

Hat Creek 2009 Summary Report

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State of California

Natural Resources Agency

Department of Fish and Game

Heritage and Wild Trout Program



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Introduction:

Hat Creek, in Shasta County, is a popular California fishing destination and one of the first streams in the state to receive designation as a Wild Trout Water by the California Fish and Game Commission (CFGC). Flowing north out of Lassen National Park, Hat Creek enters the Pit River at Lake Britton and has wild populations of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and numerous non-game species. The portion of Hat Creek from Powerhouse # 2 Dam downstream to Lake Britton is designated by the CFGC as a Wild Trout Water (Figure 1). Wild Trout Waters are those that support self-sustaining trout populations, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers or size of trout, and are open to public angling. Wild Trout Waters may not be stocked with catchable-sized hatchery trout (Bloom and Weaver 2008). The Department of Fish and Game's (DFG) Heritage and Wild Trout Program (HWTP) monitors this fishery by conducting population and habitat assessments, along with angler surveys. In 2009, the HWTP conducted a direct observation snorkel survey along 1.7 miles of Hat Creek, within the Wild Trout-designated section, from the Powerhouse # 2 riffle (just downstream of the dam) to the Highway 299 Bridge (Figure 2).

Methods:

Direct observation surveys were conducted using snorkeling methods, an effective survey technique in many streams and creeks in northern California and the Pacific Northwest (Hankin & Reeves, 1988). To replicate previous survey efforts, the HWTP located the boundaries of the section using written direction, maps, and GPS coordinates. The number of divers was determined based on stream width, water visibility, habitat complexity, and the availability of personnel trained in direct observation survey techniques. Twelve people participated in the survey, including three boaters. Nine divers, maintaining an evenly-spaced line perpendicular to the current, counted fish by species. All observed trout were further categorized 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). The YOY category is defined by the HWTP as age 0+ fish, emerged from the gravel in the same year as the survey. 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 but 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 assisted the divers in maintaining their position in the water and acted as a safety backup and lookout for the dive team. Water temperature and water visibility

were measured and recorded and the section was documented with representative photographs. Section length was determined based on previous survey efforts and GIS analysis.

Results:

Eleven DFG staff and one volunteer participated in the direct observation survey which began at the bottom of the riffle below Hat Creek Powerhouse #2 and ended at the Highway 299 Bridge on July 21, 2009 (Figure 2). Divers performed the survey in a downstream direction. Weather conditions were sunny and clear. The section length was approximately 1.7 miles and surveyors observed 1762 rainbow trout, 11 sculpin (*Cottus* sp.), 873 Sacramento suckers (*Catostomus occidentalis*), and 43 cyprinids (Table 1). The cyprinids observed were small and difficult to identify; however, based on species reported from previous DFG Hat Creek surveys, they were likely Sacramento suckers. Two western pond turtles (*Clemmys marmorata*) were observed in the section. Clams, mussels, crayfish, and a garter snake were also observed but were not identified to genus or species. Based on section length and the total number of fish observed by species, fish densities were calculated (Table 1) and compared to previous findings (Table 2, Figure 3). The water temperature was 18 °C at 3:20 p.m. Water visibility was approximately five feet in this flatwater-dominated section.

Figure 1. Map of Hat Creek wild trout designation.

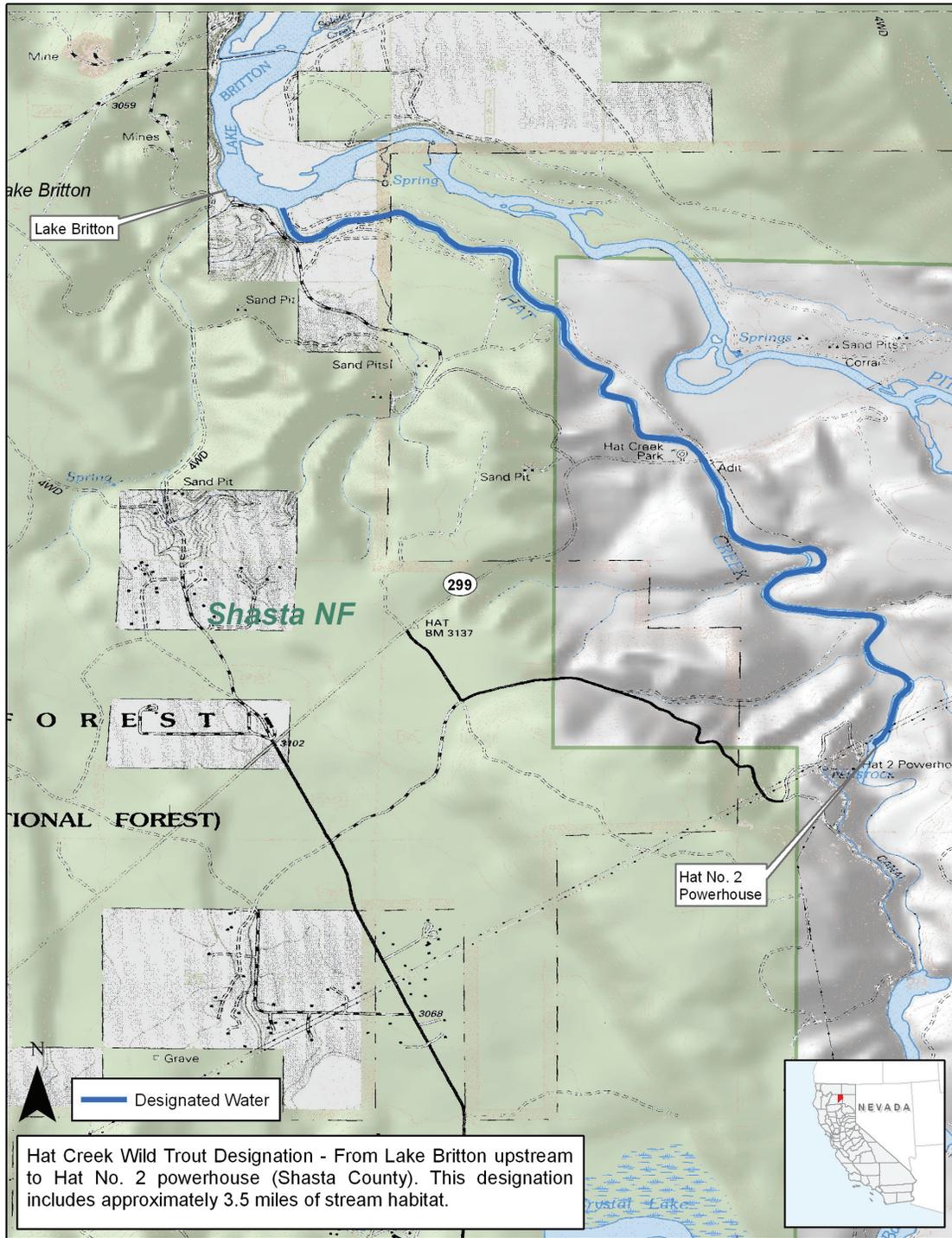


Figure 2. National Geographic map showing Hat Creek survey location (noted in red).

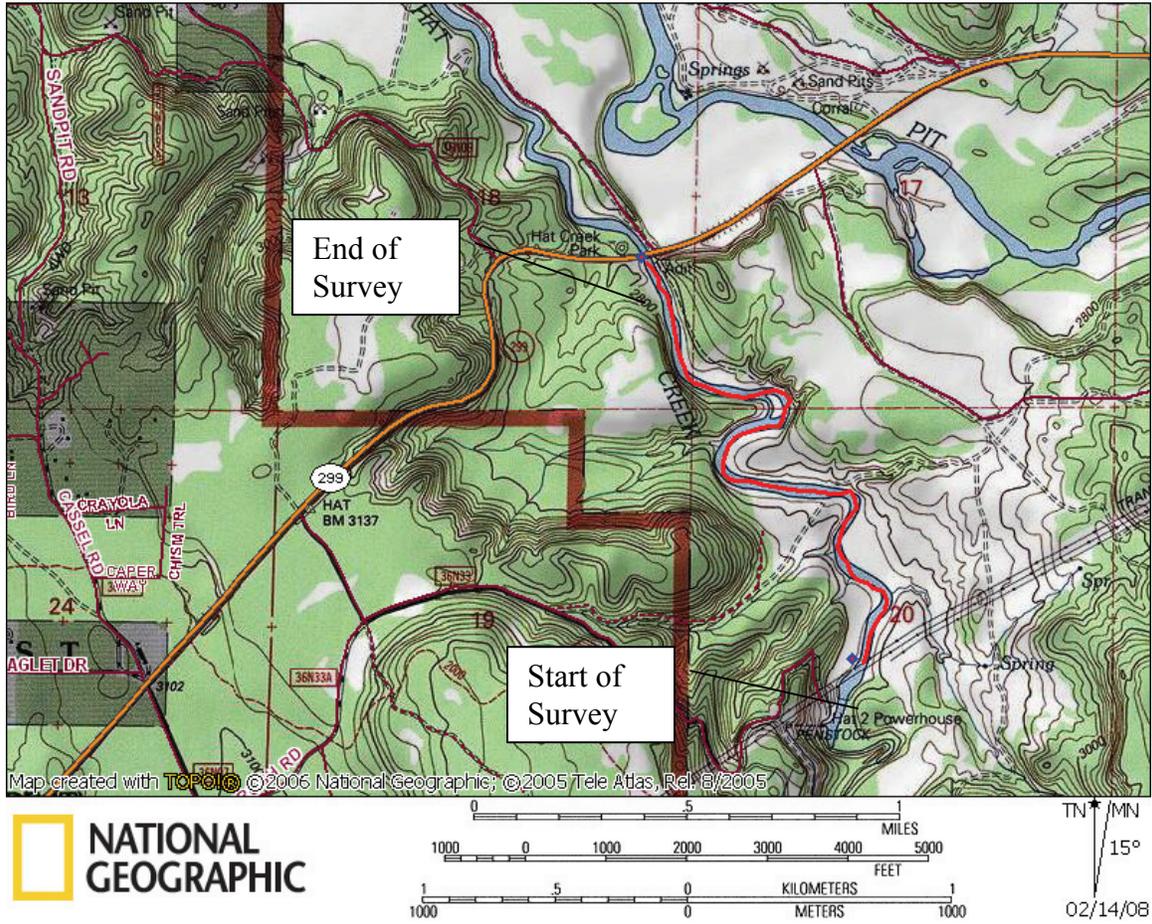


Table 1. Summary of Hat Creek 2009 direct observation survey results including the number of fish observed and estimated density by species. Only trout species were counted by size class.

Species	YOY	Small	Medium	Large	Extra-large	Total	Estimated density (fish/mile)
		< 6"	6"-11.9"	12-17.9"	≥18"		
rainbow trout	26	1590	135	10	1	1762	1036
sculpin						11	6
Sacramento sucker						873	514
cyprinids						43	25

Table 2. Comparison of Hat Creek direct observation results (1993-2009) for rainbow trout, brown trout, and Sacramento suckers.

Survey Date	# of Divers	rainbow trout		brown trout		total trout		Sacramento sucker	
		# observed	density (fish/mi)	# observed	density (fish/mi)	# observed	density (fish/mi)	# observed	density (fish/mi)
8/19/1993	8	5499	3235	117	69	5616	3304	422	248
8/26/1993	14	6613	3890	18	11	6631	3901	43	25
8/3/1995	11	5080	2988	3	2	5083	2990	512	301
8/7/1997	9	4394	2585	5	3	4399	2588	217	128
7/28/1998	13	3846	2262	191	112	4037	2375	198	116
8/3/1999	14	5523	3249	161	95	5684	3344	402	236
7/16/2007	9	572	336	38	22	610	359	1999	1176
7/28/2008	14	2831	1665	46	27	2877	1692	2626	1545
7/21/2009	9	1762	1036	0	0	1762	1036	873	514
Average	11.22	4013	2361	64	38	4078	2399	810	477

Figure 3. Fish density estimates from direct observation surveys (1993-2009).

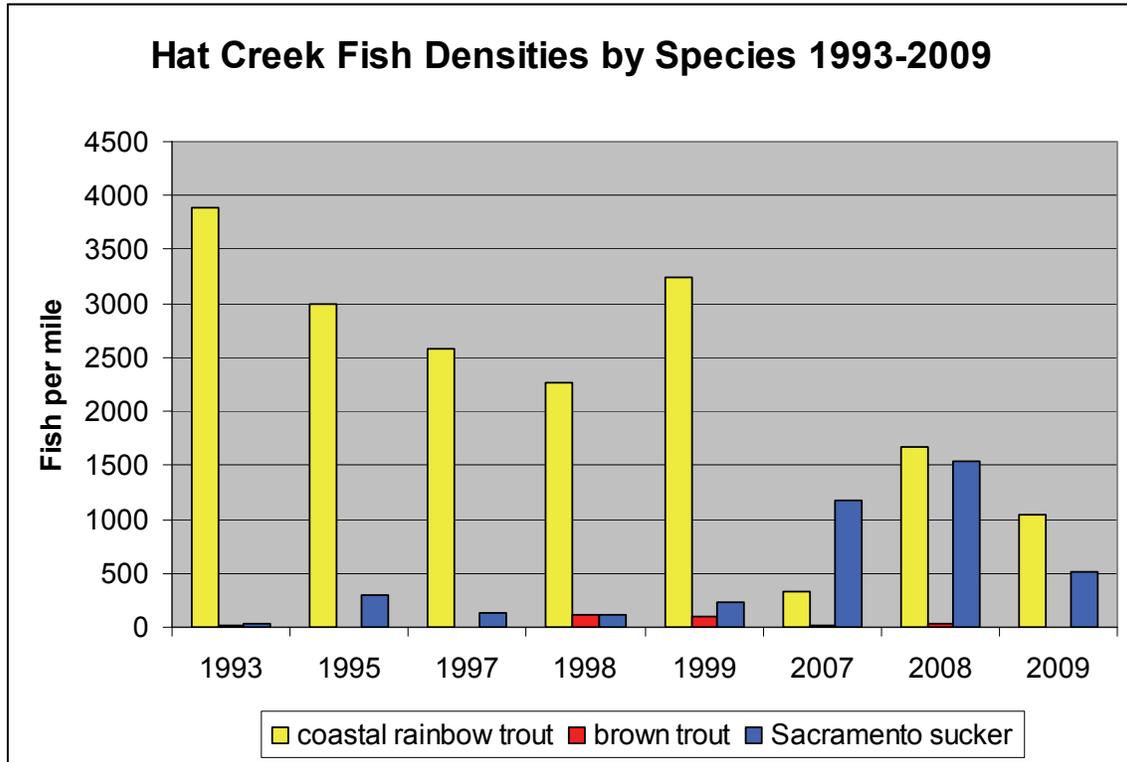


Figure 4. Total annual catch from angler survey box data in the Wild Trout section of Hat Creek (2003-2008). Anglers reported catching predominantly rainbow trout with some brown trout.

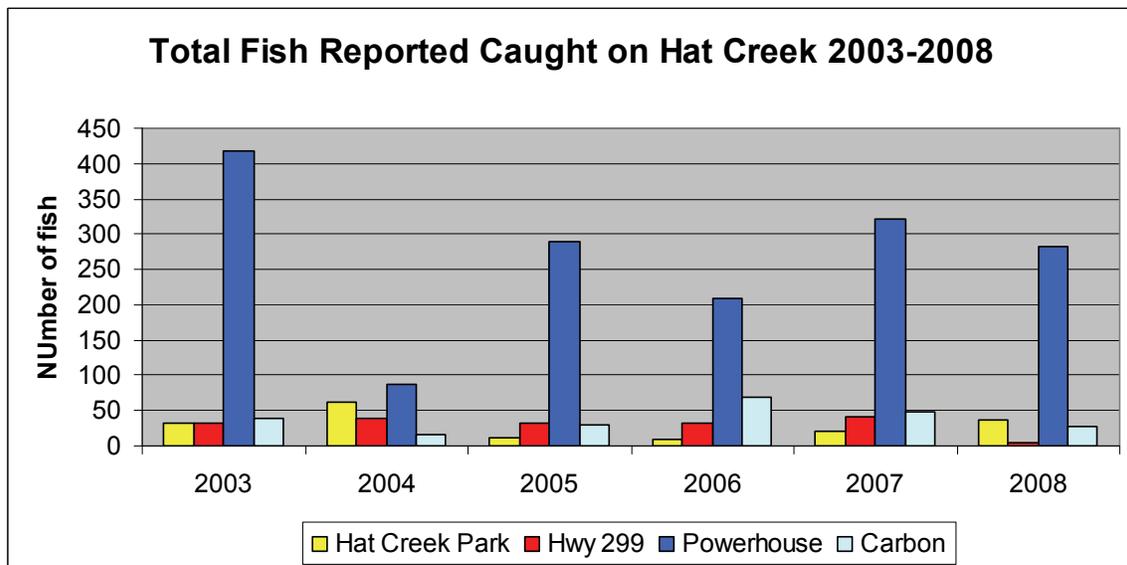
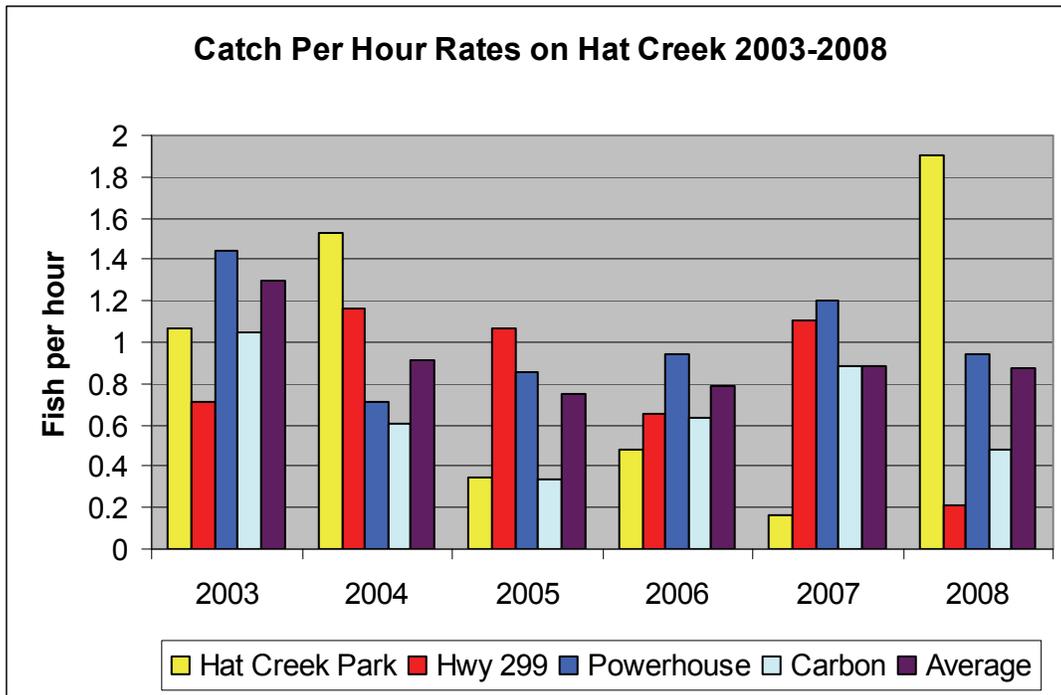


Figure 5. Catch rates from angler survey box data in the Wild Trout section of Hat Creek (2003-2008).



Discussion:

Based on section length and the number of trout observed in 2009, rainbow trout abundance in the Wild Trout-designated section of Hat Creek was estimated at 1,036 fish per mile (Table 1). All size classes were represented and 90% of the rainbow trout observed were classified as small (Table 1).

This section of Hat Creek has been surveyed in July for three consecutive years (2007-2009). In 2009, there were fewer fish observed than in 2008 for all species except sculpin (Weaver and Mehalick 2008). The number of rainbow trout observed in 2009 decreased by over 1,000 individuals from 2008, but was higher than the number observed in 2007 (Weaver and Mehalick 2007). Zero brown trout (*Salmo trutta*) and zero Sacramento pikeminnow (*Ptychocheilus grandis*) were observed in 2009; however, both species were observed in previous years. The number of Sacramento suckers observed decreased from 2,626 fish in 2008 to 873 fish in 2009. Sculpin numbers were similarly low in the two most recent years and zero sculpin were observed in 2007 (Table 1).

Several factors may have affected detection rates in recent years (2007-2009). Survey timing, habitat and lighting conditions, and the number of divers varied from year to year. In 2007, nine divers conducted the survey in the morning when light conditions were poor. Field notes indicate that surveyors were unable to see their entire survey area (dive lane) due to inadequate numbers of divers,

turbidity, and poor lighting. As a result, the number of divers was increased to 14 people in 2008 and the survey was conducted in the afternoon when light conditions were more conducive to observing fish. In addition, two boaters were used in 2008 to keep divers in even lanes and act as a safety back-up. Water clarity was better (six feet in 2008 versus three feet in 2007) and there appeared to be less aquatic vegetation in 2008. Overall, greater numbers of fish were observed in 2008 than in 2007 (the 2007 fish counts are considerably lower than all previous years' counts dating back to 1993). It is unknown whether higher counts in 2008 were due to improved detection (due to having more divers and/or improved visibility) or were reflective of an actual increase in fish numbers from one year to the next.

The 2008 DFG HWTP Hat Creek Summary Report (Weaver and Mehalick 2008) recommended that future surveys employ the same level of effort and timing in order to minimize sampling variability and error. Based on this recommendation, the HWTP conducted the 2009 survey at the same time of year (end of July) and during the same time of day (afternoon) as in 2008; however, the number of divers decreased to 2007 levels (nine divers). This was due to a shortage of personnel trained in direct observation surveys. Although the number of divers was the same for both 2007 and 2009, the number of rainbow trout observed shows a three-fold increase from 2007 to 2009. Time of day, water clarity, and lighting conditions (early morning and low light in 2007 as opposed to afternoon and full light in 2009) may have contributed to increased detection and higher counts in 2009 with the same level of effort as in 2007.

Due to the variation in the number of divers, survey timing and habitat conditions across time, it may be of value to compare current year counts with long-term averages, as well as direct observation counts with angler survey box (ASB) data to look for correlations between in-water fish counts and angler reports of catch. For both the number of fish observed and estimated density, an average was calculated by species for all direct observation survey data from 1993 through 2009 and the 2009 data were then compared to these averages. In 2009, the number of rainbow trout and brown trout and their estimated densities were considerably lower than the long-term averages (Table 2). In 2009, the number of Sacramento suckers was similar to the long-term average (Table 2).

There are four ASBs located within the Wild Trout-designated section of Hat Creek (at Hat Creek Park, Highway 299, Powerhouse #2, and Carbon). An examination of voluntary angling data obtained at these four ASB locations provides further insight into this fishery from an angler perspective including catch rates, catch sizes, and angler satisfaction. All completed forms from these boxes were examined for the years 2003 through 2008 (Figures 4 and 5). Due to the variation in fish counts and survey effort over the last three years, ASB data were examined to see if total catch and catch rates followed the same trend. In 2008, the total number of fish caught at all four ASB locations was similar to historic levels (dating back to 2003; Figure 4). The average reported catch rates from all four ASB boxes was similar from 2003 through 2008 (Figure 5). The

2009 ASB data forms from Hat Creek were not yet available at the time this report was generated. In general, the ASB data do not correlate with direct observation counts in recent years, other than a decrease in catch rates from 2006 to 2007 at Hat Creek Park, followed by a pronounced increase in catch rates reported at this location in 2008 (Figure 5).

Conclusion:

Hat Creek receives considerable fishing pressure, both within and outside of the Wild Trout-designated area. There is easy road access to the river and, during the course of the survey, numerous anglers were observed on the water. The number of total trout observed (coastal rainbow and brown combined) has varied from a low of 610 in 2007 to a high of 6631 in 1993. Long-term monitoring shows an apparent and nearly steady decline in trout numbers in this very high profile fishery, especially in the past few years (Table 2; Figure 3). It is worth noting that low numbers of Sacramento suckers were observed in past years (1993-1999), but a marked rise in detection occurred in the past three years, which closely follows the trajectory of trout counts (Figure 3). Given that there is a seven year gap in the direct observation data set (2000-2006) and a noticeable shift in fish assemblage from 1999 to 2007, this fishery should continue to be closely monitored.

Survey timing (both seasonal and time of day) as well as the numbers of surveyors should be consistent over time to ensure equal effort and allow for more accurate comparisons of fish counts from year to year. Due to presumed poor detection rates utilizing direct observation survey methods in recent years, a combination of direct observation and boat electrofishing surveys should be considered in order to compare in-river fish counts with electrofishing capture rates in order to calibrate direct observation detection on this river. Turbidity and aquatic vegetation have negatively affected direct observation detection in recent years. Detection and identification to species of small fish has been especially problematic. These variables would likely be eliminated during electrofishing surveys.

In addition, all historic Hat Creek direct observation surveys have occurred upstream of the Highway 299 bridge. The Wild Trout-designated portion of Hat Creek downstream of the Highway 299 bridge extends another 1.5 miles and has not been assessed as part of the HWTP's long-term monitoring of this fishery. No barriers to fish movement exist from the dam at Baum Lake downstream to the mouth of Lake Britton and it is entirely possible that other habitat types are represented in the lower half of the river system. Therefore, future surveys should encompass the entire length of Hat Creek, from Powerhouse #2 riffle downstream to the mouth of Lake Britton in order to better assess the overall fishery and obtain more accurate fish counts and density estimates.

References:

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