eosc | Blue-Cloud2026

# Vlab 3 Carbon-Plankton dynamics

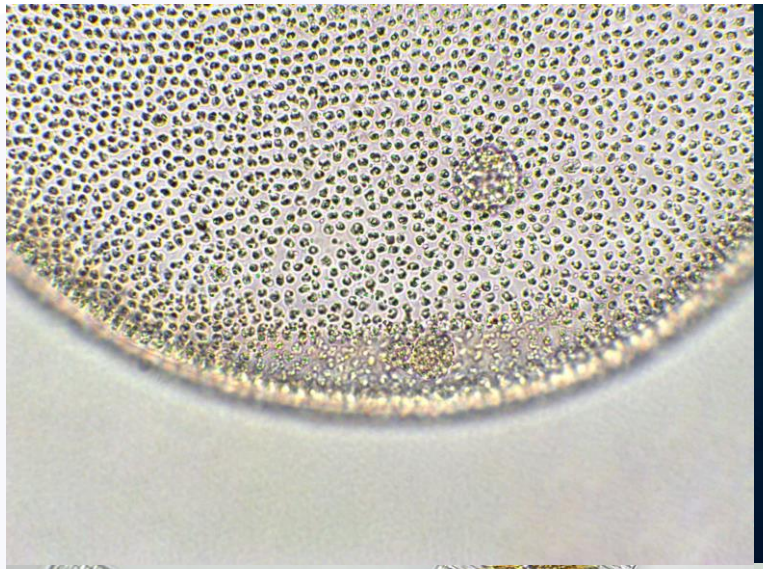
Flanders Marine Institute (VLIZ)

Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)

Funded by the European Union

# Phytoplankton

- Produces 50% of the world oxygen
- Base of the marine food chain
- Plays a crucial role in carbon cycling, oxygen production and nutrient cycling



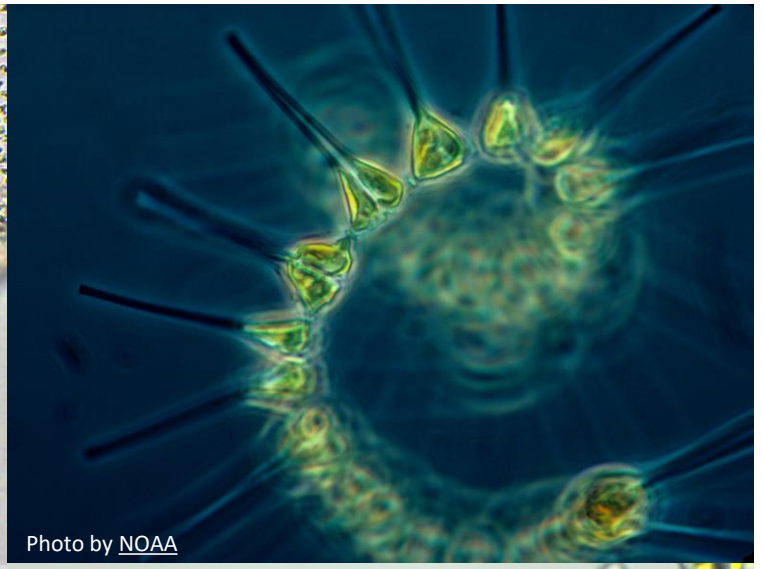
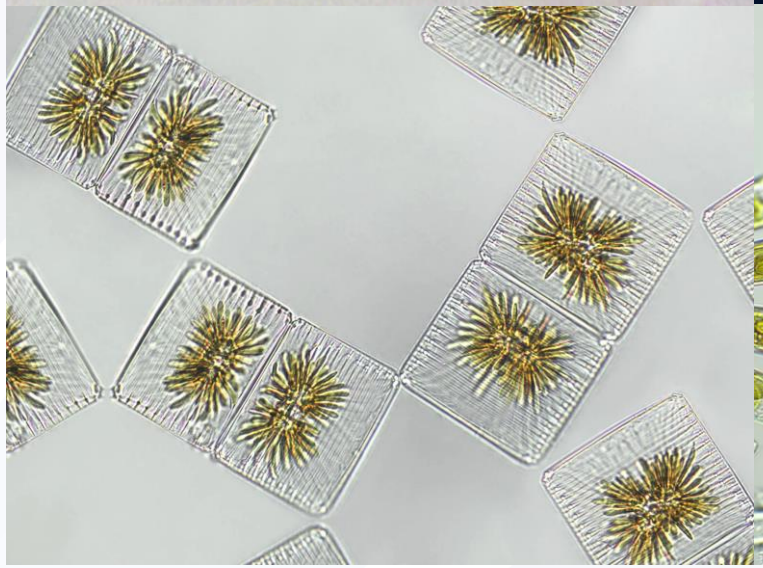
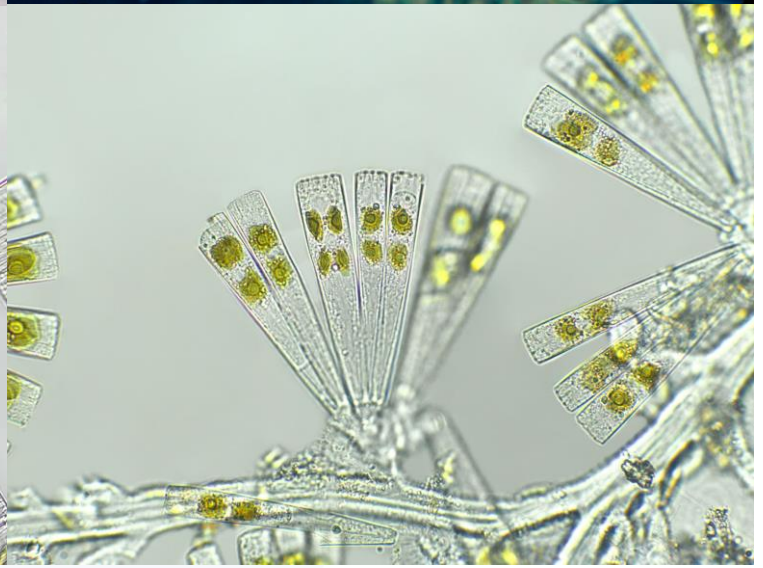


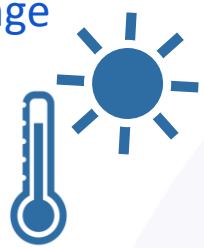
Photo by NOAA





# Phytoplankton under stress

- Climate change



- Blue economy

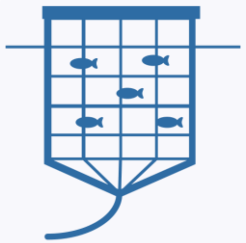



Photo by Hederik Kolk

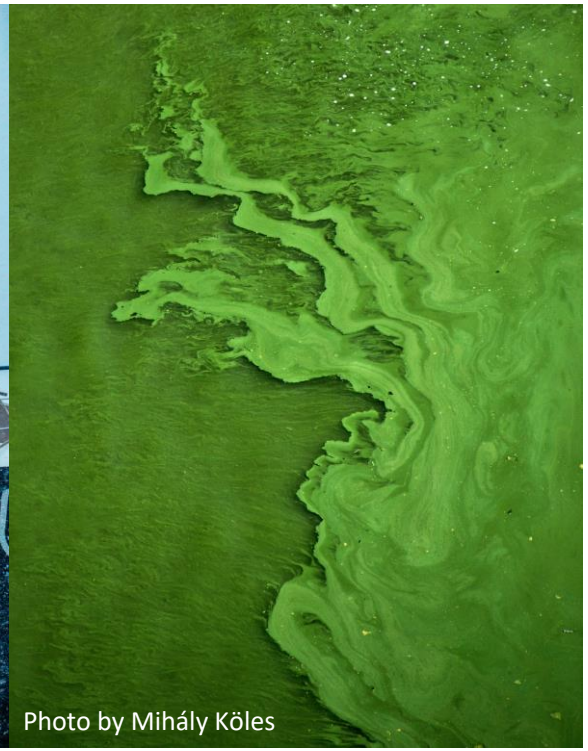


Photo by Mihály Köles

**Understanding the impact on phytoplankton dynamics is crucial for effective management and conservation of marine ecosystems**

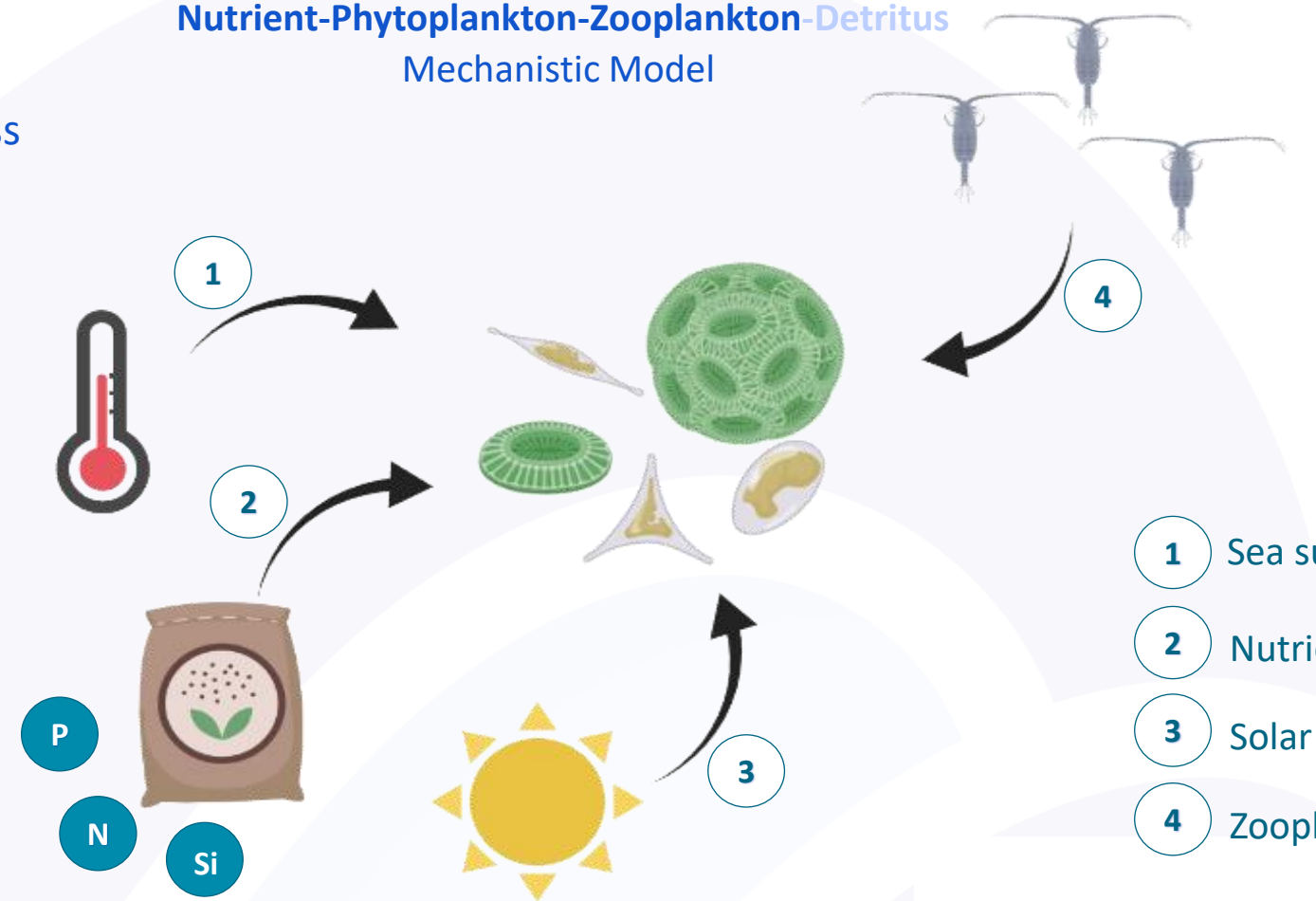
# NPZD model

**Nutrient-Phytoplankton-Zooplankton-Detritus**
Mechanistic Model

## Main goals:

Identify drivers of

1. phytoplankton biomass dynamics
2. Carbon fluxes




1. Sea surface temperature
2. Nutrients
3. Solar irradiance
4. Zooplankton grazing

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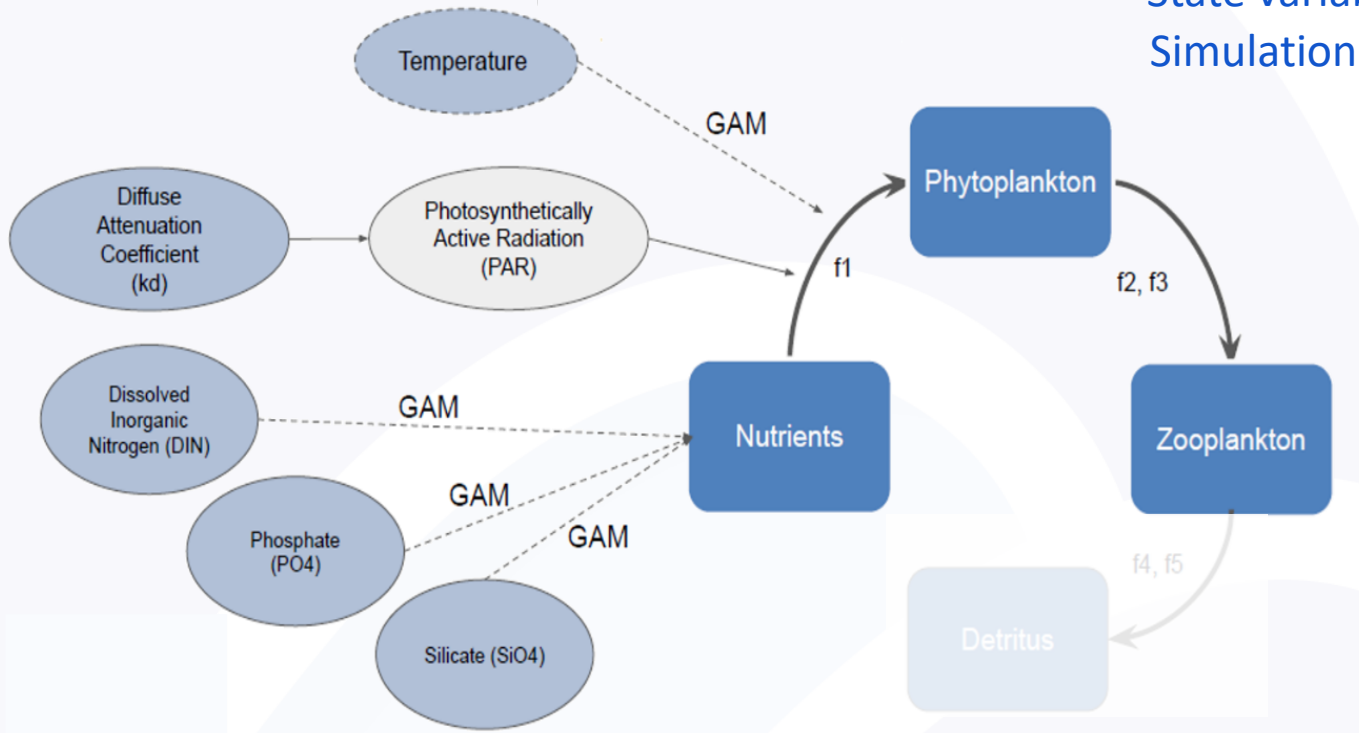
State variables: mmol N $m^{-3}$
Simulation time steps: days




Soetaert & Herman (2009)

# Modelling phyto- and zooplankton interactions

This Modelling phyto- and zooplankton interactions service is a workflow to run a mechanistic model using near real-time data to quantify the relative contributions of the bottom-up and top-down drivers in phytoplankton dynamics. **The Nutrient-Phytoplankton-Zooplankton (NPZ) model** used in this demonstrator was adjusted from the Nutrient-Phytoplankton-Zooplankton-Detritus (NPZD) model of Soetaert and Herman (2009). The NPZD model is widely used and describes the four state variables of nutrients, phytoplankton, zooplankton and detritus. Phytoplankton dynamics are simulated based on information from nutrient concentrations and zooplankton density. The Modelling phyto- and zooplankton interactions VLab calculates the relative contribution that limit the growth of phytoplankton of Dissolved Inorganic Nitrogen (DIN), Phosphate (PO~4~) and Silicate (SiO~4~), Photosynthetically Active Radiation (PAR), Sea-surface Temperature (SST) and zooplankton grazing, over time.

## Data sources

| VARIABLES | DATA SOURCES | DATA ACCESS |
|---|---|---|
| Phytoplankton abundances (Chla) | https://rshiny.lifewatch.be/station-data/ | LifeWatch/Blue-Cloud Vlab* |
| Zooplankton abundances | http://rshiny.lifewatch.be/zooscan-data/ | LifeWatch/Blue-Cloud Vlab* |
| Nutrients | http://rshiny.lifewatch.be/station-data/ | LifeWatch/Blue-Cloud Vlab* |
| Photosynthetically active radiation (PAR) | https://rshiny.lifewatch.be/ctd-data/ | LifeWatch/Blue-Cloud Vlab* |
| Sea-surface Temperature (SST) | https://rshiny.lifewatch.be/ctd-data/ | LifeWatch/Blue-Cloud Vlab* |
| | https://rshiny.lifewatch.be/mvb-data/ | Meetnet Vlaamse Banken |

*Blue-Cloud Vlab= Data also available in the 'VRE Folders' in the Vlab.

Modelling phyto- & zooplankton interactions docs

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| | https://rshiny.lifewatch.be/mvb-data/ | Meetnet Vlaam |

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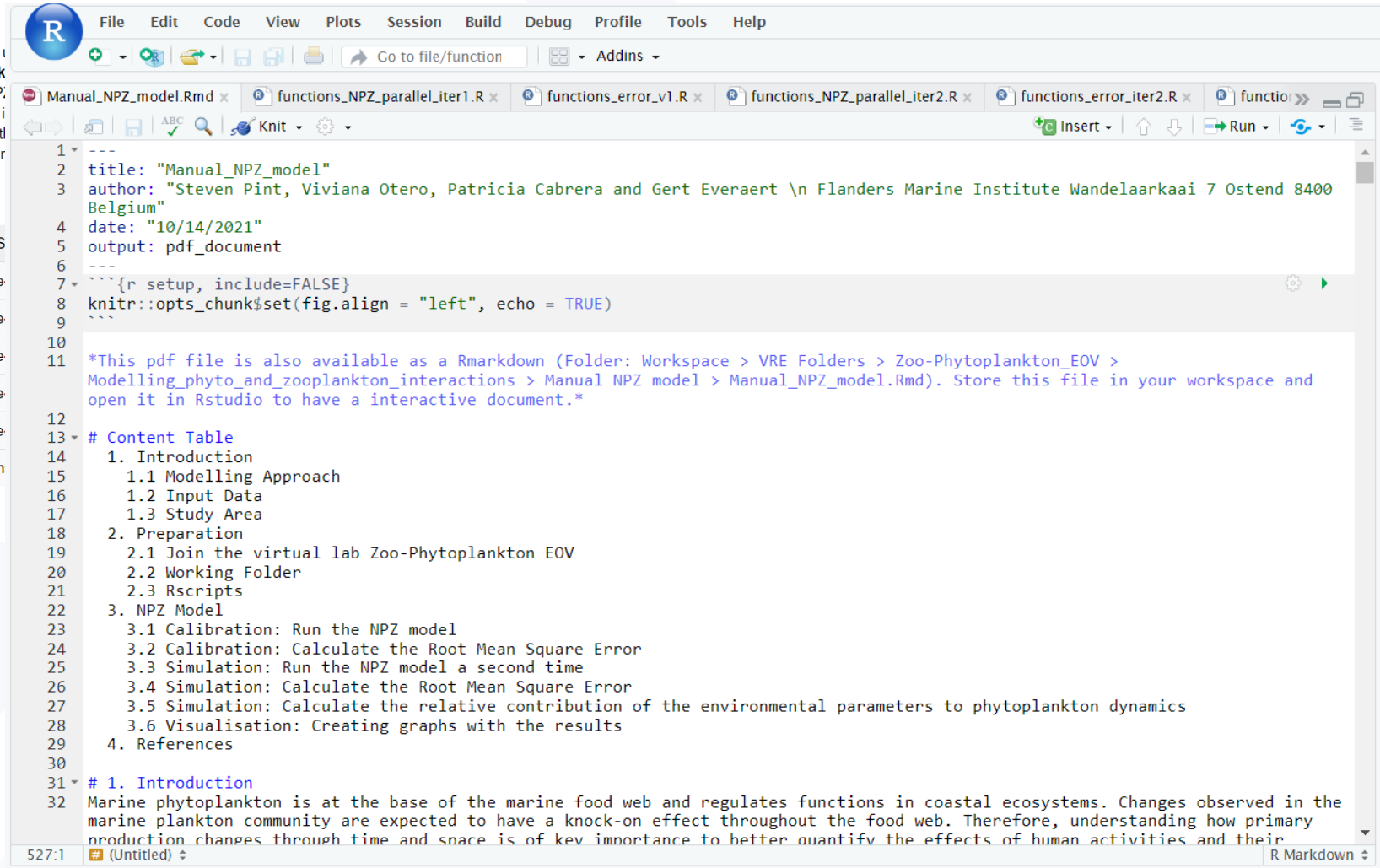
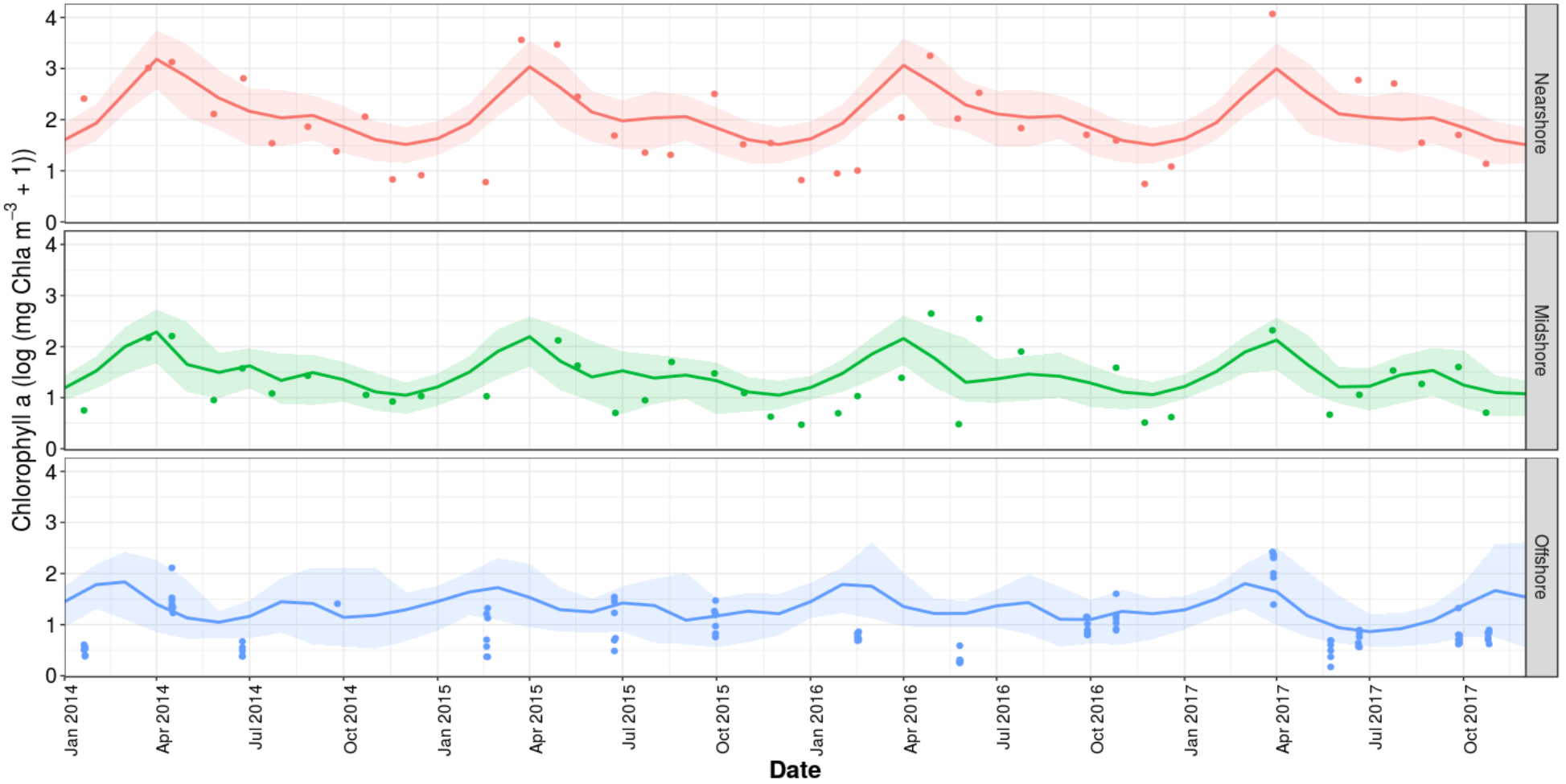
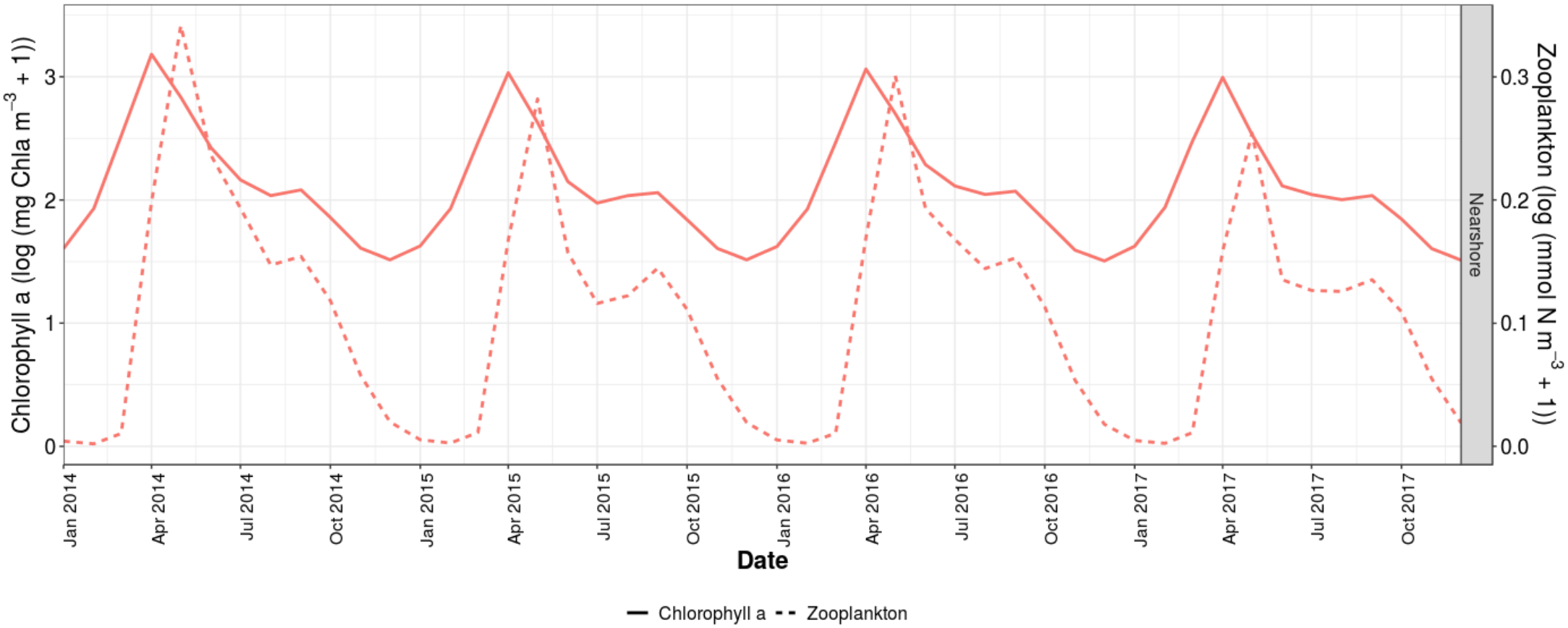


# Phytoplankton biomass dynamics



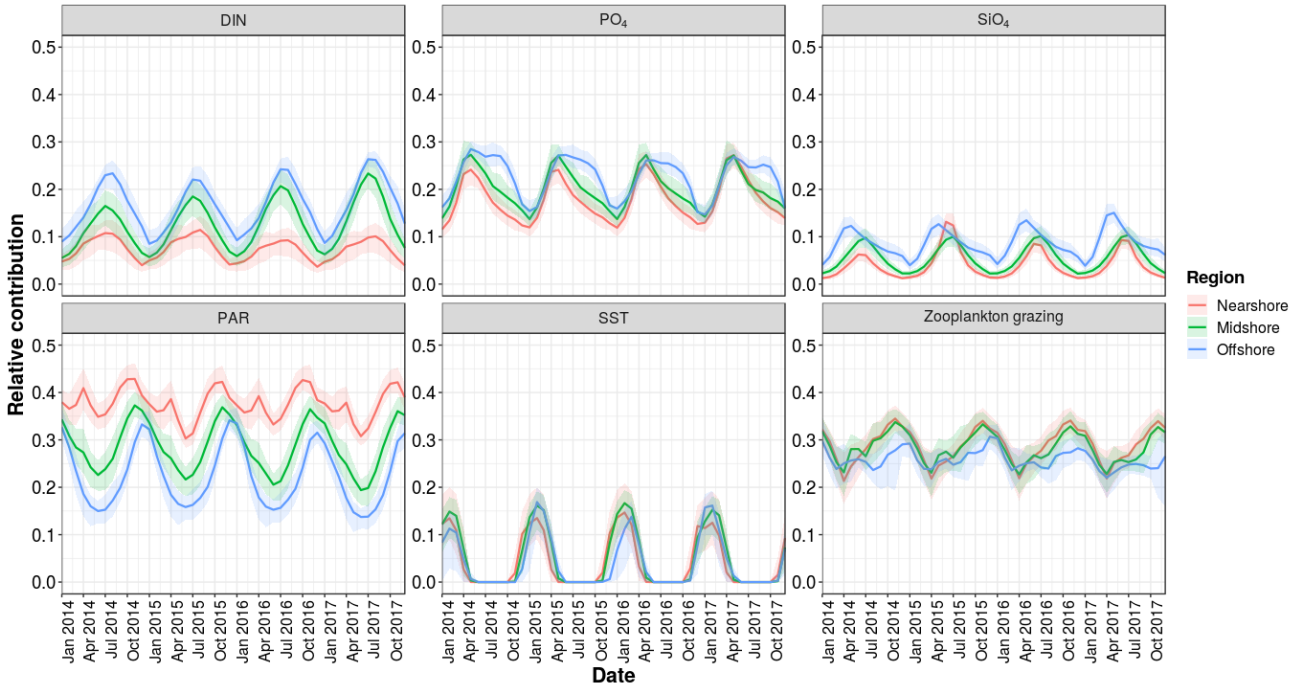

Otero et al. (submitted)

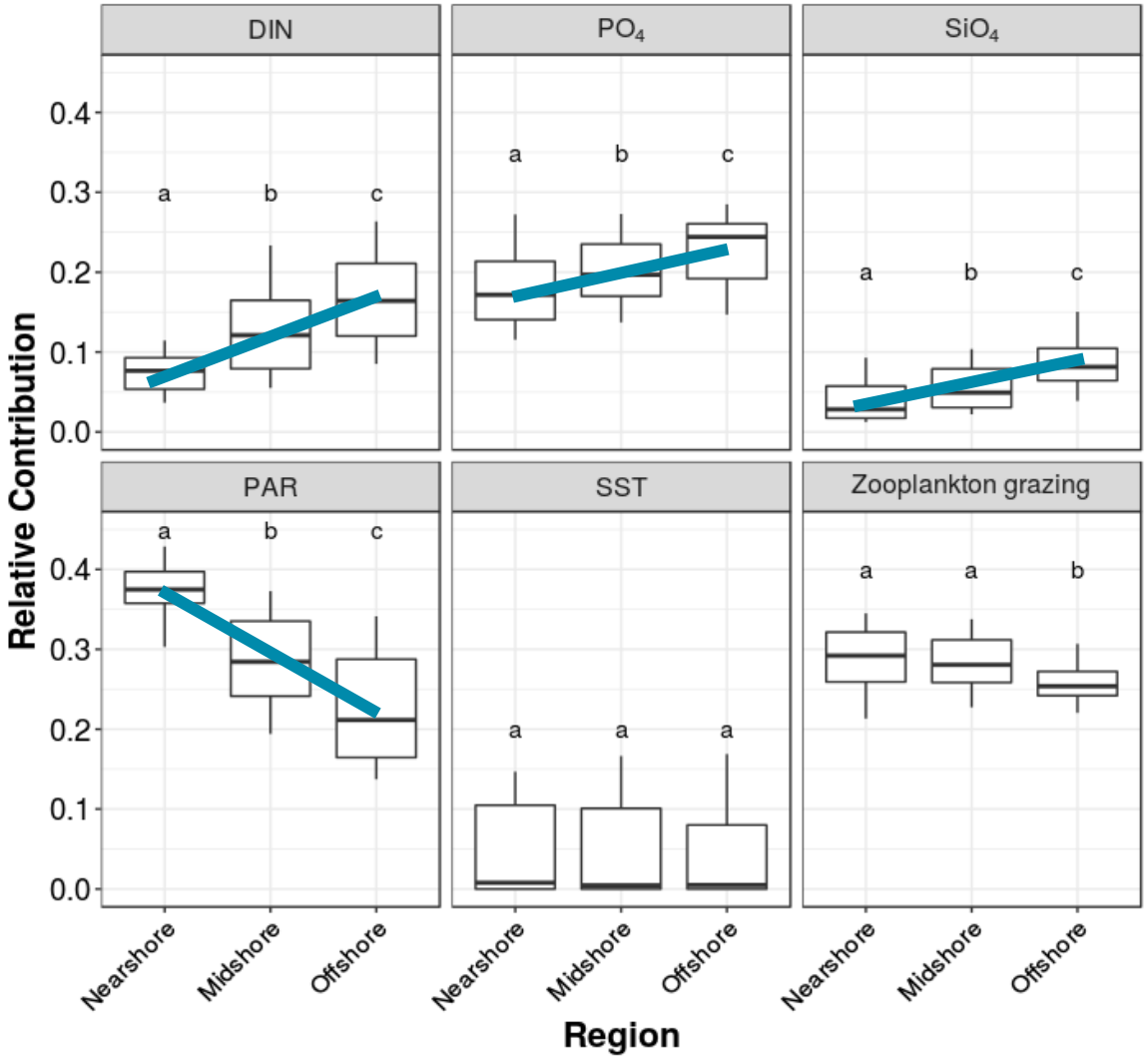
# Classic predator-prey pattern




Otero et al. (submitted)

# Relative contribution of determinants

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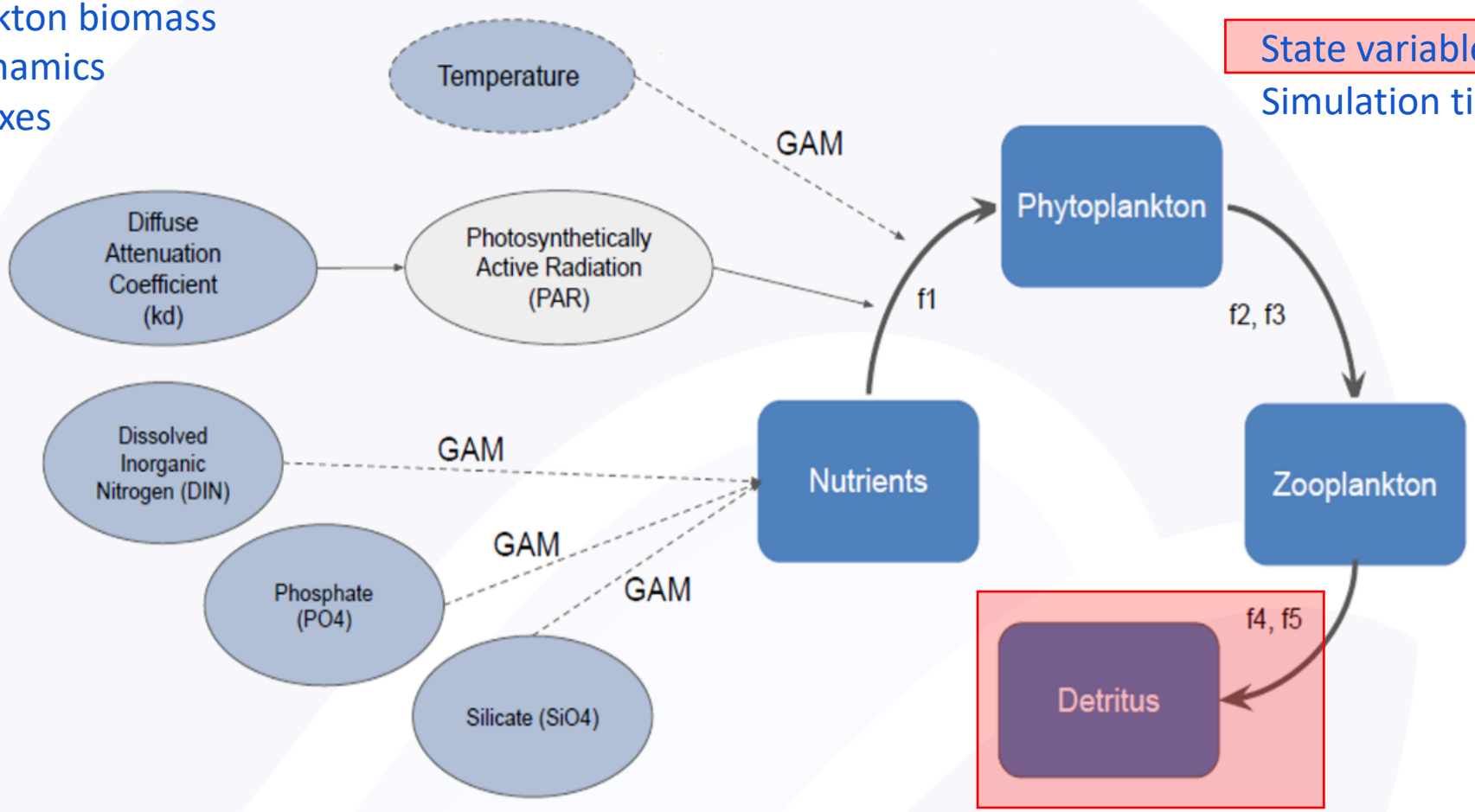
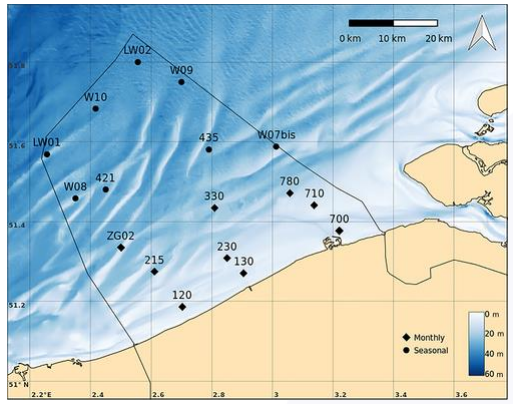


# Study area & Data sources

## Belgian part of the North Sea




Mortelmans et al. (2019)

VLIZ

LifeWatch BELGIUM

EMODnet BIOLOGY

Dive into data on Europe's marine life

## Abiotic

P

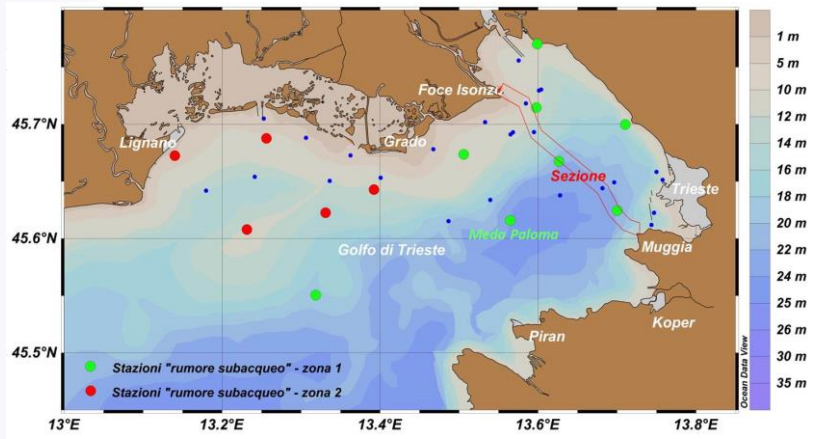
Si

N

## Biotic

## Northern Adriatic Sea

OGS




ogs.it

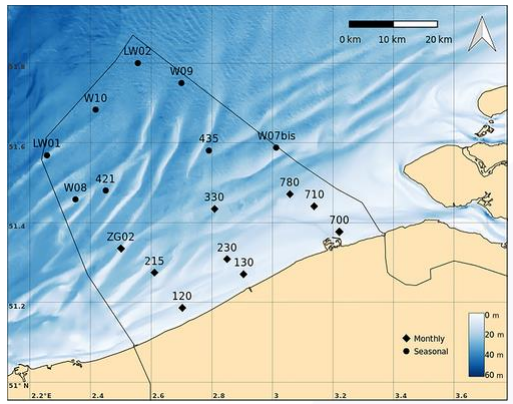
EurOBIS

European Ocean Biodiversity Information System

EMODnet CHEMISTRY

Data & Products on marine water quality

# Study area & Data sources

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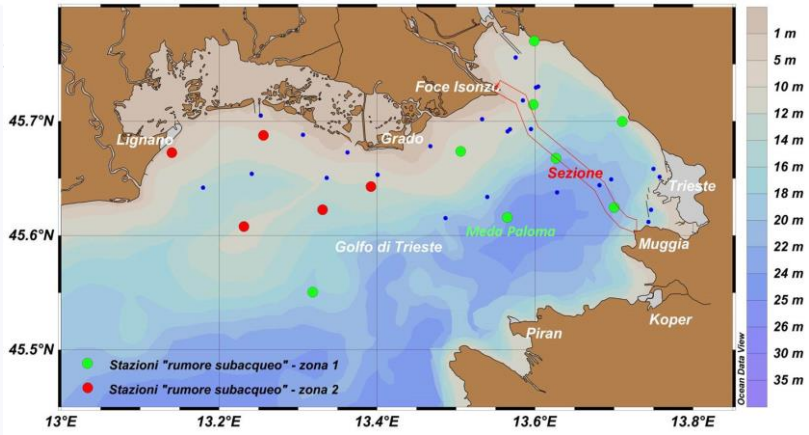


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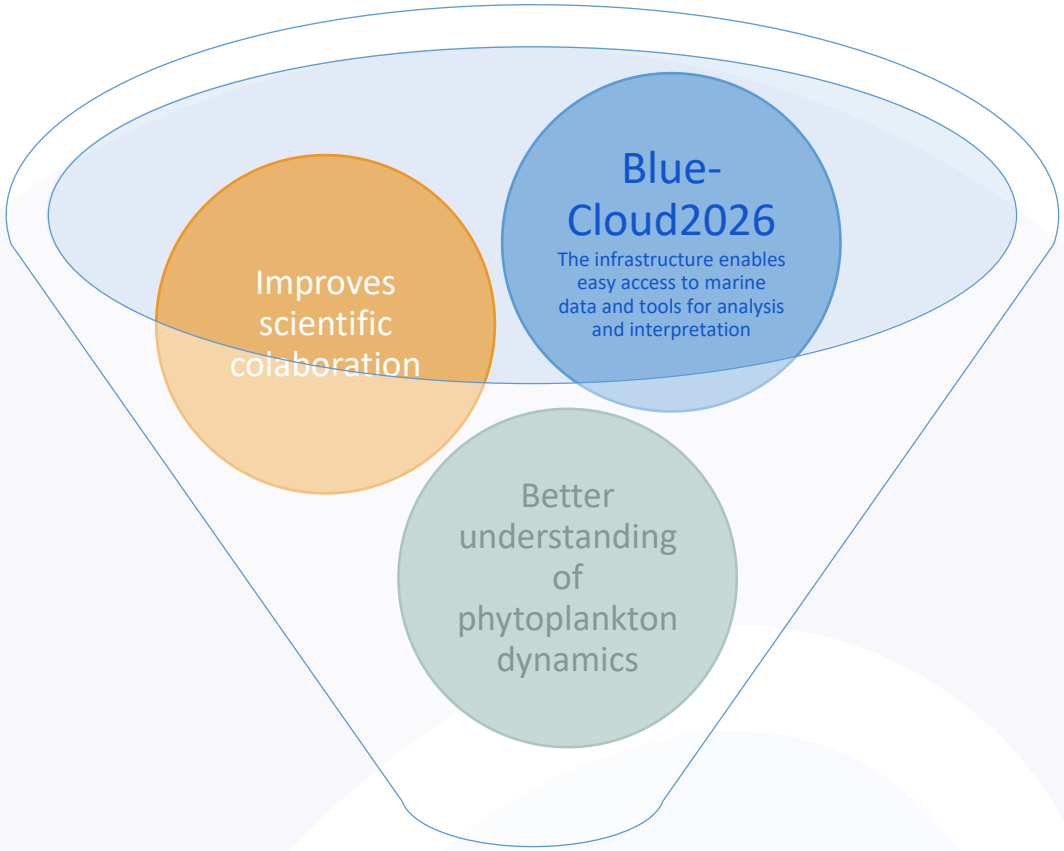
**Carbon**

# Conclusion

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