A Direct Observation Survey of the Lower Rubicon River

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Abstract. The Rubicon River drains a portion of the west slope of the Sierra Nevada, and is tributary to the Middle Fork of the American River. The Rubicon is relatively unregulated, with the exception of a couple of small dams. The middle and lower reaches of the river, below Hellhole Reservoir, are not stocked with hatchery fish. A direct observation survey was made by three members of the California Department of Fish and Game's Statewide Wild Trout Program to establish baseline fish population numbers. An inventory of the local ecology was also recorded. Large numbers of rainbow trout were observed, with pike minnows, Sacramento suckers, brown trout, and riffle sculpins present at lower densities.

Introduction

The Rubicon River flows from the Sierra crest, west to its confluence with the Middle Fork of the American River. From Hellhole Reservoir in the upper watershed to the Ralston Powerhouse near the Middle Fork confluence, over 25 miles of the Rubicon River is designated as a Wild Trout Stream. This section is remarkably unregulated for a Sierra Nevada river, with only Hellhole Reservoir high in the watershed to keep flood flows in check. In addition, the Rubicon is not stocked with hatchery fish, which means that only naturally reproducing populations of fishes exist in the stream. Due to its relatively natural flow patterns, the Rubicon River is an excellent stream to study in order to understand fish populations under natural conditions.

The upper reaches of this section, near Ellicott Bridge, have been previously sampled using both electroshocking and direct observation techniques to examine fish populations. The lower reaches of the river, however, have not been previously assessed. Access to this part of the stream is difficult, with only a couple of steep, high-clearance dirt roads leading into the lower canyon. The purpose of the present study is to establish baseline data on fish populations and riparian ecology of the lower Rubicon River.

The portion of the lower Rubicon River sampled in this study flows through a steep, narrow bedrock canyon, characteristic of the entire watershed. The lower canyon is composed of low and mid-grade metamorphic rock. In wider sections of the bedrock canyon, gravel and cobble bars are formed, mainly consisting of granitic rocks transported from higher in the watershed. The stream forms a step-pool system within the confines of the canyon. Pools range from 2 to 20 feet deep, with riffles from 5 to 100 feet long connecting each pool. The substrate is mainly large cobbles and boulders, with large boulders over 5 feet in diameter being common and providing the majority of instream cover. Gravel and sand can be found in slower water and on small point bars.

Riparian vegetation of the lower Rubicon is sparse, mainly consisting of willows and white alders growing on cobble bars. Sedges, rushes, ferns and monkey-flower all grow on the water's edge. Slower water and pools exposed to sun support heavy filamentous algae growth. Ponderosa pine and live oak are

found growing on the canyon walls close to the stream. Overall, riparian vegetation provides little stream cover when compared to boulders and the canyon walls.

The stream section examined by this study is located above the lower Rubicon angler survey box, reached by a dirt road from Ralston Ridge. Above the pool at the bottom of the access trail leading from the angler survey box, the first seven pools were surveyed. Three members of the California Department of Fish and Game (DFG) statewide Wild Trout Crew used direct observation snorkel surveys to examine fish populations. In addition, notes on the ecological conditions of the area were made, including riparian vegetation and incidental species observation.

Methods

Direct observation snorkel surveys were used because of the depth of the pools and the number of people available to conduct the study. Only pools were surveyed because the riffle areas were too shallow for snorkeling. The surveys took place on July 12th, 2001.

In the 7 pools chosen for survey, fish counts were collected using standard snorkeling techniques. The three snorkelers moved upstream through the pool, starting at the toe and moving up into the bubble curtain at the cascade or riffle at the head of the pool. The snorkelers maintained equal distance from one another while moving upstream, counting all fish between themselves and the snorkeler to their left. The person on the right counted to the bank as well. Fish were counted as the passed under an individual snorkeler's lane. Snorkelers communicated verbally and with hand signals when fish passed near survey lane boundaries to avoid confusion and miscounting. Only a single pass was made in each pool surveyed.

PVC slates and pencils were used to record data while snorkeling. Trout species were counted according to three size classes (0-6 inches, 6-12 inches, and 12+ inches), while all non-game species were counted for presence but not according to size classes. After completing the survey of each pool, the pool's physical dimensions were measured, including length and three width measurements. Water temperature was recorded from the first pool surveyed.

The fish data collected was analyzed in several ways. First, the total numbers of each species observered were calculated. Then rainbow trout, due to its abundance, was separated out to look at proportions of age classes observed within that species. Average number of fish per 100 feet and per mile were estimated from the observations, so that comparisons could be made with similar figures calculated for the upper Rubicon River from previous DFG surveys near Ellicott Bridge. Finally, the relationship between pool length and fish abundance was examined for linear trends.

In addition to fish surveys, the incidental reptile, amphibian, and invertebrate species observations were made. Riparian plant species within the study site were identified and their relative abundance was estimated as well.

(Note: For raw data on individual pools and counts, see Appendix II. For incidental species and riparian cover observations, see Appendix III)

Results

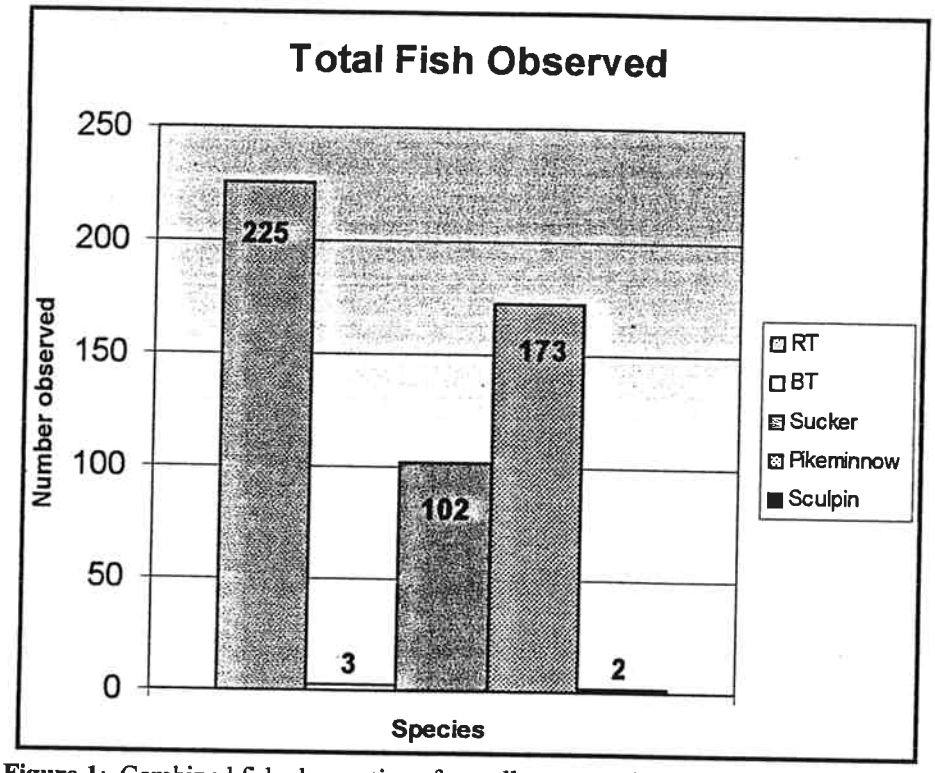

Figure 1: Combined fish observations from all seven pools sampled.

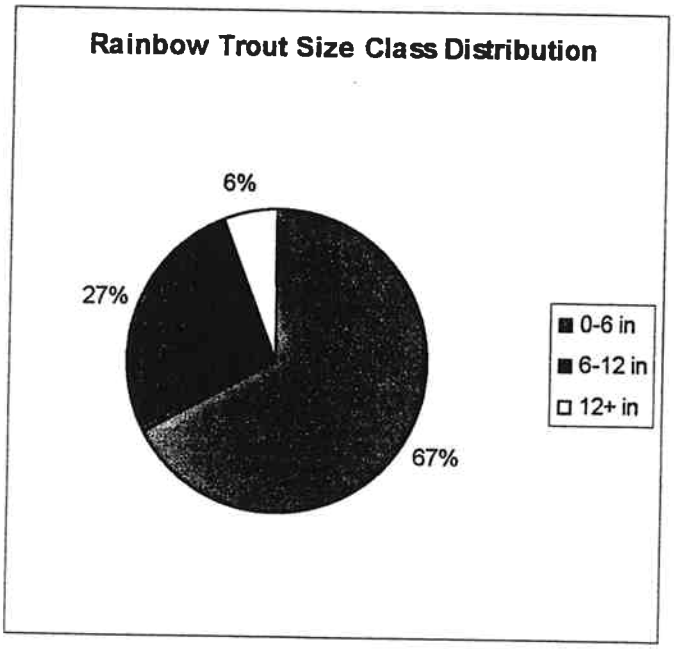

Figure 2: Age class percentages for rainbow trout observed in all pools.

Table 1: Calculated values for fish per 100 feet.

Average # Fish per 100 ft	
Rainbow Trout	23.5
Brown Trout	0.3
Sac Sucker	10.6
Pikeminnow	18.0
Sculpin	0.2

Table 2: Calculated values for fish per mile.

Average # Fish per Mile	
Rainbow Trout	1238.8
Brown Trout	16.5
Sac Sucker	561.6
Pikeminnow	952.5
Sculpin	11.0

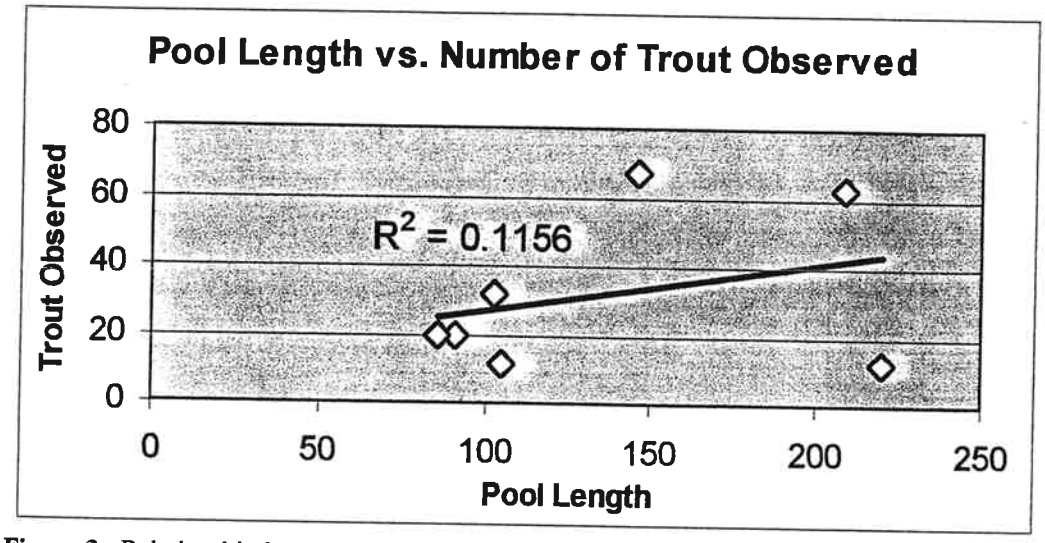

Figure 3: Relationship between pool length and the number of trout observed in the pool.

Conclusions

In examining Figure 1, sculpin and brown trout numbers appear extremely low. For sculpins, this likely is due to their coloration and size, making observations difficult especially in deep pools. Brown trout numbers are likely abnormally low due to their life history traits of hiding in difficult to see places and feeding during dusk and nighttime hours. It is probable that the actual population numbers for both of these species is much higher than observed.

The number of rainbow trout per mile calculated from direct observations on the lower Rubicon for this study are similar to calculations from higher in the watershed. In 1994, two DFG electrofishing surveys of the upper Rubicon, near Ellicott Bridge, yielded rainbow trout per mile figures of 1260 (+/- 246) and 4675 (+/- 493). The value of 1238.8 calculated from direct observation surveys is within this range. Considering the likely undercount due to using the direct observation method, the lower Rubicon's rainbow trout population dynamics seem to be similar to the upper watershed.

The number of rainbow trout observed and pool length appear to not be well correlated based on the graph and analysis seen in Figure 3. This is possibly due to natural variations in the physical aspects of each pool (e.g. depth, habitat type within the pool, cover), but is more likely due to the presence of an extreme outlier data point. The longest pool, Pool 5, was 220 feet in length but only 12 rainbow trout were observed. It is possible that the pool was an isolated phenomenon, and does not represent normal variation in fish present. If Pool 5 is removed from the analysis, the regression line fits much better and is likely reflective of the true relationship.

Appendix I

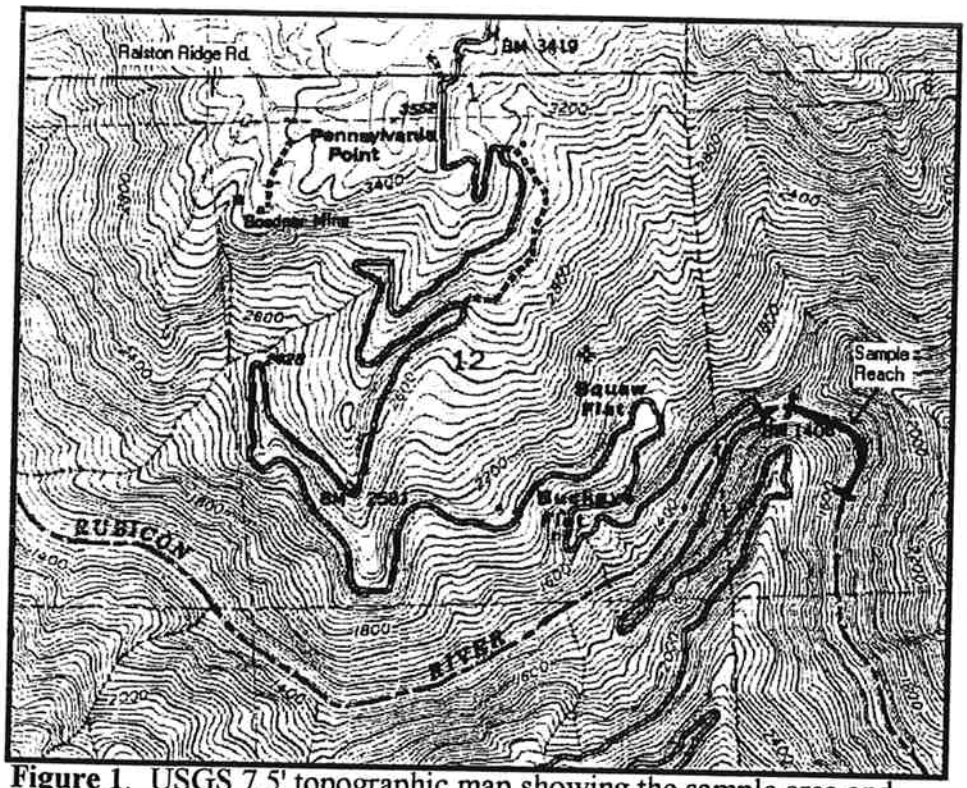

Figure 1. USGS 7.5' topographic map showing the sample area and access road.

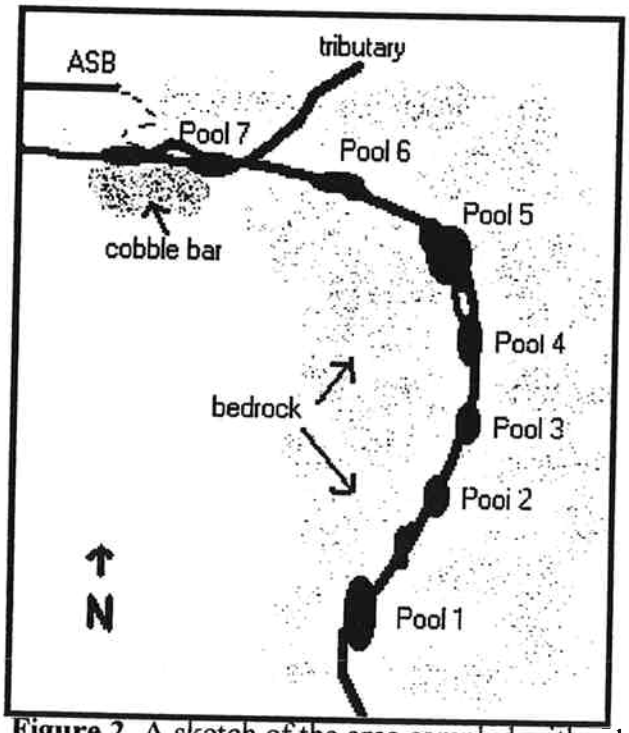

Figure 2. A sketch of the area sampled with relative locations of the pools and substrates.

Appendix II

Raw data from direct observation surveys.

Species		Size Classes (for trout)		Total
	0-6 in	6-12 in	12+ in	
Rainbow Trout	53	11	3	67
Brown Trout				0
Sac Sucker	8			8
Pikeminnow	29			29
Sculpin				0

pool 1 *Length:* 146 ft *Width:* 30.7 ft

Rainbow Trout	12	4	4	20
Brown Trout				0
Sac Sucker	16			16
Pikeminnow	5			5
Sculpin	1			1

pool 2 *Length:* 91 ft *Width:* 35.3 ft

Rainbow Trout	1	9	1	11
Brown Trout				0
Sac Sucker	7			7
Pikeminnow	9			9
Sculpin				0

pool 3 *Length:* 105 ft *Width:* 26.7 ft

Rainbow Trout	21	9	2	32
Brown Trout		1		1
Sac Sucker	18			18
Pikeminnow	87			87
Sculpin				0

pool 4 *Length:* 103 ft *Width:* 38 ft

Rainbow Trout	7	5		12
Brown Trout			1	1
Sac Sucker	17			17
Pikeminnow	25			25
Sculpin				0

pool 5 *Length:* 220 ft *Width:* 44.7 ft

Species		Size Classes (for trout)		Total
	0-6 in	6-12 in	12+ in	
Rainbow Trout	8	10	2	20
Brown Trout	1			1
Sac Sucker	11			11
Pikeminnow	12			12
Sculpin	1			1

pool 6 *Length:* 86 ft *Width:* 30 ft

Rainbow Trout	49	12	2	63
Brown Trout				0
Sac Sucker	25			25
Pikeminnow	6			6
Sculpin				0

pool 7 *Length:* 208 ft *Width:* 53 ft

Appendix III

Riparian Species

Species	Relative Dominance
Salix sp. (2)	50%
Alnus rhombifolia	20%
Populus trichocarpa	5%
Pinus ponderosa	5%
Urtica dioica	3%
Mimulus sp. (3)	3%
Juncus sp.	3%
Carex sp.	3%
Annual grasses	3%
Equisetum sp.	2%
Rubus sp.	2%
Typhus sp.	1%

Incidental Reptile and Amphibian Observations

Species	No. observed
Western fence lizard	2
Western whiptail lizard	1
Common garter snake	1
Foothill yellow-legged frog	hundreds

Incidental Invertebrate Observations

Species	Abundance
Water strider	common
Dragon-flies	scarse
Caddis-fly larvae	common
Small aquatic snail	common
Damsel-flies	common