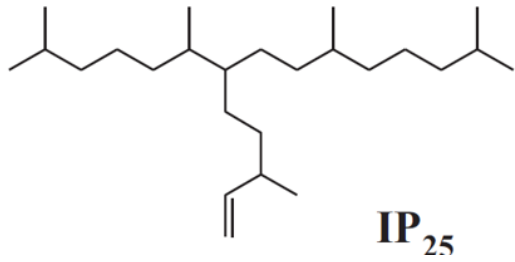


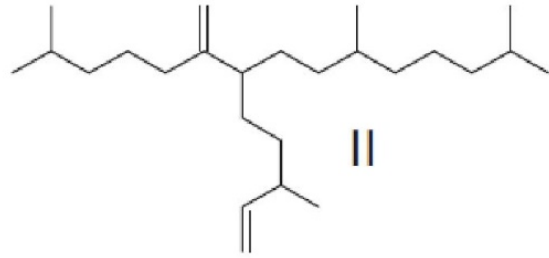
Exploring the production, contributions
and utilization of sea ice algae in DBO
using IP_{25} and other diatom biomarkers

Chelsea Wegner Koch

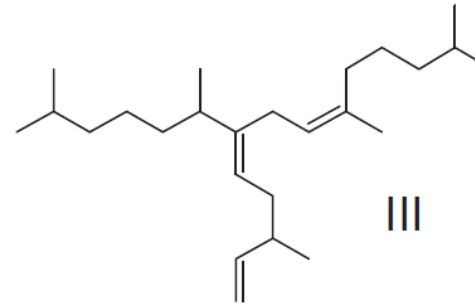
Highly Branched Isoprenoids



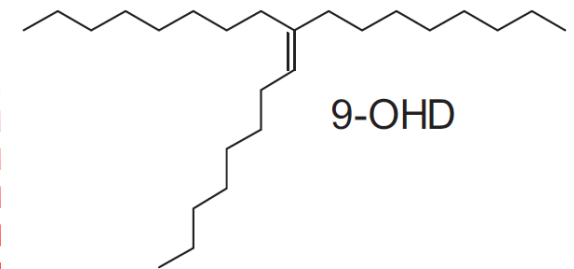
m/z = 350.3



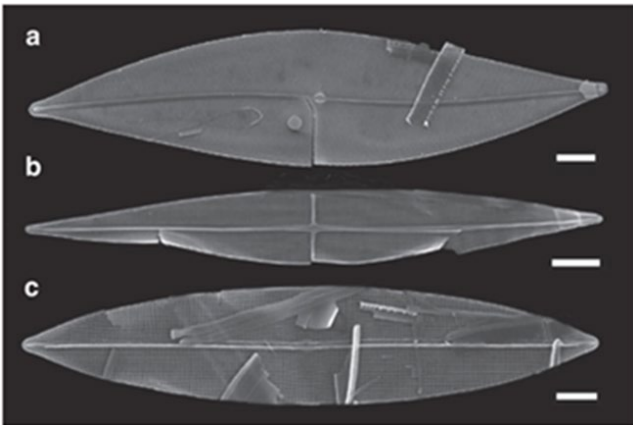
m/z = 348.3
IPSO₂₅



m/z = 346.3



m/z = 350.3



Brown *et al.* 2014

Sea Ice Associated Diatoms

IP₂₅ Producers:

- Pleurosigma stuxbergii* var. *rhomboides* (a)
- Haslea crucigeroides* (b)
- Haslea kjellmani* (c)
- Haslea spicula* (b – maybe)

Pelagic Diatoms

Known III Producers:

- Rhizosolenia* spp.
- Pleurosigma* spp.

Belt *et al.* 2000, 2018

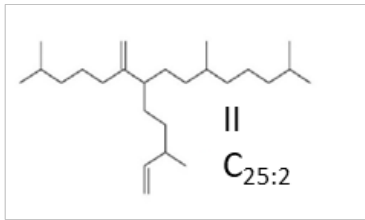
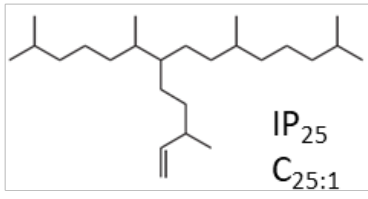
Internal Standard

Not found in marine sediments

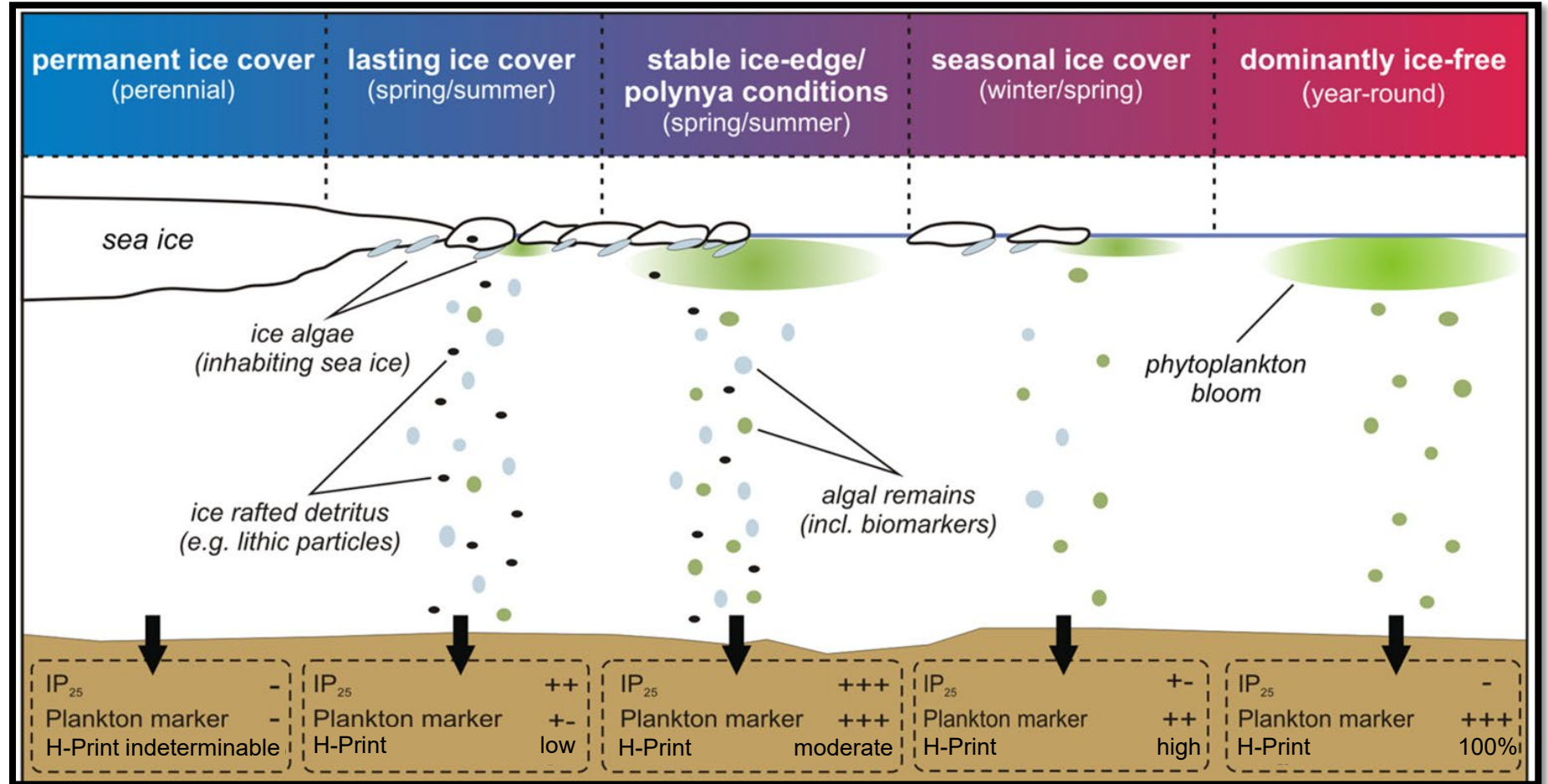
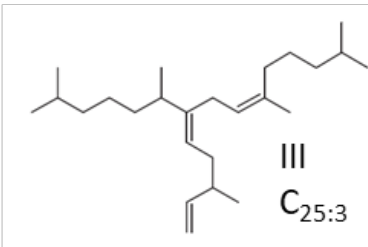
Same mass to ion charge (*m/z*) as IP₂₅

Conditions for HBI Synthesis

Sea Ice Diatom Source



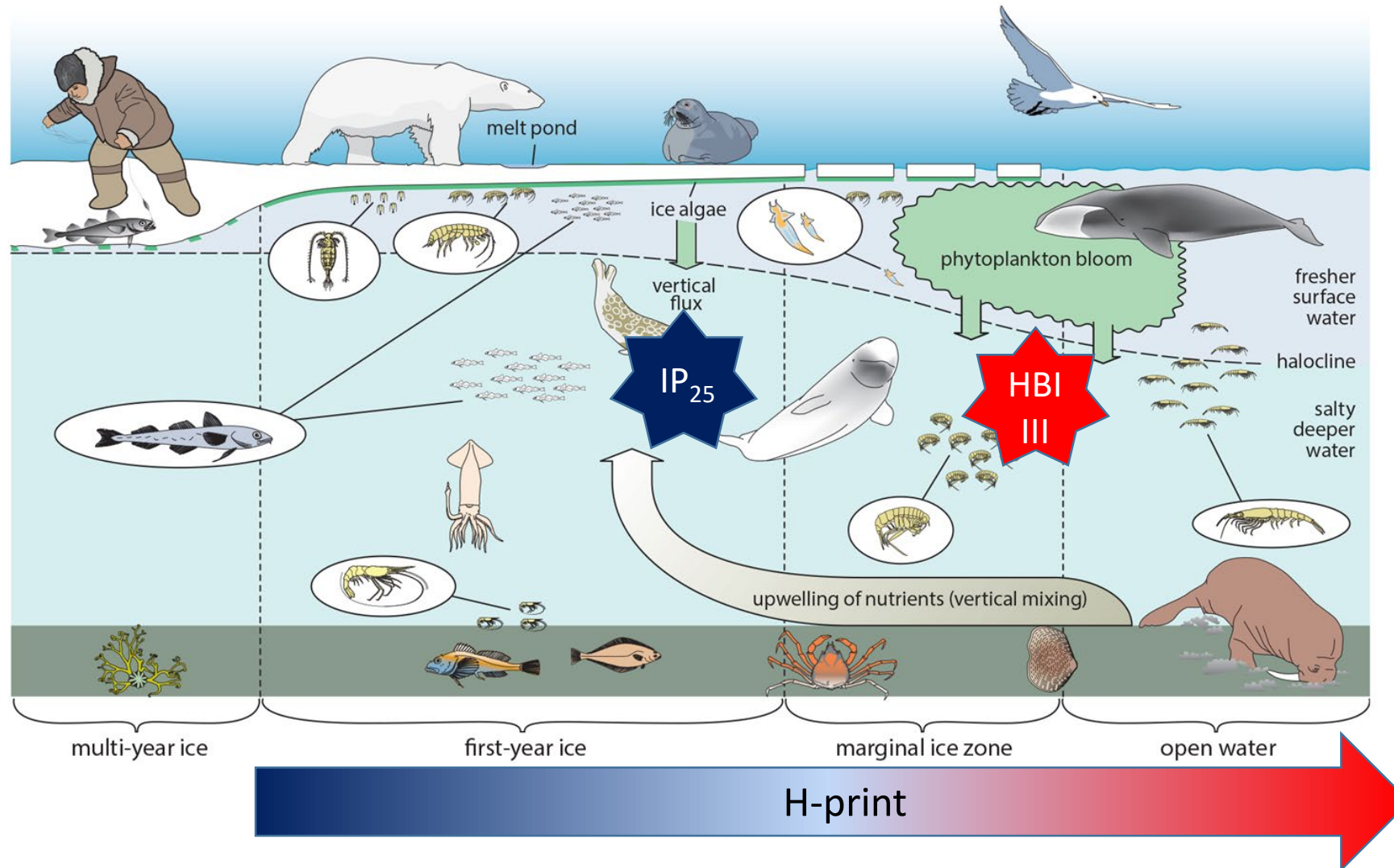
Pelagic Diatom Source



Modified from Müller et al. 2011

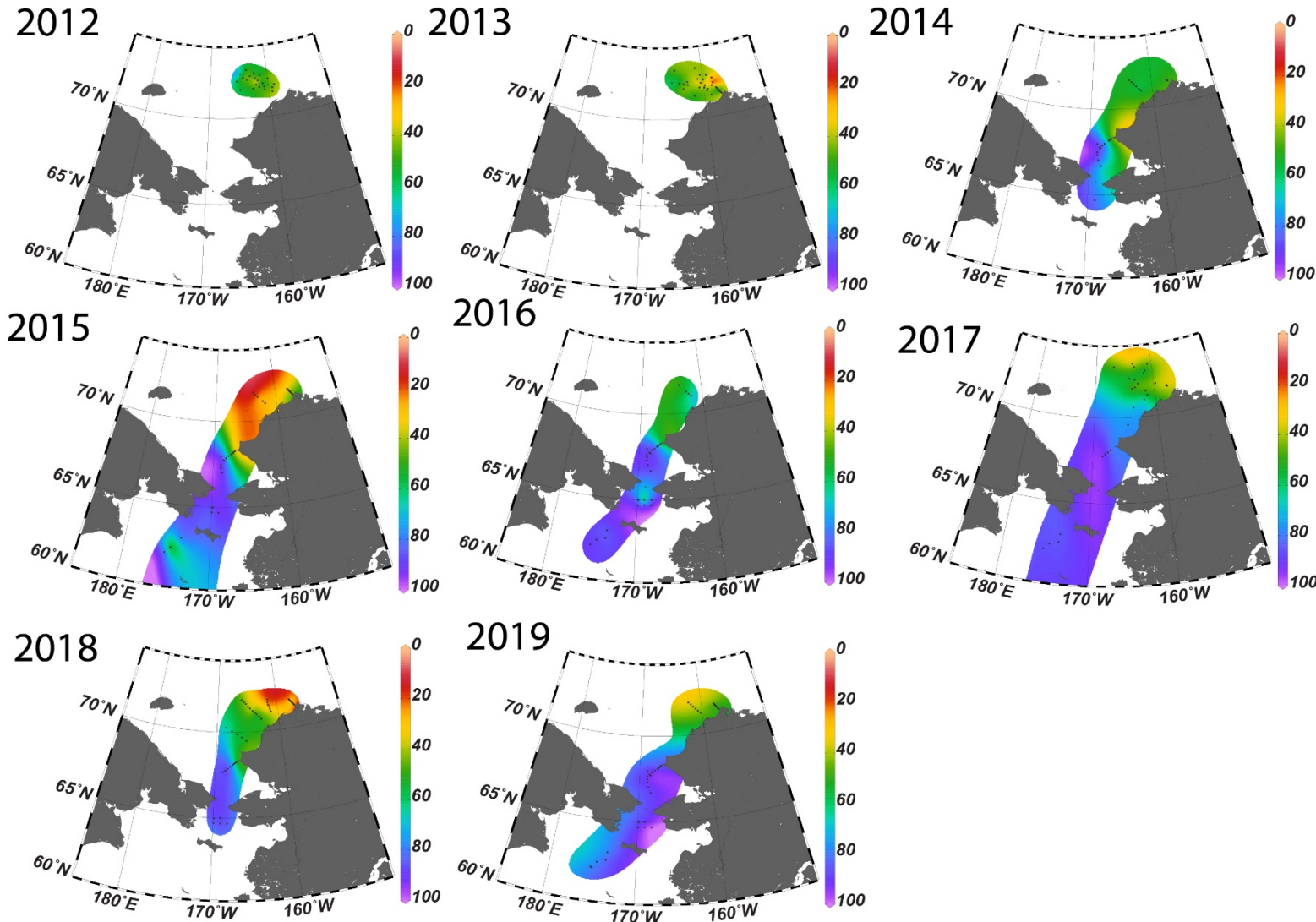
$$H - print = \frac{HBI\ III}{\sum(IP_{25} + HBI\ II + HBI\ III)} \times 100$$

Applying HBI Biomarkers to the Arctic food web



HBI depositional patterns across DBO

Surface Sediment H-print (%)



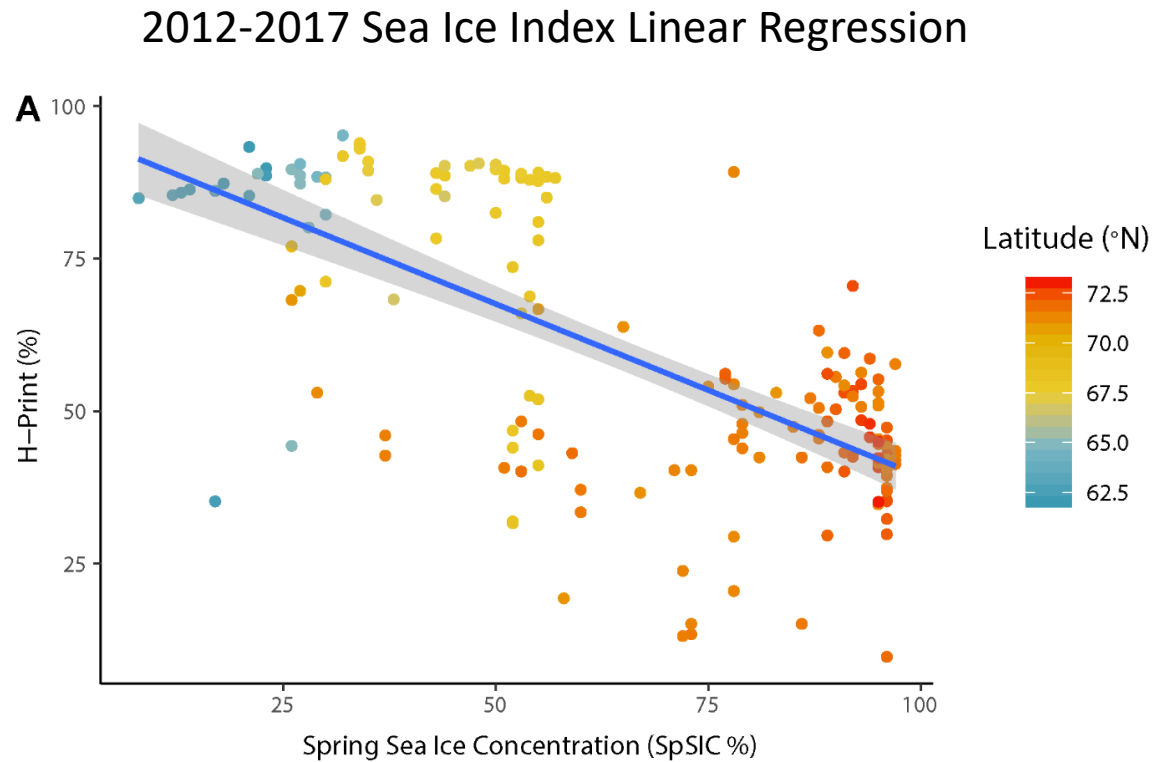
Overall, two distinct regions of varying HBI proportions.

DBO 1-3 tends to be comprised of primarily pelagic HBI signal. Minimal IP_{25} concentrations.

East-west gradients in DBO 3, transitional.

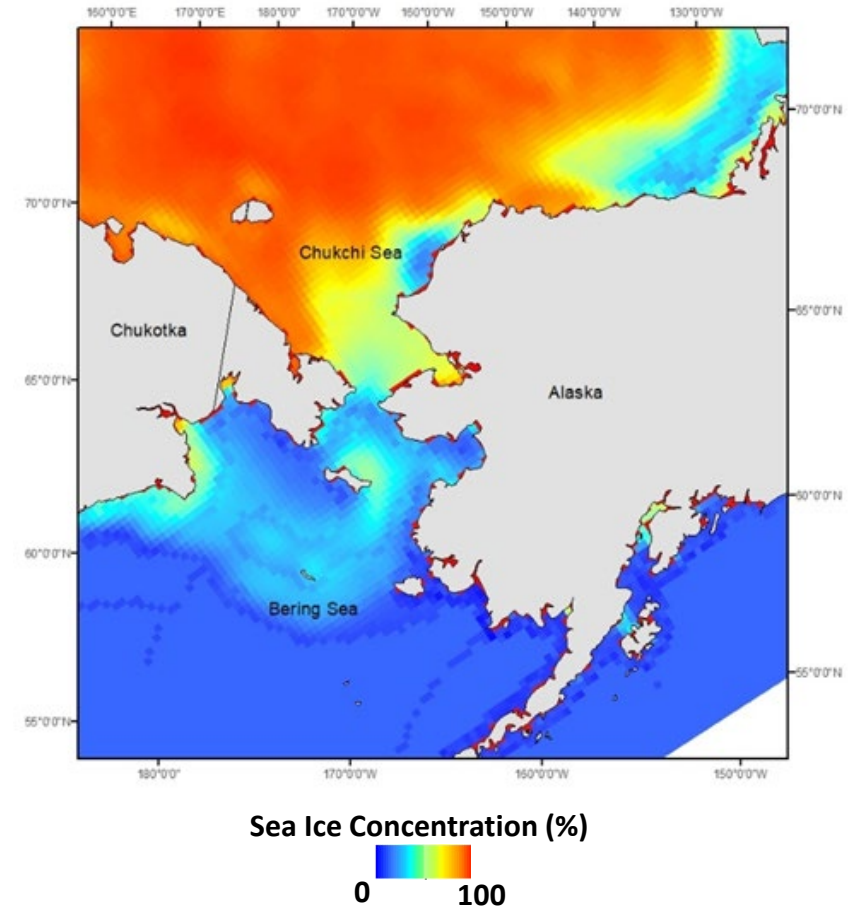
DBO 4-5 has a consistently strong sympagic signal. Elevated IP_{25} concentrations.

Relationship with Satellite-derived Sea Ice Observations



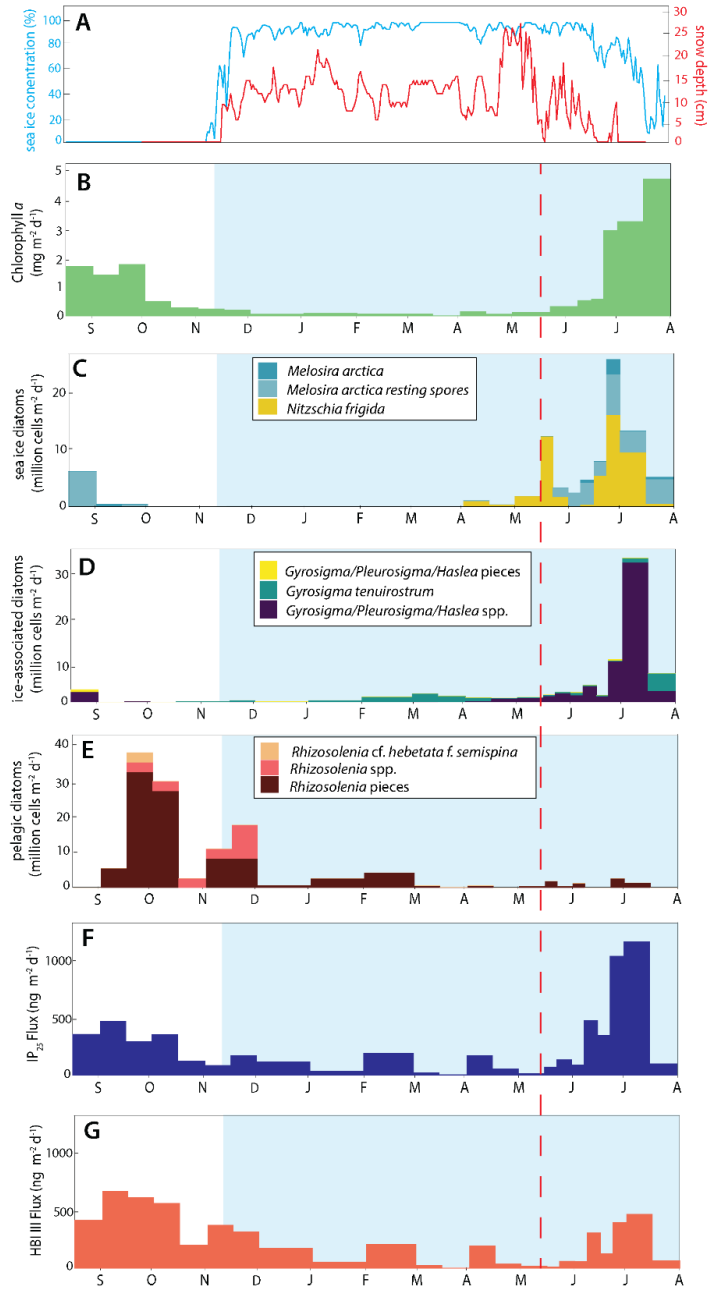
The relationship between H-print and April – June monthly mean sea ice concentrations was moderate $p < 0.001$, $R^2 = 0.46$, $n = 184$

Modified from C.W. Koch et al., in review



2016 AMJ spring sea ice concentrations from NSIDC

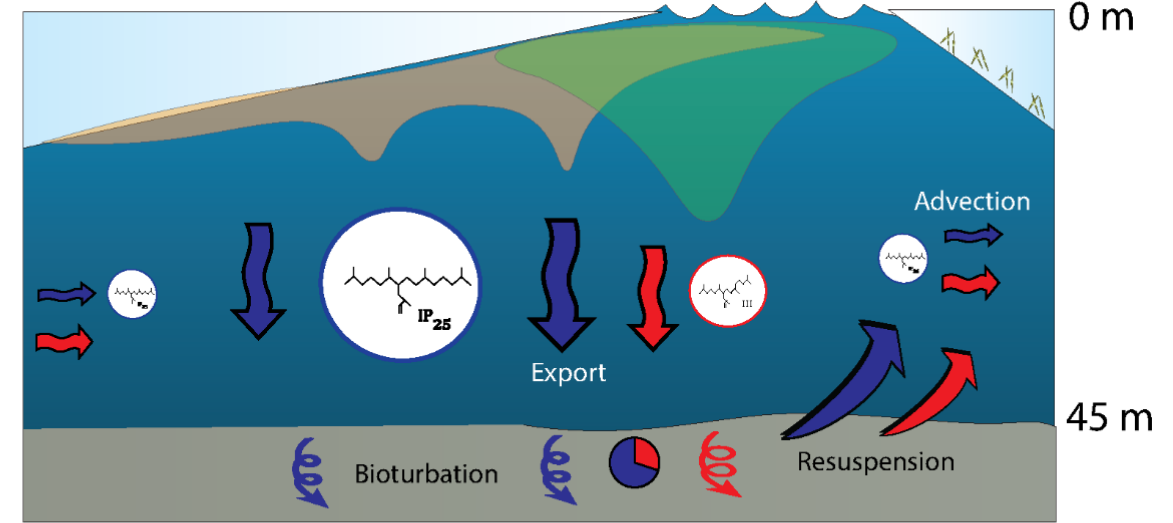
2015-16 Chukchi Ecosystem Observatory



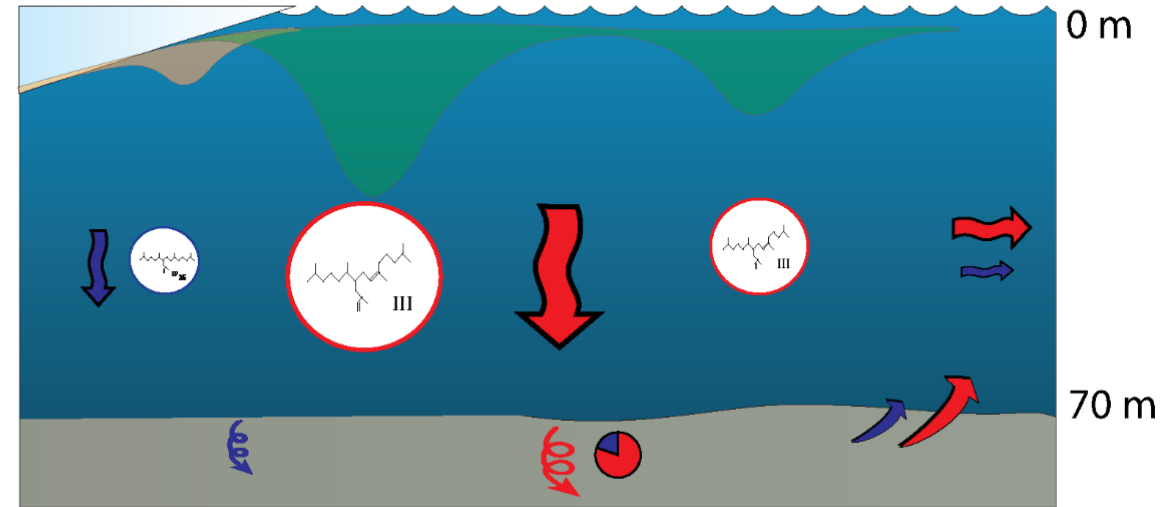
70-72 °N

62-65 °N

Northeast Chukchi Sea

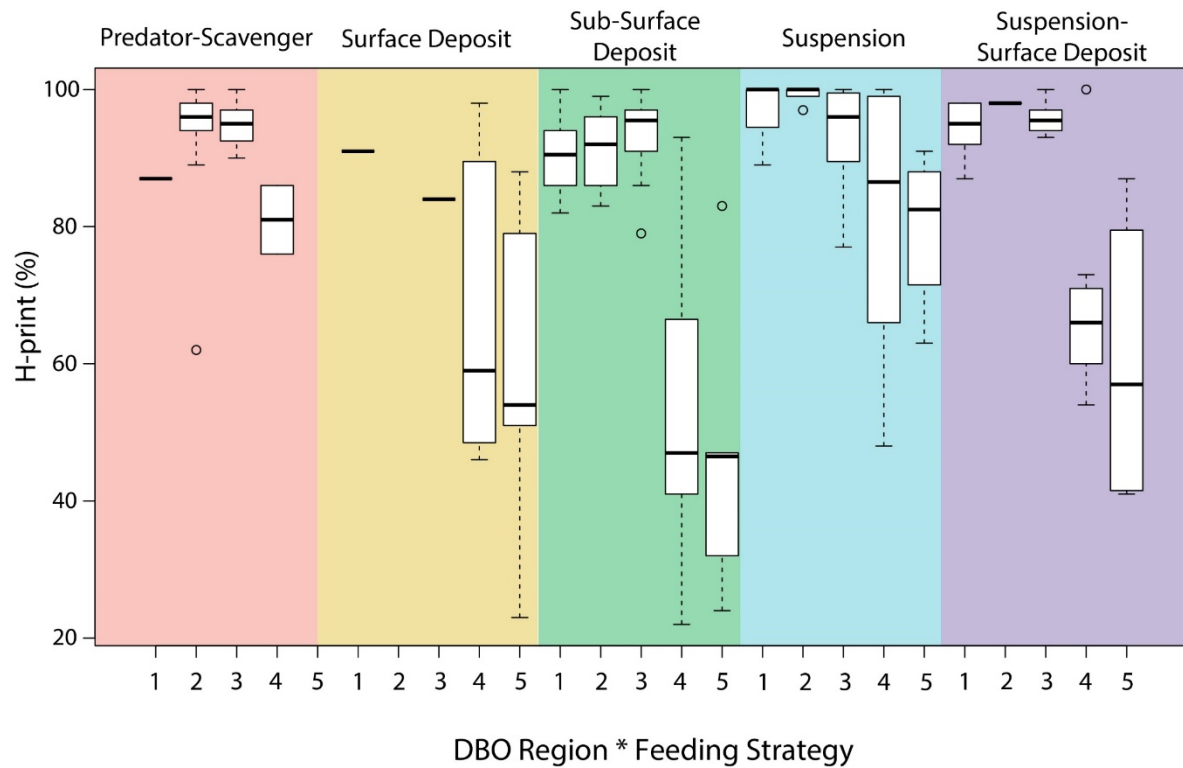


Northern Bering Sea

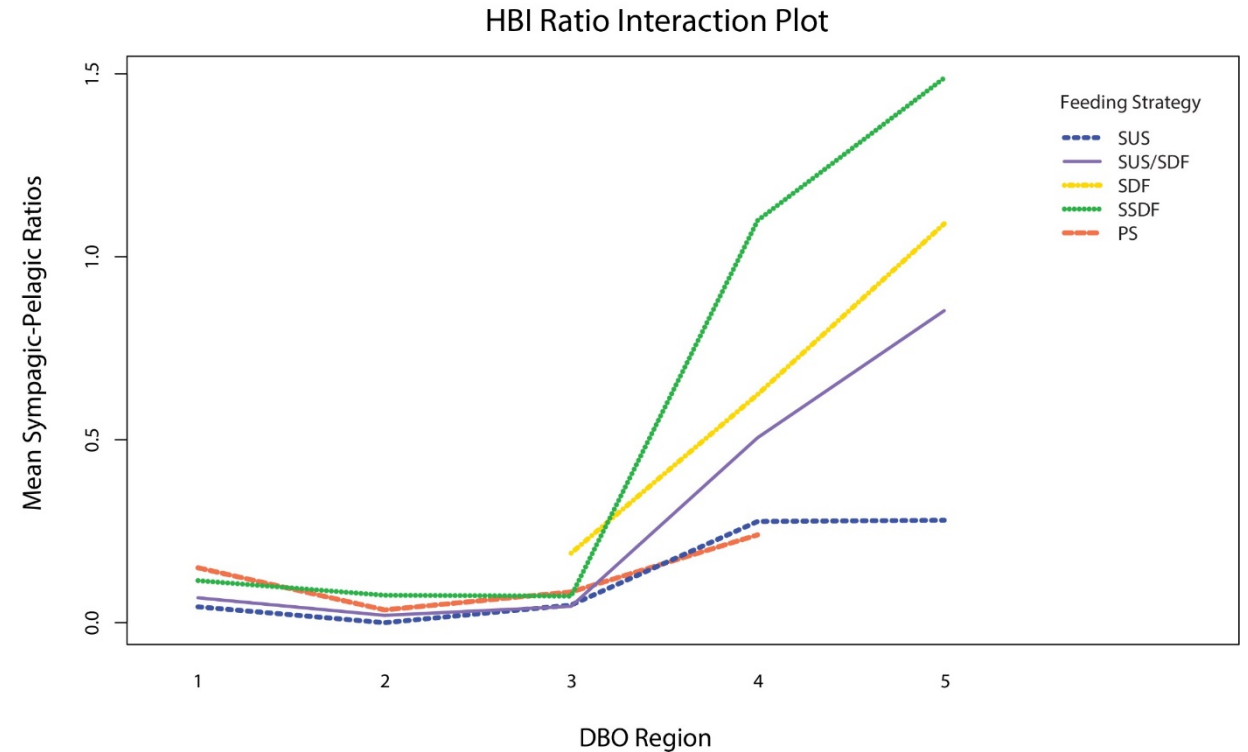


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Ice Derived Organic Matter Uptake by Benthic Macrofauna – HLY18

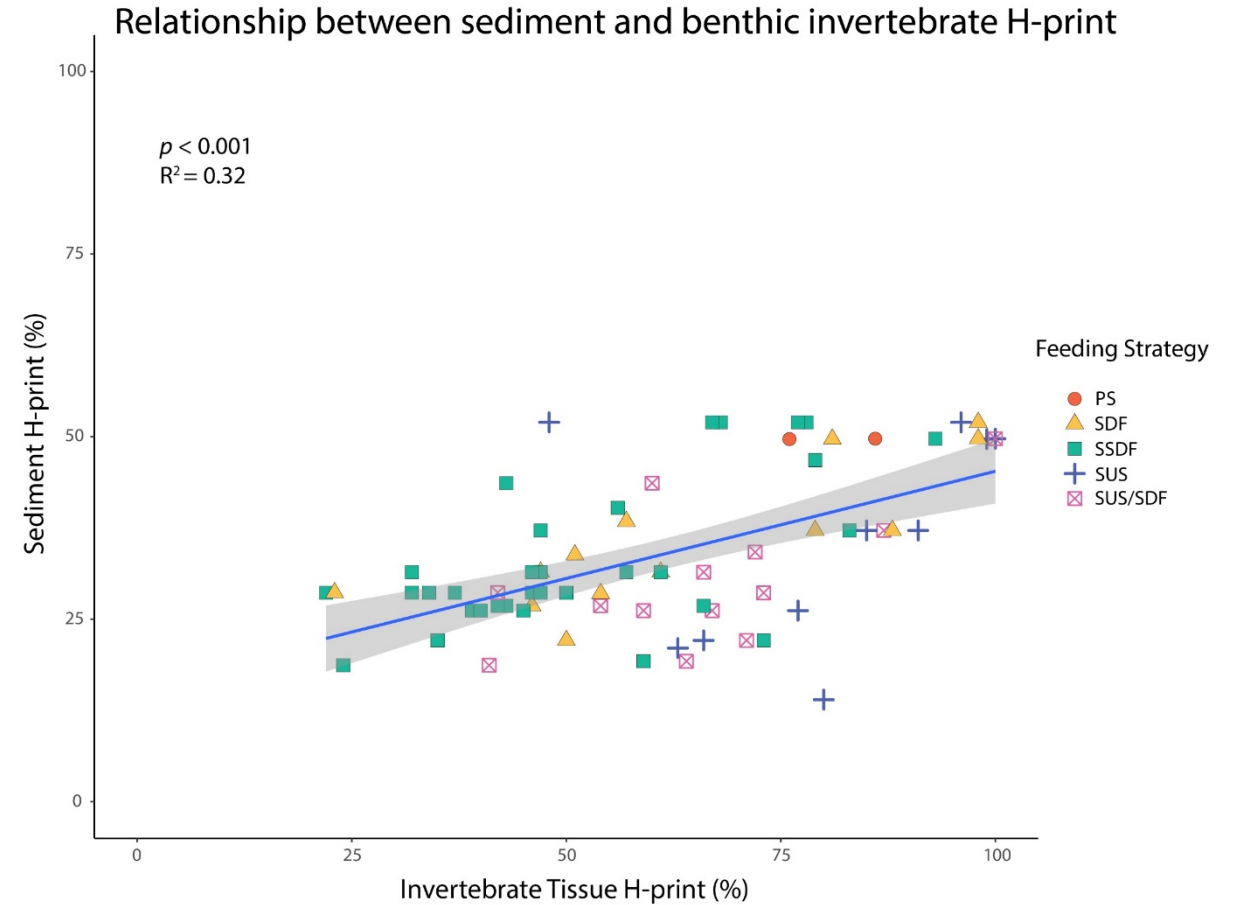
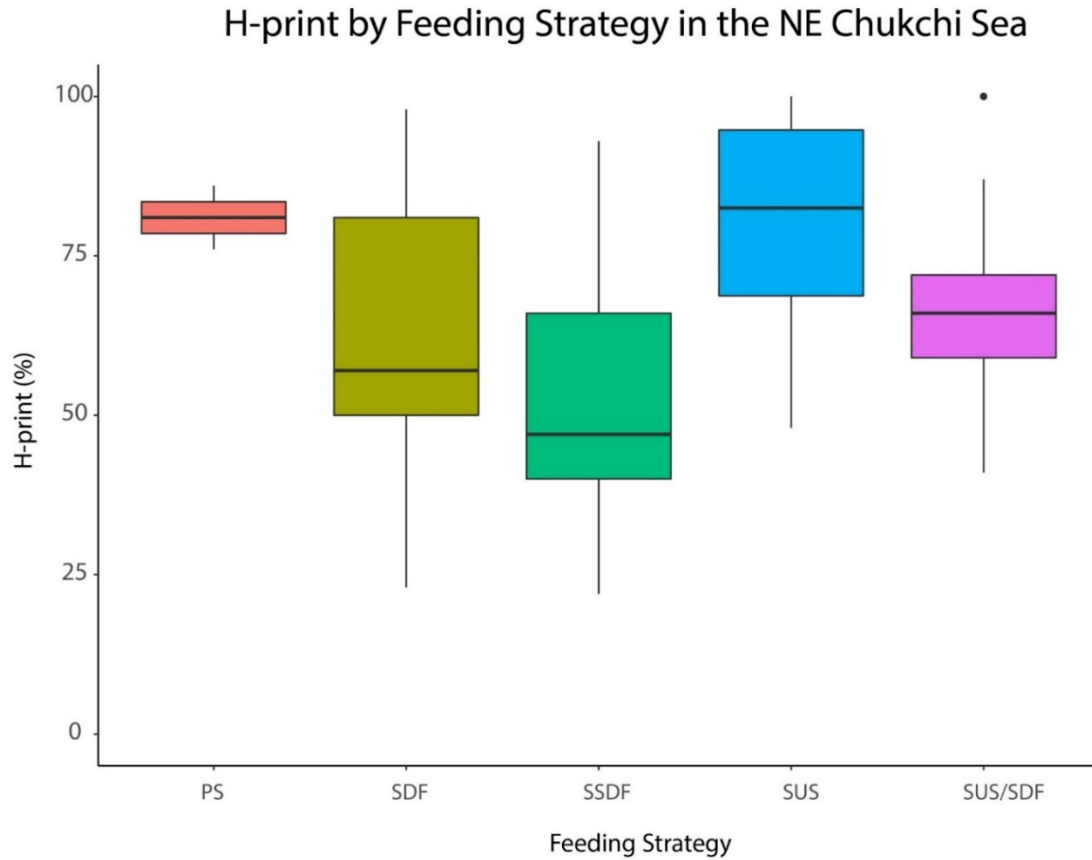


$$H - print = \frac{HBI III}{\sum(IP_{25} + HBI II + HBI III)} \times 100$$



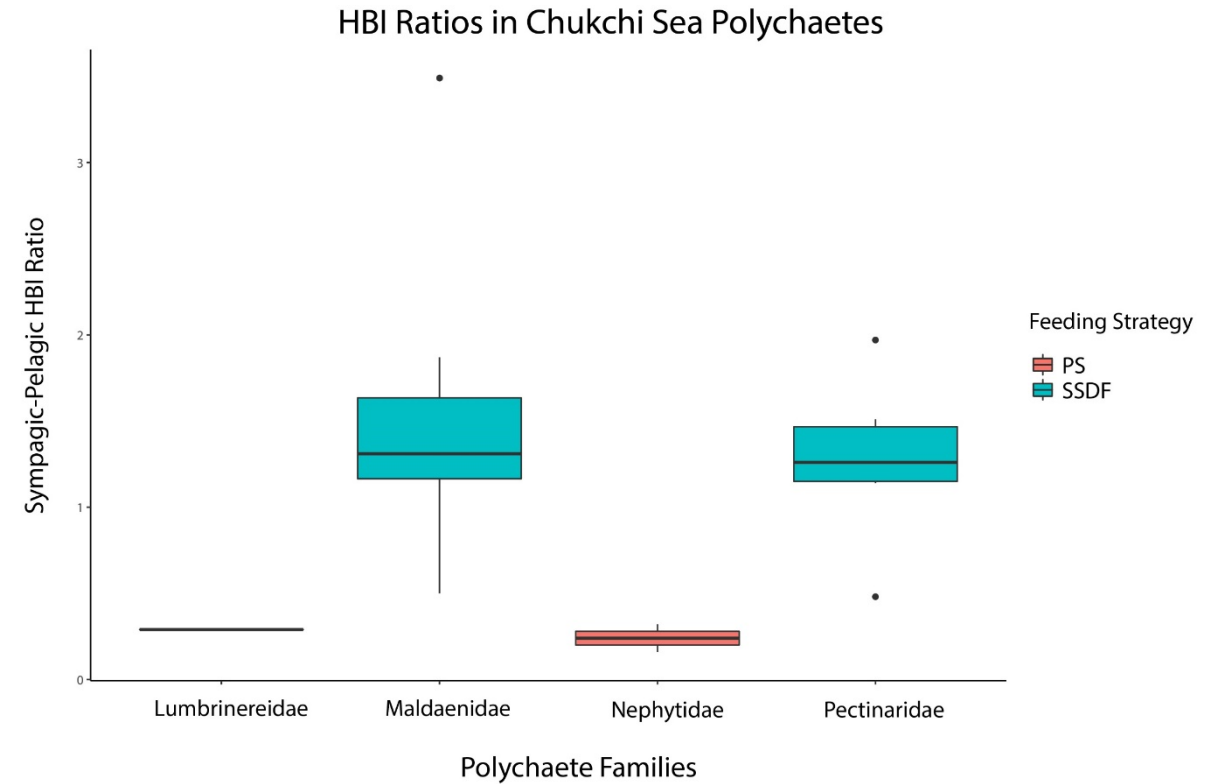
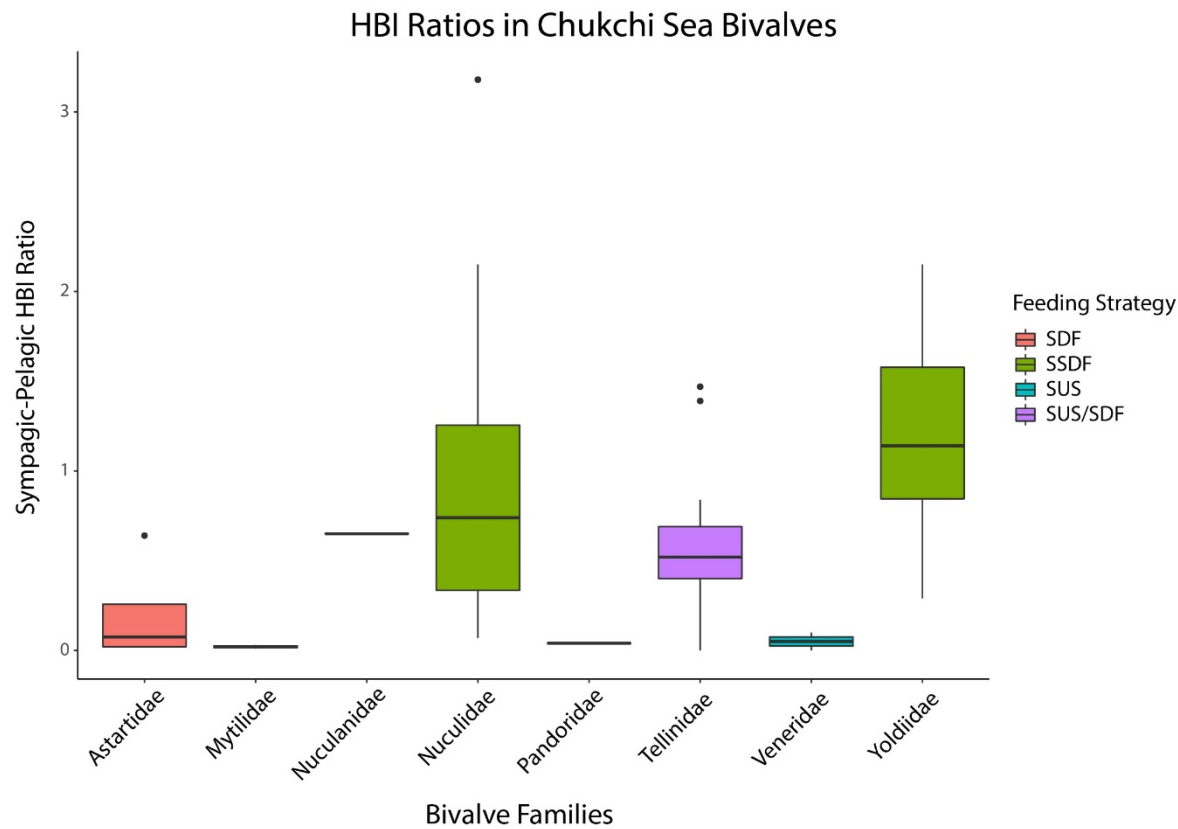
$$Sympagic\ to\ Pelagic\ Ratio = \frac{IP_{25} + HBI II}{HBI III}$$

Variation of ice-derived resources within feeding guilds

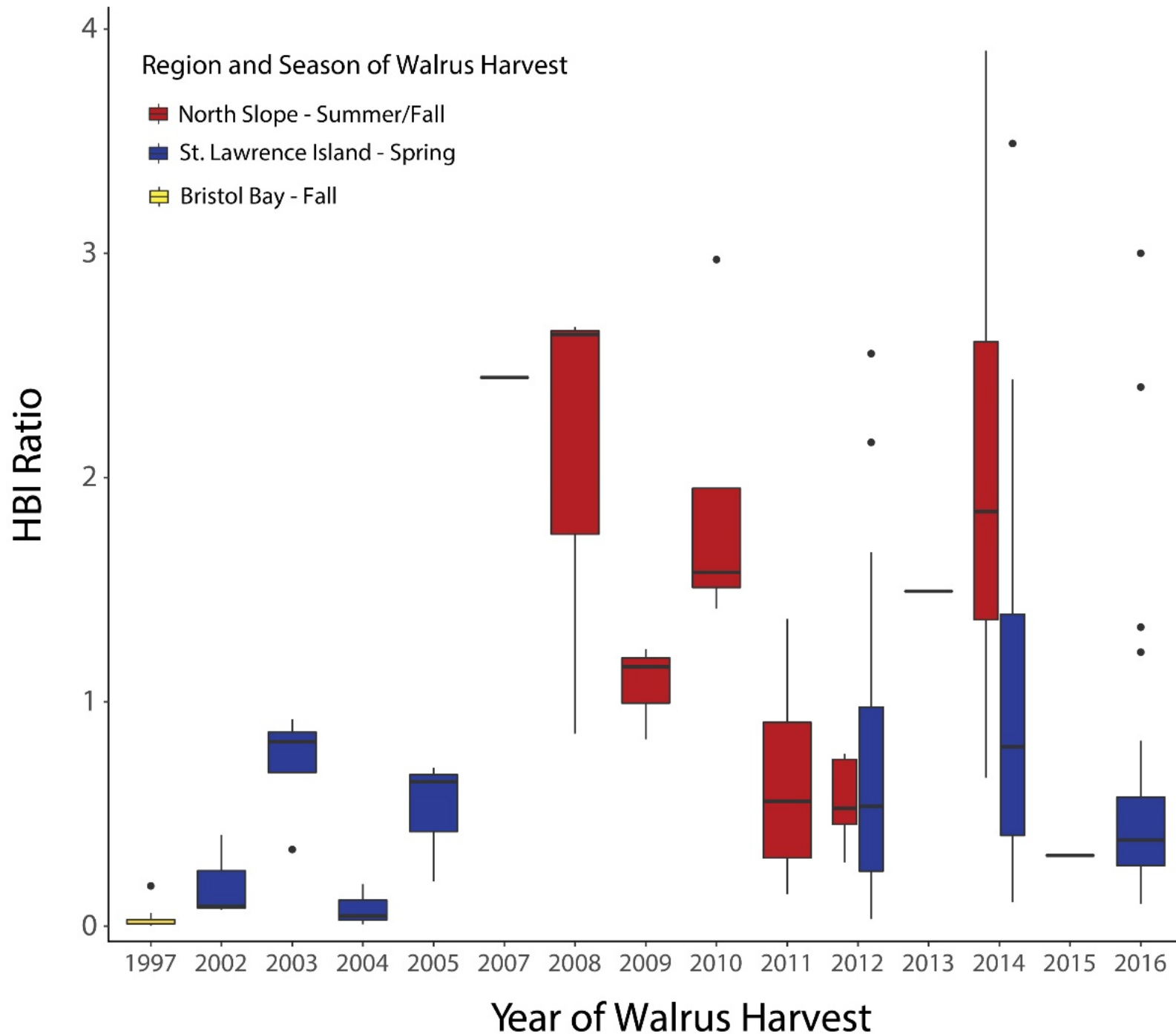


$$H - print = \frac{HBI III}{\sum(IP_{25} + HBI II + HBI III)} \times 100$$

Variation of ice-derived resources within major taxa

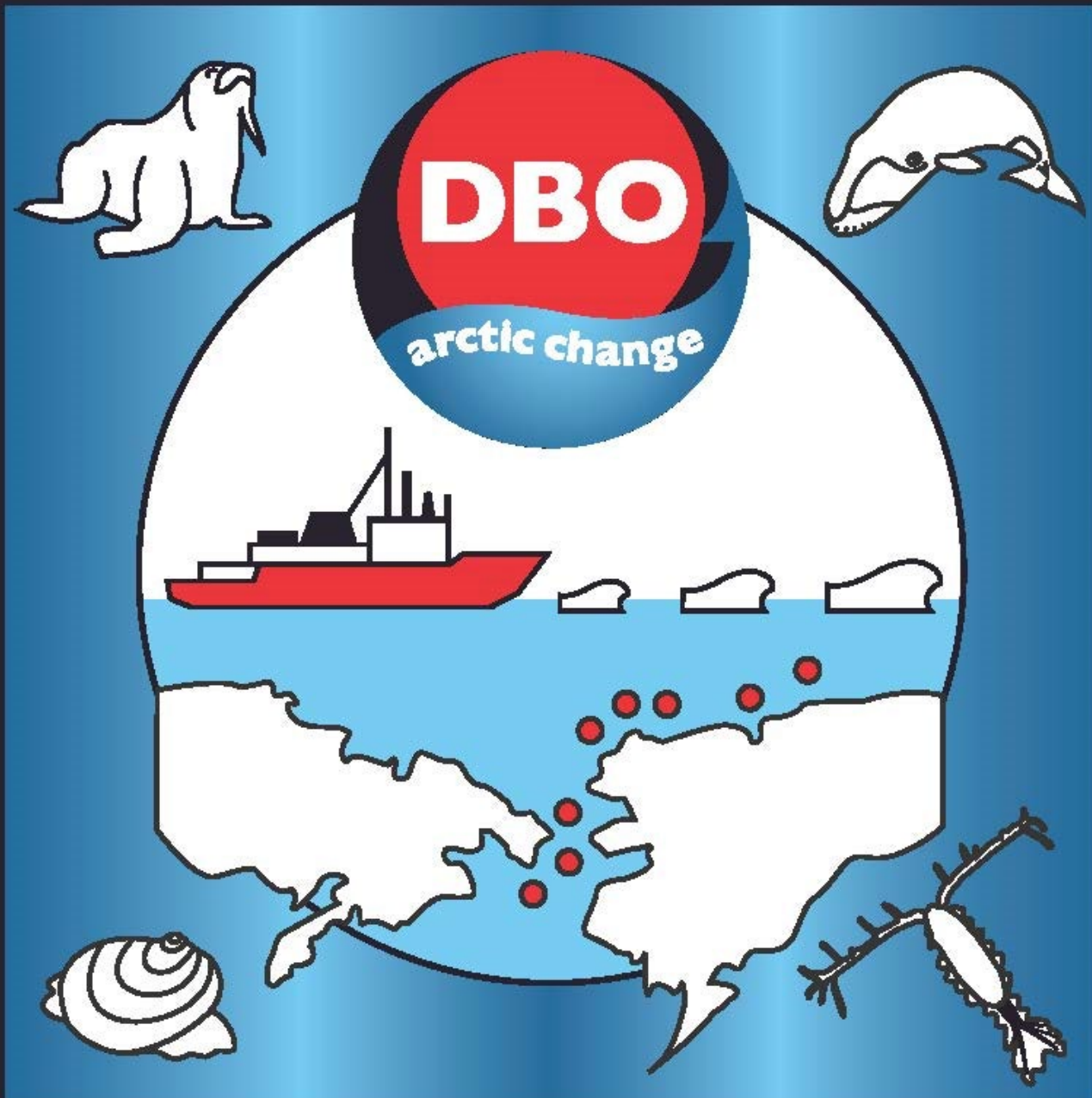


$$\text{Sympagic to Pelagic Ratio} = \frac{IP_{25} + HBI II}{HBI III}$$



- Stronger sea ice signal in diets of walrus harvested while foraging in the Chukchi Sea
- No difference between regions in 2012 – the record low sea ice year for the Arctic, including the Chukchi Sea but not the Bering Sea.

$$\text{Sympagic to Pelagic Ratio} = \frac{IP_{25} + HBI II}{HBI III}$$



Thank you!

Lee Cooper, Jackie Grebmeier & Christina Goethel – UMCES
Thomas Brown – Scottish Association for Marine Science
Catherine Lalande – Amundsen Science, Université Laval
Karen Frey – Clark University

All scientists involved with DBO cruises and data collection!

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