



# MONITORING OF CHEMICAL CONTAMINANTS IN MARINE BIOTA

## A French perspective

### IFREMER

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# Monitoring Programs for level and trend assessment

## ❑ FRENCH MUSSEL WATCH (ROCCH) (contact: [agrouhel@ifremer.fr](mailto:agrouhel@ifremer.fr))

### Implementation

- ✓ Operated **since 1979**
- ✓ Shellfish (**mussels, oysters**, cockles, clams)
- ✓ Once/year, 120 coastal sampling sites
- ✓ **Trace metals and organic legacy contaminants (POPs)**



### Objectives

- Environmental levels and trends of legacy contaminants in the French coastal environment
- Fulfill international Conventions (North-East Atlantic/OSPAR, Mediterranean/Barcelona), MSFD, Public Health
- Environmental Specimen Bank

## ❑ CEC AND PRIORITY SUBSTANCE INVESTIGATION (contact: [cmunschy,yaminot@ifremer.fr](mailto:cmunschy,yaminot@ifremer.fr))

### Implementation

- ✓ Operated **since 2010**
- ✓ **Mussels, oysters**
- ✓ Once/year, 20 coastal sampling sites
- ✓ Focus on **CECs** (aBFRs, OPEs, PFASs and precursors, Synthetic Musks) + **Non Target Analysis** (challenging !)



### Objectives

- Environmental occurrence of CECs in the French coastal environment
- Levels, spatial distribution, profiles / sources
- Temporal trends: environmental impact of replacement substances compared to legacy ones

# **PS and CEC investigation in coastal areas**

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## **Levels and trends**

# Sampling strategy

## OSPAR Joint Assessment and Monitoring Program (JAMP)

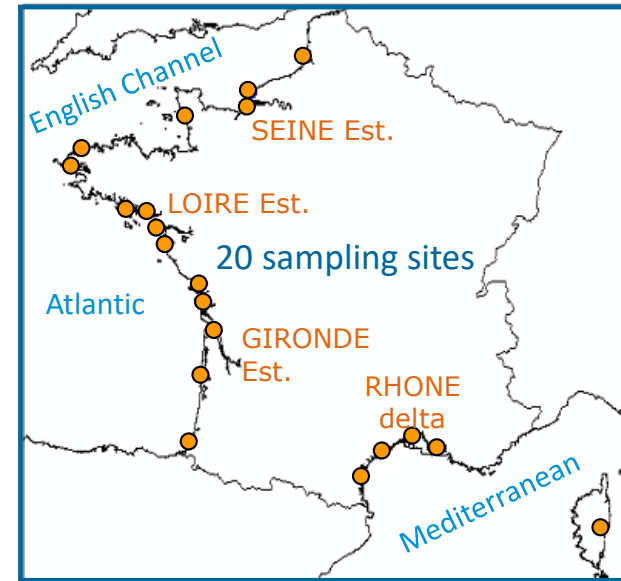
- Mussels, oysters as **sentinel organisms**

*Mytilus sp. / Crassostrea gigas*



IFREMER/O. Barbaroux

- 20 sampling sites  
Various anthropogenic inputs



- Samples collected once a year, **avoiding the spawning period**

- Archived IFREMER, Biogeochemistry and Ecotoxicology Unit  
**Environmental Specimen Bank (ESB)** since 1981 (ROCCH)





# Contaminants of Interest

## □ Evolutive list of Contaminants of Emerging Concern (CECs)

### Brominated Flame Retardants (BFRs)

HBB  
BB-153  
HBCDD  
PBDE



BTBPE  
DBDPE  
Alternative BFRs

### Per- and polyfluoroalkyl Substances (PFASs)

Perfluorocarboxylic acids - PFCAs  
Perfluorosulfonic acids - PFSA



Precursors

### Synthetic Musks

HHCB  
AHTN  
Musk xylene  
Musk ketone

### Organophosphate Esters (OPEs) (FRs and plastic additives)

TEP, TPRP, TNBP, TBOEP, TCEP,  
TPHP, TCIPP, TDCIPP, TPEP,  
TDBPP, MPDPP



# Perfluoroalkyl substances (PFASs)

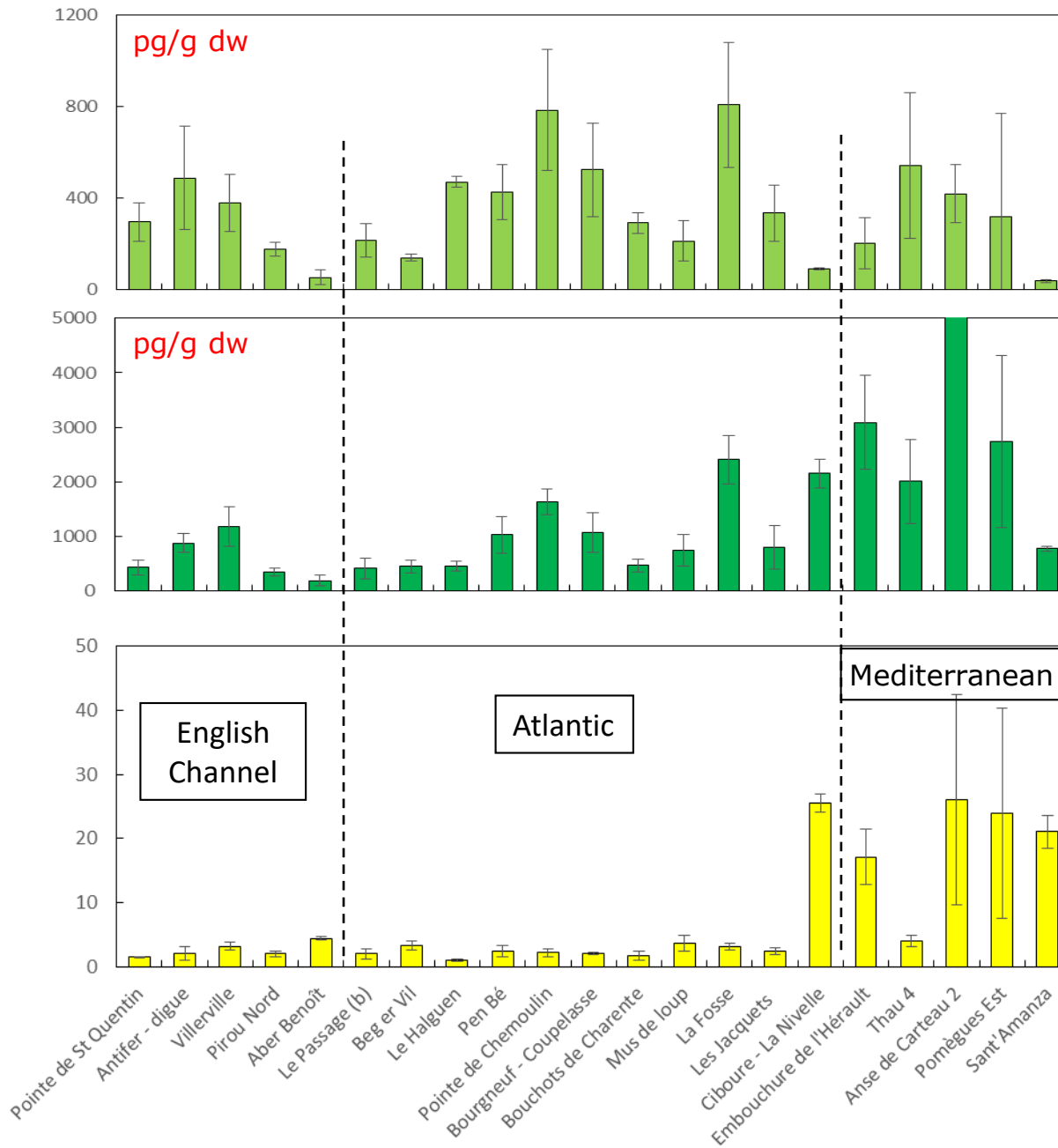
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## Geographical distribution and temporal shift in profiles



# Spatial Distribution (2016-2018)

PFASs



**PFOS**

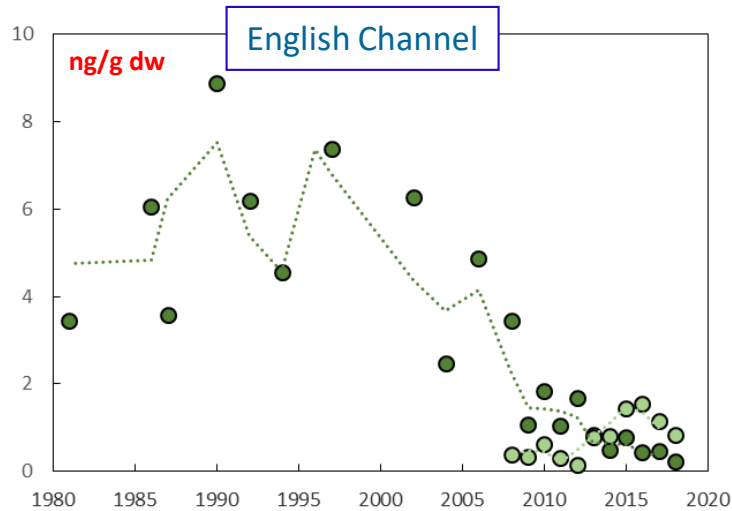
Detection 95 %  
Median = 311 pg/g dw

**PFCAs**

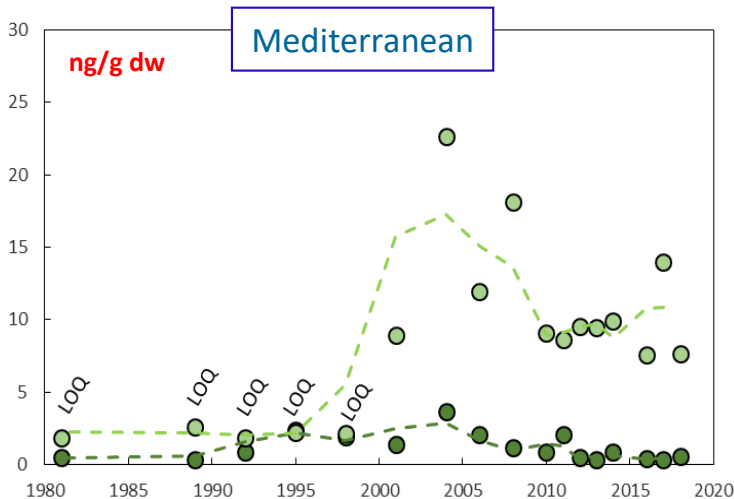
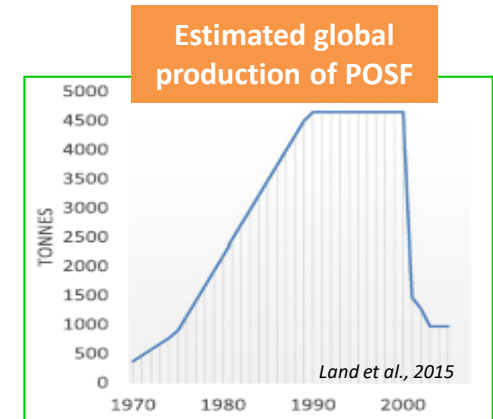
69-100%  
Median = 871 pg/g dw

**PFCAs / PFOS**

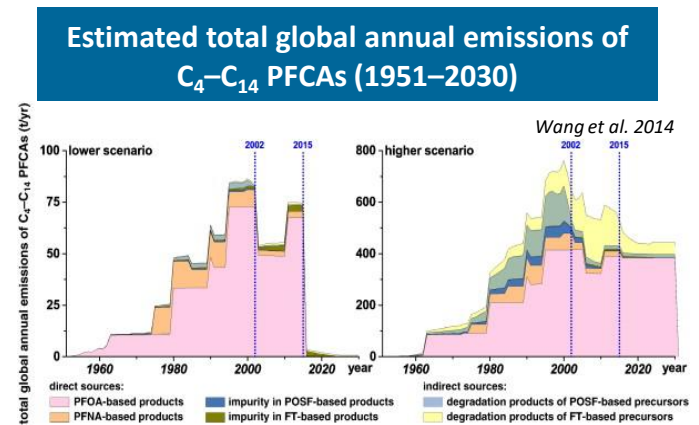
8 times higher in  
Mediterranean samples  
( $p < 0.05$ )



PFOS predominant  
until 2013



- ✓ PFCA >> PFOS in most samples
- ✓ PFCA ↗ after 1995 then stabilized





# Monitoring Programs for GES assessment

## □ CONTAMINATION OF OFFSHORE TROPHIC NETWORKS (contact: [amauffret@ifremer.fr](mailto:amauffret@ifremer.fr))

### Implementation

- ✓ Operated since 2014
- ✓ Various trophic levels (fish)
- ✓ Two/3 years, offshore and deep habitats
- ✓ C and N stable isotopes and energy density
- ✓ Trace metals and organic contaminants



### Objectives

- Good Ecological Status D8 C1 (MSFD)
  - Primary : Contaminants concentrations in the environment

## □ BIOLOGICAL EFFECTS AND CHEMICAL CONTAMINANTS (contact: [amauffret@ifremer.fr](mailto:amauffret@ifremer.fr))

### Implementation

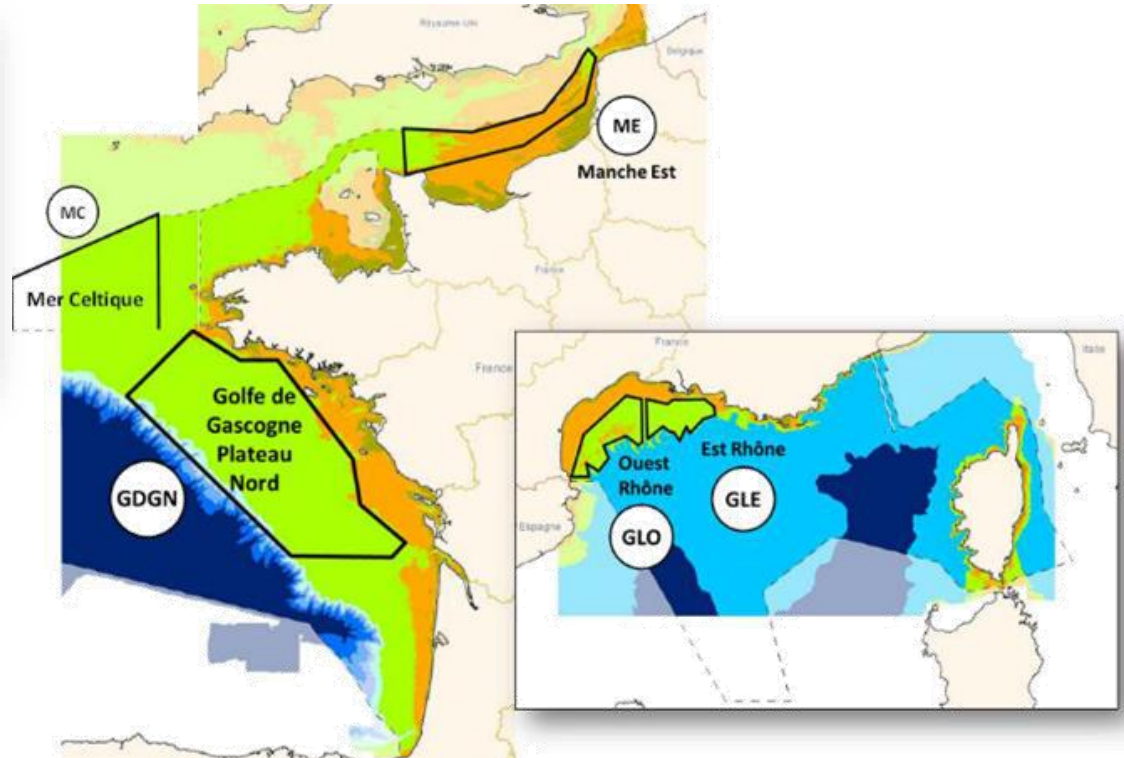
- ✓ Operated since 2016
- ✓ Benthic fish (sole, flounder) and mussels
- ✓ Once/year, 1 coastal area (English Channel, Atlantic, Mediterranean)
- ✓ Trace metals and organic contaminants (Priority Substances)
- ✓ Biological effects



### Objectives

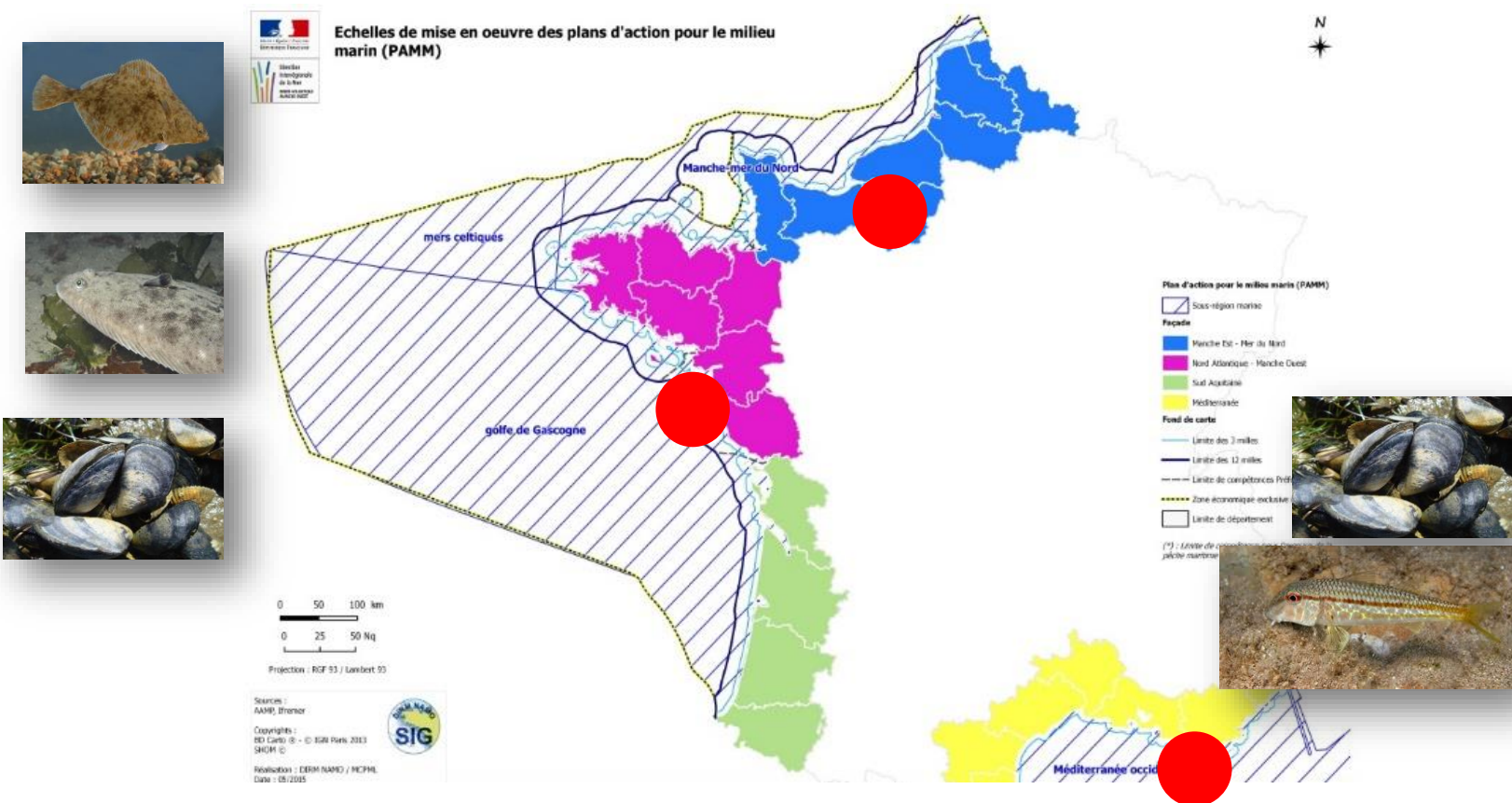
- Good Ecological Status D8 C2 (MSFD)
  - Secondary : Diffuse contamination effects on species health and habitat conditions
- Link contaminants and ecotoxicological effects

# Contamination of offshore trophic networks



- Mackerel, hake, sardine, dogfish, blue whiting, cod, plaice
- 2014/2015: first assay
- DCF (Data collection framework) sea campaign optimization (Baudrier et al 2018, Mar Pol) / D4+D8+D9
- 4 subregions => spatial assessment at offshore scale
- Trace Metals, PCBs, PCDD/Fs
- Every 2 years since 2017

- Chemical contaminants (Priority Substances)
- Ecotoxicological effects: dedicated sea campaign since 2016
- Biomarkers of genotoxicity, reprotoxicity, neurotoxicity, pathology, general status
  - ✓ Development of thresholds and aggregation methods (indiv. scale)





## ❑ SELECTING (AND DE-SELECTING) HAZARDOUS SUBSTANCES OF CONCERN FOR THE MARINE ENVIRONMENT


- ✓ On-going work MCWG and MSWG / ICES based on a document produced in 2017 (DOI: 10.17895/ices.pub.3693)
  - Occurrence of CECs in European marine environment from 2010 to today
  - > 15 participating countries
  - Various families of substances:  
PCPs, pharmaceuticals, PFASs, OPEs, a-BFRs, Dechloranes, REE, Benzotriazoles, Stenoxanes,...
- ✓ Objective: monitoring other CECs



❑ **INVESTIGATE MORE CONTAMINANTS USING NON TARGET ANALYSIS** (contact: [yaminot@ifremer.fr](mailto:yaminot@ifremer.fr))

- ✓ Challenging, even more in the marine environment

☐ **CECs IN FRENCH MARINE COASTAL WATERS** (contact: [iamouroux@ifremer.fr](mailto:iamouroux@ifremer.fr))

- ✓ POCIS-DGT and shellfish to investigate « other » chemical substances (pesticides, pharmaceuticals, metals,...)
  - ✓ Starting in 2021
  - ✓ Objective: selecting Specific Pollutants for the marine env.
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- A map of the English Channel region, showing the coastline of France and the UK. A yellow dot marks the location of the monitoring site near St. Quentin. A compass rose is visible in the top right corner of the map.

