

Smith River Adult Trout and Salmon Surveys Summer 2007

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

Introduction

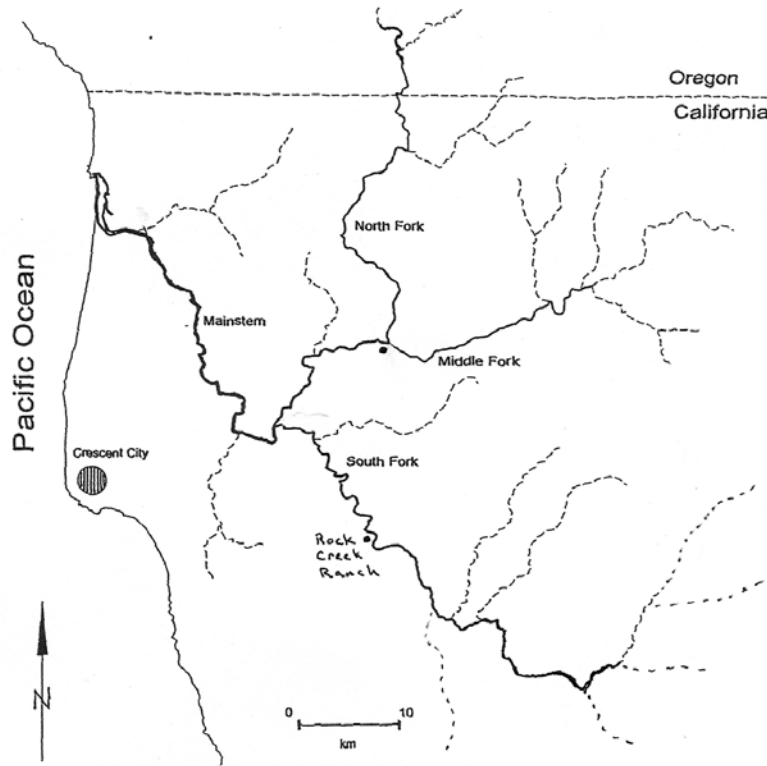
The Smith River Alliance has led coordination, training and data collection for the annual summer “Fish Count” since 2000. The project is done in coordination with the U.S Forest Service Smith River National Recreation Area (SRNRA) who conducted similar surveys in previous years, and the California Department 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 2007 Fish Count and 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. The Fish Count has developed unparalleled instructional resources and has become a popular educational event, providing a unique opportunity for community involvement in natural resource monitoring.



*Coastal cutthroat trout approximately 10” in length
(Photo by Z. Larson)*

Figure 1: The location of the Smith River's three forks and Rock Creek Ranch. Large tributaries are shown with dashed lines. The solid lines represent major tributaries accessible by anadromous fish.



Survey Methods

The following method has been designed, in corroboration with participants from twelve years of Smith River fish surveys, to be the best method for accurate counts of adult fish in the three forks of the Smith River. Teams of two or more snorkelers count adult fish while moving from the upstream to the downstream end-points of designated survey segments¹. 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. In response to limited crews, segment selection follows an upstream moving pattern that minimizes 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. Captains tally observed fish on dive slates before and after surveying each large pool. All

¹ The term “segments” is used in accordance with a hierarchical classification of stream habitat (Frissell et al 1996) that reserves the term “reach” for shorter, non-contiguous sections of river.

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.



*Snorkeling surveyor examining shallow undercut boulder
(Thomas Dunklin)*

Results

Eleven river segments, totaling 23.7 miles, were surveyed in 2007. Surveys covered 17.7 contiguous miles of the South Fork from Indian Bar (RM 17.7) to the Middle Fork confluence. Mike McCain of the US Forest Service led surveys of two segments of the Middle Fork from the North Fork confluence (RM 7.1) to Milepost 9 (RM 1.1). These surveys were conducted on July 28. On a July 29th survey of the South Fork from Bucks Creek (RM 22) to McClendon Ford (RM 20), data on cutthroat trout were lost. No steelhead and Chinook salmon were found on this survey, and the partial results are omitted from the remainder of this section. Number of fish per reach and other details for all surveyed segments are reported in the Appendix Table A.

The 2007 survey recorded a total of 3 Chinook, 9 summer steelhead, 22 resident rainbow trout and 688 cutthroat trout. Table 1 reports the total numbers of adult fish counted in the South Fork and Middle Fork. In the six miles of the Middle Fork surveyed, we observed no steelhead or Chinook adults and found 95% of the observed suckers. Among all segments, we observed a range of 15-50 total adult cutthroat trout per mile.

We saw less than 2 resident rainbow trout per mile throughout. All three Chinook were found within the same segment, and 2/3rds the steelhead were found in the upper 30% of the surveyed South Fork.

Table 1: Total counts of adult fish for surveyed segments of the South Fork (17.7 Miles) and Middle Fork (6 Miles) Smith River, summer 2007.

Fish Category	Species	Size Range (inches)	South Fork	Middle Fork
Cutthroat, large	<i>O. clarki clarki</i>	12 – 20"	156	43
Cutthroat, medium	<i>O. clarki clarki</i>	10 – 12"	185	31
Cutthroat, small	<i>O. clarki clarki</i>	7 – 10"	215	58
Resident Rainbow	<i>O. mykiss</i>	10 – 12"	17	5
Steelhead	<i>O. mykiss</i>	16 – 28"	9	0
Half-pounder ²	<i>O. mykiss</i>	12 -- 16"	0	0
Chinook	<i>O. tshawytscha</i>	18 – 42"	3	0
Sucker	<i>C. rimiculus</i>	8 – 20"	2	80

All 37 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 such as the 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. For the first year ever, I found no data warranting a resurvey of any segment.

Water clarity in the South Fork enabled identification of fish at distances of up to 30 feet, depending on sunlight and other factors. As typical during warm summers, water clarity in the South Fork began deteriorating in late July due to increases in suspended algae. The water clarity change was most pronounced in the lower and warmer segments.

HoboTemp[®] thermographing probes were used to record temperature at ½-hour intervals at two locations in the South Fork near Rock Creek Ranch (RM 8). One of the temperature probes was detected stolen after one week of monitoring, so the remaining probe was moved from the ambient location (at depth in thalweg) to ‘Cutthroat Cave’ a nearby undercut ledge 10’ deep and frequently inhabited by adult cutthroat during the peak of summer. Handheld thermometers were additionally used to check temperature at the location of various segment start and end points.

According to thermograph data (Figure 2), ambient water temperature on July 28th ranged from 64.5° to 70.4° F. The 7-day average water temperature for the week was 68° F with

² Half-pounders were not emphasized in training. Four were seen in the two-mile survey of the upper South Fork (Bucks Creek to McClendon Ford) on July 29.

a fairly consistent 5° diurnal fluctuation. In Cutthroat Cave during the period August 1-6, water temperature ranged from 60.5 ° to 66°, with daily average temperature in the range 62-64° and a maximum temperature of 66°. The diurnal temperature fluctuation in the cave was 3-4.5° F.

Air temperature was obtained from CDEC. The Oak Knoll Station is operated by the US Forest Service at 1940' and within 3 miles of Rock Creek Ranch. Mean daily air temperature at Oak Knoll ranged from 74-79° (mean 77°) degrees during the July 25-31 period and from 70-78° (mean 75°) during the August 1-5 period. Figure 3 is useful, by comparison to Figure 2, in showing that the described differences in water temperature between Cutthroat Cave and the ambient location are not driven by air temperature.

At the ambient location daily water temperature peaked at approximately 6:00 pm. In Cutthroat Cave, daily maximum water temperatures were similar to daily minimum ambient water temperature. Daily peaks in the cave occurred in the morning at times ranging from 8:00 am on August 2 to 1:00 am on August 6. The last three days of temperature record in Cutthroat Cave show a secondary peak of water temperature corresponding with the timing of peak ambient water temperature.

Discussion

The 2007 Fish Count was not as extensive as the prior year and some recent years due to limited professional assistance. The 24 miles surveyed, however, represents the segments frequently surveyed in past years. In addition, the quality of training and performance of volunteers surpassed all prior efforts. The Smith River Fish Count Instructional Video enhanced training substantially as evidenced by the confidence level of surveyors in identifying fish and conducting the surveys to standards of efficiency. Also, more than half of the volunteers had prior experience with recent Smith River Fish Counts and all team leaders were accomplished.

The results of the 2008 Fish Count are generally consistent with results from previous years of survey (Appendix Table B). The prior record of data is useful for examining ranges in abundance and patterns of distribution among segments, but methods varied greatly prior to 1994. This report does not formally analyze density or distribution of fish surveyed. A previous report (Reedy 2005) investigated patterns of distribution for cutthroat trout and rainbow trout and also compared results of all previous summer fish counts on the Smith River. Analysis of distribution patterns and trends will be the focus of a future report after completion of the tenth consecutive annual surveys by the Smith River Alliance and collaborators.

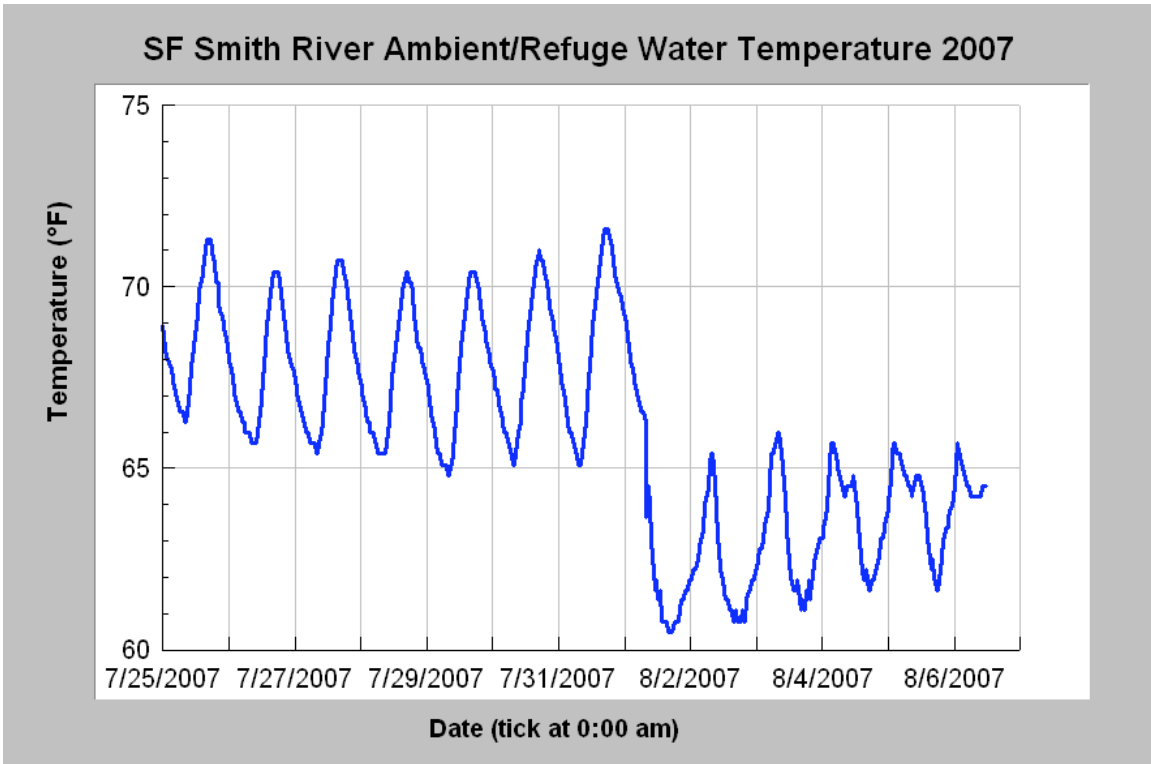


Figure 2. Water temperature measurements at an ambient location July 25-31, and in Cutthroat Cave (known refuge location during peak summer temperatures) August 1-6, 2007. Both locations are near Rock Creek Ranch on the South Fork Smith River.

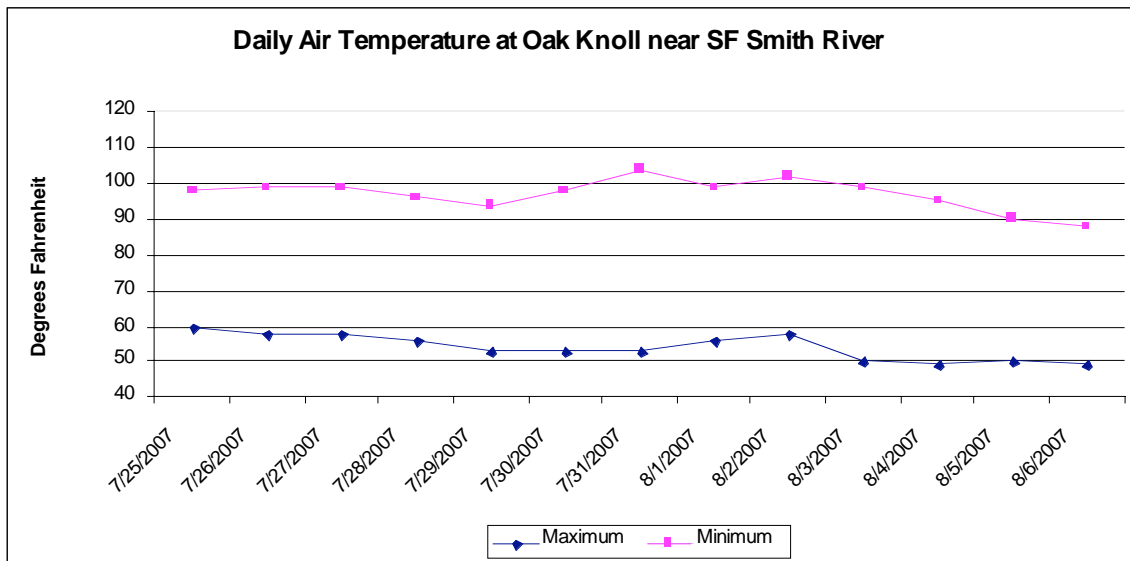


Figure 3. Daily maximum and minimum air temperature for the period July 25-August 6, 2007 at Oak Knoll Station located within three miles of Rock Creek Ranch, South Fork Smith River.

The observed abundance of cutthroat trout in 2007 (15-40 fish/mile; grand summary of 31.4 fish/mile) is very similar to the results of the last two years and slightly higher than prior years. An apparent increase in cutthroat abundance over the last seven years is likely the result of an increased percentage of actual fish that are observed. My belief is that better instruction and more thorough effort have resulted in a smaller number of cutthroat being missed. Most of the increase in cutthroat numbers comes from the number small cutthroat trout seen. Also, the proportion of medium relative to large trout has increased. As expected, better training and leadership has enhanced observational effort and corrected overestimation of size.

The Smith River Fish Count methods differ from other summer fish counts that may be focused on salmon or steelhead to the detriment of accurate trout numbers. Participants in the Smith River Fish Count work carefully and methodically to obtain accurate numbers for adult trout. Still, the accuracy of counts is subject to several factors. Some fish will always 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 three 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 probably suffer the greatest inaccuracies, because these fish can be misidentified in multiple ways.

Numbers of adult chinook and steelhead have never been impressively high in the Smith River during summer. The low numbers observed in 2007 were within the range found in previous years, but very likely lower than they would have been if surveys of the upper Middle Fork and upper South Fork segments could have been accomplished. These upper segments have typically had the highest numbers of these fish. As shown in previous reports (Reedy 2005), water temperature may be up to 10° F lower in upper anadromous reaches compared to lower reaches.

Habitat for adult salmonids of the Smith River is limited during summer by water temperature which peaks above 72° in July or August of most years in the South, Middle and North Forks, with daily average water temperature surpassing 68°. These temperature values are known thresholds of stress to holding adult salmonids (McCullough 1999). 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 has at least 6 miles of accessible habitat with water which stays 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 provide contain many springs and seeps that provide

similar refuge locations for salmonids. Cutthroat trout display a conspicuous use of temperature refuge locations, especially in the South Fork. The thermograph from one such location, Cutthroat Cave, relative to the ambient river illustrates a substantial degree of relief that the fish can experience by use of such habitat. The quality and extent of these locations is determined by the physical configuration of where the cold water enters and mixes with the river, as well as other factors. Figure 3 shows a diurnal oscillation of temperature in the Cutthroat Cave that opposes the oscillation in the ambient river. Whatever the cause, this phenomenon enhances the quality of the location as habitat by providing the coolest temperatures when trout most need refuge. The thermograph also indicates a breakdown in the diurnal oscillation of temperature in Cutthroat Cave over the six days measured with consequence to how quickly the location returns to low temperatures and how low the water temperature gets. The deterioration in quality of the refuge location warrants additional monitoring and research.

Acknowledgements

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APPENDIX TABLE A:

Fish observed by segment in the South and Middle Forks, Smith River, summer 2007.

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	Leader	Crew#
SF	Buck Cr	McClendon Ford	2.0	29-Jul	NA	NA	NA	0	0	4	0	0	J.Gillespie	3
SF	Indian Bar	Hurdygurdy Cr	3.0	28-Jul	40	25	20	4	4	0	0	0	Warnock	3
SF	Hurdygurdy Cr	Steven Bridge	1.2	28-Jul	23	17	8	1	2	0	0	0	T.Gillespie	4
SF	Steven Bridge	Rattlesnake Slide	1.1	28-Jul	15	16	13	1	0	0	0	0	J.Gillespie	4
SF	Rattlesnake Slide	Rock Cr Ranch	3.5	28-Jul	20	33	38	5	0	0	3	1	J.Katz	3
SF	Rock Cr Ranch	Sand Camp	1.2	28-Jul	23	16	20	2	1	0	0	1	Reedy	4
SF	Sand Camp	Carter Falls	2.4	28-Jul	32	29	17	0	2	0	0	0	K.Willits	4
SF	Carter Falls	Above Surprise	3.2	28-Jul	22	26	28	2	0	0	0	0	J. Burke	3
SF	Above Surprise	Craigs Beach	1.0	28-Jul	17	4	11	0	0	0	0	0	C. Strong	4
SF	Craigs Beach	Middle Fork	1.1	28-Jul	23	19	1	2	0	0	0	0	T. Dunklin	3
MF	North Fork	Mary Adams Br	1.7	28-Jul	26	10	32	3	0	0	0	32	M. McCain	3
MF	Mary Adams Br	MP9	4.3	28-Jul	32	21	11	2	0	0	0	48	R. McCain	3

Smith River Adult Fish Counts, Summer 2007

**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

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 2007