

Does dissolved oxygen level influence size and distribution of *Benthosema glaciale* and *Maurollicus muelleri*?

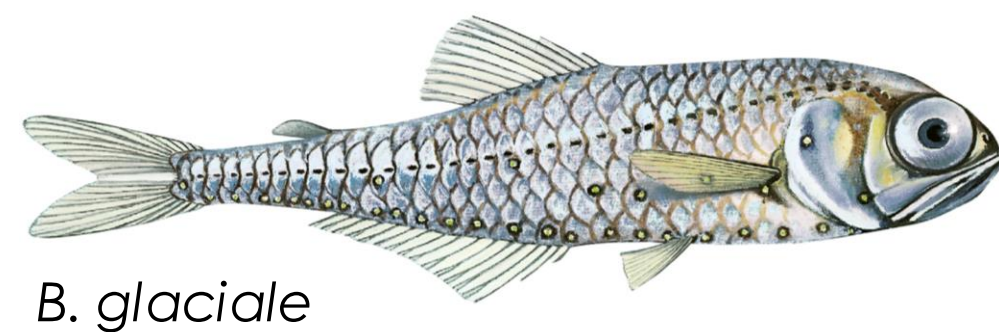
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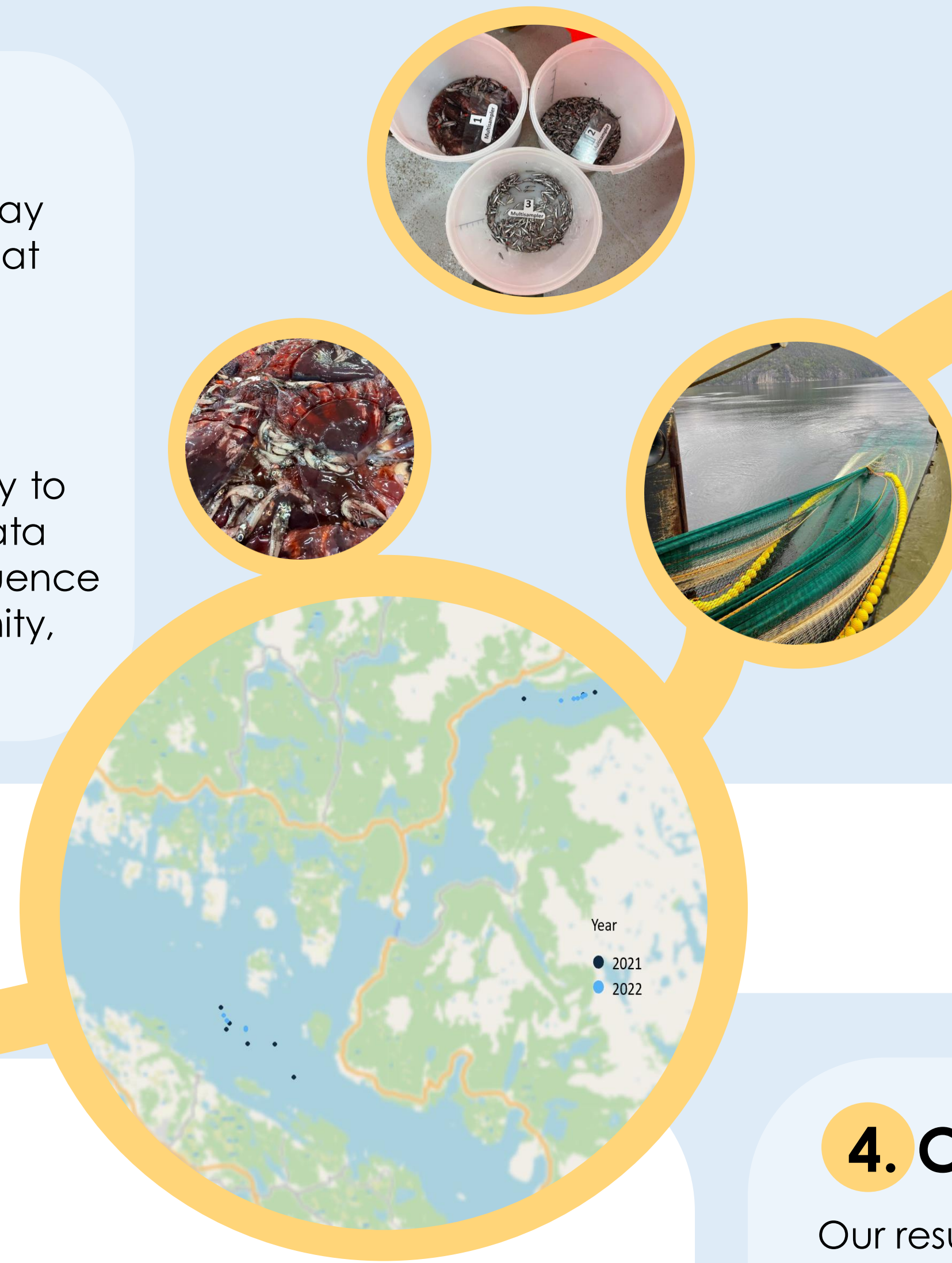
1. Background

Fensfjorden and Masfjorden are two connected fjords in western Norway with similar, if not the same, species richness. One of many attributes that distinguish two fjords is their dissolved O₂ levels. While Fensfjorden has relatively stable and rich levels of O₂, Masfjorden has fluctuating and often so low levels that it becomes hypoxic₁.

As a part of the BIO325 Ocean Science course, we had the opportunity to collect data on board G.O. Sars in September of 2022. We used the data and compared it with the data from 2021 to see whether O₂ levels influence the size distribution of two dominating fish in the mesopelagic community, *Benthosema glaciale* and *Maurollicus muelleri* in Masfjorden.



B. glaciale



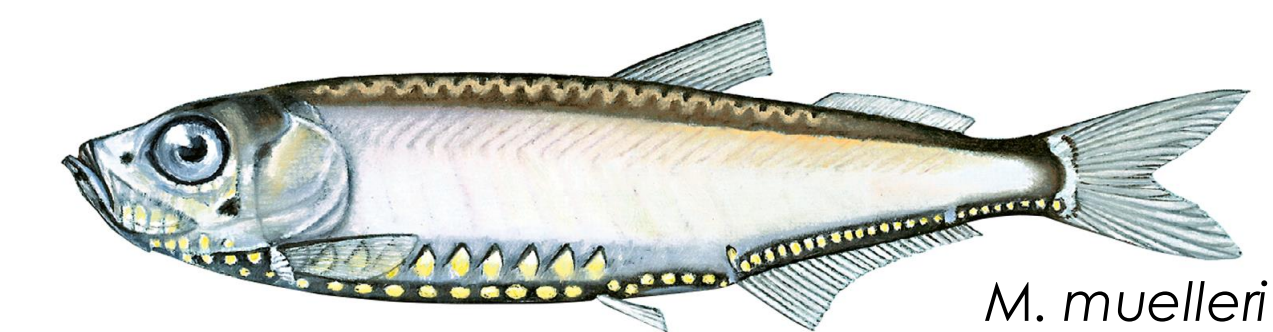
2. Methods

Data collection

- o Fish was collected at fixed-depth intervals using a multisampler trawl with three cod-ends
- o Fish were randomly sampled, and then length measured (Standard Length) in ImageJ
- o O₂ data with Seabird SBE 991 CTD

Data analysis

- All data was tabulated and analyzed in R-studios where we found:
- o Average oxygen amounts in water columns of two fjords
 - o Size distribution of two species per year, fjord and time of the day
 - o Mapped trawl and CTD location and marked them by the year



M. muelleri

3. Results

Size distribution of *Benthosema glaciale* and *Maurollicus muelleri*

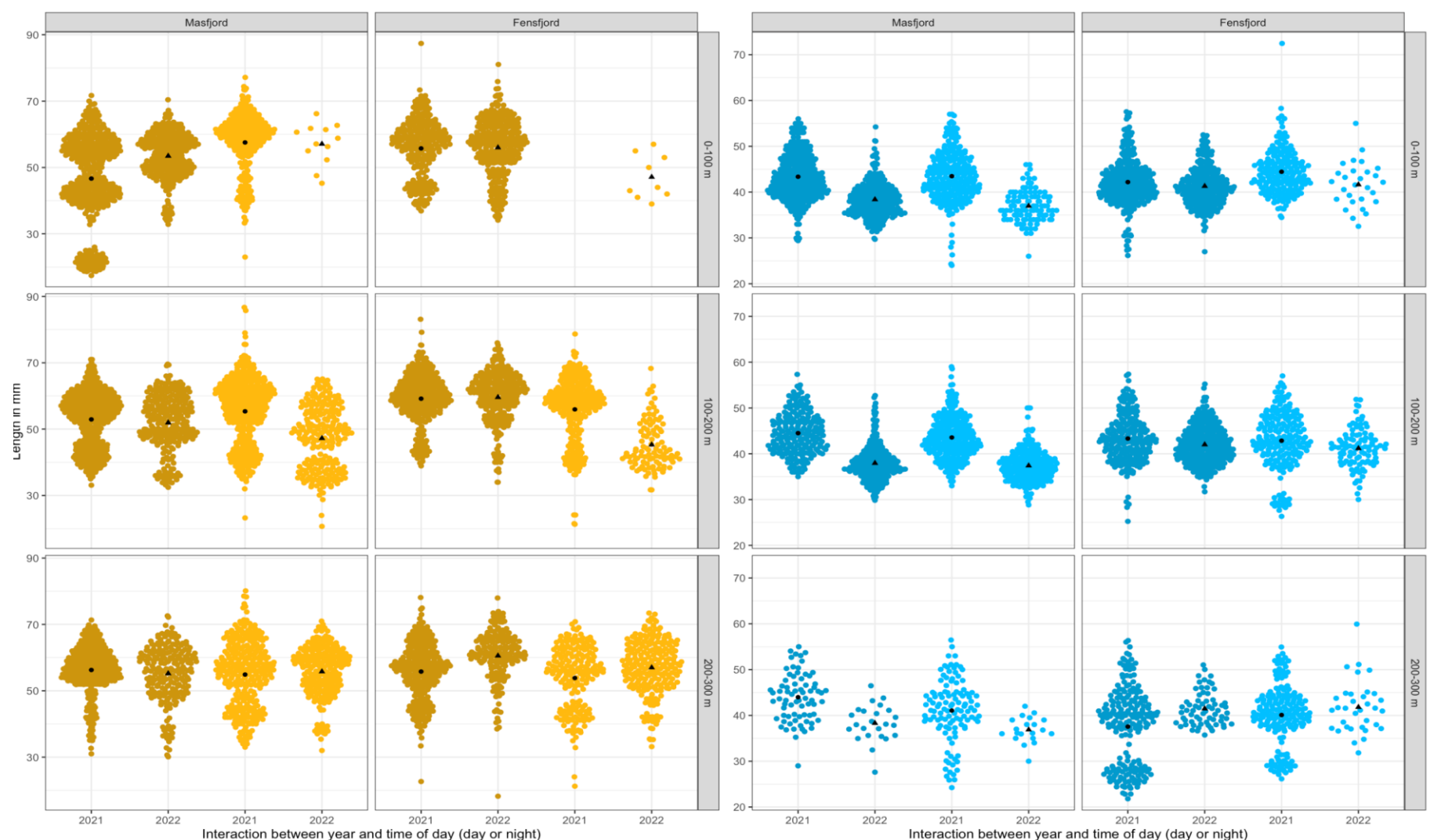


Figure 1 Size distribution of *B. glaciale* and *M. muelleri* in Masfjord and Fensfjord in September 2021 and September 2022 with the mean size. On x-axis are years 2021 and 2022 and time of day, day or night. Y-axis shows length in mm. In each cell is data per fjord (Masfjorden or Fensfjorden) per depth layer (0-100 m, 100-200 m, 200-300 m).

Average amount of O₂ in Masfjorden and Fensfjorden from 0 - 300 meter

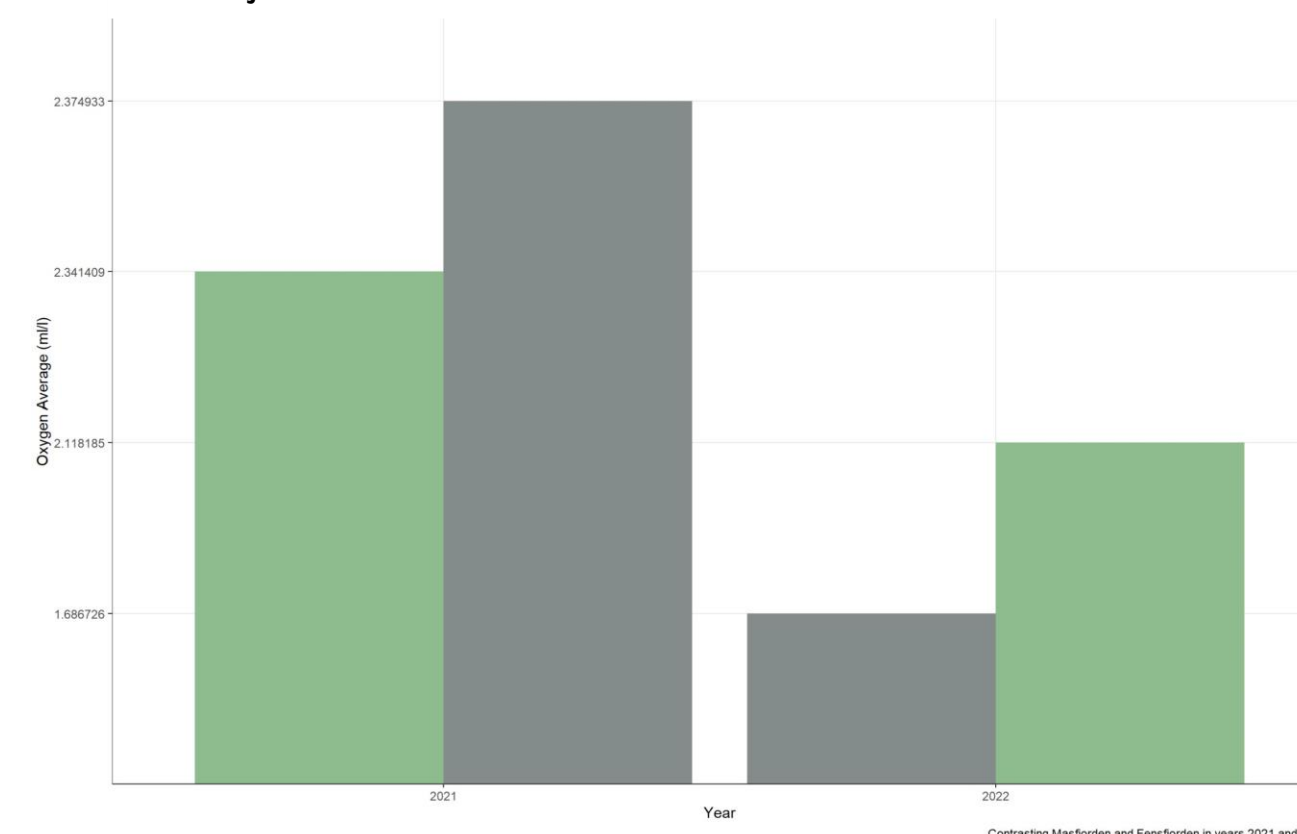


Figure 2 Average oxygen amounts in water column (0-300 m) in Fensfjord and Masfjord. On x-axis are years 2021 and 2022 and y-axis is average dissolved oxygen (ml/l).

4. Conclusion, and what next?

Our results indicate that oxygen levels affect the size distribution of *M. muelleri* (Figure 1), and it shows that the mean size of *M. muelleri* in Masfjorden is smaller in 2022 when oxygen levels are low (Figure 2).

As for *B. glaciale*, our findings do not show a clear trend in the size difference between 2021 and 2022 as they do for *M. muelleri*. However, they suggest that oxygen levels do not affect size distribution deeper in the water column (i.e., 200-300 m).

Further, we can compare our data to years in which oxygen levels are like those of 2022 to see whether there is a clear trend. We can also normalise time trawled in both fjords to compare the biomass between fjords and years.

References:
 1: Aksnes, D. L., Aure, J., Johansen, P.-O., Johnsen, G. H., & Veia Salvanes, A. G. (2019). Multi-decadal warming of Atlantic water and associated decline of dissolved oxygen in a deep fjord. *Estuarine, Coastal and Shelf Science*, 228, 106392. <https://doi.org/10.1016/j.ecss.2019.106392>
 Fekjan, D. *Maurollicus muelleri* (Gmelin 1789). Artsdatabanken. <https://artsdatabanken.no/Pages/F37403>
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