Nooksack Indian Tribe - https://nooksacktribe.org/departments/natural-resources/water-resources/stream-temperature-monitoring/

Stream Temperature Monitoring

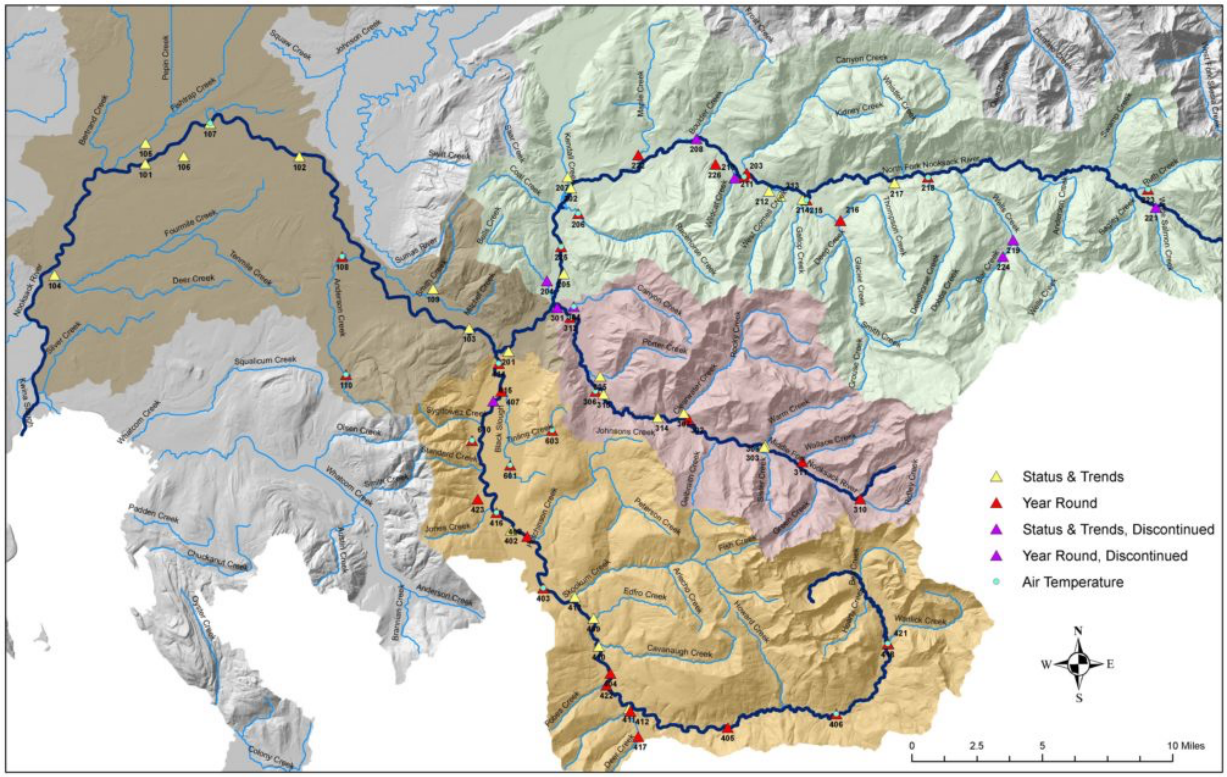
Since the mid-1990's, the Nooksack Indian Tribe (NIT) has been monitoring stream temperature in an effort to evaluate the status and trends of the Nooksack River watershed and its salmonid habitat viability. This ongoing work is funded through EPA Clean Water Act (CWA) Section 106 grants, EPA Clean Water Act Section 319 grants, and the EPA Indian General Assistance Program (IGAP), and the Bureau of Indian Affairs (BIA) Forest and Fish grant funding, BIA Tribal Climate Resilience and Rights Protection Implementation grants that constitute components of the *Nooksack Indian Tribe Performance Partnership Grant* (PPG) with EPA. A major overarching goal of the program is to characterize water temperatures in support of the planning and implementation of measures to protect and restore natural temperature regimes throughout salmonid habitats of the Nooksack River watershed.

The specific objectives of the project are the following:

1. Establish a baseline or reference conditions of stream temperature
2. Document the status and trends of summer and year-round surface water temperature in Nooksack early chinook salmon habitats and other salmonids throughout the streams and rivers of the Nooksack River watershed,
3. Refine understanding of the underlying causes and non-point sources of degraded temperature regimes in the Nooksack River and its tributaries, especially the South Fork Nooksack River,
4. Evaluate the effects of climate change on stream temperature
5. Evaluate habitat restoration effectiveness on mitigating stream temperature
6. Provide stream temperature data to calibrate and validate hydrologic models

Increased water temperatures affect water quality and biotic communities in several ways. As water temperature increases, saturation concentrations for dissolved gases such as oxygen decrease, and physical, chemical, and biological reactions change causing subsequent adverse impacts. The reduced dissolved oxygen available in warmer water can be a potential source of respiratory stress and other biochemical processes for fish and invertebrates. In addition, warmer water diminishes the efficiency of enzymes in cold water species and increases metabolic rates and demands. Higher water temperature also increases the solubility of most metals and chemicals and reduces their adsorption to sediment particles thereby increasing concentrations of metals and chemicals. Higher water temperatures also promote deleterious algae growth that further depletes available dissolved oxygen. Increases in water temperature can therefore be expected to increase pollutant concentrations in the water column thus affecting human health. When combined, these changes in temperature and water quality alter the habitat and species composition of the biotic community, resulting directly and indirectly in reduced survival of salmonids and other species

High water temperatures during summer represent an important limiting factor for Nooksack early chinook salmon and other salmonids in the Nooksack River watershed, especially in the South Fork Nooksack River (SFNR), which is listed as Category 5 on the Clean Water Act 303(d) list for high temperatures. High water temperatures in the SFNR regularly exceed optimal temperature ranges and approach lethal limits for salmonids during summer months when the lowest flows occur. The 7-day average of the daily maximum (7DADM) regularly exceeds temperature ranges considered optimal for chinook salmon incubation (11-15^{o}C) and juvenile rearing (14.2^{o}C -16.8^{o}C). High temperatures in the lower SFNR stress holding and spawning fish and increase susceptibility to disease, which can cause prespawning mortalities or otherwise reduce reproductive success.



Monitoring locations of stream temperature and air temperature in the Nooksack watershed.

Field Methods

Stream temperature is monitored at approximately 60 locations throughout the Nooksack watershed at 30 minute intervals. Many sites also record air temperature in order to assess the relationship with stream temperature. Temperature probes are deployed in streams in two different ways: either cabled to the bank, or epoxied to instream boulders. Some streams, especially the larger rivers, have rapidly changing channels that change over time, sometimes in one winter. Some stream channels do not have large enough boulders to stay in place for long-term deployment of temperature sensors, therefore sensors must be cabled to the bank. Temperature sensors are epoxied to instream boulders in channels that are relatively stable and have large pools that ensure the sensor will remain underwater. If you come across these sensors in the river, please do not disturb and make sure it remains in the water!


Examples of cabled temperature sensors (left) and epoxied temperature sensors (right)