

A U.S.-Russian Federation collaboration on

Abundance and distribution of seals and polar bears across Beringia



**NOAA
FISHERIES**

**Peter Boveng
Marine Mammal Laboratory
Alaska Fisheries Science Center
Seattle, WA USA**

Arctic Biodiversity Congress, October 12, 2018, Rovaniemi, Finland

Peter Boveng
Principal Investigator, U.S.A.

Vladimir Chernook
Principal Investigator, Russian Federation



ChukotTINRO



U.S. Fish and
Wildlife Service



Giprorybflot



MagadanNIRO



North Pacific Wildlife
Consulting, LLC



NOAA Fisheries



КФ ТИГ ДВО РАН
Kamchatka Branch – Pacific
Geographical Institute, RAS



Marine Mammal Council



Severtsov Institute of
Ecology and Evolution, RAS



**Polar
Bear**



**Ringed
Seal**



**Bearded
Seal**



**Spotted
Seal**



**Ribbon
Seal**

The species are
Strongly associated with sea ice and
vulnerable to modification and loss of habitat
in the warming climate

Vital to indigenous peoples of Beringia

Poorly documented for abundance, trends,
and vital rates

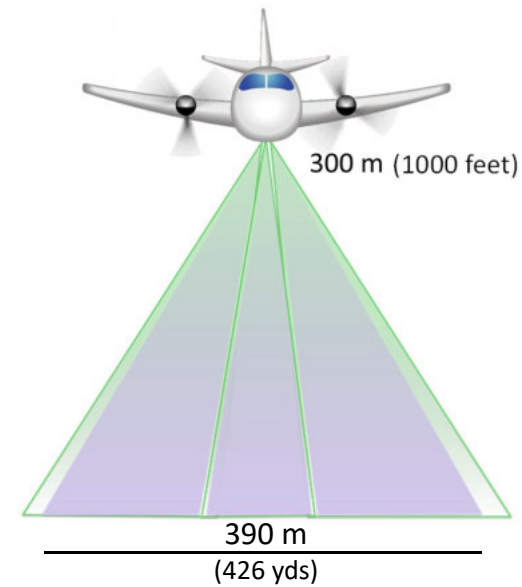
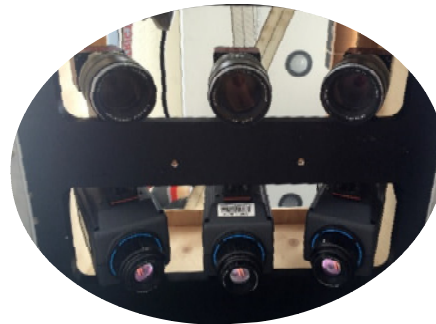
Inadequately assessed for management;
largely missing from ecosystem models and
integrated studies

Fundamental goal: Obtain the first comprehensive and reliable estimates of abundance and distribution for each species

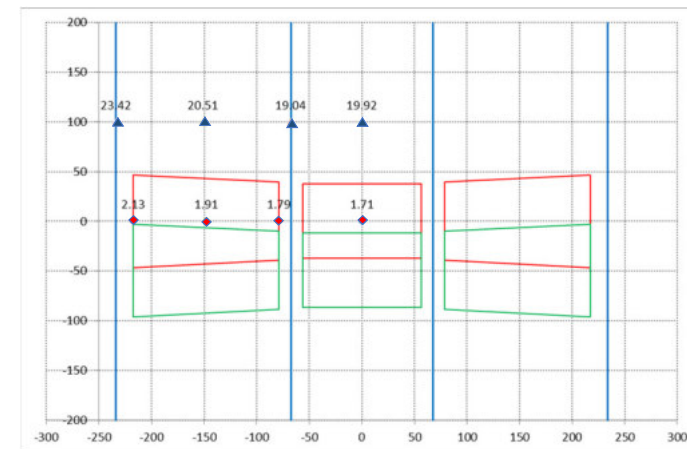
- Comprehensive == whole sea basin breeding populations
- Reliable == reasonable precision, accounting for all the important sources of uncertainty
 - Detection rate
 - Availability of each species to be detected
 - Species misclassification rates

Approach

- Coordinated aerial surveys of the spring sea ice on both sides of the marine boundary between the U.S. and the Russian Federation
- Instrument-based surveys using infrared (IR) for detection and color for species ID (many advantages over traditional, visual-sightings methods)
- Develop hierarchical statistical models and methods that incorporate all the sources of uncertainty and carry them through to the results



Aircraft:	King Air A90
Target altitude:	300 m
Thermal camera:	cooled LWIR 25mm lens
Color camera:	machine vision 29 MP, 100mm lens
Swath width:	470 m IR; 390 m color
Survey speed:	260-300 km/h (151 knots)
Resolution-thermal:	20-23 cm/pixel
Resolution-color:	1.71-2.13 cm/pixel

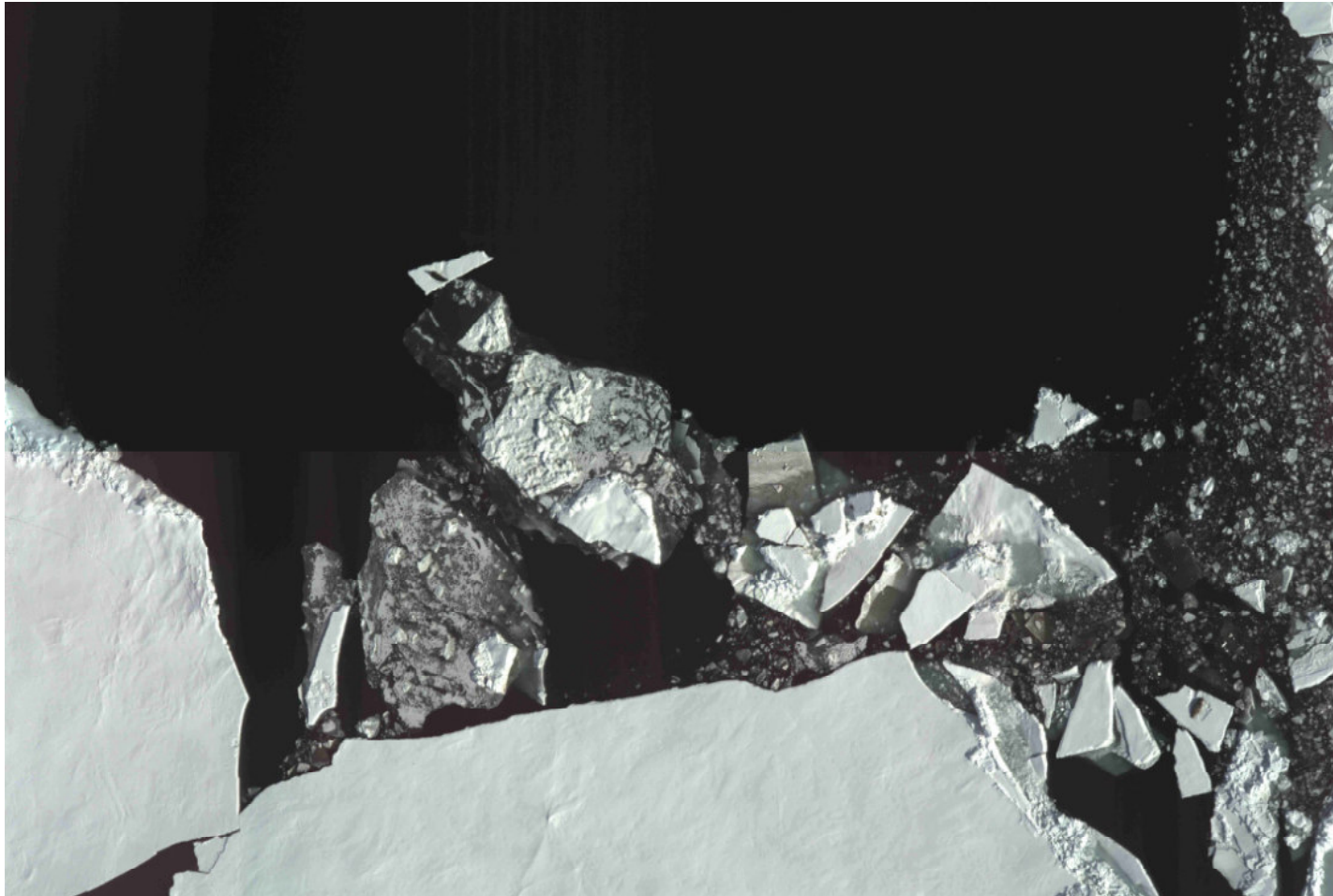


Thermal image footprint — and resolution (cm/pixel)
 Color image footprint — and resolution (cm/pixel)

“Hot spots” . . .



“Hot spots” . . . seals. . .



“Hot spots” . . . seals. . . bearded seals!

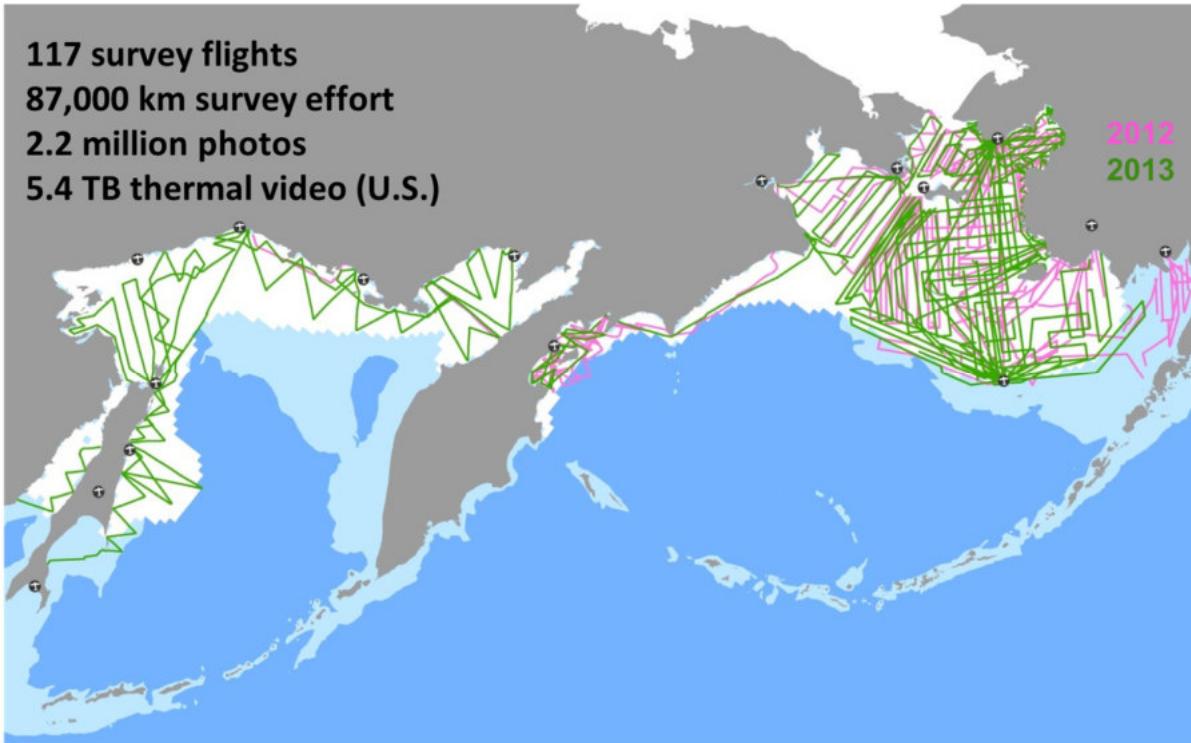


Accomplishments

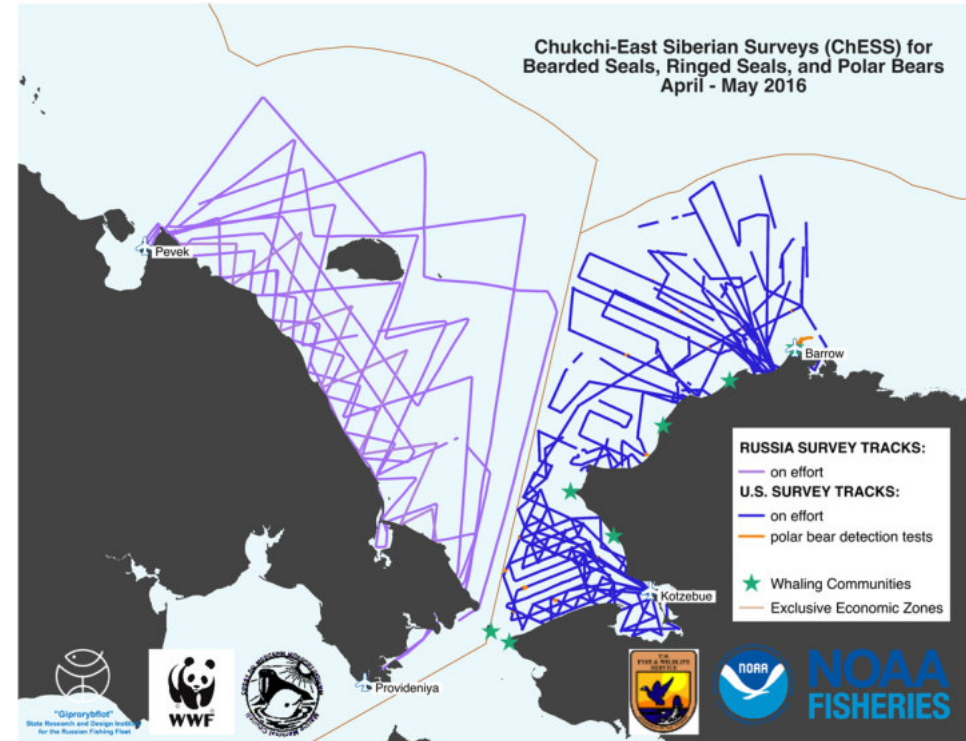
- Completed surveys for seals in the entire sea-ice zones of the Bering and Okhotsk seas in April-May of 2012 and 2013
- Completed survey for seals and polar bears in the sea-ice zone of the Chukchi Sea in April-May of 2016
- Completed the processing of approximately 8 million IR and color images
- 2 publications (in Russian) on results of Okhotsk and western Bering seas
- 6 publications on survey design, statistical methods, and partial results from the eastern Bering Sea (U.S. surveys); analysis and manuscript completed for bearded, spotted, and ribbon seals in eastern BS

115,000 km of survey track line; approximately 8 million digital images

117 survey flights
87,000 km survey effort
2.2 million photos
5.4 TB thermal video (U.S.)



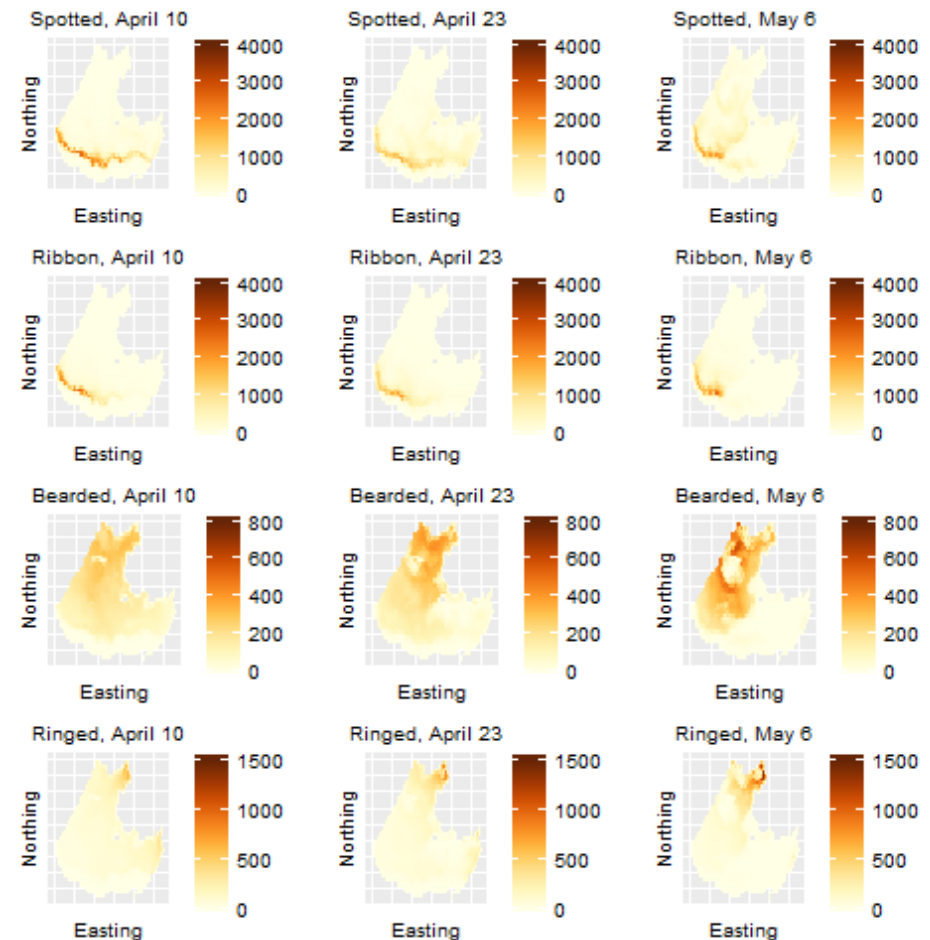
Chukchi-East Siberian Surveys (ChESS) for
Bearded Seals, Ringed Seals, and Polar Bears
April - May 2016



Example of results from eastern Bering Sea:

2012

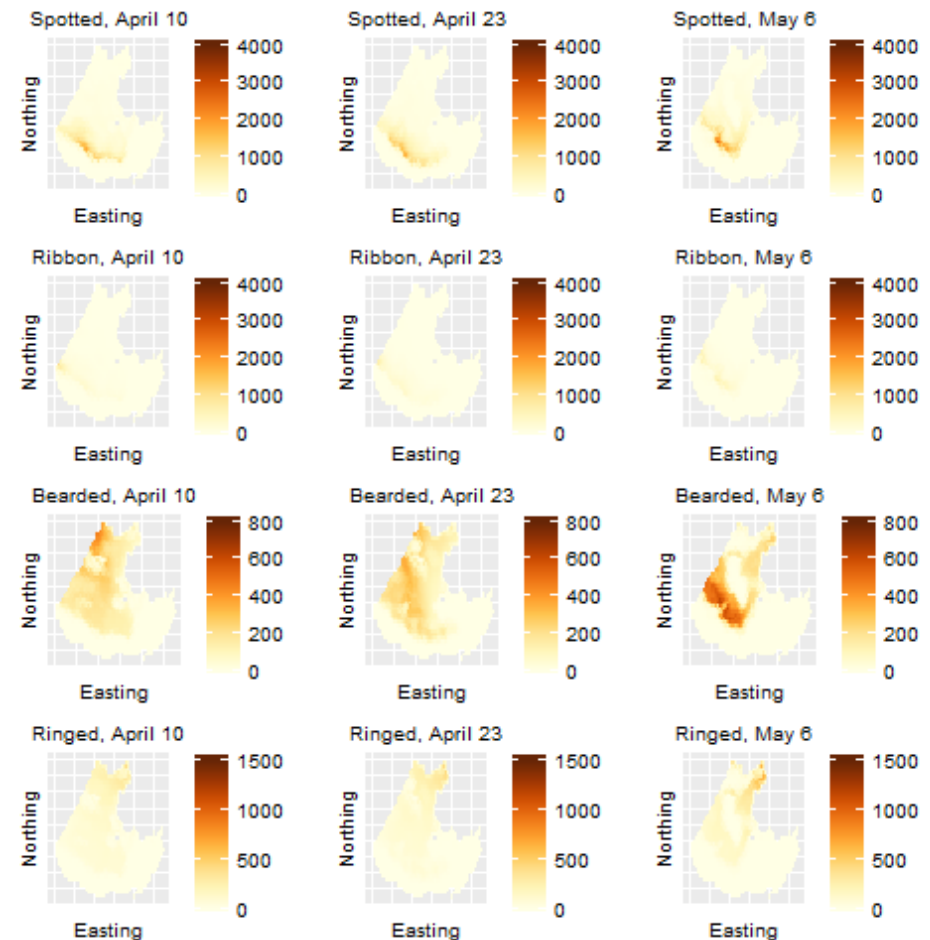
- Species distributions consistent with natural history observations
- Space-time model gives daily distributions as sea-ice field shifts and melts
- 2012 and 2013 consistent in major features but different in abundance of ribbon & spotted seals



Example of results from eastern Bering Sea:

2013

- Species distributions consistent with natural history observations
- Space-time model gives daily distributions as sea-ice field shifts and melts
- 2012 and 2013 consistent in major features but different in abundance of ribbon & spotted seals



Remaining steps

- Merge U.S. and Russian data for combined analysis using consistent method for Bering Sea overall
- Modified analyses for ringed seals to account for different survey effort in shore-fast ice and the timing of ringed seal availability due to snow melt
- Analysis & publication of Chukchi Sea seal results
- Analysis & publication of Chukchi Sea polar bear results (North Pacific Research Board)

Lessons learned

- Although this project was mostly funded by the U.S., it would not have been possible to complete unilaterally
- Bering Strait is narrow but it represents a broad gulf of challenges posed by differences in predictability and cost of key logistical resources, rules for sharing data, ways of moving money, and permitting
- A person (organization?) with ‘one foot planted’ on each side of Bering Strait seems vital for these collaborations