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VOLUME 7

Section **Page**

1 BAY OF BISCAY AND IBERIAN SEAS

1.1 Ecosystem Overview

1.1.1 Ecosystem components

General description

Four different areas can be distinguished in the eco-region G, (i) the eastern Bay of Biscay, (ii) the Cantabrian Sea, with a diminishing Atlantic influence towards the interior of the Bay of Biscay, (iii) the west coast of the Iberian Peninsula with seasonal coastal upwelling in summer and constituting the northern limit of the Eastern North Atlantic Upwelling Region and (iv) the Gulf of Cadiz area with strong influence of the Mediterranean Sea. Within these zones the topographic diversity and the wide range of substrates result in many different types of coastal habitat (OSPAR, 2000). Bottom topography, substrates, and circulation

Bottom: The continental shelf in the northern Bay of Biscay has more than 140 km wide and gentle slopes, and becomes narrower to the south. 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 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 eco-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.

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. Contoured deposits occur in the Cantabrian Sea and, particularly 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 on the Galician shelf it appears also to be 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 sub-polar 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}).

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 and Le Cann, 1990). In the Cantabrian Sea the surface currents generally flow eastwards during winter and spring and change westwards in the summer. These changes in the direction of currents produce seasonal coastal upwellings. The circulation on 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). 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).

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).Another important feature 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 fjord-like lagoons (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 distances in the North Atlantic.

Physical and chemical oceanography (temperature, salinity, nutrients)

The 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 the western Cantabrian Sea, especially in summer (Fiuza *et al.,* 1982, Blanton *et al.,* 1984). The appearance of upwelling pulses during the summer is important in fuelling nutrients in the surface layer. 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. 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 the Northeast Bay of Biscay, mainly in summer, weak upwelling events occur off South Brittany and the Landes coastline (Fig 2.19).

Mean wind speed in the Bay of Biscay decreased in the first half of the 20th century and then increased to speeds comparable to the 1840–70s. The windspeed during the 1990s was greater by 1 m s^{-1} compared to 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 interannual variability at each station (Planque *et al.,* 2003). Regarding off the Northwest Iberian coast 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).

Rivers represent the principal sources of freshwater. On yearly average, the French region received 27 000 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 average of the last 10 years, and preliminary data indicate that in 2004 the flow is close to the long-term average (Figure 2.20). Off 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 Garone or Loira. On the other hand, on the Northwest Spanish coast the "*rias*" constitute an important sediment and fresh water source, although river plumes have smaller importance than in France.

Mean surface water temperatures increased 1.4ºC in the southeast Bay of Biscay for the period 1972–1993 (0.6ºC per decade), and 1.03°C over the last century (Koutsikopoulos, 1998; Planque *et al.,* 2003). The increase in heat content stored in the water column appears to be greater in the 200–300 m layer (González-Pola and Lavín, 2003); in this layer ENACW responds quickly to climatological forcing.

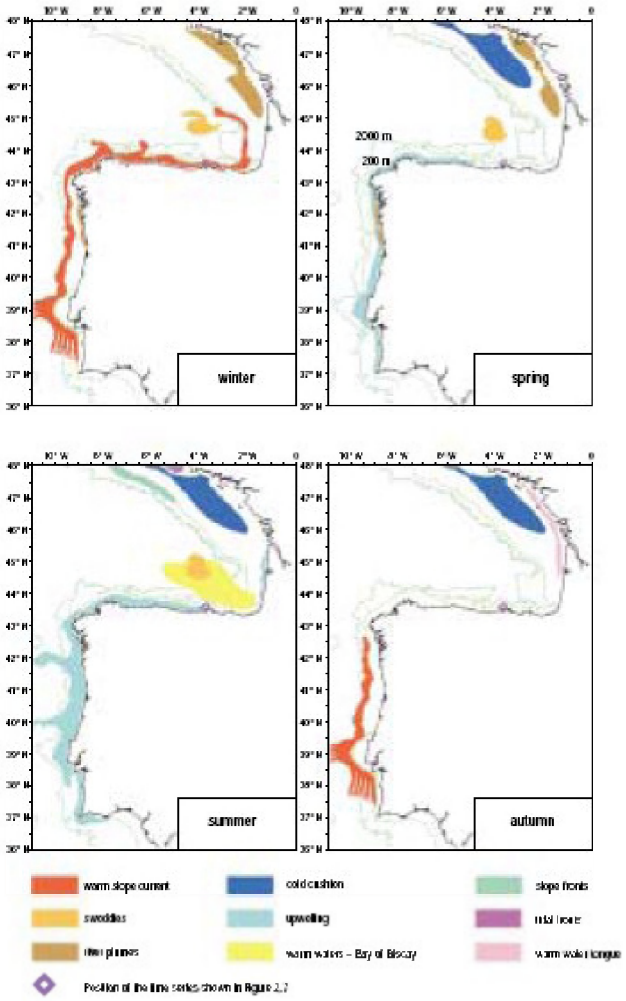

Figure 2.19. Seasonal variation in the main hydrographic features. Source: Koutsikopoulos and Le Cann (1996).

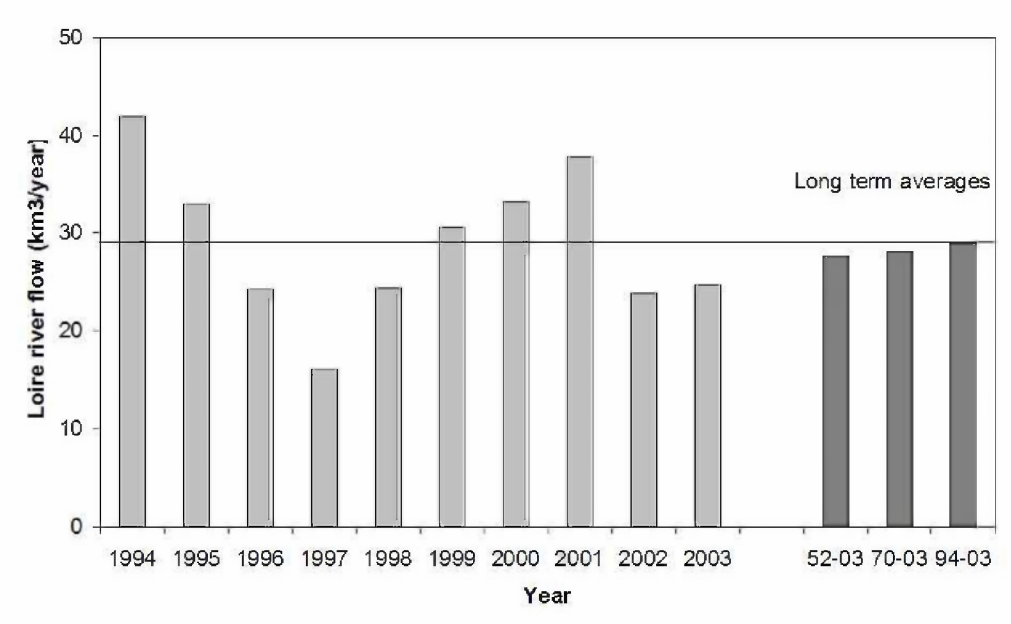

Figure 2.20 Time-series of the river Loire outflow. Data from the French data bank on hydrology and hydrometry, available at http://hydro.rnde.tm.fr/

Broad-scale climate and 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 to the increase in northerly winds during the 1970s.

Phytoplankton

In the Bay of Biscay the onset of the spring bloom occurs with remarkable regularity in March; 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. 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 especially during upwelling events, while microflagellates and small naked dinoflagellates dominate during winter. Small dinoflagellates dominate offshore warmer stratified waters (Valdés *et al.,* 1991 ; Fernandez and Bode, 1994 ; Varela, 1996 ; Casas *et al.,* 1997).

In the Northern and Central Iberia the main patterns of phytoplankton biomass are related to water column stratification, nutrient availability and the intensity and persistence of upwelling conditions. Maximum values of chlorophyll usually occur in spring (can occur from February) and summer (Nogueira *et al.,* 1997; Moita, 2001), although high chlorophyll values may also be recorded in autumn, particularly in zones with elevated retention characteristics. 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). In summer, a recurrent band of high chlorophyll concentration is found near the coast and associated with upwelled waters and strong cross-shelf gradients that separate upwelled and oceanic waters (Figure 2.22). Maximum values of chlorophyll near the coast occur in surface waters, while offshore these extend in a subsurface maximum which coincides with the nutricline (Moita, 2001; Tilstone *et al.,* 2003). Pulses of weak to moderate upwelling disrupt stratification and bring nutrients into the photic zone allowing phytoplankton growth on the inshore side of a well-developed thermal front, at the same time as stratified oceanic waters are poor in phytoplankton due to nutrient depletion (Moita, 2001). During strong upwelling events and weak thermal stratification, features typical of early spring, phytoplankton blooms are advected from the coast and occur on the oceanic side of a poorly developed upwelling front (Figure 8). Under these conditions, chlorophyll maxima are often found in an area of convergence or retention formed by poleward-flowing slope water which serves as a barrier to the offshore flow of surface upwelled waters (Moita, 2001; Santos *et al.,* 2004).

Zooplankton

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.

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.

In relation to the summer upwelling, the regional zooplankton biomass production is highest off Galicia where in several months it surpasses 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 2.22) (Llope *et al.*, 2002).

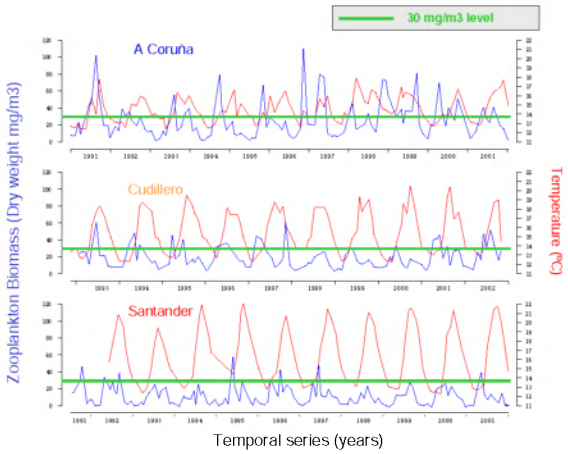

Figure 2.21 (Llope *et al.*, 2002; modified by Valdés)

Regarding the whole Bay of Biscay, since 1992, temporal and spatial biomass distribution of mesozooplankton (200–2000 µm) shows the same patterns as described for phytoplankton, with biomass values of ~70 mg DW m^{-3} just after the phytoplankton spring bloom. After the spring bloom zooplankton decreases, showing a patchy distribution with some hot spots in connection with upwelling regions and freshwater plumes. Abundances in oceanic and oligotrophic waters of the Bay of Biscay basin remain very low most of the time.

Benthos

The bathymetric differences in species distribution in the Cantabrian Sea show a progressive decrease by depth in mean fish species richness (Sanchez, 1993). In contrast the inverse phenomenon appears in invertebrates (Olaso, 1990), which prefer deeper water and muddy substrates due to their predominantly detritivorous feeding habits.

Off the North Spanish coast, the distribution of both epibenthic and endobenthic communities is determined by depth as the main driving factor, followed by sediment characteristics (grain size and organic contents). In the Cantabrian Sea, as for the rest of the communities there is an increase of the presence of Mediterranean species westwards, which is more evident in the littoral and not so clear in the shelf communities.

The eco-region is locally suitable for aquaculture, e.g. >200 000 tonnes per year of mussels from raft aquaculture in the Iberian area, and the invertebrates exploited by fisheries are: red shrimp (*Aristeus antennantus*), rose shrimp (*Parapeneus longirostris*), *Nephrops*, and Cephalopods (*Octopus vulgaris*, *Sepia officinalis*, *Loligo* spp., and others).

Fish community

Species composition and diversity

The main pelagic species are sardine, anchovy, mackerel, horse mackerel, and blue whiting. To the south, chub mackerel (*Scomber japonicus*), Mediterranean horse mackerel (*Trachurus mediterraneus*) and blue jack mackerel (*T. picturatus*) are common, too. Seasonally, albacore (*Thunnus alalunga*) occur along the shelf break. The main commercial demersal species caught by the trawl fleets are hake, blue whiting, megrims (*Lepidorhombus boscii* and *L. whiffiagonis*), anglerfishes and sole. Horse mackerel is also an important target for these fleets. Most of these demersal species are distributed throughout the eco-region, although not evenly.

In the demersal habitats major elasmobranch species are the rays, *R. clavata* and *R. montagui*, and the catsharks, *S. canicula* and *G. melastomus*, found at the coast and on the inner and outer shelf, respectively (Rodríguez-Cabello *et al.*, 2004). In deeper waters, several deepwater sharks and chimaeroids are found (Sánchez and Serrano, 2003; Lorance *et al.*, 2000), and among the pelagic species only blue shark (*Prionace glauca*) is a target species for longliners operating in the area during the summer.

Fish diversity is quite high in relation to the co-occurrence of sub-tropical, temperate, and boreal species, whose relative abundances follow latitudinal gradients. More than 200 species occur in the demersal survey in the North East Bay of Biscay (Bertrand *et al.*, 2004). Only 5 species comprise more than 50% of the total biomass and abundance of demersal

fish (Blanchard, 2001). The 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). Species richness is highest in coastal shallow water, down to 50 m (Blanchard, 2001).

Strong environmental gradients in their distribution are found in this area, especially in the Cantabrian Sea; where, due to its narrow and steep shelf, depth is the most influential factor determining the assemblages observed. Regarding species richness and diversity both have remained quite stable during the 1990s, with changes in diversity due to blooms of some species. The only exception is the coastal stratum (70- to 120-m depth), where there was a decrease in richness from 1990 to 1994; but in the rest of the decade this index increased again (Sánchez & Serrano, 2003).

Off west Iberia, species richness seemed to have increased slightly in the 90s, but no clear pattern of diversity was detected over time (Bianchi et al 2000, Sousa et al 2004b). Recently, rare species from North Africa have been reported in the Algarve (Brander *et al.* 2003).

Trophic web

In the northern Iberian shelf ecosystem, most of the biomass and production are contained within the pelagic domain. Phytoplankton grazing is low and 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*).

Sardine, anchovy, mackerel, and horse mackerel have all been found in the diet of cetacean and fish species (e.g. hake, tuna, John Dory, etc., with sardine and anchovy being taken also by mackerel and horse mackerel). Also blue whiting is one of the main preys of many demersal ichtiophagous fishes (Velasco and Olaso, 1998a and 1998b; Preciado *et al.*, Submitted). Decapod crustaceans also play an important role as preys of other benthic fish species as megrims, gurnards, skates, and *Trisopterus* sp. (Rodríguez-Marín, 2002), whereas cephalopods are minor preys for most of the demersal fish predators found in this area (Velasco *et al.*, 2001).

Sardine and anchovy are the main preys of common dolphins (*Delphinus delphis*) (Silva, 1999a; Santos *et al.,* 2004, Meynier, 2004). There is a degree of cannibalism by adults on juveniles and/or eggs when food is scarce (e.g. Silva, 1999b; Cabral and Murta, 2002).

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, e.g. snipe-fish (*Macrorramphosus scolopax*), silver pout (*Gadiculus argenteus*), or the medium-sized blue whiting (*Micromesistius poutassou*). All species are dead when discarded (Pérez *et al.*, 1996).

There is evidence of an important utilization of discards by demersal fishes in Galicia and the Cantabrian Sea (Olaso *et al.*, 1998), indicating that discards probably play an important role as a food source in the trophic web in north Spanish shelf.

Mammals and birds

No information was provided for this meeting.

Mammals

Seven species of mysticeti, twenty-three species of odontocet, and seven species of pinnipeds have been reported in the eco-region. The main habitat and status of these species is summarised in Table 2.2. Detailed information on distribution and migratory patterns is restricted to the most common species.

Table 2.2 Main marine mammal species

Species	Frequency and trends	Habitat, or temporal occurence
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	The whole eco-region
Fin Whale (*Balaenoptera Physalus*)	Fairly Common	Oceanic waters only
Sperm whale (*Physeter macrocephalus*)		Summer aggregation feeding on cephalopods over the continental slope
Cuvier's beaked whale (*Ziphius cavirostris*)	Small permanent numbers	Slope and canyons
Common dolphin (*Delphinus delphis*)	Most common (>50% of strandings)	Continental shelf, slope and oceanic waters
Bottlenose dolphin (*Tursiops truncatus*)	Common	The whole eco-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 behaviour. 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 constitutes up to 70% of the total number of seabirds. Their 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).

Elasmobranchs

This eco-region comprises broad continental shelves and deepwater slopes. The deepwater elasmobranch assemblage is described in the deepwater section and this section gives details of the shelf-dwelling species.

In this region the demersal fauna has a wide diversity of demersal sharks and rays and skates. Within the sharks are the following species: lesser spotted dogfish (*Scyliorhinus canicula*), bull huss (*S. stellaris*), smoothhound (*Mustelus mustelus*), starry smoothhound (*M. asterias*), blackmouth catshark (*Galeus melastomus*), and angel shark (*Squatina squatina*).

Rays and skates: These can be divided into viviparous forms (rays) and ovo-viviparous forms (skates). The species fauna differs from north to south. The main skates in Division VIIIc are thornback ray (*Raja clavata*), cuckoo ray (*L. naevus*), spotted ray (*R. montagui*), blond ray (*R. brachyuran*), undulate ray (*R. undulate*), and small-eyed ray (*R. microocellata*). Further south in XIa *R. miraletus* and *Rostroraja alba* become more abundant. Stingrays, *Dasyatis* spp. are also found in this region, these are viviparous species.

Widely migratory and migratory sharks that occur in this region include: blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrynchus*), porbeagle (*Lamna nasus*), tope (*Galeorhinus galeus*), and spurdog (*Squalus acanthias*). Some of these are taken in mixed demersal fisheries, others in pelagic fisheries, especially for tuna and swordfish. Blue shark and shortfin mako shark are trans-North Atlantic stocks. Spurdog, porbeagle, and tope shark are thought to comprise unitary stocks in the NE Atlantic. The deepwater slopes of the region have a large diversity of different species, and these are dealt with elsewhere.

Impact of the "Prestige" oil spill

Between November 2002 and August 2003 23 000 birds (6000 alive and 17 000 dead) were collected in French, Spanish, and Portuguese coasts as a consequence of the "Prestige" oil spill. 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 less affected species. In general, more than 60% of the oily birds were females (See more at http://www.seo.org/2002/prestige).

1.1.2 The major environmental effects on ecosystem dynamics

Upwelling intensity, and to a 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; Carrera and Porteiro, 2003; Allain *et al.*, 2001; Villamor *et al.*, 2004).

As stated above, demersal and benthic species distribution is determined mainly bathymetrically and by sediment types, these being also related to the mesoscale features mentioned in the previous paragraph, but also with bottom topography and with river outlets.

Global warming has been related to changes in the distribution of several species (Quéro *et al.*, 1998) that are progressively increasing their northernmost distribution limits. Recently, rare species from North Africa have been reported in the Algarve (Brander *et al.*, 2003).

1.1.3 The major effects of the ecosystem on fisheries

Northerly winds and their intensity seem to be related to anchovy recruitment. When upwelling is particularly intense, surface signals can be observed and studied by remote sensing, revealing that upwelled waters are advected offshore and form filaments that extend westward following the 200-m isobaths and transporting biological material towards oceanic waters.

Borges *et al.*, (2003) showed that a NAO positive phase corresponded to a low catch period of sardine, whereas a NAO negative phase coincided with high catches. Also, the strength of upwelling and its indexes have been used to improve environmental stock-recruitment relationships in some pelagic species (Carrera and Porteiro, 2003; Villamor *et al.*, 2004). In relation to the strength of the upwellings and the Navidad current optimal environmental windows have also been defined for some demersal species such as hake and megrims (Sánchez *et al.*, 2003a & 2003b).

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.

1.1.4 The major effects of fishing on the ecosystem

Fishing is the major disturbance to the megafaunal communities of the offshore shelf of the Bay of Biscay. On the Grande Vasière, a sedimentary area trawled for *Nephrops*, species diversity was less and large invertebrates were less abundant in the most exploited areas. In less exploited areas, the dominant species were commercial species and a benthic species sensitive to the physical effects of the fishing gears. In the heavily exploited areas, the dominant species were opportunistic carnivorous species of minor or no commercial interest and there were no fragile invertebrates (Blanchard *et al.*, 2004).

No significant changes in the community of the Bay of Biscay were seen from indicators based on cruises over the period 1987 to 2002 (Table 2.3) (Bertrand, 2004). Further on-going analysis of the effects of fishing and warming observed during the last 3 decades in the Bay of Biscay indicate that the mean trophic level decreased and the biomass ratio of pelagic/demersal increased, consistently with fishing effects (Blanchard *et al.*, 2004b).

In the Cantabrian Sea, the fisheries have a major effect on the structure and dynamics of the ecosystem (Sánchez and Olaso, 2004). They have become more industrialised over the past 50 years, with the catch reaching about 200 000 tonnes per year. Trawlers fish on the muddy bottoms of the shelf, whereas longliners operate mainly on the shelf-break bottoms and gillnets are used on rocky grounds near the coast and shelf-break, a pattern similar to what occurs on the Galician shelf.

Table 2.3 The indicators for the demersal fish community of the Bay of Biscay

Category of Indicator	Indicator	Direction of change
Population	Abundance of populations	1 in 51 decrease ; 20 in 51 increase
	Mean size in the population	3 in 51 decrease ; 0 increase
Community	Total abundance	Stable
	Total biomass	Increase
	Mean weight in the community	Stable
	Mean size in the community	Stable
	Multispecies size spectra Slope Intercept	 Stable Increase

In the long term some large bottom chondrichthyans (*Echinorhinus brucus, Squatina squatina, Raja batis, Raja brachyura, Dasyatis pastanica Myliobatis aquila, Galeorhinus galeus, Mustelus asterias, Raja clavata*) and teleosts *Trigla lyra* 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 and rays seem more subject to adverse impact.

The sturgeon (*Acipenser sturio*) is a critically endangered species due to fishing and alteration of freshwater habitats. The blackspot (=red) seabream (*Pagellus bogaraveo*) is depleted in the Bay of Biscay, which might be regarded as a major change in the fish community as is used to be one of the dominant large fish species, taxonomically different from other main species.

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

Incidental catch of cetaceans

Some incidental catches of mammals were recorded in pelagic trawl fisheries (Morizur *et al.,* 1999). Bycatches in bottom trammel netting for sole also occurs at an unknown level. Over 1998–2003, 200 to 700 strandings per year were recorded, the common dolphin (*Delphinus delphis*) comprising 60% of strandings (Van Canneyt *et al.,* 2004). 30 to 60% of all stranded animals have prints from fishing gears.

1.1.5 Other effects of human use of the ecosystem

Concerning other anthropogenic impacts on the ecosystem it is important to mention the "Prestige" oil spill in front of Galicia's coast in November 2002. This catastrophe affected most of the northern Spanish coast and especially the northern part of Galicia. Nevertheless, up to now the Prestige oil spill has not had an evident direct impact on the demersal stocks in the area, although possible long-term impacts through the food chain or fecundity reductions will require further research. However, there was an indirect and immediate impact on the demersal exploited species because of the reduction of the fishing effort in the Galician area, due to the closures after the oil spill. It is difficult to assess the effect of this reduction in the fishing activity of the fleets.

1.1.6 References

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1.2 The human use of the ecosystem

1.2.1 Fisheries and their impacts

1.2.2 Description of the 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 main Portuguese fisheries in the area are the trawl, artisanal, purse-seine, and longline fisheries.

The trawl fishery comprises two fleet components e.g., the trawl fleet catching demersal fish (65-mm mesh size) and the trawl fleet directed at crustaceans (55-mm mesh size and above 70 mm for Norway lobster). About 100 vessels operate in this fishery, 35 of which are licensed for crustaceans.

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 in the Southwest and South in deeper waters, from 100 to 750 m. The main species landed are: hake, white and black anglerfish, megrim and four-spot megrim, horse mackerel, mackerel, Spanish mackerel, blue whiting, red shrimp (*Aristeus antennatus*), rose shrimp (*Parapenaeus longirostris*), and Norway lobster.

Trawl fishing effort in Portuguese continental waters has been recorded since 1950 until present as hours fished. It can be seen that effort increased until the early 1970s, and has since then decreased to levels similar to those of the 1950s. The artisanal fishery is composed of a large number (around 7500) of small boats, operating mainly inshore and using a variety of gears as gillnets (the majority), seines, beam trawls, longlines, traps, and dredges. Some of these boats are licensed for more than one type of gear. The main species landed are octopus, pouting, horse mackerel, hake, mackerel, and sardine.

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. 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. In mainland Portugal, 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.

During the last three years the total number of trawlers was 110 (35 being crustaceans), with an average of 140 GRT and an average of 500 kW engine power. In 2003, the number of vessels using fixed nets was 468, with an overall length exceeding 12 m, an average GRT of 35.5, and an average of 167 kW. The number of small boats (< 12 m) using fixed nets was around 7500 units, with a mean GRT of 2 and an average of 15 kW engine power.

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.).

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.

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
Long line 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	

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.

Two stocks of **anchovy** are considered in the Iberian Region, one in Subarea VIII and one in Division IXa. The Spanish and French fleets fishing for anchovy in Subarea VIII are well separated both geographically and in time. The Spanish fleet operates mainly in Division VIIIc and VIIIb in spring, while the French fleets operate in Division VIIIb later in summer and winter, and in Division VIIIa during summer.

The number of Spanish purse seiners for anchovy has remained stable since 1990, while a slight increase in the number of French purse seiners has been observed in the last five years.

Traditionally the anchovy fishery in Division IXa is located in the Gulf of Cadiz (Division IXa South). However, in 1995 the bulk of the fishery was located in the North of Portugal and to the West of Galicia (Division IXa North) and

was very reduced in the Gulf of Cadiz, owing to exceptional availability of anchovy in the northern part of Division IXa. In recent years the bulk of the anchovy fishery in IXa has again been located in the Gulf of Cadiz.

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.

Mackerel is a target species for the hand line 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 have been increasing in recent years and reached a maximum of 50 000 t in 2002.

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.

Belgium

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.

France

Table 2.2.2 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 used 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 2.2.2 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 Albaccore	
Divisions VIIIab	Purse-Seine	Sardine, Anchovy	
Divisions VIIIabd	Gill-nets Gill-nets large mesh	Hake Anglerfish	
Divisions VIIIabd	Miscellaneous	Crabs, Bass, Conger…	

1.3 Assessments and advice

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 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 by 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.

ICES can offer the following comments on the fisheries:

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.

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.

At present the Spawning Stock Biomass of sardine is considered high due to the strong 2000 year class; however, the abundance of sardine in some areas of the stock continues to be low when compared to the mid-1980s.

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.

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 2005
	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	
Southern stock of hake (Div. VIIIc and Ixa)	Reduced reproductive capacity	Harvested unsustainably	Overexploited		The *status quo* fishing mortality is estimated at 0.55, which is around the $\mathbf{F}_{lim}$ associated with stock collapse, and well above rates that would support optimal long-term yield and low risk of stock depletion. Candidate target fishing mortalities for a recovery plan for southern hake should be in the range $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.	Fishing mortality is around $\mathbf{F}_{lim}$ and the stock is well below $\mathbf{B}_{lim}$. In the absence of an agreed recovery plan, no catch should be taken from this stock in 2006. A recovery plan should be implemented as a prerequisite to reopening the fishery. The recovery plan should include monitoring the development of the stock, clearly stating specified reopening criteria, and monitoring the fishery when it is reopened.	Zero catch
Nephrops in Divisions VIIIa,b (Management Area N)	Reference points not defined	Reference points not defined				The stock appears to have recovered from a low stock size based on recent landings in the order of 3 500 t. In the absence of reliable catch forecasts, ICES recommends that landings in 2006 should not exceed the recent average of 3 500 t.	Recent average catch 3 500 t
Megrim (*L. boscii* and *L. whiffiagonis*) in Div. VIIIc and IXa	Not defined	Not defined	Appropriate (*L. boscii*), Appropriate (*L. whiffiagonis*)		The current fishing mortality for *L. whiffiagonis*, estimated as 0.13, is lower than rates that would achieve a high long-term yield ($\mathbf{F}_{0.1}$ = 0.15) and low risk of stock depletion. The current fishing mortality for *L. boscii*, estimated as 0.26, is below $\mathbf{F}_{0.1}$ = 0.27.	At recent levels of fishing mortality for both species (*L. whiffiagonis* 0.13 and *L. boscii* 0.32), SSB have been stable or slightly increasing. Fishing mortality should not be allowed to increase. This level of exploitation would correspond to landings in 2006 of around 175 t for *L. whiffiagonis* and 1 006 t for *L. boscii*. The combined landings at the current exploitation level would be around 1 200 t.	1 200

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 2005
	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	
Anglerfish (*L. piscatorius* and *L. budegassa*) in Div. VIIIc and IXa	Not defined	Not defined	Overexploited		No catch or recovery plan	Fishing mortality equal to zero in 2005 is required to bring SSB back to $\mathbf{B}_{MSY}$ in the short term. If this is not possible then a recovery plan should be established that will ensure rapid and safe recovery of the SSB above $\mathbf{B}_{MSY}$. Landings in 2001 and 2002 have apparently brought fishing mortality down to $\mathbf{F}_{MSY}$. This should be considered as an upper bound for landings in a recovery plan.	Zero catch
*Southern horse mackerel (*Trachurus trachurus*) in Div. IXa*	unknown	unknown	unknown			Given the state of the stock and the likely decrease in spawning biomass, fishing effort must not increase and catches in 2006 should not exceed the recent average of 25 000 t (2000–2004, excluding 2003 because of the **"**Prestige**"** accident). The TAC for this stock should only apply to *Trachurus trachurus*.	Recent average catches of 25 000 t
Southern Mackerel Component of NEA Mackerel	Uncertain	Harvested unsustainably	Overexploited	The agreed management plan (F between 0.15 and 0.20) would, assuming catches in the range of 433 000 t in 2005, imply landings between 373 000 t and 487 000 t in 2006 with an expected increase in SSB of 5–10% in 2007 compared to 2005.			

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 2005
	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 Galician West and North of Portugal (FU26-27)	Reference points not defined	Reference points not defined	Cannot be defined			In FUs 26–27, there has been a progressive recruitment failure, and there should be no fishery unless recruitment improves.	FUs 26-27 Zero catch
Nephrops in Div IXa – SW and South of Portugal (FU28-29) (Management Area Q)	Reference points not defined	Reference points not defined	Cannot be defined			In FUs 28–29 the stock appears to have recovered from a low stock size based on recent landings in the order of 200 t (1996–2001) In the absence of reliable catch forecasts, ICES recommends that landings in 2006 should not exceed the recent average of 200 t.	FUs28-29: 200 t
Nephrops in Div Ixa – Cadiz (FU 30) – (Management Area Q)	Reference points not defined	Reference points not defined	Cannot be defined			For FU 30, the information is sparse, and the state of the stock is unclear. As the stock clearly is at least fully exploited, it is recommended not to increase the catches above the lowest recent landings of 50 t.	FU30: 50 t.

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 2005
	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	
Blue whiting combined stock (Subareas I-IX, XII and XIV)	Full reproductive capacity	harvested unsustainably		Fishing within the limits of the management plan (F=0.32) implies catches of less than 1.5 million t in 2006. This will also result in a high probability that the spawning stock biomass in 2006 will be above $\mathbf{B}_{pa}$. The present fishing level is well above levels defined by the management plan and should be reduced. The management plan point 4 calls for a reduction of the catch of juvenile blue whiting which has not been taken place. The primarily approach to reduce catch of juveniles is to reduce overall fishing mortality. Catches of juveniles in the last 4 years are much greater than in earlier periods. If an overall reduction of fishing mortality cannot be achieved then specific measures should be taken to protect juveniles.		Exploitation boundaries in relation to precautionary limits are the same as the exploitation boundaries in relation to the existing management plan.	
Sardine in Divisions VIIIc and IXa	Unknown	Unknown	Unknown			ICES recommends that fishing mortality should not increase above the level in 2002–4 of 0.22, corresponding to a catch of less than 96 000 t in 2006.	Fishing mortality should not increase catch of less than 96 000 t
Anchovy-Sub-Area VIII	Reduced reproductive capacity	Acceptable	Unknown			ICES recommends that the fishery should remain closed and should, at the earliest, be considered for opening if the acoustic and egg surveys in May-June 2006 demonstrate a strong 2005 year class.	ICES recommends that the fishery should remain closed.

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 2005
	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	
Anchovy in Division IXa	Unknown	Unknown	Unknown			*Catches in 2006 should be restricted to 4 700 t (mean catches from the period 1988–2002 excluding 1995, 1998, 2001, and 2002). This level should be maintained until the response of the stock to the fishery is known.* 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.	4 700 t
Black scabbardfish in Div IXa							
Red (=blackspot) seabream in Subareas IX and X							

Identification of critical stocks

The first of the above tables 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 are no catches on *Nephrops* for FU 25, FU 31, and FU 26–27, and a fishing mortality equal to zero in 2006 is required to bring SSB back to $\mathbf{B}_{MSY}$ in the short term for anglerfish. These should also be considered critical stocks.

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

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.

1.3.1 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 FU 26–27: if a rebuilding plan is not implemented then there should be no catches;**
- **For anglerfish and *Nephrops*: rebuilding plans should be established that will ensure rapid rebuilding to precautionary levels, and which ensure large reductions in F in 2006. Such rebuilding plans should imply no catch or discards of southern hake;**
- **Regarding deep-sea species, see Section**

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 FU 31	SP-Trawl	SP-Trawl	SP-Trawl		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nephrops North Galiza FU 25	SP-Trawl	SP-Trawl	SP-Trawl	None		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nephrops West Galiza + 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?	

1.3.2 Special Requests

1.3.2.1 Special request on Anchovy in ICES Subarea VIII

ICES was requested by Spain in August 2005 to

"examine the following questions related to the Anchovy stock in VIII ... in order to have better scientific knowledge of the real situation and define the best standard management procedures in the future".

ICES Comments

The stock situation is, based on all available evidence that of a stock on a very low level. Low recruitment since 2001 and almost complete recruitment failure in 2004 are the primary causes of this low level. Anchovy is a short-lived species and the spawning stock biomass (SSB) is in a given year a direct reflection of the recruitment at age 0 in the previous year through the growth and maturation of the recruits, Figure 1.3.2.1.1.

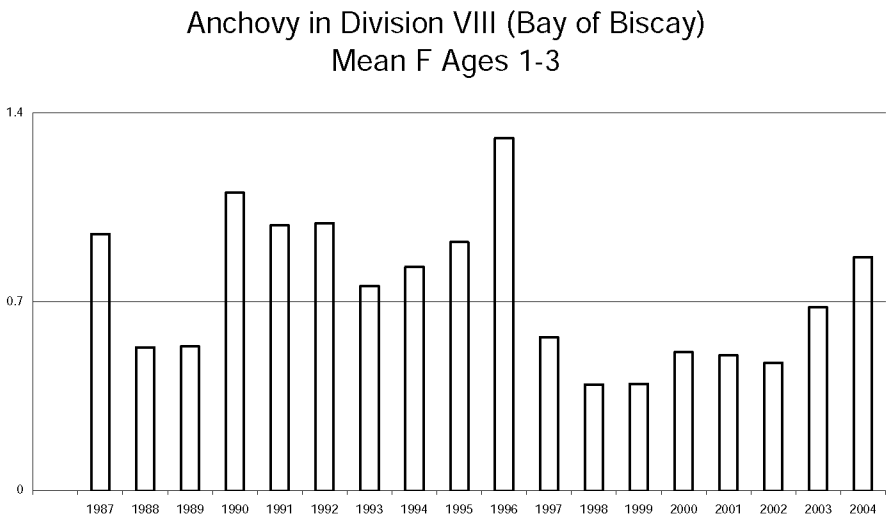
"Is the fishing mortality the main cause of the situation of the Anchovy stock or rather, can it be attributed to other factors?"

Though it is not fully understood how SSB is related to the subsequent recruitment, it is likely that the recruitment will be impaired if SSB becomes very low. However, there are examples when anchovy has produced good year classes from a small SSB.

The anchovy fishery in Biscay catches between 30% and 80% of the SSB When the spawning biomass is low this percentage increases (Figure 1.3.2.1.2). and fishing mortality comprises a significant proportion of the total mortality. Since 2003 fishing mortality has increased as a consequence of industry attempts to maintain catch levels at low SSB. Although poor recruitment is the major reason for the current low SSB, survival from juveniles to adult anchovy has been low; the biomass is further reduced by high fishing mortality.

As mentioned above, there is an increased risk that recruitment will be poor when SSB becomes very low, but anchovy recruitment is also influenced by the environment. The mechanisms are still not fully understood, e.g. the low recruitments of one-year-old fish as observed in 2003, 2004, and 2005 do not seem to be related to environmental conditions. Whether low recruitments most often are driven by low biomass or by environmental factors cannot be concluded.

When the spawning biomass is above $\mathbf{B}_{pa}$, the fishing mortality should be below what would reduce the population by 50% compared to the unexploited state. Such a fishing mortality is considered to be in agreement with the precautionary approach. For anchovy in Division VIII (Bay of Biscay) this implies that fishing mortality should be below ~0.7. On average, fishing mortality between 1990 and 2004 reduced the spawning biomass to about 63% of what would have been the case without exploitation (Figure 1.3.2.1.3). The figure below shows F(ages 1-3) fishing mortality for the period 1987-2004. The figure furthermore shows the F= 0.7 line.



Fishing has been within precautionary limits between 1997 and 2003. Low spawning stock biomass should be counteracted by an increased survival of the juveniles in contrast to the present situation. In recent years, the fishery has compensated low recruitment by high fishing mortality in order to maintain catches. This has further reduced the SSB, possibly to a level where recruitment failure is a concern.

Even though the recruitment under normal conditions is mainly determined by other factors than the SSB, a low SSB may by itself lead to reduced recruitment.

"If since 2001 there were not fishing activity, do you consider anchovy recruitments should be maintained at the same levels?"

In absence of a fishery for the past three years and assuming the same recruitment, the SSB would have been about 140% higher than the current level. How this would have affected recruitment during that period is unknown although higher recruitments would have been more likely than with the current low levels of SSB.

"Situation of the stock is due to small recruitments, reduced SSB or other reasons?"

The "situation of the stock" has been interpreted as meaning "low abundance of the stock". For the Biscay anchovy stock, the SSB is usually dominated by the recruits. In recent years, there has been low recruitment and because of this, the SSB has been low. As pointed out above the influence of the SSB level on subsequent recruitment is not fully understood, but recruitment has a higher likelihood of being lower at very low stock sizes.

"I will also propose to study the evolution of the rates of fishing mortality by the different fishing fleets exploiting this resource using the historical data."

The relative impact of the different fleets has been explored using a seasonal assessment method that was developed specifically for this purpose. The results, although preliminary, are compatible but not exact the same as obtained with the standard assessment. The results are given in Table 1.3.3.1.1. The Spanish fishery in the spring and the French fishery in the 2nd half of the year are the main contributors to the fishing mortality for this stock.

Table 1.3.2.1.1:

SUMMARY SEASONAL ASSESSMENT OF THE FISHEY OF ANCHOVY IN VIII

Year\ ages	Spawning Stock	Recruitment	Annual Catches	Catches Expected	Ratio Yield/SSB	Annual Average F (1-3+)	F (1-3+) Winter France	F (1-3+) Spring France	F (1-3+) 2nd half France	F (1-3+) Spring Spain	F (1-3+) 2nd half Spain
1987	41,845	7,656	15,309	15,197	0.366	0.490	0.000	0.075	0.082	0.277	0.056
1988	37,015	3,410	15,581	18,787	0.421	0.802	0.140	0.093	0.211	0.277	0.082
1989	18,039	17,884	10,614	10,415	0.588	0.628	0.060	0.051	0.034	0.384	0.099
1990	54,520	6,717	34,272	37,455	0.629	1.062	0.000	0.036	0.367	0.370	0.289
1991	23,131	25,986	19,635	21,904	0.849	1.074	0.215	0.101	0.193	0.522	0.042
1992	69,316	24,243	37,885	50,027	0.547	1.120	0.145	0.009	0.337	0.603	0.026
1993	84,895	11,404	40,392	38,108	0.476	0.695	0.106	0.012	0.283	0.260	0.034
1994	49,718	10,189	34,631	35,055	0.697	0.845	0.116	0.044	0.230	0.389	0.065
1995	39,734	14,304	30,116	31,959	0.758	1.048	0.075	0.058	0.248	0.644	0.022
1996	43,575	16,044	34,373	37,621	0.789	1.325	0.088	0.030	0.507	0.619	0.082
1997	42,009	29,653	22,339	21,437	0.532	0.605	0.083	0.020	0.242	0.194	0.066
1998	97,969	12,489	31,617	31,723	0.323	0.408	0.062	0.014	0.243	0.075	0.015
1999	71,888	22,533	27,258	26,775	0.379	0.387	0.057	0.010	0.148	0.127	0.045
2000	86,995	21,333	36,994	37,665	0.425	0.542	0.066	0.016	0.180	0.253	0.026
2001	88,705	3,945	40,149	38,048	0.453	0.494	0.015	0.011	0.198	0.233	0.036
2002	45,230	3,827	17,497	18,980	0.387	0.443	0.105	0.015	0.170	0.096	0.056
2003	21,727	6,838	10,595	10,462	0.488	0.675	0.002	0.056	0.515	0.093	0.008
2004	25,579	613	16,360	16,494	0.640	0.977	0.016	0.066	0.479	0.393	0.024
2005	8,322		1,152	1,352	0.138	0.128					
Average 1990-2004	56,333	14,008	28,941	30,248	0.558	0.780	0.077	0.033	0.289	0.325	0.056

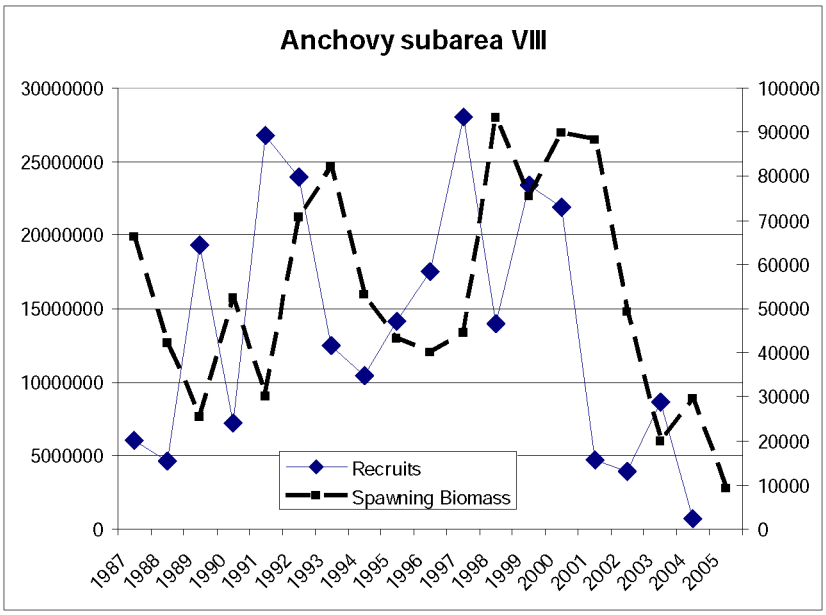


Figure 1.3.2.1.1 Series of recruitments and spawning biomass of anchovy (according to a standard ICA assessment).

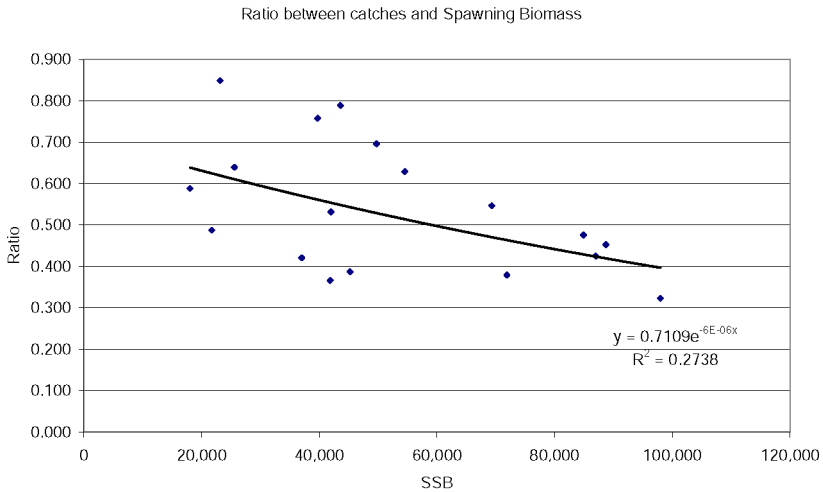


Figure 1.3.2.1.2 Ratio of annual catches to spawning biomass in relation to the spawning biomass estimates.

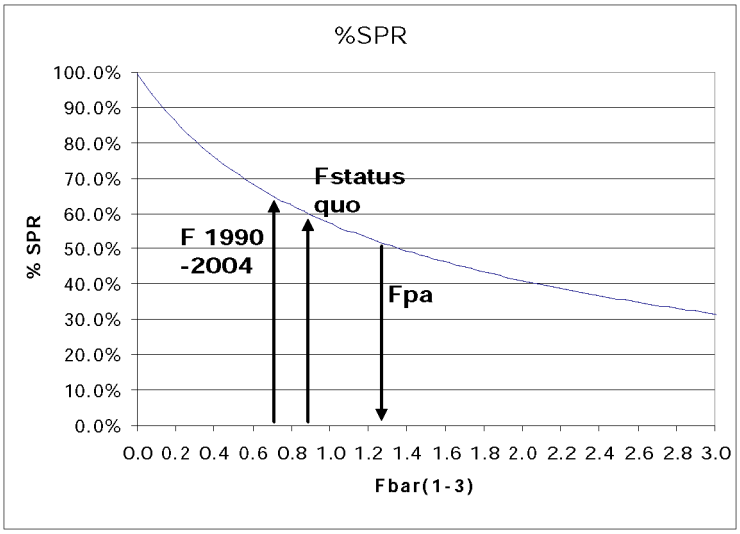


Figure 1.3.2.1.3 Analysis of spawning biomass per recruit for anchovy under different levels of exploitation.

1.4 Bay of Biscay and Iberian Seas

1.4.1 Hake – Southern stock (Divisions VIIIc and IXa excluding the Gulf of Cadiz)

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	Harvested unsustainably	Overexploited	

Based on the most recent estimates of SSB, ICES classifies the stock as having reduced reproductive capacity and being at risk of being harvested unsustainably. The SSB continually decreased between 1982 and 1997 and has remained close to the lowest value in the time-series in the most recent years. Recruitment was high in the mid-1980s and has been at a much lower level since then. Fishing mortality has been above $\mathbf{F}_{lim}$ for most of the time after 1994.

Management objectives

There are no specific management objectives for this stock.

Reference points

	ICES considers that:	**ICES proposed that:**
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 25 000 t	$\mathbf{B}_{pa}$ be set at 35 000 t
	$\mathbf{F}_{lim}$ is 0.55	$\mathbf{F}_{pa}$ be set at 0.40
Target reference points		$\mathbf{F}_{y}$ is not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	0.553	0.172	0.299
$\mathbf{F}_{max}$	0.284	0.190	0.749
$\mathbf{F}_{0.1}$	0.179	0.180	1.205
$\mathbf{F}_{med}$	0.531	0.174	0.317

Technical basis

$\mathbf{B}_{lim}$: The level below which there are indications of impaired recruitment	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$	$\mathbf{F}_{pa} \sim \mathbf{F}_{lim} * 0.72$

Single-stock exploitation boundaries

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

The *status quo* fishing mortality is estimated at 0.52, which is around the $\mathbf{F}_{lim}$ associated with stock collapse, and well above rates that would support optimal long-term yield and low risk of stock depletion. Candidate target fishing mortalities for a recovery plan for southern hake should be in the range $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

Exploitation boundaries in relation to precautionary limits

Fishing mortality is around $\mathbf{F}_{lim}$ and the stock is well below $\mathbf{B}_{lim}$. In the absence of an agreed recovery plan, no catch should be taken from this stock in 2006. A recovery plan should be implemented as a prerequisite to reopening the fishery. The recovery plan should include monitoring the development of the stock, clearly stating specified reopening criteria, and monitoring the fishery when it is reopened.

Short-term implications

Outlook for 2006

Basis: $\mathbf{F}_{sq}$=mean F(02-04)=0.52; R04-05 = GM 1989-2002=43 millions; landings (2005) = 6.3; SSB(2006) = 11.3. 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 0.4. 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 0.28.

Rationale	Landings (2006)	Basis	F HCons (2006)	SSB (2007)	%SSB change [1)]	%TAC change [2)]
Zero catch	0.0	F=0	0.00	18.6	65%	-100%
High long-term yield	3.9	F(long-term yield)	0.28	14.7	30%	-35%
Status quo	0.8	$\mathbf{F}_{sq}$ *0.1	0.05	17.8	58%	-87%
	1.6	$\mathbf{F}_{sq}$ *0.2	0.10	17.0	51%	-74%
	3.6	$\mathbf{F}_{sq}$ *0.5	0.26	14.9	33%	-40%
	5.1	$\mathbf{F}_{sq}$ *0.75	0.39	13.4	19%	-15%
	5.9	$\mathbf{F}_{sq}$ *0.9	0.46	12.6	12%	-1%
	6.4	$\mathbf{F}_{sq}$ *1	0.52	12.1	8%	7%
	6.9	$\mathbf{F}_{sq}$ *1.1	0.57	11.6	3%	16%
	7.6	$\mathbf{F}_{sq}$ *1.25	0.64	11.0	-3%	27%
Precautionary limits	0.6	F(prec limits) *0.1	0.04	18.0	60%	-90%
	1.5	F(prec limits) *0.25	0.10	17.1	52%	-75%
	2.9	F(prec limits) *0.5	0.20	15.7	39%	-52%
	4.1	F(prec limits) *0.75	0.30	14.4	28%	-31%
	4.8	F(prec limits) *0.9	0.36	13.7	22%	-20%
	5.2	$\mathbf{F}_{pa} = \mathbf{F}_{sq}$ *0.78	0.40	13.3	18%	-12%
	5.7	F(prec limits) *1.1	0.44	12.9	14%	-5%
	6.3	F(prec limits) *1.25	0.50	12.3	9%	5%
	7.2	F(prec limits) *1.5	0.60	11.4	1%	21%
	8.0	F(prec limits) *1.75	0.70	10.5	-7%	35%
	8.8	F(prec limits) *2	0.80	9.8	-13%	48%
	9.5	F(prec limits) *2.25	0.90	9.1	-19%	60%

All weights in '000 tonnes.
Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2007 relative to SSB 2006.
[2)] Predicted landings 2006 relative to TAC 2005 (5968 tonnes).

All options will result in the spawning stock biomass in 2006 being below $\mathbf{B}_{pa}$.

Management considerations

The spawning stock biomass has been consistently overestimated and there are also tendencies to underestimate fishing mortality. It is likely that the stock is still being overestimated at present. This seriously compromises the quality of the short-term forecasts and there are no signs yet that the bias problem has been redressed. Due to the uncertainties in the assessment, the standard approach to managing this fisheries through TACs based on numerical forecasts may not be appropriate. An adaptive approach to management should be developed which allows for effective management even when the stock status cannot be accurately estimated.

Hake is taken in a mixed species trawl fishery, and the management of other stocks such as blue whiting, horse mackerel, mackerel, megrim, anglerfish, and *Nephrops* needs to be taken into account when managing the hake stock.

There is good evidence of low recruitment at low SSB.

Given the tendency for the assessment to overestimate SSB and underestimate F, any attempts to gradually reduce fishing mortality through TACs are not likely to be successful in the recovery of the stock.

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 greater than 100 m deep. The most important prey species in shallower waters are horse mackerel, sardine, and snipefish. Hake are known to be a cannibalistic species.

Factors affecting the fisheries and the stock

The effects of regulations

A TAC is set for all the Atlantic Iberian Peninsula (including the Gulf of Cadiz). The 2004 TAC was set at 5950 t and total landings were 5710 t.

The minimum mesh size for trawl gear is 70 mm. Derogations are applicable for ICES Division IXa west of 7º23'48" (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 trammel nets using a minimum mesh size of 100 mm.

In Spain, trawling is prohibited in Galician waters from La Coruña-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.

Changes in fishing technology and fishing patterns

In recent years hake has comprised around 6% of the total landings of the Spanish trawl fishery, although this percentage used to be higher in the 1980s and before. During the last years there has been an increase in Spanish trawlers using a new Very High Vertical Opening gear towed by a single vessel and targeting more the 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 differing zooplankton biomass.

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

The analytical age-based assessment (XSA) is based on landings, four 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.

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 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 is not clearly based on a biological basis for stock separation. The Gibraltar strait is the southern boundary, splitting the Southern Stock from the Mediterranean hake. Nevertheless, the fact that during the last years the high abundances of small hake present in the Gulf of Cadiz are not to be found elsewhere when they become older, has raised doubts as to the identity of the stock and the origin of the Gulf of Cadiz population.

Discards are not included in the assessment and this could result in a bias in the perception of stock development and recruitment.

There are concerns about the accuracy of aging data and the calculation of historic catch-at-age data.

The reason for the recent tendency to overestimate stock size and underestimate fishing mortality is not clear, but could be linked to the problem of different tuning fleets giving conflicting signals on the development of the stock.

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

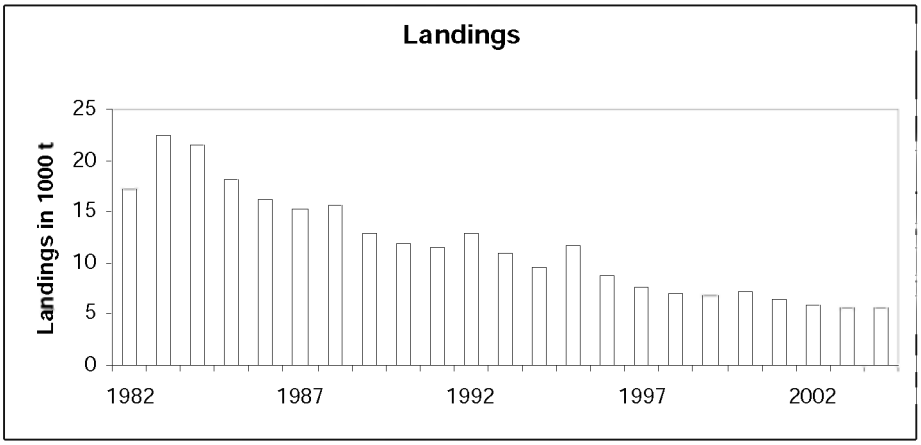
Spawning stock biomass has been consistently overestimated and there are also tendencies to underestimate fishing mortality. Such biases seriously compromise the quality of the short-term forecasts. Estimation of recent recruitments has been also problematic. Recruitment has been estimated from two surveys that show different patterns.

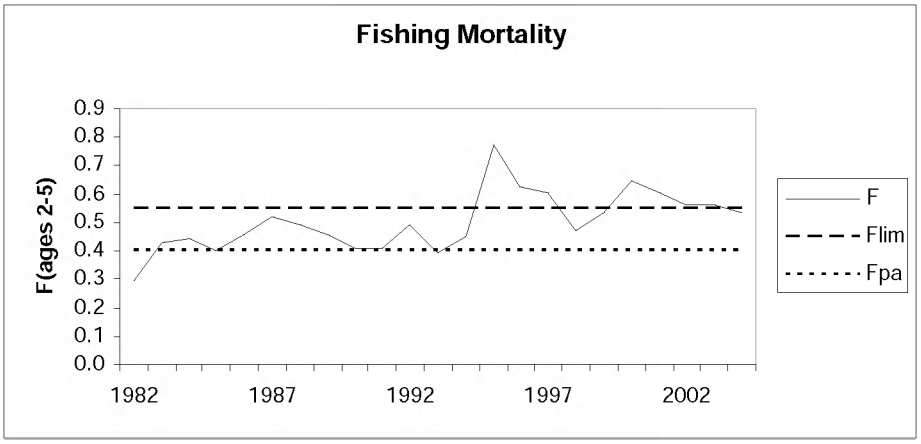
Source of information

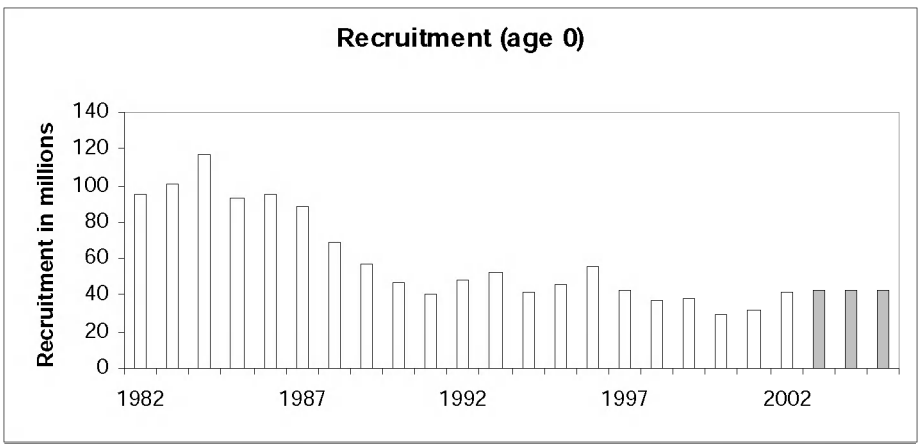
Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. May 2005 (ICES CM 2006/ACFM:01).

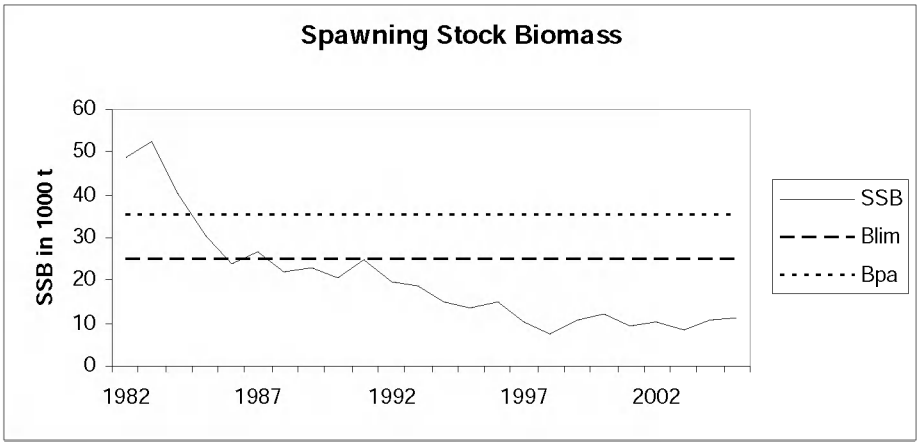
Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. To advice	Predicted catch corresp. To Single-Stock Exploitation Boundaries	Agreed TAC	ACFM Landings
1987	Precautionary TAC; juvenile protection		15.0		25.0	16.2
1988	TAC; juvenile protection		15.0		25.0	16.4
1989	TAC; juvenile 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[1]	Zero catch		0		5.95	6.8
2005[1]	Zero catch		0		5.968	
2006	Zero catch		0			

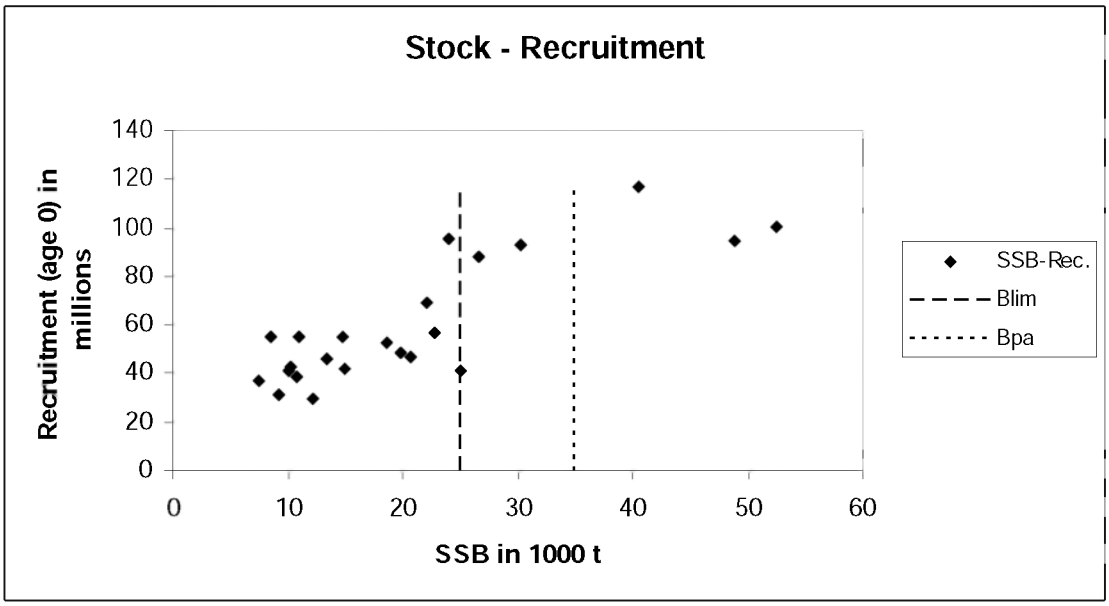
Weights in '000 t.
[1] Assessment excluding the Gulf of Cadiz.

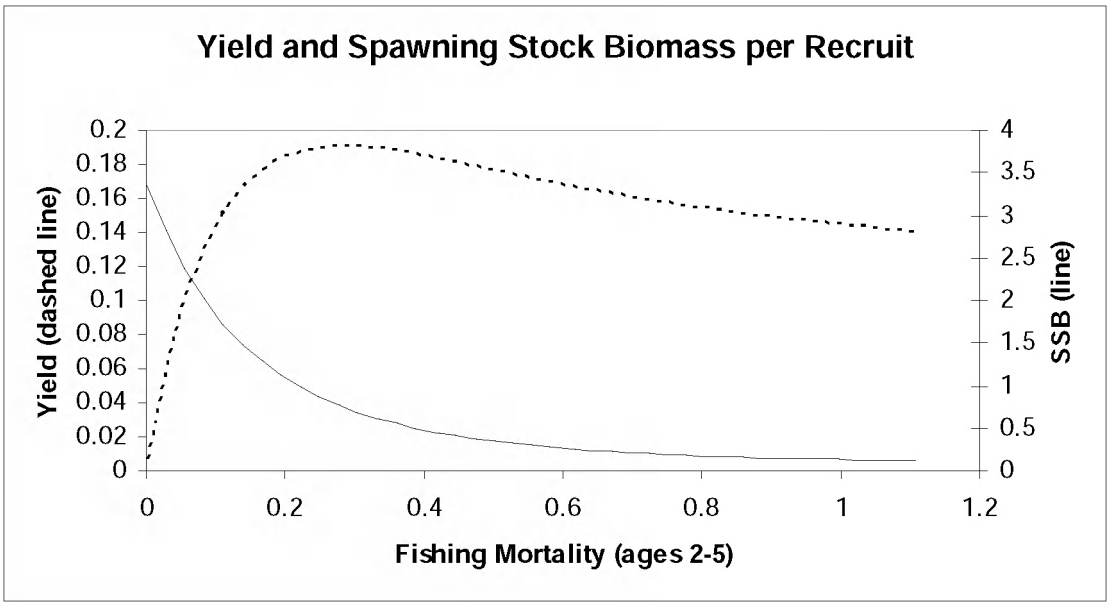

Landings
Landings in 1000 t
25
20
15
10
5
0
1982
1987
1992
1997
2002


Fishing Mortality
F(ages 2-5)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1982
1987
1992
1997
2002
F
Flim
Fpa


Recruitment (age 0)
Recruitment in millions
140
120
100
80
60
40
20
0
1982
1987
1992
1997
2002


Spawning Stock Biomass
SSB in 1000 t
60
50
40
30
20
10
0
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 2-5)

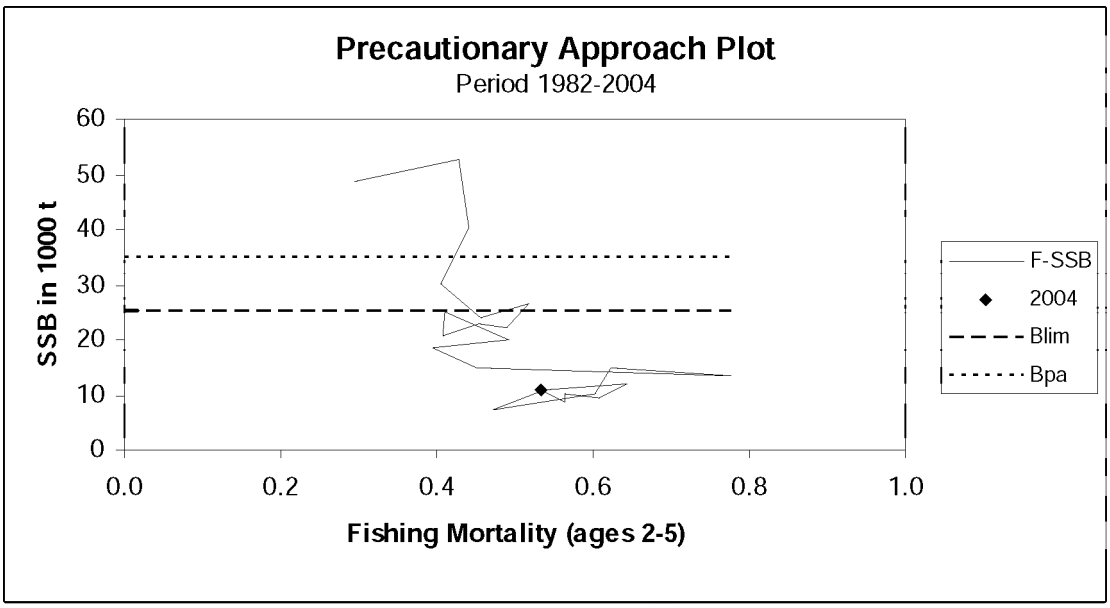

Precautionary Approach Plot
Period 1982-2004
SSB in 1000 t
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 2-5)
F-SSB
2004
Blim
Bpa

Table 1.4.1.1 Hake – Southern Stock (Divisions VIIIc and IXa) – Landings estimates ('000 t) by country and gear, 1972–2004.

YEAR	Spain										Portugal			France	TOTAL		
	Gillnet	Small Gillnet	Longline	Artisanal Unallocated	Artisanal Cadiz	**Total Artisanal**	Trawl North	Trawl Cadiz	**Total Trawl**	**Total**	Artisanal	Trawl	**Total**		**North**	**Gulf of Cadiz**	**STOCK**
1972	-	-	-	-	-	7.10	10.20	-	10.20	17.30	4.70	4.10	8.80		26.1	-	26.10
1973	-	-	-	-	-	8.50	12.30	-	12.30	20.80	6.50	7.30	13.80	.20	34.8	-	34.80
1974	2.60	1.00	2.20	-	-	5.80	8.30	-	8.30	14.10	5.10	3.50	8.60	.10	22.8	-	22.80
1975	3.50	1.30	3.00	-	-	7.80	11.20	-	11.20	19.00	6.10	4.30	10.40	.10	29.5	-	29.50
1976	3.10	1.20	2.60	-	-	6.90	10.00	-	10.00	16.90	6.00	3.10	9.10	.10	26.1	-	26.10
1977	1.50	.60	1.30	-	-	3.40	5.80	-	5.80	9.20	4.50	1.60	6.10	.20	15.5	-	15.50
1978	1.40	.10	2.10	-	-	3.60	4.90	-	4.90	8.50	3.40	1.40	4.80	.10	13.4	-	13.40
1979	1.70	.20	2.10	-	-	4.00	7.20	-	7.20	11.20	3.90	1.90	5.80		17	-	17.00
1980	2.20	.20	5.00	-	-	7.40	5.30	-	5.30	12.70	4.50	2.30	6.80		19.5	-	19.50
1981	1.50	.30	4.60	-	-	6.40	4.10	-	4.10	10.50	4.10	1.90	6.00		16.5	-	16.50
1982	1.25	.27	4.18	-	-	5.69	3.92	.49	4.41	10.10	5.01	2.49	7.49		17.1	0.5	17.59
1983	2.10	.37	6.57	-	-	9.04	5.29	.57	5.87	14.91	5.19	2.86	8.04		22.4	0.6	22.95
1984	2.27	.33	7.52	-	-	10.13	5.84	.69	6.54	16.66	4.30	1.22	5.52		21.5	0.7	22.18
1985	1.81	.77	4.42	-	-	7.00	5.33	.79	6.12	13.12	3.77	2.05	5.82		18.2	0.8	18.94
1986	2.07	.83	3.46	-	-	6.37	4.86	.98	5.84	12.21	3.16	1.79	4.95	.01	16.2	1.0	17.16
1987	1.97	.53	4.41	-	-	6.91	3.50	.95	4.45	11.36	3.47	1.33	4.80	.03	15.2	1.0	16.19
1988	1.99	.70	2.97	-	-	5.65	3.98	.99	4.96	10.61	4.30	1.71	6.02	.02	15.7	1.0	16.65
1989	1.86	.56	1.95	-	-	4.37	3.92	.90	4.82	9.19	2.74	1.85	4.58	.02	12.9	0.9	13.79
1990	1.72	.59	2.13	-	-	4.44	4.13	1.20	5.33	9.77	2.26	1.14	3.40	.03	12	1.2	13.19
1991	1.41	.42	2.20	-	-	4.02	3.63	1.21	4.84	8.87	2.71	1.25	3.96	.01	11.6	1.2	12.83
1992	1.48	.40	2.05	-	-	3.94	3.79	.98	4.76	8.70	3.77	1.33	5.10		12.8	1.0	13.80
1993	1.26	.36	2.74	-	.01	4.37	2.67	.54	3.21	7.58	3.04	.87	3.91		10.9	0.5	11.49
1994	1.90	.37	1.47	-	.00	3.74	2.72	.33	3.04	6.79	2.30	.79	3.09		9.5	0.3	9.87
1995	1.59	.37	.96	-	.00	2.92	5.27	.46	5.73	8.65	2.57	1.03	3.59		11.8	0.5	12.24
1996	1.15	.21	.98	-	.03	2.37	3.64	.98	4.61	6.98	2.01	.89	2.90		8.9	1.0	9.88
1997	1.04	.30	.77	-	.04	2.15	3.10	.88	3.98	6.13	1.51	.91	2.42		7.6	0.9	8.54
1998	.75	.32	.63	-	.04	1.73	2.83	.52	3.35	5.09	1.67	.91	2.58		7.1	0.6	7.67
1999	.60	.17	.25	.22	.02	1.27	2.45	.57	3.02	4.29	2.12	1.09	3.21		6.9	0.6	7.50
2000	.85	.13	.15	.13	.01	1.27	2.81	.58	3.39	4.66	2.09	1.16	3.25		7.3	0.6	7.91
2001	.58	.18	.11	.14	.04	1.04	2.18	1.20	3.38	4.42	2.00	1.20	3.20		6.4	1.2	7.62
2002	.60	.12	.14	.05	.02	.94	2.13	.88	3.01	3.95	1.80	.97	2.77		5.8	0.9	6.72
2003	.43	.25	.17	.23	.02	1.10	2.43	1.25	3.68	4.78	1.15	.96	2.11		5.6	1.3	6.9
2004	.42	.25	.13	.19	.03	1.03	2.79	1.06	3.85.	4.88	1.19	0.73	1.93		5.71	1.09	6.81

Table 1.4.1.2 Hake – Southern stock (Divisions VIIIc and IXa).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	95086	48838	17108	0.2943
1983	100532	52607	22376	0.4288
1984	117002	40476	21485	0.4417
1985	92827	30299	18152	0.4040
1986	95357	23960	16185	0.4573
1987	88102	26695	15232	0.5186
1988	69311	22004	15667	0.4902
1989	57233	22764	12887	0.4551
1990	46873	20673	11994	0.4084
1991	40786	25002	11618	0.4102
1992	48418	19903	12824	0.4913
1993	52318	18581	10944	0.3961
1994	41986	14986	9542	0.4515
1995	45879	13370	11782	0.7764
1996	55396	14845	8875	0.6235
1997	42598	10273	7619	0.6019
1998	37449	7399	7100	0.4714
1999	38766	10748	6911	0.5374
2000	29341	12089	7318	0.6446
2001	31308	9284	6365	0.6072
2002	41568	10158	5817	0.5635
2003	42827 *	8549	5617	0.5629
2004	42827 *	10947	5710	0.5331
2005	42827 *	11252		
Average	58192	20238	11701	0.5030

* Geometric mean recruitment (1989–2002).

1.4.2 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	Appropriate (*L. boscii*), Appropriate (*L. whiffiagonis*)	

In the absence of defined reference points, the state of the two stocks cannot be evaluated with regard to biological reference points.

There has been a decrease in landings since the late 1980s. SSB of both species decreased since the late 1980s and then stabilised at a lower level. Fishing mortality has declined in recent years. Recent recruitments have been lower than in the second half of the 1980s.

There is no evidence of reduced recruitment at SSB levels observed in the short time-series available for these stocks, and the SSB estimated in 2004 (1105 t for *L. whiffiagonis* and 4800 t for *L. boscii*) are above the B_{loss} values of 960 t and 4 400 t, respectively.

Management objectives

There are no explicit management objectives for these stocks.

Reference points

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

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	B_{lim} is not defined	B_{pa} is not defined
	F_{lim} is not defined	F_{pa} is not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.256	0.040	0.243
$F_{0.1}$	0.273	0.041	0.233
F_{med}	0.361	0.044	0.190

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 $F_{0.1}$. $F_{max}$is poorly defined for this stock.

Technical basis:

B_{lim}: is not defined	B_{pa}: is not defined
F_{lim}: is not defined	F_{pa}: is not defined

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

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	B_{lim} is not defined	B_{pa} is not defined
	F_{lim} is not defined	F_{pa} is not defined
Target reference points		F_y is not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.127	0.058	0.478
$\mathbf{F}_{0.1}$	0.153	0.062	0.429
$\mathbf{F}_{med}$	0.261	0.067	0.302

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 $\mathbf{F}_{0.1}$. $\mathbf{F}_{max}$is poorly defined for this stock.

Technical basis:

$\mathbf{B}_{lim}$: is not defined	$\mathbf{B}_{pa}$: is not defined
$\mathbf{F}_{lim}$: is not defined	$\mathbf{F}_{pa}$: is not defined

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 0.13, is lower than rates that would achieve a high long-term yield ($\mathbf{F}_{0.1}$ = 0.15) and low risk of stock depletion. The current fishing mortality for *L. boscii,* estimated as 0.26, is below $\mathbf{F}_{0.1}$ = 0.27.

Exploitation boundaries in relation to precautionary considerations

At recent levels of fishing mortality for both species (*L. whiffiagonis* 0.13 and *L. boscii* 0.32), SSB has been stable or slightly increasing. Fishing mortality should not be allowed to increase. This level of exploitation would correspond to landings in 2006 of around 175 t for *L. whiffiagonis* and 1006 t for *L. boscii.* The combined landings at the current exploitation level would be around 1200 t.

Short-term implications

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

Outlook for 2006

L. whiffiagonis: Basis: F_{sq}=mean F(02-04)=0.13; R04-05 = GM 1992-2003=4 millions; landings (2005) = 0.2; SSB(2006) = 1.5.
L. boscii: Basis: F_{sq}=mean F(02-04)=0.26; R04-05 = GM 1990-2003=26 millions; landings (2005) = 0.9; SSB(2006) = 5.8.
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 0.15 (*L. whiffiagonis*), and 0.19 (*L. boscii*).

					L. whiffiagonis			*L. boscii*			
Rationale	**Landings *L. whiff.* (2006)**	**Landings *L. boscii* (2006)**	**Combined landings (2006)**	**Basis**	**F (2006)**	**SSB (2006)**	**%SSB change[1)]**	**F (2006)**	**SSBB (2007)**	**%SSB change[1)]**	**%TAC change[2)]**
Zero catch	0.000	0.000	0.000	F=0	0.00	1.81	22%	0.00	7.07	22%	-100%
High long-term yield	0.265	1.055	1.320	F(long-term yield)	0.15	1.85	20%	0.27	5.89	1%	-10%
Status quo	0.019	0.111	0.130	F_{sq} *0.1	0.01	1.79	21%	0.03	6.95	20%	-90%
	0.037	0.220	0.257	F_{sq} *0.2	0.03	1.77	19%	0.05	6.83	18%	-81%
	0.091	0.531	0.622	F_{sq} *0.5	0.06	1.71	15%	0.13	6.48	12%	-53%
	0.133	0.775	0.909	F_{sq} *0.75	0.10	1.66	12%	0.19	6.21	7%	-32%
	0.159	0.915	1.074	F_{sq} *0.9	0.11	1.64	10%	0.23	6.05	4%	-20%
	0.175	1.006	1.181	F_{sq} *1	0.13	1.62	9%	0.26	5.95	3%	-12%
	0.192	1094	1.286	F_{sq} *1.1	0.14	1.60	8%	0.28	5.85	1%	-4%
	0.216	1.224	1.439	F_{sq} *1.25	0.16	1.57	6%	0.32	5.71	-2%	8%

All weights in '000 tonnes.
Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2007 relative to SSB 2006.
[2)] Landings 2006 relative to TAC 2005 = 1336 t.

Management considerations

Both species are caught in mixed fisheries targeting demersal fish including southern hake and *Nephrops*. Management measures applied to southern hake will have implications for other stocks like megrim.

Both species of megrim are caught on the same grounds and by the same fleets, and are usually not separated by species in landings and the fishing mortalities are linked. Both species show similar trends in stock trajectories (Figure 1.4.2.1). 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 ranges between 40 and 90 mm depending on the catch composition. The minimum landing size of megrims is 20 cm. Fishing with 40-mm mesh give rise to substantial discards.

Changes in fishing technology and fishing patterns

Both species are taken as a bycatch in the mixed bottom trawl fisheries by Portuguese and Spanish fleets, and also in small quantities by the Portuguese artisanal fleet. The majority of the catches are taken by Spanish trawlers. With the decreasing catch of hake, some fleets have changed their main target. 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 VHVO trawl (targeting horse mackerel) caused a reduction of the catch of four-spot megrim (*L. boscii*) in recent years. The VHVO trawl affects *L. boscii* more than *L. whiffiagonis* because of differences in their distribution area of the two species. The increasing use of pair trawlers (targeting blue whiting) and VHVO (targeting horse mackerel) has 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 shallow waters of both ICES Divisions (VIIIc and IXa), with its highest abundance in Division VIIIc. Four-spot megrim (*L. boscii*) is distributed in both ICES 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 (for each species separately) are based on landings data, two commercial CPUE series, and one 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 species using the relative abundances for the two species in the sampled landings. Discard data are not used in this assessment because of the lack of data in some years of the time-series. Discard 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, this means that the CPUE series is only useable up to 1999 for *L. boscii*. The assessment of *L. boscii* is only calibrated by one survey series for the most recent years.

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 for *L. boscii* was a large outlier and was excluded from the assessment.

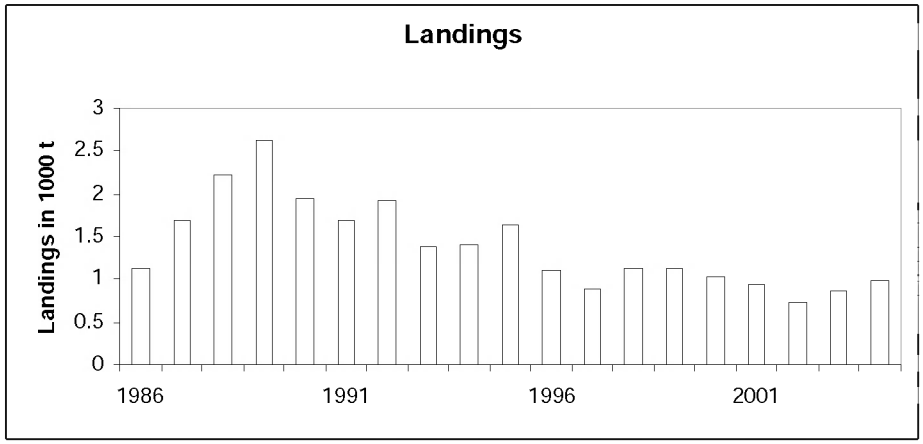
Comparison with previous assessment and advice

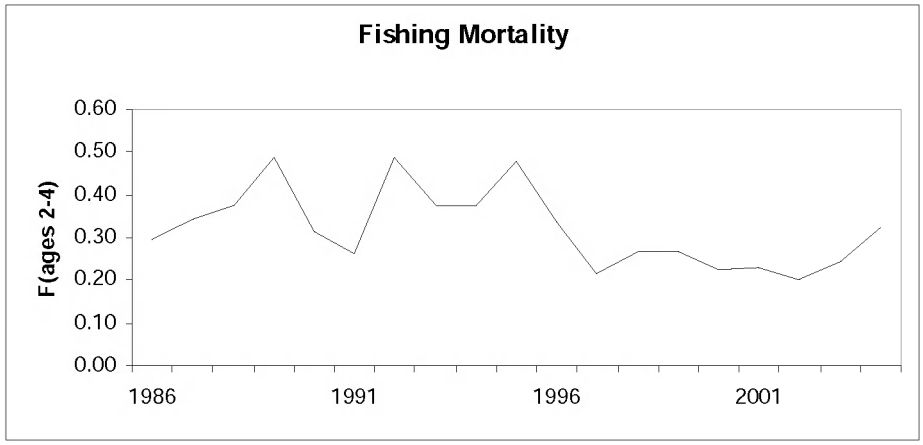
The current assessment and advice are reasonably consistent with previous years. Assessments for *L. boscii* have a tendency to overestimate stock size and underestimate fishing mortality.

Source of information
Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. May 2005 (ICES CM 2006/ACFM:01).

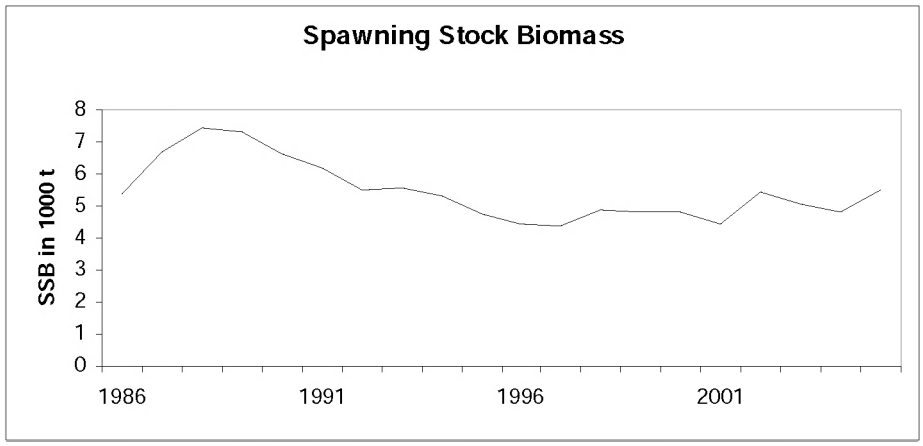
Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice[1]	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC[1]	ACFM landings[1]	Landings *L. boscii*	Landings *L. whiff.*
1987	Not dealt with		-		13.0	2.19	1.69	0.50
1988	Not dealt with		-		13.0	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			
2006	No increase in F		1.2					

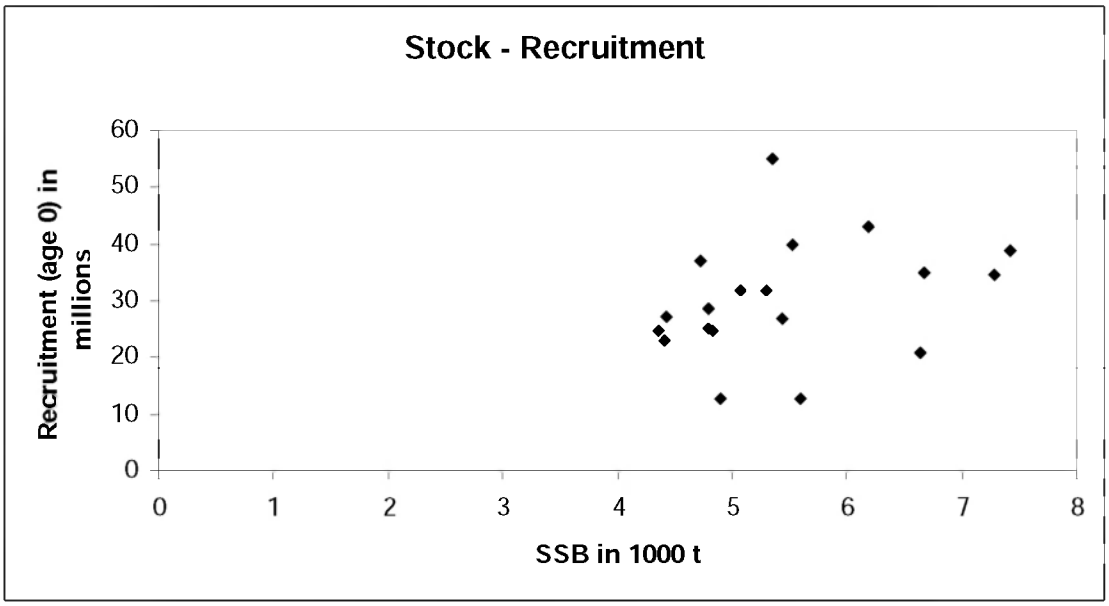
Weights in '000 t.
[1] *L. whiffiagonis+ L. boscii.*
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries.

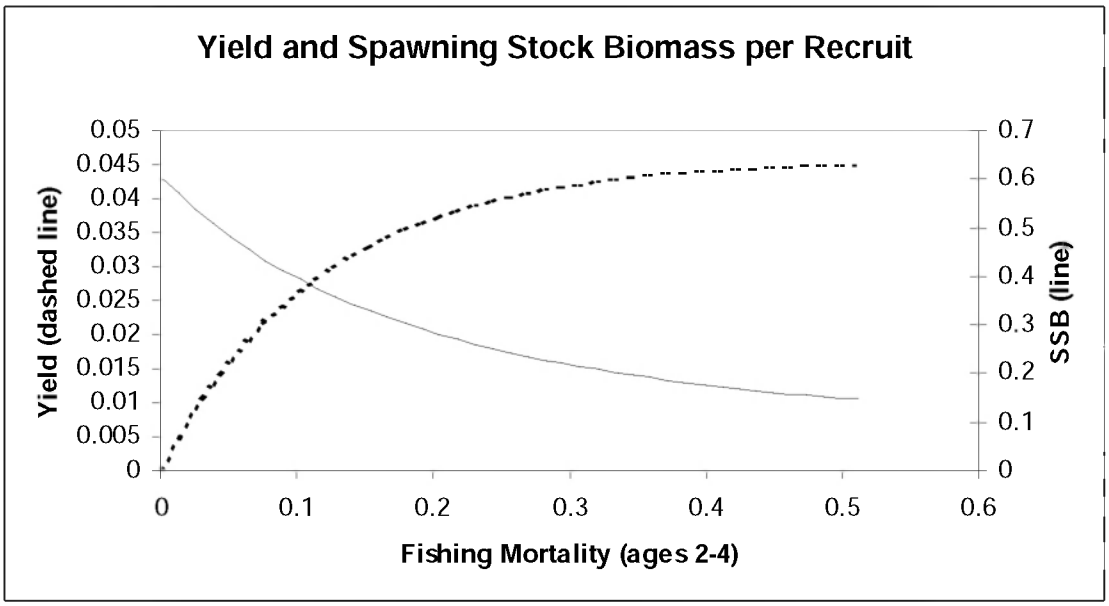

Landings
Landings in 1000 t
3
2.5
2
1.5
1
0.5
0
1986
1991
1996
2001

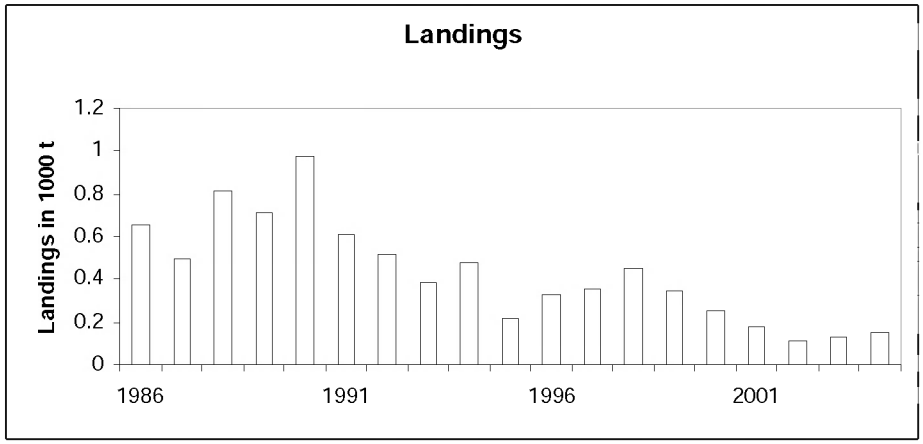

Fishing Mortality
F (ages 2-4)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1986
1991
1996
2001

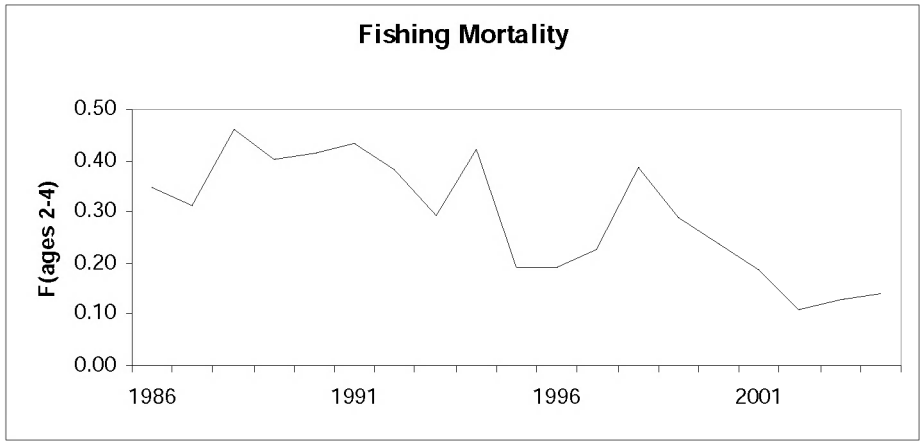

Recruitment (age 0)
Recruitment in millions
60
50
40
30
20
10
0
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
8
7
6
5
4
3
2
1
0
1986
1991
1996
2001

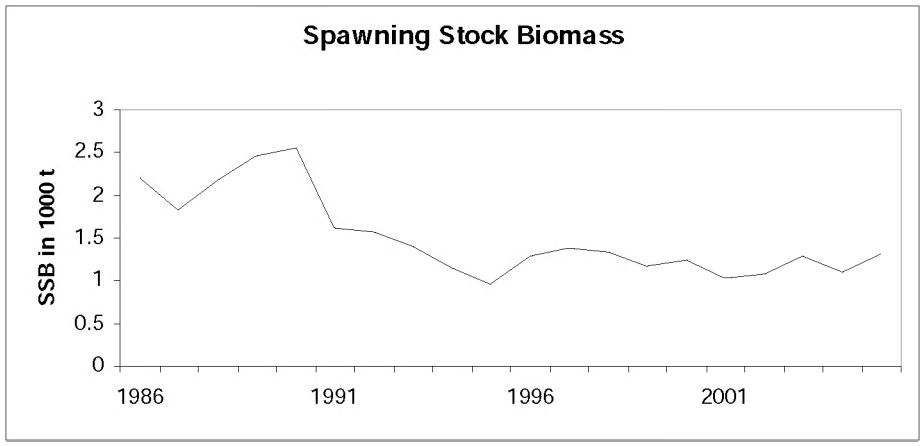

Stock - Recruitment
Recruitment (age 0) in millions
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
SSB in 1000 t

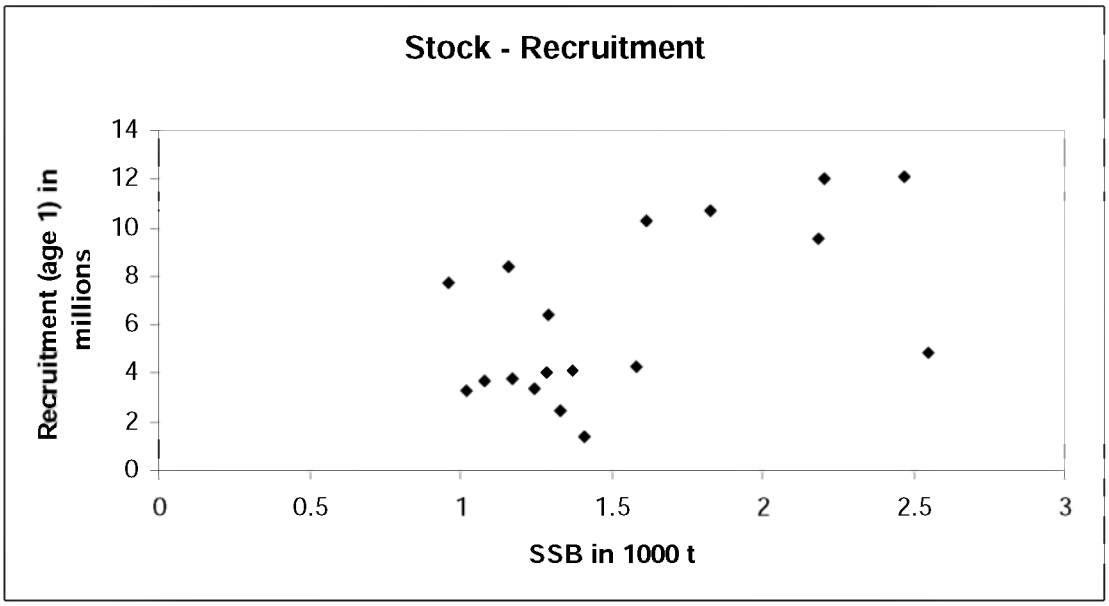

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
SSB (line)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 2-4)


Landings
Landings in 1000 t
1.2
1
0.8
0.6
0.4
0.2
0
1986
1991
1996
2001


Fishing Mortality
F (ages 2-4)
0.50
0.40
0.30
0.20
0.10
0.00
1986
1991
1996
2001


Recruitment (age 1)
Recruitment in millions
14
12
10
8
6
4
2
0
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
3
2.5
2
1.5
1
0.5
0
1986
1991
1996
2001


Stock - Recruitment
Recruitment (age 1) in millions
14
12
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5
3
SSB in 1000 t

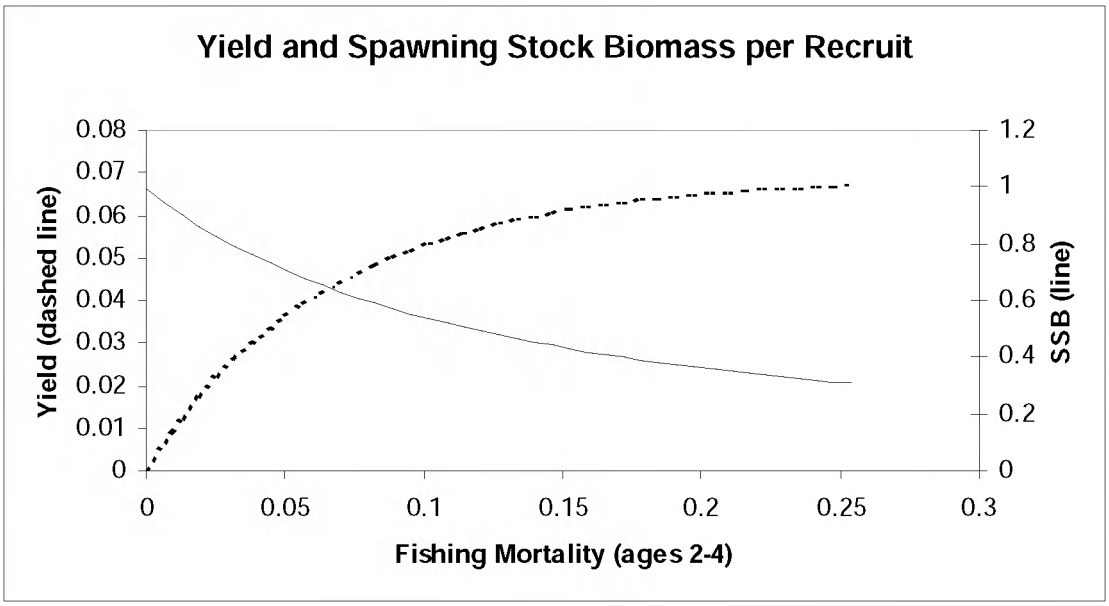

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
SSB (line)
1.2
1
0.8
0.6
0.4
0.2
0
0
0.05
0.1
0.15
0.2
0.25
0.3
Fishing Mortality (ages 2-4)

Table1.4.2.1 Four-spot megrim (*L. boscii*) in Divisions VIIIc–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	162	991

Table 1.4.2.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Total landings (t).

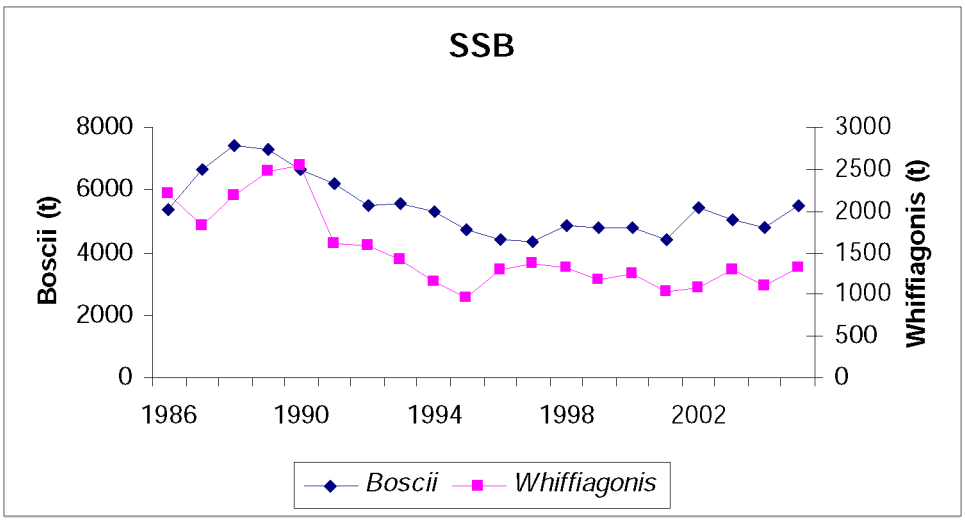
	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	508	98	606	53	659
1987	404	46	450	47	497
1988	657	59	716	101	817
1989	533	45	578	136	714
1990	841	25	866	111	977
1991	494	16	510	104	614
1992	474	5	479	37	516
1993	338	7	345	38	383
1994	440	8	448	31	479
1995	173	20	193	25	218
1996	283	21	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

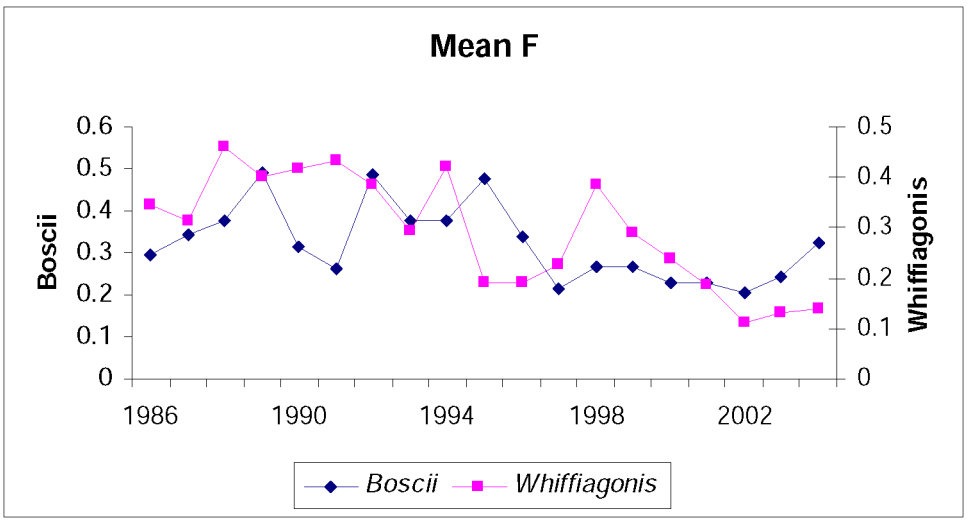
Table 1.4.2.3 Megrim (*L. boscii*) in Divisions VIIIc and IXa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	54889	5352	1124	0.2942
1987	34919	6669	1688	0.3438
1988	38682	7417	2223	0.3754
1989	34548	7285	2629	0.4892
1990	20987	6643	1945	0.3152
1991	43118	6196	1682	0.2615
1992	39905	5525	1916	0.4856
1993	12652	5587	1384	0.3769
1994	31678	5291	1403	0.3766
1995	37044	4721	1652	0.4769
1996	27174	4430	1098	0.3398
1997	24622	4365	896	0.2154
1998	12673	4890	1123	0.2655
1999	24633	4828	1125	0.2654
2000	28446	4786	1041	0.2262
2001	23066	4411	931	0.2296
2002	26804	5437	720	0.2039
2003	31918	5074	876	0.2415
2004	25212	4801	991	0.3215
2005	25952	5478		
Average	29946	5459	1392	0.3213

Table 1.4.2.4 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	8967	2204	659	0.3463
1987	12061	1829	497	0.3131
1988	10741	2185	817	0.4608
1989	9550	2469	714	0.4011
1990	12116	2548	977	0.4147
1991	4860	1613	614	0.4334
1992	10282	1581	516	0.3834
1993	4307	1412	383	0.2919
1994	1417	1159	479	0.4214
1995	8403	961	218	0.1895
1996	7778	1291	329	0.1910
1997	6421	1374	356	0.2253
1998	4101	1328	446	0.3850
1999	2446	1173	343	0.2878
2000	3751	1245	253	0.2398
2001	3339	1023	175	0.1880
2002	3285	1079	117	0.1113
2003	3695	1288	134	0.1306
2004	4026	1105	149	0.1394
2005	4302	1309		
Average	6292	1509	430	0.2923





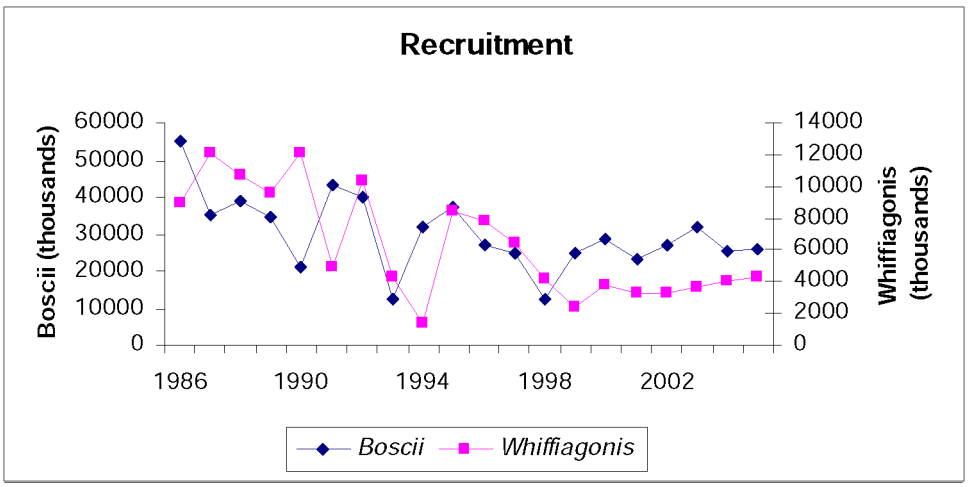


Figure 1.4.2.1 Megrim (*L. boscii* and *L. whiffiagonis*) in Divisions VIIIc and IXa. Trends in fishing mortality and mean standardized SSB and recruitment.

1.4.3 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 2003 was around 1.7 times $\mathbf{F}_{MSY}$ and increased in 2004 to be 2.3 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 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 2006 is required to bring SSB back to $\mathbf{B}_{MSY}$ in the short term. If this is not possible then a recovery plan should be established that will ensure rapid and safe recovery of the SSB above $\mathbf{B}_{msy}$. Landings in 2001 and 2002 have apparently brought fishing mortality down to $\mathbf{F}_{MSY}$. This should be considered as an upper boundary for landings in a recovery plan.

Short-term implications

Outlook for 2006

Basis: F(2005)/$\mathbf{F}_{MSY}$ = 2.33; B(2006) / $\mathbf{B}_{MSY}$ = 0.41; catch (2005) = 3745 t.

Rationale	**TAC (2006)[1]**	**Basis**	**F (2006) / $\mathbf{F}_{MSY}$**	**B (2007) / $\mathbf{B}_{MSY}$**	**% B change [1)]**	**% TAC change [2)]**
Zero catch	0	F=0	0	0.48	+17	
Target reference point	**1599**	**F(2004)*0.43 = F(2006)**	**1**	**0.43**	**+5%**	**-30%**
Status quo	3514	$\mathbf{F}_{sq}$	2.33	0.38	-7%	+52%

TAC weights in tonnes.
Shaded scenarios are not considered consistent with the Precautionary Approach.
[1)] SSB 2007 relative to SSB 2006.
[2)] TAC 2006 relative to TAC 2005.

Management considerations

Combined landings increased since 2002 and were in 2004 well above the TAC of 2300 t. Measures should be taken to assure that the TAC is restricting the fishery.

The two species are managed under a common TAC. The two species are usually landed together and they are recorded together in the landing statistics. Consequently, constraining fishing mortality on either species alone is impossible under a common TAC.

Both anglerfish species are slow-growing with late maturation (age 7 for males and higher for females). Such species generally require a low fishing mortality to be exploited sustainably.

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 year 2000.

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 leads to highly clumped distributions 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 of *L. piscatorius* represented on average 81% of the total landings.

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 26% from the trawl fleet and 74% 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 1.4.3.1). Two commercial CPUE series were used in the model.

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 exploratory assessment is completely dependent on commercial CPUE data which may be biased due to targeting behavior, local depletions, and changes in efficiency. Also, by performing a combined species assessment, the status of each species separately cannot be evaluated.

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.

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

Comparison with previous assessment and advice

Last year's assessment using ASPIC was very unstable due to the contradicting LPUEs between fleets in the 2003 value. The present assessment is more stable because the same signal is obtained from the two fleets in the 2004 values. The F and B ratio trends of the present assessment are similar to the trends of the WG2003 and to exploratory assessments using the shorter time-series (1986–2004).

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 2005 (ICES CM 2006/ACFM:01).

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	4.0	3.1	0.9
2005		F = 0 or recovery plan			2.0			
2006		F = 0 or recovery plan						

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.

Table 1.4.3.1 ANGLERFISH (*L. piscatorius*) – Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978–2004 as determined by the Working Group.

YEAR	VIIIc			IXa				VIIIc+IXa
	Spain Trawl	Spain Gillnet	TOTAL	Spain Trawl	Portugal Trawl	Portugal Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	258	0	115	373	
1979	n/a	n/a	n/a	319	0	225	544	
1980	2806	1270	4076	401	0	339	740	4816
1981	2750	1931	4681	535	0	352	887	5568
1982	1915	2682	4597	875	0	310	1185	5782
1983	3205	1723	4928	726	0	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	24	257	546	3076

n/a: not available

Table 1.4.3.2 ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978–2004 as determined by the Working Group.

YEAR	VIIIc			IXa				VIIIc+IXa
	Spain Trawl	Spain Gillnet	TOTAL	Spain Trawl	Portugal Trawl	Portugal Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	248	0	107	355	
1979	n/a	n/a	n/a	306	0	210	516	
1980	1203	207	1409	385	0	315	700	2110
1981	1159	309	1468	505	0	327	832	2300
1982	827	413	1240	841	0	288	1129	2369
1983	1064	188	1252	699	0	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	46	222	553	924

n/a: not available

Table 1.4.3.3. ANGLERFISH (*L. piscatorius* and *L. budegassa*) – Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978–2004 as determined by the Working Group.

	VIIIc			IXa				VIIIc+IXa
YEAR	Spain Trawl	Spain Gillnet	TOTAL	Spain Trawl	Portugal Trawl	Portugal Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	506		222	728	
1979	n/a	n/a	n/a	625		435	1060	
1980	4008	1477	5485	786		654	1440	6926
1981	3909	2240	6149	1040		679	1719	7867
1982	2742	3095	5837	1716		598	2314	8151
1983	4269	1911	6180	1426		888	2314	8494
1984	3600	1866	5466	1136	409	950	2495	7961
1985	2679	2495	5174	977	466	1355	2798	7972
1986	3052	3209	6261	1049	367	1757	3172	9433
1987	3174	2571	5745	1133	426	1668	3227	8973
1988	3583	3263	6846	1254	344	1577	3175	10021
1989	2291	2498	4789	1111	531	1142	2785	7574
1990	1930	1127	3057	1124	713	1231	3068	6125
1991	1993	854	2847	878	533	1545	2956	5803
1992	1668	1068	2736	786	363	1610	2758	5494
1993	1360	959	2319	699	306	1231	2237	4556
1994	1232	1028	2260	629	149	549	1327	3587
1995	1743	677	2420	814	134	297	1245	3665
1996	2146	850	2995	749	265	574	1589	4584
1997	2249	1389	3638	838	191	860	1889	5527
1998	1660	1507	3167	865	209	829	1903	5070
1999	1116	1140	2256	750	119	692	1561	3817
2000	710	612	1322	485	146	675	1306	2628
2001	614	364	978	247	117	459	823	1801
2002	559	415	974	344	104	380	828	1802
2003	1190	771	1961	617	96	529	1242	3203
2004	1513	1389	2901	549	70	479	1098	4000

n/a: not available

Table 1.4.3.4 ANGLERFISH (*L. piscatorius* and *L. budegassa*) – Divisions VIIIc and IXa. ASPIC estimates for F/$\mathbf{F}_{MSY}$ ratio and B/$\mathbf{B}_{MSY}$ ratio.

	F/ $\mathbf{F}_{MSY}$ Ratio	B/$\mathbf{B}_{MSY}$ Ratio
1980	0.911	2.074
1981	1.122	1.918
1982	1.262	1.766
1983	1.430	1.626
1984	1.453	1.494
1985	1.571	1.383
1986	2.040	1.280
1987	2.161	1.149
1988	2.740	1.032
1989	2.346	0.891
1990	2.072	0.804
1991	2.109	0.747
1992	2.144	0.696
1993	1.883	0.649
1994	1.525	0.620
1995	1.581	0.613
1996	2.049	0.603
1997	2.676	0.571
1998	2.725	0.514
1999	2.226	0.463
2000	1.579	0.437
2001	1.059	0.436
2002	1.015	0.455
2003	1.784	0.476
2004	2.329	0.466
2005		0.435

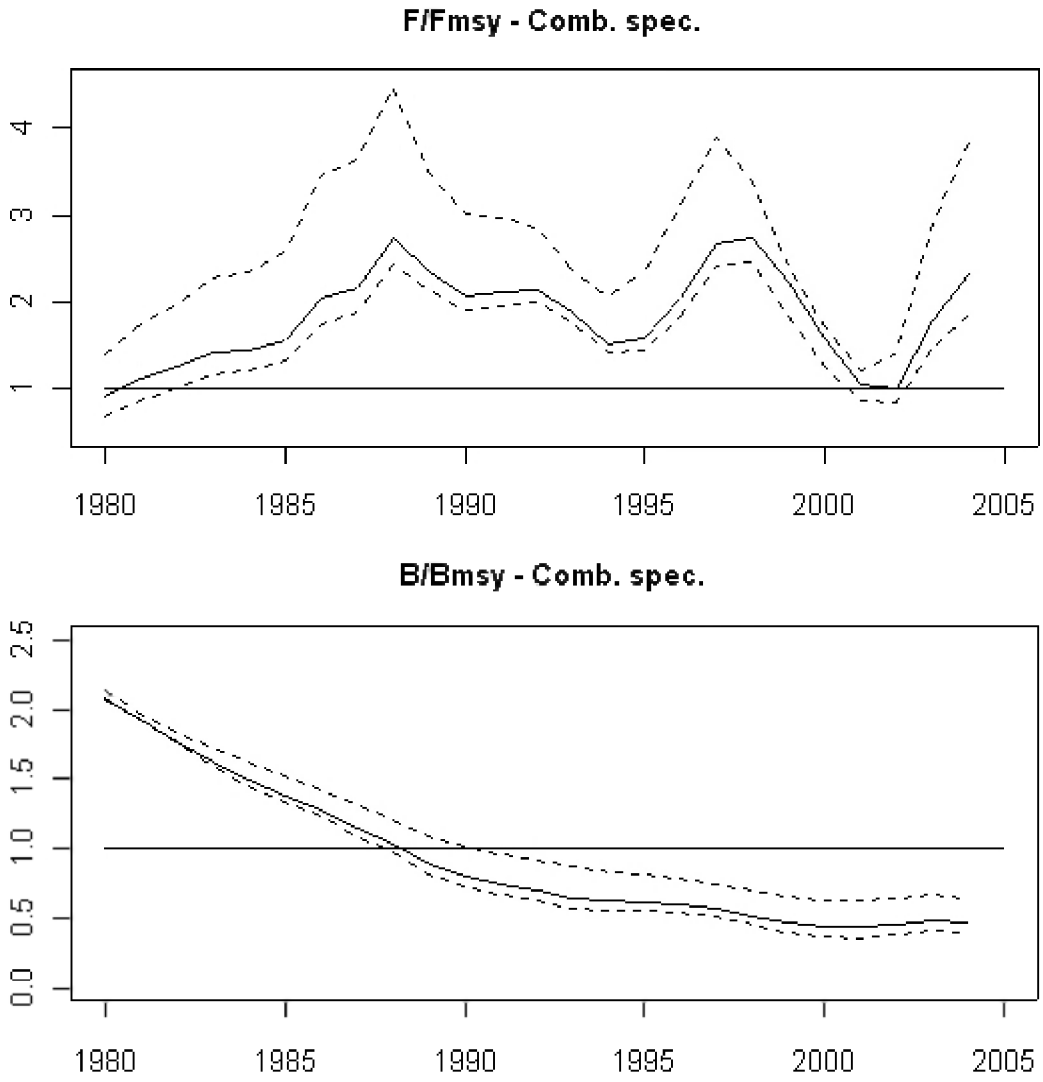


Figure 1.4.3.1 Anglerfish in Divisions VIIIc and IXa (*L. piscatorius and L. budegassa*). ASPIC 80% confidence intervals (dotted lines) and median of the F/$\mathbf{F}_{MSY}$ and B/$\mathbf{B}_{MSY}$ ratios.

1.4.4 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	

Stock boundaries have been changed as a result of new research. The available information is insufficient to evaluate the spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. However, indications from exploratory assessments are that the SSB has been decreasing since the late 1990s. Catches decreased from the early 1960s but have been relatively stable since the early 1990s.

Management objectives

There are no explicit management objectives for this stock.

Reference points

The previously proposed precautionary reference points will need to be reviewed as the stock boundaries have now been changed. Reference points should be revisited when a stable assessment is available.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Given the state of the stock and the likely decrease in spawning biomass, fishing effort must not increase and catches in 2006 should not exceed the recent average of 25 000 t (2000–2004, excluding 2003 because of the "Prestige" accident).

The TAC for this stock should only apply to *Trachurus trachurus*.

Short-term implications

Given the uncertainty of the assessment, no short-term forecast is presented.

Management considerations

The southern horse mackerel stock delimitation has been revised recently according to the conclusions of the HOMSIR project (QLK5-CT1999-01438). This revision resulted in data aggregation from Portugal and Spain different from what had been done in years before 2003. Division VIIIc is defined as part of the distribution area of the western horse mackerel stock.

In calculating the average of recent catches, 2003 had been left out as this year was abnormal due to the "Prestige" accident.

Factors affecting the fisheries and the stock

The fishery for horse mackerel is carried out essentially by the same purse seiners that fish sardine and the same trawlers that target hake and other demersal species. Therefore, the fishing mortality of horse mackerel is controlled by the restrictions imposed on the sardine and demersal mixed fisheries. If fishing effort is reduced to protect other species such as Iberian hake, this could also lead to a reduction in exploitation on southern horse mackerel in the future.

Scientific basis

Data and methods

An exploratory assessment was made. The assessment is considered to be indicative of trends only and, accordingly, catch forecasts are not provided. There is an indication from catches that the abundance of the 2003 year class may be above those seen in recent years.

Uncertainties in assessment and forecast

The southern boundary of the southern stock is uncertain. However, preliminary results from biological tags suggest that the current southern boundary at Gibraltar may be adequate.

Comparison with previous assessment and advice

This is the first assessment of the stock as currently defined. The basis for the advice is the same as last year.

Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, September 2005 (ICES CM 2006/ACFM:08).

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
1991	Precautionary TAC		61		73.0[4]	46
1992	If required, precautionary TAC		61		73.0[4]	51
1993	No advice		-		73.0[4]	57
1994	*Status quo* prediction		55[5]		73.0[4]	53
1995	No long-term gains in increasing F		63[5]		73.0[4]	53
1996	No long-term gains in increasing F		60[5]		73.0[4]	45
1997	No advice		-		73.0[4]	57
1998	F should not exceed the F(94–96)		59		73.0[4]	64
1999	No increase in F		58		73.0[4]	52
2000	F <$\mathbf{F}_{pa}$		<59		68.0[4]	49
2001	F <$\mathbf{F}_{pa}$		<54		68.0[4]	46
2002	F <0.113		<34		57.5[4]	46
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]	
2006	[6]	Should not exceed the recent average (2000–2004, excluding 2003)	[6]	<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. Numbers apply to Division IXa only.

Table 1.4.4.1 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	11875	11,702	23,577

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

Table 1.4.4.2 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)*

(*) In parenthesis: the Spanish catches from Subdivision IXa south are also included. These catches are only available for 2002, 2003, and 2004 and they will not be considered in the assessment data until the rest of the time-series is complete.

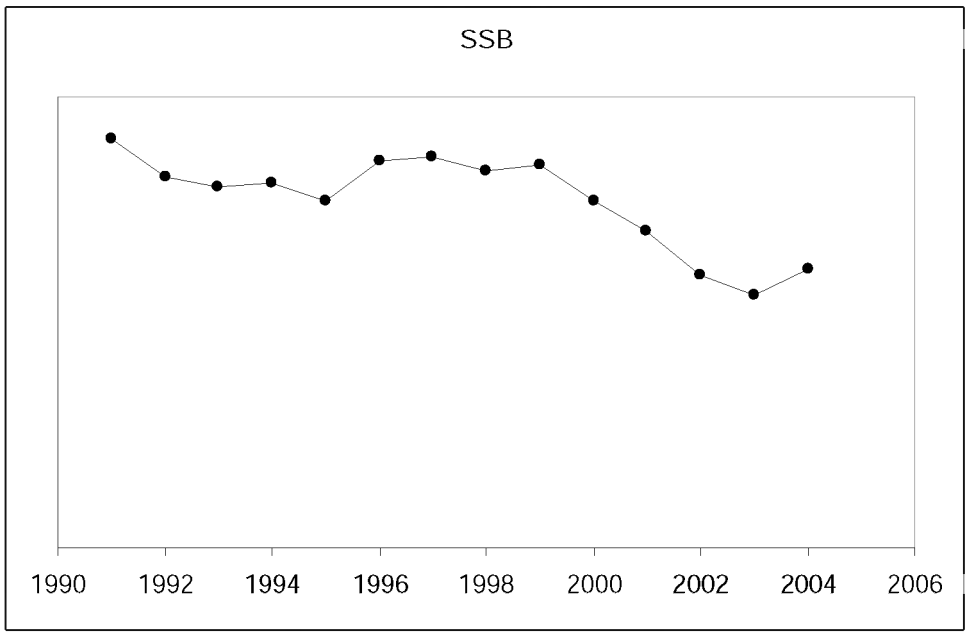


Figure 1.4.4.1 Trends in Stock Spawning Biomass since 1991.

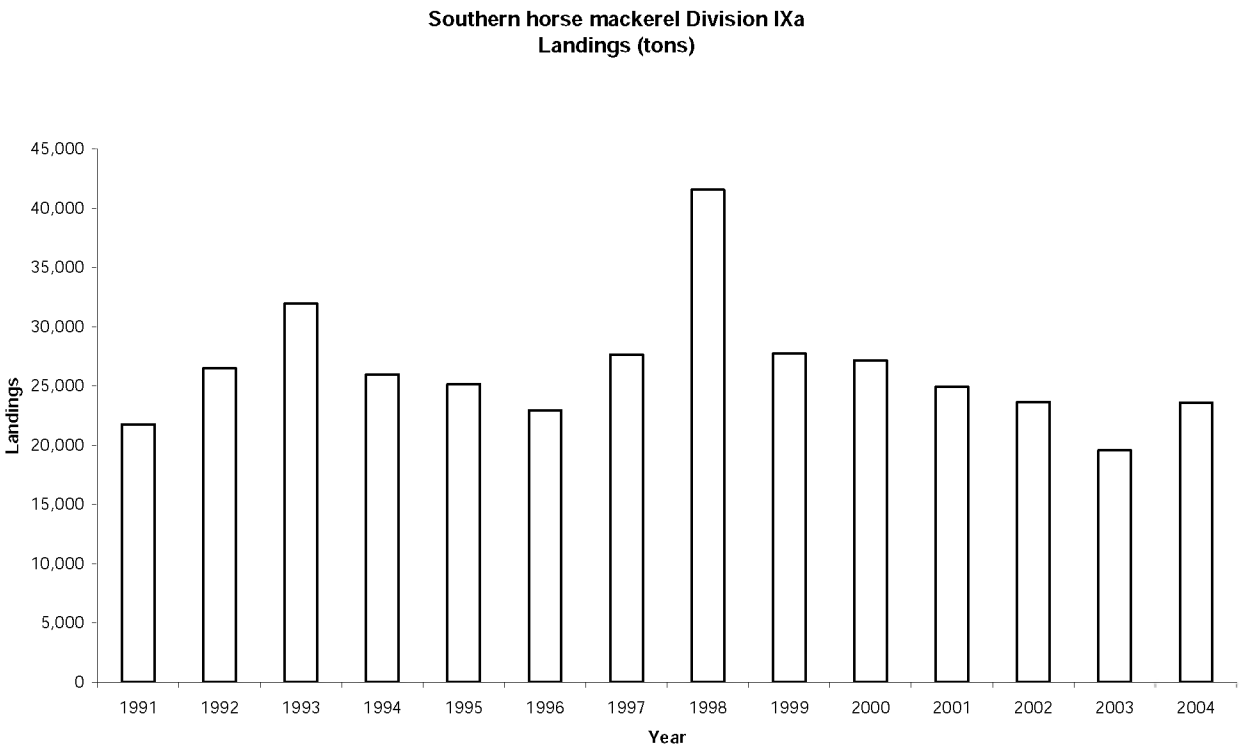


Figure 1.4.4.2 Southern horse mackerel landings.

1.4.5 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 biological reference points. The assessment indicates an SSB of 431 000 t in 2004. While the spawning biomass is close to the median value, it shows a decrease of 23% compared to 2003 as a result of the depletion of the strong 2000 year class and the absence of good year classes in 2002 and 2003. The assessment indicates a strong 2004 year class but this estimate is still uncertain. Furthermore, the abundance of sardine in some areas of the stock continues to be low when compared to the mid-1980s. 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 2002–04 level of 0.22, corresponding to a catch of less than 96 000 t in 2006.

Short-term implications

Outlook for 2006

Basis: F(2005) = 0.23 ; $\mathbf{F}_{sq}$ = F(02-04 Unscaled) = 0.22; SSB[1](2005) = 405; catch[2](2005) = 103. Recruitment in 2004 is assumed to be equal to that of 2000.

Rationale	Landings (2006)	Basis	F (2006)[2)]	SSB (2007)	%SSB change [1)]
Zero catch	0	F=0	0	561	+11
Status quo	96	$\mathbf{F}_{sq}$	0.22	463	-5
Status quo	78	$\mathbf{F}_{sq}$ * 0.8	0.18	481	-2
	87	$\mathbf{F}_{sq}$ * 0.9	0.20	472	-3
	96	$\mathbf{F}_{sq}$ * 1.0	0.22	463	-5
	105	$\mathbf{F}_{sq}$ * 1.1	0.25	454	-6
	114	$\mathbf{F}_{sq}$ * 1.2	0.27	446	-7

Weights in '000 t.
[1)] SSB 2007 relative to SSB 2006.
[2)] TAC 2006 relative to TAC 2005.
Shaded scenarios are not considered consistent with the precautionary approach.

Management considerations

Even through the SSB is considered to be at a satisfactory level, the abundance of sardine in some areas of the stock continues to be low when compared to the mid-1980s. The SSB is expected to increase from 2005 onwards due to the strong 2004 recruitment. The absolute value of this recruitment has to be confirmed. The 2004 year class is mainly distributed off northwest Iberia and its impact on other areas depends on dispersal. In addition, the 2000 year class appears to have been depleted faster than strong year classes from the 1980s. The implication of this is that the stock is now more dependent on the strength of the incoming recruitment.

Ecosystem considerations

Sardine forms large schools usually close to the coast and at depths up to around 50 m from the sea surface.

Sardine, anchovy, mackerel, and horse mackerel in waters off the Iberian Peninsula and the Bay of Biscay 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 was found to be 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 7 000 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 2004, 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 hypothesised to influence the small pelagic fish community, both worldwide and for the Iberian Peninsula. Yearly variations on 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 of inshore-offshore transport.

Scientific basis

Data and methods

The assessment is based on three independent 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 these fishery-independent indices of abundance and catch-at-age information.

Information from the fishing industry

Almost all catches are taken by Spanish and Portuguese purse seiners in a directed human consumption fishery.

Uncertainties in assessment and forecast

The main sources of uncertainty of the current sardine assessment have been extensively described in recent reports (ICES 2003, 2004, 2005) and relate to the definition of the stock unit, migration patterns within the stock area and across stock boundaries, and the relationship between stock dynamics in the 1980s and 1990s. The need to revise biological data included in the assessment has been also been pointed out in last year's report. The ongoing "SARDYN" project is expected to provide information about these topics and thus a revision of the stock unit, a comprehensive analysis of biological data and further exploration of area-based modelling is anticipated for the 2006 benchmark assessment.

The 2004 year class is estimated as the highest of the time-series, but its absolute magnitude is uncertain. There is, however, evidence of its strength and, in the survey, it appears at levels similar to the 2000 year class. It should be noted that the 2000 year class was initially overestimated by the assessment, and this may also prove to be the case for the 2004 year class. In addition, there is clear information that the 2004 year class is restricted to the western Iberian waters, mainly the northern Portuguese coast, as was also the case for the 2000 strong cohort. Its abundance in some of the stock areas (Cantabrian waters and southern Portuguese waters) is low, indicating that the impact on the different areas is dependent on its dispersal.

Comparison with previous assessment and advice

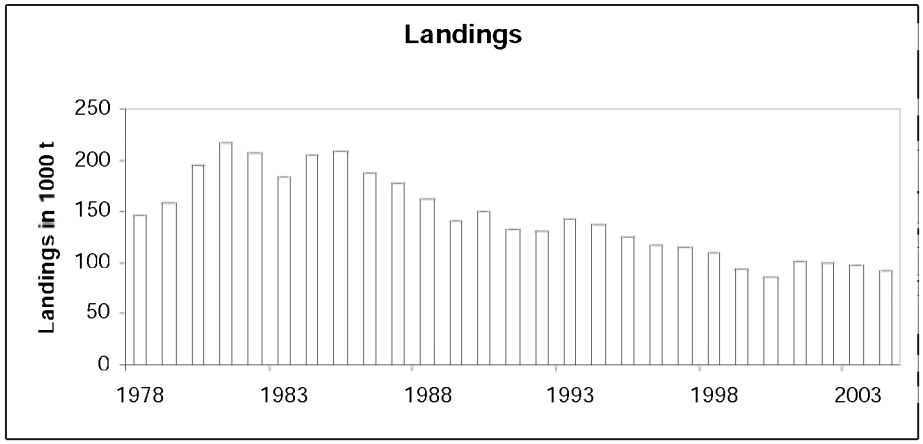
This is an update assessment, using the same model formulation as last year. The perception of the state of the stock provided by annual assessments has been stable in recent years.

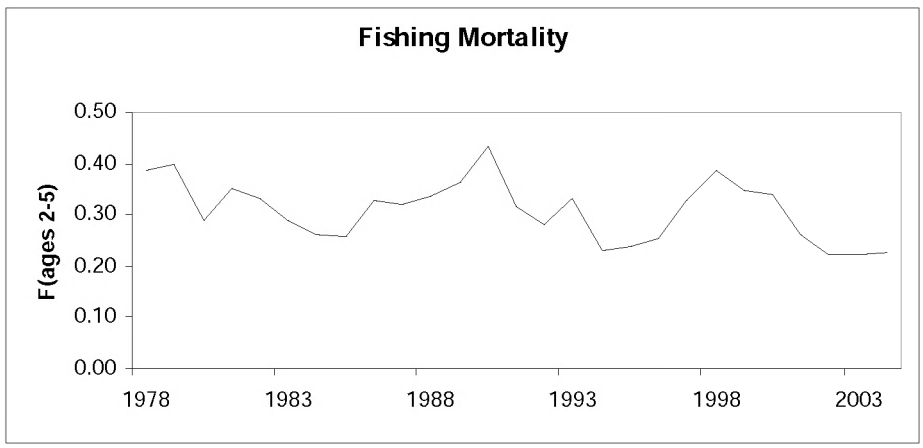
Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 6-15 September 2005 (ICES CM 2006/ACFM:08).

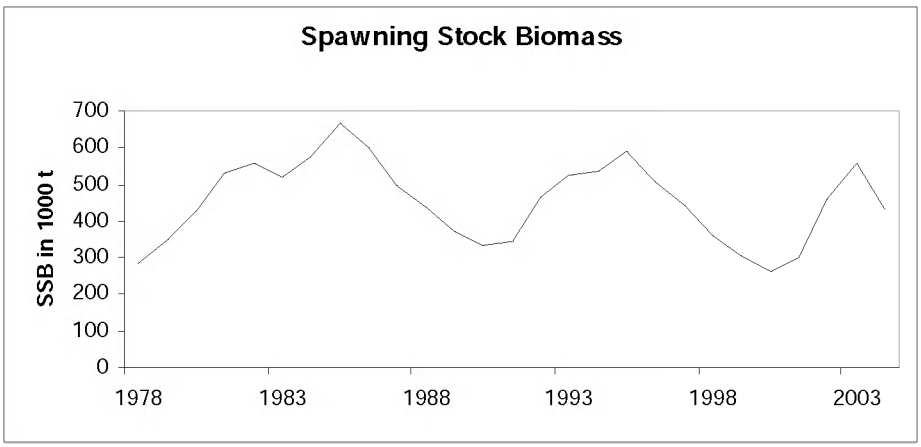
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings VIII & IX	ACFM Landings[3]
1987	No increase in F; TAC	140	-		178
1988	No increase in F; TAC	150	-	167	162
1989	No increase in F; TAC	212	-	146	141
1990	Room for increased F	227[2]	-	150	149
1991	Precautionary TAC	176	-	135	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	92
2005	No increase in F	106	-		
2006	No increase in F	96			

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.


Landings
Landings in 1000 t
250
200
150
100
50
0
1978
1983
1988
1993
1998
2003


Fishing Mortality
F (ages 2-5)
0.50
0.40
0.30
0.20
0.10
0.00
1978
1983
1988
1993
1998
2003


Recruitment (age 0)
Recruitment in billions
25
20
15
10
5
0
1978
1983
1988
1993
1998
2003


Spawning Stock Biomass
SSB in 1000 t
700
600
500
400
300
200
100
0
1978
1983
1988
1993
1998
2003

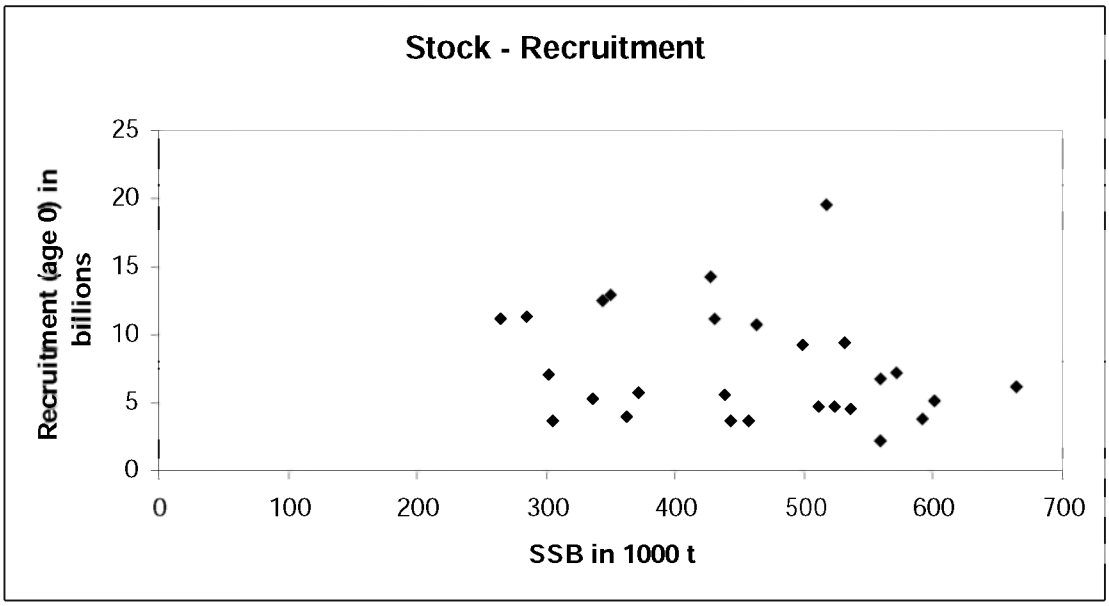

Stock - Recruitment
Recruitment (age 0) in billions
25
20
15
10
5
0
0
100
200
300
400
500
600
700
SSB in 1000 t

Table 1.4.5.1 Iberian sardine landings (tonnes) by Subarea and total for the period 1940–2003.

	Subarea										
Year	VIIIc	IXa North	IXa Central North	IXa Central South	IXa South Algarve	IXa South Cadiz	All Subareas	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**

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

Table 1.4.5.2 Sardine in Divisions VIIIc and IXa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1978	11327072	285715	145609	0.385
1979	12913393	349656	157241	0.397
1980	14320704	428198	194802	0.290
1981	9471025	531551	216517	0.350
1982	6823527	559113	206946	0.333
1983	19485728	517895	183837	0.290
1984	7251385	571941	206005	0.261
1985	6118734	665026	208439	0.259
1986	5208978	600577	187363	0.330
1987	9259239	499096	177696	0.320
1988	5589434	438476	161531	0.337
1989	5701080	371308	140961	0.365
1990	5289988	336284	149429	0.434
1991	12536342	343537	132587	0.318
1992	10707869	462689	130250	0.283
1993	4668419	523788	142495	0.332
1994	4544286	536509	136582	0.229
1995	3862658	590856	125280	0.240
1996	4723358	510400	116736	0.253
1997	3689069	442475	115814	0.330
1998	3901945	362385	108924	0.386
1999	3730510	304992	94091	0.347
2000	11190992	264423	85786	0.340
2001	7055308	302492	101957	0.263
2002	3690099	456964	99673	0.223
2003	2253894	558465	97831	0.223
2004	*11190992	430845	91886	0.228
Average	7648371	453543	145047	0.309

* Recruitment is assumed to be as high as in 2000.

1.4.6 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	Acceptable	Unknown	Fishery closed since July 2005

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

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 1.0-1.2.
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 should remain closed and should, at the earliest, be considered for opening if the acoustic and egg surveys in May–June 2006 demonstrate a strong 2005 year class.

Short-term implications

Outlook for 2006

The fishery is mostly dependent on the year class recruiting at age 1. Since there is no reliable indicator of the strength of the recruiting year class before it enters the fishery, informative short-term forecasts cannot be provided for 2006.

Management considerations

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, the population of which is dominated by the incoming year class. The lack of an index of recruitment has precluded the provision of informative population and catch forecasts for the anchovy fishery in the Bay of Biscay.

Since 2002, the total annual catches have been well below the fixed annual TAC, indicating that when the recruitment level 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.

The management of this stock should be based on a reliable indicator of the latest year-class strength prior to its recruitment into the adult stock and fishery. For the time being, the existing acoustic and egg surveys carried out in spring are the only ones able to provide such an indicator. These should be continued. In the future, earlier indices could be considered. These could result from autumn acoustic surveys covering the entire juvenile distribution area and for which the fish capture methods used include pelagic trawling. Existing autumn surveys should be developed on an annual basis and should be coordinated between research institutes and countries. The results of the autumn acoustic surveys should be properly tested with respect to their predictive performance of incoming recruitment before being used for management purposes.

ICES recommends a revision of the current management regime to take into account the fluctuations in recruitment. This may be achieved by developing a decision rule using directly the information from the May surveys or, possibly in the future, by basing decision on an assessment that takes the results of the September–October juvenile surveys into consideration. Additional measures like area restrictions may also be considered. Such revision should be achieved through dialogue between ICES and managers. In recent years, there has been a considerable development of tools for evaluating management strategies and accordingly, consideration of the management regime is timely.

Ecosystem considerations

Anchovies are a prey species for other pelagic and demersal species as well as 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

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.

The environment

The recruitment is likely to be strongly dependent on environmental factors. However, prediction of incoming recruitment based on environmental indices has been attempted and 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 the way it is for most of the other stocks ICES provides advice on.

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 management actions. In practice, this means that a $\mathbf{B}_{lim}$ will be necessary.

Scientific basis

Data and methods

Results from this assessment and from a new biomass model are in accordance with the assessment produced last year. These models were based on the egg (1987–2005) and acoustic surveys (1989–2005), as well as on the catches from French and Spanish fisheries.

Uncertainties in assessment and forecast

The biomass model gives results consistent with the current assessment model. The current model forces the use of age-disaggregated information which is not particularly informative on a species like anchovy. On the other hand, one of the sources of uncertainty in the biomass model is related to having to make assumptions about the statistical distribution of the estimated parameters. The new biomass model is promising as the basis for future assessments of this stock, but more testing is needed to assess the impact of some assumptions on recruitment and biomass estimates. The main source of uncertainty for this stock is related to the lack of recruitment index.

Comparison with previous assessment and advice

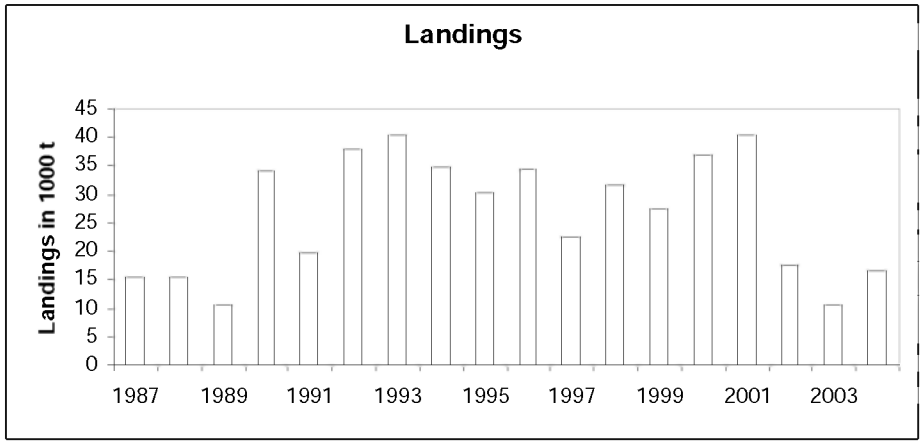
The perception of the stock has not changed from last year. It confirms poor recruitment since 2001.

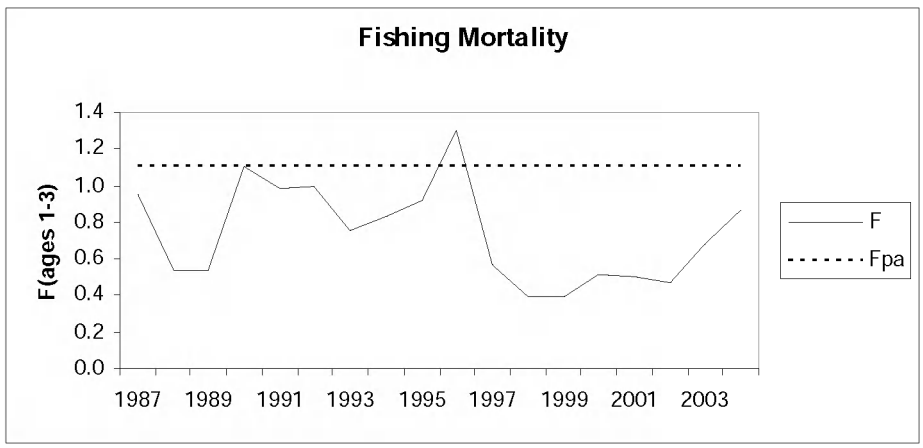
Source of information

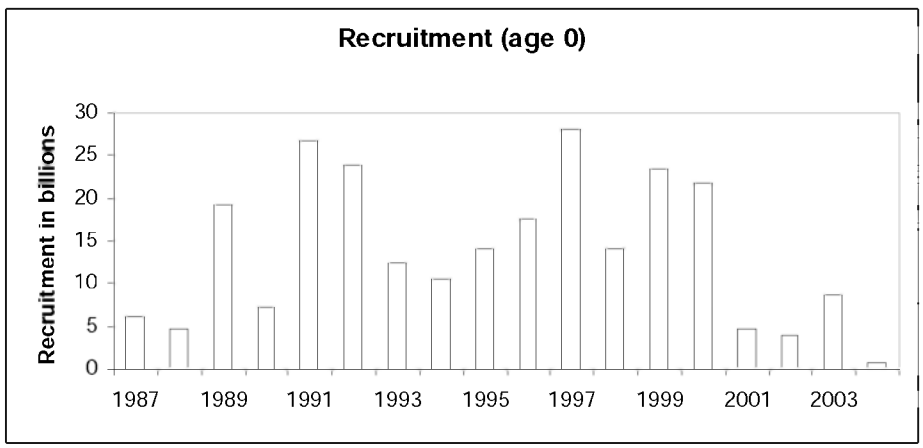
Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 6–15 September 2005 (ICES CM 2006/ACFM:08).

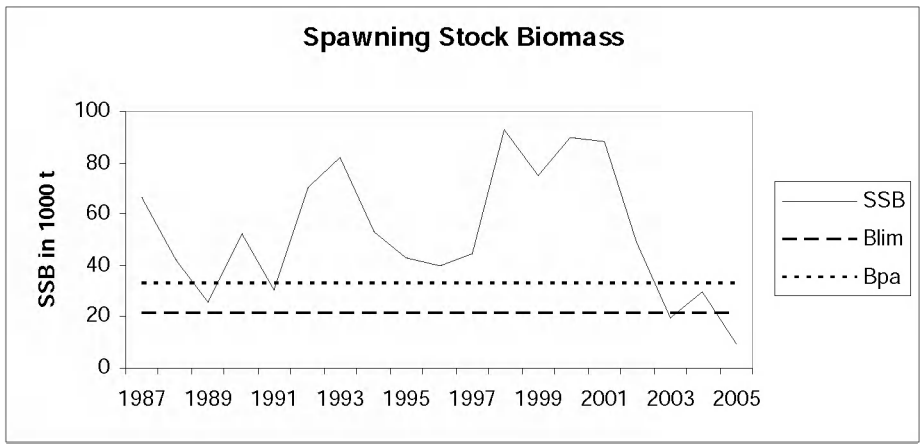
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Not assessed	-	32	14	15
1988	Not assessed	-	32	14	16
1989	Increase SSB; TAC	10.0[1]	32	n/a	11
1990	Precautionary TAC	12.3	30	n/a	34
1991	Precautionary TAC	14.0	30	n/a	20
1992	No advice	-	30	n/a	38
1993	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[2]
2005	Rebuilding SSB	5	30	n/a	
2006	Closure of the fishery*	0			

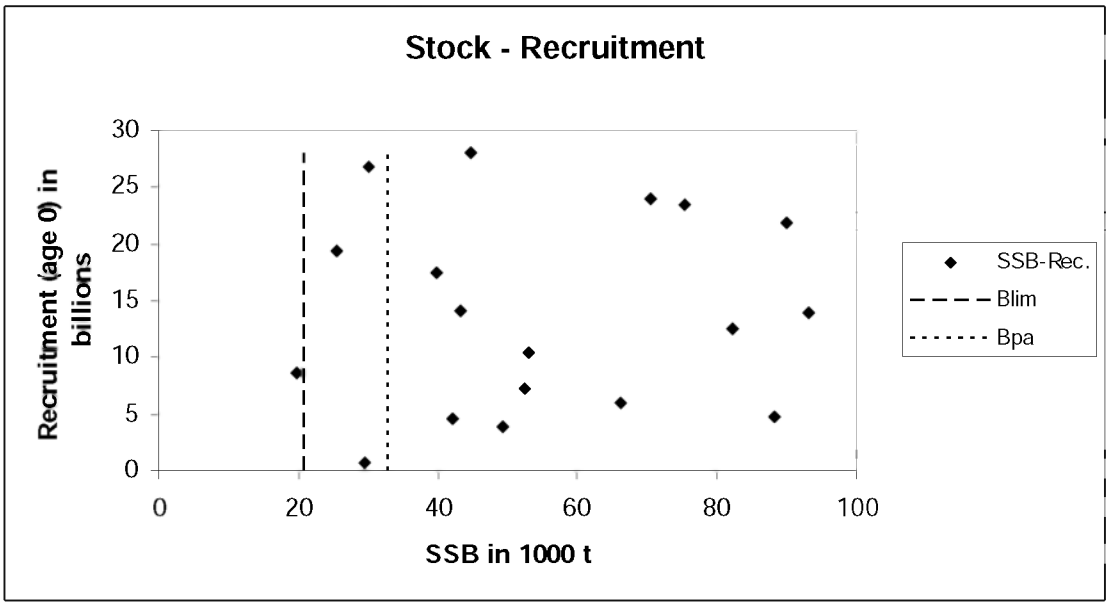
Weights in '000 t.
[1]Mean catch of 1985–1987.
[2]Preliminary estimate of catches up to 1st September.
n/a: not available.
* to be reconsidered after new information from Spring survey.


Landings
Landings in 1000 t
45
40
35
30
25
20
15
10
5
0
1987
1989
1991
1993
1995
1997
1999
2001
2003


Fishing Mortality
F(ages 1-3)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1987
1989
1991
1993
1995
1997
1999
2001
2003
F
Fpa


Recruitment (age 0)
Recruitment in billions
30
25
20
15
10
5
0
1987
1989
1991
1993
1995
1997
1999
2001
2003


Spawning Stock Biomass
SSB in 1000 t
100
80
60
40
20
0
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
30
25
20
15
10
5
0
0
20
40
60
80
100
SSB in 1000 t
SSB-Rec.
Blim
Bpa

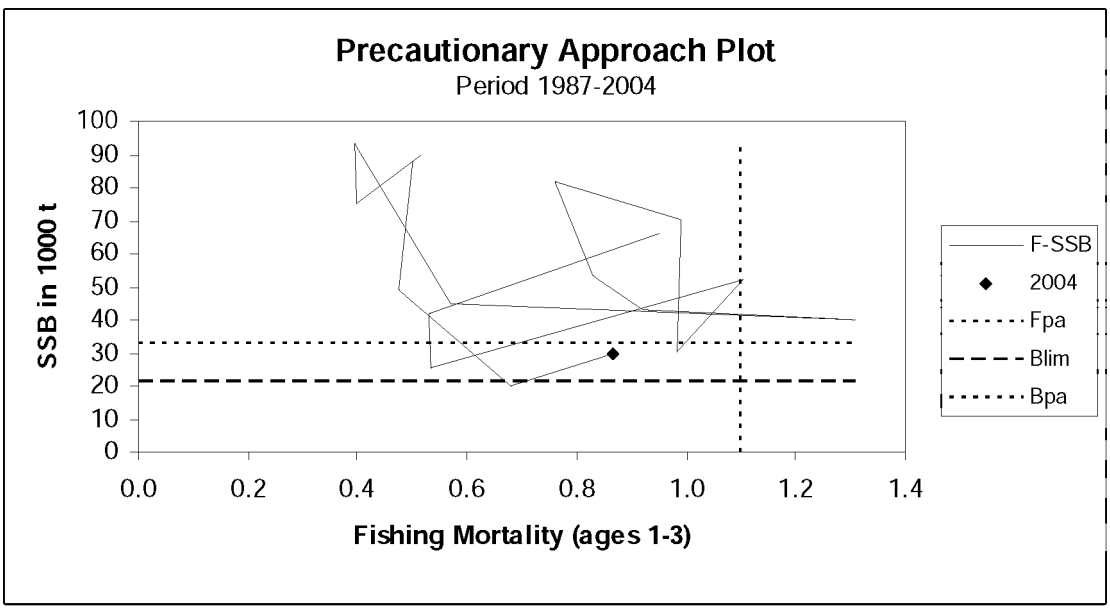

Precautionary Approach Plot
Period 1987-2004
SSB in 1000 t
100
90
80
70
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Fishing Mortality (ages 1-3)
F-SSB
2004
Fpa
Blim
Bpa

Table 1.4.6.1 Annual catches (in tonnes) of Bay of Biscay anchovy (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	200	n/a	1,152
AVERAGE (1990-04)	14,025	14,722	291	28,941

***Provisional estimate for 1st half of the year**

Table 1.4.6.2 Anchovy in Subarea VIII (Bay of Biscay).

Year	Recruitment Age 0 thousands	SSB (Jan. 1) tonnes	Landings tonnes	Mean F Ages 1-3
1987	6016810	66228	15308	0.9515
1988	4608420	42095	15581	0.5318
1989	19330460	25423	10614	0.535
1990	7261820	52298	34272	1.1049
1991	26801030	30224	19634	0.9837
1992	23990200	70602	37885	0.9912
1993	12504440	82103	40293	0.7592
1994	10445260	53047	34631	0.8299
1995	14137350	43315	30115	0.9215
1996	17494330	39927	34373	1.307
1997	28068180	44617	22337	0.5689
1998	13947780	93098	31617	0.3943
1999	23393350	75333	27259	0.3967
2000	21873820	89883	36994	0.5139
2001	4677090	88142	40564	0.502
2002	3963950	49190	17507	0.4736
2003	8622950	19836	10595	0.6797
2004	695980	29526	16361	0.8662
2005		9200		

1.4.7 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 risk. 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

Catches in 2006 should be restricted to 4700 t (mean catches from the period 1988–2002 excluding 1995, 1998, 2001, and 2002). This level should be maintained until the response of the stock to the fishery is known.

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.

Management considerations

There are large interannual fluctuations in the spawning stock. The fishery depends largely on the incoming year class, the abundance of which cannot be properly estimated before it has entered the fishery. Therefore in-year monitoring and management should be considered.

Ecosystem considerations

Anchovies are 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

There is a regular fishery for anchovy 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.

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 responsible for anchovy harvesting 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; this resulted in a remarkable increase in the effective fishing effort. The effort exerted by the entire purse-seine fleet since 1997 has been high.

Given the uncertain state of the stock, the high level of effort directed towards this stock since 1997 is undesirable. Accordingly, ICES advises reducing the catches.

The effects of regulations

In Portugal, the purse-seine fishery was closed during 2003 and 2004 in the northern part (north of 39º 42" North) of the Portuguese coast from the 1st of February to 31st of March.

The regulatory measures in place for the Spanish anchovy purse-seine fishing in the 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 (Sub-division 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 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, although the exact dates for the fishery closure in 2005 have not been decided yet.

While the fishery closure in autumn 2004 has not been formally evaluated, it did not have a major impact on the overall annual fishing effort (6824 effective fishing days in 2004, compared to 6823 fishing days in 2003). The same was also observed in the landings. The only noticeable effect of such a closure was the decrease in the effort exerted in autumn 2004 as compared to that exerted in the autumn in previous years (a 35% decrease). From the quarterly distribution of the catches in recent years, it appears that such a measure may have the potential to prevent annual effort levels raising to the historical maxima reached in 1999, 2001, and 2002.

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 fundamental 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

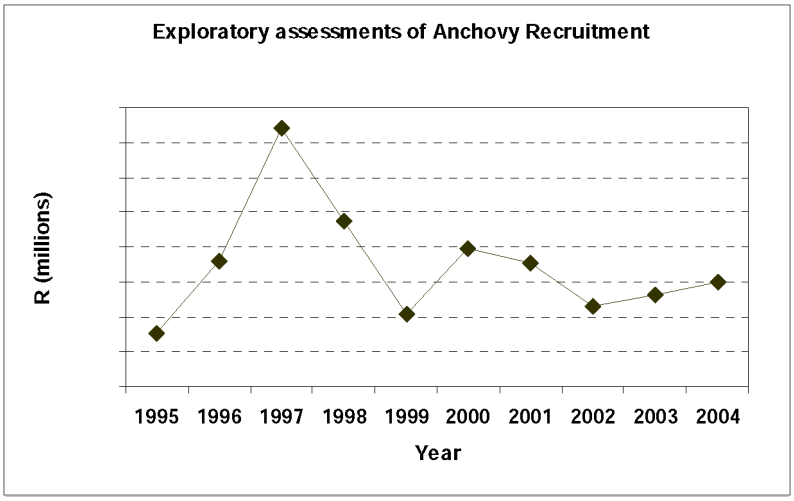
Data availability and some fishery (recent catch trajectories) and biological evidence have in previous years justified a separate data exploration of anchovy in Subdivision IXa South (Algarve and Gulf of Cadiz). However, an analytical assessment is not possible because of the age structure in the fishery (only age groups 0, 1, and 2 are present). As an alternative, an *ad hoc* seasonal (half-year periods) separable model has been used in the last years, but only for the purposes of data exploration of anchovy catch-at-age data from 1995 onwards. Results from this exploratory assessment are only valid to obtain a perception of relative trends in recruitment, SSB, and fishing mortality. The model formulation is currently under investigation and the state of the stock is therefore still unknown.

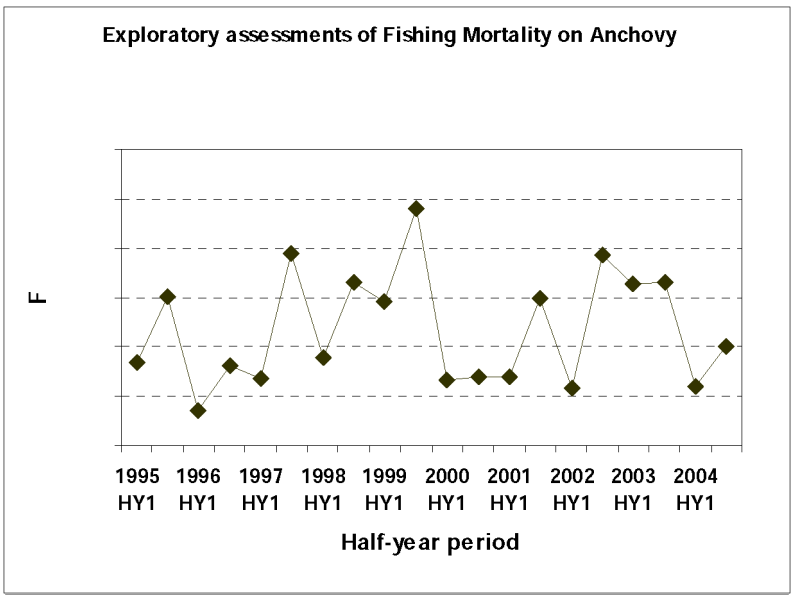
Source of information

Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 6–15 September 2005 (ICES CM 2006/ACFM:08).

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	
2006	Average catch excl. 95, 98, 01, and 02	4.7		

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


Exploratory assessments of Anchovy Recruitment
R (millions)
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Year


Exploratory assessments of Fishing Mortality on Anchovy
F
1995 HY1 1996 HY1 1997 HY1 1998 HY1 1999 HY1 2000 HY1 2001 HY1 2002 HY1 2003 HY1 2004 HY1
Half-year period

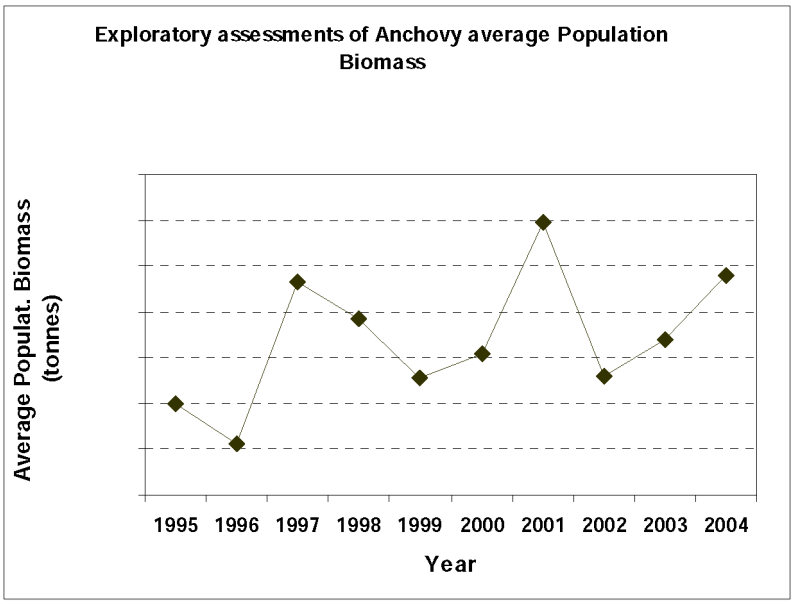

Exploratory assessments of Anchovy average Population Biomass
Average Populat. Biomass (tonnes)
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Year

Table 1.4.7.1. Portuguese and Spanish annual landings (tonnes) of anchovy in Division IXa (from Pestana, 1989 and 1996, and Working Group members).

	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	81	139	354	574	4	5183	5187	5761

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

1.4.8 *Nephrops* in Divisions VIIIa,b (Management Area N)

There are two Functional Units in this Management Area: a) Bay of Biscay North (FU 23) and b) Bay of Biscay South (FU 24), together called 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
Reference points not defined	Reference points not defined	Unknown	

In the absence of defined reference points, the state of the stock cannot be evaluated in this regard.

The stock assessment is indicative of trends only. The spawning stock biomass has recovered from a historical minimum and the fishing mortality has been decreasing.

Landings have declined over the last 20 years, but have stabilised in recent years.

Management objectives

There are no management objectives set for this fishery.

Reference points

Precautionary reference points have not been defined.

Single-stock exploitation boundaries

The stock appears to have recovered from a low stock size based on recent landings in the order of 3500 t. In the absence of reliable catch forecasts, ICES recommends that landings in 2006 should not exceed the recent average of 3 500 t.

Management considerations

Taking into account the large amounts of discards, improvement of selection pattern should be encouraged. Trials of selective grids for *Nephrops* are being carried out by fishers.

Northern hake is a major bycatch species in this fishery. A substantial part of the Northern hake bycatch is discarded because they are undersized. Recent experiments with square mesh panels have shown that these catches of undersized hake can be reduced by around 25–30%. These square mesh panels are being implemented under the French national regulation and further effort should be developed to increase the escapement of immature hake.

Factors affecting the fisheries and the stock

The effects of regulations

A mesh change was implemented by the EC in 2000 (Council Regulation EC N°850/98). 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. The expected consequence of the mesh size change would be a reduction in discards, which should result in a longer-term improvement in recruitment. Catch sampling data collected in 2003 and 2004 showed that discard rates stayed high (50–60% of *Nephrops* caught in number). The mesh regulation does not seem to have improved the fishing pattern.

In 2005, fishers initiated a licencing system in the *Nephrops* fishery to prevent an increase in the number of vessels targeting *Nephrops* in the Bay of Biscay.

Ecosystem

The predator stocks are all at a relatively low level. A rebuilding of predator stocks like hake is expected to increase natural mortality and reduce the yield from the stock.

Changes in fishing technology and fishing patterns

Nearly all landings from FUs 23 and 24 are taken by French trawlers. Landings have been generally high between 4500 and 7000 t until the early 1990s, but have decreased since then. The number of fishing days has decreased since 1994, owing to decommissioning of vessels.

The introduction of twin trawls and rockhoppers and the increased deployment of GPS are thought to have increased efficiency in the late 1990s and to have allowed exploitation of previously inaccessible areas.

Scientific basis

Data and methods

The stock was assessed with XSA using catch-at-'age' data generated by deterministic 'slicing' of sampled length distributions. Discard data were only available for 1987, 1991, 1998, 2003, and 2004. 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.

Uncertainties in assessment and forecast

The use of slicing to convert length compositions into age compositions 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. Therefore, a short-term prediction can only be provided for F *status quo*.

The assessment is calibrated with one single commercial CPUE series, where the definition of fishing effort is problematic because increases in technical efficiency are not taken into account. No fishery-independent information is available.

The recruitment estimates are sensitive to the extrapolated discards data.

Retrospective analyses indicate substantial overestimation of SSB and instability in the estimates of recent recruitment.

Comparison with previous assessment and advice

Compared to last year, the trends in spawning stock biomass and fishing mortality are similar, but the number of tuning fleets has been changed so that the results are not directly comparable to last year.

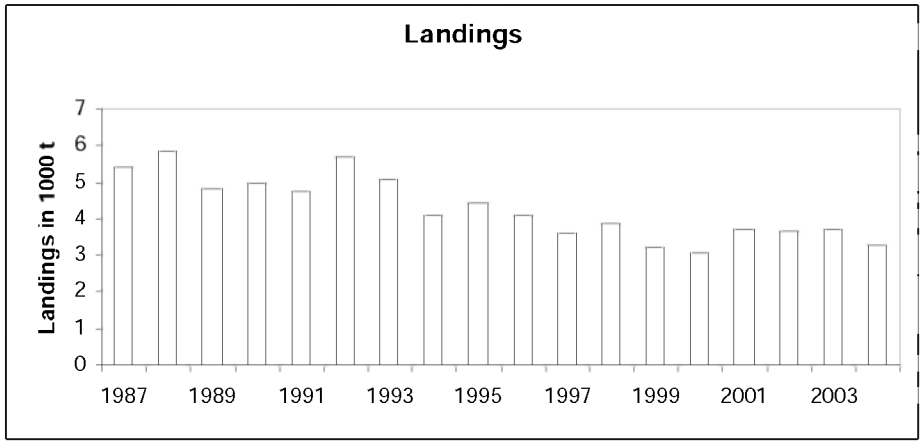
In 2003 ICES addressed a special request by the government of France to "consider the effects on stock development of different management scenarios if applied to the fishery for *Nephrops* in the Bay of Biscay". The conclusion from the analysis was that "If discards are not reduced and fishing mortality remains at the 2002 level (*status quo* scenario), SSB and landings are predicted to remain stable around the lowest value of the time-series. A 20% reduction in F in 2004 and an improvement of the fishing pattern in 2005 onwards is expected to reverse the decline in SSB in the medium term (scenario 1)". There is no evidence in the current assessment to contradict this conclusion.

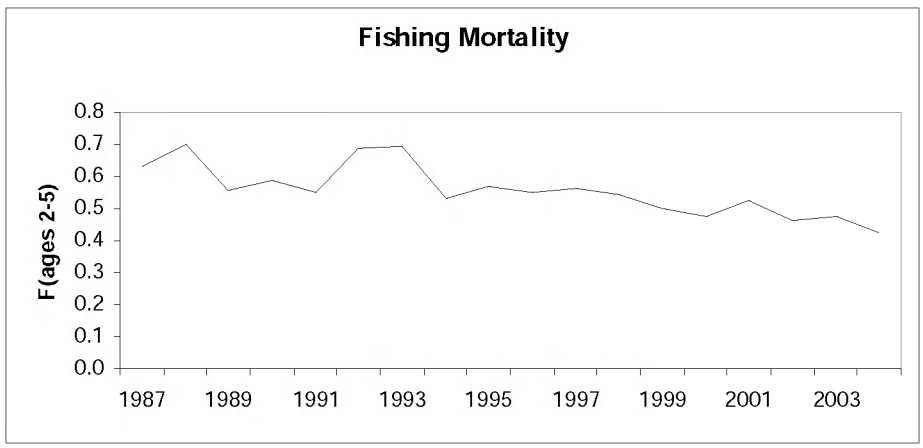
Source of information

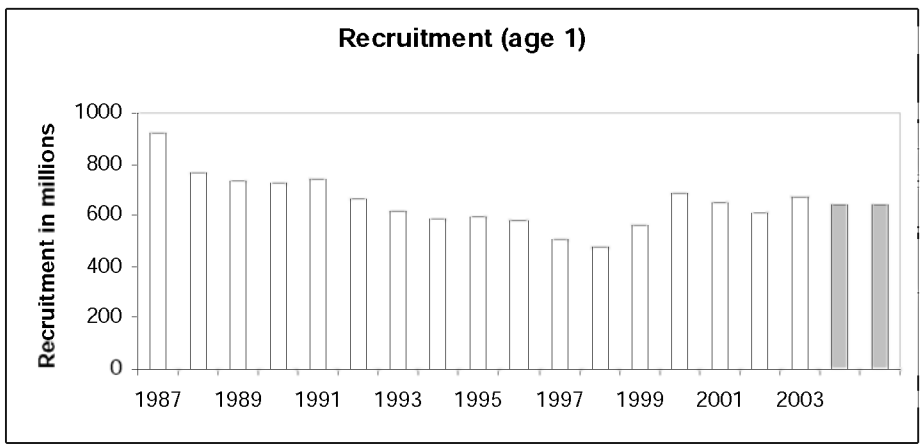
Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ACFM:01).

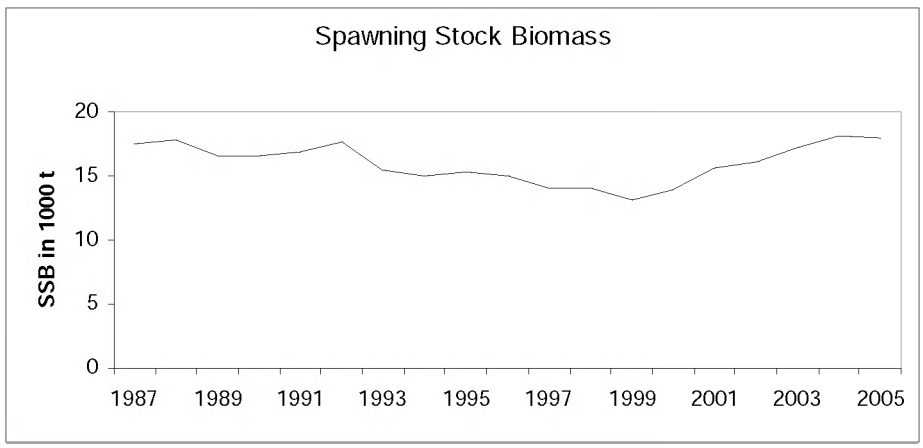
Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings [1]
1987				5.5
1988				5.9
1989				5.2
1990				5.1
1991				4.8
1992		~6.8	6.8	5.7
1993		6.8	6.8	5.2
1994		6.8	6.8	4.1
1995		6.8	6.8	4.5
1996		6.8	6.8	4.1
1997		6.8	6.8	3.6
1998		4.2	5.5	3.3
1999		4.2	5.5	3.2
2000		4.2	4.44	3.1
2001		4.2	4.0	3.8
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	
2006	Recent average landings	3.5		

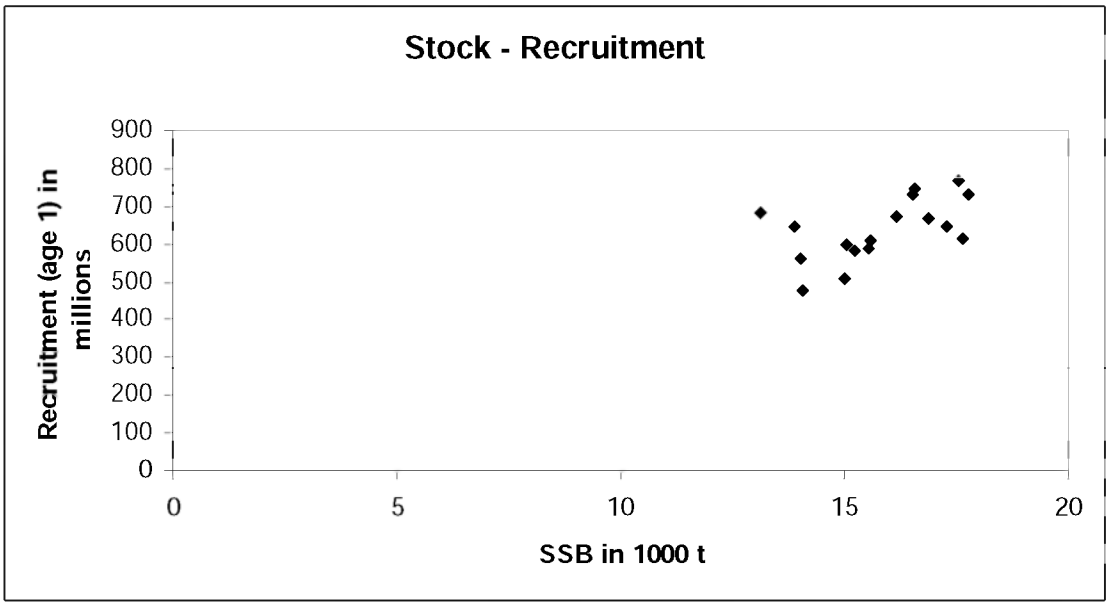
Weights in '000 t.
[1)] Does not include discards.


Landings
Landings in 1000 t
0
1
2
3
4
5
6
7
1987
1989
1991
1993
1995
1997
1999
2001
2003


Fishing Mortality
F (ages 2-5)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1987
1989
1991
1993
1995
1997
1999
2001
2003


Recruitment (age 1)
Recruitment in millions
0
200
400
600
800
1000
1987
1989
1991
1993
1995
1997
1999
2001
2003


Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005


Stock - Recruitment
Recruitment (age 1) in millions
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
SSB in 1000 t

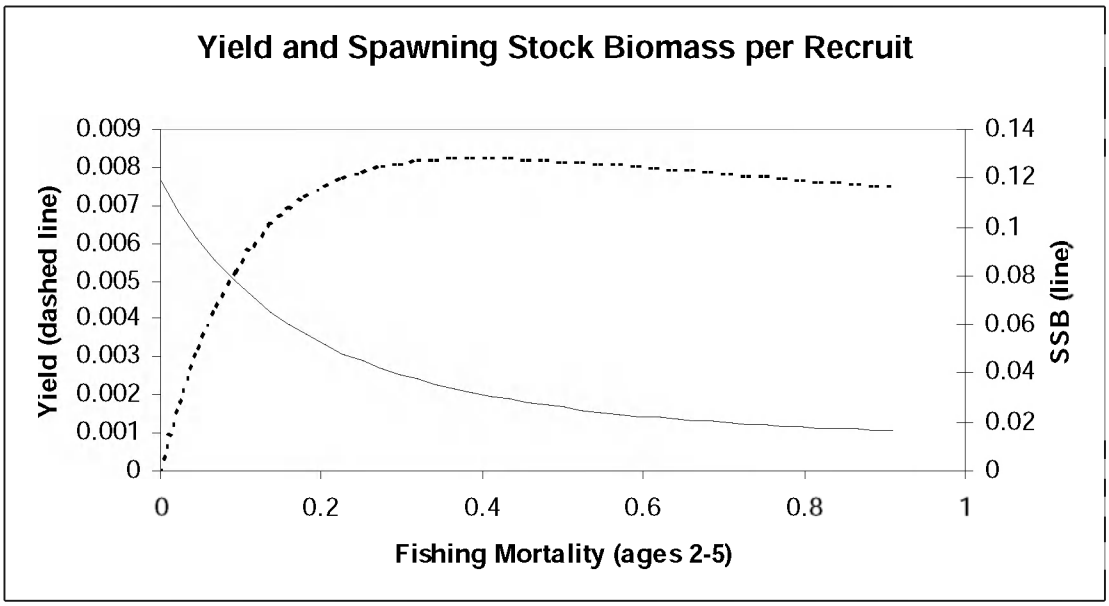

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
SSB (line)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
0.2
0.4
0.6
0.8
1
Fishing Mortality (ages 2-5)

Table 1.4.8.1. *Nephrops* in FUs 23–24 Bay of Biscay (VIIIa,b) – Estimates of catches (t) by FU for 1960–2004.

	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	-	4529	620	77	5226	1459		6685
1990	1	4613	359	87	5060	1290		6350
1991	1	4353	401	55	4810	1213	*	6022
1992	0	5123	558	47	5728	1583		7311
1993	0	4577	532	49	5158	1444		6602
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	1781		5420
1998	2	2974	250	40	3266	1453	*	4719
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	na	2970	315	5	3290	2193	*	5483

(1) Working Group estimates.

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

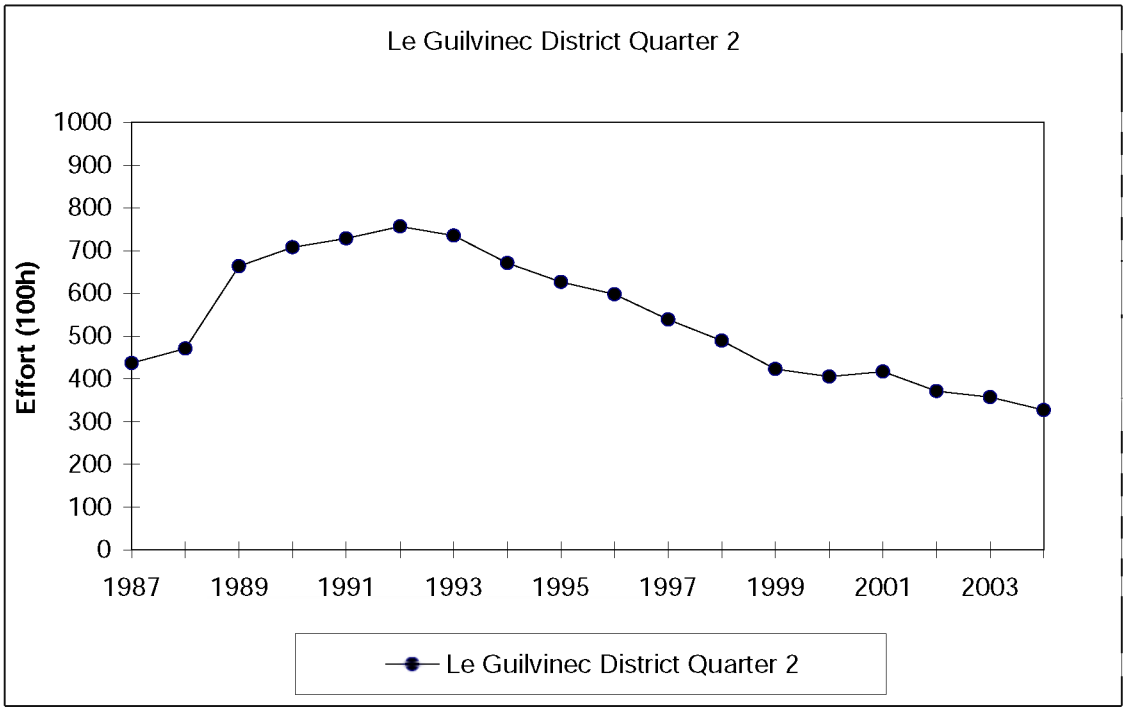
(3) Management Area N.

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

Table 1.4.8.2 *Nephrops* in Divisions VIIIa,b (Management Area N).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1987	921102	17543	5397	0.6307
1988	768739	17773	5875	0.7019
1989	731500	16501	4835	0.5562
1990	727994	16547	4972	0.5864
1991	745359	16854	4754	0.5515
1992	665118	17613	5681	0.6889
1993	614760	15527	5109	0.6947
1994	588068	15047	4092	0.5291
1995	596577	15235	4452	0.5663
1996	579849	15001	4118	0.5477
1997	508004	14062	3610	0.5621
1998	478297	14024	3865	0.5428
1999	561341	13135	3209	0.5019
2000	685378	13884	3069	0.4749
2001	646667	15578	3730	0.5236
2002	610744	16141	3679	0.4604
2003	671126	17260	3742	0.4776
2004	643435*	18052	3285	0.4267
2005	643435*	17917		
Average	651973	15984	4304	0.5569

* GM 1987–2002.



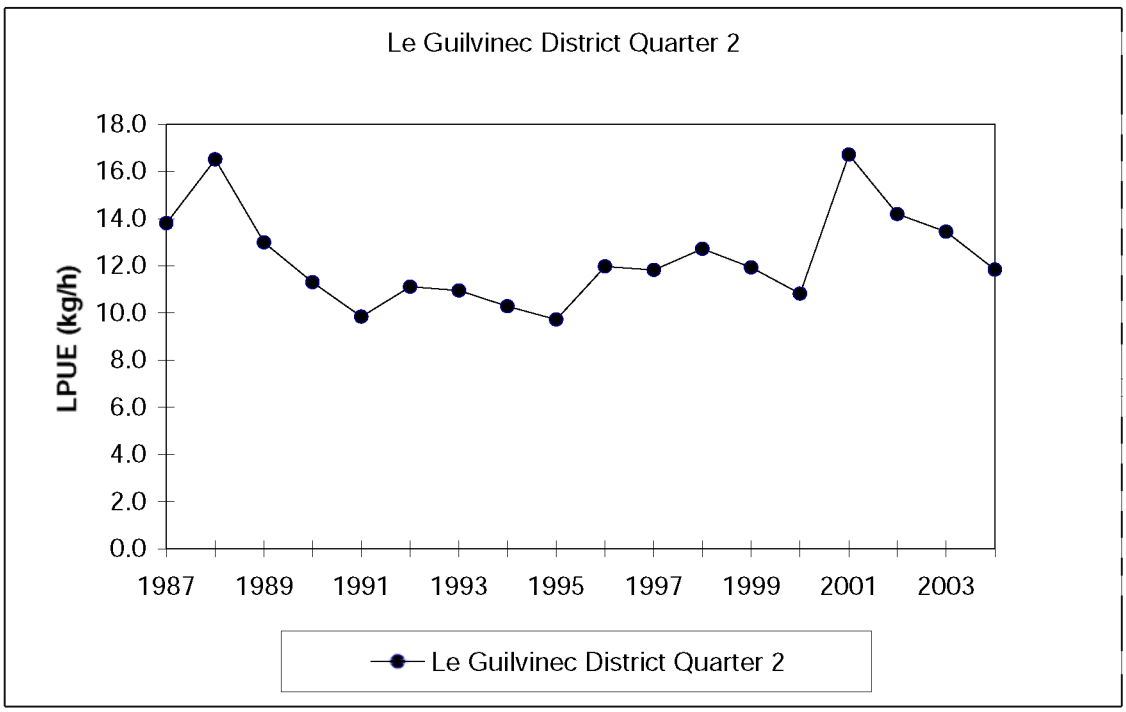


Figure 1.4.8.1 *Nephrops* in FU 23–24 Bay of Biscay (VIIIa,b) – Effort and LPUE values of the Le Guilvinec commercial fleet in quarter 2 (main *Nephrops* fishery) used to calibrate the assessment.

1.4.9 *Nephrops* in Division VIIIc (Management Area O)

There are two Functional Units in this Management Area: 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 last 12 years, 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 may have been reduced in recent years.

b) Cantabrian Sea (FU 31): No analytic assessment in 2005. Landings are currently at the lowest levels on record. Total effort information is not available for 2004, but the trend is declining. Previous assessments indicate drastic declines in recruitment and biomass of both males and females.

Management objectives

There are no management objectives set for this fishery, but a recovery plan for southern hake and Iberian *Nephrops* stocks is under development and will likely consist of progressive effort reduction.

Reference points

There are no reference points for these stocks. There is no yield-per-recruit table for these stocks.

Single-stock exploitation boundaries

Given the very low state of the stock, ICES repeats its advice of a zero TAC for this Management Area.

Management considerations

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 in 2004 has not been restrictive.

Mean length in the landings of both males and females shows an overall increasing trend, compatible with a declining recruitment or highgrading 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. Landings and effort in both functional units have declined and landings are now at extremely low levels compared to earlier years.

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.

The stock in FU 25 was assessed by using catch-at-'age' data generated by deterministic 'slicing' of sampled length distributions. The assessment was calibrated using data from one commercial LPUE time-series.
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 is considered to give a realistic reflection of the depleted state of this stock.

The assessment in FU25 is calibrated with a single commercial CPUE series, where the definition of fishing effort is based on nominal effort. There is no fishery-independent information 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. All these sources of information point to a collapse of stocks in Management Area O.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, 10–19 May 2005 (ICES CM 2006/ACFM:01).

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	
2006	Reduce catches to zero	0		

Weights in '000 t.

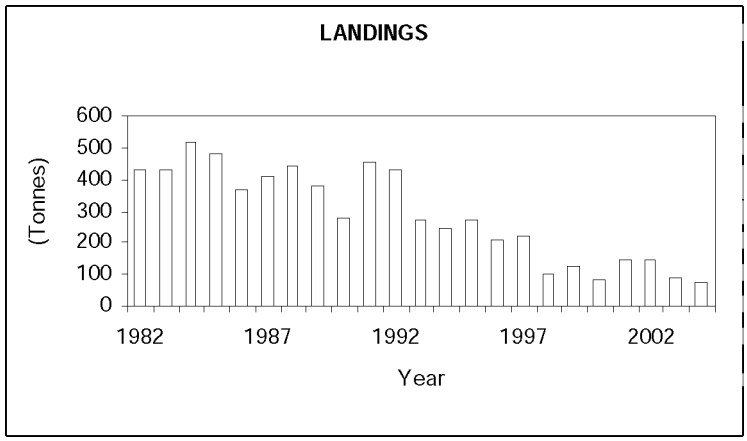
Table 1.4.9.1 *Nephrops* landings (tonnes) by Functional Unit in management area O (VIIIc). All landings taken by Spain.

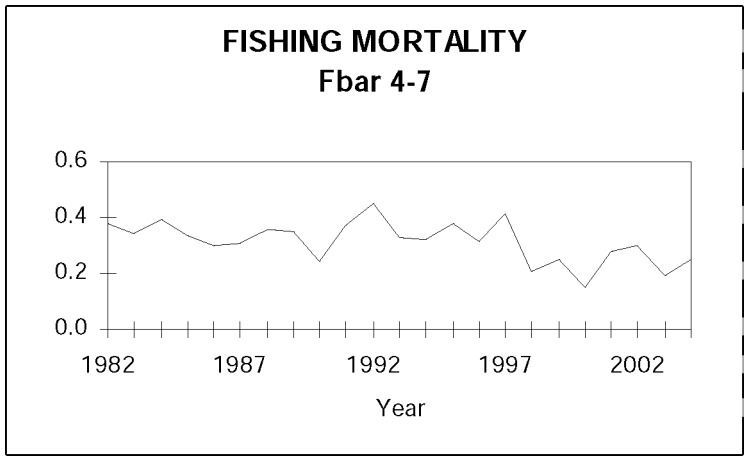
Year	FU 25	FU 31	**Total**
1983	433	63	496
1984	515	100	615
1985	477	128	605
1986	364	127	491
1987	412	118	530
1988	445	151	596
1989	376	177	553
1990	285	174	459
1991	453	109	562
1992	428	94	522
1993	274	101	375
1994	245	148	393
1995	273	94	367
1996	209	129	338
1997	219	98	317
1998*	103	72	175
1999*	124	48	172
2000*	81	34	115
2001*	147	27	174
2002	143	26	169
2003	89	22	111
2004*+	75	17	92

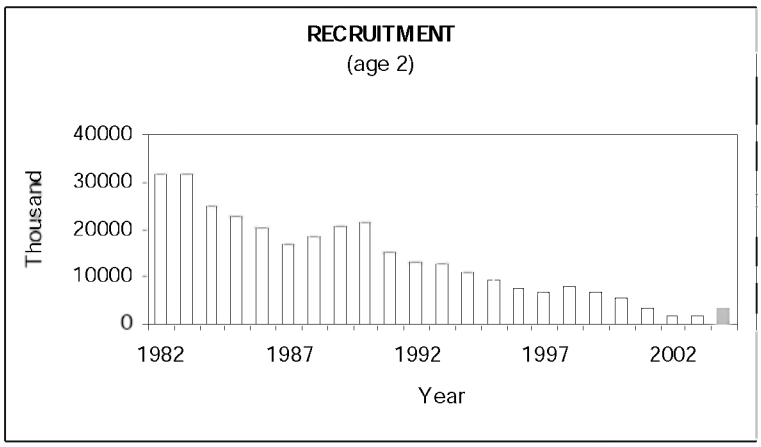
* estimated landings from sampling program
\+ preliminary

Table 1.4.9.2 *Nephrops* in Division VIIIc (Management Area O).

Year	Recruitment	SSB	Landings	Mean F
	thousands	tonnes	tonnes	
1982	31547	1952	431	0.3788
1983	31580	1969	432	0.3399
1984	24882	2219	515	0.3918
1985	22930	2036	477	0.3327
1986	20407	1879	364	0.2966
1987	17008	2009	411	0.3078
1988	18449	1977	444	0.3586
1989	20686	1982	376	0.3497
1990	21638	1784	280	0.2443
1991	15326	1774	452	0.3697
1992	13132	1561	427	0.4470
1993	12742	1318	274	0.3307
1994	10960	1213	246	0.3185
1995	9390	1139	273	0.3775
1996	7471	1014	208	0.3142
1997	6793	832	219	0.4178
1998	7944	749	103	0.2083
1999	6670	752	124	0.2524
2000	5560	731	81	0.1532
2001	3545	739	147	0.2766
2002	1680	679	143	0.3011
2003	1570	554	89	0.1954
2004	1625	465	74	0.2469
2005	1625	389		
Average	13132	1322	287	0.3135







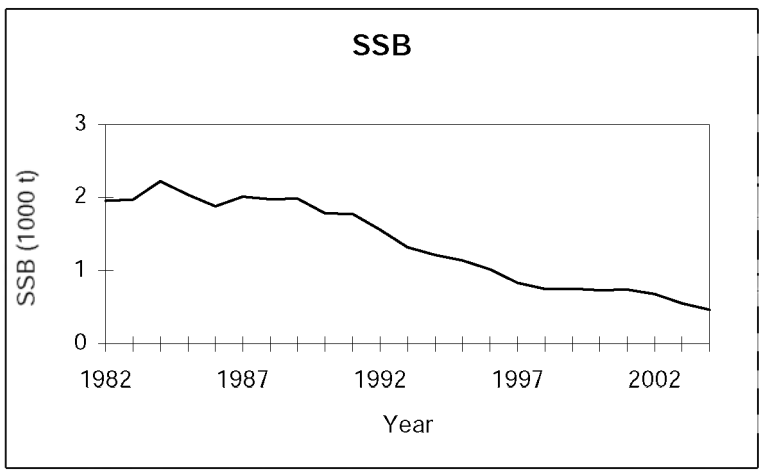


Figure 1.4.9.1 *Nephrops* (FU 25) North Galicia: Trends in landings, fishing mortality, recruitment, and Spawning Stock Biomass.

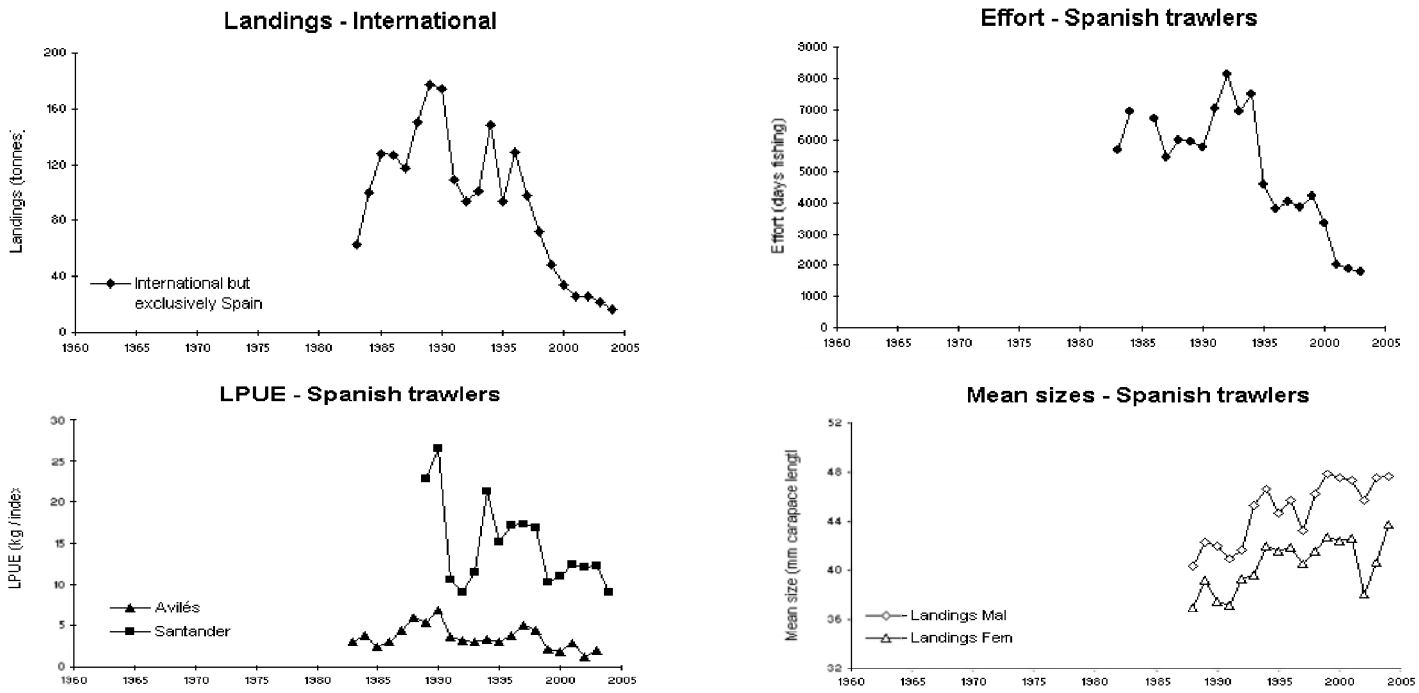


Figure 1.4.9.2 *Nephrops* Cantabrian Sea (FU 31): Long-term trends in landings, effort, LPUEs, and mean sizes.

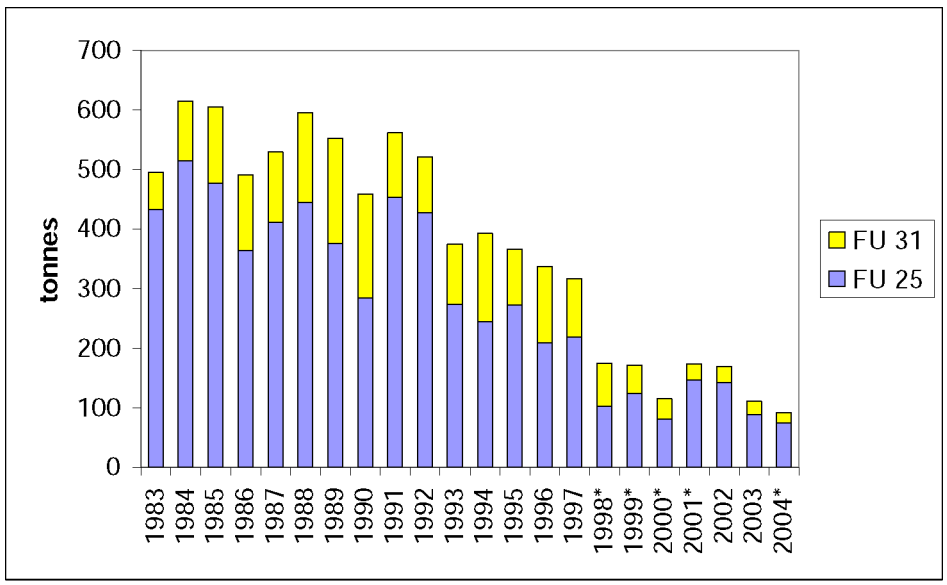


Figure 1.4.9.3 *Nephrops* VIIIc (Management area O): Long-term trends in landings by functional unit.

1.4.10 *Nephrops* in Division IXa (Management Area Q)

There are five Functional Units in this Management 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 gone gradually down since the 1980s, and are now very low. Recruitment is very low, and the stock size is reduced accordingly. The fishing mortality has fluctuated without any clear trend.

c+d) FU 28+ FU 29 SW and S Portugal: Landings declined sharply from 1992 to 1996, but have increased since then. Recruitment and SSB sharply reduced in the early 1990s and has remained low since then. Fishing mortality has increased in recent years.

e) FU 30 Gulf of Cadiz: There is no analytical assessment for this stock. Landings have increased to a maximum value in 2003. The state of the stock is uncertain. The survey and the LPUE information indicate a decline in the stock in 2004.

Management objectives

There are no management objectives set for this fishery.

Reference points

There are no reference points for these stocks. There is no yield-per-recruit table for these stocks.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

In FUs 26–27, there has been a progressive recruitment failure, and there should be no fishery unless recruitment improves.

In 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 2006 should not exceed 200 t.

For FU 30, the information is sparse, and the state of the stock is unclear. As the stock clearly is at least fully exploited, it is recommended not to increase the catches 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 somewhat better situation for the more southerly components, a subdivision of the TAC management area should be considered.

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 Management Area.

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) enforces a complete closure for the deepwater crustacean trawl fishery in January–February and establishes a ban in *Nephrops* fishing from 15 September to 15 October. Although these periods do not correspond to the main fishing season for *Nephrops*, some reduction in effort is expected. The ban in September–October was already implemented in 2004.

In 2004, the Gulf of Cadiz bottom trawl fleet was not allowed to operate during November. However, this fact seems not to have had any effect on the *Nephrops* fishery as the main directed effort in FU 30 occurs from April to September.

There is no evidence that the restrictions already in effect have a major impact on the status of the *Nephrops* stocks in FUs 28–30.

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 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, better equipped and more powerful ones.

Scientific basis

Data and methods

LPUE, effort data, and mean size data are available for the FUs of this Management Area. Length-composition data are available for FUs 26–27 combined, for FUs 28–29 combined, and for FU 30. It is assumed that discarding is minimal in these fisheries. Research trawl survey data are available for FU 26, FUs 28–29, and FU 30.

The stocks in FUs 26–27 and FUs 28–29 were assessed by XSA using catch-at-'age' data generated by deterministic 'slicing' of sampled length distributions. 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 for the period 1997–2003. 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 analytic assessment was carried out for this stock.

Uncertainties in assessment and forecast

The use of slicing to convert length compositions into age compositions (in FUs 25–29) 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 assessments are considered to give a realistic reflection of the depleted state of the stocks in Management Area Q.

Comparison with previous assessment and advice

Previous assessments of the West Galicia and North Portugal stocks (FUs 26–27) and of the SW and S Portugal stocks (FUs 28–29) indicated strong declines in biomass and recruitment in both cases and the 2005 assessment for FUs 26–27 confirms these trends.

Last year ICES recommended a recovery plan for *Nephrops* in FUs 28–29. The current perception of stock development indicates that the stock is increasing despite the catches taken from this stock. Therefore, ICES considers that there is no reason to reiterate the advice for a recovery plan, but instead recommends a low catch.

Sources of information

Report of the Working Group on *Nephrops* Stocks, 28 March–2 April 2004 (ICES CM 2004/ACFM:18).
Report of the Working Group on the Assessment of Hake, Monk and Megrim (WGHMM), 10–19 May 2005 (ICES CM 2006/ACFM:01).

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	
2006	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.

Table 1.4.10.1 *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	107	0	***792***
1995	117	10	384	273	132	0	***916***
1996	264	67		132	49	0	***512***
1997	359	74		136	99	0	***668***
1998	295	50		161	89	0	***595***
1999	194	54		211	123	0	***581***
2000	102	30		201	92	0	***425***
2001	105	27		271	178	0	***582***
2002	59	28		359	247	0	***693***
2003	39	33		362	285	0	***719***
2004*	38	31		372	130	0	***572***
* provisional							

Table 1.4.10.2 *Nephrops* landings (tonnes) by country in Management Area Q (IXa).

Year	Portugal	Spain	Total
1994	259	533	***792***
1995	283	633	***916***
1996	149	363	***512***
1997	142	526	***668***
1998	169	426	***595***
1999	216	365	***581***
2000	210	215	***425***
2001	278	304	***582***
2002	363	330	***693***
2003	373	346	***719***
2004*	379	192	***572***
* provisional			

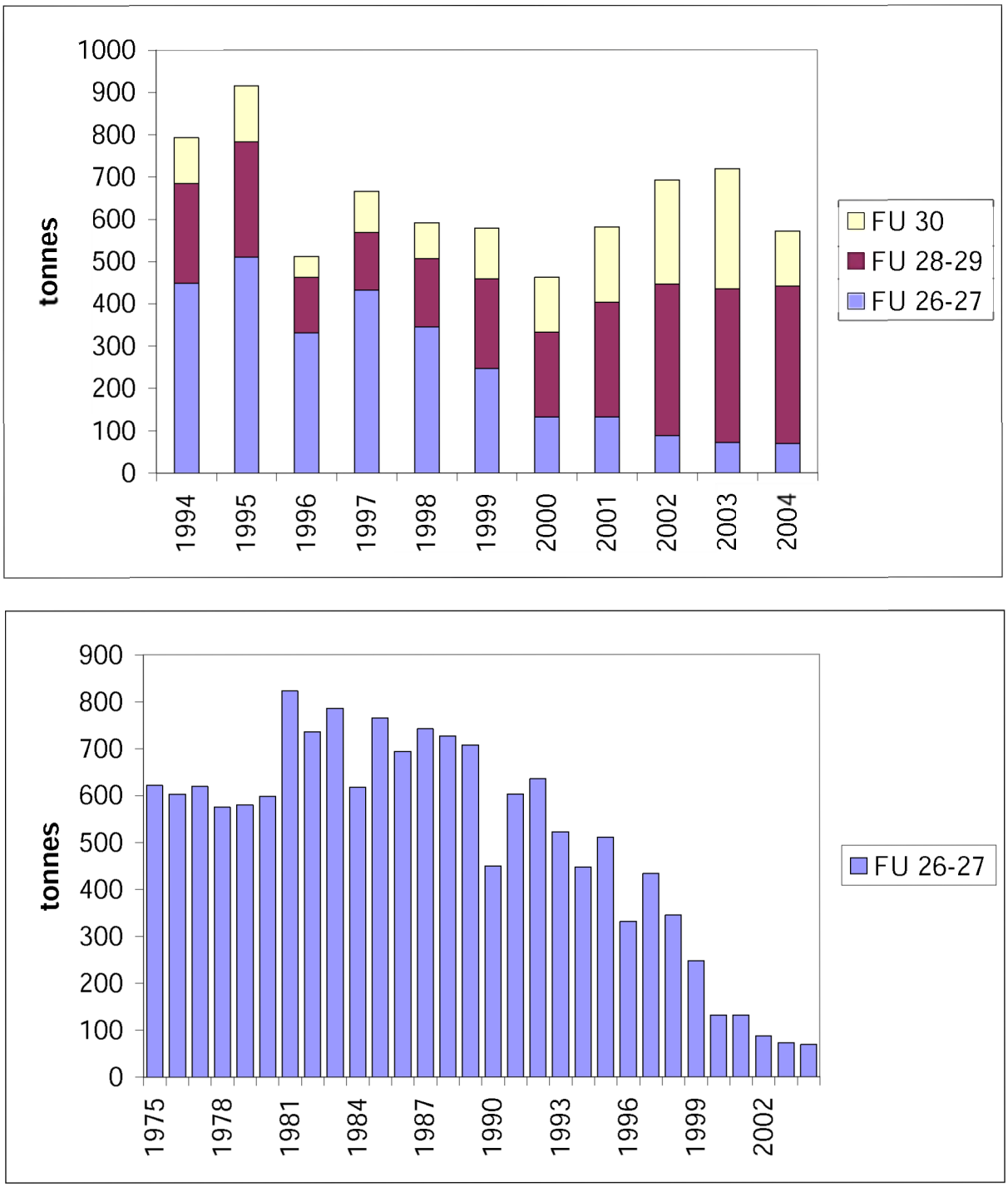


Figure 1.4.10.1 *Nephrops* landings (tonnes) by Functional Unit in Management Area Q (IXa).

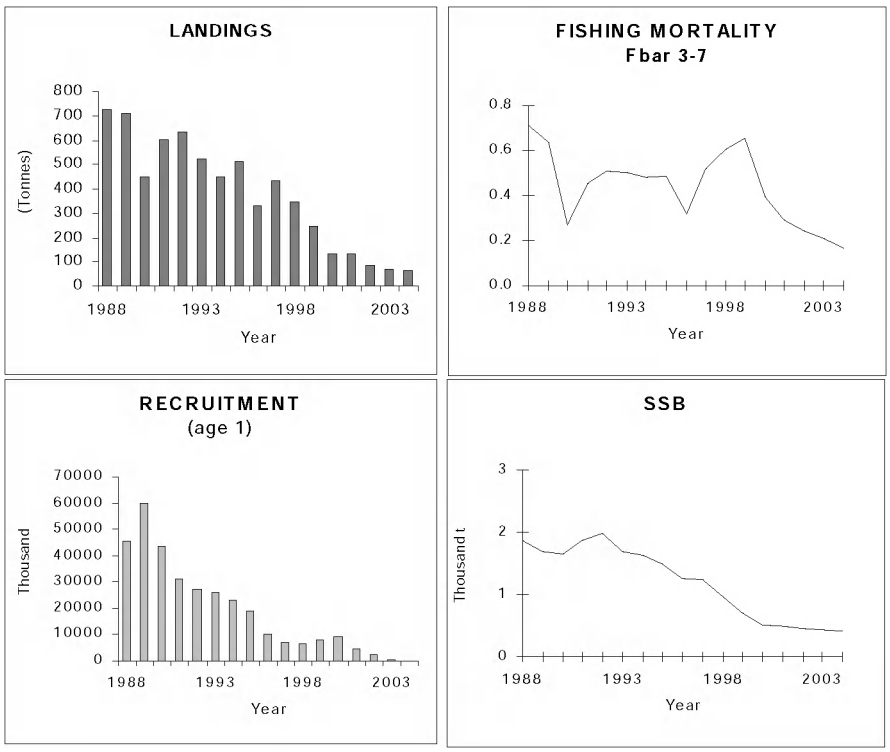


Figure 1.4.10.2 (FUs 26–27) West Galicia & North Portugal: Output VPA: Trends in landings, $\mathbf{F}_{bar}$, recruitment, and Spawning Stock Biomass.

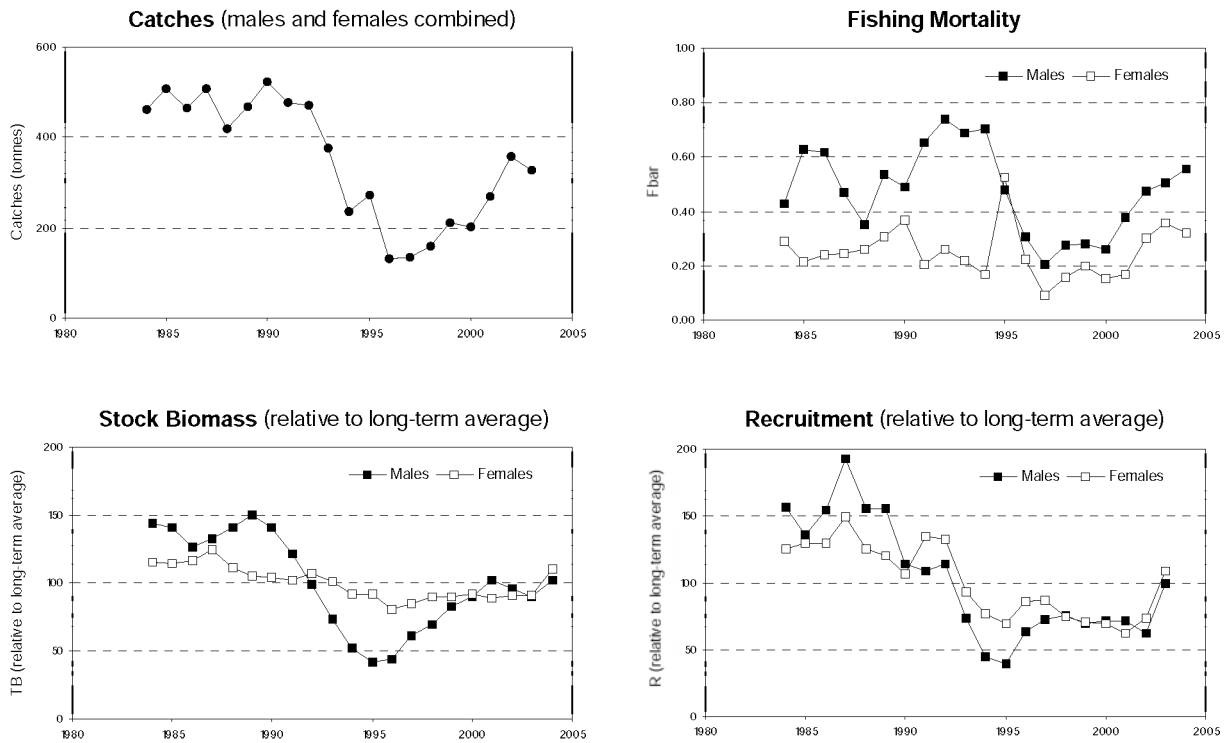


Figure1.4.10.3 Southwest and South Portugal (FU 28-29): Output VPA: Trends in catches, $\mathbf{F}_{bar}$, stock biomass, and recruitment.

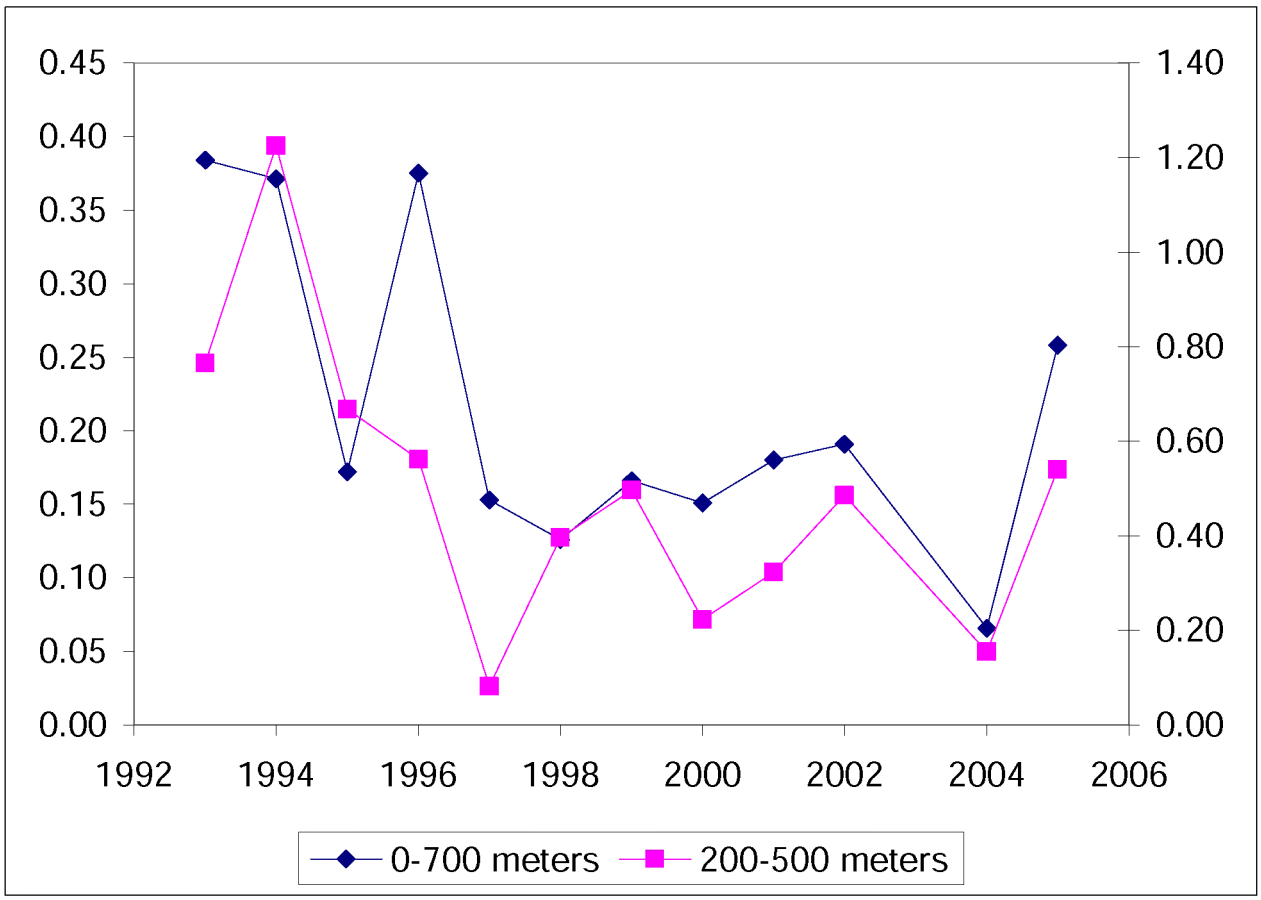


Figure 1.4.10.4 *Nephrops* in FU 30. Trend in survey data (kg/hour).

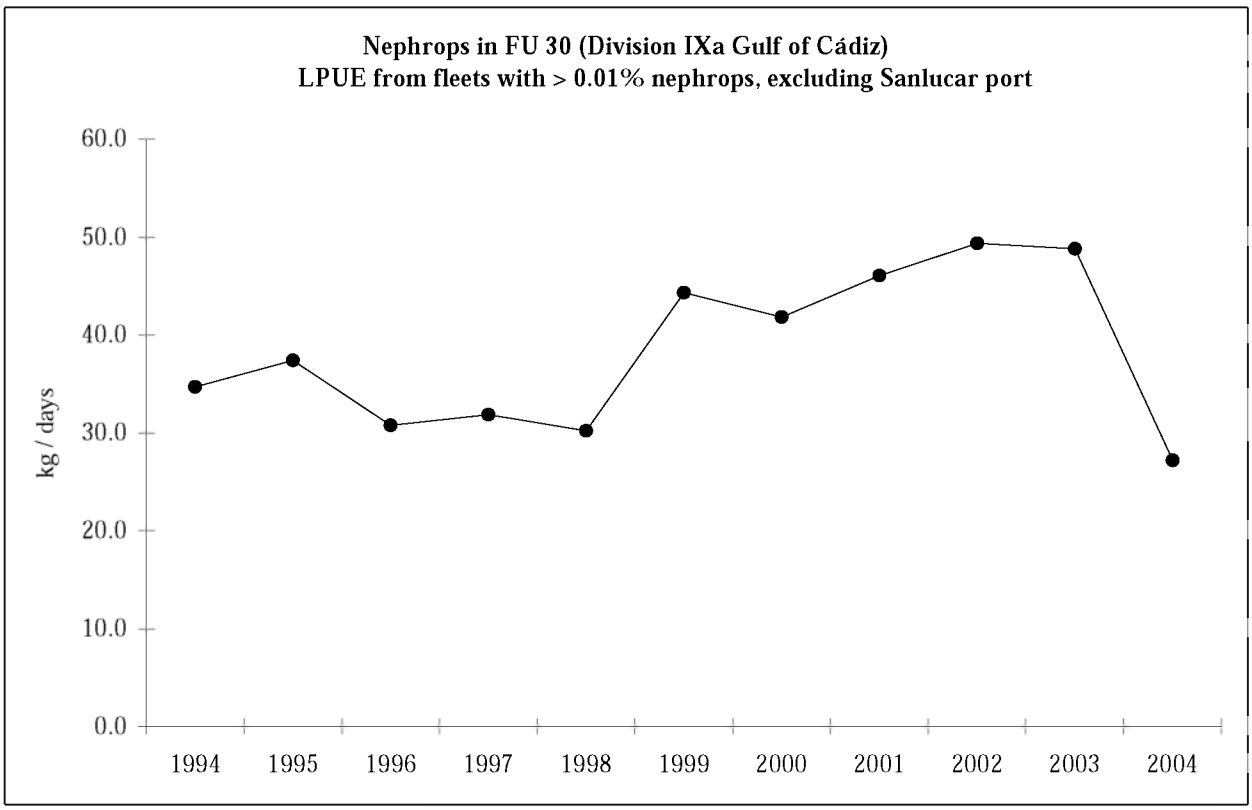


Figure 1.4.10.5 *Nephrops* in FU 30. Trend in LPUE.

1.4.11 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; since then F has decreased, but remains above $\mathbf{F}_{pa}$. Since 1992 recruitment has been at a lower, but stable level.

Management objectives

There are no specific management objectives for this stock.

Reference points

Precautionary Approach Reference Points (changed in 2001):

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.
$\mathbf{F}_{lim}$ = 0.5, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ = 0.36.

Yield and spawning biomass per Recruit
F-reference points

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 5 years	0.52	0.219	0.469
$\mathbf{F}_{max}$	0.213	0.245	1.208
$\mathbf{F}_{0.1}$	0.11	0.223	2.12
$\mathbf{F}_{med}$	0.49	0.225	0.55

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 (0.52) is well above the candidate reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.

Exploitation boundaries in relation to precautionary limits

Fishing at $\mathbf{F}_{pa}$ implies a 31% reduction in F and corresponds to landings less than 4 200 t in 2006. This will lead to an SSB in 2007 at or above $\mathbf{B}_{pa}$.

Short-term implications

Outlook for 2006

Basis: F(2005) = mean F(03-04) unscaled ; $\mathbf{F}_{sq}$ = 0.52 ; R_{04-05} = GM = 23.6 million; SSB(2005) = 11.6 kt; SSB(2006) = 12.2 kt; landings (2005) = 4.7 kt.

Thus, F in 2005 is set to the 2003–2004 mean i.e. 0.43, giving predicted landings in line with expected landings in 2005. $\mathbf{F}_{sq}$ is the 2000–2004 mean to overcome the inclusion of an exceptionally high 2002 F in the mean.

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0.00		0.00	18.38	50%	-100%
Status quo	5.67	$\mathbf{F}_{sq}$	0.52	11.84	-3%	37%
High long-term yield	2.65	F(long-term yield)	0.21	15.31	25%	-36%
	0.71	$\mathbf{F}_{sq}$*0.1	0.05	17.56	44%	-83%
	1.70	$\mathbf{F}_{sq}$*0.25	0.13	16.41	34%	-59%
	3.20	$\mathbf{F}_{sq}$*0.5	0.26	14.68	20%	-23%
Status quo	4.51	$\mathbf{F}_{sq}$*0.75	0.39	13.17	8%	9%
	5.23	$\mathbf{F}_{sq}$*0.9	0.47	12.35	1%	26%
	5.67	$\mathbf{F}_{sq}$*1	0.52	11.84	-3%	37%
	6.10	$\mathbf{F}_{sq}$*1.1	0.57	11.36	-7%	47%
	6.69	$\mathbf{F}_{sq}$*1.25	0.65	10.68	-13%	62%
	0.49	TAC($\mathbf{F}_{pa}$) *0.1	0.04	17.81	46%	-88%
	1.20	TAC($\mathbf{F}_{pa}$) *0.25	0.09	16.99	39%	-71%
	2.30	TAC($\mathbf{F}_{pa}$) *0.5	0.18	15.72	29%	-45%
	3.30	TAC($\mathbf{F}_{pa}$) *0.75	0.27	14.56	19%	-20%
	3.87	TAC($\mathbf{F}_{pa}$) *0.9	0.32	13.91	14%	-7%
Precautionary limits	4.23	$\mathbf{F}_{pa} = \mathbf{F}_{sq}$*0.69	0.36	13.50	10%	2%
	4.57	TAC($\mathbf{F}_{pa}$) *1.1	0.40	13.10	7%	10%
	5.06	TAC($\mathbf{F}_{pa}$) *1.25	0.45	12.53	3%	22%
	5.84	TAC($\mathbf{F}_{pa}$) *1.5	0.54	11.65	-5%	41%
	6.55	TAC($\mathbf{F}_{pa}$) *1.75	0.63	10.85	-11%	58%
	7.19	TAC($\mathbf{F}_{pa}$) *2	0.72	10.11	-17%	74%
	7.79	TAC($\mathbf{F}_{pa}$) *2.25	0.81	9.44	-23%	88%
Mixed Fisheries						

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

Management considerations

Even though the selection pattern of this stock has improved in the past due to the development of the gillnet fishery (in the mid-1980s), fishing mortality is too high to allow a sustainable exploitation of this stock.

Management at fishing mortalities which are considerably lower than the present would imply robustness in relation to assessment uncertainty and risk to SSB. The short-term advice remains to reduce fishing mortality to allow SSB to increase above $\mathbf{B}_{pa}$. ICES continues to recommend that a management plan be developed in consultation with stakeholders to reduce fishing to a longer-term target. Such a plan might involve progressive reductions in fishing mortality while maintaining landings levels. An example management scenario is given in Figure 1.4.11.1 where F is reduced by 10% annually to $\mathbf{F}_{max}$.

Ecosystem considerations

Studies in Vilaine bay showed a significant positive relationship between the fluvial discharges in winter-spring and the size of the 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 the impact of this has not been taken into account in stock projections.

Factors affecting fishing

Environmental conditions have a large influence on the catches of sole in the first quarter. This was particularly true in 2002 when hydrodynamic conditions very favourable to the fixed nets' fishery (frequent strong swell periods in the first quarter). More usual hydrodynamic conditions have been observed in the beginning of 2003 and of 2004, and also in the first half of 2005.

Factors affecting the fisheries and the stock

Regulations and their effects

The landings of sole in the Bay of Biscay are subject to a TAC regulation. Restrictive TACs since 2002 have been overshot particularly in 2002 and have not reduced fishing mortality significantly. The minimum landing size is 24 cm and the minimum mesh size is 70 mm for trawls and 100 mm for fixed nets, when directed on sole. Furthermore, since 2002, the hake recovery plan has increased the minimum mesh size for trawl to 100 mm in a large part of the Bay of Biscay. 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 swapping occurs usually with the Netherlands to increase Belgian fishing possibilities.

Changes in fishing technology and fishing patterns

The French fixed net fishery for sole (largely in the spawning season) has increased over the assessment period, from less than 5% of landings prior to 1985, to around 70% in recent years and this has resulted in an improvement of the selection pattern.

Scientific basis

Data and methods

The assessment is analytical and based on landings. Partial discards 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. CPUE data series from surveys and commercial fleets are used. 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 representatives of the fishing industry in France was held prior to the Working Group meeting. It confirmed the agreement on the state of the stock as assessed by the 2004 Working Group. Information provided on the activities of La Rochelle and Les Sables fleets by fishers' organisations validate the tuning fleets data revisions as carried out this year.

Uncertainties in assessment and forecast

This assessment is tuned almost entirely by commercial fleets. This may result in an overly optimistic estimate of SSB and an underestimate of F as the targeted nature of the tuning fleets may result in stable CPUEs patterns in situations when the population is actually declining. Currently there are no reliable fishery-independent survey data for this stock. This is particularly a problem when estimating the incoming recruitment, and it is an important deficiency in the assessment and forecast. The forecast catch and SSB is dominated by assumed mean recruitment (63% of the 2006 landings and 62% of the 2007 SSB).

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 is probably minimal as the catch is dominated by France.

Comparison with previous assessment and advice

Recent estimates of fishing mortality, SSB, and recruitment are consistent with last year's estimates.

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

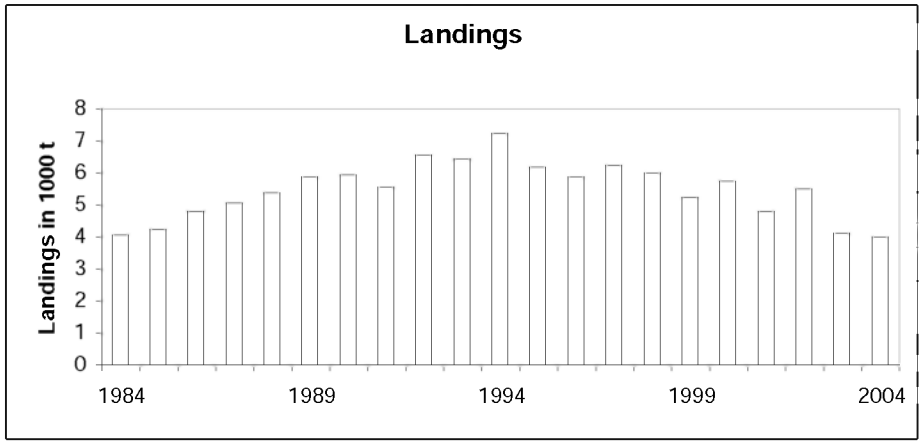
Source of information

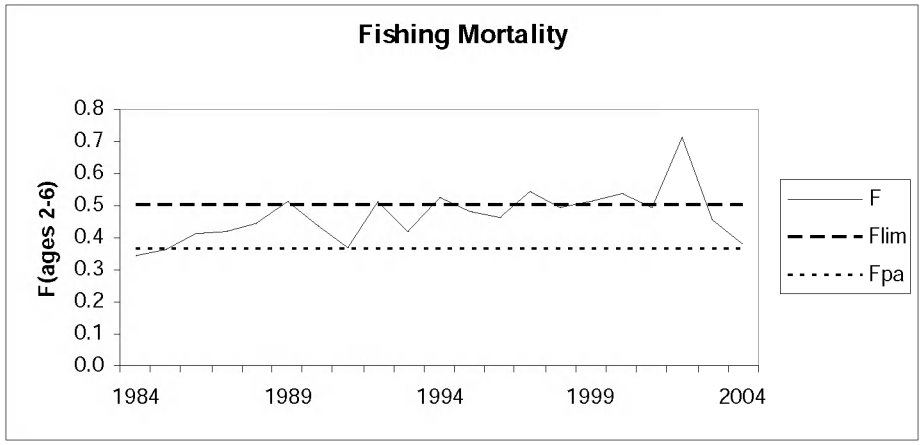
Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

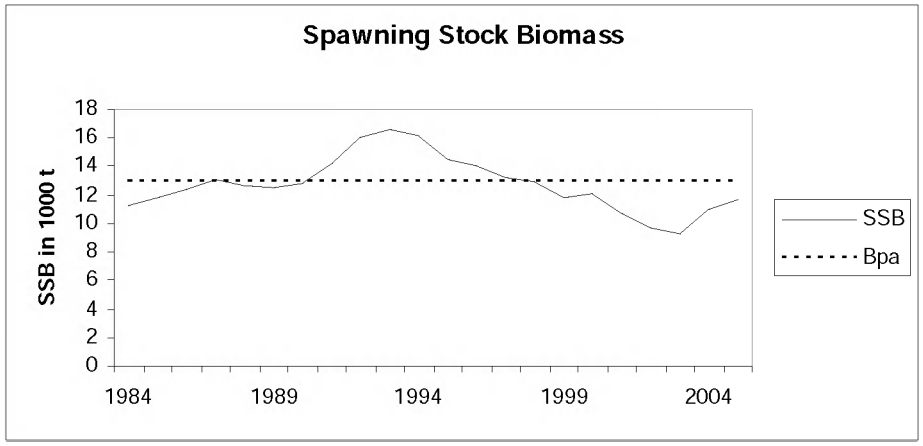
Year	ICES Advice	Single-stock exploitation boundaries	Catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed		-		4.4	4.4	5.1	0.2[3]	5.3
1988	Precautionary TAC		3.7		4.0	4.4	5.4	0.3[3]	5.6
1989	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	3.7	4.1	0.0	4.0
2004	[5]	65% reduction in F or recovery plan	[5]	<2.0	3.6		4.0	-	-
2005		F at $\mathbf{F}_{pa}$		<4.1	4.14				
2006		F at $\mathbf{F}_{pa}$		<4.2 or management plan					

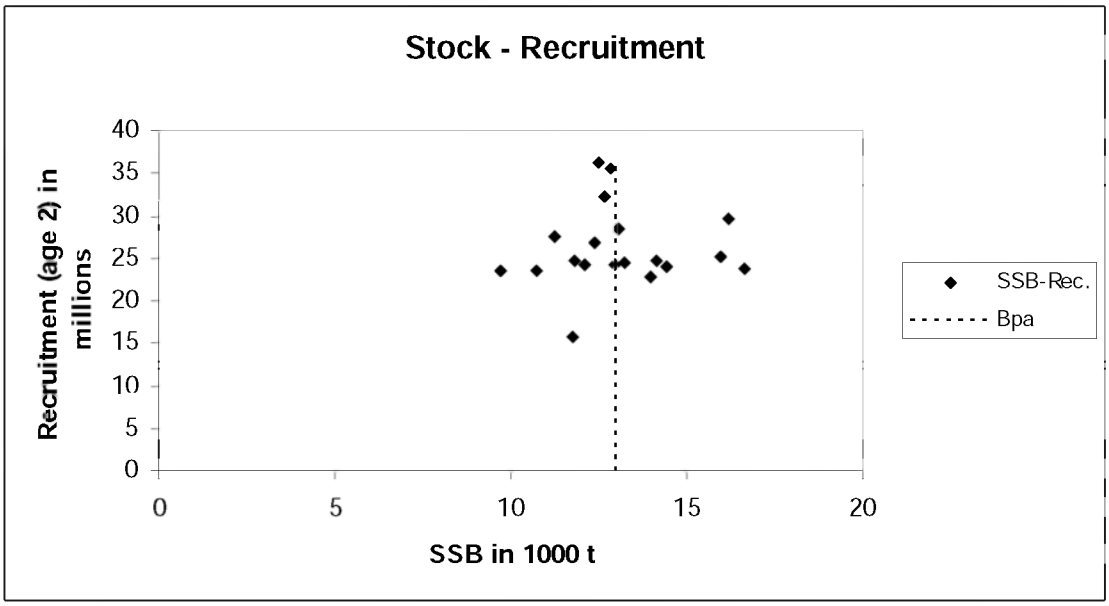
Weights in '000 t.
[1]Not reported for all countries. [2]Landings assuming current discarding practise. [3] Discards revised in 1998. [4] Preliminary. TAC in 2001 increased from 5.8 to 6.3 in Nov. [5] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed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

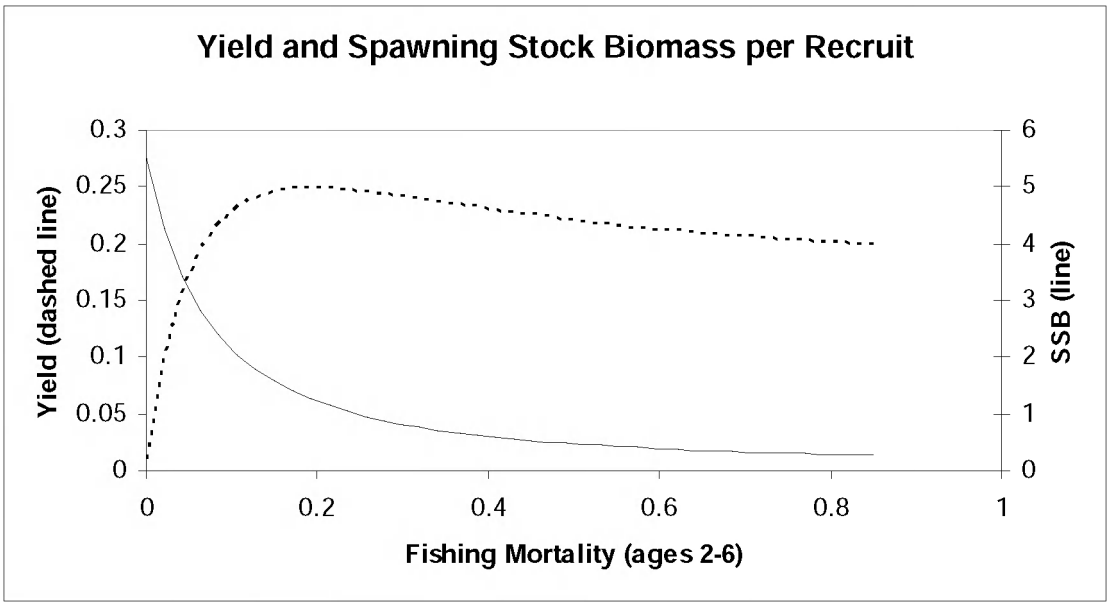
Sole in Divisions VIIIa,b (Bay of Biscay).








Stock - Recruitment
Recruitment (age 2) in millions
40
35
30
25
20
15
10
5
0
0
5
10
15
20
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
Fishing Mortality (ages 2-6)

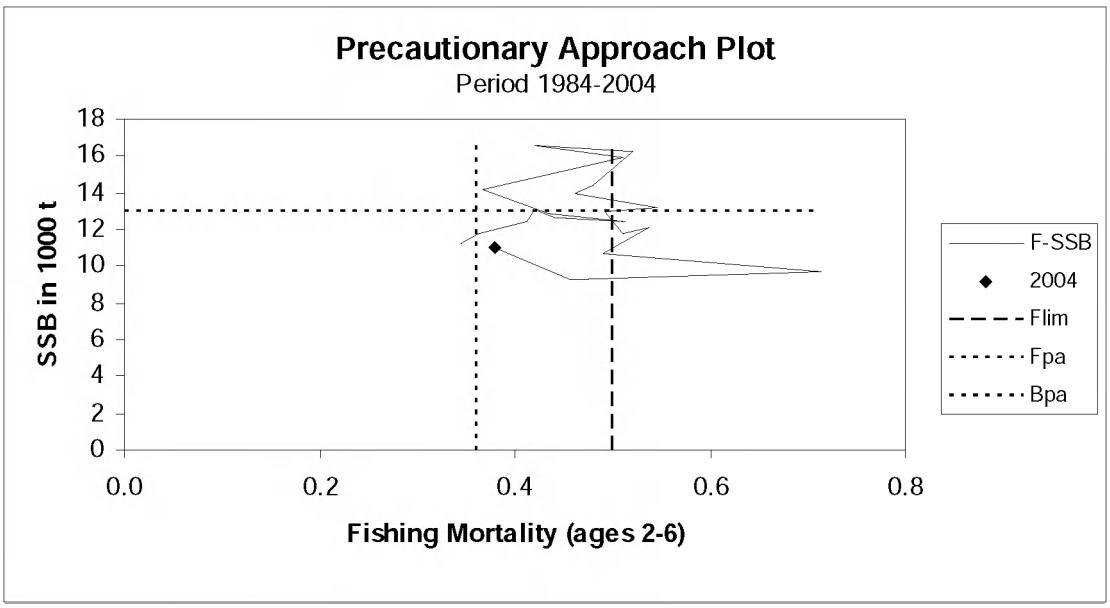

Precautionary Approach Plot
Period 1984-2004
SSB in 1000 t
18
16
14
12
10
8
6
4
2
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-6)
F-SSB
2004
Flim
Fpa
Bpa

Table 1.4.11.1 Bay of Biscay Sole (Division VIIIa,b). International 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*	3679		27***	1	4010	1457	5467	21	5488
2003	296*	3445				3741	365	4106	20	4126
2004	323	N/A			1	323	3667	3990	-	-

* reported in VIII
** Preliminary
N/A

*** reported as *Solea* spp (*Solea lascaris* and *solea solea*) in VIII
[1] Discards = Partial estimates for the French offshore trawlers fleet
Non available

Table 1.4.11.2 Bay of Biscay Sole (Division VIIIa,b). Contribution (in %) to the total French landings by different 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
Shrimp trawlers	1	1	0	0	0	0	0	0	0	0	0	0
Inshore trawlers	14	12	14	13	12	11	6	9	10	8	9	12
Offshore trawlers	30	31	28	28	32	33	27	23	23	19	26	24
Fixed nets	55	56	58	59	56	56	67	68	67	73	65	64

Table 1.4.11.3 Sole in Divisions VIIIa,b,d (Bay of Biscay).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1984	22297	11234	4038	0.344
1985	27460	11794	4251	0.363
1986	27443	12401	4805	0.412
1987	24608	13088	5086	0.420
1988	26713	12686	5382	0.441
1989	28447	12483	5845	0.512
1990	32322	12846	5916	0.435
1991	36322	14153	5569	0.368
1992	35488	15968	6550	0.510
1993	24743	16625	6420	0.421
1994	25190	16201	7227	0.522
1995	23690	14415	6205	0.481
1996	29571	14003	5854	0.462
1997	23992	13218	6259	0.546
1998	22822	12931	5982	0.492
1999	24563	11780	5249	0.511
2000	24262	12100	5760	0.538
2001	15698	10717	4828	0.491
2002	24177	9740	5485	0.713
2003	23417	9240	4106	0.458
2004	23602*	11015	3990	0.379
2005	23602*	11610		
Average	25929	12739	5467	0.468

* R2003 assumed to be GM93-03.

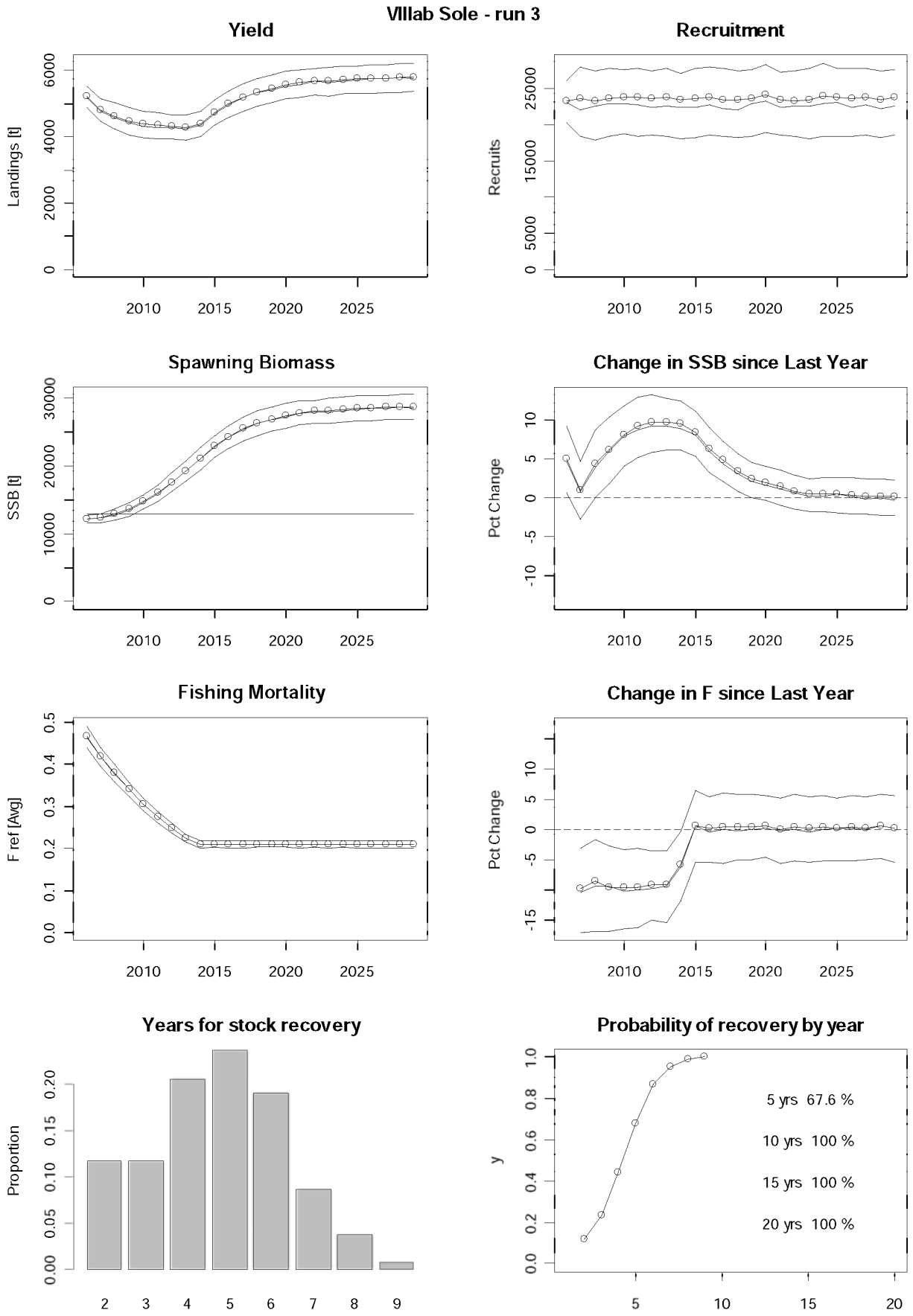


Figure 1.4.11.1 CS5 HCR results (F06 = 0.9 F_{sq}; F 2007 onwards: -10% every year; Target = F_{max}).

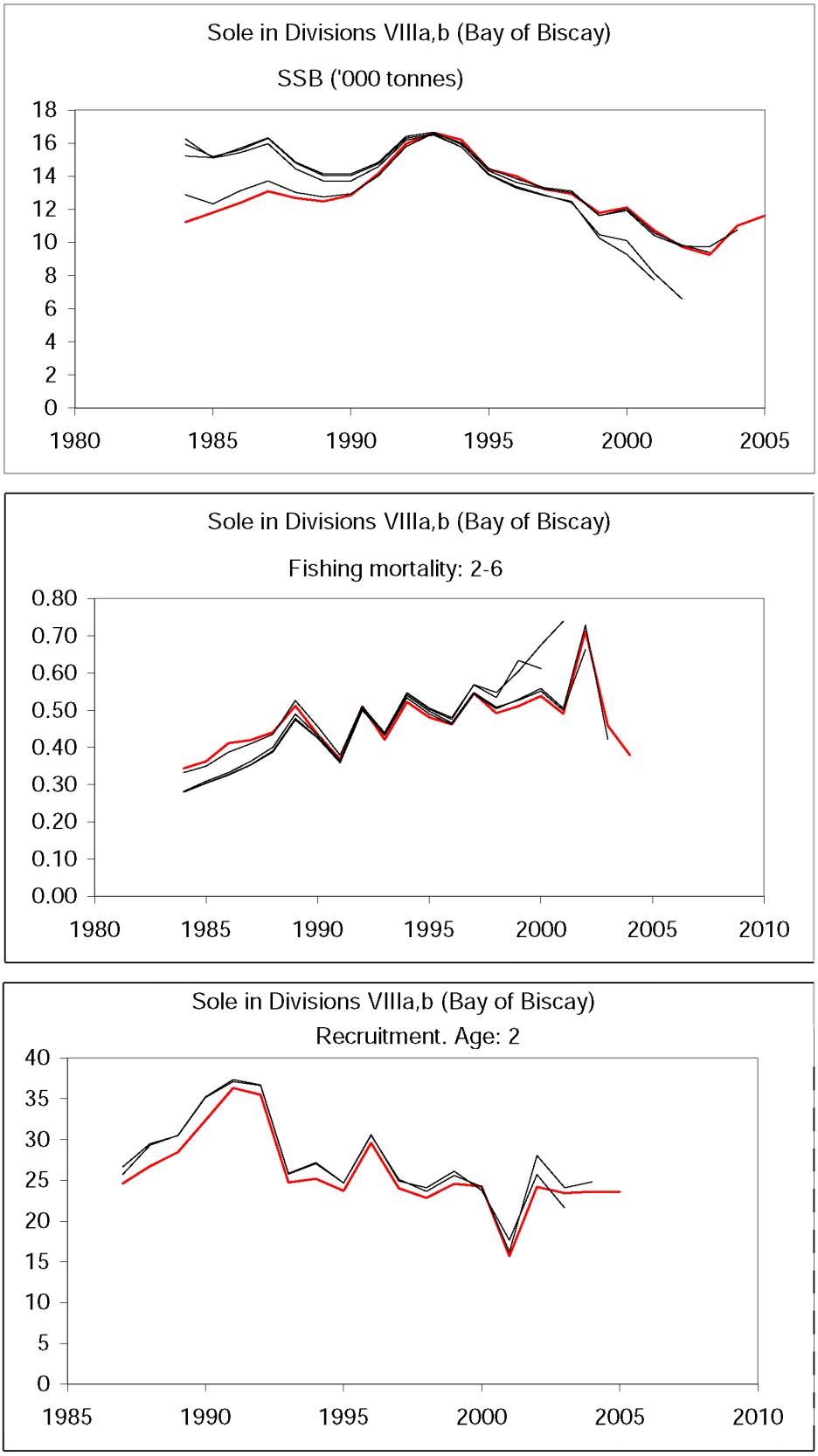


Figure 1.4.11.2 Comparison between present and previous assessments.