

The need for (near) real time Ocean Data in Ocean- and Coastal Management



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Do we meet the society and industry's need for data and products?

Using different platforms, data are collected in near real time from:

- Argo floats
- Ferry box system's
- Marine observatories / rig's
- Wave Gliders - surface
- Sail Gliders – surface
- Sea Gliders - subsurface

Most of these data are not used in near real time

Lots of the data are not used within a decade after they have been collected

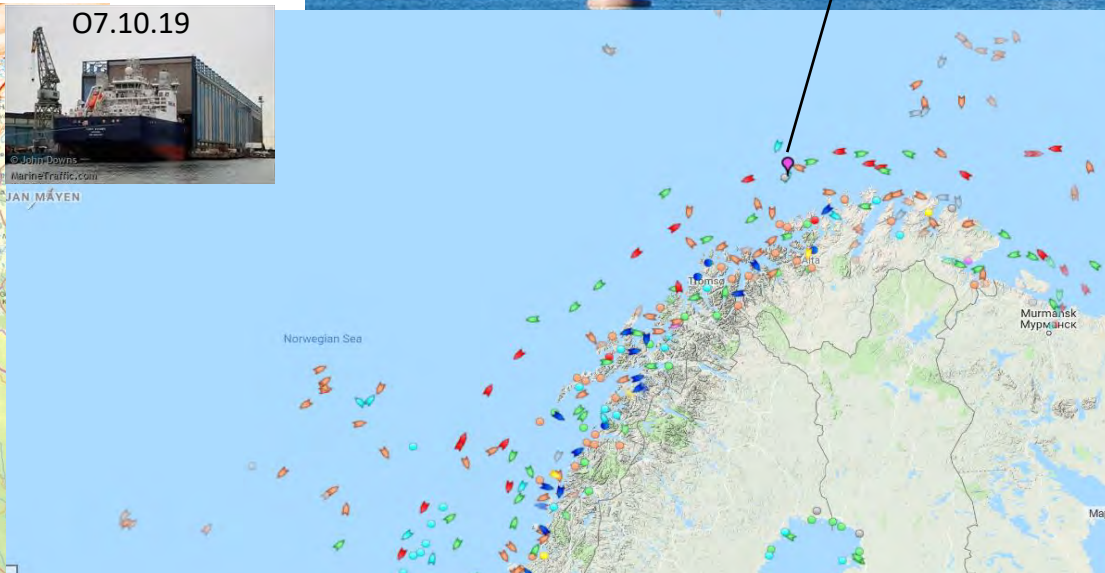
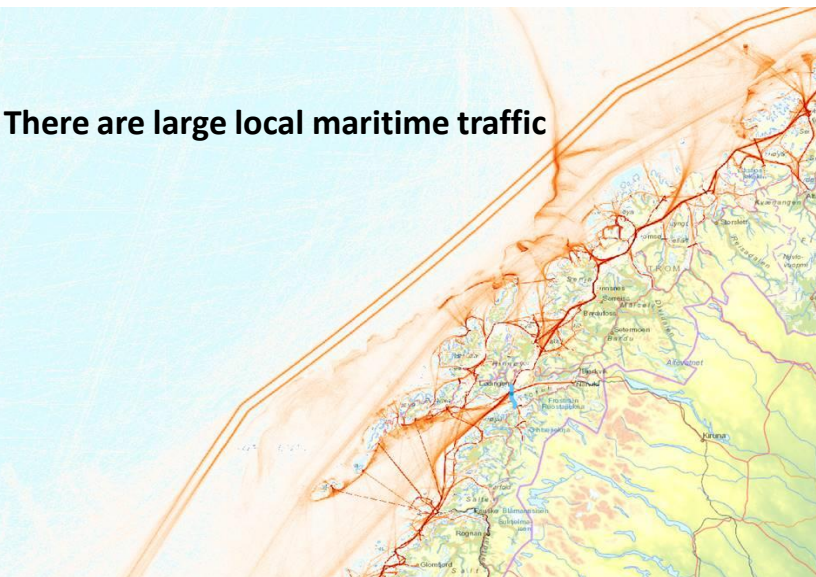
Could we do better?

Are there a need for data or products
based on near real time observations?

Increased use of Norwegian waters

Maritime corridor / traffic separation system

Dangerous cargo: tankers, bulk and dry cargo ship



Arctic Norway has large marine military activity

Andøya Space Centre

Testing of maritime Missiles

Increased activity in Rocket based research

Testing and Development of Drone Technology

Hub for Gliders



The need:

Improved wave forecast

Rescue operations

Whale migration

Key species distribution

<https://www.maritime-executive.com/article/video-frigate-damaged-in-missile-explosion>

2018 June

Last Friday, during an exercise off the coast of Norway, an SM-2 missile failed to lift out of the vertical launch tube below the *Sachsen's* deck (a "hangfire"). It burned and exploded, sending a blast upwards just forward of the frigate's wheelhouse.



USS Benfold launches an SM-2 (USN file image)

Fish farming and petroleum activity:



The need:

- Oil Spill Modelling
- Environmental Risk Assessments
- Oil Spill Contingency Analyses
- Oil Spill Response Planning
- Rescue operations
- Salmon lice and organic pollution
- Algae bloom and toxic algae
- Optimal management

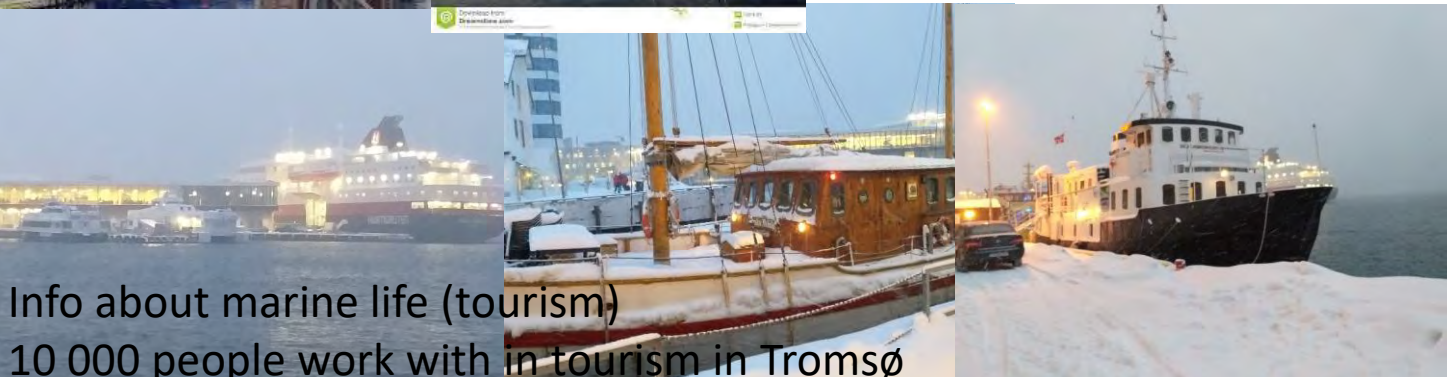
The need for research along the Arctic Coast of Norway (Northern Norway)

The Northern Norway coastal regions, shelf break and open ocean areas offshore in the Norwegian Sea are:

- a) Key areas for major traditional fisheries and whaling (cod, haddock, saithe, herring, minke whale)
- b) Spawning site and feeding area for the early life stages of major fish stock
- c) Increased Tourism

The need:

- Weather and wave forecast
- Rescue operations
- Distribution of fish and key specie



Info about marine life (tourism)
10 000 people work with in tourism in Tromsø

The *Calanus* fisheries

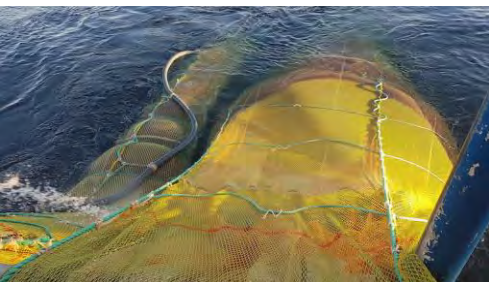
Along the coast of Northern Norway we are now harvest on 3-4 trophic levels

The newly opened fishery on *Calanus* sp. means that Norwegian waters is one of the few in the world that is open for harvesting on 3 to 4 trophic level. Super swarm of *Calanus* zooplankton (Raudåte) has been recorded in the area

New marine recourses in the North includes:

krill and mesopelagic fish:

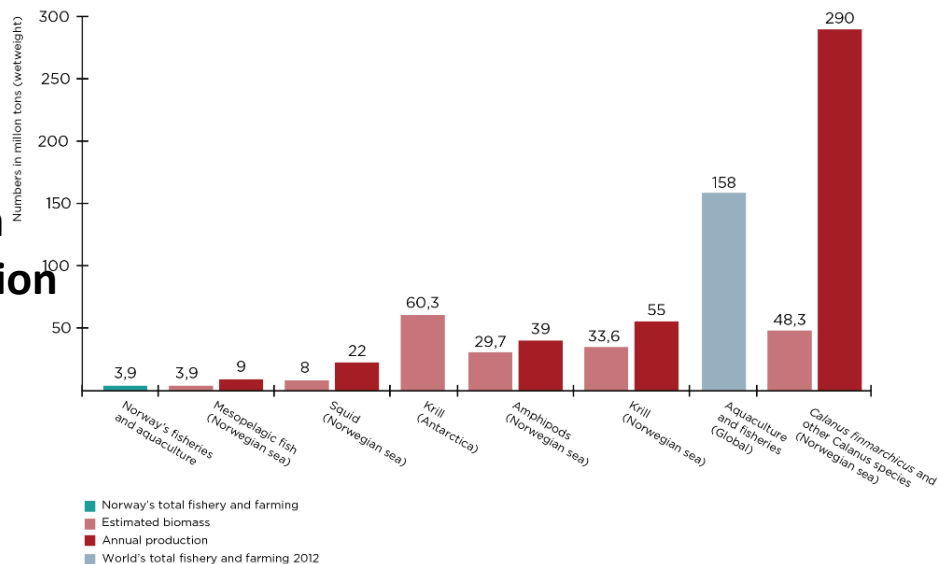
high lipids – functional food



The need:

- Optimal fishing area
- Fish larvae distribution

BIOMASS AND PRODUCTION OF SELECTED SPECIES



Overview of biomass estimates for selected species/areas.

Source: Directorate of Fisheries (2016), Institute of marine research (2016), FAO (2014), Skjoldal (2004)

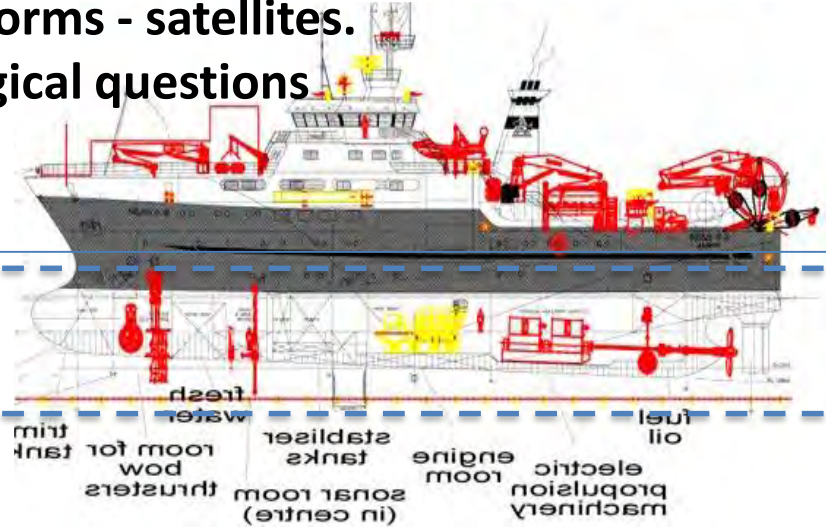
Research ships destroy the biological and physical structure in the upper 50m.

Do we have to rethink our understanding of the marine system in the photic zone?

GLIDER – Observatories – Argo floats platforms - satellites.
Modern instrumentation to address biological questions

70, 333 kHz

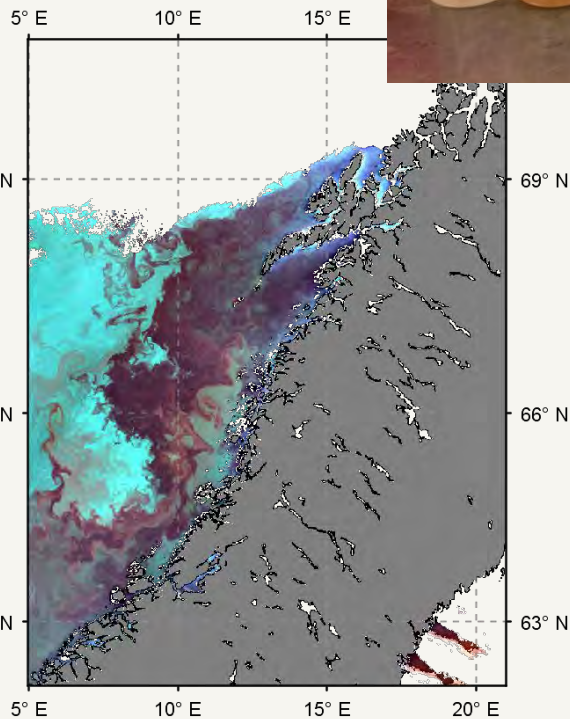
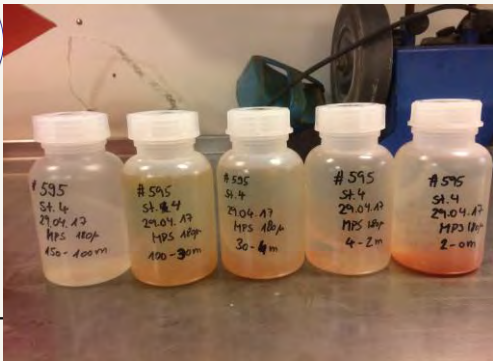
333 kHz



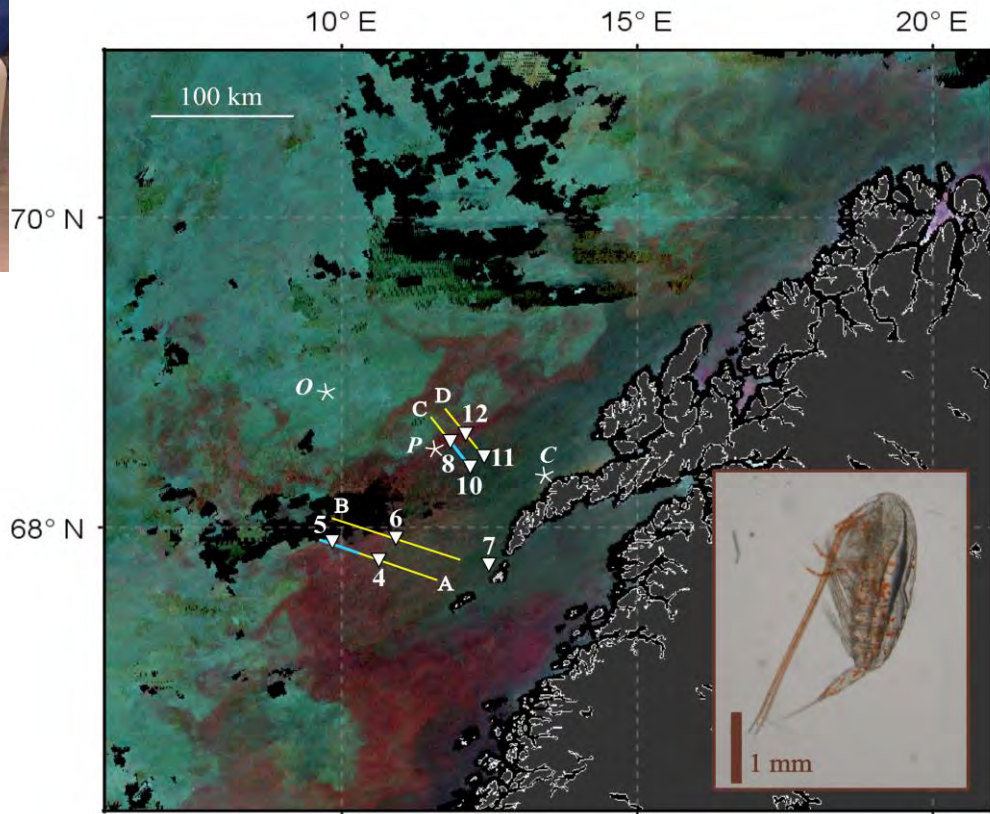
*Platform illustrations: Maritime Robotics / Liquid Robotics (Wave Glider)
Offshore Sensing (Sailbuoy), IMR (GO Sars)*



SeaPatches



Satellitits – Super swarm of *Calanus* in the upper 20 m (max upper 5)



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Basedow et al. 2019

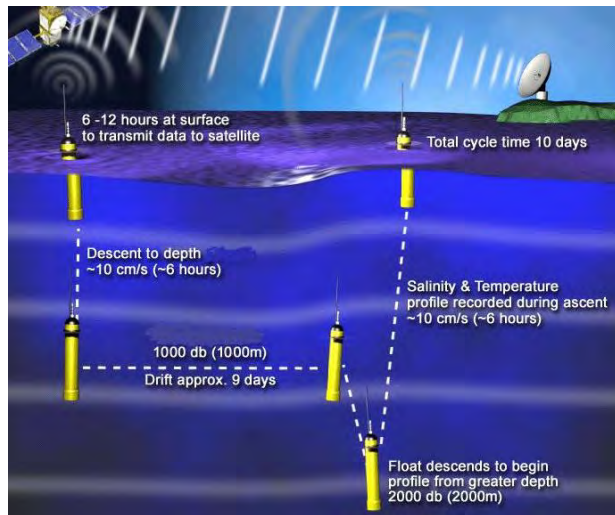
NorArgo2

- the Norwegian contribution to the European and global Argo infrastructure



Deployment of an Argo float

Institute of Marine Research is the coordinator of NorArgo



Ten days cycle. A float can do ~200 cycles (4-5 years)

NorArgo will operate ~30 autonomous vertical profiling floats, Argo floats. (pressure, temperature, salinity, oxygen, pH, nitrate, fluorescence)



Daily updated data and locations

<http://www.imr.no/forskning/prosjekter/norargo/map>



GLIDER
Unmanned Ocean Exploration



Cutting edge data available.

Modis:

1. VIIRS RGB and Modis satellites

Wave Glider – surface vehicle:

1. Surface water
 1. Temperature and salinity,
 2. Turbidity, fluorescence (phytoplankton), oxygen concentration, pH, CO₂ concentration
2. PAR (light)
3. **EK 80 echosounder (zooplankton, fish fry, pelagic fish, demersal fish – 70 and 333 kHz)**
4. Passive acoustics (mammal vocalization, anthropogenic noise)
5. Wind speed and direction, air temperature and pressure

Sailbuoy – surface vehicle:

1. **EK 80 echosounder (zooplankton, fish fry – 333 kHz)**
2. Surface water
 1. Salinity and temperature
 2. Oxygen concentration

Seaglider – subsurface vehicle:

1. Passive acoustics (marine mammals and anthropogenic noise)
2. Profiles to (up to) 1000 m of
 1. Currents speed and direction (estimated)
 2. Temperature and salinity
 3. Oxygen concentration
 4. Turbidity
 5. Chlorophyll fluorescence (phytoplankton)
 6. FDOM fluorescence

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SIMRAD WBT mini (EK80)

Preliminary results March to September 2018

Marine algae, zoo-plankton, fish juveniles and fish, marine mammals, meteorology and oceanography



Total distance sailed: more than 11 000 km

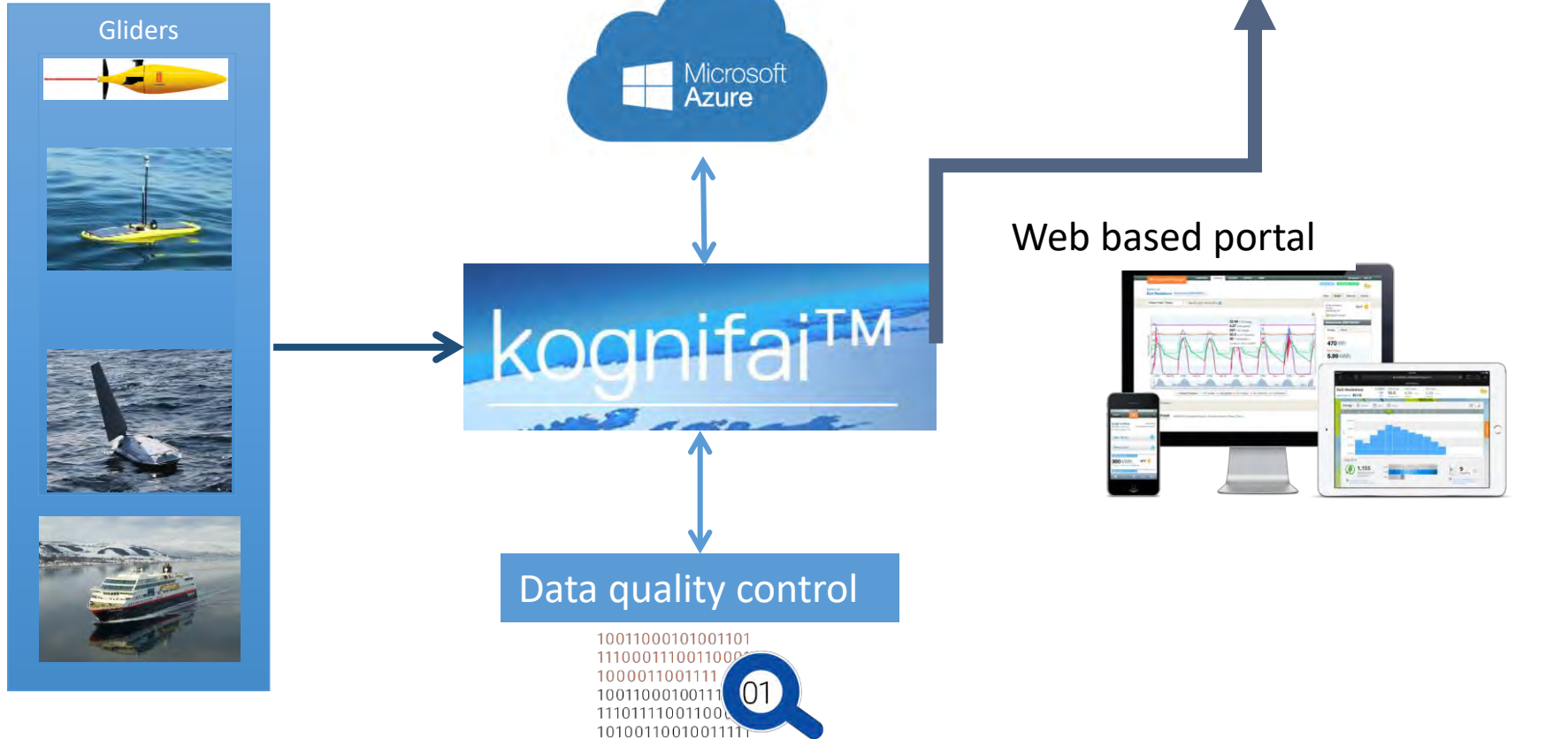


Data management platform

Real time data

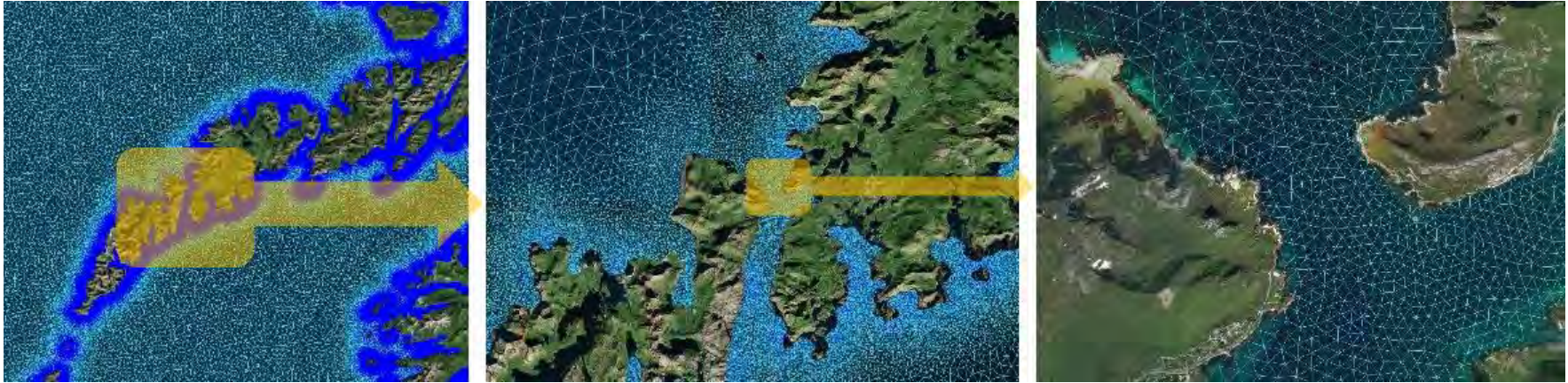
Applications for stakeholders

Ecosystem understanding & monitoring



Fabrication of high resolution model suited for complex coastline

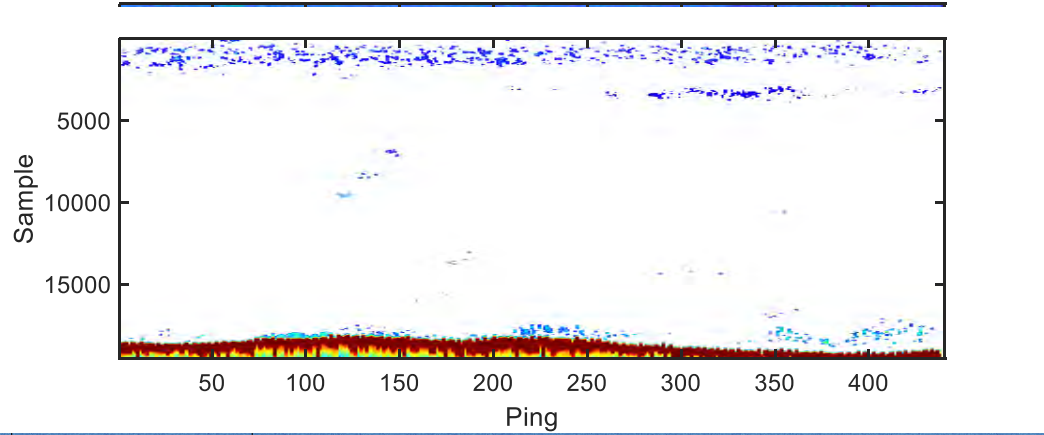
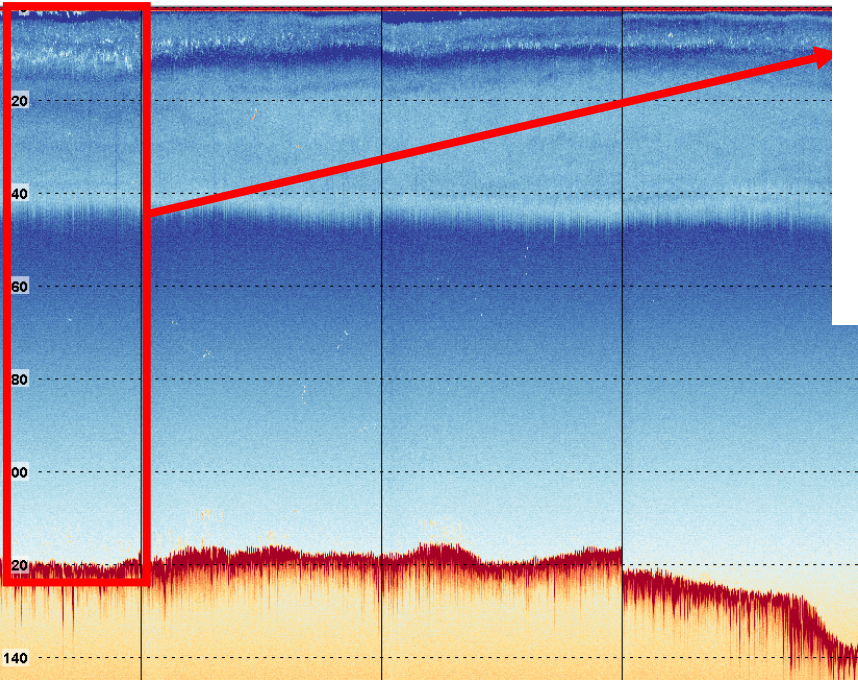
Real time data input to operational models, how can we achieve this?




FVCOM Model

<http://apnkyst.no/kategorier/kartlosning/>

Separat zooplankton and fish larvae



Gimsøy – Fishing for *Calanus*



From research to value creation

S Falk-Petersen: https://scholar.google.no/citations?hl=no&user=liGY_PEAAAAJ