

Bowhead whales use adaptive foraging strategies to maximize feeding opportunities



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Introduction

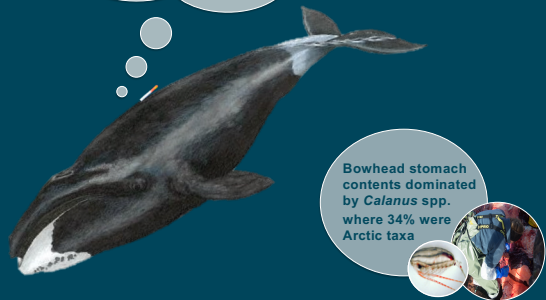
Climate-induced shifts in prey quality and quantity is likely to alter the feeding success of bowhead whales. However, little is known about their foraging behaviour and diet under current environmental conditions.

Methods

Multi-scale foraging ecology study in Cumberland Sound, NU (Aug and Sept 2016) to determine:

- Prey composition (net samples n=26 and stomach contents n=1)
- Vertical prey distribution (optical plankton counter n=72)
- Foraging behaviour (short and long-term biologgers to record dive behaviour n=12)
- Focal follows (drone) to evaluate whale behaviour in real-time

Sure—I'll feed on these small temperate copepods at the surface but...I'd rather dive deeper for those bigger, juicier Arctic copepods!



At what depth do whales feed?

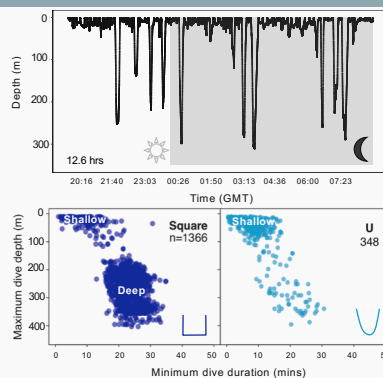


Figure 1. Top: Fine-scale and short-term dive data for one animal showing variability in dive depth. Bottom: Coarse-scale and long-term dive data (n=9 animals) during daytime in August and September in Kingnait Fjord in Cumberland Sound. Data are separated by dive type where Square and U dives reflect probable feeding behaviour.

How does prey abundance and size vary with depth?

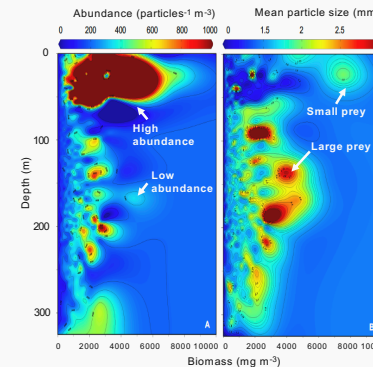


Figure 2. Biomass (mg m^{-3}), abundance (m^{-3}) (A) and mean size (mm) (i.e., equivalent circular diameter) (B) of prey particles (i.e., zooplankton) using a 1 mm particle size threshold and 4 m aggregated depth bins for all OPC casts ($n=72$) collected from Kingnait Fjord in August.

Where do high biomass prey layers occur?

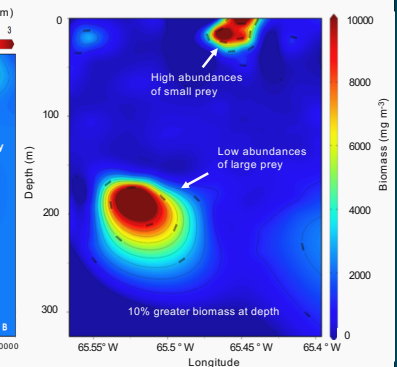


Figure 3. Vertical particle biomass concentrations that were particularly high (≥ 1000 particles· m^{-3}) for some OPC casts at the surface and at depth in an area of Kingnait Fjord where bowheads were presumed to feed in August.

Results

- Whales conducted shallow ($23 \text{ m} \pm 4.5 \text{ SD}$) and deep ($260 \text{ m} \pm 35.8 \text{ SD}$) feeding dives during the day (Fig. 1)
- Deep layer contained fewer, but larger, prey than the shallow layer (Figs. 2 & 3)
- Biomass dominated by large Arctic taxa (*Calanus glacialis*) at depth (Fig. 2)
- Shallow biomass comprised of mostly small, temperate species (*C. finmarchicus*)
- Bowheads allocated less time to feeding ($\sim 6 \text{ hrs/d}$) compared to the closely related North Atlantic right whale ($\sim 17 \text{ hrs/d}$)

Conclusions

Bowheads alternated between deep and shallow feeding dives but showed a preference for larger, Arctic taxa found at depth (likely undergoing diapause). Only a small portion of the day was allocated to foraging behaviour. This flexible foraging strategy may help buffer bowhead whales from climate driven shifts in prey.



Thank you! ᐅᐅᐅᐅᐅᐅ