United States
Department of
Agriculture

Forest Service

Northern Region

FOREST PLAN

MONITORING AND EVALUATION REPORT

Fiscal Year 2000

Bitterroot National Forest

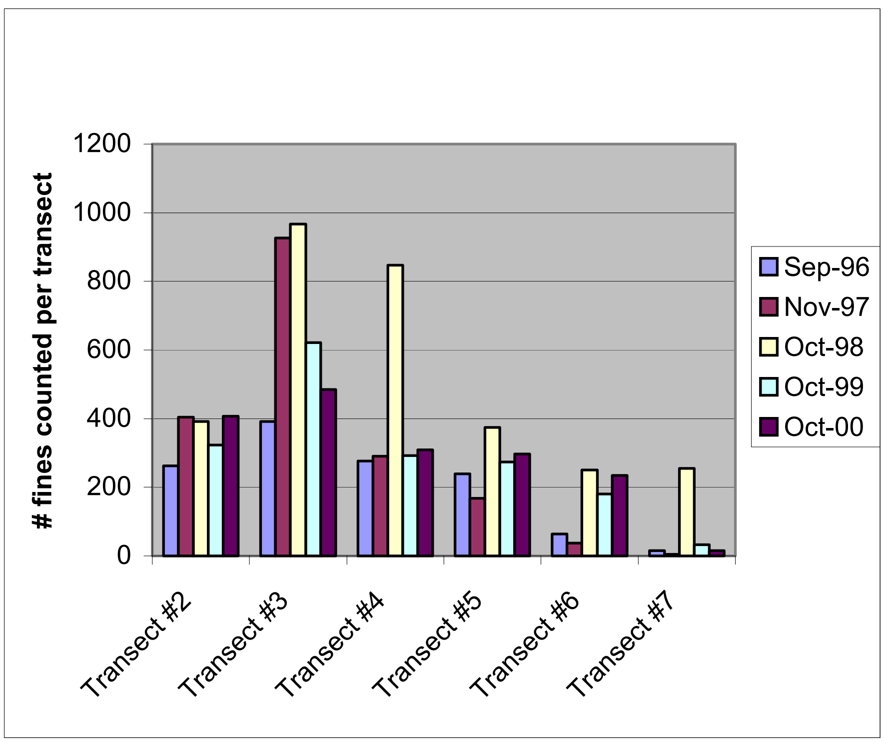
Facilities Management

Tin Cup Dam. In the spring of 1998, a significant leak was discovered in Tin Cup Dam. There was an effort to alleviate the immediate danger of dam failure by lowering the water level behind the dam. To do this, the spillway was lowered, first by using hand crews and later with an excavator. Finally, after the water level in Tin Cup Reservoir had dropped, the dam was partially breached. From the start, this project had the potential to adversely affect fish and stream conditions in Tin Cup Creek downstream of the dam. Monitoring by Forest Service personnel occurred continually (24 hours per day) throughout the project.

We established seven sediment monitoring transects in Tin Cup Creek downstream of the dam in September 1996. We measured sediment levels at these transects in September 1996 to document the baseline condition prior to any work at the dam. The purpose of documenting the baseline condition was to measure and compare the effects of the dam repair activities. The seven transects are located in two areas. The upper four transects (#1-4) are located in the first 150 meters of Tin Cup Creek downstream of the dam outlet. The lower three transects (#5-7) are located about 1.5 miles downstream from the dam, at the first stream crossing of the Tin Cup Trail. Annual follow-up monitoring of the seven transects occurred in November 1997, October 1998, October 1999, and October 2000. We conducted this year's sediment monitoring on October 16, 2000. As in 1998 and 1999, we were unable to re-measure transect #1 because the riprap from the dam breach covered the location.

Figure 3 displays the results of the monitoring from 1996 to 2000. The maximum number of fines that could occur on a transect is 980, which equates to 100 percent sediment. Fifty percent sediment equates to 490 fines.

Figure 3
Sediment Levels In The Monitoring Transects In
Tin Cup Creek Downstream From Tin Cup Dam



Overall, the 2000 sediment levels were similar to the 1999 sediment levels. Two of the transects (#2 and #6) had small sediment increases in 2000, two (#4 and #5) showed little change, and two (#3 and #7) had small decreases. The overall trend is still not clear. The sediment reductions that had been occurring since the 1998 dam repairs are slowing down, and at some of the transects, sediment levels may have stabilized at slightly higher levels than the 1996 baselines. Half of the transects (#4, #5, and #7) have returned to their 1996 baseline sediment levels. The other half (#2, #3, and #6) still contain higher sediment levels than their 1996 baselines. Two of those transects (#2 and #3) are located immediately downstream of the dam outlet. We do not plan to monitor the sediment transects again until additional construction work occurs at Tin Cup Dam.

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Bitterroot N.F. fisheries personnel monitored water temperatures in Tin Cup Creek with continuously recording

HOBO-TEMP thermisters during the summers of 1998, 1999, and 2000. Water temperatures were monitored at the same three sites during all three years. These three sites were:

- The Tin Cup trailhead (stream milepost 5.0)
- The first trail crossing downstream of Tin Cup Dam (stream milepost 16.0)
- Directly below the outlet of Tin Cup Dam (stream milepost 16.7)

In 2000, a fourth site was added in Tin Cup Creek at its inlet to Tin Cup Reservoir (stream milepost 17.5). The monitoring period was the same for all three years (July 15th to October 1st). Temperatures were recorded at each site every 4.5 hours.

Figure 4

Mean-maximum water temperature over the warmest 7-day period in 2000 at four locations in tin cup creek

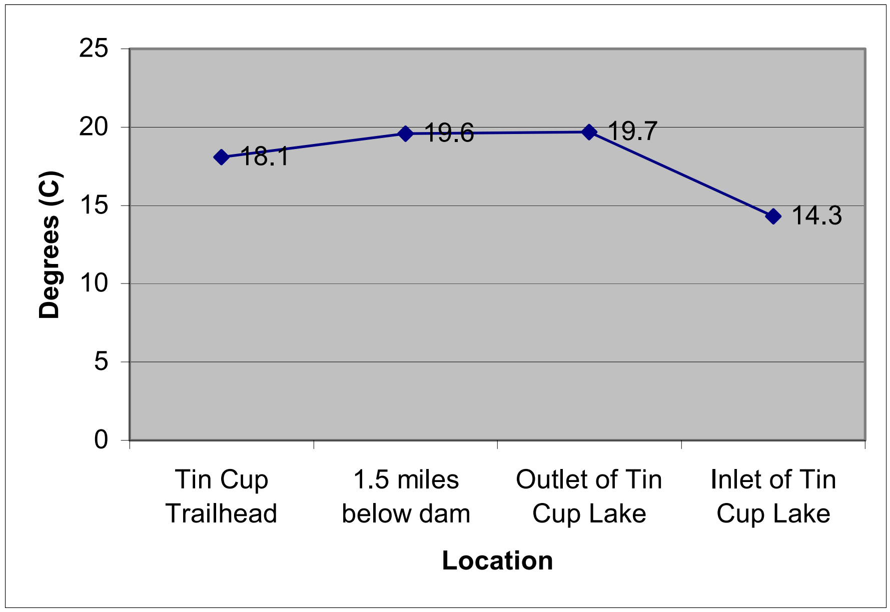
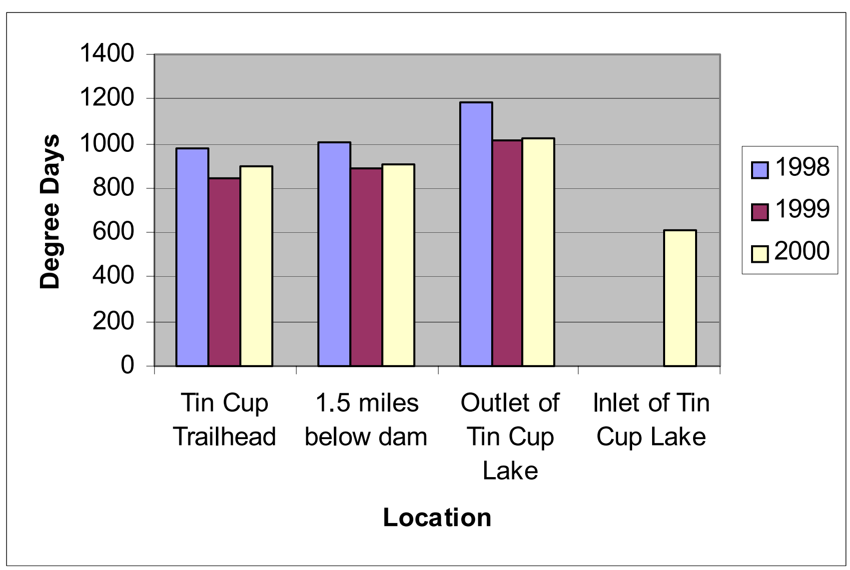


Figure 5 displays the number of degree-days accumulated at each site between July 15th and October 1st in 1998, 1999, and 2000. The number of degree-days is calculated by adding up the mean temperatures (in degrees Celsius) for each day in the 78-day monitoring period. The lower the degree-days, the colder the stream. We did not measure stream temperatures at the inlet of Tin Cup Lake in 1998 and 1999.

Figure 5

Degree days at four locations in tin cup creek in 1998, 1999, and 2000



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The mean-maximum and degree-day data indicate several things:

1) Tin Cup Reservoir warms temperatures in Tin Cup Creek considerably. During summer 2000, the reservoir raised maximum temperatures in Tin Cup Creek by 5.4° C (about 11° F). The degree-days below the dam outlet are much higher than the degree-days at the inlet to the reservoir.

2) Maximum temperatures in Tin Cup Creek cool by about 2° C over the 12 miles of stream between Tin Cup Dam and the Tin Cup trailhead. The warm water coming out of Tin Cup Dam is alleviated by cold-water influxes from several small side canyon tributaries. In 1998, 1999, and 2000, the degree-days at the trailhead were always lower than the degree-days at the dam outlet. Under the natural condition, Tin Cup Creek would warm as it flowed downstream out of its headwaters.

3) Early in summer, water temperatures are similar at the trailhead and dam outlet. However, throughout August and September, temperatures at the trailhead are consistently 4-6° C colder than temperatures immediately downstream of the dam. Heating of the top water layers in the reservoir causes the warmer water near the dam. The colder water at the trailhead is caused by the influx of cold water from several small side canyon tributaries that enter Tin Cup Creek between the dam and trailhead. In October, water temperatures get cold throughout the drainage, and are similar at the dam outlet and trailhead.

4) On the Bitterroot NF, mid canyon reservoirs at such as Tin Cup Reservoir and Fred Burr Reservoir warm streams more than the higher elevation reservoirs at the upper ends of their canyons (Bass Lake Reservoir, Big Creek Reservoir, etc).

What does this mean for the fishery? Bull trout and westslope cutthroat trout, the two native trout species in the Bitterroot drainage, are present in most of the streams below these reservoirs. Both species require cold water and do not fare well in streams that exceed 15° C for prolonged periods of time. Westslope cutthroat trout are more tolerant of temperatures above 15° C than bull trout, but cannot tolerate temperatures that exceed 20° C for prolonged periods. The first symptom of stream warming which usually manifests itself in both species is elevated physiological stress, which causes increased mortality through a variety of factors, including reduced over-winter survival (caused by poor condition and low energy reserves going into winter), reduced egg production, and reduced growth. All of these factors combine to make our native trout populations vulnerable to displacement by non-native trout species (brook trout, brown trout, and rainbow trout). Brook trout, brown trout, and rainbow trout are more tolerant of higher stream temperatures than bull trout and westslope cutthroat trout, and have a clear competitive edge in the warmer streams on the forest. In some of the warmer streams, bull trout and westslope cutthroat trout populations have been significantly reduced or even completely replaced by non-native trout. In Tin Cup Creek, brook trout and brown trout are common downstream of the trailhead, and bull trout are rare. Warm water could be a factor in the lack of bull trout. Brook trout and brown trout are also present in the lower reaches of most of the west side canyon streams that contain bull trout and westslope cutthroat trout populations and irrigation reservoirs (eg. Fred Burr Creek, Big Creek, Bass Creek, Blodgett Creek, Mill Creek). The bottom line is that where opportunities are available, the Forest Service should work together with the irrigation districts to minimize stream warming.

In addition to warming, the operation of Tin Cup Dam (outlet pipe gate closed vs. open) also dewaters the first several hundred meters of Tin Cup Creek below the dam from mid October through early July when the outlet pipe is closed for storage. During the dewatered months, suitable fish habitat is not available in the first several hundred meters of Tin Cup Creek below the dam.

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Figure 6
Tin Cup Creek below dam outlet, looking downstream. Outlet gate is open

Figure 7
Tin Cup Creek below dam, dewatered stream when outlet gate is closed

The Forest does not plan to monitor Tin Cup Dam stream temperatures again until additional construction work occurs at the dam.