# Movements and Dive Behavior of Ribbon and Spotted Seals: Evidence for Resource Partitioning in the Bering Sea

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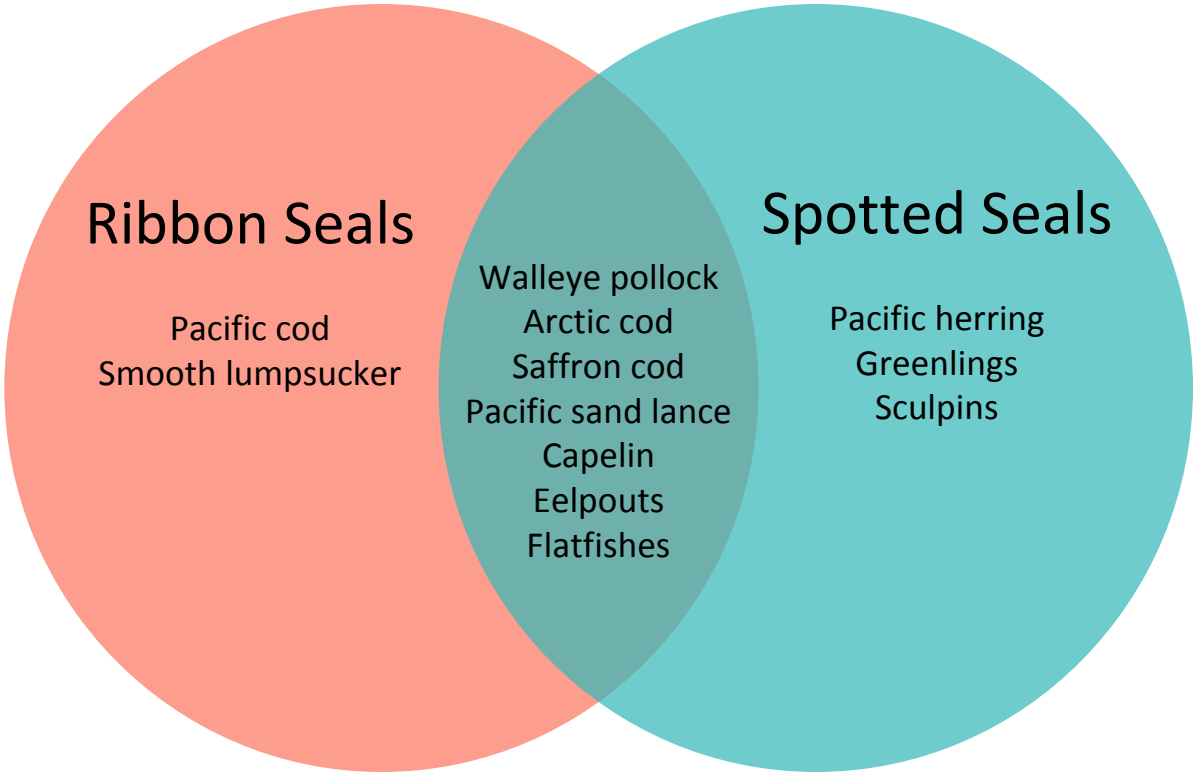
# Similarity of Major Prey for Ribbon and Spotted Seals



# More Evidence for Similarity in Diets

## FATTY ACIDS

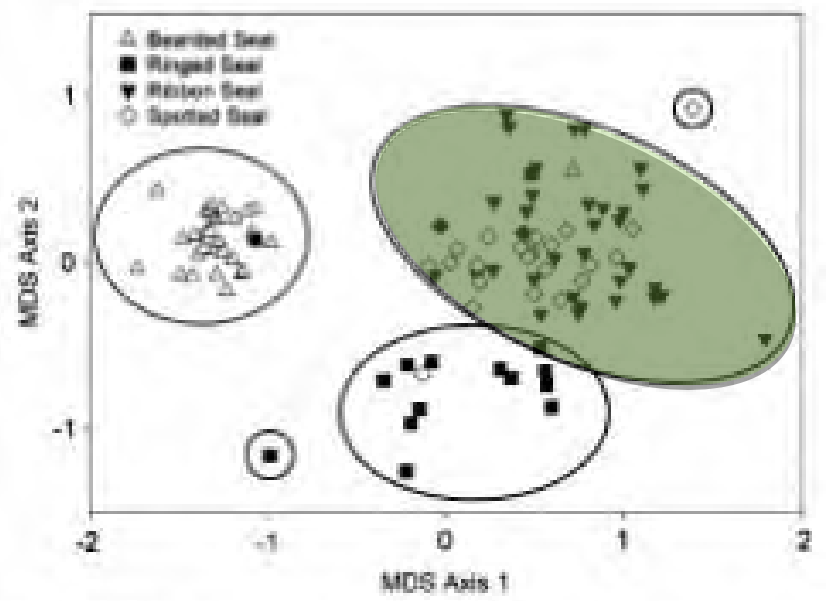



Fig. 1 MDS ordination of blubber FA composition from four species of ice-associated seals (2D Stress of 0.1). Groupings of 90% similarity (*black lines*), based on cluster analysis, are superimposed to verify adequacy of ordination results

Dehn *et al.*, Polar Biol (2007) 30:167–181

## STABLE ISOTOPES

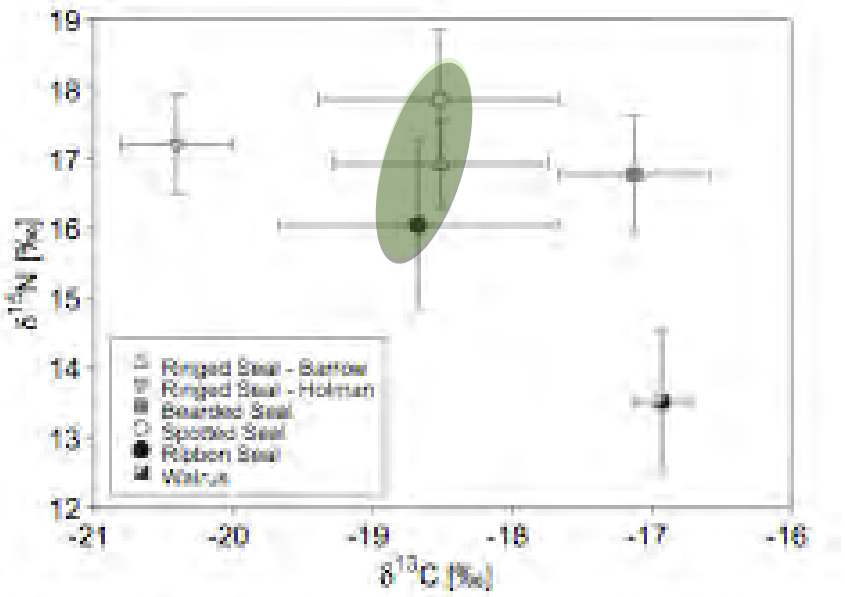
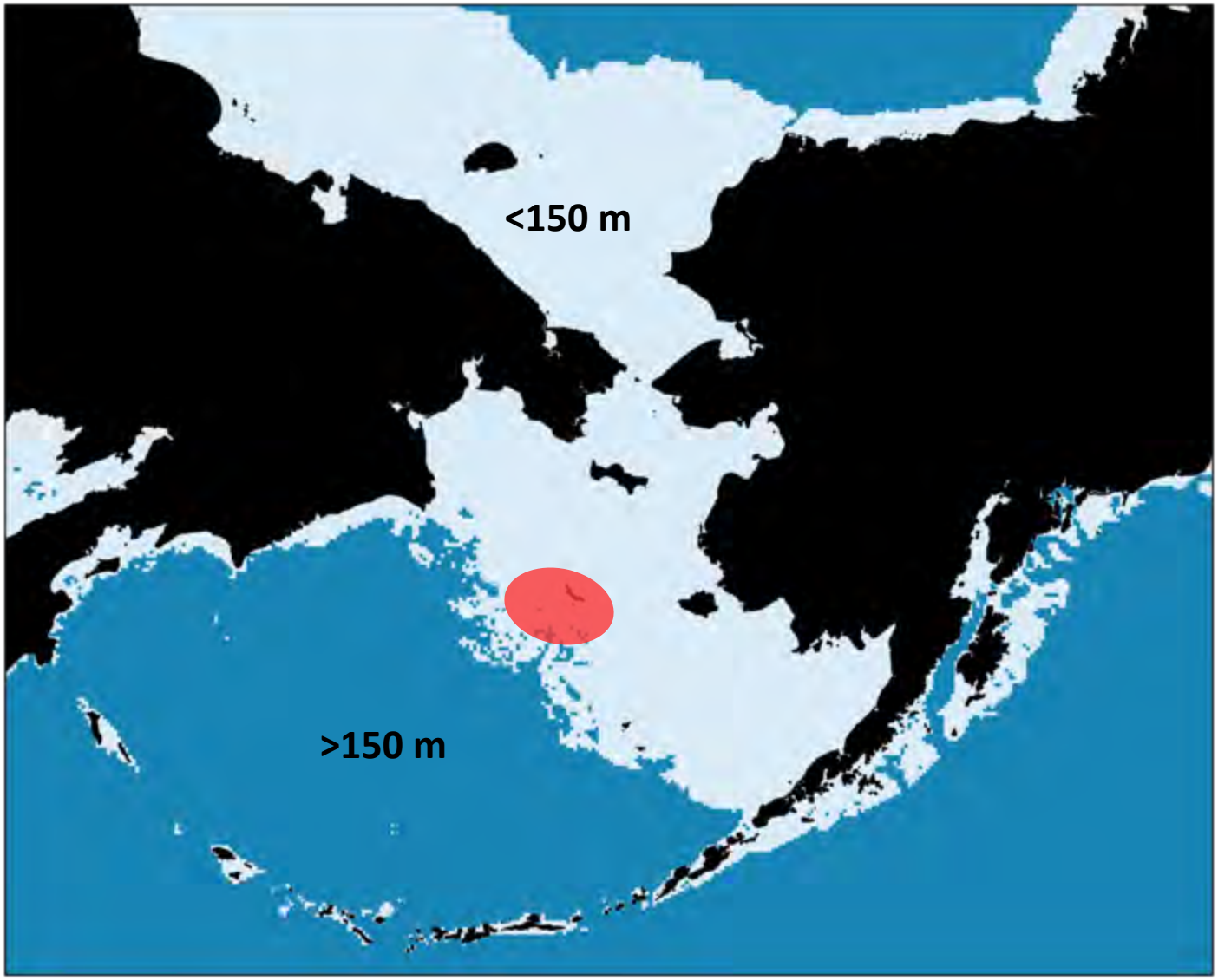



Fig. 2 $\delta^{13}C$ versus $\delta^{15}N$ of ringed seals harvested in Alaska and Canada, and bearded, ribbon and spotted seals, 1996–2003 and walrus 1998 and 2003 from Alaska. *Symbols* present the mean values and *error bars* show the standard deviations (± 1 SD)

Cooper *et al.*, Polar Biol (2009) 32:1137–1145



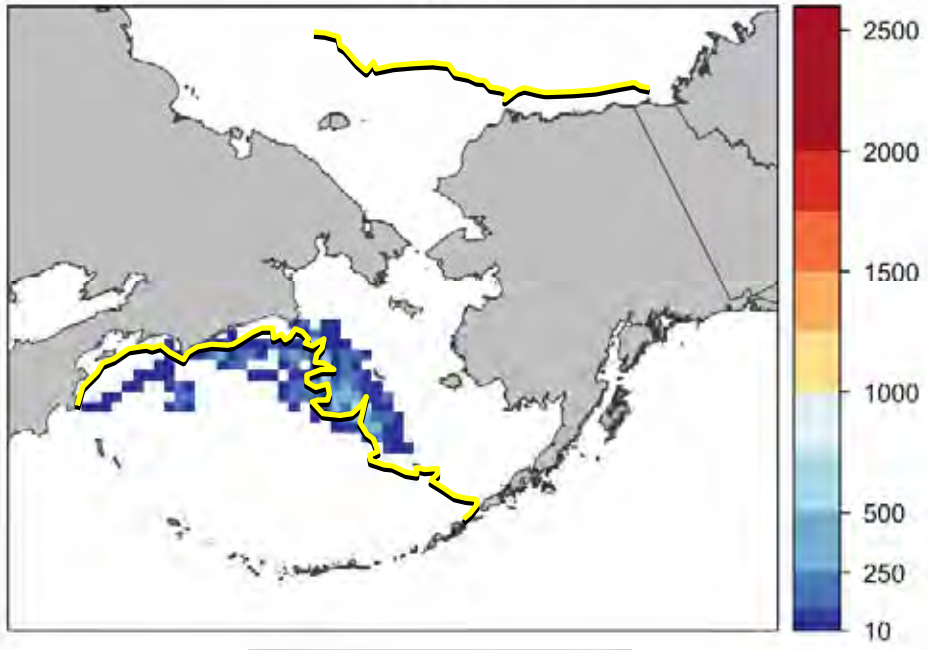

139 Ribbon and spotted seals tagged with satellite trackers and dive recorders, 2007-2010

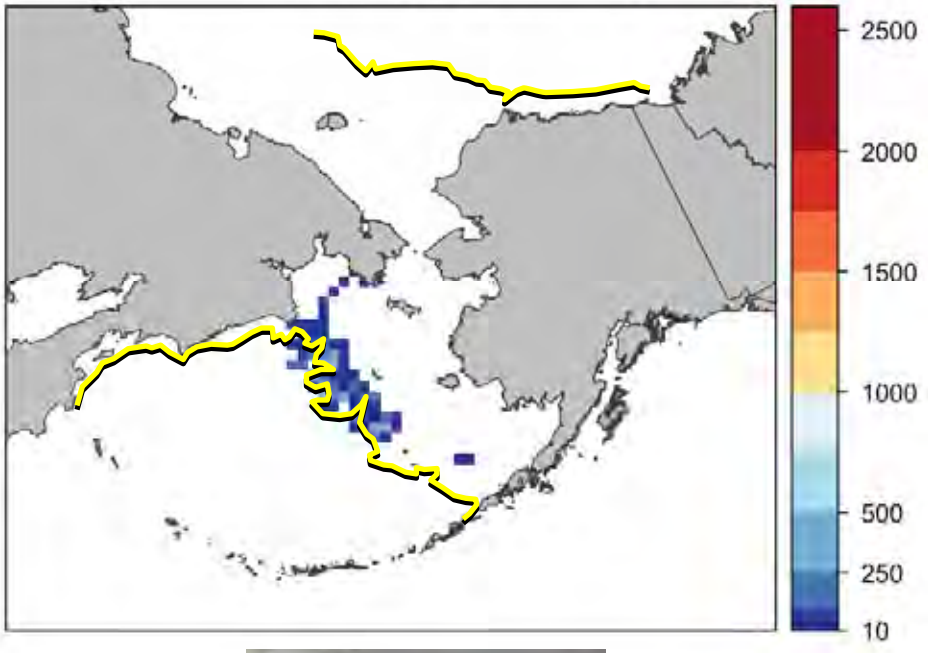
- **Do movements and foraging behaviors reveal any clues about how these similar species have coexisted?**

- **Do movements and foraging behaviors provide any hints about how these species may respond to a warming climate and diminished seasonal ice cover?**

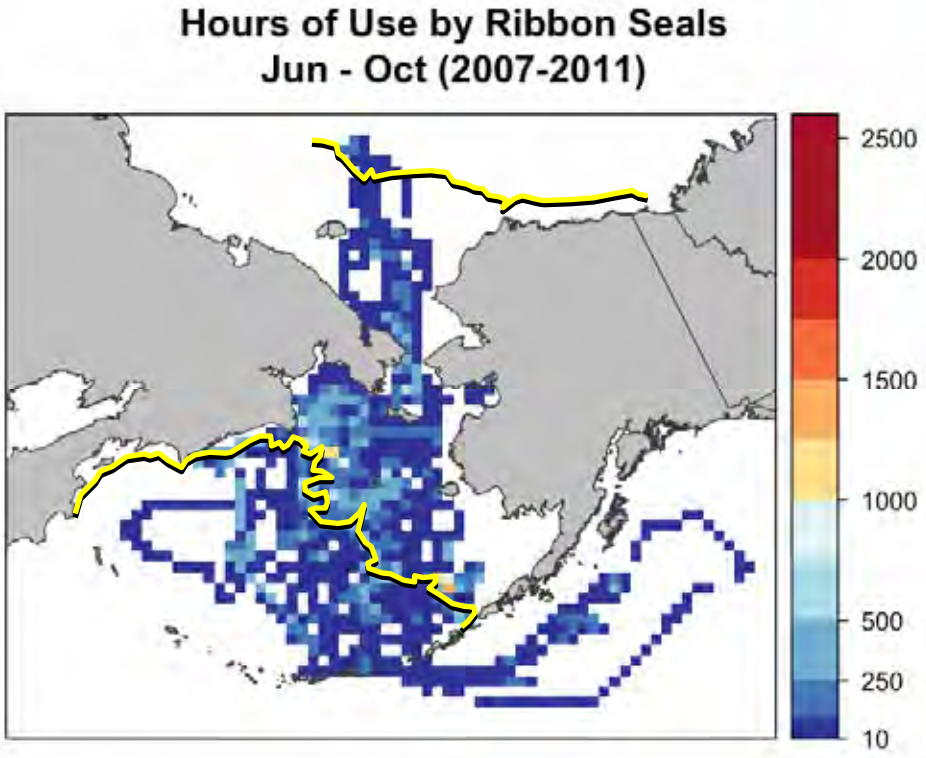
- **We examined recent data from our satellite telemetry studies for evidence of spatial and temporal separation that may reflect adaptations for partitioning of a shared prey assemblage**

# Ice-associated Period
# BREEDING

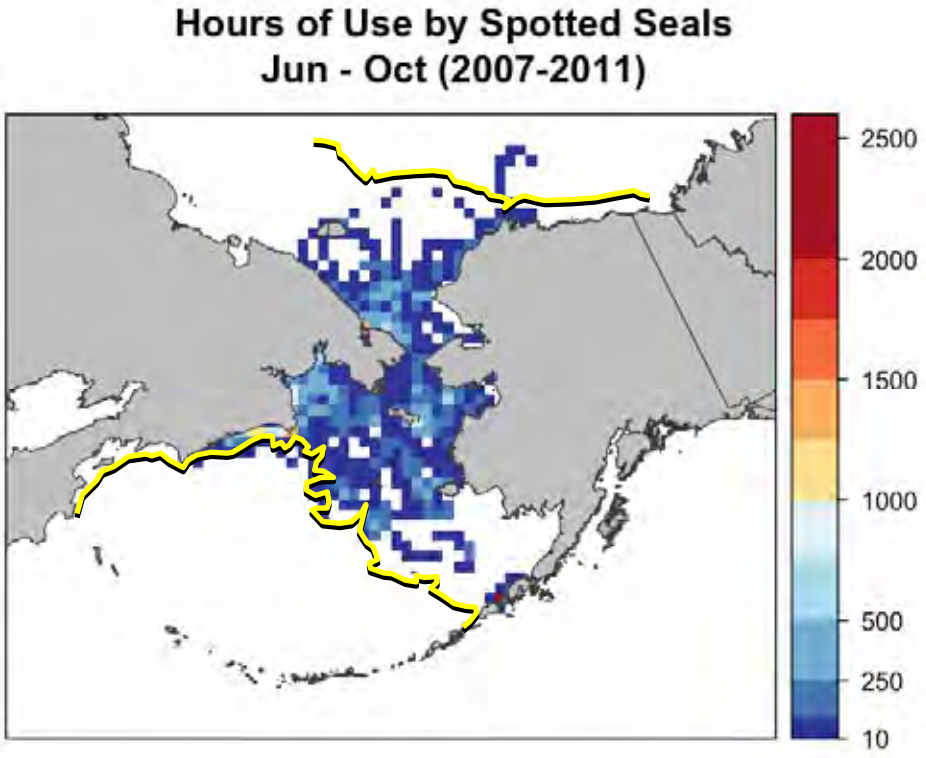



# Non-ice-associated Period

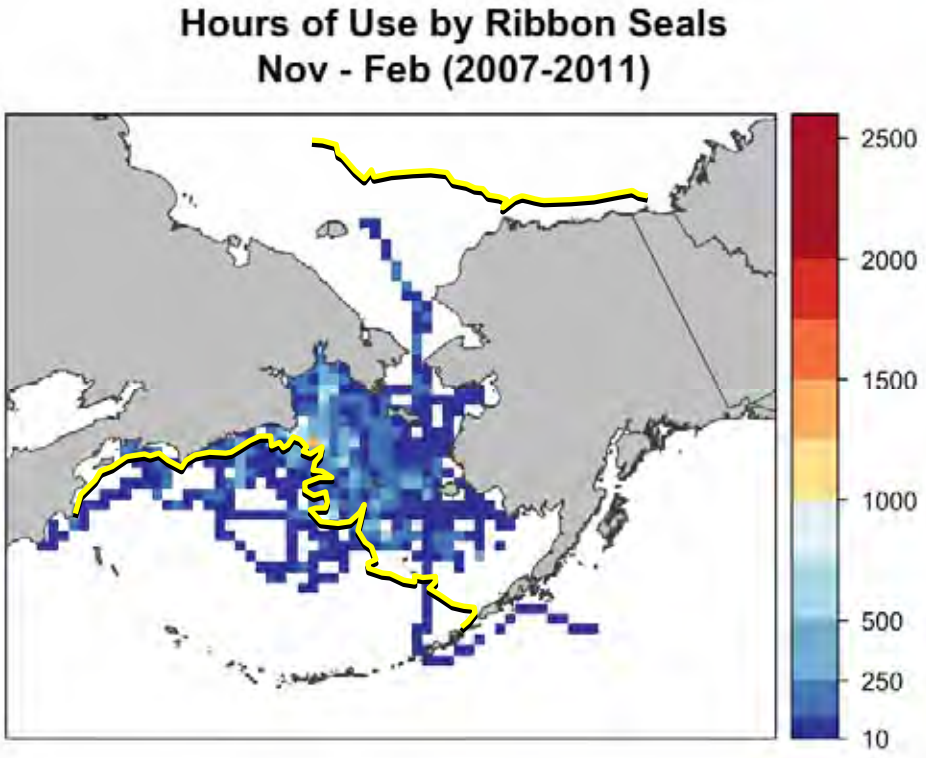


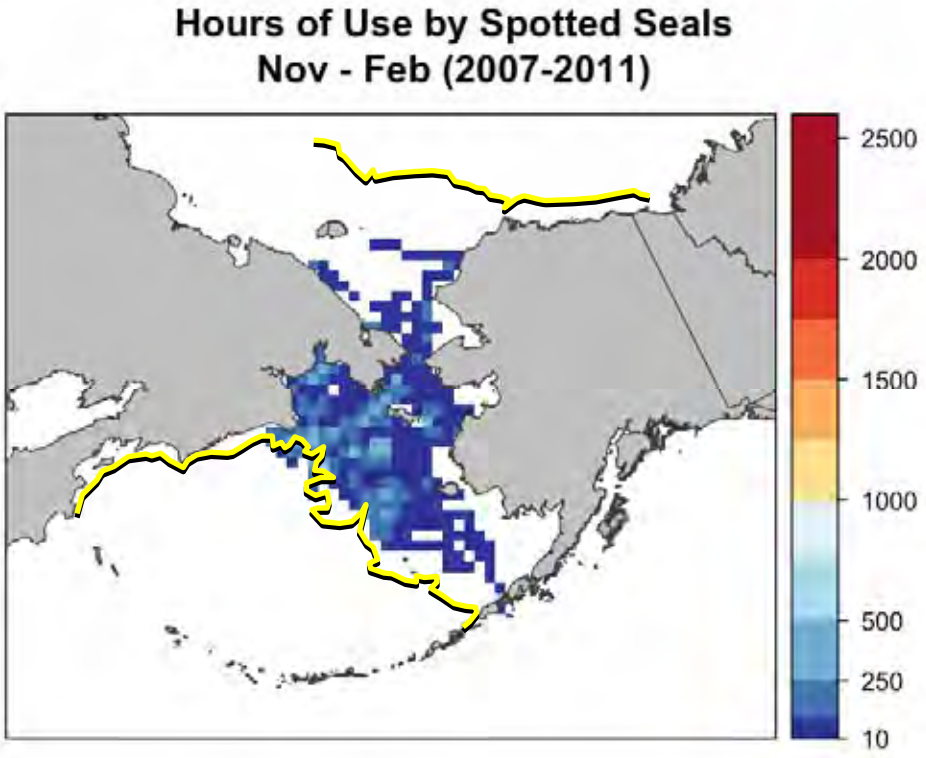

- Remain offshore
- Large portion of time off-shelf and near shelf break




- Move onshore
- Negligible portion of time off-shelf

# Ice-associated Period
# NON-BREEDING

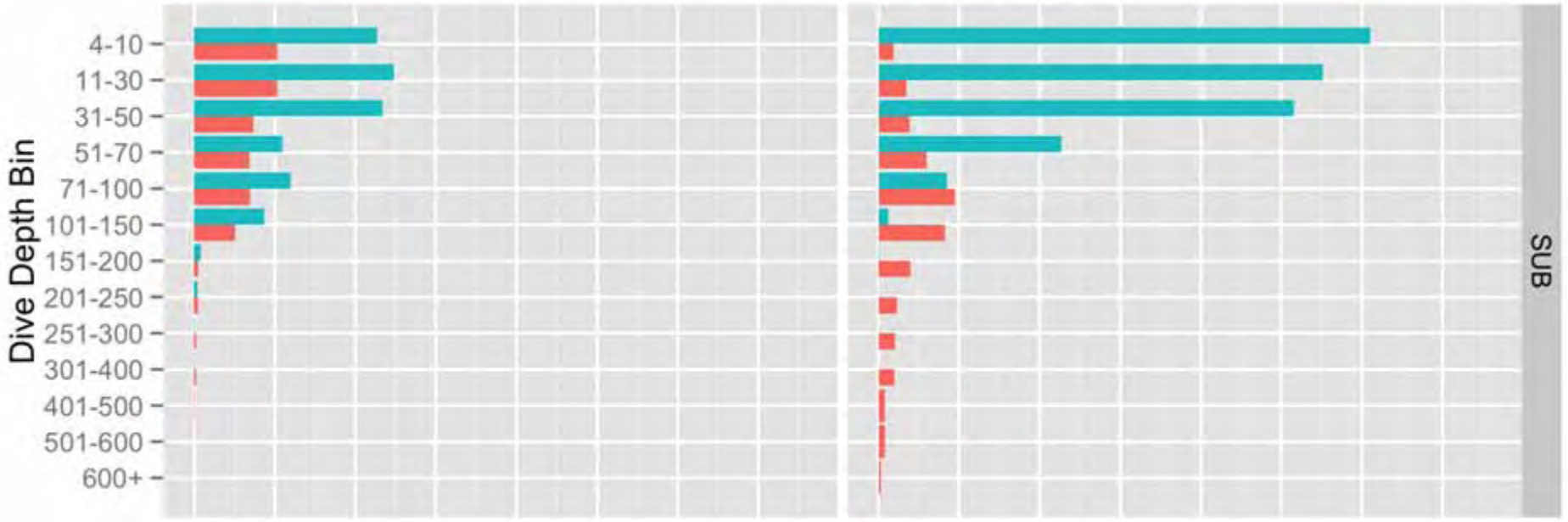


# Depth of Dives

**Ice-associated Period**
**November - May**

**Non-ice-associated Period**
**June – October**



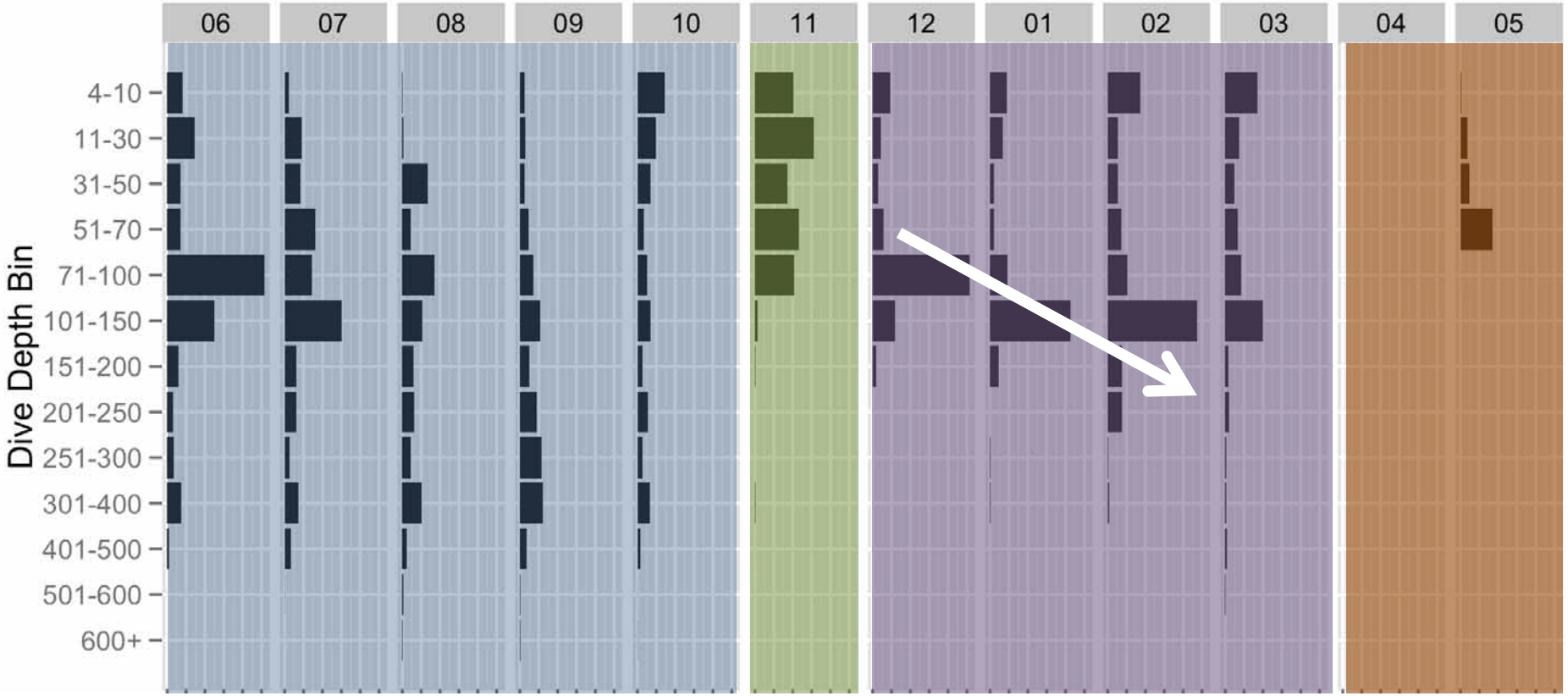

Mean Number of Dives

**Species**

Ribbon seal

Spotted seal

# Adult Ribbon Seal Diving By Month



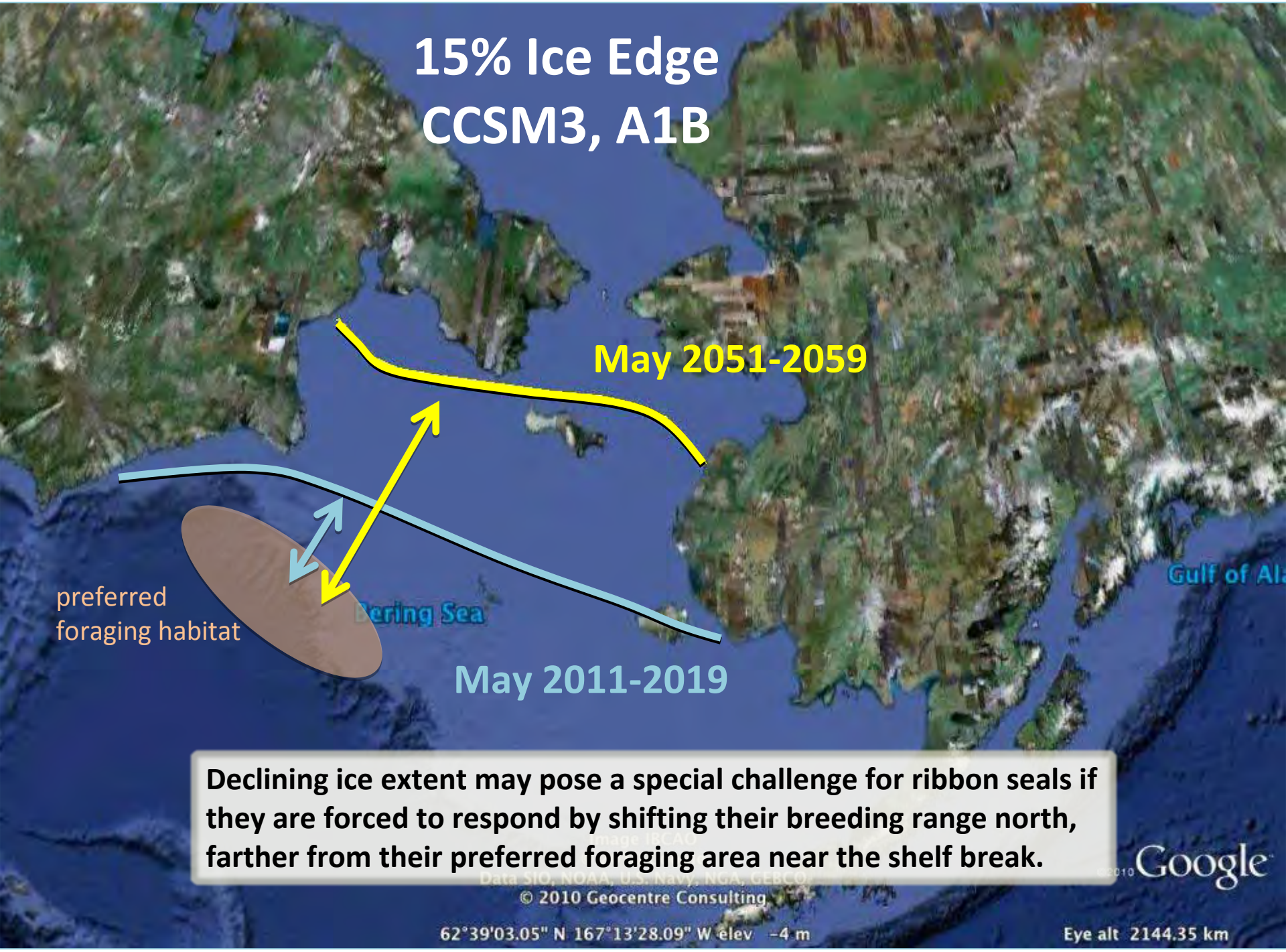

Mean Number of Dives →

**Non-ice period**
**Deep water**
**Deep dives**

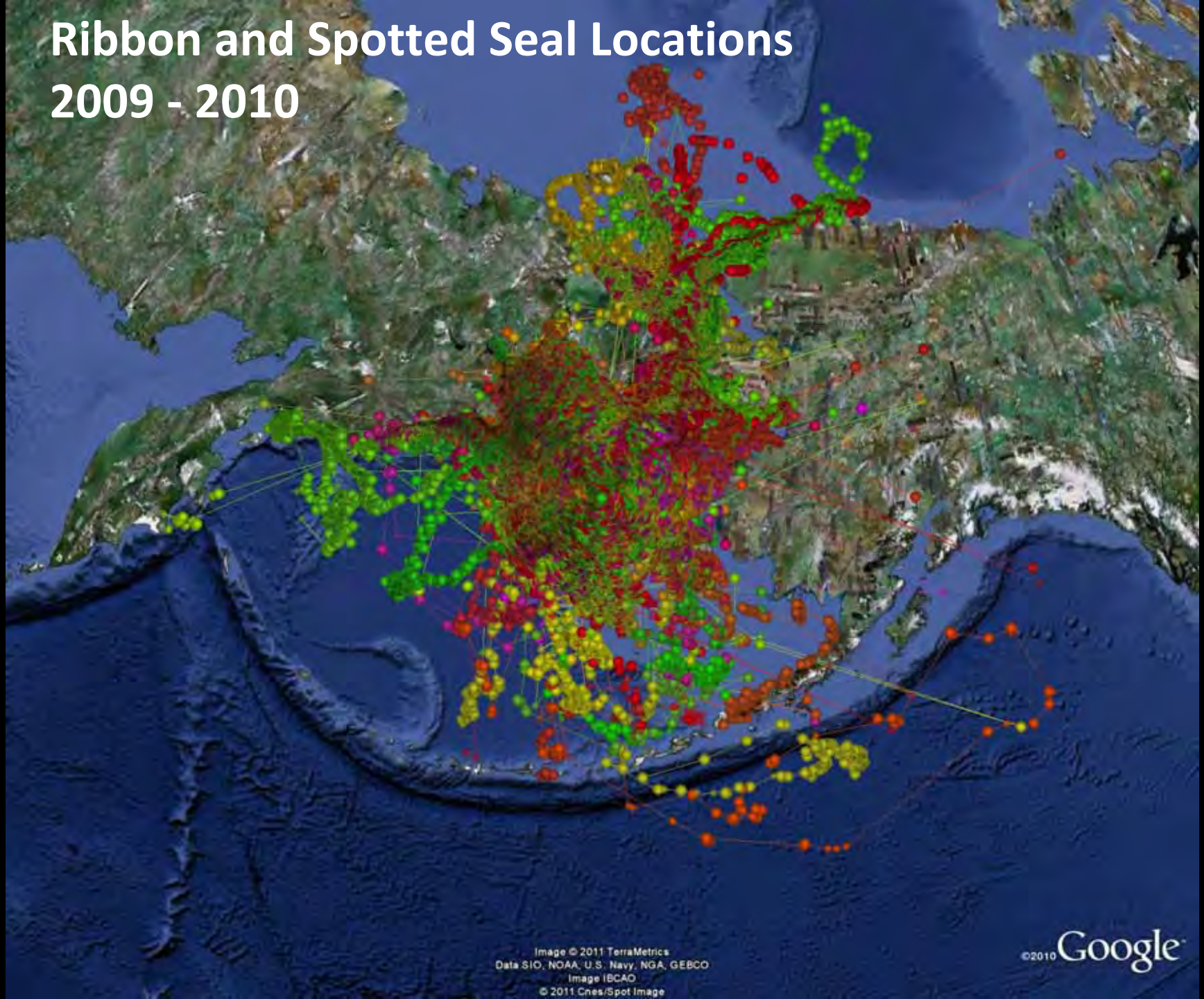
**North to meet new ice, far from shelf break**

**Ice expands southward**
**Better access to preferred depths**

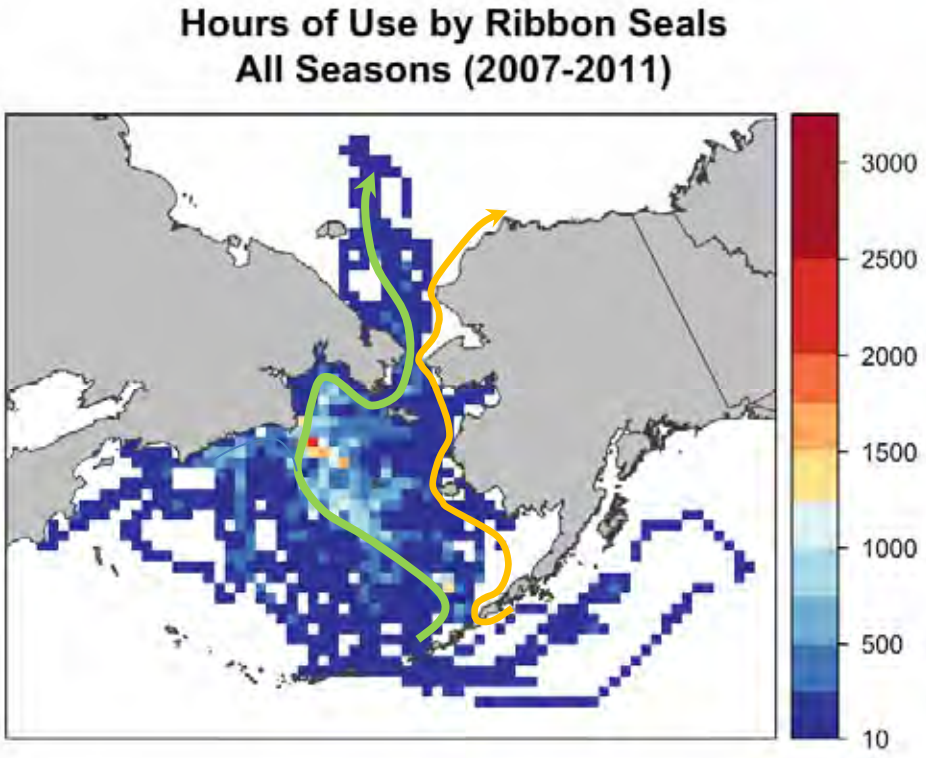
**Critical breeding, molting period (sparse data)**

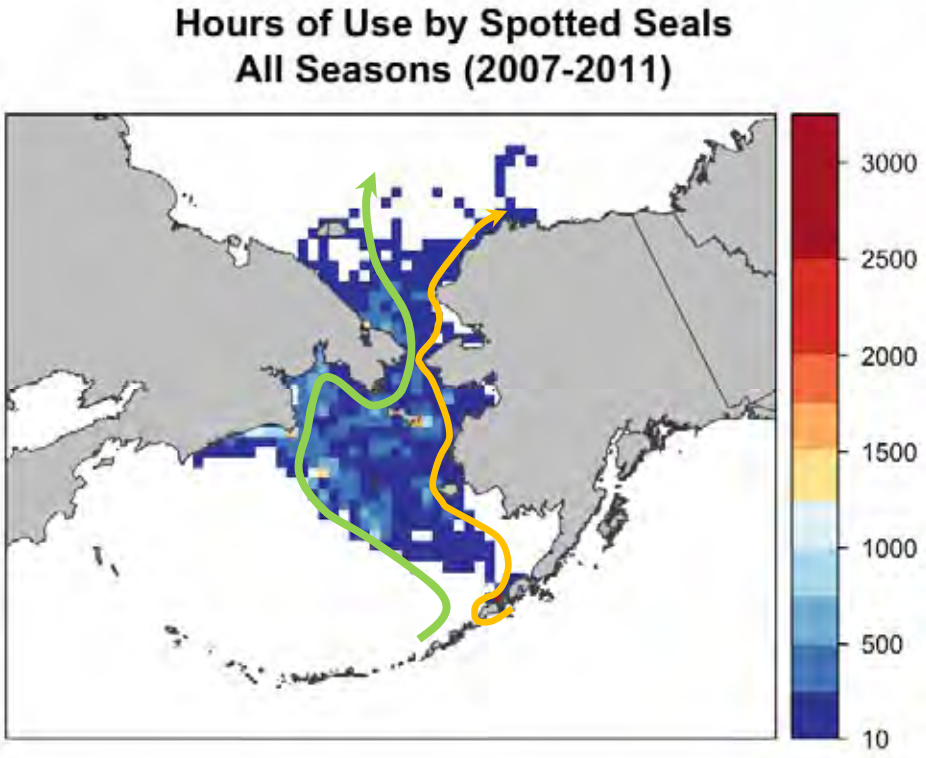

15% Ice Edge
CCSM3, A1B
May 2051-2059
preferred
foraging habitat
Bering Sea
May 2011-2019
Gulf of Al
Declining ice extent may pose a special challenge for ribbon seals if they are forced to respond by shifting their breeding range north, farther from their preferred foraging area near the shelf break.
Image IBCAO
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Geocentre Consulting
62°39'03.05" N 167°13'28.09" W elev -4 m
Eye alt 2144.35 km
Google

# Ribbon and Spotted Seal Locations 2009 - 2010



# Quantifying Ecosystem Relationships and Importance



# Conclusions

- **Strong geographic separation during the summer and autumn (non-ice) may reflect adaptations for partitioning prey resources common to ribbon and spotted seals**

- **In winter and spring, when the species overlap strongly due to the need for sea ice to support breeding and molting, ribbon seals apparently prefer and continue to exploit deeper waters, as proximity of the ice allows**

- **This apparent preference may pose a special challenge for ribbon seals if they are forced to respond to diminished ice extents by shifting their breeding range north, farther from the shelf break**

- **New information from satellite telemetry provides a basis for quantitative investigation of relationships between these upper-trophic consumers and their physical and biological environments**

# Questions?

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