

Water Temperature Monitoring of the Klamath River Mainstem

Progress Report ##4

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PROGRESS REPORT # 4

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BACKGROUND

This is the fourth progress report to the United States Fish and Wildlife Service concerning activities conducted under the terms of the Cooperative Agreement Number 14-48-0001-92663 from October 1994 to September 1995. This report summarizes the temperature data collected for water year 1995 and describes the activities that have been initiated and/or completed for the Water Temperature Monitoring of the Klamath River Mainstem Project. The temperature data collected during the spring, summer, and fall of 1995 were collected at the 13 locations along the Klamath River mainstem presented in Table 1:

TABLE 1
Water Temperature Monitoring Locations

Location
Station #1 Below Link River Dam
Station #2 Below Keno Dam
Station #3 Below Boyle Dam
Station #4 Below Copco Dam
Station #5 Below Iron Gate Dam
Station #6 Above the Shasta River
Station #7 Below the Shasta River
Station #8 Above the Scott River
Station #9 Below the Scott River
Station #10 Above the Salmon River
Station #11 Below the Salmon River
Station #12 Above the Trinity River
Station #13 At the Mouth Near the Pacific Ocean

Planned Activities

In an effort to evaluate the water temperature data collected from 1993 to present, the Karuk Tribe has contracted out water temperature analysis and report writing to Riverside Technology, inc. (RTi) in Fort Collins, Colorado. RTi's first task was to complete Progress Report #4. Over the winter months, a relational database will be employed to evaluate all the water temperature data and isolate any changes in mainstem water temperatures that may exist by stream reach (Program Objective B). In addition to water temperature data, the relational database will be populated with U.S. Geological Survey (USGS) flow data, which will be used to establish the relationship between water temperature and streamflows from Lost River, Keno, and Iron Gate Dams (Program Objective C). Other information, such as pH, dissolved oxygen, and other possible data, will be evaluated for incorporation into the relational database. This evaluation will be included in the final report (Program Objective D).

Since Salmonids are sensitive to water temperatures above and below certain thresholds, the database will enable a user to query the temperature data to obtain the number of days that the water temperature was above or below a specified value. This information will be valuable in ascertaining the temperatures at each station or comparing between stations throughout the Klamath River mainstem.

COLLECTION AND REPORTING OF TEMPERATURE DATA

Data are collected on an hourly basis using Ryan **TempMentor™** digital recording thermometers. Each TempMentor is calibrated by Ryan Instruments at the factory with equipment traceable to the National Institute of Standards and Technology.

Data Format

The water temperature data collected during the 1995 water year were collected in 1-hour intervals. In an effort to maintain consistency with other water temperature reports in the Klamath River basin (Olsen and Reichert 1993), the USGS mean daily water temperature reporting procedure has been adopted as the standard reporting format in this report. In addition, mean daily temperatures are graphically plotted for the entire year by station (*Appendix A*).

Data Analysis

Water temperature data were collected at each of the 13 locations displayed in *Table 1*. Data collected at these locations may or may not be continuous for the entire water year. Data gaps throughout the water year reflect the difficulties that are faced by cooperators in maintaining temperature gages in the river channel year-round.

Klamath River below the Link River Dam

Water temperature data were recorded continuously from October 1, 1994, through November 14, 1994, and from March 7 through September 30, 1995. The minimum temperature recorded during this period was 36.1 degrees Fahrenheit on November 14, 1995. The maximum temperature recorded during this period was 74.5 degrees Fahrenheit on August 6, 1995.

Klamath River below the Keno Dam

Water temperature data were recorded continuously from October 1, 1994, through September 30, 1995. The minimum temperature recorded during this period was 35.1 degrees Fahrenheit on January 11, 1995. The maximum temperature recorded during this period was 74.2 degrees Fahrenheit on August 5, 1995.

Klamath River below Boyle Dam

Water temperature data were recorded continuously from October 1, 1994, through November 14, 1994. The minimum temperature recorded during this period was 42.3 degrees Fahrenheit on November 14, 1994. The maximum temperature recorded during this period was 57.1 degrees Fahrenheit on October 1, 1994.

Klamath River below the Copco Dam

Water temperature data were recorded continuously from July 19, 1995, through September 30, 1995. The minimum temperature recorded during this period was 62.6 degrees Fahrenheit on

September 30, 1995. The maximum temperature recorded during this period was 69.9 degrees Fahrenheit on August 5, 1995.

Klamath River below the Iron Gate Dam

Water temperature data were recorded continuously from October 1, 1994, through September 29, 1995. The minimum temperature recorded during this period was 38.9 degrees Fahrenheit on January 15, 1995. The maximum temperature recorded during this period was 72.0 degrees Fahrenheit on August 7, 1995.

Klamath River above the confluence with Shasta River

Water temperature data were recorded continuously from October 1, 1994, through February 8, 1995, and from July 4 through September 30, 1995. The minimum temperature recorded during this period was 38.1 degrees Fahrenheit on December 30, 1994. The maximum temperature recorded during this period was 73.2 degrees Fahrenheit on July 4, 1995.

Klamath River below the confluence with Shasta River

Water temperature data were recorded continuously from October 1, 1994, through February 8, 1995, and from July 21 through September 30, 1995. The minimum temperature recorded during this period was 37.5 degrees Fahrenheit on December 30, 1994. The maximum temperature recorded during this period was 72.4 degrees Fahrenheit on August 5, 1995.

Klamath River above the confluence with Scott River

Water temperature data were recorded continuously from October 1, 1994, through February 8, 1995, and from July 4 through September 30, 1995. The minimum temperature recorded during this period was 37.0 degrees Fahrenheit on December 30, 1994. The maximum temperature recorded during this period was 74.7 degrees Fahrenheit on August 5, 1995.

Klamath River below the confluence with Scott River

Water temperature data were recorded continuously from October 1, 1994, through June 29, 1995, and from July 4 through September 30, 1995. The minimum temperature recorded during this period was 36.4 degrees Fahrenheit on December 30, 1994. The maximum temperature recorded during this period was 74.3 degrees Fahrenheit on August 5, 1995.

Klamath River above the confluence with Salmon River

Water temperature data were recorded continuously from October 1, 1994, through October 12, 1994, and from July 14 through September 28, 1995. The minimum temperature recorded during this period was 57.7 degrees Fahrenheit on October 12, 1995. The maximum temperature recorded during this period was 75.3 degrees Fahrenheit on August 5, 1995.

Klamath River below the confluence with Salmon River

Water temperature data were recorded continuously from October 1, 1994, through January 27, 1995. The minimum temperature recorded during this period was 39.1 degrees Fahrenheit on December 31, 1994. The maximum temperature recorded during this period was 65.2 degrees Fahrenheit on October 1, 1994.

Klamath River above the confluence with Trinity River

Water temperature data were recorded continuously from October 1, 1994, through September 30, 1995. The minimum temperature recorded during this period was 39.8 degrees Fahrenheit on

December 31, 1994. The maximum temperature recorded during this period was 76.0 degrees Fahrenheit on August 1, 1995.

At the Mouth near the Pacific Ocean

Water temperature data were recorded continuously from October 11, 1994, through January 28, 1995, and from July 12 through September 30, 1995. The minimum temperature recorded during this period was 42.9 degrees Fahrenheit on December 10 and 31, 1994. The maximum temperature recorded during this period was 69.2 degrees Fahrenheit on August 15, 1995.

SUMMARY

Table 2 shows the water temperature locations ordered from upstream to downstream. This table also shows the date and value of minimum and maximum water temperatures.

TABLE 2
Water Year 1995
Minimum and Maximum Water Temperatures

Location	Min. Temp (Degree F)	Date Min. Temp	Max Temp (Degree F)	Date Max. Temp
Below Link River Dam	36.1	Nov. 14, 1994	74.5	Aug. 6, 1995
Below Keno Dam	35.1	Jan. 11, 1995	74.2	Aug. 5, 1995
Below Boyle Dam	NC*	NC*	NC*	NC*
Below Copco Dam	NC*	NC*	69.9	Aug. 5, 1995
Below Iron Gate Dam	38.9	Jan. 15, 1995	72.0	Aug. 7, 1995
Above Shasta	38.1	Dec. 30, 1994	73.2	Aug. 5, 1995
Below Shasta	37.5	Dec. 30, 1994	72.4	Aug. 5, 1995
Above Scott	37.0	Dec. 30, 1994	74.7	Aug. 5, 1995
Below Scott	36.4	Dec. 30, 1994	74.3	Aug. 5, 1995
Above Salmon	NC*	NC*	75.3	Aug. 5, 1995
Below Salmon	39.1	Dec. 31, 1994	NC*	NC*
Above Trinity	39.8	Dec. 31, 1994	76.0	Aug. 1, 1995
Klamath Mouth	42.9	Dec. 31, 1994	69.2	Aug. 15, 1995

(*) - Generally, the minimum water temperatures were recorded in late December and early January and the maximum water temperatures were recorded in early August. An asterisk means that data were not recorded at this location during one of these two periods.

From *Table 2*, it can be seen that the seasonal fluctuation in water temperature is consistent throughout the entire Klamath River mainstem. The annual minimum water temperature occurs near the end of December while the annual maximum water temperature occurs at the beginning of August. Annual minimum water temperatures along the Klamath River mainstem range from 35.1 degrees Fahrenheit at the Keno Tailrace to 42.9 degrees Fahrenheit at the mouth of the Klamath River. Annual maximum water temperatures along the Klamath River mainstem range from 69.2 degrees Fahrenheit at the mouth of the Klamath River to 76.0 degrees just upstream of the confluence with the Trinity River.

It is interesting to note that the influence of each of the tributaries to the Klamath River (Shasta, Scott, and Salmon rivers) is to decrease the water temperature in the Klamath mainstem. As more data becomes available, water temperature trends can be determined.

Maximum water temperatures in the Klamath River mainstem for water year 1995 peaked at 76.0 degrees Fahrenheit above the Trinity River.

From *Table 3*, it can be seen that the largest variability in water temperature occurs during the months of November, December, and January, as well as in the low flow month of July.

TABLE 3
Water Year 1995
Mean Monthly Water Temperatures
Degrees Fahrenheit

Mon	Below Link River Dam	Below Keno	Below Boyle Dam	Below Copco	Below Iron Gate	Above Shasta	Below Shasta	Above Scott	Below Scott	Above Salmon	Below Salmon	Above Trinity	Mouth
Oct	52.0	53.3	51.7	-	58.9	58.2	57.4	56.9	56.4	-	57.4	57.8	57.7
Nov	38.9	39.2	44.7	-	48.8	47.8	46.8	46.0	45.3	-	45.3	45.8	48.1
Dec	-	35.9	-	-	41.5	41.1	40.8	41.1	40.5	-	41.9	42.5	45.0
Jan	-	36.3	-	-	39.4	40.4	40.7	42.0	41.7	-	44.0	44.6	46.8
Feb	-	42.7	-	-	42.5	43.3	43.9	45.3	44.4	-	-	46.2	-
Mar	43.6	44.5	-	-	45.3	-	-	-	45.9	-	-	46.9	-
Apr	49.3	49.8	-	-	49.2	-	-	-	49.5	-	-	49.3	-
May	56.7	58.2	-	-	56.7	-	-	-	55.0	-	-	54.5	-
Jun	63.6	64.4	-	-	63.5	-	-	-	58.8	-	-	59.0	-
Jul	70.2	70.9	-	68.6	69.1	70.2	68.9	70.3	68.6	71.8	-	68.8	65.1
Aug	68.2	69.4	-	67.8	69.5	69.8	69.3	70.0	69.4	69.9	-	70.0	66.3
Sep	65.1	66.3	-	64.6	66.2	66.1	65.5	66.4	66.1	66.8	-	67.5	67.1

- Means were calculated for all months.

Appendix A provides tables and plots of mean daily water temperature at each of the gaging locations. The tables include mean, maximum, and minimum monthly values.

Appendix B provides plots of mean monthly water temperature at each of the gaging locations.

REFERENCE

Olsen, A. and M. Reichert. (1993). Stream Temperature Data Compilation, Klamath River Basin, Number One, R-5 Fish Habitat Relationship Technical Report. USDA Forest Service, Happy Canyon Ranger District. Happy Canyon, California.