3.9 Widely distributed and migratory populations

Widely distributed marine populations

A number of marine populations are not confined to the individual areas considered in other sections of this report. They include sea mammals and fish species with stock units that are distributed over much wider areas such as hake and a number of deepwater species, and migratory species such as mackerel, horse mackerel, and blue whiting.

3.9.1 The North East Atlantic ecosystem in relation to widely distributed populations

It is difficult to characterise the whole North East Atlantic ecosystem; however, some broad descriptions are possible. Detailed information on the hydrography of this area is available from the Annual ICES Ocean Climate Status Summary (Hughes and Lavin, 2004). The most studied feature is the North Atlantic Oscillation (NAO). The NAO index is a measure of the difference in normalised sea level pressure between Iceland and the subtropical Eastern North Atlantic. When the NAO index is positive there is a strengthening of the Icelandic low and Azores high. This strengthening results in an increased north–south pressure gradient over the North Atlantic, causing colder and drier conditions over the western North Atlantic and warmer and wetter conditions in the eastern North Atlantic. During a negative NAO, a weakening of the Icelandic low and Azores high decreases the pressure gradient across the North Atlantic and tends to reverse these effects. The NAO index has been useful in the past to describe the climate of the North Atlantic region. Generally the most useful NAO index is for the winter (December through March). The winter index is called the Hurrell Index.

Following a long period of increase from an extreme and persistent negative phase in the 1960s to a most extreme and persistent positive phase during the late 1980s and early 1990s, the NAO index underwent a large and rapid decrease during the winter preceding 1996. Recent ICES Annual Ocean Climate Status Summaries (IAOCSS) describe the return of the NAO to positive conditions in the years following 1996 until a further reversal occurred over the winter preceding 2001. The NAO index is limited in that it can only describe the strength of the north–south dipole in sea level pressure (SLP) anomaly. Although this has been the predominant pattern over the last 30 years, it is not always the case. During the winter of 2002 the SLP anomaly pattern did exhibit a north–south dipole, but this was limited to the eastern region. Therefore the Hurrell NAO index was weakly positive. During 2003, the typical north-south NAO pattern was replaced by an east–west sea level pressure anomaly leading to a low value for both NAO indices in 2003. A high NAO index is believed to lead to a weakening of the warm North Atlantic current, and a stronger poleward current along the European shelf break, as well as stronger cold Labrador Sea water inflow. A low NAO index suggests a stronger North Atlantic current penetrating further into the Norwegian Sea, and a weaker slope current.

In most areas of the North Atlantic during 2003, temperature and salinity in the upper layers remained higher than the long-term average, with new records set in several regions. In Biscay, sea surface temperature in summer 2003 was the warmest in the time-series (1993–2003). Values were 1ºC above the mean from June to October and the thermocline was shallow. In the Rockall Trough the high surface temperatures and salinities continued a rise which began in 1995. Salinity values over the top 800 m were the highest on record, and corresponding temperatures were more than 0.5°C above the long-term average. Surface waters in the Faroe Shetland Channel continued the general warming trend observed over the last 20 years. Modified Atlantic Waters in the Faroe Shetland Channel were warmer and saltier in 2003 than at any period during the last 50 years. The sea surface temperature in 2003 was higher than normal over most of the Norwegian Sea. The distribution area of Atlantic water has decreased since the beginning of the 1980s, while the temperature has shown a steady increase. Since 1978 the temperature of Atlantic water has increased by about 0.6°C.

In terms of the ecosystem, probably the most important factor impacting fish stocks is the abundance of zooplankton, particularly copepods. In broad terms the long-term Continuous Plankton Recorder database provides useful data. Long-term trends in the North East Atlantic show a general decline in zooplankton abundance (Edwards *et al.*, 2004). A detailed examination of the demography of *Calanus* in the NE Atlantic is provided by Heath *et al.* (2000).

There is no fully comprehensive understanding of the links between the ecosystem and the fish stocks. However, some specific studies have illustrated particular examples:

- The distribution of mackerel prior to the pre-spawning migration and the timing of that migration appears to be related to water temperature in the northern North Sea in the winter. The temperature evolution in this area is largely modulated by the shelf edge current (Reid *et al.*, 2001a).

- The potential fecundity of mackerel appears to some extent to be modulated by feeding conditions in the Norwegian Sea in the previous autumn (Slotte and Iversen, 2004). Hence availability of zooplankton (*Calanus*) will affect the reproductive success of this species.

- The scale of the migration of western horse mackerel into the Norwegian Sea and the capture rate in the Norwegian fishery have been successfully correlated to Atlantic inflow to the North Sea and phytoplankton colour indices (Reid *et al.*, 2001b). This suggests that different patterns in the scale of inflow can influence the scale of the horse mackerel migration.

- Other changes have occurred in the spatio-temporal pattern of migration in the western mackerel over the last 30 years, which are likely to have ecosystem correlates although these have yet to be clarified. Specifically, in the 1970s the mackerel migrated from the North Sea to the spawning areas in the autumn (September/October). By the 1990s this migration occurred in January/February. This required changes in management, and in a distinct change in the timing and location of the fishery (Reid *et al.*, 2002; WD to WGMHS, 2002).

- Hake belongs to a very extended and diverse community of commercial species. The main species concerned are megrim, anglerfish, *Nephrops*, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus spp*, conger, pout, conger, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), rays, etc. (Lucio *et al.* (WD to WGHMM, 2003)). The relative importance of these species in the hake fishery varies largely in relation to the different gears, sea areas, and countries involved.

3.9.2 The populations and their exploitation

3.9.2.1 Fish and fisheries

The fisheries and their impact

The blue whiting stock is fished in Subareas II, V, VI, and VII and by a number of countries, mainly by Norway, Russia, Iceland, Denmark, Faroe Islands, United Kingdom, and Ireland. Most of the catches are taken in the directed pelagic trawl fisheries. The main fishery has traditionally been in the spawning and post-spawning areas (Divisions Vb, VIa,b, and VIIb,c). The catches in this area have more than doubled over the last 7–8 years. In the Norwegian Sea (Subareas I and II, in Divisions Va, and XIVa,b), catches have increased dramatically over the last 8 years from 23 000 tonnes in 1996 to 964 000 tonnes in 2004. Catches are also taken in the directed and mixed fishery in Subarea IV and Division IIIa. These catches have increased by 200–300 % since the mid-1990s. The total catches in the northern areas have thus increased from 0.55 million tonnes in 1995 to 2.33 million tonnes in 2004 t. 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, but increased to 85 000 tonnes in 2004. In Division IXa blue whiting is mainly taken as bycatch in mixed trawl fisheries.

The Norwegian spring-spawning herring is fished in Subareas I and II and by a number of countries, mainly by Norway, Iceland, Russia, Faroe Islands, Denmark, Netherlands, UK, Germany, and Poland. The 2004 catches were almost 800 thousand t. Most of the catches were landed for human consumption. The spawning stock biomass was estimated at 6.7 million t in 2004.

The North Eastern Atlantic mackerel is fished in Subareas II, IV, V, VI, VII, VIII, and IX by a number of countries, mainly Norway, Russia, Ireland, UK, Ireland, Denmark, Netherlands, Germany, and the Faroe Islands. Most of the catches are taken in directed trawl fisheries in the Norwegian Sea (between 50 000 and 150 000 tonnes), in the northern part of the North Sea (between 200 000 and 400 000 tonnes), and to the west of the British Isles (200 000 to 250 000 tonnes). There are smaller-scale fisheries in Biscay and the Iberian Peninsula, where they are often taken in mixed fisheries with other pelagic species; mainly horse mackerel, sardine, and anchovy – these are dealt with in more detail in the section covering Iberian stocks. The stock is divided into three spawning components; North Sea, Western, and Southern, based on the areas in which the fish spawn. The North Sea component is no longer assessed separately, but is considered as severely depleted and around 220 000 tonnes. Before the late 1960s, the North Sea spawning biomass of mackerel was estimated at above 3 million tonnes. Due to recruitment overfishing, recruitment has failed since 1969, leading to a decline in the stock. The North Sea spawning component has increased since 1999, but it is still far below the level in the 1960s.

There are a variety of protective measures in place for this stock, including closure of the mackerel fishery in Divisions IVb,c and IIIa throughout the whole year and in Division IVa from February to July. This closure has unfortunately resulted in increased discards of mackerel in the non-directed fisheries (especially horse mackerel fisheries) in these areas as vessels at present are permitted to take only 10% of their catch as mackerel bycatch. The distribution area of

the North Sea component overlaps with the western component particularly in the second half of the year, and may be implicated in the fishery at that time. The western and southern components are managed together and represent the bulk of the NEA mackerel fishery. The SSB was estimated at 2.6 million tonnes in 2005. The stock generally experiences good recruitment, although 2000 was an unusually weak year and preliminary information on the 2003 year class suggests that it may also be weak.

The western horse mackerel stock is fished in Subareas II, III IV, VI, VII, and VIII by a number of countries, mainly Norway, Ireland, UK, Ireland, Denmark, France, Netherlands, and Germany. Most of the catches are taken in directed trawl or purse seine fisheries in the Norwegian Sea (decreasing from c. 150 000 tonnes in the early 1990s to 20 000 tonnes in recent years), along the western shelf edge and in the English channel (between 120 000 and 400 000 tonnes), and in Biscay (30 000 to 75 000 tonnes). The major characteristic of this stock is the dependence of the stock abundance and the fishery on a single very strong year class (1982). Recruitment otherwise has generally been low, although 2001 may be better. The 1982 year class dominated the stock throughout the 1980s and early 1990s, and it is assumed that no major changes will occur unless another large year class appears. The SSB was not estimated in 2004 due to data inadequacy, but has been decreasing since the late 1980s, as the outstanding 1982 year class was depleted.

The northern hake landings are reported to have been at around 90 000 tonnes in the early 60s. In the recent past, landings have generally decreased from 66 500 t in 1989 to 35 000 t in 1998. Since then they have fluctuated around 40 000 t. In the early 80s, Subareas VII and VIII contributed equally to the total landings (around 30 000 t each). While landings from Subarea VII have slightly declined since then (to around 25 000 t), those from Subarea VIII have experienced a stronger decrease (to 10–15 000 t). All information available suggest that discard rates could be high (up to 95%) in some years and area, and for some fleets. The fishery employs a variety of different gears in different areas, including longlines and gillnets. The SSB was estimated at 138 000 tonnes in 2005, just below $\mathbf{B}_{pa}$.

3.9.2.2 Ecosystem impact of fisheries

Sea mammals

Bycatch in fisheries has been acknowledged to be a threat to the conservation of cetaceans in the northeast Atlantic region (CEC, 2003a; Ross and Isaacs, 2004). Cetacean bycatch in the northeast Atlantic, as elsewhere, affects mainly small cetaceans – i.e. dolphins, porpoises, and the smaller toothed whales. Species caught in the region are primarily the harbour porpoise, common dolphin, striped dolphin, Atlantic white-sided dolphin, white-beaked dolphin, bottlenose dolphin, and long-finned pilot whale (CEC, 2002a). However, other larger cetaceans, such as the minke whale, can also be affected.

An extensive review of the bycatch of cetaceans in pelagic trawls was carried out for Greenpeace in 2004 (Ross and Isaacs, 2004). This report considered published and anecdotal information. In the context of the fisheries considered here, the report identified a small number of fisheries where cetacean bycatch could be documented. These were:

- Mackerel and horse mackerel trawling SW of Ireland
- Hake trawling along the shelf edge in Biscay
- Gill netting for hake in the Celtic Sea

In all cases, the number of animals caught was low. The report identified that many countries had initiated cetacean bycatch monitoring programmes, and had generally found little or no evidence that serious bycatch had occurred.

Other interactions between cetaceans as well as other sea mammals undoubtedly occur. Many cetaceans predate on the fish covered in this overview, and may be regarded as competing with the fishery, but there is little or no data on this interaction. Anecdotal reports from observers in the mackerel fishery in the North Sea in the autumn suggest that killer whales associate with this fishery. The whales appear to target the fish discarded after the net is pumped out. The number of whales involved in this interaction is unknown, as is whether this is a subset of the population or whether it is more general.

Salmon

Post-smolt is widely distributed in the areas covered by this overview. There is a potential for bycatch of post-smolt in pelagic fisheries near the surface in the summer season. There is evidence that some post-smolt is caught, in particular in mackerel and horse mackerel fisheries, but the impact of these bycatches on the salmon stocks is still not clear.

Technical interactions between fish species

In general, mackerel and horse mackerel are caught in targeted, single-species fisheries. In the NEA mackerel fishery, particularly in the northern North Sea in quarter 4, there is some bycatch of herring. In the western area, there is relatively little interaction, except between mackerel and horse mackerel themselves. There may be interaction with blue whiting in this area as well, as the species spawn in the same area, but there is no evidence of this. The smaller scale fishery in the Iberian Peninsula has interactions between mackerel and horse mackerel, as well as other pelagic species such as sardine, anchovy, and Spanish mackerel, and possibly some demersal species. This is covered in more detail in the Iberian overview (Section XXX). There may be some technical interactions for mackerel in quarter 3 in the Norwegian Sea, where it may be implicated in the blue whiting fishery, but the scale of this is unclear.

The fisheries for Norwegian spring-spawning herring are largely directed fisheries with purse seine or midwater trawl, with minor interactions with other species.

As detailed by Lucio *et al.* (WD to WGHMM, 2003), the hake fishery is carried out as part of a general fishery on an extensive demersal assemblage including megrim, anglerfish, *Nephrops*, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus spp*, conger, pout, conger, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), rays, etc. Interaction between hake and other species are less evident for the longline and gillnet fisheries.

3.9.2 Fisheries advice

The fisheries on the widely distributed stocks are, except for hake, largely taken in single-stock fisheries, and the single-stock exploitation boundaries as presented in Section 4.9 would therefore apply. They are summarised in the table below:

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

Species	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			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 target reference points	In relation to agreed management plan	In relation to precautionary limits	in relation to target reference points	
Hake – Northern stock	Increased risk	Increased risk	Overexploited	Following the agreed management, a fishing mortality of F = 0.25 is expected to lead to an SSB of 153 000 t in 2007 with estimated landings in 2006 of **44 000 t**. This implies a change in SSB of +5%.	The fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$. This is equivalent to the recovery plan. A fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5% and in TAC of 3%.	The current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.17). This indicates that long-term yield is expected to increase at fishing mortalities well below the historic values. Fishing at such a lower mortality is expected to lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	44 000 t
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.	None	none	373 000 t to 487 000 t
Western Horse	Uncertain	Uncertain	Uncertain	No agreed	None	ICES recommends that catches of horse mackerel in Divisions	150 000 t

Species	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			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 target reference points	In relation to agreed management plan	In relation to precautionary limits	in relation to target reference points	
Mackerel				management plan		IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c,e-k, and VIIIa-e be limited to less than 150 000 t. Note that Division VIIIc is now part of the stock definition.	
Blue Whiting	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 taken place. ICES recommends that measures be taken to protect juveniles.	Exploitation boundaries in relation to precautionary limits are the same as the exploitation boundaries in relation to existing management plans.		1 500 000 t
Norwegian spring-spawning	Full reproductive capacity	Harvested sustainably		The management plan implies maxim-um catches of	The current long-term management plan is considered to be	The target defined in the management plan is consistent with high-term yield and have	732 000 t

Species	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			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 target reference points	In relation to agreed management plan	In relation to precautionary limits	in relation to target reference points	
herring				732 000 t in 2006 which is expected to lead to a spawning stock of 7.7 million tonnes in 2007.	precautionary.	a low risk of depletion production potential.	

ICES advice for fishery management

For the blue whiting combined stock (Subareas I-IX, XII, and XIV): ICES recommends that 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 B_{pa}. The present fishing level is well above levels defined by the management plan and should be reduced.

For Norwegian spring-spawning herring: ICES advises that this fishery should be managed according to the agreed management plan with a fishing mortality of no more than F=0.125, implying maximum catches of 732 000 t in 2006. This is expected to lead to a spawning stock of 7.7 million tonnes in 2007.

For NEA mackerel, ICES advises following the agreed management plan (F between 0.15 and 0.20) which would 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 (assuming catches of the order of 433 000 t in 2005).

For western horse mackerel, ICES has advised that in the absence of a strong year class sustainable yield is unlikely to be higher than 130 000 t for the traditional stock areas. This corresponds to catches less than 150 000 t in the revised stock area (i.e. 130 000 t for the traditional stock area, plus 20 000 t for the inclusion of Division VIIIc in the stock definition). Accordingly, ICES recommends that catches of horse mackerel in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c,e-k, and VIIIa-e be limited to less than 150 000 t.

For northern hake, following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007, with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.

Regulations in force and their effects

In 2002 the EU, Faroe Islands, Iceland, and Norway agreed a long-term management plan for the fisheries of the blue whiting stock aimed at constraining the harvest within safe biological limits and designed to provide for sustainable fisheries and a greater potential yield. The management plan as a whole has not been implemented, because it has not been agreed between all countries participating in the fishery. The combined total of the catches exceeds the provisions of the agreed management plans.

For the Norwegian spring-spawning herring, there was no agreement between the Coastal States (European Union, Faroe Islands, Iceland, Norway, and Russia) regarding the allocation of the quota for 2005. The Norwegians increased their quota by 14%, as did the Icelanders and the Faroese. The sum of the total revised national quotas for 2005 amounts to about 1 million tonnes.

For NEA mackerel, Division IVa is closed to mackerel fishing from the 14th of February until late summer to protect the North Sea component. Management has aimed at a fishing mortality in the range of 0.15–0.2 since 1998. The fishing mortality realised since then has been in the range of 0.25 to 0.35.

For the western horse mackerel, the distributional range of this stock increased when the exceptional 1982 year class entered the fishery. This resulted in the development of unregulated fisheries outside the TAC area in the Northern North Sea. Catches outside the area covered by a TAC have been reduced in recent years. At present, the TAC for the Western areas includes Division Vb (EU waters only), Subareas VI and VII, and Divisions VIIIa,b,d,e. A separate TAC includes EU waters in Division IIa and Subarea IV. ICES allocates horse mackerel to the Western stock which is taken in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIe–k, and VIIIa-e.

For northern hake, the minimum legal sizes for fish caught in Subareas IV, VI, VII, and VIII is set at 27 cm total length (30 cm in Division IIIa). From 14th of June 2001, an Emergency Plan was implemented by the European Commission for the recovery of the Northern hake stock (Council Regulations Nos. 1162/2001, 2602/2001, and 494/2002). In addition to a TAC reduction, 2 technical measures were implemented. A 100-mm minimum mesh size has been implemented for otter-trawlers when hake comprises more than 20% of the total amount of marine organisms retained onboard. This measure did not apply to vessels less than 12 m in length and which return to port within 24 hours of their most recent departure. Furthermore, two areas have been defined, one in Subarea VII and the other in Subarea VIII, where a 100-mm minimum mesh size is required for all otter-trawlers, whatever the amount of hake caught.

ICES has not been able to quantify the likely impact of the changes in mesh size. However, since hake is a late maturing fish, any improvement in the selection pattern that reduces the catch of younger fish is only expected to increase SSB in the medium term.

There are explicit management objectives for this stock under the EC Reg. No. 811/2004 implementing measures for the recovery of the northern hake stock. The aim is to increase the quantities of mature fish to values equal to or greater than 140 000 t. This is to be achieved by limiting fishing mortality to 0.25 and by allowing a maximum change in TAC between years of 15%. The TAC for northern hake has not appeared to be effective in controlling landings.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Quality of assessments and uncertainties

For blue whiting, conflicting signals in the catch and survey data influence the models in ways that could not be resolved. The assessment of blue whiting has been very uncertain in recent years with upward revisions of the historic perception of the stock size with every new assessment. This trend has been driven by exceptionally good recruitment compared to the earlier period, while at the same time little fishery-independent information has been available on the recruitment. However, the quality of the assessment and recruitment estimates have been improved in this year, mostly due to a longer recruitment survey time-series, which could be used for the first time this year.

For Norwegian spring-spawning herring there has been a tendency to overestimate the spawning stock historically. The standard deviation of the spawning stock, derived from bootstrap replicates, has increased considerably from last year. The distribution is also more skewed than last year. However, there is an overall high consistency between the current assessment and that of last year.

For NEA mackerel, due to the lack of fishery-independent data and the absence of age-disaggregated information for the spawning stock index, the results of this assessment are uncertain. In recent years, there has been a tendency to overestimate the SSB and to underestimate fishing mortality. There is a broad perception that there are substantial undeclared landings in this fishery. The assessment is strongly dependent on the catch information, both recently and in the past. Managers are encouraged to obtain reliable catch information.

For western horse mackerel, no fishery-independent estimates of SSB or recruitment are currently available. Therefore, it is not possible to determine the absolute level of SSB, recruitment, and fishing mortality. Accordingly, only relative trends in these quantities have been derived.

For northern hake, several sources of uncertainties remain for this stock. This concerns mainly growth, discards estimation, and CPUE indices in the earlier years. The CPUE series and surveys do not cover the whole area. There is a lack of reliable recruitment indices for this stock, which has implications for the quality of short-term forecasts. Northern hake is a wide ranging stock where the stock definition is considered to be problematic. There are concerns about the accuracy of aging data and the calculation of historic catch-at-age data.

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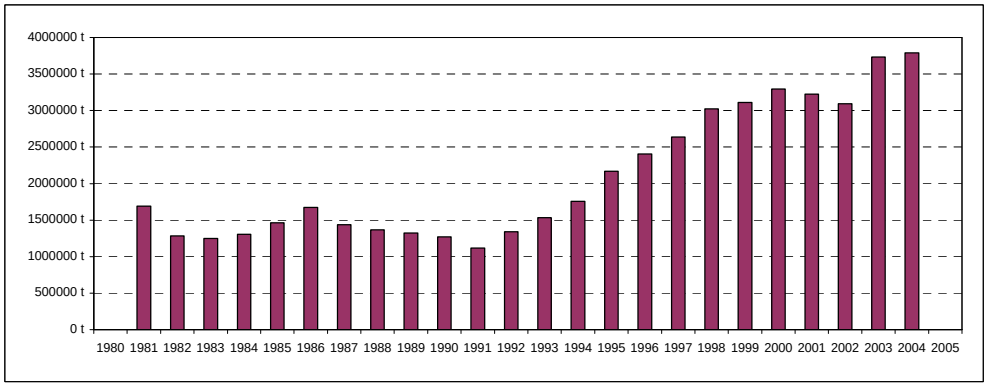
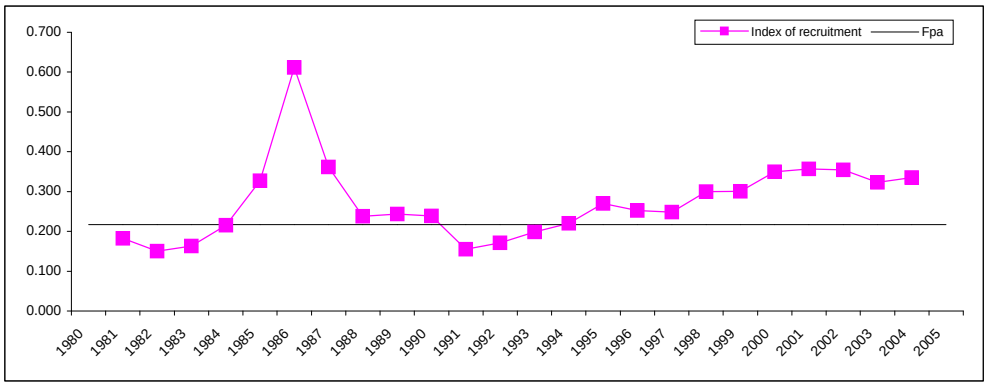
Highly Migratory Small Pelagics - Overview

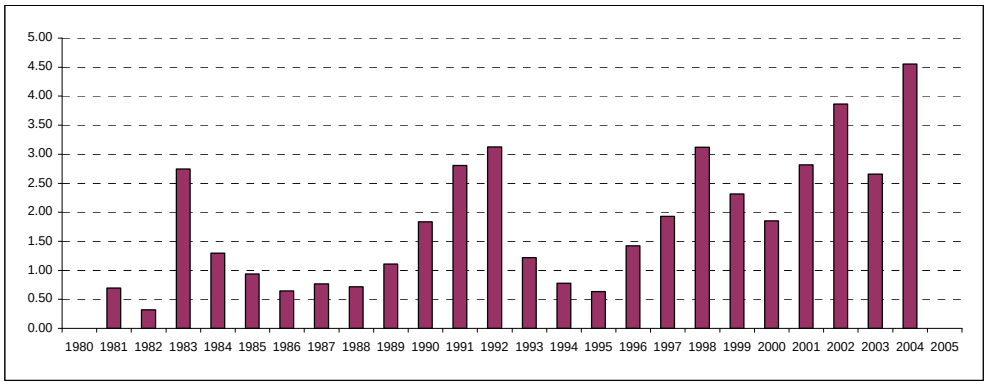
Landings (mackerel, blue whiting and Norwegian herring)



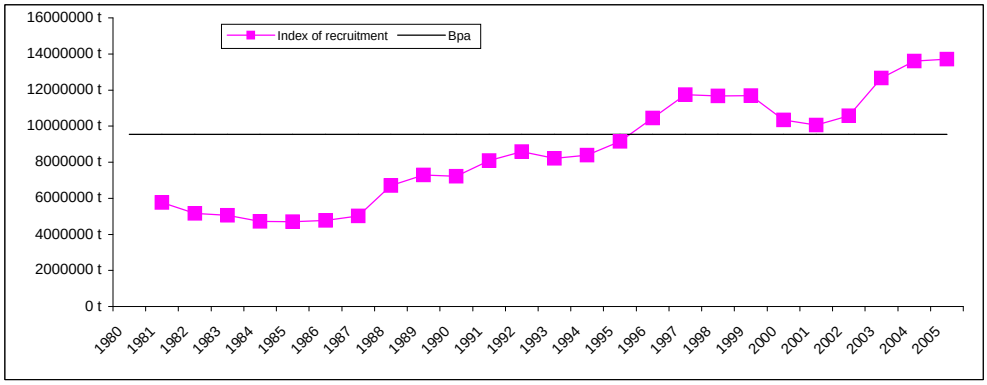
Mean F (weighted by average stock size)



Index of recruitment

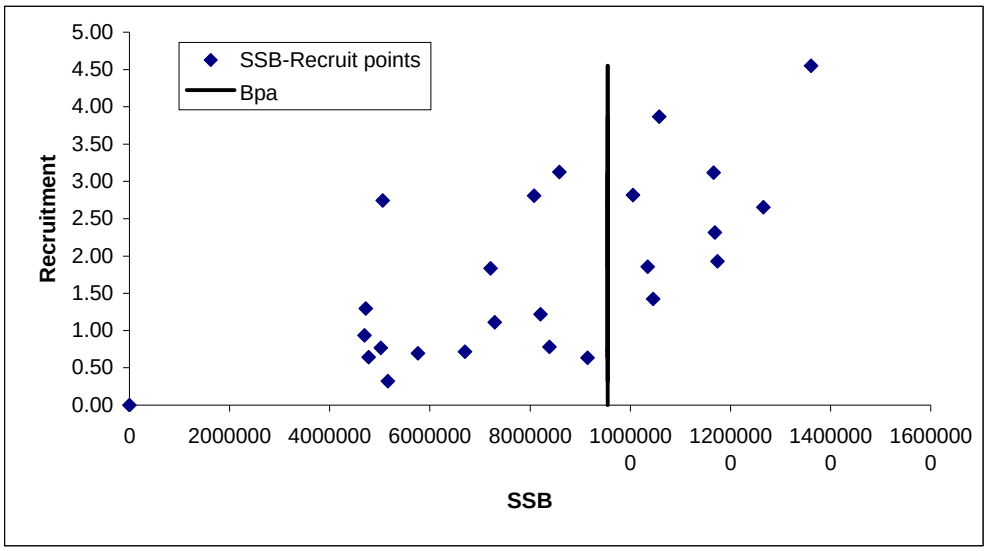


SSB

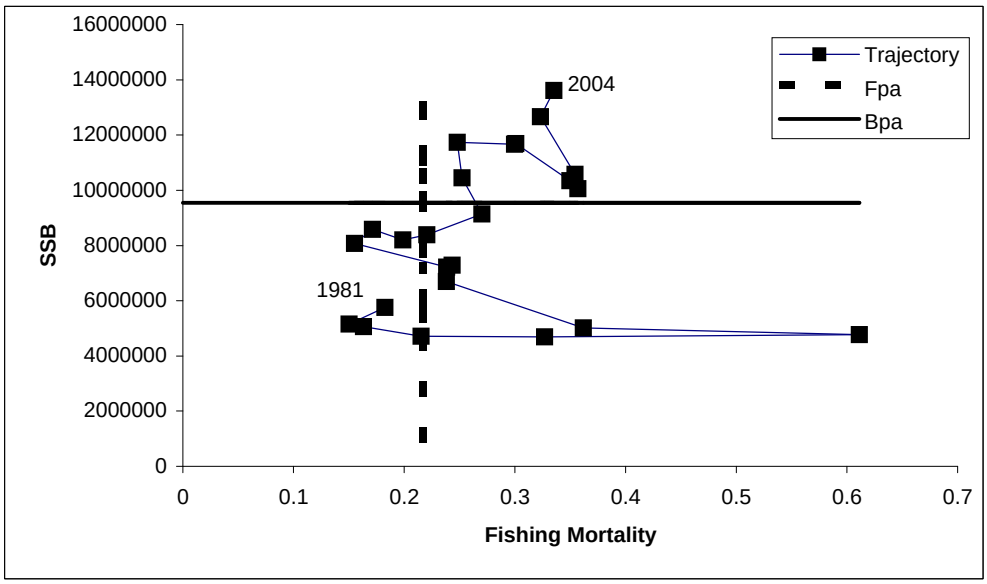


Stock-Recruitment plot for the highly migratory small pelagics (taken together) and corresponding precautionary approach plots.

Stock-Recruitment



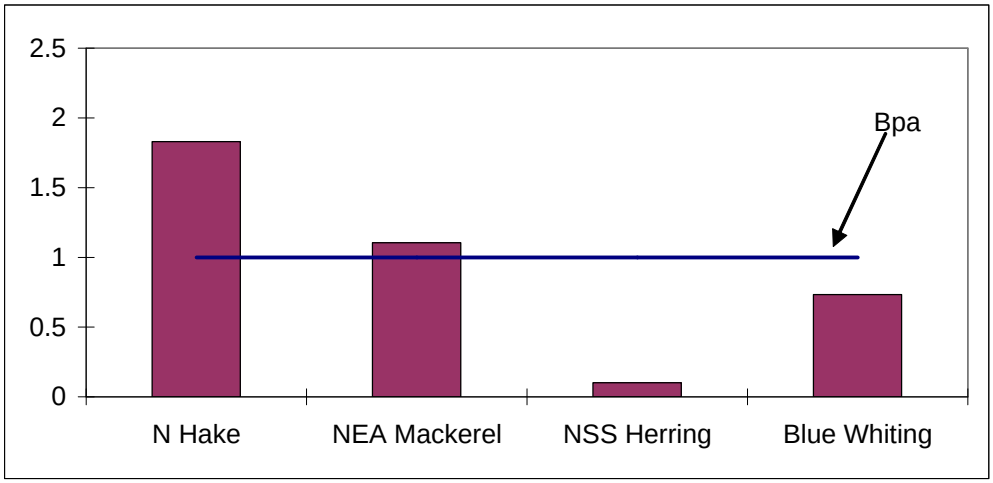
Precautionary Approach Plot



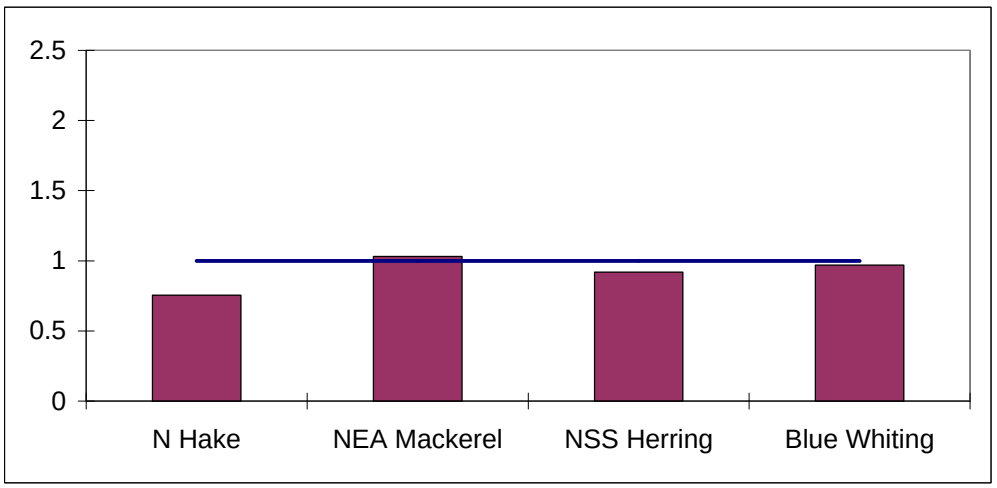
Includes NEA mackerel, Norwegian Spring Spawning herring and blue whiting.

Stock Spawning Biomass in relation to Bpa (normalized to unity) for widely distributed and migratory stocks.

1985



1995



2005