

Final

**SAN JUAN RIVER BASIN RECOVERY IMPLEMENTATION PROGRAM
WATER TEMPERATURE MONITORING**

2016 ANNUAL REPORT



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Ecosystems Research Inc
Logan, Utah
and
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Table of Contents

INTRODUCTION 1
 Objectives.....1
METHODS 3
RESULTS & DISCUSSION 3
REFERENCES 9

List of Tables

Table 1. Water temperature monitoring locations..... 4

List of Figures

Figure 1. Water temperature monitoring locations. Map courtesy of Google maps. 2

Figure 2. Average daily water temperature at Archuleta compared to discharge at Archuleta. 5

Figure 3. Average daily water temperature on the Animas River near Farmington compared to discharge on the Animas River. 5

Figure 4. Average daily water temperature on the Animas River (Animas Temp) and the San Juan River at Farmington(Farmington Temp) compared to discharge at Farmington (Farmington Discharge).... 6

Figure 5. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Farmington..... 6

Figure 6. Average daily water temperature at Four Corners compared to discharge at Four Corners..... 7

Figure 7. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Four Corners..... 7

Figure 8. Average daily water temperature at Mexican Hat compared to discharge at Mexican Hat. 8

Figure 9. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Mexican Hat. 8

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INTRODUCTION

As part of the San Juan River Basin Recovery Implementation Program (SJRIP), water temperature and hydrology studies have been undertaken since 1992. This report summarizes the water temperature data collected from October 1, 2015 to September 30, 2016 as part of the long-term monitoring program.

Objectives

- 1. Monitor water temperature at five existing locations in the San Juan River, NM and UT (Figure 1).**

In 2015/16, five locations were monitored for water temperature by USGS real-time monitoring. Data collection was transferred to the USGS as a means to continue long-term monitoring without some of the difficulties associated with separate loggers. It provides real-time data retrieval for use by any researcher rather than end-of-year reporting. Further, the data are archived in USGS permanent records and simplify database administration for the San Juan Program.

The USGS maintains realtime, continuous monitoring at the following locations: San Juan River at Archuleta (USGS 09355500), San Juan River at Farmington (USGS 09365000), Animas River at Farmington (USGS 09364500) and San Juan River at Four Corners (USGS 09371010). These locations were chosen because they currently have USGS gages that monitor discharge.

- 2. Add FY2015 data to the water temperature database, which can be accessed at the SJRIP website.**

The FY2016 water temperature data has been submitted. These data are in the same format as the database for previous years.

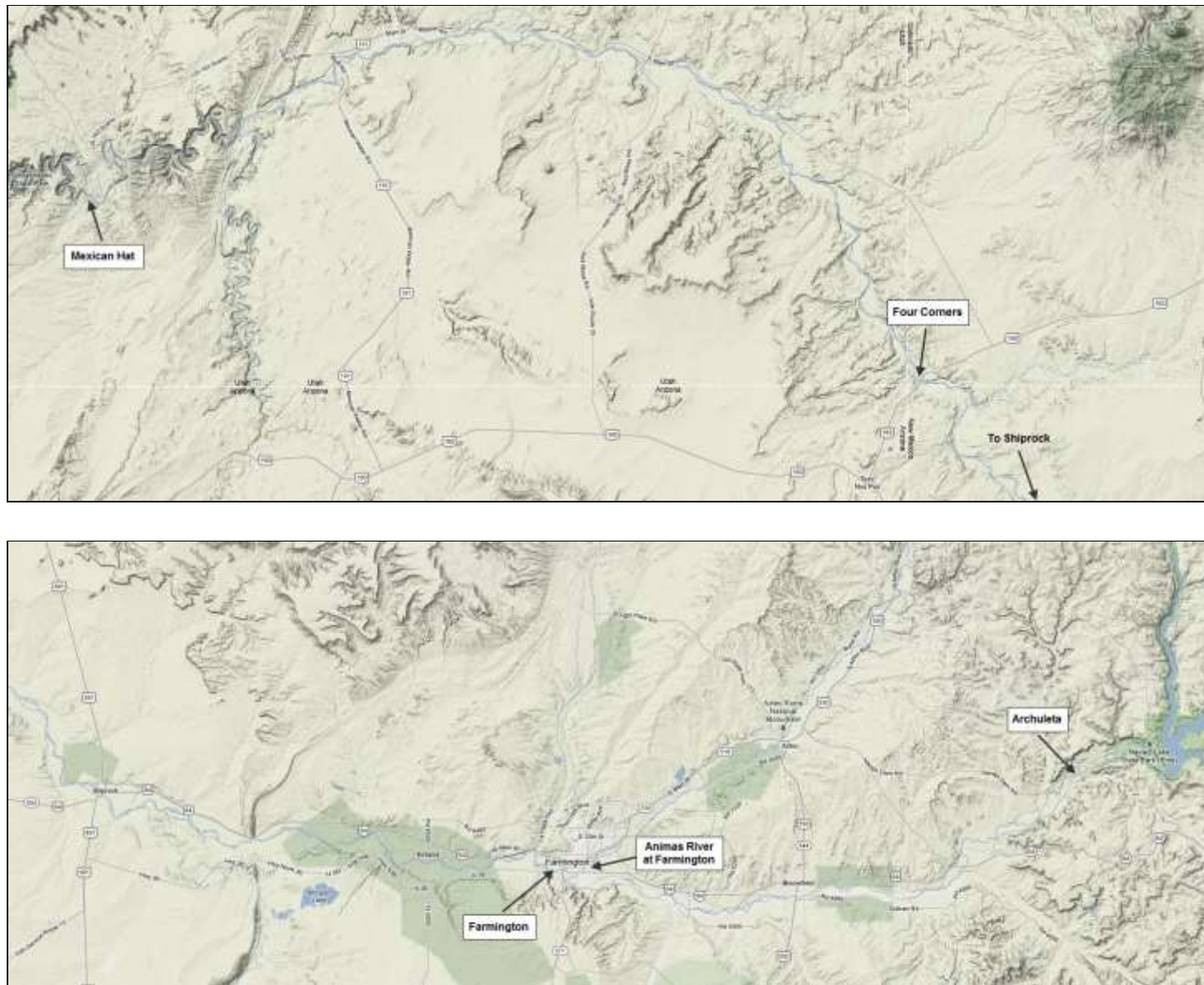


Figure 1. Water temperature monitoring locations. Map courtesy of Google maps.

METHODS

Water temperature has been recorded since the summer of 1992 at the locations shown in Table 1 (not including the two locations established in 2011). Those data are found in reports posted to the San Juan River Recovery Implementation website. Water temperature and discharge data were downloaded from the USGS's website every 2-3 months. Fifteen-minute temperature data were summarized into daily values using R software (R Development Core Team 2013). Water temperature data were quality checked for errors by visual comparison of graphic data. USGS also completes data quality protocols and removes erroneous data.

Quality-checked temperature data were added to the Microsoft Access database that contains all 15-minute data from each site. The database also contains tables that summarize daily maximum, minimum and mean temperature for each site. Daily average water temperatures at each site were then plotted along with the daily hydrograph of the San Juan River. Discharge data were obtained from the USGS gages listed in Table 1.

RESULTS & DISCUSSION

There was a large release of water from Navajo Dam in 2016. Average daily flow at the Archuleta gage peaked at approximately 4,800 cubic feet per second (cfs) in mid-May, 2016 (Figure 2). This was similar to the peak of nearly 5,200 cfs that came from the most recent release in 2012. Peak flows in May and June were associated with the flow recommendations. Water temperature did decrease with the increases in flow in May and June. The peak average daily temperature at Archuleta occurred on July 20 and was 13.7°C.

Flows in the Animas River began to increase from base levels in April, peaking at 5,270 cfs on June 10 (Figure 3). Once flows subsided in June, temperature rose steadily through the remainder of the month and through most of July. The maximum average daily temperature was 24.8°C and occurred on July 31, 2016.

Temperatures in the Animas River were similar to the San Juan River at Farmington until early May (Figure 4). Since flows were lower in the Animas River compared to flows at Archuleta, it is likely that the Animas River served to moderate the cold release temperatures in the San Juan River during runoff.

For the San Juan River at Farmington, average daily flow peaked at 8,070 cfs on June 12 and was a combination of peak release and flows from the Animas River. The maximum average daily temperature was 24.6°C and occurred on August 10, 2016 (Figure 4). Water temperature did not exceed 20.0°C until the late July (Figure 5).

The peak flow at Four Corners was 8,479 cfs on June 12, 2016 (Figure 6). The maximum average daily water temperature was 26.1°C on July 29, 2016 (Figure 6). Water temperature did not exceed 20.0°C until mid-July due to the extended release from Navajo Dam. Maximum water temperatures remained near or exceeded 20.0°C during July and August (Figure 7).

Peak flow at Mexican Hat was 8,200 cfs on June 13, 2016. The maximum average daily water temperature was 27.5°C and occurred on July 29, 2016 (Figure 8). Temperature patterns were generally similar to those observed at other locations. There was substantial water temperature suppression during the peak flow release. This was likely due to the majority of the discharge at peak originating from Navajo Dam with a smaller proportion of the flow from the Animas River. Water temperature did not exceed 20.0°C until June 29, 2016 (Figure 9).

Table 1. Water temperature monitoring locations.

Location	River Mile	UTM Zone	UTM Northing (m)	UTM Easting (m)	Comments
Archuleta – San Juan at USGS gage location	218.6	13S	4076301	259235	Discontinued May 2014; transferred to USGS
Farmington – San Juan at USGS gage location	180.1	12S	4067579	747929	Discontinued May 2014; transferred to USGS
Four Corners – San Juan at USGS gage location	119.4	12S	4096658	675400	Discontinued May 2014; transferred to USGS
Mexican Hat – San Juan near Bluff gage location	52.1	12S	4112151	600678	Discontinued May 2014; transferred to USGS
Animas at Farmington – Animas River at USGS gage location	n/a	12S	4067756	749902	Discontinued May 2014; transferred to USGS

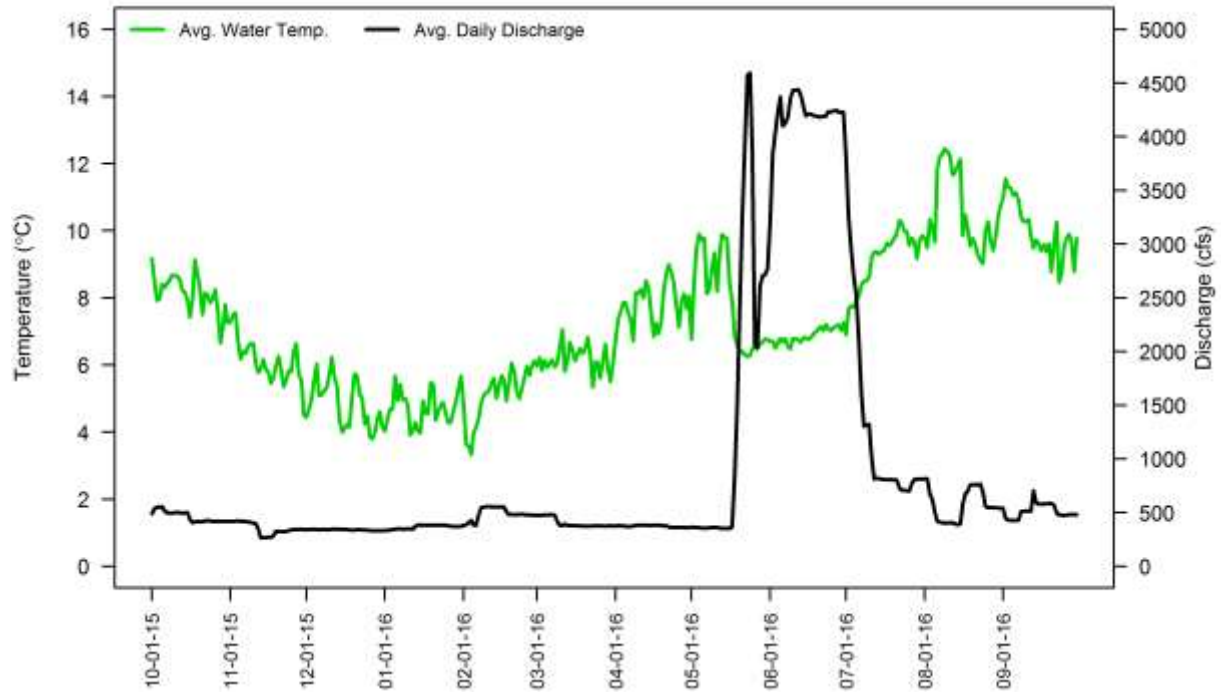


Figure 2. Average daily water temperature at Archuleta compared to discharge at Archuleta.

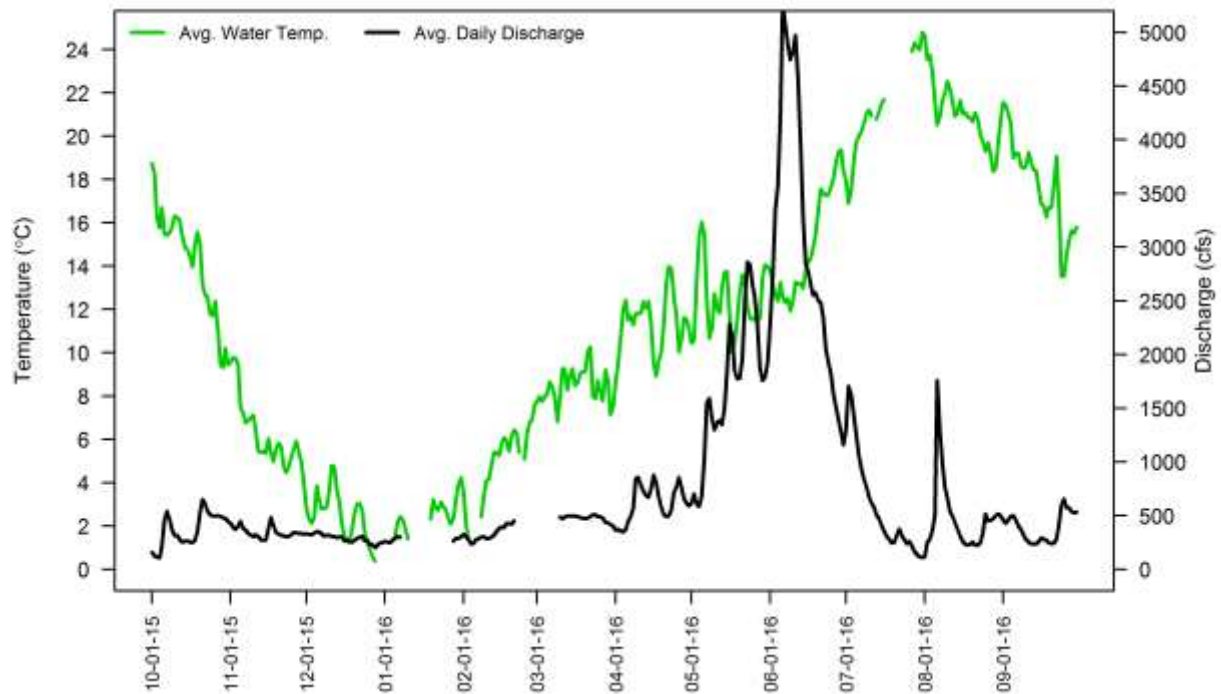


Figure 3. Average daily water temperature on the Animas River near Farmington compared to discharge on the Animas River.

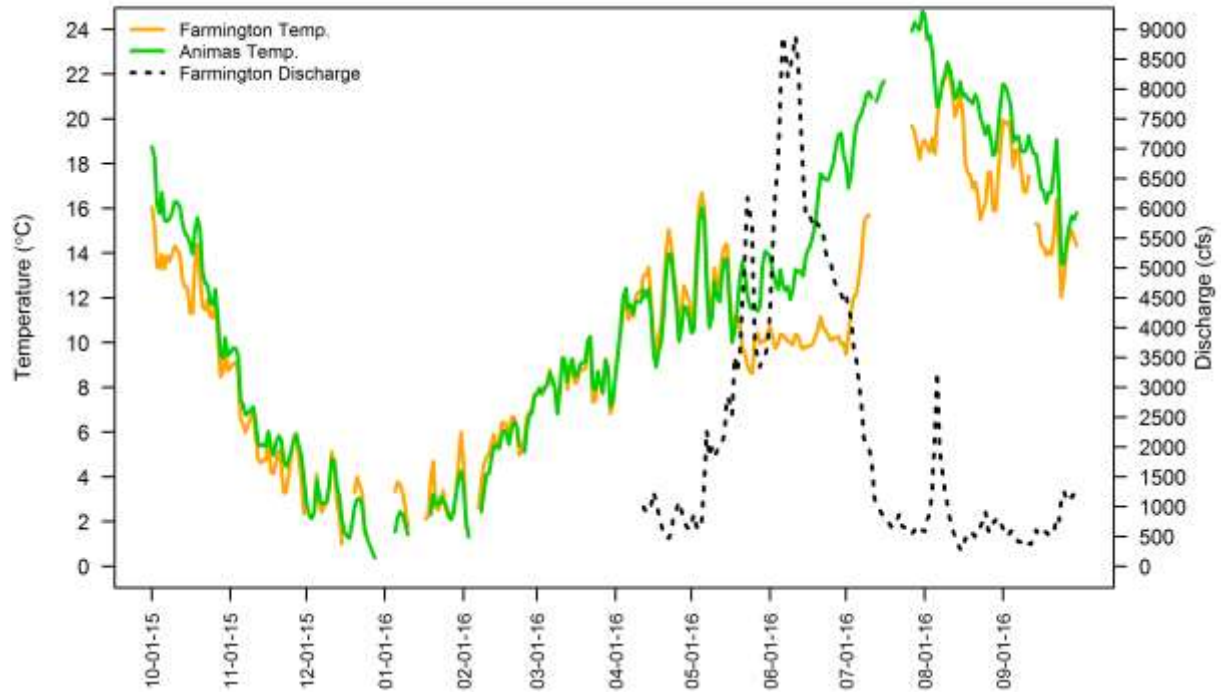


Figure 4. Average daily water temperature on the Animas River (Animas Temp) and the San Juan River at Farmington (Farmington Temp) compared to discharge at Farmington (Farmington Discharge).

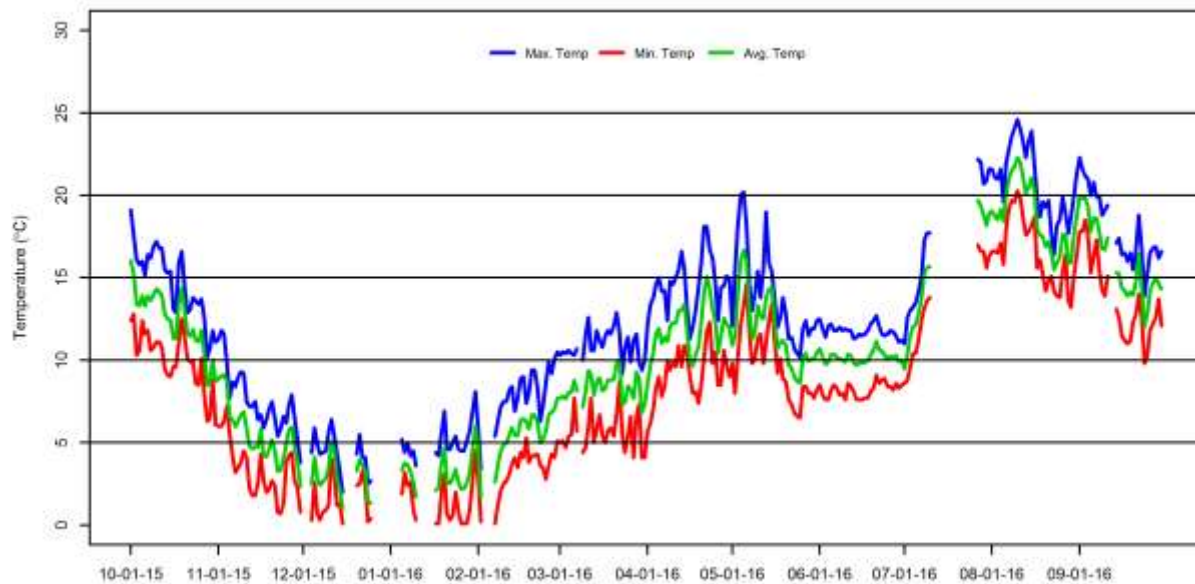


Figure 5. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Farmington.

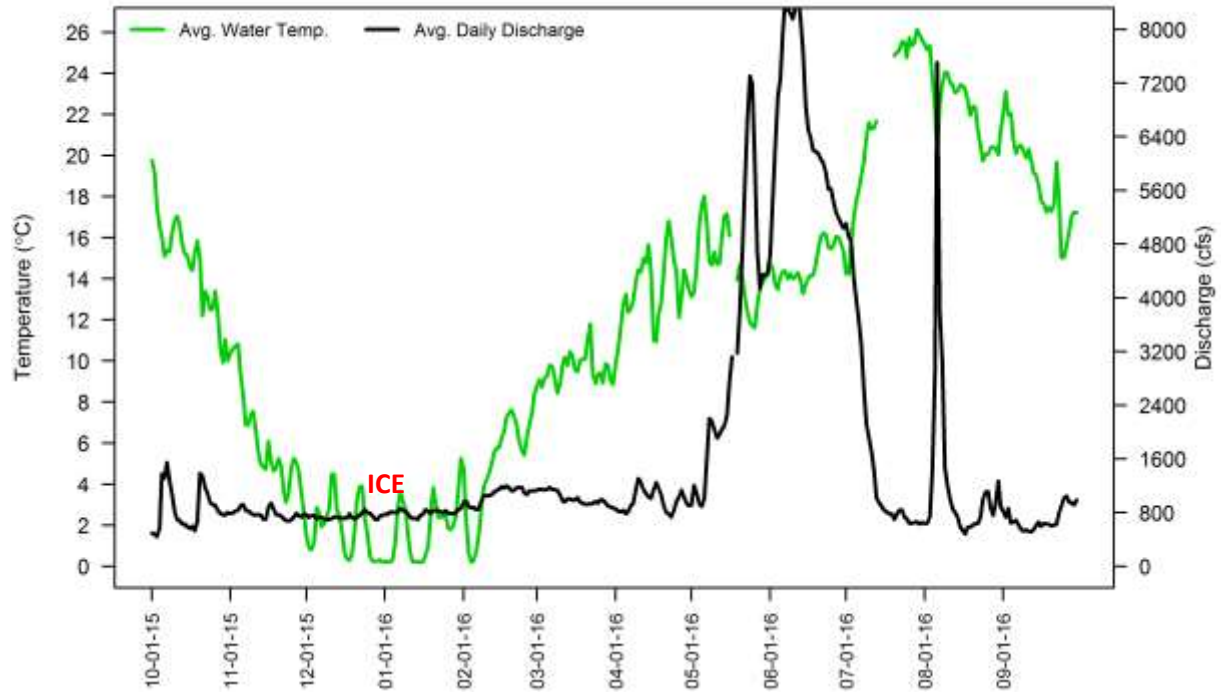


Figure 6. Average daily water temperature at Four Corners compared to discharge at Four Corners.

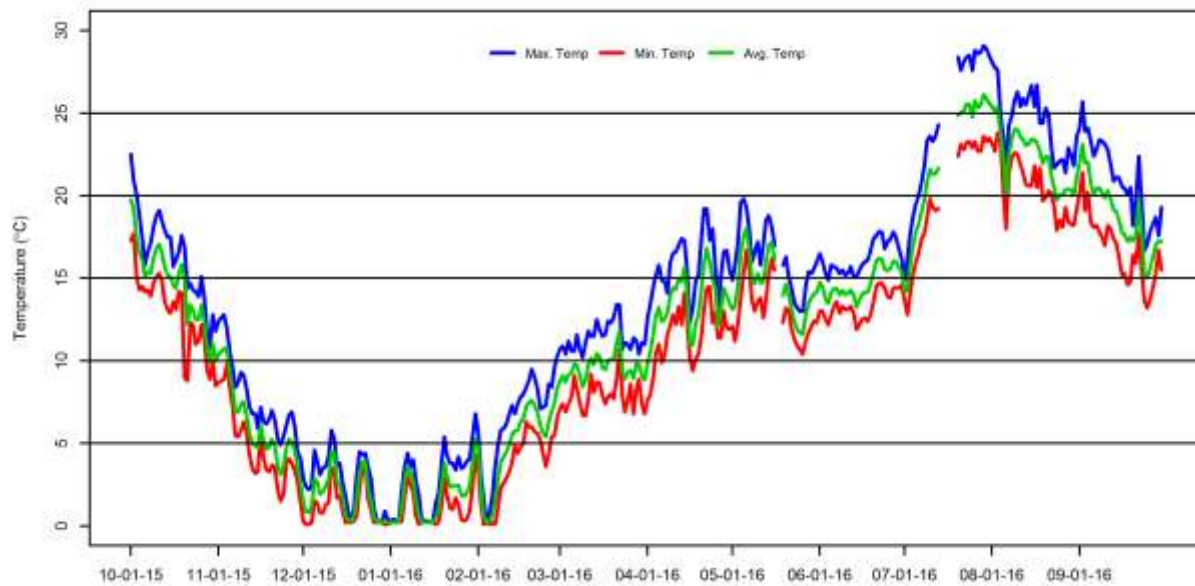


Figure 7. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Four Corners.

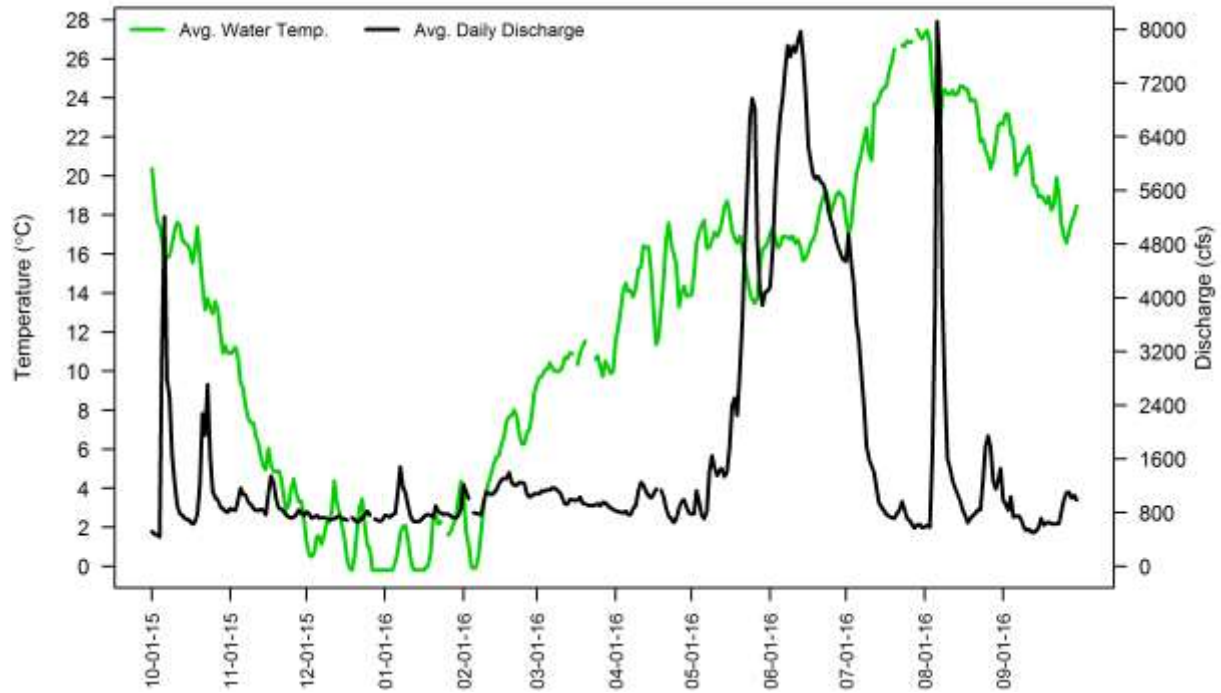


Figure 8. Average daily water temperature at Mexican Hat compared to discharge at Mexican Hat.

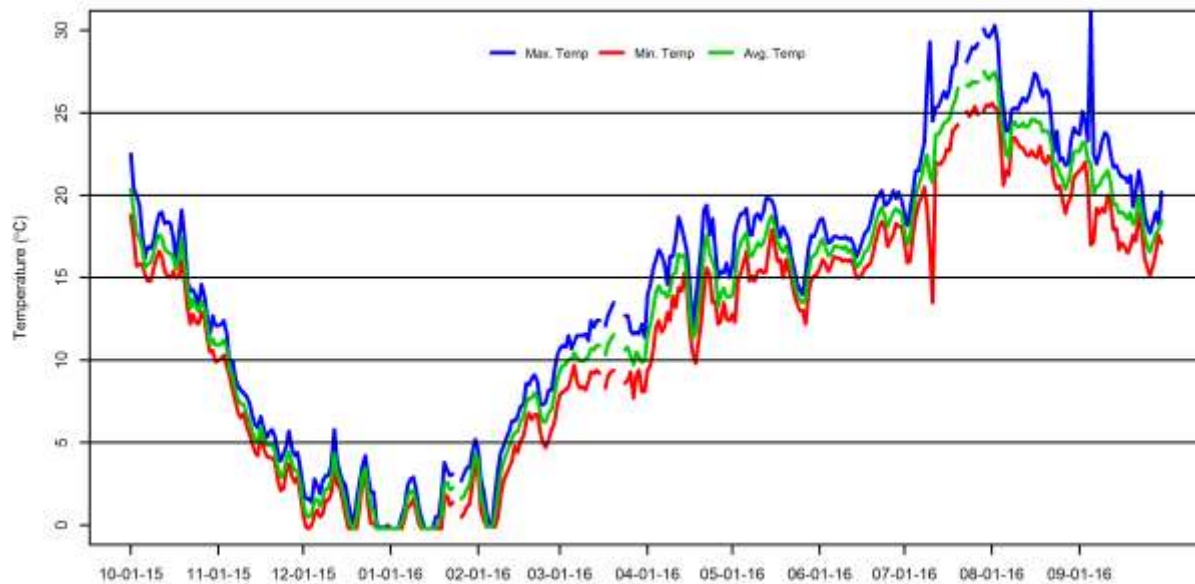
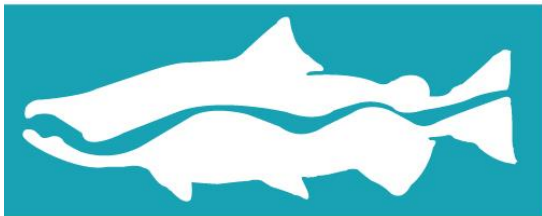


Figure 9. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Mexican Hat.

In summary, water temperature monitoring provides documentation of annual thermal regimes in the San Juan River. Water temperature monitoring is one component of the habitat monitoring program specified in the San Juan River Recovery Implementation Program Long Range Plan. These monitoring data could be used for investigations of impacts of water temperature on the San Juan River fish community.

REFERENCES

R Development Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.



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