9TH EUROGOOS INTERNATIONAL CONFERENCE

A regional approach for operational ocean health information service

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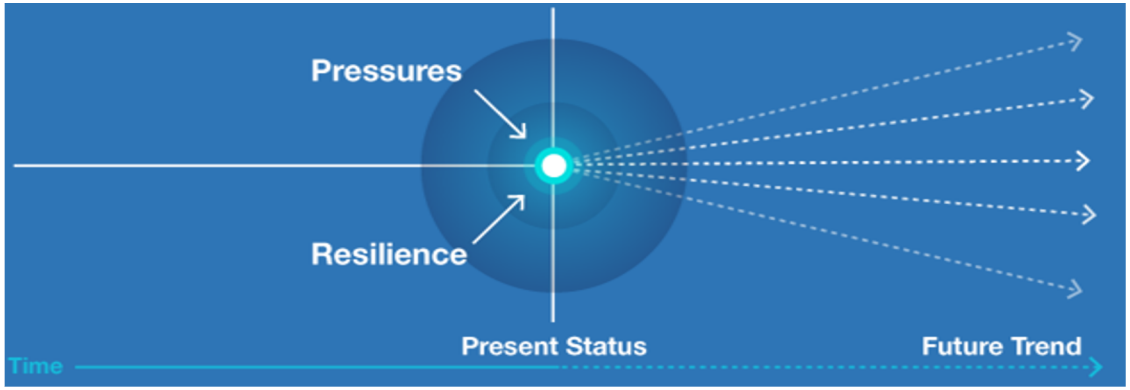
Information service for ocean health

- **Scope**
  - Marine pollution
  - Ecosystem assessment and resilence
  - Biodiversity
- **Time scale**
  - Forecast (days to months)
  - Interim reanalysis (1-12M)
  - Scenario projections

- **Platform: Operational Ecology**
- **Objectives:**
  - Predicting evolution of high impact events: oil/litter/nutrient pollution, algae bloom/oxgen depletion
  - Rapid assessment of environment status in interim scales
  - Ecosystem resilience to climate change, aqua-farm/fishing and offshore energy: scenario service



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State-of-the-art on operational ecology

Observations

- Operational: BOOS – Argo, glider & FBs
- Environmental: HELCOM monitoring program
- Fishery: EMFF, ICES
- Commercial: fishing gears, gliders, sail drones, offshore platforms
- Research: RIs
- Satellite: High resol. Coastal-estuary data, bathynmetry; hourly SST, SPM

Modelling:

- **BAL MFC**: NEMO-ERGOM-PDAF: BGC forecast & reanalysis
- **Member States**:

  Open sea-coastal-estuary PHY-BGC modelling

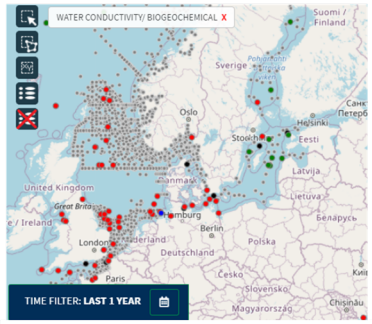
  Climate-Hydrological modelling

  Climate-PHY-BGC-BIO-Socioeconomic modelling

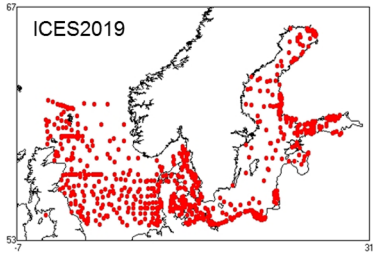
  E2E modelling Atlantis

  Partical & tracer modelling (Oil spill/marine plastics/SPM)

  Hindcast and projections (pre-operational) for BGC and BIO variables



Source: EMODnet

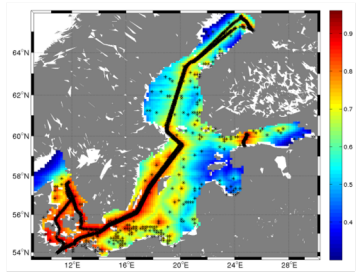


Source: ICES

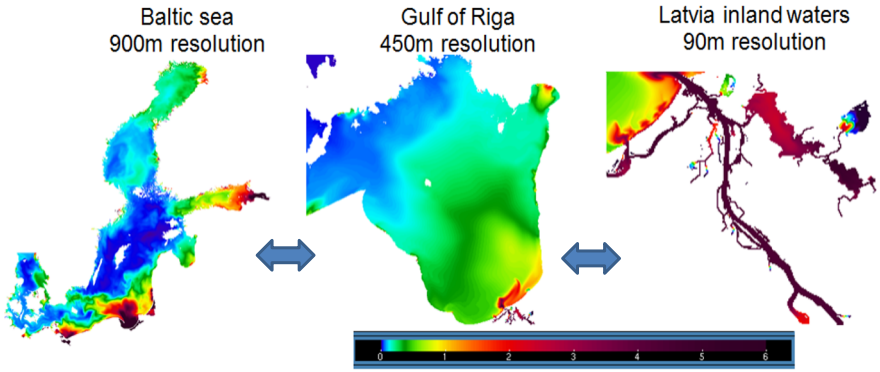
Chl-a data in the Baltic-North Sea

- EMODnet: R/Vs, Argo, Ferrybox, moorings
- ICES2019: R/Vs
- EMODnet and ICES data compensate each other

Effective coverage



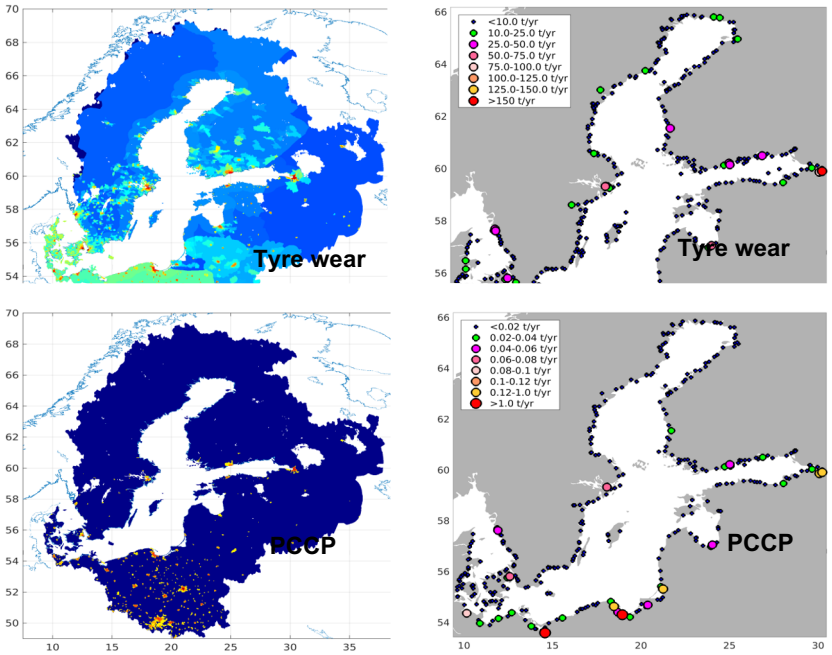
Source: She et al., 2014



Progress on operational ecology: microplatic modelling

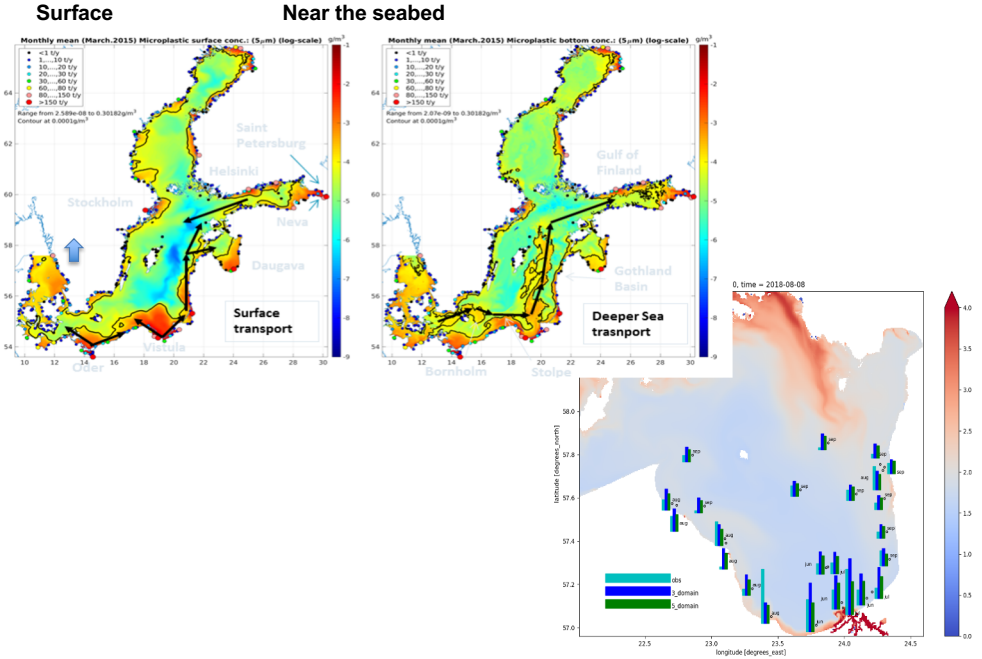
Source modelling:

- Tyre wear microplastic sources and pathway
- Laundary/PCCP microplastic sources and pathway



Fate modelling

- Hydrodynamics + tracers + biofouling, sedimentation
- Model and observation intercomparison in Gulf of Riga in 8 Aug. 2018: blue – HBM with 3 nested layers; green: HBM with 5 nested layers; light blue: observations > 300 µm. Correlation: 0.65



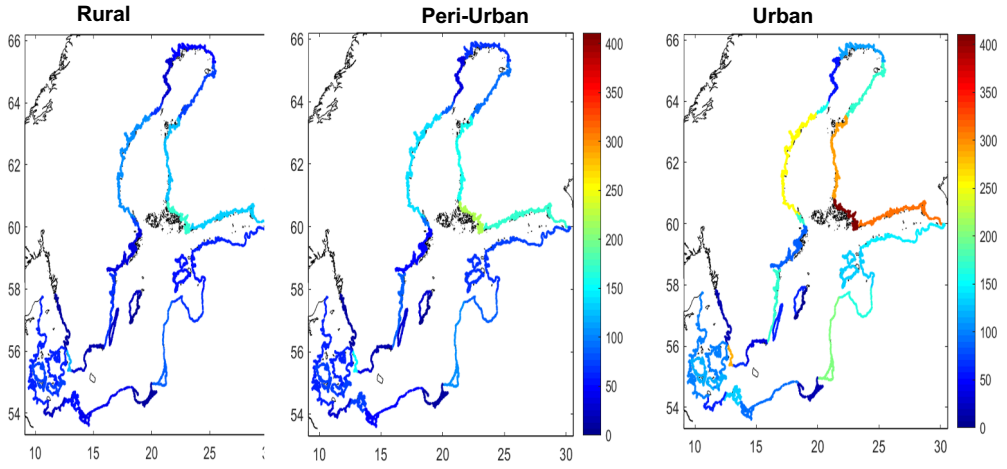
Progress on operational ecology: macroplatic modelling

Source modelling:

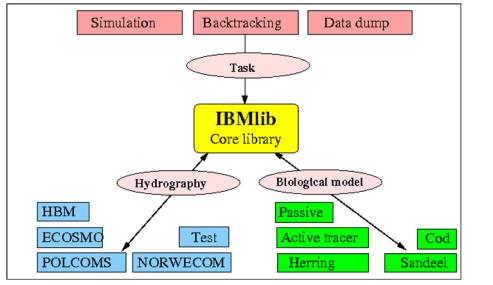
- Macroplastic mapping in the coast
- Macroplastic mapping from rivers

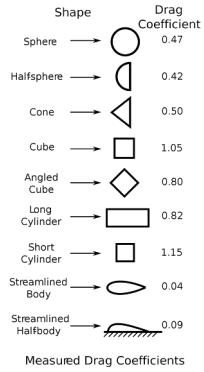
Fate modelling

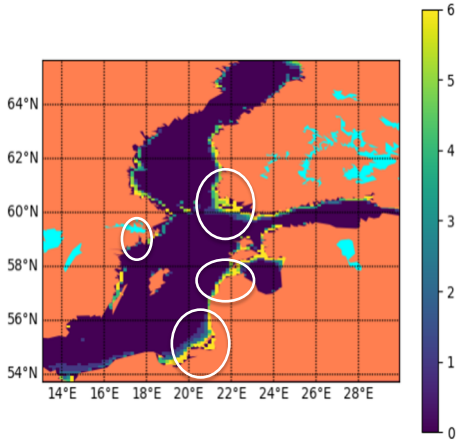
- Lagrangian IBM: Dynamical resampling algorithm, Windage varying with shaps, Sinking/deposition: and Beaching



Macroplastic litter density (n/100 m)
Left: rural beach; middle: peri-urban beach and right: urban beach.







Simulated Baltic Sea macropalstic Distribution

FORCOAST

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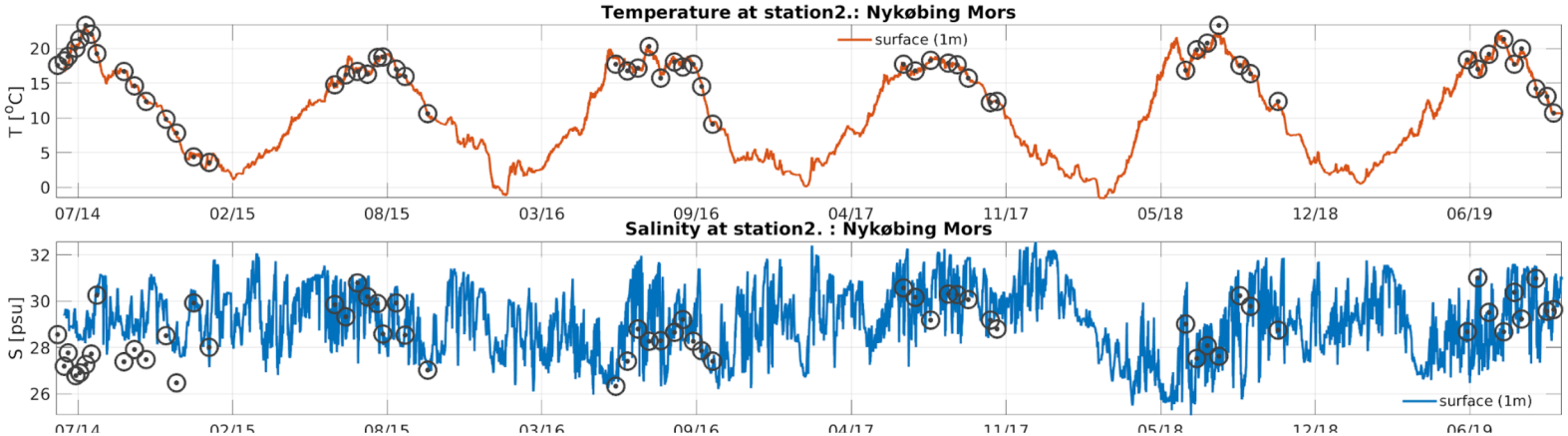
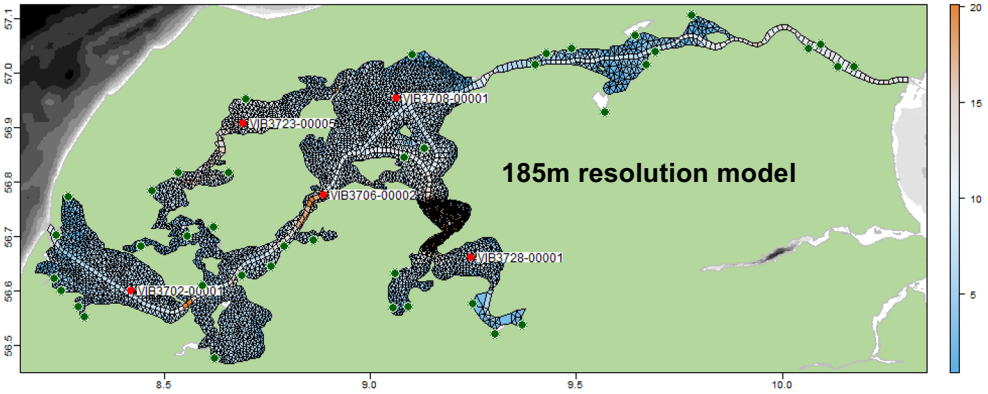
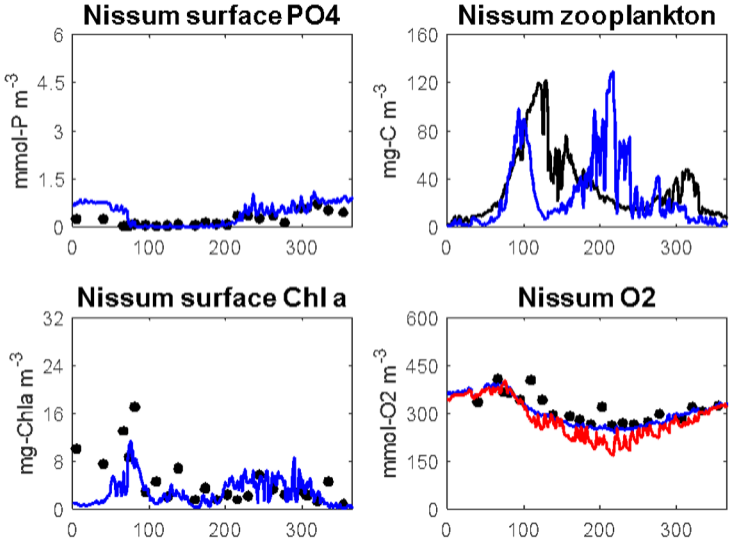
Ecological service for Limfjord oyster farming





Source: Maar M., 2021



Gaps for Baltic Sea operational ecology

Observing and data management
- Significant data gaps in high tropic level
- Lack of integration for multi-sector BGC data and centralized, timely and quality-ensured data access

Use of BGC/BIO observations
- Few observations are used together with models or model data

Modelling
- Capability for predicting high impact BGC event is low
- Many modelling components have not been operationalized
- Model products are yet to be validated extensively

Significant knowledge gaps exist in many key processes.

Fit-for-purpose operational products are yet to be designed and developed

Research priorities for Baltic Sea operational ecology

Integrated observing and data management
- Provide centralized access to BGC/BIO from multi-sectors
- Improved timeliness and quality of BGC/BIO data
- Optimal sampling design to fill BGC/BIO data gaps

Operationalising seamless modelling system for
- High impact event BGC forecasting
- Rapid Environment Assessment in interim scale
- Future scenarios
- Pollutant transport

Use of BGC/BIO observations
- Fill knowledge gaps using high resolution and high frequency data from FB, bliders, Argo and satellite
- Further develop BGC/BIO Data assimilation
- Use more observations to improve model products (objective analysis, MME, ML/AI algrithms etc.)
- Uncertainty quantification

Fill knowledge gaps
- Nutrient cycle; Blue carbon cycle;
- Impact of flooding on coastal water quality
- Air-sea-optics-biological interaction in algae bloom development
- Interaction between climate, hypoxia and eutrophication
- Interaction between marine plastics and coastal habitat and sediments etc.

Fit-for-purpose products and services
- Rapid environment assessment
- Forecast of high impact events
- Products to support sectoral applications: fishery & Aquafarming, offshore energy, ecosystem management
- Ecosystem status assessment: ocean health indicators

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Thank you!