ADULT AND JUVENILE STEELHEAD POPULATION SURVEYS, GUALALA RIVER, CALIFORNIA, 2006

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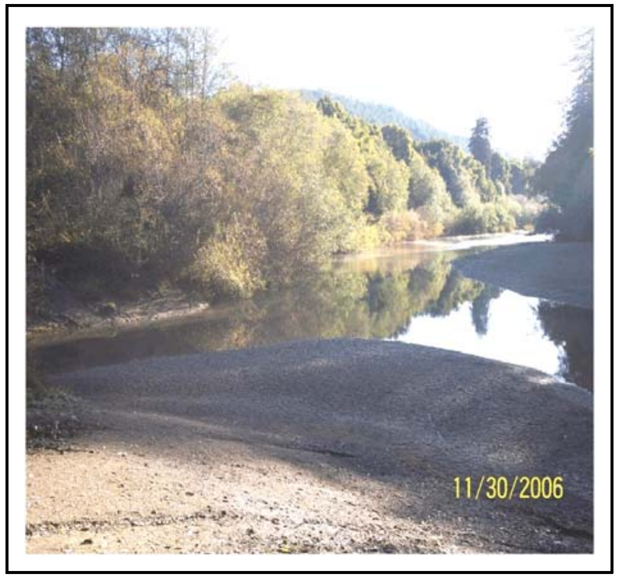
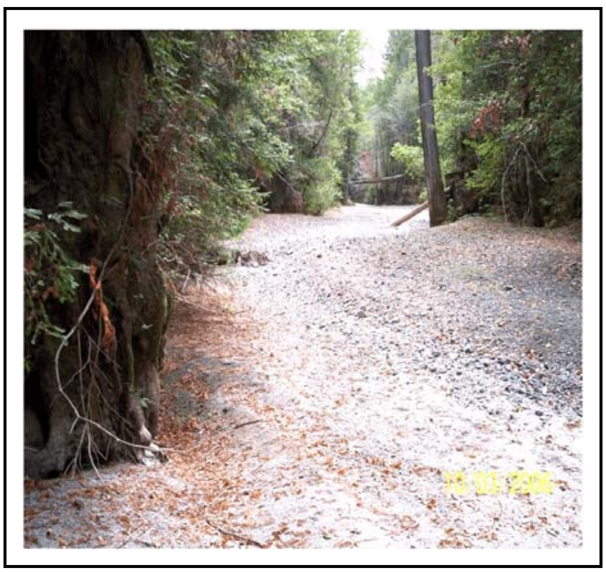
December 31, 2006





L/R (Top)–River Mouth still closed by a sandbar, despite over 5 inches of seasonal rainfall; a resultant record high estuary stage, with flow backed upstream well past the North Fork mouth (entering from left). **L/R (Bottom)–**Haupt Creek, dry and severely aggregated by mid-summer; road "improvements" along the Wheatfield Fork which threaten to deliver yet more sediment to the river.

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SUMMARY: Seasonal steelhead spawning surveys (counts of adults and redds) conducted in 2002-2005 along an 18.3-mile reach (index reach) of the Wheatfield Fork, from House Creek downstream to the South Fork, were continued in 2006. This index reach was surveyed four times (64 miles) between December 12, 2005 and April 29, 2006 from small, aluminum drift-boats. A total of 96 adult steelhead and 2 redds were recorded; adult numbers peaked (57 fish=59%) during a late-February survey. Unusually high rainfall (60-84 inches) and stream flows during the spawning season limited numbers of adults seen and facilitated their spawning upstream of the index reach. Large numbers of juvenile steelhead (JSH), previously unseen during spawning surveys, were recorded during the first survey on December 12-13, 2005. This anomaly was preceded by relatively good rearing conditions JSH experienced in summertime 2005, due to well-above-average April-May 2005 precipitation. The 2006 adult spawning survey data will be coalesced with long-term results for later analysis and publication. Snorkeling surveys of JSH were also continued in 2006 at nine study sites established in 2005 and six new sites. The 2006 snorkeling indicated that: (1) as in 2005, Wolf Creek continued as an important producer of JSH; (2) as in 2005, both the extent and severity of impairment of JSH production in the watershed, due to excessive water temperatures, were reduced compared to 2004; (3) as in 2005, extensive stream reaches that went dry (or lacked continuous surface flow) in summer 2004 flowed continuously through the summer; (4) as in 2005, Gualala roach and threespine stickleback were less numerous than in 2004; (5) as in 2005 (and in contrast to typical years), the Wheatfield Fork became a more important producer of JSH; (6) as in 2005, and owing to much more summertime rearing in upstream reaches compared to 2004, the importance of the estuary to JSH summertime rearing (and overall annual production) diminished; and (7) in contrast to 2005 (and despite good summertime rearing conditions), overall numbers and densities of JSH declined as a result of very high rainfall and flows, especially during March and April, which may have reduced adult steelhead spawning success. Nevertheless, back-to-back years with moderate-to-high annual rainfall, coupled with high springtime rainfall, may bode well for steelhead spawning escapement in 1-2 years.

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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), 2003 (DeHaven 2003) 2004 (DeHaven 2004) and 2005 (DeHaven 2005) 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 2006 winter-to-early-spring spawning surveys conducted along this indexing reach.

In addition, during summer and fall 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 developed and implemented, in 2005, a long-term snorkeling-survey protocol to complement the spawning surveys. The second annual results of the snorkeling protocol are presented here.

Snorkeling survey data together with the spawning survey data already being gathered may allow attainment of my goal: to determine the present status and trend of the river's steelhead population. 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 separated by the Annapolis Road bridge, which is also known as Clark's Crossing. Both sections are surveyed from small aluminum drift-boats. The spawning-survey protocol is described in my 2002 annual report (DeHaven 2002).

In addition, in 2006 one new element was added to the protocol regarding size estimates of adult fish. In the past, I have been hesitant to concern myself with this issue, because of the difficulty (especially among different observers) of accurately estimating size of adult fish which are often only briefly seen from above, in a boat, over deep pools (mostly), runs and riffles. Size estimates would likely be much more reliable if made while snorkeling. Nevertheless, I am gradually becoming more confident of my size-estimating ability as my experience on the index reach, which now totals nearly 30 complete surveys since 2002, has accumulated. Also, it has become clear that I will be the primary observer during most of these spawning surveys, thus observer variation is not a significant issue.

Therefore, henceforth (beginning with the first survey of 2006), I am instituting and using the following size classes (based on total length) for all spawning-survey observations of adult steelhead: size 1=$\leq$24 inches TL (about 2-4 lbs); size 2= 25-31 inches TL (about 5-10 lbs); size

3=≥32 inches TL (roughly >10 lbs). I will also make special note of any very large adults observed ≥34 inches TL (roughly ≥15 lbs), such as recorded during the 2005 spawning season.

For the snorkeling surveys, a protocol was designed that could easily be conducted over a 2-day period by a two-person team, with one person snorkeling while the other person recorded data and measured temperatures. Nine study sites were selected across eight widely scattered locations in the watershed. These study sites and the snorkeling survey protocol are described in my 2005 annual report (DeHaven 2005).

In addition, in 2006 I implemented snorkeling-only surveys (i.e., estimates of water volume and fish density were not made) at six new, 100-ft-long sites located close to the original nine study sites. These snorkel-only sites are: **#3a**-Wheatfield Fork, 1/4-mi upstream from the Lady-in-the-Car site; **#4a**-Wheatfield Fork, directly beneath the Annapolis Road Bridge; **#4b**-Wheatfield Fork, 3/8-mi downstream from the Annapolis Road Bridge (i.e., about 100 yards upstream from the mouth of Haupt Creek); **#9**-Mainstem, at the Highway 1 bridge in the vicinity of the unimproved boat-landing area; **#5c**-Mainstem, at the mouth of the North Fork where it empties into the mainstem; and **#5d**-Mainstem, about 100 yards upstream from the North Fork mouth.

For each individual snorkeling survey and spawning survey, a Memorandum to the File (File Memo) with basic data and findings, was prepared. These File Memos are diary-type reports. File Memos 056-062 for 2006 surveys are attached (Appendix 1).

RESULTS AND DISCUSSION

Brief discussion of 2006 results and findings follows below. In some instances, the individual File Memos (Appendix 1) contain additional discussion and some or all of the field data that were collected. In addition, various digital photographs taken in 2006 appear in the photo galleries which are part of the File Memos. Photos are digitally-captioned so as to be self-explanatory.

2006 Spawning Surveys.

Number and Temporal Spacing of Surveys–The index reach was surveyed four times between December 12, 2005 and April 29, 2006 (Table 1). Three of the surveys were complete (i.e., all 18.3 miles surveyed) while one survey covered only the upper half of the index reach. A total of 64 miles of stream was surveyed.

I conducted three of the surveys alone and one survey with assistance from another biologist. Two surveys were 2-day events and two were done in 1 day. The December 12-13 survey was the earliest seasonal spawning survey yet conducted; adult steelhead were observed. The relatively low total number of surveys was mainly a result of this season's high rainfall, runoff and stream flows, although some injuries and illnesses I encountered during the year were also a contributing factor.

Table 1. Steelhead spawning survey results, Wheatfield Fork index reach, Gualala River, 2006 season. *(Further detail is provided in the individual survey reports [Appendix 1]. Conditions defined as follows:* ***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. NS=Not Surveyed*)

DATE(S)/ OBSERVER(S)	CONDITIONS			NUMBER ADULTS		NUMBER REDDS	
	flow	clarity	weather	Upper Reach	Lower Reach	Upper Reach	Lower Reach
12/12-13; RD	L	E	F	3	2	0	0
02/15-16; RD	M	F	F	7	27	2	0
02/24; RD	L	E	E	57	NS	0	NS
04/29; RD,EB	H	F	F	0	0	0	0
TOTALS	--			67	29	2	0

Spawning-Season Precipitation and River Hydrology–As in the previous 2 years, seasonal rainfall in the Gualala watershed was tracked from the Venado (VEN) and Fort Ross (FRR) rain-gages. An 8-month period, October through May, was examined (Figure 1).

In contrast to 2005, which had roughly average yearly precipitation (but well above-average April-May rainfall), 2006 was a year of far above average–in some respects epic–rainfall throughout the season (Figure1). The 8-month totals for VEN and FRR were roughly 84 and 60 inches, respectively, versus an average annual (57- year) 12-month rainfall of just over 38 inches for FRR. Although the other five months were about average, December (FRR-15.7 inches; VEN-25.4 inches), March (FRR-11.4 inches; VEN-17.0 inches) and April (FRR-14.1 inches; VEN-12.6 inches) each had more than double the average rainfall.

From December 17 to January 4, over 38 inches was recorded at the VEN gage, with rain on 19 consecutive days; four of the daily amounts exceeded 3 inches and on 1 day (December 30) almost 6 inches were recorded. Nearly 5 inches were recorded on February 27. During March, rainfall occurred on 24 of 31 days, with 4.8 inches falling on March 5. During the first 16 days of April, rainfall was recorded on all but 2 days.

The high rainfall created high stream flows. Unfortunately, reliable real-time stream gage data by which to memorialize them became problematic during 2006. Gualala River Watershed Council (GRWC) began having difficulty keeping the river's three gages (USGS equipment with GWRC as operating cooperator) on (internet)-line during late January 2006. Eventually, all three gages were apparently permanently pulled off-line during February and March 2006. As a

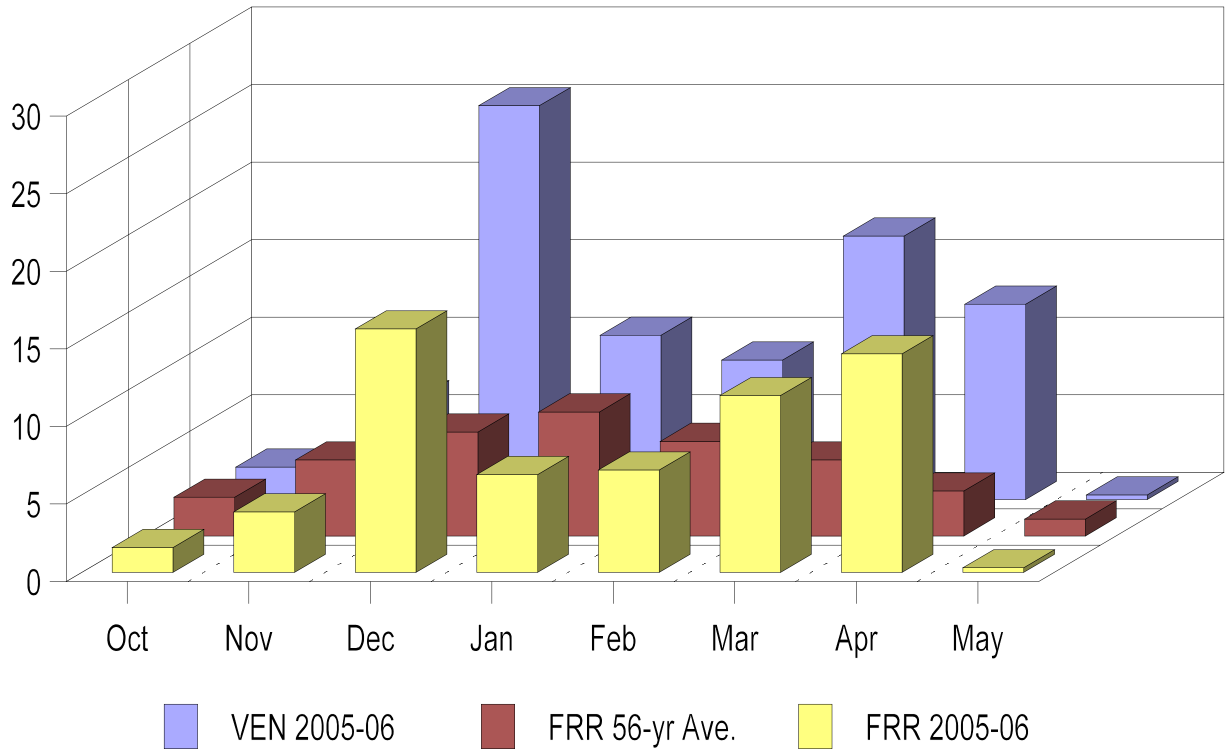

Figure 1. Gualala River steelhead spawning-season monthly rainfall pattern, in inches, 2006 spawning season, compared to average.

result and as in the past, I began relying on the USGS real-time gage at Navarro on the Navarro River as an index to Gualala River (Wheatfield Fork) flows.

The October-May hydrograph for the Navarro (Figure 2) illustrates the runoff pattern during the steelhead spawning season. Noteworthy are the several peaks to about 10,000 cfs or greater, including one brief peak at the end of December to over 40,000 cfs. Prior to being taken off-line, the Wheatfield Fork gage on the Gualala River exhibited similar peaks to over 20,000 cfs during late December-early January. Most surprising and unusual, however, was that flows during most of March and April also remained substantially elevated–at between 1,000 to 10,000 cfs.

In addition to restricting survey opportunities, the high flows had a number of other obvious or potential effects. I observed several new landslides and the input of several new large, whole trees into the river along the index reach. Most of the important adult steelhead holding pools along the index reach showed major filling-in from sedimentation. Spawning gravel cementation (i.e., degree of gravel embedding) at the end of the spawning season (i.e., April 29 survey) was

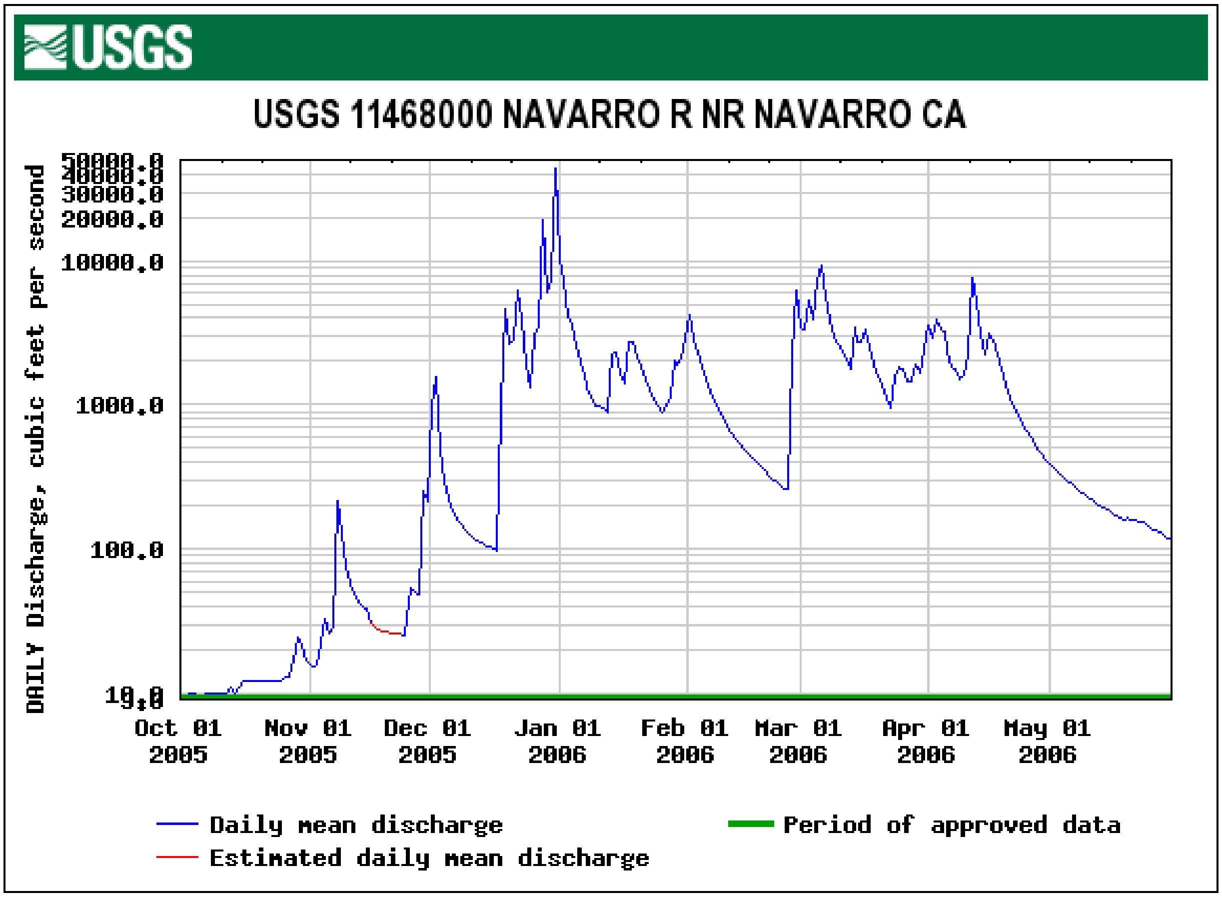

Figure 2. Gualala River watershed spawning-season index-reach hydrology during the 2006 season, as indicated by the USGS Navarro River real-time gage at Navarro.

the worst I have ever observed in my 6 years of study. Very little spawning actually occurred within the index reach, as fish were likely forced to spawn in areas well upstream. And finally, based on the JSH snorkeling results during summer 2006 (see below), I believe that adult steelhead spawning success may have been relatively low in 2006, likely reduced by the high, late-season flows and heavy sediment loading.

Number of Redds**–**Two steelhead redds were found (Table 1), both in the upper survey reach during the second survey on February 15, 2006. This was the lowest number of redds recorded in any season to date and reflects the very high flows which facilitated spawning in reaches upstream of the index reach. Lamprey redds were similarly scarce, with the lowest number ever recorded–four.

Number of Live Adults and Carcasses**–**No steelhead carcasses were found this season. A total of 96 adults were counted, 67 and 29 along the upper and lower survey reaches, respectively (Table 1). Counts of adults were no doubt greatly reduced by the poor survey conditions which persisted throughout most of the spawning season.

Temporal Distribution of Spawning–Five adults were recorded during the first survey conducted on December 12-13, 2006; in my judgement, one of the five appeared to be spent (see File Memo #056). Immigrating adults could potentially have begun ascending the river as much as 2-3 weeks earlier, when the hydrograph first began rising (Figure 2) and the river mouth likely breached.

A majority (59 percent) of the adults was observed on the February 24, 2006 survey (Table 1). This was despite only the upper half of the index reach being surveyed (due to the author injuring his back during the survey). During 2005, when a record 433 total adults were counted, a significant peak (38 percent of total) in numbers also occurred during February (10-11) survey.

Spatial Distribution of Spawning–With just two redds being found, most spawning was clearly occurring upstream of the index reach and little can thus be said about spawning distribution within the index reach. However, during 2007 I intend to plot and map all of the redd locations found during the six years of study to date. Appropriate maps showing these locations and accompanying GPS coordinates will be included in my 2007 annual report and posted on my web site by mid-2007.

Discernability of Redds–Of the two redds found on February 15, 2006, one was still discernable when reexamined 9 days later and one was not. This observation supports previous years' findings. Nothing new was learned this season regarding observer variation in steelhead redd identification or of problems involving misidentification of lamprey versus steelhead redds.

Angling Survey Results–I did not conduct any angling trips in 2006. The few anglers I spoke to were lamenting their low catch rates during the season, however.

Observations of Juvenile Steelhead–Observations of juvenile steelhead (JSH) crossed a milestone during 2006. During spawning surveys conducted in previous years, observations of JSH have always been relatively uncommon and invariably involved sightings of only widely scattered individual fish. During the December 12-13, 2005 spawning survey, the number of individual JSH seen increased dramatically. In addition, several large schools of age 1 and age 2 JSH–a phenomenon not previously seen during spawning surveys–were also recorded (see File Memo #056). I believe these unique observations relate directly to upstream river reaches, including the Wheatfield Fork and tributaries (instead of the estuary), becoming highly important to JSH rearing (likely for the first time in many years) during the 2005 summertime rearing season. This is turn was a result of the exceptionally high rainfall during April and May 2005, which sustained much higher than normal flows (and thus lower water temperatures) through the summer of 2005.

2006 Snorkeling Surveys.

Two complete (following protocol) snorkeling surveys were conducted, one on June 24-25 and a second on July 22-23. The nine original sites and six supplemental sites were examined. Unfortunately, illness and resulting surgery kept me from conducting additional summertime snorkeling in 2006. However, I did conduct a third and final, end-of-season survey on October 3, 2006. This was a brief 1-day examination of each of the 15 sites while walking along the stream bank (because I was unable to snorkel) to determine flow status (i.e., whether surface flow was continuous or intermittent) and presence/absence of JSH, when possible.

Results from snorkeling at the nine original sites during the June 24-25 survey are summarized in Table 2a. Snorkeling at the six supplemental sites for this survey revealed JSH of various ages at five sites, including each of the three supplemental Wheatfield Fork sites.

Results from snorkeling at the nine original sites during the July 22-23 survey are summarized in Table 2b. Snorkeling at the six supplemental sites showed JSH of various ages at three sites, including two of the three Wheatfield Fork sites.

Key findings from the season-ending stream-bank survey on October 3 were: (1) the Wolf Creek site had continuous surface flow, but JSH were absent, both from the site and nearby areas; (2) the Twin Bridges site (Wheatfield Fork) still had continuous surface flow with JSH definitely present; (3) the South Fork site was reduced to intermittent surface flow with JSH presence undeterminable; (4) the Haupt Creek site was completely dry; and (5) all remaining sites had continuous surface flows, with JSH presence/absence undeterminable.

Further details of the three snorkeling surveys for 2006 are given in File Memos #060-062. In addition, brief site-by-site discussions of key 2006 findings, mainly regarding JSH numbers and densities for the nine primary sites, follow below. The trend in JSH densities appeared to be downward in 2006 compared to 2005.

Wolf Creek–JSH density in June 2006 was similar to June 2005. From June to July 2006, JSH density increased moderately, but was well below July 2005 density. Flows in 2005 and 2006 were similar.

House Creek Mouth–JSH density in June 2006 was far below June 2005. From June to July 2006, JSH density increased moderately and older age-classes arrived, but overall density was well below July 2005 density.

Wheatfield Fork (Lady-in-the-Car)–JSH density in June 2006 was far higher than June 2005. From June to July 2006, JSH density dropped to zero. However, a river otter which swam through the site just prior to snorkeling in July 2006 may have influenced snorkeling results.

Wheatfield Fork (Annapolis Road Bridge)–JSH density of zero was recorded in June of both 2006 and 2005. During July 2006, 12 JSH representing three age-classes were observed, despite 84^0F water; this compares with 1 JSH recorded in July 2005.

Table 2a. June 24-25, 2006 juvenile steelhead snorkeling survey results at nine sampling locations, Gualala River, California.

#	LOCATION	FLOW [2]	AVE. WDT (ft)	AVE. VEL.[3] (ftps)	PERCENT[4]			VOLUME[5]		H_2O TEMP[6]	JSH #s			DENSITY/	
					Pool	FH_20	Rif	$100ft^3$	m^3		yoy	1+	2+	$100ft^3$	m^3
1	Wolf Cr.	CF	14.2	0.7	30	45	25	5.5	15.5	66	90	5	5	18.3	6.5
2	House Cr.	CF	18.8	1.3	40	20	40	11.5	32.5	70-72[7]	50	-0-	-0-	4.4	1.5
3	WF Fk. (Ldy)	CF	14.3	0.5	40	60	-0-	10.3	29.3	76	100	10	10	11.6	4.1
4	WF Fk. (Bdg)	CF	54.0	<0.5	100	-0-	-0-	104.1	294.7	79	-0-	-0-	-0-	0.0	0.0
5A	Nr. N. Fork-U	CF	75.4	0.4	-0-	100	-0-	117.5	332.8	70	3	1	2	<0.1	<0.1
5B	Nr. N. Fork-L	CF	66.8	0.7	25	75	-0-	88.2	249.6	70	-0-	-0-	-0-	-0-	-0-
6	Twin Bridges	CF	35.2	1.2	-0-	100	-0-	40.0	113.2	66	1	-0-	-0-	<0.1	<0.1
7	S. Fork Brdg.	CF	52.8	0.5	50	25	25	38.1	107.9	68	1	1	1	<0.1	<0.1
8	Haupt Cr.	CF	15.6	0.40	50	-0-	50	11.4	32.1	70	2	-0-	-0-	0.2	<0.1

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

[3] Equivalent to average maximum velocity, as measured at the point of maximum velocity (usually at or near the center of thalweg) along each stream cross-section.

[4] Percentages of these three basic habitat types making up the 100-ft-long sample reaches.

[5] Total volume of the 100-ft-long sample (snorkeled) reach, as measured by the ten cross-sections.

[6] Maximum water temperature, in ^{0} F, recorded at the site during the data gathering.

[7] At this site, temperatures are recorded at three locations: in House Creek above confluence; and in Wheatfield Fork above and below confluence. All temperatures are time-of-day dependent. Please see text for when temperature were recorded.

Table 2b. July 22-23, 2006 juvenile steelhead snorkeling survey results at nine sampling locations, Gualala River, California.

#	LOCATION	FLOW [8]	AVE. WDT (ft)	AVE. VEL.[9] (ftps)	PERCENT[10]			VOLUME[11]		H_2O TEMP[12]	JSH #s			DENSITY/	
					Pool	FH$_2$0	Rif	100ft^3	m^3		yoy	1+	2+	100ft^3	m^3
1	Wolf Cr.	CF	13.6	0.7	40	35	25	4.6	13.1	73	120	5	10	29.2	10.3
2	House Cr.	CF	16.6	1.2	40	20	40	8.9	25.2	75-78[13]	100	40	10	16.9	6.0
3	WF Fk. (Ldy)	CF	14.1	0.4	40	60	-0-	9.1	25.8	70	-0-	-0-	-0-	0.0	0.0
4	WF Fk. (Bdg)	CF	53.0	<0.1	100	-0-	-0-	103.2	292.2	84	2	8	2	0.1	<0.1
5A	Nr. N. Fork-U	CF	85.6	0.4	-0-	100	-0-	110.3	312.3	70	20	5	-0-	0.2	<0.1
5B	Nr. N. Fork-L	CF	87.6	0.4	50	50	-0-	90.8	259.3	70	50	50	12	1.2	0.4
6	Twin Bridges	CF	33.2	0.7	70	30	-0-	34.2	96.8	69	25	20	5	1.5	0.5
7	S. Fork Brdg.	CF	52.4	0.2	70	10	20	37.9	107.4	67	150	5	2	4.1	1.5
8	Haupt Cr.	IF	6.6	<0.1	100	-0-	-0-	3.9	11.1	70	40	-0-	-0-	10.2	3.6

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

[9] Equivalent to average maximum velocity, as measured at the point of maximum velocity (usually at or near the center of thalweg) along each stream cross-section.

[10] Percentages of these three basic habitat types making up the 100-ft-long sample reaches.

[11] Total volume of the 100-ft-long sample (snorkeled) reach, as measured by the ten cross-sections.

[12] Maximum water temperature, in ^{0} F, recorded at the site during the data gathering.

[13] At this site, temperatures are recorded at three locations: in House Creek above confluence; and in Wheatfield Fork above and below confluence. All temperatures are time-of-day dependent. Please see text for when temperature were recorded.

Near North Fork Mouth (Lower Section)–JSH were not recorded in June 2006, but were also low in density in June 2005. From June to July 2006, JSH density increased moderately to higher than recorded in July 2005.

Near North Fork Mouth (Upper Section)–JSH density in June 2006 was far lower than June 2005. From June to July 2006, a small increase of JSH density was observed, but density remained far below the July 2005 level. At the various sites near the North Fork, water temperatures were far higher in 2006 than 2005.

Twin Bridges (Wheatfield Fork, beneath the Wheatfield Fork bridge)–JSH densities in June 2006 and June 2005 were similarly low. From June to July 2006, densities increased moderately, the same phenomenon observed in 2005.

South Fork (beneath the Stewart's Point-Skaggs Springs Road bridge)–JSH densities were similarly low in June of both 2006 and 2005. From June to July 2006, densities increased markedly to higher levels than recorded in July 2005.

Haupt Creek–JSH numbers and density in June 2006 were far lower than June 2005. From June to July 2006, JSH density increased substantially, but remained below 2005 levels. This stream became intermittent much more rapidly and early in the season in 2006 compared to 2005.

CONCLUSIONS

- Immigration and spawning of adult steelhead began at least by early December 2005 and ended sometime before the end of April 2006.
- Numbers of adults and redds recorded were relatively low, largely a function of poor survey conditions due to high rainfall and flows.
- The high rainfall and flows were likely conducive to relatively rapid spawning and emigration, with most spawning occurring upstream of the index reach.
- As in 2005, and in contrast to 2004 and most other years, JSH rearing was less impaired and limited by adverse summertime water temperatures and (low or intermittent) flows.
- As in 2005, the Wheatfield Fork was a more important producer of JSH, due to lower temperatures and higher flows, than in 2004 and most other years.
- As in 2005, with improved upstream rearing conditions, the relative importance of the estuary to JSH summertime rearing declined.
- Despite relatively good JSH summertime rearing conditions in upstream areas, JSH numbers and densities declined in 2006 compared to 2005, with adult steelhead reproductive success reduced by high, sediment-laden flows, especially springtime flows.

- Large numbers of JSH observed during the mid-December 2005 spawning survey were likely related to the good summertime rearing conditions JSH experienced in 2005, a result of well-above-average springtime (April-May) precipitation.

- Highly unusual back-to-back years (2005-2006) with moderate-to-high annual rainfall and high springtime rainfall may bode well for adult steelhead spawning escapement in 1-2 years, assuming favorable ocean conditions and survival.

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