OSPAR COMMISSION

Assessment of the environmental impact of fishing

Monitoring and Assessment Series

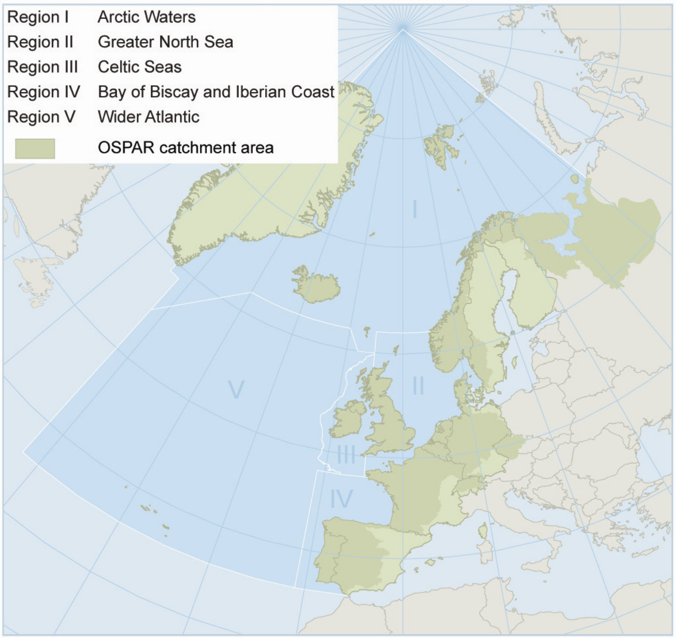
2009

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998.
La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l'Espagne.



Acknowledgement

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Assessment of the "State" of the Demersal Fish Communities in OSPAR Regions II, III, IV and V (electronically accessible):

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***Supplementary Report 2**:* Analysis of National Bottom Trawl (NBTS) data covering boundary areas of the North Sea (OSPAR Region II) to examine trends in the "health" of the demersal fish community

***Supplementary Report 3**:* Analysis of National Bottom Trawl (NBTS) data covering the Western Continental Shelf (OSPAR Region III) to examine trends in the "health" of the demersal fish community

***Supplementary Report 4**:* Analysis of National Bottom Trawl (NBTS) data covering the Bay of Biscay (OSPAR Region IV) to examine trends in the "health" of the demersal fish community

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Electronic navigator to assessments also contributing to QSR Chapter 8 on Fishing

- ICES 2008 Assessment of the impact of fisheries on the marine environment of the OSPAR maritime area
- NEAFC Fisheries Status Report 1998-2007

Executive Summary

The marine environment is home to a diverse range of plants and animals and over time man has utilised the rich resources of the North-East Atlantic. During the latter part of the 20th Century, exploitation of the fisheries were such that in 1999 ICES reported that two thirds of major stocks for which they provided information to OSPAR, covering all five OSPAR regions, were outside safe biological limits. At the same time evidence was being presented of fishing-induced effects on reproductive traits.

Many efforts over the last decade to improve fisheries management

As a consequence of the evidence being presented in respect of the impact of fisheries, the last ten years has witnessed significant developments in the management of fisheries across the North-East Atlantic. This has included reform of the Common Fisheries Policy, the introduction of Regional Advisory Councils, closer collaboration between the industry and regulator and an increasingly integrated approach to fisheries management so as to ensure that there is a genuine progression towards a sustainable fishing industry within the OSPAR Maritime Area. Over the period covered by this assessment there has been, across the OSPAR Maritime Area, a reduction in the size of fishing fleets, reduction in catches and improvements in the status of some stocks as evidenced by reductions in fishing mortality and increases in spawning stock biomass as well as an improvement in the large fish indicator for North Sea demersal stocks, although the Ecological Quality Objective has not yet been achieved. There have been some successes in addressing illegal, unreported and unregulated fishing and a move towards more concerted efforts to tackle discards across the OSPAR area.

Fishing pressure continues to have a considerable effect on marine ecosystems

However, with ICES only able to state in 2009 that 10 of the fish stocks the organisation assesses (excluding the Baltic Sea) are within safe biological limits, and with habitat destruction, the depletion of key predator and prey species and the consequent food-web effects a key concern, it is apparent that substantial improvements are required so as to ensure sustainable use of the fisheries resource in the North-East Atlantic.

Status of many exploited stocks cannot be fully assessed due to poor data

There remain many stocks for which the status in relation to safe biological limits is not known due to poor data and or a lack of progress in defining precautionary reference points. This situation has remained relatively unchanged throughout the reporting period covered by this assessment. There is also a lack of data on deep sea species and there is a need to obtain more scientific information so as to ensure sustainable use of the resources of our deeper waters.

Further efforts are needed to address the problems that remain

Progress has, and continues, to be made in terms of the management of our fisheries resources across the OSPAR Maritime Area. However, there remain regional variations and it is important when considering the status of fisheries to examine not only the overall picture, but also the situation at more refined scales such as OSPAR Regions or indeed more discrete geographical areas. The complexity of management arrangements and the need for international agreements requires the provision of sound scientific data and assessment. As the next decade approaches, there remain significant challenges in the management of our fisheries. With many stocks outside safe biological limits the current status of many fish stocks is still ominous. However, the trends are encouraging and there is a genuine aspiration that multi-species assessments within an ecosystem-based approach to fisheries management becomes reality and that our marine resources are used in a manner such that future generations will be able to benefit from the improved management practices currently being developed.

Récapitulatif

L'environnement marin est la demeure d'une gamme variée de plantes et d'animaux et l'homme utilise depuis toujours les ressources riches de l'Atlantique du Nord-est. Pendant la dernière partie du 20[ième] siècle, le rapport CIEM 1999 décrivant l'exploitation des pêches a signalé que 2/3 des stocks majeurs pour lesquels ils informent OSPAR, couvrant les 5 Régions d'OSPAR, étaient en dehors des limites biologiques de sécurité. Au même moment la preuve des effets causés par la pêche sur les caractères liés à la reproduction a été avancée.

De nombreux efforts pour améliorer la gestion des pêches ont été fournis durant la dernière décennie

En conséquence de la preuve des impacts de la pêche, les 10 dernières années ont été témoins de développements significatifs dans la gestion des pêches à travers l'Atlantique du Nord-est. Ceci a inclus la réforme de la politique commune des pêches, l'introduction des conseils régionaux consultatifs, une plus proche collaboration entre l'industrie et le régulateur et une approche de plus en plus intégrée pour la gestion des pêches afin de s'assurer d'une véritable progression vers une industrie durable de la pêche au sein de la région maritime d'OSPAR. Au delà de la période couverte par cette évaluation il y a eu, à travers la région maritime d'OSPAR, une réduction de la taille des flottes de pêche, une réduction des prises et des améliorations dans l'état de certains stocks comme le montre les réductions de la mortalité par pêche et l'accroissement de la biomasse féconde, ainsi qu'une amélioration de l'indicateur « grand poisson » pour les stocks démerseaux de la mer du Nord, même si l'objectif de qualité écologique n'a pas encore été atteint. Il y a eu quelques succès dans la lutte contre la pêche illégale, non compte-rendu et non régulée et un mouvement vers plus d'efforts concertés pour tacler les déchets de poissons à travers la région OSPAR.

La pression de la pêche continue d'avoir un effet considérable sur les écosystèmes marins

Cependant, avec le CIEM capable seulement d'indiquer en 2009 que 10 des stocks de poissons évalué par l'organisation (La Mer Baltique exclue) sont dans des limites biologiques de sécurité, et avec la destruction d'habitat, l'épuisement des prédateurs clés et des espèces proies et la conséquence des effets sur la chaîne alimentaire source d'inquiétude clé, il est clair que des améliorations substantielles sont requises afin d'assurer une utilisation durable de la ressource des pêches dans l'Atlantique du Nord-est.

Les états de plusieurs stocks exploités ne peuvent pas être pleinement évalués en raison de données pauvres

Il reste plusieurs stocks pour lesquels les états en relation avec les limites biologiques de sécurité n'est pas connu en raison de données pauvres et /ou un manque de progrès dans la définition des points de référence préventifs. Cette situation est restée relativement inchangée tout au long de la période de compte-rendu couverte par cette évaluation. Il existe aussi un manque de données sur les espèces d'eaux profondes et il est nécessaire d'obtenir plus d'informations scientifiques afin d'assurer une utilisation durable des ressources de nos eaux profondes.

Des efforts supplémentaires sont nécessaires pour aborder les problèmes qui persistent

Des progrès ont, et continuent, d'être accomplis en termes de gestion de nos ressources de pêches à travers la région maritime d'OSPAR. Cependant, il reste des variations régionales et il est important de considérer l'état des pêches pour examiner non seulement l'image d'ensemble, mais aussi la situation plus détaillée comme les régions d'OSPAR ou des régions plus distinctes géographiquement. La complexité des dispositions de gestion et le besoin pour des accords internationaux exigent la fourniture d'évaluation et de données scientifiques solides. Comme la prochaine décennie approche, il reste des défis importants dans la gestion de nos pêches. Avec plusieurs stocks en dehors des limites biologiques de sécurité, l'état actuel de plusieurs stocks de poissons est toujours alarmant. Cependant, les tendances sont encourageantes et il y a une sincère aspiration pour que des évaluations sur de multiples espèces au sein d'une approche écosystémique pour la gestion des pêches deviennent réalité et que nos ressources marines soient utilisées de manière à ce que les générations futures puissent bénéficier de l'amélioration des pratiques de gestion actuellement en développement.

1. Introduction

Some preliminary thoughts

The seas of the North-East Atlantic have long been used by man as a food resource. Fish and shellfish were one of primitive man's main foods in his earliest days as a food gatherer. However, as today, the ability to utilise this wild resource was dependent on the tools available and, ultimately, the catching ability of the 'fleet'. In the 8th Century the arrival in Scotland of the Vikings with their large sea-going boats introduced the Scots on the north and west of the country to the bountiful supply of herring which were present in the seas around Scotland. Over successive centuries landing of herring have fluctuated whether it be in Sweden, Norway or the south west coast of the United Kingdom. Such fluctuations have been associated with climatic variability and thus it is apparent that our exploitation of living resources must be tuned to these climatic, and other, fluctuations if we are to manage them sustainably.

Worldwide, 52% of fish stocks are fully exploited, 25% overexploited, depleted or recovering and just 23% moderately exploited or underexploited. Within the OSPAR Maritime Area there appears to be one of the most heavily fished marine region on earth, the North Sea. Consequently, of all the human activities affecting the North Sea's fish community, fishing is likely to be the historical activity to have had the greatest detrimental impact on the community's condition and 'health'.

Fishing has both direct (e.g. mortality of large piscivorous fish caught in the trawl) and indirect (e.g. proliferation of small fish arising through a reduction on natural predation mortality rates) effects on marine ecosystems. More generally, the effects of fishing include the removal of target species, mortality of non-target species, birds, mammals and marine mammals, physical disturbance of the sea bottom through some demersal fishing gear and therefore an adverse impact on the benthic habitats and communities, shifts in community structure and indirect effects on the food web.

The need to develop and implement an ecosystem approach to marine management (EAMM) requires improved knowledge of the impact of all human marine-related activities. This obviously includes fishing. However, it is not simply about aggregating the impact of the various human activities, the ecosystem approach to marine management will require a move from single stock assessments to multi-species assessment.

Ultimately, our prime objective must be to ensure that our exploitation of the marine environment is sustainable. Part of that process is assessing current methodology and status, of which the QSR 2010 is a part.

This JAMP QSR assessment of fisheries has been finalised in parallel with the assessment of fisheries presented in the QSR 2010. This may seem a curiosity to some but comes about primarily due to the continually evolving information that has been available and, to some extent, because of the quite strong and often emotive views held with respect to fisheries. OSPAR does not have a direct management role in fisheries yet this human activity is of fundamental importance when considering the impact of humans on marine ecosystems and the effect that fishing has on biodiversity. OSPAR is required to raise with the competent authorities any issue of concern it may have with respect to fisheries and the ecosystem.

The objective of the OSPAR Commission with regard to the protection and conservation of the ecosystems and biological diversity of the OSPAR maritime area is to protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected. It is in this context that OSPAR seeks to assess the impact of fisheries and to report its findings within the QSR 2010.

This is not the first such quality status report. OSPAR published a quality status report in 2000. This report, QSR 2000, concluded that fishing was extremely important for many of the OSPAR countries. However, there was general overcapacity in most fishing fleets in the OSPAR area and consequently the EU (through the Multi-Annual Guidance Programme III) and the Icelandic and Norwegian authorities, implemented measures intended to decrease fishing effort. Within the EU, fleet reductions were compensated for by an increase in efficiency, resulting in no net reduction in pressure. In 1999, ICES reported that two thirds of major stocks for which they provided information to OSPAR, covering all five OSPAR regions, were outside safe biological limits (SBL)[1]. It was noted that the main tools for fisheries management included setting the Total Allowable Catch (TAC), technical measures (e.g. minimum mesh size, minimum landing size), fleet reduction programmes and effort restriction.

With the development and application of an ecosystem approach to the management and protection of our seas, precautionary references points for spawning stock biomass (SSB) and fishing mortality (F), relevant for single species, were highlighted in QSR 2000 as not being precautionary with respect to multi-species interactions, nor to wider ecosystem effects. There was also a plea for the inclusion of social and economic considerations in the management of fisheries.

QSR 2000 further highlighted that the deep-sea ecosystems were particularly vulnerable and that discards were a particular issue for some fisheries. In considering priorities between the various themes covered by QSR 2000, there was agreement that the most important issue raised by the assessment in all five regions was the resolution of the questions on the subject of fisheries. Other important issues were also highlighted and there was an acceptance that selected issues had a greater significance in specific Regions. However, fisheries were given a prominence across all Regions. In this context areas where current knowledge was a limiting factor were identified as were priorities for action. With a view to achieving stock sizes and exploitation rates that were within safe biological limits and to minimize ecological damage, action by the appropriate authorities was advised on:

- excessive fishing effort and overcapacity in fishing fleets in some regions;
- the lack of precautionary reference points for biomass and mortality of some commercially exploited stocks;
- how to address the particular vulnerability of deep-sea species;
- the risks posed to certain ecosystems and habitats, such as seamounts, hydrothermal vents, sponge associations and deep-water coral communities;
- adverse environmental impacts of certain fishing gear, especially those leading to excessive catches of non-target organisms and habitat disturbance; and
- the benefits for fisheries and/or the marine environment of temporary or permanent closure or other protection of certain areas.

This JAMP assessment reports on the developments in management activities over the last 10 years and provides details of the current status of stocks and the use of the fisheries related ecological quality objectives (EcoQOs) since 'fish communities' were identified by OSPAR one of their nine Ecological Quality Issues (EcoQs) for the North Sea. This JAMP assessment highlights where there have been improvements since it is important that, where this is indeed the case, it is clearly articulated.

[1] The definition for safe biological limits presented in QSR 2000 was: A stock is considered to be outside or harvested outside 'safe biological limits' (SBL) when the spawning stock biomass is below B_{pa}, which is the lowest biomass where there is a high probability that the production of offspring/recruits is not impaired, or when fishing mortality is higher than F_{pa}, which is a fishing mortality that with high probability is sustainable.

The gathering of the evidence

The evidence for this JAMP assessment has been gathered in a variety of ways including:

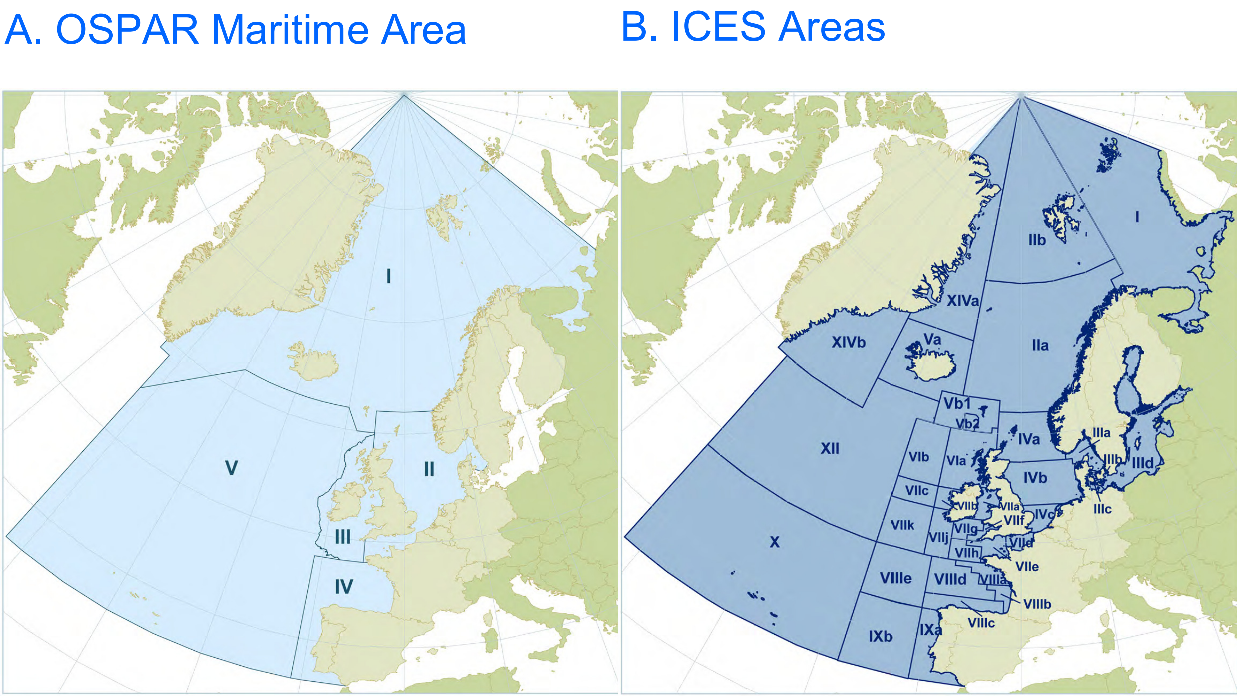
- A report, commissioned by OSPAR, from the International Council for the Exploration of the Sea (ICES) (ICES 2008 Advice Book 1 section 1.5.5.9);
- The deliberations of the 'QSR 2010 Fisheries Drafting Group'[2]; and
- Experts from OSPAR contracting parties who have responded to drafts of the QSR 2010 text presented at meetings of the Management Group for the Quality Status Report 2010 (MAQ) and the Environmental Assessment and Monitoring Committee (ASMO), and from the consultation process on Draft 1 and Draft 2 of the QSR 2010.

The ICES report, an annex to this JAMP Assessment, was prepared primarily by the ICES Working Group on Ecosystem Effects of Fishing Activities (WGECO) under the term of reference:

"Prepare a draft final assessment of the environmental impact of marine fisheries as a contribution to the Quality Status Report 2010, with reference to the scoping work completed by WGECO in 2007."

The focus of the report was on changes that had occurred over a 10 year period from 1998, i.e. since the production of the QSR 2000. The report included case studies illustrating initiatives that were taken forward to reduce the environmental impact of fisheries.

As well as presenting summary information for the OSPAR Maritime Area, the ICES report presented assessments for each of the five OSPAR Regions. However, the situation is made complex by the fact that the ICES assessment areas do not exactly correspond with the OSPAR Regions (Figure 1.1).



[2] Members of the Fisheries Drafting Group are listed in the Acknowledgemenst section at the start of this report.

C. OSPAR Maritime Area D. ICES Areas

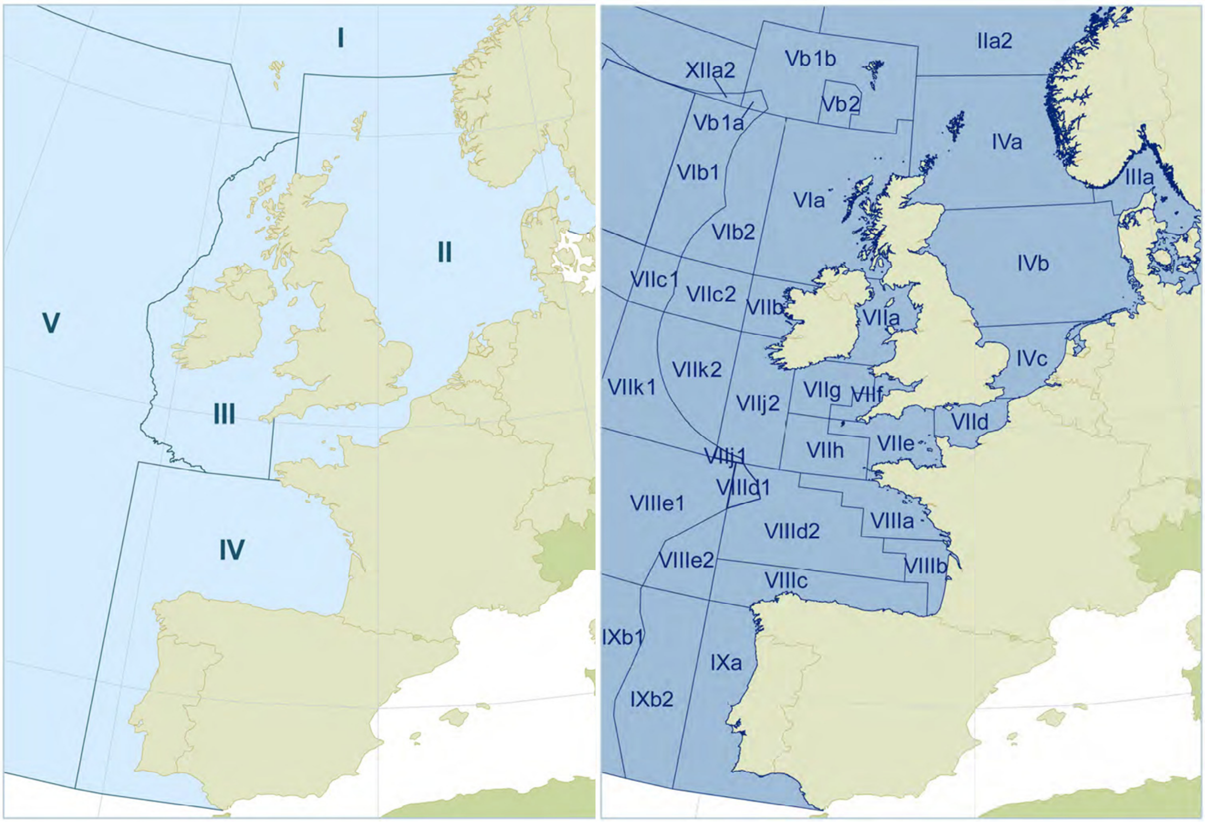


Figure 1.1: *Comparison of the ICES assessment areas with the OSPAR Regions. A. OSPAR Maritime Area; B. ICES Areas; C. OSPAR Maritime Area with a focus on Regions II, II and IV; and D. ICES Areas with a focus on the areas covered by OSPAR Regions II, III and IV.*

In addition, ICES reported that the information available was very patchy and as a result the regional reports did not address each of the subject areas covered in the report with the same level of detail for each of the regions.

The QSR 2010 Fisheries Drafting Group considered the 5 primary sections as outlined by OSPAR for the preparation of text for the QSR. These were:

- Introduction to the topic;
- What has been done?;
- Did it work, is it working, changes since 1998?;
- Impacts of fishing and its effects on the marine environment; and
- What should be done next?

The Drafting Group then prepared text which represents the majority of the body of this assessment.

Edited into the initial text prepared by the Drafting Group has been the additional information received from fisheries experts from within the OSPAR Contracting Parties during meetings of both MAQ and ASMO.

The process of developing the QSR 2010 text has also been overseen by the Drafting Group and is a summary of the all information gathered.

Terminology

Within fisheries management the four main characteristics of an exploited fish population that are taken account of to determine its health are fishing mortality (F), spawning stock biomass, recruitment and landings. Other terms and phrases that are integral to fisheries management are presented in Table 1.1.

Table 1.1: *Definitions for key terms used in Fisheries Management for the purposes of QSR 2010.*

By-catch	retained catch of non-targeted species together with the portion of the catch returned to the sea as a result of economic, legal, or personal considerations.
Depleted	Catches are well below historical levels, irrespective of the amount of fishing effort exerted.
Discards	those items captured by the fishing gear and taken on board that are not landed, consumed on board or used as bait in subsequent fishing operations, but put back into the sea.
Fishing capacity (synonymous of fishing power) of a fishing fleet	the potential ability of that fleet to capture fish per unit time. The indicators of fishing capacity are generally related to the size (tonnage, length) and number of the vessels in the fleet, to their engine power and to the size of the gear used. A fleet has overcapacity with respect to a given management regime when its potential to catch fish is beyond what is foreseen by the management regime.
Fishing Effort (synonymous with fishing pressure)	A quantification of the effective utilization of the existing fishing capacity in a management period. It is usually expressed in units of capacity multiplied by units of time (ex.: kW x days).
Fishing Mortality (F)	A measure of the proportion of a fish stock taken each year by fishing.
Fully exploited	The fishery is operating at or close to an optimal yield level, with no expected room for further expansion.
High Grading	retaining on board for ulterior landing only those fish that can fetch good prices at the market, while discarding the less-valued fish.
Maximum Sustainable Yield (MSY)	the largest yield (or catch) that can be taken from a fish stock over an indefinite period. Management policies should ideally aim at maintaining fish stocks, for a long term, at levels capable to produce MSY, although other environmental, economic and social objectives may also play an important factor.
Moderately Exploited	Exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production.
Overexploited	The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse.

Overfishing	is taken to occur when the stock size has been reduced beyond the levels targeted by the management regime in place, or when the fishing mortality of the stock is beyond the levels aimed at by such management regime. A fleet with overcapacity is likely to produce such a situation unless its fishing effort is reduced by either reducing the capacity and/or the time fishing to appropriate levels.
Recovering	Catches are again increasing after having been depleted
Spawning Stock Biomass (SSB)	the total weight of fish in the stock that are old enough to spawn. It is one of the most important metrics of the size and health of commercial fish stocks.
Total Allowable Catch (TAC)	the maximum quantity of fish that is allowed to be caught and subsequently landed from a stock during a management period (usually one year).
Underexploited, Undeveloped or New Fishery	Believed to have a significant potential for expansion in total production

In preparing fisheries advice for the management of stocks, ICES has defined various precautionary (pa) and limit (lim) reference points for exploited stocks. These include a precautionary biomass reference point (B_{pa}), a limit reference point relating to spawning stock biomass (B_{lim}), a precautionary reference point for fishing mortality (F_{pa}) and a limit reference point for fishing mortality (F_{lim}). The limit reference points signify (stock) conditions which should be avoided while precautionary reference points give stock conditions with a high probability of avoiding the limit reference points.

ICES also adopted some specific phrases that it used to describe the condition of a stock relative to its precautionary reference points. However, experience has shown that some of the terms used are prone to being misunderstood and, in response, ICES introduced a new set of terms in 2004 (i.e. during the reporting period for QSR 2010) to describe the state of a stock. In addition, as part of recent developments in fisheries management, ICES has moved from giving advice on individual fish stocks (stock-based advice) to the provision of advice on the basis of mixed fisheries (fisheries-based advice). This, in turn, can be considered a step on the path towards developing a more integrated ecosystem based approach to fisheries management.

In the years immediately prior to 2004, ICES used some very specific phrases to describe the state of a stock. If an assessment indicated that the spawning biomass was below B_{pa} the stock was classified as being ‘outside safe biological limits’, regardless of the fishing mortality rate. In such a case ICES provided advice to increase spawning biomass above B_{pa}, which may also have involved reducing fishing mortality. If B_{pa} could not easily be reached in the short term, ICES then recommended the development of a recovery plan, specifying measures to increase SSB above B_{pa} in an appropriate time scale.

When an assessment indicated that the stock was above B_{pa} but that the fishing mortality was above F_{pa}, it was classified as ‘harvested outside safe biological limits’. ICES would then recommend that the fishing mortality be reduced below F_{pa} in the short term. This scheme is illustrated in Figure 1.2. Being outside safe biological limits meant that the ability of a stock to replace itself was reduced. It did not indicate an imminent risk of biological extinction. Despite a clear explanation of this, and usage of the same phrase in international agreements, some recipients of the ICES advice misunderstood its meaning and it was sometimes mistakenly equated with a risk of biological extinction.

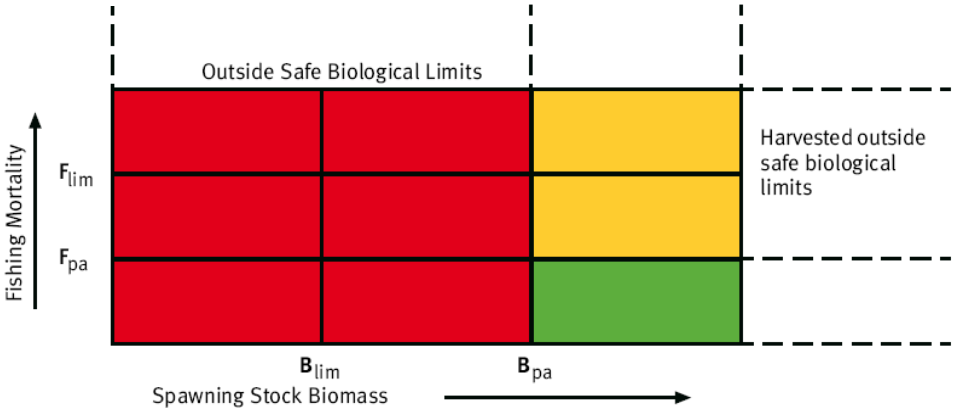


Figure 1.2: *Scheme developed and used prior to 2004 to provide fisheries advice. The limit (lim) and precautionary (pa) reference points for spawning stock biomass and fishing mortality (F) are used to develop the matrix. When stocks were below B_{pa} they were described as being 'outside safe biological limits' regardless of the fishing mortality rate*[3]*.*

In 2004, ICES adopted a new set of descriptions for indicating the state of a stock to be used along with the single-species exploitation boundaries. If SSB is above B_{pa}, the stock is considered to have 'full reproductive capacity'. If it is between B_{pa} and B_{lim} then it is considered to be 'at risk of reduced reproductive capacity', and below B_{lim} it is either 'suffering reduced reproductive capacity' or it is at a level where the 'stock dynamics are unknown'. Either of the cases where SSB is below B_{pa} correspond to the previous definition of a stock as outside safe biological limits.

For fishing mortality, where it is less than F_{pa} the stock is considered to be 'harvested sustainably'. If it is between F_{pa} and F_{lim} then it is 'at risk of being harvested unsustainably', and above F_{lim} it is 'harvested unsustainably'. The latter two cases correspond to the previous definition of a stock harvested outside safe biological limits. The revised scheme is illustrated in Figure 1.3.

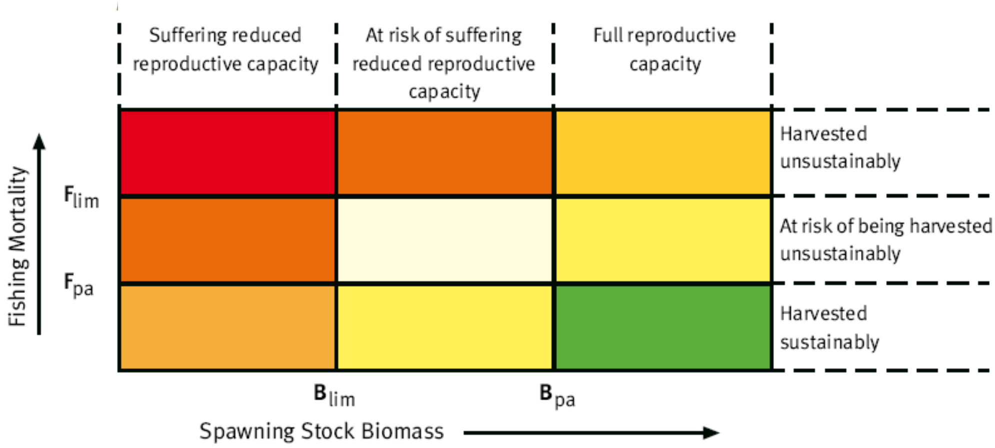


Figure 1.3: *The revised terminology used by ICES from 2004. The same precautionary and limit reference points are used.*

[3] If data exist, then a stock is considered within safe biological limits if its spawning stock biomass (SSB) estimated at the end of a year is higher than the SSB corresponding to the precautionary approach level, as recommended by ICES (B_{pa}).

In the ICES assessment prepared as part of this assessment (ICES 2008 Advice Book 1 section 1.5.5.9), the scheme outlined in Figure 1.3 was used. However, the colour coding was reduced to four colours, red, yellow, amber and green as illustrated in Figure 1.4. Thus stocks were assessed as ‘green’ when the spawning stock biomass was above B_{lim} and the fishing mortality was less than F_{lim}.

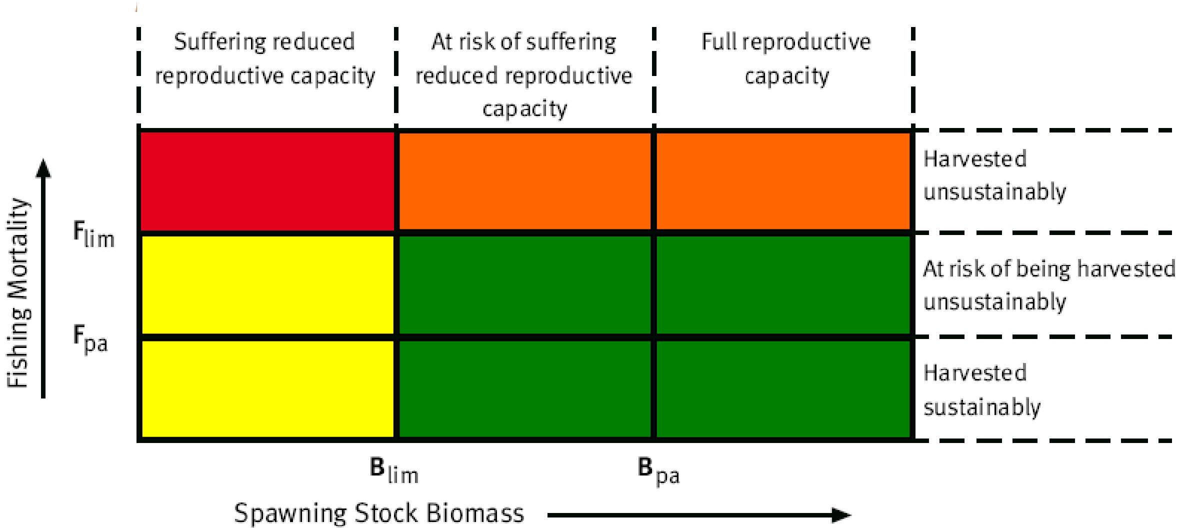


Figure 1.4: *Schematic used in the ICES fisheries assessment (see the section entitled ‘The gathering of the evidence’).*

An evolving time for fisheries

Since the QSR 2000 was published, there have been a number of developments with respect to fisheries management. These are presented in more detail in a subsequent section. However, in brief,

- there have been significant developments around European Union Common Fisheries Policy (CFP). A review in 2002 opened the way for a more long-term approach to fisheries management, involving the establishment of multi-annual recovery plans for stocks outside safe biological limits and of multi-annual management plans for other stocks. It aimed to progressively implement an ecosystem-based approach to fisheries management. Then, in 2008, the Commission launched a review of the Common Fisheries Policy which was based on an analysis of the achievements and shortcomings of the policy which existed at the time, and looked at experiences from other fisheries management systems so as to identify potential avenues for future action. It is intended that the revised version of the CFP will be agreed and implemented during 2010.
- As indicated above, there was clarification of terminology and the nature of the advice provided by ICES.
- There has been the introduction of the 7 Regional Advisory Committees (RACs). These were established by Council Decision 2004/858/EC under the Common Fisheries Policy. The RACs consist of management units based on biological criteria. They cover sea areas which are the concern of at least two Member States (Figure 1.5). An RAC has therefore been established for:

1. Baltic Sea – IIIb, IIIc and IIId[4];

2. Mediterranean Sea – Maritime Waters of the Mediterranean of the East of line 5°36' West;

3. North Sea – IV and IIIa (Figure 1.4);

4. North-western waters – V (excluding Va and only EC waters in Vb), VI, VII;

5. South-western waters – VIII, IX and X (waters around Azores), and CECAF divisions 34.1.1, 34.1.2 and 34.2.0 (waters around Madeira and the Canary Islands);

6. Pelagic stocks (blue whiting mackerel, horse mackerel, herring) – All areas (excluding the Baltic Sea and the Mediterranean Sea); and

7. High seas/long distance fleet – All non-EC waters.

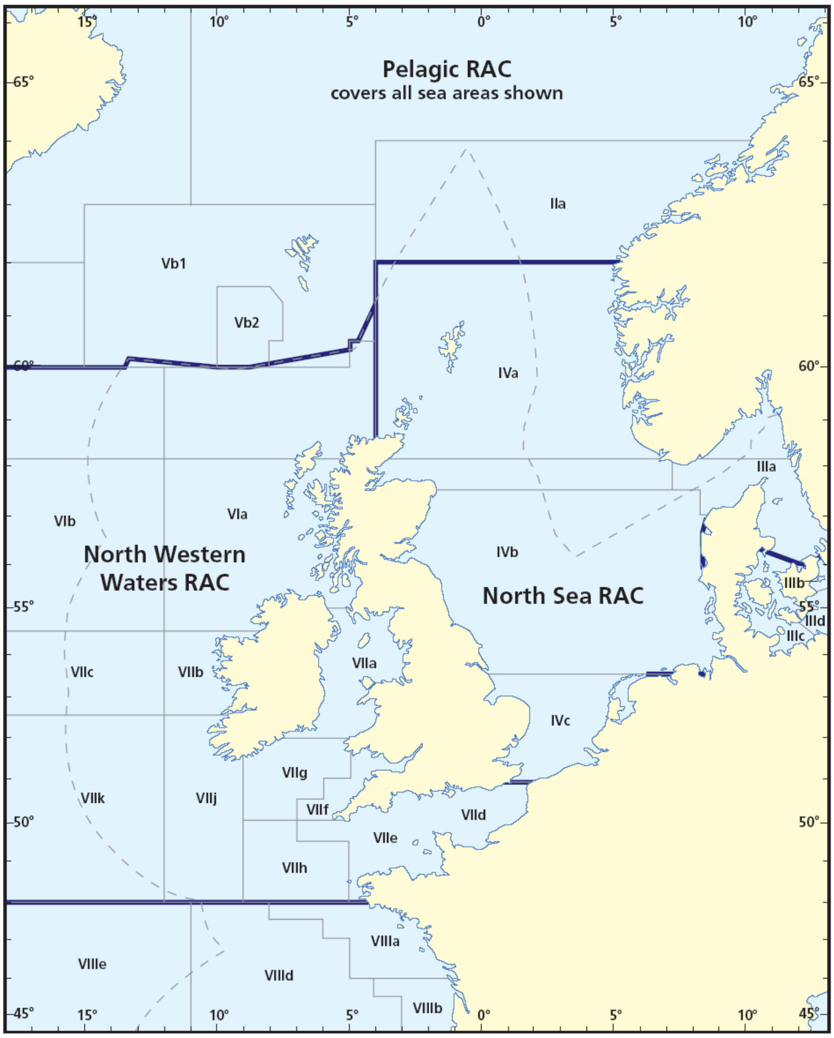


Figure 1.5: *Areas covered by the North Western Waters RAC, North Sea RAC and Pelagic RAC relative to ICES Areas*

[4] ICES areas, the Fishery Committee for the Eastern Central Atlantic (CECAF) divisions, and General Fisheries Commission for the Mediterranean. For the purposes of Decision 2004/858/EC, ICES areas are as defined in Regulation (EEC) No 3880/91 (OJ L 365, 31.12.1991, p. 1), Regulation as last amended by Regulation (EC) No 1882/2003 of the European Parliament and of the Council (OJ L 284, 31.10.2003, p. 1) and CECAF Divisions are as defined in Regulation (EC) No 2597/95 (OJ L 270, 13.11.1995, p. 1). Regulation as last amended by Regulation (EC) No 1882/2003.

- The establishment of Regional Advisory Councils (RACs), a mainstay of the reform of the common fisheries policy (CFP), seeks to involve stakeholders in the fisheries sector more closely in the decision-making process in this field. Through these ongoing forums, all the parties concerned are able to maintain a dialogue and cooperate in the development and implementation of the CFP.
- There has been a move towards encouraging fishermen to be more environmentally conscious through schemes such as the Conservation Credits adopted within Scotland. Very recently, the introduction of closed circuit television on-board vessels has provided a new tool for surveillance of activity.

Ultimately, in some countries, there has been closer collaboration between industry and regulator and an increasingly integrated approach to fisheries management so as to ensure that there is a genuine progression towards a sustainable fishing industry within the OSPAR Maritime Area.

Photo: John Dunn

2. Fishing in the OSPAR Convention Area

Fishing is the most extensive and most historic human activity in the OSPAR area which contributes around 10% of global fisheries yield. Fishing remains of great economic and social importance to many OSPAR coastal States. Iceland, Norway and the Russian Federations are among the world's most important fishing nations, approximately 30% of the Russian Federation's total catch coming from the Food and Agriculture Organization of the United Nations (FAO) Fishing Area 27 (Northeast Atlantic) (Figure 2.1). For the Faroe Islands, fisheries products, including farmed fish, represent 20% of national GDP and 95% of Faroese exports. In the case of Iceland, fishing, operation of fish hatcheries and fish farms and the processing and preserving of fish products contributed an average of 7.1% to the GDP over the three year period 2004 – 2006. This was slightly less than the previous four year period where the contribution to GDP averaged 10.6%. The EU is the world's second biggest fishing power after China, with fish providing over 11% of protein consumed there, but fisheries account for less than 1% of EU GDP. Yet, as an activity, it is highly significant in some regions.

In terms of capture production of fish, crustaceans, molluscs etc from the FAO Fishing Area 27 (Northeast Atlantic) (Figure 2.1) by OSPAR Contracting Parties, Norway has the largest quantity with a 10 year (1998 – 2007 inclusive) average of just over 2.5 million tonnes (Figure 2.2). Denmark (including Greenland and the Faroe Islands) and Iceland both exceed 1.7 million tonnes followed by the UK at just over 0.7 million tonnes. The average total for OSPAR Contracting Parties for capture production of fish crustaceans, molluscs etc from the FAO Fishing Area 27 over the period 1998 – 2007 is 8.99 million tonnes.

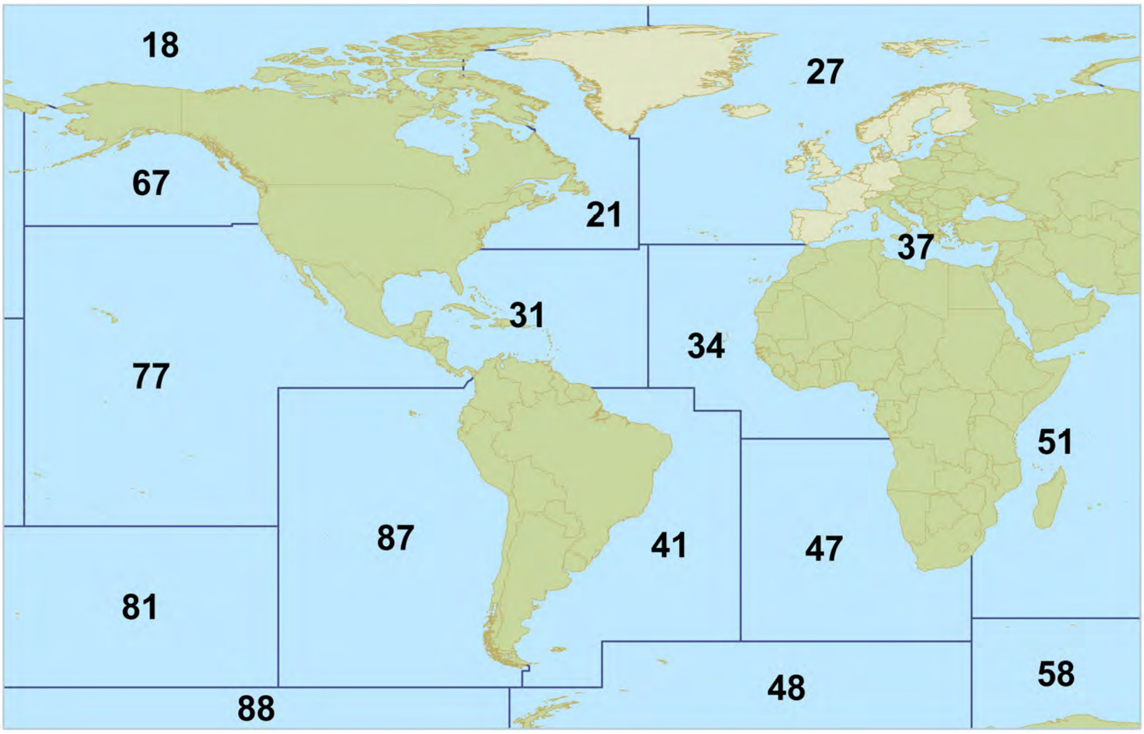


Figure 2.1: *Food and Agriculture Organization of the United Nations (FAO) Major Fishing Areas. The greatest overlap with the OSPAR Maritime Area is Area 27. However, this includes the Baltic Sea. Many OSPAR Countries obtain the largest proportion of their capture fisheries from Area 27.* However, *some OSPAR Countries obtain significant amounts of their capture fisheries from beyond Area 27, especially Areas 34 and 37. OSPAR countries are highlighted by the tan colour.*

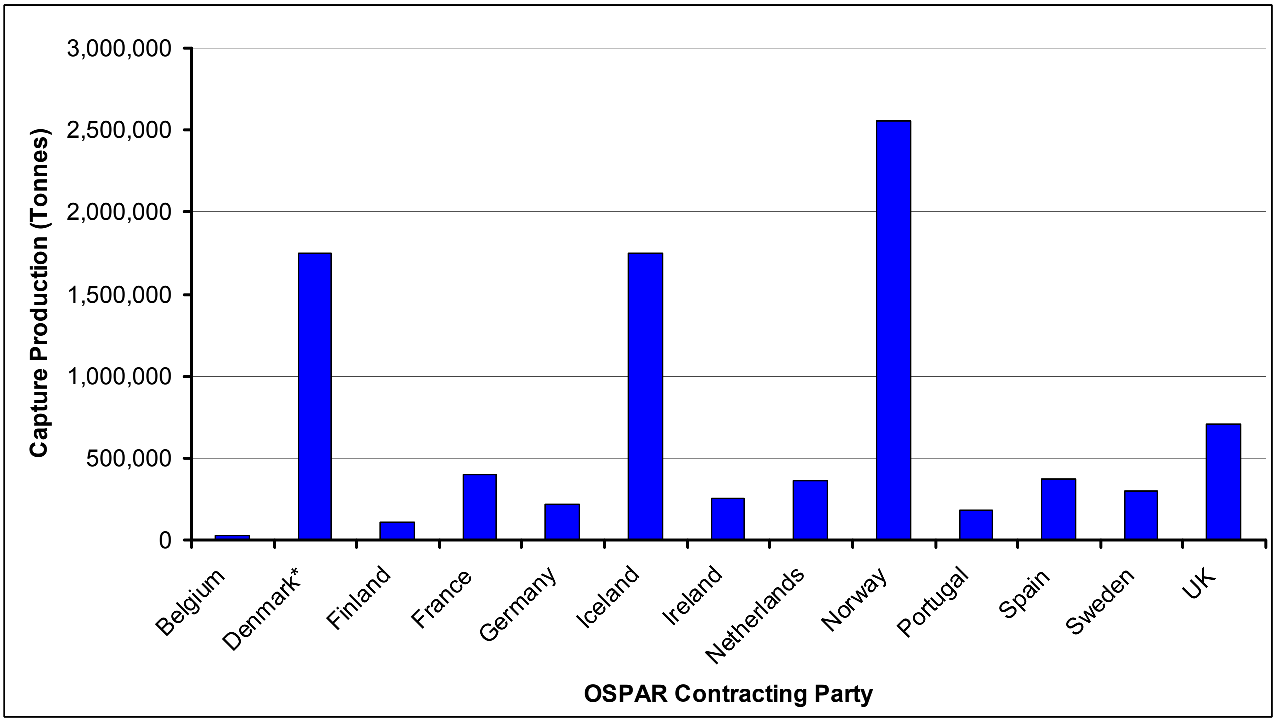


Figure 2.2: *Ten year average capture production (Tonnes) of fish, crustaceans, molluscs etc by OSPAR Contracting Parties from FAO Major Fishing Area 27. (Data extracted from the FAO Yearbook, 2007)*

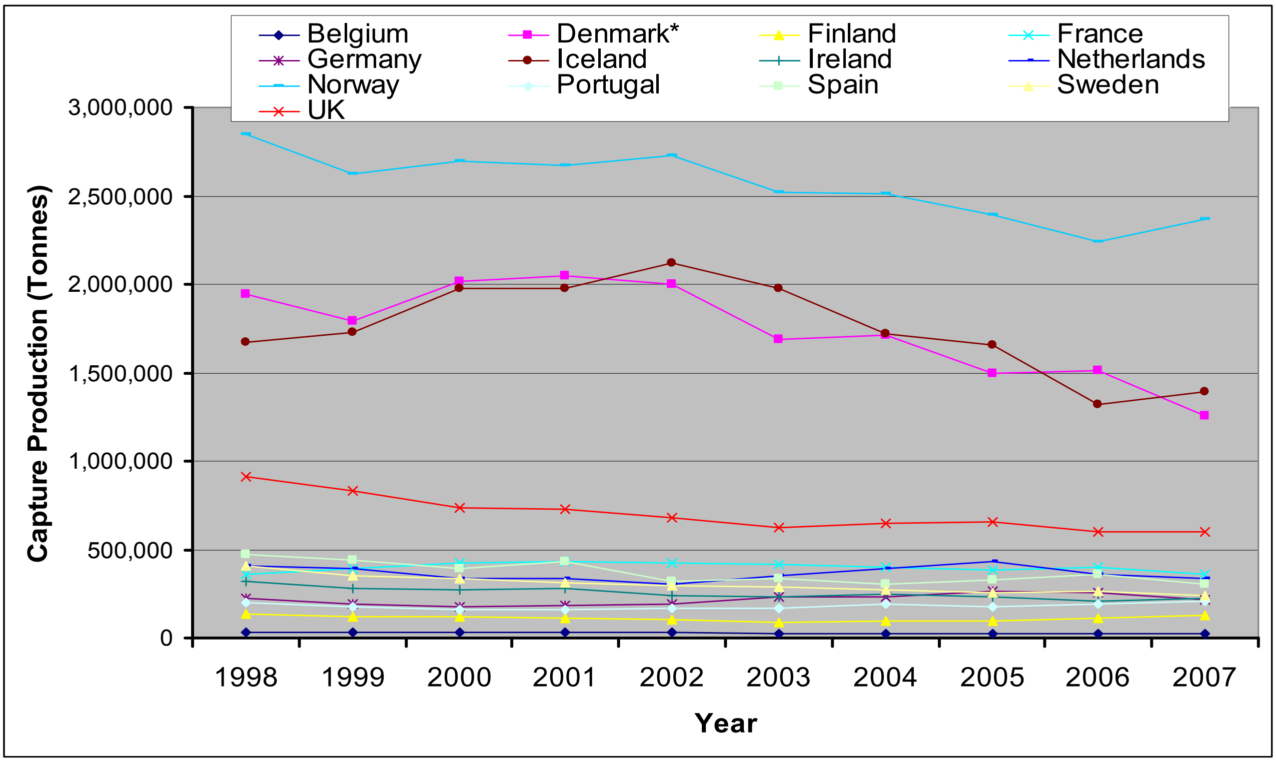


Figure 2.3: *Capture production (Tonnes) of fish, crustaceans, molluscs etc by OSPAR Contracting Parties for the period 1998 – 2007. (Data extracted from the FAO Yearbook, 2007).*

In recent years the capture production of fish, crustaceans, molluscs etc from Fishing Area 27 has decreased for the four leading countries (Norway, Denmark, Iceland and UK; Figure 2.3). This is reflected in the annual total which has shown a progressive decrease since 2002. Before this time the figure was relatively steady at approximately 9.7 million tonnes (Figure 2.4). However, by 2007 the figure had dropped to 7.7 million tonnes.

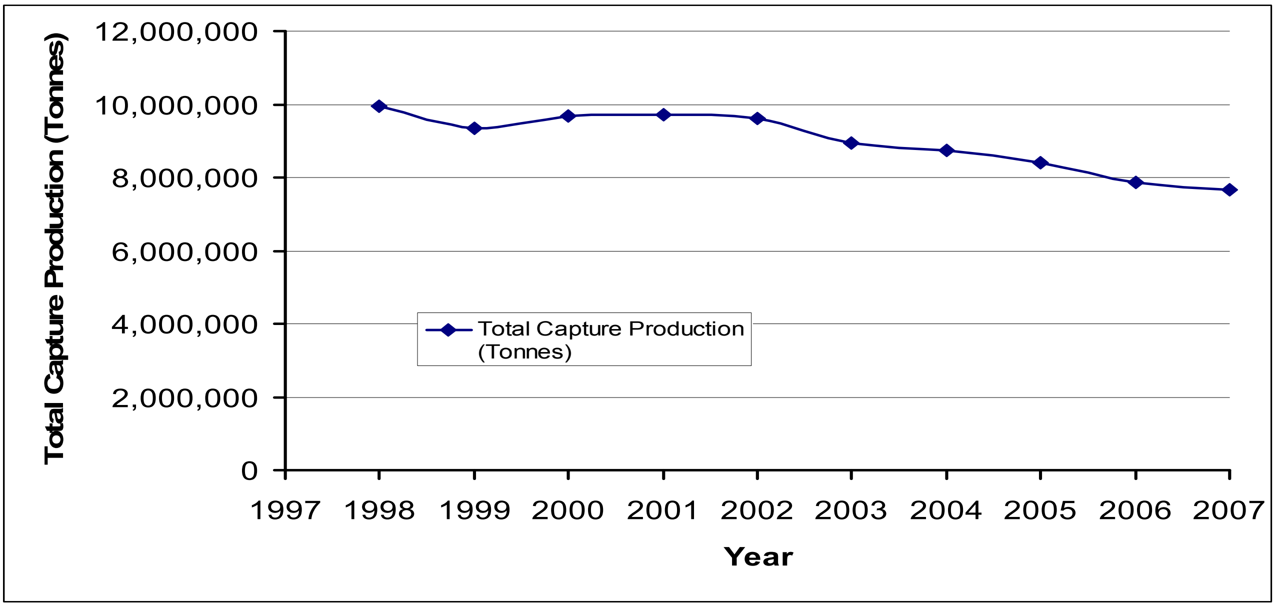


Figure 2.4: *Total capture production (Tonnes) from FAO Fishing Area 27 by OSPAR Contracting Parties between 1998 and 2007 inclusive.*

Although some countries (e.g. Norway, United Kingdom) capture greater than 95% of their fish from Fishing Area 27, others (e.g. Spain) take only approximately 40% of their fisheries from this fishing area, with significant capture fisheries in the Mediterranean (FAO Fishing Area 37) and the Eastern Central Atlantic (FAO Fishing Area 34). The Netherlands have, in the past, taken approximately one fifth of their fish annual capture fisheries from FAO Fishing Area 34.

Most traditional fisheries in the OSPAR area, and indeed globally, are fully exploited, over exploited or depleted. These include healthy, well-managed stocks, but fishing on these should not be increased. Of the 600 global marine fish stocks monitored by FAO, 3% are underexploited, 20% are moderately exploited, 52% are fully exploited, 17% are overexploited, 7% are depleted and 1% are recovering from depletion. ICES advice covers over 135 separate fish and shellfish stocks. For those stocks for which the maximum sustainable yield (MSY) is defined (32 – 35 stocks across the period 2003 - 2009 accept for 2006 when 23 stocks were assessed) more than 80% are overfished compared to MSY (Figure 2.5).

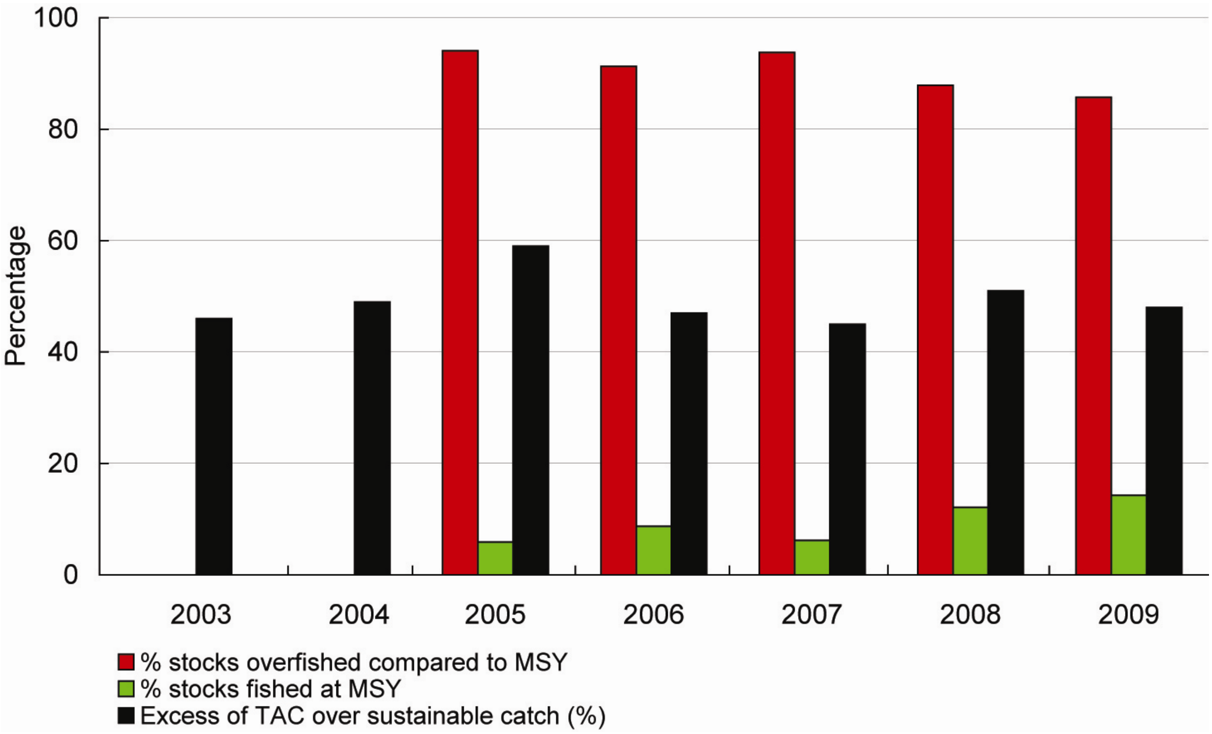


Figure 2.5: *State of stocks assessed by ICES for which maximum sustainable yield (MSY) is defined. This equates to 32 – 35 stocks across the period 2003 - 2009 except for 2006 when 23 stocks were assessed on this basis. MSY was not used for fisheries advice before 2005. ICES advice covers over 135 separate fish and shellfish stocks. TAC, total allowable catch. Stocks covered by this analysis are listed in Annex 1. These are defined according to the fishing zones for which TACs are set by the EC. (Data supplied by ICES).*

Fisheries in the North East Atlantic peaked at 13 million tonnes in 1976 and have since declined to around 11 million tonnes. Note that this figure includes non-OSPAR Contracting Parties. While new fisheries have developed, these fisheries tend to target stocks which are notoriously sensitive to exploitation, such as deep sea species, or are of lesser value (e.g. blue whiting) than traditional stocks such as cod.

The distribution of fisheries dependent regions in the EU is illustrated in Figure 2.6. The contrast between the location of these regions and the main European population centres and industrialised areas emphasises the disproportionate importance of fishing to these peripheral regions. Coastal populations have suffered from the decline in fish, the lack of alternative job opportunities and the movement of the workforce to the main centres of employment. Fishing remains the mainstay for many of these fragile areas, helping maintain rural coastal communities and economies. Fisheries policies of OSPAR Contracting Parties generally have a strong community aspect in recognition of the role that fishing plays.

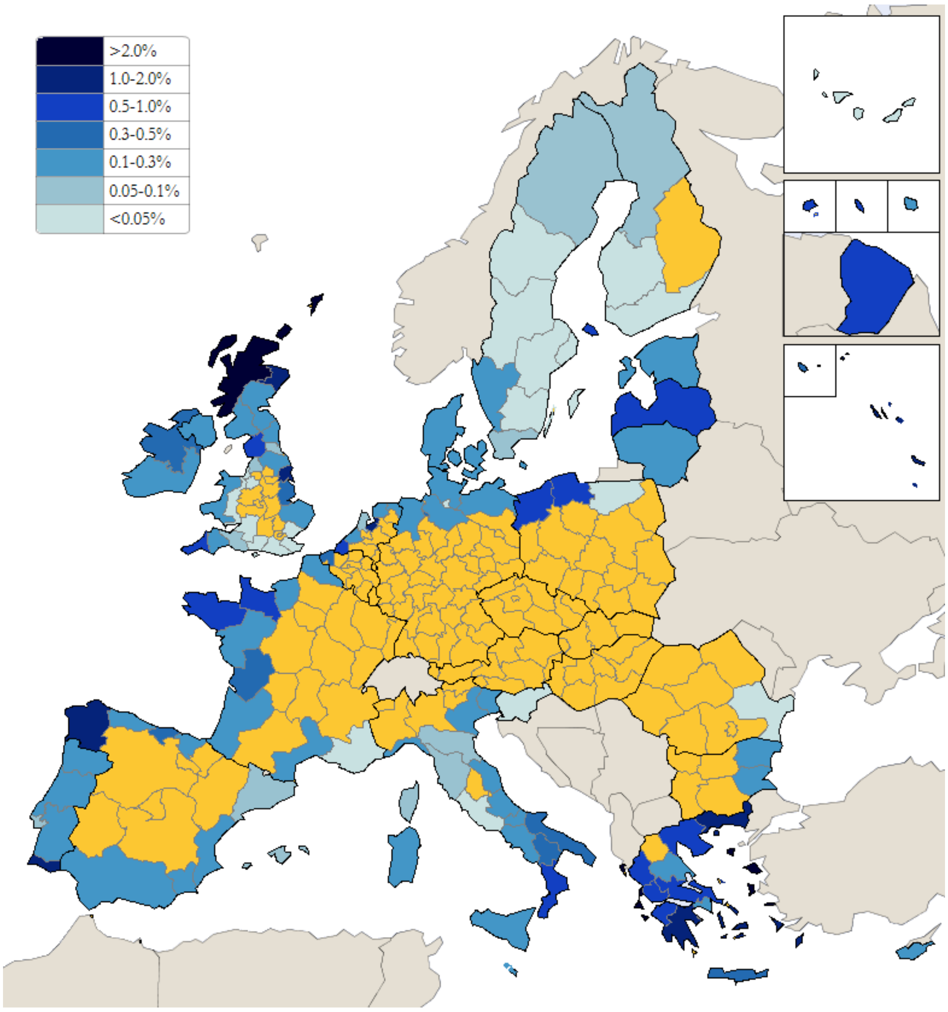


Figure 2.6: *Total fisheries sector – income dependence by NUTS-2 region (taken from Final report of the study for the Committee on Fisheries of the European Parliament)*

Constant change is a feature of fisheries

Increasing public and political understanding and concern regarding the state of world fisheries and marine ecosystems has accelerated moves towards ecosystem management of fisheries and an emphasis on a precautionary approach to management. At the same time technical developments have led to the more efficient exploitation of stocks.

Fisheries management is challenging because fisheries is constantly changing. There are changes in the availability if commercial species, changes in regulatory regimes and changes in the market prices. In recent years, fish prices in some countries have not followed the patterns of economic growth and have therefore stagnated or even decreased in relative terms. Partially this was due to competition with cheap imports of new products, but it is also likely that consumer concern with the sustainability of stocks and the condition of the marine environment has contributed to this process. At the same time dramatic increases in costs, particularly fuel, has had serious impacts on vessel profitability.

New fisheries develop to meet market demand or when effort is diverted from other fisheries. Areas fished change as fish stocks and migration patterns respond to environmental change, when technical developments allow new areas to be exploited or as a result of management e.g. closed areas.

Such challenges contribute to the complexities of managing fisheries. However there are other complexities, not least of which is the multi-national aspect of their management, the wide area across which fisheries are managed and the inevitable tension of operating a successful business that delivers a required product but, at the same time has an impact on the ecosystems from which the biomass is being removed.

3. Fisheries management and regulation in the OSPAR area

Regulation of fisheries in the OSPAR Maritime Area within EU waters is achieved through the Common Fisheries Policy (CFP) and within Faroese, Greenlandic, Icelandic, Norwegian and Russian waters by national policy and regulation (Figure 3.1). Whereas some fisheries are regulated autonomously by the corresponding authorities, others require bilateral or multilateral agreements (Table 3.1). Examples of this are the joint management between Norway and the EU for North Sea fisheries, the Russian-Norwegian agreement for the Barents Sea and the Coastal States consultations for mackerel, blue whiting and redfish. In the High seas, the North East Atlantic Fisheries Commission (NEAFC) Regulatory Area management measures are agreed by the NEAFC Commission and monitoring, surveillance and control is under the NEAFC Scheme of Control and Enforcement. Together with NEAFC, the International Commission for Conservation of Atlantic Tunas (ICCAT) and the North Atlantic Salmon Conservation Organisation (NASCO) also operate as Regional Fisheries Management Organisations (RFMOs) in the OSPAR Maritime areas. A Memorandum of Understanding was established in September 2008 between NEAFC and OSPAR to formalise roles towards the goal of conserving marine biodiversity, (OSPAR other agreement 2008-4).

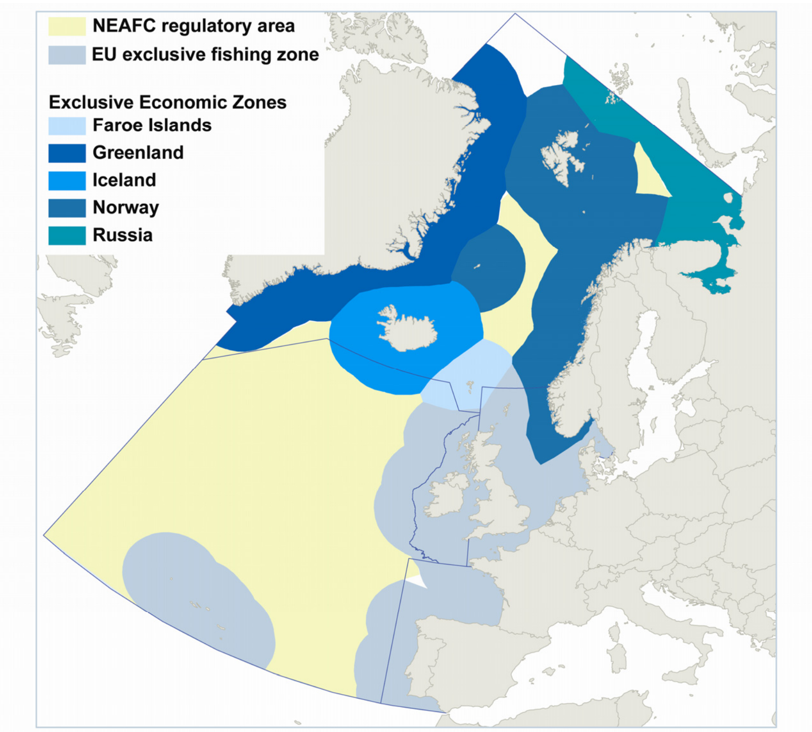


Figure 3.1: *Fisheries management zones in the OSPAR area.*

Table 3.1: *Bi-lateral and Multi-lateral fisheries management arrangements in the OSPAR Area. More details are provided in the following text*

Organisation	**Contracting Parties**	**Objective and fisheries**
North East Atlantic Fisheries Commission (NEAFC)	EU, Faroe Islands Greenland, Iceland, Norway, Russian Federation	*Objective*: long-term conservation and optimum utilization of fishery resources in order to provide sustainable economic, environmental and social benefits *Stocks*: Atlanto–Scandian herring, mackerel, blue whiting, redfish, Rockall Haddock and deep sea fisheries in the Atlantic and Arctic Oceans
International Commission for Conservation of Atlantic Tunas (ICCAT)	46, incl. EU, Iceland, Norway, Russia and several States whose high seas fleets fish in the ICCAT Area	*Objective:* conservation of tunas and tuna-like species to permit the maximum sustainable catch for food and other purposes *Stocks*: ~30 high seas species – tunas, billfish, mackerel and shark 'by-catch' in Atlantic and adjacent seas
North Atlantic Salmon Conservation Organization (NASCO).	Canada, EU, Faroe Islands, Greenland, Iceland, Norway, Russian Federation and the USA	*Objective:* to promote the conservation, restoration, enhancement and rational management of salmon stocks in the North Atlantic Ocean through international co-operation *Stocks:* Faroe Islands and Greenland High Seas salmon fisheries
The International Whaling Commission (IWC)	At present 88 Contracting Parties	*Objective:* Conservation and management of whale stocks.
The North Atlantic Marine mammals Commission (NAMMCO)	Faroe Islands, Greenland, Iceland, Norway	*Objective:* Conservation and management of marine mammals in the North Atlantic
Bilateral Coastal States Consultations	EU, Norway Norway, Russian Federation	Management of joint stocks in the North Sea, including Skagerrak Joint management of cod, haddock and capelin in the Barents Sea
Various bilateral agreements between parties in the North East Atlantic	Parties: EU, Faroe Islands, Greenland, Iceland, Norway, Russia,	Exchange of quotas in each other's waters; other management issues
Coastal state cooperation on stocks that straddle into international waters (coastal state groups)	Various depending on species	*Blue whiting*: EU, Faroe Islands, Iceland, Norway, *Mackerel*: EU, Faroe Islands, Norway *Norwegian spring spawning (Atlanto Scandian) herring*: EU, Faroe Islands, Iceland, Norway, Russian Federation *Redfish in the Irminger Sea*: Faroe, Greenland, Iceland

The OSPAR Commission fully recognises the competence of the various authorities, mentioned above and detailed in Table 3.1, to regulate fisheries. However, as mentioned in the Introduction to this JAMP Assessment, where OSPAR considers that action is desirable in relation to a question relating to fisheries management, it shall draw that question to the attention of the authority or international body competent for that question. Where action within the competence of the OSPAR is desirable to complement or support action by those authorities or bodies, OSPAR endeavours to cooperate with them (Article 4 of Annex V of the OSPAR Convention).

3.1 Global Network

All fishing regimes in the five OSPAR regions are underpinned by the United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS codified the rights and duties of Coastal States with regard to their respective continental shelf area and Exclusive Economic Zone (EEZ). Articles 61 to 64 address the rights, jurisdiction and duties of coastal States with regard to the conservation and exploitation of living resources, the management of straddling and highly migratory stocks. The mosaic of fisheries management regimes which cover the OSPAR maritime area must heed these requirements such as:

> 61(2) The coastal State, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of living resources in the exclusive economic zone is not endangered by over exploitation. As appropriate, the coastal State and competent international organisations, whether subregional, regional or global, shall co-operate to this end.

On the High Seas, fishing States are required to adopt conservation measures for fishery resources in respect of vessels flying their flag on the basis of the best scientific evidence available to them and to co-operate with each other in the conservation and management of such resources (Article 117). In particular, States whose nationals exploit identical living resources, or different living resources in the same area, are required to enter into negotiations with a view to taking the measures which are necessary for the conservation of the living resources concerned. To this end they are required to co-operate, as appropriate and to establish sub-regional or regional fisheries organizations (Article 118). As mentioned above, two such organisations are active in the OSPAR area, NEAFC and ICCAT. NASCO also plays an important role in preventing catches of salmon in the marine environment.

A number of coastal States felt that UNCLOS did not provide adequate means for the management and conservation of high seas fisheries. In 1993, the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks undertook to address this problem. The resulting Agreement is the basis for international fisheries management and for conservation of straddling and highly migratory stocks. The Agreement elaborates and develops specific rules set out in UNCLOS, including provisions related to the strengthening of Flag States duties over their vessels fishing on the high seas, as well as of the role of RFMOs in the conservation and management of fishery resources in areas under their competence. It further introduces port controls to promote compliance with high seas fisheries conservation and management measures.

The 1995 FAO Code of Conduct for Responsible Fisheries (FAO Code of Conduct) is a voluntary instrument that describes principles for responsible fishing and fisheries activities, taking into account biological, technological, economic, social, environmental and commercial aspects. The Code also seeks to promote structural adjustments in the fisheries sector so that fisheries are utilized in a long-term sustainable and responsible manner for the benefit of present and future generations. The Code is complemented by four international plans of action:

- the plan to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing;

- the plan for reducing incidental catch of seabirds in longline fisheries;
- the plan for the conservation and management of sharks; and
- the plan for the management of fishing capacity.

In 2004 the Conference on Biological Diversity accepted that the FAO Code of Conduct provided the appropriate model for the ecosystem approach in the fisheries sector. The Convention on Wetlands of International Importance, called the Ramsar Convention, has accepted the same in 2007.

3.2 Coastal States management of fisheries - principles

Despite the high level aim of avoiding over-exploitation, overcapacity of fishing fleets remains a general issue across the OSPAR area. Many target species within the OSPAR area are outwith safe biological limits. Over the period 2003 – 2009 inclusive the number of stocks assessed as being outwith safe biological limits varied between 23 and 28 while between 8 and 11 stocks were assessed as being within safe biological limits (Figure 3.2). However, over the same period some 48 – 56 stocks were designated as being of unknown state due to poor date. (Figure 3.2). In 2006, approximately 20% of fish taken from EC managed waters was taken from stocks outwith safe biological limits. What is also apparent is that, in terms of the percentage catch within safe biological limits taken from stocks where the EU has a management responsibility, there is a marked difference between pelagic and demersal stocks and that this difference has been a feature of such fisheries over many years (Figure 3.3). Fisheries management policies are therefore orientated to reduce over-exploitation and commonly feature:

- Catch limits for commercial stocks;
- Effort management measures;
- Technical conservation measures; and
- Fleet reduction programmes.

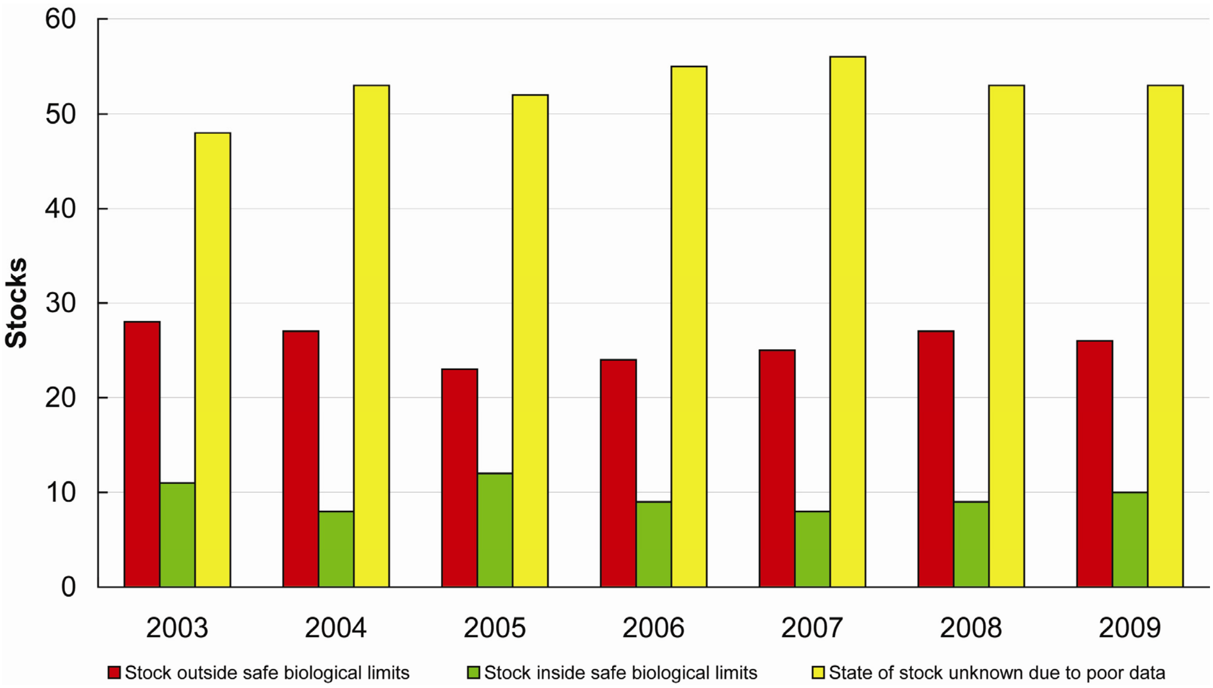


Figure 3.2: *Status of ICES assessed stocks (excluding those in the Baltic Sea) for the period 2003 – 2009. Stocks covered by this analysis are listed aT Annex 1. These are defined according to the fishing zones for which TACs are set by the EC. (Data supplied by ICES)*

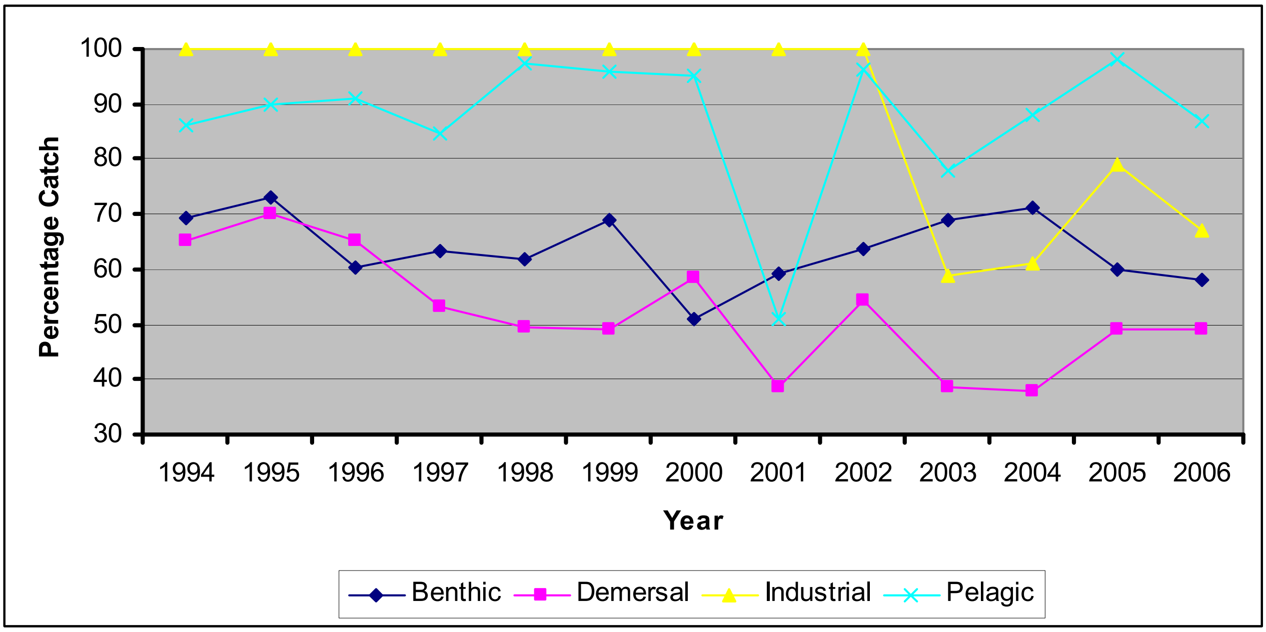


***Figure 3.3:** Percentage catch within safe biological limits taken from stocks where the EU has a management responsibility.*

Catch limits are generally established by the setting of Total Allowable Catches (TACs). TACs are based on assessment of stock condition against precautionary limits for Spawning Stock Biomass (SSB) and Fishing Mortality (F) (For further information on terminology the reader is directed to the Introduction). While coastal States are obliged to establish catch limitations with regard to best available science, that science suffers from incomplete knowledge of the state of fish stocks (Figure 3.2). This is partly because stocks assessment is highly dependent on data difficult to obtain as fish species are patchily distributed over vast areas. Another source of error is the degree of discarding which occurs across the OSPAR Maritime Area. Discarding can have a range of causes but its impact on stock assessment is, when discards are not properly monitored, to introduce uncertainty due to unrecorded mortality of discarded fish.

The setting of TACs alone can also aggravate discarding as catch limitations are set for single species in isolation, whether or not that particular stock forms part of a mixed fishery. Consequently the discarding of marketable fish can follow if a skipper prosecuting a mixed fishery runs out of quota for 1 species, as happened in the North Sea in 2008 where a low TAC for cod in the mixed demersal fishery resulted in high discarding of this species when prosecuting fisheries primarily targeting haddock, whiting and plaice. The high level of discarding led to a significant increase in cod TAC for 2009.

Considering the issue of discards a bit further, it is clear that discarding has been a serious problem in the North East Atlantic for which an estimate was 1.4 million tonnes in the early 2000s. To tackle this priority issue, the EU, during 2007, initiated a new policy to reduce unwanted by-catches and progressively eliminate discards in European fisheries. Discarding is done for a variety of reasons, among which are existing EU regulations requiring discarding of catches in excess of quotas in multispecies fisheries, and strong economic incentives in many fisheries to discard fish to maximize the value of the landing, so called 'high-grading'. This practice is because different sizes or qualities of fish command different market prices and quotas restrict the amount that can be landed. In addition, capacity restrictions (e.g. cooling limitation) can lead to high-grading of low value species in preference to higher value species. During 2009 the EU introduced a prohibition to high-grade species under quota in the North Sea and Skagerrak with pilot-scale studies also being undertaken on ways to reduce discarding. This measure may be extended to other parts of the Atlantic. By 1997 Norway, Iceland and the Faroe Islands had all taken action to limit discards. The Norwegian discard ban from 1988 originally covered cod and haddock in the economic zone north of 62°N, but the ban has been gradually expanded so that today it is prohibited to discard most commercial species of fish in Norwegian waters. The Faroe Islands have a similar discarding ban while Iceland has a ban on discards of all commercial species and has adopted additional measures that discourage high-grading. Some of the Icelandic measures include that a vessel's excess catches are subject to be withdrawn from the following year's quota. In addition, fishers can land small or undersize fishes with only 50% of the weight being charged against the annual catch quota up to a certain limit, generally 10% of the total landings of each species and receiving not a full price for the catch. Furthermore, strict surveillance of fishing vessels, including observers on board, stiff penalties for violations of Individual Transferable Quotas (ITQ) rules and regulations and flexibility in quota management allowing transfer of quotas between different species, have played an important role in addressing the high-grading issue. As a consequence, there has been no detectable increase in high-grading in Iceland. At its Annual Meeting in November 2009, the NEAFC adopted a ban on discards in NEAFC high seas fisheries.

The problems encountered by the reliance on TACs have led to an increasing use of effort management tools. These measures allow access to a fishery on a time-limited basis, for example a capped number of days at sea. Management of fisheries in the Faroe Islands in fact utilise a "quotas of fishing days" approach rather than rely on quota allocations of tonnes of fish. Fishing days are allocated to groups of vessels (groups are designated by vessels size and gear type) and trade in fishing effort allowed within these groups. The system evolved to account for the mixed nature of the Faroese groundfish fisheries. By controlling fishing capacity and effort on stocks, rather than catch limitations, the incentive to discard has been reduced. Since the introduction of the fishing days regime in 1996, there has been around a 20% reduction in total fishing days in order to adjust for likely increases in fishing efficiency.

Another means of controlling fishing effort is to remove capacity from the fleet. There has been a range of programmes undertaken by coastal States within the OSPAR regions to bring fleet capacity more in line with sustainable fishing opportunities. While these schemes have generally been successful in reducing the number of active fishing vessels, this is often counter-balanced by technological improvements that increase fishing efficiency, this resulting in little if any reduction in effective fishing effort.

Technical conservation measures are generally aimed at making fishing practices and patterns more selective. Changes to fishing gear, such as larger mesh sizes or the inclusion of square mesh panels and separator grids aid selectivity and reduction of the impact of the gear on the bottom. Closed areas are provided to protect spawning or juvenile fish, or more frequently in recent years, vulnerable seabed habitats. A growing feature of fisheries policy in recent years has been the acceptance that functioning ecosystems are an important condition for healthy fish stocks.

3.3 The European Union and the Common Fisheries Policy (CFP)

The European Union represents the world's second biggest fishing power, after China. In 2005, EU Member States caught around 5.6 Mtonnes of fish, 75% of which were caught in the OSPAR Maritime Area, with a fleet comprising more than 88,000 vessels. Within the EU, 4 Member States are responsible for nearly 60% of total EU commercial fisheries production. These are Denmark, Spain, France and the UK.

Despite these statistics, fishing provides a low share of employment and accounts for less than 1% of GDP across Member States. This apparent disparity is due to the highly regionalised nature of fisheries across Europe. Fisheries remain an important economic and social activity in places removed from the industrial and commercial centres of Europe. The most fisheries-dependent areas in the EC include Galicia in Spain, the Algarve and Azores of Portugal, North East Scotland and parts of Greece.

The Common Fisheries Policy (CFP) is the EU instrument to manage fisheries. It is a complex piece of legislation dealing as it does with a huge number of stocks, fishing vessels and fishing patterns. Member States have widely varying interests in particular stocks and the annual negotiations in December to establish fishing opportunities for the following year tend to dominate fisheries policy concerns.

Management of exploitation rates within the CFP is primarily based on TACs and Quotas with growing emphasis on effort management and long term management plans. The CFP applies to all EU vessels in all waters and to EU waters for all vessels and provides access to Member States outwith each Member State territorial zone (areas beyond 12 nautical miles – see Figure 3.1).

The CFP is unlimited in time but it is reviewed approximately every 10 years. As detailed earlier, the most recent formulation of the CFP has been in operation since 1 January 2003. The reforms introduced in 2003 included:

- Implementation of a long term approach to stock management to improve stock condition and economics;
- Fleet policy measures to reduce capacity including the removal of subsidies to increase capacity;
- Streamlining and harmonisation of enforcement rules; and
- Increased stakeholder involvement in policy design.

These improvements have been achieved to some extent although it is widely accepted that greater reform is still required, including further reductions in fleet capacity. The Commission have already embarked on the reform process with a Green Paper published during 2009.

The European Fisheries Fund (EFF) is the financial component of the CFP. The EFF will run for seven years (2007-2013) with a total budget of around € 3.8 billion. The EFF aims to support the objectives of the Common Fisheries Policy (CFP) by:

- supporting sustainable exploitation of fisheries resources and a stable balance between these resources and the capacity of Community fishing fleet;
- strengthening the competitiveness and the viability of operators in the sector;
- promoting environmentally-friendly fishing and production methods;
- providing adequate support to people employed in the sector; and
- fostering the sustainable development of fisheries areas.

3.4 Norway

Norway is a major fishing nation (see Figure 2.2) and one of the largest exporters of seafood products. It has extensive and rich fishing grounds around Norway and the islands of Svalbard and Jan Mayen. With over 2 million km^2 of waters under its jurisdiction Norwegian fisheries have evolved into a highly-regulated industry with quotas and licensing requirements.

The most important fish stocks migrate between Norwegian and foreign waters, and consequently good governance requires close co-operation with neighbouring countries. Bilateral agreements operate between Norway and Russia, Iceland, Faroes, Greenland and the EU (see Table 3.1). All major North Sea stocks are managed jointly by the EU and Norway with long-term management plans agreed for cod, haddock, saithe, plaice and herring.

Norwegian fisheries exploit around 80 stocks landing around 2.2 million tonnes in 2006. The single most important stock is cod, however it is pelagic species that dominate Norwegian fisheries in terms of landed volume.

Fisheries are managed through effort and capacity controls, TACs and Quotas and a range of technical measures. Notably, the Norwegian authorities enforce a discard ban that, since the adoption of the recent Marine Living Resources Act, is practically all-encompassing.

Norwegian fisheries patrol vessels can request vessels to move elsewhere if there is a high proportion of juvenile fish in their catch. Fishing grounds in the Barents Sea are closed for bottom trawling on a real time basis when there are high proportions of juveniles or undersized fish. This means that there are times when large areas of the Barents Sea are closed to bottom trawling. Norway has also introduced special protection measures to protect cold water coral reefs off its coast. In 2003, a ban on bottom trawls was introduced in an area approximately 43 km long and 6.8 km wide. Eight four other similar reef structures have also been granted protection.

3.5 The Faroe Islands

The Faroe Islands sea area extends to 274, 000 square kilometres. The main demersal fisheries are for the mixed groundfish (cod, haddock, saithe) also important are redfish, ling, tusk, Greenland halibut, angler fish and deep water species. The biggest landings are pelagic stocks, Atlanto-Scandian (Norwegian Spring Spawning) herring, mackerel and blue whiting. The Faroe Islands have bilateral agreements with the EU, Iceland, Norway, Greenland and Russia, allowing for exchange of fishing rights, maintaining important Faroese fisheries within the EEZs of those countries.

As previously mentioned, Faroese demersal fisheries are managed through a fishing days regime. The system which was developed:

- is based on fishing effort rather than catch limits;
- restricts vessels of a certain size and gear type to particular portions of the waters around the Faroe Islands; and
- allows all fish which are caught during a trip to be legally landed and sold.

Since introducing this system of effort management in 1996, fisheries managers have not followed ICES' advice, which has recommended cuts in effort even when stocks are above precautionary biomass limits. (ICES advice is standard single stock TAC advice and thus not directly applicable for regulating the number of fishing days in mixed fisheries). It has been claimed that the Faroese effort system is successful because it allows fishermen to follow the natural fluctuations in stocks, and because landings of demersal fish have since increased.

This system is strongly supported by the fishing industry and may appear to be successful to fishermen because of recent improved catches, but since it was introduced in 1996, the average fishing mortality of cod and haddock has actually increased.

Other management measures such as real time closures, seasonal closures and technical measures are also utilised to manage fisheries. A number of sites within Faroese waters have also been closed to trawling to protect cold water corals.

3.6 Iceland

Historically fisheries have provided the main economic driver of the Icelandic economy. Today the economy remains highly dependent upon fisheries, with marine products representing more than 40% of the value of goods exports in 2007. The recent global financial difficulties have served to emphasise Iceland's dependency on its marine resources. Cod is the most important commercial stock for Iceland accounting for around 40% of seafood export revenue.

At the end of 2008, the total number of fishing vessels in the Icelandic fleet, registered at the Icelandic Maritime Administration, was 1,529. This represents a decrease of 113 vessels from the previous year. The number of decked vessels was 769 and their combined size was 86,390 gross tonnage (GT). The number of decked vessels had decreased by 65 items and their total size by 5,266 GT. The number of trawlers was 60 at the end of 2008 and their total size amounted to 69,889 GT. Icelandic vessels landing around 1.4 million tonnes of fish in 2007. 25% of that catch was capelin with significant amounts of cod, haddock and herring also being landed. 75% of the quantity of catch is small pelagics (capelin, herring and blue whiting) which only account for around 25% of the value. Demersal species account for 25% of the volume but 75% of the value. Fisheries management seeks to balance active catches with carrying capacity of stocks. Catch limitations, technical measures area closures and the usual mechanisms seen in fisheries management around the world are utilised by the Icelandic Government. However, the most distinctive feature of Iceland's fisheries management regime is the use of Individual Transferable Quotas (ITQs) which give skippers a fixed % share of TACs. The skipper can then choose to trade or augment through the purchase of quota.

Fisheries management evolved into a system of ITQs, which was enshrined by the Fisheries Management Act of 1990. Quota holders pay an annual fishing inspection fee and vessel owners pay for transfer of quota between vessels. Also, fishery-monitoring charges are collected through a charge on quota issue amounting to US$2m annually.

The introduction of ITQs in Iceland has had considerable economic benefits:

- over-investment in fishing capacity has been restrained;
- the fleet has contracted; and
- fishing effort has been reduced.

At the same time, most fishing firms have become profitable whereas many had previously made heavy losses. However, this new system is not universally supported. The small boat sector and fishermen's unions complained that the cost of renting quota has reduced the crew's income, which was addressed by adopting a new institutional mechanism. While consolidation has resulted in a profitable fleet, some fishing-dependent communities have been left vulnerable due to losing quota. It is though disputed to what extent this is due to technological development which reflects a general trend in industrialized countries where employment has been shifting from primary industries to services. Special shock absorbers or regional policy instruments have been adopted to mitigate the effects on individual communities. An example of this is that the Minister of Fisheries has a mandate to allocate a certain amount of cod equivalent for special purposes. The amount is normally less than 3%

of the total quota allocations. The specially allocated quotas are basically intended to serve as a ‘shock absorber’ and regional policy instruments. These quotas are used for example when local stocks collapse and the impact is severe and limited to a group of vessels that had specialised in catching of these local stocks. This arrangement has been applied to coastal shrimp and scallop fisheries that have experienced large fluctuations in stock status and catches. These quotas are also used to compensate small communities that lose quotas for various reasons. A community that suffers from the loss of quotas through transfers or because of a reduction in catches for other reasons can apply to the Minister for a special regional quota allocation.

The introduction of the ITQ approach was an important factor in the reduction of the Icelandic fishing fleet in terms of both numbers and tonnage. The Icelandic fishing industry also contributed to a decommissioning scheme between 1990 and 1997 in which vessels were decommissioned from commercial fishing activity by having their licenses revoked but did not have to be physically scrapped. The decommissioning program was financed by a loan from the government to the Fisheries Development Fund, to be repaid with interest. The Fund issued grants to vessel owners who wished to decommission with preference being given to smaller vessels.

3.7 Greenland

Fishing in Greenland represents a hugely significant sector. 92% of all exports are seafood products, mainly in the form of processed shrimp while fishing provides 23% of all employment in Greenland. Greenlandic fisheries, in contrast to European fisheries, have suffered from a small range of target species. Consequently the Greenlandic economy is particularly sensitive to market value of shrimps. In the 1980s, cod was the main income generator.

Management of Greenlandic fisheries is based on the setting of annual TACs by the Greenlandic Home Rule Government, based on scientific advice. An ITQ system was introduced in the 1990s, firstly for the offshore shrimp fleets and later for the inshore fleets, in order to reduce over capacity. It was only partially successful in achieving this.

The offshore shrimp fleet is a small, modern segment comprising of few large vessels which are able to sustain a profit. In contrast, the inshore fleets comprise many smaller, antiquated vessels showing marginal profitability. Most processing occurs on the offshore shrimp vessels although some processing plants are to be found on the mainland and have in the past received subsidies to provide an economic focus for communities.

As well as TACs and ITQs, successive Greenlandic governments have also employed fleet reduction programmes, effort controls and other restrictions to manage fisheries. Greenland retains a small interest in fishing opportunities in Iceland, Faroes, Norway, Russia and international waters.

3.8 Russia

The Russian Federation is one of the world's most important fisheries nations, with considerable catches both within the country's exclusive economic zone (EEZ) and on the high seas (Figure 3.1). Overall responsibility for the country's fisheries policy lies with the Russian Federation's State Committee for Fisheries. Regulatory action is partly delegated to regional authorities and federal bodies located in the regions of Russia's five fishery basins, of which the far eastern (the Pacific) and the northern (the north-east Atlantic) are the most important.

In 2004-05, the northeast Atlantic (including the Barents Sea and the North-East Atlantic Fishery Commission (NEAFC) area provided 40% of the national total catch.

Much of the Russian catch is exported. Leading importers of Russian frozen fish in 2005 were China, South Korea, Japan, Kazakhstan and Ukraine. The export market for frozen filet is dominated by Atlantic cod (43% of total net weight) 2005, exported mostly to the countries of the European Union.

Box 3.1

Deep sea fisheries

Particular concern has been expressed regarding deep sea fisheries in parts of the OSPAR maritime area, most notably in Area V (Figure 3.4). Deep water fishing (generally below 500 m depth) has taken place in this area to the west of Britain for two decades.

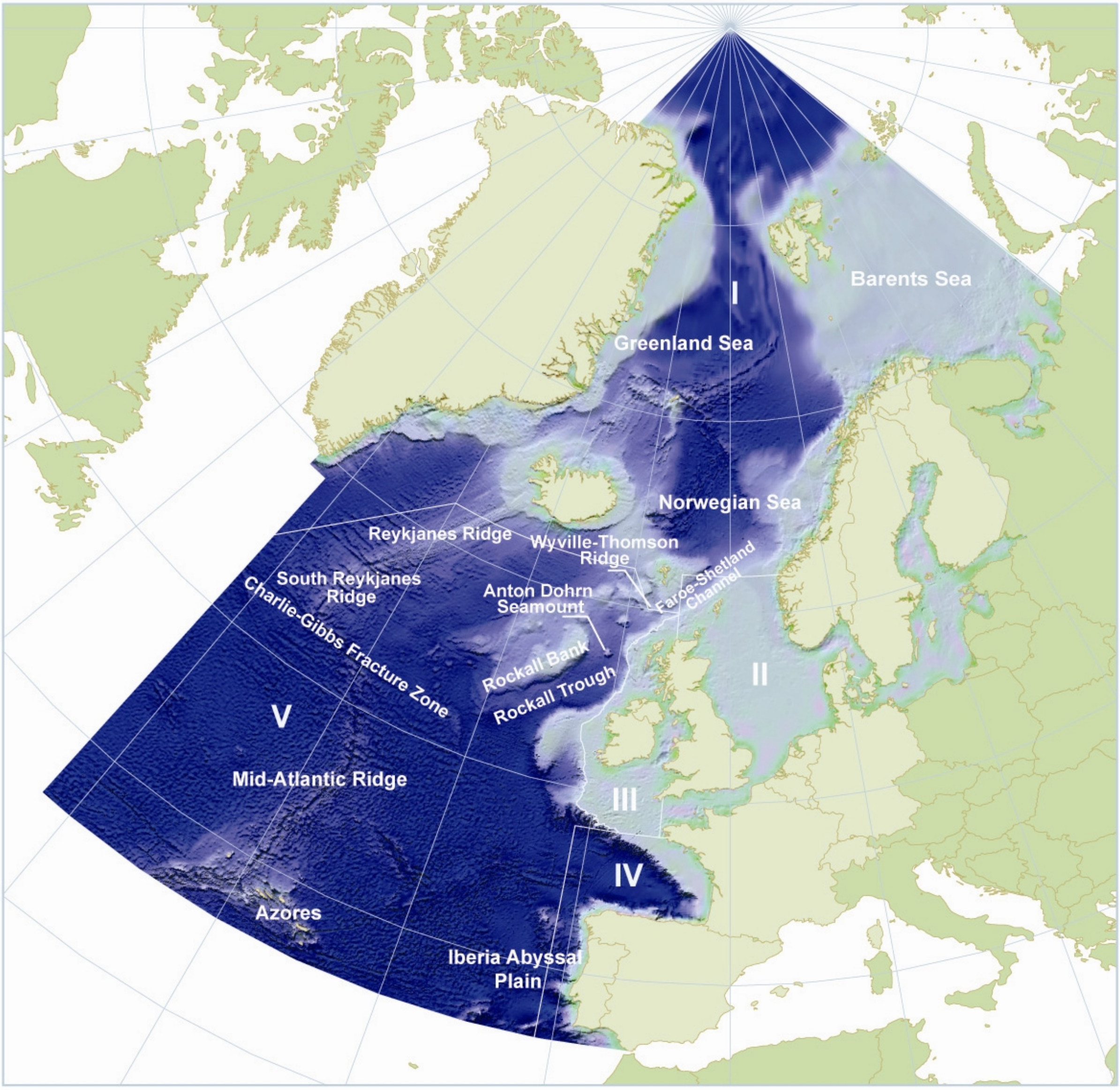


Figure 3.4: *Deep sea areas in the North-East Atlantic and the OSPAR Regions with specific features highlighted. OSPAR countries are highlighted in tan on the map.*

The life history of deep water species makes them particularly sensitive to exploitation. They are slow growing species, a consequence of the low temperatures and scarcity of food in the deep sea, have a late age of maturation, may not always reproduce every year and have long lifespans. Some stock aggregate in certain areas, for example orange roughy (*Hoplostethus atlanticus*) can gather round seamounts, increasing that species catchability. Similarly, due to their spatial distribution associated with seamounts, their life history and their aggregation behaviour, alfonsinos are easily overexploited by trawl fisheries; they can only sustain low rates of exploitation. Furthermore, the current ICES advice for alfonsinos is that exploitation of new seamounts should not be allowed so as to avoid wiping out entire subpopulations that have not yet been mapped and assessed. Many deep water species have fragile scales and skins and contact with a net can prove fatal even for escapees. Given the huge pressure change in bringing these species up from the depths, discard survival rate is generally negligible. In recognition of the vulnerability of these stocks, OSPAR has included a number of deep water species in its list of threatened and declining species (Reference No: 2008-6); the gulper shark (*Centrophorus granulosus*), the leafscraper shark (*Centrophorus squamosus*) and orange roughy[5].

Scientific data on the state of these stocks is notoriously difficult and expensive to collect. None the less, some data was collected prior to the establishment of a deep water fishery. Comparison of the data with current information is not straightforward but declining trends in deep sea assemblage biodiversity and fish size have been observed where fisheries have been prosecuted.

Most of the deep sea fishery occurs within EU or NEAFC waters. Within the EU zone deep sea fisheries are subject to CFP regulations. Total allowable catches (TACs) were set in 2002 for the period 2003-2004. In 2004, TACs were extended to previously unregulated species, and closed areas were introduced for the protection of orange roughy. Other measures were added to these including the limitation of fishing effort, reporting obligations, data collection and control. In terms of TACs, their effectiveness has been limited due to the fact that they were set at levels beyond what many stocks could sustain. Indeed, the declared catches on most of them have been significantly lower than the TACs. The problem has been compounded by the fact that the mixed nature of the fisheries, combined with incomplete information on catch composition, discards and the geographical distribution of the stocks, has made it difficult to use TACs in a targeted manner. Not surprisingly, the Commission has concluded that the implementation of the measures has been too poor to adequately protect deep sea stocks. Current ICES advice for a number of deep sea stocks emphasises their continued vulnerability. As an example, ICES advise that there should be no direct fishing for blue ling (*Molva* dypterygia) during 2009 and 2010 while fisheries on greater forkbeard (*Phycis blennoides*), black scabbard fish (*Aphanopus carbo*) and greater silver smelt (*Argentina silus*) should not be allowed to expand unless it can be shown that it is sustainable. The advice nearly always highlights the need to collect data which can be used to evaluate a long-term sustainable level of exploitation for individual species. On 8 June 2009, the FAO published a set of technical guidelines aimed at helping the fisheries sector reduce its impacts on fragile deep-sea fish species and ecosystems. The guidelines were adopted by FAO members at a technical consultation held in Rome in September 2008. These *International Guidelines for the Management of Deep-sea Fisheries in the High Seas* (http://www.fao.org/fileadmin/user_upload/newsroom/docs/i0816t.pdf) were developed through a participatory process involving fisheries experts, fishery managers from governments, the fishing industry, academia and non-governmental and intergovernmental organizations. The guidelines are designed to provide guidance on management factors ranging from an appropriate regulatory framework to the components of a good data collection programme, and include the identification of key management considerations and measures necessary to ensure the conservation of target and non-target species, as well as affected habitats. These guidelines are voluntary and constitute an instrument of reference to help States and RFMO/As (Regional fisheries management organizations and arrangements) in formulating and implementing appropriate measures for the management of deep-sea fisheries in the high seas.

[5] Current (9 October 2009) ICES advice for orange roughy (all areas) is that due to its very low productivity, orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. ICES recommends no directed fisheries for this species. Bycatches in mixed fisheries should be as low as possible.

3.9 Multilateral *ad-hoc* fisheries consultations

For some stocks extending over several EEZs, coastal States have made ad-hoc arrangements in order to decide on catch levels and propose NEAFC to collaborate with them when this organisation fixes the catch levels in areas beyond the jurisdiction of coastal States. Multilateral consultations have been carried out since the mid nineties and concern blue whiting (Norway, EU, Faroe, Iceland), redfish in the Irminger Sea (Iceland, Faroe, Greenland), mackerel (Norway, EU, Faroe) and Atlanto-Scandian herring (Norway, EU, Faroe, Iceland, Russia).

3.10 Regional Fisheries Management Organisations (RFMOs)

Within the OSPAR Maritime Area, 2 RFMOs manage international waters and highly migratory stocks; the North East Atlantic Fisheries Commission (NEAFC) and the International Commission for Conservation of Atlantic Tuna, (ICCAT). NASCO manages fisheries for salmon in the high seas.

3.10.1 North East Atlantic Fisheries Commission (NEAFC) – www.neafc.org

The North East Atlantic Fisheries Commission (NEAFC) was formed to recommend measures to maintain the rational exploitation of fish stocks in the Atlantic and Arctic Oceans. Most of this area is under the fisheries jurisdiction of NEAFC's Contracting Parties (Denmark (in respect of the Faroe Islands and Greenland), the EC, Iceland, Norway and the Russian Federation), but four large areas (including the area around the North Pole) are international waters and constitute the NEAFC Regulatory Area (Figure 3.5). NEAFC's primary objective is to ensure the long-term conservation and optimum utilization of the fishery resources, providing sustainable economic, environmental and social benefits. The present membership is therefore made up as follows:

- The European Union
- Denmark (in respect of the Faroe Islands and Greenland)
- Iceland
- Norway
- The Russian Federation

The main fisheries in the Convention Area are for Norwegian Spring Spawning (Atlanto–Scandian) herring, mackerel, blue whiting and oceanic pelagic redfish. These fisheries are all regulated, at least in part, by NEAFC. Around 1 million tonnes of these stocks are taken annually from the NEAFC area.

The catches of the three pelagic species in 2005 had a landed value of approximately 9,117 million Norwegian kroner (or 681 million US$) from the Convention Area and 1,566 million Norwegian kroner (or 236 million US$) from the Regulatory Area.

These fisheries are industrial in nature and are mostly fished by large mid water trawl and purse seine vessels. Landings from these vessels form the basis of large operations processing for human consumption, fish feed for the aquaculture sector, and fish oil and meal in general. NEAFC fisheries have significant economic and social importance to Coastal States and fishing communities.

Article 5 and Article 6 of the NEAFC Convention set up two scenarios for the management of NEAFC fisheries. Article 5 provides for recommendations for straddling stocks in waters beyond the areas under the jurisdiction of Contracting Parties. Article 6 allows for recommendations that apply to waters under the fisheries jurisdiction of Contracting Parties. This is done at the request of the Contracting Party in question and a recommendation must receive its affirmative vote.

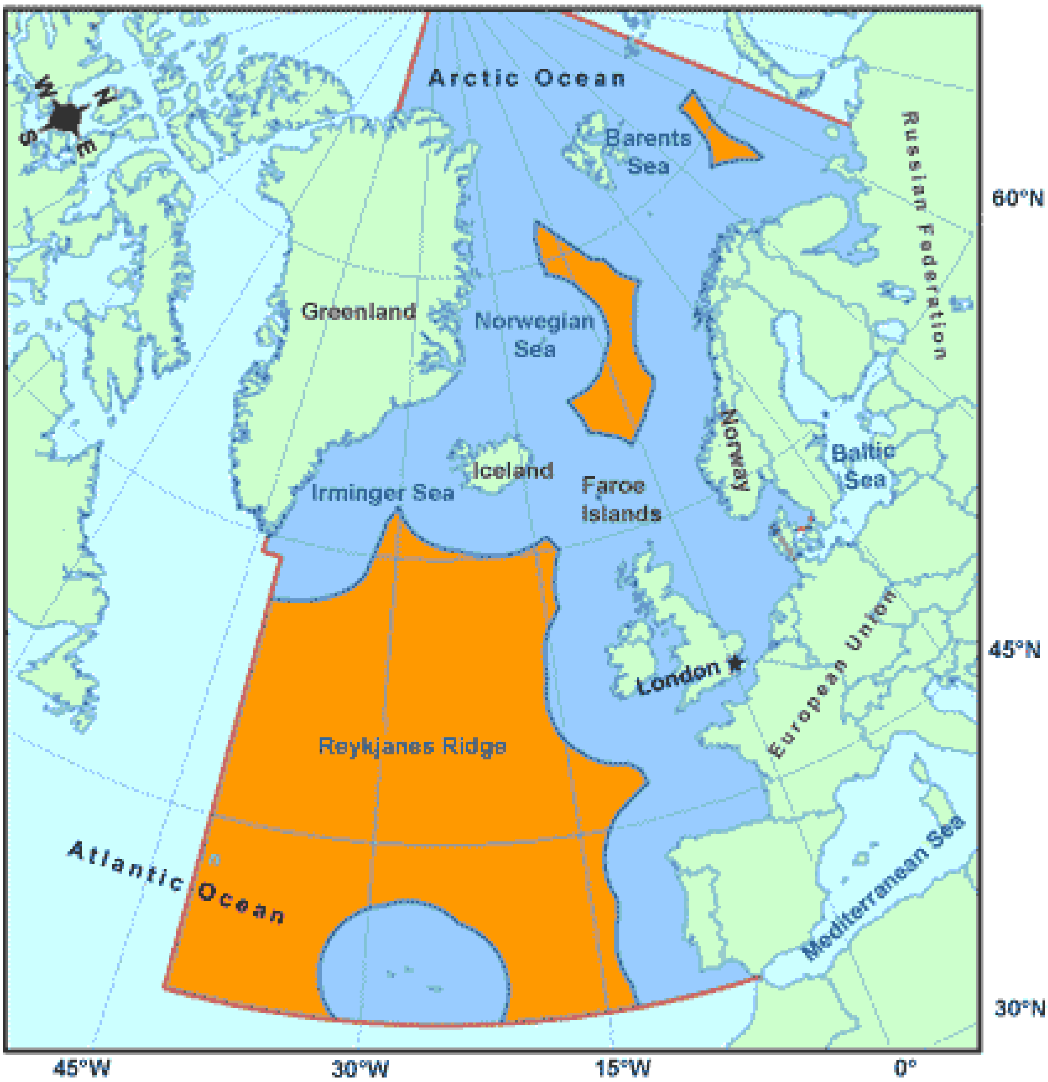


Figure 3.5: *Map of the North East Atlantic Fisheries Commission (NEAFC) Regulatory Area (orange blocks)*

The Contracting Parties of NEAFC have utilised both of these scenarios as follows:

a. Coastal State groups adopt management measures and allocations for the whole distribution area of the fish stocks, this includes proposing measures to be adopted by NEAFC for areas beyond the jurisdiction of Contracting Parties (i.e. the Regulatory Area). Examples are the pelagic fisheries for Norwegian spring spawning (Atlanto-Scandian) herring, mackerel and blue whiting and Rockall haddock; and

b. NEAFC adopts management measures and allocations for the whole distribution area of the stock for areas inside and beyond the jurisdiction of Contracting Parties. Examples are the fishery for pelagic redfish and deep-sea fisheries.

As already mentioned, during 2008 a Memorandum of Understanding between NEAFC and OSPAR was established to facilitate joint working in areas of mutual interest, including in areas beyond national jurisdiction. The stated goal of the MOU is to conserve living resources of the sea by:

- ensuring there is a free flow of information between NEAFC and OSPAR;
- highlighting other human activities that may effect the marine environment;
- pro-actively undertaking spatial planning; and
- working together to enhance knowledge and understanding of fish and other marine species populations, abundance and distribution in order to better protect them.

3.10.2 The International Commission for the Conservation of Atlantic Tunas (ICCAT) – www.iccat.int/en/

The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. The organization was established at a Conference of Plenipotentiaries, which prepared and adopted the International Convention for the Conservation of Atlantic Tunas, signed in Rio de Janeiro, Brazil, in 1966. After a ratification process, the Convention entered formally into force in 1969.

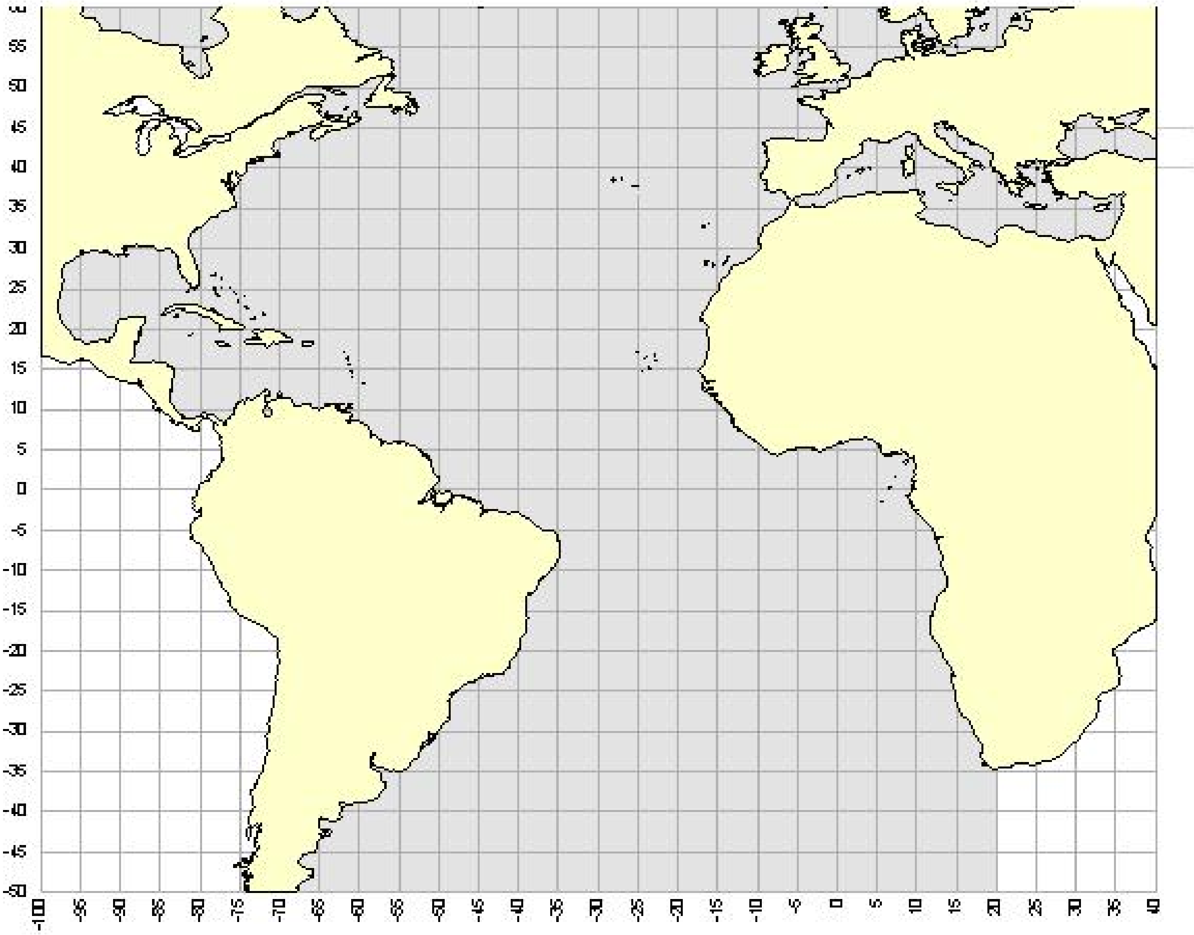


Figure 3.6: *The International Commission for the Conservation of Atlantic Tunas (ICCAT) convention area which is highlighted by the dark grey squares*

About 30 fish species are of direct concern to ICCAT including Atlantic bluefin, skipjack, yellowfin, albacore, swordfish, blue marlin, sailfish, mackerels such as spotted Spanish mackerel and king mackerel; and, small tunas like black skipjack, frigate tuna, and Atlantic bonito.

Through the Convention, it is established that ICCAT is the only fisheries organization that can undertake the range of work required for the study and management of tunas and tuna-like fishes in the Atlantic. Such studies include research on biometry, ecology, and oceanography, with a principal focus on the effects of fishing on stock abundance. The Commission's work requires the collection and analysis of statistical information relative to current conditions and trends of the fishery resources in the Convention area. The Commission also undertakes work in the compilation of data for other fish species that are caught during tuna fishing ("bycatch", principally sharks) in the Convention area, and which are not investigated by another international fishery organization.

The most recent advice from ICCAT (October 2009) is presented in the Report of the Standing Committee on Research and Statistics (SCRS) which is available at the following web address: http://www.iccat.int/Documents/Meetings/Docs/2009-SCRS_ENG.pdf. This includes a report on an extension to the 2009 SCRS Meeting to consider specifically the status of Atlantic bluefin tuna (*Thunnus thynnus*) populations with respect to CITES Biological Listing Criteria (e.g. evaluation of stock productivity and decline).

3.10.3 North Atlantic Salmon Conservation Organization (NASCO) – www.nasco.int

NASCO was established to promote the conservation, restoration, enhancement and rational management of salmon stocks in the North Atlantic Ocean through international co-operation under the Convention for the Salmon in the North Atlantic Ocean. The Convention applies to the salmon stocks which migrate beyond areas of fisheries jurisdiction of coastal States of the Atlantic Ocean north of 36°N latitude throughout their migratory range.

The Convention was adopted at a Diplomatic Conference convened in 1982 in Reykjavik. It entered into force in December 1983 and has its headquarters in Edinburgh in Scotland. The parties to the Convention are: Canada, Denmark (in respect of the Faroe Islands and Greenland), EU, Iceland[6], Norway, the Russian Federation and the US. It comprises a Council with 3 regional Commissions; the North American Commission, the West Greenland Commission and the North East Atlantic Commission (the latter being of relevance to the OSPAR maritime area)

The principal role of NASCO is to set the regulatory measures for the salmon fisheries of Greenland and the Faroe Islands. NASCO has also established internationally agreed protocols to regulate introduction and transfers of salmon while collaboration with ISFA has led to significant progress in developing codes of practice in relation to containment of fish at farms. Other issues covered in Commission and Council meetings include the assessment of progress by Contracting Parties in implementing the Application of the Precautionary Approach to salmon management and the assessment of the socio-economic importance of salmon and salmon fisheries.

[6] Iceland has decided to withdraw from NASCO with effect from 31 December 2009 because of financial considerations.

3.11 A complex regime

A key aspect of the management remains the provision of scientifically-based advice. Much of the scientific advice for the North-East Atlantic comes from the deliberations of ICES.

ICES continues to revise their advisory system to provide more robust, efficient and integrated ecosystem-based approach. ICES advice covers over 135 separate fish and shellfish stocks with this advice going to the EC, NEAFC and NASCO.

As has been indicated already, this section of the JAMP Assessment on Fisheries has illustrated the complexity of fisheries management which, to some extent, contributes to the difficulties of managing fisheries in the North-East Atlantic. However, it is evident that there is proactive negotiations and a general common goal in that both ecosystem-based management and the precautionary approach are generally a feature of all aspects of today's management of fisheries regardless of the organisation or managing body.

4. What has been done and what has taken place – deliberate and non-deliberate forces on the industry

Fisheries management in the OSPAR area has continued to evolve towards models that incorporate economic drivers and biological targets in diverse combinations with a view to achieve sustainability in its broader sense. The issues identified by QSR 2000 have been addressed either specifically or as part of broader management targets as outlined in the following text.

4.1 Fishing effort and capacity management

The issue of excessive fishing effort and overcapacity attracted most of the management workload. In the EU, the reform of the CFP in 2002[7] meant a turning point on capacity management, in that the previous policy of setting capacity targets for different kinds of fishing was replaced by a new approach leaving more responsibility to national authorities. The new system[8] implied that every Member State should establish an enduring balance between the fish resources that were allocated to them and the fishing capacity of the fleets that would exploit these resources. The mechanisms to achieve this balance and the speed at which it should be achieved were left to national authorities, while three very simple rules were set at the EU level: i) the entry-exit scheme, by which any new entry of capacity (either a new vessel entering into the fleet or an increase of the capacity of existing vessels) should be compensated by a permanent withdrawal of an equivalent capacity, ii) any capacity withdrawn with public aid cannot be rebuilt and iii) no public aid shall be given for increases in capacity that may result in greater ability to catch fish.

A rule was also set that Member States should inform the EU, every year, about the evolution of their fleets and on the mechanisms used to attain the desired balance between resources and capacity. Some of the Member States use economic incentives such as decommissioning schemes, while others use measures based on property rights, such individual transferrable quotas (ITQs). The European Commission issues an annual report compiling Member States' reports.

In Norway, all commercial fishing, with one or two marginal exceptions, is now “closed” in that vessels cannot participate/engage other than on the basis of a specific vessel quota under a global TAC. Capacity management is done almost exclusively by market-like instruments (MLI's) based on individual vessel quotas (IVQ's) and a structural quota system (SQS), by which if a vessel owner buys another vessel to benefit from the IVQ associated with it, then they are obliged to scrap the acquired vessel. The system is also associated with a few restrictions, such as maximum IVQ size and limitations on the transferability of IVQ's within regions or vessel groups. These restrictions prevent undesired effects of MLI's such as a geographical or ownership concentration of fishing rights. Decommissioning schemes existed recently in Norway for small-scale vessels, but these were phased out in 2008.

Capacity management in Iceland follows similar principles as in Norway and includes a mechanism to avoid over-concentration of fishing rights, including of different species. Since 2004, fishing rights are subject to a levy that contributes to giving added responsibility to the fleet.

In the Faroe Islands demersal fisheries capacity is regulated by the number of licenses (this number was frozen in 1995), the number of fishing days allocated (reduced by about 30 % since 1996) and areas closed permanently to bottom trawling or seasonally for all gears (41 % of the total fishing area).

[7] Most of the measures under CFP reform are set in Regulation (EC) No 2371/2002
[8] Defined in Articles 11 to 16 of Regulation (EC) No 2371/2002

RFMOs with a management mandate in the North East Atlantic do not have a particular regime to control fishing capacity and avoid overcapacity, although ICCAT has initiated reflection on this issue. In NEAFC it has been established that capacity is dealt with by individual Contracting Parties, as most of the NEAFC fisheries are extensions of fisheries in the EEZs.

Ultimately, the fishing fleet in the European Union has been reduced over the period 2000 – 2008 (Table 4.1). During this period the maximum number of vessels was 95,200 (year 2000) with the minimum being 86,228 (year 2008). This nearly 10% reduction in the number of vessels correspond with a reduction in both the fleet tonnage and the engine power (Table 4.1). Equivalent data for Norway (Table 4.2) shows that reduction of greater than 40% in the fleet numbers between 2001 and 2008.

Table 4.1*: Fleet's number of vessels, tonnage and engine power for the European Union. Data includes Belgium, Bulgaria, Cyprus, Denmark, Germany, Spain, Estonia, France, Finland, United Kingdom, Greece, Ireland, Italy, Lithuania, Latvia, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia and Sweden.*

Year	Number of Vessels	Tonnage (GT*)	Average Tonnage (GT*)	Engine Power (kW)	Average Engine Power
2000	95,200	2,025,871	21	7,631,462	80
2001	92,107	2,016,909	22	7,508,050	82
2002	89,758	1,967,608	22	7,291,738	81
2003	88,040	1,909,216	22	7,110,417	81
2004	92,469	2,103,236	23	7,499,181	81
2005	88,729	2,018,033	23	7,246,459	82
2006	86,690	1,957,298	23	7,069,433	82
2007	88,188	1,920,487	22	7,011,029	80
2008	86,228	1,864,855	22	6,854,294	79

**Under the EU legislation the member States are required to record the vessel tonnage using the Gross Tonnage (GT) under the London Convention (1969) as opposed to the previously used Gross Register Tonnage (GRT) under the Oslo Convention (1946). This change in recording tonnage has taken place over a number of years throughout the 1990s and at varying rates in different countries. Given that the GT of a vessel is generally significantly greater than the GRT, care is required when comparing tonnages of the various fleets at different times. By the end of 2003 the recording of the tonnage by GT was largely completed.*

Table 4.2: *Norwegian registered fishing vessels, gross tonnage (GT) and engine power (HP) for the period 2001 – 2008. Data supplied by the Norwegian Directorate of Fisheries*

YEAR	**Number of vessels**	**Gross Tonnage (GT)**	**Engine Power (HP)**
2001	11922	403600	1852279
2002	10641	394547	1837899
2003	9915	391519	1843590
2004	8189	390396	1809504
2005	7722	368944	1730699
2006	7301	363895	1714764
2007	7041	354907	1698400
2008	6790	363169	1686661
Change over period	**-43%**	**-10%**	**-9%**

In terms of coastal OSPAR Contracting Parties (i.e. excluding both Luxemburg and Switzerland) there has been quite a dramatic reduction in the number of fishing vessels. Over the period 1998 – 2006, the total number of vessels decreased by 25% from 77,874 to 58,399 with substantial percentage decreases for Norway (45%) Sweden (32%) and Denmark (31%) (Figure 4.1). In absolute terms Norway also saw the greatest reduction in number of vessels at 5,946. Spain (4,586 vessels), Portugal (2,597 vessels), Denmark (1,438 vessels), the United Kingdom (1,435 vessels) and France (1,145 vessels) also experienced reductions of at least 1000 vessels (Figure 4.1).

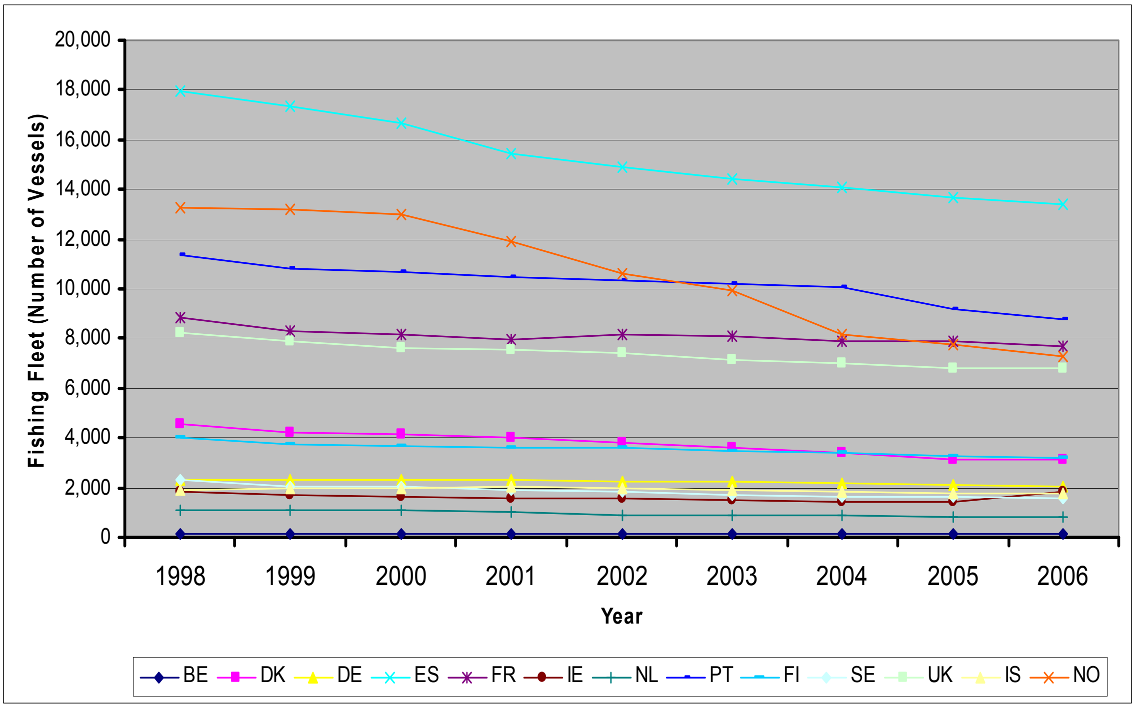


Figure 4.1 *Changes in the number of vessels for OSPAR Contracting Parties (excluding Switzerland and Luxemburg) over the period 1998 – 2006. (Data extracted from the European Environment Agency at http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=3465)*

A comparison of power, tonnage, number and average size of vessels for various country groupings is presented in Figure 4.2. This shows a general downward trend in power, tonnage and number across the four grouping of EU15, EFTA, EU7 and Romani + Bulgaria (see Figure 4.2 for definition of groupings).

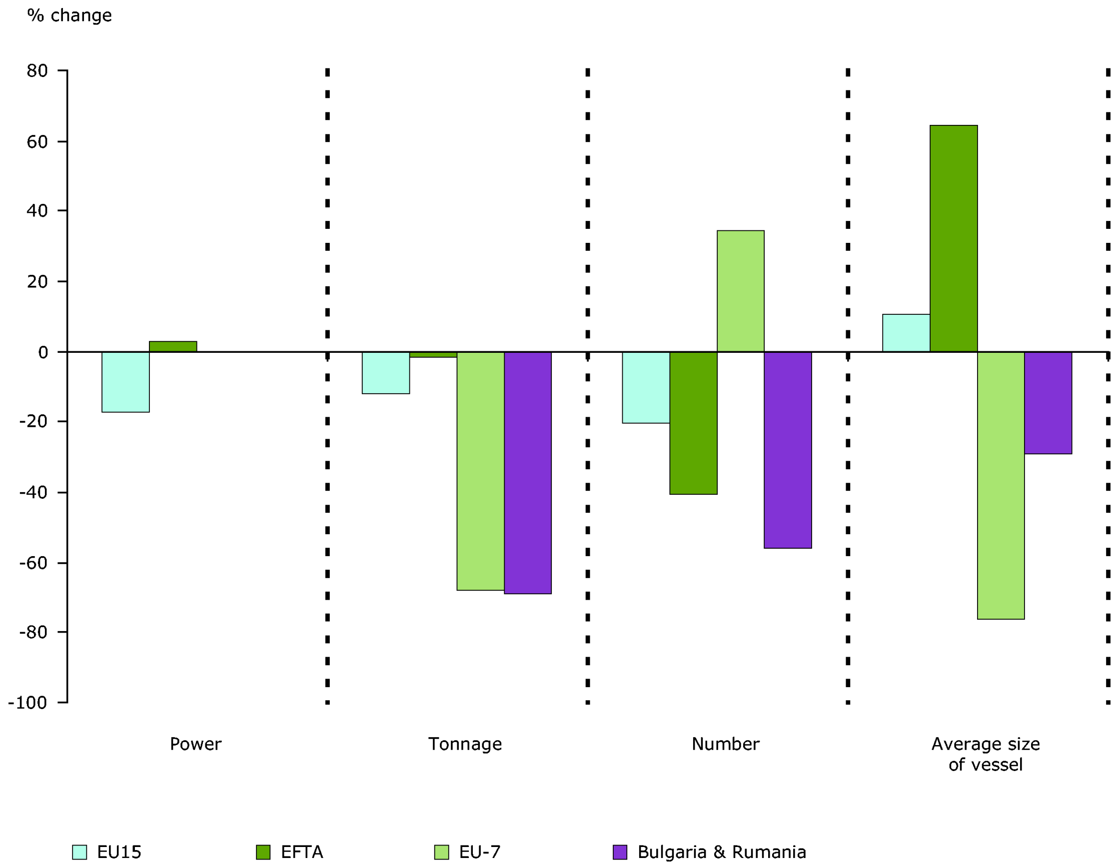


Figure 4.2: *Percentage change in power, tonnage, number and average size of fishing vessel across the EU-15, EFTA, EU-7 and Bulgaria & Romania. (Graph from the European Environment Agency website)*[9]

4.2 Precautionary reference points for management

Since 2000, ICES has continued to develop the advisory framework in the context of precautionary reference points. As outlined in the introduction, ICES has defined precautionary reference points (pa) in terms of either spawning stock biomass (B_{pa}) or fishing mortality (F_{pa}) for up to about fifty stocks fished within the OSPAR area. Most fisheries management regimes, whether autonomous, bi-lateral or multi-lateral, are based on long-term objectives set on the basis of these precautionary reference points. Quite a large number of stocks, however, remain without precautionary reference points or

[9] (Countries have been grouped into the following categories: EU-15: Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom. EFTA: Iceland and Norway. EU-7: Estonia, Cyprus, Lithuania, Latvia, Malta, Poland, and Slovenia. Bulgaria and Romania. Power, tonnage, number of vessels, and average size of vessel changes refer to 1998-2006 for EU-15 and EFTA. Tonnage and number changes for EU-7 refers to the period 1995-2006, but no data available from the years 1996-2003. Tonnage and number of vessels changes for Romania and Bulgaria refers to the period 1989-1995 (no recent data available). The period 1998-2006 for EU-15 and EFTA has been chosen in order to make comparisons between these countries groups.)

similar indices of precautionary levels, but most of them are caught in fisheries subject to the above-mentioned management regimes, where precautionary reference points are adopted for the main target stocks.

4.3 Deep-sea species

Deep-sea species are a particularly difficult issue for the reasons highlighted in Box 3.1, but both coastal States and NEAFC are willing to address the problem in all its extension. ICES has indicated that there is not sufficient scientific knowledge to establish TAC regimes for individual deep-sea stocks. Fishing effort and catch quotas on these species are subject to constant and severe reductions and a few prohibitions to fishing have been agreed. Furthermore, some restrictions set to protect deep-water habitats, as described below, are giving extra protection to these very vulnerable fish stocks.

4.4 Vulnerable habitats and marine protected areas

QSR 2000 had underlined the importance of protecting habitats from physical disturbance by fishing gear, and this is a field of work where considerable progress has been achieved although further work is still required. OSPAR has drawn the attention of fisheries management authorities to the need for protection of cold-water corals, such reefs of *Lopehlia pertusa*, from bottom fishing gear. OSPAR has also identified deep-sea sponge aggregations, coral gardens, carbonate mounds, hydrothermal vents and seamounts as priority deep sea habitats for protection from the effects of human activities in the deep seas by including these habitats on the OSPAR List of threatened and/or declining species and habitats

In the context of the EU, environmental legislation[10] requires that Member States should establish a network of protected sites with the aim either to safeguard some pre-defined habitats or to give additional protection to some threatened species. The establishment of such networks (commonly known as the Natura 2000 network) in the terrestrial zone and in the territorial waters is nearly completed, but much work is still to be done to complete the network in the EEZ's of Member States. Natura 2000 sites should have associated management programmes or measures which, in the case of marine sites, very often include fishery management measures. In the case of marine sites beyond territorial waters, these measures are in practice taken in the context of the common fisheries policy. The CFP also foresees the setting of restrictions for the protection of certain features of the seabed in the context of the ecosystem approach, and it has done so in a large area around the Azores Islands, where fishing with bottom trawls and gillnets is banned. It has also adopted a system to detect and protect vulnerable habitats in the high seas from the activity of EU vessels[11], giving unilateral response to the UN Resolution 61/105 of 2006 in areas not covered by RFMOs.

Norway initiated investigations of deep-water corals in 1997. Although the precise number of Norwegian reefs is not yet known, several hundred locations have been mapped with an estimated total spatial coverage of about 2000 km². However, scientific research as such - and mapping of coral reefs in particular - is very time-consuming and expensive. Mapping of coral reefs in the Norwegian Economic Zone is still expected to continue for many years. Pursuant to the Sea Fisheries Act and the Act related to its EEZ, Norway has concluded in 2007 a process to set an important network of protected areas in its EEZ aiming at safeguarding *Lophelia pertusa* reefs extending along the Norwegian Sea and in the Norwegian Trench of the North Sea. Norway has also taken the lead in elaborating proposals for the protection of seamounts and hydrothermal vents in the high seas. These proposals have been approved within NEAFC and provide an adequate response to UN Resolution 61/105 in the multilateral (RFMO) context. Norway has also set a procedure to avoid gear loss, whose

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[10] In particular, Directives 79/409/EEC and 92/43/EEC
[11] Regulation (EC) No 734/2008

continuity in the sea bed may produce damage to the seabed communities, and has further initiated programmes for the retrieval of lost gear.

As a result of this process, NEAFC has approved restrictions on the use of bottom gear in a number of high sea areas, including a large section of Mid-Atlantic Ridge (see figure 4.3). NEAFC has further adopted a system to map vulnerable habitats so as to avoid these areas being fished by vessels using bottom gear. NEAFC has also adopted a recommendation to ban the use of gillnets beyond 200 m of depth, with the aim of avoiding habitat damage and ghost fishing.

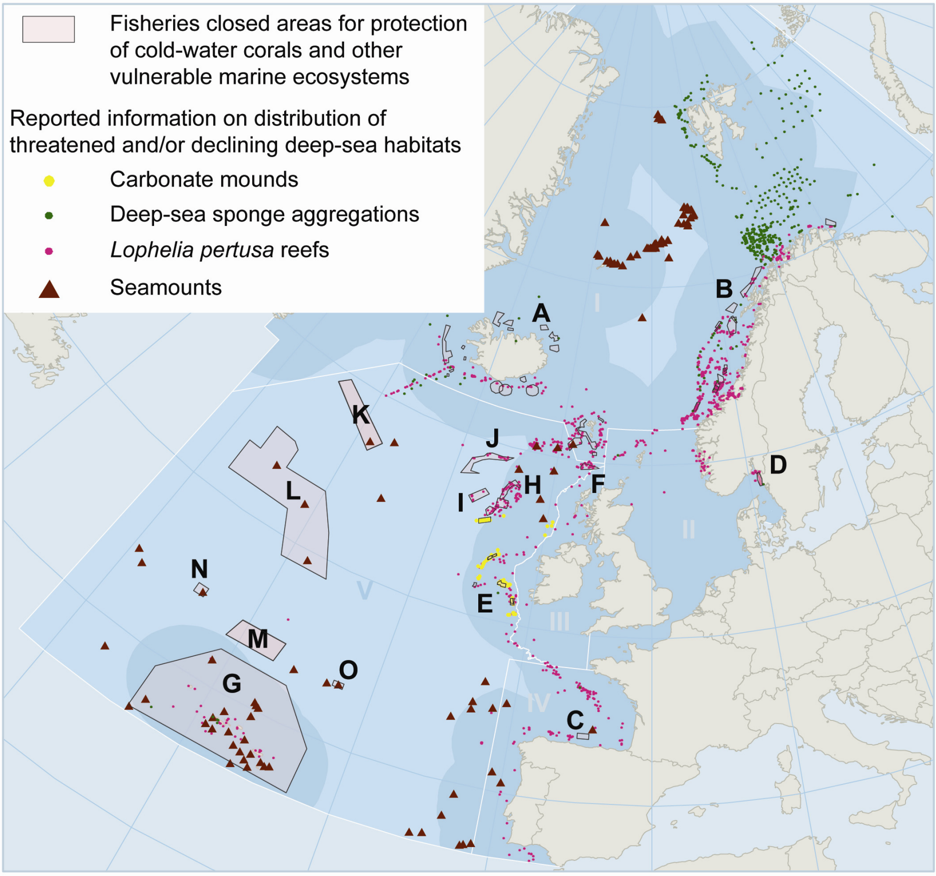

Figure 4.3. *Fisheries closures for the protection of cold-water corals and other vulnerable deep-water habitats. There has been significant progress in establishing closed areas to fisheries around known reefs, with almost 600 000 km^2 of the OSPAR area currently protected. Protected areas within Icelandic (A), Norwegian (B), Spanish (C) and Swedish (D) waters have been included in the OSPAR MPA network and some fisheries closures have been introduced in Faroese waters. Certain reefs have been jointly designated by EU Member States under the Habitats Directive and the OSPAR network, including four areas in Irish waters (E) and the Darwin Mounds (F) in UK waters. Initial restrictions on fishing gear in these areas were introduced through provisions under the Common Fisheries Policy. This approach has also been used to protect reefs around the Azores (Portugal) (G) and on North West Rockall Bank (UK) (H). One of the most significant conservation measures in the OSPAR area is the NEAFC temporary closure of an area comprising 330 000 km^2 to bottom trawling for the purpose of protecting vulnerable deep-water habitats. This includes closure of three areas to the west and south of the Rockall Bank (I), a part of the Hatton Bank (J), three large areas on the Mid-Atlantic Ridge (K,L,M) and two isolated seamounts (N,O). The map above includes known distribution of four threatened deep-sea habitats included on the OSPAR List of threatened and/or declining species and habitats based on the OSPAR habitat-mapping programme (Lophelia pertusa reefs, Carbonate mounds, deep-sea sponge aggregations and seamounts).*

4.5 Incidental catches of non-target species

The issue of catching non-target species has received attention in every management context, with particular attention to the catch of species which are sensitive in terms of conservation status or by reasons of public concern, even if the species are not threatened. Within the EU, Directives 79/409/EEC and 92/43/EEC already provide a high degree of protection to birds and marine mammals and reptiles, and specific rules under the CFP12 grant some specific protection to cetacean against incidental by-catch. However, the Directives lack clear mechanisms to transpose obligations into fisheries management measures and the Regulation has a number of technical drawbacks resulting in poor enforcement and poor efficiency in respect of protection for cetaceans.

4.6 Other issues not specifically identified by QSR 2000

In addition to advances made on issues identified by QSR 2000, it is important to note how fisheries policies have progressed in some important ancillary fields: the provision of scientific advice for management, the integration of stakeholders in the decision-making process and surveillance and control.

Scientific advice for fisheries management is provided for most fisheries in a cooperative fashion, centralised and organised by ICES. ICES has progressively adapted to provide more robust, efficient and ecosystem-based assessments. However, during 2008 significant changes to the advisory process were introduced. This culminated in the demise of the three Advisory Committees (marine fisheries, marine environment and ecosystems) and the creation of a single Advisory Committee (ACOM) which is the sole competent body for ICES for scientific advice in support of the management of coastal and ocean resources and ecosystems. The aim was to produce more effective and integrative advice and strengthen the quality through peer review. Client commissions (e.g. OSPAR, HELCOM) meet once a year with ICES and evaluate the advisory processes. The data that feeds into the ICES work is collected from various sources by national scientists in accordance with a number of specifications and sampling procedures. Data collection is an expensive business that requires coordination and, very often, public funding. The EU has, since 2000, established a framework[13], for data collection which includes financial means and protocols to guarantee data quality. The new regulatory framework includes the collection of data needed to build up indicators in the context of an ecosystem approach to fisheries management.

Since the CFP reform of 2002, stakeholders are better integrated in the decision process in the context of EU fisheries through the creation of regional advisory committees (RACs) which involve the whole range of interested parties with a particular emphasis on the fishing industry. There are five RACs involved in fisheries across the OSPAR Maritime Area: North Sea RAC, North Western Waters RAC, South Western Waters RAC, Pelagic RAC and Long Distance Fisheries RAC.

Surveillance and control have been in constant evolution since 2000, and it is important to note a few fundamental changes introduced since then. In the EU, the vessel monitoring system (VMS) extended its application, more power was given to Community inspectors, and new control schemes entered into force, such as joint deployment programmes. The Community Fisheries Control Agency (CFCA) was created in 2005 in order to organise operational coordination of fisheries control and inspection activities by the Member States. A regulation was issued to combat illegal, unregulated and unreported (IUU) fishing[14] and a proposal to revamp and strengthen the Community control policy was issued in 2008.

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[12] Regulation (EC) No 812/2004
[13] Regulation (EC) No 1543/2000, renovated in 2008 (Regulation (EC) No 199/2008 and subsequent i mplementing legislation)
[14] Regulation (EC) No 1005/2008

The EU has also agreements to cooperate on control issues with Norway and the Faroe Islands; of particular interest is the agreement on the weighting of pelagic fish, which has improved substantially the control of landings of mackerel and other species.

Monitoring, Surveillance and Control (MSC) agencies in the Norwegian, Icelandic, Faroese and Greenlandic EEZs are generally deemed to be in a position to control fisheries efficiently. In addition, the Russian Federation has recently increased the resources of their agencies.

In the multi-lateral context, the NEAFC Scheme of Control and Enforcement and the NEAFC VMS database enables Fisheries Monitoring Centres to plan inspections at sea efficiently. The NEAFC blacklists and port state control system have proved to be efficient tools in combating IUU fishing. These recommendations are designed to lead to improved Port State Control and increased compliance by non-Contracting Parties and include special documentary procedures, IUU vessel lists and the possibility of patrol vessels from NEAFC contracting parties inspecting all vessels fishing in the NEAFC area. Increased multi-lateral cooperation to fight IUU by implementing the NEAFC Port State Control measures resulted in illegal fishing of cod in the Barents Sea being reduced from an estimated volume in excess of 100,000 tonnes in 2005 to less than 15,000 tonnes in 2008.

ICCAT has also similar provisions to combat IUU fishing and strengthen control, especially of bluefin tuna catches. A catch documentation programme for bluefin tuna has been established and cooperation between ICCAT Contracting parties has been improved by exchange of information on VMS and other control issues.

5. Did it work, is it working, changes in pressure since 1998

A number of management initiatives described in the early sections of the fishery report have sought to reduce the fishing effort applied in a number of the OSPAR Regions. This section explores effort trend information, spatial data and a synthesis of stock assessment output material to ask two key questions. These are:

a. did the management measure work? (i.e. was there a reduction in effort?); and

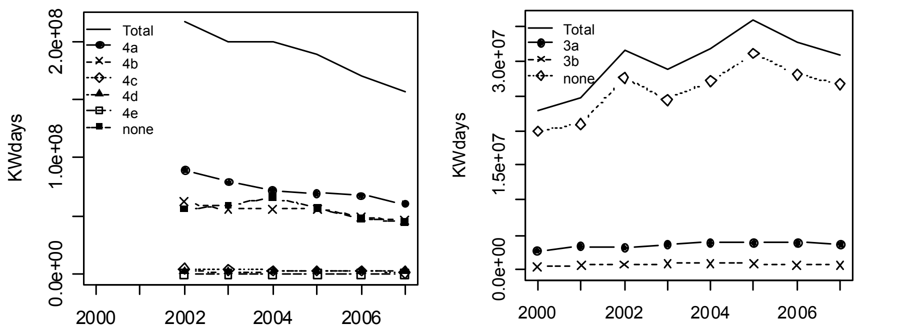
b. what was the impact on stocks?

Comprehensive summaries of effort information have been compiled for European Union Countries by STECF (Scientific, Technical and Economic Committee for Fisheries) (STECF, 2008). These data have been collated for areas that cover the distributions of key cod stocks that have been one of the main drivers for effort management in recent years. Although the summaries are based on ICES areas, it is possible to use some of these to give a broad indication of recent effort trends approximately aligned to some of the OSPAR Regions.

5.1 Have reductions in fishing effort been achieved?

Figures 5.1 - 5.2 show recent trends in effort (kWdays) in OSPAR Regions II-IV. In the North Sea part of OSPAR Region II, decreases in effort by trawl gears and beam trawls have resulted in an overall decline in effort (Figure 5.1A). In the western channel component, however, there has been an increase in effort recently, largely driven by non-regulated gears or gears for which details were not available (Figure 5.1B).

A. OSPAR Region II – North Sea B. OSPAR Region II – Western Channel



a = otter trawls; b= beam trawls; c= gill net: d= trammel net; e =longline;
none = non-regulated gear or unspecified gear.

Figure 5.1: *Trends in effort (kWdays) for the principal regulated gears in use in OSPAR Region II (wider North Sea including Western Channel).*

Trends in the various areas making up the wider Celtic Seas, (OSPAR Region III) vary. Declines in effort can be seen in the Irish Sea (Figure 5.2B) and particularly the West of Scotland (Figure 5.2A). Celtic Sea effort has, however, remained high with no obvious trend over the time period (Figure 5.2C).

Recent trends along the Iberian coast (part of OSPAR Region IV) are difficult to interpret but overall appear to have risen (Figure 5.2D).

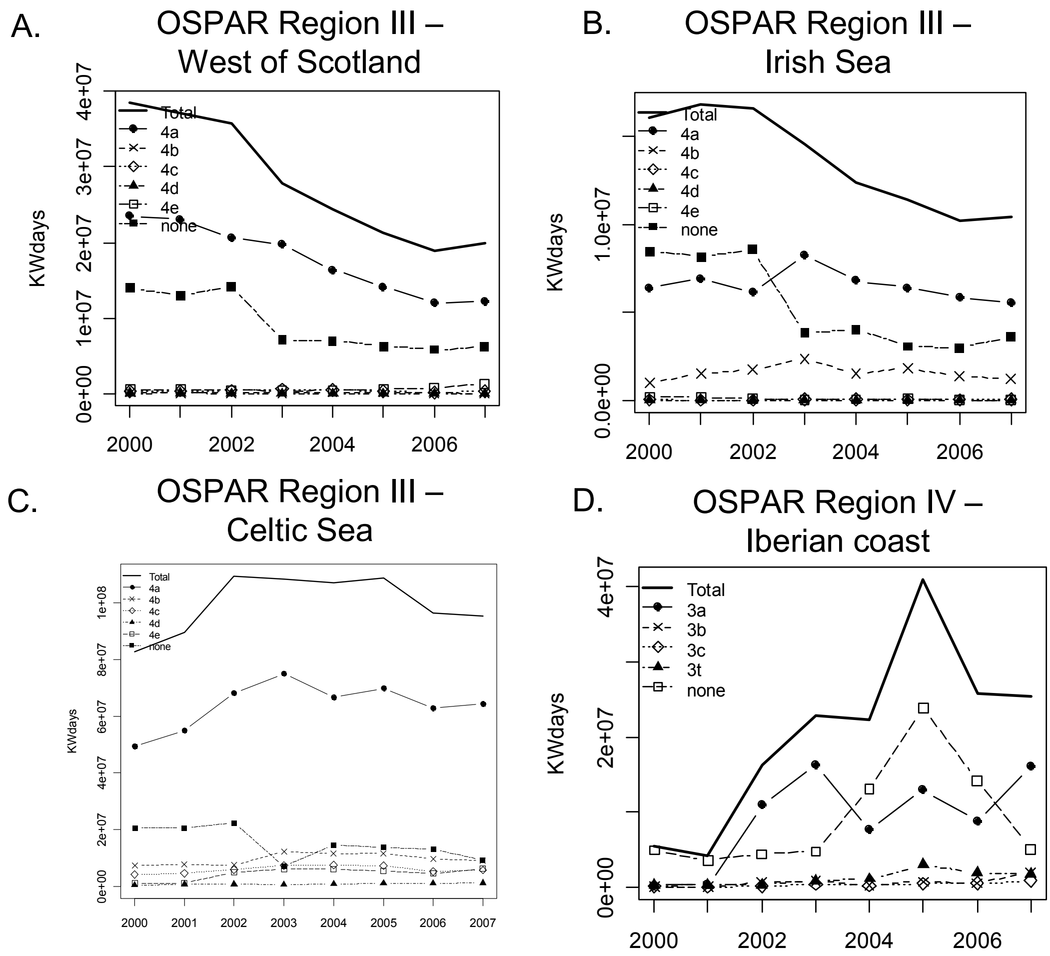


***Figure 5.2**: Trends in effort (kWdays) for the principal regulated gears in use in OSPAR Region III (Celtic Sea Areas including West of Scotland, Irish Sea and Celtic Sea) and OSPAR Region IV (Bay of Biscay and Iberian Coast). a = otter trawls; b= beam trawls; c= gill net: d= trammel net; e =longline; none = non-regulated gear or unspecified gear.*

Spatial information on fishing activity in some of the OSPAR Regions is available in different forms. For OSPAR Region I information compiled by the Norwegian authorities provides a partial picture of activity in the region for 2008 (Figure 5.3). The data are screened to provide fishing activity (vessel monitoring system (VMS) signals with speed 1-5 knots) for vessels above 24 meters (EU vessels above 15 meters) in an area limited by N 82 W 045 and N 62 and E 050. Note that it is only in the Norwegian Economic Zone and the zone around Jan Mayen that VMS tracking of both Norwegian and foreign vessels is available. In the Svalbard-zone, VMS from foreign vessels is incomplete. Outside the economic zone/Jan Mayen/Svalbard only Norwegian vessel VMS is available.

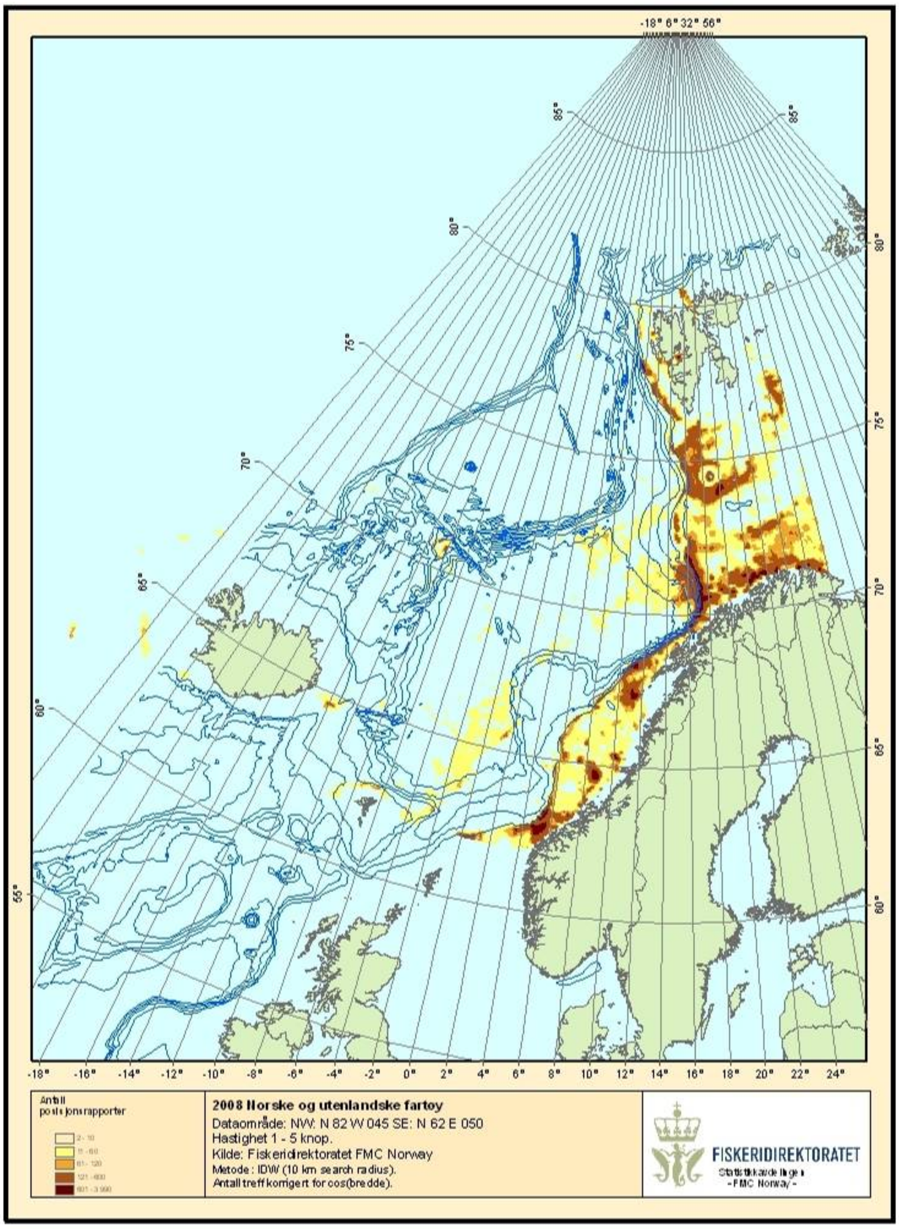


Figure 5.3: *Distribution of fishing activity from VMS data in OSPAR Region I for 2008. Limitations are indicated in the text.*

The spatial distribution of towed gear effort (hours fishing for years 2003 - 2007) is also available from the STECF analysis (Figures 5.4 – 5.8). Again this relates to areas which are not identical to the OSPAR boundaries but are close enough to provide a helpful insight.

In OSPAR Region II (Figures 5.4 and 5.5), trawl effort is mainly distributed in the northern part of the North Sea and is also intense at the western end of the Channel. In contrast, beam trawl activity is mainly located in the southern North Sea and Channel. Taken together these observations indicate that the western channel is subject to considerable towed gear activity from a variety of sources.

In OSPAR Region III (Figures 5.6 and 5.7) the trawl activity is distributed throughout the area but is relatively more intense in the southern parts and has declined off Scotland. Beam trawling is almost absent from West of Scotland but is more evident in the south, particularly the Celtic Sea.

Figure 5.8 shows the Iberian coast and here the trawl effort is fairly widespread.

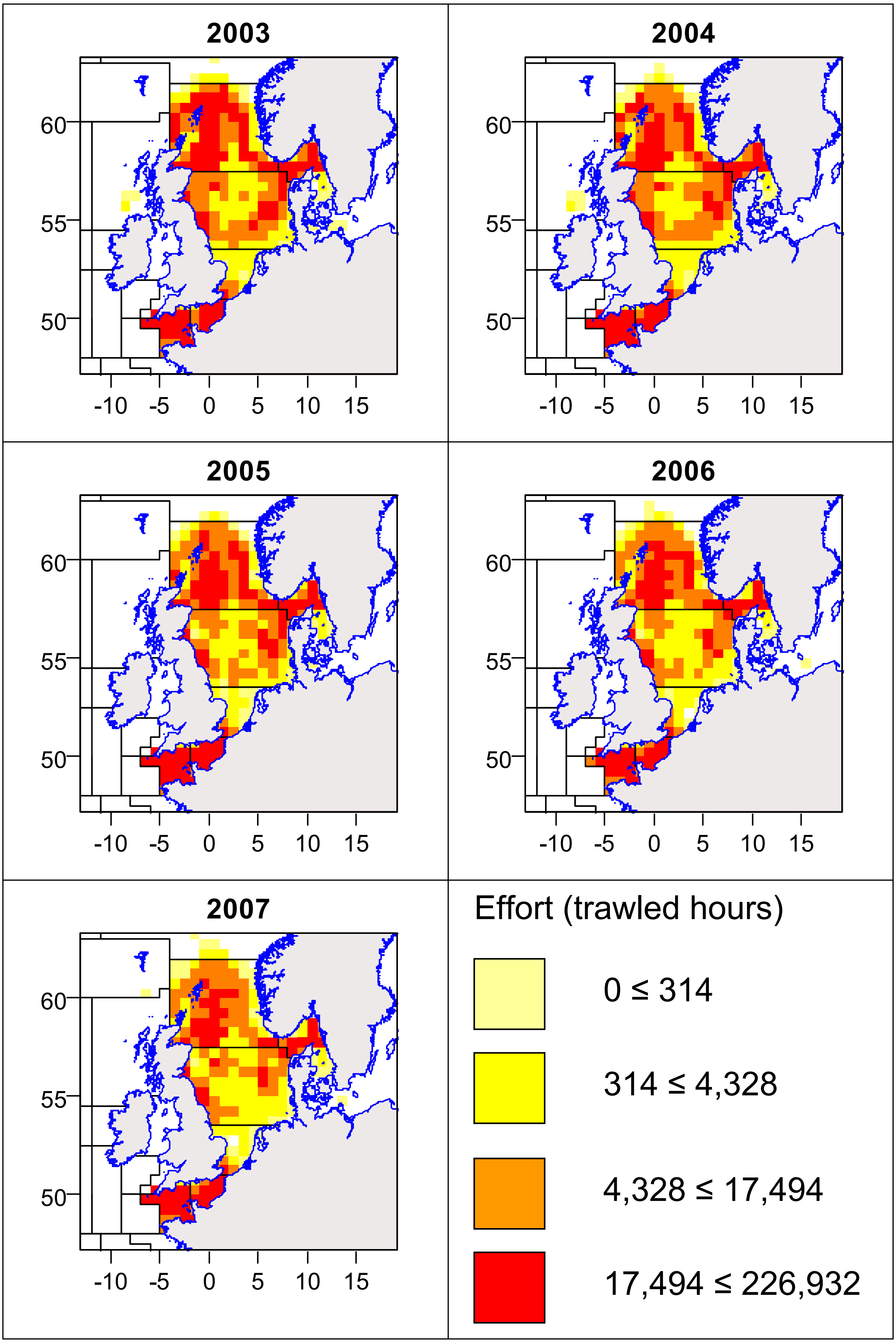


Figure 5.4: *OSPAR Region II - Distribution of aggregate trawl effort for EU vessels covering the period 2003 – 2007.*

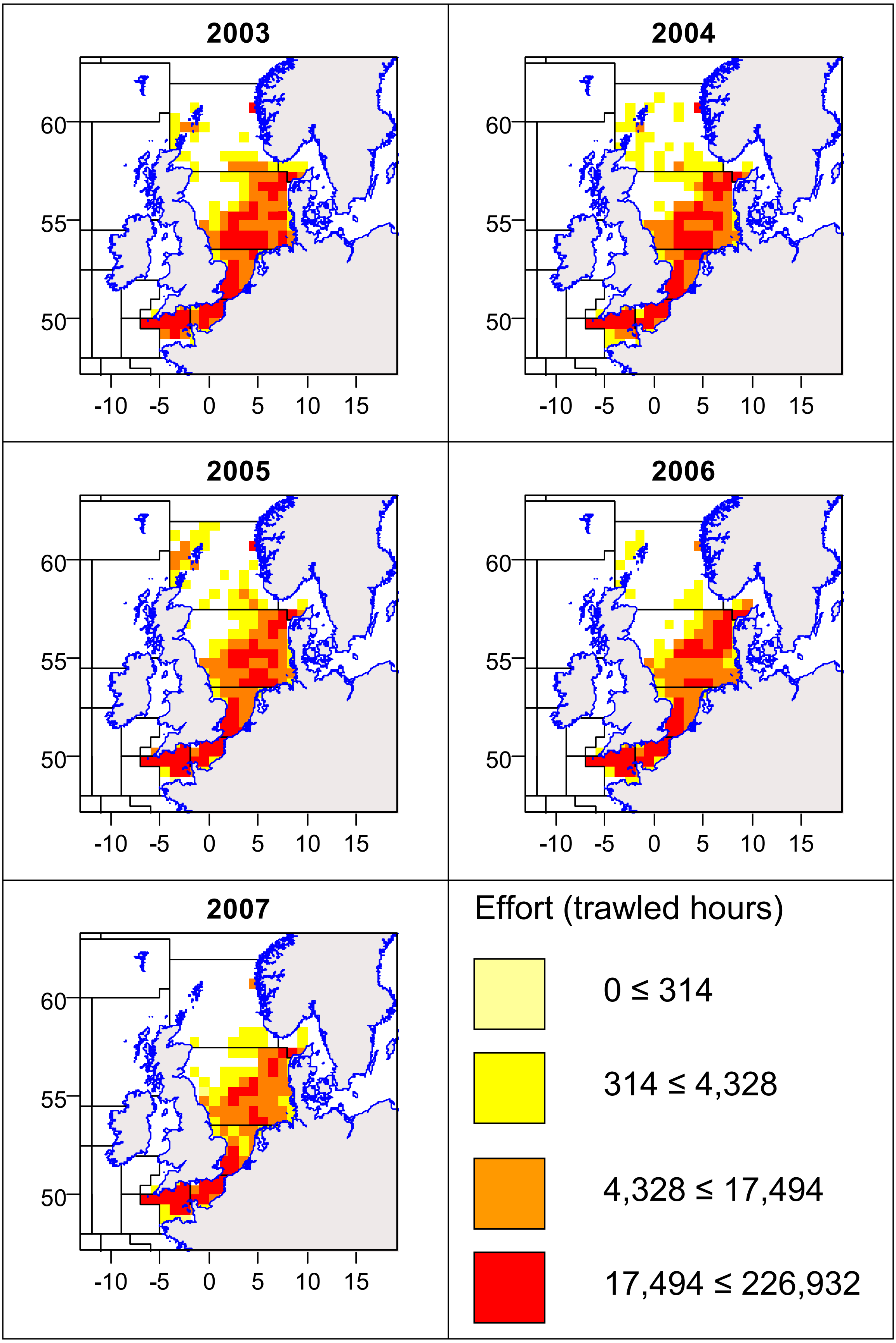


Figure 5.5: *OSPAR Region II - Distribution of aggregate* <u>*beam*</u> *trawl effort for EU vessels over the period 2003 – 2007.*

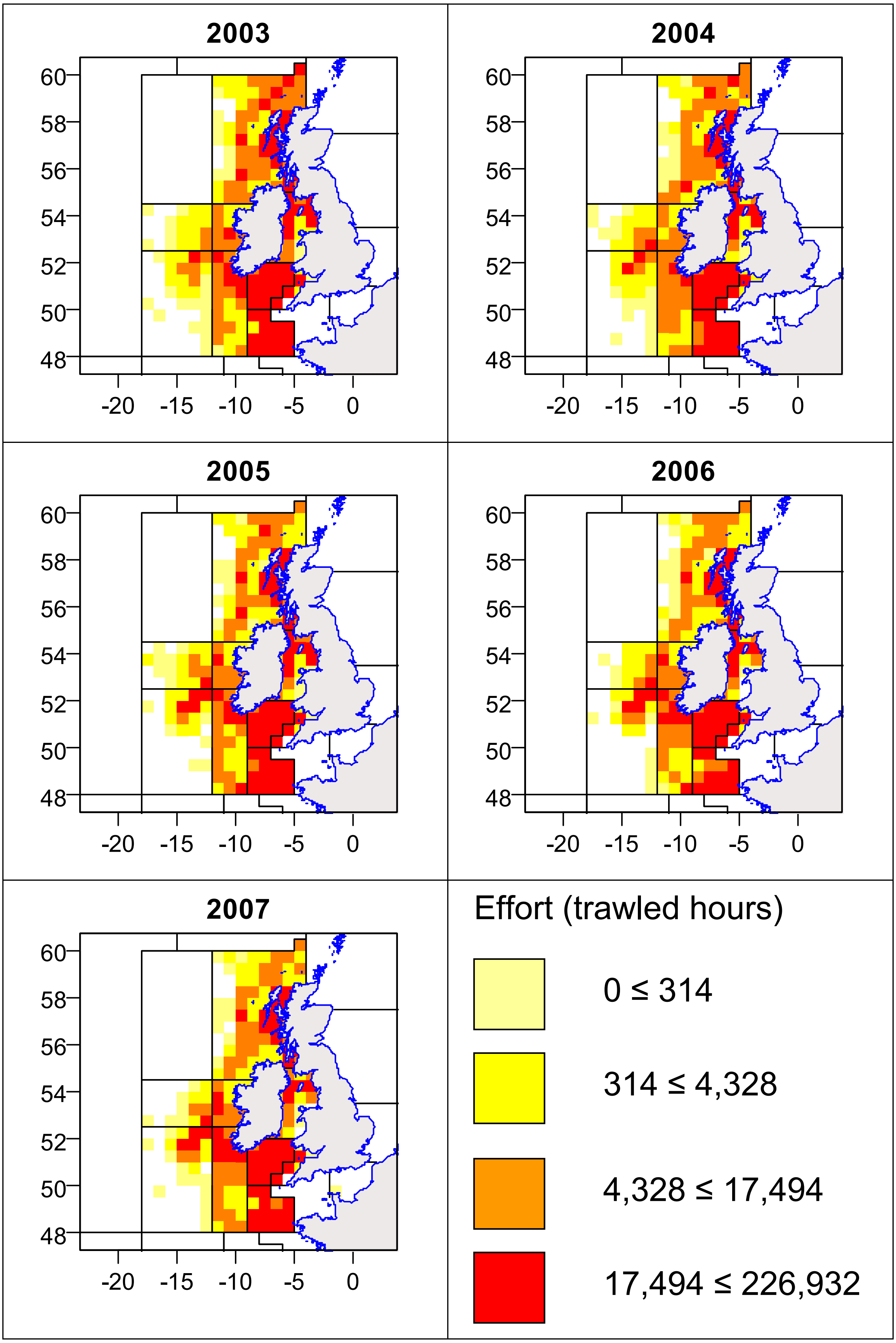


Figure 5.6: *OSPAR Region III - Distribution of aggregate trawl effort for EU vessels covering the period 2003 – 2007.*

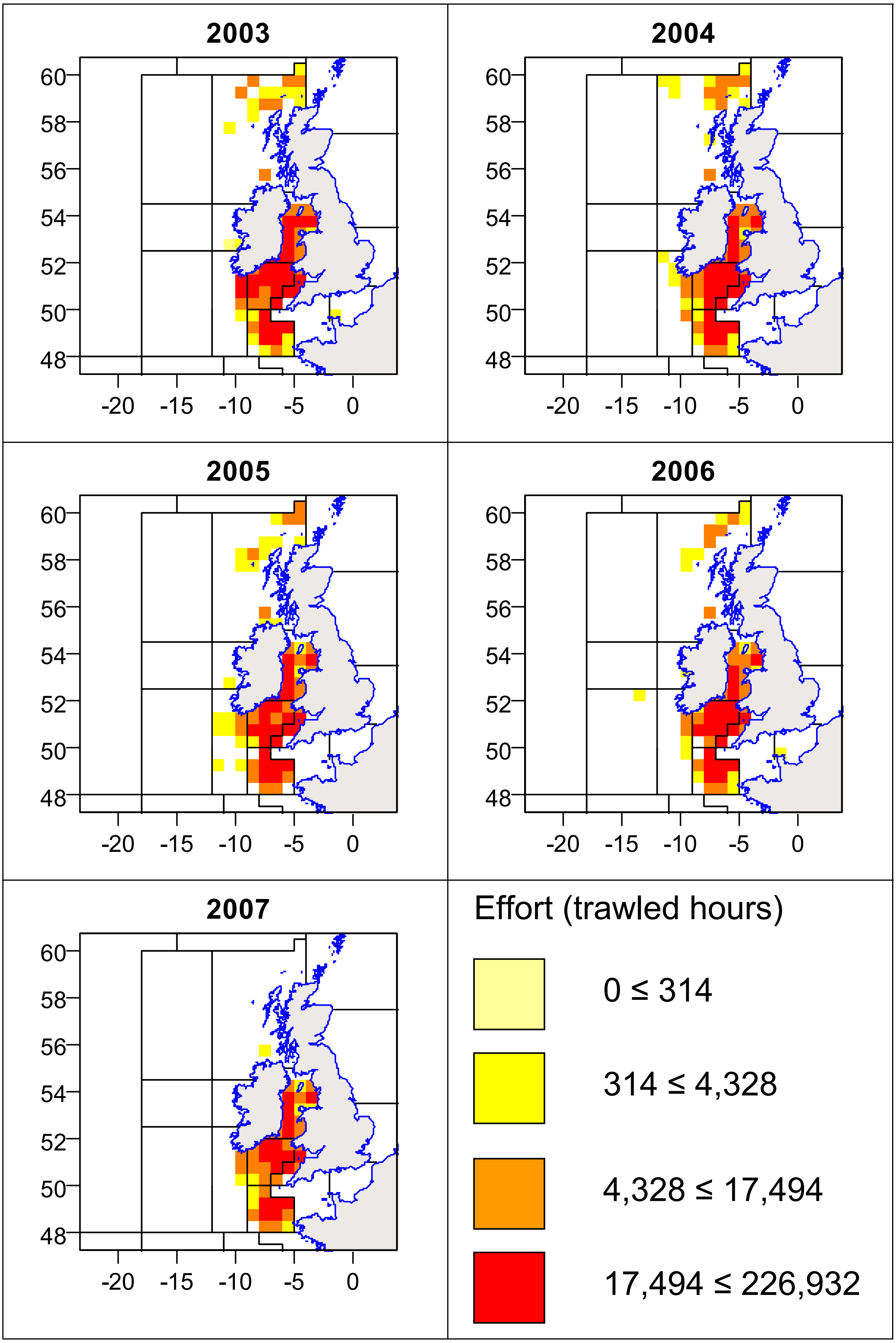


***Figure 5.7:** OSPAR Region III - Distribution of aggregate beam trawl effort EU vessels covering the period 2003 – 2007.*

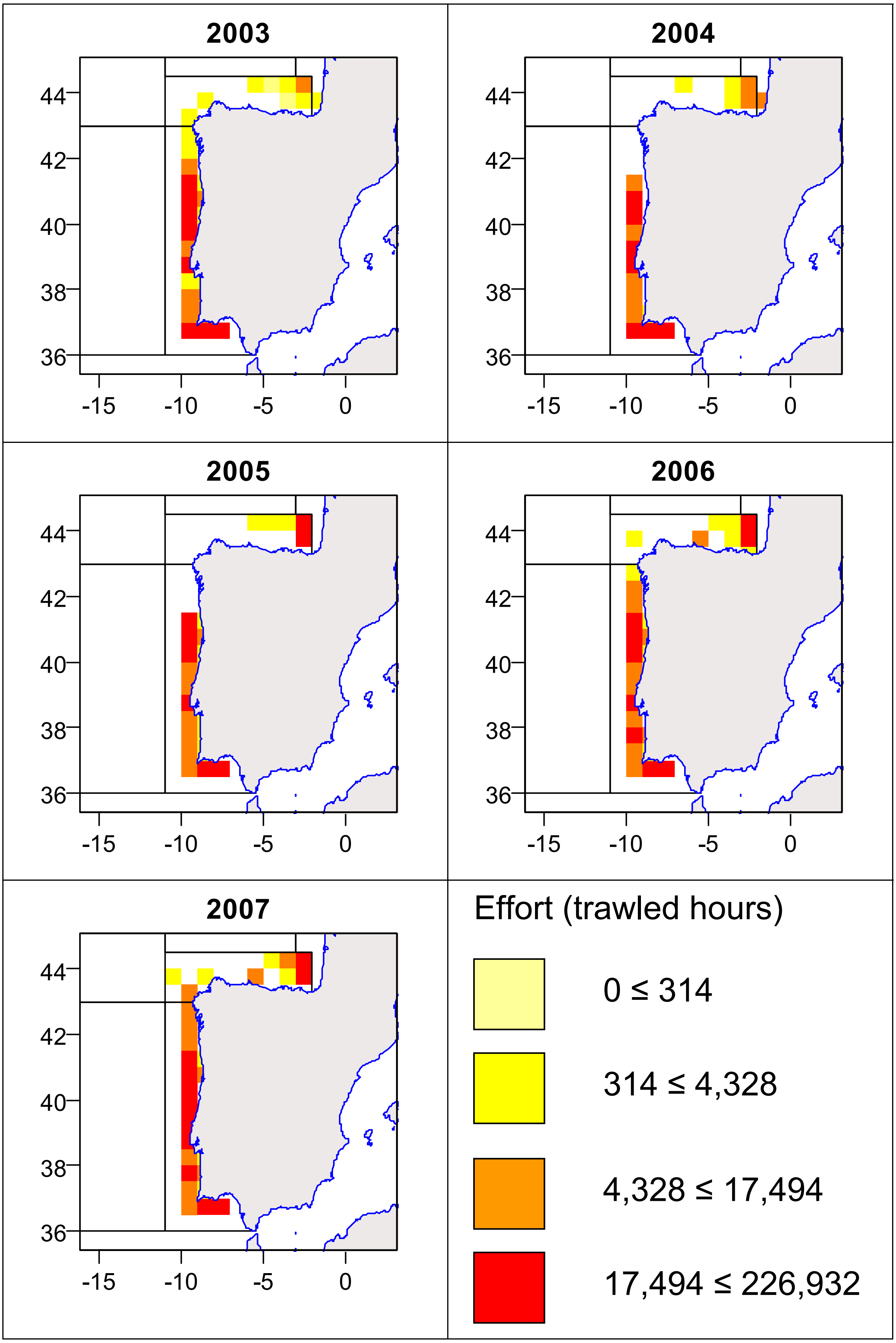


Figure 5.8: *OSPAR Region IV - Distribution of aggregate trawl effort for EU vessels covering the period 2003 – 2007.*

5.2 What impact has there been on fish stocks?

A number of holistic indicators have been developed in an attempt to monitor progress towards more sustainable fisheries in the North east Atlantic. One of these was outlined in the European Union's Eurostat 2005, in its issue "Measuring Progress towards a more sustainable Europe", subheaded "Sustainable development indicators for the European Union". This indicator describes the quantity of fish caught that was taken from stocks grouped according to whether they were within or outside safe biological limits at the end of the year and expressed in percentage terms. Values have been calculated for various species groupings in areas defined according to the NEAFC regions. For the purposes of QSR 2010, the short time series available for this indicator is considered insufficient and results are not presented here. In addition, the perception of good or bad status can be heavily influenced by the presence of catches from species with large stock biomasses (such as mackerel) which may mask finer detail from a range of other species characterised by smaller biomass.

Analysis here has focussed on the direct use of ICES assessment output without any weighting according to the scale of the fisheries concerned. Overall, recent management measures to reduce fishing effort appear to have led to downward trends in overall fishing effort in a number of the OSPAR Regions described above. Examination of the out-turn stock assessments for fish species exploited in these areas provides a way of judging the impact of these changes on fishing mortality rate (F) and stock sizes (measured as spawning stock biomass – SSB).

In its 2008 advice, ICES provided an overall summary of the state of stocks for those with available precautionary approach reference points. Figure 5.9 shows trends over time in the proportion of stocks falling into each of 4 categories relating to F_{lim} and B_{lim}[15]. The results for the lower right panel suggest a slow increase in the proportion present in the preferable category where $F<F_{lim}$ and $B>B_{lim}$.

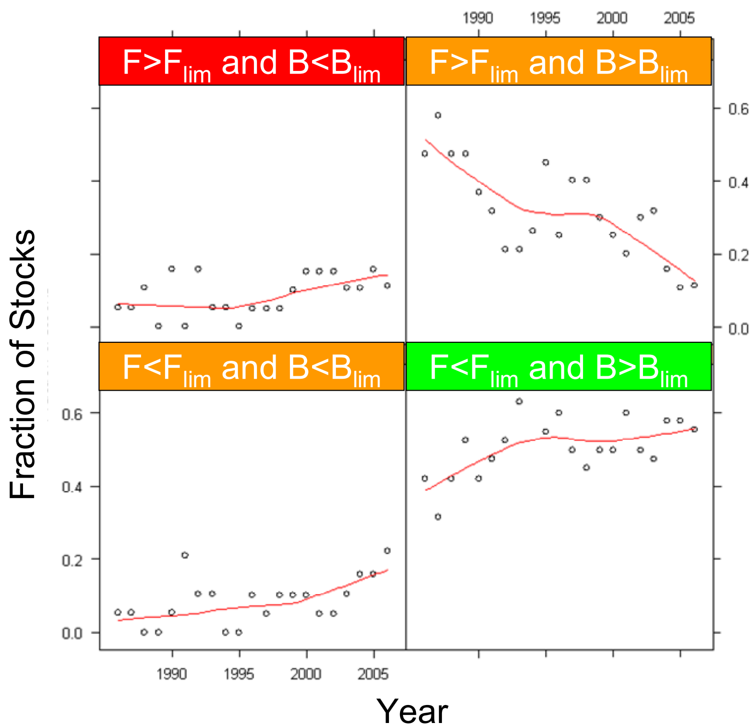


Figure 5.9: *Development of the status of those assessed stocks where limit reference points were provided for both fishing mortality and spawning-stock biomass from 1986–2006. The estimates from the last two data years have to be treated with caution as these are more uncertain than the rest, due to the convergence feature of fish stock assessment models. Loess smoother (span=0.75 see, e.g.*

[15] ICES has defined what can be termed 'limit' reference points relating to both SSB (B_{lim}) and fishing mortality (F_{lim}).

www.r-project.org) has been used. The preferred category is $F<F_{lim}$ and $B>B_{lim}$ (bottom right panel). There are relatively few stocks where both F and SSB are available, especially in Regions III, IV and V.

This analysis, of course, groups together two indicators, F and SSB. The former is potentially manageable through measures applied to fishing activity. The second is controlled to a large extent by environmental drivers. The analysis also depends on reference points being available and there are quite a number of stocks for which this is not the case.

Developments in status of ICES assessed stocks (1988-2007)

Two additional types of analysis are included here which examine the trends in F and SSB separately. In the first of these, the output F and SSB metrics for all stocks covered by ICES in the OSPAR Region for which there was an agreed assessment in 2008 (Table 5.1) have been divided into two time periods. These periods broadly cover the QSR 2000 and QSR 2010 data gathering periods (1988-1997 and 1998 – 2007 respectively). Spearman Rank correlation has then been applied to these data sets to test whether there were significant (at p = 0.05 level) positive or negative correlations indicating an increase or decrease in the two time periods. Simple bar graphs are then used to indicate the number of stocks in each period falling into each of three categories; increase, decrease or no trend. By comparing the left and right plots, a signal of general improvement in fishing mortality rates is interpreted as a larger number of stocks falling into the decrease in F category (upper 2 panels in each case) and broadly speaking a larger number of stocks falling into the increase in SSB category (lower 2 panels in each case).

Table 5.1: *List of stocks, by OSPAR Region, for which there was an agreed assessment in 2008 and which have been used in the assessment of status based on fishing mortality and spawning stock biomass. The data is presented in Figures 5.10 – 5.16.*

OSPAR Region	Stock		OSPAR Region	Stock	
	Species	**Location**		**Species**	**Location**
I	Cod	Arctic	II	Sole	West Channel
I	Cod	Iceland	II	Whiting	IV
I	Haddock	Arctic	III	Blue whiting	Widely distributed western and northern waters
I	Haddock	Iceland	III	Cod	Celtic Sea
I	Atlanto-Scandian herring	Widely distributed northern waters	III	Cod	VI
I	Herring	Va	III	Haddock	Rockall
I	Saithe	Arctic	III	Haddock	VI
I	Saithe	Iceland	III	Hake	Widely distributed western and northern waters
II	Cod	IV	III	Herring	VI
II	Haddock	IV	III	Horse mackerel	Widely distributed western and northern waters
II	Herring	IIIa22	III	Mackerel	Widely distributed northern, western and southern waters
II	Herring	IV	III	Plaice	Celtic Sea
II	Norway pout	IV	III	Plaice	Irish Sea
II	Plaice	IV	III	Sole	Celtic Sea
II	Saithe	IV and VI	III	Sole	Irish Sea
II	Sandeel	North Sea	IV	Horse mackerel	Southern waters, Iberia
II	Sole	East Channel	IV	Sardine	VIII
II	Sole	IV	IV	Sole	Biscay
II	Sole	Skagerrak			

Figure 5.10 shows the results for the 37 stocks in the OSPAR region as a whole for which suitable assessment data were available. Results show that for fishing mortality rate, F, the majority (27 out of 37) of stocks in the first time period exhibited no obvious trend whereas in the more recent period (1997 – 2008), there has been a noticeable increase in the number of stocks with a significant negative correlation. This could imply that fishery management measures applied have been having an impact on reducing F.

The three stocks in the earlier period which showed an increasing F, Atlanto-Scandian herring in Region I and mackerel and horse mackerel in Region III, all showed an improvement in the second period with the horse mackerel and Atlanto-Scandian herring both showing a decreasing F in the second period.

The situation with the five cod stocks studied (Table 5.1) improved in the second period with all the cod stocks across the OSPAR maritime area showing a decreasing F over the period 1998 – 2007. In the previous period only Icelandic cod showed a degreasing F.

Across the OSPAR Maritime Area there has been a shift in SSB towards more stocks with 'improved' increasing biomass but this is less pronounced than the observed changes in F and suggests that the fisheries management measures have had less impact on this metric (Figure 5.10C and D).

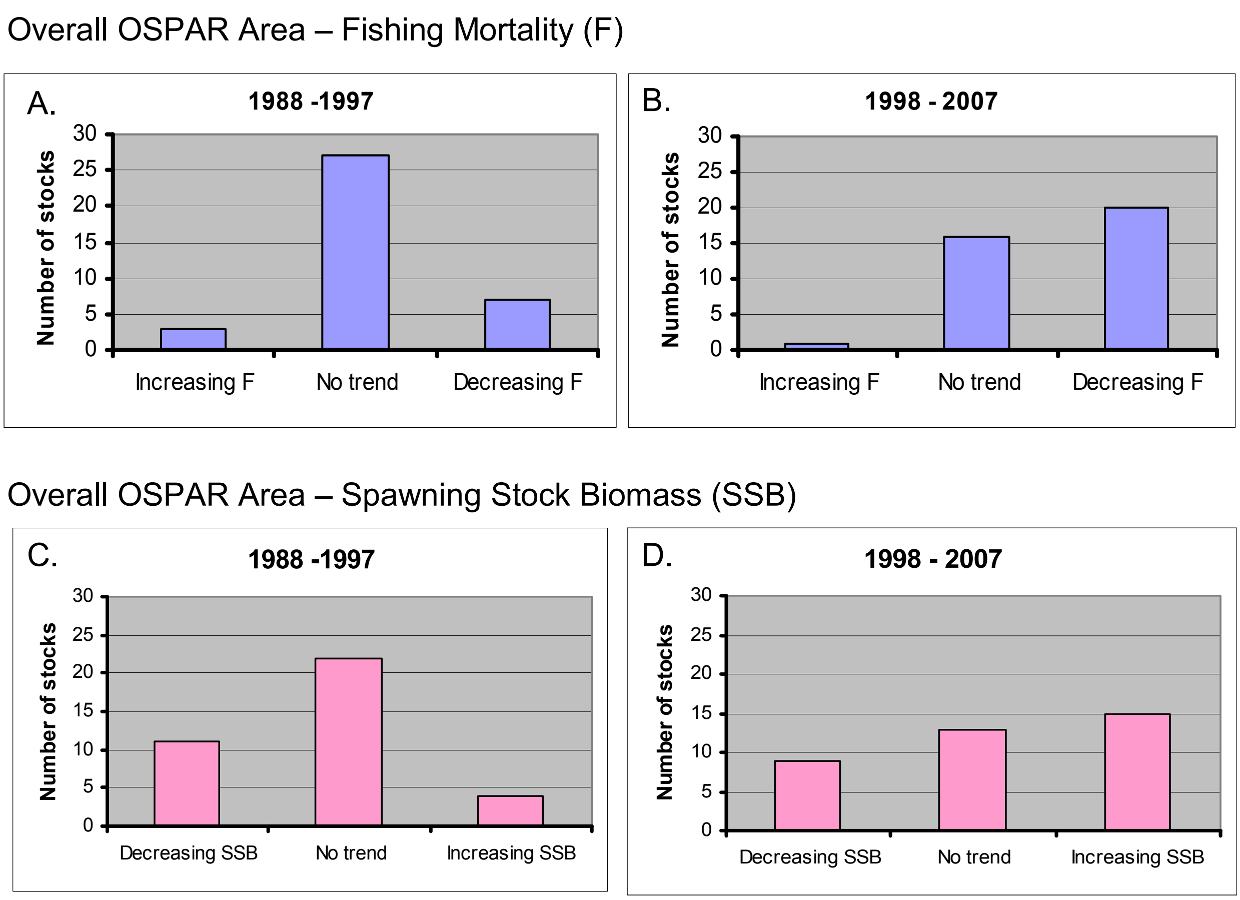
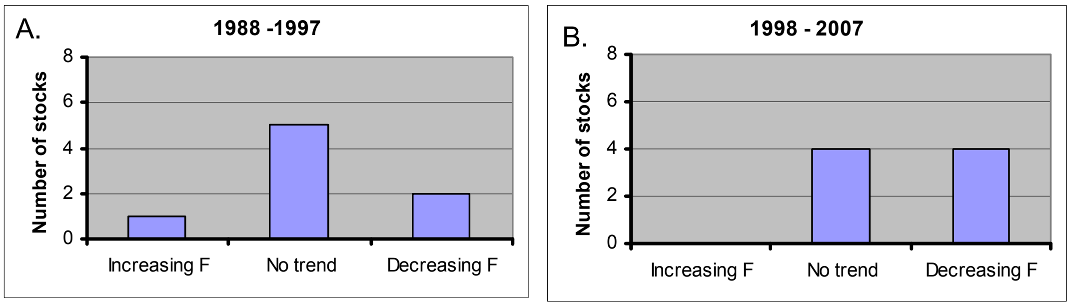


Figure 5.10: *Number of stocks with significant increasing or decreasing trends in fishing mortality (F) and spawning stock biomass (SSB) for the OSPAR Maritime Area over two time periods, 1988 – 1997 and 1998 - 2007. The data assess 37 stocks across the OSPAR Maritime Area. These time periods correspond approximately with the data collection for QSR 2000 and QSR 2010 respectively. Spearman rank correlation applied to data obtained from ICES assessments 2008.*

The overall trend for the OSPAR Maritime Area is generally replicated in each of Regions I – IV with more stocks showing reducing F in the recent time period. In Region I, for which 8 stocks were analysed covering cod, haddock, Atlanto-Scandian herring, herring and saithe (Table 5.1), no stock showed an increasing F in the period 1998 – 2007 while in the earlier period Atlanto-Scandian herring had shown an increasing F (Figures 5.11A and B). At the same time four of the eight stocks, Arctic cod, Icelandic cod, Atlanto-Scandian herring and herring from ICES area Va, showed a decreasing F.

Thirteen stocks in Region II were investigated covering cod, haddock, herring, Norway pout, plaice, saithe, sandeel, sole and whiting. Sole from the Western Channel showed an increasing F in the more recent period (1998 – 2007). However 5 stocks (cod, Norway pout, plaice, saithe and sole from area V) showed a decreasing F in the period 1998 – 2007 relative to only 3 stocks in the period 1988 – 1997 (Figure 5.12A and B). For both periods, the dominant category was the 'no trend' in F.

OSPAR Region I – Fishing Mortality (F)



OSPAR Region I – Spawning Stock Biomass (SSB)

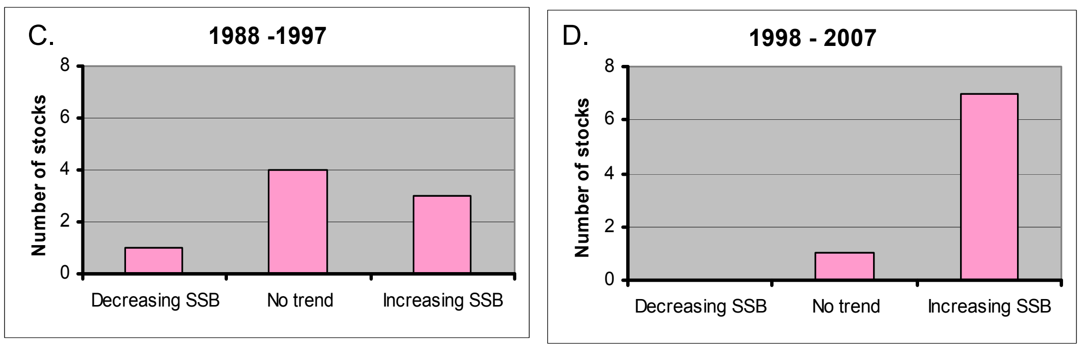
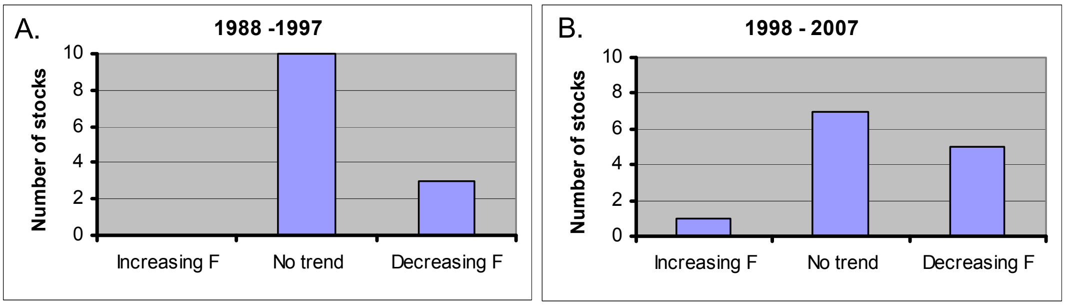


Figure 5.11: *OSPAR Region I. Number of stocks, from a total of 8 stocks within Region I, with significant increasing or decreasing trends in F and SSB over periods 1988 – 1997 and 1998 - 2007. Spearman rank correlation applied to data obtained from ICES assessments 2008.*

OSPAR Region II – Fishing Mortality (F)



OSPAR Region II – Spawning Stock Biomass (SSB)

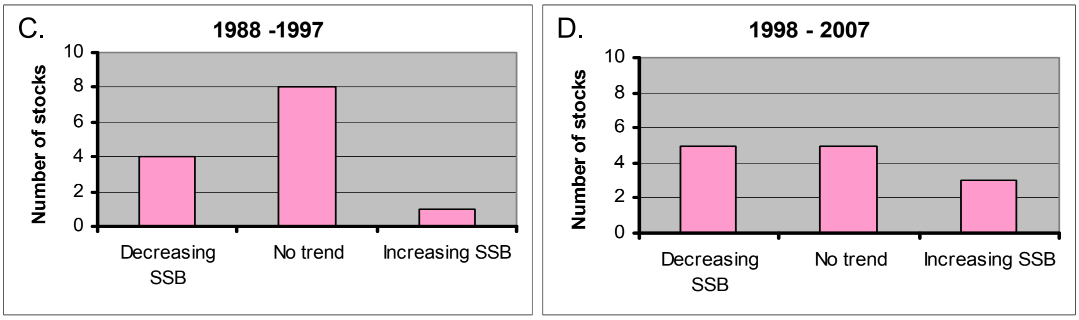
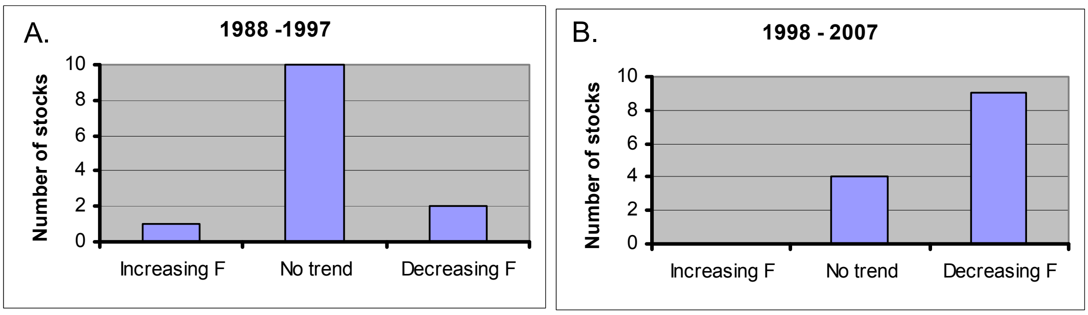


Figure 5.12: *OSPAR Region II. Number of stocks, from a total of 13 stocks within Region II, with significant increasing or decreasing trends in F and SSB over the time periods 1988 – 1997 and 1998 – 2007. Spearman rank correlation applied to data obtained from ICES assessments 2008.*

OSPAR Region III – Fishing Mortality (F)



OSPAR Region III – Spawning Stock Biomass (SSB)

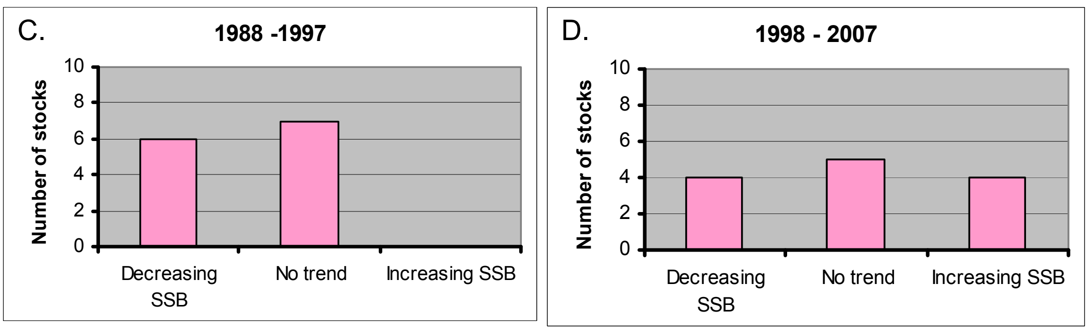


Figure 5.13: *OSPAR Region III. Number of stocks, from a total of 13 assessed stocks in Region III, with significant increasing or decreasing trends in F and SSB over the time periods 1988 – 1997 and 1998 - 2007. Spearman rank correlation applied to data obtained from ICES assessments 2008.*

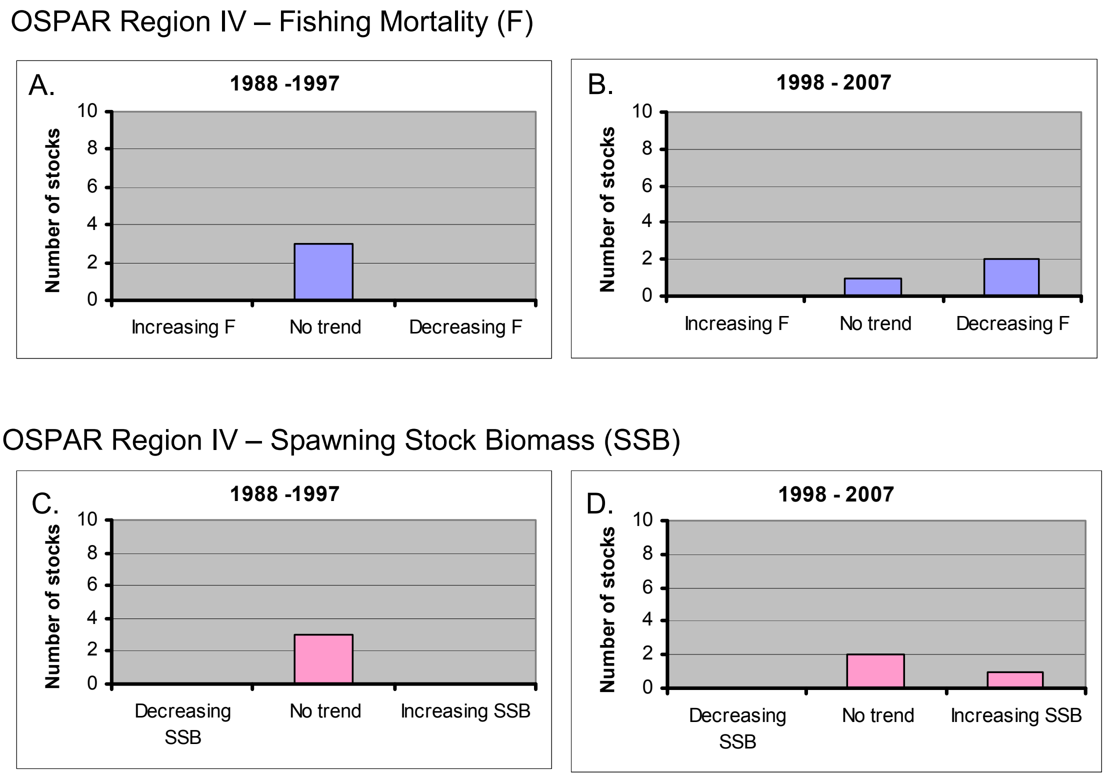


Figure 5.14: *OSPAR Region IV. Number of stocks, from a total of 3 assessed stocks, with significant increasing or decreasing trends in F and SSB over the time periods 1988 – 1997 and 1998 - 2007. Spearman rank correlation applied to data obtained from ICES assessments 2008.*

Region III, for which again 13 stocks were included in the analysis (Table 5.1), gave a more favourable picture for the period 1998 – 2007 than for 1988 – 1997 (Figure 5.13A and B) for fishing mortality. None of the stocks showed an increasing F. The two stocks which had shown an increasing F in the earlier period (horse mackerel and mackerel) showed either no trend over the period 1998 – 2007 (mackerel) or a decreasing F (horse mackerel). None of the stocks in Region III showed a deterioration in their 'status' going from the earlier to more recent period. Indeed, the majority of stocks showed a decreasing F for the period 1998 – 2007 (Figure 5.13).

Only three stocks were assessed from Region IV (Table 5.1). The general improvement in status between the two periods is evident with both sardine and sole showing a reducing F in the period 1998 – 2007 (Figure 5.14A and B).

The Regional analysis of SSB provides a more variable picture. In OSPAR Region I, there has been a more substantial rise in the number of stocks with increasing SSB in the recent period (Figure 5.11C and D). Elsewhere the picture is more like that of the overall OSPAR Maritime Area. Within Region II although there was an increased number of stocks showing an increasing SSB in the more recent period, there was also an increased number showing a reduced SSB in the second period relative to the first period (Figure 5.12C and D). Only sole in area IV and whiting in area V did not change status with the whiting showing a decreasing SSB in both periods and sole showing no trend in both periods.

For Region III, none of the analysed stocks showed an increasing SSB in the first period (Figure 5.13C). However, in the period 1998 – 2007, 4 stocks showed an increasing SSB including blue whiting, hake, horse mackerel and Irish Sea plaice (Figure 5.13D).

Overall this analysis tends towards showing an improved situation in the period 1998 – 2007 relative to the period 1988 – 1997 (Figure 5.15).

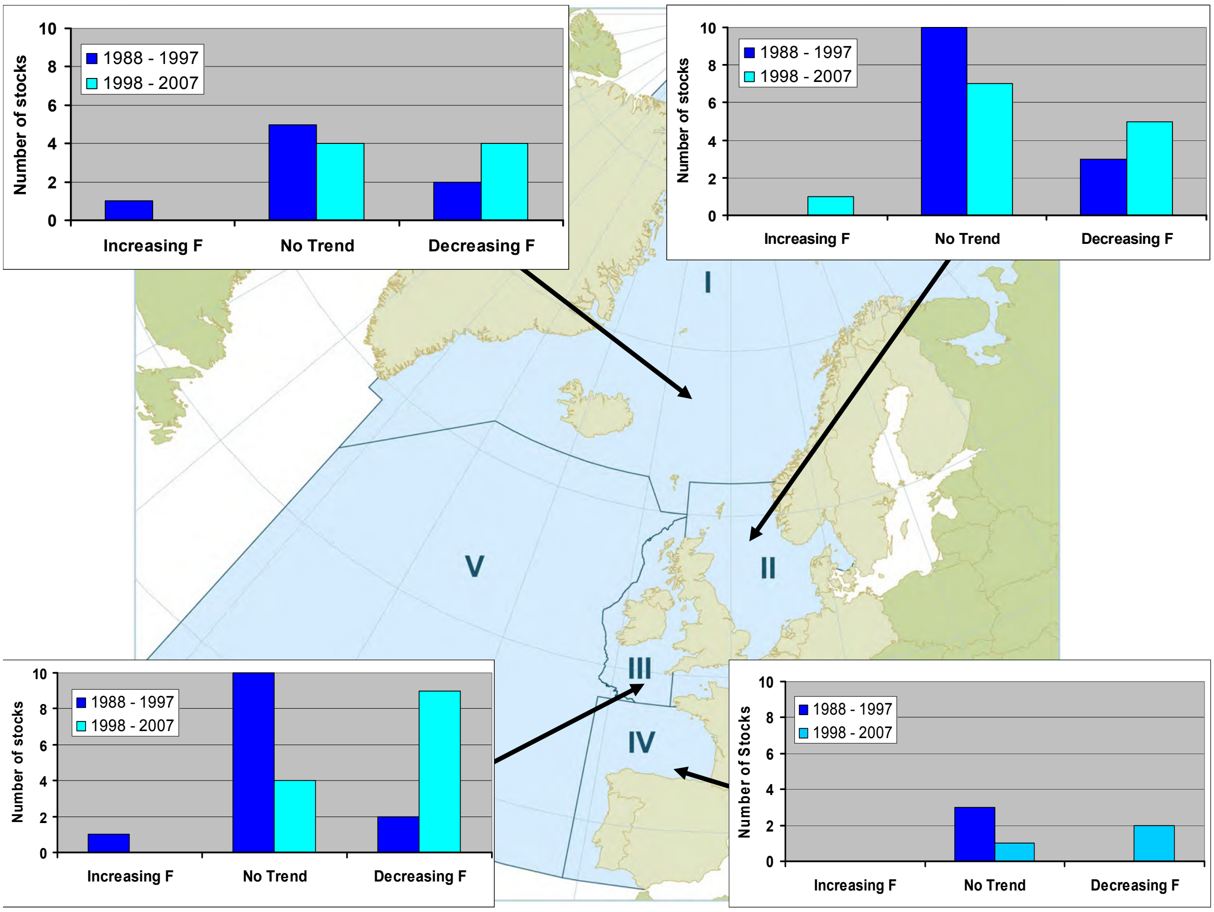


Figure 5.15: *Summary of the comparison of changes in fishing mortality (F) for the periods 1988 – 1997 and 1998 – 2007 for OSPAR Regions 1 – 1V. This particular analysis is consistent with an improving situation across the OSPAR Maritime Region as a whole. OSPAR countries are highlighted in tan on the map. The Roman numerals represent the OSPAR Regions.*

The second analysis addressed the question 'is there a difference in state between the last QSR (QSR 2000) and the present one (QSR 2010). The approach involved fitting smoothers through each of the available time series of F and SSB (using a LOWESS approach implemented in r – Rob Fryer pers comm.) and then testing for a significant difference between the fitted value at the end of the recent QSR data period (2007) and the end of the previous QSR data period (1997). Results are shown in Figure 5.16 for the fishing mortality time series and Figure 5.17 for the spawning stock biomass time series. The results are presented for the overall OSPAR Maritime Area and by OSPAR Region. Results tend to confirm those of the first approach suggesting reasonable progress in reducing fishing mortality (a low proportion of stocks with increasing F and over 50% in several areas showing decreasing F). Progress on spawning stock biomass is not so obvious (higher proportion of stocks with decreasing biomass and, apart from in OSPAR Region I, a lower proportion with increasing biomass).

Presentation of the results in this way is rather different from that which compares stock state with reference points. A number of the stocks here remain outside safe biological limits according to the ICES precautionary approach. On the other hand, this analysis helps to show the direction of travel in key stock parameters and, particularly in the case of fishing mortality, suggests that recent efforts in fisheries management are having the desired effect of pushing exploitation rates downwards. The slower response of SSB to these measures is perhaps indicative of the environmental influence and possibly other factors.

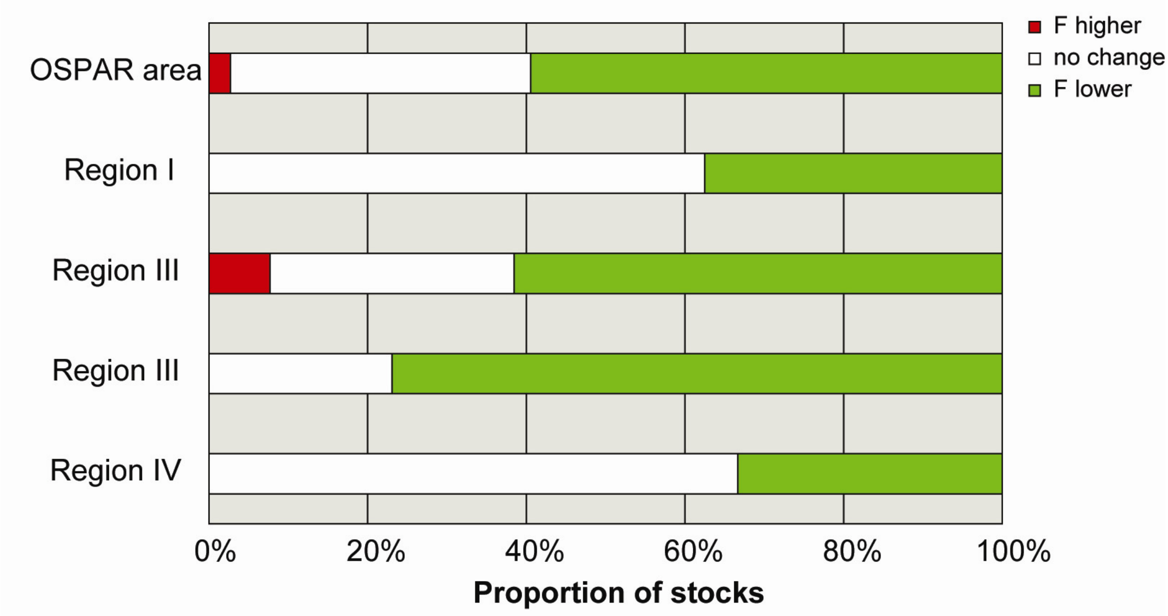


Figure 5.16: *Proportion of stocks where fishing mortality (F) is significantly different in 2007 compared with 1997 (significantly higher – red; significantly lower – green) for OSPAR Regions I - IV and for the overall OSPAR Maritime Area (OSPAR). The stocks included in this analysis are detailed in Table 5.1.*

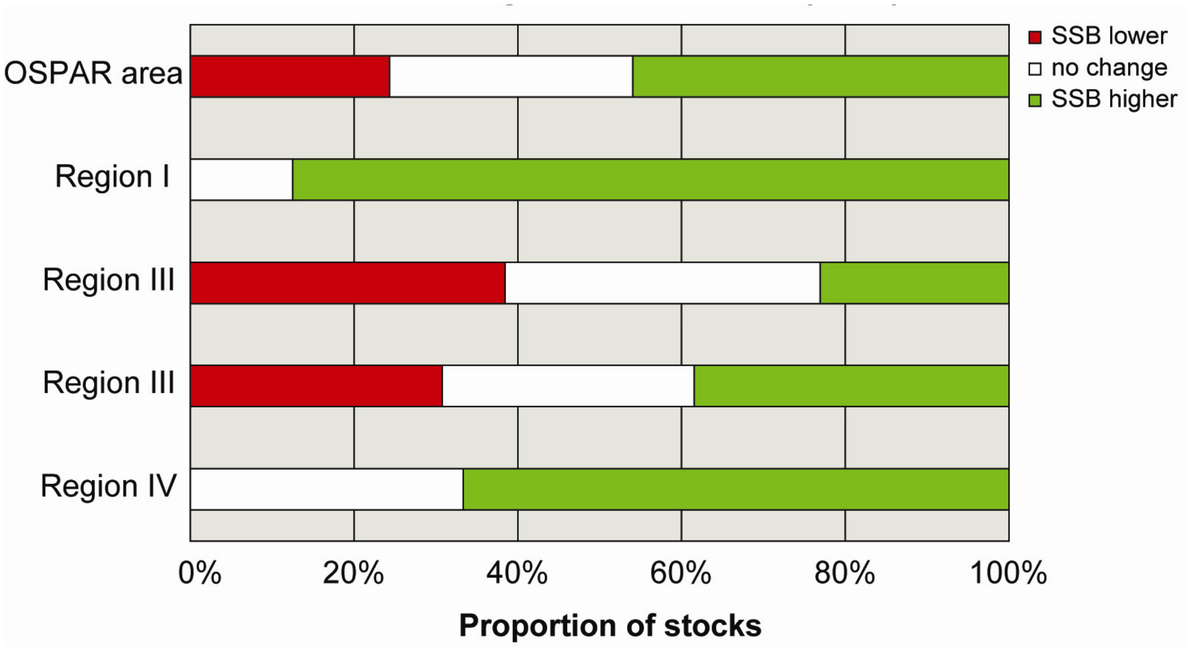


Figure 5.17: *Proportion of stocks where spawning stock biomass (SSB) is significantly different in 2007 compared with 1997 (significantly higher – green; significantly lower – red) for OSPAR Regions I - IV and for the overall OSPAR Maritime Area (OSPAR). The stocks included in this analysis are presented in Table 5.1.*

The number of stocks that were included in this assessment was 37 with there only being 3 stocks from Region IV. However larger numbers of stocks were assessed for Regions 1 (8 stocks), Region II (13 stocks) and Region III (13 stocks). ICES provide advice on a considerably larger number of stocks and, indeed, there are more than 37 stocks exploited across the North-East Atlantic. Figure 3.2 summarised the ICES scientific advice provided over the period 2003 – 2009 for between 87 and 89 stocks. This is presented on the basis of whether or not stocks are within safe biological limits. However, approximately 60% of stocks were designated as being of unknown state. This lack of knowledge will be further highlighted when discussing the state of stocks compared to maximum sustainable yield (MSY).

Landings in the OSPAR area (1997-2008)

In the section entitled 'Fishing in the OSPAR Convention Area' information was presented which showed changes in capture production of fish, crustaceans, molluscs etc from FAO Fishing Area 27 from 1998 until 2007. Information was also presented by OSPAR Contracting Party. However, there is merit, when assessing the effectiveness of measures, in examining landings data in more detail. To this end, landings data for demersal, pelagic and shellfish stocks have been assembled for each OSPAR Region over the period 1998 - 2008.

In terms of total landings for the OSPAR Maritime Area, this was 9.53 million tonnes in 1998, based on the data from the ICES Statlant database (http://www.ices.dk/fish/statlant.htm). By 2008, this had decreased to 7.33 million tonnes (Figure 5.18). Between 1998 and 2002, there was, in fact, an increase in total catch to a maximum of 9.95 million tonnes. However, post 2002, there has been a progressive and sustained decrease in landings.

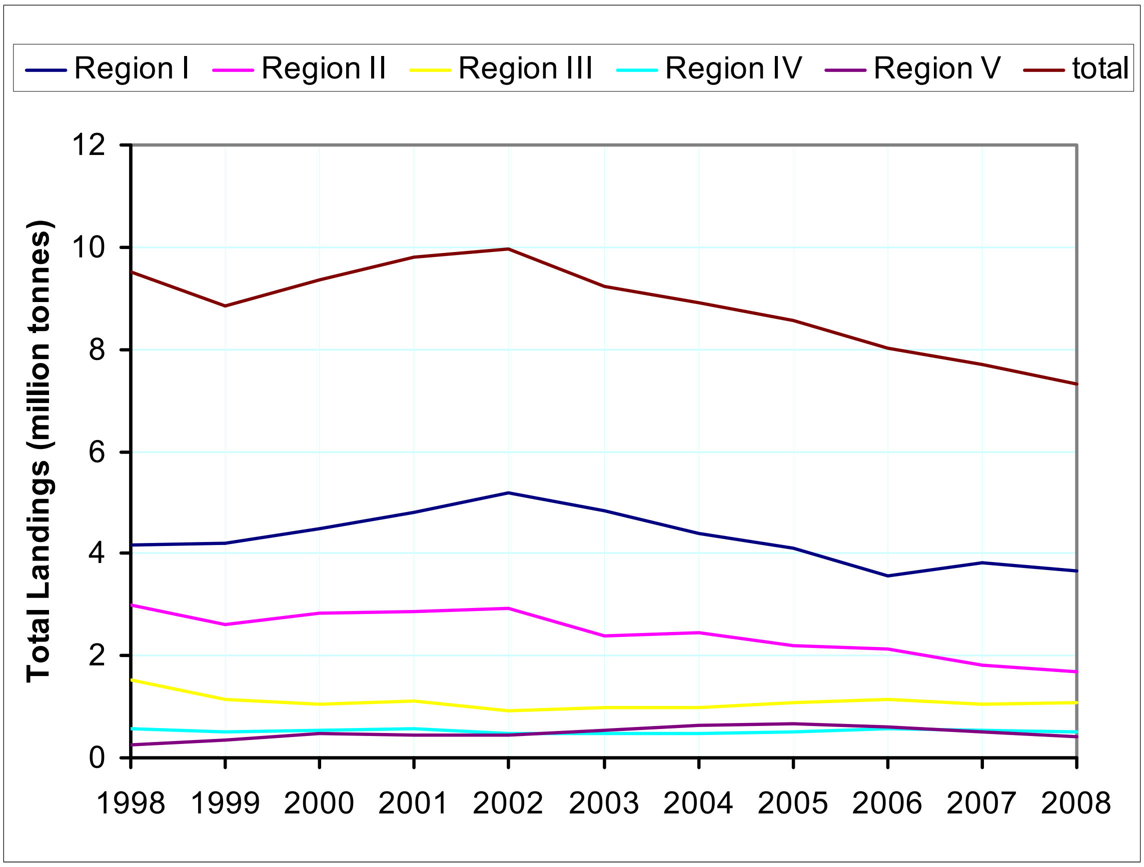


Figure 5.18: Total landings (million tonnes) for pelagic species, demersal species and shellfish for the OSPAR Maritime Area over the period 1998 to 2008 inclusive. Over this time period there was a net reduction in landings such that by 2008 7.33 million tonnes were landed which is 74% of the maximum landings (data for 2002) and 77% of the landings in 1998. *Data from the ICES Statlant database (http://www.ices.dk/fish/statlant.htm).*

Pelagic species comprise the largest proportion, averaging 62.7% of the landings with demersal fish comprising an average of 31.1% (Figure 5.19), the remainder (average of 6.1%) being shellfish.

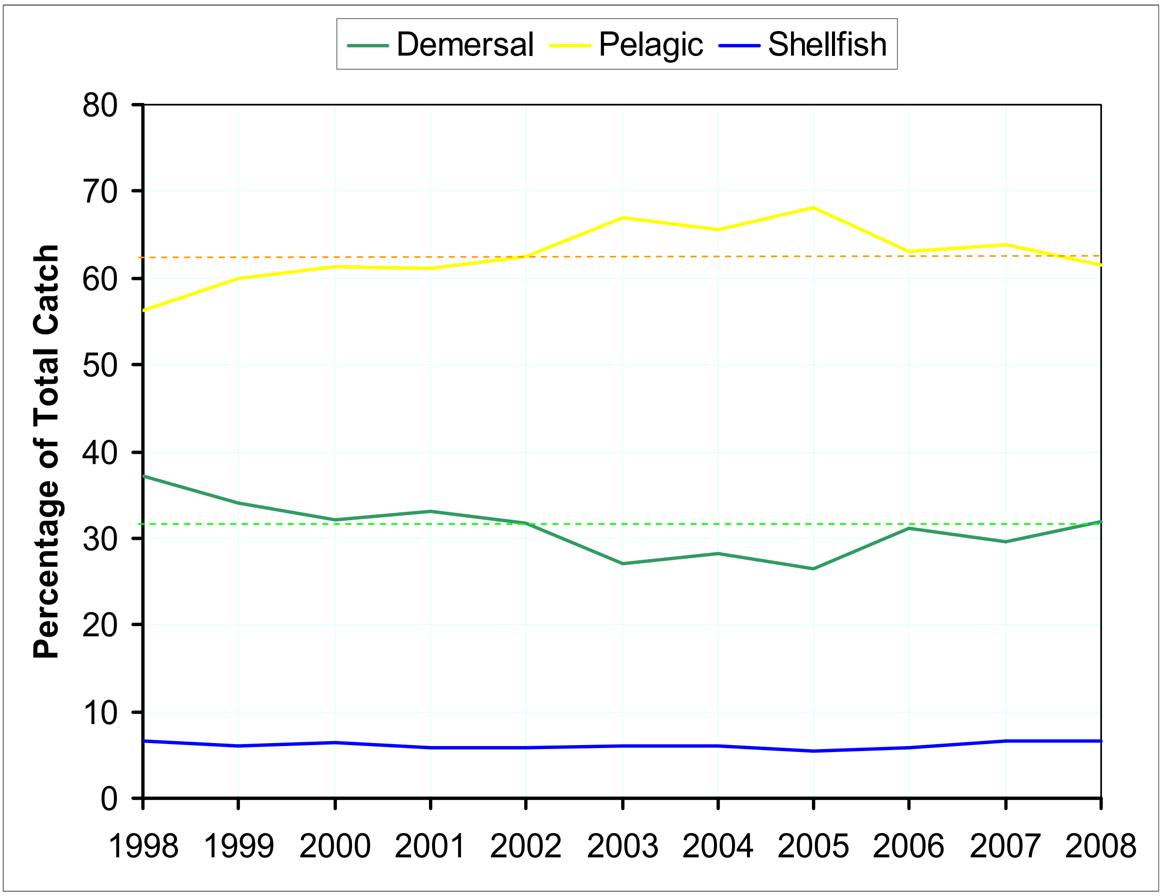


Figure 5.19: Percentage of total catch that is demersal, pelagic or shellfish for the OSPAR Maritime Area over the period 1998 to 2008 inclusive. The dashed lines represent the average percentage for pelagic (---------) and demersal (----------) species.

Between 1998 and 2008 there was a slight increase in the proportion of pelagic species landed with an associated decrease in the percentage of demersal fish landed. There was no net change in the proportion of shellfish landed over the period 1998 to 2008,

Throughout the reporting period, the greatest tonnage was consistently landed in Region I (Figure 5.18). This was followed by Region II and then Region III. Approximately the same tonnage of fish and shellfish was landed in Regions IV and V (Figure 5.18).

Across the 5 OSPAR Regions there was considerable variability in terms of both temporal variations and the relative difference between pelagic landings and demersal landings. In all but Region V, there was net decrease in landings between 1998 and 2008. However, for Region V, landings in 2008 were 1.6 times greater than in 1998. In intervening years landings in Region V generally increased to a maximum of 0.68 million tonnes in 2006 after which landings decreased to the 0.41 million tonnes recorded in 2008. The observed increase was primarily due to the changes in pelagic landings. However, in more recent years both demersal and pelagic landings showed a decrease (Figure 5.20E).

Pelagic landings generally dominated in all regions. However, between 2003 and 2007 demersal landings dominated in Region II (Figure 5.20B).

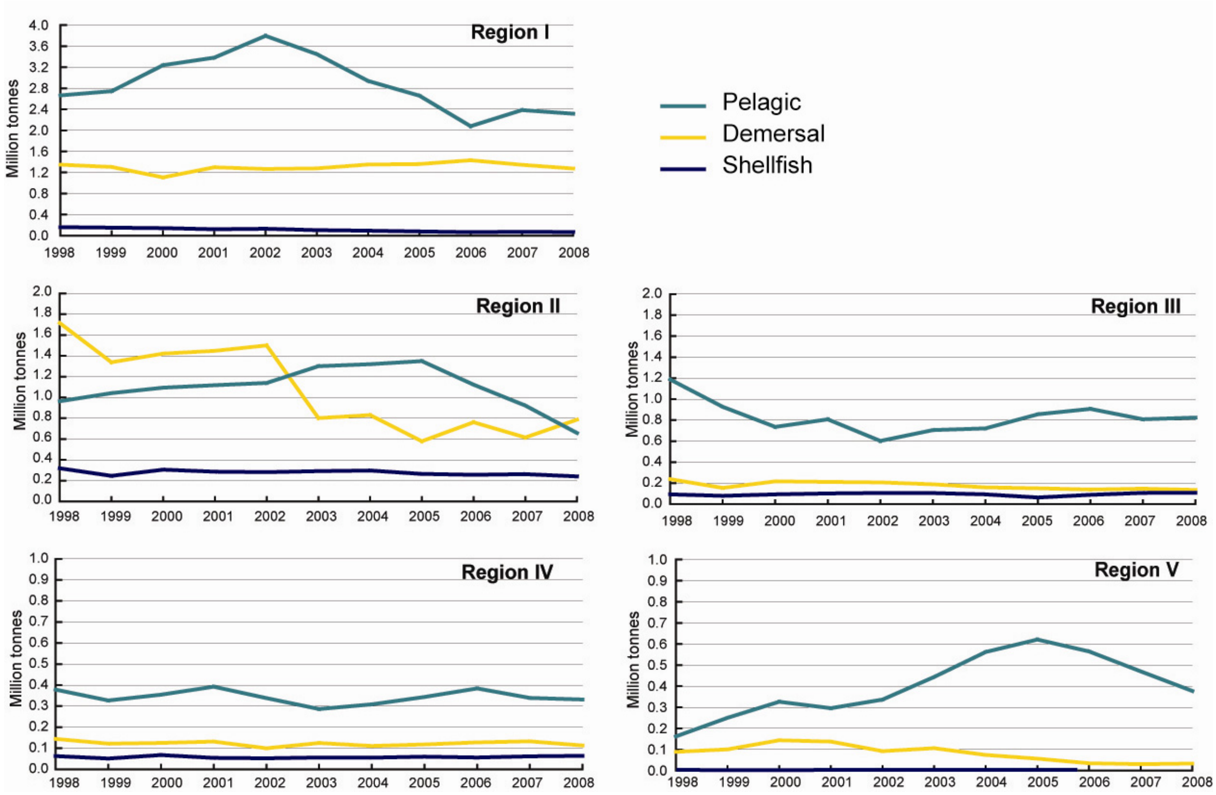


Figure 5.20: *Landings of demersal fish, pelagic fish and shellfish in A. Region I, B. Region II, C. Region III, D. Region IV and E, Region V over the period 1998 to 2008 inclusive. Shellfish data is presented for Region V, however the landings are very low (2,343 tonnes to 4,120 tonnes) resulting in the blue line not being differentiated from the x-axis.*

Demersal landings in Region I showed little change (Figure 5.20A). However, pelagic landings increased to a maximum of 3.8 million tonnes in 2002 after which there was a relatively steady decrease such that in 2008 the pelagic landings were less than in 1998 (Figure 5.20A).

Pelagic landings fell in Region III to a minimum in 2002. Since then there has been a slight increase but the landings of pelagic fish in 2008 remains less than in 1998 (Figure 5.20C). Demersal landings in Region III have remained relatively constant.

In Region IV, landings showed little change (Figure 5.20D).

Across all OSPAR Regions variations in shellfish landings were limited other than in Region I where there was a progressive decrease from 0.159 million tonnes in 1998 to 0.068 million tonnes in 2008.

What this data shows is that where there have been changes these have generally been towards a reduction in landings. In some cases this has been more or less progressive over the analysis period (e.g. pelagic fish in Region II). However, in other cases (e.g. pelagic fish in Region I and demersal fish in Region II) the ultimate decrease in landings observed in more recent years was preceded by an increase in landings. Even in Region V, where there was a significant increase in pelagic landings, the trend is no downwards although landing sin 2008 exceed those of 1998.

ICES have provided advice on fishing opportunities over the period 2003 – 2009. In this analysis (Figure 5.21) no scientific advice was available for between 29 and 40 stocks (year dependent). Stocks where stock size and fishing mortality could be forecast accounted for between 30 and 40 stocks (year dependent) while scientific advice concerning fishing opportunities was available for a 52 to 60 stocks (year dependent).

The Maximum Sustainable Yield (MSY) for a stock is the largest yield (or catch) that can be taken from a fish stock over an indefinite period. ICES provide information about the state of a stock compared to maximum sustainable yield (Table 5.2). What this shows is that, where the state of a stock is known compared to the maximum sustainable yield, the majority of these stocks are overfished. However, the number of stocks for which this data is available is again limited.

What is clear from the data presented in Figures 3.5 and 5.21, as well as Table 5.2, is that these particular metrics are not showing any significant temporal trends over the data period (2003 – 2009 accept for the analysis against MSY for which the data period is 2005 – 2009). Furthermore, the analyses that are undertaken are restricted by the number of stocks to which they relate. As such, there is a need to meet the challenge of increasing the stocks for which there are reference points and thus reduce the number of stocks for which no scientific advice is available.

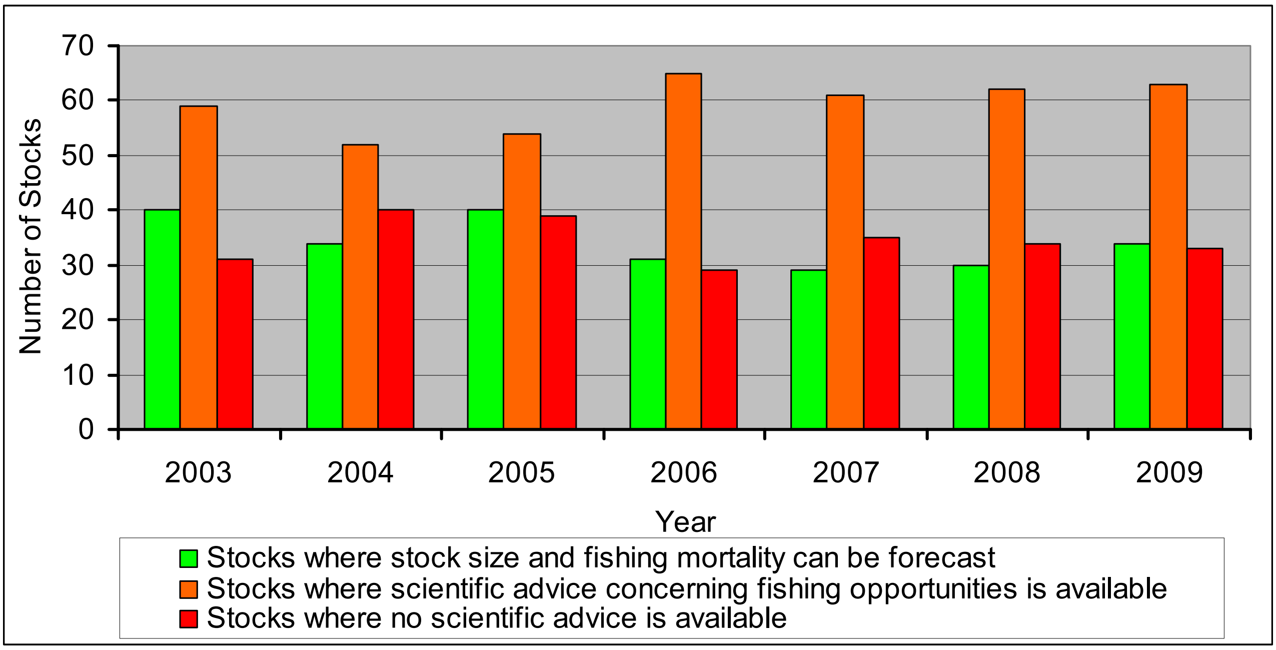


Figure 5.21: *Summary of the scientific advice from ICES regarding fishing opportunities over the period 2003 – 2009. This data includes 7 Baltic stocks. Stocks covered by this analysis are listed in Annex 1. These are defined according to the fishing zones for which TACs are set by the EC. (Data supplied by ICES)*

Table 5.2: *An assessment of the state of fish stocks (including stocks in the Baltic Sea) relative to maximum sustainable yield over the period 2005 – 2009. Stocks covered by this analysis are listed in Annex 1. These are defined according to the fishing zones for which TACs are set by the EC. (Data supplied by ICES)*

	2005	**2006**	**2007**	**2008**	**2009**
The state of the stock is known compared to maximum sustainable yield	34	23	32	33	35
The stock is overfished compared to maximum sustainable yield	32	21	30	29	30
The stock is fished at maximum sustainable yield	2	2	2	4	5

There are several important stocks within Region I which are managed through NEAFC. These include Atlanto-scandian herring, blue whiting, mackerel, pelagic redfish and deep sea species in general[16]. The average catch for the various stocks over the period 1998 – 2007 is: Atlanto-scandian herring ~1 million tonnes; blue whiting ~1.7 million tonnes; mackerel ~0.6 million tonnes; and pelagic redfish ~0.1 million tonnes.

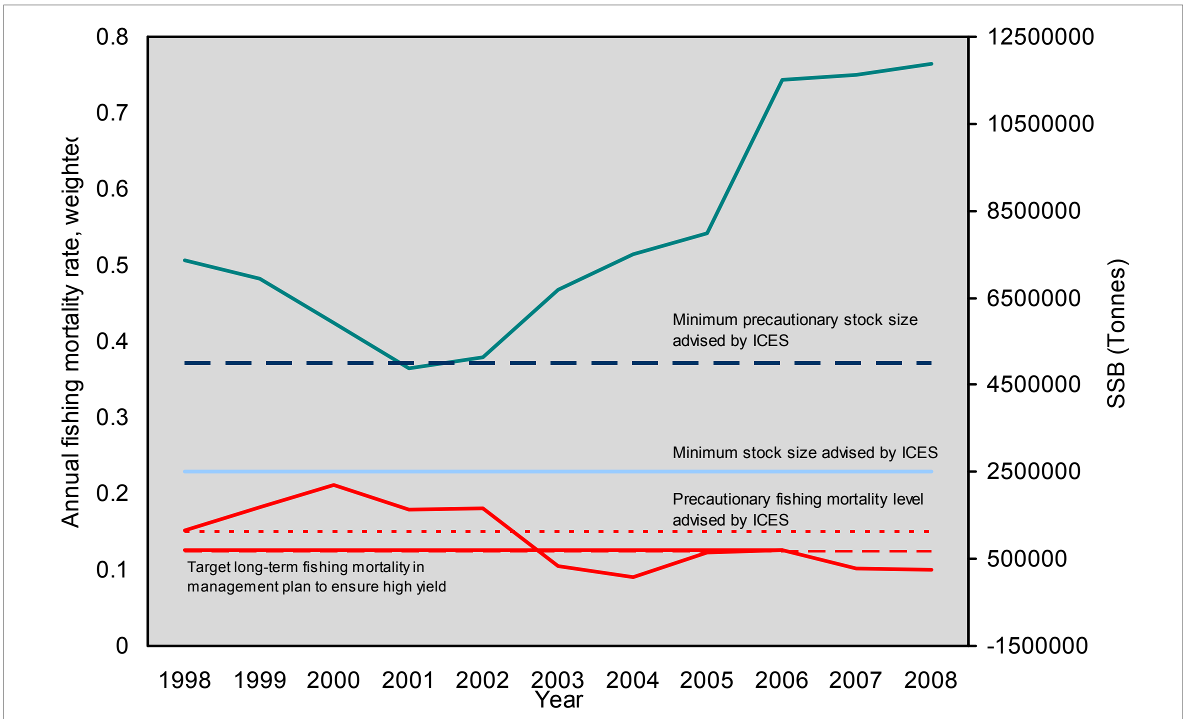


Figure 5.22: *Limit and precautionary values for both SSB and F for Atlanto-scandian herring together with the annual values of both F (red line) and SSB (blue line).*

[16] It should be noted that the term 'deep-sea fisheries' covers a heterogeneous group of fishing, fleets, species and areas. Deep sea fisheries on the continental slope and seamounts include Greenland halibut, monkfish, blue ling, orange roughy, argentine, black scabbard, roundnose grenadier. forkbeard and alfonsinos.

The EU, Faroe Islands, Iceland, Norway and Russia agreed in 1996 to implement a long-term management plan for Atlanto-scandian herring. This stock is fully controlled under the national control and enforcement and the NEAFC Scheme of Control and Enforcement. The plan includes both limit and precautionary values for SSB as well as precautionary and limit values for fishing mortality (Figure 5.22). This profitable fishery shows a decreasing F and increasing SSB (Figure 5.22) in recent years (up to and including 2008) such that the current status of the stock is good as is the outlook in terms of fishing pressure (Table 5.3).

Table 5.3: *Status of selected commercial fish stocks in Region I*

OSPAR Regions	Status of commercial fish stocks	Trend in F and SSB 1998-2006	Status of current fisheries management	Outlook (fishing pressure)	Action required
Atlanto-scandian Herring		↓(F) (SSB)↑			None
Blue Whiting		↔ ↓			None
Mackerel		↔ ↑			Address change in distribution
Pelagic Redfish		? ↔			Develop a management plan and reference points
Deep sea species		? ↔			Obtain more scientific in formation

The status of the blue whiting stocks in Region I is also good (Table 5.3). However, the situation for both mackerel and redfish is not so good with the status of current fisheries management for pelagic redfish (*Sebastes mentellal)* being classified as poor (Table 5.3). This is because of a lack of age data and reference points. The most recent (2009) ICES advice for redfish (*Sebastes mentella*) in ICES Areas I and II is the same as was given in 2007 for the 2008 fishery and reiterated in 2008 for the 2009 fishery and this is that there should be no directed trawl fishery on *Sebastes mentella* in Subareas I and II in 2010. The advice also concludes that by-catch limits should be as low as possible until a significant increase in SSB has been verified.

Deep seas species in Region I remain at risk and require improved management with the need for increased scientific data.

In considering the various analyses presented in this section it is clear that management actions are having an impact, that there is a concerted effort to deliver sustainable fishing and that landings and fishing mortality are going down for a number of stocks while spawning stock biomass of some stocks is increasing. However, what is also clear is that there remains a lack of precautionary reference points and there remain many stocks for which there are insufficient data to draw conclusions on status. This is especially the case for deep sea stocks. As such, there is a need to develop precautionary reference points and to improve the data that is available so as to ensure that more stocks in the North-East Atlantic are being appropriately assessed and the impact of improved management can be unambiguously stated.

6. Impacts of fishing and its effects on the marine environment

6.1 Assessment of the "State" of the demersal fish communities in OSPAR Regions II, III, IV and V[17, 18]

6.1.1 Introduction and Methods

OSPAR is developing an ecosystem approach for the management of marine natural resources. Ecological Quality Objectives have been developed as tools to support the application of such an approach. Ten Ecological Quality Issues have been identified, with the intention of setting Ecological Quality Objectives (EcoQOs) for each issue. This scheme has been developed and piloted in the North Sea Since 2000 (i.e. during the reporting period for QSR 2010),. Fish Communities is the fifth in the list of Ecological Quality Issues, and is considered to be one of the three community-level issues. In addressing concerns regarding anthropogenically induced change in fish communities therefore, a community-level approach has been widely adopted. This has generally involved the application of uni-variate metrics to groundfish survey data to quantify change in various aspects of the community's composition, structure and function. The element of Ecological Quality for the North Sea fish community focuses on "changes in the proportion of large fish and hence the average weight and average maximum length of the fish community", thus clearly identifying the need for a community size composition metric as the "indicator" on which to base an EcoQO for the "fish community" Ecological Quality Issue. The chosen metric, the Large Fish Indicator (LFI) was eventually defined as "the proportion by weight of fish greater than 40 cm in length", based on ICES first quarter (Q1) International Bottom Trawl Survey (IBTS) data.

The LFI was intended to be an indicator of the "general health" of the demersal fish community. However, other aspects of the composition, structure and functioning of fish communities, such as abundance, biomass, productivity, species richness, species diversity and mean life-history trait composition, can also be summarised using univariate metrics. Any one, or all, of these alternative metrics might also be considered to be indicative of the "health" of fish communities. The LFI was chosen ahead of these alternative metrics because it was believed to be particularly sensitive to variation in fishing pressure, and therefore to indicate directly the effect of fishing on state of the fish community. However, this raises the question as to whether one indicator is sufficient to inform on the general health of the demersal fish community, or is a suite of indicators necessary in order to provide information on various different aspects of a community's composition, structure and function? In this assessment of the state of the demersal community in OSPAR Regions II to V, fifteen uni-variate metrics are applied to groundfish survey data to quantify changes in five main aspects of community composition, structure and function: abundance/biomass/productivity; size composition; species richness; species diversity; and life-history trait composition (Annex 2).

Bottom trawl surveys have been carried out as part of the traditional annual fisheries management process for several decades. These surveys routinely provide point estimates of the abundance at length of each species sampled; therefore providing the ideal data sets for the application of uni-variate community metrics. Many of these surveys have run for two or three decades now, providing ideal time series with which to evaluate changes in the composition, structure and function of fish communities. Furthermore, most coastal European nations have been involved in survey activity,

[17] This analysis was undertaken based on data accessed by the co-authors of this section who were Simon Greenstreet, Helen Fraser, John Cotter and John Pinnegar. This did not include data from OSPAR Region I

[18] Note: All tables presented in this text are included at the end of the text.

providing data from most of the continental shelf waters in the OSPAR area. In this assessment, otter trawl survey data is analysed to assess changes in the fish communities present in OSPAR Regions II to V (Figure 6.1).

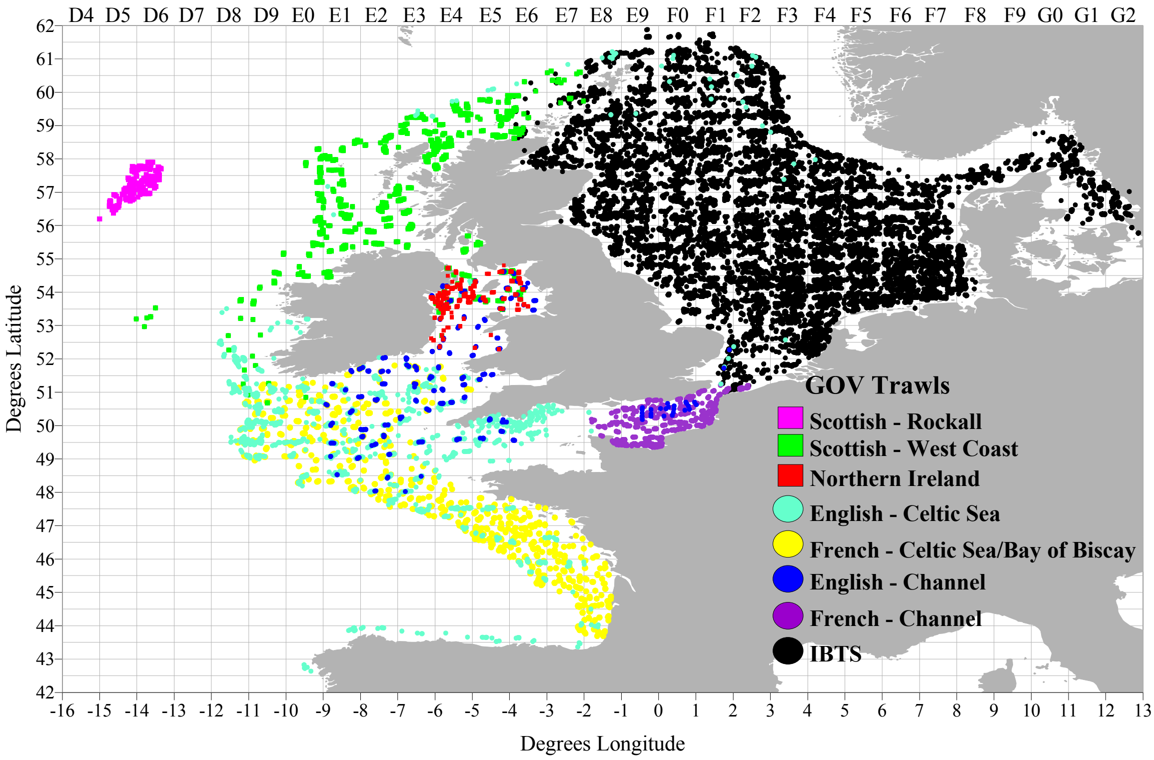


Figure 6.1: *Chart showing positions of otter trawl survey samples available for analysis.*

To assess the state of the demersal fish community in OSPAR Regions, II, III, IV and V, and make a judgement on the changes observed, it was necessary to decide what constituted “beneficial” and “detrimental” change. Emphasis is generally placed on conserving and restoring biodiversity; implying that declines in species diversity (both richness and evenness) are detrimental. The converse was therefore also assumed to hold. The life-history trait composition responses of populations and communities to anthropogenically raised levels of mortality have recently received considerable attention. Declines in population age and length at maturity, decreased community average ultimate body length, and increased in community average growth rate are all considered to be detrimental consequences. Improved management would therefore be expected to induce the opposite, beneficial trends.

Established population dynamics theory predicts that size-related fishing mortality reduces the mean size and proportion of large fish in exploited populations (including non-target species taken as by-catch). This concept underpins development of the LFI as the basis for the OSPAR North Sea Fish Community EcoQO. Reductions in LFI are therefore considered detrimental. Changes in LFI were generally inversely correlated with changes in the abundance, biomass and (growth) productivity of the fish community. The von Bertalanffy growth equation makes it clear that larger fish, closer to their ultimate body length (L_∞), have lower daily specific growth rates. Large fish exert a strong predation loading on small fish abundance. Since trophic transfer efficiency is around 10%, every kg of production by larger fish requires 10 kg of production in their smaller prey fish populations. Specific growth rates among smaller fish are approximately twice that of larger fish, so 5 kg of prey fish are required to support every kg of larger fish. Reductions in the abundance of larger fish, with the consequent reduction in predation loading on smaller prey fish, would therefore tend to result in a rapid increase in the abundance and biomass of small fish; a typical trophic cascade effect.

In assessing of the state of the demersal fish community in four of the OSPAR Regions, two questions were addressed. Firstly, how has the state of the community changed over the last decade, from 1999 to 2008; the period of particular interest to the current QSR. Secondly, how does the state of the community over the period 2004 to 2008 (i.e. now) compare with that prevalent during the eight-year period when data were first available for analysis. Detrimental trends were assigned a “red” colour code and beneficial trends “green”. Where no discernable trend was apparent, an “orange” colour code was applied. Five separate aspects of composition, structure and function of the demersal fish community were considered, and a judgement was made based on the trends observed in the 15 uni-variate community metrics applied to the groundfish survey data. Linear regression was used to make an assessment of metric trends over the last decade. In comparing the current situation with the earlier “reference period”, mean metric values over the period 2004 to 2008 were determined and the assessment was scored red or green depending on whether the recent mean value differed by more than one standard deviation either side of the mean value determined for the “reference period”.

In OSPAR Regions IV and V, only single data sets were available for analysis, each covering only a fraction of the whole region concerned. For these regions therefore, assessment was straightforward. In OSPAR Region II, data sets were available that covered almost the entire region, allowing a single “analytical” assessment to be made based on all the data from throughout the region. In OSPAR Region III, data were available that more or less covered the entire region, but from several different surveys, not a single co-ordinated survey. This necessitated the division of the Region into seven sub-regions, with each sub-region assessed individually. To determine an overall regional assessment, weighted averages were then calculated. Red cells were given a value of 1, orange a value of 2, and green a value of 3, and cells were then weighted by the number of ICES statistical rectangles in the sub-regions. For the final regional assessment, weighted average scores greater than 2.35 were considered good and assigned a “green” code; scores of less than 1.65 were considered poor and assigned a “red” cod; while scores of 1.65 to 2.35 were deemed to indicate little change and assigned an “orange” code. This analysis revealed considerable variation between sub-regions in the way that the different aspects of the composition, structure and functioning of the fish community in OSPAR Region III had varied over time. So the same approach was applied to OSPAR Region II to determine whether the single “analytical” assessment had masked similar sub-regional variation. This had two benefits. Firstly, it allowed sub-regions, such as the English Channel, part of OSPAR Region II, but not covered by the single co-ordinated survey, to be included in the regional assessment. Secondly, it provided a comparison of the “analytical” and “weighted average” approaches.

6.1.2 Regional Assessments

OSPAR Region II – "Analytical" assessment

Figure 6.2 illustrates the development of the LFI and provides an explanation for the EcoQO indicator target of 0.3. From the early 1980s, the Large Fish Indicator (LFI) declined from around 0.3 to its lowest point of less than 0.05 in 2001, since when it has recovered to around 0.22 in 2008.

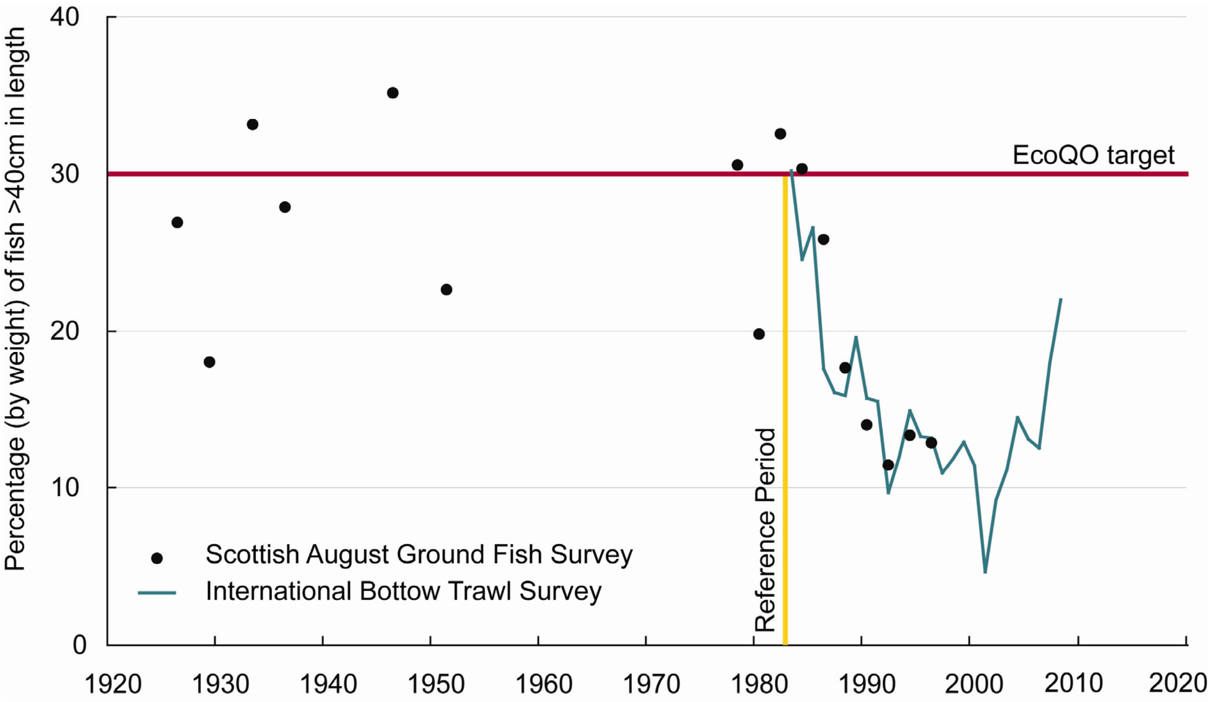


Figure 6.2: *Variation in the LFI, which is based on the Q1 International Bottom Trawl Survey (IBTS). Stock assessments in the early 1980s suggested that stocks were not being over-exploited at that time and that therefore fishing was at sustainable levels. The early 1980s were therefore considered to be a "reference" period, and the LFI recorded at that time deemed to be an appropriate level for fisheries managers to aspire to. The EcoQO is therefore 0.3; an LFI value consistent with individual stock conservation and preservation of the integrity of the wider demersal fish community, and yet a level that should still allow an economically viable fishing industry to persist. Analysis of the Scottish August Groundfish Survey (SAGFS), which stopped in 1997, confirms that an LFI value of 0.3 is an appropriate target for management. The SAGFS LFI tracks the IBTS Q1 index remarkably well over the period that the two surveys coincided, whilst the earlier index values varied around 0.29.*

Figure 6.3 indicates trends in all 15 uni-variate metrics. Increases in species richness were apparent since 1990, while species evenness oscillated, but was generally higher in the later part of the time-series than in the earlier. Concomitant with the recent trend towards larger fish in the community, total abundance, biomass and productivity all appear to have declined. Average life-history trait composition has also oscillated over the full time period, but clear trends were not obvious, except for a possible increase in the average age-at-maturity among demersal fish in the North Sea.

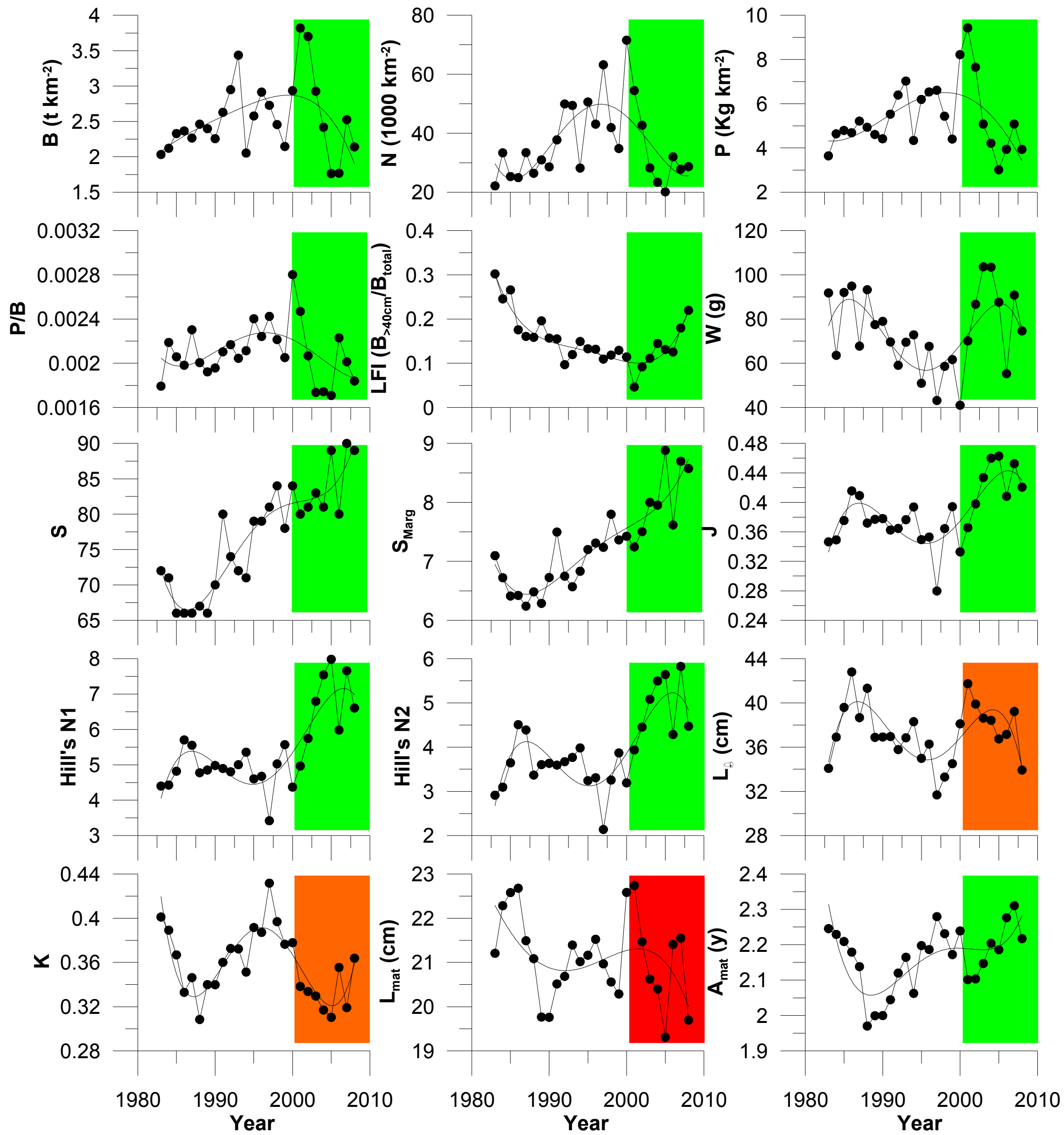


Figure 6.3: *Trends in fifteen indicator metrics applied to the IBTS Q1 groundfish survey data for the whole North Sea (OSPAR Region II). The metrics used are indicated on the plot y axes, these are: B - Biomass; N - Abundance; P - Daily growth production; P/B - Daily production to biomass ratio; LFI - Large fish indicator; W - Mean weight of fish; S - Species count; S_{Marg} - Margalef's species richness; J - Pielou's evenness; N1 - Hill's N1 diversity; N2 - Hill's N2 dominance; L_∞ - Mean ultimate body length; K - Mean growth coefficient; L_{mat} - Mean length at maturity; A_{mat} - Mean age at maturity. Colour bars indicate whether the metric trend since 2000 suggests that state of the demersal fish community in North Sea is improving (green), deteriorating (red), or where the data are inconclusive (orange).*

Table 6.2 provides the "analytical" regional assessment of these trends. Most aspects of the composition, structure and functioning of the Greater North Sea demersal fish community have improved over the last decade, such that the state of the community is now on a parity with, or better than, the situation observed in the early to mid 1980s. The exception to this is the size composition of the community, which is the basis of the OSPAR EcoQO. Here the data suggest that the situation is improving, but that there is still a little way to go.

In the following sections, all the sub-regional and regional assessments were based on similar sets of plots to those shown in Figure 6.3. These can be accessed in the supplementary material annexes referred to at the end of each section.

Table 6.2: *Assessment of changes in the composition, structure and function of the demersal fish community in the Greater North Sea, OSPAR Region II. Green cells indicate beneficial changes. Red cells indicate detrimental changes. Where no discernable trend is apparent, cells are coded orange. Regional "reference periods" are indicated in the lower half of the table.*

Aspect of Fish Community Composition, Structure and Function	Abundance, Biomass and Productivity	Size Composition	Species Richness	Species Evenness	Life-history Trait Composition
Assessment of Trend Since 1999					
Greater North Sea (Region II)	(green)	(green)	(green)	(green)	(orange)
Comparison of State of Fish Community in Last Five-year Period with First Eight-year Period in Time Series					
Greater North Sea (Region II)	1983-1990 (orange)	1983-1990 (red)	1983-1990 (green)	1983-1990 (green)	1983-1990 (orange)

OSPAR Region II - "Weighted average" assessment

Sub-regional analysis (Table 6.3) confirmed that changes in the composition, structure, and function of the demersal fish community were not consistent across the entire OSPAR region II. In the recent decade, however, most aspects of the community's composition, structure, and function had improved, or at least shown no obvious decline; the exception to this being a deterioration in species evenness and life-history trait composition in the Northwestern Basin and a deterioration in the abundance/biomass/productivity and size composition aspects in the Eastern Central Basin. Comparison of the current situation with the situation prevailing when data were first available highlights size composition as the aspect of fish community composition, structure and function over which there should be greatest concern. In seven of the ten sub-regions the situation now is worse than it was in the early to late 1980s. In contrast, species richness is now higher in seven of the ten sub-regions than it was previously.

Generally, the sub-regional weighted average approach to providing a regional assessment of the state of the composition, structure and function of the demersal fish community in the entire OSPAR Region II provided similar results to the overall analytical assessment (compare Tables 6.2 and 6.3). Results were identical in the assessments of recent trends and in the comparison of the current situation with the earliest date period, only the assessment for the species evenness aspect differed: this was scored as an improvement in the analytical assessment (Table 6.2), and as no change in the weighted average assessment (Table 6.3).

Supplementary Material Annexes 2.1 and 2.2 provide further details of the data sets available and the results of all the analyses undertaken.

***Table 6.3:** Assessment of changes in the composition, structure and function of the demersal fish community in each sub-region of OSPAR Region II and overall assessment for the entire region. Green cells indicate beneficial changes. Red cells indicate detrimental changes. Where no discernable trend is apparent, cells are coded orange. Sub-regional "reference periods" are indicated in the lower half of the table. Values in the overall regional assessment rows indicate weighted average scores. Two assessments for the Northwestern Continental Shelf are shown; east refers to the IBTS based assessment documented in the Supplementary Material Annex 2.1. The assessment labelled (west) show the results of the assessment based on the Scottish West Coast Groundfish Survey, which along with the English Channel assessment, is documented in Supplementary Material Annex 2.2.*

Aspect of Fish Community Composition, Structure and Function	**Abundance, Biomass and Productivity**	**Size Composition**	**Species Richness**	**Species Evenness**	**Life-history Trait Composition**
Assessment of Trend Since 1999					
Northwestern Continental Shelf (east)					
Northwestern Basin					
Northeastern Basin					
Norwegian Deeps					
Kattegat and Skagerrak					
Western Central Basin					
Eastern Central Basin					
Southern Basin					
English Channel					
Northwestern Continental Shelf (west)					
OSPAR REGION II ASSESSMENT	**2.39**	**2.36**	**2.90**	**2.44**	**2.12**
Comparison of State of Fish Community in Last Five-year Period with First Eight-year Period in Time Series					
Northwestern Continental Shelf (east)	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Northwestern Basin	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Northeastern Basin	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Norwegian Deeps	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Kattegat and Skagerrak	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Western Central Basin	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Eastern Central Basin	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
Southern Basin	1983-1990	1983-1990	1983-1990	1983-1990	1983-1990
English Channel	1986-1993	1986-1993	1986-1993	1986-1993	1986-1993
Northwestern Continental Shelf (west)	1988-1995	1988-1995	1988-1995	1988-1995	1988-1995
OSPAR REGION II ASSESSMENT	**2.20**	**1.30**	**2.65**	**2.08**	**1.69**

OSPAR Region III

In all sub-regions of OSPAR Region III, the fish community is currently in a poorer or similar state to that prevalent at the start of each of the sub-regional time series (Table 6.4). In all cases, however, recent trends indicate an improving situation. These improvements are most marked in the more northerly sub-regions. The overall regional assessment reflects a similar pattern. Nearly all aspects of the composition, structure and functioning of the demersal fish community in OSPAR Region III have improved over the last decade, such that, in many respects, the community is in a similar state to the one observed when data were first available. The aspects of most concern at the present time relate to the size structure, abundance, biomass and productivity of the community.

Supplementary Material Annex 2.3 provides further details of the data sets available and the results of all the analyses undertaken.

Table 6.4: *Assessment of changes in the composition, structure and function of the demersal fish community in each sub-region of OSPAR Region III and overall assessment for the entire region. Green cells indicate beneficial changes. Red cells indicate detrimental changes. Where no discernable trend is apparent, cells are coded orange. Paler coloured cells indicate instances where confidence in the assessment is low. Sub-regional "reference periods" are indicated in the lower half of the table. Values in the overall regional assessment rows indicate weighted average scores.*

Aspect of Fish Community Composition, Structure and Function	Abundance, Biomass and Productivity	Size Composition	Species Richness	Species Evenness	Life-history Trait Composition
Assessment of Trend Since 1999					
Hebridean Continental Shelf					
Minches and Western Scotland					
Northwestern Irish Continental Shelf					
Southwestern Irish Continental Shelf					
Irish Sea					
Northern Celtic Sea					
Southern Celtic Sea					
OSPAR REGION III ASSESSMENT	2.25	2.40	2.36	2.68	2.69
Comparison of State of Fish Community in Last Five-year Period with First Eight-year Period in Time Series					
Hebridean Continental Shelf	1986-1993	1986-1993	1986-1993	1986-1993	1986-1993
Minches and Western Scotland	1986-1993	1986-1993	1986-1993	1986-1993	1986-1993
Northwestern Irish Continental Shelf	1986-1993	1986-1993	1986-1993	1986-1993	1986-1993
Southwestern Irish Continental Shelf	1984-1991	1984-1991	1984-1991	1984-1991	1984-1991
Irish Sea	1992-1998	1992-1998	1992-1998	1992-1998	1992-1998
Northern Celtic Sea	1984-1991	1984-1991	1984-1991	1984-1991	1984-1991
Southern Celtic Sea	1984-1991	1984-1991	1984-1991	1984-1991	1984-1991
OSPAR REGION III ASSESSMENT	1.55	1.55	1.91	2.23	2.25

OSPAR Region IV

Data were only available for French continental shelf waters within OSPAR Region IV. Over the recent decade, improvements in the life-history trait composition and species richness of the Bay of Biscay demersal fish community were noted (Table 6.5), however, little change was apparent in the other three aspects of community composition, structure and functioning. Over the longer term, size composition, species evenness, and abundance/biomass/productivity aspects were all considered to be in poorer state now than in the mid to late 1980s, while little change was apparent in the species richness and life-history trait composition of the community.

Supplementary Material Annex 2.4 provides further details of the data sets available and the results of all the analyses undertaken.

Table 6.5: *Assessment of changes in the composition, structure and function of the demersal fish community in the French Bay of Biscay sub-region of OSPAR Region IV. Green cells indicate beneficial changes. Red cells indicate detrimental changes. Where no discernable trend is apparent, cells are coded orange. Paler coloured cells indicate instances where confidence in the assessment is low. Sub-regional "reference periods" are indicated in the lower half of the table.*

Aspect of Fish Community Composition, Structure and Function	Abundance, Biomass and Productivity	Size Composition	Species Richness	Species Evenness	Life-history Trait Composition
Assessment of Trend Since 1999					
Bay of Biscay (French coast)	(orange)	(orange)	(green)	(orange)	(green)
Comparison of State of Fish Community in Last Five-year Period with First Eight-year Period in Time Series					
Bay of Biscay (French coast)	1984-1991 (red)	1984-1991 (red)	1984-1991 (orange)	1984-1991 (red)	1984-1991 (orange)

OSPAR Region V

Data were only available for the Rockall Bank Plateau area within OSPAR Region V. Metric trends over the last decade impart a mixed message (Table 6.6). The species diversity and size composition of the Rockall Bank demersal fish community has improved, whilst abundance/biomass/productivity appears little changed. However, the life-history trait composition metrics suggest a decrease in "climax community" species and an increase in the abundance of "opportunistic" species. A similar story emerges with regard to longer-term change in the composition, structure and function of the Rockall Bank demersal fish community, except that recent changes in size composition have simply achieved parity with the earlier data. Given the scarcity of data, particularly the gap between 1986 and the start of the systematic surveys in 2001, confidence in these assessments is low.

Supplementary Material Annex 2.5 provides further details of the data sets available and the results of all the analyses undertaken.

Table 6.6: *Assessment of changes in the composition, structure and function of the demersal fish community in the Rockall Bank Plateau sub-region of OSPAR Region V. Green cells indicate beneficial changes. Red cells indicate detrimental changes. Where no discernable trend is apparent, cells are coded orange. Paler coloured cells indicate instances where confidence in the assessment is low. Sub-regional "reference periods" are indicated in the lower half of the table.*

Aspect of Fish Community Composition, Structure and Function	**Abundance, Biomass and Productivity**	**Size Composition**	**Species Richness**	**Species Evenness**	**Life-history Trait Composition**
Assessment of Trend Since 1999					
Rockall Bank Plateau					
Comparison of State of Fish Community in Last Five-year Period with First Eight-year Period in Time Series					
Rockall Bank Plateau	1986	1986	1986	1986	1986

6.1.3 Overall Regional Summary

Examination of the summary assessment for each of Regions II, III, IV and V shows that, in general the trends since 1999 have been positive with beneficial changes in the majority of the metrics in Regions II, III and V (Figure 6.4). Where there has been no improvement in the metric, in all but one case (life-history trait composition in Region V) there is no discernable trend. Thus, based on this particular analysis, over the last decade the situation with respect to the demersal fish community has either remained unchanged or improved. However, the status over the period 2004 – 2008 is generally not as good as determined for a reference period which was generally the early 1980s to early 1990s.

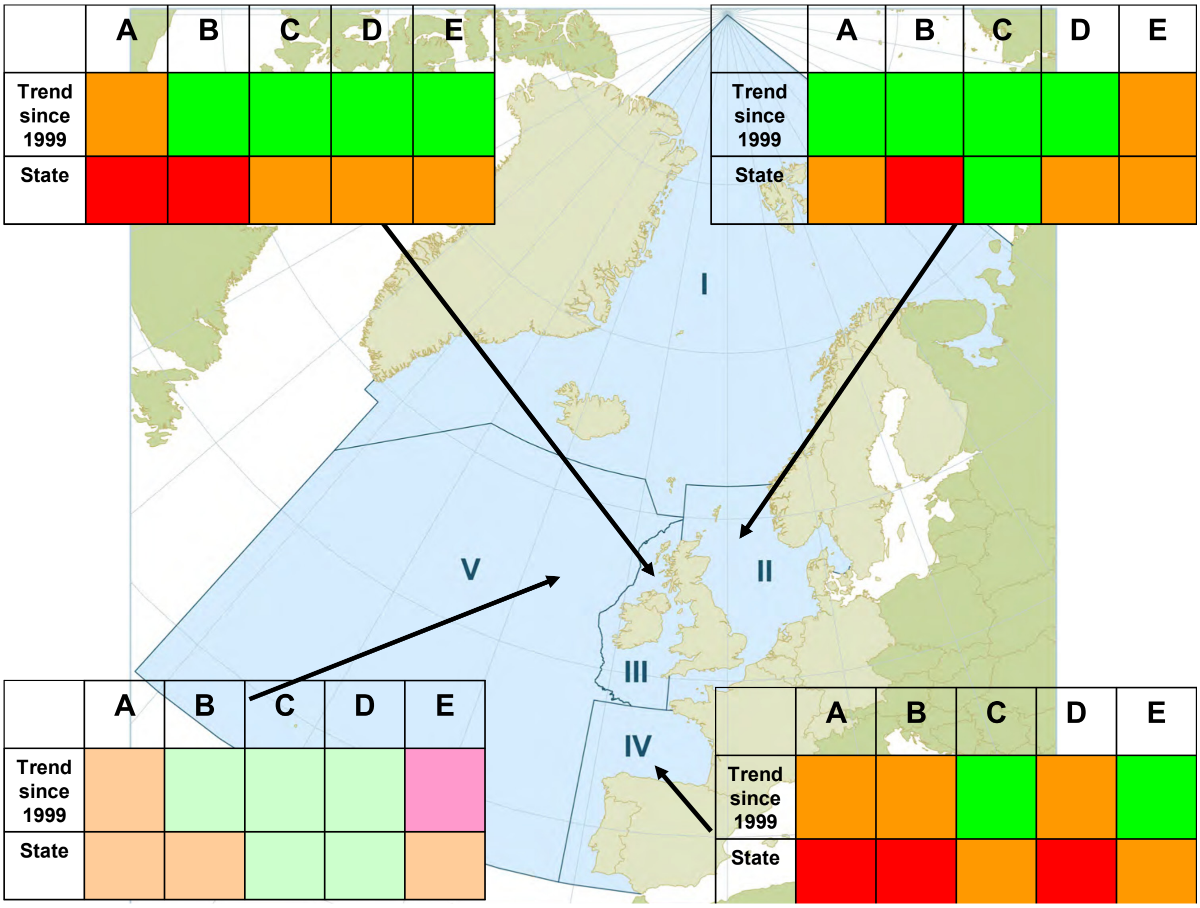


Figure 6.4: *Summary of the individual regional assessments of the demersal fish community for Regions II, III, IV and V. The assessment is based on the Quarter 1 International Bottom Trawl Survey (IBTS) data and National Bottom Trawl Surevy (NBTS) data. This data was used to assess a range of aspects of fish community composition, structure and function including A. Abundance/Biomass/Productivity, B. Size Composition, C. Species Richness, D. Species Evenness and E. Life-History Trait Composition. An improvement has been observed in several aspects of the demersal fish community's composition, structure and function in the four Regions analysed over the last decade. Only the life-history trait composition in Region V has shown a detrimental change. However, the 'mean' state over the period 2004 – 2008 relative to a reference period, which was generally the early 1980s to early 1990s, is generally poorer with detrimental changes apparent for several aspects of the demersal fish composition, structure and function in each Regions III and IV. The paler clours used to present the data in Region V indicate a lower confidence in the analysis. Green cells indicate beneficial changes; Red cells indicate detrimental changes. Orange cells show where there has been no discernable trend or change. OSPAR countries are highlighted in tan on the map. The Roman numerals are the Regions.*

Across the OSPAR Regions considered here (Regions II, III, IV and V), the overall assessment suggests that over the last decade, size composition, species richness and species evenness aspects of the composition, structure and function of the demersal fish community have all improved, whilst there has been little change in the life-history trait composition and abundance/biomass/productivity aspects (Table 6.7). Four of the five aspects are currently on parity with the situation prevailing when data in each region were first available; the exception being the size composition of the community. Here the assessment indicates that, despite recent improvements, a full recovery to earlier conditions has yet to be achieved.

Table 6.7: *Assessment of changes in the composition, structure and function of the demersal fish community in each OSPAR Region and overall assessment across the four Regions. Green cells indicate beneficial changes. Red cells indicate detrimental changes. Where no discernable trend is apparent, cells are coded orange. Cell values indicate weighted average scores. Overall assessment is based on the "weighted average" assessment of OSPAR Region II. Paler coloured cells indicate instances where confidence in the assessment is low.*

Aspect of Fish Community Composition, Structure and Function	**Abundance, Biomass and Productivity**	**Size Composition**	**Species Richness**	**Species Evenness**	**Life-history Trait Composition**
Assessment of Trend Since 1999					
OSPAR region II (analytical)					
OSPAR region II (weighted average)	2.39	2.36	2.90	2.44	2.12
OSPAR region III (weighted average)	2.25	2.40	2.36	2.68	2.69
OSPAR region IV					
OSPAR region V					
OVERALL ASSESSMENT	**2.27**	**2.42**	**2.76**	**2.54**	**2.24**
Comparison of State of Fish Community in Last Five-year Period with First Eight-year Period in Time Series					
OSPAR region II (analytical)					
OSPAR region II (weighted average)	2.20	1.30	2.65	2.08	1.69
OSPAR region III (weighted average)	1.55	1.55	1.91	2.23	2.25
OSPAR region IV					
OSPAR region V					
OVERALL ASSESSMENT	**1.87**	**1.43**	**2.41**	**2.14**	**1.81**

6.2 Other aspects of the impacts of fishing on the marine environment

This section has focussed on changes to the demersal fish communities and represents a new analysis specifically performed for this assessment. Clearly fishing has much wider impacts than this. The following are covered in the ICES 2008 assessment of the environmental impact of fisheries on the marine environment of the OSPAR maritime area (ICES Advice Book 2008 Section 1.5.5.9) and are not repeated here:

Effects on non-target species, including birds, marine mammals, and discarded fish;

Effects on the sea bed and associated benthic communities and habitats;

Effects on community structure and food webs; and

Effects on genetic diversity.

Where appropriate the above effects of fishing were presented in the Regional Assessments undertaken by ICES as well as the overall assessment.

The overall conclusions and recommendations presented in Section 7 take account of the information presented in the ICES assessment (Overall and Regional).

7. Conclusions and key recommendations

Fisheries are a major economic activity across the OSPAR Maritime Area. Fish stocks from the OSPAR area supply almost 10% of the global fisheries yields. Norway harvest the largest weight of fish, molluscs and crustaceans. However, since 2002 capture production of fish, crustaceans, molluscs etc from FAO Fishing Area 27 has decreased for the four leading countries (Norway, Denmark, Iceland and UK). Across the OSPAR Maritime Area there has been a decrease in the number of fishing vessels; Norway showed the largest percentage decrease (43% over period 2001 – 2008).

Fisheries management practices in the NE Atlantic continue to evolve with the priority of ensuring a European fishery that is environmentally, economically, and socially sustainable. With growing global pressure on the food supply and the need for high grade protein and health promoting substances such as polyunsaturated fatty acids that are abundant in seafood, the fisheries sector will remain under pressure to deliver high quantities of material. Managing the fishery within ecologically sustainable limits and meeting societal objectives for the conservation of biodiversity against this moral, social, and economic imperative will be a growing challenge for fisheries management.

During the period covered by this report there were several significant developments in fisheries management covering the North-East Atlantic. These include reform of the Common Fisheries Policy, the creation of Regional Advisory Councils (RACs) and a greater focus on ecosystem-based management of fisheries. However management of stocks across the OSPAR Maritime Area remains a complex issue with a range of agreements and organisations involved and a variety of management processes and procedures.

Gear-based technical measures have made a contribution to reducing the environmental impact of some fisheries. Regulatory and market incentives can both lead to an improvement of fishing practice, as can education and outreach initiatives.

Overall levels of fisheries exploitation remain high. Indeed, many of the stocks are fished so heavily that the stocks are outside or very close to the safe biological limit for exploitation. In most fisheries higher yields, more security of supply, and lower environmental impacts would follow from further reductions in fishing effort. An examination of fishing mortality for some 37 stocks from Regions I, II, III and IV showed that it was significantly lower in 2007 compared with 1997 for 60% of these stocks. Only in the case of 1 stock was F significantly higher with no difference being detected for the remaining stocks. A comparison of changes in fishing mortality for the periods 1988 – 1997 and 1998 – 2007 for OSPAR Regions 1 – 1V was consistent with an improving situation across the OSPAR Maritime Region as a whole.

There remain a significant number of stocks for which it is not possible to provide a status for due to poor data. This situation has remained almost unchanged over the last 7 years (2003 0 2009 inclusive). There are also a number of stocks for which no scientific advice is available. There is a need to address these gaps.

OSPAR Region I is a very large and diverse region. The fish stocks and fisheries of the region are equally diverse, with major differences between parts of the region. The major demersal stocks include cod, haddock, saithe, and shrimp while the major pelagic stocks in the area are Atlanto-scandian herring, blue whiting, mackerel, capelin and pelagic redfish. There are also a number of deep sea species fished in this Region.

The current status of some stocks (e.g. Atlanto-scandian herring, blue whiting and mackerel) in Region I is good while the status of pelagic redfish and deep seas species is poor. However, improved management of fish stocks in Region I means that the outlook, in terms of fishing pressure, for several stocks is good. More scientific information is required in respect of deep sea species.

Estimates of unreported catches of cod and haddock in the Barents Sea in 2002–2006 indicate that illegal, unreported, and unregulated fishing (IUU) was a considerable problem during this time. However in more recent years this issue has been successfully addressed such that by 2008 the IUU fishing for cod in the Barents Sea was approximately 15% of the tonnages estimated for 2005.

Focussing on Region II, fishing effort and mortality rates have started to fall in this Region during the period covered by this assessment and there are tentative signs of increases in the abundance of some fish stocks and the proportion of larger individuals and species in the fish community. The species that are most vulnerable to fishing in Region II, especially skates and rays, continue to be impacted by unsustainable rates of fishing. Despite recent reductions in effort and smaller reductions in mortality, Region II is still heavily modified by fishing and both fish stock abundance and the state of some other components of the marine environment are not consistent with management objectives.

Even for a 'data-rich' region, a relatively small proportion of species impacted by fishing in Region II are quantitatively assessed and reference points have only been determined for a small number of these. Further, for those stocks with reference points, the assessments still focus on advice relating to the avoidance of limits rather than the attainment of targets that are more consistent with commitments to achieving maximum sustainable yield (MSY).

The fisheries of OSPAR Region III are economically important to the large coastal population of the region. They continue to evolve taking on technical developments, exploiting new fishing opportunities, responding to regulation, and increasingly being constrained by economic forces such as the fuel price and consumer preferences, although the effect of the latter has yet to be fully evaluated.

The fisheries resources in Region III are heavily exploited and the level of fishing mortality remains high on most species. There is good evidence of impacts of the fishery extending across the ecosystem of the region. For some stocks mitigation measures and regulations do not appear to have reduced the levels of fishing mortality.

Of particular note is that in OSPAR Region III, there is increasing effort on non-quota species such as scallops, and that these are currently fully or over-exploited. As other fishing opportunities decline many fishers are turning to these fisheries. It would be prudent to introduce quotas or a limited license entry scheme for scallops to regulate this fishery before the situation deteriorates further.

Despite a decrease in the number of fishing vessels in the French fleet, fishing effort has increased and, under this continuing pressure, the impact of fishing cannot be said to have decreased over the last ten years. Although some management measures have proven efficient, such as the northern hake recovery plan, in general there has been low or no improvement in the status of target species and in the impact of fishing on the community, and the anchovy fishery had to be closed in 2005. Moreover, undersized individuals and bycatch species continue to be caught and discarded in large amounts. Recent changes in fishing gears for example, in the *Nephrops* fishery, have not yet proven efficient.

The effects of fishing in OSPAR Region V are relatively poorly studied. The high value of the large pelagic fish in the region has also led to depletion of their stocks. A number of the deep-water biogenic habitats in Region V are very susceptible to damage from seabed fisheries, particularly trawling, but also to the intense or prolonged use of other gears. Damage has been documented at a number of locations, but there is very likely to have been more damage than that documented. Fisheries managers have introduced closed areas to protect some of these habitats. Bycatch of birds, marine mammals, and sharks occurs, and in the case of sharks this is probably affecting stocks in an unsustainable manner.

Priorities in OSPAR Region V are primarily to continue to improve the management of fisheries. In general a reduction in fishing effort in deep-water trawl and pelagic long-lining (tuna) fleets will be effective, but other fisheries management tools are available. Further scientific surveys are required to identify habitats of particular importance, along with fisheries closures to protect vulnerable marine ecosystems. Bycatch can be reduced using technical measures, but these require dedicated development, usually best undertaken in association with relevant fishers.

From the review it is apparent that formal assessment of regulatory measures remains incomplete, with only limited data available on the benefit to stocks of commercial fish species. It would be useful to derive new measures (metrics) or continue to develop/apply existing ones (e.g. EcoQOs) in order to distinguish between different forces acting on the communities (i.e. partition effects between environmental, economic, and regulatory forces). Ultimately the goal would be to assess the effectiveness of existing management measures (through legislation and/or voluntary measures) to improve stocks and mitigate against detrimental environmental impacts. In addition, it would be informative, as new mitigation or conservation measures are implemented, to recommend or develop appropriate metrics (that can be easily monitored and reported) in order to measure the success of such measures.

Ultimately it can be concluded that:

- The current excessive general fishing pressure has a considerable impact on marine ecosystems, especially when considering the cumulative effect of other pressures;
- Overall status of fish stocks is improving but is still far from good enough and this is a cause of concern;
- Habitat destruction and depletion of key predator and prey species, with the consequent disruption of food webs, are particularly worrying ecosystem effects of fishing;
- International cooperation has reduced illegal, unreported and unregulated fishing in several areas;
- There remain many stocks for which there are no precautionary limits or where the state is not known due to poor data. There has been little improvement in this respect over the last 7 years; and
- More scientific information is needed so that deep water fisheries can be appropriately managed.

OSPAR recommends that:

- Further reductions in fishing pressure are urgently required, taking due account of technological improvements;
- Dealing with discards remains a priority;
- Precautionary reference points are developed for stocks for which they do not currently exist;
- Management of deep-water fisheries should take into account the special vulnerability of both the species exploited and their habitats;
- By-catch of species such as cetaceans and marine birds should be kept as low as possible and preferably eliminated; and
- There is a need to integrate fisheries management into the wider maritime management context, promoting consistency and synergy between fisheries policies and the policies regulating other maritime uses.

ANNEX 1

Fish stocks used as the basis for Figures 2.5, 3.2, 3.3, 5.21 and Table 5.2.

Stocks in this list are defined according to the fishing zones for which TACs are set under EU legislation. Some stocks outside the EU exclusive fishing zone are not included

Species	Latin name	Stock defined by TAC zone	Category : P=Pelagic D=Demersal	Shared stock ?	2003				2004				2005				2006				2007				2008				2009			
					Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?
Anchovy	Engraulis encrasolicus	VIII	P		No	no	yes		no	yes	no		no	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	no	yes	no	no
Anchovy	Engraulis encrasolicus	IX,X,CECAF 34.1.1.	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Anglerfish	Lophiidae	IIa (EC), North Sea (EC)	D		No	yes	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Anglerfish	Lophiidae	Vb(EC), VI, XII, XIV	D		No	no	no		no	yes	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Anglerfish	Lophiidae	VII	D		No	yes	no		no	yes	no		no	yes	no	yes	no	yes	no	no	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Anglerfish	Lophiidae	VIIIabde	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Anglerfish	Lophiidae	VIIIc,IXa	D		No	yes	no		yes	yes	no		no	no	no	yes	no	no	no	yes	no	no	no	yes	yes	no	no	yes	yes	no	no	yes
Basking shark	Cetorhinus maximus	Community waters of zones IV, VI and VII	P		No	no	no		no	no	no		no	no	no	no	yes	yes	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no
Blue whiting	Micromesistius poutassou	overall TAC	P	Y	No	yes	no		no	yes	no		no	yes	no	no	no	yes	no	no	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Cod	Gadus morhua	Skagerrak	D	Y	yes	no	no		yes	no	no		yes	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	no	no	no	no
Cod	Gadus morhua	Kattegat	D		yes	yes	no		yes	yes	no		yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Cod	Gadus morhua	IIa (EC), North Sea (EC)	D	Y	yes	yes	no		yes	yes	no		yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	no	yes	no	yes	yes	yes	no	yes
Cod	Gadus morhua	Vb(EC) VI,XII,XIV	D		yes	yes	no		yes	yes	no		yes	yes	no	yes	yes	yes	no	no	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes
Cod	Gadus morhua	VIIa	D		yes	yes	no		yes	yes	no		yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes
Cod	Gadus morhua	VIIb-k, VIII,IX,X,CECAF 34.1.1	D		No	yes	no		no	yes	no		no	no	yes	yes	yes	no	no	no	yes	yes	no	yes	yes	yes	no	yes	no	yes	no	yes
Common sole	Solea solea	Skagerrak and Kattegat, IIIbcd	D		No	yes	no		no	yes	no		no	no	yes	yes	no	no	yes	no	no	no	yes	no	no	no	yes	yes	no	no	yes	yes
Common sole	Solea solea	IIa (EC), North Sea (EC)	D		No	yes	no		no	yes	no		no	yes	no	yes	no	no	yes	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Common sole	Solea solea	Vb (EC), VI, XII, XIV	D		No	no	no		no	no	no		no	no	no	no		no	no	no		no	no	no	no	no	no	no		no	no	no
Common sole	Solea solea	VIIa	D		No	no	yes		no	yes	no		no	yes	no	yes	no	no	no	no	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes
Common sole	Solea solea	VIIbc	D		No	no	no		no	no	no		yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Common sole	Solea solea	VIId	D		No	no	yes		no	yes	no		no	no	yes	yes	no	yes	no	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Common sole	Solea solea	VIIe	D		yes	yes	no		yes	yes	no		no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Common sole	Solea solea	VIIfg	D		No	yes	no		no	yes	no		no	no	yes	yes	no	no	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Common sole	Solea solea	VIIhjk	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Common sole	Solea solea	VIIIab	D		yes	yes	no		no	yes	no		no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Dab and flounder	Limanda/Platichthys	IIa (EC), North Sea (EC)	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no		no	no	no		no	no	no		no	no	no
Greenland halibut	Reinhardtius hippoglossoides	IIA (EC), VI	D		yes	no	no			no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Haddock	Melanogrammus aeglefinus	Skagerrak and Kattegat, IIIbcd (EC)	D	Y	yes	no	no		yes	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Haddock	Melanogrammus aeglefinus	IIa (EC), North Sea (EC)	D	Y	yes	yes	no		no	no	yes		no	yes	no	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Haddock	Melanogrammus aeglefinus	VIb, XII, XIV (Rockall)	D		yes	yes	no		yes	no	no		yes	no	no	no		no	no	no	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Haddock	Melanogrammus aeglefinus	VIa Subunit	D		yes	yes	no		no	no	yes		no	no	yes	yes	no	no	yes	yes	no	yes	no	yes	no	yes	no	yes	yes	yes	no	yes
Haddock	Melanogrammus aeglefinus	VII, VIII, IX, X, CECAF 34.1.1 (	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Haddock	Melanogrammus aeglefinus	VIIa subunit	D		yes	no	no		no	yes	no		no	yes	no	yes	no	no	no	no	no	no	no	yes	no	no	no	yes	no	no	no	yes
Hake	Merluccius merluccius	overall TAC	D		yes	yes	no		no	yes	no		no	yes	no	yes	no	yes	no	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Hake	Merluccius merluccius	VIIIc, IX, X, CECAF 34.1.1 (EC	D		yes	yes	no		yes	yes	no		yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes
Herring	Clupea harengus	Skagerrak and Kattegat bc	P	Y						no	no		no	no	no	no	no	no	no	no		no	no	no	no	no	no	no		no	no	no
Herring	Clupea harengus	Skagerrak and Kattegat HC	P	Y	yes	no	no			no	no		no	no	no	no	no	no	no	no		no	no	no	no	no	no	no		no	no	no
Herring	Clupea harengus	North Sea IV ab	P	Y	No	no	yes		no	no	yes		no	no	yes	yes	no	no	yes	no	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Herring	Clupea harengus	IVc, VIId	P	Y	yes	no	no			no	no		no	no	no	no	no	no	no	no		no	no	no	no	no	no	no	no	no	no	no
Herring	Clupea harengus	Vb, VIaN, VIb	P		No	no	yes		no	no	no		no	no	yes	no	no	no	yes	no	no	no	no	no	no	yes	no	no	no	yes	no	no
Herring	Clupea harengus	VIaS,VIIbc	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	yes	no	no	no	no	yes	no	no	yes	yes	no	no
Herring	Clupea harengus	VIa Clyde	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no
Herring	Clupea harengus	VIIa	P		No	no	yes		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Herring	Clupea harengus	VIIe,f	P		No	no	no		no	no	no			no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Herring	Clupea harengus	VIIghjk	P		No	no	no		no	no	no		no	no	no	no	no	yes	no	no	yes	yes	no	no	no	yes	no	no	no	yes	no	no
Horse Mackerel	Trachurus spp.	All areas	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Horse Mackerel	Trachurus spp.	X, CECAF Azores	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Horse Mackerel	Trachurus spp.	CECAF (EC) Madeira	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Horse Mackerel	Trachurus spp.	CECAF (EC) Canary	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Lemon sole and wi	Microstomus/Glyptocephalus	IIa (EC), North Sea (EC)	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Mackerel	Scomber scombrus	overall TAC	P	Y	No	yes	no		no	yes	no		no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Megrims	Lepidorhombus spp.	IIa (EC), North Sea (EC)	D		yes	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Megrims	Lepidorhombus spp.	Vb (EC), VI, XII, XIV	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Megrims	Lepidorhombus spp.	VII	D		No	yes	no		no	yes	no		no	no	yes	yes	no	yes	no	yes	no	no	no	no	no	no	no	no	no	no	no	no
Megrims	Lepidorhombus spp.	VIIIabde	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Megrims	Lepidorhombus spp.	VIIIc,IX, CECAF34.1.1(EC)	D		No	no	no		no	no	no		no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes
Nephrops	Nephrops norvegicus	IIIa	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Nephrops	Nephrops norvegicus	IIa (EC), North Sea (EC)	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Northern prawn	Pandalus borealis	Skagerrak and Kattegat	D	Y	No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Northern prawn	Pandalus borealis	IIa (EC), North Sea (EC)	D		No	no	no			no	no			no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Norway Lobster	Nephrops norvegicus	Vb(EC), VI	D		No	no	no		no	no	yes		no	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Norway lobster	Nephrops norvegicus	VII	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Norway lobster	Nephrops norvegicus	VIIIabde	D		No	no	no		no	no	no		no	no	no	yes	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	yes
Norway lobster	Nephrops norvegicus	VIIIc	D		yes	no	no		yes	no	no		yes	yes	no	yes	yes	yes	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no
Norway lobster	Nephrops norvegicus	IX,X, CECAF 34.1.1 (EC)	D		No	no	no		no	no	no		no	no	no	yes	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Norway pout	Trisopterus esmarki	IIa (EC), Skagerrak and Kattegat, North Sea (EC)	D		No	no	no		no	no	yes		yes	yes	no	no	no	yes	no	no	yes	yes	no	no	no	no	yes	no	no	no	yes	no
Plaice	Pleuronectes platessa	Skagerrak	D	Y	No	yes	no		no	yes	no		no	yes	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Plaice	Pleuronectes platessa	Kattegat	D	Y	No	no	no		yes	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Plaice	Pleuronectes platessa	IIa (EC), North Sea (EC)	D	Y	No	yes	no		no	yes	no		no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	no	yes	yes
Plaice	Pleuronectes platessa	Vb (EC), VI, XII, XIV	D		yes	no	no		no	no	no		no	no	no	no		no	no	no	no	no	no	no	no	no	no	no		no	no	no
Plaice	Pleuronectes platessa	VIIa	D		No	no	yes		no	no	yes		no	no	yes	no	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Plaice	Pleuronectes platessa	VIIbc	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no

ANNEX 1

Fish stocks used as the basis for Figures 2.5, 3.2, 3.3, 5.21 and Table 5.2.

					2003				2004				2005				2006				2007				2008				2009			
Species	Latin name	Stock defined by TAC zone	Category : P=Pelagic D=Demersal	Shared stock ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?	Advice provided by ICES	Outside SBL?	Inside SBL ?	Consistent with MSY ?
Plaice	Pleuronectes platessa	VIIde	D		No	yes	no		no	yes	no		no	yes	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Plaice	Pleuronectes platessa	VIIfg	D		No	yes	no		no	yes	no		no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Plaice	Pleuronectes platessa	VIIhjk	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Plaice	Pleuronectes platessa	VIII, IX, X, CECAF 34.1.1 (EC)	D		No	no	no		no	no	no		no	no	no	no		no	no	no	no	no	no	no	no	no	no	no		no	no	no
Pollack	Pollachius pollachius	Vb(EC), VI, XII, XIV	D		No	no	no		no	no	no		no	no	no	no		no	no	no	no	no	no	no	no	no	no	no		no	no	no
Pollack	Pollachius pollachius	VII	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Pollack	Pollachius pollachius	VIIIabde	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Pollack	Pollachius pollachius	VIIIc	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Pollack	Pollachius pollachius	IX,X,CECAF 34.1.1 (EC)	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Saithe	Pollachius virens	North Sea and West Scotland	D	Y	No	no	yes		no	no	yes		no	no	yes	yes	no	no	yes	no	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Saithe	Pollachius virens	Vb(EC) VI, XII, XIV	D	Y	yes	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Saithe	Pollachius virens	VII, VIII, IX, X, CECAF 34.1.1 (	D		No	no	no		no	no	no			no	no	no	no	no	no	no		no	no	no		no	no	no		no	no	no
Sandeel	Ammodytidae	IIa (EC), North Sea (EC)	D		No	no	yes		no	no	no		no	yes	no	no	yes	yes	no	no		yes	no	no	yes	yes	no	no	yes	yes	no	no
Skates and rays	Rajidae	IIa (EC), North Sea (EC)	D		No	no	no		no	no	no		no	no	no	no	yes	yes	no	yes	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Sole	Solea spp.	VIIIcde,IX,X, CECAF 34.1.1 (E	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Sprat	Sprattus sprattus	Skagerrak and Kattegat	P	Y	No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Sprat	Sprattus sprattus	IIa (EC), North Sea (EC)	P		No	no	yes		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Sprat	Sprattus sprattus	VIIde	P		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Spurdog/dogfish	Squalus acanthias	IIa (EC), North Sea (EC)	P		No	no	no		no	no	no		no	no	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Spurdog/dogfish	Squalus acanthias	IIIa, EC and intl waters of I,V,V	P																		yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Turbot and Brill	Psetta maxima/Scopthalmus	IIa (EC), North Sea (EC)	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Whiting	Merlangius merlangus	IIIa	D	Y	No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Whiting	Merlangius merlangus	IIa (EC), North Sea (EC)	D	Y	yes	yes	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	yes	no	no	no	yes
Whiting	Merlangius merlangus	Vb(EC), VI, XII, XIV	D		yes	yes	no		no	no	no		no	no	no	no	yes	no	no	no	yes	no	no	no	yes	yes	no	no	yes	yes	no	no
Whiting	Merlangius merlangus	VIIa	D		yes	yes	no		yes	yes	no		yes	no	no	no	yes	no	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Whiting	Merlangius merlangus	VIIb-k	D		No	no	yes		no	no	yes		no	no	yes	yes	no	no	yes	yes	no	no	no	yes	no	no	no	no	no	no	no	no
Whiting	Merlangius merlangus	VIII	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no
Whiting	Merlangius merlangus	IX,X,CECAF 34.1.1 (EC)	D		No	no	no		no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no		no	no	no

ANNEX 2

Descriptions, abbreviations and derivations of the fifteen univariate community metrics applied to the groundfish survey data.

Metric	Abbreviation	Metric calculation	Terminology
Biomass	B	$B=\sum_{s=1}^{S}\sum_{l=\min}^{l=\max}\sum_{n_{s,l}=1}^{N_{s,l}}c_s l^{b_s}$	Where *S* is the total number of species, *l* is the length class, $N_{s,l}$ is the total number of individuals in each length class of each species. The constants c_s and b_s are the constant and exponent values respectively in the species-specific weight at length relationship.
Abundance	N	$N=\sum_{s=1}^{S}\sum_{l=\min}^{l=\max}n_{s,l}$	Where *S* is the total number of species, *l* is the length class, and $n_{s,l}$ is the number of fish in each species and length class.
Daily growth production	P	$P=\sum_{s=1}^{S}\sum_{l=\min}^{l=\max}\sum_{n_{s,l}=1}^{N_{s,l}}c_s b_s l^{b_s-1}\frac{k_s}{365}\left[l_{\infty,s}-l\right]$	Where *S* is the total number of species, *l* is the length class, $N_{s,l}$ is the total number of individuals in each length class of each species. The constants c_s and b_s are the species-specific weight at length relationship constant and exponent values respectively. The constants k_s and $l_{\infty,s}$ are the species-specific von Bertalanffy growth function growth and ultimate body length values respectively. k_s is divided by 365 to convert and annual parameter to a daily parameter.
Daily production to biomass ratio	P/B	$"P/B"=\frac{P}{B}$	Where *P* is the total daily growth production and *B* total biomass of the fish community (see above).
Large fish indicator	LFI	$"LFI"=\frac{\sum_{s=1}^{S}\sum_{l>40cm}^{l=\max}\sum_{n_{s,l}=1}^{N_{s,l}}w_{s,l}}{B}$	For term explanations, see "Biomass" above. Note that in the numerator, the summation is carried out across lengths >40cm only.
Mean weight of fish	W	$W={}^{B}\!/_{N}$	Where *B* is the total biomass and *N* the total number of fish in the sample (see above).
Species count	S	*S*	Where *S* is the count of the number of species in the sample.
Margalef's species richness	S_{Marg}	$S_{M\arg}=\frac{(S-1)}{LogN}$	Where *S* is the total number of species and *N* the total number of individuals in the sample (see above)

Pielou's evenness	J	$J = \frac{-\sum_{s=1}^{S} N_s/N \log N_s/N}{LogS}$	Where N_s is the number of individuals belonging to species *s*, *N* is the total number of individuals of all species in the sample, and where *S* is the total number of species recorded in the sample (see above).
Hill's N1 diversity	N1	$"N1" = e - \sum_{s=1}^{S} \frac{N_s}{N} \log \frac{N_s}{N}$	Where N_s is the number of individuals belonging to species *s*, *N* is the total number of individuals of all species in the sample, and where *S* is the total number of species recorded in the sample (see above).
Hill's N2 dominance	N2	$"N2" = 1 \Big/ \sum_{s=1}^{S} \frac{N_s}{N}$	Where N_s is the number of individuals belonging to species *s*, *N* is the total number of individuals of all species in the sample, and where *S* is the total number of species recorded in the sample (see above).
Mean ultimate body length	L_∞	$L_\infty = \frac{\sum_{s=1}^{S} \sum_{n_s=1}^{N_s} l_{\infty,s}}{N}$	Where $l_{\infty,s}$ is the von Bertalanffy ultimate body length of each species *s*. *S* is the total number of species recorded in the sample and N_s is the total number of individuals of each species caught. *N* is the total number of individuals recorded in the sample.
Mean growth coefficient	K	$K = \frac{\sum_{s=1}^{S} \sum_{n_s=1}^{N_s} k_s}{N}$	Where $k_{,s}$ is the von Bertalanffy growth parameter for each species *s*. *S* is the total number of species recorded in the sample and N_s is the total number of individuals of each species caught. *N* is the total number of individuals recorded in the sample.
Mean length at maturity	L_{mat}	$L_{mat} = \frac{\sum_{s=1}^{S} \sum_{n_s=1}^{N_s} l_{mat,s}}{N}$	Where $l_{mat,s}$ is the length at maturity of each species *s*. *S* is the total number of species recorded in the sample and N_s is the total number of individuals of each species caught. *N* is the total number of individuals recorded in the sample.
Mean age at maturity	A_{mat}	$A_{mat} = \frac{\sum_{s=1}^{S} \sum_{n_s=1}^{N_s} a_{mat,s}}{N}$	Where $a_{mat,s}$ is the age at maturity of each species *s*. *S* is the total number of species recorded in the sample and N_s is the total number of individuals of each species caught. *N* is the total number of individuals recorded in the sample.

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