

## Smith River Adult Trout and Salmon Surveys Summer 2008

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*Fish Count Training Day at Rock Creek Ranch. (www.thomasbdunklin.com/gallery/FishCount)*

### Introduction

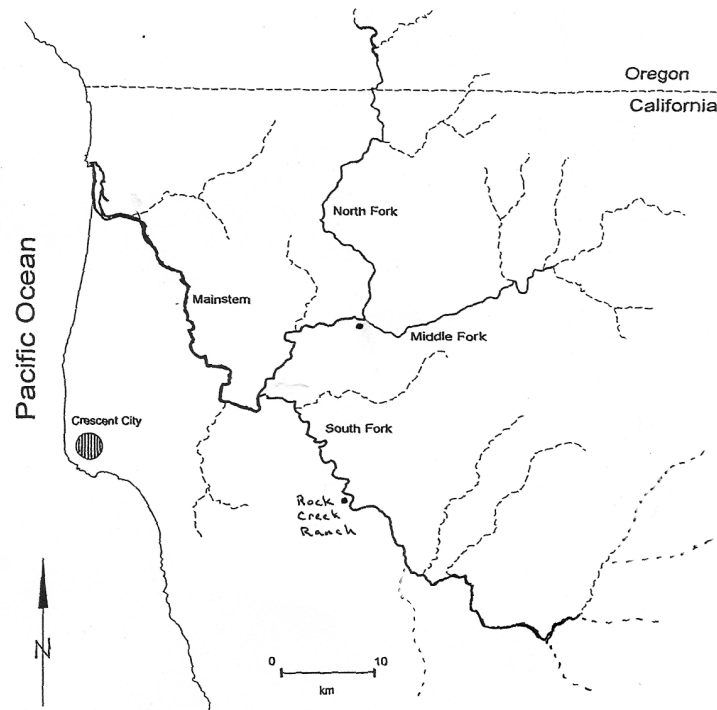
The Smith River Alliance has led coordination, training and data collection for the annual summer “Fish Count” since 2000. The project is done in coordination with the U.S Forest Service Smith River National Recreation Area (SRNRA) who conducted similar surveys in previous years, and the California Department of Fish and Game (CDFG). The objective of the project is to consistently and accurately record annual abundance and distribution of all adult fish each summer in order to detect any trends or changes over time. This report includes results from the 2008 Fish Count and summary data from all previous surveys as an appendix.

The three main forks of the Smith River comprise over 70 miles of adult salmon and trout holding habitat that can be readily surveyed by snorkelers in summer due to low flows, exceptional visibility, and depths not in excess of thirty feet (Figure 1). The first official survey was performed by CDFG contractors in 1988. The USFS conducted intermittent surveys from 1989 to 1999. Survey techniques and levels of effort varied between years and among crews. Since 2000, up to 50 volunteers have gathered each year at Rock Creek Ranch on the South Fork to train alongside available experts and agency staff. Currently, the project is supported by many instructional resources, including a video. Many local participants, including youth trained in the Immersion Camp, have established expertise in performing these surveys.



*Cutthroat Trout (Zack Larson)*

**Figure 1:** The three forks of the Smith River are shown in solid lines up to target extents of annual fish count, and large tributaries are shown in dashed lines.



## Survey Methods

Teams of two or more snorkelers count adult fish while moving from the upstream to the downstream end-points of designated survey segments. Survey segments range in length from 1.0 to 4.5 miles. All segments of each Fork of the river are surveyed in the shortest period of days possible, progressing upstream as needed to minimize the possibility of missing upstream migrating fish. The South Fork is prioritized because it has the longest running data set.

Each team is assigned a captain with adequate experience for confirming fish identification and providing leadership in the application of best techniques. Captain's tally observed fish on dive slates before and after surveying each large pool. All snorkelers are also trained in swiftwater safety. The following techniques are employed to increase the probability of observing each fish and reduce the probability of over-counting:

- Snorkelers all receive training in the Smith River prior to collecting data.
- Each team includes one or more divers capable of investigating holding sites under cover of boulders, logs or ledges.
- A diver is "spotted" by adjacent snorkelers to avoid unseen displacement of fish.
- Teams maintain positions and assigned lanes while moving downstream.
- A minimum three snorkelers are used for all but the small headwater segments.
- Snorkelers communicate each fish observation by pointing and vocalizing.
- Teams keep all heads in the water until completely through each pool or run.
- Riffles, pocket-water and turbulent areas are surveyed to the degree possible without compromising safety.
- Rapid entry into pools from upstream riffles is preceded by the stealthy entry of one or more snorkelers from the bank.
- Snorkelers calibrate their size estimates underwater by using props of known length.
- Fish counting activity is conducted between the hours of 9:30 and 4:30 pm to provide optimal light conditions.

All species are tallied according to categories listed in Table 1. Juvenile salmonids are not targeted in this survey, but snorkelers are trained in their identification and instructed to report any observations of juvenile coho salmon.

### *Smith River Adult Fish Counts, Summer 2008*

## Results

Thirteen river segments, totaling 30.1 miles, were surveyed in 2008. On the South Fork, surveys on July 26 covered 17.7 contiguous miles, from Indian Bar to the Middle Fork confluence. On the Middle Fork, four segments were surveyed, between July 26 and July 29. Number of fish per segment and other details for all surveyed segments are reported in the Appendix Table A.

The 2008 survey recorded a total of 2 Chinook, 6 summer steelhead, 33 resident rainbow trout and 1019 cutthroat trout. Table 1 reports the total numbers of adult fish counted in the South Fork and Middle Fork. Data are shown separately for the Middle Fork above and below the North Fork confluence due to contrasting size and water. Of six total steelhead found, five were in the uppermost section of the Middle Fork. Both Chinook were found in the same reach of the South Fork.

For trout, data were summarized as fish per mile for each segment. With only three exceptions, counts of cutthroat trout were in the range of 20-50 per mile. More than 75 total adult cutthroat per mile were counted in two segments of the Middle Fork and one in the South Fork. In the uppermost segment of the Middle Fork (Siskiyou-Patricks), highly experienced surveyors recorded 143 total adult cutthroat per mile. Less than 2 resident rainbow trout per mile were found in all but the uppermost Middle Fork segment where 19 rainbow trout per mile were counted.

**Table 1:** Total counts of adult fish in surveyed segments of the South Fork (17.7 Miles), and Middle Fork below (6.0 Miles) and above (6.4 Miles) the North Fork Smith River, summer 2008.

Fish Category	Species	Size	South Fork (17.7 mi)	Middle Fk, Lower (6.0 mi)	Middle Fk, Upper (6.4 mi)
Cutthroat, large	<i>O. clarki clarki</i>	12 – 20"	155	37	43
Cutthroat, medium	<i>O. clarki clarki</i>	10 – 12"	206	69	63
Cutthroat, small	<i>O. clarki clarki</i>	7 – 10"	242	103	101
Resident Rainbow	<i>O. mykiss</i>	10 – 12"	9	0	24
Steelhead	<i>O. mykiss</i>	16 – 28"	1	0	5
Half-pounder	<i>O. mykiss</i>	12 -- 16"	0	0	0
Chinook	<i>O. tshawytscha</i>	18 – 42"	2	0	0
Sucker	<i>C. rimiculus</i>	8 – 20"	4	36	11

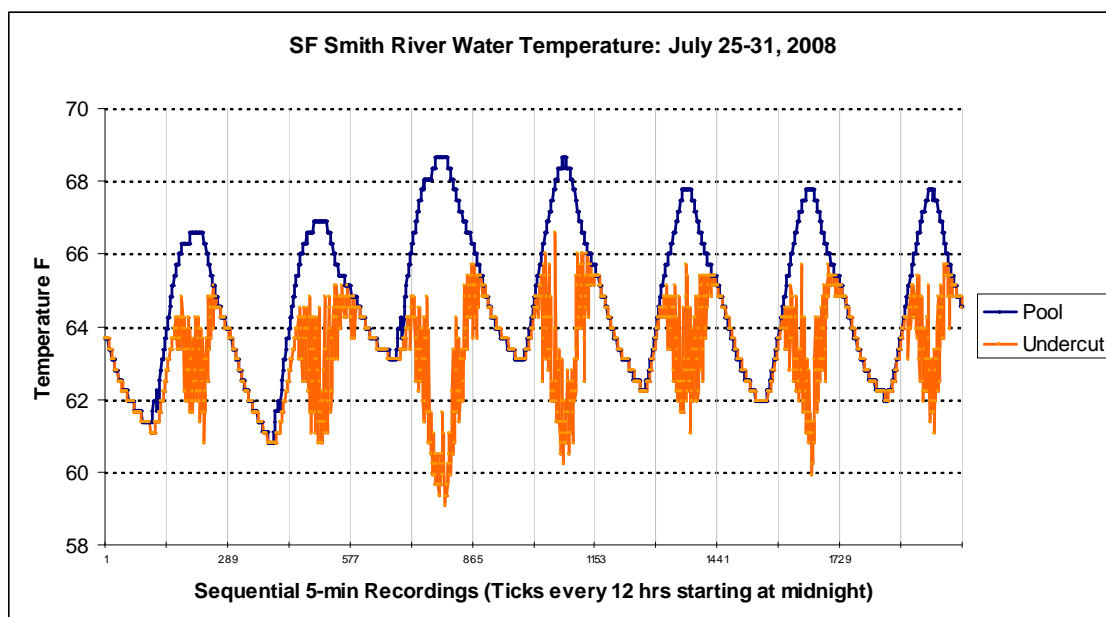
All 40 surveyors were trained or re-trained according to the methods described above. An additional 4 volunteers assisted with driving and logistics. As quality assurance steps, I interviewed team leaders about data, investigated discrepancies and examined several data parameters that may reflect sources of measurement error. These parameters include proportional count of cutthroat by size, and the number of cutthroat trout per mile

compared to the average, maximum and minimum trout per mile for all segments and from past years. Unusually high density of cutthroat trout in three reaches warranted recounts, but resources in 2008 did not permit this quality control step.

Temperature loggers were used to record temperature at 15-minute intervals at two locations in the South Fork near Rock Creek Ranch (RM 8). In addition to a “pool” location to monitor ambient conditions, one probe was placed in a deep undercut where cutthroat trout are commonly observed throughout the day. Handheld thermometers were additionally used to check temperature at the location of distal segments surveyed.

During the 7-day period including surveys, ambient water temperature in the pool at Rock Creek Ranch ranged from 61° to 69° F with an average temperature of 64.8° F. Handheld measurements indicate that the South Fork was approximately three degrees cooler in the uppermost surveyed segment, and three degrees warmer at the lowest surveyed segment. Figure 2 illustrates a diurnal pattern of temperature change with amplitude of five degrees, and peak temperatures in the early evening. In the undercut, the daily pattern of temperature change includes a drop in temperature in the late part of the day. In the undercut, water temperature ranged from 59° to 66°, with average temperature 62.3°.

**Figure 2.** Water temperature at two locations near Rock Creek Ranch on the South Fork Smith July 25-31, 2008.



Water clarity in the South Fork enabled identification of fish at distances of up to 30 feet. Several measurements of visibility – determined by ability to identify parr marks on a large lure – indicated that typical and functional visibility due to variable light conditions may more typically 15-20 feet.

## Discussion

While the 2008 survey was not as extensive as some prior years, it covered the 30 miles most frequently surveyed in past years, thus providing comparable data for long-term monitoring of adult fish abundance in the Smith River during summer. The quality of training and performance of volunteers was at the highest level yet reached, and generally equal to the recent two years which also benefited from a high proportion of experienced people and the availability of the Smith River Fish Count Instructional Video. Training was enhanced by assistance from graduates of the Immersion Camp, a 4-day program for local youth which culminated with service to the fish count. Quality was also high due to the fact that more than one-half of the volunteers had prior experience with recent Smith River Fish Counts.

The methods of the Smith River Fish Count put emphasis on finding rare fish and obtaining accurate estimates of trout by size class. Still, accuracy is subject to several factors, and past analysis of repeat counts suggests a coefficient of variation for total cutthroat trout of 0.1 to 0.3, with lower variation for more highly trained crews (Reedy, unpublished). Fish may be missed (negative bias) and poor technique or weak leadership can result in double counting of fish (positive bias). Inaccurate estimation of size introduces error among the many categories of *O. mykiss* (large juveniles, resident rainbows, half-pounders and steelhead), as well as among three classes of cutthroat trout. Counts of resident rainbow trout and half-pounders may suffer the greatest inaccuracies, because these fish can be misidentified in multiple ways. While the extremely low abundance of these types of trout in 2008 may reflect negative bias, they are likely more accurate than some previous years when juvenile trout were commonly mistaken for either of these types of adult trout.

Three segments surveyed in 2008 warranted resurveys based on atypically high densities of cutthroat trout and relatively inexperienced crews. However, each of the three crew leaders was diligent and confident, and each of the segments had relatively high densities of trout in the past. Data from these segments may reflect some double counting among crew members.

The prior record of data (Appendix Table B) is useful for examining ranges in abundance and patterns of distribution among segments, but methods varied greatly prior to 1994. The abundance of cutthroat was only slightly higher than the average for the previous nine years. A possible trend in increasing cutthroat abundance over all annual surveys could be due to improved field methods and increased effort expended by survey teams. This report does not formally analyze density or distribution of fish surveyed. A preliminary analysis of distribution patterns was provided previously (Reedy 2005), and additional analysis is planned for a future report after completion of the ten or more consecutive annual surveys.

The 2008 results indicate low abundance of summer steelhead and spring-run Chinook in the Smith River. Actual basin-wide abundance could only be estimated following

extensive surveys including most upstream segments. Results from past efforts suggest that steelhead favor upstream habitats probably due to cooler water temperatures. South Fork surveys in 2008 did reach up to segments with adequately cool water temperature for holding steelhead, but did not include more than ten miles of additional habitat upstream. All five steelhead seen in the Middle Fork were found in water cooler than the upstream most surveyed section of the South Fork.

Habitat for adult salmonids of the South Fork Smith River is limited during summer by high water temperatures which may peak above 72°. For weeks at time in July or August, daily average water temperature surpasses 68°. These temperature values exceed known thresholds of stress for holding salmon and trout (McCullough 1999, Sullivan et al. 2000). Temperature stresses would be expected to move adult salmon and steelhead further up the forks of the Smith River. Relative to the uppermost extent of the 2007 surveys, low-flow access and deep pools can be found for an additional 11-14 miles in the South and Middle Forks. The North Fork is the warmest of the three forks, but toward the headwaters in Oregon, at least 6 miles of accessible habitat keep below temperature thresholds. Until all these segments are included in the annual survey, the Fish Count cannot accurately address total actual numbers of steelhead and chinook.

The canyons of the Smith River contain many springs and seeps that provide refuge for salmonids. Cutthroat trout display a conspicuous use of temperature refuge locations, and are often seen in backwater pools collecting cold water inputs. In the Majesty pool at Rock Creek Ranch, cold water can be found collecting in an undercut space more than ten feet deep, and congregations of large trout are reliably found there during the afternoon. Thermographs illustrate the substantial degree of relief that fish experience by use of such habitat, particularly during the afternoon periods during which ambient water temperature is highest. In addition, the thermograph from the undercut shows an oscillation in temperature during the afternoon which opposes the concurrent pattern in the ambient river. This phenomenon, also recorded in 2007, enhances the quality of the location as habitat by providing the coolest temperatures when trout most need refuge.

The quality and extent of temperature refuge habitat available to trout is largely determined by the physical configuration of where the cold water enters and mixes with the river. The undercut at Rock Creek Ranch is usually present, but in some years has been filled with bed material making it unusable by trout. Currently, insufficient information is available to either fully explain the complex pattern of daily temperature fluctuation in the undercut, or to evaluate the quantity and variability in such habitat throughout the South Fork.

### **Acknowledgements**

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## **References**

- McCullough, D. 1999. A Review and Synthesis of Effects of Alterations to the Water Temperature Regime on Freshwater Life Stages of Salmonids, with Special Reference to Chinook Salmon. Columbia Intertribal Fisheries Commission, Portland, OR. Prepared for the U.S. Environmental Protection Agency Region 10. Published as EPA 910-R-99-010.
- Reedy, G. 2005. Smith River Adult Salmon and Trout Surveys, Summer 2005. Prepared for the California Dept. of Fish and Game and the Smith River Alliance.
- Reedy, G. 2006. Smith River Adult Salmon and Trout Surveys, Summer 2006. Prepared for the Smith River Alliance.
- Reedy, G. 2007. Smith River Adult Salmon and Trout Surveys, Summer 2007. Prepared for the Smith River Alliance.
- Sullivan, K., D. J. Martin, R. D. Cardwell, J. E. Toll, and S. Duke. 2000. An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria. Sustainable Ecosystems Institute . Portland, OR. 192 pp.

**APPENDIX TABLE A:**

**Fish observed by segment in the South and Middle Forks, Smith River, summer 2008.**

*CTT = Coastal cutthroat trout; RBT = Resident rainbow trout; SHT = Steelhead trout; ½ lb'r = Half-pounder steelhead.*

Fork	Segment Top	Segment Bottom	Miles	DATE	CTT<10"	CTT10-12"	CTT>12"	RBT	SHT	1/2 lb'r	Chinook	Suckers
SF	Indian Bar	Hurdygurdy Cr	3.0	26-Jul	23	30	8	2	0	0	0	0
SF	Hurdygurdy Cr	Steven Bridge	1.2	26-Jul	32	15	10	2	0	0	0	0
SF	Steven Bridge	Rattlesnake Slide	1.1	26-Jul	35	27	21	0	0	0	0	0
SF	Rattlesnake Slide	Rock Cr Ranch	3.5	26-Jul	34	35	34	0	0	0	0	0
SF	Rock Cr Ranch	Sand Camp	1.2	26-Jul	21	14	14	0	1	0	0	0
SF	Sand Camp	Carter Falls	2.4	26-Jul	38	31	22	5	0	0	0	2
SF	Carter Falls	Above Surprise	3.2	26-Jul	28	21	17	0	0	0	2	2
SF	Above Surprise	Craigs Beach	1.0	26-Jul	13	13	16	0	0	0	0	0
SF	Craigs Beach	Middle Fork	1.1	26-Jul	18	20	13	0	0	0	0	0
MF	Siskiyou Fork	Patricks Creek	3.2	28/29-Jul	14	15	21	21	5	0	0	0
MF	Madrone Camp	Panther Flat	3.2	27-Jul	87	48	22	3	0	0	0	11
MF	North Fork	Mary Adams Br	1.7	26-Jul	65	42	20	0	0	0	0	25
MF	Mary Adams Br	MP9	4.3	26-Jul	38	27	17	0	0	0	0	11

*Smith River Adult Fish Counts, Summer 2008*



**APPENDIX Table B:  
Summary of previous summer adult fish surveys in the main forks of the Smith River with total counts in the South Fork.**

Year	SF Date	Start	End	Miles	Chinook	CTT>12"	SHT	RBT	Other Forks	Surveyors
1982	7/26-8/27	Eightmile	Middle Fork	25	11	91	5	NA	MF, NF	William T. Mitchell
1989	8/28	GO Road	Craigs Cr	13.2	2	125	5	NA		USFS?
1990	9/11	GO Road	Craigs Cr	13.2	0	138	7	NA		USFS?
1991	9/9-12	GO Road	Craigs Cr	13.2	1	51	8	NA	MF	Wood/Rogers (CDFG)
1992	9/3-5	Rattlesnake	Scaling Stat.	11	1	120	8	NA	MF, NF	USFS/Reedy
1993	9/7-9	Hurdygurdy	Middle Fork	15.2	17	111	4	NA	MF, NF	USFS/Reedy
1994	8/10 - 9/5	Harrington	Scaling Stat.	27	8	190	7	13	MF, NF	USFS/Reedy
1995	8/2-3	Hurdygurdy	Middle Fork	15.2	21	161	4	19	MF, NF	USFS/Reedy
2000	8/19	Hurdygurdy	Lower Concrete Br	8	1	101	2	2		SRA/Reedy
2001	8/18	Hurdygurdy	Scaling Stat.	13.2	2	235	1	6		SRA/Reedy
2002	8/24	Indian Bar	Gorge	15	14	283	4	17		SRA/Reedy
2003	8/6-14	Eightmile	Middle Fork	25	17	290	2	29	MF	SRA/Reedy
2004	8/15	Hurdygurdy	Scaling Stat.	13.2	12	126	8	39	MF	SRA/Reedy
2005	7/23-8/16	Buck Cr	Middle Fork	23	2	216	13	46	MF	SRA/Reedy
2006	7/29-8/3	Eightmile Creek	Middle Fork	25	11	336	11	43	MF, NF	SRA/Reedy
2007	7/28	Indian Bar	Middle Fork	15	3	156	9	17	MF	SRA/Reedy
2008	7/26	Indian Bar	Middle Fork	15	2	214	1	12	MF	SRA/Reedy

*Note: The above table lists all known surveys. The Middle Fork and North Fork were not surveyed in any year when the South Fork was not surveyed. Data prior to 1992 was not provided with complete descriptions of data collection methods or personnel.*

**Smith River Adult Fish Counts, Summer 2008**