

A MUCH-NEEDED BASELINE OF PHYTOPLANKTON DISTRIBUTIONS IN THE CHUKCHI SEA

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Research overview – WHOI's Coastal Research Institute, through the Rinehart Coastal Research Fund, supported a project by PI Laney (WHOI Biology Department) to collate and archive phytoplankton abundance and distribution data from the Chukchi Sea (Arctic Ocean), that have been collected in the course of Laney's research program over the past five years. The collection of these data has been supported by numerous agencies and identities, including WHOI's Arctic Research Initiative, NASA's ICESCAPE program, and collaborations with other WHOI PIs who have ongoing Chukchi Sea field programs (notably C. Ashjian and R. Pickart). To date, the primary scientific effort has been to focus on the collection of these data – not their analysis or synthesis – in order to obtain robust seasonal and spatial coverage within the data set in as short amount of time as possible. The only sources of this field support with explicit funding for any analysis of these data was the NASA ICESCAPE program, involving a detailed taxonomic assessment of the massive 2011 Chukchi Sea under-ice phytoplankton bloom.

This Rinehart-funded research was timely because the Arctic coastal margin is at the front lines of research for climate change and the impact of increased human activity in newly ice-free areas of the ocean. The physical alterations to the coastal Arctic are being examined in detail, but the corresponding ecological changes still remain greatly under-studied. Given the rapid changes occurring in Arctic coastal ecosystems, it was imperative to generate a synoptic climatology of basic ecosystem variables. Among the most important variables to measure are the distributions and seasonality of organisms that mediate major ecosystem processes such as primary production, which in this case means phytoplankton. Databases that collate such information are essential for guiding future interpretations of climate change in the coastal Arctic, as they provide important baseline data against which future ecological changes can be benchmarked.

Although this project was small in scope it has already broadened the use of these data in the greater science community. These data have been incorporated into the doctoral research of two visiting doctoral students from research groups at NASA Goddard Space Flight Center (Ms. Aimee Neely) and Stanford University (Ms. Virginia Selz), who have each made use of this data archive by long-term visits to the Laney lab to learn how to

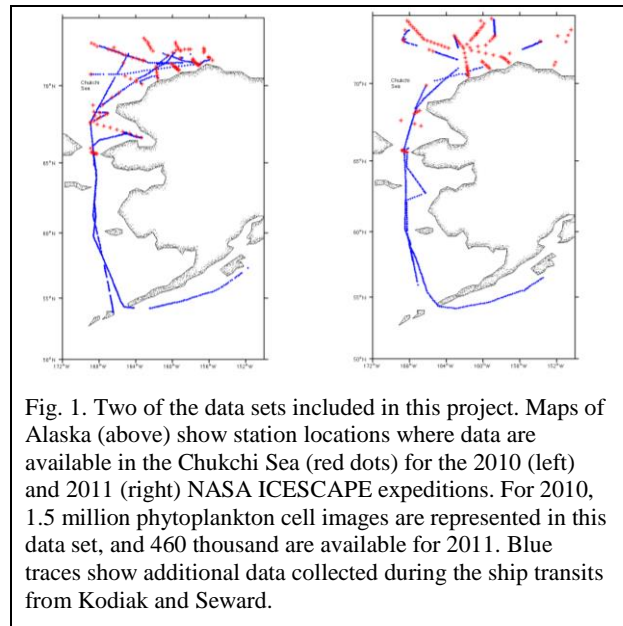


Fig. 1. Two of the data sets included in this project. Maps of Alaska (above) show station locations where data are available in the Chukchi Sea (red dots) for the 2010 (left) and 2011 (right) NASA ICESCAPE expeditions. For 2010, 1.5 million phytoplankton cell images are represented in this data set, and 460 thousand are available for 2011. Blue traces show additional data collected during the ship transits from Kodiak and Seward.

access and utilize these data, under supervision by PI Laney. Papers from each of these two PhD candidates, utilizing these data, are in preparation under the supervision of their academic advisors. Additionally, a research colleague at NOAA's Alaska Fisheries Science Center (Seattle WA) also has begun to utilize these datasets, given AFSC's increased interest in ecological dynamics in the Chukchi Sea. These data remain available now in their archived form on servers in the Laney lab, for other future users.

Research leveraging – In addition to the primary objective of creating a single, unified database for these types of Chukchi Sea phytoplankton data, a second longer-term objective of this project was to use this Chukchi-specific database as a demonstration of value, to support future initiatives to permanently install a comparable phytoplankton instrument on one or both of the US Arctic research icebreakers (USCGC Healy and RV Sikuliaq). PI Laney has field experience on both of these vessels, and during the project performance period also served as a scientist on the new RV Sikuliaq's initial sea ice science acceptance trials in the Bering Sea. This provided the travel opportunity mentioned in the proposal to examine Sikuliaq's instrumentation suite and layout, and to engage ship science technicians as to best-practice approaches for adding such instrumentation to these ships. Laney is currently using this experience and information to develop an instrument-augmentation strategy for these ships that could best integrate these types of phytoplankton abundance data into the continuous, real-time measurement suite already performed by these two ships. With recent changes to NSF's Arctic (Polar Programs) proposal solicitation process, this potential project is being envisioned not only as fostering new science but also as expanding our national research asset capabilities in the coastal Arctic.