



Pole Star
Ecological Research LLC

Seabird studies during the Northern Gulf of Alaska Long Term Ecological Research Program

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Introduction

The Northern Gulf of Alaska (NGA) is characterized by high productivity and intense environmental variability, which is hypothesized to drive species responses (and adaptations) towards high resilience. In 2018, a new Long-Term Ecological Research (LTER) site was established in the NGA, building on decades of multidisciplinary observations along the Seward Line. The NGA-LTER utilizes spatially and temporally expanded series of observations, as well as experimental and modeling components, to evaluate processes that drive productivity, as well as species and community responses to environmental variability. Sampling is conducted during cruises in April-May, July, and September, and incorporates features that contribute to regional productivity, such as the Copper River plume and Albatross Bank. Observations include physics, chemistry, micro- and macronutrients, particles, phytoplankton, zooplankton, and seabirds; here we describe efforts and preliminary results for the latter.

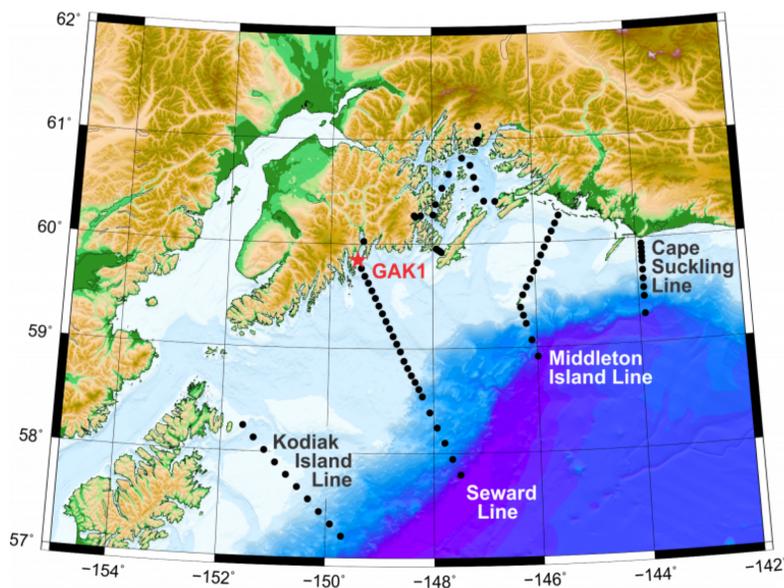


Fig. 1. The Northern Gulf of Alaska Long Term Ecological Research Site. Sampling stations are indicated by circles. Over two decades of multidisciplinary observations have been conducted along the Seward Line (center).

Seward Line seabird surveys

Vessel-based seabird surveys have been a component of Seward Line research cruises, annually from 1998 - 2003 and 2006 - 2018, with shifts in cross-shelf distribution of seabirds evident under different temperature regimes during the latter period (Fig 2).

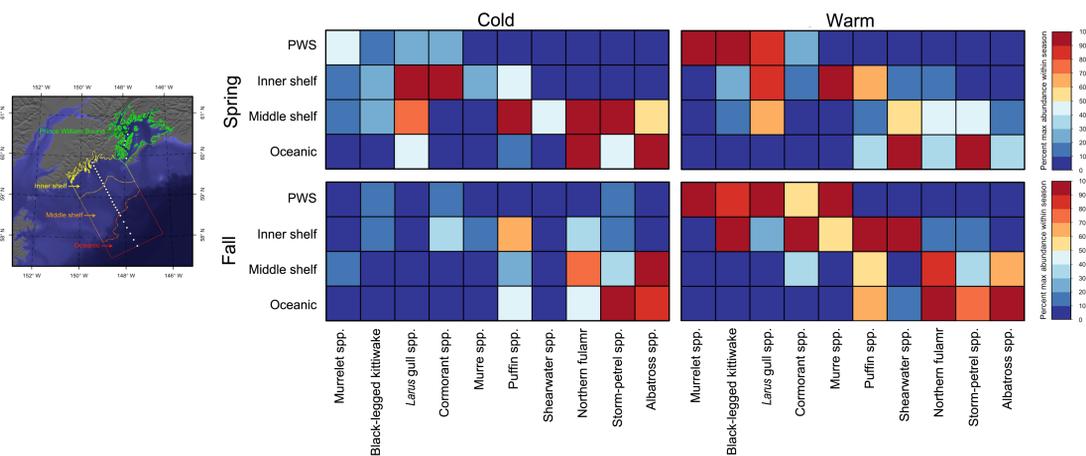


Fig. 2. Cross-shelf distribution of 10 species-groups seasonally and between cold & warm years along the Seward Line, 2007-2015. Species groups on x-axis are arranged by tendency to be inshore or offshore foragers. Inshore species showed greatest differences between cold & warm years.

Initial results from 2018

Cruise	Km surveyed	Mean birds · km ⁻²	No. bird species (on-transect / + off-transect)
April/May	1919	6.2	36 / 56
July	2217	10.3	37 / 46
September	1557	13.0	29 / 51

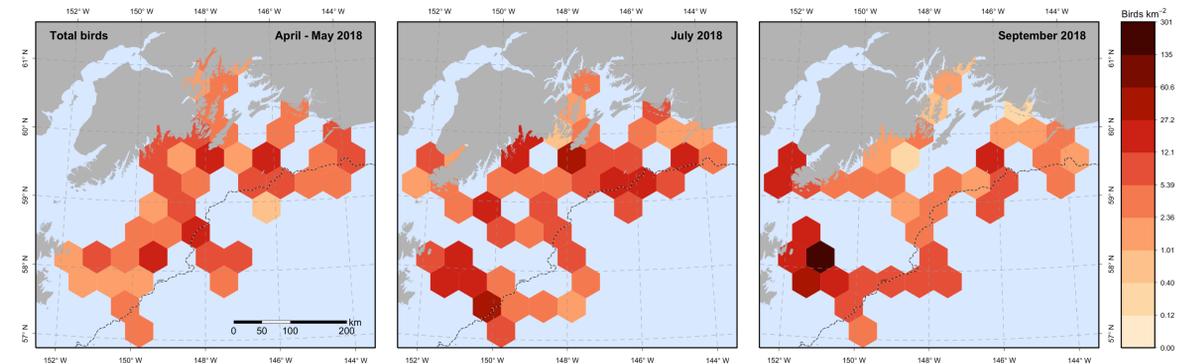


Fig. 3. Total birds (all species combined) during 2018 NGA LTER cruises. Survey transects were subdivided into 3-km sections, and density (birds · km⁻²) calculated for each segment. Segments were then averaged within 50-km grid cells.

Future Directions: Responses to perturbation

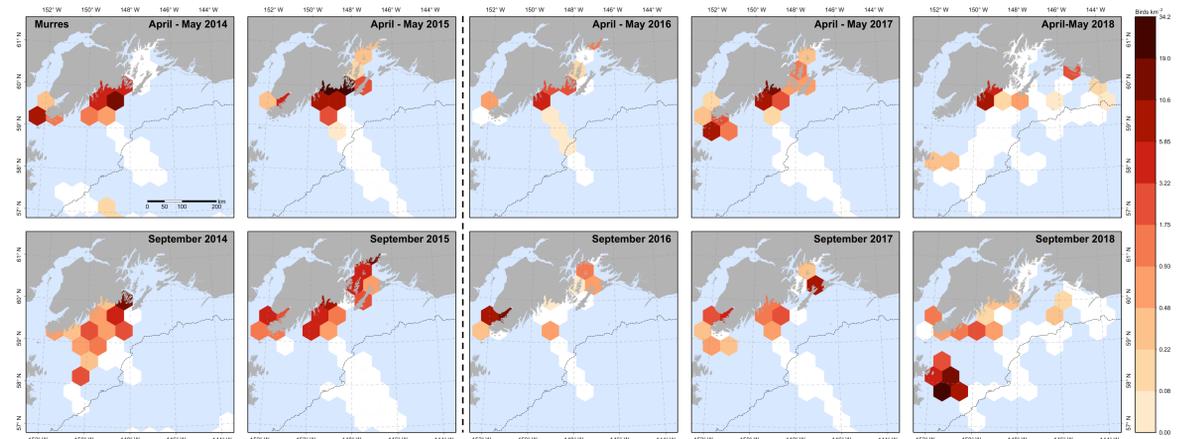


Fig. 4. Distribution and abundance of common and thick-billed murre during April-May (top row) and September (bottom row) 2014-2018, before and after the winter 2015-16 mass mortality event (dashed line). Spatially and temporally expanded sampling will enhance our understanding of responses to ecosystem perturbations.

Future Directions: Relationships with environmental drivers

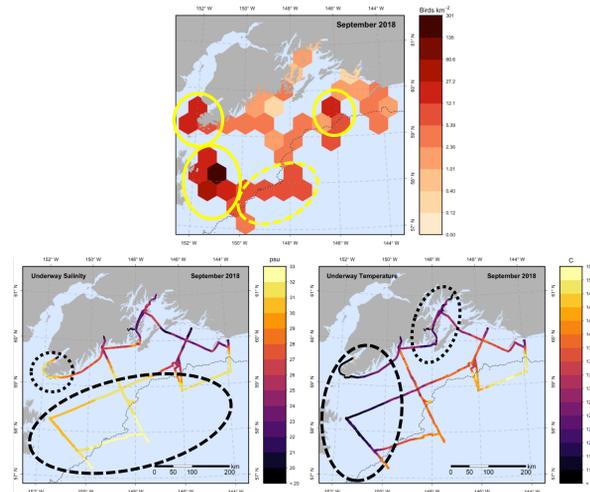


Fig. 5. During September 2018, high densities of birds were often coincident with areas of colder and saltier surface water.

Future Directions: Cross-system comparisons with the California Current Ecosystem LTER

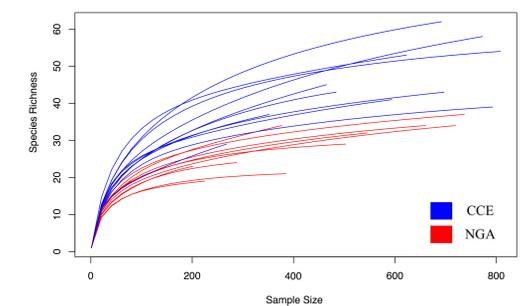


Fig. 6. Rarefaction curves depicting species richness during fall in the California Current Ecosystem (blue) and the Northern Gulf of Alaska (red). Cruises were conducted during fall 2006-2017; each curve represents one cruise. Species richness was higher in the California Current than the Northern Gulf of Alaska. Figure courtesy of Brian Hoover, Farallon Institute.