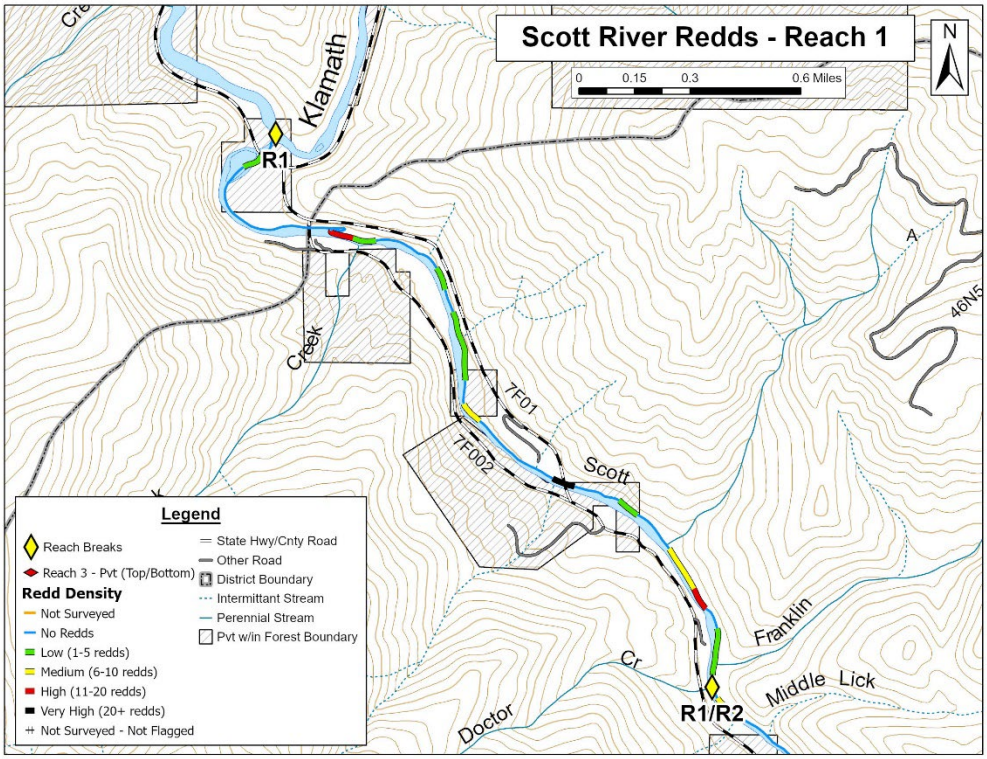


Figure D-SC2. Redd distribution and density for Scott River, Reach 1.

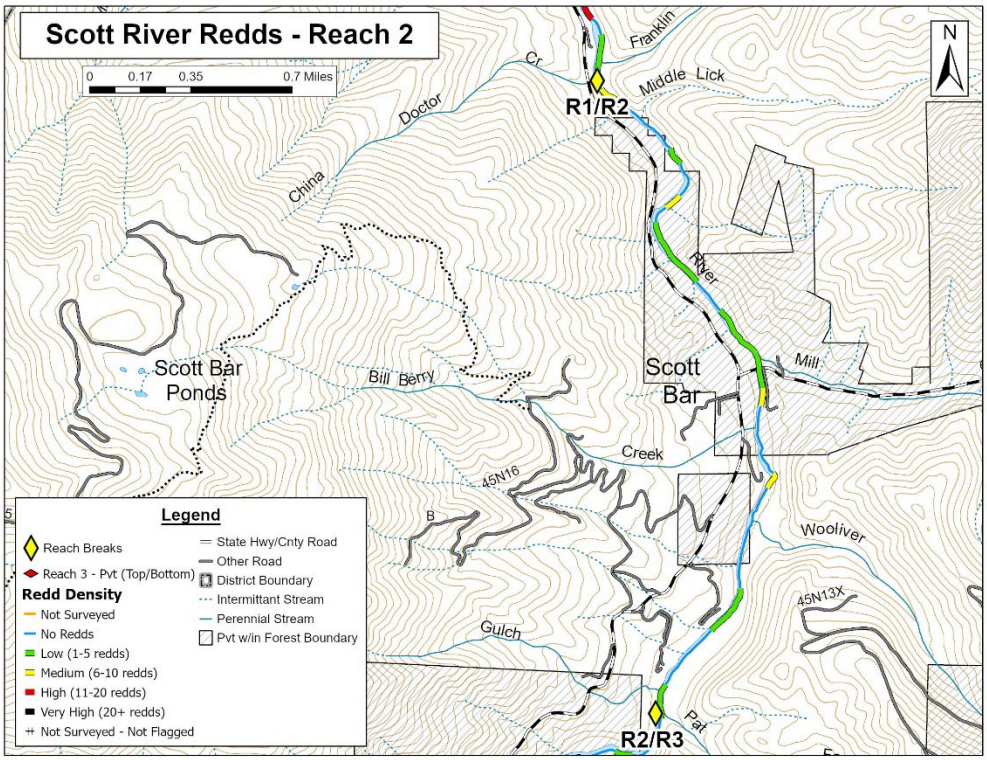


Figure D-SC3. Redd distribution and density for Scott River, Reach 2.

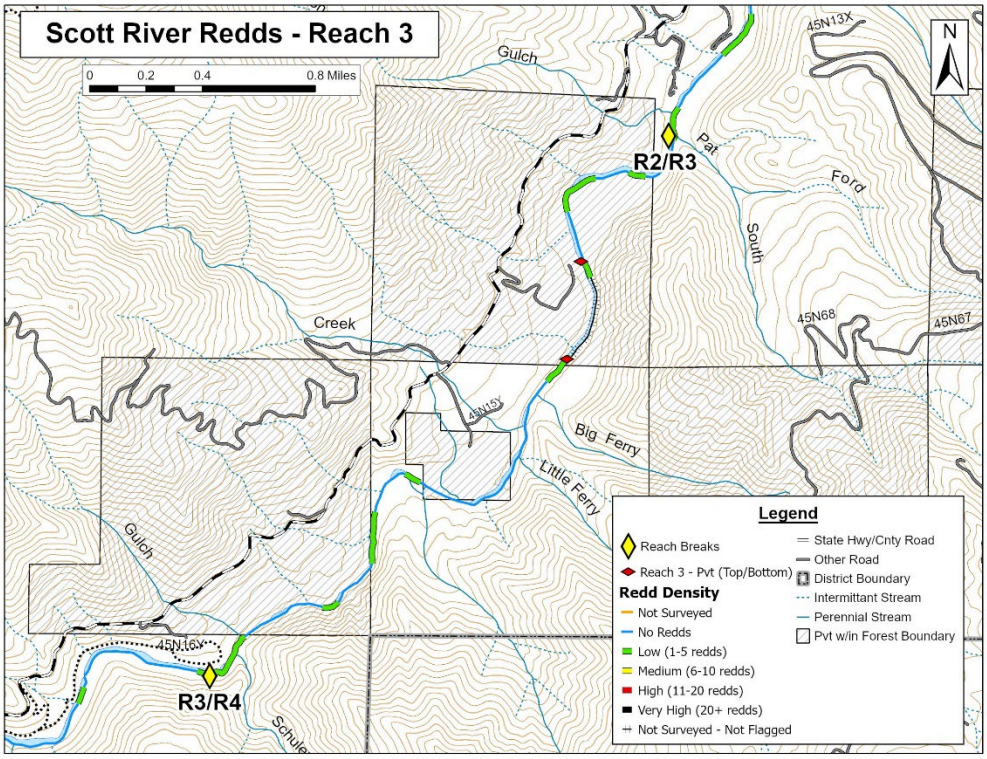


Figure D-SC4. Redd distribution and density for Scott River, Reach 3.

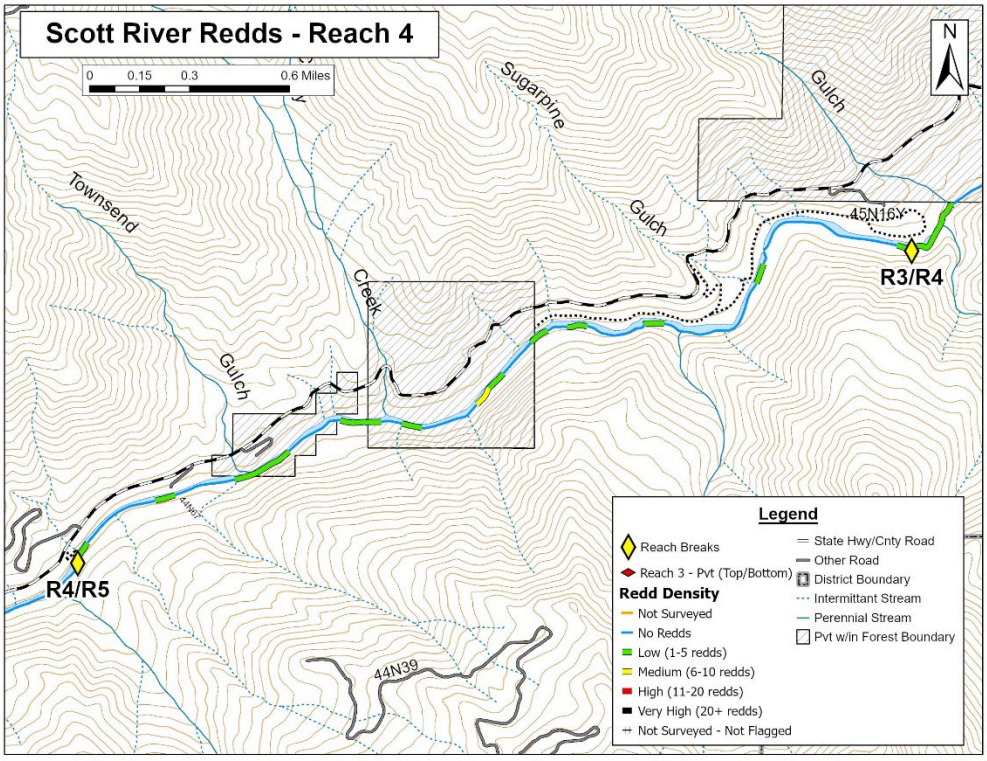


Figure D-SC5. Redd distribution and density for Scott River, Reach 4.

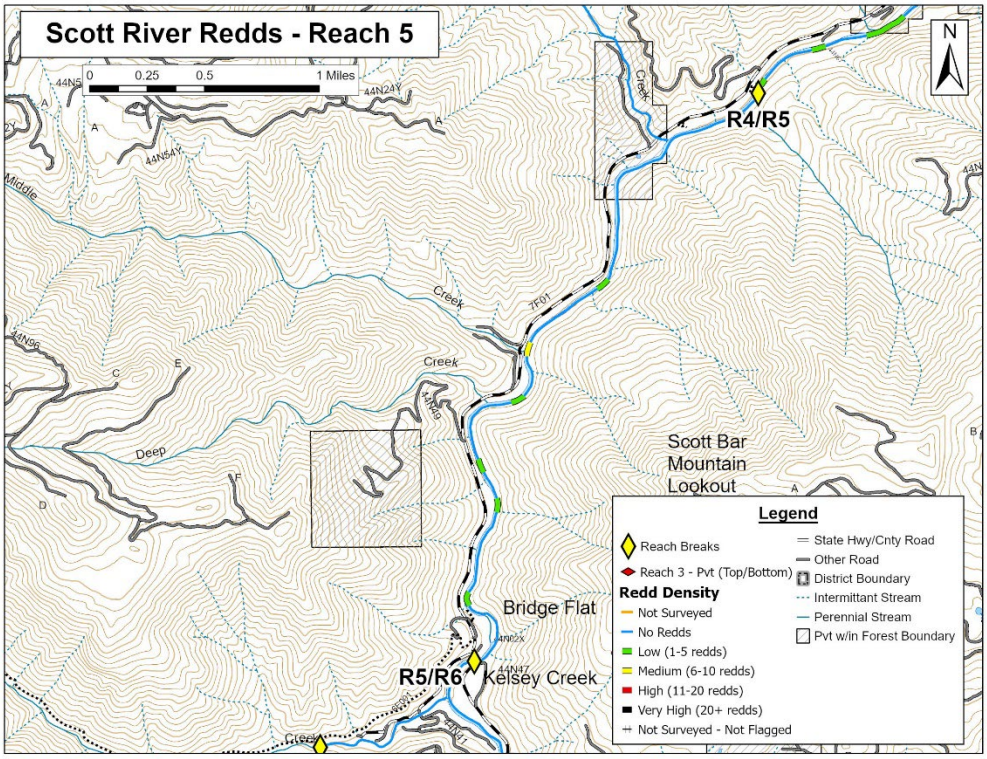


Figure D-SC6. Redd distribution and density for Scott River, Reach 5.

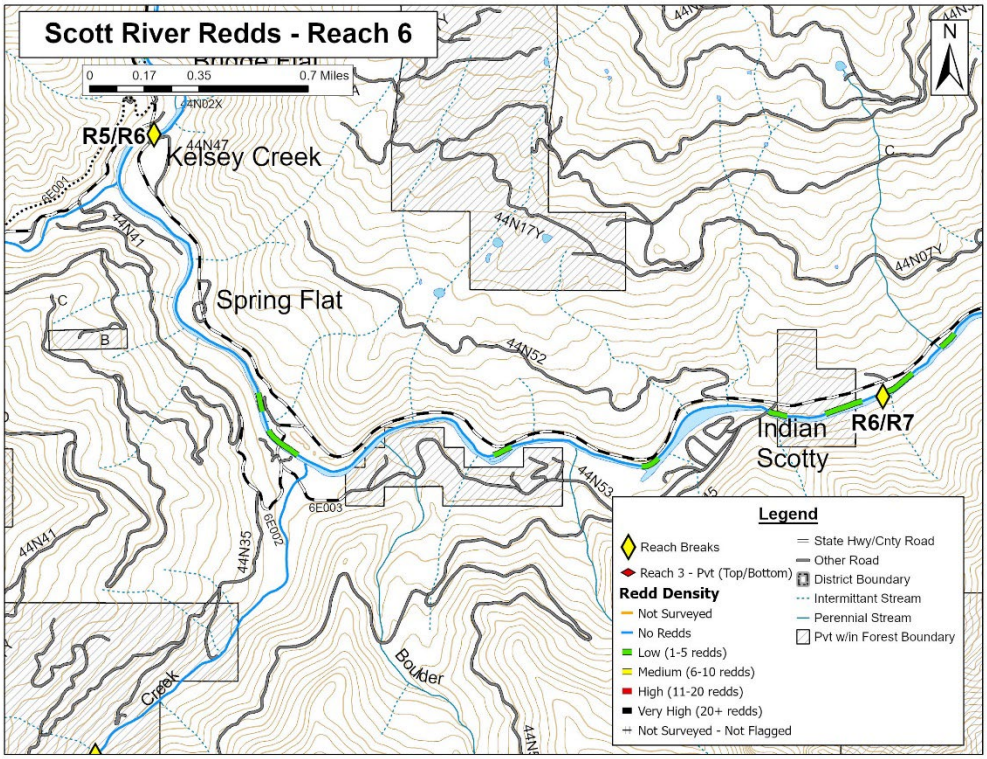


Figure D-SC7. Redd distribution and density for Scott River, Reach 6.

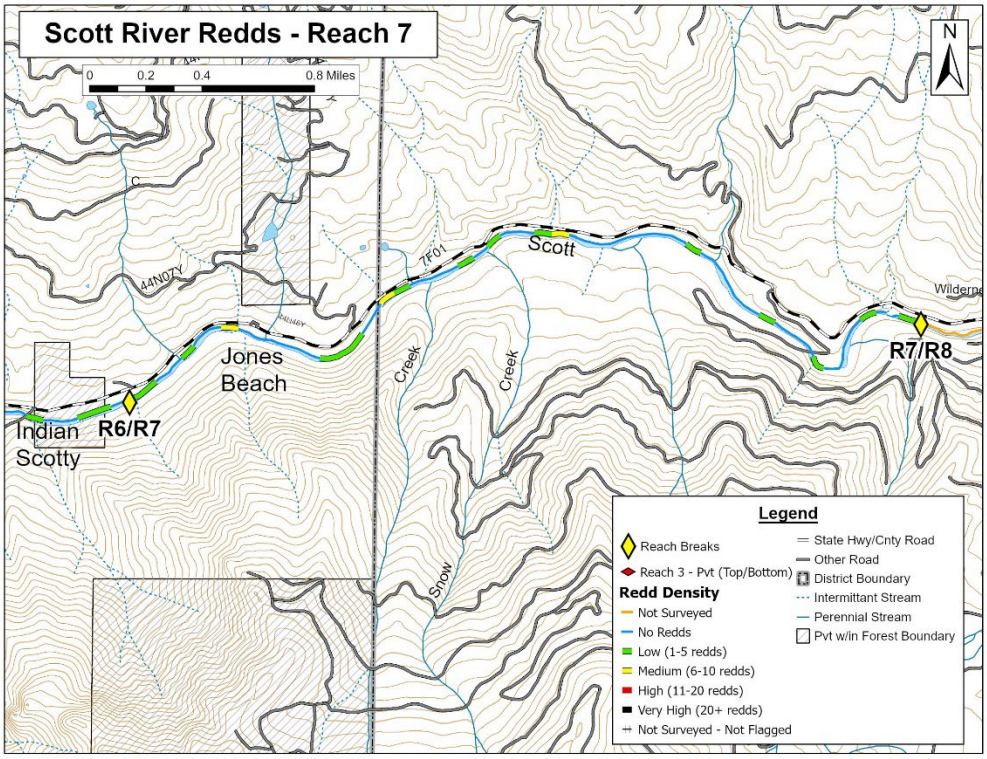


Figure D-SC8. Redd distribution and density for Scott River, Reach 7.

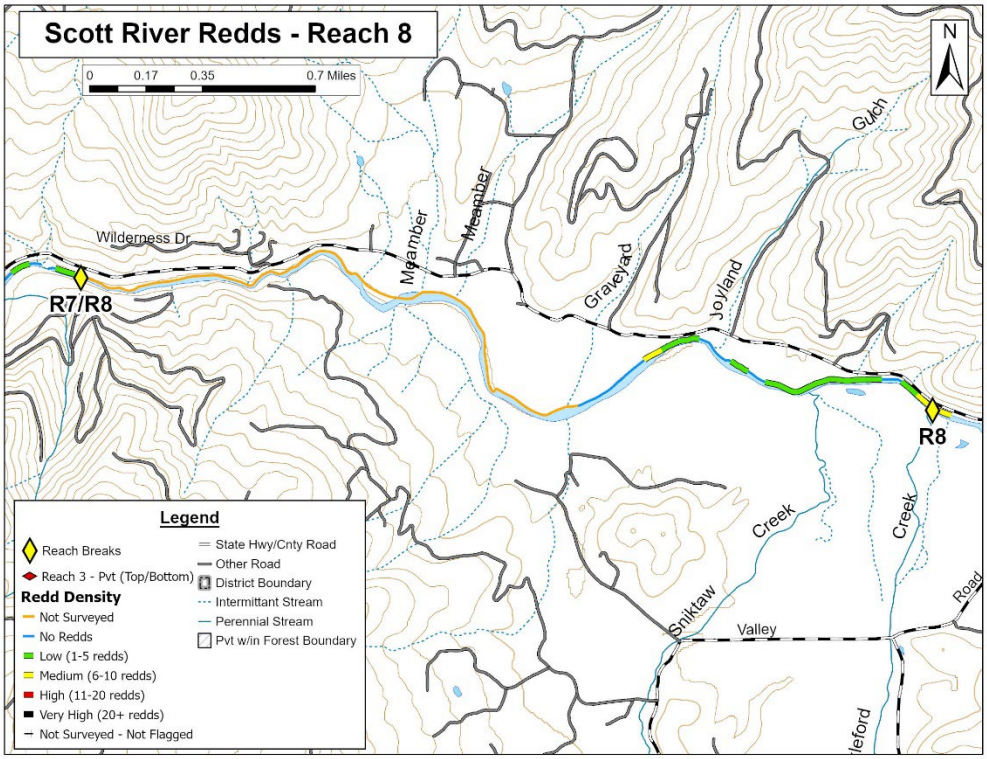


Figure D-SC9. Redd distribution and density for Scott River, Reach 8.

Appendix E – List of Cooperators and Contributions

Federal
U.S. Fish and Wildlife Service

U.S. Forest Service
-Klamath National Forest
-Six Rivers National Forest

State
California Department of Fish and Wildlife
-Arcata Office
-Yreka Office

Tribal
Karuk Tribe
Quartz Valley Indian Reservation

Other
Local volunteers
Junction School District
Mid-Klamath Watershed Council
Northern California Resource Center
Salmon River Restoration Council
Siskiyou Resource Conservation District