Fall River Summary Report
July 29-30, 2008

Heritage and Wild Trout Program
California Department of Fish and Game

Prepared by Jeff Weaver and Stephanie Mehalick

Introduction:

The Fall River in Shasta County is a low-gradient, spring-fed system located in the Fall River Valley in northeastern California. The Fall River is surrounded by fertile farmlands and active cattle ranches and is well-publicized in sport fishing magazines for its renowned trout fishing. The Fall River became one of the first rivers in California to receive Wild Trout designation. From its source at Thousand Springs downstream to the confluence with the Tule River (a tributary to the Pit River), gear and size restrictions are in place (artificial lures with barbless hooks; maximum size limit of 14 inches). These special fishing regulations also apply to Spring Creek, one of the Fall River's major tributaries. Downstream of the confluence with the Tule River, General Sierra District Regulations apply (open from the last Saturday in April through November 15 with a two bag limit). The designated Wild Trout area of the Fall River spans from Thousand Springs downstream to the Pit #1 Powerhouse Intake. The California Department of Fish and Game (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 2008, The Heritage and Wild Trout Program (HWTP) conducted direct observation surveys on three historic sections of the Fall River at Gas Line (Section 1), Whipple Ranch (Section 2), and Island Road (Section 3) (Figures 1 and 2).

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. The number of divers needed for each section was determined based on stream width, water visibility, and habitat complexity. Twelve to 16 divers were used for these surveys (see Table 1 for section specifics). 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 are generally between zero and three inches in total length. If a trout was observed to be less than six inches 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. Two personnel on

paddle craft participated in the survey effort by boating behind the divers; these boaters helped the divers maintain their position in the water and acted as a safety backup and lookout for the dive team. For all three sections, we measured water and air temperature as well as water visibility. Representative photographs were taken and section lengths were determined based on GIS analysis (at a scale of 1:3000).

Figure 1. Map of Fall River survey locations

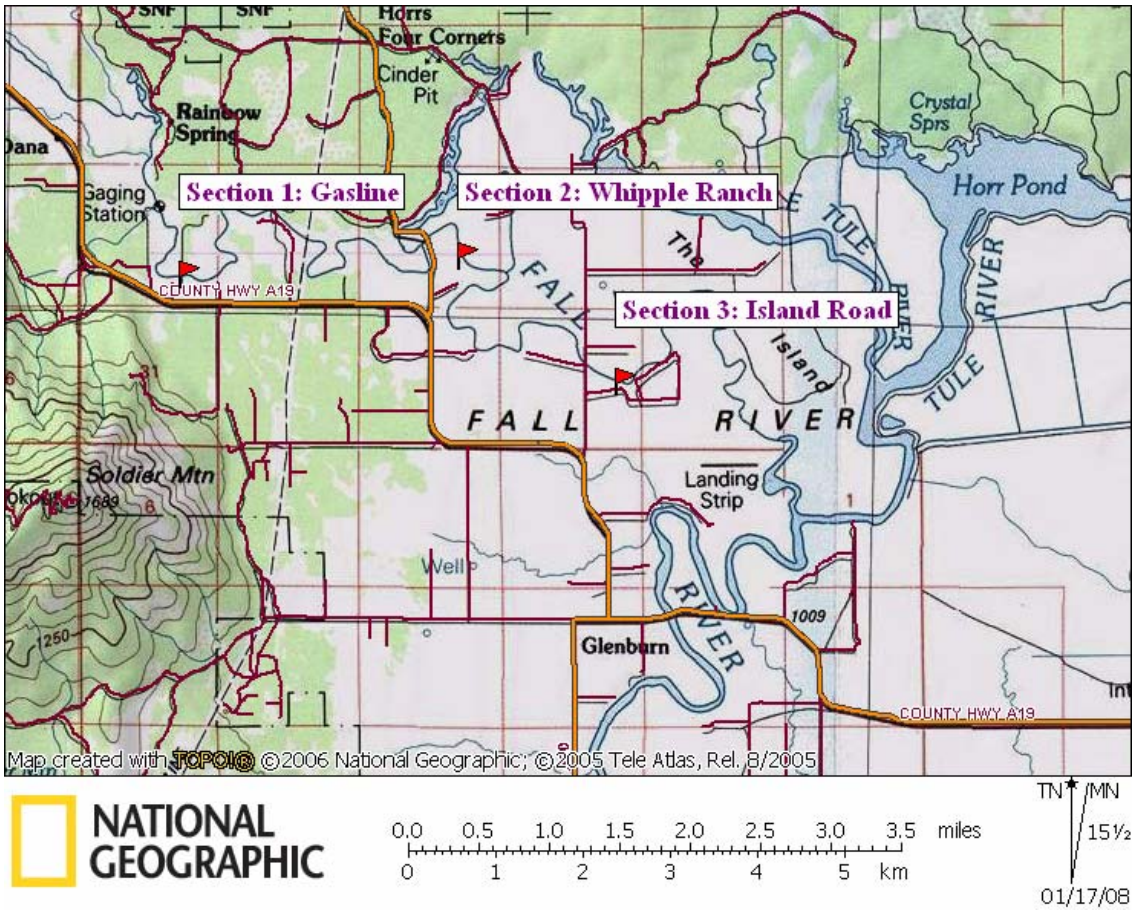
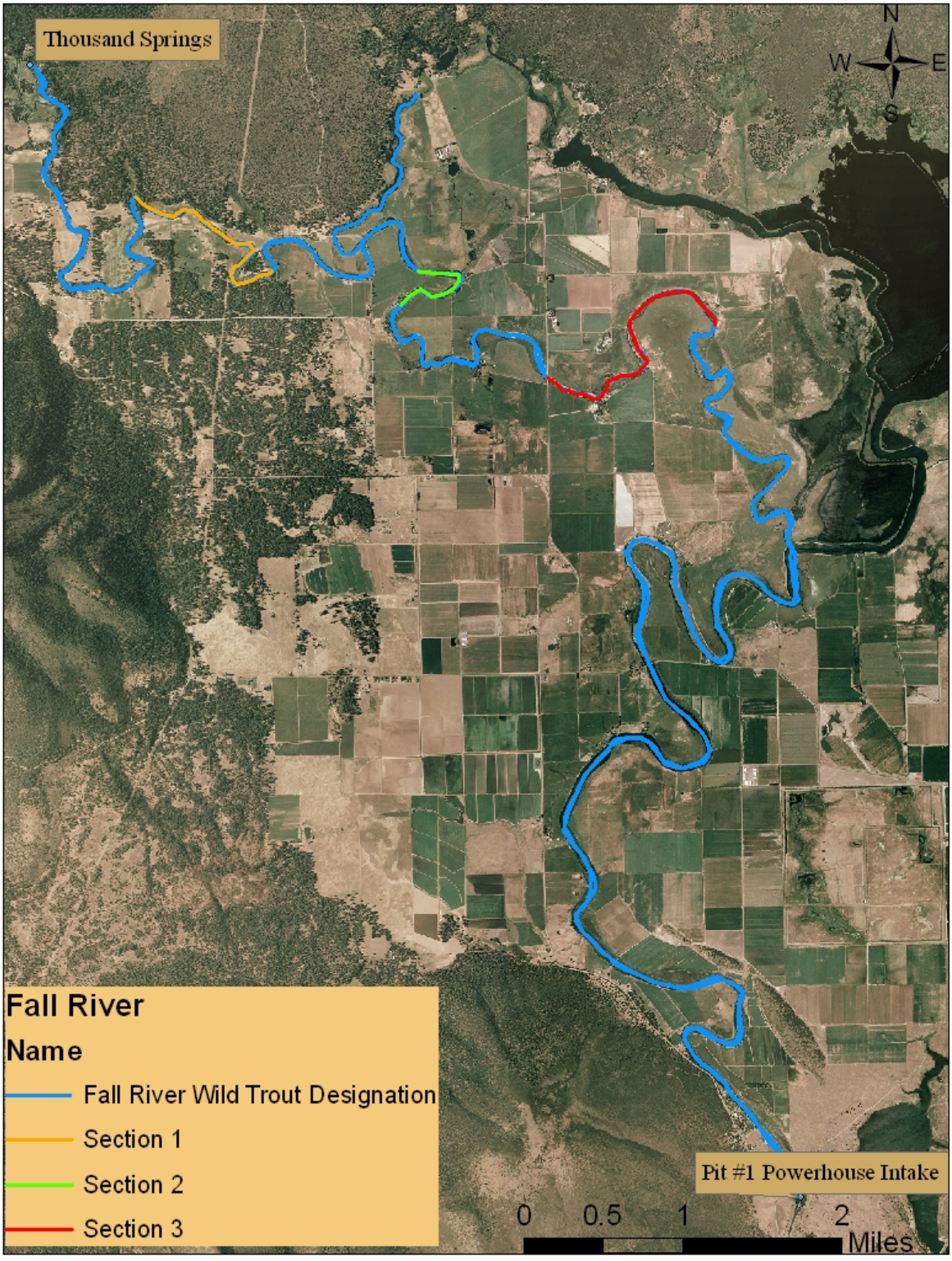


Figure 2. Map of Fall River including the Wild Trout-designated area and 2008 direct observation section locations



Results:

For all three surveys, the weather was sunny and clear with ambient air temperatures ranging from 24 to 27 degrees Celsius. Water temperatures ranged from 13 to 15 degrees Celsius. The Fall River has a relatively consistent flow regime; therefore, due to long section lengths and the extended exposure time of the divers to cold water, we did not take wetted width or water depth measurements. Data from 2007 showed an average stream width of 147 feet and average water depth of 5.6 feet, with some deep areas exceeding 20 feet in depth. Due to its low gradient and near constant flow, channel profile characteristics in the Fall River change very little from year to year. Presumably, water depths and widths were similar in 2007 and 2008. 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 15-plus feet, depending on location. Vegetation (both submersed and overhanging), large woody debris, water depth, and canopy cover provided fish cover.

Table 1. Direct observation survey results (2008); a summary of the number of fish observed by species and their 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	XLarge >18"	Total	
1 at Gas Line	7/29/08	12	1.4	coastal rainbow trout	296	2141	88	156	8	2689	1921
				brown trout	5	6	1	0	0	12	9
				unknown trout	0	0	0	1	0	1	1
				sculpin	n/a					10	7
				Sacramento pikeminnow	n/a					25	18
2 at Whipple Ranch	7/29/08	12	0.8	coastal rainbow trout	171	2311	757	869	81	4189	5236
				unknown trout	0	0	2	0	0	2	3
				sculpin	n/a					1	1
				Sacramento pikeminnow	n/a					1	1
3 at Island Road	7/30/08	16	1.8	coastal rainbow trout	435	5569	377	253	40	6674	3708
				sculpin	n/a					8	4
				Sacramento sucker	n/a					1002	557
				unknown cyprinid	n/a					300	167

Section 1 at Gas Line, surveyed on July 29th, 2008, is 1.4 miles in length. HWTP divers observed 2689 coastal rainbow trout (*Oncorhynchus mykiss irideus*), 12 brown trout (*Salmo trutta*), one unknown trout species, 10 sculpin (*Cottus* spp.), and 25 Sacramento pikeminnow (*Ptychocheilus grandis*) (Table 1). In addition, divers observed three crayfish, two muskrat, two Western pond turtles (*Clemmys marmorata*), and one lamprey (dead). With the exception of the Western pond turtle, these other organisms were not identified to species. Water visibility was greater than 15 feet. Due to a broken mask there was one less diver for the last 15 minutes of the survey effort. During this time, the remaining 11 divers adjusted their positions in the water to accommodate for one less diver. It is not believed to have affected the integrity of the survey, largely due to the extended in-water visibility in this portion of the river.

Section 2 at Whipple Ranch was surveyed on July 29th, 2008. HWTP divers observed 4189 coastal rainbow trout, two trout of unknown species, one sculpin, one Sacramento pikeminnow, and numerous crayfish (Table 1). The section length was 0.8 miles. Water visibility was approximately 10 feet. In this section, we were limited by the number of divers. In wide spots of the river, divers were unable to clearly see adjacent divers, thus the lanes were too wide for effective detection during some portions of this effort. For future surveys, the HWTP recommends a minimum of 16 divers for Section 2.

Section 3 at Island Road, surveyed on July 30th, 2008, is approximately 1.8 miles in length. HWTP divers counted 6674 coastal rainbow trout, eight sculpin, 1002 Sacramento suckers (*Catostomus occidentalis*), and 300 unknown minnows (Family Cyprinidae) (Table 1). Water visibility was poor in Section 3 (between 3 and 10 feet). It was noted that, at times, divers could not see clearly all the way to the streambed or to adjacent divers. As divers were entering the water to begin the survey effort, sediment was disturbed from the streambed which decreased water visibility. The resulting "sediment plume" followed divers downstream as the survey effort progressed. Due to poor visibility and assumed poor fish detection rates from the suspended sediment, divers made a concerted effort to actively swim downstream in order to get ahead of the "plume." In addition, the length of this survey section, coupled with cold water temperatures, contributed to noticeable diver fatigue. As a result, it is likely that fish counts were artificially low during this effort, due to poor detection. The HWTP recommends increasing the number of divers in this section for future surveys.

Data from 2008 show that Section 2 had the highest trout density (5239 trout/mile), followed by Section 3 (3708 trout/mile) and then Section 1 (1930 trout/mile) (Table 1). These values are for total trout and include coastal rainbow, brown, and unknown trout observed during the 2008 survey effort. In total, the HWTP counted 13,567 trout in four miles of stream habitat, yielding an estimated overall density of 3392 trout per mile within the study area. Due to differing habitat types throughout the entire length of the Fall River, this density estimate is only applicable to the portion of the river in the vicinity of Sections 1 through 3 (the upper one-half of the Fall River) and is not representative of the entire system.

Table 2. Comparison of trout numbers observed by section from 1993-2008 and estimated densities. Density estimates were generated using the total number of trout, by species, observed among all 3 sections with a total survey length of four miles. Trout not identified to species were not included.

Survey Year	Number of coastal rainbow trout observed				Estimated density (coastal rainbow trout/mile)
	Section 1 at Gas Line	Section 2 at Whipple Ranch	Section 3 at Island Road	Total of all sections	
1993	4118	1322	3517	8957	2239
1995	259	2448	3879	6586	1647
1997	6727	3951	2786	13464	3366
1998	9170	2247	5184	16601	4150
1999	5979	4500	3376	13855	3464
2001	6187	5757	2953	14897	3724
2004	2996	2129	6041	11166	2792
2007	6024	8316	3681	18021	4505
2008	2689	4189	6674	13552	3388
Average number of coastal rainbow trout per mile (1993-2008)				=	3253

Survey Year	Number of brown trout observed				Estimated density (brown trout /mile)
	Section 1 at Gas Line	Section 2 at Whipple Ranch	Section 3 at Island Road	Total of all sections	
1993	65	0	5	70	18
1995	1	0	1	2	1
1997	7	0	1	8	2
1998	13	6	1	20	5
1999	15	5	2	22	6
2001	0	0	0	0	0
2004	2	0	0	2	1
2007	52	2	0	54	14
2008	12	0	0	12	3
Average number of brown trout per mile (1993-2008)				=	5

Discussion:

The Fall River is dominated by coastal rainbow trout. There is concern that anthropogenic changes in the Fall River Valley and areas upstream 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. To replicate previous survey efforts, we attempt to conduct the surveys at the same time of year. In 2007, a rain event postponed the Section 3 survey until October (as opposed to July). Due to the nearly three month delay in survey timing, comparisons between years for Section 3 may not be accurate. This fact may also have a bearing on the overall density estimates generated (Table 2). In Sections 1 and 2, fewer trout were observed in 2008 than in 2007. Section 3 saw an increase in

trout numbers from 2007 to 2008 but, because of the difference in survey timing, it is difficult to interpret whether this is due to an actual increase in the trout population. Overall, the estimated density of trout in the Fall River decreased from 2007 (Table 2).

Coastal rainbow trout densities within these three sections have ranged from 1647 fish per mile to 4505 fish per mile since 1993, with an average of approximately 3253 fish per mile (Table 2). In this 15-year period, it appears that the coastal rainbow trout population in the Fall River has remained relatively stable. All size-classes were observed in 2008. Density estimates for 2008 (3388 coastal rainbow trout/mile) are slightly above the long-term, aggregate average. Brown trout numbers in the Fall River were low in 2008 (approximately three brown trout per mile). However, this low density estimate appears consistent across time from 1993 to the present.

Based on GIS analysis (at a scale of 1:3000), the Wild Trout-designated area of the Fall River is approximately 24 miles in length (including Spring Creek). The total length surveyed in 2008 (total of Sections 1, 2, and 3) was approximately four miles in length. Therefore, the three survey sections represent roughly 16.5 percent of the total Wild Trout-designated length of the Fall River. This level of sub-sampling exceeds HWTP goals of surveying a minimum of ten percent of stream habitat(s) within a given system. However, the sections on the Fall River were originally selected based on past electrofishing surveys and are relegated to the upper one-half of the river, all of which is upstream of the confluence with the Tule River. These sections may or may not be representative of the system in general, due to changes in habitat and fishing regulations downstream of the confluence with the Tule River.

Habitat attributes vary widely throughout the Fall River system, especially in the headwaters and downstream of the confluence with the Tule River. HWTP staff recommends selecting new survey sections in order to more appropriately subsample differing parts of the entire Fall River system. Some level of stratified randomization should be employed in future survey site selections and the survey area should include Spring Creek as well as the lower stretch of the river downstream of the Tule River. Maintaining one or more historic sections (for long-term trend monitoring) is important. However, randomization in survey site selection is equally important from a sampling standpoint. Although past direct observation surveys are useful to monitor localized trends via comparison in fish densities over time and can be useful in identifying a problem with the fishery in the upper section of the river, 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 gear to survey this area of the river. In order to compare these results with those of

the 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 numbers. DFG Northern Region 1 biologists have committed to updating the Fisheries Management Plan for the Fall River; once revised, this document will provide further insight on sampling strategy and management plans for this important and popular 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.