

## **Monitoring Polycyclic Aromatic Hydrocarbons (PAHs) in Sediments of the Colville River and Subsistence Fishes Important to the Community of Nuiqsut**

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The village of Nuiqsut in the northeast National Petroleum Reserve in Alaska (NPR-A) is largely surrounded by oil and gas (O&G) exploration and development, including a number of activities on BLM-managed lands in the region. Like other remote villages within the North Slope, community members are heavily dependent on locally available subsistence foods such as caribou, marine mammals, and non-salmon fishes. More specifically, non-salmon fish species account for up to 23% of the community's total estimated harvest, and the primary subsistence fishery in Nuiqsut is the fall under-ice harvest of Arctic cisco. Other important fishes include least cisco, broad whitefish, Arctic grayling, and humpback whitefish. Due to the proximity of this community to permanent O&G facilities, there has been increasing concern among North Slope communities regarding potential contaminant in subsistence fishes.

More specifically, community members of Nuiqsut have expressed concerns regarding Polycyclic Aromatic Hydrocarbons (PAHs), a group of organic contaminants ubiquitous in the environment. Within the NPR-A, a previous study to assess baseline concentrations of PAHs was conducted over the course of seven years, with distinct collection events in 2004, 2005, 2008, and 2010. The results of this study indicated concentrations of PAHs fish were low, often below detection limits (Wetzel et al. 2012). Further, a 2017 study that examined hydrocarbons and trace metals in marine fish tissues concluded trace metal concentrations were generally low and PAHs were not detected (Dasher et al. 2018). These results led the authors to conclude that sampled sites were largely representative of typical reference conditions within the region. However, these sampling efforts primarily occurred prior to the development of permanent O&G facilities within the NPR-A, as construction of the first permanent O&G drill site began in 2013; the site produced first oil in 2015. Two additional gravel drill sites were subsequently permitted and began producing oil in 2018 and 2021, respectively. With the increase in O&G activity near areas that serve as important aquatic habitats, a follow-up monitoring effort to evaluate PAH levels in fish tissues and sediments is warranted to ensure that the Village of Nuiqsut, the North Slope Borough, and BLM are effective at protecting these sensitive aquatic ecosystems and comply with BLM's Required Operating Procedures (ROPs).

In addition, some community members feel that PAH contamination may be associated with whitefishes infected with *Saprolegnia*, a water mold that can result in a fish disease called Saprolegniosis. This water mold was first found on broad whitefish by Nuiqsut fishermen during the fall of 2013. The occurrence of this mold has since been observed on additional whitefish species, including humpback whitefish, Arctic cisco, and least cisco (2020). While Saprolegniosis tends to be associated with fish that have physical wounds on their skin or are under stress, some causes of wounding and stress can be pollution, crowding, changes in environment (water temperature, salinity, water flow), and production (especially spawning males).

To address these concerns, a project is being planned to conduct a monitoring effort to (1) evaluate potential changes in PAH concentrations in sediments and fish tissues within areas of the NPR-A and (2) to assess whether elevated PAH levels are associated with fish infected with *Saprolegnia*. To achieve these goals, the project will pursue the following objectives:

- 1) With assistance from the Nuiqsut community of fishers, collect subsamples of four fish species caught by subsistence users (i.e., broad whitefish, humpback whitefish, Arctic cisco, and least

cisco). Fish collected for analyses will include fish infected with *Saprolegnia*; representative fish species not infected with *Saprolegnia* will serve as the control.

- 2)
  - a. Compare potential PAH levels in the muscle and liver of broad whitefish to baseline levels documented by Wetzel et al. (2012).
  - b. Compare potential PAH levels in all four species of subsistence fishes noted above using muscle and liver of fish to evaluate if PAH pollution is present and potentially associated with infection.
- 3) With input and assistance from the Nuiqsut community, collect sediments to assess potential PAHs from locations in the Colville River to compare values to baseline levels established by Wetzel et al. (2012).
- 4) If PAHs are detected, then the laboratory would characterize/fingerprint the source of PAH based on the chemical signature to clarify whether from fresh (petrogenic) or combusted (anthropogenic) oil sources.
- 5) Disseminate results (presentations and written reports) to local residents and the scientific community.

The Bureau of Land Management (BLM) is applying for internal funding to support this study. This funding is anticipated to cover the costs of North Slope Borough Staff (Sformo) to travel to Nuiqsut and sample a proportion of fish caught by subsistence users, honoraria to subsistence users for donating fish samples, cover travel costs for two to three Nuiqsut community members (along with Drew and Sformo) to visit the laboratory where analyses and being conducted, and contract contaminants specialists at the Mote Marine Laboratory to conduct analyses, summarize, and disseminate results to local communities (at least Nuiqsut and Utqiagvik) and the scientific community.