ADULT AND JUVENILE STEELHEAD POPULATION SURVEYS, GUALALA RIVER, CALIFORNIA, 2010

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Twin Bridges Snorkeling Site, Wheatfield Fork, Gualala River at mid-summer 2010. Due to above-average seasonal rainfall, including well-above-average springtime rainfall, flow was the highest the author has observed at this time of year. High summertime stream flows in 2010 and relatively mild summertime air temperatures provided near-ideal rearing conditions for juvenile steelhead (JSH). In most years, less optimal flow-temperature regimes result in dewatering of this site and extensive areas throughout the watershed–to the detriment of JSH production.

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SUMMARY: *Seasonal spawning surveys of adult steelhead conducted in 2002-2009 along an 18.7-mile reach of the Wheatfield Fork, Gualala River, California (Index Reach), were continued in 2010, along a reduced, 9.4-mile reach. The shortened Index Reach was surveyed five times (47 miles) from a small, aluminum drift-boat between late December 2009 and late April 2010. A record low count of 31 adult fish was recorded; and a record low population estimate of 296 fish was generated, using Area-Under-the-Curve (AUC) methodology. However, results were likely biased low, due to consistently poor fish-counting conditions (high flows and turbidity) during the season. A spawning population for the Wheatfield Fork for 2010 in the range of 500 to 1,500 fish, at minimum, appears more likely. One mid-summer (July 16th) snorkeling survey at 15 sites in the watershed revealed a robust JSH (juvenile steelhead) population concentrated upstream of the estuary and excellent summertime rearing conditions, owing to high stream flows and favorable water temperatures. High flows were a function of above-average rainfall; favorable water temperatures were a function of high flows and mild summer air temperatures. Such ideal JSH rearing conditions should portend good adult spawning returns in 2-3 years.*

INTRODUCTION AND BACKGROUND

Due to a dearth of current information, in 2001, I began a 10-year population study of steelhead (SH) on the Gualala River. The main focus has been annual wintertime surveys, by boat, of an 18.7-mile reach of the Wheatfield Fork to monitor the adult steelhead spawning population. Specifically, I have sought answers to several basic questions: How many fish are returning to spawn today? What trends are the numbers showing? Is the species in jeopardy of disappearing from the river anytime soon?

A related study component has been counts of juvenile SH (JSH) during summertime snorkeling surveys at 15 locations within the watershed. The goal has been to monitor summertime rearing and production of JSH, as regulated by stream flows and water temperatures. In addition, in 2007, surveys were conducted by helicopter, to broaden spawning survey coverage and monitor summertime stream dewatering–one of the most serious issues the river is facing. Through my reports and website, I have been sharing my study results and findings with those working to recover the river's ecological health and preserve its salmonid fisheries for future generations.

In this, my tenth annual report of activities on the river, I am beginning a "winding down" process, as I wait for the next person, group, or agency to step forward and continue the effort. As 'wind down' continues, this, and my future annual reports (number to be determined) will focus on clarity and *brevity*, with only the most important *new* methods, findings and conclusions presented. That means the standard study methods I have developed the past decade will not be restated–only any *new* methods will be given. For a more detailed description of the past 10 years' study methods and results, refer to my earlier annual reports (DeHaven 2001-2009), particularly the 2007 and 2008 reports, and related publications on my website.

ACKNOWLEDGMENTS

This year, I am indebted to John Nelson, for shuttling me between take-out and put-in locations (for boat surveys) on several occasions; Greg Benke, for accompanying me on one spawning survey; and Ed Ballard, for assisting on the snorkeling survey (of JSH).

METHODS

Methods for 2010 were the same as previously described, except for one key change. During my first spawning survey of the season on December 19-20, 2009, it became painfully (literally) clear that a chronic, low-back problem was going to preclude me from surveying the entire 18.7-miles (a 2-day survey) of the Index Reach (of the Wheatfield Fork) any longer. As a result, I decided that the Index Reach, for spawning population monitoring, would be reduced to the lowermost 9.4 miles (from Annapolis Road bridge to the Wheatfield Fork bridge, at Twin Bridges) of the 18.7-mile-reach. Thus, for all spawning surveys in 2010, only this 9.4-mile-reach was surveyed during 1 day (each of five surveys). Thus, the spawning population estimate for 2010, derived using Area-under-the-Curve (AUC) methodology, is based on the 9.4-mile revised Index Reach. In conjunction, a new assumption employed was that basic (before any additions to account for high- and low-flow conditions, which tend to halt adult SH movements) Survey Life (SL) in this shortened reach was 3 days. For a better understanding of these changes and how the AUC population estimates are derived, refer to the Methods section of my 2007 Annual Report.

This year, as in the past, File Memos (FM; *see* 2007 Annual Report, Methods section for description) played a key role in documenting my work. Six FMs were prepared, five for spawning surveys and one for the single snorkeling survey. These, and this Annual Report, will be available on the internet at my website (www.gualalariversteelhead.info) by mid-2011.

RESULTS AND DISCUSSION

Rainfall and Stream flows

Rainfall in the watershed for 2010 was about 66 inches (Table 1), or about 121% of average, based on the Venado realtime gage in the upper Russian River watershed, as an index. However, as I have repeatedly attempted to convey, total seasonal rainfall alone is not a useful metric for predicting all-important summertime hydrology patterns (i.e., stream flows) and rearing conditions for JSH. Often, intra-seasonal rainfall pattern variations are a greater determinant of summertime stream suitability for JSH. This year was no exception.

In particular, October, the start of the rainfall season, was much wetter than average (7.4 inches). November (2.9 inches) and December (6.5 inches) were drier than average. January (21.2 inches) was much wetter than average, including one exceptional 11-consecutive-day-period in which almost 17 inches accumulated. Then, February (8.1 inches) declined to near-average rainfall.

More noteworthy, however, was that the springtime months of March (8.1 inches), April (7.9 inches) and May (3.6 inches), each had well above average rainfall. Springtime rainfall is key to determining summertime stream flows. As a result, the Wheatfield Fork's flows dramatically increased for several days by up to 5,000 cfs late (spring) in the rainfall season. And the all-

Table 1. Seasonal rainfall log for the Gualala River watershed, 2009-2010 season (October-September), based on the realtime rainfall gage at Venado in the Russian River watershed, with flow effects inferred from the realtime stream gage on the Navarro River at Navarro (index to Wheatfield Fork, Gualala River), the realtime stream gage on the South Fork, Gualala River (*) or from the author's estimate, due to lack of instantaneous gage data (**).

Event No.	Event Starting Date	Number of Consecutive Days w/ Rainfall	Max. 1-Day Rainfall (in)	Total Event Rainfall (in)	Max. Effect on River Flow at Twin Bridges	Season Cum. Total Rainfall (in)
1	10/12	4	5.68	6.88	+450 cfs*	6.88
2	10/19	1	0.56	0.56	+10 cfs*	7.44
3	11/05	2	0.92	1.32	+25 cfs*	8.76
4	11/17	1	0.20	0.20	+90 cfs	8.96
5	11/20	1	1.16	1.16	+90 cfs	10.12
6	11/22	1	0.20	0.20	No Change	10.32
7	12/10	4	1.64	2.76	+1,000 cfs	13.08
8	12/15	3	0.72	1.40	+50 cfs	14.48
9	12/20	3	0.60	0.84	+50 cfs	15.32
10	12/26	2	0.16	0.28	No Change	15.60
11	12/29	1	0.40	0.40	+40 cfs	16.00
12	12/31	2	0.72	0.84	+400 cfs	16.84
13	01/08	1	0.04	0.04	No Change	16.88
14	01/11	3	3.08	3.72	+400 cfs	20.60
15	01/16	11	3.24	16.96	+1,950 cfs	37.56
16	01/29	2	0.48	0.54	No Change	38.10
17	02/02	1	0.04	0.04	No Change	38.14
18	02/04	3	2.64	3.28	+3,500 cfs	41.42R
19	02/08	2	0.20	0.28	No Change	41.70

Rainfall event log 2009-2010 season, continued.						
Event No.	**Event Starting Date**	**Number of Consecutive Days w/ Rainfall**	**Max. 1-Day Rainfall (in)**	**Total Event Rainfall (in)**	**Max. Effect on River Flow at Twin Bridges**	**Season Cum. Total Rainfall (in)**
20	**02/11**	**3**	**0.36**	**0.60**	**No Change**	**42.30**
21	**02/23**	**2**	**2.16**	**2.20**	**+15,000 cfs**	**44.50**
22	**02/26**	**2**	**1.52**	**1.72**	**+12,000 cfs**	**46.22**
23	**03/02**	**2**	**1.36**	**2.24**	**+1,300 cfs**	**48.46**
24-25	**03/09**	**1 each (2)**	**1.64**	**1.96**	**+1,000 cfs**	**50.42**
26	**03/24**	**2**	**0.40**	**0.60**	**No Change**	**51.02**
27	**03/29**	**5**	**1.08**	**3.32**	**+1,000 cfs****	**54.34**
28	**04/04**	**2**	**1.56**	**1.84**	**+2,000 cfs****	**56.18**
29	**04/11**	**2**	**2.96**	**3.80**	**+5,000 cfs****	**59.98**
30	**04/19**	**2**	**0.44**	**0.56**	**No Change**	**60.54**
31	**04/26**	**3**	**1.40**	**1.72**	**+1,000 cfs****	**62.26**
32-36	**05/10**	**1 each (5)**	**1.08**	**3.56**	**+1,000 cfs****	**65.82**
37	**06/04**	**1**	**0.08**	**0.08**	**No Change**	**65.90**
38	**09/19**	**1**	**0.12**	**0.12**	**No Change**	**66.02**
					Total 2009-2010 Rainfall	**66.02**

critical recharging of groundwater aquifers occurred just before the onset of harsher summertime conditions (i.e., long day lengths, maximum solar radiation, and high ambient air temperatures typical of summer) which, in synchronicity, often elevate water temperatures above JSH growth and survival tolerances.

Following the springtime moisture surge, the Gualala's flows declined much more gradually than usual during June through August; by early September, as the next rainfall season approached, flows were still substantially higher than normal (Figure 1).

In short, summertime 2010 was characterized by high stream flows, a lack of dewatering and good-to-excellent JSH rearing conditions throughout the watershed. It is difficult to imagine Mother Nature delivering a more favorable scenario for JSH survival and production.

JSH Snorkeling Results

Because of anticipated high summertime stream flows, one snorkeling survey was deemed adequate for a rough picture of JSH numbers and distribution. This survey, a 1-day event in which all 15 established sites were snorkeled, occurred on July 16th (FM 103; *see* Appendix A); this date was specifically selected near the end of what is usually the most critical (in terms of survival) June-July JSH rearing period.

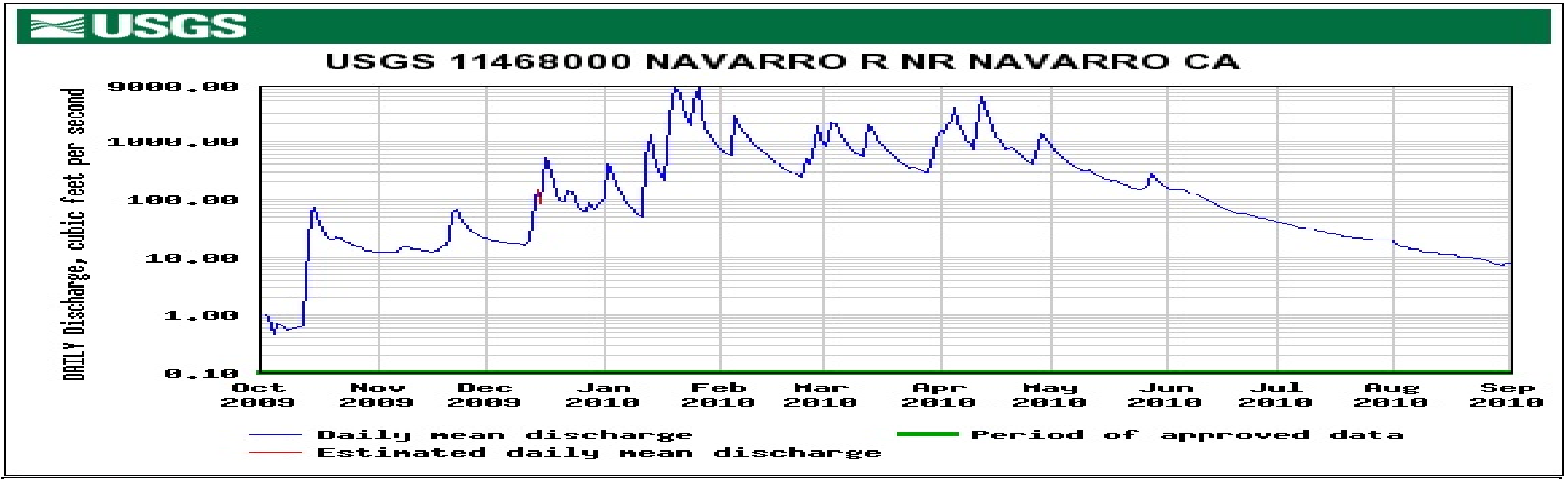
Based on Santa Rosa, California records, ambient air temperatures for the early summer period just prior to the survey were relatively mild. Only two brief, 2-day, heat spells had occurred, one starting June 12th and a second beginning June 27th. A third, 1-day heat surge occurred July 15th, the day before the survey. Moreover, relatively mild weather and air temperatures continued throughout most of the remaining summer season, with only one more 3-day period of elevated air temperatures during August 23-25.

Mother Nature thus delivered a double boost for JSH rearing: (1) High stream flows (from abundant rainfall), which expanded habitat, kept juvenile fish in upstream areas and ameliorated water temperatures; and (2) mild summer air temperatures, which further ameliorated water temperatures throughout the watershed (and, importantly, lessened the need for groundwater pumping for vineyards). The result was a near-ideal natural alignment of favorable conditions for JSH rearing and production. In 2-3 years, significant upticks in spawner returns should occur, if ocean conditions do not pose a significant limiting factor to SH survival.

With the 2010 spawning surveys indicating a rather anemic adult return (*see* below), we were apprehensive that the snorkeling might reveal relatively low numbers and densities of JSH. However, just as in 2009, our apprehension quickly proved unfounded. We counted YOY (young-of-year) fish in the sample reaches at every site and YOY numbers at several sites were in moderate-to-high ranges. There was also a good showing of Age 1+ and 2+ JSH at several sites.

And, as expected, all sites had relatively high flows, several being at the highest stages I have seen at this time of year. For example, whereas it is usually either flowing intermittently or is totally dry by mid-July, the Haupt Creek (#8) site was still flowing continuously.

JSH numbers over the 15 sites also displayed the expected trend of greater *upstream* versus *downstream* (estuary) numbers and densities. This is common with good summertime stream conditions and is the preferred scenario which usually leads to robust JSH production.



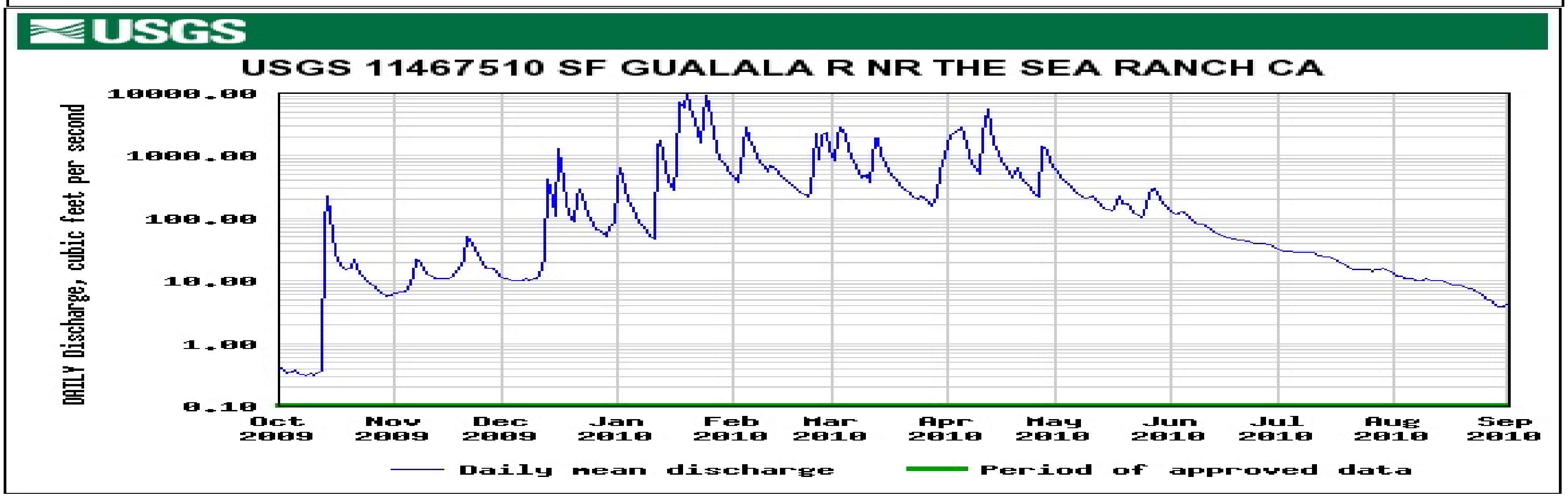


Figure 1. Gualala River 2010 hydrographs (Navarro River is index to Wheatfield Fork), from USGS provisional gaging data.

Site-by-site results and findings from the snorkeling survey appear in FM 103 (Appendix A).

Spawning Survey Results

Based on established criteria (*see* 2007 Annual Report, Methods), the SH spawning season spanned 140 days, from December 12, 2009 to April 30, 2010. Five relatively well-spaced spawning surveys were conducted over this period, on December 20, 2009 and January 4, February 18, March 21 and April 26, 2010 [FMs 098-102; Appendix A]) along the shortened, 9.4-mile-long Index Reach of the Wheatfield Fork.

However, due to abundant rainfall, ability to see and count adult SH during surveys was relatively poor. Although surveys one and two had estimated Observer Efficiencies (OEs; *see* 2007 Annual Report, Methods) of 60% and 50%, respectively, the last three surveys, during what is normally the peak February-March spawning period, had (estimated) OEs of 20% each. If, in fact, substantially more than the estimated 80% of fish were not seen, then the population indices and estimates are substantial underestimates. This is quite possible, given the relatively high flows, turbidity, and adverse weather factors, especially during the last three surveys.

Nevertheless, to maintain ongoing trend analyses, the 2010 results are presented as derived by the standardized methodology: Total count–31 adults; Adjusted (from OE) total count–149 adults; Peak count–22 adults on February 18th; Mean count–6.2 adults; and Expanded (from OE) mean count–29.8 adults. Also, the estimated spawning population was 296 fish (Table 2), derived with AUC methodology based on a 20-week season and average SL (Survey Life) per week of 3.8 days–the lowest annual SL to date. Although 296 fish is the lowest value in 9 years, below both the 369 fish for 2009 and 486 fish for 2004, because of the poor counting conditions, my experience tells me that 296 fish substantially underestimates the true spawning return. The actual spawning return may have been many hundreds of fish–or more–larger.

The only nearby reference point for any reasonable comparison is Dry Creek in the Russian River watershed. As of April 26, 2010, the Don Clausen Fish Hatchery (mitigation for Warm Springs Dam) on the creek had recorded a return of 1,408 adult SH, compared to 842 (a long-term low) by the same date in 2009. Although 2010 was roughly double 2009, both of these recent values are well below the long-term average return for the hatchery.

This hatchery's annual returns and Gualala River returns based on my results have been tracking nearly parallel. Thus, I am inclined to believe that the Gualala's true adult SH return for 2010 was larger than the 2009 return. The question is: How much larger? Based on my experience–and my sources' reports of relatively good angling results during the 2010 season, my best professional judgement is that the true 2010 adult SH return for the Wheatfield Fork was, at a minimum, within a range of from a few hundred to perhaps slightly over a thousand fish. This in turn would place the whole-river return at somewhere in the low thousands of fish.

After 2011 spawning surveys are completed, a full 10 years of spawning survey data will be in hand. At that time, I will reexamine all previous surveys, with an eye towards better defining how

Table 2. Seasonal spawning population estimates of adult steelhead, Wheatfield Fork, Gualala River, 2002-2010 (based on procedures described in "Methods" of 2007 Annual Report; all estimates provisional and subject to change from additional analyses).

YEAR	SPAWNING SEASON			SURVEYS	TOTAL ADULTS	AVE. PER SURVEY	ESTIMATED POPULATION
	Start	End	Days				
2002	11/22	04/30	159	8	377	47.1	1,584
2003	12/14	04/30	137	4	211	52.8	1,543
2004	12/07	04/30	144	8	121	15.1	486
2005	12/07	04/30	144	7	433	61.9	2,375
2006	12/01	04/30	151	4	86	38.3	1,036
2007	12/12	04/30	139	9	762	84.7	2,086
2008	12/06	04/30	147	6	1,402	233.7	5,843
2009	12/22	04/30	130	5	126	25.2	369
2010	12/12	04/30	140	5	31	6.2	296
AVE.	12/08	04/30	143	6.2	440	69.9	1,735

results may have been biased up or down by annual rainfall patterns and amounts, resulting stream flows, turbidity and weather factors. I hope to bracket each season's results (i.e., accuracy of relative population indices and population estimates) into some simple categories, such as "good," "not-so-good," and "poor" population estimates (and indices). In addition, at some point in the future, I am still planning to attempt to corroborate my adult SH trend metrics, via counts at weirs, mark-recapture applications, or other appropriate census techniques.

Finally, I should emphasize that the five 2010 spawning surveys were also unique for what they did not show: (a) any SH redds or SH carcasses; and (b) any adult lampreys, lamprey carcasses or lamprey redds. Moreover, this is the second consecutive year that lampreys failed to show along the Index Reach. It is unclear whether they were just missed during high-flow periods and were thus only spawning farther upstream than the Index Reach (the likely case for SH), or if they failed to return from sea in recordable numbers (possible for lampreys). I will be following this phenomenon with interest in 2011 and beyond.

CONCLUSIONS

- The watershed had above-average rainfall, including well-above-average springtime rainfall, in 2010.

- The 2010 adult steetlhead population metrics for the Wheatfield Fork were the lowest in 9 years, however, they were likely biased low, due to poor survey conditions (high turbidity and stream flows) which precluded fish from being seen and counted.

- Given the observed population metrics, poor survey conditions, relatively good angling results and recent Dry Creek SH returns, a more reasonable (than the 296-fish estimate) 2010 population estimate for the Wheatfield Fork is at least 500-1,500 fish, placing the whole-river spawning return in the low thousands of fish.

- JSH rearing conditions and production in the watershed in 2010 were likely excellent, owing to high stream flows–from abundant rainfall–and mild summer air temperatures.

- Pacific lampreys were conspicuously absent from the Index Reach for the second consecutive season.

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