

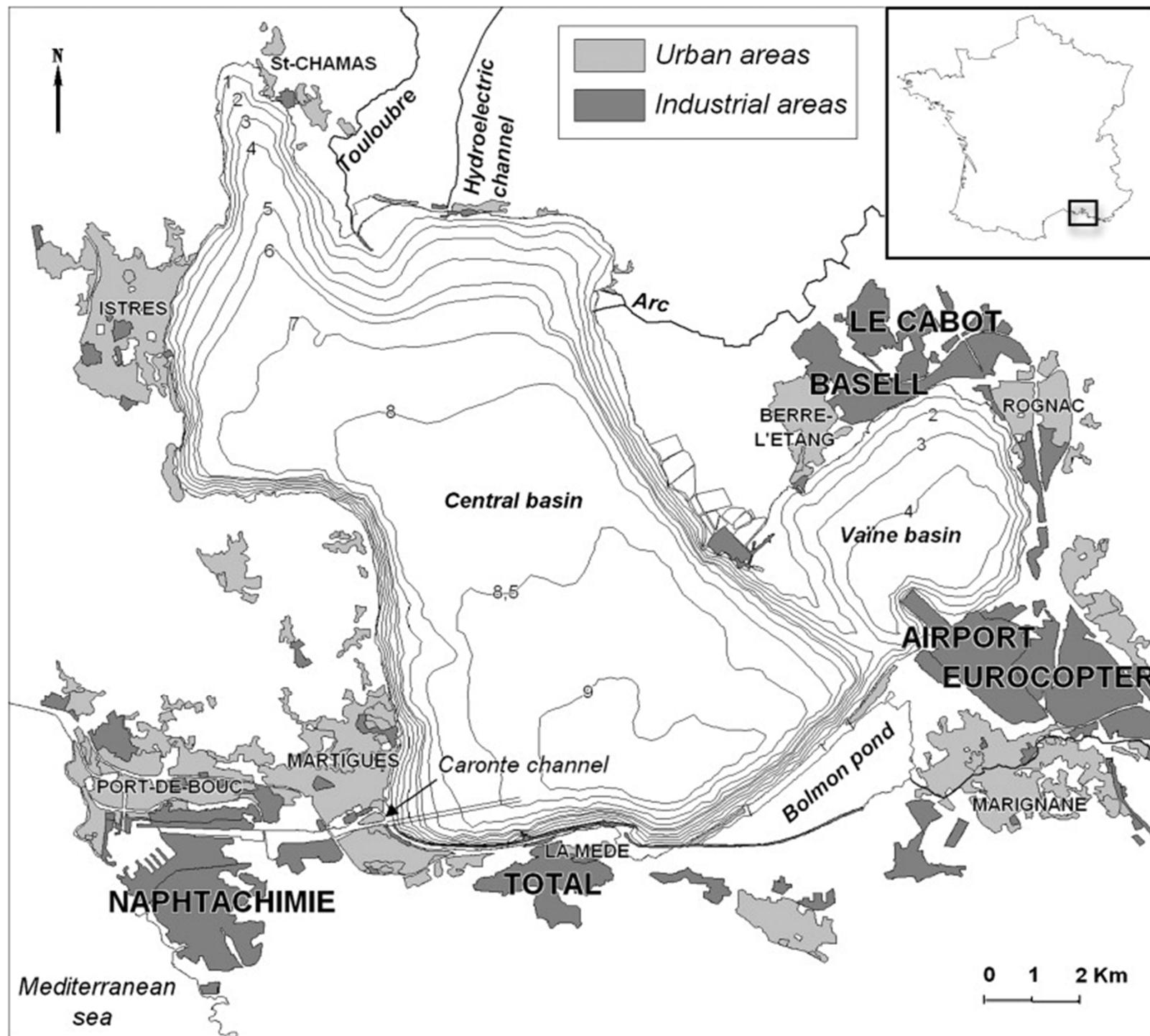
*Suivi temporel et spatial de l'écosystème planctonique de  
l'étang de Berre.  
Conséquences des contraintes environnementales et de  
l'invasion de *Mnemiopsis leidyi**



Delphine Thibault

Institut Méditerranéen d'Océanologie – Aix-Marseille Université





**1920-30**

Ouverture du Canal du Rove

Approfondissement du canal de  
Caronte



**Centrale hydroelectrique EDF**  
Effondrement tunnel du Rove

Interdiction de la peche

**Industries chimiques et  
petrochimiques**

Ouverture du Canal du Rove

Approfondissement du canal de  
Caronte

1966  
1963

1957

1920-30



# EDF Hydroelectric power plant

Freshwater inputs

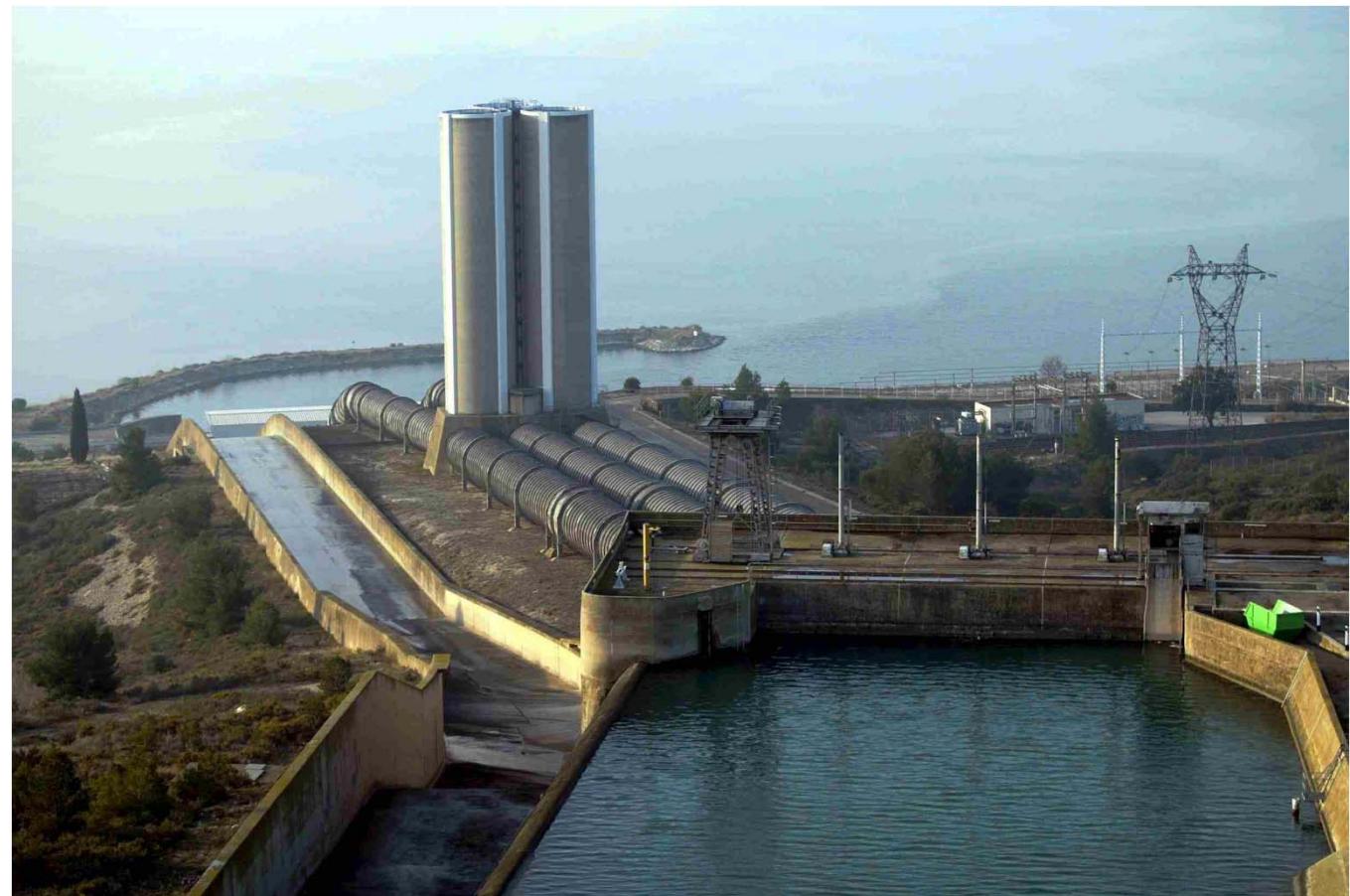
$3.3^* \text{billions m}^3 \text{ y}^{-1}$

i.e. 3.7 times the  
volume of the lagoon

Up to 7 billions  $\text{m}^3$  in  
1977

Silt inputs

$520\,000 \text{ t y}^{-1}$





**Centrale hydroelectrique EDF**  
Effondrement tunnel du Rove

Interdiction de la peche

**Industries chimiques et  
petrochimiques**

Opening of the Rove's tunnel

Deepening of the Caronte's canal

1920-30

1966

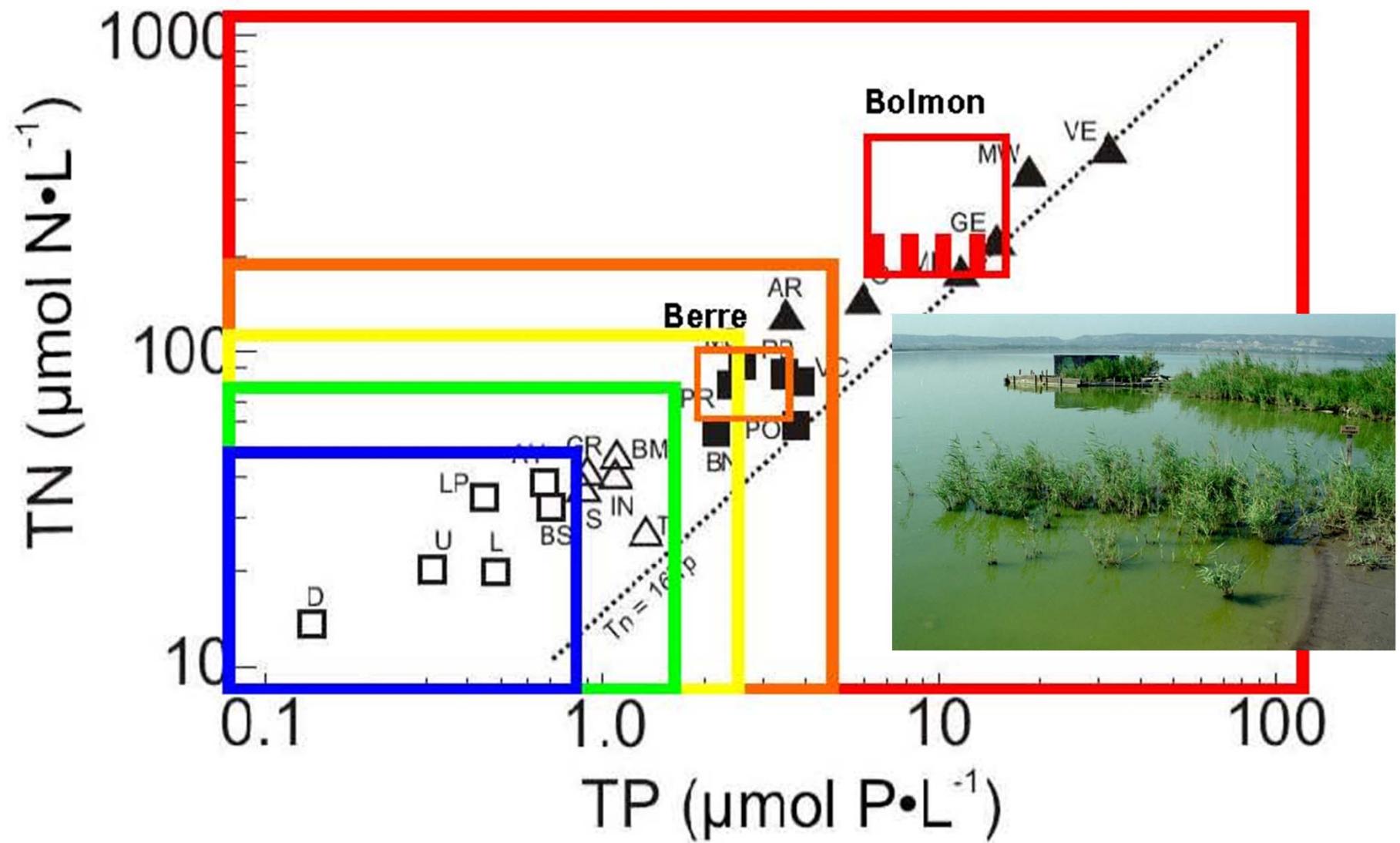
1963

1957

**Urbanisation massive**

**Acieries (golfe de Fos)**





**Plan Barnier**

**1994**

2.7 puis 2.1 milliards m<sup>3</sup> eau par an  
Limon = 200 000 tonnes par an.

**Urbanisation massive**

**Acieries (golfe de Fos)**

**Centrale hydroelectrique EDF**  
Effondrement tunnel du Rove

**Interdiction de la peche**

**1966  
1963**

**1957**



**Industries chimiques et petrochimiques**

**1920-30**



**Opening of the Rove's tunnel**

**Deepening of the Caronte's canal**



## Contentieux Européen

2006

Apport annuel eau = 1.2 milliards m<sup>3</sup>, moyenne semaine (62.4 million m<sup>3</sup>), limon = 60 000 t.

## Plan Barnier

1994

2.7 puis 2.1 milliards m<sup>3</sup> eau par an  
Limon = 200 000 tonnes par an.

## Urbanisation massive

## Acieries (golfe de Fos)

Centrale hydroelectrique EDF  
Effondrement tunnel du Rove

1966

1963



Interdiction de la peche

1957

## Industries chimiques et petrochimiques

1920-30

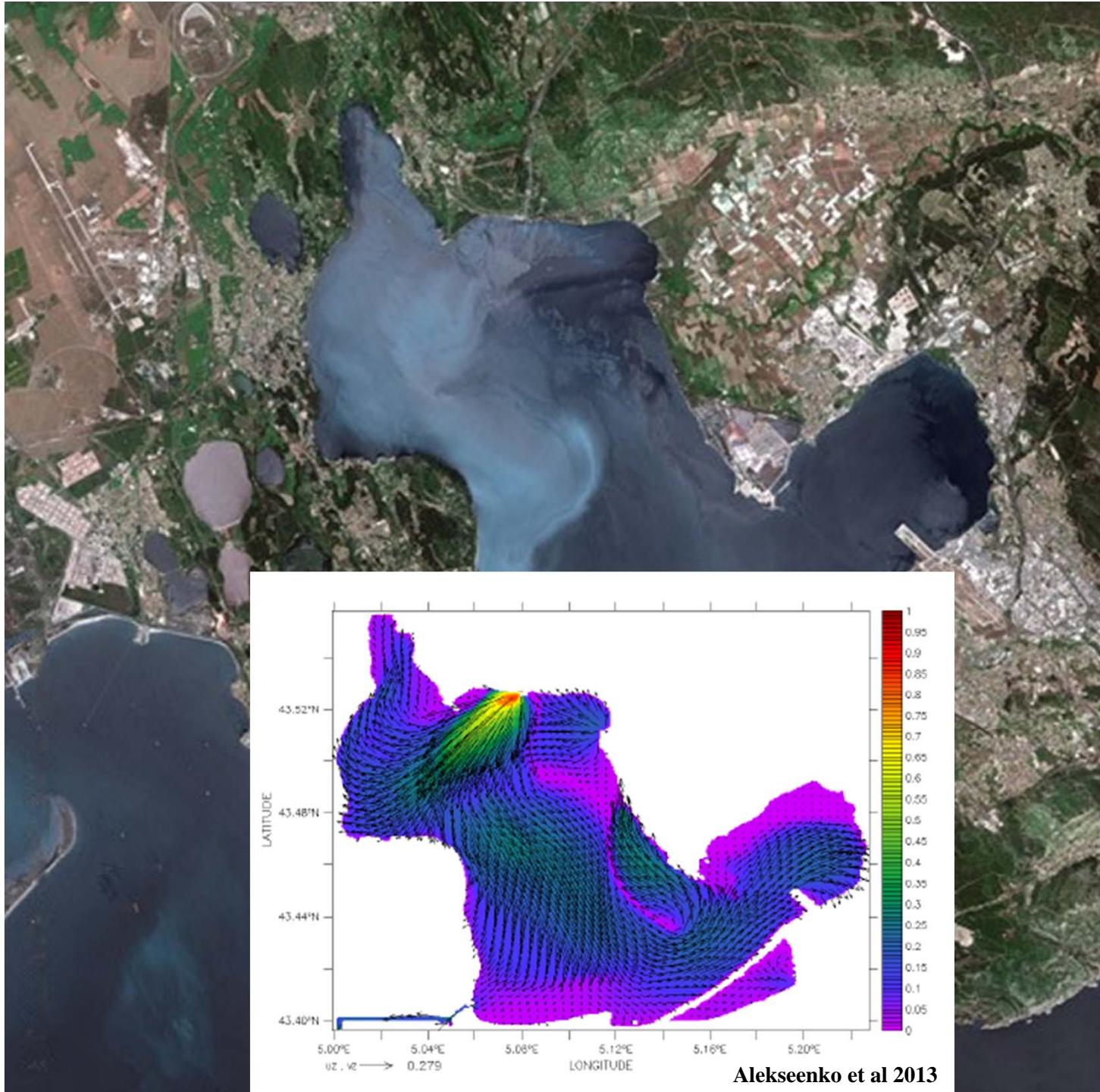


Opening of the Rove's tunnel

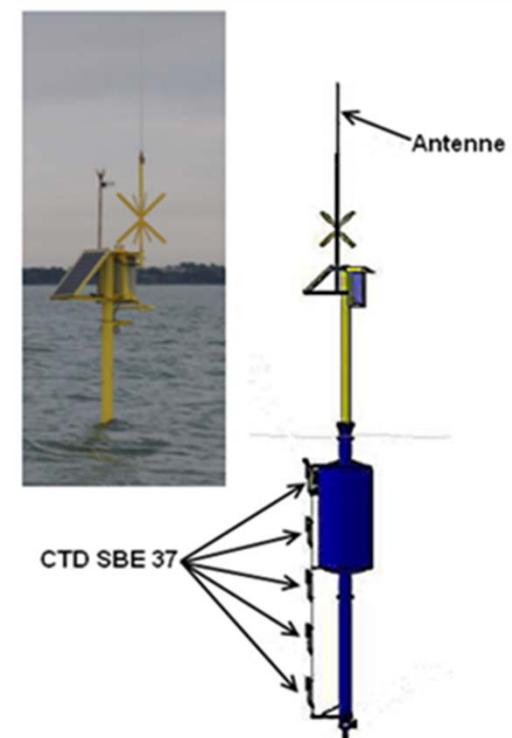
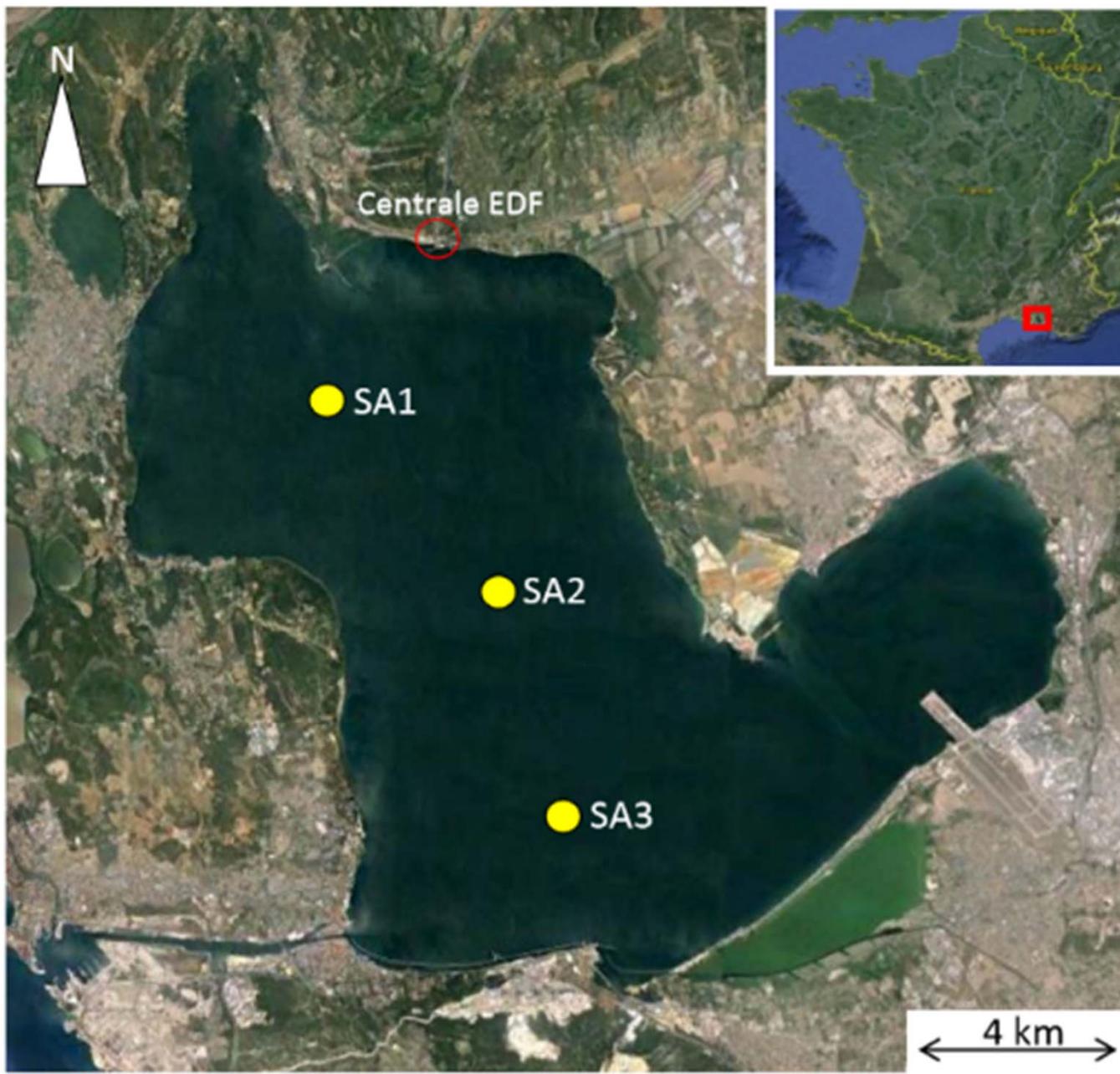


Deepening of the Caronte's canal

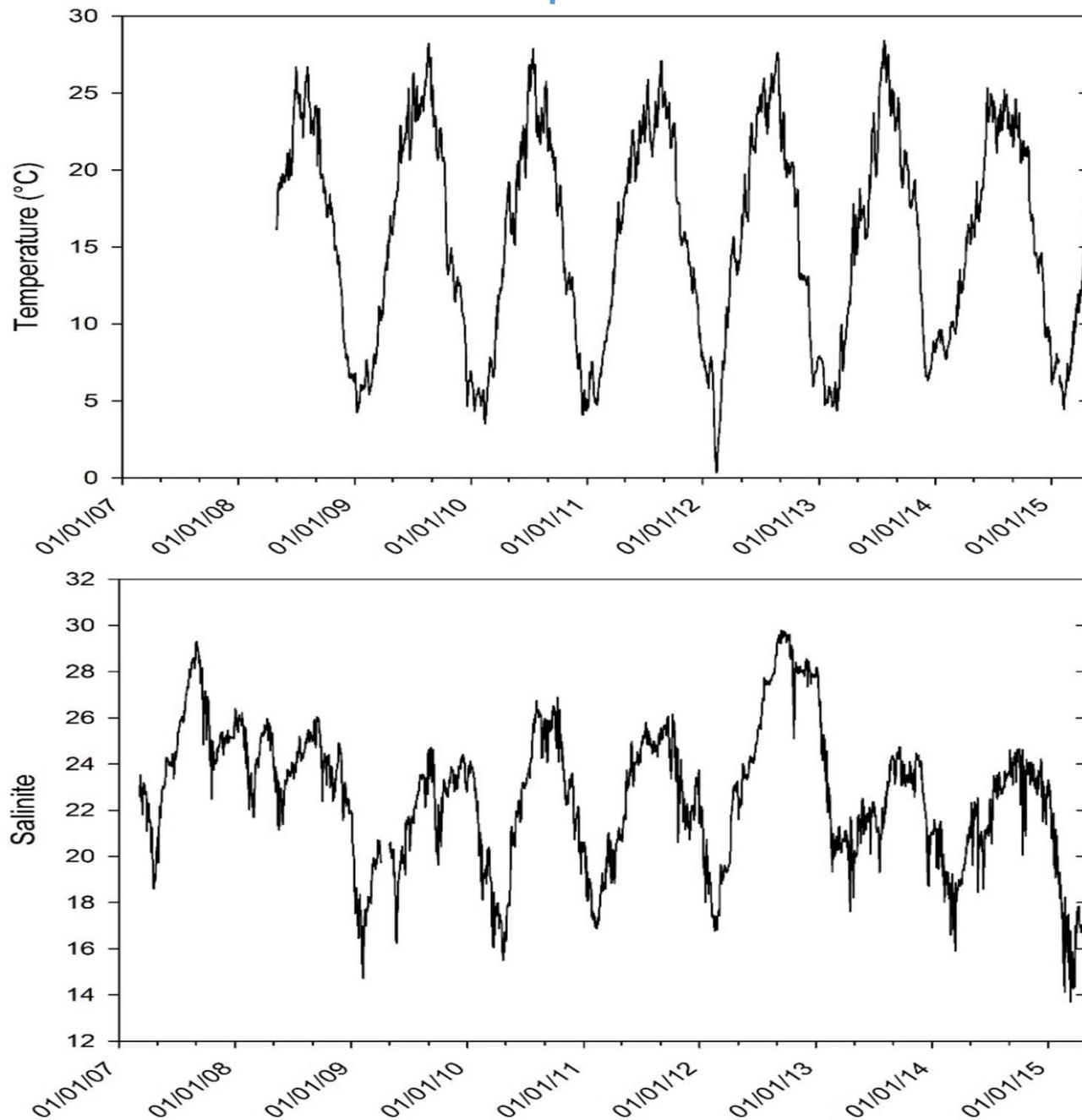




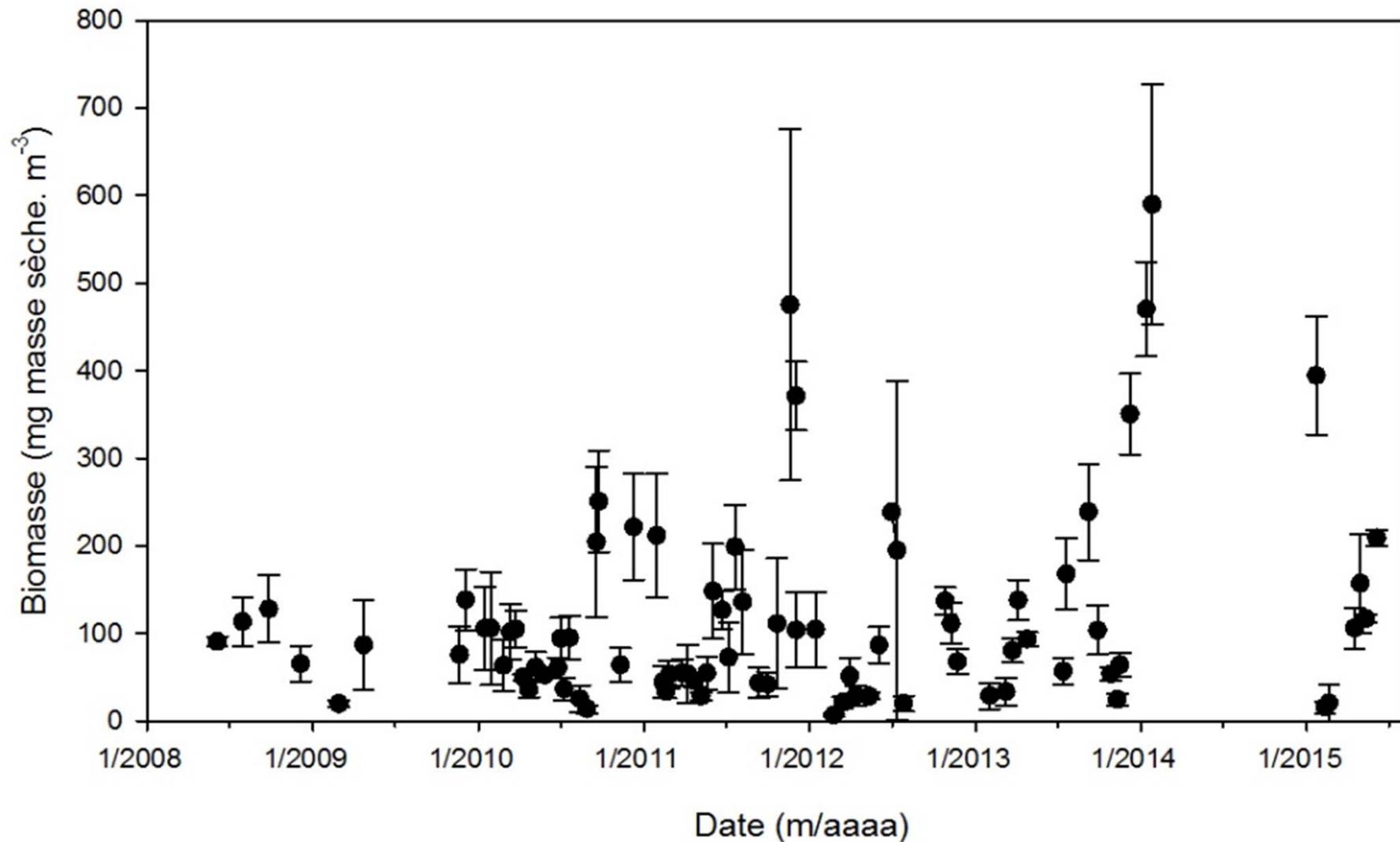
## Sites d'étude et méthodes



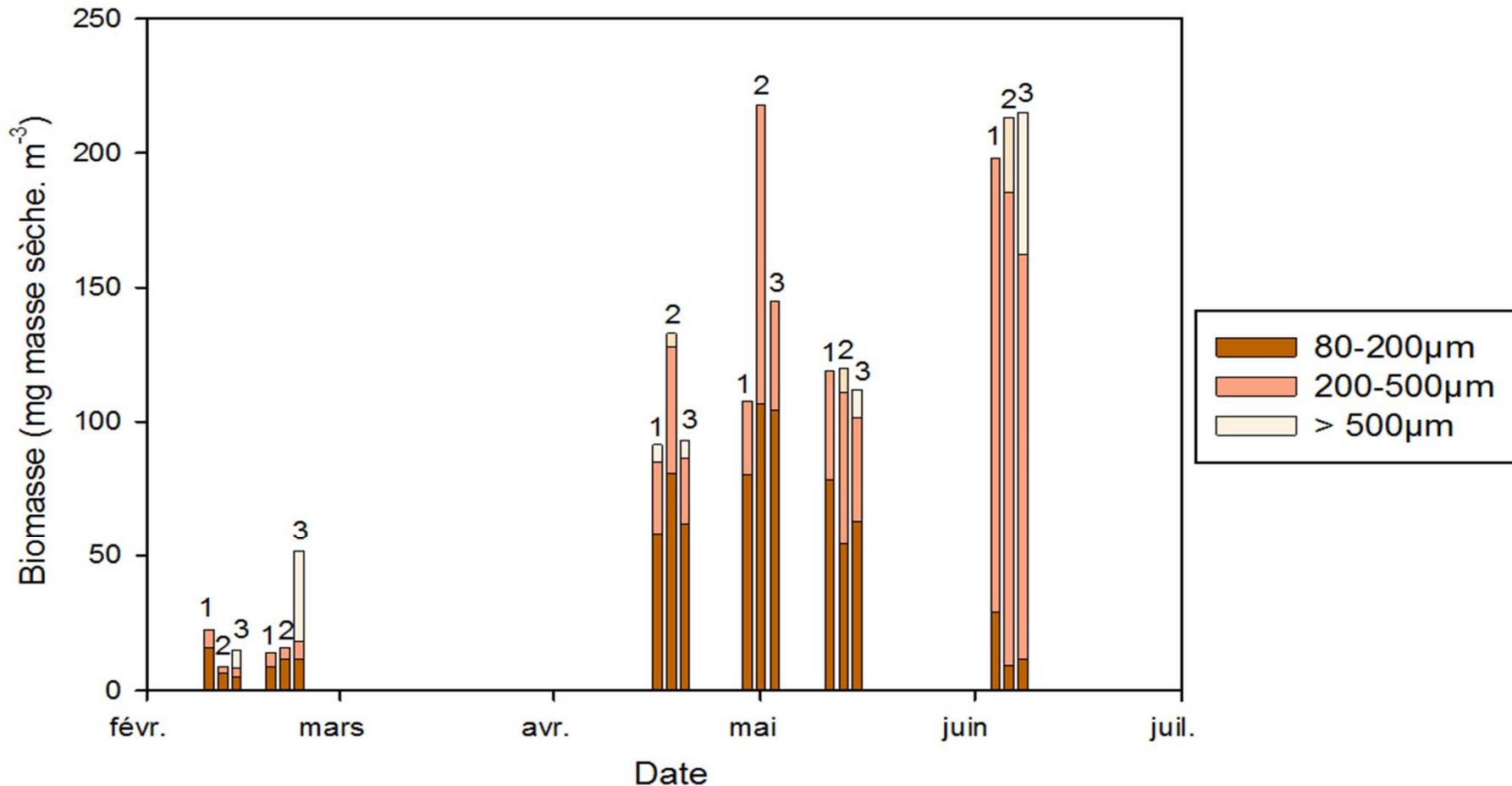
## Evolution de la température et de la salinité



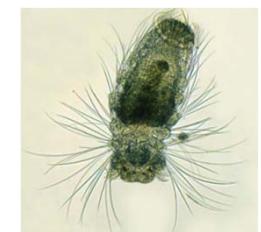
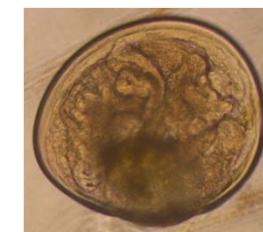
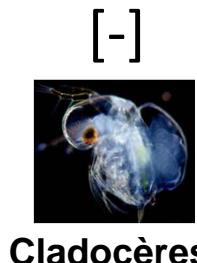
## Evolution de la biomasse planctonique



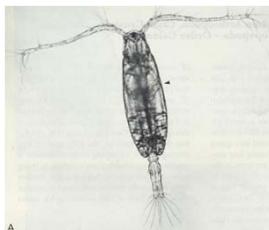
## Evolution de la biomasse planctonique par classe de taille



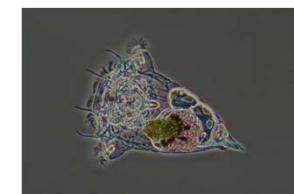
## Evolution de la diversité planctonique; marinisation de la lagune?



Entrée d'espèces  
Méditerranée



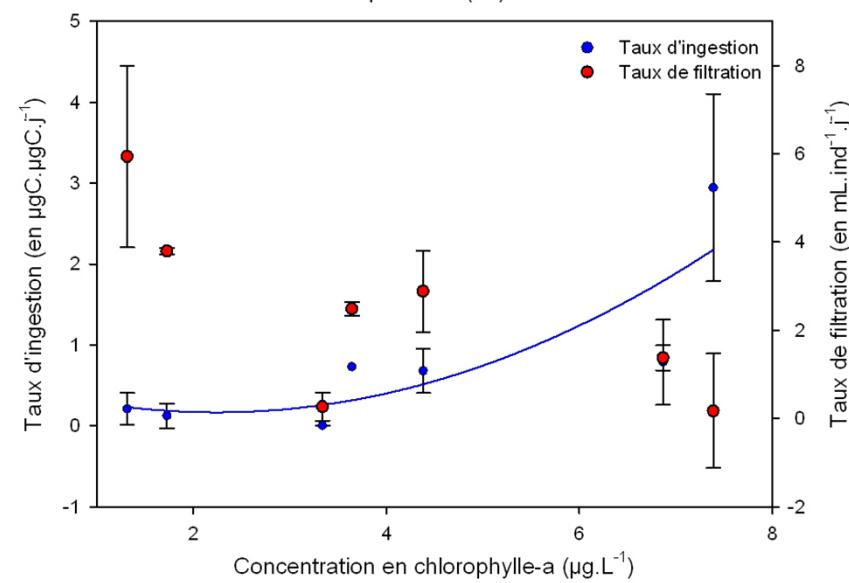
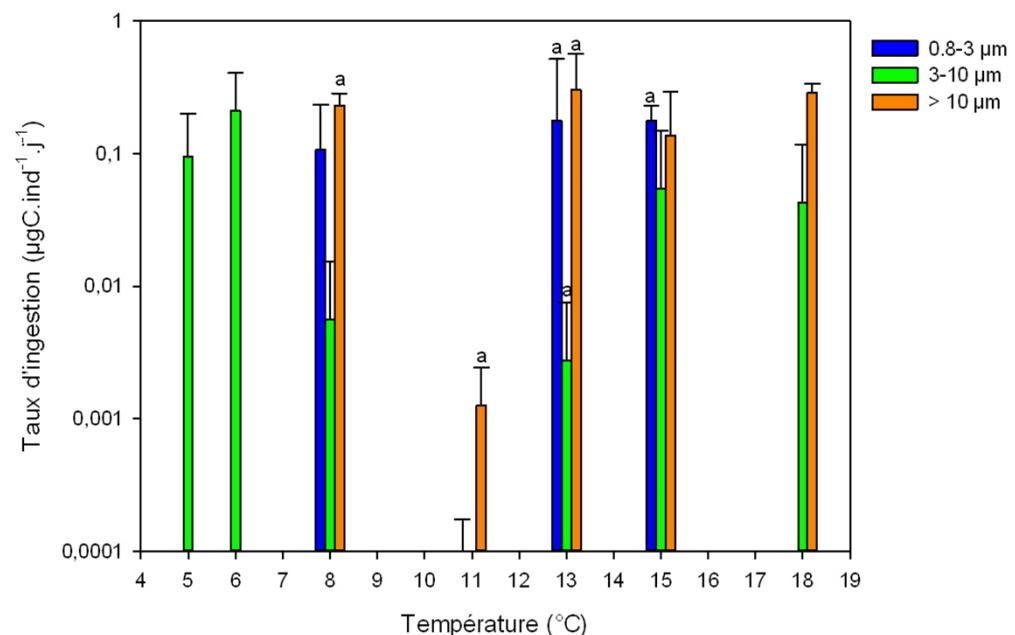
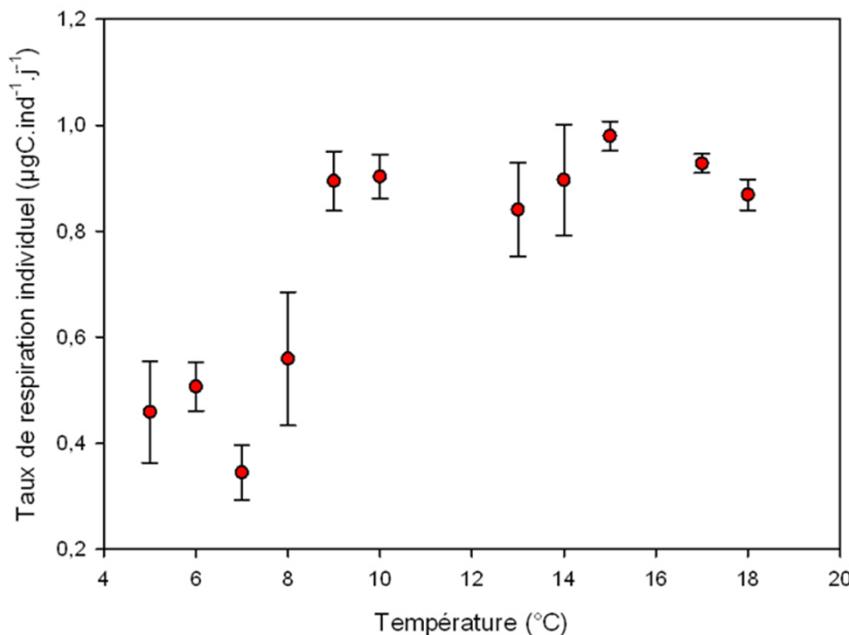
Apparition  
d'espèces  
exotiques



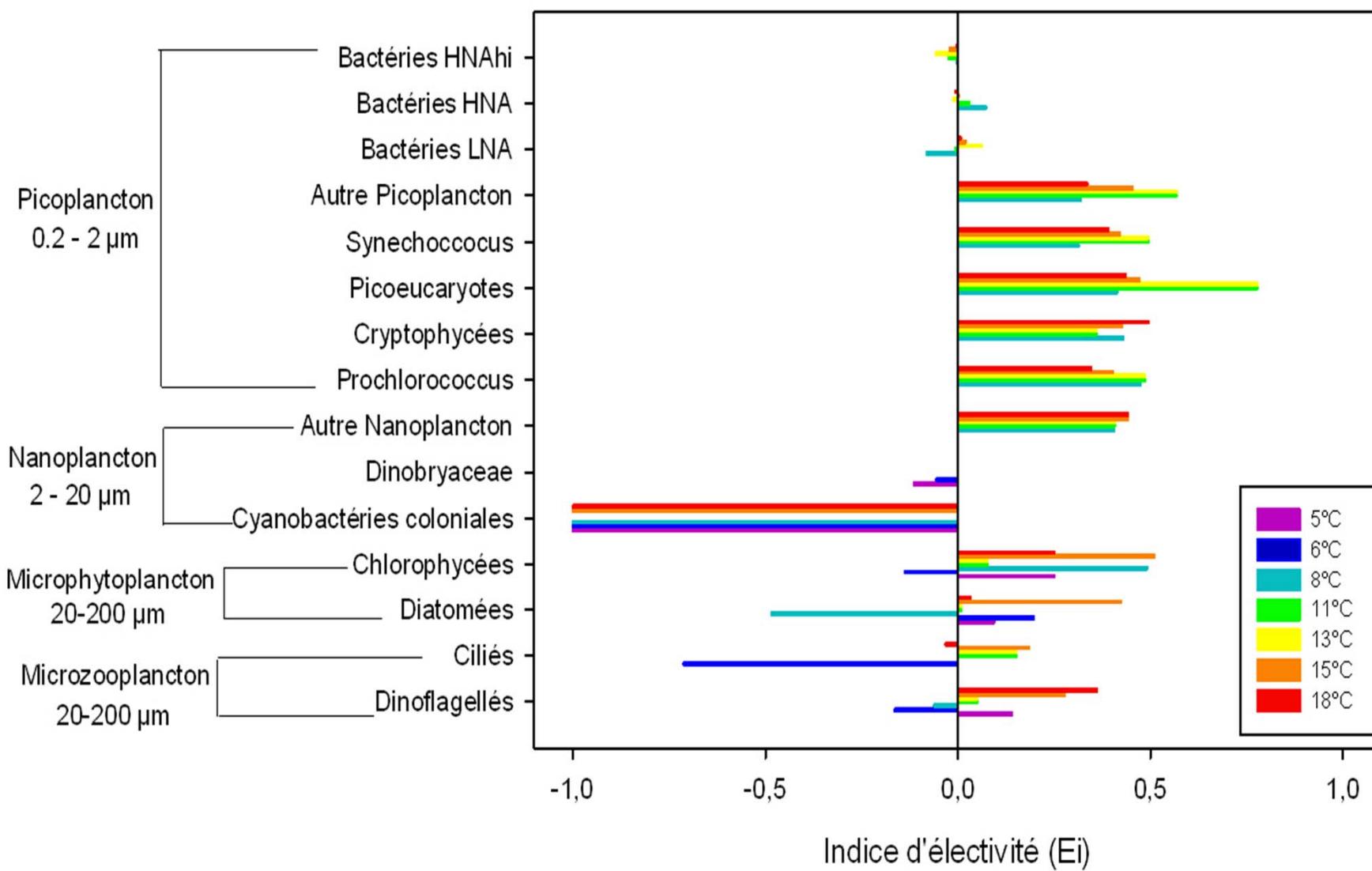
Zooplancton  
gélatineux



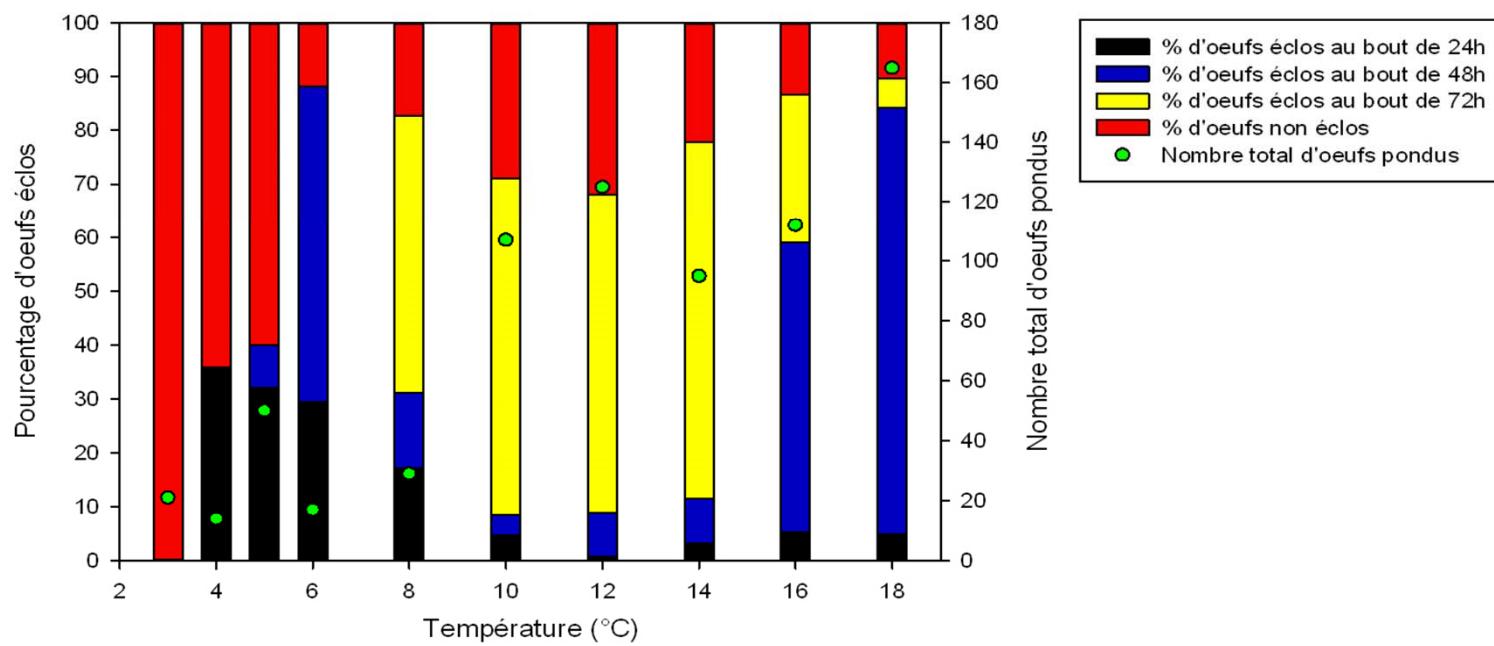
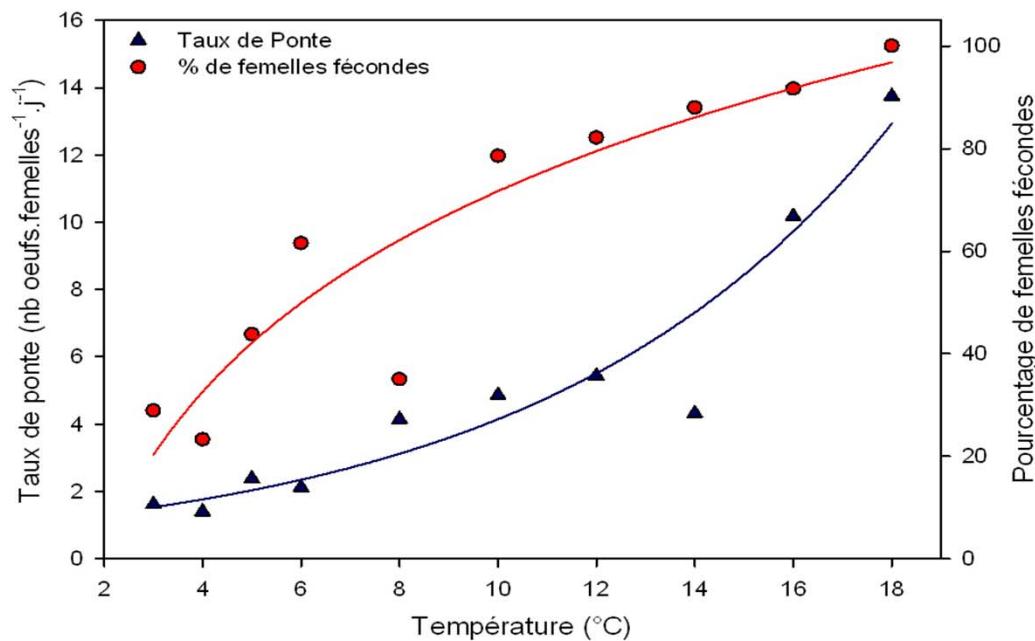
## Métabolisme du mésozooplancton naturel



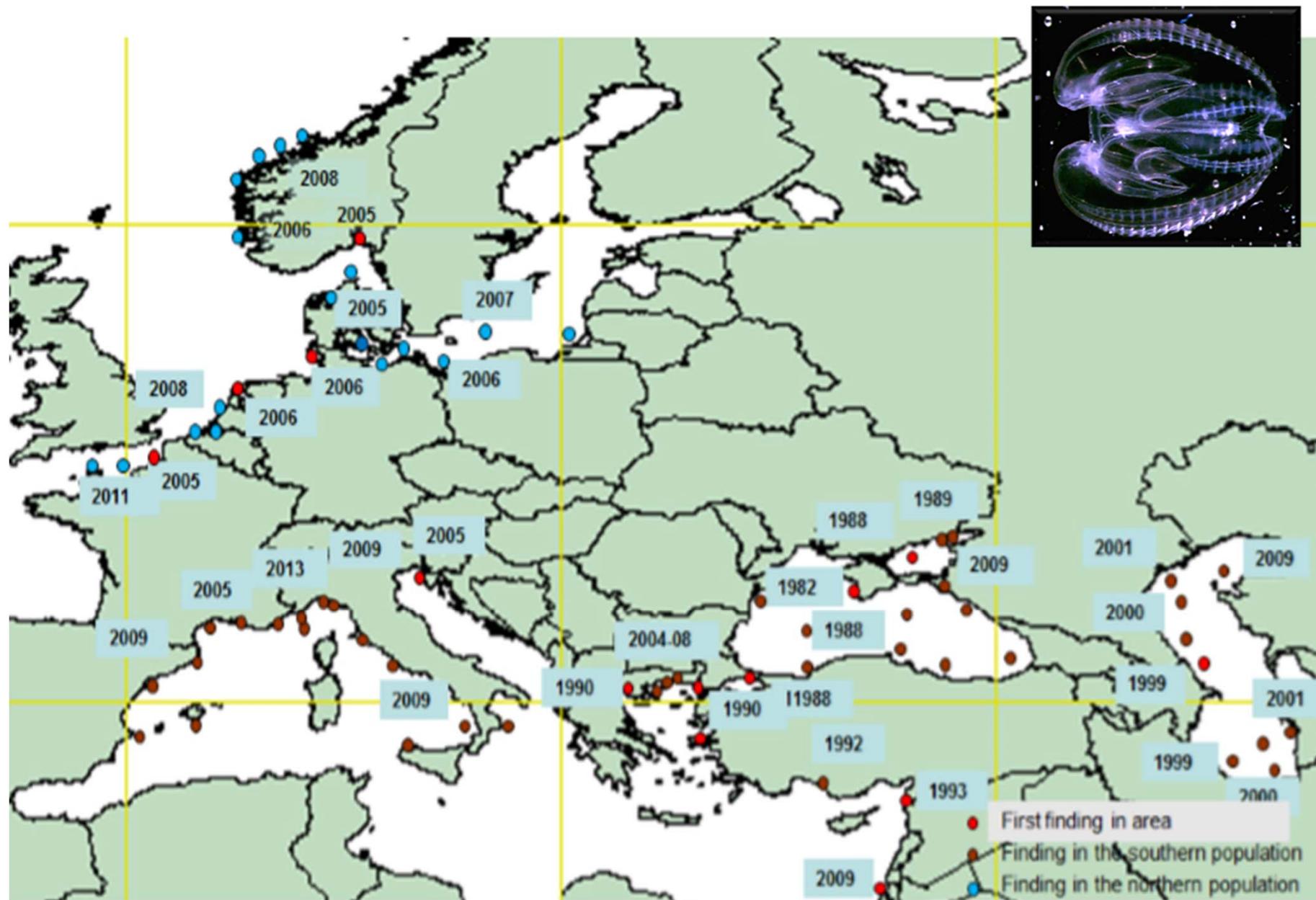
## Sélectivité du mésozooplancton naturel



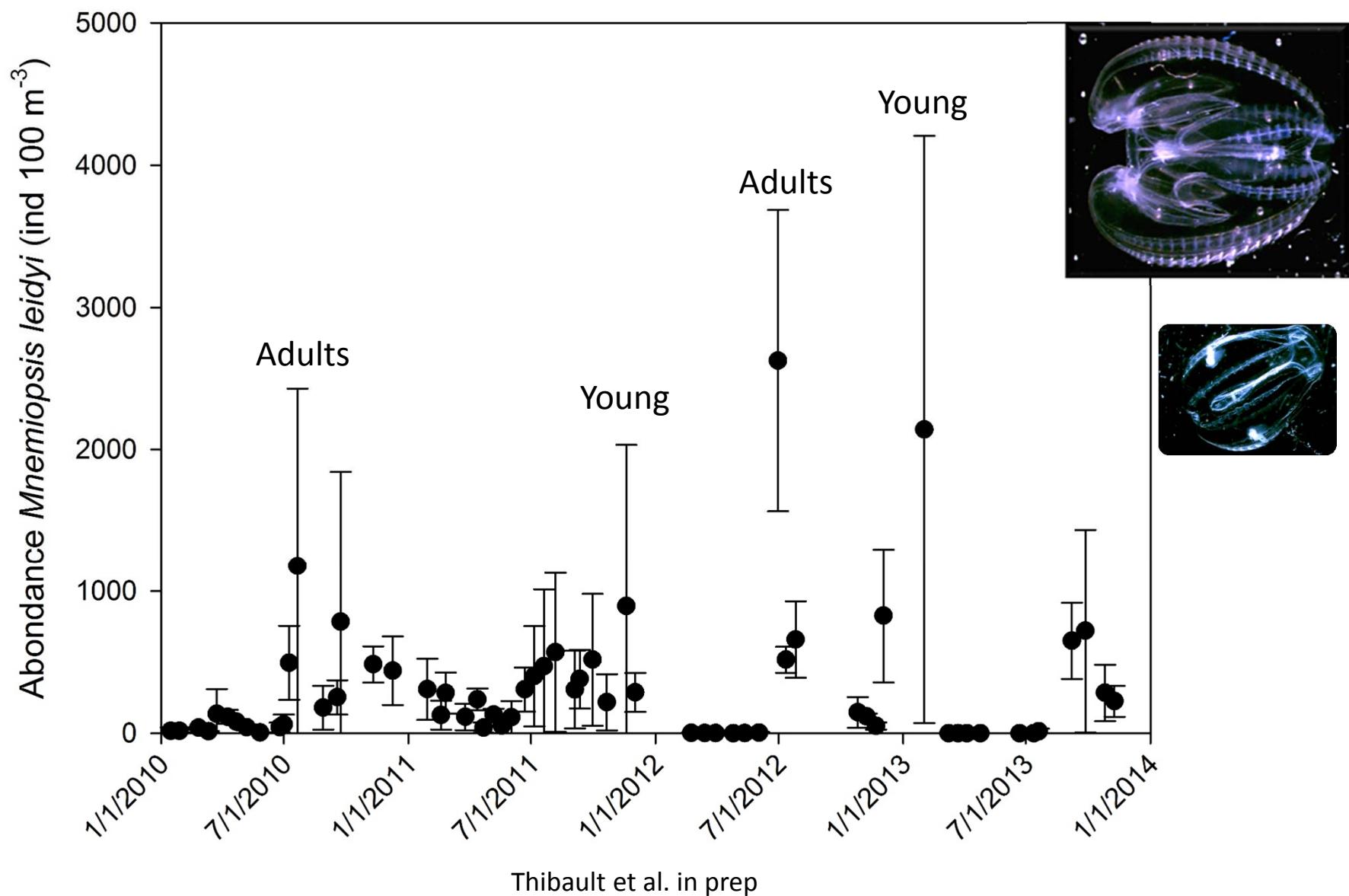
## Ponte d'*Acartia tonsa*



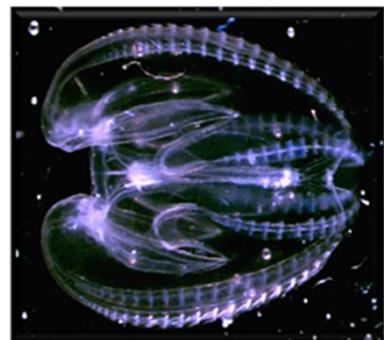
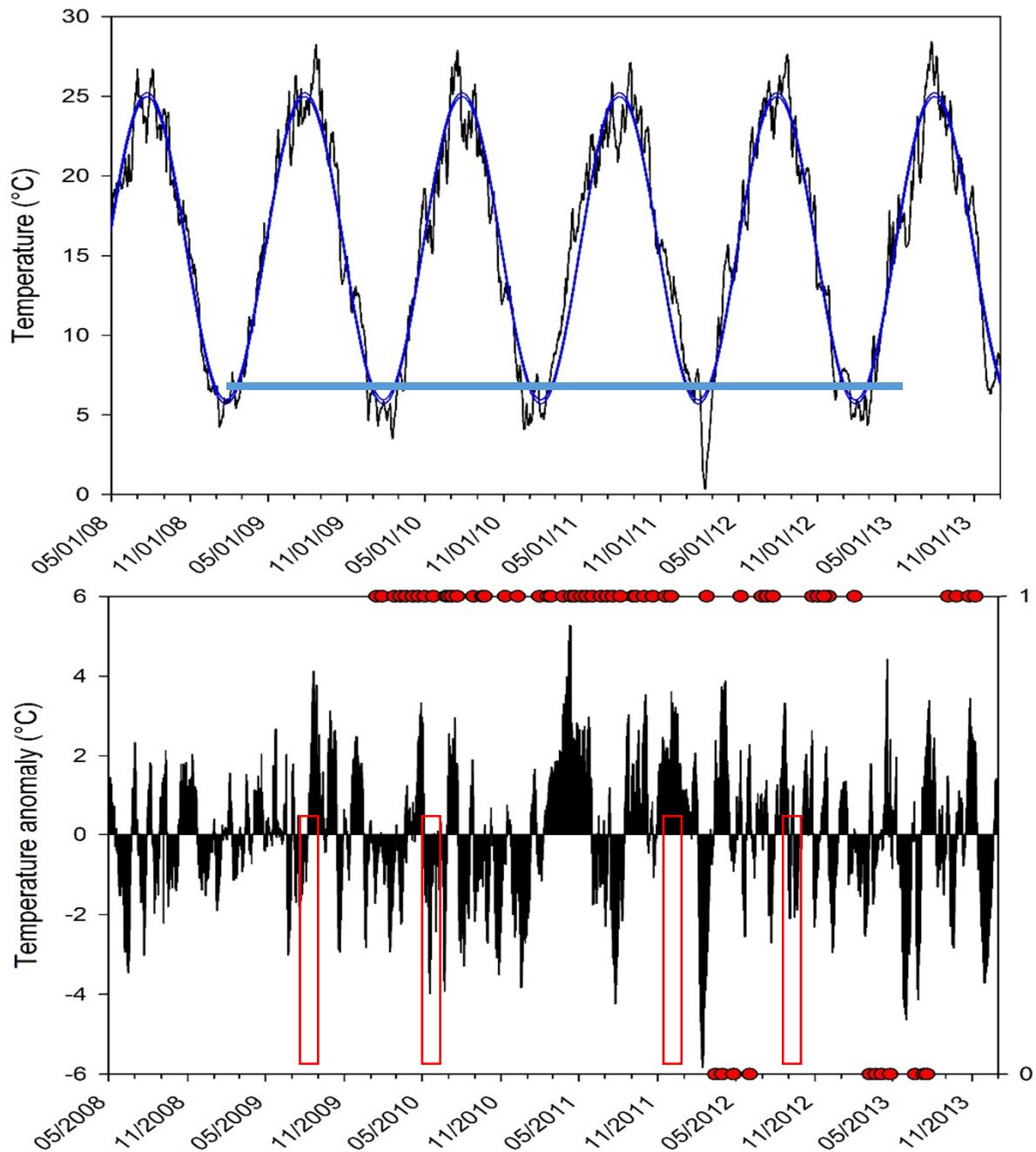
## Distribution de *Mnemiopsis leidyi*



## Evolution de l'abondance de *Mnemiopsis leidyi*

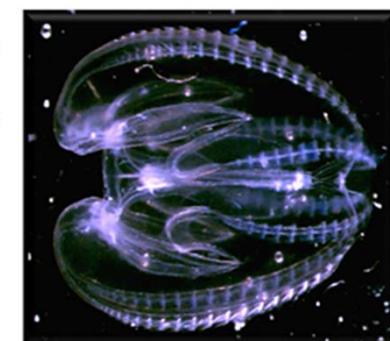
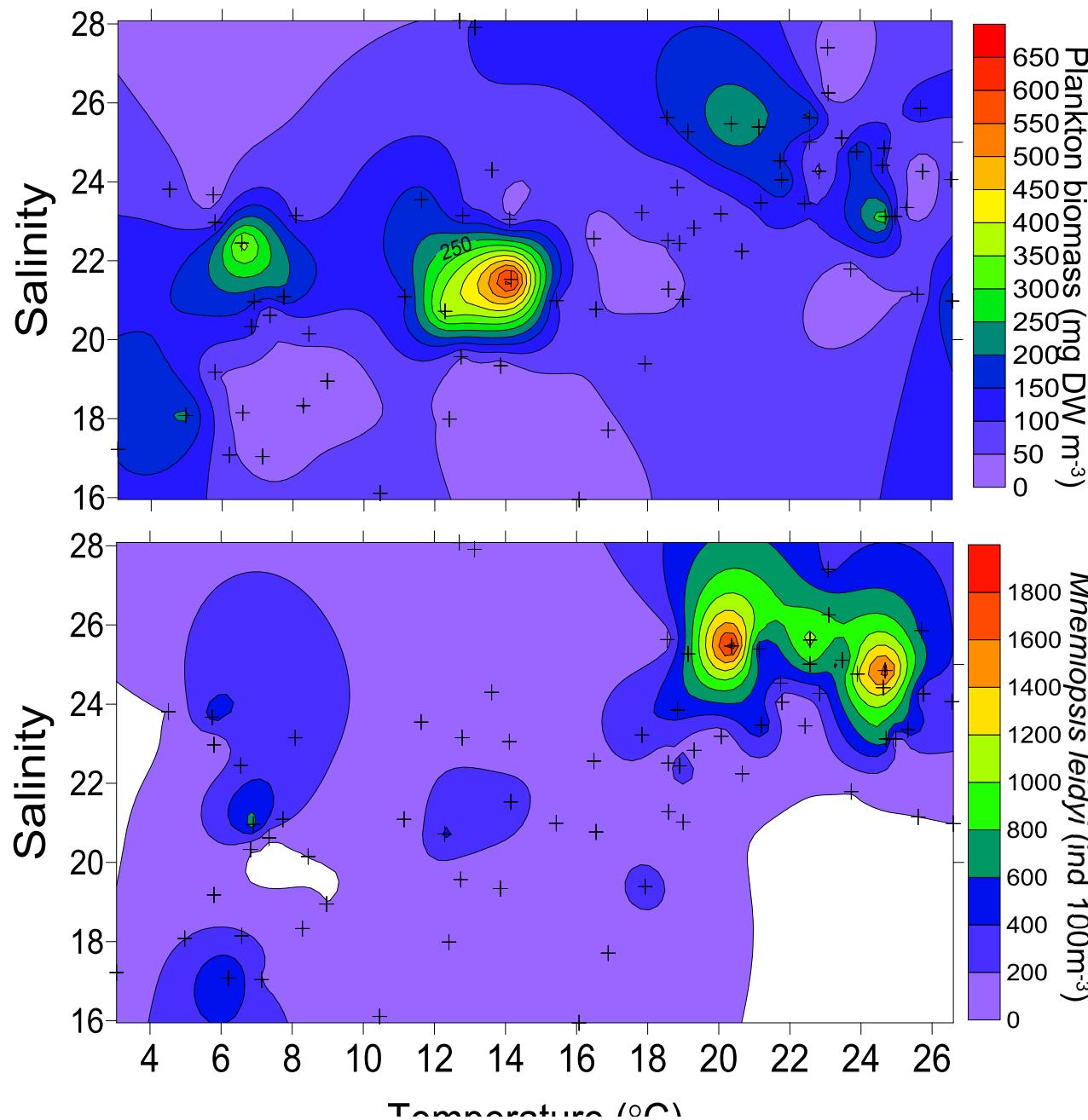


## Relation température /*Mnemiopsis*

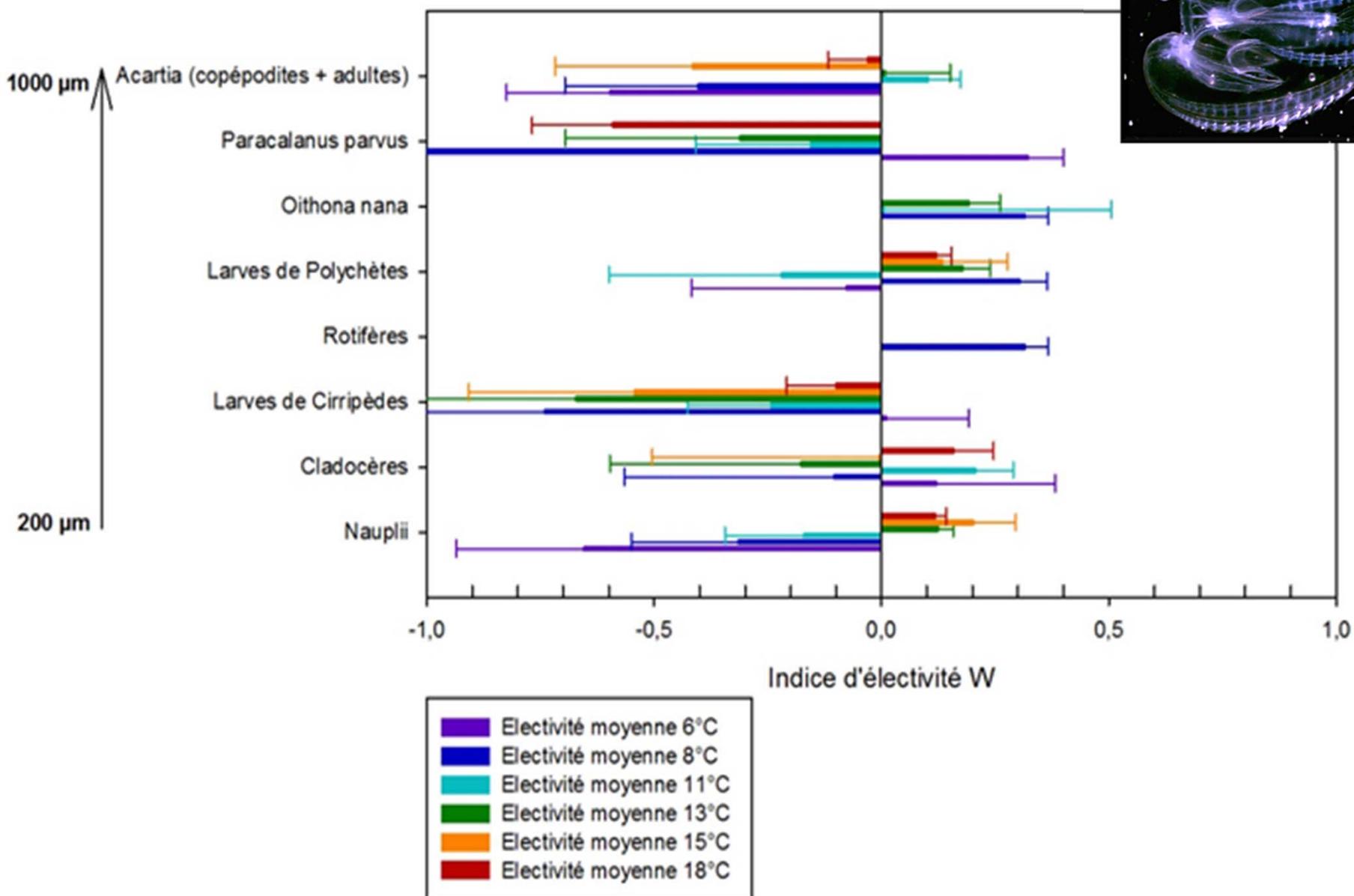


*Mnemiopsis leidyi*  
presence/absence

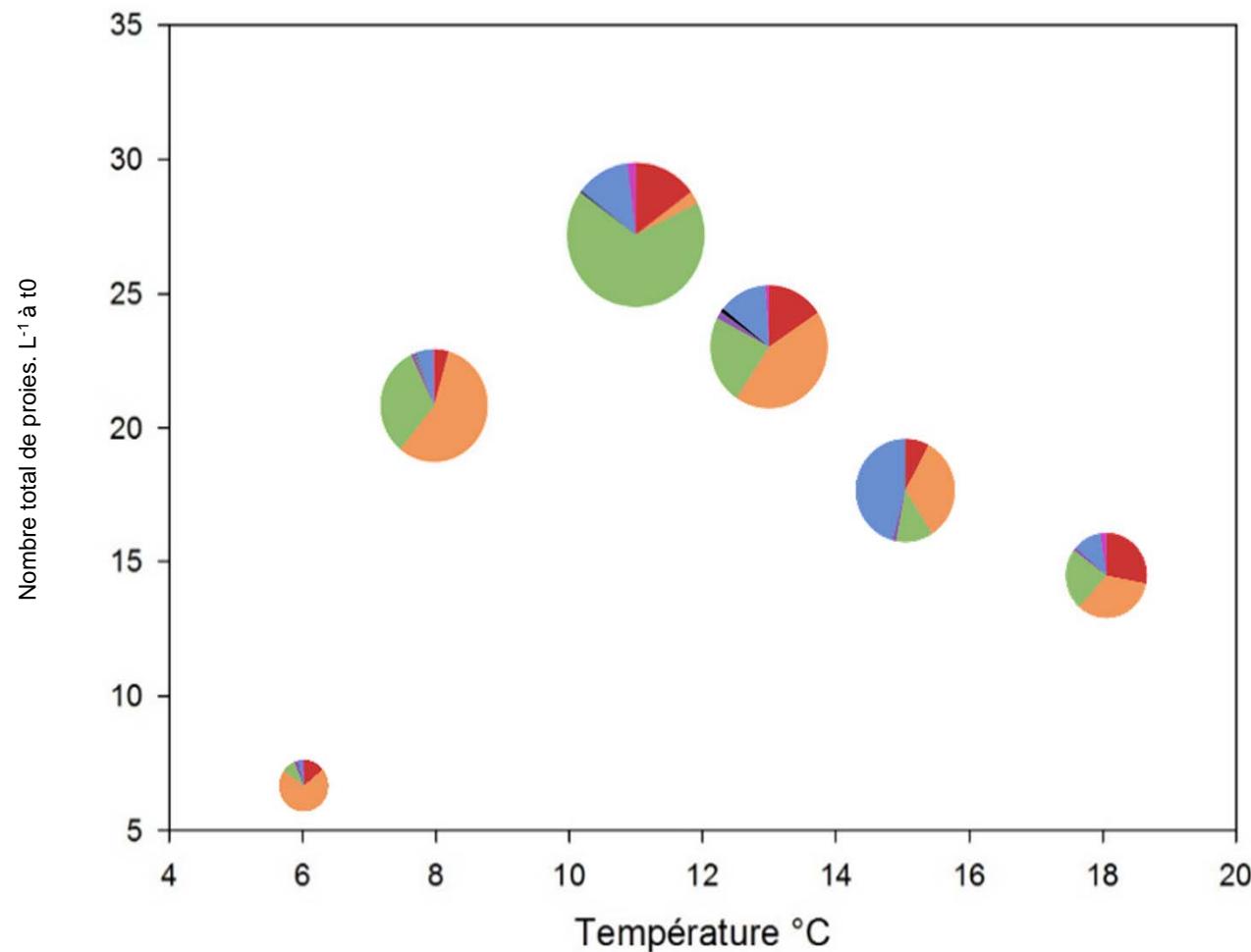
## Relation température, salinité sur la biomasse planctonique et *Mnemiopsis*



## Sélectivité de *Mnemiopsis*



## Ingestion de *Mnemiopsis*



- Larves de cirripèdes
- Acartia (copepodites + adultes)
- Rotifères
- Larves de polychètes
- Nauplii
- Cladocères
- Oithona nana
- Paracalanus Parvus

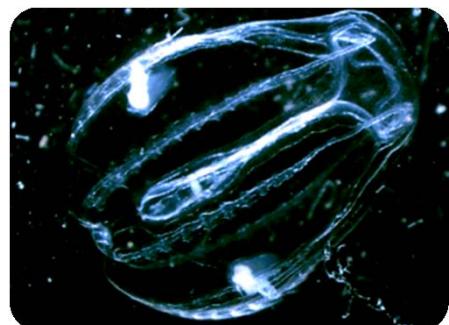
## Stade de développement *Mnemiopsis leidyi*



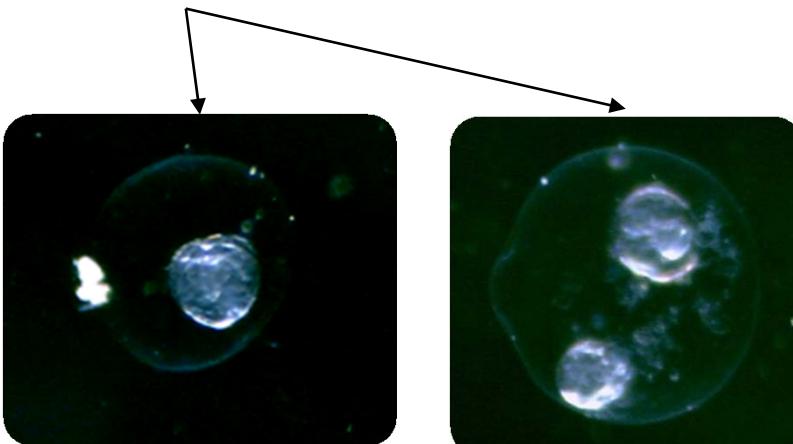
Œuf non fécondé conservé dans du lugol acide 2 %



Œuf autofécondé conservé dans du lugol acide 2 %.

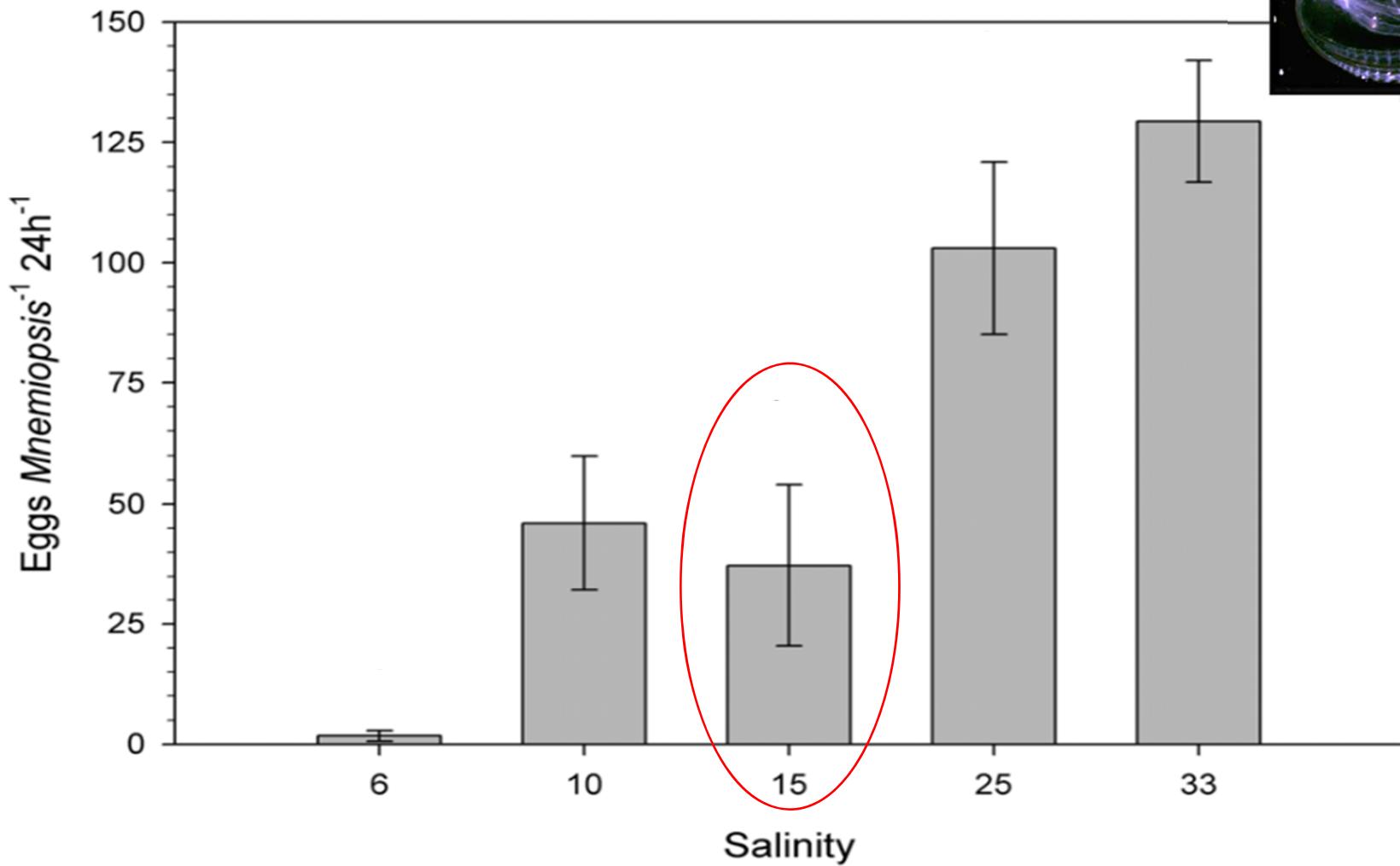


Larve cydippide  
(tentacules perdus)

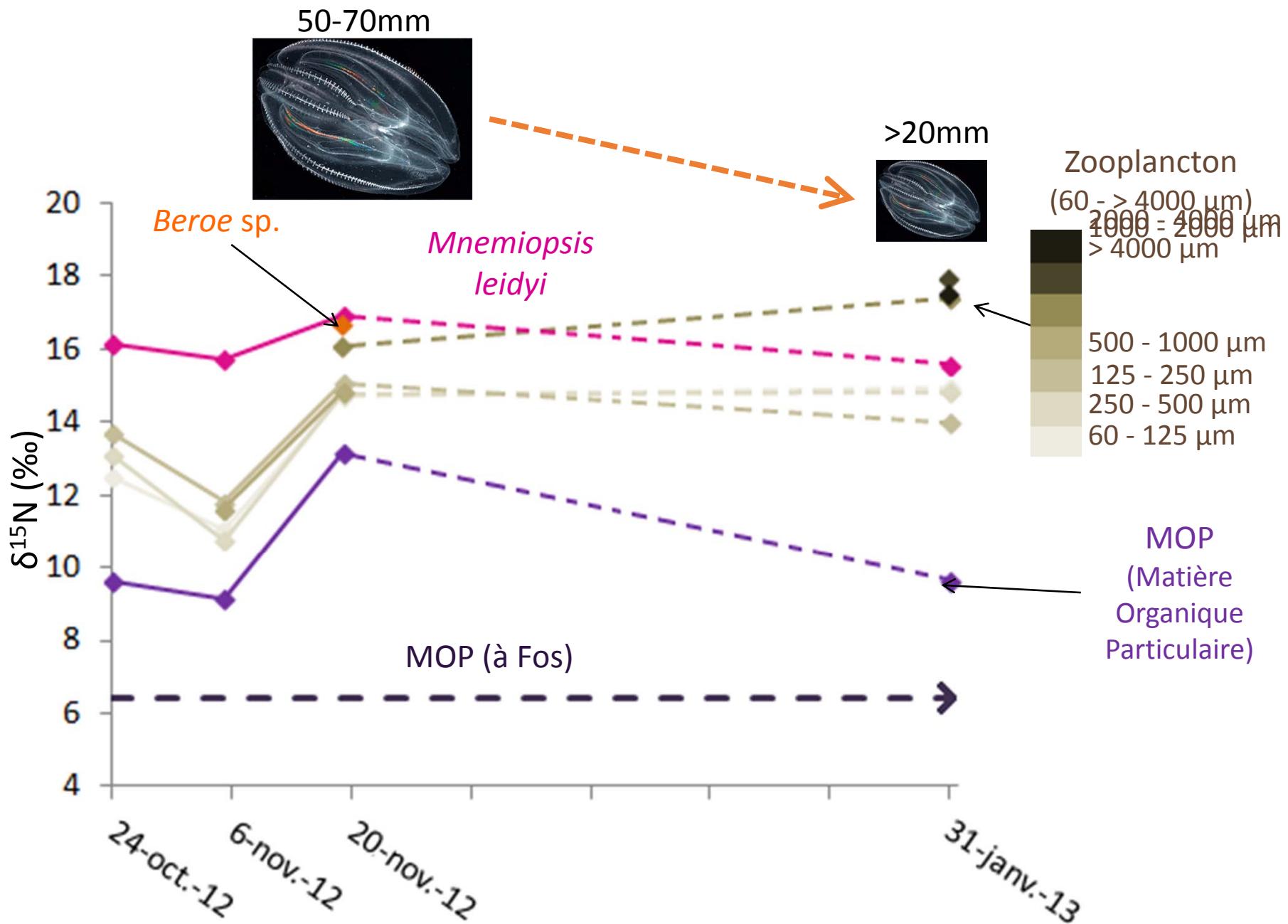


Embryon viable dans l'enveloppe ovoïde      Deux embryons viables dans une enveloppe ovoïde

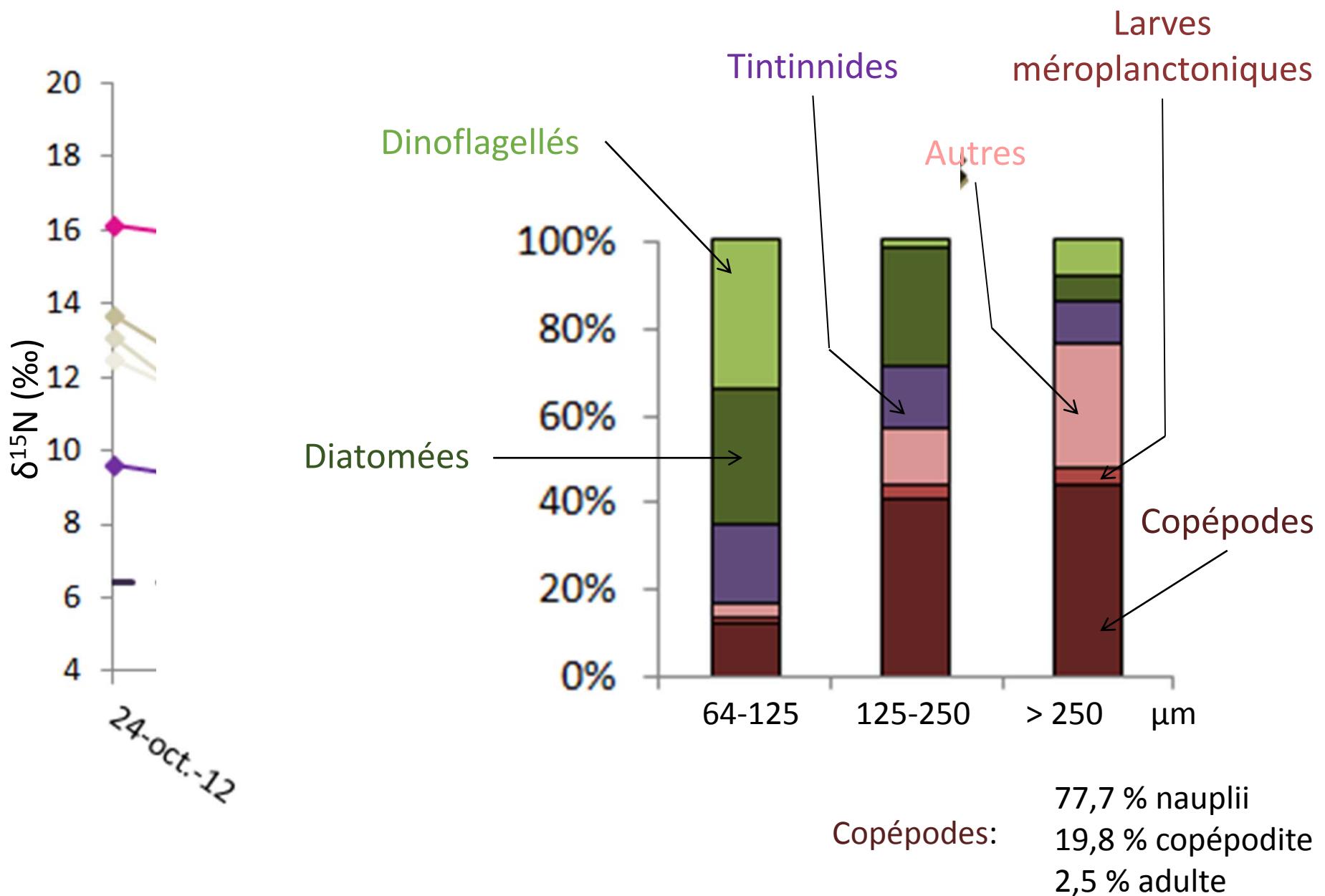
## Taux de ponte *Mnemiopsis leidyi*



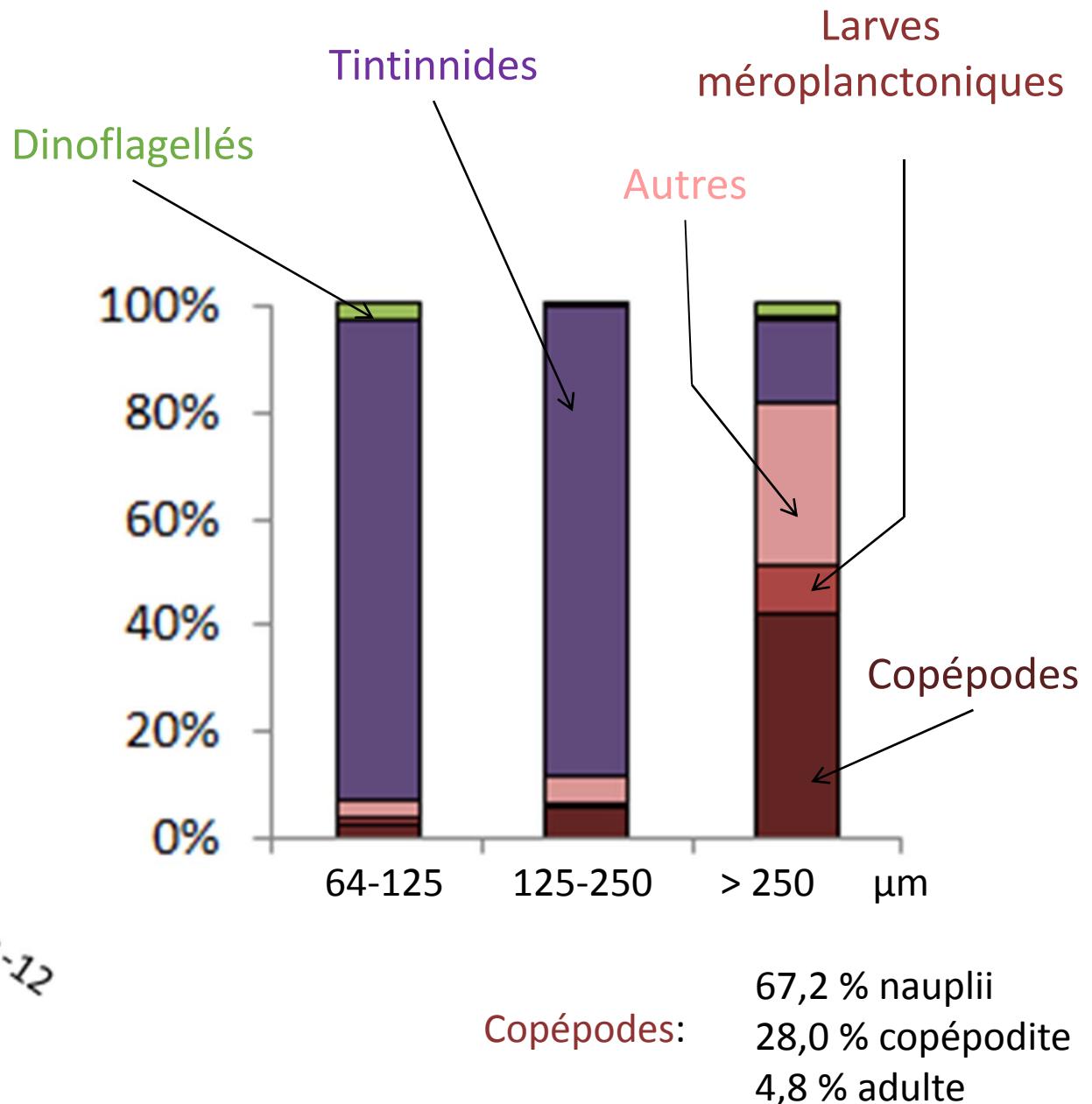
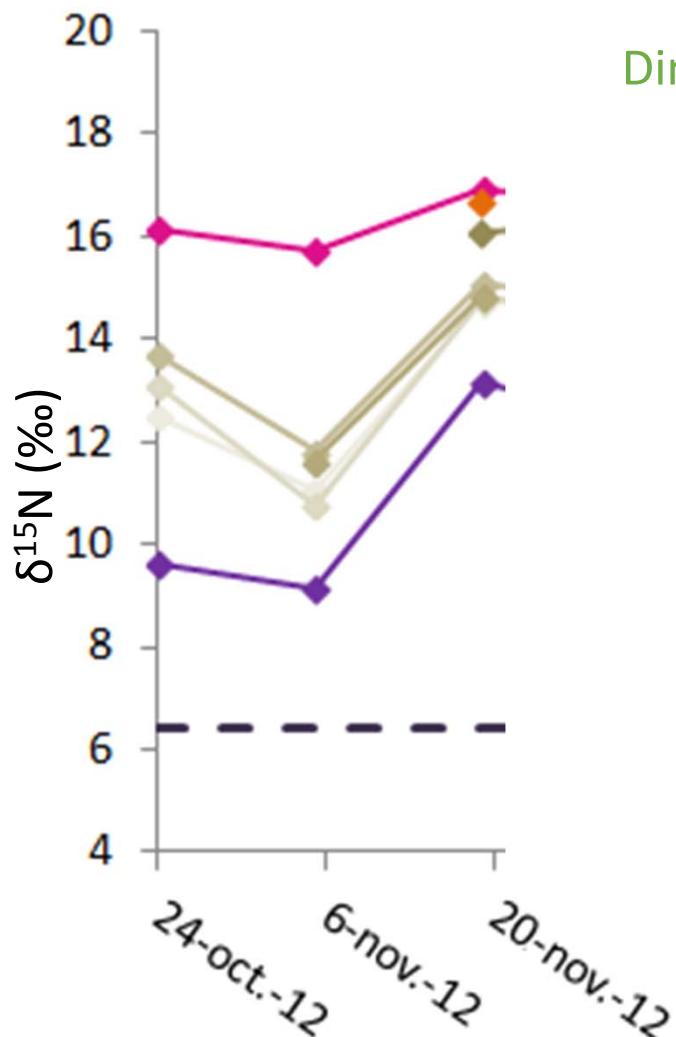
## Structure trophique – approche par isotopie stable



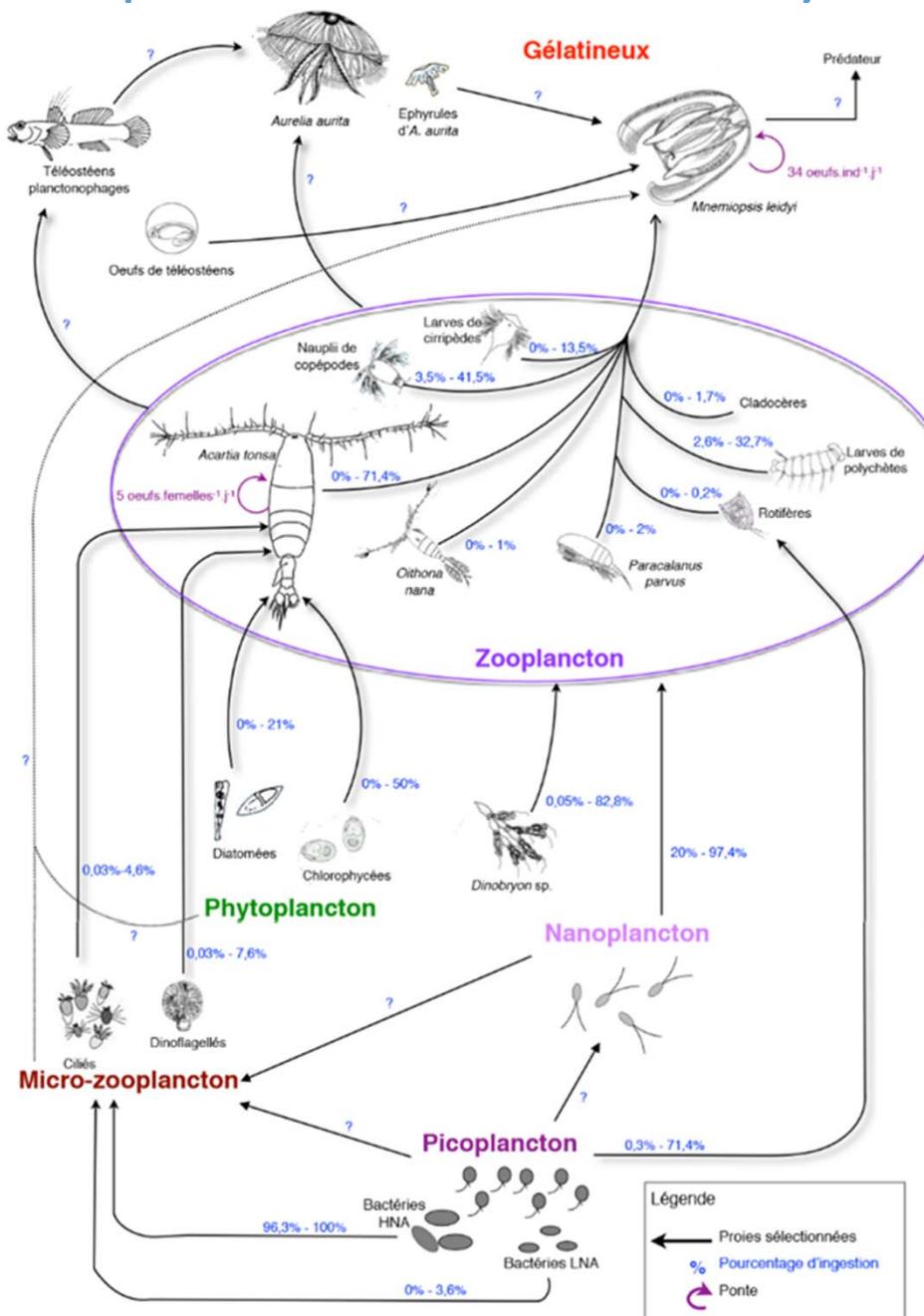
## Structure trophique – approche par isotopie stable



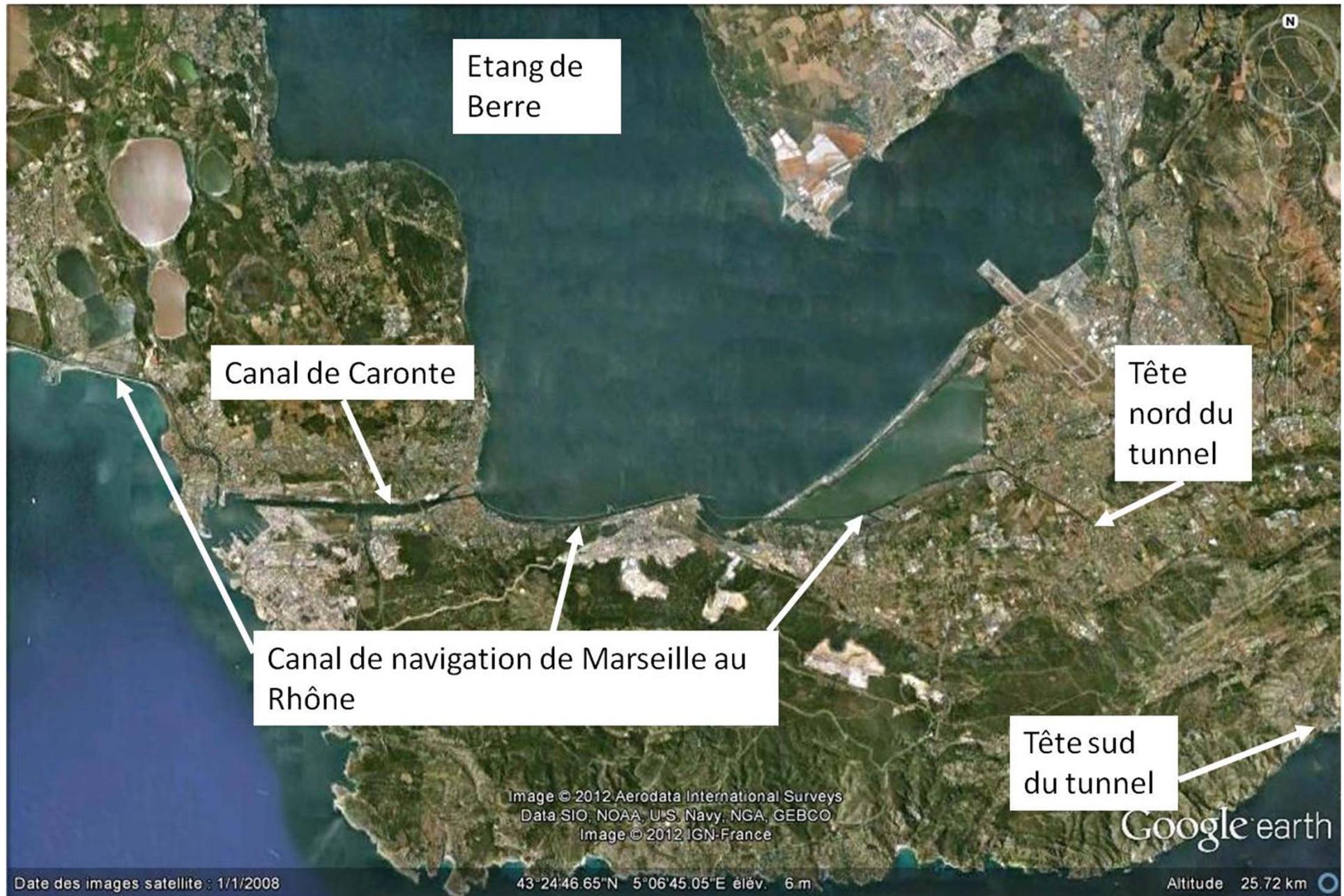
## Structure trophique – approche par isotopie stable



## Schéma conceptuel du fonctionnement de l'écosystème pélagique



## Devenir de l' étang – réouverture du canal de Caronte



## Publications, conférences et rapports

- Delpy F., Albouy-Boyer S., Pagano M., **Thibault D.**, Blanchot J., Guilhaumon F., Bonnet D., soumis. *Mnemiopsis leidyi* population dynamics in Northwestern Mediterranean lagoons. Marine Pollution Bulletin.
- Marchessaux G., 2015. Ecologie trophique et fonctionnelle du zooplancton de l'Etang de Berre en réponse aux modifications environnementales. Master 2 Oceanographie, Aix-Marseille Université.
- Barth L., 2015. Réponse de *Mnemiopsis leidyi* aux modifications environnementales de l' étang de Berre. Mémoire de Fin d'Etudes, ISARA Lyon.
- Thibault D.**, Delpy F., Blanchot J., Guilloux L., Lèon S., Pagano M., 2014. *Mnemiopsis* in the Berre Lagoon, what are the main triggers for its expansion? ICES-CIESM Joint workshop on Mnemiopsis Science, A Coruña, 18-20 Sep 2014. Invited talk
- Lilley M., **Thibault-Botha D.**, Lombard F., 2014. Respiration demands increase significantly with both temperature and mass in the invasive ctenophore *Mnemiopsis leidyi*. Journal of Plankton Research. 36, 831-837.
- Ghabooli S., Shiganova T.A., Briski E., Piraino S., Fuentes V., **Thibault-Botha D.**, Angel D.L., Cristescu M.E., MacIsaac H.J., 2013. Invasion pathway of the ctenophore *Mnemiopsis leidyi* in the Mediterranean Sea. Plos One, 8(11): 1-9
- Bolte S., Fuentes V., Haslob H., Huwer B., **Thibault-Botha D.**, Angel D., Galil B., Javidpour J., Moss A.G., Reusch T.B.H, 2013. Population genetics of the invasive ctenophore *Mnemiopsis leidyi* in Europe reveal source-sink dynamics and secondary dispersal to Mediterranean Sea. Marine Ecology Progress Series, 485: 25–36.
- Delpy F. (2013). Écologie du cténophore *Mnemiopsis leidyi* (Agassiz, 1865) dans l'Étang de Berre : Étude des facteurs contrôlant sa population et de son impact potentiel sur l'écosystème planctonique. These Aix-Marseille Université
- Delpy F., Pagano M., Blanchot J., Carlotti F., **Thibault-Botha D.**, 2012. Man-induced hydrological changes, metazooplankton communities and invasive species in the Berre Lagoon (Mediterranean Sea, France). Marine Pollution Bulletin, 64(9): 1921-1932.
- Delpy F., **Thibault-Botha D.**, Carlotti F., 2011. Modification of the Berre Lagoon pelagic ecosystem since the 1980's. In Global Change: Mankind-Marine Environment Interactions, Proceedings of the 13th French-japanese Oceanography symposium, Ceccaldi H-J., Dekeyser I. Girault M., Stora G. (eds), Springer. DOI 10.1007/978-90-481-8630-3\_64
- Delpy F., Boyer S., Pagano M., **Thibault-Botha D.**, Blanchot J., Bonnet D., 2013. Does latitude matter? A comparison of three non-indigenous species between the North and Mediterranean Seas. Non indigenous species in the North East Atlantic 20-22 novembre 2013, Ostend, Belgique,
- Delpy F., Pagano M., Blanchot J., **Thibault-Botha D.**, 2013. Effect of the concentration and prey types on the ingestion of the invasive ctenophore *Mnemiopsis leidyi* (Agassiz, 1865) in the Berre Lagoon (France). 40th CIESM Congress, 28 October - 1 November 2013, Marseille, France
- Thibault-Botha D.**, Delpy F., Pagano M., Blanchot J., Leon S., Hunt B., 2013. *Mnemiopsis leidyi* invasive success in the Berre Lagoon and impact on the ecosystem structure and functioning? 4th International jellyfish Bloom Symposium, 5-8 June 2013, Hiroshima, Japan
- Delpy F., **Thibault-Botha D.**, Pagano M., Blanchot J., 2012. The Berre Lagoon (Mediterranean Sea, France). Metazooplankton community structure response to man-induced hydrological changes. 50th ECSA Conference: Today's science for tomorrow's Management, 3-7 June 2012, Venice, Italy
- Delpy F., Pagano M., Blanchot J. et **Thibault-Botha D.**, 2012. Impact des changements hydrologiques sur la communauté zooplanctonique de l'Etang de Berre : le cas des proliférations d'organismes gélatineux. LAGUN'R Recherche et Restauration, Rencontres Scientifiques autour de l'étang de Berre. 14-15 Mars 2011, Europole de l'Arbois, Aix-en-provence, France.
- Thibault-Botha D.**, Delpy F., Laguia M., Pagano M., Blanchot J., 2010. Gelatinous zooplankton along the French Mediterranean Coast: Biodiversity, and Impact on local human activities. Third International jellyfish Bloom Symposium, 13 - 16 July 2010 Mar del Plata, Argentina
- Thibault-Botha D.**, Delpy F., Laguia M., Pagano M., Blanchot J., 2010. Gelatinous zooplankton along the French Mediterranean Coast: Biodiversity, and Impact on local human activities. Third International jellyfish Bloom Symposium, 13 - 16 July 2010 Mar del Plata, Argentina