Trinity River Restoration Program Performance Measure

Adult Salmon Water Temperature Targets

Hypothesis: Managing flow to provide suitable water temperatures for adult freshwater life stages of anadromous fish will, increase habitat quality, decrease pre-spawn mortality, and increase gamete viability, which will result in increased juvenile salmonid production.

Importance: Water temperatures are a critical component of fish habitat for adult salmon in streams because they influence pre-spawning mortality and gamete viability, which influence spawning success and juvenile salmonid production. Summer and early fall flow releases from Lewiston Dam are managed to provide suitable water temperatures for Chinook Salmon holding and spawning in the upper mainstem Trinity River.

Objective: Water temperature targets for adult salmonids were established by the California Water Quality Control Board under WR 90-5 and supported by Endangered Species Act consultations on the Trinity River Mainstem Fishery Restoration Environmental Impact Statement. These targets were established to protect holding and spawning adult salmonids in the upper Trinity River and incorporated into the flow recommendations contained in the Trinity River Flow Evaluation (USFWS and HVT 1999); and subsequently into the Trinity River Record of Decision (USDOI 2000) recommendations. The specific objective identified in the Integrated Assessment Plan (TRRP and ESSA 2009) is:

> **Objective 2.2.1** Provide optimal temperatures to improve spawning success of spring and fall-run Chinook Salmon

Targets, Predicted or Desired Response: Adult salmonid temperature targets were established to provide suitable temperatures and account for the temporal and spatial aspects of holding and spawning fish (Table 1, CRWQCB-NCR 1991). The water temperature target of 60°F at Douglas City (River Mile 92.3) from July 1 through September 15 provides suitable holding temperatures for spring-run Chinook Salmon (Figure 1). The 56°F temperature target at Douglas City from September 16 through September 30 and the 56°F water temperature target at the North Fork Trinity River confluence (River Mile 73.3) from October 1 through December 31 provides suitable temperatures for spring-run and fall-run Chinook Salmon and Coho Salmon spawning.

Technical Approach: Flow and temperature data were obtained from the California Data Exchange Center for the Lewiston Gage (#11525500), Douglas City gage (#11525254), and the gage above the North Fork Trinity River confluence (#11526400). Flow and water temperature data at Lewiston and water temperature at Douglas City and above the North Fork Trinity River confluence were used to evaluate the effectiveness of flow releases at meeting the targets. Data were summarized from July 1 through October 31. The water temperature targets continue to December 31 but for this analysis the time period was truncated to October 31 to reflect when dam releases are managed to meet temperature targets. Seasonal cooling after October 31 makes dam releases for meeting temperature targets unnecessary.

Results: Attainment of adult water temperature targets was variable across years and within years (Table 2, Figure 1). The percentage of days that temperature targets were met ranged from 72% in 2009 to 100% in 2011 and 2013. In 2008 and 2010, the majority of days when targets were not met, 13% and 27% respectively, occurred during time period when the temperature compliance point transitions from Douglas City downstream 23 miles the North Fork Trinity River confluence. Augmented flow releases from Lewiston Dam to improve conditions in the lower Klamath River (USBOR 2013) also helped meet temperature targets in 2012 and 2013.

In 2009, the temperature target from July 1 to September 15 at Douglas City was only met 64% of the days due to a prolonged period of 20 days (July 15 to August 3) where temperature exceeded 60°F. Additionally, when the temperature target at Douglas City changed from 60°F to 56°F the target was not met for the first 5 days (33% of the days).

In 2014, the percentage of days the 56°F target was met at both the Douglas City and above the North Fork Confluence compliance points was 67% and 52%, respectively. From August 23rd to September 23rd flows from Lewiston Dam were increased above summer baseflow to improve conditions in the lower Klamath River. These augmented flows contributed to meeting temperature targets during this period. When flows returned to baseflow the temperature targets were not consistently met until the third week of October. The large percentage of days that temperature target was not met (48%) after flow augmentation is attributed to the low reservoir levels experienced in 2014 that reduced the volume of cold water for release. The temperature of water released from Lewiston Reservoir actually exceeded the 55°F during the third week of October but downstream water temperature targets were met due to cooling ambient air conditions.

Summary: Management of water releases from the Trinity River Division (TRD) of the Central Valley Project is critical in meeting water temperature targets necessary to provide holding and spawning habitat for adult salmonids in the mainstem Trinity River. In particular, spring-run Chinook Salmon require cool water temperatures in summer because they hold in the mainstem river below Lewiston Dam for several months before spawning (USFWS and HVT 1999). Water temperature targets have been met for the majority of the time. However, in 2009 and 2014, targets were not met during a large percentage of days. Failure to meet the temperature targets can be attributed to a combination of increasing air temperature, TRD operations, and changes in temperature targets (60°F to 56°F) and/or transitions in compliance points (Douglas City to North Fork Trinity confluence) (Scheiff and Zedonis 2010). Future analyses will associate pre-spawning mortality with the magnitude and duration of periods when temperature targets are not met.

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Table 1. Trinity River adult salmonid water temperature targets (USFWS and HVT 1999)

Reach	Date	Target
Trinity River at Douglas City	July 1 –September 15	≤60°F
Trinity River at Douglas City	September 16 – 30	≤56°F
Trinity River at confluence with NF Trinity River	October 1 – December 31	≤56°F

Table 2. Percentage of days that adult water temperature targets were met on the mainstem Trinity River, 2008-2014.

			Year						
Location	Date	Target	2008	2009	2010	2011	2012	2013	2014
Douglas City	July 1 –Sept 15	≤60°F	100%	64%	92%	100%	100%	100%	84%
Douglas City	Sept 16–30	≤56°F	100%	67%	100%	100%	100%	100%	67%
North Fork Confluence	Oct 1 to 31[a]	≤56°F	87%	94%	77%	100%	97%	100%	52%
Total	July 1-Oct 31		97%	72%	89%	100%	99%	100%	74%

a. The target continues to December 31 but for this analysis the time period was truncated to October 31 to reflect the time period when dam releases are managed to meet temperature targets. After October 31 water temperature targets are met due to seasonal cooling.

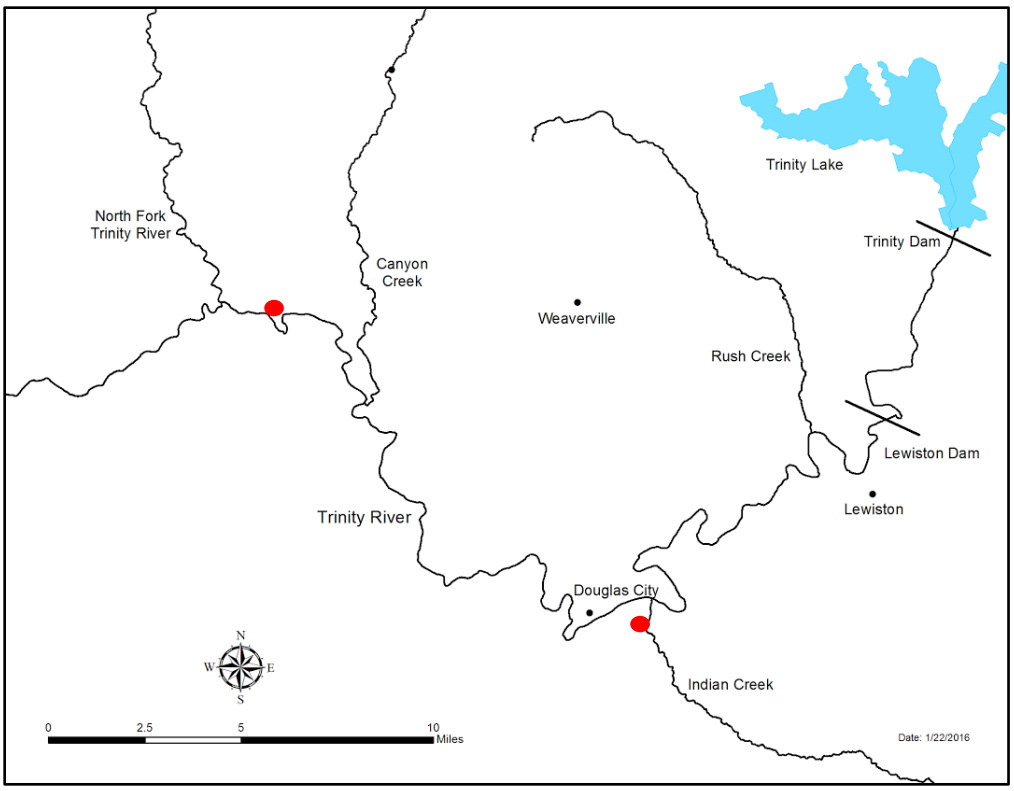


Figure 1. Upper mainstem Trinity River with temperature compliance points (red dots).

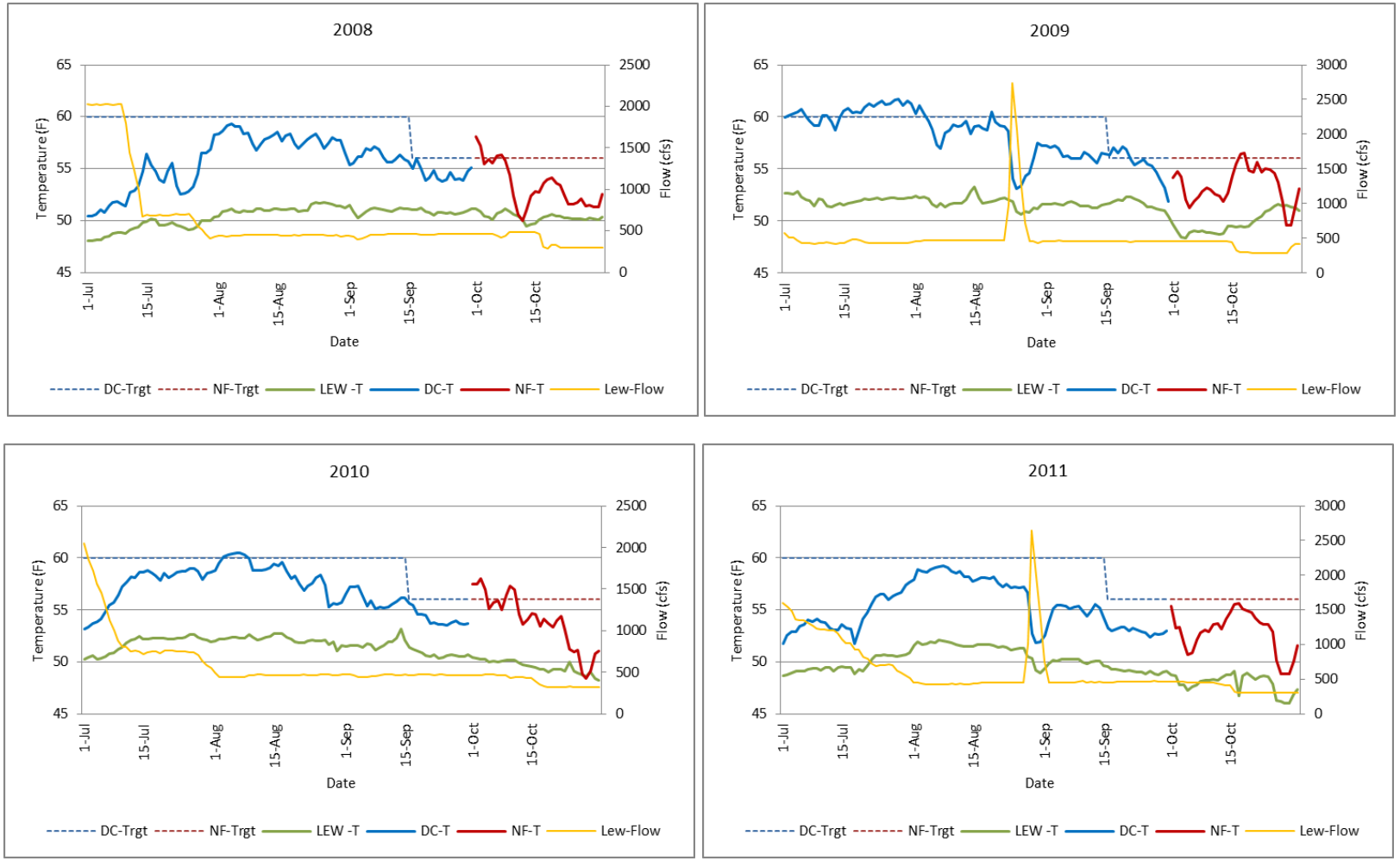
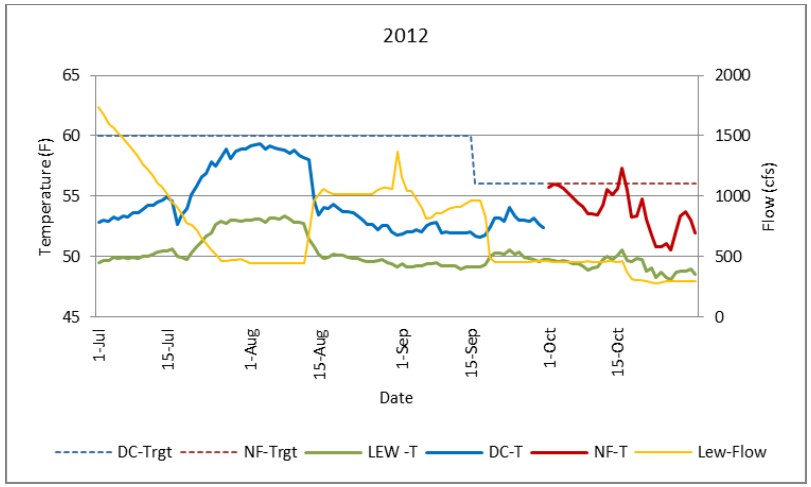
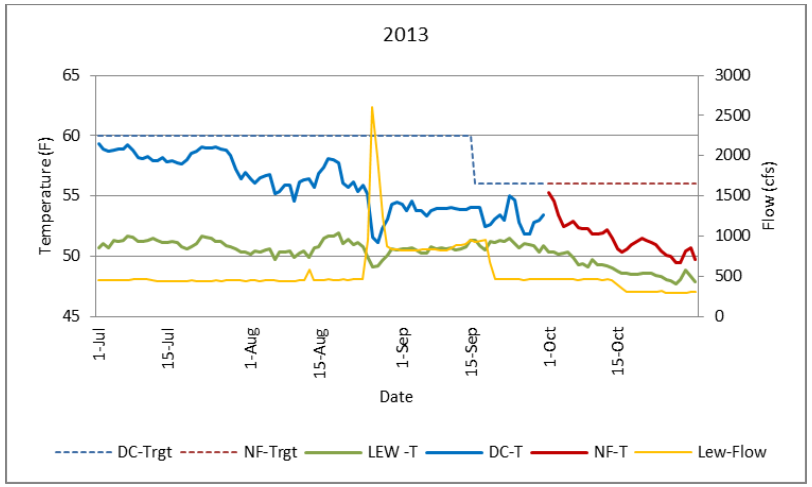


Figure 2. Trinity River mainstem water temperature and summer/fall adult temperature targets, 2008-2014. [DC-Trgt (Trinity River at Douglas City water temperate target), NF-Trgt (Trinity River above the North Fork Trinity Confluence temperature target), LEW-T (water temperature at Lewiston), DC-T (water temperature at Douglas City), NF-T (water temperature above the North Fork Trinity Confluence (NF-T), and Lewiston flow (Lew-flow).





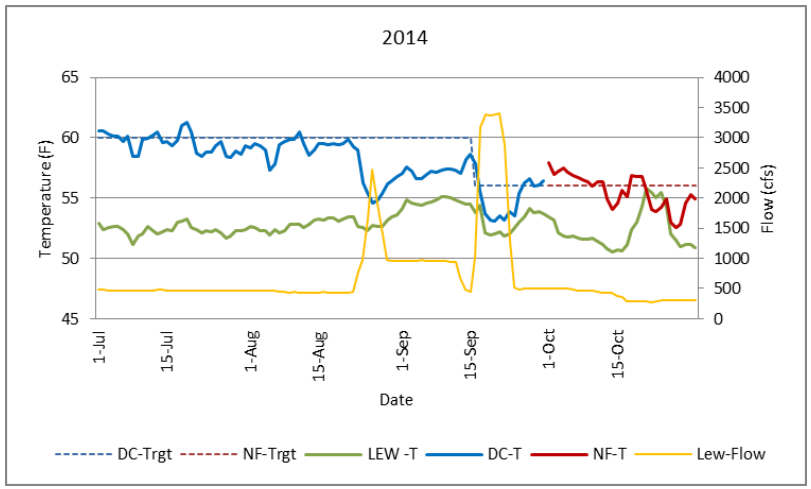


Figure 2. Continued.

References

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