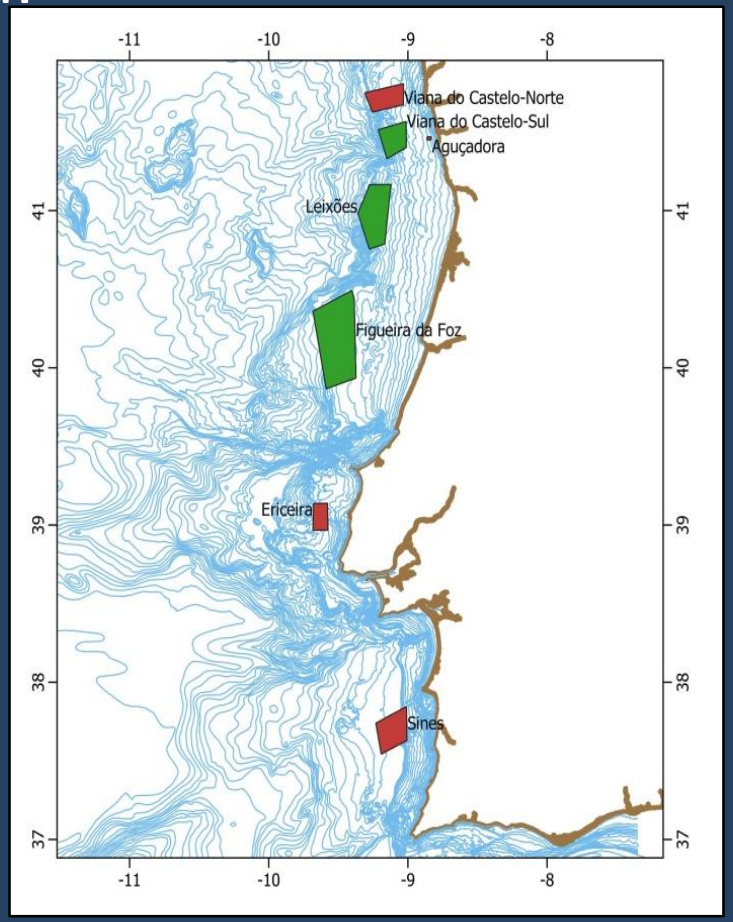
Baseline studies of the marine ecosystem for the development of offshore wind farms on the Portuguese coast

2024-2026

Allocation Plan for Offshore Renewable Energy in Portugal

Area_ID	Area (km2)	Power (GW)	Distance from coast (nm)		Water depth (m)		
			Max.	Min	Max.	Min.	Mean
Figueira da Foz	1325	4	34.1	21.7	530.4	124.4	178.9
Leixões	644	2	32.3	22.5	324.4	120.0	150.5
Viana do Castelo-Sul	294	1	17.9	10.5	560.1	73.0	110.1
Total	**2 263**	7	---	---	---	---	---



Objetive: 10 GW in 2030

First phase: 1.3 GW in 3 priority areas

Depth range: ~50 m to -550 m

Public consultation completed; results are being analysed

Allocation Plan for Offshore Renewable Energy in Portugal

- Development of OW has specific challenges due to the characteristics of the coast
  - narrow continental shelf
  - high morphological and sedimentary heterogeneity
  - varying slope

- Floating offshore wind turbine technology was considered the most viable choice for the Portuguese coast

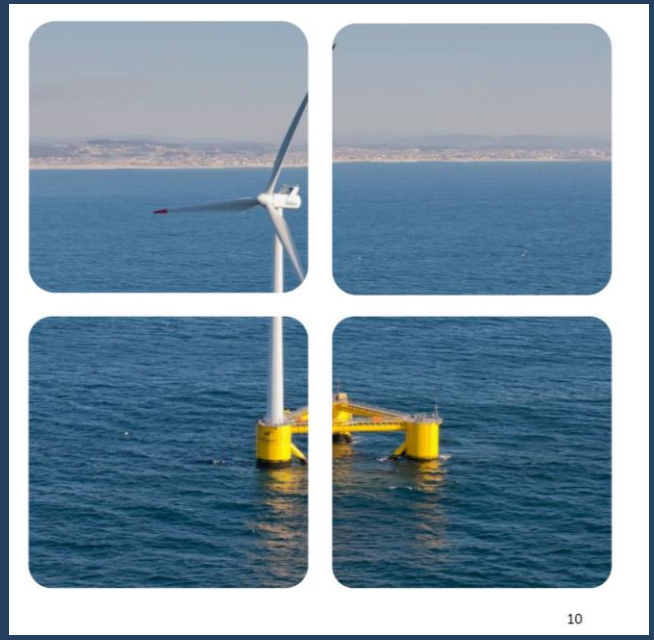
- Potential impacts of OWF may also show some specificities
  - The Portuguese western waters are characterised by upwelling in Spring and Summer
  - Similar to other EBUS, productivity is very dependent on upwelling

OWF projects in Portugal – current situation

- Windfloat pilot project (2012)

Development, construction and demonstration of a grid-connected semi-submersible floating platform

- 2 MW commercial turbine
- 6 km distant to coast
- ~50 m depth



Environmental Appraisal study (EIncA) (2014-2017)

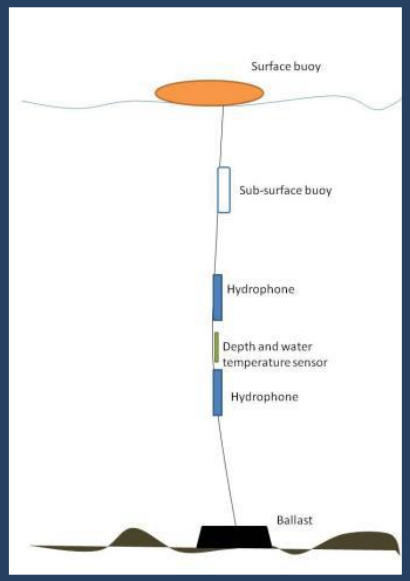
Environmental monitoring (2012 – 2015)

WavEC Offshore Renewables

Unlocking Sustainability

WGORE member

Windfloat pilot project - Environmental monitoring



Assessment of biofouling assemblages on the floaters

- video imaging (ROV + divers)
- collection of in situ samples

Results: artificial reef effect

- ✓ belt of red algae and mussels, from 0 to 2.2 m depth
- ✓ belt of laminaria and mussels from around 2.3 until the 5.5 m depth
- ✓ Mussels' coverage with echinoderms, from 5 m until the bottom of the structure
- ✓ Communities varied between years

Assessment of background noise and noise emitted by the turbine

- Passive acoustics

Results:

- ✓ sound radiated by the turbine on the low frequency range
- ✓ can be critical for cetaceans with high hearing sensitivity in the low frequency range, e.g., baleen whales
- ✓ acoustic impacts are not expected on animals with high hearing sensitivity in the medium/high - frequency range, e.g. dolphins and harbor porpoises

Windfloat Atlantic project

- The world's first semi-submersible floating wind farm
  - 3 turbines
  - 8.4 MW each turbine
  - located 18 km offshore
  - northern part of the coast (near border with Spain)
  - 90-100 m depth

Windfloat Atlantic Project (Portugal)

Windfloat Atlantic project

Environmental monitoring (Wavec, research centres, etc.)

Water quality

CTD casting; water sampling and turbidity assessment at different depths, PAHs and Oils + Greases

Results

- ✓ PAHs levels below the detection limit in sampling points and depths
- ✓ Higher levels of oils and greases during installation in park and cable areas
- ✓ Decreased significantly during operation but remained slightly higher than at pre-installation.

Marine mammals

Visual surveys + passive acoustic methods

- ✓ Common dolphins, Minke whale, harbour porpoise
- ✓ Porpoises more frequent in the operational phase
- ✓ Other cetaceans more frequent in the preinstallation phase.
- ✓ Porpoises more frequent and longer stays in the control area
- ✓ Other cetaceans more frequent and longer stays in the impact area.

- Seabirds
- Benthic community
- …

Windfloat Atlantic Project (Portugal)

Interactions with the fishing industry

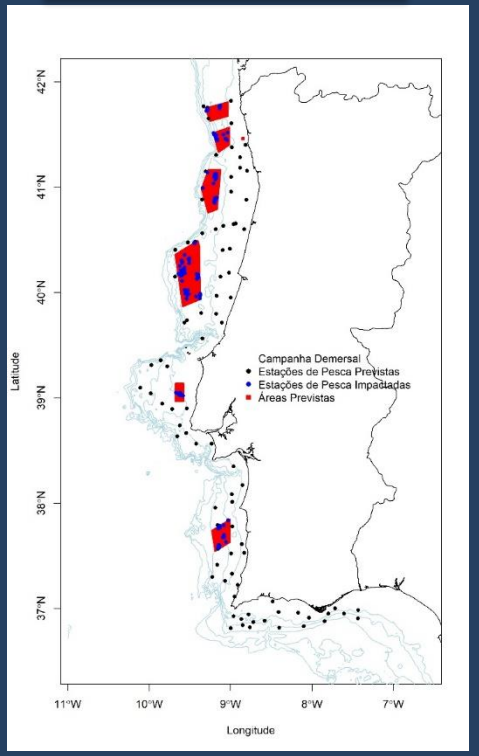
- Portuguese association of industrial fisheries (ADAPI) asked for IPMA technical advice on a set of 17 questions related to OWF development (June 2023)
  - Direct and indirect effects of windfarms on fisheries
  - Impacts on different populations of commercial species, both within OWF areas and in shallower waters where cables will be laid
  - How might the implementation of OWF areas interact with closed periods and protection zones already established
- Regarding the current and future OWFs
  - Informal opinions
  - Competing use
  - Essential to be part of discussions

Research surveys

Coordinated by IBTSWG

BOTTOM TRAWL

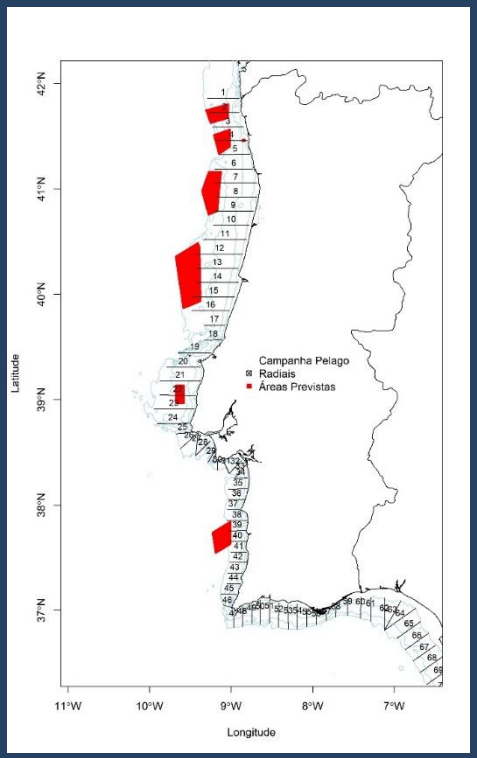
Started discussion on the loss of sampling areas



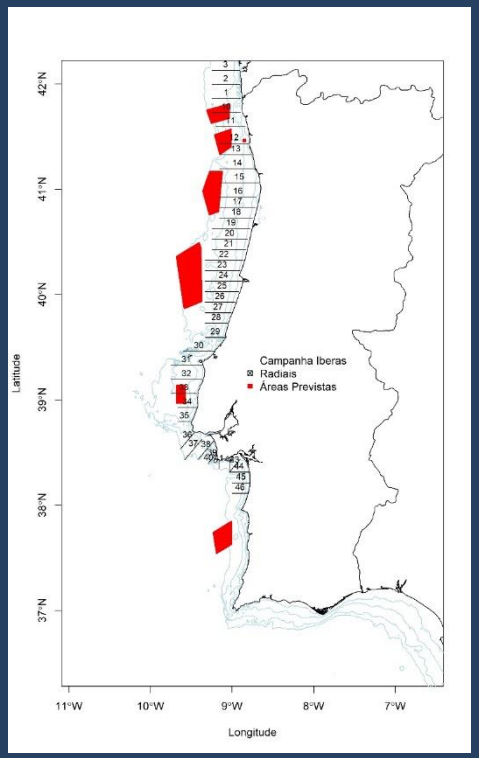
Coordinated by WGACEGG

Silence for the moment…

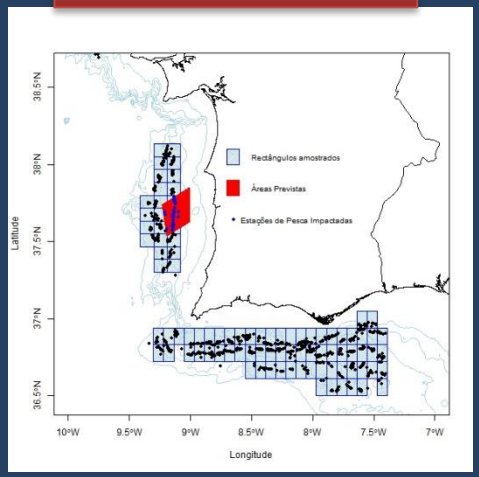
ACOUSTIC



ACOUSTIC JUVENILE

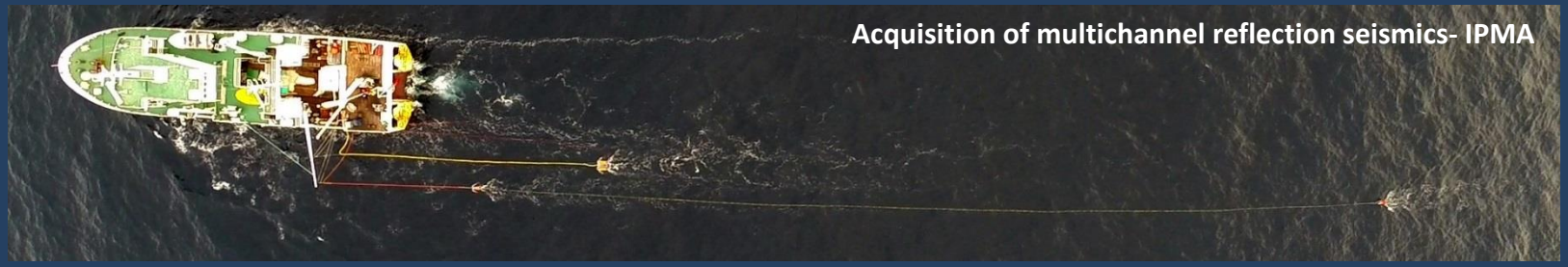


CRUSTACEAN



Baseline project: GEOLOGY, ENERGY, CULTURAL PATRIMONY AND ENVIRONMENT

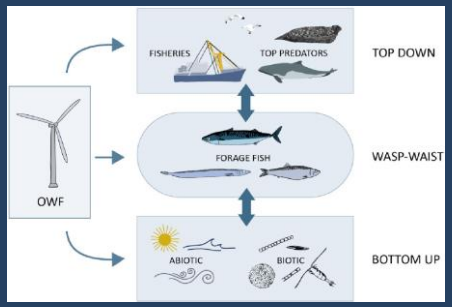
- **Geophysics**
  - Multibeam
    - Bathymetry
    - Backscatter
  - Side Scan Sonar
  - Magnetics
  - Seismic reflection
- **Geotechnics**
  - Seafloor superficial sediments
  - Vibrocores
  - Cone penetration tests
- **Energy**
  - Wind, waves and currents



Acquisition of multichannel reflection seismics- IPMA

Environment: Ecosystem baseline studies

1. Contaminants in the water column
2. Circulation and upwelling patterns
3. Productivity in the water column, plankton and non-indigenous species
4. Plankton dispersal patterns
5. Structure and sediment contamination
6. Chemical contaminants in fish and other products
7. Benthic fauna communities (incl. non-indigenous species)
8. Vulnerable Marine Ecosystems –VMEs
9. Communities of demersal, pelagic, pelagic migratory organisms
10. Seabirds, marine mammals and reptiles
11. Trophic webs
12. Fishing activity
13. Storage, data management and information mapping



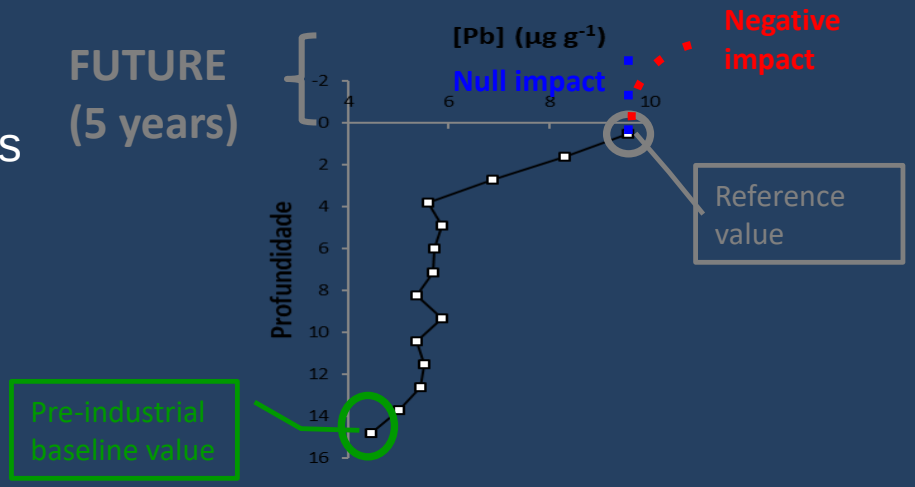
Key study

Structure and contamination of the sediment

Evaluate potential transfer of contaminants from structures (marine litter due to coating flaking, POPs from paints) and galvanic protection anodes (metals)

Establish the contamination reference by:

- Metals
- Persistent Organic Pollutants
- Marine Trash
- Microplastics



Key study

Circulation and upwelling patterns

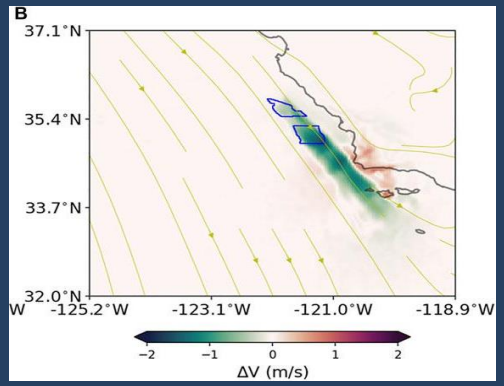
POTENTIAL IMPACTS

- Shadow effect: change in upwelling patterns due to localized reduction in wind
- Appearance of upwelling/downwelling cells in regions adjacent to wind farms
- Changes in the positions of filaments, vortices and coastal jets, which in turn affect the dispersal of eggs and larvae of marine organisms

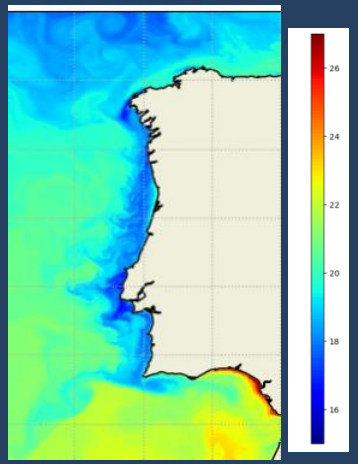
Study

- Characterization of the mean circulation and dispersal patterns of eggs and larvae using modelling tools
- May be repeated in the future in the presence of wind farms to assess the possible impacts

Decrease in the N-S wind speed component; coast of California (Raghukumar et al.



Example of ocean model output. Surface temperature, 1/8/2006. Upwelling front with several visible filaments.



Key study

Benthic fauna communities associated with sedimentary and rocky bottoms

- Community composition
- Detection of non-indigenous species
- Diversity indices, multimetric indices for assessing the state of ecological quality
- Identification and assessment of the conservation status of Vulnerable Marine Ecosystems (VMEs)

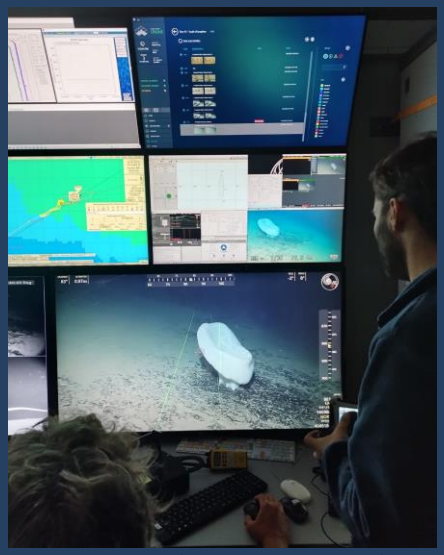
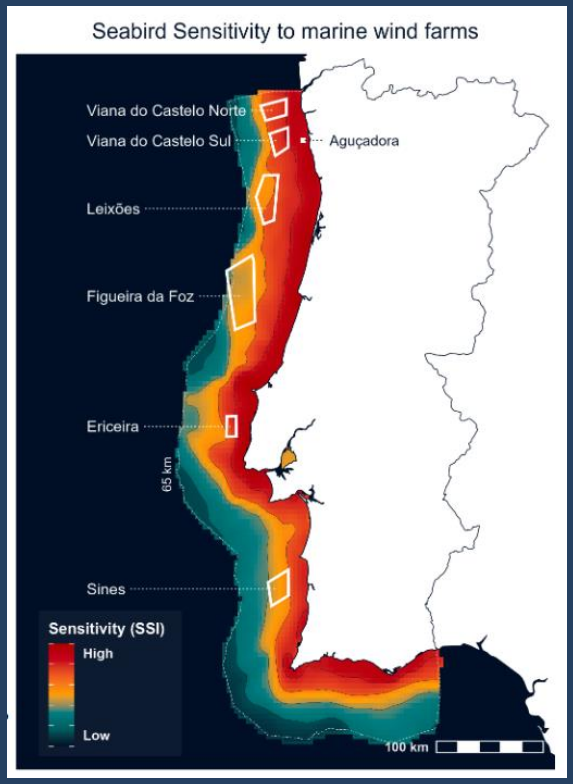


Imagem: Laboratório de Estudos Bentónicos, campanha CMT2022

Key study

Abundance, distribution, migratory flow and biodiversity of seabirds

- Characterization of communities
- Abundance assessment
- Spatial distribution
- Migratory flows of the main species



(flight altitude, flight manoeuvrability, percentage of time in flight activity, night flight activity, susceptibility to disturbance, flexibility in habitat use, biogeographic population, adult survival rate, threat and conservation status)

Key study

Fisheries

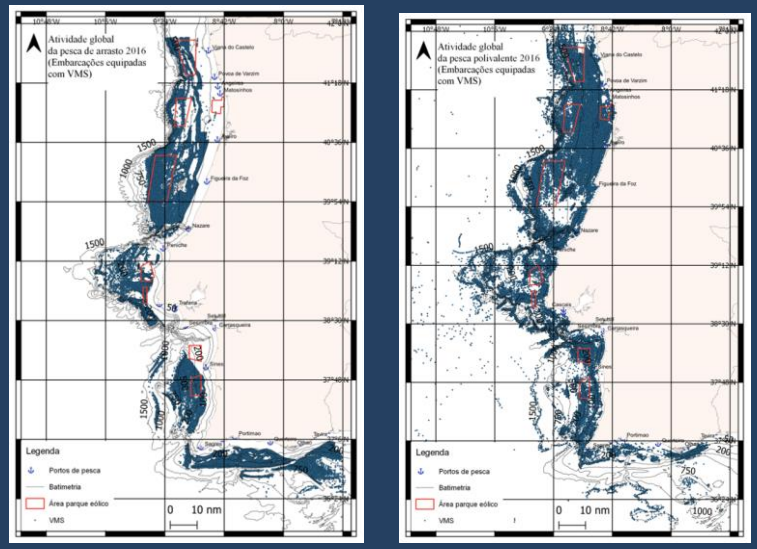
- Map fishing effort, CPUE, catch biomass and value

  Combination of VMS/AIS with daily landings data

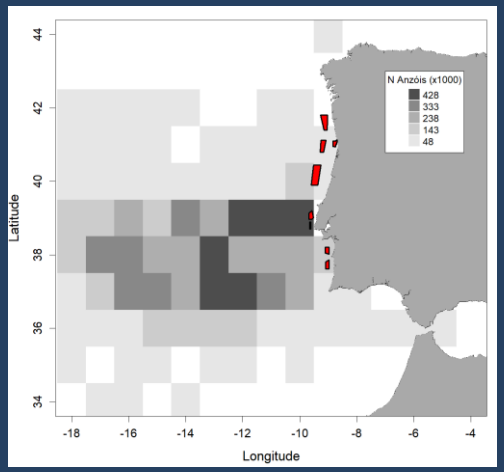
- Apply spatiotemporal models: describe, synthesise and predict
- Assess the relative importance of potential OWF areas for fishing

Bottom trawl

Multi-gear



Paths of bottom trawlers and multi-gear fleets (LoA> 15 m) in 2016 (based on VMS data).



Effort of the longline fleet based on data collected by on-board observers.

THANK YOU VERY MUCH