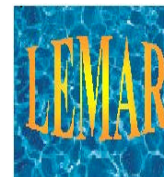




# Genetic and Reproduction Strategy in *Crassostrea gigas* Mortality

**J.Moal\*, E.Bédier, P.G.Fleury, A.Langlade,  
Y.LeCoguic, L.Dégremont, P.Boudry, J.R.Le Coz,  
S. Pouvreau, M. Enriquez-Diaz, C. Lambert,  
C.Quéré, P. Soudant, J.F.Samain**





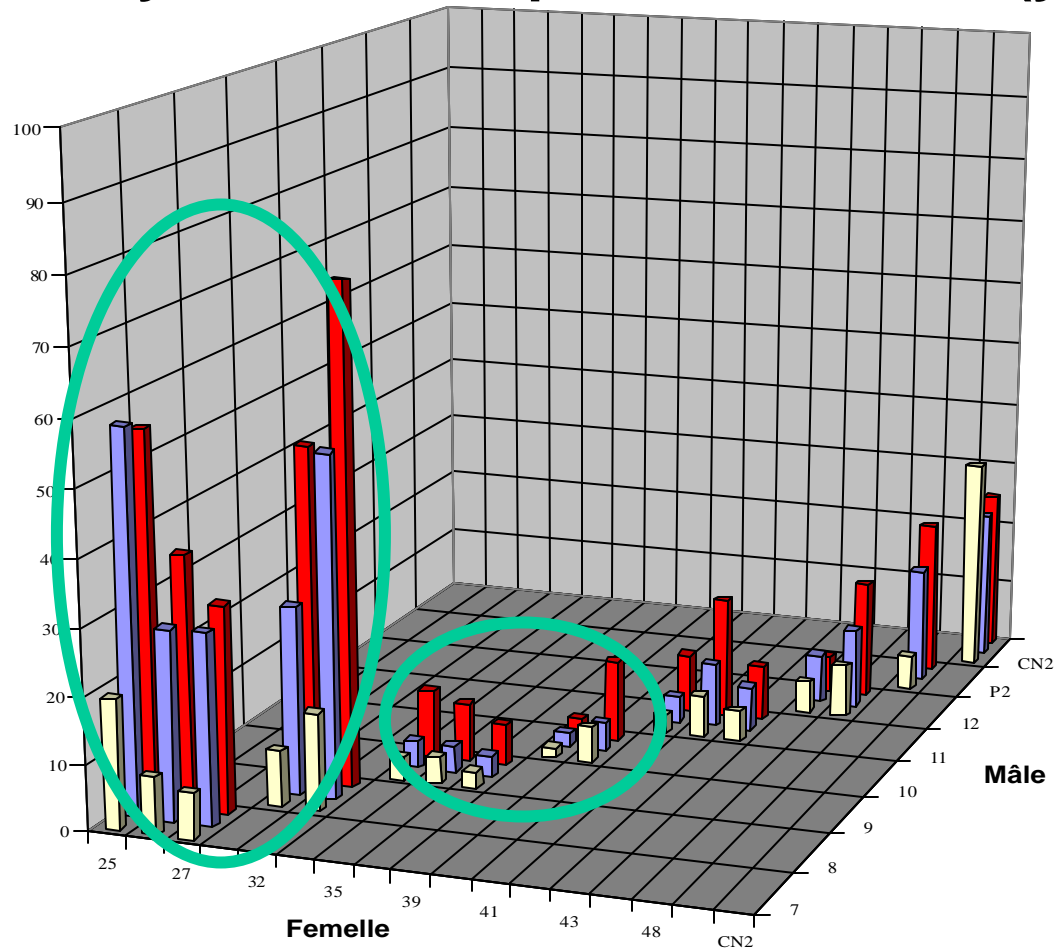
## Questions?

What are the differences (physiological, immunological) between resistant and sensitive oysters ?



# Material and methods

## 2001: mortality rate of F1 biparental families (year 1)



**FLOP**

**TOP**

**Sensitive**

**Resistant**

**High mortality**

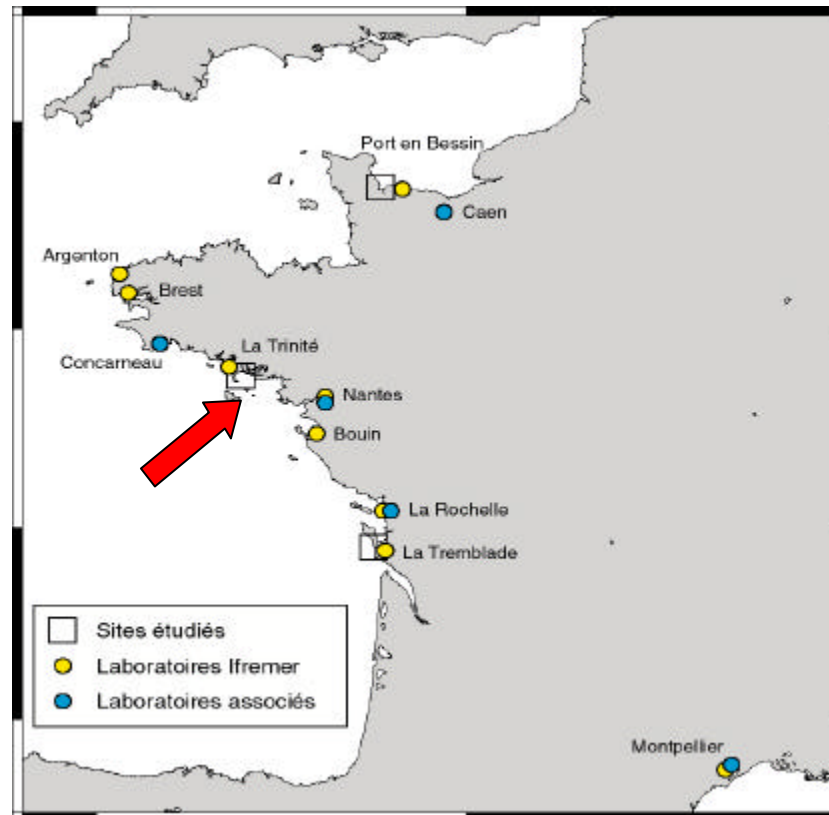
**Low mortality**



# Material and Methods

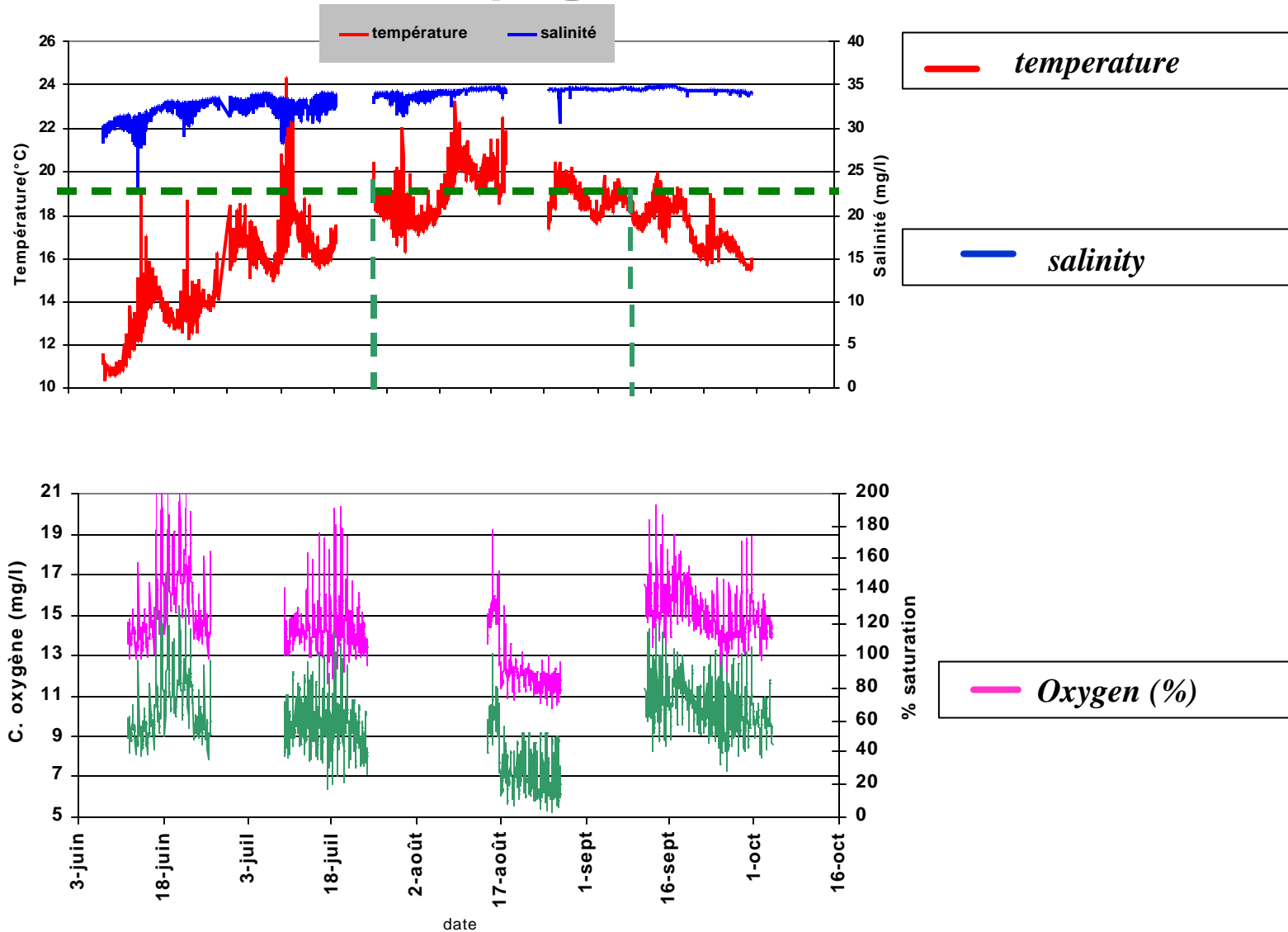
April 2002 (year 2)

**TOP** et **FLOP** maintained without mortality in 2001 were transferred in Brittany ( Fort Espagnol)





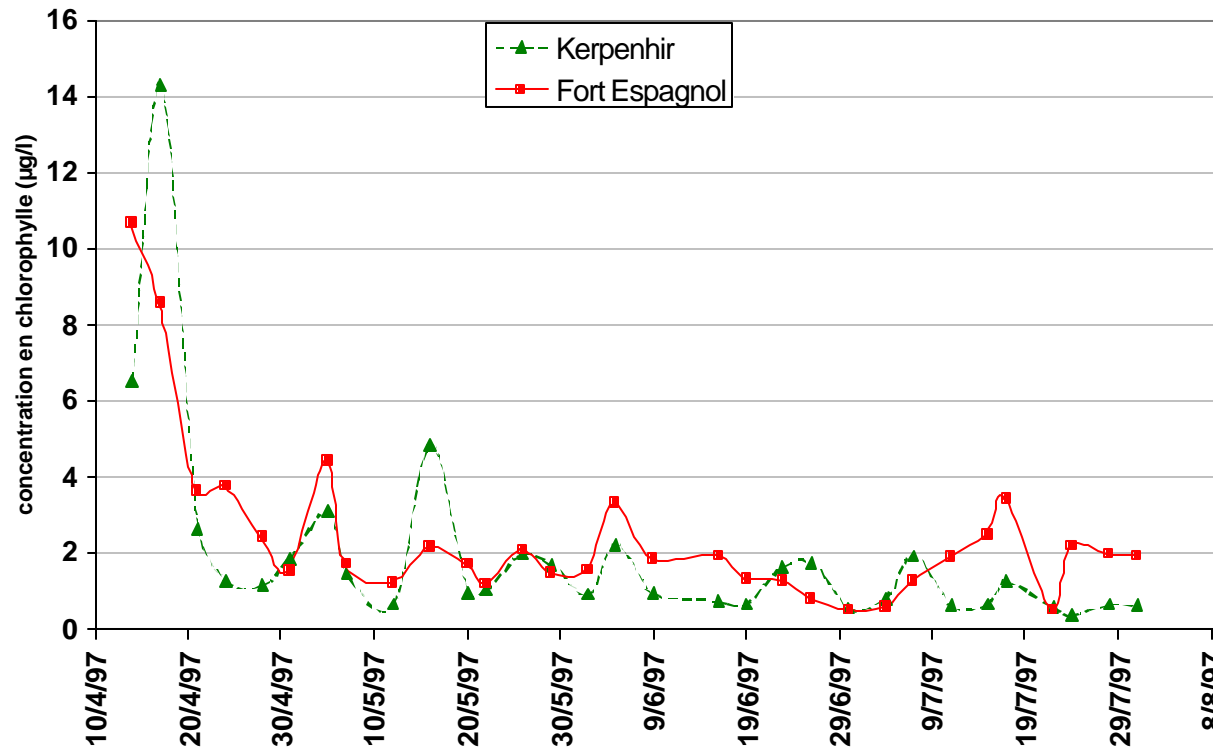
# Environmental parameters at Fort Espagnol





# Chlorophyll at Fort Espagnol

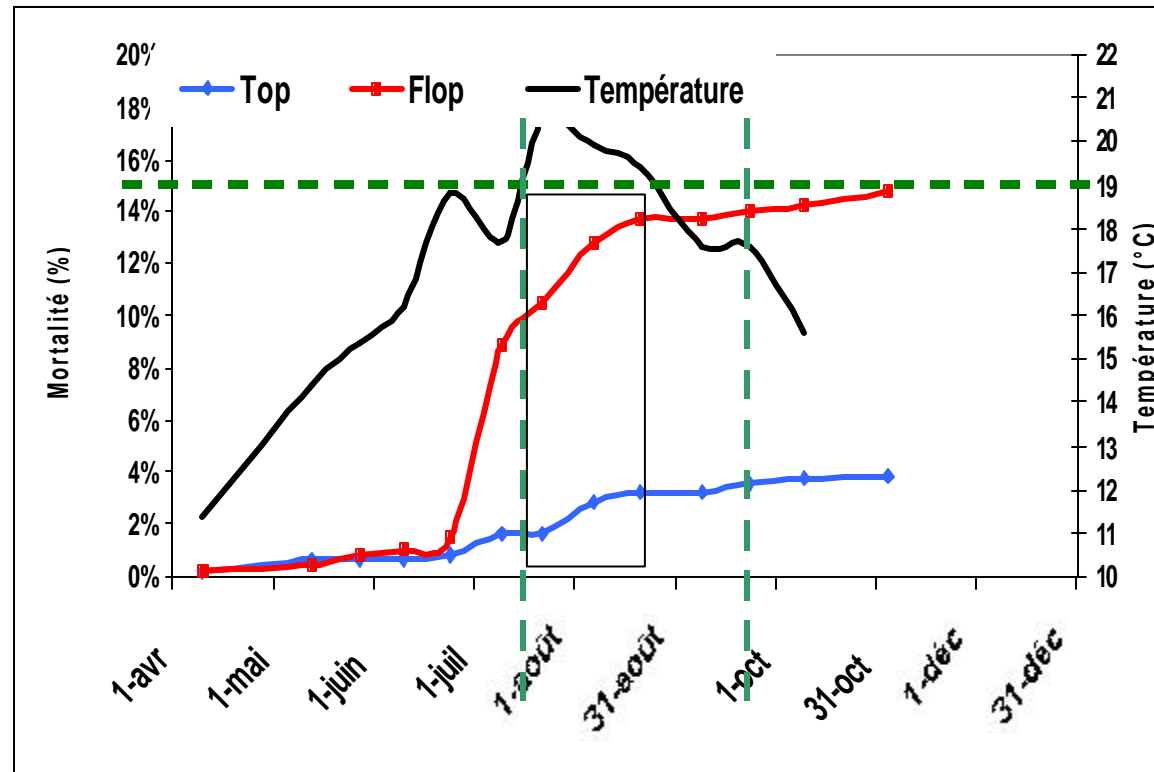
CHLOROPHYLLE en 2 stations de rivière d'Auray en 1997



*Données DEL/MPL*



# Mortality rate

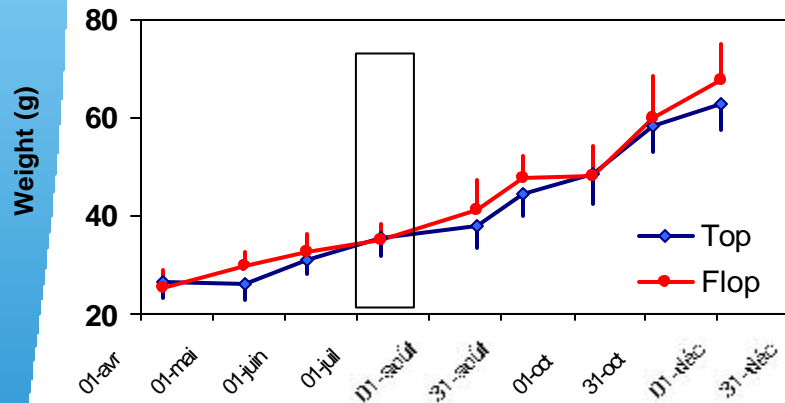


- **Mortality occurred from end of June**
- **Only FLOP died (15%)**
- **Coincidence with temperature 19°C**



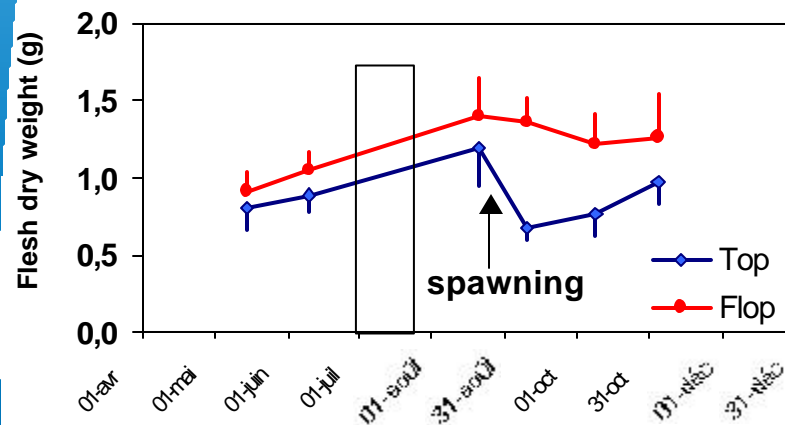
# Growth

### Live weight



Similar growth from spring to autumn

### Dry weight



DW FLOP > DW TOP but NS

The spawning of TOP is shown by the fall in dry weight between 21 of August and 10 of September

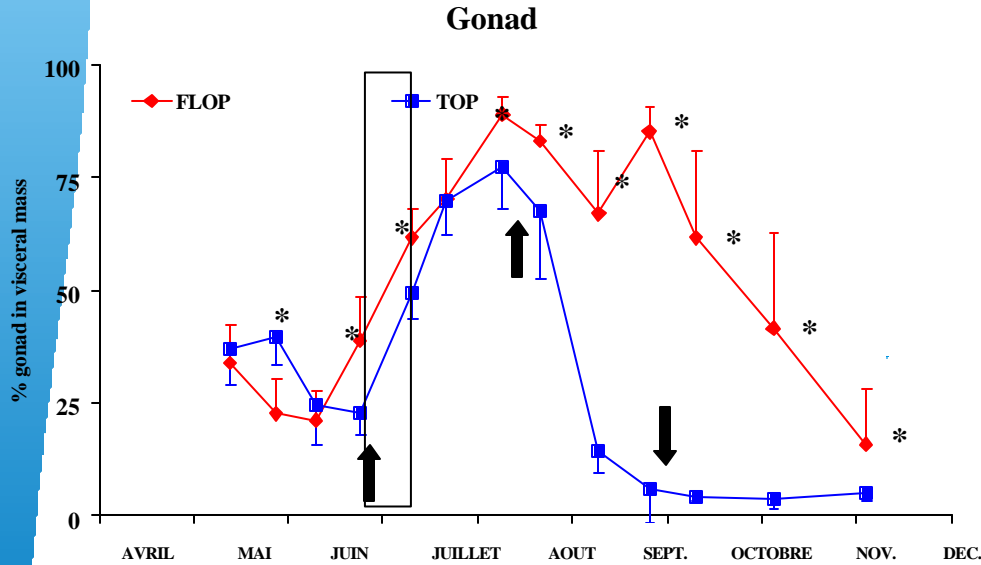
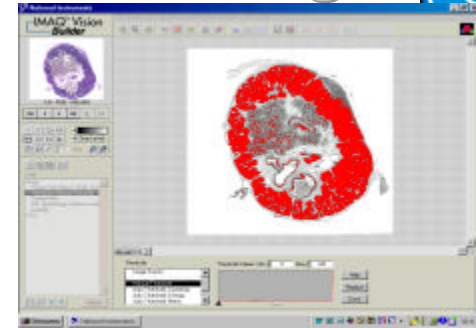
No spawning for FLOP



*Different strategy of spawning*



# Gonad development (histology and image analysis)



- Gametogenesis active from June to August
- Reproduction effort is slightly higher for FLOP
- TOP massive spawning end of August
- FLOP: partial gamete emission

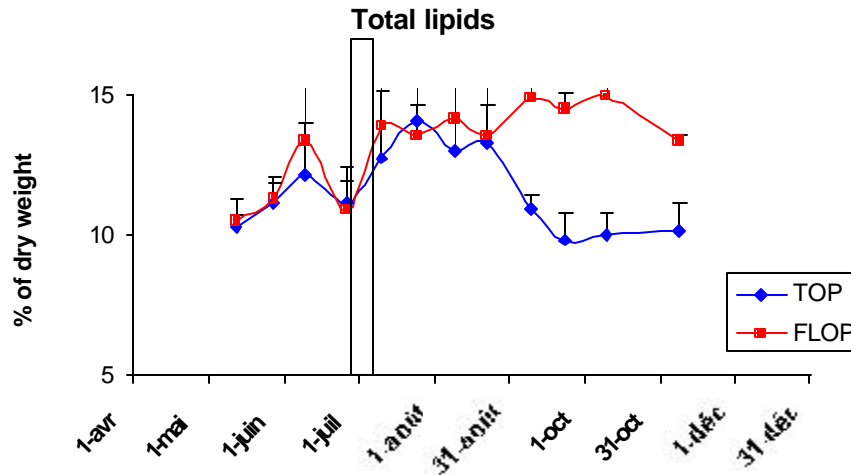
\* Analyse de la composition ovocytaire

\* Différence significative à 5% par le test U de M

**Spawning strategy is different for TOP and FLOP**  
**Intensity of reproduction effort (FLOP > TOP)**

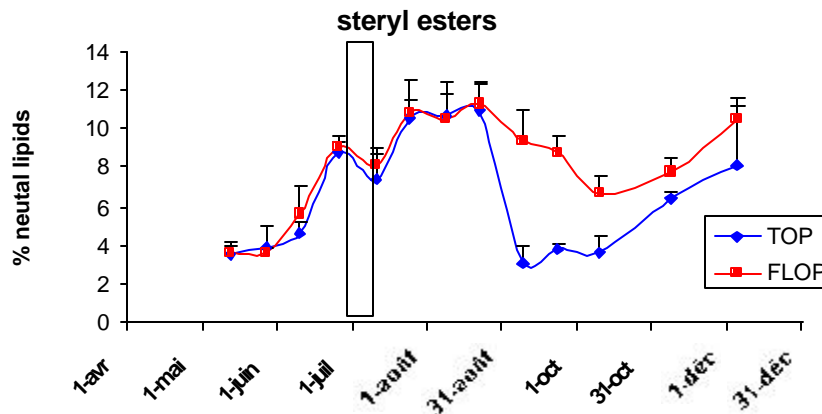


# LIPIDS



***Increase of total lipids during gametogenesis similar for Top and Flop***

***Drop of total lipids only for Top in August***



***Steryl esters : same profile but stronger relationship with female gametogenesis***

Ifremer



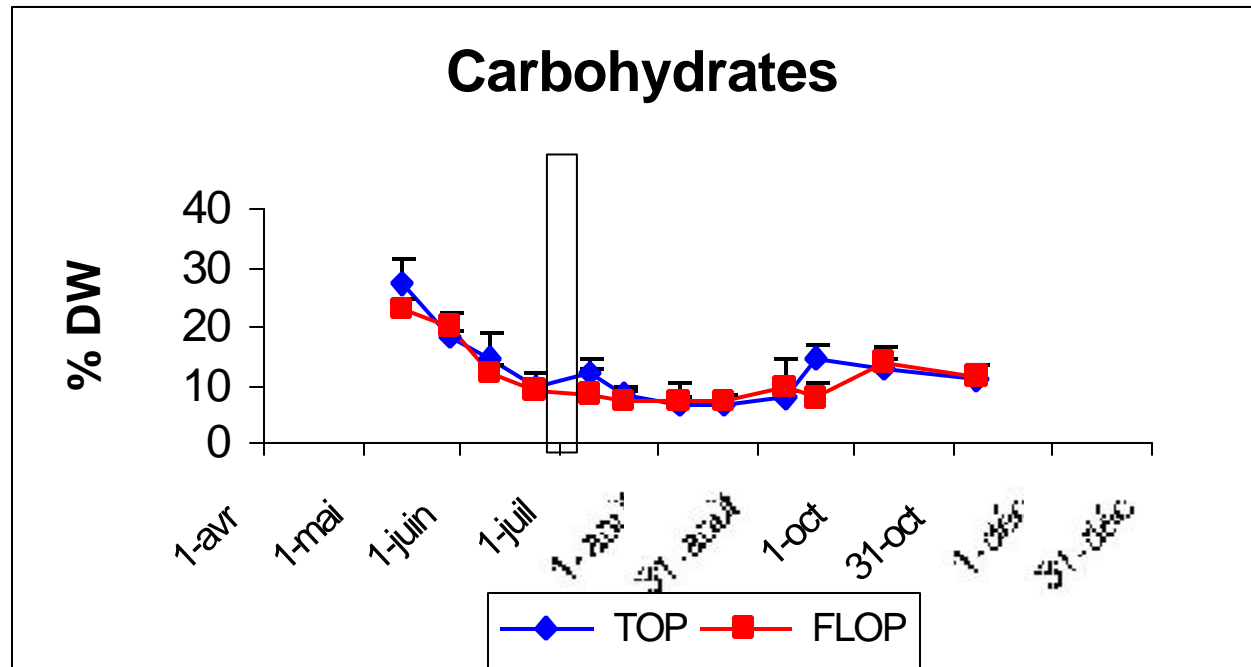
**TOP and FLOP exhibit different strategy of spawning**



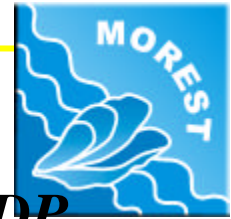
**Similar importance of vitellogenesis for TOP and FLOP**



# Biochemical composition

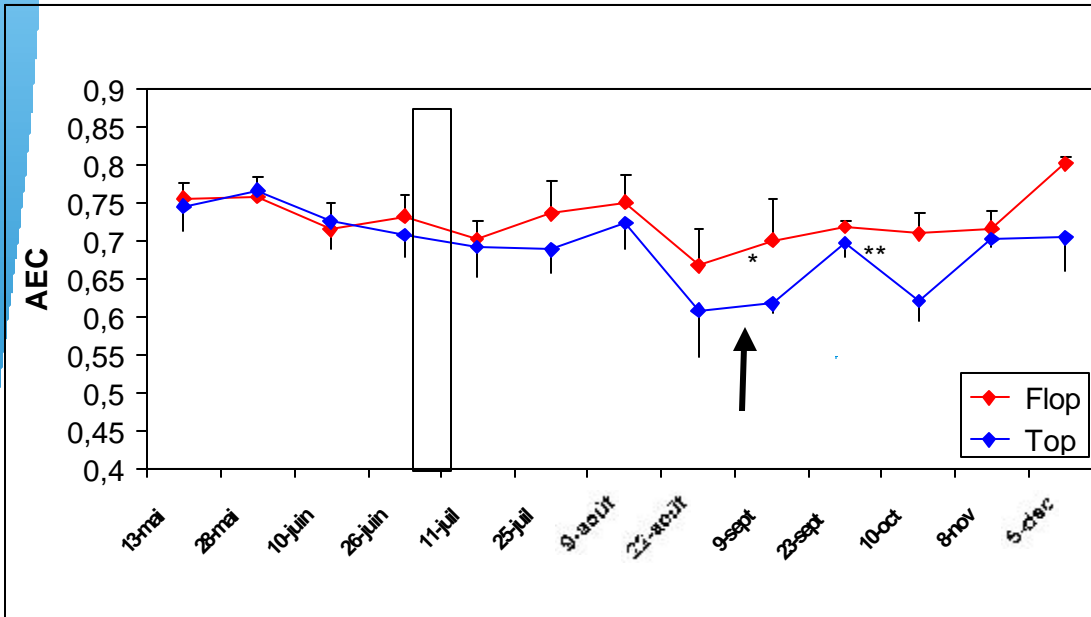


- **Use of carbohydrates during gametogenesis was similar for Top and Flop**



# Adenylate energy charge (AEC)

$$\frac{ATP + 0.5 ADP}{ATP + ADP + AMP}$$



- Slight decrease of AEC during active gametogenesis, similar for TOP and FLOP
- Before spawning, drop of AEC values TOP>FLOP
- After spawning AEC TOP<FLOP

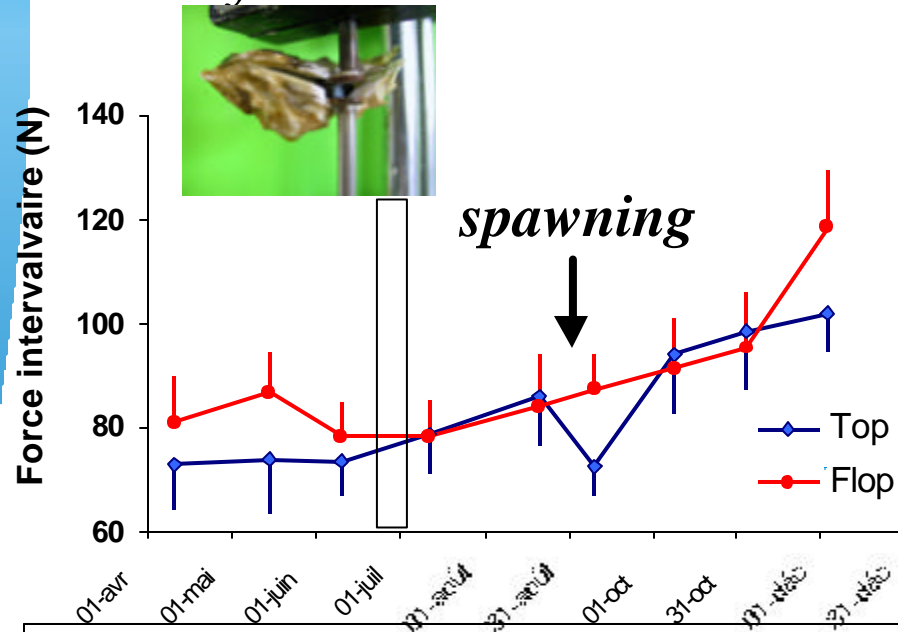
## Cost of gametogenesis

*Un-balance between the energy available (Food and storage) and energy expense for the reproduction before spawning?*

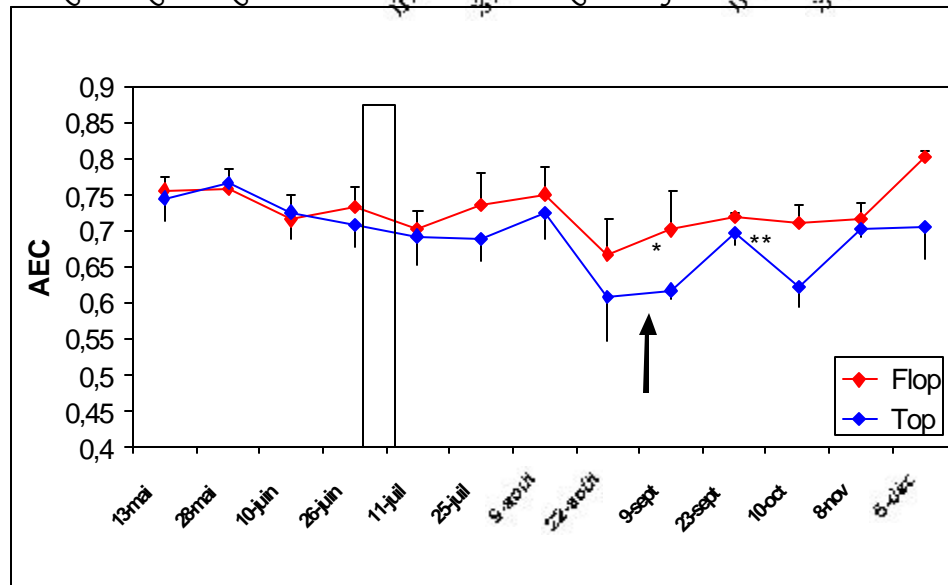


# Muscular strength

*Commercial dynamometer: maximal strength measure = capacity to close valves*



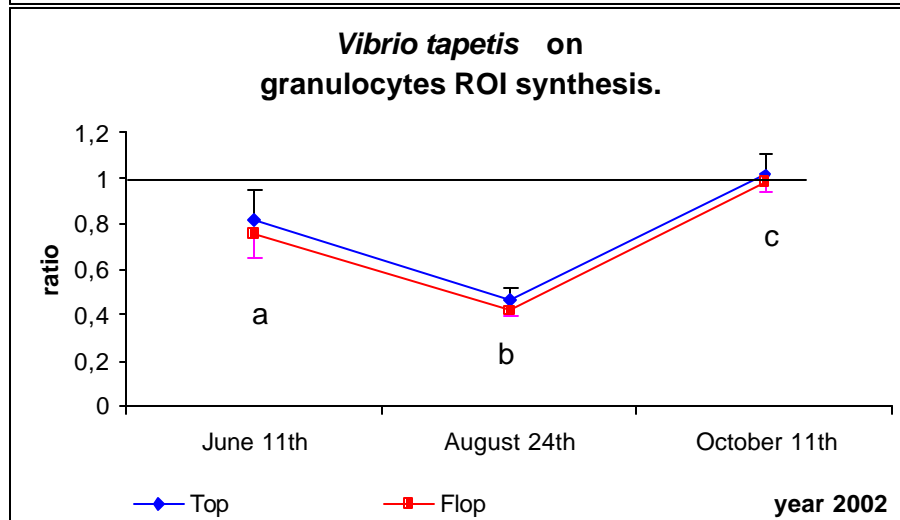
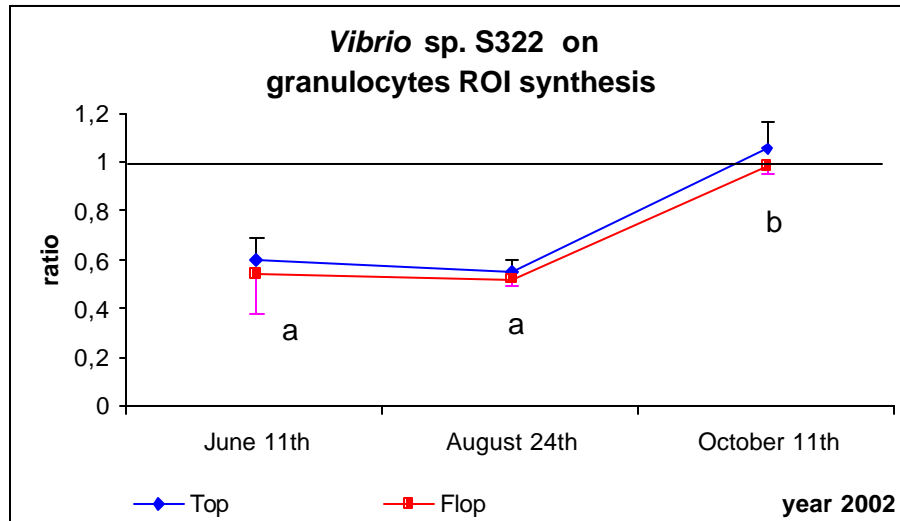
- General increase relative to biomass increase
- Decrease simultaneous to spawning for TOP
- Is spawning costly?



- Decrease of AEC before spawning for TOP, traduce a general weakness and explain the weakness of muscle?



# Immunology



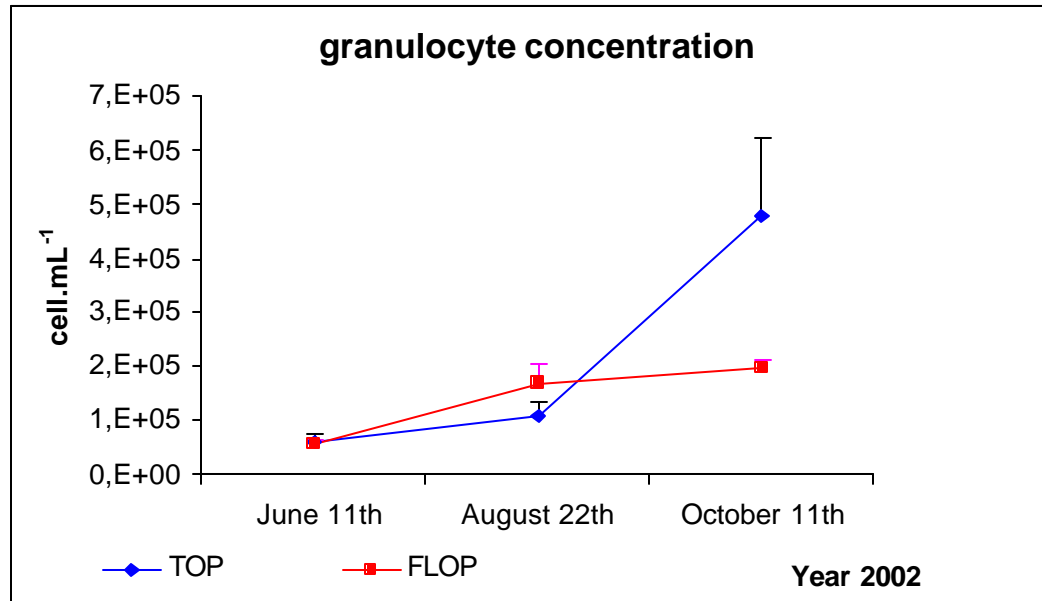
**Hemocytes are more sensible to vibrio during the gametogenesis**

**No differences between Top and Flop**

**Relation to the energetic deficit during gametogenesis process?**



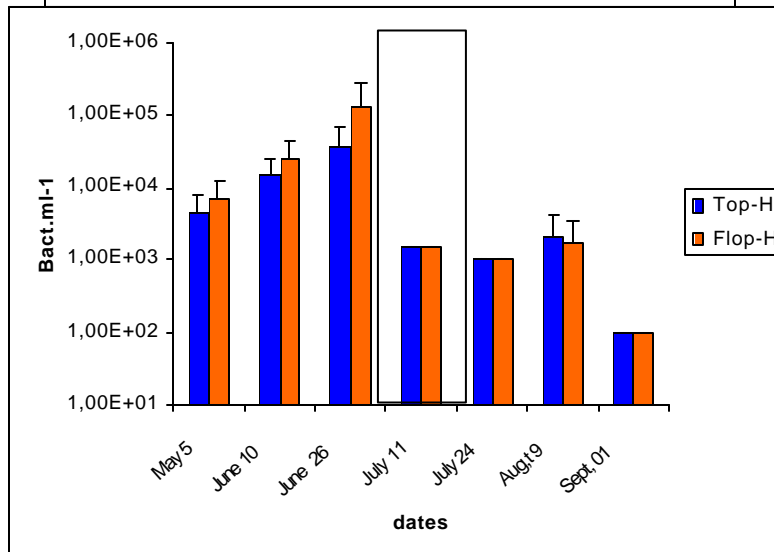
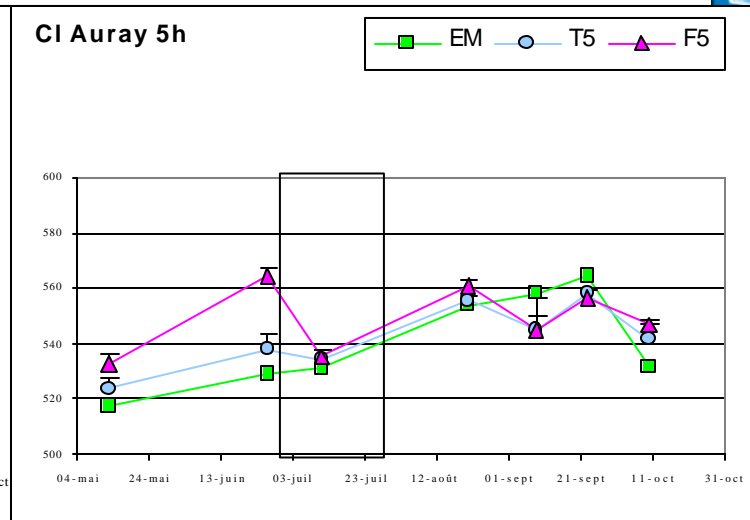
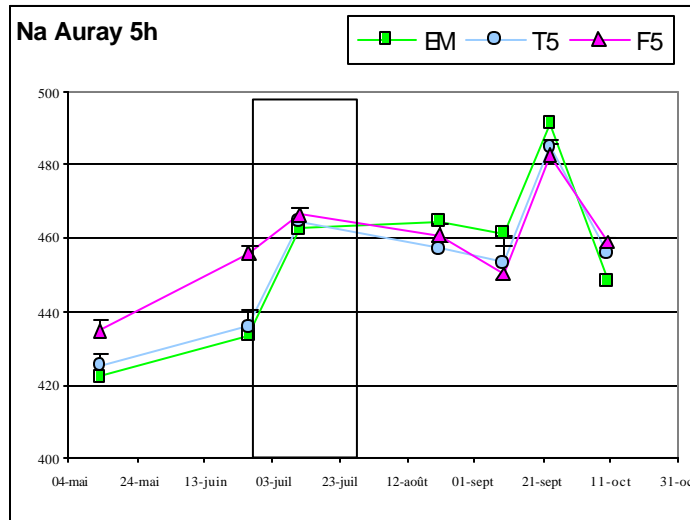
# Immunology



- Granulocyte concentration tends to increase from June to October
- No distinction between Top and Flop in June and August
- October :Top > Flop = defense capacity restoration after spawning?



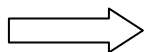
# Hemolymph



***FLOP : perturbation of osmoregulation before mortality event***

***Hemolymph bacterial concentration increased before mortality***

***Related phenomena? weakness of oysters?***



***Parallel with low hemocyte concentration, low phagocytosis rate?***





# Conclusions

## 1- Reproduction strategy

### ➤ Difference for resistant and sensitive families

#### ❖ Spawning TOP >> FLOP

✓ *DW, lipids, histology, AEC, muscular strength*

#### ❖ Reproduction effort FLOP <sup>3</sup> TOP

✓ *DW, histology*

*Different behavior (filtration, assimilation, respiration),? Could lead to different energy acquisition and allocation*

Go further in knowledge of overall reproduction processes : criteria for initiation of gametogenesis, reproductive effort, spawning and tissue restructuration

Understand the consequences of the differential spawning success on recruitment of FLOP in the field



# Conclusions

## 2 - Mortality

- **Few or No criteria allowed distinction between TOP and FLOP during mortality event :**
  - ❖ Higher bacterial concentration in hemolymph associated with perturbation of osmoregulation only in FLOP
  - ❖ No discrimination of defense system though it is weakened during gametogenesis.
  - ❖ but as mentioned previously (Lambert et al.), perturbation of this system only occurred when selective pressures were high. Indeed, **mortality level was low in this experiment.**
  
- **Relationship with the entire reproduction strategy?**



# Acknowledgements

- **Technical personnal in the field, the laboratory**
- **Funds from**
  - ❖ **Ifremer**
  - ❖ **Regional councils**
    - ✓ *Normandy*
    - ✓ *Brittany*
    - ✓ *Pays de Loire*
    - ✓ *Poitou Charentes*