



Structure and adaptation of scallop populations along the European latitudinal gradient

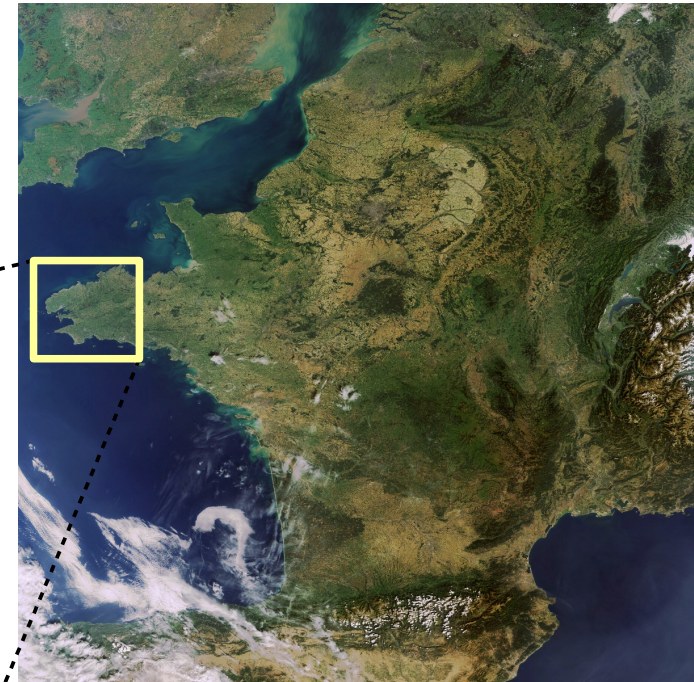
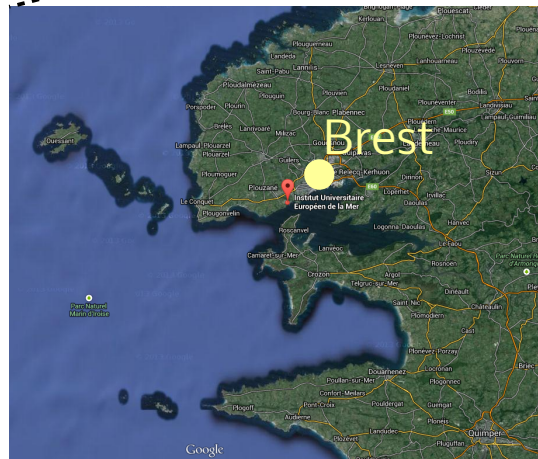
Introduction to research at LEMAR

G. Charrier, R. Morvezen, A. Jolivet, L. Chauvaud,
S. Artigaud, V. Pichereau, P. Boudry, J. Laroche

A few words about my new home...

Since September 2013

- Lecturer at the University of Western Brittany (UBO), Brest, France



- Research at the LEMAR laboratory : Mixed Research Unit (UMR 6539)



UBO, CNRS, Ifremer, IRD

A few words about my new home...

■ European University Institute for the Sea (IUEM)



- ✓ Multi-disciplinary institute gathering marine sciences

↳ From biology and geology to human and social sciences...

- ✓ Several research laboratories
- ✓ Several PhD and Master programs
- ✓ www.iuem.univ-brest.fr/en

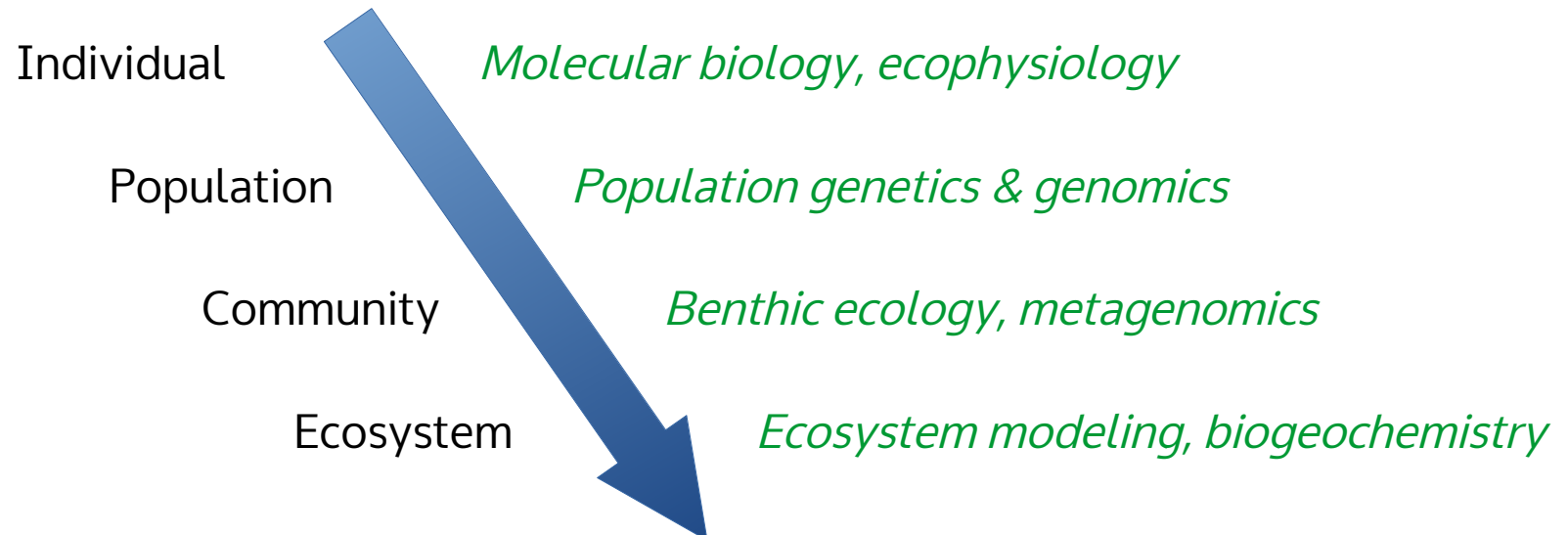


A few words about my new home...

- LEMAR (UMR 6539): Laboratory of Marine Environmental Sciences



- ✓ Multi-disciplinary laboratory focusing on multiple scales



- ✓ Researchs activities articulated around three teams

A few words about my new home...

■ Scientific questions addressed at LEMAR

✓ Team 1 : Responses of organisms to global changes: an integrative approach

- Acclimation of individuals to environmental stress
- Structure and adaptation of populations to environmental pressures

✓ Team 2: Biotic interactions and environmental variability

- Host-pathogen interactions
- Trophic interactions
- Chemical ecology

Preparing the new structure for 2017...

✓ Team 3: Ecosystem functioning

- Cycles of carbon, silicium...
- Physical oceanography

■ ~180 people: 70 permanent researchers, 35 post-docs, 45 PhD students and 40 technicians and engineers

A few words about my new home...

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- **Structure and adaptation of populations to environmental pressures**

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Preparing the new structure for 2017...

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- ### ■ ~180 people: 70 permanent researchers, 35 post-docs, 45 PhD students and 40 technicians and engineers

Responses of organisms to global changes: an integrative approach

HABITAT

Environmental pressures

INDIVIDUAL

Genotype

Phenotypic plasticity during the life-cycle

Acclimatation of individuals

Phenotype

Genetic diversity

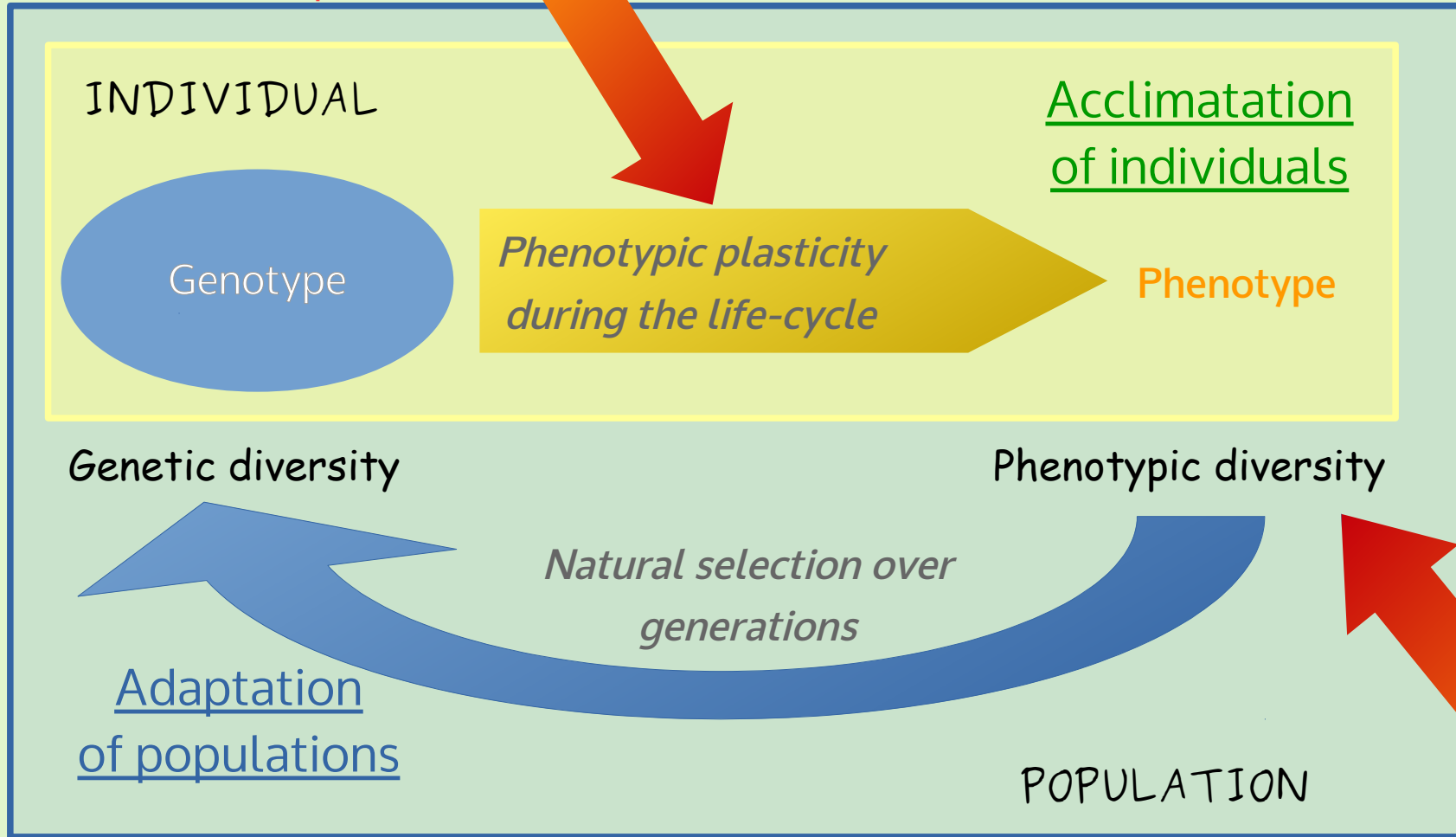
Phenotypic diversity

Natural selection over generations

Adaptation of populations

POPULATION

Environmental pressures



Structure and adaptation of marine populations

- Three main species of interest



Great scallop
(*Pecten maximus*)



Honeycomb worm
(*Sabellaria alveolata*)



European flounder
(*Platichthys flesus*)

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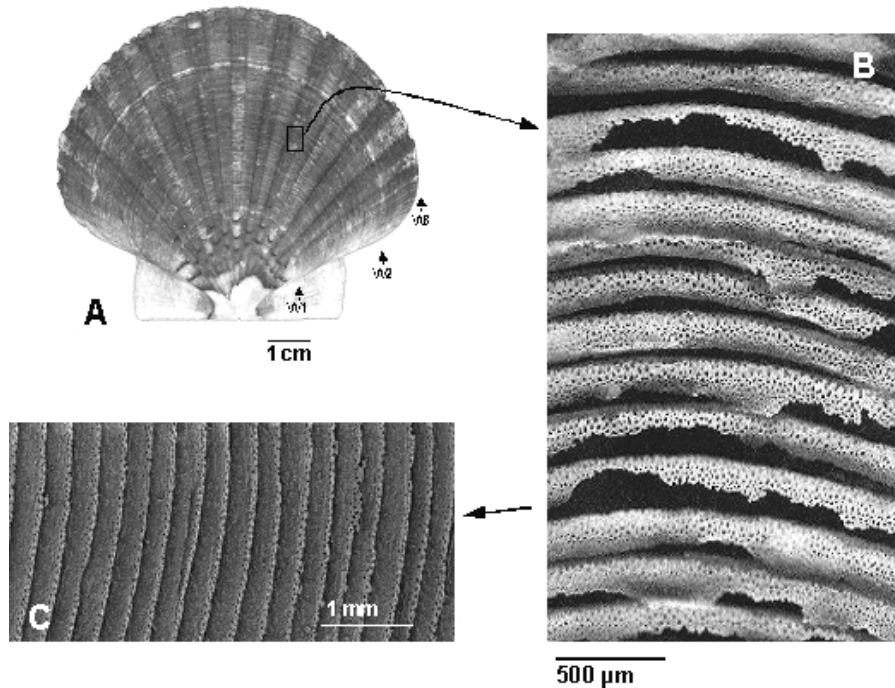
European flounder
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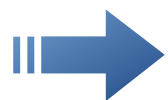
The great scallop in brief...



- Distribution over the whole latitudinal cline along the European coasts
- Daily shell growth = very fine phenotype integrated over the entire life of the individual



- Proxy for environmental variability: sclerochemistry (stable isotopes...)



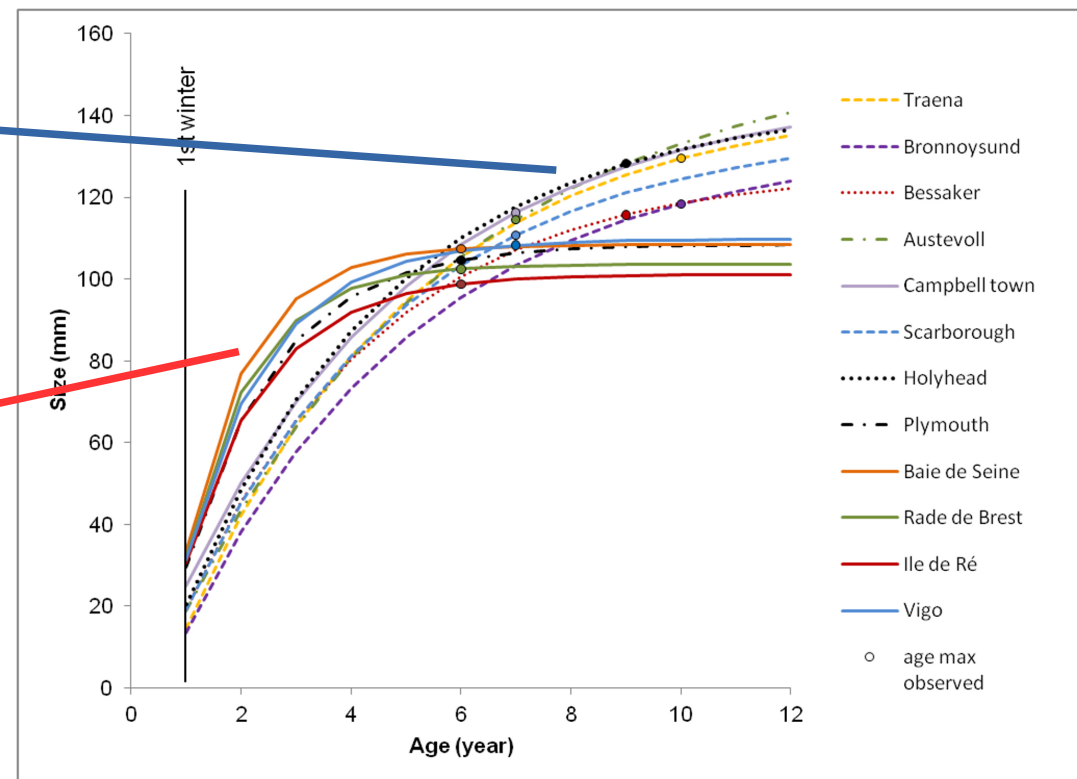
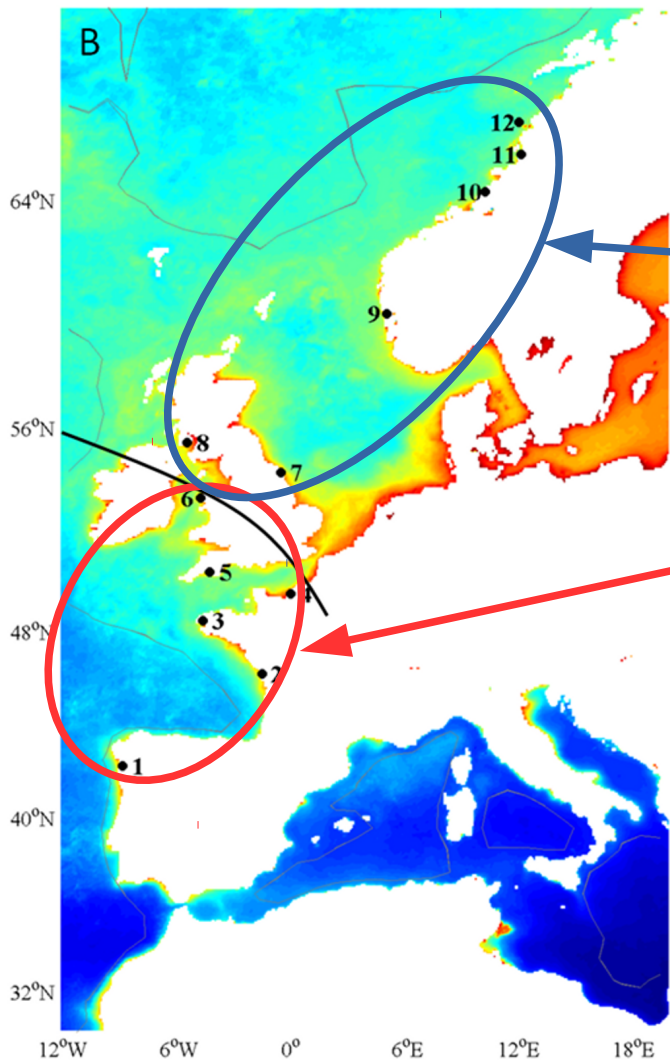
Very old expertise at LEMAR for the study of scallop shells

Phenotypic structure along the latitudinal gradient



■ Contrasted growth patterns between northern and southern populations

⇒ Plasticity or adaptation of populations?



Chauvaud L, Patry Y, Cam E, Jolivet A, Legoff C, Strand Ø, Charrier G, Thébault J, Lazure P, Clavier J (2012) *PLoS ONE* 7(5)

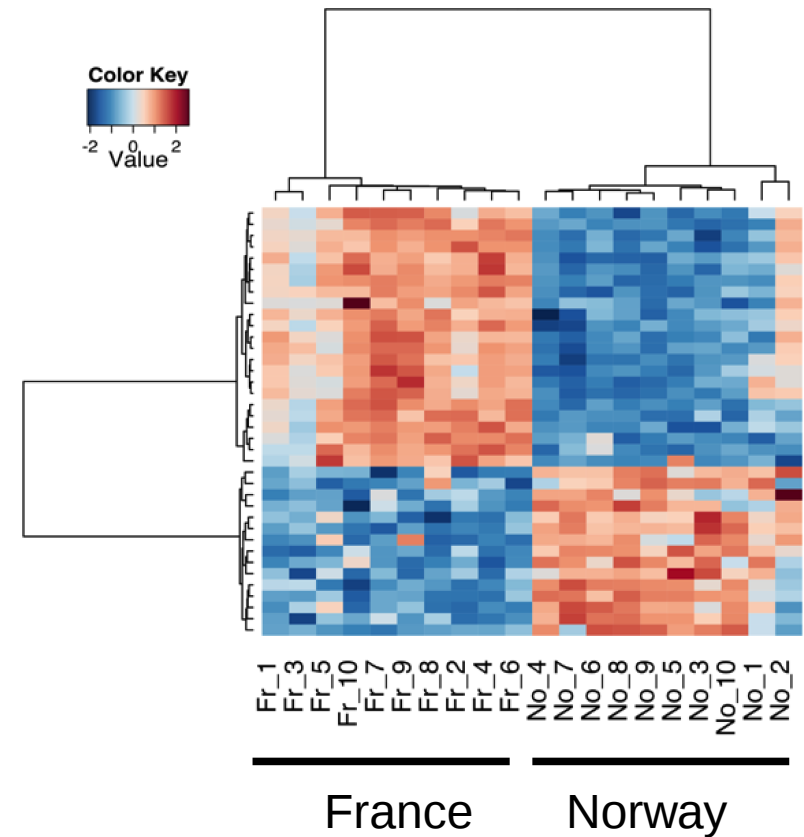
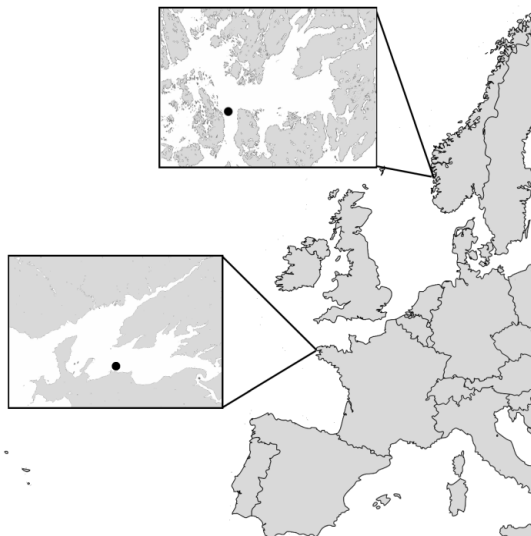
Phenotypic structure along the latitudinal gradient



■ Differentiation at the proteomic level

- ✓ 38 proteins differentially expressed
- ✓ 11 proteins identified: 8 actin isoforms, 2 filamin isoforms & elastase

➡ Important role of cytoskeleton in the response to contrasted environments

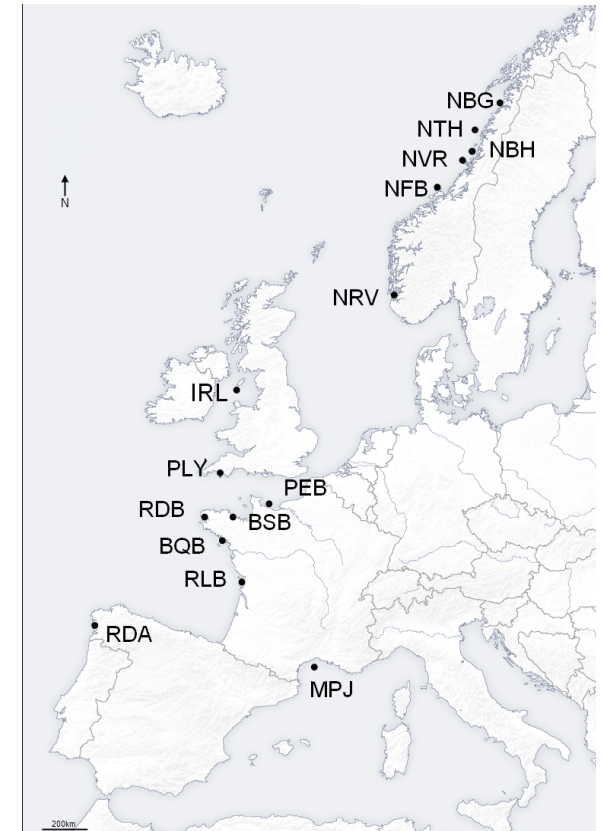


Artigaud S, Lavaud R, Thébault J, Jean F, Strand Ø, Strohmeier T, Milan M, Pichereau V (2014). Journal of Proteomics (2014) 105 : 164-173

Patterns of population genetic structure



- 12 microsatellites
- 14 populations of *P. maximus*
 - ↳ Whole distribution of the species
- 1 population of *P. jacobeus*



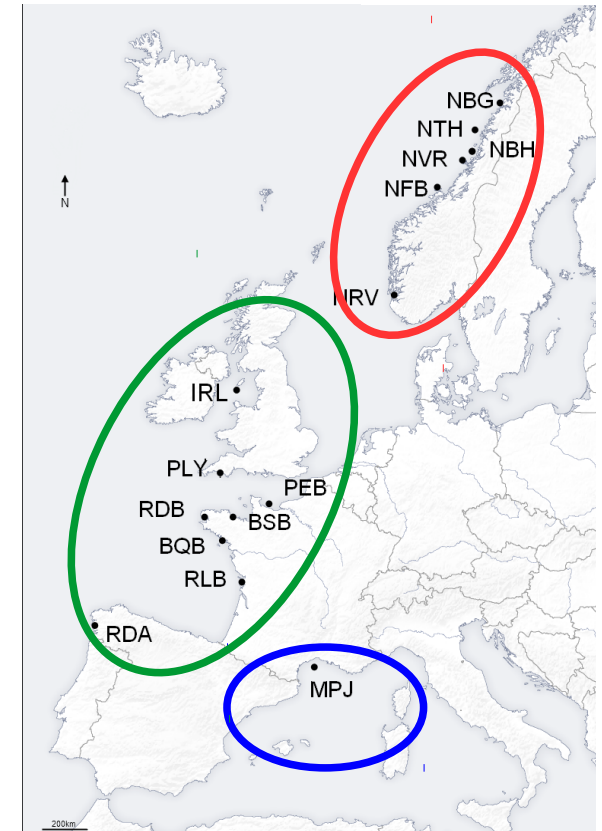
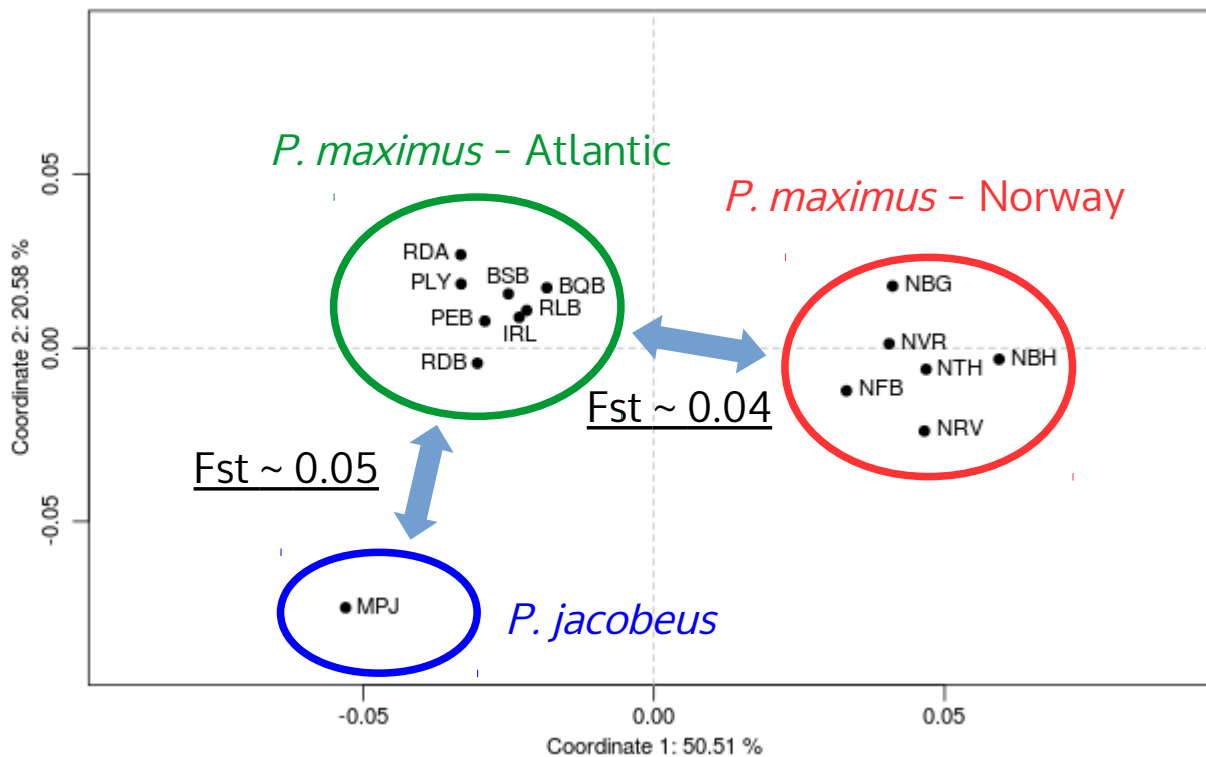
Morvezen R, Charrier G, Boudry P, Chauvaud L, Breton F, Strand Ø, Laroche J. Genetic structure of a commercially exploited bivalve, the great scallop *Pecten maximus*, along the European coasts. *Conservation Genetics*. In revision

Population genetic structure



Population differentiation

- ✓ Significant genetic structure at a large scale
- ✓ Lack of structuring within groups



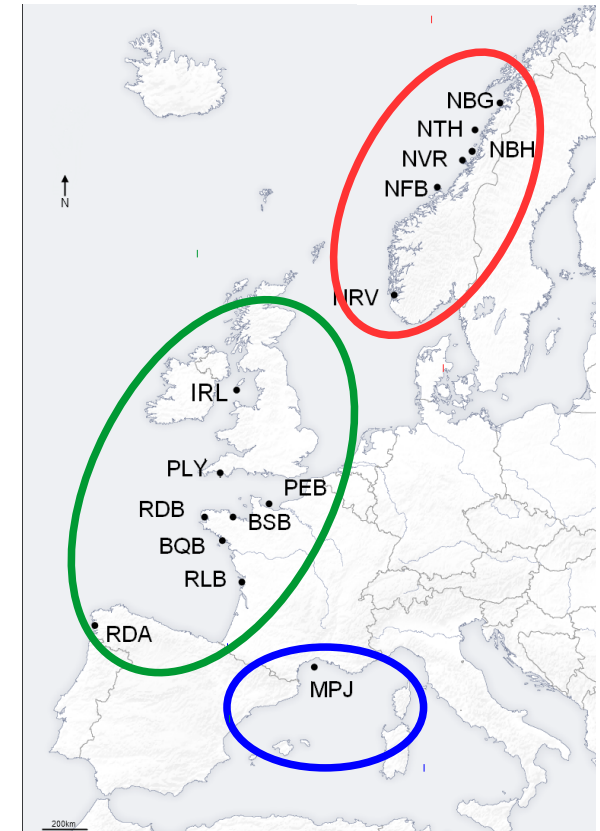
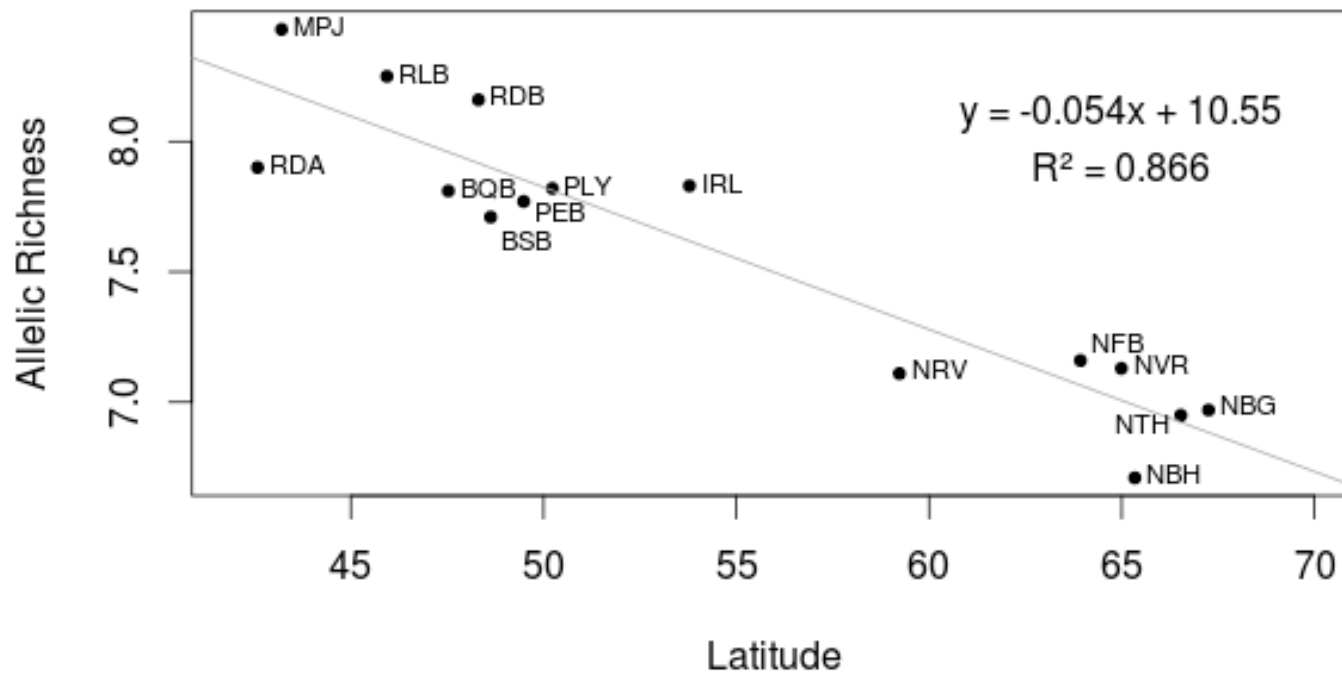
Within groups : $F_{st} < 0.01$

Population genetic structure



Genetic diversity

- ✓ Loss of diversity from South to North, along the latitudinal gradient
- ✓ Highest diversity in *P. jacobaeus* (Mediterranean Sea)
- ✓ Non significant correlation within main groups

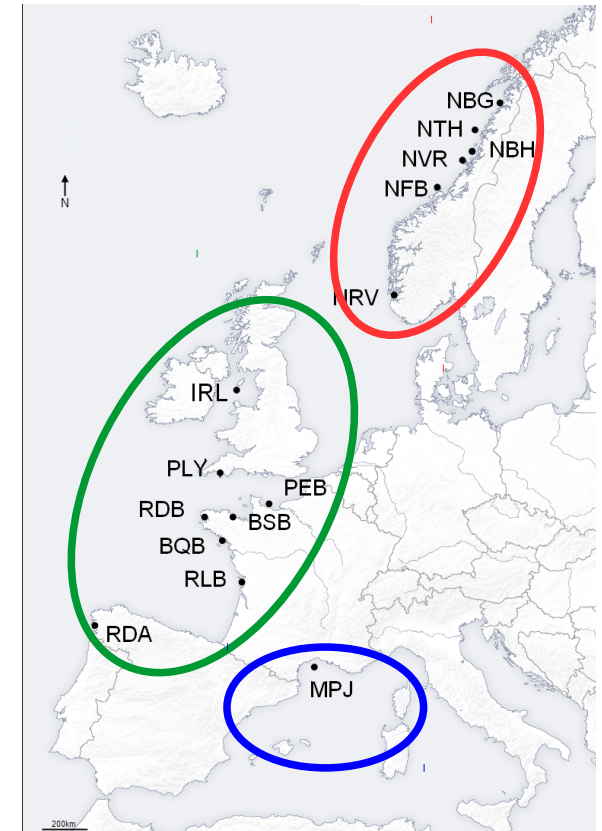


Population genetic structure



■ Interpretations

- ✓ Genetic signatures of the phylogeographic history of the great scallop?
- ✓ Deep divergence between main groups associated with distinct glacial refugia?
- ✓ Lower diversity in northern populations induced by the colonization history of Norwegian coasts?
- ✓ Relatively high gene flow at meso-scale, associated with larval dispersal?
- ✓ *P. maximus* & *P. jacobeus* = differentiated populations of the same species?

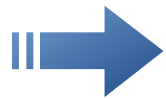


Ongoing projects...



■ Population genomics

- ✓ RAD-seq study starting in May, first data expected during Summer
- ✓ Study over the whole latitudinal gradient, from the Mediterranean Sea to Norway



Phylogeographic history?

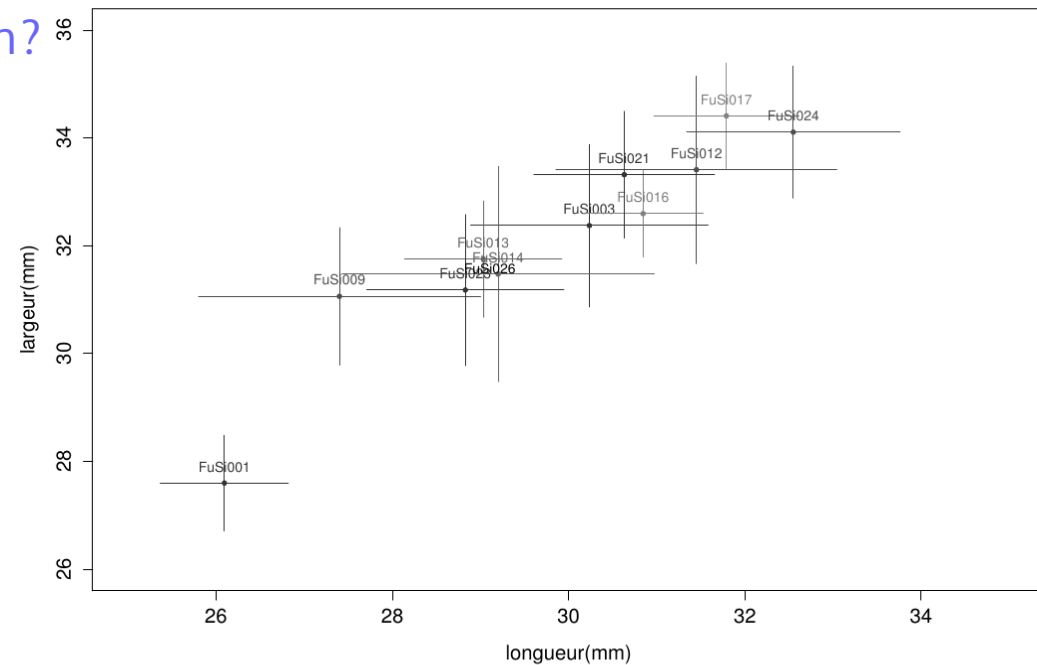
Genomic signatures of selection?

■ Quantitative genetics

- ✓ Families produced in hatchery
- ✓ Offspring raised in laboratory or in cages in the wild



Genetic basis of traits?



■ Conservation genetics: impact of sea ranching on the genetic diversity of natural stocks

As a conclusion, a tool for collaborating...

■ Labex-MER



- ✓ Cluster of excellence in Western France in the field of marine sciences
- ✓ Objective: Tackling fundamental issues related to the functioning of the ocean in the context of global change
- ✓ Funded by the french Ministry of Research and Education
- ✓ 11 million euros for a period of 10 years: 2011-2019
 - ↳ {
 - ~ 8 M€ for research (projects, post-docs...)
 - ~2 M€ for training (student mobility, courses...)

As a conclusion, a tool for collaborating...

■ Seven axes in the Labex-MER

■ Actions for research

- ✓ Small projects
- ✓ Post-doc fellowships
- ✓ Funding for visiting researchers
- ✓ Etc...

■ Actions for training

- ✓ Mobility grants or Master & PhD students
- ✓ Funding for thematic schools and courses
- ✓ Etc...



Ocean engine at
very high resolution



Efficiency of the
biological pump



Geobiological interactions
in extreme environments



Sediment transfer from
coast to abyss



Dynamics and vulnerability
of coastal zones



Evolution of marine habitats
and adaptation of populations



Sea motions and interactions
with marine structures

As a conclusion, a tool for collaborating...



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INTERNATIONAL POST-DOCTORAL FELLOWSHIPS - 2015 CALL NOW OPEN

2015 edition

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