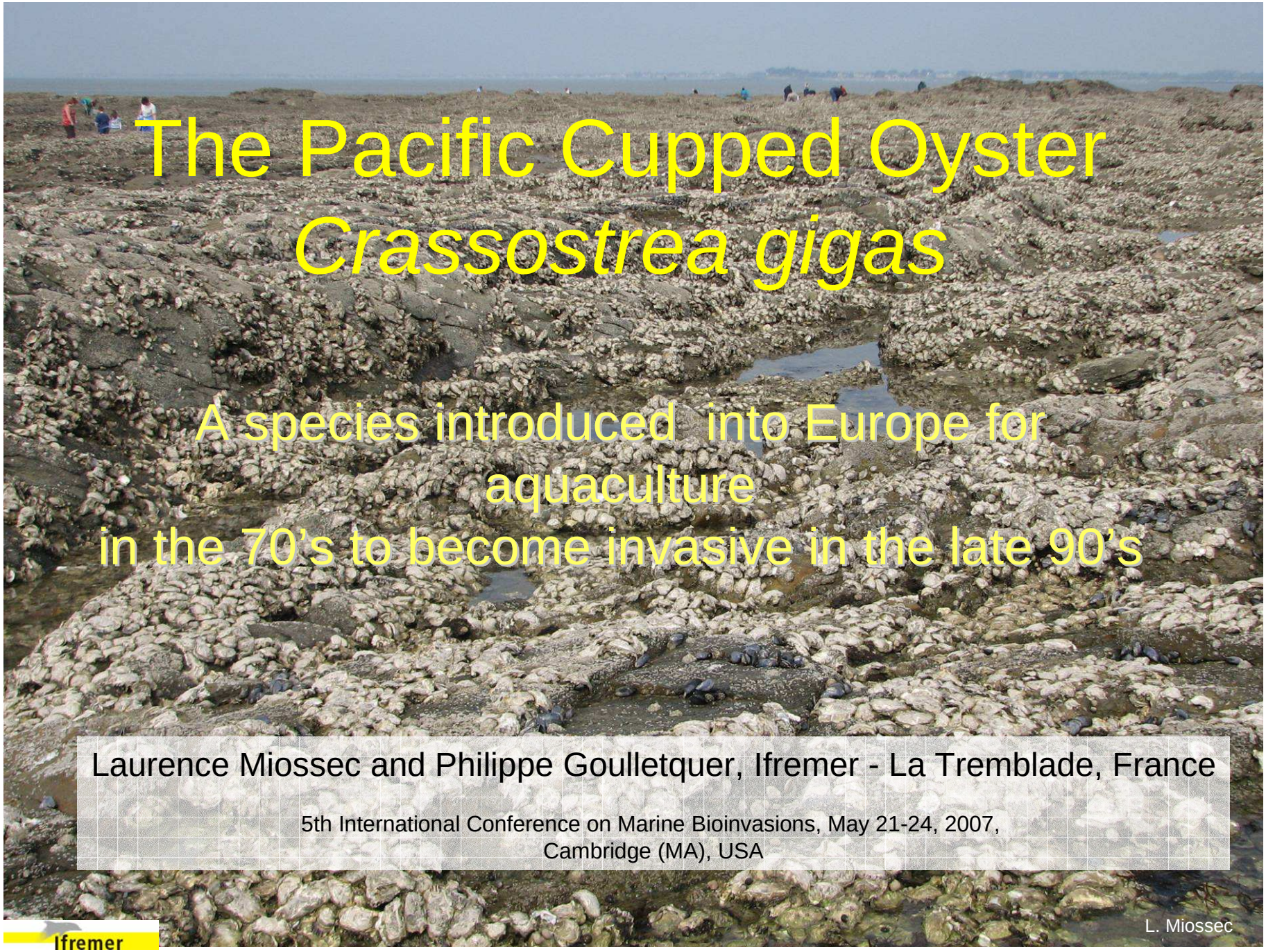


The Pacific Cupped Oyster *Crassostrea gigas*

A species introduced into Europe for aquaculture in the 70's to become invasive in the late 90's

Laurence Miossec and Philippe Goulletquer, Ifremer - La Tremblade, France

5th International Conference on Marine Bioinvasions, May 21-24, 2007,
Cambridge (MA), USA

Ifremer

L. Miossec

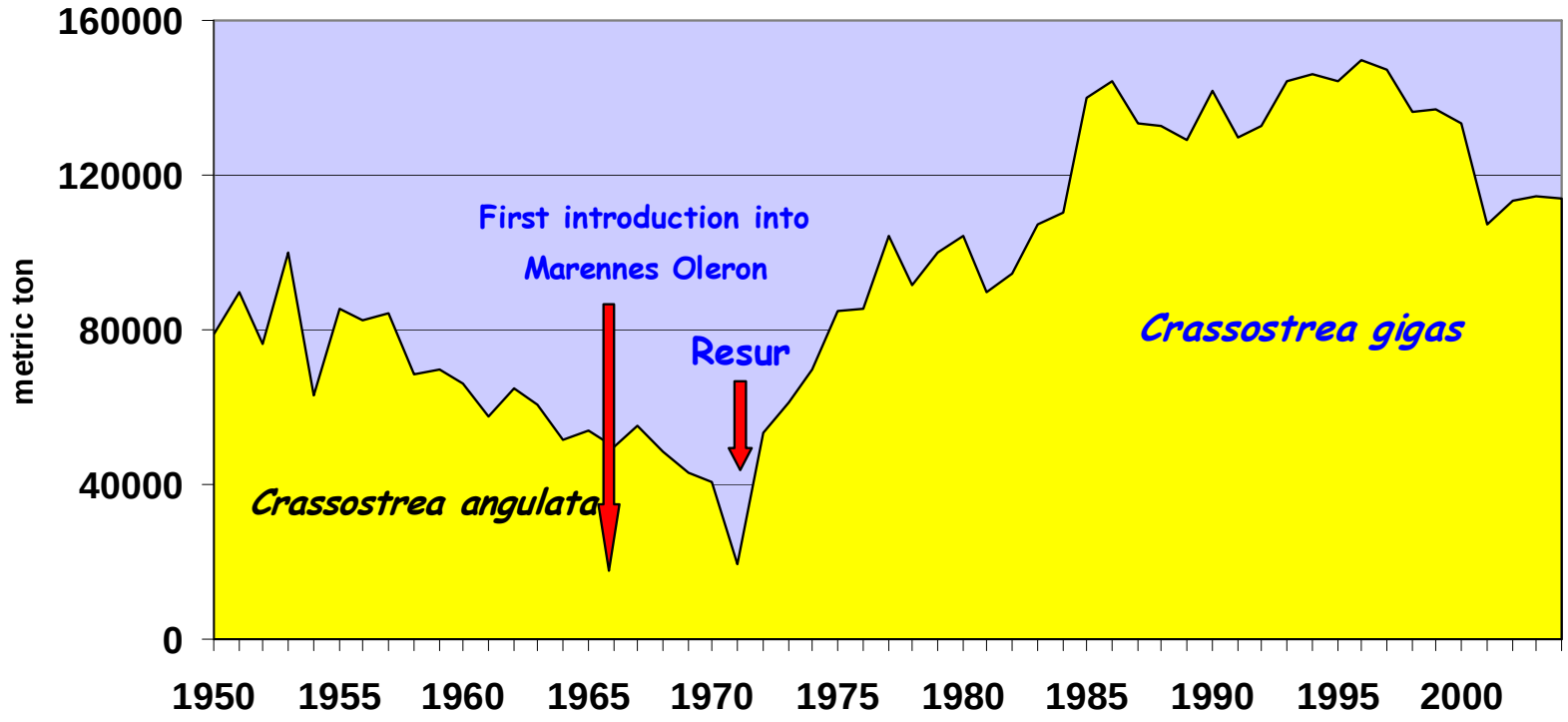
Introduction of *Crassostrea gigas* worldwide for aquaculture

(FAO, 2007 – Ruesink et al, 2005)

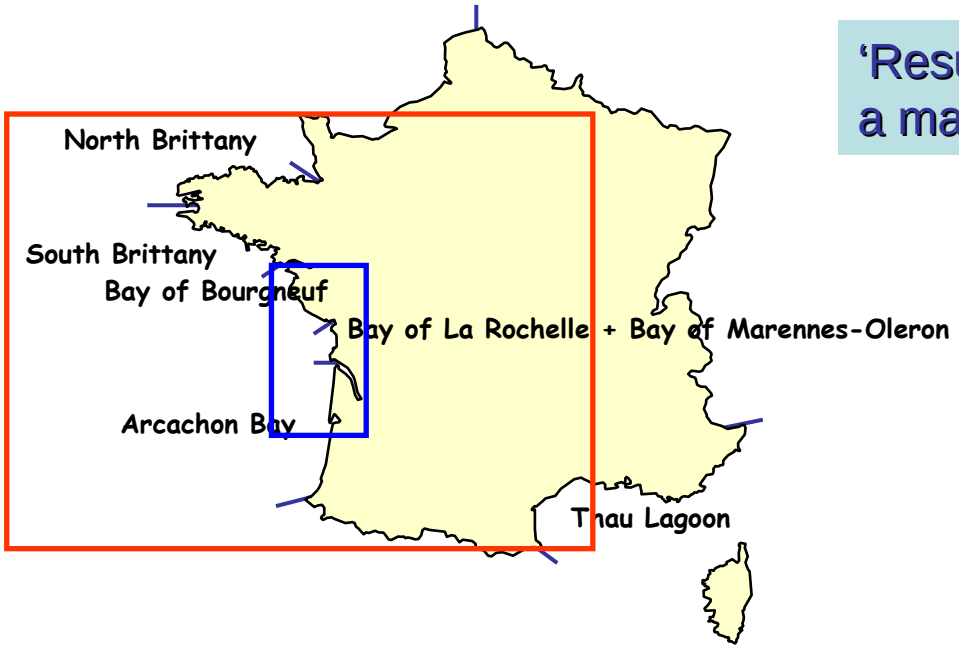
World aquaculture production of *Crassostrea gigas* in 2004 (FAO, 2005)

4.43 million tons

French production of cupped oyster (in tons) 1950 - 2004



From FAO, 2005



'Resur' campaign: a massive introduction

Adults

562 t of *C. gigas* from British Columbia (Canada) between 1971 and 1975

Spat

More than 5 billion spats from Japan between 1971 and 1977

A successful introduction

✓ *C. gigas* established successfully

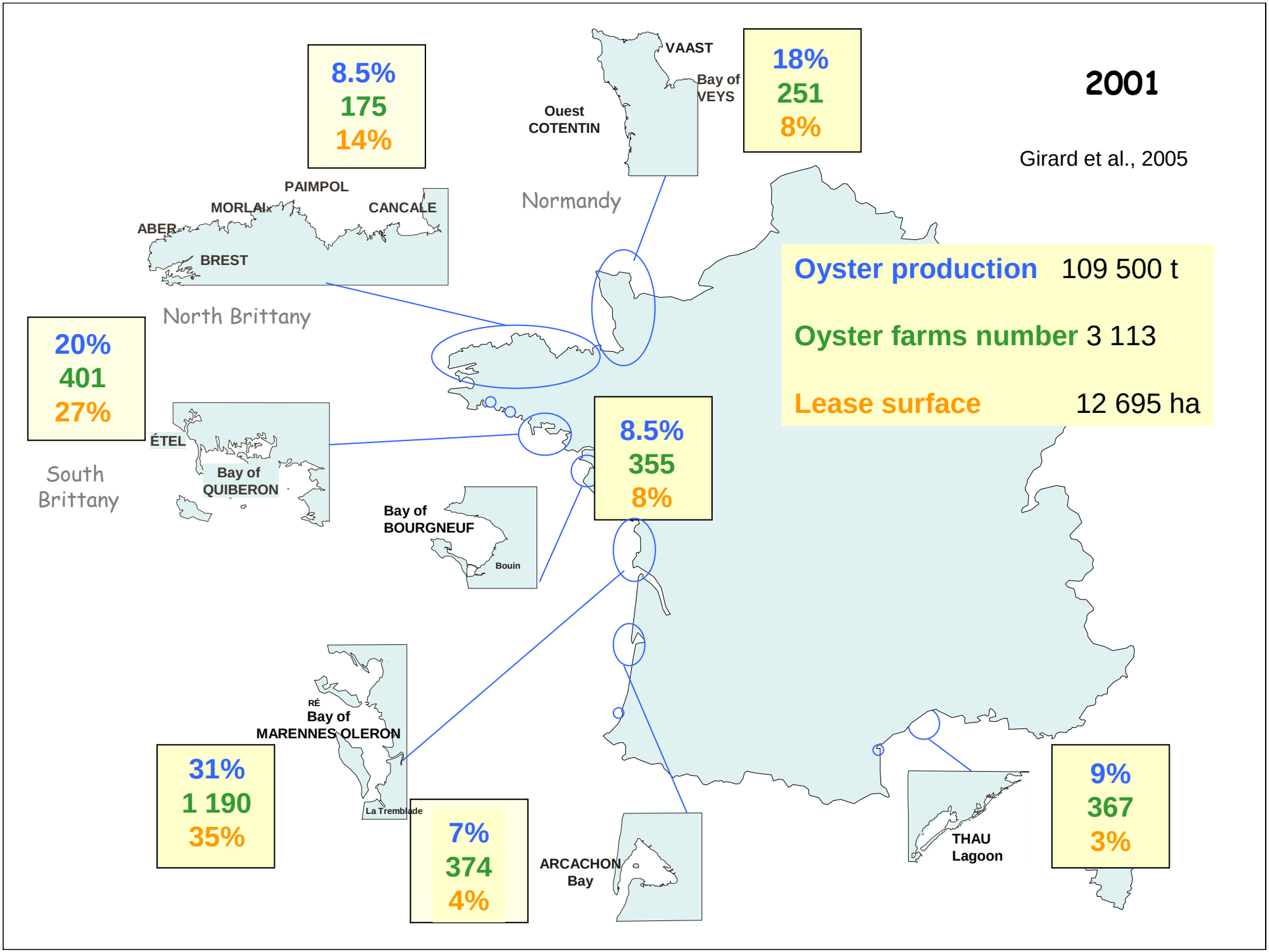
As soon as 1975 natural spat from Arcachon Bay and Bay of Marennes-Oléron was sufficient to sustain the French oyster production

✓ The national production increased quickly, reaching 100 000 tons in 1979

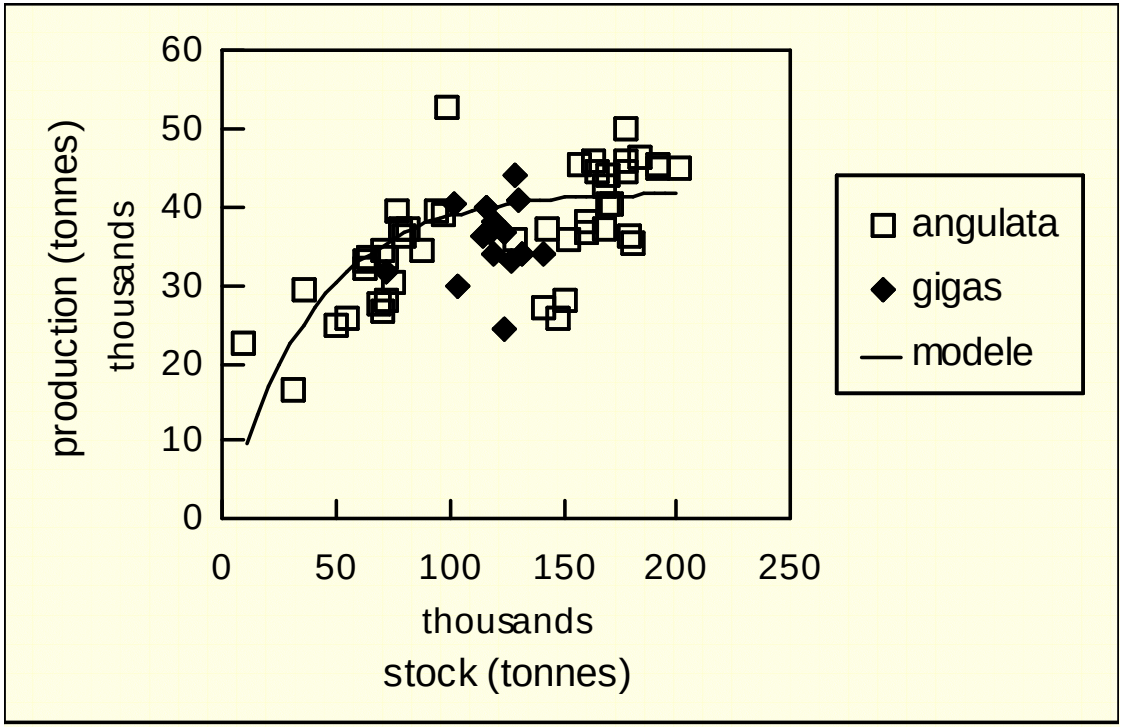
Years	1960	1970	1971	1972	1973	1975
Crassostrea angulata	65 900	40 300				
Crassostrea gigas			18 800	53 900	61 100	85 000

Grizel et Héral, 1991

✓ Since 1980's stable oyster production between 100 000 and 140 000 tons/year

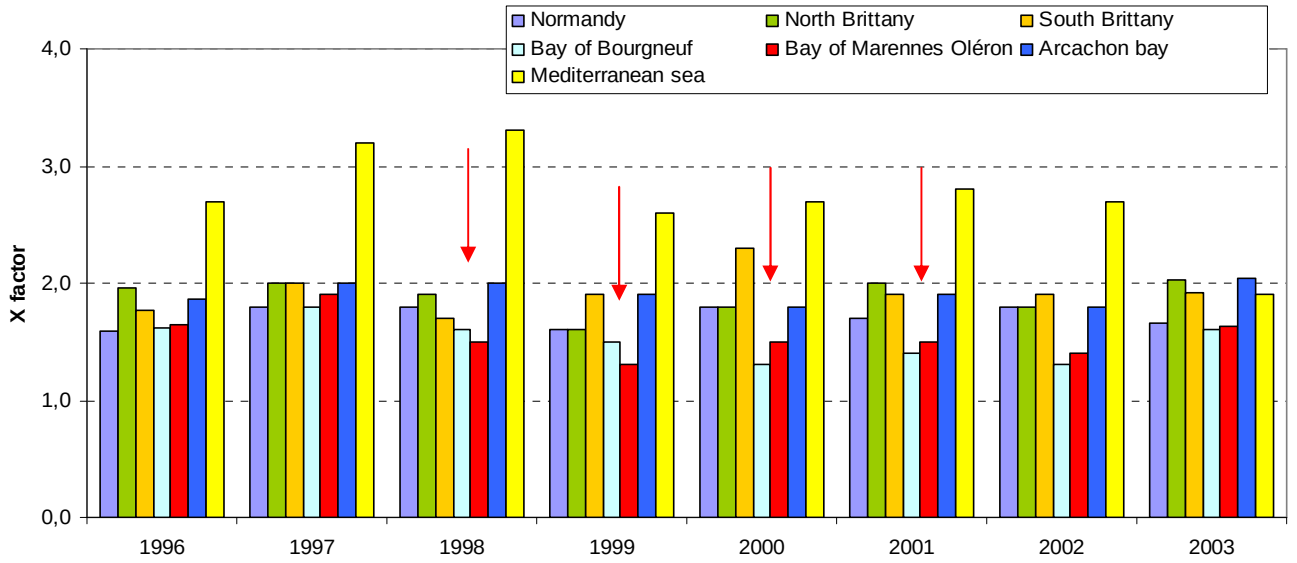

2001
Girard et al., 2005
Oyster production 109 500 t
Oyster farms number 3 113
Lease surface 12 695 ha
8.5%
175
14%
PAIMPOL
MORLAIX
CANCALE
ABER
BREST
North Brittany
20%
401
27%
ÉTEL
Bay of
QUIBERON
South
Brittany
VAAST
Bay of
VEYS
Ouest
COTENTIN
18%
251
8%
Normandy
8.5%
355
8%
Bay of
BOURGNEUF
Bouin
RÉ
Bay of
MARENNES-OLERON
La Tremblade
31%
1 190
35%
7%
374
4%
ARCACHON
Bay
THAU
Lagoon
9%
367
3%

Reduction of growth performance in Marennes Oléron Bay



From Héral, 1986

✓ Maximum production capacity of the Bay: 40 000 tons due to limited trophic capacity of the bay



Rearing efficiency according to the different French production areas (REMORA, Ifremer data)

Limited growth performances of the Bay of **Marennes Oléron** compared to others shellfish areas as

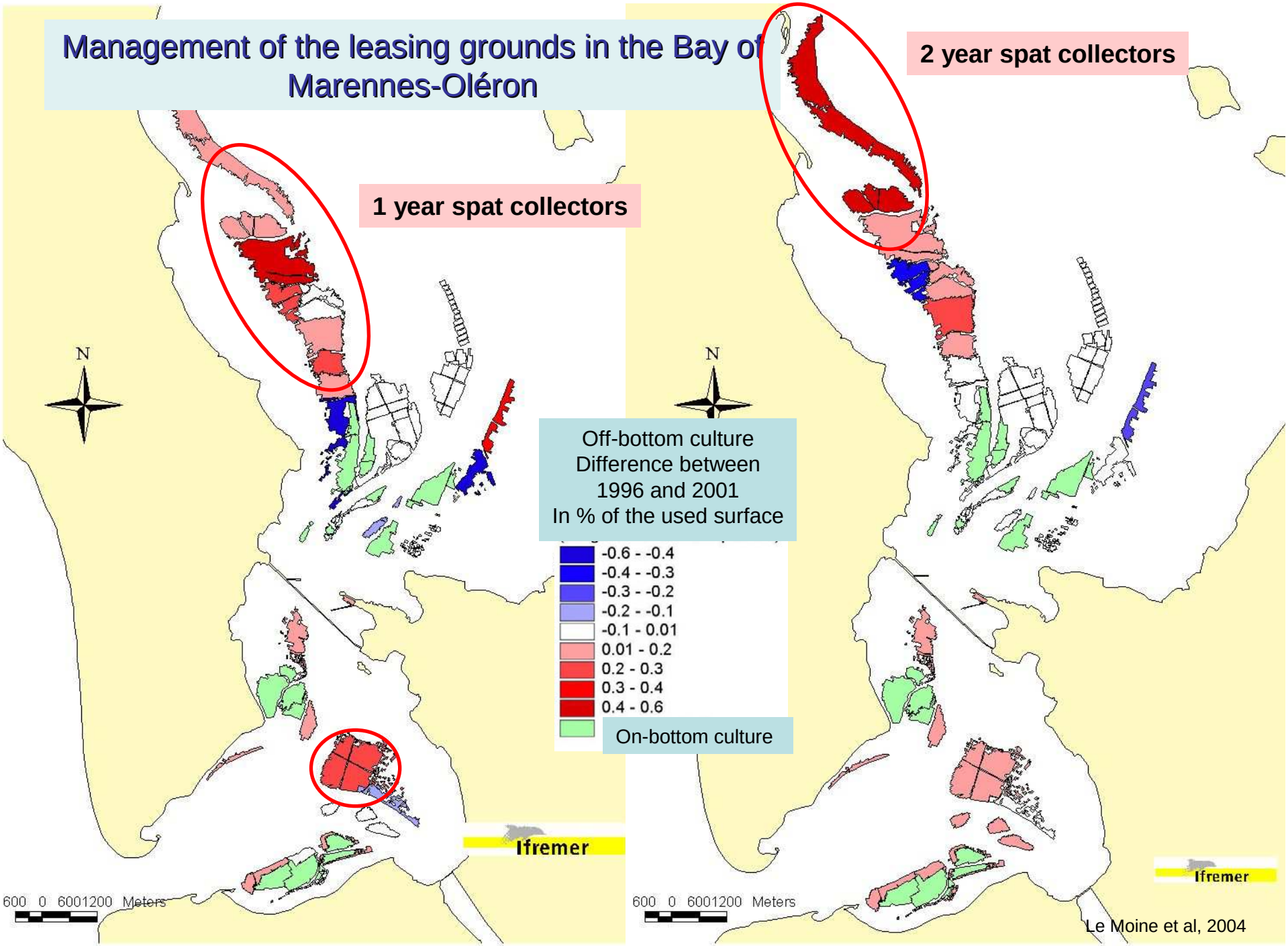
- **Normandy**
- **North Brittany**
- **South Brittany**

where large lease areas are available

Modifications of the cultural practices in the bay of Marennes Oléron

- ✓ Management of the stock
- ✓ Transfer: economic growth strategy relies on multi-localisation

Management of the leasing grounds in the Bay of Marennes-Oléron

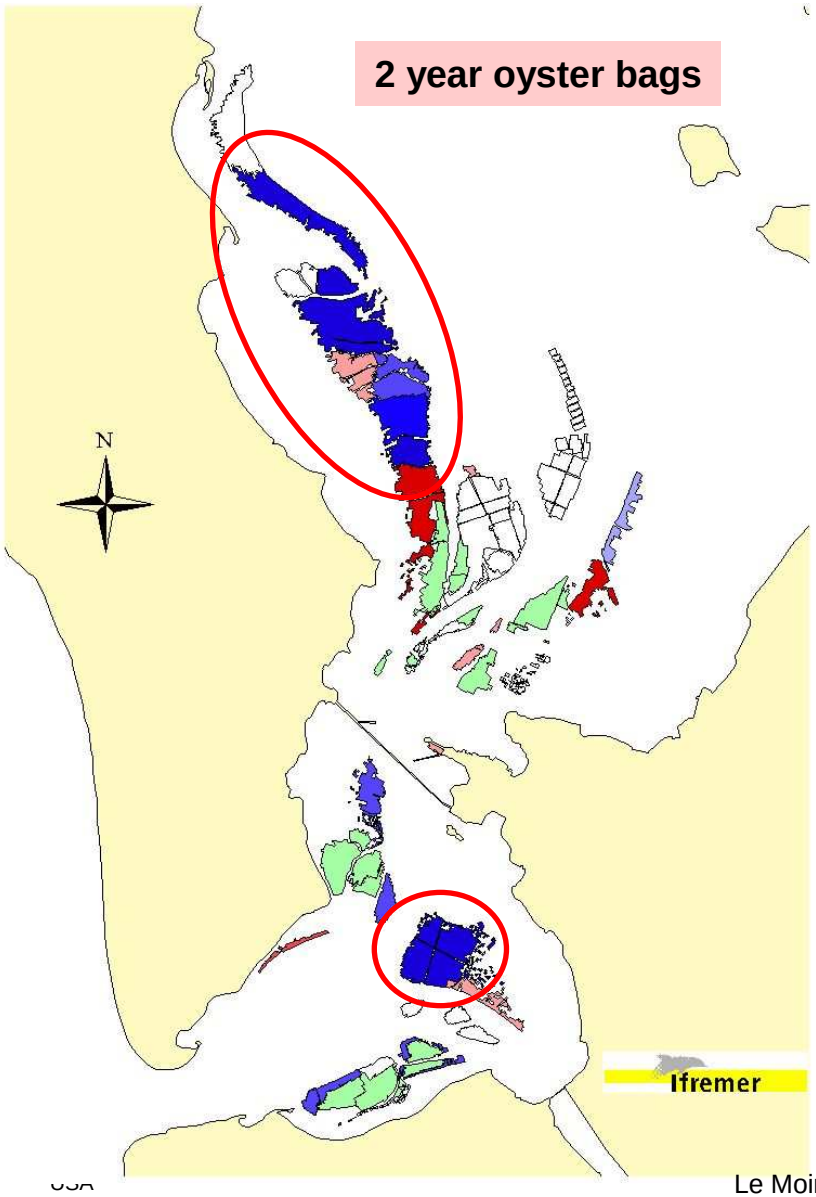


Le Moine et al, 2004

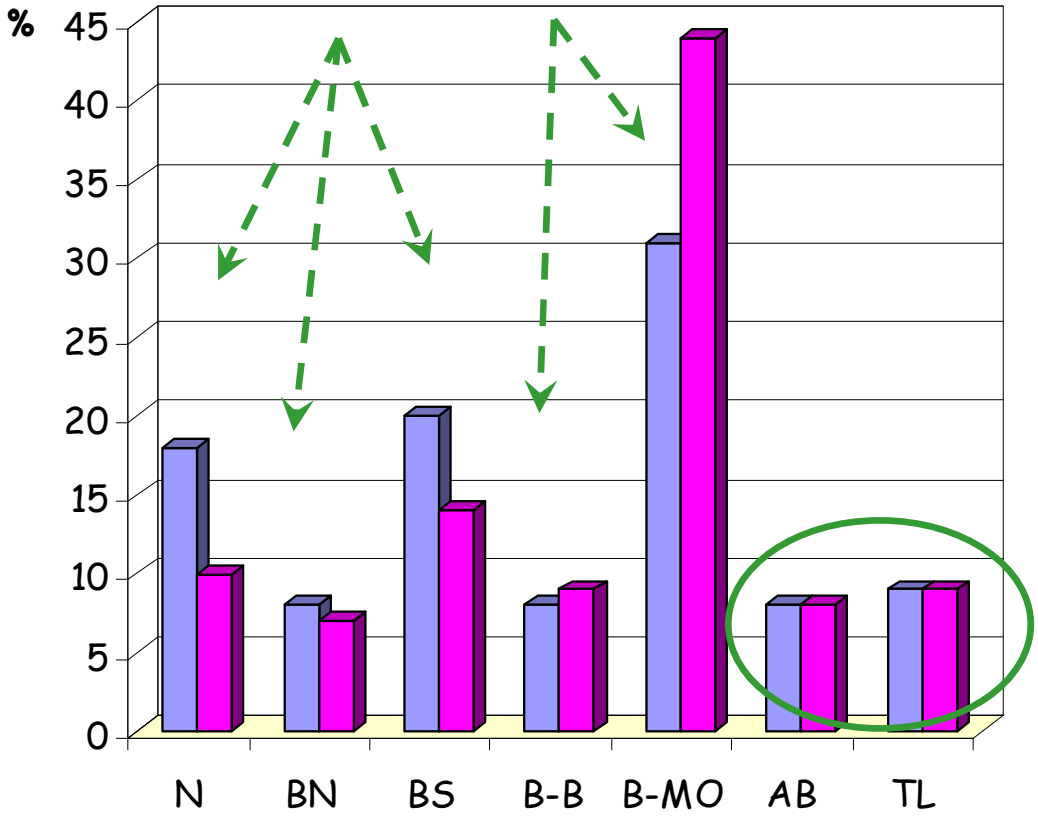
Management of the leasing grounds in the Bay of Marennes-Oléron

Off-bottom culture
Difference between
1996 and 2001
In % of the used surface

- -0.6 - -0.4
- -0.4 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.01
- 0.01 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.6
- On-bottom culture



Le Moine et al, 2004



Production
Commercialisation

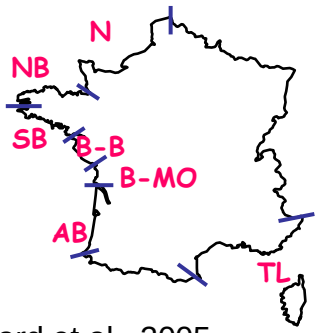
Transfers

N Normandy
NB North Brittany
SB South Brittany
B-B Bay of Bourgneuf
B-MO Bay of Marennes-Oléron
AB Arcachon Bay
TL Thau Lagoon

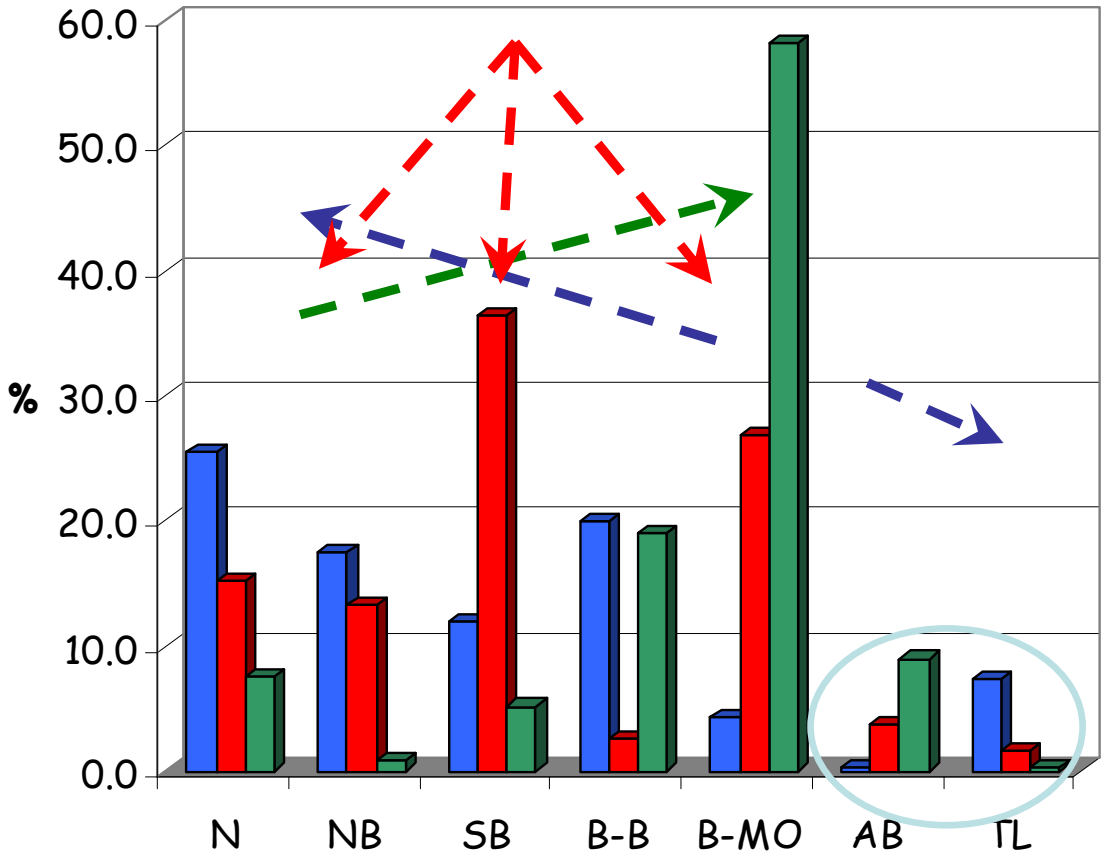
Oyster production and marketing in the different French growing areas in 2001

Oyster production: 109 500 tons

Oyster marketing: 107 400 tons



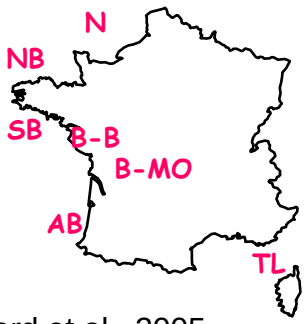
Girard et al., 2005



Transfers

N Normandy
NB North Brittany
SB South Brittany
B-B Bay of Bourgneuf
B-MO Bay of Marennes-Oléron
AB Arcachon Bay
TL Thau Lagoon

Oyster transfers among oyster rearing areas at different developmental stages (receiving areas) in 2001



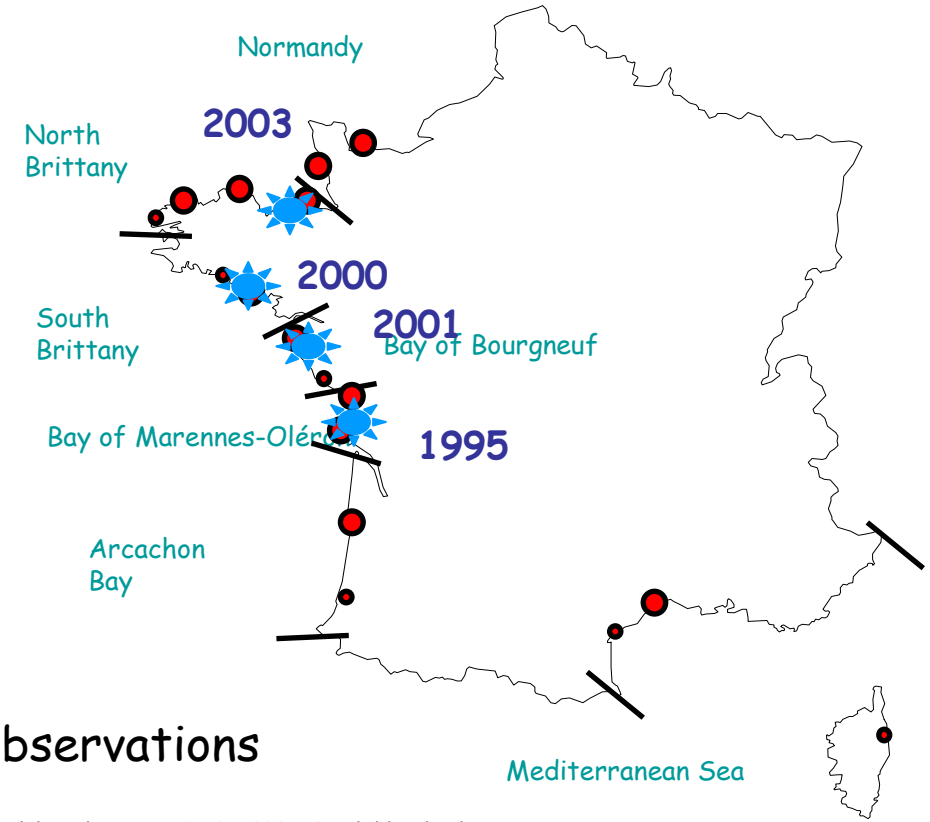
Girard et al., 2005

Transfers: a pathway for non-indigenous introduction

Ocinebrellus inornatus first detection in 1995 in Marennes Oleron Bay

Recent results demonstrated the major role of oyster importation as vector of the exotic species *Ocinebrellus inornatus* from North America into France and its expansion along the French Atlantic coastline due to cultural practices

Martel et al, 2004



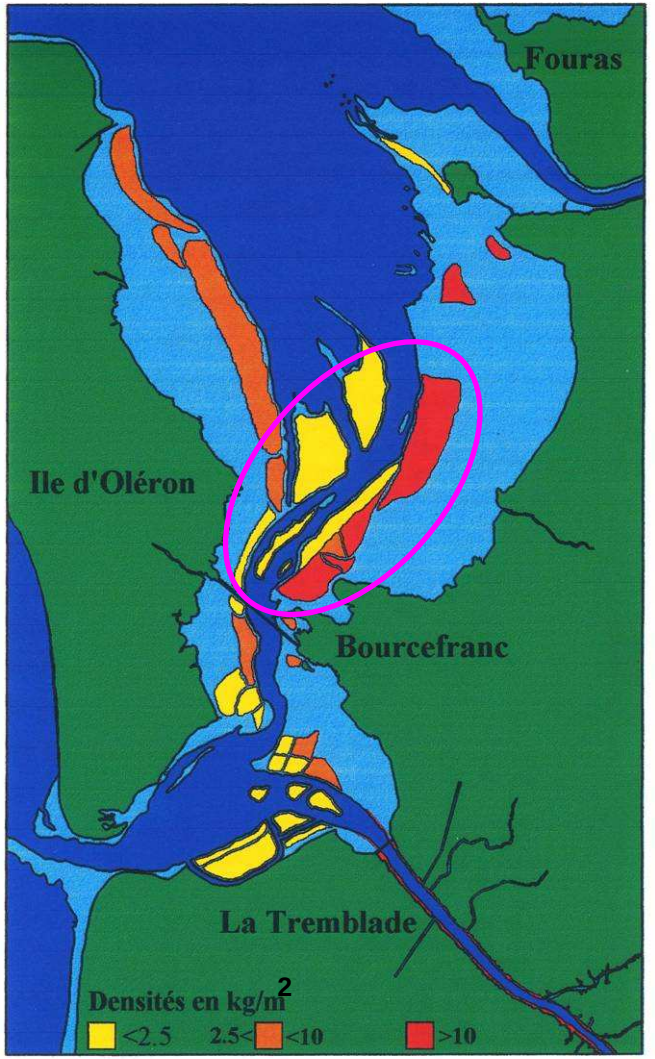
Ocinebrellus inornatus observations

Poor management of the rearing area

Natural development of wild stocks in natural beds and unused or abandoned leasing grounds

In 1993

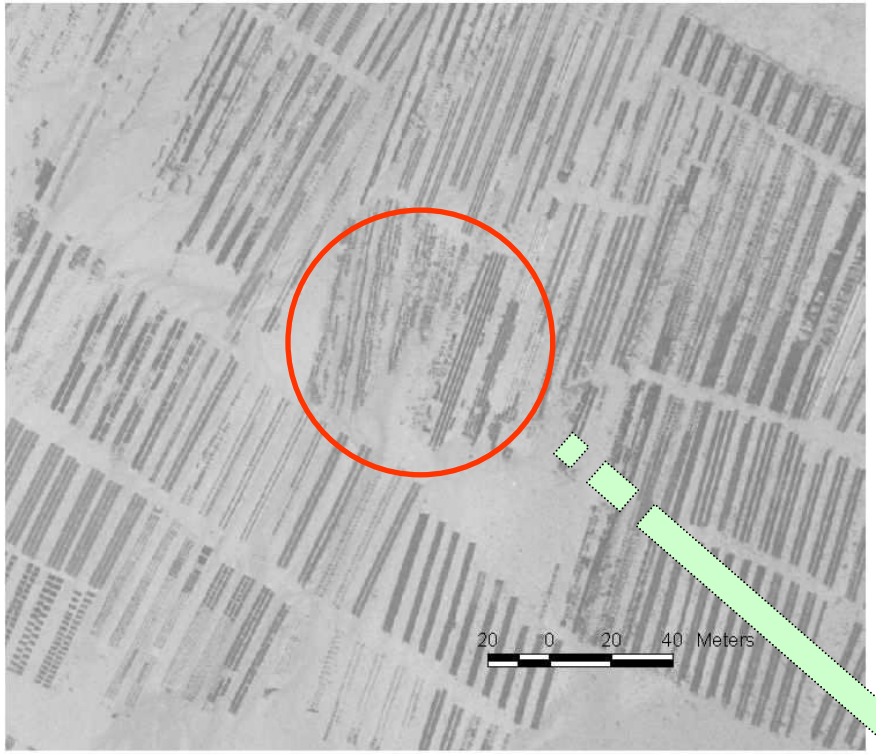
Cultivated oysters:	95 000 t
Wild abandoned oysters	20 000 t
Wild natural beds	3 000 t



Wild stock of *Crassostrea gigas*:

- ✓ a trophic competitor for Pacific oyster culture in the Bay of Marennes-Oléron
- ✓ a natural barrier reducing local currentology

Prou et al., 1994



Unused or abandoned leasing grounds in the Bay of Marennes-Oléron

Shellfish wastelands in the Bay of Marennes-Oléron

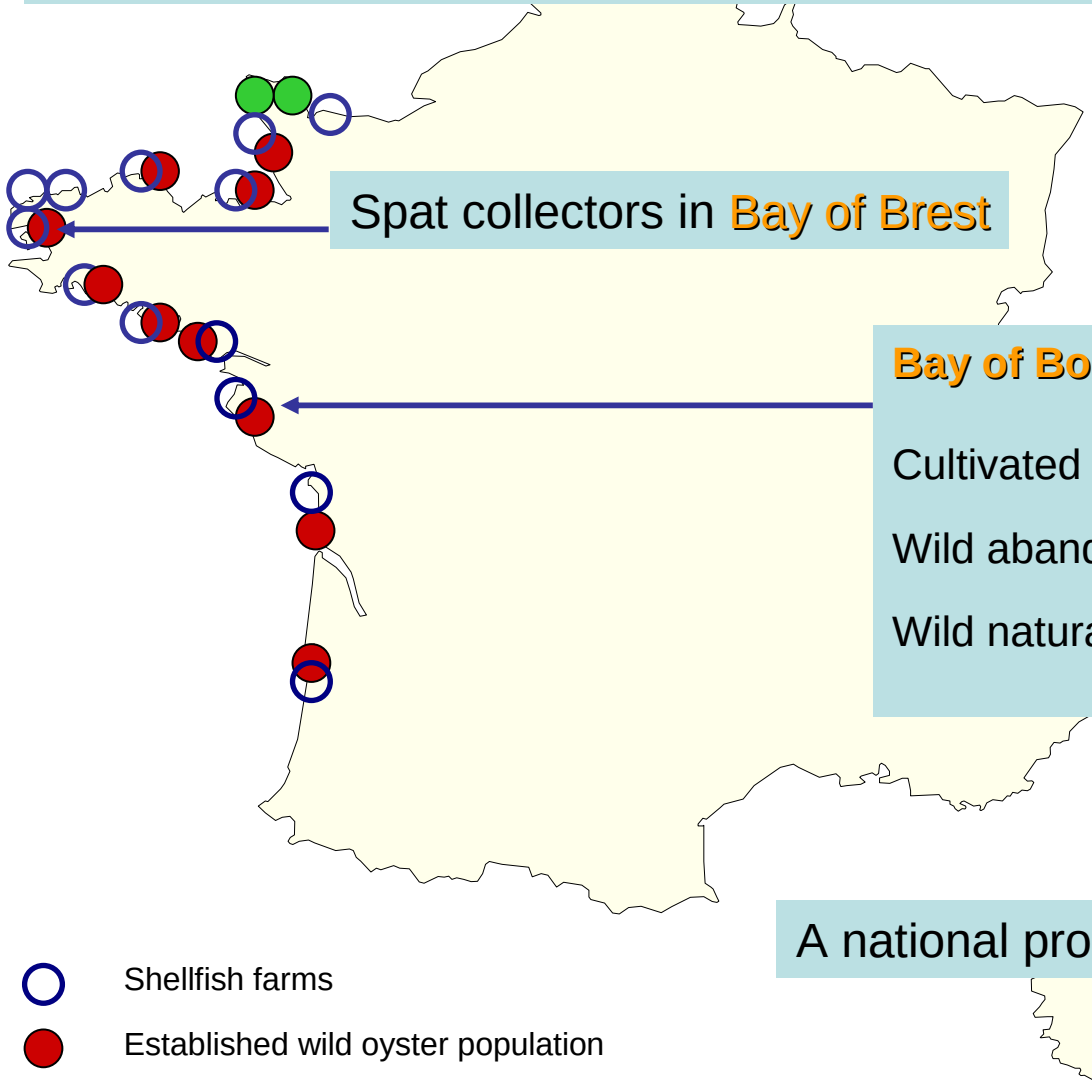
Restructuring the leasing ground

Cleaning and restructuring the leasing grounds of the Bay of Marennes-Oléron including:

- ✓ collecting abandoned shellfish gear (racks, concrete sticks,…)
- ✓ destruction of wild oyster beds
- ✓ gathering slimper limpets and oyster drillers
- ✓ quarrying of stones, sand and mud

In 2004, 600 ha cleaned for a cost of 610 keuro

Natural expansion of the Pacific oyster along the French Atlantic coast
due to global warming



Spat collectors in Bay of Brest

Bay of Bourgneuf

Cultivated oysters:	46 000 t
Wild abandoned oysters	18 700 t
Wild natural beds	9 800 t

Martin et al, 2005

A national programme **PROGIG**

- Shellfish farms
- Established wild oyster population
- Non permanent wild oyster population

From Hily, Lejart, 2006

Conclusions

✓ A beneficial introduction of the Pacific oyster for the French shellfish industry

✓ Good breeding and growth capacity with consequences on shellfish area management and cultural practices

✓ From invited guest in Europe in the 70's to invasive guest in the late 90's

- An invited guest with some hitchhikers
- An invasive guest with high capacity of colonization in France and in Europe (UK, Germany, Netherlands and Scandinavia)

Need for comprehensive rules regarding introductions, transfers and containment of aquatic organisms in aquaculture

Acknowledgements

Olivier Le Moine (Ifremer- La Tremblade)
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Laurent Champeau and Francis Bedis (SRC Marennes-Oléron)

Thank you for your attention

Ifremer - L. Coïc