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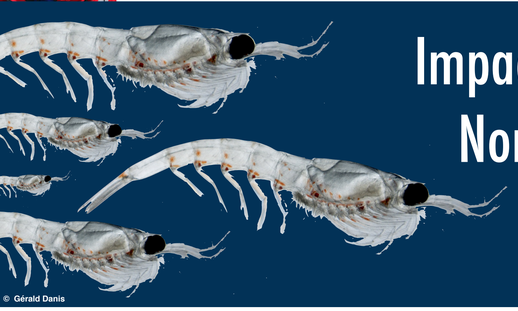

Impacts of changes in krill vertical distribution and density on foraging efficiency of Northwest Atlantic blue whales in the Estuary and Gulf of St. Lawrence, Canada

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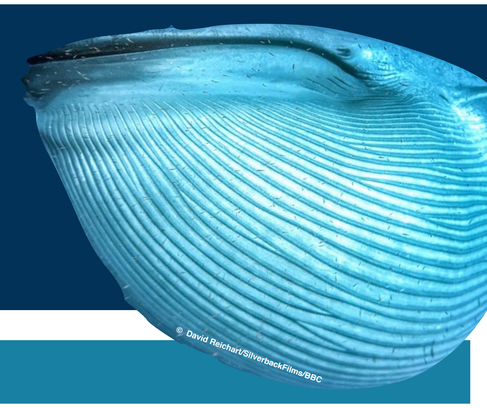
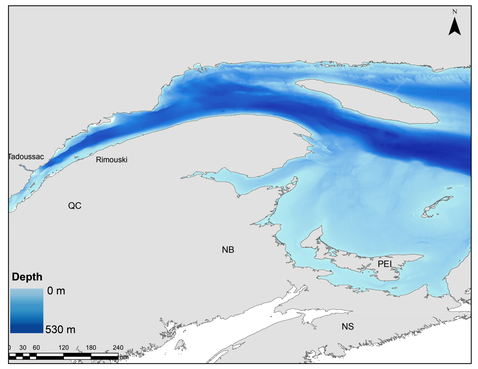


Context

- Climate change have the potential to impact krill communities by affecting environmental conditions. Changes can be spatial (vertical and horizontal distribution, optimal habitat loss), physiological (alteration of size and lipid content) but also behavioural (patch density).

- Blue whales are capital breeders, critically fuelling reproduction and other energetic expenses on previously acquired energy stocks. The **Northwest Atlantic blue whale population** is listed as endangered on the Canadian Species at Risk Act with estimates in the low hundreds with signs of low calving rate. They use the **Estuary and Gulf of St. Lawrence** (EGSL) as feeding grounds to replenish their fat reserves by foraging mostly on **arctic krill** (*Thyssanoessa raschii*) during an intense feeding season. Our previous study showed that, with the foraging effort exhibited (fig. 1, cf. talk ECO03 Thursday 11:45), they already have to seek the highest densities within krill patches with low leeway in their reachable foraging efficiency.



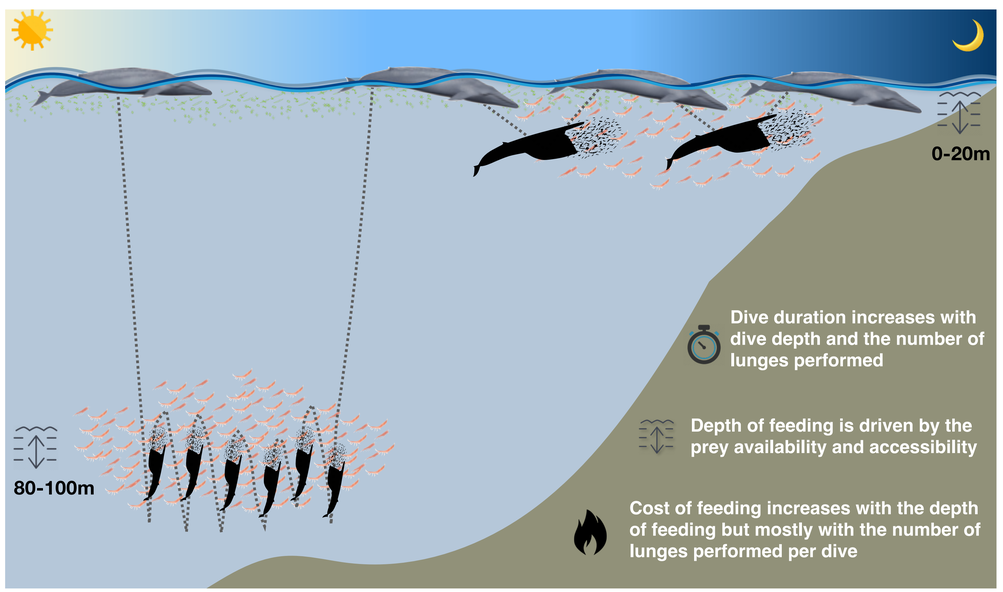


Fig. 1. Diurnal foraging effort of blue whale in the EGSL inferred from archival data loggers. Deeper, longer dives during the **day** with higher number of lunges per dive. Shallower, shorter dives during the **night** with one lunge per dive while following the vertical migration of krill. Feeding at the surface also occurs during daytime hours when blue whales find krill reproducing close to the surface.

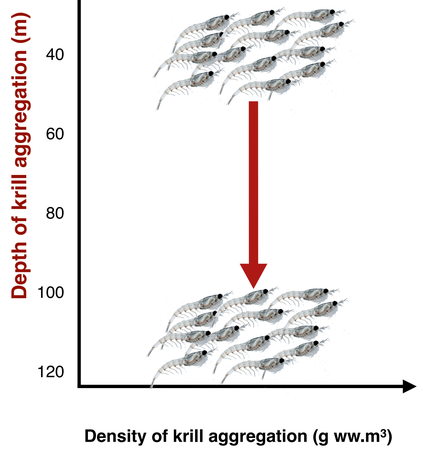
Objective

➔ **Study the effects of climate and natural variability in krill density and vertical distribution on blue whale foraging efficiency**

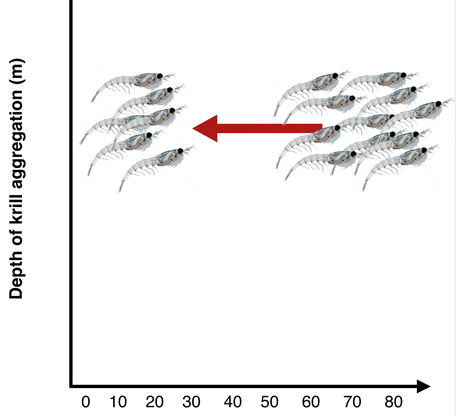
Methods

- **3 scenarios** recreating potential changes :

1. Change in the depth of krill



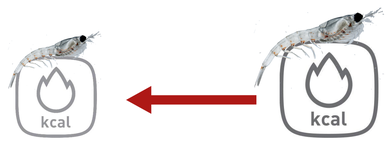
2. Change in the krill density



3. Change in the energy content

Arctic krill energy content

Now: 4.3 kJ.g ww ± 0.58 SD in the EGSL



- Use of **Monte Carlo simulations** for each scenarios to get an **output distribution of blue whale foraging efficiencies** (median, 90%CI).

$$\text{Foraging efficiency} = \frac{\text{Energy gained}}{\text{Energy expended}} = \frac{\text{Volume engulfed} \times \text{Feeding rate} \times \text{Krill density} \times \text{Krill energy content} \times \text{Assimilation efficiency} \times \text{Success rate}}{\text{Energy expenditure}}$$

- Effects of each scenario on blue whale foraging efficiency will be tested **one by one** but also as multiple **combination** of two or more changes.

Key points expected

- It is hypothesized that the **change in prey density is likely to reduce the blue whales foraging efficiency the most**. Whereas the changes relative to the depth of krill and the change in krill energy content are hypothesized to have a negative impact on blue whale foraging efficiency while **combined with the other parameters**.
- Ultimately, it will provide **information on blue whales energetic ability to cope with changes** in the prey field, due to long-term changes in the climate
- Further simulations will include the concurrent impact of **anthropogenic disturbances** (whale-watching activities) on the foraging efficiency of blue whales as it reduces the time allocated to foraging and could have a significant impact in terms of energy intake.

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