



# TWP2: Modeling of the impact of continental nutrient inputs on the dynamics of planktonic diversity

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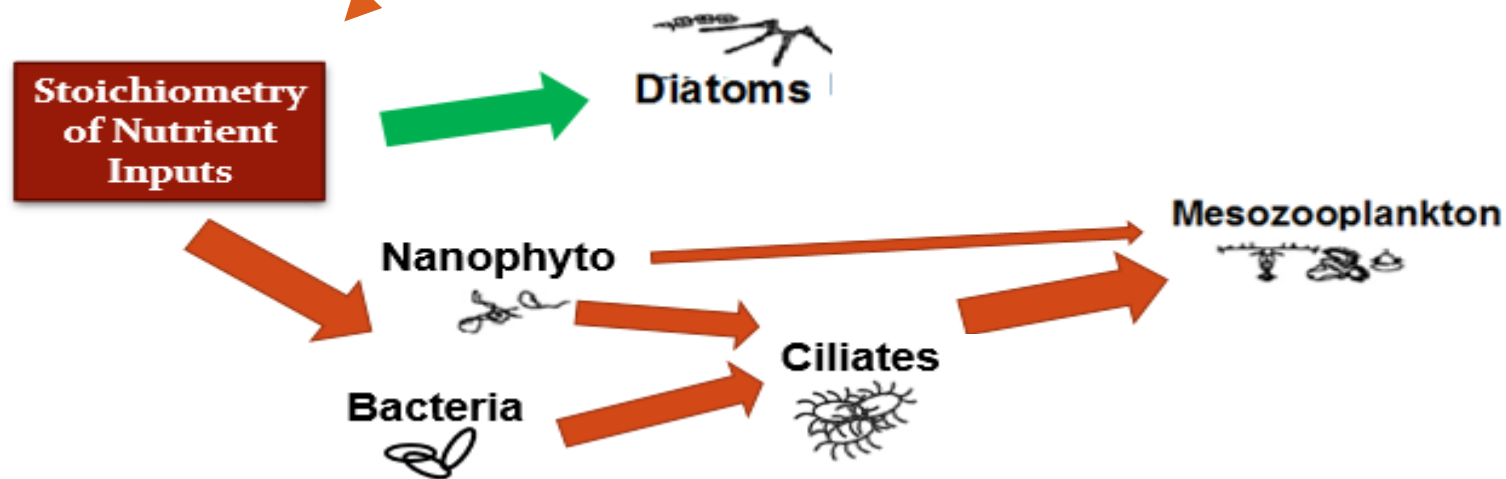
***Other collaborators: François Carlotti, Pierre Garreau, Arnaud Guyennon***

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Mediterranean Institute of Oceanography

# Scientific objective

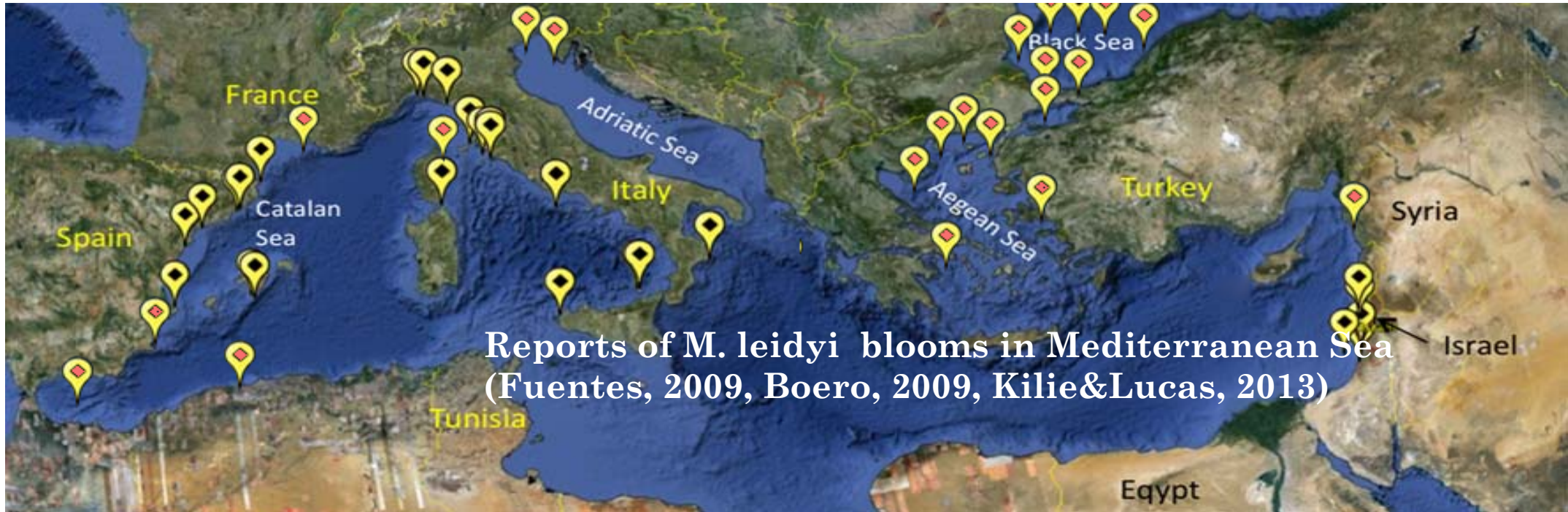
Impact of the high continental  
NO<sub>3</sub>:PO<sub>4</sub> ratio on the structure of the  
food web?



## Scientific strategy:

3D modeling of NW Med Sea.  
Coupled model MARS3D/ECO3M-  
MED.

# Why to choose *Mnemiopsis leidyi*?

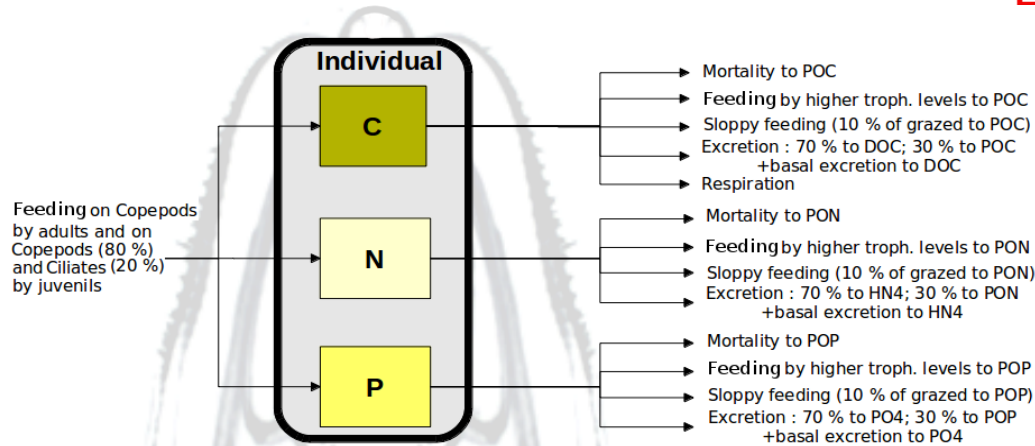
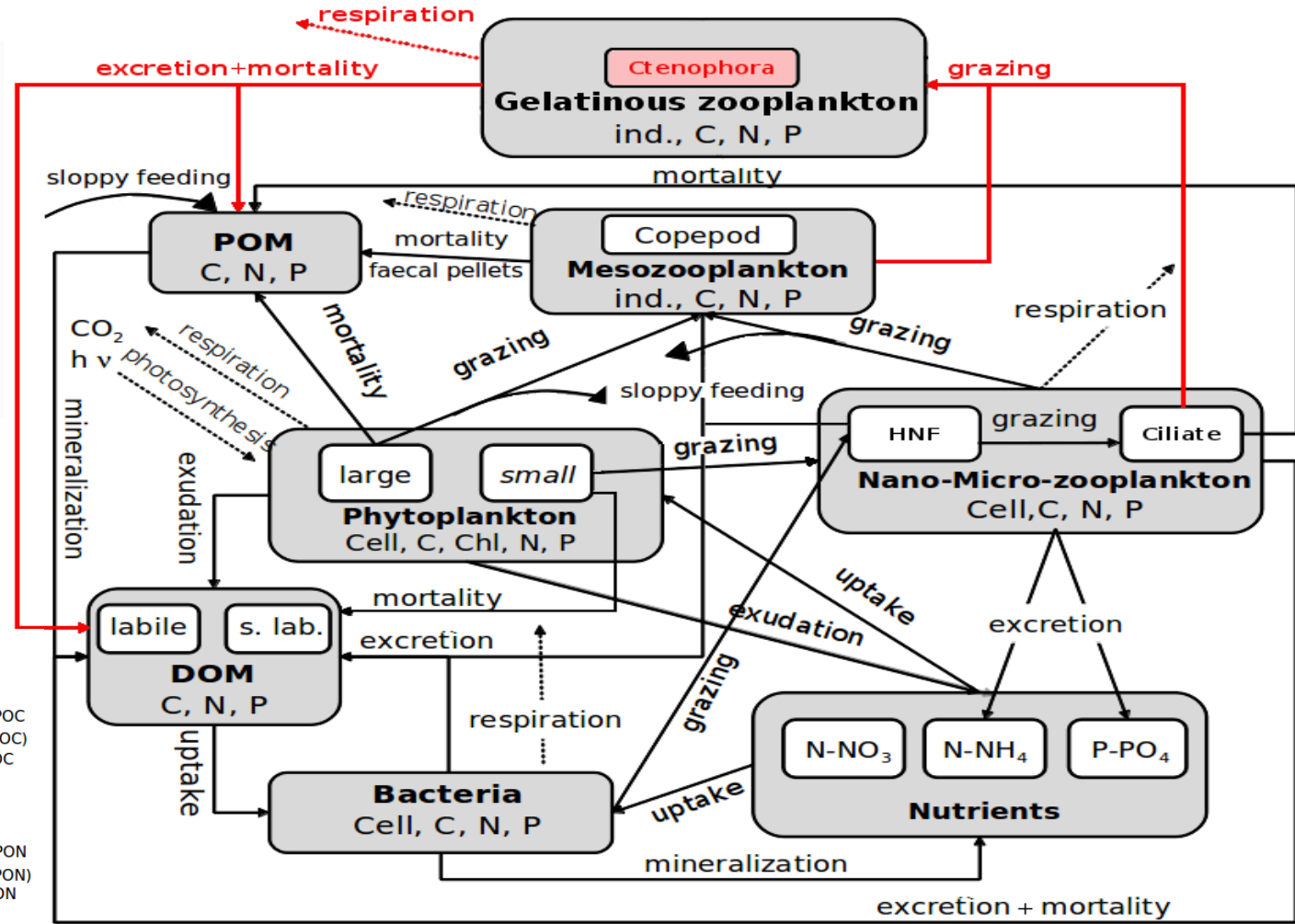


- Chosen species – comb-jelly *Mnemiopsis leidyi* :
  - An alien species which successfully colonizes Mediterranean coasts in the last decades



# Eco3M-Med biogeochemical model

- Implementation of jellyfish into Eco3M model  
(Alekseenko et al, in prep.)

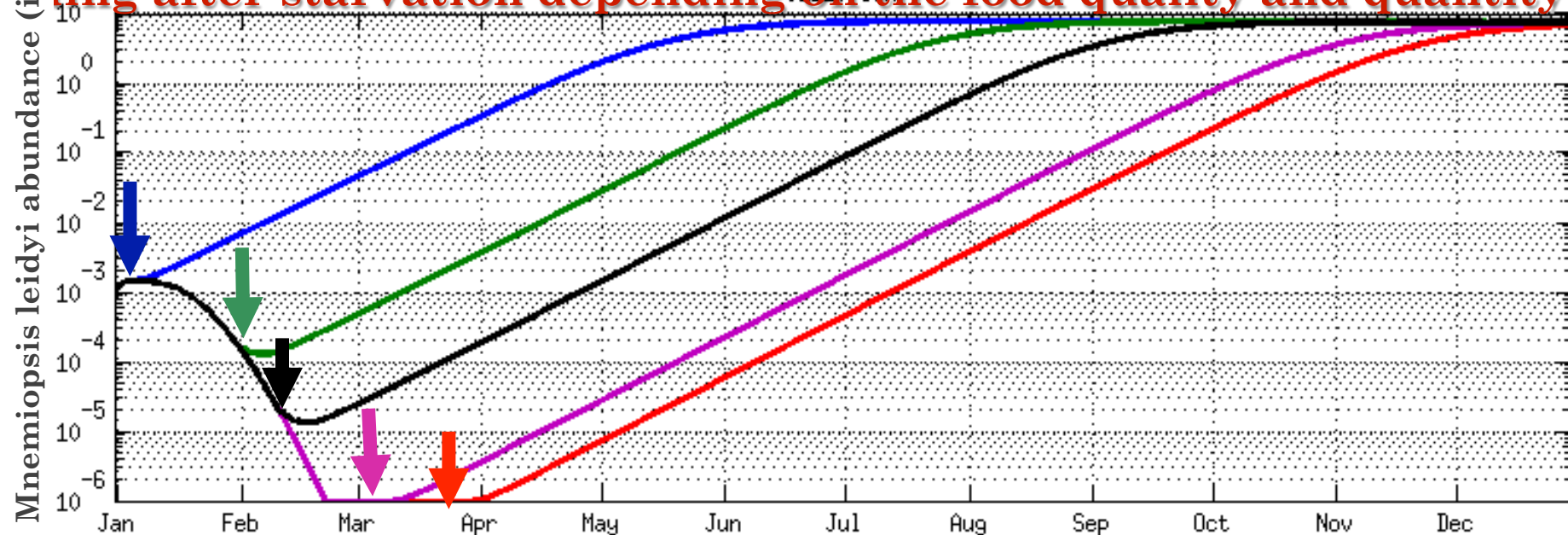


# 0D scenarios on the Mnemiopsis leidyi behaviour

For the appropriate Mnemiopsis leidyi implementation into the Eco3M-MED model

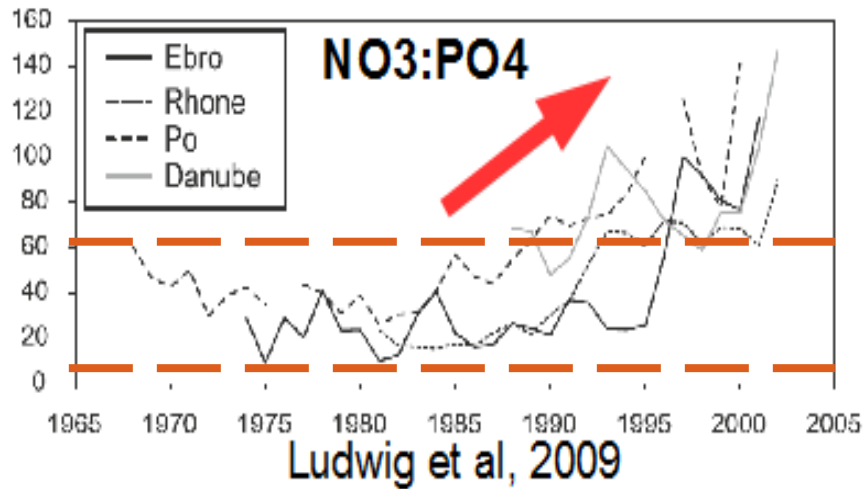
numerous 0D tests were made on its physiology:

- Growth rate and reproduction
- Grazing
- Mortality
- Metabolic requirements
- Temperature impact
- Feeding after starvation depending on the food quality and quantity

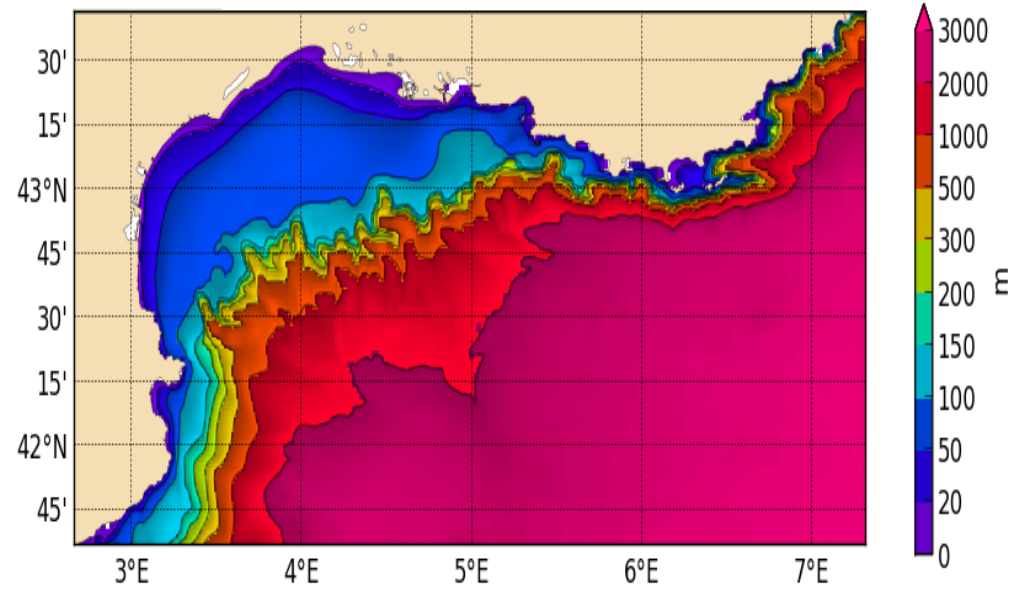


Feeding by constant food concentration of 10 ind/l after 5, 30, 40, 60, 80 days of starvation. M.L has strong survival ability at high food concentration

# A case study on the NW Mediterranean Sea under the influence of the Rhone River



Model bathymetry



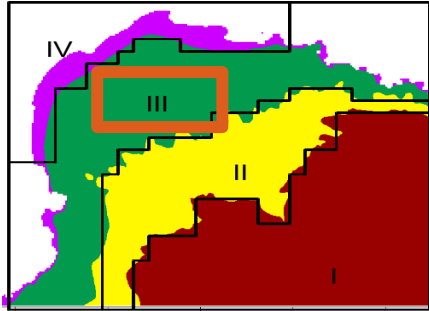
## Modeled scenarios

- high/low NO<sub>3</sub>:PO<sub>4</sub> ratio of the Rhone River ;
- with/without jellyfish

Modeled region – Gulf of Lions under impact of the Rhone River

# Carbon repartition

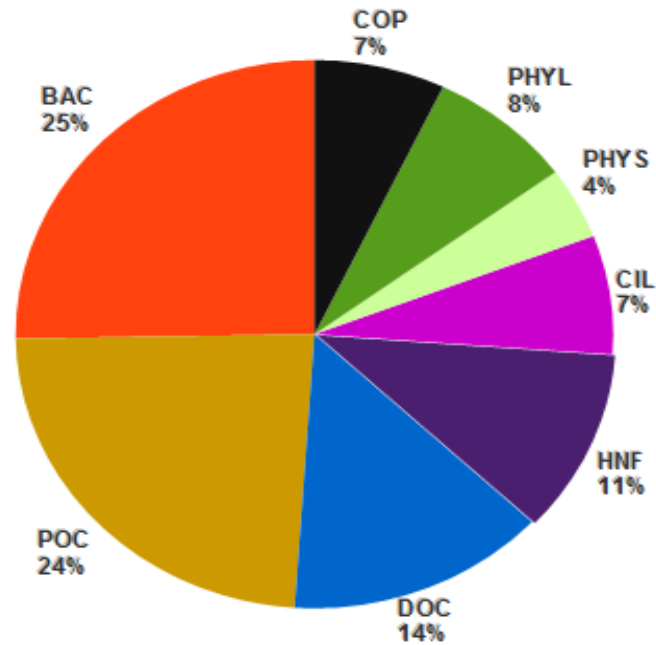
in % from Total Carbon,  
in the zone III at two contrasting situations  
Scenario: no Jellyfish, Rhone NO<sub>3</sub>:PO<sub>4</sub> of 2010



10th April 2010

**Bloom period**

- more diatoms
- more Carbon biomass

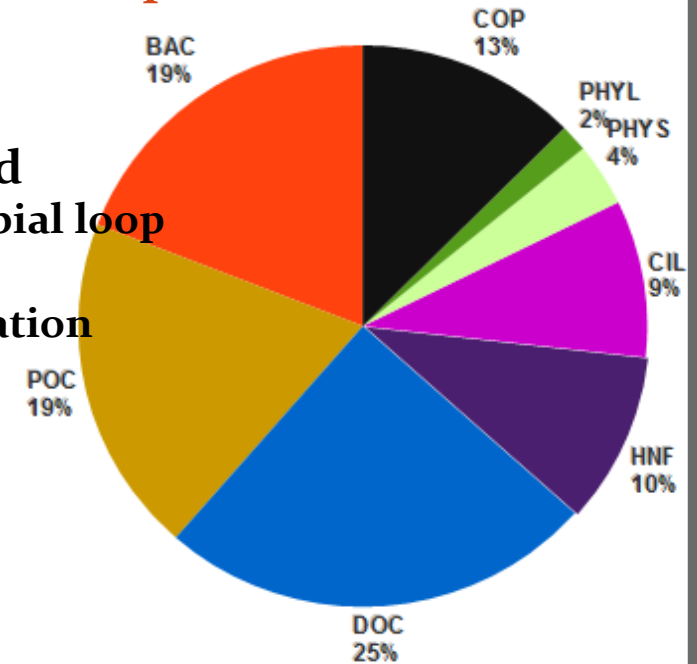


Total Carbon: 0.0063 mol/l

10th September 2010

**Stratified period**

- intense microbial loop
- DOC accumulation



Total Carbon: 0.0040 mol/l

Nonliving: POC,DOC

BAC

Copepod

μZoo

nZoo

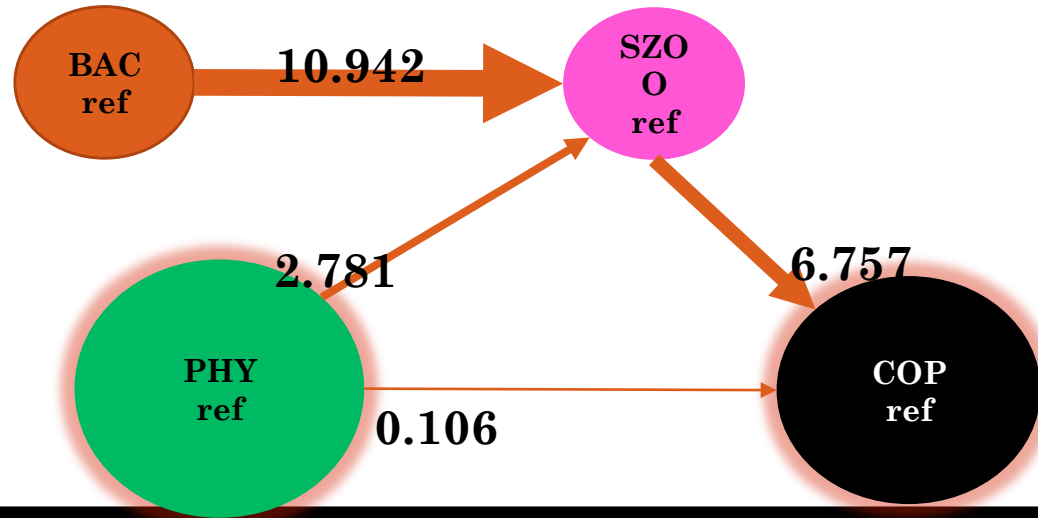
phytoplankton

# Community shifts

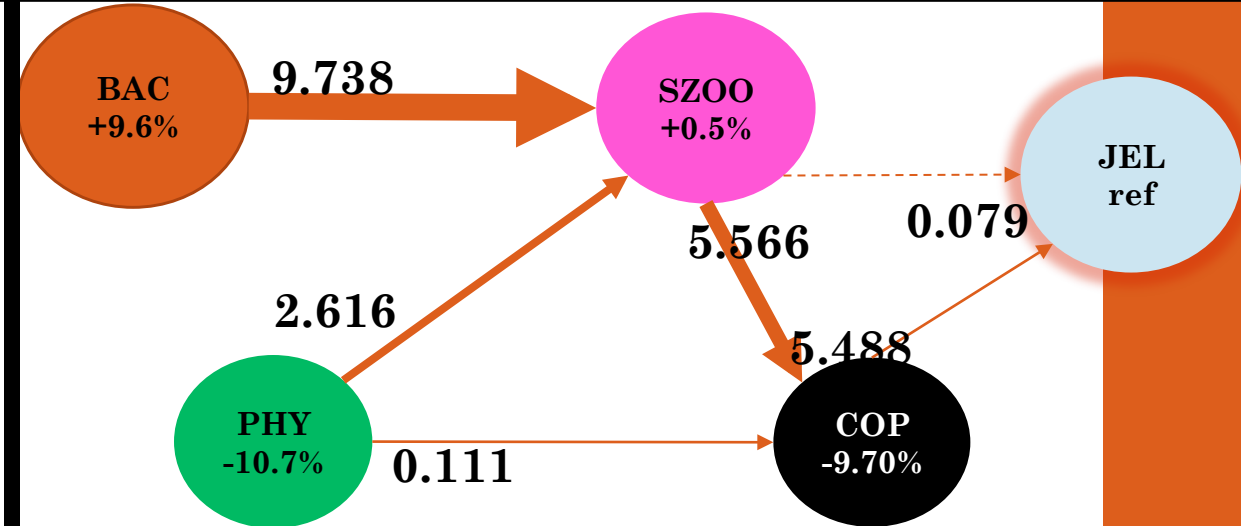
Units: fluxes over summer period in mmolC/m<sup>3</sup>

NO<sub>3</sub>:P04

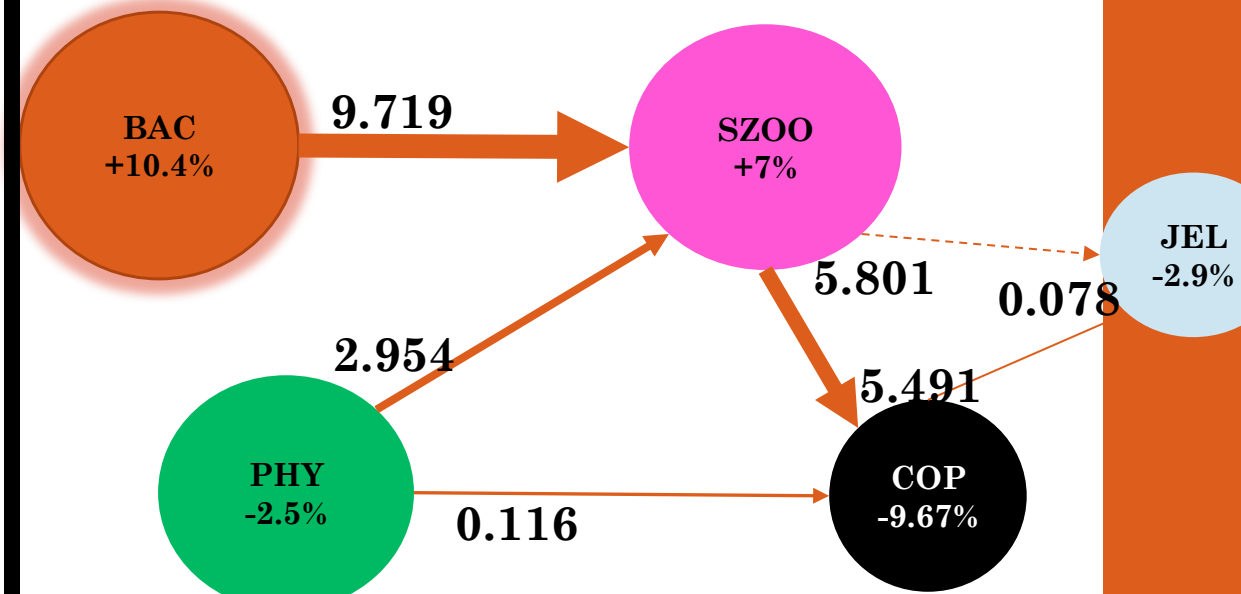
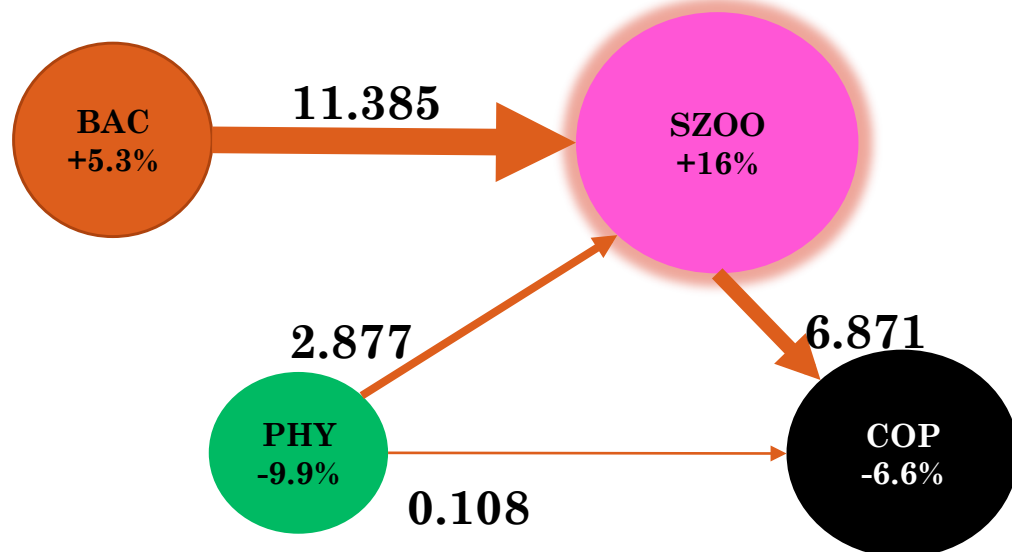
**NO JELLYFISH**



**WITH JELLYFISH**



2\*NO<sub>3</sub>:P04





# Conclusions

- Mnemiopsis leidyi species was implemented into the Eco3M-MED model
- Variety of 0D scenarios on the physiological processes was made
- 3D modelling with different  $\text{NO}_3:\text{PO}_4$  ratios in the Rhone River showed:
  - The presence of **jellyfish in the system activates the microbial loop** during the summer period, which is **more reinforced with the  $\text{NO}_3:\text{PO}_4$  increase**
  - **The impact of the  $\text{NO}_3:\text{PO}_4$  increase on copepods and jellyfish is weaker due to their lower growth rates.** Therefore, for studying such impacts on these organisms, longer simulations are needed

These preliminary results show the complex plankton dynamics induced by nutrient changes and how it could impact the higher trophic levels.

# Thank you for your attention!

## Scientific production

### Accepted publication:

- *Alekseenko E.*, Raybaud V., Espinasse B., Carlotti F., Queguiner B., Thouvenin B., Garreau P., Baklouti M. (2014) "Seasonal dynamics and stoichiometry of the planktonic community in the NW Mediterranean Sea: a 3D modeling approach". Ocean Dynamics.

### Newsletter article

- V. Garnier, I.L. Pairaud, A. Nicolle, *E. Alekseenko*, M. Baklouti, B. Thouvenin, F. Lecornu, P. Garreau."MENOR: a high resolution (1.2 km) modelling of the North-Western Mediterranean Sea; Routinely run by the PREVIMER; Operational Forecast System", Newsletter Mercator N49

### Participation in conferences

- **CIESM, November 2013, Marseille, France:** *E.Alekseenko*, Thouvenin B., Tixier C., Tronczynski J., Baklouti M., Garreau P., Verney R., Carlotti F., Espinasse B., Queguiner B., Loizeau V. "Modeling of the PCB transfer into the trophic chain of the Gulf of Lions; 3D coupled model application.". **Poster and oral presentation**

- **EGU 2014, May 2014, Vienna, Austria:** *Alekseenko E.*, Baklouti M., Carlotti F., Guyennon A., Garreau P. "Modeling of the impact of Rhone River nutrient inputs on the dynamics of planktonic diversity. **Oral presentation**

- **DIOXIN, September 2014, Barselona, Spain:** *E.Alekseenko*, Thouvenin B., Tixier C., Tronczynski J., Baklouti M., Garreau P., Verney R., Carlotti F., Espinasse B., Queguiner B., Loizeau V. "Modeling of the PCB transfer into the trophic chain of the Gulf of Lions; 3D coupled model application.". **Poster**

### Publication in preparation

- *Alekseenko E.*, Baklouti M., Carlotti F. "Mnemiopsis Leidyi modelling; Eco3M-Med approach"

# Perspectives

Application of the model MARS3D/ECO3M of NW Med Sea

Other models from the LABEX (hydrological, socio-economical,...)

What evolution in the future (changes in agricultural practices and other anthropic pressures from the continental domain)?

