Central Alaska Network

Denali NP & Pres. • Wrangell-St. Elias NP & Pres. • Yukon-Charley Rivers N Pres.

Streams & Rivers Resource Brief
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Status & Trends

Biological Assessment of Water Quality

Brachycentrus americanus

Monitoring water quality is a key focus for the Central Alaska Network. Because accurately measuring all aspects of water quality is very difficult, the Central Alaska Network is taking a biological approach to water quality assessment. This type of approach uses the condition or health of biological indicators as way to determine water quality. The health of the aquatic insect community is an excellent indicator of water quality, because aquatic insects are abundant, diverse, and sensitive to the kinds of stressors that cause changes in water quality. Although it seems obvious, they are also constantly present in the stream, meaning that they integrate the effects of multiple stressors over both time and space, something that is otherwise very difficult to measure.

One way to assess water quality using aquatic insects is called O/E modeling. This approach uses natural environmental gradients to predict the species composition of the aquatic insect community that we would expect to see at a stream if it is unaffected by human activity. By comparing the species that we actually observe at a site (O) to the species we expect (E), we obtain a site-specific and standardized measure of taxonomic completeness. For example, an O/E score of 0.70 means that only 70% of the expected species were actually observed, or in other words, 30% of the native taxa were missing. Large deviations away from expectations (low O/E scores) can be used to infer that a site has impaired water quality. The Central Alaska Network recently developed an O/E model for DENA and WRST, the first of its kind in Alaska. The standard deviation (a measure of precision) of the model is 0.17, which is comparable to O/E models that are used to assess water quality in other areas. This model will now be used to start assessing water quality in network parks.

Objectives

What do we want to know about streams & rivers in CAKN?

- Determine long-term trends in chemical and biological measures of water quality.
- Determine long-term trends in the composition and spatial distribution of aquatic communities, including macroinvertebrates and diatoms.
- Monitor changes in the distribution of anadromous and resident fish species in network parks.
- Determine long-term trends in annual and seasonal flow patterns in selected streams and rivers.
- Develop tools for park managers to assess biological water quality in selected streams and rivers.

Streams and rivers are being monitored in all 3 network parks

Importance

Why are streams and rivers important in the Central Alaska Network?

Streams and rivers are vital components of network ecosystems. They provide habitat for fish, including all 5 species of salmon. Fish in turn are important food sources not only for park wildlife, but also for people. For example, the world-famous Copper River sockeye salmon spawn in Wrangell-St. Elias NP & Pres. All 3 parks support subsistence and recreational fisheries as well. The aquatic insects that live in streams are an important food source for both fish and birds.

Streams and rivers are constantly reshaping the landscape, creating a diverse array of landforms and habitats that are important for both terrestrial and aquatic species. These changes can be either gradual, like the slow growth of a river delta, or dramatic, like the destruction of riparian forests during a large flood. The end result of these processes is a dynamic mosaic of habitats that increases the diversity of terrestrial vegetation and wildlife.

Contact: Trey Simmons, Aquatic Ecologist, Trey_Simmons@nps.gov (907) 455-0666

Management Applications

How can monitoring protect streams and rivers in CAKN?

- Assess water quality in park streams and rivers
- Improve management of subsistence and recreational fisheries
- Provide early detection of aquatic invasive species
- Improve modeling and prediction of high flows in park streams and rivers

Long-term Monitoring

How are we monitoring streams and rivers in CAKN?

To monitor ecological change in streams and rivers, the Central Alaska Network uses a wide variety of information. This includes biological, chemical and physical measurements collected during field visits, and also data derived from satellite and airborne instrumentation. Data are collected each year from a small number of easily-accessed sentinel streams in each network park, as well as from a large number of remote streams that are visited only once every 10 years or so.

At each stream, network scientists collect data on the species composition and abundance of aquatic insects, and diatom and fish communities. Because these organisms are in the streams year-round, their responses to the stream environment serve as biological indicators of ecological change that scientists may not be able to detect when collecting other types of data. Detailed chemical and physical information about each stream is collected as well.

By combining these various types of information, network scientists will be able to detect changes in how stream ecosystems are behaving, not just at the small percentage of streams that are being studied, but across all 21 million acres of the vast and remote Central Alaska Network.

CENTRAL ALASKA NETWORK

USING SCIENCE TO PROTECT OUR PARKS

THE CENTRAL ALASKA NETWORK (CAKN) IS ONE OF 32 NATIONAL PARK SERVICE INVENTORY AND MONITORING NETWORKS. EACH NETWORK EXISTS AS PART OF A NATIONAL EFFORT TO BETTER UNDERSTAND AND MANAGE PARK LANDS USING SCIENCE-BASED INFORMATION.

In order to focus this effort, 270 national park units with significant natural resources were grouped into 32 regional networks.

The Central Alaska Network is made up of 3 parks: Denali National Park and Preserve, Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve. Together, these 3 parks contain over 21.7 million acres and makeup 25% of all the land in the National Park Service. They represent a great diversity of climate and landform, from temperate coastal rainforests to glaciated mountain ranges. What they share in common are their largely wild and unaltered landscapes.

In order to track the condition of our parks, Central Alaska Network scientists have chosen 35 key indicators, or "vital signs," to represent the overall health of the network. Each vital sign falls into one of 4 categories: animal life, physical environment, human use, or plant life. Underlying these 4 vital sign categories is a focus on habitat change.

CAKN VITAL SIGNS:

Animal Life

Arctic Ground Squirrel
Bald Eagles
Brown Bear
Caribou
Dall's Sheep
Freshwater Fish
Golden Eagles
Moose
Passerines
Peregrine Falcons
Ptarmigan
Small Mammals
Snowshoe Hare
Wolves

Physical Environment

Air Quality
Climate
Fire
Glaciers
Land Cover
Permafrost
Shallow Lakes
Snow Pack
Soundscape
Streams & Rivers
Volcanoes & Tectonics

Human Use

Human Populations
Human Presence/Use
Natural Resource Consumption
Trails

Plant Life

Exotic Species
Insect Damage
Plant Phenology
Subarctic Steppe
Vegetation Structure/Composition

CONTACT US AT: (907) 457-5752, 4175 GEIST ROAD, FAIRBANKS, ALASKA 99709
OR VISIT HTTP://SCIENCE.NATURE.NPS.GOV/IM/UNITS/CAKN