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REPORT OF THE

# STUDY GROUP ON ELASMOBRANCH FISHES

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International Council for the Exploration of the Sea

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# 1 INTRODUCTION

## 1.1 Participants

| | |
|---|---|
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| Hiroaki Matsunaga | (Observer - ICCAT[2]) |
| Mike Pawson | UK |
| Matthias Stehmann | Germany |
| Paddy Walker (Chairperson) | Netherlands |

Addresses of participants are listed in Appendix 4.

## 1.2 Terms of reference

In accordance with C. Res. 1996/2:34, the Study Group on Elasmobranch Fishes (SGEF), under the chairmanship of P. Walker (Netherlands) met at ICES Headquarters from 26th to 30th May 1997 to:

a) analyse the data available on the geographical distribution of species and identify species for which the data are sufficient for analytical assessment;

b) conduct analytical assessments and evaluate the effects of exploitation and/or environmental changes on the stocks considered;

c) prepare identification sheets for deep-water sharks, skates and rays, including "skate wings" and identify the most important species;

d) re-evaluate the ICES species codings for sharks, skates and rays;

e) consider the status of the Study Group in the light of future requirements for work on elasmobranch fishes.

# 2 BACKGROUND

After the meeting in 1995 (ICES, 1995), the Study Group decided that in order to be able to move forward in evaluating the status of elasmobranch stocks it should study those species for which there are most data, preferably covering a range of habitats and life histories. Deep-water sharks, blue shark, spurdog and skates and rays were chosen. Information on fisheries, catches, landings and discarding will be found under those species headings. Other information on landings can be found in Appendix 2.

For deep-water sharks the availability of biological and fisheries information on 27 species has been presented in tabular form in order to highlight the extent and limits of our present knowledge. Much of the information presented is taken from an ongoing EU-funded project which will be completed by late 1998. For the blue shark (*Prionace glauca*) the SG had access to the species description in the draft IUCN Shark Specialist Group Status Report and two previously unpublished documents, of which a resumé is presented in this report. The information on the spurdog (*Squalus acanthias*) is presented in this report as a first step towards providing the background available to evaluate the impact of exploitation in relation to the biology and distribution of the species. Trends in abundance and distribution and changes in life history parameters of skates and rays in the North Sea are discussed as a case study.

The identification guide on skates was prepared for the 1996 meeting by correspondence by Matthias Stehmann. He prepared the other two, on skate wings and deep-water sharks, prior to the 1997 meeting.

Sharks and other cartilaginous fishes have, in the past few years, become the focus of increased attention on the part of national, regional and international management authorities, Conventions, and non-governmental organisations. This is the result not only of elasmobranch fisheries management concerns, but also the significant

[1] = IUCN — the World Conservation Union.
[2] = International Commission for the Conservation of Atlantic Tuna.

wildlife and wider marine ecological implications of their exploitation and trade. Concerns have largely focused on the inadequate or inappropriate management (if any) of most directed and incidental shark and ray fisheries, and the lack of data on stocks, fisheries (including landings, bycatch, and discards), trade, and habitats required for the formulation of management advice. It is no longer possible to avoid action because of a lack of evidence[3]. As a result, several international initiatives have arisen which overlap with ICES' activities, or may do so. These are described in Appendix 3, provided by Sarah Fowler (IUCN).

The species coding has received special attention with regard to improving information at the species level, but also improving the collection of data for those groups of species which, although not abundant, would otherwise be lost in the registration process (e.g. stingrays).

# 3 DEEP-WATER SPECIES

## 3.1 Introduction

The biological peculiarities of all chondrichthyan fishes, namely

- slow growth
- longevity
- first sexual maturity reached after several years
- extremely low reproductive rate per female
- extremely long embryonic development for oviparous and viviparous species, from several months up to about two years
- bi- or even tri-ennial reproductive cycle for the majority of species

apply the more so to all deep-water cartilaginous fishes and make them particularly vulnerable to fishery impact, be they target species or discarded as by-catch (see Connolly & Kelly, 1996). In the latter case, their survival rate as deep-water species, especially from trawl catches, is considerably lower than for species inhabiting shelf or oceanic epipelagic waters.

In contrast to most shallow water chondrichthyans, the deep-water representatives also have a very wide distributional range within their more or less uniform environment with little variation of its abiotic, physical conditions. Regular long distance migrations are part of the life cycle of many of the schooling squaloid sharks in particular, as is proven for several species (Stehmann, unpubl. data) and can thus be assumed accordingly for related deep-water species.

Small juveniles of nearly all NE Atlantic squaloid sharks are never found along the European continental slopes, where only adults occur in large schools. An exception is the Kitefin Shark (*Dalatias licha*), which is commercially fished for around the Azores, where there are only adult specimens (da Silva, 1983), whereas smaller juveniles were found on the slope off mainland Portugal (Figueiredo & Correia, 1996a). Both life history and migratory patterns indicate a regular migration behaviour of these deep-water sharks in the NE Atlantic, probably even including a pelagic phase over the deep basins. The scarce existing data allow the conclusion that mating and nursery areas for most of these North Atlantic deep-water squaloid sharks may be along the Mid-Atlantic Ridge, where the young may spend their first years of life, until they join the schools of the adults. The latter appear to spend a long phase along the Mid-Atlantic Ridge and move from there to the continental slopes of northwest Africa and western Europe in the course of a feeding migration to the north as far as the Rockall Trough, Faroe-Iceland Ridge and Iceland itself. Sexual segregation by depth of the schools has been found in most places, and females were regularly found at various stages of gestation and embryonic development.

[3] *Paragraph 7.5.1. of Article 7.5 of the FAO Code of Conduct reads as: "States should apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. ***The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.***" Paragraph 7.5.2 states: "In implementing the precautionary approach States should take into account, inter alia, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distribution of fishing mortality and the impact of fishing activities, including discards on non-target and associated and dependent species as well as environmental and socio-economic conditions." In Paragraph 7.5.3 the question of limit reference points is discussed as follows "States and subregional or regional fisheries management organisations and arrangements should, on the basis of the best scientific evidence available, inter alia, determine stock specific *limit reference points* and, at the same time, the action to be taken if they are exceeded."

Their deep-water habitat, being out of range and interest of commercial fisheries until recently, has not allowed regular monitoring and sampling of these stocks, so that biological and life history information is generally scarce for all species. For a large part of their distributional area and life cycle, mainly when over the deep NE Atlantic oceanic basins and at the Mid-Atlantic Ridge, hardly any information exists at all. Exploratory surveys have only recently provided preliminary information, and line fishing especially in these mostly untrawlable areas promises additional data in the future.

However, as compared with shallow water cartilaginous and bony fishes, several problems cannot be overcome. As for most deep-water bony fishes, ageing of deep-water chondrichthyans - by use of vertebrae and fin spines - is still unresolved, as was recently shown during an Ageing Workshop of the EU FAIR CT96-655 Project, held in April 1997 in Concarneau, France. To overcome this important gap in knowledge, the idea was raised to organise an EU-funded Concerted Action focusing on sampling and then analysing material by various methods for ageing. However, it is likely that the ageing of deep-water chondrichthyans will remain an unresolved problem and, because tagging is nearly impossible, other modes of describing and assessing deep-water stocks must be applied.

What must be taken into consideration is the significance of especially the sharks among chondrichthyans as top predators in the marine food web and ecosystems. The deep-water sharks are no exception but, in contrast, may play an even more important role for various reasons. The deep-water environment is a very sensitive system, with all its organisms being highly adapted and specialised to living in cold, dark, water with limited food resources, for which they must hunt actively, or depending on benthic food mainly on submarine ridges and elevations within their vertical depth range. The limitations in food may be the reason why geographical areas and habitat types for young and adult specimens are indeed different, as shallow nursery areas for protecting the young are not an option. The large schools, in which especially deep-water squaloid sharks occur, will enable them to hunt jointly for large prey and/or scavenge, for instance, on marine mammals. In any case, these large schools play a significant role in a well balanced ecosystem, and they should - being highly migratory - not be misinterpreted as a large resource. Different fisheries take their share from probably one and the same population at various places, where these sharks occur during their life cycle, and normally exploit only the large adults. A drastic reduction of these schooling sharks by fishery impact may unbalance the ecosystem, and recovery of depleted stocks would take much longer than with shallow water elasmobranch stocks. As deep-water fisheries are still at their beginning but are exploiting the last available resource in the oceans, precautionary measures are necessary, even if the background information will remain insufficient for a long time still in terms of providing evidence of the effects of exploitation. Further, as deep-water fisheries target bony fishes in the first place, with an unavoidable high by-catch rate of elasmobranchs, it is no argument that these elasmobranchs are not (? yet) target species and do not require attention. (See Conolly & Kelly (1996) for recent information on catch and discards from experimental trawl and longline fishing in the deep water of the Rockall Trough.)

The present state of knowledge of 27 relatively common NE Atlantic deep-water shark species is tabulated in Tables 3.1–27, mainly based on published information only. Beyond a few unpublished French and German data and specific references given, information in Tables 3.1–27 is largely based on the two handbooks by Whitehead *et al.* (1984, FNAM vol. 1) and Compagno (1984, FAO World Shark Catalogue).

## 4 BLUE SHARK (*PRIONACE GLAUCA*)

### 4.1 Introduction

The blue shark was chosen by the SG as a species to be considered for analytical assessment because it is a pelagic species with a wide distributional area and data could be acquired from scientists working on both sides of the Atlantic. It is also a species which has recently been described by John Stevens in the IUCN Shark Specialist Group's Status Report for Chondrichthyan Fishes. Most of the information in this section is taken from a draft version of the report.

### 4.2 Distribution

The blue shark is one of the most wide-ranging of all sharks, being found throughout tropical and temperate seas from about 60°N to 50°S latitude. It is oceanic and pelagic, found from the surface to about 350 m depth; occasionally it occurs close inshore. The blue shark prefers temperatures of 12–20°C and is found at greater depths in tropical waters (Last and Stevens 1994).

## 4.3 Ecology and life history

The blue shark reaches a maximum size of about 380 cm TL. About 50% of males in the Atlantic are sexually mature by 218 cm, although some may reach maturity as small as 182 cm. Females are fully mature from 221 cm (Pratt 1979), although pregnant fish as small as 183 cm have been recorded from the Eastern Pacific (Williams 1977).

Blue sharks are viviparous, producing litters averaging about 30 (although as many as 135 have been recorded) after a gestation period of 9-12 months. At birth the pups are 35-50 cm long. Reproduction has been reported as seasonal in most areas, with the young often born in spring or summer (Pratt 1979, Nakano 1994, Stevens 1984) although the periods of ovulation and parturition may be extended (Strasburg 1958, Hazin *et al.* 1994). Ageing studies suggest a longevity of about 20 years, with males maturing at 4-6 and females at 5-7 (Stevens 1975, Cailliet *et al.* 1983, Nakano 1994).

In the North Atlantic, Pratt (1979) recognised three groups of females: immatures, sub-adults and matures, and postulated the following reproductive cycle. Four and five year old females (173-221 cm TL) arrive on the continental shelf off southern New England in late May - early June. Four year old females actively mate but are too undeveloped to store sperm in their nidamental glands. Five year old females mate and store sperm; the following spring these six year old fish stay offshore and fertilise their eggs in May/June. Embryos take 9-12 months to develop and are born from April-July. Gravid females have ripe ovarian eggs suggesting another fertilisation is imminent.

Blue sharks are highly migratory with complex movement patterns related to reproduction and the distribution of prey. There tends to be a seasonal shift in population abundance to higher latitudes associated with oceanic convergence or boundary zones as these are areas of higher productivity. Tagging studies of blue sharks have demonstrated extensive movements in the Atlantic with numerous trans-Atlantic migrations which are probably accomplished by swimming slowly and utilising the major current systems (Stevens 1976, Casey 1985, Stevens 1990). Figure 4.1, which is taken from another document made available to the Study Group (O'Boyle *et al.*, 1996c), shows trans-Atlantic migrations based on tagging data.

Stevens (1990) expanded the movement model of Casey (1985) for blue sharks in the North Atlantic. In the western Atlantic, where the population consists mainly of juveniles and adult males, they move offshore into the Gulf Stream or south along the margins of the Gulf Stream during late summer and autumn, some travelling as far south as the Caribbean and South America. Juvenile and sub-adult females, most of which have recently mated, move offshore and probably do not return; some of these fish probably ride the current systems to the eastern Atlantic. During spring, sharks move inshore from the Gulf Stream and north along the continental shelf and in summer they occur in large numbers off southern New England, Georges Bank, Nova Scotia and the Grand Banks (Casey 1985). Mature females are rare in inshore waters of the western North Atlantic. In the eastern Atlantic during winter, adult females are found in the area between the Canary Islands and African coast at about 27–32°N (Munoz-Chapuli 1984), at which time many are pregnant (Casey 1985). Adult males are found further north off the Portuguese coast, along with juvenile and sub-adult females that have moved south from northern Europe; some mating of sub-adult females probably occurs at this time. Immature males are not caught in this region and may be offshore. In spring and summer, adult males and females are found between about 32-35°N where they mate. Immature males also occur in this area. Adult females seem to have a seasonal reproductive cycle while males and sub-adult females are sexually active throughout the year (Pratt 1979, Stevens 1984). The immature females migrate north to northern Europe, where they are common in summer, particularly off the coast of south-west England (Stevens 1976). Birth probably occurs in early spring; nursery areas are found in the Mediterranean and off the Iberian peninsula, particularly off Portugal, but extend as far north as the Bay of Biscay. Juvenile sharks remain in the nursery areas and do not take part in the extensive migrations of the adults until they reach a length of about 130 cm (Stevens 1976, Munoz-Chapuli 1984). In the eastern Atlantic mature females, pregnant fish and new-born young are common during certain seasons and it seems that a large proportion of the North Atlantic breeding population occurs in this region (Casey 1985).

## 4.4 Exploitation and threats

Blue sharks are rarely targetted as a commercial species but are a major by-catch of longline and driftnet fisheries, particularly from nations with high seas fleets such as Japan, Taiwan, Korea and Russia. Because there is usually no requirement for these fisheries to record their blue shark catch, the magnitude of the catch (and of the subsequent mortality) is not reflected in catch statistics. Blue sharks are also taken by sport fishermen, particularly in the United States, Europe and Australia.

Periodically, small target fisheries have existed for blue sharks. For example, there has been a seasonal longline fishery for juveniles of 50–150 cm total length near Vigo, Spain. Some three tonnes of gutted juveniles were observed over a two day period at Vigo fish market, although it is not clear what proportion of this catch was due to the target fishery (Andy Kingman, pers. comm.). A Taiwanese longline fishery in Indonesian waters took about 13,000 t live weight of blue sharks in 1993 (Nokome Bentley, pers. comm.). Currently, a directed fishery in Nova Scotia is exporting blue shark to the Caribbean (Sid Cook, pers. comm.). The real impact on blue shark stocks comes from the by-catch component of fleets targeting tuna and billfish. However, because of the increasing price paid for shark fins the difference between target and by-catch species is becoming less clear.

The shark by-catch from longline and driftnet fleets targeting species such as tunas, billfish and squid has received little attention and is poorly known. Logbook records, where available, probably under-report catches and observer coverage is non-existent on the high seas and, at best, limited where fleets are allowed access to National fishing zones.

A swordfish longline fishery out of Vigo, Spain landed 2,408 tonnes of blue shark (237,660 individuals) (Mejuto 1985) and by 1990 these figures had increased considerably (Andy Kingman, pers. comm.). Catch rates from research longlining can also provide information on likely catch rates expected from commercial operations. Average catch rates of blue sharks per 1000 hooks from research longlining vary from 3.2–70.0 in the North Atlantic (Murray 1953; Sivasubramaniam 1963), 4.3 in the equatorial Pacific (Strasburg 1958, Nakano 1994) and from 3.2–27.6, and exceptionally 83.0, in the North Pacific (Shomura and Otsu 1956; Strasburg 1958; Sivasubramaniam 1963; Williams 1977, Nakano 1994). In general, blue sharks are found throughout the areas fished by high-seas longline fleets. Bonfil (1994) estimates total world-wide longline effort as about 750 million hooks with a by-catch of 4 million blue sharks by high-seas fleets.

Bonfil (1994) estimates that 6.2-6.5 million blue sharks are taken annually by high seas fleets around the world. Blue sharks are a key species in the oceanic ecosystem and, as noted by Bonfil (1994), lack of knowledge prevents any assessment of the impacts of blue shark mortality on the oceanic ecosystem or on the blue shark populations. Nothing is known of blue shark stock structure or population sizes. Nakano and Watanabe (1992) provide one of the few assessments of the impact of high seas fisheries on blue shark stocks. By estimating catches and using cohort analysis, they believe that the catch rates of the late 1980s did not have a significant impact on North Pacific populations. However, other authors (Wetherall and Seki 1992) consider that appropriate information for this kind of assessment is lacking. Matsunaga and Nakano (1996) examined Japanese longline species composition and CPUE data from two time periods (1967-70 and 1992-95) and two areas (0-10°N and 10-20°N) in the Pacific and concluded that there had been no significant change in blue shark abundance. Nakano (1996), using standardised Japanese longline CPUE data from 1971-93, found no significant trend with time in blue shark catch rates in the Atlantic or Indian Oceans, but noted a 20% decrease in the North Pacific.

### 4.5 Other information made available to the group on blue shark

O'Boyle *et al.*, have reviewed the data on blue shark in the North Atlantic as part of the Maritimes Regional Advisory process and give recommendations for further research (O'Boyle *et al.* 1996c). These authors give a valuable overview of the data and explore avenues for stock assessment related to life history strategies.

A resumé of data on blue shark catches around the coasts of Ireland and SW England (P. Vas, pers. comm.) was provided in the 1995 SGEF report (ICES CM 1995/G:3).

## 5 SPURDOG — FISHERIES, STATE OF STOCKS AND EVALUATION OF EFFECTS OF EXPLOITATION

(This Section will be provided as a working paper to the ICES Working Group on the Assessment of Other Fish and Shellfish Species)

## 5.1 Overview

Spurdog (*Squalus acanthias*) are a far ranging species of small shark which move in large packs, often segregated by size and sex. As a consequence, catch rates by commercial and survey fishing can vary considerably, and longline fishermen in particular have used "feelers" - short lines with few hooks - to locate a spurdog pack before deploying the main gear. Directed fisheries for spurdog have developed from time to time through the 20th Century wherever the species abundance has made this an economic proposition, but today most spurdog are caught as a by-catch in trawl fisheries. Spurdog markets, which tend to require mature females, have generally been good in Europe, and the emerging fisheries in North America have depended on this for export opportunities.

In the North-west Atlantic, the population of spurdog increased to historically high levels by the late 1980s, apparently as a result of the US fleets' practice of selecting only larger-sized fish of mostly cod and flounders on Georges Bank (Murawski and Idoine, 1989), thus making more food available for dogfish. There has been a decrease in the abundance and average size of mature females since 1990, and the stock was classified by NMFS as "fully exploited" in 1993. In the North-east Atlantic, on the other hand, spurdog populations appear to have been depleted by directed fishing of British, French, Norwegian and other fishing fleets since the second world war. In the 1970's, scientists in the U.K. and Norway considered that this stock was overexploited and urged for restrictions. Except for minimum landing size regulations in some countries (primarily for commercial reasons), nothing has been imposed.

## 5.2 Fisheries trends

This section is based on information presented at the 1995 SG meeting (ICES CM 1995/G:3) and national landings statistics for 1994-95 presented to ICES (Table 5.1). The intention is to provide a description of the trends and patterns of commercial fishing for spurdog in the North Atlantic as a basis for understanding the effects of exploitation on the stocks and the scope for data collection. It should be noted that, though most elasmobranch species are usually recorded in combined groupings in landings statistics, spurdog are recorded in a mono-specific category by many countries.

### 5.2.1 North-east Atlantic

#### 5.2.1.1 Belgium

The main fishing area for spurdog is the central and southern North Sea, with relatively less in the Irish Sea and Celtic Sea, and landings reached a peak of around 1,500 t in 1966–1969, since when they have gradually declined to less than 20 t in 1995.

#### 5.2.1.2 Denmark

Reported landings of spurdog from the North Sea and Division IIIa peaked at nearly 1,500 t in 1988 and had decreased to around 150 t by 1995, though it is known that other species have been landed illegally as "spurdog" to avoid problems with quota restrictions. This also applies to the Netherlands statistics.

#### 5.2.1.3 France

Spurdog are landed mainly by trawlers working in the NE Atlantic from the Faroes south to Northern Biscay, and there is some longlining activity for spurdog in the Celtic Sea and the western English Channel. Most of the catches since 1979 have come from the Celtic Sea, where catches peaked at 6–8 thousand t in 1981–1984 and again in 1987–1988, but had fallen to under 1,000 t by 1993. A similar pattern was observed in the English Channel, with 1,500–1,800 t being landed in 1980–1983 and 1,240–3,000 t in 1986-1988, falling to around 500 t in 1995. Landings from the North Sea peaked at 2,500 t in 1979–81 and have since declined continuously to under 20 t by 1994. Landings from the west coast of Scotland, the Irish Sea and west of Ireland also peaked in the mid 1980s, at around 2,500 t, 1,600 t and 850 t respectively, and by 1994 together amounted to just over 200 t. Annual landings from the northern Bay of Biscay remained at between 200 and 520 t up until 1988, but had declined to 150 t by 1994.

#### 5.2.1.4 Germany

Elasmobranchs have only been taken as by-catch in Germany, mainly by bottom trawls, though the spurdog is one of the few species which have been landed regularly for human consumption. As landings of spurdog from the North Sea have declined to below 50 t in the 1990s, the market has been supplied by imports from Norway and Canada.

#### 5.2.1.5 Iceland

Landings of spurdog from Division Va reported to ICES since 1967 averaged around 20 t until 1991, but rose to over 100 t in 1992-1995.

#### 5.2.1.6 Netherlands

The Dutch fleet is composed primarily of beam trawlers which take elasmobranchs in the North Sea as by-catch, fishing in an area 30-50 miles wide along the Dutch, German and Danish coast, outside the 12-mile zone. Landings of spurdog, most of which was exported, have decreased since 1976.

#### 5.2.1.7 Norway

Norway's spurdog fishery grew rapidly from just under 3,000 t in 1946 to a peak of around 30,000 t per annum in 1961–1963. The main fishing grounds were off the west coast of Norway in winter-spring and on the banks north of Scotland in summer-autumn. Tagging experiments had shown that the "Scottish-Norwegian stock" of spurdog migrated between these two areas, but there was a change in the spurdog's migration pattern in the years when Norway's fishery was at its peak. Instead of wintering off western Norway, the spurdog migrated southward in the North Sea to the Dogger Bank area. Norwegian longliners became aware of this development in 1968, and it led to better catches for about five years. Catches in the North Sea then continued to decline and in 1996 were below 1,000 t, with only a few larger auto-line vessels fishing seasonally for spurdog.

In the late 1980s, a spurdog fishery developed in the fjords and coastal waters of Nord-Troendelag (64–65° N, Division IIa), carried out by small local vessels, mainly with gill nets. This led to a temporary increase in landings, peaking at 5,200 t in 1991, though catches there had declined to less than 400 t in 1996.

#### 5.2.1.8 United Kingdom and Ireland

Spurdog have been exploited in directed fisheries around the British Isles, being taken on longlines in the southern North Sea and in fixed gill nets in the Bristol Channel and Irish Sea, though these fisheries are seasonal and have recently become sporadic. In all areas, most spurdog landings now arise as a by-catch in otter trawls and seines aimed principally at whitefish. The Scottish spurdog landings from west of Scotland and the northern North Sea reached a peak in 1975/76, when over 10,000 t were reported, and the fishery has continued to account for landings of at least 4,500 t each year (8,500 t in 1995). Landings of spurdog by England and Wales fleets working in the North Sea have declined from over 4,000 t in 1981 to around 500 t in 1995, whilst there was a peak in catches in the Irish Sea between 1985 and 1988, at 3–4,000 t each year, with landings being below 1,000 t in 1995. A spurdog gill-net fishery has developed along the west coast of Ireland since 1976 and catches reached a peak of over 5,000 t in 1984–1988, with landings in 1994 and 1995 being around 1,000 t.

### 5.2.2 North-west Atlantic

#### Canada and United States

Spurdog are taken by a directed fishery in the Scotian Shelf and Bay of Fundy areas and a directed fishery has also developed in the southern Gulf of St. Lawrence. Landings of spurdog from foreign fisheries on the Scotian Shelf peaked at around 24,000 t in 1972–1975, but were then replaced by national fisheries. Total US landings never exceeded 5,000 t until 1981 and, from a level of about 4,000 t in 1987, increased to over 20,000 t in 1993. Over 95% of these landings consisted of mature females of at least 80 cm in length. The total landings for NAFO areas 2,3,4,5 and 6 in 1996 were around 25,000 t. About 70% of the current landings are taken by set gill nets, with most of the remainder caught by otter trawlers. Discards from other fisheries, particularly by otter trawlers targeting groundfish, contribute an unknown but substantial fraction of the total mortality.

### 5.3 State of the stocks

#### 5.3.1 Spurdog in the North-east Atlantic

An examination of the national fishery trends presented above indicates that spurdog catches in the North Sea have fallen since the mid-late 1970's. Catches of spurdog increased in the late 1970's in the Irish Sea, Celtic Sea and English Channel, following a period in which little was caught, but declined after reaching a peak between 1980 and 1988, depending on area. The apparent decline in spurdog landings in all areas since the late 1980's may be partly due to the fact that spurdog are not a TAC species in the NE Atlantic, and reporting of catches is not mandatory. Spain, for example, is understood to have taken catches of several thousand tonnes, which do not appear in *ICES Fisheries Statistics*.

CPUE data are available either from commercial fisheries or research vessel surveys for most sea areas around the British Isles. The longest time series are for Scottish seine netters and trawlers fishing in the North Sea and to the west of Scotland. These suggest that the spurdog population in the North Sea increased in abundance between 1967 and 1977, when it is thought that there was a change in the pattern of migration, and then returned to the level observed in the early 1960s. This high abundance period corresponds with a much more marked peak on the west coast, where there was a second peak in 1985-88, which was not seen in the North Sea data. Commercial CPUE data for English and Welsh Vessels in the Irish Sea indicate a peak in abundance between 1982 and 1985.

The IBTS and English August groundfish survey in the North Sea show peaks in relative abundance of spurdog, but not in corresponding years. In the former survey, the maximum relative abundance was seen in 1976, after which few of the species were caught, but in the UK survey the maximum peak was seen in 1986, corresponding to a peak in the Kattegat/Skagerrak IBTS series. CPUE from the English Celtic sea survey (1982–95) show wide fluctuations and no discernible trends. These discrepancies are probably due to variations in catchability of the species. Spurdogs are known to be fast swimmers, migrating several hundred kilometres in large packs, and the half hour hauls used in research surveys are unlikely to take a representative sample of the stock.

It appears, therefore, that spurdog abundance might fluctuate widely in a particular sea area, irrespective of the overall stock trends, and that short time series (i.e. less than 15-20 years) for limited sea areas do not necessarily indicate their stock status. Local abundance increases may be the result of an influx of maturing fish to a particular area, which are soon depleted as fisheries develop. They should not be taken as representative of the state of the stock as a whole. The general conclusion, then, is that there was a peak in abundance of spurdog in the NE Atlantic in the mid 1970s to mid 1980s, after which most indices of abundance have shown a marked decline.

#### 5.3.2 Spurdog in the North-west Atlantic

Spurdog is currently one of the most abundant demersal species in the NW Atlantic, and it is considered that one stock undergoes large seasonal migrations throughout the entire NW Atlantic. Swept-area estimates from survey trawl data indicate that its biomass increased 6-fold between the late 1960s and 1989 (Rago *et al.*, 1994). In its 1994 "Status of the Fishery resources off the North-eastern United States", NMFS reported that fishing mortality rates had increased 5-fold since 1980 and that research trawl survey indices show that the stock is now declining. The mean size of fish in the stock, and particularly of the mature females, continues to decline.

### 5.4 Population Biology

#### 5.4.1 Fecundity

There is more information on the reproductive dynamics of the spurdog than for all other elasmobranchs, and there has been considerable variability in the average number of embryos or pups reported from the different populations of spurdog in the North Atlantic and north Pacific Oceans. It is difficult to judge if phenotypic plasticity is responsible for these area and time differences or whether they can be interpreted as responses to changes in population density due to exploitation.

Holden (1974) suggested that the differences between the fecundity of the Scottish-Norwegian stock (5.78 embryos/female) and that of the NW Atlantic stock (4.20, Templeman, 1944) could reflect a response by the European stock to decreased abundance caused by fishing, though Nammack et al. (1985) gave a value of 5.8 for the NW Atlantic stock in 1980–81.

Fecundity studies of Pacific spurdog in British Columbia waters indicated a much smaller range, from 6.2 (Ketchen, 1972) to 7.3 embryos per female (Jones and Geen, 1977; Bonham *et al.*, 1949). Unlike the Scottish-Norwegian stock, the NE Pacific population was subject to a high level of exploitation during the 1940s, which was later reduced by at least 90% (Wood *et al.*, 1979).

Variations in fecundity were also detected in the NW Atlantic population (Silva and Ross, 1993 and Silva, 1993a; 1993b). Fecundity increased until 1976/1978, decreased in 1980–1981 and increased again in 1985–1986. Then fecundity decreased until 1991, reaching a level generally lower than in 1961. Mean fecundities and abundance were negatively correlated, and there were positive correlations between fecundity and mean mature female weight. It should be noted that all authors agree that the gestation period of spurdog is 20–22 months and, as individual mature females either carry "candle" embryos or large pups, this implies that the reported fecundities represent at least a biennial production level of young.

### 5.4.2 Length and age at maturity

An important reproductive parameter with implications for juvenile production by a fish population is the length (and/or age) at 50% maturity. It appears that there are some regional differences in spurdog which have been consistent through time. In the NE Pacific, Bonham *et al.* (1949) estimated that the length at which 50% of female spurdog were mature was 92 cm, which is close to the estimate of 93.5 cm reported by Ketchen (1972). In the NE Atlantic, a smaller length at 50% maturity for females was reported; 82 cm for the Scottish-Norwegian stock by Holden and Meadows (1964) and 83 cm 15 years later by Gauld (1979); and 75–80 cm reported by Hickling (1930) and 74 cm reported by Fahy (1989b), both for spurdog from off South-west Ireland.

Although female size at 50% maturity in NW Atlantic spurdog was achieved at the same length (81 cm) in 1942 and 1980–1981, Silva and Ross (1993) subsequently reported variations from 86 cm in 1985–1986 to 82 cm in 1987–1988 and 84 cm in 1991. Silva (1993a; 1993b) argued that these changes may not represent a direct density-dependent mechanism but, as both variables were correlated with growth, the increasing growth rate of the juveniles during the 1970s (Silva, 1992) resulted in increased size at maturity. Male size at maturity showed a similar trend to the one observed with females.

### 5.4.3 Compensatory mechanisms

If compensatory mechanisms act on elasmobranch populations, predicting the effect that changes in exploitation will have upon future generations requires that the stock-recruitment relationship is taken into account. This requires a knowledge of stock identity.

It is possible that the plasticity of an elasmobranch population for changes in fecundity might be limited by the size of the maternal body cavity and the relatively slow growth of mature individuals. This would restrict the scope for compensation. However, Gauld (1979) reported an increase in individual spurdog fecundity by 42% since the early 1960s (Holden and Meadows, 1964) in the Scottish-Norwegian population, and an increase in fecundity of 78% was reported for the NW Atlantic stock since the early 1940s (Templeman, 1944; Nammack, 1982; Silva and Ross, 1993). Information on the number of pups per kg of female body weight is required to know whether these increases are due to changes in size at maturity or mean size of breeding females in the population, or to a response of individual fish to better feeding opportunities, for example.

Some authors have suggested that, though recruitment and mature stock biomass in spurdogs are closely linked, some compensatory mechanisms must exist in order for these populations to survive in changing environments (Holden, 1973; Holden, 1977; Fogarty *et al.*, 1989). A stock-recruitment analysis applied to the NW Atlantic population of spurdog (Silva 1993a; 1993b) indicated that this stock appears to have compensatory mechanisms strong enough to inflect the stock-recruitment relationship.

The large size at birth, and consequent lower variability in mortality rates in elasmobranch fish populations, should also result in greater predictability of recruitment processes than is possible with teleosts. Predation is likely to be of less importance to elasmobranchs than to teleosts, but prey availability may be of major importance in determining the recruitment success in a given year and area. Wood *et al.* (1979) suggested that compensatory changes in natural mortality represent the principal factor determining the stock-recruitment relationship of British Columbia spurdog. This would be particularly strong if cannibalism of young by the mature stock exists, but segregation by size and sex in spurdog reduces the likelihood of cannibalism.

### 5.5 Modelling and assessment

Most attempts at assessing spurdog in European waters have been based on the application of production models. Unlike VPA and Yield-per-Recruit analysis, these models imply compensatory changes in life-history parameters in response to exploitation. One characteristic of elasmobranchs that makes the application of the method more suited than to teleosts, is their deterministic stock/recruitment relationship, which enables incorporation of compensation in production models. Although it is usually implied that the populations are at equilibrium, non-equilibrium models should be chosen due to the long life usually exhibited by elasmobranchs.

Catch and effort data are required, but good time series are rare for the reasons described above. Effort has to cover a range of stock abundance for the results of the model to be reliable. One limitation to the application of such models occurs if fishermen direct the effort towards high density areas, which may apply especially to spurdog.

Holden (1968) examined the relationship between mean length at entry into the fishery of the Scottish-Norwegian stock of spurdog and the instantaneous total mortality rate (Z) obtained from tagging experiments, and concluded that the stock would continue to decline at the prevailing rate of fishing because the female part of the stock could not produce enough young to maintain recruitment. This interpretation, however, relied on the assumption that this spurdog population is separate from two other "stocks", the Atlantic and Norwegian coastal, which contrasts with Aasen's (1964) supposition that these fish belong to a single NE Atlantic stock. On the basis of the latter assumption, Gauld (unpublished data) has estimated Z on males to be 0.36–0.47 over the period 1980–1984, which falls within the range given by Holden for the early 1960s. Holden and Meadows (1964) also provided a method of estimating the level of Z that can be withstood by an elasmobranch population at constant recruitment, as a function of the mean number of female young produced per year, age at 50% maturity, and Z. This showed that at a total mortality rate of 0.29 (Aasen, 1964) and 50% female maturity at 82 cm, the replacement rate of 0.7 (at the upper 95% confidence limit) would mean that the stock could not maintain itself.

The first age-structured compensatory model developed for an elasmobranch population was applied to spurdog in British Columbia waters (Wood *et al.*, 1979). This incorporates information regarding growth and reproduction to evaluate mechanisms of density-dependent regulation of abundance in relation to predictability of observed patterns in the historical fishery. The rate of natural mortality was estimated at 0.09, and the minimum size at recruitment appeared to have little effect on MSY.

A biomass dynamics model based upon observed catches, an estimate of natural mortality, and a biomass production function applied by Brodziak *et al.* (1994) to the NW Atlantic stock gave estimates of F of 0.02 for the total stock during 1968–1993 and F of 0.012 to 0.044 for recruits (individuals > 80 cm in length) during 1980–1993.

A life-history type of model, incorporating density-dependent sub-models for growth, fecundity and recruitment, was developed to simulate changes in the reproductive dynamics of the NW Atlantic stock of spurdog (Silva, 1993, 1994). It suggested that the increase in abundance observed during the 1980s and early-1990s is, at least partially, explained by changes in juvenile growth observed during the 1970s, which subsequently resulted in increased mean size at maturity and fecundity.

A further transformation and development of the life-history model by Rago *et al.* (1994), combined with a Y/R sub-model, gave an estimated F of 0.26 on fully recruited females in 1993 (compare with F= 0.01–0.04 from Brodziak *et al.*, 1994). At a minimum length at entry into the fishery of 84 cm, the maximum F that would ensure replacement recruitment was about 0.25, when the corresponding Y/R would be less than 0.05 kg. Yield per recruit decreases with increasing minimum size, owing to the slow growth of spurdog at these sizes, and maximum Y/R (0.55 kg) was estimated at an F of about 0.07 and a minimum size of recruitment at 67 cm. Since reproduction in females occurs primarily in animals ≥ 80 cm, and a substantial amount of fishing occurs on fish as small as 50 cm, F in excess of 0.1 would probably result in negative female pup replacement. Rago *et al.*'s prognosis for this stock was that, despite considerable uncertainty about the critical data and parameter estimates, a protracted period of exploitation at current levels would eventually reduce the total biomass to levels observed in the 1970s, and result in a reduction in long-term recruitment.

### 5.6 Recommendations for future work

There are many difficulties posed by spurdogs for the application of conventional stock assessment methods — not least the likelihood that cpue series for individual fisheries or surveys do not represent the trends in abundance of the stock as a whole. Spurdog populations tend to have a patchy distribution, by size and sex, and it is difficult to obtain catch information and biological samples which represent the whole population. It is therefore necessary to have reliable information on stock identity and stock delimitation, and to have a good knowledge of the fishery(ies) exploiting the stock. As with many teleosts, in many fisheries which catch spurdog, especially through trawling, mortality due to discards is unquantified.

The Study Group suggests that the ICES Study Group on the Assessment of Other Fish and Shellfish Species is requested to fully evaluate the methods described above, using all the available data on the spurdog in the NE Atlantic, on the assumption that they belong to one biological population. It would be useful to compile a spurdog catch data series for the maximum time period by ICES division and country, and to identify the corresponding biological data (length/age distributions, size at maturity, growth, fecundity etc). This may enable length cohort analysis to be applied so long as the length frequency samples can be assumed to represent the whole population and, though there may not be discernible year class modes in large-sized fish, there is some prior knowledge of the growth parameters due to the ability to age spurdog.

## 6 CASE STUDY: NORTH SEA RAYS AND SKATES

This section will be reworked as necessary and appear as a Study Group Working Document which will be made available to the ICES Study Group on Assessment of Other Fish and Shellfish Species.

### 6.1 Introduction

Rays and skates have a benthic distribution, occupying the same spatial niche as teleost flatfish. Although they are mainly caught as by-catch, there is still a limited tangle-net fishery for rays off the British coast and in the past directed fisheries occurred off the European continental coast (Walker, 1996). All of the North Sea skate and ray species have a commercial value, except for the starry ray (*Raja radiata*). This species is landed incidentally in the Danish industrial fisheries. Commercial landing data on rays and skates have been collected by ICES since 1903, although the data are not usually detailed to species level. Landings of all skates and rays started declining in the North Sea in the early 1920's and again in the mid-1950's, following a period of recovery during the second world war, but have levelled out over the past 15–20 years (Figure 6.1).

The present distribution of the four most common ray species in the North Sea shows that the species have quite discrete distributions. The starry ray is abundant offshore in the central North Sea, whereas the cuckoo ray (*Raja naevus*) occurs mainly in northern British coastal waters. Thornback rays (*R. clavata*) are found primarily in the coastal waters around the Wash and the Thames estuary and spotted rays (*R. montagui*) off the east coast of Britain and around the Wash. The common skate (*R. batis*) is currently caught only off the Shetlands. However, in the first half of this century, the distribution of thornback rays and common skates was considered to be extensive throughout the central/southern and central/northern North Sea, respectively (Walker, 1996). The limited evidence available suggests that in the past few decades the common skate has retreated to the very northern North Sea, that the thornback ray is no longer caught in the south-eastern bight and that the starry ray has replaced other species in the central North Sea (Walker, 1996; Rijnsdorp *et al.*, 1996; Walker & Heessen, 1996).

The skate and ray species in the North Sea show a wide range in their age and length at maturity (Holden, 1973; 1974; 1975, Vinther, 1989) and it is to be expected that fisheries exploitation will affect each species differently. Although only the larger individuals (> about 70 cm) are landed regularly, most length and age classes are caught in trawls due to their large size at hatching (9–24 cm) and morphology (large 'wings' and presence of sturdy spines) and individuals as small as 30 cm have been seen to be landed (Walker, personal observation). Since only mature individuals can contribute to the next generation, survival during the juvenile period is a key factor in ray population dynamics. Therefore, it is to be expected that those species with the lowest length and/or age at maturity have the highest chance of survival at increasing levels of exploitation.

There is evidence that growth and maturation of four North Sea ray species have changed over a period of decades (Walker *et al.*, in preparation). Intraspecific variation in growth and reproductive parameters may be due to either phenotypic or genetic differences and it is possible that the removal of individuals from the population by fisheries has a selective influence. The intraspecific plasticity of age and size at maturity in fish has been described by several authors (Stearns & Crandall, 1984; Roff, 1991; Rijnsdorp, 1993). Stearns & Crandall (1984) suggest that age and length at maturity are not independent traits under selection but are linked in a trajectory which is itself subjected to selection.

In this section international landings data and four series of survey data have been examined to identify the changes occurring in abundance and distribution of the major species in the North Sea. Data on growth and maturation from ongoing research (Walker *et al.*, in preparation) have also been analysed to determine the differences between species with regard to life history parameters and are compared to published and unpublished data to see how these have changed over time. Some comparative data from the Irish Sea and NW Atlantic are also available. This section forms a basis for the interpretation of the effects of fishing on the stocks of skates and rays in the North Sea. The characteristics of eleven *Raja* species occurring in the North Sea are shown in Table 6.1.

## 6.2 Changes in abundance and distribution

### 6.2.1 ICES landings

Landings from the whole North Sea decreased significantly during the 1930s but increased just after World War II, during which period fishing had almost stopped (Figure 6.2). In the southern North Sea landings declined around 1948 and again in 1963, whereas in the northern and central area the major decline started around 1965. Since the mid-1970s, total landings have remained more or less constant. Rijnsdorp & Millner (1996) show that fishing mortality on plaice has increased substantially during the post-war period. The same appears to be the case for cod and haddock, indicating that effective effort has increased. Thus it seems likely that catch rates of skates and rays have decreased faster than is suggested by the total catches.

### 6.2.2 Historical and current survey data from Scotland and England (from Walker & Hislop, submitted)

Scottish survey data for the central and northern North Sea are available for the periods 1929-1956 and 1981-1995 (Greenstreet and Hall, 1996). The four areas for which data were available (East Shetland, NW Central, Central & Scottish East Coast) are shown in Figure 6.3. Historical data from 1906–1909 were compared to data from 1990–1995 from the Southern Bight (Rijnsdorp *et al.*, 1996).

Annual catch rates of six species taken in the Scottish surveys are shown in Figure 6.4. This shows that *R. batis* was caught regularly during the first period, but disappeared from the entire survey area between 1956 and 1981. The spotted ray entered the north-eastern North Sea survey data in 1991 for the first time. The starry and cuckoo rays were caught throughout the two periods, but the thornback ray became less abundant between 1981–1995 than between 1929 and 1956. In Figures 6.5 and 6.6 the catches of skates and rays in each of the four areas are shown separately for the periods 1929–1956 and 1981–1995. The overall abundance has increased in the two offshore areas (NW Central and Central) and decreased in the northern (East Shetland) area (Figure 6.5). There has been a marked change in the species composition in all areas (Figure 6.6). In the more northern and coastal areas, the common skate, the thornback ray and the cuckoo ray were all quite abundant in 1929-1956. However, by 1981–1995 the common skate and the thornback ray were no longer caught and the starry ray predominated in these areas. Data for the Southern Bight are shown in Table 6.2 (Rijnsdorp *et al.*, 1996). Although the estimate of abundance is dependent on the gear used, it is apparent that the thornback ray has decreased in numbers, whilst the common skate is no longer caught in the area.

Changes in length-frequency of all species are shown in Figure 6.7. In the areas East Shetland, Northwest central and Scottish East coast the largest size classes were no longer caught in the 1990's, whereas the length-frequency in the central area (where the starry ray was most common in both periods) does not appear to have changed. The shape of the length-frequency relationship has changed accordingly.

### 6.2.3 International Bottom Trawl Survey (IBTS)

Trends in CPUE and distribution are shown in Figures 6.8 and 6.9–6.12, respectively (Walker & Heessen, 1996). Starry ray was the most abundant species in the survey catches and the abundance and area of distribution increased with time (Figures 6.8 and 6.9). Years before 1974 are unreliable, because the survey did not extend over the entire North Sea in those years. Trends in abundance for the other species are less reliable up until 1984, because the Southern Bight was not sampled consistently until then. No obvious trends in abundance or distribution could be observed for these species.

### 6.2.4 English Groundfish Survey (EGFS)

CPUE data are shown in Figure 6.13 for three species. Between 1977 and 1991 a Granton trawl was used to sample the area, but in 1992 the gear was switched to the GOV ('grande ouverture verticale'). There was an increase of the starry ray in the area from 1981 onwards, but catches of this species were significantly lower with the GOV than with the Granton trawl. Both the thornback and spotted rays showed large fluctuations in abundance through time (Figure 6.13).

### 6.2.5 Sole Transect data - Netherlands Institute for Fisheries Research

Three series of transects perpendicular to the Dutch coast have been sampled since 1951, with > 90% of the catches being thornbacks (Walker & Heessen, 1996). Since the mid-1950s, no rays of any species have been caught in these transects, with the exception of a few single individuals.

### 6.3 Changes in life history parameters

Ongoing work has produced preliminary results on growth and maturation for four rays species in the North Sea (Walker *et al.* in preparation). The results on age at maturity and fecundity (Table 6.3) will be used here to estimate the level of mortality that a population at steady state could withstand. This value of 'replacement' mortality can be calculated using the the Euler-Lotka equation (Stearns, 1992); the rationale being that at steady state ($r = 0$) each adult female replaces itself in the population:

$$1 = \sum_{X=\alpha}^{X=\omega} e^{-rX}\, l_x\, m_x$$

Where $\omega$ = maximum age; $\alpha$ age at maturity; $r$ = exponential rate of growth of the population; $X$ = age; $l$ = survival; $m$ = fecundity. Rate of increase of the population ($r$) can be estimated using a life table; for an example see Table 6.4. The mean number of eggs/female was used for fecundity. The results of the analyses are shown in Table 6.5 and it can be seen that at the observed age at maturity and fecundity the species rank order is starry > cuckoo > spotted > thornback. The values presented here are different to those published by Brander (1981) as shown in Figure 6.16, due to a higher fecundity in the starry ray, a lower age at maturity for the spotted and cuckoo rays and a higher age at maturity for the thornback ray. The data presented by Brander were primarily from the west coast of Britain and the Irish Sea, but this illustrates quite well the effect of a shift in age at maturity on survival. The spotted ray could withstand a total mortality of about 0.48 when maturing at 9 years old, whereas now (mature at 8 years) it can withstand a total mortality of 0.54.

Estimates of total mortality have been made from catch curves in which relative age is plotted against ln(abundance) (Hilborn & Walters, 1992). Values for thornbacks were based on data from 1991–1995. The largest age class of the spotted ray was not included in the estimate, as this represents a number of individuals with lengths up to 20 cm above the estimate of $L_{inf}$ (Table 6.3). The blonde ray, *Raja brachyura*, has a similar morphology to the spotted ray, but has a higher asymptotic size (Table 6.1) and it is possible that the species have been confused. The length-frequencies and catch curves are shown in Figure 6.14. The values of total mortality and 'r' are shown in Table 6.5 for the four species. Assuming these levels of mortality apply to all age classes (and rays often enter the fisheries during their first year of life) then the rate of increase of the population (r), as estimated from life tables, is negative for all species, except the starry ray (Table 6.5).

The life table approach presented here is the most simple form of this type of analysis and is used to illustrate how the changes observed in age at maturity might have an effect on the population. Incorporating differentiate survival by age class and length at recruitment to the fisheries, as well as changes in fecundity in relation to size are the obvious next steps.

## 6.4 Species similarities and differences

The demise of the common skate *(R. batis)*, in the Irish Sea has been described by Brander (1981). The evidence from long-term survey data in the southern (Philippart 1996), central and north-western (Walker & Hislop, submitted) North Sea shows that the species has not been caught since the 1960s in the southern North Sea and, although still present in surveys in 1956, was not caught between 1981 and 1995. The barndoor skate (*R. laevis*) has a similar biology to the common skate and is found in the NW Atlantic. This species showed a decline in relative abundance in the northern NW Atlantic during the 1950s and 1960s (Jill Casey, personal communication; in ICES files).

Length at maturity data of thornback rays from the British west coast and the Irish Sea were collected by CEFAS in Lowestoft and made available to the SG. These are shown, together with the data from the North Sea in Figure 6.15. The females appear to mature at a lower size in the Irish Sea than in the North Sea, although different gears were used in each area which might bias the results. Length at 50% maturity for females is 77.7 cm in the Irish Sea and 86.3 cm in the North Sea; for males it is 67.5 cm in both areas.

The starry ray *(Raja radiata)* has become a commercial species in the NW Atlantic (where it is known as the thorny skate) since 1994 (Atkinson, 1995; Kulka *et al.* 1996). Before this it was the greatest 'non-commercial' by-catch, with amounts caught during the early to mid-1980s of 3,000-4,000 tonnes (Kulka *et al.* 1996). Here, however, the species' length at 50% maturity is between 64 (3N) and 73 cm (3Ps), as compared to 40 cm in the North Sea. In the NW Atlantic the species is divided into two management stocks (3LNO, 3Ps), based on the difference in length at maturity (Atkinson, 1995). It appears that whilst this species has increased in abundance in the North Sea, it is showing signs of a decrease in the NW Atlantic (Kulka *et al.* 1996; Atkinson, 1995). This illustrates the species-specific phenotypic plasticity for growth and highlights the importance of taking effects of temperature and/or latitude into consideration when doing comparative studies.

## 6.5 Susceptibility, Vulnerability and Catchability

Species susceptibility to fishing exploitation is not only a matter of the vulnerability as dictated by a specific life history and the eventual ability to compensate, but also the catchability as defined by distribution, seasonal behaviour and gear. For example data from the EGFS show that the catches of *R. radiata* were significantly lower with the GOV, as compared to the Granton trawl. In gillnets the peak length class caught is 46–48 cm (Vinther, 1995), as opposed to 41–44 cm in the GOV.

## 6.6 Concluding remarks

The life history of the common skate, its large size and commercial importance make it the most susceptible of the North Sea *Raja* species and the stocks have, quite predictably, been severely depleted. Even the populations of the other species that are still present in the North Sea are unlikely to be able to withstand the current level of total mortality for long, despite changes in maturation which, at a population level, appear to enable the spotted and starry ray to survive a slightly higher level of mortality now than in the past. The species-specific differences are especially interesting, i.e there are species which have 'disappeared' e.g. the common skate; species which have decreased in distribution and/or abundance but which show certain changes in life history parameters e.g. spotted rays; and species which have increased in abundance and distribution e.g. the starry ray. It is a point for discussion if these apparent changes are due to: (i) changes in population structure (i.e. removal of large and slow growing individuals by fisheries or (im)migration of individuals with different growth characteristics); (ii) density-dependent feedback (compensatory) mechanisms; or possibly (iii) temperature.

The ranking of susceptibility to fisheries as shown in Figure 6.16 is quite illustrative, and this life-table approach to defining replacement mortalities is definitely worth pursuing as it can incorporate changes in year class survival and fecundity. This is especially useful in the light of stock assessment.

# 7 SPECIES IDENTIFICATION GUIDES

At the 1995 Study Group meeting it was agreed, and accordingly the ToR for 1996 stated, that M. Stehmann (D) should elaborate three illustrated field guides in order to provide easy identification of common NE Atlantic elasmobranch species. Existing scientific handbooks like, for example, FNAM (1984) and the FAO World Shark Catalogue (Compagno, 1984), although extensive, were apparently either not being used, or inappropriate for quick field identifications. Providing these poster guides through ICES should enable scientists and non-scientists to quickly identify at sea and ashore catches and landings of the common skates, rays and deep-water sharks to species level in favour of getting the badly needed information on catches, discards and landings of these elasmobranchs.

The **first key concept for 13 common NE Atlantic and North Sea skate and ray species (*Raja* spp.)** was prepared by summer 1996 and submitted to ICES in time for the 1996 Annual Science Conference. This guide was designed for printing as an illustrated wall poster in a dichotome graphic scheme, to be published in durable form by ICES in English, French, Portuguese and Spanish. This draft, with text and figures, became Appendix 1 of the SG's 1996 Report.

The relevant ICES WGs and Committees found this guide proposal acceptable at the 1996 Annual Science Conference, though no formal approval for publication was given.

With the same design, the **second field guide to landed wings of the same 13 species of rays and skates** was prepared and submitted to the SG's 1997 meeting, and it appears as Appendix 1 to this report.

The **third field guide to 27 common species of North Atlantic deep-water sharks** was presented as a part-draft of the key texts for discussion at the 1997 SG,s meeting. It will be prepared ready for poster printing in the same way as the two other guides and be submitted to the ICES Secretariat in time for the 1997 ICES Science Conference.

It is intended that all three guides be officially forwarded to the relevant bodies of the 1997 Annual Science Conference for formal approval and recommendation for printing and distribution by ICES. The poster guide to wings of skates and rays will be bilingual English/French, whereas that for the deep-water sharks should be in the four languages used for the skate and ray species.

## 8 SPECIES CODING

Following recommendation by the SG in 1995 for changes and additions to the Classification and Codings of cartilaginous fishes in the "STATLANT 27A Reporting Form" (see Figure 8.1 for a schematic overview) the SG recommends the following in order to obtain as detailed as possible the urgently needed missing information on catches, eventual discards and landings of an increasing number of chondrichthyan species especially from deep water.

HOLOCEPHALI (HOL)
Add species code for *Chimaera monstrosa*
Add *Hydrolagus* spp. and lump both under family CHIMAERIDAE
Add family RHINOCHIMAERIDAE and specify under this heading *Rhinochimaera* spp. and *Harriotta* spp.

Under BAI - Hypotremata - separate specifically a) family RAJIDAE (skates) and b) "all other rays" and assign code also to the latter ones.

Under SKA 1006 - *Raja* spp. (skates) - , add the following species and assign specific codes also to these: *Raja alba* (White or Bottlenose Skate), *Raja microocellata* (Small-eyed Ray), *Raja undulata* (Undulate Ray), *Raja radiata* (Starry Ray), *Raja fyllae* (Round Ray), *Raja circularis* (Sandy Ray), *Raja brachyura* (Blonde Ray)

Under SYX 1011 - family SCYLIORHINIDAE - , add the followings subunits and assign group or specific codes to them: *Pseudotriakis microdon* (False Catshark), *Apristurus* spp., *Galeus* spp., *Galeus melastomus* (Blackmouth Catshark), *Scyliorhinus canicula* (small-spotted catshark)

Under DGX 1005- family SQUALIDAE - , specify the following subunits and assign group or specific codes to them: *Echinorhinus brucus* (Bramble Shark), *Oxynotus paradoxus* (Sailfin Roughshark), *Oxynotus centrina* (Angular Roughshark), *Dalatias licha* (Kitefin Shark), *Somniosus rostratus* (Little Sleeper Shark), *Centroscyllium fabricii* (Black Dogfish), *Etmopterus pusillus* (Smooth Lanternshark), *Etmopterus princeps* (Great Lanternshark), *Etmopterus spinax* (Velvet Belly), *Deania calcea* (Birdbeak Dogfish), *Deania* spp., *Scymnodon ringens* (Knifetooth Dogfish), *Scymnodon obscurus* (Smallmouth Knifetooth Dogfish), *Centroscymnus crepidater* (Longnose Velvet-Dogfish), *Centroscymnus coelolepis* (Portuguese Shark), *Centroscymnus cryptacanthus* (Shortnose Velvet-Dogfish), *Centrophorus squamosus* (Leafscale Gulpershark), *Centrophorus lusitanicus* (Lowfin Gulpershark), *Centrophorus granulosus* (Gulper Shark), *Centrophorus uyato* (Little Gulpershark)

Of the taxa mentioned above, *Pseudotriakis m.*, *Echinorhinus b.* and *Oxynotus p.* and *O. centrina* are also assigned to their own families Pseudotriakidae, Echinorhinidae and Oxynotidae, respectively.

The proposed additions will also cover the species considered in M. Stehmann's field guides to the common skate/ray and deep-water shark species in the North Atlantic.

## 9 INITIATIVES RELATED TO ELASMOBRANCH MANAGEMENT AND CONSERVATION

### 9.1 Existing or proposed international initiatives related to elasmobranch management and conservation

Sharks and other cartilaginous fishes have, in the past few years, become the focus of increased attention on the part of national, regional and international management authorities, Conventions, and non-governmental organisations. This is the result not only of elasmobranch fisheries management concerns, but also the significant wildlife and wider marine ecological implications of their exploitation and trade. Concerns have largely focused on the inadequate or inappropriate management (if any) of most directed and incidental shark fisheries, and the lack of data on stocks, fisheries (including landings, by-catch, and discards), trade, and habitats required for the formulation of management advice. Several international initiatives have arisen as a result which overlap with ICES' activities, or may do so. Examples, which are described in Appendix 3, include the following.

- Activities arising from the 'Shark Resolution' (Conf. 9.17) of the 1994 meeting of CITES, the Convention in International Trade in Endangered Species, for example:
  - ◊ initiatives to improve identification, recording and reporting at species level of landings, bycatch and trade;
  - ◊ new research and management efforts;
  - ◊ planning for a consultative meeting of 'experts'; and
  - ◊ a resolution for the establishment of a CITES Marine Fish Working Group.

- The conclusions of the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues, Bergen, March 1997, which invited competent authorities to establish priorities for the elaboration of stock assessments and forecasts for the elasmobranchs, and noted that ICES considered it could provide the technical information necessary within a ten year time frame.

- The overlap of interests between ICES and other international bodies, such as FAO, ICCAT, IUCN, and other environmental non-governmental organisations.

- The increased tendency for elasmobranchs (and other commercial fish species) to be proposed for protected status through addition to the relevant appendices of international wildlife and environmental conventions and national legislation.

The implications of these initiatives for future ICES work on elasmobranch fishes are significant, and have been taken into account when considering the SGEF recommendations for future work.

### 9.2 Proposal for a Concerted Action Plan

Elasmobranchs are becoming increasingly more exploited as fisheries pressure is diverted from the more traditional species. This is not only the case on the continental slope and coastal areas, but also in oceanic deep-water. In order to successfully manage these 'new' stocks information is needed on their biology and population dynamics. Basic biological data and data on changes in abundance of elasmobranchs, although collected by many institutes, are not readily available, being pooled with other data or disregarded.

Initiatives taken by the ICES SGEF to attempt stock assessments have been hindered by lack of data. Not because there are no data, but because data collection and analysis is not well coordinated on a European basis and has a low priority in relation to data on commercially important teleost species. However, with the growing demand for 'alternative' species and for elasmobranch products, concerted action must be taken to find out what type of data have been collected and where and, more importantly, what information is required in order to develop an understanding of the population dynamics of the cartilaginous species and the changes in life history parameters in response to exploitation. This would provide the basis for management advice.

Concurrent with a Concerted Action (funded, if possible, by the EU), a proposal for collaborative research should be written, attempting to coordinate and enhance our knowledge and to create and standardise a network of people and information. An ongoing part of the Concerted Action should be to develop standard assessment procedures, which will not only create a framework for identifying changes in the population dynamics over a long time period by monitoring particular biological traits (i.e. size and age at maturity and fecundity), but determine what sort of data should be collected. A complementary approach would be to set up a coordinating body which would ensure that information pertaining to elasmobranch research, fisheries and general biology, be registered (by ICES) so that the data source is accessible.

It is envisaged that those involved would come from both sides of the Atlantic, and possibly further afield, to coordinate ongoing intiatives. The participating institutes will contribute by making their data accessible to a project coordinator who will be responsible for the collection and dissemination of the data and for preparing the subsequent research proposal. The project coordinator should be nominated to attend a meeting of the ICES Study Group on Elasmobranch Fishes.

## 10 CONCLUSIONS & RECOMMENDATIONS

### 10.1 Conclusions

Elasmobranch species are not currently covered by ICES conventional assessment procedures, and no advice is given on the status of the stocks. This may be reflected in the low priority given to these species by national institutes and the poor attendance and input to this Study Group. In the light of recent international initiatives (e.g. the Intermediate Meeting of Ministers in Bergen, March 1997) and in view of the precautionary principle (see Section 2), the need for appropriate advice has arisen. Although we do not have the data to carry out conventional VPA stock assessments on elasmobranchs, the population dynamics of these species are easier to predict than those of most teleosts, due to the deterministic relationship between stock and recruitment and the relatively uniform survival rate of juveniles and adults. Limit reference points (defined as replacement mortalities) are easy to determine according to the Euler-Lotka relationship, with basic information on age at maturity and fecundity, and rate of change in population size at different mortalities can be predicted. By providing threshold values, rather than catch options, ACFM will be in a position to give advice on elasmobranch stocks.

### 10.2 Recommendations

The ICES Study Group on Elasmobranch Fishes recommends that:

- three posters prepared by the group identifying skates, 'skate wings', and deep-water sharks be published by ICES and that this recommendation be passed on to the Publications Committee;
- steps are taken to improve the knowledge of the biology and exploitation patterns of elasmobranchs, i.e. by initiating data collection and biological sampling from commercial fleets (deep-water sharks) and through market surveys (shelf species) — see Concerted Action plan (Section 9.2);
- ICES supports an initiative to examine the NE Atlantic data on spurdog (*Squalus acanthias*), in view of the species-specific catch data available and in order to evaluate the effects of exploitation in relation to the geographical distribution, life history patterns and compensatory mechanisms exhibited by the species, to provide a blueprint for the evaluation of shark populations in general;
- initiatives be explored for alternative methods of evaluating the status of elasmobranch stocks;
- if the initiatives for a consultative meeting of experts to be convened by FAO and a CITES Marine Fish Working Group receive approval from the 10th Conference of Parties to CITES in June 1997, ICES should seek representation on both these fora;
- ICES keep a register (prepared under the Concerted Action plan) of available data on elasmobranch fishes;
- the species coding as suggested in this report be adopted by ICES;

- establish a database/register of named scientists and institutes who/which are or have been active in the field of elasmobranch research and management in recent years. The register will include names of individuals or main contact persons in each organisation, information on past and present research studies/initiatives (with dates of research activity), and details of the published and unpublished material produced. It will list sources of data only, not the data themselves. This register could be co-ordinated through the European Elasmobranch Association and should be available on the WWW;
- the Study Group work by correspondence in 1998 in order to monitor the progress of the various courses of action recommended above, as well as the other international initiatives being taken, and prioritise the course of action the group should take, with a view to consolidating this at a meeting in 1999.

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TABLE 3.1

| | |
|---|---|
| **Species :** | ***Pseudotriakis microdon***, False catshark |
| **Geographical distribution :** | throughout North Atlantic |
| **Abundance :** | moderately common, often singly, at most small schools of 5-10 specimens |
| **Depth range :** | 200-1500 m, mostly 400-800 m |
| **Size range/area :** | males up to 270 cm, mature 200-270 cm; females up to 300 cm , usually 120-220 cm, mature 212-295 cm |
| **Sexual segregation/area/depth :** | too little information |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data from North Atlantic |
| **Number offsprings/litter :** | 2-?4 of 70-85 cm TL |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | nowhere regularly |
| **Landed quantity :** | ----- |
| **as by catch :** | by various countries as by-catch |

TABLE 3.2

| | |
|---|---|
| **Species :** | ***Apristurus laurussoni***, Iceland catshark |
| **Geographical distribution :** | entire northern N Atlantic |
| **Abundance :** | locally relatively abundant |
| **Depth range :** | 500-1500 m |
| **Size range/area :** | up to 70 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | oviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | ----- |
| **Number egg-capsules/season :** | 2 egg-case at a time, total per season ?? |
| **L/W relationship :** | no data published but probably available at places |
| **Age/growth :** | no data |
| **Landed in :** | nowhere at present |
| **Landed quantity :** | ----- |
| **as by catch :** | taken by various countries regularly but being discarded without specific registration |

TABLE 3.3

| | |
|---|---|
| **Species :** | ***Apristurus maderensis***, Madeira catshark |
| **Geographical distribution :** | patchy in NE Atlantic |
| **Abundance :** | relatively common but often mistaken for other spp. |
| **Depth range :** | 600-1500 m |
| **Size range/area :** | up to 70 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | oviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | ----- |
| **Number egg-capsules/season :** | no data |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | nowhere at present |
| **Landed quantity :** | ----- |
| **as by catch :** | in catches by various countries, but discarded without specific recognition |

TABLE 3.4

| | |
|---|---|
| **Species :** | *Apristurus manis*, Ghost catshark |
| **Geographical distribution :** | N-Atlantic |
| **Abundance :** | moderately common but mostly mistaken for other spp. |
| **Depth range :** | ca 650-1740 m |
| **Size range/area :** | up to 85 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | oviparous (supposed) |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | ----- |
| **Number egg-capsules/season :** | no data |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | nowhere at present |
| **Landed quantity :** | ----- |
| **as by catch :** | if recognised at all, in moderate numbers at lower latitudes |

TABLE 3.5

| | |
|---|---|
| **Species :** | ***Galeus melastomus***, Blackmouth catshark |
| **Geographical distribution :** | Eastern North Atlantic and Mediterranean |
| **Abundance :** | frequent |
| **Depth range :** | 300-1200 m |
| **Size range/area :** | males up to 65 cm, mature at 34-42 cm<br>females up to 90 cm, mature 39-45 cm<br>Slope off Portugal (Figuereido & Correia, 1996b):<br>depth: young < 40 cm TL in 300-600 m<br>adults > 40 cm TL in 600-800 m |
| **Sexual segregation/area/depth :** | Figueiredo et al. (1995) |
| **Reproductive mode :** | oviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | ----- |
| **Number egg-capsules/season :** | no data |
| **L/W relationship :** | Pereda & Perez (1996, in press), slope off Portugal 1994:<br>summer -<br>Females $W = 0.002 \times L^{3.05}$ (n = 245)<br>Males $W = 0.002 \times L^{3.07}$ (n =216)<br>winter -<br>Females $W = 0.002 \times L^{3.16}$ (n= 976)<br>Males $W = 0.002 \times L^{3.12}$ (n = 822) |
| **Age/growth :** | Figueiredo & Correia (1996b) |
| **Landed in :** | Portugal, Spain, Italy, Greece |
| **Landed quantity :** | Portugal: 1991 - 13.7 t, 1992 - 17.3 t, 1993 - 23.2 t, 1994 - 39.3 t, 1995 - 30.8 t, 1996 - 29.8 t (but a large part of the Portuguese landings is not reported, pers. comm. J. Correia 1997) |
| **as by catch :** | countries also off W and N Europe but mostly discarded |

TABLE 3.6

| | |
|---|---|
| **Species :** | ***Galeus murinus***, Mouse catshark |
| **Geographical distribution :** | northern NE Atlantic |
| **Abundance :** | moderately common |
| **Depth range :** | 380-1200 m |
| **Size range/area :** | up to 60-70 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | oviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | ----- |
| **Number egg-capsules/season :** | 2 at a time, total unknown |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | nowhere at present |
| **Landed quantity :** | ----- |
| **as by catch :** | occasionally by various countries but discarded |

TABLE 3.7

| | |
|---|---|
| Species : | ***Echinorhinus brucus*** , Bramble shark |
| Geographical distribution : | entire North Atlantic |
| Abundance : | rare |
| Size range/area : | up to 300 cm |
| Depth range : | 400-900 m |
| Reproductive mode : | ovoviviparous |
| Sexual segregation/area/depth : | no data |
| Reproductive cycle : | no data |
| Number offsprings/litter : | 15-24 of 29-90 cm TL |
| Number egg-capsules/season : | ----- |
| L/W relationship : | no data |
| Landed in : | nowhere at present |
| as bycatch : | occasionally and singly |

TABLE 3.8

| | |
|---|---|
| **Species :** | ***Oxynotus centrina,*** **Angular roughshark** |
| **Geographical distribution :** | Southern NE Atlantic and Mediterranean |
| **Abundance :** | relatively uncommon |
| **Depth range :** | 60-660 m |
| **Size range/area :** | up to 150 cm, mostly 50-60 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number egg-capsules/season :** | no data |
| **Number offsprings/litter :** | no data, young 25 cm TL |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | Portugal |
| **Landed quantity :** | Portugal (see Correia, 1996, but data highly unlikely) |
| **as by catch :** | eventually by various countries |

TABLE 3.9

| | |
|---|---|
| **Species :** | ***Oxynotus paradoxus*** **,** Sailfin rough shark |
| **Geographical distribution :** | Eastern North Atlantic |
| **Abundance :** | locally occasionally in small numbers |
| **Depth range :** | 265-720 m on sloper |
| **Size range/area :** | up to 120 cm, usually 70-85 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | no data, but smallest young 25 cm TL |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Landed in :** | nowhere at present |
| **as by catch :** | occasionally but not for consumption, or discarded |

TABLE 3.10

| | |
|---|---|
| **Species :** | ***Centrophorus granulosus***, Gulper shark |
| **Geographical distribution :** | central NE Atlantic and NW Atlantic slopes, also western Mediterranean |
| **Abundance :** | locally/seasonally abundant schooling shark |
| **Depth range :** | 100-1200 m, mainly 350-500 m |
| **Size range/area :** | up to about 150 cm |
| **Sexual segregation/area/depth :** | likely to occur but no published data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | no data, but likely only 1-10 of 30-42 cm |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target sepcies |
| **Landed quantity :** | ----- |
| **as by catch :** | occasionally taken in small numbers at lower latitudes, when partly landed, and partly discarded |

TABLE 3.11

| | |
|---|---|
| **Species :** | ***Centrophorus lusitanicus,*** Lowfin gulper shark |
| **Geographical distribution :** | Central Eastern Atlantic slopes from Iberian Peninsula southward and on Mid Atlantic Ridge |
| **Abundance :** | Localy/seasonally relatively abundant in small schools |
| **Depth range :** | 300-1400 m |
| **Size range/area :** | up to 160 cm; males mature from 72-128 cm; females 88-144 cm |
| **Sexual segregation/area/depth :** | likely to occur but no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | 1-6 of 36 cm TL |
| **Number egg-capsules/season :** | no data |
| **L/W relationship :** | no published data |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | locally regularly taken in small numbers by lines and trawls |

TABLE 3.12

| | |
|---|---|
| **Species :** | ***Centrophorus squamosus***, Leafscale gulper shark |
| **Geographical distribution :** | NE Atlantic on slopes and around islands, also found in oceanic midwater |
| **Abundance :** | common and locally/seasonally quite abundant. schooling species |
| **Depth range :** | 400-1875 m in NE Atlantic, at other places as shallow as 230 m and as deep as 2359 m |
| **Size range/area :** | up to 160 cm; males mature from 100 cm, females from 124 cm (unpubl. data Du Buit) |
| **Sexual segregation/area/depth :** | no published data, but segregation found in surveys |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data, but likely tri-annual |
| **Number offsprings/litter :** | little data, 5 pups reported |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data published |
| **Age/growth :** | no data |
| **Landed in :** | in various countries as target species |
| **Landed quantity** | 1994 361 t France<br>1995 1404 t<br>1996 1410 t |
| **as by catch :** | regularly taken by various countries, when partly landed unspecified or being discarded |

TABLE 3.13

| | |
|---|---|
| **Species :** | ***Centrophorus uyato***, Little gulper shark |
| **Geographical distribution :** | central NE Atlantic on slopes, and Mediterranean |
| **Abundance :** | common, locally/seasonally abundant |
| **Depth range :** | 50-1400 m mostly 500-1000 m |
| **Size range/area :** | up to 100 cm, males mature at 81-94 cm, females at 75-89 cm (length figures probably reversed by Compagno, 1984) |
| **Sexual segregation/area/depth :** | likely occurring but no published data |
| **Reproductive mode :** | little data |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | eventually only 1-2 pups of 40-50 cm |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data published |
| **Age/growth :** | no data published |
| **Landed in :** | in south European countries in small quantities, often livers only |
| **Landed quantity :** | ----- |
| **as by catch :** | regularly by various countries by line fishing or trawling at lower latitudes in NE Atlantic |

TABLE 3.14

| | |
|---|---|
| **Species :** | *Centroscyllium fabricii,* Black dogfish |
| **Geographical distribution :** | throughout N Atlantic |
| **Abundance :** | abundant schooling shark |
| **Depth range :** | shallower to upper shelf edge in subarctic latitudes, as deep as 1600 m south but most abundant at 500-800 m on slopes |
| **Size range/area :** | up to 100 cm, mostly 60-80 cm; females mature at 58-70 cm |
| **Sexual segregation/area/depth :** | both sexes at 500-1000 m, females dominant in deeper water off West Greenland (Yano, 1995) |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | probably tri-annual |
| **Number offsprings/litter :** | up to 50, mostly up to 40 young of 15-18 cm |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.009L^{3.42}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | though abundant, not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | regularly taken in rather large numbers by bottom trawls by various countries but mainly discarded |
| | remark ; occasional hermaphrodites were found on west Greenland waters (Yano, 1995) |

TABLE 3.15

| | |
|---|---|
| **Species :** | *Centroscymnus coelolepis*, Portuguese shark |
| **Geographical distribution :** | throughout N Atlantic on slopes, and oceanic |
| **Abundance :** | locally and seasonally quite abundant schooling shark |
| **Depth range :** | 400-2700 m, most abundant between about 500-1200 m |
| **Size range/area :** | up to 130 cm, mostly 90-115 cm; males mature at 80-86 cm, females from 100 cm (unpubl. data DuBuit) |
| **Sexual segregation/area/depth :** | well proven from unpublished data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | not confirmed but likely tri-annual |
| **Number offsprings/litter :** | 8-19 of about 30 cm (unpubl. data DuBuit) |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.0043L^{3.12}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | target species in several countries by bottom trawl and line fishing. Data France, Spain, Portugal, Norway, Faeroes<br>landed often livers only |
| **Landed quantity :** | France 1994 658 t<br>1995 1256 t<br>1996 1657 t |
| **as by catch :** | regularly taken by trawl and on lines and mostly landed |

TABLE 3.16

| | |
|---|---|
| **Species :** | ***Centroscymnus crepidater***, Longnose velvet dogfish |
| **Geographical distribution :** | NE Atlantic slopes |
| **Abundance :** | fairly common schooling shark |
| **Depth range :** | 270-1270 m |
| **Size range/area :** | up to 95 cm |
| **Sexual segregation/area/depth :** | no data but likely segregating |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | 4-6 of at least 25 cm |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.0024L^{3.25}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | regularly taken in moderate numbers by various countries but mostly discarded |

TABLE 3.17

| | |
|---|---|
| **Species :** | ***Centroscymnus cryptacanthus***, Shortnose velvet-dogfish |
| **Geographical distribution :** | NE Atlantic on slopes |
| **Abundance :** | relatively uncommon |
| **Depth range :** | 400-1164 m |
| **Size range/area :** | up to 104 cm, mostly around 70 cm |
| **Sexual segregation/area/depth :** | no data but likely segregating |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | no data |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | not a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | sporadically taken by several countries in small numbers and likely to be mixed up with *C. coelolepis* |

TABLE 3.18

| | |
|---|---|
| **Species :** | *Dalatias licha,* Kitefin shark |
| **Geographical distribution :** | throughout N Atlantic |
| **Abundance :** | common, locally abundant |
| **Depth range :** | 90-1800 m, mostly 300-600 m, |
| **Size range/area :** | up to 180 cm, mostly ca 150 cm; Norwegian data (20 spec.) average 141 cm and 15 kg |
| **Sexual segregation/area/depth :** | around Azores males at 450-520 m, females at 220-260 m; males are mainly caught in gillnets and females by handlines at different places and depths :<br>Males 98-132 cm (lines), 102-126 cm (bottom nets)<br>Females 119-161 cm (lines), 123-162 cm (bottom nets) (da Silva, 1988) |
| **Reproductive mode :** | ovoviviparous, young ca 30 cm |
| **Reproductive cycle :** | probably tri-annual (da Silva, 1988) |
| **Number offsprings/litter :** | 10-16 of ca 30 cm TL |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | Males $W = 5.13 \times 10^{-5} \times L^{2.52}$; Females $W = 1.50 \times 10^{-4} \times L^{2.35}$; 50 males L 102-126 cm = average 114 cm, W 6.65-10.25 kg = average 7.76 kg; 224 females L 125-161 cm = average 144 cm; W 15.5-19.1 kg = average 17.2 kg |
| **Age/growth :** | no data |
| **Landed in :** | various countries, as target species mainly in Portugal (Azores) for squalen oil and meat |
| **Landed quantity :** | see Correia (1996, Fig. 2a) |
| **as by catch :** | by various countries<br>remark : no small immatures taken at Azores (da Silva, 1983) but at slope continental Portugal (40-100 cm) (Figueiredo & Correia, 1996b) |

TABLE 3.19

| | |
|---|---|
| **Species :** | ***Deania calcea***, Birdbeak dogfish |
| **Geographical distribution :** | NE Atlantic |
| **Abundance :** | common, locally and seasonally abundant schooling shark |
| **Depth range :** | 400-1260 m, mainly 500-800 m |
| **Size range/area :** | up to 140 cm, mostly 70-100; males mature 70-91 cm, females 70-111 cm |
| **Sexual segregation/area/depth :** | no data but likely segregating |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data but probably tri-annual |
| **Number offsprings/litter :** | 6-12 of at least 30 cm |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.0012L^{3.26}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | regularly taken by various countries in rather large numbers but mostly being discarded |

TABLE 3.20

| | |
|---|---|
| **Species :** | ***Deania profundorum***, Arrowhead dogfish |
| **Geographical distribution :** | throughout N Atlantic at lower latitudes around 10-30° N on slopes |
| **Abundance :** | moderately rare |
| **Depth range :** | 275-1785 m |
| **Size range/area :** | up to 80 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data but likely tri-annual |
| **Number offsprings/litter :** | no data |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | sporadically taken along with *D. calcea* and probably mostly mistaken for the latter |

TABLE 3.21

| | |
|---|---|
| **Species :** | ***Etmopterus princeps,*** Great lantershark |
| **Geographical distribution :** | throughout North Atlantic |
| **Abundance :** | relatively common, more abundant in eastern than in western Atlantic, occuring in small schools |
| **Depth range :** | 300 to 2213 m, deeper at subtropical/tropical latitudes |
| **Size range/area :** | up to 75 cm; males mature at 55 cm |
| **Sexual segregation/area/depth :** | no data but likely segregating |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data but probably tri-annual |
| **Number offsprings/litter :** | no data |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.0028 \times L^{3.15}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | regularly taken in moderate numbers in bottom trawls by various countries but mainly discarded |

TABLE 3.22

| | |
|---|---|
| **Species :** | ***Etmopterus pusillus***, Smooth lanternshark |
| **Geographical distribution :** | central NE Atlantic, slopes and oceanic |
| **Abundance :** | moderately rare |
| **Depth range :** | 300 m to more than 1000 m |
| **Size range/area :** | up to 70-80 cm; males mature at 31-39, females at 38-47 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | probably tri-annual but no data |
| **Number offsprings/litter :** | no data |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | taken by various countries in moderate numbers, said to be utilized at times but likely mainly discarded |

TABLE 3.23

| | |
|---|---|
| **Species :** | ***Etmopterus spinax***, Velvet belly |
| **Geographical distribution :** | Eastern Atlantic slopes |
| **Abundance :** | common, locally and/or seasonally abundant in schools |
| **Depth range :** | 70-2000 m, mostly 200-500 m |
| **Size range/area :** | up to 60 cm, mostly 40-45 cm TL; males mature at 33-36 cm |
| **Sexual segregation/area/depth :** | no data but likely segregating |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data but probably tri-annual |
| **Number offsprings/litter :** | 6-20 of 12-14 cm TL |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.0018 \times L^{3.24}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | regularly taken in bottom and also deeper midwater trawls by various countries, mainly discarded |

TABLE 3.24

| | |
|---|---|
| **Species :** | ***Scymnodon obscurus***, Smallmouth knifetooth dogfish |
| **Geographical distribution :** | throughout N Atlantic on slopes, and oceanic |
| **Abundance :** | moderately rare |
| **Depth range :** | 550-1450 m on slopes, oceanic from near surface to about 600 m |
| **Size range/area :** | up to about 60 cm; males mature at 51, females at 59 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data |
| **Number offsprings/litter :** | no data |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | not a target species |
| **Landed quantity :** | ----- |
| **as by catch :** | occasionally but possibly mistaken for *S. ringens* |

TABLE 3.25

| | |
|---|---|
| **Species :** | ***Scymnodon ringens***, Knifetooth dogfish |
| **Geographical distribution :** | NE Atlantic on slopes and around |
| **Abundance :** | common and locally/seasonally quite abundant; schooling species |
| **Depth range :** | 400-1875 m in NE Atlantic, at other place as shallow as 230 m and as deep as 2359 m |
| **Size range/area :** | up to 110 cm |
| **Sexual segregation/area/depth :** | no published data, but segregation found in surveys |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | no data, but likely tri-annual |
| **Number offsprings/litter :** | little data, 5 pups reported |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | $W = 0.0043 \times L^{3.12}$ (Gordon & Hunter, 1994) |
| **Age/growth :** | no data |
| **Landed in :** | not yet a target species |
| **Landed quantity :** | no data |
| **as by catch :** | regularly taken on small number by various countries but mostly being discarded |

TABLE 3.26

| | |
|---|---|
| **Species :** | ***Somniosus microcephalus***, Greenland shark |
| **Geographical distribution :** | throughout North Atlantic, including Arctic waters |
| **Abundance :** | usually singly, locally in small groups in Arctic latitudes. |
| **Depth range :** | from Arctic shelf areas down to at least 1200 m farther south |
| **Size range/area :** | up to 700 cm, mostly about 450 cm; most specimens both sexes mature between 244 and 427 cm TL |
| **Sexual segregation/area/depth :** | not data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | probably tri-annual |
| **Number offsprings/litter :** | 10-20 of some 37 cm TL |
| **Number egg-capsules/season** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | ----- |
| **Landed in :** | regularly by hook and line and longlines in Greenland, Iceland, north Norway |
| **Landed quantity** | Iceland: (see below) |
| **as by catch :** | at Arctic latitudes often also entangled in nets and traps |

Landed quantity, Iceland:

| | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|
| tonnes | 61 | 68 | 69 | 54 | 40 | 23 | 31 |

| 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|
| 19 | 31 | 54 | 57 | 68 | 39 | 42 | -- | 63 |

TABLE 3.27

| | |
|---|---|
| **Species :** | ***Somniosus rostratus***, Little sleeper shark |
| **Geographical distribution :** | Central NE Atlantic, with northern limit eventually off Porcupine west slope, also western Mediterranean |
| **Abundance :** | moderately rare |
| **Depth range :** | 200-1000 m |
| **Size range/area :** | up to ca 140 cm; males mature at 71 cm, females at 82-134 cm |
| **Sexual segregation/area/depth :** | no data |
| **Reproductive mode :** | ovoviviparous |
| **Reproductive cycle :** | probably tri-annual but no information |
| **Number offsprings/litter :** | unknown, pups 21-28 cm |
| **Number egg-capsules/season :** | ----- |
| **L/W relationship :** | no data |
| **Age/growth :** | no data |
| **Landed in :** | probably only sporadically |
| **Landed quantity :** | ----- |
| **as by catch :** | by several countries in small numbers from lines and bottom trawls |

**Table 5.1** Landings of spurdog reported to ICES for 1994 and 1995.

| Country 1994 | IIa | IIIa | IVa | IVb | IVc | Va | Vb | VIa | VIb | VIIa | VIIb | VIIc | VIId | VIIe | VIIf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belgium | | | + | 7 | 8 | + | | | | 1 | | | 1 | | 1 |
| Denmark | | 66 | 77 | 66 | 2 | | | 1 | | | | | | | |
| France | | | 6 | | 6 | | 3 | 85 | | 84 | 30 | 16 | 311 | 185 | 105 |
| Germany, Fed. Rep. | | | 12 | 10 | | | | | | | | | | | |
| Iceland | | | | | | 97 | | | | | | | | | |
| Ireland | | | | | | | | 1031 | | 260 | 1048 | 7 | | | |
| Norway[1] | 3127 | 154 | 1269 | 1 | | | | | | | | | | | |
| Sweden | | 95 | | | | | | | | | | | | | |
| UK (Eng/Wales/NI) | + | | 16 | 294 | 181 | | + | 194 | 1 | 1756 | 36 | 7 | 41 | 88 | 315 |
| UK (Scotland) | | | 1854 | 100 | | | 2 | 2661 | 10 | 44 | 2 | | | | |
| Total | 3127 | 315 | 3234 | 478 | 197 | 97 | 5 | 3972 | 11 | 2145 | 1116 | 30 | 353 | 273 | 421 |



| Country 1994 | VIIg | VIIh | VIIj | VIIk | VIII | Total |
|---|---|---|---|---|---|---|
| Belgium | 1 | | | | 1 | 20 |
| Denmark | | | | | | 212 |
| France | 236 | 413 | 33 | 1 | 140 | 1161 |
| Germany, Fed. Rep. | | | | | | 22 |
| Iceland | | | | | | 97 |
| Ireland | 41 | | 1237 | | | 3624 |
| Norway[1] | | | | | | 4552 |
| Sweden | | | | | | 95 |
| UK (Eng/Wales/NI) | 179 | 91 | 168 | 28 | 3 | 3398 |
| UK (Scotland) | | | 1 | | | 4674 |
| Total | 457 | 504 | 1439 | 29 | 144 | 17855 |

[1]Preliminary.

Continued

**Table 5.1** Continued

| Country 1995 | IIa | IIIa | IVa | IVb | IVc | Va | Vb | VIa | VIb | VIIa | VIIb | VIIc | VIId | VIIe | VIIf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belgium | | | | 4 | 3 | | | | | 5 | | | 1 | | |
| Denmark | | 59 | 37 | 50 | | | | | | | | | | | |
| France | No data | | | | | | | | | | | | | | |
| Germany, Fed. Rep. | No data | | | | | | | | | | | | | | |
| Iceland | | | | | | 166 | | | | | | | | | |
| Ireland | | | | | | | | 337 | 3 | 195 | 1042 | 6 | | | |
| Norway[1] | 2734 | 129 | 1075 | 1 | | | | | | | | | | | |
| Sweden | | 184 | | | | | | | | | | | | | |
| UK (Eng/Wales/NI) | | | 13 | 207 | 272 | | | 127 | 24 | 719 | 12 | 7 | 30 | 106 | 261 |
| UK (Scotland) | | | 4662 | 565 | | | 1 | 3177 | 51 | 31 | 6 | 2 | | | |
| Total | 2734 | 292 | 5787 | 827 | 275 | 166 | 1 | 3641 | 78 | 950 | 1060 | 15 | 31 | 106 | 261 |

| Country 1995 | VIIg | VIIh | VIIj | VIIk | VIII | Total |
|---|---|---|---|---|---|---|
| Belgium | 1 | | | | | 14 |
| Denmark | | | | | | 146 |
| France | | | | | | |
| Germany, Fed. Rep. | | | | | | |
| Iceland | | | | | | 166 |
| Ireland | 21 | | 829 | 3 | | 2436 |
| Norway[1] | | | | | | 3939 |
| Sweden | | | | | | 104 |
| UK (Eng/Wales/NI) | 161 | 124 | 87 | 11 | 151 | 2316 |
| UK (Scotland) | | | 2 | 2 | | 8499 |
| Total | 183 | 124 | 918 | 16 | 151 | 17620 |

[1]Preliminary

**Table 6.1.** Characteristics of skate and ray species occurring in the North Sea. Biomass estimates (in thousand tonnes) are from Daan et al., (1990). Values marked with an asterisk are taken from Walker *et al.*, (in preparation); values for *R. batis* from Du Buit, 1976a; for *R. brachyura* from Holden *et al.*, 1971 and for *R. fullonica* and *R. oxyrinchus* from Wheeler, 1978. Type shows the main distributional area.

| Species | Common name | Type | Biomass | $L_{inf}$ (F) | $L_{mat}$ (F) |
|---|---|---|---|---|---|
| *R. batis* | Common skate | Southern | 2.2 | 237 | 160 |
| *R. brachyura* | Blonde ray | Southern | 0.2 | 113 | 92 |
| *R. circularis* | Sandy ray | Southern | 2.5 | | |
| *R. clavata* | Thornback ray | Southern | 11.6 | 118* | 86* |
| *R. fullonica* | Shagreen ray | Northern | 2.5 | 115 | |
| *R. microocellata* | Small-eyed ray | Southern | - | | |
| *R. montagui* | Spotted ray | Southern | 16.1 | | 62* |
| *R. naevus* | Cuckoo ray | Southern | 45.5 | | 56* |
| *R. oxyrinchus* | Long-nose skate | Northern | 1.2 | 156 | |
| *R. radiata* | Starry ray | Northern | 308.4 | | 39* |
| *R. undulata* | Undulate ray | Southern | - | | |

**Table 6.2.** Standardised mean catch rate (numbers per hour fishing) for four *Raja* species in the Southern Bight. (Roundfish Area 6). OT = otter trawl; BT = beam trawl; GOV = 'grande ouverture verticale'. + = < 0.05; NR = not recorded. Data from Rijnsdorp *et al.*, 1996.

| Species | 1906-1909 20 foot OT | 1906-1909 90 foot OT | 1906-1909 13 m BT | 1990-1995 GOV | 1990-1995 8 m BT |
|---|---|---|---|---|---|
| R. batis | 0 | + | 0.1 | 0 | 0 |
| R. clavata | 2.8 | 0.5 | 0.2 | + | 0.1 |
| R. montagui | 0 | NR | NR | + | + |
| R. radiata | 0 | 0.2 | + | + | 0.1 |

**Table 6.3** Values on growth and maturation parameters taken from Walker *et al.* (in preparation). Agemat = age at first maturity; fecundity = number of eggs per female per year. Fecundity values for *R. clavata* and *R. montagui* from Holden (1972); for *R. naevus* from Fahy (1989a).

| Species | $L\infty$ | K | t0 | Lmat | $L\infty$/Lmat | Agemat | Fecundity |
|---|---|---|---|---|---|---|---|
| *R. clavata* | 118 | 0.14 | -0.88 | 86 | 0.73 | 10 | 140 |
| *R. montagui* | 79.2 | 0.21 | -1.11 | 62 | 0.79 | 8 | 60 |
| *R. naevus* | 75.2 | 0.16 | -0.95 | 56 | 0.74 | 8 | 90 |
| *R. radiata* | 70.9 | 0.10 | -1.64 | 40 | 0.56 | 4 | 38 |

**Table 6.4.** Life table used to estimate the following: reproductive value (R0 ($\Sigma$lxmx); 1 at steady state); generation time (G in years (R0/$\Sigma$Xlxmx)); rate of increase of the population (r (lnR0/G); 0 at steady state); and percentage increase of the population (%). Z = total mortality; Fec. = average number of female eggs per female. X = age; lx = year class survival; mx = year class fecundity. This example shows input data for *R. radiata*, based on present observations.

| X | lx | mx | lx*mx | X*lx*mx | | |
|---|---|---|---|---|---|---|
| 0 | 1 | | | | R0 | 1.002643 |
| 1 | 0.418532807 | | | | | |
| 2 | 0.175169711 | | | | G | 4.719787 |
| 3 | 0.073314271 | | | | | |
| 4 | 0.030684428 | 19 | 0.583004123 | 2.332016491 | r | 0.000559 |
| 5 | 0.01284244 | 19 | 0.244006352 | 1.22003176 | | |
| 6 | 0.005374982 | 19 | 0.102124663 | 0.612747981 | % | 0.055944 |
| 7 | 0.002249606 | 19 | 0.042742522 | 0.299197655 | | |
| 8 | 0.000941534 | 19 | 0.017889148 | 0.143113182 | Z | 0.871 |
| 9 | 0.000394063 | 19 | 0.007487195 | 0.067384757 | | |
| 10 | 0.000164928 | 19 | 0.003133637 | 0.031336368 | Fec. | 19 |
| 11 | 6.90279E-05 | 19 | 0.00131153 | 0.014426828 | | |
| 12 | 2.88904E-05 | 19 | 0.000548918 | 0.006587019 | | |
| 13 | 1.20916E-05 | 19 | 0.00022974 | 0.002986624 | | |
| 14 | 5.06073E-06 | 19 | 9.61539E-05 | 0.001346154 | | |
| 15 | 2.11808E-06 | 19 | 4.02435E-05 | 0.000603653 | | |
| 16 | 8.86486E-07 | 19 | 1.68432E-05 | 0.000269492 | | |
| 17 | 3.71024E-07 | 19 | 7.04945E-06 | 0.000119841 | | |
| 18 | 1.55286E-07 | 19 | 2.95043E-06 | 5.31077E-05 | | |
| 19 | 6.49921E-08 | 19 | 1.23485E-06 | 2.34622E-05 | | |
| 20 | 2.72013E-08 | 19 | 5.16825E-07 | 1.03365E-05 | | |
| 21 | 1.13846E-08 | 19 | 2.16308E-07 | 4.54247E-06 | | |
| 22 | 4.76485E-09 | 19 | 9.05321E-08 | 1.99171E-06 | | |
| 23 | 1.99425E-09 | 19 | 3.78907E-08 | 8.71485E-07 | | |
| 24 | 8.34657E-10 | 19 | 1.58585E-08 | 3.80604E-07 | | |
| 25 | 3.49331E-10 | 19 | 6.6373E-09 | 1.65932E-07 | | |
| 26 | 1.46207E-10 | 19 | 2.77793E-09 | 7.22261E-08 | | |
| 27 | 6.11923E-11 | 19 | 1.16265E-09 | 3.13916E-08 | | |
| 28 | 2.5611E-11 | 19 | 4.86609E-10 | 1.3625E-08 | | |
| 29 | 1.0719E-11 | 19 | 2.03662E-10 | 5.90619E-09 | | |
| 30 | 4.48627E-12 | 19 | 8.52391E-11 | 2.55717E-09 | | |
| 31 | 1.87765E-12 | 19 | 3.56754E-11 | 1.10594E-09 | | |
| 32 | 7.85858E-13 | 19 | 1.49313E-11 | 4.77802E-10 | | |
| 33 | 3.28907E-13 | 19 | 6.24924E-12 | 2.06225E-10 | | |
| 34 | 1.37659E-13 | 19 | 2.61551E-12 | 8.89274E-11 | | |
| 35 | 5.76146E-14 | 19 | 1.09468E-12 | 3.83137E-11 | | |
| 36 | 2.41136E-14 | 19 | 4.58159E-13 | 1.64937E-11 | | |
| 37 | 1.00923E-14 | 19 | 1.91754E-13 | 7.09491E-12 | | |
| 38 | 4.22397E-15 | 19 | 8.02555E-14 | 3.04971E-12 | | |
| 39 | 1.76787E-15 | 19 | 3.35896E-14 | 1.30999E-12 | | |
| 40 | 7.39912E-16 | 19 | 1.40583E-14 | 5.62333E-13 | | |

**Table 6.5.** Replacement values of Z for four *Raja* species in the North Sea, based on published and unpublished values for age at maturity and fecundity (see above); estimates of present values of Z from catch curves and the rate of increase (or decrease) of the population associated with this value of Z.

| Species | $Z_{present}$ at r = 0 | $Z_{present}$ catch curves | $r_{present}$ | % change |
|---|---|---|---|---|
| *R. clavata* | 0.516 | 0.60 | -0.08 | -8.1 |
| *R. montagui* | 0.535 | 0.72 | -0.12 | -11.5 |
| *R. naevus* | 0.578 | 0.69 | -0.11 | -10.7 |
| *R. radiata* | 0.871 | 0.79 | 0.08 | 8.4 |

**Table 6.6.** Replacement values of Z for four *Raja* species in the North Sea, based on published and unpublished values for age at maturity and fecundity (see above); estimates of present values of Z from catch curves and the rate of increase of the population associated with this value of Z.

| Species | $Z_{present}$ at r = 0 | $Z_{past}$ at r = 0 | $Z_{present}$ catch curves | $r_{present}$ |
|---|---|---|---|---|
| *R. clavata* | 0.61 | 0.50 | 0.60 | 0.0093 |
| *R. montagui* | 0.56 | 0.52 | 0.46 | 0.21 |
| *R. naevus* | 0.74 | 0.52 | 0.69 | 0.052 |
| *R. radiata* | 0.87 | 0.66 | 0.79 | 0.081 |

**Figure 4.1** Movements of blue shark based on recoveries from tagging releases by the NMFS Cooperative Tagging Project (after Casey and Kohler, 1991).

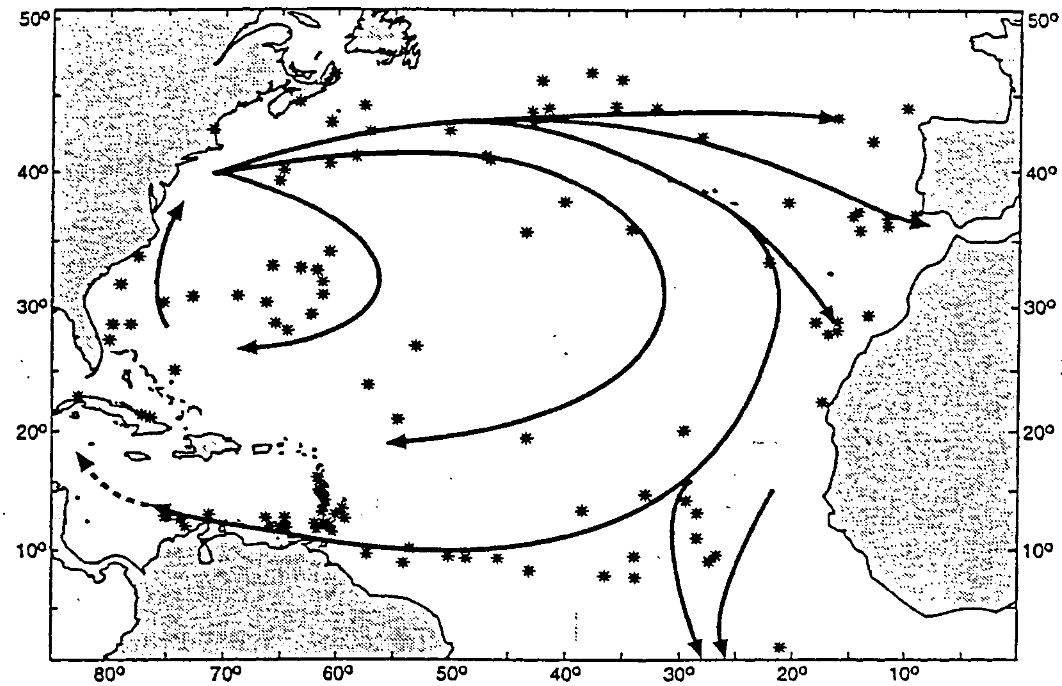


**Figure 6.1** Landings of skates and rays as reported to ICES Sub-area IV.

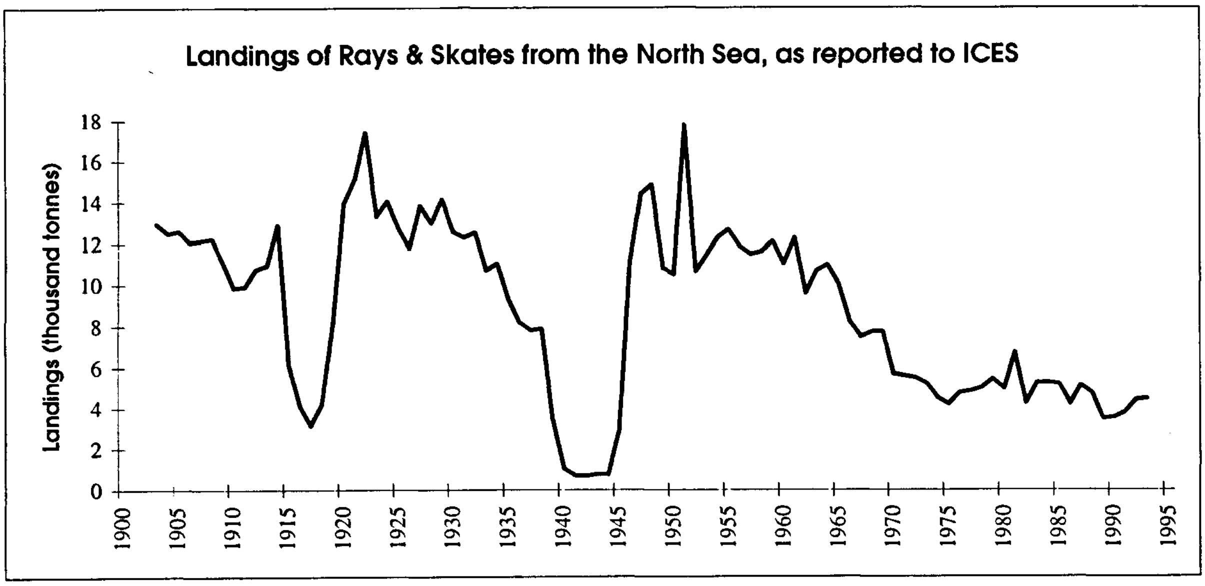


**Figure 6.2** Landings of skates and rays from the southern (Division IVc) and total North Sea (Sub-area IV), separately. Trends in fishing mortality on plaice in shown as an index of fishing effort (F extrapolated, from Rijnsdorp & Millner, 1996). From Walker & Heessen, 1996.

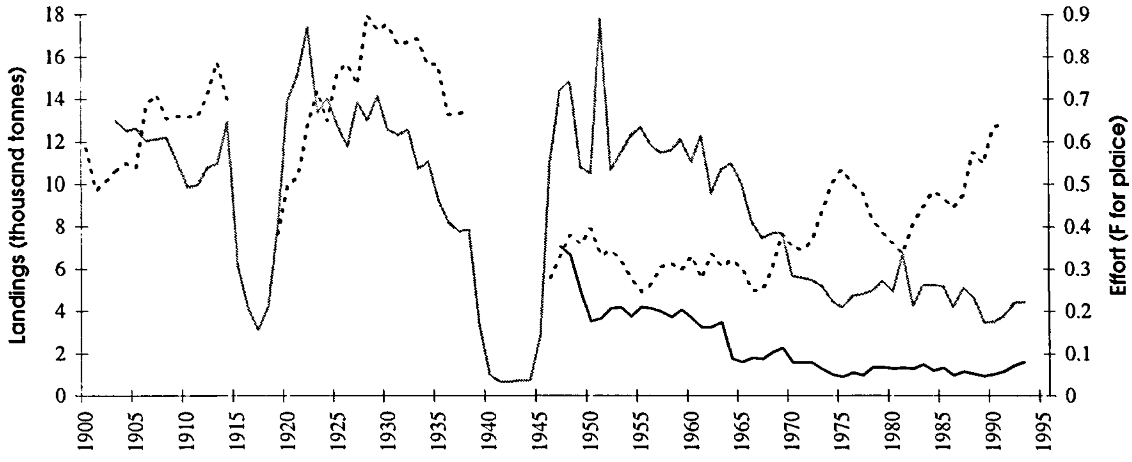


**Figure 6.3** Areas sampled in the North Sea during the Scottish survey programme and the Southern Bight (Roundfish Area 6), sampled in 1906–1909 and 1990–1995. From Walker & Hislop, submitted.

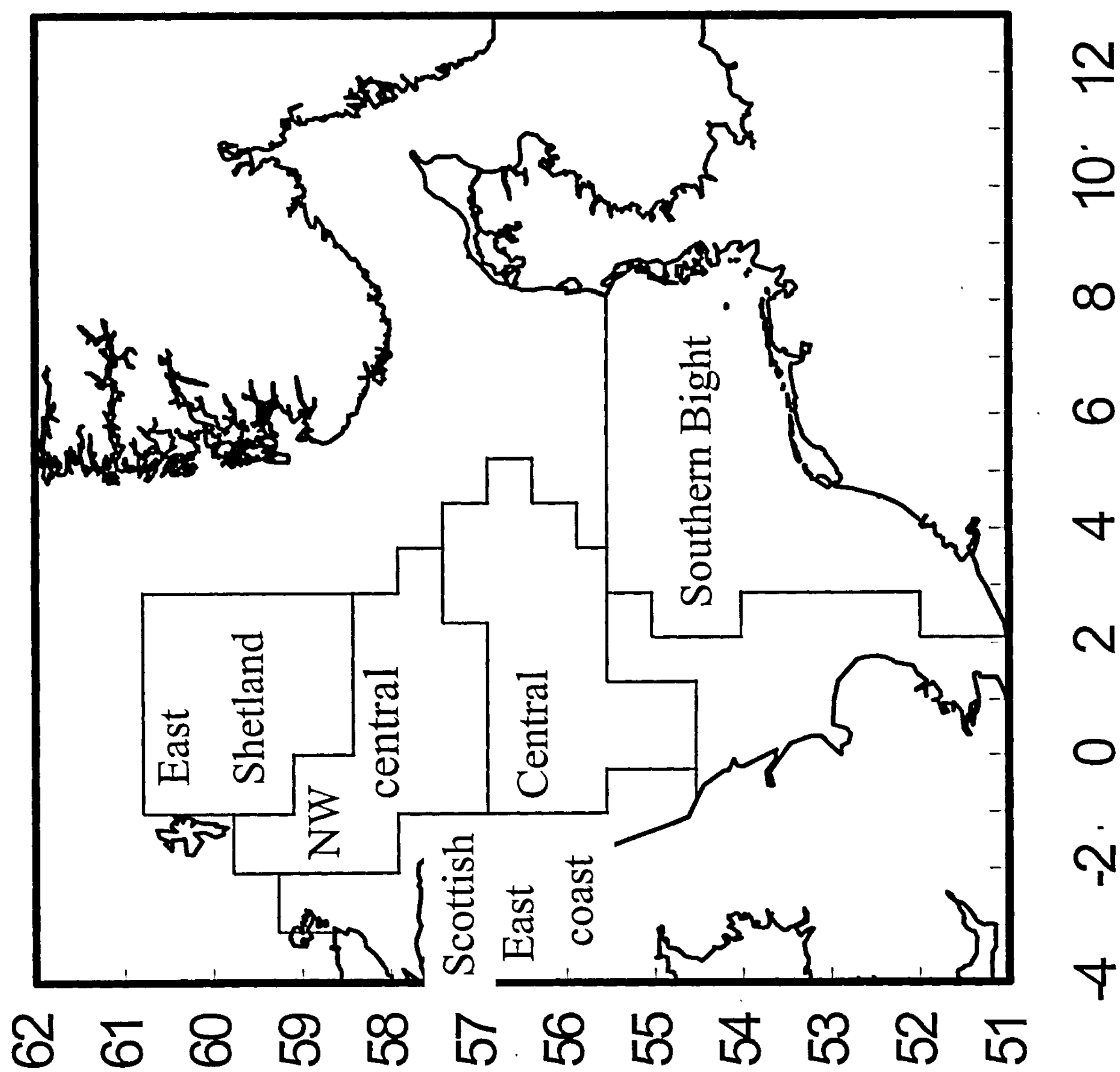


**Figure 6.4** Average catch/hour for six *Raja* species during the entire survey period in all four areas as shown in Figure 3. From Walker & Hislop, submitted.

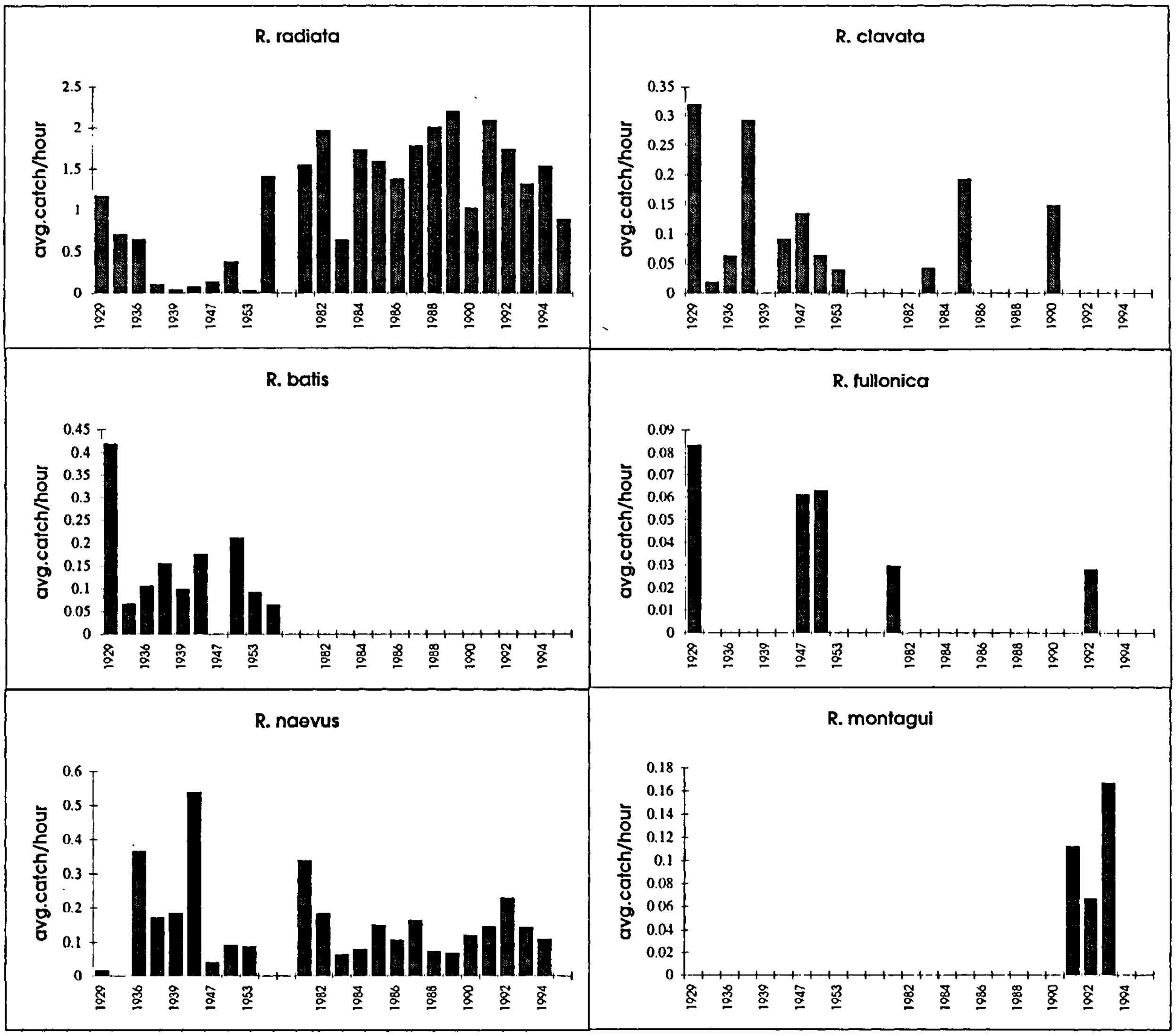


**Figure 6.5** Average catch/hour of all rays and skates in each of the areas as shown in Figure 3. From Walker & Hislop, submitted.

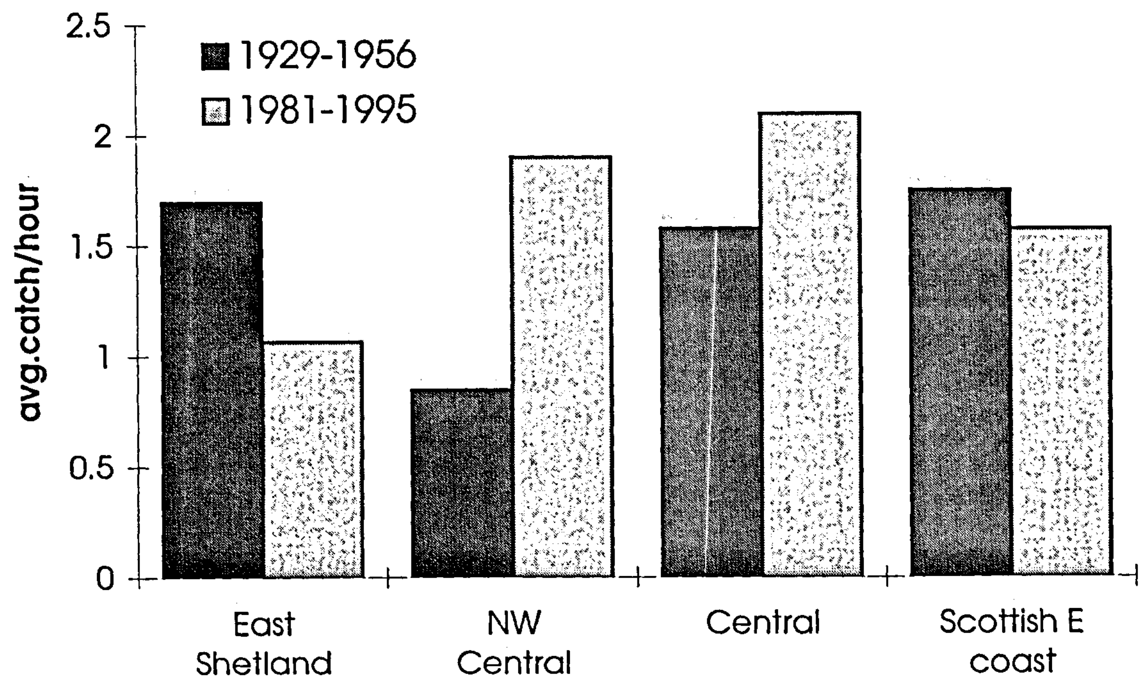
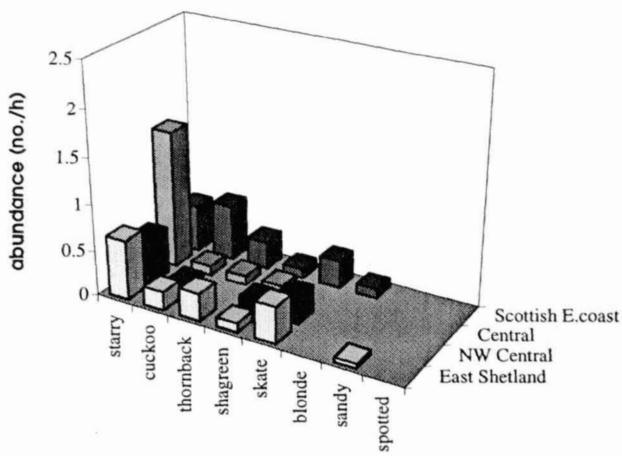


**Figure 6.6** Species abundance in each of the four areas sampled during the Scottish survey programme. Starry = R. radiata; cuckoo = R. naevus; thornback = R. clavata; shagreen = R. fullonica; skate = R. batis; blonde = R. brachyura; sandy = Raja circularis; spotted = R. montagui. From Walker & Hislop, submitted.



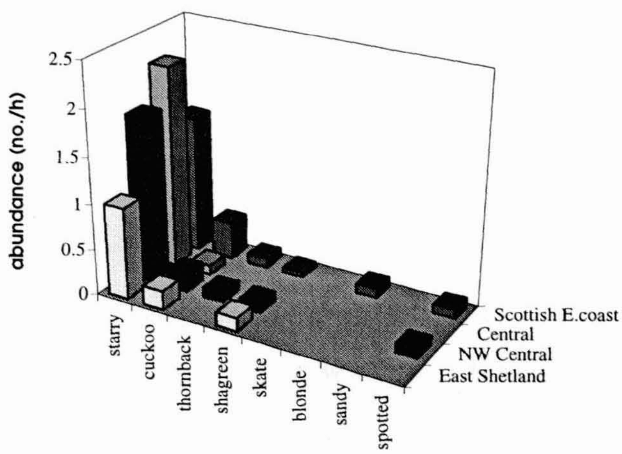



**Figure 6.7** Proportional length-frequency relationship for each of the four area studied. Catches of all species (*R. batis, R. brachyura, R. clavata, R. fullonica, R. naevus, R. montagui* and *R. radiata*) have been combined. The data have been smoothed by taking the running mean three 5-cm length classes. From Walker & Hislop, submitted.

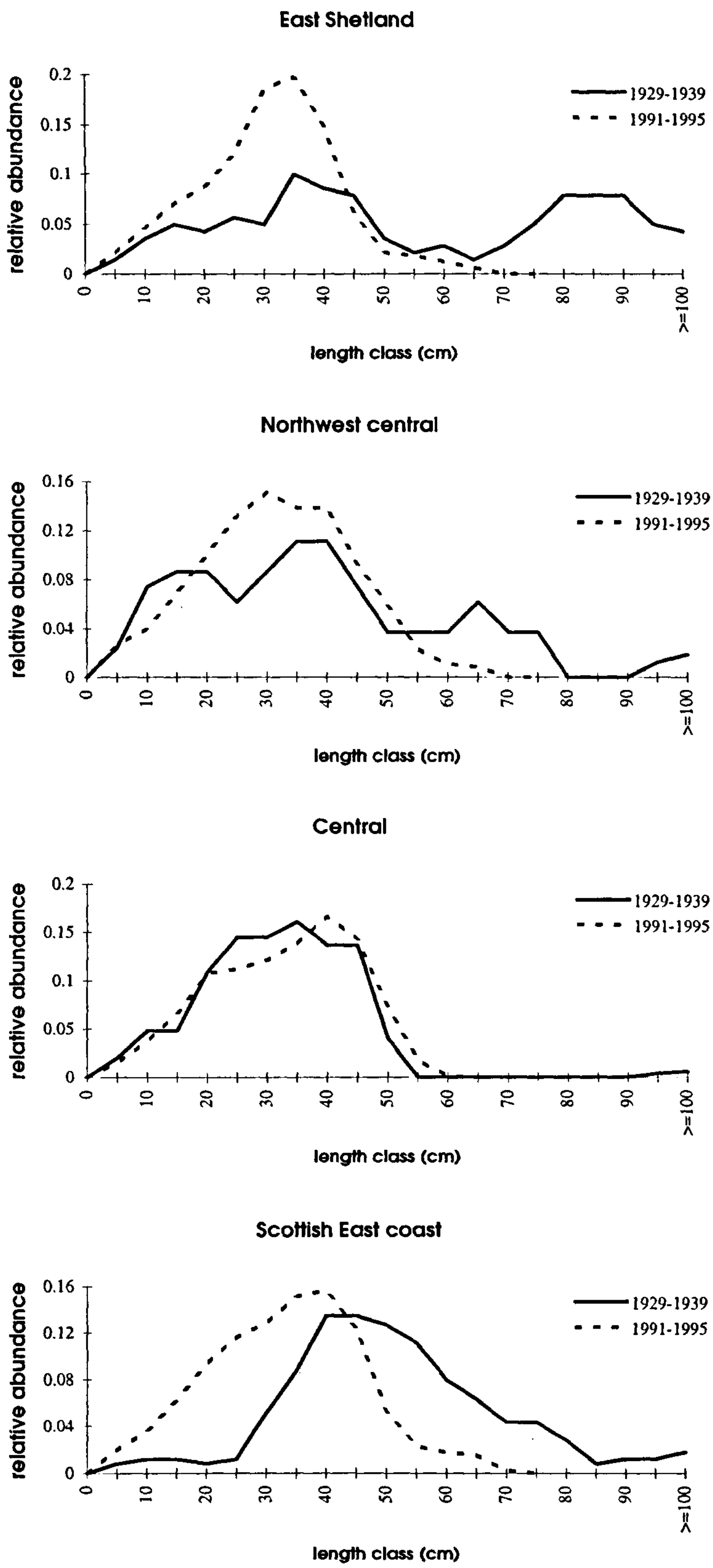
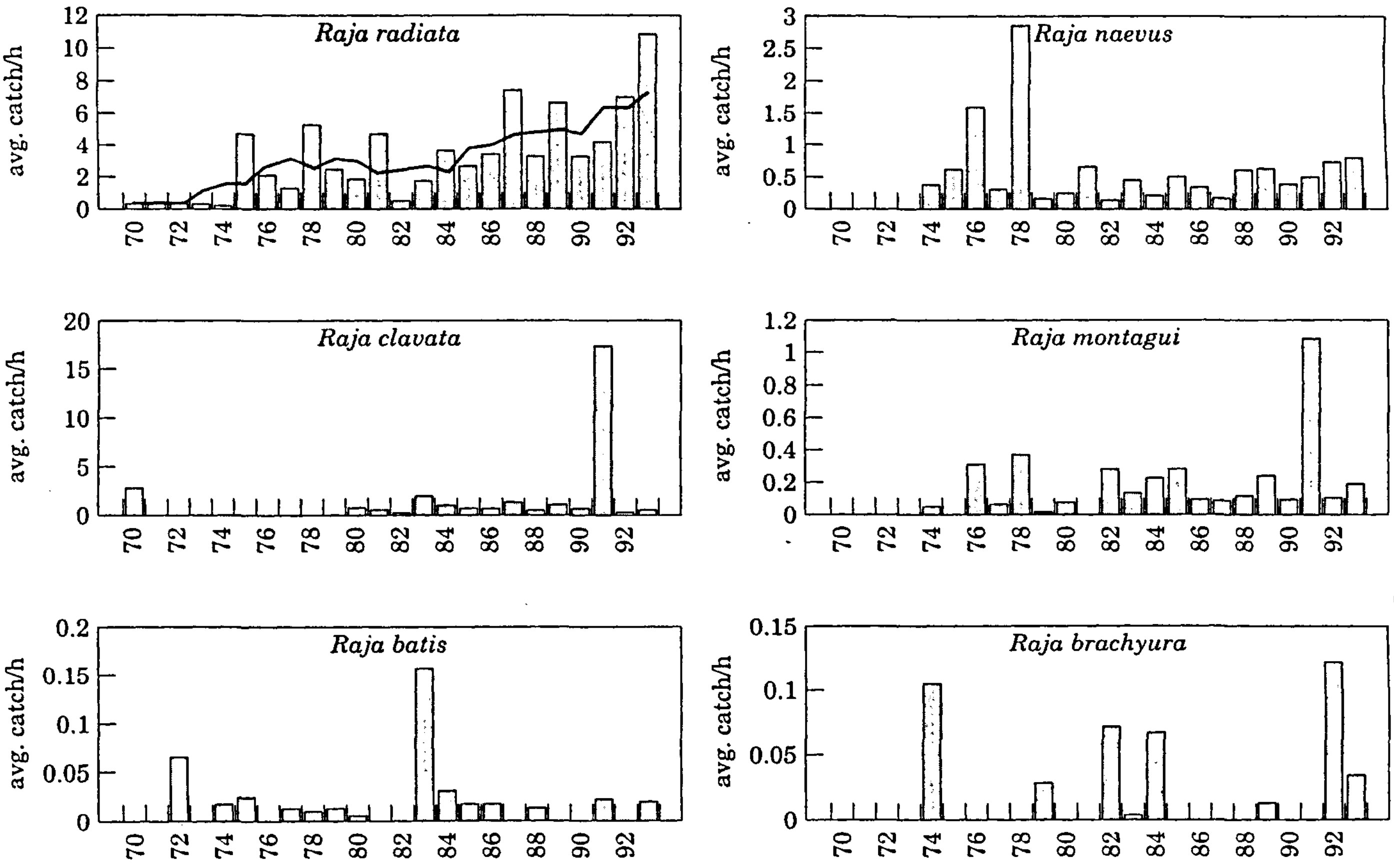


**Figure 6.8** Average catch per hour of six rays species caught during the IBTS 1970–1993. A 5-year running mean is shown for *Raja radiata*. From Walker & Heessen, 1996.



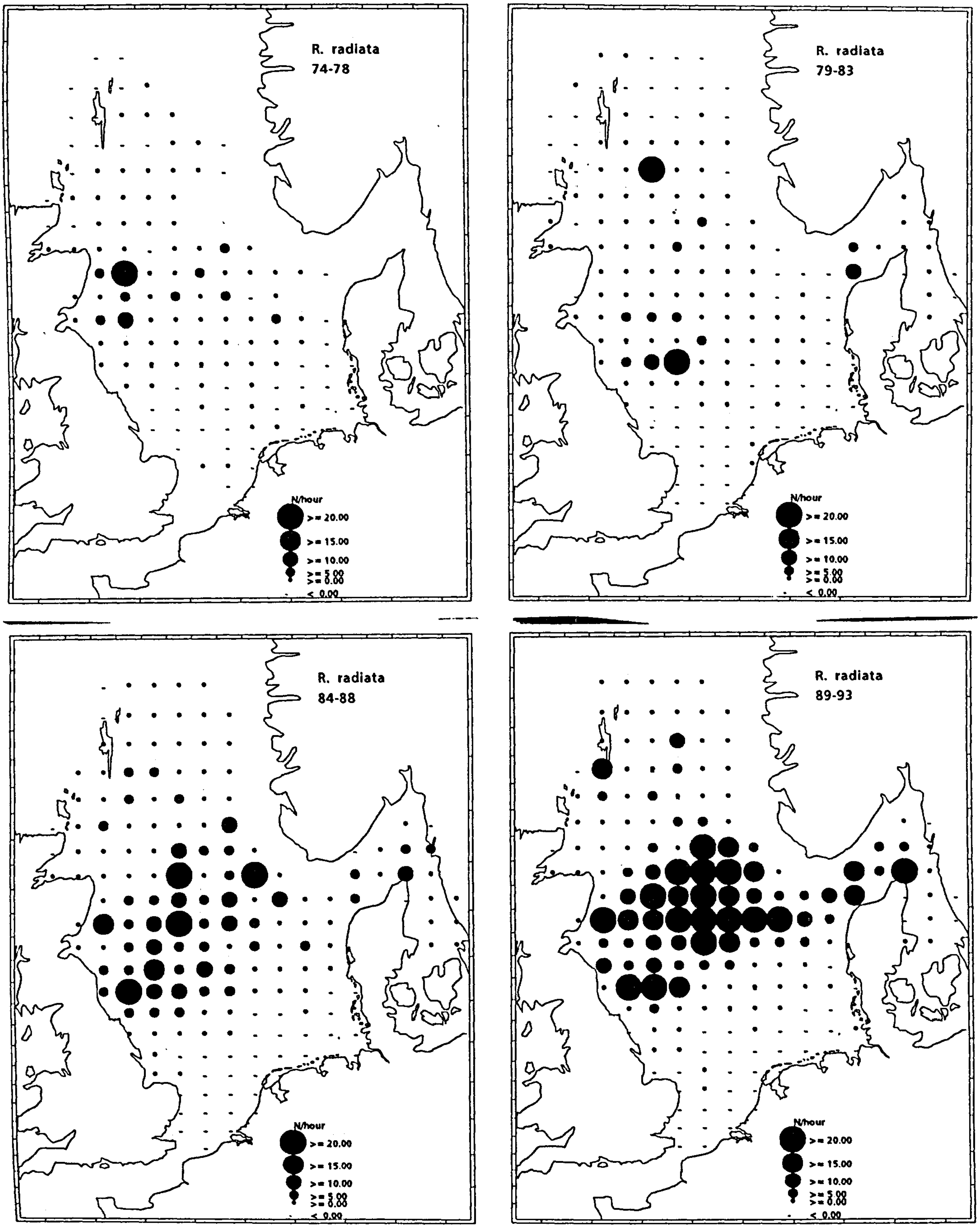



**Figure 6.9** Distribution of starry ray *Raja radiata)* by 5-year period (N/h; IBTS). From Walker & Heessen, 1996.

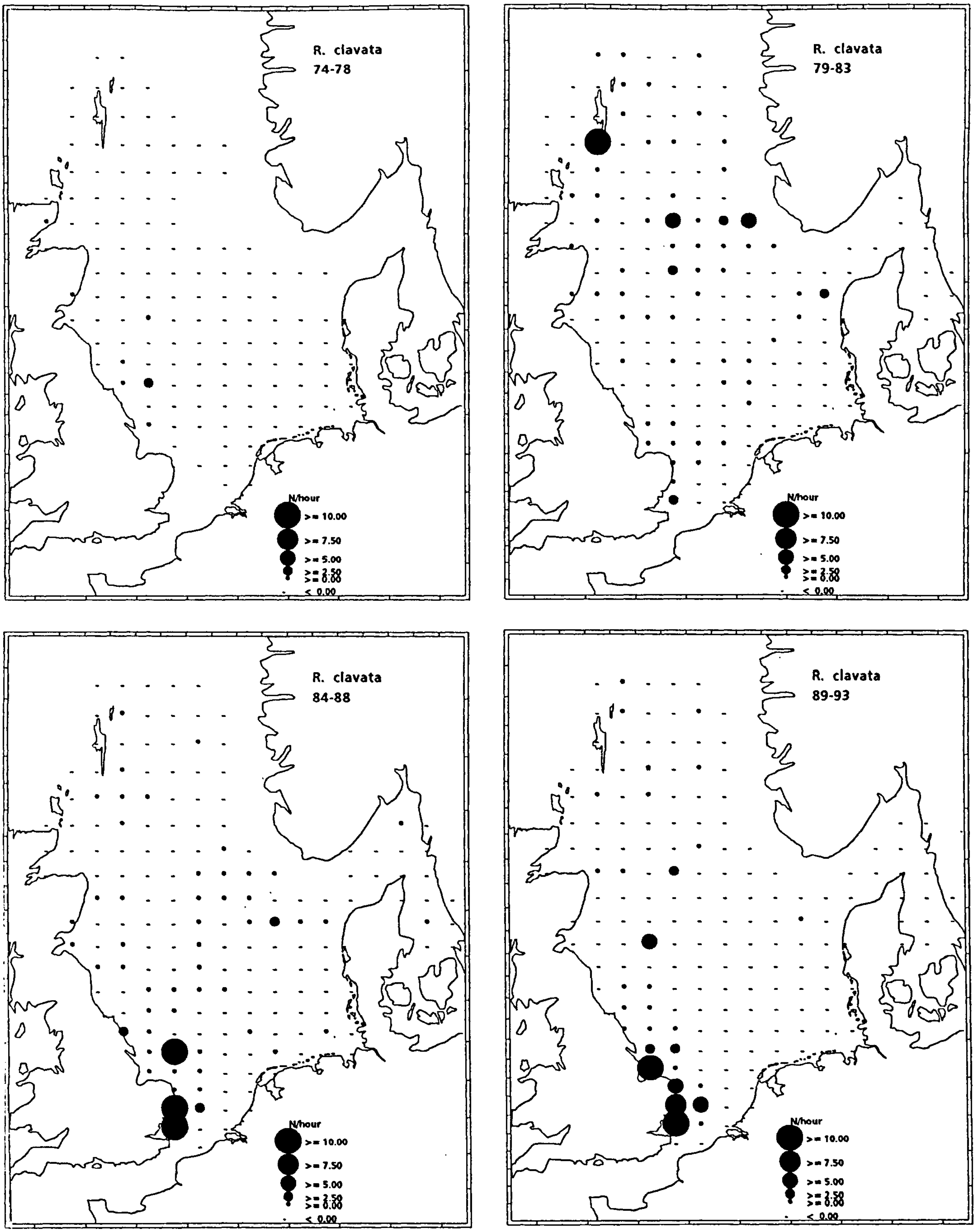



**Figure 6.10** Distribution of thornback ray (*Raja clavata)* by 5-year period (N/h; IBTS). From Walker & Heessen, 1996.

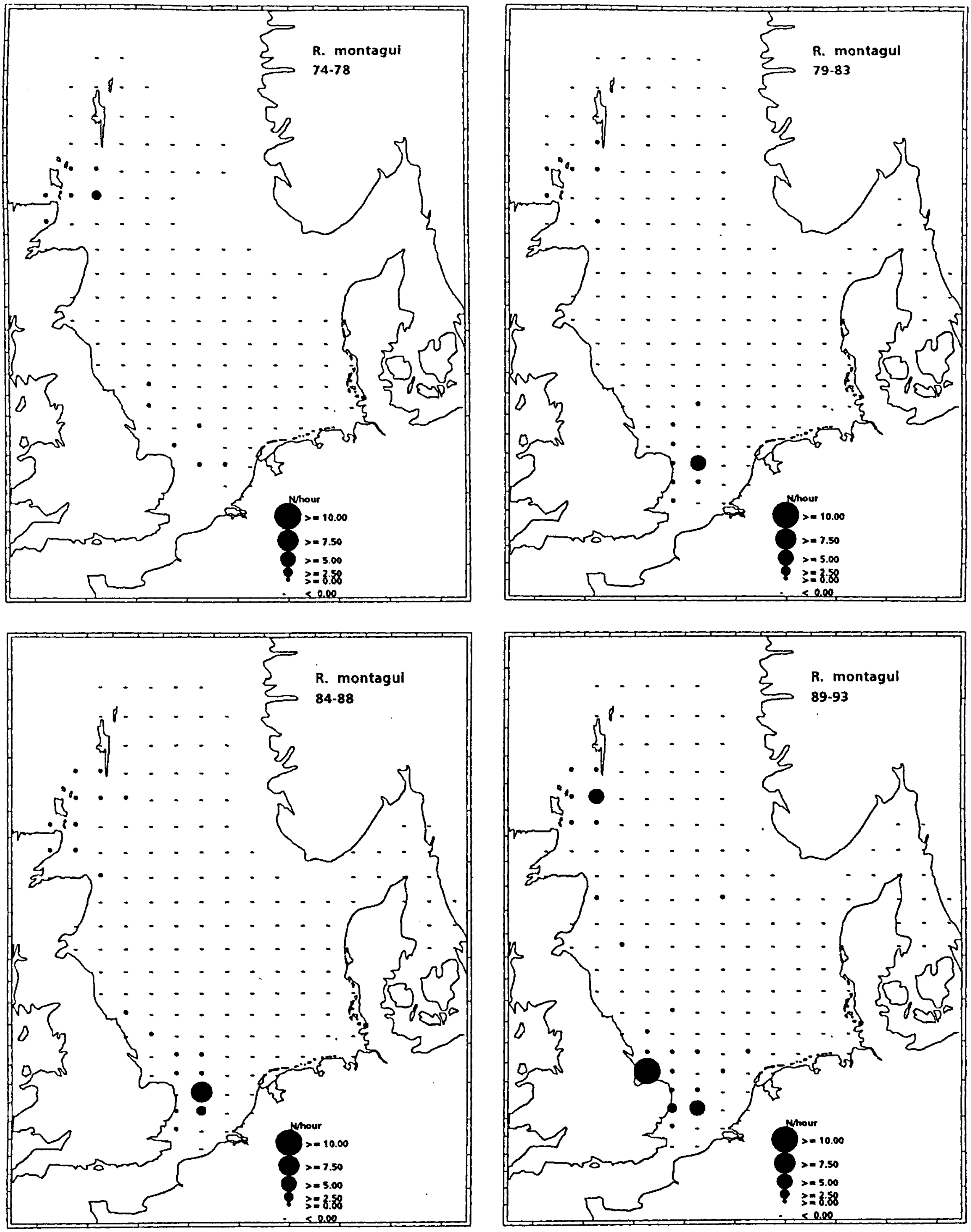



**Figure 6.11** Distribution of spotted ray (*Raja montagui*) by 5-year period (N/h; IBTS). From Walker & Heessen, 1996.

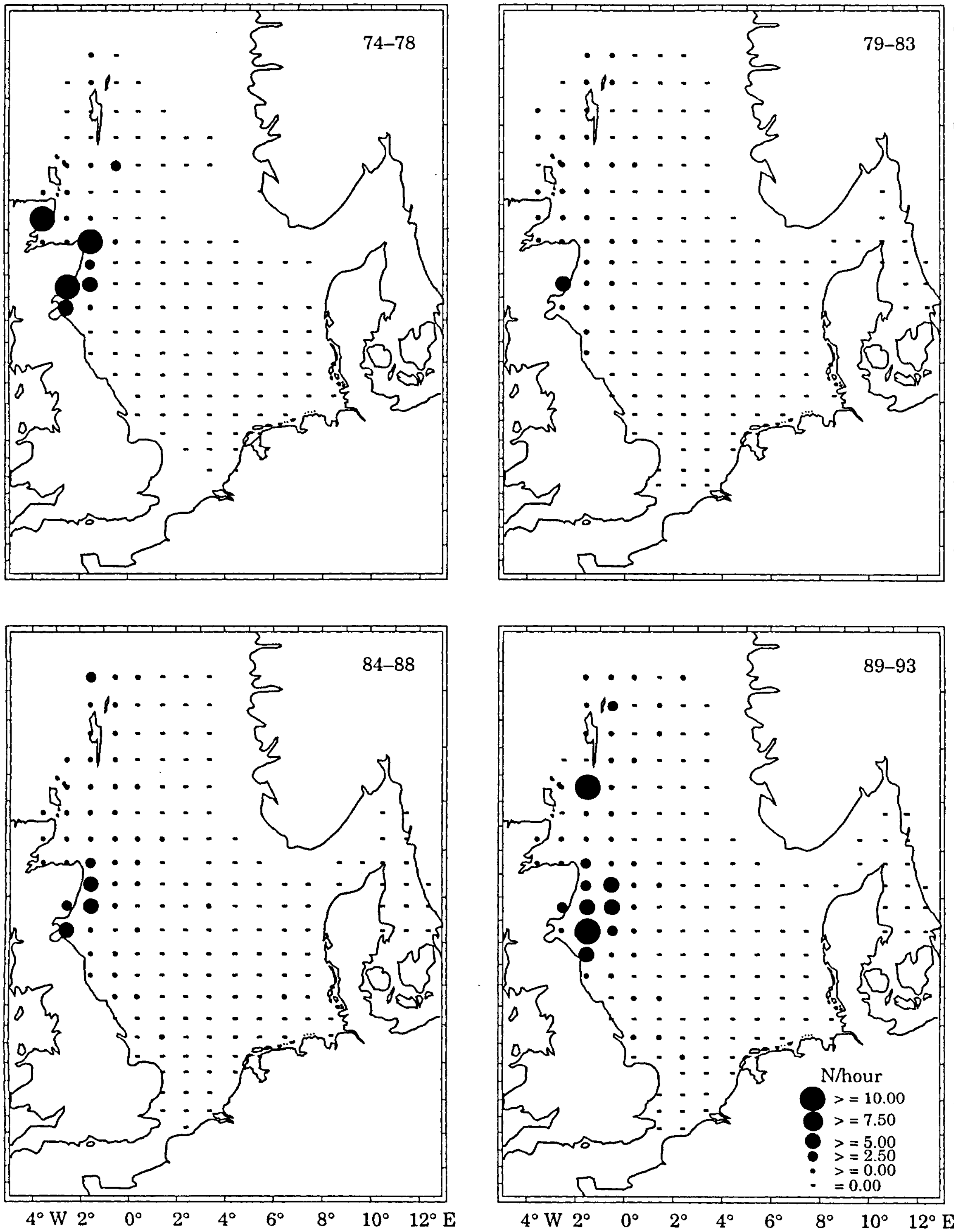



**Figure 6.12** Distribution of cuckoo ray (*Raja naevus*) by 5-year period (N/h; IBTS). From Walker & Heessen, 1996.

**Figure 6.13** Average catch per hour of three ray species caught in the North Sea, south of 55.30 N during the English Groundfish Survey.

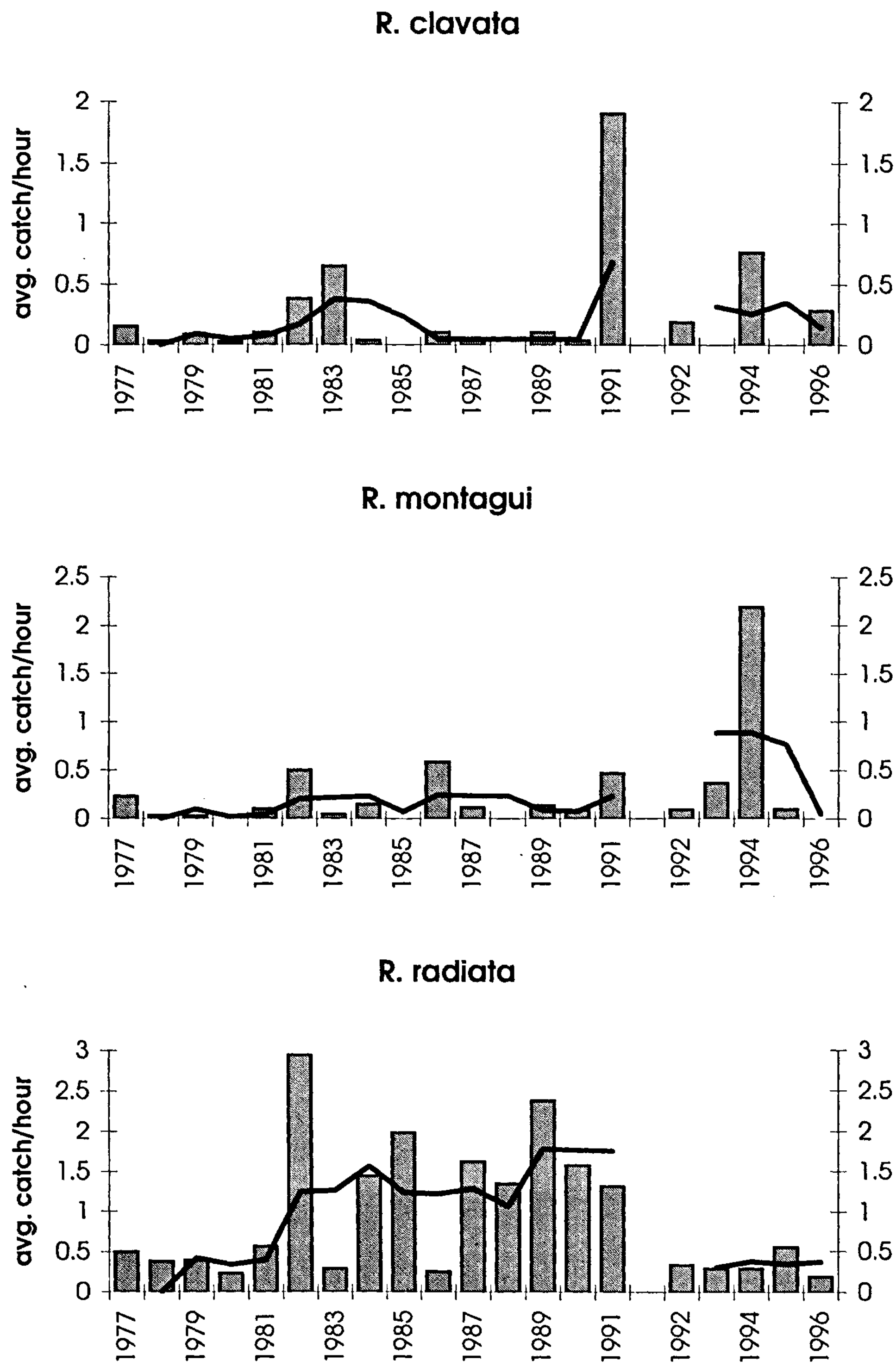


Figure 6.14 Length-frequencies from IBTS surveys (1992-1995) and corresponding catch curves for four ray species.

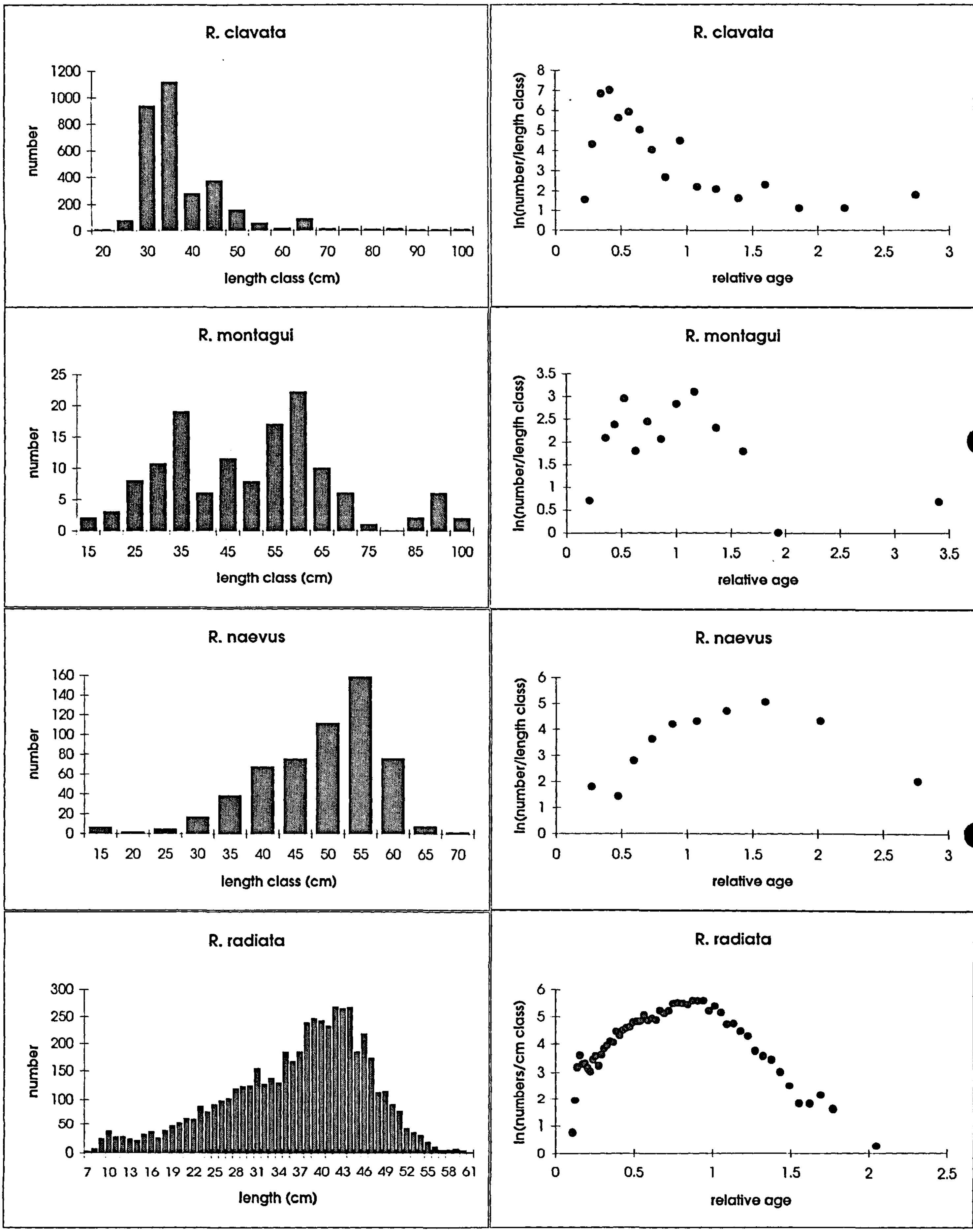
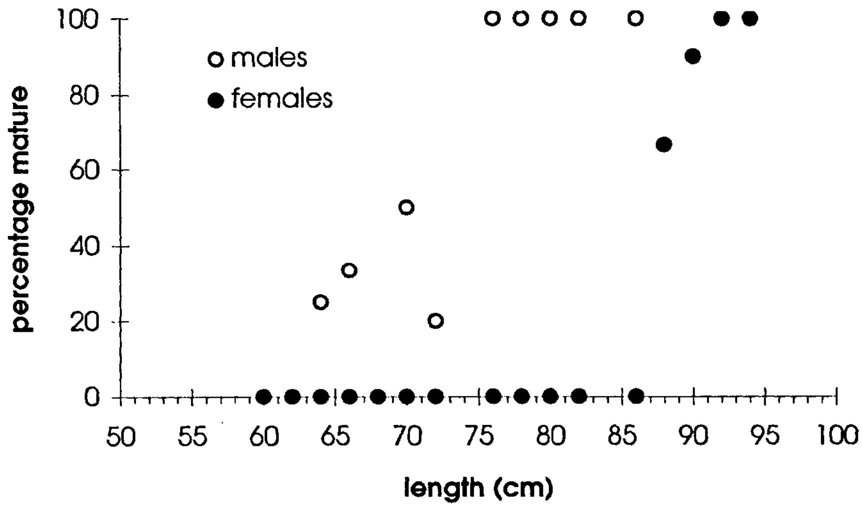


**Figure 6.15** Percentage mature per length class for thornback rays (*R. clavata*) in the North Sea and British west coast and Irish Sea.

**R. clavata - North Sea (1992-1996)**




**R. clavata - British west coast & Irish Sea (1992-1996)**

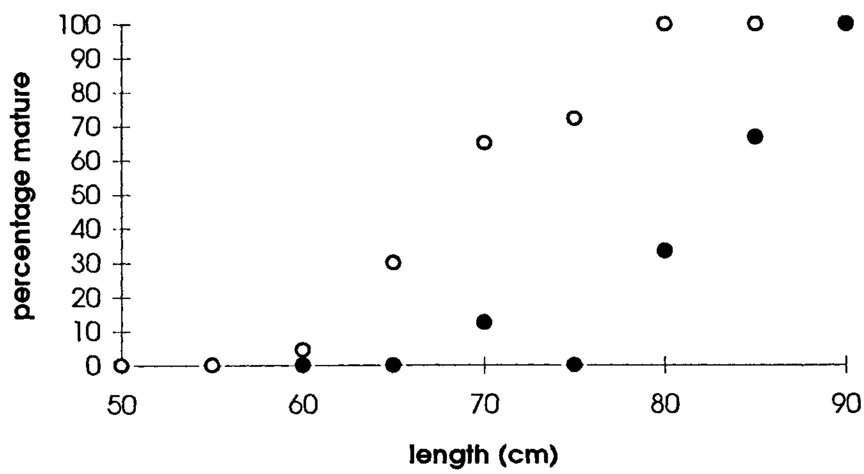


**Figure 6.16** A: values of mortality rate of mature Fish ($Z_m$) and on immature fish ($Z_i$) needed to maintain the population of the common sake (*R. Batis*) in equilibrium; fecundity 20 female eggs/year (a) and 10 female eggs/year (b). B: replacement trajectories for total mortality ($Z_i$=$Z_m$) beyond which the population will collapse shown for a number of different species. From Brander 1981.

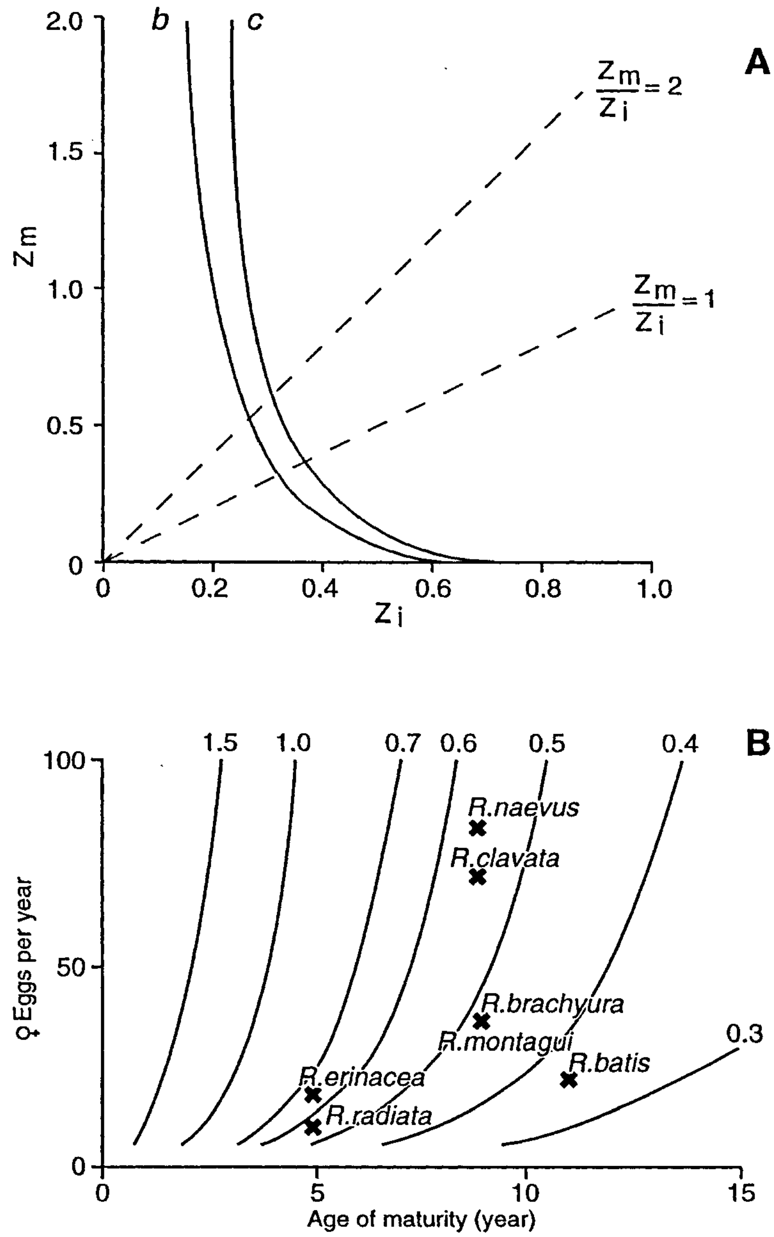
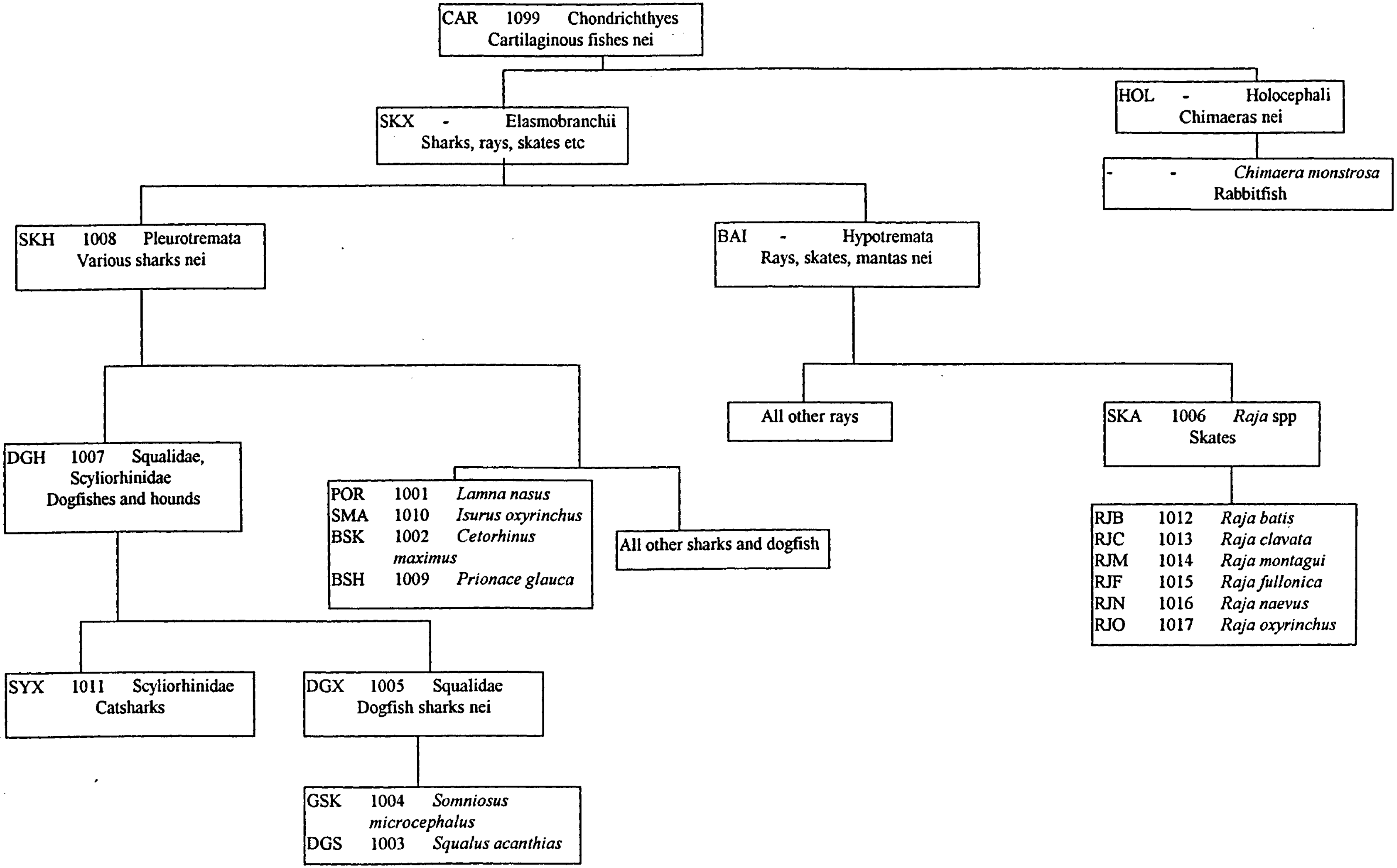
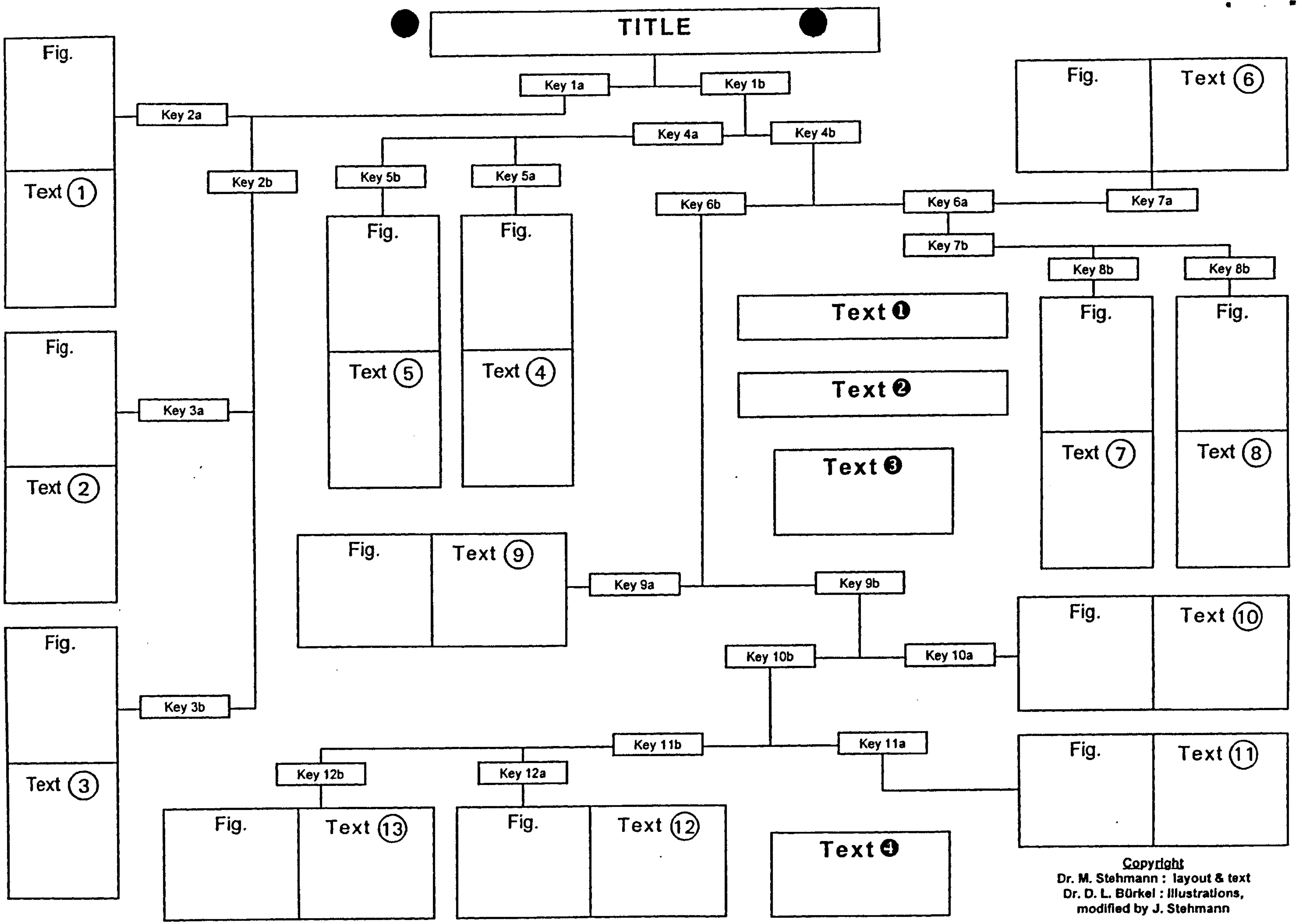


**Figure 8.1** Classification and codings of cartilaginous fishes.



# APPENDIX 1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Key 1b
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Key 8b
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Key 10a
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Fig.
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# FIELD KEY to WINGS of COMMON SKATE SPECIES (*Raja* spp.) in NORTHERN EU SHELF WATERS

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❶

Skates are seemingly often difficult to identify, because they all appear to look very much alike due to their flattened, more or less rhombic body disc and rather rudimentary tail being sharply marked off. However like with flatfishes, knowing the features distinguishing the various species and giving specimens a closer look will allow their specific identification, without being an expert, as in more familiar bony fishes. This key refers to easily recognisable external features only of general wing shape, squamation and colouration and colour pattern for the specific identification of landed skate wings only.

❷

Being typical bottom dwellers, skates tend to adapt their colour and pattern closely to the bottom substrate and may thus vary in colour appearance within one and the same species. Furthermore, their body proportions, principal squamation (scale coverage) and its prominence, as well as arrangement of enlarged thorns may vary considerably depending on size and age, and between females and males. As both sexes can easily be recognised externally from smallest postembryonic size onward through the paired, rod-like 'claspers' of males along inner margins of their pelvic fins, specimens should always be registered by sex prior to preparation. Illustrations of this key show only the wings of mature males of the individual species, with head, trunk, claspers and tail missing.

❸

A few terms of squamation are used in the key, namely spinules, thornlets, thorns: **spinules** are the small dermal denticles forming the principal coverage, totally or partly, of placoid scales on a skate's upper side, as well as partly or wholly on the underside at least in some species; shape of spinules hardly recognisable without magnification, but their presence can be felt in any case, as spinulose areas are more or less rough to touch like sandpaper of different grain-size. **Thornlets** are modified spinules of medium size, usually on a discernibly radiated basal plate and with sharp tip; without forming a definite pattern, they appear mostly on certain regions of the upper surface only, e.g., on snout, along anterior disc margins and arranged as additional parallel rows along back of trunk and tail. **Thorns** are modified placoid scales of very distinct size and shape, appearing only on certain regions of the upper surface in rather species specific arrangement and numbers, e.g., on orbital rims, nape and shoulders, along back of trunk and tail, as well as on sides and lower edges of tail; a circular to oval basal cone may be ribbed or smooth and bears a medially or asymmetrically placed more or less erect, or rearward inclined or curved sharp tip. Only exceptionally, thorns will also be found on a skate's underside in irregular distribution in very few species. Thornlets and thorns will be found on upper side of wings at most on snout tip and on anterior and inner parts of the pectoral wings only in most species.

Maturing males develop two sex-specific, paired fields of thorns on upper disc: **malar thorns** (often only of thornlet size) in an irregular patch or stripe at anterior disc margins about level with eyes and spiracles. Very characteristic, claw-like **alar thorns** with long, obliquely inward directed tips; in species treated here, each alar thorn is erectile from its individual dermal pocket, and they are arranged in a stripe of several longitudinal rows running across the outer wing tips. All illustrations of this key show mature males with their malar and alar thorn fields being present also on landed wings.

❹

Illustrations of the wings were prepared as computer artwork by J. Stehmann based on those by D. L. Bürkel of the entire skates, respectively, and they are presented in this key in a way, that only the part-region of the left upper wing (pectoral fin) shows primary colour and colour pattern components, whereas on remainder of upper surface the principal spinulation, remaining thornlets and thorns on the wings are illustrated. If underside views of species are given in addition, the smaller part-area indicates squamation, the larger one colour and its eventual pattern or specific components. Experiences gathered in the past have shown, that primary colour, colour pattern and squamation components cannot be combined adequately in one and the same drawing for identification purposes. The unusual appearance of the present figures is thus only for the benefit of presenting specific key characters for the identification of skate wings as clear as possible.

## ① *Raja (Rostroraja) alba* Lacepède, 1803

**White Skate, Bottlenose Skate**

[Raie blanche (F), Raya bramante (E), Raia Tairoga (P)]

**FIELD CHARACTERS:** Snout very long and pointed. its tip pronounced. General outline broadly rhombic, with wing tips acutely angled, and more or less undulated front margins distinctly concave; except for very small young, a theoretical line from snout tip to wing tip not touching front margin of disc. **Squamation:** Upper surface only devoid of spinules in early juveniles but almost entirely spinulose in larger specimens, which at most show bare patches on wings. Underside smooth in juveniles, except for snout and anterior wing margins, but more or less spinulose in large specimens which have only outer wings smooth. **Colour:** Upper surface reddish-brown mainly in young, rather dark greyish-blue in larger specimens, with numerous variously obvious light or pale spots. Underside white, with a broad blackish (young) to grey margin (larger specimens) around pectoral wings; mucus and sensory pores on disc not marked by colour. **Size:** a very large growing, heavy species, to over 200 cm total length.

**DISTRIBUTION and HABITAT:** NE-Atlantic coasts northward to south-western Ireland, also western Mediterranean. Bottom dwelling from inshore to upper slope down to about 400 m.

## ② *Raja (Dipturus) oxyrinchus* Linnaeus, 1758

**Long-nosed Skate**

[Pocheteau noir (F), Picón (E), Raia bicuda (P)]

**FIELD CHARACTERS:** Snout extremely long and pointed but its tip not markedly pronounced. General outline broadly rhombic, with outer wings tips acutely angled, and somewhat undulated front margins very deeply concave; a theoretical line from snout tip to wing tip not touching front margin of disc. **Squamation:** Upper surface only devoid of spinules in juveniles but almost entirely spinulose in larger specimens, which at most show bare patches on wings. Underside smooth only in young, becoming almost entirely spinulose in adults, but bare patches on wings. **Colour:** Upper side from light brown in juveniles to dusky brown or grey in larger specimens, with a pattern of more or less distinct light spots and black dots. Underside almost dark brown to blue-grey, somewhat lighter in young. Mucus and sensory pores on both surfaces of disc marked as blackish dots and streaks, which are very numerous on anterior two thirds of wings underneath. **Size:** large growing species, to about 150 cm TL.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to the Faroes, the Shetlands and central Norway, also northern North Sea and Skagerrak; also in the Mediterranean but hardly at less than 500 m. Bottom dwelling from mid-shelf depth at about 90 m to mid-slope depth to about 900 m, but mainly around 200 m.

## ③ *Raja (Dipturus) batis* Linnaeus, 1758

**Skate, Common Skate**

[Pocheteau gris (F), Noriega (E), Raia Oirega (P)]

**FIELD CHARACTERS:** Snout very long and pointed but its tip not markedly pronounced. General outline broadly rhombic, with wings tips acutely angled, and somewhat undulated front margins deeply concave; a theoretical line from snout tip to wing tip not touching front margin of disc. **Squamation:** Upper surface only devoid of spinules in juveniles but spinulose in larger specimens along front margins; large females may show more intense spinulation. Underside more or less spinulose in adults of both sexes. **Colour:** upper side olive-grey or brown with a variable pattern of light spots, dusky blotches and often an oval eye-spot-like colour mark on each pectoral wing especially in subadult specimens. Underside ashy-grey to blue-grey. Mucus and sensory pores on both surfaces marked as blackish dots and streaks, which are numerous all over underside. **Size:** The largest growing and heaviest skate in European waters; females attain up to 285 cm total length and 200 cm disc width, males remain somewhat smaller up to about 200 cm total length, and weights to 113 kg have been reported.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to Iceland, the Faroes and northern coasts of Norway, North Sea except for southern part, Skagerrak and Kattegat (rare); also in the Mediterranean, but rare in eastern part. Bottom dwelling from coastal waters to mid-slope depth at about 600 m, but mainly within the 200 m range.

## ④ *Raja (Raja) microocellata* Montagu, 1818

**Small-eyed Skate/Ray**

[Raie mêlée (F), Raya colorada (E), Raia zimbreira (P)]

**FIELD CHARACTERS:** General outline evenly rhombic, with angled wing tips and straight to gently undulated front margins; snout short and bluntly angled, its tip a little marked off. **Squamation:** Upper surface largely spinulose, but centre and posterior third of pectoral wings almost smooth. Underside smooth only in juveniles but more or less spinulose in larger specimens. **Colour:** Upper side greyish, or olive to light brown, with a characteristic pattern of light blotches, mainly on wing centres, and long whitish bands arranged almost parallel to front and rear margins of wings; the light markings often edged dusky. Underside white. **Size:** up to about 80 cm total length and and 60 cm in width, adult males remain somewhat smaller; adult weight 5-6 kg.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to southwestern Ireland and England, southern Irish Sea and western English Channel; not in the North Sea and Mediterranean. Bottom dwelling from close inshore tidal areas, bays and estuaries to about 100 m shelf depth preferably on sandy grounds.

## ⑤ *Raja (Raja) undulata* Lacepède, 1802

**Undulate Skate/Ray**

[Raie brunette (F), Raya mosaica (E), Raia curva (P)]

**FIELD CHARACTERS:** General outline rhombic, with wings tips narrowly rounded rather than angled, and with undulated front margins; snout short and bluntly angled, its tip hardly marked off. **Squamation:** Upper side largely spinulose, except for centres and hind parts of pectoral wings in large specimens. Underside smooth, except for rough spinules on snout and at front edges. **Colour:** Yellowish- to greyish- or deep brown above with a characteristic pattern of several more or less undulating dark bands and elongated blotches which all edged with small white spots like pearl-strings. Underside white. **Size:** northern specimens usually up to 100 cm total length and 6-7 kg weight, southern representatives growing up to 120 cm.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to south-western Ireland and England and western English Channel; not in the North Sea but in western Mediterranean. Bottom dwelling from shallow coastal waters to the shelf edge at about 200 m depth, mostly between about 45 m and 100 m, and preferably on soft and sandy grounds.

## ⑥ *Raja (Amblyraja) radiata* Donovan, 1808

**Starry Skate/Ray**

[Raie radiée (F), Raya radiante (E), Raia repregada (P)]

**FIELD CHARACTERS:** General outline rhomboid, with wing tips roundish rather than acute, and with undulated (mature males) or convex (females and young) front margins; snout short and bluntly angled, its extreme tip a little marked off. **Squamation:** Upper surface very rough and spiny, less so from spinules than from solid, sharp thornlets usually scattered over pectoral wings and showing ribbed basal cone on stellate base. **Colour:** Upper surface greyish-brown, sometimes clouded with darker or a few pale blotches, but often with black dots arranged as rosettes. Underside white, with occasionally few small dark blotches. **Size:** a relatively small species somewhat differing in size according to its great geographical and depth range; to about 60 cm total length at lower latitudes and moderate depth, but up to 90-100 cm in deep water and at high latitudes. Males in the North Sea and around the British Isles becoming sexually mature already at about 40 cm total length.

**DISTRIBUTION and HABITAT:** all over northern North Atlantic up to Arctic latitudes and with southern limit of its range at Ireland and the British Isles, in the North Sea (except in its southeastern part) and the very western Baltic Sea. Bottom dwelling at high latitudes from inshore to more than 1000 m depth, but mostly between 50 m and 100 m in European Seas, and on nearly all kinds of bottom substrate.

## ⑦ *Raja (Leucoraja) fullonica* Linnaeus, 1758

**Shagreen Skate/Ray**

[Raie chardon (F), Raya cardadora (E), Raia pregada (P)]

**FIELD CHARACTERS:** General outline rhombic, with wing tips gently angled and front margins weakly undulated; snout relatively long, narrowly angled and pointed, with the tip somewhat marked off. **Squamation:** Upper surface entirely spinulose. Underside of head spinulose, but hind two thirds of pectoral wings mostly smooth. **Colour:** Upper side plain ashy-grey, often rather pale, without any colour pattern. Underside white. **Size:** a medium-sized species growing to about 120 cm total length, but mostly around 100 cm.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to Iceland, the Faroes, along Norway to the Murman coast, in the northern North Sea and Skagerrak, also western Mediterranean. Bottom dwelling on the shelf and upper slope in cold water from about 30 m to 550 m; mostly on the outer shelf at around 200 m in the north, deeper in the south. Regular catches by longliners may indicate a preference for rough grounds.

## ⑧ *Raja (Rajella) fyllae* Lütken, 1888

**Round Skate/Ray**

[Raie ronde (F), Raya redonda (E)]

**FIELD CHARACTERS:** General outline roundish particularly in young and half-grown specimens, rather than subrhombic, with wing tips very broadly rounded and front margins convex, except deeply undulated front margins in mature males. Snout very short and obtusely angled at up to ca. 155° angle, its short tip marked off. **Squamation:** Upper surface entirely rough with coarse spinules on snout and pectoral wings and many thornlets concentrated on snout and hind parts of wings; bare patches on wing centres mainly in adult males. Underside usually completely smooth. **Colour:** ashy-grey to dark brown above, often with inconsistent variable pattern of dark and pale spots, or clouded darker or paler; dark blotching more distinct in juveniles. Underside predominantly white, but regularly with greyish-brown spots on snout and along wing margins. **Size:** A small growing species with up to about 55-60 cm total length and 30 cm in width.

**DISTRIBUTION and HABITAT:** entire northern North Atlantic in cold water of 1-7 °C to beyond the Arctic Circle. Southern limit in NE Atlantic at about 45° N in northern Bay of Biscay, and in northern North Sea and Skagerrak. Bottom dwelling from shelf into deep water at higher latitudes, only at upper to mid-slope depths at lower latitudes; most common at 300-800 m but deepest record from 2.050 m.

## ⑨ *Raja (Leucoraja) naevus* Müller & Henle, 1841

**Cuckoo Skate/Ray**

[Raie fleurie (F), Raya santiguesa (E), Raia de dois olhos (P)]

**FIELD CHARACTERS:** General outline roundish rather than rhombic, with wing tips broadly rounded and front margins more or less undulated, more so in mature males. Snout relatively short and bluntly angled, with its tip a little marked off. **Squamation:** Upper side almost completely covered with spinules, only wing centres smooth in large specimens. Underside smooth, except for spinules on snout and at anterior margins. **Colour:** Upper side ochre to more or less light greyish-brown with faint light and dark spots. A large, roundish very distinct blackish eye-spot, marbled with irregular yellowish spots and worm-like stripes, on each inner pectoral wing near level of shoulder girdle; rarely a few additional smaller eye-spots of this kind on hind and outer parts of wings. Underside white. **Size:** up to about 70 cm total length and about 3 kg weight.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to around Ireland and Britain and in the northern and central North Sea to Kattegat, also western Mediterranean but very rare in eastern part. Bottom dwelling on shelf and upper slope at 20-250 m, most common between 70 m and 100 m but deeper to the south, where deepest record off Rio de Oro at 900 m.

## ⑩ *Raja (Leucoraja) circularis* Couch, 1838

**Sandy Skate/Ray**

[Raie circulaire (F), Raya falsa vela (E), Raia de Sao Pedro (P)]

**FIELD CHARACTERS:** General outline subrhombic, with broadly rounded wing tips and distinctly undulated front margins. Snout relatively short and bluntly angled, its tip marked off. **Squamation:** Upper side almost entirely spinulose, but large adults often with centre and hind part more or less smooth. Underside largely smooth, but spinules present on snout and at front margins. **Colour:** Upper side reddish-brown to dark brown with a typical constant pattern (very rarely missing) of 4-6 small creamy spots, each encircled dusky, on each pectoral wing in hind two thirds, and these spots symmetrically arranged on both wings. Underside white. **Size:** a medium-sized species growing up to 120 cm total length, usually around 70 cm, and about 10 kg in weight.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to Scotland, Faroes, southern Norway, northern and central North Sea and Skagerrak, also in western Mediterranean. Bottom dwelling on shelf and upper slope from about 70-275 m, mainly at 50-100 m.

## ①① *Raja (Raja) brachyura* Lafont, 1873

**Blonde Ray/Skate**

[Raie lisse (F), Raya boca de rosa (E), Raia pontuada (P)]

**FIELD CHARACTERS:** General outline broadly rhombic, with wing tips more or less acutely angled at about 90° and weakly (females) to moderately (males) undulated anterior margins. Snout relatively short and bluntly angled, its tip a little marked off. **Squamation:** Upper side only partly spinulose in juveniles but wholly prickly in adults. Underside largely smooth in juveniles, with spinules only on snout and along front margins. **Colour:** Upper surface ochre to various shades of lighter brown, with few pale spots or blotches on disc and constant pattern of numerous small, circular blackish spots extending to the very outer edges of wings. Dark spots rather regularly encircling pale spots and blotches to form eye-spot-like components. Underside white. **Size:** A medium-sized species growing to maximum of about 120 cm total length and up to 20 kg weight, but usually found of smaller size only.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward along western side of Ireland and Britain to the Shetlands and western North Sea, also English Channel and western Mediterranean. Bottom dwelling on the shelf from inshore to about 100 m depth but most common on sandy grounds at around 40 m depth.

## ①② *Raja (Raja) montagui* Fowler, 1910

**Spotted Ray/Skate**

[Raie douce (F), Raya pintada (E), Raia manchada (P)]

**FIELD CHARACTERS:** General outline rhombic, with wing tips more or less acutely angled at about 90° and weakly (juveniles and females) to moderately (males) undulated anterior margins. Snout relatively short and bluntly angled, its tip a little marked off. **Squamation:** Upper surface nearly smooth in young, but increasingly spinulose in larger specimens, except for bare centres and hind parts of pectoral wings. Underside largely smooth, except for narrow bands of spinules along front margins. **Colour:** Upper surface a warm brown, with constant pattern of numerous circular blackish spots not extending to the extreme margins of wings. Some pale spots and blotches may occur on wings, and frequently a large pale blotch on posterior centre of wing is encircled by black spots giving the appearance of an eye-spot on each wing, with dark spots also in centre. Underside white. **Size:** A medium-sized species growing up to about 75 cm total length and 50 cm in width with a weight hardly exceeding about 3.5-4 kg. Fully grown males remain smaller than females.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to the Shetlands, English Channel, North Sea (except for southeastern part), Skagerrak and Kattegat, also in western Mediterranean. Bottom dwelling on the shelf from deeper inshore waters at about 25 m to about 120 m depth. More common than the Blonde Ray.

## ①③ *Raja (Raja) clavata* Linnaeus, 1758

**Thornback Ray/Skate, Roker**

[Raie bouclée (F), Raya de clavos (E), Raia Lenga (P)]

**FIELD CHARACTERS:** General outline rhombic, with wing tips acutely angled at less than 90° and weakly (juveniles and females) to distinctly (adult males) undulated front margins. Snout relatively short and more or less bluntly angled, its tip a little marked off. **Squamation:** Upper side always wholly rough and densely spinulose, even in early juveniles. Large thorns with button-like 'swollen', smooth base (called 'bucklers') are scattered regularly in large specimens on upper wings; particularly large females show such 'buckler' thorns scattered also on underside of wings. Underside almost entirely spinulose in large females, whereas juveniles and large males have spinules mainly on snout and at front margins of wings. **Colour:** Upper side extremely variable with all shades of brown to greyish, variegated with dark and light spots and blotches, often mottled and marbled and producing reticulate pattern and eye-spot-like structures, but also plain coloured specimens reported. Juveniles tend to be spotted rather, whereas adults become mottled and marbled mostly. Underside white, with faint greyish margin around disc. **Size:** A medium-sized species growing to about 90 cm total length and 60 cm in width, when attaining a weight of up to 14 kg. Adult female always growing larger than largest mature males.

**DISTRIBUTION and HABITAT:** NE Atlantic coasts northward to Faroes, Iceland and Norway (south of Arctic Circle), North Sea, Skagerrak and Kattegat, western Baltic Sea (rare) and entire Mediterranean, as well as Black Sea. Wide spread farther south along West Africa (except on tropical shelf) to South Africa and in SW Indian Ocean. Bottom dwelling on shelf and upper slope from inshore to about 300 m depth on all kinds of bottom substrate but rare on rough grounds. Moderately common species mainly between 10 and 60 m depth.

[1a] Snout very long and pointed; a line from tip of snout to outer wing-tip not touching front margin of disc, if wings positioned more or less in natural way. Outer wing tips acutely angled.

[1b] Snout moderately long to short; a line from tip of snout to outer wing-tip touching or cutting front margin of disc.

[2a] Underside white, with a broad blackish (young) to grey outer margin (larger specimens) around pectoral wings. Mucus and sensory pores on underside of wings not marked by colour.

① *Raja alba*

**White Skate, Bottlenose Skate**

[2b] Underside more or less dark, with mucus and sensory pores marked as blackish dots and/or dashes.

[3a] Snout extremely long and pointed, with anterior wing margins being deeply concave. Upper and lower sides nearly smooth only in young but largely spinulose in large specimens, with bare patches centrally on wings. Dusky brown or grey above in larger specimens, with relatively indistinct pattern of few scattered light spots and black dots; underside rather dark brown to dark bluish-grey.

② *Raja oxyrinchus*

**Long-nosed Skate**

[3b] Snout long but less pointed at wider angle, with anterior wing margins being moderately concave to nearly straight in posterior two thirds to outer corners. Young and even large specimens fairly smooth above, except for large females being more prickly but showing less concave anterior margins; underside largely the same, with larger areas being smooth, except in large females. Olive-grey or brown above, with variable pattern of more numerous lights spots, dusky blotches and often an eye-spot-like oval on inner posterior wings especially in halfgrown specimens; underside lighter ashy-grey to blue-grey, the darker area in anterior third.

③ *Raja batis*

**Skate, Common Skate**

[4a] Upper side of wings variegated, typically with long blackish transverse bands or with light bands running almost parallel with disc margins.

[4b] Upper side of wings either plain coloured, or with eye-spots, light and/or dark spots and blotches, which may give a marbled, banded or reticulate pattern.

[5a] Upper side of wings with several light bands plus larger spots running almost parallel with disc margins.

④ *Raja microocellata*
**Small-eyed Ray/Skate**

[5b] Upper side of wings with several dark bands plus larger spots running almost transverse and partly parallel with disc margins; each dark band bordered by numerous small whitish spots like pearl strings.

⑤ *Raja undulata*
**Undulate Ray/Skate**

[6a] Upper side of wings plain coloured, or usually so; at least no clearly defined colour pattern.

[6b] Upper side of wings always variegated, with eye-spots, symmetrically arranged dark and light spots and blotches, with regular pattern of mainly dark circular spots, or with a combination of several of these components.

[7a] Prominent, sharp thornlets, with distinctly ribbed basal cone scattered on pectoral wings and on snout tip. Upper side very 'spiny' to touch. Greyish-brown above, often clouded with darker and few pale whitish blotches, and also often with black dots arranged as rosettes; underside white, with occasional small dark blotches.

⑥ *Raja radiata*
**Starry Ray/Skate**

[7b] If present at all, few thornlets with rather smooth basal cone only on snout tip, and at anterior wing margins of large males with 'alar thorns' being already developed (except for Round Ray. *R. fyllae*). Remainder of skin may be more or less smooth, or rough to touch depending on coverage with spinules.

[8a] General outline rhomboid, with angled wing tips; snout moderately elongated and rather pointed. Upper side entirely spinulose, but underside only in anterior third. Plain ashy-grey above, without colour pattern, underside white.

⑦ ***Raja fullonica***
**Shagreen Ray/Skate**

[8b] General outline roundish, with very broadly rounded outer wing corners; snout very short and obtusely angled. Anterior wing margins distinctly undulated in mature males. Snout, anterior wing margins and inner posterior wings very rough with spinules and thornlets; underside smooth. Ashy-grey to dark brown above, clouded darker or paler; young with more or less distinct dark blotches. In certain places, specimens may show large whitish blotch at inner posterior wings, and entirely pale whitish specimens may occur at middle slope depths. Underside predominantly white, but usually with irregular greyish to brown spots along outer margins of wings.

⑧ ***Raja fyllae***
**Round Ray/Skate**

[9a] Snout short and obtusely angled. General outline inverse heart-shaped to roundish, with broadly rounded outer corners. A large eye-spot on each upper inner pectoral wing, which ochre to light greyish-brown, shortly posterior to level of shoulder girdle (occasionally a few smaller ones in addition on wings) consisting of a dusky roundish blotch with irregular yellowish spots and worm-like stripes. Underside white. Upper side entirely spinulose, except for bare wing centres of large specimens. Underside smooth, except for prickly anterior wing edges.

⑨ ***Raja naevus***
**Cuckoo Ray/Skate**

[9b] Upper side colour pattern either consisting of few small creamy spots, or of dark and/or light blotches, spots and dots in various arrangements. Dark spots or dots may form eye-spot-like rings differing from real eye-spots by not consisting of various colour components and a solid centre.

[10a] Snout rather short and bluntly angled, with tip marked off. General outline inverse heart-shaped to rather roundish, with outer wing corners broadly rounded. Reddish-brown to dark brown above, with a constant colour pattern (very rarely missing) of 4-6 paired small circular creamy spots on posterior two thirds of pectoral wings; these spots being symmetrically arranged, and each is encircled by a dusky ring. Underside white. Upper side almost entirely spinulose, except for bare areas sometimes in hind half in adults. Underside prickly only on snout and at anterior wing margins.

⑩ ***Raja circularis***
**Sandy Ray/Skate**

[10b] Upper side of wings with various arrangements of numerous light and/or dark dots, spots and blotches forming apparent colour pattern. General outline rhombic, with marked outer wing tips.

[11a] Upper side ochre, with pattern of numerous small dark spots reaching to extreme outer wing margins; the spots sometimes encircling a few light blotches appearing thus eye-spot-like. Underside white. Except in juveniles, upper side entirely spinulose; underside prickly only along anterior wing margins. Snout short, bluntly angled, with its tip marked off a little.

①① ***Raja brachyura***
**Blonde Ray/Skate**

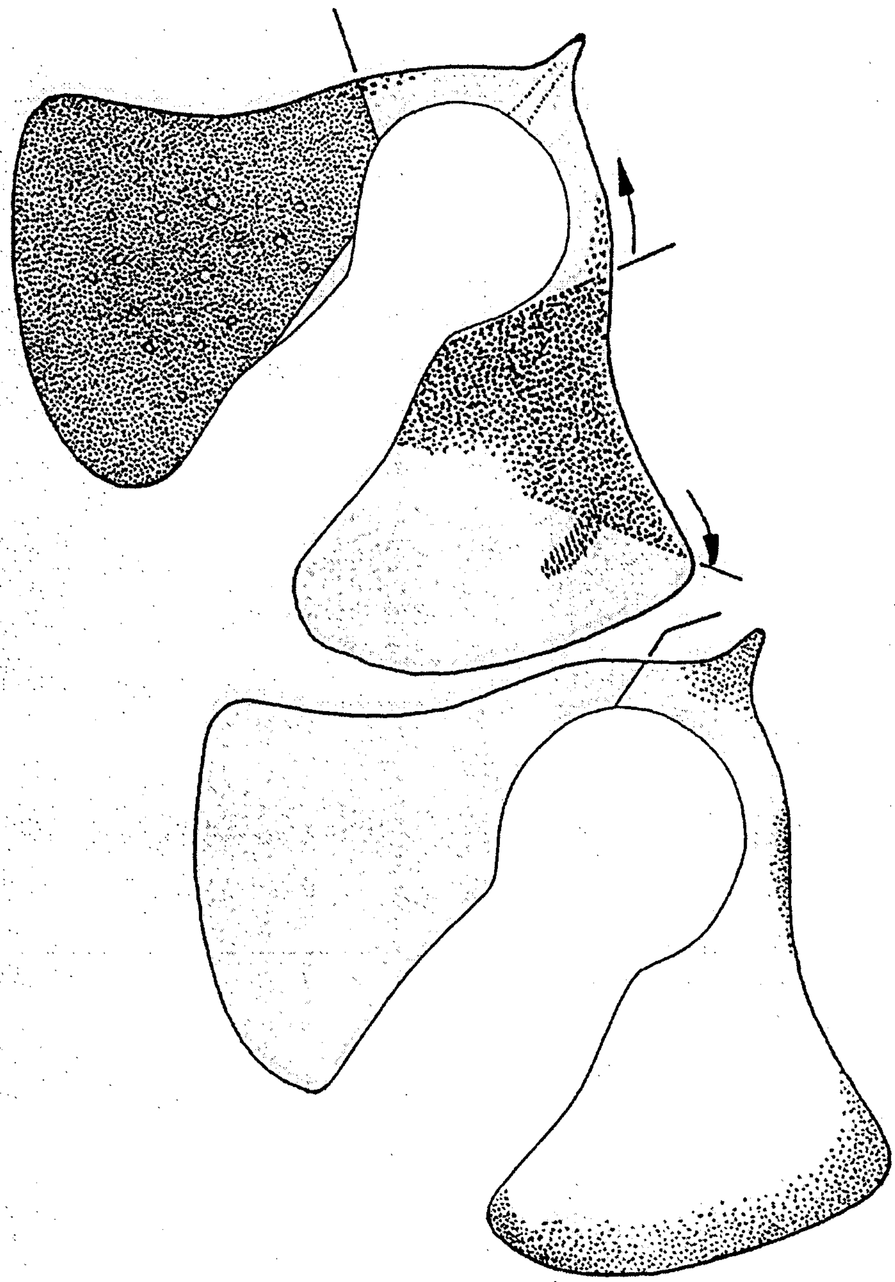
[11b] Upper side either dark spotted, but not to wing margins, or spotted and mottled light and dark to varying degrees.

[12a] Upper surface of wings almost smooth in young, more spinulose in larger specimens, but spinules never covering the entire surface of wings. No thorns scattered on the pectoral wings above or below. Underside smooth, except for narrowly prickly anterior wing edges. Upper side a warm brown with many circular dark spots not extending to extreme outer wing margins and frequently forming eye-spot-like rings at centre of pectoral wings. Underside white. Snout short, rather narrowly angled, with its tip a little marked off.

①② ***Raja montagui***
**Spotted Ray/Skate**

[12b] Upper surface of wings entirely rough spinulose at all sizes; underside prickly only on snout and at anterior wing margins in young and larger males but almost entirely spinulose in large females. Additional large and sharp thorns with 'swollen' smooth base ('bucklers') often scattered on upper wings in large specimens, as well as relatively often on underside of disc mainly in large females. Basic colour of upper side all shades of brown, with light and dark spots and blotches forming all kinds of colour pattern to an extreme degree of variability, including eye-spot-like blotches. Underside white, but margins of wings often greyish. Snout rather short, relatively narrowly angled, with its tip marked off.

①③ ***Raja clavata***
**Thornback Ray/Skate, Roker**



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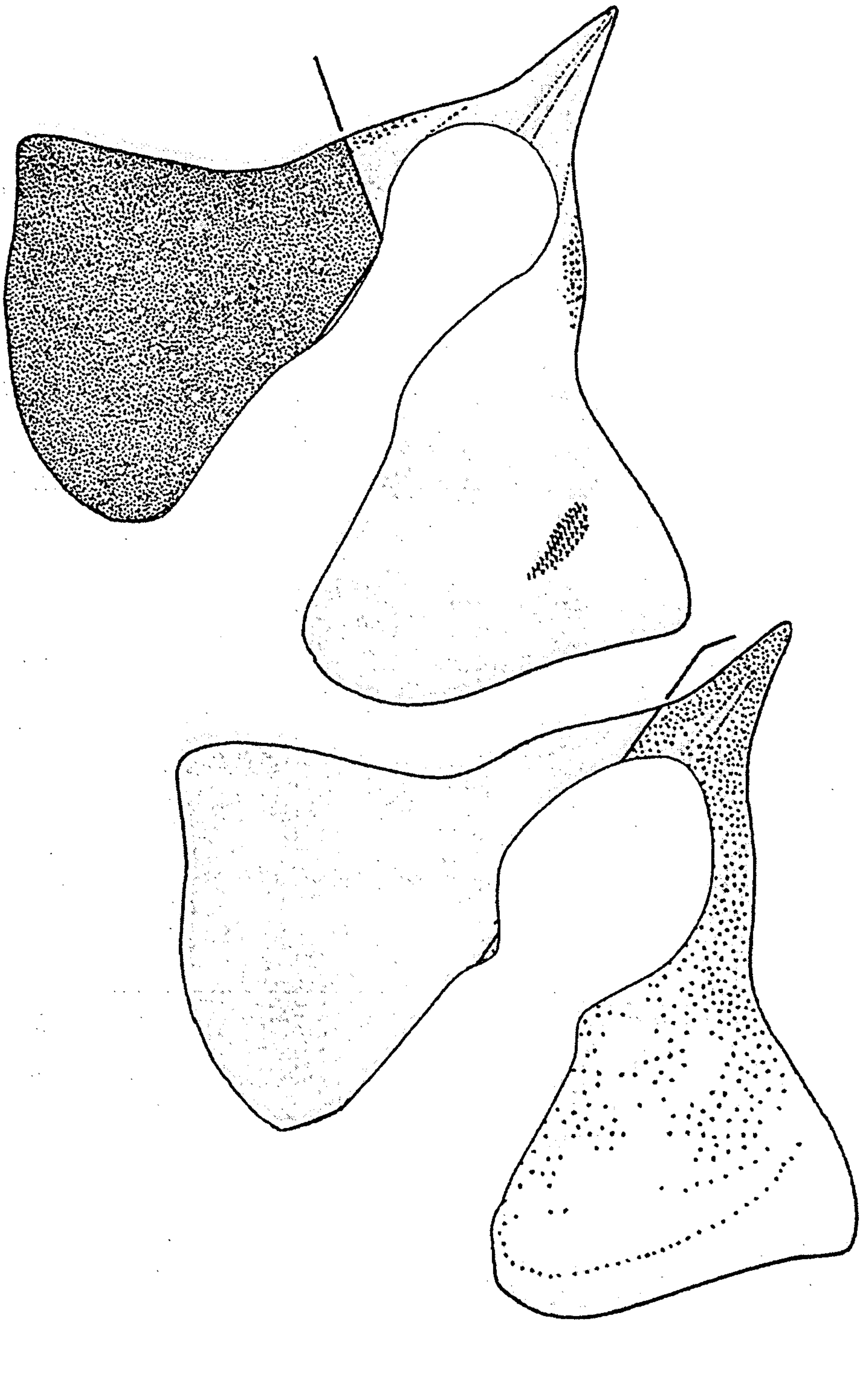

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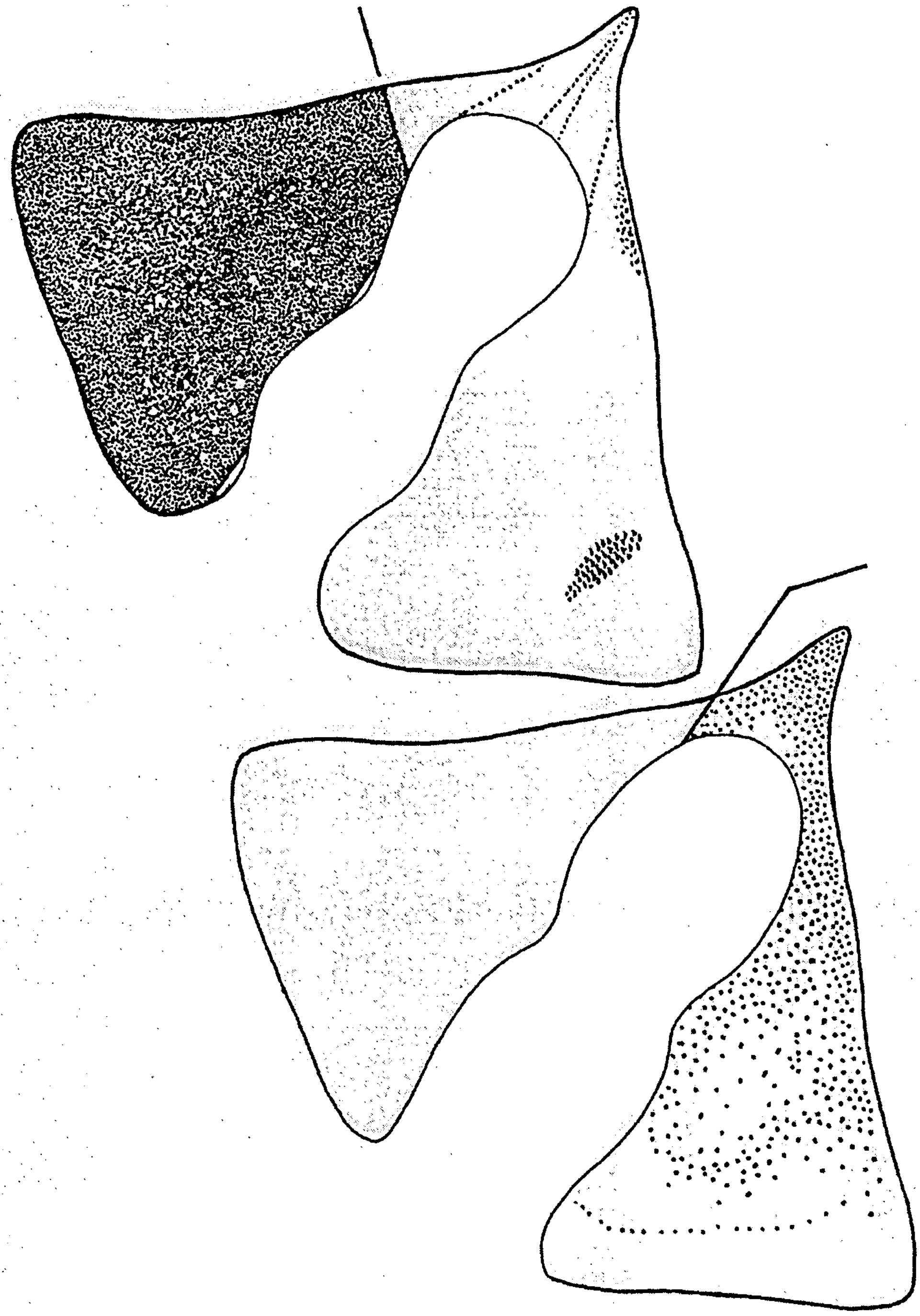

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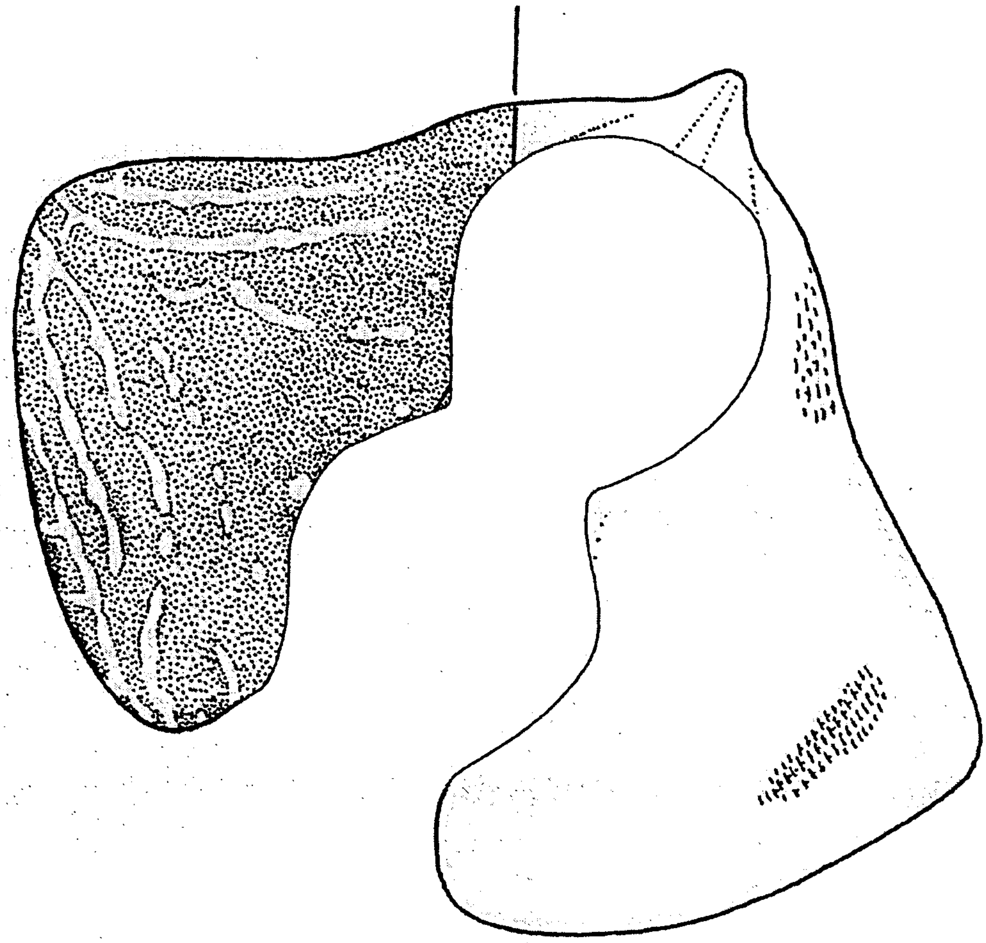

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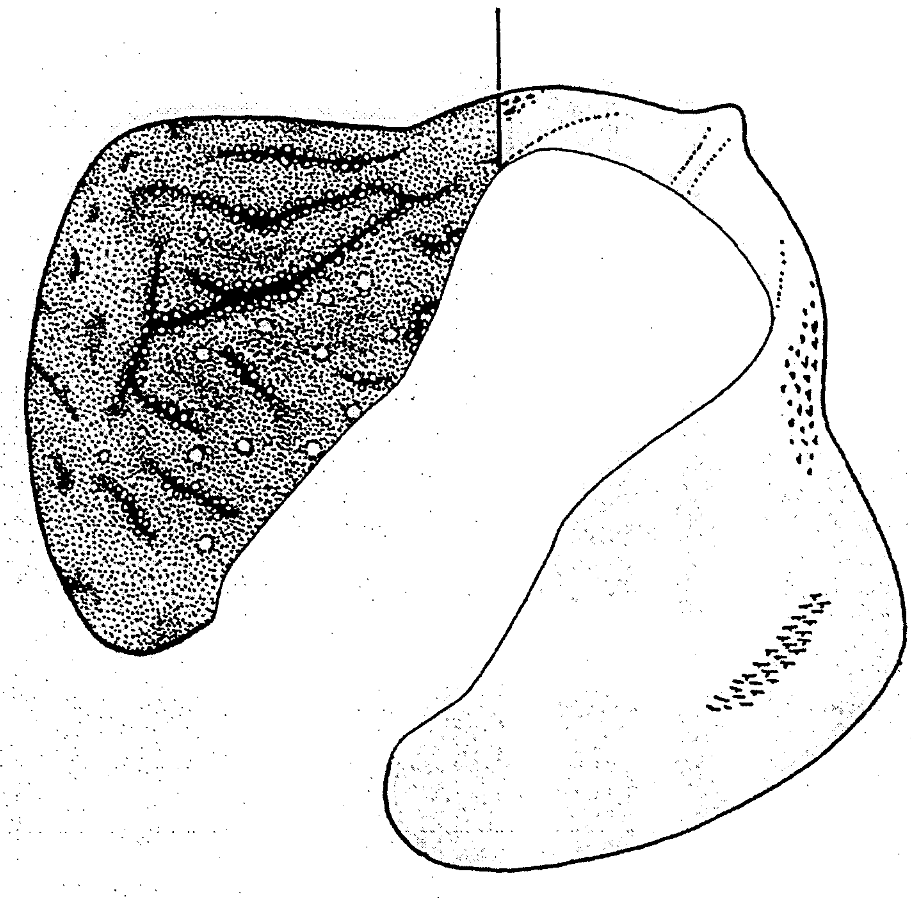

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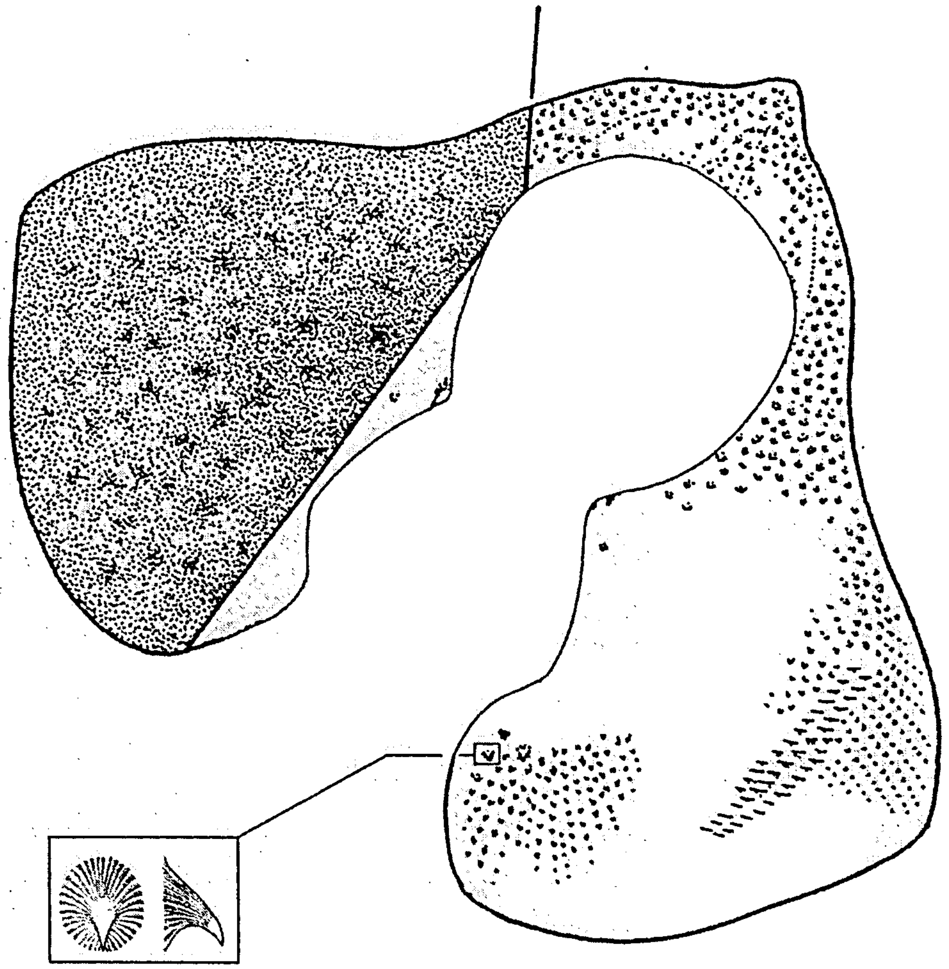

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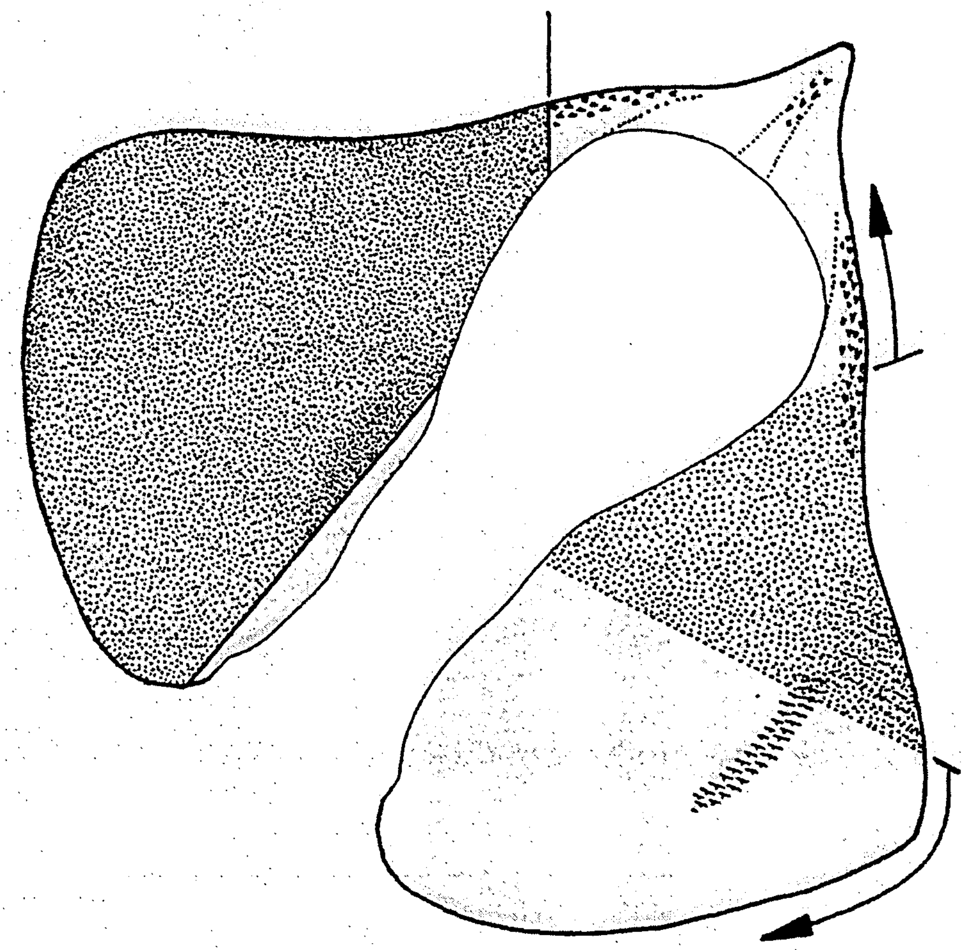

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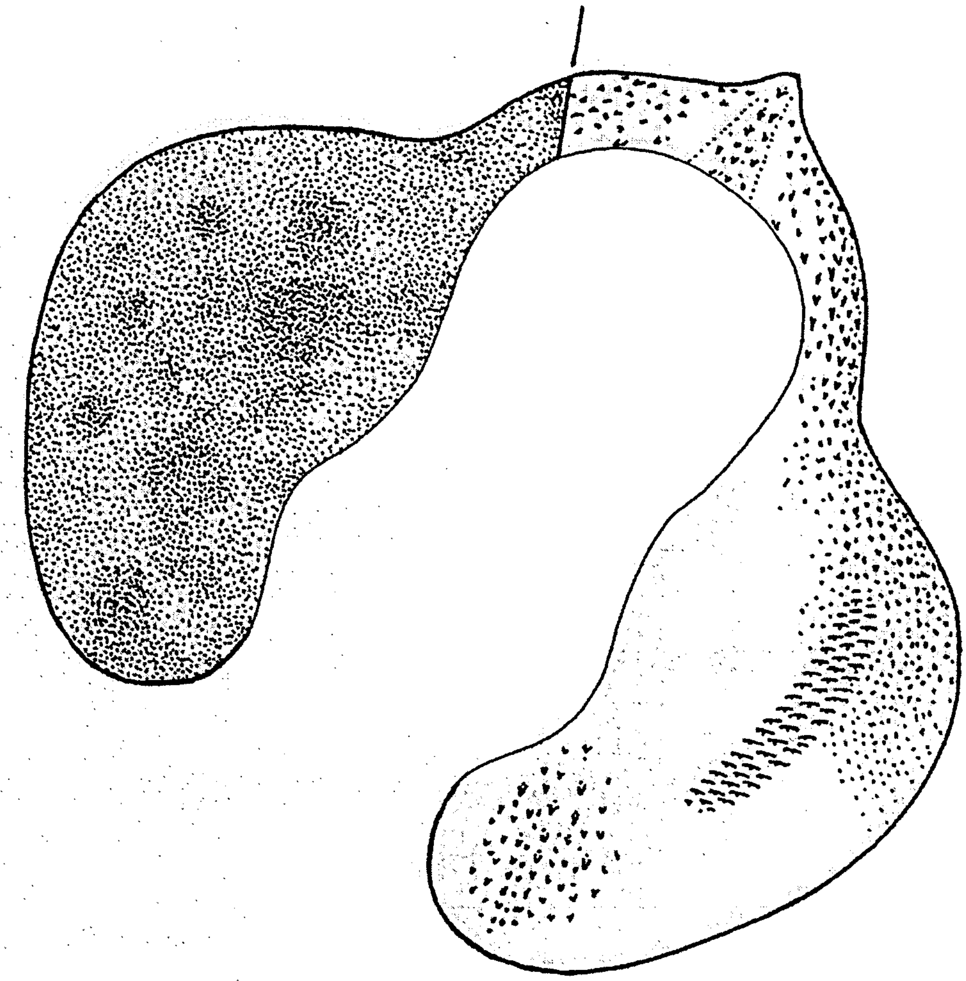

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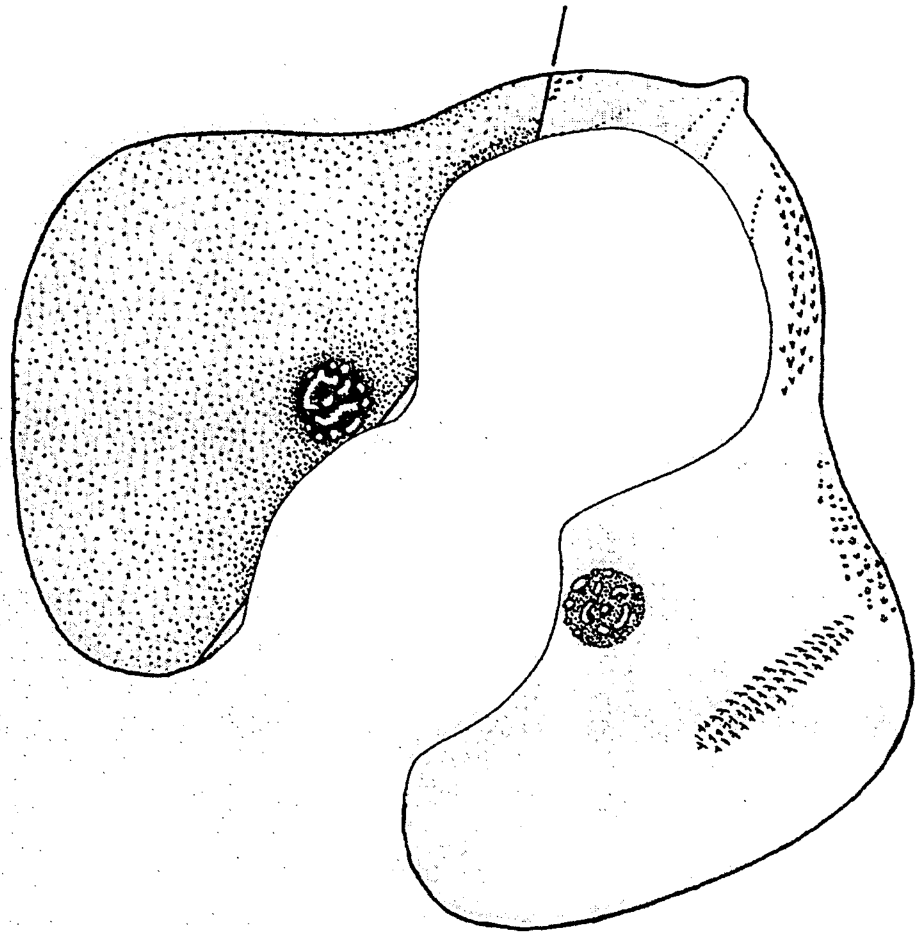

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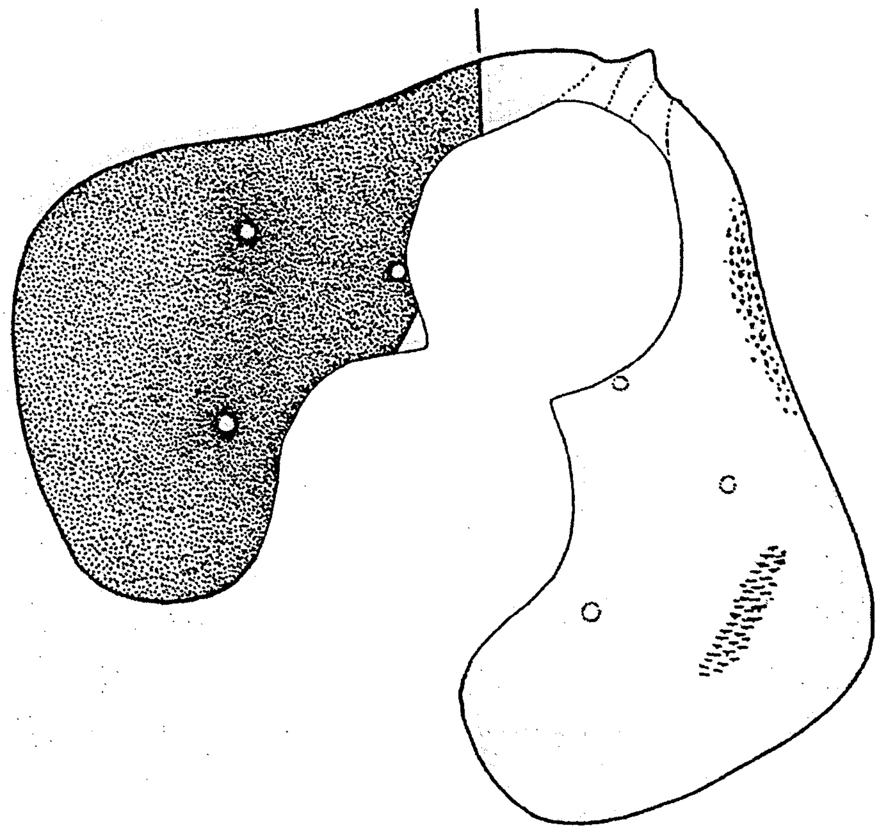

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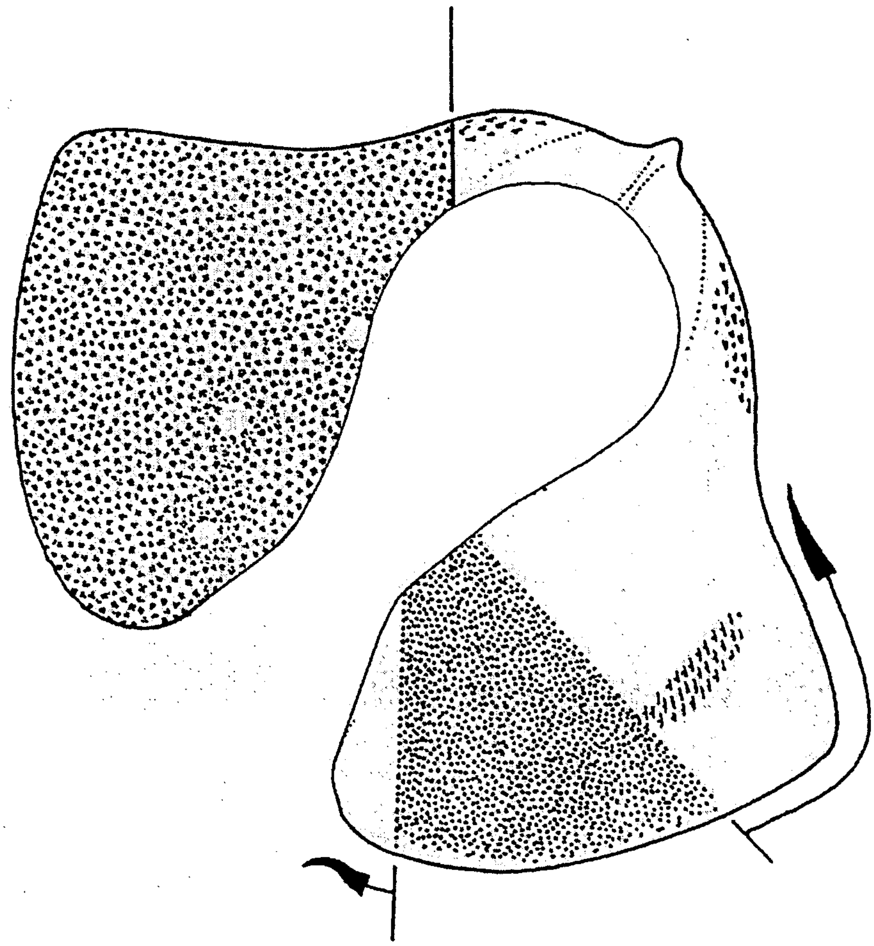

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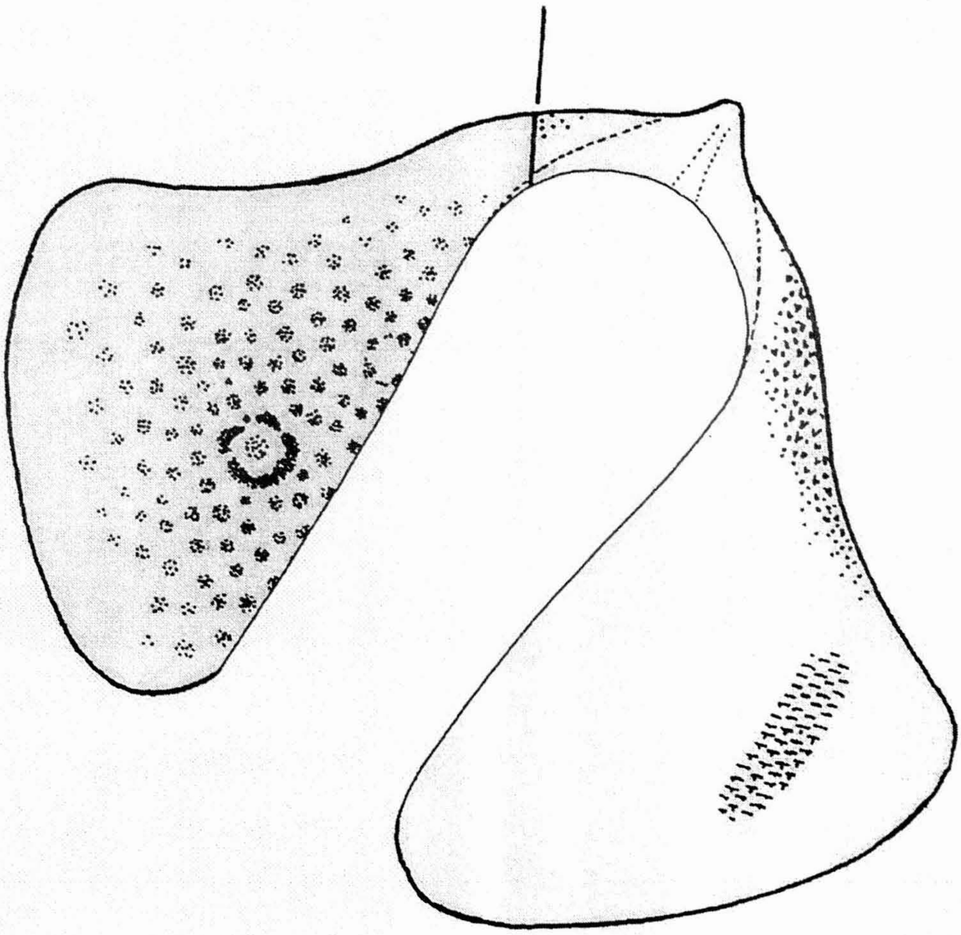

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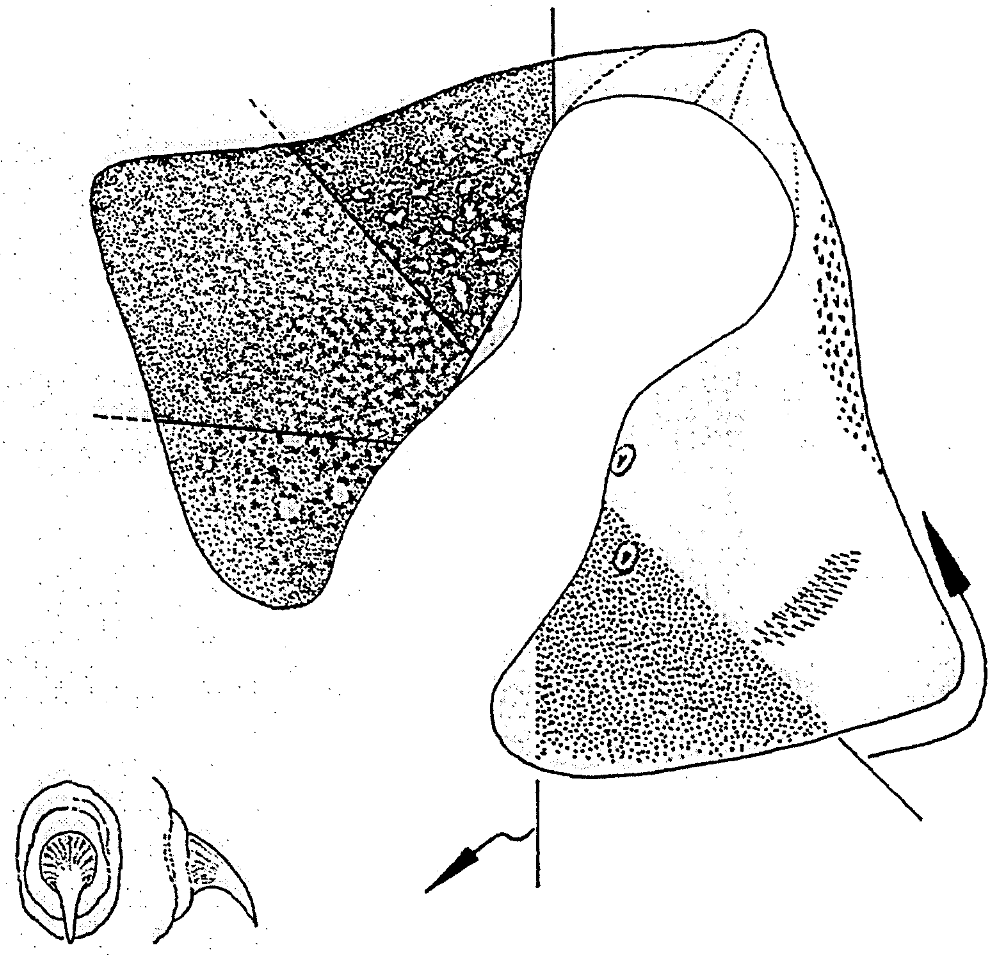

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# APPENDIX 2

Danish Elasmobranch Landings
Codes used.
SHJ=Porbeagle, 'ROK' = Rays and Skates, PHJ = spiny dogfish

The weight are whole fish weight for SHJ and PHJ and 'wing' weight for 'ROK'
Area 3=Skagerrak/Kattegat, Area 4 = North Sea

------------ DKQRT.DAT follows ------------

| species | area | year | month | kg | species | area | year | month | kg | species | area | year | month | kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PHJ | 3 | 87 | 1 | 46593 | ROK | 3 | 87 | 1 | 6841 | SHJ | 3 | 87 | 4 | 4 |
| PHJ | 3 | 87 | 2 | 24536 | ROK | 3 | 87 | 2 | 6901 | SHJ | 3 | 87 | 6 | 170 |
| PHJ | 3 | 87 | 3 | 1766 | ROK | 3 | 87 | 3 | 2897 | SHJ | 3 | 87 | 7 | 5844 |
| PHJ | 3 | 87 | 4 | 8068 | ROK | 3 | 87 | 4 | 10599 | SHJ | 3 | 87 | 8 | 7512 |
| PHJ | 3 | 87 | 5 | 159951 | ROK | 3 | 87 | 5 | 5583 | SHJ | 3 | 87 | 9 | 7237 |
| PHJ | 3 | 87 | 6 | 34357 | ROK | 3 | 87 | 6 | 3754 | SHJ | 3 | 87 | 10 | 3214 |
| PHJ | 3 | 87 | 7 | 21932 | ROK | 3 | 87 | 7 | 5133 | SHJ | 3 | 87 | 11 | 866 |
| PHJ | 3 | 87 | 8 | 13349 | ROK | 3 | 87 | 8 | 2993 | SHJ | 3 | 87 | 12 | 239 |
| PHJ | 3 | 87 | 9 | 36767 | ROK | 3 | 87 | 9 | 6877 | SHJ | 3 | 88 | 3 | 36 |
| PHJ | 3 | 87 | 10 | 95674 | ROK | 3 | 87 | 10 | 7234 | SHJ | 3 | 88 | 4 | 43 |
| PHJ | 3 | 87 | 11 | 134527 | ROK | 3 | 87 | 11 | 3626 | SHJ | 3 | 88 | 5 | 93 |
| PHJ | 3 | 87 | 12 | 168964 | ROK | 3 | 87 | 12 | 3734 | SHJ | 3 | 88 | 6 | 77 |
| PHJ | 3 | 88 | 1 | 59005 | ROK | 3 | 88 | 1 | 2957 | SHJ | 3 | 88 | 7 | 475 |
| PHJ | 3 | 88 | 2 | 4422 | ROK | 3 | 88 | 2 | 1788 | SHJ | 3 | 88 | 8 | 2654 |
| PHJ | 3 | 88 | 3 | 1846 | ROK | 3 | 88 | 3 | 5092 | SHJ | 3 | 88 | 9 | 4568 |
| PHJ | 3 | 88 | 4 | 6114 | ROK | 3 | 88 | 4 | 5026 | SHJ | 3 | 88 | 10 | 1366 |
| PHJ | 3 | 88 | 5 | 49003 | ROK | 3 | 88 | 5 | 4254 | SHJ | 3 | 88 | 11 | 1125 |
| PHJ | 3 | 88 | 6 | 75352 | ROK | 3 | 88 | 6 | 2503 | SHJ | 3 | 89 | 5 | 113 |
| PHJ | 3 | 88 | 7 | 43817 | ROK | 3 | 88 | 7 | 4404 | SHJ | 3 | 89 | 6 | 281 |
| PHJ | 3 | 88 | 8 | 30437 | ROK | 3 | 88 | 8 | 6069 | SHJ | 3 | 89 | 7 | 397 |
| PHJ | 3 | 88 | 9 | 37350 | ROK | 3 | 88 | 9 | 3353 | SHJ | 3 | 89 | 8 | 960 |
| PHJ | 3 | 88 | 10 | 69490 | ROK | 3 | 88 | 10 | 2406 | SHJ | 3 | 89 | 9 | 5441 |
| PHJ | 3 | 88 | 11 | 103468 | ROK | 3 | 88 | 11 | 4482 | SHJ | 3 | 89 | 10 | 2549 |
| PHJ | 3 | 88 | 12 | 151179 | ROK | 3 | 88 | 12 | 1175 | SHJ | 3 | 89 | 11 | 1010 |
| PHJ | 3 | 89 | 1 | 12340 | ROK | 3 | 89 | 1 | 2733 | SHJ | 3 | 90 | 5 | 1092 |
| PHJ | 3 | 89 | 2 | 855 | ROK | 3 | 89 | 2 | 2048 | SHJ | 3 | 90 | 6 | 921 |
| PHJ | 3 | 89 | 3 | 2374 | ROK | 3 | 89 | 3 | 4290 | SHJ | 3 | 90 | 7 | 1236 |
| PHJ | 3 | 89 | 4 | 8943 | ROK | 3 | 89 | 4 | 3783 | SHJ | 3 | 90 | 8 | 3022 |
| PHJ | 3 | 89 | 5 | 37294 | ROK | 3 | 89 | 5 | 2713 | SHJ | 3 | 90 | 9 | 2338 |
| PHJ | 3 | 89 | 6 | 95087 | ROK | 3 | 89 | 6 | 2034 | SHJ | 3 | 90 | 10 | 1452 |
| PHJ | 3 | 89 | 7 | 25879 | ROK | 3 | 89 | 7 | 5004 | SHJ | 3 | 90 | 11 | 373 |
| PHJ | 3 | 89 | 8 | 14062 | ROK | 3 | 89 | 8 | 4071 | SHJ | 3 | 90 | 12 | 279 |
| PHJ | 3 | 89 | 9 | 47822 | ROK | 3 | 89 | 9 | 3426 | SHJ | 3 | 91 | 6 | 78 |
| PHJ | 3 | 89 | 10 | 99530 | ROK | 3 | 89 | 10 | 2714 | SHJ | 3 | 91 | 7 | 299 |
| PHJ | 3 | 89 | 11 | 172315 | ROK | 3 | 89 | 11 | 2130 | SHJ | 3 | 91 | 8 | 872 |
| PHJ | 3 | 89 | 12 | 62650 | ROK | 3 | 89 | 12 | 1735 | SHJ | 3 | 91 | 9 | 1443 |
| PHJ | 3 | 90 | 1 | 38867 | ROK | 3 | 90 | 1 | 1930 | SHJ | 3 | 91 | 10 | 2528 |
| PHJ | 3 | 90 | 2 | 6624 | ROK | 3 | 90 | 2 | 1808 | SHJ | 3 | 91 | 11 | 284 |
| PHJ | 3 | 90 | 3 | 3368 | ROK | 3 | 90 | 3 | 3081 | SHJ | 3 | 91 | 12 | 301 |
| PHJ | 3 | 90 | 4 | 16311 | ROK | 3 | 90 | 4 | 4342 | SHJ | 3 | 92 | 2 | 11 |
| PHJ | 3 | 90 | 5 | 64776 | ROK | 3 | 90 | 5 | 1865 | SHJ | 3 | 92 | 5 | 2 |
| PHJ | 3 | 90 | 6 | 44339 | ROK | 3 | 90 | 6 | 3626 | SHJ | 3 | 92 | 6 | 4601 |
| PHJ | 3 | 90 | 7 | 28168 | ROK | 3 | 90 | 7 | 1416 | SHJ | 3 | 92 | 7 | 532 |
| PHJ | 3 | 90 | 8 | 55912 | ROK | 3 | 90 | 8 | 2045 | SHJ | 3 | 92 | 8 | 1173 |
| PHJ | 3 | 90 | 9 | 33134 | ROK | 3 | 90 | 9 | 1080 | SHJ | 3 | 92 | 9 | 1651 |
| PHJ | 3 | 90 | 10 | 78880 | ROK | 3 | 90 | 10 | 1871 | SHJ | 3 | 92 | 10 | 1590 |
| PHJ | 3 | 90 | 11 | 91386 | ROK | 3 | 90 | 11 | 880 | SHJ | 3 | 92 | 11 | 485 |
| PHJ | 3 | 90 | 12 | 120243 | ROK | 3 | 90 | 12 | 1061 | SHJ | 3 | 93 | 4 | 221 |
| PHJ | 3 | 91 | 1 | 61874 | ROK | 3 | 91 | 1 | 11644 | SHJ | 3 | 93 | 6 | 57 |
| PHJ | 3 | 91 | 2 | 26051 | ROK | 3 | 91 | 2 | 2978 | SHJ | 3 | 93 | 7 | 468 |
| PHJ | 3 | 91 | 3 | 33958 | ROK | 3 | 91 | 3 | 3511 | SHJ | 3 | 93 | 8 | 843 |
| PHJ | 3 | 91 | 4 | 13855 | ROK | 3 | 91 | 4 | 3064 | SHJ | 3 | 93 | 9 | 1144 |
| PHJ | 3 | 91 | 5 | 62005 | ROK | 3 | 91 | 5 | 1228 | SHJ | 3 | 93 | 10 | 1430 |
| PHJ | 3 | 91 | 6 | 36000 | ROK | 3 | 91 | 6 | 1422 | SHJ | 3 | 93 | 11 | 785 |
| PHJ | 3 | 91 | 7 | 20470 | ROK | 3 | 91 | 7 | 317 | SHJ | 3 | 94 | 1 | 21 |
| PHJ | 3 | 91 | 8 | 14262 | ROK | 3 | 91 | 8 | 1001 | SHJ | 3 | 94 | 4 | 3 |
| PHJ | 3 | 91 | 9 | 4562 | ROK | 3 | 91 | 9 | 931 | SHJ | 3 | 94 | 6 | 84 |
| PHJ | 3 | 91 | 10 | 48760 | ROK | 3 | 91 | 10 | 1075 | SHJ | 3 | 94 | 9 | 861 |
| PHJ | 3 | 91 | 11 | 75927 | ROK | 3 | 91 | 11 | 721 | SHJ | 3 | 94 | 10 | 782 |
| PHJ | 3 | 91 | 12 | 48681 | ROK | 3 | 91 | 12 | 1278 | SHJ | 3 | 94 | 12 | 96 |
| PHJ | 3 | 92 | 1 | 40332 | ROK | 3 | 92 | 1 | 4446 | SHJ | 3 | 95 | 6 | 12 |
| PHJ | 3 | 92 | 2 | 725 | ROK | 3 | 92 | 2 | 2744 | SHJ | 3 | 95 | 7 | 138 |
| PHJ | 3 | 92 | 3 | 86334 | ROK | 3 | 92 | 3 | 3501 | SHJ | 3 | 95 | 8 | 88 |
| PHJ | 3 | 92 | 4 | 45885 | ROK | 3 | 92 | 4 | 3254 | SHJ | 3 | 95 | 9 | 473 |
| PHJ | 3 | 92 | 5 | 17387 | ROK | 3 | 92 | 5 | 1608 | SHJ | 3 | 95 | 10 | 476 |
| PHJ | 3 | 92 | 6 | 23269 | ROK | 3 | 92 | 6 | 1046 | SHJ | 3 | 95 | 11 | 1197 |
| PHJ | 3 | 92 | 7 | 5475 | ROK | 3 | 92 | 7 | 450 | SHJ | 3 | 95 | 12 | 214 |
| PHJ | 3 | 92 | 8 | 14007 | ROK | 3 | 92 | 8 | 1513 | SHJ | 3 | 96 | 6 | 7 |
| PHJ | 3 | 92 | 9 | 14008 | ROK | 3 | 92 | 9 | 1089 | SHJ | 3 | 96 | 7 | 11 |
| PHJ | 3 | 92 | 10 | 36927 | ROK | 3 | 92 | 10 | 970 | SHJ | 3 | 96 | 8 | 455 |
| PHJ | 3 | 92 | 11 | 36514 | ROK | 3 | 92 | 11 | 421 | SHJ | 3 | 96 | 9 | 844 |
| PHJ | 3 | 92 | 12 | 17692 | ROK | 3 | 92 | 12 | 812 | SHJ | 3 | 96 | 10 | 548 |
| PHJ | 3 | 93 | 1 | 1610 | ROK | 3 | 93 | 1 | 617 | SHJ | 3 | 96 | 11 | 19 |
| PHJ | 3 | 93 | 2 | 22376 | ROK | 3 | 93 | 2 | 2025 | SHJ | 3 | 96 | 12 | 17 |
| PHJ | 3 | 93 | 3 | 16909 | ROK | 3 | 93 | 3 | 1896 | SHJ | 4 | 87 | 1 | 237 |
| PHJ | 3 | 93 | 4 | 7013 | ROK | 3 | 93 | 4 | 935 | SHJ | 4 | 87 | 4 | 127 |
| PHJ | 3 | 93 | 5 | 6252 | ROK | 3 | 93 | 5 | 1956 | SHJ | 4 | 87 | 5 | 379 |
| PHJ | 3 | 93 | 6 | 4947 | ROK | 3 | 93 | 6 | 997 | SHJ | 4 | 87 | 6 | 1762 |
| PHJ | 3 | 93 | 7 | 2604 | ROK | 3 | 93 | 7 | 733 | SHJ | 4 | 87 | 7 | 17000 |
| PHJ | 3 | 93 | 8 | 1954 | ROK | 3 | 93 | 8 | 1200 | SHJ | 4 | 87 | 8 | 6296 |
| PHJ | 3 | 93 | 9 | 5050 | ROK | 3 | 93 | 9 | 1699 | SHJ | 4 | 87 | 9 | 1240 |
| PHJ | 3 | 93 | 10 | 84222 | ROK | 3 | 93 | 10 | 1060 | SHJ | 4 | 87 | 10 | 1344 |
| PHJ | 3 | 93 | 11 | 50838 | ROK | 3 | 93 | 11 | 1360 | SHJ | 4 | 87 | 11 | 1631 |
| PHJ | 3 | 93 | 12 | 13738 | ROK | 3 | 93 | 12 | 1572 | SHJ | 4 | 87 | 12 | 640 |
| PHJ | 3 | 94 | 1 | 2260 | ROK | 3 | 94 | 1 | 5003 | SHJ | 4 | 88 | 1 | 994 |
| PHJ | 3 | 94 | 2 | 599 | ROK | 3 | 94 | 2 | 3512 | SHJ | 4 | 88 | 2 | 316 |
| PHJ | 3 | 94 | 3 | 103 | ROK | 3 | 94 | 3 | 3556 | SHJ | 4 | 88 | 3 | 912 |
| PHJ | 3 | 94 | 4 | 1205 | ROK | 3 | 94 | 4 | 2808 | SHJ | 4 | 88 | 4 | 121 |
| PHJ | 3 | 94 | 5 | 6339 | ROK | 3 | 94 | 5 | 4035 | SHJ | 4 | 88 | 5 | 541 |
| PHJ | 3 | 94 | 6 | 3675 | ROK | 3 | 94 | 6 | 2244 | SHJ | 4 | 88 | 6 | 2558 |
| PHJ | 3 | 94 | 7 | 1575 | ROK | 3 | 94 | 7 | 1165 | SHJ | 4 | 88 | 7 | 2319 |
| PHJ | 3 | 94 | 8 | 7483 | ROK | 3 | 94 | 8 | 1485 | SHJ | 4 | 88 | 8 | 3861 |
| PHJ | 3 | 94 | 9 | 879 | ROK | 3 | 94 | 9 | 949 | SHJ | 4 | 88 | 9 | 3678 |
| PHJ | 3 | 94 | 10 | 12579 | ROK | 3 | 94 | 10 | 1092 | SHJ | 4 | 88 | 10 | 4476 |
| PHJ | 3 | 94 | 11 | 15922 | ROK | 3 | 94 | 11 | 1790 | SHJ | 4 | 88 | 11 | 1856 |
| PHJ | 3 | 94 | 12 | 13814 | ROK | 3 | 94 | 12 | 876 | SHJ | 4 | 88 | 12 | 185 |
| PHJ | 3 | 95 | 1 | 1649 | ROK | 3 | 95 | 1 | 2208 | SHJ | 4 | 89 | 1 | 3461 |
| PHJ | 3 | 95 | 2 | 515 | ROK | 3 | 95 | 2 | 3406 | SHJ | 4 | 89 | 2 | 182 |
| PHJ | 3 | 95 | 3 | 312 | ROK | 3 | 95 | 3 | 4248 | SHJ | 4 | 89 | 3 | 242 |
| PHJ | 3 | 95 | 4 | 1510 | ROK | 3 | 95 | 4 | 2989 | SHJ | 4 | 89 | 4 | 257 |
| PHJ | 3 | 95 | 5 | 2355 | ROK | 3 | 95 | 5 | 2035 | SHJ | 4 | 89 | 5 | 1317 |
| PHJ | 3 | 95 | 6 | 2416 | ROK | 3 | 95 | 6 | 1726 | SHJ | 4 | 89 | 6 | 1496 |
| PHJ | 3 | 95 | 7 | 5863 | ROK | 3 | 95 | 7 | 486 | SHJ | 4 | 89 | 7 | 1116 |
| PHJ | 3 | 95 | 8 | 1002 | ROK | 3 | 95 | 8 | 1360 | SHJ | 4 | 89 | 8 | 4497 |
| PHJ | 3 | 95 | 9 | 3794 | ROK | 3 | 95 | 9 | 1444 | SHJ | 4 | 89 | 9 | 5354 |
| PHJ | 3 | 95 | 10 | 17150 | ROK | 3 | 95 | 10 | 2189 | SHJ | 4 | 89 | 10 | 2749 |
| PHJ | 3 | 95 | 11 | 15244 | ROK | 3 | 95 | 11 | 2879 | SHJ | 4 | 89 | 11 | 1736 |
| PHJ | 3 | 95 | 12 | 7573 | ROK | 3 | 95 | 12 | 828 | SHJ | 4 | 89 | 12 | 348 |
| PHJ | 3 | 96 | 1 | 1989 | ROK | 3 | 96 | 1 | 2082 | SHJ | 4 | 90 | 1 | 1621 |
| PHJ | 3 | 96 | 2 | 600 | ROK | 3 | 96 | 2 | 2009 | SHJ | 4 | 90 | 2 | 355 |
| PHJ | 3 | 96 | 3 | 1140 | ROK | 3 | 96 | 3 | 2463 | SHJ | 4 | 90 | 3 | 105 |
| PHJ | 3 | 96 | 4 | 918 | ROK | 3 | 96 | 4 | 3559 | SHJ | 4 | 90 | 4 | 146 |
| PHJ | 3 | 96 | 5 | 2936 | ROK | 3 | 96 | 5 | 2871 | SHJ | 4 | 90 | 5 | 2104 |
| PHJ | 3 | 96 | 6 | 2410 | ROK | 3 | 96 | 6 | 1652 | SHJ | 4 | 90 | 6 | 1900 |
| PHJ | 3 | 96 | 7 | 2338 | ROK | 3 | 96 | 7 | 664 | SHJ | 4 | 90 | 7 | 12243 |
| PHJ | 3 | 96 | 8 | 2285 | ROK | 3 | 96 | 8 | 1355 | SHJ | 4 | 90 | 8 | 3089 |
| PHJ | 3 | 96 | 9 | 1636 | ROK | 3 | 96 | 9 | 1193 | SHJ | 4 | 90 | 9 | 2435 |
| PHJ | 3 | 96 | 10 | 22404 | ROK | 3 | 96 | 10 | 1006 | SHJ | 4 | 90 | 10 | 1873 |
| PHJ | 3 | 96 | 11 | 9777 | ROK | 3 | 96 | 11 | 1020 | SHJ | 4 | 90 | 11 | 2647 |
| PHJ | 3 | 96 | 12 | 10901 | ROK | 3 | 96 | 12 | 769 | SHJ | 4 | 90 | 12 | 697 |
| PHJ | 4 | 87 | 1 | 28356 | ROK | 4 | 87 | 1 | 6606 | SHJ | 4 | 91 | 1 | 2318 |
| PHJ | 4 | 87 | 2 | 16059 | ROK | 4 | 87 | 2 | 7478 | SHJ | 4 | 91 | 2 | 1893 |
| PHJ | 4 | 87 | 3 | 16561 | ROK | 4 | 87 | 3 | 3935 | SHJ | 4 | 91 | 3 | 343 |

------------ DKYEAR.DAT follows ------------

| species | area | year | kg |
|---|---|---|---|
| PHJ | 3 | 87 | 746484 |
| PHJ | 3 | 88 | 631483 |
| PHJ | 3 | 89 | 579151 |
| PHJ | 3 | 90 | 582008 |
| PHJ | 3 | 91 | 446405 |
| PHJ | 3 | 92 | 338555 |
| PHJ | 3 | 93 | 217513 |
| PHJ | 3 | 94 | 66433 |
| PHJ | 3 | 95 | 59383 |
| PHJ | 3 | 96 | 59334 |
| PHJ | 4 | 87 | 644896 |
| PHJ | 4 | 88 | 862939 |
| PHJ | 4 | 89 | 506119 |
| PHJ | 4 | 90 | 781355 |
| PHJ | 4 | 91 | 797830 |
| PHJ | 4 | 92 | 457418 |
| PHJ | 4 | 93 | 268175 |
| PHJ | 4 | 94 | 144055 |
| PHJ | 4 | 95 | 86815 |
| PHJ | 4 | 96 | 83080 |
| ROK | 3 | 87 | 66172 |
| ROK | 3 | 88 | 43509 |
| ROK | 3 | 89 | 36681 |
| ROK | 3 | 90 | 25005 |
| ROK | 3 | 91 | 29170 |
| ROK | 3 | 92 | 21854 |
| ROK | 3 | 93 | 16050 |
| ROK | 3 | 94 | 28515 |
| ROK | 3 | 95 | 25798 |
| ROK | 3 | 96 | 20643 |
| ROK | 4 | 87 | 51011 |
| ROK | 4 | 88 | 31370 |
| ROK | 4 | 89 | 23412 |
| ROK | 4 | 90 | 34676 |
| ROK | 4 | 91 | 17889 |
| ROK | 4 | 92 | 23232 |
| ROK | 4 | 93 | 18115 |
| ROK | 4 | 94 | 23761 |
| ROK | 4 | 95 | 18921 |
| ROK | 4 | 96 | 22985 |
| SHJ | 3 | 87 | 25086 |
| SHJ | 3 | 88 | 10457 |
| SHJ | 3 | 89 | 10751 |
| SHJ | 3 | 90 | 10713 |
| SHJ | 3 | 91 | 5805 |
| SHJ | 3 | 92 | 10045 |
| SHJ | 3 | 93 | 4948 |
| SHJ | 3 | 94 | 1847 |
| SHJ | 3 | 95 | 2598 |
| SHJ | 3 | 96 | 1901 |
| SHJ | 4 | 87 | 30656 |
| SHJ | 4 | 88 | 21817 |
| SHJ | 4 | 89 | 22755 |
| SHJ | 4 | 90 | 29215 |
| SHJ | 4 | 91 | 78665 |
| SHJ | 4 | 92 | 70017 |
| SHJ | 4 | 93 | 86367 |
| SHJ | 4 | 94 | 91671 |
| SHJ | 4 | 95 | 83799 |
| SHJ | 4 | 96 | 69556 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PHJ | 4 | 87 | 4 | 14748 | ROK | 4 | 87 | 4 | 4347 | SHJ | 4 | 91 | 4 | 61 |
| PHJ | 4 | 87 | 5 | 144542 | ROK | 4 | 87 | 5 | 6841 | SHJ | 4 | 91 | 5 | 2022 |
| PHJ | 4 | 87 | 6 | 98609 | ROK | 4 | 87 | 6 | 8719 | SHJ | 4 | 91 | 6 | 11493 |
| PHJ | 4 | 87 | 7 | 18354 | ROK | 4 | 87 | 7 | 3979 | SHJ | 4 | 91 | 7 | 33307 |
| PHJ | 4 | 87 | 8 | 45843 | ROK | 4 | 87 | 8 | 1656 | SHJ | 4 | 91 | 8 | 12048 |
| PHJ | 4 | 87 | 9 | 76862 | ROK | 4 | 87 | 9 | 644 | SHJ | 4 | 91 | 9 | 9297 |
| PHJ | 4 | 87 | 10 | 73775 | ROK | 4 | 87 | 10 | 1730 | SHJ | 4 | 91 | 10 | 4371 |
| PHJ | 4 | 87 | 11 | 61150 | ROK | 4 | 87 | 11 | 1427 | SHJ | 4 | 91 | 11 | 617 |
| PHJ | 4 | 87 | 12 | 50037 | ROK | 4 | 87 | 12 | 3649 | SHJ | 4 | 91 | 12 | 895 |
| PHJ | 4 | 88 | 1 | 95386 | ROK | 4 | 88 | 1 | 5917 | SHJ | 4 | 92 | 1 | 684 |
| PHJ | 4 | 88 | 2 | 57970 | ROK | 4 | 88 | 2 | 3367 | SHJ | 4 | 92 | 2 | 1281 |
| PHJ | 4 | 88 | 3 | 4573 | ROK | 4 | 88 | 3 | 1683 | SHJ | 4 | 92 | 3 | 379 |
| PHJ | 4 | 88 | 4 | 26532 | ROK | 4 | 88 | 4 | 2751 | SHJ | 4 | 92 | 4 | 16 |
| PHJ | 4 | 88 | 5 | 95592 | ROK | 4 | 88 | 5 | 3838 | SHJ | 4 | 92 | 5 | 731 |
| PHJ | 4 | 88 | 6 | 151283 | ROK | 4 | 88 | 6 | 5261 | SHJ | 4 | 92 | 6 | 5190 |
| PHJ | 4 | 88 | 7 | 29480 | ROK | 4 | 88 | 7 | 1080 | SHJ | 4 | 92 | 7 | 19268 |
| PHJ | 4 | 88 | 8 | 77378 | ROK | 4 | 88 | 8 | 3456 | SHJ | 4 | 92 | 8 | 34708 |
| PHJ | 4 | 88 | 9 | 119974 | ROK | 4 | 88 | 9 | 612 | SHJ | 4 | 92 | 9 | 2668 |
| PHJ | 4 | 88 | 10 | 120505 | ROK | 4 | 88 | 10 | 438 | SHJ | 4 | 92 | 10 | 3354 |
| PHJ | 4 | 88 | 11 | 62740 | ROK | 4 | 88 | 11 | 1370 | SHJ | 4 | 92 | 11 | 751 |
| PHJ | 4 | 88 | 12 | 21526 | ROK | 4 | 88 | 12 | 1597 | SHJ | 4 | 92 | 12 | 967 |
| PHJ | 4 | 89 | 1 | 62929 | ROK | 4 | 89 | 1 | 2426 | SHJ | 4 | 93 | 2 | 3092 |
| PHJ | 4 | 89 | 2 | 38997 | ROK | 4 | 89 | 2 | 1319 | SHJ | 4 | 93 | 3 | 43 |
| PHJ | 4 | 89 | 3 | 12433 | ROK | 4 | 89 | 3 | 2396 | SHJ | 4 | 93 | 4 | 116 |
| PHJ | 4 | 89 | 4 | 21169 | ROK | 4 | 89 | 4 | 3030 | SHJ | 4 | 93 | 5 | 689 |
| PHJ | 4 | 89 | 5 | 81283 | ROK | 4 | 89 | 5 | 6268 | SHJ | 4 | 93 | 6 | 8967 |
| PHJ | 4 | 89 | 6 | 41336 | ROK | 4 | 89 | 6 | 1206 | SHJ | 4 | 93 | 7 | 13005 |
| PHJ | 4 | 89 | 7 | 13153 | ROK | 4 | 89 | 7 | 1257 | SHJ | 4 | 93 | 8 | 24905 |
| PHJ | 4 | 89 | 8 | 34326 | ROK | 4 | 89 | 8 | 1425 | SHJ | 4 | 93 | 9 | 13486 |
| PHJ | 4 | 89 | 9 | 70706 | ROK | 4 | 89 | 9 | 716 | SHJ | 4 | 93 | 10 | 8725 |
| PHJ | 4 | 89 | 10 | 40753 | ROK | 4 | 89 | 10 | 499 | SHJ | 4 | 93 | 11 | 8796 |
| PHJ | 4 | 89 | 11 | 73328 | ROK | 4 | 89 | 11 | 2112 | SHJ | 4 | 93 | 12 | 4533 |
| PHJ | 4 | 89 | 12 | 15706 | ROK | 4 | 89 | 12 | 758 | SHJ | 4 | 94 | 1 | 491 |
| PHJ | 4 | 90 | 1 | 50224 | ROK | 4 | 90 | 1 | 3119 | SHJ | 4 | 94 | 2 | 157 |
| PHJ | 4 | 90 | 2 | 49271 | ROK | 4 | 90 | 2 | 3823 | SHJ | 4 | 94 | 3 | 15 |
| PHJ | 4 | 90 | 3 | 44271 | ROK | 4 | 90 | 3 | 3577 | SHJ | 4 | 94 | 4 | 16 |
| PHJ | 4 | 90 | 4 | 63579 | ROK | 4 | 90 | 4 | 2568 | SHJ | 4 | 94 | 5 | 611 |
| PHJ | 4 | 90 | 5 | 107404 | ROK | 4 | 90 | 5 | 2251 | SHJ | 4 | 94 | 6 | 3297 |
| PHJ | 4 | 90 | 6 | 80170 | ROK | 4 | 90 | 6 | 4423 | SHJ | 4 | 94 | 7 | 23551 |
| PHJ | 4 | 90 | 7 | 58843 | ROK | 4 | 90 | 7 | 5554 | SHJ | 4 | 94 | 8 | 42824 |
| PHJ | 4 | 90 | 8 | 75725 | ROK | 4 | 90 | 8 | 6273 | SHJ | 4 | 94 | 9 | 10789 |
| PHJ | 4 | 90 | 9 | 48208 | ROK | 4 | 90 | 9 | 1345 | SHJ | 4 | 94 | 10 | 3377 |
| PHJ | 4 | 90 | 10 | 105638 | ROK | 4 | 90 | 10 | 520 | SHJ | 4 | 94 | 11 | 6092 |
| PHJ | 4 | 90 | 11 | 68522 | ROK | 4 | 90 | 11 | 706 | SHJ | 4 | 94 | 12 | 451 |
| PHJ | 4 | 90 | 12 | 29500 | ROK | 4 | 90 | 12 | 517 | SHJ | 4 | 95 | 1 | 698 |
| PHJ | 4 | 91 | 1 | 59620 | ROK | 4 | 91 | 1 | 912 | SHJ | 4 | 95 | 2 | 527 |
| PHJ | 4 | 91 | 2 | 86397 | ROK | 4 | 91 | 2 | 3045 | SHJ | 4 | 95 | 3 | 144 |
| PHJ | 4 | 91 | 3 | 98826 | ROK | 4 | 91 | 3 | 4154 | SHJ | 4 | 95 | 4 | 278 |
| PHJ | 4 | 91 | 4 | 72859 | ROK | 4 | 91 | 4 | 4206 | SHJ | 4 | 95 | 5 | 165 |
| PHJ | 4 | 91 | 5 | 112132 | ROK | 4 | 91 | 5 | 653 | SHJ | 4 | 95 | 6 | 1870 |
| PHJ | 4 | 91 | 6 | 209347 | ROK | 4 | 91 | 6 | 877 | SHJ | 4 | 95 | 7 | 8539 |
| PHJ | 4 | 91 | 7 | 15647 | ROK | 4 | 91 | 7 | 670 | SHJ | 4 | 95 | 8 | 36997 |
| PHJ | 4 | 91 | 8 | 29904 | ROK | 4 | 91 | 8 | 736 | SHJ | 4 | 95 | 9 | 21481 |
| PHJ | 4 | 91 | 9 | 12977 | ROK | 4 | 91 | 9 | 889 | SHJ | 4 | 95 | 10 | 5026 |
| PHJ | 4 | 91 | 10 | 27268 | ROK | 4 | 91 | 10 | 435 | SHJ | 4 | 95 | 11 | 7127 |
| PHJ | 4 | 91 | 11 | 44139 | ROK | 4 | 91 | 11 | 313 | SHJ | 4 | 95 | 12 | 947 |
| PHJ | 4 | 91 | 12 | 28714 | ROK | 4 | 91 | 12 | 999 | SHJ | 4 | 96 | 1 | 474 |
| PHJ | 4 | 92 | 1 | 32375 | ROK | 4 | 92 | 1 | 1069 | SHJ | 4 | 96 | 2 | 262 |
| PHJ | 4 | 92 | 2 | 18624 | ROK | 4 | 92 | 2 | 2487 | SHJ | 4 | 96 | 3 | 12 |
| PHJ | 4 | 92 | 3 | 18713 | ROK | 4 | 92 | 3 | 3553 | SHJ | 4 | 96 | 4 | 59 |
| PHJ | 4 | 92 | 4 | 96204 | ROK | 4 | 92 | 4 | 6388 | SHJ | 4 | 96 | 5 | 1253 |
| PHJ | 4 | 92 | 5 | 107999 | ROK | 4 | 92 | 5 | 2200 | SHJ | 4 | 96 | 6 | 1593 |
| PHJ | 4 | 92 | 6 | 57345 | ROK | 4 | 92 | 6 | 1734 | SHJ | 4 | 96 | 7 | 9543 |
| PHJ | 4 | 92 | 7 | 16352 | ROK | 4 | 92 | 7 | 480 | SHJ | 4 | 96 | 8 | 20080 |
| PHJ | 4 | 92 | 8 | 23393 | ROK | 4 | 92 | 8 | 729 | SHJ | 4 | 96 | 9 | 19497 |
| PHJ | 4 | 92 | 9 | 27093 | ROK | 4 | 92 | 9 | 937 | SHJ | 4 | 96 | 10 | 15369 |
| PHJ | 4 | 92 | 10 | 33925 | ROK | 4 | 92 | 10 | 1399 | SHJ | 4 | 96 | 11 | 785 |
| PHJ | 4 | 92 | 11 | 10536 | ROK | 4 | 92 | 11 | 606 | SHJ | 4 | 96 | 12 | 609 |
| PHJ | 4 | 92 | 12 | 14859 | ROK | 4 | 92 | 12 | 1650 | | | | | |
| PHJ | 4 | 93 | 1 | 6568 | ROK | 4 | 93 | 1 | 244 | | | | | |
| PHJ | 4 | 93 | 2 | 57998 | ROK | 4 | 93 | 2 | 1267 | | | | | |
| PHJ | 4 | 93 | 3 | 48520 | ROK | 4 | 93 | 3 | 6091 | | | | | |
| PHJ | 4 | 93 | 4 | 4249 | ROK | 4 | 93 | 4 | 1440 | | | | | |
| PHJ | 4 | 93 | 5 | 39927 | ROK | 4 | 93 | 5 | 2325 | | | | | |
| PHJ | 4 | 93 | 6 | 11785 | ROK | 4 | 93 | 6 | 1883 | | | | | |
| PHJ | 4 | 93 | 7 | 9603 | ROK | 4 | 93 | 7 | 765 | | | | | |
| PHJ | 4 | 93 | 8 | 7979 | ROK | 4 | 93 | 8 | 925 | | | | | |
| PHJ | 4 | 93 | 9 | 11545 | ROK | 4 | 93 | 9 | 1220 | | | | | |
| PHJ | 4 | 93 | 10 | 13153 | ROK | 4 | 93 | 10 | 598 | | | | | |
| PHJ | 4 | 93 | 11 | 30343 | ROK | 4 | 93 | 11 | 832 | | | | | |
| PHJ | 4 | 93 | 12 | 26505 | ROK | 4 | 93 | 12 | 525 | | | | | |
| PHJ | 4 | 94 | 1 | 20696 | ROK | 4 | 94 | 1 | 626 | | | | | |
| PHJ | 4 | 94 | 2 | 4044 | ROK | 4 | 94 | 2 | 2563 | | | | | |
| PHJ | 4 | 94 | 3 | 22696 | ROK | 4 | 94 | 3 | 4485 | | | | | |
| PHJ | 4 | 94 | 4 | 13271 | ROK | 4 | 94 | 4 | 3899 | | | | | |
| PHJ | 4 | 94 | 5 | 15878 | ROK | 4 | 94 | 5 | 4200 | | | | | |
| PHJ | 4 | 94 | 6 | 21194 | ROK | 4 | 94 | 6 | 4560 | | | | | |
| PHJ | 4 | 94 | 7 | 8976 | ROK | 4 | 94 | 7 | 951 | | | | | |
| PHJ | 4 | 94 | 8 | 4457 | ROK | 4 | 94 | 8 | 406 | | | | | |
| PHJ | 4 | 94 | 9 | 2543 | ROK | 4 | 94 | 9 | 343 | | | | | |
| PHJ | 4 | 94 | 10 | 11913 | ROK | 4 | 94 | 10 | 389 | | | | | |
| PHJ | 4 | 94 | 11 | 10894 | ROK | 4 | 94 | 11 | 951 | | | | | |
| PHJ | 4 | 94 | 12 | 7493 | ROK | 4 | 94 | 12 | 388 | | | | | |
| PHJ | 4 | 95 | 1 | 5237 | ROK | 4 | 95 | 1 | 596 | | | | | |
| PHJ | 4 | 95 | 2 | 2653 | ROK | 4 | 95 | 2 | 2231 | | | | | |
| PHJ | 4 | 95 | 3 | 10586 | ROK | 4 | 95 | 3 | 4448 | | | | | |
| PHJ | 4 | 95 | 4 | 2892 | ROK | 4 | 95 | 4 | 3602 | | | | | |
| PHJ | 4 | 95 | 5 | 11405 | ROK | 4 | 95 | 5 | 2519 | | | | | |
| PHJ | 4 | 95 | 6 | 6793 | ROK | 4 | 95 | 6 | 2524 | | | | | |
| PHJ | 4 | 95 | 7 | 5069 | ROK | 4 | 95 | 7 | 560 | | | | | |
| PHJ | 4 | 95 | 8 | 6180 | ROK | 4 | 95 | 8 | 717 | | | | | |
| PHJ | 4 | 95 | 9 | 2717 | ROK | 4 | 95 | 9 | 832 | | | | | |
| PHJ | 4 | 95 | 10 | 12185 | ROK | 4 | 95 | 10 | 555 | | | | | |
| PHJ | 4 | 95 | 11 | 8674 | ROK | 4 | 95 | 11 | 112 | | | | | |
| PHJ | 4 | 95 | 12 | 12424 | ROK | 4 | 95 | 12 | 225 | | | | | |
| PHJ | 4 | 96 | 1 | 6662 | ROK | 4 | 96 | 1 | 619 | | | | | |
| PHJ | 4 | 96 | 2 | 12860 | ROK | 4 | 96 | 2 | 2232 | | | | | |
| PHJ | 4 | 96 | 3 | 2632 | ROK | 4 | 96 | 3 | 5026 | | | | | |
| PHJ | 4 | 96 | 4 | 8709 | ROK | 4 | 96 | 4 | 1885 | | | | | |
| PHJ | 4 | 96 | 5 | 11364 | ROK | 4 | 96 | 5 | 4618 | | | | | |
| PHJ | 4 | 96 | 6 | 5278 | ROK | 4 | 96 | 6 | 2337 | | | | | |
| PHJ | 4 | 96 | 7 | 4657 | ROK | 4 | 96 | 7 | 1422 | | | | | |
| PHJ | 4 | 96 | 8 | 1892 | ROK | 4 | 96 | 8 | 835 | | | | | |
| PHJ | 4 | 96 | 9 | 1371 | ROK | 4 | 96 | 9 | 1271 | | | | | |
| PHJ | 4 | 96 | 10 | 4592 | ROK | 4 | 96 | 10 | 651 | | | | | |
| PHJ | 4 | 96 | 11 | 11290 | ROK | 4 | 96 | 11 | 936 | | | | | |
| PHJ | 4 | 96 | 12 | 11773 | ROK | 4 | 96 | 12 | 1153 | | | | | |

| Species Codes for French Landings | | |
|---|---|---|
| ;odeCrts | Nom officiel français | Nom scientifique |
| 3801 | REQUIN TAUPE COMMUN | Lamna nasus |
| 3802 | REQUIN PELERIN | Requin pélerin |
| 3803 | PETITE ROUSSETTE | Scyliorhinus sp/canicula |
| 3804 | REQUIN HA | Galeorhinus galeus |
| 3805 | EMISSOLE | Mustelus sp |
| 3806 | PEAU BLEUE | Prionace glauca |
| 3807 | AIGUILLAT COMMUN | Squalus acanthias |
| 3809 | ANGE DE MER | Squatina squatina |
| 3810 | TORPILLE MARBREE | Torpedo marmorata |
| 3811 | POCHETEAU GRIS | Raja batis |
| 3812 | POCHETEAU NOIR | Raja oxyrinchus |
| 3813 | RAIE BOUCLEE | Raja clavata |
| 3814 | RAIE FLEURIE | Raja naevus |
| 3815 | RAIE DOUCE | Raja montagui |
| 3816 | PASTENAGUE COMMUNE | Dasyatis pastinaca |
| 3817 | AIGLE DE MER COMMUN | Myliobatis aquila |
| 3819 | GRANDE ROUSSETTE | Scyliorhinus stellaris |
| 3820 | RAIE CIRCULAIRE | Raja circularis |
| 3821 | RAIE CHARDON | Raja fullonica |
| 3822 | REQUIN RENARD | Aloptias vulpinus |
| 3823 | RAIE BRUNETTE | Raja undulata |
| 3842 | "SIKI" (spp) | Centroscymnus, Centrophorus, Etmopt |
| 3890 | DIV.SQUALES | divers squales |
| 3891 | DIV.POCHETEAUX | divers pocheteaux |
| 3892 | DIV.RAIES | divers raies |
| 3899 | DIV SQLES RAIES CHIM | divers squales, raies, chimères |

French Elasmobranch Landings by species for 1996

Landings by port in tonnes for 1996

| PORT | TOTA | 3807 | 3803 | 3819 | 3804 | 3805 | 3801 | 3842 | 3806 | 3822 | 3890 | 3811 | 3812 | 3813 | 3815 | 3814 | 3821 | 3820 | 3823 | 3891 | 3892 | 3809 | 3810 | 3816 | 3817 | 3899 | AUTR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XBL | 1960.6 | 21.7 | 364.5 | 0.1 | 19.5 | 0 | 12.2 | 1278.1 | 0 | 0 | 0 | 36.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 228.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| XLR | 1015.7 | 71.5 | 223.5 | 0 | 8.4 | 7.3 | 119.8 | 0.4 | 33.1 | 0 | 3.8 | 51.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 495.7 | 0.5 | 0 | 0 | 0 | 0 | 0 |
| WLS | 0.2 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| XDP | 553.5 | 4.2 | 283.3 | 15.7 | 6.1 | 64.7 | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 | 171.2 | 5.8 | 0 | 0 | 0 | 0 | 0 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| CBA | 56.5 | 23.9 | 1 | 0 | 0 | 0 | 7.6 | 0 | 14.3 | 2.3 | 0 | 0 | 0 | 3.8 | 0 | 0 | 0 | 0 | 0 | 0 | 3.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| XLS | 542.1 | 24.8 | 94.5 | 0 | 0 | 0 | 110.4 | 0 | 58.8 | 3.1 | 1 | 0 | 0 | 137.7 | 0 | 94.1 | 0 | 0 | 0 | 15.5 | 2.1 | 0.1 | 0 | 0 | 0 | 0 | 0 |
| XAD | 84 | 0.4 | 4.8 | 0 | 8.6 | 0 | 1 | 0 | 0.2 | 0 | 0 | 0.4 | 0 | 0 | 65.5 | 0 | 0 | 0 | 0 | 0 | 3.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| XCC | 3819 | 375.9 | 382 | 0 | 37.6 | 36.7 | 1.8 | 1054 | 19.3 | 0 | 0 | 0.3 | 292.8 | 504.8 | 0.2 | 946.8 | 0 | 149.6 | 0 | 0 | 15.9 | 1.4 | 0 | 0 | 0 | 0 | 0 |
| XGV | 3220.6 | 190.6 | 286.1 | 0 | 48.6 | 63.7 | 3.4 | 0 | 15 | 0 | 0.3 | 0 | 0 | 50.7 | 198.8 | 1967.9 | 0 | 334.8 | 0 | 0 | 60.8 | 0.1 | 0 | 0 | 0 | 0 | 0 |
| XLO | 1395.5 | 29 | 121.2 | 0 | 18 | 0.3 | 3.1 | 668.3 | 37.7 | 0.4 | 159.2 | 6.9 | 31.9 | 174.4 | 48.8 | 80.4 | 14.3 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 1 | 0 |
| CSN | 70.9 | 3.2 | 32.4 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 35.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| YYE | 189.7 | 4.3 | 33.3 | 0 | 13.4 | 0 | 92.3 | 0 | 26.6 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19.2 | 0 | 0 | 0 | 0.1 | 0 | 0 |
| KMN | 203.7 | 0.8 | 47.2 | 0 | 0 | 8.3 | 1.3 | 0 | 18.4 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 116.8 | 0.1 | 8.3 | 0.7 | 0.9 | 0 | 0 |
| ALS | 41 | 0.3 | 11.2 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 12.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.8 | 0 | 3.4 | 0 | 0.3 | 0 | 0 |
| UCH | 527.5 | 0.2 | 258.3 | 7.6 | 3.4 | 34.7 | 1.6 | 0 | 0 | 0 | 0 | 0 | 0 | 27.2 | 60.2 | 114.4 | 0 | 0 | 0 | 0 | 19.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| WLR | 2.5 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0.6 | 0 | 0 | 0 | 0 |
| DBA | 16.3 | 3.3 | 0.7 | 0 | 0 | 0 | 2.2 | 0 | 4.6 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| ACN | 12.2 | 0 | 10.5 | 0.6 | 0 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NCN | 56.5 | 0 | 33.1 | 1.7 | 0.1 | 5.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 15.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| LCN | 1376.3 | 28.1 | 766.3 | 29.3 | 11.5 | 90.5 | 1.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23.6 | 99.2 | 0 | 0 | 0 | 0 | 325.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| EMN | 76.4 | 2.5 | 4.7 | 0 | 0 | 0 | 1.4 | 0 | 6.3 | 1.4 | 0 | 0 | 0 | 22.6 | 34.9 | 1.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.9 | 0 | 0 |
| XMN | 10.5 | 0 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0.6 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 3 | 0 | 0.1 | 0 | 0 |
| BGV | 82.2 | 0 | 17.6 | 0 | 9.4 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0.1 | 0 | 0 | 0 | 44.2 | 0 | 0 | 0 | 0 | 10.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| CGV | 1232.2 | 169.9 | 234.6 | 0 | 4.9 | 16.7 | 0.2 | 0 | 2.7 | 0 | 0 | 111.4 | 0 | 79.6 | 208.3 | 307.6 | 35.1 | 2.6 | 0 | 0 | 58.4 | 0.3 | 0 | 0 | 0 | 0 | 0 |
| AGV | 791 | 59.6 | 202.2 | 0 | 8.8 | 42.5 | 1.5 | 0.4 | 23 | 0 | 31.8 | 47 | 0 | 34 | 59.4 | 161.3 | 0 | 30 | 0 | 0 | 89.1 | 0 | 0 | 0.3 | 0 | 0 | 0 |
| XSM | 153.1 | 1.9 | 39.8 | 1.9 | 2.4 | 4.7 | 0.3 | 0 | 0 | 0 | 0 | 4.6 | 0 | 46.9 | 35.4 | 0 | 0 | 0 | 0 | 0 | 15.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| XDZ | 772 | 188.8 | 122.4 | 0 | 5.4 | 27.6 | 1.4 | 66.2 | 4.4 | 0 | 0 | 57 | 0 | 51.4 | 120.4 | 86.2 | 0 | 0 | 0 | 0 | 40.6 | 0.1 | 0 | 0 | 0 | 0 | 0 |
| PAS | 36.8 | 1.8 | 6.7 | 0 | 11.8 | 0 | 2.2 | 0 | 3.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| YAC | 60.2 | 0 | 7.7 | 0 | 9.9 | 0 | 5.9 | 0 | 17 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9 | 0 | 15.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| DNO | 5 | 0 | 2.2 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1.6 | 0 | 0 | 0 | 0 |
| BSN | 43.6 | 0 | 27.8 | 0 | 3.3 | 0 | 0.3 | 0 | 3 | 4.1 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| XCH | 1147.7 | 50.5 | 442.2 | 43.1 | 111.1 | 65.3 | 3.1 | 0 | 1.1 | 0 | 0 | 0 | 0 | 0 | 0 | 28.8 | 0 | 0 | 0 | 0 | 402.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| BLS | 3.7 | 0 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9 | 0 | 0.5 | 0 | 0 | 0 | 0 |
| ADK | 5.6 | 0 | 3.3 | 0 | 1.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| XFC | 292.9 | 0.4 | 133.4 | 7.9 | 3 | 34.2 | 0.3 | 0 | 0 | 0 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 112.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| YBX | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| WAC | 2.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.7 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 |
| XDK | 5.9 | 0 | 2 | 0 | 0.9 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| ABA | 3.4 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| XBA | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| BSM | 0.6 | 0 | 0.3 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BNO | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| Landings by ICES Divisions -1996 in tonnes | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESPES | TOT | 05B | 06A | 04A | 02A | 04B | 04C | 08B | 08A | 80 | 07D | 08C | 08D | 07E | 07G | 07A | 7 F | 07J | 07K | 70 | 07B | 10A | 07C | 07H | 08E | 09B | 12A | 06B |
| TOTA | 19873 | 260.6 | 2953.9 | 42.3 | 10.8 | 25.7 | 153.9 | 322.3 | 2424.1 | 409.9 | 2628.7 | 15.7 | 169.3 | 1958 | 2458.5 | 394 | 567.6 | 491.7 | 351.2 | 128.9 | 193.4 | 5 | 185.2 | 3587.7 | 9.8 | 0.6 | 121.4 | 2.3 |
| 3807 | 1257.8 | 0.1 | 77.4 | 4.2 | 0.3 | 0.1 | 3.1 | 10.4 | 65.8 | 29.2 | 20.1 | 0 | 2.1 | 116.5 | 246 | 23.4 | 18.4 | 32.2 | 1.6 | 12.1 | 19.9 | 0 | 4.7 | 569.8 | 0.1 | 0 | 0.3 | 0 |
| 3803 | 4202.2 | 0 | 148.6 | 0.5 | 0 | 0.1 | 76.8 | 46.3 | 480.6 | 86 | 1409.7 | 0 | 4.4 | 786.9 | 512.9 | 70.3 | 152.5 | 30.2 | 2.2 | 38.6 | 41.4 | 0 | 3.7 | 310.4 | 0 | 0 | 0 | 0 |
| 3819 | 108 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 72.6 | 0 | 0 | 31 | 0.3 | 0 | 3.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0 | 0 |
| 3804 | 347.8 | 0 | 13.7 | 0.3 | 0 | 0 | 11.3 | 15.8 | 61.6 | 13.7 | 117.2 | 0.1 | 3 | 26.4 | 24 | 4.6 | 18.2 | 1 | 0.1 | 1.1 | 0.5 | 0 | 0.5 | 34.5 | 0.3 | 0 | 0 | 0 |
| 3805 | 503.7 | 0 | 3.6 | 0 | 0 | 0 | 0.4 | 3.9 | 83.2 | 6.3 | 222.7 | 0 | 2 | 86.2 | 14.1 | 2 | 5 | 0.9 | 0 | 0.8 | 0.1 | 0 | 0 | 72.5 | 0 | 0 | 0 | 0 |
| 3801 | 376 | 0 | 0.2 | 0.4 | 0 | 0 | 5.3 | 14.9 | 54.5 | 82.4 | 11.1 | 8.7 | 78.7 | 3.5 | 23 | 9.3 | 1.9 | 71.8 | 3.9 | 0.1 | 0 | 0.4 | 0.2 | 3.8 | 0.9 | 0 | 0.8 | 0 |
| 3842 | 3067.4 | 257.4 | 2063 | 4.4 | 0 | 24.7 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0.1 | 0 | 0.5 | 0 | 0 | 81.2 | 318.2 | 0.1 | 55.1 | 0.1 | 151.6 | 0.9 | 0.2 | 0 | 108.2 | 1.4 |
| 3806 | 290.5 | 0 | 0 | 0 | 0 | 0 | 0 | 51.2 | 108.4 | 32.3 | 0 | 5.9 | 34.8 | 0.6 | 12.3 | 4.1 | 1.7 | 6.5 | 4.9 | 0.1 | 0 | 4.4 | 0 | 2.5 | 8.3 | 0.6 | 11.7 | 0 |
| 3822 | 14.9 | 0 | 0 | 0 | 0 | 0 | 0 | 3.2 | 3.7 | 3.8 | 1 | 0.9 | 1.1 | 0.9 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3890 | 214.8 | 0 | 150 | 3.4 | 0 | 0 | 0 | 7.9 | 41.8 | 1.8 | 1.5 | 0 | 0.4 | 0.1 | 0.6 | 0 | 0 | 0.2 | 3.2 | 0.4 | 0.3 | 0 | 2.1 | 0.5 | 0 | 0 | 0 | 0.5 |
| 3811 | 315.6 | 1.6 | 39.7 | 15 | 4.8 | 0.5 | 0 | 0 | 1.3 | 1.3 | 0.2 | 0 | 0 | 11.9 | 129.1 | 0.4 | 3.4 | 8.8 | 6.3 | 12.5 | 12.3 | 0 | 1.5 | 64.3 | 0 | 0 | 0.3 | 0.4 |
| 3812 | 324.7 | 0 | 174.2 | 0.4 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0 | 0.2 | 5.7 | 22.8 | 0.2 | 2.3 | 10.6 | 3.9 | 0 | 8 | 0 | 11.6 | 84.3 | 0 | 0 | 0 | 0.1 |
| 3813 | 1340.1 | 0 | 98.3 | 0.2 | 0 | 0 | 0 | 24.1 | 171.8 | 8.2 | 172.8 | 0 | 0.7 | 91.4 | 501.1 | 110.7 | 70.2 | 24 | 0.5 | 0 | 11.9 | 0 | 1.9 | 52.1 | 0 | 0 | 0 | 0 |
| 3815 | 861.4 | 0 | 2.9 | 0 | 0 | 0 | 0 | 25.7 | 118.4 | 9 | 9.8 | 0 | 1.4 | 178.7 | 293 | 29.5 | 46.4 | 3.8 | 0 | 0 | 0.8 | 0 | 0 | 142 | 0 | 0 | 0 | 0 |
| 3814 | 3933.2 | 0 | 134.4 | 0.4 | 0 | 0 | 0 | 13.5 | 1007.5 | 3.6 | 45.1 | 0 | 35.1 | 285.3 | 258.6 | 35.2 | 54.4 | 183.7 | 0.7 | 0 | 7.2 | 0 | 6.2 | 1862.1 | 0 | 0 | 0 | 0 |
| 3821 | 49.4 | 0 | 1.8 | 0.2 | 0 | 0 | 0 | 0.1 | 1.6 | 0 | 0 | 0 | 0.2 | 2.3 | 25.5 | 0.2 | 2.4 | 1.2 | 0.1 | 0 | 0.2 | 0 | 0.1 | 13.7 | 0 | 0 | 0 | 0 |
| 3820 | 517 | 0 | 22.7 | 0 | 0 | 0 | 0 | 0.2 | 92.2 | 0 | 0 | 0 | 4.8 | 7.4 | 45.5 | 0.7 | 3.3 | 23.8 | 2.7 | 0 | 0.8 | 0 | 0.4 | 312.5 | 0 | 0 | 0 | 0 |
| 3823 | 5.8 | 0 | 0 | 0 | 0 | 0 | 0 | 5.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3891 | 15.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0.6 | 0 | 0 | 0 | 0 | 0.3 | 9.1 | 0 | 0 | 0.2 | 0 | 0.6 | 0 | 0 | 0 | 4.4 | 0 | 0 | 0 | 0 |
| 3892 | 2101.7 | 1.4 | 21.8 | 12.8 | 5.6 | 0.2 | 57 | 93.7 | 118.6 | 127.8 | 544.8 | 0 | 0.4 | 322.9 | 338.7 | 102.9 | 183.8 | 11.8 | 2.6 | 62.6 | 34.7 | 0 | 0.6 | 56.9 | 0 | 0 | 0.1 | 0 |
| 3809 | 3.3 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0.3 | 0.2 | 0.1 | 0 | 0 | 0 | 0.1 | 1.5 | 0.3 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 |
| 3810 | 17.4 | 0 | 0 | 0 | 0 | 0 | 0 | 3.6 | 10.5 | 3.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3816 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.5 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3817 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.7 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3899 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AUTR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Captures per vessel for 1996 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGIN | TOTA | 3807 | 3803 | 3819 | 3804 | 3805 | 3801 | 3842 | 3806 | 3822 | 3890 | 3811 | 3812 | 3813 | 3815 | 3814 | 3821 | 3820 | 3823 | 3891 | 3892 | 3809 | 3810 | 3816 | 3817 | 3899 | AUTR |
| TO | 19873 | 1257.8 | 4202.2 | 108 | 347.8 | 503.7 | 376 | 3067.4 | 290.5 | 14.9 | 214.8 | 315.6 | 324.7 | 1340.1 | 861.4 | 3933.2 | 49.4 | 517 | 5.8 | 15.5 | 2101.7 | 3.3 | 17.4 | 1 | 2.4 | 1 | 0 |
| 93 | 17328 | 1042.8 | 3508.1 | 69 | 196.9 | 403.6 | 20.4 | 3066.7 | 25.1 | 0.9 | 190.1 | 296.8 | 324.6 | 1243 | 734.2 | 3883.3 | 49.4 | 516.2 | 0.1 | 15.5 | 1730.2 | 2.8 | 5.8 | 0.6 | 0.2 | 1 | 0 |
| 94 | 143.3 | 1.6 | 36.9 | 1.8 | 6.4 | 12.3 | 7.3 | 0 | 19.4 | 10 | 11.7 | 0 | 0 | 6.3 | 7.3 | 11 | 0 | 0 | 0 | 0 | 10.2 | 0 | 0.2 | 0.2 | 0.6 | 0 | 0 |
| | 794.3 | 33.6 | 285 | 4.6 | 14.4 | 31.2 | 89 | 0.6 | 47.2 | 0.7 | 1.9 | 17.9 | 0.1 | 23.5 | 15.2 | 23.1 | 0 | 0 | 0 | 0 | 204.3 | 0 | 1.8 | 0 | 0.2 | 0 | 0 |
| 81 | 14.1 | 0 | 5.3 | 0.1 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6 | 0.2 | 1.2 | 0 | 0 | 0 | 0 | 5.5 | 0.2 | 0 | 0 | 0 | 0 | 0 |
| 51 | 498.2 | 15.9 | 161.4 | 2.6 | 40.1 | 21.9 | 5.8 | 0 | 47.5 | 1.6 | 6.2 | 0.9 | 0 | 38.2 | 72.6 | 0.7 | 0 | 0.4 | 0.8 | 0 | 73.7 | 0.1 | 7.4 | 0.1 | 0.4 | 0 | 0 |
| 5 | 97.2 | 0.4 | 10.2 | 0.4 | 0.2 | 0.6 | 1.8 | 0 | 22.6 | 0.1 | 2.3 | 0 | 0 | 12.5 | 15.3 | 0.4 | 0 | 0 | 0 | 0 | 27.8 | 0 | 1.9 | 0.1 | 0.6 | 0 | 0 |
| 3 | 18.9 | 0.1 | 8.8 | 1.3 | 0.1 | 0 | 0 | 0 | 3.4 | 0 | 0.1 | 0 | 0 | 0.3 | 1.9 | 1.4 | 0 | 0 | 0 | 0 | 1.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 788.3 | 163.2 | 120 | 27.9 | 89 | 29.2 | 234.9 | 0 | 65.5 | 0.3 | 2.2 | 0 | 0 | 8.9 | 9.4 | 3.5 | 0 | 0 | 4 | 0 | 30.1 | 0 | 0.1 | 0 | 0.1 | 0 | 0 |
| 52 | 75.3 | 0 | 0.1 | 0 | 0.1 | 0 | 16.1 | 0 | 55.9 | 1.4 | 0.3 | 0 | 0 | 0.5 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0.1 | 0 | 0 |
| 9 | 59.9 | 0 | 34.1 | 0.1 | 0 | 4.1 | 0 | 0 | 1.3 | 0 | 0 | 0 | 0 | 1.8 | 4.4 | 7.1 | 0 | 0 | 0 | 0 | 6.7 | 0 | 0.2 | 0 | 0 | 0 | 0 |
| 24 | 8 | 0 | 2.3 | 0.1 | 0.2 | 0.1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 2.9 | 0 | 0 | 0 | 0 | 0.9 | 0 | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 3.3 | 0 | 0.2 | 0 | 0 | 0 | 0.5 | 0 | 1.1 | 0 | 0 | 0 | 0 | 0.1 | 0.2 | 0.6 | 0 | 0.4 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 92 | 40.7 | 0 | 28.9 | 0.2 | 0.5 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.1 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0.5 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 1.8 | 0 | 0.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.2 | 0.9 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0.3 | 0 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 |

German Elasmobranch Landings

FANG

ANLANDUNGEN (ANLANDEDATEI) DER DEUTSCHEN FISCHEREIFLOTTE in kg

GESAMTES | JAHR | 1996

DORNHAI | DGS | *Squalus acanthias*

| FLOTTENSEGMENTE | C11 | C12 | C19 | G11 | G13 | G16 | G17 | G19 | G20 | G21 | G22 | Z25 | SXX | Summe | GEBIETSBEZICHNUNG | GEBIETE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GEBIETE | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | 0 | 1 | Barentssee |
| 2A | | | | | | | 31 | | | | | | | 31 | 2A | Norwegische See |
| 2B | | | | | | | | | | | | | | 0 | 2B | Spitzbergen und Bäreninsel |
| 3AN | 5 | | | | | | | | | | | | | 5 | 3AN | Skagerrak |
| 3AS21 | | | | | | | | | | | | | | 0 | 3AS21 | Kattegatt |
| 3B23 | | | | | | | | | | | | | | 0 | 3B23 | Sund |
| 3C22 | | | | | | | | | | | | | | 0 | 3C22 | Belt |
| 3D24 | | | | | | | | | | | | | | 0 | 3D24 | zentrale Ostsee |
| 3D25 | | | | | | | | | | | | | | 0 | 3D25 | zentrale Ostsee |
| 3D26 | | | | | | | | | | | | | | 0 | 3D26 | zentrale Ostsee |
| 3D27 | | | | | | | | | | | | | | 0 | 3D27 | zentrale Ostsee |
| 3D28 | | | | | | | | | | | | | | 0 | 3D28 | zentrale Ostsee |
| 3D29 | | | | | | | | | | | | | | 0 | 3D29 | zentrale Ostsee |
| 4A | | | | | | 36 | 8994 | | 49 | | | | | 9079 | 4A | Nördliche Nordsee |
| 4B | 1585 | 3436 | | 7 | 1657 | 1 | 2775 | | | | | | | 9461 | 4B | Mittlere Nordsee |
| 4C | 16 | 14 | | | 78 | · | 13 | | | | | | | 121 | 4C | Südliche Nordsee |
| 5A | | | | | | | | | | | | | | 0 | 5A | Island |
| 5B | | | | | | | | | | | | | | 0 | 5B | Färöer |
| 6AN | | | | | | | | | | | 199 | | | 199 | 6AN | Westlich Schottlands (Nord) |
| 6ANHER | | | | | | | | | | | | | | 0 | 6ANHER | Westlich Schottlands (Nord) |
| 6AS | | | | | | | | | | | | | | 0 | 6AS | Westlich Schottlands (Süd) |
| 6ASHER | | | | | | | | | | | | | | 0 | 6ASHER | Westlich Schottlands (Süd) |
| 6B | | | | | | | | | | | | | | 0 | 6B | Westlich Irlands |
| 7A | | | | | | | | | | | | | | 0 | 7A | Irische See |
| 7B | | | | | | | | | | | | | | 0 | 7B | Rockall |
| 7C | | | | | | | | | | | | | | 0 | 7C | Porcupine Bank |
| 7D | | | | | | | | | | | | | | 0 | 7D | Östlicher Ärmelkanal |
| 7E | | | | | | | | | | | | | | 0 | 7E | Westlicher Ärmelkanal |
| 7F | | | | | | | | | | | | | | 0 | 7F | Bristolkanal |
| 7G | | | | | | | | | | | | | | 0 | 7G | Südöstlich Irlands |
| 7H | | | | | | | | | | | | | | 0 | 7H | Little Sole |
| 7I-J | | | | | | | | | | | | | | 0 | 7I-J | Great Sole |
| 7K | | | | | | | | | | | | | | 0 | 7K | Westlich Great Sole |
| 8A | | | | | | | | | | | | | | 0 | 8A | Südlich der Bretagne |
| 8B | | | | | | | | | | | | | | 0 | 8B | Südlich Biskaya |
| 8D | | | | | | | | | | | | | | 0 | 8D | Mittlere Biskaya |
| 8E | | | | | | | | | | | | | | 0 | 8E | Westliche Biskaya |
| 9B | | | | | | | | | | | | | | 0 | 9B | Westlich Portugal |
| 10 | | | | | | | | | | | | | | 0 | 10 | Azoren |
| 12 | | | | | | | | | | | | | | 0 | 12 | Nördliche Azoren |
| 14 | | | | | | | | | | | | | | 0 | 14 | Ostgrönland |
| NF-1A | | | | | | | | | | | | | | 0 | NF-1A | Westgrönland (WG),Disko |
| NF-1B | | | | | | | | | | | | | | 0 | NF-1B | Westgrönland,Gr.Heilbutt-Bank |
| NF-1C | | | | | | | | | | | | | | 0 | NF-1C | Westgrönland,Kl.Heilbutt-Bank |
| NF-1D | | | | | | | | | | | | | | 0 | NF-1D | WG,Fyllas,Fiskenes,Danas-Bank |
| NF-1E | | | | | | | | | | | | | | 0 | NF-1E | WG,Frederiksh.,Nonamè,Sermersok |
| NF-1F | | | | | | | | | | | | | | 0 | NF-1F | WG,Kap Desol.,Thorshavn,Nanortalik.,Kap Farvel |
| NF-3L | | | | | | | | | | | | | | 0 | NF-3L | Nose of The Grand Bank |
| NF-3M | | | | | | | | | | | | | | 0 | NF-3M | Flämische Kappe |
| NF-3N | | | | | | | | | | | | | | 0 | NF-3N | Tail of the Grand Bank |
| NF-3O | | | | | | | | | | | | | | 0 | NF-3O | Südwest- -Neufundland |
| COPACE 34.1.1 | | | | | | | | | | | | | | 0 | COPACE 34.1.1 | |
| gesamt 8 | | | | | | | | | | | | | | 0 | | |
| | | | | | | | | | | | | | | | | |
| NORDSEE | 1606 | 3450 | 0 | 7 | 1735 | 37 | 11782 | 0 | 49 | 0 | 0 | 0 | 0 | 18666 | NORDSEE | 3AN,4A,4B,4C,7D |
| OSTSEE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | OSTSEE | 3AS21,3B23,3C22,3D(24-29) |
| AND. GEBIETE | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 199 | 0 | 0 | 230 | ANDERE GEBIETE | |
| TOTAL | 1606 | 3450 | 0 | 7 | 1735 | 37 | 11813 | 0 | 49 | 0 | 199 | 0 | 0 | 18896 | TOTAL | |

# German Elasmobranch Landings

FANG

**ANLANDUNGEN (ANLANDEDATEI) DER DEUTSCHEN FISCHEREIFLOTTE in kg**

**GESAMTES | JAHR | 1996**

**ANDERE HAIE** DGX **Other sharks**

| FLOTTENSEGMENTE | C11 | C12 | C19 | G11 | G13 | G16 | G17 | G19 | G20 | G21 | G22 | Z25 | SXX | Summe | GEBIETSBEZICHNUNG | GEBIETE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GEBIETE | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | 0 | 1 | Barentssee |
| 2A | | | | | | | | | | | | | | 0 | 2A | Norwegische See |
| 2B | | | | | | | | | | | | | | 0 | 2B | Spitzbergen und Bäreninsel |
| 3AN | | | | | | | | | | | | | | 0 | 3AN | Skagerrak |
| 3AS21 | | | | | | | | | | | | | | 0 | 3AS21 | Kattegatt |
| 3B23 | | | | | | | | | | | | | | 0 | 3B23 | Sund |
| 3C22 | | | | | | 1 | | | | | | | | 1 | 3C22 | Belt |
| 3D24 | | | | | | | | | | | | | | 0 | 3D24 | zentrale Ostsee |
| 3D25 | | | | | | | | | | | | | | 0 | 3D25 | zentrale Ostsee |
| 3D26 | | | | | | | | | | | | | | 0 | 3D26 | zentrale Ostsee |
| 3D27 | | | | | | | | | | | | | | 0 | 3D27 | zentrale Ostsee |
| 3D28 | | | | | | | | | | | | | | 0 | 3D28 | zentrale Ostsee |
| 3D29 | | | | | | | | | | | | | | 0 | 3D29 | zentrale Ostsee |
| 4A | | | | | | 9 | 20 | | | 217 | | | | 246 | 4A | Nördliche Nordsee |
| 4B | 371 | 473 | 112 | | 315 | | 139 | | 14 | | | | | 1424 | 4B | Mittlere Nordsee |
| 4C | 89 | 218 | 6 | | 28 | | 1 | | | | | | | 342 | 4C | Südliche Nordsee |
| 5A | | | | | | | | | | | | | | 0 | 5A | Island |
| 5B | | | | | | | | | | 30667 | | | | 30667 | 5B | Färöer |
| 6AN | | | | | | | | | | 4747 | | | | 4747 | 6AN | Westlich Schottands (Nord) |
| 6ANHER | | | | | | | | | | | | | | 0 | 6ANHER | Westlich Schottands (Nord) |
| 6AS | | | | | | | | | | 670 | | | | 670 | 6AS | Westlich Schottands (Süd) |
| 6ASHER | | | | | | | | | | | | | | 0 | 6ASHER | Westlich Schottands (Süd) |
| 6B | | | | | | | | | | 110202 | 178 | | | 110380 | 6B | Westlich Irlands |
| 7A | | | | | | | | | | | | | | 0 | 7A | Irische See |
| 7B | | | | | | | | | | | | | | 0 | 7B | Rockall |
| 7C | | | | | | | | | | 17160 | | | | 17160 | 7C | Porcupine Bank |
| 7D | | | | | | | | | | | | | | 0 | 7D | Östlicher Ärmelkanal |
| 7E | | | | | | | | | | | | | | 0 | 7E | Westlicher Ärmelkanal |
| 7F | | | | | | | | | | | | | | 0 | 7F | Bristolkanal |
| 7G | | | | | | | | | | | | | | 0 | 7G | Südöstlich Irlands |
| 7H | | | | | | | | | | | | | | 0 | 7H | Little Sole |
| 7I-J | | | | | | | 3779 | | | 122962 | | | | 126741 | 7I-J | Great Sole |
| 7K | | | | | | | 3758 | | | 12915 | | | | 16673 | 7K | Westlich Great Sole |
| 8A | | | | | | | | | | | | | | 0 | 8A | Südlich der Bretagne |
| 8B | | | | | | | | | | | | | | 0 | 8B | Südlich Biskaya |
| 8D | | | | | | | | | | | | | | 0 | 8D | Mittlere Biskaya |
| 8E | | | | | | | | | | | | | | 0 | 8E | Westliche Biskaya |
| 9B | | | | | | | | | | | | | | 0 | 9B | Westlich Portugal |
| 10 | | | | | | | | | | | | | | 0 | 10 | Azoren |
| 12 | | | | | | | | | | | | | | 0 | 12 | Nördliche Azoren |
| 14 | | | | | | | | | | | 166 | | | 166 | 14 | Ostgrönland |
| NF-1A | | | | | | | | | | | | | | 0 | NF-1A | Westgrönland (WG),Disko |
| NF-1B | | | | | | | | | | | | | | 0 | NF-1B | Westgrönland,Gr.Heilbutt-Bank |
| NF-1C | | | | | | | | | | | | | | 0 | NF-1C | Westgrönland,Kl.Heilbutt-Bank |
| NF-1D | | | | | | | | | | | | | | 0 | NF-1D | WG,Fyllas,Fiskenes,Danas-Bank |
| NF-1E | | | | | | | | | | | | | | 0 | NF-1E | WG,Frederiksh.,Noname,Sermersok |
| NF-1F | | | | | | | | | | | | | | 0 | NF-1F | WG,Kap Desol.,Thorshavn,Nanortalik.,Kap Farvel |
| NF-3L | | | | | | | | | | | | | | 0 | NF-3L | Nose of The Grand Bank |
| NF-3M | | | | | | | | | | | 99 | | | 99 | NF-3M | Flämische Kappe |
| NF-3N | | | | | | | | | | | | | | 0 | NF-3N | Tail of the Grand Bank |
| NF-3O | | | | | | | | | | | | | | 0 | NF-3O | Südwest- -Neufundland |
| COPACE 34.1.1 | | | | | | | | | | | | | | 0 | COPACE 34.1.1 | |
| gesamt 8 | | | | | | | | | | | | | | 0 | | |
| | | | | | | | | | | | | | | | | |
| NORDSEE | 460 | 691 | 118 | 0 | 343 | 9 | 160 | 0 | 14 | 217 | 0 | 0 | 0 | 2012 | NORDSEE | 3AN,4A,4B,4C,7D |
| OSTSEE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | OSTSEE | 3AS21,3B23,3C22,3D(24-29) |
| AND. GEBIETE | 0 | 0 | 0 | 0 | 0 | 0 | 7537 | 0 | 0 | 299323 | 443 | 0 | 0 | 307303 | ANDERE GEBIETE | |
| TOTAL | 460 | 691 | 118 | 0 | 343 | 10 | 7697 | 0 | 14 | 299540 | 443 | 0 | 0 | 309316 | TOTAL | |

# German Elasmobranch Landings

FANG

**ANLANDUNGEN (ANLANDEDATEI) DER DEUTSCHEN FISCHEREIFLOTTE in kg**

**GESAMTES ROCHEN** | **JAHR 1996** | Skates and rays

| FLOTTENSEGMENTE | C11 | C12 | C19 | G11 | G13 | G16 | G17 | G19 | G20 | G21 | G22 | Z25 | SXX | Summe | GEBIETSBEZICHNUNG | GEBIETE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GEBIETE | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | 0 | 1 | Barentssee |
| 2A | | | | | | | 216 | | | | | | | 216 | 2A | Norwegische See |
| 2B | | | | | | | | | | | | | | 0 | 2B | Spitzbergen und Bäreninsel |
| 3AN | | | | | | | | | | | | | | 0 | 3AN | Skagerrak |
| 3AS21 | | | | | | 1 | | | | | | | | 1 | 3AS21 | Kattegatt |
| 3B23 | | | | | | | | | | | | | | 0 | 3B23 | Sund |
| 3C22 | | | | | | | | | | | | | | 0 | 3C22 | Belt |
| 3D24 | | | | | | | | | | | | | | 0 | 3D24 | zentrale Ostsee |
| 3D25 | | | | | | | | | | | | | | 0 | 3D25 | zentrale Ostsee |
| 3D26 | | | | | | | | | | | | | | 0 | 3D26 | zentrale Ostsee |
| 3D27 | | | | | | | | | | | | | | 0 | 3D27 | zentrale Ostsee |
| 3D28 | | | | | | | | | | | | | | 0 | 3D28 | zentrale Ostsee |
| 3D29 | | | | | | | | | | | | | | 0 | 3D29 | zentrale Ostsee |
| 4A | | | | | | | 1842 | | 85 | 1808 | | | | 3735 | 4A | Nördliche Nordsee |
| 4B | 540 | 263 | | | 870 | | 446 | | | | | | | 2119 | 4B | Mittlere Nordsee |
| 4C | 938 | 2212 | | | 603 | | 36 | | | | | | | 3789 | 4C | Südliche Nordsee |
| 5A | | | | | | | | | | | | | | 0 | 5A | Island |
| 5B | | | | | | | 438 | | | | 8 | | | 446 | 5B | Färöer |
| 6AN | | | | | | | 28 | | | 384 | | | | 412 | 6AN | Westlich Schottands (Nord) |
| 6ANHER | | | | | | | | | | | | | | 0 | 6ANHER | Westlich Schottands (Nord) |
| 6AS | | | | | | | | | | 42 | | | | 42 | 6AS | Westlich Schottands (Süd) |
| 6ASHER | | | | | | | | | | | | | | 0 | 6ASHER | Westlich Schottands (Süd) |
| 6B | | | | | | | | | | 49499 | | | | 49499 | 6B | Westlich Irlands |
| 7A | | | | | | | | | | | | | | 0 | 7A | Irische See |
| 7B | | | | | | | | | | | | | | 0 | 7B | Rockall |
| 7C | | | | | | | | | | 4218 | | | | 4218 | 7C | Porcupine Bank |
| 7D | | | | | | | | | | | | | | 0 | 7D | Östlicher Ärmelkanal |
| 7E | | | | | | | | | | | | | | 0 | 7E | Westlicher Ärmelkanal |
| 7F | | | | | | | | | | | | | | 0 | 7F | Bristolkanal |
| 7G | | | | | | | | | | | | | | 0 | 7G | Südöstlich Irlands |
| 7H | | | | | | | | | | | | | | 0 | 7H | Little Sole |
| 7I-J | | | | | | | | | | | | | | 0 | 7I-J | Great Sole |
| 7K | | | | | | | | | | 60 | | | | 60 | 7K | Westlich Great Sole |
| 8A | | | | | | | | | | | | | | 0 | 8A | Südlich der Bretagne |
| 8B | | | | | | | | | | | | | | 0 | 8B | Südlich Biskaya |
| 8D | | | | | | | | | | | | | | 0 | 8D | Mittlere Biskaya |
| 8E | | | | | | | | | | | | | | 0 | 8E | Westliche Biskaya |
| 9B | | | | | | | | | | | | | | 0 | 9B | Westlich Portugal |
| 10 | | | | | | | | | | | | | | 0 | 10 | Azoren |
| 12 | | | | | | | | | | | | | | 0 | 12 | Nördliche Azoren |
| 14 | | | | | | | | | | | 165 | | | 165 | 14 | Ostgrönland |
| NF-1A | | | | | | | | | | | | | | 0 | NF-1A | Westgrönland (WG),Disko |
| NF-1B | | | | | | | | | | | | | | 0 | NF-1B | Westgrönland,Gr.Heilbutt-Bank |
| NF-1C | | | | | | | | | | | | | | 0 | NF-1C | Westgrönland,Kl.Heilbutt-Bank |
| NF-1D | | | | | | | | | | | | | | 0 | NF-1D | WG,Fyllas,Fiskenes,Danas-Bank |
| NF-1E | | | | | | | | | | | | | | 0 | NF-1E | WG,Frederiksh.,Noname,Sermersok |
| NF-1F | | | | | | | | | | | | | | 0 | NF-1F | WG,Kap Desol.,Thorshavn,Nanortalik.,Kap Farvel |
| NF-3L | | | | | | | | | | | | | | 0 | NF-3L | Nose of The Grand Bank |
| NF-3M | | | | | | | | | | | 100 | | | 100 | NF-3M | Flämische Kappe |
| NF-3N | | | | | | | | | | | | | | 0 | NF-3N | Tail of the Grand Bank |
| NF-3O | | | | | | | | | | | | | | 0 | NF-3O | Südwest- -Neufundland |
| COPACE 34.1.1 | | | | | | | | | | | | | | 0 | COPACE 34.1.1 | |
| gesamt 8 | | | | | | | | | | | | | | 0 | | |
| NORDSEE | 1478 | 2475 | 0 | 0 | 1473 | 0 | 2324 | 0 | 85 | 1808 | 0 | 0 | 0 | 9643 | NORDSEE | 3AN,4A,4B,4C,7D |
| OSTSEE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | OSTSEE | 3AS21,3B23,3C22,3D(24-29) |
| AND. GEBIETE | 0 | 0 | 0 | 0 | 0 | 0 | 682 | 0 | 0 | 54203 | 273 | 0 | 0 | 55158 | ANDERE GEBIETE | |
| TOTAL | 1478 | 2475 | 0 | 0 | 1473 | 1 | 3006 | 0 | 85 | 56011 | 273 | 0 | 0 | 64802 | TOTAL | |

**Elasmobranch commercial landings from Icelandic waters (Va). Values in metric tonnes**

| | *Raja radiata* | *Raja batis* | *Squalus acanthias* | *Somniosus microcephalus* | *Lamna nasus* |
|---|---|---|---|---|---|
| 1981 | - | 229 | 22 | 61 | |
| 1982 | 9 | 248 | 13 | 68 | 1 |
| 1983 | 12 | 188 | 25 | 69 | |
| 1984 | 47 | 174 | 5 | 54 | 1 |
| 1985 | 16 | 118 | 9 | 40 | |
| 1986 | 45 | 105 | 7 | 23 | |
| 1987 | 126 | 129 | 5 | 31 | |
| 1988 | 39 | 152 | 4 | 19 | |
| 1989 | 100 | 152 | 17 | 31 | |
| 1990 | 161 | 222 | 15 | 54 | |
| 1991 | 284 | 300 | 54 | 57 | |
| 1992 | 317 | 361 | 180 | 68 | 1 |
| 1993 | 295 | 273 | 109 | 39 | 3 |
| 1994 | 1201 | 300 | 97 | 42 | 4 |
| 1995 | 1745 | 245 | 166 | | |
| 1996 | 1493 | 181 | 157 | 63 | 5 |

Table 1. NORWAY - Spiny dogfish (Squalus acanthias) landings 1993-1996. Preliminary figures for 1994-1996. Weight in tonnes.

| ICES area | Year 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|
| I | + | 1 | | |
| IIa | 5102 | 3117 | 2736 | 1853 |
| IIIa | 330 | 154 | 129 | 208 |
| IVa | 1508 | 1269 | 1076 | 688 |
| IVb | 1 | | 1 | + |
| VIa | 3 | | | |
| Total | 6945 | 4552 | 3939 | 2749 |

Table 2. NORWAY - Porbeagle (Lamna nasus) landings 1993-1996. Preliminary figures for 1994-1996. Weight in tonnes.

| ICES area | Year 1993 | 1994 | 1996 | 1997 |
|---|---|---|---|---|
| I | | | | + |
| IIa | 8 | 3 | 6 | 9 |
| IIIa | 2 | 2 | 17 | 17 |
| IVa | 12 | 17 | 3 | 2 |
| $Vb_1$ | | + | + | + |
| $Vb_2$ | | | + | |
| VIa | | | | + |
| VIb | | + | + | |
| XIV | | + | | |
| Total | 24 | 25 | 27 | 28 |

Table 3. NORWAY - Basking shark (Cetorhinus maximus) landings 1993-1996. Preliminary figures for 1994-1996. Weight in tonnes.

| | | | | |
|---|---|---|---|---|
| IIa | 2910 | 1505 | 104 | 413 |
| IVa | | 257 | 4 | |
| Total | 2910 | 1762 | 108 | 413 |

Table 4. NORWAY - Other sharks (unspecified) landings in 1993-1996. Preliminary figures for 1994-1996. Weight in tonnes.

| | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|
| Total | + | 101 | 367 | 106 |

Table 5. NORWAY - Skate and ray landings 1993-1996. Preliminary figures for 1994-1996. Weight in tonnes.

| ICES area | Year 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|
| I | 28 | 72 | 9 | 28 |
| IIa | 287 | 144 | 193 | 184 |
| IIb | + | 7 | 44 | 12 |
| IIIa | 80 | 108 | 120 | 150 |
| IVa | 406 | 324 | 283 | 180 |
| IVb | 1 | 1 | 4 | 1 |
| IVc | + | + | | |
| Va | | | + | + |
| $Vb_1$ | 55 | 12 | 8 | 40 |
| $Vb_2$ | 20 | 9 | 7 | 20 |
| VIa | 56 | 9 | 74 | 29 |
| VIb | 170 | 271 | 176 | 95 |
| VIIbc | + | 92 | 25 | 43 |
| XIV | 8 | 8 | 7 | 14 |
| 1D (ICNAF) | | | | 2 |
| 3K (ICNAF) | | | | + |
| Total | 1112 | 1060 | 952 | 797 |

# APPENDIX 3

# Appendix 3.
# Other international initiatives related to elasmobranch management and conservation

Convention on International Trade in Endangered Species (CITES)
The 9th Conference of the Parties (CoP) to CITES, held in November 1994, adopted a Resolution on Sharks (Conf. 9.17, Trade in Sharks and Shark Products). This Resolution has resulted in several significant new international initiatives on the monitoring and management of elasmobranchs, to take place over the six year period between the 9th and 11th CoPs.

The Resolution directed the CITES Animals Committee to compile and review existing data on the biological and trade status of shark species subject to international trade and to prepare a discussion paper on these data prior to the 10th CITES Conference in June 1997. It also requested FAO and other international fisheries management organisations to establish programmes to provide biological and trade data (in time for the 11th CoP, probably in the year 2000), and all nations utilising and trading in sharks to cooperate with these organisations and assist developing States in the collection of species-specific data.

The CITES Animals Committee report (*Biological and Trade Status of Sharks)* was produced with assistance from a number of governmental and non-governmental organisations, which had compiled data from several sources to produce the following documents:

- *Overview of impacts on the biological status of sharks* (Doc. AC 13.6 & Annex: US NMFS, facilitator).
- *CPUE trend and species composition of pelagic shark caught by Japanese research and training vessels in the Pacific Ocean* (Doc. AC 13.6.1 & Annex: Japan).
- *The biology and conservation status of sharks and their implications for exploitation and management* (Doc. AC 13.6.2: IUCN Shark Specialist Group).
- *The utilisation and trade of sharks and related species* (Doc. AC 13.6.3: TRAFFIC network, summary of Rose, 1996).
- *Implementation of Resolution Conf. 9.17 on sharks: activities undertaken by FAO* (Doc. AC 13.6.4).

The Animals Committee report, *Biological and trade status of sharks*, (which at the time of writing had not yet been presented to the 10th CoP in June 1997) notes that the Shark Resolution should cover all chondrichthyan fishes, not just the sharks. Sections summarise the following:

- the biological status of sharks, including reproduction and management constraints;
- factors influencing the status of shark stocks (commercial directed and by-catch fisheries, recreational sportfishing, habitat degradation and loss, and beach meshing);
- world trade in shark products;
- reporting on fisheries and trade (including products traded and the incomplete nature of such reporting);
- limitations of available data;
- current management of sharks; and
- intergovernmental fishery management and scientific organisations (major international treaties and agreements, and descriptions of relevant bodies, including ICES);

The Animals Committee's conclusions and recommendations are appended. They recommend that the CoP endorse a number of actions directed towards the full implementation of Conf. 9.17, as summarised below:

- improvement of identification, recording and reporting, at species level, of landings, by-catch and trade;
- discrimination between different shark products in international trade;
- initiation of a more intensive FAO work programme on sharks and rays;
- initiation of research and management efforts by Parties to CITES which operate shark fisheries, including data collection, compilation of life history information, biological parameters, distribution, and reduction of by-catch mortality;
- improved subscription to and implementation of the principles and practices in the FAO Code of Conduct for Responsible Fisheries; the FAO Precautionary Approach to Fisheries (Part I: Guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions); and the FAO Code of Practice for Full Utilisation of Sharks;
- FAO to convene a consultative meeting of FAO representatives, fisheries biologists/managers, intergovernmental fisheries organisations and non-governmental organisations with expertise on shark management; and
- the CITES Secretariat to communicate relevant recommendations to FAO and other intergovernmental fisheries management and/or research organisations and to establish liaison with them to monitor implementation.

As noted above, ICES is included in the AC report as one of the relevant intergovernmental fishery management and scientific organisations. For this reason, it is likely that ICES will be one of the organisations invited to participate in the experts meeting to be convened by FAO (see below for more information).

**CITES proposal for the establishment of a Working Group for Marine Fish Species**

A separate recommendation for the establishment of a temporary Marine Fish Working Group (MFWG) is being proposed by the United States of America at the CITES Conference in June 1997. If established, this Group will represent a forum for the discussion of the special technical and practical issues associated with implementation of listing those marine fish species which are subject to large-scale commercial harvesting and international trade on CITES. There are a significant number of such species, including certain sharks and the sturgeons, which currently qualify for inclusion in CITES Appendices, and indeed it is likely that proposals for listing some species of sharks will be submitted to the 11th CoP in three years time. The proposal suggests that the MFWG will be directed to coordinate preparation of an analysis of technical and practical implementation concerns associated with including such species on CITES; define the relationship of the group with existing international organisations involved in marine fish species data collection; and coordinate and consult with FAO and other international fishery management bodies. The MFWG would also have a role in advising regional fishery treaty organisations on necessary marine fish data collection and reporting.

As noted above, the international advisory role of ICES is such that, if this resolution is passed by the Conference, ICES may be invited to become a member of this MFWG.

**Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues, Bergen, March 1997.**

This meeting was organised by Norway at the invitation of the Fourth International Conference on the Protection of the North Sea, Esbjerg, 1995. Recognising the desirability of an ecosytem approach to fisheries, environmental protection, conservation and management measures, the

Ministers resolved at the meeting to follow up and build on the political commitment to integrate further fisheries and environmental policies, in order to protect the North Sea Environment and to ensure the sustainability of its fish stocks and associated fisheries. With respect to achieving sustainable exploitation, Ministers agreed that the fishing mortality rate should be reduced or controlled so that total stocks and spawning stocks are rebuilt to or maintained at a sustainable level. Competent authorities were therefore invited to consider within the appropriate fora and without delay the establishment of priorities for the elaboration of stock assessments and forecasts, or other appropriate stock indicators, for a number of named species or species groups, including 'sharks, skates, rays (*Elasmobranchii*)'.

The Statement of Conclusions notes that ICES had indicated during preparations for the Intermediate Ministerial Meeting that it 'may be able to provide the necessary technical information to enable establishment, by the competent authorities, of target and limit reference points and to present stock assessments and forecasts, or other appropriate stock indicators, where these are not currently available, within [a ten year] time frame from initiation' for elasmobranchs. (ICES is frequently referred to in the Statement of Conclusions, and its role recognised 'as the international scientific organisation for research and independent scientific advice on living marine resources and environment issues in the North Sea'.)

**FAO Shark Experts Consultation Panel**

This meeting has been under discussion since March 1996, when FAO, Japan and the US made a commitment to jointly host an Experts Panel on sharks. It will be funded by the Japanese government and will probably take place in Japan in mid 1998. Terms of Reference will be drawn up by the US and Japan in mid-late 1997.

Indications are that the US may be seeking to make the meeting multidisciplinary, rather than solely restricted to a limited number of scientific experts. There is particular interest in focusing on consideration of management needs and directives (e.g. the role of existing treaties), rather than primarily considering data collection and related subjects at the meeting. However, FAO technical consultations are usually restricted to no more than 30 participants and are closed to observers. This may mean that a preliminary meeting will be held with a wider range of participants than just the technical sector, and used to help set the agenda and directives for the technical consultation. Scientific input may be sought from interested parties early in the process, and a series of papers commissioned from scientists and others to form the information base of the consultation.

ICES is likely to be one of the organisations contacted to contribute to the Consultation Panel, and may possibly wish to contribute to the scientific papers to be prepared ahead of the meeting.

**UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks**

This Agreement facilitates implementation of the UN Convention on the Law of the Sea (UNCLOS) provisions relating to the conservation and management of high seas fish stocks. It was opened for signature and ratification in December 1995, and will enter into force for each State or entity that ratifies or accedes to it 30 days after receipt of the 30th instrument of ratification. The Agreement will establish rules and conservation measures for high seas fishery resources (and is complemented by the FAO Code of Conduct for Responsible Fisheries which sets out principles and international standards of behaviour for responsible practices). The Agreement calls for Parties to protect marine biodiversity, minimise pollution, monitor fishing levels and stocks, provide accurate reporting of and minimise by-catch and discards, and gather reliable, comprehensive scientific data as the basis for management decisions. It mandates a precautionary, risk-averse approach to the management of these species when scientific uncertainty exists. The Agreement also directs States to pursue cooperation in relation to these species through appropriate subregional fishery management organisations or arrangements.

Under UNCLOS, oceanic sharks defined as highly migratory species are: *Hexanchus griseus*, *Cetorhinus maximus*, *Rhincodon typus*, Alopiidae spp., Carcharinidae spp., Sphyrnidae and Lamnidae spp. Other species and populations may qualify as a 'straddling stock' under Article 63(2) of the Convention, particularly in areas where jurisdiction has not been extended to the 200 mile limit. For these sharks, coordinated management and assessment of shared migratory populations would promote an understanding of the cumulative impacts of fishing effort on the status of shared populations.

(Above text is taken from the report of the CITES Animals Committee, *Biological and Trade Status of Sharks*.)

**<u>EC Council Regulation COM(95) 322 final</u>**

The proposal for a Council Regulation (EC) establishing the lists of species to be recorded in fisheries logbooks and landing declaration was published in July 1995. The list of species to be recorded includes those subject to TAC and quota, those subject to technical conservation measures in EEC Regulations, species subject to international measures for the conservation and protection of living marine resources and species of particular scientific or commercial interest. The proposal was intended to contribute to systematic recording of regulated and highly migratory species. Information derived from such recording will facilitate better scientific analysis of marine resource exploitation. Improved recording in logbooks and reporting of landings of certain sharks in European Community waters (e.g. basking shark, spiny dogfish, porbeagle, dogfish sharks [Squalidae spp.], smoothhounds [Mustelidae spp.] and mako shark) will result from this Regulation. No batoids are listed in the proposal.
**STILL NEED TO CHECK DEVELOPMENTS IN PAST 2 YEARS.**

**<u>Wildlife Conventions</u>**

A number of wildlife conventions are now starting to address the issue of elasmobranch conservation.

The Barcelona Convention for the Protection of the Mediterranean Sea (1976) Protocol concerning specially protected areas and biological diversity in the Mediterranean was signed in Barcelona in 1995. Three elasmobranchs (white shark *Carcharodon carcharias*, basking shark *Cetorhinus maximus*, and giant devil ray *Mobula mobular*) are listed in Annex II of Endangered or threatened species, and should therefore receive full protection when the Convention is ratified. Annex III, Species whose exploitation is regulated, lists shortfin mako *Isurus oxyrinchus*, porbeagle *Lamna nasus*, blue shark *Prionace glauca*, white skate *Raja alba*, and angelshark *Squatina squatina*.

Several recommendations for the addition of elasmobranchs to the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats) have recently been received by the Convention Secretariat in the Council of Europe from Monaco. This state proposed six species of elasmobranch for addition to Appendix III (protected fauna) in 1996: *Isurus oxyrinchus, Lamna nasus, Mobula mobular, Prionace glauca, Raja alba* and *Squatina squatina*, and the basking shark *Cetorhinus maximus* for addition to Appendix II (Strictly protected fauna species) in the Mediterranean only. An additional proposal in 1997 recommended the giant devil ray *Mobula mobular* for addition to the more strictly protected list of Appendix II in the Mediterranean only.

The Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) recognises the need for countries to cooperate in the conservation of animals that migrate across national boundaries or between areas of national jurisdiction and the high seas, if an effective response to threats operating throughout a species' range is to be made. No elasmobranchs have yet been proposed for listing on this Convention, but such proposals are likely in the future. Marine species already covered by the Convention are seals and cetaceans.

Other international Conventions or Directives may, in the future, include elasmobranchs in their remit. For example, the European Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) is a major contribution by the European Community to the Biodiversity Convention agreed by more than 150 countries at the 1992 Rio Earth Summit. It does not list any elasmobranchs at the present time, but future revisions of the appendices may result in additions. An indication of this is that the UK Steering Group Biodiversity Report *Meeting the Rio Challenge* published in 1996 includes a list of some 1,250 species which are of conservation concern (the list is not considered to be comprehensive), including basking shark *Cetorhinus maximus*, tope *Galeorhinus galeus*, porbeagle *Lamna nasus* and blue shark *Prionace glauca*. The report notes that monitoring these species is important in establishing a review of the health of biodiversity in the UK, and should take place within five years.

## IUCN - The World Conservation Union

IUCN (the International Union for the Conservation of Nature and Natural Resources, usually known as the World Conservation Union) is the umbrella body for the world's conservation agencies and institutions. Its members comprise 74 sovereign states, 105 government agencies 640 non-governmental organisations and 32 affiliates.
IUCN has three basic conservation objectives:

- to secure the conservation of nature, and especially of biological diversity, as an essential foundation for the future;
- to ensure that where the earth's natural resources are used, this is done in a wise, equitable and sustainable way; and
- to guide the development of human communities towards ways of life that are both of good quality and in enduring harmony with other components of the biosphere.

### IUCN's Species Survival Commission (SSC)

The Species Survival Commission (SSC) is the largest and most active of IUCN's six volunteer Commissions. It was formed in 1949 to provide leadership to species conservation efforts. The SSC network encompasses nearly 7,000 scientists, field researchers, government officials and conservation leaders from 188 countries. SSC members provide technical and scientific counsel for conservation projects throughout the world, and serve as resources to governments, international conventions and conservation organisations.

The SSC's goal is to conserve biological diversity by developing and executing programmes to save, restore and wisely manage species and their habitats. To reach this goal the SSC:

- develops and promotes global conservation Action Plans which prioritise steps that must be taken to ensure the survival of selected species and habitats;
- provides technical information about biological diversity to international treaties, such as the treaty to regulate international trade in endangered species (CITES, see above); and
- formulates policy recommendations related to a variety of issues, such as sustainable use of wild species.

The SSC works primarily through its over 100 specialist groups.

**IUCN SSC Shark Specialist Group**

The Shark Specialist Group (SSG) was established by the SSC in 1991. It is intended to provide leadership for the conservation of threatened species and populations of all chondrichthyan fishes. It aims to ensure the healthy and continued diversity of this group through the promotion of sustainable use, wise management and conservation.

These aims will be achieved through determining the status and needs of the taxa and promoting the implementation of necessary research and management programmes; promoting the wise management and sustainable use of all taxa; and ensuring their conservation through the development of conservation strategies and the promotion of specific projects to be carried out by appropriate organisations and governments. Terms of Reference and a membership policy for the group are currently in preparation. However, SSG members are appointed by invitation only and must be actively involved in elasmobranch research and fisheries management, marine conservation and/or policy formulation.

The SSG produced a report in 1996 for the CITES Animals Committee (Anon 1996) to assist the Committee with the preparation of its report to the 10th CoP (see CITES above). Two other IUCN SSG publications are in preparation: a *Status Report on the chondrichthyan fishes*, and an *Action Plan for the conservation of chondrichthyan fishes*.

The Status Report will update and extend the 1996 *IUCN Red List of Threatened Species*, which included only 14 elasmobranchs. The purpose of the Red List is 'to highlight those species which are under higher risk from the biological and environmental factors which cause extinction and to focus on conservation measures designed to protect them'. The Red List has no specific legal status, but is frequently used by governments and other organisations as a guide to setting priorities for conservation. The initial Red List of elasmobranchs includes several North Atlantic species, including kitefin shark, basking shark and porbeagle.

**IUCN Marine and Coastal Programme**

The goal of the Marine and Coastal Programme (MCP) is to contribute towards conservation of marine biodiversity by promoting, influencing and catalysing sustainable uses and equitable sharing of the resources as well as protecting the ecosystems. MCP's objectives are:

- Develop and implement a focused Union-wide marine and coastal program.
- Establishment of active networks and partnerships for the implementation of the program as well as tapping and/or increasing capacity in marine conservation and management.
- Influence global debate and decisions concerning the conservation, management and sustainable use of marine and coastal resources.

The Programme is managed by a small Secretariat at IUCN's Head-quarters (HQ) working closely with other HQ thematic programmes (CNG), members, commissions and partners and forms part of the Ecosystems management group in IUCN HQ. Field activities are implemented through IUCN's Regional and Country Offices (RCOs).

Specialist Networks include:

- IUCN Marine Advisory Group
- WCPA Network for Marine Protected Areas
- Commission on Ecosystem Management
- Coral Reef Initiative Network

- Joint Group of Experts on the Scientific Aspects for Marine Environmental Protection (GESAMP)
- SSC Marine species specialist groups

**TRAFFIC**

TRAFFIC is the wildlife trade monitoring programme of IUCN and the World Wide Fund for Nature (WWF). The TRAFFIC network carried out a global study of international trade in sharks and shark parts from early 1994 to the end of 1996. It published a single overview report (Rose, 1996) and a number of regional reports on this theme. A summary report on this global overview was prepared for the CITES Animals Committee to assist the Committee with the preparation of its report to the 10th Conference (see CITES above).

The report found that the trade in sharks and shark products is vast and increasing, with at least 125 countries involved, and new domestic and international markets emerging in recent years. It concludes that improved trade monitoring is clearly needed to assess the species composition of products in trade and to detect regional and world-wide trends in demand and supply. Even more pressing, however, are improvements in basic fisheries management, research and data collection.

**Food and Agriculture Organization of the United Nation (FAO)**

In response to the request for the collation of species-specific catch and trade data on sharks from the 9th CITES Conference of Parties (see above), the FAO agreed to collate data supplied by national reporting offices and by regional fishery commissions. The FAO studies were broadened to cover all elasmobranchs and include:

- commissioning a consultancy on the biological and trade data available on sharks;
- producing an FAO Global Species Catalogue for batoid fishes, and revising the Shark World Species Catalogue (Compagno 1984); and
- updating the Shark Utilization and Marketing Monograph issued in 1978.

The first of these activities will be completed in 1997 (and will including hiring consultants to undertake case studies of shark fisheries — a possible area of interest to ICES), but the others will take longer. FAO will also be setting up a database, as biological and trade data become available from the first of the above studies.

Because of the serious shortcomings of fishery and trade data on elasmobranchs, FAO recognise that it is unlikely that national fisheries statistical systems will be able, in the near future, to provide the level of detail needed for management. FAO also considers that the creation of treaty-based management bodies, as implemented for tuna fisheries, could be more difficult to achieve for elasmobranchs because of their lower economic importance. FAO therefore favour a more focused approach to elasmobranch management, based on the known biological characteristics of the species affecting their susceptibility to overfishing, combined with recent catch trends for the area or country involved (Ardill, 1996).

**International Commission for the Conservation of Atlantic Tunas (ICCAT)**

ICCAT established a Shark Working Group in 1995 and began to collect shark by-catch data from tuna fisheries, in response to the CITES Shark Resolution (Conf. 9.17). A primary objective of the Working Group is to improve the identification of shark species caught as by-catch in fisheries targeting tunas and tuna-like species. ICCAT has produced and distributed a shark data collection form to all of its contracting parties, in order to improve data collection.

Both organizations have agreeded to exchange data and biological information on elasmobranch fishes, and have collaborated very closely with each other since 1995. Observers have been sent by ICCAT to ICES study group meetings, and an ICES observer attended the ICCAT workshop.It may be beneficial to maintain closer links between the two organizations, and to exchange knowledge on elasmobranch fishes for the development of research.

## European Elasmobranch Association

The European Elasmobranch Association (EEA) was established in October 1996. It is a non-profit body comprised of an association of national organisations dedicated to the study and conservation of sharks and rays, and seeks to coordinate their activities internationally. Its objectives are to advance research, sustainable management, conservation and education throughout the region. The EEA will seek to address the following priorities:

- introducing effective management on a regional basis to regulate shark and ray fisheries and ensure their sustainability;
- reducing shark and ray by-catch in other fisheries;
- improving records of catches, landings and international trade;
- improving research effort on the biology of sharks and rays and the impacts of fisheries;
- improving management of threatened elasmobranch habitats; and
- providing information to the public and decision-makers.

The EEA will be establishing a scientific network, chaired by Dr Bernard Seret (France), to formulate its scientific policy and draw up specific research priorities within the areas listed above. The EEA is expected to develop collaborative research proposals for international funding and implementation. The recommendations of the ICES SGEF will likely be used by the EEA to help determine its priorities and development of research proposals.

## Center for Marine Conservation, Washington DC, USA

This non-governmental organisation has, in cooperation with TRAFFIC, prepared a document reviewing the scope and potential of existing international agreements and conventions relevant to management and trade in sharks (Weber and Fordham, 1997).

## WWF's Endangered Seas Campaign

Launched in 1995. Promotes the conservation and sustainable use of marine fisheries. Working to build the necessary political will world-wide to end chronic over-fishing, revitalise devastated fisheries, improve management regimes, and reduce the use of destructive gear and practices. The goal is to halt and reverse the effects of unsustainable fishing on marine fishes and the ocean ecosystems on which they depend. The campaign has three principle targets:

- to establish effective recovery plans for key threatened species - tunas, swordfish, marlins and sharks;
- to create powerful social and economic incentives for sustainable fishing;
- to reduce or eliminate the by-catch of marine wildlife in commercial fishing operations.

The centrepiece of the campaign is the Marine Stewardship Council, launched in 1996 and established in 1997 in partnership with Unilever. The MSC will harness market forces and consumer power in favour of sustainable fisheries through independent certification and ecolabelling of seafood products.

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## Identification guides

The need for greatly improved recording and reporting of elasmobranchs and their products at species level in landings, markets and trade is widely acknowledged. Several organisations have recognised that there are considerable problems with undertaking these activities because of the inadequate nature of keys for the identification of elasmobranch species, particularly after initial processing of the catch has taken place. As a result, at least one other organisation besides ICES is producing new keys and guides.

The Ocean Wildlife Campaign, a consortium of US non-governmental organisations with an interest in marine environmental issues, commissioned the preparation of a *Field Identification Guide to sharks and shark parts* from Dr L Compagno and Mr S Cook (the latter recently deceased) in late 1995. Field research for the preparation of this guide was carried out in a wide range of locations world-wide. It should be available in published form at end of 1997. The Identification Guide will include two page species accounts, including maps, photos and drawings (whole and parts) for at least 75 species of elasmobranchs that are commonly found in trade or are important in directed fisheries and bycatch.

A North American company *[details needed]* is also producing a series of fish identification guides in CD ROM form. The elasmobranch guide is in a fairly early stage of preparation, but will be previewed at the Annual meeting of the American Society of Ichthyologists and Herpetologists in Seattle, June 1997.

FAO is one of several organisations or research centres world-wide undertaking genetic studies to determine the factors permitting the identification of elasmobranch species. This should provide a valuable tool where body parts are not sufficiently large to permit identification. However, the cost and complexity of the procedures involved will limit the application to small samples for research or forensic purposes.

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Rose, D.A. 1996. *An Overview of World Trade in Sharks and Other Cartilaginous Fishes.* TRAFFIC International. 106 pp.

Weber, M. and Fordham, S. 1997. Managing shark fisheries: opportunities for international conservation. Center for Marine Conservation, Washington DC, USA.

**Recommendations of the CITES Animals Committee report *Biological and Trade Status of Sharks***

It is recommended that the Conference of the Parties endorse the following actions directed towards full implementation of Resolution Conf 9.17.

1. Improve methods to accurately identify, by species, record and report landings of sharks from directed fisheries and sharks taken as a bycatch of another fishery.

2. Parties which operate a shark fishery and/or trade in sharks and shark products should establish appropriate species-specific recording and reporting systems for all sharks that are landed as a directed catch or a bycatch.

3. In an effort to improve trade statistics of sharks and shark products, the Secretariat, in collaboration with FAO, should consult the World Customs Organisation to establish more specific headings within the standard 6-digit Customs tariff headings, adopted under the 'Harmonised System' tariff classification to discriminate between shark meat, fins, leather, cartilage and other products.

4. FAO should, as a matter of urgency, initiate a work program involving:
- the manner in which it requests members to record and report data on shark landings;
- a consultancy to design and undertake an inquiry on the availability of biological and trade data on sharks (commenced in 1996);
- update the Shark World Species Catalogue and the 1978 Shark Utilisation and Marketing Monograph, and
- finalise and publish the World Catalogue of Rajiformes.

5. FAO should transmit the results of the consultancy to the CITES Secretariat for circulation to and comment by the Parties to the Convention.

6. Parties which operate a shark fishery should initiate research and management efforts to:
- collect species-specific data on landings, discards and fishing effort;
- compile information on life-history and biological parameters such as growth rate, life span, sexual maturity, fecundity and stock-recruitment relationships of sharks taken in their fisheries;
- document the distribution of sharks by age, sex, seasonal movements and interactions between populations;
- reduce mortality of sharks captured incidentally in the course of other fishing activities, and [*sic.*]

7. Parties are encouraged to initiate management of shark fisheries at the national level and develop international/regional bodies to coordinate management of shark fisheries throughout the geographic range of species which are subject to exploitation in order to ensure that international trade is not detrimental to the long-term survival of shark populations.

8. The Conference of the Parties to the Convention should urge the FAO to encourage its member States that operate a shark fishery, or a fishery that takes sharks as a bycatch, to subscribe to and implement the principles and practices elaborated in:
i) the FAO Code of Conduct for Responsible Fisheries;
ii) the FAO Precautionary Approach to Fisheries, Part 1: Guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions; and
iii) the FAO Code of Practice for the Full Utilisation of Sharks.

9. FAO in collaboration with the CITES Secretariat and the CITES Animals Committee should convene a consultative meeting comprising FAO representatives, fisheries biologists/managers, intergovernmental fisheries organisations and non-government organisations with expertise on shark management to develop a program for further implementing Resolution Conf 9.17.

10. The Secretariat should communicate the relevant recommendations to FAO and other intergovernmental fisheries management and/or research organisations and establish liaison with these bodies to monitor implementation.

## APPENDIX 4

WHEN COMPLETE, PLEASE RETURN THIS LIST TO THE ICES SECRETARIAT

## STUDY GROUP ON ELASMOBRANCH FISHES

ICES, Headquarters, 26–30 May 1997

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