

# **Integration of shellfish farming activities in three French coastal environments: Mont Saint-Michel Bay, Gulf of Morbihan, and Marennes-Oléron Bay**

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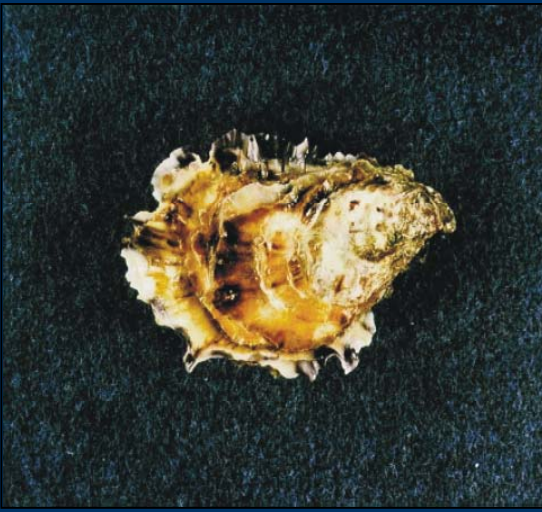
with the help of O. Le Moine, J. Populus and J.P. Allenou,  
A. Gangnery J.Y. Stanisière, P. Cugier, C. Struski...

# Chapter 1

- **Shellfish history and production in France**
- Site constraints and opportunities...
- Water quality,
- Trophic resource
- Nature conservation
- Coastal zone management

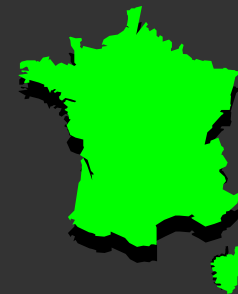
# Various species

*cultivated in France & Europe*



OF  
07

# Uneven progression of *French oyster production* over a century



150 000 t

Up and down!

100 000 t

*C. angulata*

*C. gigas*

50 000 t

*O. edulis*

iridovirus

Marteilia

Bonamia

1900

10

20

30

40

50

60

70

80

90

2000

# Shellfish aquaculture in France

*(3 sites retained)*

Mont Saint Michel

Gulf of Morbihan

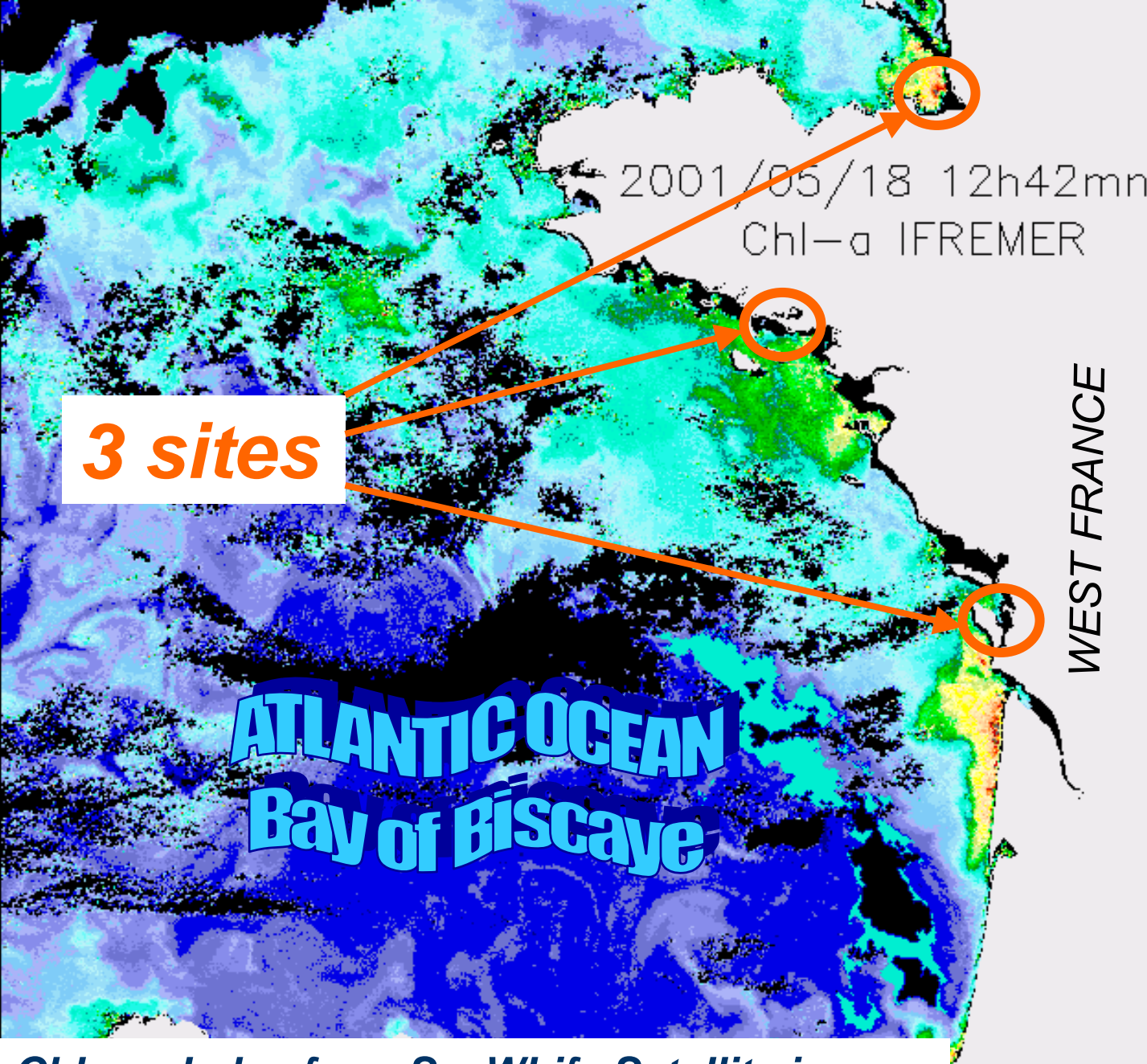
Marennes-Oléron



# Chapter 2

- Shellfish history and production in France
- **Sites constraints and opportunities...**
- Water quality,
- Trophic resource
- Nature conservation
- Coastal zone management





3 sites rich in  
**phytoplankton** :  
2 of 3 near the  
mouth of large  
**estuaries** :  
Gironde, Loire

**Chlorophyll a, from SeaWiifs Satellite image**  
(Algorithm by F.Gohin, Ifremer)

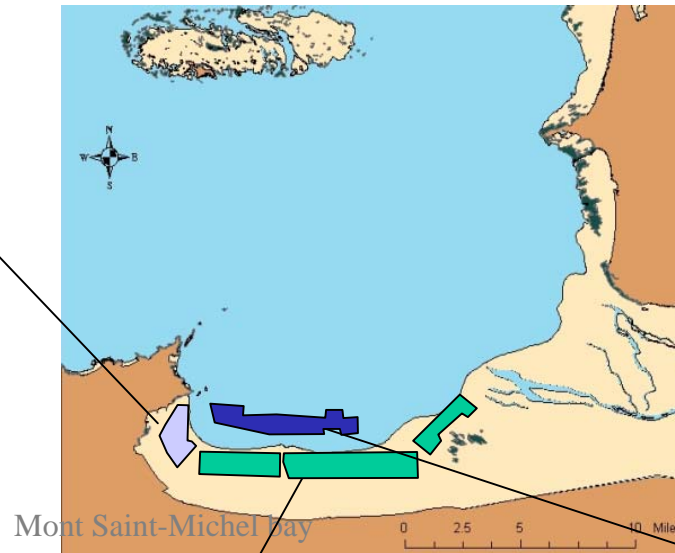
# Mont Saint Michel Bay :

« *the bay of filter-feeders* »

## Cupped Oyster *C. gigas*

Stock 8000 tons

Production 5000 tons



- ❑ Sedimentary bay of 500 km<sup>2</sup>
- ❑ 15 m tide amplitude
- ❑ Bed communities dominated by suspension feeders
- ❑ 15 km<sup>2</sup> leased for shellish farming out of 240 km<sup>2</sup> Intertidal

## Flat Oyster *O. edulis*

Stock 3000 tons

Production 1500 tons



## Mussel *M. edulis*

Stock 10-12000 tons

Production 10-12000

tons

(~320,000 poles)



COASTAL WETLAND. SUNCHEON, KOREA, 28-31<sup>st</sup> may 2007

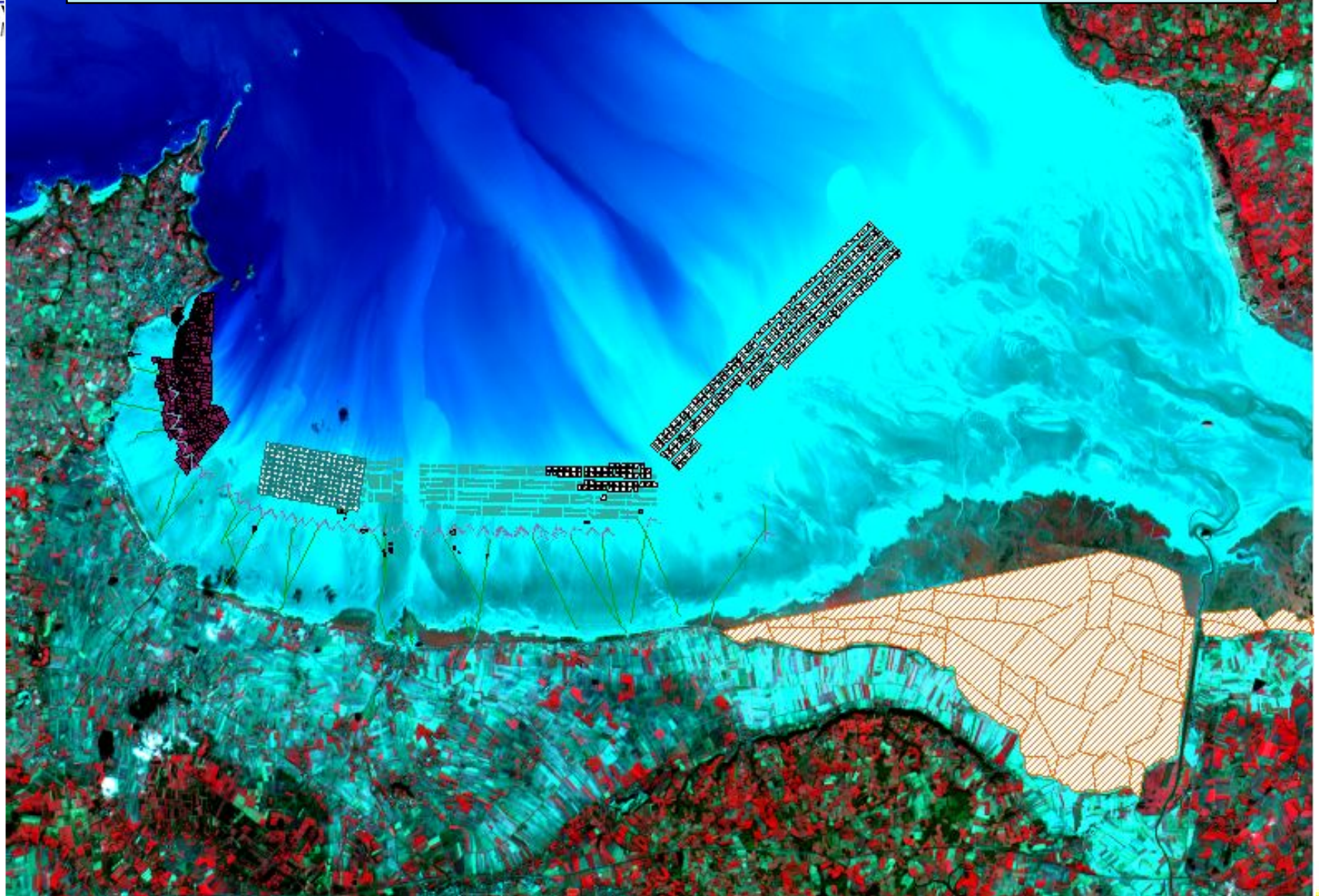






# MONT SAINT-MICHEL BAY :

## Shellfish culture and polders extension ( SPOT 1999)



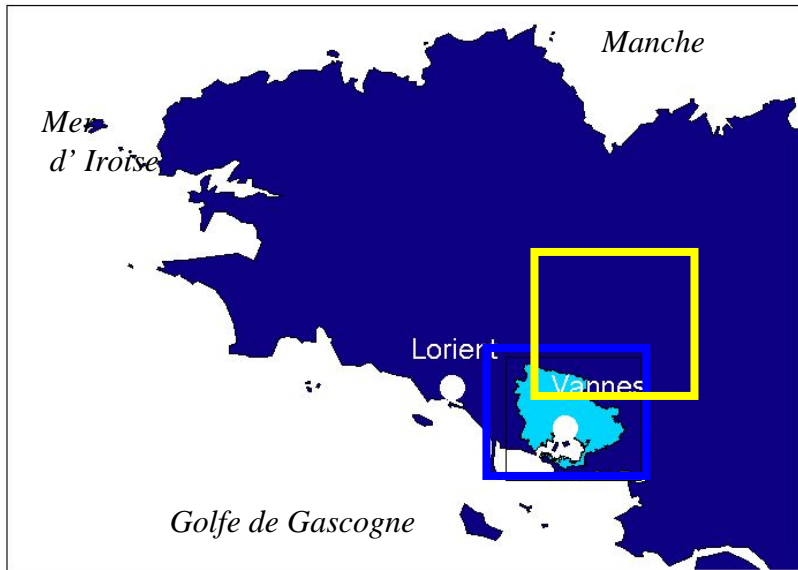
INTERNATIONAL SYMPOSIUM FOR BETTER MANAGEMENT OF  
COASTAL WETLAND. SUNGHEON, KOREA, 28-31<sup>st</sup> may 2007

l'Émer

Extrait du SIG . Base de données environnementales de la baie du Mont Saint - Michel

# MORBIHAN GULF

*small, enclosed sea in South Brittany*





# Morbihan Gulf : a few figures



## Watershed :

Surface : 800 km<sup>2</sup>

37 districts  
(17 bordering the Gulf)

260 000 permanent habitants

**Seawater Surface** : 145 km<sup>2</sup>

**Intertidal Surface** : 65 km<sup>2</sup>

**Leased surface** : 16 km<sup>2</sup>

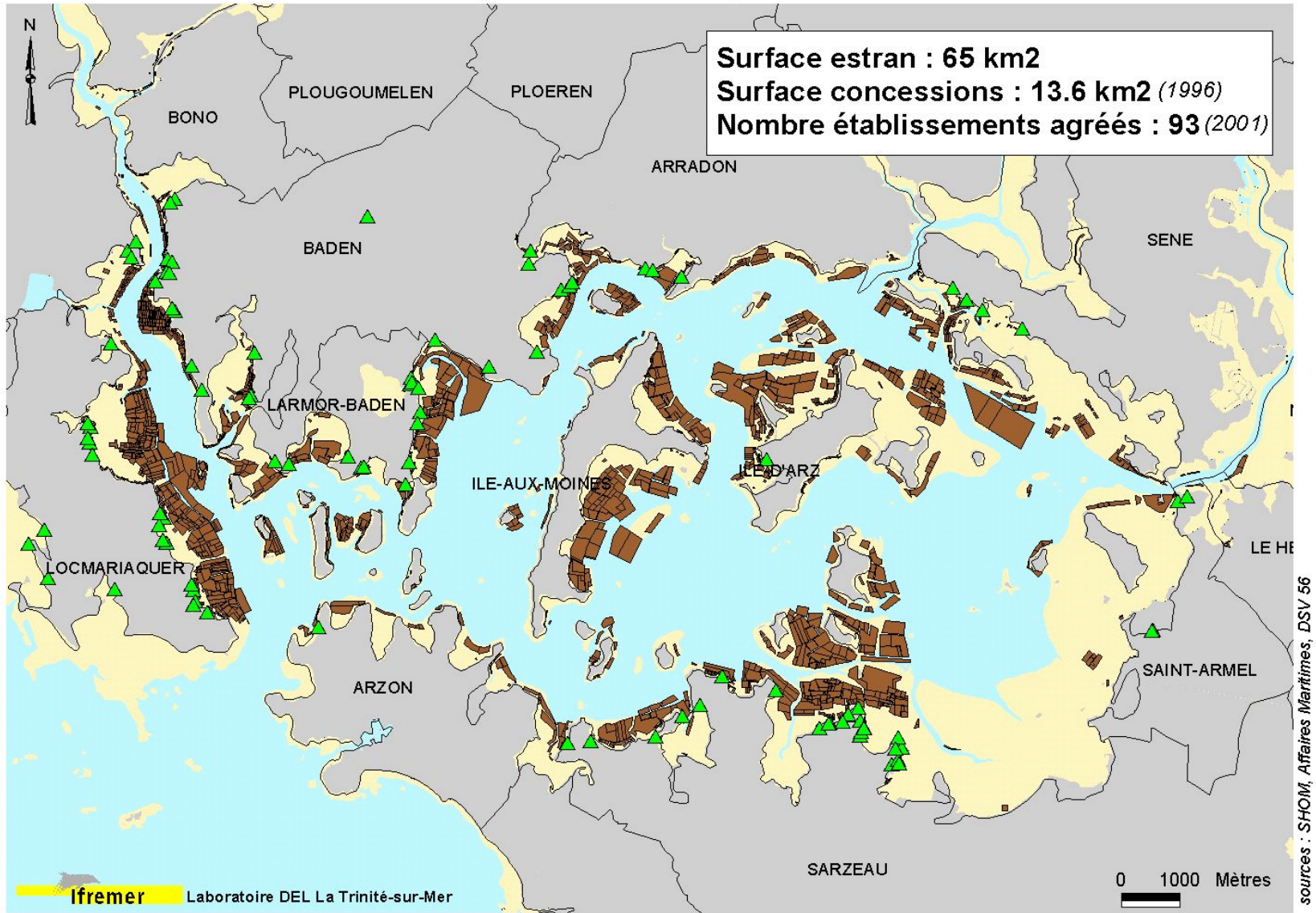
**Tourism** : 1,2 millions tourists in the summer period; total capacity: 114000 beds  
(4% Hotels, 16% Campings and 64% summer houses)

**Boating** : 7,000 sailing boats & boats with mooring

**Shellfish culture** : 5,000 tons/year cupped oysters + 1,500 tons/year of clams;  
107 approved establishments



# Bivalves culture in Morbihan Gulf



▲ Etablissements conchylicoles

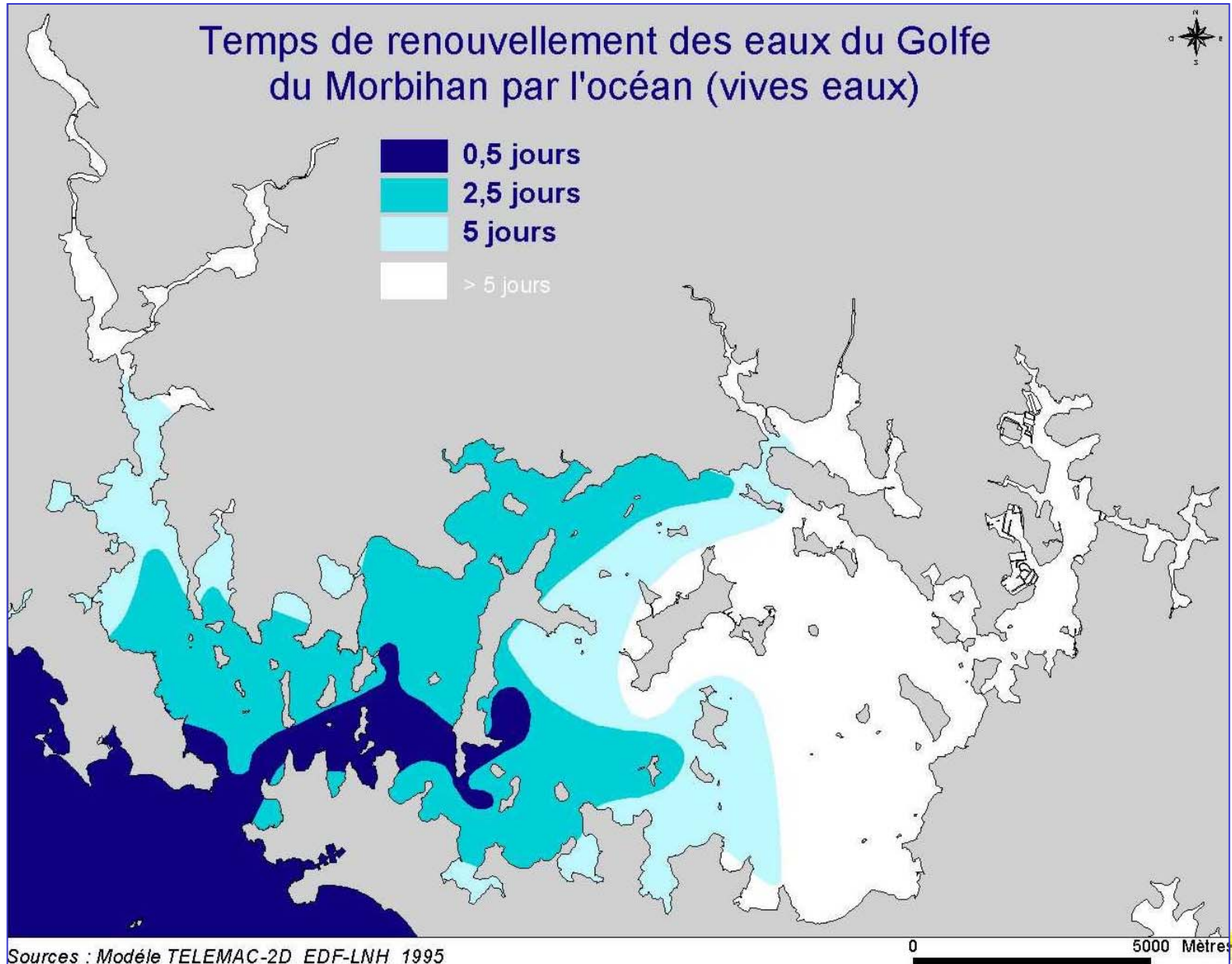
■ Cadastre conchylicole  
(situation administrative 1996)

mer

estran

terre

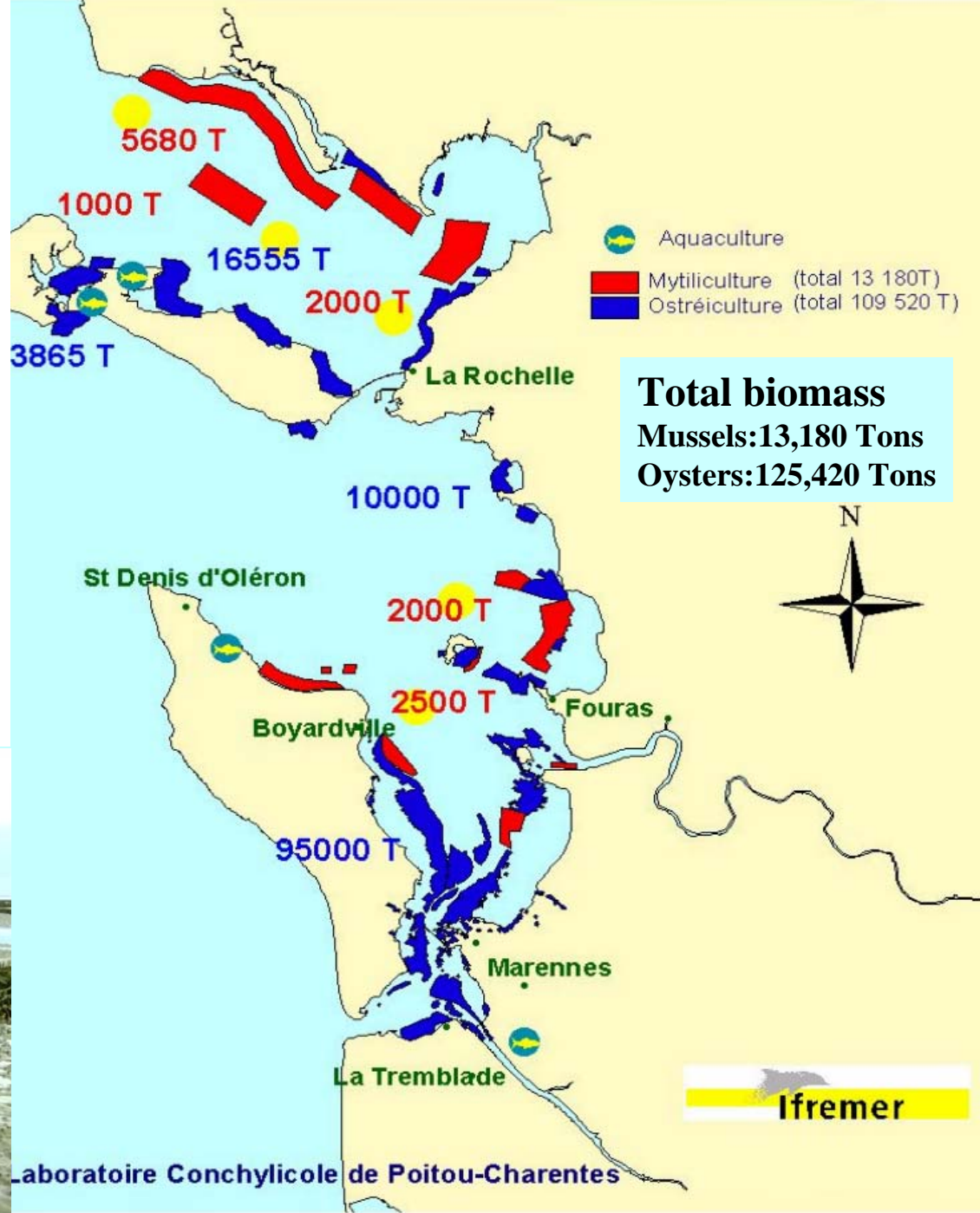
# Residence time varying from 0.5 to >5 days





# MARENNES OLERON : shellfish cultivation

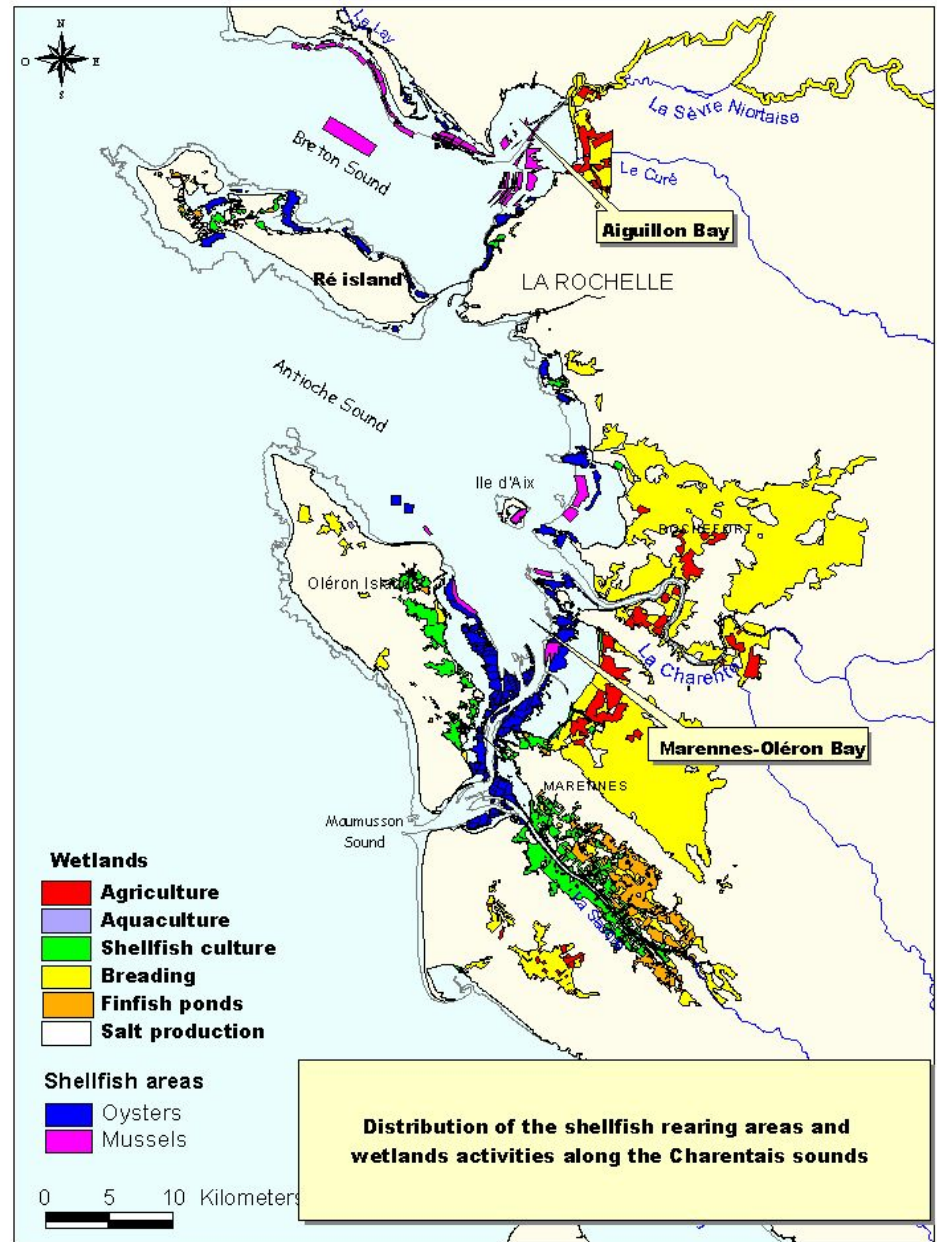
- More than **1257 companies** with 8050 full time employment
- **23 km<sup>2</sup> of leasing grounds / 93 km<sup>2</sup> intertidal & 21km<sup>2</sup> oyster ponds**
- Annual production: **60 000 tons marketed** (35 000 tons grown locally)
- Spat production (oysters & mussels)



# Marennes-Oléron :

*2 locations for shellfish sites*

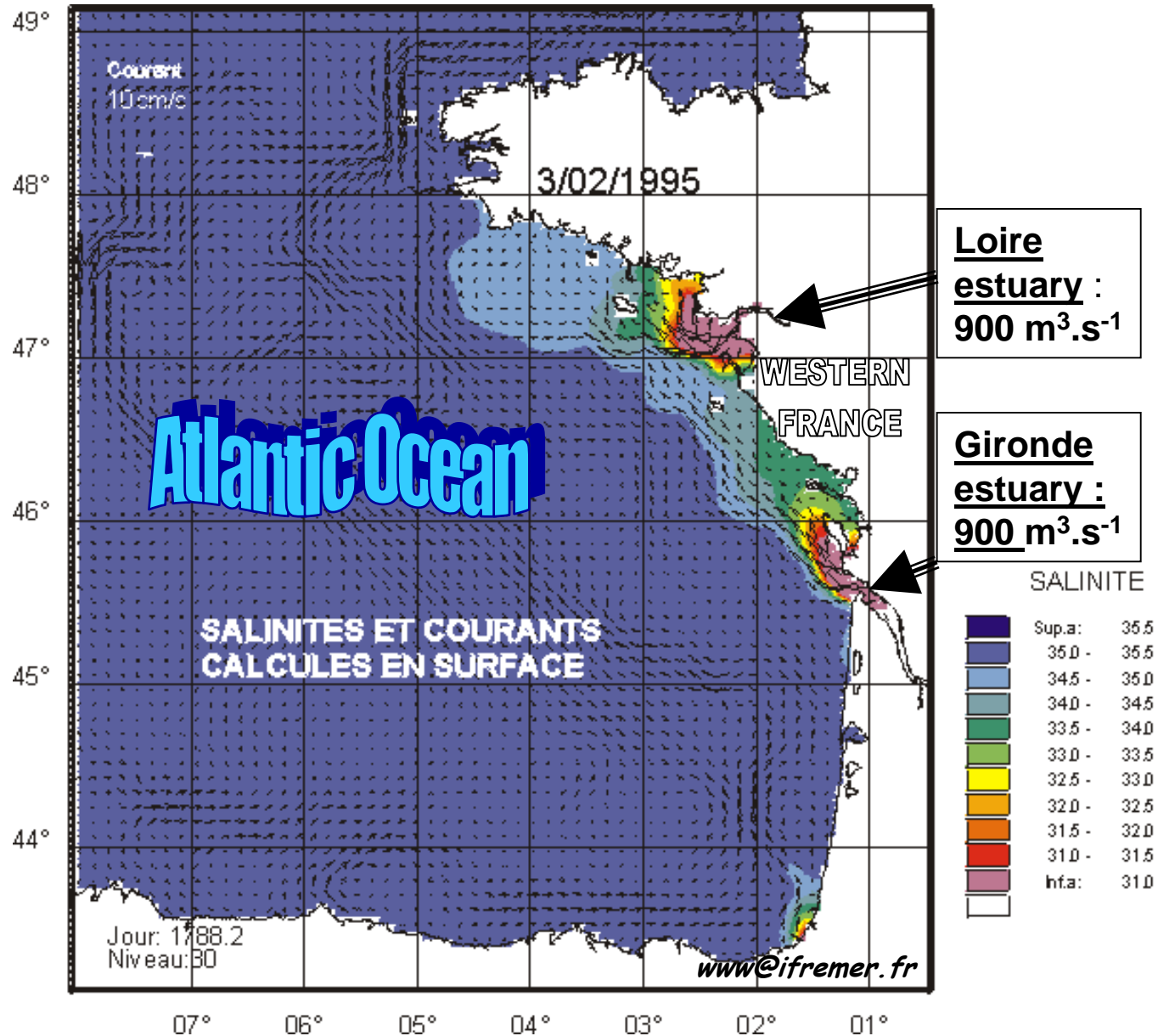
- **Tidal & subtidal** culture (oysters and mussels)
- + Traditional culture (>150y) using **oyster ponds** of ecological interest (ancient salt marshes...)





Terrestrial input  
(**rivers...**) and  
dispersion by  
**currents...**

...Are the main  
sources and  
forces that  
determine  
salinity (map)  
and **control**  
the **coastal**  
production



# Freshwater quality : *input modifications-qualitative*

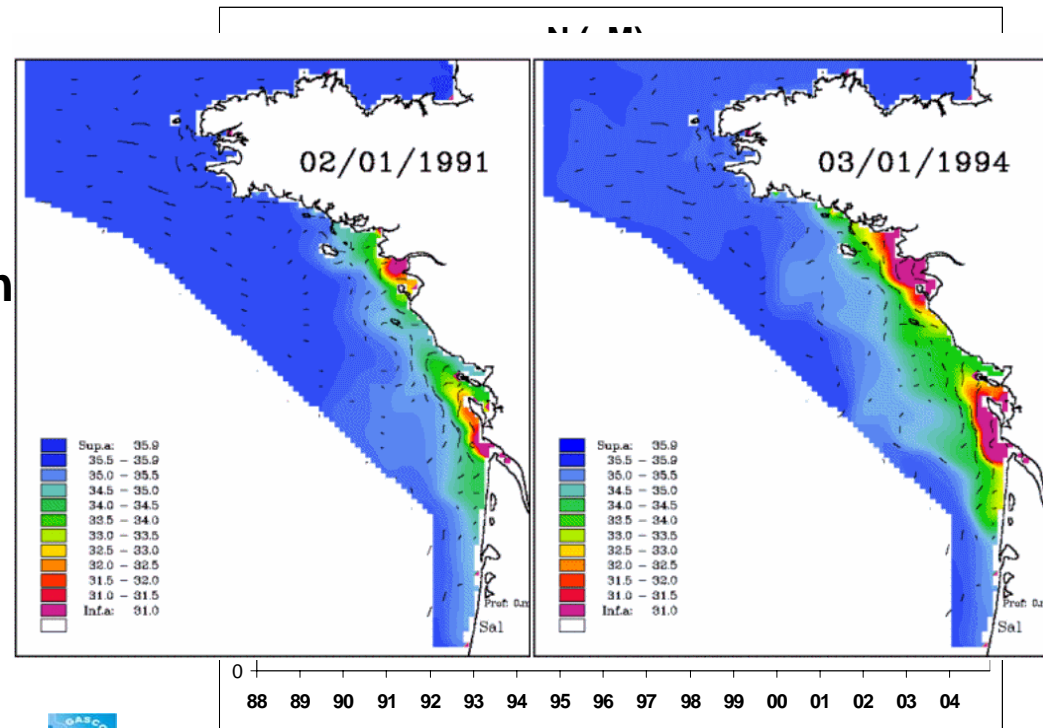
## Major global change over the last 30 years:

- Nitrogen : + 70 %, +1,6 % / year  
(agriculture..)
- Phosphate : -30 % in 16 years  
- 2,2 % / year (improved sewage  
treatment plants...)

## Impacts on planctonic population (N/P ratio)...food web changes...:

- *dystrophic - eutrophication* –  
*reduced production* – *Toxic sp.*  
(*phycotoxines..*)

and therefore, on side effects, **on  
cultured species... !**



(Blanchard et al., 2005)

# Chapter 3

- Shellfish history and production in France
- Morphological and spatial constraints...
- **Water quality for shellfish**
- Trophic resource
- Nature conservation
- Coastal zone management

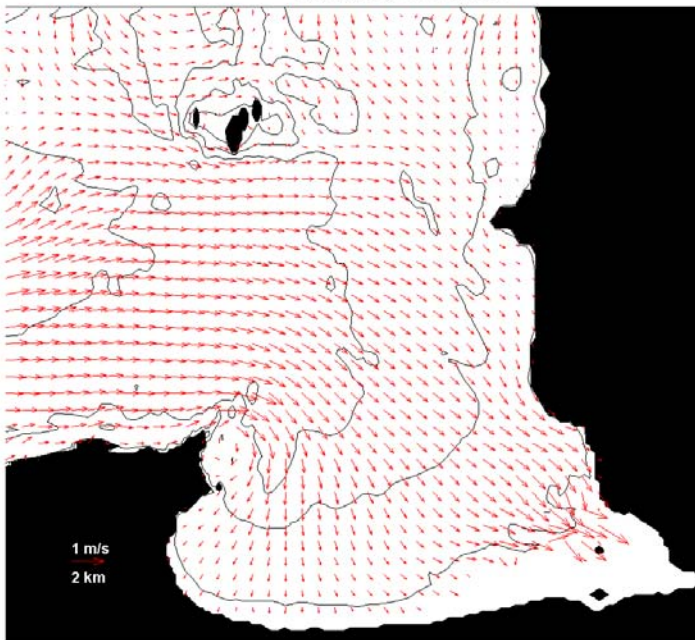
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- Shellfish history and production in France
- Morphological and spatial constraints...
- Water quality,
- **Trophic resource**
- Nature conservation
- Coastal zone management

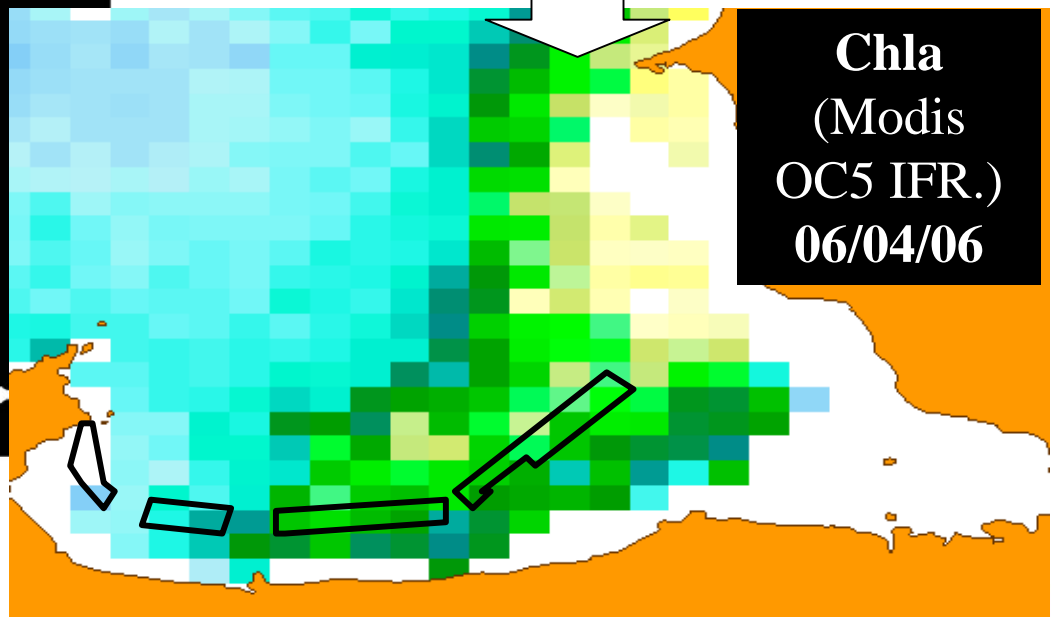
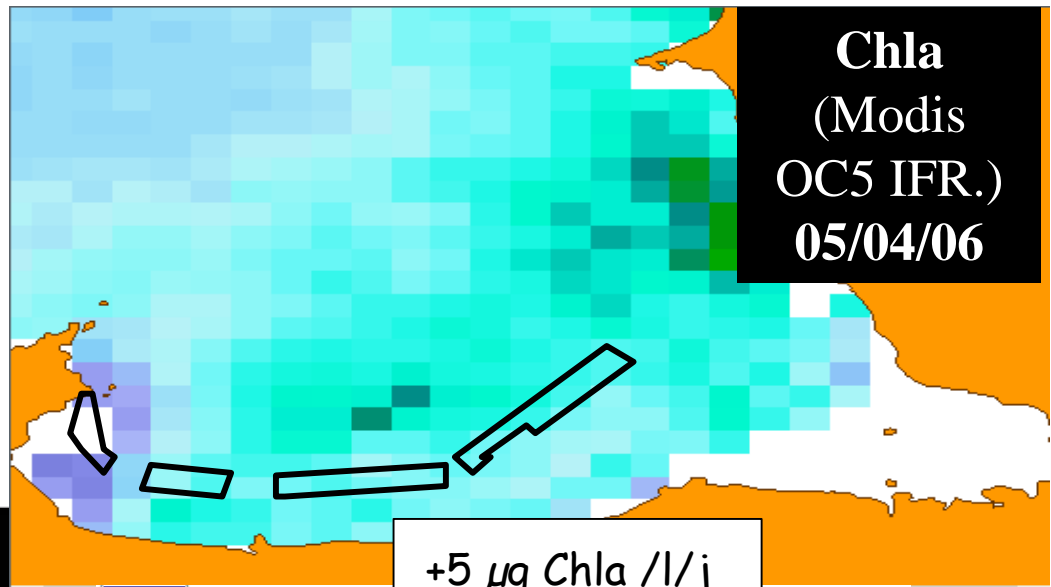


# Satellite monitoring of Chl a (Modis) and temperature

DONNEES SIMULEES DE COURANT (m/s)  
- Date : 10-May-2002 05:00:23 -



*Tidal currents simulation (Ifremer-Dyneco)*



INTERNATI  
COASTAI

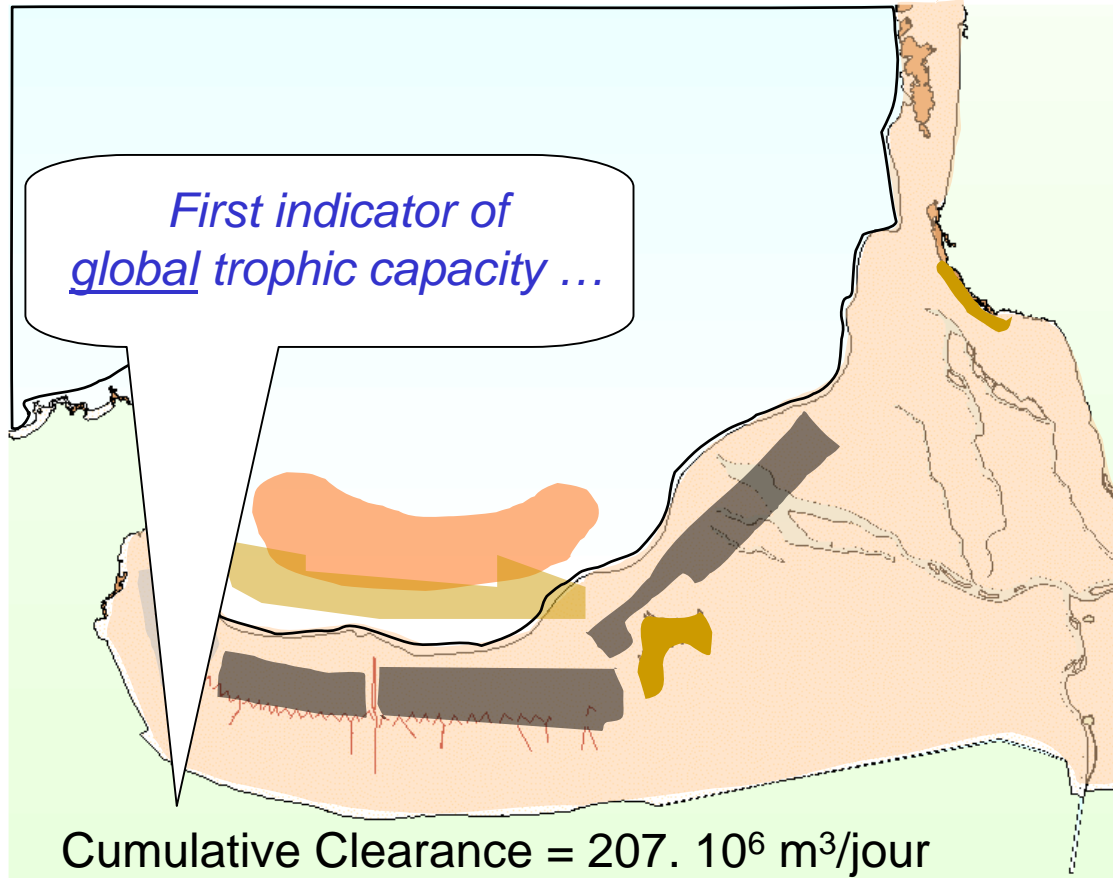
Ifremer

# MONT SAINT MICHEL BAY : estimation of cumulated clearance

rate of filter-feeders => non saturated at large scale

Clearance  
10e+6

Biomass m<sup>3</sup>/jour



=> **8 % clearance rate daily (12 days filtration time)**

<i>Cerastoderma edule</i>	7 500 t	45
<i>Macoma balthica</i>	1 600 t	0,8
<i>Abra alba</i>	2 300 t	3,6
<i>Glycemeris glycemeris</i>	10 800 t	3,6
<i>Spisula ovalis</i>	4 200 t	15
<i>Paphia rhomboïdes</i>	2 500 t	4
<i>Sabellaria alveolata</i>	252 ha (3 000 t)	2,6
<i>Crepidula fornicata</i>	150 000 t	115
Huîtres plates	3 300 t	3,7
creuses	6 450 t	0,7
Moules	12 000 t	13

# Mont-Saint-Michel Bay at leases scale : Growth of mussels decreasing East=>West according to residual currents direction

=> overstocked at medium scale

## Kg harvested per pole in 2000 (comm. C. Beaulieu)

Plan de St Benoit

60,0	64,5	58,0
36,0	42,5	46,6
25,5	33,0	

Plan de Cherrueix

46,3	58,2	73,5	92,5
41,3	40,0	63,0	36,5
	28,5	45,0	27,0
		27,0	

Plan des Hermelles

82,0	97,5	121,0
79,5		113,0
67,0		111,3

Nouveau plan

?
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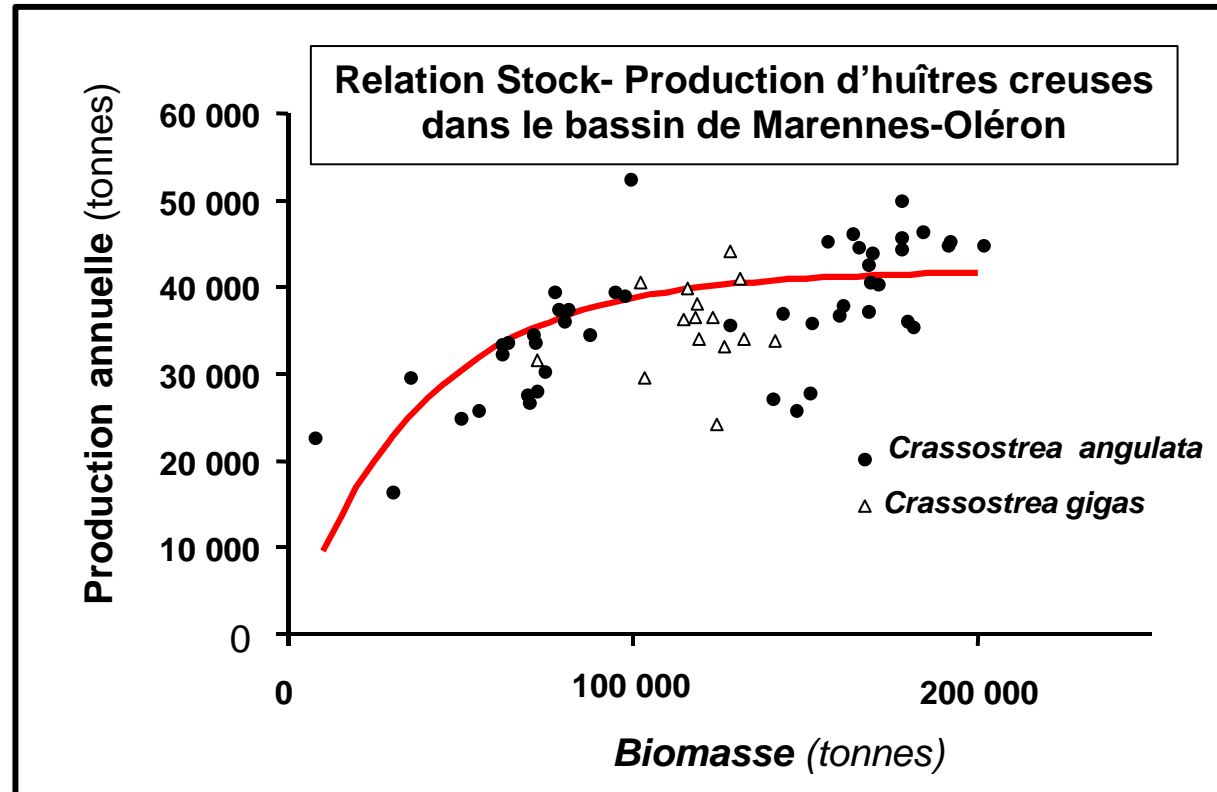
Clear suspicion of trophic competition inter-zones

Restructuration 2003-2005

# MARENNES OLERON : *Limited trophic capacity*



Source : Chaussade et Corlay



- trophic capacity is limited by **food availability** (endogeneous or exogeneous) : phytoplankton, micro-phytobenthos, micro-organic detritus...
- ⇒ **Stocks and densities** must be adjusted (legally regulated)



# Chapter 5

- Shellfish history and production in France
- Morphological and spatial constraints...
- Water quality,
- Trophic resource
- **Nature conservation**
- Coastal zone management

# Nature conservation

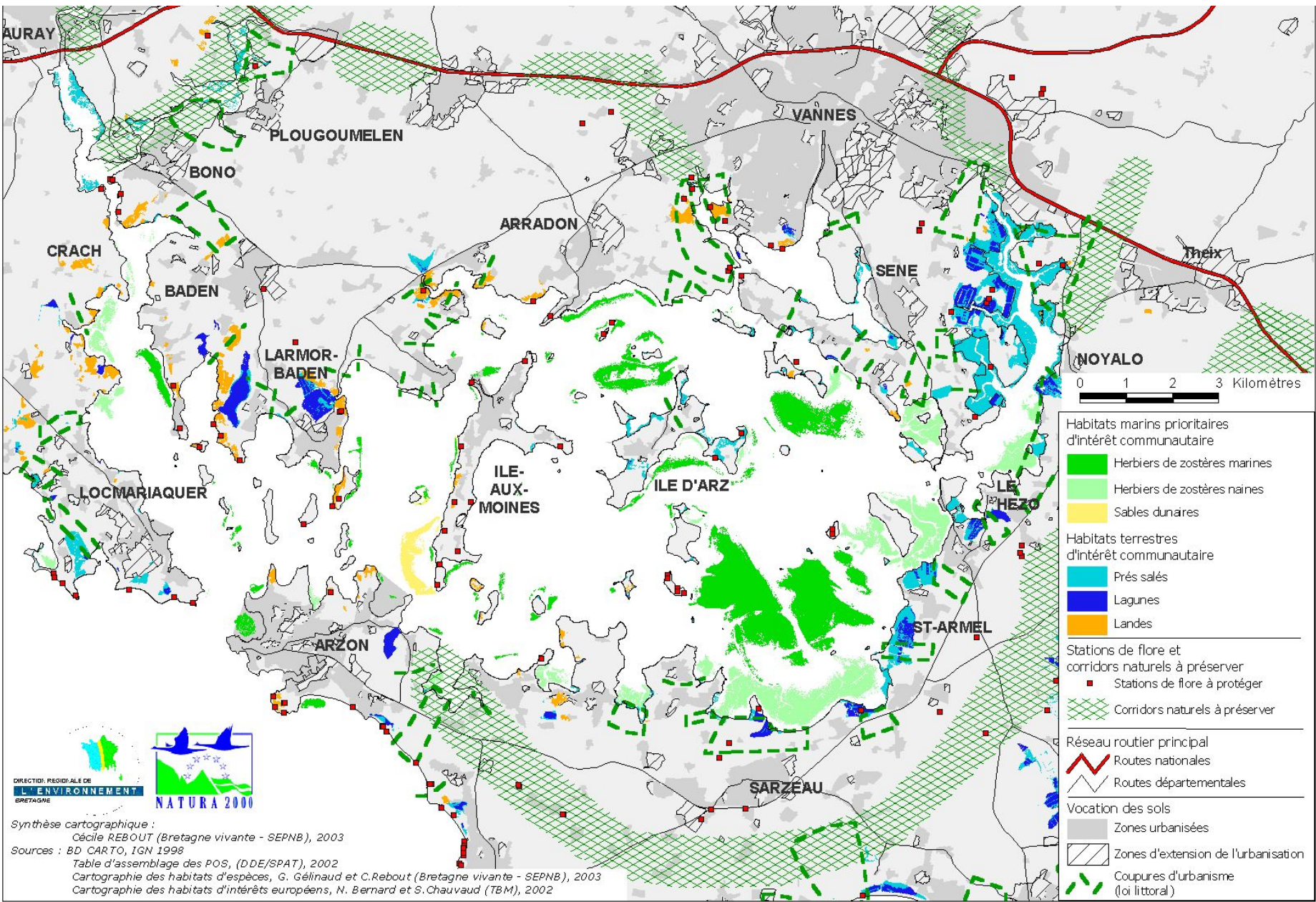
*The increasing public interest for nature conservation exerts more and more influence on shellfish farming:*

- oyster culture in **Mont-Saint-Michel** bay is questioned for invading Sabellaria reefs;

there is also a dilemma between preservation of common scoters Melanitta nigra and their frightening away as mussel predators.

- Oyster culture in **Morbihan Gulf** has been questioned for its impact on biodiversity, including siltation on seagrasses (Zostera), favorite habitat of burned goose bernicle bernicle : *but only a marginal impact was demonstrated.*

# Morbihan Gulf : natural habitats and ecological « corridors »



Synthèse cartographique :  
 Cécile REBOUT (Bretagne vivante - SEPNB), 2003  
 Sources : BD CARTO, IGN 1998  
 Table d'assemblage des POS, (DDE/SPAT), 2002  
 Cartographie des habitats d'espèces, G. Gélinaud et C.Rebout (Bretagne vivante - SEPNB), 2003  
 Cartographie des habitats d'intérêts européens, N. Bernard et S. Chauvaud (TBM), 2002

# Competing uses

*Competition for the same public resources, between shellfish farmers and other stakeholders, is a major concern:*

- regarding the **landscape**, acrimony exists against mollusc farming facilities, when they are judged unaesthetic or too dispersed as is the case in **Morbihan Gulf**;
- in neighbouring **salt marsh** areas (oyster “claires” from **Marennes-Oléron** basin, looked upon as natural ecosystems by environmentalists...)
- in intertidal, coastal zones (by way of example oyster trestles are considered to interfere with the free **access to beaches** in **Morbihan Gulf**); deep conflicts also exist with **fishermen**, whose trawls may capture cultivated oysters or accidentally damage the bordering bouchots (**Mont-Saint-Michel bay**).
- Less directly, but often more contentiously, water quality may be a debated issue: an agreement made in **Morbihan Gulf** for better management of **sewage plants** is an example of successful **cooperation** for improved water quality.
- Such an agreement remains to be found between corn farmers from the watershed of **Marennes-Oléron**, and oyster farmers, for **freshwater** availability in summer, when it is scarce and much needed by both sectors.



# Mont Saint-Michel :

*oysters collecting on sabellaria reef*



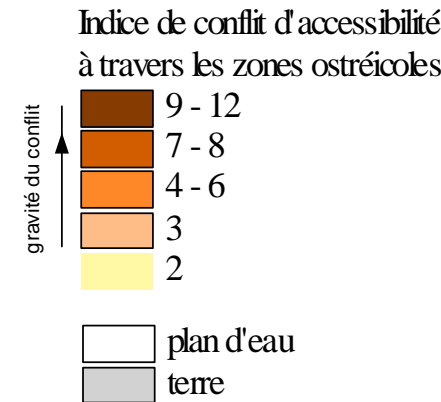
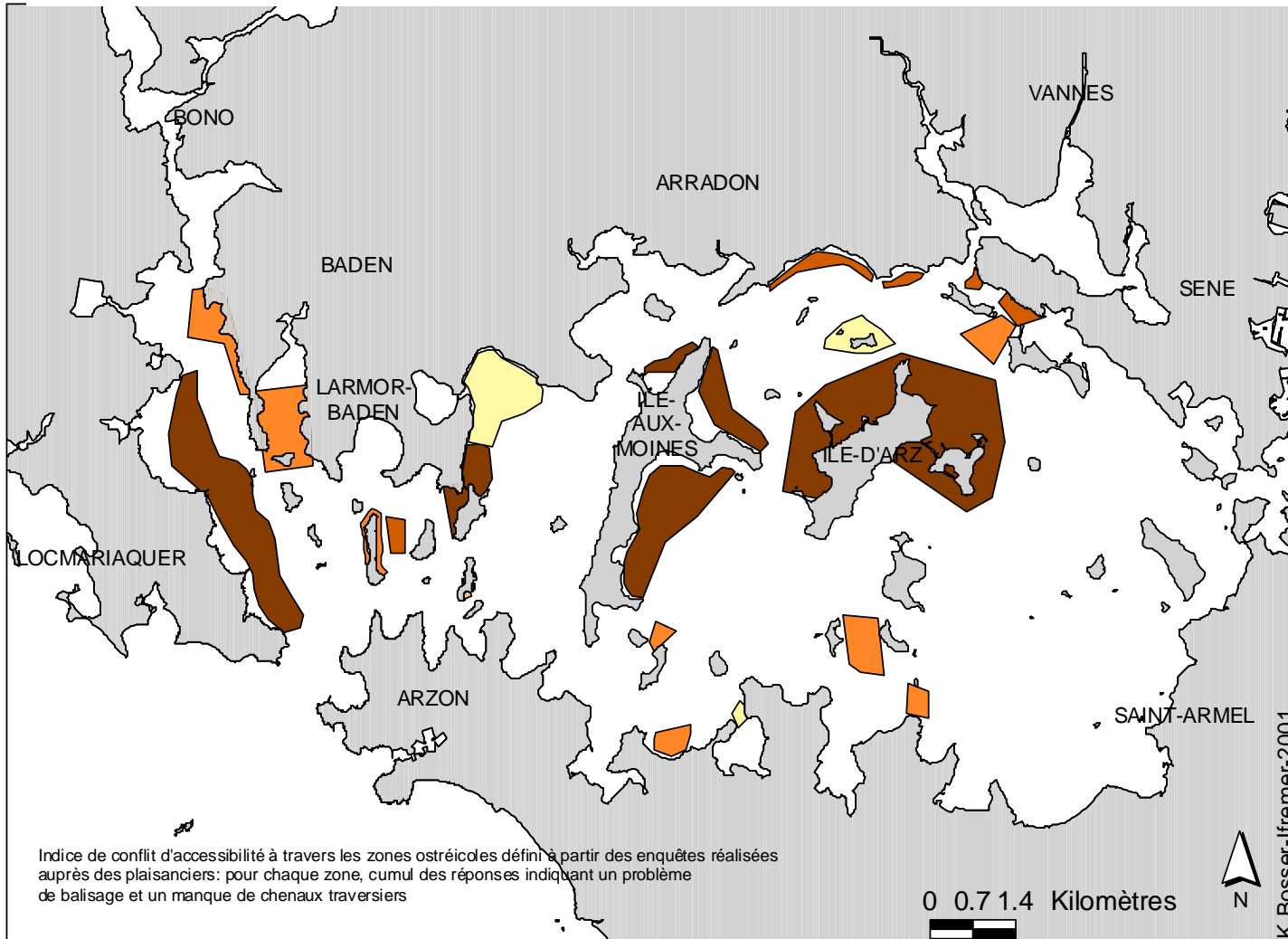


# Mont-Saint-Michel : Sea scoters & mussels



# MORBIHAN GULF

## Access conflicts with oyster farmers





# MORBIHAN GULF : Urbanism developing...



# Chapter 6

- Shellfish history and production in France
- Morphological and spatial constraints...
- Water quality,
- Trophic resource
- Nature conservation
- **Coastal zone management**





*Port blanc*

**mouillages**

**vasières**

*Ile d'Irus*

**plage**

**tables ostréicoles**

**plaisance**



# *Integrated Coastal Zone Management*

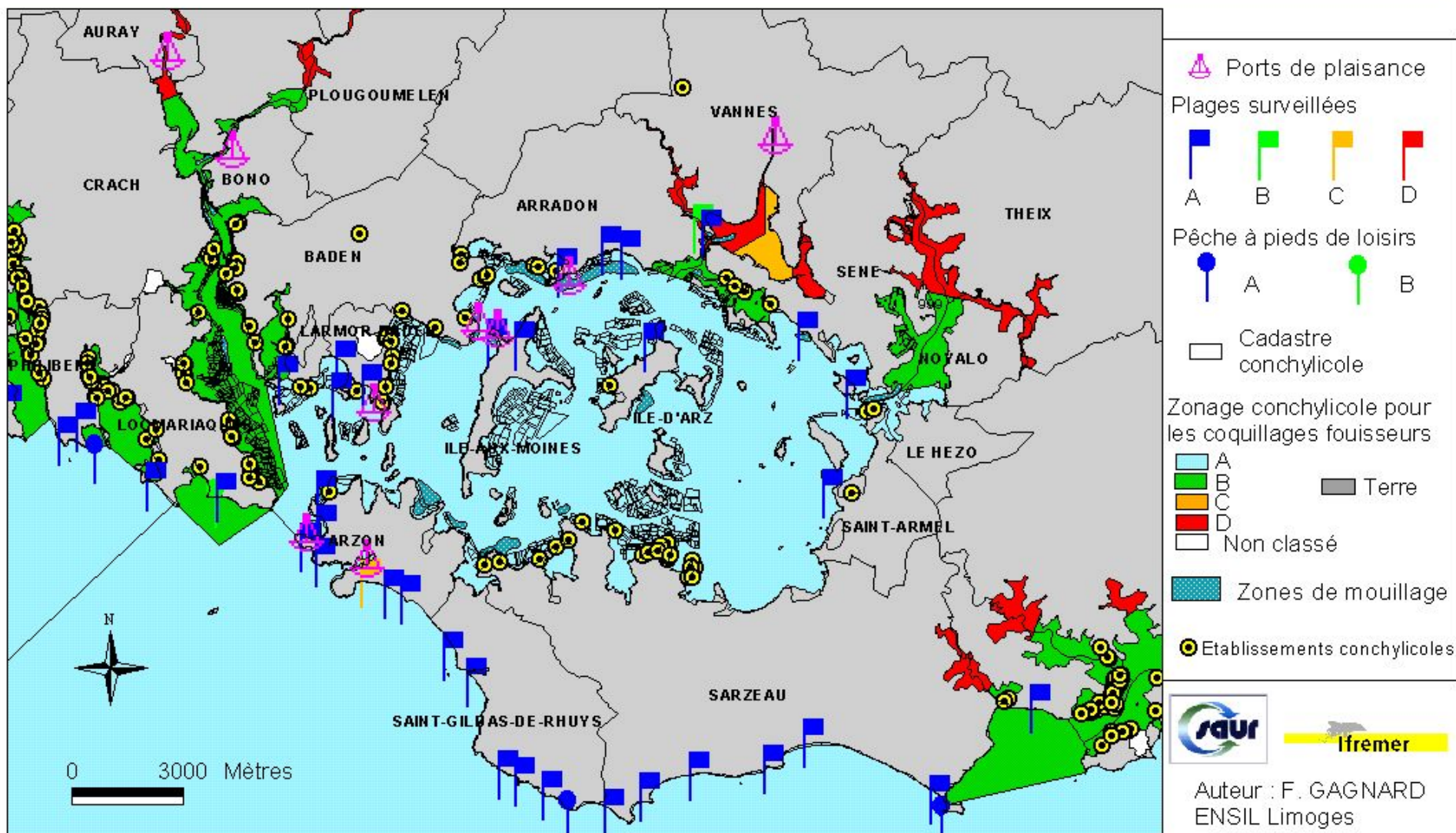
- **Integrated Coastal Zone Management** has been identified as a **framework** to analyse interactions among human activities. A project on Science and Policy Integration for Coastal System Assessment (SPICOSA, <http://www.spicosa.eu/>) supported by the European Commission has started in 2007.
- A recommending way would consist in **matching** a **scientific approach** (numeric models coupling physical and biological processes), and a **participatory one**.

# Sensitive uses in Morbihan Gulf

Source : IFREMER / DDASS / DDAM / DSV

Année 2001

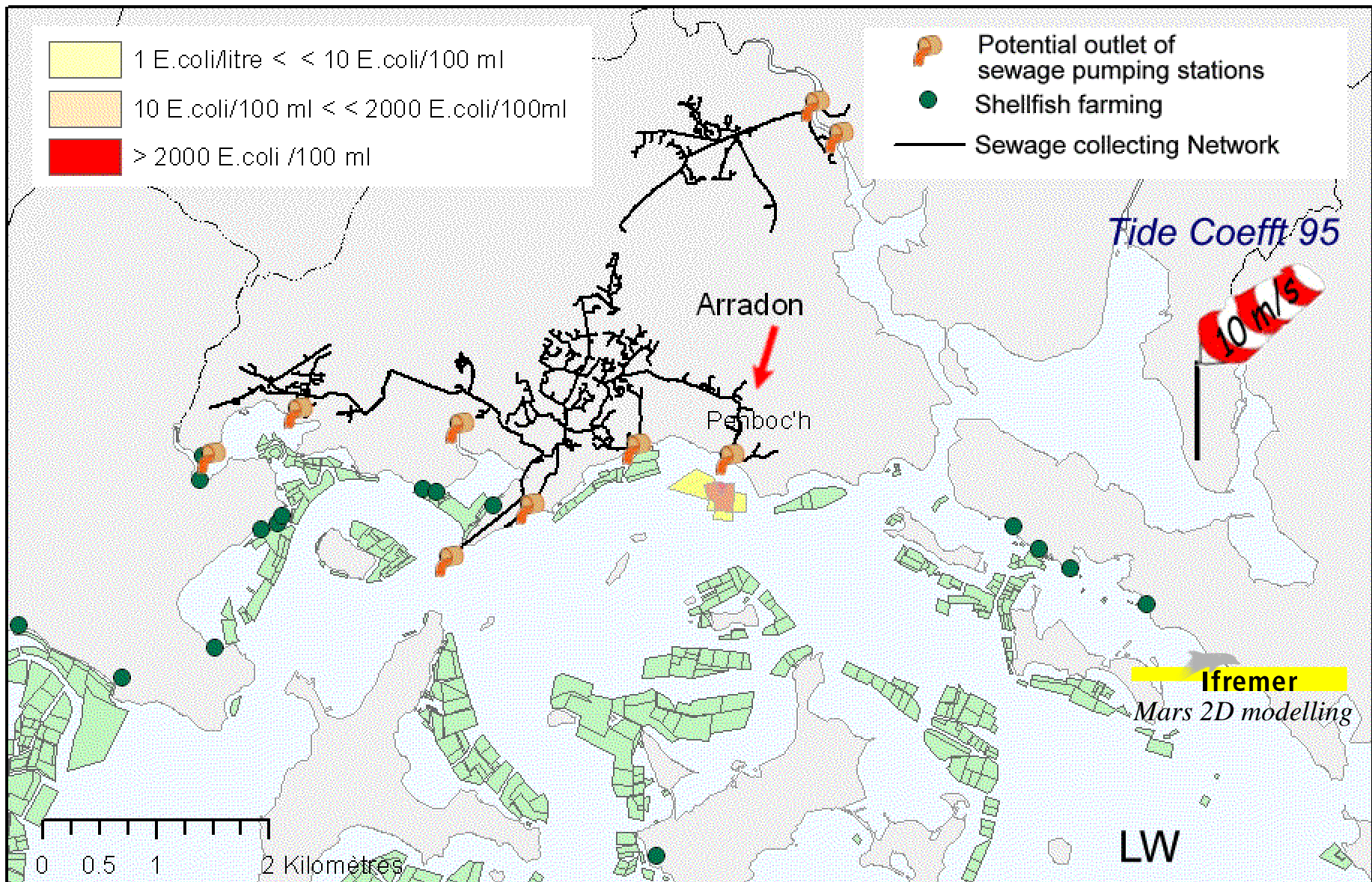
Golfe du Morbihan



Auteur : F. GAGNARD  
ENSIL Limoges

- Shellfish history and production in France
- Morphological and spatial constraints...
- Water quality,
- Trophic resource
- Nature conservation
- **Coastal zone management :**  
**=> an example : sanitary management**

# Impact modelisation of potential outlet of sewage pumping stations

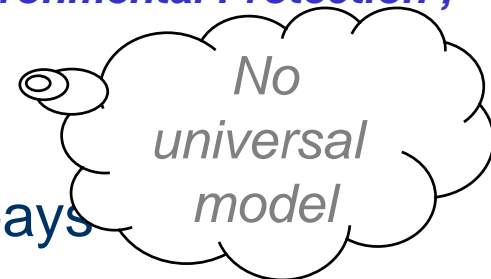




# Planning for sustainable coastal shellfish culture development

*GESAMP = Group of Experts for Scientific Aspects of Marine Environmental Protection ;  
FAO report & studies 68 (2001)*

- A clear planned objective
- 2 principles : precautionary approach & polluter pays
- public involvement (representative organisations)
- assessment of costs and benefits
- Assessment of environmental capacity
- Regulation at the proper administrative level
- Incentives to stimulate environmental management
- Control of effects rather than the size
- Iterative approach : action-monitor-evaluate-adapt...
- Capacity of institutions to implement the plan



# As a conclusion...

- Connaître  
(first) To know
- Aimer  
(then) To love
- Protéger  
(last) To protect

**commandant  
J.Y. Cousteau**