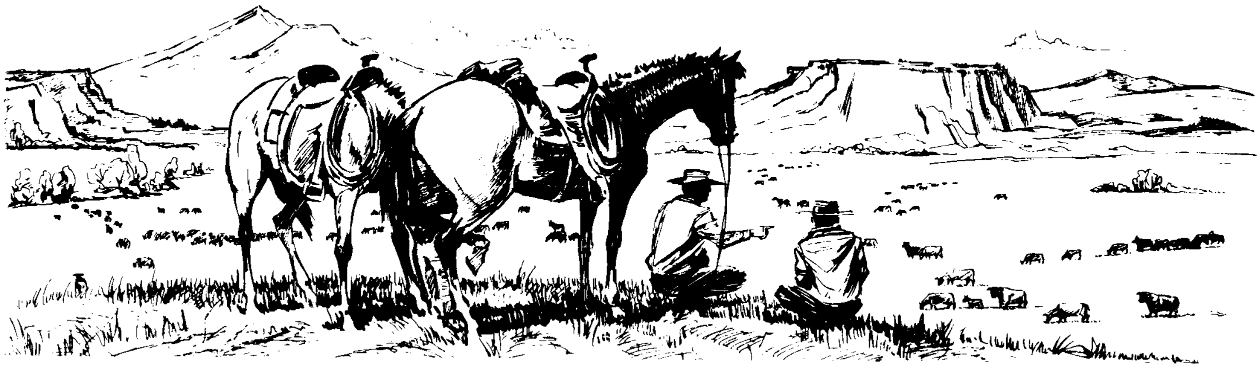
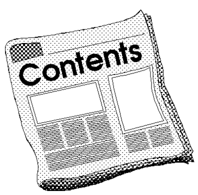


SISKIYOU STOCKMAN

What's New in the "Top of the State". A report for Siskiyou Livestock Producers put out by the Farm Advisors Office, Cooperative Extension of the University of California, located at 1655 South Main Street, Yreka, California 96097

October 2001



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Calendar

Nov 3	Siskiyou County Cattlemen's Annual Fall Program, Yreka. http://www.sisqtel.net/~armstrng/sccahome.html
Nov	Annual California Cattlemen's Association Convention, Burbank, CA. http://www.calcattlemen.org/
Jan	Red Bluff Bull Sale, Red Bluff, CA. http://www.red-bluff.com/
Jan 31 - Feb 2	Klamath Falls Bull Sale, Klamath Falls, OR. http://klamathbullsale.com
Dec 2 - 5	California Farm Bureau Annual Meeting, Anaheim, CA. http://www.cfbf.com/

Will more water in the river improve temperature conditions for cold water fish?

It has been suggested that increasing stream flows in the Shasta River will lower water temperatures, improving conditions for cold water fish. Proposals have included reduced diversions to leave more water in the Shasta, hoping that more water will spell colder water. However, what is the actual relationship between flow and water temperature? The mantra is "increase flow to reduce stream temperature". Is this the case? Let's look at some data.

The highest stream temperatures in the Shasta River are from about mid June to the end of September. The average daily maximum water temperature for that period last year (2000) was 71.6°F. This was recorded by automatic data recording equipment (Shasta CRMP site[1]) on the Shasta River near the Montague-Grenada bridge, just south of Montague (Table 1). In 1999, the average was 70.9, and for 1998 the average was 71.8—not much variation in stream temperature. A second temperature recorder (maintained by DWR) also near the Montague-Grenada bridge had a 71.1°F average in 2000, 70.6 in 1999 and 71.5 in 1998, almost identical to the CRMP recorder. This stream temperature pattern from 1998 to 2000 was not unique to the Montague-Grenada bridge location. Stream temperatures

[1] Data kindly provided by Dave Webb, Shasta River CRMP coordinator.

further downstream on the Shasta River, near Yreka, (USGS site 11517500) had a similar pattern across years with slightly higher temperatures overall (Table 1).

Table 1. Flow, stream and air temperatures for the Shasta River. Daily average (± SD, standard deviation) maximum water and air temperature for June 10 through September 30 by year, measured near the Montague-Grenada bridge (Shasta CRMP site). Additional readings for water only by another recording device (maintained by DWR) at the same location. Flow and water temperature was measured downstream from the Montague-Grenda bridge on the Shasta near Yreka at a USGS site (number 11517500). Maximum values determined from hourly samples.

Year	Flow, CFS	Water Temperature, °F, Montague-Grenada Bridge	Water Temperature, °F, Mouth	Air Temperature, °F, Montague-Grenada Bridge
2000	58.9 ± 31.7	71.6 ± 4.9 (CRMP) 71.1 ± 5.1 (DWR)	75.7 ± 6.2 (DWR)	86.5 ± 8.5 (CRMP)
1999	73.9 ± 26.9	70.9 ± 4.3 (CRMP) 70.6 ± 4.2 (DWR)	74.9 ± 5.0 (DWR)	86.7 ± 6.9 (CRMP)
1998	179.7 ± 188	71.8 ± 4.3 (CRMP) 71.5 ± 4.2 (DWR)	75.3 ± 5.7 (DWR)	88.6 ± 9.5 (CRMP)

August 4-7 temperature data excluded for each year due to missing data in 2000.

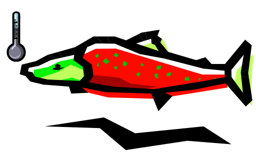
What were the flows during that same period? Flow records are available on the Shasta River near Yreka (USGS site 11517500). The average daily flow for the same time period in 2000 was 58.9 cubic feet per second (CFS). In 1999, the average daily flow was 73.9 CFS — about 25 percent more than the flow in 2000. The average daily flow over the same time period in 1998 was far greater, 179.7 CFS. Surprisingly, even though flows were three times higher in 1998, the stream temperature was about the same.

Perhaps there was another factor other than flow that had a greater influence on water temperature. Average air temperature varied between years. In 1998, the high flow year, average daily maximum air temperature was the highest of the three years, 88.6°F. Air temperature was 86.7 in 1999 and 86.5 in 2000. It is difficult to interpret the air temperature effect on water temperature since the pattern is not consistent between years. However, the data is very clear when viewed as a graph (Figure 1).

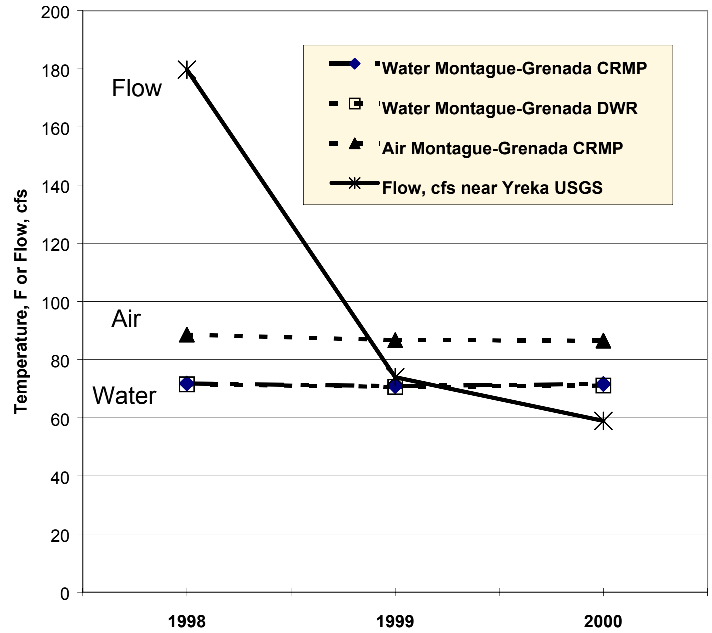
Water temperature was very similar from year-to-year, despite huge variation in flow. In this comparison of three years, higher flow does not appear to be associated with lower stream temperatures. Stream temperatures, however, did seem to mirror air temperatures. Unfortunately, from a management standpoint, there is very little that can be done to influence air temperature. In addition, these data suggest that even if people managed the stream to increase flows, it would have little influence on stream temperature.

The period evaluated (June 10 to September 30) covers the summer time period when stream temperatures might be a problem. To reduce the risk of that period being unique or unusual, or the potential of obscuring patterns due to too large of a time period, the same analysis was conducted focusing on only July and August. The results were the same pattern, higher flow in 1998 compared to 1999 or 2000, but very little difference in stream temperature (data not shown).

The huge differences in flows between 1998, 1999 and 2000, and the small variation in water temperature certainly suggests increasing flows will not make much, if any, difference in stream temperature. But this must be an exception, "everyone" knows increased flow will improve stream temperatures. Research being conducted by Dr. Ken Tate, watershed hydrologist at UC Davis, on coastal watersheds indicates that while increased flow is associated with decreased stream temperature, flow may not be as important in determining stream temperatures as other factors especially air temperature. On a coastal California stream under intense analysis, he found a 10 percent change in stream flow would decrease stream temperature about 0.2°F, whereas a 10 percent change in air temperature would change stream temperature 7.0°F. His work also indicates that canopy, watershed position, and stream order also effect stream temperatures. The combined results of the analysis presented here and work across the state make a clear case that stream temperature is a complex variable that responds to numerous natural and management factors. Research, conservation, or management approaches to reduce stream temperature must be based on an understanding of all these factors. A stream temperature model by Mike Deas working with the Shasta CRMP has been started and with continuing support could be such a model for the Shasta.



Perhaps the use of averages is hiding something. Besides, we aren't interested in averages, but rather in specific days or even hours of stressful or unhealthy temperatures. Some people use a figure of 68°F as a red flag for stressful water temperatures for cold water fisheries. For the year 2000, using 68 degrees as a threshold, the number of days from June 10 to September 30 which exceeded the threshold was 70 (Table 2). In 1999, when flows were 25 percent higher the number of days with a daily maximum average water temperature above 68°F were 60. In 1998, when flows were three times higher, the number of days exceeding the same threshold were 74.



Flow, water and air temperature of the Shasta River

Figure 1. Display of data for Montague Grenada bridge area temperatures and flow from Table 1. Water and air temperatures varied little between 1998, 1999 and 2000 despite flows three times higher in 1998 than 2000. Water temperatures were less but mirrored air temperature.

So, higher flows (three times higher) did not reduce the number of potentially stressful days.

These data seems to support the concept that water temperature is not closely tied to flow, and increasing flows will likely have very little impact on stream temperature.

Table 2. Sub sample of data from table 1 showing the number of days that average daily water temperature exceeded 68°F.

Year	Number of days water temperature exceeded 68F	Average water temperature, °F	Average air temperature, °F
2000	70	73.5 ± 3.2	89.5 ± 6.1
1999	60	73.2 ± 2.4	88.0 ± 7.2
1998	74	74.1 ± 2.8	93.6 ± 6.9

Was the high flow in 1998 a fluke? It was unusual but equal or higher flows for that period have occurred three other years going back to 1934 data. Those years were 1938, 1941 and 1978. These data suggests increasing summer flows, even to historically high summer flow levels, do not result in significantly lower water temperatures.

This is your copy of the Siskiyou Stockman, which you requested, or which we thought would be of interest to you.

Sincerely,

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