Fall River Summary Report

July 20-21, 2009

State of California Natural Resources Agency

Department of Fish and Game

Heritage and Wild Trout Program

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Introduction:

The Fall River in Shasta County is a spring-fed system that meanders through farmlands and cattle ranches in the Fall River Valley before joining with the Tule River and, eventually, the Pit River. The Fall River became one of the first streams in California to receive Wild Trout designation. This famed trout fishery is well-publicized; however, much of the surrounding land in the Fall River Valley is privately owned, so public access to the fishery is limited and generally necessitates use of a boat. From its source at Thousand Springs downstream to the confluence with the Tule River (a tributary to the Pit River), the open fishing season is from the last Saturday in April through November 15th with gear restrictions and size and bag limits in place (artificial lures with barbless hooks; maximum size limit of 14 inches total length; two-fish bag limit).These special fishing regulations also apply to Spring Creek. Downstream of the confluence with the Tule River, California Department of Fish and Game (DFG) Sierra District General Regulations apply (open from the last Saturday in April through November 15th with a two-fish bag limit). The designated Wild Trout area of the Fall River spans from Thousand Springs downstream to the Pit #1 Powerhouse Intake including Spring Creek (Figure 2) and comprises approximately 22.4 miles of stream habitat.

The DFG has a long-standing history of monitoring this system by conducting electrofishing, visual observation, and angler use surveys since the early 1970s. Data from these surveys are used to monitor species abundance, instream distribution, and size class composition. In July, 2009, The Heritage and Wild Trout Program (HWTP) conducted direct observation surveys on two historic sections of the Fall River at Gas Line (Section 1) and Whipple Ranch (Section 2) (Figures 1 and 2).

Figure 1. Overview map of Fall River historic direct observation survey locations.

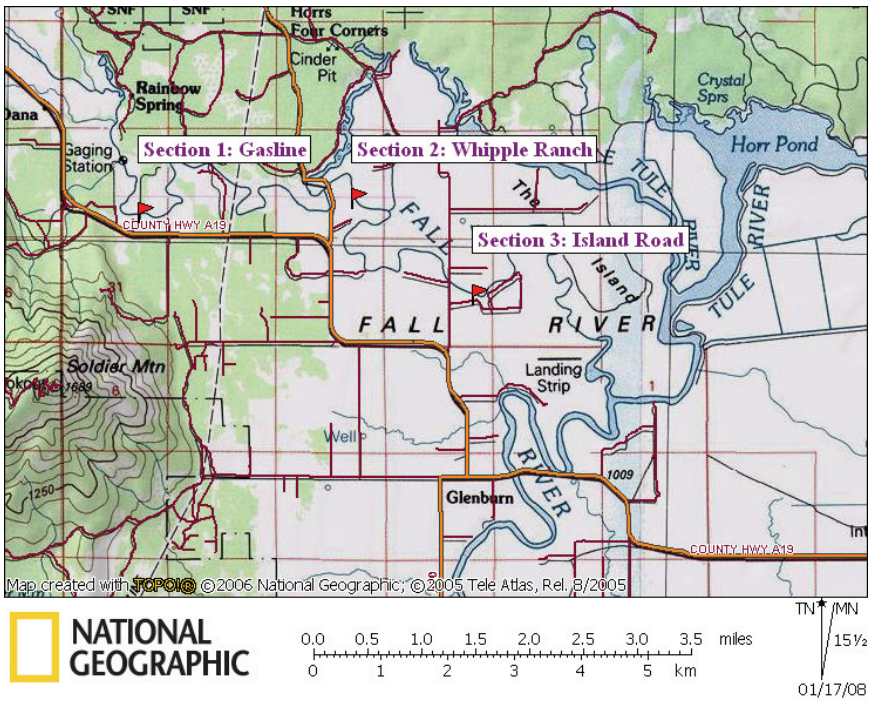
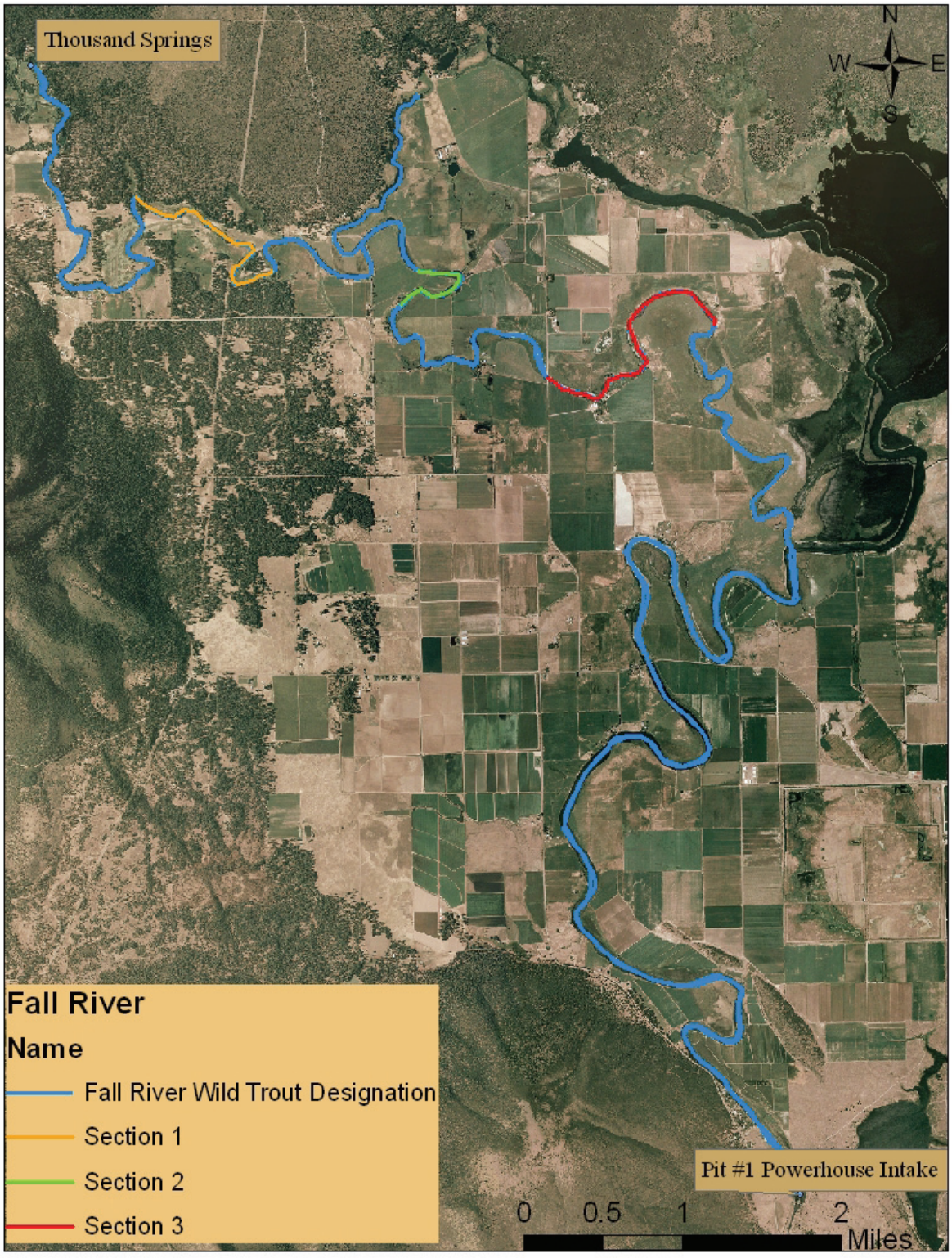


Figure 2. Detail map of Fall River including the Wild Trout-designated area and survey section locations. Section 3 (red) was not surveyed in 2009.



Methods:

Direct observation surveys were conducted using snorkeling methods, an effective survey technique in many small streams and creeks in northern California and the Pacific Northwest (Hankin & Reeves, 1988). To replicate previous efforts, the section boundaries were located using written direction, maps, and GPS coordinates. Nine divers and three boaters were used for each survey. Divers, maintaining an evenly-spaced line perpendicular to the current, counted fish by species. All observed trout were further separated and counted by size class. Size classes were divided into the following categories: young of year (YOY); small (< 6 inches); medium (6-11.9 inches); large (12-17.9 inches); and extra-large (≥ 18 inches). YOY are defined by the HWTP as age 0+ fish, emerged from the gravel in the same year as the survey effort. Depending on species, date of emergence, relative growth rates, and habitat conditions, the size of YOY varies greatly, but is generally between zero and three inches in total length. If a trout was observed to be less than six inches in total length but it was difficult to determine whether it was an age 0+ or 1+ fish, by default it was classified in the small (<6 inches) size class.

Divers were instructed in both visual size class estimation and proper snorkel survey techniques (establishing a dominant side, determining the extent of their visual survey area, how and when to count (or not count) fish observed, safety considerations, etc.) prior to starting the survey. Three personnel on paddle craft participated in the survey by helping divers maintain their position in the water and acted as a safety backup and lookout for the dive team. For both sections, water temperature, air temperature, and water visibility were measured. Representative photographs were taken and section lengths were determined based on GIS analysis (at a scale of 1:3000).

Results:

During both surveys, the weather was sunny and clear with ambient air temperatures ranging between 24 ºC and 29 ºC. Water temperatures ranged from 13 ºC to 14 ºC. Neither wetted widths nor water depths were measured since the Fall River has a relatively consistent flow regime, our survey sections are long (approximately one mile), and efforts must be made to minimize diver exposure to cold water. Data from the 2007 HWTP direct observation surveys showed an average wetted width of 147 feet and an average water depth of 5.6 feet, with some areas exceeding 20 feet in depth (Weaver and Mehalick 2007). Due to its low gradient and near constant flow over time, channel profile characteristics in the Fall River change very little from year to year. Presumably, water depths and wetted widths in 2009 were similar to those in 2007. The Fall River is characterized by slow moving flatwater with water visibility exceeding 15 feet in certain areas. Riffles and deep pools are absent. During the surveys, water visibility ranged from three feet to more than 15 feet, depending on location (due to changes in cover complexity and/or turbidity). The average water visibility was approximately nine feet. Vegetation (both submerged and overhanging),

large woody debris, water depth, and canopy cover provided fish cover.

Table 1. 2009 Fall River direct observation survey results including the number of fish observed in each section by species and estimated densities.

Section	Survey date	Number of divers	Section length (miles)	Species	Number of fish observed						Estimated density (fish/mile)
					YOY	Small 0-5.9"	Medium 6"-11.9"	Large 12"-17.9	Extra-large >18"	Total	
1 at Gas Line	7/20/09	9	1.4	rainbow trout	330	8828	1081	468	40	10747	7676
				brown trout	0	0	0	0	1	1	1
				Sacramento sucker						1	1
				sculpin (dead)						1	1
				lamprey (dead)						1	1
2 at Whipple Ranch	7/21/09	9	0.8	rainbow trout	9	2010	1420	731	50	4220	5275

Section 1 at Gas Line is 1.4 miles long and was surveyed on July 20th, 2009 (Table 1). HWTP divers observed 10,747 rainbow trout (*Oncorhynchus mykiss*), one brown trout (*Salmo trutta*), one Sacramento sucker (*Catostomus occidentalis*), one sculpin (*Cottus* spp.), and one lamprey (*Lampetra* spp.). Both the sculpin and lamprey were dead and were not identified to species. The lamprey was being eaten by a rainbow trout. In addition, divers observed crayfish but did not identify them to species. Water visibility was 10 feet.

Section 2 at Whipple Ranch is 0.8 miles long and was surveyed on July 21st, 2009. HWTP divers observed 4,220 rainbow trout (Table 1). Water visibility was approximately eight feet. More divers were needed in order to effectively survey this section. In wide spots of the river, surveyors were unable to clearly see adjacent divers, thus the areas in which divers were responsible for counting fish (diver lanes) were too wide for effective detection during some portions of this effort. It was noted that, at times, divers were spaced more than 30 feet apart (with 8 ft of visibility). For future surveys, the HWTP recommends a minimum of 16 divers for Section 2.

Typically, Section 3 at Island Road is surveyed in conjunction with Sections 1 and 2. However, visibility in Section 3 is generally lower than in Section 2 due to

wider stream widths and more aquatic vegetation. DFG Northern Region biologists determined that the number of divers available was insufficient and the survey for Section 3 was cancelled.

In 2009, Section 1 had a higher rainbow trout density (7676 trout/mile; see Table 1) and greater species diversity than Section 2. HWTP surveyors counted nearly four times as many rainbow trout in Section 1 in 2009 than in 2008 (Table 2). A similar number of rainbow trout were observed in Section 2 in both 2008 and 2009. Zero pikeminnow (*Ptychocheilus grandis*) were observed in 2009.

Table 2. Comparison of Fall River trout numbers observed and estimated densities by species and section from 1993-2009.

	Number of rainbow trout observed						Number of brown trout observed				
Survey year	Section 1 at Gas Line	Section 2 at Whipple Ranch	Section 3 at Island Road	Total of all sections	Estimated density (fish/mile)	Survey year	Section 1 at Gas Line	Section 2 at Whipple Ranch	Section 3 at Island Road	Total of all sections	Estimated density (fish/mile)
1993	4118	1322	3517	8957	2239	1993	65	0	5	70	18
1995	259	2448	3879	6586	1647	1995	1	0	1	2	1
1997	6727	3951	2786	13464	3366	1997	7	0	1	8	2
1998	9170	2247	5184	16601	4150	1998	13	6	1	20	5
1999	5979	4500	3376	13855	3464	1999	15	5	2	22	6
2001	6187	5757	2953	14897	3724	2001	0	0	0	0	0
2004	2996	2129	6041	11166	2792	2004	2	0	0	2	1
2007	6024	8316	3681	18021	4505	2007	52	2	0	54	14
2008	2689	4189	6674	13552	3388	2008	12	0	0	12	3
2009	10747	4220	n/a	14967	6803	2009	1	0	n/a	1	0
Average number of rainbow trout per mile (1993-2009)				=	3608	Average number of brown trout per mile (1993-2009)				=	5

In 2009, HWTP surveyors counted 14,967 rainbow trout in 2.2 miles of stream habitat, yielding an estimated density of 6803 rainbow trout per mile within the study area. The single brown trout, sculpin, Sacramento sucker, and lamprey observed in Section 1 represent a density estimate of 0.45 fish per mile for each species. For comparative purposes, a density estimate was generated for each trout species for the years 1993 through 2009. Density estimates were based on the total number of trout observed by species among all sections in a given year. These estimates were then averaged across all years (Table 2). This allows for a comparison between the most recent estimated density of a species and the long-term average density based on historic data.

Rainbow trout densities within the three survey sections have ranged from 1647 fish per mile to 6803 fish per mile since 1993, with an average of approximately 3608 fish per mile (Table 2). In this 17-year period, it appears that the rainbow trout population in the sections surveyed has remained relatively stable with the highest density recorded this year. The density estimate in 2009 for rainbow trout was nearly double that of the long-term, aggregate average. Although only one brown trout was observed in 2009, this low density estimate appears consistent across time from 1993 to the present.

The HWTP also examined size class distribution over time. In some previous surveys, size classes were divided into three categories (less than six inches; between six and 12 inches; and greater than 12 inches) rather than the five size classes used in 2009 (See Methods). In order to compare data across time, the YOY and small fish observed in 2009 were lumped into the “less than six inches” class. Similarly, large and extra-large fish were lumped into the “larger than 12 inches” class. The medium size class range (between six and 12 inches) is consistent for both size classifications. A comparison of size classes in Section 1 shows that the number of rainbow trout observed in each size class more than tripled from 2008 to 2009 (Table 3). For medium-sized rainbow trout in Section 1 (between six and twelve inches), there was a twelve-fold increase from 2008 to 2009. The number of medium-sized rainbow trout in Section 2 also increased from 2008 to 2009; other size classes were similar for both years.

Table 3. Comparison of trout observed by size class and section on the Fall River from 1993 through 2009.

Section 1 at Gas Line:									
Survey date	Number of divers	rainbow trout				brown trout			
		< 6"	6"- 12"	>12"	Total	< 6"	6"- 12"	>12"	Total
08/25/93	12	3762	288	68	4118	58	1	6	65
08/01/95	9	106	113	40	259	0	0	1	1
08/05/97	13	5765	708	254	6727	0	0	7	7
07/29/98	11	3995	3412	1763	9170	0	3	10	13
08/04/99	12	4506	1079	394	5979	0	6	9	15
08/01/01	13	2653	2520	1014	6187	0	0	0	0
08/05/04	11	1235	1292	469	2996	0	0	2	2
07/17/07	12	5331	490	203	6024	42	10	0	52
07/29/08	12	2437	88	164	2689	11	1	0	12
07/20/09	9	9158	1081	508	10747	0	0	1	1

Table 3 continued.

Section 2 at Whipple Ranch:									
Survey date	Number of divers	rainbow trout				brown trout			
		< 6"	6"- 12"	>12"	Total	< 6"	6"- 12"	>12"	Total
08/23/93	11		1322		1322	none recorded			n/a
08/02/95	10	440	1134	874	2448	none recorded			n/a
08/06/97	12	1420	1113	1418	3951	none recorded			n/a
07/28/98	13	389	1355	503	2247	0	3	3	6
08/03/99	12	2145	1674	681	4500	0	5	0	5
07/31/01	13	1190	3515	1052	5757	0	0	0	0
08/04/04	11	391	1051	687	2129	none recorded			n/a
07/17/07	12	5362	2100	854	8316	2	0	0	2
07/29/08	12	2482	757	950	4189	0	0	0	0
07/21/09	9	2019	1420	781	4220	0	0	0	0

Section 3 at Island Road:									
Survey date	Number of divers	rainbow trout				brown trout			
		< 6"	6"- 12"	>12"	Total	< 6"	6"- 12"	>12"	Total
08/24/93	11	2421	806	290	3517	0	1	4	5
08/02/95	11	2090	1303	486	3879	0	0	1	1
08/06/97	12	1602	704	480	2786	0	0	1	1
07/30/98	12	3175	1356	653	5184	0	0	1	1
08/04/99	12	2371	817	188	3376	0	0	2	2
08/01/01	13	664	1438	851	2953	0	0	0	0
08/05/04	11	2106	2599	1336	6041	0	0	0	0
10/04/07	11	2160	1230	291	3681	0	0	0	0
07/30/08	16	6004	377	293	6674	0	0	0	0

Discussion:

The Fall River is dominated by rainbow trout. There is concern that anthropogenic changes in the Fall River Valley and areas upstream of the survey sections have negatively affected the Fall River fishery, including increased sediment-loading from Bear Creek, cattle grazing, agricultural runoff, and degraded stream banks. A long-standing dataset of direct observation surveys on the Fall River allows us to compare fish densities, species composition, and age class structure over time. This enables the HWTP to closely monitor this fishery by detecting changes in fish distribution, age class composition, and other population parameters. However, the direct observation survey sections on the Fall River were originally selected based on past electrofishing surveys. They are relegated to the upper one-half of the system and do not include the headwaters, any tributaries, or the lower section of the river downstream of the confluence with the Tule River (Figure 2). The three sections surveyed in recent years may or may not be representative of the fishery as a whole due to changes in habitat throughout the river. The HWTP recommends selecting new sections for future surveys using stratified random sampling techniques. The entire river from the headwaters downstream to the Pit #1 Powerhouse intake, including tributaries (such as Spring Creek), should be included when selecting new section locations. In addition, the HWTP recommends maintaining one or more historic sections for long-term trend monitoring. Although past direct observation surveys are useful for comparison of estimated fish densities, spatial distribution, and age class structure over time, without randomized site selection throughout the entire river, it is difficult to assess the overall fish population dynamics of the Fall River.

Due to changes in habitat and flow of the Fall River downstream of the Tule River confluence, sampling technique will need to be further developed in this portion of the river. The HWTP recommends using boat electrofishing methods to survey this area of the river. In order to compare future electrofishing data with those from snorkel surveys dating back to 1993, it may be useful to conduct both a direct observation survey and boat electrofishing survey in one of the historic Fall River sections to use as a calibration tool to better understand how snorkel survey counts compare to electrofishing capture data. DFG North Coast Regional HWTP biologists have committed to updating the Fisheries Management Plan for the Fall River; once revised, this document should provide guidelines for sampling strategy, methods, survey locations, and monitoring frequency for this world class fishery.

References:

Hankin D.G. and G.H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Sciences. 45:834-844.

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