



Thriving in Unexpected Places: Food Webs Supporting Arctic Grayling in Alaska's Far North

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Researchers enjoying the midnight sun at a remote field camp on Alaska's Arctic Coastal Plain. Photo credit: Jason McFarland.

Alaska's vast Arctic Coastal Plain is dominated by a complex network of lakes, ponds, wetlands, and small to large streams. These freshwater ecosystems are potentially threatened by rapid climate change and expanded petroleum development. Small streams are very susceptible to these threats because of their size relative to the surrounding landscape. Beaded streams are a common small stream type in this extreme environment, yet very little is known about their ecology or the species they support.

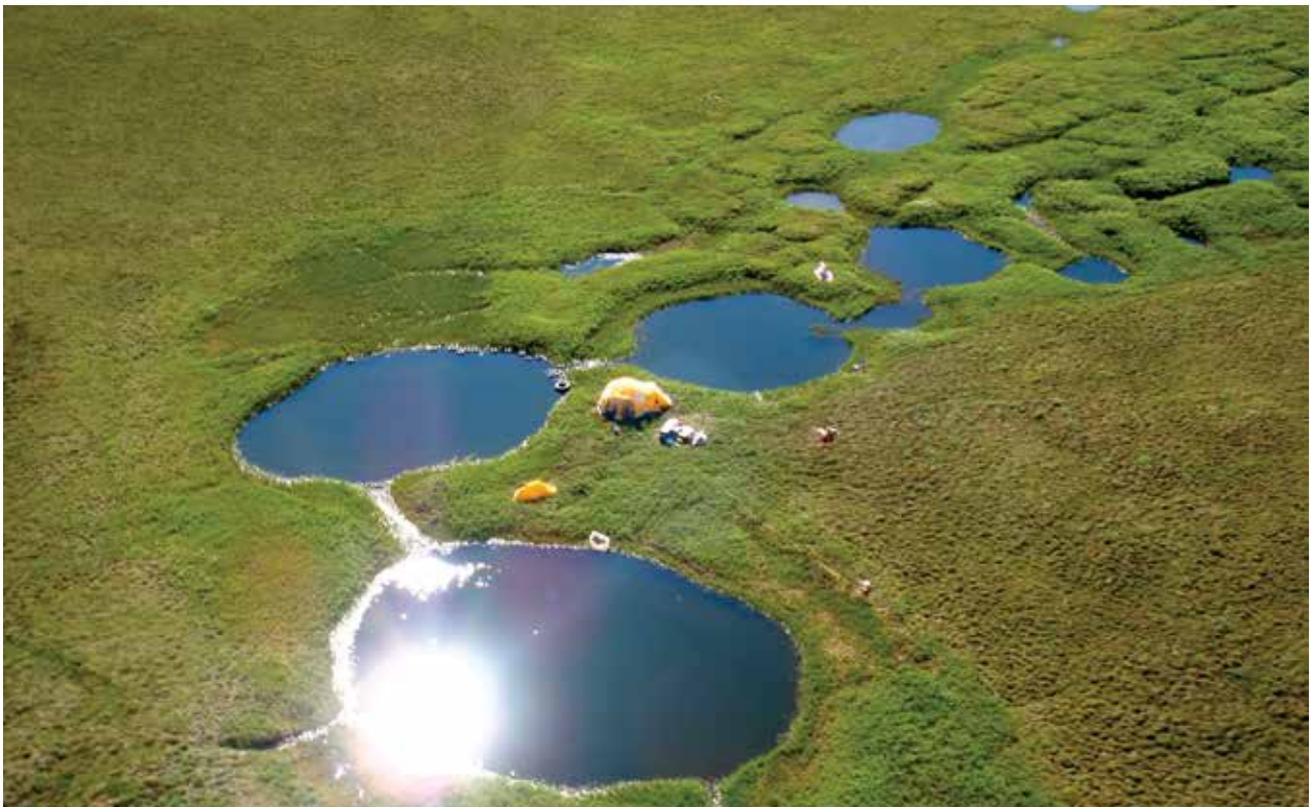
Arctic Grayling *Thymallus arcticus*, known as "the sailfish of the North," are an iconic circumpolar species recognized by their enlarged and pronounced dorsal fin. These medium-sized predatory fish migrate into beaded streams to forage during the short Arctic summers. One would expect that being at the northern most part of their range, these grayling would be scrawny and sparse. However, the opposite seems to be true. Researchers learned that grayling in beaded streams were thriving and in excellent body condition. This surprising result may be partly explained



Arctic Grayling are the most common top aquatic predator in many small streams on the Arctic Coastal Plain. Photo credit: Nathan Sather.



Tens of thousands of lakes and streams of all sizes cover the permafrost-laden landscape of the Arctic Coastal Plain. Photo credit: Google Earth.



A research camp along a beaded stream. These streams are named for their resemblance to beads on a string, where circular pools are connected by narrow stream channels. Pools and channels are formed by permafrost freeze-thaw processes and are often deeper than wide. Photo credit: Jason McFarland.



A team of scientists from the University of Alaska Fairbanks and U.S. Bureau of Land Management electrofish a beaded stream for Arctic Grayling. Photo credit: Matthew Whitman.

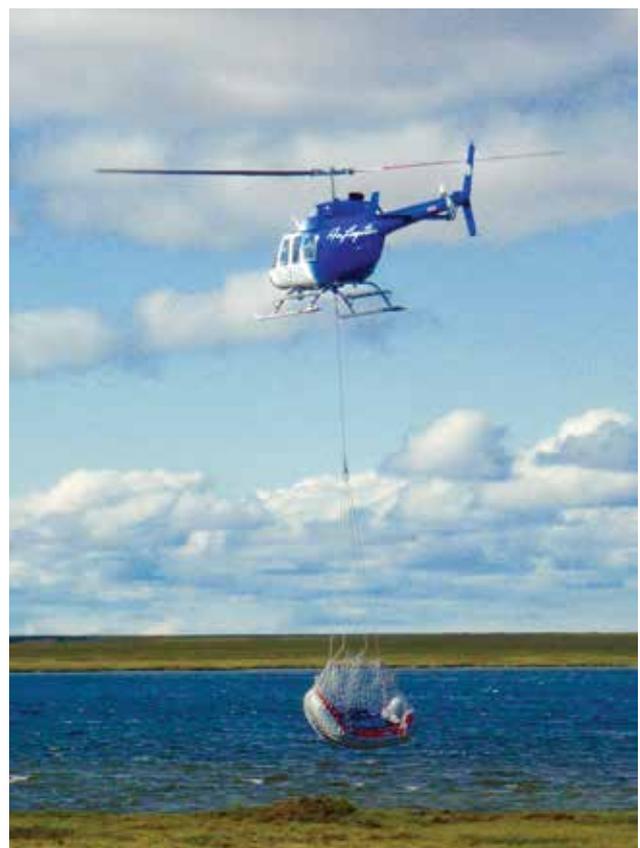
by their diet. Small grayling, like grayling throughout the world, consumed mostly aquatic and terrestrial insects. However, larger grayling gorged themselves on copious amounts of a smaller fish, Ninespine Stickleback *Pungitius pungitius*. Some grayling were found with nearly 100 stickleback in their stomachs at a time, or about 20% of their body weight. Researchers believe that the short summer feeding period coupled with the massive supply of stickleback, which are larger and more energy-dense than insects, may be driving grayling productivity.

Stickleback are extremely abundant in nearly all aquatic habitats on the Arctic Coastal Plain, including beaded streams. Thousands of stickleback can be found in a tiny beaded pool. What supports all of these fish? Beaded streams were also brimming with zooplankton. These tiny crustaceans originate from both headwater and other lakes along the length of the stream and drift downstream, serving as a buffet line for stickleback.

This study documented Arctic Grayling consistently consuming large quantities of Ninespine Stickleback and is the first step towards understanding food webs that support stream fishes in these harsh, high-latitude ecosystems. Results from a series of studies in this area are helping to interpret if and how climate change and petroleum development may affect stream ecosystem structure, function, and productivity, and fishes in the Far North.

AFS

Helicopters and float planes are often the only way to access the remote field sites in the roadless and relatively pristine landscape of the Arctic Coastal Plain.
Photo credit: Jason McFarland.





Strikingly colorful and large fins coupled with iridescent body markings make Arctic Grayling one of the most beautiful freshwater fishes of the North. Photo credit: Jason McFarland.

Despite having only 3 ice-free months to gain enough energy to survive the 9-month, harsh winter, Arctic Grayling on the Arctic Coastal Plain appear to thrive.



Top: A fyke net brims with Ninespine Stickleback, which achieve massively high summer densities in nearly all freshwater habitats. Photo credit: Jason McFarland. Left: A researcher prepares to use gastric lavage (stomach pumping) to collect the stomach contents of an Arctic Grayling. Photo credit: Nathan Sather.



Ninespine Stickleback may be a small fish (generally less than 60 mm), however, because of their importance as prey, pack a large ecological punch. Photo credit: Sergey Yeliseev/Flickr.

A hefty diet of Ninespine Stickleback is likely a key factor driving Arctic Grayling's success on the northern edge of their range.



Despite inclement weather, multiple gear types are deployed to capture Arctic Grayling. Photo credit: Matthew Whitman.

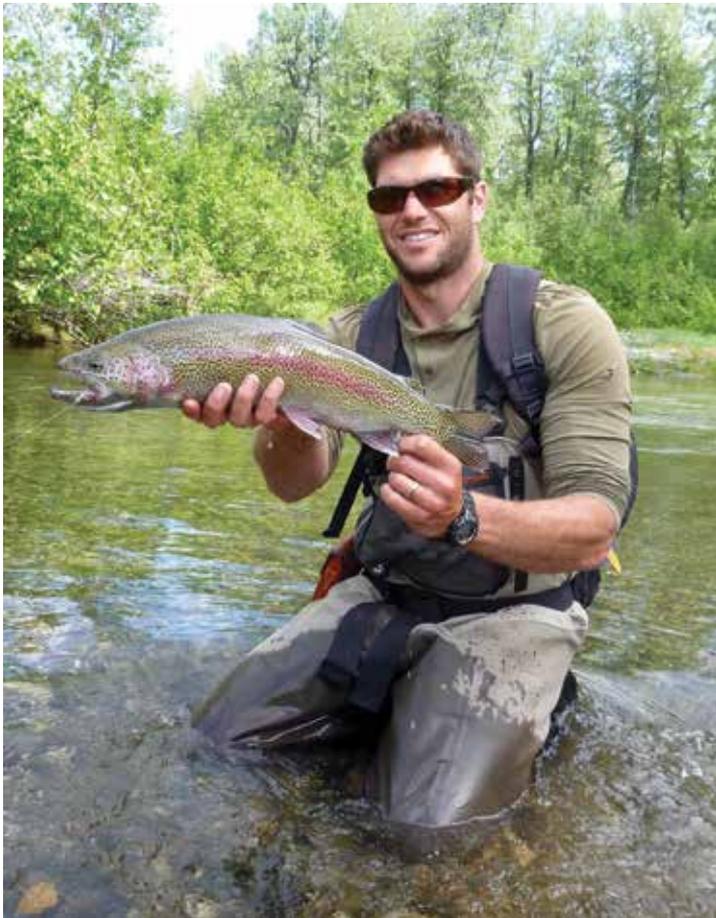


Researchers use an iceberg as a temporary lab platform to process fish samples while enjoying 24-hour summer sunshine. Photo credit: Nathan Sather.

Ninespine Stickelback thrive on zooplankton, which can achieve densities of nearly 1,000 per cubic meter of stream water.



A sample containing tens of thousands of zooplankton collected from a beaded stream. These tiny crustaceans have red pigment in their shells that, when collected in abundance, leaches out by the preservative fluid in the sample bag making it appear red. Photo credit: Jason McFarland.



BIOGRAPHY

Jason McFarland recently graduated with a M.S. Degree from the University of Alaska Fairbanks. Along with graduate advisor Mark Wipfli, Ph.D., McFarland studied food webs supporting stream fishes on Alaska's Arctic Coastal Plain. After graduating he returned to this area to work with oil and gas companies to mitigate development impacts to Arctic ecosystems. In his spare time, Jason guides clients to fish Alaska's Interior.

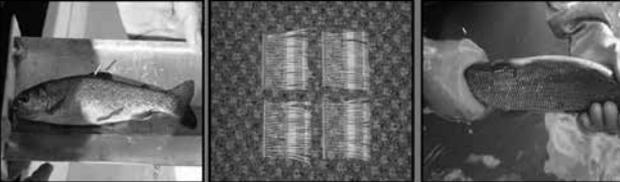
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