2017 Fall Chinook Salmon Spawning Ground Survey

Salmon-Scott Rivers Ranger District
Klamath National Forest

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ABSTRACT

Cooperative 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 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 2017 cooperative survey began October 12th and ended December 12th. While river discharge for was considered to be normal at the start of surveys, mid-November storms elevated flow and caused survey cancelations for both drainages. However, survey effort to locate redds did not appear to be overly impacted because spawning had largely been completed by the time storms began. Surveys in both drainages also included tributary visits.

Approximately 1,665 fish returned to the Salmon River and 2,576 fish returned to the Scott River. 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 2017 returns are below average for both Salmon River [ranked 26th (of 40 years)] and Scott River [ranked 31st (of 40 years)].

INTRODUCTION

Since 1978, the California Department of Fish and Wildlife (CDFW) has determined Fall 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 together to accomplish spawner escapement surveys, partially due to shrinking budgets in both State and Federal programs, but also the desire to increase cooperative operations between agencies. These surveys now include collaboration with the Karuk Tribal Government, Yurok 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 2017, 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 12th through December 12th on the KNF portion of the Salmon and Scott Rivers (i.e., within the Salmon-Scott Rivers Ranger District [SSRD]). The exception of this is Wooley Creek and the Salmon River below Nordheimer Creek, which were surveyed by SRNF and/or CDFG personnel. Data from these latter locations is covered 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 2018).

Table 1. The 2017 survey schedule for KNF crews for the Salmon River and Scott River. Cooperators may have surveyed on days denoted as federal holidays when KNF crews were not present. On the Salmon River only, CDFW may have surveyed one or two reaches by boat when the water was otherwise unsafe to enter.

Survey Week	Scott River (Monday)	Salmon River (Tuesday)	No surveys on Wednesday	Scott River (Thursday)	Salmon River (Friday)
1				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		Nov-09	Nov-10 (ns - holiday)
6	Nov-13	Nov-14 (ns - high water)		Nov-16	Nov-17 (ns - high water)
7	Nov-20	Nov-21 (ns - high water)		Nov-23 (ns - holiday)	Nov-24 (ns - holiday)
8	Nov-27 (ns - high water)	Nov-28 (ns - high water)		Nov-30	Dec-01 (ns - high water)
9	Dec-04 (ns - no crew)	Dec-05 (ns - high water)		Dec-07	Dec-08
10	Dec-11 (Last day Scott)	Dec-12 (Last day Salmon)			

*ns - no survey

METHODS

In 2017, redd surveys were conducted on the Salmon River and Scott River, as well as various tributaries. **Table 2** summarizes each reach for 2017, including reach number and length, number of times surveyed, and total number of redds counted over the course of the survey season. Each mainstem reach of the respective rivers were to be surveyed once to twice weekly, but high water impacted the schedule.

- Salmon River is surveyed from mile marker 10 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. The NF also includes occasional surveys from mile marker 12 to mile marker 10.
    - Tributaries surveyed in 2017 include Knownothing Creek and its forks, Little North Fork Salmon River, Methodist Creek, and Nordheimer 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 reaches above Meamber (Quartz Valley) Bridge were conducted by the

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

- Tributaries surveyed in 2017 include canyon tributaries of Canyon Creek, Kelsey Creek, Mill Creek, and Tompkins Creek; valley tributaries of French Creek; and upper valley tributaries of Boulder Creek, Fox Creek, Sugar Creek, and SF Scott River.

The USFS and CDFW held two training sessions for agency employees, Tribal employees, and volunteers. On October 10th, the redd survey/carcass mark-recapture training was held at Indian Scotty group campground on the Scott River. Similar training was held at Oak Bottom River Access on the mainstem Salmon River on October 11th. Topics discussed at the trainings incorporated redd and fish identification; carcass marking, including the explanation of mark-recapture estimates; scale and otolith sampling; data collection; salmonid life cycles; and survey safety procedures.

Table 2. Fall Chinook spawning survey reach descriptions for Salmon River and Scott Rivers in 2017. 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	37
	Forks of Salmon to Otter Bar	4B	2.4	10	92
North Fork	Mile 2 to Forks of Salmon[2]	9A	2.0	9	55 (9)
	Mile 4 to Mile 2	9B	2.0	5	32
	Mile 6 to Mile 4	10A	2.0	4	23
	Mile 8 to Mile 6	10B	2.0	4	42
	Mile 10 to Mile 8	11A	2.0	3	11
	Mile 12 to Mile 10	11B	2.0	2	3
South Fork	Henry Bell to Forks of Salmon	5A	3.0	7	49[3]
	O'Farrill Gulch to Henry Bell	5B	2.0	8	39
	Indian Ck to O'Farrill Gulch[2]	6A	3.0	6	30
	Matthews Ck to Indian Ck	6B	2.2	4	9
Tributaries	Knownothing Creek		2.5	1	0
	Knownothing Ck (EF)		1.5	1	0
	Knownothing Ck (WF)		1.7	1	0
	Little NF Salmon River	A (lower)	2.3	1	0
	Methodist Creek		2.4	2	0
	Nordheimer Creek	A (lower)	1.8	2	17

Scott River					
	Midpoint to Confluence	1	2.5	9	51
	"Cabin Hole" to Midpoint	2	2.5	7	9
	George Allen to "Cabin Hole"[4]	3	3.0	8	8 (5)
	Tompkins Creek to George Allen	4	2.5	8	13
	Bridge Flat to Tompkins Creek	5	4.0	9	28
	CDFW Weir to Bridge Flat	6	3.8	6	17
	USGS Gauge to CDFW Weir	7	3.5	7	64
	Shackleford Creek to USGS Gauge	8	2.9	7	211
	Oro Fino to Quartz Valley Bridge[5]	9	4.2	0	27
	Hwy 3 to Oro Fino[5]	10	7.0	0	Not surveyed
	Eller Lane to Hwy 3[5]	11	5.5	0	0
	Etna Creek to Eller Lane[5]	12	3.6	0	23
	Horn Lane to Etna Creek[5]	13	1.8	0	78
	Young's Point to Horn Lane[5]	14	2.1	0	89
	Fay Lane to Young's Point[5]	15	3.6	0	48
	Callahan to Fay Lane[5]	16	6.9	0	14
Tributaries (Canyon)	Canyon Creek		1.3	2	0
	Kelsey Creek		0.6	1	0
	Mill Creek (Scott Bar)		1.6	2	0
	Tompkins Creek		2.5	2	0
Tributaries (Upper Valley)	Boulder Creek (SF Scott R)		1.1	1	0
	Fox Creek		1.2	1	0
	Sugar Creek		2.5	2	0
	SF Scott River		1.8	2	0
Tributaries (Valley [RCD])	French Creek[5]		2.5	1	1

[1]Flagging marking redds may have been removed prior to end of carcass surveys. "Times Surveyed" includes ALL surveys, even those performed end-of-season when redds may have been no longer counted.
[2]Several locations may not flagged due to crew safety concerns (Reach 6A) or request to avoid a redd concentration area by adjacent landowner (Reach 9A). Any numbers in parenthesis represent the maximum number of unflagged redds observed from bank during a single survey and not accounted for via GPS.
[3]Reach 5A (Henry Bell to Forks of Salmon) is not flagged. Number reported is the maximum number of observed redds (10/31/17).
[4]Portions of private property in Reach 3 of Scott River not flagged, although property was still traversed. Numbers in parenthesis is the maximum number of unflagged redds.
[5]Scott River reaches 9 through 16 and "valley" tributaries are surveyed by RCD. See the text for additional information. Additionally, the portion of the reaches actually surveyed is dependent upon landowner access and discharge conditions, with only partial coverage of Reaches 9, 11, 12, and 16 in 2017.

On the Salmon and Scott Rivers, crews conducted two concurrent protocols on survey reaches, using redd counts and carcass counts (CDFW 2017). A typical crew consisted of two people. Each crew walked two to four miles of river each survey day unless health or safety concerns limited ability to survey. The number of times a reach was surveyed was directly related to the number of people available on the survey dates. When a lack of available surveyors was a concern, the reaches to be surveyed were determined by the level of activity observed on the prior survey date and personnel knowledge of the system. Access to private land was also a limiting factor on the Scott River. An attempt was made to have people survey different reaches throughout the season so as to reduce estimator bias.

On both rivers, all redds were counted, 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, redds (where flagged) were characterized as to size (width/length) and habitat type in which it was observed. Throughout the season redds were GPSed. Original field maps of redd locations are available at the Salmon-Scott Rivers Ranger District Office in Fort Jones, CA.

- Salmon River, not flagged – Reach 5A; canyon segment of 6A
- Scott River, not flagged – portion of Reach 3 in front of a landowner's house

RESULTS

Salmon River

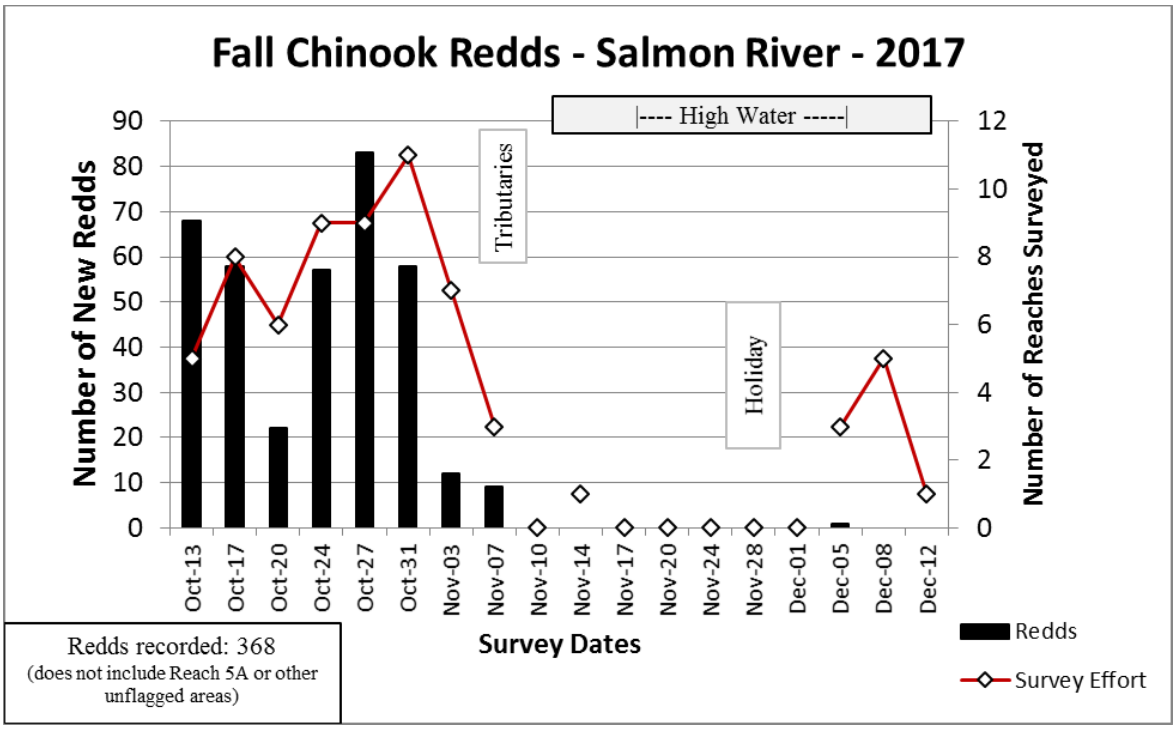
Overall effort on the Salmon River was good until early-November. Beginning mid-November, a series of storm events generated unsafe water conditions characterized by elevated discharge and often turbid water (**Appendix B**). Due to the high energy character of the Salmon River, combined with challenging terrain, many survey days were cancelled. CDFW did have boats which allowed access in Reach 4 in flows otherwise too high for walking, but conditions were often too difficult to allow for a comprehensive survey effort. Survey cancellation appeared to occur when redd construction was largely complete. Tributary surveys occurred in early-November, just prior to initiation of the multiple storm events.

The date of peak spawning on the Salmon River is unclear (**Figure 1**). In most years since 2010 when detailed reporting of survey efforts upon the SSRD began, the temporal pattern for the Salmon River is for spawning to be heavy at the survey start, with a subsequent decline in number of new redds thereafter, except when a freshet may trigger an uptick. In 2017, this broad pattern seems to have been in effect, with initial surveys in mid-October observing redds already built, followed by a subsequent decline and a resurgence following the first significant freshet of the season in late-October. Overall survey effort was affected by number of surveyors available, weather, and flows. In this case, data may be confounded by crew availability, with additional personnel in late-October allowing an expansion of the survey area to include Reaches 10 and 11 on the North Fork Salmon River. As these reaches had not been previously surveyed, any redds seen were "counted" for the first time, regardless of their actual construction date, thereby inflating redd numbers upon the initial survey date. In turn, the number of new redds appears elevated late-October compared to mid-October. However, on the more continuously monitored locales of Reach 4, 5, and 9, there is also evidence of an upturn following the freshet. Therefore, it is likely that the second pulse of redds is a combination of newly constructed redds after an

increase in discharge combined with first reporting of older redds upon reaches not previously surveyed. See **Appendix C** for a table of redd numbers organized by reach and date.

Prediction for fish returning to the Klamath River system, including Salmon River, was for low numbers. In 2017, only 368 redds were identified, not including Reach 5A (and 417 with Reach 5A). This is compared to an average of ~830 redds and ~925 redds, respectively as per previous, for surveys conducted between 2011 and 2015. Although the return in 2017 was not as low as 2016, the total number of fish was still well below average. For 2017, no reach recorded over 100 redds, with Reach 4B (mainstem Salmon River) having the most spawning documented with 88 redds. Although a lesser proportion of the run used SF Salmon River compared to other years, overall spatial distribution was broadly similar to established patterns in regards to concentrated use and regular use areas. See **Appendix D** for redd spatial distribution and location information.

Figure 1. Fall Chinook redds observed and survey effort on the Salmon River in 2017. Surveys occurred on NF Salmon River from Mile 12 to Forks of Salmon; on SF Salmon River from Matthews Creek to Forks of Salmon; and on the mainstem Salmon River from Forks of Salmon to Nordheimer Creek.



Specific areas of the Salmon River display a greater preference for use by spawning Fall Chinook. The mapping of redds by GPS (with hardcopy map back-ups) 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 shown 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 two years since 2011. An exception for inclusion in the dataset is 2016, when persistently high early season flows confounded the survey effort.

The regular use area dataset identifies well-defined clusters of redds which occur in the same location most years. The concentrated use area dataset is a subset of the larger regular use area dataset, which additionally includes sites which do not meet the strict linear density requirement of the former. Locales often represent pool tail-outs or lower gradient riffle/glide areas. Following the 2017 spawning season, several sites originally mapped as concentrated use were reassigned to regular use – the longer dataset has revealed heavy use to have occurred in only one year. These sites will continue to be tracked to determine the potential conditions that trigger elevated use at these locales.

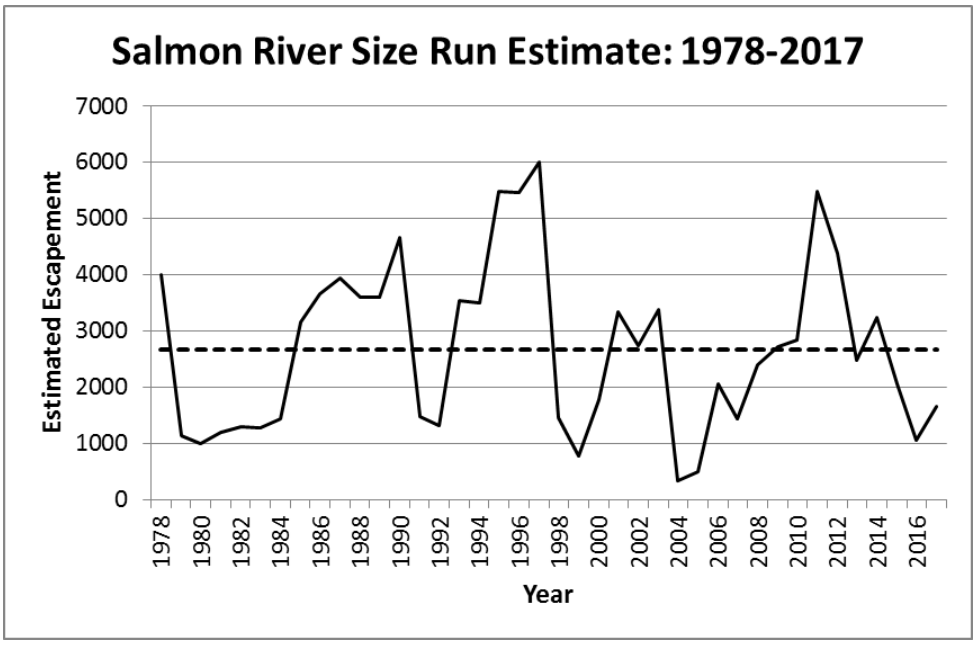
Continued acquisition of data will better refine identified concentrated use areas, as well as further define other sites with consistent, but lighter, use. Furthermore, the definition of "concentrated use area" may occur in the next year or two as the longer dataset highlights sites which may receive elevated use only during specific conditions of run size or water discharge.

- Mainstem Salmon River (Nordheimer Creek to Forks of Salmon – ~4.0 miles)
    - 17 regular use areas
    - 11 concentrated use areas (subset of regular use areas)
        - Since 2011, the following sites have demonstrated elevated use every year: Horn Field.
- North Fork Salmon River (Forks of Salmon to Kelly Gulch – ~12.0 miles)
    - 38 regular use areas
    - 16 concentrated use areas (subset of regular use areas)
        - Since 2011, the following sites have demonstrated elevated use every year: Forks of Salmon bridge; Pollocks Gulch vicinity; Red Bank engine access
- South Fork Salmon River (Forks of Salmon to Matthew Creek – ~10.2 miles)
    - 44 regular use areas
    - 18 concentrated use areas (subset of regular use areas)
        - Since 2011, the following sites have demonstrated elevated use every year: County Road 1C02 river crossing downstream of O'Farrill Gulch; upstream of O'Farrill Gulch; Methodist Creek bridge

The GoogleEarth redd overlay was updated in 2018 to reflect adjustments made to the concentrated use area and regular use area datasets.

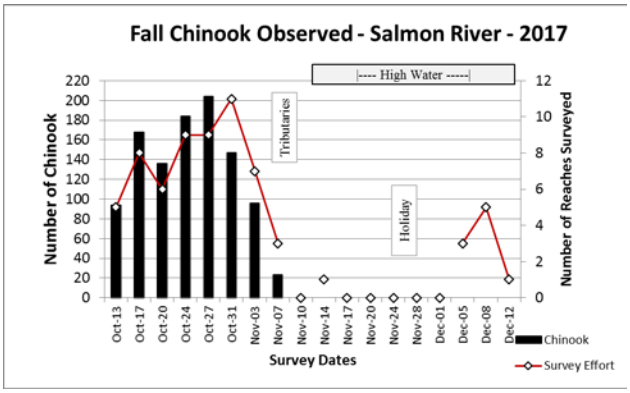
Using survey data, the Salmon River is estimated to have had 1,665 fall-run Chinook salmon return in the fall of 2017 (**Figure 2**; **Appendix A**). Based on long-term tracking data compiled by CDFW, 2017 was below average, ranking 26th (of 40 years) for run size.

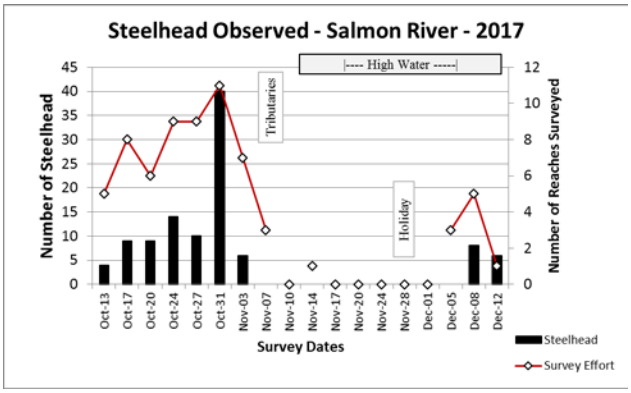
Figure 2. Salmon River fall-run size estimates for 1978 to 2017. Dashed line is average over long-term survey period.



Live Chinook and steelhead were tallied during surveys (**Figure 3**). As with redds, fish observation is affected by number of surveyors, weather, discharge conditions, and surveyor experience. Peak live Chinook was observed in late-October, following the first significant freshet. Steelhead numbers were generally low throughout the survey season, with the exception of October 31st – steelhead are known to move following storm events, and the freshet may have encouraged fish movement. Alternatively, the reach on October 31st which reported the bulk of the steelhead (Reach 4A) included a snorkeler; and fish are more visible and easier to count when viewed underwater as opposed to from shore. Overall, teams which include at least one snorkeler tend to count more fish – Chinook and steelhead – compared to the same reaches with walkers only. 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 2017 Salmon River surveys.





Coho were incidentally observed during the Fall Chinook surveys:

- October 31st
  - 2 Coho constructing/defending a redd observed in Reach 4A (Mile 2 to Forks)

Salmon River tributary surveys occurred during November and December. Chinook salmon redds and live Chinook were observed on Nordheimer Creek. Neither fish nor redds were reported on Knownothing Creek (or its forks), Little North Fork Salmon River, or Methodist Creek. Because storm events which brought a significantly elevated discharge to an otherwise low water-year did not occur until the tail of the run, the mouths of most tributaries may have been difficult for fish to access when individuals were actively searching for spawning substrate. No steelhead were seen on any tributary.

Scott River

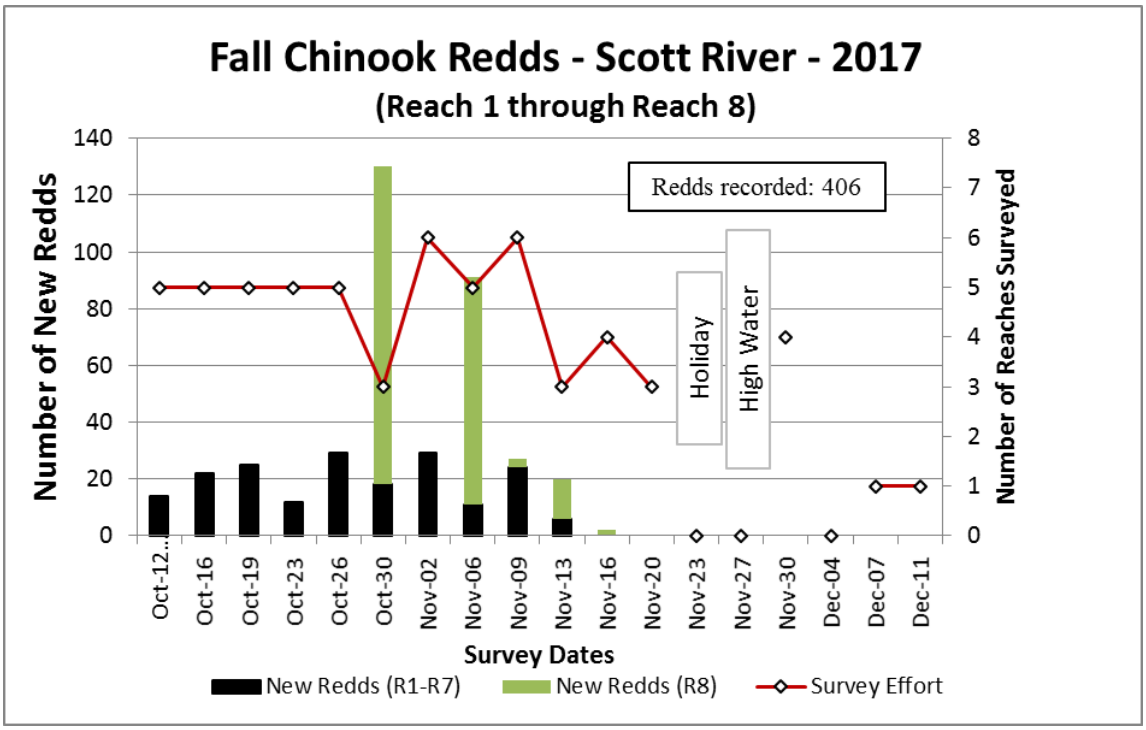
Overall effort on the Scott River was good. Storms in mid- and late-November created turbidity which was difficult to view through and, eventually, elevated discharge to unsafe levels for surveyors (**Appendix B**). However, this did not occur until the end of the survey season when redd construction was largely complete and the majority of Fall Chinook were either dead or dying.

Based on the available data, the Scott River reached the peak of spawning in late-October for Reach 1 through reach 8 (**Figure 4**). The exact date is difficult to determine because surveys of Reach 8, where the majority of redds are normally constructed, were delayed until spawning was well established and the video weir had tracked many Chinook passing through to the valley area. Therefore, the first survey of Reach 8 had inflated numbers as redds were counted for the first time, regardless of actual construction date. Of note, Reach 7 had much greater use than normal when compared to surveys conducted since 2011 (0%-9% of the total run [2011-2016] versus 16% [2017]), although areas utilized are similar to locales previously used. See **Appendix C** for a table of redd numbers organized by reach and date.

Access to portions of Reach 2 and Reach 3 which traverse private property in the lower Scott River was an issue prior to 2015. Starting in 2015, direction was to walk and flag all properties. The only exception is Reach 3 within the riverfront viewscape of the Trabucco residence, where no flags are hung for several hundred feet. In this location, all redds are counted each time. The maximum number of unflagged redds observed during a single survey in Reach 3 was five. Redds in the unflagged portions of this reach are not included in final map outputs.

Prediction for fish returning to the Klamath River system, including Scott River, was for low numbers. The number of redds recorded in Reach 1-8 in 2016 was 406, as compared to the range of 476 to 1128 redds (annual average ~830) counted between 2011 and 2015. Although the return in 2017 was not as depressed as 2016, the total number of fish was still below average. Overall spatial distribution was broadly similar to established patterns in regards to concentrated use and regular use areas, although, as expected, redd density throughout the survey area was generally low. See **Appendix D** for redd spatial distribution and location information.

Figure 4. Fall Chinook redds observed and survey effort on the Scott River in 2017 (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. Surveys prior to 2017 left redds unflagged due to landowner preference, with surveyors counting all redds each survey date due to inability to reliably differentiate between "new" and "old" redds. However, beginning in 2017, all individual redds were flagged and/or GPSed such that it was possible to track the appearance of new redds over the spawning season, similar to effort on Reach 1 through 8. A total of 279 redds were recorded; and peak spawning for most reaches was reached in late-October or early-November (**Table 3**). Only one tributary was surveyed in 2017 because surface flow was not re-established with mainstem Scott River for most streams until mid-November, at the end of the spawning season. For additional information concerning the Scott Valley effort, contact RCD for a copy of their spawning survey report.

Table 3. Total number of redds and date of maximum observed for Reach 9 through Reach 16 for Scott River in 2017.

	Reach 9	Reach 10	Reach 11	Reach 12	Reach 13	Reach 14	Reach 15	Reach 16	Total
Total Redds	27	N/A	0	23	78	89	48	14	279
	Nov-02			Nov-09	Oct-23	Oct-26	Oct-30	Nov-02	

Specific areas of the Scott River display a greater preference for use by spawning Fall Chinook. The mapping of redds by GPS (with hardcopy map back-ups) 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 and/or only available under certain discharge conditions.

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 two years since 2011. An exception for inclusion in the dataset is 2016, when persistently high early season flows confounded the survey effort.

The regular use area dataset identifies well-defined clusters of redds which occur in the same location most years. The concentrated use area dataset is a subset of the larger regular use area dataset, which additionally includes sites which do not meet the strict linear density requirement of the former. Locales often represent pool tail-outs or lower gradient riffle/glide areas.

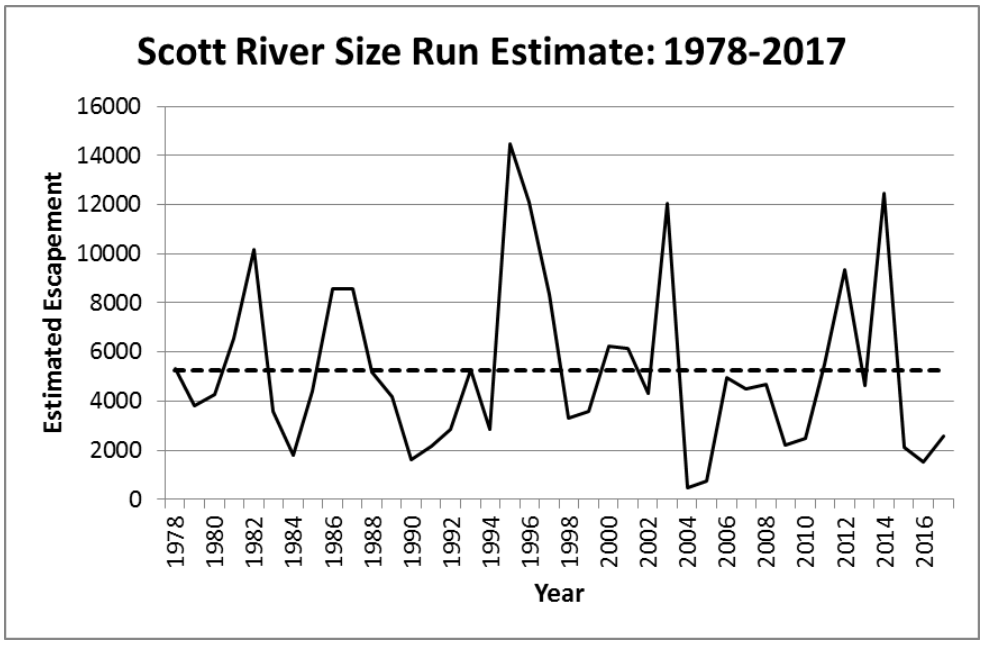
Continued acquisition of data will better refine identified concentrated use areas, as well as further define other sites with consistent, but lighter, use. Furthermore, the definition of "concentrated use area" may occur in the next year or two as the longer dataset highlights sites which may receive elevated use only during specific conditions of run size or water discharge.

- Scott River (Reach 1 through Reach 8 – ~24.5 miles)
    - 78 regular use areas
    - 42 concentrated use areas (subset of regular use areas)
        - Since 2011, 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.

The GoogleEarth redd overlay was updated in 2018 to reflect adjustments made to the concentrated use area and regular use area datasets.

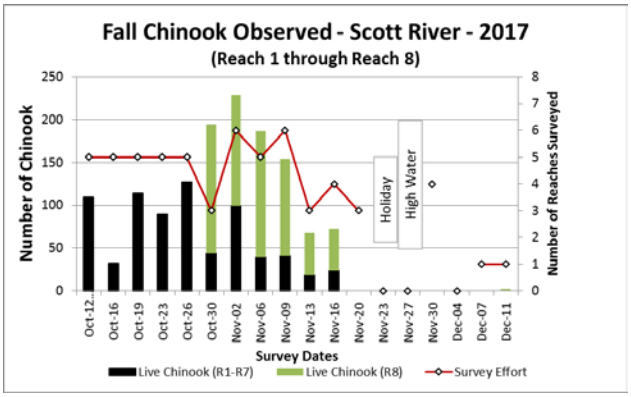
Using survey data and video weir observation, the Scott River is estimated to have had 2,576 Fall Chinook salmon return in 2017 (**Figure 5**; **Appendix A**). Based on long-term tracking data compiled by CDWF, 2017 was below average, ranking 31st (of 40 years) for run size.

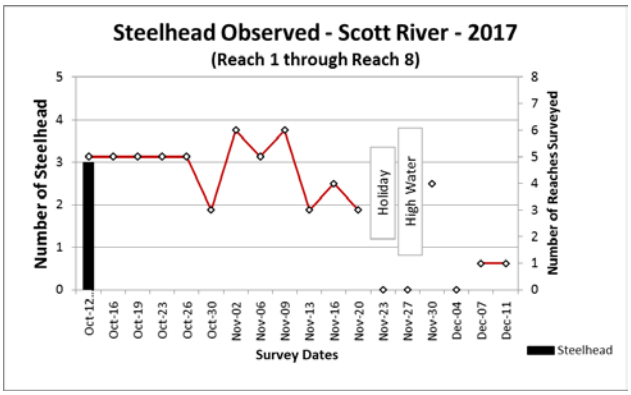
Figure 5. Scott River fall-run size estimates for 1978 to 2017. Dashed line is average over long-term survey period.



Live Chinook and steelhead were tallied during surveys (**Figure 6**). As with redds, fish observation is affected by number of surveyors, weather, discharge conditions, and surveyor experience. Peak live Chinook was observed in late-October to early-November; and only a few steelhead were reported on the first survey day. 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 2017 Scott River surveys (Reach 1 through Reach 8 only).





Coho were incidentally observed during the Fall Chinook surveys:

- October 30th
  - 1 Coho observed in Reach 12 by RCD crew

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

- Canyon Reaches: Neither live fish, carcasses, nor redds were seen within Canyon Creek, Kelsey Creek, Mill Creek, or Thompkins Creek.

- Upper Valley Reaches: Neither live fish, carcasses, nor redds were seen within Boulder Creek, Fox Creek, Sugar Creek, or SF Scott River.
- Valley Reaches (RCD): One live fish and a redd was seen in French Creek. Other Valley tributaries were not surveyed due to lack of connectivity with mainstem Scott River until the end of the Chinook run.

DISCUSSION

Low Chinook salmon returns within the Klamath Basin defined the 2017 survey season. Early-season prediction for Fall Chinook returns to the Klamath River basin was for a below average run year (KRTT 2017). The final estimate of run size by CDFW confirmed run size throughout the Klamath Basin to be depressed, although it was better than the near-record low of 2016 (**Appendix A**). This was the second consecutive year of reduced numbers for the Scott River; and the third for the Salmon River.

Spawning season water discharge for both Salmon River and Scott River were within the long-term range of "normal", with end-of-season storms arriving in November. As is usual, elevated water levels occurred earlier in Salmon River than Scott River, but both drainages had multiple survey cancellations due to safety. The increase in discharge did not occur until the tail-end of spawning, at which time few redds were under active construction and those fish left in the system were dying. Therefore, the high water is not expected to have appreciably affected surveyor effort in regards to capturing presence of new redds. Unlike the critically low water year of 2015 when fish distribution within both watersheds was impacted by low-flow barriers, fish should have had access upon the mainstems to all customary spawning areas.

The lack of freshets in October and early-November, when fish were actively searching for spawning gravels, means that fish poorly, or did not, utilize tributaries for redd construction. In particular, the mouths of many Salmon River tributaries within the survey area possess a steep, often cascading, approach through a delta which are observed to be difficult for fish to ascend during fall baseflows; and Scott River valley tributaries are similarly inaccessible due to dry channel. A comparison can be made between 2014 and 2017. Although 2014 began the season similar to 2017 in regards to normal low baseflows and inaccessible tributaries, October storms arrived at the perfect mid-season time for fish to take advantage of the subsequent increase in discharge to move into tributaries in higher numbers than usual, and in some cases migrating further upstream than is customarily observed. Conversely, 2017 never included a significant event to allow fish to circumvent low-water confluence barriers, and, therefore, these streams were never utilized. A similar lack of early- or mid-season freshet was observed in 2015, with a comparable lack of utilization of tributaries by Chinook. In contrast, Nordheimer Creek, with its easily entered mouth, is used by spawning Fall Chinook annually despite low discharge conditions. In the Scott River, it is unknown why fish did not enter either Canyon Creek or Kelsey Creek in 2017, but due to adequate flows and low fish numbers in the mainstem, there may have been little competition over spawning gravels, and therefore there was little impetus for fish to seek tributary spawning opportunities.

See **Table 4** for a summary of discharge, storm timing, and run size since 2011 for Salmon River and Scott River

Table 4. Summary of river discharge, storm timing, and Fall Chinook run size for Salmon River and Scott River for 2011 through 2017.

Year	Salmon River			Scott River		
	Discharge[1]	Storms[2]	Run Size[3]	Discharge	Storms	Run Size
2011	Normal	Early Late	Well above average	Normal	None	Average to above
2012	Normal	Mid-Late Late	Well above average	Low	Late	Well above average
2013	Normal to low	Early Late	Average to below	Very low to low	None	Below average
2014	Normal	Mid-Early Mid-Late Late	Above average	Low to normal	Mid-Early Late	Well above average
2015	Low to very low	None	Below average	Very low	None	Well below average
2016	High to very high	Mid-Early Mid-Late Late	Well below average	Very high to high	Mid-Early Mid-Late Late	Well below average
2017	Normal to high	Mid-Late Late	Well below average	Normal	Late	Well below average

[1]Discharge – defined using the same daily discharge percentile cut-offs as the USGS gage dataset (see Appendix B for gage locations). 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]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
- Above/below average - within 10% to 50% of long-term average
- Well above/below average - more than 50% deviation from long-term average

Although specifics in regards to the Salmon/Scott River drainages are unknown, it is anticipated that climate change will eventually have an effect on the region. Safeeq, *et al*. (2015) took historical winter data from the western United States to determine which regions were more sensitive to projected temperature increases and, hence, shifts in the projected proportion of precipitation falling as snow and/or rain. For the Klamath Mountains, they projected that by 2040, the average winter precipitation year will look more like what happens during current warm winters. In other words, the average snow line will be higher, there will be less snow at low elevations and less snow overall as more precipitation falls as rain. In turn, there will be hydrologic changes as a smaller, higher elevation snowpack translates to less cumulative spring run-off and less water in general through the remainder of the year. Leng, *et al.* (2016) agrees

that there will be an alteration in stream flows in the Pacific Northwest area, including northern California; and under most scenarios, modeling suggests that earliest emergence of significant changes – beyond normal background variability – regarding decreased summer discharge could occur in the region as early as the 2030s. In contrast, the elevation of winter flows as more precipitation falls as rain instead of snow, may not occur until the 2070s (Leng, *et al.* 2016). Winter temperatures will not only be affected, but temperatures throughout the year; and by the 2060s, what is now considered to be an exceptionally "hot" summer day will become much more common in California, as will be the occurrence of multiple sequential "hot" days (Pierce, *et al*. 2013). The effect of climate change upon timing and amount of precipitation is less clear. The most recent research on climate models for California suggest that average annual precipitation in the northern portion of the state will remain relatively constant (Pierce, *et al*. 2013). A slight increase in winter precipitation may be offset by less summer precipitation, but overall, precipitation patterns will likely remain within the range of historical natural variation, making it very difficult to resolve if climate change is having an effect of precipitation amount or timing (Pierce, *et al*. 2013).

The challenge of climate change will eventually affect fall-run Chinook. Current inter-annual variability, including recent past and near future, of factors such as river discharge and run-size are not necessarily attributable to climate change, but are likely instead within the variability of the natural cycle. However, observations of Chinook behavior and habitat use made during current cycles of dry, normal, and high water, as well as differences between above- and below-average run years, do provide a view of future expectations as the climate shifts. For instance, river discharge, in conjunction with the timing of fall storms, strongly influences access. The underlying summer/fall baseflow is expected to be affected by climate change, with less winter snowpack and/or more frequent incidences of drought directly influencing how much water upmigrating Fall Chinook encounter when they enter the river. As low flow and exceptionally low flow conditions become more common, then a scenario similar to that observed in 2015 may also become more frequent; and those circumstances can be amplified in drainages like the Scott River which include large amounts of water withdrawal for irrigation and other purposes. On the other hand, at this time it appears climate change will minimally affect normal fall precipitation events, so their occurrence will remain within the range of past variation (i.e., sometimes they occur [2012, 2014]; and sometime they do not [2015, 2017]). These events will become increasingly critical in permitting Fall Chinook to access traditionally utilized locations which may otherwise be difficult to reach. Large, early-fall storms, similar to that observed in 2016, that can present an unseasonably early scour risk to redds are likely to retain their current return interval. How future impacts from climate change will ultimately affect success of Fall Chinook, and other fish species, is a large question, one which requires a long-term dataset like that available from the Scott River and Salmon River to address.

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 (Forest Service and private individuals) in regards 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 in the future 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, else persist if not effectively corrected from the start. Additionally, other common 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 annually reoccurring issues, it is the responsibility of the agency survey manager, or their representative, to ensure crews fully understand all aspects of 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 reach and it is much more difficult to capture the group attention. 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.

The morning rush by surveyors to leave for assigned reaches means not all datasheets/maps may be gathered, even with repeated verbal reminders. Additionally, survey fatigue begins to set in during November. As a consequence, there are times when not all datasheets/maps are turned in, leading to missing data; and data quality starts to slip by the end of the season compared to the beginning. Over the last several years gains have been made in respect to datasheet return and data quality, but problems persist.

- Recommendation #1: continue to provide data packets (carcass sheets, redd sheets, maps) to each crew individually. This procedure should occur on both the Salmon River and the Scott River. Packets may be handed out personally by the survey administrators, else via a delegated individual. During the free-for-all morning gathering of datasheets/maps, there are inevitably crews who forget something. Additionally, 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 their delegate at end of survey day. Early returning crews may be required to wait if administrator and/or

delegate is not present. If administrator and/or delegate cannot be present or crews must leave early due to travel distance, then it is suggested a "check-in checklist" be developed that crews must use before they leave the survey site. This action will verify datasheets to be complete and an appropriate level of data quality is retained.

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

- Correctly fill out all datasheets.
    - Complete header information as appropriate – start/end time, weather, streamflow, temperature (when available), crew names, etc. Header information allows survey administrators to gage effort. For instance, it is expected that better data will have been gathered in conditions of clear water and sunny skies, compared to rain/wind with high flows.
    - For redds, always use the header/map sheet. Only use the continuation sheet as the primary datasheet for redds when no header/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 asks for Coho and steelhead. <u>If there are no fish, write a "0"</u>. This action confirms to the administrator that a count was undertaken.
    - "Live fish" on the summary sheet is <u>Chinook only</u> (includes jacks and adults). If other species are to be reported, they should be written in the comment section.
    - **<u>Redd dimensions should be measured to the nearest 0.1 meter</u>, or as close as possible given equipment limitations. **Do not** use feet. **Do not** use the nearest meter or half meter. **Do not** assume all redds are the same size and thereby report the same dimensions repeatedly.
    - "Unflagged Segments" on the redd sheet should only be filled in when and where not flagged. This may be an entire reach (i.e., Reach 5A, Salmon River) or a partial reach (i.e., Reach 3, Scott River). For reaches which are only partially flagged, the final redd count will be split into two components: measured redds and count-only (not-measured) redds.
    - **<u>Always fill out the hardcopy maps</u>! They are used for post-season QA/QC, as well as a back-up should GPS data be lost or not collected.
        - This is <u>especially</u> important in years with low fish numbers, numerous cancelled surveys, and overall poor effort due to high water. Some locations may only have one or two surveys, compared to the normal regime of six to ten (or more). All data is important because it helps local and State management of the fish stocks, including spawning ground usage and estimation of run size.
- Perform the GPS protocol correctly.
    - Input the correct redd number label.
    - **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
    - At the end of the survey day, turn in all datasheets and maps, even those with negative information; and completely fill out the summary sheet, ensuring information is entered on the correct date.
    - Where reaches are split into "A" and "B", survey administrators need to ensure crews are aware of which subreach is being surveyed. Subreaches primarily occur on the Salmon River, although, depending upon fish numbers, they may also be used part of the season 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/or GPSing should still occur, as directed by the survey administrator.
    - Ensure crews know any "special instructions" for a reach, such as flag/no-flag segments and entry/exits to avoid private property.
    - Where there are "special instruction" areas that are skipped for part of the season (e.g., Salmon River, Reach 9A, at Pollocks Gulch by request of adjacent landowner), be sure that redds are recorded and GPSed prior to end of the season.
    - **It is obvious that some individuals/crews present at the pre-season trainings are not fully paying attention. Training is viewed primarily as a social occasion; and some individuals are not fully engaged. These individuals/crew are often same ones whom have built habits, sometimes undesirable, through years of surveying; and even when reminded during the season to make adjustments, they return to their old practices within a survey or two.
        - Of particular concern, there are also individuals who should be at the survey trainings, but do not show up.
        - Additionally, trainers do not always have the opportunity to traverse stations, and therefore may not be exposed to protocol changes which may have occurred since the previous spawning season.

Continuing, there are several recommendations aimed specifically at KNF and CDFW, as based upon multiple years of survey observations:

- The KNF administrator should continue to ensure that redd/map datasheets are always available, thereby eliminating the need for crews to improvise.
- The Forest Service should continue incorporation of several 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.
- 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 so forth.
- Require crews to carry at least one gaff with measure marks (meters and tenth-meters)
- Discuss between USFS and CDFW survey administrators about how to manage *consistently* individuals/crews whom have been identified as exhibiting undesirable habits.
- Coordination with CDFW to investigate the possibility of minor modifications to daily summary sheets.
    - Expand the "Live Fish" field to specify "Live Fish – Chinook", "Live Fish – Steelhead", and "Live Fish – Coho". Alternately, "Live Fish" is altered to ensure surveyors understand it is Chinook only.
    - Include a checkbox with each reach for the survey manager to mark when a reach is not surveyed. The manager should also comment why the reach was omitted (e.g., high water, insufficient crew, safety concerns).

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

- 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.
- Overall, crews are more likely to turn in the entirety of the datasheet/map packets, even when no redds, fish, and/or carcasses are found. It is better understood that a negative result is still valid information, whereas "missing data" is the same as if the survey was never completed.
- The CDFW summary sheets were altered to provide separate entries for "A" and "B" subreaches, as appropriate. This change eliminated the need for crews to manually draw a divider under the reach number and increased the likelihood that data was reported in the correct location.
- Forest Service redd datasheets were altered to incorporate a map on the back of the header page. Redd datasheets were also updated to include an example of a redd GPS point.
- Forest Service maps were updated, where necessary, to include a special instruction box for reaches, or portions thereof, that are not flagged.
- KNF more often checks on-site stock of redd/map datasheets to ensure sufficient supplies are available for survey use.
- 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 GPSes are available to map redds. Between KNF, CDFW, watershed councils, tribal crews, and other entities, there is often sufficient equipment to GPS every reach every day for both Salmon River and Scott River drainages.
- More regular downloading of GPSes. The KNF administrator brings a computer once a week to surveys to capture GPS data and tracks the downloaded data files.

LITERATURE CITED

California Department of Fish and Wildlife (CDFW). 2018. Klamath River Basin Fall Chinook salmon spawner escapement, in-river harvest and run-size estimates – 1979-2017.

California Department of Fish and Wildlife (CDFW). 2017. Klamath Basin cooperative spawning ground survey – 2017 training manual. 62 p.

Klamath River Technical Team (KRTT). 2017. Ocean abundance projections and prospective harvest levels for Klamath River Fall Chinook, 2017 Season. Available: http://www.pcouncil.org/wp-content/uploads/2017/03/krtt.stock_.proj_.2017.FINAL_.03Mar.pdf

Leng, G., Huang, M., Voisin, N., Zhang, X., Asrar, G.R., and L.R. Leung. 2016. Emergence of new hydrologic regimes of surface water resources in the conterminous United States under future warming. Environmental Research Letters 11 114003. Doi:10.1088/1748-9326/11/11/114003.

Pierce, D.W., Das, T., Cayan, D.R., Maurer, E.P., Miller, N.L., Bao, Y., Kanamitsu, M., Yoshimura, K., Snyder, M.A., Sloan, L.C., Franco, G., and M. Tyree. 2013. Probability estimates of future changes in California temperature and precipitation using statistical and dynamical downscaling. *Climate Dynamics* 40: 839-856.

Safeeq, M., Shukla, S., Arismendi, I., Grant, G.E., Lewis, S.L., and A. Nolin. 2015. Influence of winter season climate variability on snow-precipitation ratio in the western United States. *International Journal of Climatology* doi:10.1002/joc.4545.

Personal Communication

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Appendix A – California Department Fish and Wildlife "MegaTable"

Due to large size of the Klamath River Fall Chinook "MegaTable" (1978 to 2017), 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, 1978-2017 a/

SPAWNER ESCAPEMENT

	2014			2015			2016		
Hatchery Spawners	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Iron Gate Hatchery (IGH)	1,039	24,300	25,339	220	7,956	8,176	151	2,436	2,587
Trinity River Hatchery (TRH)	221	6,975	7,196	224	3,129	3,353	401	1,142	1,543
Hatchery Spawner Subtotals:	**1,260**	**31,275**	**32,535**	**444**	**11,085**	**11,529**	**552**	**3,578**	**4,130**
Natural Spawners									
Main Stem Klamath River n/ (excluding IGH)	1,844	22,443	24,287	259	7,407	7,666	159	2,902	3,061
Salmon River basin	527	2,706	3,233	92	1,978	2,070	26	1,032 hh/	1,058
Scott River basin	2,051	10,419	12,470	21	2,092	2,113	139	1,376	1,515
Shasta River basin	3,945	14,412	18,357	133	6,612	6,745	135	2,754	2,889
Bogus Creek basin	323	12,607	12,930	45	2,308	2,353	38	830	868
Misc. Klamath tributaries o/ (above Yurok Reservation)	1,498	6,877	8,375	49	2,244	2,293	30	1,218	1,248
Yurok Reservation tribs. (Klamath River) p/	332	1,245	1,577	149	632	781	27	264	291
Klamath Natural Spawner Subtotals:	**10,520**	**70,709**	**81,229**	**748**	**23,273**	**24,021**	**554**	**10,376**	**10,930**
Main Stem Trinity River dd/ (excluding TRH)	6,620	23,312	29,932	2,660	4,727	7,387	1,295	3,444	4,739
Misc. Trinity tributaries o/ (above Hoopa Reservation)	47	515	562	26	46	72	21	55	76
Hoopa Reservation tribs. (Trinity River) p/	52	568	620	38	66	104	24	62	86
Trinity Natural Spawner Subtotals:	**6,719**	**24,395**	**31,114**	**2,724**	**4,839**	**7,563**	**1,340**	**3,561**	**4,901**
Natural Spawner Subtotals:	**17,239**	**95,104**	**112,343**	**3,472**	**28,112**	**31,584**	**1,894**	**13,937**	**15,831**
Total Spawner Escapement	**18,499**	**126,379**	**144,878**	**3,916**	**39,197**	**43,113**	**2,446**	**17,515**	**19,961**

IN-RIVER HARVEST

	2014			2015			2016		
Angler Harvest	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Klamath River (below Hwy 101 bridge)	268	1,093	1,361	292	2,914	3,206	31	801	832
Klamath River (Hwy 101 to Weitchpec)	2,847	1,875	4,722	1,224	2,258	3,482	91	24	115
Klamath River (Weitchpec to IGH)	75	1,496	1,571	65	2,607	2,672	24	416	440
Trinity River basin above Weitchpec aa/	174	922	1,096	24	63	87	16	69	85
Angler Harvest Subtotals:	**3,364**	**5,386**	**8,750**	**1,605**	**7,842**	**9,447**	**162**	**1,310**	**1,472**
Tribal Harvest e/									
Klamath River (below Hwy 101 bridge)	153	20,096	20,249	405	22,508	22,913	121	3,185	3,306
Klamath River (Hwy 101 to Trinity mouth)	130	3,432	3,562	44	3,520	3,564	19	1,224	1,243
Trinity River (Hoopa Reservation)	65	2,439	2,504	47	2,020	2,067	20	751	771
Tribal Harvest Subtotals:	**348**	**25,967**	**26,315**	**496**	**28,048**	**28,544**	**160**	**5,160**	**5,320**
Total In-river Harvest	**3,712**	**31,353**	**35,065**	**2,101**	**35,890**	**37,991**	**322**	**6,470**	**6,792**

IN-RIVER RUN

	2014			2015			2016		
Totals	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
In-river Harvest and Escapement	22,211	157,732	179,943	6,017	75,087	81,104	2,768	23,985	26,753
Angling Mortality (2.04% of harvest) ff	69	110	179	33	160	193	3	27	30
Net Mortality (8.70% of harvest) ff	31	2,282	2,313	43	2,451	2,494	14	459	473
Klamath Basin disease testing jj/	10	272	282	1	123 kk/	124 kk/	2	111	113
Total In-river Run	**22,321**	**160,396**	**182,717**	**6,094**	**77,821**	**83,915**	**2,787**	**24,582**	**27,369**

(continued next page)

Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, 1978-2017 a/

SPAWNER ESCAPEMENT

	2017			2018			2019		
Hatchery Spawners	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Iron Gate Hatchery (IGH)	3,193	7,443	10,636			0			0
Trinity River Hatchery (TRH)	1,863	3,770	5,633			0			0
Hatchery Spawner Subtotals:	5,056	11,213	16,269	0	0	0	0	0	0
Natural Spawners:									
Main Stem Klamath River n/ (excluding IGH)	2,322	3,922	6,244			0			0
Salmon River basin	327	1,338 hh/	1,665			0			0
Scott River basin	307	2,269	2,576			0			0
Shasta River basin	6,618	3,287	9,905			0			0
Bogus Creek basin	848	1,874	2,722			0			0
Misc. Klamath tributaries o/ (above Yurok Reservation)	154	1,002	1,156			0			0
Yurok Reservation tribs. (Klamath River) p/	45	140	185			0			0
Klamath Natural Spawner Subtotals:	10,621	13,832	24,453	0	0	0	0	0	0
Main Stem Trinity River dd/ (excluding TRH)	5,715	4,534	10,249			0			0
Misc. Trinity tributaries o/ (above Hoopa Reservation)	96	76	172			0			0
Hoopa Reservation tribs. (Trinity River) p/	90	72	162			0			0
Trinity Natural Spawner Subtotals:	5,901	4,682	10,583	0	0	0	0	0	0
Natural Spawner Subtotals	16,522	18,514	35,036	0	0	0	0	0	0
Total Spawner Escapement	21,578	29,727	51,305	0	0	0	0	0	0

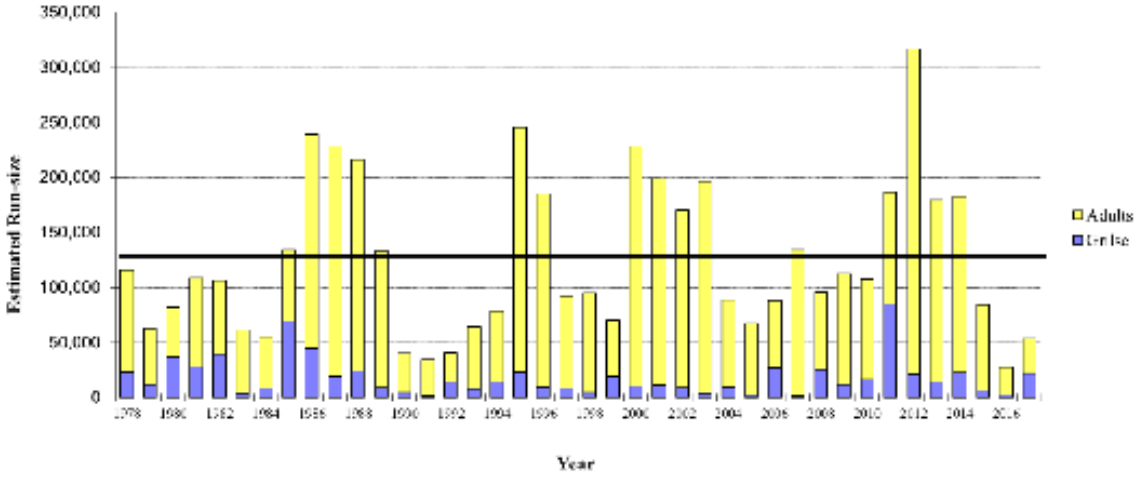
IN-RIVER HARVEST

	2017			2018			2019		
Angler Harvest	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Klamath River (below Hwy 101 bridge)	26	47	73			0			0
Klamath River (Hwy 101 to Weitchpec)	10	17	27			0			0
Klamath River (Weitchpec to IGH)	0	0	0			0			0
Trinity River basin above Weitchpec aa/	6	7	13			0			0
Angler Harvest Subtotals:	42	71	113	0	0	0	0	0	0
Tribal Harvest e/									
Klamath River (below Hwy 101 bridge)	65	205	270			0			0
Klamath River (Hwy 101 to Trinity mouth)	7	11	18			0			0
Trinity River (Hoopa Reservation)	194	1,660	1,854			0			0
Tribal Harvest Subtotals:	266	1,876	2,142	0	0	0	0	0	0
Total In-river Harvest	308	1,947	2,255	0	0	0	0	0	0

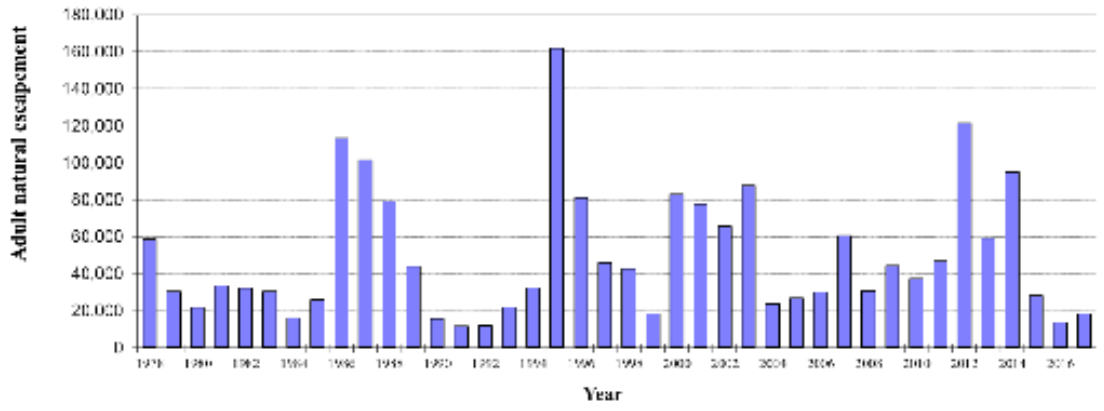
IN-RIVER RUN

	2017			2018			2019		
Totals:	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
In-river Harvest and Escapement	21,886	31,674	53,560	0	0	0	0	0	0
Angling Mortality (2.04% of harvest) ff	1	1	2	0	0	0	0	0	0
Net Mortality (8.70% of harvest) ff	16	163	179						
Klamath Basin disease testing jj/	0	0	0			0			0
Total In-river Run	21,903	31,838	53,741	0	0	0	0	0	0

Klamath River Basin Fall-Run Chinook Salmon Run-size Estimates, 1978-2017 a/



Klamath River Basin Adult Fall-Run Chinook Salmon Natural Escapement Estimates, 1978-2017 a/



a/ 2017 data are preliminary

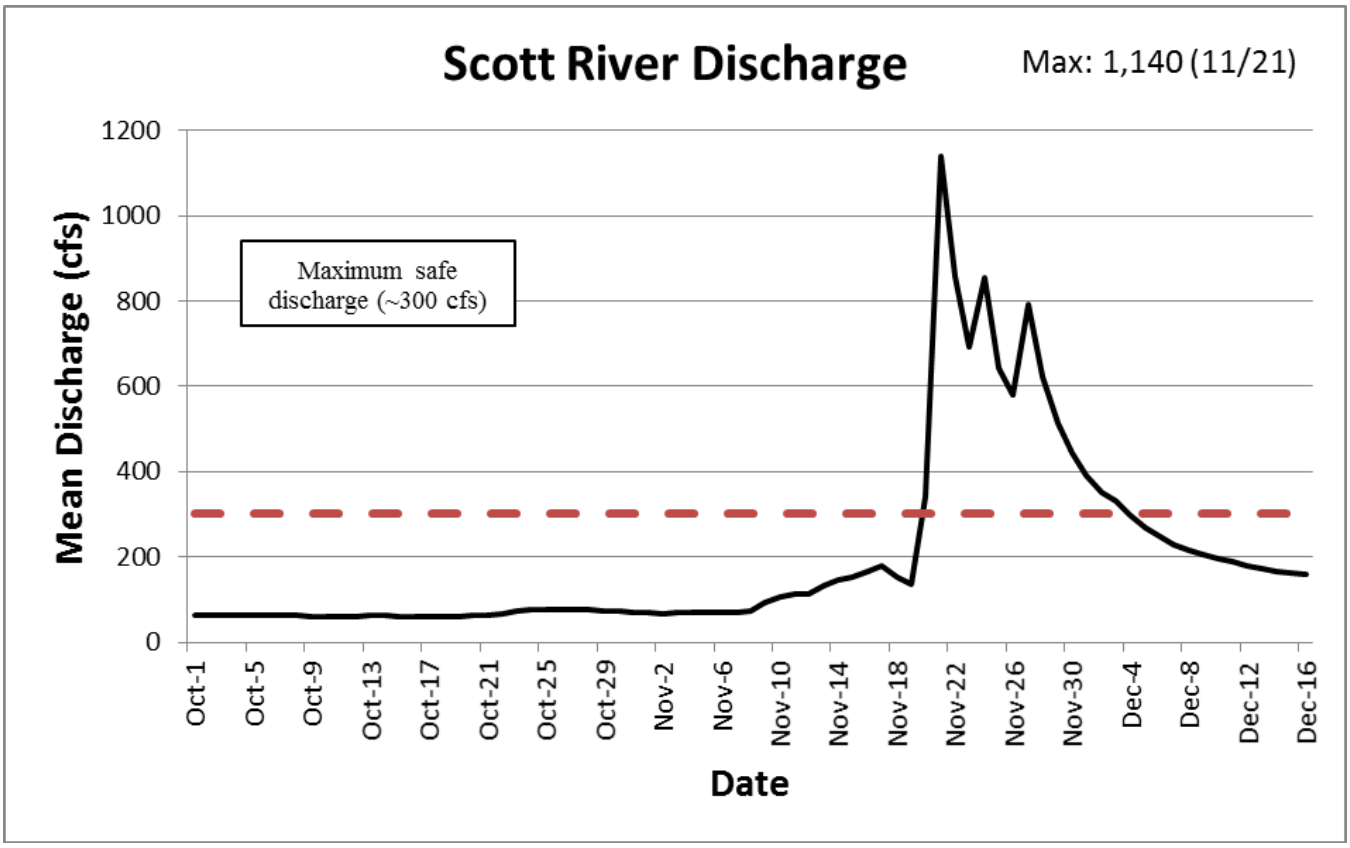
Appendix B – USGS Discharge Charts

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 16th, 2017, 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.

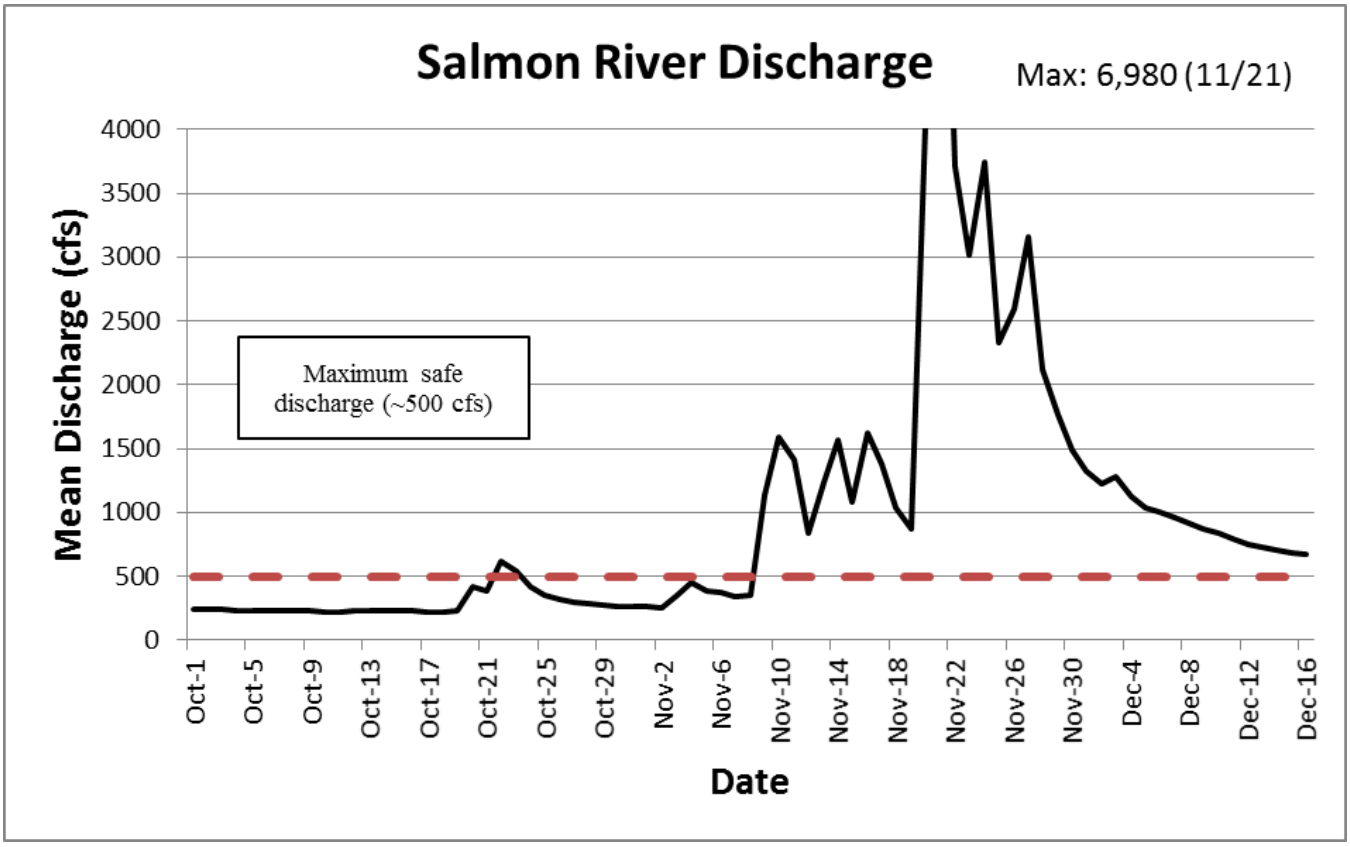


Salmon River

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 16th, 2017, 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 (2017)

Salmon River Redds

Reach	Date																	
	Oct-13	**Oct-17**	**Oct-20**	**Oct-24**	**Oct-27**	**Oct-31**	**Nov-03**	**Nov-07**	**Nov-10**	**Nov-14**	**Nov-17**	**Nov-20**	**Nov-24**	**Nov-28**	**Dec-01**	**Dec-05**	**Dec-08**	**Dec-12**
Mainstem																		
4A - Otter Bar to Nordheimer Ck		12		4	3	13	3	1	----	0	----	----	----	----	----	1	-	
4B - Forks to Otter Bar	29	7	7	1	35	5	1	2									-	
North Fork																		
9A - Mile 2 to Forks	11	7	8	12	10	1	0	6	High Water	High Water ----	High Water	High Water	Holiday	High Water	High Water		0	
9B - Mile 4 to Mile 2	17	3		3		9											0	
10A - Mile 6 to Mile 4				1	11	11											0	
10B - Mile 8 to Mile 6				18	22	2											0	
11A - Mile 10 to Mile 8					2	9										0		
11B - Mile 12 to Mile 10							3									0		
South Fork																		
5A - Henry Bell to Forks[1]	(17)	(25)	(15)	(24)	(45)	(49)	(37)		----	----	----	----	----	----	----			
5B - O'Farrill Gulch to Henry Bell	11	11	2	14	-[2]	1	-[2]										0	
6A - Indian Ck to O'Farrill Gulch		14	4	4		3	5											0
6B - Matthews Ck to Indian Ck		4	1		0	4												

[1]Reach 5A is not flagged - total number of redds counted each survey

[2]Redd numbers counted during these surveys are suspect, and therefore were excluded from the dataset

*Underline = days which included pulling flagging. Carcass surveys ("cs") may be conducted after this date, but redds are not recorded.

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

Salmon River Tributary Surveys

Tributary	Date	Redds	Chinook	Steelhead
Knownothing Creek	Nov-07	0	0	0
Knownothing Ck (EF)	Nov-07	0	0	0
Knownothing Ck (WF)	Nov-07	0	0	0
Little NF Salmon River	Nov-07	0	0	0
Methodist Creek	Nov-07	0	0	0
Nordheimer Creek	Nov-07	15	6	0
	Dec-08	2	1	0

Salmon River (Live) Chinook Observation

Reach	Date																	
	Oct-13	Oct-17	Oct-20	Oct-24	Oct-27	Oct-31	Nov-03	Nov-07	Nov-10	Nov-14	Nov-17	Nov-20	Nov-24	Nov-28	Dec-01	Dec-05	Dec-08	Dec-12
Mainstem																		
4A - Otter Bar to Nordheimer Ck		10		16	6	23	9	2	---|	0	---|	---|	---|	---|	---|	0	-	
4B - Forks to Otter Bar	39	37	73	53	57	42	20	12									-	
North Fork																		
9A - Mile 2 to Forks	26	35	29	31	27	7	22	9	High Water	High Water ----|	High Water	High Water	Holiday	High Water	High Water		0	
9B - Mile 4 to Mile 2	9	11		6		5												nd	
10A - Mile 6 to Mile 4				3	12	7												0	
10B - Mile 8 to Mile 6				28	32	19												0	
11A - Mile 10 to Mile 8					1	0										0			
11B - Mile 12 to Mile 10							0									0			
South Fork																		
5A - Henry Bell to Forks	7	55	14	23	36	15	28		|-----	|-----	|-----	|-----	|-----	|-----	|-----			
5B - O'Farrill Gulch to Henry Bell	13	13	10	21	29	26	7										0	
6A - Indian Ck to O'Farrill Gulch		7	10	3		1	10											0
6B - Matthews Ck to Indian Ck		0	0		4	2												

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

Salmon River (Live) Steelhead Observation

Reach	Date																	
	Oct-13	Oct-17	Oct-20	Oct-24	Oct-27	Oct-31	Nov-03	Nov-07	Nov-10	Nov-14	Nov-17	Nov-20	Nov-24	Nov-28	Dec-01	Dec-05	Dec-08	Dec-12
Mainstem																		
4A - Otter Bar to Nordheimer Ck		0		0	0	36	0	0	----	0	----	----	----	----	----	0	-	
4B - Forks to Otter Bar	0	0	6	0	0	0	0	0									-	
North Fork																		
9A - Mile 2 to Forks	1	0	2	7	0	0	3	0	High Water	High Water ----|	High Water	High Water	Holiday	High Water	High Water		0	
9B - Mile 4 to Mile 2	0	0		7		0											nd	
10A - Mile 6 to Mile 4				0	0	0											1	
10B - Mile 8 to Mile 6				0	3	0											0	
11A - Mile 10 to Mile 8					0	4										0		
11B - Mile 12 to Mile 10							0									0		
South Fork																		
5A - Henry Bell to Forks	0	9	0	0	7	0	0		|----	|----	|----	|----	|----	|----	|----			
5B - O'Farrill Gulch to Henry Bell	3	0	1	0	0	0	0										7	
6A - Indian Ck to O'Farrill Gulch		0	nd	0		0	3											6
6B - Matthews Ck to Indian Ck		0	0		0	0												

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

Scott River Redds

Reach	Date																	
	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
R1 - Midpoint to Confluence	4	8	14	4	4	17		0			0		Holiday	|---- High Water ----|	0	|-- No Crew Available --|		
R2 - "Cabin Hole" to Midpoint	4		2	1		1		1			0				0			
R3 - George Allen to "Cabin Hole"[1]	3	3	0	0			1		0	1					0			
R4 - Townsend Gulch to George Allen	1	5	5	0	2		0		0			0						
R5 - Bridge Flat to Townsend Gulch	2	0	4	7	3		10	2	0			0						
R6 - CDFG Weir to Bridge Flat		6			6		3		2			0			0			
R7 - USGS Gauge to CDFG Weir					14		15	8	22	5	0						0	
R8 - Blw Meamber Bridge to USGS Gauge						112	-[2]	80	3	14	2							0
R9 - Oro Fino to Quartz Valley Bridge[3]		2			6		14		5		0	-			0			
R11 - Eller Lane to Hwy 3[3]		0		0			0					-						
R12 - Etna Creek to Eller Lane[3]				7	6	0	0	nd	10	nd	nd	nd						
R13 - Horn Lane to Etna Creek[3]			nd	29	21	0	6	nd	15	4	nd	3						
R14 - Young's Point to Horn Lane[3]			2	13	28	15	13	9	3	3	3	0						
R15 - Fay Lane to Young's Point[3]			2	10	7	15	10	1	0	3	0	0						
R16 - Callahan to Fay Lane[3]					2		9		2		0	1						

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

[1]Reach 3 - Does not include unflagged redds (5) counted in front of house on private property (Trubucco)

[2]Redds were counted (47) but not measured, flagged, or GPSed. There were captured in the subsequent survey.

[3]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.

*Note: surveys included unflagged sections of Reach 3; and the redd count from this location is not included in the above table. The Reach 2 maximum number of unflagged redds was 5. This redd count is reported separately in the document (Table 2) and not included in the compounded redd number (Figure 4).

Scott River Tributary Surveys

Scott Canyon (Agency-Cooperative)

Tributary	Date	Redds	Chinook	Steelhead
Canyon Creek	Nov-13	0	0	0
	Dec-04	0	0	0
Kelsey Creek	Dec-04	0	0	0
Tompkins Creek	Nov-29	0	0	0
	Dec-04	0	0	0
SF Scott River	Nov-14	0	0	0
	Dec-12	0	0	0
Boulder Creek (SFSR)	Nov-14	0	0	0
Fox Creek	Dec-12	0	0	0
Sugar Creek	Nov-17	0	0	0
	Dec-07	0	0	0
Mill Creek (Scott Bar)	Nov-21	0	0	0
	Dec-07	0	0	0

Scott Valley (Siskiyou Resource Conservation District)

Tributary	Date	Redds	Chinook	Steelhead
French Creek	Nov-08	1	1	0

Note: other tributaries normally surveyed by RCD not connected to mainstem Scott River until end of run.

Scott River (Live) Chinook Observations

Reach	Date																	
	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
R1 - Midpoint to Confluence	14	9	47	43	38	43		6			0		Holiday	|--- High Water ---|	0	|-- No Crew Available --|		
R2 - "Cabin Hole" to Midpoint	54		32	10		1		18			0				0			
R3 - George Allen to "Cabin Hole"	19	12	9	5			2		0	2					0			
R4 - Townsend Gulch to George Allen	7	3	13	7	22		12		19			0						
R5 - Bridge Flat to Townsend Gulch	15	1	13	24	13		26	7	0			0						
R6 - CDFG Weir to Bridge Flat		7			21		32		5			0			0			
R7 - USGS Gauge to CDFG Weir					33		27	8	17	16	24						0	
R8 - Blw Meamber Bridge to USGS Gauge						150	129	147	113	50	48							2
R9 - Oro Fino to Quartz Valley Bridge[1]		5			12		27		17		5				0			
R11 - Eller Lane to Hwy 3[1]		0		0			0											
R12 - Etna Creek to Eller Lane[1]				26	26	8	32	12	22	8	9	0						
R13 - Horn Lane to Etna Creek[1]			37	117	102	135	87	83	64	36	28	6						
R14 - Young's Point to Horn Lane[1]			4	35	97	127	131	94	72	53	43	9						
R15 - Fay Lane to Young's Point[1]			1	21	37	76	78	60	44	25	10	4						
R16 - Callahan to Fay Lane[1]					7		21		12		2	5						

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

[1]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 (Live) Steelhead Observations

Reach	Date																	
	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**
R1 - Midpoint to Confluence	0	nd	nd	0	0	0		0			0		Holiday	|--- High Water ---|	nd	|-- No Crew Available --|		
R2 - "Cabin Hole" to Midpoint	0		0	0		0		0			0				0			
R3 - George Allen to "Cabin Hole"	nd	0	0	nd			0		0	nd					0			
R4 - Townsend Gulch to George Allen	1	nd	nd	0	0		0		0			0						
R5 - Bridge Flat to Townsend Gulch	2	0	0	nd	0		0	0	0			0						
R6 - CDFG Weir to Bridge Flat		nd			0		0		0			0			0			
R7 - USGS Gauge to CDFG Weir					0		0	nd	0	0	0						0	
R8 - Blw Meamber Bridge to USGS Gauge						nd	nd	0	0	0	0							nd
R9 - Oro Fino to Quartz Valley Bridge[1]																		
R11 - Eller Lane to Hwy 3[1]																		
R12 - Etna Creek to Eller Lane[1]																		
R13 - Horn Lane to Etna Creek[1]																		
R14 - Young's Point to Horn Lane[1]																		
R15 - Fay Lane to Young's Point[1]																		
R16 - Callahan to Fay Lane[1]																		

*nd = no data (surveys performed, but steelhead count not reported; number likely 0)

[1]Survey for RCD (valley) reaches did not include steelhead in 2017

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

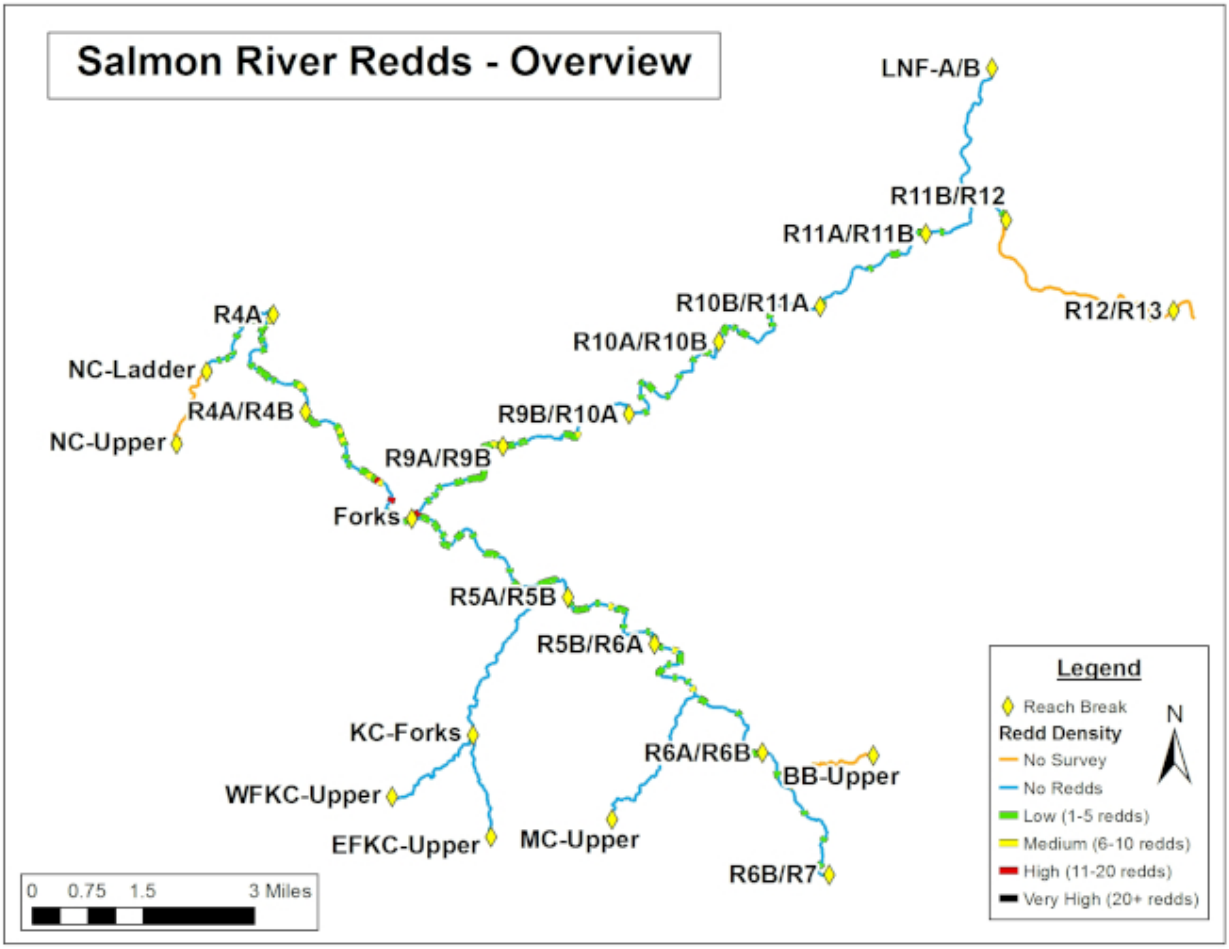


Figure D-SA1. General overview of redd distribution and density for Salmon River surveys. Map is of survey area only and does not include roads, hillslopes, or other landmarks.

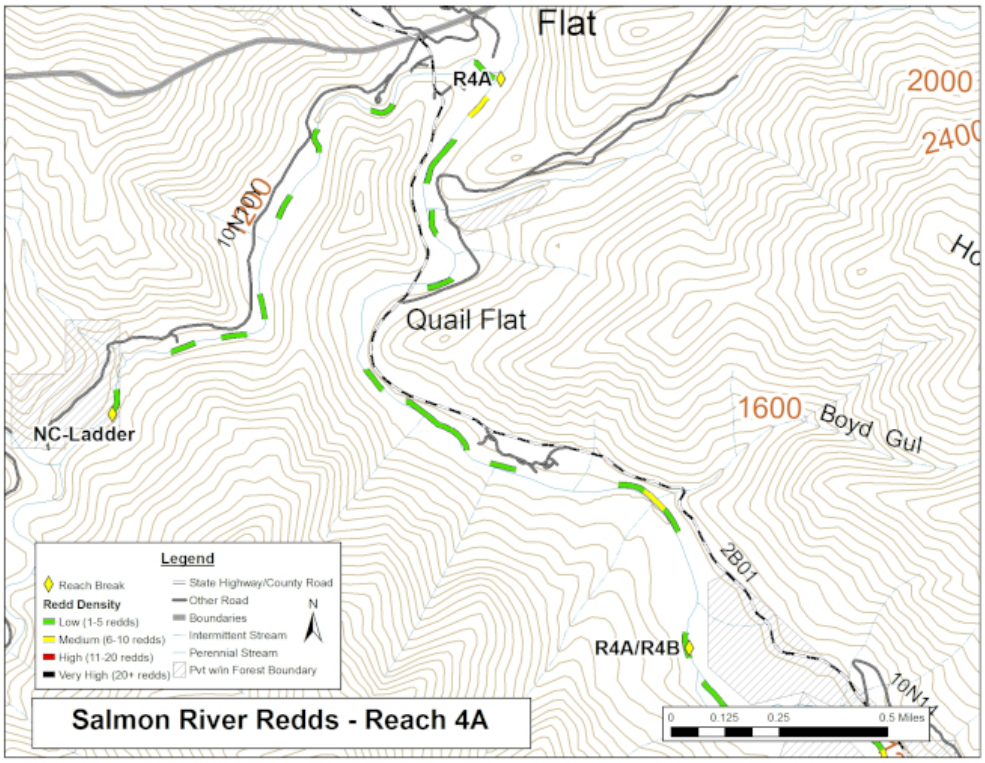


Figure D-SA2. Redd distribution and density for mainstem Salmon River, Reach 4A.

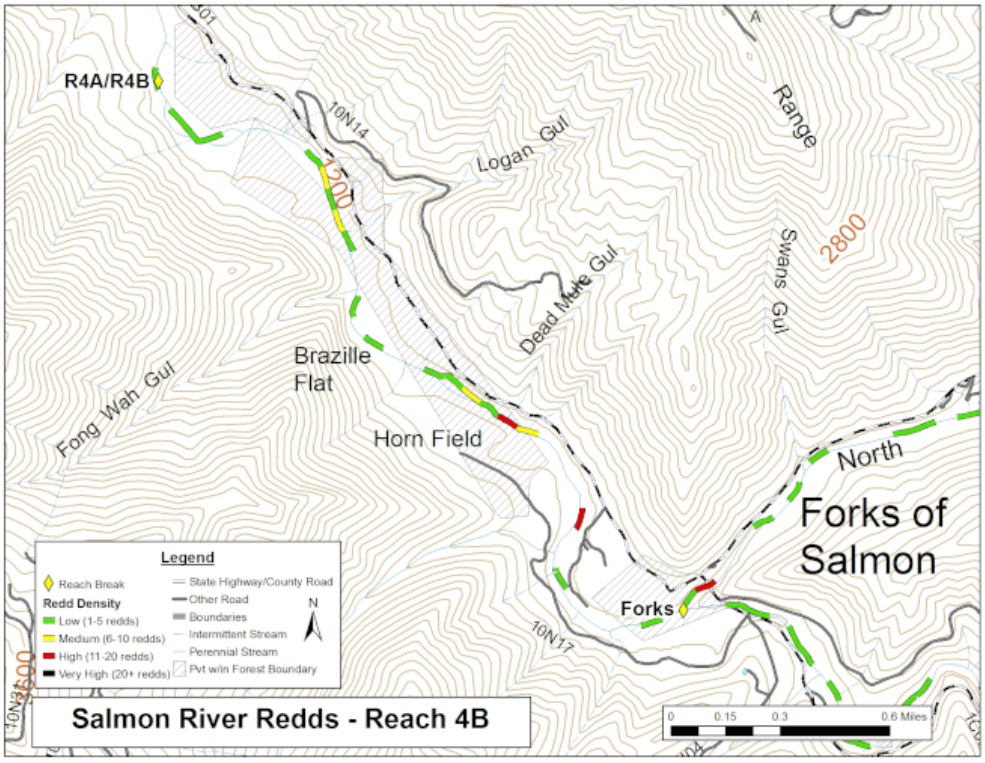


Figure D-SA3. Redd distribution and density for mainstem Salmon River, Reach 4B.

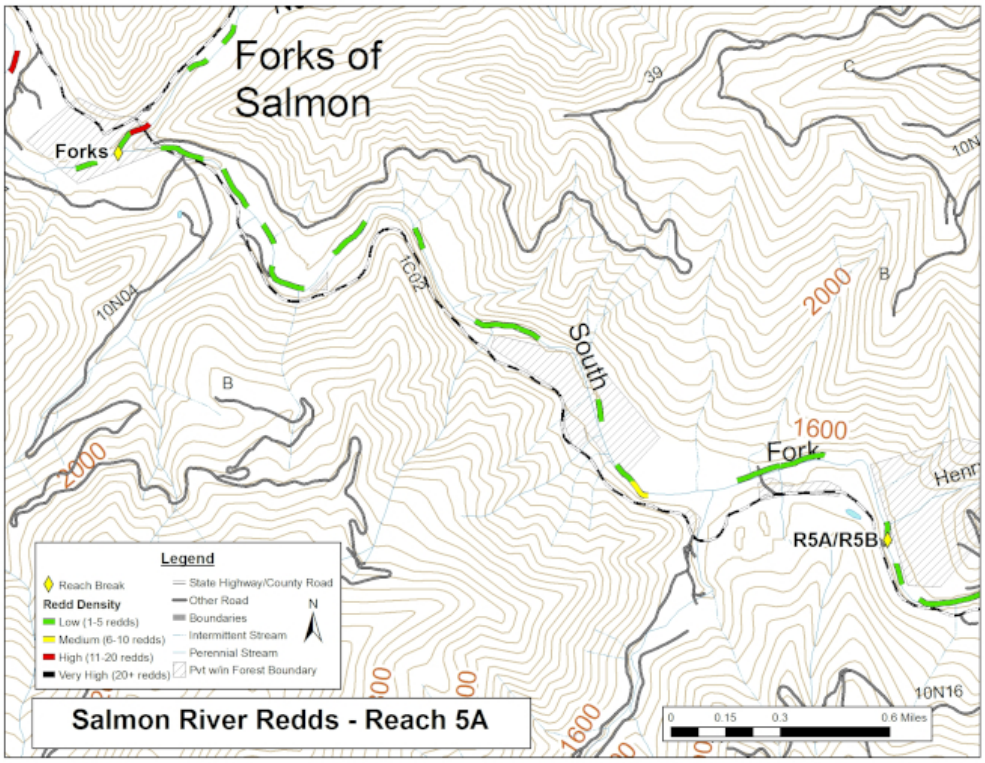


Figure D-SA4. Redd distribution and density for SF Salmon River, Reach 5A.

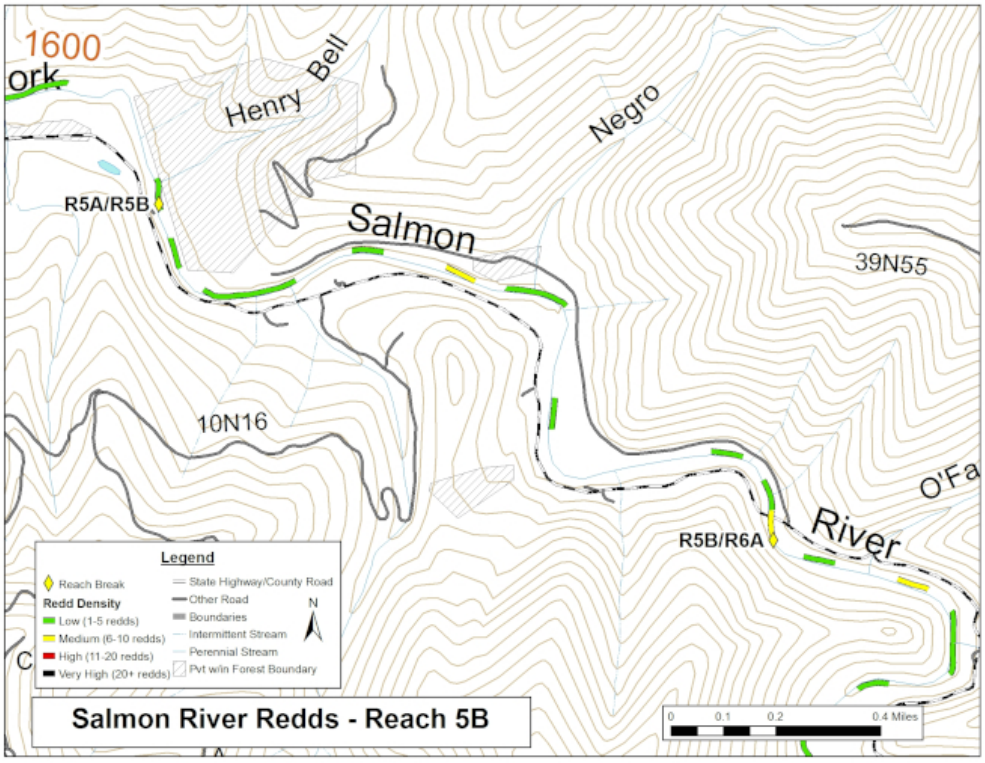


Figure D-SA5. Redd distribution and density for SF Salmon River, Reach 5B.

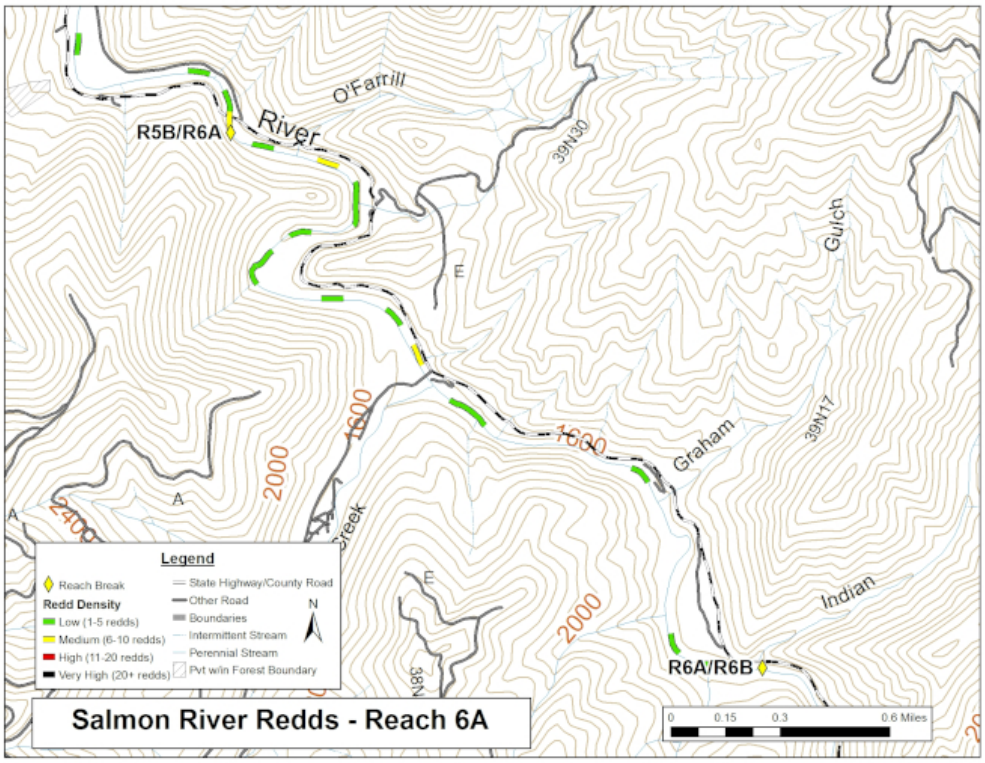


Figure D-SA6. Redd distribution and density for SF Salmon River, Reach 6A.

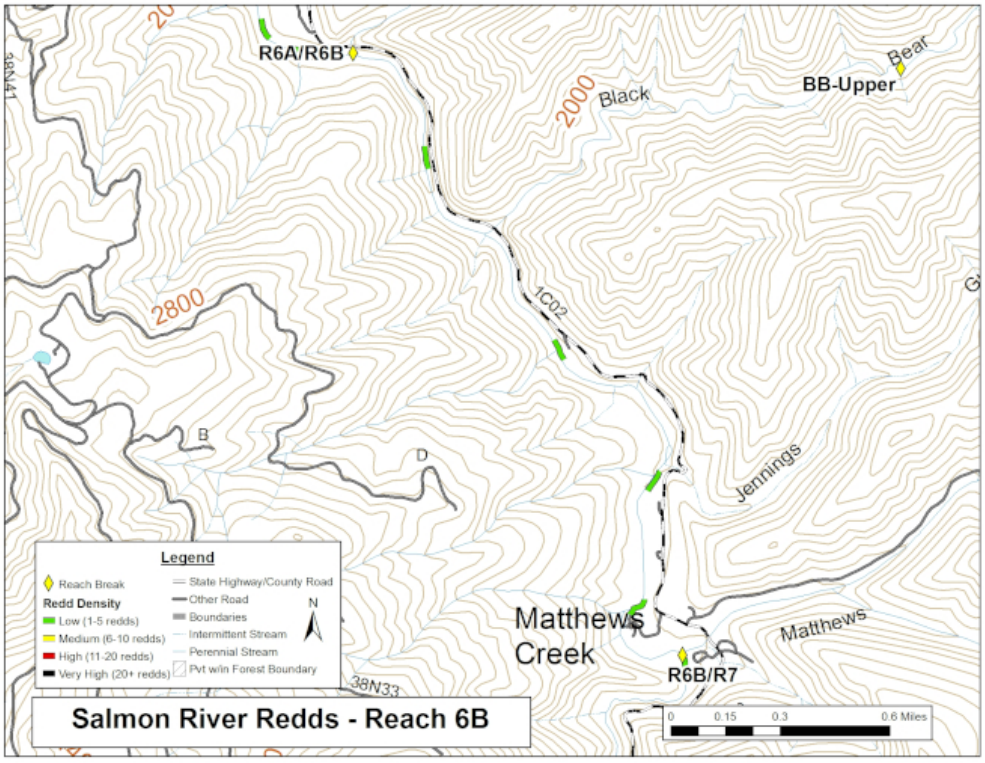


Figure D-SA7. Redd distribution and density for SF Salmon River, Reach 6B.

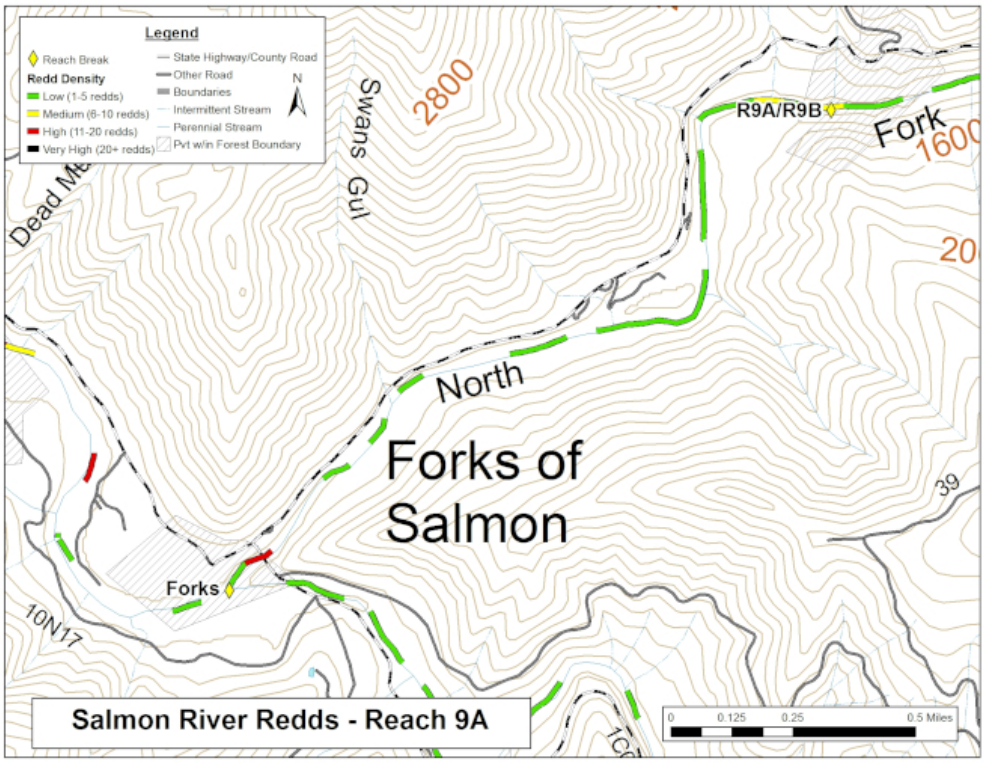


Figure D-SA8. Redd distribution and density for NF Salmon River, Reach 9A.

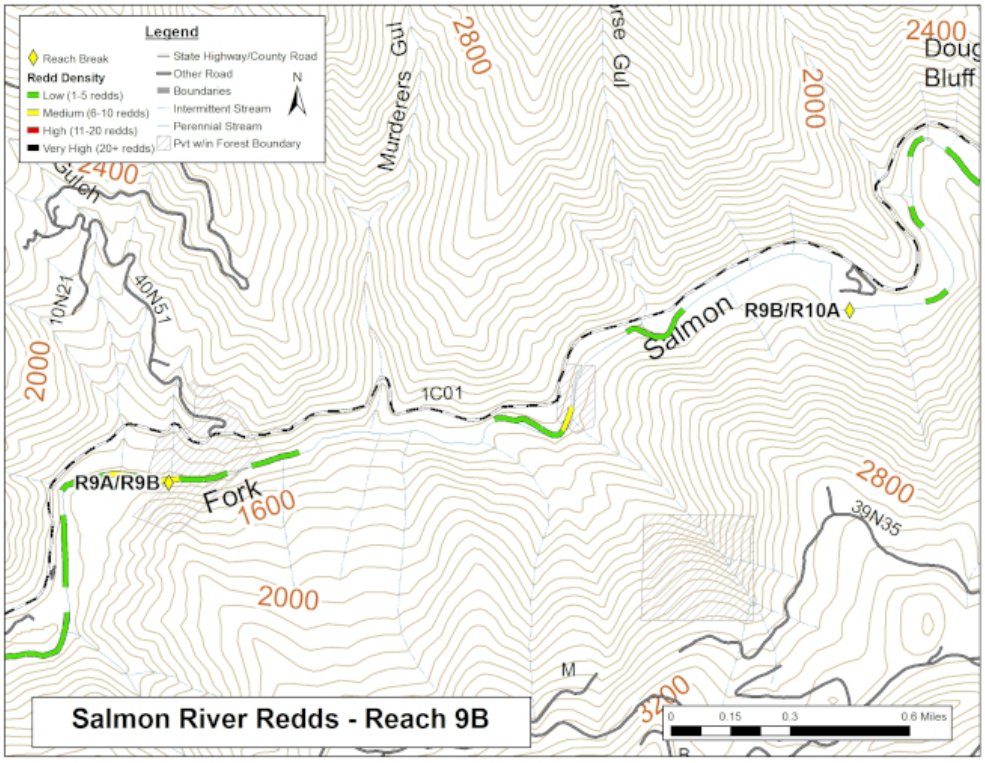


Figure D-SA9. Redd distribution and density for NF Salmon River, Reach 9B.

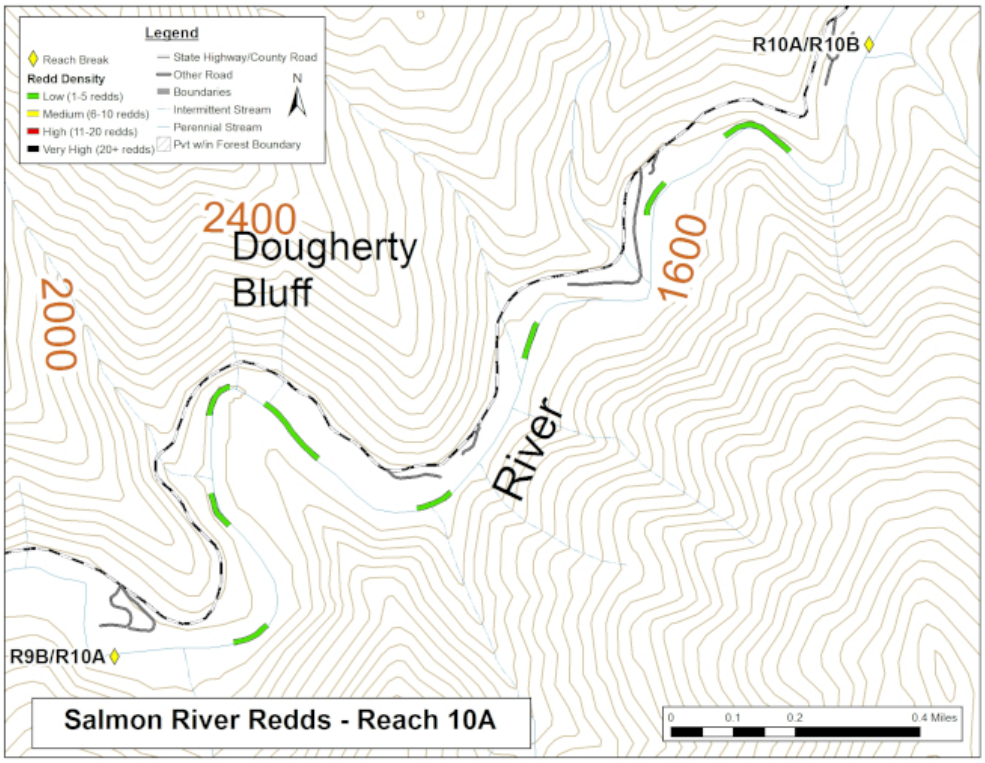


Figure D-SA10. Redd distribution and density for NF Salmon River, Reach 10A.

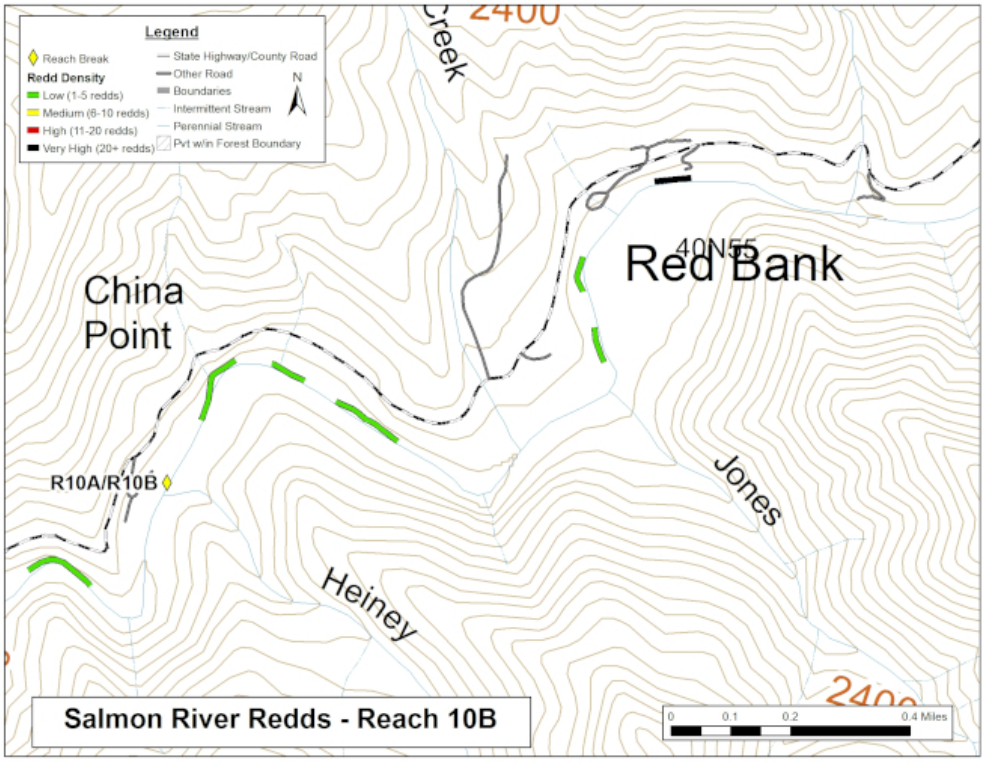


Figure D-SA11. Redd distribution and density for NF Salmon River, Reach 10B.

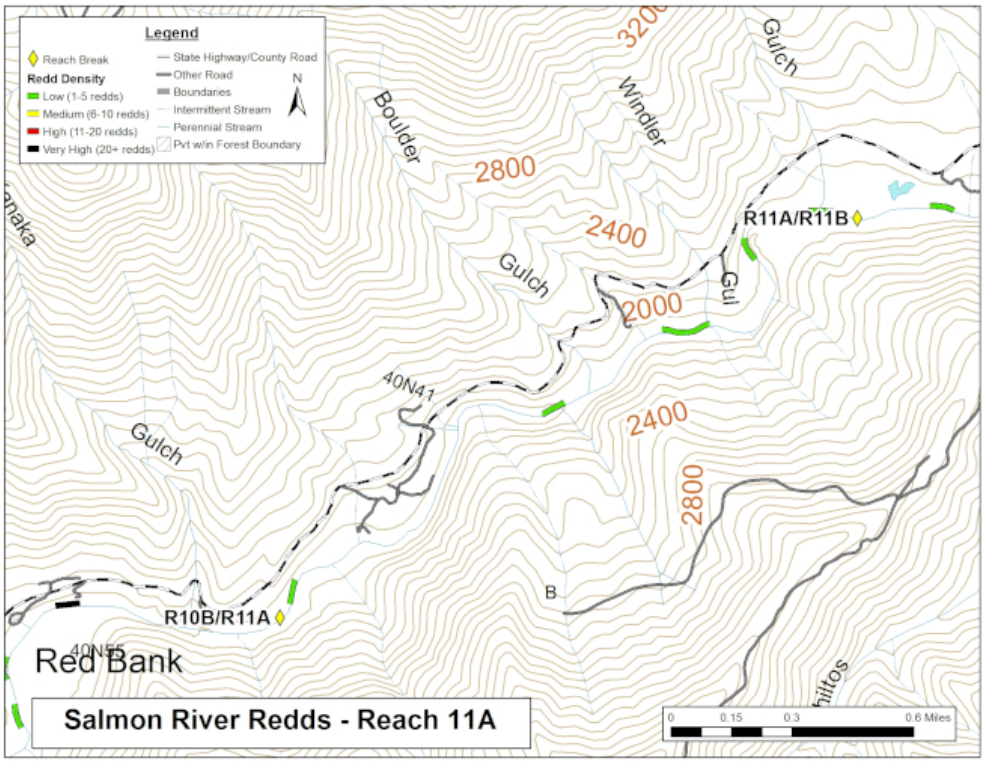


Figure D-SA12. Redd distribution and density for NF Salmon River, Reach 11A.

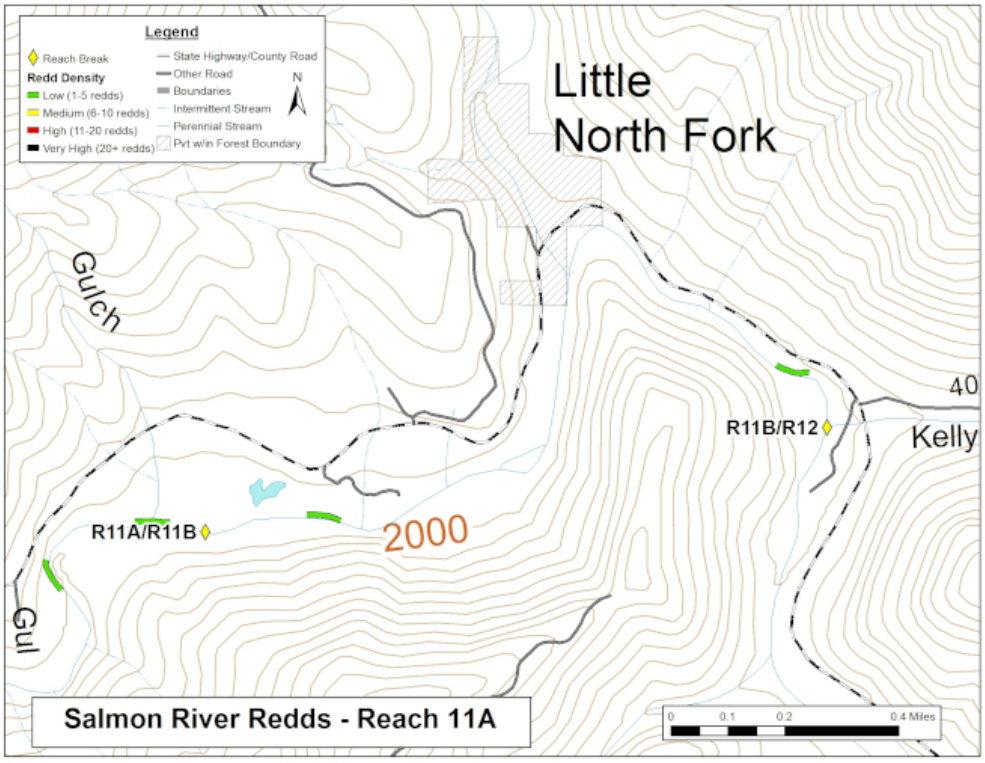


Figure D-SA13. Redd distribution and density for NF Salmon River, Reach 11B

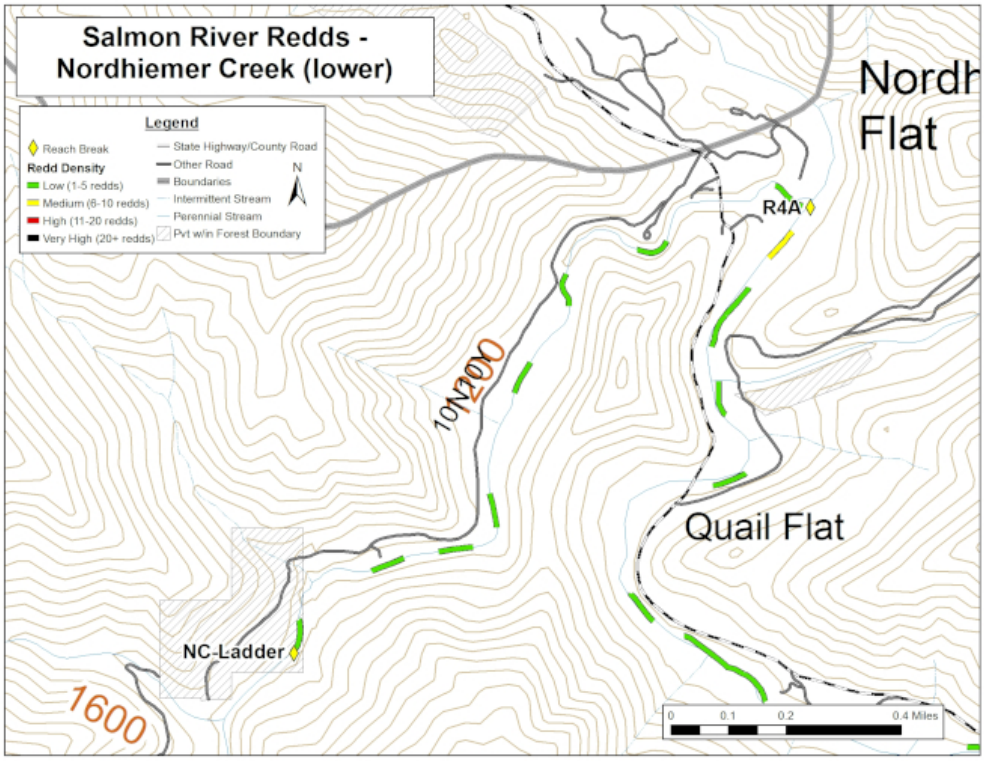


Figure D-SA14. Redd distribution and density for Nordheimer Creek (lower).

Scott River Data

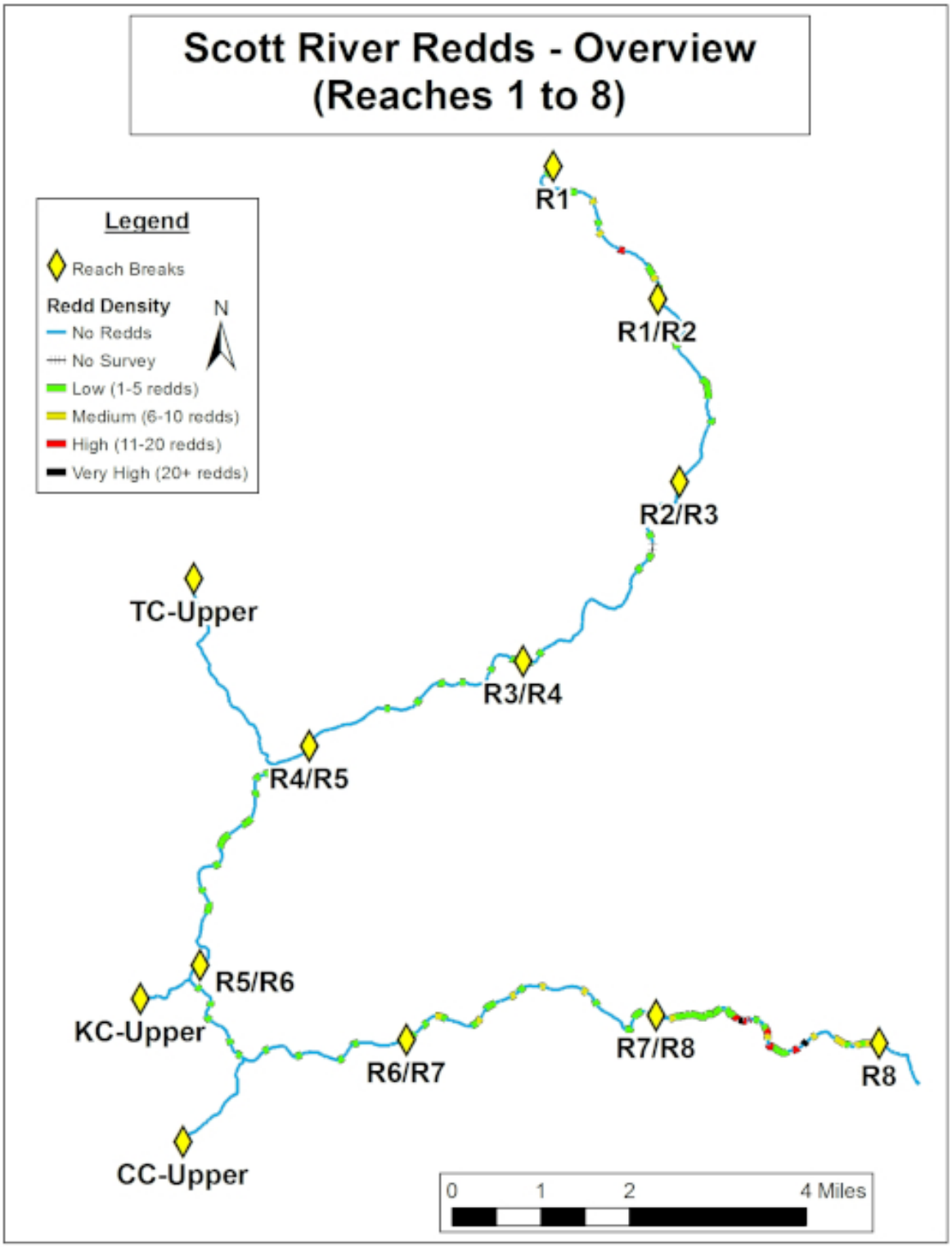


Figure D-SC1. General overview of redd distribution and density for Scott River surveys, Reach 1 through Reach 8. Map is of survey area only and does not include roads, hillslopes, or other landmarks.

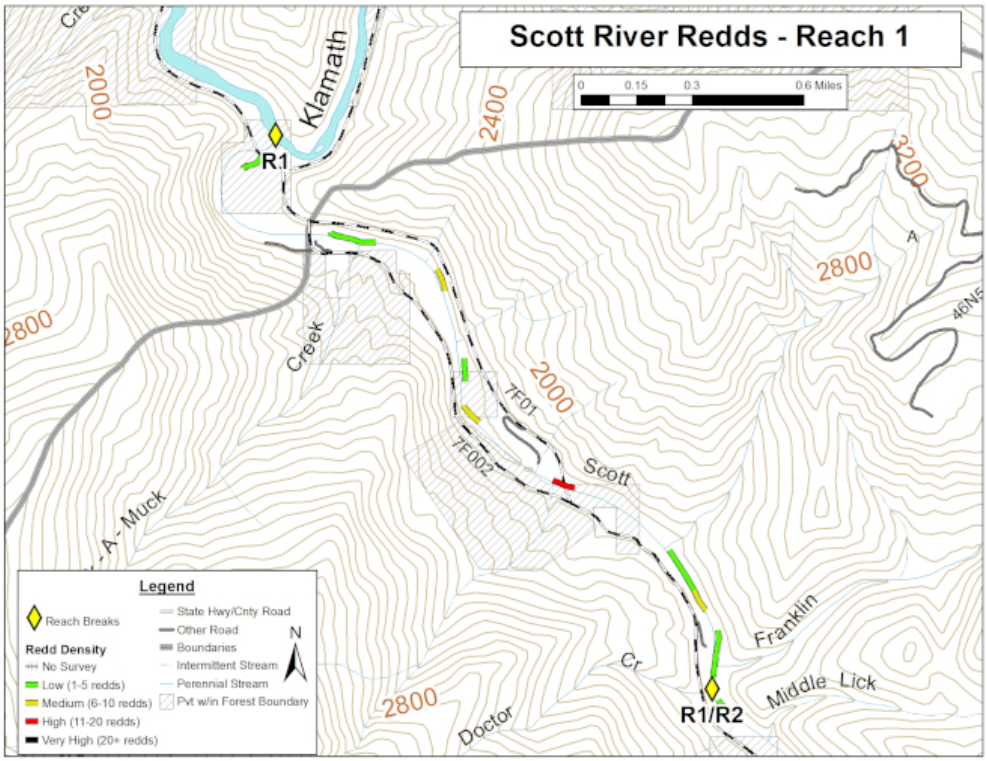


Figure D-SC2. Redd distribution and density for Scott River, Reach 1.

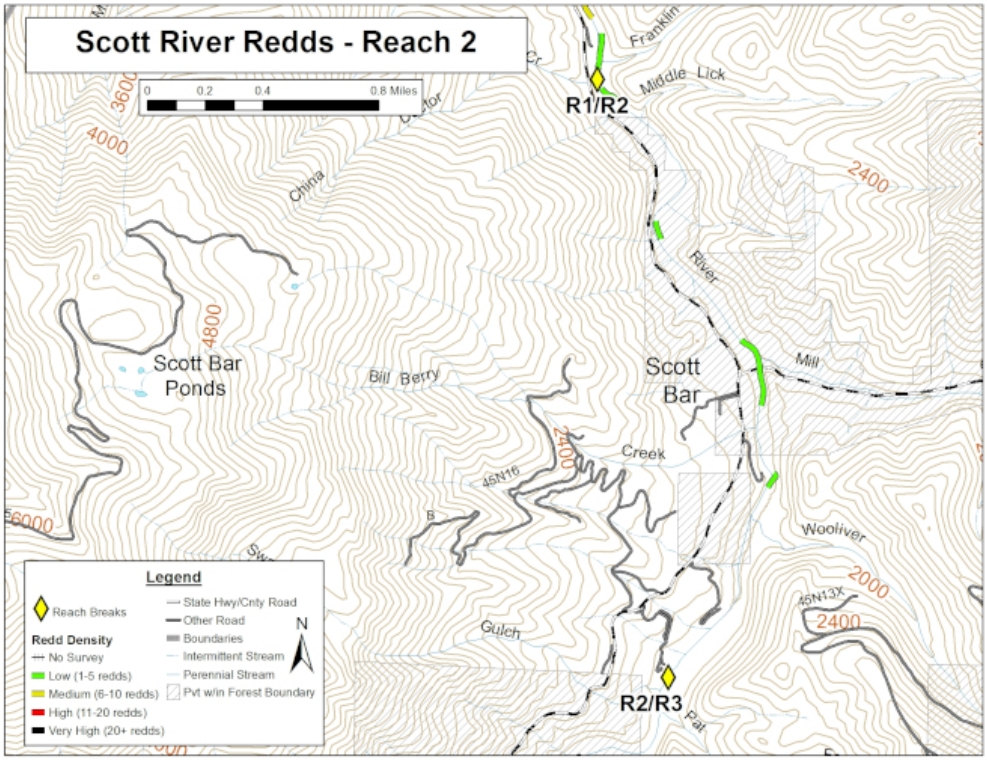


Figure D-SC3. Redd distribution and density for Scott River, Reach 2.

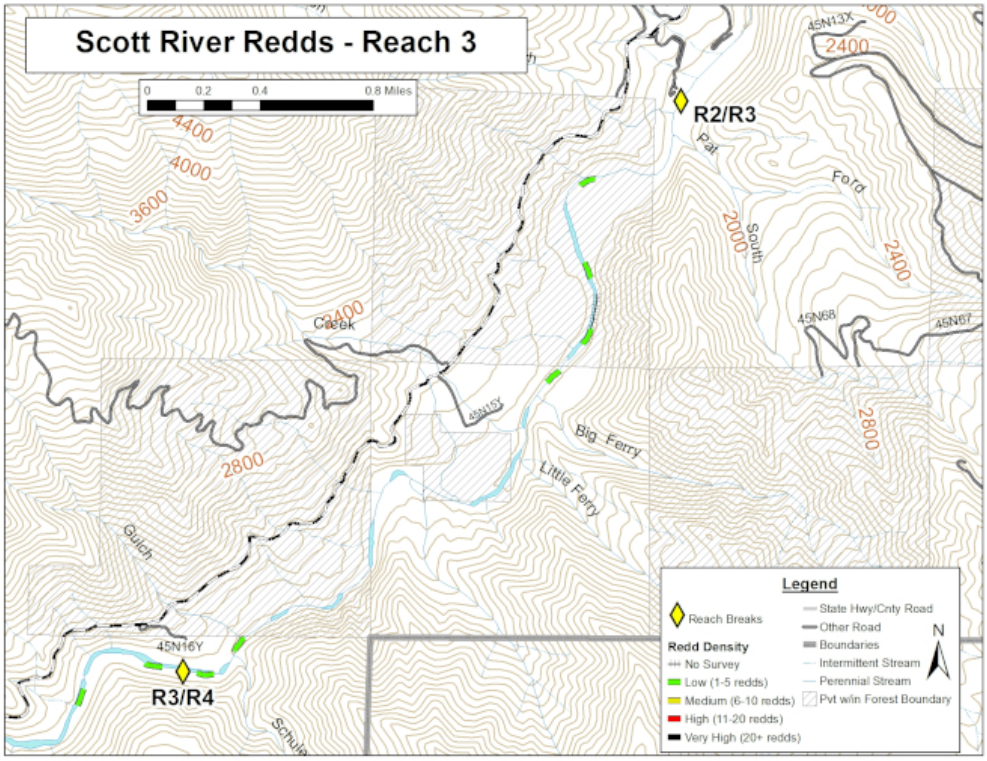


Figure D-SC4. Redd distribution and density for Scott River, Reach 3.

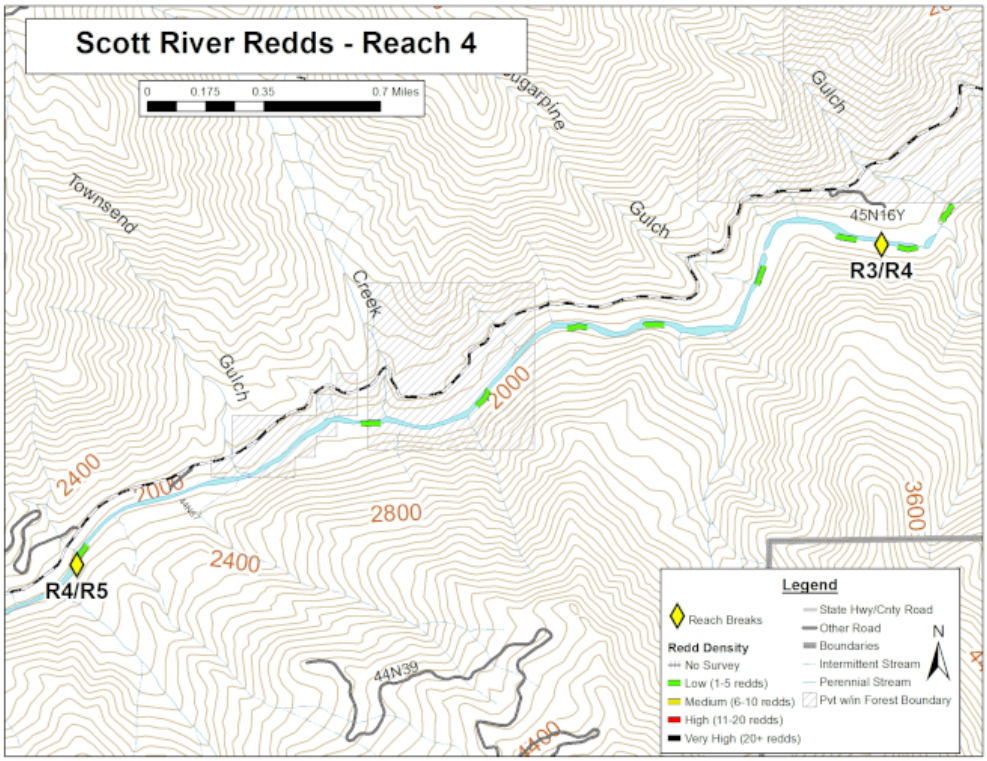


Figure D-SC5. Redd distribution and density for Scott River, Reach 4.

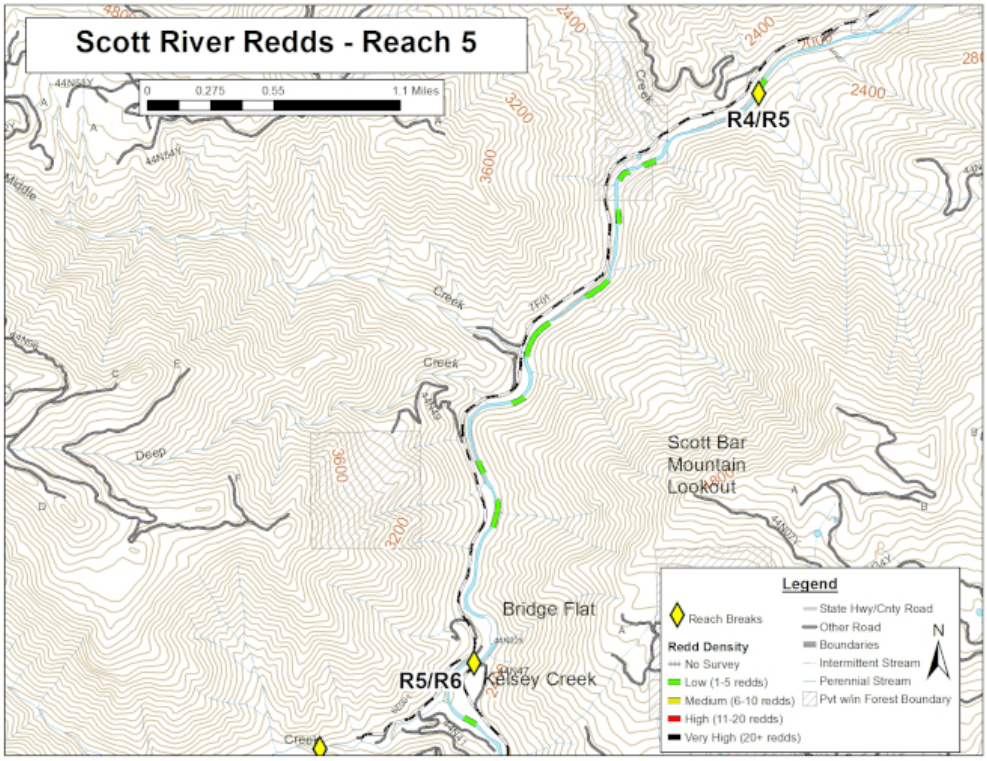


Figure D-SC6. Redd distribution and density for Scott River, Reach 5.

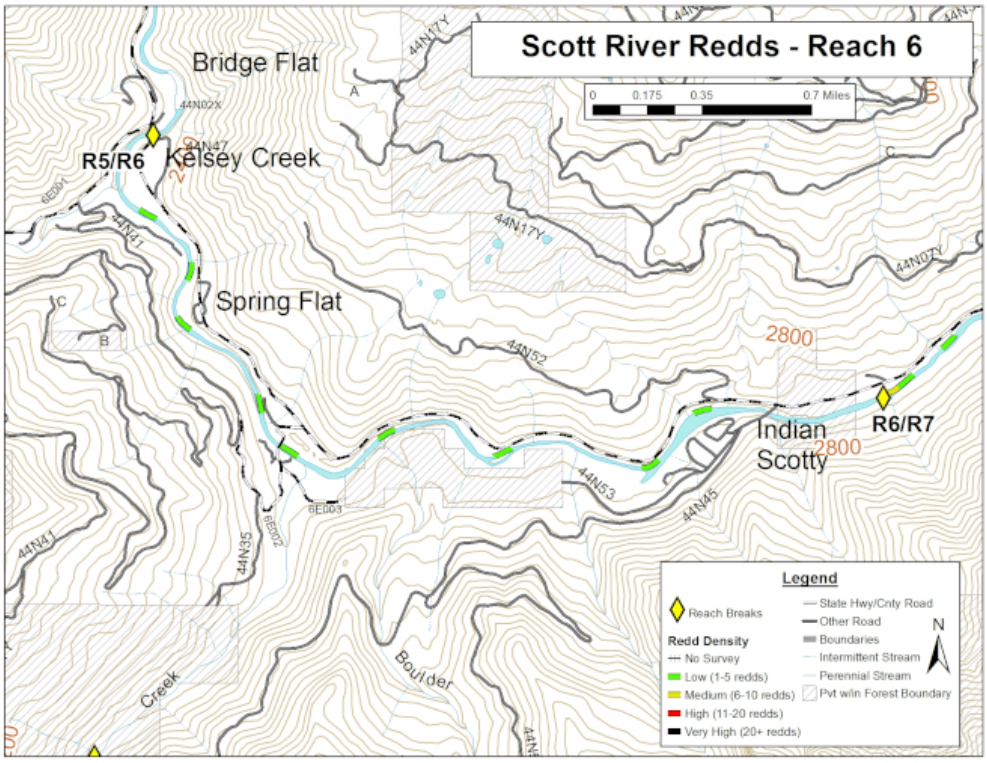


Figure D-SC7. Redd distribution and density for Scott River, Reach 6.

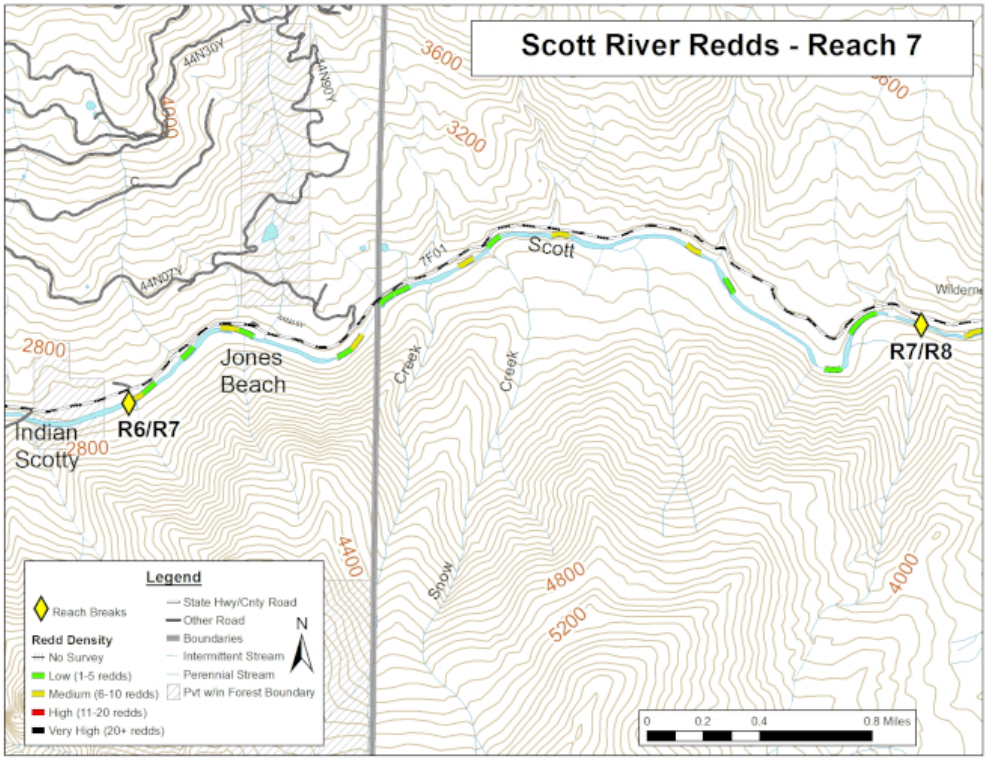


Figure D-SC8. Redd distribution and density for Scott River, Reach 7.

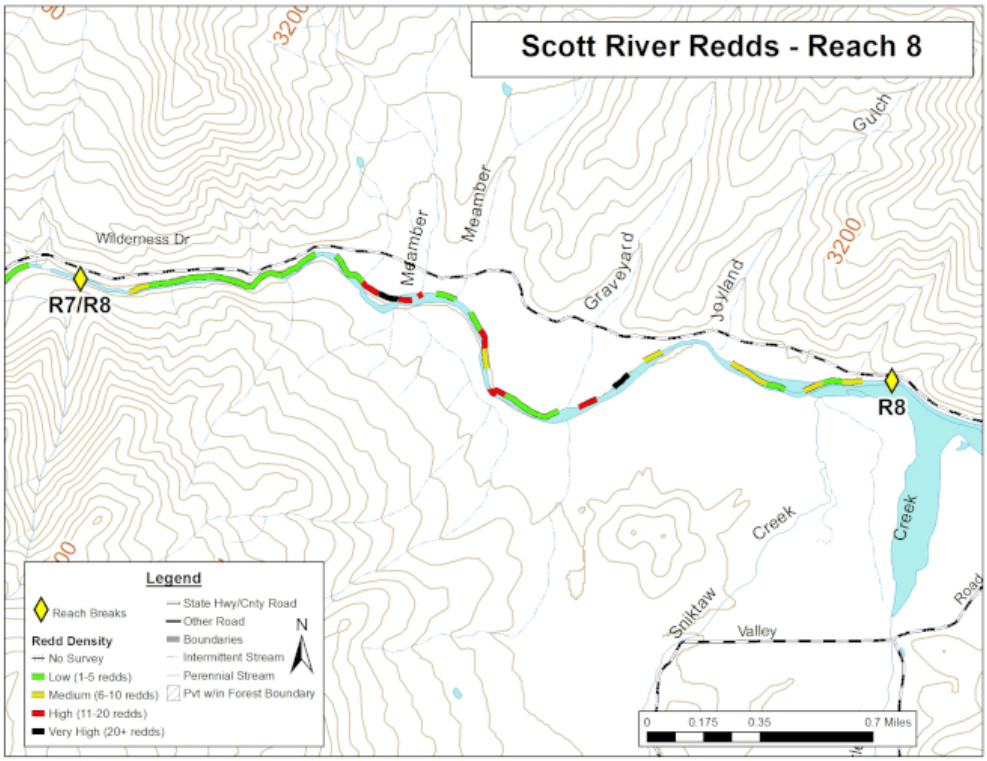


Figure D-SC9. Redd distribution and density for Scott River, Reach 8.

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
Yurok 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