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# Plan of Action for the Conservation and Management of Sharks in UK Waters

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# 1. Summary

In 1999, the Committee on Fisheries (COFI) of the United Nations Food and Agriculture Organisation adopted a voluntary International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). This called upon all states to produce a Shark Assessment Report (SAR) and, if they have shark fisheries, to develop and implement National Plans of Action (Shark Plans). The term 'shark' includes sharks, skates, rays and chimaeras. The EU has adopted the IPOA-sharks on behalf of its Member States however no Community Shark Plan has yet been produced. Although the EC has competence in fisheries matters the waters of Member States, this does not prevent the UK producing its own national Shark Plan in the absence of or in addition to an EU Shark Plan. Although constrained by the Common Fisheries Policy in actions that can be taken unilaterally to manage shark fisheries, the UK is able to exercise control over fisheries within the 6 and 12 nautical mile exclusive fishing zones and to take very considerable action to improve the quality of data collection and the provision of scientific advice on chondrichthyan fisheries generally. This document sets out recommendations that should form the basis of a UK Shark Plan as well as for management measures which should be included in an EU plan.

Sharks, rays and chimaeras (chondrichthyans) are caught in the waters adjacent to the UK by directed fisheries and as bycatch in fisheries directed at other species. The majority of directed fisheries have failed to produce sustainable returns due to rapidly declining catch rates under exploitation. Examples of such declines include various Scottish, Irish and Norwegian fisheries for basking shark[1], Scandinavian fisheries for porbeagle shark and UK longline fisheries for spurdog in the Irish Sea. A number of localised and seasonal directed fisheries continue to operate around the UK coast. The majority of catches of chondrichthyans today are taken as a bycatch, either utilized or discarded, in fisheries principally directed at more abundant teleost species. A number of species of deep-water sharks, rays and chimaeras are taken in recently developed deep-water fisheries; these species are considered to be particularly at risk from exploitation. Pelagic sharks are taken as bycatch in offshore fisheries for tunas. Recreational fisheries also exist around the coast and may catch chondrichthyans either as target or as bycatch. In some cases, recreational catches are returned to the sea alive.

Yields of traditionally targeted chondrichthyans have decreased considerably over the past century with some formerly abundant species having disappeared almost entirely from landings. Landings data are very inadequate due to the fact that fishermen are not obliged to record catches in official logbooks and the practice in most European countries of recording landings in grouped categories such as 'skates and rays'.

Techniques for assessing the state of stocks are at an early stage of development. Preliminary stock assessments were carried out for a number of species under the EU funded DELASS project (Heessen 2003) and these indicated that several stocks including spurdog, thornback ray and kitefin shark were severely depleted. For the majority of species, there are no such stock assessments and in the absence of analytical assessments, trends in catch per unit effort (CPUE) and/or landings may be used as indicators of population trends. For many species, including porbeagle shark, basking shark, blue shark, angel shark and several species of skates and rays, these suggest severe declines in abundance and/or possible extirpation from

[1] All scientific names are given in Appendix 1

large parts of their former range. Against the general trend, a few small-bodied species which are generally discarded live by fisheries are believed to be stable or increasing.

Until recently, very little effort has been made to manage chondrichthyan fisheries. Very few of the management measures currently in force have the direct purpose of protecting or rebuilding stocks of chondrichthyan species. The EU has set TACs for 'skates and rays' (all species combined) and for spurdog in European Union waters of the North Sea but these have been set according to historic catch levels and are considerably higher than recent catches. They therefore do nothing to limit or control catches of these species. There is a quota allocated for Norwegian and Faroese vessels to catch porbeagle shark in European Union waters and again, this is currently set considerably higher than recent landings and so is not constraining catches. The UK has listed basking shark under schedule five of the Wildlife and Countryside Act 1981 meaning that this species now has full legal protection up to 12 nautical miles from the UK coastline, and the EU has set a TAC of zero catch for this species. Within the UK's six nautical mile exclusive fishing zone, some Sea Fisheries Committees have set local regulations imposing minimum landing sizes for skates and rays.

The UK exports porbeagle shark, spurdog, and ray wings to mainland Europe and raw shark fin to East Asia for processing. The EU also imports spurdog and porbeagle shark from New Zealand and from over-exploited stocks in the USA and Canada. Trade in basking shark and whale shark is controlled under appendix II of CITES and there is currently a proposal to upgrade white shark from appendix III to appendix II.

In addition to fishing pressures, chondrichthyans in UK waters may face potential threats from *inter alia*, habitat loss, pollution, disturbance from ecotourism, climate change and the fields produced by sub-sea electric cables. The magnitude of these potential impacts is likely to be small in comparison to fishing but, where stocks are already depleted, may be sufficient to inhibit recovery.

The IPOA-Sharks listed ten objectives that should be achieved by national Shark Plans.

- Ensure that shark catches from directed and non-directed fisheries are sustainable
- Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use
- Identify and provide special attention, in particular to vulnerable or threatened shark stocks
- Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives
- Minimize unutilised incidental catches of sharks
- Contribute to the protection of biodiversity and ecosystem structure and function
- Minimize waste and discards from shark catches
- Encourage full use of dead sharks

- Facilitate improved species-specific catch and landings data and monitoring of shark catches

- Facilitate the identification and reporting of species-specific biological and trade data

The Technical Guidelines for the conservation and management of sharks (FAO 2000) identify four elements of the IPOA-Sharks:

(1) Management requirements of shark fishery resources for sustainable use

(2) Particular conservation needs of some shark and other chondrichthyan species

(3) Maintenance of biodiversity through viability of shark populations

(4) The need for habitat protection

Specific actions under these general headings which are necessary to deliver the objectives of the IPOA-Sharks are given in Box 1 (page 46). More detailed recommendations for actions required to meet the objectives of the IPOA are listed below. These include measures which can be implemented unilaterally by the UK and which should be included in a UK Shark Plan as well as others which can only be achieved within the context of the Common Fisheries Policy and are therefore recommended for inclusion in an EU Shark Plan.

**(1) Species identification, data collection and data handling** – Management of many chondrichthyan species is severely hampered by lack of species-specific data on landings. It is recommended that the UK and EU take steps to produce identification guides to enable fishermen to identify species, improve the collection of data on landings, ensure adequate levels of market sampling and improve the sharing of data within Europe.

**(2) Stock assessment** - Identify gaps and deficiencies in current data and address these, undertake research to identify stock units for assessment purposes and devote increased effort to the development of more appropriate abundance indices. Undertake assessments for target and non-target species at regular intervals. Where detailed stock assessments are not possible, undertake regular semi-quantitative assessments of the risk profile of all European chondrichthyan stocks and species, categorising each into high, medium or low risk, based on their susceptibility to capture and ability to recover from depletion. These should generally use the semi-quantitative IUCN Red List and FAO-recommended CITES listing criteria for commercially exploited aquatic species. Improve the understanding of species' distributions, biological productivity and migration patterns, and critical habitats.

**(3) Management and conservation measures** – The EU should develop TACs for exploited stocks (precautionary where stock assessments are not available) and introduce effort reductions for vulnerable species. Closed areas should be established where concentrations of vulnerable species are located and recovery programs produced for depleted species. The five elasmobranch species identified in the 4$^{th}$ quinquennial review of the Wildlife and Countryside Act,1981 should be added to Schedule five of the act and lists of species should be prepared for consideration for additional protection under the European Species and Habitats Directives, Bern Convention, Barcelona Convention, Convention on Migratory Species, OSPAR and/or CITES.

**(4) Technical measures** – Introduce minimum and maximum landing sizes for specified groups of skates and rays, legislate against ray winging and strengthen legislation against shark finning. Action can be taken at a UK level but is also required from the EU.

**(5) Discarding** – Collect more detailed data on discarding and introduce measures to reduce discarding when it is at high levels, carry out research to determine survival of discards. Action required by both UK and EU.

**(6) Deep-water fisheries** - There is currently no management in place for the particularly vulnerable species of deep-water shark. Recommend measures for EU management of these fisheries include the introduction of gear limitations for deep-water longliners and gill-netters, reduction in fishing effort by deep-water trawlers, and the introduction of closed areas.

**(7) Stakeholders and public awareness** - An implementation group for the UK Shark Plan, drawn from a wide variety of stakeholders, should be established as soon as possible. The functions of this group would be to develop implementation strategies, oversee implementation, provide coordination, develop a schedule for action, act as a central depository for advice on progress and to disseminate information to stakeholders.

Amongst the above recommendations are a number of actions which should form the basis of a UK Shark Plan. More specific management measures to be included in the Shark Plan are listed in table 5 (page 53).

# 2. Introduction

Around 60 species of sharks, rays and chimaeras are resident or more or less regular visitors to UK and/or adjacent EU or deep waters (see Appendix 1). As a group, these species are correctly known as 'chondrichthyans' (class *chondrichthyes*) with the term elasmobranch being used for the sub-class comprising the sharks and rays alone. Many of these are caught in fisheries as either target species or bycatch. As a consequence of declining catches in traditional fisheries, there has been a trend for fisheries to target novel species and for bycatch species to become increasingly important. Though chondrichthyans face many of the same problems of overfishing as do teleosts, they have certain characteristics that make them particularly vulnerable to fishing pressure; their growth is often slow, they mature at a relatively late age and they usually produce very few offspring (sometimes as few as 1 or 2 young every two years). Because of these characteristics, chondrichthyans lack the resilience to withstand sustained exploitation by fisheries (Holden 1974, Pratt and Cassey 1990) and in this respect, they resemble mammals more than other fish species. Their stocks can therefore easily be overfished, and there is a real risk of severe depletion or extinction of rare species, with a consequent loss of biodiversity.

The UN Convention on Biodiversity (1992) places an obligation on all its signatories to develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity. This obligation extends to territorial waters and to 200 nautical miles from coastlines. Managing shark populations is essential to preserving biodiversity within UK waters.

In 1999, in response to concern about the global state of shark stocks, the Committee on Fisheries (COFI) of the United Nations Food and Agriculture Organisation adopted a voluntary International Plan of Action for the Conservation and Management of Sharks[2] (IPOA-Sharks). The IPOA-Sharks highlighted the action required for sharks within the context of the FAO Code of Conduct for Responsible Fisheries. It called upon all states to produce a Shark Assessment Report (SAR) and, if they have shark fisheries, to develop and implement National Plans of Action (NPOA) by early 2001. States should report on progress of their Shark Plans as part of their biennial reporting to FAO on the Code of Conduct for Responsible Fisheries.

The IUCN Shark Specialist Group and TRAFFIC assessed progress by states and Regional Fisheries Management Organisations (RFMOs) with the implementation of the IPOA-Sharks during 2002 (IUCN and TRAFFIC 2002a, 2002b) and concluded that progress had been negligible. Although 113 states report shark landings to FAO (18 with landings of >10,000 t/yr), only 29 states had at that time reported any progress with IPOA implementation; only five Shark Assessment Reports (SAR) or National Plans of Action (NPOA) were available for public consultation and review. This included a preliminary draft plan of action from the European Commission (see below), which failed to meet most of the requirements of the IPOA-Sharks and has since been withdrawn. Furthermore, although several RFMOs have a mandate enabling them to implement conservation and management measures for sharks and other bycatch species (hence to implement the IPOA-Sharks), only a few have implemented

[2] The term 'sharks' is taken to include all species of sharks, skates, rays and chimaeras (Class *Chondrichthyes*), and the term "shark catch" is taken to include directed, bycatch, commercial, recreational and other forms of taking sharks.

specific measures for sharks beyond basic catch reporting requirements. Additional SARs and NPOAs have since been released and a new review of progress with IPOA was undertaken by the IUCN Shark Specialist group for consideration of the 20th CITES Animals Committee in 2004. At that time, 63 states reported some progress towards the implementation if the IPOA and 16 reported that they had produced draft or final SARs or Shark Plans.

Among the reasons for a lack of progress with the preparation of a SAR or NPOA for UK waters are that the EU signed up to the IPOA-Sharks on behalf of Member States and that commercial fisheries in the Atlantic waters of the European Union are subject to regulation under the EU Common Fisheries Policy (CFP). Fisheries is one of a number of policy areas where the EC has exclusive competence, meaning that Member States are not at liberty to establish their own management regimes nor to enter into separate international agreements in relation to fisheries. The scope for unilateral action by the UK to conserve fish stocks that are of interest to both the UK and other EU fleets is, therefore, only limited and a European Shark Plan would have a greater impact on shark stocks than would unilateral action by Member States.

Progress with the implementation of the IPOA-sharks by the EU has been slow. Three years after the FAO's suggested target date for development and implementation of NPOAs and the very limited circulation of a preliminary draft European Shark Plan at the FAO Committee on Fisheries (COFI) meeting in 2001, no European Shark Plan had yet formally been developed for consultation. The Council regulation on the conservation and sustainable exploitation of fisheries resources (Council Regulation (EC) No. 2371/2002) extends the CFP to take into account conservation, management and exploitation of living aquatic resources whenever adopting management regulations. Furthermore the communication from the Commission COM(2002) 186 final, 28.05.02, includes a commitment to implement a Community action plan to manage sharks in the context of FAO IPOAs and to propose legislation for this purpose before the end of 2003. In 2002 the Subgroup on Resource Status of the European Commission's Scientific, Technical and Economic Committee for Fisheries (STECF) met in response to a European Commission request for assistance with the preparation of a new POA within the framework of the IPOA-Sharks (SGRST 2002). This group held a second meeting in late July 2003 (SGRST 2003). The terms of reference of this group included identifying 'possible desirable management objectives and strategies for the various species or group of species and fisheries targeting chondrichthyans'.

The primary objective of the CFP is to ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions. The revised CFP framework regulation (EC No. 2371/2002) came into force on 1 January 2003. It makes more explicit the need for fisheries policy to take account of the impact of fishing activities on marine ecosystems, with the aim of the progressive implementation of an ecosystem based approach to fisheries management. The revised CFP should, through the implementation of an environmental integration Action Plan, have an improved focus on the wider marine environment. This should include the development of a long-term strategy to promote the protection of vulnerable species, such as cetaceans, sharks, (including skates, rays and chimaeras) and marine birds.

A derogation from the principle of equal access (renewed in 2002) means that the UK is able to assume effective control over inshore waters from the baseline to 6 nautical miles offshore, and from 6-12 miles provided that measures are non-discriminatory and that Member States with historic fishing rights are consulted. The UK can also take measures for the conservation

and management of stocks on a unilateral basis out to 200 miles, although these can only apply to UK vessels. Furthermore, while many necessary actions relating to the management of fisheries are outside UK competence, there are other necessary actions, such as improving the collection of data and provision of scientific advice, which the UK could adopt unilaterally and immediately. In view of the absence of any effective management measures for shark stocks in EU waters, it is important therefore that the UK develop and implement its own Shark Plan. This is necessary in order to comply with the IPOA-Sharks' requirement for the development of National Shark Plans regardless of actions taken at regional (in this case, EU) level.

The purpose of this report is to identify threats to sharks, rays and chimaeras within UK waters and management measures that can be taken to improve their status and move towards sustainable fisheries at UK and EU levels. Chapter 4 contains recommendations for measures that should be included in a plan of action for the conservation and management of sharks in UK waters. Some of these can be taken unilaterally by the UK and should be included in a UK Shark Plan while others are essential requirements of an EU Shark Plan if it is to fulfil its objectives with respect to the conservation of sharks within UK waters. It is also essential that those UK Overseas Territories that have shark fisheries work towards the development of Shark Plans. Appendix 3 gives descriptions of some known shark fisheries in UK Overseas Territories, but is not exhaustive.

# 3. Shark Assessment Report

There is no formal Shark Assessment Report (SAR) for the UK, but the published and unpublished literature describes chondrichthyan biodiversity, distribution and a number of target and bycatch fisheries for sharks and rays (e.g. Pawson and Vince 1999, Ellis *et al*. 2002, Heessen 2003, Walker *et al*. in press, SGRST 2002, 2003, ICES 1995, 1996, 1997, 2002, 2003). Gray (1995) and Pawson *et al*. (2002) reviewed the status of the coastal fisheries of England and Wales.

It is clear from these and other sources that there are both target and bycatch commercial and recreational fisheries for chondrichthyan species in British waters. It is also possible to obtain an overview of the status of these fisheries and the stocks that they harvest. In line with the precautionary approach to fisheries management, the lack of a detailed formal SAR is, therefore, no reason to defer the development of an initial Shark Plan, although the preparation of a detailed SAR would be of considerable assistance in refining the latter.

In the absence of a full SAR, the following brief description of fisheries and summary of trends, stock status and management has been prepared. This follows the suggested list of contents for a Shark Assessment Report presented in Appendix B of the IPOA-Sharks. It would be possible to expand considerably upon this by reviewing the published literature in more detail; even more by using unpublished fisheries records held by CEFAS and fisheries laboratories or departments in Scotland and Northern Ireland.

## 3.1 Description of fisheries

Fisheries that catch chondrichthyan species in UK coastal waters, EU waters, and international waters can be divided into four general categories: directed commercial, incidental commercial, directed recreational and incidental recreational. Directed fisheries are those that target sharks, skates, rays or chimaeras, whereas incidental fisheries take them as bycatch while fishing for other species. In virtually every fishery (e.g., gillnet, longline, trawl, purse seine, pot, handgear), there are varying levels of directed or incidental catch of chondrichthyan species. Incidentally caught species may be either retained or discarded depending on their market value (Pawson and Vince 1999).

### 3.1.1 Coastal and shelf fisheries

In recent years, the UK has had the second or third largest landings of chondrichthyan species in Europe after France and Spain. The major part of shark, skate, ray and chimaera landings from UK waters and elsewhere in the Northeast Atlantic arises as a minor component of fisheries primarily targeting more abundant teleost species. The few directed fisheries for chondrichthyan species have developed rapidly, and have in some areas been fished intensively until no longer economically viable. One example is the recent spurdog[3] fishery in the Irish Sea, where they were initially landed as a bycatch by trawlers targeting other species, but which expanded due to the development of a fleet of longline vessels based at Holyhead. In 1981, English and Welsh vessels landed 920 t. By 1984, this had increased to 2,500 t and landings peaked at 3,940 t in 1987, reducing to 1,133 t by 1996. The Norwegian

[3] All scientific names are given in Appendix 1

porbeagle and basking shark fisheries are other examples of this phenomenon (Heessen 2003).

Although directed fisheries for spurdog continue to operate locally and seasonally, most catches of this species are taken as partially-utilised bycatch in fisheries aimed principally at whitefish. Spurdogs are taken by UK and foreign vessels in virtually all trawl and seine fisheries around the UK with the largest catches taken by the UK and France. Many countries do not report landings at species level but continue to use grouped categories such as "dogfish and hounds" and it is thus not always possible to distinguish landings of spurdog from those of lesser spotted dogfish, nursehound, smooth-hounds, and occasionally tope.

A small number of inshore fixed net fisheries in the Irish, Celtic and southern North Sea target rays, particularly thornback, and there is a seasonal directed fishery by French vessels in the Irish and Celtic Seas. However, the majority of catches are taken as bycatch in mixed trawl and seine fisheries by UK and foreign vessels. Ray landings are mainly of thornback, cuckoo and spotted ray, although several other species are also landed. Some of the larger species, such as longnose and white skates, which were formerly recorded in coastal ray fisheries have now apparently disappeared from catches, while others such as common skate are no longer caught in large parts of their former range.

The angel shark was formerly common in a number of coastal fisheries but is now virtually extirpated in waters around the UK (Ellis 2001). In 2002, just 20 kg of angel shark was reported in UK landings, with a total value of £5.

Large numbers of porbeagle sharks were formerly caught in a targeted fishery by Norwegian and Danish longliners. In the period from 1930 to 1950, the Norwegian fishery extended into the central and northern North Sea including Orkney and Shetland and southwards off the west coast as far as Ireland (Gauld 1989). Declining catches led to a rapid decline in this fishery and now only a very small numbers of vessels operate in the central North Sea and Skagerrak. Norway has a quota for this species in EU waters but the proportion of the Norwegian catch that is taken in EU or UK waters is unknown. UK and French vessels also target this species to the south and west of England and small numbers are taken as bycatch in mixed demersal fisheries. According to the FAO yearbook of fisheries statistics (FAO 2002), porbeagle shark landings in 1994 by all countries have been in the range of ~400-1,700 t, with the largest landings by Spain (when reported) and France, followed by Denmark and Norway, of which Norway landed only 17-33 t.

UK Coastal fisheries occasionally target small aggregations of porbeagle shark (~7 t, worth ~£20,000 were declared in 2002) and set drift lines offshore for blue shark in summer (~5.7 t worth £5,800 in 2002) (landings data from Defra statistics). These pelagic sharks are also taken on lines, in gillnets and in trawls in fisheries directed at other species with, more rarely, shortfin mako shark, thresher shark and tope. Much larger numbers of pelagic sharks are taken offshore in high seas fisheries (see below).

There is no longer a targeted basking shark fishery in the UK since a fishery in the Firth of Clyde, which experienced declining catches during its operation from 1982 to 1994, ceased to operate. An earlier Scottish west coast fishery in the 1940s-50s was also short-lived. Basking sharks have been taken in the Northeast Atlantic by a Norwegian fleet since the 1950s. Annual catches have fluctuated considerably, reaching a maximum of over 4,000 individuals in 1960, but there has been a general declining trend since the mid 1970s and recent catches

have been less than 100 individuals per year. There are anecdotal reports of this fishery extending into the Irish Sea in the 1970s, but, since the mid 1970s, most catches have been taken off the Norwegian coast. There are no records of target fisheries for basking sharks in England, although bycatch may have been utilised from time to time and still occurs in the southwest. In 1998, this species was added to Schedule 5 of the Wildlife and Countryside Act 1981. Since 2002, the EU has set a zero Total Allowable Catch (TAC) in ICES subareas IV, VI and VII, meaning that basking sharks are now effectively protected in all waters around the UK.

Pawson et al. (2002) provide a description of inshore (0-6 mile) fisheries in England and Wales. Almost all demersal fisheries around the coast take some dogfish (mainly spurdog) and rays (mainly thornback) in trawls, gill nets, tangle nets, stake nets and line fisheries from spring to autumn. In most parts of the country, these are taken as bycatch or as a desired component of multi-species fisheries. For example, bycatch of rays and dogfish are significant in trawl fisheries for roundfish and flatfish and tangle net fisheries for sole and other flatfish during spring and summer on the North Sea and eastern Channel coast. A few line, trawl and tangle net fisheries also target rays and shoals of spurdog in season, with flatfish providing a bycatch in tangle net fisheries for rays. Chondrichthyans become more important from the central Channel to the west, with a wider range of species of shark and ray captured inshore by both anglers and commercial fishers, including a small amount of longlining and recreational fishing for pelagic sharks. Some fisheries operate year-round in the southwest. The target fishery for rays in South Wales has expanded considerably since the mid-1980s. The target longline fishery for spurdog in North Wales has declined very considerably since the late 1980s and has been partly replaced by tangle netting for rays.

Scottish inshore fisheries are dominated by creel fishing (potting) and, to a lesser extent, *Nephrops* trawling. Of these, only the latter takes a significant bycatch of chondrichthyans, comprising mainly spurdog, lesser spotted dogfish and rays, of which the most abundant are cuckoo ray and spotted ray. Inshore *Nephrops* fisheries are mainly concentrated in the Firths of Forth and Clyde, the Minches and Hebrides and the Moray Firth. Small numbers of inshore trawlers and seiners target whitefish on the east and west coasts and a few gill-netters work around Shetland; these vessels also take bycatch of dogfish and rays. Scallop dredgers work all around the coasts but particularly the Irish Sea and the North West and these vessels probably take a small bycatch of chondrichthyans. In recent years, there have been a few small-scale line fisheries for non-quota species including spurdog on the west coast and for porbeagle sharks around Shetland. These fisheries have generally been short lived but can be expected to recur when economic conditions are right.

Recreational sea fisheries are also very important in some coastal waters. Charter angling trips for a wide range of small sharks and rays as well as teleosts are a significant source of income for some commercial fishermen on North Sea, Channel and southwestern English coasts. It has been argued that their economic importance outweighs that of commercial fisheries in some parts of the country.

### 3.1.2 Deep-water fisheries

Deep-water fisheries in UK waters began in the late 1970s when French vessels began to target blue ling on the western slope of the continental shelf and offshore banks in the Northeast Atlantic. In the early days, there were no markets for deep-water sharks and unknown quantities were discarded at sea but, since 1989, markets for a number of species

have developed and these species are now landed in France and the UK. The fisheries are conducted primarily by France and the UK, at depths of 400-1500 m and, in addition to a mixed catch of teleost species, regularly catch around 12 species of deep-water sharks. Many of the species caught belong to the order Squaliformes, of which the most regularly landed species are the Portuguese shark, and leafscale gulper shark, often referred to by their trade names, "siki" and "false siki". Long-nose velvet dogfish, birdbeak dogfish, greater lantern-shark, velvet belly, black dogfish and black-mouthed dogfish are regularly taken as bycatch and usually discarded and a number of other species including gulper shark and kitefin shark are caught more rarely.

A number of species of chimaeras are taken in this fishery and, at certain depths, may make up the bulk of the catch. Species caught include rabbitfish, large-eyed rabbitfish, and a number of other, less abundant species. Until 1999 all of these species were discarded however since then, markets have been developed and a mixed catch, comprising mainly rabbitfish, is now landed. A number of ray species are also caught, the most abundant being round ray in the Rockall trough and Arctic skate the Faroe-Shetland channel; these are generally discarded. Small numbers of common skate continue to be caught and utilised by vessels targeting monkfish and megrims at the shelf edge. It should be noted that deep-water species very rarely survive being brought to the surface, and discarded individuals will almost always be returned to the sea dead or dying.

Deep-water areas west of the UK are also fished by Spanish and UK registered longliners and gill-netters. These vessels mainly target hake *Meluccius merluccius* and ling *Molva molva* along the shelf edge, but when economic conditions are right, they may target leaf-scale gulper shark and Portuguese shark in deeper water.

### 3.1.3 High seas pelagic fisheries

Large numbers of oceanic sharks (primarily blue shark, but also mako and thresher) are taken as bycatch in high seas fisheries targeting tuna and billfish. The International Council for the Conservation of Atlantic Tunas (ICCAT) manages these fisheries. ICCAT's remit covers other species of fishes exploited in tuna fisheries. It has recommended that members develop and conduct observer programs to collect accurate data on shark catches and discards by species, particularly blue, porbeagle and shortfin mako sharks, but members are not complying with its guidance and the value of these data is limited.

## 3.2 Past and present trends for effort

Commercial fishing effort increased significantly in coastal waters during the 1970s, when the establishment of 200 mile fishing limits meant that the UK fleet was excluded from former distant-water fishing grounds. Gray (1995) described a steady increase in the numbers of smaller vessels operating a wide range of fishing gears in inshore waters (0-6 miles) close to their home ports in England and Wales during the last quarter of the 20th Century. Pawson *et al*. (2002), however, describe the more recent downturn in activity in many of these fisheries. Some have become uneconomical due to a lack of resource, while management measures to reduce fishing mortality have reduced the scale of other fisheries (not focused on the chondrichthyans, although some bycatch species may have benefited from these measures). The numbers of vessels over 10m registered in Scotland declined from 1992 to 2002, while smaller vessels increased in number (Scottish Fisheries Statistical Tables 2003). This reflects an overall decline in the importance of demersal finfish fisheries resulting from

declining stocks and the effects of management measures such as quota restrictions and decommissioning schemes. Relatively unrestricted inshore fisheries for shellfish have fared better and consequently the number of under-10m vessels has increased.

Numbers of vessels operating in offshore fishing grounds showed similar increasing trends in the second half of the 20th century but decommissioning under the European Multi-Annual Guidance Programmes (MAGP III and IV, 1992 to 2002) has resulted in a downward trend in fleet capacity both in terms of numbers of vessels and vessel power since the mid 1990s (Table 1). The general decline in the numbers of vessels and in vessel power in recent years does not necessarily equate to a reduction in fishing capacity as technological advances (e.g. the introduction of twin-rig trawling) may have greatly increased the catching power of the remaining vessels.

Recreational sea fishing effort in at least some parts of the UK has also declined in recent years due to declining fish stocks, as anglers redirect their effort to inland waters (C. Davies pers. comm in Fowler 1999).

**Table 1. The evolution of the UK fishing fleet since 1991**

| Year | Number of vessels | Gross Registered Tonnage | Gross Tonnage | Power (kW) |
|---|---|---|---|---|
| 1991 | 11,411 | 209,351 | | 1,228,931 |
| 1992 | 11,561 | 210,088 | | 1,262,034 |
| 1993 | 11,692 | 209,405 | | 1,271,359 |
| 1994 | 10,827 | 198,224 | | 1,197,341 |
| 1995 | 9,720 | 193,485 | | 1,136,749 |
| 1996 | 8,667 | 186,263 | 274,532 | 1,054,927 |
| 1997 | 8,458 | | 272,421 | 1,026,542 |
| 1998 | 8,271 | | 270,644 | 1,006,071 |
| 1999 | 8,039 | | 264,453 | 978,644 |
| 2000 | 7,818 | | 262,406 | 980,636 |
| 2001 | 7,721 | | 263,040 | 1,001,648 |
| 2002 | 7,578 | | 240,898 | 947,964 |
| Source:- Defra sea fisheries statistical tables 2003 | | | | |

Deep-water fisheries began in the late 1970s, since when effort has increased significantly in response to declining shelf stocks of whitefish and the development of markets for novel species. Estimating total effort in this fishery is very difficult as vessels are able to move rapidly between deep-water and traditional shelf fisheries. In 2002, France had 30 medium (32-40 m) and 22 large (50 – 55m) trawlers working in deep-water fisheries and 21 UK registered trawlers recorded significant landings of the main target species, roundnose grenadier. The introduction of TACs for deep-water species from 2003 brought about a marked decrease in effort from UK trawlers, which received a very small quota, and in that year, only 13 vessels reported landings of roundnose grenadier. French vessels received a much larger share of the TAC but overall catch levels were reduced and it is likely that there has been some reduction in overall effort. At least one French company has withdrawn all of its vessels from deep-water fisheries.

## 3.3 Past and present trends for yield

### 3.3.1 Physical yield

Yields in many commercial and recreational fisheries targeting stocks of chondrichthyan species have decreased very significantly over the past century, and particularly over the past three decades (see Figures 1, 2, & 3). Landings from many well-established fisheries in the Northeast Atlantic have declined or even ceased (Pawson and Vince 1999). Large-bodied species have been most seriously affected; several formerly abundant species including longnose skate, white skate and angel shark, are now almost completely absent from catches in UK waters and common skate is considered to be commercially extinct in the North Sea and Irish Sea (Brander 1981, Walker and Heessen 1996, Walker and Hislop 1998).

Official landings data for many species are relatively uninformative because of the failure over many years of most European countries to record landings at species level. This problem has now been addressed for some species but for others, e.g. skates and rays, accurate species-specific data is still lacking for most countries. Landings data for skates and rays (figure 1) contains a mixture of species, some of which are known to have declined significantly while others may be increasing in abundance; these changes are not apparent in mixed landings data. Landing for porbeagle shark and spurdogs (figures 2 and 3) must be taken to represent minimum values, as unknown quantities of these species are likely to have been recorded under other categories such as “sharks not identified” or “dogfish and hounds” or to have gone unrecorded altogether.

In 1969, total landings of non-teleost fishes from the Northeast Atlantic amounted to ~127 thousand tonnes, out of total landings of all finfish of over nine million tonnes, or about 1.4% (ICES Fisheries Statistics). Since then, there has been a more or less continuous decline, interrupted only by a slight increase over a four-year period in the early 1980s (Heessen 2003). The respective figures in 1982 were ~77 000 t out of almost 10 million tonnes, or ~0.77% (Figure 4). To put this into a global context, chondrichthyans have for many decades represented about 1% of world fin fish catches, the result of a pattern of declining catches in some regions (e.g. the Northeast Atlantic) being offset by increases elsewhere as fisheries develop (Bonfil 1994).

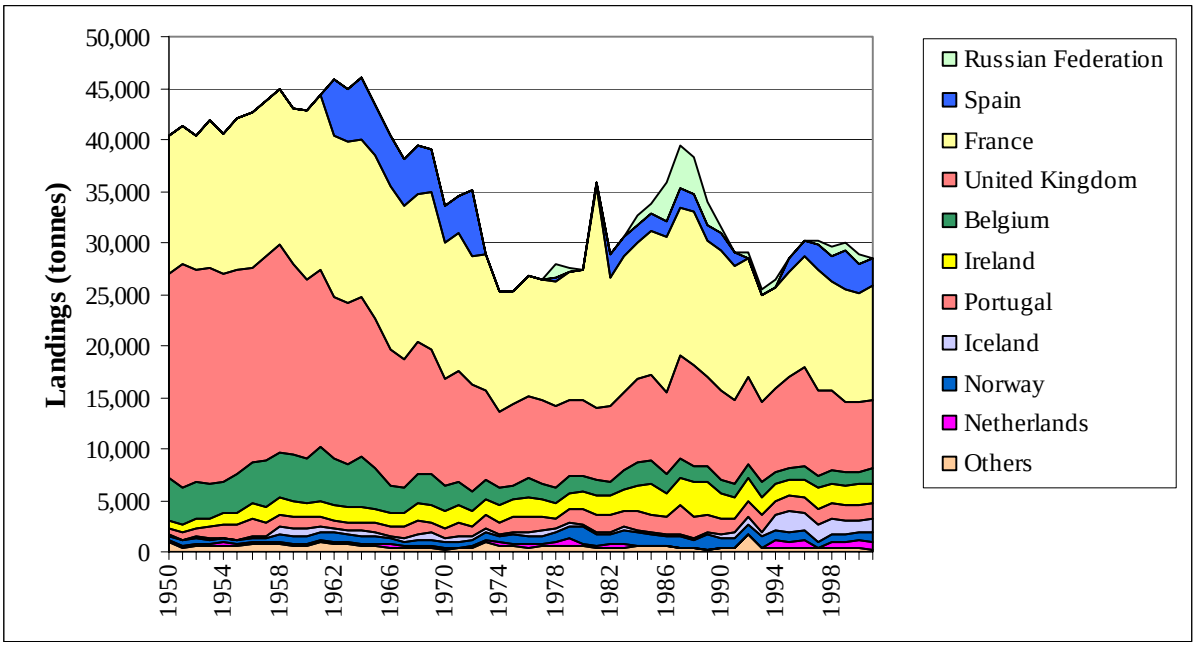


**Figure 1. Skate and ray landings from the NE Atlantic; data 1950–1972 from FAO, 1973-1998 ICES WG estimates, 1999-2001 WG estimates updated with data from STATLANT**

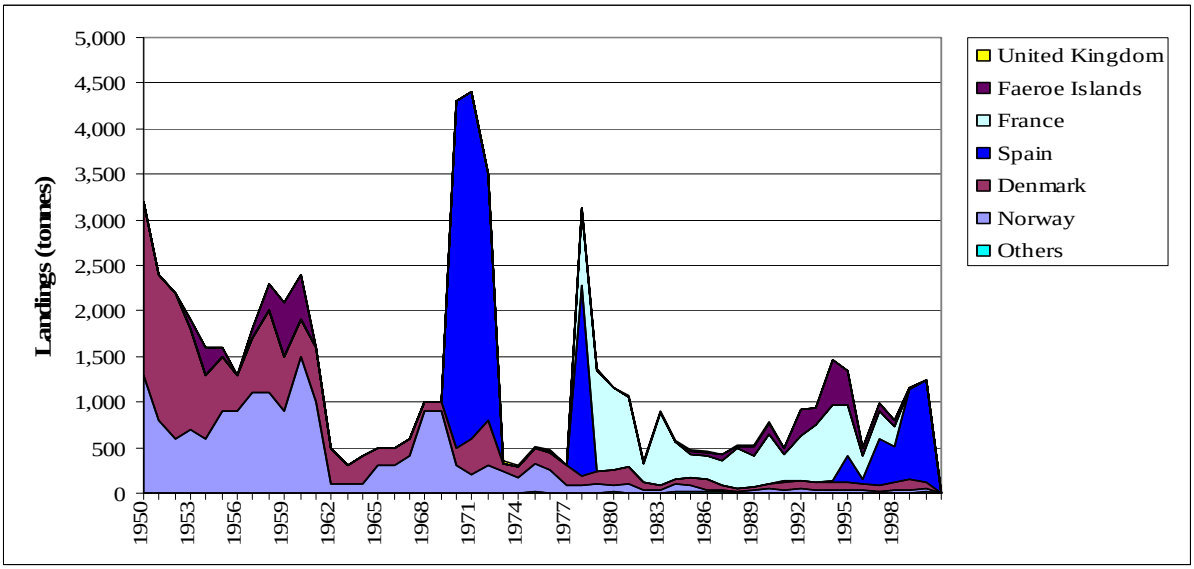


**Figure 2. Landings of Porbeagle sharks from the Northeast Atlantic: data 1950-1972 from FAO, 1973-2001 ICES working group estimates. Data after 2000 are provisional**

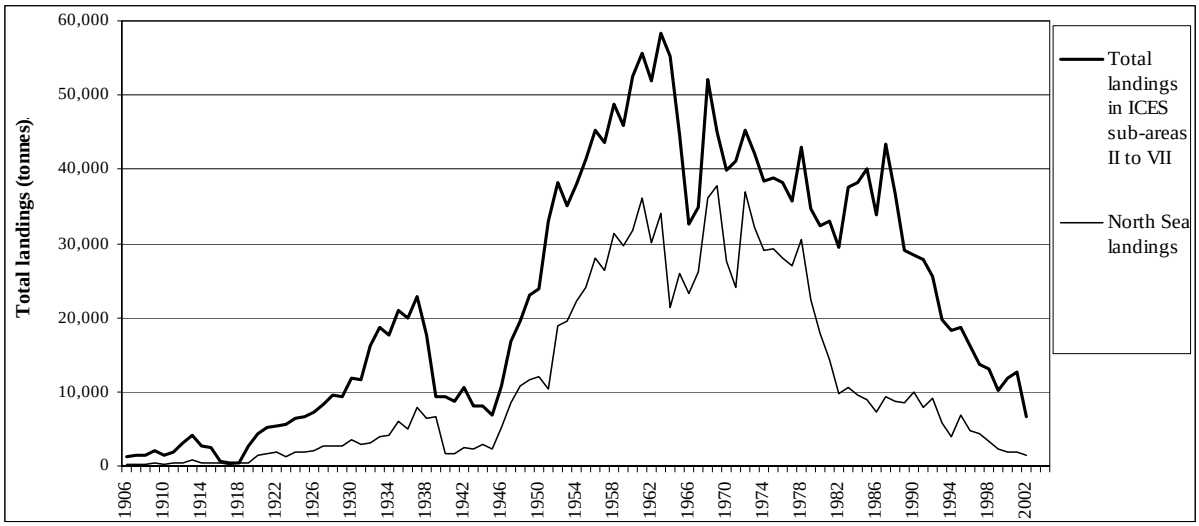


**Figure 3. Spurdog landings, ICES sub-areas II-VII, 1906-2002. Data after 2000 are provisional. (ICES statistics)**

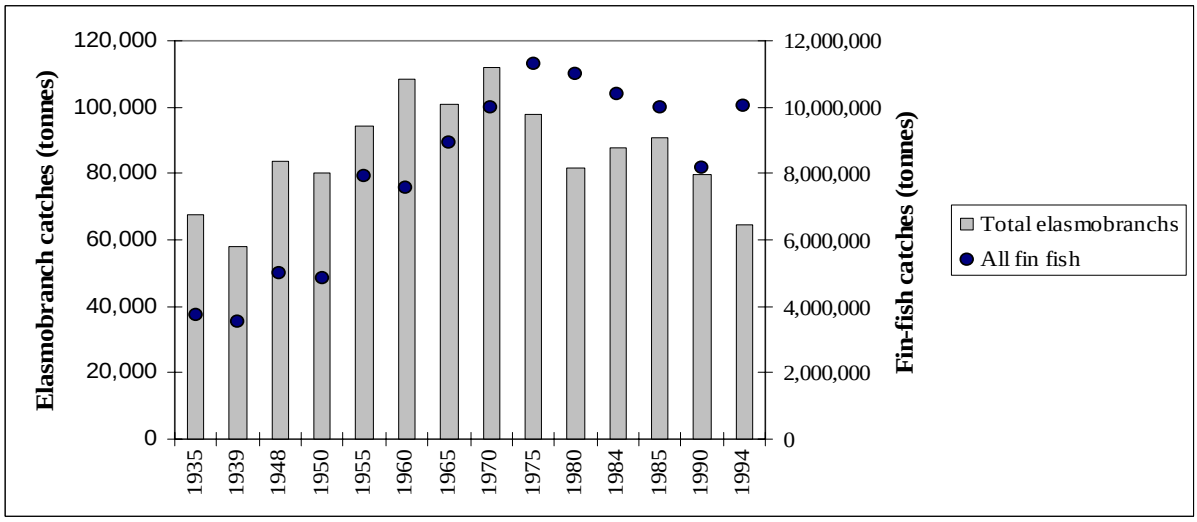


**Figure 4. Nominal catches of elasmobranchs and total fin-fish from the Northeast Atlantic in selected years, 1935-1994 (from Pawson and Vince 1999)**

## 3.3.2 Economic yields

The market price per kg obtained for skates and rays (several species) and dogfish, compared with cod prices, maintained its value well from 1960 to the late 1990s (see Table 2). The value of dogfish, in particular, increased significantly from a minimum of less than 40% to almost 80% of the value of cod (this may be due to strong market demand in continental Europe combined with declining catches). Skate prices fell after the 1960s and 1970s, when skate was more valuable than cod, but skate were still worth more than dogfish and their value almost comparable with that of cod in the mid-late 1990s. In most cases, the larger species and individuals of skates have a greater economic value than smaller species and individuals (this is also true for dogfish with mature females, which are larger than males, preferentially targeted). It is possible that economic yields from commercial chondrichthyan fisheries may, therefore, have declined not only because of falling landings, but also as a result of changes in the species composition and size composition of the remaining catch. The

average value of landings of skates and rays taken by beam trawl in 2002 was about £1000/t, while those taken on long lines (yielding larger higher quality fish) was £1350/t (Defra statistics 2002).

**Table 2. Average annual prices of cod, 'dogfish' and 'skates and rays' in the UK 1960–1996 (£/t; live-weight)** (from Pawson and Vince 1999).

| | **1960** | **1970** | **1980** | **1985** | **1990** | **1992** | **1993** | **1994** | **1995** | **1996** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cod** | 56.0 | 80.0 | 480.0 | 663.0 | 1087.0 | 1150.0 | 1002.0 | 990.0 | 884.0 | 921.0 |
| **Dogfish** | 26.0 | 48.0 | 200.0 | 248.0 | 681.0 | 712.0 | 706.0 | 767.0 | 704.0 | 722.0 |
| ***As % of cod.*** | 46.4 | 60.0 | 41.7 | 37.4 | 62.6 | 61.9 | 70.5 | 77.5 | 79.6 | 78.4 |
| **Skates and rays** | 62.0 | 103.0 | 382.0 | 381.0 | 641.0 | 743.0 | 813.0 | 867.0 | 865.0 | 893.0 |
| ***As % of cod.*** | 110.7 | 128.8 | 79.6 | 57.5 | 59.0 | 64.6 | 81.1 | 87.6 | 97.9 | 97.0 |

Pawson and Vince (1999) suggest that the catching and processing of chondrichthyans probably create wealth and, where they are taken as bycatch, may make the difference between profitability and loss; however, as is the case for many other fisheries in the region, they probably do not make an economic profit *per se*. A socio-economic review of recreational sea angling in England and Wales commissioned by Defra is due to report at the end of 2004. It is not known whether the value of recreational and commercial fisheries specifically for chondrichthyans will be assessed. Other similar studies, however, have identified the economic returns from recreational angling as being significantly higher in many cases than benefits from commercial fisheries (e.g. Picket *et al.*1995, Pawson and Vince 1999, Nautilus Consultants 2000, South Wales Sea Fisheries Committee 2000). Most of these studies focused on Wales, where many anglers target chondrichthyans. Fowler (1999) reported that the estimated number of active anglers rose from 1.5 million in the 1970s to around 3 million in the late 1990s, with an economic value calculated by the National Anglers Council of over £1 billion per annum. The overall number of active sea anglers, however, had apparently fallen in Southwest England since the 1970s and 1980s, as coastal fish stocks declined, with many anglers having moved to better-stocked inland waters. Over the same period there has been a trend towards sea anglers releasing their catch alive (this has particularly been the case for larger less common species, including skates, rays and sharks).

## 3.4 Status of stocks

The status of the majority of chondrichthyan stocks around the British coast is poorly known but many of those that have been studied are thought to be severely depleted and it is very likely that the majority of other species are similarly depleted. Some of the largest bodied species, which are morphologically the most vulnerable to fisheries and usually also biologically most vulnerable to over exploitation, have been extirpated or virtually extirpated from coastal waters (e.g. white skate, common skate and angel shark, all of which were formerly common in UK waters). Conversely, stocks of some of the smallest, most fecund species are either stable or have increased as a result of their low commercial value coupled with competitive release as larger species of chondrichthyan and teleost have been depleted.

Historically, efforts to assess quantitatively the state of chondrichthyan stocks in the Northeast Atlantic have been very limited. Holden (1974) drew attention to the likely unsustainable nature of elasmobranch fishes in the Northeast Atlantic. Meetings of the ICES

Study Group on Elasmobranch Fisheries (SGEF) in 1997 and 1999 were unable to perform any formal assessments, chiefly due to lack of data. Consequently, the EC-funded "Development of Elasmobranch Assessments" (DELASS) project was initiated in 1998. This project made some progress in improving the quality of landings data and attempted assessments for nine "case study" stocks. Of these, spurdog (Northeast Atlantic), kitefin shark (Azores), and thornback ray (North Sea) were found to have suffered severe declines and were considered to be depleted (Heessen 2003).

Knowledge of the structure of exploited stocks, an essential prerequisite for meaningful assessment and management, is also lacking. The DELASS study evaluated some of the available methodologies for studying stock identity and attempted to define biological stocks for the nine "case study" species and STECF recommended management units for species in EU waters based on known or assumed biological stocks (SGRST 2003). These studies have identified a number of species for which there are insufficient data to reliably infer the extent of biological stock units and in these cases stock structure was assumed on the basis of limited information.

The status of chondrichthyans recorded from UK waters and adjacent areas of the Northeast Atlantic is presented in Table 3 (the majority of these are deep-water species that occur well offshore). Where stock assessments have not been performed or have proved inconclusive, other evidence, such as declining CPUE, declining catches in conjunction with increasing or stable prices, anecdotal evidence of "missing" species and status of exploited populations elsewhere has been used to infer status in UK waters.

Spurdog has a worldwide distribution in shelf waters. France, United Kingdom, Norway and Ireland all take spurdog in directed fisheries that continue to operate locally and seasonally and as an important utilised bycatch in otter trawls and seines aimed principally at whitefish. There is believed to be one unit stock in the Northeast Atlantic and considerable progress has been made in the assessment of this stock. Preliminary assessments were carried out under the DELASS project using a variety of methodologies which suggested that the stock is seriously depleted, one assessment putting it as low as 2 - 9% of virgin biomass (Heesen 2003). Compagno (1984) describes this species as possibly the most abundant living shark, but this was before recent stock assessments quantified the significant declines in several populations.

The International Council for the Conservation of Atlantic Tunas (ICCAT) collects data on shark (mostly blue shark) bycatch from tuna fisheries, but has not yet been able to produce a stock assessment due to the inadequate data provided by its members. For that reason, DELASS was unable to assess the status of the single North Atlantic stock of blue shark, but other sources report significant declines in CPUE since the 1980s. Simpfendorfer *et al*. (2002) report an approximate 80% decline in male blue shark CPUE between the mid-1980s and the early 1990s (no significant change in female catch rates was found). Baum *et al*. (2003) analysed logbook data from US pelagic longline fleets targeting swordfish and tunas in the Northwest Atlantic, identifying a 60% decline in blue shark abundance from the mid 1980s to 2000.

Porbeagle sharks are often taken as a bycatch in trawls, seines, pelagic and bottom gill nets and by surface longlines set for billfish and tunas. No attempt has been made to assess this species in the Northeast Atlantic. There has been a well-documented depletion of the Northwest Atlantic stock to about 11% of baseline by target fisheries, despite the exclusion of

European vessels from the Canadian EEZ in the 1970s and the more recent introduction of quotas for Canadian vessels. In view of the considerably longer period of exploitation in the Northeast Atlantic and the lack of effective management, it seems highly likely that the Northeast Atlantic stock is even more severely depleted.

Combined landings data for Northeast Atlantic stocks of the deep-water Portuguese dogfish and leafscale gulper shark indicate a decline, but lack of differentiation between these species in landings data make independent analyses difficult. Trends in CPUE derived from Irish and Norwegian longline and SAMS trawl surveys indicate very severe declines in abundance of both species. The greatest declines were observed for leafscale gulper shark which, because of its shallower depth distribution, has probably been subject to greater pressure from fisheries. Although usually considered together, these species have very different life history strategies which may result in differing levels of resilience to exploitation. Leafscale gulper sharks have lower fecundity than Portuguese dogfish but may in fact be less vulnerable because mature and gravid females are not exploited (Hareide, 2003). A regulation on deep-water fisheries was implemented in January 2003 one of the requirements of which is to have observers onboard fishing vessels to gather data. The collected data will then be available for the review of the regulation in 2004.

In contrast to these declining trends, Heessen (2003) noted that some smaller, rapidly growing and more fecund species, some of which are discarded from catches and may survive well, have increased in abundance. Cuckoo ray (Celtic Sea) has shown signs of increase and then decrease in the 1990s, while the lesser spotted dogfish has shown an increase over the period 1991 to 2001 in the Cantabrian Sea. No assessment was possible under DELASS for the deep-water black-mouthed dogfish.

Increased awareness of the biological vulnerability of many chondrichthyan species, their marine biodiversity value, poor status as a result of unregulated fishing activity, and their potential importance as keystone species has led to increased public awareness of the importance of their conservation. This has led to the establishment of non-governmental organisations to promote their conservation and management, the adoption of chondrichthyan conservation programmes by existing NGOs and the addition of threatened species to national and international biodiversity instruments. The IUCN Shark Specialist Group is assessing the status of the chondrichthyans regionally and worldwide, drawing upon a number of the scientific and fisheries information sources noted above. This may lead to some species being placed on lists of threatened species. Appendix 2 presents IUCN Red List assessments for those species reviewed up to 2003 (www.redlist.org). More information will become available in 2004 as IUCN Red List Assessments for many Northeast Atlantic and deep-water species are completed, reviewed and published.

The ICES Working Group on Elasmobranch Fishes (WGEF) developed a list of species of conservation concern in the ICES area, assigning them to the following three levels of priority based on available data for the listed species from their entire range (ICES 2003). The analysis considered references from other regions where the taxa have declined because in several cases similar data are not yet available from the ICES area. This list has been amended to reflect species occurring within UK waters (Table 4).

**Priority 1:** Taxa requiring urgent assessment because of their high conservation importance and/or vulnerability and/or inclusion in international instruments. These species are very likely to be the subject of requests to ICES for information.

**Priority 2:** Taxa requiring analysis of their status in the ICES area because of conservation concerns. Some of these are a higher conservation priority on a worldwide scale, but the ICES area (and UK waters) represent only a small part of their range.

**Priority 3:** Species of lower priority because they may only occur very rarely in the ICES area (possibly not at all in UK waters), are not listed on any international instrument, or although listed where data indicate that they are of favourable biological status in the ICES area.

**Table 3. The status of chondrichthyan species in the UK and adjacent waters**

| Species (see appendix 1 for scientific names) | Probably extirpated | Nearly extirpated | Depleted | Stable or increasing | Unknown | Comments |
|---|---|---|---|---|---|---|
| Frilled shark | | | | | ✓ | |
| Seven-gilled shark | | | | | ✓ | |
| Six-gilled shark | | | | | ✓ | Population depletion reported elsewhere in the world. |
| Bramble shark | | | | | ✓ | |
| Spurdog | | | ✓ | | | Assessed under DELASS. Seriously depleted and still exploited at unsustainable levels. |
| Gulper shark | | | ? | | ✓ | At the edge of its range in UK waters but depleted elsewhere. Genus extremely vulnerable to overexploitation by fisheries. |
| Leafscale gulper shark | | | ✓ | | | Probably severely depleted. Genus extremely vulnerable to overexploitation by fisheries. |
| Birdbeak dogfish | | | | | ✓ | |
| Black dogfish | | | | | ✓ | |
| Great Lantern-shark | | | | | ✓ | |
| Velvet belly | | | | | ✓ | |
| Longnose Velvet shark | | | ? | | | Large numbers caught and discarded by deep-water trawlers. |
| Portuguese Dogfish | | | ✓ | | | Important commercial species, all life stages fished, populations thought to be in serious decline, but landings data are inadequate at species level. |
| Knifetooth dogfish | | | | | ✓ | |
| Greenland shark | | | ✓ | | | Fished in northern NE Atlantic, where some evidence of depletion. Not regularly reported in UK. |
| Angular Rough-shark | | | | | ✓ | |
| Sailfin rough-shark | | | | | ✓ | |
| Kitefin shark | | | ? | | | Seriously depleted around the Azores. Was abundant in MAFF surveys west of the UK in the 1970s but now rarely seen in surveys or commercial fisheries. |

| Species (see appendix 1 for scientific names) | Probably extirpated | Nearly extirpated | Depleted | Stable or increasing | Unknown | Comments |
|---|---|---|---|---|---|---|
| Angel shark | | ✓ | | | | Proposed for legal protection in British waters. |
| Thresher shark | | | ✓ | | | ~80% decline reported in northwest Atlantic. |
| Basking shark | | | ✓ | | | Steep decline in former target fisheries. Protected in British waters. |
| Shortfin mako | | | ✓ | | | High value, important in pelagic bycatch. Widely distributed in N. Atlantic, highly migratory. |
| Porbeagle shark | | | ✓ | | | High value, important in pelagic bycatch, targeted in some areas. |
| Black-mouthed dogfish | | | | | ✓ | DELASS unable to undertake stock assessment. |
| Mouse catshark | | | | | ✓ | |
| Iceland catshark | | | | | ✓ | |
| Ghost catshark | | | | | ✓ | |
| Deep-water catshark | | | | | ✓ | |
| Lesser spotted dogfish | | | | ✓ | | |
| Bull huss | | | | | ✓ | |
| False catshark | | | | | ✓ | |
| Tope | | | ✓ | | | Mainly bycatch, limited commercial importance in NE Atlantic, targeted elsewhere. Important in recreational fisheries. |
| Smoothhound | | | | | ✓ | |
| Starry smoothhound | | | | | ✓ | |
| Blue shark | | | ✓ | | | 60-80% declines reported in Northwest Atlantic. |
| Hammerhead | | | | | vagrant | |
| White skate | ✓ | | | | | Proposed for legal protection in British waters. Large bodied and vulnerable to over-exploitation by fisheries. |
| Common skate | | ✓ | | | | Proposed for legal protection in British waters. Nominated by OSPAR as threatened/declining species. Large bodied and vulnerable to over-exploitation by fisheries. Still occurs off NW Scotland. |

| Species (see appendix 1 for scientific names) | Probably extirpated | Nearly extirpated | Depleted | Stable or increasing | Unknown | Comments |
|---|---|---|---|---|---|---|
| Blonde ray | | | ✓ | | | Large bodied and vulnerable to over-exploitation by fisheries. |
| Sandy ray | | | | | ✓ | |
| Thornback ray | | | ✓ | | | Assessed under DELASS. In decline in some coastal waters. |
| Shagreen ray | | | | | ✓ | Fairly large bodied and vulnerable to over-exploitation by fisheries. Still occurs off northern Scotland. |
| Small-eyed ray | | | | | ✓ | Commercially important, particularly in Bristol Channel. |
| Undulate ray | | | | | ✓ | |
| Spotted ray | | | | ✓ | | Fairly small body size. Commercially important. |
| Cuckoo ray | | | | ✓ | | Small body size. Commercially important. |
| Long-nose skate | | ✓ | | | | Proposed for legal protection in British waters. Large bodied and vulnerable to over-exploitation by fisheries. |
| Starry ray | | | | ✓ | | Small body size, usually discarded. |
| Norwegian skate | | | | | ✓ | Proposed for legal protection in British waters. Large bodied and vulnerable to over-exploitation by fisheries. |
| Round ray | | | | | ✓ | Small body size, usually discarded. |
| Arctic skate | | | | | ✓ | Usually discarded. |
| Spinetail ray | | | | | ✓ | |
| Mid-Atlantic skate | | | | | ✓ | |
| Deep-water ray | | | | | ✓ | |
| Bigelow's ray | | | | | ✓ | |
| Krefft's ray | | | | | ✓ | |
| Blue ray | | | | | ✓ | |
| Rabbitfish | | | | | ✓ | Landed as utilised bycatch |
| Large-eyed Rabbitfish | | | | | ✓ | Landed as utilised bycatch |
| Ghost Rabbitfish | | | | | ✓ | Landed as utilised bycatch |

| Species (see appendix 1 for scientific names) | Probably extirpated | Nearly extirpated | Depleted | Stable or increasing | Unknown | Comments |
|---|---|---|---|---|---|---|
| Small-eyed Rabbitfish | | | | | ✓ | Landed as utilised bycatch |
| Narrownose chimaera | | | | | ✓ | Discarded from commercial fisheries |
| Spearnose chimaera | | | | | ✓ | Discarded from commercial fisheries |

**Table 4. Priority shark species for conservation assessment and management in UK waters (Adapted from ICES 2003 and STECF 2003)**
See page 24 for explanation of priority ratings

| Taxa | Priority | Rationale | | | | |
|---|---|---|---|---|---|---|
| | | **Biology** | **Trend** | **Policy/Legislation** | **IUCN Red List** | **Comments** |
| Six-gilled shark *Hexanchus griseus* | 2 | Large, deep-water species. Possibly low 'r' | Other regional populations depleted (no data from NE Atlantic) | UN Fish Stocks Agreement. Unmanaged | Near Threatened Globally | Requires management under UNCLOS (Cook *et al*. in press) |
| Spurdog *Squalus acanthias* | 1 | Biologically highly vulnerable (low 'r') | Severely depleted | Unmanaged. | Near Threatened globally. (Endangered in the NE Atlantic) | A commercial species assessed under the DELASS project (Heessen 2003) and likely to be the subject of continued work by WGEF. Unsuccessfully proposed in EU 2004 for consideration for CITES II listing. (Fordham *et al*. in press) |
| Genus *Centrophorus* Gulper sharks | 1 | Genus extremely vulnerable to exploitation. 'Widely distributed species' may prove to be many similar endemics or completely discrete stocks. All available CPUE and fisheries-independent data indicate steep (possibly irreversible) declines. Unmanaged | | | | (Cavanagh *et al*. 2003, Daley *et al*. 2002, Graham *et al*. 2001) |
| Leafscale gulper shark *Centrophorus squamosus* | 1 | " | CPUE decline data from autolines in northern area | Unmanaged | Not evaluated | A commercial species with preliminary assessment under the DELASS project (Heessen 2003). Likely to be the subject of continued work. (SGRST 2002) |
| Gulper shark *Centrophorus granulosus* | 2 | " | See *C. uyato* | Unmanaged | Vulnerable globally | Probably at the limit of its range in UK waters. This may include *C. uyato* (IUCN Red List 2000) |
| Lowfin gulper shark *Centrophorus lusitanicus* | 2 | " | ? | Unmanaged | Not evaluated | Occurs, if at all, as a vagrant in UK waters |
| Dwarf gulper shark *Centrophorus uyato*-like species | 2 | " | Over 99% decline in 20 years off NSW | Unmanaged | Critically Endangered in Australasia | This may not be a valid species in the North Atlantic (Cavanagh *et al*. 2003, Daley *et al*. 2002, Graham *et al*. 2001) |
| Greenland shark *Somniosus microcephalus* | 2 | Large-bodied species vulnerable to target fisheries | Evidence of declines and local extirpations | Unmanaged | Not evaluated | The relative importance of over-fishing and hydrographic changes is unknown (IUCN Red List 2000) |

| Taxa | Priority | Rationale | | | | |
|---|---|---|---|---|---|---|
| | | **Biology** | **Trend** | **Policy/Legislation** | **IUCN Red List** | **Comments** |
| Kitefin shark *Dalatias licha* | 2 | High biological vulnerability (low 'r') | Commercially exploited stock in Azores has shown severe decline and may be depleted | Unmanaged | Data deficient globally, Near Threatened NE Atlantic | Occasionally discarded by deep-water fisheries in UK waters. A commercial species elsewhere, with preliminary assessment under the DELASS project. Likely to be the subject of continued work (Heessen 2003, Compagno *et al*. in press) |
| Family Squatinidae Angel sharks | 1 | Highly vulnerable to over-exploitation because of biology and habitat (inshore, large size, low fecundity), low dispersal and limited recolonisation. All documented populations apparently in decline and/or with local extirpations. Unmanaged | | | | |
| Angel shark *Squatina squatina* | 1 | As above. Restricted to Northeast Atlantic and Mediterranean. Vulnerable throughout range to bycatch | Becoming increasingly uncommon. Extirpated from parts of its former range. | UK 4QR (2001). Annex III Barcelona Convention; Annex III Bern Convention. Unmanaged | Vulnerable | OSPAR nomination supported by SGEF (ICES 2002). (Rogers and Ellis 2000) |
| Thresher shark *Alopias vulpinus* | 1 | Biologically vulnerable to target and bycatch fisheries | Severe decline and population collapse in Northwest Atlantic | UN Fish Stocks Agreement. Unmanaged | Data deficient, under review | Requires co-ordinated management and assessment under UNCLOS (Baum *et al*. 2003). |
| Basking shark *Cetorhinus maximus* | 1 | Extremely vulnerable to fisheries (low 'r') | Significant decline in landings while value remained high. | UN Fish Stocks Agreement CITES, OSPAR, CMS, Bern, Barcelona Conventions. GB protected and UK BAP species. | Vulnerable, Endangered in the Northeast Atlantic | OSPAR nomination supported by SGEF (ICES 2002). Zero quota in EU waters. |
| White shark *Carcharodon carcharias* | 2 | | Severely depleted | CMS/CITES III (Australia)/Bern. UN Fish Stocks Agreement. Unmanaged | Vulnerable | Likely very rare and only occasionally reported in ICES area. 2004 proposal for CITES II listing. (Baum *et al*. 2003). |
| Porbeagle shark *Lamna nasus* | 1 | Biological vulnerability | Extreme depletion | UK Biodiversity priority list. UN Fish Stocks Agreement. Unmanaged | Near Threatened, Vulnerable in NE Atlantic | Important, high value pelagic long-line species targeted in some areas. Unsuccessfully proposed in EU in 2004 for consideration for CITES II listing. (Anon 1995) |
| Tope *Galeorhinus galeus* | 2 | Biological vulnerable. Some populations severely depleted. | | UK Biodiversity priority list. Unmanaged | Vulnerable | Commercial and recreational fisheries in EU waters. Seriously depleted in some parts of the world. (Anon 1995) |

| Taxa | Priority | Rationale | | | | |
|---|---|---|---|---|---|---|
| | | **Biology** | **Trend** | **Policy/Legislation** | **IUCN Red List** | **Comments** |
| Family Carcharhinidae requiem sharks | | | | UN Fish Stocks Agreement. | | |
| Blue shark *Prionace glauca* | 2 | Moderately fecund | Heavily exploited as target and bycatch. Depleted | UK species of biodiversity concern. Unmanaged | Near Threatened | Studied by DELASS and subject to ongoing work by WGEF/ICCAT (Baum *et al*. 2003, Anon 1995) |
| Smooth hammerhead *Sphyrna zygaena* | 2 | " | ? | " | Near Threatened | A vagrant in UK waters |
| White skate *Rostroraja alba* | 1 | Large size, highly vulnerable to over-exploitation | Decline | Annex III Barcelona Convention. Annex III Bern Convention. UK 4QR (2001). Unmanaged | Not evaluated | OSPAR nomination supported by SGEF (2002). (Dulvy and Reynolds. 2002) |
| Common skate *Dipturus batis* | 1 | Large size, highly vulnerable to over-exploitation. Endemic to NE Atlantic. | Severely declined in shelf seas. Still fished on shelf edge. | UK 4QR (2001). OSPAR. UK Biodiversity Action Plan, Barcelona Convention. Unmanaged | EN globally, CR in shelf seas | OSPAR nomination supported by SGEF (2002). (Dulvy *et al*. 2002, Brander 1981) |
| Norwegian skate *Dipturus nidarosiensis* | 2 | Large size, highly vulnerable to over-exploitation | Unknown | UK 4QR (2001). Unmanaged | Not evaluated | (Dulvy *et al*. 2002) |
| Long-nose skate *Dipturus oxyrinchus* | 1 | Large size, highly vulnerable to over-exploitation | Declined following historic records of target fishery | UK 4QR (2001). Unmanaged | Not evaluated | (Dulvy *et al*. 2002) |
| Thornback ray *Raja clavata* | 2 | Moderately large size, sensitive to exploitation | Severely depleted Still heavily fished. | | Near Threatened | North Sea stock nominated for OSPAR, supported by SGEF 2002 (Heessen 2003) |
| Spotted ray *Raja montagui* | 3 | Small, relatively fecund species | Recent historical increase in abundance and range. Trend stable (if not increasing) | OSPAR Convention | Not evaluated | Would not be included on this list if not for proposed OSPAR listing, which was not supported by SGEF 2002. |

## 3.5 International trade

Patterns of international trade in spurdog and porbeagle shark have been reviewed by TRAFFIC Europe under contract to the German CITES Authority. Northeast Atlantic fisheries can no longer supply the European market because the stock is so depleted. The largest EU importers of spurdog are France, Denmark, Italy and the UK, as indicated by Eurostats, but imports of spurdog into the EU are now also declining (Figures 5 and 6). The largest exporters to the EU include the USA, which has heavily depleted its stocks (these are shared with Canada, which also exports to the EU), while Norway shares the seriously depleted Northeast Atlantic stock. New Zealand exports from a fishery that is believed to be sustainably managed. Some shark meat imports recorded as spurdog (e.g. from Argentina) may actually be tope or smoothhound species, which are also high value species in Europe. The UK and EU also imports some high value shark meat from a number of areas and states in the Indian, Pacific and Atlantic Oceans. These are not recorded to species level in statistics but likely include porbeagle, mako, thresher and blackfin sharks. Small quantities of processed shark fin products are imported, primarily for the restaurant trade. The UK ships porbeagle shark, spurdog, and ray wings to mainland Europe and exports raw shark fin to East Asia for processing.

The Convention on International Trade in Endangered Species (CITES) establishes the international legal framework for the prevention of trade in endangered species, and for regulation of trade in species that might become endangered without such regulation. The convention currently lists three species of shark on its appendices: basking shark (proposed by the UK) and whale shark (a tropical species that occurs in the waters of some UK Overseas Territories) on Appendix II, and white shark on Appendix III. The latter is also proposed (by Australia & Madagascar) for consideration for Appendix II listing at the Conference of Parties in 2004. Appendix II listings require international trade to be regulated and monitored to ensure that it is not detrimental to the status of the listed species. It provides a mechanism for international co-operation in trade regulation, enabling consumer countries to support management efforts of producer countries. Germany recently (2003/2004) requested the EU to agree to submit proposals to list two of Europe's most valuable, heavily fished and over-exploited shark species (spurdog and porbeagle shark) on Appendix II of CITES. The proposal failed to attract sufficient support from other EC Member States and, accordingly, has not been submitted as a CITES listing proposal.

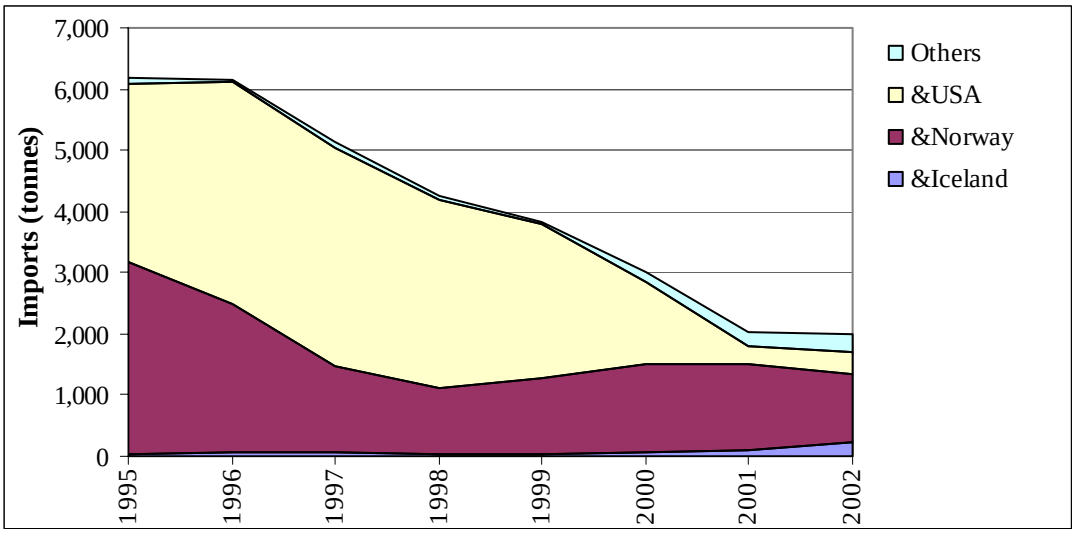


**Figure 5. Imports of fresh/chilled spurdog to the EU (Eurostats data)**

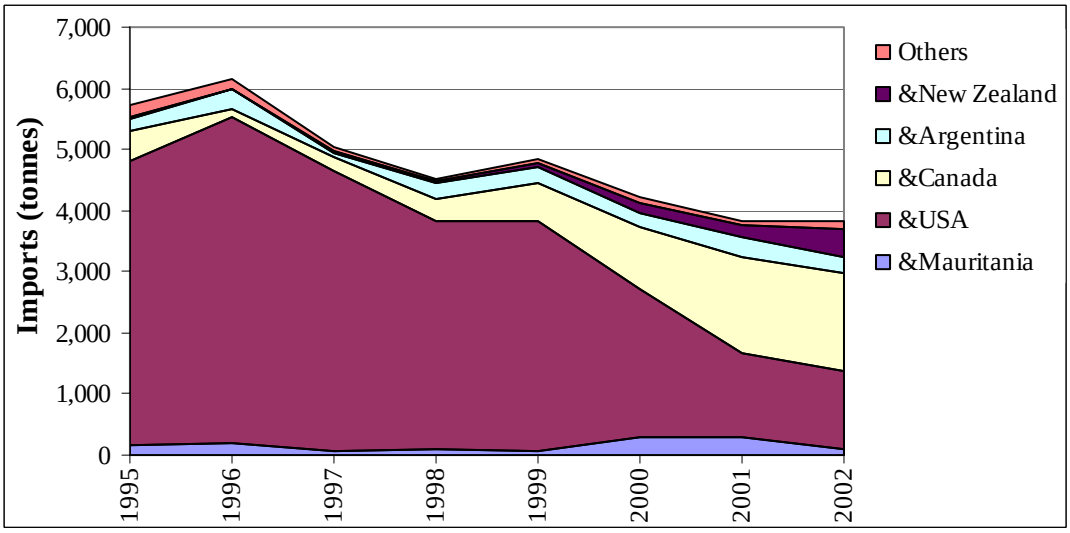


**Figure 6. Imports of frozen spurdog to the EU (Eurostats data)**

## 3.6 Management measures

Pawson and Vince (1999) noted the lack of catch controls and monitoring at species level for most chondrichthyans taken in the Northeast Atlantic despite their acknowledged biological vulnerability. The management measures currently in place which are of direct or potential relevance to the management of chondrichthyans in UK and European waters are set out below. Most are only indirect management measures, not targeted specifically for the sustainable management of chondrichthyans and are therefore of limited value for this purpose.

### 3.6.1 Control of access to fishing grounds

Under international law, states are able to exercise exclusive control over fishing zones extending to 200 nautical miles from their coastline. In the Northeast Atlantic, the exclusive fishing zones of EU Member States are managed as a single Community fishing zone to

which the vessels of all Member States have equal access. The European Common Fisheries Policy (CFP) sets out the rules applicable to fisheries in these waters but rules can also be applied to Community fishing vessels wherever they fish. Other non-EU countries with traditional fisheries in EU waters must negotiate for quota allocations (see resource access agreements, below).

Under a derogation from the principle of equal access, EU Member States have authority to apply additional management measures to fisheries within their territorial waters out to 12 nautical miles from the baseline. Within 6 nautical miles of the baseline, the coastal state has exclusive access but between 6 and 12 nautical miles, access must be permitted for vessels of other Member States if historic fishing rights exist. Coastal states have powers to introduce non-discriminatory measures applying to all vessels within their 12 nautical mile territorial waters for the purpose of conserving both fisheries and the marine ecosystem. Member States can also take measures, applicable exclusively to their own vessels, for the conservation of stocks in all waters under their sovereignty (out to 200 nautical miles). Measures introduced on a unilateral basis that do not apply to all EU vessels fishing in an area can, without support from the fishing industry, be seen as inequitable and are unpopular.

Since 2002, Council Regulation 2347/2002 has restricted fishing effort in deep water by stipulating that vessels landing deep-water species must carry a special deep-water license. Total tonnage and power of vessels licensed to fish in deep water is capped at the maximum level recorded in 2000.

### 3.6.2 Catch limits

**Total allowable catches** (TACs) have been set by the EU for skates/rays and spurdog in the North Sea only. These are ‘precautionary’ TACs, meaning that they are not based on stock assessments. They are not, however, precautionary in the sense that they restrict catches to more precautionary levels (i.e. lower) in order reduce the risk of stock depletion where there is scientific uncertainty. Rather, they are based on historic catch levels. Figures 7 and 8 illustrates that for many years, catches have been significantly lower than recently set quotas for spurdog and for skates and rays in the North Sea. TACs at their current level therefore do nothing to control the exploitation of these species.

In January 1998, a precautionary TAC for skates and rays of 6,060 tonnes was introduced for EU waters of ICES division IIa and the North Sea based on landing statistics from the previous five years. This TAC has been progressively reduced, but the 2004 level of 3,503 tonnes for the EC and UK quota of 2,266 are still much greater than the recent landings and therefore not effectively constraining catches.

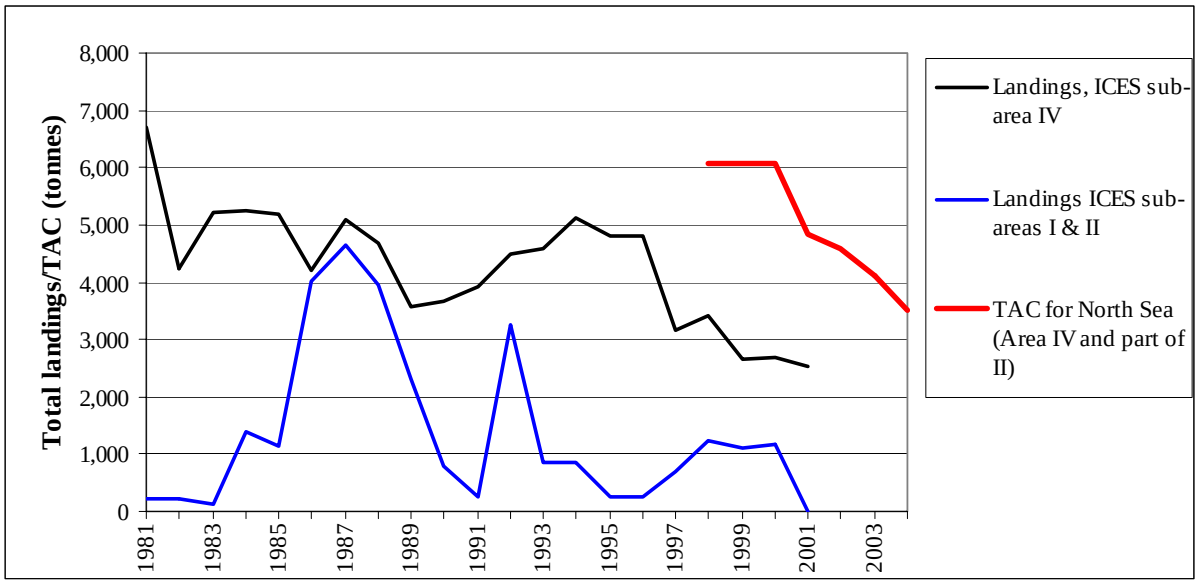


**Figure 7. Skate and ray TAC and landings in North Sea (ICES sub-area IV) and Norwegian sea (sub-areas I and II), 1981-2002 (Data from ICES. Landings after 2000 are provisional)**

The EC quota for spurdog in the North Sea has been progressively reduced from 8,870 tonnes in 2000 to 4,472 in 2004 and the UK allocated quota from 7,177 tonnes to 3,618 over the same period. This figure is still over three times the recently recorded UK landings from the North Sea. Additionally, the amount of discarding of this species is not taken into account when setting the TAC.

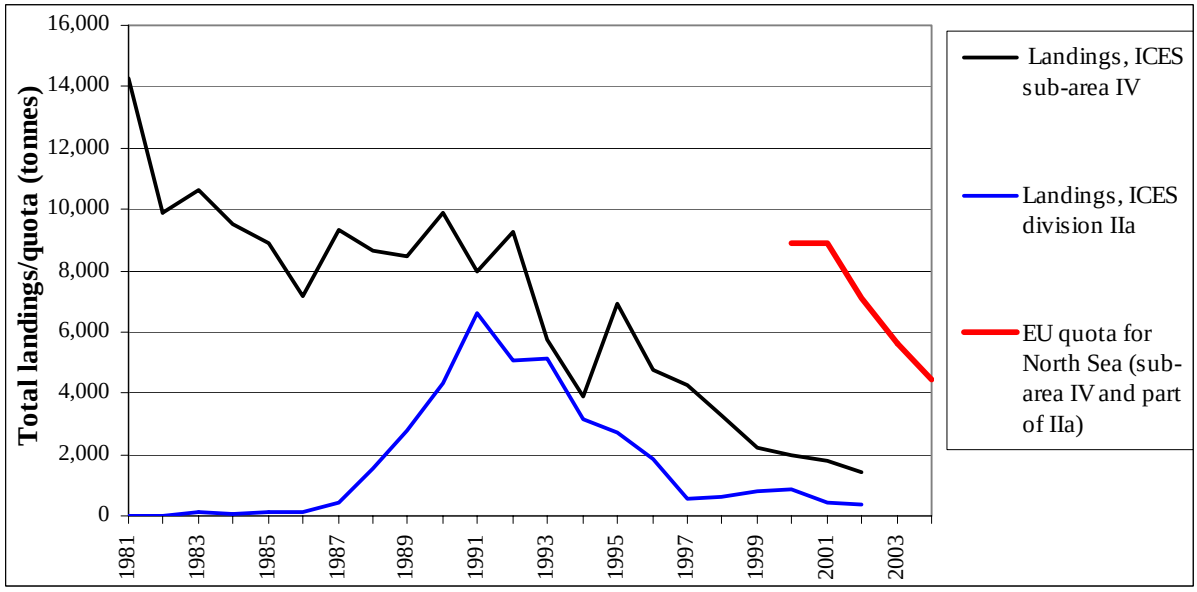


**Figure 8. EU quota for spurdog and total international landings in the North Sea (sub-area IV) and Norwegian Sea (division IIa) reported to ICES, 1981-2002 (Data from ICES. Landings after 2000 are provisional)**

Since 2002, the EU has set a zero TAC for basking sharks in ICES sub-areas IV, VI and VII thus effectively preventing their exploitation in Community waters.

**Resource access agreements** have been established with Norway and the Faroe Islands to allow these states to take quotas of some chondrichthyans in EU waters, but not within territorial waters (0-12 nautical miles from baseline). The quota allocated to Norway under

this agreement for basking sharks has been reduced to zero. Norway has been allocated a quota of 100 tonnes of porbeagle shark and the Faroe Islands 125 tonnes (fished by long line in ICES sub-areas IV, VI and VII) and Norway has a quota of 200 tonnes of spurdog (Including catches taken with long lines of tope and some deep-water sharks). Figure 9 shows porbeagle shark quota allocated to non-Community states in comparison with recent total landings for all States from ICES sub-areas I to VII.

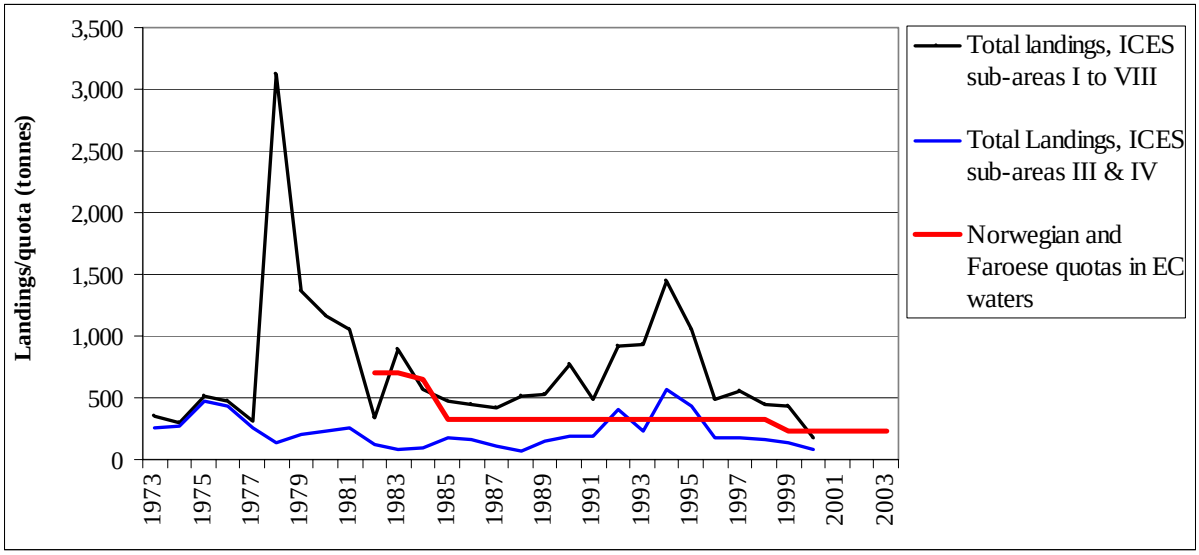


**Figure 9. Landings of porbeagle shark Lamna nasus from ICES sub-areas I to VIII and quotas agreed under EU access agreements. (Data from ICES)**

## 3.6.3 Technical measures

**Technical gear measures.** Council Regulation 850/98 sets a mesh size of 80-99 mm for vessels fishing with towed gears and targeting skates and rays or dogfish (Scyliorhinidae) (i.e. with either of these species comprising at least 70% of the catch). Few, if any vessels fishing in UK waters will come into this category. Other vessels are obliged to use mesh sizes set with the objective of releasing juveniles of the target, teleost species. In most cases, these will be inappropriate for the management of chondrichthyans and particularly for skates which, by virtue of their shape and comparatively large size at birth, are not easily released through meshes. Mesh limits currently in force for towed gears vary according to the target species and may also be varied to take account of the use of square mesh panels.

Within inshore waters, the relevant authorities (Welsh Assembly Government (WAG), the Scottish Executive Environment and Rural Affairs Department (SEERAD), the Department of Agriculture and Rural Development for Northern Ireland (DARD) and the various Sea Fisheries Committees) have introduced more local regulations. For example, the Inshore Fishing (Monofilament Gill Nets) (Scotland) Order 1996 prohibits any UK vessel from using or carrying gill nets with mesh less than 250mm within six nautical miles of the baseline.

**Minimum Landing Sizes** based on species biology have been introduced by some Sea Fisheries Committees within 0-6 miles of English and Welsh coasts for skates and rays and by Norway (in territorial waters only) for spurdog. The aim is to reduce mortality on juveniles and increase proportion of stocks surviving to maturity. Unfortunately, the MLS for skates have been set for all species, regardless of size at maturity and maximum size. This means that the smallest species (which are also the most fecund, resilient to fisheries

exploitation, and whose stocks are stable or increasing) are protected throughout their entire life cycle, while the larger, more vulnerable, species are still at risk. There is no MLS protection for any species of shark, skate or ray at an EU level.

### 3.6.4 Fleet capacity reduction

The third and fourth European Multi-Annual Guidance Programmes (MAGP III and IV), which operated between 1992 and 2002, aimed to reduce excess capacity in member states' fleets and hence fishing mortality. Under these programmes, the UK has offered decommissioning payments to fishing vessel owners who permanently remove their vessels from the fleet. This was intended as a measure to reduce mortality on gadoid stocks but has undoubtedly had additional benefits for exploited chondrichthyan species.

### 3.6.5 Other management measures

**Protected species status** has been granted to the basking shark in the territorial waters of Britain and the Isle of Man. Protected status in British waters under the Wildlife and Countryside Act 1981 has been under consideration since 1991 for angel shark, common skate, Norwegian skate, long-nose skate, and white skate. All of these species were recommended for addition to Schedule 5 of the Wildlife and Countryside Act 1981 in the JNCC's 4$^{th}$ Quinquennial Review of the act in 2001. Their addition to the act will be subject to the results of a public consultation to be carried out later this year.

Basking sharks and common skates are the subject of Species Action Plans under the UK **Biodiversity Action Plan** and deep-water sharks are covered by in the grouped species plan for deep-water species.

## 3.7 Monitoring, control and surveillance

The general lack of management for chondrichthyans means that there is only very limited monitoring, control and surveillance activity focused upon these taxa. Very few species of chondrichthyan have had TACs allocated or any control measures and there is therefore no requirement for catches (whether retained or discarded) to be entered in logbooks for the majority of species.

Vessels are required to make a declaration of their catches of all species at the time of landing. In the case of some chondrichthyans, there is no requirement to identify catches to species level and consequently they are often reported in grouped categories such as "skates and rays" or "dogfish and hounds". This has severely limited the availability of statistical information by species. Several European countries, including England, Wales and Scotland, have put in place market sampling programs. Length frequency data for spurdog has been recorded since 1983 and species composition and length frequency data for landings of skates and rays since 2000.

Council Regulation No 1639/2001 of 25 July 2001 established the minimum and extended Community programmes for the collection of data in the fisheries sector. This regulation is a framework for the collection and management of data needed to implement the CFP. It is intended to harmonise data collection within EU and standardise accuracy of data to ensure

that scientists and others with a responsibility for making decisions about the management of fisheries are provided with sufficient information.

There is no requirement for vessels to record catch of any species that are discarded at sea. Discard monitoring has generally been targeted on commercially important species such as gadoids but discards of other species are recorded. FRS Marine Laboratory, Aberdeen has collected discard data from Scottish fisheries going back to 1979 but the current systems for accessing elasmobranch discard data are cumbersome. New and ongoing database developments should make this much more straightforward.

## 3.8 Effectiveness of management measures

As explained above, quotas are in place for skates and rays (all species combined) and spurdog in the North Sea, and minimum landing sizes have been set for skates and rays in some British coastal regions under the jurisdiction of Sea Fisheries Committees. These are inadequate to stem the current declining trend in chondrichthyan populations and effective management measures are needed, either through the adaptation of existing mechanisms or the development of new mechanisms.

## 3.9 Management advice

ICES has been evaluating the status of chondrichthyan fisheries through its Study Group (latterly Working Group) on Elasmobranch Fishes (WGEF) since 1989. WGEF has attempted assessments of spurdog, blue shark, Portuguese dogfish, leafscale gulper shark, thornback ray and cuckoo ray in the ICES area and starry ray in the Northwest Atlantic. To date, available data and the quality of assessments have proved inadequate to assess stocks relative to reference levels of biomass (B) and fishing mortality (F), as is the norm in teleost fisheries.

The European Commission's Scientific, Technical and Economic Committee on Fisheries (STECF) Sub-Group on Elasmobranch Fisheries has been asked to "identify possible desirable management objectives and strategies for the various species or group of species and fisheries targeting elasmobranchs". In 2003 the sub-group identified appropriate stock and management units for some elasmobranchs and recommended objectives and contents for a Community Plan of Action for Sharks, but did not develop any species-specific management recommendations on quotas. In recent years, STECF (which reviews ICES advice and proposes quotas for fish stocks where ICES has chosen not to provide advice due, for example, to lacking or uncertain stock assessments) has been developing quota recommendations for spurdog and skates/rays in the North Sea.

## 3.10 Other threats

Although over-exploitation by fisheries appears to pose the greatest threat to the survival of chondrichthyan populations, other threats, including those posed by habitat-loss, pollution, climate change and sub-sea electric cables must also be considered. These may pose particular threats to chondrichthyans which, because of their K-selected life history, tend to be unable to adapt readily to a rapidly changing environment. These influences may become particularly significant where species are already severely depleted by fisheries and, either alone or acting in conjunction with ongoing fisheries mortality, may be sufficient to inhibit recovery.

### 3.10.1 Habitat degradation and loss

In order to sustain viable populations, any species must have access to suitable habitat to sustain its life-cycle. Habitat requirements vary for different species at different stages in their life cycles and may include spawning and pupping grounds, nursery areas and adult feeding habitat. Activities with the potential to restrict the availability of critical habitats include, but are not restricted to, benthic damage from mobile fishing gears, land reclamation, construction of tidal barrages and aggregate extraction. Anthropogenic effects on habitat are likely to be greatest close to land thus species that depend on inshore breeding or nursery ground or that are dependent throughout their lives on inshore areas or estuaries are likely to be most affected. The habitat requirements of sharks and rays around the UK are poorly known, and therefore little is known about the location of such areas. Research could include mapping the distribution of egg cases and occurrence of gravid females or juveniles as well as of the seasonal distribution of adults.

When projects are proposed which are likely to have an effect on marine habitats, the presence of chondrichthyan species in the area and potential impacts on the population of habitat change or destruction should be considered in the planning process.

### 3.10.2 Pollution

Persistent pollutants including heavy metals and organic compounds such as PCBs can be accumulated through time in individual organisms (bio-accumulation) or can increase in concentration as they are passed through the food chain (bio-amplification) leading to concentrations far in excess of background levels. Chondrichthyans, being long-lived and often acting as top predators in the food chain, may be particularly at risk from bio-accumulation and bio-amplification. No studies are known to have been undertaken into the toxic effects of pollutants on sharks and rays in UK waters but Manire *et al* (2001) found that high levels of infertility in bonnethead sharks *Sphyrna tiburo* along the Florida coast could be correlated with organochloride concentrations. Such effects could inhibit recovery from exploitation.

### 3.10.3 Ecotourism

In recent years, a small but growing industry has offered tourists the opportunity to view basking sharks in the wild. This activity can be entirely boat-based or can involve swimming, snorkelling or diving with the sharks. The effects of the activities of boats or divers on the feeding or other behaviour of the sharks are not known. Although likely to be minor in comparison with the effects of fishing, it is possible that such disturbance may prevent the recovery of an already depleted species, particularly if breeding is affected.

Under the Wildlife and Countryside Act 1981 and Schedule 12 of the Countryside and Rights of Way Act 2000, it is illegal to intentionally or recklessly disturb basking sharks in the territorial waters of England and Wales. The Marine Conservation Society and other NGOs have published a basking shark code (Shark Trust, 2004) and encourage members of the public and commercial operators to follow it.

Recreational tag and release of sharks and rays can cause disturbance and injury to the subjects and should only be undertaken with due care by experienced individuals.

### 3.10.4 Climate change and ozone thinning

Predicted effects of long-term anthropogenic climate change include changes in sea level, water temperature, tidal patterns and storm frequency. It is likely that these factors will result in ecosystem change and that such change will ultimately affect the abundance of top predators such as many chondrichthyans. Climate change is particularly likely to affect those species that rely on predictable timing of specific conditions to coincide with migrations or particular life history events such as spawning or egg-hatching. Ozone thinning has the potential to affect the abundance and mix of phytoplankton species and such changes are likely to have effects further up the ecosystem.

### 3.10.5 Electric cables

Many chondrichthyan species use the electric fields of prey species to detect potential food, and some use the earth's magnetic field for navigation (Gill and Taylor 2001). Electric cables can induce fields with a range of strengths that could either attract or repel electrosensitive fish and thus could act as barriers to their natural movements (CMACS, 2003). Although the theoretical possibility of such interactions exists, there has been little *in-situ* observation of chondrichthyan behaviour in relation to cables. These effects are considered to explain reports of damage from shark bites to sub-sea cables (Musick and McMillan 2003) and such effects may be increased in areas of strong tidal flow (Walker 2001). The development of offshore renewable power sources, such as wind-farms, will be accompanied by an increase in sub-sea cabling in a limited number of areas in UK waters. If these areas are important to chondrichthyan populations, then there may be detrimental effects. Further research is required to establish the effects of cables on chondrichthyan behaviour and the importance of wind-farm development areas for chondrichthyans. Walker and Heessen (1996) show that both the Greater Thames and Greater Wash strategic wind areas are important for thornback and spotted rays in a North Sea context.

# 4. Plan of Action for sharks in UK Waters

The IPOA-Sharks suggests that member states of the FAO that have shark fisheries should voluntarily develop an NPOA-Sharks to ensure the conservation and management of sharks. The EU represents its member states within FAO, but the UK is also a member state of FAO in its own right. The NPOA should identify research, monitoring and management needs for all chondrichthyan fishes that occur in their waters. In implementing the IPOA, States are urged to ensure effective conservation and management of sharks that are transboundary, straddling, highly migratory and high seas stocks.

This section of this document makes suggestions and recommendations for the conservation of sharks in UK's European waters. It does not cover UK's high seas fisheries for these species or fisheries in UK Overseas Territories, which require separate attention. As noted above, the EU has exclusive competence for fishery matters, with UK having only limited powers on its own. This document identifies what can and should be done at the UK level and makes suggestions for promoting action at the EU level.

The FAO IPOA-Sharks states that Shark Plans should aim to:

- Ensure that shark catches from directed and non-directed fisheries are sustainable;
- Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use;
- Identify and provide special attention, in particular to vulnerable or threatened shark stocks;
- Improve and develop frameworks for establishing and co-ordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;
- Minimize unutilized incidental catches of sharks;
- Contribute to the protection of biodiversity and ecosystem structure and function;
- Minimize waste and discards from shark catches in accordance with article 7.2.2.(g) of the Code of Conduct for Responsible Fisheries (for example, requiring the retention of sharks from which fins are removed);
- Encourage full use of dead sharks;
- Facilitate improved species-specific catch and landings data and monitoring of shark catches;
- Facilitate the identification and reporting of species-specific biological and trade data.

The Shark Plan should contain:

**A. Description of the prevailing state of:**

- Shark stocks, populations;
- Associated fisheries; and,
- Management framework and its enforcement.

**B. The objective of the Shark Plan.**

**C. Strategies for achieving objectives. The following are illustrative examples of what could be included:**

- Ascertain control over access of fishing vessels to shark stocks
- Decrease fishing effort for shark species caught unsustainably
- Improve the utilization of sharks caught
- Improve data collection and monitoring of shark fisheries
- Train all concerned in identification of shark species
- Facilitate and encourage research on little known shark species
- Obtain utilization and trade data on shark species

The descriptions required under point A. have been addressed in chapters 2 and 3.

## 4.1 Objectives of the Plan of Action for sharks in UK waters

Recommended overall objective for sharks in UK waters:

***To ensure the conservation and management of sharks, skates, rays and chimaeras occurring in the European waters of the UK and taken in target and incidental fisheries by the UK fleet.***

The following ten sub-objectives are listed in the FAO IPOA-Sharks. Each raises important issues for consideration when considering the conservation and management of UK and European shark species and fisheries.

**Objective 1: Ensure that shark catches from directed and non-directed fisheries are sustainable**

**Issues:** There have, until very recently, been no explicit national or regional management objectives to maintain stocks and no concerted attempt to manage directed or bycatch shark fisheries in Europe. A few local initiatives (e.g. seeking to manage target or multi-species skate and ray fisheries in England and Wales by introducing minimum landing sizes) are still at an early stage and may not yet be capable of allowing stocks to rebuild or ensuring that fisheries are biologically sustainable (particularly when not backed by complementary

measures in other UK and EU waters). The recent TACs introduced for skates/rays and spurdog in the North Sea and the access agreements with Norway and the Faroe Islands are based solely on levels of former catches rather than on a process of stock assessment, do not take into account the uncertainty due to mis-reporting or discarded bycatch, and cannot therefore be regarded as a tool for delivering sustainable fisheries. The only possibly effective management actions currently taken for chondrichthyans in UK waters are the zero TAC for basking sharks and the protection afforded this species by the Wildlife and Countryside Act 1981. These initiatives were introduced in recognition of the stock depletion that resulted from an earlier lack of fisheries management, and not with the objective of achieving sustainable fisheries.

**Objective 2: Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use**

**Issues:** The lack of research and monitoring activity targeted at chondrichthyans and the consequent lack of data on which to base assessments of threat, to identify critical habitats and to make recommendations for sustainable harvesting strategies currently make it almost impossible to deliver these aims in Europe. In the absence of analytical assessments, the main indicators of stock abundance continue to be catch per unit effort (CPUE) data from logbooks, scientific surveys and catch returns. The DELASS report (Heessen 2003) makes a number of recommendations for improving data collection and research activity that would improve future stock assessments.

**Objective 3: Identify and provide special attention, in particular to vulnerable or threatened shark stocks**

**Issues:** Virtually all chondrichthyan species are, by virtue of their life history characteristics, biologically 'vulnerable' to over-exploitation. Many stocks and species are also 'threatened', if threatened status is classified as a combination of biological vulnerability and past, current or likely future declines under current levels of unmanaged fishing mortality. The long history of unmanaged fisheries in European waters have resulted in serious declines in the majority of stocks that are or were the subject of targeted fisheries or which are taken as bycatch. These declines are apparent in several ways, ranging from declining trends in CPUE, catches and landings (in the absence of other data, these can be used as indicators of population status), to anecdotal information regarding 'missing' species. Indeed, the only species that are apparently not currently threatened are the smallest and most fecund species of rays and catsharks (landings and CPUE for these species appear to be stable or rising) and probably also a few small pelagic or deep-water species for which there are no target and few bycatch fisheries. Tables 3 and 4 in chapter three of this report make an initial identification of threatened stocks and species in the Northeast Atlantic.

**Objective 4: Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives**

**Issue:** There is no national framework that involves all stakeholders in research, management and educational activities. The development of Regional Advisory Councils (RACs) under the revised CFP framework regulation may provide an opportunity to meet this objective, although it seems unlikely that chondrichthyans will be an early priority of these Councils.

**Objective 5: Minimize unutilised incidental catches of sharks**
**Issue:** Most of the current mortality that prevents the recovery of depleted stocks arises from bycatch in fisheries targeted on other species. If chondrichthyan stocks are to recover so that they can once more support viable fisheries, it is essential to reduce incidental catch and mortality. Technical measures, such as the closure of areas supporting seasonal aggregations or the introduction of bycatch reduction or exclusion devices in fishing gear could help achieve this aim.

**Objective 6: Contribute to the protection of biodiversity and ecosystem structure and function**
**Issue:** As noted above, little is known about which habitats are used by chondrichthyans throughout their life cycle. There is also little knowledge of the role that they play in the ecosystem though, as top predators, this role may be important. Research is required on both of these topics before we can identify the precise needs for the conservation of essential habitat for chondrichthyans.

**Objective 7: Minimize waste and discards from shark catches**
**Issue:** This objective derives from article 7.2.2.(g) of the Code of Conduct for Responsible Fisheries: the need to minimise pollution, waste, discards, catch by lost or abandoned gear, catch of non-target fish and non-fish species, and to minimise impacts on associated and dependent species through the use of selective, environmentally-safe and cost-effective fishing gear and techniques. This target is relevant to all shark fisheries (both target and bycatch). The practice of finning sharks (removing the fins and discarding the remainder of the fish at sea) should cease. Although the EU has recently adopted Council Regulation (EC) No 1185/2003 to prohibit finning in EU waters and by EU vessels worldwide, many of the provisions of the original draft supported by the UK were lost during the consultation process, resulting in some significant loopholes. NGOs are urging that EU Member States with shark fisheries enact their own, more effective finning regulations. Member States are required to report to the Commission annually on implementation of the regulation. The Commission is required to report to the European Parliament and the Council no later than 1 January 2006 on the operation of the regulation, and to submit any amendment (based on the advice of STECF).

**Objective 8: Encourage full use of dead sharks**
**Issue:** This objective is closely linked with Objective 7 and raises most of the same considerations. Captured sharks should be utilised for their meat and preferably also other products, as well as their fins.

**Objective 9: Facilitate improved species-specific catch and landings data and monitoring of shark catches**
**Issue:** All reviews of the monitoring and management of chondrichthyan fisheries agree that current data collection and collation in the UK and EU is seriously inadequate. There is a need to prepare identification sheets/publications for all fisheries, but particularly for deep-water sharks, skates, and rays; initiate data collection and biological sampling to improve knowledge on biology and exploitation patterns; and to explore alternative methods to evaluate the status of chondrichthyan stocks. Current records on chondrichthyan catches kept by fishers are inadequate and systems in place to collate this information centrally need upgrading.

**Objective 10: Facilitate the identification and reporting of species-specific biological and trade data**

**Issue:** Stock assessments of chondrichthyans in UK waters rely at present on life history information and data from a small group of species studied by the DELASS project (Heessen 2003). Information on distribution, stock structure, and life history characteristics remains extremely limited. There is therefore a need to collect commercial fishery size composition data by species, to increase at-sea sampling of directed landings and bycatch, and to improve the identification of the species composition of the catch (particularly for those species such as 'dogfish' and 'skates and rays' which are only rarely recorded to species level). Similarly, trade data are only rarely recorded at species level; this issue is the subject of debate within the CITES Animals Committee, which has been asked by the World Customs Organisation to advise on species and shark products that should be recorded in trade.

## 4.2 Strategies for achieving the objectives of the plan of action for sharks in UK waters

The Technical Guidelines for the conservation and management of sharks (FAO 2000) identify four elements of the IPOA-Sharks relating to the principles of 'ecologically sustainable development' and 'inter-generation equity', in that they should provide ongoing benefits to successive generations of humans:

- The management requirements of shark fishery resources for sustainable use
- The particular conservation needs of some shark and other chondrichthyan species
- The need for maintenance of biodiversity through viability of shark populations
- The need for habitat protection.

Box 1 lists major categories of actions required under each of these headings, with the actions expanded in more detail in the following pages.

## 4.3 Timetable for implementation of FAO IPOA-sharks

In view of the considerable length of time necessary to move from the current position in Europe of largely unmanaged, depleted and threatened stocks, towards rebuilt, sustainably managed stocks and fisheries, the timetable for implementation of the FAO IPOA-Sharks must be far longer than the four-year review process recommended in the text of the IPOA. The long life span and slow maturation of many sharks often means that the effects of fishing and of management will not be apparent until 15-20 years after initiation (Camhi *et al*. 1998). The most recent stock assessment for the US Atlantic population of spurdog, which has experienced a 75% depletion of mature females since the fishery started in 1989, indicates that an effective recovery plan will take decades to succeed. For the Northeast Atlantic population of this species, which has been targeted for much longer and is now seriously depleted, such a plan would obviously take much longer to succeed. It is therefore necessary that measures adopted under the Shark Plan should be applied and monitored over a period of several decades.

## 4.4 Delivery, monitoring and reporting

Delivering the objectives of the Shark Plan in the UK will require cooperation between a wide range of agencies and organisation and will ultimately require management measures to be implemented by a number of statutory bodies.

Defra has direct responsibility for the management (within the CFP), monitoring and policing of the offshore fisheries of England and Wales. For inshore waters, many of these functions are carried out by the 12 regional Sea Fisheries Committees (SFCs) and the Welsh Assembly Government. In the seas around Scotland and Northern Ireland, both inshore and offshore, these functions are devolved to Scottish Executive, and the Department of Agriculture and Rural Development for Northern Ireland (DARD). Statutory responsibilities for nature conservation within territorial waters are carried out by the three country conservation agencies and the Environment and Heritage Service in Northern Ireland and, outside territorial waters, by the JNCC.

Many of the powers that would be necessary to implement the Shark Plan are thus devolved from UK central government. Implementing the plan will require action from Defra, the Welsh Assembly, Scottish Executive and DARD and close consultation with these bodies will be necessary in drawing up a detailed management plan and implementing legislation. In order to ensure coordination between the various agencies and administrations and to monitor progress in meeting the objectives of the Shark Plan, it will be necessary to set up an implementation group. The IPOA calls for reporting every two years to assess the progress of the SAR and Shark Plan; this reporting will be the responsibility of Defra. As part of this report, the Implementation Group would be required to report on its progress in implementing the Shark Plan. It would therefore be appropriate to set the groups meeting schedule to correspond to the FAO reporting schedule.

## Box 1. Recommended actions under the Plan for sharks in UK waters

**Management requirements for sustainable use**

1. Improve data collection and scientific research at species level on:
   - Catches
   - Effort
   - Landings
2. Determine biological stock structure of species occurring in UK waters
3. Develop stock assessments and provision of fisheries advice.
4. Introduce truly precautionary management in the absence of stock assessments, including measures to prevent targeted fisheries for stocks which are considered to be depleted below safe biological limits.
5. Control fishing mortality by:
   - limiting fishing effort and/or catch
   - employing biological controls such as legal minimum sizes,
   - technical controls such as prescribed fishing mesh or hook sizes, closed seasons and closed areas,
   - through the above measures, closure of target fisheries harvesting depleted stocks.

**Species conservation**

1. Assess status of all stocks in UK waters
2. Identify species/stocks in need of special protection.
3. Identify the major threats to each species/stock.
4. Introduce appropriate conservation and fisheries management measures for each species/stock (e.g. legal protection, prohibition of certain fishing gears, closed or restricted areas).

**Biodiversity maintenance**

1. Identify threats to chondrichthyan biodiversity arising from increased mortality, loss or degradation of habitat, environmental changes, competition with other species, or other ecological changes.
2. Assess the urgency of each threat and the extent to which these may feasibly be addressed through management.
3. Introduce appropriate measures for the management of chondrichthyan biodiversity.

**Habitat protection**

1. Identify critical chondrichthyan habitats (particularly pupping, egg laying and nursery grounds, and seasonal feeding or breeding aggregations).
2. Identify the main threats to these habitats and to their use by chondrichthyans.
3. Introduce appropriate management to address threats to chondrichthyan biodiversity.

## 4.5 Recommendations for UK and EU action

Action to conserve sharks, rays and chimaeras in UK waters is required at EU and UK levels. The following recommendations include actions that should be included in Community and UK Shark Management Plans.

The first priorities should be:

- to introduce fisheries and conservation management measures, based on existing knowledge of biology and other data available. The precautionary approach should be applied where such data are not available;

- to improve the resources available to chondrichthyan monitoring and research, enabling the initiation of a significantly improved programme of research, monitoring, data collation and analysis to inform future management measures;

- to introduce and implement a continual process of reviews of data, research outputs and fisheries performance, in order to fine-tune future management decisions.

**Precautionary conservation and management measures**

The key challenges with implementing management of chondrichthyan fisheries include:

- achieving sustainable management of fisheries that take species of different productivity, or when species are taken in two or more fisheries;

- ensuring that data collection, assessment and research are sufficient and adequate;

- achieving consistent and complementary management arrangements across fisheries, particularly where the fisheries extend across administrative boundaries;

- ensuring that adequate resources are assigned to the above.

The objectives of a Shark Plan will be met if the following measures are implemented. Many of these measures require actions that are within the exclusive competence of the European Union and therefore cannot be taken by the UK independently. These include the setting of quotas, the closure of areas outside the 12 nm limit and the specification of gear types. Other management actions, such as certain technical measures, can be taken by the UK in isolation only where they apply exclusively to vessels registered in the UK. However such measures may be unpopular among fishers and could be subject to legal challenge. For each of the recommendations below, the appropriate level at which action should be taken (e.g. UK, EU, ICES) is indicated. Where recommendations are identified as EU actions, they could form the basis of UK policy position in any European negotiations and are recommended for inclusion in a Community Plan of Action for chondrichthyans.

**(1) Species identification, data collection and data handling**

Lack of adequate data is a major constraint on the development of scientific fisheries management and conservation advice. The following actions are required to address this.

- The development of identification guides to improve the ability of all fishermen (commercial and recreational) to identify target, bycatch and legally protected species taken in UK waters and all areas where UK vessels fish. These guidelines could be accompanied by training courses. (UK,EU)

- The identification of gaps and deficiencies in current data sets in order to address these in future data collection, collation and analysis systems. (UK,EU,ICES)

- Improvement of landings recording to ensure, where possible, that landings data from all fisheries catching chondrichthyans are recorded at species level. Where this is impossible, market sampling should be implemented with sufficient coverage to enable disaggregation of combined landings at an appropriate level of spatial and temporal resolution. (UK,EU)

- Inclusion of sampling of chondrichthyan landings at an adequate level to allow assessment of species composition and length frequency for all landed species in the minimum and extended sampling programs (as set out under EC regulation 1639/2001) of all Member States. (UK,EU)

- The use of logbooks and observer programmes to collect reliable data on directed and incidental catch, discards, and CPUE in fisheries that take chondrichthyans. These data may also help to improve knowledge of the spatial distribution of species, locations and characteristics of nursery areas and of essential habitat (UK,EU)

- Improved collation and data sharing within the UK, the EU, other North Atlantic states and Regional Fisheries Management Organisations (RFMOs) so as to improve ability to undertake collaborative stock assessments. These assessments should determine whether the level of total fishing mortality of shark, chimaera, skate, and ray species is sustainable, provide the advice necessary for the development of stock rebuilding programmes and enable collaborative management programmes to be established. UK,EU, ICES, ICCAT, NEAFC, NAFO)

**(2) Stock assessments**

Stock assessments are essential tools for the management of chondrichthyan species, stocks and fisheries. Lack of data makes the development of more robust and quantitative stock assessments and evaluations of threatened status difficult to perform. The following actions are therefore high priority:

- Identify gaps and deficiencies in current data and address these (see (1)). (UK,EU,ICES)

- Undertake research to identify biologically meaningful stock units for assessment purposes (UK,EU,ICES)

- Devote increased effort to the collection of fishery-independent data that will allow the development of more appropriate abundance indices. (UK,EU)

- Use the most appropriate and quantitative methods and best available data when undertaking stock assessments and/or Population Viability Analyses. (UK,EU,ICES)

- Undertake species or stock specific assessments for target and non-target species at regular intervals. (UK,EU,ICES)

- Where detailed stock assessments are not possible, undertake regular, biennial, semi-quantitative assessments of the risk profile of all European chondrichthyan fish stocks and species, including non-commercial species, categorising each into high, medium or low risk, based on their susceptibility to capture by various fishing methods and their resilience, or ability to recover from depletion. (UK,EU,ICES)

- For the majority of data-poor species, evaluations should use the semi-quantitative IUCN Red List criteria and those recommended by FAO for the listing under CITES of commercially exploited aquatic species. These combine evaluation of biological vulnerability with an assessment of the extent of recent or historic stock declines, either over a period relevant to the life cycle of the species studied (IUCN), or from an historic baseline (FAO). (UK,EU,ICES)

- Improve the understanding of impacts of changes to the marine environment on chondrichthyan species by mapping species' distributions, biological productivity and migration patterns, and critical habitats (which for some species includes nursery areas and aggregation sites for feeding, mating and pupping). (UK,EU,ICES)

**(3) Management and conservation measures**

- Use the above to develop species specific TACs and quotas at least for the major targeted and bycatch species, taking into account the nature of multi-species fisheries. (EU)

- For exploited stocks for which stock assessment is not possible, reduce catches to levels that are likely to ensure stock recovery or sustainability in accordance with the precautionary approach. (EU)

- Introduce effort reductions in fisheries that take the most vulnerable species. (EU)

- Establish closed areas where concentrations of threatened or vulnerable species are located. These closures should not apply to types of fishing that can be demonstrated to have minimal detrimental effect, either at certain times of year or using gear that does not take a bycatch of these species. (UK(for inshore waters),EU)

- Implement effective recovery programs for depleted species including porbeagle shark, spurdog, thornback ray and common skate. (EU)

In addition to the management actions above, rare species and species with poor conservation status may require special protection or management. Certain chondrichthyan species are more vulnerable to exploitation than others due to exceptionally low productivity, restricted ranges, susceptibility to certain fishing gears, international fishing effort, or other relevant factors (Smith *et al.*, 1998). Currently, the basking shark is listed on Schedule 5 of the Wildlife and Countryside Act 1981 and five more species of chondrichthyan fishes were proposed for listing in 2001.

- Common skate, black skate, long-nose skate, white skate and angel shark should be added to Schedule 5 of the Wildlife and Countryside Act 1981, as recommended in the 4th Quinquennial Review of the act. All of these species would benefit from strict legal protection, and can be expected to survive release from fishing gear relatively well. Full protection would prohibit deliberate targeting of these species within territorial waters and require live release of bycatch. It would also make it illegal to possess or sell in the UK specimens caught outside territorial waters. Much of the benefit of protection would arise from good practice measures designed to prevent the fish being caught as bycatch and promote the release alive of bycaught species. Implementation will require further legislation requiring skates to be landed in a form that can be identified to species level; i.e. with wings and skin attached. (UK)

- Lists should be prepared of additional threatened species which qualify for addition to relevant annexes of the European Species and Habitats Directive, Berne Convention, Barcelona Convention, Convention on Migratory Species, OSPAR and/or CITES. (UK, EU, ICES)

**(4) Technical measures**

The following technical measures should be implemented.

- Introduce minimum landing sizes for specified species-groups of skates and rays immediately. (UK(for inshore waters), EU)

- Establish maximum landing sizes to protect mature females of the largest and most vulnerable species of skates, rays and sharks. (UK(for inshore waters), EU)

- Legislate against ray winging, which can prevent the identification of species and the enforcement of minimum/maximum landing sizes. (UK,EU)

- Finning is prohibited in EU waters and by EU vessels worldwide by Council regulation (EC) No 1185/2003, which came into force in September 2003. There is, however, concern that the regulation will be difficult and expensive to enforce and contains loopholes that could enable some finning to continue. It only provides the minimum acceptable level of control on finning, with EU Member States able to enact their own regulations that will not only determine how the Council Regulation will be enforced in each shark fishing state, but which may include more stringent requirements. It is important that the UK enact domestic shark finning regulations that are effective, enforceable and meet the criteria that the UK had hoped to see embodied in the EC regulation. This should be done before the EC regulation is reviewed in 2005/06, noting that each EU Member State is required to report on their implementation of the Regulation by 1 May annually. (UK)

**(5) Discarding**

Introduce and improve data collection programmes to determine the directed catch, bycatch and discarding of chondrichthyans in various fisheries, by:

- Using existing data from discard sampling programmes to evaluate the discard rate of chondrichthyans and existing observer schemes to collect more detailed data. (EU,UK)

- Placing observers onboard vessels that are believed to have a large bycatch of any chondrichthyan species. (UK,EU)

- Reduce discards of threatened and vulnerable chondrichthyan species by reducing fishing effort where high levels of discarding occur, implementing research programs to develop selective gear or excluding devices and other measures. This is particularly important for fishing methods that are deployed in mixed species fisheries where the degree of improvement of selectivity to bring about significant reduction in discarding of one of the species may result in decreased catches of the target species. Implement a code of practice to increase survival rates of released bycaught species. (UK, EU)

- Undertake research to determine uncounted mortality of chondrichthyan species including predation mortality, gear drop out, ghost fishing and post-release mortality (live catch that is returned to the sea but fails to survive).(UK, EU)

- Introduce legislation that requires fishermen to depart from fishing grounds if discard or bycatch reaches specified precautionary levels. (UK(for inshore waters),EU)

- Incorporate the issue of discards of chondrichthyan species into the draft discard proposal from the Commission, so the coming regulation due for implementation in 2005 contributes towards the proposed European Shark Plan. (EU)

**(6) Deep-water fisheries**

The EU has not set quotas for the deep-water shark species that are being affected by the deep-water fisheries in the Northeast Atlantic. This recommendation for the management of deep-water fishery is considered separately from those for other target and non-target chondrichthyan fisheries because it is such a very high priority. The continued exploitation of the deep sea west of the UK seems inevitable, due to the depleted state of more traditional shelf fish stocks. The European Commission and NEAFC are required to ensure the conservation of deep-water sharks. Effort reduction should be implemented as soon as possible in deep-water fisheries to allow deep-water species and habitats to recover in order to allow sustainable fisheries in the future:

- Take immediate steps to ensure that accurate species-specific catch data are available for all chondrichthyan species landed or discarded by deep-water fisheries.

- The licensing system for deep-water vessels should be strengthened to deliver reductions in effort rather than simply capping effort at pre-2000 levels. Such a system would be more effective than TACs in reducing effort in the mixed deep-water

fishery, as TACs potentially result in excessive discarding, high-grading and misreporting and serve only as a system of allocation, not conservation.

- Introduce gear limitations for longliners (limit numbers of hooks) and gill-netters (limit numbers of nets) fishing in deep water. (UK (for British flag vessels), EU).

- Closed areas should be investigated as a potential long-term measure for deep-water fisheries. (EU)

**(7) Stakeholder and public awareness**

An implementation group for the UK Shark Plan should be established as soon as possible, and should include stakeholders from Defra, devolved administrations, research institutes, statutory conservation agencies, fishermen, anglers and NGO's. The role of this group should be to:

- Develop a strategy for implementation;

- Oversee implementation;

- Provide any coordination required;

- Develop a schedule for undertaking actions within each priority group;

- Act as a central depository for advice by responsible agencies on progress;

- Disseminate to all interested stakeholders annual advice on progress and any other information relevant to the conservation and management of chondrichthyan fishes.

- Report on progress in implementing the Shark Plan as required by the FAO IPOA sharks.

**Table 5. Priorities for action under the UK National Shark Plan**

| Issue and Recommendations | Urgent | Short term | Medium-Long term |
|---|---|---|---|
| The FAO IPOA-Sharks calls upon all States to produce a **Shark Assessment Report** (SAR). This has not been undertaken for the UK and is a high priority, although management actions should not be delayed until the SAR is available. | | Collate existing data on shark fisheries and stocks and prepare a UK Shark Assessment Report.<br><br>Urge the Commission to develop an EU Shark Plan. | |
| Landings of **spurdog** have declined dramatically in the last 20-25 years. Preliminary stock assessments indicate that the Northeast Atlantic stock is seriously depleted. The UK holds 77% of the North Sea spurdog quota, which greatly exceeds present catches. Introduction of effective fisheries management and stock rebuilding is therefore urgently recommended. Imports to the EU are declining as other stocks become depleted. | Introduce measures to prevent targeted UK fisheries for spurdog.<br><br>Urge the EU to adopt truly precautionary TACs for spurdog in all areas, reflecting the state of the stocks rather than the needs of MS's fleets. In the North Sea, this will require a reduction of 80% to reflect recent low catches. | Advocate within the EC for a moratorium on spurdog landings.<br><br>Urge the EU to develop a stock recovery plan for spurdog, recognising that the Council is obligated to implement rebuilding measures where a decline in stock is documented. | Develop reliable data series and stock assessment techniques.<br><br>Undertake regular stock assessments. |
| **Skates and rays** used to support large, economically valuable fisheries around the UK and elsewhere in the EU. These have declined seriously through overfishing, but are still of considerable importance in some regions. Management is urgently needed to enable stocks to rebuild and ensure that future fisheries are viable and economically valuable. | Improve inshore management through minimum and maximum landing sizes and seasonal closure of nursery grounds.<br><br>Ensure that all landings are recorded at species level or that market sampling is carried out with sufficient coverage to allow disaggregation of grouped landings.<br><br>Promote reduction of EC skate and ray quotas to truly precautionary levels and introduction of new TACs for areas that are currently unmanaged. | Produce literature to enable fishers and other non-specialists to identify rays to species level.<br><br>Introduce pilot projects to fishers for them to register all bycaught and discarded species at species level.<br><br>Urge the Commission to include skates and rays in any discard pilot projects which are initiated in the future. | Advocate in EC for species-specific reportings of catches and landings of all chondrichthyan species.<br><br>Conduct research to identify habitat requirements including spawning and nursery grounds.<br><br>Conduct research to assess effects of sub-sea electric cables. |
| Landings of **porbeagle shark** from shelf waters have declined dramatically in the last 20-25 years. The Northeast Atlantic stock is believed to have collapsed. Fisheries closure and stock rebuilding is therefore urgently recommended | Introduce measures to prevent targeted commercial and recreational fisheries for porbeagle shark by UK vessels. | Advocate within EC for a moratorium on porbeagle shark landings. | Develop reliable data series and stock assessment techniques, and undertake regular assessment.<br><br>Develop stock recovery plan. |

| **Issue and Recommendations** | **Urgent** | **Short term** | **Medium-Long term** |
|---|---|---|---|
| Several large-bodied species of chondrichthyan are nearing extinction in UK and EU shelf waters. Legal protection and the development of recovery plans are urgently required for these **threatened species** | Implement Schedule 5 listing proposals for common skate, white skate, long-nosed skate, black skate and angel shark under the Wildlife and Countryside Act. | Advocate in EU for Natura 2000 and OSPAR listings of threatened species and for the development of recovery plans. | Develop recovery plans for common skate, white skate, long-nosed skate, black skate and angel shark within UK waters. |
| Conservation measures for **deep-water species** | Identify key areas with high bycatch of deep-water chondrichthyans with a view to their closure and the establishment of marine protected areas. | Advocate for the improvement of the Regulation for deep-water fisheries by implementing precautionary measures for the conservation of deep-water species. | Make funding available for research into deep-water habitats and species.<br><br>Advocate for improved management of deep-water sharks through NEAFC. |
| **Finning** (removal and retention of shark fins from carcasses that are discarded at sea) is believed to be widespread in some fleets. The UK has taken a leadership role in advocating for an international ban on this activity. It is important to demonstrate the UK's commitment by implementing appropriate national regulations | Introduce regulation to implement the EU finning ban by requiring UK vessels to land sharks whole.<br><br>Report to EU by 1 May annually on implementation of finning regulation. Actively promote the introduction of similar regulations in UK Overseas Territories. | Advocate for an improved EU regulation on the prohibition of shark finning when the present regulation is reviewed in 2005.<br><br>Press for the immediate Implementation of the prohibition of shark finning in ICCAT. | Advocate for a high seas shark finning ban in all relevant regional and international fora (e.g. ICCAT, UNGA, World Conservation Congress). |
| Minimum and maximum landing sizes | Initiate pilot project to introduce minimum and maximum landing sizes for other species of chondrichthyan. | UK regulation on minimum/ maximum landing sizes. | Advocate for the inclusion of minimum/ maximum landing sizes in the EC regulation on technical measures. |
| Stock assessments | | Collect species specific data. Ensure adequate levels of market sampling. | Develop appropriate assessment methods and carry out stock assessment for the most important commercial chondrichthyan species. |

| **Issue and Recommendations** | **Urgent** | **Short term** | **Medium-Long term** |
|---|---|---|---|
| Collection of bycatch and discard data | Develop template and identification guides for observer monitoring of chondrichthyan catches and discards. | Ensure appropriate levels of observer coverage on demersal fishing vessels believed to have a bycatch of chondrichthyans. | Consider time/area closures in areas where high chondrichthyan bycatch occurs. |
| Rapid assessments of chondrichthyan bycatch vulnerability | | | Undertake assessments to rank the vulnerability of chondrichthyans to bycatch. Revise and develop mitigation measures. |
| Reporting on progress of Shark Plans | | Provide biennial reports to FAO on progress with the UK Shark Assessment Report and NPOA and contribute to the preparation of the biennial reports of the European SAR and Shark Plan. | |
| Overseas Territories | | Assist OTs in the production of Shark assessment Reports. | Encourage and assist OTs with target or bycatch shark fisheries to develop NPOAs. |
| ICCAT | Develop proposals for the implementation of conservation and management plans for blue, mako and thresher shark. | Promote the introduction of precautionary shark bycatch management measures pending stock assessments in 2005. | Advocate conservation measures equivalent to those contained in the revised CFP within ICCAT. |
| NEAFC | | Promote the introduction of chondrichthyan bycatch management measures. | Advocate conservation measures equivalent to those contained in the revised CFP within NEAFC.<br><br>Support the Norwegian government in the implementation of MPAs within NEAFC |

| Issue and Recommendations | Urgent | Short term | Medium-Long term |
|---|---|---|---|
| NAFO | Support the establishment of a technical session on the status and management of thorny skates. | Promote the introduction of thorny skate and deep-water shark conservation and management plans. | Advocate conservation measures equivalent to those contained in the revised CFP within NAFO<br><br>Develop guidelines for observers to increase quality of data. Ensure that observer data are made available for researchers and other stakeholders. |
| CCAMLR | | Analyse existing data on bycatch of rays and sharks to develop management measures for these species. | Develop management plans for chondrichthyan species. |

## References


Agnew, D J, Nolan, C P and Pompert, J (1999) Management of the Falkland Islands skate and ray fishery. In *Case studies of the management of elasmobranch fisheries. FAO Fisheries Technical Paper 378/1*. (ed R Shotton) FAO, Rome

Anderson, R C, Sheppard, C R C, Spalding, M D and Crosby, R (1998) Shortage of sharks at Chagos. *Shark News*. **10**, 1-3. IUCN Shark Specialist Group.

Baum, J K, Myers, R A, Kehler, B D G, Worm, B, Harley, S J and Doherty, P A (2003) Collapse and Conservation of Shark Populations in the Northwest Atlantic. *Science* **299**, 389-392.

Bonfil, R (1994) *Overview of World Elasmobranch Fisheries*. FAO Fisheries Technical Paper 341. FAO. Rome.

Brander, K (1981) Disappearance of the common skate *Raja batis* from the Irish Sea. *Nature*, **290**, 48-49.

Burgess, G H (1998) Diving with elasmobranchs: a call for restraint. *Shark News* **11,** 1–3. IUCN Shark Specialist Group

Cavanagh, R D, Kyne, P M, Fowler, S L, Musick, J A and Bennet, M B, (2003) *Conservation Status of Australian Chondrichthyans*: Report of the IUCN Shark Specialist Group Australia and Oceania Regional Red List Workshop, University of Queensland – School of Biomedical Sciences.

CMACS (2003) *A baseline assessment of electromagnetic fields generated by offshore windfarm cables*. COWRIE Report EMF - 01-2002 66.

Colman, J (1998) Whale shark management programme, Western Australia. *Shark Ne*ws **11**, 5. IUCN Shark Specialist Group

Compagno, L J V (1984) *Catalogue of Sharks of the World Vol. I*. FAO, Rome.

Daley, R K, Stephens, J D, Last, P R and Yearsley, G K (2002) *Field Guide to Australian Sharks and Rays*. CSIRO, Hobart, Tasmania. Australia.

Dulvey, N K and Reynolds, J D (2002) Predicting extinction vulnerability in skates. *Conservation Biology,* **16,** 440-450

Ellis, J (2001) Bad news for angels this Christmas. *Shark Focus* **12**, 10-11.

Ellis, J R, Cruz, A, Rackham, B B and Rogers, S I (2002) *The distribution of chondrichthyan fishes around the British Isles and implications for conservation*. NAFO SCR Doc. 02/101.

FAO (2000) *Fisheries Management. 1. Conservation and Management of Sharks,* FAO technical guidelines for responsible fisheries. No. 4, Supplement 1. FAO, Rome.

FAO (2002). *The State of World Fisheries and Aquaculture 2002*. FAO Information Division, Rome, Italy.

Fowler, S L (1999) *Guidelines for managing the collection of bait and other shoreline animals within UK European marine sites*. English Nature (UK Marine SACs Project)

Graham, K J, Andrew, N L and Hodgson, K E (2001) Changes in relative abundance of Sharks and Rays on /Australian South East Fishery Trawl grounds after twenty years of fishing. *Marine and Freshwater Research.* **52** 549-561

Gray, M J (1995) *The coastal fisheries of England and Wales, Part III: A review of their status 1992-1994.* Fisheries Research Technical Report 100. MAFF Directorate of Fisheries Research, Lowestoft

Gauld, J A (1989). *Records of Porbeagles landed in Scotland, with observations on the biology, distribution and exploitation of the species.* Scottish Fisheries Research Report Number 45. Department of Agriculture and Fisheries for Scotland, Aberdeen.

Gill, A B & Taylor, H (2002) *The potential effects of electromagnetic fields generated by cabling between offshore wind turbines upon elasmobranch fishes,* CCW Contract Science Report No 488. Countryside Council for Wales

Hareide N-R (2003) Presentation to Deepsea Chondrichthyan Workshop, Portobello, New Zealand, 27-29 November 2003

Heessen, H J L (Ed). (2003) *Development of Elasmobranch Assessments DELASS.* Final Report of DG Fish Study Contract 99/055.

Holden, M J (1974) Problems in the rational exploitation of elasmobranch populations and some suggested solution. In *Sea Fisheries Research* (Ed. Harden-Jones, F R). John Wiley and Sons, New York, 117-137.

ICES (1995) *Report of the Study Group Elasmobranch Fishes, 15-18 August 1995*. ICES CM 1995/G:3

ICES (1996) *Report by Correspondence of the Study Group Elasmobranch Fishes*, ICES CM 1996/G:2.

ICES (1997) *Report of the Study Group Elasmobranch Fishes*, ICES CM 1997/G:2, Ref.: Assess.

ICES (2002) *Report of the Study Group Elasmobranch Fishes, 6-10 May 2002*. ICES CM 2002/G:08

ICES (2003) *Report of the Study Group Fish Ecology, 3-7 March 2003*. ICES CM 2003

IUCN (2003) *2003 IUCN Red List of Threatened Species.* <www.redlist.org>. Downloaded on 19 November 2003.

IUCN Species Survival Commission's Shark Specialist Group and TRAFFIC (2002a) *Implementation of Decision 11.94 regarding the biological and trade status of sharks: Report on Implementation of the International Plan of Action for Sharks (IPOA-Sharks).* CITES Animals Committee document AC18 Doc.19.2.

IUCN Species Survival Commission's Shark Specialist Group and TRAFFIC (2002b) *The role of CITES in the conservation and management of sharks*. CITES Notification ESF042A (revised and updated from AC18 Doc.19.2).

Manire, C A, Gelsleichter, J, Rasmussen, L E L and Cortes, E (2001) *Infertility in Bonnethead Sharks, Sphyrna tiburo, in the Eastern Gulf of Mexico may be caused by endocrine disrupting chemicals in the environment.* American Elasmobranch Society Meeting, Pennsylvania, July 2001.

Musick, J and McMillan, B (2003) *The Shark Chronicles: A Scientist Tracks the Consummate Predator*. Owl Books, New York.

Nautilus Consultants (2000) *Study of inland and sea fisheries in Wales. A Report to the National Assembly of Wales by Nautilus consultants and EKOS economic consultants.* Unpublished report.

Pawson, M G and Vince, M R (1999) Management of shark fisheries in the Northeast Atlantic. In *Case studies of the management of elasmobranch fisheries. FAO Fisheries Technical Paper* no. 378. (Ed R Shotton) pp 1-46 FAO. Rome.

Pawson, M G, Pickett., G D and Walker, P (2002) *The Coastal Fisheries of England and Wales, Part IV: A Review of their Status 1999-2001*. Science Series Technical Report Number 116. CEFAS, Lowestoft, UK.

Pratt, H L Jr and Casey, J G (1990) Shark reproductive strategies as a limiting factor in directed fisheries, with a review of Holden's method of estimating growth-parameters. In *Elasmobranchs as living resources: advances in biology, ecology, systematics and status of the fisheries* (eds H L Pratt Jr., S H Gruber and T Taniuchi) NOAA Tech. Rep. NMFS 90 97-109.

Picket, G D, Eaton, D R, Cunningham, S, Dunn, M R, Potten, S D and Whitmarsh, D (1995) *An Appraisal of the UK Bass Fishery and its Management* Laboratory leaflet 75, MAFF Directorate of Fisheries Research, Lowestoft

Rogers, S I and Ellis, J R (2000) Changes in the demersal fish assemblages of British coastal waters during the 20th century. ICES *Journal of Marine Science*. **57**, 866-881.

SGRST (2002) *Report of the Subgroup on Resource Status (SGRST) of the Scientific, Technical and Economic Committee for Fisheries (STECF): Elasmobranch Fisheries*. Commission of the European Communities, Brussels, 23-26 September 2002.

SGRST (2003) *Report of the Subgroup on Resource Status (SGRST) of the Scientific, Technical and Economic Committee for Fisheries (STECF): Elasmobranch Fisheries*. Commission of the European Communities, Brussels, 22-25 July 2003.

Shark Trust (2004) *Basking shark code of conduct*. Shark Trust, Plymouth

Simpfendorfer, C A, Hueter, R E, Bergman, U and Connett, S M H (2002) Results of a fishery-independent survey for pelagic sharks in the western North Atlantic, 1977-1994. *Fisheries Research* **55**, 175-192.

South Wales Sea Fisheries Committee (2000) *Response to the Agriculture and Rural Development Committee regarding the Nautilus Review of inland and sea fisheries in Wales*. Unpublished report.

Spalding, M D (2003) Partial recovery of reef sharks in Chagos waters. *Shark News* **15**, 12-13 IUCN Shark Specialist Group.

Walker, P A and Heessen, H J L (1996) Long-term changes in ray populations in the North Sea, *ICES Journal of Marine Science* **53**, 1085-1093.

Walker, P A and Hislop, J R G (1998) Sensitive skates or resilient rays? Spatial and temporal shifts in ray species composition in the Central and North-western North Sea. *ICES Journal of Marine Science*, **55** 392-402.

Walker, P, Cavanagh, R, Ducrocq, M and Fowler, S (In press) North East Atlantic Region. In *Sharks, rays and chimaeras: the status of the chondrichthyan fishes*. (Ed Fowler *et al*) In press. IUCN SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Walker, T I (2001) *Basslink project review of impacts of high voltage direct current sea cables and electrodes on chondrichthyan fauna and other marine life*. Marine and Freshwater Resources Institute Report No. 20, Marine and Freshwater Resources Institute: Queenscliff, Victoria, Australia.

## Appendix 1. Chondrichthyan fishes recorded from British and adjacent EU waters

| Common name | Scientific name | Habitat | | |
|---|---|---|---|---|
| | | Continental Shelf | Pelagic | Deep-water |
| Frilled shark | *Chlamydoselachus anguineus* | | | ✓ |
| Seven-gilled shark | *Heptranchias perlo* | | | ✓ |
| Six-gilled shark | *Hexanchus griseus* | | | ✓ |
| Bramble shark | *Echinorhinus brucus* | | | ✓ |
| Spurdog | *Squalus acanthias* | ✓ | | |
| Gulper sharks | *Centrophorus granulosus* | | | ✓ |
| Leafscale gulper shark | *Centrophorus squamosus* | | | ✓ |
| Birdbeak dogfish | *Deania calcea* | | | ✓ |
| Black dogfish | *Centroscyllium fabricii* | | | ✓ |
| Great Lantern-shark | *Etmopterus princeps* | | | ✓ |
| Velvet belly | *Etmopterus spinax* | | | ✓ |
| Longnose Velvet shark | *Centroscymnus crepidater* | | | ✓ |
| Portuguese Dogfish | *Centroscymnus coelolepis* | | | ✓ |
| Knifetooth dogfish | *Scymnodon ringens* | | | ✓ |
| Greenland shark | *Somniosus microcephalus* | | | ✓ |
| Angular Rough-shark | *Oxynotus centrina* | | | ✓ |
| Sailfin rough-shark | *Oxynotus paradoxus* | | | ✓ |
| Kitefin shark | *Dalatias licha* | | | ✓ |
| Angel shark | *Squatina squatina* | ✓ | | |
| Thresher shark | *Alopias vulpinus* | | ✓ | |
| Bigeye thresher shark | *Alopias superciliosus* | | ✓ | |
| Basking shark | *Cetorhinus maximus* | ✓ | ✓ | ✓ |
| White shark | *Carcharodon carcharias* | ✓ | ✓ | |
| Shortfin mako | *Isurus oxyrinchus* | | ✓ | |
| Porbeagle shark | *Lamna nasus* | ✓ | ✓ | |
| Black-mouthed dogfish | *Galeus melastomus* | | | ✓ |
| Mouse catshark | *Galeus murinus* | | | ✓ |
| Iceland catshark | *Apristurus larussonii* | | | ✓ |
| Ghost catshark | *Apristurus manis* | | | ✓ |
| Deep-water catshark | *Apristurus aphyodes* | | | ✓ |
| Lesser spotted dogfish | *Scyliorhinus canicula* | ✓ | | |
| Bull huss | *Scyliorhinus stellaris* | ✓ | | |
| False catshark | *Pseudotriakis microdon* | | | ✓ |
| Tope | *Galeorhinus galeus* | ✓ | | |
| Smoothhound | *Mustelus mustelus* | ✓ | | |
| Starry smoothhound | *Mustelus asterias* | ✓ | | |
| Blue shark | *Prionace glauca* | | ✓ | |
| Hammerhead shark | *Sphyrna zygaena* | ✓ | ✓ | |
| White skate | *Rostroraja alba* | ✓ | | |
| Common skate | *Dipturus batis* | ✓ | | ✓ |

| | | | | |
|---|---|---|---|---|
| Blonde ray | *Raja brachyura* | ✓ | | |
| Sandy ray | *Leucoraja circularis* | ✓ | | |
| Thornback ray | *Raja clavata* | ✓ | | |
| Shagreen ray | *Leucoraja fullonica* | ✓ | | ✓ |
| Small-eyed ray | *Raja microocellata* | ✓ | | |
| Undulate ray | *Raja undulata* | ✓ | | |
| Spotted ray | *Raja montagui* | ✓ | | |
| Cuckoo ray | *Leucoraja naevus* | ✓ | | |
| Long-nose skate | *Dipturus oxyrinchus* | ✓ | | |
| Starry ray | *Amblyraja radiata* | ✓ | | |
| Norwegian skate | *Dipturus nidarosiensis* | | | ✓ |
| Round ray | *Rajella fyllae* | | | ✓ |
| Arctic skate | *Amblyraja hyperborea* | | | ✓ |
| Spinetail ray | *Bathyraja spinicauda* | | | ✓ |
| Mid-Atlantic skate | *Rajella kukujevi* | | | ✓ |
| Deep-water ray | *Rajella bathyphila* | | | ✓ |
| Bigelow's ray | *Rajella bigelowi* | | | ✓ |
| Krefft's ray | *Malacoraja kreffti* | | | ✓ |
| Blue ray | *Neoraja caerulea* | | | ✓ |
| Marbled electric ray | *Torpedo marmorata* | ✓ | | |
| Electric ray | *Torpedo nobiliana* | ✓ | | |
| Stingray | *Dasyatis pastinaca* | ✓ | | |
| Rabbitfish | *Chimaera monstrosa* | | | ✓ |
| Large-eyed Rabbitfish | *Hydrolagus mirabilis* | | | ✓ |
| Ghost Rabbitfish | *Hydrolagus pallidus* | | | ✓ |
| Small-eyed Rabbitfish | *Hydrolagus affinis* | | | ✓ |
| Narrownose chimaera | *Harriotta raleighana* | | | ✓ |
| Spearnose chimaera | *Rhinochimaera atlantica* | | | ✓ |

**Appendix 2. Chondrichthyan fishes from British and adjacent waters listed on the 2003 IUCN Red List of Threatened Species (IUCN 2003)**

| Scientific Name | Common Name | Red List Classification (assessment year) * |
|---|---|---|
| *Alopias vulpinus* | Thresher Shark | DD (2003) |
| *Carcharodon carcharias* | Great White Shark | VU (2000) |
| *Centrophorus granulosus* | Gulper Shark | VU (2000) |
| *Centrophorus squamosus* | Leafscale Gulper Shark | VU (2003) |
| *Centrophorus uyato* | Little Gulper Shark | DD` (2003) |
| *Centroscymnus coelolepis* | Portuguese Dogfish | NT (2003) |
| *Centroscymnus crepidater* | Golden/Longnose Velvet Dogfish | LC (2003) |
| *Cetorhinus maximus* | Basking Shark<br>Northeast Atlantic subpopulation | VU (2000)<br>EN (2000) |
| *Chlamydoselachus anguineus* | Frilled Shark | NT (2003) |
| *Dalatias licha* | Kitefin Shark<br>Northeast Atlantic subpopulation | DD (2000)<br>LR/nt (2000) |
| *Deania calcea* | Birdbeak Dogfish | LC (2003) |
| *Dipturus batis* | Common Skate | EN (2000) |
| *Echinorhinus brucus* | Bramble Shark | DD (2003) |
| *Galeorhinus galeus* | Tope | VU (2000) |
| *Heptranchias perlo* | Sharpnose Sevengill Shark | NT (2000) |
| *Hexanchus griseus* | Bluntnose Sixgill Shark | LR/nt (2000) |
| *Isurus oxyrinchus* | Shortfin Mako | LR/nt (2000) |
| *Lamna nasus* | Porbeagle shark<br>Northeast Atlantic subpopulation | LR/nt (2000)<br>VU (2000) |
| *Mustelus asterias* | Starry Smoothhound | LR/lc (2000) |
| *Mustelus mustelus* | Common Smoothhound | LR/lc (2000) |
| *Prionace glauca* | Blue Shark | LR/nt (2000) |
| *Raja clavata* | Thornback Skate | LR/nt (2000) |
| *Raja microocellata* | Smalleyed Ray | LR/nt (2000) |
| *Sphyrna zygaena* | Smooth Hammerhead | LR/nt (2000) |
| *Squalus acanthias* | Spurdog/ Piked / Spiny Dogfish<br>Northeast Atlantic subpopulation | LR/nt (2000)<br>EN (2000) |
| *Squalus mitsukurii* | Green-Eye Spurdog | DD (2003) |
| *Squatina squatina* | Angel Shark | VU (2000) |

* Assessments dated 2003 used version 3.1 (2001) of the IUCN Categories and Criteria. Assessments dated 2000 used version 2.3 (1994).

CR: Critically Endangered
EN: Endangered
VU: Vulnerable
NT: Near Threatened (ver. 3.1)
LR/nt: Near Threatened (ver. 2.3)
LC: Least Concern (ver. 3.1)
LR/lc: Least Concern (ver. 2.3)
DD: Data Deficient

**Key to Appendix 2 . IUCN Red List Categories and Criteria**

| | |
|---|---|
| **Critically Endangered (CR)** | A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild. |
| **Endangered (EN)** | A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild. |
| **Vulnerable (VU)** | A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild. |
| **Near Threatened (NT** or **LR/nt)** | A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future. |
| **Least Concern (LC** or **LR/lc)** | A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category. |
| **Data Deficient (DD)** | A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. |

All Threatened assessments were reached using IUCN Red List Criterion ‘A’, reduction in population size. See www.redlist.org for more information on the criteria and for species data.

## Appendix 3. Shark fisheries in Overseas Territories and on the high seas

The multi-species skate fishery around the **Falkland Islands** is relatively well monitored and managed. A small number of large freezer trawlers target skate directly; in this fishery, most of the catch is utilised and because the fishing gear is designed for skate, some of the discarded catch may survive following discard alive back to the sea. A similar mix of ray species is caught, together with spurdog *Squalus acanthias* and the catshark *Schroederichthys bivius*, as bycatch in the extensive demersal trawl fisheries targeting two squid species and mixed finfish. Porbeagle sharks and a number of species of deep-water rays are caught as bycatch in the longline fishery for Patagonian toothfish (*Dissostichus eleginoides*). In these fisheries, catch utilisation is more varied; the larger rays and sharks may be retained but smaller species, *S. acanthias* and *S. bivius* are usually discarded.

In the directed fishery, a programme of mandatory daily catch reporting from licensed vessels, separated into northern and southern areas, supplemented and validated by species-level length/frequency data collected by observers, provides a series of catch composition and catch per unit effort data in real time. This has been used to identify a serious decline in the stock of the major commercial skate species, following which an area to the south of the Islands was closed to fishing and effort restricted in winter (Agnew *et al*. 1999 and C. Nolan pers. comm.).

Reef sharks in the isolated **Chagos Archipelago (British Indian Ocean Territory)** were abundant during surveys in the 1970s, but had declined very significantly when the reefs were resurveyed in 1996. This was mainly attributed to an illegal Sri Lankan shark fishery (Anderson *et al*. 1998). A UK fisheries patrol vessel stationed permanently in Chagos waters since 1996 in order to manage the offshore tuna fishery and to patrol the islands and reefs has made several high profile arrests and impoundments of vessels fishing sharks illegally. This appears to have led to reduced fishing pressure, with observations in 2001 indicating some recovery of populations (Spalding 2003). A licensed Mauritanian reef fishery for demersal species (mainly snappers and groupers) took a large number of sharks in 1998 when it changed to using steel hook traces; these were banned in 1999. There is also a significant but localised sports shark fishery around the US military base on the island of Diego Garcia.

No information was obtained on shark fisheries in other Overseas Territories.

In the Southern Ocean, CCAMLR has developed conservation measures in the directed fisheries in certain areas where bycatch of skates and rays shall not exceed 120 tonnes (‘skates and rays’ are counted as a single species). Furthermore if the bycatch in any one haul of skates and rays is equal to, or greater than 2 tonnes, then the fishing vessel shall not fish using that method of fishing at any point within 5 nautical miles of the location where the by-catch exceeded 2 tonnes for a period of at least five days. The location where the by-catch exceeded 2 tonnes is defined as the path followed by the fishing vessel from the point at which the fishing gear was first deployed from the fishing vessel to the point at which the fishing gear was retrieved by the fishing vessel.