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Book 7
Bay of Biscay and Iberian Seas

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BOOK 7

Section **Page**

7 BAY OF BISCAY AND IBERIAN SEAS

7.1 Ecosystem overview

7.1.1 Ecosystem components

General description

The advisory region extends from west of Brittany (48°N) to the Gibraltar Straight (36°N). To the North, the Bay of Biscay is limited by the Brittany coast. A large shelf extends west of France. The southern part of the Bay of Biscay, along the Northern Spanish coast is known as the Cantabrian Sea and is characterised by a narrow shelf. Further south a narrow shelf continues west off Portugal (Figure 7.1.1). Lastly, to the south, the Gulf of Cadiz has a wider shelf strongly influenced by the Mediterranean Sea. Within these zones the topographic diversity and the wide range of substrates result in many different types of shelf habitat (OSPAR, 2000).

Bottom topography and substrates

The continental shelf in the northern Bay of Biscay is about 140 km wide, it become narrower to the south (about 50 km off southern France). From coast to offshore, the depth increases almost regularly down to 200 m, the shelf is mainly flat. One major sedimentary area off South West Brittany is known as Grande Vasière (large muddy area). On the southern border of the Bay of Biscay, the continental shelf of the Cantabrian sea is as narrow as 12 km. Off western Iberia the only relatively wide shelf section is between the river Miño/Minho and the Nazaré Canyon, whereas the continental shelf in the Gulf of Cadiz is of the order of 50 km wide, particularly to the east (OSPAR, 2000). The shelf-break occurs at depths of around 200 m to the north of the advisory region, and at 130-150 m in the Gulf of Cadiz. The slope is mainly steep and made of rough bottom, with canyons and cliffs, with the only exceptions of a few small terraces mainly to the north and the deep (500m-800m) Landes Plateau in the southern Bay of Biscay.

The sediment cover of the continental margin mainly consists of thick turbidity sheet-fan deposits. These alternate with deposits reflecting periods with less energetic sedimentation. Contouritic deposits occur in the Cantabrian Sea and in the Gulf of Cadiz. The continental shelf and upper slope sediments originate mostly from the continent. The inner shelf (depth <100 m) has mainly rocky or sandy substrate, whereas the outer shelf has predominantly muddy substrate. This muddy substrate is associated with deep canyons on the shelf-break, while in the Galician shelf appear also related to the large estuarine systems of the "*rias*" (López-Jamar *et al.,* 1992).

Circulation

Most of the water masses are of North Atlantic origin, including those that have been transformed after mixing with the Mediterranean water. The region is affected by both the subpolar and subtropical gyres depending on latitude, but the general circulation in the area mainly follows the subtropical anticyclonic gyre in a relatively weak manner (1-2 $cm.s^{-1}$). Figure 7.1.1 indicates the principal water masses and currents as explained by Mason et al. (2005).

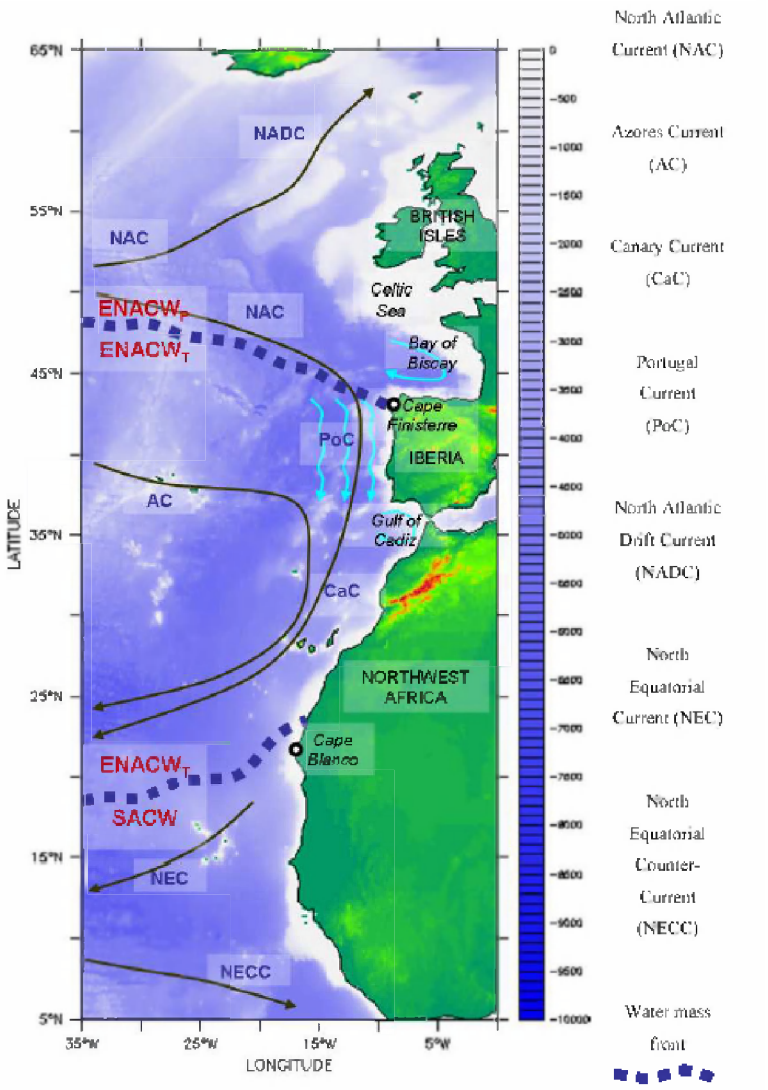

Figure 7.1.1 The main water masses in the Advisory region G are North Atlantic Central Water of sub-polar (ENACWp) and sub-tropical (ENACWt) origins and South Atlantic Central Water (SACW). The main large-scale surface currents are the North Atlantic Current (NAC), the Azores Current (AC), the Canary Current (CaC) and the Portugal Current (PoC). Also shown are the North Atlantic Drift Current (NADC), the North Equatorial Current (NEC) and the North Equatorial Counter Current (NECC). The general circulation of the Bay of Biscay and the Gulf of Cadiz are indicated. Source from Mason et al (2005).

Off France, at the slope of the Bay of Biscay, the mean residual current flows towards the north, although at slope depth (below ca 500 m) it goes down the slope (Pingree & Le Cann, 1990). In the Cantabrian Sea the surface currents generally flow eastwards during winter and spring and change westwards in the summer following the wind forcing (Lavin et al 2006). These changes in the currents direction produce seasonal coastal upwellings. The circulation of the west coast of the Iberian Peninsula is characterized by a complex current system subject to strong seasonality and mesoscale variability, showing reversing patterns between summer and winter in the upper layers of the slope and outer shelf (e.g., Barton, 1998; Peliz *et al.*, 2005, Ruiz Villareal et al, in press). During spring and summer northerly winds along the coast are dominant causing coastal upwelling and producing a southward flowing at the surface and a northward undercurrent at the slope (Fiúza *et al.*, 1982; Haynes and Barton, 1990; Peliz et al., 2005, Mason et al. 2005).

In the autumn and winter, the surface circulation is predominantly northward, partially driven by meridional alongshore density gradients (Peliz *et al.*, 2003a,b), and transporting higher salinity and warmer (subtropical) waters over the slope and shelf break (Frouin *et al.*, 1990; Haynes and Barton, 1990; Pingree and Le Cann, 1990) - the Iberian Poleward Current (Peliz *et al.*, 2003b). These waters are nutrient poor and contribute to fronts which determine the distribution of plankton, fish eggs and larvae (Fernández *et al.*, 1993; González-Quirós *et al.*, 2003). Strong subtropical water intrusions in the Cantabrian Sea may be a feature strongly influenced by wind events (Villamor et al., 2005). Another important features of the upper layer is the Western Iberia Buoyant Plume (WIBP) (Peliz *et al.*, 2002), which is a low

salinity surface water body fed by winter-intensified runoff from several rivers from the northwest coast of Portugal and the Galician Rias. The WIBP could play an important role in the survival of fish larvae (Santos *et al.,* 2004).

The intermediate layers are mainly occupied by a poleward flow of Mediterranean Water (MW), which tends to contour the southwestern slope of the Iberia (Ambar and Howe, 1979), generating mesoscale features called Meddies (e.g., Serra and Ambar, 2002), which can transport salty and warm MW over great distance. The exchange of water masses through the Gibraltar Straits is driven by the deep highly saline (S>37) and warm Mediterranean Outflow Water (MOW) that flows into the Gulf of Cadiz and the less saline, cool water mass of the Atlantic Intermediate Water (AIW) at the surface.

Physical and chemical Oceanography (temperature, salinity, nutrients)

Most important features enhancing primary production are coastal upwelling, coastal run-off and river plumes, seasonal currents and internal waves and tidal fronts.

Upwelling events are a common feature in Portugal, Galicia and western Cantabrian Sea, especially in summer (Fraga, 1981, Fiuza *et al.,* 1982, Blanton *et al.,* 1984). The occurrence of upwelling pulses during summer is important since the upwelling process injects nutrients in the surface layer that fuel primary production. Under conditions of moderate upwelling, the innermost coastal 25 km are about 10 times more productive than offshore waters and the upwelling centres about 20 times more. However upwelling events in the northern Iberian Shelf are generally restricted to a narrow band near the coast in the western Cantabrian Sea (Botas *et al.,* 1990; OSPAR, 2000). In northeast Bay of Biscay, mainly in summer, weak upwelling events occur off South Brittany and the Landes coastline (Figure 7.1.2).

The wind-speed during the 1990s, was greater by 1 $m.s^{-1}$ than over the previous decades. Since the 1940s annual mean speed has tended to decrease in the south of the Bay of Biscay while it has increased in the north. However, these trends are small in comparison with the degree of inter-annual variability at each station (Planque *et al.,* 2003). Regarding off northwest Iberian a notable shift in the winds has occurred during the last two decades, resulting in a reduction in the spring-summer upwelling (Cabanas *et al.,* 2003).

Water temperature is highest to the south, where it is influenced by the MW. For example, the yearly mean temperature at 100m depth is 11.2 °C to the North of the advisory region, 48°N, and 15.6 to the South, 36°N (Levitus, 2001).

Mean surface water temperatures increased 1.4°C in the southeast Bay of Biscay for the period 1972-1993 (0.6°C per decade), and. 1.03°C over the last Century (Koutsikopoulos et al., 1998 ; Planque *et al.* 2003). Heat stored in central waters below the mixed layer underwent an important increase in the last decade. ENACW (Eastern North Atlantic Current Water) increased at rates of 0.032°C yr^{-1} and Mediterranean water about 0.020°C yr^{-1}, linked to a density compensating salinity increase. These warming rates are from two to six times greater than those accepted for the North Atlantic in the course of the 20^{th} century. The overall result is a net warming of 0.24 °C for this water column in the period 1992-2003 (Gonzalez-Pola and Lavin, 2003; Gonzalez-Pola et al., 2005).

On the continental shelf, bottom salinity is close to 35. 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). Low salinity lens from rivers is an important feature in the inner Bay of Biscay (Lavín et al, 2006). On yearly average, the French region received 27000 m^3 s^{-1} of run-off from the major rivers. The major indicators show that flows for 2002 and 2003 are slightly below the long-term average from 1952-2003 and the last 10 years average and preliminary data indicate that in 2004 is close to the long term average (Figure 7.1.3). In the northern Spanish coast, rivers flowing into the Cantabrian Sea are of short length and with smaller importance compared with those of the French coast, as Garonne or Loire. In the north west Spanish coast the rias constitute an important sediment and fresh water source.

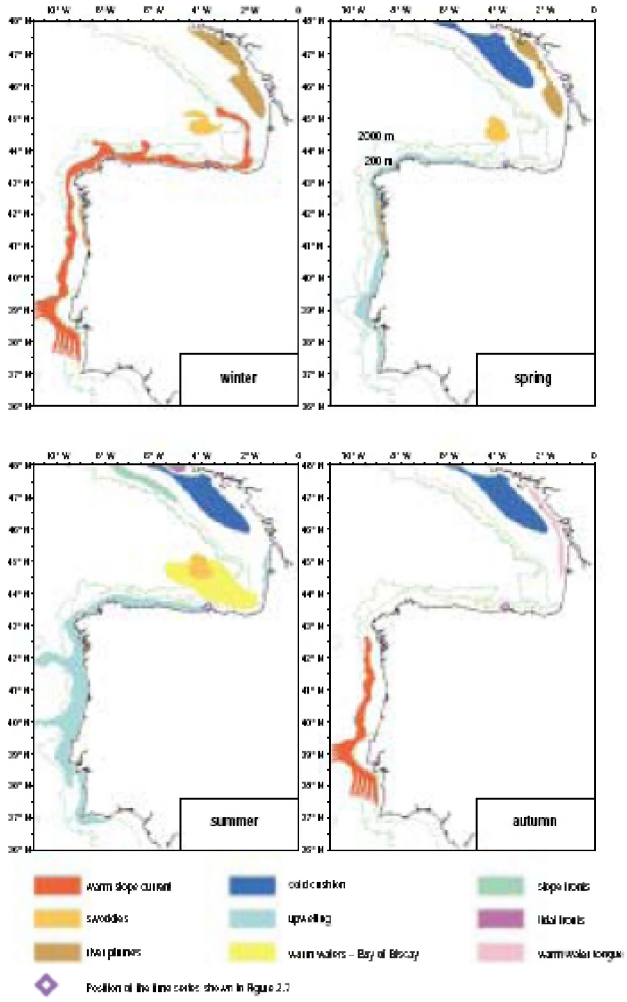

Figure 7.1.2 Seasonal variation in the main hydrographic features. Source: Koutsikopoulos and Le Cann (1996).

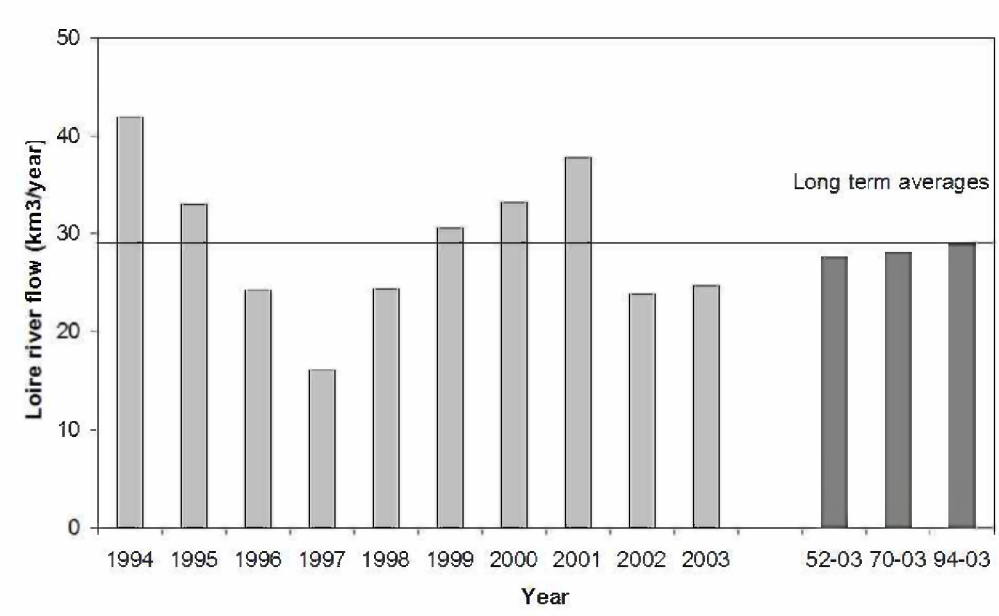

Figure 7.1.3 Time series of the river Loire outflow. Data from the French data bank on hydrology and hydrometry, available at http://hydro.rnde.tm.fr/

Broad-scale climate & Oceanographic features & and drivers:

Large positive values of the NAO index are associated with higher dominance of the middle-latitude easterly wind flow during winter that can lead to increased winter upwelling episodes. Dickson *et al.* (1988) related the decline in zooplankton and phytoplankton in the North Atlantic and in the catch of sardines off Portugal with the increase in northerly winds during the 1970s. These increased winter upwelling episodes related with large positive NAO indices were also observed during the 1990s (Borges, *et.al.* 2003). Over recent years the Hurrell NAO index was close to long-term (100 years) average.

Phytoplankton

The onset of the spring bloom occurs sometimes as soon as February in western Iberia and the south of the advisory region (Nogueira *et al.*, 1997; Moita, 2001, Manzano et al., 2004) and, with remarkable regularity in March, in the Bay of Biscay. By March-early April the spring bloom covers the entire region. From May onwards, chlorophyll drops sharply, and the lowest values are observed in summer. The autumn bloom is variable in timing and intensity, and restricted to coastal areas, for example, high chlorophyll concentrations are found in the Rías Baixas, at the time of seasonal transition from upwelling to downwelling (Nogueira *et al.*, 1997; Figueiras *et al.*, 2002). During winter months and in the coastal areas inwards the 100 m isobath chlorophyll estimates persist relatively high.

Diatoms dominate the phytoplankton community during most of the year and specially during upwelling events, while microflagellates and small naked dinoflagellates dominate during winter. Small dinoflagellates dominate in warmer, stratified waters, offshore (Valdés *et al.*, 1991 ; Fernandez and Bode, 1994 ; Varela, 1996 ; Casas *et al.*, 1997).

Zooplankton

Zooplankton blooms follow the pulse of phytoplanktonic production. In coastal zones, mesozooplankton abundance presents a seasonal variation with absolute values rarely over 3000 ind/m^3 in spring. In winter values are 250 ind/m^3. The oceanic area off Iberia is oligotrophic and zooplankton biomass varies little throughout the year with a peak in April.

Regarding the whole Bay of Biscay, since 1992, temporal and spatial biomass distribution of mesozooplankton (200-2000 µm) show the same patterns described for phytoplankton with biomass (values of ~70 mgDW m^{-3}) closely after the phytoplankton spring bloom. After the spring bloom, zooplankton decreases showing a patchy distribution with some hot spots in coincidence with upwelling regions and freshwater plumes.

In summer, due to the upwelling, the regional zooplankton biomass production is highest off Galicia where it is often over 30 mg DW m^{-3} (60 mg DW m^{-3} peak are frequent) (Bode *et al.*, 1998). Along the Cantabrian Sea the biomass decreases towards the east (Figure 7.1.4) (Llope et al., 2003).

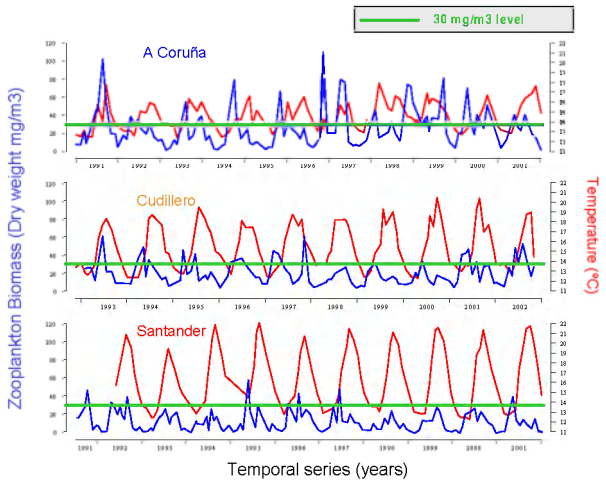

Figure 7.1.4 Variations in zooplankton biomass and temperature in the Cantabrian Sea. (Llope et al ; 2003, modified by Valdés).

Zooplankton in the Iberian coastal and shelf waters is very rich in terms of taxonomic groups and species. Copepods account for 60-85% of total zooplankton abundance off the north coast of Spain, and are present all the year round, whereas other holoplankton and meroplankton groups have a marked seasonal distribution.

Benthos

In the Cantabrian Sea, an most probably in the whole region, the depth is the main factor of the distribution of both epibenthic an endobenthic communities, a second factor is the sediment characteristics (grain size and organic contents). The mean fish species richness shows a progressive decrease with depth (Sánchez, 1993) while the inverse phenomena appears in invertebrates (Olaso, 1990), which prefer deeper water and muddy substrates due to their predominantly detritivorous feeding habits. Mediterranean species occur in the south of the advisory region, their occurence decrease eastwards in the Cantabrian Sea at least for shallow species. The dominant mobile invertebrates on the soft grounds on the shelf are detritivorous-crustaceans and molluscs, while the same type of grounds in deeper areas are dominated by filter feeders such as sponges and cnidarians. These later are abundant on rocky bottoms together with echinoderms (Serrano et al., 2006). Bioherm such as maerl beds in shallow waters and *Lophelia* reefs on the slope occur in some areas.

The main exploited invertebrates in the advisory region are: red shrimp (*Aristeus antennatus*) rose shrimp (*Parapeneus longirostris*), Nephrops and Cephalopods (*Octopus vulgaris*, *Sepia officinalis*, *Loligo* spp., and others). Smaller fisheries exist for rocklobster (*Palinurus elephas*) and red crab (*Chaceon affinis*). Nephrops occurs in almost all the advisory region it is exploited from coastal water (eg south of Brittany) to the upper slope as in the Gulf of Cadiz. Various bivalves species are exploited on the coastal shelf and in the intertidal area (eg Scallops *Pecten maximus* but also clam *Ruditapes decussatu*s, cockle *Cerastoderma edule*, telline *Donax truncates*). Some species were introduced for aquaculture purposes and some settled as wild populations (eg *Ruditapes phillipinarum*) now exploited. The introduced slipper limpet (*Crepidula fornicata*) is locally abundant. It may be a competitor of exploited filter feeders and has a negative effect on the substrat availability to juvenile sole in their nurseries (Le Pape et al., 2003c). This advisory region is locally suitable for shellfish aquaculture, e.g. more than 200.000 tons per year of mussels from raft aquaculture are produced off Galicia.

Fish community

Species composition and diversity

Fish diversity is quite high in relation to the co-occurrence of sub-tropical, temperate and boreal species which relative abundances follow latitudinal gradients.

The main pelagic species are sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*), mackerel (*Scomber scombrus*), horse mackerel (*Trachurus trachurus*) and blue whiting (*Micromesistius poutassou*). To the south west of the Iberian Peninsula, other mackerels and horse mackerels such as the chub mackerel (*Scomber japonicus*), the Mediterranean horse mackerel (*Trachurus mediterraneus*) and the blue jack mackerel (*T. picturatus*) are also common. Seasonally, albacore (*Thunnus alalunga*) occur along the shelf break. To the south, northern bluefin tuna (*Thunnus thynnus*) is caught in the Gulf of Cadiz during its migratory way (in or out) to the Mediterranean.

Throughout the advisory region, the demersal fish community is organised according to depth, bottom and latitude and is stable over time despite species abundance variations and trends (Souissi *et al.,* 2001, Poulard *et al.,* 2003 Gomes, *et.al.*, 2001; Sousa, *et al,* 2005). In general, the same species composition and population structures occur on the French and the Cantabrian shelves (ICES, 2005). However, some differences were found in the shelf off the Gironde estuary, which seems to be the southern limit of cold water species, such as the herring (*Clupea harengus*), haddock (*P. virens*), Norway pout (*T. esmarkii*), dab (*L. limanda*), sprat (*S. sprattus*) and whiting (*M. merlangus*).

More than 200 species occur in the northeast Bay of Biscay (Bertrand *et al.,* 2004). Only 5 species make up more than 50% of the total biomass and abundance of demersal fish (Blanchard, 2001). Species richness is highest in coastal shallow waters, down to 50 m (Blanchard, 2001). Strong environmental gradients occur in the Cantabrian Sea and affect the fish distribution. Due to the narrow and steep shelf, depth is the most influential factor determining the assemblages observed in this area. The physical and faunal variability are larger in both the coastal and shelf break strata. Regarding trends in species richness and diversity both have remained quite stable during the 1990s (Sánchez & Serrano, 2003).

Off Portugal horse mackerel (*Trachurus trachurus*) is more important in autumn assemblages whereas the boarfish (*Capros aper*) dominates in summer. On the upper slope the fish community is dominated by blue whiting (*Micromesistius poutassou*). The importance of Sparids in the fish community increases to the south (Gomes et al., 2001).The shallow fish community of the Gulf of Cadiz has some affinities with subtropical and tropical fish communities, due to the occurrence of species such as *Umbrina canariensis*, *Pomadasys incisus*, *Spicara flexuosa*, *Diplodus bellottii*, *Pagelus bellottii bellottii*, *Halobratrachus didactylus, Caranx rhonchus, Pomatomus saltatrix,*

Dentex spp. and *Epinephelus* spp. (Fernández-Delgado, 1987). Some of these species also occur in part of the Mediterranean Sea. Deeper, the scabbardfish *Lepidopus caudatus* is abundant.

The main Elasmobranch species in the region are the rays, *Raja clavata, R. montagui,* and *R. miraletus* and the catsharks, *Scyliorhinus canicula* and *Galeus melastomus* at the coast and on the inner and outer shelf respectively (Sánchez et al., 2005a; Rodríguez-Cabello *et al.* 2005). Several deepwater sharks and chimaeroids are also found (Sánchez and Serrano, 2003; Lorance *et al.* 2000). Widely migratory sharks occur in this region such as blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrnchus*), porbeagle (*Lamna nasus*), tope (*Galeorhinus galeus*) and spurdog (*Squalus acanthias*). Some are taken in mixed demersal and pelagic (especially for tuna and swordfish) fisheries.

The main commercial demersal species caught by the trawl are hake, megrims (*Lepidorhombus boscii* and *L. whiffiagonis*), monkfishes and sole. Most of these species are distributed all through the advisory region, although not evenly.

Trophic web

In the northern Iberian shelf ecosystem, most of the biomass and production are contained within the pelagic domain. Phytoplankton grazing is low, consequently, detritivorous species are important. Suspension and deposit feeders constitute a high percentage of the biomass to the detriment of pelagic plankton (Sanchez and Olaso, 2004). Abundant suprabenthic zooplankton is available to pelagic and small demersal fish species (mackerel, horse mackerel, blue whiting, *Gadiculus argenteus*, *Capros aper*). Decapod crustaceans play an important role as preys of benthic fish species as megrims, gurnards, skates and *Trisopterus* spp. (Rodríguez-Marín, 2002).

Blue whiting is one of the main preys of many demersal piscivorous fishes (Velasco and Olaso, 1998a,b; Preciado *et al*., 2006). Sardine, anchovy, mackerel and horse mackerel have all been found in the diet of fish species (e.g. hake, tuna, John Dory, etc. with sardine and anchovy being taken also by mackerel and horse mackerel). There is a degree of cannibalism by adults on juveniles and/or eggs when food is scarce (e.g. Silva, 1999; Cabral & Murta, 2002).

The cetaceans may play an important role in the regional trophic web both as zooplankton consumers as well as competitors with the commercial fisheries. Sardine and anchovy are the main preys of common dolphins (*Delphinus delphis*) (Silva, 1999; Santos *et al.,* 2004, Meynier, 2004).

There are evidences of an important utilization of discards by demersal fishes in Galicia and the Cantabrian Sea (Olaso *et al.* 1998; 2002).

Mammals

Seven species of mysticeti, twenty-three species of odontoceti and seven species of pinnipeds have been reported in the eco-region. The main habitat and status of these species is summarised in Table 7.1.1.1. Detailed information on distribution and migratory patterns is restricted to the most common species.

Table 7.1.1.1 Main marine mammals species

Species	**Frequency and trends**	**Habitat, or temporal occurrence**
Grey seal (*Halichoerus grypus*)	Permanent in Brittany, southernmost breeding colony, 7% increase	Dispersion of youngs from British breeding colonies
Harbour seal (*Phoca vitulina*)	Permanent along French Channel coasts, southernmost breeding groups, increasing rapidly	
Habour porpoise (*Phocoena phocoena*)	Probably decreasing	All region
Fin Whale (*Balaenoptera Physalus*)	Fairly common	Oceanic waters only
Sperm whale (*Physeter macrocephalus*)	Fairly common	Summer aggregation feeding on cephalopods over continental slope
Cuvier's beaked whale (*Ziphius cavirostris*)	Small permanent numbers	Slope and canyons
Killer whale (*Orcinus orca*)	Rare	All region
Common dolphin (*Delphinus delphis*)	Most common (>50% of strandings)	Continental shelf, slope and oceanic waters
Bottlenose dolphin (*Tursiops truncatus*)	Common	All region (mainly coastal)
Striped dolphin (*Stenella coerulaeoalba*)	Most common	Oceanic waters
Long-finned pilot whale (*Globicephala melas*)	Common	Mostly slope waters, visits into coastal waters in the summer

Birds

The Iberian Peninsula gives rise to large seabird populations due to its strategic geographical position regarding their migratory pattern. Seabirds are grouped in terms of pelagic species (e.g. yelkouan shearwater (*Puffinus puffinus*), Leach's petrel (*Oceanodroma leucorhoa*), northern gannet (*Morus bassanus*) and razorbill (*Alca torda*), coastal species (e.g. shag (*Phalacrocorax aristotelis*), terns (*Sterna* spp.) and common scoter (*Melanitta nigra*) and gulls. The seabird community is dominated by the yellow-legged gull (*Larus cachinnans*) which makes up 70 % of the total number of seabirds. Its feeding habits (fish discards and rubbish dumps) together with the protection of their colonies explains their strong demographic growth in recent decades. Other nesting seabirds of importance are the very similar lesser black-backed gull (*L. fuscus*), the shag, European storm-petrel (*Hydrobates pelagicus*), black legged kittiwake (*Rissa tridactyla*) and guillemot (*Uria aalge*) (OSPAR, 2000).

Turtles

Two marine turtles species the loggerhead (*Caretta caretta* and the leatherback *Dermochelys coriacea*) occur year round in the south of the advisory region. Seasonal variations in abundance in the Gulf of Cádiz are related to a migration pattern through the Gibraltar Straits (Camiñas and Valeiras, 2001). As a consequence of the long migrations undertaken by the oceanic marine turtles using the Gulf Stream some occasional occurrences of *C. Caretta*, *D. coriacea*, *Chelonia mydas*, *Eretmochelys imbricata* and *Lepidochelys kempii* are also reported throughout the advisory region.

7.1.2 Major environmental influences on ecosystem dynamics

Upwelling intensity, and to lesser extent other factors such as water stability, retention areas produced by local or general current fields and other mesoscale features like river plumes and eddies affect biological processes, recruitment, mortality and food availability to the small pelagic fish community (Bode *et al.* 2001; Allain *et al.* 2001). Indices of the strength of upwelling have been used to improve environmental-stock-recruitment relationships in some pelagic species (Carrera and Porteiro 2003, Villamor *et al.*, 2004). Subtropical water intrusions in the Cantabrian Sea and/or early spring extreme wind forcing events are of great importance for the pelagic ecosystem understanding and may be linked to important failures in the recruitment of mackerel (Villamor *et al.* 2004). Also in relation with the strength of the upwellings and the Navidad current optimal environmental windows have been defined for some demersal species such as hake and megrims (Sánchez and Gil, 2000; Sánchez *et al.,* 2003a, b).

At the coast, sole recruitment was shown to be related to river output, higher fluvial discharge in winter-spring increasing the estuarine nurseries size (Le Pape et al. 2003a,b).

Borges *et al.,* (2003) showed that a NAO positive phase, increased the winter upwelling events and constrained the productivity to a low recruitment period of sardine, whereas a NAO negative phase favoured the occurrence of high recruitment years. There is circumstantial evidence of a relation between low NAO values and high recruitment levels /CPUE in the Spanish swordfish fishery (Mejuto, 1998).

Temperature increase has been related with changes on the distribution of several species (Quéro *et al.* 1998) that are progressively increasing their northernmost distribution limits. Some species may be favoured by warming (Blanchard and Vandermeirsch, 2005) and recently, species from North Africa were reported in the Algarve (Brander *et al.* 2003).

7.2 The human impacts on the ecosystem

7.2.1 Fishery effects on benthos and fish communities

Fishing is a major disturbance factor of the continental shelf communities of the region. Trawling may have some impact on the sediment compound. The sediment compound of a large area of sedimentary bottom know as "Grande Vasiere" and trawled for *Nephrops*, to the south west of Brittany, appeared to have changed over the last 30 years. The proportion of mud decreased, and the change may be due to sediment remobilization by storms and trawling (Bourillet et al., 2004). Such an habitat change may have adverse effect on sedimentary species and burying animal such as *Nephrops*. Nevertheless, the participation of natural (storms) and anthropogenic (fishing) drivers of this change is still uncertain. In the same area, diversity studies of benthic megafauna showed that large invertebrates were less abundant in the most exploited stations. In the heavily exploited stations, the dominant species were opportunistic carnivorous species of minor or no commercial interest and there was no fragile invertebrates (Blanchard *et al.,* 2004).

Recent studies (Rochet et al., 2005), based on the EVHOE bottom-trawl survey data from the Bay of Biscay 1987-2002, developed a diagnostic based on indicators for 51 fish populations and the fish community. At the start of the time series (1987) the shelf fish community was considered impacted by fishing. Over the study period, the situation of the fish populations and community did not improve and the overall diagnostic was for a steady (not improving) situation.

In the Cantabrian Sea, the fisheries have a major effect on the structure and dynamics of the ecosystem. In recent decades, the mean trophic level of the demersal and benthic fisheries declined. This is reflected in a gradual transition of landings from long-lived, high trophic level piscivorous groundfish (hake, anglerfish, megrim) towards lower trophic level planktivorous fish (blue whiting, horse mackerel). The mean trophic level was estimated to have declined from 4.10 in 1983 to 3.95 in 1993, then to have varied without clear trend (Sánchez and Olaso, 2004).

On the long term some large bottoms chondrichthyans (*Echinorhinus brucus, Squatina squatina, Raja batis, Raja brachyura, Dasyatis pastanica Myliobatis aquila, Galeorhinus galeus, Mustelus asterias, Raja clavata*) declined severely (Quéro and Cendrero, 1996) in the Bay of Biscay. Further south, although the fishing mortality of catshark (*S. canicula*) seems excessive it also profits from discards. The recovery of elasmobranchs in the Cantabrian Sea in recent years can be attributed to reduced fishing mortality associated with a reduction of the trawl fishing effort (Sánchez et al., 2005a). The sturgeon (*Acipenser sturio*) is a critically endangered species due to fishing and alteration of freshwaters habitats. The blackspot(=red) seabream (*Pagellus bogaraveo*) is depleted in the Bay of Biscay.

The catches of the common spiny lobster (*Palinurus elephas)* dropped from about 1000 t/year in the first half on 20th century to about 100 t now. The deeper pink spiny lobster (*Palinurus mauritanicus)* were depleted as a result of overexploitation from bottom net fisheries.

In relation to discards in the Bay of Biscay, bottom trawl reach the biggest rate of discards, due to the mixed species fishery. Among fishes, the main species discarded in number are the small fish snipe-fish (*Macrorramphosus scolopax*) silver pout (*Gadiculus argenteus*) and the medium sized blue whiting (*Micromesistius poutassou*). All these species are dead when discarded (Pérez et. al, 1996).

Fisheries have a considerable influence at different levels on the distribution of seabirds at sea due to the supply of discards that are used as food for scavenging species.

Some incidental catches of mammals were recorded in pelagic trawl fisheries (Morizur *et al.,* 1999). Catches of mammals in bottom trammel net for sole also occur to an unknown level. Over 1998-2003, 200 to 700 strandings per year were recorded. The common dolphin (*Delphinus delphis*) makes up 60% of strandings (Van Canneyt *et al.,* 2004). 30 to 60 % of all stranded animals have prints of fishing gears.

7.2.2 Pollution

Impact of the "Prestige" oil spill

The "Prestige" oil spill off Galicia in November 2002 affected most of the northern Spanish coast and especially the northern part of Galicia. From November 2002 to August 2003, 23000 birds (6000 alive and 17000 dead) were collected on French, Spanish and Portuguese coasts. More than 90 species were identified. The most affected species was the guillemot (51 %), followed by the razorbill and the Atlantic puffin (*Fratercula arctica*). Other species found in significant numbers were the black-legged kittiwake, the little auk (*Alle alle*) and the great northern diver (*Gavia immer*). According to their relative abundance, the yellow-legged gull and the common scoter were the less impacted species. In general, more than 60 % of the oily birds were females (http://www.seo.org/2002/prestige).

Three years after the Prestige oil spill, there has not been a clear effect of the event on the demersal and pelagic domains of the Iberian shelf. Although, based upon abundance indices and bottom trawl surveys, an initial abundance decrease of some primarily benthic species (e.g. four-spot megrim, Norway lobster and other benthic decapod crustaceans) was observed in 2003, it was followed by an increase in 2004 (Sánchez et al., 2006; Serrano et al., 2006 [b], Trujillo et al, 2005)

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7.3 Assessment and advice

7.3.1 Assessment and advice regarding protection of biota and habitats

ICES has not in 2006 provided advice regarding protection of biota and habitats in this ecosystem.

7.3.2 Assessment and advice regarding fisheries

Description of fisheries

A large number of commercial and non-commercial fish species are caught for human consumption in this eco-region. The fisheries in the Bay of Biscay and Atlantic Iberian Peninsula exploit demersal and pelagic fish species, crustaceans, and cephalopods. Different kinds of Spanish and Portuguese fleets operate in this area.

The main pelagic species in the Iberian Peninsula are sardine and anchovy (small pelagic) and mackerel and horse mackerel (middle-size pelagic). These species form the basis of important fisheries in the Iberian Peninsula and in the Bay of Biscay, which represent an important source of income for local economies. Also characteristic are other species more common to temperate and subtropical waters, such as chub mackerel (*Scomber japonicus*), Mediterranean horse mackerel (*Trachurus mediterraneus*), and blue jack mackerel (*Trachurus picturatus*). Small pelagic fishes are generally caught by purse seiners, while a wider variety of gears are used to catch middle-sized pelagic fishes, e.g. hand-lines and bottom trawl gears.

The demersal fisheries mainly target the following southern stocks; hake, megrim, four-spot megrim, anglerfish (*Lophius. piscatorius* and *L. budegassa*), and *Nephrops*.

Portuguese fisheries

The Portuguese National Fisheries and Aquaculture Directorate (DGPA) establishes four major fleet segments:

1. **The small-scale regional fleet**. Small vessels with reduced autonomy (75% with no engine) and with a high diversity of fishing gears (beam trawl, gill and trammel nets, hooks and longline, traps and pots). Target mainly coastal and estuarine species. Gears and fishing activity may be very typical on a regional scale.
2. **The purse-seine fleet**. Vessels with high engine power and autonomy. This fleet uses mainly seine nets and targets small pelagic species.
3. **The trawl fleet**. Vessels with a high engine power and autonomy. Use mainly bottom trawl nets. Target a great variety of benthonic and demersal species including fish, cephalopods, and crustaceans.
4. **The artisanal/multi-gear (polyvalent) fleet**. Vessels with higher engine power and autonomy compared to vessels of the small-scale regional segment. Use a great variety of fishing gears (gill and trammel nets, hooks and longline, traps and pots). This fleet targets a great diversity of benthonic, demersal, and pelagic species (fish, shellfish, cephalopods, and crustaceans) and it contributes to an important part of the total annual landings of the demersal fish species, in particular for hake and anglerfish.

The text table below indicates the main characteristics of the fleet with at least one landing day during the year.

The Portuguese trawl fleet comprises two fleet components, i.e. the trawl fleet catching demersal fish (using 65-mm mesh size) and the trawl fleet directed at crustaceans (55-mm mesh size and above 70 mm for Norway lobster). During the period 2003–2005, a total number of 102 trawlers had operated, 72 fish trawlers and 30 crustacean trawlers.

In 2003–2005 the mean values of the main characteristics of these trawl fleets were:

- Fish trawlers: 705 HP, 182 GRT, and 27 m overall length;
- Crustacean trawlers: 563 HP, 178 GRT, and 25 m overall length.

The trawl 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.

For the fish trawlers the main species are horse mackerel and blue whiting, hake being fifth to seventh in importance by weight. For the crustacean trawlers the most important species are Norway lobster (*Nephrops norvegicus*) and deepwater rose-shrimp (*Parapenaeus longirostris*), although in the last two years blue whiting became the first species in weight landed. Hake ranks fourth in weight landed.

The artisanal/multi-gear fleet is a very important fishing fleet in the Portuguese continental coast. It is responsible for around 50% of the total annual landings of hake and for around 80% of anglerfish. The fishing strategies, target species,

types of fishing operations, and seasonal variation of fishing tactics are very complex and variable. During the same fishing trip a variety of different fishing gears can be used and in this case, the species composition of the landing is the outcome of different gears and fishing operations. Also, the same species can be targeted by different fishing gears, in different fishing areas and seasons.

The purse-seine fishery, the most important in landings volume, is composed of around 130 purse seiners. This fleet targets mainly sardine, which constitutes more than 80% of their landings, using a mesh size of 35 mm. Other pelagic species landed are horse mackerel and Spanish mackerel.

The longline fishery, of artisanal nature, is composed of 22 vessels and targets black scabbardfish (*Aphanopus carbo*) in a limited area (hard grounds along canyon slopes off Sesimbra (South of Lisbon)). Fishing takes place at depths ranging from 800 to 1200 m.

Portuguese fisheries taking demersal elasmobranchs are mainly coastal trawlers and the artisanal fishing fleet. Two species, lesser-spotted dogfish *Scyliorhinus canicula* and bull huss *S. stellaris* are landed in the major ports under the generic name of *Scyliorhinus* spp. Although it is believed that *S. canicula* is the dominant species in the landings, the percentage of mixture is not known.

Most of the landings are recorded under the generic name of *Scyliorhinus* spp., and annual landings have increased from around 500 t in 1986 to between 700 and 800 t in 1997–2001. During 2002–2004 landings were stable (700 t), decreasing to 400 t in 2005. Skates and rays are landed under the generic name of *Raja* spp. as bycatches of the artisanal fishery (different types of fishing gear such as longline and gillnet) and trawl segments of the commercial fleet. Landings consist of *Rostroraja alba*, *Raja brachyura*, *Raja microocellata*, *Raja clavata*, *Raja miraletus*, *Raja montagui*, *Raja undulata*, and *Leucoraja naevus*. *R. brachyura* and *R. clavata* were the most abundant in landings, while *R. miraletus* was the most infrequent species.

Table 7.3.2.1 Portuguese fleet – number of vessels, mean engine power (HP), and mean length over all of fishing vessels by segment and year.

	Regional					
	Total	**Engine**	**No engine**	**Purseine**	**Trawl**	**Artisanal/ Multi-gear**
Vessel number						
2003	3563	897	2666	129	95	385
2004	3485	868	2617	124	98	376
2005	3404	839	2564	117	93	369
Mean Engine Power (HP)						
2003	34,6			332,5	678,1	214,2
2004	35,7			335,7	679,1	210,2
2005	36,2			339,5	687,9	213,3
Mean length over all (m)						
2003	6,5			20,2	27,1	16,0
2004	6,5			20,4	27,0	15,8
2005	6,5			20,5	26,8	15,9

Spanish fisheries

The Spanish fleets operating in the Atlantic Iberian Peninsula shelf also catch a variety of species: hake, white and black anglerfish, megrim and four-spot megrim, Norway lobster, blue whiting, mackerel, and horse mackerel. In the Gulf of Cadiz, the southeastern border of the Atlantic Iberian region, two groups of trawlers can be distinguished: the most numerous group normally operates in shallow waters (30–50 m), for which the target species are a mixture of sparids, cephalopods, sole, hake, and horse mackerel, and the other group which operates between 90 and 500 m and mainly targets blue whiting, shrimp, horse mackerel, hake, and Norway lobster. The latter group consists of smaller trawlers fishing for hake as well as crustaceans, molluscs, and cephalopods (octopus, etc.).

A summary of the Spanish fleets operating in the Bay of Biscay and Iberian Peninsula waters is presented below.

Fishery	Area	Gear	Target species	Description
Small gillnet "Beta"	Division VIIIc and IXa North	Fixed nets	Hake	Mesh size of 60 mm
Gillnet "Volanta"	Division VIIIc			Mesh size of 90 mm
Gillnet "Rasco"			Anglerfish	Mesh size of 280 mm
Longline fleet	Division VIIIc	Longline	Hake + Great Fork beard + Conger	
North Spain Artisanal fleet		Miscellaneous		Miscellaneous fleet
Gulf of Cadiz Artisanal fleet	South of Division IXa			Miscellaneous fleet
Baca Otter Trawl Mixed Fishery	Divisions VIIIc and IXa North.	Trawl	Horse mackerel + Blue whiting+ Mackerel+ White fish	Mesh size of 65 mm Opening: 1.2–1.5 m
Pair Bottom Trawl Fishery			Blue whiting	Mesh size of 55 mm Vertical opening of 25 m
VHVO Bottom Trawl Fishery	Divisions VIIIc West and IXa North		Horse mackerel	Mesh size of 65 mm Vertical opening of 5–5.5 m
Gulf of Cadiz_Trawl fleet (<35 GRT)	South of Division IXa		Sparids+ Cephalopods+ Sole+ Hake + Horse mackerel	
Gulf of Cadiz_Trawl fleet (>35 GRT)			Blue whiting+ Shrimp+ Horse mackerel+ Hake+ Norway lobster	
?	?	Purse Seine	Sardine + Anchovy	

In northern Spanish waters, sardine is taken by purse seiners (n = 341) ranging in size from 8 to 38 m (mean vessel length = 22 m). Vessel engine power ranges widely between 16 to 1100 (mean = 333). In the Gulf of Cadiz, purse seiners taking sardine are generally targeting anchovy (n = 99) and range in size from 5.8 to 21.6 m (horse power between 22 to 500). (source: WGMHSA 2006).

In Divisions VIIIc (East) and VIIIb the target species for the purse seine fleet change with the season – anchovy in spring and tuna in the summer. This fleet changes gear and uses trolling and bait boats to catch tuna.

Spanish fisheries take many species of rays with a wide variety of gears, but most of the landings come from the bycatch of fisheries targeting other demersal species such as hake, monkfish, and megrim. Historically the most commercial elasmobranchs are *Leucoraja naevus* and *Raja clavata* and *Scyliorhinus canicula*. Other species include *R. montagui, R. brachyura, R. undulata*, and *R. microocellata.* In 1994, a total of 7089 t of elasmobranchs were caught by trawl fleets in the Cantabrian Sea; of these 87% was discarded.

Belgian fisheries

Belgium has a flatfish-directed fisheries mainly targeting sole in VIIIa,b. Vessels taking part in these fisheries are mostly large beam trawlers with engine powers exceeding 900 HP. Vessels often shift between these areas (and the Celtic and Irish Seas), even during the same voyage, depending on quota availability and catch opportunities.

French fisheries

The text table below lists the main French métiers operating in the Bay of Biscay. The main species caught in this area are *Nephrops* (bottom-trawl), sole (gillnet), and anchovy (pelagic trawl). Anglerfish and hake are mostly caught by French-flagged vessels based in Spain (Basque Country). These vessels use gillnets.

The French fisheries take the largest proportion of elasmobranchs of any fleets in this region. Traditionally, the French fishery was limited to the continental shelf of the Celtic Sea, the Channel, and the Bay of Biscay, and only two species

of sharks (*S. acanthias* and *S. canicula)* and one ray (*L. naevus)* were particularly important in the catches (about 60 to 70% of elasmobranch landings), with *L. naevus* accounting for about 30%.

Table 7.3.2.2 Summary of the main métiers of the French fleets in the Bay of Biscay (Divisions VIIIabde).

Area	Gear	Target species	Bycatches
Divisions VIIIabd	Bottom trawls (mostly twin trawls)	*Nephrops*	Hake (discarded)
Divisions VIIIabd	Bottom trawls	Mixed: Sole, whiting, Cuttlefish	Red-mullet, pollack
Divisions VIIIabd+VII	Bottom trawls (mostly twin trawls)	Anglerfish	Megrim, Rays
Divisions VIIIabde + VIIe +VIIIe+VII	Pelagic Trawl small mesh Pelagic Trawl	Anchovy Bass Albacore	
Divisions VIIIab	Purse-Seine	Sardine, Anchovy	
Divisions VIIIabd	Gill-nets Gill-nets large mesh	Hake Anglerfish	
Divisions VIIIabd	Miscellaneous	Crabs, Bass, Conger…	

Mixed fisheries and fisheries interactions

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly those with reduced reproductive capacity, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

All fisheries should be considered in the management; the major fisheries in the area are:

- Bottom-trawl fishery targeting *Nephrops*, but also taking hake and anglerfish as their main bycatch;
- Bottom-trawl fishery for mixed fish, i.e. hake, anglerfish, megrim, horse mackerel, and blue whiting;
- Artisanal/multi-gear gillnet fishery for mixed demersal fish, i.e. hake, anglerfish, megrim;
- Baca-trawl fleet for blue whiting, hake, horse mackerel and *Nephrops*, megrims;
- Trawl for horse mackerel, with a small bycatch of other species (not *Nephrops*);
- Pair trawl for blue whiting;
- Fixed-net fisheries (Rasco directed at anglerfish, Beta and Volanta directed at hake);
- Longline fishery for hake and other demersal species;
- Longline fishery for black scabbardfish;
- Artisanal fleet taking miscellaneous species.

Both megrim species are caught together in fisheries, which also take a large number of other commercial species, including southern hake. The decreasing catch of hake has modified the target species of some of the fleets and has reduced the effort on these species in recent years.

A portion of the catch of anglerfish (*L. piscatorius* and *L. budegassa*) is taken together with other species in mixed trawl fisheries.

The number of trawlers has decreased since the early 1980s, resulting in a decreasing trend in the overall effort in the Portuguese and Spanish fleets. The number of boats in fleets operating with gillnets and longlines has also declined in recent years. Portuguese and Spanish boats using trawl, longline, or fixed nets are currently subjected to a restricted access system.

Southern horse mackerel are mainly exploited by Spanish and Portuguese purse seiners and by Portuguese trawlers. While the purse seiners mainly catch juvenile fish, the catches taken by trawlers comprise also older fish. There is a significant bycatch of *Trachurus mediterraneus* and *Trachurus picturatus*, mainly in the trawl fishery.

For blue whiting most of the catches are taken in the directed pelagic trawl fishery in the spawning and post-spawning areas (Divisions Vb, VIa,b, and VIIb,c). Catches are also taken in a directed and a mixed fishery in Subarea IV and Division IIIa and in the pelagic trawl fishery in the Subareas I and II, and in Divisions Va and XIVa,b. These fisheries

in the northern areas have taken 340 000–1 390 000 t per year in the last decade, while catches in the southern areas (Subareas VIII, IX, Divisions VIId,e and g–k) have been stable in the range of 25 000–34 000 t. In Division IXa blue whiting is mainly taken as a bycatch in the mixed trawl fishery, and in the case of the Portuguese trawl this bycatch is discarded at sea.

Fisheries for anchovy are targeted by trawlers and purse seiners. The Spanish and French fleets fishing for anchovy in Subarea VIII are well separated geographically and in time. The Spanish fleet operates mainly in Division VIIIc and VIIIb in spring, while the French fleets operate in Division VIIIa in summer and autumn and in Division VIIIb in winter and summer. There is fishing for anchovy throughout the year.

There is a regular fishery for anchovy in Division IXa South (Gulf of Cadiz). The fleets in the northern part of Division IXa occasionally target anchovy when abundant, as occurred in 1995. The anchovy in Division IXa South has different biological characteristics and dynamics compared to anchovy in other parts of Division IXa. The anchovy population in Subdivision IXa South appears to be well established and relatively independent of populations in other areas.

Mackerel is a target species for the handline fleet during the spawning season in Division VIIIc, during which about one-third of the total catches are taken. It is also taken as a bycatch by the trawl fleets in Division VIIIc and IXa. The highest catches (80%) from the southern component are taken mainly from Division VIIIc in the first half of the year and consist of adult fish. In the second half of the year, catches consist of juveniles and are mainly taken in Division IXa, as bycatches of the trawl fisheries. Catches from the southern component (Div. VIII c and IXa) have been decreasing in 2003 and 2004 to around 30 000 t, from a maximum of 50 000 t in 2002. In 2005 the catches increased again to a second maximum level of 50 000 t.

Single-stock exploitation boundaries

The state and the limits to exploitation of the individual stocks are presented in the stock sections.

The state of stocks and single-stock exploitation boundaries are summarized in the table below.

Stock	State of the stock			ICES considerations regarding single-stock based exploitation limits			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2007
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to high long-term yield	In relation to agreed management plan	In relation to high long-term yield	In relation to precautionary limits	
Sole in Bay of Biscay (Div. VIIIab)	Increased risk	Increased risk	Overexploited	According to the management plan, landings should be less than 4540 t in 2007.	F is well above $F_{0.1}$.	F needs to be reduced to 0.41; catches of less than 4830 t in 2007.	4540 t.
Southern stock of hake (Div. VIIIc and IXa)	Unknown	Unknown	Overexploited	Preliminary evaluation of the recovery plan indicated that the proposed level of F might be insufficient to rebuild the stock within 10 years.	Fishing mortality is likely well above levels that would support optimal long-term yield.	The only option which would allow rebuilding of the stock in the short term with a high probability is a closure of the fishery in 2007.	Zero catch.
Nephrops in Divisions VIIIa,b (Bay of Biscay, FU 23-24)	Reference points not defined	Reference points not defined			The present fishing mortality is well above the Fmax of 0.20.	No increase of catches over the recent level of 3 600 t (2003-2005).	Recent average catch 3600 t.
Megrim (*L. boscii* and *L. whiffiagonis*) in Div. VIIIc and IXa	Not defined	Not defined	Overexploited (*L. boscii*), Appropriate (*L. whiffiagonis*)		F for *L. whiffiagonis* is around $F_{0.1}$, while F for *L. boscii* is above $F_{0.1}$.	F should therefore not be allowed to increase.	1440 t.
Anglerfish (*L. piscatorius* and *L. budegassa*) in Div. VIIIc and IXa	Not defined	Not defined	Overexploited			Fishing mortality equal to zero or a recovery plan	Zero catch.
Southern horse mackerel *(Trachurus trachurus) in Div. IXa*	unknown	unknown	unknown			Fishing effort must not increase and catches in 2007 should not exceed the 2000–2004 average of around 25 000 t.	Recent average catches of 25 000 t.
Southern Mackerel Component of NEA Mackerel (*Scomber scombrus*)	Uncertain	Harvested unsustainably	Overexploited	The agreed management plan (F between 0.15 and 0.20) would imply catches between 390 000 t and 509 000 t in 2007.			Only advice applicable to the whole NEA mackerel stock.

Stock	State of the stock			ICES considerations regarding single-stock based exploitation limits			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2007
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to high long-term yield	In relation to agreed management plan	In relation to high long-term yield	In relation to precautionary limits	
Nephrops in Div IXa: West Galicia and North of Portugal (FU 26-27)	not defined	not defined	not defined			ICES advises that there is no fishing on *Nephrops* until the recruitment improves considerably.	Zero catch.
Nephrops in Div IXa: SW and South of Portugal (FU28-29)	not defined	not defined	not defined			Landings in 2007 should not exceed 200 t.	200 t.
Nephrops in Div IXa: Cadiz (FU 30)	not defined	not defined	not defined			Not to increase the catches in 2007 above the lowest recent landings of 50 t.	50 t.
Sardine in Divisions VIIIc and IXa	Unknown	Unknown	Unknown			Fishing mortality should not increase above the 2003–05 level of 0.21, catch of less than 114 000 t.	114 000 t.
Anchovy- Sub-Area VIII	Reduced reproductive capacity	not harvested	Unknown			Fishery should remain closed until signs of a strong 2006 year class.	Zero catch.
Anchovy in Division IXa	Unknown	Unknown	Unknown			Catches in 2007 should be restricted to 4800 t	4800 t.
Black scabbardfish in Div IXa	Unknown	Unknown	Unknown			*Status quo* exploitation level	
Red (=blackspot) seabream in Subareas IX and X	Unknown	Unknown	Unknown			The fishery should not be allowed to expand unless it can be shown that it is sustainable.	

Identification of critical stocks

The table above identifies the stocks outside precautionary reference points.

The critical stocks which are below $\mathbf{B}_{lim}$ are the southern hake stock and anchovy in Subarea VIII. ICES has advised that there should be no catches on *Nephrops* for FU 25 (Northern Galicia), FU 31 (Cantabrian Sea), and FUs 26–27 (West Galicia and North Portugal), and for both southern anglerfish species a fishing mortality equal to zero in 2007 is required to bring SSB back to $\mathbf{B}_{MSY}$ in the short term. These should also be considered critical stocks.

Other stocks for which reduction in exploitation is required are the NEA mackerel and sole in Bay of Biscay.

These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered.

Advice for fisheries management

Sardine and anchovy should be fished according to the single-stock boundaries.

The demersal fisheries in the Iberian Region should be managed such that the following rules apply simultaneously:

- **For southern hake, anglerfish, *Nephrops* in FU 25, FU 31, and FUs 26–27: zero catch unless a rebuilding plan is implemented which is consistent with the precautionary approach;**
- **For anglerfish a rebuilding plan should be established that will ensure rapid rebuilding to precautionary levels, and which ensures large reductions in F in 2007. The rebuilding plan implemented in 2006 for southern hake and *Nephrops* appears to be insufficient for reaching its aim;**
- **Regarding deep-sea species, see Section 9.3.**

The fishing of each species should be restricted within the precautionary limits as indicated in the table of individual stock limits above.

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.

Management considerations

ICES notes that this advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. If industry-initiated programs aim at reducing catches of species outside safe biological limits to levels close to zero in mixed fisheries, then these programmes could be considered in the management of these fisheries. Industry-initiated programmes to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported.

Short-term implications

The catch options that would apply if single stocks could be exploited independently of others are summarized in the table above.

However, the mixed fisheries management options must be based on the expected catch in specific combinations of effort in the various fisheries, taking into consideration the advice given above. The distributions of effort across fisheries should be responsive to objectives set by managers, but must also result in catches that comply with the scientific advice presented above.

The information on the mix of species observed caught in fisheries in this area is not complete. An evaluation of the effects of any combination of fleet effort on depleted stocks would require that the catch data on which such estimates were based included discard information for all relevant fleets. Such data are not available to ICES. ICES is therefore not in a position to present scenarios of the effects of various combinations of fleet effort. If data including discards were available it might be possible to present a forecast based on major groupings of fleet/fisheries.

There is information which indicates that the exploitation of some stocks is linked. There is no database for a precise estimate of this linkage. The implications of the linkages regarding management of stocks taken in mixed fisheries would be as summarized in the table below:

IBERIAN – Divisions VIIIc and Subareas IX and X
Demersal stocks

	Hake VIIIc+IXa	Anglerfish * VIIIc+Ixa	Megrims* VIIIc+IXa	*Nephrops* Cantabrian FU 31	*Nephrops* North Galiza FU 25	*Nephrops* West Galiza + North Portugal FUs 26+27	*Nephrops* SW and South Portugal FUs 28+29	*Nephrops* Cadiz FU 30	Horse mackerel IXa	Blue whiting VIIIc+IXa	Black scabbardfish IXa	Red seabream IX and X
Hake VIIIc+IXa		**H**	**H**	**L**	**H**	**H**	**H**	**H**	**H**	**M**	**L**	**L**
Anglerfish VIIIc+IXa	PT-SP-trawls and PT-SP-gillnets		**H**	**L**	**H**	**H**	**H**	**0**	**M**	**L**	**0**	**L**
Megrims VIIIc+IXa	PT-trawl, PT-gillnets	PT-trawl, PT-gillnets		**L**	**L**	**L**	**H**	**0**	**M**	**L**	**0**	**L**
Nephrops Cantabrian Sea FU 31	SP-Trawl	SP-Trawl	SP-Trawl		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nephrops North Galica FU 25	SP-Trawl	SP-Trawl	SP-Trawl	None		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nephrops West Galica + North Portugal FUs 26+27	SP-Trawl PT- trawl	SP-Trawl PT-trawl	SP-Trawl PT-trawl	None	None		**0**	**0**	**L**	**L**	**0**	**0**
Nephrops SW and South Portugal Fus 28+29	Crustacean PT-trawl	Crustacean PT-trawl	Crustacean PT-trawl	None	None	None		**0**	L	M	**0**	**0**
Nephrops Cadiz FU 30	SP-Trawl	None	None	None	None	None	None		**M**	**H**	**0**	**0**
Horse mackerel IXa	PT-trawls, PT-artisanal, SP-trawl- H SP GOV -L	PT-trawl, PT-gillnets SP-trawl- H SP GOV -L	PT-trawl, PT-gillnets SP-trawl- H SP GOV -L	None	None	SP-Trawl PT-trawl	Crustacean PT-trawl	SP-Trawl		**M**	**0**	**0**
Blue whiting VIIIc+IXa	PT-trawls SP-trawl SP pair trawl	Crustacean PT-trawl SP-trawl	Crustacean PT-trawl SP-trawl	SP-Trawl-L	SP-Trawl-L	SP-Trawl-L	Crustacean PT-trawl	SP-Trawl	PT-trawls SP-trawl SP-pair Trawl SP GOV -L		**0**	**0**
Black scabbardfish IXa	PT- Longline	None	None	None	None	None	None	None	None	None		**0**
Red seabream IX and X	PT-artisanal	PT-artisanal	PT-artisanal	None	None	None	None	None	PT-artisanal	None	None	

IBERIAN – Divisions VIIIc and Subareas IX and X
Pelagic stocks

	Horse mackerel VIIIc	**Horse mackerel IXa**	**Mackerel**	**Sardine**	**Anchovy VIII**	**Anchovy IXa**
Horse mackerel VIIIc		**H**	**M/L**	**H**	**L**	**M**
Horse mackerel IXa	SP-trawl, SP-purse seine, SP-GOV		**H**	**H**	**0**	**L**
Mackerel	**SP- purse seine** (M) SP- artisanal **(L)**	PT fish trawl, PT-artisanal, PT-purse seine, SP-trawl, SP-purse-seine, SP-GOV		**H**	**L**	**L**
Sardine	**SP-purse seine**	PT-artisanal, PT-purse seine, SP- purse seine	PT-artisanal, PT- purse seine, SP-purse seine, SP-artisanal		**L**	**H**
Anchovy VIII	SP- purse seine	None	SP- purse seine SP-artisanal	SP- purse seine SP-artisanal		**0**
Anchovy IXa	None?	PT purse seine	PT-artisanal, PT purse seine SP- purse seine SP-artisanal	PT-artisanal, PT purse seine SP- purse seine SP-artisanal	None?	

7.4 Stock Summaries (Bay of Biscay and Iberian Seas)

7.4.1 Hake – Southern stock (Divisions VIIIc and IXa)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to target	Comment
Reduced reproductive capacity	Harvested unsustainbly	Overexploited	Above target	

The assessment is uncertain in terms of absolute values, but is indicative of stock trends. SSB appears to have decreased between 1982 and 1997 to a level likely well below $\mathbf{B}_{lim}$, and has been stable or slightly increasing since. F has fluctuated without particular trend at a high level since the mid-1990s. There is no indication of a recent reduction in F. Recruitment was high in the mid-1980s and has been much lower since. There are indications of good recruitments in 2004 and 2005.

Management objectives

There are explicit management objectives for southern hake and *Nephrops* under the EC Reg. No. 2166/2005 establishing measures for the recovery of the Southern hake and Norway lobster stocks in the Cantabrian Sea and Western Iberian peninsula by January 2006. The main articles of interest adopted by this Regulation are:

Article 1. Subject matter

This Regulation establishes a recovery plan for the following stocks (hereinafter referred to as the stocks concerned):

(a) the Southern hake stock which inhabits Divisions VIIIc and IXa, as delineated by the International Council for the Exploration of the Sea (ICES);
(b) the Norway lobster stock which inhabits ICES Division VIIIc;
(c) the Norway lobster stock which inhabits ICES Division IXa.

Article 2. Objective of the recovery plan

The recovery plan shall aim to rebuild the stocks concerned to within safe biological limits, in keeping with ICES information.

This shall mean:

(a) as regards the stock referred to in Article 1(a), reaching a spawning stock biomass of 35 000 tonnes during two consecutive years, according to the available scientific reports, or increasing the quantities of mature individuals within a period of 10 years so that values are reached equal to or higher than 35 000 tonnes. This figure shall be adjusted in the light of new scientific data from the STECF;
(b) as regards the stocks referred to in Article 1(b) and (c), rebuilding the stocks to within safe biological limits within a period of 10 years.

Article 3.Evaluation of recovery measures

1. The Commission shall, on the basis of advice from ICES and STECF, evaluate the impact of the recovery measures on the stocks concerned and the fisheries on those stocks in the second year of application of this Regulation and in each of the following years.

2. Where the Commission finds, on the basis of the annual evaluation, that any of the stocks concerned have reached the objective set out in Article 2, the Council shall decide by qualified majority on a proposal from the Commission to replace, for that stock, the recovery plan provided for in this Regulation by a management plan in accordance with Article 6of Regulation (EC) No 2371/2002.

3. Where the Commission finds, on the basis of the annual evaluation, that any of the stocks concerned do not show proper signs of recovery, the Council shall decide by qualified majority on a proposal from the Commission on additional and/or alternative measures in order to ensure recovery of the stock concerned.

Article 4. ***Setting of TACs***

1. Each year, the Council shall decide by qualified majority on the basis of a proposal from the Commission on a TAC for the following year for the stocks concerned.
2. The TAC for the stock referred to in Article 1(a) shall be set in accordance with Article 5.
3. The TACs for the stocks referred to in Article 1(b) and (c) shall be set in accordance with Article 6.

Article 5. ***Procedure for setting the TAC for the Southern hake stock***

1. Where the fishing mortality rate for the stock referred to in Article 1(a) has been estimated by the STECF in the light of the most recent report of ICES to be above 0,3 per year, the TAC shall not exceed a level of catches which, according to a scientific evaluation carried out by the STECF in the light of the most recent report of ICES, will result in a reduction of 10 % in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year.

2. Where the fishing mortality rate for the stock referred to in Article 1(a) has been estimated by the STECF in the light of the most recent report of ICES to be equal to or below 0,3 per year, the TAC shall be set at a level of catches which, according to a scientific evaluation carried out by the STECF in the light of the most recent report of ICES, will result in a fishing mortality rate of 0,27 per year in the year of its application.

3. Where STECF, in the light of the most recent report of ICES, is able to calculate a level of catches corresponding to the mortality rates specified in paragraphs 1 and 2 for only a part of ICES Divisions VIIIc and IXa, the TAC shall be set at a level that is compatible with both:

- *(a) the level of catch corresponding to the specified mortality rate in the area covered by the scientific advice, and*
- *(b) maintaining a constant ratio of catches between that area covered by the scientific advice and the totality of Divisions VIIIc and IXa. The ratio shall be calculated on the basis of catches in the three years preceding the year in which the decision is taken.*

Article 6. ***Procedure for setting the TACs for the Norway lobster stocks***

Based on the latest scientific evaluation of the STECF, the TACs for the stocks referred to in Article 1(b) and (c) shall be set at a level that will result in the same relative change in its fishing mortality rate as the change in fishing mortality rate achieved for the stock referred to in Article 1(a) when applying Article 5.

Article 7. ***Constraints on variation in TACs***

As from the first year of application of this Regulation, the following rules shall apply:

- *(a) where application of Article 5 or Article 6 would result in a TAC which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which shall not be more than 15 % greater than the TAC of that year;*
- *(b) where application of Article 5 or Article 6 would result in a TAC which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is not more than 15 % less than the TAC of that year.*

ICES has not fully evaluated this recovery plan in relation to the precautionary approach. Preliminary results indicate that the recovery plan does **not** serve the purpose of rebuilding the SBB to levels above $\mathbf{B}_{lim}$ with a high probability within the next 10 years.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	B_{lim} is 25 000 t.	B_{pa} be set at 35 000 t.
	F_{lim} is 0.55.	F_{pa} be set at 0.40.
Target reference points		F_y is not defined.

Technical basis

B_{lim}: The level below which there are indications of impaired recruitment.	$B_{pa} \sim B_{lim} * 1.4$.
F_{lim}: F_{loss}	$F_{pa} \sim F_{lim} * 0.72$.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The *status quo* fishing mortality is not known precisely, but appears to be well above levels that would support optimal long-term yield and low risk of stock depletion.

Exploitation boundaries in relation to precautionary limits

The fishing mortality is not known precisely; however, it is likely much too high to allow recovery of the stock. SSB is considered to be well below B_{lim}. The only option which would allow rebuilding of the stock in the short term with a high probability is a closure of the fishery in 2007.

Exploitation boundaries in relation to recovery plan

The recently adopted recovery plan aims at reducing F to 0.27. Although the present F is not precisely known, it is likely to be far above 0.27. In addition, the preliminary evaluation of the recovery plan indicated that the proposed level of F might be insufficient to rebuild the stock within 10 years. Under these circumstances, ICES is not in a position to advise on exploitation boundaries in relation to the implemented recovery plan. ICES recommends the development of a revised recovery plan with a stronger reduction in F, which gives a sufficient probability of stock recovery. This should, at the same time, be less dependent on precise estimates of stock parameters.

Conclusions on exploitation boundaries

ICES continues to advise on exploitation boundaries in relation to the precautionary approach, as the preliminary evaluation of the management plan shows that it does not ensure a safe and fast recovery of the stock: There should be no fishing for southern hake in 2007.

Management considerations

Landings in 2005 were estimated to be 8346 t, 40% above the TAC (5968 t).

The recruiting year classes 2004 and 2005 appear to be strong. These year classes would have the potential to rebuild the stock, and should therefore be protected as much as possible.

There is considerable discarding of hake, and a large fraction of the discard consists of younger ages. The discards estimated for 2005 show an increase when compared to 2004. However, the precision of the estimates is very low and these results must be considered with caution. Discards of juveniles might become even more problematic when strong recruitment occurs, as appears to be the case at present.

Ecosystem considerations

Juvenile hake mainly feed on zooplankton and decapod prawns. Larger hake feed predominantly on fish, with blue whiting being the most important prey in waters deeper than 100 m. The most important prey species in shallower waters are horse mackerel, sardine, and snipefish. Hake are known to be cannibalistic.

Recovery plan evaluation

A preliminary evaluation of the recovery plan indicated that the probability of meeting its aims, to rebuild SSB to 35 kt within 10 years, is not higher than 50%, even if the plan is perfectly implemented. The results are sensitive to the

assumptions on stock recruitment relationships, which are considered to be poorly understood. A complete evaluation of the recovery plan also requires more information and/or more explicit modelling regarding the major sources of uncertainty, including discarding, TAC overshooting, and growth rates.

The critical issue for the performance of the recovery plan appears to be the rate and extent of reduction in F. Furthermore, the present plan is strongly dependent on precise estimates of stock parameters. It has proven problematic to provide absolute estimates of such parameters in the recent past for a variety of reasons, *inter alia* growth rate, age estimation, and the stock identity of southern hake. Therefore, it is recommended to consider recovery plans with a faster and stronger reduction in F. These should also be less dependent on precise annual estimates of abundance and mortality in absolute terms, but rather use trends in these parameters as guidance. The problem with growth and stock identity of hake should be further addressed. In particular, further tagging studies are recommended and should be conducted in coordination with those proposed for northern hake.
High discarding rates or unreported landing of juveniles will reduce the effectiveness of the management plan and delay its progress. Direct information indicates that the level of juvenile mortality through these causes is high.

In recent years overshooting of the TAC has occurred, which has lead to the inclusion of effort control measures in the recovery plan. Preliminary considerations of the HCR decision rule suggest that it may be highly sensitive to assumptions made (regarding the level of F) for the intermediate year of projection and the mismatch between estimated landings and TAC, and that this may result in a rapid reduction in F.

Factors affecting the fisheries and the stock

The effects of regulations

A TAC is set for all of the Atlantic Iberian Peninsula, including the Gulf of Cadiz. The 2005 TAC was set at 5968 t and total landings were 8346 t.

The minimum mesh size for trawl gear is 70 mm. Derogations are applicable for ICES Division IXa west of 7°23'48" (55 mm), the Gulf of Cadiz (40 mm, providing that the weights of species like hake are below 10%), and when fishing for blue whiting, horse mackerel, and mackerel. Hake is further exploited by gillnets using mesh sizes between 80 and 99 mm and by trammel nets using a minimum mesh size of 100 mm.

In Spain, trawling is prohibited in Galician waters from La Coruña to Cedeira, from 1st October to 31st January. Trawling is further prohibited in Division IXa (Portuguese Southern area), between Milfontes and Arrifana, from 1st December to the last day of February. The target of these regulations is the protection of juvenile hake.

The minimum landing size of southern hake is 27 cm.

Since 2006 a recovery plan has been implemented, aimed at recovering the SSB above $\mathbf{B}_{pa}$ and reducing F to 0.27.

Changes in fishing technology and fishing patterns

In recent years, hake has comprised around 6% of the total landings of the Spanish trawl fishery in Atlantic waters around the Iberian peninsula, while this percentage used to be higher in the 1980s and before. During the last years Spanish trawlers have increasingly used a new High Vertical Opening gear towed by a single vessel and targeted more pelagic species (blue whiting and horse mackerel).
The environment

Hake recruitment processes lead to patches of juveniles, found in localized areas of the continental shelf. These concentrations vary in density according to the strength of the year class, although they remain generally stable in size and spatial location. The spatial patterns can be related to environmental conditions. In the eastern shelf of the Cantabrian Sea, years of large inflow of the shelf-edge current have produced low recruitment due to larvae and pre-recruits being transported away from spawning areas.

In Portuguese continental waters the abundance of recruits is higher in autumn and early spring; in the southwest concentrations are mainly found at depths of 200–300 m, in the south they are mainly distributed in coastal waters, and in the north between 100 and 200 m depth. These different depth-area associations may be related to the differences in zooplankton biomass availability.

Other factors

Hake in Divisions VIIIc and IXa is caught in a mixed fishery by Spanish and Portuguese trawlers and artisanal fleets.

The Spanish trawl fleet is quite homogeneous and uses mainly two gears, pair trawl and bottom trawl. The artisanal fleet is very heterogeneous and uses a wide variety of gears, traps, large and small gillnets, longlines, etc. Even though the percentage of hake in the landings of Spanish trawlers is small, these vessels account for 55% of the total Spanish hake landings in recent years.

Hake is caught by the Portuguese fleet in the trawl and artisanal mixed fishery together with other fish species and crustaceans: horse mackerel, anglerfish, megrim, mackerel, Spanish mackerel, blue whiting, red shrimp (*Aristeus antennatus*), rose shrimp (*Parapenaeus longirostris*), and *Nephrops*. Recently, hake represents 5% of the total Portuguese landings from trawl and 2% from the artisanal fishery.

Scientific basis

Data and methods

An exploratory age-based assessment (XSA) was conducted, based on landings, two commercial CPUE series, and three surveys. Discards are not included in the assessment, but sampling shows that discards in numbers range between 45 and 70% and are mainly composed of the younger age classes. The assessment is considered as indicative for trends. Absolute values are thought to be too uncertain to provide a basis for a short-term forecast.
Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time-series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

Uncertainties in assessment and forecast

The assessment is considered uncertain for a variety of reasons, including uncertainty about growth rate and age, stock identity and migration, the extent of discarding, and year-to-year variation in the performance of the scientific surveys.

The Southern stock of hake is distributed all along the Atlantic coast of the Iberian Peninsula. The northern boundary of the stock, at the Spanish–French border, was defined mainly from a management perspective and has no biological basis. The Gibraltar Strait is the southern boundary, splitting the Southern Stock from the Mediterranean hake. This split is supported by a recent genetic study. The relation to hake stocks further south on the African shelf remains unknown.

Environment conditions

Mixed fisheries aspects, ecological interactions, and environmental conditions are not taken into account in the assessment due to a lack of quantifiable knowledge of these processes.

Comparison with previous assessment and advice

The assessment has previously been accepted as a basis for short-term predictions. However, it has been considered uncertain for several years for a variety of reasons:

- Growth and age estimation in this species (in both northern and southern stocks) remains uncertain. Discards are not included in the assessment, but sampling indicates that discards in numbers may range between 45 and 70% and are mainly composed of the younger age classes;
- There are conflicts within the tuning series and between the tuning series and the trends derived from the catch data;
- There are doubts about the stock identity for Southern hake.

None of these problems are new, but the quality of the assessment has not improved. Even though the exploratory assessment this year is comparable with that for last year, this has not been the case in the past and cannot be expected to be the case in the near future. Therefore, ICES this year decided to stop providing short-term forecasts and base the advice instead on the long-term trends in the assessment, which are believed to be sufficiently reliable.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. May 2006 (ICES CM 2006/ACFM:29).

Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Agreed TAC	ACFM Landings
1987	Precautionary TAC; juvenile protection		15.0		25.0	16.2
1988	TAC; juvenile protection		15.0		25.0	16.4
1989	TAC; juvenile protection		15.0		20.0	13.8
1990	TAC; juvenile protection		15.0		20.0	13.2
1991	Precautionary TAC		10.0		18.0	12.8
1992	Precautionary TAC		10.3		16.0	13.8
1993	F = 10% of F 91		1.0		12.0	11.5
1994	F lowest possible, at least reduced by 80%		2.0		11.5	9.9
1995	F lowest possible		-		8.5	12.2
1996	F lowest possible		-		9.0	9.9
1997	F lowest possible		-		9.0	8.5
1998	60% reduction in F		4.0		8.2	7.7
1999	Reduce F below $\mathbf{F}_{pa}$		9.5		9.0	7.5
2000	20% reduction from 1994–98 average landings		< 7.7		8.5	7.3
2001	Reduce F below $\mathbf{F}_{pa}$; no increase in landings		8.5		8.9	7.6
2002	F below $\mathbf{F}_{pa}$		< 8.0		8.0	6.7
2003	Lowest possible catch / rebuilding plan		0		7.0	6.9
2004	Zero catch		0		5.95	6.8
2005	Zero catch		0		5.968	8.3
2006	Zero catch		0		6.661	
2007	Zero catch		0			

Weights in '000 t.

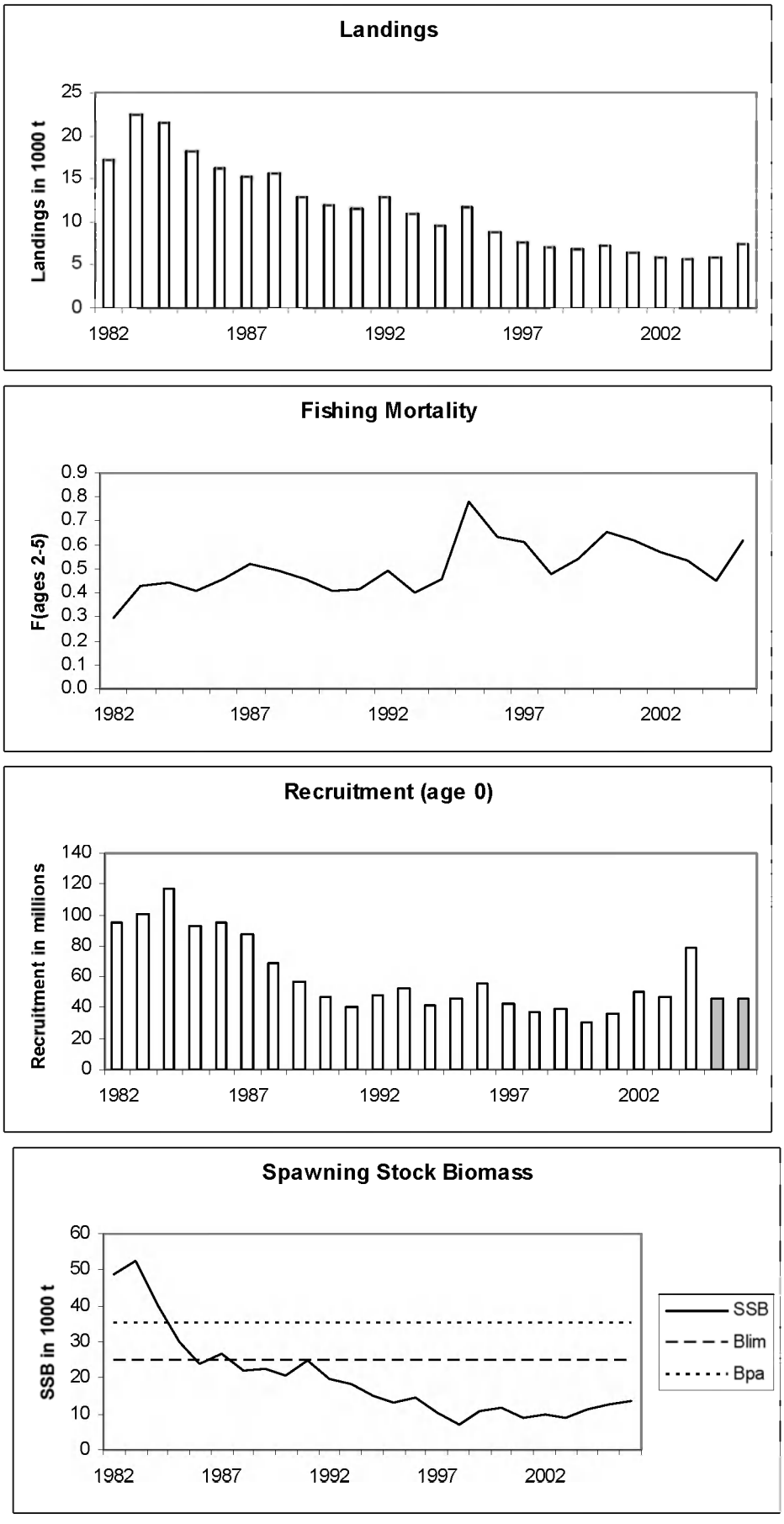
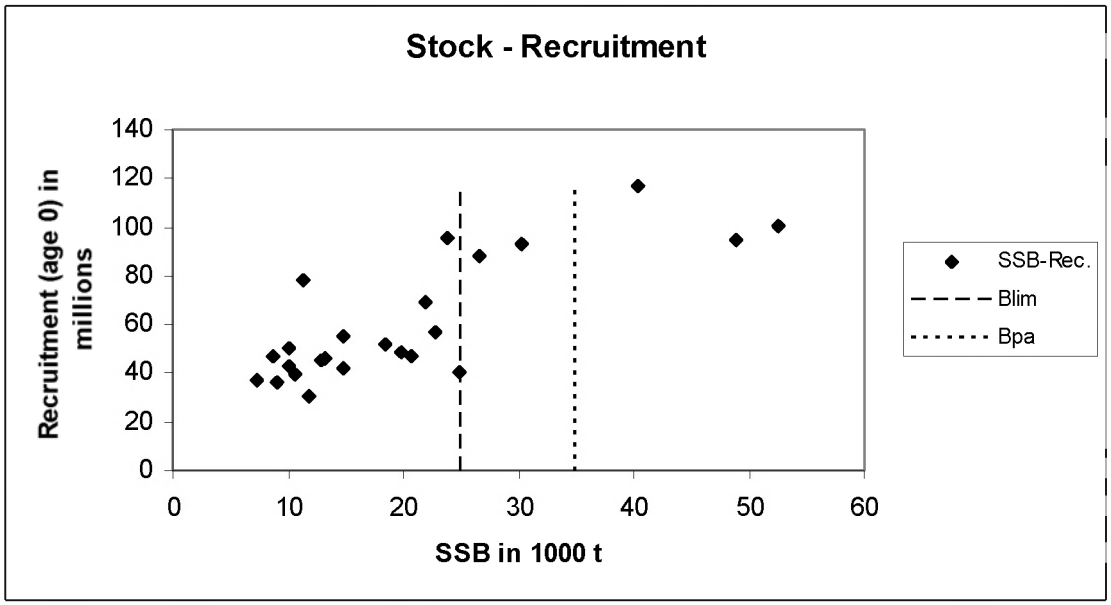
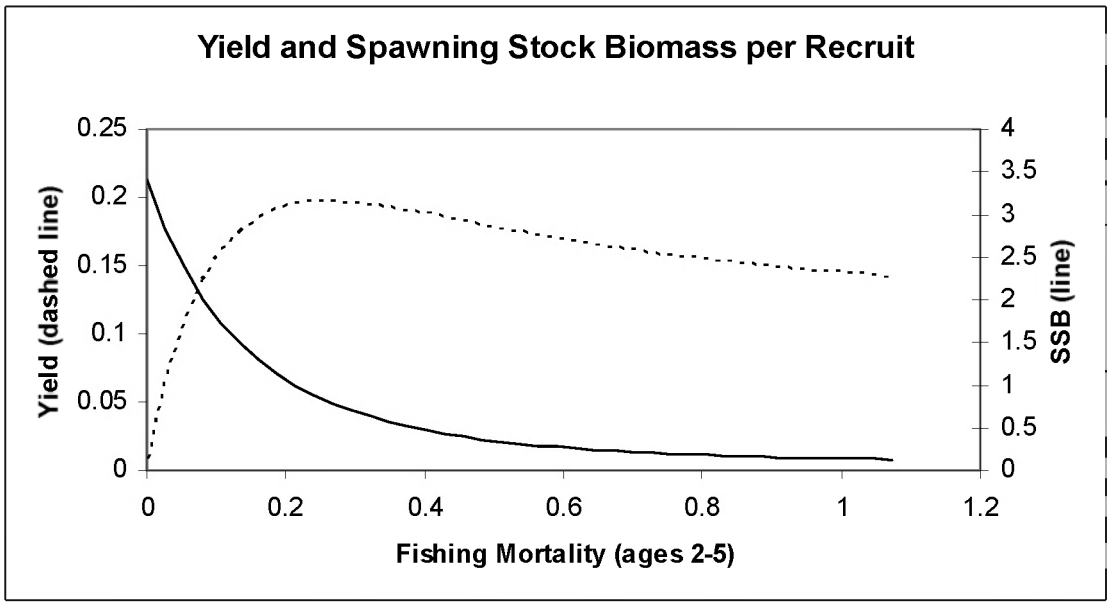


Figure 7.4.1.1 Hake – Southern stock (Divisions VIIIc and IXa). Landings, fishing mortality, recruitment and SSB.





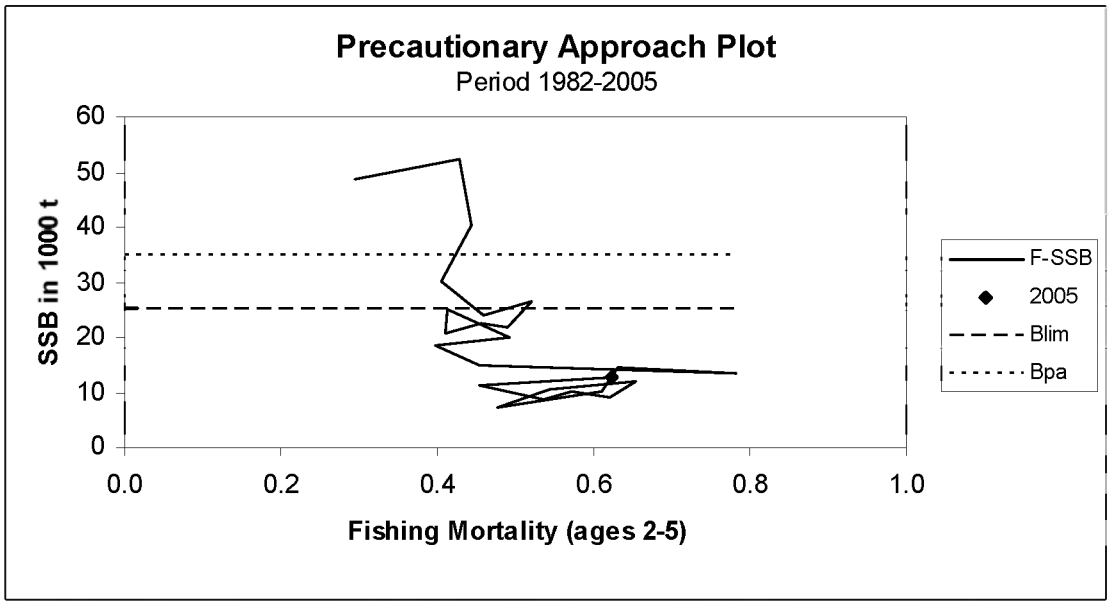


Figure 7.4.1.2 Hake – Southern stock (Divisions VIIIc and IXa). Stock and recruitment; Yield and SSB per recruit.

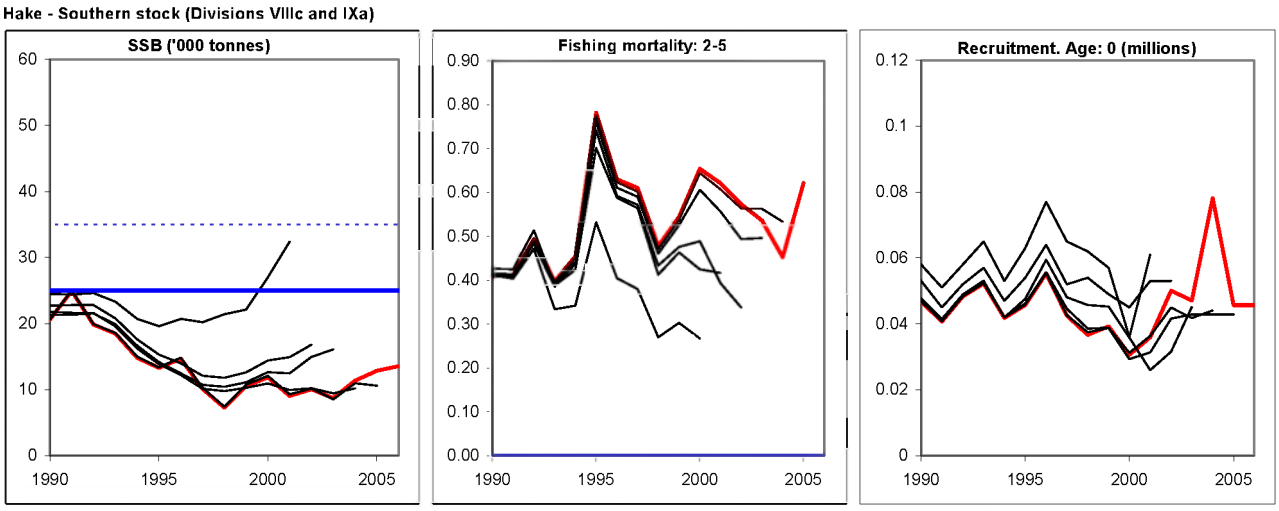


Figure 7.4.1.3 Hake – Southern stock (Divisions VIIIc and IXa). Historical performance of the assessment (SSB, Fishing mortality and recruitment)

Table 7.4.1.1 Hake – Southern Stock (Division VIIIc IXa) – Landings estimates ('000 t) by country and gear, 1972–2004.

YEAR	Spain										Portugal			France	Total Stock Without Cadiz	TOTAL STOCK
	Gillnet	Small Gillnet	Longline	Artisanal Unallocated	Artisanal Cadiz	**Total Artisanal**	Trawl North	Trawl Cadiz	**Total Trawl**	**Total**	Artisanal	Trawl	**Total**			
1972	-	-	-	-	-	7.1	10.20	-	10.2	17.3	4.70	4.10	8.8		26.1	26.1
1973	-	-	-	-	-	8.5	12.30	-	12.3	20.8	6.50	7.30	13.8	0.20	34.8	34.8
1974	2.60	1.00	2.20	-	-	5.8	8.30	-	8.3	14.1	5.10	3.50	8.6	0.10	22.8	22.8
1975	3.50	1.30	3.00	-	-	7.8	11.20	-	11.2	19.0	6.10	4.30	10.4	0.10	29.5	29.5
1976	3.10	1.20	2.60	-	-	6.9	10.00	-	10.0	16.9	6.00	3.10	9.1	0.10	26.1	26.1
1977	1.50	0.60	1.30	-	-	3.4	5.80	-	5.8	9.2	4.50	1.60	6.1	0.20	15.5	15.5
1978	1.40	0.10	2.10	-	-	3.6	4.90	-	4.9	8.5	3.40	1.40	4.8	0.10	13.4	13.4
1979	1.70	0.20	2.10	-	-	4.0	7.20	-	7.2	11.2	3.90	1.90	5.8		17.0	17.0
1980	2.20	0.20	5.00	-	-	7.4	5.30	-	5.3	12.7	4.50	2.30	6.8		19.5	19.5
1981	1.50	0.30	4.60	-	-	6.4	4.10	-	4.1	10.5	4.10	1.90	6.0		16.5	16.5
1982	1.25	0.27	4.18	-	-	5.7	3.92	0.49	4.4	10.1	5.01	2.49	7.5		17.1	17.6
1983	2.10	0.37	6.57	-	-	9.0	5.29	0.57	5.9	14.9	5.19	2.86	8.0		22.4	22.9
1984	2.27	0.33	7.52	-	-	10.1	5.84	0.69	6.5	16.7	4.30	1.22	5.5		21.5	22.2
1985	1.81	0.77	4.42	-	-	7.0	5.33	0.79	6.1	13.1	3.77	2.05	5.8		18.2	18.9
1986	2.07	0.83	3.46	-	-	6.4	4.86	0.98	5.8	12.2	3.16	1.79	4.9	0.01	16.2	17.2
1987	1.97	0.53	4.41	-	-	6.9	3.50	0.95	4.5	11.4	3.47	1.33	4.8	0.03	15.2	16.2
1988	1.99	0.70	2.97	-	-	5.6	3.98	0.99	5.0	10.6	4.30	1.71	6.0	0.02	15.7	16.7
1989	1.86	0.56	1.95	-	-	4.4	3.92	0.90	4.8	9.2	2.74	1.85	4.6	0.02	12.9	13.8
1990	1.72	0.59	2.13	-	-	4.4	4.13	1.20	5.3	9.8	2.26	1.14	3.4	0.03	12.0	13.2
1991	1.41	0.42	2.20	-	-	4.0	3.63	1.21	4.8	8.9	2.71	1.25	4.0	0.01	11.6	12.8
1992	1.48	0.40	2.05	-	-	3.9	3.79	0.98	4.8	8.7	3.77	1.33	5.1		12.8	13.8
1993	1.26	0.36	2.74	-	0.01	4.4	2.67	0.54	3.2	7.6	3.04	0.87	3.9		10.9	11.5
1994	1.90	0.37	1.47	-	0.00	3.7	2.72	0.33	3.0	6.8	2.30	0.79	3.1		9.5	9.9
1995	1.59	0.37	0.96	-	0.00	2.9	5.27	0.46	5.7	8.7	2.57	1.03	3.6		11.8	12.2
1996	1.15	0.21	0.98	-	0.03	2.4	3.64	0.98	4.6	7.0	2.01	0.89	2.9		8.9	9.9
1997	1.04	0.30	0.77	-	0.04	2.2	3.10	0.88	4.0	6.1	1.51	0.91	2.4		7.6	8.5
1998	0.75	0.32	0.63	-	0.04	1.7	2.83	0.52	3.4	5.1	1.67	0.91	2.6		7.1	7.7
1999	0.60	0.17	0.25	0.22	0.02	1.3	2.45	0.57	3.0	4.3	2.12	1.09	3.2		6.9	7.5
2000	0.85	0.13	0.15	0.13	0.01	1.3	2.81	0.58	3.4	4.7	2.09	1.16	3.3		7.3	7.9
2001	0.58	0.18	0.11	0.14	0.04	1.0	2.18	1.20	3.4	4.4	2.00	1.20	3.2		6.4	7.6
2002	0.60	0.12	0.14	0.05	0.02	.9	2.13	0.88	3.0	3.9	1.80	0.97	2.8		5.8	6.7
2003	0.43	0.25	0.17	0.23	0.02	1.1	2.43	1.25	3.7	4.8	1.15	0.96	2.1		5.6	6.9
2004	0.42	0.25	0.13	0.19	0.03	1.0	2.79	1.06	3.9	4.9	1.31	0.80	2.1		5.9	7.0
2005	0.63	0.17	0.23	0.40	0.02	1.5	3.91	.89	4.8	6.3	1.12	0.96	2.1		7.4	8.3

Table 7.4.1.2 Southern stock of hake. Summary of indicative assessment.

Run title : SOUTHERN STOCK OF HAKE-WG 2006

At 16/05/2006 15:44

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	REC Age 0	TOTALB	TOTSPB	LANDING	YIELD/SSI	FBAR 2- 6
1982	95035	82785	49784	17109	0.3507	0.2948
1983	100601	78695	52537	22378	0.4259	0.4294
1984	118965	67207	40401	21465	0.5312	0.4427
1985	92816	55731	30213	16152	0.5008	0.4047
1986	85302	51523	23876	16165	0.6770	0.458
1987	97963	47010	28814	15232	0.5723	0.5193
1988	59266	44490	21927	15667	0.7142	0.4909
1989	57176	40928	22702	12887	0.5677	0.458
1990	48773	40692	20822	11994	0.5816	0.4093
1991	40701	38810	24927	11618	0.4661	0.4115
1992	48294	37615	19840	12524	0.6462	0.4933
1993	52223	35204	18474	10944	0.5924	0.3975
1994	41776	32152	14830	9542	0.6434	0.4638
1995	45710	26233	13283	11762	0.887	0.7817
1996	55297	23959	14898	8875	0.8038	0.6297
1997	42503	22434	10121	7619	0.7527	0.6103
1998	38669	24579	7262	7100	0.9776	0.4779
1999	39267	22871	10557	6911	0.6546	0.5443
2000	30647	22611	11873	7318	0.6163	0.6539
2001	35914	19637	9061	6365	0.7023	0.6209
2002	50030	20653	10043	6817	0.6792	0.5727
2003	47071	22004	9896	6817	0.6459	0.6359
2004	78205	26538	11357	5890	0.5186	0.4525
2005	(151679)	27649	12865	7437	0.5779	0.6218
Arith. Mean	84905	38017	20232	11531	0.6203	0.5068
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

() replaced by GM 89-04 = 45651

7.4.2 Megrim (*Lepidorhombus boscii* and *Lepidorhombus whiffiagonis*) in Divisions VIIIc and IXa

State of the stocks

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Not defined	Not defined	Overexploited (*L. boscii*), Appropriate (*L. whiffiagonis*)	

In the absence of defined precautionary reference points, the state of the two stocks cannot be evaluated with regard to these. Landings have decreased for both species since the late 1980s and stabilised since 2001 for *L. whiffiagonis* and since the mid-1990s for *L. boscii*. SSB of both species has decreased since the late 1980s and stabilised close to the historic low since the mid-1990s. Fishing mortality has declined in parallel with the landings. For *L. whiffiagonis*, recent recruitments have been lower than in the second half of the 1980s. For *L. boscii*, recruitment appears to be rather stable over the whole time period.

Management objectives

There are no explicit management objectives for these stocks.

Reference points

Four-spotted megrim (*L. boscii*) in Divisions VIIIc and IXa

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2–4	Yield/R	SSB/R
Average last 3 years	0.271	0.043	0.194
$\mathbf{F}_{max}$	0.483	0.044	0.137
$\mathbf{F}_{0.1}$	0.173	0.039	0.251
$\mathbf{F}_{med}$	0.330	0.043	0.172

$\mathbf{F}_{max}$ is poorly defined for this stock.

Candidates for target reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$.

Megrim (*L. whiffiagonis*) in Divisions VIIIc and Ixa

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2–4	Yield/R	SSB/R
Average last 3 years	0.149	0.060	0.444
$\mathbf{F}_{max}$	0.361	0.068	0.242
$\mathbf{F}_{0.1}$	0.161	0.062	0.424
$\mathbf{F}_{med}$	0.297	0.068	0.280

$\mathbf{F}_{max}$ is poorly defined for this stock.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality for *L. whiffiagonis*, estimated as 0.15, is at a level that would achieve high long-term yield ($\mathbf{F}_{0.1}$ = 0.16) and low risk of stock depletion.

The current fishing mortality for *L. boscii,* estimated as 0.27, is above $\mathbf{F}_{0.1}$ = 0.17.

Exploitation boundaries in relation to precautionary considerations

Even at the recent low levels of fishing mortality for both species (*L. whiffiagonis* 0.15 and *L. boscii* 0.27), SSB has been stable showing no strong signs of increase. Fishing mortality should therefore not be allowed to increase. This level of exploitation would correspond to landings in 2007 of around 190 t for *L. whiffiagonis* and around 1240 t for *L. boscii*. The combined landings at the current exploitation level would be around 1440 t.

Short-term implications

Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa and four-spotted megrim (*L. boscii*) in Divisions VIIIc and IXa

Outlook for 2007

L. whiff.: Basis: $\mathbf{F}_{sq}$ =mean F(age 3–5)=0.15; $R_{2006\text{-}07}$ = GM 1992–2003=4 millions; landings (2006) = 0.2t.; SSB(2007) = 1.4 t.
L. boscii: Basis: $\mathbf{F}_{sq}$ =mean F(age 3–5)=0.27; $R_{2006\text{-}07}$ = GM 1990–2003=25 millions; landings (2006) = 1.2 t.; SSB(2007) = 5.7 t.
The fishing mortality applied according to the agreed management plan (F(management plan)) is not defined.
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is not defined (*L. whiff.*), and not defined (*L. boscii*).
The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.1608 (*L. whiff.*), and 0.1725 (*L. boscii*).

					L. whiffiagonis			***L. boscii***			
Rationale	**Landings *L. whiff.* (2007)**	**Landings *L. boscii* (2007)**	**Combined landings (2007)**	**Basis**	**F (2007)**	**SSB (2008)**	**%SSB change[1)]**	**F (2007)**	**SSBB (2008)**	**%SSB change[1)]**	**%TAC change[2)]**
Zero catch	0.000	0.000	0.000	F=0	0.00	1.76	22%	0.00	6.93	22%	-100%
High long-term yield	0.207	0.834	1.040	F(long-term yield)	0.16	1.53	6%	0.17	6.01	6%	-18%
Status quo	0.021	0.142	0.163	$\mathbf{F}_{sq}$*0.1	0.01	1.74	20%	0.03	6.77	20%	-87%
	0.041	0.280	0.321	$\mathbf{F}_{sq}$*0.2	0.03	1.72	19%	0.05	6.62	17%	-75%
	0.100	0.669	0.769	$\mathbf{F}_{sq}$*0.5	0.07	1.65	14%	0.14	6.19	9%	-39%
	0.148	0.967	1.114	$\mathbf{F}_{sq}$*0.75	0.11	1.60	10%	0.20	5.86	4%	-12%
	0.175	1.136	1.311	$\mathbf{F}_{sq}$*0.9	0.13	1.57	8%	0.24	5.68	0%	3%
	0.193	**1.244**	**1.437**	$\mathbf{F}_{sq}$	**0.15**	**1.55**	**7%**	**0.27**	**5.56**	**-2%**	13%
	0.211	1.349	1.560	$\mathbf{F}_{sq}$*1.1	0.16	1.53	6%	0.30	5.44	-4%	23%
	0.237	1.501	1.738	$\mathbf{F}_{sq}$*1.25	0.19	1.50	4%	0.34	5.28	-7%	37%

All weights in '000 tonnes.
Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2008 relative to SSB 2007.
[2)] Landings 2007 relative to TAC 2006 = 1269 t.

Management considerations

Both species are caught in mixed fisheries targeting demersal fish including southern hake and *Nephrops*. Management measures aimed at reducing fishing mortality on southern hake will likely result in reductions of fishing mortality on megrim stocks.

Both species of megrim are caught on the same grounds and by the same fleets, are usually not separated by species in landings, and the fishing mortalities are linked. Both species show similar trends in stock trajectories. So far the stocks have developed synchronously but this may not be so in the future, in which case they should be managed separately.

Factors affecting the fisheries and the stock

Regulations and their effects

The minimum mesh size for towed gears catching megrims (mainly as a by-catch) ranges between 40 and 90 mm. The minimum landing size of megrims is 20 cm. Fishing with 50-mm mesh and below leads to substantial discards of megrims.

Changes in fishing technology and fishing patterns

Both species are bycatch in the mixed bottom trawl fisheries by Portuguese and Spanish fleets. Both species are also taken in small quantities by the Portuguese artisanal fleet. The majority of the catches are taken by Spanish trawlers. Due to the decreasing catch of hake, some fleets have changed their main target species. These fleets now focus on species such as horse mackerel, blue whiting, or mackerel, and do not usually take megrim in the catch. Furthermore, the recent increase in the use of the HVO (High Vertical Opening) trawling gear targeting horse mackerel has caused a reduction in the catch of four-spotted megrim (*L. boscii*) because this gear catches less megrim and is mainly used in an area where *L. boscii* is more abundant than *L. whiffiagonis*. The increasing use of pair trawlers targeting blue whiting has also reduced the effort on megrim in recent years.

A decrease in the Spanish effort is apparent in 2003 as a consequence of the "Prestige" oil spill in November 2002.

The environment

Megrim (*L. whiffiagonis*) is distributed in both Divisions (VIIIc and IXa), with its highest abundance in Division VIIIc. Four-spotted megrim (*L. boscii*) is distributed in both Divisions (VIIIc and IXa). There is a certain bathymetric segregation between the two species. *L. boscii* has a preferential depth range of 100 to 450 m and *L. whiffiagonis* of 50 to 300 m.

Scientific basis

Data and methods

Age-based (XSA) assessments were conducted for each species separately. They are based on landings data, two commercial LPUE series, and one CPUE survey series. Age information prior to 1990 is not available on an annual basis and has been extrapolated for some years.
Portuguese and Spanish landings of megrim were split into the two species using their relative abundances in the sampled landings. Discards data are not used in this assessment because of the lack of data in some years. Discards data will be introduced into the assessment when the time-series is sufficiently long.

Uncertainties in assessment and forecast

The Spanish trawl fleet has diversified its gears in recent years. As a consequence, the LPUE series from the Coruña trawl fleet has been used for years only up to 1999 for *L. boscii*. For the most recent years, only the Spanish survey series is used for tuning in the *L. boscii* assessment.

The Spanish survey provides a good estimate for young and middle-ages and it covers all the distribution areas of the stocks. The 2003 survey index value for *L. boscii* was a large outlier and was not used in the assessment. For this species, this survey registered a very high abundance index in 2005.

Comparison with previous assessment and advice

The current assessment and advice are reasonably consistent with those from previous years. Assessments for *L. boscii* have had a tendency to overestimate stock size and underestimate fishing mortality.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. May 2006 (ICES CM 2006/ACFM:29).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice[1]	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC[1]	ACFM landings[1]	Landings *L. boscii*	Landings *L. whiff.*
1987	Not dealt with		-		13.0	2.19	1.69	0.50
1988	Not dealt with		-		13.0	3.04	2.22	0.82
1989	Not dealt with		-		13.0	3.34	2.63	0.71
1990	Not dealt with		-		13.0	2.93	1.95	0.98
1991	No advice		-		14.3	2.29	1.68	0.61
1992	No advice		-		14.3	2.44	1.92	0.52
1993	*L. boscii* no long-term gain in increasing F, *L. whiff.* within safe biological limits		-		8.0	1.76	1.38	0.38
1994	No long-term gains in increasing F		-		6.0	1.88	1.40	0.48
1995	Concern about low SSB		-		6.0	1.87	1.65	0.22
1996	Mixed fishing aspects		-		6.0	1.43	1.10	0.33
1997	Reduce F by at least 50%		-		6.0	1.25	0.90	0.36
1998	Reduce F by at least 50%		0.9		6.0	1.57	1.12	0.45
1999	Reduce F by at least 50%		1.0		6.0	1.46	1.12	0.35
2000	Reduce F by at least 20%		< 1.5		5.0	1.29	1.04	0.25
2001	No increase in F		1.61		5.0	1.11	0.93	0.18
2002	No increase in F		1.55		4.0	0.84	0.72	0.12
2003	No increase in F		1.55		2.4	1.01	0.88	0.13
2004	No increase in F		1.38		1.336	1.14	0.99	0.15
2005	No increase in F		*) 1.09	1.05	1.336	1.13	0.98	0.15
2006	No increase in F			1.2	1.269			
2007	No increase in F			1.4				

Weights in '000 t.

[1] *L. whiffiagonis*+ *L. boscii*.

*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.

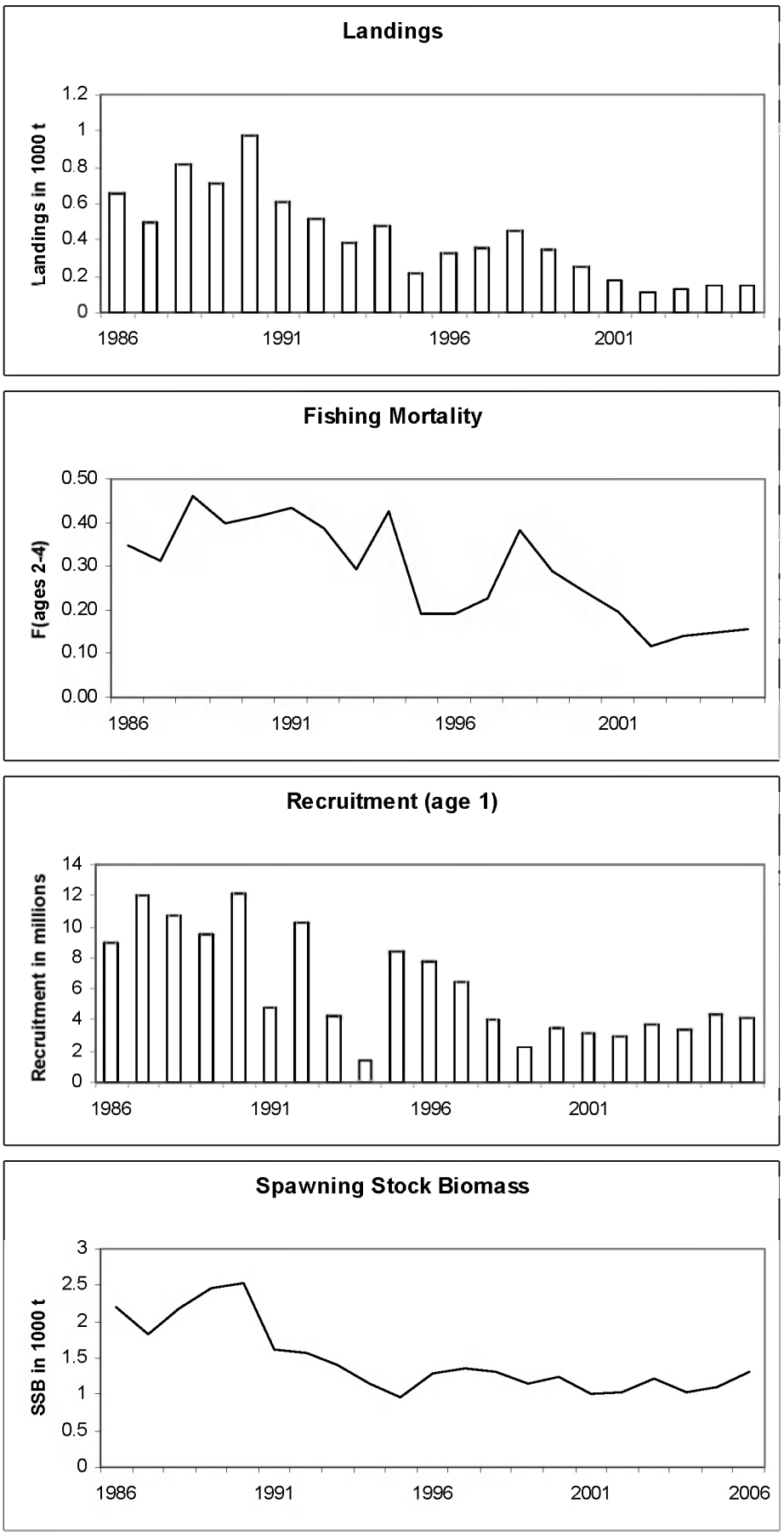
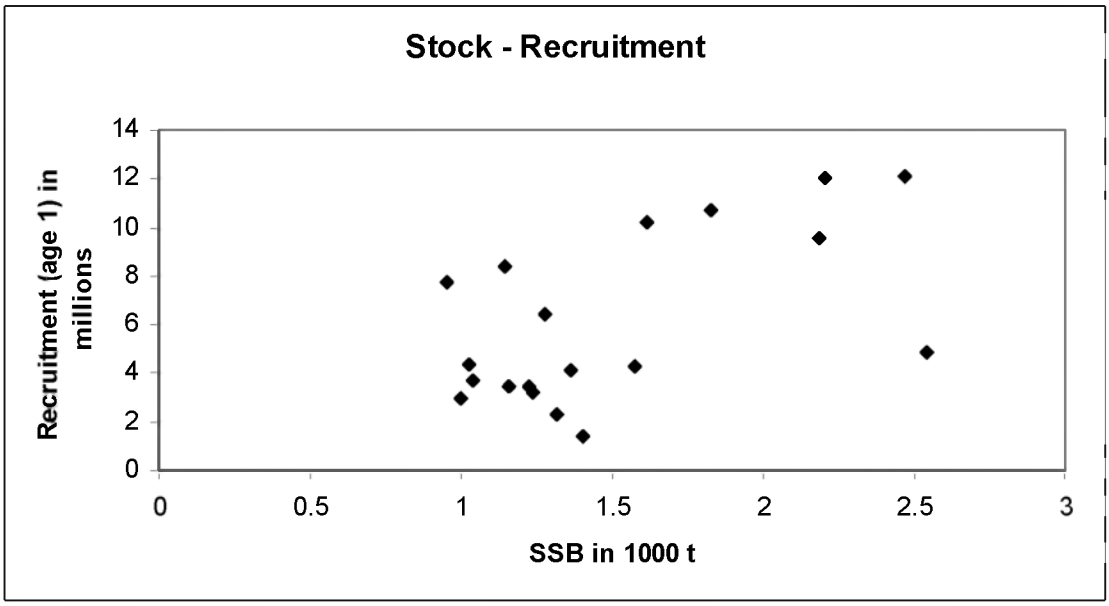
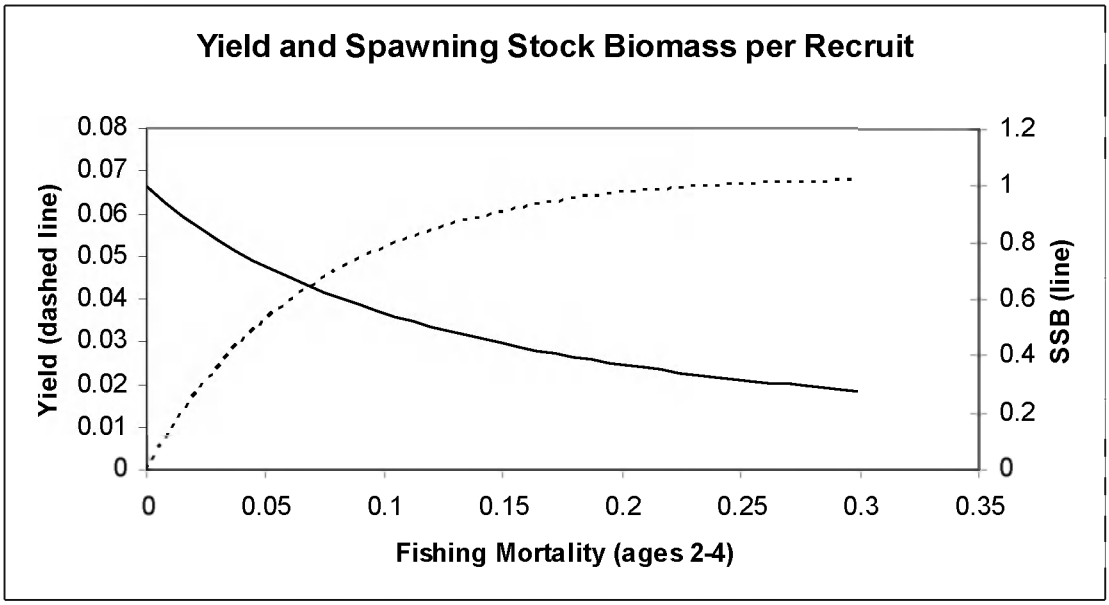


Figure 7.4.2.1 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Landings, fishing mortality, recruitment and SSB.





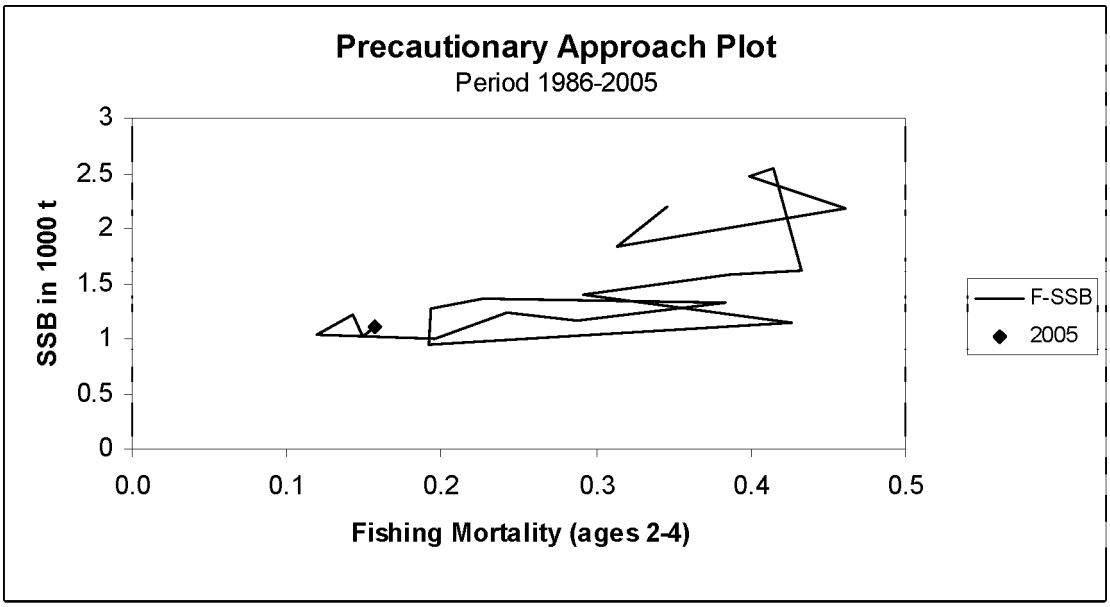


Figure 7.4.2.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Stock and recruitment; Yield and SSB per recruit.

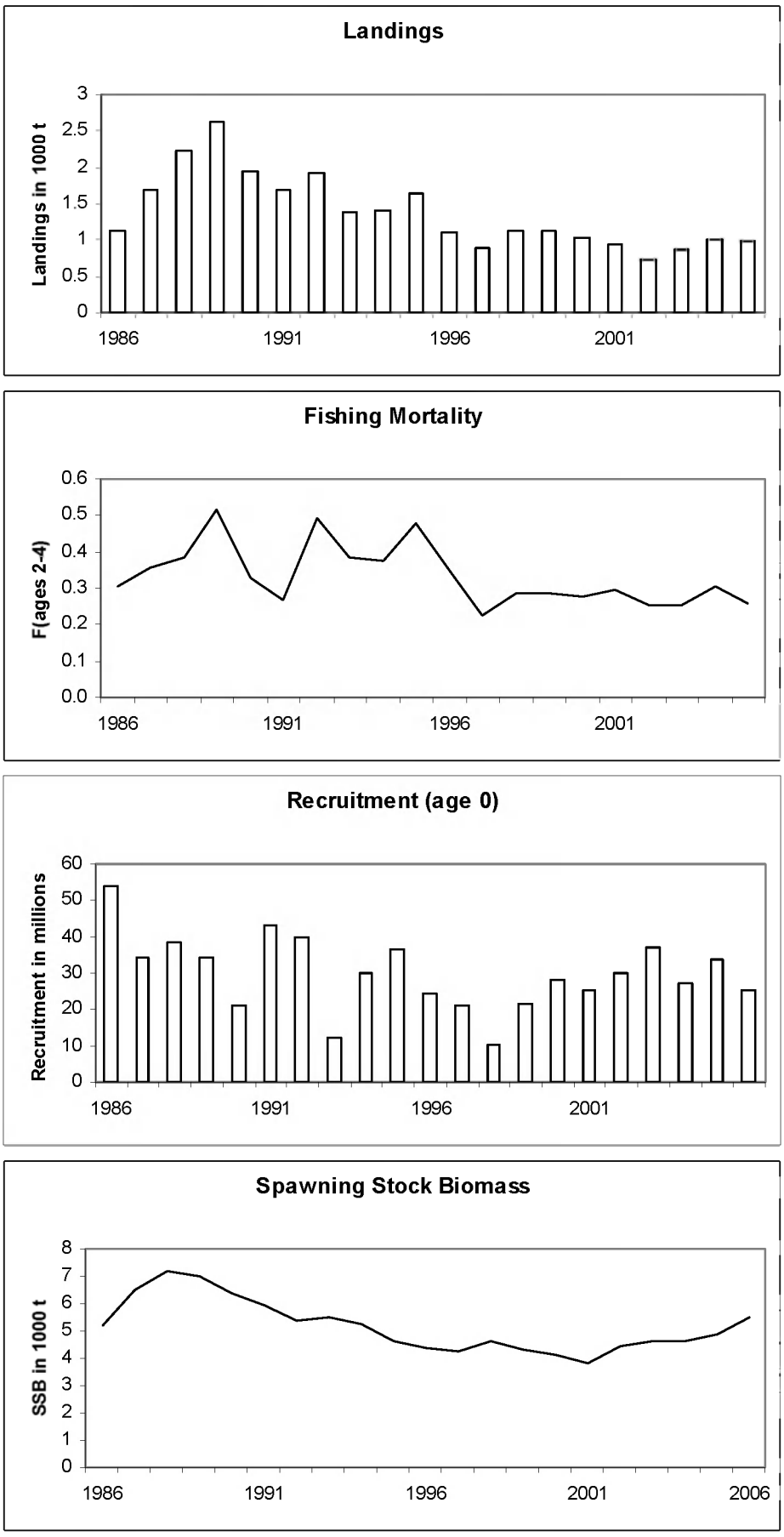
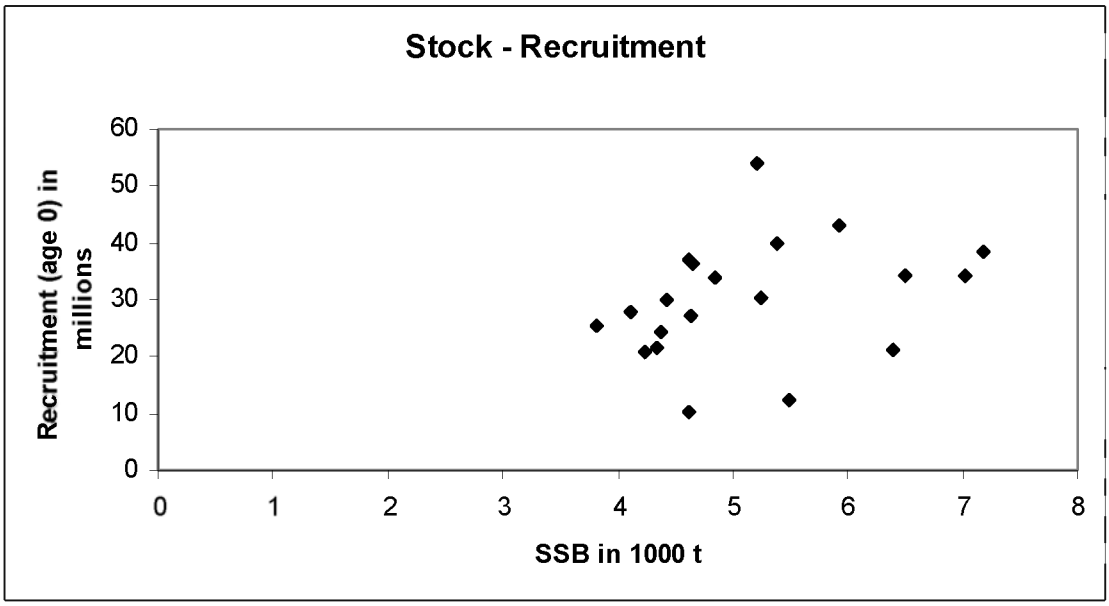
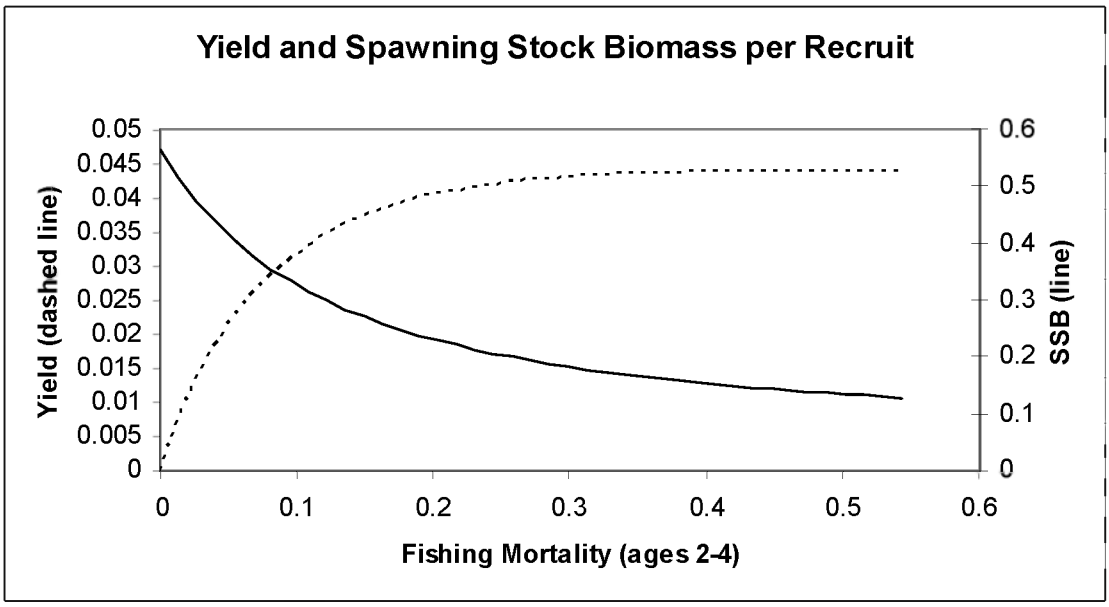


Figure 7.4.2.3 Megrim (*L. boscii*) in Divisions VIIIc and IXa. Landings, fishing mortality, recruitment and SSB.





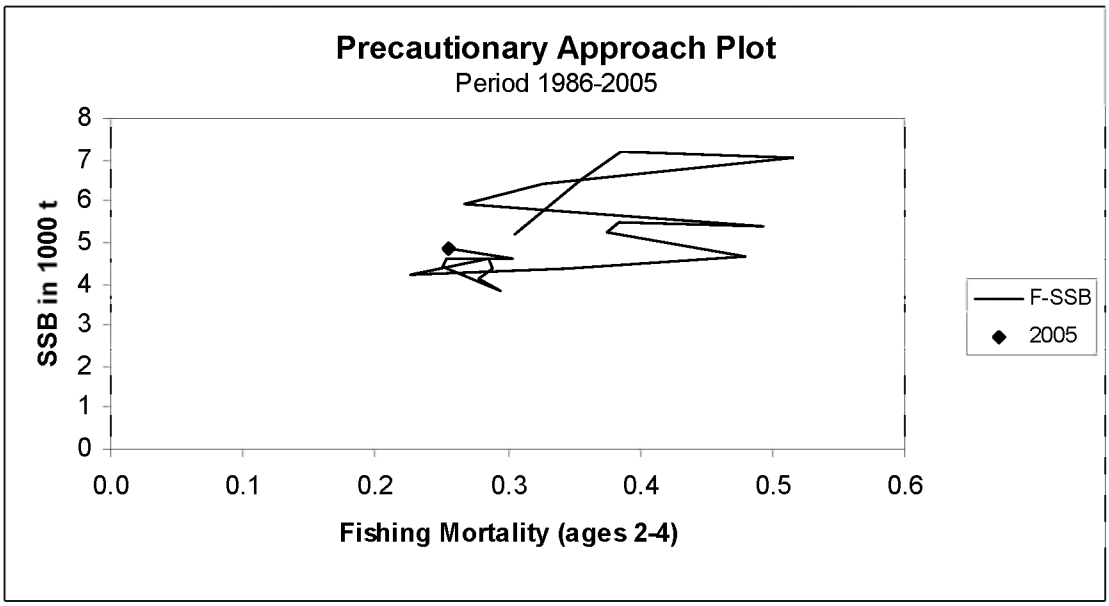


Figure 7.4.2.4 Megrim (*L. boscii*) in Divisions VIIIc and IXa. Stock and recruitment; Yield and SSB per recruit.

Table. 7.4.2.1 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	508	98	606	53	659
1987	404	46	450	47	497
1988	657	59	716	101	817
1989	533	45	578	136	714
1990	841	25	866	111	977
1991	494	16	510	104	614
1992	474	5	479	37	516
1993	338	7	345	38	383
1994	440	8	448	31	479
1995	173	20	193	25	218
1996	283	21	305	24	329
1997	298	12	310	46	356
1998	372	8	380	66	446
1999	332	4	336	7	343
2000	238	5	243	10	253
2001	167	2	169	5	175
2002	112	3	115	3	117
2003	113	3	116	17	134
2004	142	1	144	5	149
2005	120	1	121	26	147

Table. 7.4.2.2. Four-spotted megrim (*L. boscii)* in Divisions VIIIc and IXa. Total landings (t)

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc IXa
1986	799	197	996	128	1124
1987	995	586	1581	107	1688
1988	917	1099	2016	207	2223
1989	805	1548	2353	276	2629
1990	927	798	1725	220	1945
1991	841	634	1475	207	1682
1992	654	938	1592	324	1916
1993	744	419	1163	221	1384
1994	665	561	1227	176	1403
1995	685	826	1512	141	1652
1996	480	448	928	170	1098
1997	505	289	794	101	896
1998	725	284	1010	113	1123
1999	713	298	1011	114	1125
2000	674	225	899	142	1041
2001	629	177	807	124	931
2002	343	247	590	130	720
2003	393	314	707	169	876
*2004	534	295	829	177	1006
2005	473	321	794	189	983

* Revised Portuguese Landing

Table 7.4.2.3 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	8986	2203	659	0.346
1987	12058	1829	497	0.313
1988	10745	2186	817	0.461
1989	9512	2469	714	0.399
1990	12126	2541	977	0.415
1991	4829	1613	614	0.433
1992	10247	1576	516	0.386
1993	4261	1404	383	0.292
1994	1377	1147	479	0.426
1995	8413	953	218	0.192
1996	7779	1278	329	0.193
1997	6419	1365	356	0.227
1998	4080	1320	446	0.384
1999	2346	1158	343	0.288
2000	3499	1236	253	0.242
2001	3202	997	175	0.196
2002	2964	1037	117	0.119
2003	3709	1223	134	0.142
2004	3420	1026	149	0.149
2005	4353	1103	147	0.157
2006	4196	1310		
Average	6120	1475	416	0.288

Table 7.4.2.4 Four-spotted megrim (*L. boscii*) in Divisions VIIIc and IXa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	54041	5212	1124	0.305
1987	34383	6497	1688	0.355
1988	38402	7174	2223	0.386
1989	34162	7031	2629	0.515
1990	21036	6393	1945	0.326
1991	43116	5922	1682	0.267
1992	39964	5391	1916	0.493
1993	12419	5491	1384	0.384
1994	30177	5245	1403	0.375
1995	36422	4655	1652	0.479
1996	24279	4372	1098	0.345
1997	20989	4232	896	0.227
1998	10273	4620	1123	0.285
1999	21486	4342	1125	0.288
2000	28055	4113	1041	0.278
2001	25522	3811	931	0.295
2002	30005	4420	720	0.251
2003	37202	4611	876	0.254
2004	27117	4628	1006	0.304
2005	33887	4845	983	0.256
2006	25318	5530		
Average	29917	5168	1372	0.333

7.4.3 Anglerfish in Divisions VIIIc and IXa (*Lophius piscatorius* and *Lophius budegassa*)

State of the stock

Spawning biomass in relation to precautionary consideration	Fishing mortality in relation to precautionary considerations	Fishing mortality in relation to highest yield	Comment
Not defined	Not defined	Overexploited	

The assessment is only considered indicative of stock trends and cannot be used as an absolute measure of stock status. The stock size of the combined stocks (*Lophius piscatorius* and *L. budegassa*) is considered to be well below the level associated with harvesting at maximum sustainable yield. The fishing mortality is estimated to be well above $\mathbf{F}_{MSY}$. The fishing mortality in 2004 was around 2.0 times $\mathbf{F}_{MSY}$ and increased in 2005 to be 2.4 times higher than $\mathbf{F}_{MSY}$.

Management objectives

There are no explicit management objectives for these stocks.

Reference points

$\mathbf{B}_{MSY}$ and $\mathbf{F}_{MSY}$ points can be used as a lower boundary for the biomass and an upper boundary for F. $\mathbf{B}_{MSY}$ and $\mathbf{F}_{MSY}$ are defined in the context of a production model and correspond to lower exploitation levels than those adopted for stocks with similar population dynamics for which PA points are based on an analytical assessment.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Fishing mortality equal to zero in 2007 is required to bring SSB back to $\mathbf{B}_{MSY}$ in the medium term. If this is not possible then a recovery plan should be established that will ensure rapid and safe recovery of the SSB towards $\mathbf{B}_{MSY}$. Landings in 2001 and 2002 might have reduced fishing mortality to $\mathbf{F}_{MSY}$. Catches in that order could be considered as a preliminary guidance for maximum landings in a recovery plan.

Short-term implications

Outlook for 2007

Basis: $F(2006)/\mathbf{F}_{MSY}$ = 2.35; $B(2007) / \mathbf{B}_{MSY}$ = 0.38; catch (2006) = 4154 t.

Rationale	**Landings (2007)[1]**	**Basis**	**F (2007) / $\mathbf{F}_{MSY}$**	**B (2008) / $\mathbf{B}_{MSY}$**	**% B change [1)]**	**% TAC change [2)]**
Zero catch	0	F=0	0	0.46	+21%	
F_{MSY}	1747	F(2005)*0.42 = F(2007)	1	0.41	+8%	-11%
Reduction of 50%	2039	F(2005)*0.50 = F(2007)	1.18	0.40	+5%	+4%
Reduction of 40%	2414	F(2005)*0.60 = F(2007)	1.41	0.39	+3%	+23%
Reduction of 30%	2779	F(2005)*0.70 = F(2007)	1.65	0.38	0%	+42%
Reduction of 20%	3134	F(2005)*0.80 = F(2007)	1.88	0.37	-3%	+60%
Reduction of 10%	3479	F(2005)*0.90 = F(2007)	2.12	0.36	-5%	+78%
Status quo	3815	$\mathbf{F}_{sq}$	2.35	0.35	-8%	+95%

TAC weights in tonnes.
Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2008 relative to SSB 2007.
[2)] TAC 2007 relative to TAC 2006.

Management considerations

Combined landings increased since 2002 and overshot the TAC in 2005 by more than 100%. Measures should be taken to assure that the TAC is effectively restricting the fishery.

The two species are managed under a common TAC. They are usually landed and recorded together in the landing statistics. It is impossible to manage each species separately under a common TAC.

Both anglerfish species are slow-growing with late maturation (age 7 for males and even higher for females). A sustainable exploitation of such species generally requires a low fishing mortality.

Factors affecting the fisheries and the stock

The effects of regulations

There is no minimal landing size for anglerfish, but the EU Council Regulation (2406/96), laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. In Spain this minimum weight was put into effect in 2000.

The southern hake and *Nephrops* recovery plan implemented in January 2006 is expected to have a positive effect on the anglerfish stocks, as they are partly caught in the same mixed fisheries.

The environment

The spawning of *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon that may measure more than 10 m. This particular spawning may lead to a highly clumped distribution of eggs and newly emerged larvae. Although this could result in recruitment being sensitive to environmental variations, this has not been observed.

Other factors

Gillnet catches show higher mean lengths than trawl catches.

For *L. piscatorius*, the Spanish landings in recent years have been on average 51% from the trawl fleet and 49% from the gillnet fishery. Since 1997 Portuguese landings have been on average 8% from bottom trawlers and 92% from gillnets. Spanish landings represented on average 82% of the total landings of *L. piscatorius*.

For *L. budegassa*, the Spanish landings in recent years have been on average 88% from the trawl fleet and 12% from the artisanal fleet. The averages for the Portuguese landings in the same period were 24% from the trawl fleet and 76% from the artisanal fleet. Since 1997 Spanish landings have represented on average 70% of the total *L. budegassa* landings.

Scientific basis

Data and methods

A surplus production model (ASPIC) was used to provide estimates of stock biomass and fishing mortality relative to their respective maximum sustainable yield (MSY) values (see Figure 7.4.3.1). Two commercial CPUE series were used in the model. It has to be taken into account that production models analyse trends of total biomass and do not account for any changes in the population structure that may have occurred recently.

Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time-series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

Uncertainties in assessment and forecast

The combined anglerfish assessment was improved by extending the time-series back until 1980. The exploratory assessment is completely dependent on commercial CPUE data which may be biased due to targeting, local depletions, and changes in efficiency. Also, by performing a combined species assessment, the status of each species separately cannot be evaluated. An age-based assessment, which is expected to deliver more reliable results, is under development.

Production models do not estimate recruitment in a dynamic process. Therefore, recruitment failure may not be detected using production models.

Landings and CPUE for *L. piscatorius* have increased in recent years, while for *L. budegassa* they have been relatively stable at very low levels.

Discards are not included in the assessment, but observations indicate that the level of discarding is very low. Discards mainly consist of smaller length classes.

Comparison with previous assessment and advice

The production model assessment is relatively stable to changes in the initial parameter settings and parameter estimates, and trends of relative biomass and fishing mortality are similar between both assessments.

The advice for the two stocks is the same as last year.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2006 (ICES CM 2006/ACFM:29).

Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch[1)] corresp. to advice	Predicted catch[1)] corresp. to Single-Stock Exploitation Boundaries advice	Agreed TAC[1)]	ACFM Landings[1]	Landings of *L. piscat.*	Landings of *L. budeg.*
1987	Not dealt with		-		12.0	8.9	5.1	3.8
1988	Not dealt with		-		12.0	10.0	6.3	3.7
1989	Not dealt with		-		12.0	7.6	5.0	2.6
1990	Not dealt with		-		12.0	6.1	3.8	2.3
1991	No advice		-		12.0	5.8	3.6	2.2
1992	No advice		-		12.0	4.2	3.4	2.1
1993	No long-term gain in increasing F		-		13.0	4.5	2.3	2.2
1994	No advice		-		13.0	3.6	2.0	1.6
1995	If required a precautionary TAC		-		13.0	3.6	1.8	1.8
1996	If required a precautionary TAC		-		13.0	4.6	3.0	1.6
1997	If required a precautionary TAC		-		13.0	5.5	3.7	1.8
1998	Restrict catch to < 80% recent levels				10.0	5.1	3.0	2.1
1999	Reduce F to $\mathbf{F}_{pa}$		4.2		8.5	3.8	1.9	1.9
2000	60% reduction in F		1.6		6.8	2.6	1.3	1.4
2001	50% reduction in F		2.8		6.0	1.8	0.8	1.0
2002	30% reduction in F		3.5		4.8	1.8	1.0	0.8
2003	5% reduction in F		3.2		4.0	3.2	2.3	0.9
2004	[2)]	F = 0 or recovery plan	[2)]	0	2.3	4.1	3.1	1.0
2005		F = 0 or recovery plan		0	2.0	4.5	3.6	0.9
2006		F = 0 or recovery plan		0	2.0			
2007		F = 0 or recovery plan		0				

Weights in '000 t.
[1)] For both species combined. [2)] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

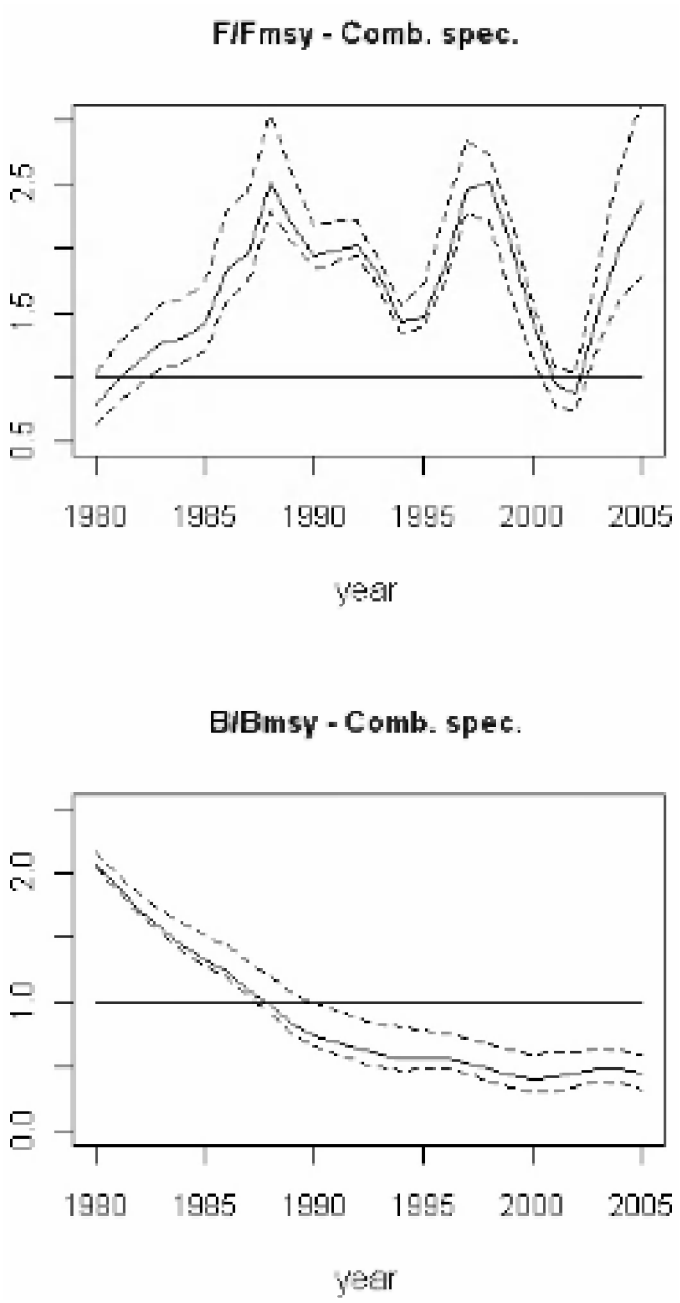


Figure 7.4.3.1. Anglerfish in Divisions VIIIc and IXa (*L. piscatorius and L. budegassa*). Landings (upper graph) and ASPIC results. 80% confidence intervals (dotted lines) and medians of the F/$\mathbf{F}_{MSY}$ and B/$\mathbf{B}_{MSY}$ ratios are indicated.

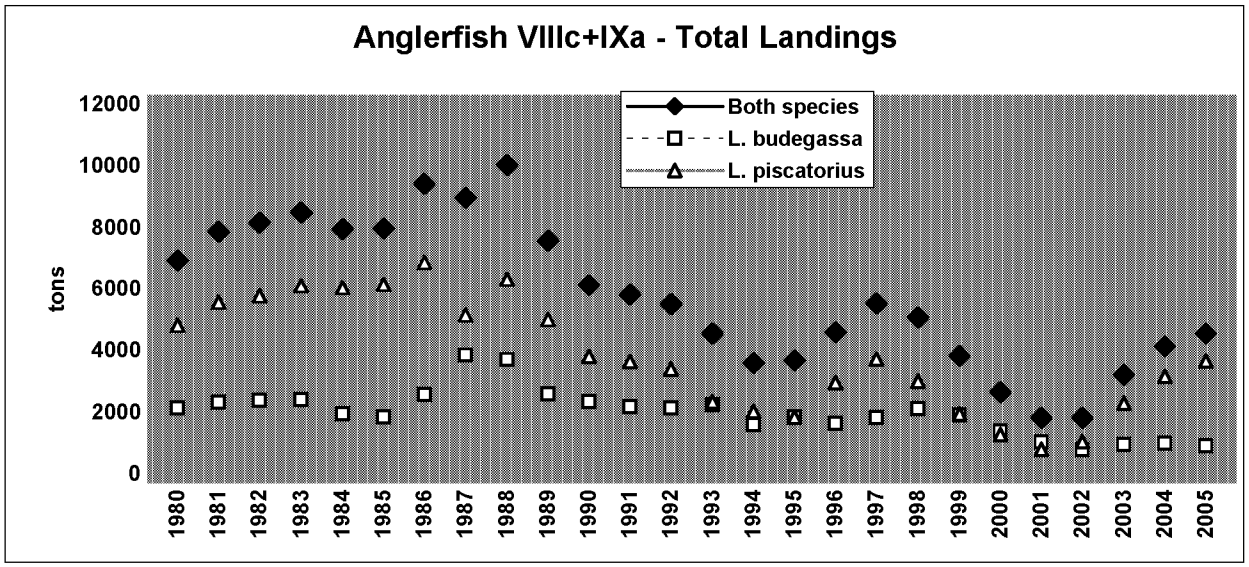


Figure 7.4.3.2 Anglerfish in Divisions VIIIc and IXa (*L. piscatorius and L. budegassa*).

Table 7.4.3.1 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2005 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	258		115	373	
1979	n/a	n/a	n/a	319		225	544	
1980	2806	1270	4076	401		339	740	4816
1981	2750	1931	4681	535		352	887	5568
1982	1915	2682	4597	875		310	1185	5782
1983	3205	1723	4928	726		460	1186	6114
1984	3086	1690	4776	578	186	492	1256	6032
1985	2313	2372	4685	540	212	702	1454	6139
1986	2499	2624	5123	670	167	910	1747	6870
1987	2080	1683	3763	320	194	864	1378	5141
1988	2525	2253	4778	570	157	817	1543	6321
1989	1643	2147	3790	347	259	600	1206	4996
1990	1439	985	2424	435	326	606	1366	3790
1991	1490	778	2268	319	224	829	1372	3640
1992	1217	1011	2228	301	76	778	1154	3382
1993	844	666	1510	72	111	636	819	2329
1994	690	827	1517	154	70	266	490	2007
1995	830	572	1403	199	66	166	431	1834
1996	1306	745	2050	407	133	365	905	2955
1997	1449	1191	2640	315	110	650	1075	3714
1998	912	1359	2271	184	28	497	710	2981
1999	545	1013	1558	79	9	285	374	1932
2000	269	538	808	107	4	340	451	1259
2001	231	294	525	57	16	190	263	788
2002	385	341	726	110	29	168	307	1032
2003	911	722	1633	312	29	305	645	2278
2004	1262	1269	2531	264	27	335	626	3157
2005	1378	1622	3000	371	29	244	643	3644

n/a: not available

Table 7.4.3.2 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2005 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	248		107	355	
1979	n/a	n/a	n/a	306		210	516	
1980	1203	207	1409	385		315	700	2110
1981	1159	309	1468	505		327	832	2300
1982	827	413	1240	841		288	1129	2369
1983	1064	188	1252	699		428	1127	2379
1984	514	176	690	558	223	458	1239	1929
1985	366	123	489	437	254	653	1344	1833
1986	553	585	1138	379	200	847	1425	2563
1987	1094	888	1982	813	232	804	1849	3832
1988	1058	1010	2068	684	188	760	1632	3700
1989	648	351	999	764	272	542	1579	2578
1990	491	142	633	689	387	625	1701	2334
1991	503	76	579	559	309	716	1584	2163
1992	451	57	508	485	287	832	1603	2111
1993	516	292	809	627	196	596	1418	2227
1994	542	201	743	475	79	283	837	1580
1995	913	104	1017	615	68	131	814	1831
1996	840	105	945	342	133	210	684	1629
1997	800	198	998	524	81	210	815	1813
1998	748	148	896	681	181	332	1194	2089
1999	571	127	698	671	110	406	1187	1885
2000	441	73	514	377	142	336	855	1369
2001	383	69	452	190	101	269	560	1013
2002	173	74	248	234	75	213	522	770
2003	279	49	329	305	68	224	597	926
2004	251	120	371	285	50	267	603	973
2005	273	97	370	283	31	214	527	897

n/a: not available

Table 7.4.3.3 ANGLERFISH (*L. piscatorius* and *L. budegassa*) – Divisions VIIIc and IXa. ASPIC estimates for total F (y^{-1}), average biomass (t), $F/\mathbf{F}_{MSY}$ ratio and $B/\mathbf{B}_{MSY}$ ratio.

	Estimated Total F (y^{-1})	Model Average Biomass (t)	F/F_{MSY} Ratio	B/B_{MSY} Ratio
1980	0.092	75320	0.796	2.057
1981	0.114	68890	0.989	1.884
1982	0.129	62990	1.121	1.720
1983	0.147	57620	1.277	1.575
1984	0.150	52960	1.302	1.439
1985	0.163	48930	1.411	1.330
1986	0.213	44380	1.841	1.228
1987	0.227	39560	1.965	1.094
1988	0.291	34420	2.522	0.975
1989	0.253	29980	2.189	0.828
1990	0.224	27290	1.944	0.740
1991	0.229	25320	1.985	0.686
1992	0.234	23510	2.024	0.637
1993	0.205	22200	1.778	0.592
1994	0.165	21750	1.428	0.568
1995	0.169	21720	1.462	0.568
1996	0.217	21150	1.877	0.566
1997	0.283	19520	2.453	0.539
1998	0.290	17460	2.515	0.482
1999	0.238	16060	2.059	0.431
2000	0.167	15750	1.445	0.408
2001	0.109	16470	0.947	0.415
2002	0.102	17740	0.880	0.445
2003	0.174	18430	1.506	0.481
2004	0.230	17950	1.993	0.481
2005	0.272	16700	2.355	0.456

7.4.4 Southern horse mackerel (*Trachurus trachurus*) (Division IXa)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
unknown	unknown	unknown	

In absence of a reliable assessment and precautionary reference points, the state of the stock cannot be evaluated.

Catches decreased from the early 1960s but have been relatively stable since the early 1990s. The age composition appears to be stable over the past 10 years, and there is no clear indication of recent strong year classes. Exploratory analyses might indicate a lower spawning stock biomass at present than at the beginning of the relatively short time-series (early 1990s), but the fishing mortality appears to be rather stable and at a low level over the whole period.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No reference points have been proposed for this stock.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Given the unknown state of the stock, fishing effort must not increase and catches in 2007 should not exceed the 2000–2004 average of around 25 000 t. The reference period of 2000–2004 excludes 2003 because of the reduced effort as an effect of the "Prestige" oil spill. The TAC for this stock should only apply to *Trachurus trachurus*.

Short-term implications

No short-term forecast is presented.

Management considerations

The assessment for this stock suffers from poor data. Exploratory analyses suggest that it is not heavily exploited, which leads to the advice of maintaining recent catch levels.

The development of new trawls especially designed for horse mackerel has led to a marked increase of the catches in Division IXa North between 1991 and 1998. The overall exploitation pattern therefore changed with a significant increase in the catches of old adults in that subdivision. More recently, there is a diversion of effort from demersal fishing to semi-pelagic fishing with the consequence that there is an increasing capacity for the exploitation of horse mackerel in Division IXa North. With no sign of incoming good recruitment and weak indications for a declining biomass, this should be closely monitored in spite of the apparently stable fishing mortality.

Other species of horse mackerel are caught together with *T. trachurus* in Division IXa, in particular *Trachurus picturatus* of which 300 to 600 t have been caught annually since 2000.

Scientific basis

Data and methods

Information from two surveys and catch-at-age is available for this stock. Only exploratory assessments were made. Accordingly, catch forecasts are not provided.

Uncertainties in assessment and forecast

The major problem in the assessment of horse mackerel in this area is the lack of consistent signals in the catch-at-age and survey data. This may be related to the problem of stock identity. The present management and advice implies that Southern horse mackerel is a self-contained stock, which might not be the case. Linkages to a larger stock in the south are at present not resolved. However, preliminary results from biological tags suggest that the current southern boundary at Gibraltar may be adequate.

Comparison with previous assessment and advice

The assessment is still exploratory. The basis for advice provided this year is the same as that used by ICES last year.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, Galway, Ireland, 5–14 September 2006 (ICES CM 2006/ACFM:36).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice[2]	Predicted catch corresponding to single-stock	Agreed TAC[1]	ACFM Landings[2]
1987	Not assessed		-		72.5[3]	55
1988	Mesh size increase		-		82.0[3]	56
1989	No increase in F; TAC		72.5		73.0[3]	56
1990	F at $\mathbf{F}_{0.1}$; TAC		38		55.0[4]	49[4]
1991	Precautionary TAC		61		73.0[4]	22[7]
1992	If required, precautionary TAC		61		73.0[4]	26[7]
1993	No advice		-		73.0[4]	32[7]
1994	*Status quo* prediction		55[5]		73.0[4]	26[7]
1995	No long-term gains in increasing F		63[5]		73.0[4]	25[7]
1996	No long-term gains in increasing F		60[5]		73.0[4]	23[7]
1997	No advice		-		73.0[4]	28[7]
1998	F should not exceed the F(94–96)		59		73.0[4]	42[7]
1999	No increase in F		58		73.0[4]	28[7]
2000	F <$\mathbf{F}_{pa}$		<59		68.0[4]	27[7]
2001	F <$\mathbf{F}_{pa}$		<54		68.0[4]	25[7]
2002	F <0.113		<34		57.5[4]	24[7]
2003	Average of last 3 years		<49		55.2[4]	20[7]
2004	[6]	Should not exceed the recent average (2000–2002)	[6]	<47	55.0[4]	24[7]
2005	[6]	Should not exceed the recent average (2000–2002)	[6]	<25[7]	55.0[4]	23[7]
2006	[6]	Should not exceed the recent average (2000–2004, excluding 2003)	[6]	<25[7]	55.0[4]	
2007		Should not exceed the recent average (2000–2004, excluding 2003)		<25[7]		

Weights in '000 t.
[1]Includes all *Trachurus* spp. [2]Includes only *Trachurus trachurus* L. [3]Division VIIIc, Subareas IX and X, and CECAF Division 34.1.1 (EC waters only). [4]Division VIIIc and Subarea IX. [5]Catch at *status quo* F. [6]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. [7]Stock boundaries were changed in 2004. Figures apply to Division IXa only.

Table 7.4.4.1. Time-series of southern horse mackerel historical catches by country (in tonnes).

	Country		
Year	Portugal (Subdivisions: IX a central north; IXa central south and IXa south)	Spain (Subdivisions IXa North and IXa south*)	Total Catch
1991	17,497	4,275	21,772
1992	22,654	3,838	26,492
1993	25,747	6,198	31,945
1994	19,061	6,898	25,959
1995	17,698	7,449	25,147
1996	14,053	8,890	22,943
1997	16,736	10,906	27,642
1998	21,334	20,230	41,564
1999	14,420	13,313	27,733
2000	15,348	11,812	27,160
2001	13,760	11,152	24,910
2002	14,270	8,236 // (9,393)*	22,506 // (23,663)*
2003	11,242	7,645 // (8,324)*	18,887 // (19,566)*
2004	11,875	11,377 // (11,702)*	23,252 // (23,577)*
2005	13,307	9,388 // (9,804)*	22,695 // (23,111)*

(*) In parenthesis: the Spanish catches from Subdivision IXa south are also included. These catches are only available since 2002 and they will not be considered in the assessment data until the rest of the time-series is completed.

Table 7.4.4.2 Annual catches (tonnes) of Southern horse mackerel by country in Division IXa. Data from 1984–2003 are Working Group estimates.

Year	Portugal	Spain	Total
1963	64,760	[1]	
1964	68,776	[1]	
1965	63,105	[1]	
1966	57,425	[1]	
1967	66,648	[1]	
1968	80,664	[1]	
1969	62,487	[1]	
1970	59,946	[1]	
1971	57,467	[1]	
1972	81,033	[1]	
1973	45,497	[1]	
1974	48,105	[1]	
1975	46,421	[1]	
1976	51,488	[1]	
1977	51,078	[1]	
1978	32,043	[1]	
1979	26,917	[1]	
1980	25,224	[1]	
1981	23,733	[1]	
1982	30,886	[1]	
1983	30,951	[1]	
1984	17,307	[1]	
1985	9,420	[1]	
1986	28,526	[1]	
1987	21,445	[1]	
1988	25,629	[1]	
1989	25,231	[1]	
1990	19,958	[1]	
1991	17,497	4,275[2]	21,772
1992	22,654	3,838[2]	26,492
1993	25,747	6,198[2]	31,945
1994	19,061	6,898[2]	25,959
1995	17,698	7,449[2]	25,147
1996	14,053	8,890[2]	22,943
1997	16,736	10,906[2]	27,642
1998	21,334	20,230[2]	41,564
1999	14,420	13,313[2]	27,733
2000	15,348	11,812[2]	27,160
2001	13,760	11,152[2]	24,912
2002	14,270	9,393	23,663
2003	11,242	8,324	19,566
2004	11,875	11,702	23,577
2005	13,307	9,804	23,111

[1]Spanish catch data for IXa only are not yet available.
[2]Does not include Spanish catches in IXa South.

7.4.5 Sardine in Divisions VIIIc and IXa

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Unknown		

In the absence of defined reference points, the state of this stock cannot be evaluated with regard to these. Based on the most recent assessment, SSB was 386 000 t in 2005 and is expected to increase in 2006. The strong 2000 year class contributed to rebuild the biomass to an average level. The 2004 year class is confirmed to be strong and it's contribution to the SSB in 2006 is considerable. Fishing mortality has been stable since 2002.

Management objectives

There are no explicit management objectives for this stock.

Reference points

Reference points have not been identified for this stock.

Single stock exploitation boundaries

ICES recommends that fishing mortality should not increase above the 2003–05 level of 0.21, corresponding to a catch of less than 114 000 t in 2007.

Short-term implications

Outlook for 2007

Basis: F(2006) = 0.21 ; $\mathbf{F}_{sq}$ = F(03–05 unscaled) = 0.21; SSB(2006) = 545; catch(2006) =116. Recruitment in 2005 is assumed to be equal to the geometric mean of 1994–2003, excluding the strong 2000 recruitment. Recruitment in 2006 is assumed to be equal to the geometric mean of 1994–2004.

Rationale	Landings (2007)	Basis	F (2007)	SSB (2007)	SSB (2008)	%SSB change [1)]
Zero catch	0	F=0	0	530	546	3
Status quo	114	$\mathbf{F}_{sq}$	0.21	506	441	-13
Status quo	93	$\mathbf{F}_{sq}$ * 0.8	0.17	511	461	-10
	104	$\mathbf{F}_{sq}$ * 0.9	0.19	509	451	-11
	114	$\mathbf{F}_{sq}$ * 1.0	0.21	506	441	-13
	125	$\mathbf{F}_{sq}$ * 1.1	0.23	504	432	-14
	135	$\mathbf{F}_{sq}$ * 1.2	0.25	502	423	-16

Weights in '000 t.
[1)] SSB 2008 relative to SSB 2007.
Shaded scenarios are not considered consistent with the precautionary approach.

Management considerations

There are no management objectives for this stock and there is no TAC. Almost all catches are taken by Spanish and Portuguese purse seiners in a directed human consumption fishery. The stock is managed by Portugal and Spain through minimum landing size, maximum daily catch, fishing day limitations, and closed areas.

Sardine is distributed in the Iberian region, to the north in Subareas VII and VIII and in the North Sea, and to the south on the Moroccan shelf. The information presented here assumes that sardine in VIIIc and IXa is a unit stock, based on biological characteristics. However, it is known that there is some movement of fish between VIIIb and VIIIc. The effect of this is not important for the estimation of the stock in the assessed area (VIIIc and IXa) but may be locally significant in VIIIc. If regional or local management is considered important, the tools and insight on migration acquired through the EU project SARDYN may prove an important source for developing such advice.

In 2005, the Spawning Stock Biomass is at an intermediate abundance considering the stock trajectory in the last 10 years. The strong 2000 cohort appears to have been depleted faster than strong year classes from the 1980s and has not led to a similar rise in the spawning biomass as previous large year classes did. The 2002 and 2003 year classes were weak. The implication of this is that the buffer biomass is removed from the stock and therefore the stock will become more dependent on the strength of the recruitment than in the 1980s. There is evidence of a strong 2004 recruitment, but the magnitude of this year class is still not firmly established. Therefore, the short-term impact of this recruitment on SSB remains uncertain.

Ecosystem considerations

Sardine forms large schools usually close to the coast and at depths down to around 50 m.

In waters off the Iberian Peninsula and the Bay of Biscay sardine, anchovy, mackerel, and horse mackerel have all been found in the diet of several cetacean species, as well as in other fish species. There is also a degree of cannibalism by adults on juveniles and/or eggs when food is scarce. Sardine is one of the main prey species in the diet of common dolphins (*Delphinus delphis*) stranded and bycaught in Galician (NW Spain) and Portuguese waters, while both anchovy and sardine were found to be the most abundant prey taken by common dolphins stranded on the Atlantic French coast. Mackerel and horse mackerel were also reported in the diet. Common dolphins are the most abundant cetacean species in the area, with numbers estimated to reach several thousands. Other less common cetacean species also known to predate on sardine, anchovy, mackerel, and horse mackerel are: harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), striped dolphin (*Stenella coeruleoalba*), and white-sided dolphin (*Lagenorhynchus acutus*).

Factors affecting the fisheries and the stock

The effects of regulations

The various fishery regulations enforced by both Spain and Portugal since 1997 may have contributed to the decline in fishing mortality. Different management measures were implemented in each country. A minimum landing size of 11 cm (EU reg. 850/98) has been in force since 1999 in all EU waters. In Spain, a maximum allowable catch of 7000 kg per fishing day and a 5-fishing-days week limitation in effort is regulated. In Portugal, regulations have been gradually implemented since 1997. Management measures include: (1) an overall limitation in the number of fishing days (180 days per year, and a weekend ban) and (2) a yearly quota for all fishers' organisations (some organisations have distributed this quota in daily catch limits by boat). Daily catch limitations were imposed for the first time in 1999.

In 2005, a fishing closure took place from the 1st of February to 31st March off the northern Portuguese coast and from the 17th November to the 31st December in the Gulf of Cadiz. The yearly quota for the Portuguese Producers Organization was limited to 80 000 tonnes.

The environment

Local oceanographic conditions are believed to affect recruitment and migration, and thus availability of parts of the stock to the different fleet areas. Large positive values of the North Atlantic Oscillation (NAO) index are associated with higher dominance of the middle-latitude easterly wind flow during winter that can lead to increased winter upwelling episodes. A NAO positive phase corresponded to a low catch period of sardine, whereas a NAO negative phase coincided with high catches. The decline in zooplankton and phytoplankton in the North Atlantic and in the catch of sardines off Portugal has been related to the increase in northerly winds during the 1970s. The decrease in sardine recruitment has been related to global warming and this hypothesis is currently under investigation.

Food availability and changes in the plankton community due to environmental shifts have also been hypothesized to influence the small pelagic fish community, both worldwide and for the Iberian Peninsula. Yearly variations in food availability are associated with variability in the intensity of upwelling events, as well as with local enrichment associated with features such as river plumes and inshore-offshore transport. The variable influence of the poleward current in the North Iberian Peninsula has a large effect on food availability, both due to water impoverishing and interruption by inshore-offshore transport.

Scientific basis

Data and methods

The assessment is based on combined Spanish and Portuguese March acoustic surveys, a DEPM (Daily Egg Production Method) survey series, and catch-at-age data. These have been analysed in a flexible age-structured model, combining the fishery-independent indices of abundance and catch-at-age information.

The Portuguese November acoustic survey is no longer used in the assessment as an index of stock abundance but can be used in the future to provide qualitative information on recruitment.

Uncertainties in assessment and forecast

In this year's final assessment the Spanish and Portuguese March acoustic surveys were merged in order to provide an acoustic abundance index series covering the whole Iberian area. The alternative, which is to apply local survey data to an area-disaggregated assessment model, was explored. This approach is heavily dependent on assumptions on migration which may potentially influence the final results. The assessment presented here is robust to existing knowledge on migration of sardine and the results with and without model formulation using migration are consistent in trends. The progress made in area-disaggregated methods may prove useful if future local management is considered important.

Comparison with previous assessment and advice

This year a benchmark assessment of sardine was carried out. Maturity ogives, stock weights-at-age and the DEPM survey estimates have been revised. A data and model exploration was carried out and the assessment has been modified by using a combined index of the Portuguese and Spanish March acoustic survey, providing a complete coverage of the stock.

Previously, the biomass estimates derived from the DEPM data were treated as absolute. The current assessment treats them as relative indices of spawning biomass and the estimated catchability is close to the previous assumption.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, Galway, Ireland, 5–14 September 2006 (ICES CM 2006/ACFM:36).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings VIII & IX	ACFM Landings[3]
1987	No increase in F; TAC	140	-		178
1988	No increase in F; TAC	150	-	167	162
1989	No increase in F; TAC	212	-	146	141
1990	Room for increased F	227[2]	-	150	149
1991	Precautionary TAC	176	-	135	133
1992	No advice	-	-	139	130
1993	Precautionary TAC	135	-	153	142
1994	No advice	118[1]	-	147	137
1995	No advice; apparently stable stock	-	-	137	125
1996	Lowest possible level	-	-	134	117
1997	Lowest possible level	-	-	n/a	116
1998	Significant reduction	-	-	n/a	109
1999	Reduce F to 0.2	38	-	n/a	94
2000	F below 0.2	<81	-	n/a	86
2001	F below 0.2	<88	-	n/a	102
2002	F below 0.25	<95	-	n/a	100
2003	No increase in F	100	-	n/a	98
2004	No increase in F	128	-	n/a	98
2005	No increase in F	106	-	n/a	97
2006	No increase in F	96	-		
2007	No increase in F	114	-		

Weights in '000 t.
[1]Estimated catch at *status quo* F.
[2]Catch corresponding to 20% increase in F.
[3] Includes only VIIIc and IXa.
n/a=not available.

Figure 7.4.5.1 Sardine in Divisions VIIIc and IXa. Landings, fishing mortality, recruitment and SSB.

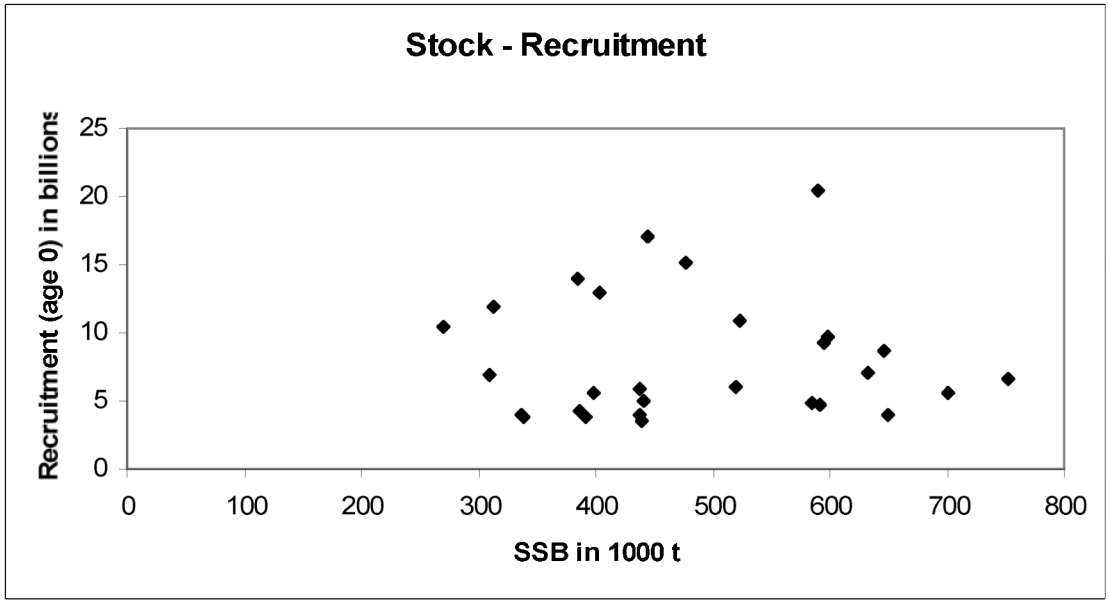


Figure 7.4.5.2 Sardine in Divisions VIIIc and IXa. Stock Recruitment

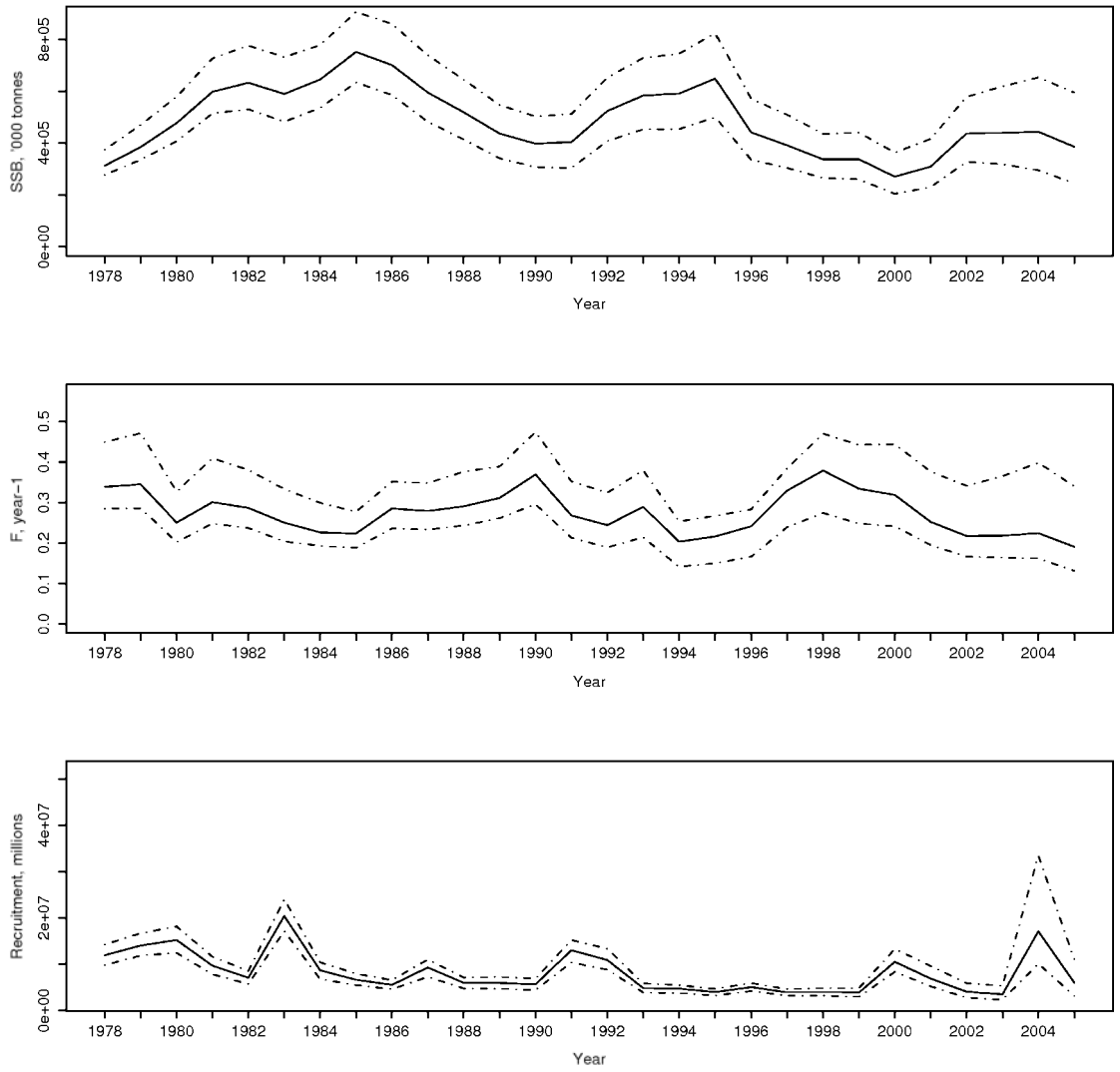


Figure 7.4.5.3. Sardine VIIIc and IXa**:** Bootstrap trajectories of SSB, recruitment and F for the final assessment model. Dotted lines represent the 90% limits.

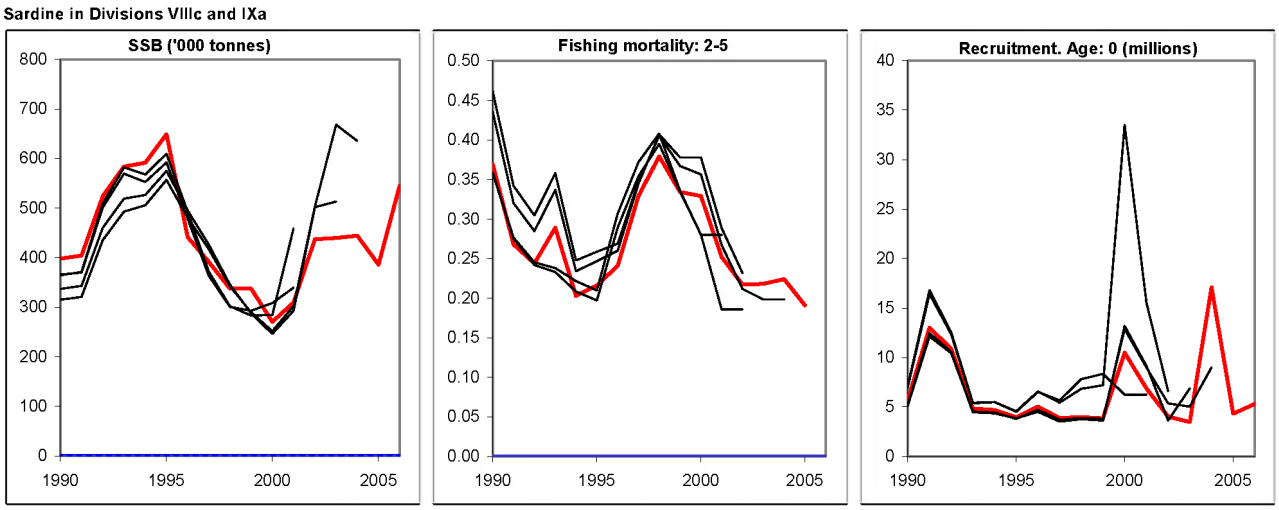


Figure 7.4.5.4 Sardine in Divisions VIIIc and IXa. Historical performance of the assessment (SSB, Fishing mortality and recruitment)

Table 7..4.5.1 Sardine in VIIIc and IXa. Iberian Sardine Landings (tonnes) by sub-area and total for the period 1940-2005.

	Sub-area										
Year	VIIIc	IXa North	IXa Central North	IXa Central South	IXa South Algarve	IXa South Cadiz	All sub-areas	Div. IXa	Portugal	Spain (excl.Cadiz)	Spain (incl.Cadiz)
1940	66816		42132	33275	23724		165947	99131	99131	66816	66816
1941	27801		26599	34423	9391		98214	70413	70413	27801	27801
1942	47208		40969	31957	8739		128873	81665	81665	47208	47208
1943	46348		85692	31362	15871		179273	132925	132925	46348	46348
1944	76147		88643	31135	8450		204375	128228	128228	76147	76147
1945	67998		64313	37289	7426		177026	109028	109028	67998	67998
1946	32280		68787	26430	12237		139734	107454	107454	32280	32280
1947	43459	21855	55407	25003	15667		161391	117932	96077	65314	65314
1948	10945	17320	50288	17060	10674		106287	95342	78022	28265	28265
1949	11519	19504	37868	12077	8952		89920	78401	58897	31023	31023
1950	13201	27121	47388	17025	17963		122698	109497	82376	40322	40322
1951	12713	27959	43906	15056	19269		118903	106190	78231	40672	40672
1952	7765	30485	40938	22687	25331		127206	119441	88956	38250	38250
1953	4969	27569	68145	16969	12051		129703	124734	97165	32538	32538
1954	8836	28816	62467	25736	24084		149939	141103	112287	37652	37652
1955	6851	30804	55618	15191	21150		129614	122763	91959	37655	37655
1956	12074	29614	58128	24069	14475		138360	126286	96672	41688	41688
1957	15624	37170	75896	20231	15010		163931	148307	111137	52794	52794
1958	29743	41143	92790	33937	12554		210167	180424	139281	70886	70886
1959	42005	36055	87845	23754	11680		201339	159334	123279	78060	78060
1960	38244	60713	83331	24384	24062		230734	192490	131777	98957	98957
1961	51212	59570	96105	22872	16528		246287	195075	135505	110782	110782
1962	28891	46381	77701	29643	23528		206144	177253	130872	75272	75272
1963	33796	51979	86859	17595	12397		202626	168830	116851	85775	85775
1964	36390	40897	108065	27636	22035		235023	198633	157736	77287	77287
1965	31732	47036	82354	35003	18797		214922	183190	136154	78768	78768
1966	32196	44154	66929	34153	20855		198287	166091	121937	76350	76350
1967	23480	45595	64210	31576	16635		181496	158016	112421	69075	69075
1968	24690	51828	46215	16671	14993		154397	129707	77879	76518	76518
1969	38254	40732	37782	13852	9350		139970	101716	60984	78986	78986
1970	28934	32306	37608	12989	14257		126094	97160	64854	61240	61240
1971	41691	48637	36728	16917	16534		160507	118816	70179	90328	90328
1972	33800	45275	34889	18007	19200		151171	117371	72096	79075	79075
1973	44768	18523	46984	27688	19570		157533	112765	94242	63291	63291
1974	34536	13894	36339	18717	14244		117730	83194	69300	48430	48430
1975	50260	12236	54819	19295	16714		153324	103064	90828	62496	62496
1976	51901	10140	43435	16548	12538		134562	82661	72521	62041	62041
1977	36149	9782	37064	17496	20745		121236	85087	75305	45931	45931
1978	43522	12915	34246	25974	23333	5619	145609	102087	83553	56437	62056
1979	18271	43876	39651	27532	24111	3800	157241	138970	91294	62147	65947
1980	35787	49593	59290	29433	17579	3120	194802	159015	106302	85380	88500
1981	35550	65330	61150	37054	15048	2384	216517	180967	113253	100880	103264
1982	31756	71889	45865	38082	16912	2442	206946	175190	100859	103645	106087
1983	32374	62843	33163	31163	21607	2688	183837	151463	85932	95217	97905
1984	27970	79606	42798	35032	17280	3319	206005	178035	95110	107576	110895
1985	25907	66491	61755	31535	18418	4333	208439	182532	111709	92398	96731
1986	39195	37960	57360	31737	14354	6757	187363	148168	103451	77155	83912
1987	36377	42234	44806	27795	17613	8870	177696	141319	90214	78611	87481
1988	40944	24005	52779	27420	13393	2990	161531	120587	93591	64949	67939
1989	29856	16179	52585	26783	11723	3835	140961	111105	91091	46035	49870
1990	27500	19253	52212	24723	19238	6503	149429	121929	96173	46753	53256
1991	20735	14383	44379	26150	22106	4834	132587	111852	92635	35118	39952
1992	26160	16579	41681	29968	11666	4196	130250	104090	83315	42739	46935
1993	24486	23905	47284	29995	13160	3664	142495	118009	90440	48391	52055
1994	22181	16151	49136	30390	14942	3782	136582	114401	94468	38332	42114
1995	19538	13928	41444	27270	19104	3996	125280	105742	87818	33466	37462
1996	14423	11251	34761	31117	19880	5304	116736	102313	85758	25674	30978
1997	15587	12291	34156	25863	21137	6780	115814	100227	81156	27878	34658
1998	16177	3263	32584	29564	20743	6594	108924	92747	82890	19440	26034
1999	11862	2563	31574	21747	18499	7846	94091	82229	71820	14425	22271
2000	11697	2866	23311	23701	19129	5081	85786	74089	66141	14563	19644
2001	16798	8398	32726	25619	13350	5066	101957	85159	71695	25196	30262
2002	15885	4562	33585	22969	10982	11689	99673	83787	67536	20448	32136
2003	16436	6383	33293	24635	8600	8484	97831	81395	66528	22819	31303
2004	18306	8573	26864	21590	7377	9176	91886	73580	55831	26879	36055
2005	19800	11663	25696	24619	7175	8391	97345	77545	57490	31464	39855

Div. IXa = IXa North + IXa Central-North + IXa Central-South + IXa South-Algarve + IXa South-Cadiz

Table 7.4.5.2 Sardine in Divisions VIIIc and IXa.

Year	Recruitment Age 0 thousands	SSB tonnes	Catch tonnes	Mean F Ages 2-5
1978	11912623	312823	173761	0.339
1979	14005930	384979	162454	0.345
1980	15210110	477416	204861	0.250
1981	9652309	598201	242574	0.301
1982	7046886	633318	214148	0.287
1983	20391263	589978	176636	0.250
1984	8660205	645524	215114	0.226
1985	6616995	752286	219928	0.223
1986	5519006	701422	192838	0.285
1987	9261886	595386	176283	0.279
1988	5959631	519120	157273	0.291
1989	5939720	437032	146539	0.311
1990	5630168	398049	142966	0.369
1991	13008279	404135	132785	0.268
1992	10873371	523878	131196	0.244
1993	4833461	583768	144949	0.289
1994	4694904	591399	138725	0.203
1995	3971409	648862	126755	0.216
1996	5034118	441428	115179	0.241
1997	3883808	391637	117250	0.329
1998	3982341	337598	112033	0.379
1999	3850767	337627	95793	0.334
2000	10489833	270662	87272	0.329
2001	6873412	309425	102903	0.252
2002	4033829	437401	101741	0.217
2003	3469470	439777	99113	0.218
2004	17085601	444147	98464	0.224
2005	4332000*	385976	97282	0.191
2006	5318844**	545459		
Average	7984213	487542	147386	0.275

* Geometric mean of 1994–2003, excluding the strong 2000 recruitment.
** Geometric mean of 1994–2004.

7.4.6 Anchovy – Subarea VIII (Bay of Biscay)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Reduced reproductive capacity	not harvested	Unknown	Fishery closed since July 2006

Based on the most recent estimates of SSB, ICES classifies the stock as suffering from reduced reproductive capacity. SSB is estimated to be about $\mathbf{B}_{lim}$. Low recruitment since 2001 and almost complete recruitment failure of the 2004 year class are the primary causes of the stock collapse. This led to the closure of the fishery in July 2005 and July 2006. The 2005 year class appears to be slightly stronger but is still amongst the lowest in the time-series.

Management objectives

There are no explicit management objectives for this stock. The present closure of the fishery aims at protecting the remaining stock until a strong year class recruits to the stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 21 000 t, the lowest observed biomass in the 2003 assessment.	$\mathbf{B}_{pa}$ be set at 33 000 t.
	There is no biological basis for defining $\mathbf{F}_{lim}$.	$\mathbf{F}_{pa}$ be established between 1.0 and 1.2.
Target reference points		Not defined.

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$ = 21 000 t.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$ x 1.645.
$\mathbf{F}_{lim}$: not defined.	$\mathbf{F}_{pa}$: = F for 50% spawning potential ratio, i.e. the F at which the SSB/R is half what it would have been in the absence of fishing.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

ICES recommends that the fishery remains closed and should, at the earliest, be considered for re-opening if the acoustic and egg surveys in May–June 2007 demonstrate a strong 2006 year class.

Management considerations

Historically, the fishable anchovy stock predominantly consisted of one-year-old fish with exceptions in some years where age 2 fish were present. Accordingly, the estimate of recruitment at age 1 is a key factor in determining a TAC.

The anchovy stock has been managed by annual TACs which have been set at a fixed level (in the range of 30 000 t to 33 000 t) independent of the advice (from 1979 to 2004). However, this management strategy seems to be inadequate for a short-lived species like anchovy, which is dominated by the incoming year class. In the absence of a reliable recruitment index, ICES cannot provide catch forecasts for the anchovy fishery in the Bay of Biscay in 2007.

Since 2002, the total annual catches have been well below the fixed TAC, indicating that when the recruitment is low, a management regime based on such annual TACs has not constrained the fishery. This could lead to overexploitation in years where recruitment is low.

ICES recommends a revision of the current management regime to take into account the fluctuations in recruitment; this requires a reliable indicator of the latest year-class strength which can be obtained from the May surveys. In the future, an earlier assessment (prior to the TAC year) may be possible that takes the results of the September-October juvenile surveys (under development) into consideration, but for the time being, the acoustic and egg surveys carried out in spring of the TAC year are the only surveys available to provide an indicator of the strength of the incoming year class. Acoustic recruitment surveys on juveniles covering the entire juvenile distribution area in September-October are under development. These surveys may serve as earlier predictors of incoming recruitment to the fishery. Such an estimation

would be preferential for the fishery conducted in the first half of the year. Before being used for management purposes, the performance of these autumn acoustic surveys need to be properly tested with respect to their predictive capability. The surveys should preferably be internationally coordinated.

Ecosystem considerations

Anchovy is a prey species for other pelagic and demersal species as well as cetaceans and birds. Further information on their role in the ecosystem is provided in the overview (see Section 1.1, this volume).

Factors affecting the fisheries and the stock

Fisheries for anchovy are targeted by trawlers and purse seiners. The Spanish and French fleets fishing for anchovy in Subarea VIII are spatially and temporally well separated. The Spanish fleet operates mainly in Divisions VIIIc and VIIIb in spring, while the French fleets operate in Division VIIIa in summer and autumn and in Division VIIIb in winter and summer. There is fishing for anchovy throughout the year.

The environment

The recruitment strongly depends on environmental factors. The prediction of incoming recruitment based on environmental indices has been attempted, but so far such predictions have not been sufficiently accurate to estimate the population one year in advance.

Other factors

A $\mathbf{B}_{pa}$ reference point is difficult to use in management for this short-lived stock, and the advice given by ICES is therefore not linked to this reference point in the same way it is for most of the other stocks for which ICES provides advice.

A decision framework under a revised management regime may make the current precautionary reference points redundant as these may be substituted by other controls or indicators. However, in the context of the precautionary approach, there will be a need to ensure that the recruitment is not impaired by a depleted spawning stock. Management should therefore ensure that SSB is kept above a critical level, which means that a $\mathbf{B}_{lim}$ will also be necessary in the future. In the light of the recent history of the population, the present value of $\mathbf{B}_{lim}$ appears to be appropriate.

Scientific basis

Data and methods

A Bayesian Biomass based model (BBM) assessment was used, based on the egg (1987–2006) and acoustic surveys (1989–2006) and catches from the French and Spanish fisheries.

Uncertainties in assessment and forecast

The model estimates age 1 and total biomass from the research surveys (DEPM and acoustics). The results are highly dependent upon the precision of the surveys, and the reliability of the current assessment depends on the reliability of the surveys themselves. The two surveys are in close agreement and there is little uncertainty about the low level of biomass observed in recent years. .

The current model provides an estimate of the precision of the results and these could be translated into risk should there be a need to include those in harvest rules.

Comparison with previous assessment and advice

The results of the current assessment are consistent with those of the assessment carried out last year using the same approach. Despite the fact that the 2005 year class appears to be stronger than the 2004 year class, the spawning biomass is still low. Previous advice on this stock was for a closure of the fishery and this advice remains unchanged.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, Galway, Ireland, 5–14 September 2006 (ICES CM 2006/ACFM:36).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Not assessed	-	32	14	15
1988	Not assessed	-	32	14	16
1989	Increase SSB; TAC	10.0[1]	32	n/a	11
1990	Precautionary TAC	12.3	30	n/a	34
1991	Precautionary TAC	14.0	30	n/a	20
1992	No advice	-	30	n/a	38
1993	Reduced F on juveniles; closed area	-	30	n/a	40
1994	Reduced F on juveniles; closed area	-	30	n/a	35
1995	Reduced F on juveniles; closed area	-	33	n/a	30
1996	Reduced F on juveniles; closed area	-	33	n/a	34
1997	Reduced F on juveniles; closed area	-	33	n/a	22
1998	Reduced F on juveniles; closed area		33	n/a	32
1999	Reduced F on juveniles, closed area		33	n/a	27
2000	Closure of the fishery	0	33	n/a	37
2001	Preliminary TAC corresponding to recent exploitation	18	33	n/a	40
2002	Preliminary TAC corresponding to recent exploitation	33	33	n/a	17.5
2003	Preliminary TAC corresponding to recent exploitation	12.5	33	n/a	10.6
2004	Preliminary TAC corresponding to recent exploitation	11	33	n/a	16.4
2005	Rebuilding SSB	5	30	n/a	1.1
2006	Closure of the fishery*	0	5		1.4[2]
2007	Closure of the fishery*	0			

Weights in '000 t.
[1]Mean catch of 1985–1987.
[2]Preliminary estimate of catches up to 1st July.
n/a: not available.
* to be reconsidered after new information from Spring survey.

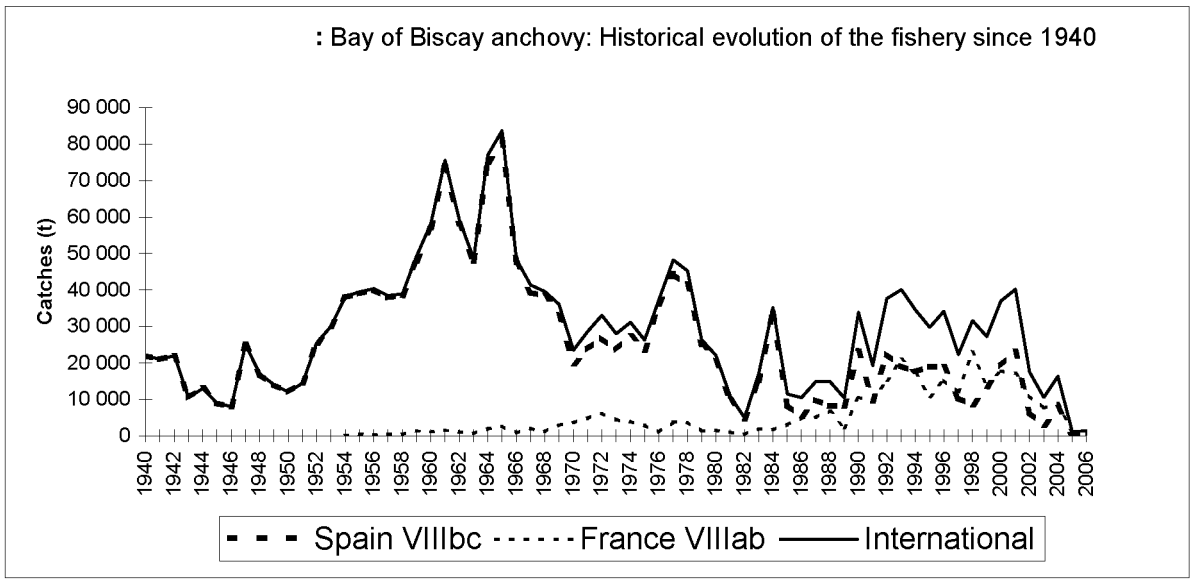


Figure 7.4.6.1 Bay of Biscay anchovy: Catches (in tonnes).

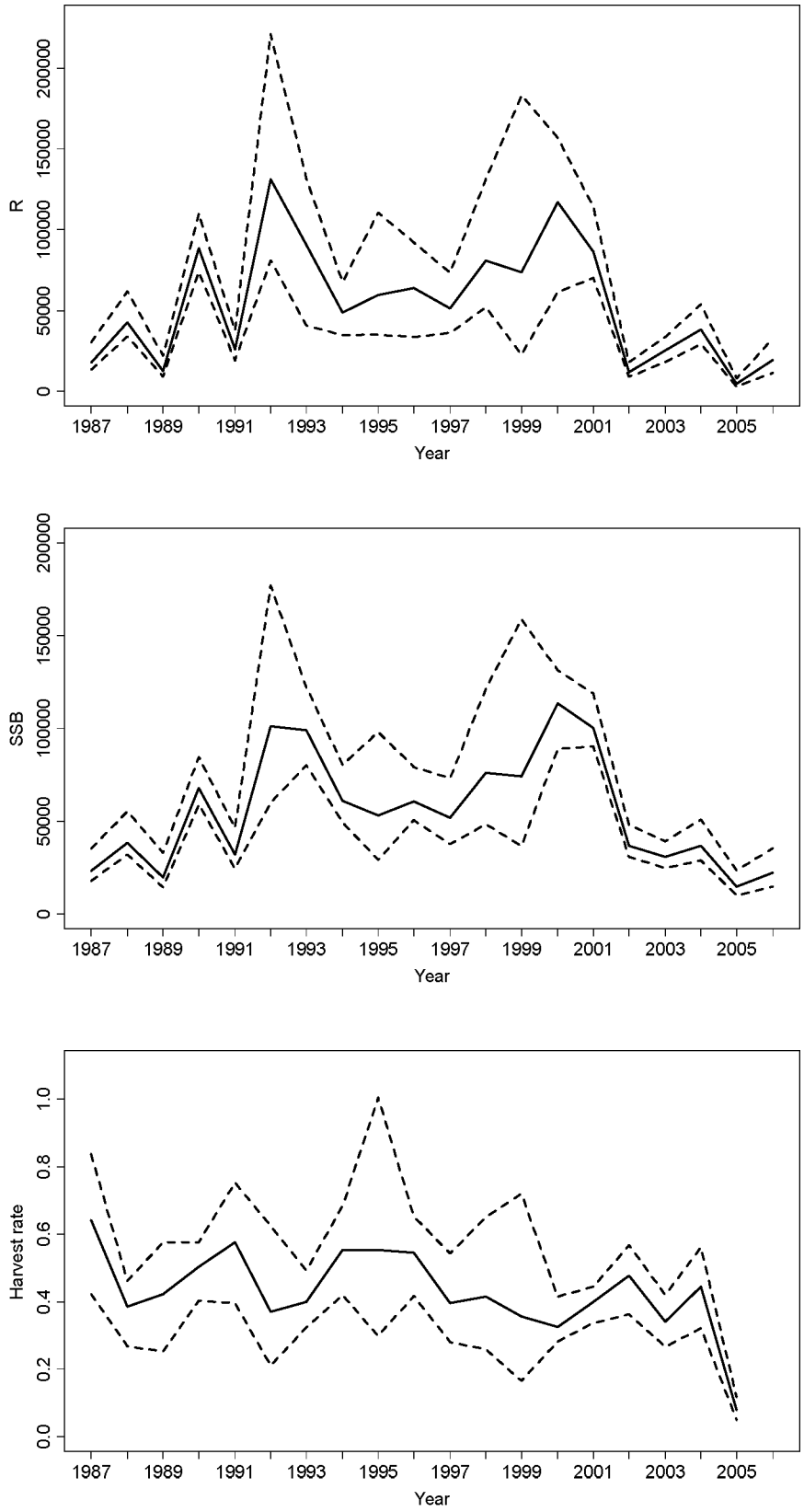


Figure 7.4.6.2 Bay of Biscay anchovy: Recruitment at age 1 (in tonnes), the spawning stock biomass (in tonnes), and the harvest rates (catch/SSB) from the Bayesian Biomass Model (BBM). Posterior median (solid line) and 95% credible intervals (dotted lines) are displayed.

Table 7.4.6.1 Bay of Biscay Anchovy. Annual catches (in tonnes) (Subarea VIII) As estimated by the Working Group members.

COUNTRY	FRANCE	SPAIN	SPAIN	INTERNATIONAL
YEAR	VIIIab	VIIIbc, Landings	Live Bait Catches	VIII
1960	1,085	57,000	n/a	58,085
1961	1,494	74,000	n/a	75,494
1962	1,123	58,000	n/a	59,123
1963	652	48,000	n/a	48,652
1964	1,973	75,000	n/a	76,973
1965	2,615	81,000	n/a	83,615
1966	839	47,519	n/a	48,358
1967	1,812	39,363	n/a	41,175
1968	1,190	38,429	n/a	39,619
1969	2,991	33,092	n/a	36,083
1970	3,665	19,820	n/a	23,485
1971	4,825	23,787	n/a	28,612
1972	6,150	26,917	n/a	33,067
1973	4,395	23,614	n/a	28,009
1974	3,835	27,282	n/a	31,117
1975	2,913	23,389	n/a	26,302
1976	1,095	36,166	n/a	37,261
1977	3,807	44,384	n/a	48,191
1978	3,683	41,536	n/a	45,219
1979	1,349	25,000	n/a	26,349
1980	1,564	20,538	n/a	22,102
1981	1,021	9,794	n/a	10,815
1982	381	4,610	n/a	4,991
1983	1,911	12,242	n/a	14,153
1984	1,711	33,468	n/a	35,179
1985	3,005	8,481	n/a	11,486
1986	2,311	5,612	n/a	7,923
1987	4,899	9,863	546	15,308
1988	6,822	8,266	493	15,581
1989	2,255	8,174	185	10,614
1990	10,598	23,258	416	34,272
1991	9,708	9,573	353	19,634
1992	15,217	22,468	200	37,885
1993	20,914	19,173	306	40,393
1994	16,934	17,554	143	34,631
1995	10,892	18,950	273	30,115
1996	15,238	18,937	198	34,373
1997	12,020	9,939	378	22,337
1998	22,987	8,455	176	31,617
1999	13,649	13,145	465	27,259
2000	17,765	19,230	n/a	36,994
2001	17,097	23,052	n/a	40,149
2002	10,988	6,519	n/a	17,507
2003	7,593	3,002	n/a	10,595
2004	8,781	7,580	n/a	16,361
2005	952	176	n/a	1,128
2006(Up 1st July)	458	972	n/a	1,430
AVERAGE (1990-04)	6,394	26,337	318	32,824

7.4.7 Anchovy in Division IXa

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The available information is inadequate to evaluate the spawning stock or fishing mortality relative to PA reference points. Accordingly, the state of the stock is unknown.

Management objectives

There are no explicit management objectives for this stock.

Reference points

At present, there is no sufficient information to estimate reference points for this stock.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Catches in 2007 should be restricted to 4800 t (mean catches from the period 1988–2005 excluding 1995, 1998, 2001, and 2002, the years where catches were probably influenced by exceptionally high recruitment). This level should be maintained until the response of the stock to the fishery is known.

Management considerations

As this stock experiences high natural mortality and is highly dependent upon recruitment, an in-season management or alternative management measures could be considered. Such measures should, however, take into account the data limitations on that stock.

Ecosystem considerations

Anchovy is a prey species for other pelagic and demersal species, and for cetaceans. Further information on their role in the ecosystem is provided in the overview (see Section 1.1, this volume).

Factors affecting the fisheries and the stock

Most of the fishery for this anchovy stock takes place in Subdivision IXa South (Gulf of Cadiz). The fleets in the northern part of Division IXa occasionally target anchovy when abundant, as occurred in 1995. The anchovy in Subdivision IXa South has different biological characteristics and dynamics compared to anchovy in other parts of Division IXa. The anchovy population in Subdivision IXa South appears to be well established and relatively independent of populations in other parts of Division IXa. These other populations seem to be abundant only when suitable environmental conditions occur.

The effects of regulations

In 2000, catches in Division IXa South decreased, probably as a result of a large reduction in the fishing effort by the Barbate single-purpose purse-seine fleet, one of the main fleets harvesting anchovy in the area. Most of these vessels accepted a tie-up scheme in 2000 and 2001 because the EU-Morocco Fishery Agreement was not renewed. Since 2002, these vessels have been fishing again in the Gulf of Cadiz. The effort exerted by the entire purse-seine fleet since 1997 has been high (even with a fishing closure in the 2004 fourth quarter). However, in 2005, the possible combination of a new fishing closure in the fourth quarter and the reduction of the number of active vessels fishing anchovy (from 127–129 vessels in 2003–2004 to only 99 vessels in 2005) led a marked decrease in fishing effort. Such a decreasing trend seems to have affected all fleet segments.

The regulatory measures in place for the Spanish anchovy purse-seine fishing in this Division were the same as for the previous years and are summarized as follows:

- Minimum landing size: 10 cm total length.
- Minimum vessel tonnage of 20 GRT with temporary exemption.
- Maximum engine power: 450 h.p.
- Purse-seine maximum length: 450 m.
- Purse-seine maximum depth: 80 m.
- Minimum mesh size: 14 mm.
- Fishing time limited to 5 days per week, from Monday to Friday.
- Cessation of fishing activities from Saturday 00:00 hrs to Sunday 12:00 hrs.
- Fishing prohibition inside bays and estuaries.

Until 1997, the Spanish purse-seine fleet voluntary closed the fishery each year from December to February in the Gulf of Cadiz (Subdivision IXa South).

In 2004, two complementary sets of management measures have been implemented.

The first one was the new "*Plan, to be implemented urgently, for the conservation and sustainable management of the purse-seine fishery in the Gulf of Cadiz National Fishing Ground*". This plan was in force during 12 months from October 30th 2004 and included a fishery closure of 45 days from November 17th to December 31st, accompanied by a subsidized tie-up scheme for the purse-seine fleet. This plan also includes additional regulatory measures on the fishing effort (200 fishing days/vessel/year as a maximum) and daily catch quotas per vessel (6000 kg of sardine-anchovy mixing, but the catch of each of these species cannot exceed 3000 kg). This plan was also implemented in 2005 with a closure of the fishery in the same period as in 2004.

While the effect of the fishery closures have not been formally evaluated, it appears that it has limited a further expansion of effort. Although the effective fishing days in the first year of implementation were higher than in the previous year (6919 effective fishing days in 2004, compared to 6830 fishing days in 2003), the effort exerted in autumn 2004 as compared to that exerted in the autumn in previous years showed a 35% decrease. In 2005, both fishing effort and landings in the fourth quarter significantly decreased.

The second management action in 2004 was the creation of a marine protected area (fishing reserve) in the mouth and surrounding waters of the Guadalquivir river, a zone that plays a important role as a nursery area for fish (including anchovy) and crustacean decapods in the Gulf. Fishing in the reserve is only allowed (with appropriate regulatory measures) for gillnets and trammel-nets, and only in waters outside the riverbed. Neither purse-seine nor bottom trawl fishing is allowed in this marine protected area.

From a conservation point of view, the implementation of both of these measures should benefit the stock.

Scientific basis

Data and methods

An analytical assessment is not possible. An exploratory analysis of the data is under development. No information is available on the stock size in 2007 as the stock in 2007 is comprised entirely of fish that have not yet been recruited in the survey. The state of the stock is therefore still unknown.

Comparison with previous assessment and advice

Advice is framed in a precautionary manner to limit exploitation and, accordingly, the basis for advice is average catches over a reference period, as was done last year.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, Galway, Ireland, 5–14 September 2006 (ICES CM 2006/ACFM:36).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings
1987	Not assessed	-	4.6	n/a
1988	Not assessed	-	6	4.7
1989	Not assessed	-	6	6.0
1990	Not assessed	-	9	6.5
1991	Not assessed	-	9	5.9
1992	Not assessed	-	12	3.2
1993	If required, precautionary TAC	-	12	2.0
1994	If required, precautionary TAC	-	12	3.4
1995	If required, precautionary TAC	-	12	13.0
1996	If required, precautionary TAC	-	12	4.6
1997	If required, TAC at pre-95 catch level	-	12	5.3
1998	No advice		12	11.0
1999	If required, TAC at pre-95 catch level	4.6	13	7.4
2000	Fishery less than pre-95 level and develop and implement management plan	4.6	10	2.5
2001	Average catch excl. 95 and 98	4.9	10	9.1
2002	Average catch excl. 95 and 98	4.9	8	8.8
2003	Average catch excl. 95, 98, and 01	4.7	8	5.3
2004	Average catch excl. 95, 98, 01, and 02	4.7	8	5.8
2005	Average catch excl. 95, 98, 01, and 02	4.7	8	4.5
2006	Average catch excl. 95, 98, 01, and 02	4.7	8	
2007	Average catch 1988-2005 excl. 95, 98, 01, 02	4.8		

Weights in '000 t.
[1]TAC for Subareas IX and X and CECAF 34.1.1.
n/a=not available.

Table 7.4.7.1. Anchovy in Division IXa. Portuguese and Spanish annual landings (tonnes),

	Portugal				Spain			
Year	IXa C-N	IXa C-S	IXa South	Total	IXa North	IXa South	Total	TOTAL
1943	7121	355	2499	9975	-	-	-	-
1944	1220	55	5376	6651	-	-	-	-
1945	781	15	7983	8779	-	-	-	-
1946	0	335	5515	5850	-	-	-	-
1947	0	79	3313	3392	-	-	-	-
1948	0	75	4863	4938	-	-	-	-
1949	0	34	2684	2718	-	-	-	-
1950	31	30	3316	3377	-	-	-	-
1951	21	6	3567	3594	-	-	-	-
1952	1537	1	2877	4415	-	-	-	-
1953	1627	15	2710	4352	-	-	-	-
1954	328	18	3573	3919	-	-	-	-
1955	83	53	4387	4523	-	-	-	-
1956	12	164	7722	7898	-	-	-	-
1957	96	13	12501	12610	-	-	-	-
1958	1858	63	1109	3030	-	-	-	-
1959	12	1	3775	3788	-	-	-	-
1960	990	129	8384	9503	-	-	-	-
1961	1351	81	1060	2492	-	-	-	-
1962	542	137	3767	4446	-	-	-	-
1963	140	9	5565	5714	-	-	-	-
1964	0	0	4118	4118	-	-	-	-
1965	7	0	4452	4460	-	-	-	-
1966	23	35	4402	4460	-	-	-	-
1967	153	34	3631	3818	-	-	-	-
1968	518	5	447	970	-	-	-	-
1969	782	10	582	1375	-	-	-	-
1970	323	0	839	1162	-	-	-	-
1971	257	2	67	326	-	-	-	-
1972	-	-	-	-	-	-	-	-
1973	6	0	120	126	-	-	-	-
1974	113	1	124	238	-	-	-	-
1975	8	24	340	372	-	-	-	-
1976	32	38	18	88	-	-	-	-
1977	3027	1	233	3261	-	-	-	-
1978	640	17	354	1011	-	-	-	-
1979	194	8	453	655	-	-	-	-
1980	21	24	935	980	-	-	-	-
1981	426	117	435	978	-	-	-	-
1982	48	96	512	656	-	-	-	-
1983	283	58	332	673	-	-	-	-
1984	214	94	84	392	-	-	-	-
1985	1893	146	83	2122	-	-	-	-
1986	1892	194	95	2181	-	-	-	-
1987	84	17	11	112	-	-	-	-
1988	338	77	43	458		4263	4263	4721
1989	389	85	22	496	118	5330	5448	5944
1990	424	93	24	541	220	5726	5946	6487
1991	187	3	20	210	15	5697	5712	5922
1992	92	46	0	138	33	2995	3028	3166
1993	20	3	0	23	1	1960	1961	1984
1994	231	5	0	236	117	3035	3152	3388
1995	6724	332	0	7056	5329	571	5900	12956
1996	2707	13	51	2771	44	1780	1824	4595
1997	610	8	13	632	63	4600	4664	5295
1998	894	153	566	1613	371	8977	9349	10962
1999	957	96	355	1408	413	5587	6000	7409
2000	71	61	178	310	10	2182	2191	2502
2001	397	19	439	855	27	8216	8244	9098
2002	433	90	393	915	21	7870	7891	8806
2003	211	67	200	478	23	4768	4791	5269
2004	83	139	434	657	4	5183	5187	5844
2005	82	6	38	126	4	4385	4389	4515

(-) Not available
(0) Less than 1 tonne

7.4.8 *Nephrops* in Divisions VIIIa,b: Functional Unit 23 and 24 (Bay of Biscay North and Bay of Biscay South) – *Nephrops* Area N

This *Nephrops* Area N has two Functional Units, which are assessed as one entity: a) Bay of Biscay North (FU 23) and b) Bay of Biscay South (FU 24).

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Reference points not defined	Reference points not defined	Overexploited	

In the absence of defined precautionary reference points, the state of the stock cannot be evaluated in this regard. Landings declined until 2000, but they have stabilised in recent years with a slightly increasing trend. Recruitment showed a declining trend up to 1998, but seems to have improved since then. The recruitment 2004 appears to be the strongest of the whole time-series 1987–2004, but its actual strength is still not confirmed. Spawning biomass has been stable over the whole time-series with a slight increase since 2000. The fishing mortality is well above the $\mathbf{F}_{max}$ of 0.20.

Management objectives

No management objectives have been set for this fishery.

Reference points

F-Reference points Landings	F multiplier	Absolute F
Fleet1 Landings $\mathbf{F}_{bar}(2–5)$	1.00	0.36
$\mathbf{F}_{max}$	0.55	0.20
$\mathbf{F}_{0.1}$	0.36	0.13
$\mathbf{F}_{35\%SPR}$	0.45	0.16

Based on Landings.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The present fishing mortality is well above the $\mathbf{F}_{max}$ of 0.20. Fishing at $\mathbf{F}_{max}$ in 2007 would be equivalent to landings of 2700 t.

Exploitation boundaries in relation to precautionary considerations

The stock appears to have tolerated the exploitation level exerted over a longer period. This would lead to advice of maintaining F at F *status quo*. A *status quo* F would, under the present assumption of an exceptional incoming year class, lead to an increase in catch opportunities of about 20% in 2007. However, as the strength of this year class is still considered uncertain, ICES recommends not to increase catches in 2007 over the recent level of 3600 t (2003–2005) until the strengths of the recent year classes have been confirmed.

Short-term implications

Numeric short-term forecasts are not provided, as the assessment was not considered reliable enough to present these.

Management considerations

The agreed TAC in 2005 for VIIIab areas has been exceeded by the actual landings. For 2006, the *status quo* F will provide estimated landings of 4700 t, whereas the agreed TAC is 4030 t. Penalties have been issued by EC because of quota overshot in 2005, leading to a reduction of the 2006 TAC. It should be taken into consideration that a conflicting situation might occur if the TACs are not adequately implemented.

The fishing pattern implies a high mortality of small *Nephrops*. Taking into account the large amounts of discards, improvement of gear selectivity should be encouraged. Trials of selective devices (grids, square mesh panels) for *Nephrops* are being carried out by fishers. To avoid increase in the discard rate the use of these must be encouraged in agreement with the recent increase of the French MLS. Any improvement in selectivity pattern still needs to be combined with control of fishing mortality.

The license system in effect since 2004 and the restrictions applied by the French Producers' Organisations since 2006 (no activity allowed during week-ends, individual quotas) are expected to reduce fishing effort on *Nephrops*.

The central mud bank of the Bay of Biscay is a nursery of the northern stock of hake, the major bycatch species in this fishery. In 2006, *Nephrops* trawlers are allowed to fish for one year in the hake box with the current mesh size of 70 mm, provided that they have adopted a square mesh panel of 100 mm.

Factors affecting the fisheries and the stock

Regulations and their effects

A mesh change was promulgated in 2000. The regulation stipulates a minimum codend mesh size for all trawlers, including *Nephrops* trawlers in the Bay of Biscay of 70 mm, instead of the former 55 mm for the *Nephrops* trawlers. A consequence of the mesh size change would be a reduction in discards, which is expected to improve the survival of recruits.

The average weight of discards per year for the assessment period (1987–2005) is estimated at about 1500 t, if derived from sampling in 1987, 1991, and 1998, whereas discards of the recent sampled years (2003–2005) is much higher (2200 t, corresponding to 50–65% in number). This change in the amount of discards could be the consequence of the strength of the recent recruitments, the change in the MLS (which tends to increase the discards), or the change in selectivity (which should tend to reduce the discards). The relative contribution of each of these three factors remains unknown.

Changes in fishing technology and fishing patterns

Nearly all landings from FUs 23 and 24 are taken by French trawlers. Landings have fluctuated between 3500 and 6000 t during the time-series. These fluctuations are explained either by the variability of the recruitment or by the reduction of the fishing effort (a decrease in the number of fishing days since 1994, owing to decommissioning of vessels). Despite the decommissioning programme, it is likely that effective effort has been stabilised or even increased due to increased gear efficiency. The effort data used in the assessment do not take these efficiency gains into account, so it is likely that there is some underestimation of the fishing mortality.

Scientific basis

Data and methods

The stock was assessed with XSA using catch-at-age data generated by slicing of sampled length distributions. Discard data were available for 1987, 1991, 1998, and since 2003. Missing years were filled in by extrapolation. The assessment was calibrated with one commercial LPUE series from the Le Guilvinec district (*Nephrops* specialists), with effort derived from sales records. Catch-at-age data were combined for males and females.

Information from the fishing industry

The French fishing industry and scientists have met to discuss information that can be used in the assessments. Industries have not provided any additional quantitative information that can be used in the assessment. However, the perception of the stock trends by the industry generally supports the signals given by the data used in this year assessment.

Uncertainties in assessment and forecast

Compared to recent years, the assessment has improved and is thought to reliably reflect historic stock trajectories. This improvement is mainly due to a longer time-series for landings and discards which have become available. Age data derived from length distributions of *Nephrops* (slicing) are uncertain, and the assessment using these input data are not considered sufficiently precise to be used in short-term predictions.

In the past, discards could not be sampled every year because of insufficient technical and financial resources. The continuation of the catch sampling programme on-board French *Nephrops* trawlers will avoid the use of "derived" data on missing years. Applying discard data from 'sampled' to 'non-sampled' years bears the risk of inconsistency between

the different data sets because it induces an inter-dependence between years and prevents the detection of any sign of recruitment strength. The recruitment of the 1999 year class was stronger than the average value of the preceding years, but this estimate was biased by the lack of independent observations of discards. In contrast, the 2003 year class, the most abundant in the analysed data, was estimated as reliable owing to the on-board sampling.

The effort data used in the assessment do not take into account likely increases in catch efficiencies associated with the introduction of new gears and equipment in this fishery. This results in an underestimation of F (and an over-estimation of SSB) for the period in which these technical changes occurred.

Assessment results indicate that the 2004 year class is strong. This is supported by the results of a scientific survey, which is, however, not directed at *Nephrops*. Since the strength of this year class is still poorly known, it is not considered for the advice. The actual strength of this year class cannot be confirmed before it has fully recruited to the fishery. An improvement of the present survey or a specific *Nephrops*-directed survey would be required to derive more precise estimates of incoming year classes and to increase the precision of the assessment.

Comparison with previous assessment and advice

The quality of the assessment has improved, mainly due to the longer time-series for landings and discards which have become available.

The maturity ogive which has been used for a long time was revised based on recent observations. The maturity of males is explained by the first size of functional maturity assumed to be knife-edged, whereas the maturity of females is described by an s-shaped curve. The processing on both sexes combined gave a new ogive that does not allow a direct comparison of SSB between 2005 and 2006. The perception of the trend in SSB remains the same, but the absolute estimates of SSB have been halved.

The comparison of the assessments 2005 and 2006 shows that, apart from the difference in SSB level due to the input of new maturity data, the main difference is an upwards revision of $\mathbf{F}_{2\text{-}5}$ in recent years by 10–15% whereas recruitment levels are close to and consistent with those presented last year.

This year's assessment has been accepted for the stock trends. The basis for this year's advice is unchanged.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2006 (ICES CM 2006/ACFM:29).

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings (discards not included)
1987				5.5
1988				5.9
1989				5.2
1990				5.1
1991				4.8
1992		~6.8	6.8	5.7
1993		6.8	6.8	5.2
1994		6.8	6.8	4.1
1995		6.8	6.8	4.5
1996		6.8	6.8	4.1
1997		6.8	6.8	3.6
1998		4.2	5.5	3.3
1999		4.2	5.5	3.2
2000		4.2	4.44	3.1
2001		4.2	4.0	3.8
2002	*40% reduction of current exploitation rate*	2.0	3.2	3.7
2003	*50% reduction of current exploitation rate*	2.2	3.0	3.8
2004	*20% reduction of current exploitation rate*	3.3	3.15	3.3
2005	*20% reduction of current exploitation rate*	3.1	3.1	3.7
2006	*Maintain recent catch*	3.5	4.0	
2007	*Maintain recent catch*	3.6		

Weights in thousand tonnes.

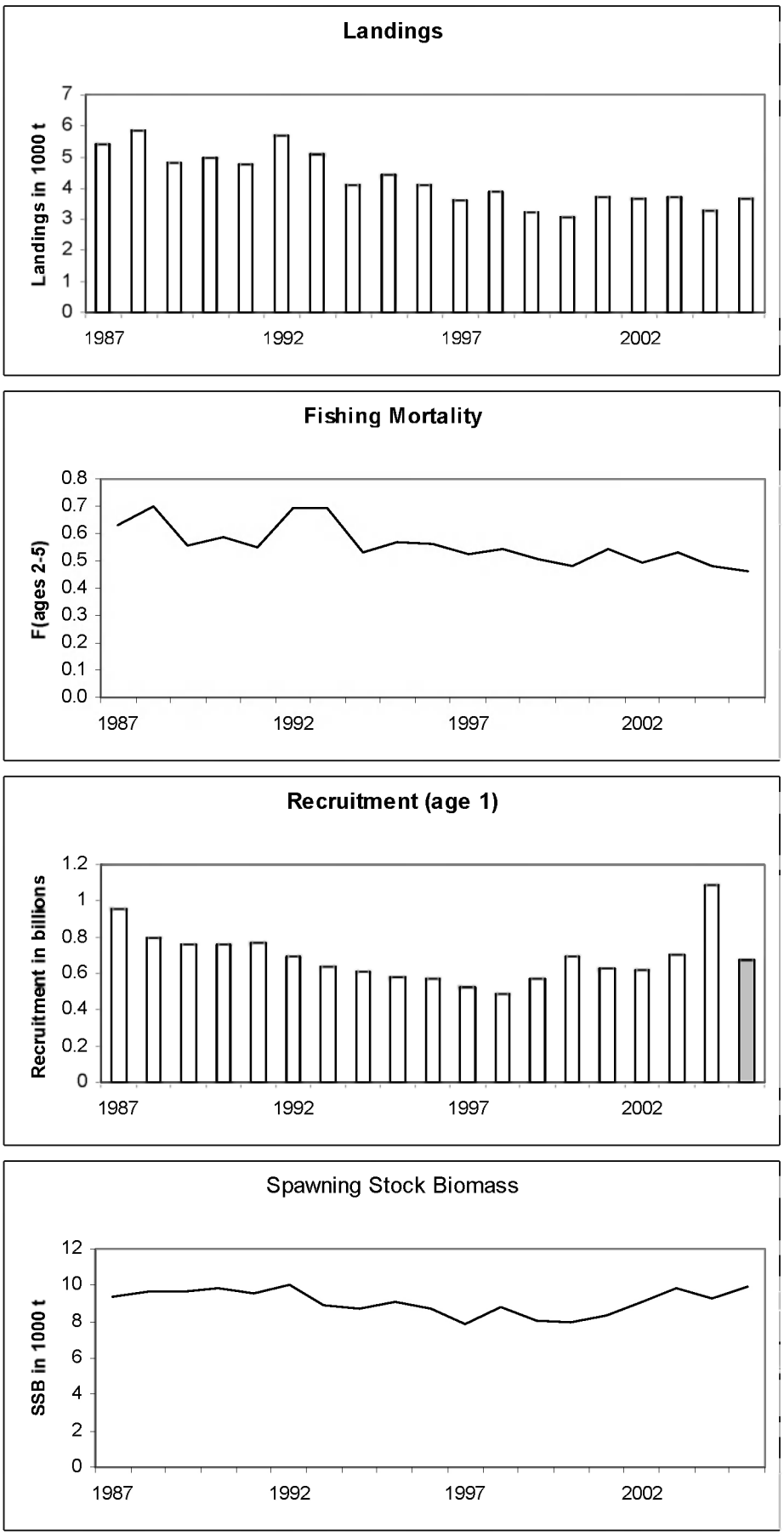
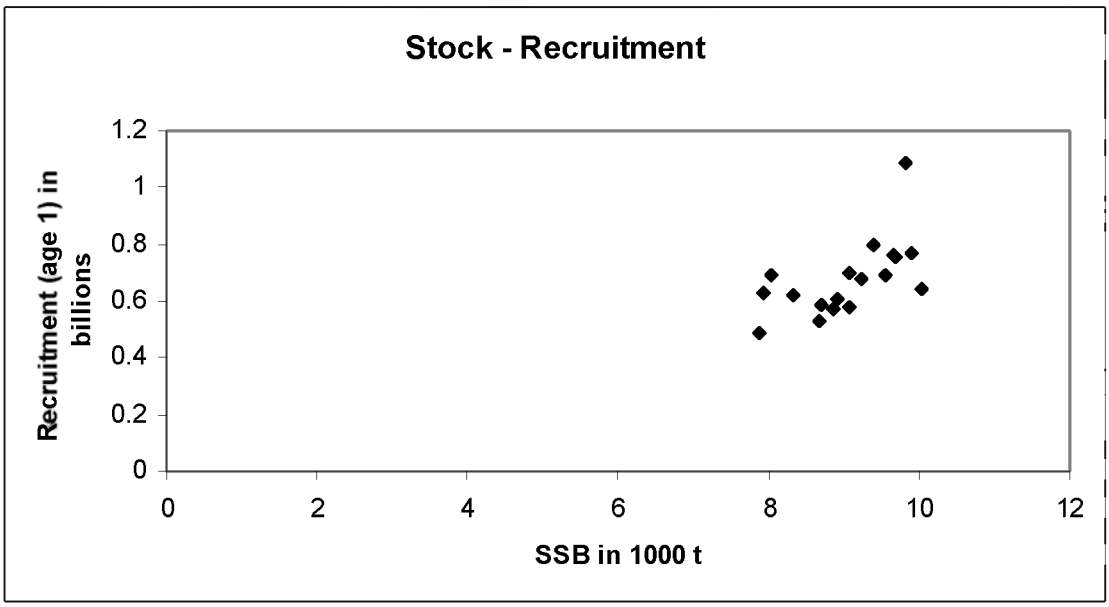
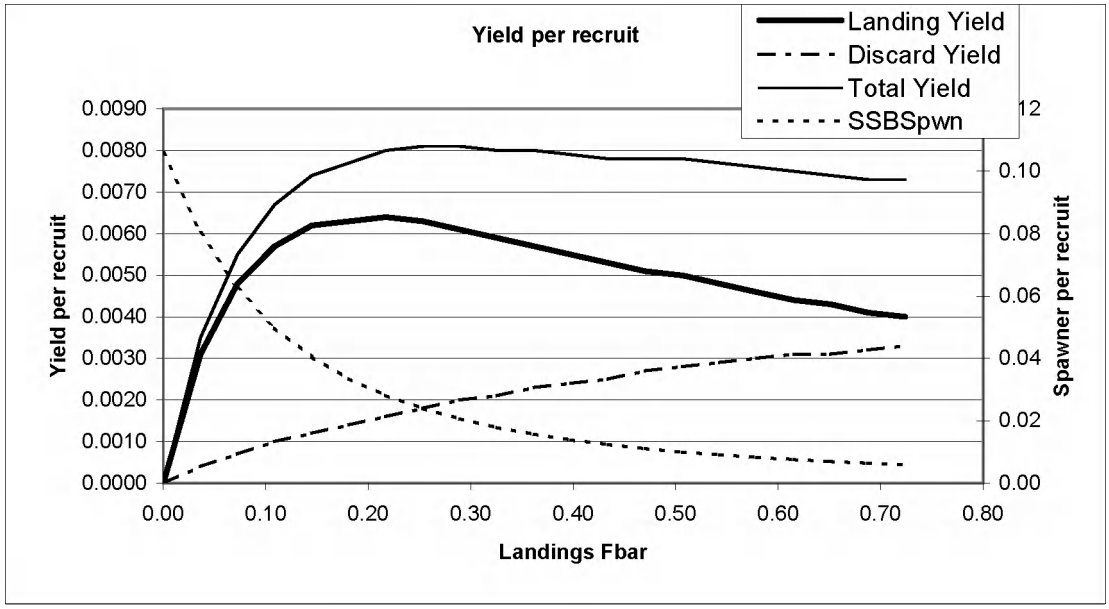


Figure 7.4.8.1 *Nephrops* in FUs 23–24 Bay of Biscay (Divisions VIIIa,b). Landings, fishing mortality, recruitment and SSB.





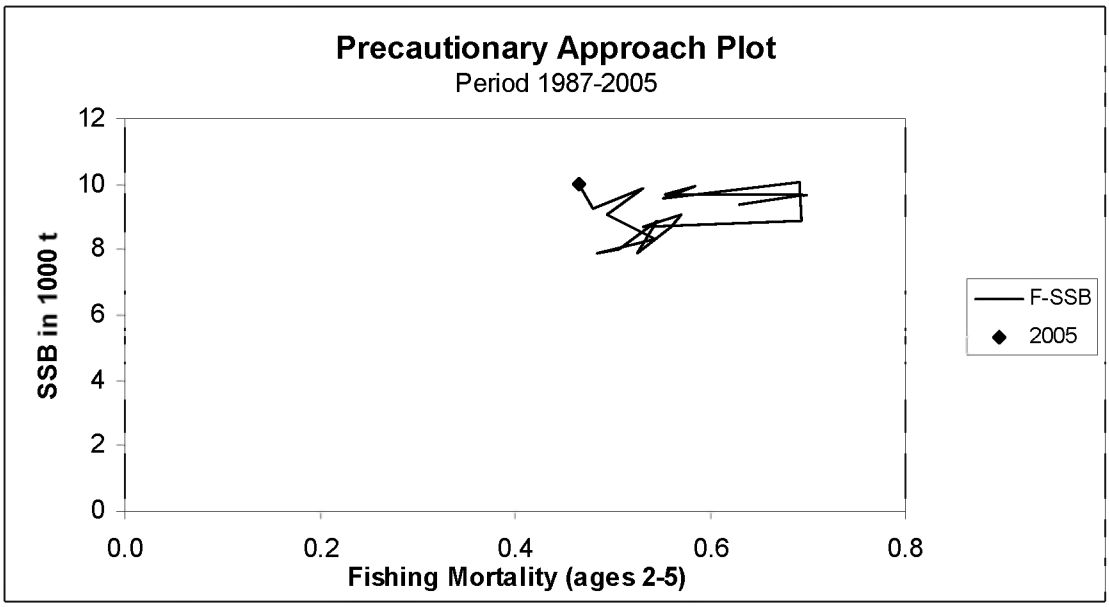


Figure 7.4.8.2 *Nephrops* in FUs 23–24 Bay of Biscay (Divisions VIIIa.b). Stock and recruitment; Yield and SSB per recruit

Table 7.4.8.1. *Nephrops* in FUs 23–24 Bay of Biscay (VIIIa,b). Estimates of catches (t) by FU for 1960–2005.

	Landings [1]					Total Discards		Catches
Year	FU 23-24 [2]	FU 23	FU 24	Unallocated (MA N) [3]	Total	FU 23-24		Total
	VIIIa,b	VIIIa	VIIIb	VIIIa,b	VIIIa,b	VIIIa,b		VIIIa,b
1960	3524	-	-	-	3524	-		3524
1961	3607	-	-	-	3607	-		3607
1962	3042	-	-	-	3042	-		3042
1963	4040	-	-	-	4040	-		4040
1964	4596	-	-	-	4596	-		4596
1965	3441	-	-	-	3441	-		3441
1966	3857	-	-	-	3857	-		3857
1967	3245	-	-	-	3245	-		3245
1968	3859	-	-	-	3859	-		3859
1969	4810	-	-	-	4810	-		4810
1970	5454	-	-	-	5454	-		5454
1971	3990	-	-	-	3990	-		3990
1972	5525	-	-	-	5525	-		5525
1973	7040	-	-	-	7040	-		7040
1974	7100	-	-	-	7100	-		7100
1975	-	6460	322	-	6782	-		6782
1976	-	6012	300	-	6312	-		6312
1977	-	5069	222	-	5291	-		5291
1978	-	4554	162	-	4716	-		4716
1979	-	4758	36	-	4794	-		4794
1980	-	6036	71	-	6107	-		6107
1981	-	5908	182	-	6090	-		6090
1982	-	4392	298	-	4690	-		4690
1983	-	5566	342	-	5908	-		5908
1984	-	4485	198	-	4683	-		4683
1985	-	4281	312	-	4593	-		4593
1986	-	3968	367	99	4434	-		4434
1987	-	4937	460	64	5461	1767	*	7228
1988	-	5281	594	69	5944	1909		7853
1989	-	4253	582	77	4912	1460		6372
1990	1	4613	359	87	5060	1281		6341
1991	1	4353	401	55	4810	1213	*	6022
1992	0	5123	558	47	5728	1583		7311
1993	0	4577	532	49	5158	1405		6563
1994	0	3721	371	27	4119	1060		5179
1995	0	4073	380	14	4467	1086		5554
1996	0	4034	84	15	4133	1005		5138
1997	2	3450	147	41	3640	1049		4688
1998	2	3565	300	40	3907	1453	*	5360
1999	2	2873	337	26	3238	1177		4415
2000	0	2848	221	36	3105	1213		4318
2001	1	3421	309	22	3753	1512		5265
2002	2	3323	356	36	3717	1645		5362
2003	1	3399	343	49	3792	1977	*	5769
2004	n/a	2970	315	5	3290	2193	*	5483
2005	n/a	3306	383	n/a	3689	2698	*	6387

(1) Working group estimates.

(2) Up to 1974 data available for combined FUs only. From 1990, Belgian landings available for combined FUs.

(3) Management Area N.

* = Observed discards (discards for other years are derived).

n/a = not available.

Table 7.4.8.2 *Nephrops* in FUs 23-24 Bay of Biscay (VIIIa,b).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1987	954379	9388	5397	0.6300
1988	797171	9674	5875	0.7003
1989	757818	9657	4835	0.5546
1990	759038	9889	4972	0.5855
1991	770358	9563	4754	0.5521
1992	693594	10020	5681	0.6912
1993	639160	8906	5109	0.6941
1994	607636	8704	4092	0.5315
1995	585867	9074	4452	0.5712
1996	576530	8676	4118	0.5604
1997	526417	7870	3610	0.5260
1998	490561	8858	3865	0.5465
1999	573437	8036	3209	0.5074
2000	691319	7924	3069	0.4841
2001	629906	8339	3730	0.5433
2002	618899	9086	3679	0.4950
2003	699528	9828	3742	0.5310
2004	1086669	9244	3285	0.4807
2005	678575*	9983	3689	0.4648
Average	691414	9090	4272	0.5605

* Geometric mean recruitment (1987–2004).

7.4.9 *Nephrops* in Division VIIIc: FU 25 (North Galicia) and FU 31 (Cantabrian Sea) (*Nephrops* Area O)

There are two Functional Units in this *Nephrops* Area O: a) North Galicia (FU 25) and b) Cantabrian Sea (FU 31).

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Reference points not defined	Reference points not defined	Unknown	

The stock assessments are only indicative of stock trends. In the absence of defined reference points, the state of the stocks cannot be evaluated in this regard. However, both stocks in this management area suffer severe recruitment failure.

a) **North Galicia (FU 25):** Recruitment has declined over the time-series, and is now extremely low. Landings and LPUE have fluctuated along a marked downward trend. Landings are currently very low. There is a sharp decline in stock biomass and recruitment. The fishing mortality has been reduced in recent years.

b) Cantabrian Sea (FU 31): No analytic assessment in 2006. Landings are currently at the lowest levels on record. Fishing effort is declining. LPUEs are currently at low levels.

Management objectives

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relatively to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005). The main Articles of interest adopted by this Regulation are:

Article 1. Subject matter

This Regulation establishes a recovery plan for the following stocks (hereinafter referred to as the stocks concerned):
(a) the Southern hake stock which inhabits Divisions VIIIc and IXa, as delineated by the International Council for the Exploration of the Sea (ICES);
(b) the Norway lobster stock which inhabits ICES Division VIIIc;
(c) the Norway lobster stock which inhabits ICES Division IXa.

Article 2. Objective of the recovery plan
The recovery plan shall aim to rebuild the stocks concerned to within safe biological limits, in keeping with ICES information.

This shall mean:
(a) as regards the stock referred to in Article 1(a), reaching a spawning stock biomass of 35 000 tonnes during two consecutive years, according to the available scientific reports, or increasing the quantities of mature individuals within a period of 10 years so that values are reached equal to or higher than 35 000 tonnes. This figure shall be adjusted in the light of new scientific data from the STECF;

(b) as regards the stocks referred to in Article 1(b) and (c), rebuilding the stocks to within safe biological limits within a period of 10 years.

Article 3.Evaluation of recovery measures

1. The Commission shall, on the basis of advice from ICES and STECF, evaluate the impact of the recovery measures on the stocks concerned and the fisheries on those stocks in the second year of application of this Regulation and in each of the following years.

2. Where the Commission finds, on the basis of the annual evaluation, that any of the stocks concerned have reached the objective set out in Article 2, the Council shall decide by qualified majority on a proposal from the Commission to replace, for that stock, the recovery plan provided for in this Regulation by a management plan in accordance with Article 6 of Regulation (EC) No 2371/2002.

3. Where the Commission finds, on the basis of the annual evaluation, that any of the stocks concerned do not show proper signs of recovery, the Council shall decide by qualified majority on a proposal from the Commission on additional and/or alternative measures in order to ensure recovery of the stock concerned.

Article 4. ***Setting of TACs***

1. Each year, the Council shall decide by qualified majority on the basis of a proposal from the Commission on a TAC for the following year for the stocks concerned.
2. The TAC for the stock referred to in Article 1(a) shall be set in accordance with Article 5.
3. The TACs for the stocks referred to in Article 1(b) and (c) shall be set in accordance with Article 6.

Article 5. ***Procedure for setting the TAC for the Southern hake stock***

1. Where the fishing mortality rate for the stock referred to in Article 1(a) has been estimated by the STECF in the light of the most recent report of ICES to be above 0,3 per year, the TAC shall not exceed a level of catches which, according to a scientific evaluation carried out by the STECF in the light of the most recent report of ICES, will result in a reduction of 10 % in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year.

2. Where the fishing mortality rate for the stock referred to in Article 1(a) has been estimated by the STECF in the light of the most recent report of ICES to be equal to or below 0,3 per year, the TAC shall be set at a level of catches which, according to a scientific evaluation carried out by the STECF in the light of the most recent report of ICES, will result in a fishing mortality rate of 0,27 per year in the year of its application.

3. Where STECF, in the light of the most recent report of ICES, is able to calculate a level of catches corresponding to the mortality rates specified in paragraphs 1 and 2 for only a part of ICES Divisions VIIIc and IXa, the TAC shall be set at a level that is compatible with both:

(a) the level of catch corresponding to the specified mortality rate in the area covered by the scientific advice, and
(b) maintaining a constant ratio of catches between that area covered by the scientific advice and the totality of

Divisions VIIIc and IXa. The ratio shall be calculated on the basis of catches in the three years preceding the year in which the decision is taken.

Article 6. ***Procedure for setting the TACs for the Norway lobster stocks***
Based on the latest scientific evaluation of the STECF, the TACs for the stocks referred to in Article 1(b) and (c) shall be set at a level that will result in the same relative change in its fishing mortality rate as the change in fishing mortality rate achieved for the stock referred to in Article 1(a) when applying Article 5.

Article 7. ***Constraints on variation in TACs***

As from the first year of application of this Regulation, the following rules shall apply:

(a) where application of Article 5 or Article 6 would result in a TAC which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which shall not be more than 15 % greater than the TAC of that year;
(b) where application of Article 5 or Article 6 would result in a TAC which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is not more than 15 % less than the TAC of that year.

ICES has not evaluated the current recovery plan for *Nephrops* in relation to the precautionary approach.

Reference points

There are no reference points for these stocks.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Given the very low state of the stock, ICES repeats its advice of a zero TAC for both fishing units in this management area.

Management considerations

For the *Nephrops* fishery in FU 25 and 31, stronger measures than those established by the EC recovery plan are required to rebuild the stocks. The assessment for both stocks is too uncertain to allow the calculation of a precise TAC corresponding to a reduction of F of 10% as stated in the recovery plan.

Nephrops are taken together with hake, anglerfish, megrim, horse mackerel, and mackerel. Due to the mixed nature of the demersal fisheries in this management area, management measures for the target finfish species have influenced exploitation of *Nephrops*. The TAC has not been restrictive.

Mean length in the landings of both males and females shows an overall increasing trend, which is in line with a declining recruitment in the fishery.

Factors affecting the fisheries and the stock

Changes in fishing technology and fishing patterns

Nephrops are a small component of landings taken by 'baca' bottom trawls. All catches from this management area are taken by Spain.

Scientific basis

Data and methods

LPUE and mean size data are available for both functional units. Length–frequency data has been available for FU 25 since 1982 and for FU 31 since 1989. Discarding of *Nephrops* in these fisheries is minimal, based on observer information.

The stock in FU 25 was assessed by using catch-at-'age' data generated by 'slicing' of sampled length distributions. The assessment was calibrated using data from one commercial LPUE time-series. This assessment is only indicative of trends. There was insufficient information for FU 31, so no assessment was performed for this stock; the last analytical assessment was conducted in 2002.

Uncertainties in assessment and forecast

The use of slicing to convert length compositions into age compositions (in FU 25) is uncertain, especially for older age groups (3 and older). The assessment reflects the status of the stock and the relative trends but cannot be used for predicting the response of the stock to management measures/changes. Nevertheless, the assessment confirms the depleted state of this stock.

The assessment in FU 25 is calibrated with a single commercial CPUE series, where the definition of fishing effort is based on nominal effort. No fishery-independent information is available.

Comparison with previous assessment and advice

The assessment results from FU 25 this year confirm those from previous years and corroborate conclusions drawn previously from fishery statistics. The perception of the state of the stocks and the advice for both remains unchanged.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, 10–19 May 2006 (ICES CM 2006/ACFM:29).

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				0.53
1988				0.60
1989				0.52
1990				0.46
1991				0.56
1992		0.51	0.8	0.52
1993		0.51	1.0	0.37
1994		0.51	1.0	0.39
1995		0.51	1.0	0.37
1996		0.51	1.0	0.34
1997		0.51	1.0	0.32
1998		0.51	1.0	0.18
1999		0.51	1.0	0.17
2000		0.51	0.8	0.12
2001		0.51	0.72	0.17
2002	Reduce catches to zero	0	0.36	0.17
2003	Reduce catches to zero	0	0.18	0.11
2004	Reduce catches to zero	0	0.18	0.09
2005	Reduce catches to zero	0	0.16	0.08
2006	Reduce catches to zero	0	0.146	
2007	**FU 25:** Reduce catches to zero	0		
	FU 31: Reduce catches to zero	0		

Weights in '000 t.

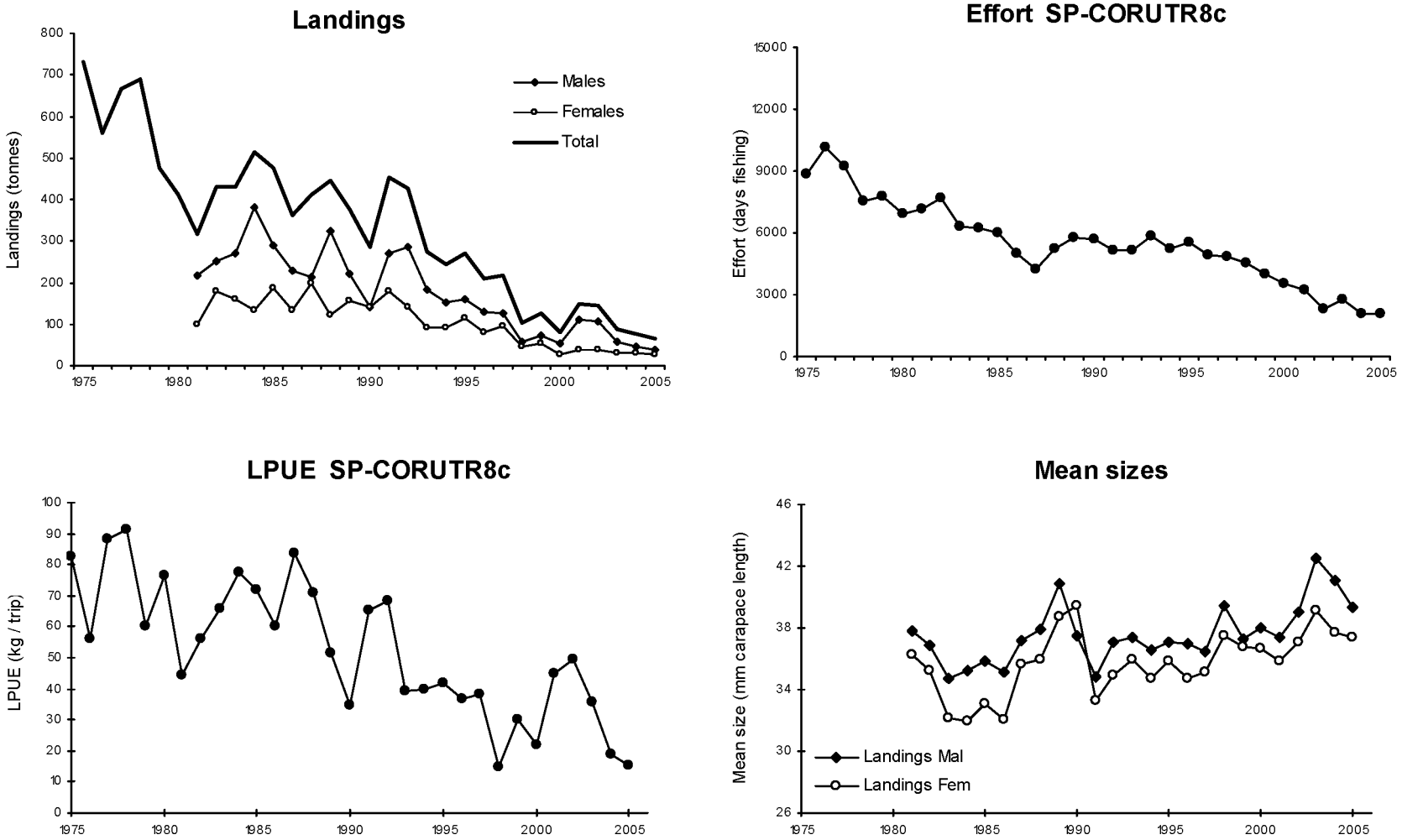


Figure 7.4.9.1 - Nephrops FU 25, North Galicia: Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

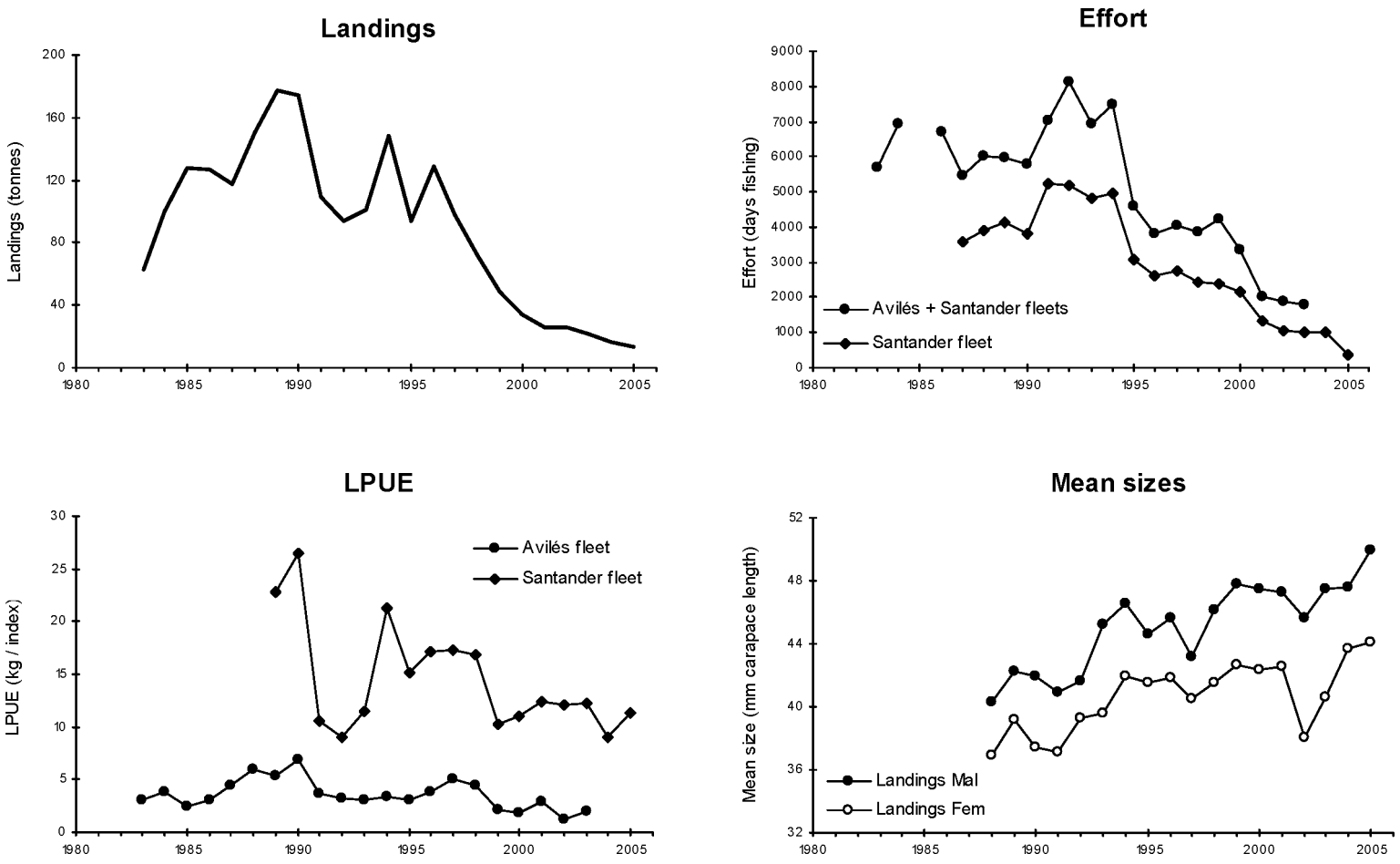


Figure 7.4.9.2 **. - Nephrops FU 31, Cantabrian Sea: Long-term trends in landings, effort, LPUE, and mean sizes.**

Table 7.4.9.1. Nephrops FU 25, North Galicia
Landings in tonnes

Year	Total
1975	731
1976	559
1977	667
1978	690
1979	475
1980	412
1981	318
1982	431
1983	433
1984	515
1985	477
1986	364
1987	412
1988	445
1989	376
1990	285
1991	453
1992	428
1993	274
1994	245
1995	273
1996	209
1997	219
1998*	103
1999*	124
2000*	81
2001*	147
2002	143
2003	89
2004*	75
2005*+	63

* estimated landings from sampling program
+ preliminary

Table 7.4.9.2 Nephrops FU31, Cantabrian Sea
Landings in tonnes

Year	Trawl	Creel	Total
1980			
1981			
1982			
1983	63		63
1984	100		100
1985	128		128
1986	127		127
1987	118		118
1988	151		151
1989	177		177
1990	174		174
1991	105	4	109
1992	92	2	94
1993	95	6	101
1994	146	2	148
1995	90	4	94
1996	120	9	129
1997	97	1	98
1998	69	3	72
1999	46	2	48
2000	33	1	34
2001	26	1	27
2002	25	1	26
2003	21	1	22
2004	17	0	17
2005*	14	0	14

*preliminary

7.4.10 *Nephrops* in Division IXa (*Nephrops* Area Q)

There are five Functional Units in this *Nephrops* Area: a) West Galicia (FU 26), b) North Portugal (FU 27), c) Southwest Portugal (FU 28), d) South Portugal (FU 29), and e) Gulf of Cadiz (FU 30).

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Reference points not defined	Reference points not defined	Unknown	

The stock assessments are only indicative of stock trends. In the absence of defined reference points, the state of the stocks cannot be evaluated in this regard.

a+b) FU 26+FU 27 West Galicia and North Portugal: Landings have gradually declined since the 1980s, and are now very low. Recruitment appears to have failed in recent years and the stock size is considered to be extremely low. The fishing mortality has been declining since 1999.

c+d) FU 28+ FU 29 SW and S Portugal: Landings declined sharply from 1992 to 1996, but have increased since then to levels slightly below those of the mid-1980s. Recruitment and SSB were sharply reduced in the early 1990s. Recruitment was stable at a low level in the period 1996–2002, but has increased again in the last three years. After the lowest value in 1996, SSB has shown an increasing trend. Fishing mortality has shown the same decline to the mid-1990s and subsequent increase for the males, but appears to be stable for the females.

e) FU 30 Gulf of Cadiz: There is no analytical assessment for this stock. Landings have shown an increasing trend since 1996 to levels observed in the 1980s. The state of the stock is uncertain. The survey and LPUE information indicate that at present the stock is at about half of its level at the beginning of the time-series.

Management objectives

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relative to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005). The main articles of interest adopted by this Regulation are:

Article 1. Subject matter

This Regulation establishes a recovery plan for the following stocks (hereinafter referred to as the stocks concerned):

(a) the Southern hake stock which inhabits Divisions VIIIc and IXa, as delineated by the International Council for the Exploration of the Sea (ICES);
(b) the Norway lobster stock which inhabits ICES Division VIIIc;
(c) the Norway lobster stock which inhabits ICES Division IXa.

Article 2. Objective of the recovery plan
The recovery plan shall aim to rebuild the stocks concerned to within safe biological limits, in keeping with ICES information.

This shall mean:

(a) as regards the stock referred to in Article 1(a), reaching a spawning stock biomass of 35 000 tonnes during two consecutive years, according to the available scientific reports, or increasing the quantities of mature individuals within a period of 10 years so that values are reached equal to or higher than 35 000 tonnes. This figure shall be adjusted in the light of new scientific data from the STECF;

(b) as regards the stocks referred to in Article 1(b) and (c), rebuilding the stocks to within safe biological limits within a period of 10 years.

Article 3.Evaluation of recovery measures

1. The Commission shall, on the basis of advice from ICES and STECF, evaluate the impact of the recovery measures on the stocks concerned and the fisheries on those stocks in the second year of application of this Regulation and in each of the following years.

2. Where the Commission finds, on the basis of the annual evaluation, that any of the stocks concerned have reached the objective set out in Article 2, the Council shall decide by qualified majority on a proposal from the Commission to replace, for that stock, the recovery plan provided for in this Regulation by a management plan in accordance with Article 6of Regulation (EC) No 2371/2002.

3. Where the Commission finds, on the basis of the annual evaluation, that any of the stocks concerned do not show proper signs of recovery, the Council shall decide by qualified majority on a proposal from the Commission on additional and/or alternative measures in order to ensure recovery of the stock concerned.

Article 4. ***Setting of TACs***

1. Each year, the Council shall decide by qualified majority on the basis of a proposal from the Commission on a TAC for the following year for the stocks concerned.

2. The TAC for the stock referred to in Article 1(a) shall be set in accordance with Article 5.

3. The TACs for the stocks referred to in Article 1(b) and (c) shall be set in accordance with Article 6.

Article 5. ***Procedure for setting the TAC for the Southern hake stock***

1. Where the fishing mortality rate for the stock referred to in Article 1(a) has been estimated by the STECF in the light of the most recent report of ICES to be above 0,3 per year, the TAC shall not exceed a level of catches which, according to a scientific evaluation carried out by the STECF in the light of the most recent report of ICES, will result in a reduction of 10 % in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year.

2. Where the fishing mortality rate for the stock referred to in Article 1(a) has been estimated by the STECF in the light of the most recent report of ICES to be equal to or below 0,3 per year, the TAC shall be set at a level of catches which, according to a scientific evaluation carried out by the STECF in the light of the most recent report of ICES, will result in a fishing mortality rate of 0,27 per year in the year of its application.

3. Where STECF, in the light of the most recent report of ICES, is able to calculate a level of catches corresponding to the mortality rates specified in paragraphs 1 and 2 for only a part of ICES Divisions VIIIc and IXa, the TAC shall be set at a level that is compatible with both:

- *(a) the level of catch corresponding to the specified mortality rate in the area covered by the scientific advice, and*
- *(b) maintaining a constant ratio of catches between that area covered by the scientific advice and the totality of Divisions VIIIc and IXa. The ratio shall be calculated on the basis of catches in the three years preceding the year in which the decision is taken.*

Article 6. ***Procedure for setting the TACs for the Norway lobster stocks***
Based on the latest scientific evaluation of the STECF, the TACs for the stocks referred to in Article 1(b) and (c) shall be set at a level that will result in the same relative change in its fishing mortality rate as the change in fishing mortality rate achieved for the stock referred to in Article 1(a) when applying Article 5.

Article 7. ***Constraints on variation in TACs***

As from the first year of application of this Regulation, the following rules shall apply:

- *(a) where application of Article 5 or Article 6 would result in a TAC which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which shall not be more than 15 % greater than the TAC of that year;*
- *(b) where application of Article 5 or Article 6 would result in a TAC which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is not more than 15 % less than the TAC of that year.*

ICES has not evaluated the current recovery plan for *Nephrops* in relation to the precautionary approach.

In order to reduce F on *Nephrops* stocks in this Management Area even further, a seasonal ban was introduced in the trawl and creel fishery in two boxes, located in FU 26 and 28, in the peak of the *Nephrops* fishing season.

Reference points

There are no reference points for these stocks.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

For FUs 26–27 (Galicia an N Portugal): Given that there has been a progressive recruitment failure and the stock is at an extremely low level, ICES advises that there is no fishing on *Nephrops* until the recruitment improves considerably.

For FUs 28-29 (SW and S Portugal): The stock appears to have recovered from a low stock size after a period (1996–2001) of landings in the order of 200 t. The current fishing mortality is high and the stock productivity can be improved with a reduction in fishing mortality to average levels of that period. Therefore, ICES advises that landings in 2007 should not exceed 200 t.

For FU 30 (Cadiz): As the stock clearly is at least fully exploited, it is recommended not to increase the catches in 2007 above the lowest recent landings of 50 t.

Management considerations

Because of the difference in stock status between FUs 26–27 (severely depleted) and the better situation for the more southerly components, a subdivision of the TAC by Functional Unit should be considered. The practice of managing three distinctive *Nephrops* stocks by a joint TAC may lead to unbalanced exploitation of the individual stocks. This is particularly true for *Nephrops* area Q where the state of the individual stocks is quite different. In addition to this, landings have been in excess of the TAC for some recent years and the TAC has not constrained the fishery. Therefore fine-scale management of catches and/or effort at a geographic scale that corresponds to the *Nephrops* stock distribution should be implemented.

The reduction in F intended by the recovery plan for southern hake and *Nephrops* stocks appears to be consistent with the present ICES advice for *Nephrops* in FUs 28–29 and 30. For FUs 26–27, however, stronger measures are required to prevent a collapse of the stock. The assessment for all three stocks is too uncertain to allow the calculation of a precise TAC corresponding to the 10% reduction of F implied by the recovery plan.

Factors affecting the fisheries and the stock

The effects of regulations

Nephrops represents a small but valuable bycatch in fisheries targeting mainly demersal fish species. In FUs 28–29 there is a crustacean trawl fishery, targeting mainly deepwater crustaceans. These vessels are licensed to take *Nephrops* with 70-mm mesh codends, but it is not clear whether this mesh is actually used rather than the smaller 55-mm mesh for shrimp. For these FUs, a Portuguese national regulation (Portaria no. 1142/2004, 13th September 2004) enforced a complete closure for the deepwater crustacean trawl fishery in January–February and established a ban on *Nephrops* fishing from 15 September to 15 October. Although these periods do not correspond to the main fishing season for *Nephrops*, these measures resulted in some reduction in effort. The ban in September–October was already implemented in 2004. This regulation was revoked in January 2006 after the implementation of the EC recovery plan.

In 2005, the Gulf of Cadiz bottom trawl fleet was not allowed to operate for 45 days in September–October. However, this measure seems not to have had any effect on the *Nephrops* fishery as the main directed effort in FU 30 occurs from April to September.

Changes in fishing technology and fishing patterns

The fishery in FUs 26, 27, and 30 is mainly conducted by Spain, and that in FUs 28 and 29 by Portugal.

The Portuguese fleet comprises of two main components: demersal fish trawlers and crustacean trawlers. The number of trawlers targeting crustaceans has been fixed at 35 since the early 1990s. However, since the late 1990s, some vessels have been replaced by new ones, better equipped and with a more powerful engine.

Scientific basis

Data and methods

LPUE, effort data, and mean size data are available for the FUs of this *Nephrops* Area. Length-composition data are available for FUs 26–27 combined, for FUs 28–29 combined, and for FU 30. Research trawl survey data are available for FUs 28–29, and FU 30. No discard information is available from FUs 26–27, and only preliminary data from the other FUs. In earlier assessments, it has been assumed that discarding of *Nephrops* is minimal in these fisheries.
The stocks in FUs 26–27 and FUs 28–29 were assessed by XSA using catch-at-'age' data generated by 'slicing' of sampled length distributions. These assessments can only be considered as indicative of trends. The assessment for FUs 26–27 was tuned using one commercial LPUE series. That for FUs 28–29 was tuned using data from a commercial trawl fleet and survey data. Assessments were performed for sexes combined for FUs 26–27 and for males and females separately for FUs 28–29. Length compositions of landings have been available since 2001 for FU 30. No analytical assessment was carried out for this stock. For FUs 28–29, exploratory runs with a production model (ASPIC) were performed.

Uncertainties in assessment and forecast

The use of slicing to convert length compositions into age compositions (in FUs 26–29) is uncertain, especially for older age groups (3 and older). The assessments reflect the status of the stocks and their relative trends.

Underwater TV surveys of burrow densities should be considered for future use as a fishery-independent method of quantifying the abundance and distribution of stocks within this *Nephrops* Area.

Comparison with previous assessment and advice

The assessments for FUs 26–27 and 28–29 are in agreement with those presented last year. There is a slight change in SSB levels due to the adoption of a new maturity ogive in 2006.

In FU 30, the effort and LPUE series were revised in 2006 giving an altered perception of stock trends compared to last year, in particular in the early part of the time-series.

The advice for all three stocks remains unchanged.

Source of information

Report of the Working Group on the Assessment of Hake, Monk and Megrim (WGHMM), 10–19 May 2006 (ICES CM 2006/ACFM:29).

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				1.55
1988				1.29
1989				1.35
1990				1.19
1991				1.31
1992		1.3	2.5	1.35
1993		1.3	2.5	1.06
1994		1.3	2.5	0.79
1995		1.3	2.5	0.92
1996		1.3	2.5	0.51
1997		1.3	2.5	0.67
1998		0.5	2.5	0.60
1999		0.5	2.0	0.58
2000		0.5	1.5	0.45
2001		0.5	1.2	0.58
2002		0.17	0.8	0.69
2003	Zero catches for FUs 26–27 and FUs 28–29, catch at the lowest recent level for FU 30	0.05	0.6	0.72
2004	Zero catches for FUs 26–27 and FUs 28–29, catch at the lowest recent level for FU 30	0.05	0.6	0.57
2005	Zero catches for FUs 26–27 and FUs 28–29, catch at the lowest recent level for FU 30	0.05	0.54	0.69
2006	Zero catches for FUs 26–27, 200 tonnes in FUs 28–29, catch at the lowest recent level for FU 30	0.25	0.486	
2007	Zero catches for FUs 26–27, 200 tonnes in FUs 28–29, catch at the lowest recent level for FU 30	0.25		

Weights in '000 t.

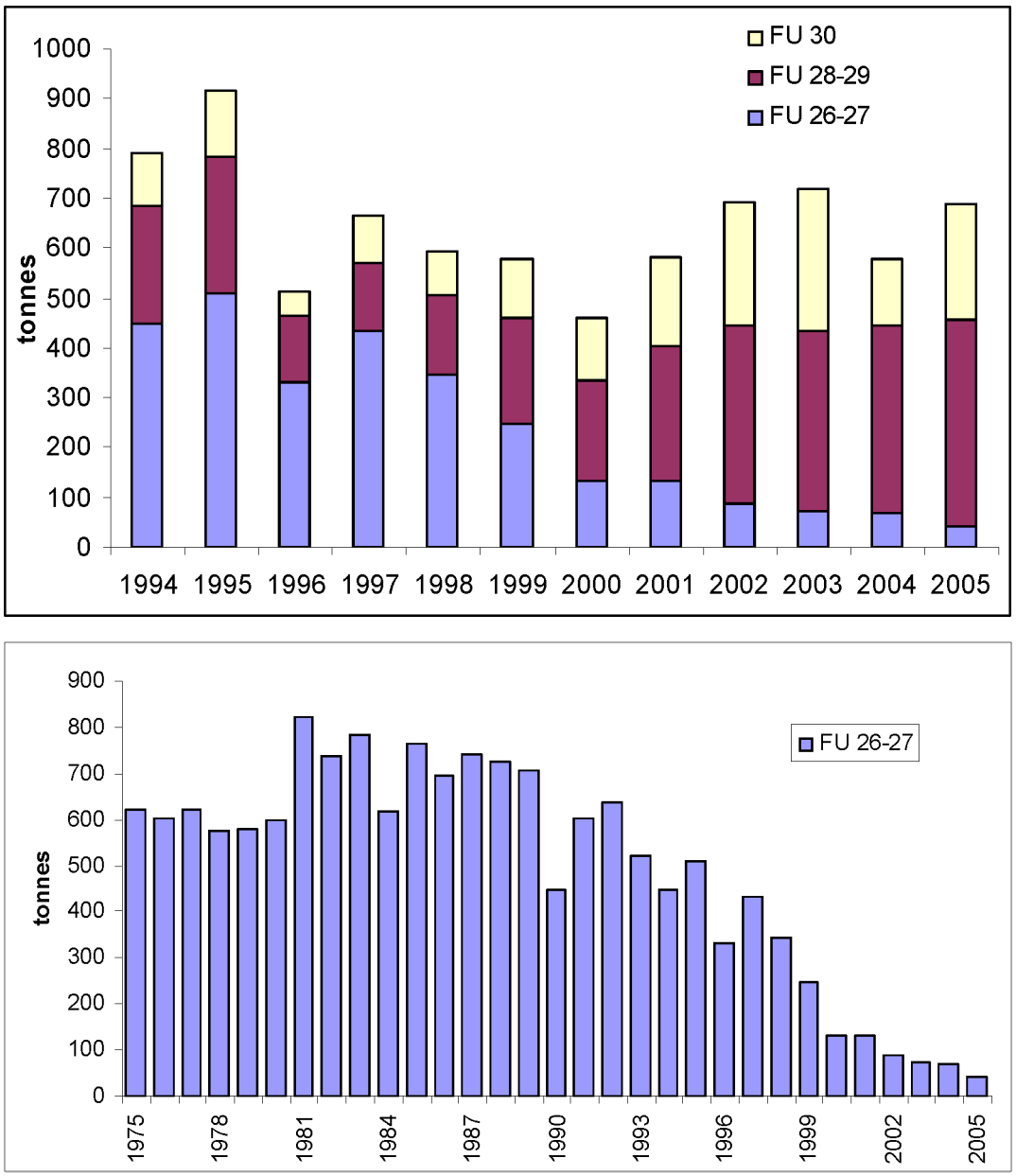


Figure 7.4.10.1 *Nephrops* landings (tonnes) by Functional Unit in Management Area Q (IXa).

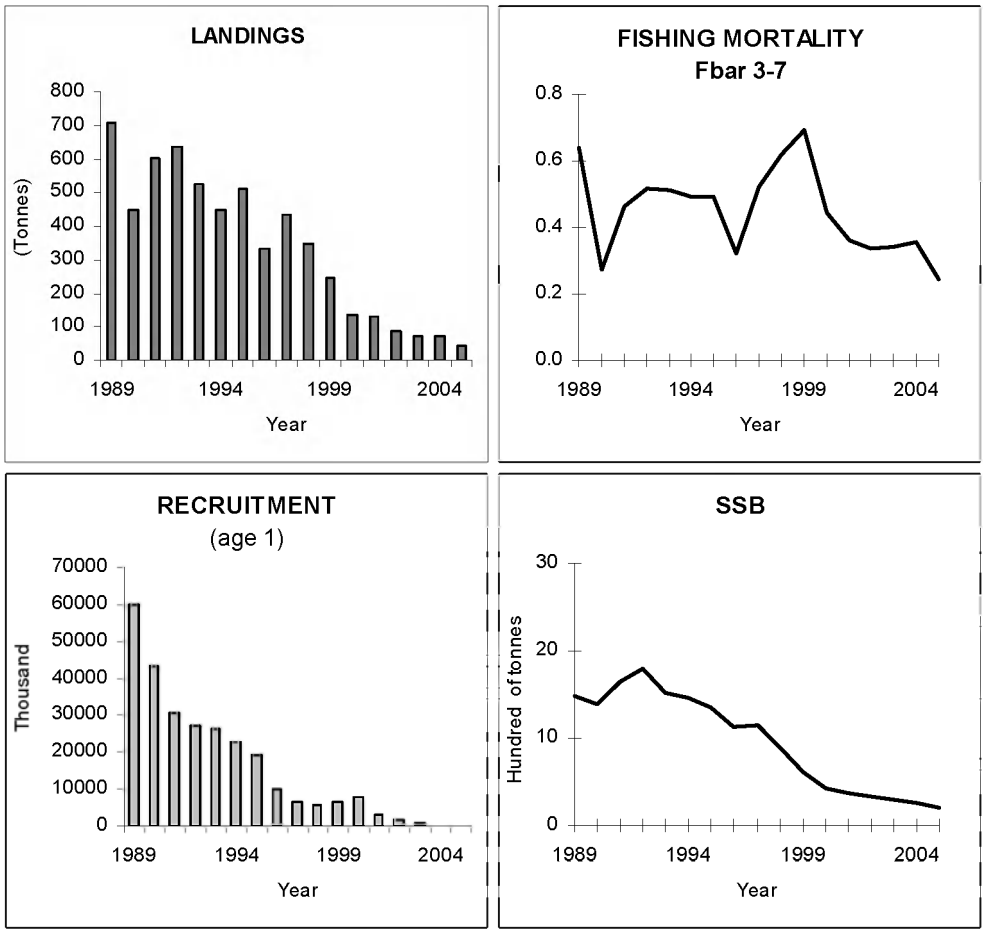


Figure 7.4.10.2 West Galicia & North Portugal (FUs 26–27): Output VPA: Trends in Landings, Fbar, Recruitment, and Spawning-Stock Biomass.

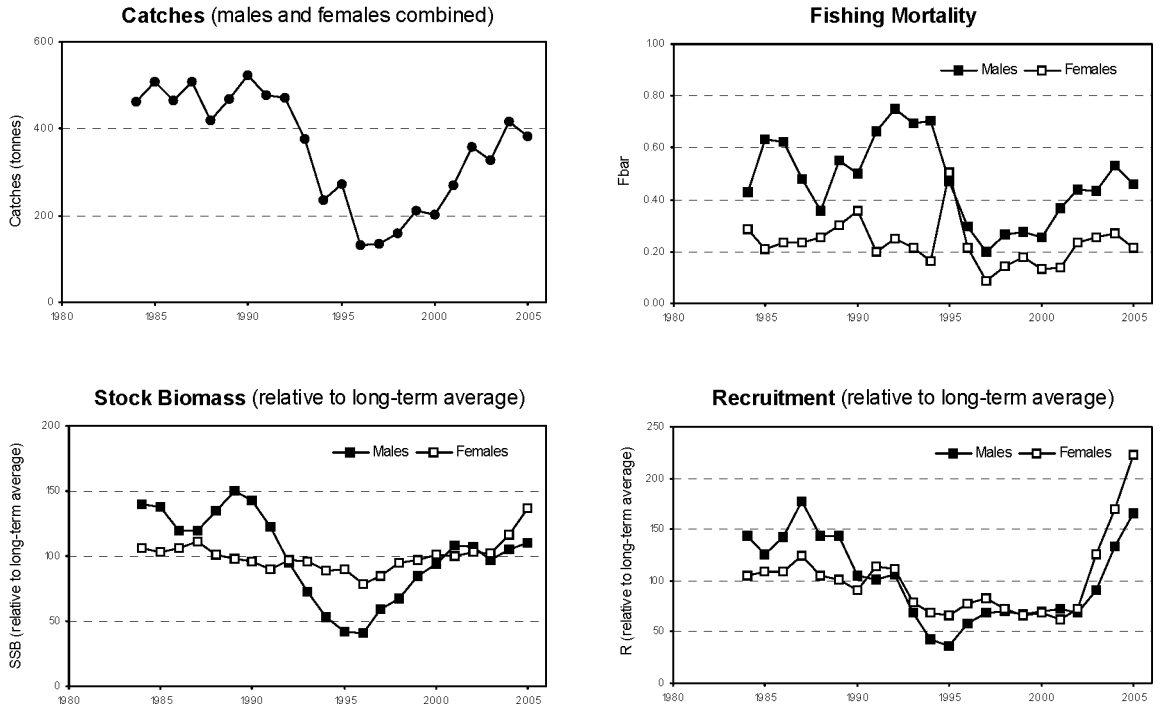


Figure 7.4.10.3 South-West and South Portugal (FUs 28–29): Output VPA: Trends in Catches, Fbar, Stock Biomass, and Recruitment.

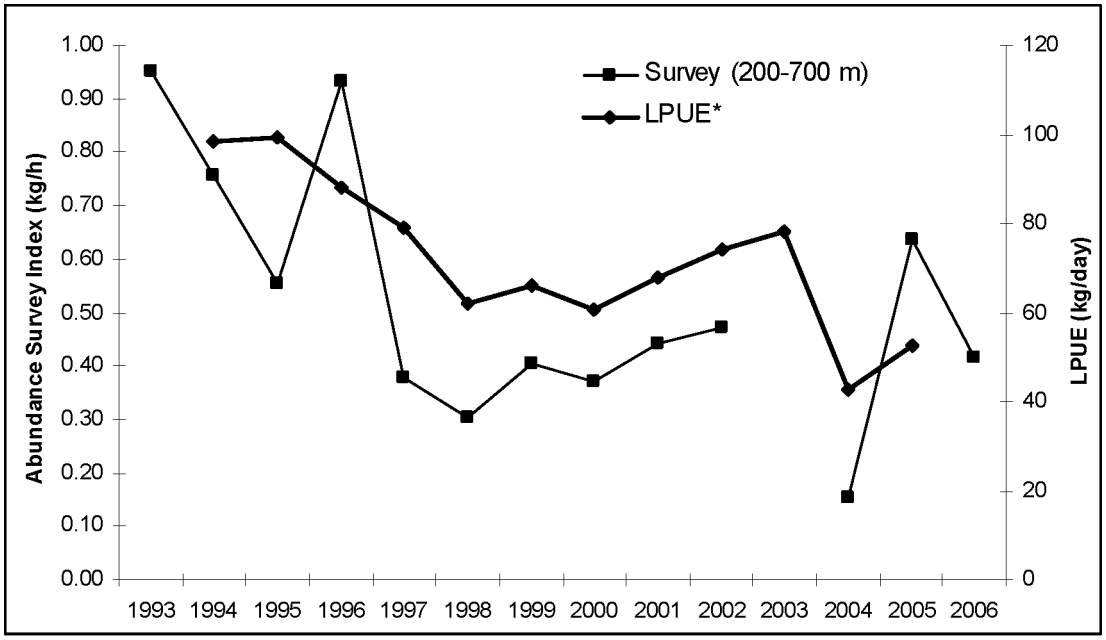


Figure 7.4.10.4 *Nephrops* in FU 30. Trends in survey data (kg/hour) and LPUE (kg/day). LPUE* was estimated from vessels landing at least 10% *Nephrops* per trip.

Table 7.4.10.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area Q (IXa).

Year	FU 26	FU 27	FU 26-27	FU 28-29	FU 30	Other	Total
1994	120	22	306	237	108	0	***793***
1995	117	10	384	273	131	0	***915***
1996	264	67		132	49	0	***512***
1997	359	74		136	97	0	***666***
1998	295	50		161	85	0	***591***
1999	194	54		211	120	0	***578***
2000	102	30		201	129	0	***462***
2001	105	27		271	178	0	***582***
2002	59	28		359	247	0	***693***
2003	39	33		362	285	0	***718***
2004	38	32		375	135	0	***579***
2005*	16	26		413	235	0	***690***
* provisional							

Table 7.4.10.2 *Nephrops* landings (tonnes) by country in Management Area Q (IXa).

Year	Portugal	Spain	Total
1994	259	534	***793***
1995	283	632	***915***
1996	149	363	***512***
1997	142	524	***666***
1998	169	422	***591***
1999	216	362	***578***
2000	210	252	***462***
2001	278	304	***582***
2002	363	330	***693***
2003	373	346	***718***
2004	387	192	***579***
2005*	426	264	***690***
* provisional			

7.4.11 Sole in Divisions VIIIa,b,d (Bay of Biscay)

State of stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Increased risk	Increased risk	Overexploited	Not applicable	

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of reduced reproductive capacity. SSB has declined from the high levels of 1992–94, and has been below $\mathbf{B}_{pa}$ since 1999. Based on the most recent estimates of fishing mortality, ICES classifies the stock as being harvested unsustainably. Fishing mortality has generally increased since 1984 and has been around $\mathbf{F}_{lim}$ from 1992 to 2001. In 2002 the fishing mortality was exceptionally high; and for the past 3 years F has been around $\mathbf{F}_{pa}$. Since 1992 recruitment has been at a lower, but stable level up to 2000. Since then two low recruitments have occurred in 2001 and 2004.

Management objectives

The EC regulation 388/2006 of 23 February 2006 has established a management plan which set the objective of bringing the spawning stock biomass above 13 000 tonnes in 2008. Once the SSB is evaluated by ICES to be equal to or above this level, a long-term target fishing mortality shall be decided as well as a rate of reduction to reach it. The key articles of this "Multiannual plan for the sustainable exploitation of the stock of sole in the Bay of Biscay" are reproduced below:

Article 1. ***Subject matter***

1. This Regulation establishes a multiannual plan for the sustainable exploitation of the sole stock living in the Bay of Biscay (hereinafter referred to as Bay of Biscay sole).

2. For the purpose of this Regulation 'Bay of Biscay' means the area of the sea delineated by the International Council for the Exploration of the Sea (ICES) as Divisions VIIIa and VIIIb.

*Article 2.****Objective of the management plan***

1. The plan shall aim to bring the spawning stock biomass of Bay of Biscay sole above the precautionary level of 13 000 tonnes in 2008 or before and, thereafter, to ensure its sustainable exploitation.

2. This objective shall be attained by gradually reducing the fishing mortality rate on the stock.

*Article 3 .****Legislative measures and annual TAC setting***

1. Once the spawning stock biomass is evaluated by ICES to be equal to or above the precautionary level of 13 000 tonnes, the Council shall decide by qualified majority, on the basis of a Commission proposal, on:

- *(a) a long-term target fishing mortality rate; and*
- *(b) a rate of reduction in the fishing mortality rate for application until the target fishing mortality rate decided under (a) has been reached.*

2. Each year the Council shall decide by qualified majority, on the basis of a proposal from the Commission, on a TAC for the following year for Bay of Biscay sole.

*Article 4.****Procedure for setting the TAC***

1. Where the spawning stock biomass of Bay of Biscay sole has been estimated by the Scientific, Technical and Economic Committee for Fisheries (STECF), in the light of the most recent report from ICES, to be below 13 000 tonnes, the Council shall decide on a TAC which, according to the STECF estimation, shall not exceed a level of catches which will result in a 10 %reduction in fishing mortality rate in its year of application compared to the fishing mortality rate estimated for the preceding year.

2. Where the spawning stock biomass of Bay of Biscay sole has been estimated by the STECF, in the light of the most recent report from ICES, to be equal to or above 13 000 tonnes, the Council shall decide on a TAC which shall be set at a level of catches which, according to the STECF estimation, is the higher of:

(a) that TAC whose application conforms with the reduction in fishing mortality rate that has been decided on by the Council in accordance with Article 3(1)(b);
(b) that TAC whose application will result in the target fishing mortality rate that has been decided on by the Council in accordance with Article 3(1)(a).

3. Where application of paragraph 1 or 2 of this Article would result in a TAC which exceeds the TAC of the preceding year by more than 15 %, the Council shall adopt a TAC which is 15 % greater than the TAC of that year.

4. Where application of paragraph 1 or 2 would result in a TAC which is more than 15 % less than the TAC of the preceding year, the Council shall adopt a TAC which is 15 % less than the TAC of that year.

This plan has not yet been evaluated by ICES.

Reference points

Precautionary approach reference points (changed in 2006):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ not defined.	$\mathbf{B}_{pa}$ be set at 13 000 t. The probability of reduced recruitment increases when SSB is below 13 000 t.
$\mathbf{F}_{lim}$ = 0.58, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ = 0.42.

The F reference points have been revised because the $\mathbf{F}_{bar}$ age range has been changed from 2–6 to 3–6. The rationale for setting the reference points remains unchanged.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3–6	Yield/R	SSB/R
Average last 3 years	0.422	0.231	0.597
$\mathbf{F}_{max}$	0.212	0.248	1.220
$\mathbf{F}_{0.1}$	0.107	0.226	2.143
$\mathbf{F}_{med}$	0.485	0.225	0.513

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

Technical basis

$\mathbf{B}_{lim}$: Not defined.	$\mathbf{B}_{pa}$ ~ historical development of the stock (lowest observed for the converged part of the VPA, i.e. the most recent years are not included).
$\mathbf{F}_{lim}$: based on historical response of the stock.	$\mathbf{F}_{pa}$ = $\mathbf{F}_{lim}$ * 0.72.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Target reference points have not been agreed for this stock. The present F (0.42) is well above the candidate reference point $\mathbf{F}_{0.1}$.

Exploitation boundaries in relation existing management plans

According to the EU management plan, landings should be less than 4540 t in 2007, as they must be less than those resulting in a 10% reduction in F (in 2007 compared to 2005), as long as SSB is below 13 000 t. This catch for 2007 corresponds to a fishing mortality of 0.38, which is below $\mathbf{F}_{pa}$.

Exploitation boundaries in relation to precautionary limits

In order for the predicted SSB to reach $\mathbf{B}_{pa}$ in the short term, F would have to be reduced to 0.41. This implies catches of less than 4830 t in 2007.

Conclusion on exploitation boundaries

Although ICES has not evaluated the agreed management plan, it uses the exploitation boundaries in relation to the management plan as basis for the advice for 2007, as this plan is expected to give higher long-term gains in the present situation and is already implemented. ICES therefore recommends to limit landings in 2007 to 4540 t.

Short-term implications

Outlook for 2007

Basis: F(2006) = $\mathbf{F}_{sq}$ = 0.42; R06-07 = GM = 23 million; SSB(2006) = 12.05 kt; SSB(2007) = 12.55 kt; landings (2006) = 4.73 kt.
The maximum fishing mortality which would be in accordance with precautionary limits ($\mathbf{F}_{pa}$) is 0.42.
The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.21.

Rationale	TAC(2007) [1]	Basis	F(2007)	SSB(2008)	%SSB change	%TAC change
Zero catch	0.00	F=0	0.00	18.42	47%	-100%
Status quo	4.95	Fsq	0.42	12.87	3%	22%
High long-term yield	2.71	F(long term yield)	0.21	15.37	22%	-33%
	0.59	Fsq *0.1	0.04	17.75	41%	-86%
Status quo and	1.42	Fsq *0.25	0.11	16.82	34%	-65%
Agreed	2.72	Fsq *0.5	0.21	15.36	22%	-33%
Management Plan	3.87	Fsq *0.75	0.32	14.07	12%	-5%
	4.54	Fsq *0.9	0.38	13.33	6%	12%
	4.95	Fsq *1	0.42	12.87	3%	22%
	5.34	Fsq *1.1	0.46	12.43	-1%	32%
	5.88	Fsq *1.25	0.53	11.83	-6%	45%
	0.59	TAC(Fpa) *0.1	0.04	17.76	41%	-86%
	1.42	TAC(Fpa) *0.25	0.11	16.82	34%	-65%
	2.71	TAC(Fpa) *0.5	0.21	15.37	22%	-33%
	3.87	TAC(Fpa) *0.75	0.32	14.07	12%	-5%
	4.51	TAC(Fpa) *0.9	0.38	13.35	6%	11%
	4.83	TAC(Fpa) *0.97	0.41	13.00	4%	18%
Precautionary limits	4.95	Fpa = Fsq *1	0.42	12.87	3%	22%
	5.34	TAC(Fpa) *1.1	0.46	12.43	-1%	32%
	5.88	TAC(Fpa) *1.25	0.53	11.83	-6%	45%
	6.75	TAC(Fpa) *1.5	0.63	10.86	-13%	66%
	7.53	TAC(Fpa) *1.75	0.74	10.00	-20%	86%
	8.25	TAC(Fpa) *2	0.84	9.21	-27%	103%
	9.26	TAC(Fpa) *2.25	0.95	8.08	-36%	128%
Mixed Fisheries						

All weights in thousand tonnes.
(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.
Shaded scenarios are not considered consistent with the Precautionary Approach .

Management considerations

The SSB has been below $\mathbf{B}_{pa}$ since 1999. Fishing mortality has been reduced in recent years and the SSB is expected to increase towards $\mathbf{B}_{pa}$ in the short term with a further reduction in F.

The management plan introduced by the EU in 2006 has not yet been evaluated by ICES, and some elements in the plan are not clearly specified. In the short term, the SSB is expected to reach $\mathbf{B}_{pa}$ in 2008 if the plan is implemented and the recruitment is at an average level as assumed in the prediction. However, there have been some weak year classes in recent years, hence stronger reductions in F may be needed to reach the target SSB in 2008.

Ecosystem considerations

Studies in Vilaine Bay showed a significant positive relationship between the fluvial discharges in winter-spring and the size of the local nursery. The extent of the river plume influences both the larval supply and the size and biotic capacity of habitats in estuarine nursery grounds and determines the number of juveniles produced. This localised effect is not apparent on the scale of the whole VIIIabd stock and therefore the impact of this relationship was not taken into account in stock projections.

Environmental conditions have a large influence on the catches of sole in the first quarter. This was particularly true in 2002 when hydrodynamic conditions were very favourable to the fixed net fishery (frequent strong swell periods in the first quarter). More usual hydrodynamic conditions have been observed in the beginning of the following years.

Factors affecting the fisheries and the stock

Effects of regulations

The landings of sole in the Bay of Biscay are subject to a TAC regulation. Restrictive TACs since 2002 have been exceeded particularly in 2002 and failed to reduce fishing mortality as much as recommended. The minimum landing size is 24 cm and the minimum mesh size in the directed sole fishery is 70 mm for trawls and 100 mm for fixed nets. To comply with the northern hake recovery plan, the minimum mesh size for trawls has since 2002 had to be increased to 100 mm in a large part of the Bay of Biscay. In 2006, and only for one year, otter-trawlers using a square mesh panel are allowed to use 70-mm mesh size in this area. Given the predominance of gillnet catches this may have a limited impact on the sole stock.

The Belgian beam trawlers are subject to trip catch controls. The Belgian quota is less than 2% of the TAC, but exchange with the Netherlands normally occurs to increase Belgian fishing possibilities.

Changes in fishing technology and fishing patterns

The French fixed net fishery for sole, taking place mainly in the spawning season, has increased from less than 5% of landings prior to 1985, to around 70% in recent years .This shift between the fleets has resulted in a change of the selection towards older fish.

Scientific basis

Data and methods

An age-based analytical assessment was conducted based on landings and CPUE data series from surveys and commercial fleets. Partial discard information is available from 1984 to 2003, but is no longer included in the assessment in 2004 because of the low contribution of discards to the catch and therefore to the assessment. No recruitment indices are available for this stock. Data prior to 1984 are not considered reliable. An observed maturity ogive based on females has been used since 2001.

Information from the fishing industry

A meeting with some representatives of the fishing industry in France was held prior to the Working Group meeting. Information provided on the activities of La Rochelle and Les Sables fleets by fishers' organisations in 2005 validate the revision of tuning fleet data carried out last year.

Uncertainties in assessment and forecast

This assessment is tuned almost entirely by commercial fleets. Although the data examination conducted in 2005 allows some confidence in the LPUE trends, they may not reflect the abundance trend exactly. The lack of fishery-independent survey data for this stock is considered to be an important deficiency of the assessment, and also of the prediction when estimating the incoming recruitment. The catch forecast and SSB is driven by the assumed mean recruitment (80% of the 2007 landings and 60% of the 2008 SSB). The apparent increased frequency of weak year classes in recent years leads to increased uncertainty in the predictions.

An age-reading discrepancy causes a difference between the French and Belgian numbers-at-age distribution and the weights-at-age. The impact of this depends on the accuracy of French age readings as the catch is dominated by France.

Comparison with previous assessment and advice

The reference ages for the calculation of the fishing mortality have been altered this year, from 2–6 to 3–6, to account for the low number of 2-year-old fish in the catch. Limit and precautionary approach F reference points have been updated accordingly, without changing the basis for these.

Recent estimates of fishing mortality and SSB are consistent with last year's estimates, but the GM recruitment assumed last year has been revised downwards.

The assessment and advice this year is consistent with last year's advice.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, 27 June–6 July 2006 (ICES CM 2006/ACFM:33).

Year	ICES Advice	Single-stock exploitation boundaries	Catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed		-		4.4	4.4	5.1	0.2[3]	5.3
1988	Precautionary TAC		3.7		4.0	4.4	5.4	0.3[3]	5.6
1989	No increase in effort; TAC		4.5		4.8	5.8[1]	5.8	0.4[3]	6.2
1990	No increase in F; TAC		5.1		5.2	5.5[1]	5.9	0.3[3]	6.2
1991	Precautionary TAC		4.7		5.3	4.7[1]	5.6	0.2[3]	5.8
1992	F = F(90)		5.0		5.3	6.4[1]	6.6	0.1[3]	6.7
1993	No long-term gain in increasing F		-		5.7	6.5	6.4	0.1[3]	6.5
1994	No long-term gain in increasing F		-		6.6	7.1	7.2	0.2[3]	7.4
1995	No long-term gain in increasing F		5.4[2]		6.6	5.9	6.2	0.1[3]	6.3
1996	No increase in F		5.0		6.6	4.3	5.9	0.1[3]	6.0
1997	40% reduction in F		3.1		5.4	5.0	6.3	0.1	6.4
1998	No increase in F		7.6		6.0	4.4[4]	6.0	0.1	6.1
1999	Reduce F below $\mathbf{F}_{pa}$		< 5.0		5.4	3.8[4]	5.2	0.2	5.4
2000	F at $\mathbf{F}_{pa}$		< 5.8		5.8	5.9[4]	5.7	0.1	5.8
2001	TAC 2001 at most TAC 2000		< 5.8		6.3	5.2[4]	4.8	0.0	4.9
2002	Establish rebuilding plan or no fishing		-		4.0	4.0	5.5	0.0	5.5
2003	Establish rebuilding plan or no fishing		-		3.8	4.1	4.1	0.0	4.0
2004	[5]	65% reduction in F or recovery plan	[5]	<2.0	3.6	4.1	4.0	-	4.0
2005		F at $\mathbf{F}_{pa}$		<4.1	4.14	2.5	4.4	-	4.4
2006		F at $\mathbf{F}_{pa}$		<4.2 or management plan	4.06				
2007		Management plan: 10% reduction in F		4.54					

Weights in '000 t.
[1]Not reported for all countries. [2]Landings assuming current discarding practise. [3] Discards revised in 1998. [4] Preliminary. TAC in 2001 increased from 5.8 to 6.3 in Nov. [5] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.

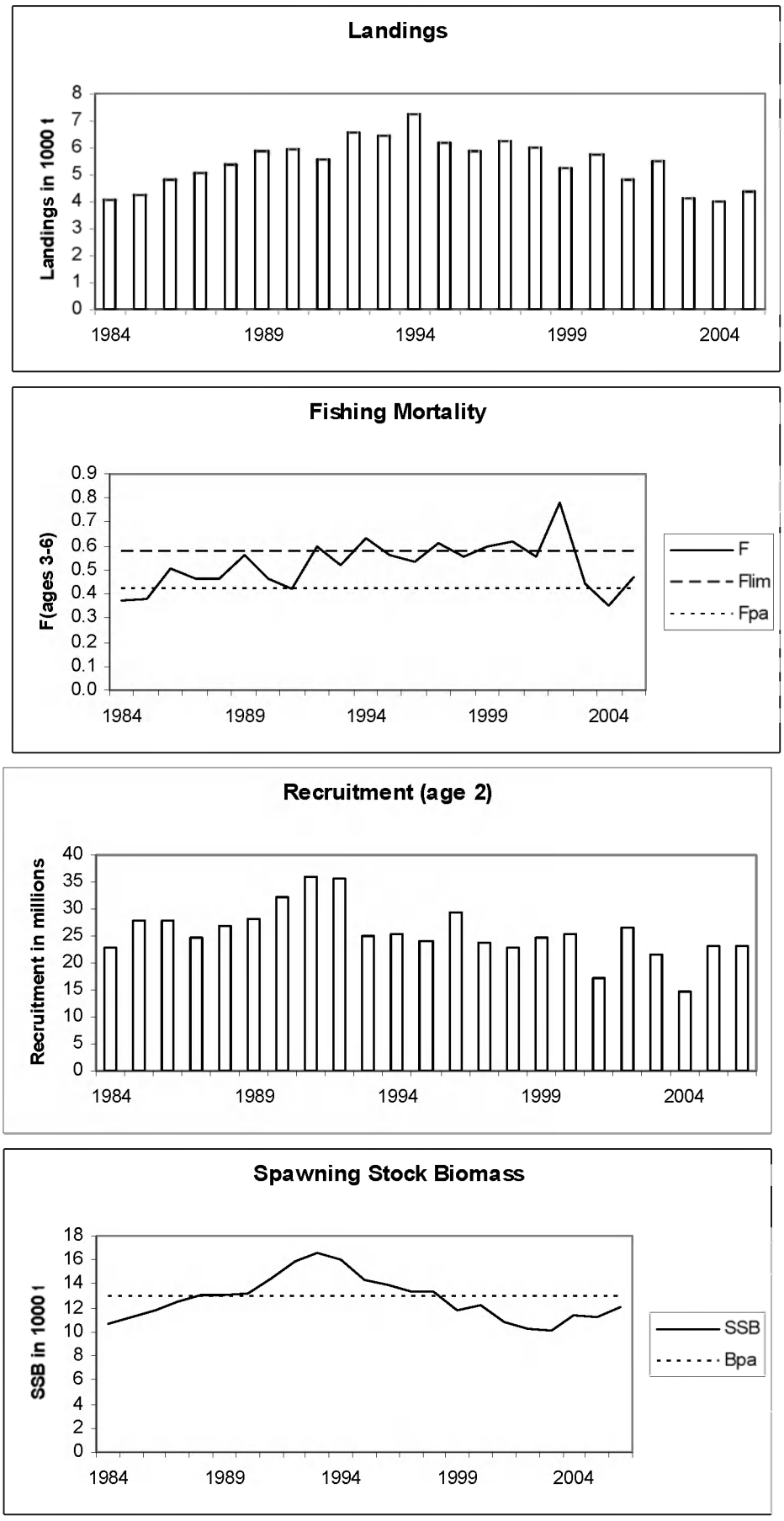
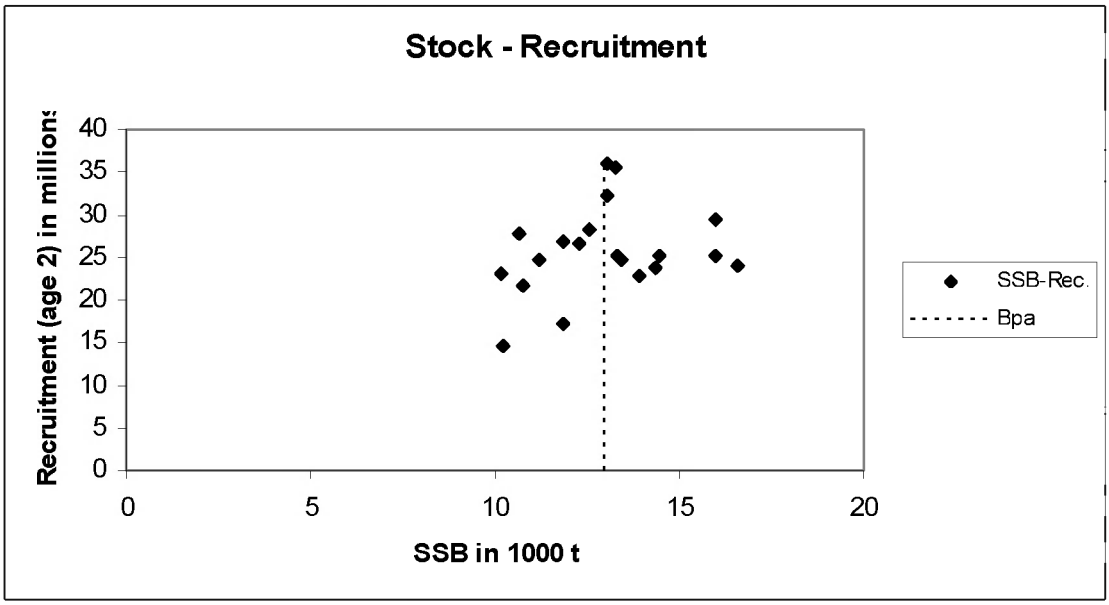
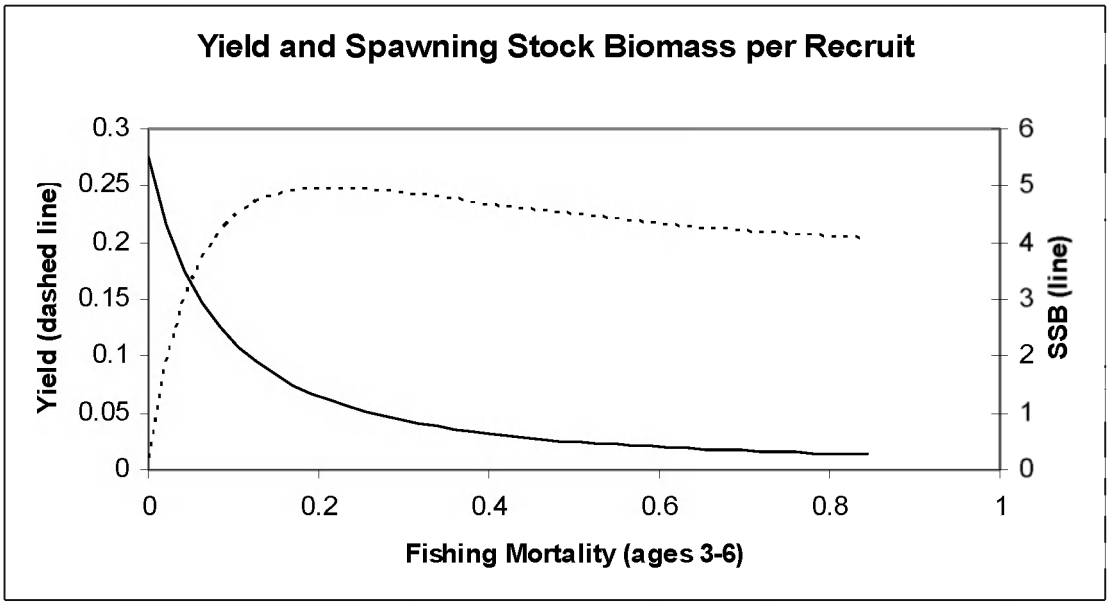


Figure 7.4.11.1 Sole in Divisions VIIIa,b (Bay of Biscay). Landings, fishing mortality, recruitment and SSB.





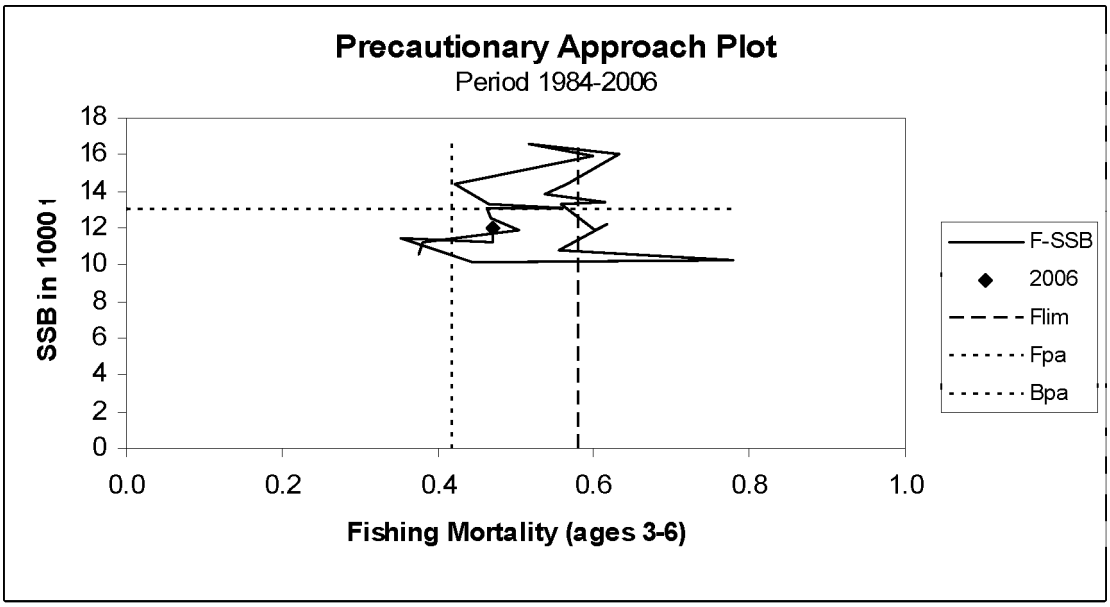


Figure 7.4.11.2 Sole in Divisions VIIIa,b (Bay of Biscay). Stock and recruitment; Yield and SSB per recruit.

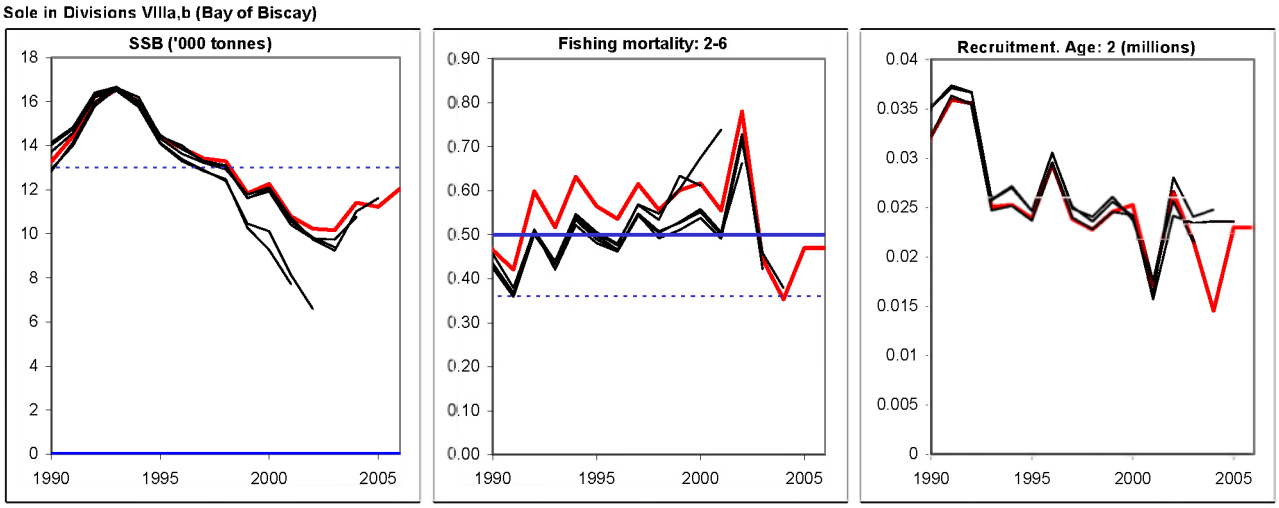


Figure 7.4.11.3 Sole in Divisions VIIIa,b (Bay of Biscay. Historical performance of the assessment (SSB, Fishing mortality and recruitment)

Table 7.4.11.1 : Bay of Biscay sole (Division VIIIa,b). Internationnal landings and catches used by the Working Group (in tonnes).

	Official landings						Unallocated	WG	Discards[1]	WG
Years	Belgium	France	Nether.	Spain	Others	Total	landings	landings		catches
1979	5*	2376		62*		2443	176	2619	-	-
1980	33*	2549		107*		2689	297	2986	-	-
1981	4*	2581*	13*	96*		2694	242	2936	-	-
1982	19*	1618*	52*	57*		1746	2067	3813	-	-
1983	9*	2590	32*	38*		2669	959	3628	-	-
1984		2968	175*	40*		3183	855	4038	99	4137
1985	25*	3423	169*	308*		3925	326	4251	64	4315
1986	52*	4227	213*	75*		4567	238	4805	27	4832
1987	124*	4009	145*	101*		4379	707	5086	198	5284
1988	135*	4308				4443	939	5382	254	5636
1989	311*	5471*				5782	63	5845	356	6201
1990	301*	5231				5532	384	5916	303	6219
1991	389*	4315		3		4707	862	5569	198	5767
1992	440*	5919				6359	191	6550	123	6673
1993	400*	6083		13		6496	-76	6420	104	6524
1994	466*	6620		17***		7103	123	7226	184	7410
1995	546*	5325		6***		5877	328	6205	130	6335
1996	460*	3843		13***		4316	1537	5853	142	5995
1997	435*	4526		23***	1	4985	1274	6259	118	6377
1998	469*	3821	44	40***	1	4375	1607	5982	127	6109
1999	504*	3280		41***		3825	1424	5249	110	5359
2000	451	5293		95***	1	5840	-81	5759	51	5810
2001	361	4361	201	224***	1	5148	-320	4828	39	4867
2002	303	3680		27***	1	4011	1456	5467	21	5488
2003	296	3805		12***	3	4116	-10	4106	20	4126
2004	324	3739		54***	11	4128	-138	3990	-	-
2005	358	2139**		0	1	2498	1871	4369	-	-

* reported in VIII

** Preliminary

*** reported as *Solea* spp (*Solea lascaris* and *solea solea*) in VIII

[1] Discards = Partial estimates for the French offshore trawlers fleet

Table 7.4.11.2 : Bay of Biscay sole (Division VIIIa,b). Contribution (in %) to the total french landings by differents fleets.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Shrimp trawlers	7	7	8	11	6	5	5	3	3	2	2	2	1	1
Inshore trawlers	30	29	28	26	32	30	34	27	29	26	18	14	14	13
Offshore trawlers	60	61	59	59	58	57	38	42	46	47	43	43	42	33
Fixed nets	3	3	5	4	4	6	23	28	22	25	37	41	43	53

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Shrimp trawlers	1	1	0	0	0	0	0	0	0	0	0	0	0
Inshore trawlers	14	12	14	13	12	11	6	9	10	8	9	10	9
Offshore trawlers	30	31	28	28	32	33	27	23	23	19	26	25	25
Fixed nets	55	56	58	59	56	56	67	68	67	73	65	65	66

Table 7.4.11.3 Sole in Divisions VIIIa,b (Bay of Biscay).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1984	22842	10635	4038	0.375
1985	27819	11208	4251	0.381
1986	27851	11868	4805	0.504
1987	24748	12533	5086	0.467
1988	26796	13038	5382	0.462
1989	28220	13043	5845	0.561
1990	32262	13275	5916	0.465
1991	35909	14435	5569	0.421
1992	35561	15955	6550	0.599
1993	25096	16554	6420	0.517
1994	25290	16000	7227	0.632
1995	23930	14372	6205	0.565
1996	29375	13888	5854	0.536
1997	23865	13412	6259	0.615
1998	22786	13290	5982	0.557
1999	24591	11842	5249	0.601
2000	25288	12260	5760	0.617
2001	17169	10787	4828	0.555
2002	26601	10229	5485	0.780
2003	21553	10163	4106	0.444
2004	14535	11405	3990	0.353
2005	22971	11226	4369	0.470
2006		12051		
Average	25566	12760	5372	0.519