

MEFEPO

South Western Waters Atlas

Velasco, F.; Aanesen, M.; Abreu, H.; Armstrong, C.; Bashmashnikov, I.; Borges, M.S.; Cabanas, J.M.; Garza, D.; Hegland, Troels Jacob; Lens, S.; Martins, A.M.; Mendes, H.V.; Mendonca, A.; Pereiro, J.; Pérez, M.; Porteiro, C.; Raakjær, Jesper; Rui Pinho, M.; Samedy, V.; Serrano, A.

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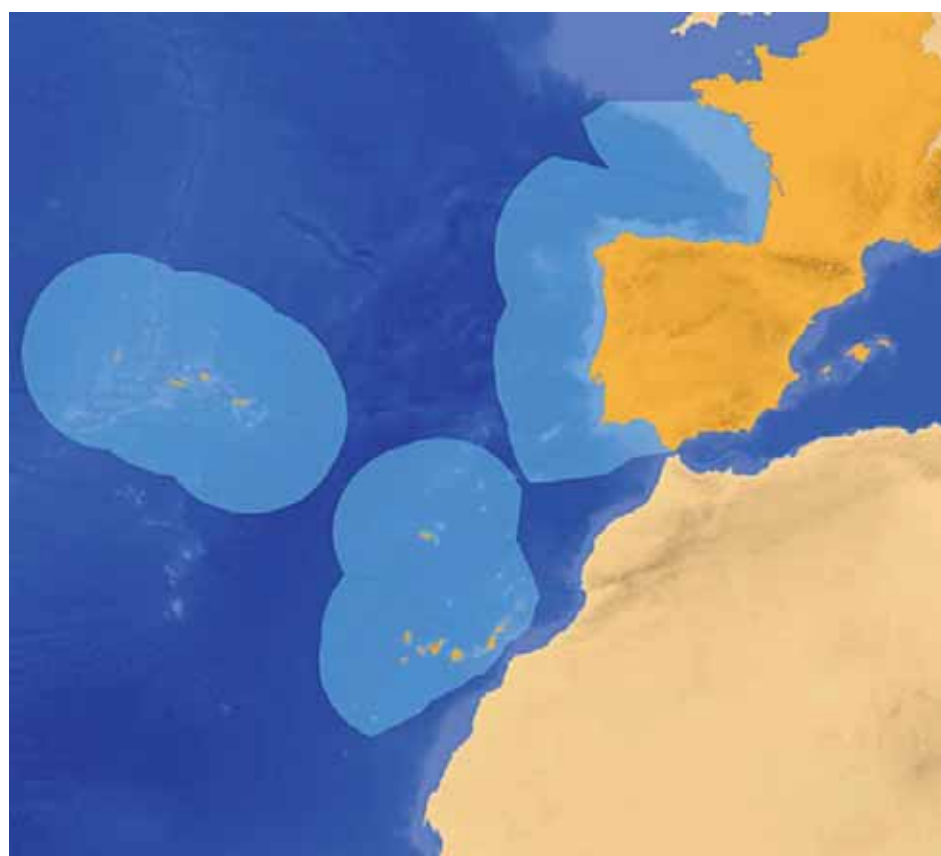
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MEFEPO

Making the European Fisheries Ecosystem Plan Operational

South Western Waters Atlas



August 2009



Welcome to **MEFEPO!**

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“ The oceans and the seas sustain the livelihoods of hundreds of millions of people, as a source of food and energy, as an avenue for trade and communications and as a recreational and scenic asset for tourism in coastal regions. So their contribution to the economic prosperity of present and future generations cannot be underestimated .”

José Manuel Durao Barroso,
President of the EU Commission



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Preface

Welcome to the MEFEPO Atlas! This Atlas is intended for policy makers, managers and interested stake-holders. Its purpose is to provide a general ecosystem overview of the Southern Western Waters (SWW) Regional Advisory Council (RAC) area covered in the project, i.e. Bay of Biscay, Iberian Atlantic Coast and the Azores Archipelago. We cannot cover all aspects of the complex ecosystems existing in the area, but we can highlight the key features and give a broad overview.

In the Atlas, we have tried to make the science as clear and concise as possible. We have kept the technical language to a minimum and presented the information through a blend of text, tables, figures and images. There is a glossary of terms and a list of more detailed scientific references, if you would like to follow up certain issues.

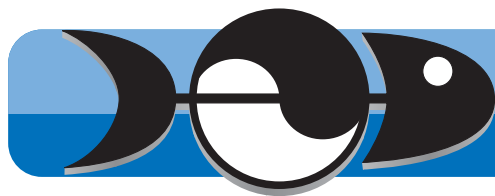
The Atlas includes general summary information on the physical and chemical features, habitat types, biological features, birds, mammals, reptiles, fishing activity and other human activities of the SWW RAC region. Background material on four SWW case study fisheries are presented (Mixed bottom trawl fishery, French *Nephrops* fishery, sardine purse-seine fishery in Iberian coasts and mixed lines demersal fishery in the Azores Archipelago). These will be important case studies in the MEFEPO project.

Knowledge of the Southern Western Waters RAC area is not as advanced as in other areas included in the MEFEPO Project (e.g. the North Sea). The information available and used in this Atlas was dispersed in the literature, various national reports and national research programmes. The International Council for the Exploration of the Sea (ICES), and the Oslo Paris Commission (OSPAR) literature were important sources of information, supplemented by published papers and various literature and reports.

The information presented in this South Western Waters Atlas is sourced from the *Making European Fisheries Ecosystem Plans Operational* (MEFEPO) project "South Western Waters Technical Report".

OSPAR will produce a new Quality Status Report for the North East Atlantic in 2010 (last updated in 2000). This will be a major source of new information for the SWW. The present Atlas for the South Western Waters RAC (version 2009) will be updated in 2012 (at the end of MEFEPO project) to incorporate feedback from stakeholders and the new OSPAR information.

The MEFEPO partners hope you find this Atlas useful and would welcome any feedback and comment. Please forward any comments to any of the project partners listed inside the front cover.



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MEFEPO (Making the European Fisheries Ecosystem Plan Operational) is a group of ecologists, economists, management experts and fisheries scientists who are trying to make ecosystem based fisheries management a reality in Europe.

MEFEPO partners:

- (1) University of Liverpool, (ULIV), UK
- (2) National Institute for Fisheries and Marine Research, (IPIMAR), Portugal
- (3) IMARES, part of Wageningen UR, Netherlands
- (4) Université de Bretagne Occidentale (LEMAR/IUEM), France
- (5) Marine Institute, Ireland
- (6) University of Tromsø, (UIT), Norway
- (7) Centre for Environment, Fisheries and Aquaculture Science, (CEFAS), UK
- (8) Innovative Fisheries Management - an Aalborg University Research Centre (IFM), Denmark
- (9) University of the Azores, Portugal
- (10) Spanish Institute of Oceanography, (IEO), Spain

This South Western Waters Atlas was produced by the Spanish Institute of Oceanography as part of the MEFEPO project.

Every effort has been made to ensure the accuracy of the information contained in this atlas. However the size of the document means that much detail has had to be omitted and some simplifications have been made for the sake of clarity. The Making the European Fisheries Ecosystem Plans Operational project has produced a companion technical report that contains more detail and full references to the original sources.

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MEFEPO. "South Western Waters Atlas". University of Liverpool. ISBN 0 906370 61 2. 1 Spanish Institute of Oceanography (Spain). 2 University of Tromsø (Norway). 3 National Institute for Fisheries and Marine Research (Portugal). 4 University of the Azores, (Portugal). 5 University of Vigo (Spain). 6 Innovative Fisheries Management, (Denmark). 7 Université de Bretagne Occidentale, (France)



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Summary

1. The South Western Waters Regional Advisory Council (SWW RAC) covers the Atlantic area from the point of Brittany in the north to the Straits of Gibraltar in the south, as well as the ultraperipheral regions of Madeira, Azores and the Canarias Islands. Only the Azores Archipelago is considered in this atlas and in the MEFEPO project. The SWW RAC area has a very diverse range of depths from the broad shelf in the French area, to the narrow and steep shelf with numerous canyons in the Cantabrian Sea, and the Iberian Basin with numerous sea mounts that arise from the deep sea to the mid Atlantic Ridge.
2. The main large-scale currents associated with the eastern part of the anticyclonic North Atlantic sub-tropical gyre are the North Atlantic Current, the Azores Current, Portugal Current and the Canary Current. The Mediterranean flow is a relatively warm current that sinks to around 1000 m depth as it enters in the Atlantic and flows northwards with variable intensity from year to year. These currents in combination with the winds produce upwelling events of great importance in Portuguese and Galician coasts.
3. The Azores High, (also known as North Atlantic High/Anticyclone or the Bermuda High/Anticyclone in the United States), is a large subtropical semi-permanent centre of high atmospheric pressure found near the Azores in the Atlantic Ocean, at the Horse latitudes. It forms one pole of the North Atlantic Oscillation, the other being the Icelandic Low.
4. The North East Atlantic upper waters have experienced progressive warming during the past and the present century. Mean surface water temperatures increased by 1.4°C in the south-eastern Bay of Biscay over the period 1972-1993 (0.6°C per decade) and by 1.03°C over the past century.
5. The North West Atlantic waters are dominated by high-salinity North Atlantic Central Water separated into Polar and Tropical modes. The Polar mode is formed at the Bay of Biscay and diffuses east and south-east, reaching the Azores. The Tropical mode is observed mainly close to the continental margin, between the Canaries and Iberian Peninsula.
6. In the Eastern North Atlantic, coastal upwelling occurs between April and October. The high productivity of upwelling regions on the food web are well-known and the Atlanto-Iberian fisheries benefit from this. In the Bay of Biscay the rivers are the major source of nutrients.
7. The distribution of organisms which live on or near the sea floor is determined by the type of substrate present (e.g. mud, sand, gravel or rock). Examples of these maps in the SWW area are presented in this atlas.



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Summary

8. Marine Protected Areas (MPAs) are areas of the ocean protected from human activities. Maps of MPAs in the SWW area are included in the Atlas, which include MPAs developed for conservation purposes and those to protect fish stocks.
9. Essential fish habitat are broadly defined to include those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Following this definition, essential fish habitats for species as hake, Norway lobster, megrim, horse mackerel, sardine, and blackspot seabream and bluemouth rockfish inhabiting the sea mounts in the Azores Islands, are presented.
10. The phytoplankton pattern in the Bay of Biscay and Iberian coast is the typical for a temperate sea. The NE Atlantic oceanic waters show a highest seasonal mean during the spring ('spring bloom') and high mesoscale variability patterns are often observed. The Azores region shows typical mid-latitude behaviour with pronounced spring phytoplankton bloom patterns.
11. A large variety of marine mammals, both boreal and temperate, have been reported in the South Western Waters (SWW) region. Seven pinnipeds (seals) and thirty cetaceans have been documented. However, some records correspond to vagrant individuals, outside their normal range and therefore cannot be considered part of the regional fauna.
12. In terms of numbers and biomass, the nesting seabird community is low in comparison with other European Atlantic areas. However the strategic geographical position of the Iberian Peninsula and the high biological production of coastal areas give rise to an important autumn migration and large wintering populations.
13. Five species of sea turtles have been recorded in this region: loggerhead, green, hawksbill, Kemp's ridley and leatherback turtles.
14. Human activities along the coasts in the SWW are summarised with information on port traffic, tourism and aquaculture in the area.
15. Some of the fisheries in the SWW area have been selected as case studies in the MEFEPO project, these are: mixed demersal trawl in Iberian waters, Norway lobster fishery by the French trawl fleet, purse seiner fishery on the north-western Iberian Peninsula, and mixed demersal lines in the Azores archipelago. Descriptions of these fisheries and their importance for the communities inhabiting the coastal areas are presented.



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The MEFEPO project

MEFEPO are a group of ecologists, economists, management experts and fisheries scientists that are trying to make ecosystem based fisheries management work in Europe. In recent years considerable effort has been devoted to addressing the governance, scientific, social and economic issues required to develop and introduce an ecosystem approach to European marine fisheries. MEFEPO will seek to harness and apply these efforts. Fisheries management needs to support the 'three pillars of sustainability' (ecological, social and economic). One of the greatest challenges of management is searching for ways of achieving these objectives simultaneously. The economic and social pillars can be considered subsidiary to the ecological pillar since the loss of an ecological resource base will mean that no social and economic benefits can be derived from the seas.

Ecosystem-Based Fisheries Management

"The comprehensive integrated management of human activities based on best available scientific knowledge of the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity."

Fisheries Ecosystem Plans (FEPS)

In the US, Fisheries Ecosystem Plans (FEPs) were developed for further integration of the ecosystem approach in fisheries management and as a tool to assist managers with considering the ecological, social and economic implications of their management decisions. The FP5-funded European Fisheries Ecosystem Plan (EFEP) project developed a FEP for European waters, using the North Sea as a case study. This project incorporated social and political sciences, marine ecology, fisheries science and mathematical modelling to identify the effects of fisheries management scenarios (including changes in effort, changes in gear types and spatial closures) on the ecosystem and their acceptability to a broad range of marine stakeholders including fishers, fish processors, managers, policy makers, scientists and environmentalists. The project also developed a step-wise framework for the transition of management from the current regime to an ecosystem approach, and an outline of how the FEP could be made operational within existing legislation

Regional Advisory Councils (RACs)

The RACs were introduced in 2004 to provide 'new forms of participation by stakeholders'.

The RACs aim to provide a formal mechanism for communication between the European Union and fisheries stakeholders.

Stakeholders include fishing representatives, conservationists and other groups such as womens' or angling groups.

The RACs have a regional focus and cover seven areas.

The MEFEPO project is using three of the RACs as case studies (see map opposite). These are:

North Sea (NS)

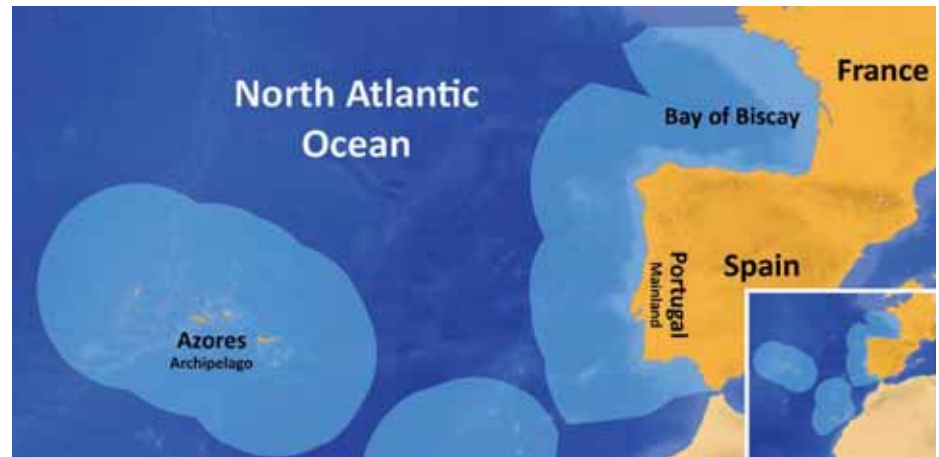
North Western Waters (NWW)

South Western Waters (SWW)

South Western Waters Atlas



■ The three RAC regions used as case studies by MEFPO. From north to south these are the North Sea (NS), the North Western Waters (NWW) and the South Western Waters (SWW).



Map of the area covered by the South Western Waters RAC

The South Western Waters Regional Advisory Council (SWW RAC) covers the Atlantic area from the point of Brittany in the north to the Straits of Gibraltar in the south as well as the ultraperipheral regions of Madeira, Azores and the Canarias Islands (VIII, IX and X CIEM subareas and the COPACE divisions 34.1.1., 34.1.2, 34.2.0).

The SWW RAC mission is to contribute to achieve the goals of a sustainable exploitation like it is fixed by the Common Fisheries Policy, which nowadays is based on integrating the ecosystem approach and being based on the precautionary principle.



Depth

The depth profiles of the SWW RAC area are very diverse. The areas can broadly be divided into:

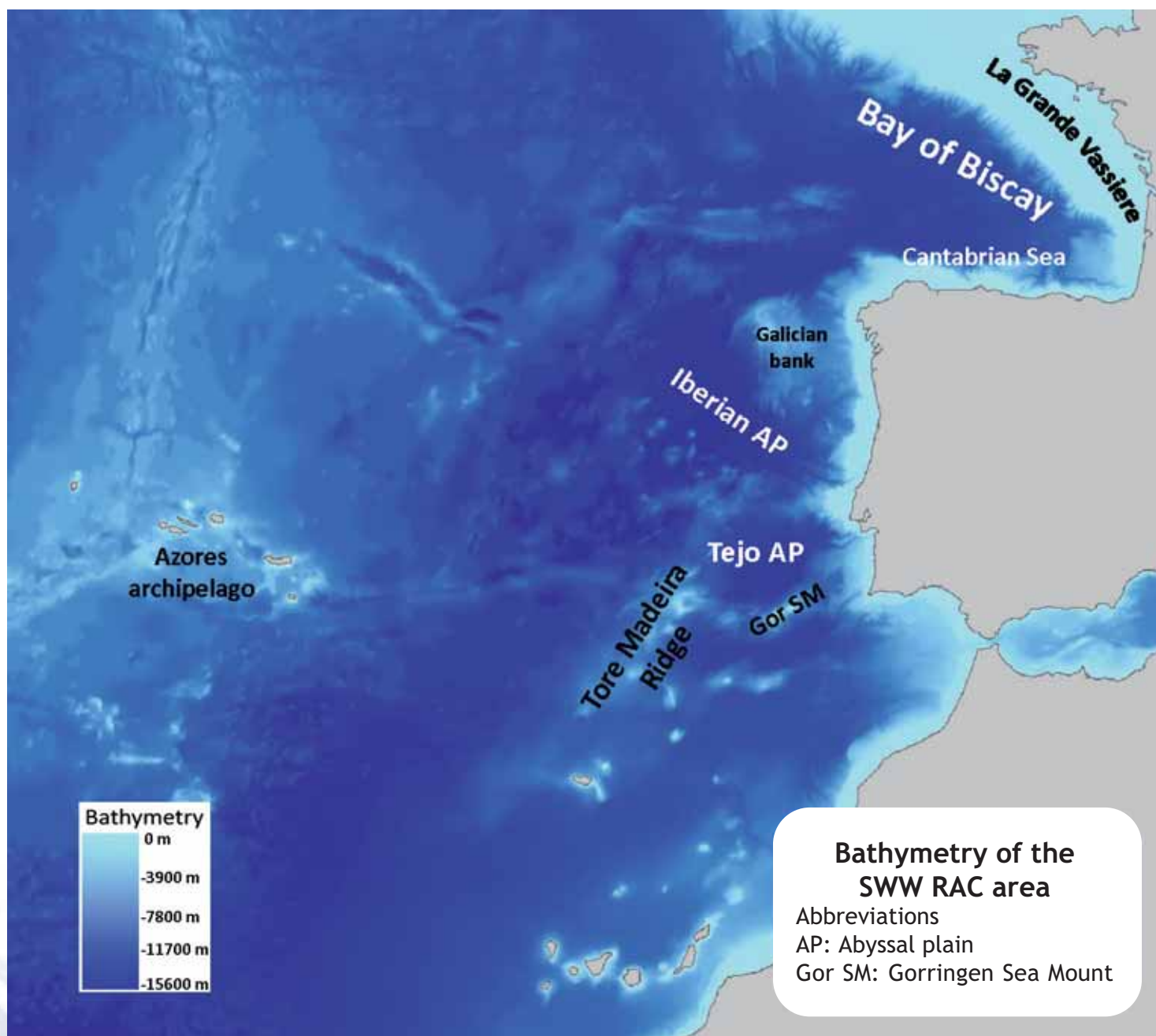
- **French shelf or La Grande Vassiere:** from 140 _km _wide in the north to 50 km off southern

France. Depth increases almost regularly down to 200 m. The shelf is mainly flat.

- **Cantabrian sea shelf is as narrow as 12 km** and present seamounts such as the "Le Danois Bank" and deep canyons such as "Cañón de Avilés"

- **The Iberian Basin** including the Iberian and the Tejo Abyssal Plains is limited to the north by the Galician Bank, to the south by the Tore Madeira Ridge and the Gorringe Sea Mount, and to the west by the Tore Madeira Ridge.

South Western Waters Atlas



Currents and Circulation

The main large-scale currents associated with the eastern part of the anticyclonic North Atlantic sub-tropical gyre are the North Atlantic Current (NAC), the Azores Current (AzC), Portugal Current (PoC) and the Canary Current (CaC)

The NAC is separated in several branches. To the north of the Azores Islands between 42-53°N, and the AzC, south of Azores, between 34-35°N, are basin-scale currents. Exchange between the two is enabled by the broad, slow, southward-flowing Portugal Current (PoC).

The intermediate layer is dominated by Mediterranean Water (MW), which leaves the Strait of Gibraltar, rapidly sinks to about 1000 m, and propagates west, forming a layer with anomalously high salinity and temperature.

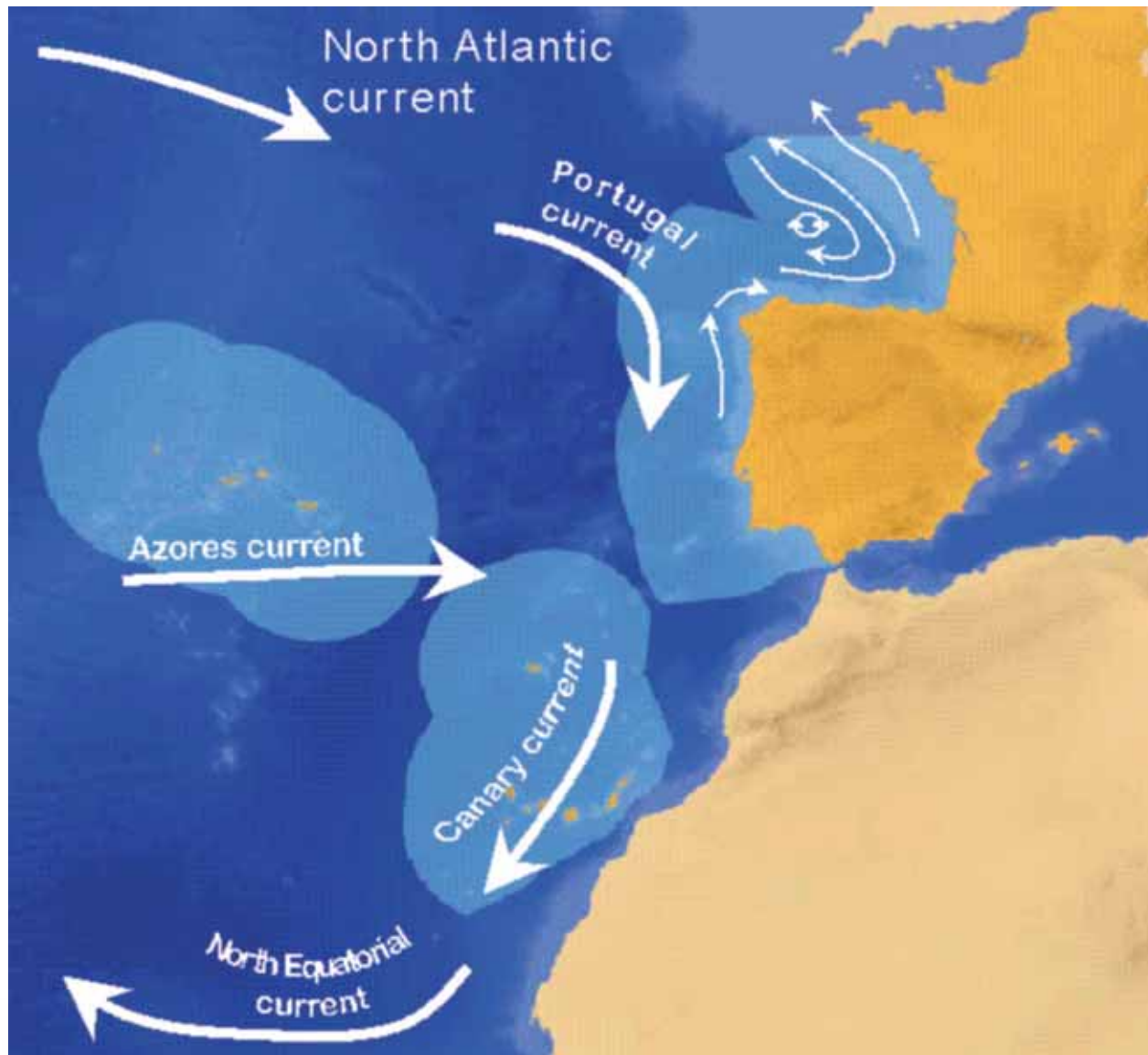
Near the Iberian Peninsula, the current system shows reversing patterns between summer and winter in the upper layers of the shelf and slope.

During spring and summer, northerly winds along the coast cause coastal upwelling and produce a southward current at the surface and a northward undercurrent at the slope.

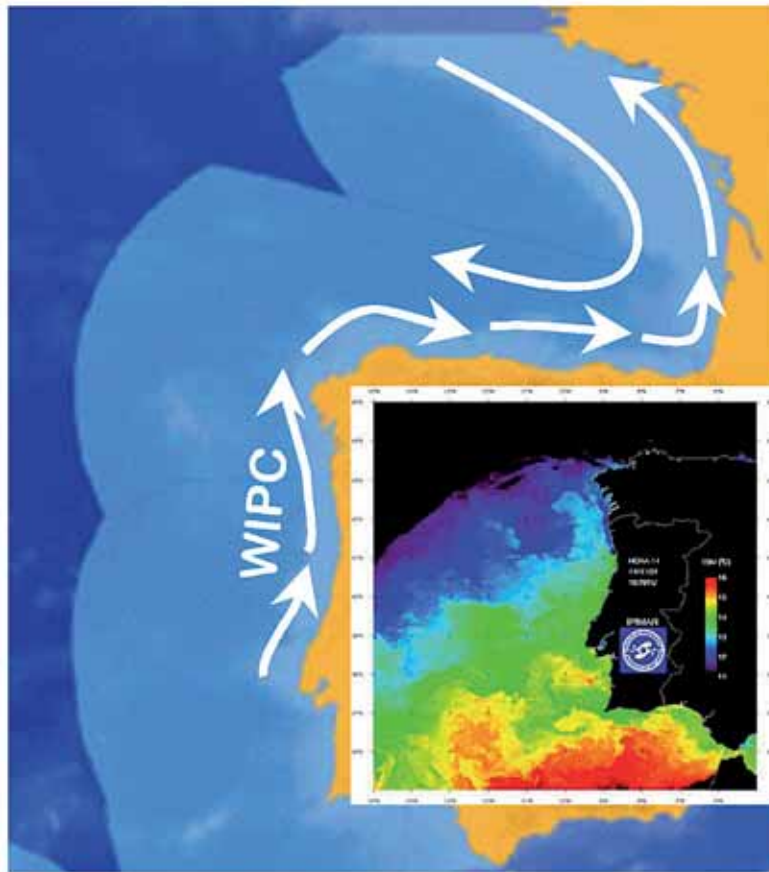
In autumn and winter, the surface circulation is predominantly northwards transporting higher salinity, nutrients-poor and warmer (subtropical) waters over the shelf break. The

Iberian Poleward Current and the Western Iberia Buoyant Plume (WIBP) is a low salinity surface water body fed by winter-intensified runoff from several rivers and seems to play an important biological role in the survival of fish larvae.

In the Cantabrian Sea, the surface currents generally flow eastwards during winter and early spring, and change westwards in late spring and summer following the wind forcing. In autumn and winter, the surface circulation is predominantly northwards, partially driven by southwards winds and meridional alongshore density gradients and transporting higher salinity, nutrients poor and warmer (subtropical) waters over the shelf break.

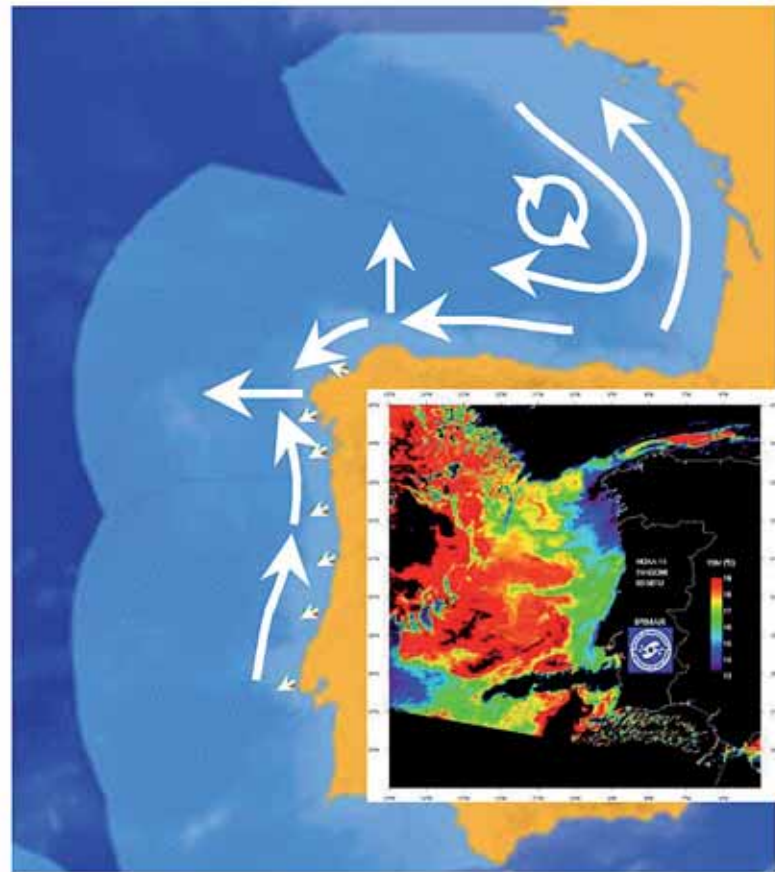


■ Schematic diagram of the general circulation in the Eastern North Atlantic.



■ Iberian and Biscay Winter Circulation

As a response to the autumn winter S-SW wind regime, and to meridional density gradients, a Western Iberian Poleward Current (WIPC) carries relatively warm, salty and nutrient poor subtropical water along the continental slope. (Inset: satellite image of the winter down-welling on the western coast of the Iberian peninsula)



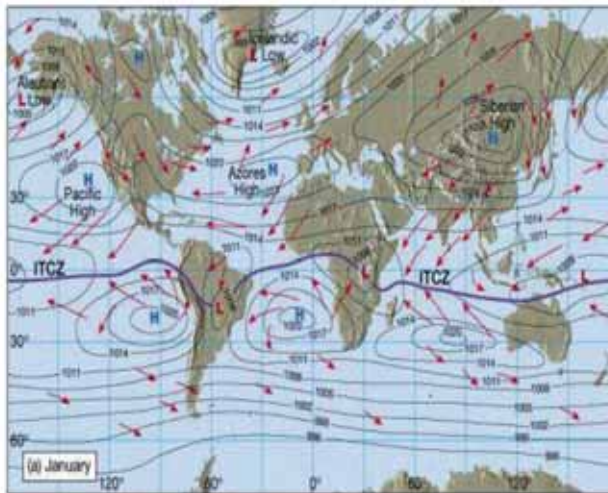
■ Iberian and Biscay Summer Circulation

During the spring and summer, northerly winds along the coast are dominant and cause coastal upwelling. This produces a south-westward current at the surface near the coast and a northward current offshore with fronts in Finisterre and Ortegal (Inset: satellite image of the summer upwelling on the western coast of the Iberian peninsula)

Hydrography and climate: large scale

The Azores High, (also known as North Atlantic High/Anticyclone or the Bermuda High/Anticyclone in the United States), is a large subtropical semi-permanent centre of high atmospheric pressure found near the Azores in the Atlantic Ocean at the Horse latitudes. It forms one pole of the North Atlantic Oscillation, the other being the Icelandic Low. This system influences the weather and climatic patterns of vast areas of North Africa and Europe. The aridity of the Sahara Desert and Mediterranean Basin is due to the subsidence of air in the system.

In summer, the central pressure lies around 1024 mbar (hPa), and moves north towards the Iberian Peninsula, causing ridging across France, northern Germany and the southeastern United Kingdom. This brings hot and dry weather to these areas. In years that the Azores High is well developed, it extends westward toward Bermuda, and begins to influence weather in the eastern United States. While it affects conditions in the western Atlantic, the Azores High can also be called the Bermuda High. In winter, the High moves to the south of the Azores, and fluctuations in pressure result in more variable weather. This high pressure block exhibits anticyclonic nature, circulating the air clockwise. Due to this direction of movement, African eastern waves are impelled along the southern periphery of the Azores High away from coastal West Africa towards North America and the Caribbean, sometimes triggering tropical cyclogenesis, especially during the hurricane season.



■ World scheme of high and low pressures

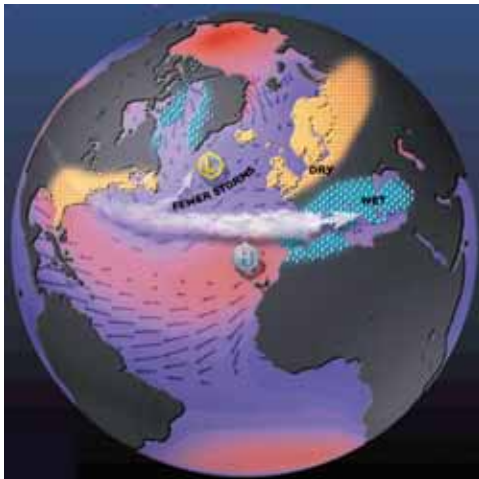


■ Tropical wave formation

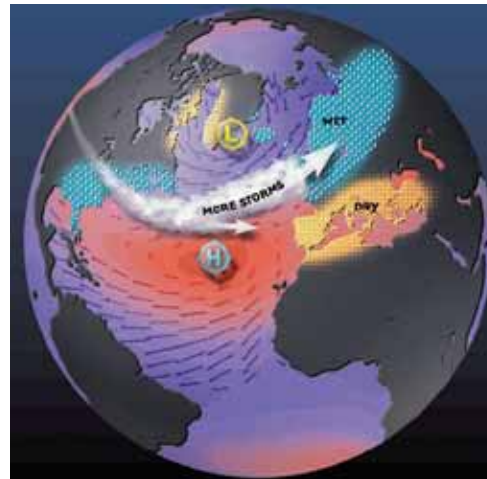
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The North Atlantic Oscillation (NAO) is a pattern of atmospheric variability that has a significant impact on oceanic conditions. It affects wind speed, precipitation, evaporation, and the exchange of heat between ocean and atmosphere. Its effects are most strongly felt in winter.

negative NAO



positive NAO



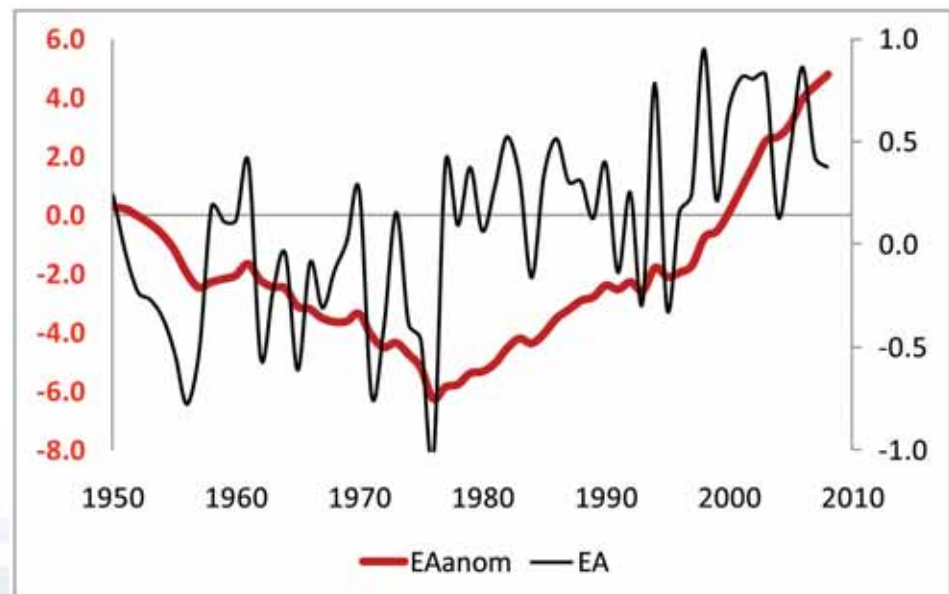
The NAO index is a simple technique used to describe the state of the NAO. It is a measure of the strength of the sea level air pressure gradient between Iceland and the Azores. When the NAO index is positive, there is a strengthening of the Icelandic low-pressure system and the Azores high-pressure system. This produces stronger mid-latitude westerly winds, with colder and drier conditions over the western North Atlantic and warmer and wetter conditions in the eastern North Atlantic. When the NAO index is negative, there is a reduced pressure gradient, and the effects tend to be reversed.

Another index, which is more regional than NAO, is the East Atlantic (EA) pattern. The EA pattern consists of a north-south dipole displaced southeastward of the NAO centre and contains a strong subtropical link that makes the EA pattern more suitable to SW European Waters

The positive phase of the EA pattern is associated with above-average surface temperatures with below-average precipitation across southern Europe.

The EA pattern exhibits the negative phase prevailing during much of 1950-1976, and the positive phase occurring during much of 1977-2008.

■ East Atlantic (EA) pattern

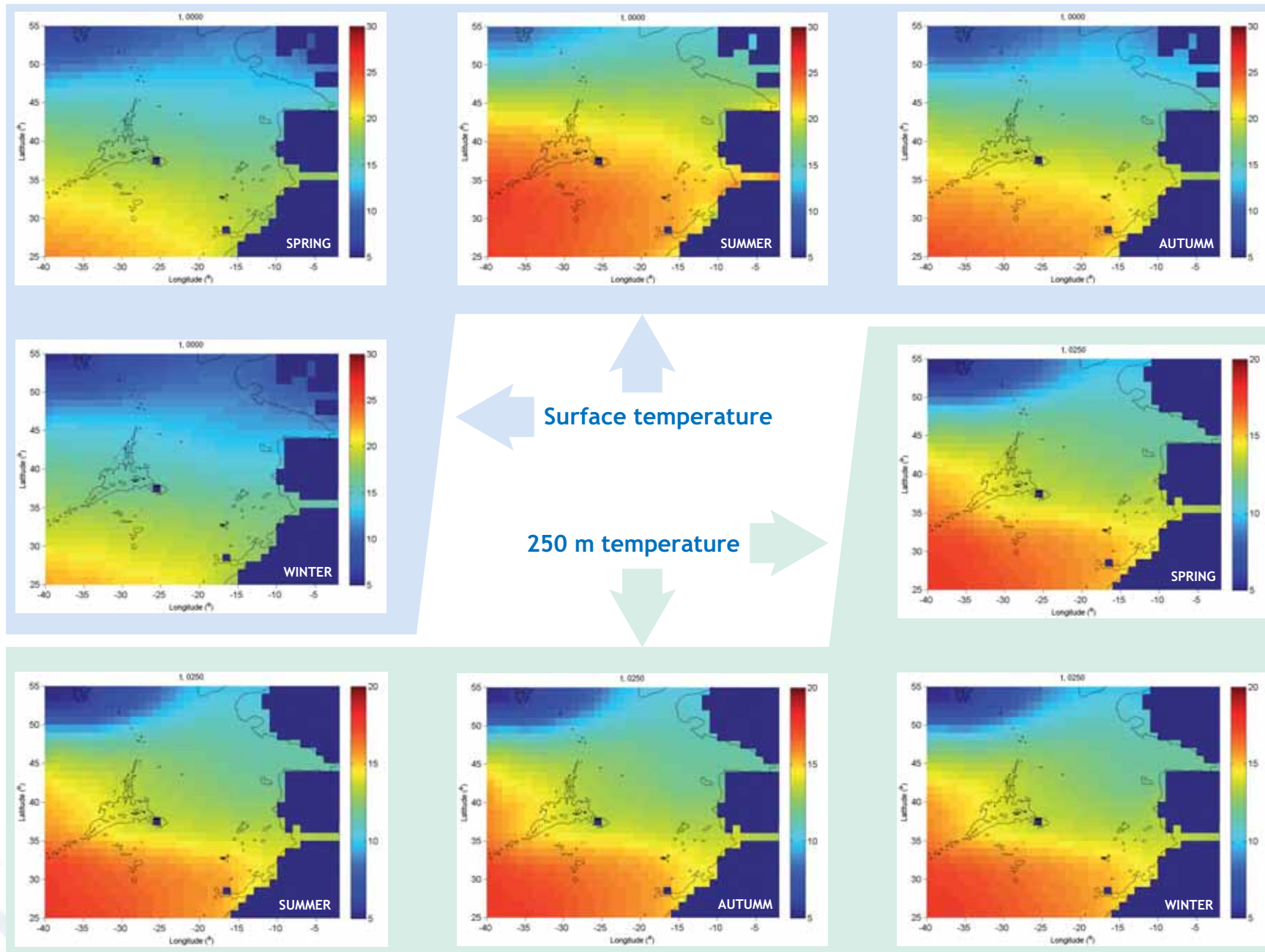


Temperature and global warming

The North East Atlantic upper waters have experienced progressive warming during the past and the present century. Mean surface water temperatures increased by 1.4°C in the south-eastern Bay of Biscay over the period 1972-1993 (0.6°C per decade) and by 1.03°C over the past century. The increase in heat content stored in the water column appears to be greatest in the 200-300 m layer, and it is in this layer that Eastern North Atlantic central waters respond quickly to climate forcing in areas of water mass formation located in the northern Bay of Biscay and adjacent areas.

In the next pages, mean seasonal temperatures are shown for the SWWRAC area. Data was obtained at NODC (WOA05).

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Salinity

The average concentration of salts in seawater is 35.5‰ by weight.

The average concentration of the main ions in seawater (shown as parts per thousand by weight) are:

Chloride Cl^-	18.980
Sulphate SO_4^{2-}	2.649
Bicarbonate HCO_3^-	0.140
Bromide Br^-	0.065
Borate H_2BO_3^-	0.026
Fluoride F^-	0.001
Sodium Na^+	10.556
Magnesium Mg^{2+}	1.272
Calcium Ca^{2+}	0.400
Potassium K^+	0.380
Strontium Sr^{2+}	0.013

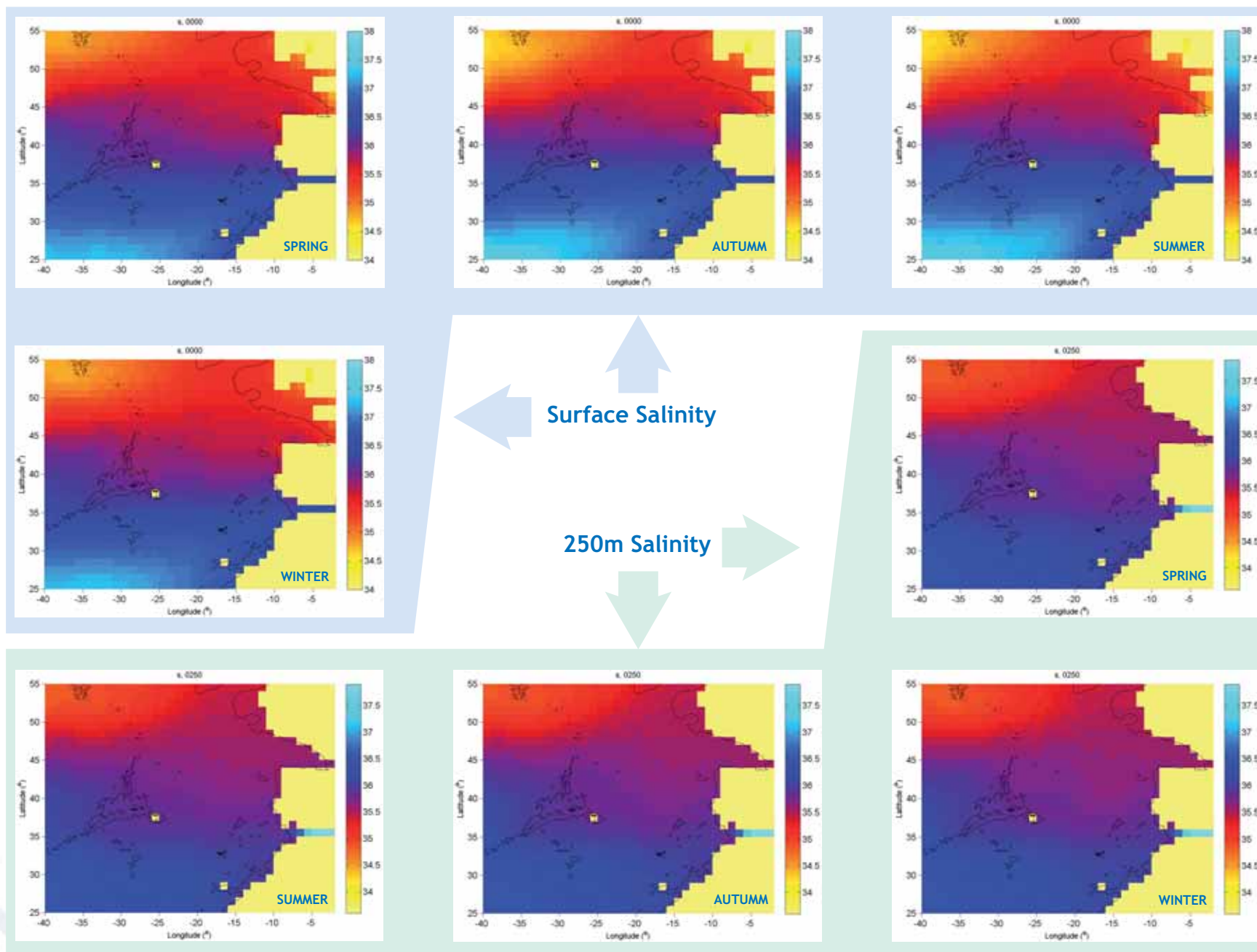
The north east Atlantic waters is dominated by high-salinity North Atlantic Central Water separated into Polar and Tropical modes. The Polar mode is formed at the bay of Biscay and diffuses east and south-east, reaching the Azores. The Tropical mode is observed mainly close to the continental margin, between the Canaries and Iberia spreading with the general eastward flow towards Iberia.

In the next pages, salinity seasonal means are shown for the SWWRAC. Data was obtained at NODC (WOA05).

Surface salinity is affected by factors such as evaporation, precipitation and river run off, mainly near coast and in winter time.

On the continental shelf, bottom salinity is close to 35.5‰. At slope depth, high salinities are found due to the MW (values around 37.0‰ in the Gulf of Cadiz and above 35.5‰ in the Bay of Biscay).

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Nutrients

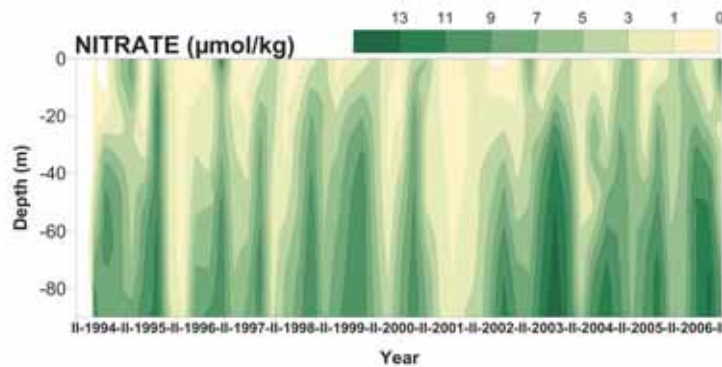
Nutrients are a series of elements and molecules which are dissolved in the ocean, and are essential for the growth of aquatic life. In the oceanic waters of the SWW region, concentrations of nutrients (such as nitrate, phosphate and silicate), are generally lower than in other oceans.

The deep waters are relatively 'young' and contain relatively low concentrations of nutrients regenerated from the remineralisation of sedimentary particles. Thus, despite the comparatively great depths to which winter cooling overturns and vertically mixes the water column in the North-east Atlantic, particularly in the area to the west of the Bay of Biscay, overall nutrient content is relatively low.

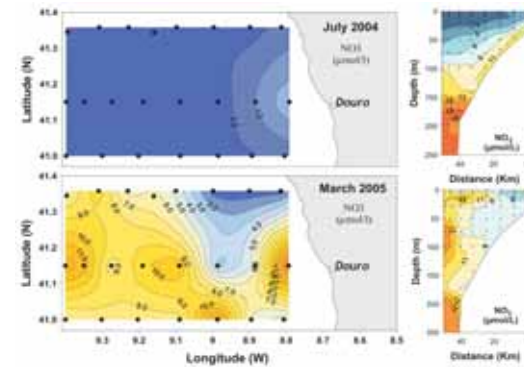
In the Eastern North Atlantic, coastal upwelling occurs between April and October. The subsurface waters that reach the surface in the coastal zone during upwelling are transported to the open sea as relatively cold and nutrient-rich streams and extend offshore for hundreds of kilometres. The high productivity consequences on the trophic chain are well-known in upwelling regions and the Atlanto-Iberian fisheries benefits from this. Under conditions of moderate upwelling, the innermost coastal 25 km are about 10 times more productive than offshore waters and the upwelling centers are about 20 times more productive.

In the Bay of Biscay the rivers are the major source of nutrients. In early spring, the production is limited by silica and phosphorus. Loyer (2001) has shown that phosphorus limitation is especially important within the coastal zone and occurs directly in late winter in front of the Gironde estuary. Through high nitrogen inputs from the rivers, the winter nitrate limitation is only reached at the end of the summer or beginning of autumn. However, silicate concentrations show a clear increase during summer, indicating the importance of the regeneration processes from the shallow benthic compartment.

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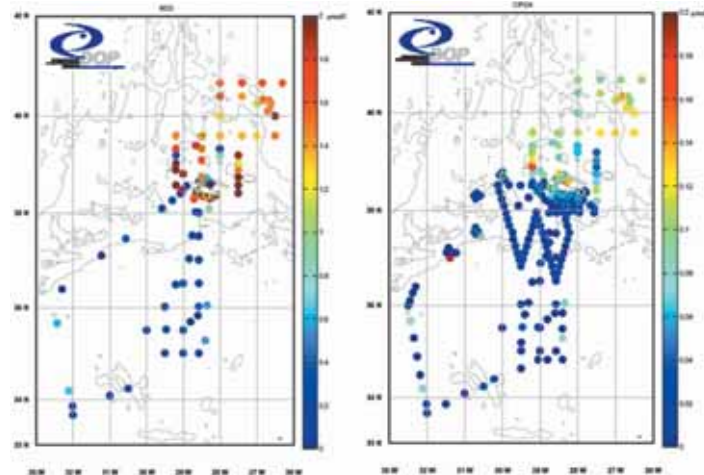


■ Time series of nitrate levels in coastal waters in NW Iberia peninsula (front of Ria de Vigo).

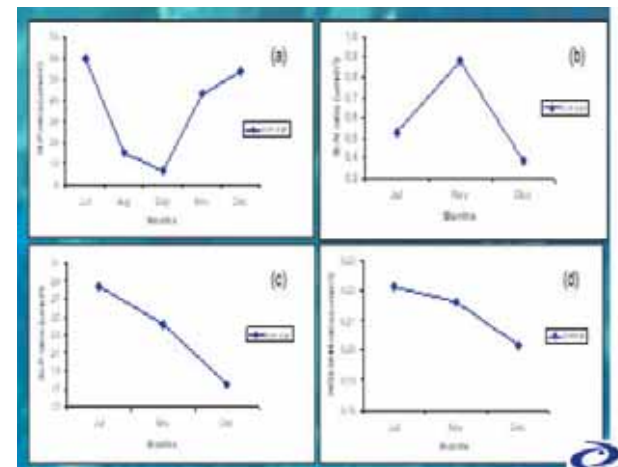


■ Nitrate levels in coastal waters in western Iberian Peninsula (front of the Douro plume) in an upwelling scenario (Summer 2004), and a no-upwelling scenario (Spring 2005).

By kind permission of Graça Cabeçadas



■ Spatial variability of nitrate (left) and ortho-phosphate (right) from surface sampling stations collected within the framework of several projects in the Azores region, between July 2006 and September 2008. The Azores constitute a nutrient transition region in the NE Atlantic.



■ Temporal variability of average ratios (a) N:P, (b) Si:N, (c) Si:P and (d) $\text{NO}_3:\text{NH}_4$ from surface sampling stations collected within the framework of several projects in the Azores region between July 2006 and September 2008.

By kind permission of Sandra Sequeira

Sea Floor Habitats

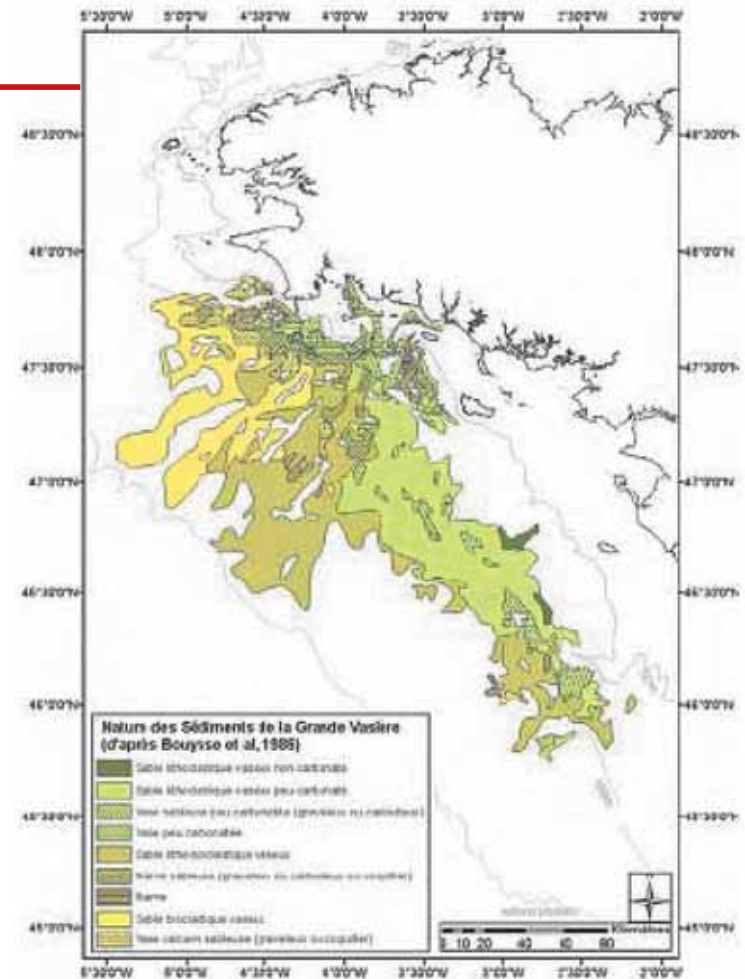
The distribution of organisms which live on or in the sea floor is determined by the type of substrate (e.g. mud, sand, gravel or rock) present. The distribution of substrate is dependent on the geomorphology, hydrography and the currents in each area, and also on the river outputs and other sediment sources.

The type of sea floor will be one of the most important drivers determining the organisms present in each area. Likewise some organisms, especially sessile (stationary) ones, have an important role on the sea floor habitats sheltering juveniles and benthic organisms, or protecting sediments against the erosion produced by the currents.

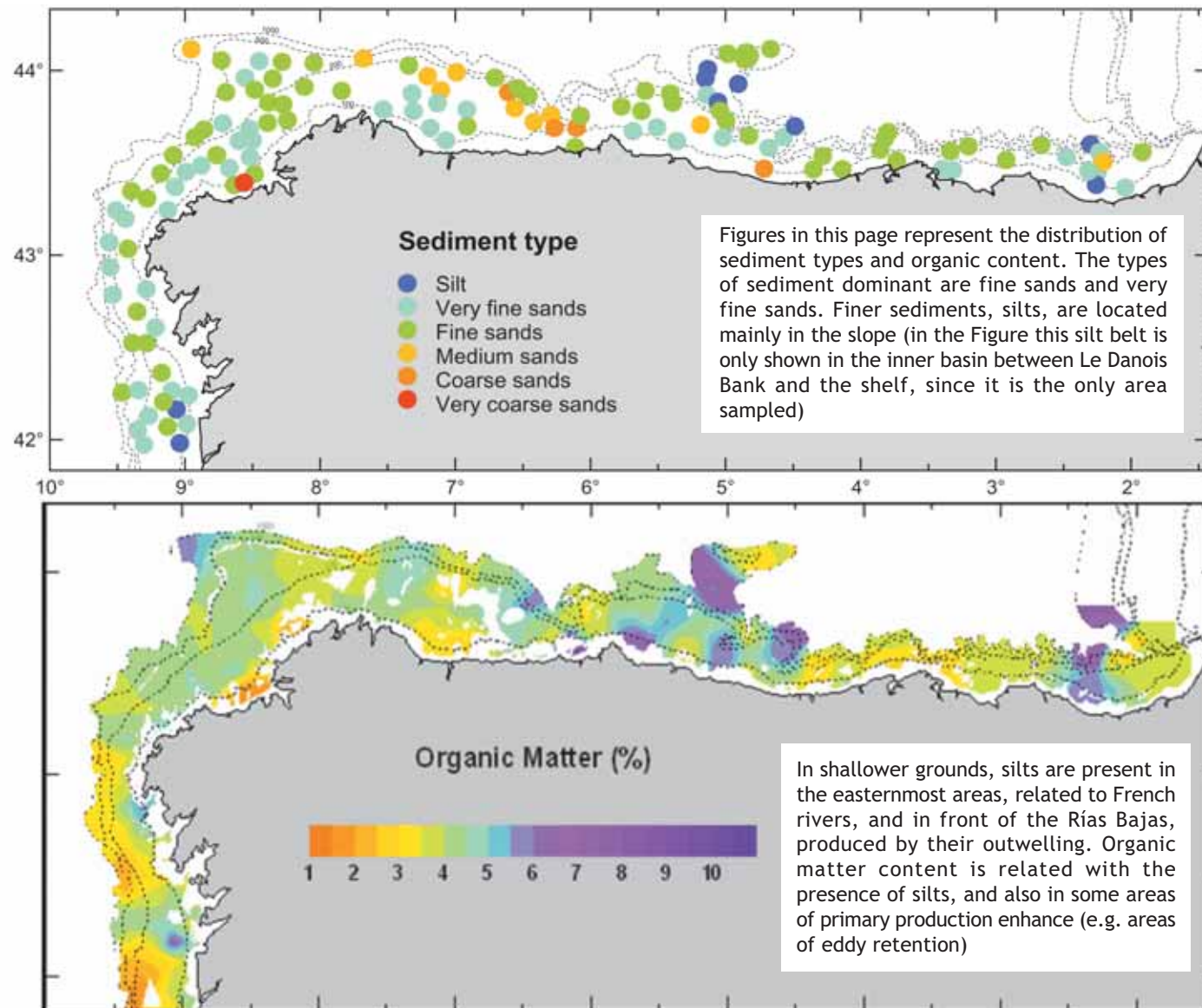
Due to all these aspects, maps of sediments and sea floor habitats are very important to understand the distribution and abundance of the organisms and resources. Examples of these maps in the SWW area are presented in this section.



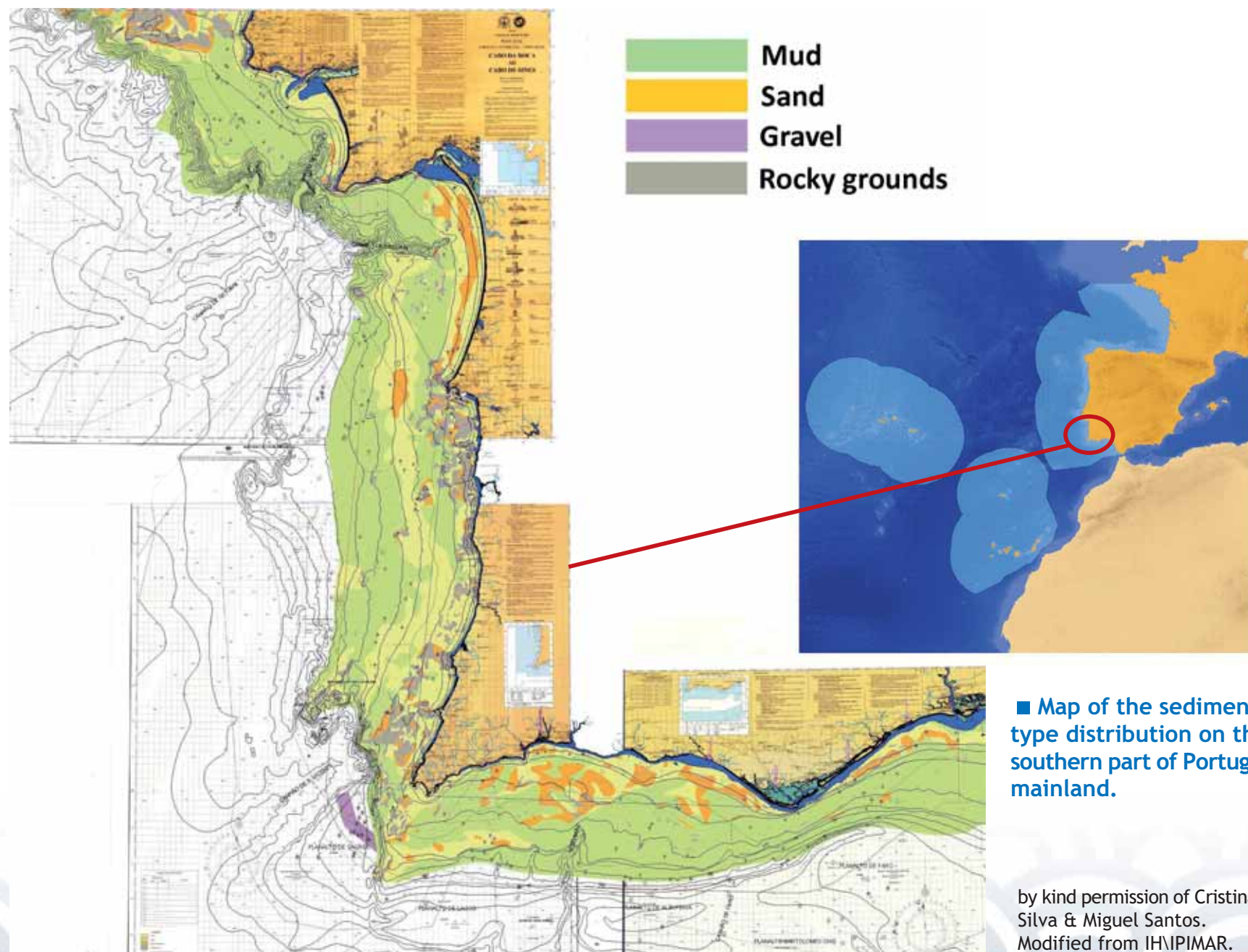
■ Map of sediment types distribution on the Grande Vassiere (Bay of Biscay) based on a Seabed sediment map of English Channel and North Sea, modified by Carpentier et al. (2008) after "Seafloor sediment of the North Sea" from the MARGIS project (Larsonneur et al., 1982; Augris et al., 1995; Duphorn et al. 1970; Figge, 1981; British Geological Survey, (BGS) 1977-1993; Danish Geological Survey (GEUS), 1992) extended with a more detailed map of the Dutch Maritime area.



South Western Waters Atlas



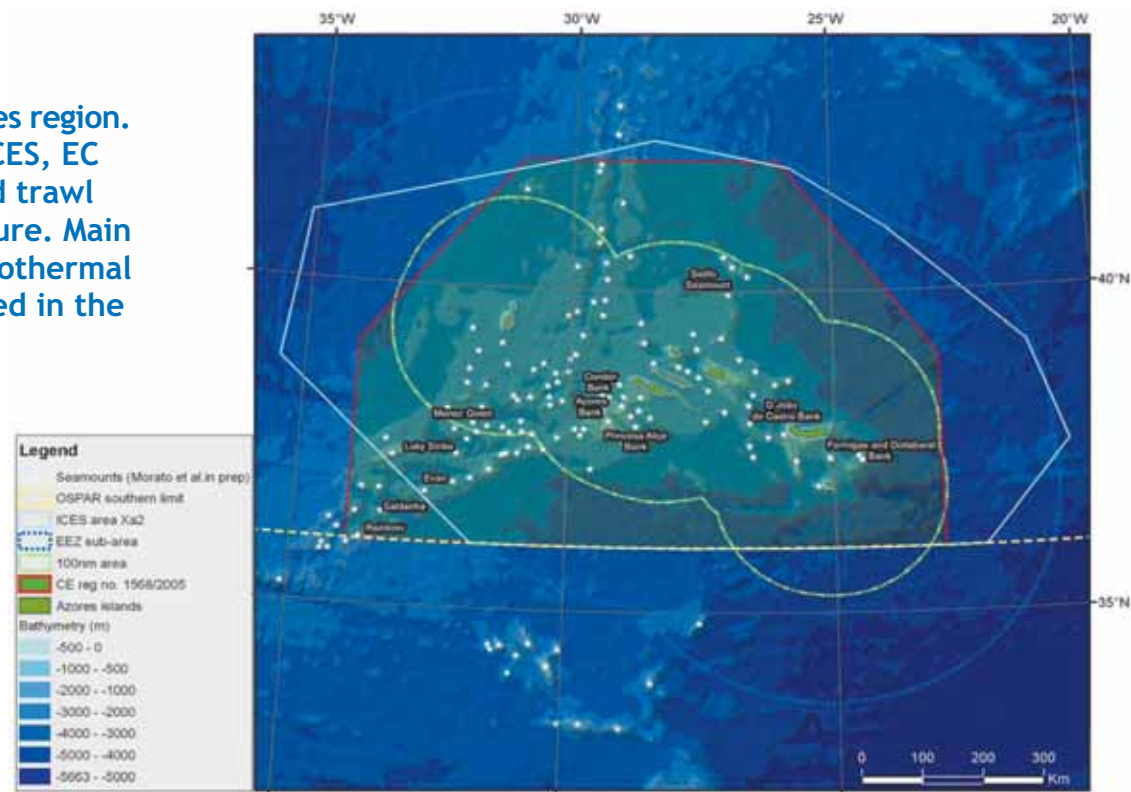
South Western Waters Atlas



South Western Waters Atlas

The oceanic marine environment around the Azores is considered a deepwater one characterized by narrow or absent coastal island platform (the strata from 0 to 1 000 m represents about one percent of the total Azorean EEZ area) and large proportions of the abyssal areas (ca 4000m) punctuated by seamounts. The seamounts (including knolls, hills or guyots) are the predominant habitat (about two percent of the total EEZ). A density of about 3.3 peaks of all sizes per 1000 km² was estimated for the Azores EEZ, a value that may be of the same order of magnitude as that estimated on the Mid-Atlantic Ridge. A total of 63 large and 398 small seamount-like features are mapped and described in the Azorean EEZ.

■ Seamounts distribution on the Azores region. Convention and law areas (OSPAR, ICES, EC regulations of 100 and 200 miles and trawl banning) are included also on the figure. Main banks and seamounts as well as hydrothermal vents of the region are also illustrated in the figure (black)



by kind permission of Fernando Tempera



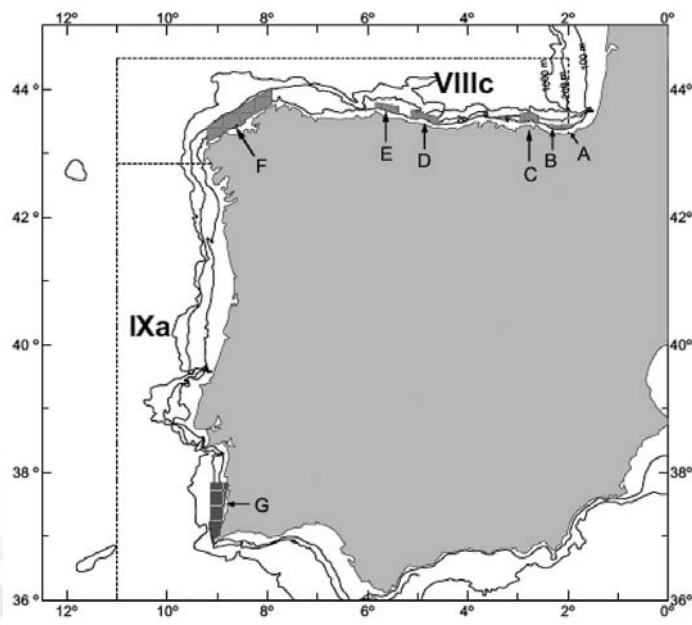
Marine Protected Areas

Marine Protected Areas (MPAs) are areas of the ocean protected from human activities for either conservation purposes or to protect fish stocks. MPAs cover a wide range of marine areas, with different levels of restriction to protect living, non-living, cultural, and/or historic resources. A commonly used definition is one developed by the World Conservation Union (IUCN) which states that it is 'any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment'. In the EU, MPAs are mainly declared using two different criteria: the Natura 2000 network and OSPAR. Both criteria use the presence of vulnerable habitats and threatened and sensitive species as key factor, differing in the list of habitats and species.

South Western Waters Atlas

The network of Marine Protected Areas (MPAs) in the SWW area is under development, and many of the areas identified are still being studied before a final decision is taken. In the case of the Azores Archipelago, some projects focused on seamounts and hydrothermal vents habitats have identified several areas already designed as MPAs under OSPAR and Natura 2000 SACs.

A different type of protection, more directly related to fishing and fisheries are the exclusion areas for some gears, usually oriented to the protection of recruits for some species or spawning areas. For example in the northern Spanish shelf, trawling is banned in grounds shallower than 100 m. Some of these exclusion areas are shown on the next page and usually relate to the distribution of recruits detected in scientific surveys. Figure below.



■ Existing Spanish and Portuguese closed areas

A: Fuenterrabia; C: Bermeo; D: Llanes - Trawl prohibited all year

B: Guetaria - Trawl prohibited September to December

E: El Callejón and La Carretera - Trawl prohibited September to March

F: A Coruña and Cedeira - Trawl prohibited October to December

G: Milfontes and Arrifana - All gears prohibited December to February



Essential Fish Habitats

The term Essential Fish Habitats was introduced by the U.S. Congress in 1996 (as an amendment to the Magnuson-Stevens Fishery Conservation and Management Act) where the importance of habitat protection to healthy fisheries was emphasized. This habitat is termed "essential fish habitat" (EFH) and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Species' EFH includes habitats important for the different stages of a fish's lifecycle, as most fish use different habitats and different areas during their lifespan. Thus, EFH mapping requires continuous monitoring of fisheries' resources and updating of existing EFH maps in order to depict the environmental changes that affect species' distributions as well as the extent of different habitat use.

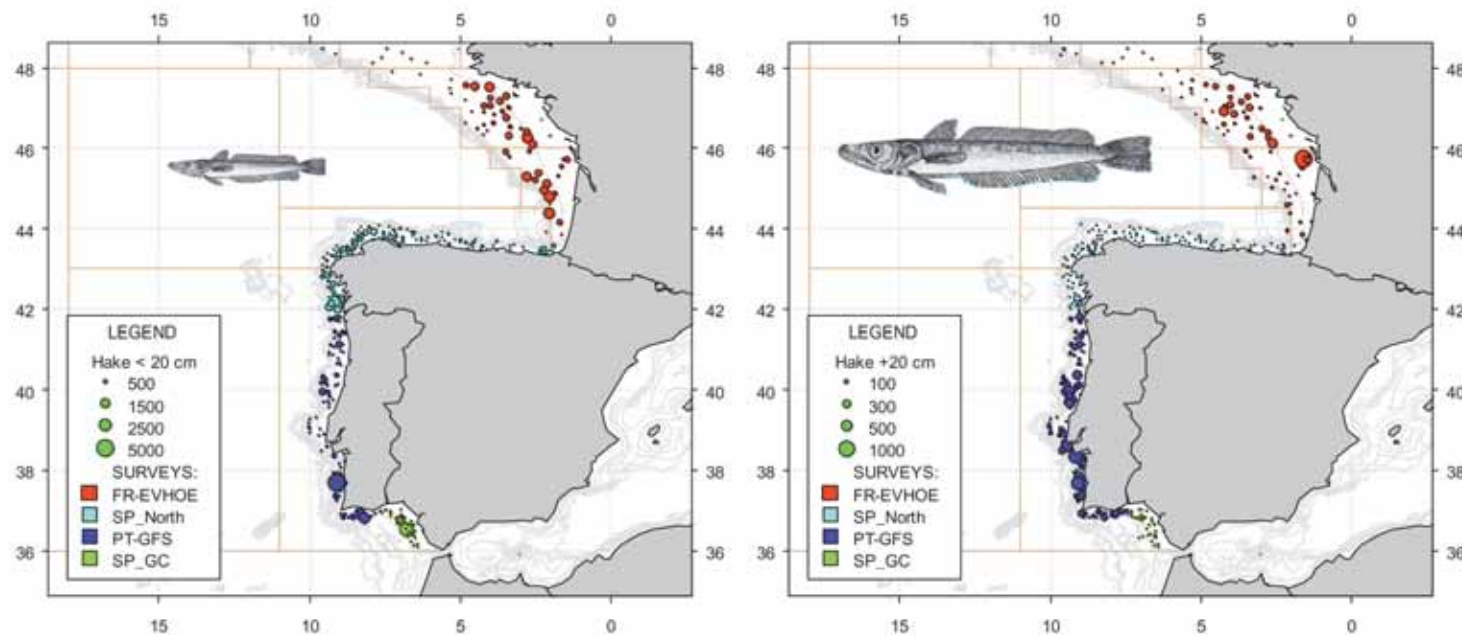
The following sections describe the essential fish habitats for the main target species in the fisheries studied in this Atlas.

South Western Waters Atlas

Nurseries areas and demersal fish stock distribution

Mesoscale pattern seems to be very important in early stages of fish lifecycles. In the case of hake, there is a relationship between the recruitment and environmental conditions in southern Bay of Biscay. In the eastern, progressively narrowing, shelf of the Cantabrian Sea, years of massive inflow of the eastward shelf-edge current produce low recruitment indices, due to larvae and pre-recruits being transported away from spawning areas to the open ocean.

However, adults tend to concentrate more on the rocky part of the shelf break, though there are depth migrations depending on feeding and reproduction seasons.



■ Distribution maps of hake recruits and adults.

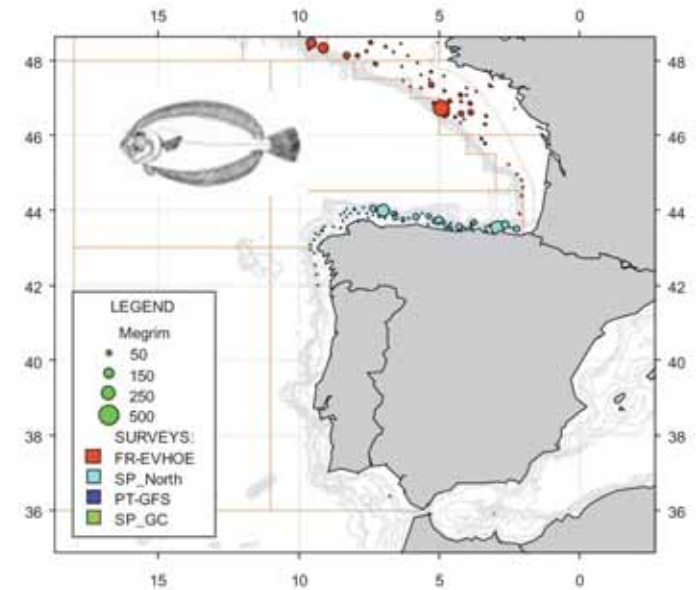
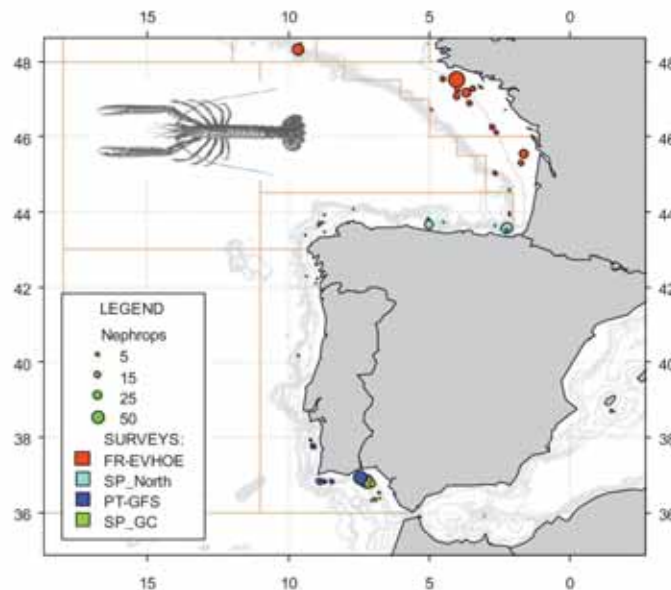
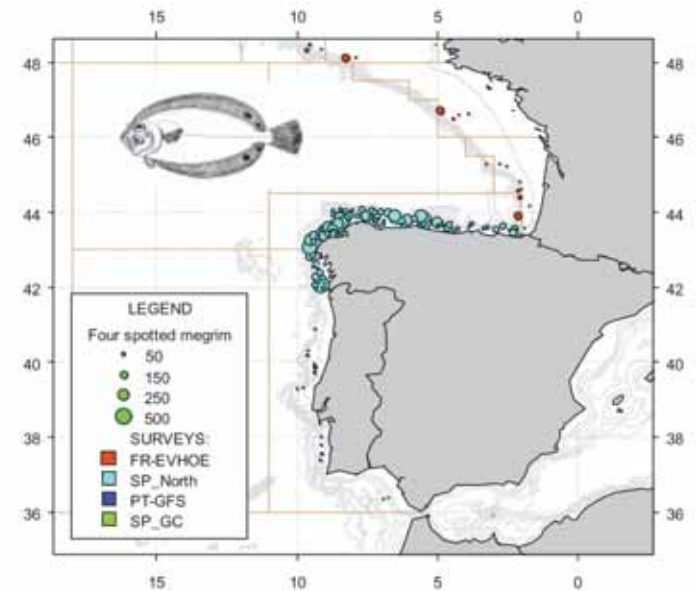
These results come from surveys carried out annually by IFREMER, IEO and IPIMAR on different vessels using different gears. Therefore the results are only comparable within surveys, and not between the different areas.

Demersal fish stock distribution

Distribution maps of Nephrops, megrim and four spotted megrim, three of the main targets of the mixed bottom trawl fishery in all the SWW RAC area.

See previous page on limitations of the results shown. The limitation is more important in the case of benthic species as megrim and four-spotted megrim. These maps are based on the bottom trawl surveys coordinated under the ICES International Bottom Trawl Survey WG 2007 and partially funded by the EU under the DCR.

Horse mackerel occupation areas for the period 1992-2002. Results from Portuguese bottom trawl surveys between 20 and 750 m

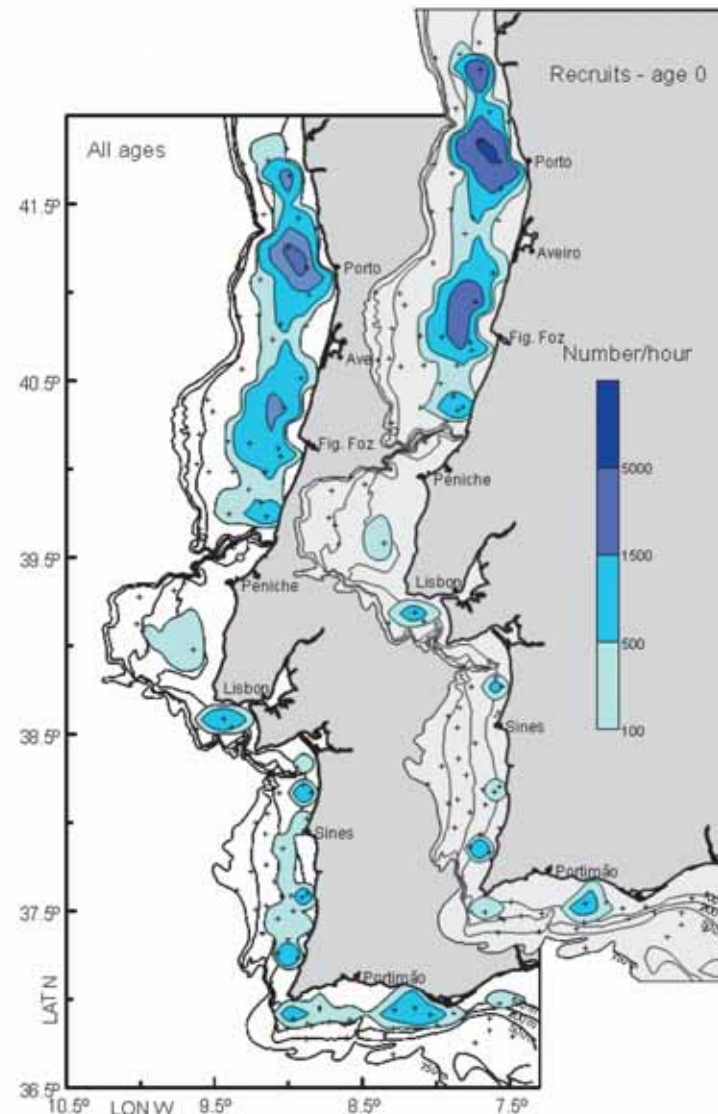
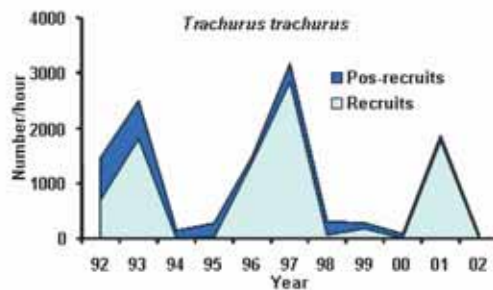


HORSE MACKEREL



Trachurus Trachurus

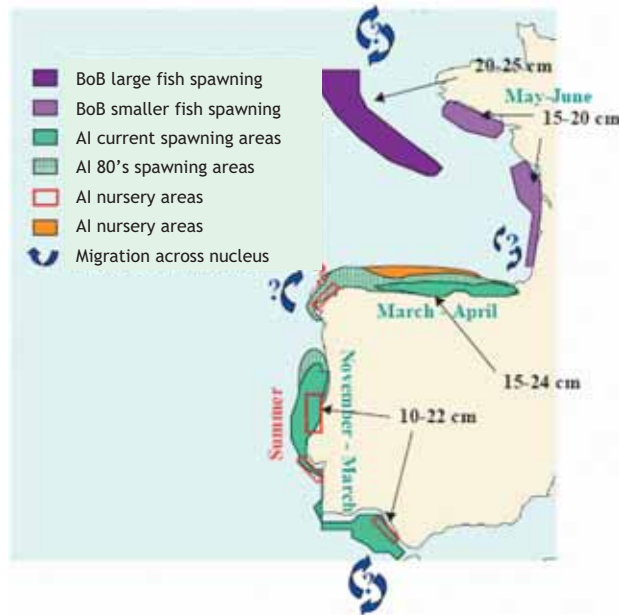
- Distributed along the whole area mainly at waters < 200 m depth;
- Abundance indices oscillating and dominated by recruits;
- Recruits distributed mainly at North of Peniche;
- High level of recruits in 1993, 1996, 1997 and 2001, low level in 2002.



■ Horse mackerel occupation areas for the period 1992-2002. Results from Portuguese bottom trawl surveys between 20 and 750 m

By kind permission of Fatima Cardador

SARDINE



Wide distribution of genetically homogeneous populations along the Iberian peninsula and Bay of Biscay; distribution limits in North East Atlantic from Northern Morocco to the English Channel. Different population nuclei connected by reduced individual flow. Different life history characteristics (growth, age structure), asynchronous recruitment dynamics, and variability in time in the different nuclei.

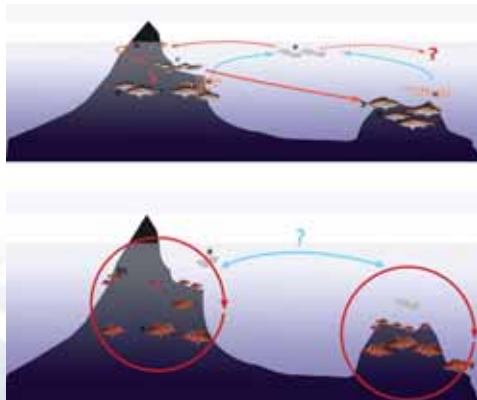
Spawning is widespread on the shelf in the 1980s, reduced to patches or coastal spots in the 1990s and showing some recovery in the 2000s Recruitment is associated with retention areas.

The Northern Iberian nucleus sustained by recruitment from adjacent areas (Northern Portugal and Southern Bay of Biscay) and composed of mainly old and large individuals

■ Conceptual diagram of sardine dynamics in the Iberian Peninsula. BoB: Bay of Biscay, AI : Atlanto-Iberian area. Months (in green) indicate spawning period, while numbers (in black) indicate length range. (ICES, 2004)

By kind permission of B. Santos and M. Bernal, IEO

The spatial ecology of seamount fishes (such as the essential habitat, migrations, and dispersal) is virtually unknown for the vast majority of the target species. This gap seriously hinders our capacity to devise sound spatial management schemes for seamount fisheries. The spatial ecology of target species of the Azores ecosystem is also poorly known. In particular, the question of whether seamount fishes depend on shallower habitats to complete their life cycle remains unanswered. This question is of major importance, given the high degree of isolation that apparently affects populations around the Azores region. This issue may constrain exploitation. Stock assessment and the application of appropriate management measures since management units are not very well defined.



■ Figure 1 - Representation of life cycle (red lines) and the hypothesized connectivity (blue line) scenarios island-seamount for blackspot seabream (upper panel) and bluemouth rockfish (lower panel).

- a) pelagic larvae,
- b) pelagic recruits
- c) demersal juveniles
- d) adults and
- e) eggs.

By kind permission of J. Fontes



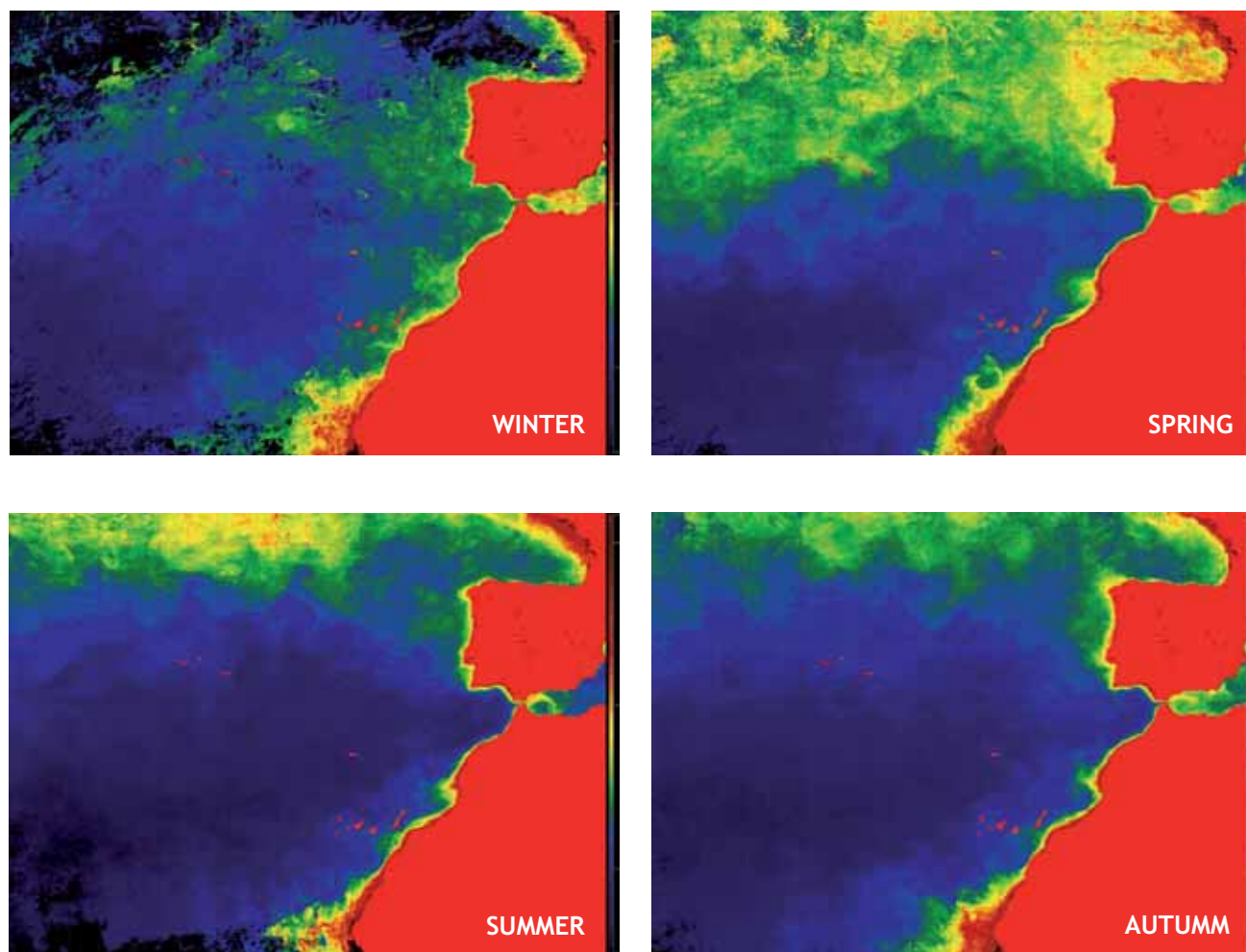
Plankton

The phytoplankton pattern in the Bay of Biscay and Iberian coast is the typical for a temperate sea and characterised by a winter mixing period followed by a stratification phase during summer. Phytoplankton blooms during the transition periods (i.e. in spring and autumn) are characterised by an almost absolute dominance of diatoms. During summer stratification, nutrient concentrations drop and phytoplankton biomass decreases to low levels. In winter, mixing and low light levels prevent phytoplankton growth despite high nutrient concentrations.

During the winter the plumes of the large rivers (as the Loire, Gironde, Minho, Tejo and Douro) produce short-lived plankton blooms.

NE Atlantic oceanic waters shows the highest seasonal means during springtime and rich mesoscale variability patterns are often associated. The Azores region, in particular, shows typical mid-latitude behaviour with pronounced spring phytoplankton bloom patterns. These blooms are mostly triggered by increased light supply and changes in the depth of vertical mixing (i.e. warmer temperatures and increased sunlight, creates a thermocline that traps nutrients at the ocean surface, allowing phytoplankton to absorb energy and take in the nutrients they need to photosynthesize and multiply). During summertime, phytoplankton uses up the available nutrients and begin to die and drift to the bottom. As autumn begins, cooler days cause some vertical mixing that may bring nutrients up from below resulting in a relatively smaller fall bloom. Once winter begins, plummeting temperatures and frequent storms cause heavy mixing. As phytoplankton do not remain at the surface in this mix, they do not have ready access to sunlight, so blooms generally do not occur in winter at these latitudes.

South Western Waters Atlas



MODIS OC calculated seasonal medians for the SWW RAC (in Chl a mg m⁻³) (see <http://oceano.horta.uac.pt/detra/>). Spring blooms and winter mixing effects in Chl a mean distributions is quite evident in the NE Atlantic (see modis/modis_pesquisar.php)

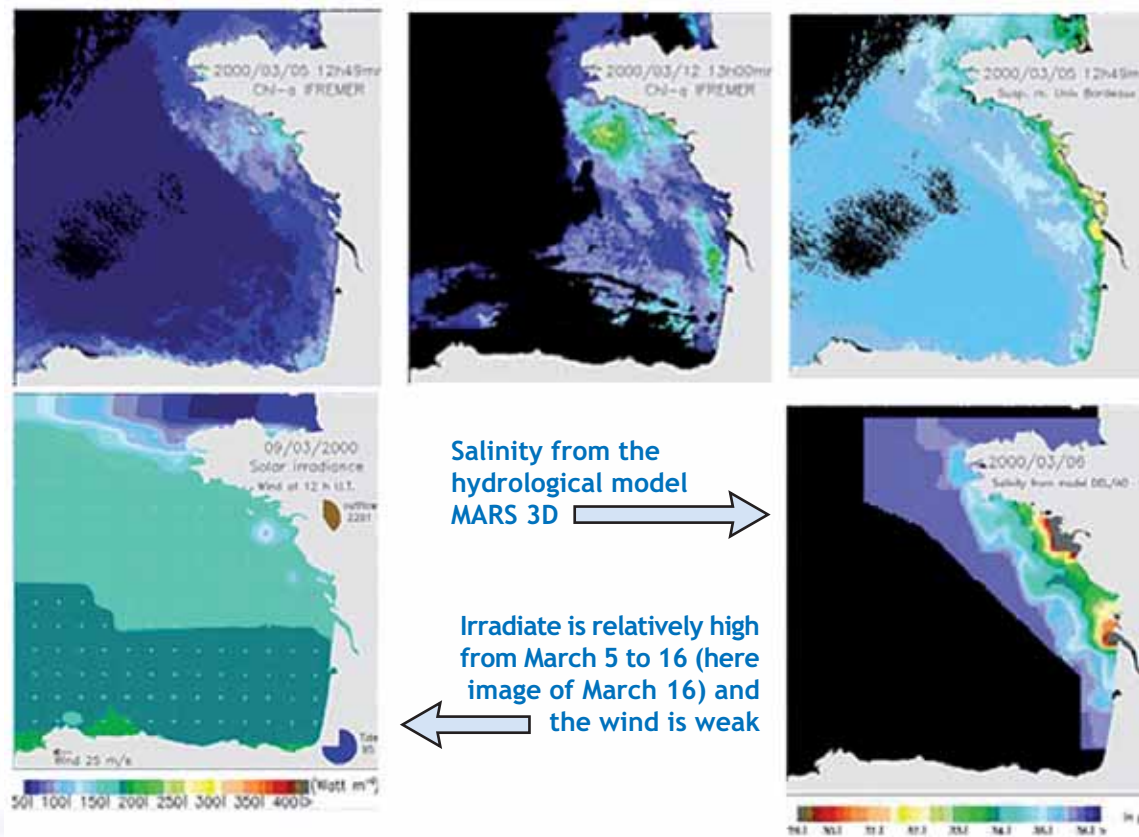
South Western Waters Atlas

A late winter bloom observed in March 2000:

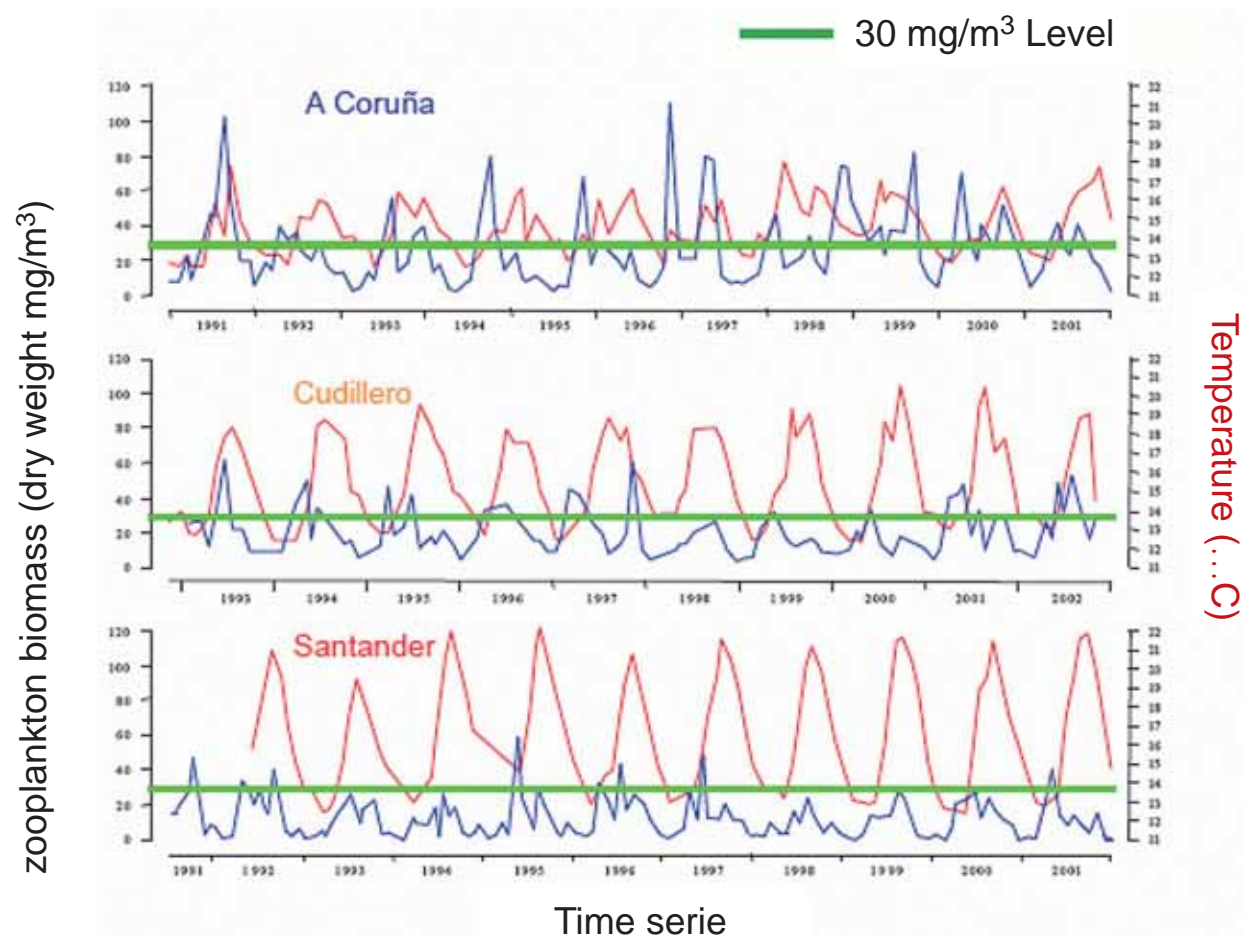
Offshore of Southern Brittany, a bloom started from clear and stratified waters located over the 120 meter depth line (March 5) and reached the coast on March 16. This bloom appeared in frontal waters, in the plume of the rivers of South Brittany (Loire, Vilaine, ...).

Thanks to haline stratification, the homogeneous surface layer was thin enough (30 m) for favouring the exploitation of the incoming light by phytoplacton.

At that period of the year, the light is the limiting parameter and blooms develop outside of the turbid areas.



South Western Waters Atlas



■ Annual cycle along the decade of 1990 of zooplankton abundance in three radials off the north Spanish Coast

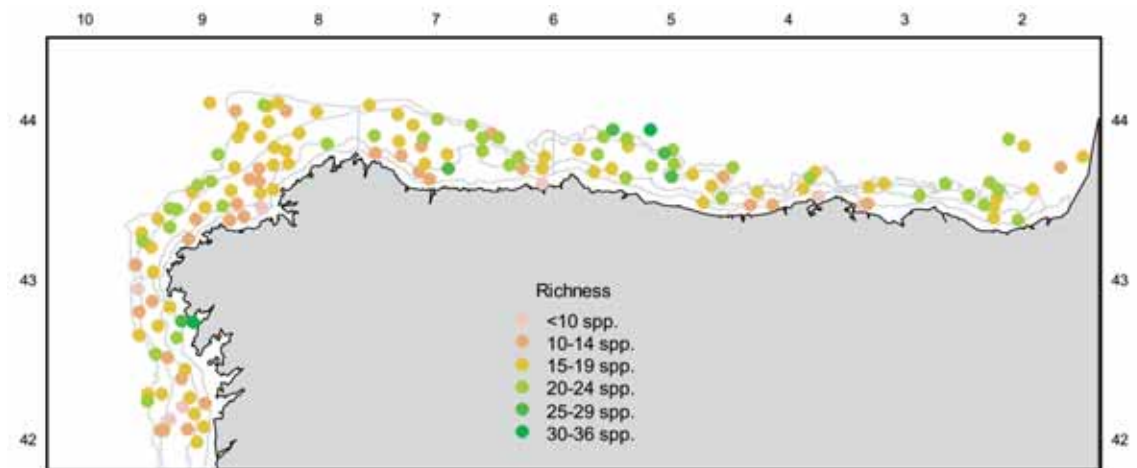
Organisms in/on the sea floor



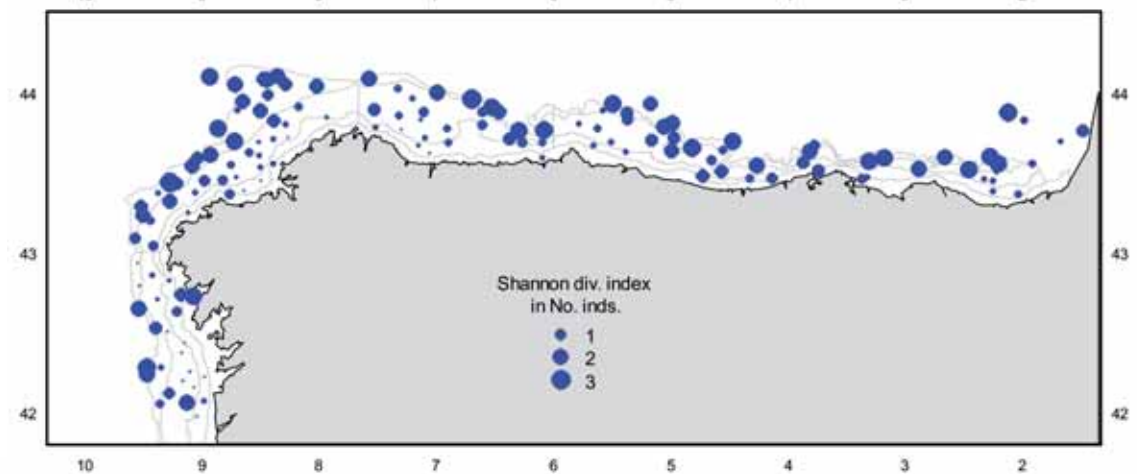
South Western Waters Atlas

Invertebrates richness and diversity

■ Number of different species of invertebrates per haul in 2008 bottom trawl surveys on the Northern Spanish shelf



■ Diversity of invertebrates per haul in 2008 bottom trawl surveys on the Northern Spanish Shelf



Marine mammals



Marine Mammals

A large variety of marine mammals, both boreal and temperate, have been reported in the South Western Waters (SWW) region. Seven pinnipeds (seals) and thirty cetaceans have been documented. However, some records correspond to vagrant individuals, outside their normal range and therefore cannot be considered part of the regional fauna. Information about some rare species is very scarce.

The pinnipeds most commonly seen are the grey seal and the harbour seal. The southernmost breeding colony of grey seals is found in Brittany, with a permanent population. The harbour seals specimens are vagrants from the southernmost breeding groups along French Channel coasts. Monk seals were once common in the south-eastern North Atlantic, from the Azores Islands to near the equator, but at present only breeding colonies subsist on Madeira and Desertas Islands and around Cape Blanco on the Mauritanian coasts.

Two species of great whales: the fin whale and the sperm whale, and six smaller species: long-finned pilot whale, Risso's dolphin, bottlenose dolphin, striped dolphin, common dolphin and harbour porpoise are the most common cetaceans in these waters.

Among the cetaceans with baleen plates in their mouths (instead of teeth), only fin whales are common through the entire region. During spring and summer fin whales approach the continental shelf for feeding, mainly on krill. Fin whales have also been found offshore Atlantic waters in winter. Sei and blue whales are common in the Azores during spring and early summer, spending days to weeks foraging around the islands and seamounts. The northern right whale that once was a common species along the northern and western Spanish coast has only been reported in these waters over the last 30 years on very exceptional occasions. Among the toothed whales, the sperm whales tend to aggregate in summer over the continental slope, feeding on cephalopods. Males undertake large scale migrations while females and young animals remain all year round in tropical and temperate waters, at latitudes less than 50° N.

Common dolphin is the most frequently observed cetacean at sea in the SWW region and also represents about 50% of all strandings. In the Azores is the most abundant species during winter and early spring. Common dolphins feed upon commercially important fish species such as blue whiting, sardine and horse mackerel. Bottlenose dolphins are encountered around the coast of France, Spain, Portugal and the Macaronesian Archipelagos, occurring year round. Groups of bottlenose dolphins are resident in several inshore bays from Brittany to Portugal and in the Atlantic islands. The highest densities are found on the coastal waters of the Iberian Peninsula. The most important prey species are blue whiting and hake. Harbour porpoise was considered one of the most common species in the area, but now sightings and strandings are only common in western Galician and northern Portuguese coasts. This distributional pattern coincides with an ongoing habitat-related fragmentation. Contemporaneous climate warming seems to be contributing to this fragmentation process. The Atlantic spotted dolphin becomes the dominant species in the Azores between May and September.

Pressures and impacts

Increasing underwater noise, produced by maritime traffic, seismic surveys and military exercises is a general concern for the conservation of cetaceans.

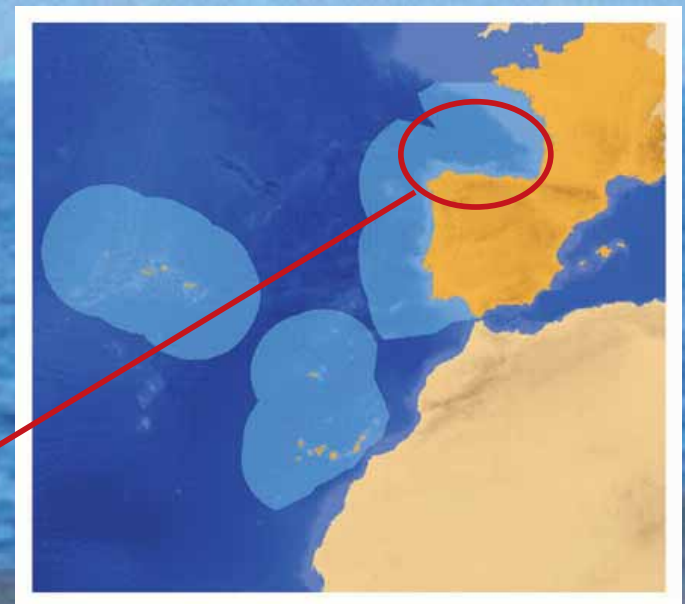
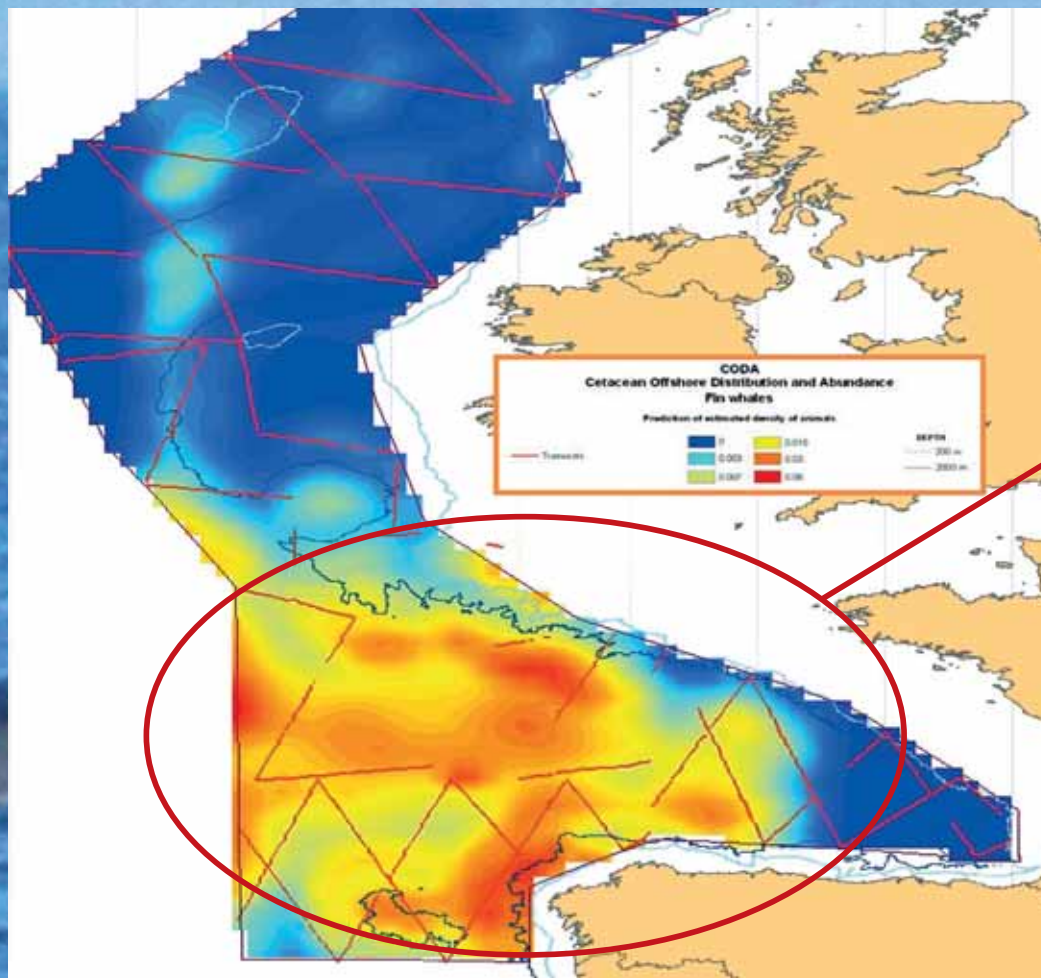
Incidental catches of common dolphins are reported in several fisheries in the northern part of the SWW region, including bottom gillnets and tuna and herring pelagic trawl fisheries. In 2004 the EU introduced a Regulation with measures to reduce the incidental capture of cetaceans that applies to several ICES Divisions within this region.

Bottlenose dolphin and harbour porpoise which have a predominant coastal habitat can be chronically contaminated with PCBs and other persistent residues from land, and can also be impacted by other anthropogenic alterations of their habitats. Whale watching is an important activity in the Canary and Azores Islands and in the Gibraltar Sts. and may be the most important threat to the welfare of cetaceans in some of these areas. Regulations and codes of conduct are in place to minimise the impact.

South Western Waters Atlas

Population estimates

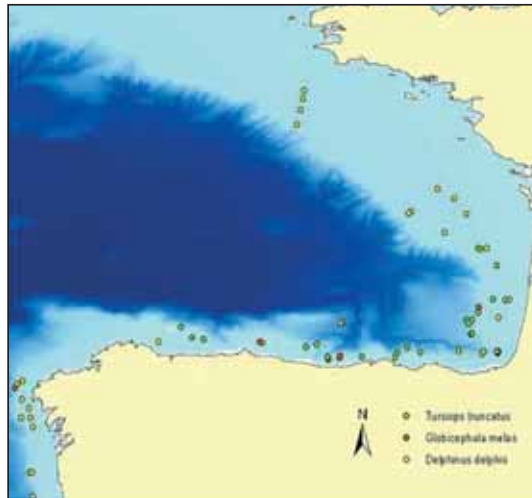
Several dedicated and combined sighting surveys have been carried out to estimate cetacean abundance in western European waters, but none of them covered the full extension of the SWW region. Available data on distribution and abundance for the most abundant species are only snapshots for particular areas and times of the year (See maps of cetacean distribution or abundance in this and the following pages).



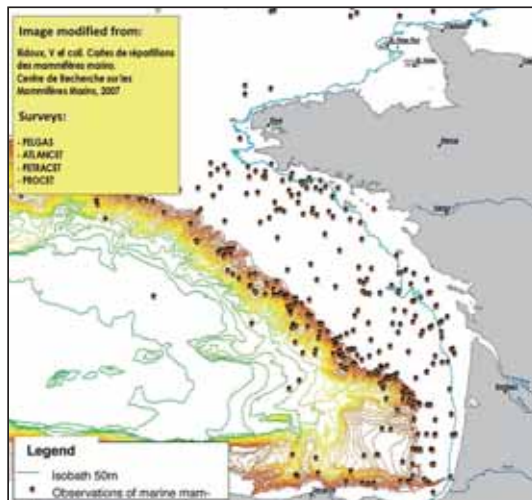
■ Predicted fin whale abundance from the CODA surveys in July 2007.

figure taken from the CODA Project Report by kind permission of P.S. Hammond. Unpublished

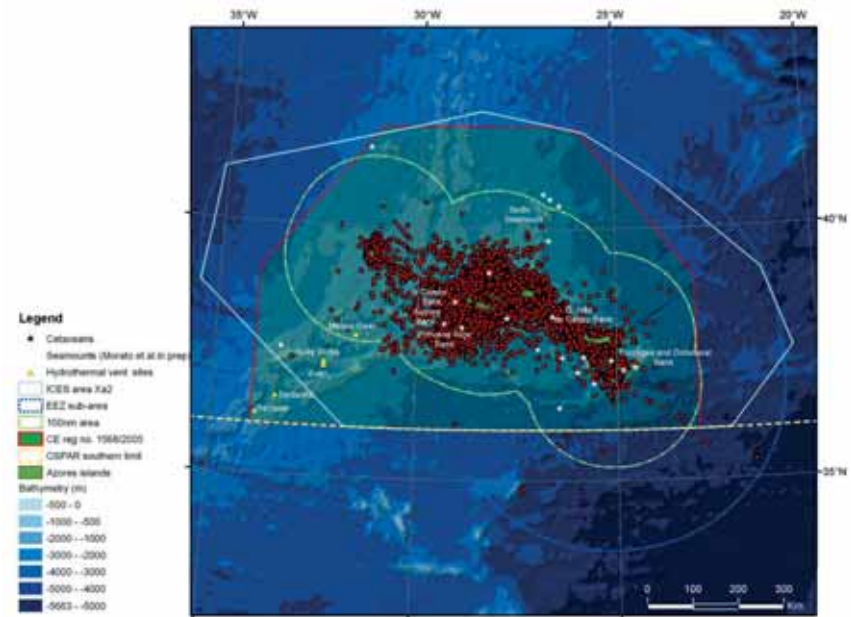
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■ Position of marine mammal sightings (*Delphinus delphis*, *Tursiops truncatus* and *Globicephala melas*) observed during the spring and autumn PELACUS surveys (2007-2008).



■ Map of sightings of marine mammals from surveys Pelgas, Atlancet, Petracet et Procet



■ Marine mammals sightings around the Azores archipelago

by kind permission of Fernando Tempera

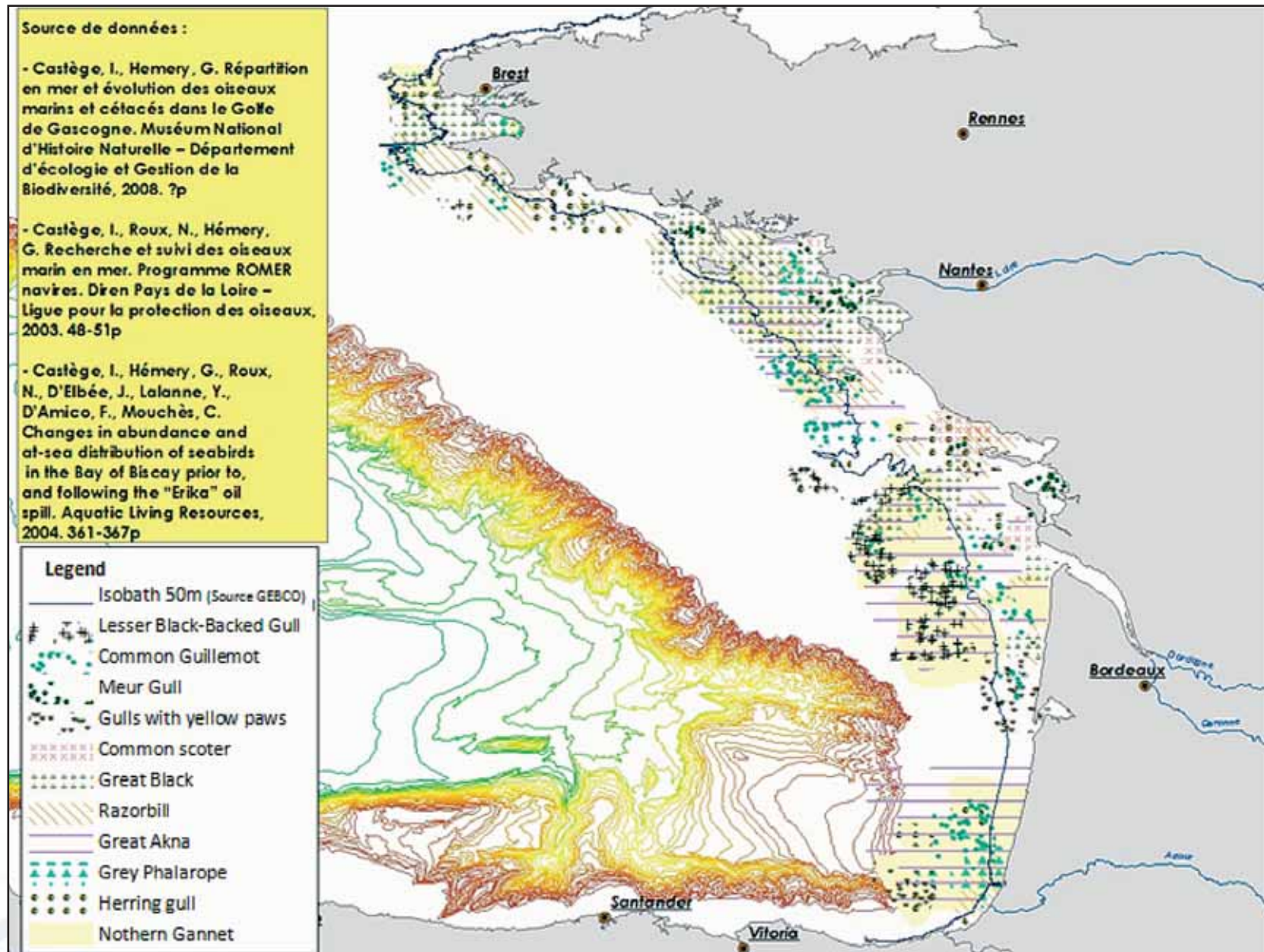




Seabirds

In terms of numbers and biomass the nesting seabird community is low in comparison with other European Atlantic areas. However the strategic geographical position of the Iberian Peninsula and the high biological production of coastal areas give rise to an important autumn migration and large wintering populations. Most important species in terms of abundance are the northern gannet, the gulls (7 species), the Balearic shearwater, the sooty shearwater, the Cory's shearwater, the razorbill and the Atlantic puffin.

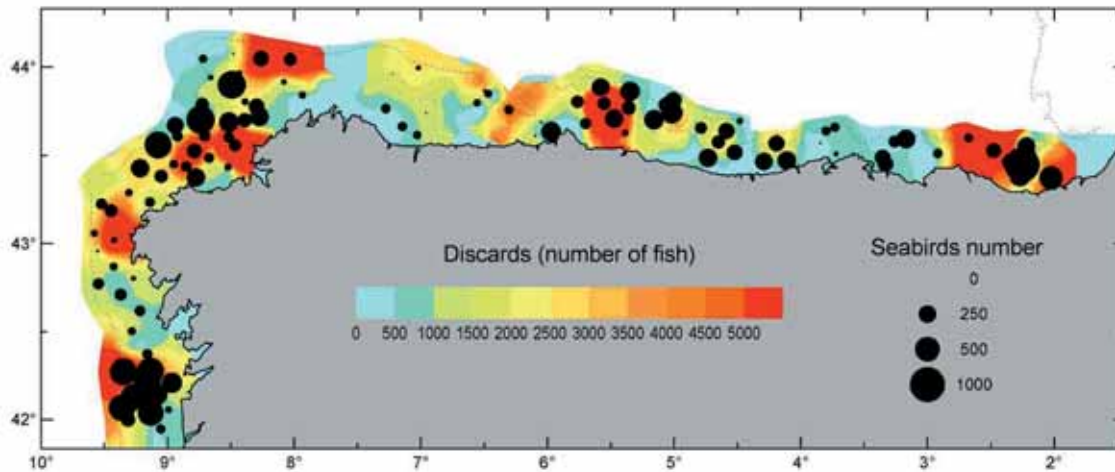
South Western Waters Atlas



■ Distribution of the marine avifauna on the French part of Biscay Bay

South Western Waters Atlas

Fisheries have a considerable influence on the distribution of scavenging seabirds which feed on discards. The spatial distribution of scavengers is driven by fishing discards availability and the distribution of fishing boats, this idea is reflected by the results shown on the image below, where there is a clear relation between the numbers of seabirds sighted from a research vessel and the number of fish discarded during the bottom trawl survey the vessel was carrying out.



■ Abundance of fish discards and total number of seabirds attending trawling fishing operations at Galician and Cantabrian continental shelf. Northern Spanish Shelf Bottom Trawl Survey 2006.



■ Estimated abundance of Cory shearwater in the region kernel density estimation made using the data from GPS loggers.



by kind permission of ´ Ramirez, I.P.; Geraldès, A.; Amorim, P. & Paiva, V, Project LIFE04NAT/PT/000213. SPEA. Lisboa

Sea Turtles

Five species have been recorded in this region:

Loggerhead, green, hawksbill, Kemp's ridley and leatherback turtles. Seasonal variations in abundance in the Bay of Biscay, Gibraltar Straits and the Macaronesian archipelagos are related to a migration pattern that marine turtles undertake using the Gulf Stream. Leatherback turtles arrive every year between June and October to the Bay of Biscay. Loggerhead and the leatherback occur year round in the southern part of the region. No turtles breed along the Western European margin.

Pressures and impacts

Turtles are caught in fishing nets and on longlines. They are also vulnerable to injury through the ingestion of plastic debris accumulating along convergent fronts, as it resembles the jellyfish on which they feed. Recent reports indicate a global epidemic of a form of non-cancerous tumour affecting most species of turtle. It is speculated that pollutants, by weakening the turtles' immune systems, make them more susceptible to viral infections.



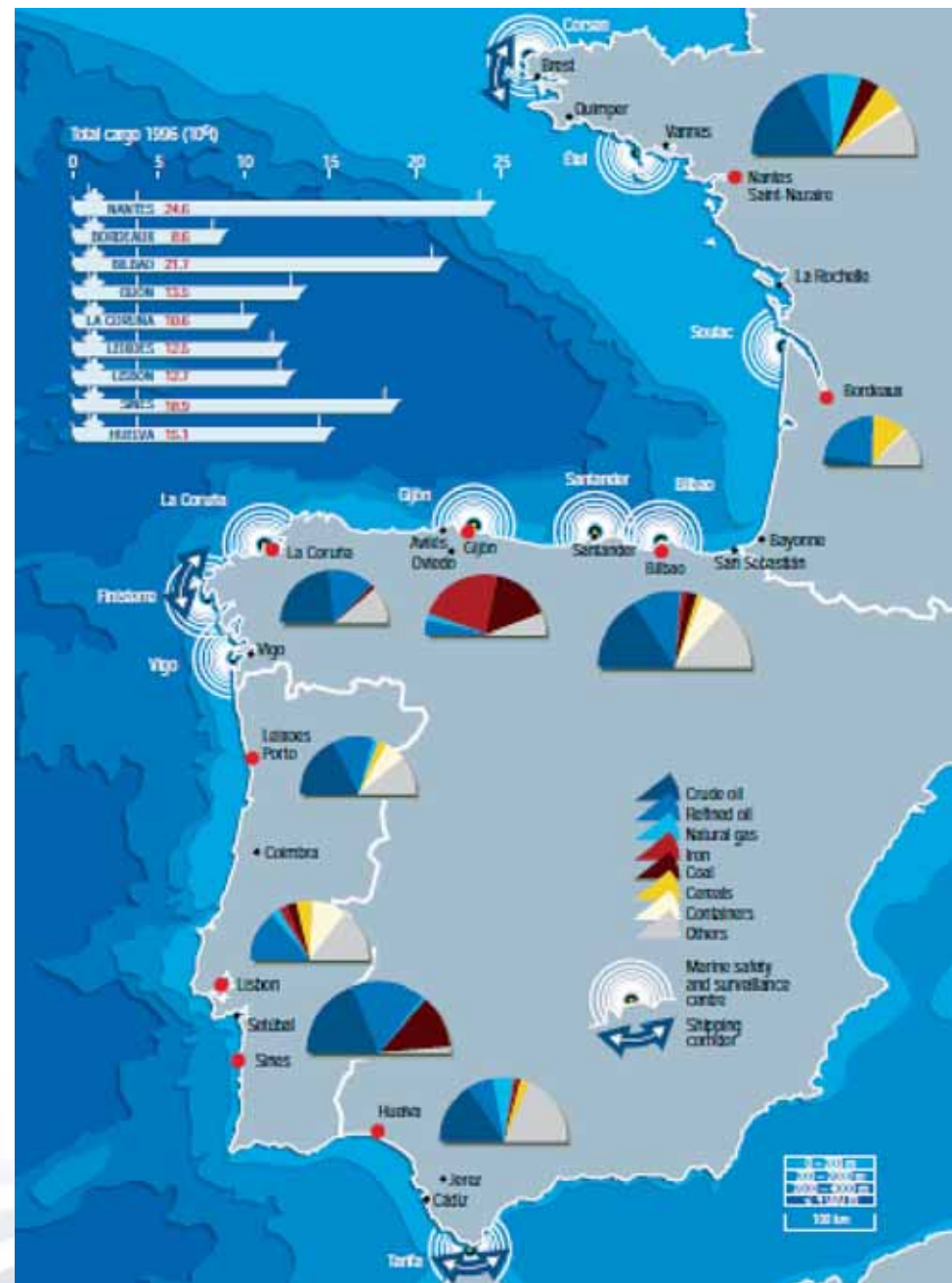
Distribution of Human Activities



Port traffic

Port traffic along the Atlantic seaboard is about 180×10^6 t/yr. Ports handling $> 10 \times 10^6$ t/yr control nearly 82% of the port traffic in Region IV. Port activities are centred on twenty principal ports; the three most important being Nantes-Saint-Nazaire, Bilbao and Sines (Figure 3.9 and Table 3.7). The transportation of hydrocarbons is concentrated at these ports, where as container shipping is largely controlled by Bilbao and by Leixoes-Porto and Lisbon in Portugal. These ports each handle around 2 million containers.

Map and text taken from OSPAR Quality status report 2000 for OSPAR region 4: Biscay bay and Iberian Coast.



Tourism

In France, the Atlantic region contains 24% of the available accommodation for visitors and 25% of the potential for overnight stays in hotels and campgrounds.

Brittany and Aquitaine are the two biggest tourist areas each possessing 7% of the national accommodation available for visitors; although this capacity has more to do with the extended coastline in these regions than with a higher density of tourists. Of these regions Vendée and Charente Maritime head the list. In France, the tourist season is focused on the two summer months, particularly from mid-July to mid-August. This seasonal tendency is becoming increasingly marked as the holiday period is shortening, and thus translating to an increased environmental pressure.

During summer, the resident population is multiplied by a mean factor of 1.4 in Brittany, 3.2 in Aquitaine and 3.5 in the Loire and Charente. The maximum is a factor of 6.0 for Vendée.

The Spanish Atlantic coast is not a frequent destination for tourists; the total number of overnight stays in local hotels on the Atlantic coast represents 6% of overnight stays in Spain and 87% of the visitors are Spanish.

A total of 1.2 million people visited the five Portuguese administrative regions along the Region IV coast in 1996; 50% visiting the Algarve, the most southern and smallest region.

Tourism and recreation in coastal areas during summer are important social and economic activities along the Atlantic coast of France and Portugal. The additional services and infrastructure required can lead to a rapid degradation of coastal habitats and resources, however it is difficult to determine these impacts in detail due to poor data availability.

Taken from OSPAR report 2000 Region IV.

Aquaculture

Marine aquaculture is spread widely along the Atlantic coast and concentrated in several well defined areas. In France, southern Brittany and the areas around Bourgneuf Bay, Ré Island, Marennes-Oléron and Arcachon Bay, are all major sites of aquaculture. In Spain, aquaculture takes place along the greater part of the coastline, being particularly important in Galicia and on the north-west coast. In Portugal, marine aquaculture occurs along the western and southern coasts, particularly in some of the more important estuaries. The Ria Formosa lagoon is important for mollusc culture.

Taken from OSPAR report 2000 Region IV

Fisheries studied in the SWW atlas area

Fishing is an important source of income for coastal communities in the SWW area, many of which are almost totally dependent on fisheries and related activities. The ecosystem has a high diversity of species, and there is demand for these species in local markets. The three countries involved in this area (France, Portugal and Spain) have high consumption levels of fish per capita (45-60 kg, depending on the country).

MIXED DEMERSAL TRAWL: the value of landings from this fleet was close 119 million euros in 2006, and this gear generates 2261 direct jobs (in FTE).

PURSE SEINER FISHERY: The value of landings from this fleet was over 78 million euros in 2006, and employs 2294 people (in FTE).

MIXED DEMERSAL LINES: The value of landings from this fleet was close 11 million euros in 2006, and this gear generates 1257 direct jobs (in FTE).

Mixed demersal trawl

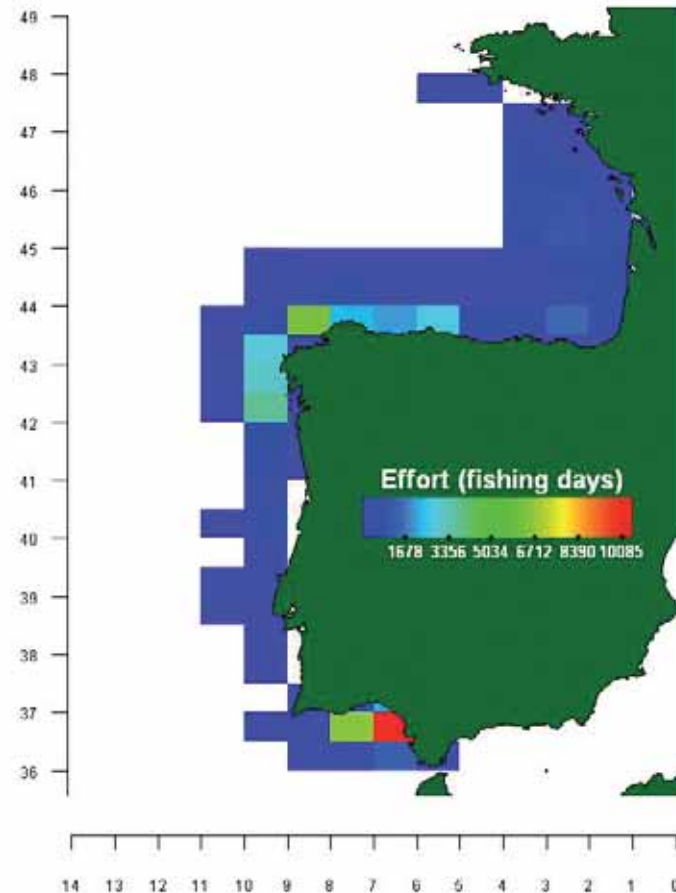


Spanish mixed trawl Fishery in SWW

Analysis from the period 1989-1993 showed that hake, the main target species in the 1970s, had decreased 6% of the total weight landed, while catches of blue whiting and horse mackerel increased up to 47% and 18% respectively. At the end of the 1980s and early 1990s this fleet included bottom otter trawlers (OTB) and bottom pair trawlers (PTB). OTB fleet, includes two different gears: "baca" and "jurelera". The "baca" is the traditional trawl gear targeting demersal species. It has a codend mesh size of 65 mm, a vertical opening of 1.2-1.5 m. "jurelera" gear also uses a codend mesh size of 65 mm but has a larger vertical opening of 5-5.5 m. The vessels of these fleets employ between 6 and 8 crewmembers.

The PTB fleet, uses a specific gear with a cod end mesh size of between 45-55 mm and a vertical opening of around 25 m, and employs between 7 and 10 crewmembers. In recent years, OTB is used to target mainly horse mackerel with the demersal species traditionally appreciated in the Spanish markets (hake, megrim, monk and Norway lobster). PTB is especially efficient targeting blue whiting (69%) but also lands important catches of hake, most of both fleet's catches, OTB and PTB, are landed in Galician ports.

The EU within CFP has regulated these fleets and their target stocks[1] through TAC's and Technical measures (minimum landing size, mesh size, closed areas, two days moored per week) since 2006 a recovery plan was implemented for Iberian hake stock and Norway lobster.



■ Annual average of 2003-2006 effort in fishing days of the Spanish mixed trawl fishery.

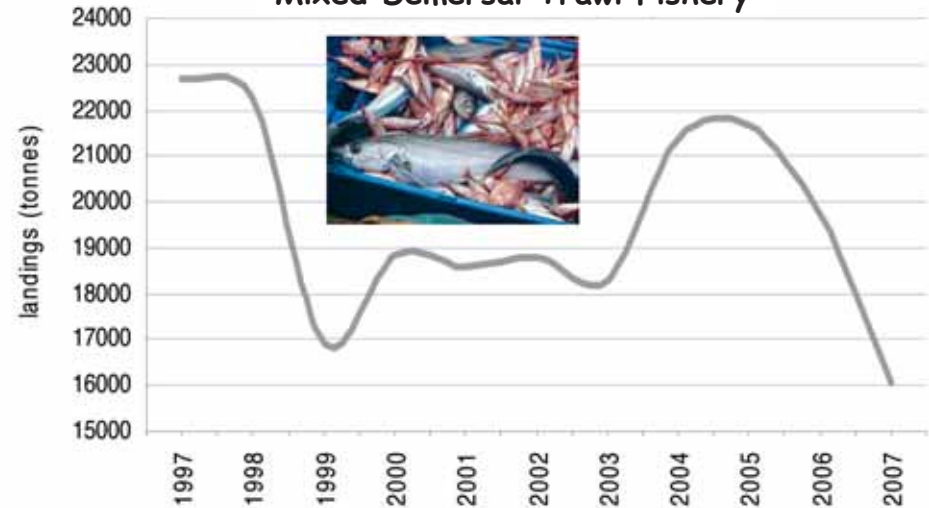
Portuguese mixed trawl Fishery in SWW

The trawl fleet is the second most important fleet in Portuguese waters and comprises two components: 1) the trawl fleet catching demersal fish (using 65 mm mesh size) and 2) the trawl fleet directed at crustaceans (70 mm for Nephrops, 55 mm for other crustaceans). The fleet targeting fish operates off the entire Portuguese coast, mainly at depths between 100 and 200 m, while the fleet targeting crustaceans operates mainly to the southwest and south of Portugal in deeper waters, from 100 to 750 m. The species targeted by this fleet are hake, megrim, four-spotted megrim, anglerfish, monkfish and Nephrops.

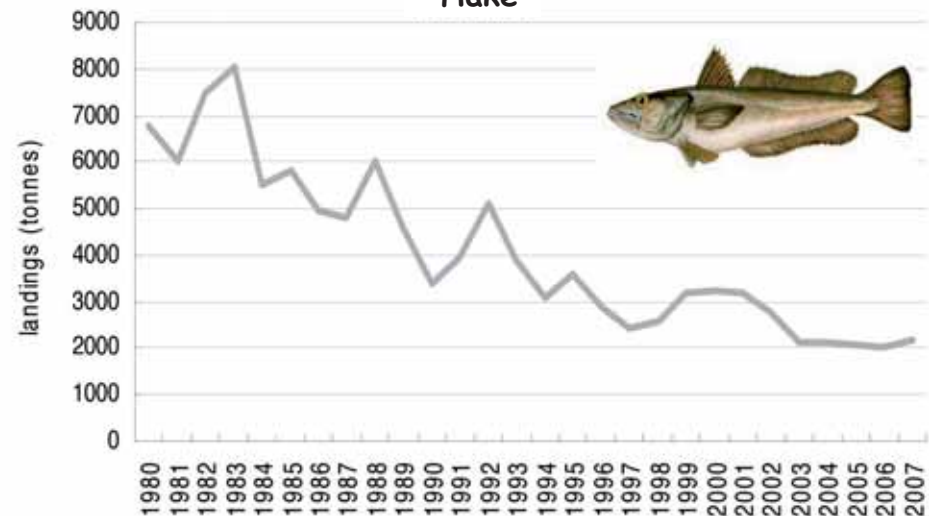
Portuguese fleet have been decreasing in size since the early 1980s due to restructuring in order to meet EU legislation and to adjust fishing capacity to available resources. Vessels have been modernized to improve on-board fish conservation methods, automate work systems and install electronic navigation and fish detection systems.

Fisheries management in the region, following the CFP, is based on annual TACs and quotas for certain species and fishing areas, technical conservation measures and the limitation of fishing effort. Technical measures used in the Iberian Sea waters include: minimum size/weight for fish caught, mesh sizes, the maximum percentage of by-catch and minimum percentages for target species catches and the restriction of fishing in certain areas, seasons and using certain gears.

Mixed Demersal Trawl Fishery



Hake



■ Catches of Portuguese mixed demersal trawl fishery, and below catches of hake of the fishery.

French Nephrops mixed trawl fishery

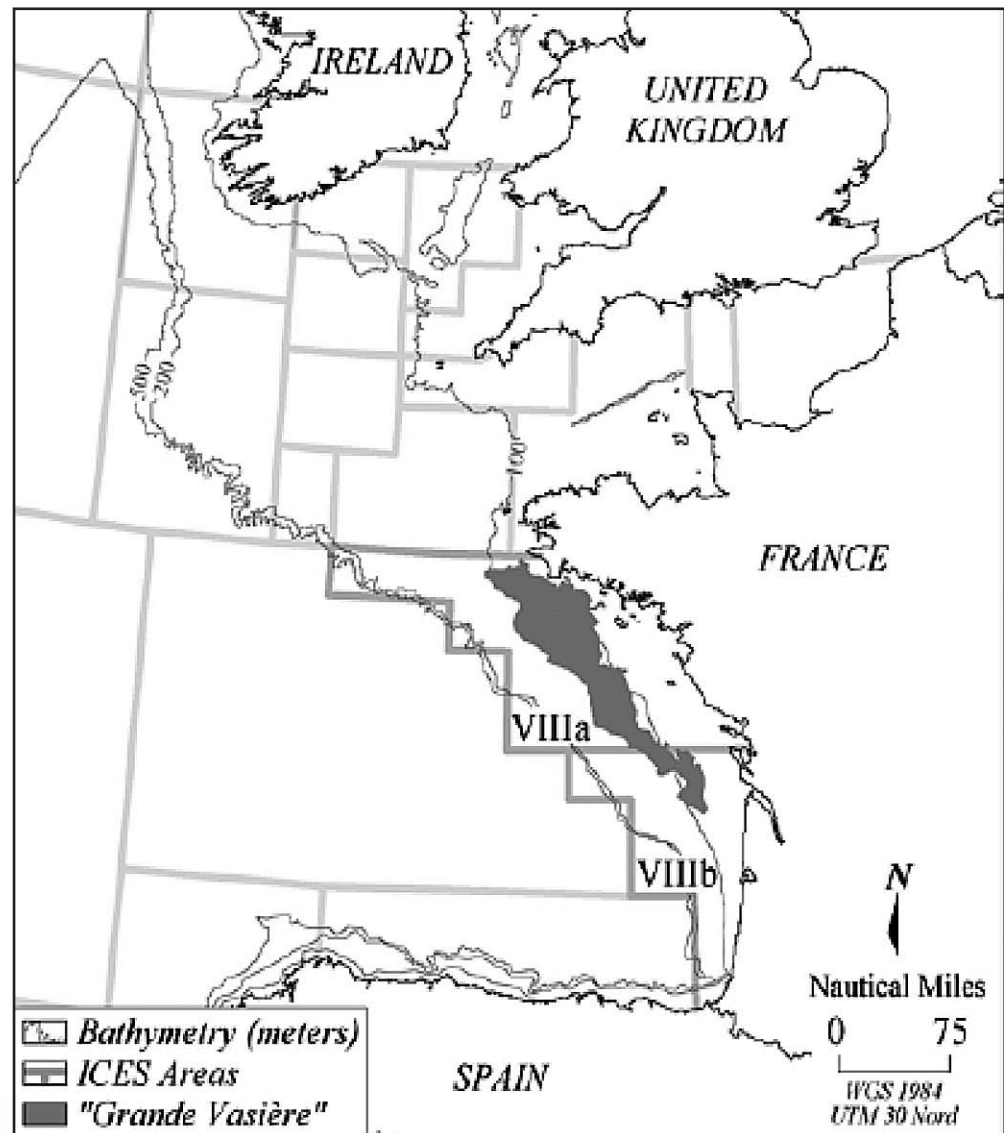
The Nephrops trawl fishery is one of the most important fisheries in the Bay of Biscay. Nephrops are targeted on a sand-muddy area called «La Grande Vassiere ».

Approximately 250 boats target Nephrops in the area, though the fishery is mainly multispecific, as hake is also an important target.

Each vessel employs between 3 and 5 men on board and vessel length is around 15 m and vessels are 19 years old on average. 1100 offshore jobs are considered to be related to the Nephrops fishery: 350 fishermen, 320 FTE directly related to the fishery and 500 jobs on the economy related to it.

The fishery management essentially relies on conservation measures, with a TAC for Nephrops, together with a minimum landing size (MLS) and minimum net mesh size (70 mm stretched mesh). Discards are one of the problems for this fishery in spite of the measures stated above, since sometimes in large quantities of undersized target species (hake, Nephrops) or non-target species (blue whiting, horse mackerel) are rejected after sorting the catch.

Despite the Nephrops fishing unit in VIII a,b being considered to be at a good level by ICES, substantial improvements can be obtained by reducing discards which are still quite important.



■ The fishing grounds on "La Grande Vassière" on the French shelf, are the main area used by the Nephrops trawl fleet

Purse Seine



Spanish Purse Seiner Fishery in SWW

In 2006, a total of 410 vessels were registered as purse seiners in this area. The fishery takes advantage of seasonal resources such as anchovy and mackerel (in VIIIc East), sardine (in VIIIc West and in IXa North), or present in the area as horse mackerel. Part of the fleet change gears to “curricán” (trolling lines) or “Cebo vivo” (hand lines) targeting tuna during the summer.

The vessels are over 21 m in length, and most can work five days a week, resting continuously for 48 hours per week. The gear has a maximum length of 600 m excluding the purses, whose maximum size is 30 m, with a maximum height of 130 m and mesh size of 14 mm.

Landings

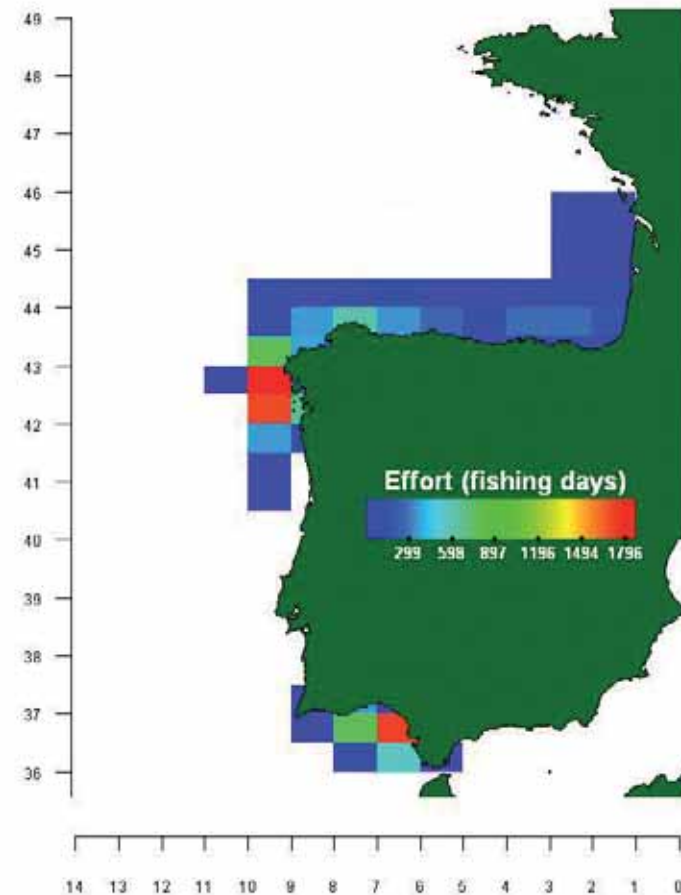
Current purse seine landings show an increase in the landings of medium size pelagic species (such as horse mackerel and mackerel) and a decrease in small pelagic species (sardine and anchovy). For the decrease in anchovy landings, it must be noted that this fishery collapsed in 2005. Purse seine catches are mainly landed in Galician ports.

Management and governance

Purse seine target species management is regulated through TAC and technical measures enforced by the EU. The exceptions are the sardine, whose management has been transferred to Spanish and Portuguese national governments and the anchovy which following a collapse in 2005 has had a fishing ban in the Bay of Biscay since 2006.

Socioeconomic basic data

The value of landings from this fleet was close to €52 million[1] in 2006. The most important costs are the crew share (56%) and fuel (20%). Vessels fishing with purse seine employ between 6 and 8 crew members, and the fishery generates 1700 direct jobs.



■ Annual average of 2003-2006 effort in fishing days of the Spanish purse seiner fishery, including only trips that landed some sardine.

South Western Waters Atlas

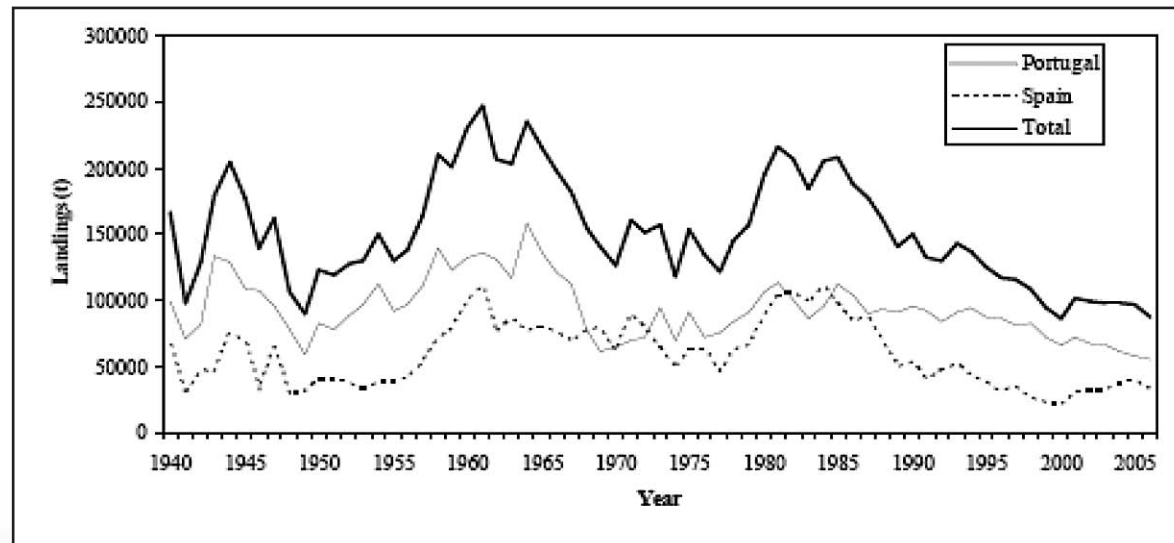
Portuguese Purse Seiner Fishery in SWW.

Purse seiners are the most important fishery in Portuguese waters in terms of landings volume. In 2006, the fleet was composed of 143 purse-seiners.

This fleet targets mainly sardine (*Sardina pilchardus*), which constitutes more than 80% of their landings. Vessels use a mesh size of 16 mm. Sardine and horse mackerel are the most important species landed in Portugal, both in terms of weight and value. In 2006, 48 thousand tons of sardine and 14 thousand tons of horse mackerel with a value of €26.28 million and €16.47 million respectively were landed.

Other small pelagic species, such as anchovy (*Engraulis encrasicolus*) and middle-size pelagic mackerel (*Scomber scombrus*), are also a important fisheries in the area

Quotas can be allocated by the national fisheries authority to individual vessels or to groups of vessels. The latter is the case for the Portuguese purse-seine fishery, where sardine catch limits are determined by producers' organisations. Individual vessel quotas may be transferable within the ship owners' companies to allow for flexible management and a maximum utilisation of these quotas. However, if Portugal does not use all its quota for certain species, they are traded with other EU Member States to ensure optimal use, and to achieve a mutually beneficial equilibrium, without affecting relative stability.



■ Evolution of Iberian purse seiner fishery catches between 1940 and 2007. (ICES)

Mixed demersal lines

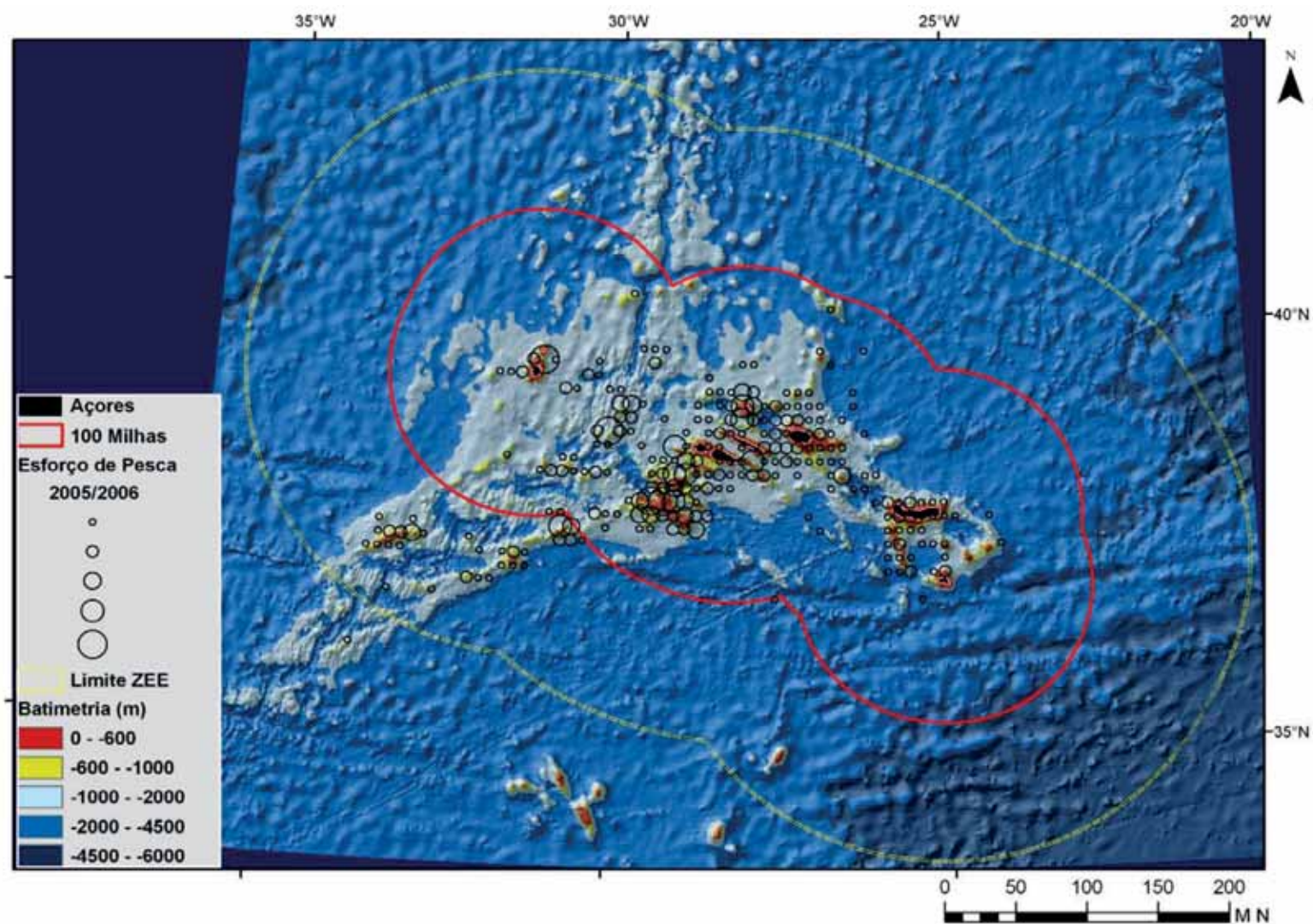


The Azorean demersal line fishery is multispecies, multigear and multifleet where several different species are caught at the same time in one set, using different hook gear configurations and vessel types. The fishery is considered to be small-scale because of the high proportion (90%) of small vessels (<12m). It operates in the island areas, banks and seamounts covering the 50-1000m depth strata. Target species and gear type vary according season, area, depth and price. Three major assemblages are defined according to depth: shallow (<250m), intermediate (250-700m) and deep (>700m).

Black spot seabream (*Pagellus bogaraveo*) is the most important species and seems to control the dynamic of the fishery, although other important commercial species, such as bluemouth (*Helicolenus dactylopterus*), wreckfish (*Polyprion americanus*) and alfonsinos (*Beryx* sp.) are also caught.

Management measures (regional, national or EC regulations) include entrance, gear and area restrictions; By catch control; TAC and quotas; Minimum species landing lengths.

South Western Waters Atlas



- Effort of the fleet working with mixed demersal lines around Azores archipelago area



Glossary

Benthic component: related to the bottom of the sea or to the organism that live on it, including the surface sediment and the first sub-surface layers

DCR: Data Collection Regulation agreed by the EU members to ensure the collection of the data needed for the Fishery Management

Demersal: dwelling at or near the bottom of the sea or other body of water

Eddy: a current, as of water or air, moving contrary to the direction of the main current, especially in a circular motion

Hydrothermal vent: A hot spring on the ocean floor, found mostly along mid-oceanic ridges, where heated fluids exit from cracks in the earth's crust

Intertidal zone: coastal area exposed to the air at low tide and submerged at high tide

Outwelling: outflow of nutrients and sediments from a river estuary or salt-marsh system

Primary production: total amount of new organic matter produced by photosynthesis

Seamount: a mountain rising from the ocean seafloor that does not reach to the water's surface

Subtidal zone: marine area always covered by the water at low and high tides

TAC: Total Allowable Catch, usually per species or stock and allocated by country. Is fixed by the EU as a technical measure for fisheries management

Upwelling: oceanographic phenomenon that involves motion of dense, cooler and usually nutrient rich water towards the ocean surface, replacing the warmer and usually nutrient-depleted surface water

Vagrant: One who wanders (in the ocean) from place to place without staying in an area

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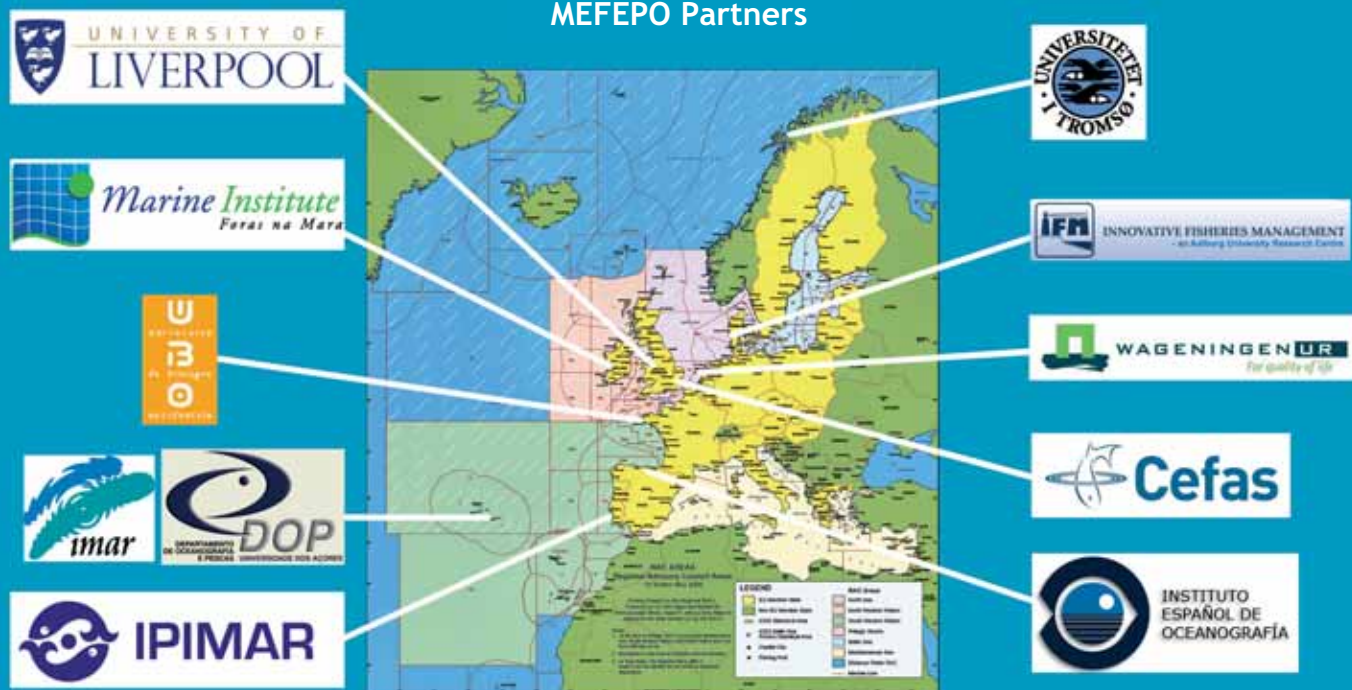
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