ADULT AND JUVENILE STEELHEAD POPULATION SURVEYS, GUALALA RIVER, CALIFORNIA, 2009

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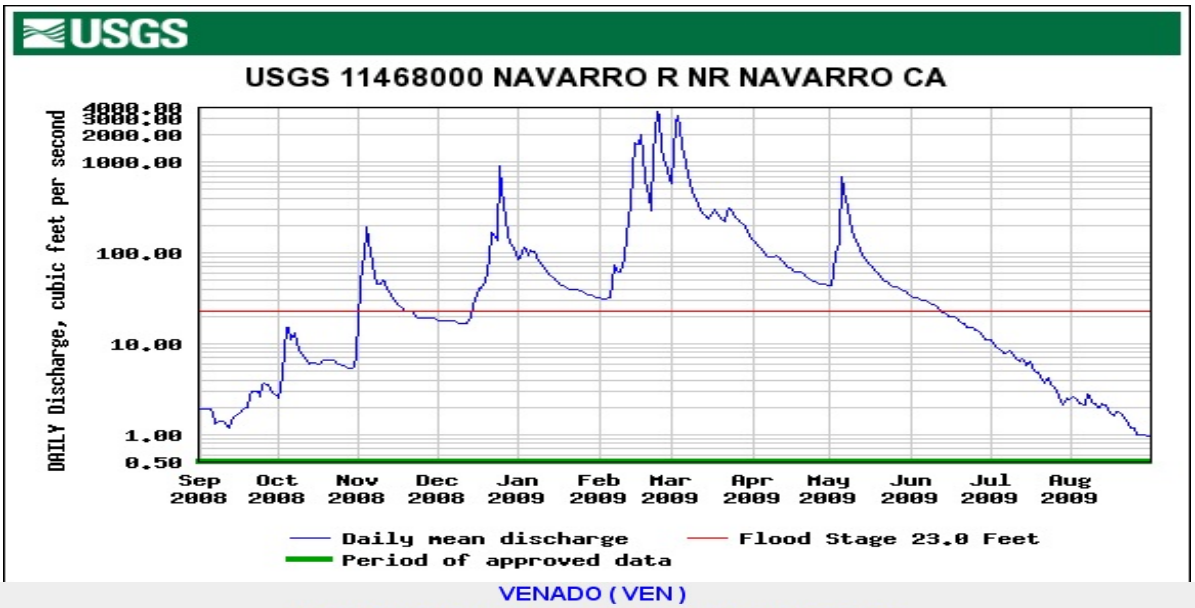

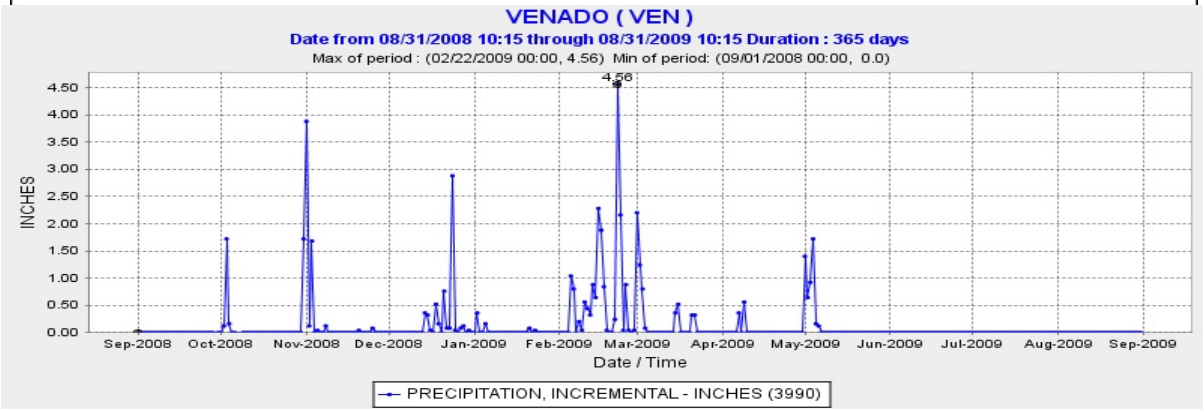

Wheatfield Fork, Gualala River flow (as inferred from Navarro River gage) **and rainfall** (as inferred from VEN gage on Russian River) for the 2009 season. Dry conditions in January, March and April, which would normally have created below-average summertime flows and relatively poor juvenile steelhead (JSH) rearing conditions, were substantially ameliorated by a "miracle" 5-day late-season rainfall event in early May. As a result, JSH rearing conditions in the critical early summer period from late June to early July were significantly improved.

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SUMMARY: *Seasonal spawning surveys of adult steelhead conducted in 2002-2008 along an 18.7-mile reach of the Wheatfield Fork, Gualala River, California (Index Reach), were continued in 2009. The Index Reach was surveyed five times (94 miles) from a small, aluminum drift-boat between late December 2008 and mid-April 2009. A relatively low count of 126 adult fish was recorded, with a peak (82) in late December; the average of 25 adult fish per survey compared to 15 (2004) to 234 (2008) per survey for the seven preceding seasons. The provisional (pending further methodology refinements) spawning population estimate for the Wheatfield Fork, based on area-under-the-curve-trapezoidal (AUC-T) methodology, was 369 fish, the lowest value in 8 years. A total of 19 steelhead redds was also recorded; most spawning occurred upstream of the Index Reach. For the first time in 8 years, neither adult lampreys nor any lamprey redds were found. One early-summer (June 28th) snorkeling survey of JSH (juvenile steelhed) at 15 sites revealed a robust JSH population likely dominated by a strong 2008 year-class from the record 2008 return of adult fish. Rainfall in the watershed in 2009, was, for a third consecutive year, well below average, with high intra-season patchiness, including record drought and low stream flows in January. Nevertheless, a "miracle" rainfall event in early May 2009 greatly improved otherwise poor summertime rearing conditions for JSH. Efforts to improve estimates of adult steelhead spawning populations using AUC-T methodology are continuing.*

INTRODUCTION AND BACKGROUND

The last large-scale population monitoring of steelhead in the Gualala River, a mid-sized northern California coastal stream, was conducted by the California Department of Fish and Game during the mid-1970s. Due to a lack of current information on this listed fish's population status, I initiated annual spawning surveys of steelhead on the river in 2001 (DeHaven 2001). These surveys were continued and expanded in 2002 through 2008, focusing on an 18.7-mile reach of the Wheatfield Fork as an Index Reach for long-term population monitoring (DeHaven 2002-2008). In this report, I present results of 2009 spawning surveys along the Index Reach.

In addition, during summer 2004, I conducted reconnaissance-level snorkeling surveys of juvenile steelhead (JSH) at strategic locations in the Gualala River watershed. From the initial snorkeling results, a long-term snorkeling-survey protocol, to complement the spawning surveys, was developed and implemented starting in 2005. Snorkeling results from 2009 are also presented here.

My various reports and website (http://www.gualalariversteelhead.info/) have a primary purpose of sharing study results with agencies, groups and individuals working to recover the Gualala River's ecological health and salmonid populations. Related secondary purposes include outreach (seminars and lectures) to educate the lay public about the river's plight; furthering knowledge of life history of the river's steelhead; identifying the most serious threats to the river's steelhead and coho salmon; and helping to develop the most effective strategies to aid recovery of listed salmonid species.

ACKNOWLEDGMENTS

This year I thank the following individuals for their contributions to the study effort: Michael Bower, Greg Benke, and Larry Thompson, for assistance on one or more surveys; John Nelson, for shuttling me upstream to my boat-survey starting locations on several occasions; Marc Felton for contributing an almost-new motor scooter also used for shuttling; and Jon Draugelis for a cash contribution in support of my work.

METHODS

This year's report has a goal of brevity. Thus, study methods are not being restated. The interested reader should refer to the previous annual reports, particularly the 2007 report, and my website for descriptions of procedures.

As in previous years, after each individual survey (i.e., spawning or snorkeling survey) a Memorandum to the File (File Memo=FM) was prepared. FMs are diary-type field reports; frequently, these have undergone minimal editing. However, FMs often include procedures, raw data, findings, discussions, conclusions and photographs–sometimes in greater detail than given in annual reports such as this one. For 2009, six FMs (92-97; *see* Appendix1) were prepared. The FMs and this annual report will be available on my website by mid-2010.

RESULTS AND DISCUSSION

Spawning Surveys

Five complete surveys of the Index Reach were conducted between December 30, 2008 and April 12, 2009 (Table 1; FMs 92-96). One survey each occurred in December, January, and April. Two surveys were conducted in March (often the peak spawning month) but, due to high flows, none were conducted in February. As usual, the distribution of surveys was strictly a function of stream flow (as controlled by rainfall) and related ability to see and count adult fish. Basically, I strived to conduct a survey every 2 weeks when possible.

The first survey December 30-31 (FM 92) at a flow of about 100 cfs yielded a moderately high count of 82 adult fish. Most were fresh-run adults moving upstream to spawn; but at least a few kelts moving downstream were also present. No steelhead spawning (redds) was recorded within the Index Reach on this survey. No lampreys or lamprey redds were recorded.

The second survey was conducted January 31-February 1 (FM 93), after a record dry January (*see* report cover). Stream flow was reduced to just 15-20 cfs, making it unnavigable. Thus, we had to walk the entire 18.7-mile survey reach. A relatively low number of adult fish (22) were recorded, mostly fresh-run, but including a few kelts. Sixteen new steelhead redds were recorded. Neither any lampreys nor lamprey redds were found. The mouth of the river was closed by a very large sandbar and the estuary stage was very high.

The third survey on March 13-14 (FM 94) at a flow of about 250-275 cfs yielded another relatively low count of just 16 adult fish, mostly widely scattered kelts. One new steelhead redd

Table 1. Steelhead spawning survey results, Wheatfield Fork Index Reach, Gualala River, 2009 season.[1]

Date(s) and Observer(s)	Conditions			Number Adults								Number Redds		
						By Size Class					% Kelts			
	F	C	W	Up. Rch.	Lwr. Rch.	1	2	3	4	T		Up. Rch.	Lwr. Rch.	T
12/30-31; RD	M	E	E	10	72	0	42	37	3	82	5	0	0	0
1/31-02/01; RD/MB	L	E	E	1	21	0	21	1	0	22	5	2	14	16
3/13-14; RD/GB	H	F	F	1	15	1	8	7	0	16	80	0	1	1
3/28-29; RD	H	E	E	1	2	2	1	0	0	3	100	1	0	1
4/11-12; RD	M	E	F	0	3	2	1	0	0	3	100	0	1	1
Totals	-	-	-	13	113	5	73	45	3	126	18	3	16	19

[1]*See individual survey reports (File Memos #92-96) for further detail. Conditions as follows:* ***flow (F)****:* ***H****igh=>200 cfs;* ***M****oderate=75-200 cfs;* ***L****ow=<75 cfs.* ***clarity (C)****:* ***E****xcellent=bottom of all pools visible;* ***F****air=bottom of up to one-half of the deepest pools not visible.* ***weather (W)****:* ***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. Adult size criteria: size 1=≤24 inches TL (roughly 2-4 lbs); size 2=25-31 inches TL (roughly 5-10 lbs); size 3=≥32 inches TL (roughly ≥10 lbs); and special note made of any very large adults over ≥34 inches TL (size 4=roughly ≥15 lbs).*

was found, but the previous 16 redds were no longer discernable. Again, no lampreys or lamprey redds were found; this was highly unusual for this late stage of the spawning season.

The fourth survey conducted on March 28-29 (FM 95) at a flow of about 200 cfs had a very low count of just three adult steelhead kelts. One new steelhead redd was found. The absence of lampreys and lamprey redds continued.

The final survey on April 11-12 (FM 96) at a flow of about 95 cfs yielded another very low count of just three adult steelhead kelts. One more steelhead redd was found, bringing the total for the season in the Index Reach to 19 (*see* FM 96 for GPS locations). The highly unusual complete absence of lampreys or lamprey redds, the first such season in 8 years, continued.

The low steelhead counts for the 2009 season were in stark contrast to the record adult steelhead return recorded in 2008 (DeHaven 2008).

Spawning Population Estimate

Using procedures detailed in the 2007 annual report (DeHaven 2007), the 2009 spawning population estimate was 369 fish (Table 2). This is the lowest value in 8 years and less than 10% of the record estimate of 5,843 (4,000-6,000) fish for 2008. Related 2009 population metrics included: total count of adult fish=126; expanded (based on OE [observer efficiency]) total count=223; mean number/survey=25.2; and expanded mean number/survey=44.6.

Table 2. Seasonal spawning population estimates of adult steelhead, Wheatfield Fork, Gualala River, 2002-2009 (see *Methods* in 2007 Annual Report for procedures).

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
AVE.	12/08	04/30	143	6.4	440	69.9	1,915

The 2009 population estimate is based on a spawning-season starting date of December 22, a total spawning-season length of 130 days, OEs of from 35 to 80% for the five surveys, and a weekly average Survey Life (SL=total time a steelhead is present in the survey area) of 14.8 days, the longest such seasonal value to date.

As discussed in detail in both the 2007 (DeHaven 2007) and 2008 (DeHaven 2008) annual reports, *all* population estimates to date, including the 2009 estimate, are preliminary and provisional. They are subject to modification as accuracy of the two key metrics used in calculations–OE and SL–is improved. If and when OE and SL estimation procedures have been sufficiently validated, a more robust Area-Under-the-Curve (AUC) population calculation approach may be warranted. This may include placing confidence bounds on the population estimates. For now, a prudent conclusion is simply that the 2009 spawning population was a few hundred fish and likely not more than about 1,000 fish. Work to improve and validate OE and SL estimation is underway. One aspect of this work is a weir and automated counting "pass-box" to be installed and operated on the stream in 2011. As efforts to improve OE and SL–and thus the population estimates–come to fruition, details will be reported.

It is clear, however, that the Gualala River was not the only California coastal stream with a very low steelhead spawner return in 2009. Adult runs were uniformly low up and down the coast, including the hatchery-supported runs on the Russian River. Such a system-wide decline suggests poor ocean conditions as a factor. The lack of a lamprey run in 2009 may support this factor. However, after nearly a decade of observing firsthand how steelhead "go with the flow" on such uncontrolled, small coastal streams as the Gualala, I would not rule out a possible

alternative causative factor for low 2009 adult returns: the low, patchy seasonal rainfall, especially the record low rainfall and stream flows in January 2009 (*see* cover and following discussion). It may be that when what is supposed to be the wettest month of the season (i.e., January) is actually the driest month, steelhead returns for the rest of a season are reduced, especially when seasonal flow spikes due to rainfall have been relatively small (*see* below).

Watershed Rainfall and Stream Flows

The watershed's total rainfall in 2009 was, for a third consecutive year, substantially below average. Although the total 45.4 inches recorded was nearly identical to 45.5 inches recorded in 2008 (and about 4.5 inches more than 2007), it was 17% below average and only about half the 84 inches recorded in 2006. (Note: As in my previous reports, rainfall discussions are based on the Venado [VEN] realtime gage in the upper Russian River watershed, which is believed to provide a good indication of rainfall in the wetter parts of the Gualala River watershed. I do recognize, however, that rainfall varies widely across the coastal, mountainous Gualala River watershed, in response to location, elevation and terrain.)

In addition, the temporal rainfall pattern for 2009 was, just as in 2008, highly uneven (*see* report cover; Table 3). In particular, the start of the rainfall season was characterized by a relatively wet October (2008) with well above average rainfall, whereas November and December followed with drier than average conditions. Then, January, which is normally the wettest month of the year, was still drier yet with only 0.64-inch recorded. February then followed with slightly above average rainfall. Finally, both March and April were again drier than average.

The maximum effect on stream flow of seasonal rains in 2009 was a flow increase of about 4,000 cfs in late December (Table 3); this is a relatively low seasonal value given that spikes of 20,000 to 40,000 cfs are not uncommon. Five other relatively low flow spikes of about 1,000 to 3,000 cfs also occurred. Otherwise, the seasonal rainfall events had little, if any, effect on stream flow over the 5-month steelhead spawning period. Thus, overall, the 2009 flow spikes were both relatively small and definitely relatively short-lived.

In most years, such patchy, uneven, and low seasonal rainfall and small, short-lived flow spikes would have resulted in a low summertime hydrograph for the stream; this in turn usually sets up poor rearing conditions for JSH by early or mid summer.

However, in 2009, the first 6 days of May brought a rather miraculous rainfall event, with about 5 inches of precipitation recorded. As a result, stream flow dramatically increased for several days by up to 1,100 cfs and critical recharging of groundwater aquifers occurred just before the onset of harsh summertime conditions (i.e., the long day lengths, maximum solar radiation, and high ambient air temperatures typical of summer, which combine to raise water temperatures above JSH tolerances). Moreover, water needs of vineyards in the watershed simultaneously were dramatically reduced by the late-season rainfall, providing a further potential benefit to stream flows heading into the critical summer season.

Table 3. Seasonal rainfall events for the Gualala River watershed, 2008-2009 season (October-September), as inferred from the realtime rainfall gage at Venado in the Russian River watershed, with flow effects as inferred from the realtime gage on the Navarro River near Navarro (or realtime gage on the South Fork, Gualala River [asterisk]).

No.	Starting Date	No. Consecutive Days Rainfall	Max. 1-Day Rainfall (in)	Total Event Rainfall (in)	Max. Effect on River Flow at Twin Bridges	Season Cum. Total Rainfall (in)
1	10/02	3	1.72	2.00	+20 cfs	2.00
2	10/31	4	3.88	7.40	+1,000 cfs*	9.40
3	11/05	1	0.04	0.04	No Change	9.44
4	11/08	1	0.12	0.12	No Change	9.56
5	11/20	1	0.04	0.04	No Change	9.60
6	11/25	1	0.08	0.08	No Change	9.68
7	12/14	3	0.36	0.72	No Change	10.40
8	12/18	2	0.52	0.68	No Change	11.08
9	12/22	5	2.88	3.84	+4,000 cfs	14.92
10	12/27	2	0.12	0.20	No Change	15.12
11	12/30	1	0.04	0.04	No Change	15.16
12	01/02	1	0.36	0.36	No Change	15.52
13	01/05	1	0.16	0.16	No Change	15.68
14	01/21	1	0.08	0.08	No Change	15.76
15	01/23	1	0.04	0.04	No Change	15.80
16	02/05	2	1.04	1.84	>+2,000 cfs	17.64
17	02/08	11	2.28	8.12	>+1,000 cfs	25.76
18	02/21	6	4.56	7.92	>+3,000 cfs	33.68
19	02/28	5	2.20	4.36	Not Available	38.04
20	03/15	2	0.52	0.88	Not Available	38.92
21	03/21	2	0.32	0.64	No Change	39.56
22	04/07	1	0.36	0.36	No Change	39.92
23	04/09	1	0.56	0.56	+10 cfs	40.48
24	05/01	6	1.72	4.96	+1,100 cfs	45.44

Snorkeling Survey

This year, just one snorkeling survey was conducted on June 28, 2009 (FM 97). This was a long, 1-day event in which all 15 snorkeling sites were visited and snorkeled. I had planned to conduct the usual two additional summertime surveys. However, a neck injury (herniated disc) sustained while albacore fishing alone, 45 miles offshore from Bodega Bay in mid-summer, restricted my mobility (confined to home) and prevented additional surveys for over 3 months.

As a result of the miracle May rainfall event, when snorkeled on June 28th the 15 sites were all still flowing continuously, an unexpected occurrence, given the low overall seasonal rainfall and otherwise dry springtime. Moreover, most sites had flows as high–or higher–than I have previously seen (at the same sites) at this stage of summer.

I was apprehensive about what the snorkeling would reveal, given the low return of adult steelhead to the stream. Such apprehensive quickly proved unfounded as we recorded JSH at every site, with relatively high numbers at some (*see* FM 97).

Although most JSH counted were classified as YOY, their relatively large sizes suggested that many may have actually been age 1+ fish (see FM 97). This would be consistent with a very large spawning return and year-class production in 2008, which may have created a relatively large carryover of JSH into 2009.

In addition, JSH distribution across the sample sites (i.e., the [a] low numbers at key upstream sites 1 and 2, [b] high numbers at key middle-watershed sites 4, 4a, and 4b, and [c] low numbers at most estuary sites [except for the Hwy 1 bridge site]) appeared to suggest that a mass downstream migration was occurring on the survey date. Such movement was likely triggered by the 5-day heat wave and resulting high water temperatures occurring during the survey (see FM 97).

CONCLUSIONS

1. In contrast to a record high return of 4,000-6,000 adult fish the previous season, the 2009 return of adult steelhead appeared to be at an 8-year low of just a few hundred adult fish.

2. A sharp decline of adult returning steelhead coast-wide in 2009 suggests that poor ocean conditions were involved. However, low rainfall and stream flows during the 2009 season, particularly in January, may have been a additional factor.

3. One snorkeling survey conducted at the end of June 2009 revealed a robust JSH population despite the low 2009 return of adult spawners. A significant carryover of JSH from a large 2008 year-class likely boosted JSH density.

4. A mass downstream movement of JSH in response to high water temperatures appeared to be underway during the late June snorkeling survey.

5. For the first time in 8 years, Pacific lamprey spawning was not recorded in the Index Reach.

6. Improvement and validation of OE and SL methodology are essential to improving annual adult population estimates. Such work is underway and will be reported later.

7. For a third consecutive year, rainfall in the watershed remained well below average, with distinct intra-season patchiness.

8. Nevertheless, a "miracle" rainfall event the first 5 days of May 2009 helped alleviate what would otherwise have been poor early summertime rearing conditions for JSH.

LITERATURE CITED

(All reports available on the internet at http://www.gualalariversteelhead.info/)

DeHaven, R. W. 2001. Reconnaissance-level spawning and habitat surveys of steelhead trout, Gualala River, California, 2001. Prepared by the author (Richard_DeHaven@fws.gov), April 2001, for use by agencies, groups and individuals involved in steelhead recovery efforts. 23pp.

DeHaven, R. W. 2002. Steelhead spawning surveys, Wheatfield Fork and other selected reaches, Gualala River, California, 2002. Prepared by the author (Richard_DeHaven@fws.gov or drdehave@hotmail.com), September 2002, for use by agencies, groups and individuals involved in steelhead recovery efforts. 42pp.

DeHaven, R. W. 2003. Steelhead spawning surveys, Wheatfield Fork, Gualala River, California, 2003. Prepared by the author (Richard_DeHaven@fws.gov or drdehave@hotmail.com), December 2003, for use by agencies, groups and individuals involved in steelhead recovery efforts. 14pp.

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.

DeHaven, R. W. 2005. Adult and juvenile steelhead population surveys, Gualala River, California, 2005. Prepared by the author (drdehave@hotmail.com), December 31, 2005, for use by agencies, groups and individuals involved in steelhead recovery efforts. 64pp.

DeHaven, R. W. 2006. Adult and juvenile steelhead population surveys, Gualala River, California, 2006. Prepared by the author (drdehave@hotmail.com), December 31, 2006, for use by agencies, groups and individuals involved in steelhead recovery efforts. 47pp.

DeHaven, R. W. 2007. Adult and juvenile steelhead population surveys, Gualala River, California, 2007. Prepared by the author (drdehave@hotmail.com), December 31, 2007, for use by agencies, groups and individuals involved in steelhead recovery efforts. 106 pp.

DeHaven, R. W. 2008. Adult and juvenile steelhead population surveys, Gualala River, California, 2008. Prepared by the author (drdehave@hotmail.com), December 31, 2008, for use by agencies, groups and individuals involved in steelhead recovery efforts. 67 pp.