February 20, 2025

Identifying the Planktic Foraminifera in Alaska Waters

UA Faculty Initiative Fund AY24 Tier II Report

PI: Shannon Doherty
Assistant Professor
College of Fisheries and Ocean Sciences

Project Abstract

Planktic foraminifera, single-celled marine plankton that form shells, are crucial to studies of Earth's climate. Although Alaska waters have great potential for research on high-latitude planktic foraminifera, little work has been done characterizing the planktic foraminifera around Alaska. This Tier-II project established the geographic boundaries of planktic foraminifera species living in Alaska coastal waters, generating 1) preliminary data to be used in future NSF proposals and 2) a set of foraminifera fossil samples to be used in teaching and outreach. In addition, the equipment purchased for this analysis constitutes a full suite of micropaleontology resources for future research at the University of Alaska.

Project Goals

1) Collect preliminary data
    a. establish the species and geographic boundaries of planktic foraminifera in Alaska waters
    b. establishing the existence of *N. pachyderma* coastal populations in the Gulf of Alaska
2) Develop teaching and outreach tools
3) Establish necessary resources to advance micropaleontology research within the College of Fisheries and Ocean Sciences

Budget

The project budget was spent as detailed in the proposal: $3,670 supporting 1 week of Summer 2024 salary for PI Doherty to complete sample analysis and $6,321 spent on a microscope with a camera and other sample analysis tools, including micropaleontology slides, brushes, and archival equipment to complete this project and establish micropaleontology resources.

Project Outcomes and Results

Collection of preliminary data

In addition to the plankton tow samples listed in the proposal, Doherty had the opportunity to collect plankton samples on a cruise of opportunity aboard the *USCGC Healy* in October 2024. These samples are included in the proposal results below. Samples were processed in Spring 2024, Summer 2024 and the Fall 2025. The results were presented at the Alaska Marine Science Symposium in Anchorage, January 27-31, 2025. These preliminary data will also be included in a NSF EPSCoR Fellowship proposal and a NSF Office of Polar Programs proposal, to be submitted this spring and summer, respectively.

1a. Establish the species and geographic boundaries of planktic foraminifera in Alaska waters

The combination of the June 2023 samples and the samples collected in October 2024 completed a geographic transect of Alaskan waters from Seward, west through Unimak Pass, and north to

the Chukchi Sea (see Figure 1). Interestingly, foraminifera were absent on the shallow continental shelf in the Bering and Chukchi Seas. The cause of foraminifera absence on the shelf is the basis of a forthcoming NSF proposal.

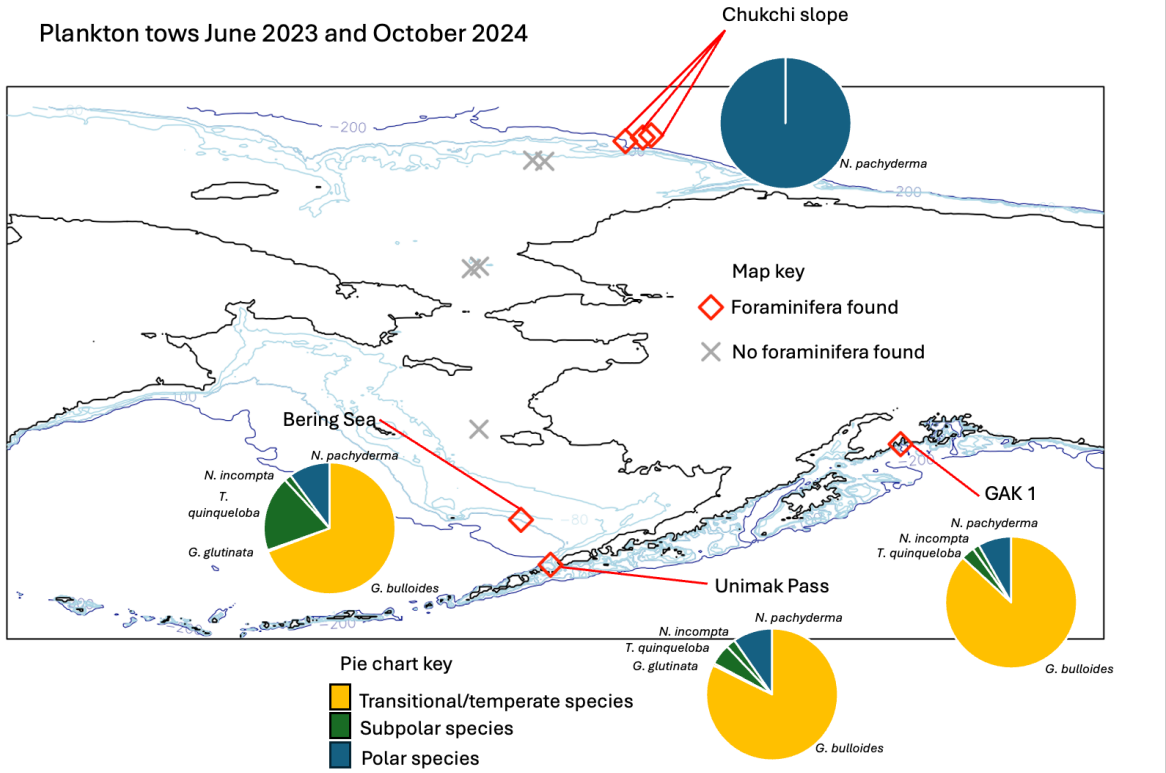

Figure 1. Location of plankton tows, presence/absence of foraminifera, and species assemblages

Planktic foraminifera species assemblages are dependent on temperature, and species can be grouped into biogeographic regions based on temperature. The species found in Alaskan waters were the polar species *N. pachyderma*, the subpolar species *Neogloboquadrina incompta* and *Turbotalita quinqueloba*, and the transitional/temperate species *Globigerina bulloides* and *Globigerinita glutinata*. South of the Bering Strait, *G. bulloides* was the most abundant species (Figure 1), matching observations for summertime species assemblages in the California Current. These assemblages are "warmer" than those collected in previous decades in the subarctic North Pacific and may indicate a warming trend in this region.

1b. Establishing the existence of N. pachyderma coastal populations in the Gulf of Alaska
The species *N. pachderma* was found in all plankton samples, and was the only species found on the Chukchi Shelf (Figure 1). This is the only planktic foraminifera species that has been cultured for multiple generations in aquaria, and confirming that this species is present in coastal waters in the Gulf of Alaska (GAK 1, Figure 1) supports future proposals for foraminifera culturing experiments based out of the Seward Marine Center.

Figure 2. Slides used as teaching and outreach aids (bottom and middle) and portable microscope (top). Sharpie pen for scale.

Development teaching and outreach tools
In addition to foraminifera shells, pteropod shells have been preserved on slides as a teaching aid for discussing the carbon cycle and ocean acidification. The microscope slides (Figure 2) created during the plankton analysis have been used as teaching aids in Chemical Oceanography (OCN F460/F660; Doherty was the instructor Spring 2024 and 2025) and for the Rural Alaska Honors Institute (Doherty was an instructor Summer 2024). They will be available for future outreach projects and courses.

Establish necessary resources to advance micropaleontology research within CFOS
Since the FIF funds were awarded, Doherty has been appointed to Assistant Professor in CFOS. Laboratory space was included in this appointment, and room 208 in the O'Neill Building at UAF has become the "Paleoceanography Lab." This space is outfitted with microscopes and equipment for microfossil analysis funded in part by this FIF award. A master's student and a PhD student will join Doherty's lab in Summer and Fall 2025, and both will use this equipment to advance their graduate research. Included in this research will be the analysis of archived material from sediment traps from the Gulf of Alaska, Bering, and Chukchi Seas, currently housed in CFOS. This analysis will expand upon the species assemblage and geographic range work completed for this project.