First results of an epidemiological study on oyster (*Crassostrea gigas*) mortality events in France during summer 2008

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Introduction

French oyster production: between 110 000 and 130 000 tons/year

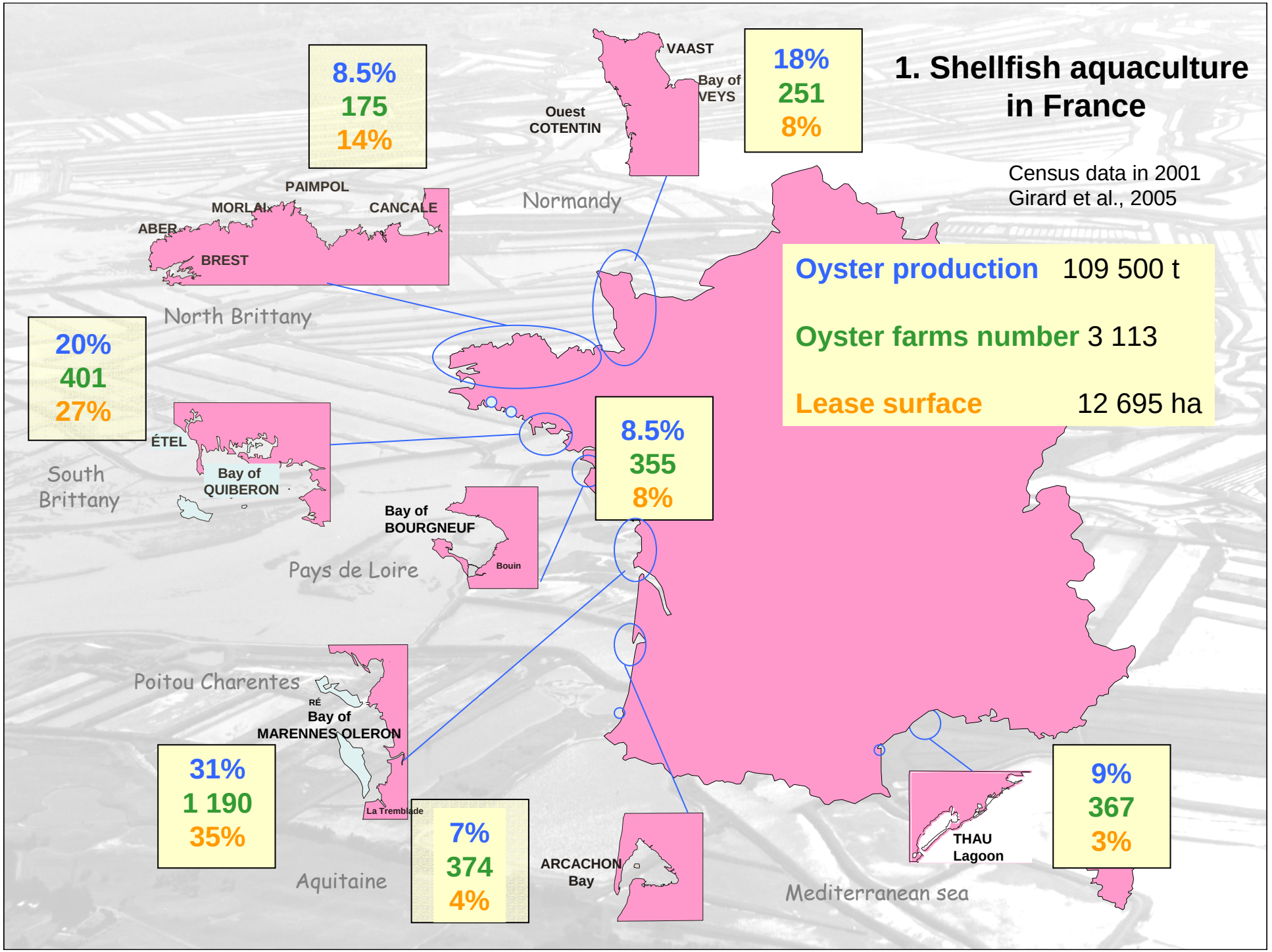
→ **first production in Europe**

Some characteristics of this production

- ✓ **Multiple growing areas**
- ✓ **Spat production: mainly natural production**

  (70% *versus* 30% from hatcheries)
- ✓ **Lot of oyster movements for spat supply, yield optimisation and commercial purposes**

Periodical mass mortality observed in France since the end of 70s due to multiple factors (T°C, physiological stress, aquaculture practices, pathogens, pollutants, phytoplanctonic toxins…)


1. Shellfish aquaculture in France
Census data in 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
Pays de Loire
Poitou Charentes
RÉ
Bay of MARENNES OLERON
La Tremblade
31%
1 190
35%
7%
374
4%
ARCACHON Bay
Aquitaine
THAU Lagoon
9%
367
3%
Mediterranean sea

Context in 2008

Exceptional mass mortality affecting 6 to 18 month old juveniles of *Crassostrea gigas*, observed simultaneously in all French growing areas in June-July 2008

First analyses

- ✓ **No notifiable pathogen detected**
- ✓ **OsHV-1 and V*ibrio species* frequently detected and together in some samples**
- ✓ **Suspected associated environmental parameters: mild winter, rainy spring, rapid temperatures increase in May, local toxic algal blooms for marine life**

Aim of the epidemiological study:

Describe the phenomenon, identify associated factors and the cause (or causes) of these mortalities

An investigation in 2 parts

- ✓ **A descriptive study**
- ✓ **An analytical study**

Objective of this talk:

To present the results of the descriptive part of this investigation

Objectives of the descriptive epidemiological study

- ✓ To describe the pattern of mortalities in time and space
- ✓ To identify the affected population

Methods

1. Data collection

✓ Mortality notifications collected through the departmental Offices of Maritime Affairs (local competent authority) and the regional mollusc producer bodies between January and September 2008

✓ Data from regional surveys to evaluate farmers losses

✓ National and regional surveillance network data

* REPAMO (Ifremer)
* REMORA (Ifremer)
* networks developed by local technical organisations of shellfish farmers in Marennes Oleron area and in Normandy

2. Database

1 notification = 1 site (lease) + dates (mortality observation, duration) + percentage of mortality + age + origin (spat) + zoo technical data

2. Database (following)

Coded data:

Age

1 : Spat (≤ 12 months)
2 : Juveniles (>12 – ≤ 24 months)
3 : Adults (> 24 months)

Spat origin

1 : Natural spat
2 : Hatchery spat

Temporal unit

Period = tidal cycle LT-HT (around 15 days)

- Date of notification
- Mortality date
- Observation date
- Period of mortality

Period of time

mois	jour	coef	période
	28	54	
JUIN	29	57	
	30	63	
	1	72	
	2	82	
	3	90	n°11
	4	95	
	5	96	
	6	93	
	7	86	
	8	76	
	9	[illegible]	
	10	53	
	11		
	12	40	
JUILLET	13	37	
	14	40	
	15	47	n°12
	16	55	
	17	63	
	18	70	
	19	76	
	20	80	
	21	82	
	22	81	
	23	78	
	24	72	
	25	[illegible]	
	26	57	
	27	53	

Spatial unit

Oyster leases with geographic coordinates

3. Map-based analysis using Arcview 9.2 with lease coordinates

First results

2. Distribution of data according to the shellfish areas

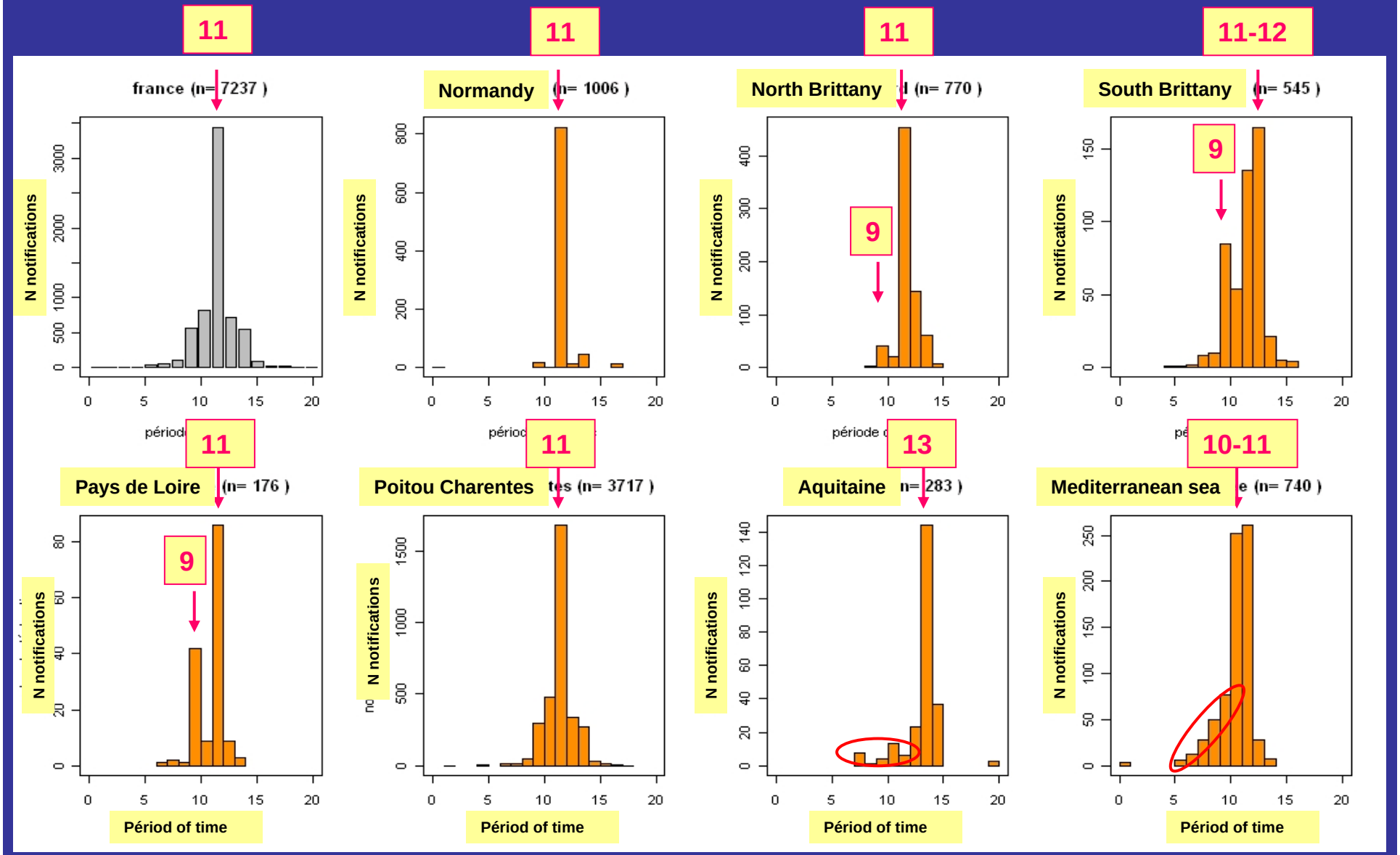
A database with **7237 mortality data (notifications + networks)**

Shellfish areas	Local competent authority data (Notifications)	Regional producer bodies	Other sources (national and regional surveillance networks)	Total	N oyster farms (2008 – CNC data)
Normandy	100	775	131	1006	353
North Brittany	125	642	3	770	468
South Brittany	161	351	33	545	714
Pays de Loire	77	36	63	176	405
Poitou Charentes	3612	0	105	3717	1273
Aquitaine	109	157	17	283	455
Mediterranean sea	723	0	17	740	494
Total	4907	1961	369	7237	4162

Hypothesis: if **mortality notification** of Japanese oyster, there is **mortality**

Case definition : batch of oysters (*Crassostrea gigas)* growing in French territory and impacted by mass mortality between January and September 2008

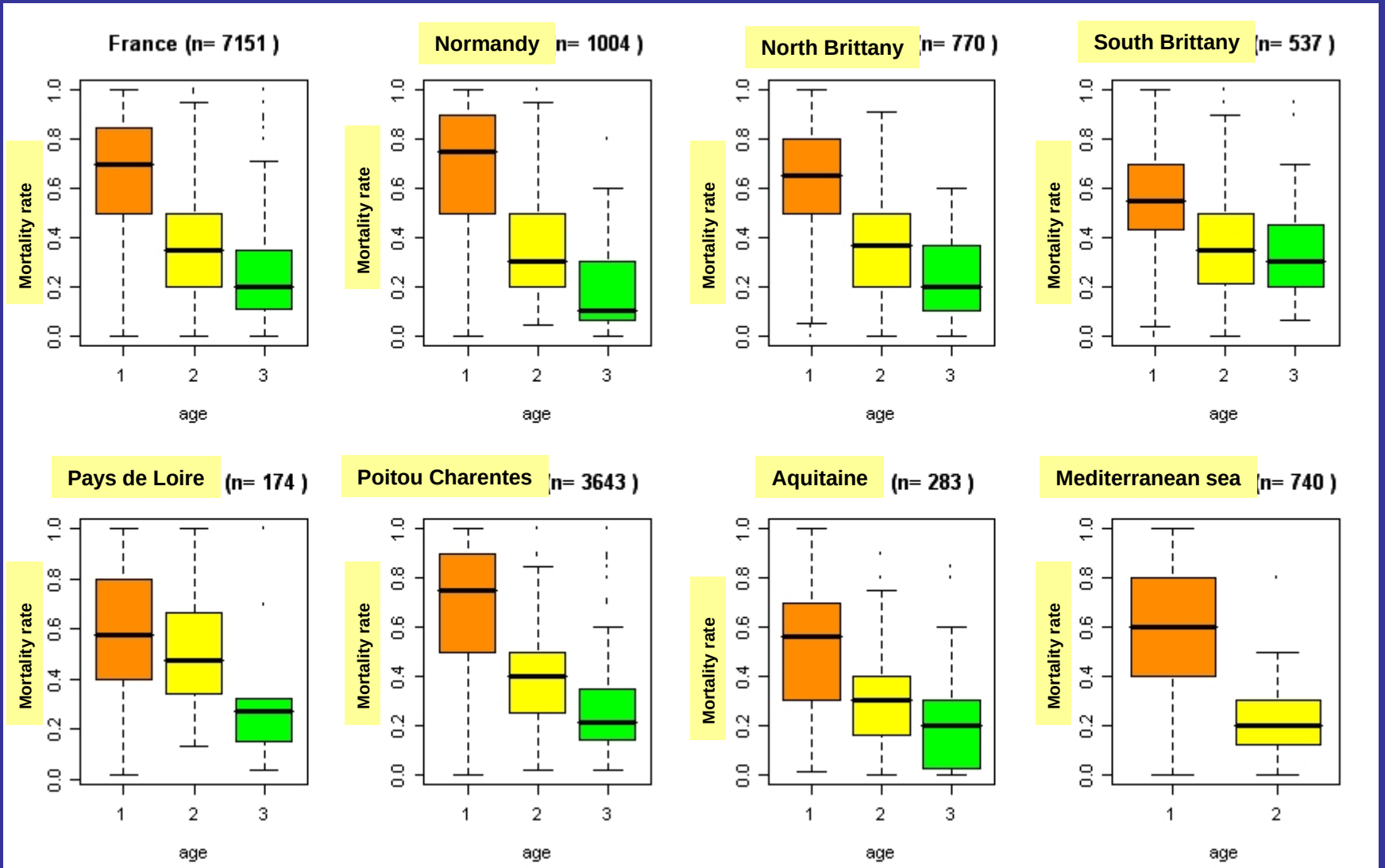
3. Temporal dynamics of mortality events in 2008



Notification frequency according to period of time (n=7237)

9: 24 May - 8 June
11 : 24 June – 8 july
12: 9 – 24 July
13: 25 July–7 August

3. Relationship with age (mortality rate)



Ages

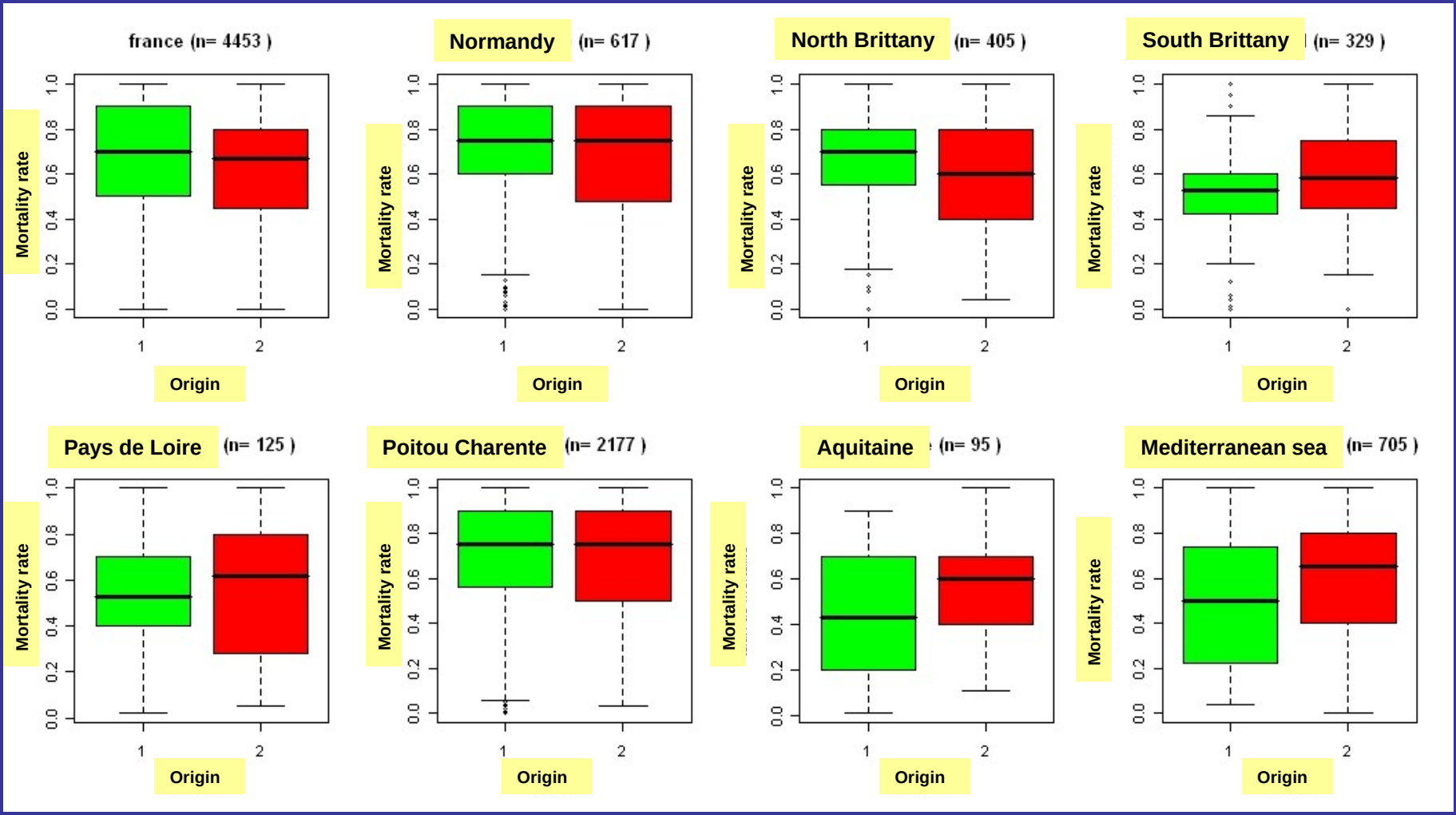
1 : Spat (≤ 12 months)

2 : Juveniles (>12 –≤24 months)

3 : Adults (> 24 months)

All ages impacted but mainly spat
Higher mortality in spat

4. Relationship with origin (mortality rate)



Origin

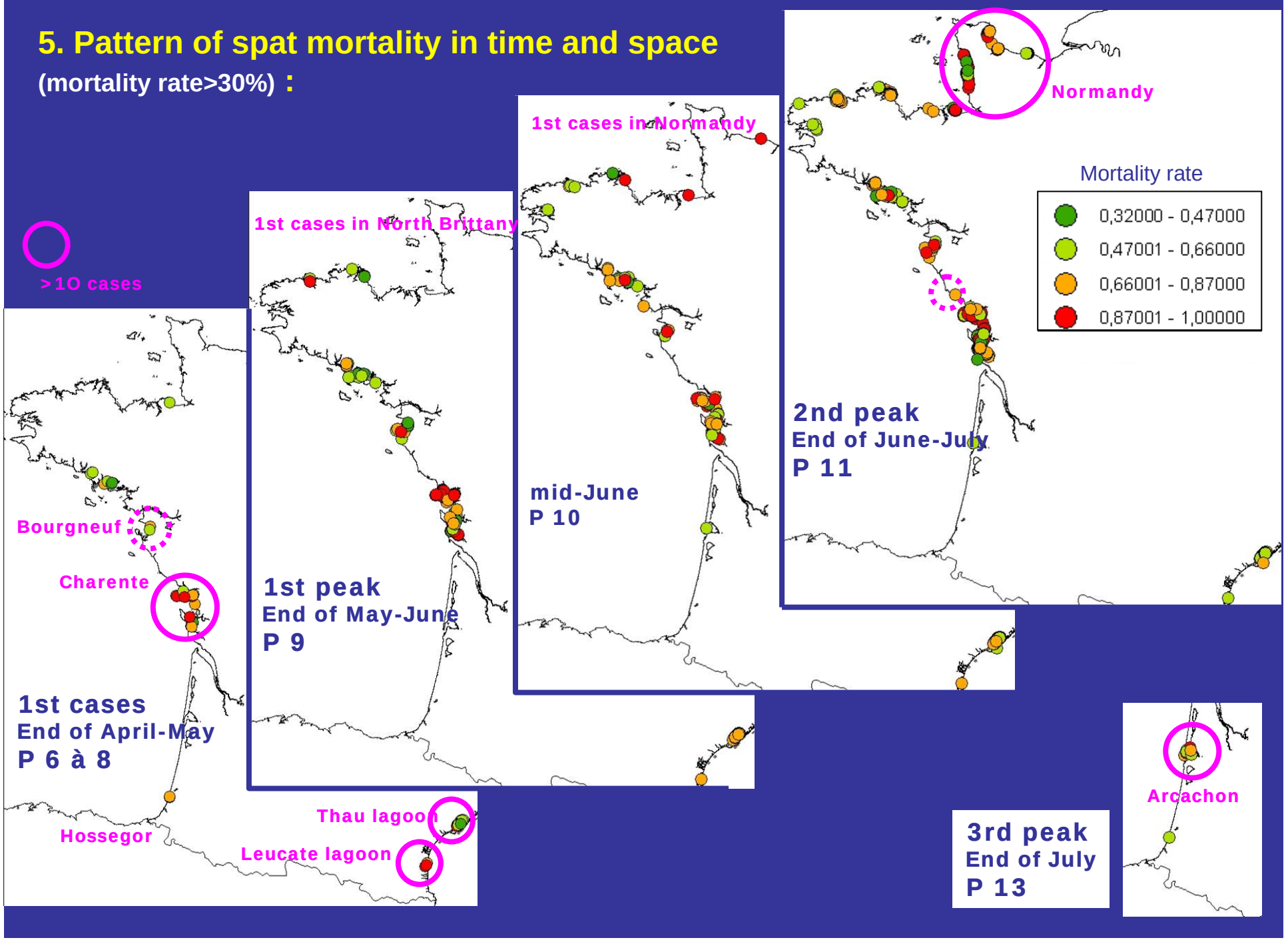
1 : Natural spat

2 : Hatchery

No difference regarding the spat origin

5. Pattern of spat mortality in time and space

(mortality rate>30%) :



Discussion

Pattern of mortalities in time and space

- ✓ First cases occured in April (Mediterranean sea and Atlantic coast)
- ✓ The first peak of mortality observed at the end of May-beginning of June
- ✓ The second peak, heavy and general, registered at the end of June (in Normandy, only the 2nd peak)
- ✓ Sporadic cases in August except in one area (Arcachon Bay)
- ✓ Few areas without loss (small areas with a limited number of oysters farmers, limited growing oysters and few movements of oysters)

Identification of the affected population

- ✓ All age classes are affected but mainly spat
- ✓ Higher level of mortality for spat
- ✓ Similar mortality rate between natural spat and hatchery spat

Limit and bias of the study

Study based on shellfish farmers notifications

- ✓ **Underreporting of mortality events**
- ✓ **First cases:**
  - **linked or not with the 2008 event?**
  - **Underreporting of the first cases if mortality rate was low**

Limited knowledge on the cultivated oysters population including associated cultural practices (density and transfers between shellfish growing areas)

- ✓ **Natural spat production *versus* hatchery spat production**
- ✓ **Half growing oyster production**
- ✓ **Adult growing oyster production**

Conclusions et perspectives

Conclusions

- First epidemiological study based on mortality notifications in France

- Results of the descriptive study are in accordance with observations in the field during summer 2008

- Needs of recording growing oysters production data including growing oysters density and movements for a better analyses of these data

Perspectives

Observational study

To estimate the quantitative effects of the various components causes that contribute to the occurrence of mortality

Risk factors (*cf* Morest, 2007)

Environmental parameters	Pathogens	Cultural practices
- Rain	OsHV-1	transfers
- Air T°C	*Vibrio*	Density
- Water T°C, salinity		Oyster bags bathymetry
- Toxic phytoplankton		
- Currents		

Acknowledgments

IFREMER laboratories situated along the coast

The departmental Offices of Maritime Affairs (local competent authority)

The regional mollusc producer bodies

Thank you for your attention