Science, Service, Stewardship

Gray Seals (*Halichoerus grypus atlantica*) in the Northwest Atlantic

Kimberly Murray, Protected Species Branch

with contributions from the North Atlantic Seal Research Consortium (NASRC) community

NOAA FISHERIES SERVICE

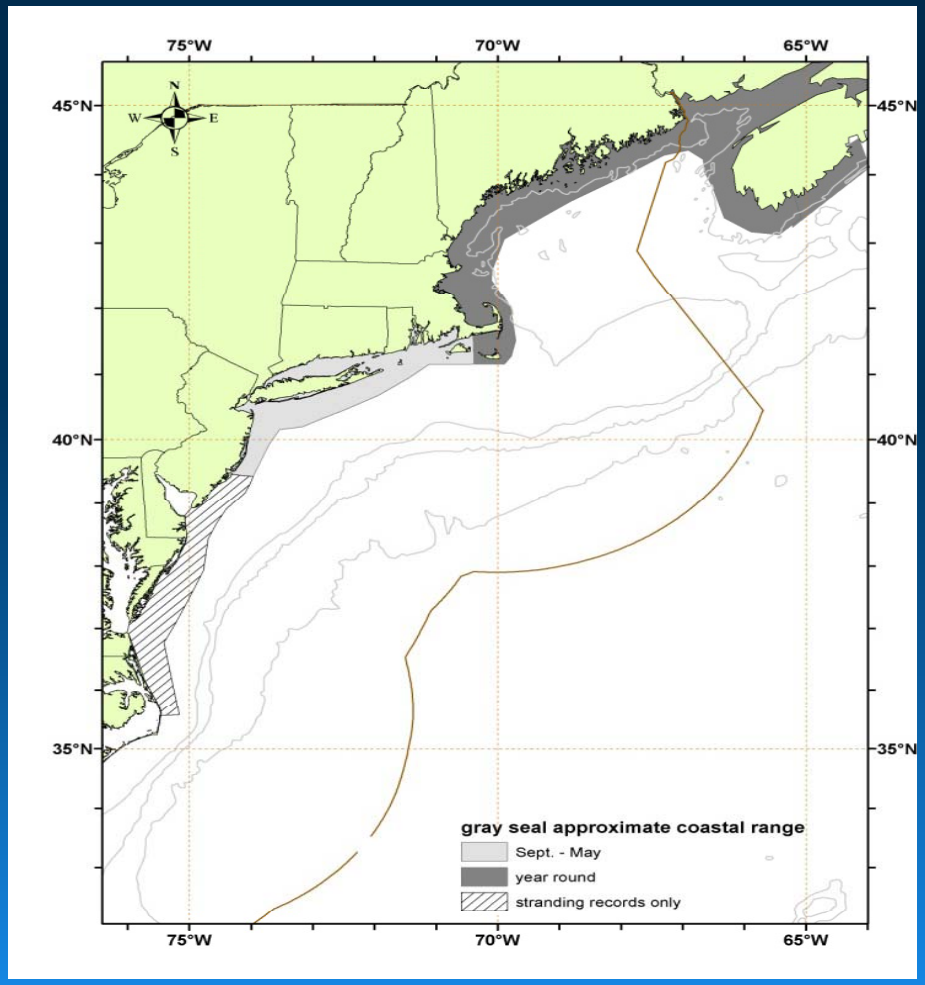
Marine Mammal Commission Annual Meeting, 6 April 2017

Overview of Presentation

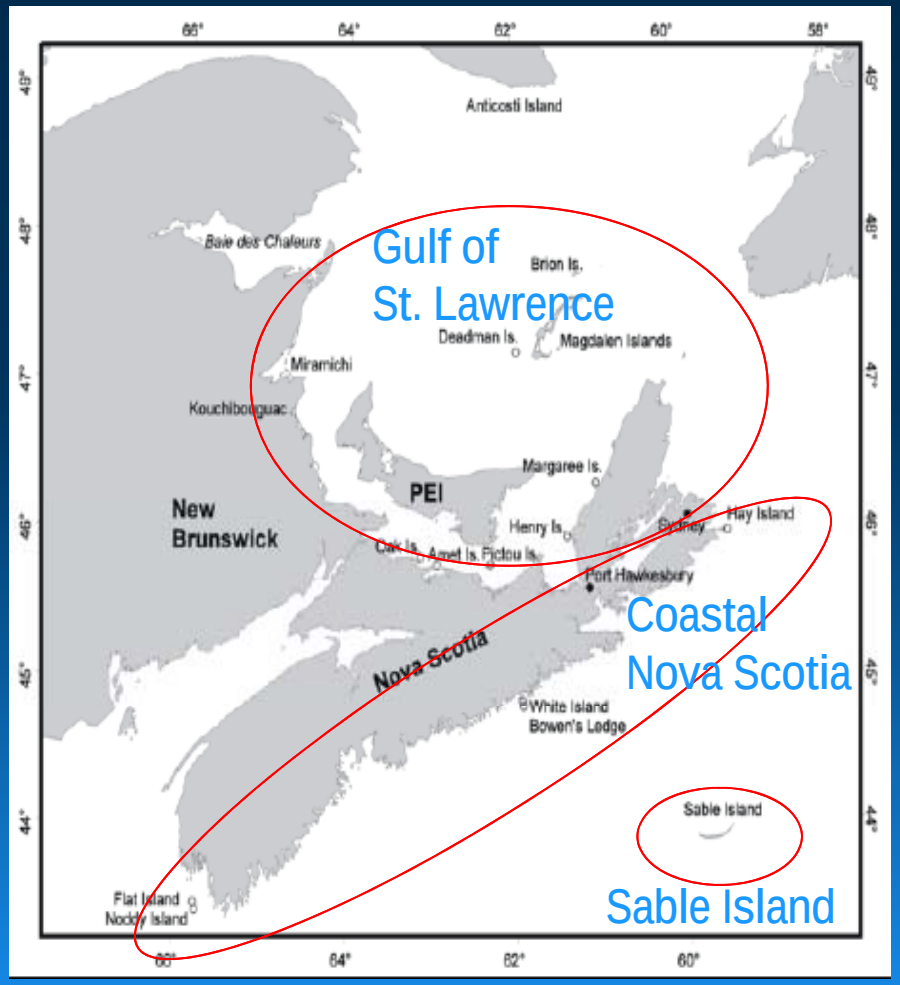
- Stock Definition
- Abundance and Trends
- Distribution and Movements
- Diet

Northwest Atlantic Stock Definition

US/Canada



Canada



Gray Seals in U.S. and Canada – Same Stock

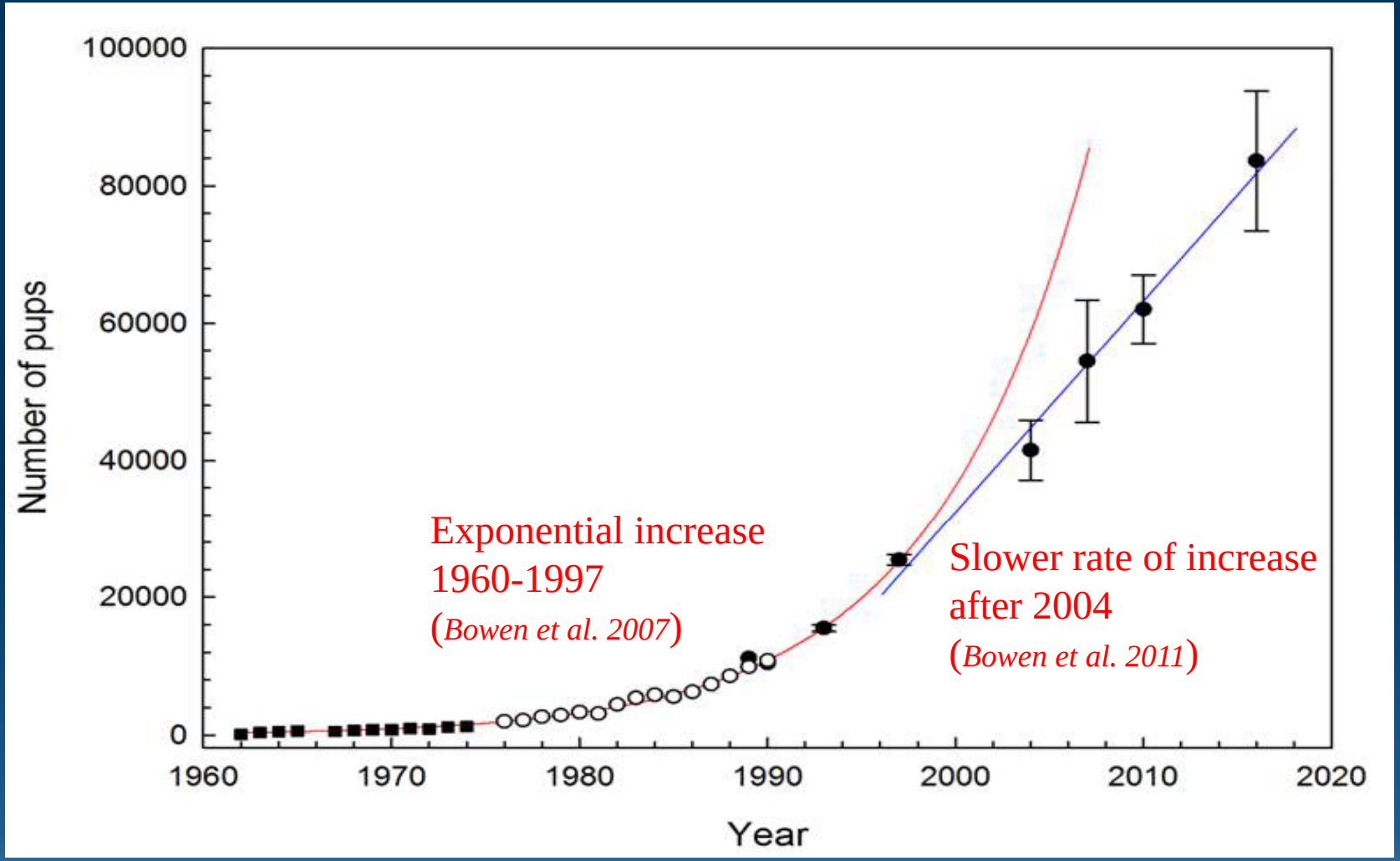
- "Based on mtDNA haplotypes, no significant difference was found between the Sable Island and Gulf of St Lawrence populations, or the Canadian and the US populations" (Wood et al. 2011)

- Lack of genetic differences among animals from U.S. and Canada corroborated by other research (Bostovic et al. 1996, Cammen et al. in review)

MMPA Stock Definition

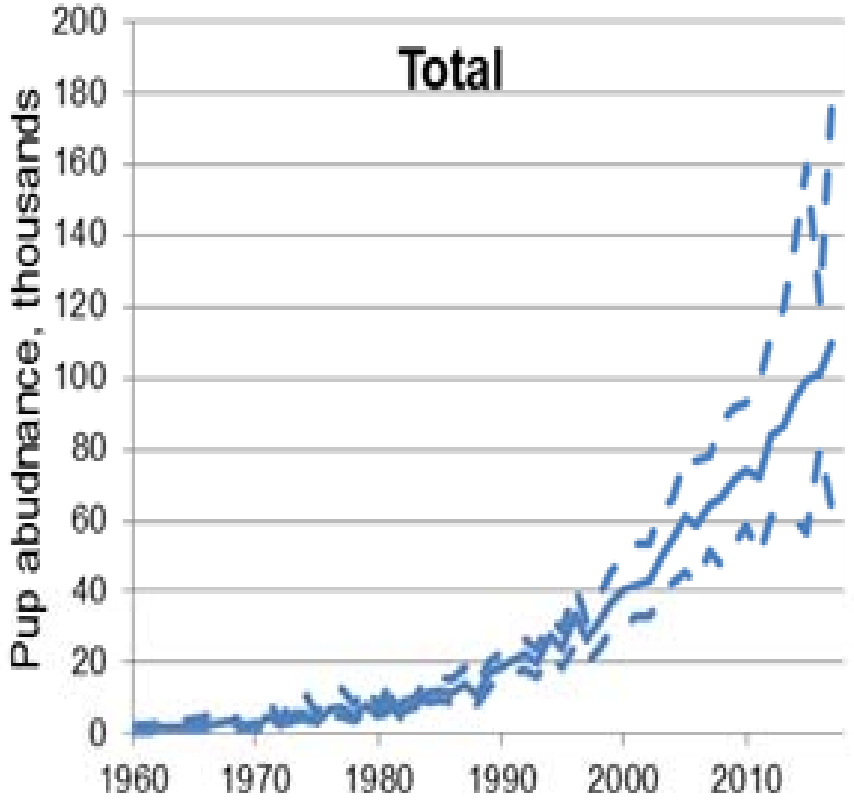
- "For the purposes of management under the MMPA, a stock is recognized as a demographically independent biological population"
- Movement data, sightings of branded animals, and observed pup counts provide evidence that gray seals in Canada are supplementing U.S. gray seal population
- Therefore, seals in U.S. NOT demographically independent

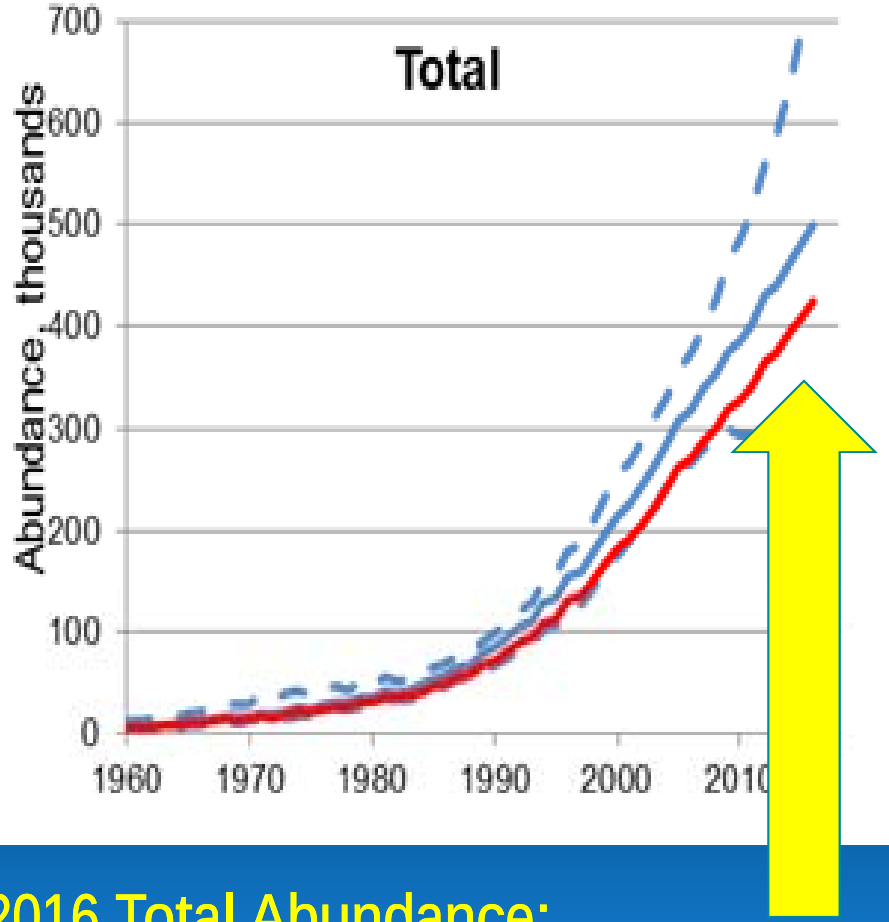
Pup Production – Sable Island, Canada



From: den Heyer, C.E., S.L.C. Lang, W.D. Bowen, and M.O. Hammill. 2016. Pup Production at Scotian Shelf Grey Seal (Halichoerus grypus) Colonies in 2016. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/nnn. vi + xx p.

Trends in Abundance - Canada





DFO, 2016. in press. Stock assessment of Canadian grey seals (*Halichoerus grypus*). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep.

2016 Total Abundance:
424,300 (95% CI: 263,000 – 578,300)

UAS Pup Surveys of Muskeget

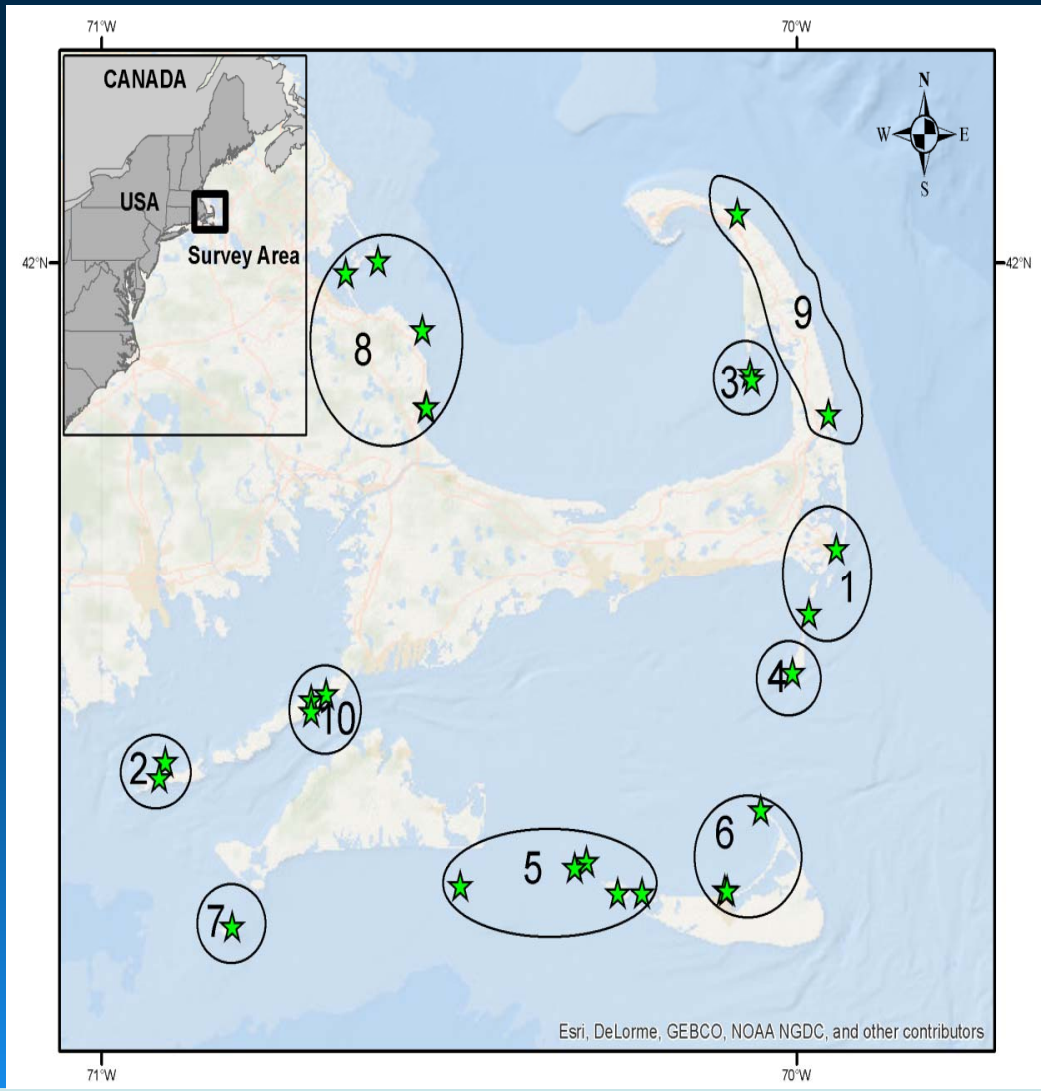
Johnston, D.W. et al. in prep. A comparison of manned and unmanned aircrafts for surveying wildlife populations: a case study of gray seals on Muskeget Island, USA

Goals:

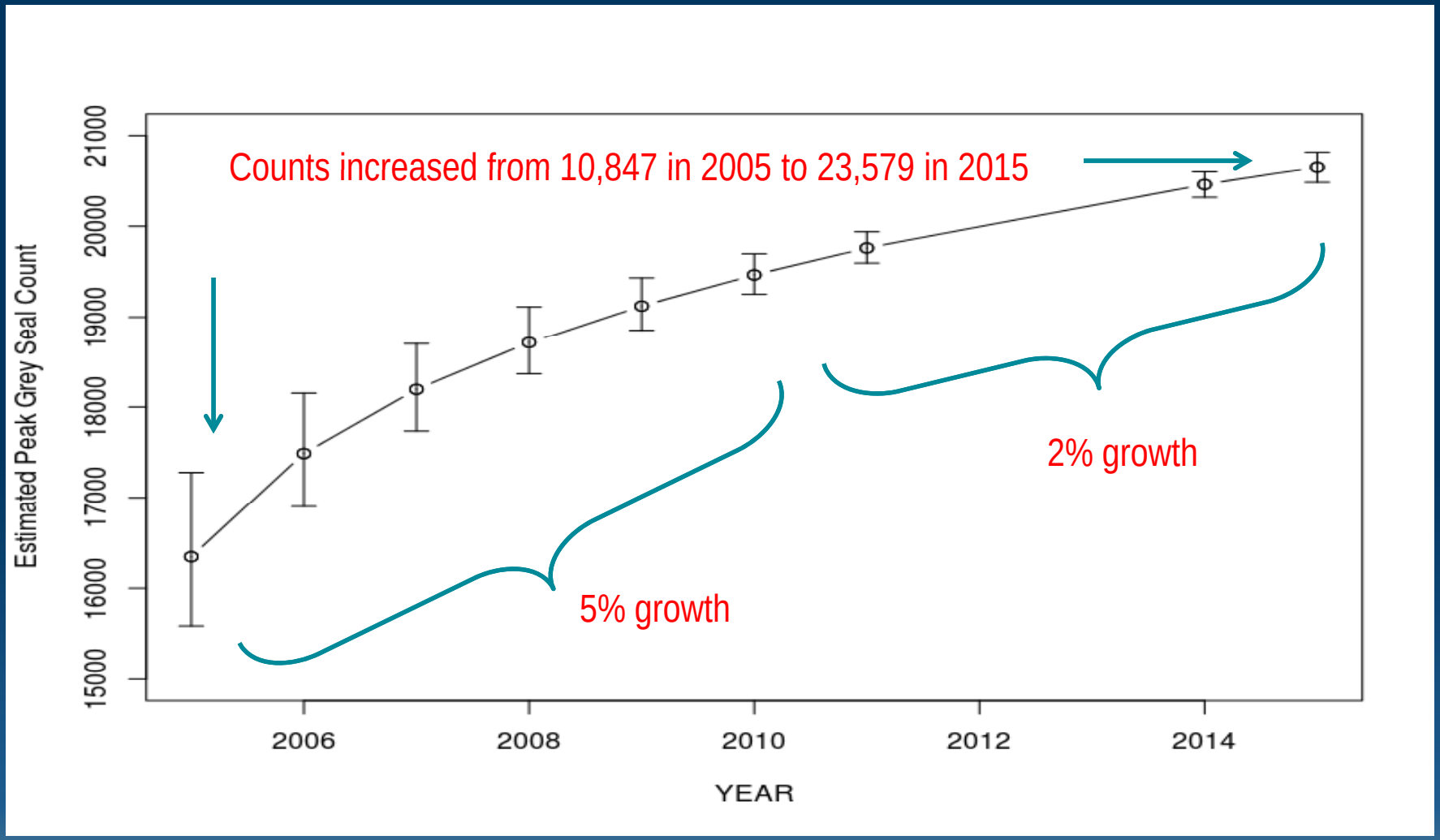
- To survey the density of pups
- To collect information on individual animal characteristics

Gray Seal Aerial Surveys 2005-2015

- 78 surveys conducted throughout seasons, across haul-out sites on Cape & Islands
- Data used to characterize within and among year trends in abundance, and spatial distribution of seasonal haul-outs



Localized Trend in Abundance – Massachusetts



Pace et al. *in revision*. Trends and patterns of seal abundance at haul-out sites in a gray seal recolonization zone.

Key Sources of Uncertainty

- Portion of the NWA stock that is in U.S. waters is unknown
- Lack of information on proportion of animals in water during surveys

- Lack of information on life history parameters (age-specific reproductive and survival rates) obscures insights into population growth and estimates of carrying capacity

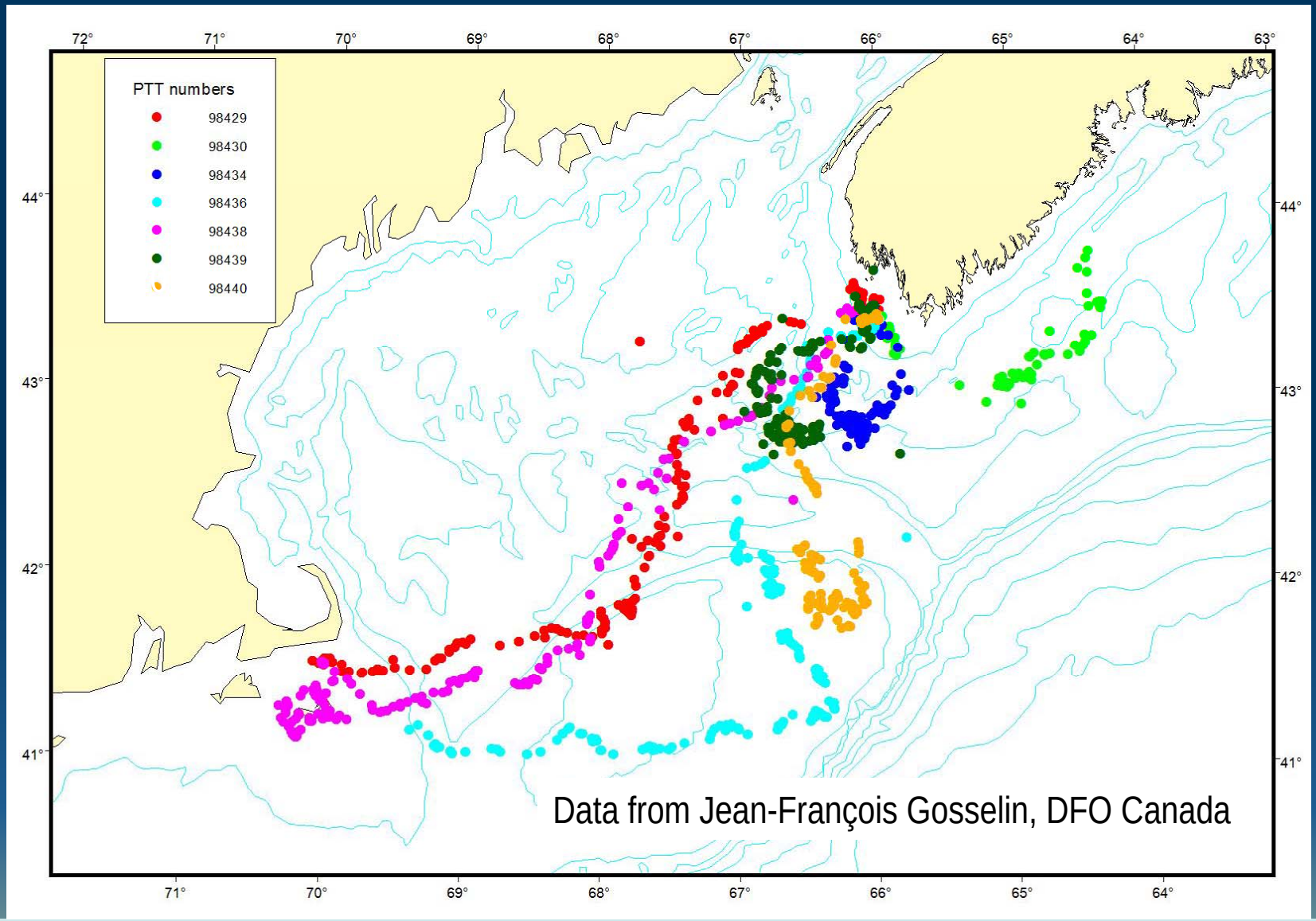
Resources Needed to Address Uncertainty

- For short-term abundance estimate: Aerial survey combined with radio tagging $$$$
- Survey platforms, boats, staffing, collaborative support
- For longer-term, population dynamics research: Safe marking techniques, sustained funding to monitor vital rates over time

Movements and Distribution

Photo credit: NOAA/NEFSC/Allison Henry

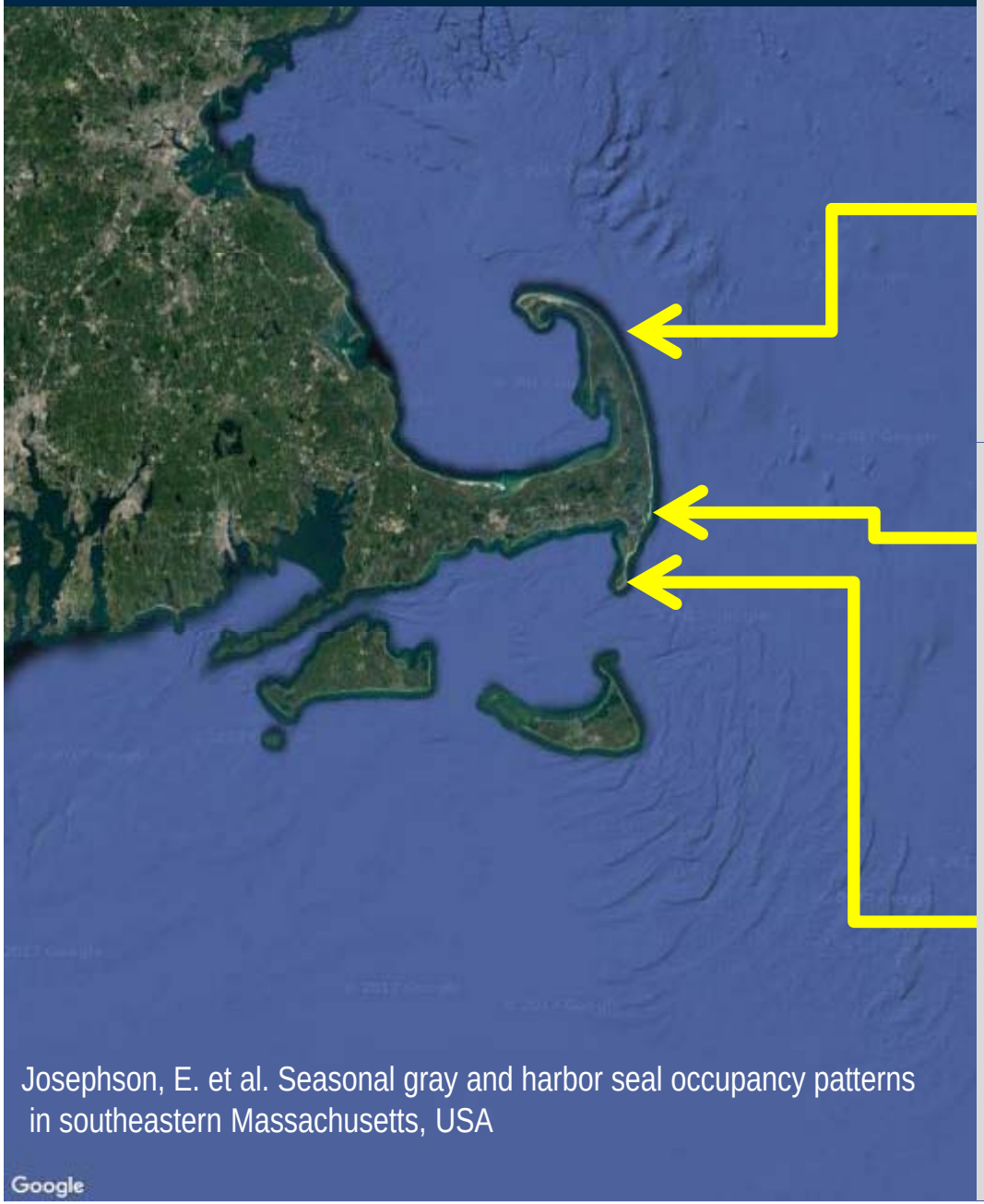
Transboundary Movements



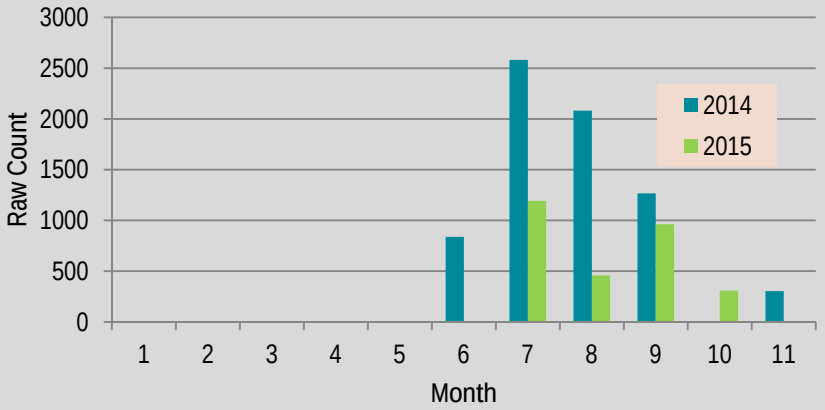
Sable Island Seals – Residents in U.S?

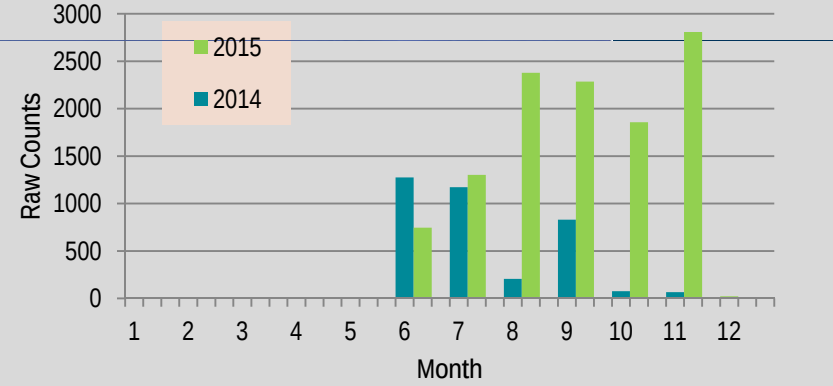
photo credit: Jim Thomason

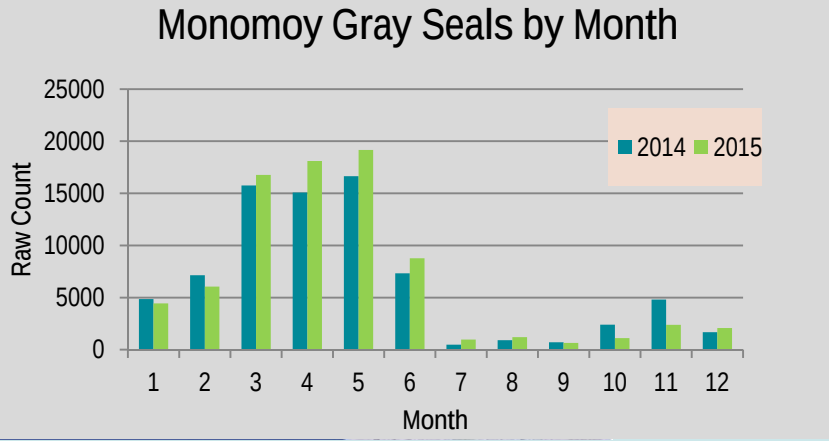
Seasonal Redistributions



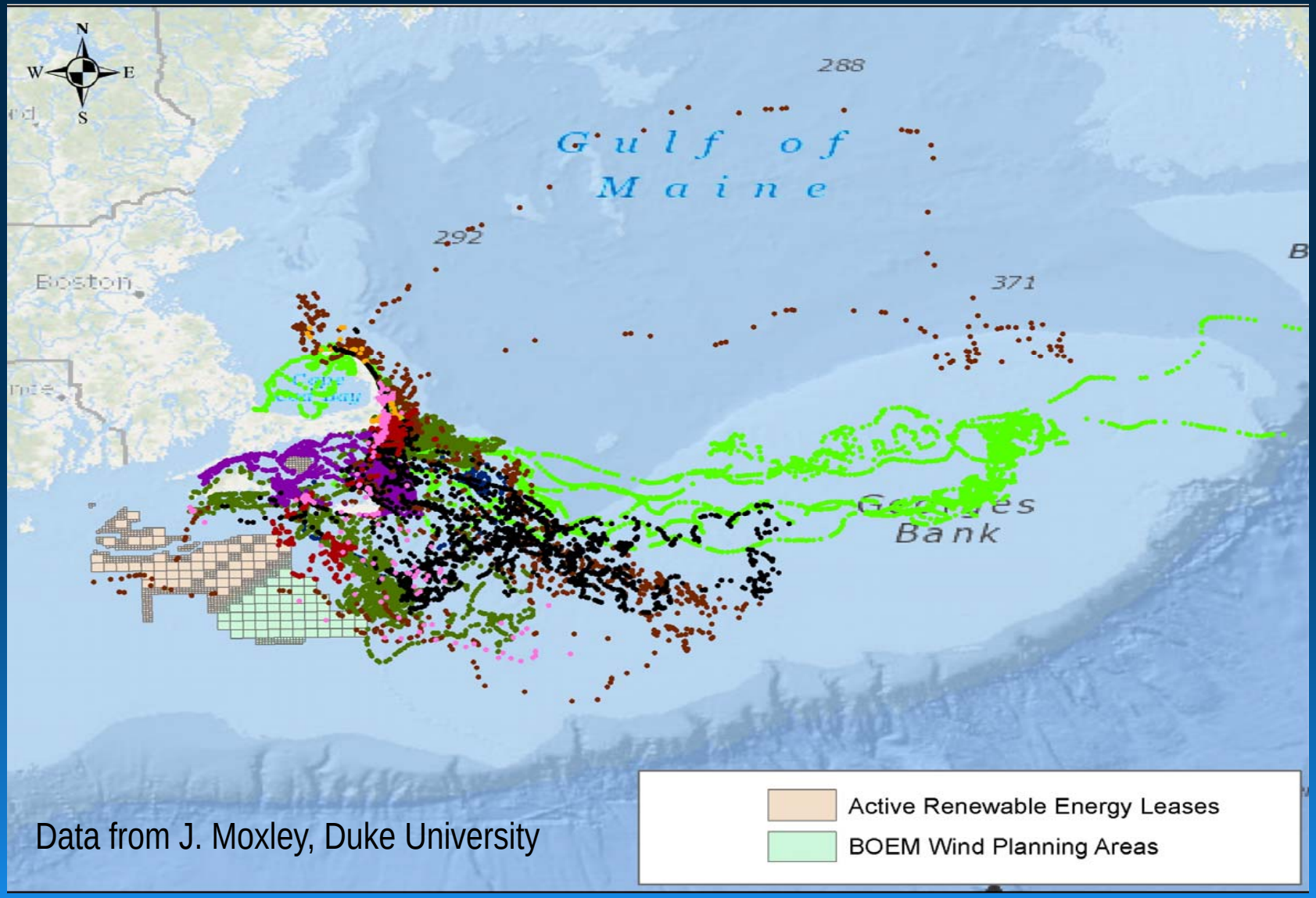
Josephson, E. et al. Seasonal gray and harbor seal occupancy patterns in southeastern Massachusetts, USA







Gray Seal Movements off Cape Cod



Data from J. Moxley, Duke University

Key Sources of Uncertainty

- Immigration & Emigration rates from/to Canadian waters

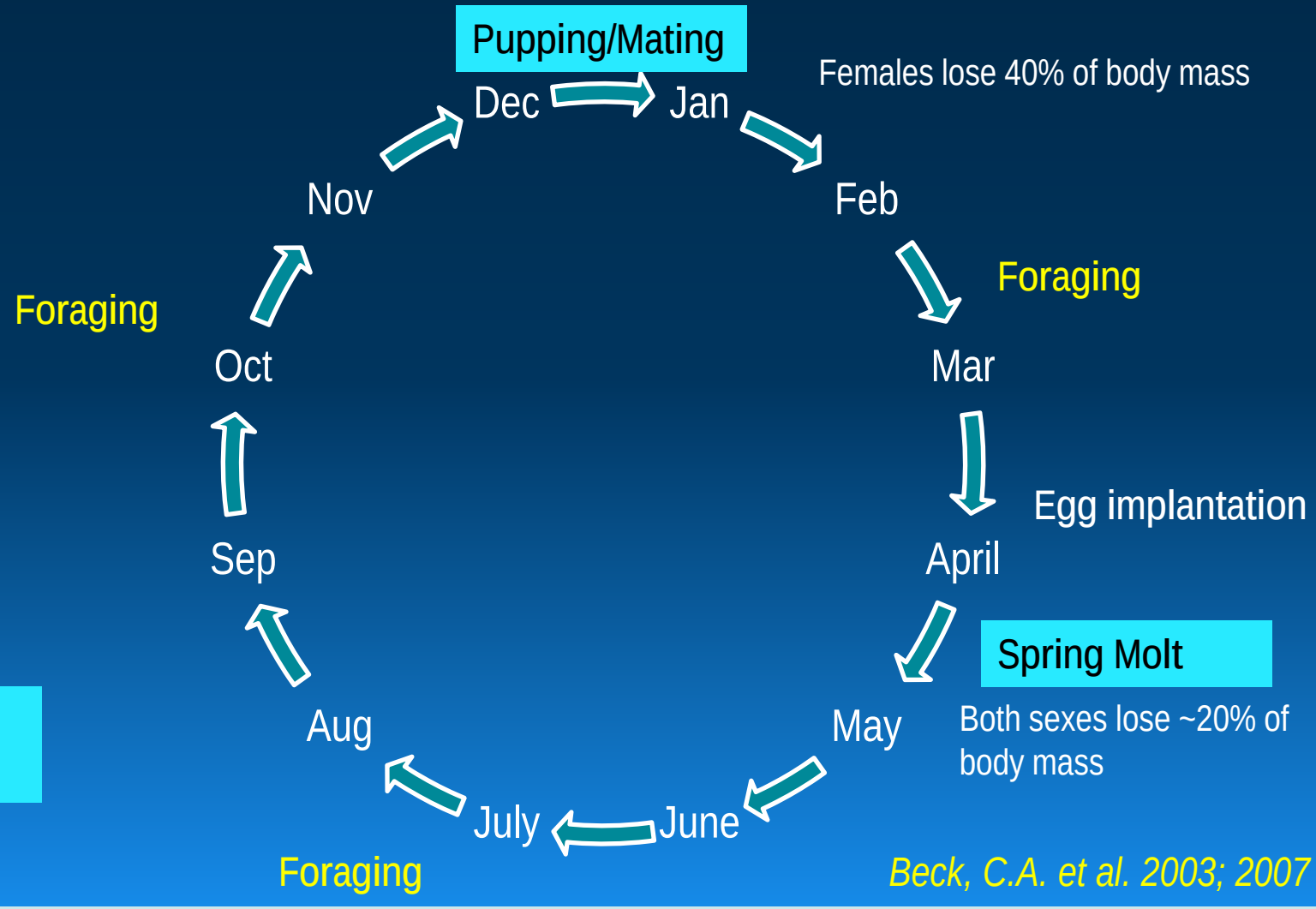
- Seasonal occupancy patterns of male and female adults and juveniles in foraging areas

Resources Needed to Address Uncertainty

- For study of movements via satellite tagged animals: $$$
- For study of movements via acoustic Vemco tagged animals: $$
- Boats, staffing, collaborative support

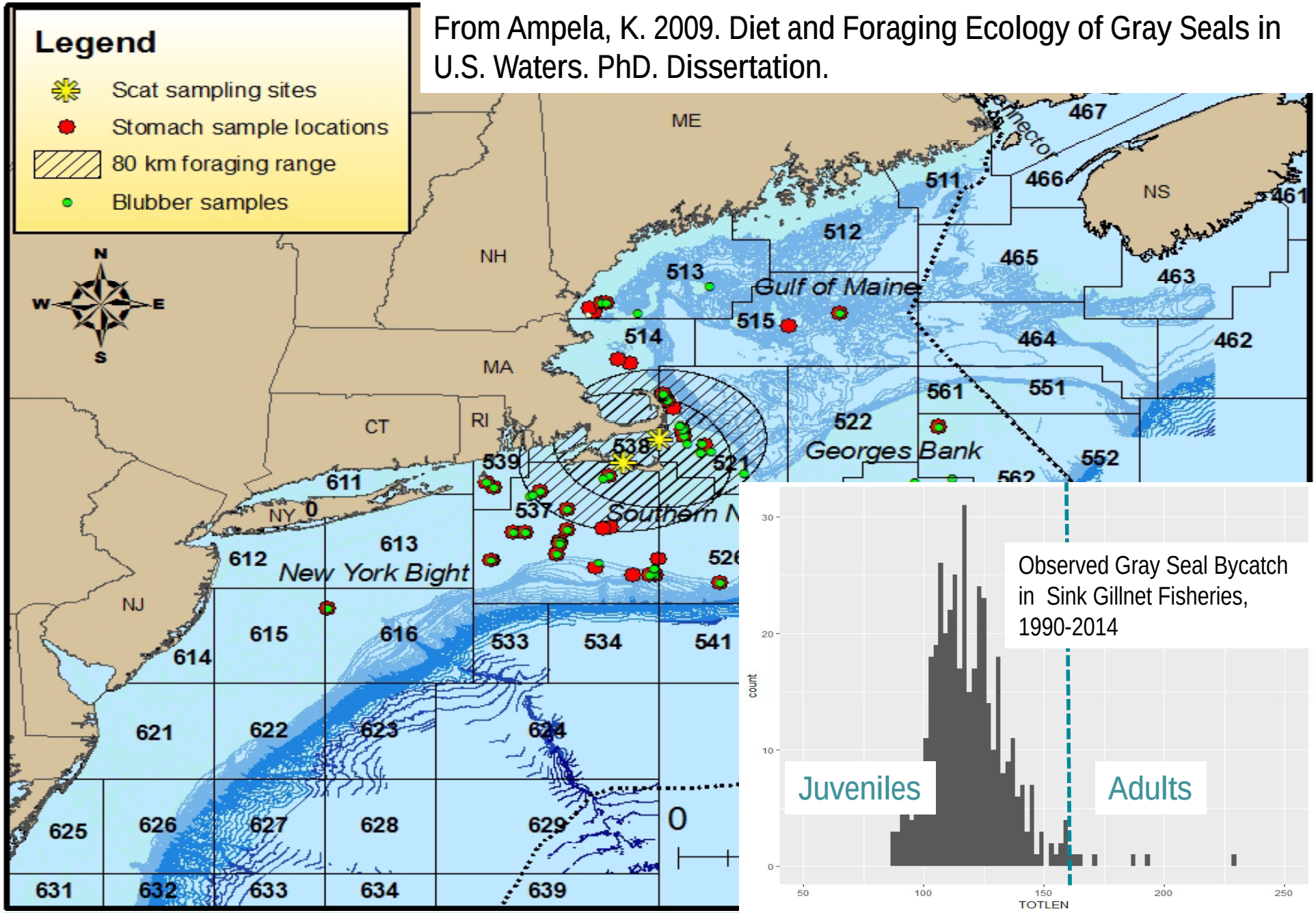
Diet and Foraging Behavior

Gray Seal Annual Cycle

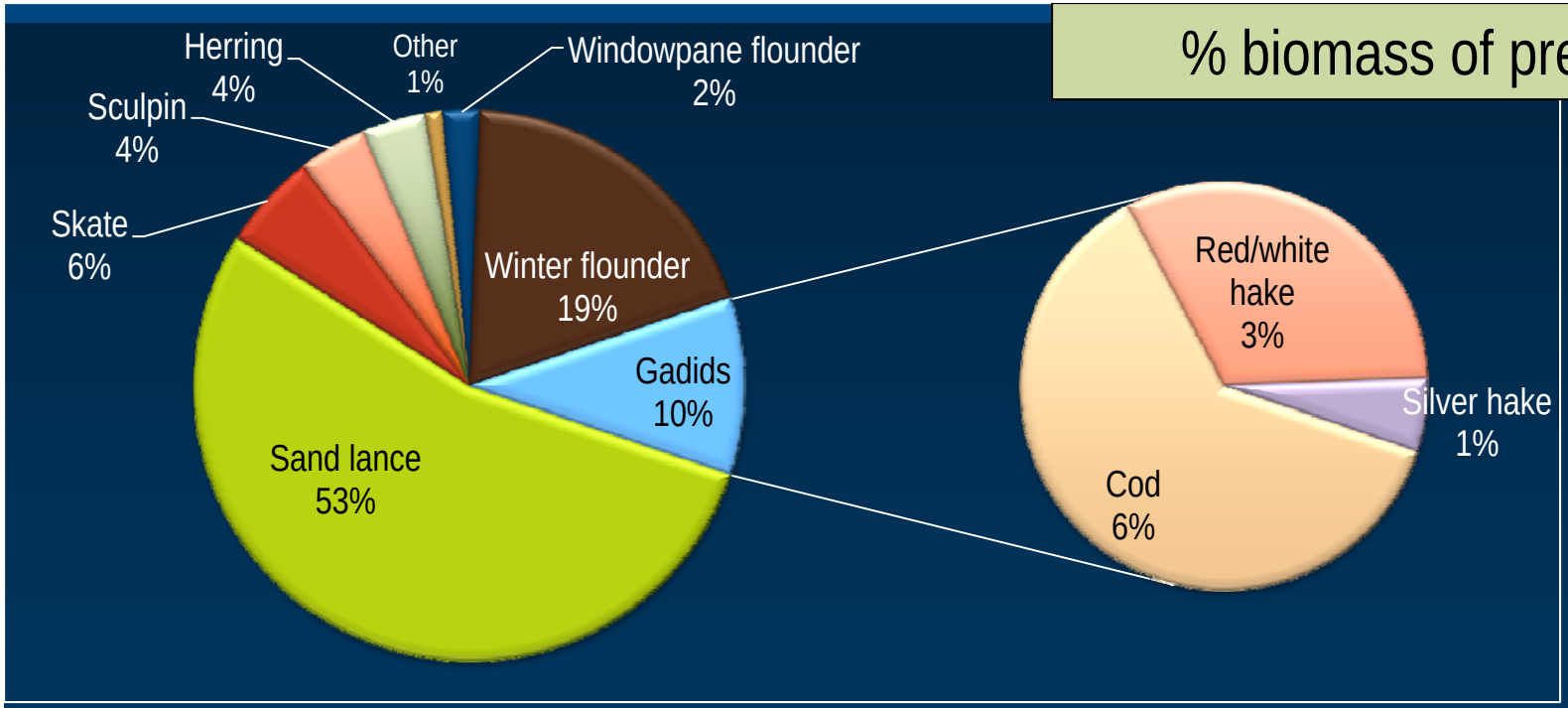


Beck, C.A. et al. 2003; 2007

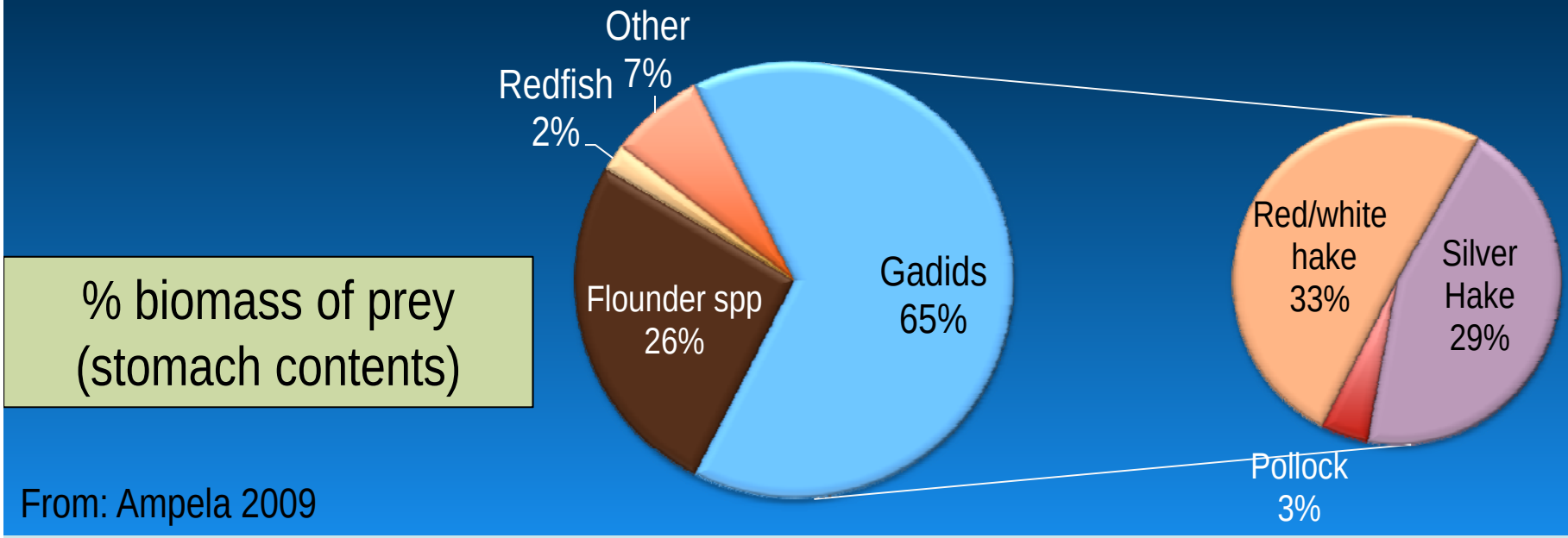
From Ampela, K. 2009. Diet and Foraging Ecology of Gray Seals in U.S. Waters. PhD. Dissertation.



% biomass of prey (scats)

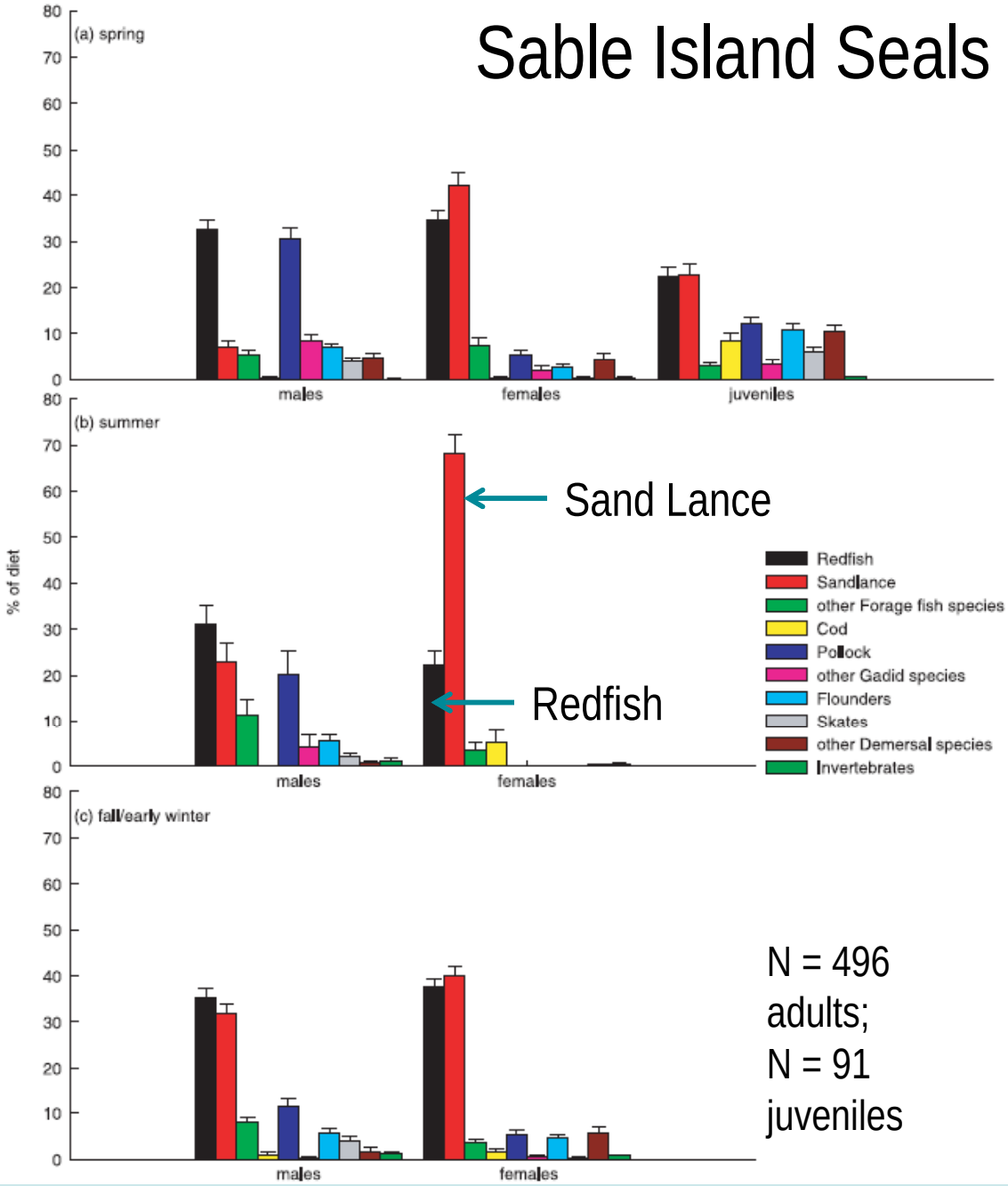


% biomass of prey (stomach contents)



From: Ampela 2009

Sable Island Seals



N = 496 adults; N = 91 juveniles

- Diet composition varies across sex and age
- Adult diet dominated by sand lance and redfish

From Beck et al. 2007 *Journal of Animal Ecology* 76, 490–502

Collaborative Diet Work

- Fatty Acids
- Fecal (hard parts)
- Stomach Contents (hard parts)
- Stable Isotope
- DNA

Investigating Seal Diet on Cape Cod: One Scat at a Time

Phase 1: Monthly Scat Collection and Hard Part Analysis

Phase 2: Prey DNA and Stable Isotope Analysis

- Build prey DNA database
- Compare prey DNA and stable isotope to hard parts found in scat
- Determine seal species and sex from scats using DNA

PSB Quantitative Fatty Acid Research

Develop FA prey library for U.S. waters

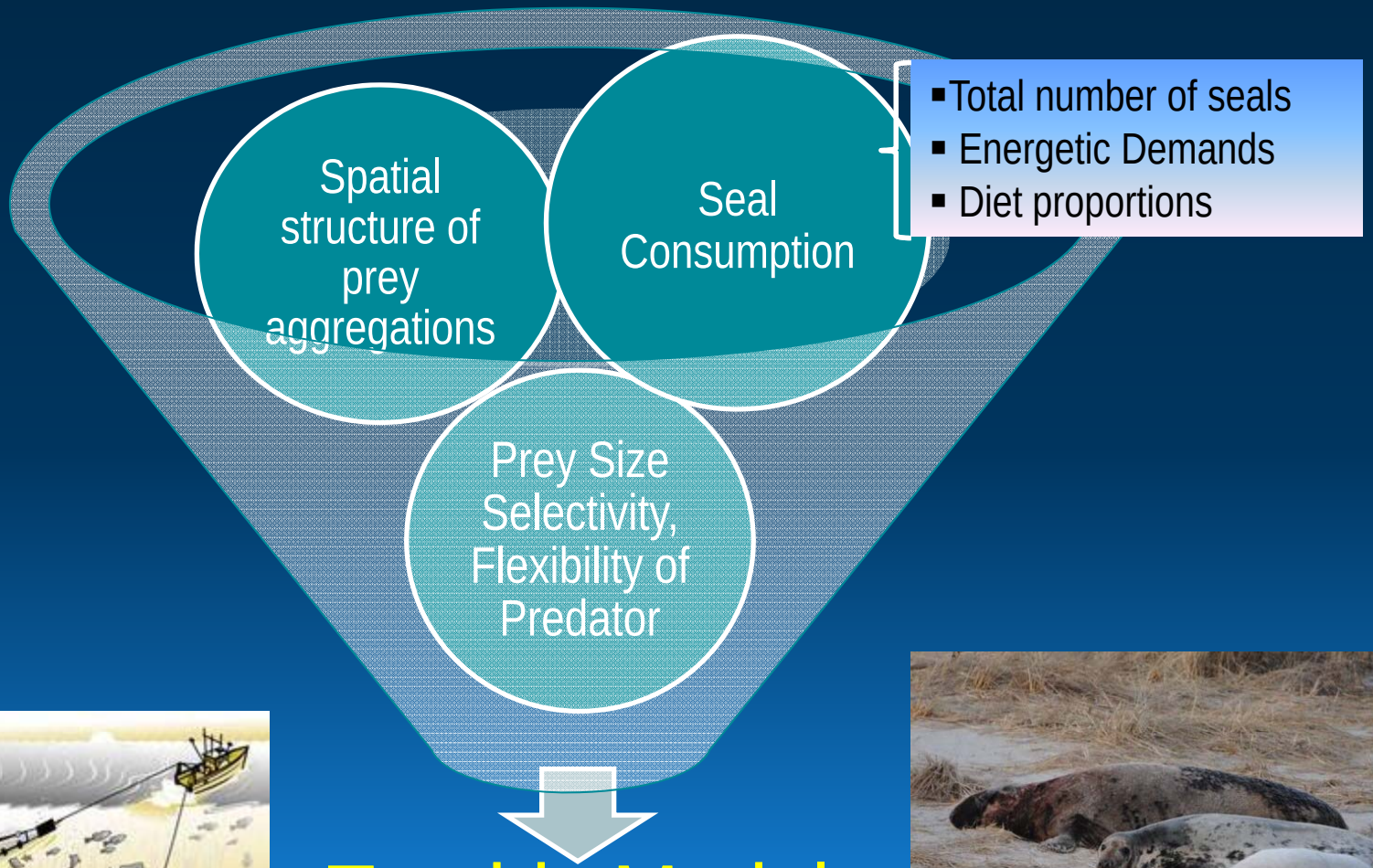
Analyze FA samples in predator and prey

Input to Consumption Models

Depredation?

Competition?

Can We Understand Trophic Impacts?



Resources Needed to Address Uncertainty

- Resources needed to estimate total abundance
- Resources needed to tag seals to understand seasonal residency patterns
- Resources needed to estimate diet using multiple methods, from animals of all ages and foraging areas

As they ponder their next move in response to the election of Trump, science organizations — universities, funders, supporters and the rest — should look harder at social problems and opportunities, and seek ways for science to help.

- *in* "Beyond the Science Bubble", *Nature*, 23 February 2017


Thank you!