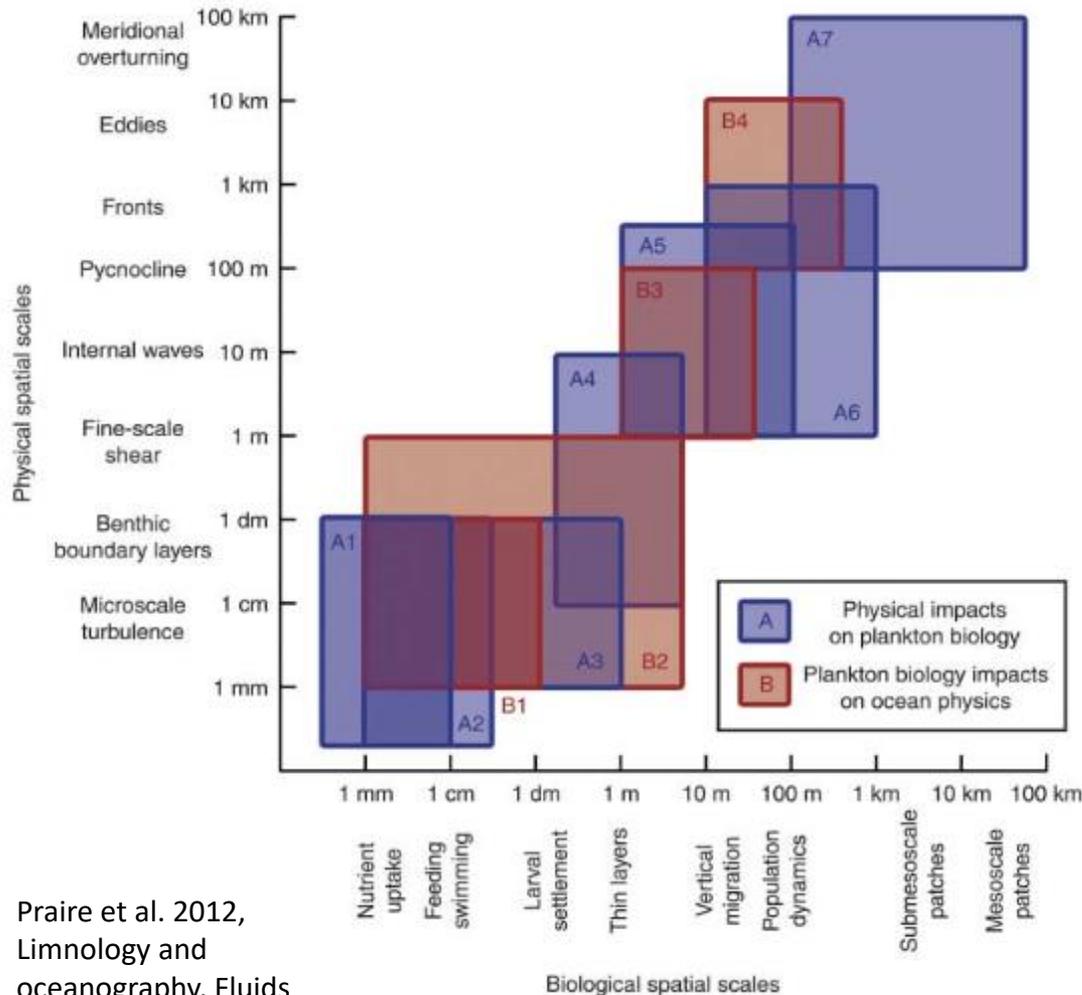# Understanding biology in dynamic regions: lessons from the ENTiCE project

Glaucia Fragoso

ENTICE project
NTNU

When and where (and how) we should sample?

Praire et al. 2012, Limnology and oceanography. Fluids and Environments.

- Depends on the question and the scale (temporal and spatial) considered.

- To answer this question, biologists need to modellers, engineers and physical oceanographers need to collaborate.

- Many cases, system is not well-known, so monitoring is needed before hypothesis-driven research takes place.

The effort needs to be combined

Praire et al. 2012, Limnology and oceanography. Fluids and Environments.
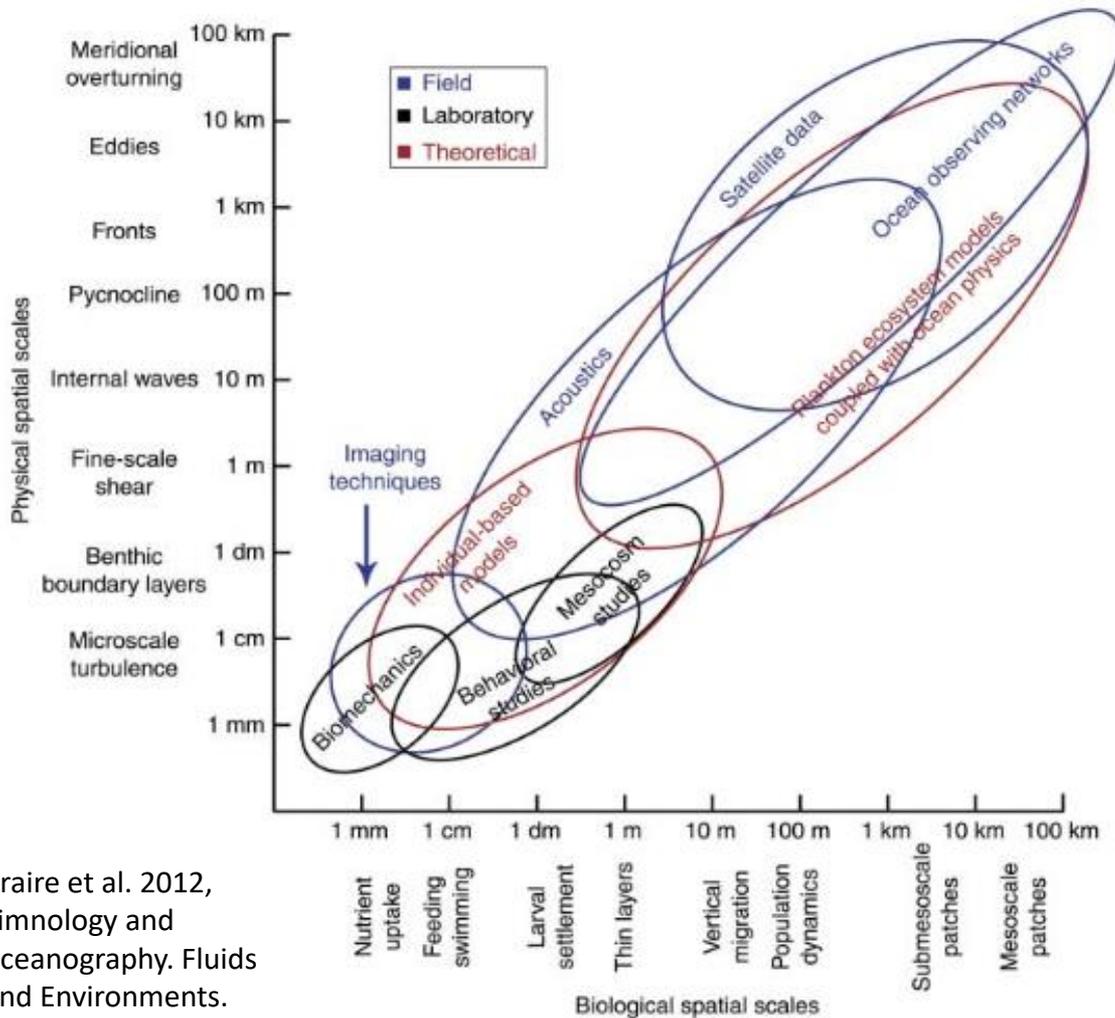
- Plankton can interact with the physical environmental at a broad scale- interaction are underappreciated.

- Techniques that involves mutiple scale can be the key.

ENTiCE project
(ENabling Technology providing knowledge of structure, function and production in a complex Coastal Ecosystem)
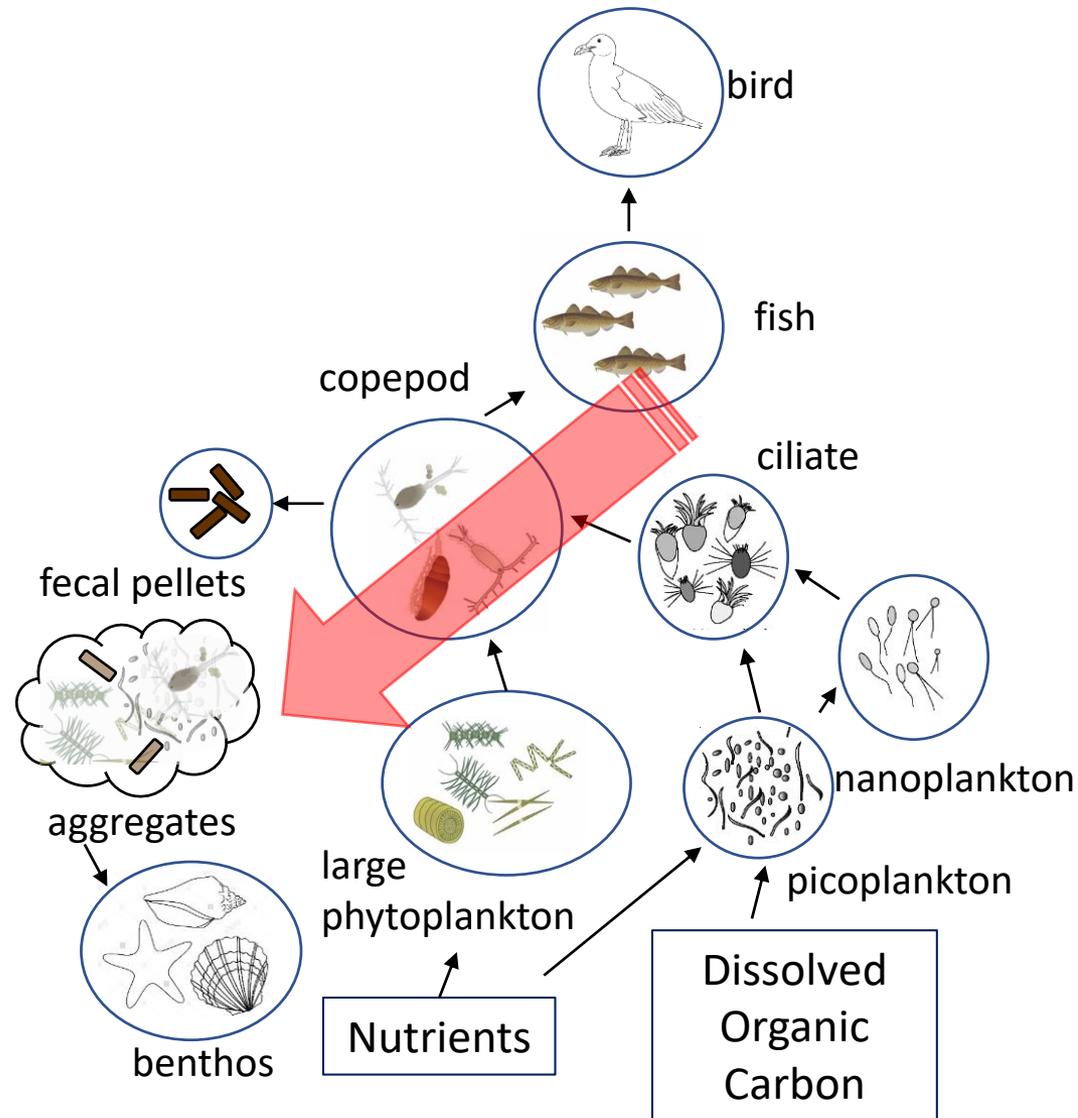
Objectives:

- **Understand the physical controls on environmental factors, productivity, community structure and function.**

- **Use enabling technology to address this questions.**

- Interdisciplinary approach (SINTEF & NTNU) – Combination of biologists, modelers and engineers.
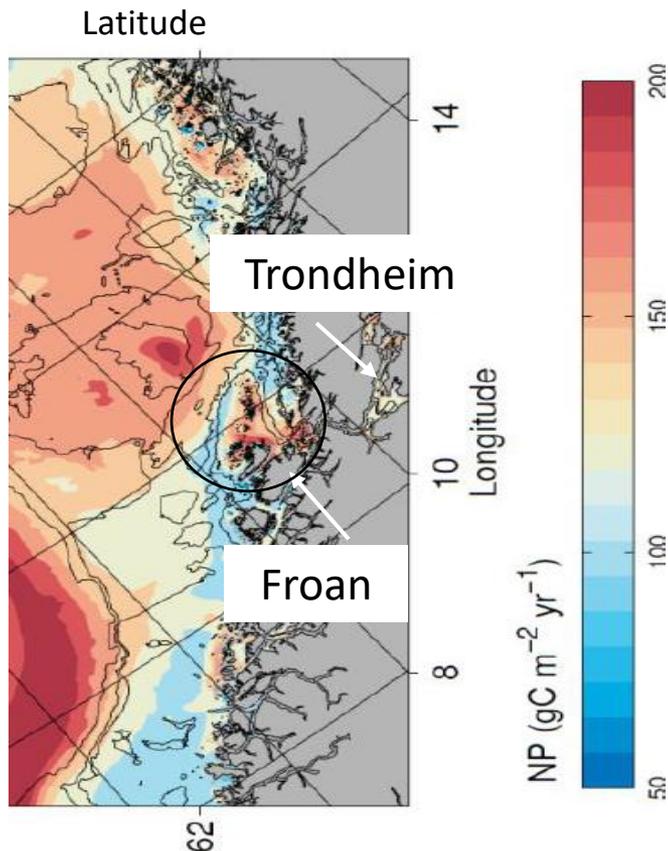
Background of my research

- Phytoplankton is the basis of the food web.

- The size of the phytoplankton influences the efficiency of energy flow in the food-web.

- As well as the nature of particles.

bird

fish

copepod

ciliate

fecal pellets

aggregates

nanoplankton

large phytoplankton

picoplankton

benthos

Nutrients

Dissolved Organic Carbon

What controls the large productivity in the area?

What is the fate of this productivity?

1) Investigated the phytoplankton size.

2) link these with particle types (biogenic form) and using *in-situ* optical instruments.
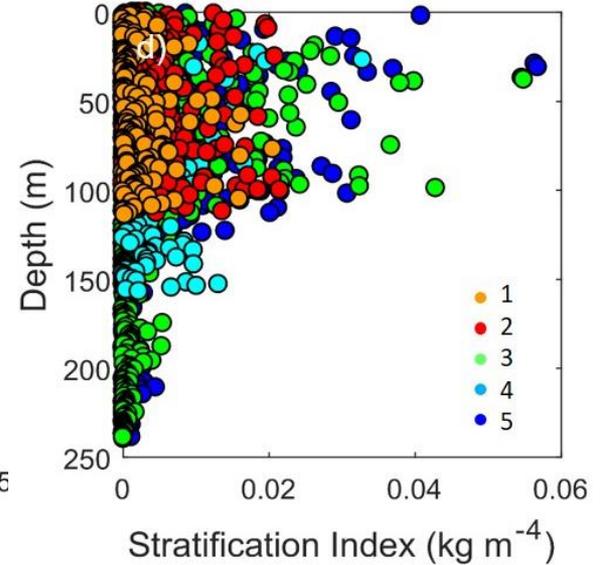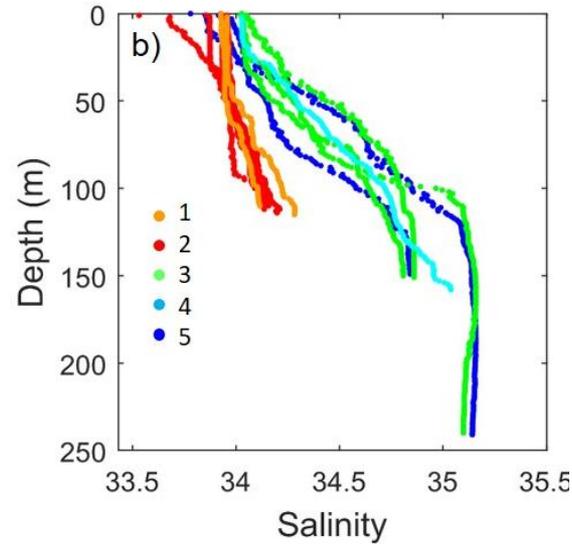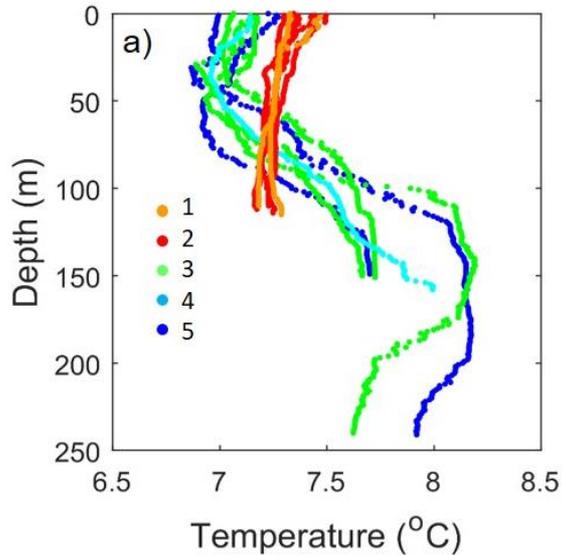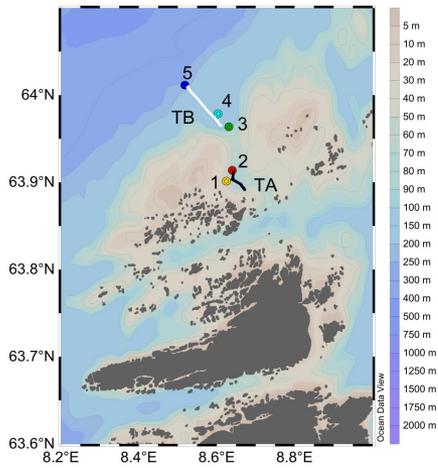
Study area & sampling
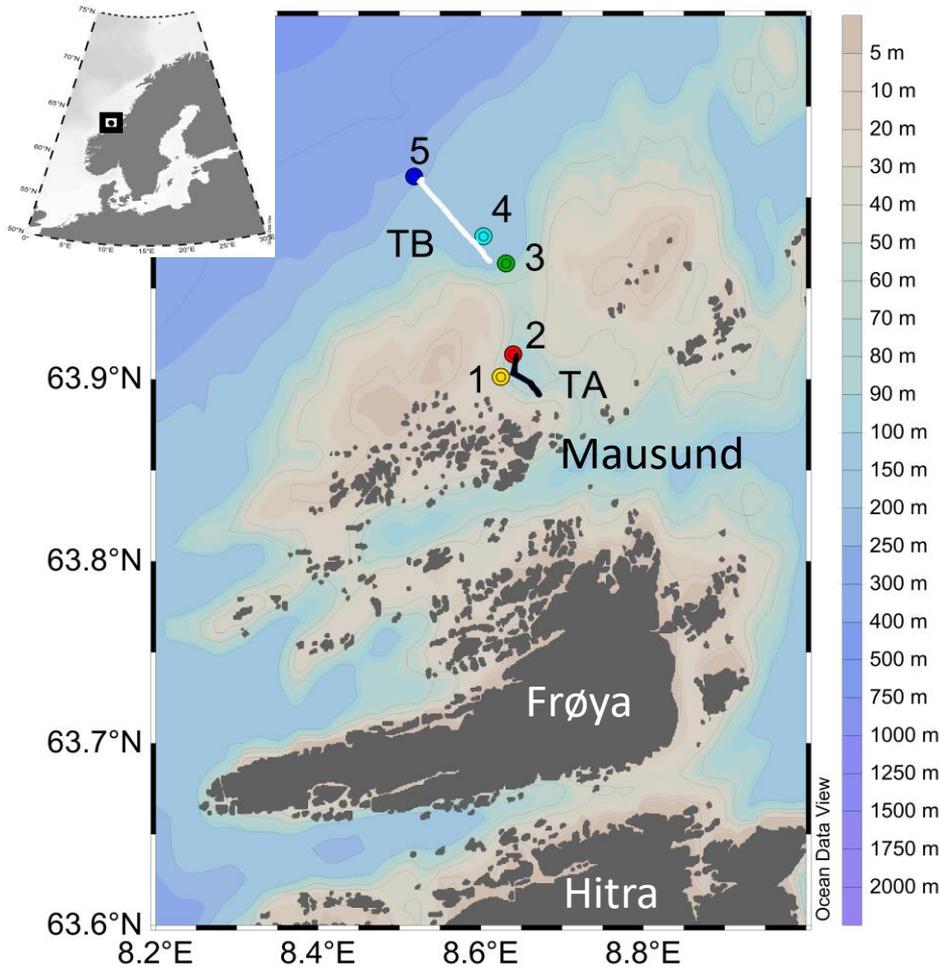
Cruise details:

- 8th – 12th May in Mausund bank

- In bank – Region A (1&2)

- Outer bank – Region B – (3, 4 &5)

- Water samples

- AUV deployed in both regions
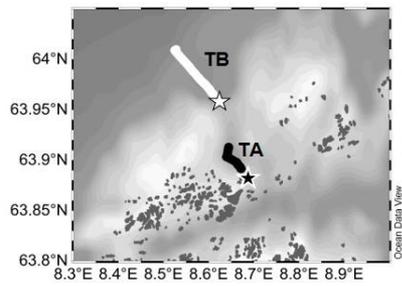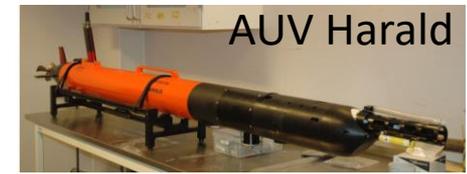
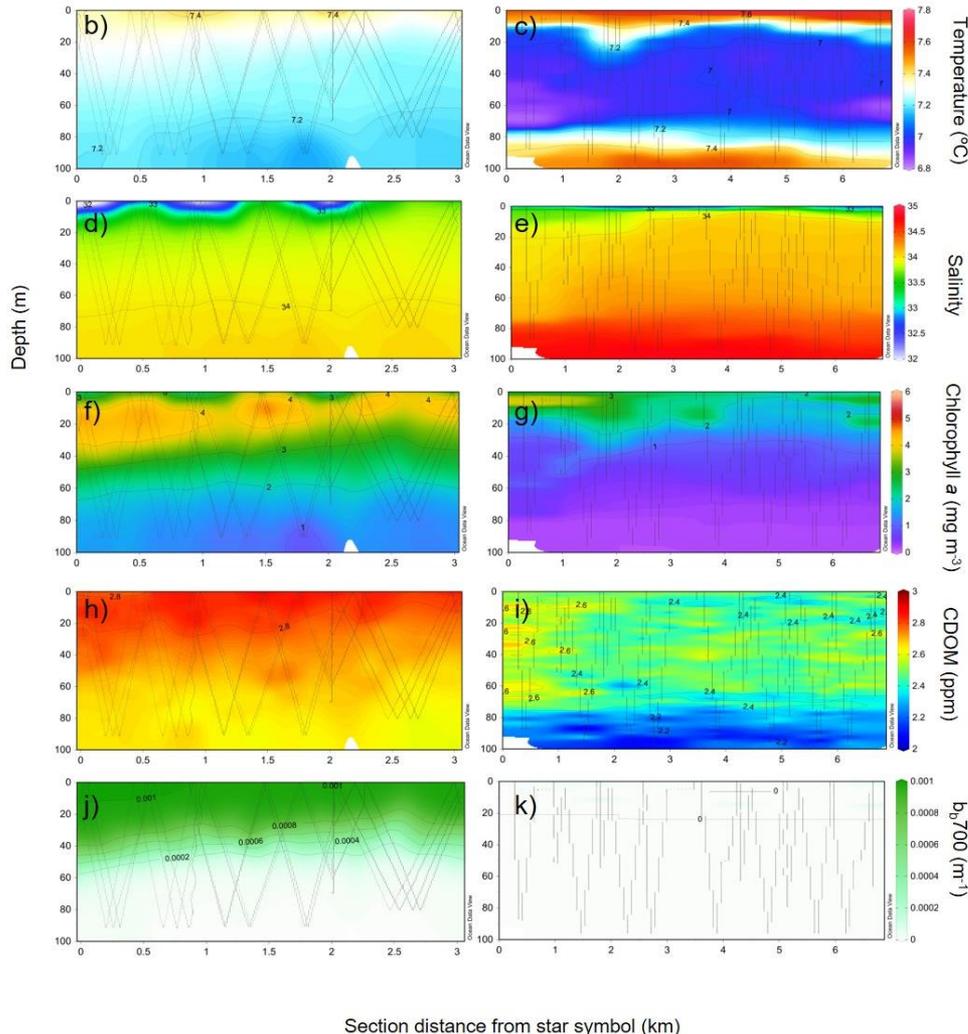- Silhoutte Camera (SilCam) – pictures of particles

Results

Hydrography

- Within bank – more MIXED; outside bank – more STRATIFIED

Results (Hydrography)

AUV Harald

Transect A (TA)

Transect B (TB)

- <u>Transect A (within bank)</u>

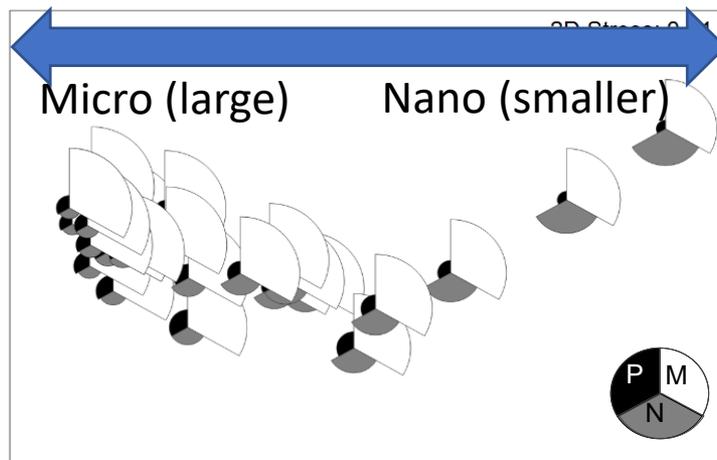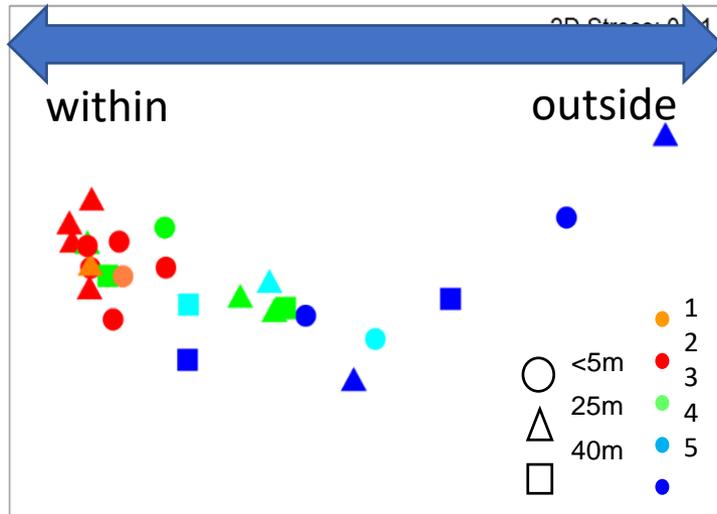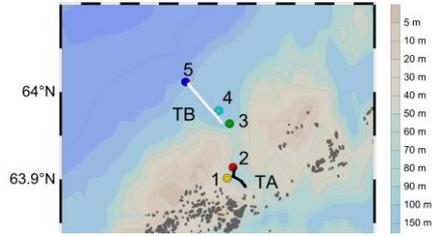   - More mixing, chlorophyll a, colored dissolved organic matter (CDOM) and particle backscatter.

- <u>Transect B (outside bank)</u>

   - Salinity (S) and temperature (T) are more stratified.

    - High T and S at deeper waters shows the influence of Atlantic nutrient-rich water mass.

Section distance from star symbol (km)

Results (phytoplankton size)

within   outside

Micro (large)   Nano (smaller)

- Pigment data was used to define size.

- Microphytoplankton is high (>90%) within the bank.

- Nanophytoplankton contribution increases outside the bank.

- Intensive mixing brings up nutrients – the more nutrients, the larger the cell.

Results (particle distributions)
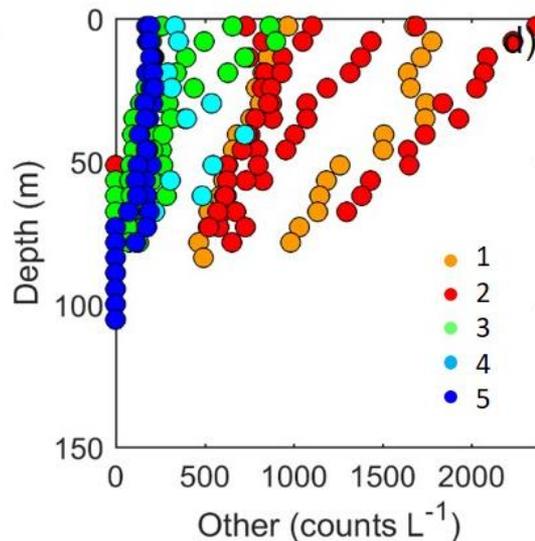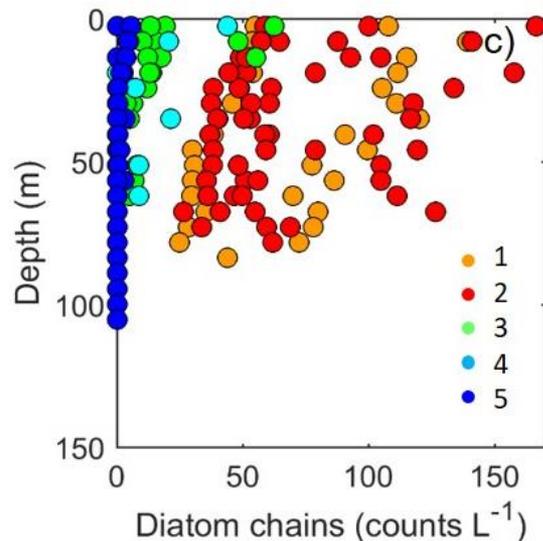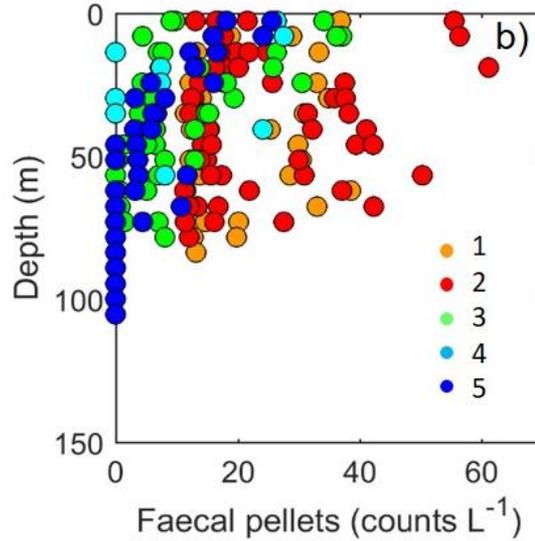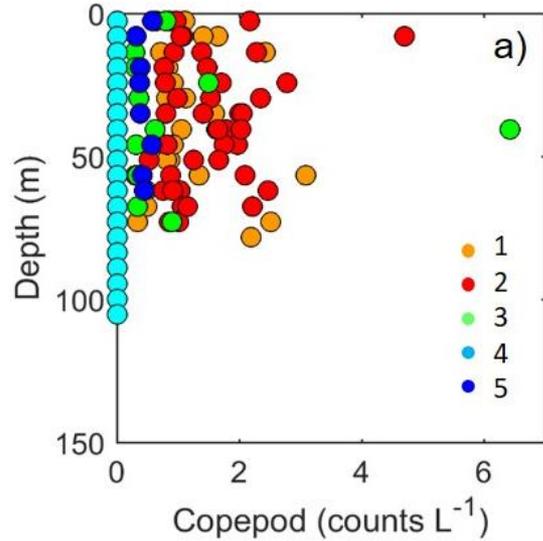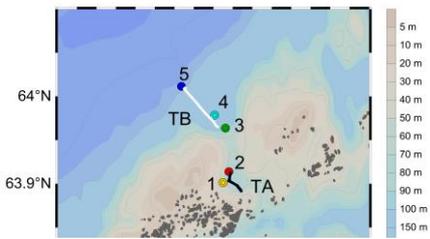
- Most particles (~87%) were not identified.

- More particles within bank.

- Particles resembled the hydrography.

- Particles indicate that copepods were grazing large phytoplankton (diatoms)

Conclusions of this study

- Phytoplankton from distinct regions of Mausund Bank (within and outside the islets) varied in size.

- Large phytoplankton, such as chain-forming diatoms were abundant in productive and well-mixed waters of the bank, whereas the contribution of small phytoplankton, such as flagellates increased towards off-bank – influence of nutrients.

- The large abundance of copepods and fecal pellets within the bank suggests that copepods were actively grazing on the microphytoplankton.

Future research
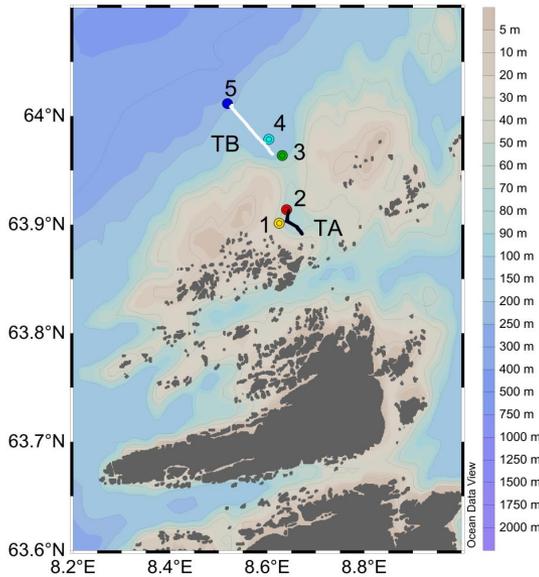
- Buoy data (Chlorophyll fluorescence, Salinity, Tempetature) near station 3 from March to September.

- Weekly CTD and water sampling for chlorophyll a, phytoplankton pigments and community structure, stoichometry (POC:PON) at station 2 and 3.

- Modelling combined with data from discrete sampling (nutrients, temperature, salinity, chlorophyll a and phytoplankton community structure) would show the influence of internal waves in bringing nutrients to the bank.
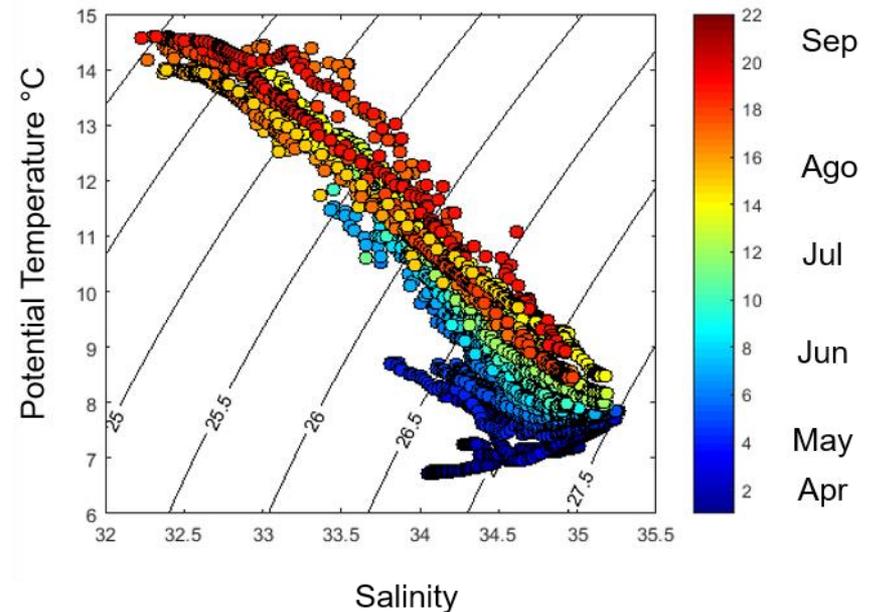
What are the lessons from ENTiCE?

- Environmental gradients (spatial or temporal) can explain.

- Invest in trait-based approach to study plankton distributions.

- Care needs to be taken for organisms that are patchly distributed (e.g. zooplankton swarms).

- Technology is great but ALWAYS use old-school techniques (chlorophyll extraction, net for zooplankton taxonomy).

- The research question needs to determine sampling and should be more focused as possible to facilitate the sampling.

- Scientist from different fields need to communicate better with each other when the research is interdisciplinary.

Tusen takk!

Emlyn J. Davies, Ingrid Ellingsen, Matilde S. Chauton, Trygve Fossum, Martin Ludvigsen, Kristine B. Steinhovden, Zsolt Volent, Geir Johnsen, Kanna Rajan (SINTEF & NTNU)