ADULT AND JUVENILE STEELHEAD POPULATION SURVEYS, GUALALA RIVER, CALIFORNIA, 2004

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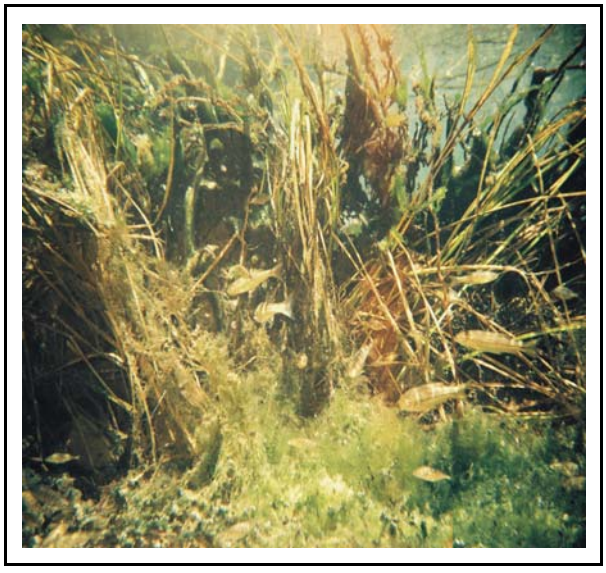
December 2004



L/R–Date, location, water temperature (^{0} F) and species shown: (1) Jul 3, Wheatfield Fork at Annapolis Road bridge, 79^0, threespine stickleback (TSS); (2) Jul 31, mainstem just downstream of North Fork mouth, 73^0, age 1+ juvenile steelhead (JSH); (3) Sep 14, Wheatfield Fork at Annapolis Road bridge, 69^0, Gualala roach (GR) and TSS; and (4) Jul 31, Wolf Creek, 1/2-mile upstream of mouth, 65^0, young-of-year JSH and GR.

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SUMMARY: Steelhead spawning surveys (counts of adults and redds) initiated in 2002 along an 18.3-mile reach (index reach) of the Wheatfield Fork, from House Creek downstream to the South Fork, were continued in 2004. The index reach was surveyed eight times (146 miles) between January 17 and April 24 from small aluminum drift-boats. A total of 121 adult steelhead and 17 redds were recorded; adult numbers peaked during late March. Relatively high flows from December through March likely facilitated considerable spawning upstream of the index reach and reduced numbers of adults and redds recorded during the surveys; relatively low flows in April coincided with greatly reduced survey numbers compared to 2002. Results continued to indicate the need for weekly spawning surveys whenever possible, extended to bi-weekly surveys at the end of the spawning season and/or during extended dry conditions, for maximizing survey accuracy. Spawning survey data from 2004 will be coalesced with long-term results for later analysis and publication. In addition, between June 5 and November 7, six reconnaissance-level snorkeling surveys of juvenile steelhead (JSH), at roughly monthly intervals, were conducted at nine locations within the watershed. These initial JSH surveys, which will be used to design a long-term JSH-snorkeling protocol for implementation in 2005, showed that: (1) many reaches of the stream are water-temperature-impaired for JSH production; (2) due to the poor condition of the watershed and despite average rainy-season precipitation, extensive stream reaches are commonly dry or lack continuous surface flow by late summer; (3) Gualala roach (GR) and threespine stickleback (TSS) are the most common species found in association with JSH; (4) dramatic changes in presence of JSH, GR, and TSS occurred following the season's first significant rainfall and runoff event in mid-October 2004; and (5) Wolf Creek is presently an important JSH rearing stream. Overall, 2004 likely provided excellent conditions for steelhead spawning, but relatively poor conditions for JSH rearing.

INTRODUCTION AND BACKGROUND

Because of a relative dearth of current information on the population status of steelhead in the Gualala River, a relatively small northern California coastal stream, I initiated annual steelhead spawning surveys in 2001 (DeHaven 2001). In 2002 (DeHaven 2002) and 2003 (DeHaven

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[1]Senior Fish and Wildlife Biologist (Retired); U.S. Fish and Wildlife Service (Service), Sacramento, California. **Recommended Report (available on CD from the author) Citation:** DeHaven, R. W. 2004. Adult and juvenile steelhead population surveys, Gualala River, California, 2004. Prepared by the author (drdehave@hotmail.com), December 2004, for use by agencies, groups and individuals involved in steelhead recovery efforts. 56pp. **Disclaimer:** All aspects of this study were self-funded and conducted during non-work hours, and not while in any official capacity as a biologist for the Service.

2003) these surveys were continued, focusing on an 18.3-mile reach of the Wheatfield Fork selected as a long-term population-indexing reach. This report presents results of 2004 winter and spring spawning surveys conducted along this indexing reach.

In addition, during summer and fall of 2004, I initiated reconnaissance-level snorkeling surveys of juvenile steelhead (JSH) at various locations in the watershed. Based on results of these initial snorkeling surveys, I plan to design and implement, in 2005, a long-term snorkeling-survey protocol. Snorkeling survey data together with the spawning survey data already being gathered may allow attainment of my goal: determining the present status and trend of the steelhead population of the river. A more extensive discussion of this goal and its basis in need is given in my 2002 annual report (DeHaven 2002).

METHODS

The spawning surveys entail periodic counts of adult steelhead and their redds. The 18.3-mile-long index reach on the Wheatfield Fork extends from House Creek downstream to the South Fork. This reach, which is navigable, has roughly equal upper (8.9 miles) and lower (9.4 miles) sections which are bounded by the Annapolis Road bridge. Both sections are surveyed from small aluminum drift-boats. Further detail of the spawning-survey protocol is given in my 2002 report (DeHaven 2002).

The reconnaissance-level snorkeling surveys were conducted during June through November at a total of nine locations. Standard wet-suits, diving masks and snorkels were utilized to make underwater observations of fish along varying lengths of stream. A ReefMaster underwater camera was used to take film photographs of fish at selected locations. Water temperatures at the sampling sites were measured with a mercury thermometer. Above-water observations were also made while walking slowly along the stream bank, either before or after the snorkeling observations. Because the sole objective was development of a standard future protocol for annual snorkeling surveys, not every site was sampled on each survey date nor were population density data gathered. Qualitative estimates of fish abundance were instead made. The snorkeling-survey protocol that is eventually developed from these reconnaissance surveys will be presented in detail in my 2005 report.

Following each spawning survey and each snorkeling survey, a diary-type report was prepared with details of that particular survey. These Memoranda to the Files are attached in Appendix 1.

RESULTS AND DISCUSSION

Spawning Surveys.

Number and Temporal Spacing of Surveys–The index reach was surveyed a total of eight times between January 17 and April 24 (Table 1). A total of 146.4 miles was thus covered. Five of the

Table 1. Steelhead spawning survey results, Wheatfield Fork index reach, Gualala River, 2004 season. *(Further detail is provided in the individual survey reports [Appendix 1].*)

DATE(S)/ OBSERVER(S)	CONDITIONS[1]			NUMBER ADULTS		NUMBER REDDS	
	flow	clarity	weather	Upper Reach	Lower Reach	Upper Reach	Lower Reach
01/17;RD/EB/CA	H	F	F	1	2	0	0
01/24-25; RD	M	F	F	6	2	1	0
03/13;RD/EB/DH	M	F	E	18	4	0	0
03/20-21; RD	M	E	F	12	62	2	1
03/28-29; RD	M	E	E-F	6	2	2	1
04/03; RD/EB	L	E	E-F	2	2	1	1
04/10; RD/AZ	L	E	E	0	2	4	2
04/24; RD/EB	L	E	E	0	0	1	1
TOTALS	(see erratum, page 22)			45	76	11	6

surveys were completed in 1 day while three were completed over 2 consecutive days. Surveys were generally confined to weekend days because of my employment with the Service. The rainfall and hydrology which occurred during the spawning season (*see* below) facilitated weekly surveys except on two occasions, in which either 2 or 3 weeks elapsed between surveys.

Spawning-Season Precipitation and River Hydrology–As in 2003, seasonal rainfall was tracked using both the Venado and Fort Ross rain-gage data (Figure 1). Results indicate that: October, March and April were drier than average; November was about average; and December and February were well above average in precipitation. At Fort Ross, the 35.40 inches of rain recorded overall during the 7-month (Oct-Apr) rainy season was 98 percent of the average 36.15 inches for the 53-year period of record and compared with 31.84 inches and 37.10 inches over the same 7-month periods in 2003 and 2002, respectively. Thus, overall, roughly average precipitation has occurred in the watershed during both 2002 and 2004, while 2003 was a slightly-below average rainfall year.

The first rainfall event of the 2004 season occurred on November 2, but the first event triggering a rise in the river hydrograph occurred a week later on November 8. The wettest months, December and February, had 18 and 16 days each, respectively, with precipitation. In contrast, March and April had only 4 and 6 days each, respectively, with precipitation. The largest 1-day rainfall events (≥3 inches recorded at Venado) were on November 8; December 29; January 1;

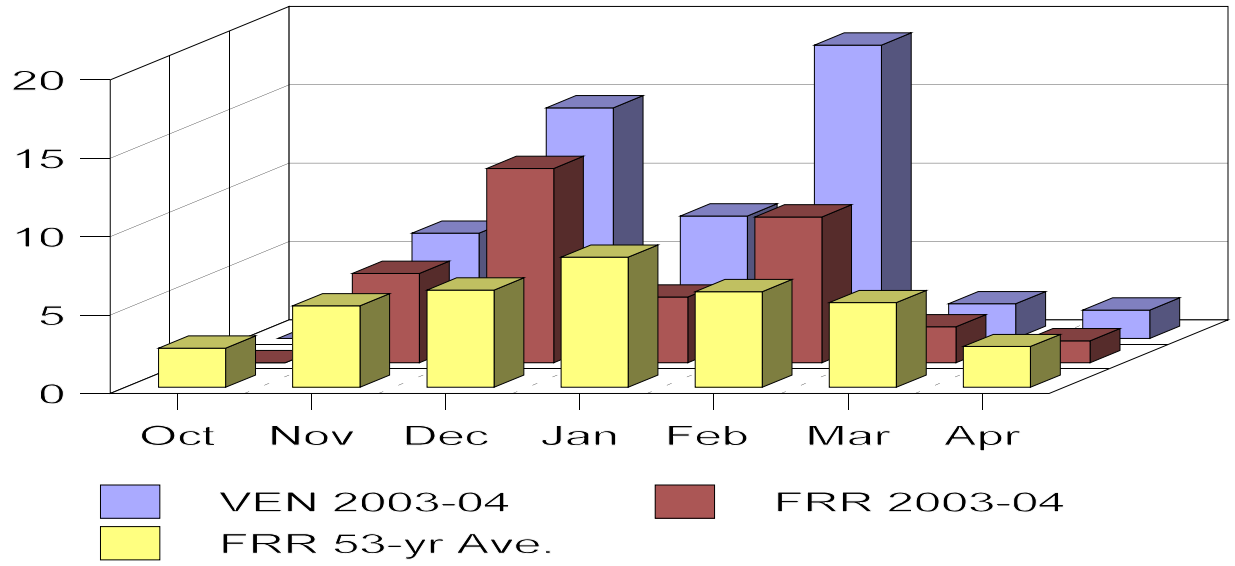

Figure 1. Gualala River steelhead spawning-season rainfall pattern, in inches, 2003-2004 season, compared to average, as indexed from the Venado (VEN; Operator-California Department of Water Resources) and Fort Ross (FRR; Operator-National Weather Service) rain gages. (*Months: October-April; FRR 53-Yr Average=yellow; FRR 2003-04=rust; VEN 2003-04=blue.)*

and February 16, 17, and 25. However, following a wet February, 23 consecutive days of March (March 2-24) were dry and the 10 total days of rainfall that occurred in late March and mid-April were all relatively small precipitation events (≤1.2 inches recorded at Venado) producing relatively small or no increases in the river hydrograph. As a result, flows and numbers of adults/redds recorded during the three index-reach surveys conducted in April were low compared to 2002. (In 2003, no surveys could be conducted in April, due to unusually high rainfall and flows).

The annual hydrograph for the river, based on USGS provisional gaging data for the Wheatfield Fork gage, showed peak flows of about 4,000 cfs (cubic feet/second) during mid-January, 2,000 cfs during late February, and several smaller flow spikes during December-March (Figure 2). Flows then rapidly subsided and remained low (or even below gage-measurement criteria) and stable during April, and until the start of the rainy season for the 2005 spawning season (*see* **Snorkeling Surveys** section). Flows at the Wheatfield Fork gage during the three surveys conducted in April (3, 10, and 24) ranged only from 37 to 66 cfs, much lower than during April in 2002-2003, but similar to flows in 2001.

The index-reach results (i.e., numbers of adults and redds; *see* below) for 2004 and the two previous years were likely highly influenced by precipitation and river hydrology. The index reach is a relatively large, fourth- or fifth-order stream. And adult steelhead returning to spawn

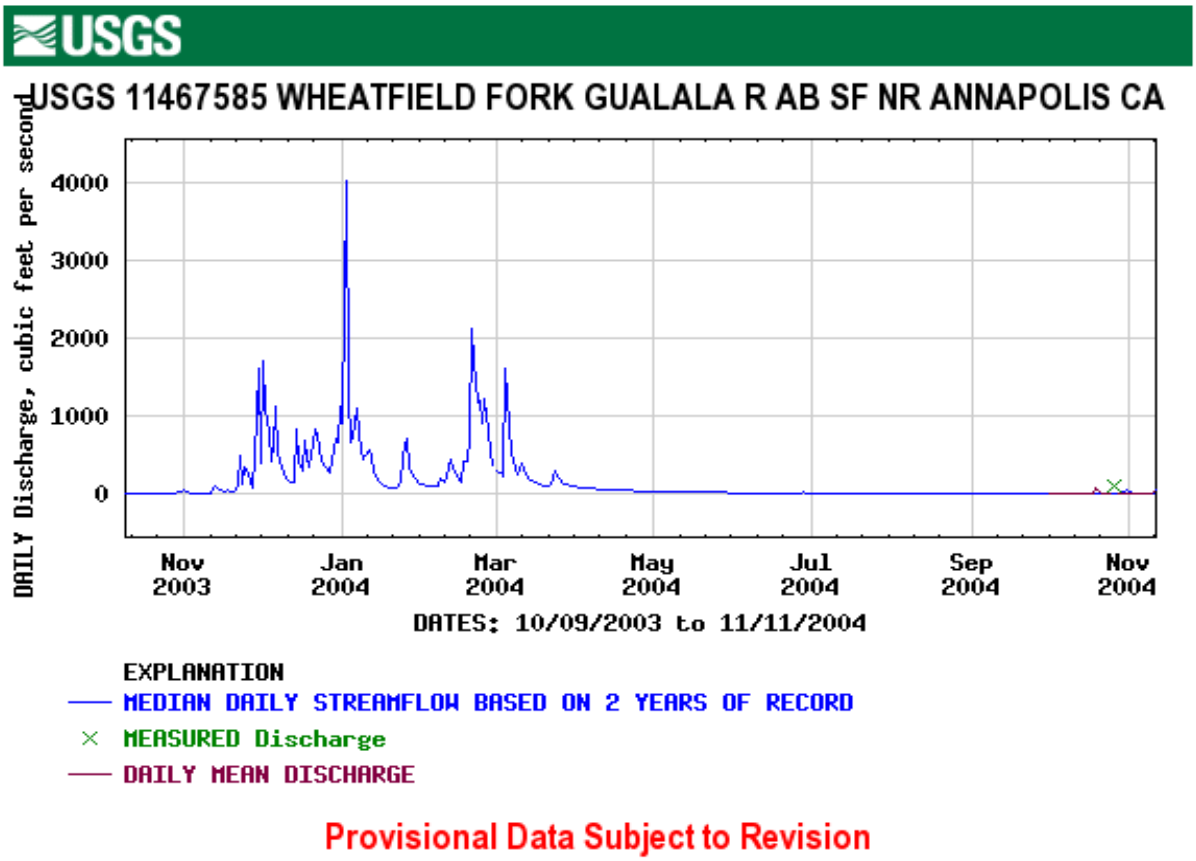

Figure 2. Wheatfield Fork spawning-survey index-reach hydrology during 2003-2004, as indicated by the USGS Wheatfield Fork real-time gage data. (*Based on 11/11/2004 provisional data from the internet.)*

characteristically "go with the flow." Thus, during periods of low rainfall and low or rapidly-declining hydrograph, they are much more likely to congregate and hold in pools where they can be counted and/or to spawn within the index reach. High rainfall and hydrograph, on the other hand, facilitate relatively quick movement through and little spawning in the index reach as the adults migrate relatively quickly to the uppermost accessible reaches of the watershed. These premises will be further addressed when the data from this multi-year study are eventually coalesced and presented for publication.

Number of Redds–A total of 17 redds (0.9/mile) was found (Table 1). This compares with (refer to the earlier annual reports): 123 (6.7/mile) in the same general area during three surveys in 2001 (before the index reach was delineated) ; 145 (7.9/mile) during eight surveys in 2002, and 9 (0.5/mile) during four surveys in 2003. Ten (59 percent) of the 17 redds were found during the three surveys in April; and 11 and 6 redds, respectively, were found in the upper and lower sections of the index reach.

Stream flows were relatively high and survey conditions generally sub-optimal during the first five surveys conducted from mid-January through the end of March (Table 1). During these five surveys only 7 redds were found. The high flows and low number of redds found, despite relatively large numbers of adults being recorded (*see* below), especially during the March 20-21 survey, suggest that most spawning at least through March probably occurred well upstream of the index reach.

Number of Live Adults and Carcasses–As in 2003, no adult steelhead carcasses were found. This compares with five carcasses found in 2001 and one carcass found in 2002.

Despite the moderate-to-high flows and sub-optimal survey conditions during the first five surveys, a moderate total number of adults–121–was nevertheless recorded (Table 1). Sixty-one percent (74 adults) of these were recorded during the March 20-21 survey and 84 percent of that 2-day total were recorded on the lower section of the index reach (including 21 adults observed in one large, deep pool). This compares with 43 adults counted in 2001, 377 in 2002, and 128 in 2003 (refer to the earlier annual reports).

In contrast to the earlier years, relatively few (six) adults were recorded during April surveys. I believe this reflects the relatively early-season spawning and emigration from the river. This in turn was a result of the favorable migration and spawning conditions occurring during January through March.

Temporal Distribution of Spawning–The earliest direct evidence of spawning in the index reach was the one redd located on the upper survey section on January 24. Due to the high-flow conditions in December-January, there may not have been any earlier spawning within the index reach, but earlier spawning almost certainly occurred upstream of the index reach. The last two redds of the season (one each on the upper and lower survey sections), found during the April 24th survey, were constructed within the previous 2-week period.

Spatial Distribution of Spawning–Of the 17 redds found, 11 were on the upper survey reach and 6 were on the lower reach. This low number was insufficient to indicate trends in spatial distribution. However, the 2004 data will be coalesced with the multiple-year results and the distribution of all redds will eventually be plotted on a map of the stream course. To date, redd locations have only been roughly approximated, due to the failure of GPSs to provide accurate and consistent "fixes" in the relatively deep canyon and heavy tree cover typifying the index reach. In 2005, however, I will attempt to ameliorate this situation using newer, more powerful GPS units and elevated (on a pole above the survey boat), external antennas.

Discernability of Redds–The 2004 results (*see* individual survey reports, Appendix 1, for details) continued to provide support for my findings from 2002-2003. In particular, three important issues are involved:

1. Length of Discernability. Length of redd discernability continued to show an inverse relationship to declining hydrograph. Thus, discernability tended to increase as the season progressed. Under high-flow conditions, discernability was generally about 1 week, although some redds were not discernable that long. Low flows extended discernability to 2-4 weeks, although considerable variation occurred. In sum, the findings continued to support a recommendation that, whenever possible, surveys should be conducted weekly, with extension to a 2-week interval during prolonged dry periods when the index-reach hydrograph remains relatively low and stable or is declining.

2. Observer Variation. I continued to accrue evidence that observer variation in redd detection and identification, as well as counts of live adults, can be substantial. Some of the likely reasons for this were discussed in my 2002 report (DeHaven 2002). Missed and mis-identified (i.e., lamprey redds incorrectly called steelhead redds) steelhead redds occurred despite the considerable experience that my assistants and I are gaining as our survey experience accumulates. In addition, in 2004 I had the assistance of a lamprey expert on one of the surveys (April 10th) and controversies still arose. In sum, these findings continued to support a recommendation that, whenever possible, surveys should be conducted only by well-trained and experienced individuals working (and collaborating on findings) in two-person teams.

3. Misidentification of Lamprey versus Steelhead Redds. The 2004 spawning season was the third year I have gathered evidence of lamprey superimposing their redds onto steelhead redds. As a result, I am now confident that this is a rather common phenomenon in the index reach, especially later in the steelhead spawning season when the lamprey arrive to spawn, and not just an occasional anomaly. I also gathered additional evidence that some large lamprey redds may be mistaken for steelhead redds. In addition, in 2004 I recorded the first instance of a steelhead redd being superimposed onto a previous steelhead redd that had become indiscernible. In sum, these findings further illustrate the need to adhere to the recommendations given in 1 and 2 above.

Snorkeling Surveys.

A total of six snorkeling surveys were conducted at roughly monthly intervals from early summer to fall. These were either 1- or 2-day events conducted on: June 5-6; July 3-4; July 31 (used to represent August conditions); September 14-15; October 6; and November 6-7. A summary of snorkeling results is provided in Table 2; further detail of each snorkeling survey appears in the individual Memo Reports (Appendix 1). Photographs of most of the snorkeling sites, showing stream conditions both at end-of-summer and just after the first fall increase in the hydrograph, appear in Figures 3.1-3.4.

I had intended to focus only on summer JSH (juvenile steelhead) rearing conditions, with the early October survey concluding the snorkeling efforts. However, a relatively early start to the 2004-2005 rainy season occurred, with the watershed receiving about 1 inch of rainfall (Venado gage) on October 17-18 followed by about 4 inches on October 19-20.

Table 2. Summary of juvenile steelhead (JSH) abundance and stream-flow conditions during six snorkeling surveys conducted on the Gualala River during summer and fall, 2004. *(Dashes denote lack of sampling or data collection, that date.)*

SITE NO.	GENERAL LOCATION[2]	JSH ABUNDANCE[3] / STREAM CONDITION (FLOW)[4] / AND TEMPERATURE[5] BY DATE																	
		Jun 5-6			**Jul 3-4**			**Jul 31**			**Sep 14-15**			**Oct 6**			**Nov 6-7**		
1	Wolf Creek	A	CF	72	A	CF	79	A	CF	65	A	CF	61	C	CF	--	0	CF	--
2	House Creek Mouth	A	CF	80	V	CF	84	R	CF	78	0	CF	74	0	IF	--	0	CF	--
3	WF[6] Fork (lady-car)	C	CF	80	C	CF	84	--	--	--	0	CF	74	0	CF	--	R	CF	--
3A	WF Fork (AR[7] bridge)	--	--	--	R	CF	79	R	CF	64	0	IF	69	--	IF	--	0	CF	--
4	Haupt Creek (lower)	A	CF	--	A	IF	65	C	D	--	0	D	--	0	D	--	0	CF	--
4A	WF Fork (Twin Brdg)	--	--	--	A	CF	70	C	CF	69	0	IF	65	0	D	--	C	CF	--
5-7	North Fork/Mainstem	V	CF	65	C	CF	62	V	CF	73	V	CF	64	V	CF	--	V	CF	--
8	South Fork Bridge	---	--	--	--	--	--	--	--	--	A	IF	--	C	IF	--	0	CF	--
9	Fuller Creek Bridge	--	--	--	--	--	--	--	--	--	--	--	--	C	CF	--	--	--	--

[2]More detailed descriptions of the sampling sites are given in the individual memo reports in Appendix 1.

[3]**A**=Abundant; **C**=Common; **V**=Present in Variable numbers, according to sub-site**; R**=Uncommon, but definitely present; **0**=Not observed.

[4]**CF**=Continuous surface flow; **IF**=Intermittent surface flow; **D**=Dry (except for, in some cases, drying pools)–No surface flow present.

[5]Temperature=maximum water temperature, in ^{0} F, recorded at the sub-sites at that location, during the sampling visit on that date.

[6]WF=Wheatfield Fork.

[7]AR=Annapolis Road bridge.

Figure 3.1. Surface flow conditions on October 6 (L) and November 6 (R), 2 weeks after the first major rainy-season storm, at the Wolf Creek (top) and House Creek (entering from left foreground) mouth (bottom) snorkeling sites.

Figure 3.2. Surface flow conditions on October 6 (L) and November 6 (R), 2 weeks after the first major rainy-season storm, at the Haupt Creek (top) snorkeling site and just downstream of the Annapolis Road bridge snorkeling site (bottom).

Figure 3.3. Surface flow conditions at Twin Bridges (South/North Forks confluence) on October 6 (L) and November 7 (R), 2 weeks after the first major rainy-season storm, showing the Wheatfield Fork snorkeling site (top) and South Fork (bottom), just upstream of its mouth.

Figure 3.4. Surface flow conditions on October 6 (L) and November 6-7 (R), 2 weeks after the first major rainy-season storm, at the South Fork bridge (top) and North Fork (entering from foreground) mouth (bottom) snorkeling sites.

The second storm event brought each of the three major forks of the river which have USGS flow gages (i.e., Wheatfield, South and North forks) up from either dry (unmeasurable at the gage) or summer-low-flow (≤3 cfs) stages to flows of about 80-100 cfs (Figure 4). Usually, the first fall storm of the season doesn't produce such runoff. A delay of several weeks normally occurs between the onset of fall rains and subsequent runoff, with the first measurable rise in the stream generally occurring between the end of November and early-to-mid December. In dry years, the first streamflow rise may not occur until January. Thus, the dry-season-ending flow spikes of mid-October prompted me to conduct one additional snorkeling survey on November 6-7, just after flows had subsided and cleared. This final snorkeling survey produced some interesting and unanticipated results, as discussed below.

Key findings from the six snorkeling surveys are briefly discussed below, by site. Neither these sites nor their numbers are necessarily those to be employed in the standardized survey protocol to be implemented in 2005. However, the site numbers used below do correspond to site numbers in the summary table (Table 2) individual reports (Appendix 1).

Wolf Creek (Site 1)–The Wolf Creek site is located about 1/2-mile upstream of the confluence of Wolf Creek with the Wheatfield Fork. The length of stream sampled varied from about 300-600 feet. The terrain is generally steep, overhead tree canopy cover is low-to-moderate, much of the site flows through bedrock, and an array of different stream habitat types is represented.

This site was examined during all six of the snorkeling surveys. Highlights of findings (Table 2; Appendix 1; Figure 3.1) were that:

- The site had a small (est. 0.3-2.0 cfs) but continuous surface flow during every survey.
- Maximum water temperatures during surveys were at times adverse to JSH, ranging from 61-79^{0}F. The steep terrain (which limited solar radiation) tended to limit the number of hours of adverse temperatures each day, however.
- Both JSH and Gualala roach (GR) were recorded on each survey through October.
- Young-of-year (YOY) JSH abundance was high on all surveys through September and moderate on the October survey, but the species was absent during the November survey.
- A marked decline of JSH condition was observed in September when low numbers of threespine stickleback (TSS) appeared.
- Wolf Creek is currently an important JSH rearing stream.

House Creek Mouth (Site 2)–This site comprises two distinct stream reaches: House Creek–just upstream of its mouth; and the Wheatfield Fork–at and just downstream of the House Creek mouth. Roughly 300-500 feet of House Creek was generally sampled, whereas about 100-150 feet of the Wheatfield Fork was sampled. The sample portion of House Creek is heavily shaded; the Wheatfield Fork is open, wider and well-exposed to the sun.

This site was examined during all six of the snorkeling surveys. Highlights of findings (Table 2; Appendix 1; Figure 3.1) were that:

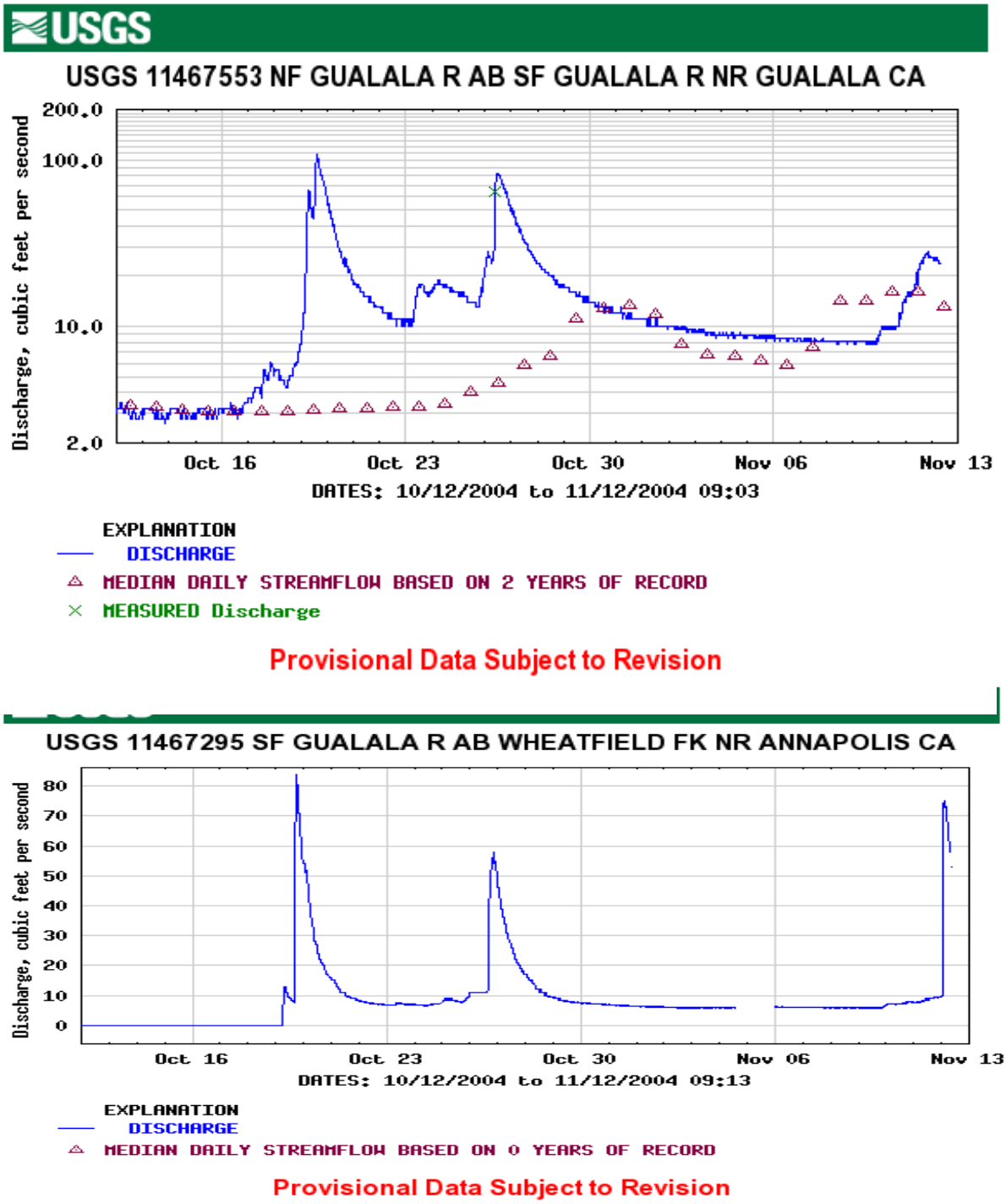

Figure 4. Gualala River watershed end-of-summer-season flow spike(s), as evidenced by the North and South forks USGS gage data, following an unusually large, early-season rainfall event beginning on October 19, 2004. *(Based on 11/12/2004 provisional data from the Internet.)*

- House Creek had a continuous surface flow during every survey; however, the Wheatfield Fork started becoming intermittent during September, was distinctly intermittent in October, and had returned to a small, but continuous surface flow in November.
- Maximum water temperatures in both branches during surveys were adverse to highly adverse to JSH, with the Wheatfield Fork ranging from 74-84^{0}F and House Creek ranging from 63-79^{0}F.
- JSH, TSS, and GR occurred at the site, but only GR were recorded on every survey.
- JSH abundance, including both YOY and Age 1+, was high in both sample reaches in June; thereafter, JSH abundance declined dramatically and the species was not recorded in either September or November.

Lady-in-the-Car (Site 3)–This site is along the Wheatfield Fork, about 4.5 miles downstream of House Creek. An unimproved four-wheel drive road leads down to the stream. About half-way down the road are several stripped and abandoned autos and numerous discarded auto batteries. When I initiated surveys on the river in 2001, a middle-aged woman was living alone in a Plymouth Voyager mini-van parked on a small turnout near the abandoned autos. She remained at this spot for over 2 years, thus I have named the site after her.

Snorkeling was generally done beginning at the base of the road and continuing downstream for about 200-300 feet and at the base of a small waterfall about 300 feet below that. Both areas are characterized by pools, runs and riffles with boulder and bedrock substrate, and a relative lack of overhead riparian cover, except at the waterfall pool.

This site was examined during each survey except the August (July 31) survey, when it appeared that more illegal dumping activity may have been underway when I arrived at the site. Highlights of findings (Table 2; Appendix 1; digital photos of the site were inadvertently lost) were that:

- The site had a continuous surface flow during every survey.
- Maximum water temperatures during surveys were highly adverse to JSH, ranging from 74-84^{0}F.
- JSH of various ages were nevertheless present in water that was 80-84^{0}F in June and July ; JSH were not recorded at the site in September and October, but were present once again, in small numbers, in November.
- GR and TSS were also recorded at the site, with GR by far the more abundant of the two species.

Annapolis Road Bridge (Site 3A)–This site begins underneath the Annapolis Road bridge and extends upstream for about 200-300 feet. The sample reach is a large, slow-moving pool-run. There are small areas that are 6-8 feet in depth, abundant large woody debris (LWD), and moderate-to-high overhead riparian cover. The deepest areas are fed by springs which appeared

to provide cool-water refugia. During the spawning season, this pool-run is often used for holding by adult steelhead, especially during low-flow conditions.

This site was examined during each survey except the first survey in June. However, snorkeling could not be done in October, due to time constraints. Highlights of findings (Table 2; Appendix 1; Figure 3.2) were that:

- The actual snorkeling site had a relatively consistent stage and depth during all surveys. However, the general site vicinity had a small, but continuous surface flow only in July and August (July 31 survey); flow was intermittent in September and October, but continuous surface flow had resumed in November.
- Maximum water temperatures during surveys were variable, but nevertheless at times highly adverse to JSH rearing, ranging from 64-79^{0}F.
- JSH, primarily age 2+, were present in low numbers in the deepest parts of the pool in July and August (July 31 survey); the species was not recorded in either September or November.
- Large schools of relatively large GR and TSS were recorded (*see* cover photos) through September.
- Fish were not recorded at the site in November.

Lower Haupt Creek (Site 4)–This sample site extended from just beneath the Haupt Creek bridge to variable points (depending on survey) 400-1,000 feet upstream. The sample reaches included the site of the major logjam I first reported in 2001 (DeHaven 2001) which has since been removed from the streambed. The terrain is relatively steep. When flowing, the sample reach has an abundance of pools, runs, and riffles with relatively high amounts of overhead riparian cover and moderate levels of LWD.

The site was examined on foot during each of the six surveys. Snorkeling was not done and considered unnecessary (as well as impractical), due to low flows (or dry conditions) and the ease with which fish could be identified while walking along the stream. Highlights of findings (Table 2; Appendix 1; Figure 3.2) were that:

- The sample reach had continuous surface flow only during the June and November surveys; during July, flows had become intermittent; during August (July31 survey), flows had ceased and only a few drying pools remained; during September and October, the entire survey reach was completely dry.
- I inadvertently failed to record water temperatures, except on one occasion (July survey--65^{0}F); nevertheless, based on best professional judgement, water temperatures did not appear to be substantially adverse (i.e., generally in the 60s [^{0}F]) for JSH rearing.
- JSH were abundant during June and July, and common (in the drying pools) in August (July 31 survey); the species was not recorded in November, after continuous surface flow had resumed.

- GR were also abundant at the site and they resumed their abundance in November in response to the resumption of continuous surface flow.

Twin Bridges-Wheatfield Fork (4A)–Twin bridges is the local name for the confluence of the Wheatfield and South forks, the upstream limit for sportfishing and where one large, concrete bridge passes over each fork of the stream (i.e., twin bridges). The snorkeling location was confined to the Wheatfield Fork, however, extending from just underneath the bridge to about 250 feet downstream. This site was about 500 feet upstream of the confluence of the two forks. The stream in this vicinity had a broad, gravelly, low-gradient floodplain generally lacking overhead riparian cover (except young growth at the streambed margins) and having low-moderate amounts of LWD. Generally, either two or three pool-riffle combinations were examined.

Snorkeling was done on every survey (with surface water present), except the June survey. Highlights of findings (Table 2; Appendix 1; Figure 3.3) were that:

- Despite its status as a fourth- or fifth-order stream, continuous surface flow occurred only during the first three surveys extending through July. By the July 31 survey, continuous surface flow was still occurring, but was greatly diminished. Surface flow became intermittent during the September survey, and the site and entire vicinity, including the lower reach of the South Fork (Figure 3.3), were completely dry during the October survey.
- Maximum water temperatures of 65-70^{0}F during the July-September period when they were recorded were not highly adverse to JSH rearing.
- JSH, representing various age-classes, were abundant and common, respectively, during the July and August (July 31) surveys, but absent in September, when intermittent surface flow prevailed**.**
- Following completely dry stream conditions in September and October, JSH again became common in November, after surface flows had resumed.
- GR and TSS were also recorded at the site, with GR by far the more abundant of the two species.

North Fork/Mainstem (Sites 5-7)–This site involved snorkeling at up to four distinct locations in the vicinity of the mouth of the North Fork: (1) the North Fork, from its mouth upstream 200-400 feet; (2) the mainstem, from North Fork mouth upstream 200-300 feet; (3) a large, deep pool of the mainstem, about 1/4-mile downstream of the North Fork mouth; and (4) the reach between the large pool and North Fork mouth. These locations covered a variety of habitat types having variable amounts of overhead riparian cover and LWD. The deep pool is roughly the upstream limit of tidal influence and backwater effect when the mouth of the river is closed by a sandbar.

The site was sampled during each of the six surveys. However, snorkeling was not done during the July (water was too cold–at 62^{0}F–for the gear I had brought) or October surveys; only a

streamside survey was conducted on these dates. Highlights of findings (Table 2; Appendix 1; Figure 3.4) were that:

- Except for the reach of the mainstem upstream of the North Fork mouth, which became intermittent in September, the various sub-sampling locations at the site had small, but continuous surface flow throughout the survey period.
- Maximum water temperatures of 62-73^{0}F recorded during the surveys were not indicative of any high degree of impairment to JSH rearing, except perhaps during the July 31 survey, when the stress to fish from high recreational-user activity at the site was coupled with a water temperature of 73^{0}F.
- JSH, mostly age 1-2+**,** were moderately abundant (but highly variable, according to sub-site) throughout the survey period, except during the November survey, when the only JSH recorded were relatively large pre-smolts (i.e., losing their parr marks) in a run in the North Fork having abundant LWD.
- The only other species recorded at the site was GR, which were generally much less abundant than at the other snorkeling sites; however, this species was not recorded during the November survey.

South Fork Bridge (Site 8)–This site involved a 200-300-foot reach of the South Fork immediately beneath the Stewart's Point-Skaggs Springs Road bridge. One-to-three pools and associated runs with moderate-to-high amounts of LWD were examined; the site is moderately heavily-shaded, depending on flow.

The site was examined during the last three surveys only--by walking and snorkeling on both the September and November surveys, and by walking only during the October survey. Water temperatures were not recorded. Highlights of findings (Table 2; Appendix 1; Figure 3.4) were that:

- Despite intermittent surface flow in September, JSH of various ages (from YOY to 2+), in apparently good condition, were present; GR and TSS were also present.
- The October fish community appeared similar to September.
- In November, no fish were recorded at the site.

Fuller Creek Bridge (Site 9)–This site, which was examined on foot only and only during the October survey, involved about 200 feet of stream upstream from the Annapolis Road bridge. This reach has several pools, a high amount of riparian shade and abundant LWD. The finding highlight (Table 2; Appendix 1) was that:

- JSH of various ages, including a least one large (10-11 inches) individual (or trout) were present.

Widespread Prevalence of Dry and Intermittent Flow Conditions–As discussed earlier, while March and April were drier than average, rainfall overall in the watershed during the 2003-2004

rainy season was about average. It was thus disturbing that during the snorkeling surveys, besides the widespread prevalence of JSH-unfriendly water temperatures, a widespread prevalence of dry and intermittent stream conditions was encountered in mid- to late-summer.

Such loss of stream surface flows appears to have been a gradual process occurring over the past several decades. When I hiked extensively throughout the watershed during 1976-1977–a record drought period–I observed many extremely low-flow conditions, but no dry or intermittent reaches, except on a few first- and second-order streams. Summer drying of fourth- and fifth-order reaches is both surprising and disturbing. This developing phenomenon has been recognized and reported by others. There are now a number of examples of continuous surface flows being anecdotally recorded in earlier decades where dry or intermittent conditions are now commonly observed today.

This disturbing trend is the result of at least three long-term, adverse factors: (1) the relatively poor long-term condition of the watershed and streambed–especially its extensive aggradation; (2) the cumulative effects from incremental water diversions (both legal and illegal) from multiple sources; and (3) the cumulative effects to watershed hydrodynamics (e.g., water absorption, storage, release and dispersal from the landscape) from incremental land-use changes (e.g., conversions to vineyards and timber harvest) and water diversions. These are complex issues whose relative contributions to surface-flow diminishment and water temperature impairment are just beginning to be understood and documented. In coming years, I intend to attempt to add to the understanding and documentation of these three factors.

In addition, in the vicinity of Twin Bridges a fourth factor in flow diminishment is clearly in play: the adverse effects from several decades of gravel mining. Such gravel mining impacts are already relatively well-understood and documented.

CONCLUSIONS

- Immigration and spawning of adult steelhead occurred throughout the 4-month (mid January-late April) spawning-survey period, with peak numbers of adults recorded in late March.

- An extended above-average hydrograph during mid-January through late March was likely conducive to (1) relatively rapid spawning and emigration of adults, and (2) substantial spawning upstream of the 18.3-mile index reach.

- Spawning activity in April was relatively low compared to previous years, likely a result of the favorable early-season spawning conditions and below-average April hydrograph.

- Additional evidence accrued that: (1) lamprey and steelhead redds are problematic to correctly identify, even for seasoned observers; (2) lamprey redds are occasionally superimposed atop earlier steelhead heads; and (3) whenever survey conditions permit, at

least weekly spawning surveys, extended to bi-weekly intervals late in the spawning season and/or under prolonged dry conditions, are desirable to maximize survey accuracy.

- Wolf Creek, despite its status as a small first- and second-order stream, supports a year-round surface flow and is currently an important JSH rearing stream.

- Elsewhere, JSH rearing is significantly and widely impaired and limited by adverse water temperatures and lack of surface flows (i.e. aquatic habitat) during mid- to late-summer.

- The inhospitable temperatures and widespread lack of surface flows in summer are symptomatic of the generally poor conditions of the river. With such existing severe habitat degradation, the next major drought in the watershed is likely to have catastrophically adverse consequences for the steelhead population.

- GR (Gualala roach) and TSS (threespine stickleback) were the only fish widely and commonly found in association with JSH at the nine sites sampled by snorkeling.

- An unusually early rainfall/hydrograph spike in mid-October resulted in major redistributions (from summer low-water conditions) of JSH populations, including likely emigration downstream to the lowermost portions of the estuary, if not to the ocean.

LITERATURE CITED

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APPENDIX 1.

Individual Memo Reports for the Eight Spawning Surveys
and Six Reconnaissance-level Snorkeling Surveys

Erratum: The inadvertently omitted descriptions of 'conditions' used in columns 2-4 of Table 1 are:

flow: **H**igh=>200 cfs; **M**oderate=75-200 cfs; **L**ow=<75 cfs
clarity: **E**xcellent=bottom of all pools visible; **F**air=bottom of up to one-half of the deepest pools not visible.
weather: **E**xcellent=sunny and clear, with little or no wind during most of day; **F**air=clouds, rain, fog, wind, or other adverse weather factors hampered visibility of the bottoms of the deepest pools during half of more of the survey.

MEMORANDUM TO THE FILE–#027

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, January 17, 2004, *my first complete survey of the index reach for the 2004 season.*

Personnel

This was the first survey of the 2004 season, a 1-day effort, with Craig Aubrey and Ed Ballard, two fellow biologists from my office. We arrived at the upper reach starting point about 0830 hours. I floated the upper reach in my new Lil' Willie 12-foot drift boat, while Aubrey and Ballard floated the lower reach in two of my older drift-style boats (the aluminum and plastic models).

Survey Methods

The upper half (8.9 miles) of the Wheatfield Fork was surveyed from 0930-1230 hrs for an average survey rate of about 3.0 mph, a relatively quick pace due to the high flow and velocities. The lower half (9.4 miles) of the Wheatfield Fork was surveyed from 0915-1515 hrs, for an average survey rate of about 1.6 mph, reflecting the inexperience and relative trepidation of the two observers.

Procedures followed for the survey of both sections were those established during the 2002 steelhead spawning season.

Weather and Stream Conditions

Due to the relatively high flow, water clarity was less than ideal and only good-to-fair along the upper reach and fair-to-poor along the lower reach. In addition, the weather was overcast the entire day. As a result, it is doubtful that we would have seen more than a small percentage of any adult steelhead that may have been present along either of the two reaches. Conditions were suitable, however, for finding most of the redds that may have been present.

As an index to flow conditions, the stage at the USGS realtime gage on the Navarro River near Navarro indicated about 530 cfs at mid-day on January 17th. In addition, the former USGS realtime gage on the Wheatfield Fork near Annapolis was again operating and showed a mid-day flow of about 313 cfs; this gage (GWF) is now being operated by DWR as one of its realtime gages.

The weather was overcast throughout the day with calm winds and a maximum air temperature of about 58^0 F at about 1500 hrs.

This was the first opportunity for a survey this season, following several weeks of relatively wet conditions and high stream flows and turbidity.

Results

Upper 8.9 miles–No steelhead redds were found. Only one adult steelhead of unknown status (i.e., spent or fresh) was seen. Despite the relatively poor survey conditions, in my opinion there were relatively few adult fish in the survey reach. I base this on observing the bottom of several of the better pools (where fish are generally sighted) in which I did not see any fish.

Lower 9.4 miles–No steelhead redds were found. Two adults of unknown status were seen. Due to higher flows and turbidity in this reach than in the upper reach, no conclusions were possible regarding how many adult fish may or may not have actually been present.

Prepared: January 21, 2004; RWD

MEMORANDUM TO THE FILE–#028

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, January 24-25, 2004*, my second complete survey of the index reach for the 2004 season.*

Personnel

This was my second survey of the 2004 season. I surveyed both halves of the survey reach alone, arriving at the put-in at House Creek about 0930 hrs on January 24, 2004. Because I was alone and because Gualala Redwoods, Inc. has recently made the take-out at Twin Bridges much more difficult by installing a new gate blocking any vehicular access to the river (boats being put-in or taken-out now have to be dragged about 150 yards), I decided to use my lightest boat: the 8-foot aluminum (Redwood Welding, Crescent City, CA), which weighs only about 60 pounds.

Survey Methods

The upper half (8.9 miles) of the Wheatfield Fork was surveyed on January 24th, from 0950-1336 hrs, for an average survey rate of about 2.4 mph. The lower half (9.4 miles) of the Wheatfield Fork was surveyed on January 25th, from 0855-1300 hrs, also for an average survey rate of about 2.4 mph. Procedures followed for the survey of both sections were as established during the 2002 steelhead spawning season.

Weather and Stream Conditions

About 1/3-inch of rain fell overnight in the watershed on January 24th, however, the precipitation had stopped just before my arrival at House Creek. This resulted in about a 25 cfs flow increase overnight. As a result, the upper survey reach was slightly off-color (greenish) and did not fully meet my survey criteria (i.e., the observer being able to see the bottoms of the deepest pools, under optimal lighting conditions while wearing polarized sunglasses and a baseball-style cap) at the start of the survey. By day's (the 24th) end, however, survey conditions had markedly improved and very nearly met my survey criteria, due to dropping flow and improving water clarity. Survey of the lower survey reach on the 24th was done under flow and clarity that did meet my condition criteria, however, I had forgotten my polarized sunglasses. Therefore, on the lower reach, I was unable to see the bottoms of the deepest pools and may have missed observing some adult fish that were present.

The Wheatfield Fork, Gualala River real-time stream gage is once again in real-time operation. This former USGS gage is now being operated and maintained by DWR. Flow at this gage from 1000-1330 hrs on January 24th was 166 cfs. In comparison, the flow at the Navarro River gage (USGS) near Navarro at noon on January 24th was about 350 cfs.

On January 25th, the Wheatfield Fork DWR gage indicated about 142-145 cfs between 0900 and 1300 hours. This contrasted to a reading of about 300 cfs at the Navarro River gage at noon on

the 25th.

The weather was partly sunny throughout the day on the 24th, with off-and-on showers, and little or no wind. On the 25th, the weather was sunny until mid-afternoon, then partly sunny with intermittent clouds the remainder of the day. Both days had mild maximum air temperatures of about 58-60^0 F at about 1500 hrs.

This was the second opportunity for a survey this season, following several weeks of relatively wet conditions and high stream flows and turbidity, during which the survey criteria were not met.

A side note is that somewhere (probably during the boat-launch) during the January 24th survey, I contacted poison oak on my left elbow. I originally thought that this was just a spider bite. The contaminated area was then inadvertently spread to my left stomach and side. I subsequently enured about 2 weeks of weeping, itching blisters, requiring an antibiotic treatment and three tubes of Zanfel at $35 a pop, before recovering. This was my first-ever adverse reaction to this plant and its toxic oil; I intend for it to be my last encounter.

Results

Upper 8.9 miles–Six adult steelhead and one new redd (flagged [on left bank] as DEH #1) were recorded. Two of the adults were in association with the redd, which was located in a pool tail-out area, two were singles seen in riffles, and two were counted in a single deep pool. I estimate that three of the adults were fresh and three were spent or in the process of spawning. While I do not believe that I missed any redds, I may have missed adult fish, due to the poor survey conditions, especially during the first half of the float.

Lower 9.4 miles–No definite steelhead redds were found. I did locate a possible old redd at 1225 hrs, but decided it was not confirmable, so it was not marked.

Two adults, one appearing spent and one appearing fresh, were recorded in separate deep pools. This survey reach has much larger and deeper deep pools than the lower reach. Despite the good water clarity, without my polarized sunglasses (which were forgotten in the car), I may have missed a considerable number of adult fish. I doubt that I missed any redds, however.

Prepared: February 16, 2004; RWD

MEMORANDUM TO THE FILE–#029

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, March 13, 2004, ***my third complete survey of the index reach for the 2004 season.***

Personnel

This was my third survey of the 2004 season, a 1-day effort, with Doug Hampton and Ed Ballard, two fellow fish and wildlife biologists from my office. We arrived at House Creek at about 0830 hours, and dropped off my boat. I then drove down to the Annapolis Road bridge, where Doug and Ed disembarked on the lower float, starting at 0917 hours. Then, I drove back up to House Creek and started the upper float at 0936 hours. My shuttle method today, following completion of the upper float, was the gas can trick.

Survey Methods

Doug and Ed where each in one of my 8-foot aluminum mini-drifters (Redwood Welding, Crescent City, CA). I used my new 12-foot 'Lil Willie drift boat. The upper half (8.9 miles) of the Wheatfield Fork was surveyed from 0936-1330 hours, for an average survey rate of about 2.23 mph. The lower half (9.4 miles) of the Wheatfield Fork was surveyed from 0917-1550 hours, for an average survey rate of about 1.45 mph; this relatively slow rate reflected the fact that Doug flipped his boat over and got soaked no less than two times along the way as well as the 40-minute lunch break Ed and Doug took about mid-day along the way.

Procedures followed for the survey of both sections were those established during the 2002 steelhead spawning season.

Weather and Stream Conditions

To my surprise, and despite the lack of any rain for more than two weeks now, the river was still relatively high. Water clarity was very good, however. Conditions were suitable for finding all or most of the redds that may have been present in the survey reaches, however, the relatively high flows prevented us from seeing the bottoms of all of the deepest pools, despite everyone wearing the standard polarized sunglasses.

The former USGS realtime gage on the Wheatfield Fork near Annapolis, now again operating as a DWR realtime gage, showed a mid-day flow of about 150 cfs. In contrast, the USGS Navarro River gage near Navarro showed about 5.25 feet and 360 cfs at mid-day on March 13th.

The weather throughout the day was unseasonably warm and sunny, with no wind. In fact, for several days now, new daily record high ambient air temperatures have been set. This was the first weekend opportunity for a survey since January 24th, following the very heavy precipitation which occurred during late January and February.

Results

Upper 8.9 miles–No steelhead redds were found. The single steelhead redd found so far this season (DeH #1) was no longer discernable; in fact, the area was completely releveled and only a remnant of the original engineer's flagging marking the spot remained.

However, a total of 18 adult steelhead were counted as follows: 4 (in a deep run); 3 (in a bedrock run); 1 (in a shallow riffle); and 10 (in a very deep pool near the end of the survey reach). Based on their behavior and condition, I believe that all of these fish were fresh (not spent). The estimated 10 fish near the end of the reach was a low-reliability estimate, since I could just barely see the pool bottom. About 100 yards from this pool, there were 14 native American teenagers diving and swimming in another deep river pool. This is the first time I have seen any such human activity along this survey reach.

Lower 9.4 miles–No steelhead redds were found. A total of 4 adult steelhead were recorded as follows: 1 (riffle, mid-channel); 1 (lateral scour pool); 2 (shallow riffle). In Ed's judgement, all of these fish were also fresh. Ed and Doug were also harassed during their lunch break by a pack of antisocial teen males, some with firearms, on 4-wheel ATVs. These teens had apparently entered the area from logging roads along the south side of this reach. Ed and Doug reported that this group proceeded to do wheelies and other stunts with their machines in the river. The result was that so much turbidity was stirred up that our minimum survey conditions were not met (couldn't see bottoms of the deepest pools) the rest of the way down the river for Ed and Doug.

Prepared: March 19, 2004; RWD
Revised: March 22, 2004; RWD

MEMORANDUM TO THE FILE–#030

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, March 20-21, 2004, *my fourth complete survey of the index reach for the 2004 season.*

Personnel

This was my fourth survey of the 2004 season, a 2-day effort conducted alone. I arrived at House Creek at 0930 hours and started the survey at 1000 hours, using one of the Redwood Welding's 8-foot aluminum mini drift-boats. After completing the survey of the upper reach on day 1, I stashed the boat and gear near the start of the day 2 float, at the Annapolis Road bridge. During boat days, I used the gas can "trick" to return to my vehicle. Both days I hit the jackpot of the first car stopping to pick me up.

Survey Methods

Procedures followed for the survey of both reaches were as established during the 2002 steelhead spawning season.

The upper half (8.9 miles) of the Wheatfield Fork was surveyed from 1000-1422 hours on March 21st, for an average survey rate of about 2.06 mph. The lower half (9.4 miles) of the Wheatfield Fork was surveyed from 0900-1305 hours, for an average survey rate of about 2.35 mph; this rate was relatively speedy, considering that an upstream wind buffeted me from about 1130 hours until the end of survey at Twin Bridges.

Weather and Stream Conditions

Survey conditions, in terms of water clarity and flow/stage were excellent. There has been no rain in the watershed since March 1, 2004 and daytime air temperatures have been well above average. The hydrograph has been undergoing a gradual, but steady, decline. Most redds should have thus been readily detectable and adult fish counts in most pools probably had good reliability. The only problems was the last 1.5 hours of day 2 on the downstream reach; the wind and surface turbulence prevented good counts of adults in the deeper pools.

The former USGS realtime gage on the Wheatfield Fork near Annapolis, now again operating as a DWR realtime gage, showed a mid-day flow of about 99 cfs and 95 cfs, on days 1 and 2, respectively. In contrast, the USGS Navarro River gage near Navarro showed about 220 cfs and 200 cfs, respectively, at mid-day on days 1 and 2.

The weather throughout the day was unseasonably warm and sunny on day 1, with no wind. Day 2 was punctuated by partly cloudy conditions, coastal fog surging inland, and afternoon upstream winds which severely hampered visibility into the deeper pools.

Results

This was a 'watershed' weekend, so to speak, with relatively high numbers of adult steelhead counted (mostly fresh fish observed in the deepest pools), three steelhead redds discovered, the first lamprey redds of the season found (in one case, with three adults active on one of the redds), numerous rough-skinned newts observed for the first time this season, and several western pond turtles seen basking–also for the first time this season–on logs. The only real low-point of the day occurred at the last deep pool before the Annapolis Road bridge, where six "native Americans" were attempting to gig adult steelhead using a 10-foot-long spear.

Upper 8.9 miles–One very large steelhead redd (DeH#2) was found at 1122 hours and another large redd (DeH#3) was recorded at 1331 hours. Also, a total of six lamprey redds were recorded throughout the reach and at various times.

A total of 12 adult steelhead were counted as follows: 1–fresh–1034 hrs–deep, bedrock run; 1–near redd #2–pool tail-out–spawning; 6–fresh–1302 hrs–deep lateral scour pool; 1–spent–1303 hrs–shallow run; and 3–fresh–1304 hrs–shallow lateral scour pool. There were also additional steelhead adults in the last pool where the "spearing" was going on–which, due to that activity, I was unable to observe or count.

Lower 9.4 miles–One steelhead redd (DeH#1) was found at 1005 hours. A total of three lamprey redds were also found scattered along this reach.

A total of 62 adult steelhead were recorded as follows: 1 (0908 hrs; shallow run); 5 (0919 hrs; deep pool); 3 (0958 hrs; deep run); 21 (1039 hrs; deep pool); 3 (1052 hrs; deep pool); 14 (1149 hrs; deep pool); 2 (1153 hrs; deep pool); 9 (1201 hrs; deep pool); and 4 (1222 hrs; deep pool). In my opinion, all of these 62 adults were fresh. This is interesting, but not surprising, given that the hydrograph has been relatively high and slowly declining for 3 weeks now, giving spent fish plenty of time to exit the spawning grounds and river. The 62 adults actually seen would, I believe, have been a substantially higher number if the afternoon surface turbulence created due to the upstream breeze had not occurred.

Prepared: March 27, 2004; RWD

MEMORANDUM TO THE FILE–#031

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, March 28-29, 2004, *my fifth complete survey of the index reach for the 2004 season.*

Personnel

This was my fifth survey of the 2004 season, a 2-day effort conducted alone. I arrived at House Creek at 1100 hours and started the upper-reach survey at 1134 hours, using one of the Redwood Welding's 8-foot aluminum mini drift-boats. After completing the survey of the upper reach on day 1, I stashed the boat and gear near the start of the second day's float, at the Annapolis Road bridge. During boat days, I used the gas can "trick" to return to my vehicle. On day 1 I hit the jackpot, with the first car along the road stopping to pick me up (and providing a ride all the way back to House Creek); on the second day, I experienced a total meltdown, with several cars ignoring me and a total of four rides obtained getting from Twin Bridges back to the Annapolis Road Bridge. My last ride during this adventure was on a fully loaded big-rig garbage truck, hauling a 20-ton load from the Transfer Station en route to the landfill near Fairfield. This one wasn't fast, but it got me there, and the rig's driver was interesting company (a young hispanic man who's been working 11 hours a day, 7 days a week for 5 years to be able to just purchase a $425,000 house in Santa Rosa).

Survey Methods

Procedures followed for the survey of both reaches were as established during the 2002 steelhead spawning season.

The upper half (8.9 miles) of the Wheatfield Fork was surveyed from 1134-1545 hours on March 28th, for an average survey rate of about 2.13 mph. The lower half (9.4 miles) of the Wheatfield Fork was surveyed from 0900-1305 hours, for an average survey rate of about 2.35 mph.

Note: This was not my usual Saturday or Saturday/Sunday survey. Due to a slight rise in the river on Saturday, I had to reschedule the survey for Sunday and Monday. I took annual leave from work for the Monday survey.

Weather and Stream Conditions

This was one of my more uniquely timed survey events. The watershed had no rain and above-normal air temperatures during the period from March 2-25. The result was a slowly declining hydrograph (as observed for DWR's Realtime Wheatfield Fork gage) which bottomed out at about 85 cfs early on the 25th. However, later on the 25th, the first rain in 3 weeks (about 1.25 inches, as measured at the Venado realtime gage in the nearby Russian River watershed) caused a rapid rise to a peak level of about 277 cfs by midnight. This was followed by a rapid drop in flow to a low of about 112 cfs by midnight on the 26th. Then, about 0.35 inches more rain on the 26th brought the flow back up to165 cfs at about noon on the 27th. However, at 1330 hours on

March 28th, during the upper-reach survey, the flow was back down to 115 cfs. The flow continued a steady decrease and was back down to about 99 cfs at noon on March 29th, during the lower-reach survey.

The weather throughout the 28th was unseasonably warm and sunny with no wind. Day 2 started out quite similar to day 1, but at about 1100 hours a cold wind began surging upstream due to coastal fog moving inland. This caused partly overcast, cool conditions for the remainder of the day. The wind and poor sunlight conditions greatly reduced my ability to see adult fish in the deepest pools.

Results

The rain and flow increase on March 25-27 appeared to have moved upstream, most of the adults recorded holding last week in the deep pools of the lower reach. Very few adults were seen on either the upper or lower survey reaches. Most of the few adults that were seen appeared spent, in contrast to last weekend when most of the 74 adults seen were fresh. In addition, whereas last week I observed western pond turtles, actively spawning lampreys, and dozens of rough-skinned newts, only one newt and no turtles or lampreys were observed during this weeks 2-day survey.

Upper 8.9 miles–One new steelhead redd (DeH#4) was found at 1155 hours and another new redd (DeH#5) was recorded at 1245 hours. One steelhead redd (DeH#2) first recorded on March 20th was no longer discernable and thus the flag was removed; another steelhead redd (DeH#3) also first recorded on the 20th, was deemed to be marginally visible (I thought that an *experienced* observer *may* have found it) and thus its unique flag was left in place.

Also, a total of nine lamprey redds were recorded throughout the reach and at various times. It is unknown whether any of these were among the six lamprey redds I counted last weekend, since lamprey redds are not, as yet, being uniquely marked.

A total of 6 adult steelhead were counted as follows: 1–fresh–1138 hrs–shallow riffle; 2–spent–1148 hrs–riffle; 1–spent–1203 hrs–run; and 2–unknown–1333 hrs–pool under rootwad. The Berkeley YMCA pool and the Indian Spearing pool were both notably devoid of any adults.

Lower 9.4 miles–One new steelhead redd (DeH#2) was found at 1246 hrs. The one previous redd (DeH#1) found along this reach now looked like a pair of lamprey redds (i.e., was *not* currently discernable), however, the flag was left in place to provide training for my fellow surveyors. A total of nine lamprey redds were also found scattered along this reach, compared to three counted on the last survey on March 21st. Neither the March 21st lamprey redds nor today's lamprey redds were uniquely marked for site-specific identification, however.

Only two adult steelhead were observed, as follows: 1 (1027 hrs; spent; in a shallow riffle); and 1 (1033 hrs; spent; in a lateral scour pool). Notably, several of the deepest pools along this reach in which adults are consistently observed, appear to be devoid of any adults today, including the

Yellow Rope pool (1138 hrs), ATV pool (1150 hrs), and the super-long, deep pool just downstream of the Power Line Crossing (1320 hrs).

In addition, one age 2+ juvenile steelhead was observed in a riffle area at 1112 hrs.

At 1255 hrs a tiny stream entering from the right bank (downstream aspect) was observed to still be carrying a sediment load, despite all other tributaries along this reach running clear.

Prepared: April 2, 2004; RWD

MEMORANDUM TO THE FILE–#032

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, April 3, 2004, *my sixth complete survey of the index reach for the 2004 season.*

Personnel

This was my sixth survey of the 2004 season, a 1-day effort conducted with fellow biologist Ed Ballard from my office. We arrived at the House Creek/Wheatfield Fork confluence at 0900 hrs, then proceeded downstream by car to the survey mid-point, the Annapolis Road bridge. There, I dropped Ed off and he began the lower- reach survey at 0945 hrs. I drove back to House Creek, put in my boat and began the upper-reach survey at 1005 hrs. Both of us floated downstream in one of the Redwood Welding's mini 8-ft drift-boats.

Survey Methods

Procedures followed for the survey of both reaches were as established during the 2002 steelhead spawning season.

The upper half (8.9 miles) of the Wheatfield Fork was surveyed from 1005-1425 hrs for an average survey rate of about 2.06 mph. The lower half (9.4 miles) of the Wheatfield Fork downstream to Twin Bridges was surveyed from 0945-1540 hrs, for an average survey rate of about 1.57 mph. Ed's relatively slow rate was due to his inexperience with this reach and the fact it was his first time down it alone.

Weather and Stream Conditions

The DWR realtime gage on the Wheatfield Fork near Annapolis indicated a flow of about 66 cfs at noon. This was the lowest flow recorded during any of the six surveys conducted so far this season.

Air temperature was about normal and atmospheric high pressure was building throughout the day. This caused both of us to encounter significant head winds blowing upriver after about noon and lasting until the end of each sub-reach survey. The resulting surface turbulence in turn limited our visibility into several of the deepest pools. However, this was somewhat offset by the very low flow and very clear water conditions. The net result was that I do not believe that a large number of adult fish were missed along either sub-reach and I think that we found most, if not all, of any steelhead redds that were present.

Results

Only four adult steelhead were seen along the entire survey reach. This compares with 8 seen last week and 74 adults recorded the week before that. In addition, whereas 2 weeks ago I observed western pond turtles, actively spawning lampreys, and dozens of rough-skinned newts, only one newt and no turtles or lampreys were observed during this week's 1-day survey.

Upper 8.9 miles–Only one new steelhead redd was observed, at the site of a previous redd (DeH#2) I first observed on March 20th and which became nondiscernible last week, thus prompting me to remove its flagging. The new superimposed redd is in the same location, but it is even larger that the previous redd, which was itself quite a large one. In addition, one redd (DeH#4) first found last week was no longer discernable as a steelhead redd (and not a lamprey redd) (the flag was left in place). One other redd first found last week (DeH#5) and one first found the previous week (DeH#3) were both still discernable, however. Also, a total of nine lamprey redds were recorded throughout the reach and at various times, the same number as last week.

Only two adult steelhead were seen, as follows: one–spent–1113 hrs–concrete pad pool; and one–spent–1319 hrs–shallow riffle. It is noteworthy that the Berkeley YMCA pool and the two Indian Spearing pools were all clearly visible and just as clearly devoid of any adults.

Lower 9.4 miles–Only one new steelhead redd (DeH#4) was found at 1024 hrs. One (DeH#1) of the two previous redds found along this reach was now marginally discernable, without a well-defined redd shape. Ed did not locate and observe the other previously marked redd (DeH#2). A total of nine lamprey redds–the same number as observed last week–were recorded along this sub-reach.

Ony two adult steelhead were observed, as follows: one (1252 hrs; spent; in a shallow riffle); and one (1328 hrs; spent; in a log-enhanced scour pool). Notably, several of the deepest pools along this reach in which adults are consistently observed, appeared to be devoid of any adults today, including the Yellow Rope pool (1225 hrs), ATV pool (1320 hrs), and the super-long, deep, pool just downstream of the Power Line Crossing (1438 hrs).

Notably, neither of us observed another human being today.

Prepared: April 5, 2004; RWD

MEMORANDUM TO THE FILE–#033

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, April 10, 2004*, my seventh complete survey of the index reach for the 2004 season.*

Personnel

This was my seventh survey of the 2004 season, a 1-day effort conducted with fellow biologist Adam Zerrenner from my office. Adam is an East-coaster (New York). He did his Master's and worked for Fish and Wildlife Service for 4 years studying the lamprey problem and control in the Great Lakes. He has seen hundreds of lamprey redds and is an expert on their biology and ecology.

We arrived at the House Creek/Wheatfield Fork confluence at 0900 hrs, then proceeded downstream by car to the survey mid-point, the Annapolis Road bridge. There, I dropped Adam off and he began the lower-reach survey starting at 0945 hrs. I then drove back upstream to House Creek, put in my boat, and began the upper-reach survey at 1020 hrs. Both of us floated downstream in one of mini 8-ft aluminum drift-boats (from Redwood Welding in Crescent City, California).

Survey Methods

Procedures followed for the survey of both reaches were as established during the 2002 steelhead spawning season.

The upper half (8.9 miles) of the Wheatfield Fork was surveyed from 1020-1510 hrs for an average survey rate of about 1.84 mph. The lower half (9.4 miles) of the Wheatfield Fork downstream to Twin Bridges was surveyed from 0945-1545 hrs, for an average survey rate of about 1.57 mph. Adam's rate was relatively rapid, despite the fact he had never been on this reach, nor on the Gualala River, in his life.

Weather and Stream Conditions

There has been no precipitation in the watershed since the last survey 1 week ago. As a result, flow is now very low compared to 50-year average flows for this date.

The DWR realtime gage on the Wheatfield Fork near Annapolis indicated a flow of about 48 cfs at noon. This was the lowest flow recorded during any of the seven surveys I have conducted so far this season. This level of flow has almost made the river unnavigable (the amount of dragging is now rapidly approaching the amount of floating) via my small aluminum boats; 40-50 cfs is probably a good cut-off point for switching from the boats, to simply walking the survey reaches. As another index, the USGS gage near Navarro on the Navarro River showed a flow of 97 cfs at noon.

Water temperature is, due to the low flow and unseasonably warm conditions (with lack of rain) of late, now bordering on being adverse for steelhead spawning. While I recorded a temperature of 57^0F at the upstream end of my survey reach at 1040 hrs, the water at Twin Bridges at 1600 hrs was 64^0F.

The weather was clear and mild. My survey reach also had calm winds; however, Adam encountered upstream winds in the afternoon, due to intrusion of marine air from the coast. This marginally limited his ability to see the bottoms of the last few deepest pools. Overall, however, with the extremely low flow and excellent water clarity, the net result of the conditions we had was that I do not believe that a large number of adult fish were missed along either sub-reach and I think that we found most, if not all, of any steelhead redds that were present.

Results

Only two adult steelhead were seen along the entire survey reach. This continued the trend of the past few surveys for very low numbers of adults observed despite the low-flow conditions. We also saw a total of four adult lampreys, including three on the lower reach (two of which were spawning) and one along the upper reach. Adam also observed one western pond turtle, whereas I saw none. I did observe about six rough-skinned newts along the upper reach, however (Adam did not report any).

Upper 8.9 miles–Four new steelhead redds were found and marked as follows: DeH#6–1026 hrs–7 paces left bank; DeH#7–1148 hrs–10 paces left bank; and DeH#8-9 (side-by-side)–1327 hrs–15 paces left bank.

Discernability of the previously marked redds were as follows: DeH#2=still discernable; DeH#5=still discernable; DeH#3=now looks like a lamprey, not a steelhead redd, and I am sure that my original determination of steelhead was accurate; and DeH#4 was still not discernable (first became non-discernable last week). Also, a total of 21 lamprey redds were recorded throughout the reach and at various times, the largest number counted this season.

No adult steelhead were seen. It is noteworthy that the Berkeley YMCA pool, the two Indian Spearing pools, and the concrete slab pool, were all clearly visible and just as clearly devoid of any adults. On adult lamprey was recorded in a shallow riffle at 1245 hrs.

Lower 9.4 miles–Two new steelhead redds were found and marked as follows: DeH#6–time NR–3 paces right bank; and DeH#7–time NR–7 paces RB. Another SH redd, DeH#5 (4 paces right bank) was also marked, but Adam decided during a post-survey discussion with me that this was likely 2-3 lamprey redds.

Status of previously marked SH redds: DeH#3 (marked last week by EB)=determined to be lamprey redds with additional fresh gravel; DeH#4 (marked last week by EB)=not found by AZ; DeH#1 (originally found by RD and thus SH-confirmed)=now looks like two lamprey pits; DeH#2 (orignally found 3/29 by RD and thus SH-confirmed)=now just barely discernable and

probably would not have been found today. A total of 26 lamprey redds–the largest total to date this season–were observed, but not marked.

Ony two adult steelhead–the same number seen last week–were observed, as follows: one (1030 hrs; unknown condition; habitat type NR); and one (1200 hrs; spent; habitat type NR). Notably, there were no adults seen in the most prominent pools (where most of the adults are typically recorded) including the Yellow Rope pool, ATV pool, and the super-long, deep, pool just downstream of the Power Line Crossing. Of the three adult lampreys Adam recorded, two were a pair on an active redd and one was alone in a riffle.

Also, notably, neither of us observed another human being today.

Prepared: April 18, 2004; RWD

MEMORANDUM TO THE FILE–#034

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: Spawning survey, Wheatfield Fork, from House Creek Confluence Downstream 18.3 Miles to South Fork Confluence, April 24, 2004*, my eighth and last complete survey of the index reach for the 2004 season.*

Personnel

This was my eighth and last complete survey of the 2004 season, a 1-day effort conducted with fellow biologist Ed Ballard from my office. As indicated earlier, Ed has extensive experience (10+ years) working with salmon and steelhead.

We arrived at the House Creek/Wheatfield Fork confluence at about 0915 hrs, then proceeded downstream by car to the survey mid-point, the Annapolis Road bridge. There, I dropped Ed off and he began the lower-reach survey starting at 0950 hrs. I then drove back upstream to House Creek and began the upper-reach survey at 1010 hrs. We were unable to float in the drift boats today; river flow was just too low. Both survey reaches had to be walked.

Survey Methods

Other than that we were walking along the streambed, rather that floating, the procedures followed for the survey of both reaches were as established during the 2002 steelhead spawning season. However, in addition, Ed wore his wet-suit and carried his snorkeling gear. He snorkeled through all of the deeper pools after first walking them, to make sure that no adult steelhead were missed while walking along the stream.

The upper half (8.9 miles) of the Wheatfield Fork was walked from 1010-1545 hrs for an average survey rate of about 1.62 mph. The lower half (9.4 miles) of the Wheatfield Fork downstream to Twin Bridges was surveyed from 0950-1730 hrs, for an average survey rate of about 1.25 mph. Ed's relatively slow survey rate was due to the additional time spent snorkeling all of the deeper pools after first walking along them.

Weather and Stream Conditions

Drought-like conditions continue to prevail throughout the watershed. The flow at noon on the survey date was 37 cfs at the DWR Wheatfield Fork gage. The period since the last survey on April 10th has seen little hydrograph change. Despite 4 days of light-to-moderate rain during April 18-21, the river hydrograph (at the DWR Wheatfield Fork gage) bumped up twice only slightly–from a low flow of about 34 cfs to about 111 cfs on April 21 and then up again (after dropping back to about 59 cfs) to about 78 cfs on April 22. The 37 cfs at the time of this survey is the lowest flow I have yet observed this season as well as the lowest flow I have observed overall during my 4 years of spawning surveys on the river. At such a low flow, the river mouth at the Ocean may well have been blocked by a sandbar, thereby preventing any adult steelhead migrations. A flow of about 40-50 cfs is roughly the cut-off point for switching from the boats for conducting surveys to just walking along the stream.

The weather during this last survey of the 2004 season was clear and mild. My upper survey reach also had calm winds; however, Ed encountered late afternoon upstream winds, due to a slight intrusion of marine air from the coast. This marginally limited his ability to see the bottoms of the last few deepest pools while walking along the stream bank. However, his snorkeling effort was able to confirm adult steelhead presence/absence in these deeper pools. Because of Ed's snorkeling efforts and the very low flows, I believe that few, if any, adult steelhead or steelhead redds were missed.

Results

We did not observe any adult steelhead along the 18.3-mile survey reach. This continued the trend of the past few surveys towards very low numbers of adults observed, despite the low-flow conditions. This suggests that the mouth of the river has likely been closed. In addition, we did not see any adult lampreys, although April is usually their peak month, again suggesting that the mouth has been closed.

We did observe two new (since the last survey) steelhead redds, one each along the upper and lower survey reaches and a total of 23 lamprey redds (total redds, not *new* redds). In addition, we observed several foothill yellow-legged frogs, western pond turtles, and one spawning mass of about 10,000 Gualala roach. However, in contrast to previous recent surveys, no rough-skinned newts were observed.

Upper 8.9 miles–The one new steelhead redd was found at 1331 hrs. It was not marked, since this was the last survey of the season.

Discernability of the four steelhead redds first found during the April 10th survey was as follows: DeH#6–Likely not now discernable; DeH#7–Not discernable as SH–now looks like a lamprey pit; and DeH#8-9 (side-by-side)–One discernable and one not discernable.

The discernability of SH redds first marked previous to the April 10th survey was: DeH#2=still discernable; all other SH redds had previously become indiscernable.

The school of 10,000 Gualala roach were observed at 1054 hrs., 2 western pond turtles were seen at 1100 hrs., and 2 yellow-legged frogs (juveniles) were seen at 1152 hrs.

Lower 9.4 miles–The one new SH redd was seen at 1146 hrs. It was not marked.

Discernability of previously found and marked SH redds was: DeH#3–first marked by EB, then determined by AZ to have been a lamprey, now viewed as a SH redd by EB on this survey. DeH#4–still discernable as SH (first called by EB); DeH#4 (marked last week by EB)=not found by AZ; DeH#1 (originally found by RD and thus SH-confirmed)=first looked like two lamprey pits on April 10th=now looks like one lamprey redd; DeH#2 (originally found 3/29 by RD and thus SH-confirmed)=was just barely discernable and probably would not have been found on April 10th=now totally ND.

Also, notably and adding to our enjoyment, neither of us observed another human being today–except on the road to and from the survey sites.

Prepared: July 27, 2004; RWD

MEMORANDUM TO THE FILE–#035

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: 2004 Reconnaissance-Level Juvenile Salmonid Snorkeling Surveys*, survey #1 on June 5-6.*

Purpose and Objectives

Snorkel surveys are a proven and effective method of observing and counting juvenile salmonids in streams of various sizes. I initiated reconnaissance-level snorkeling surveys at various locations on the Gualala River during the summer of 2004. Based on the results from these initial surveys, I intend to design a long-term snorkeling survey protocol to be initiated in 2005. This protocol would then be conducted for at least several years. Snorkeling survey data alone or in combination with the spawning survey data I am already gathering may achieve the goal I am pursuing–determining the present status and trend of the steelhead population in the Gualala River.

Personnel

This initial snorkel survey was conducted with Ann Bowers, a biologist from my former office at the U.S. Fish and Wildlife Service in Sacramento. Ann is a SCUBA diver and experienced snorkeler. However, prior to this trip, she had not observed juvenile salmonids while snorkeling.

On the other hand, this was my first snorkeling experience in more than 40 years. It was prompted partly by my new-found ability, due to recent LASIK eye surgery, to see through a diving mask–without the aid of my old "coke-bottle" corrective lenses.

Survey Methods

This initial survey was conducted over 2 days on June 5-6, 2004. We wore standard wet-suits, diving masks and snorkels. Water temperature was recorded, using a mercury thermometer, at each of the snorkeling locations. General observations were also recorded, while walking along the stream banks prior to or after the snorkeling effort at each site.

We arrived at the first sampling location (hereafter, site #1), along Wolf Creek, about ½ mile upstream of its confluence with the Wheatfield Fork at 1300 hrs on June 5th. We also sampled: (#2) at the mouth of House Creek; (#3) along the Wheatfield Fork, about 4.5 miles downstream of the mouth of House Creek; and (#4) along the lowermost 200 yards of Haupt Creek, during June 5th. During June 6th, we sampled: (#5) the lowermost 100 yards of the North Fork; (#6) for 75 yards up the mainstem, upstream of the North Fork mouth; and (#7) the large, deep, pool 1/4-mile downstream of the North Fork mouth.

Weather and Stream Conditions

Typical summer weather prevailed both days, with clear skies, warm temperatures, and little or no wind. Maximum air temperatures were ranging into the upper 80s (^{0}F) and low 90s in the afternoon, depending on location, and about 50-60^0 F at night. As usual, the higher ambient air

temperatures occurred along the more easterly portions of the watershed, while the westerly portion of the watershed was coolest, due to the Ocean influence. There was only minimal intrusion of coastal fog along the westerly portion of the watershed during the 2-day sampling period.

Results and Discussion

#1: Given the dry conditions of the past 3 months, I was surprised that Wolf Creek was still flowing, albeit at a rather modest 1-2 cfs, at most. I was also surprised at the large number of juvenile steelhead (JSH), age 1-2+, that were present. The JSH were mixed about 50/50 with small schools of Gualala roach. Water temperature at 1350 hrs was 72^0 F. JSH were in every pool and riffle we visually checked along about 100 yards of the stream. Snorkeling was done along about 50 yards of stream to confirm the above-water observations, including the JSH/Gualala roach identification.

#2: The mouth of House Creek where it enters the Wheatfield Fork, as well as the pools, runs and riffles immediately upstream along House Creek, was alive with hundreds of JSH of various ages. Due to the higher flows (i.e., several cfs) and turbulence, as compared to conditions along Wolf Creek, accurate fish ID was difficult to impossible from visual observations while walking along the stream; however, the snorkeling allowed easy fish ID and enumeration. The sampled area also contained moderate numbers of Gualala roach as well as a few large threespine stickleback. No other fish species were observed. Water temperatures at 1530 hrs were 80^0 F and 76^0 F, respectively, in the Wheatfield Fork and in House Creek immediately upstream of its mouth.

#3: The third sampling location, along the Wheatfield Fork about 4.5 miles downstream from House Creek, is where I observed (when I first began surveys of spawning adult steelhead) a woman living along the river in her Plymouth Voyager minivan for a period of at least 2 years. Henceforth, I will thus refer to this location as the "lady-in-the-car" spot. The area sampled here was primarily fast-flowing water. Few or no JSH could be seen (for identification) while walking along the stream. However, the snorkeling, conducted along about 100 yards, revealed one group of about 50 JSH and several small groups of about 1-5 JSH. These fish were all in fastest-flowing water and either underneath or very near major cover elements, primarily boulders. We inadvertently failed to measure and record the water temperature at the site, but my recollection is that it was very warm–probably at least 80^0 F (based on the 80^0 F recorded farther upstream at House Creek).

#4: We arrived at the Haupt Creek sample area, in the vicinity of where the large logjam used to occur (about 100 yards upstream of the creek's mouth) at 1630 hrs. The water in this reach was relatively cool (est. $65\text{-}70^0$ F), however, we again failed to measure and record it. JSH YOY (young-of-year) were moderately abundant in all the pools, runs, and riffles, as determined by walking along the stream. We did not snorkel in this area, due to the ease of fish ID as enhanced by the very low flow (est.<1 cfs) and lack of surface turbulence.

#5: The North Fork was flowing surprisingly high, with a flow of at least several cfs. Water temperature at 1000 hrs was 60^0 F. The comparatively fast-moving water and surface turbulence limited the above-stream observations; we saw only a few unidentified fish in the shallow stream margins. Snorkeling revealed that JSH were indeed low in abundance, with only about 25 total JSH seen, mostly in the shallower, warmer, edge-waters. About 100 yards of the stream were snorkeled.

#6: The mainstem of the river upstream of the North Fork mouth was 65^0 F at 1030 hrs. Neither the visual observations from above the water nor the snorkeling, along about 75 yards of stream, revealed any JSH or other fish species.

#7: About a 200-ft reach of the large, deep, pool area 1/4-mile downstream of the mouth of the North Fork was sampled. No fish could be seen in while walking along this reach. However, during the snorkeling, dozens of JSH of various ages, included many very large individuals 8-10 inches or more in total length, were easily seen and recorded. The water temperature at the sample site at 1130 hrs was 65^0 F.

Prepared: September 10, 2004; RWD

MEMORANDUM TO THE FILE–#036

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: 2004 Reconnaissance-Level Juvenile Salmonid Snorkeling Surveys*, survey #2 on July 3-4.*

Purpose and Objectives

The purpose and objectives are the same as stated in Memorandum #035.

Personnel

I conducted all of the snorkeling during this second reconnaissance-level snorkeling survey alone. However, Phyllis DeHaven was along to record water temperatures and assist in case of a snorkeling mishap.

Survey Methods

This survey was conducted over 2 days on July 3-4, 2004. Survey methods and locations were the same as described in Memorandum #035. In addition, two new locations along the Wheatfield Fork were added: site #3A–for about 75 yards immediately upstream of the Annapolis Road bridge; and site #4A–in three pool-riffle combinations (about 50 yards) underneath the upper of the two "twin bridges," about 100 yards upstream of the South Fork confluence with the Wheatfield Fork of the river.

Weather and Stream Conditions

Typical summer weather prevailed both days, with clear skies, warm temperatures, and little or no wind. Maximum air temperatures were ranging into the upper 80s (^{0}F)and low 90s in the afternoon, depending on location, and about 50-60^0 F at night. As usual, the higher ambient air temperatures occurred along the more easterly portions of the watershed, while the westerly portion of the watershed, which is influenced by the Ocean, was coolest. There was substantial intrusion of coastal fog along the westerly portion of the watershed the evening of July 3rd.

Results and Discussion

#1: Wolf Creek was still flowing at about 1-1.5 cfs. JSH and Gualala roach (at about a 1:1 ratio) were still abundant throughout the sample reach. Identification was adequate while walking along the stream, so there was no need for snorkeling. The majority of the fish were in pools, although they were spread throughout all of the various habitat types. Water temperature at 1300 hrs on July 3rd was 79^0 F; air temperature while we were at the site ranged from 89 to 90^0 F.

#2: The mouth of House Creek where it enters the Wheatfield Fork, as well as the habitat immediately upstream along House Creek, was sampled (walking and snorkeling) between 1330 and 1420 hrs on July 3rd. In House Creek, JSH were still relatively abundant, but could be readily identified only by snorkeling, due to the turbidity (algal growth) and substantial areas with surface turbulence. JSH of various age classes were present. Roach were also abundant. Threespine stickelback were not observed. In the Wheatfield Fork, on the other hand, only roach

were observed. Water temperatures during the sampling were 78-79^0 F in House Creek and 84^0 F in the Wheatfield Fork. Ambient air temperature was not recorded, but was probably in the low 90s.

#3: The lady-in-the-car spot was sampled (walking and snorkeling) from 1430-1500 hrs on July 3rd. Water temperature was an incredible 84^0 F. Only one age 2+ JSH was seen in the fast-moving water where about 75 JSH were observed during the first survey on June 5th. However, despite the supposedly lethal stream temperature, the deep pool below the waterfall held several age 2+ JSH and one or two very large (>10 inches TL) JSH or resident trout.

#3A: The Annapolis Road Bridge site was sampled (walking and snorkeling) from 1500-1530 hrs on July 3rd. At this time, this site was mostly a large, deep, slow-moving pool with abundant woody debris and some aquatic vegetation. The deepest parts of the pool were noticeably cooler than surrounding areas, thus perhaps providing some thermal refuge. Water temperature was 79^0 F in the warmest areas. Gualala roach, many quite large, were abundant. Several schools of large, threespine stickleback were also present. A few age 2+ JSH in poor condition (with obvious fin erosion) were observed holding in the deepest areas of the pool.

#4: The Haupt Creek site was sampled (walking only) at about 1030 hrs on July 4th. Water temperatures ranged from 64 to 65^0 F. The first 100 yards of stream above the bridge had become dry; above that, the stream was still flowing, but beginning to dry, with fish isolated in the drying pools. JSH were abundant in all pools and some of the riffles and other fast-water.

#4A: The Twin Bridges site was sampled from 1600-1630 hrs on July 3rd. Water temperature was 70^0 F. In the two pool-riffle combinations that were walked and snorkeled, JSH of various age-classes and Gualala roach were both moderately abundant, and threespine stickleback were common but less abundant. No other species were seen.

#5, #6, and #7: The North Fork site still had a surprisingly good flow of a few cfs on July 4th at 0915 hrs. Water temperature was 62^0 F at the North Fork mouth. None of these three sites were snorkeled, because I had only my "shorty" wetsuit–for which the water was too cold. However, the presence of JSH was confirmed in both the North Fork and in the downstream pool area, while walking along the stream.

Prepared: September 10, 2004; RWD

MEMORANDUM TO THE FILE–#037

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: 2004 Reconnaissance-Level Juvenile Salmonid Snorkeling Surveys, *survey #3 on July 31.*

Purpose and Objectives

See Memorandum #035.

Personnel

I conducted the snorkeling during this third reconnaissance-level snorkeling survey alone. However, Phyllis DeHaven accompanied me to record water temperatures and assist in case of a snorkeling mishap.

Survey Methods

This was a single-day effort conducted on my birthday–July 31st. Survey methods and locations were the same as described in Memoranda #035 and #036. However, not all sites were sampled, due to time limitations and my failure to bring all necessary equipment. I did bring along my new underwater camera to begin acquiring photos of the fish and their habitats, however.

Weather and Stream Conditions

Weather was overcast and atypically cool during the survey and the drive over from my home in Davis, California. We encountered fog and/or a cool breeze in most of the low-lying areas.

Results and Discussion

#1: Given the long period (>5 months) since the last rainfall, I was surprised to find that Wolf Creek was still flowing at about 1-1.5 cfs. JSH and Gualala roach were still abundant throughout the sample reach, however, it appeared that JSH had become the more abundant of the two species. Fish identification was adequate while walking along the stream, but snorkeling was also done to confirm the above-stream observations. Underwater photos were taken or several mixed groups of JSH and roach. The majority of fish were in the pools, although smaller numbers were spread throughout all of the other habitat types. Water temperature at 1035 hrs was 64^0 F, but increased to 65^0 F during the 30 minutes we were at the site.

#2: The mouth of House Creek where it enters the Wheatfield Fork, as well as the habitat immediately upstream along House Creek, was sampled (walking and snorkeling) between 1140 and 1200 hrs. Water temperature was 69^0 F in House Creek and 78^0 F in the Wheatfield Fork. Compared to the previous survey on July 3rd, JSH abundance had declined dramatically throughout the site. Gualala roach and JSH were observed at about a 10:1 ratio. A few (<20) threespine stickleback were also observed.

#3: After careful consideration, I opted not to sample at the lady-in-the-car site. The unimproved road leading down to the river at this location is littered with more than a dozen old

car batteries and several stripped automobiles. When we arrived at the entrance to the site at 1230 hrs, it appeared (from the cars and voices that could be seen/heard) that more of this illegal dumping activity may have been in progress, so I continued on to the next site at the Annapolis Road Bridge.

#3A: The Annapolis Road Bridge site was sampled (walking and snorkeling) from 1330 to 1400 hrs. Water temperature was 64^0 F. A few (<10) large JSH or trout were seen in the deepest portion of the main pool area. Several large (>100) schools of roach and one large school of stickleback were also seen in the main pool area.

#4: The Haupt Creek site was quickly examined on foot only (no snorkeling) at about 1800-1810 hrs. The first 100 yards or so of the stream were dry. Upstream of that, only a series of disconnected (i.e., no surface flow), drying pools remained. JSH and Gualala roach were present in every pool.

#4A: The Twin Bridges site was examined (walking and snorkeling) from about 1425-1500 hrs. Water temperature was 69^0 F. Flow had declined substantially since the last survey on July 3rd. While there were still JSH present, they were much less abundant than on July 3rd. Gualala roach comprised about 75-85 percent of all fish seen. Stickleback were not observed.

#5, #6, and #7: The North Fork and surrounding area site was checked (walking and snorkeling) from about 1630-1700 hrs. Water temperature in the deep pool 1/4-mile downstream of the North Fork mouth was 73^0 F; temperatures were not taken at the other locations. Dozens of people were swimming and sunbathing in the area. Numerous vehicles were being driven around on the gravel and cobble bars. The snorkeling revealed a moderate abundance of JSH–mostly age 2 and greater–despite all the disturbance from human activity. Roach were also abundant in certain locations. Stickleback were not seen.

Prepared: October 18, 2004; RWD

MEMORANDUM TO THE FILE–#038

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: 2004 Reconnaissance-Level Juvenile Salmonid Snorkeling Surveys*, survey #4 on September 14-15.*

Purpose and Objectives

See Memorandum #035.

Personnel

This was a 2-day trip to the river I conducted alone.

Survey Methods

Survey methods and locations were the same as described in Memoranda #035, #036 and #037. All of the previously examined sites were sampled, most by snorkeling as well as walking along the bank. In addition, a new site (#8) was examined on the South Fork–about a 50 yard reach directly underneath the Stewarts Point-Skaggs Springs Road bridge.

Weather and Stream Conditions

Although this was mid-September, warm, dry, summer weather prevailed, with maximum air temperatures ranging into the low 90s (^{0} F). A strong high pressure was in place over the region and a 20-25 mph N/NW wind was blowing along the coast. Most of the areas sampled over the 2-day-period were sunny and breezy, from the N/NW prevailing wind.

Results and Discussion

#1: Given the more than 6-month period since the last rainfall, I was surprised to find that Wolf Creek was still continuously flowing, although the flow volume was likely well less than 1 cfs. When I arrived at noon on September 14th, the air and water temperatures were 93^0 F and 61^0 F, respectively. Snorkeling and walking were both done, but the snorkeling had to be confined to the deeper pools, due to the very low flow. JSH were still relatively abundant, mainly in the pools, but also in some extremely shallow areas. However, the JSH were in generally poor condition–very lanky and thin. JSH were present in every pool along the 100 yards or so of stream that I sampled. Gualala roach were also still relatively abundant. JSH:roach ratios averaged about 2:3 in most areas. A few small, threespine stickleback were also mixed in with the JSH and roach. In contrast to my earlier visits, the streambed in this reach was now extensively damaged due to obvious livestock (cattle) tramping and watering activity.

#2: The mouth of House Creek where it enters the Wheatfield Fork, as well as the habitat immediately upstream along House Creek, was sampled (walking and snorkeling) between about 1315 and 1345 hrs on September 14th. Air temperature was 74^0 F with a cool breeze blowing. Water temperature was 63^0 F in House Creek 100 yards upstream of the mouth, while the Wheatfield Fork at the mouth of House Creek was 74^0 F. Gualala roach were abundant (500-

1,000 seen), a few small threespine stickleback were seen, but no JSH were observed (I did have three "possible" sightings, that, due to the turbidity from algal growth, could not be confirmed).

#3: The lady-in-the-car spot, along the Wheatfield Fork, was sampled (walking and snorkeling) from 1400 to 1430 hrs on September 14th. Air and water temperatures were 79^0 and 74^0 F, respectively, and the estimated flow, which was still continuous, was about 1-2 cfs. The same area that was snorkeling during the first survey on June 5th was resampled. No JSH or trout were observed. However, Gualala roach and threespine stickleback, at roughly a 10:1 ratio, were moderately abundant along the sampled reach.

#3A: The Annapolis Road Bridge site was sampled (walking and snorkeling) from 1445 to 1522 hrs. Water temperature was 69^0 F while the air was 84^0 F. The surface flow in this area was very low and discontinuous–much lower than at site #3. While the large pools remained, they were not connected by any surface flow. No JSH or trout were observed. Roach and stickleback, at roughly a 100:1 ratio, were moderately abundant in the deep pool just upstream of the bridge.

#4: The Haupt Creek site was examined on September 15th. The entire 300-yard reach that I walked upstream of the creek mouth was bone dry. The drying pools that I observed in the upper reach on July 31st were gone, as were all the fish.

#4A: The Twin Bridges site was examined (walking and snorkeling) from about 1145-1215 hrs on September 15th. Water temperature was 65^0 F with an air temperature of 76^0 F. Flow had declined substantially since the last survey on July 31st. Several large pools remained, but they were not connected by any surface flow. Gualala roach were abundant and the only fish observed.

#5: The North Fork was flowing continuously with about 1-1.5 cfs when checked at 1000 hrs on September 15th. Air and water temperatures at this time were 68^0 and 60^0 F, respectively. About 150 feet of stream upstream of the mouth were walked and snorkeled. Relatively low numbers of JSH, both YOY and older, were observed. Several Age 2+ JSH were in the riffle where the North Fork empties into the mainstem. No other species were observed.

#6: The mainstem of the river for 100 yards upstream of the North Fork mouth was checked by snorkeling and walking. No fish were seen.

#7: The large, deep pool area 1/4-mile downstream of the North Fork mouth was snorkeled and walking from about 1100 to 1130 hrs. The air was 78^0 F and the water was 64^0 F. JSH Age 2+ and in excellent condition were still present, but in numbers below those seen during the earlier surveys. There were also some YOY JSH present in some areas. Gualala roach were present as well, but generally less abundant than the JSH.

#8: The new site on the South Fork underneath the Stewarts Point-Skaggs Springs Road bridge was examined twice–at 1545 on September 14th (walking only) and again at 1245-1315 hrs on

September 15th (walking and snorkeling). The surface flow in this reach was very low (<1 cfs) and intermittent. Several of the large pools were not connected by any surface flow. I lost my thermometer somewhere at the site and could thus not record temperatures. JSH of various ages (YOY-2+) were moderately abundant in the pools, especially those with good instream cover. Roach and stickleback were also seen. In some areas, roach were most abundant; in others, JSH were most abundant. Overall, hundreds of JSH were present and appeared to be in good condition.

Prepared: October 19, 2004; RWD

MEMORANDUM TO THE FILE–#039

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: 2004 Reconnaissance-Level Juvenile Salmonid Snorkeling Surveys*, survey #5 on October 6.*

Purpose and Objectives

See Memorandum #035.

Personnel

This was a quick 1-day trip to the river that I conducted alone.

Survey Methods

Survey methods and locations were the same as described in Memoranda #035-#038. All of the previously examined sites were rechecked by walking along the stream. No snorkeling was done. My objective was only to confirm the presence/absence of JSH and to record the end-of-summer streamflow conditions, in particular, whether the stream was dry, intermittent (i.e., with some subsurface flow), or flowing continuously. Stream and air temperatures were not taken, since at this late date, it is unlikely that water temperatures were still a significant mortality factor. One new site (#9)–Fuller Creek at the Annapolis Road bridge crossing–was also briefly examined for presence/absence of JSH.

Weather and Stream Conditions

Typical late summer-early fall weather conditions prevailed--warm, sunny and dry. Stream flows were very low. Several of the sample sites were either completely dry or intermittently flowing; at some, both conditions were observed.

Results and Discussion

#1: Wolf Creek had an even smaller flow than on September 14th, but was nevertheless flowing continuously. JSH were still present, but in somewhat diminished numbers compared to September 14th. Gualala roach were also still relatively abundant.

#2: Both House Creek and the Wheatfield Fork had slightly more surface flow than on September 14th. Nevertheless, there was still a sub-surface flow section on the Wheatfield Fork at the sample site. Gualala roach were in abundance in both streams. No JSH were observed.

#3: The lady-in-the-car spot, along the Wheatfield Fork, was also flowing slightly greater than on September 14th. Gualala roach were present, but not abundant. No JSH were observed.

#3A: The Annapolis Road Bridge site was also flowing slightly greater than on September 14th; nevertheless, there were still disconnected areas without surface flow between some pools. Due to time constraints, I made no attempt at fish ID at this site and did not snorkel.

#4: The Haupt Creek site was still completely dry, as observed on September 15th.

#4A: At the Twin Bridges site (as observed and photographed from both brideges), both the South Fork and the Wheatfield Fork were completely lacking any surface flows for several hundred feet upstream of their confluence.

#5-#7: Both the North Fork and mainstem were low, but continuously flowing above and below the North Fork mouth. The presence of JSH was confirmed in all areas where I had previously recorded them on the four earlier surveys.

#8: Flow conditions at the South Fork site appeared the same as on September 14-15. I also confirmed that JSH were still present in sample areas below the bridge.

#9: At the new location on Fuller Creek, a quick check of two pools near the bridge confirmed the presence of moderate numbers of JSH of various ages, including one very large JSH or trout about 10-12 inches TL.

Prepared: October 19, 2004; RWD
Revised: November 12, 2004; RWD

MEMORANDUM TO THE FILE–#040

File: Gualala River Steelhead Study **From:** Richard W. DeHaven

Subject: 2004 Reconnaissance-Level Juvenile Salmonid Snorkeling Surveys*, survey #6 (final 2004 survey) on November 6-7.*

Purpose and Objectives

See Memorandum #035.

Personnel

This was a 2-day (November 6-7) trip I conducted alone. My earlier intent was that my October 6, 1-day trip to the river would be my last snorkeling event of the 2004 season. However, the large, early-season storm that the watershed received on October 16-19, 2004 provided a challenge. More than 4 inches of rain fell in parts of the watershed, causing significant (for this early in the season) runoff that reconnected surface flows throughout the stream. Additional rainfall occurred on October 27, 2004. As a result, I felt it was imperative to determine what, if any effect, the abrupt hydrology change may have had on the JSH populations I had been monitoring through the summer at the various sample sites. In particular, I was looking for any evidence that JSH (juvenile steelhead) may have moved downstream en masse as a result of the dry-season-ending storms.

Survey Methods

Survey methods and locations were the same as described in Memoranda #035-#039. All of the previously examined sites, except the Fuller Creek (#9) site, were rechecked by walking and/or snorkeling, as conditions warranted. Where snorkeling was done, I covered relatively long sample reaches in an effort to improve validity of my results. Stream and air temperatures were not taken, since at this late date water temperatures are definitely no longer a significant JSH mortality factor. The water at all sites was very cold, necessitating that all of my snorkeling gear–including gloves–be worn.

Weather and Stream Conditions

Typical fall weather prevailed–cool, sunny and dry conditions. Based on the water-marks, stream flows had subsided substantially from the peaks reached during the large October storm event. Nevertheless, despite relatively small flows, no dry areas with subsurface flows were observed.

Results and Discussion

Site #1: I arrived at the Wolf Creek site at 1115 hrs on November 6th. Flow was at least two-three times greater than on my last visit on October 6th; however, it was still low enough that good observations were possible by walking, thus snorkeling was not done. Water clarity was excellent. Only a few dozen widely scattered fish were observed, a number of which were confirmed to be GR (Gualala roach). Despite careful checks of the various habitat types,

no JSH were confirmed. If any JSH were still present, their numbers were likely quite low. Weather was sunny and warm, the water was cold.

Site #2: I reached this site at noon on November 6th. Both House Creek and the Wheatfield Fork had significantly more surface flow than on October 6th. Also, surface flows had returned to the various portions of the Wheatfield Fork that were subsurface-flowing on October 6th. The whole sample area was snorkeled and walked extensively. About 2 dozen Gualala roach were observed at scattered places in House Creek; no fish were observed in the Wheatfield Fork. No JSH were confirmed.

Site #3: The lady-in-the-car spot was walked and snorkeled from about 1245-1325 hrs on November 6th. Gualala roach were widely scattered in various habitat types and moderately abundant. TSS (threespine stickleback) were fairly common in some of the deeper, calmer pools. One large, pre-smolt (in process of losing parr marks) JSH was observed in fast water upstream of the waterfall; no other JSH were confirmed.

Site #3A: I reached the Annapolis Road Bridge site at 1335 hrs on November 6th. As with the other sites, flow was several times greater than on October 6th and surface flows had resumed at the previous subsurface-flowing locations. I snorkeled the pool and associated habitat types above the bridge for about 200 feet. No fish were observed.

Site #4: I reached the Haupt Creek site at 1415 hrs on November 6th. A small (est. ½ cfs), but continuous, surface flow had returned to the entire sample reach–a reach that was completely dry on the last observation on October 6th. About 300 yards of the stream were slowly walked; snorkeling was not necessary. Water clarity was excellent. GR were abundant (in schools) in about 1/3 to ½ of the various pools and runs. No JSH were seen.

Site #4A: The Twin Bridges site was visited from about 1115-1150 hrs on November 7th. As with the other sites, continuous surface flows had returned to the previous subsurface-flowing sections. The site was both walked and snorkeled. Water clarity was excellent. One small group of about a dozen pre-smolt JSH was observed in one riffle/pool location; no other JSH were observed. GR were present, but relatively low in abundance.

Site #5-#7: The North Fork and mainstem site was sampled by walking and snorkeling from about 1000-1130 hrs on November 7th. Flow in the North Fork was only slightly greater than on October 6th; however, flow in the mainstem was three-four times greater than on October 6th. The mouth of the river was obviously blocked, as evidenced by water being backed up nearly to this site. Water clarity was excellent. Despite snorkeling all of the previous locations, no GR or TSS were observed. The only JSH observed (2-3 dozen large, pre-smolts) were in a pool with abundant LWD in the North Fork, about 50 yards upstream of the mouth. No JSH were seen in the mainstem locations.

Site #8: The South Fork site was observed from the bridge at 1445 hrs on November 6th and by both walking and snorkeling at about noon on November 7th. Continuous surface flow had returned to all places that were subsurface-flowing on October 6th. Despite the various habitat types being checked, no fish were observed at this site.

Prepared: November 12, 2004; RWD