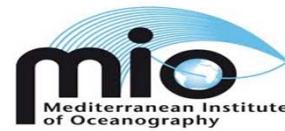


COntaminants dans le Système Tphytoplankton, zooplankton, Anchois,  
Sardine

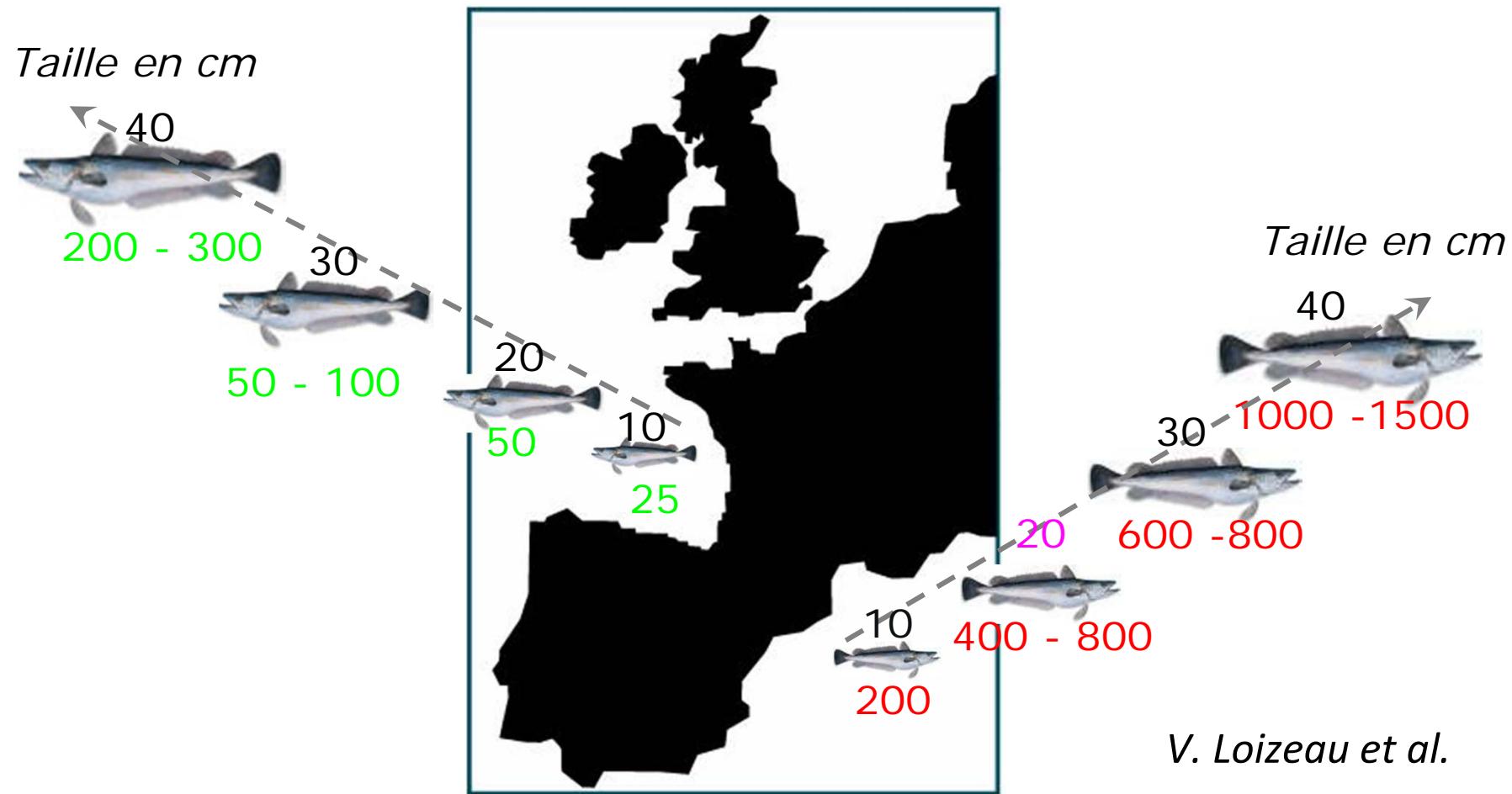
Jacek Tronczyński et François Carlotti et al.

enaires :



MED MERLUMED et d'autres projets de recherche ainsi que le ROCCH montrent une contamination de ressources biologiques dans le Golfe du Lion

→ **Merlu GL 5 à 8 fois plus contaminés qu'en Gascogne par le PCB**



amination élevée des prédateurs supérieurs en Méditerranée (le thon et mammifère)

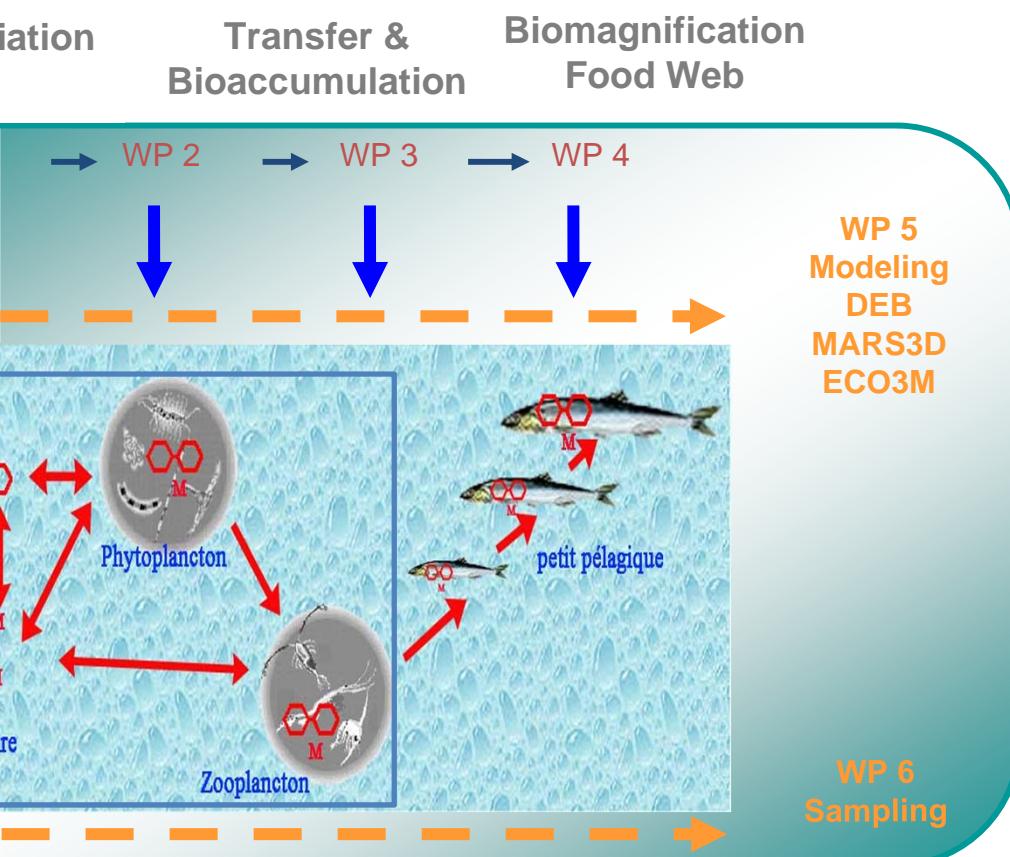
amination par des PCB des poissons en amont dans le Rhône

Costas : première étude couvrant l'ensemble - eau/plancton/petits poisson pelagique  
géochimie et écologie du écosystème ...

# ect approach

## Field studies Modeling

# Objecti



- Estimate bioaccumulation pathways (short pelagic trophic system in the GoL)
- Model primary trophic relationships contaminants transfers - plankton and an

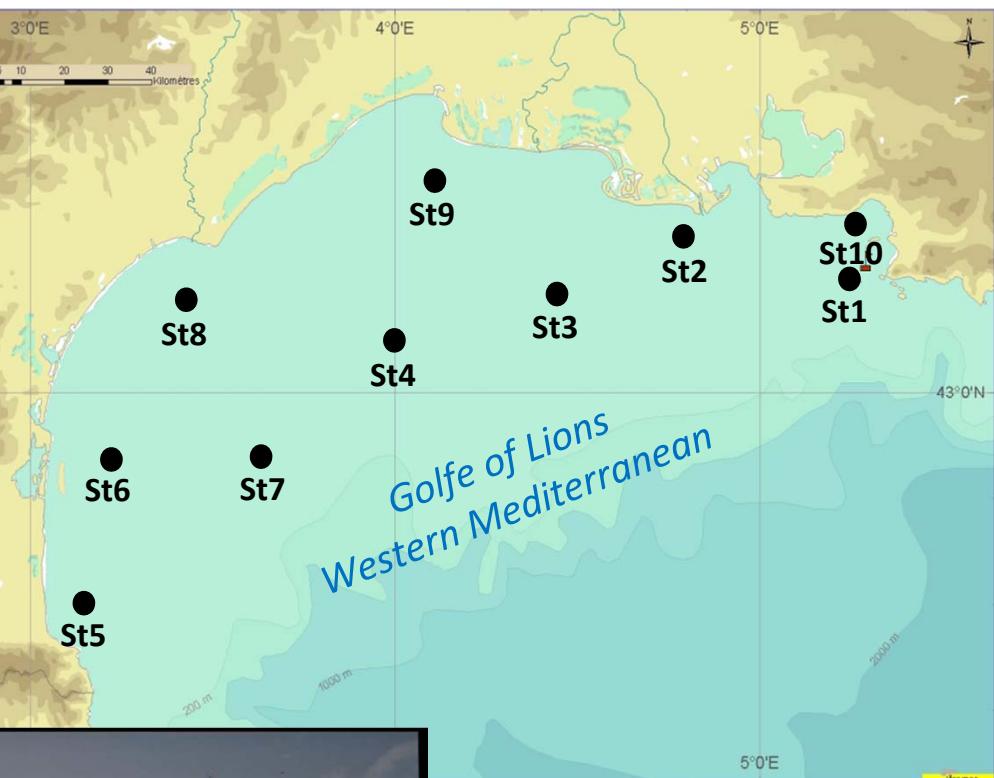
ants étudiées:

contaminants: PCBs; PBDEs; OCPs and PAHs (priority substances: DCSMM et DCE...)

# Oceanographic cruises sampling 2009 – 11, one temporal survey

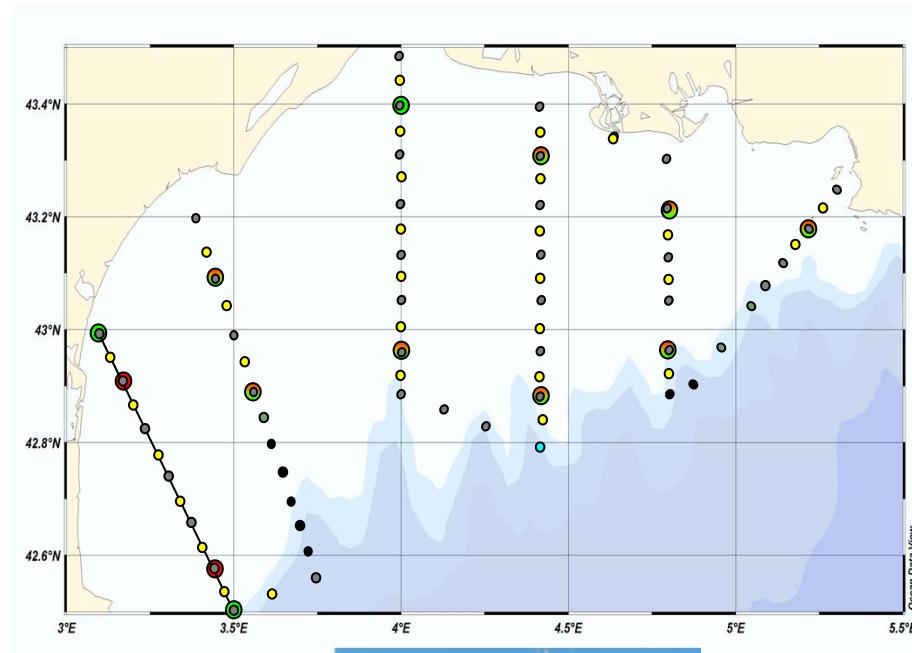
## Western Mediterranean Gulf of Lion

Contaminants biogeochemistry



N/O Europe

Physical field, plankton distribution  
and biogeochemistry



N/O Antedon II



N/O Thetys II

Costeau 1 : 6 au 23 octobre 2009

Costeau 3 : 22 avril au 18 mai 2010

Costeau 5 : 22 janvier au 10 février 2011

73 jours de mer

Costeau 2 : 2 au 17 octobre 2009

Costeau 4: 26 avril au 7 mai 2010

39 jour

Water column

CTD /water/ SPM /POC/DOC



Pumping



Clean lab. XAD



Plankton sampling



SPM GF/F 400 l



Plankton sampling



Towed net  
 $\mu\text{m}$



GF/F 0,7 - 60

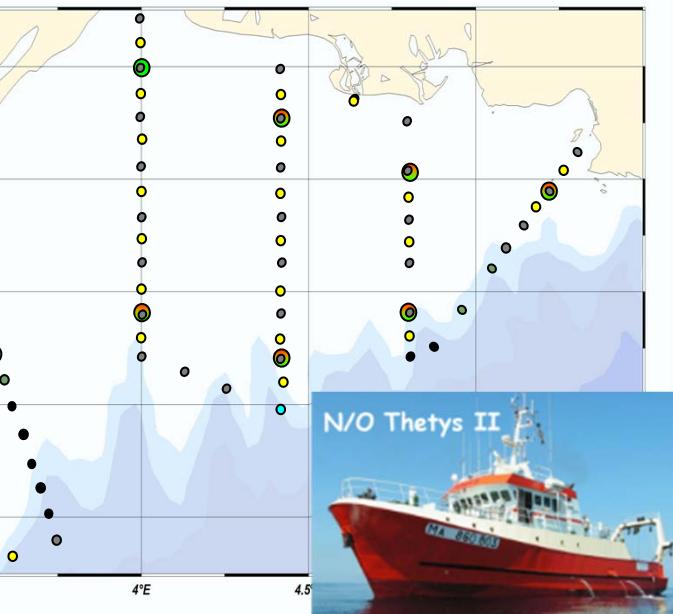
COP /COD/CHN  
 $\delta^{13}\text{C}$  et  $\delta^{15}\text{N}$



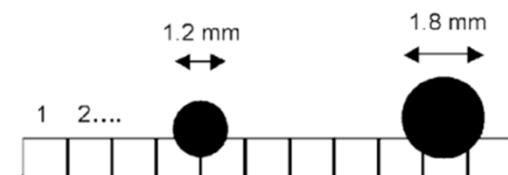
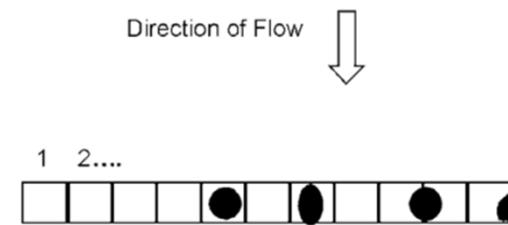
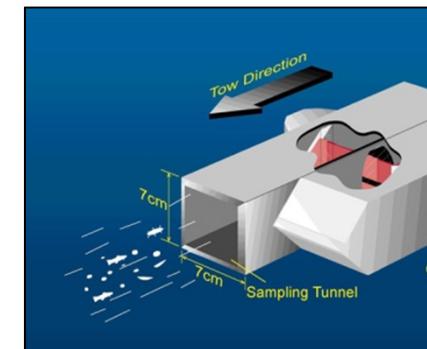
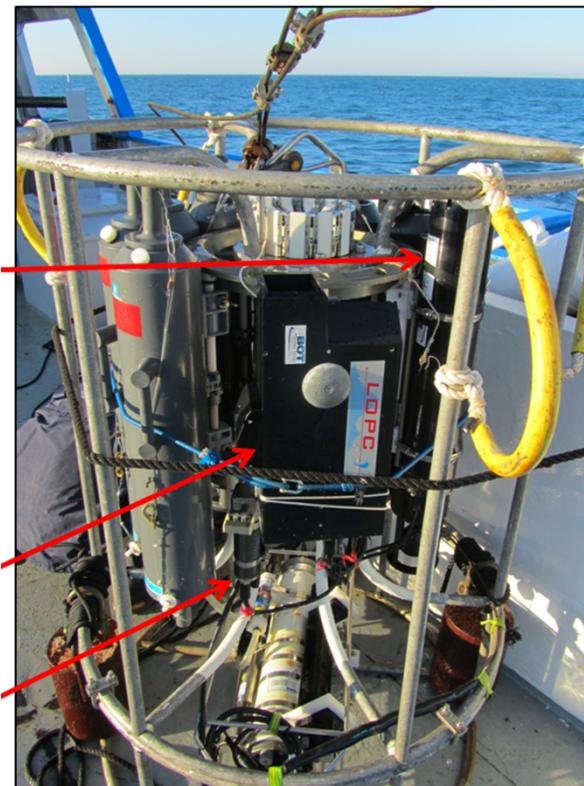
Plankton sieving

- 60-200 $\mu\text{m}$
- 200-500 $\mu\text{m}$
- 500-1000 $\mu\text{m}$

# kton biogeochemistry



Data logger  
LOPC  
micro-  
CTD



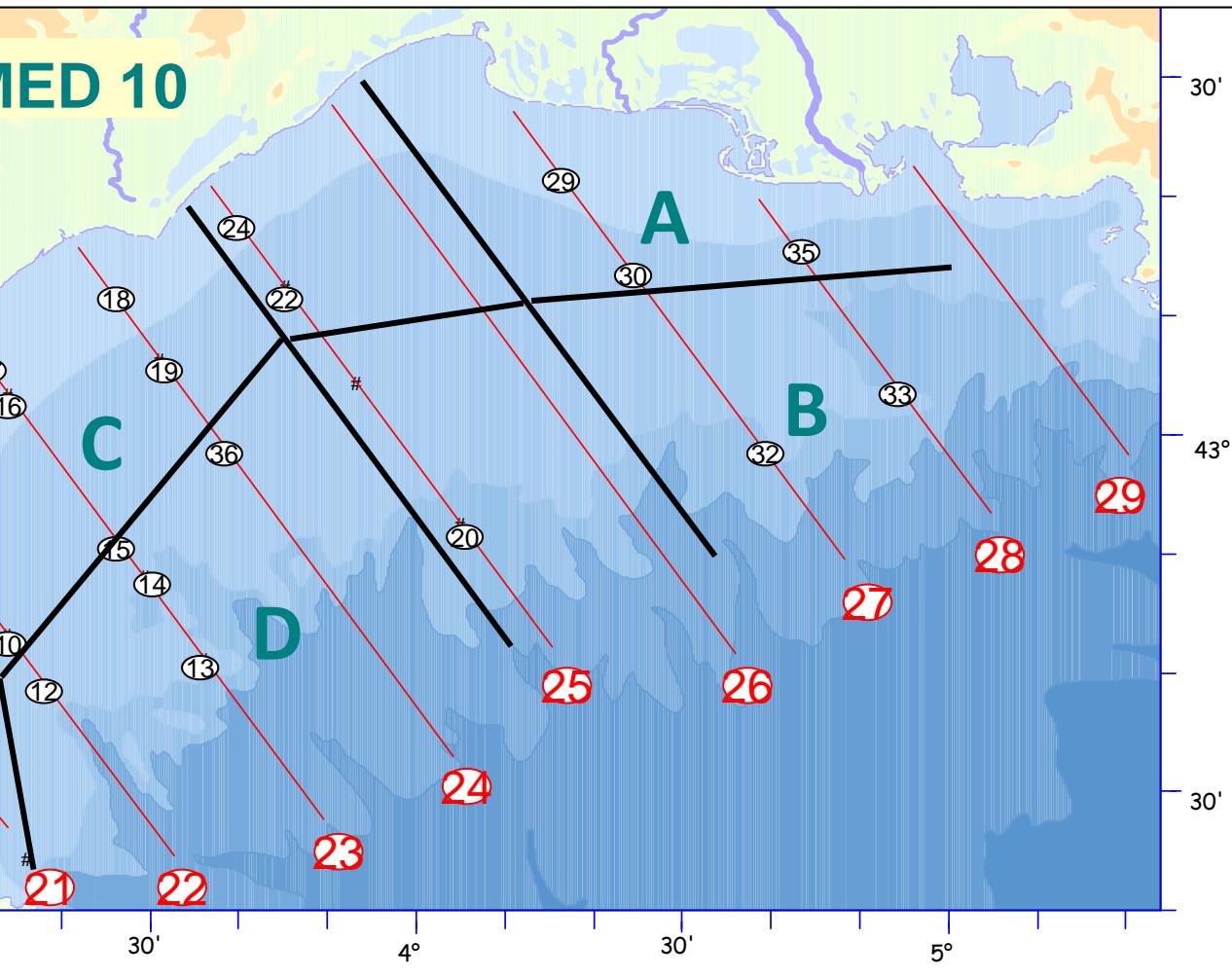
montés sur un cadre Bongo



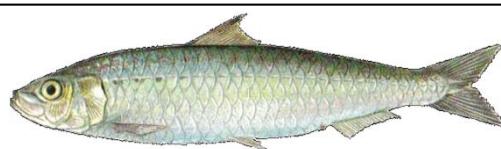
- Detection: >100 d'ESD
- Data: abundance size of particle

# Western Mediterranean Gulf of Lion

PELMED – 2010 et PRO 2011  
small pelagic fish



(*Engraulis encrasicolus*)



Sardine (*Sardina pilchardus*)

Campagne PELMED 2010 (3-25 juillet)  
Analyses 374 ANC, 357 SAR

ANCHOIS – Juillet 2010 (REPRO)

SARDINES – Juillet 2010 (REPOS)

Campagne PRO 2011 (3-24 mars 2011)  
Analyses 342 ANC, 134 SAR

ANCHOIS – Mars 2011 (REPOS)

SARDINES – Mars 2011 (POST-RÉPOS)

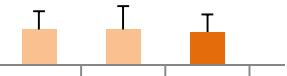
# EXAMPLES DE RESULTS

Iankton  
N ≈ 20)

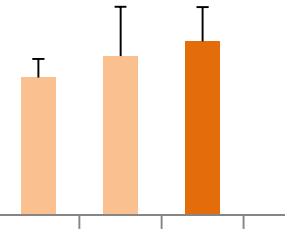
- Phytoplankton 60-200µm
- Zooplankton 200-1000 µm
- 1000 – 2000 µm

## Biomagnification & Bioaccumulation

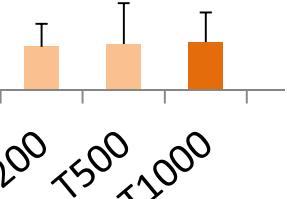
CB 153



CB 28



BDE 47

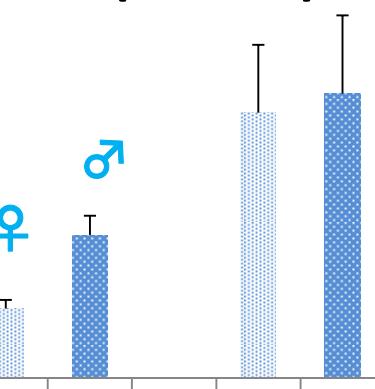


➤ Low or any biomagnification phyto vs. zoo

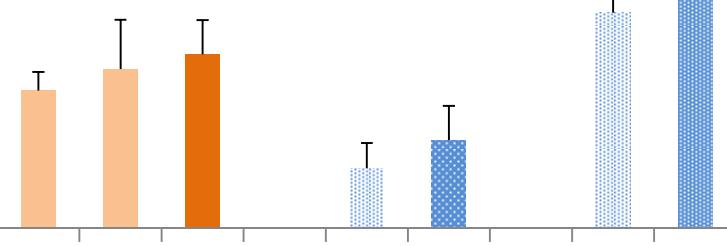
plankton  
N ≈ 20)

Small  
pelagic fish  
(N ≈ 15)

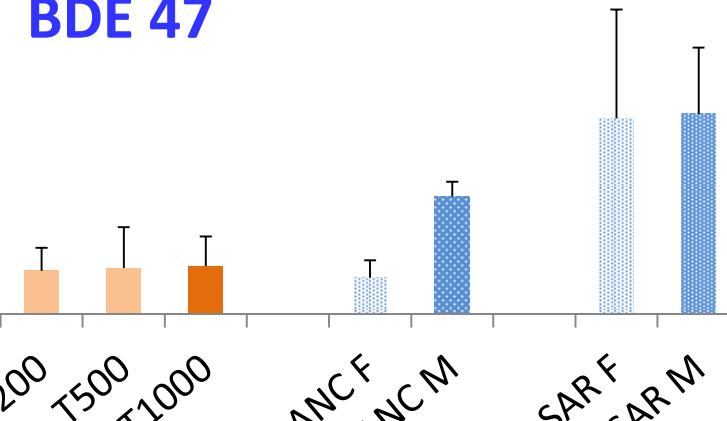
CB 153



CB 28



BDE 47



■ Phytoplankton 60-200µm  
■ Zooplankton 200-1000 µm  
■ 1000 – 2000 µm

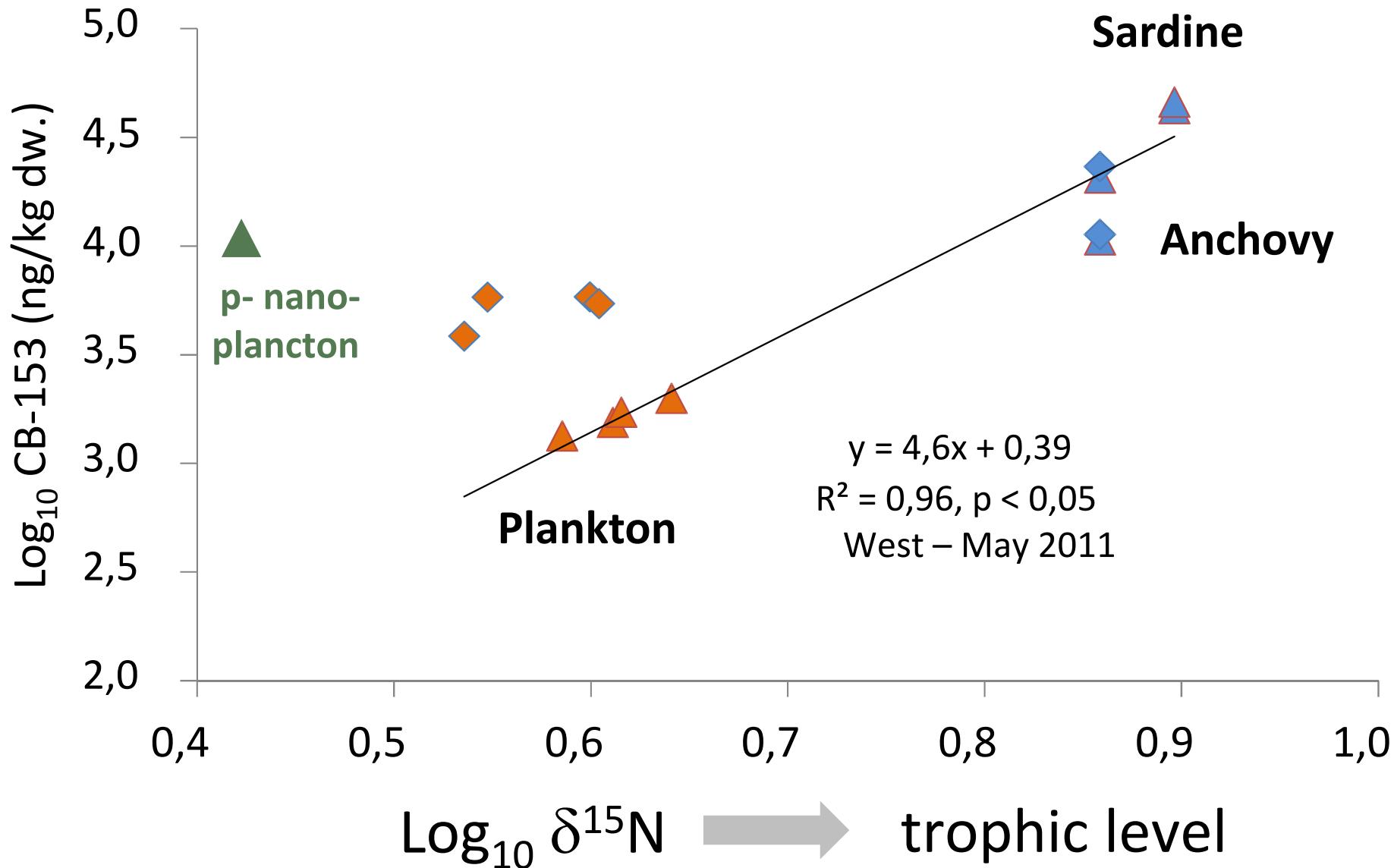
## Biomagnification & Bioaccumulation

Compound	BMFs	BAFs
	PL/PP	Phyto/Water
CB-153	2 - 12	$5 * 10^6$
CB-28	<1 - 2	$\sim 1 * 10^5$
BDE-47	<1 - 5	$\sim 1 * 10^5$

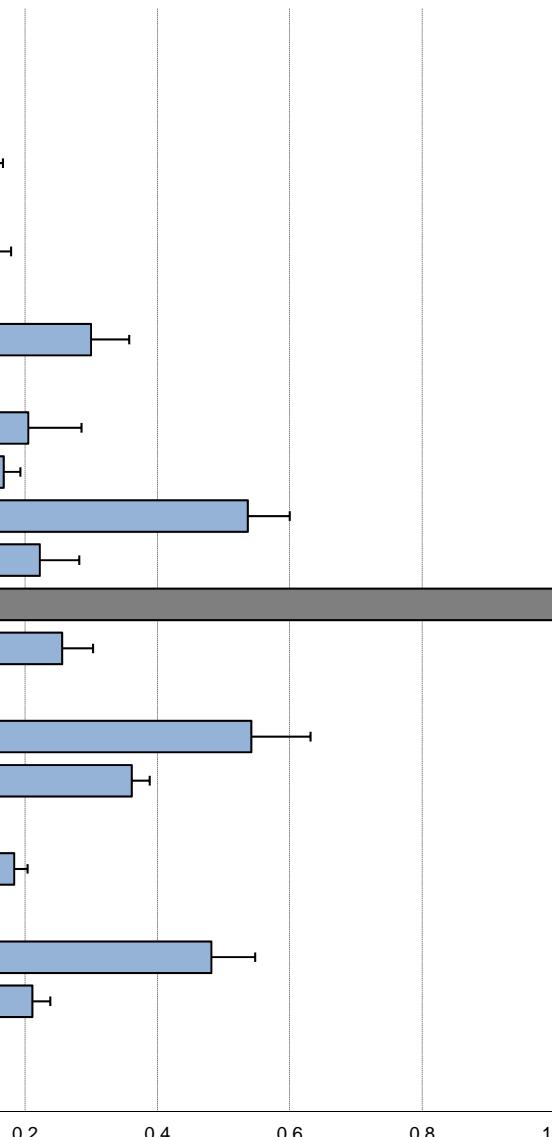
Tiano et al. 2014;

- Low or any biomagnification phyto vs. zoo
- Not all compounds are biomagnified plankton/ animal
- Most bioaccumulation water/ phytoplankton
- Species difference: sardine > anchovy

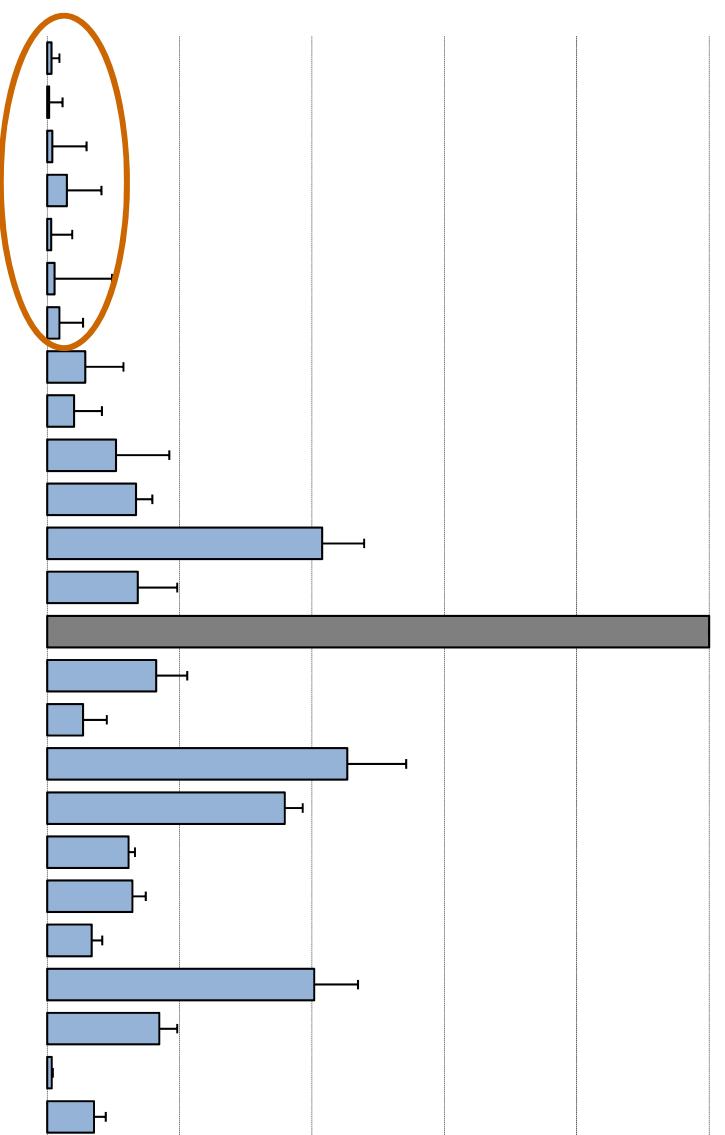
## Biomagnification of CB 153



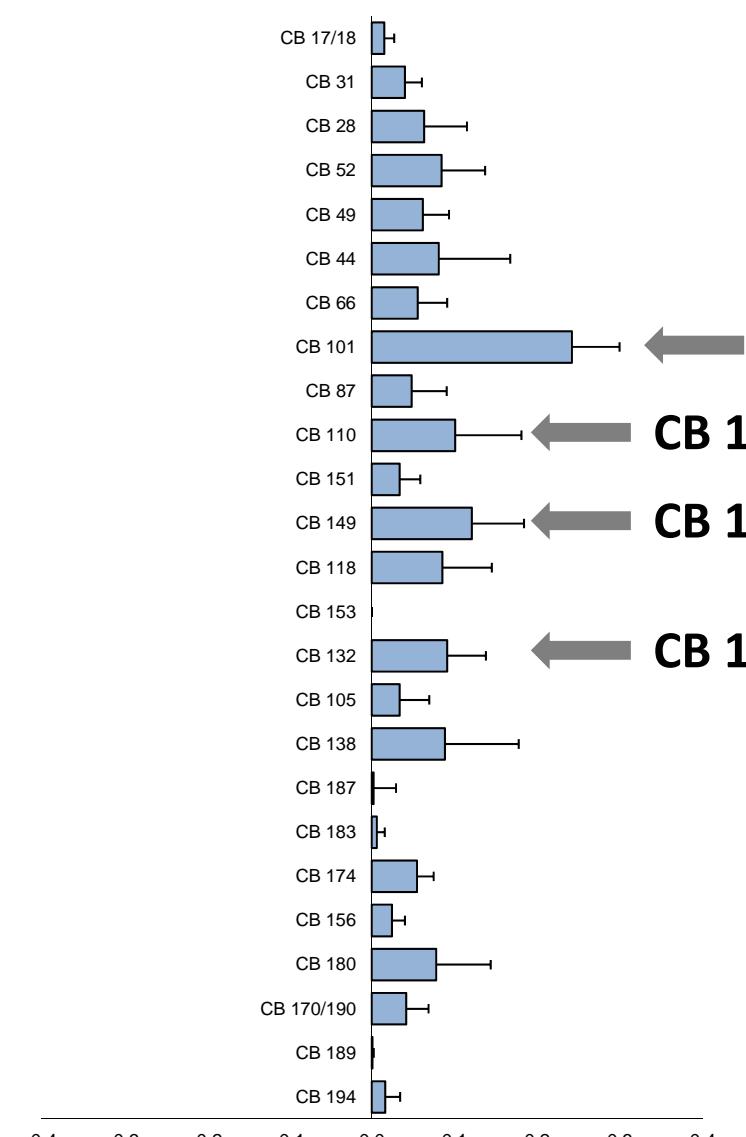
## Plankton



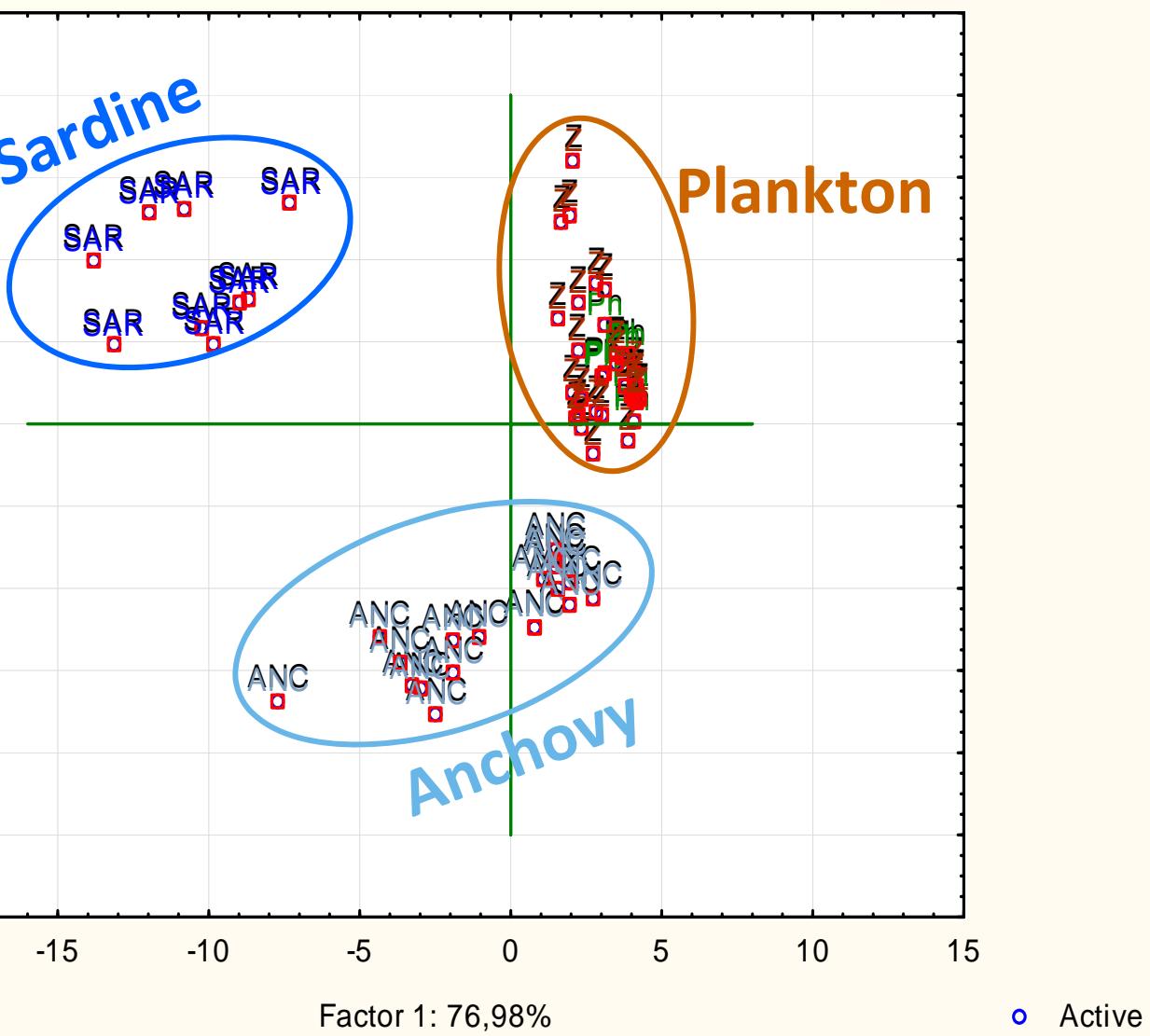
## Small pelagic fish (SPF)



## Difference Plankton - SPF



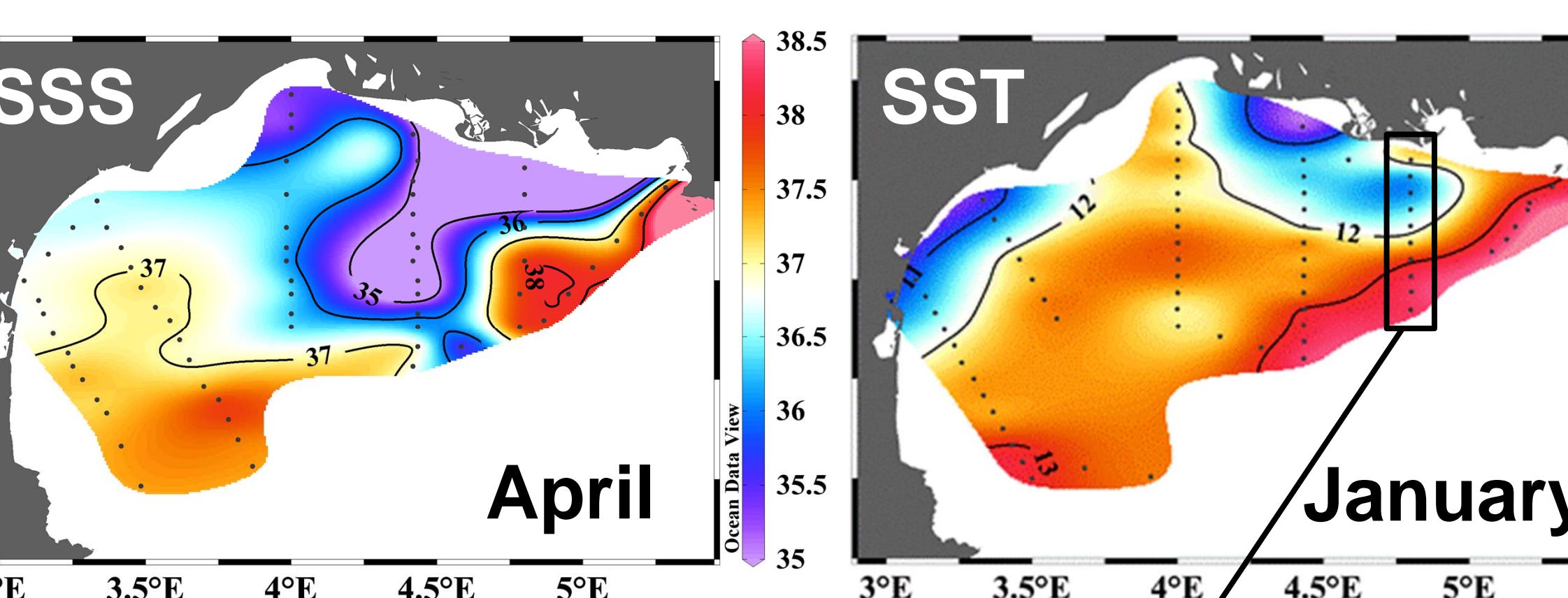
PCA projection of the variables on the factor-plan (1 x 2)



**PLANKTON : CB 3-4-CI**

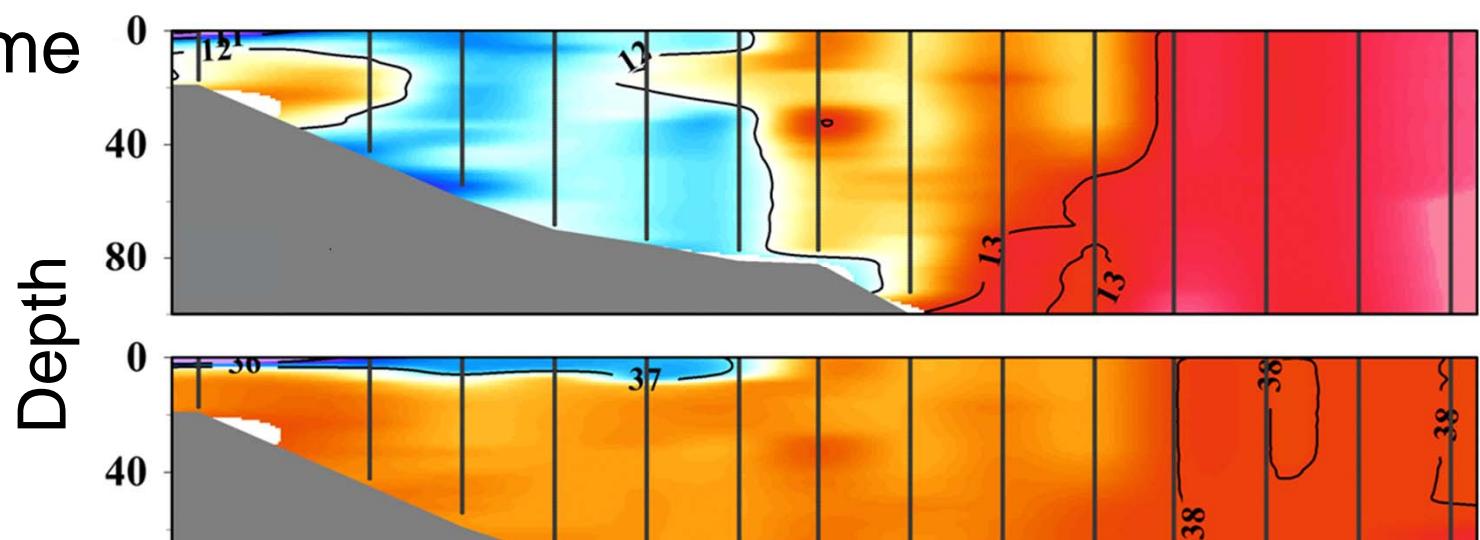
**SAR : CB 6-7-CI, 4 ortho-CI**

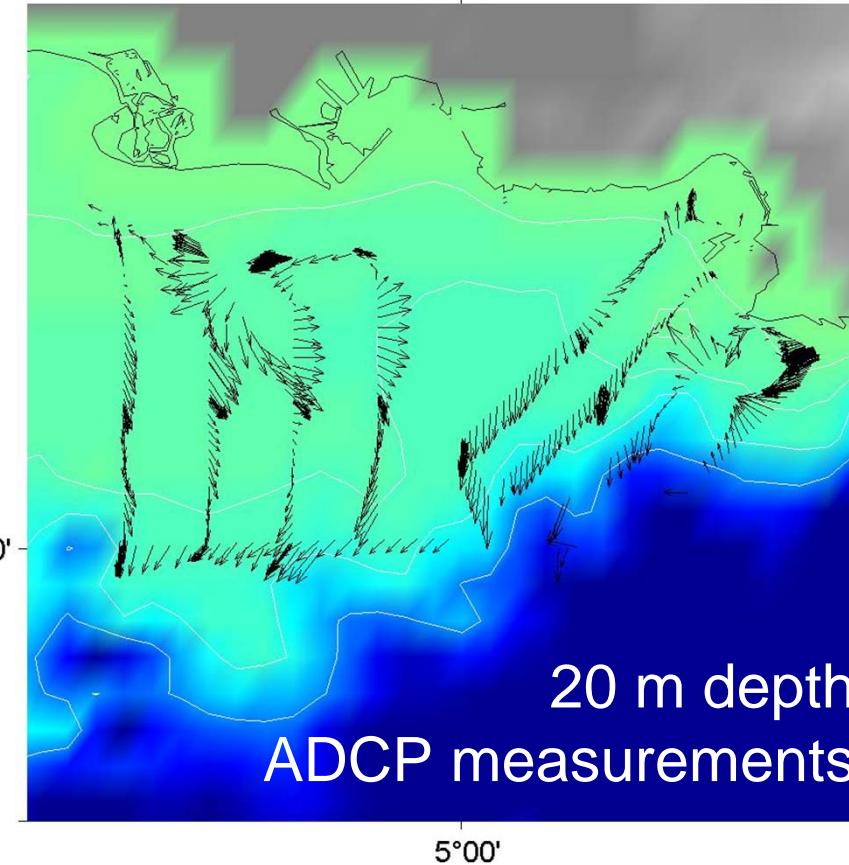
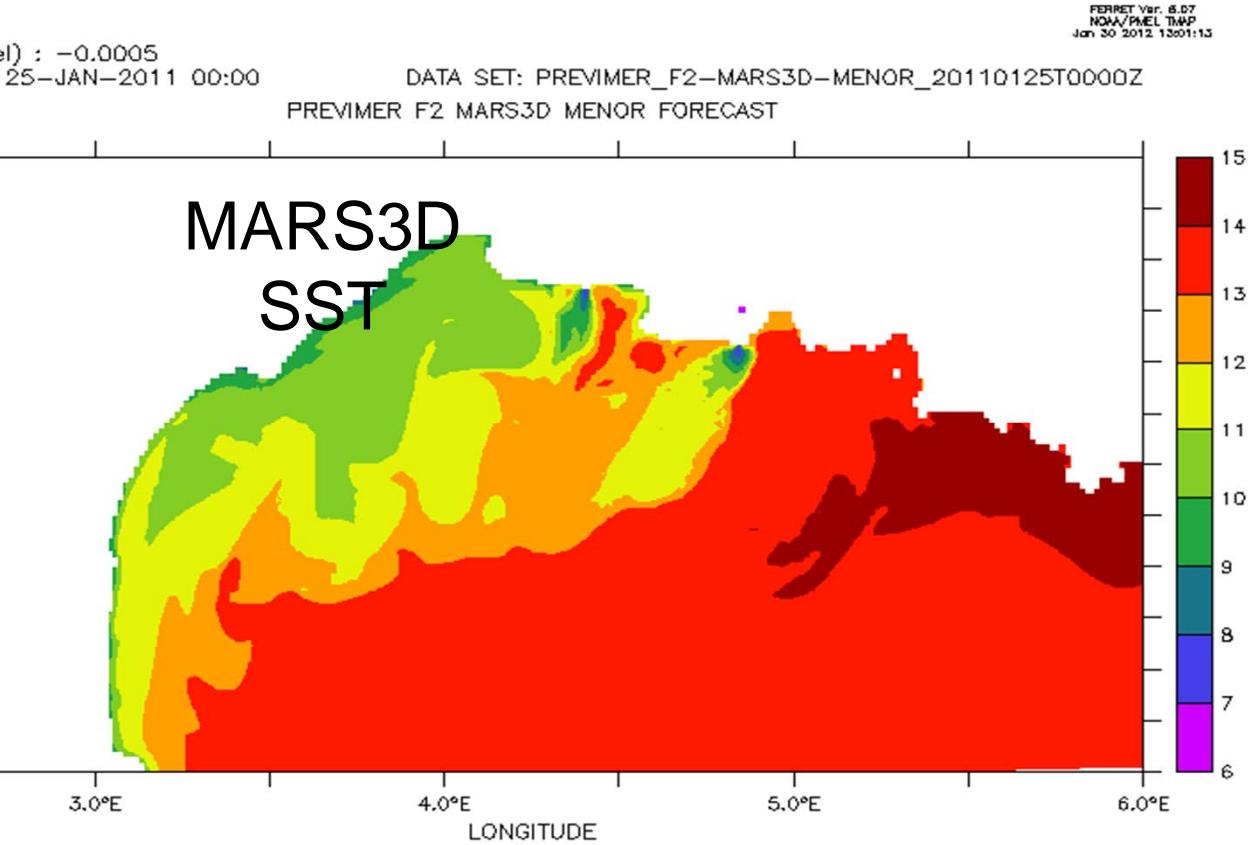
**ANC: CB- 4-6 CI, 2 ortho, vicinal H in para**



The zone of Rhône plume influence

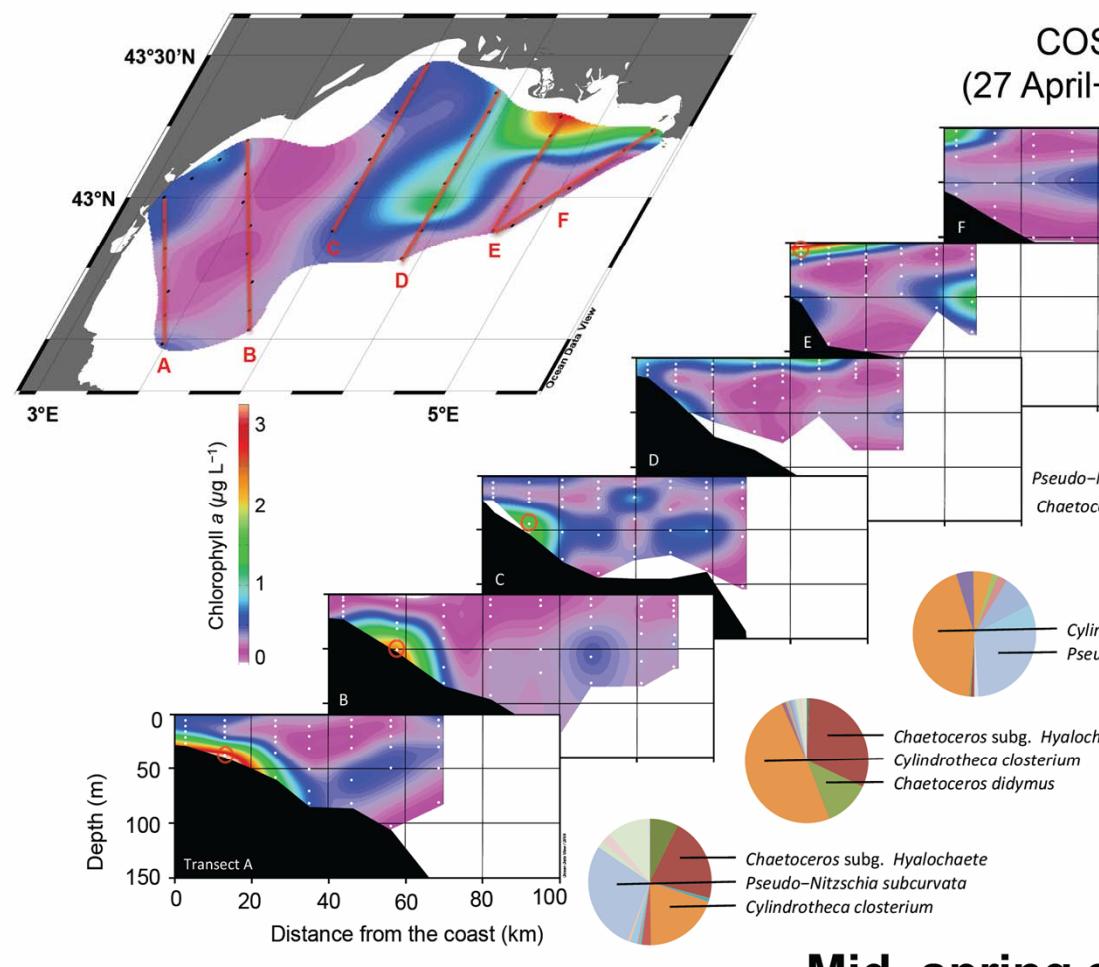
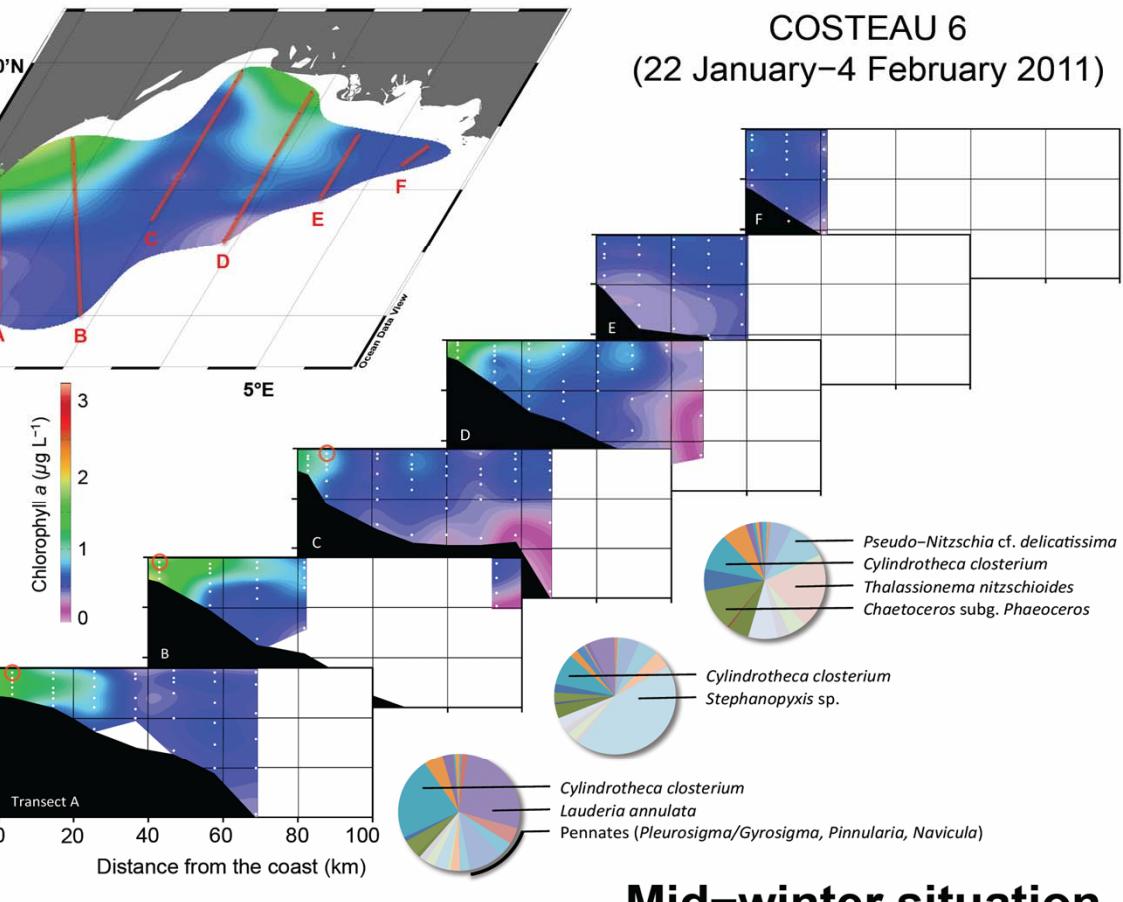
- Northern Current intrusions



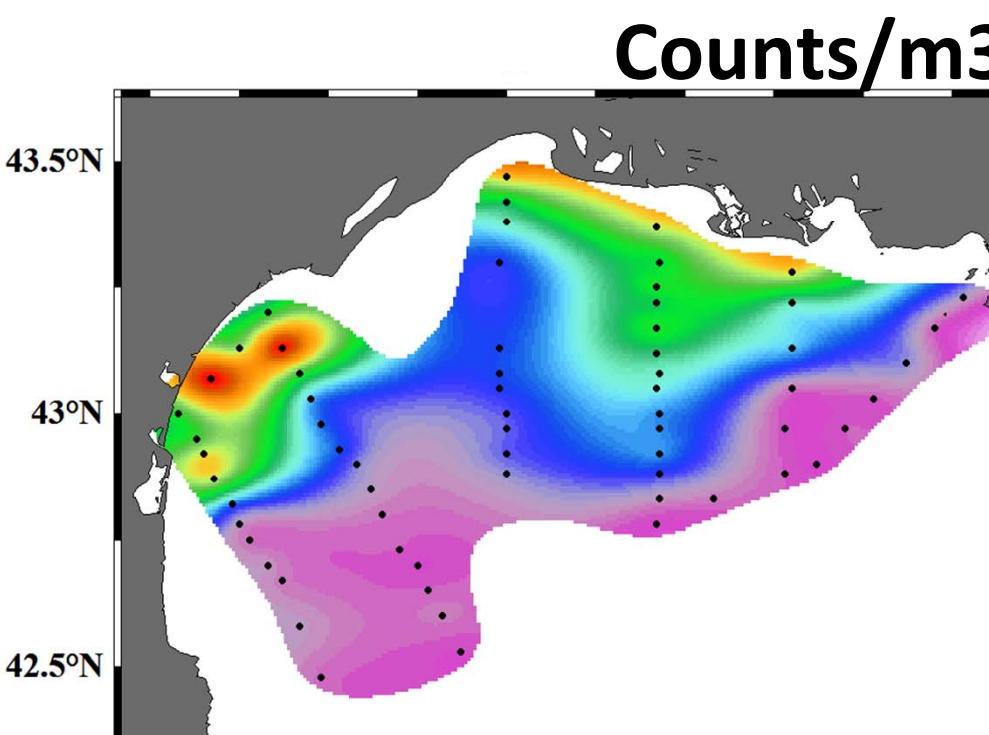
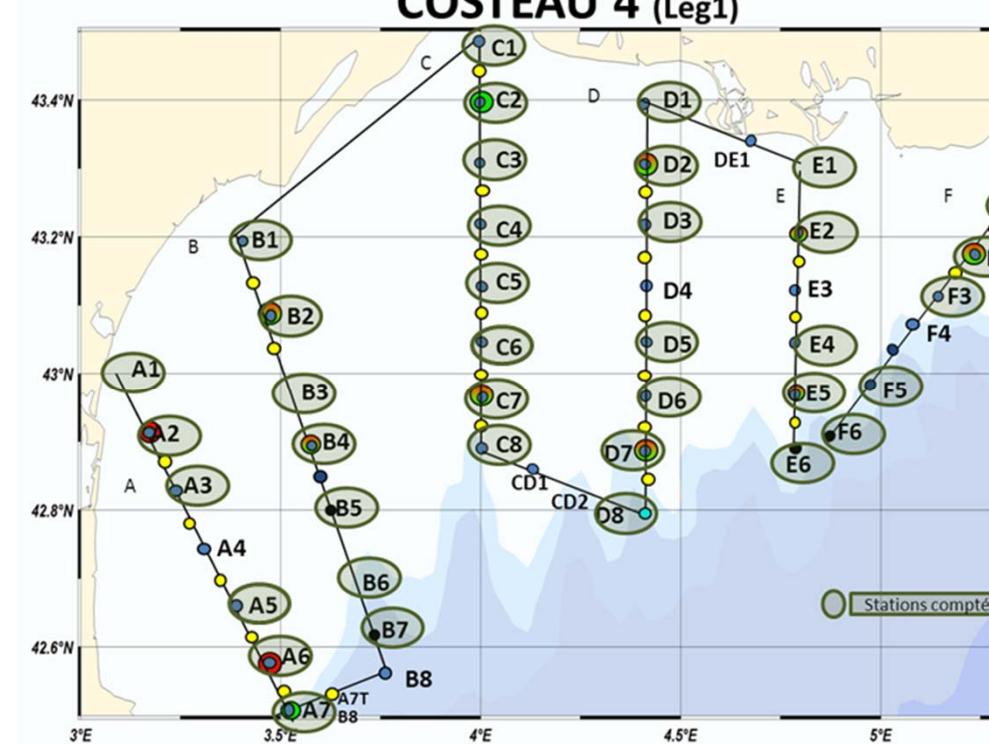
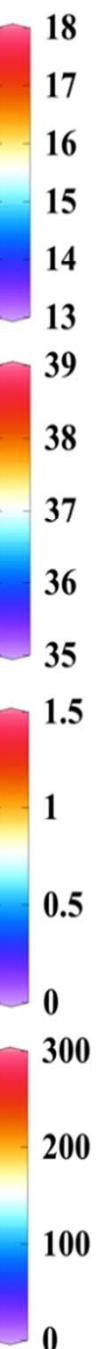
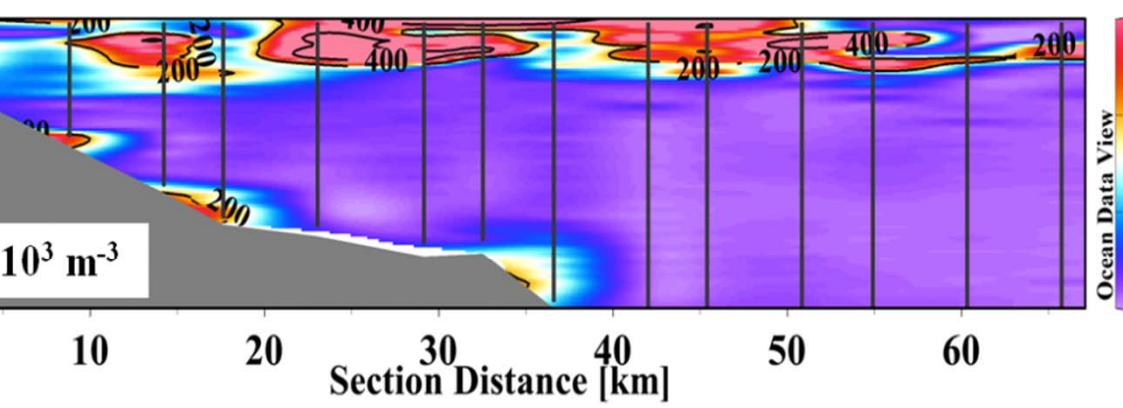
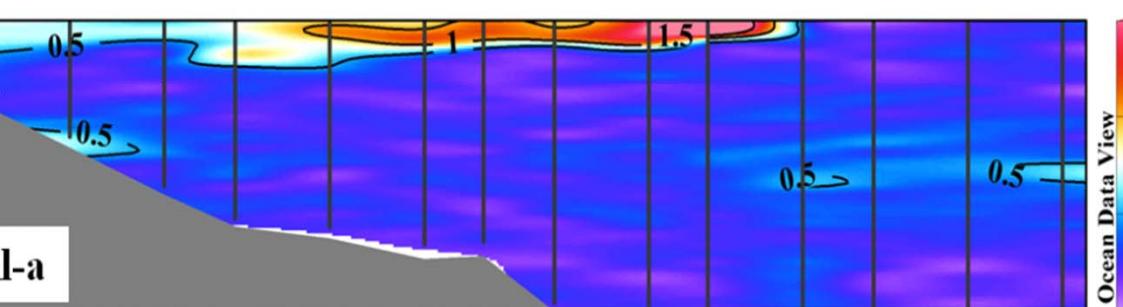
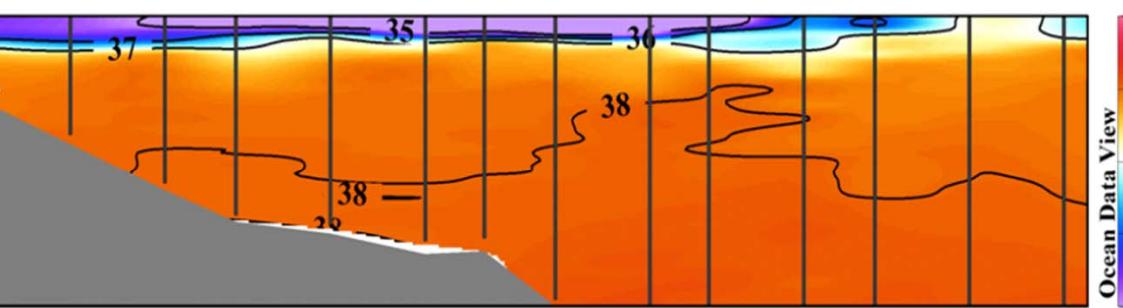
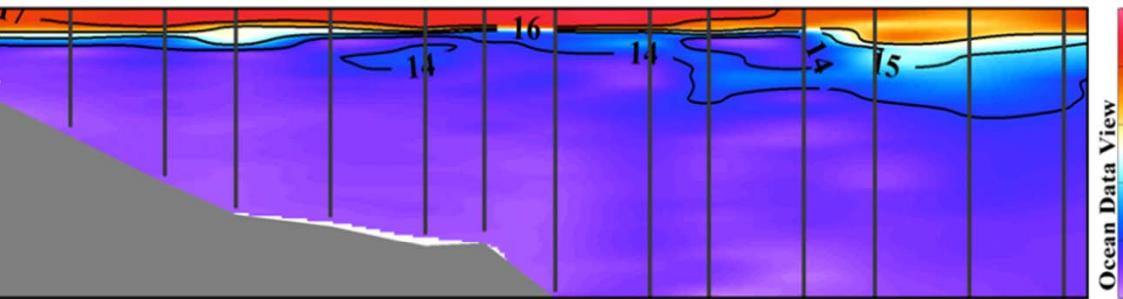


We used ADCP measurements and outputs of the hydrologic model MARS3D to assess the stationarity of the spatial distributions throughout the cruise duration.

objective: To get the distribution at high spatial resolution of plankton and zooplankton communities over the *Golfe du Lion* over seasonal cycle in conjunction with other studies on coupled/biogeogemical modelling and transfer of contaminants through food web.

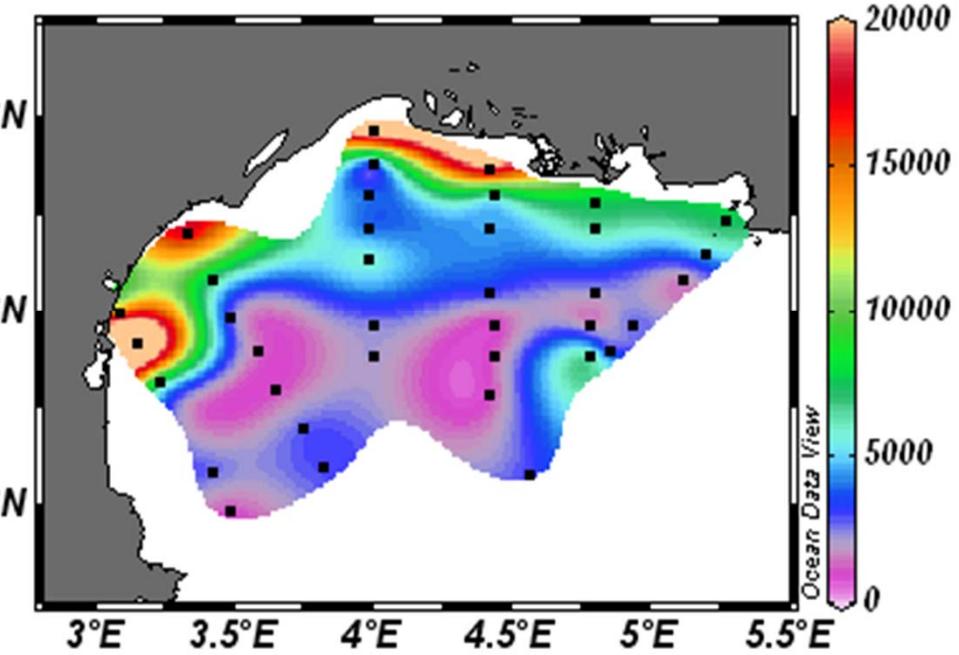


COSTEAU 4 Leg1

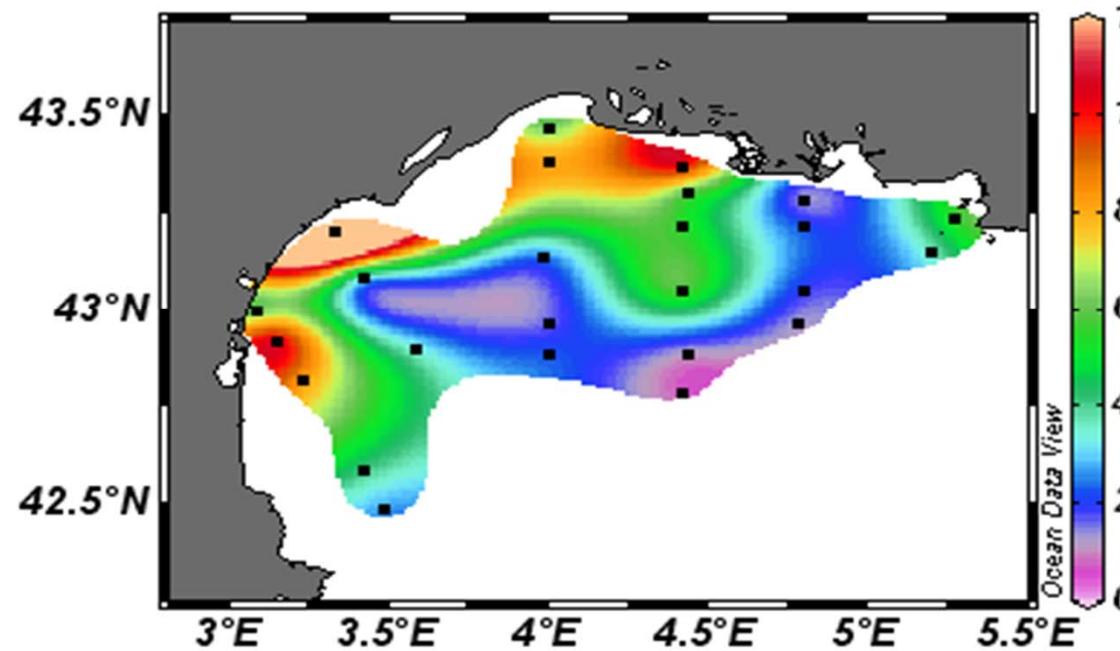


# copépodes (adultes + copepodites)

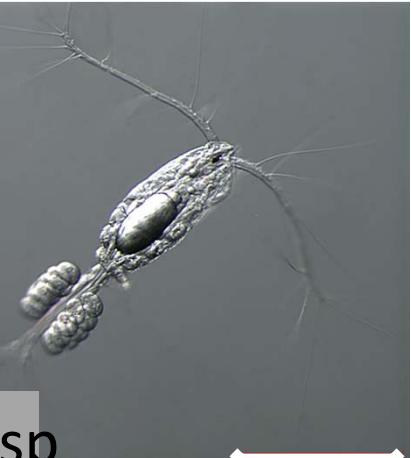
COSTEAU 4



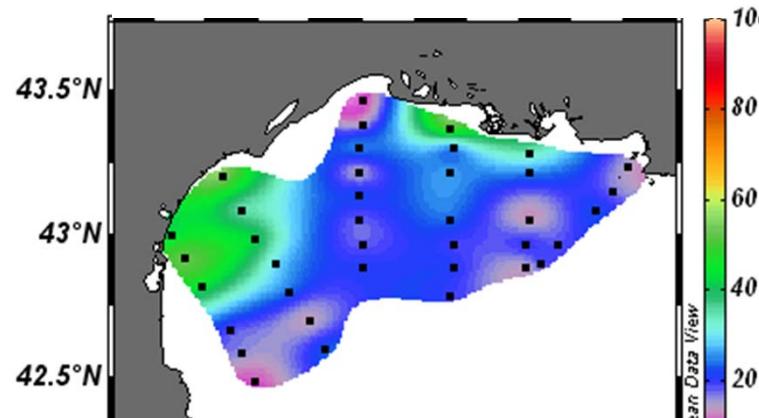
COSTEAU 6



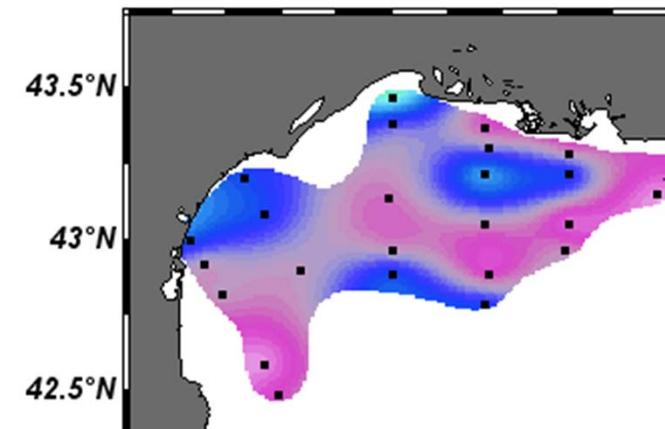
distribution par genre des copépodes



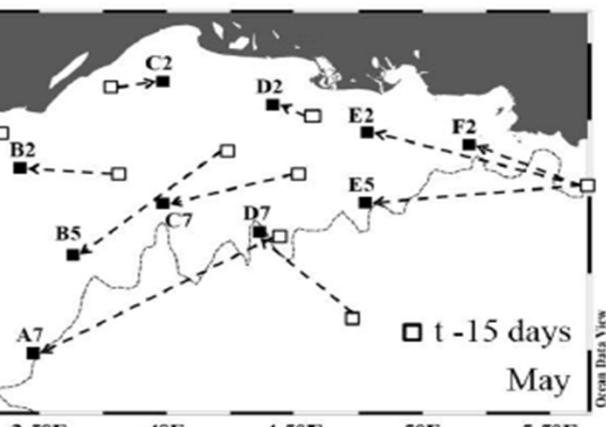
COSTEAU 4



COSTEAU 6



## water masses and plankton

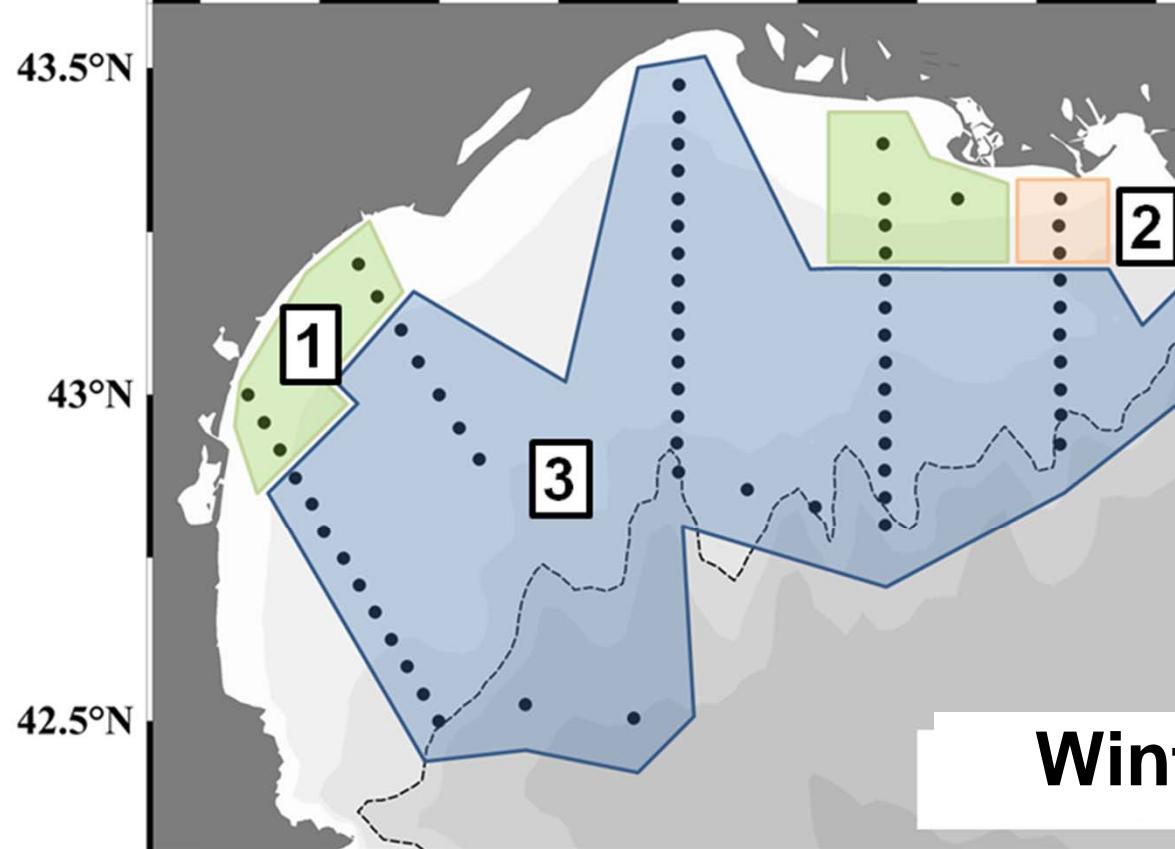


Espinasse et al. 2014b

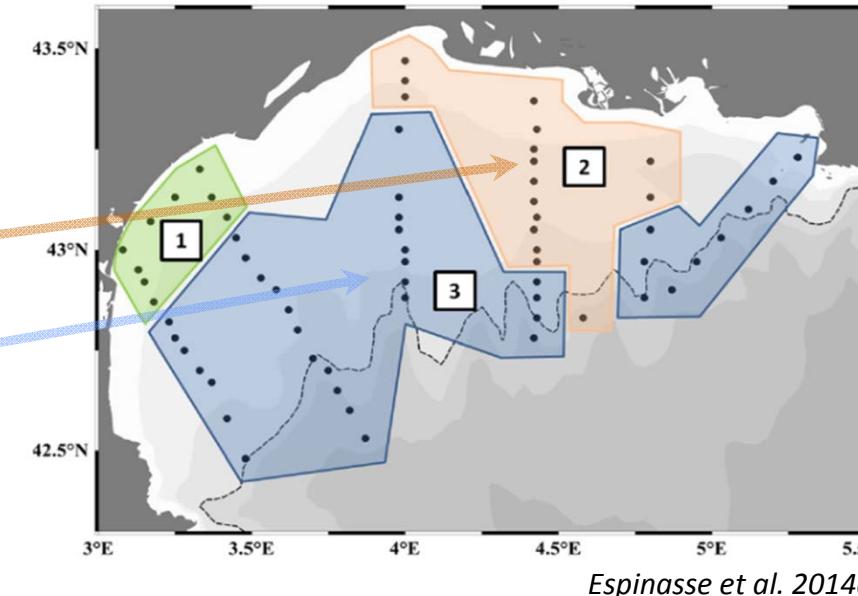
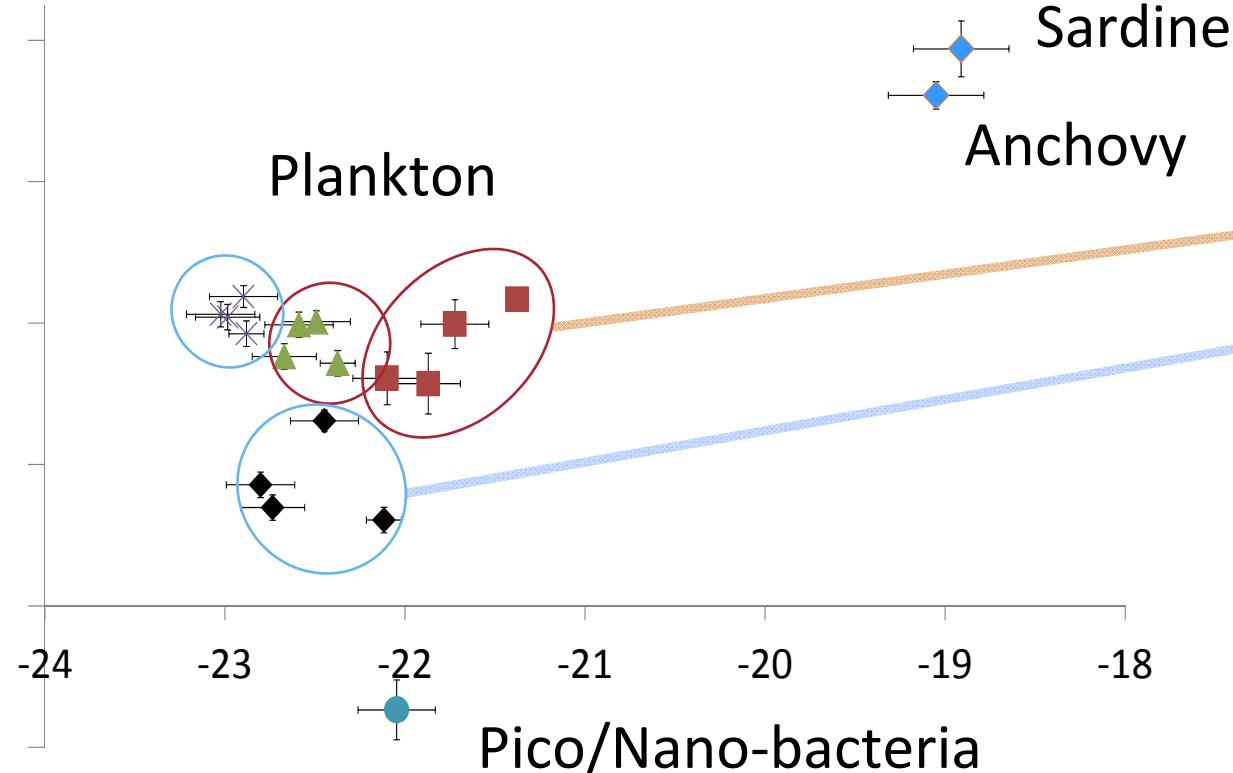
Three zones were defined:  
“coastal area” showing shallow  
waters, low Normalized biomass size  
spectrum slope (NBSS) values and high  
Chl-a concentration,

“area affected by the Rhône” with a  
marked stratification and high NBSS  
slope values,

“continental shelf” with deep mixed

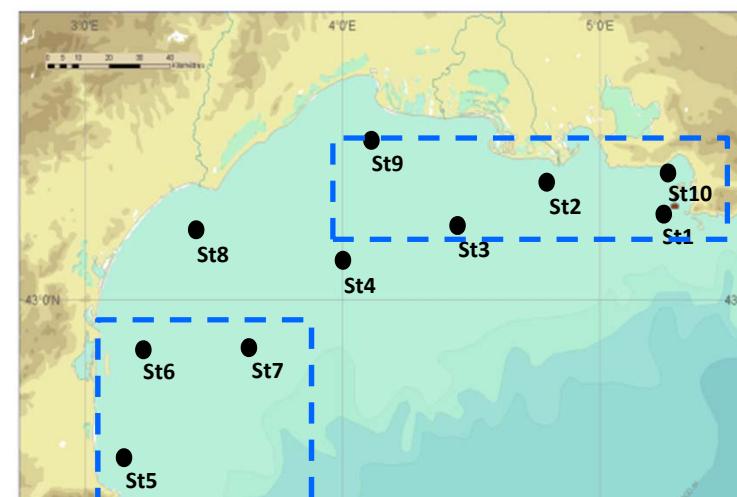
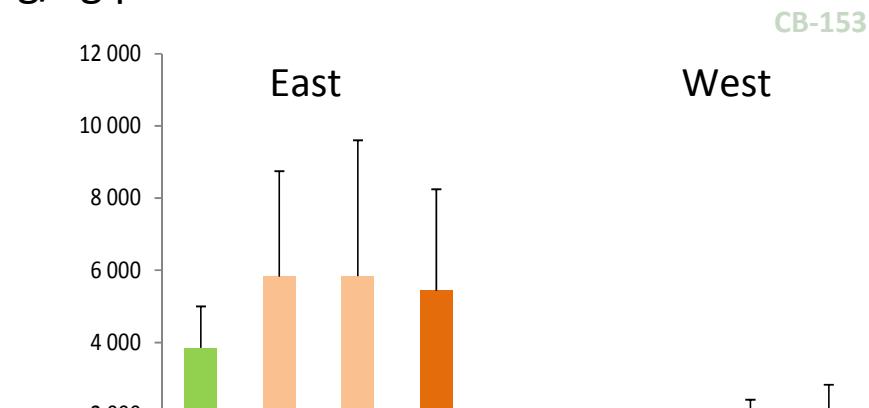


# Plankton eco-regions Golfe du Lion

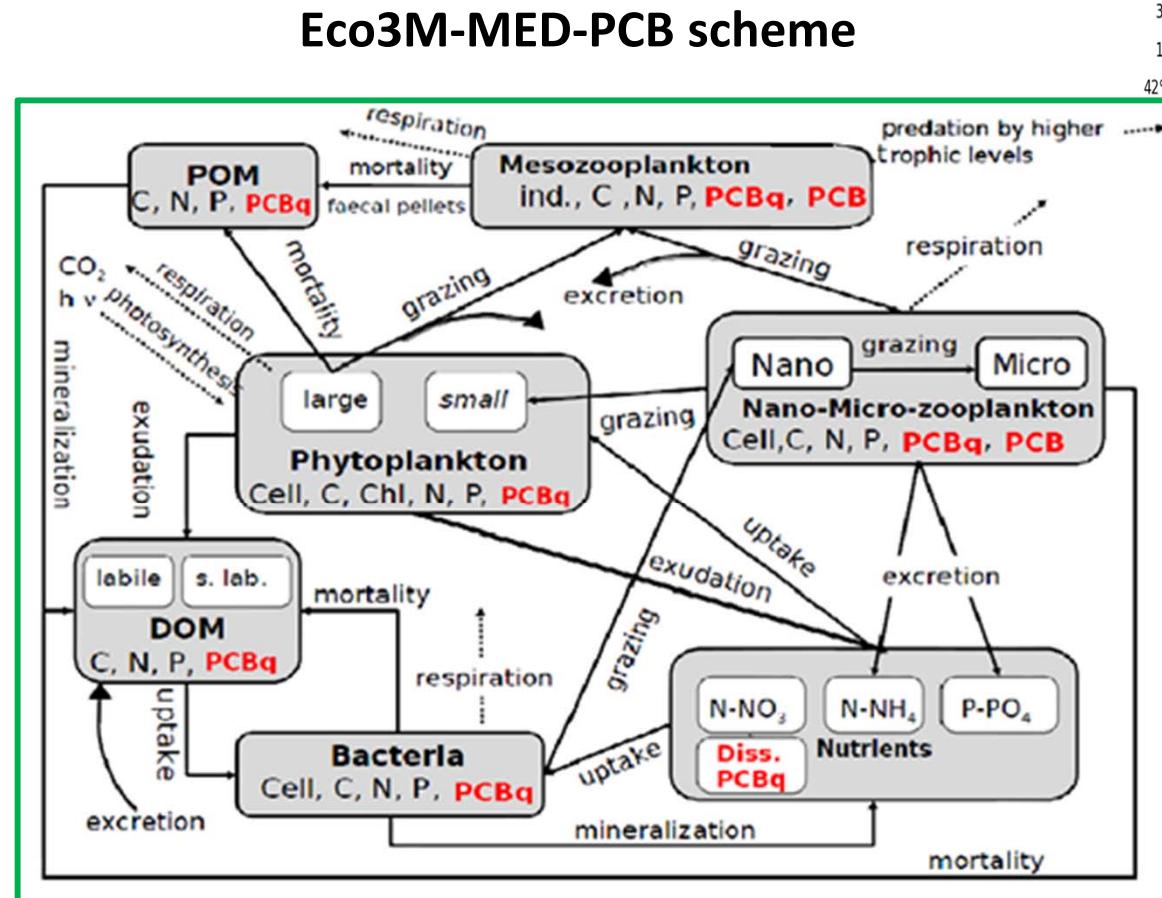
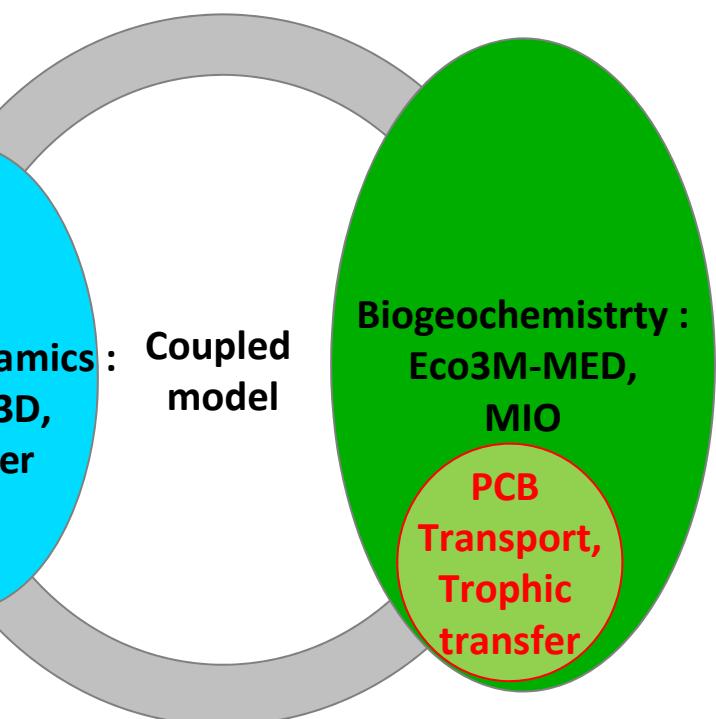


$\delta^{13}\text{C}$  → Carbone sources

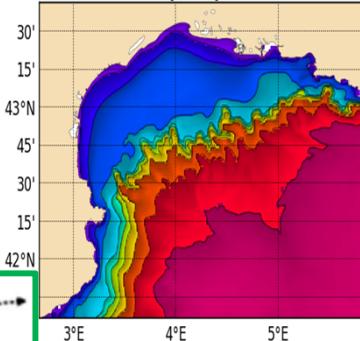
## Contaminants (avril 2010)



# ion of PCBs in the Gulf of Lions er of PCBs to zooplankton via biogeochemical processes



bathymetry relative to the mean sea level



Alekseenko E., Thouvenin B., Baklouti M. et al.,

## Basic hypotheses for PCB transport

1. The PCB fluxes along the trophic chain are related to carbon fluxes;

de données physique, chimique et biologique à l'échelle du Golfe du Lion à  
l'exception de la pollution spatiale pour différentes saisons

positions de régions représentatives de communautés planctoniques prés-  
entant des structures de taille différentes

concentrations en contaminants les plus élevées ont été déterminées dans  
la fraction du plancton (0.7 - 63 µm);

La corrélation entre niveaux de contamination en POP, la classe de taille planctonique  
et la nature isotopique  $\delta^{15}\text{N}$  varie en fonction du composé, de la saison et de  
les conditions environnementales;

Le transfert des contaminants via les relations proie-prédateur sont difficiles à  
étudier en raison de leur faible incidence dans le réseau trophique du plancton

L'amplification est démontrée chez les petits poissons pélagiques, mais elle est  
partiellement influencée par la biotransformation des contaminants organiques étudiés

## **D and post-doc**

post-doc (E. Alekseenko; E. Strady; H. Pethybridge)

PhD (B. Espinasse et M. Tiano)

## **Scientific articles**

published papers in international journals

submitted / in review papers in international journals

## **Communications**

0 communications in national congresses

0 communications in international congresses

# Remerciements aux équipes de l'Europe et du Téthys

Merci aux équipes et pour votre attention

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Céline TIXIER,  
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Romaric VERNEY,  
Alain VÉRON,  
Meng ZHOU,  
Yiwu ZHU,  
Et al.