

Fall River Summary Report

July 26-28, 2010

State of California

Natural Resources Agency

Department of Fish and Game

Heritage and Wild Trout Program



Prepared by Jeff Weaver and Stephanie Mehalick

Introduction:

The Fall River, located in northeastern California (Shasta County), is tributary to the Pit River (Figure 1) and is a spring-fed system that contains wild populations of rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). The Fall River became one of the first streams in California to receive Wild Trout designation. Wild Trout Waters are those that support self-sustaining (wild) populations of trout, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers or size of trout, and are open to public angling (Bloom and Weaver 2008). Wild Trout Waters may not be stocked with catchable-sized hatchery trout.

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, 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, including 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. The DFG has maintained three long-term monitoring sites (Sections 1-3) on the Fall River, at least two of which have been sampled consecutively since 2007. Increasing sedimentation and resulting habitat changes in areas outside the historic sampling sites led the DFG Heritage and Wild Trout Program (HWTP) to revise the sample design for Fall River monitoring in 2010. This modified approach included maintaining one or more historic sections for long-term trend monitoring, while establishing new sections using stratified random sampling. However, the portion of the Fall River downstream of the confluence with the Tule River was not included in the sample frame, as the river becomes too wide, deep, and turbid to survey effectively using direct observation snorkel survey methods.

In July, 2010, the HWTP conducted direct observation surveys at four locations (Figures 2-3). These sections included the three long-term monitoring sites (Sections 1-3) and a section newly established in 2010 in the headwaters of the Fall River system (Section 4). Alternative sampling strategies for the portion of the Fall River downstream of the Tule River are still being developed.

Figure 1. Vicinity map of Fall River survey location.

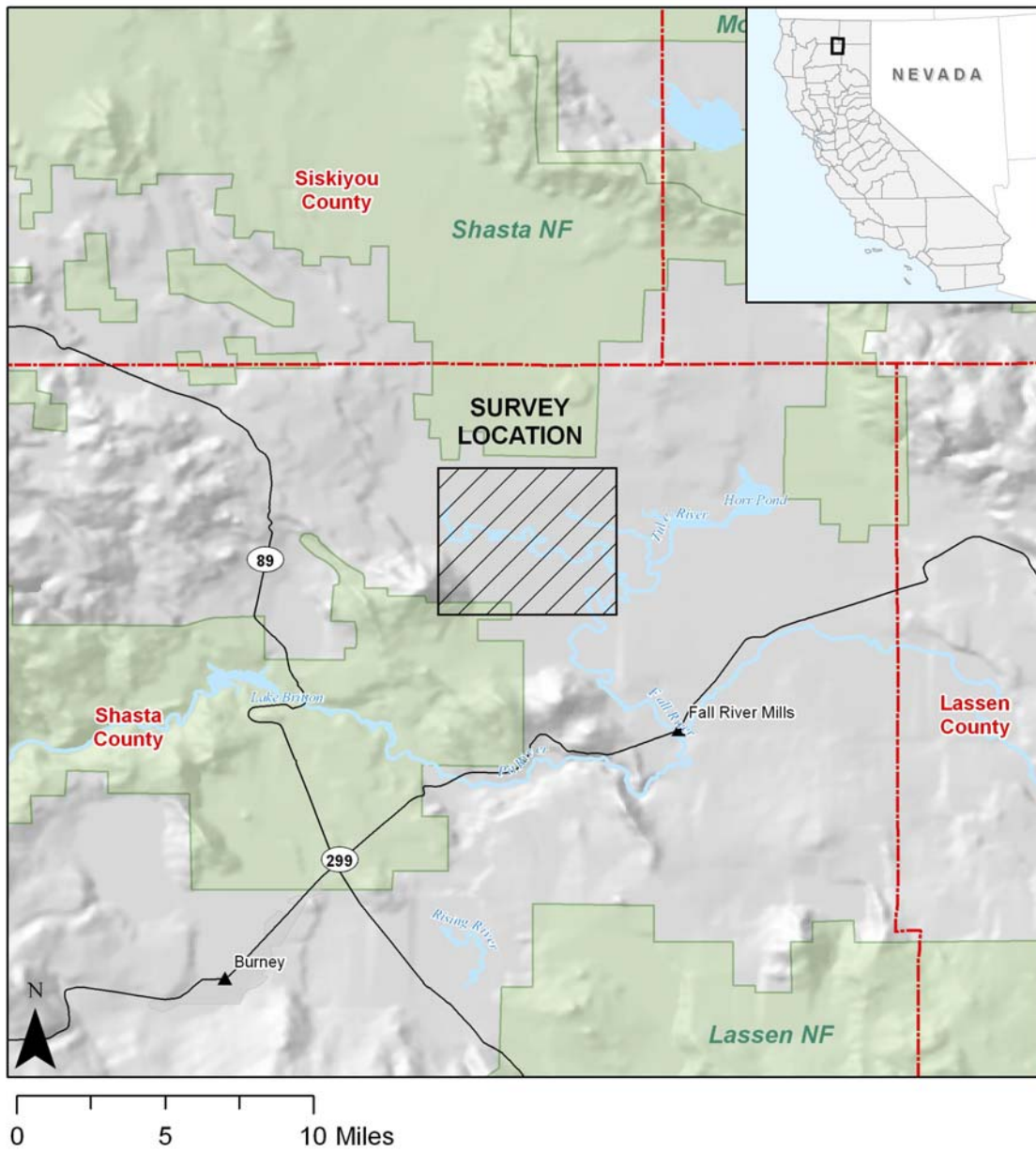


Figure 2. Detail map of Fall River including the Wild Trout-designated area and 2010 survey section locations.

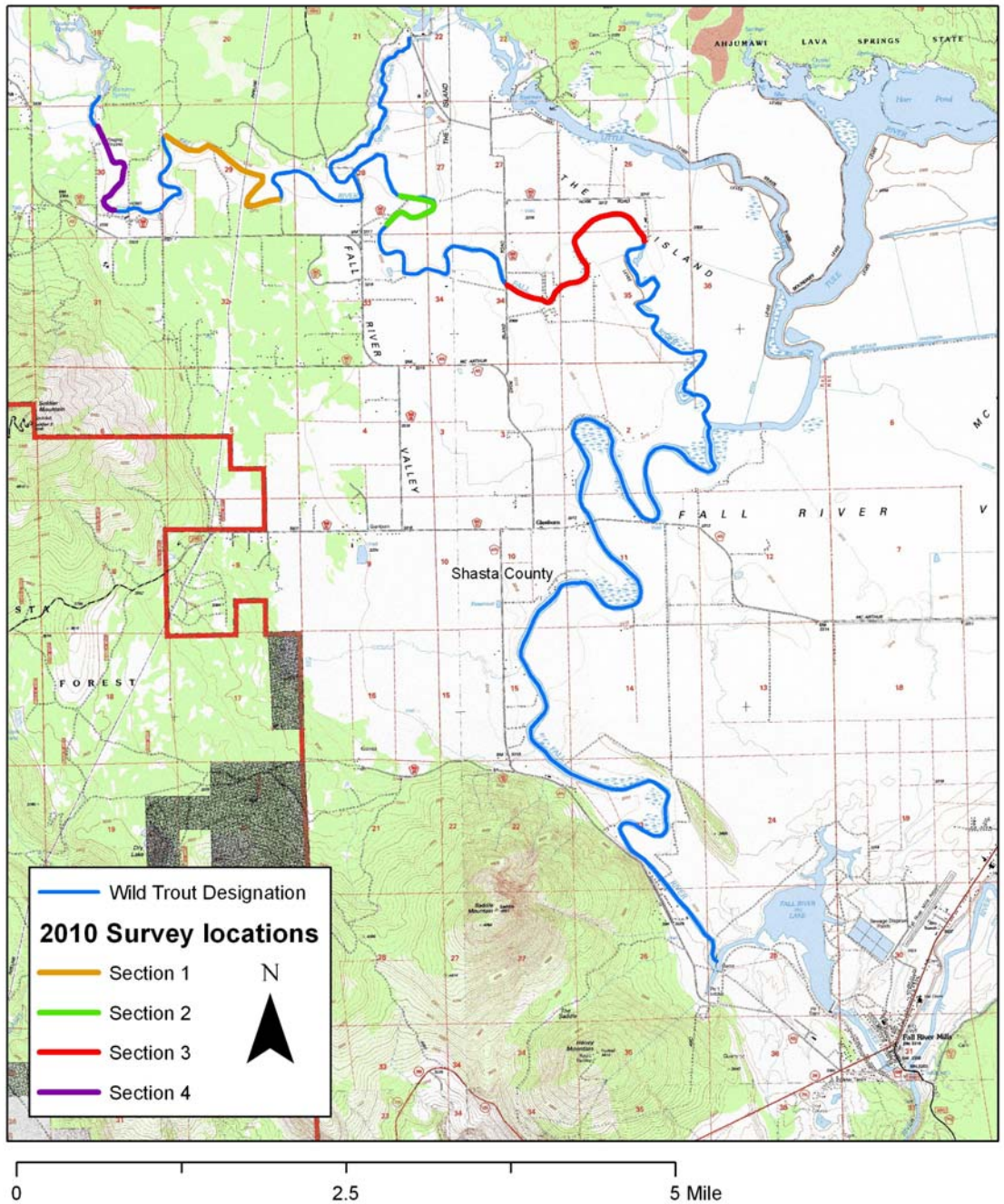
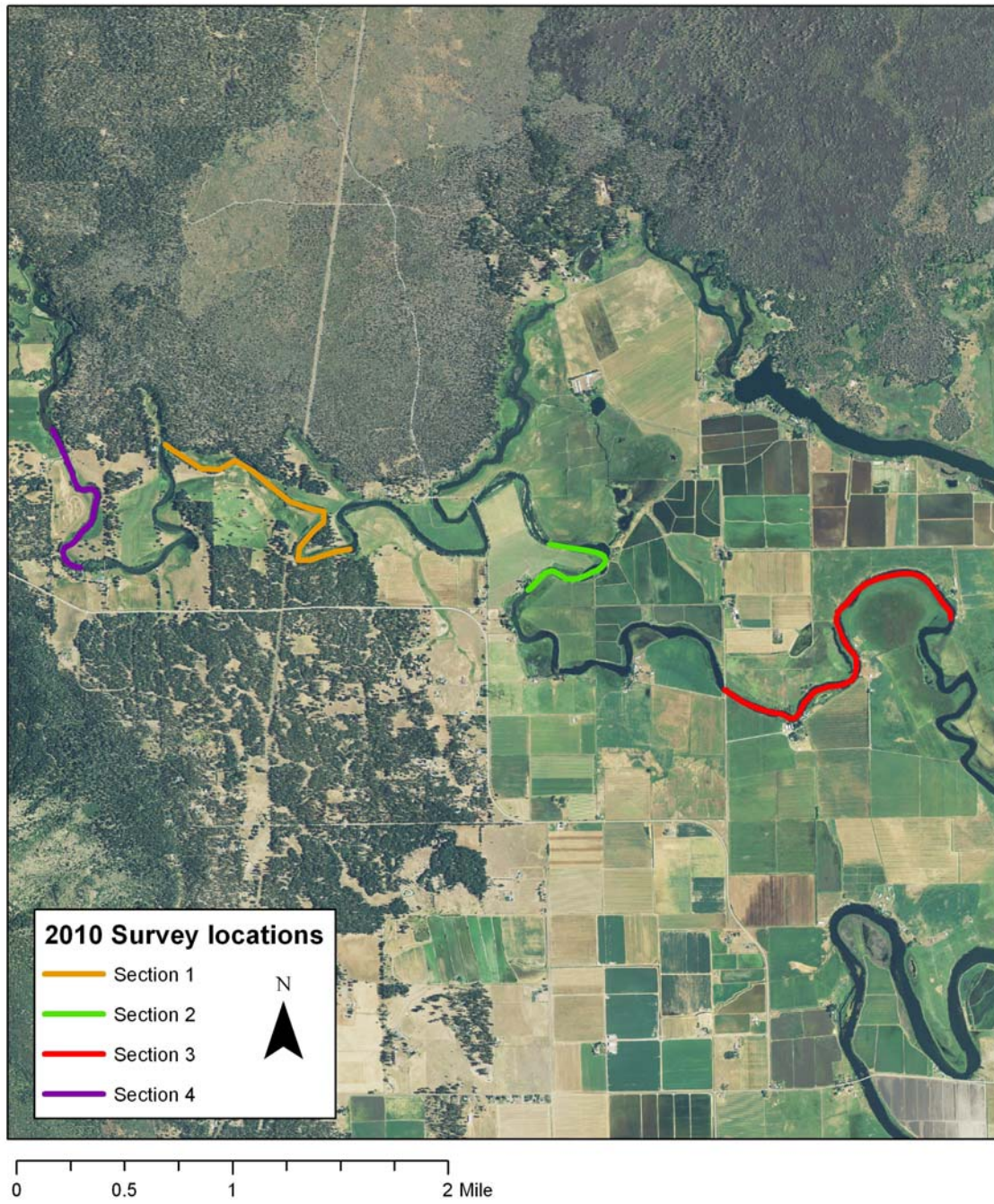


Figure 3. Aerial map of Fall River 2010 survey section locations.



Methods:

Direct observation surveys were conducted from July 26th-28th, 2010 using snorkeling methods, an effective survey technique in many small streams and creeks in northern California and the Pacific Northwest (Hankin and Reeves, 1988). To replicate previous efforts, section boundaries were located using written directions, maps, and GPS coordinates. Section 4 was selected in order to collect data from the upper portion of the watershed which had not been previously surveyed. The upstream boundary of Section 4 was located adjacent to a private dock approximately 0.3 miles downstream of the private property boundary of Thousand Springs Ranch. This area is the upstream-most publicly accessible portion of the Fall River. The downstream boundary was selected directly upstream of the Spinner Fall Lodge boat ramp based on the need for a launch point for power boat assistance to shuttle surveyors to the upstream boundary.

The surveys were conducted in a downstream direction with either 15 or 16 divers, depending on the section. Divers maintained an evenly-spaced line perpendicular to the current and 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 (\geq 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. Two personnel on paddle craft participated in the survey by helping divers maintain their dive lanes and acted as a safety backup and lookout for the dive team. For each section, surveyors measured water and air temperature, average wetted width and water depth, and water visibility. Representative photographs were taken and section lengths were determined based on GIS analysis (at a scale of 1:3000).

Results:

The Fall River is characterized by slow moving flatwater; riffles and deep pools are mostly absent. During the surveys, water visibility ranged from six feet to more than 15 feet, depending on location (due to changes in cover complexity and/or turbidity). Vegetation (both submerged and overhanging), large woody debris, and water depth provided fish cover. Weather during the survey effort ranged from sunny and clear (Sections 1-3) to partly cloudy (Section 4). Water

and air temperature were measured twice during the survey effort. Water temperature was measured at 12 °C and 13 °C, although surveyors noted warmer pockets of water in certain areas. Air temperature ranged from 23 °C to 34 °C, depending on the time of day. A total of 4.8 miles of stream habitat were surveyed (total length of all four sections) with an average wetted width of 155.8 feet and average water depth of 5.8 feet.

Section 1 at Gas Line is 1.4 miles long and was surveyed on July 26th, 2010. Divers observed 3399 rainbow trout, six brown trout, and two sculpin (*Cottus* sp.; Table 1). Divers also observed crayfish (not identified to species), snails (not identified to species), four dead rainbow trout, one rainbow trout with a spinal deformity, and numerous rainbow trout that appeared to be missing scales on the dorsum. Rainbow trout size class distribution was 6% YOY, 54% small, 30% medium, 8% large, and 2% extra-large sized fish. Brown trout size class distribution was 33% small, 33% medium, 17% large, and 17% extra-large sized fish. Abundance estimates in Section 1 were 2428 rainbow trout per mile, four brown trout per mile, and one sculpin per mile.

Section 2 at Whipple Ranch is 0.8 miles long and was surveyed on July 28th, 2010. Divers observed 5292 rainbow trout, two sculpin, one Sacramento pikeminnow (*Ptychocheilus grandis*), and 152 unknown fishes (Table 1). The latter may have included western mosquitofish (*Gambusia affinis*), suckers (*Catostomus* sp.), and/or other unknown cyprinids; these fishes were small (less than 60 mm) and difficult to identify. Water visibility was poor in this section (six feet) and, in deep areas, divers could not clearly see to the river bottom. Divers noted that the rooted aquatic vegetation was densely covered in algae. Numerous crayfish were also observed, including approximately 100 that were dead or molted. Rainbow trout size class distribution in Section 2 was 0.1% YOY, 18% small, 41% medium, 35% large, and 6% extra-large size fish. Abundance estimates were 6615 rainbow trout per mile, three sculpin per mile, one Sacramento pikeminnow per mile, and 190 unknown fishes per mile.

Section 3 at Island Road is 1.8 miles long and was surveyed on July 28th, 2010. A total of 4615 rainbow trout, four sculpin, three Sacramento pikeminnow, and 20 unknown fishes (cyprinids and/or suckers) were observed (Table 1). In addition, two dead rainbow trout were observed. Water visibility was limited in deep water habitat. Size class distribution of rainbow trout was 1% YOY, 46% small, 31% medium, 19% large, and 3% extra-large sized fish. The property owner noted that aquatic vegetation appeared much thicker this year compared to past years; large floating mats of aquatic vegetation were present along the stream margins in parts of the section and prevented divers from surveying in these areas.

Section 4, established in 2010, is 0.8 miles in length and was surveyed on July 27th, 2010. Section 4 lacked deeper water habitat and dominant substrate types were gravel and silt. A total of 1078 rainbow trout, one brown trout, three suckers, five sculpin, and 5200 unknown fishes (suckers and/or cyprinids) were observed (Table 1). Size class distribution of rainbow trout was 53% YOY, 37%

small, 5% medium, 4% large, and 1% extra-large. The one brown trout observed was in the large size class. In addition, one dead sculpin was observed. Water visibility was good in this section (15-20 feet). Estimated abundance in Section 4 was 1348 rainbow trout per mile, one brown trout per mile, four suckers per mile, six sculpin per mile, and 6500 unknown fishes per mile.

Table 1. Fall River 2010 direct observation survey data.

Section	Section length (miles)	Species	YOY	Number of fish observed				Total	Estimated density (fish/mile)
				Small	Medium	Large	Extra-large		
				0-5.9"	6"-11.9"	12"-17.9"	>18"		
1	1.4	rainbow trout	206	1831	1015	281	66	3399	2428
		brown trout	0	2	2	1	1	6	4
		sculpin						2	1
2	0.8	rainbow trout	5	976	2145	1860	306	5292	6615
		sculpin			-			2	3
		Sacramento pikeminnow			-			1	1
		unknown fishes			-			152	190
3	1.8	rainbow trout	46	2118	1441	883	127	4615	2564
		sculpin			-			4	2
		Sacramento pikeminnow			-			3	2
		unknown fishes			-			20	11
4	0.8	rainbow trout	568	394	58	42	16	1078	1348
		brown trout	0	0	0	1	0	1	1
		sucker			-			3	4
		sculpin			-			5	6
		unknown fishes			-			5200	6500

Discussion

In 2010, the HTWP surveyed a total of 4.8 miles of stream habitat and observed 14384 rainbow trout, seven brown trout, 13 sculpin, four Sacramento pikeminnow, three suckers, and 5372 unknown fishes. Overall abundance in

2010 for the Fall River was estimated at 2997 rainbow trout per mile, one brown trout per mile, three sculpin per mile, one Sacramento pikeminnow per mile, one sucker per mile, and 1119 unknown fishes per mile. These density estimates were based on the total number of fishes observed by species among all four sections in 2010. The highest density of rainbow trout was observed in Section 2 and the highest density of brown trout was observed in Section 1. Section 4 had the lowest observed density of rainbow trout; however, the majority of these fish were YOY (53%). Due to the high proportion of YOY, coupled with the presence of shallow water habitat, large areas of gravel, and the close proximity to headwater spring and tributary influence, trout may spawn in this portion of the river. Bear Creek, a headwater tributary directly upstream of Section 4, has been identified as a major spawning tributary for the Fall River; the observed YOY may have also moved out of Bear Creek into Section 4.

For comparative purposes, a density estimate was generated for each trout species for the years 1993 through 2010 (Figures 4 and 5). Density estimates were based on the total number of trout observed by species among all sections in a given year (not all sections were surveyed each year; Table 2). These estimates were then averaged across all years, allowing 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 survey sections have ranged from 1647 fish per mile (1995) to 6803 fish per mile (2009) since 1993, with an average of approximately 3552 fish per mile. The density estimate in 2010 for rainbow trout was slightly lower than that of the long-term, aggregate average and showed a nearly 50% decrease from the density observed in 2009. Few brown trout were observed in either 2009 or 2010; this low density estimate appears consistent across time from 1993 to the present. Density estimates were not compared among years for non-salmonids; all other fishes are generally observed in relatively low densities and their numbers appear consistent across time.

Figure 4. Graph of Fall River rainbow trout density estimates by year from 1993-2010 (long-term average in red).

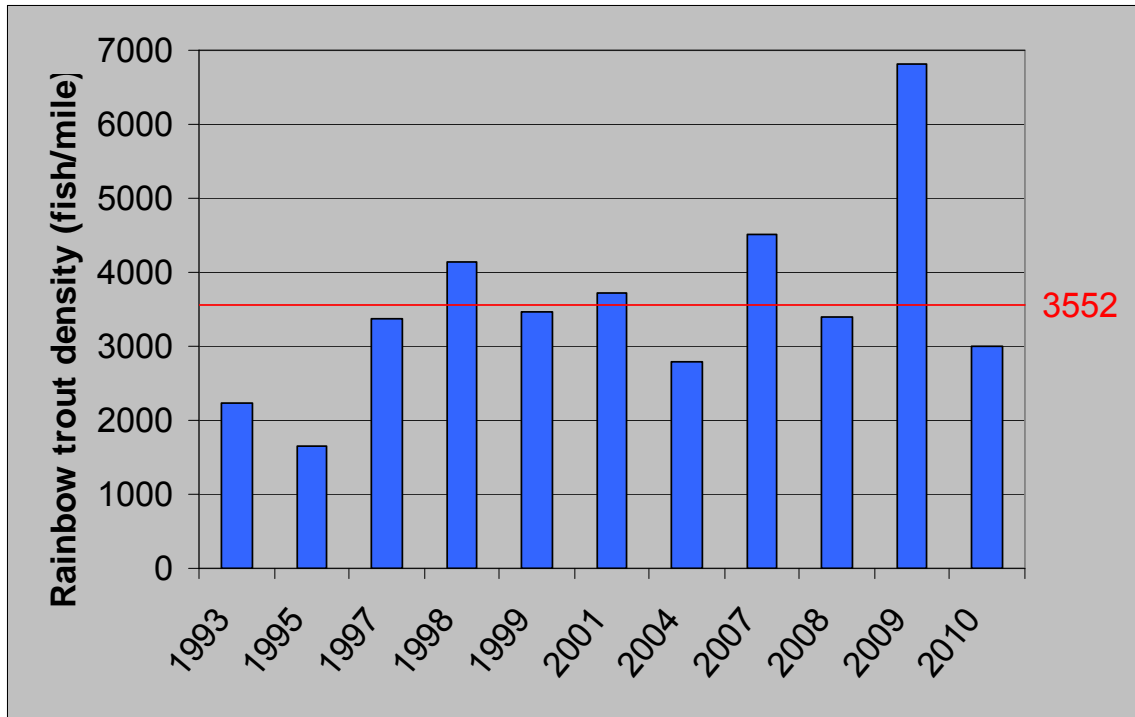


Figure 5. Graph of Fall River brown trout density estimates by year from 1993-2010 (long-term average in red).

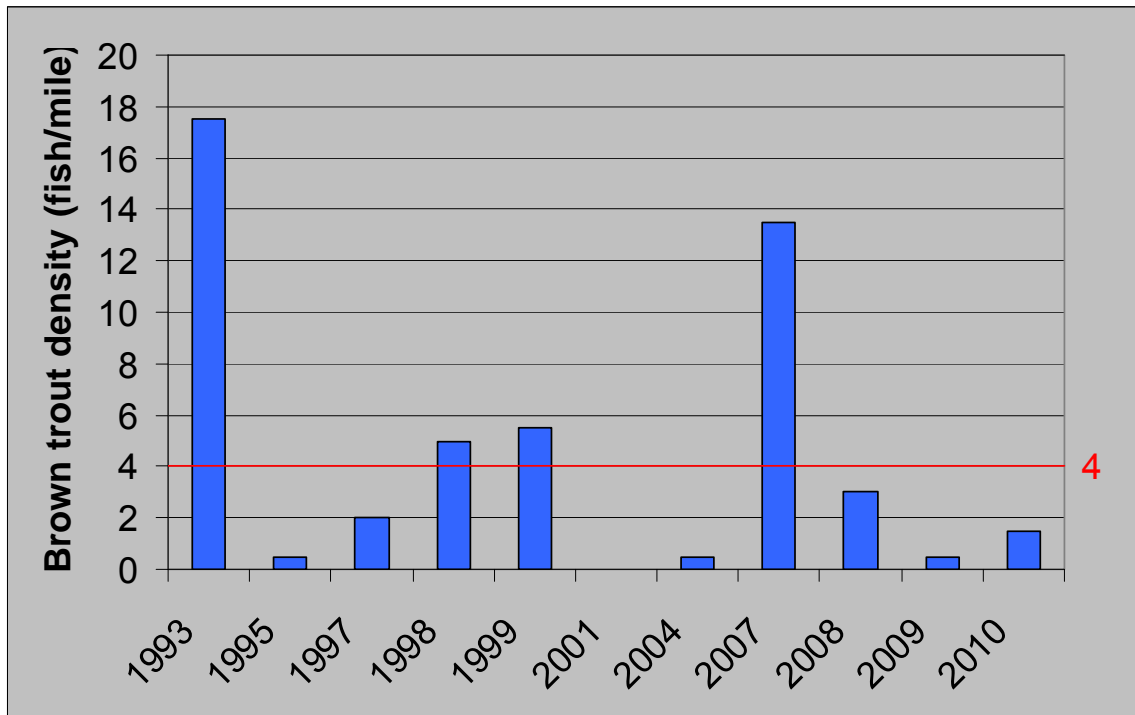


Table 2. Fall River direct observation survey data from 1993-2010.

Section 1 at Gas Line:									
Survey date	Number of divers	number of rainbow trout observed				number of brown trout observed			
		< 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
07/26/10	15	2037	1015	347	3399	2	2	2	6

Section 2 at Whipple Ranch:									
Survey date	Number of divers	number of rainbow trout observed				number of brown trout observed			
		< 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
07/28/10	15	981	2145	2166	5292	0	0	0	0

Table 2 continued.

Section 3 at Island Road:									
Survey date	Number of divers	number of rainbow trout observed				number of brown trout observed			
		< 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
7/28/2010	15	2164	1441	1010	4615	0	0	0	0

Section 4 at Rosie's Dock									
Survey date	Number of divers	number of rainbow trout observed				number of brown trout observed			
		< 6"	6"- 12"	>12"	Total	< 6"	6"- 12"	>12"	Total
07/27/10	16	962	58	58	1078	0	0	1	1

The HWTP also examined size class distribution over time. Prior to 2007, 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 from 2007 through 2010 (see Methods). To compare data across time, categories were grouped together to reflect the three size classes used prior to 2007. In addition, rainbow trout observed in Section 2 in 1993 were not tallied by size class; therefore, this year was removed from the analysis. Rainbow trout size class distribution over time appears relatively consistent. The majority of fish observed fell within the small size class (less than six inches) and larger-sized fish (greater than 12 inches) represented a smaller percentage of the surveyed population (Figure 6). However, in 2010, divers observed a greater proportion of larger-sized rainbow trout, relative to the total number observed. Brown trout size class distribution has been inconsistent over time (Figure 7); this may be due to the relatively small number of brown trout observed each year, possible misidentification of brown and/or rainbow trout (due to the difficulties of

differentiating YOY trout and/or adults in deeper areas of the river due to limited water visibility), decreased detection of brown trout due to species-specific habitat preferences or flight response, and/or natural population dynamics. Similar observations of low detection of larger-sized brown trout were observed by the HWTP in Hat Creek (Shasta County) during an effort to compare direct observation snorkel and boat electrofishing methodologies (Weaver and Mehalick, 2010).

Figure 6. Graph of Fall River rainbow trout size class distribution by year from 1995-2010.

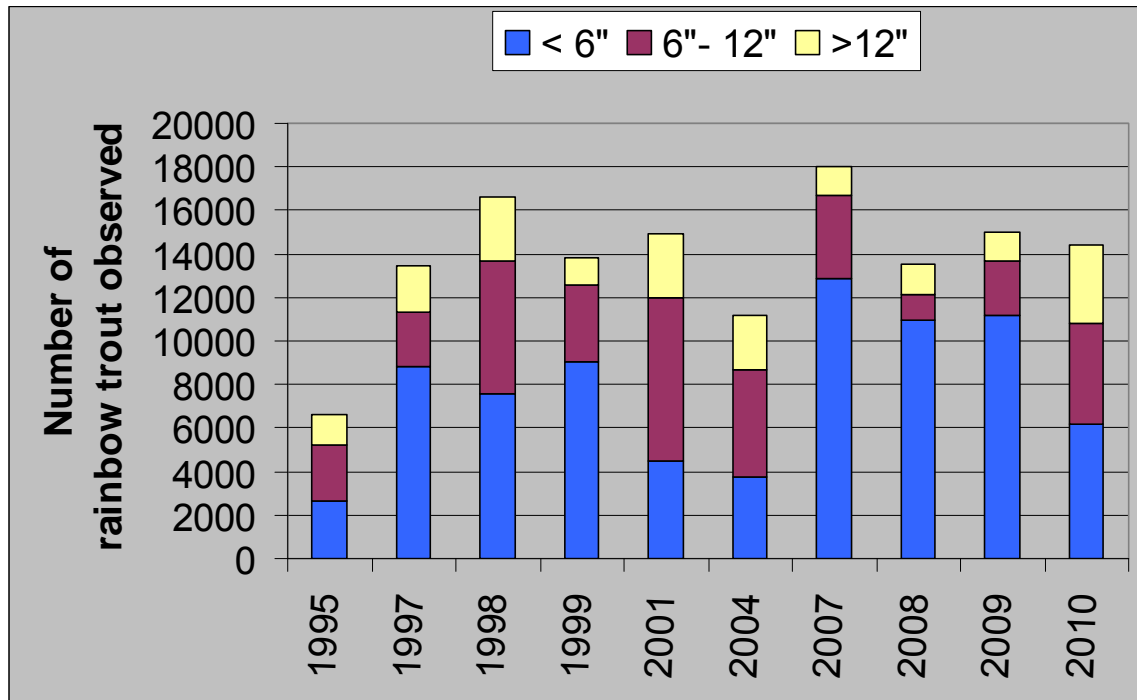
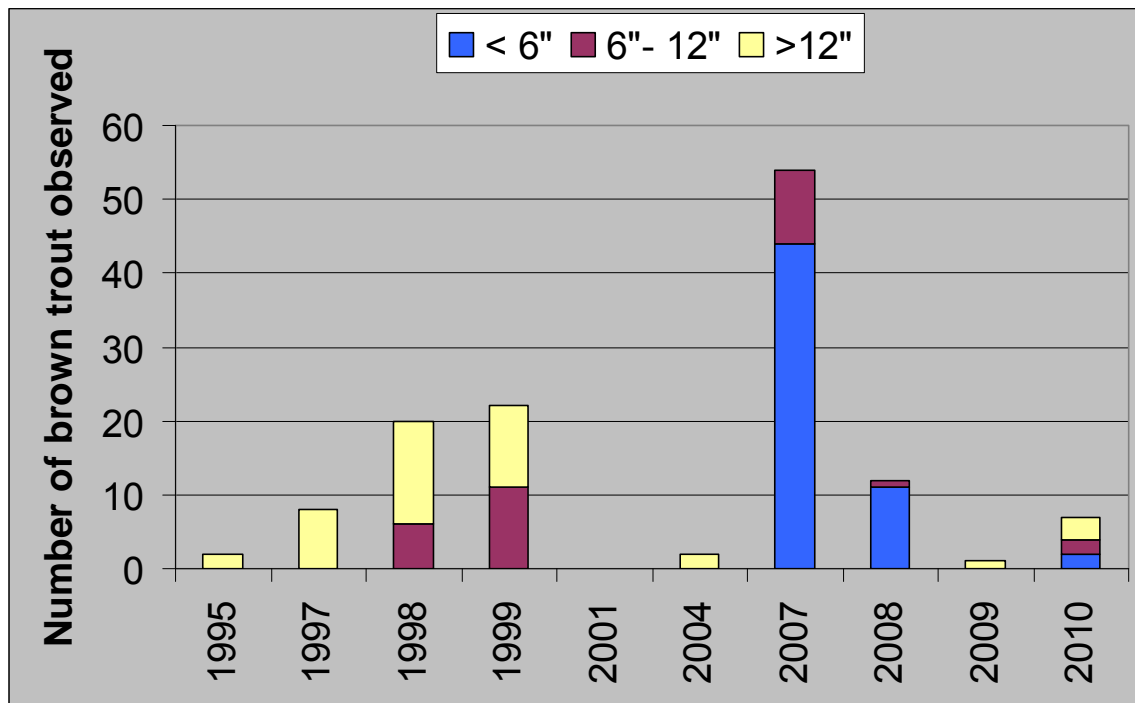


Figure 7. Graph of Fall River brown trout size class distribution by year from 1995-2010.



Conclusion

The Fall River wild trout population 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 wild trout fishery, including increased sediment-loading from Bear Creek or other sources, cattle grazing, agricultural runoff, and degraded stream banks. A long-standing dataset of direct observation surveys on the Fall River allows the DFG 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.

Based on the results of the 2009 Fall River direct observation survey, the HWTP recommended selecting new sections for future surveys due to concerns that the three historic sections may or may not be representative of the fishery as a whole (Weaver and Mehalick 2009). The three long-term monitoring sections 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. The HWTP recommended that the entire river from the headwaters downstream to the Pit #1 Powerhouse intake, including tributaries (such as Spring Creek), be included when selecting new section locations.

Section 4 was established in 2010 in order to partially fulfill these recommendations by including a section closer to the headwaters of the system. Due to changes in flow, volume, depth, and habitat of the Fall River downstream of the Tule River confluence, sampling technique will need to be further developed to effectively survey this area of the river. HWTP Northern Region 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:

Bloom, R., and J. Weaver. 2008. The California Heritage and Wild Trout Program Handbook (Draft). State of California Natural Resources Agency. Department of Fish and Game. Heritage and Wild Trout Program.

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.

Weaver, J. and S. Mehalick. 2009. Fall River 2009 Summary Report. State of California Resources Agency. Department of Fish and Game. Heritage and Wild Trout Program.

Weaver, J. and S. Mehalick. 2010. Hat Creek 2010 Summary Report. State of California Resources Agency. Department of Fish and Game. Heritage and Wild Trout Program.