Ice-Associated Seal Surveys in the Eastern Bering Sea:

Gathering Baseline Data and Utilizing a Centralized Geospatial Platform

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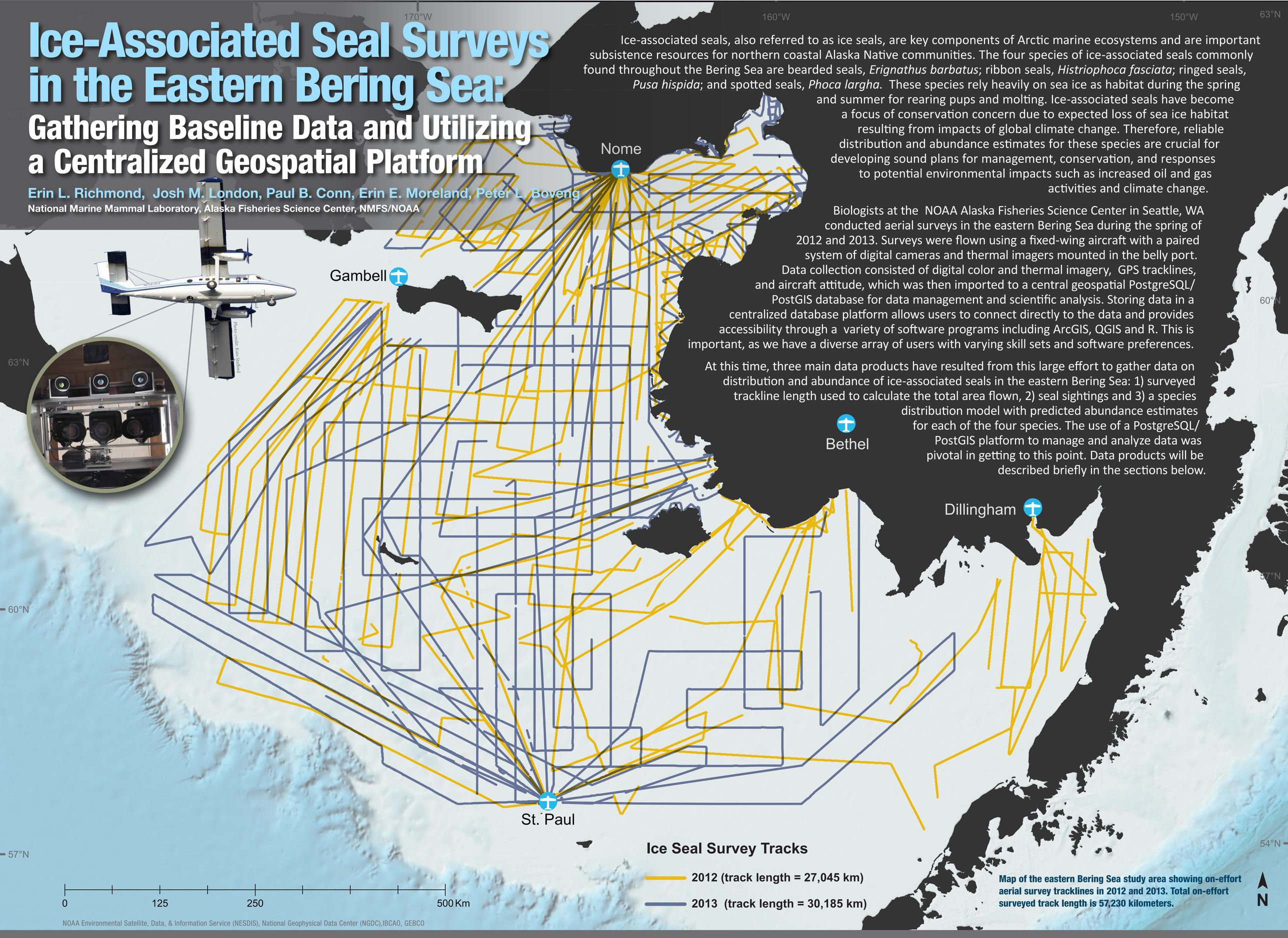
Ice-associated seals, also referred to as ice seals, are key components of Arctic marine ecosystems and are important subsistence resources for northern coastal Alaska Native communities. The four species of ice-associated seals commonly found throughout the Bering Sea are bearded seals, *Erignathus barbatus*; ribbon seals, *Histriophoca fasciata*; ringed seals, *Pusa hispida*; and spotted seals, *Phoca largha*. These species rely heavily on sea ice as habitat during the spring and summer for rearing pups and molting. Ice-associated seals have become a focus of conservation concern due to expected loss of sea ice habitat resulting from impacts of global climate change. Therefore, reliable distribution and abundance estimates for these species are crucial for developing sound plans for management, conservation, and responses to potential environmental impacts such as increased oil and gas activities and climate change.

Biologists at the NOAA Alaska Fisheries Science Center in Seattle, WA conducted aerial surveys in the eastern Bering Sea during the spring of 2012 and 2013. Surveys were flown using a fixed-wing aircraft with a paired system of digital cameras and thermal imagers mounted in the belly port. Data collection consisted of digital color and thermal imagery, GPS tracklines, and aircraft attitude, which was then imported to a central geospatial PostgreSQL/PostGIS database for data management and scientific analysis. Storing data in a centralized database platform allows users to connect directly to the data and provides accessibility through a variety of software programs including ArcGIS, QGIS and R. This is important, as we have a diverse array of users with varying skill sets and software preferences.

At this time, three main data products have resulted from this large effort to gather data on distribution and abundance of ice-associated seals in the eastern Bering Sea: 1) surveyed trackline length used to calculate the total area flown, 2) seal sightings and 3) a species distribution model with predicted abundance estimates for each of the four species. The use of a PostgreSQL/PostGIS platform to manage and analyze data was pivotal in getting to this point. Data products will be described briefly in the sections below.



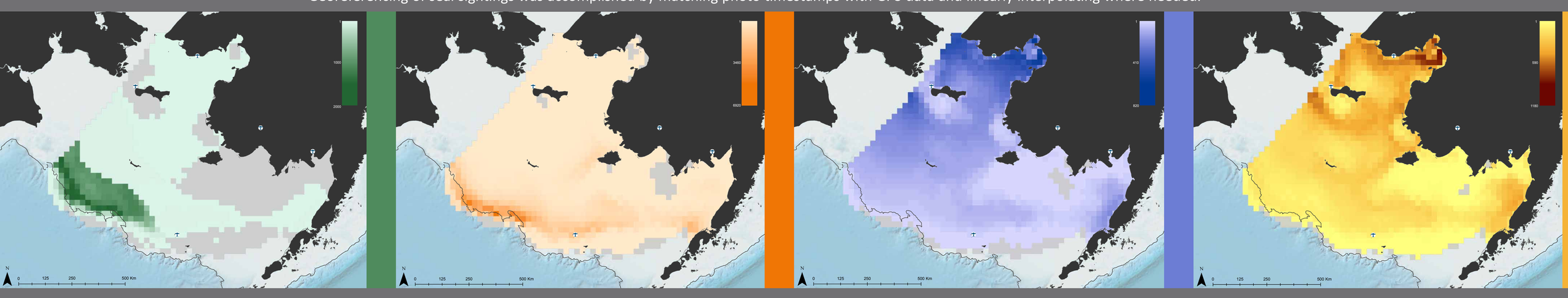
Map of the eastern Bering Sea study area showing on-effort aerial survey tracklines in 2012 and 2013. Total on-effort surveyed track length is 57,230 kilometers.

Tracklines

A 25 x 25 kilometer grid was used for the initial planning of survey tracklines. Once in flight, actual surveys often deviated from the planned tracklines due to environmental conditions such as weather and sea ice concentration. Flights lasted between 4-9 hours and were flown at an altitude of 1,000 ft to maximize the area surveyed and to minimize animal disturbance. Tracks were recorded using a GPS and were used to calculate the total distance and area flown, in addition to georeferencing digital and thermal imagery.

Seal Sightings

Thermal imagery collected during the surveys was analyzed to detect seals or "hotspots" on the ice that showed extreme heat signatures when compared to the surrounding environment. High resolution digital imagery with matched timestamps was then used for species identification. Georeferencing of seal sightings was accomplished by matching photo timestamps with GPS data and linearly interpolating where needed.



Spatial Distribution Model

Multispecies abundance estimates were calculated for the eastern Bering Sea study area using mean posterior predictions based on a 25 x 25 kilometer grid. Patterns in seal abundance adhere to historic and expected species distributions in the eastern Bering Sea, in addition to observed seal sightings based on analyzed imagery collected from the field. Grey grid cells indicate where the abundance was estimated to be zero.

Discussion

Until recently, distribution and abundance data for ice-associated seals has been poorly documented. Continually improving the monitoring of these species is a fundamental goal for the National Marine Fisheries Service (NMFS) to meet its management and regulatory mandates. The data products presented here feed directly into the goals of the agency, while shedding light on the dynamics of Arctic marine ecosystems by providing baseline data and abundance estimates for the four species of ice-associated seals in the eastern Bering Sea.

Acknowledgements

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