

Hat Creek 2012 summary report

July 23 and 26, 2012

State of California

Department of Fish and Wildlife

Heritage and Wild Trout Program



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Introduction

Hat Creek, tributary to the Pit River at Lake Britton (Shasta County; Figure 1), was one of the first waters in California to receive designation as a Wild Trout Water by the California Fish and Game Commission. This designation includes approximately 3.5 miles of stream habitat from Lake Britton upstream to Hat #2 Powerhouse (Figure 2) that is managed by the California Department of Fish and Wildlife (CDFW) Heritage and Wild Trout Program (HWTP). Wild Trout Waters are those that support self-sustaining wild 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). Hat Creek contains wild populations of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and numerous non-game species. The HWTP monitors the fishery by conducting population, habitat and angler assessments including a long-standing dataset using direct observation snorkel surveys along 1.7 miles of Hat Creek (Section 1) since 1993.

Hat Creek was last surveyed by the HWTP in 2010 (Weaver and Mehalick 2010) and, based on the results of this assessment, the HWTP recommended:

- Continue population-level surveys on a semi-annual basis
- Conduct annual analyses of Angler Survey Box (ASB) data
- Population-level monitoring should continue to include direct observation and/or electrofishing
- Consider utilizing mark recapture electrofish surveys as a calibration tool for direct observation and to better understand fish abundance and size class structure

Based on these recommendations, the HWTP continued monitoring surveys in Hat Creek in 2012 which included:

- Direct observation snorkel surveys in Section 1 (historic) and Section 112 (newly established in 2012 and located upstream of the Wild Trout designated reach; Figures 3-4)
- Boat electrofish mark-recapture survey in Section 1
- Monitoring and maintenance of four ASBs (Figures 3-4) to better understand catch rates, catch sizes, angler preferences, and angler satisfaction
- Angler creel census on Hat Creek to better understand catch rates, catch sizes, angler preferences, and angler satisfaction and to compare data gathered with those from voluntary ASB forms

This report summarizes the results of the HWTP 2012 direct observation surveys in Hat Creek. The results of the electrofish survey, creel census and ASB data from 2012 are documented separately (CDFW 2012).

Methods

Direct observation surveys were conducted using snorkel survey methods, an effective survey technique in many small streams and creeks in California and the Pacific Northwest (Hankin and Reeves 1988). Section 1 (historic) was surveyed on July 23rd, 2012; the survey extended from the riffle below Hat Creek Powerhouse #2 to the Highway 299 Bridge (Figures 3-4). Section 112 was surveyed on July 26th, 2012 and was selected in order to evaluate the fishery and habitat upstream of the Wild Trout designated reach. The survey was located about 500 feet upstream of Hat Creek Powerhouse #2 (Figures 3-4).

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. Section 1 was surveyed in a downstream direction with 11 divers and Section 112 was surveyed in an upstream direction with three divers. Divers maintained an evenly-spaced line perpendicular to the current and 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). 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. One personnel on paddle craft and one volunteer on shore followed behind the divers to assist them in maintaining their dive lanes and acted as a safety backup and lookout for the dive team. For each section, surveyors measured water and air temperature ($^{\circ}\text{C}$), average wetted width, water depth and water visibility (ft). Representative photographs of each section were taken and section length (mi) was determined based on Geographic Information System analysis (at a scale of 1:3000). Habitat type (flatwater, riffle, or pool) was identified following Level 2 protocol as defined in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). To calculate estimates of abundance, the HWTP summed all observed trout by species in each section and divided by the total survey length (fish per mile; fish/mi).

Results

Section 1 was approximately 1.7 mi in total length with an average wetted width of 139.2 ft and an average water depth of 3.0 ft. Weather conditions were overcast during the survey effort. Water visibility was approximately four feet in this flatwater-dominated section. Divers observed 1427 rainbow trout, eight brown trout, 270 unknown trout, 6 sculpin (*Cottus* sp.), 1563 suckers (*Catostomus* sp.) and 77 unknown fishes (Table 1). Sculpin and suckers were not identified to species. The unknown fishes were too small to identify and may have included cyprinids and/or catostomids. Divers also observed two western pond turtles (*Clemmys marmorata*), mussels (not identified to species), crayfish (*Pacifastacus* sp.), snails (not identified to species), one otter (not identified to species) and two large dead rainbow trout (one with a lure in its eye). Rainbow trout size class distribution was 14.2% YOY, 63.8% small-, 19.5% medium-, 2.4% large- and 0.1% extra-large-sized fish (Figure 5). Brown trout size class distribution was 25% medium-, 50% large- and 25% extra-large-sized fish. Unknown trout size class distribution was 4% YOY, 60% small- and 36% medium-sized fish. Estimated abundance in Section 1 was 839 rainbow trout/mi, 5 brown trout/mi, 159 unknown trout/mi, 4 sculpin/mi, 919 suckers/mi, and 45 unknown fish/mi.

Section 112 was 254.7 ft in total length with an average wetted width of 42.4 ft and an average water depth of 1.1 ft. Weather conditions were clear and sunny during the survey effort. The section was heavily shaded due to overhanging vegetation and canopy cover. Water visibility was approximately four feet and habitat consisted of flatwater. Divers observed 32 rainbow trout, 6 brown trout and 2 unknown trout (Table 1). Divers also observed crayfish and dime-sized clams (not identified to species). Rainbow trout size class distribution was 47% small-, 47% medium- and 6% large-sized fish (Figure 6). Brown trout size class distribution was 67% small- and 33% medium-sized fish. All unknown trout were in the medium size class. Estimated abundance in Section 112 was 663 rainbow trout/mi, 124 brown trout/mi and 41 unknown trout/mi.

Discussion

The HWTP has a long-standing dataset on Hat Creek Section 1; a comparison of current year results with past data can be used to study trends in the population (Table 2). Data prior to 2007 include counts for rainbow trout, brown trout and suckers. A density estimate was generated for each of these species for the years 1993 through 2012 based on the total number of fish observed in Section 1 (Figure 7). These estimates were then averaged across all years, allowing comparison between the most recent estimated density of a species and the long-term average density based on historic data. Rainbow trout densities in Hat Creek Section 1 have ranged from 336 (2007) to 3890 fish/mi (1993) with an average of 2189 fish/mi. The estimated density of rainbow trout in Section 1 in 2012 (839 fish/mi) was lower than the long-term average. Brown trout densities observed in Section 1 have ranged from zero (2009) to 112 fish/mi (1998) with an

average of 32 fish/mi. The brown trout estimated density observed in 2012 (five fish/mi) was lower than the long-term average. Density estimates for suckers have ranged from 25 (1993) to 1545 fish/mi (2008) with an average of 545 fish/mi. The sucker estimated density observed in 2012 (919 fish/mi) is higher than the long-term average. In previous surveys, divers observed Sacramento pikeminnow (*Ptychocheilus grandis*) and speckled dace (*Rhinichthys osculus*); neither were observed in 2012.

Section 112 was established, in part, to increase the geographic spread of sampling upstream of the designated Wild Trout reach; however, water visibility and light conditions were poor. Identification of fish to species in this section was difficult and presumably fish detection was low. Divers attempted to survey this area but water visibility was not conducive to direct observation methodology and surveys were limited in scope to only one section in this reach.

In 2010, pathological assays confirmed anecdotal observations that black spot disease was present in Hat Creek (Weaver and Mehalick 2010). Severe infection of black spot disease may cause fish mortality (Krull 1934, Hoffman 1956), negatively affect juvenile fish development, and/ or cause susceptibility to secondary infection in adult fish (Markevich 1951). Black spot disease was also observed in fish captured during the 2012 electrofish surveys.

Conclusion

Hat Creek contains wild populations of rainbow and brown trouts with the opportunity to catch trophy-sized trout. There is relatively easy access to a majority of the river and, during the course of the survey, a few anglers were observed fishing. Long-term monitoring shows a decline in trout numbers and an increase in the sucker population in recent years. The Hat Creek Wild Trout Management Plan (1999) identifies high sucker biomass as a long-term threat to the wild trout population and recommends that suckers should continue to be captured and removed whenever electrofish surveys are conducted. During the 2012 mark-recapture survey effort using boat electrofish gear, HWTP staff relocated all captured suckers downstream of the barrier and outside of the designated reach. The HWTP recommends evaluating the efficacy and continuation of this management activity as suckers are native to this water and likely play an important role in ecosystem health and function.

Habitat may be a limiting factor to the wild trout population, in part, due to increased fine sedimentation, loss of aquatic vegetation and changes in the width to depth ratio of the stream channel. California Trout was awarded River Parkways Grant funds in 2012 to restore six acres of habitat and develop new recreational amenities on Hat Creek (California Natural Resources Agency 2012) including 1.5 miles of public access trails.

In 2012, the HWTP utilized multiple survey methods to better understand the fishery, habitat, and angler use. Comparisons among survey methodologies can

provide insight on the limitations and benefits of a particular sampling strategy, while also informing a cost-benefit analysis. Based on the results of these comparisons, HWTP Northern Region staff recommend a concerted fishery, habitat and angler use survey be conducted every five years, utilizing multiple survey methodology (CDFW 2012).

The HWTP (Northern Region) is updating the Hat Creek Wild Trout Management Plan in 2013; this document provides management goals and strategies and will detail future monitoring efforts. Due to the importance of this fishery to the angling public, its designation as a Wild Trout Water, proposed habitat restoration projects, changes in species composition, and the apparent recent decline in trout numbers and angler use, the HWTP recommends:

- Continued population-level surveys on a semi-annual basis, including direct observation and/or electrofishing
- Annual angling (ASB) data maintenance and analyses
- Monitor black spot disease and potential impacts to the wild trout fishery
- Monitor habitat and potential changes to the wild trout fishery following habitat restoration efforts

References

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Figure 1. Vicinity map of 2012 Hat Creek survey location

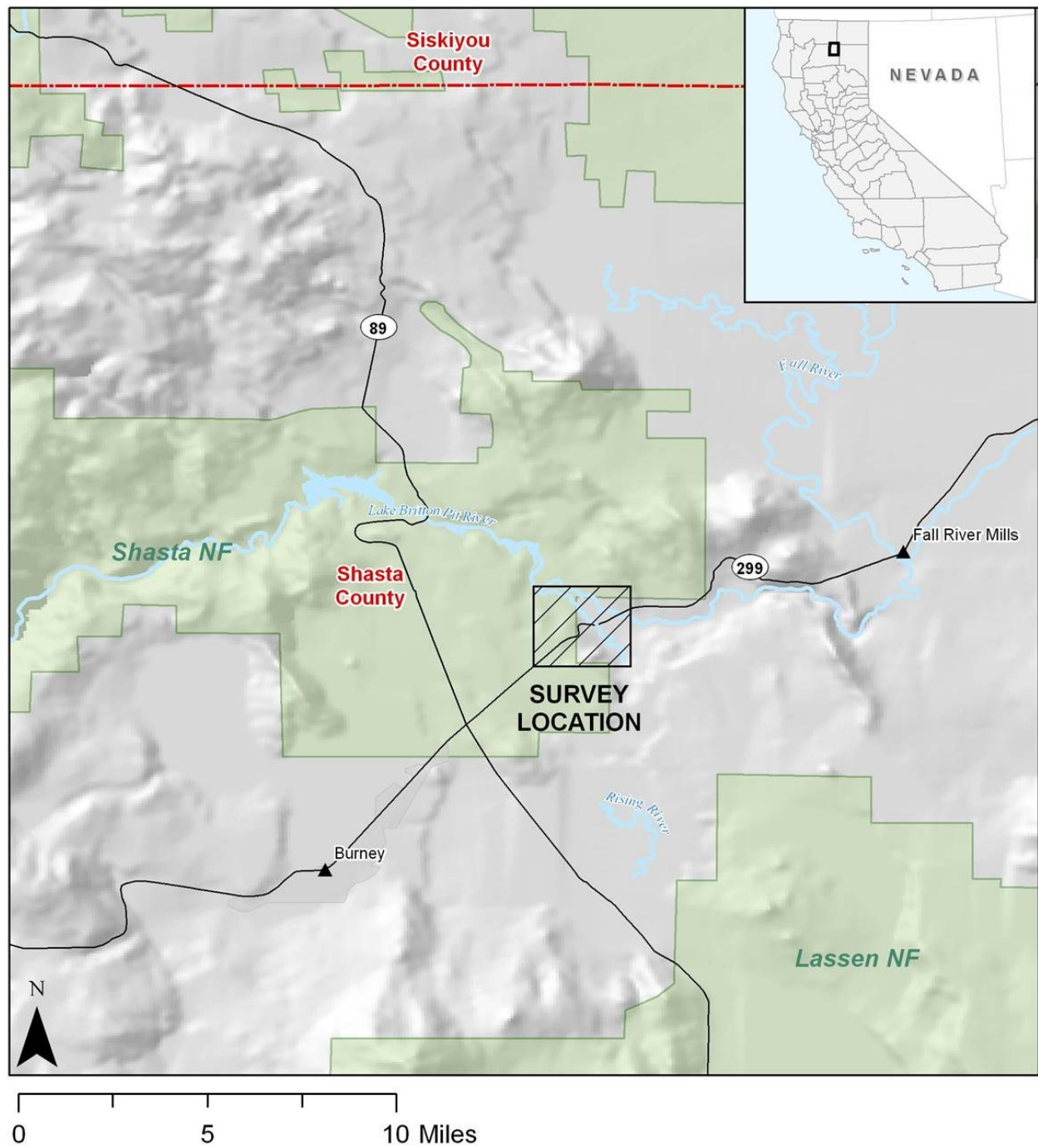


Figure 2. Map of Hat Creek Wild Trout designated reach

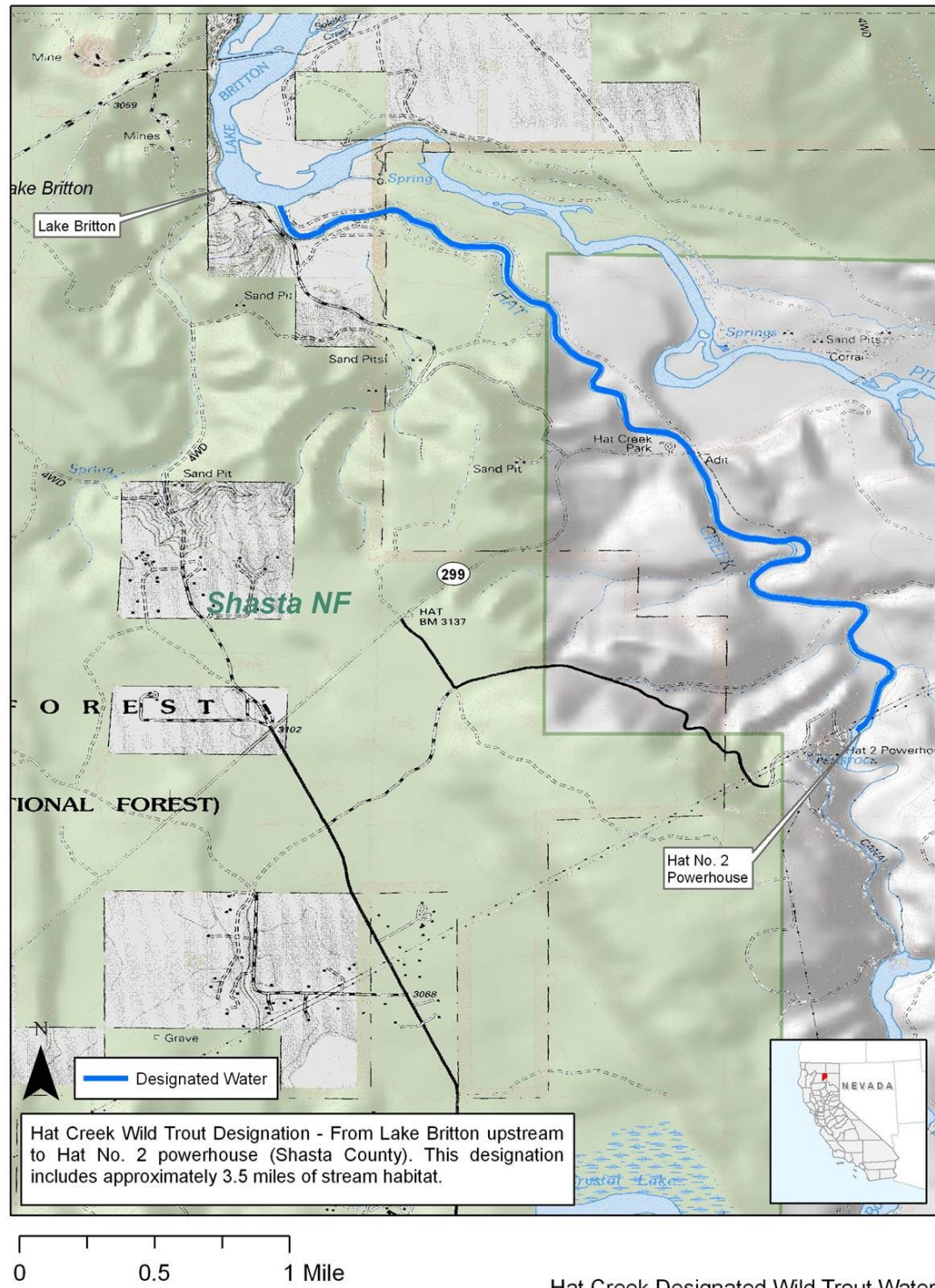


Figure 3. Detail map of Hat Creek 2012 survey sections and ASB locations

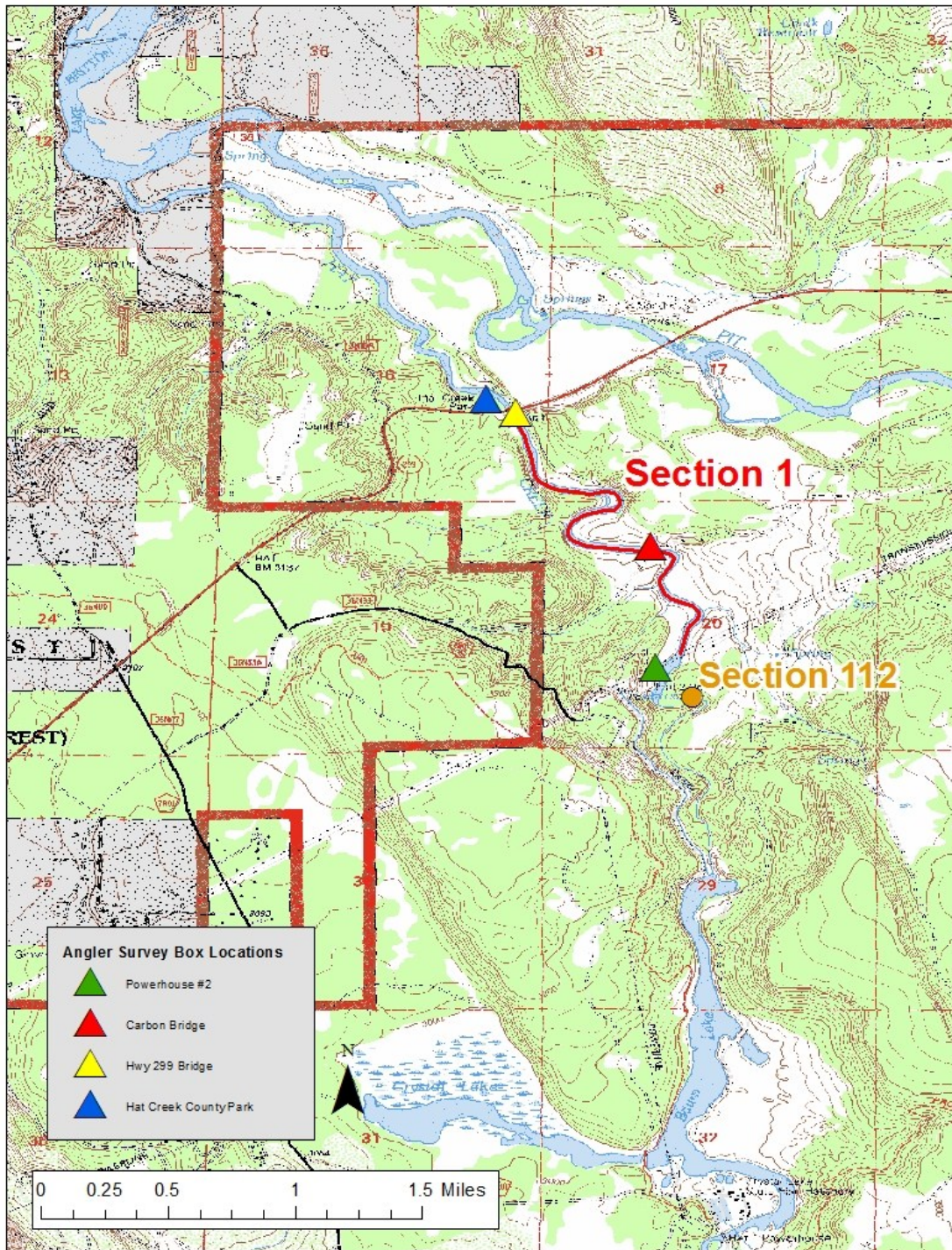


Figure 4. Aerial map of Hat Creek 2012 survey sections and ASB locations

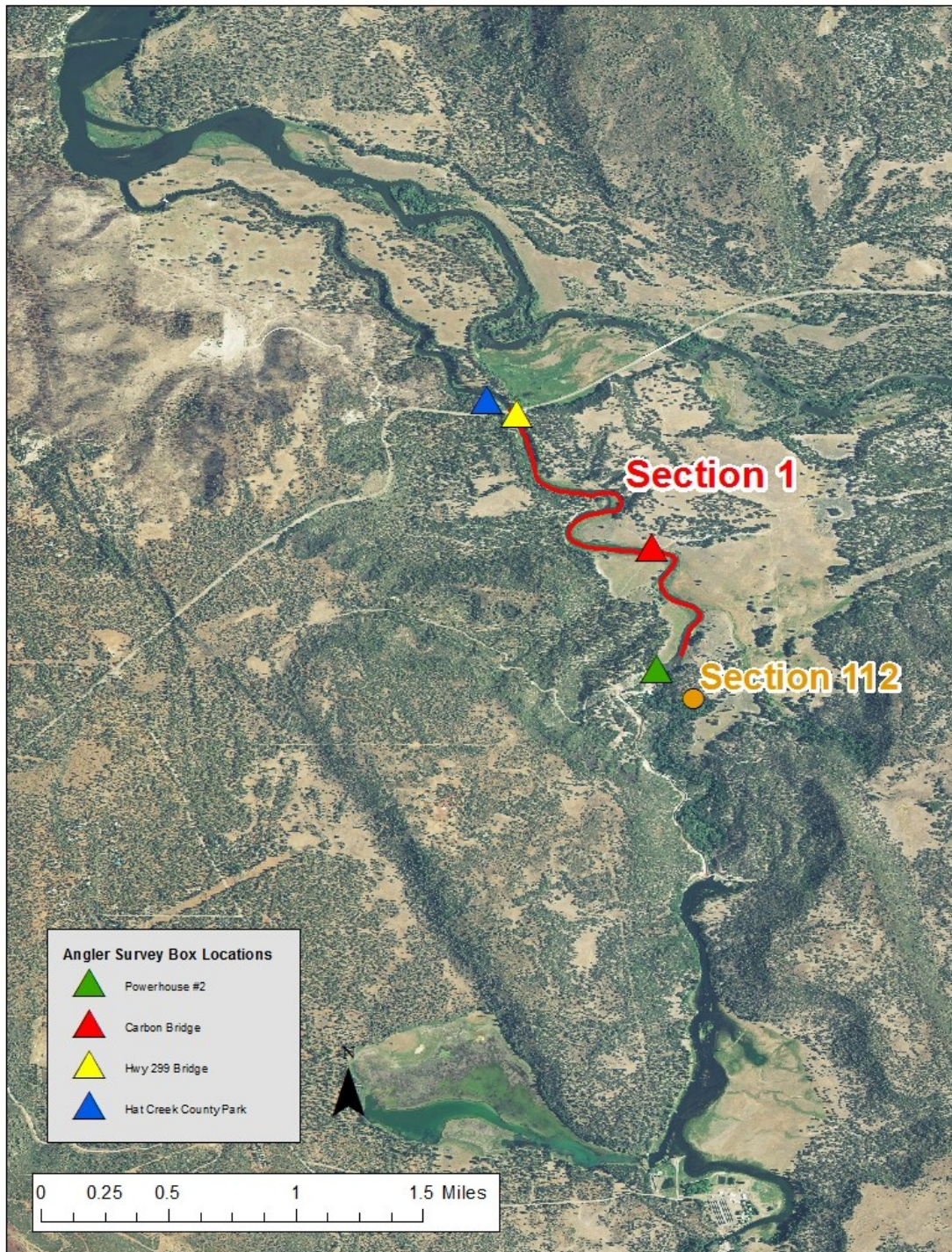


Figure 5. Graph of 2012 Hat Creek Section 1 direct observation data: observed trout size class distribution

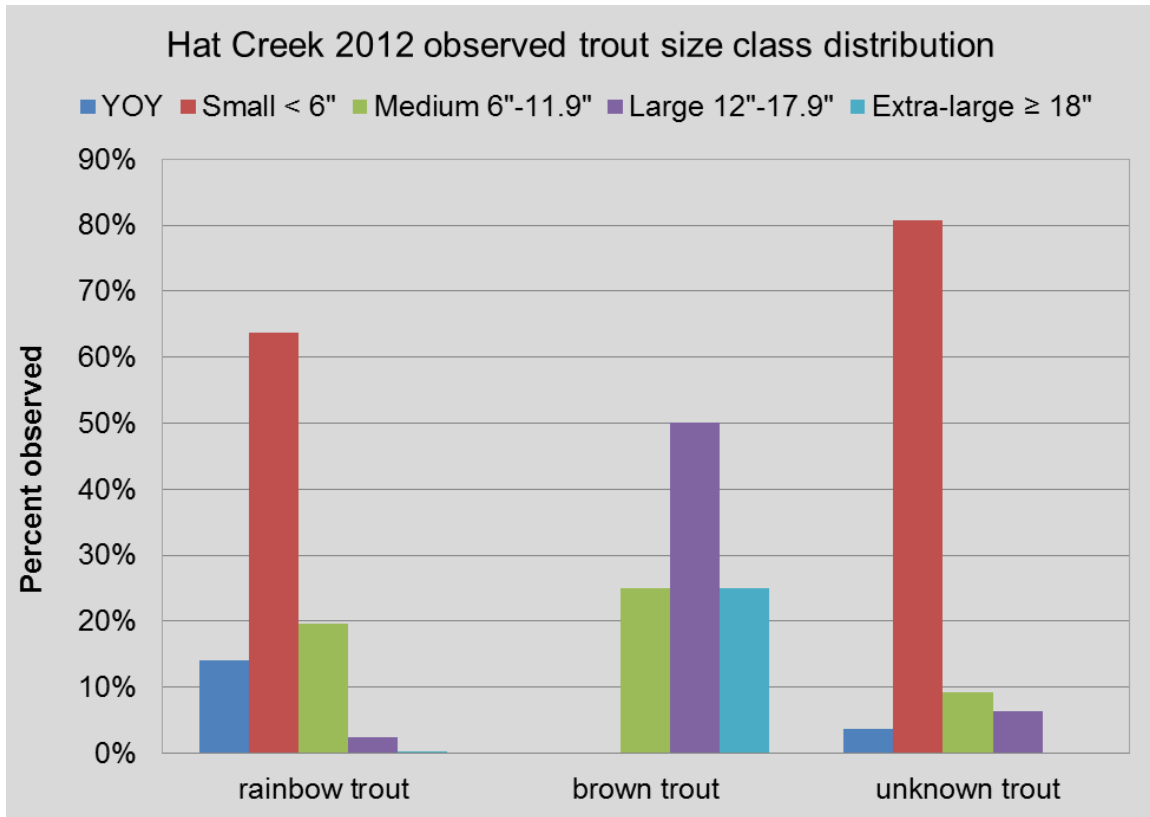


Figure 6. Graph of 2012 Hat Creek Section 112 direct observation data: observed trout size class distribution

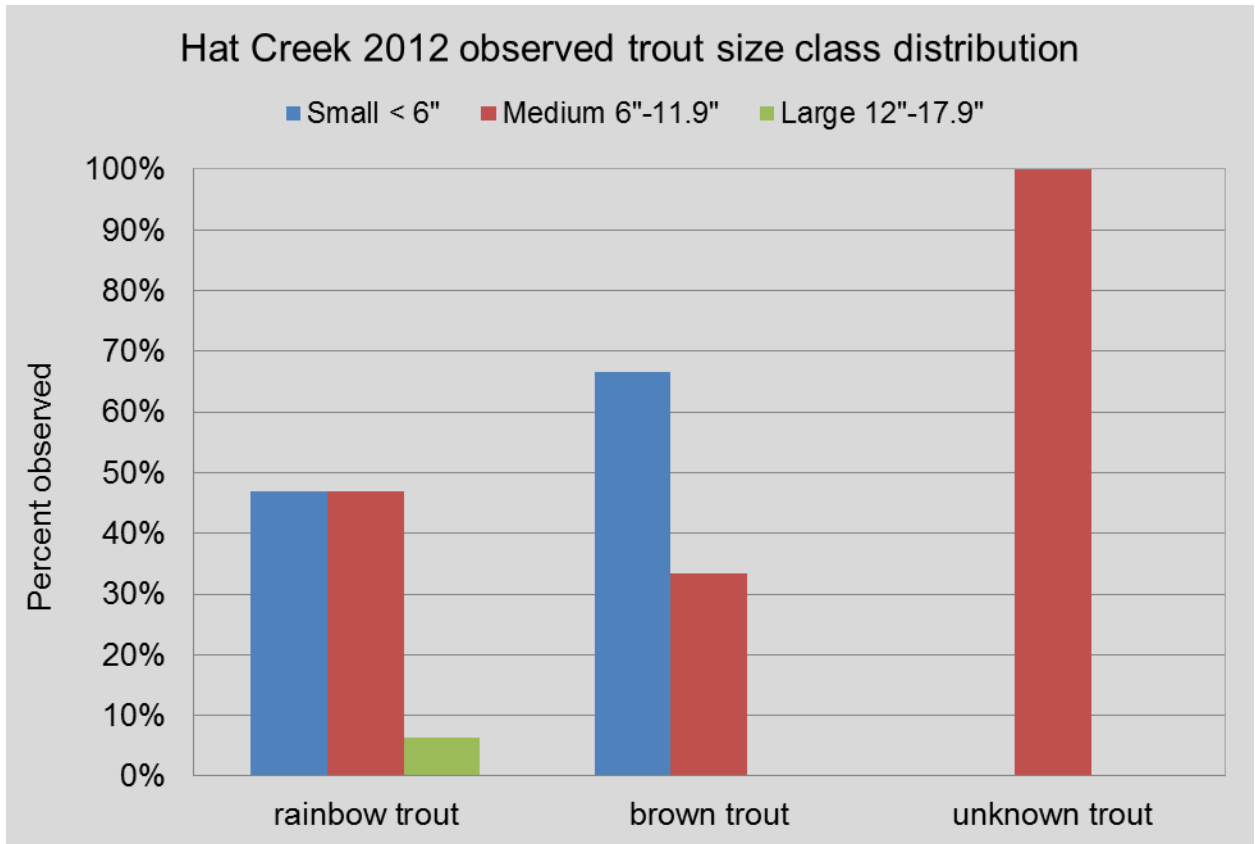


Figure 7. Graph of Hat Creek Section 1 direct observation data: estimated fish abundance by year (1993-2012)

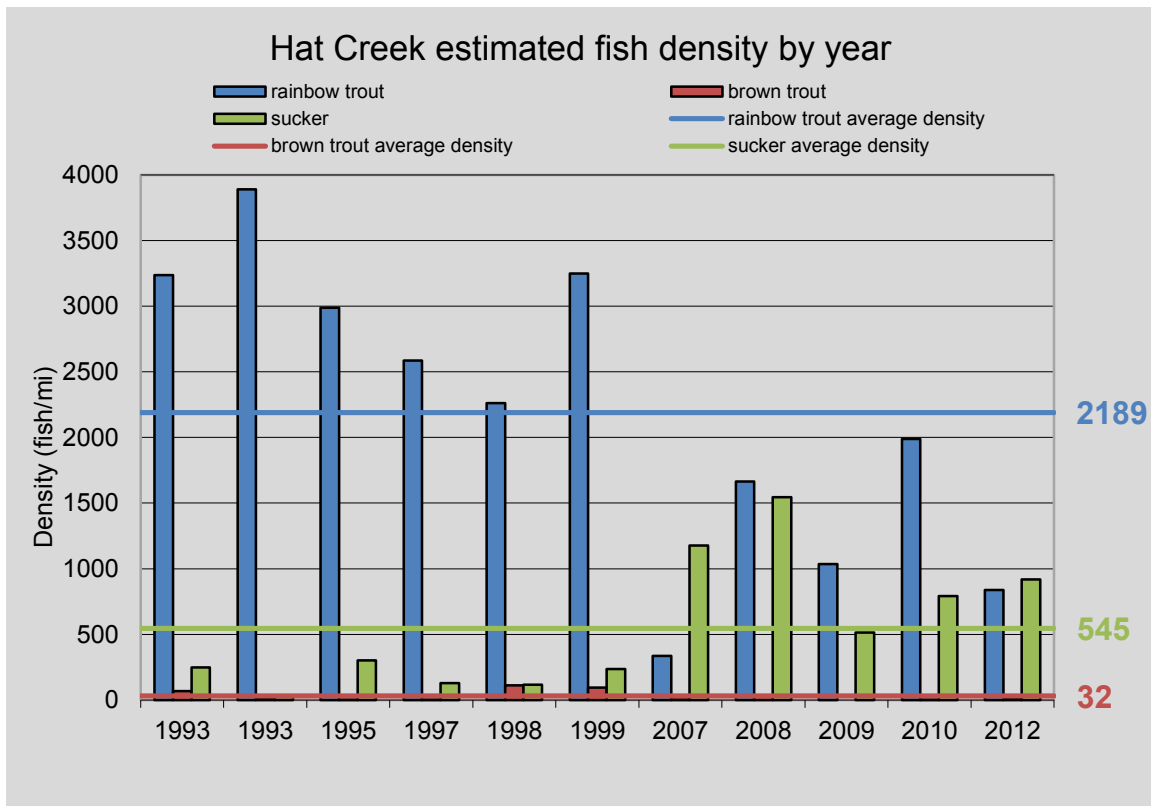


Table 1. 2012 Hat Creek direct observation survey data

Section	Section length (ft)	Habitat type	Species	YOY	Number of fish observed				Total	Estimated density (fish/mi)
					Small	Medium	Large	Extra-large		
					< 6"	6"-11.9"	12"-17.9"	≥ 18"		
1	8976.0	flatwater	rainbow trout	202	910	279	34	2	1427	839
			brown trout	0	0	2	4	2	8	5
			unknown trout	10	218	25	17	0	270	159
			unknown fishes	3	46	28	0	0	77	45
			sculpin	-	-	-	-	-	6	4
			sucker	-	-	-	-	-	1563	919
112	254.7	flatwater	rainbow trout	0	15	15	2	0	32	663
			brown trout	0	4	2	0	0	6	124
			unknown trout	0	0	2	0	0	2	41

Table 2. Hat Creek Section 1 direct observation data (1993-2012)

Survey date	Number of divers	rainbow trout		brown trout		suckers	
		Number observed	Estimated density (fish/mi)	Number observed	Estimated density (fish/mi)	Number observed	Estimated density (fish/mi)
8/19/1993	8	5499	3235	117	69	422	248
8/26/1993	14	6613	3890	18	11	43	25
8/3/1995	11	5080	2988	3	2	512	301
8/7/1997	9	4394	2585	5	3	217	128
7/28/1998	13	3846	2262	191	112	198	116
8/3/1999	14	5523	3249	161	95	402	236
7/16/2007	9	572	336	38	22	1999	1176
7/28/2008	14	2831	1665	46	27	2626	1545
7/21/2009	9	1762	1036	0	0	873	514
7/22/2010	13	3381	1989	5	3	1345	791
7/23/2012	11	1427	839	8	5	1563	919
Average	-	-	2189	-	32	-	545