Diet and isotopic niche overlap between two Arctic phocids in Cumberland Sound, Nunavut

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Background

- Sub-Arctic species expanding northward with climate change[1]
- Harp seals (*Pagophilus groenlandicus*) may follow their primary prey (capelin *Mallotus villosus*) as it responds to environmental change[2]
- Reports of reduced ringed seal (*Pusa hispida*) abundance coincident with increase in capelin[3] and harp seal[4] abundance in recent decades

Hypothesis

Harp and ringed seals are predators of similar size and foraging strategy[5], and, thus, occupy a similar ecological niche.

Materials & Methods

- Seals sampled by Inuit hunters from Pangnirtung ★ (May-Oct.; Table 1)
- Lipid-extracted muscle (slow turnover) and liver (fast turnover) analysed for $\delta^{13}C$ and $\delta^{15}N$ using *SIBER*[6]
- Stomach contents grouped by taxonomic family
- Stomach content overlap calculated using Schoener's Index ($\alpha \geq 0.60$ ecologically meaningful)[7]

Table 1: Sample sizes for collected ringed and harp seal tissues.

	Stomach	Muscle	Liver
Ringed Seals (2008-2010, 2015, 2016)	65	85	86
Harp Seals (2007, 2008, 2015, 2016)	18	27	36

Diet Metrics

Stable Isotopes
- Visual representation of isotopic (∴ dietary) niche
- Doesn't tell us WHAT prey are being consumed

Frequency of Occurrence
- # stomachs in which each prey type occurs
- Doesn't take prey quantity into account

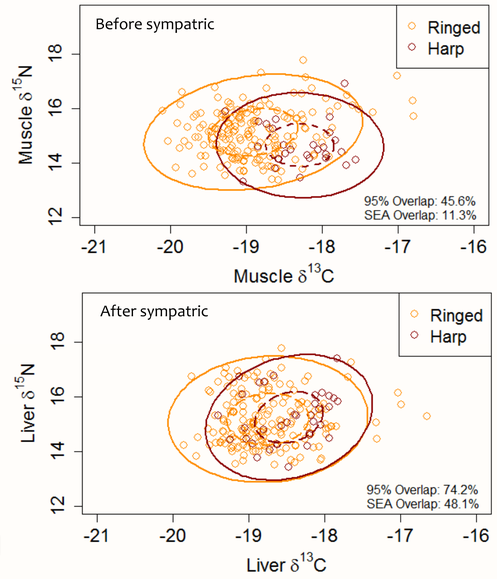
Relative Abundance
- Count of individual prey items
- Biased towards small, numerous prey types

Relative Biomass
- Estimated biomass from prey abundance
- Doesn't consider energy contributed by each prey type

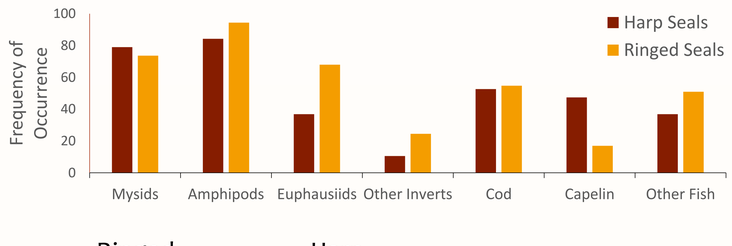
Relative Energy Density
- Estimated energy density of each prey type
- ★Judges dietary importance by energy available to predator

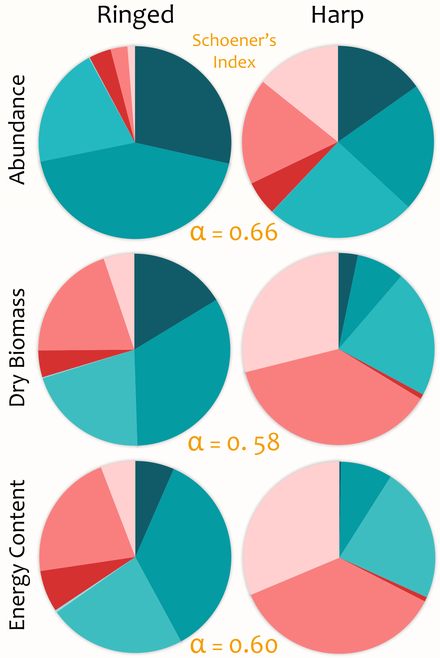
Results

Higher overlap when seals are sympatric ⇨

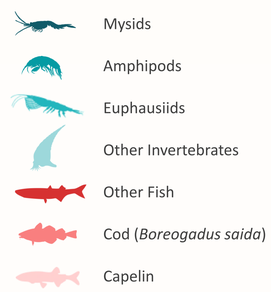


Same prey types consumed by both seals ⇩



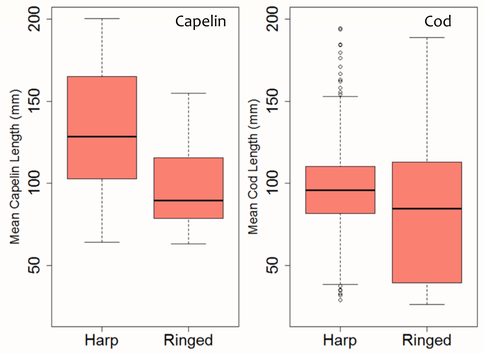


⇦ More fish in harp seal diet; more invertebrates in ringed seal diet



⇦ Schoener's Index shows overlap near the ecologically meaningful threshold

Significantly larger fish consumed by harp seals ($p>0.001$) ⇩



Conclusions

- High isotopic niche overlap before sympatric could be due to similar foraging ecology and close genetic relatedness[5] of ringed and harp seals
- Stomach contents reveal some degree of niche partitioning or prey-selection differences
  - Could suggest feeding at different depths[8]
- High degree of diet similarity suggests that competition may occur in conditions where resources are limited

Significance

Studying ringed and harp seal diet helps us to understand whether harp seals are negatively affecting ringed seal populations. Because ringed seals are the preferred seal for Inuit subsistence hunts, it is important to identify the stressors acting upon this species to allow for effective population management in the face of continued climate change.

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Harp seal photos: © Sylvain Cordier; Ringed seal photos: © Kaido Haagen