# Summer use of cold-water refugia areas by Juvenile and Adult Salmonids the Klamath River, California in August, 2002

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*Abstract*- During the summer season, mainstem Klamath River water temperatures often exceed published values for chronic and acute temperature stress for salmonids. This is thought to cause juvenile and adult salmonids to congregate at sources of cooler water, known as thermal refugia. It is not known, however, how these fish utilize these areas over an entire 24 hour period, whether these fish stay at one refugial area, or move to other nearby areas, or what food resources would be available to these fish. Snorkel observations of juvenile and adult salmonid abundance were conducted at the mouth of Elk Creek on the Klamath River near Happy Camp, California every hour or two hours on two specific dates in August of 2002 to ascertain daily usage patterns of this thermal refugial area. Macroinvertebrate drift samples were collected to ascertain food availability both in the river near the refugial area, and in the refugial area itself. These have yet to be processed. Additionally, 17 juvenile salmonids were tagged at the mouth of Elk Creek on August 12, 2002 using a photonic marking gun to assess the feasibility of a mark-recapture effort, and several dozen more were tagged at the mouth of Bluff Creek in late August, which were then relocated visually for several weeks.

On August 14th juvenile steelhead numbers increased from 140 at 11:00 am with a mainstem water temp of 24˚C to 730 fish at 7:00 pm when the mainstem water temperature reached 26.5˚C. Refugia temperatures along with creek temperatures peaked at 24.5˚C and 23˚C respectively at 5:00pm. During early morning dives the next morning, the vast majority of these fish could not be found in the immediate thermal refugial area. Surface observations of juvenile salmonids actively feeding in the river indicates a high probability that these fish were feeding in the Klamath River immediately adjacent to Elk Creek thermal refugial area. Results were similar for August 28th, but fewer fish were present.

The following is a short technical report of results, and as such, does not contain a detailed literature review that is relevant to this subject.

## Introduction

Klamath River mainstem water quality and water quantity conditions have come under increasing scrutiny as a causative factor in the decline of Klamath River anadromous

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salmonids. In its 2002 report, *Scientific Evaluation of Biological Opinions on Endangered and Threatened Fishes in the Klamath River Basin*, the National Research Council offered the hypothesis that increased mainstem Klamath River releases might reduce the effective size of thermal refugial areas by "*causing more effective mixing of the small amounts of locally derived cool water with much larger amounts of warm water from points upstream.*". Based on this hypothesis, the National Marine Fisheries Service (NMFS), ordered the Bureau of Reclamation to conduct evaluations of thermal refugial areas. These studies have taken on two broad topics, the physical characteristics of certain thermal refugial areas, and the biological significance of these areas. This report focuses on the biological investigations; the physical investigations were done by other investigators.

Before the effects of mainstem Klamath water flow management to thermal refugia areas can be ascertained, a more complete understanding of the biological characteristics of these areas is needed. This study is an attempt to obtain that information. Specifically, we are interested in the ways in which fish use these thermal refugia areas. How long do they stay there? Do they use nearby mainstem river areas? What are the food resources available to these fish as they stay in these areas?

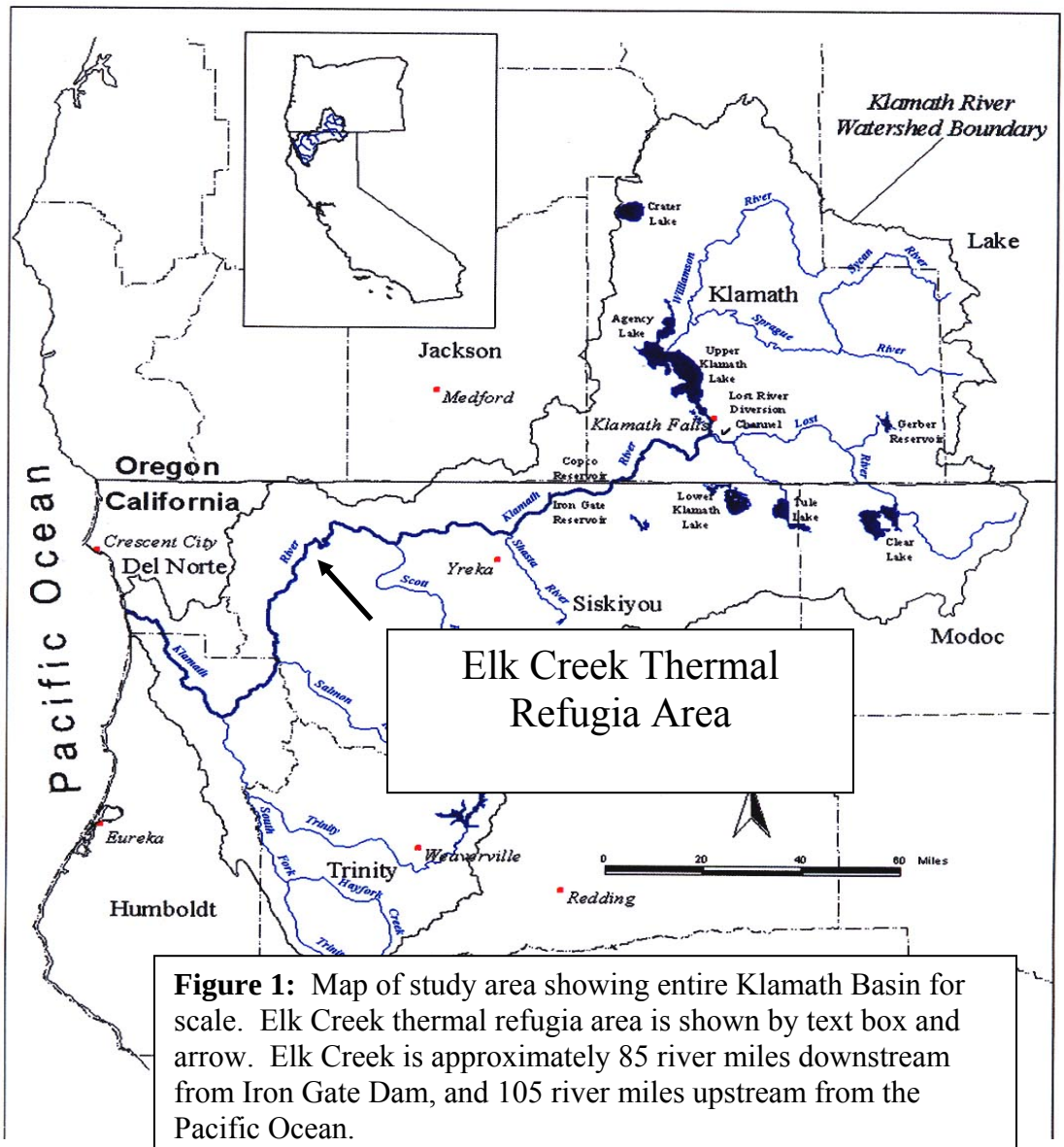


**Figure 1:** Map of study area showing entire Klamath Basin for scale. Elk Creek thermal refugia area is shown by text box and arrow. Elk Creek is approximately 85 river miles downstream from Iron Gate Dam, and 105 river miles upstream from the Pacific Ocean.

## Materials and Methods

General

Hourly snorkel observations were made during the daylight hours, and snorkel counts were attempted through the night-time hours on two hour intervals. Water temperatures were taken using a handheld thermometer (± 0.5°C) during each snorkel count with measurements taken from the mainstem river above the thermal refugia area, Elk Creek proper upstream from mouth, and the thermal mixing zone where most of the fish were observed. Flow discharge on Elk Creek was taken on 8/14/02. Two aquatic macroinvertebrate drift samples were taken, one near dawn in the mainstem Klamath, and

the other during the middle of the afternoon directly in the refugia area itself. Several days before the dives on 8/14/02, we marked 9 juvenile steelhead and 6 juvenile chinook with a photonic paint marking gun, just below the dorsal fin with bright pink paint.

Fish observations

Fish were observed and enumerated, by life stage and species according to the following classification: chinook and coho were enumerated as either 0+, 1+, jack and adult. Steelhead were enumerated as either 0+, 1+, 2+/half pounder, adult. The following table enumerates the classification and sizes of these fish. The idea was to get an estimate of the gross numbers of the different classes juveniles and adults, not to provide a precise breakdown by size class. We specifically discussed juvenile coho identification, and the crews were especially on the alert for these fish.

| **Steelhead** | | **Chinook and Coho** | |
|---|---|---|---|
| 0+ | <15 cm | 0+ | <15 cm |
| 1+ | 15-30 cm | 1+ | 15-30 cm |
| "half-pounder" | 30-70 cm | jack | 30-50 cm |
| adult | <70 cm | adult | 50+ cm |

Fish counts were conducted using the 'block' method. Divers counted fish in groups or blocks and worked their way through the whole refugia zone. A counting hierarchy was established to assist divers with counting large groups of fish in a confined area.

| Approximate number of fish | Counting method |
|---|---|
| < 50 fish | obtain exact number |
| 50-100 | count fish in 10 fish increments |
| 100-500 | count fish in 50 fish increments |
| 500 < | count fish in 100 fish increments |

Aquatic macroinvertebrate drift samples

Two aquatic macroinvertebrate drift samples were taken for each day's observation. One was taken from the river upstream of the creek mouth, and was taken near the dawn hours. This coincides with the time that juvenile fish leave the refugia area and are observed feeding in the nearby mainstem river.

Another sample was taken directly in the refugia area itself during the afternoon. This coincides with the time that fish are concentrated in the refugia area itself, and this sample was taken to see what kind of food resources were available to fish holding in these areas.

Drift samples were taken using a 9 by 12 inch 500μ mesh net, which was suspended for approximately one hour. A water velocity measurement was taken using a Marsh-McBirney flow meter so that the total volume of water passing through the net could be obtained.

All samples were stored in a solution of 10% buffered formalin, and have yet to be processed. Therefore, results from this portion of the study effort are not presented here.

Fish Marking

Eleven steelhead and six chinook juvenile salmonids were captured at the Elk Creek thermal refugial area on 8/12/02 with a beach seine. These fish were marked with a photonic paint fish-marking gun with a bright pink spot just below the dorsal fin. Two steelhead died in the process of handling, so nine steelhead ended up being released with marks on them. These fish were released into the refugial area, and subsequent dives looked for these fish visually.

## Results

August 14 and 15th, Elk Creek

River temperature varied between 21°C and 26.5°C, while the temperature of Elk Creek varied between 18 and 23°C. Temperature peaked in both the river and the creek at 5:00 and 7:00pm (Figure 2). Temperatures measured in the center of the refugia area varied between 19 and 24.5°C. The temperature difference between Elk Creek and the Klamath River varied between 3 and 5°C (Figure 3).

Fish numbers peaked at or near 7:00 pm, with a maximum total of 877 salmonids in the refugial area (Figure 2, Table 1) [3]. Salmonid numbers were dominated by juvenile steelhead young of year (YOY) and 1+ steelhead. There were several hundred suckers in the refuge area also, which was somewhat unusual when compared with other thermal refugia observations made this year and in other recent years[4] (Table 1).

Night dives were attempted, but abandoned due to inadequate lighting. The next morning, as soon as it was light enough to see, fish observations resumed. Nearly 90% of the salmonids that were observed in the refugial area the previous evening had vacated the refugia area (Figures 4,5,6; Table 1).

[3] Tables 1 and 2 can be found at the end of this document.
[4] Yurok Tribal Fisheries Program, unpublished data 1998-2002.

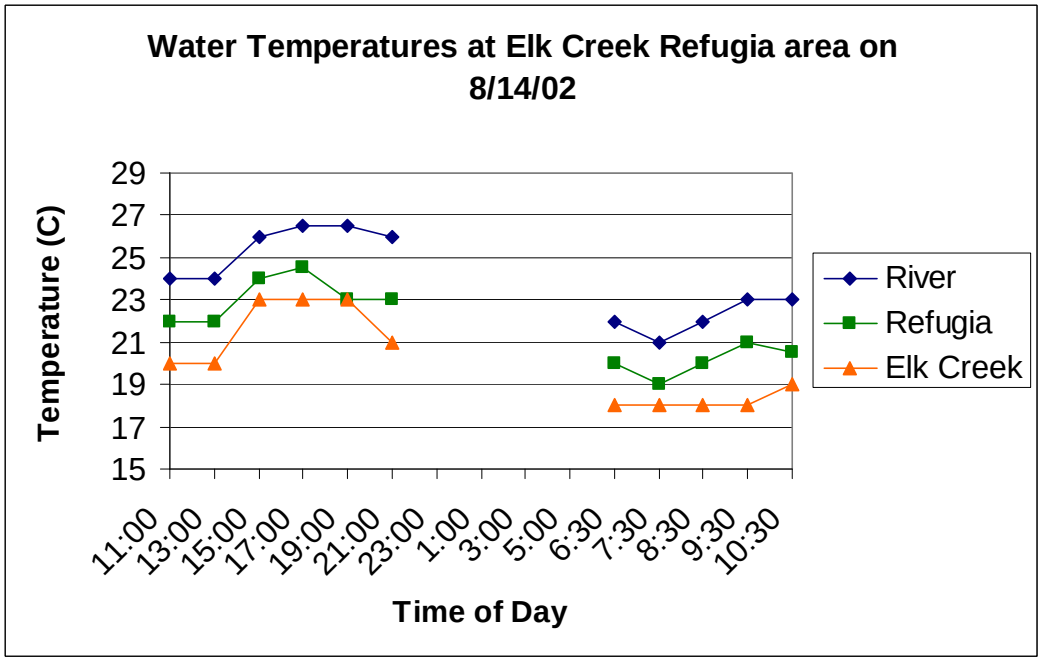


**Figure 2:** Water temperatures at Elk Creek Refugia area on 8/14 and 8/15/2002. "Refugia" temperatures were taken at or near the center of juvenile salmonid abundance within the thermal refugia itself. Klamath River temperatures were taken above the refugial area, as were Elk Creek Temperatures.

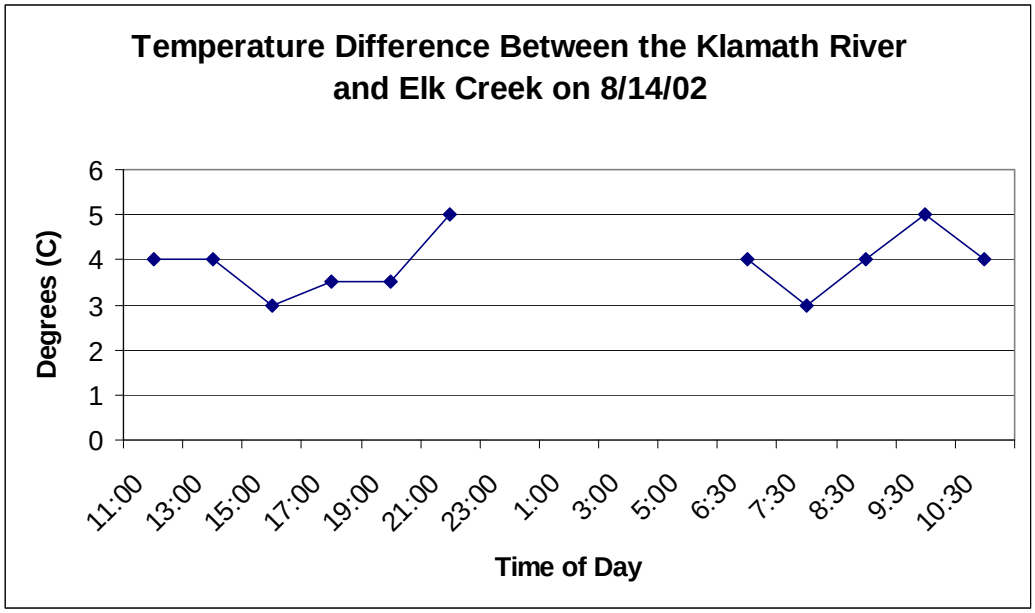


**Figure 3:** Temperature difference between Elk Creek and the mainstem Klamath River.

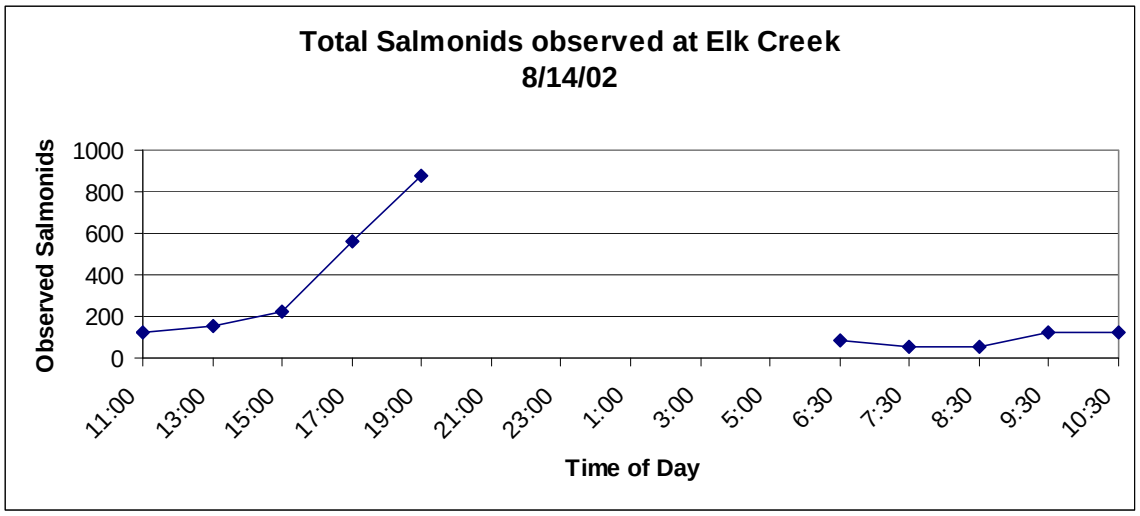


**Figure 4:** Total salmonids (adult and juvenile steelhead, chinook, and coho salmon) at Elk Creek Refugia on 8/14/02. Fish numbers peaked sharply near the end of the day at nearly 1000, but by daybreak the next day, nearly 90% of the fish had left the refugial area. These fish were observed in the Klamath River nearby the refugial area.

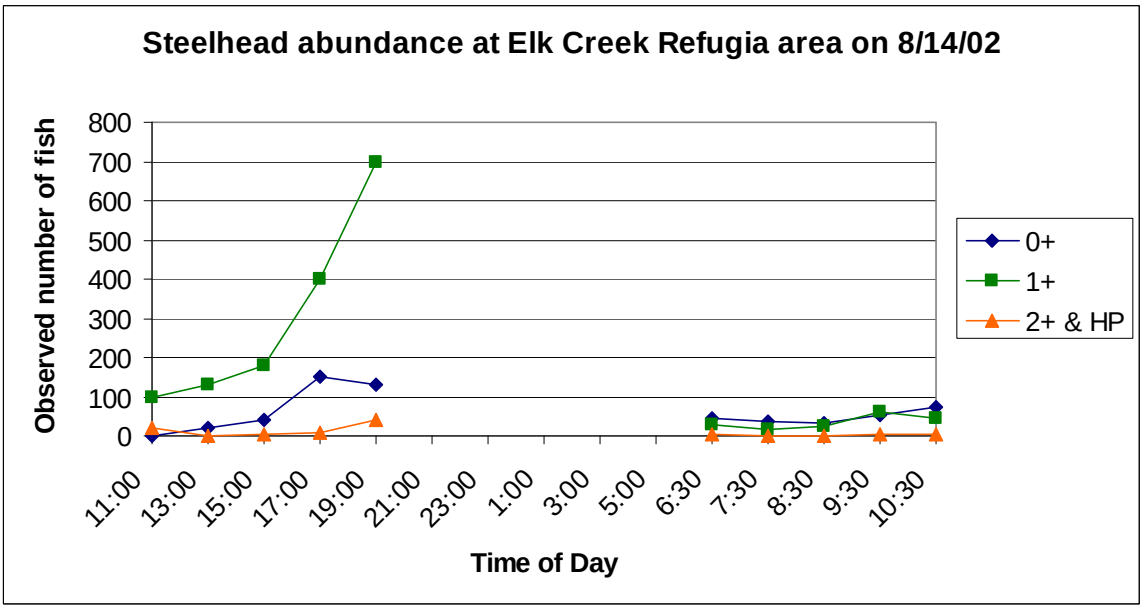


**Figure 5:** Steelhead abundance at Elk Creek Refugia on 8/14/02. Steelhead 1+ (15-30cm) numbers steadily increased all day until it was too dark to see them. By daybreak, approximately 90% of these fish could not be found in the refugial area.

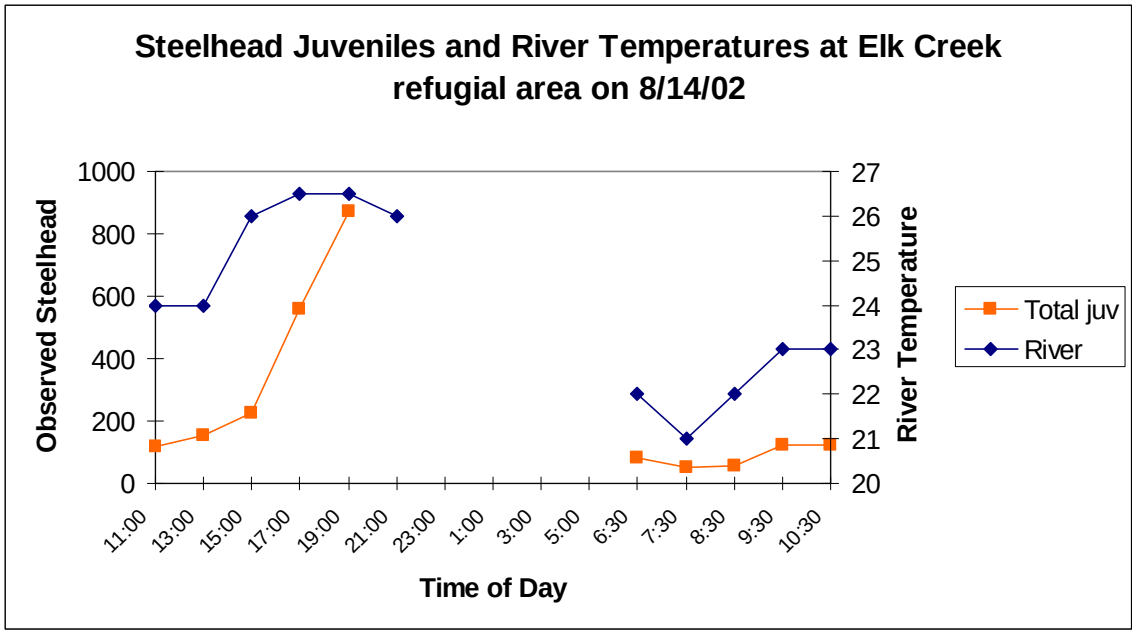


**Figure 6:** Steelhead juvenile abundance and river temperature for 8/14/02. Fish abundance rose with river temperature throughout the day, with fish abundance peaking near the same time as river temperature. Again, the next morning, nearly all fish had vacated the refugial area even though river temperatures were still over 20°C.

August 28 and 29th; Elk Creek

River temperature varied between 20.5°C and 24.5°C, while the temperature of Elk Creek varied between 17 and 22°C. Temperature peaked in both the river and the creek at 4:30 pm. 7:00pm (Figure 7). Temperatures measured in the center of the refugia area varied between 19 and 24.5°C. The temperature difference between Elk Creek and the Klamath River varied between 3 and 5°C (Figure 8).

In general, salmonid abundance was lower on August 28th than on the 14th. The maximum total number of salmonids on this date was 105, which occurred at 1630 (Figure 9).

Fish numbers peaked at 4:30 pm, with a maximum total of 105 salmonids in the refugial area (Figure 9, Table 2). Salmonid numbers were dominated by juvenile steelhead young of year (YOY) and 1+ steelhead. As on August 14 and 15th, there were several hundred suckers in the refuge area, (Table 2).

Night dives were attempted, but a nearby construction project muddied Elk Creek to the point where night dives were impossible despite adequate lighting. The next morning, as soon as it was light enough to see, fish observations resumed, as the creek had cleared by then. Again, the majority of the salmonids that were observed in the refugial area the

previous afternoon and evening had vacated the refugia area by 8:30 am the next morning (Figures 9,10,11; Table 2). By 12:30 numbers had started to climb again.

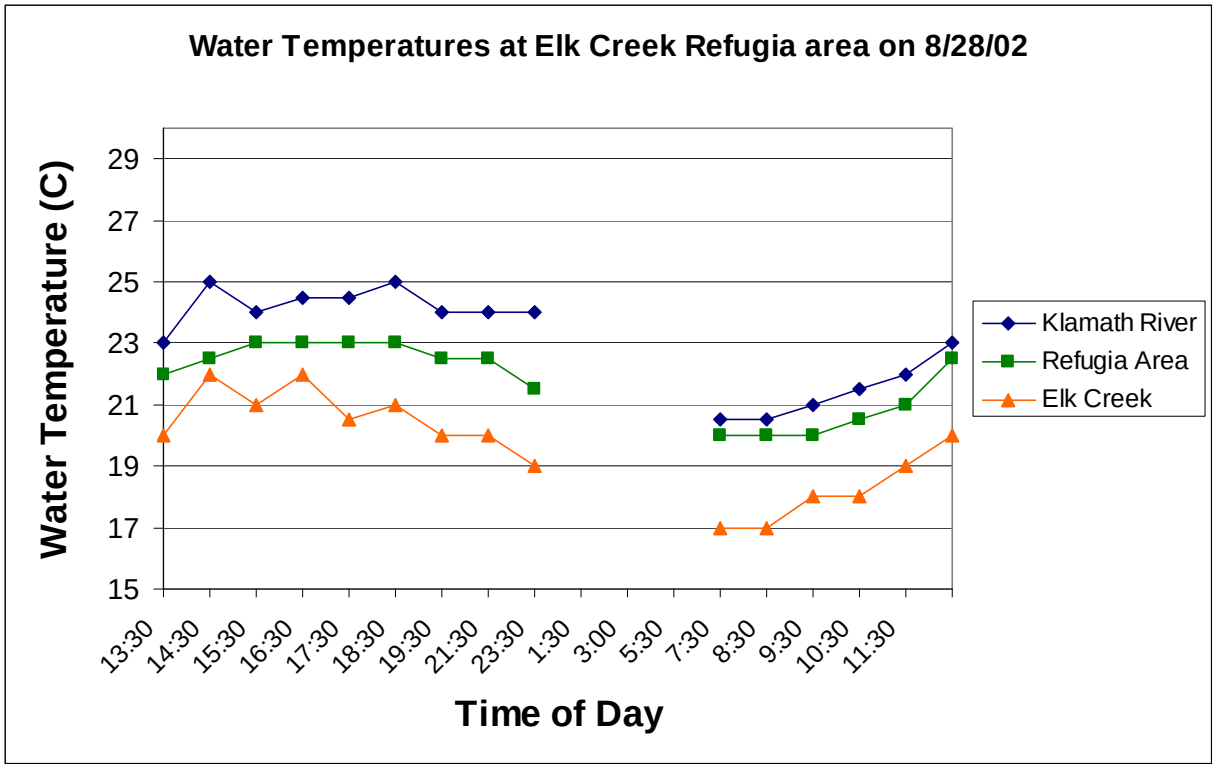


**Figure 7:** Water temperatures at Elk Creek Refugia area on 8/28 and 8/29/2002. "Refugia" temperatures were taken at or near the center of juvenile salmonid abundance within the thermal refugia itself. Klamath River temperatures were taken above the refugial area, as were Elk Creek Temperatures.

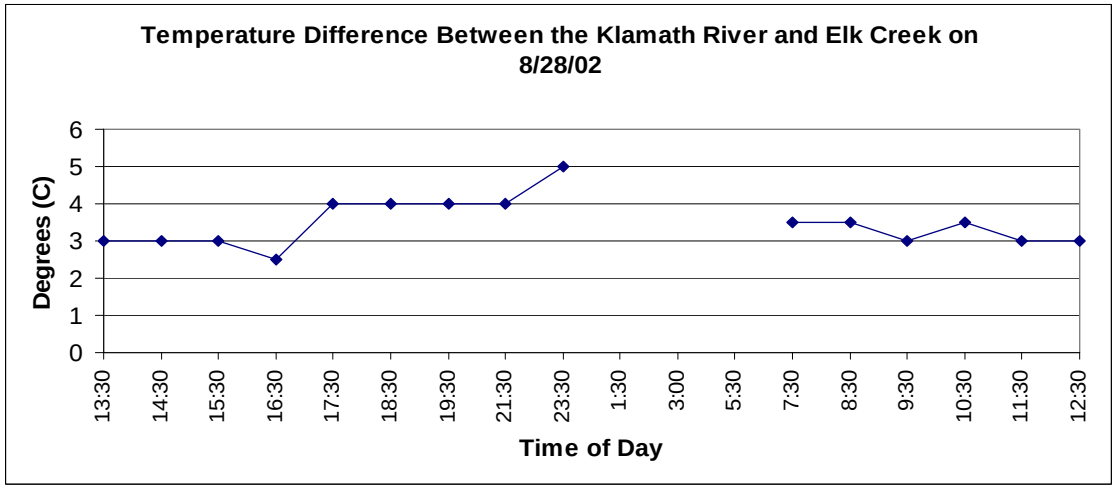


**Figure 8:** Temperature difference between Elk Creek and the mainstem Klamath River on 8/28 and 8/29/02.

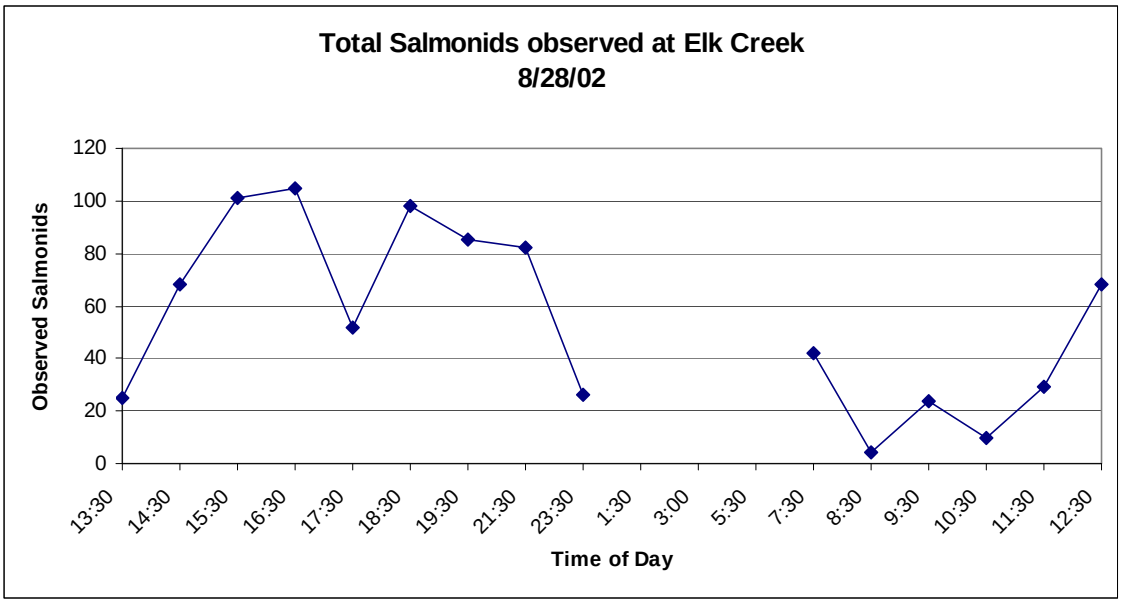


**Figure 9:** Total salmonids (adult and juvenile steelhead, chinook, and coho salmon) at Elk Creek Refugia on 8/28/02. Fish numbers peaked sharply near the end of the day at over 100, but by daybreak the next day, the majority of the fish had left the refugial area.

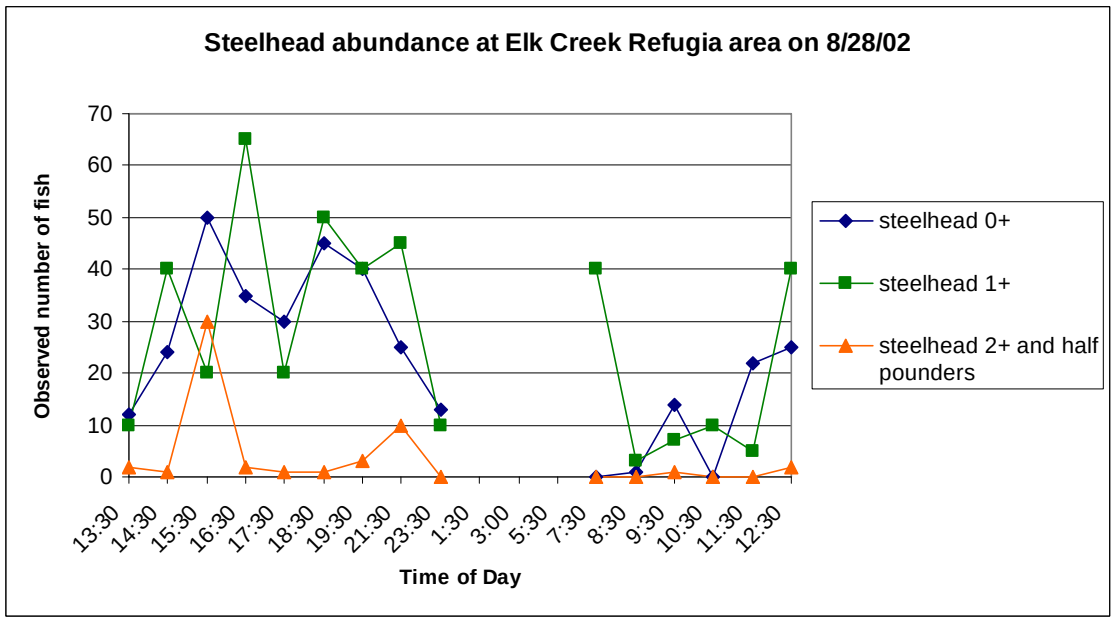


**Figure 10:** Steelhead abundance at Elk Creek Refugia on 8/28/02. Steelhead 1+ (15-30cm) numbers steadily increased all day until it was too dark to see them. By daybreak, the majority of these fish could not be found in the refugial area.

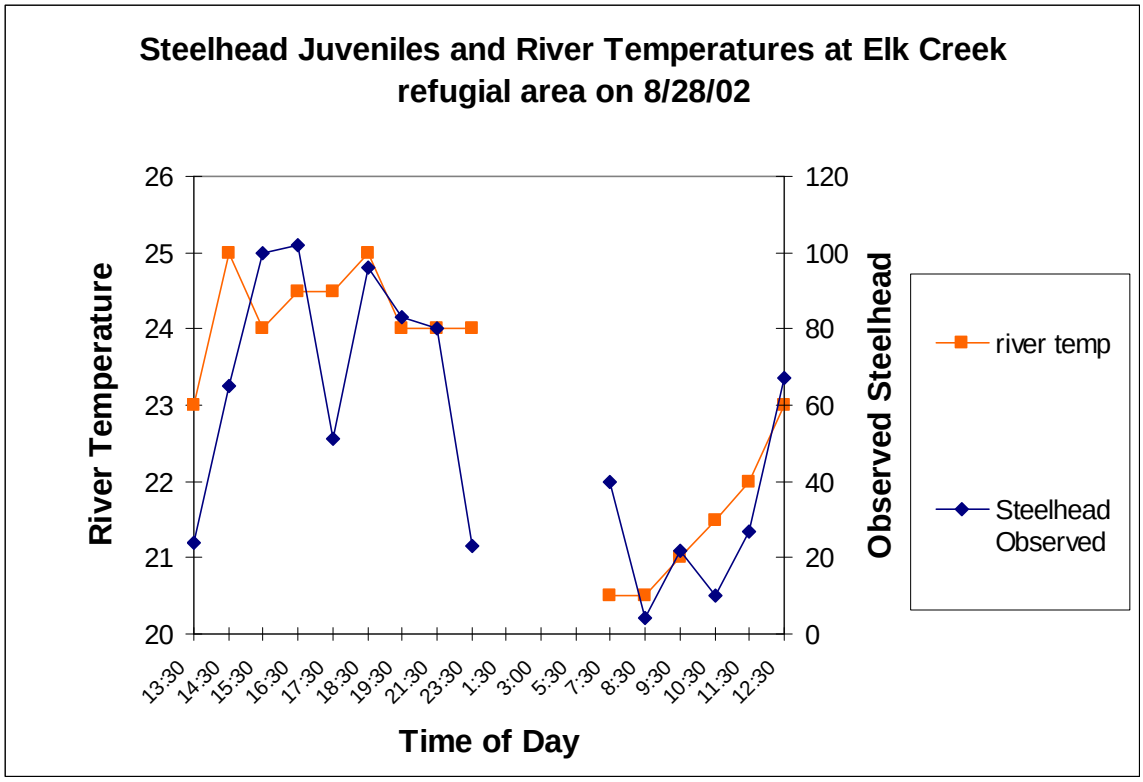


**Figure 11:** Steelhead juvenile abundance and river temperature for 8/28/02. Fish abundance rose with river temperature throughout the day, with fish abundance generally following the general trends of river temperature. Again, the next morning, nearly all fish had vacated the refugial area even though river temperatures were still near 20°C.

Correlation Between Fish Abundance and Temperature

Fish abundance was most strongly correlated with time of day and river temperature, rather than the difference between Klamath River and Elk Creek temperatures for both days (Figures 12, 13, 14,). In particular, when river temperatures rose above 24°C, salmonids and suckers both packed tightly into the refugial area where they were easily observed (Figures 3-5, 9-11, 12-14).

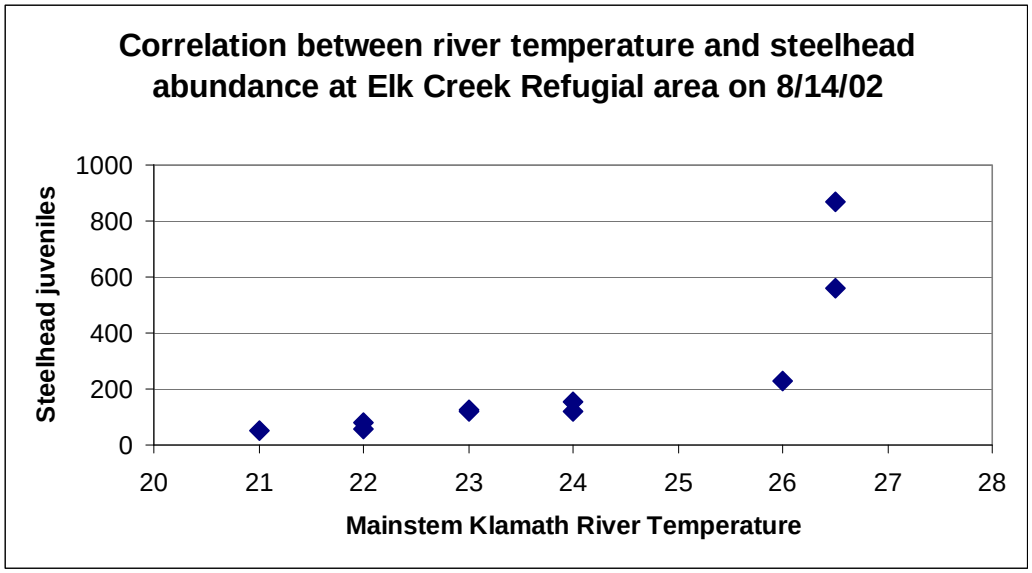


**Figure 12**: Steelhead abundance at Elk Creek Refugia on 8/14/02 as related to Klamath River mainstem water temperature. Fish abundance increases sharply above 24°C.

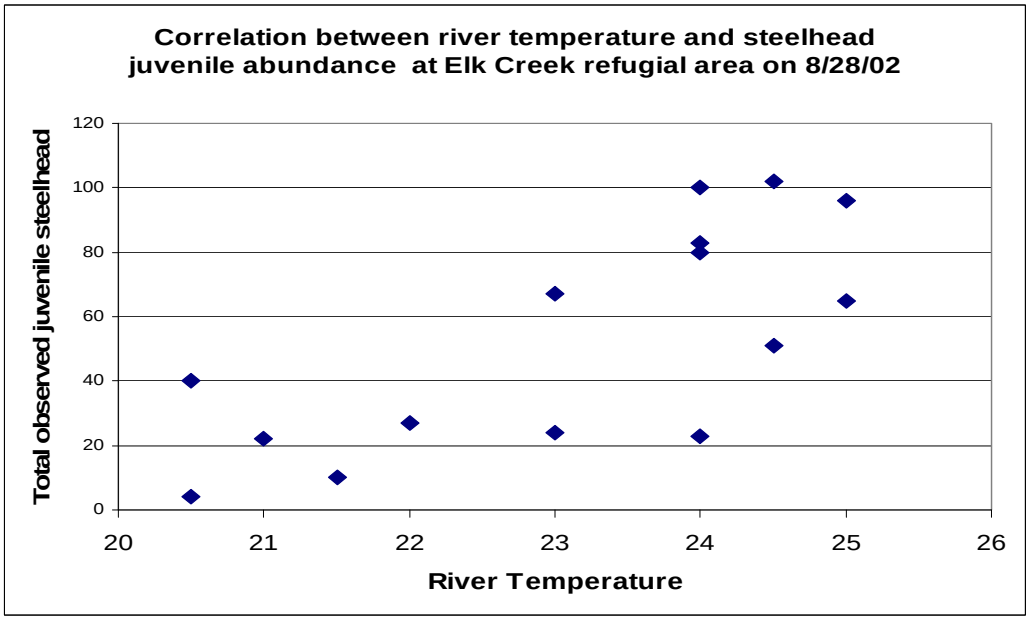


**Figure 13**: Steelhead abundance at Elk Creek Refugia on 8/28/02 as related to Klamath River mainstem water temperature. The relationship is not as clear as on 8/14 because fish abundance and river temperature were both lower. However, the highest fish abundances still occur near the warmest Klamath River temperatures.

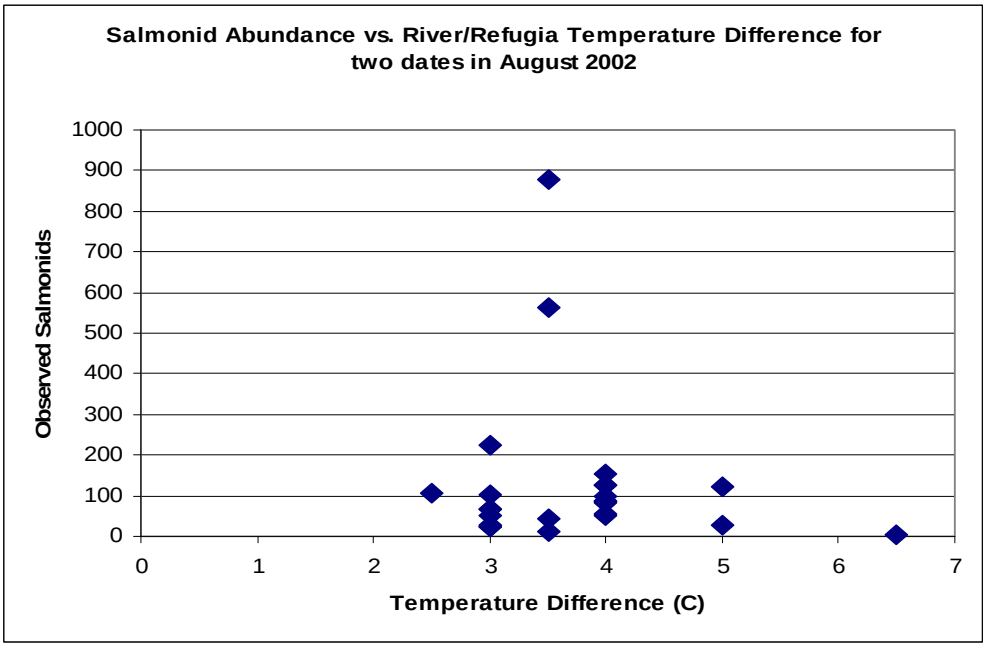


**Figure 14**: Relationship between fish abundance and the temperature difference between Elk Creek and the mainstem Klamath. Because the temperature difference remained relatively stable during the observation periods, no discernable relationship emerged.

Fish Marking

No marked fish were observed on 8/14/02 or on 8/28/02. However, at Bluff Creek, marked fish were observed for several weeks after marking. These results are being analyzed at this time, and will be available later this year.

Discharge Measurement

Elk Creek flow was measured at 22.6 cfs. The individual measurements are presented in Table 3.

**Table 3:** Flow discharge measurements for Elk Creek on 8/14/02.

| Station | Depth | Width | Velocity | Cell Q |
|---|---|---|---|---|
| 1 | 0.1 | 2.3 | -0.17 | -0.04 |
| 2 | 0.4 | 2.3 | 0.06 | 0.06 |
| 3 | 0.5 | 2.3 | 0.35 | 0.40 |
| 4 | 0.3 | 2.3 | 0.52 | 0.36 |
| 5 | 0.8 | 2.3 | 0.36 | 0.66 |
| 6 | 0.7 | 2.3 | 1.2 | 1.93 |
| 7 | 1.1 | 2.3 | 0.74 | 1.87 |
| 8 | 0.9 | 2.3 | 0.89 | 1.84 |
| 9 | 0.6 | 2.3 | 0.9 | 1.24 |
| 10 | 0.9 | 2.3 | 1.92 | 3.97 |
| 11 | 0.6 | 2.3 | 0.67 | 0.92 |
| 12 | 0.6 | 2.3 | 1.51 | 2.08 |
| 13 | 0.8 | 2.3 | 1.12 | 2.06 |
| 14 | 0.8 | 2.3 | 0.69 | 1.27 |
| 15 | 0.5 | 2.3 | 0.49 | 0.56 |
| 16 | 0.5 | 2.3 | 0.7 | 0.81 |
| 17 | 0.75 | 2.3 | 0.9 | 1.55 |
| 18 | 0.2 | 2.3 | 0.45 | 0.21 |
| 19 | 0.4 | 2.3 | 0.5 | 0.46 |
| 20 | 0.25 | 2.3 | 0.56 | 0.32 |
| | | **Creek CFS** | | **22.55** |

## Discussion

In August 2002, we observed juvenile salmonids utilizing the mainstem Klamath River during the morning hours, and crowding together during the middle of the afternoon in the refugial area itself. This is a strong indication that juvenile salmonids are utilizing a Klamath River mainstem that otherwise would be considered hostile, with daytime maximum temperatures of over 26°C.

During the morning hours, nearly all salmonids that had been crowded into the refugial area were gone. Although the mainstem Klamath was too turbid to effectively snorkeled, small salmonids could be seen feeding and jumping in the nearby vicinity. This behavior was not noted later in the day.

These juvenile fish are utilizing refugial areas, but still utilizing the mainstem Klamath during the early morning hours. Thus, water quality, food availability, and other conditions on the mainstem Klamath affect these fish. These refugial areas allow the fish to use an otherwise inhospitable and warm Klamath River.

## Other Klamath River Thermal Refugia Research and Recommendations for Future Research

The Yurok Tribal Fisheries Program has conducted observations and research on thermal refugial areas for several years now. We have:

1. Catalogued the distribution and characteristics of thermal refugia areas along the entire mainstem Klamath River;
2. Looked at seasonal trends in juvenile salmonid abundance at major refugial areas during the summers of 1998, 2001, and 2002;
3. Observed 24 hour changes in juvenile fish abundance at Indian Creek in 1998;
4. Performed morning observations at selected lower river refugial areas in 2002;
5. Conducted early morning and afternoon observations in selected refugial areas in the lower Trinity River. Because the Trinity is so much clearer than the Klamath, we are able to see how these fish utilize nearby river areas.
6. Discovered that Blue Creek refugia area is a key staging area for adult salmonids, holding several thousand adult chinook and steelhead in 2001 and 2002;
7. Discovered that fish will leave refugial areas on their own volition if mainstem temperatures drop. Repeated observations of this type may lead to a behavior based temperature preference and/or tolerance for juvenile salmonids.

The Yurok Tribal Fisheries Program expects to have our 1998 results ready within two months, and the rest of the data ready later this year.

Recent observations and research on thermal refugial areas has begun to shed light on the importance of these refugial areas to different species of salmonids in the Klamath River during the summer season, many questions remain.

Questions that remain to be answered:

1. Are these fish contributing to future generations?
    a. What is the survival rate of these fish?
        i. How many of these fish survive to adulthood, and how does that compare with survivorship of fish that migrate out of the system earlier?
    b. How healthy are these fish?
        i. Is disease a problem in these areas?
        ii. What are these fish eating?
2. How long does a particular fish inhabit a refugial area?
3. Do these fish swim up tributaries and utilize habitat in the lower reaches of Indian, Elk, Clear and other creeks?

Additionally, in the future, when studies are done at these areas, we will deploy temperature recorders with a higher precision so that we can get finer resolution on temperatures in and around the refugial areas.

As our numbers of observations increase, and we gain information on fish use during different meteorological conditions, we gain insight on these questions. In fact, we begin to close in on field-based behavioral temperature tolerance for juvenile and (at Blue Creek) adult salmonids. This would represent a tremendous leap forward in our understanding of salmonid habitat needs in the Klamath.

We recommend this direction for future research:

1. We need careful and detailed temperature monitoring of key cold water inputs and the Klamath mainstem adjacent to these areas. Tidbits or other temperature recorders should be placed near thermal refugial areas. This will facilitate the behavior based temperature tolerance.
2. We recommend a mark-recapture study to determine the residence time for these fish in these areas. This will also enable researchers to look for these fish in lower tributary areas. Careful handling will be required to pull this off without causing excessive mortality.
3. We recommend continuation of weekly and seasonal observations, especially focusing on early morning hours, as well as afternoon peak usage.
4. We recommend focusing on Blue Creek by introducing regular fish abundance monitoring, as it has been recently discovered that thousands of adults utilize this area as a holding and staging area during the summer and early fall. This is also a special area of concern because the adult salmon fish kill of 2002 was concentrated in this area. The health of these summer holding adult fish should be investigated early on before the fall run comes in.
5. We recommend monitoring thermal refugia usage on lower Trinity River tributaries. The clarity of the Trinity River will enable investigators to examine fish usage in the nearby mainstem river, and will provide important clues on Klamath River fish usage of mainstem habitats.
6. We recommend that a selected refugial area be completely characterized with regard to physical habitat and how juvenile and/or adult salmonids utilize that habitat. It may be worthwhile to introduce habitat complexity (large woody debris) into selected thermal refugial areas to increase their carrying capacity, and reduce water velocities.
7. Data from previous year's research needs to be analyzed, reviewed, and published.

## Acknowledgements

The Yurok Tribal Fisheries Program would like to extend its sincere gratitude to the Karuk Tribe of California for their support in Klamath River Flow Studies in general, and in particular this one. We would also like to extend our gratitude to the Bureau of Reclamation and the Pacific Coastal Salmon Recovery Fund for sponsoring this project and other thermal refugial work undertaken by the Yurok Tribal Fisheries Program.

**Table 1:** Complete results for thermal refugia snorkel observation monitoring from 8/14 and 8/15/02. Nighttime observations were not possible due to inadequate lighting. "Diff" is the temperature difference between the Klamath River mainstem and Elk Creek.

| 8/14/02 | Temperature | | | | Steelhead | | | | | Chinook | | | Coho | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TIME | River | Refugia | Elk Cr. | Diff | 0+ | 1+ | 2+ & HP | Total juv | Adults | 0+ | 1+ | CH Adult | 0+ | 1+ | Total Salmonids | Suckers |
| 11:00 | 24 | 22 | 20 | 4 | 0 | 100 | 20 | 120 | 2 | 1 | 1 | 0 | 1 | 0 | 125 | 300 |
| 13:00 | 24 | 22 | 20 | 4 | 20 | 130 | 2 | 152 | 0 | 0 | 0 | 0 | 0 | 0 | 152 | 400 |
| 15:00 | 26 | 24 | 23 | 3 | 40 | 180 | 6 | 226 | 0 | 0 | 0 | 0 | 0 | 0 | 226 | 350 |
| 17:00 | 26.5 | 24.5 | 23 | 3.5 | 150 | 400 | 10 | 560 | 2 | 0 | 0 | 0 | 0 | 0 | 562 | 325 |
| 19:00 | 26.5 | 23 | 23 | 3.5 | 130 | 700 | 40 | 870 | 6 | 0 | 0 | 1 | 0 | 0 | 877 | |
| 21:00 | 26 | 23 | 21 | 5 | | | | | | | | | | | | |
| 23:00 | | | | | | | | | | | | | | | | |
| 1:00 | | | | | | | | | | | | | | | | |
| 3:00 | | | | | | | | | | | | | | | | |
| 5:00 | | | | | | | | | | | | | | | | |
| 6:30 | 22 | 20 | 18 | 4 | 45 | 30 | 6 | 81 | 4 | 0 | 0 | 0 | 0 | 0 | 85 | 100 |
| 7:30 | 21 | 19 | 18 | 3 | 35 | 15 | 2 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 150 |
| 8:30 | 22 | 20 | 18 | 4 | 32 | 23 | 1 | 56 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 200 |
| 9:30 | 23 | 21 | 18 | 5 | 55 | 60 | 6 | 121 | 0 | 0 | 0 | 0 | 0 | 0 | 121 | 400 |
| 10:30 | 23 | 20.5 | 19 | 4 | 75 | 45 | 3 | 123 | 0 | 1 | 0 | 0 | 1 | 0 | 125 | 300 |

**Table 2:** Complete results for thermal refugia snorkel observation monitoring from 8/28 and 8/29/02. Nighttime observations were not possible due to turbidity caused by local construction project. "Diff" is the temperature difference between the Klamath River mainstem and Elk Creek.

| 8/28/02 | Temperature | | | | Steelhead | | | | | Chinook | | | Coho | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TIME | River | Refugia | Elk Cr. | Diff | 0+ | 1+ | 2+ & HP | Total juv | Adults | 0+ | 1+ | CH Adult | 0+ | 1+ | Total Salmonids | Suckers |
| 11:00 | 24 | 22 | 20 | 4 | 0 | 100 | 20 | 120 | 2 | 1 | 1 | 0 | 1 | 0 | 125 | 300 |
| 13:00 | 24 | 22 | 20 | 4 | 20 | 130 | 2 | 152 | 0 | 0 | 0 | 0 | 0 | 0 | 152 | 400 |
| 15:00 | 26 | 24 | 23 | 3 | 40 | 180 | 6 | 226 | 0 | 0 | 0 | 0 | 0 | 0 | 226 | 350 |
| 17:00 | 26.5 | 24.5 | 23 | 3.5 | 150 | 400 | 10 | 560 | 2 | 0 | 0 | 0 | 0 | 0 | 562 | 325 |
| 19:00 | 26.5 | 23 | 23 | 3.5 | 130 | 700 | 40 | 870 | 6 | 0 | 0 | 1 | 0 | 0 | 877 | |
| 21:00 | 26 | 23 | 21 | 5 | | | | | | | | | | | | |
| 23:00 | | | | | | | | | | | | | | | | |
| 1:00 | | | | | | | | | | | | | | | | |
| 3:00 | | | | | | | | | | | | | | | | |
| 5:00 | | | | | | | | | | | | | | | | |
| 6:30 | 22 | 20 | 18 | 4 | 45 | 30 | 6 | 81 | 4 | 0 | 0 | 0 | 0 | 0 | 85 | 100 |
| 7:30 | 21 | 19 | 18 | 3 | 35 | 15 | 2 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 150 |
| 8:30 | 22 | 20 | 18 | 4 | 32 | 23 | 1 | 56 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 200 |
| 9:30 | 23 | 21 | 18 | 5 | 55 | 60 | 6 | 121 | 0 | 0 | 0 | 0 | 0 | 0 | 121 | 400 |
| 10:30 | 23 | 20.5 | 19 | 4 | 75 | 45 | 3 | 123 | 0 | 1 | 0 | 0 | 1 | 0 | 125 | 300 |