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DEPARTMENT OF FISH AND GAME

2001-2002 ANNUAL REPORT
TRINITY RIVER TRIBUTARIES
WINTER-RUN STEELHEAD SPAWNING SURVEY REPORT
PROJECT 1d1

Prepared by

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Steelhead Research and Monitoring Program
November 2002

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ABSTRACT

Spawning surveys for winter-run steelhead were conducted on tributaries of the Trinity River from March 1 through June 27, 2002. We walked a total of 12 tributaries, four times each, for a single pass total of 77.3 km. This year, 69 adult steelhead were observed, and 265 redds were marked and recorded. 2002 redd densities were considerably higher than any of the past 10 years in the Trinity basin. The highest density of steelhead redds occurred in East Fork Hayfork Creek at 9.4 redds per km, while the lowest density occurred in Pelletreau Creek, where no redds were observed. A final pass of all tributaries was made to assess the visibility of redds, change in apparent area, and verify completion of spawning. Overall, 52% of all redds flagged were visible during the final pass, while the apparent area of those redds decreased 48%. Tributaries to be surveyed were randomly selected from a universe of all anadromous Trinity River tributaries upstream of the New River. Coincidentally, several selected tributaries duplicate the work of D.A. LaFaunce (1964), D.W. Rogers (1971, 1972), Ed Miller (1974), and the South Fork Steelhead Monitoring Project (1990-1995), and all applicable comparisons are made.

[1/] *Steelhead Research and Monitoring Program report, available from: Department of Fish and Game, 50 Ericson Court, Arcata California 95521 (707) 825-4850*

This report should be cited as: Garrison, P.S. 2002. Trinity River Tributaries Winter-run Steelhead Spawning Surveys, 2002 Season. Project 1d1. California Department of Fish and Game, P.O. Box 1185, Weaverville, CA 96093. Draft November 2002. 20 pp.

INTRODUCTION

The current state of knowledge regarding steelhead (*Oncorhynchus mykiss*) spawning in the Trinity basin is limited. Most prior spawner surveys within the KMP ESU concentrated on salmon and were therefore terminated prior to steelhead spawning. Prior surveys have been conducted on main-stem Trinity River tributaries in 1964, 1971, 1972, and 1974 to monitor the effect of Lewiston Dam on steelhead populations. Most recently, steelhead spawning surveys were conducted in South Fork Trinity River tributaries in 1989 - 1995 under the California Department Fish and Game's Trinity River Project. This season marks the third year of spawning surveys conducted by the Steelhead Research and Monitoring Program on selected Trinity River tributaries. Traditional basin-wide estimates of steelhead abundance provide little information on steelhead spawning. Surveys conducted to enumerate successful steelhead spawning and habitat utilization in tributaries will help to assess this critical component of life history.

Study Objectives

1. Quantify the number of steelhead redds in selected tributaries.

2. Assess spawning habitat conditions.

3. Verify successful spawning.

4. Create index for future comparison of redd numbers. Selected tributaries are included in future surveys for comparison and possible trend analysis.

5. Determine temporal and spatial spawning distribution of steelhead in Trinity River tributaries.

6. Verify and assess barriers to steelhead migration on surveyed tributaries.

7. Assess survey periodicity and changes in redd appearance and area during survey season.

Study Area

The area covered by these spawning surveys includes all anadromous tributaries of the Trinity basin upstream of the New River, including the South Fork of the Trinity River. A stratified random sampling design was used to select tributaries within the basin. To develop a sampling universe, all anadromous tributaries within the named basins were identified. The entire basin was then stratified into two sub-basins, the South Fork and the main-stem, each of which was sampled approximately evenly. Originally, nine tributaries were selected from each basin. Two tributaries had to be dropped from the main-stem basin due to high flow problems. No replacement tributaries were chosen in the main-stem due to time restraints. The following Trinity River tributaries were surveyed from their confluence to an upstream migrational barrier except where noted.

Smoky Creek was surveyed from the South Fork Trinity River confluence to a waterfall barrier 4.1 km upstream. Access is only available through private property owned by Jon Ostrat near Silver Creek.

Rattlesnake Creek was surveyed from the South Fork Trinity River confluence to a waterfall barrier 16.21 km upstream. Access is available via State Route 36.

Plummer Creek was surveyed from the South Fork Trinity River confluence to a waterfall barrier 5.18 km upstream. Access is available through River Spirit Land Conservancy or by Friend Lake trail. CDFG currently has a land-owner access agreement with David Rose of the South Fork Land Conservancy (River Spirit) in which a small fee is paid to help maintain their extensive private road system in exchange for year-round access. Problems with deep snow at both access points usually prevent surveys until early April.

Eltapom Creek was surveyed from the South Fork Trinity River confluence to a waterfall barrier 1.26 km upstream. Access is only available by crossing the South Fork Trinity River (SFTR), off of FH 311. A raft is recommended and sometimes necessary for crossing the SFTR at higher flows, especially in March and early April.

Pelletreau Creek was surveyed from the South Fork Trinity River confluence to a log jam/ depositional barrier 1.41 km upstream. Access is made from FH 311 just south of Hyampom. Downstream from the 311 bridge (about 200 meters) was surveyed with binoculars after private property access permission was denied.

East Fork of Hayfork Creek was surveyed from its confluence with Hayfork Creek to Byron Gulch approximately 6.77 km upstream. There is no permanent barrier on E.F. Hayfork Creek; this season however, a temporary log jam barrier blocks anadromy approximately 0.2 km upstream of the confluence with the North Fork East Fork.

Potato Creek was surveyed from its confluence East Fork Hayfork Creek to a waterfall barrier 4.03 km upstream. Access is available via FH 343.

Tule Creek was surveyed from its confluence with Hayfork Creek to a long cascade barrier approximately 8.41 km. upstream. The confluence of Tule Creek is accessible by walking the fence-line from the Salt Creek confluence; the remainder of Tule Creek is accessible via FH 10.

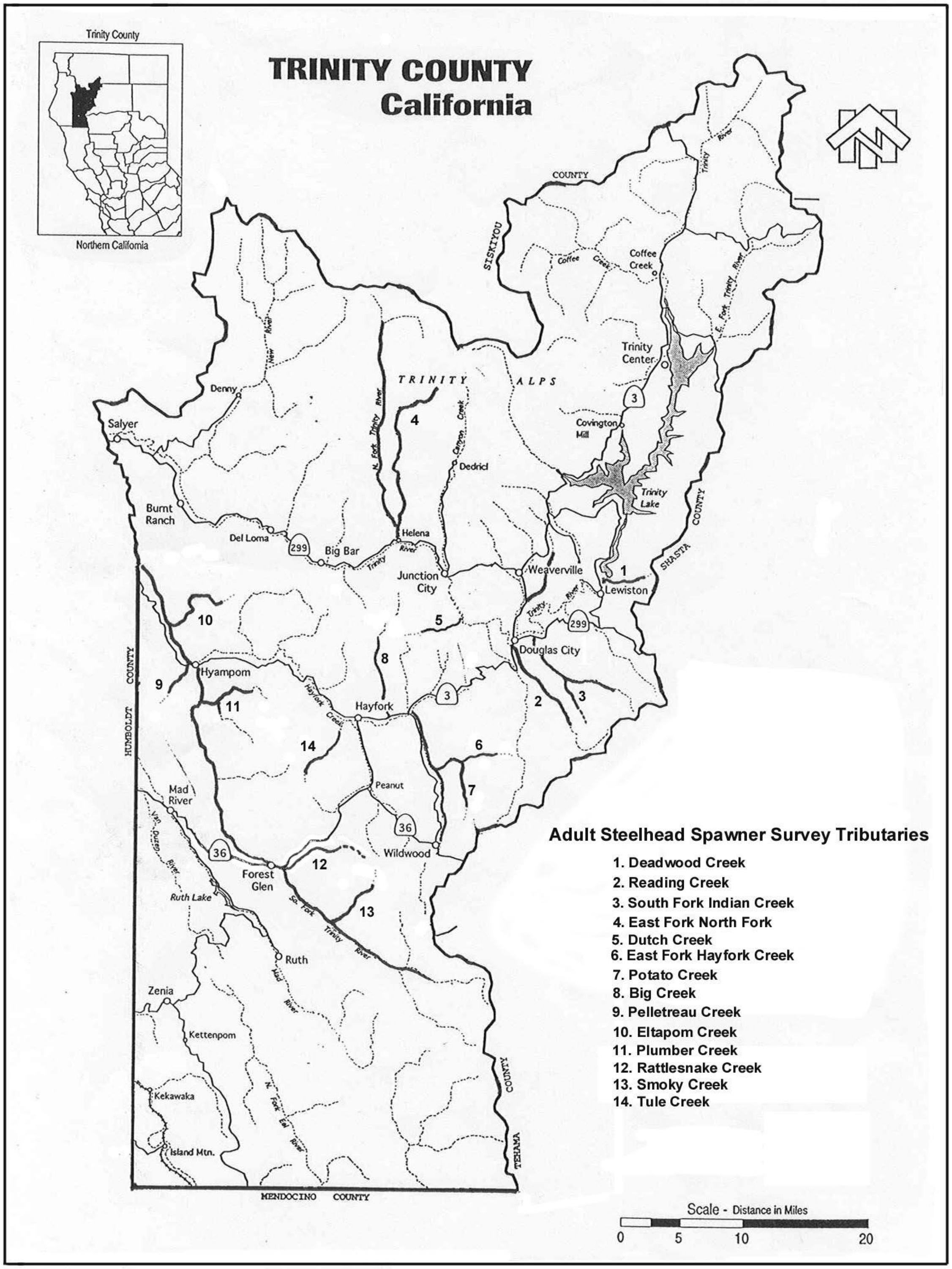

Figure 1. Map of Trinity basin with selected spawner survey tributaries.

Deadwood Creek was surveyed from its confluence with the Trinity River to a waterfall barrier 3.82 km upstream. Access is available from Deadwood Road. Deadwood is the uppermost tributary to the Trinity River below Lewiston Dam.

Dutch Creek was surveyed from its confluence with the Trinity River to a culvert barrier created by a SPI logging road. Access is available via Dutch Creek Road, but it is not advisable to drive to the confluence, especially during winter flows. Access is available to the uppermost reach via an SPI logging road. In the event of heavy rains or other events which close the logging road, an historical mining ditch is used for access on the uppermost reach of Dutch Creek.

South Fork of Indian Creek was surveyed from its confluence with Indian Creek to a waterfall barrier 1.49 km upstream. Access is available via Reading Creek Rd. and by an unnamed SPI logging road.

Reading Creek was surveyed from its confluence with the Trinity River to Byron Gulch approximately 20.86 km upstream. A log jam barrier was encountered just downstream of Byron Gulch, and was considered impassable by adult steelhead this season. Access is available via Reading Creek road and several SPI logging roads.

METHODS

Sampling Frame/Tributary Selection

The sampling frame for this study consists of all anadromous water of the Trinity River upstream of the New River, but including the South Fork Trinity River. Tributaries of the Trinity located within the Hoopa Square are also not included. The sampling frame was developed by scouring U.S. Forest Service habitat typing files located in the Hayfork and Weaverville Forest Service Fisheries offices. Tributaries located in the Six Rivers National Forest were confirmed with the local Forest Service zone fisheries biologist (L. Morgan, personal communication). Most habitat typing data from the Forest Service is 15-30 years old; some barriers are classified as semi-permanent, i.e. log-jams, short cascade fields. We are currently verifying and expanding our sampling universe when time allows.

Tributaries were selected with a weighted stratified random sample. Each tributary was assigned a weighted sampling probability dependent upon proportion of available anadromous mileage compared to available mileage in basin strata. Weighted sampling probabilities were used in order to evenly sample the basin by complete anadromous tributary distance instead of standardized length systematically sampled reaches. Spatial distribution of steelhead spawning in the Trinity basin is highly sporadic; I wanted to minimize chance of selected non-representative reaches, and better examine the “big picture” of spawning in a selected tributary. The sampling universe was stratified into the South Fork tributaries and main-stem tributaries. Each tributary was assigned a range of numbers corresponding with its anadromous mileage, therefore the probability that any one tributary would be sampled was based on the portion of anadromous habitat to that of the total sampling frame. From each strata, nine tributaries were selected. Several tributaries from each strata were dropped due to logistical complications. The East Fork of the South Fork Trinity was selected, but could not be surveyed due to winter conditions. Brock Gulch was selected in the main-stem strata, but dropped because of unsubstantial flow. The East Fork North Fork and Big French Creek have been dropped from the main-stem strata due to their extreme size and dynamic flow regime (Crews had problems navigating large water in remote environmental extremes). One additional tributary was dropped from each strata due to the refusal of private property permission; Big Creek was dropped from the South Fork strata. East Weaver Creek was dropped from the main-stem strata.

The same panel of selected tributaries is revisited every year. No new panel or revisit schedules have been implemented since the project's inception in 1999. A revised revisit schedule with several panels is planned for implementation at the conclusion of the five-year pilot period.

Private property permission

Permission to survey across private property is obtained from all landowners prior to any surveys being conducted. Specific parcels to be surveyed across are identified using ParcelQuest software, which is updated biennially. All landowners are notified by mail and asked to return a postcard allowing the Department permission to survey the named tributary across their property with the condition that crews stay below the high-water mark. Additional permission is ascertained in cases where access to the tributary across a landowners property is necessary. Letters verifying permission are sent out annually in late January or early February. Sierra Pacific Industries (SPI) is the largest private landowner in Trinity County and has been most cooperative in allowing permission on all SPI lands.

Timing

All tributaries are surveyed once monthly from March through June. Main-stem tributaries are surveyed first due to historically earlier spawning when compared to the South Fork basin. Survey reaches are surveyed sequentially from confluence to headwaters whenever possible.

Table 1. Trinity River steelhead spawning survey periodicity with dates for each pass.

Tributary	Reach	Pass 1	Pass 2	Pass 3	Pass 4
Reading	1	3/18	4/2	4/25	5/22
Reading	2	3/18	4/3	4/25	5/23
Reading	3	3/18	4/4	4/30	5/30
Reading	4	3/19	4/4	5/1	6/3
Reading	5	3/19	4/8	5/2	6/5
Smoky	1	3/27	4/22	5/15	6/25
Smoky	2	3/27	4/22	5/15	6/25
Deadwood	1	3/15	4/15	5/1	6/6
Deadwood	2	3/15	4/16	5/2	6/6
Dutch	1	3/19	4/11	5/6	6/12
Dutch	2	4/11	5/7	6/12	*
Eltapom	1	3/21	4/23	5/14	6/18
E.F. Hayfork	1	3/11	4/2	4/23	5/28
E.F. Hayfork	2	3/12	4/3	4/24	5/29
E.F. Hayfork	3	3/13	4/4	4/25	5/30
S.F. Indian	1	3/4	3/28	4/28	5/14
Plummer	1	4/2	4/24	5/16	*
Potato	1	3/21	4/8	4/29	6/6
Potato	2	3/21	4/10	5/6	6/6
Tule	1	3/20	4/17	5/9	6/10
Tule	2	3/20	4/17	5/9	6/11
Rattlesnake	1	3/25	4/9	5/7	*
Rattlesnake	2	3/25	4/9	5/8	6/19
Rattlesnake	3	3/25	4/11	5/8	6/19
Rattlesnake	4	3/26	4/16	5/8	6/20

*A fourth pass of reach was not conducted after the third pass produced no new redds.

Crews

All crews receive training in steelhead redd identification, survey methods and safety prior to the start of the season. Crews consists of two fisheries technicians, with at least one being of Scientific Aide standing. The joint USFS/SRAMP crew included Scientific Aide Paula Whitten and Biological Technician Linda Peak.

Survey methods

Stream reaches are surveyed in an upstream fashion whenever possible. Crews walk two abreast when necessary to enumerate redds and live fish. All redd and live fish sightings are recorded with a Garmin 12XL global positioning systems unit (GPS). All redds encountered are flagged and dated to prevent re-enumeration. All redds are measured for total length and mean width of mound (tailspill) and diameter of pot. Other measurements recorded include position in channel, habitat type, percent and type of cover, depth of water over pit, and substrate type. Surface substrate types were visually characterized by size class:fines (<1mm) sand (1-2mm), gravel(2-32mm), cobble(32-256mm), or boulders(>256mm).

Quality Control/Completion of spawning

A final pass to verify the completion of spawning and evaluate visibility/condition of redds is conducted of each tributary in June. Each redd previously flagged is measured, evaluated for visibility, and searched for presence of emergent fry. Table 2 describes visibility condition ranking criteria.

Table 2. Redd visibility condition criteria.

Rank	Criteria
1	New
2	still obvious but not new
3	Still identifiable
4	barely identifiable
5	test redd
6	dry
7	No redd

In order to evaluate if redds are being counted from last season, all still “fresh” looking redds are marked to be identified during next year’s survey. Redds receiving a visibility ranking of “2” or higher are permanently staked on the bank and measurements are recorded. During next year’s survey, these redds will be evaluated to examine if confusion between year’s exists.

RESULTS

During the Spring 2002 season, SRAMP crews surveyed 12 tributaries four or more times each, for a single pass distance of 77.3 km. Crews encountered and recorded a total of 265 redds and 69 live adult steelhead. Three adult steelhead carcasses were recorded; one each in E.F. Hayfork, Plummer, and Smoky Creeks. Redd density was highest in E.F. Hayfork Creek with 9.41 redds/km. Eltapom Creek, historically the creek with the highest density of redds, came in a close second with 8.46 redds/km. Only one surveyed tributary, Pelletreau Creek, had no redds or live fish observed this season; no steelhead spawning has been observed in Pelletreau Creek since 1995 (CDFG, 1996).

Table 3. Redd survey summary results for Trinity River tributaries.

Creek	Distance Surveyed (km)	Redds	Redds/km	Adult Steelhead observed	Adult Steelhead/km
Tule	8.4	19	2.26	5	0.59
E.F. Hayfork	6.8	64	9.41	11	1.62
Deadwood	3.8	17	4.47	0	0
Eltapom	1.3	11	8.46	2	1.53
Pelletreau	1.4	0	0	0	0
S.F. Indian	1.5	7	4.66	0	0
Reading	20.9	96	4.59	28	1.34
Plummer	5.2	6	1.15	6	1.15
Potato	4.0	10	2.5	0	0
Rattlesnake	16.2	24	1.48	16	0.99
Dutch	3.7	2	0.54	0	0
Smoky	4.1	9	2.19	1	0.24
Totals	77.3	265	3.42	69	0.87

All live adult steelhead encountered during redd surveys are mapped and recorded. Live fish sightings are often thought to be anecdotal information while conducting a redd survey to estimate redd numbers or adult run size. Anadromous fish in-stream residency time is often less than survey periodicity. Additionally, fish sightings are often unlikely due to excessive cover or differences/deficiencies in observer perception. A linear regression was conducted to analyze the relationship of total redds versus total live adult steelhead encountered per tributary during surveys. The number of live fish sighted was highly correlated to the number of redds observed ($R=0.879$) and highly significant ($P<0.0001$).

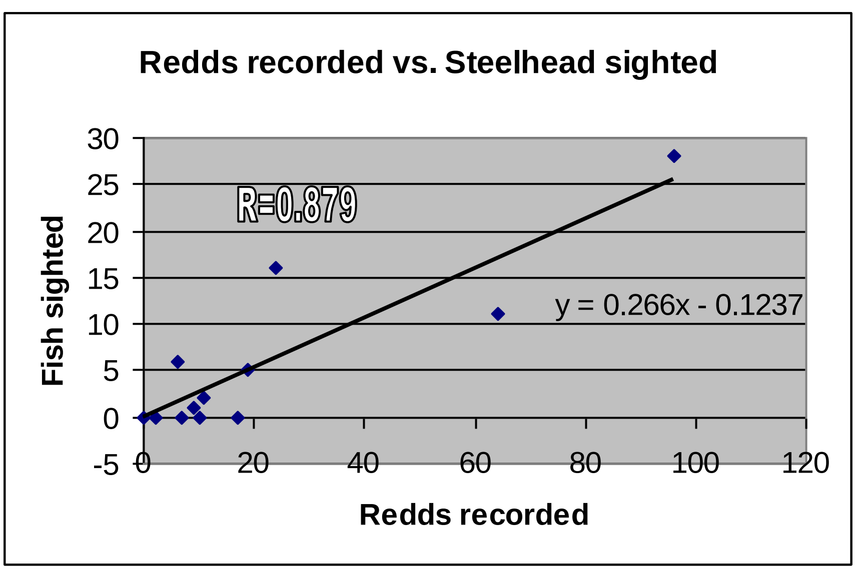

Figure 2. Redds vs. steelhead sighted per tributary.

All redds observed were measured for area. Tailspill (mound) length and mean width are recorded in addition to pot diameter. Pot diameter was not included in redd area analysis; I suspect that pot diameter has more to do with fish size and less to do with quantity of substrate laid down in the tailspill. Excluding Dutch Creek, which only had two redds, redds were largest in Reading and Potato Creeks, with mean area measurements around 12 square feet. Redd area was lowest in Plummer Creek, which coincidentally is spawning substrate limited in all but the lower 200 meters. Mean tailspill area for all creeks was 10.56 square feet. Redd tailspill area varied from 1.6 to 64.5 square feet.

Table 4. Summary redd tail-spill (mound) area by tributary.

Tributary	Mean	Standard Error	Minimum	Maximum	Count (n)	95% Confidence Level +/-
Deadwood	7.76	0.99	3.06	19.23	18	2.091
Dutch	26.51	21.49	5.01	48.00	2	273.094
Eltapom	11.71	3.00	4.28	36.81	11	6.686
EFHayfork	9.49	0.59	3.35	25.37	64	1.182
S.F.Indian	6.39	1.76	1.60	15.98	7	4.295
Plummer	5.18	1.06	3.25	10.25	6	2.716
Potato	12.12	6.65	1.89	64.58	9	15.325
Rattlesnake	8.84	0.81	3.37	18.75	25	1.672
Reading	12.51	1.07	3.07	60.00	96	2.117
Smoky	7.97	1.51	3.19	17.99	9	3.484
Tule	10.77	1.67	4.28	27.90	16	3.556
Overall	10.57	0.54	1.60	64.58	263	1.064

Temporal distribution of spawning is examined in both the main-stem and South Fork basin tributaries. Due to the periodicity of surveys, exact timing of spawning is not determinable. Therefore, verified spawning is assumed to have taken place in the month or several weeks prior to the survey. In the South Fork basin, redds were first observed during julian week 10 (2nd week of March). The majority of redds were observed between julian week 12 and 17, with a peak in week 17. From these surveys, we can infer that the majority of steelhead spawning in the South Fork basin takes place during March and early April. No new redds or live fish were observed in the South Fork basin after May 15th.

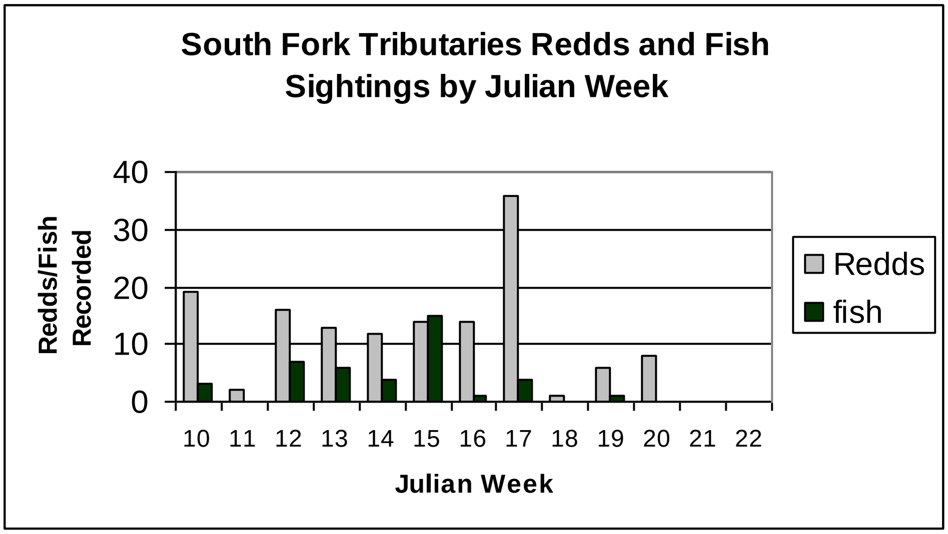

Figure 3. Redd and live adult steelhead sighting in South Fork Trinity basin tributaries by julian week.

In main-stem tributaries, redds were first observed during julian week 9 (1st week of March). The majority of redds were recorded between weeks 11 and 18, with a peak in week 14. Main-stem fish appear to spawn earlier than in the South Fork basin, and exit the basin several weeks earlier. No redds or live fish were observed in the main-stem basin after May 2nd.

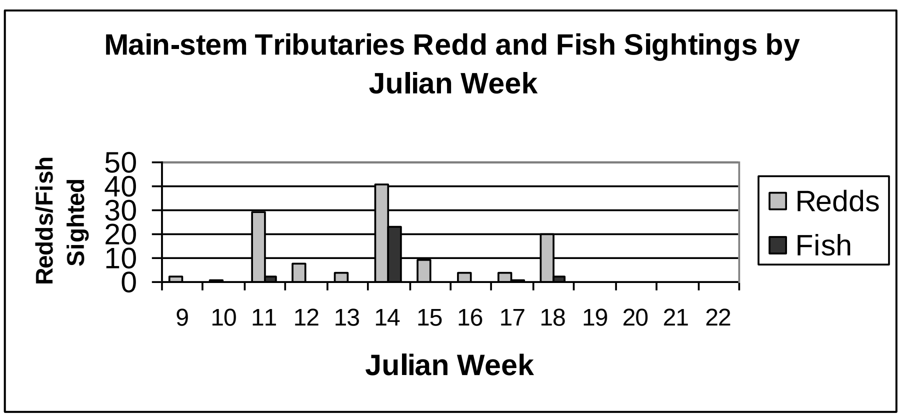

Figure 4. Redd and live adult steelhead sighting in main-stem Trinity basin tributaries by julian week.

A joint redd survey between SRAMP and the US Forest Service Hayfork Ranger District Fisheries Program was implemented in late May through early June per the request of John Lang, zone fisheries biologist. Several tributaries of interest were selected to verify successful steelhead spawning. Tributaries were selected based on current and future land management projects, and the need to gather current fisheries data on those tributaries. During the joint survey, 78 redds and one live adult steelhead were enumerated.

Table 5. USFS/SRAMP joint one-pass spawning survey summary.

Tributary	Date(s) Surveyed	Redds	Adult Steelhead
Butter	5/23/2002	14	0
Dark Canyon	5/8/2002	0	0
East Fork South Fork	5/9/2002, 5/13/2002	37	1
Goods	5/16/2002	0	0
Post	4/09/2002,4/30/2002	5	0
Dubakella	5/16/2002	0	0
Rusch	5/21/2002, 5/22/2002	16	0
Upper South Fork	5/14/2002	6	0
Totals	4/09/2002-5/23/2002	78	1

Redds were evaluated during the fourth pass for condition and visibility. Most redds in all tributaries were evaluated, with the exception of Plummer Creek. Plummer Creek was not included in the final pass when no new redds were recorded in the previous pass. Several redds were missed and omitted from evaluation due to missing flagging or other factors affecting the ability to locate the redd. All redds were evaluated for visibility, measured for current size, and examined for presence of fry.

Presence of fry in the immediate area can be an indicator of successful spawning and subsequent fry emergence. Fry presence could also be affected by previous high flows, lack of rearing habitat, or later redds from which fry have yet to emerge. Fry were present at 100% of redds evaluated on several South Fork Trinity tributaries: Rattlesnake, Tule and Eltapom. Fry presence during evaluation of redds in the main-stem was less frequent, with no fry present in Dutch Creek and only 15.9% observed presence in Reading Creek.

Overall, redds measured on the final pass were smaller than their original measurements. High flows, algal growth, and fry emergence possibly decrease the apparent area of a several month old redd. Mean redd area decreased for all tributaries from when the redd was flagged to the last pass. Overall, mean redd area decreased by 5.07 ft^2 or 47.97%.

Table 6. Redd evaluation summary; Change in area and fry presence.

Tributary	Redds evaluated	Mean Redd Area (ft^2)	Net Change in Area (ft^2)	Net Change in Area (%)	Fry Present (%)
Reading	94	6.20	-6.31	-50.44	15.9
Smoky	9	3.79	-4.18	-52.45	88.9
Deadwood	17	4.05	-3.71	-47.81	88.2
Dutch	2	8.43	-18.08	-68.20	0
Eltapom	11	6.79	-4.92	-42.02	100.0
E.F. Hayfork	56	5.74	-3.75	-39.52	73.2
S.F. Indian	6	3.17	-3.22	-50.39	50.0
Potato	9	3.57	-8.55	-70.54	55.6
Tule	19	5.31	-5.46	-50.70	100.0
Rattlesnake	23	5.13	-3.71	-41.97	100.0
Overall	247	5.50	-5.07	-47.97	56.7

During the final pass (Pass 4), all redds were evaluated for visibility and given a condition rating. Redds rated 1-3 were considered still visible and not likely to be missed during the final survey. Redds rated 4-7 were considered barely visible or non-existent, and would not have been recorded during the final survey. Month flagged and visibility status are thus examined to determine the proportion of redds that would be visible during the final pass of that particular tributary. Overall, 52.03 % of all redds recorded were still visible during the final pass. Some tributaries had a lower proportion of visible redds during the last pass, specifically Potato, Eltapom, Deadwood, and Tule Creeks. Reading Creek had the highest overall visibility of redds during the last pass, with 70.2 % of redds flagged still visible.

Table 7. Quality control periodicity evaluation results- percent still identifiable on final pass (June).

Tributary	March	April	May	Overall
Reading	63.6	66.7	93.7	70.2
Smoky	100	60.0	66.7	66.7
Deadwood	0	41.6	0	29.4
Dutch	0	0[1]	0[1]	0
Eltapom	0	33.4	20.0	27.3
E.F. Hayfork	42.1	43.2	0[2]	42.8
S.F. Indian	66.7	0[2]	0[2]	66.7
Potato	25.0	0	100	11.1
Tule	18.2	40.0	33.4	26.3
Rattlesnake	50.0	55.6	66.7	56.5
Overall	47.5	51.9	62.8	52.03

[1] No redds were observed during this month in this tributary
[2] No new redds were observed during this month in this tributary

DISCUSSION

Redd or spawning surveys serve as a good, but partially incomplete means of monitoring steelhead spawning escapement. For future clarification, I will use the terminology "redd survey" and "spawning survey" interchangeably for the remainder of this report. Redd surveys are most appropriate when other means of estimating adult escapement or spawning success are not appropriate or impossible to conduct. In the Trinity basin, problems do occur which limit the ability to estimate the abundance of winter-run steelhead. High flows and the extended length of adult steelhead migration make weir estimates partial at best. Several weirs were constructed to estimate winter-run steelhead escapement by the Department in 1989-1992 at Sandy Bar and at Forest Glen on the South Fork of the Trinity River (CDFG, 1990-95). Efforts were finally terminated after multiple blow-outs due to high flows.

Steelhead run size is highly variable from year to year, but the data gathered over the last 40 years in the Trinity basin shows the general trend that steelhead run sizes are diminishing. Redd surveys during 2002 season documented a good year for Trinity basin steelhead; average redd densities were higher than any survey in the past ten years. To compare, work by D.A. La Faunce in 1964 sets up good base-line numbers for natural production of steelhead in the Trinity basin. Those surveys show that adult steelhead estimates were markedly higher in 1964 than in any of the following years.

Table 8. Results of work by D.A. LaFaunce, 1964. A Steelhead Spawning Survey of the Upper Trinity River System.

Tributary surveyed	Distance surveyed (km.)	Redds observed	Redds/km.
Deadwood Creek	1.66	27	16.26
S.F. Indian Creek	0.37	4	10.8
E.F.N.F. Trinity	12.0	218	18.16
Reading Creek	16.3	279	17.11
Dutch Creek	2.6	72	27.6

Surveys conducted by D.W. Rogers in 1971, show that there had already been a sharp decline in steelhead spawning since 1964. This could have been an anomalous year, but surveys in 1972-1974 of other tributaries in the system continue to show this general trend.

Table 9. Results of steelhead spawning surveys conducted by D.W. Rogers (1971).

Tributary surveyed	Distance surveyed (km.)	Redds observed	Redds/km.
Deadwood Creek	3.7	0	0
S.F. Indian Creek	1.85	3	1.62
Reading Creek	19.25	35	1.81
Dutch Creek	1.85	0	0

During the 2002 season, Tule Creek produced redd counts similar to those of 1974. For 2002, nineteen redds were recorded in Tule Creek, for a redd density only slightly lower than 1974 at 2.26 redds/km. In 1974, only the lower, more productive section of Tule Creek was surveyed. During 2002, the majority of redds were recorded in this lower section. Taking this into account, I suspect more successful steelhead spawning occurred in Tule Creek in 2002 than in 1974.

Table 10. Results of steelhead spawning surveys conducted by Ed Miller (1974) .

Tributary surveyed	Distance surveyed (km.)	Redds observed	Redds/km.
Tule Creek	4.25	12	2.82

The South Fork Steelhead Monitoring Project conducted steelhead spawning surveys in the South Fork Trinity basin from 1990-1995 in conjunction with adult steelhead electrofishing to monitor spawning success (unsuccessful). These surveys are the most complete data-set to date, showing major spawning trends of steelhead in the Trinity basin. Eltapom Creek is considered the jewel of the South Fork, consistently having the highest redd densities in the basin; this year is a rare anomaly, with East Fork of Hayfork Creek having the highest recorded redd density. By examining the 1990-95 surveys, we find that there is great variation in redd densities from year to year; high quality tributaries fluctuate from two to 15 redd/km each year, while poor quality tributaries fluctuate between zero and two redds/km each year. This year's results appear to most closely resemble returns from 1990. Mean redd density for 2002 was slightly higher than 1990 at 3.42 redds/km.

No apparent trend is evident when examining redd survey data collected over the past three seasons. Results from the 2000 season appear to confirm the trend of declining numbers of redds recorded in the Trinity basin in the 1990s. Redd counts from 2001 document an even greater decline; worse than the historic low recorded in 1995. This season's redd counts (2002) document the most successful spawning season for winter-run steelhead in the Trinity basin since 1990.

Table 11. Results of work by CDFG (1990-1995) Steelhead spawning surveys compared with previous three years spawning survey (2000, 2001, 2002).

	Redds/km								
Tributary	1990	1991	1992	1993	1994	1995	2000	2001	2002
Eltapom Creek	14.0	6.2	10.0	13.5	19.2	2.5	8.72	3.84	8.46
Pelletreau Creek	0	2.5	0	0	1.7	0.9	0	0	0
E.F. Hayfork Creek	4.3	2.7	0.6	0.4	2.2	0.3	0	1.47	9.41
Potato Creek	2.1	0	0.4	0.4	0.9	0	0.99	0.50	2.5
Tule Creek	9.5	0.5	2.2	1.6	2.4	0.4	1.9	0.48	2.26
Plummer Creek	NS	6.6	7.9	5.0	6.1	2.1	0.97	0[1]	1.15
Rattlesnake Creek	2.6	0.8	1.8	0.4	0.8	0.1	0.74	0.31	1.48
Smoky Creek	6.6	5.0	5.9	1.9	1.9	2.1	1.63	0.73	2.19
Overall[2]	3.28	2.1	1.95	0.95	1.875	0.52	0.76	0.47	3.42

1 Poor conditions and less numerous surveys portray fewer redds or fish than most likely were present.

2 Overall densities are for all surveys conducted by DFG that season in the Trinity Basin; 1990-1995 surveys were of South Fork tributaries only.

Problems are commonplace and often complicate and sometimes prevent redd surveys from occurring. Possible problems include adequate survey frequency, redd discrimination by species, tributary sample selection, access, and private property permission. Some of these problems create suspicion or bias within the data, while others prevent the proper coverage of a selected tributary.

Periodicity of surveys is a major obstacle when comparing historical spawning survey data. Historically, only one or two passes was made of each tributary to quantify spawning. This could have possibly have left some redds unidentified, especially if surveys were late in the season, or interrupted by high flow events. During the 2002 survey, a minimum of four passes were made, with the exception of Plummer Creek, which was not surveyed when the third pass yielded no redds. This year, a periodicity quality control evaluation was implemented during the final pass of each tributary. This evaluation found that overall, approximately 52 % of redds were visible during the final pass. This implies that if only one survey, late in the season was completed, only 52% of all redds would be enumerated. Some tributaries would fair even worse; Eltapom, Potato, Deadwood and Tule Creeks all had final pass redd visibility ratings of under 30%. Tributaries with lower ratings could possibly benefit from more frequent surveys. Another methodology of rating survey periodicity was attempted during the 2000 season; Dutch and S.F. Indian Creeks were surveyed at double the survey periodicity. Additional surveys were terminated when neither creek produced any steelhead redds. Current surveys are all offset by at least one month, in order to provide the best temporal coverage of the season as possible.

Discrimination of redds created by different fish species is a problem which often complicates redd surveys in systems where several species of fish co-exist and spawn during similar time frames. Several fish species temporally co-exist in the Trinity basin, several of which have similar spawning time frames; coho salmon (*Oncorhynchus kisutch*) enter the watershed in November and December and spawn in January and February. Similarly, pacific lamprey (*Lampetra tridentata*) migrate into the system in the fall and winter, and spawn during the spring months. Small trout exhibiting a resident life-history also co-exist in the system and spawn during the spring. Several measures are taken by crews to ensure proper classification of steelhead redds. All redds with no substantial tail-spill or a pot diameter of less than 12 inches are consider resident trout or lamprey redds. Resident trout tend to utilize smaller substrate in areas with less apparent velocity. Lamprey redds are distinguished by a small circular pot and no tail-spill. In the Trinity basin, coho redds are infrequently confused with steelhead redds due to their earlier spawning (January/February vs. March-May). One selected tributary, Deadwood Creek had significant signs of spawning coho, five coho carcasses were recorded during the March survey, yet no redds were discovered during those same surveys. Current research is being conducted to examine the differentiation of anadromous salmonid redds in system where multiple species co-exist. In the Noyo River basin, Sean Gallagher is having success using discriminant function analysis to differeniate coho from steelhead redds (Gallagher, 2001).

Another problem facing spawning surveys is selection of the area to be surveyed within a selected tributary or basin. Many studies only cover a portion of a watershed, usually incorporating a systematic sampling methodology. This creates possible problems if habitat quality is unevenly distributed or if only a small area of the watershed is supporting spawning fish. In a perfect world, every tributary would be surveyed from confluence to a complete upstream barrier to migration. In reality, many barriers are not well documented; or were documented when popular knowledge identified log jams as impassable. It is very important to have current information regarding limits of the sampling universe, so all possibly selected tributaries can be sampled.

One primary problem that affects sample design, as well as proper and even coverage, is access. Most of the Trinity basin is composed of rugged mountainous terrain with little road coverage. Roads that do exist are often poorly maintained logging roads, which rarely lead to the confluence of a selected tributary. Some tributaries lie within wilderness areas, where no roads exist, and hiking in to survey is the only possibility. Access problems are further compounded by extreme winter conditions such as snow storms. Some tributaries, such as the East Fork of the South Fork Trinity River are inaccessible by road until late April due to heavy snow-pack.

Permission for access to private property is another possible complication affecting spawning surveys. Even though the riverbeds of all navigable rivers are held in the public trust by the State of California, it is the Department's policy to ascertain permission to cross private property, even when questioned tributaries are clearly navigable. Most of the Trinity basin is composed of U.S. Forest Service and Bureau of Land Management property, but small portions do exist which are privately owned, either by private landowners or large timber companies. Permission must be obtained for access to all streams that flow through private property. Originally, Reading Creek had refusals to be surveyed, but this was overcome by getting permission from the adjacent landowner. During the 2001 season, there was one remaining landowner refusing access through his property with no adjacent landowner to obtain permission from. This resulted in the crew having to turn around at his property line and backtrack approximately 400 meters and then leapfrog his 400 meters of property, creating a small hole in coverage. This problem was alleviated mid-season when we discovered the landowner had died. The executor of the will granted Fish and Game temporary permission to access and offered the property for sale to the State of California. Currently, one landowner has denied permission to cross her property; she had originally granted permission, but has since rescinded it. Every effort has been taken to urge her to reconsider her position, but to no avail. Most landowners appreciate the Departments presence in documenting steelhead spawning. Sierra Pacific Industries was extremely helpful; they granted permission to conduct surveys on five different tributaries crossing their property.

RECOMMENDATIONS

I would recommend the following additions and changes to the redd survey to gain a more complete understanding of steelhead spawning in the Trinity River basin.

A current survey of barriers to anadromous fish passage should be completed for the entire Trinity basin. Most habitat data available are incomplete and scattered around multiple agencies. Many tributaries that flow through private property have never been surveyed, so all useable habitat estimates are made from aerial photographs and topographic maps. Also, much of the data is antiquated; the definition of what constitutes a barrier to steelhead migration has dramatically changed within the last 10-20 years. In the 1970's, it was popular knowledge among fisheries professionals that a six foot log jam was a barrier to anadromous salmonids. We now know that this is simply untrue, Reiser and Peacock (1985) reported maximum leaping ability of steelhead at up to 3.4 meters.

A survey of Trinity basin limits of anadromy is currently being undertaken by the Weaverville SRAMP office.

Surveys should be conducted more frequently to identify redds that are possibly covered during spring high flow events. Michael Dean, of CDFG, suggested conducting surveys weekly for maximum coverage (pers comm, 1999). This year's periodicity evaluation suggested that redds diminish greatly in size over the season, and are considerably less visible as the season progresses. Several South Fork tributaries had such low visibility ratings (below 30%), that it is almost certain that a large proportion of redds were missed, and left undocumented for the season.

There should be standardization of survey distances of the same creek between years. Whenever possible, tributaries were surveyed from their confluence to an upstream migrational barrier. Year to year variation in surveyed distances can create problems when making comparisons between years. Seasonal log-jams are a frequent problem limiting the bounds of anadromy. Log jams possibly impede/limit the upstream progress of migrating steelhead, but with great uncertainty. Log-jams could be partially passable or seasonally passable; it is important that surveys continue past seasonal log-jams to ensure spawning is adequately quantified upstream. Furthermore, when the distances surveyed are not equal, only redd densities become comparable; additional comparison problems could arise if habitat quantity or quality of un-surveyed reaches changes between years.

I have several logistical recommendations that I believe will make surveys easier and more consistent between years and crew members. Crews should camp whenever possible to reduce commute time on multiple day surveys. Quad-runner all-terrain vehicles could be used to access certain tributaries that are otherwise inaccessible due to snow. Yearly training should be conducted for the crew for Swiftwater Rescue, Garmin global positioning system use, 1st aide, and steelhead redd identification. Finally, I would recommend daily data entry and downloading of map coordinates to simplify data storage and processing.

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LITERATURE CITED

CDFG. 1991-1996. Annual Reports Trinity Basin Salmon and Steelhead Monitoring Project 1989-1995 seasons. Inland Fisheries Division.

CDFG. 1998. Strategic plan for management of Klamath Mountains Province steelhead trout. Prepared for the National Marine Fisheries Service by the Resources Agency, 15 pp.

Elms-Cockrum, T.J. 1997. Salmon spawning ground surveys, 1996. Idaho Department of Fish and Game Report 97-25, Boise, Idaho.

Gallagher, S. P. 2001. Results of the 2000-2001 Coho Salmon (*Oncorhynchus kitsch*) and Steelhead (*Oncorhynchus mykiss*) spawning surveys on the Noyo River, California. California State Department of Fish and Game, 1031 South Main, Suite A, Fort Bragg, CA 95437. Draft November 2001. 45pp.

LaFaunce, D.A. 1964. A Steelhead Spawning Survey of the Upper Trinity River System, 1964. Marine Resources Administrative Report No. 65-4. California Department of Fish and Game, Region 1, Inland Fisheries Branch.

Riemen, B.E., and D.L. Myers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. Conservation Biology 11:1015-1018.

Reiser, D. W., and R. T. Peacock. 1985. A technique for assessing upstream fish passage problems at small-scale hydropower developments. Pages 423-432 in F.W. Olson, R.G. White, and R.H. Hamre, editors. Symposium on small hydropower and fisheries. American Fisheries Society. Bethesda,MD.

Rogers, D.W. 1971. A Steelhead Spawning Survey of The Tributaries of the Upper Trinity River and Upper Hayfork Creek Drainage. California Department of Fish and Game, Region 1, Inland Fisheries Branch.