

Environmental Studies Program: Ongoing Study

Title	Delineating Species and Stock Boundaries in the Arctic-Bering Cisco Species Pair (AK-19-02-14)
Administered by	Alaska Regional Office
BOEM Contact(s)	Dr. Christina Bonsell (christina.bonsell@boem.gov)
Procurement Type(s)	Cooperative Agreement
Conducting Organization(s)	University of Alaska Coastal Marine Institute
Total BOEM Cost	\$32,996 plus Joint Funding (\$28,286)
Performance Period	FY 2022–2024
Final Report Due	January 2024
Date Revised	June 9, 2022
PICOC Summary	
<i><u>Problem</u></i>	Differentiating between Bering and Arctic cisco from morphology is very difficult, which complicates assessing changes over time and resultant impacts on subsistence harvest.
<i><u>Intervention</u></i>	Researchers will develop and apply genetic tools for distinguishing species and populations.
<i><u>Comparison</u></i>	The study will use the null hypothesis that there is no genetic population structure within or among cisco caught in study locations.
<i><u>Outcome</u></i>	This study aims to use the above-mentioned tools to better understand spatial population structure and equip North Slope communities with the means of assessing composition of subsistence catch.
<i><u>Context</u></i>	Beaufort Sea and Chukchi Sea

BOEM Information Need(s): Knowledge of genetic diversity of cisco populations harvested in coastal areas is relevant to improving understanding of coastal and human environments that may be affected by mineral resource exploration and development. A better understanding of the relative composition of different species and stocks in fished habitats will help inform NEPA analyses for future lease sales, exploration plans, and development and production plans. The project will produce the necessary baseline knowledge and create tools for cost effective monitoring efforts.

Background: Populations of whitefish are important targets of subsistence fisheries across northern Alaska. Qaalataq (*Coregonus autumnalis*; Arctic cisco) and Tiipuuq (*Coregonus laurettae*; Bering cisco), two very similar species with partially overlapping distributions in the region, are very difficult to differentiate using gross external anatomical traits. However, gill raker counts and mitochondrial DNA sequence variation indicates the presence of two distinct lineages with varying distribution patterns (Politov et al., 2000; Politov et al., 2004). *Coregonus autumnalis* seems to be confined to the North Slope region, while *C. laurettae* has a wider distribution that stretches south to Southcentral Alaska. The health of this natural and cultural resource is critically dependent on the coastal lagoons and nearshore environments that represent critical habitat for growth and pre-spawning development for both species.

Importantly, these areas are also locations where summer and winter whitefish harvests take place, thus understanding the relative composition of different species and stocks in fished habitats will help inform future infrastructure development plans or emergency mitigation in the region. However, more information is needed regarding the population and species composition of catches of these fishes along different coastal communities. Improved knowledge on catches can guide effective monitoring and promote long term economic and cultural value to local communities.

Objectives:

- Identify diagnostic genetic differences between Arctic and Bering cisco across their genomes
- Characterize genetic variation and population structure of Arctic and Bering cisco harvested in Alaska's Arctic coastal communities
- Develop and validate genetic assay to support community-led monitoring of subsistence resources

Methods: Multiple techniques will be used to assess genetic diversity in Arctic and Bering cisco:

1. Low-coverage Wide Genomic Sequencing (lcWGS) analyses will capture genome-wide measures of variability, differentiation, and introgression between and within the two target species
2. Restriction-site Associated DNA-sequencing will characterize fine-scale population genetic structure of the target species along the Arctic coast
3. Easy-to-implement genetic assays will be developed to support community-directed monitoring of fish harvests
4. Tissue samples will be taken opportunistically from fish harvested as part of North Slope Borough residents' regular fishing activities following all pertinent regulations.

Specific Research Question(s): Can differences between and among harvested populations of Arctic and Bering Cisco be identified through genetics?

Current Status: Field and lab work is ongoing. Preliminary results show strong genetic differentiation within species.

Publications Completed: N/A

Affiliated WWW Sites:

<http://www.boem.gov/akstudies/>

<https://www.uaf.edu/cfos/research/cmi/>

References:

Politov, D. V., J. W. Bickham, and J. C. Patton. 2004. Molecular phylogeography of Palearctic and Nearctic ciscoes. *Annales zoologici Fennici* 41:13–23.

Politov, D. V., N. Y. Gordon, K. I. Afanasiev, Y. P. Altukhov, and J. W. Bickham. 2000. Identification of palearctic coregonid fish species using mtDNA and allozyme genetic markers. *Journal of fish biology* 57:51–71