Spokane Riverkeeper, Spokane River Watershed, Washington State, January 29, 2018.

Temperature Monitoring in Hangman Creek, summer 2017. WNTI Small Grants Report

Background:

Fig 1: Hangman Creek

Hangman Creek is a small but important tributary of the Spokane River. Both rivers are in the upper Columbia Basin and a part of the Columbia River Watershed. The Hangman Creek Watershed spans 695 sq. miles and originates in Idaho (Fig. 1 and 2). Hangman Creek is highly damaged by erosion, ditching, over-grazing and the removal of riparian habitat by industrial agricultural practices. Hangman Creek is listed as impaired on the 303(d) list for dissolved oxygen, pH, temperature, fecal coliform, and turbidity. The designated uses are for interior redband trout rearing, migration and spawning habitat. The river has a Total Maximum Daily Load (TMDL) for fecal coliform, temperature and turbidity. Poor water quality and the damaged watershed have dramatically reduced the presence of Columbia Basin interior redband trout (O. mykiss gairdneri) habitat and populations. Currently, only isolated and fragmented populations exist, and it is unknown to what extent the river is used for migration between the Spokane River and functional spawning habitats in the headwaters.

One effect of this damaged ecosystem is elevated water temperatures. The state of Washington Water Temperature Standard for non-anadromous interior redband trout is an 18C (64.4F) seven day average of daily maximum temperatures (7DADMax). Our previous monitoring shows that Hangman Creek fails to meet this standard at most of our sample sites in the watershed. Many tributaries contain much lower water temperatures and are a potential refuge for redband trout in the watershed. Fish surveys have found redband trout in the upper watershed on the Coeur d'Alene Tribal Reservation in Idaho, and in a few small tributaries in the lower watershed, such as California and Marshall Creeks[1]. In this study, we investigated whether summer water temperatures meet state standards and which reaches have temperatures cool enough to support the presence of these fish. This was undertaken to begin looking at areas to prioritize thermal habitat recovery.

[1] Redband Trout Sub-Sp. (Oncorhynchus mykiss sub-species) Data: Trout and Salmon of North America, Behnke, 2002; Various state and federal documents http://www.westernnativetrout.org/media/trout/redband-trout-assessment.pdfhttp://www.westernnativetrout.org/media/trout/redband-trout-assessment.pdf

Methods:

We monitored water temperatures in streams using temperatures loggers placed in housings in streams throughout the Hangman Watershed. Onset Hobo Pendant temperature loggers were calibrated by Washington Department of Ecology Staff and set to record every 30 minutes. Loggers were rejected if over 0.3 C discrepancy from actual temperature. Loggers were placed in a PVC shade and zip tied to a rock or brick to anchor and elevate them above the river bed (fig 2). At the field location the logger was tied to a piece of twine for retrieval and placed in the creek bed. The other end of twine was tied to a tree or large boulder. We placed loggers throughout the watershed, with five in the main-stem of Hangman Creek and six in tributaries (fig 3). In many locations tributaries go dry in the summer and only streams that were known to flow year round were selected. Locations of main-stem Hangman Creek loggers were chosen based accessibility to the Creek.

Figure 2. Temperature logger housing for placement in creeks.

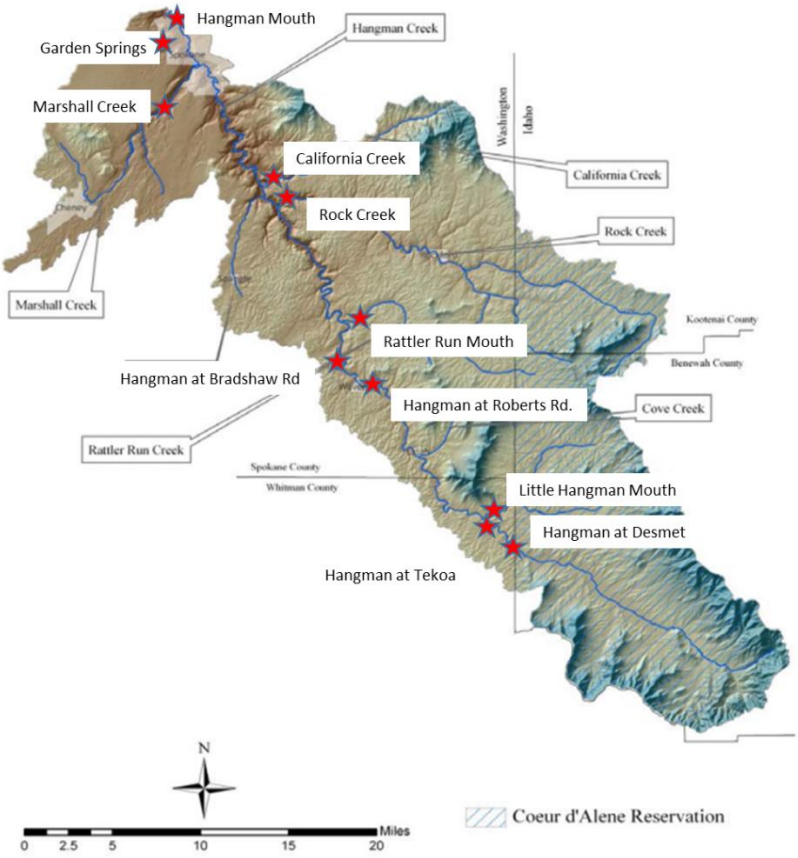

Figure 3. Locations of water temperature loggers in Hangman Creek, summer 2017

Boxplot charts were made using extreme daily highs and low temperatures, extreme daily *average* high and low temperature, average daily temperature for the sampling duration, and seven day average daily maximum temperature (7DADMax). The 7DADMax was calculated by averaging the maximum daily temperatures over a seven day period and graphing the maximum of this calculation. The Fahrenheit temperature scale was used in order to better convey this information to the public.

Results:

The Hangman Creek watershed contained high water temperatures in the summer of 2017, with almost all tributaries exceeding state standards set for non-anadromous redband trout. Tributaries to Hangman Creek had lower water temperatures than did the main-stem. The highest water temperatures we found were recorded in the watershed near the town of Waverly, Washington. This is reach is in the main-stem of Hangman Creek.

Water temperatures in Hangman Creek watershed exceeded Washington State water quality standards (Fig 4) and were at levels found to be sub-lethal or lethal for redband trout. Specifically, we broke this information down to recommend areas that are best suited to restore healthy thermal conditions and riparian habitat for trout (see end of report).

The water temperature in Hangman Creek main-stem reached a high of 83.2 F at Waverly, with the lowest high temperature of approximately 74 F occurring at the mouth of the Hangman Creek. In most cases, the main-stem of Hangman Creek did not drop below the 18 C (64F) standard during the July and August (fig 5). This section of the watershed is largely absent riparian vegetation (fig. 7) and would benefit from extensive riparian planting and recovery.

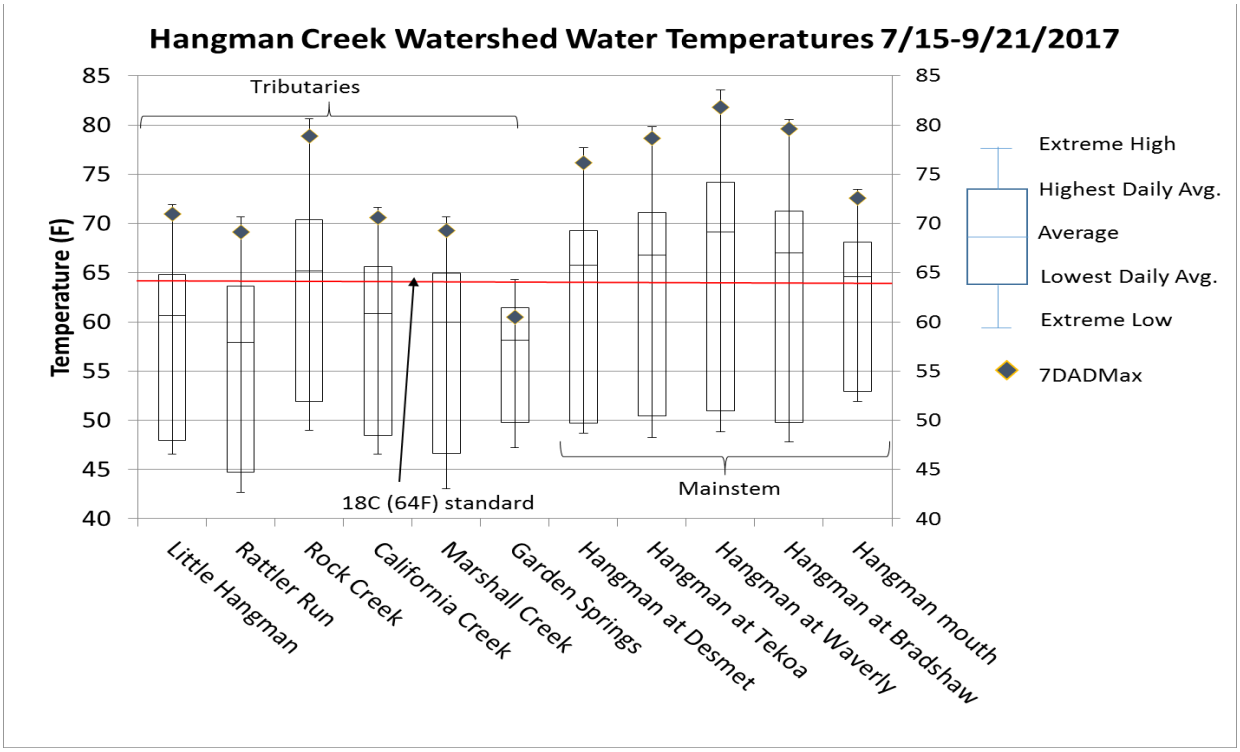

Figure 4. Box plot of water temperature data in the Hangman Creek watershed, 2017

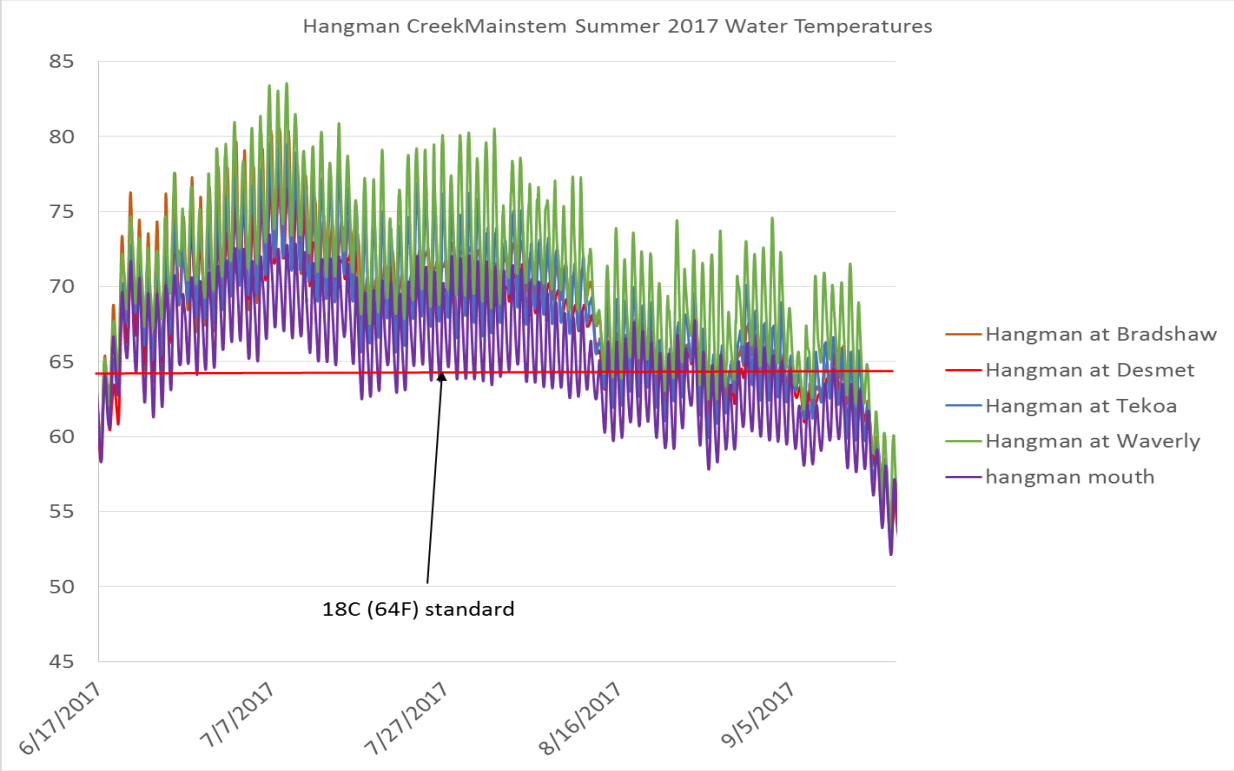

Figure 5. Hangman Creek main-stem water temperature, summer 2017.

Water temperatures in tributaries were much lower than that of the main-stem Hangman Creek, but most exceeded state standards. Rock Creek, the major tributary of Hangman Creek, contained water temperatures of up to 80 F in June, but cooled down in July and August (fig. 6). The remainder of the tributaries monitored had water temperatures that dipped below the 18C (64.4F) standard each day. These tributaries contained much cooler water than the main-stem, but still exceeded the 7DADMax (figure 6).

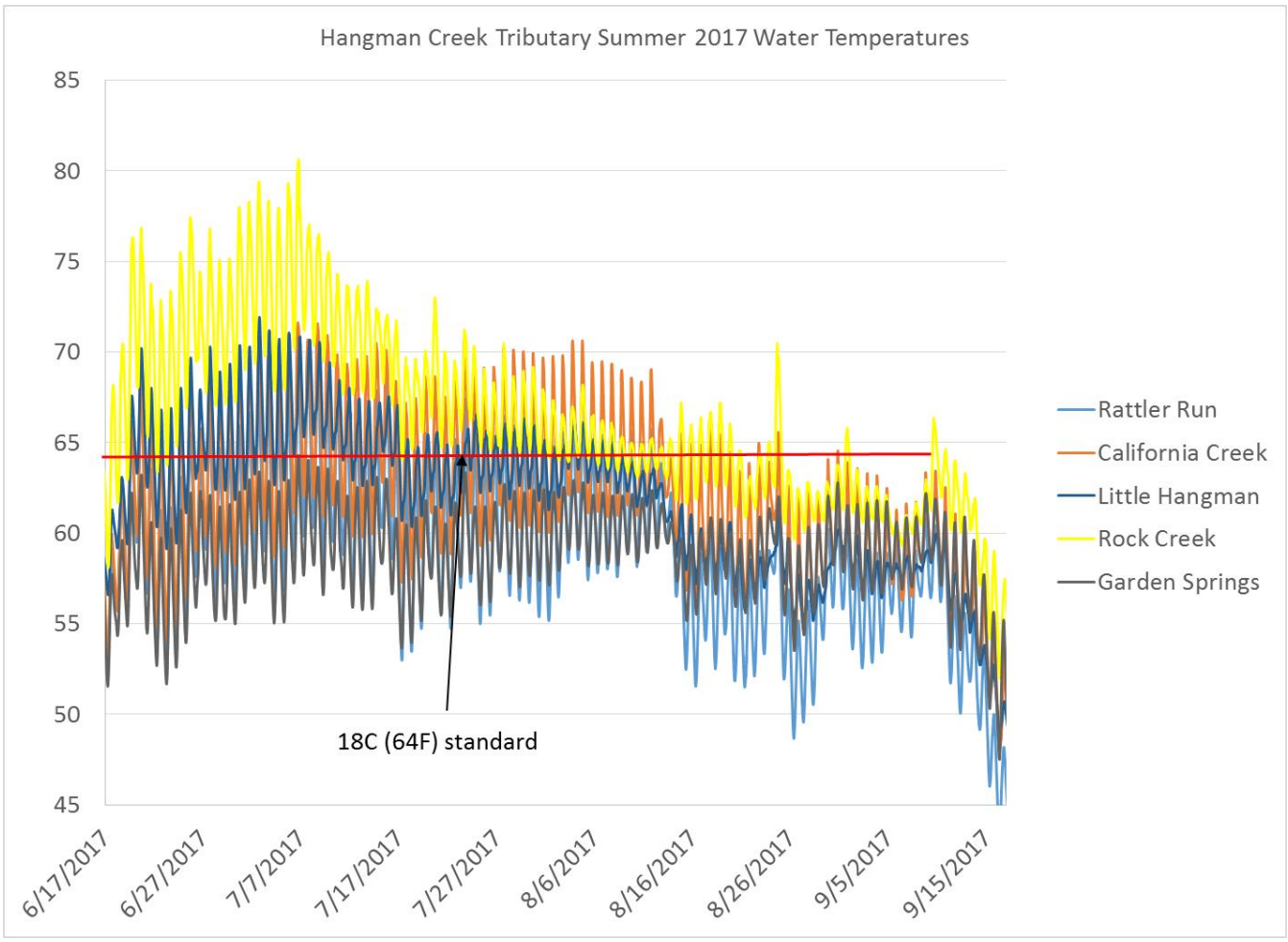

Figure 6. Graph of water temperatures of tributaries in Hangman Creek, summer 2017

Discussion:

Water temperature regimes in the Hangman Creek watershed may be influenced by degraded shorelines and the interaction of creeks with groundwater. Much of the shoreline in the Hangman Creek watershed does not function to protect water quality and restore groundwater, which impacts water temperature[2]. Hangman Creek once contained trout and anadromous salmon, however, none of these populations known to currently exist[3]. Degraded shorelines make future restoration efforts more difficult[4].

[2] Spokane County Proper Functioning Condition Stream Inventory and Assessment Spokane County Conservation District, Centennial Clean Water Fund Grant # G000029283
http://www.sccd.org/pdfs/WR_DL/June%202005%20PFC%20Final%20Report%207-05.pdf

[3] Scholz T. Allan and McLellan, Fishes of the Columbia and the Snake River Basins in Eastern Washington, 2010, Eastern Washington University, Cheney, WA

[4] (Reinke, D. and K. Fesenmyer, 2014) Hangman Creek Conservation Success Index. Trout Unlimited, Arlington, VA.
https://www.tu.org/sites/default/files/offline/science/HangmanCreekCSI_13Oct2015.pdf

This study suggests that tributaries, several of which already contain trout, may be the most efficient starting point in redband trout habitat restoration. Current redband trout distribution in the Hangman Creek watershed is limited to tributaries in the upper watershed and California Creek. Our study shows other tributaries in the lower watershed have similar temperature regimes as trout bearing streams, but lack redband trout. These creeks generally have degraded shorelines without suitable riparian areas for redband trout habitat. The relatively low water temperatures in these creeks probably occur due to the presence of groundwater in these systems. This could account for lower temperatures in creeks even though they are missing riparian vegetation. Additionally, many creeks in the Hangman Watershed have been dewatered (e.g. Spangle Creek).

Figure 7. Much of the shoreline in Hangman Creek does not contain riparian vegetation adequate to protect water quality, including temperature.

Based on our study of thermal conditions of the Hangman Creek Watershed, restoration of the riparian vegetation in the watershed must be sufficient to provide shade and restore water temperatures to levels that support redband trout. We believe that restoration would be best approached by leveraging the effects of ground water inputs in the small tributary streams. Tributaries that currently have lower, summer season water temperatures (ground water) should be prioritized for riparian restoration over main-stem locations that contain proportionally more and warmer surface water. These priority streams would respond most quickly to restoration efforts and provide opportunities for salmonid recovery whereas prioritizing efforts in the main-stem of Hangman Creek may be frustrated by continued contributions of heated surface water entering from upstream areas.

The top two priorities for redband trout restoration in the Hangman Basin are:

Priority 1. Enhance riparian vegetation for habitat along tributaries that already contain water temperatures that may support redband trout such as Rattler Run, Marshall Creek, and/or Little Hangman Creeks.

Priority 2. Enhance riparian condition for habitat and water temperature in the upper reaches of the main-stem of Hangman Creek. Hangman Creek at De Smet has lower main-stem water temperatures than locations downstream at Waverly and Bradshaw Road, which may be due to riparian recovery efforts of the Coeur d'Alene Tribe just upstream of the Idaho border.

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