Is Sea Ice Important for Seabirds in the Canadian High Arctic ?

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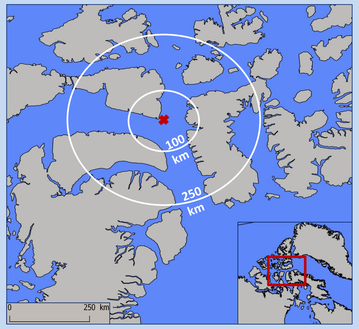
1. Introduction

Sea ice plays a central and structural role in polar ecosystems for many adapted species, including ice associated diatoms. Its progressive disappearance in summer will alter and modify the structure and the functioning of entire marine ecosystems in the Arctic.

Recent studies have shown the potential of "Highly Branched Isoprenoid" (HBIs) for tracing and quantifying the flow of ice algal-produced carbon to higher trophic levels.

- Can we use HBIs ?
  - To determine how much arctic seabirds depend on sea ice cover,
  - To investigate how changes in ice availability may affect their reproduction.



2. Methods

Study area : Prince Leopold Island in Lancaster Sound (74°N, 90°W ; Nunavut, Canada)

Eggs - Species:

Thick-billed murres
(*Uria lomvia,* TBMU)
Feeding Range = 100km


Alaska Maritime National Wildlife Refuge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Northern fulmars
(*Fulmarus glacialis,* NOFU)
Feeding Range = 250km

All analyses were done on freeze-dried, homogenized, whole eggs

HBI analysis: Lipid extraction → Saponification → Purification → GC-MS

Stable isotopes (delipidized samples): $\delta^{13}C$ (‰) = feeding habitat ; $\delta^{15}N$ (‰)= trophic level indicator

3. Results

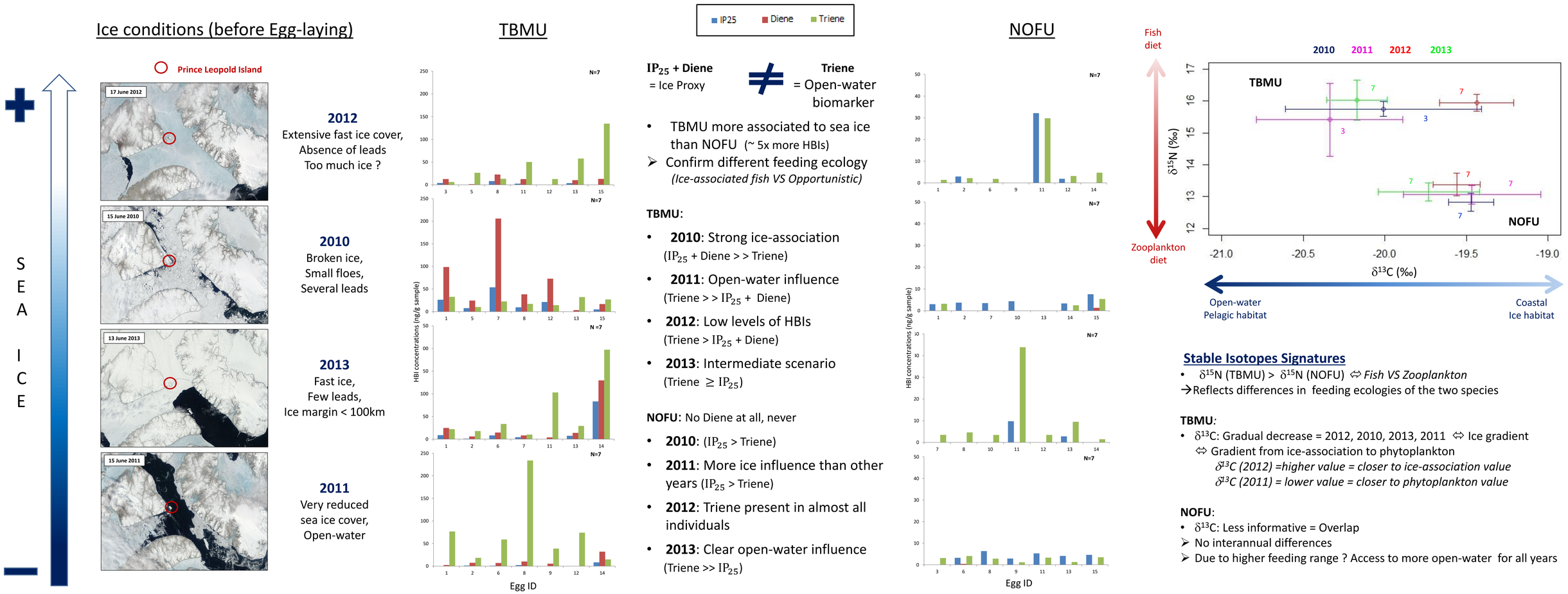

Fig.1. Prevailing ice conditions before the egg-laying period of both species (End June – Early July) around the colony (on the left), HBIs concentrations of TBMU and NOFU between 2010 and 2013 (in the center), and stable isotopes signatures for both species and each year (on the right ; numbers represent sample sizes (n)).

4. Discussion

Eggs composition reflects nutrients obtained by females through their food. The presence of HBIs in eggs therefore confirm their transfer from food and reflect bird feeding ecology. HBIs and carbon-stable isotope compositions are correlated, with higher relative abundances of sea ice derived HBIs and heavier stable isotopes during icier years. However, HBIs seem not to be correlated to the presence/absence of sea ice, but rather reflect the accessibility of prey, which are more or less associated to sea ice.

Recent studies on the effect of ice variations on the breeding ecology of seabirds on Prince Leopold Island demonstrated that years of extensive ice cover corresponded to reduced breeding effort or success. 2011 and 2013 broadly correspond to 2000 and 2003, where open-water was more prominent and led to higher reproductive success, in opposition to 2012 where seabirds probably had to commute longer distances to feed during the reproductive period. In that respect, future work will investigate relationships between HBIs and eggs morphological measurements, such as weight, length, width and volume.

Additional work will also focus on building quality indices of the food ingested through Fatty Acid Biomarkers.

5. Acknowledgements

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6. References

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