Bering-Okhotsk Seal Surveys (BOSS): Joint US-Russian Aerial Surveys for Ice-Associated Seals, April – May 2012

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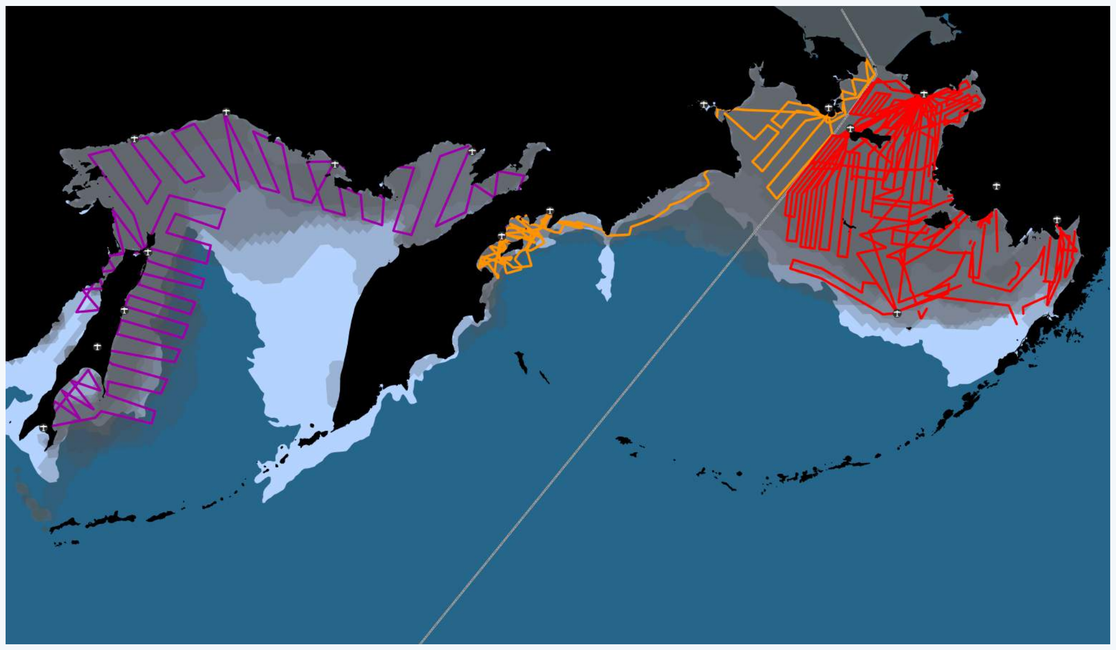
Bearded, spotted, ribbon and ringed seals are important subsistence resources for northern coastal Alaska Native communities and are key components of arctic marine ecosystems. They are protected under the Marine Mammal Protection Act and some are listed under the Endangered Species Act, yet no current, comprehensive and reliable estimate of abundance is available for any of the four species.

The distributions of these seals are wide and patchy, and the extent, locations and conditions of their sea ice habitats change rapidly. Any abundance surveys must therefore, cover the broad ranges of these species and be completed in a relatively short period of time.

In the spring of 2012, we conducted the first of two synoptic aerial abundance and distribution surveys of the Bering Sea.



Map of the area surveyed in 2012 (red=US; orange=Russian). In addition to repeating the Bering Sea surveys in 2013, Russian colleagues will also survey the Sea of Okhotsk (purple). The light blue region indicates water depths less than 1000m. The transparent gray fields represent the median ice extent in April from 2007 to 2012.

NOAA Twin Otter

Aero Commander

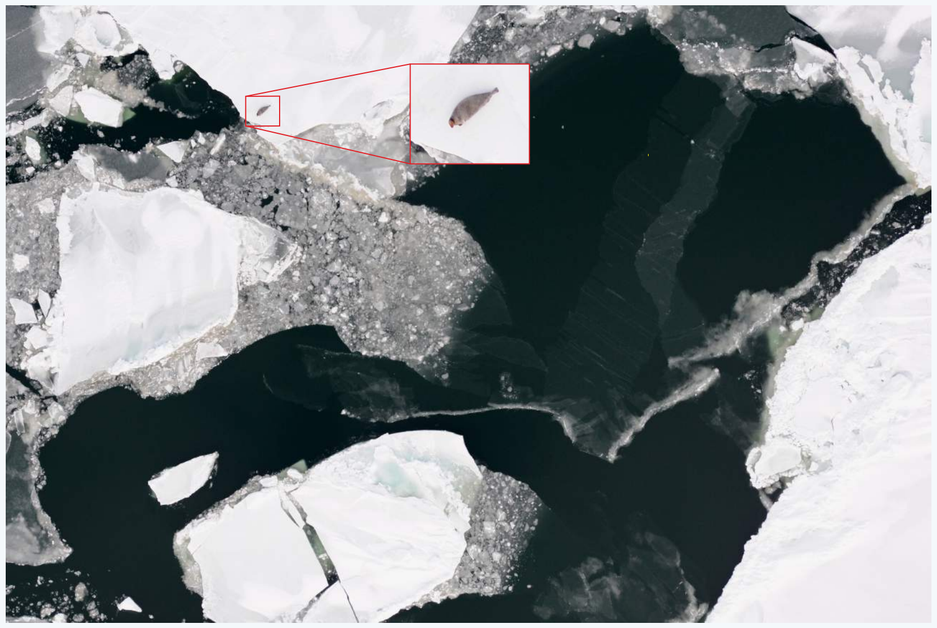
Antonov An38-100

The surveys are conducted in April and May to coincide with the reproductive and molting period when the greatest proportions of the seal populations are hauled out on the ice and detectable. Two years of survey effort are required to achieve adequate precision (CV < 0.2) and to ensure that sufficient periods of suitable weather occur during the survey period.

This effort utilizes strip-transect methodology with fixed-wing aircraft equipped with digital photographic and thermal imaging sensors instead of visual observers. In US waters, the survey aircraft used are a NOAA Twin Otter and an Aero Commander which are capable of surveying nearly all of the Bering Sea shelf from surrounding airports in Nome, Bethel and Dillingham, AK and airstrips in Gambell, on St. Lawrence Island, and St. Paul, in the Pribilof Islands. The Antonov An38-100 is the survey aircraft in Russian waters. In 2012, the Russian team began western Bering Sea surveys from Ossora, Russia, on the Kamchatka Peninsula and worked their way north to the Bering Strait.

Each aircraft is equipped with a thermal imaging sensor (FLIR SC645, or the Malahit-M with the FLIR A325), to detect the presence of seals on the ice, and high-resolution digital cameras (Canon EOS-1Ds Mark III or Nikon D3X) to identify the species of the seal.

Field tests indicated that a pixel resolution ≤ 2 cm is required to reliably identify these seals to species, requiring a flight altitude ≤ 835 or 1000 ft. depending on the lens used.



Aerial photo with a pixel resolution of 2 cm of a bearded seal hauled out on the ice.

Thermal image of the bearded seal shown above, taken at an altitude of 1,000 feet.

The Twin Otter carries three digital cameras and thermal sensors, providing a total strip-width of about 470 m (1,500 ft.) when flying at an altitude of 1,000 ft (300 m). The (Aero Commander) carries two sets of paired instruments, providing a swath width of approximately 900 ft (280 m). The two US aircraft flew over 14,000 nautical miles (27,000 km) during 39 surveys, and collected more than 885,600 images.

The Russian aircraft (AN-38 Vostok) flew more than 4,200 nautical miles (7,800 km) during 12 surveys with instruments that provided a thermal swath width of approximately 2460 ft (750 m) at an altitude of 820 ft (250 m).

Three Canon EOS-1Ds Mark III's (top) paired with three FLIR SC645 thermal sensors in the belly-port of a Twin Otter. The left and right instruments are angled to avoid overlap.

Ribbon seal pup instrumented with a SDR to record and transmit the timing of hauling out, seasonal movements and diving behavior.

In addition to repeating the Bering Sea surveys in 2013, Russian colleagues will also survey the Sea of Okhotsk.

Ultimately, the seal counts will be used in a hierarchical spatial regression model to produce the first comprehensive estimates of abundance for the four species of ice-associated seals found in the Okhotsk and Bering seas. The model will account for multiple sources of uncertainty including detection rates; seal haul-out behavior (as measured from animal-borne satellite linked data recorders; species identification; and changes in ice extent and distribution.

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