Demersal Fish Committee

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REPORT OF THE STUDY GROUP ON ELASMOBRANCH FISHES

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International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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1. INTRODUCTION

1.1 Participants

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Terms of reference

At the 1994 Statutory Meeting, ICES Resolution C.Res.1994/2:30 decided that a Study Group on Elasmobranch Fishes will be established under the chairmanship of Dr. H. da Silva (Portugal) and will meet at ICES Headquarters from 15-18 August 1995 to:

a) review the status of Elasmobranch stocks within the Northeast and Northwest Atlantic and, where possible, identify trends in biomass and recruitment;

b) identify the extent of the commercial and sport fisheries in which elasmobranchs are targeted or caught as by-catch and estimate the amount (biomass/numbers per size class) of elasmobranchs taken as catches and lost as discards;

c) describe/review the ecological role of elasmobranch species, their reproductive dynamics and predation of elasmobranchs by species or group of species;

d) coordinate techniques of age determination and age verification of elasmobranchs;

e) coordinate methods on modeling and assessment of elasmobranch stocks;

f) identify the development of compensatory mechanisms as a response to exploitation;

g) outline an action plan for attaining the goals set above;

report to the Demersal Fish Committee in 1995.

Findings from a), b) and c) will be made available to the Working Group on Ecosystem Effects of Fishing Activities.

2. BACKGROUND

Among marine fauna, elasmobranchs are one of the less well known groups, both in terms of their life histories and stock assessment. This fact seems to result from their low economical value and consequent low research priority in most fisheries laboratories. The only comparable group may have been the marine mammals. But, while this situation has changed drastically with respect to marine mammals, as conservation issues became increasingly important during the last decade, elasmobranchs have gained little attention, despite being a pivotal group in many fishery ecosystems, where they occupy a place at the top of the food-chain. Anderson (1990) stated that: "Public and governmental attitudes towards sharks, at least in most Western cultures, have not mandated conservation measures because of a lack of interest, low priority, perceived notions of inexhaustible shark resources, dislike for sharks, and so on". However, the catch of many elasmobranchs, in both direct fisheries or as by-catch from other fisheries, have increased, or even decreased under increasing fishing effort, to levels that raise doubts about their sustainability to exploitation (e.g. Holden, 1973; Holden, 1974; Holden, 1977; Compagno, 1990 and Anderson, 1990). As traditional stocks are declining, commercial interest in elasmobranchs has increased.

In recent years, as stock assessment has moved from single species approaches to the use of multispecies models, the importance of elasmobranchs in many fish communities has been ibelatedly recognized. In the NW Atlantic the populations of spiny dogfish and, to a lesser extent, skates have increased to historically high levels, apparently as a result of the highly selective fishing practiced by US fleets on Georges Bank fish stocks, selecting only larger-sized fish of mostly cod and flounders (Murawski and Idoine, 1989), thus making available more food for dogfish and skates.

The aforementioned case studies illustrate the significant role played by elasmobranchs in fish communities, and the importance of a balanced exploitation of the different species that compose those communities. However, it also demonstrates the 'slowly but steadily' strategy exhibited by elasmobranchs, which begins to explain their aptitude in occupying an originating niche and their potential extinction under direct or indirect antropogenic pressure. As typical K-strategists, elasmobranchs are slow-growing, reach sexual maturity late in life and produce relatively few young after extended reproductive cycles. The success of most populations is the result of a combination of these features with another characteristic: long life. So, if the life span of an elasmobranch fish population is shortened, as it is the case under exploitation, their endurance will depend on the populations potential plasticity (e.g., growing faster, reaching maturity earlier in life, increasing the production of young, or combinations of these). Some populations exhibit yet other characteristics that make them even more vulnerable to exploitation, such as the aggregation by single-sex schools, or external morphological characteristics which can make even juveniles susceptible to trawls and nets.

Collecting biological information relevant to stock assessment and management of elasmobranch populations is in most cases a difficult task. In some cases, like deep-dwelling species, it seems impossible to do ageing at the moment. Elasmobranchs lack the calcified structures, such as scales and otoliths, commonly used for ageing teleosts. Even when dorsal spines are present, or vertebral centra are well calcified, traditional and contemporary methods of age validation are often difficult. Another piece of information which is critical as input for the application of most stock assessment techniques is the length at 50% maturity. Maturity scales for elasmobranchs differ significantly from those for teleosts and there seems to be little agreement between those scales. Moreover, the classification is very time consuming. The sexual dimorphism in size exhibited by elasmobranchs requires that biological information be collected for sexes separated.

Additionally, limitations on data gathering makes the direct application of many fish stock assessment methods difficult. This situation results from a lack of good catch and effort information and also because similar species are often pooled together in the national statistics. Production models may have to be applied for sexes separated, which would require that all the information on catch and effort be discriminated. This is also valid for the application of Virtual Population Analyses, which is limited in view of the difficulties in ageing elasmobranch fish populations.

This Study Group meeting follows an ICES meeting on elasmobranch fisheries held in 1989 (Anon., 1989). The 1994 ICES Study Group meeting on the biology and assessment of deep-sea fisheries resources has also provided some information on elasmobranchs (Anon., 1995). Meetings relevant to elasmobranch fishes are the annual meetings of the American Elasmobranch Society and the "Shark, Skate and Ray Workshop" (Earll and Fowler, 1994). Other international meetings include the "United States-Japan Workshop" (Pratt, Gruber and Taniuchi, 1990) and "Sharks Down Under Conference" (Woon and Pepperell, 1991).

3. SCOPE OF THE WORK OF THE STUDY GROUP

The Group decided to list those species which require information on either fisheries statistics, biology or status of exploitation. Thus, the list below includes both those species for which information is presented at some point in the report and those for which information should be collected in the future. The criteria used for the inclusion of a species in the list below were based on available information about the direct or indirect capture of those species by commercial or recreational fisheries, or the likely expansion of fisheries that catch those species. In considering which species to concentrate on, the Group considered that the following were the most important elasmobranchs in the Northeast and Northwest Atlantic:

ELASMOBRANCH SPECIES LIST (NE ATLANTIC)

Skates and rays	
Raja batis	Blue skate
Raja brachiura	Blond ray
Raja circularis	Sandy ray
Raja clavata	Thornback ray
Raja fullonica	Shagreen ray
Raja montagui	Spotted ray
Raja naevus	Cuckoo ray
Raja nidarosiensis	Norwegian skate
Raja oxyrinchus	Longnosed skate
Raja radiata	Starry ray
Sharks	
Coastal sharks	
Carcharhinus falciformis	Silky shark
Cetorhinus maximus	Basking shark
Galeorhinus galeus	Tope shark
Mustelus mustelus	Smoothhound
Mustelus asterias	Starry smoothhound
Scyliorhinus canicula	Small-spotted catshark
Scyliorhinus stellaris	Nursehound
Sphyrna lewini	Scalloped hammerhead
Sphyrna zygaena	Smooth hammerhead
Squalus acanthias	Spiny dogfish
Pelagic sharks	
Alopias vulpinus	Thresher
Alopias superciliosus	Bigeye thresher
Carcharhinus longimanus	Oceanic whitetip shark
Isurus oxyrinchus	Shortfin mako
Isurus paucus	Longfin mako
Lamna nasus	Porbeagle
Prionace glauca	Blue shark
Deep-dwelling sharks	
Apristurus spp.	Deep-water catsharks
Centrophorus granulosus	Gulper shark
Centrophorus squamosus	Leafscale gulper shark
Centroscillium fabricii	Black dogfish
Centroscymnus coelolepis	Portuguese dogfish
Centroscymnus crepidaper	Longnose velvet dogfish
Dalatias licha	Kitefin shark
Deania calcea	Birdbeak dogfish
Deania profundorum	Arrowhead dogfish
Etmopterus princeps	Great lanternshark
Etmopterus pusillus	Smooth lanternshark

Etmopterus spinax	Velvet belly
Galeus melastomus	Blackmouth catshark
Heptranchias perlo	Sevengill shark
Hexanchus griseus	Sixgill shark
Odontaspis ferox	Smalltooth sand tiger
Scymnodon ringens	Knifetooth dogfish
Somniosus microcephalus	Greenland shark
Somniosus rostratus	Little sleeper shark

ELASMOBRANCH SPECIES LIST (NW ATLANTIC)

Skates and rays

Raja eglanteria	Clearnose skate
Raja erinacea	Little skate
Raja garmany	Leopard skate
Raja laevis	Brandoor skate
Raja ocellata	Winter skate
Raja radiata	Starry ray/Thorny skate
Raja senta	Smoothtailed skate

Sharks

Coastal sharks

Carcharias taurus	Sand tiger shark
Carcharhinus acronotus	Blacknose shark
Carcharhinus altimus	Bignose shark
Carcharhinus brevipinna	Spinner shark
Carcharhinus falciformis	Silky shark
Carcharhinus isodon	Fine-tooth shark
Carcharhinus leucas	Bull shark
Carcharhinus limbatus	Blacktip shark
Carcharhinus obscurus	Dusky shark
Carcharhinus perezi	Coral reef shark
Carcharhinus plumbeus	Sandbar shark
Carcharhinus porosus	Smalltail shark
Carcharhinus signatus	Night shark
Carcharodon carcharias	White shark
Cetorhinus maximus	Basking shark
Galeocerdo cuvier	Tiger shark
Ginglymostoma cirratum	Nurse shark
Mustelus canis	Dusky Smoothhound
Negaprion brevirostirs	Lemon shark
Odontaspis noronhai	Bigeye sand tiger shark
Rhincodon typus	Whale shark
Rhizoprionodon porosus	Caribbean sharpnose shark
Rhizoprionodon terraenovae	Atlantic sharpnos shark
Sphyrna lewini	Scalloped hammerhead
Sphyrna mokarran	Great hammerhead
Sphyrna tiburo	Bonnethead shark
Sphyrna zygaena	Smooth hammerhead
Squatina dumeril	Atlantic angel shark
Squalus acanthias	Spiny dogfish

Pelagic sharks

Alopias vulpinus	Thresher
Alopias superciliosus	Bigeye thresher
Carcharhinus longimanus	Oceanic whitetip shark
Isurus oxyrinchus	Shortfin mako
Isurus paucus	Longfin mako
Lamna nasus	Porbeagle
Prionace glauca	Blue shark

Deep-dwelling sharks

Centrophorus granulosus	Gulper shark
Centrophorus squamosus	Leafscale gulper shark
Heptranchias perlo	Sevengill shark
Hexanchus griseus	Bluntnose sixgill shark
Hexanchus vitulus	Bigeyed sixgill shark
Odontaspis ferox	Smalltooth sand tiger

Skates and rays, given their homogeneity, were all amalgamated, but sharks were classified according to their habitat preferences. This classification is somewhat improper for some species that may occupy different habitats at different life-stages. Coastal species inhabit nearshore areas and the continental shelves. Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Deep-dwelling species inhabit the dark, cold waters of the continental slopes and deeper waters of the open oceans, and include most cat sharks and gulper sharks.

4. DESCRIPTION OF THE FISHERIES

4.1 Northeast Atlantic

4.1.1 Denmark

[The following information was provided to the SG by Morten Vinther]

Landings of spiny dogfish peaked at nearly 1500 t in 1988 and decreased ever after to just above 200 t in 1994 (Table 4.1.1.1). These decreasing landing figures may be a result of a better control in the most recent years. Previously, other species were illegally landed as "spiny dogfish" to avoid problems with quota restrictions. Information on landings of porbeagle are also provided (Table 4.1.1.2). The landings of "other sharks" were about 5 t/year and the landings of "rays and skates" were about 50-100 t/year. "Rays and skates are also taken as by-catch in the industrial fisheries. Annual by-catch, mainly of starry ray, were about 100 t in the period.

With respect to discards some figures have been estimated. For the North Sea, 1989-91, the annual discards of starry ray have been estimated to be 708 t for bottom trawl and 658 t for Danish seiners (EC study contract 92/3508 report, "Discards of fish species of low or very little economic interest", Henrik Jensen and David Emslie, 1994). For the gillnet fisheries in the North Sea, the discards of starry rays have been estimated at 232 t during 1993 for the fisheries targeting cod or turbot (EC study contract PEM/93/01 report, "Investigation of the North Sea gillnet fisheries, Morten Vinther, 1995).

4.1.2 France

French catches of elasmobranch fishes are particularly varied; about 20 species of sharks, skates and rays are present in the commercial landings amounting to a total of 20000 tonnes in 1993 (Table 4.1.2.1). These landings have been decreasing over the last 15 years (40000 tonnes in 1981). Most species are benthic or demersal and 85% of catches are landed by trawlers. There is only a little longlining activity in the Celtic Sea and the Channel from Cherbourg and Britanny. The most abundant species of sharks are *Scyliorhinus canicula* (4441 tonnes, 21.5 %) and *Squalus acanthias* (1760 tonnes, 8.5 %); the most abundant species of rays are *Raja naevus* (2936 tonnes, 14.2 %) and *Raja clavata* (1531 tonnes, 7.4 %; from a working paper presented to the Study Group). Two species, *Lamna nasus* and *Prionace glauca* are pelagic and are caught by the longlining fleet and with pelagic nets. *Lamna nasus* is more especially fished by longliners in the Bay of Biscay and the Celtic Sea; this activity is decreasing (640 tonnes). *Prionace glauca* is landed by the tuna fleet with pelagic gillnets (187 tonnes), longliners and coastal trawlers. The discards in the gillnet tuna fishery are important and have been evaluated at about 400 tonnes during 1993. There are few fishing vessels specialising in catching elasmobranchs; most of the landings come from the entire fishing fleet. About 80% of the landings are producted by the artisanal fleet (<30 m long).

The French fisheries are working in Eastern North Atlantic from Faroes up to the Azores. Elasmobranchs are present on all fishing grounds, but 75 % of the catches come the Irish Sea (VIIa), the Channel (VIId-e), the Celtic Sea (VIIf-j) and the North Bay of Biscay (VIIIa-b). The production from the North Sea is only 338 tonnes (1993) for all species together (Tables 4.1.2.2-4.1.2.17).

In the statistics, the species are often mixed. Concerning the most abundant species, there are two categories really mono specific: *Squalus acanthias* and *Raja naevus.* For other categories there are several species together (e.g. *R.clavata, R. clavata, R.brachyura, R.montagui*) and some species are present in two categories (e.g. *R. batis* in "pocheteaux gris" for large specimens and "pocheteaux noirs" average and small specimens.

Since 1990-91 the large trawlers (> 30 m long) have extended their fishing grounds down the slope along the slope of continental shelf to the west of the British Isles between 800 and 1200 m. The target species are *Molva dypterygia, Coryphaenoides rupestris* and *Aphanopus carbo.* Deep water skarks total 7 % of their catches. About 15 species are currently caught, but only two have commercial importance ; *Centrophorus squamosus* 54 % of total "sharks" and *Centroscymnus coelolepis* (45 %). All species of deep water sharks are sorted in the same category , SIKI.

4.1.3 Germany

There has never been a directed fishery for elasmobranchs in Germany, including the period after WW II when the FRG and GDR were separated.

Elasmobranchs were only taken as bycatch mainly by bottom trawls and were either discarded at sea, or processed for fishmeal on board of factory trawlers. Only few selected species have been landed regularly, or at certain times for human consumption: e.g., a few skate species (*Raja* spp.)from the North Sea for local consumers at the coastline, regularly Spiny Dogfish (*S. acanthias*) for processing in a traditional way by smoking its belly lobes (so-called "Schiller's locks") and body fillets, also sold fresh (so-called "sea eel"), and finally Porbeagle (*L. nasus*) being processed for shark steaks.

Skates were always very marginal and offered on local markets mainly. Porbeagle became an occasional bycatch, partly due to its declined abundance, partly due to the much reduced German fishing effort because of reduced fleet capacity especially for distant trawler fisheries. Landings of Spiny Dogfish from the North Sea declined mainly beause of its obviously reduced abundance, and market demands, which are steady or increasing rather, are satisfied by imports even from overseas.

More recently, when deep trawling for deep-water species became more regular, including midwater trawling for oceanic redfish (*S. mentella*), limited numbers of deep-water sharks (various species of squaloids mainly) were also taken and either discarded, processed for fishmeal, or landed in other European countries, where used for human consumption.

Sport fishery for elasmobranchs is on very small scale and carried out only in the southern North Sea, especially around the island of Helgoland. Species taken in limited numbers are *S. canicula*, *S. acanthias* and *G. galeus*, plus occasionally *M. mustelus* and skates *Raja* spp.

The only steady, or even increasing demand on the German market is that for Spiny Dogfish (smoked) and shark steaks (usually sold frozen), and imports play the major role in serving the market but not intensified German fishing effort. For shark steaks, primarily subtropical/tropical carcharhinid sharks are imported frozen and processed further in Germany or other EU countries; imports of Porbeagle and Mako play a moderate role only.

4.1.4 Netherlands

The Dutch fleet is composed primarily of beam trawlers which take elasmobranchs as bycatch. The major fishing effort takes place in an area 30-50 miles wide along the Dutch, German and Danish coast, outside the 12 mile zone and outside the plaice box. Data on the landings of elasmobranchs are separated into two categories: rays and sharks (Table 4.1.4.1 and Figure 4.1.4.1). Until 1970 skates were also noted as a separate category. Landings of rays from all ports have increased since about 1973. A similar trend was seen in the port of Den Helder, for which separate data are available. The major species landed were *Raja clavata* and *Raja montagui.* Landings of shark species have decreased since 1975/76, although the landings at Den Helder increased until the early 1980's, after which a decline was seen. The major species landed was *Squalus acanthias,* most of which was exported. Porbeagles (*Lamna nasus*) were occasionally landed.

Sharks and rays are also taken incidentally in the recreational fisheries. The most commonly caught species (20-30 individuals per year) is the stingray *Dasyatis pastinaca* which is present in the estuaries in Zeeland in quite high numbers in the summer.

Summary of information on Dutch elasmobranch fisheries

Status of commercial landings, bycatch and discards:

* Dutch fleet primarily beam trawlers;
* most of Dutch fishing effort carried out in IVc and IVb;
* rays, skates and 'sharks' bycatch; thornback and spotted rays landed, spurdog prime shark species (export to other European countries; educative purposes)
* figure of landings all fish markets (1930-1983) and Den Helder 1968-1994;
* no information on discards.

Information on sport fishing:

* catches of sharks and rays (see below);
* probably no more than 100 individuals caught per year;
* no central registration of catches.

4.1.5 Norway

Spiny dogfish (*Squalus acanthias*)

After WW II, Norway's spurdog fishery grew fast and culminated in 1961 with a record catch of 31,479 tonnes. The catch in the two following years came close, before it gradually declined and in 1986 was down to the level of 1946 (both just under 3,000 tonnes).

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 showed that the spurdog migrated between these two areas, and this component was called the "Scottish-Norwegian stock".

Scientists, both in the U.K. and Norway, found that this stock was overexploited and urged for restrictions. Except for a minimum length of 70 cm in Norway (for commercial reasons), nothing further was imposed.

The situation may have looked even more serious than it was. Later research found that in addition to heavy exploitation on the traditional fishing grounds, there was a change in the spurdog's migration pattern in the years when Norway's fishery was at its peak. Instead of swimming to the coast of 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.

In the late 1980s, a spurdog fishery developed in the fjords and coastal waters of Nord-Troendelag (ca. 65° N), carried out by smaller local vessels, mainly with gillnets. This led to a temporary increase in landings. After a minor peak, 9634 tonnes in 1991 and most of it from this northern area, the trend goes down again. In recent years, only a few larger auto-line vessels have fished seasonally for spurdog.

Porbeagle(*Lamna nasus*)

Norway's porbeagle fishery expanded in the early 1930s and reached a peak in 1933 (3884 tonnes). Mean catch of the decade was ca. 2400 tonnes.

Landings in the early 1940s were low but rose to 2824 tonnes in 1947. Since then the trend has pointed downward for the fishery in European waters. Today the fishery is of little significance.

For a few years in the 1960s, a fleet of Norwegian longliners exploited porbeagle resources in the NW Atlantic.

Basking shark (Cetorhinus maximus)

Basking sharks were taken for the liver oil only, but in recent years the fins have also been sold. The oil price has been low lately, and if there had not been a demand for the fins, the fishery would probably have stopped.

The varying landings over the years do not give a true picture of the availability of fish. The market situation has sometimes led to stop in the fishery for periods of the season.

The basking shark is caught with harpoon, and the fishery is dependent on fairly calm weather. Recently gillnets have been tried.

In the 1960s and 1970s more than 30 vessels would participate in the fishery for the whole or part of the season (April-September). In recent years only a few vessels take part.

The fishery has taken place along the coast from the Skagerrak to the Barents Sea, in the northern North Sea and in Hebridean and Irish waters.

Skates and rays

Most of the catch, possibly all, is by-catch in other fisheries. Main areas are the northern North Sea, the area west of Scotland and the Skagerrak.

The catch is probably considerably higher than the recorded landings that in recent years seldom have exceeded 1000 tonnes.

Greenland sharks *(Somniosus microcephalus)*

Commercial fishery for the Greenland shark ended in 1960. The fish was taken for the liver oil only, and there was no longer a profitable market.

Most of the catch came from the Arctic region. Fishery was often combined with sealing. There was also a fishery in fjords and coastal waters.

In the early 1970s a subsidized fishery was carried out in some areas in western Norway to reduce a growing stock that had become a problem for other fisheries.

Sport fishing for Greenland shark has gained popularity in recent years.

4.1.6 Portugal

4.1.6.1 Mainland Portugal

Demersal fisheries

In mainland Portugal, skates and rays are landed from artisanal fisheries, mostly from demersal longliners. Landings of skates and rays from these fisheries have ranged between 1000 and 2300 t during 1986-93 (Table 4.1.6.1). Landings from coastal trawlers come next with landings ranging between 350 and 600 t during the same period. Skates (*Raja spp)* have not been separated by species in the national statistics. There are no direct fisheries for skates.

Sharks are also caught from the fisheries mentioned above. Catches of sharks from those fisheries are mostly represented by the small-spotted catshark and the tope (Table 4.1.6.2). To a lesser extent, the smoothhounds (*Mustelus spp)* are also caught. Shark landings from artisanal fisheries ranged between 800 and 1100 t during 1986-90, while those from coastal and offshore trawlers ranged between 250 and 500 t. The apparent decreased landings during 1990-1993 is simply due to the fact that these species started to be separated at a species level on the statistics.

Black skabbardfish fishery

[Extracted from a report of the Study Group on the biology and assessment of deep-sea fisheries resources (Anon. 1995)]

The deep-water species, black scabbardfish (*Aphanopus carbo)*, supports an important fishery in Portuguese continental waters. The fishery involves a fleet of small longliners fishing at a confined deep area off Sesimbra (in front of Cape Espichel - lat. 38°20'N). The fishing area ranges in depth from 1000 to 1600 m. Gulper shark constitutes an important by-catch species from this fishery very often becoming the target species itself.

Crustacean trawlers

Sharks are also caught off the Portuguese continental coast by trawlers conducting a traditional fishery for crustaceans. This fishery involves about 36 vessels of low engine power fishing mainly over the continental slope down to 600/650 m depth off the south and southwest coast of Portugal. Several species are caught from this fishery, including catsharks (*Scyliohinus canicula* and *Gleus melastomus*), gulper shark, birdbeak dogfish, kitefin shark, smooth lanternshark and velvet belly (Table 4.1.6.3).

4.1.6.2 Azores

Kitefin shark fisheries

The only direct fishery for sharks in the Azores is that for the kitefin shark. By-catches of other species from this fishery are insignificant. Both gillnets and handlines are used, the former catching mostly males and the latter females. Catch and effort data exist for years since 1972. The landings peaked in 1981 with 950 t and decreased ever since then to 309 t in 1994 (Table 4.1.6.4). Two major factors were responsible for this decrease in landings. The high level of exploitation of the resource, on one hand, and the market fluctuations in the value of the oils extracted from their livers, on the other. Apart from the value of those oils, which contain high levels of squalene, the flesh is also marketed after a preparation that includes salting and drying.

Large pelagics

Large pelagic sharks are caught as by-catch from the swordfish fishery that occurs in the area. Longliners are used in this fishery. The major shark species caught are blue shark and the shortfin mako (Table 4.1.6.5). Other species include the porbeagle, thresher and bigeye thresher sharks, hammerheads and the tope shark. Landings of blue sharks peaked at 170 t during 1992 and never exceeded 14 t for makos. Landings of other species were 3 t or less during the period 1987-1993. Discards of blue sharks are not quantified but certainly high.

Demersal fishery

The demersal longline fishery is responsible for catches of tope shark as well as thornback ray. Some other species of skates and rays are caught in negligible quantities. Discards are high for both species and the landings peaked at 115 t for the tope in 1994 and 55 t for rays. Deep-dwelling species are caught occasionally as a result of the fact that the fishery extends down to 550-600 m at present. These species include the birdbeak and arrowhead dogfish as well as the smooth lanternshark and the velvet belly and are almost fully discarded.

[This information has been summarized from Spanish Fisheries in Deep Water by Iglesias, S. and Paz, J. - contribution to Advanced Research Workshop on Deep Water Fisheries of the North Atlantic Oceanic Slope (in press)].

4.1.7 Spain

Deep-water sharks

a) ICES Sub-area VII.

A fishery for a number of species of deep-water sharks started in 1991 in ICES Sub-area VII. A number of longliners which had traditionally fished for hake in this area, following problems in maintaining profitability and with the advent of a market for the livers of these sharks for the production of oils, began to fish for sharks in waters of depths greater than 1,000 metres.

In Galicia (Northwest of Spain) the landings are made principally in the port of La Coruña. The sharks captured are a mixture of the species *Somniosus rostratus, Deanis calceus, Centrophorus granulosus, Centroscymnus coelolepis* and others. Their livers (one third to one fifth of the total body weight and of which approximately 70 to 80% of the liver weight can be extracted as oil) are the major commercial item giving rise to their capture. On occasions only the liver is retained and the remainder of the fish is discarded.

In 1991 the quantity of all deep-water sharks landed (skinned and gutted) in north Galicia was 180 t while the corresponding quantity for 1992 was 340 t, and for 1993 the catches were 234 t of sharks and 29 t of *Phycis* spp.

The annual catch rate in 1993 was 5 t/trip and no seasonal variation was observed.

b) Continental slope off Cantabrica (ICES Sub-area VIIIc).

A fishery for sharks has also developed to a limited degree on the continental slope off Cantabria in the north and northeast of Spain (ICES Division VIIIc). Fishing for sharks occurs when the traditional target species, hake and red sea bream, are lacking. The highest catches and prices occur in winter.

This fishery is conducted by vessels of 20 to 75 GRT which must be included in an official list of vessels to gain access to this fishery. The bigger vessels tend to target *Mora moro* and *Phycis blennoides* when fishing for deep-water species but sharks are also caught. The gear consists of a single longline with about 4,000 large hooks which is fished at depths of 400 to 700 metres.

In 1992, 17 vessels from Asturian and Cantabrian ports were participating in this fishery discharging 340 tonnes of sharks composed of the species *Scyliorhinus canicula, Galeus melastomus, Centrophorus spp, Etmopterus spp, Dalatias licha, Deania calcea.* In 1993 10 vessels discharged 452 tonnes.

In both of the above-mentioned fisheries, the current practice of skinning those individuals which are landed and/or retaining on board only the livers and discarding the rest of the fish makes it difficult or impossible to obtain accurate statistics of landings or catch by species.

4.1.8 United Kingdom and Ireland

Commercial fisheries

Only spurdog and rays (as a group) are presently being directly exploited in commercial fisheries around the British Isles. Spurdog are taken on baited 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 become sporadic. A spurdog gill-net fishery has developed along the west coast of Ireland from 1977 and catches reached a peak in 1986/87. Rays are increasingly targeted using tangle nets inshore throughout the English Channel, in the Bristol Channel and the Irish Sea, and with monkfish and turbot offshore in the Celtic Sea. There is little fixed netting off the Scottish coast due to a ban on the use or carriage of monofilament gear within the 6-mile zone.

The greater proportion of the landings of dogfish and ray species arises as a by-catch in towed demersal gears, more usually in otter trawls and seines aimed principally at whitefish, though the Irish fleet have a seasonally directed trawl fishery for *R. montagui, R. brachyura, R. clavata* and *R. naevus* off the east and south-east coasts. Catch statistics for the distinguished groups of elasmobranchs landed by Scottish vessels from 1960 to 1994 are given in Table 4.1.8.1, and for English and Welsh vessels from 1981 to 1994 in Table 4.1.8.2.

Landings data for skate and rays as a group by English and Welsh commercial vessels fishing in all sea areas around the British Isles are available as 5-year means from 1950 to 1990 (MAFF, unpub. data). These show a sustained decline in all areas between 1950 and 1975. Subsequently, landings have continued to decline in the northern North Sea and to the west of Scotland, but have tended to increase in areas to the south.

Landings of sharks from waters along the shelf edge and in the Celtic Sea have increased since the late 1980s due to the activity of the Anglo-Spanish fleet and the advent of tuna drift-netting by a few Cornish and Irish boats.

Basking sharks were netted and harpooned from 1947 to 1975 around Achill Island on the west coast of Ireland, though ring nets and static nets alone were used between 1951 and 1972 at Achill, and harpoons were used in 1973-75 off the south-east coast. The fishery peaked in 1951-55, when over one thousand sharks were taken annually. A small harpoon fishery for basking shark centred in the Minch and Clyde off the west coast of Scotland took place from 1946 to 1953, when less than 300 fish were taken between May and October each year. From 1983, a single boat targeted basking shark when they were available in the Clyde and northern Irish Sea, but this fishery has now ceased. These fisheries have been characterised by wide variations in abundance and occurrence from year to year.

UK recreational fisheries: rod and line only

Blue shark and some porbeagle are caught on dedicated charter trips around Cornwall and to the south and west of Ireland. Common skate are caught off the west coast of Scotland and rays are caught all round these coasts, especially in the southern North Sea and Irish Sea. Tope and smooth hound are caught in the various large estuaries around the southern coasts of the British Isles.

4.1.9 Other countries - Belgium, Iceland, Ireland and Spain

Data were taken from the ICES Fisheries Statistics for these countries as there were no country representatives. The data were collected from 1938-1993 and are shown in Tables 4.1.9.1-4.1.9.2 and Figures 4.1.9.1-4.1.9.2. Porbeagle, Greenland shark, shagreen ray and common skate were reported by Iceland in the last 2-12 years. The catches of Greenland shark have fluctuated, showing a low in 1988. Porbeagle was only caught sporadically, as was the shagreen ray. Landings of the common skate were several hundred tonnes.

There were no data from Iceland or Ireland for dogs & hounds and there were no data from Spain for 'Squalus', whilst the data for rays and skates were incomplete. For Iceland there were no data other than for rays and skates before 1966; and for Ireland before 1975. Between 1948 and 1953, the Spanish data for rays and skates included dogfish. The primary fishing areas were as follows:

* Belgium: 'Squalus' in IVb,c; dogs & hounds and rays & skates in IVc, VIIa,f,g-k; 1938/1939 also VIII; during 1950's, relatively less in area VII;
* Iceland: Va; little change over time;
* Ireland: 'Squalus' in VIa, VIIb,c; rays & skates inVIa, VIIa,b,c,f,g-k ; little change over time;
* Spain: VIII, IXa, X (in last decades); in 1947-1950 around 30-40% of landings were not reported.

4.2 Northwest Atlantic

4.2.1 Canada

Until recently, Canadian landings of elasmobranchs have been small and were generally a result of by-catches in fisheries directed for other species. Following the recent collapse of a number of traditional ground fish stocks in Atlantic Canada, exploratory fisheries have been initiated for several elasmobranch species.

Of the pelagic sharks, only the porbeagle shark was subject to a directed fishery in the past. This species was targeted by a foreign fishery and was heavily exploited during the 1960s. Landings declined rapidly in the mid- to late 1960s and remained low through the 1970s and 1980s. Canadian landings of pelagic sharks (predominantly porbeagle, shortfin mako and blue sharks) were less than 100t until 1990, and were taken as by-catches, primarily in the pelagic longline fishery for swordfish. A directed Canadian fishery for porbeagle sharks began in 1991 and landings increased from 300t to 1545t in 1994. During the same period, landings of shortfin mako and blue sharks also increased and totaled 372t in 1994. These resources have been under a fisheries management plan since 1994 to control the development of the fishery. The directed fishery is considered exploratory while data are gathered to determine the status of these resources. Significant by-catches of pelagic sharks occur in the pelagic longline fisheries for tuna and swordfish (both domestic and foreign) in Canadian Atlantic waters; however the extent of these by-catches and the mortality that results are presently unknown. A sport fishery for pelagic sharks is also developing.

Historically there has been only limited interest in fishing for skates in Atlantic Canada. Most of the reported catches have been by foreign fleets; Canadian catches have traditionally been incidental to catches of other groundfish species and skates were usually discarded. Reported catches of skates in the waters off Newfoundland increased significantly since 1985 (Table 4.2.1.1). Reported catches peak at almost 30000t in 1991; however there are some uncertainties concerning these levels due to suspected misreporting and to unquantified discarding. A directed Canadian fishery for skates in Newfoundland waters began in 1994. This fishery is managed under a TAC since 1995 (20% exploitation rate of average biomass survey index).

Data on incidental catches of skates on the Scotian Shelf exists since 1961 (Table 4.2.1.2) and estimates of by-catch of skates in directed groundfish fisheries are available also (Table 4.2.1.3). On the Scotian Shelf, a directed fishery for skates began in 1994. Precautionary measures have been taken for this fishery and a TAC (10% of estimated total skate biomass) for the eastern Scotian Shelf is in place while more information is gathered.

Spiny dogfish is the target of a small directed fishery in the Scotian Shelf and Bay of Fundy areas. Recent catch data are presented in Table 4.2.1.4. Landings from foreign fisheries on the Scotian Shelf peaked at around 20000t in 1978. Significant unquantified levels of discarding of dogfish are known to occur in a number of groundfish fisheries. Research vessel survey estimates suggest that abundance has been increasing since the late 1980's. The stock area is considered to be the entire NW Atlantic, and it is thought that the species undergoes large seasonal migrations. A directed fishery is also developing in the southern Gulf of St. Lawrence (Tables 4.2.1.5-4.2.1.10). Research data indicate an increase in the abundance of spiny dogfish in this area also in the last few years. There are no restrictions on the directed fishery at this time.

4.2.2 United States

Spiny dogfish

[The information hereby presented was extracted from a report made by Rago *et al.*, 1994]

Spiny dogfish is currently one of the most abundant demersal species in the Northwest Atlantic. While species that traditionally supported Northwest US fisheries have declined to record lows, spiny dogfish biomass has increased 4- to 5-fold since the late 1960s. In the last five years, landings have increased five-fold and are predominantly (>95%) mature females. Total landings peaked at about 26000 t in the mid 1970s owing to fishing by foreign fleets (Table 4.2.2.1). US commercial landings never exceeded 5000 t until 1981 and, from a level of about 4200 t in 1987, increased five times to over 22000 t in 1993. About 70% of the current landings are taken by sink gill nets, with most of the remainder by otter trawlers. Over 95% of the landings consist of mature females greater or equal to 80 cm in length. Recreational catches have also increased in recent years, but they only constitute about 8% of the total landings. Discards from other fisheries, particularly by otter trawlers targeting groundfish, contribute an unknown but substantial fraction of the total mortality. Minimum estimates suggested 25000 t of dogfish were discarded, of which 14000 t killed.

Skates

[The information hereby presented was extracted from a report made by T. Helser, 1995 and provided to the Group]

The principal commercial fishing method used to catch skates is otter trawling. Skates are frequently caught as bycatch during groundfishing operations and discarded. Recreational landings are insignificant. There are currently no regulations governing the harvesting of skates in US waters.

Landings of skates (all species combined) off the Northeast US were 8100 t in 1993, a 34% decrease from 12300 t landed in 1992 (Table 4.2.2.2). Skate landings peaked in 1969 at 9500 t, and declined quickly during the 1970s. Landings bottomed out at 500 t in 1981 and have since increased steadily, partially in response to the increased demand for lobster bait, and, more significantly, to the increased export market for skate wings. Wing landings are composed of winter and thorny skates, which are the two species currently known to be used for human consumption. Bait landings are primarily little skate.

Coastal sharks

[The information hereby presented was extracted from a "Report of the Atlantic Coastal Shark Fishery Analysis Review"]

Sharks of United States Atlantic coastal waters have been exploited for many years. The original fishery that began in 1936 for hides and livers (vitamin A) ceased in 1950. The recent fishery existed at a very low level until 1985 because the market value of and sport fishing interest in sharks was low. Due to successful food product marketing and increased sport fishing interest, exploitation increased dramatically after the first half of 1985 (Table 4.2.2.3). An intensive fishery has developed in both the Atlantic and Gulf of Mexico coastal waters Southern New England to Louisiana. The fishery provides shark meat to domestic markets and fins for export to Asian markets. It is the first large scale commercial shark fishery in the area in over four decades.

The southeastern United States directed coastal shark fleet employs longlines and gill nets from boats 20-120 feet in length, although most boats are about 40-55 feet. The majority of the longline catch is composed of sandbar, blacktip, bull, spinner, dusky, bignose, night, lemon, tiger, sand tiger, silky, scalloped hammerhead and great hammerhead sharks. Nurse and sand tiger sharks are also occasionally taken. Other species of smaller sharks including fine tooth, black nose, and Atlantic sharp nose are also caught, but the existing fishery targets the larger species.

Two distinctly different shark gill net fleets exist. A small boat fishery manually sets and retrieves nets in shallow coastal waters. A modern fleet with mechanized highly efficient gear fish on schools of sharks as they seasonally migrate along the coast. Fishermen using small boats from 18-22 feet in length operate in very shallow waters with one or two man crews. They often fish in estuaries. They usually fish during May through November when sharks are in the shallows pupping or are migrating through. They catch the same species as the longline fishermen the proportional composition of their catches reflects the shallow waters where they fish. Recent legislation in several states has stopped the use commercial gill nets in state waters, so these fishermen now attempt to fish in deeper waters beyond 3 miles from the shore where their nets are much less effective. The modern gill net fleet is composed of boats 36-55 feet in length. Hydraulic setting and retrieval machinery is employed as are spotter aircraft. Seven of these vessels directed their operations at blacktip sharks during 1991 off the Atlantic coast. These boats do not fish sharks year around, rather they opportunistically target peak concentrations of migrating schools close to shore in the spring and fall. Recently, legislation by several states has forced their operations, into deeper waters. These boats removed very large quantities of sharks from shallow, coastal waters and continued to do so this year (1992).

The number of boats targeting sharks increased rapidly until 1989, then decreased. After 1989 the larger vessels left the fishery until less than 100 remained in 1991. However, these and more boats entered in 1992 due to high fin prices and landings restrictions in other fisheries. The major ports for these vessels were Morehead City, North Carolina; Pot Orange on the Atlantic coast of Florida, and Madeira Beach on the Gulf of Mexico coast of Florida; and Bayou LaBatre, Alabama. Currently (1992), ports in Louisiana, the Atlantic coast of northern Florida, and north of North Carolina are becoming major landing points.

Recreational fisheries also exist for Atlantic sharks in the United States. Although landings are small and sporadic, there has been an increasing interest in shark sport fishing during the 1980s. Decreasing recreational catches, particularly in shark fishing tournaments in the southern United States, has prompted concern by the sport fishing community for the status of the resource. Several shark fishing tournaments no longer occur due to the absence of success by tournament entries in recent years.

4.3 Large pelagics in the Atlantic

4.3.1 Description of the fisheries

Several fisheries catch large pelagics including elasmobranchs in the North Atlantic Ocean. These include longliners (Canada, Japan, Taiwan, Portugal, Spain and USA), bait boats (France, Portugal and Spain), gillnets (France and USA), trolls (Canada, France and Spain), harpoons (Canada), and traps. Species lists of elasmobranchs caught by such fisheries are only available for some fisheries and countries (ICCAT 1994). It includes both coastal and pelagic species. It is hard to know which species are common in coastal areas due to the variety of species among fishery and countries, and limited information. Although information are also limited, pelagic species commonly report the following species: *Alopias superciliuosus, A. vulpinus, Isurus oxyrinchus, I. paucus, Lamna nasus, Carchrhinus falciformis, C. longimanus*, and *Prionace glauca*.

Citation

ICCAT Secretariat 1994: Summary of the survey of tuna fisheries by-catch, 1993., ICCAT Coll. Vol. Sci. Pap. XLII (2): 442-451.

4.3.2 Estimates of by-catches

The only published estimates of total by-catches of elasmobranchs in large-scale pelagic fisheries of the Atlantic is that of Bonfil (1994). According to him, the most important large-scale pelagic fisheries in the Atlantic Ocean are longline fisheries of Japan, Taiwan (Prov. of China), Korea and Spain. These fisheries target several species of tunids and billfishes, either with normal or deep longlines. Most of the incidental catches (by-catches) of elasmobranchs in these fisheries are poorly documented. However, Bonfil (1994) used available published information on catch rates of some of these fisheries in addition to total efforts, to arrive at a very rough estimate of the amount of elasmobranchs caught incidentally in these fisheries. His figures suggest by-catches during 1989 could have amounted, in the Japanese fishery to 643427 sharks (26322t) of which only 1052-15466 t might have actually died; in the Korean fishery to 190245 sharks (7783t) with about 97% discarded in unknown condition; and in the Spanish fisheries to 608000 sharks (6856t) with some 4134t discarded. For the Taiwanese fishery during 1990, he estimates by-catches of 864268 sharks (35357t) and suggests discards of approximately 34000t.

The above estimates apply to the total catches of sharks for the entire Atlantic Ocean. Detailed analysis by area was not possible due to data limitations. However, a large proportion of the effort in these fisheries take place in the southern Atlantic. Furthermore, such estimates are limited because they do not take account of the heterogeneous distribution of sharks in time and space, or the different selectivity of the two gears used in those fisheries (regular and deep longline). Differences in discard rates, survival of the different species, and the degree of finning of the sharks can strongly influence the above results (Bonfil 1994). Having mentioned this, these estimates serve as a first and rough approximation to a complex problem that should be further studied and documented.

5. STATUS OF THE STOCKS

5.1 Elasmobranch fisheries in the Northeast Atlantic

Landing data from ICES fisheries statistics was plotted to identify long-term trends in catch data. It appears that since the late 1970's catches in the North Sea have dropped for all elasmobranchs (Figures 5.1.1-5.1.3). Catches of picked dogfish (*Squalus acanthias*) and Dogs & Hounds (Squalidae and Scyliorhinidae) increased in the late 1970's in the Irish Sea, Bristol and English Channels following a period in which little was caught. Catches of skates and rays (*Raja* spp.) were variable in most of the areas. Looking at all areas, it appears that declines occurred in the 1960's for all categories, and again in the late 1980's. This last decline is possibly partly due to the fact that not all countries reported data, for example Spain, which took catches of several thousand tonnes.

5.2 *Raja* species in the North Sea

Data collected in the North Sea by the International Bottom Trawl Survey, MAFF Surveys and the August North Sea Ground Fish Survey agrees quite well for *Raja clavata*, showing sporadic peaks in abundance, but a generally stable level of relative abundance (Figure 5.2.1). For the cuckoo ray, *R. naevus* and the spotted ray, *R. montagui* there is general agreement of data, except in the last three years. However, this could be due to the change in gear used in the Britsh survey in 1991, leading to lower catchability of these two species.

Transect data from along the Dutch coast show that virtually no rays were caught in this area between 1958 and 1994. Before 1958 the most common species was the thornback ray.

The sedentary behaviour of most ray species makes them vulnerable to local exploitation. Continued exploitation in an area where the numbers have declined, will make it difficult for rays to recolonise an area, both because of the lack of egg-laying females and the low success rates of immigration of juveniles. This is possibly the case in the Irish Sea for the common skate, which has disappered from this area.

It is difficult to ascertain the status of the stocks of rajids in the North Sea with the present data.

5.3 *Raja* species in the Celtic Sea and Bay of Biscay

A study of the cuckoo ray in the Celtic Sea and northern Bay of Biscay indicated that this ray is the most important among those caught in the area. A decrease in catches from trawlers from 10 to just over 6 kg/hour was observed over the period 1985-1992 (Figure 5.3.1). An analysis of yield per recruit showed that a level of fishing effort close to the maximum was attained at the end of the period (Figure 5.3.2). However, care should be used in the interpretation of these results given that effort is not directed towards the cuckoo ray, but rather to monkfish and megrim.

Survey data from UK vessels in the Celtic Sea did not show a similar decline in CPUE (Figure 5.3.3). The relative abundance of the cuckoo ray did not appear to change over time.

5.4 Other *Raja* species

It was not possible to discern any trends for the five other ray species (*R. batis, R. barchyura, R. clavata, R. fullonica* and *R. montagui*) caught during UK surveys in the Celtic Sea (Figure 5.4.4).

5.5 Basking shark in the North Sea

In response to pressure to enhance the protected species status of basking shark in the 1980s, Kunzlik (1988) reviewed catch data and information on its biology, distribution and fishery. The basking shark is widely distributed in the north-east Atlantic and, in most cases, the fishery takes place opportunistically whenever the sharks are available in shallow water (netting) or near the surface (harpooning). There are also strong market forces related to the relative value of shark liver oil, the availability of alternative source - such as from Spanish and Portuguese catches of Kitefin and gulper sharks - and the price paid for fins, which may be sufficient to enable the fishery to be viable. Fluctuations in the fishery and its catches do not, therefore, necessarily reflect the changes in abundance of the basking shark population, both locally nor as a whole.

Whilst there is evidence in the fishery data of apparent rapid declines in 'local populations', the high variability in catchability, seasonally and from year to year, and the fluctuations in fishing effort do not allow firm conclusions on the species' status to be made. There is a lack of biological knowledge on basking sharks, on age structure and stock identity, and it is unlikely that assessments of population size or mortality rates can be carried out with the available data. It may be useful to examine the factors which are associated with their seasonal occurrence in coastal waters in temperate latitudes, in order to distinguish these effects from real population trends.

5.6 Blue shark

CPUE data are available from recreational rod-and-line fisheries around the coasts of Ireland and south west England. Vas (1995) states that annual catches in the latter fishery rose rapidly to over 6000 sharks in 1960-61, declined to between 2 and 4 thousand until 1975 and then below 300 until 1988, when catches rose to around 500 during 1990-94. The Irish fishery has taken a relatively stable annual catch of around 500 blue shark each year since 1978, during which time catch per boat day has varied between 1.34 and 4.18, with no discernible trend. These fish are part of a very extensive North Atlantic stock, the distribution of which is affected by environmental conditions and co-incidentally by the distribution of its pelagic prey species. It might be argued, therefore, that trends in local CPUE cannot be used to infer abundance changes or stock status, and that catch trends elsewhere (eg in tuna line and gill-net fisheries) are also important. An examination of size frequency distributions in these fisheries (sharks over 34 kg in England and 45 kg in Ireland are recorded as specimen fish) shows no apparent decrease in the proportion of large fish, though they were relatively more frequent in the Irish fishery than around SW England during the early 1970s. As with basking shark, an examination of the influence of environmental factors on blue shark distribution might help elucidate population trends.

5.7 Spiny dogfish

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 (Div. IV) and to the west of Scotland (Div. Via), and are illustrated in Figure 5.7.1 (SOAFD, unpub. data). These series suggest that the population in the North Sea increased in abundance between 1967 and 1977, when it is thought that there was a migration of Spring dogfish into the North 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, but the latter series also shows a second peak in 1985-88, which was not seen in the North Sea data. These cannot be checked with survey data, but the total landings in area VI do not show large peaks. Commercial CPUE data for English and Welsh Vessels in the Irish Sea indicate a peak in abundance between 1982 and 1985 (Figure 5.7.2).

Two series of survey data (IBTS and English August groundfish survey) for the North Sea show peaks in relative abundance, 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, actually corresponding to a high peak in the Kattegat/Skagerak (IBTS Survey). CPUE from the English Celtic sea survey (1982-95) show wide fluctuations and no dicernable trends.

The discrepancies in the survey data series are probably due to sampling efficiency and catchability of the species. Spiny dogfish is known to be a fast swimmer, migrating several hundred kilometers, and, although the catchability of the fish is unquantified for bottom trawls, it can be assumed that the half hour hauls used in research surveys will not take a representative sample of the stock present.

It appears, therefore, that spiny dogfish abundance might fluctuate widely in a particular sea area, irrespective of the overall stock trends, and that short time series (ie less than 15-20 years) are not useful for indicating the stock status of such a mobile species.

5.8 Spiny dogfish in Norway

Scientists, both in the UK and Norway, found that this stock was overexploited and urged for restrictions. Except for a minimum length of 70 cm in Norway (for commercial reasons), nothing further was imposed. The situation may have seem even more serious than it was. Later, research found that in addition to heavy exploitation on the traditional fishing grounds, there was a change in the spurdog's migration pattern in the years when Norway's fishery was at its peak. Instead of swimming to the coast of 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.

5.9 Kitefin shark in the Azores

Fox's exponential surplus yield model was applied to catch and effort data from the azorean kitefin shark fishery over the period 1977-1986 (Silva, 1987). Given the sexual dimorphism in size of this species and the different size selectivity of the fishing gears used in the area, the model was applied to males and females separately, as well as to both sexes together. MSY for sexes together was estimated to be 933 t/year and the corresponding effort estimated to be 294 standard units. For males, 666 t/year, close to the maximum observed landings during 1981, and 283 units were obtained for MSY and f_{MSY}. The status of the stock needs to be further investigated.

5.10 Skates in the Northwest Atlantic

Survey abundance indices for all species of skates combined are expressed as minimum population estimates from area-swept calculations, smoothed to better reflect resource trends. Over the time series from 1968 to 1994, smoothed survey indices for skates reveal three distinct trends (Figure 5.10.1). A slight decline in abundance occurred from 1968 to 1979, when a series low of 81000 t was observed. Since 1980, the survey index has increased significantly, reaching its highest point in the time series, 151000 t, in 1987. Since 1987, the smoothed abundance index has again declined somewhat, although values have remained well above the long term (1968-1992) average of 112000 t.

Recent increases in skate landings and the potential for rapidly expanding export markets bring into question the level at which sustainable fisheries for these species can be maintained. Skates have a limited reproductive capacity, and stock size could be quickly reduced through intensive exploitation. In areas of the world where skates are more fully utilized, their numbers have been reduced to extremely low levels (e.g., Irish Sea). Similarly, particularly vulnerable species in the Northwest Atlantic (e.g., barndoor skate) appear to show signs of recruitment overfishing. The abundance of winter skate has declined in recent years on Georges Bank.

5.11 Spiny dogfish in the Northwest Atlantic

A biomass dynamics model was applied to this stock (Brodziak *et al.*, 1994). Estimates of total stock biomass (all individuals) during 1968-93 and recruited biomass (individuals > 80 cm in length) during 1980-93 were calculated based upon observed catches, an estimate of natural mortality, and a biomass production function. Fishing mortality was estimated at 0.022 to 0.021 during the first period and 0.012 to 0.044 for recruits, during the second period. The corresponding biomasses (thousand tons) were estimated at 234-1090 and 480-524.

A life-history type of model, incorporating density-dependent submodels for growth, fecundity and recruitment, was developed to simulate changes in the reproductive dynamics of the Northwest Atlantic stock of spiny dogfish (Silva 1993, 1994). It was developed as a model of understanding and 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 early-1970s. These changes later resulted in increased mean size at maturity, and subsequent fecundity. It was suggested that the population, if undisturbed by fishing or new levels of competition, would fluctuate around a new stable equilibrium approached during the mid- to late 1980s.

A further transformation and development of the life-history model and combination with an Yield per Recruit sub-model, resulted in an estimated fishing mortality of 0.26 on fully recruited females in 1993, as compared with 0.04 based on the biomass dynamics model refered above (Rago et al., 1994). With a F of 0.26 and assuming a minimum length at entry into the fishery of 84 cm, the estimated number of pups per recruit was about 1, and the corresponding yield less than 0.05 Kg (Figure 5.11.1). Maximum yield per recruit (0.55) was estimated at an F of about 0.07 and a minimum size of 67 cm. Yield per recruit dereases with increasing minimum sizes, owing to the very slow growth rate at these ages. However, since reproduction in females occurs primarily in animals ≥ 80 cm, fishing mortality rates in excess of 0.1 on those animals results in negative female pup replacement.

5.12 Status of the stocks in Canada

Pelagic sharks (Porbeagle, Shortfin Mako and Blue)

There are uncertainties concerning the stock area of each of these species. Landings data are incomplete. The biology of each species is not well understood. There are no indices of stock abundance available at present. Given the limited information available, it is not possible to estimate the status of these resources.

Skates

The biomass indices from survey cruises in Newfoundland and Scotian shelf have shown various degrees of decline since 1986 for the first case and since 1976 for the second case. Most of these changes in abundance are attributable to thorny skate declines. The declines in thorny skate abundance in areas NAFO 3LN are correlated with declines in mean size and with a smaller size at maturity than in area 3OPs. Data from thorny skates suggests that these populations are sedentary, with limited movements in the region, and that this species can reach at least 20y of age.

6. THE ECOLOGICAL ROLE OF ELASMOBRANCH FISH - PREDATION AND COMPETITION

There are around 870 species of elasmobranchs, which occupy most ecological niches (Compagno, 1990). Species range from sedentary benthic rays through filter feeding rays and sharks to fast swimming pelagic sharks. There are also a small number of freshwater rays. All species are carnivorous and have well-developed sensory organs for the location of their particular prey. Although the smaller species and juvenile individuals are likely to be preyed on by larger elasmobranchs, it is likely that there are no natural predators for the larger species, except man. In some species segregation by size or sex occurs within a population, which it has been suggested may be a way of avoiding cannibalism on young or small individuals.

The ecological role of elasmobranchs, as understood by the Study Group on Elasmobranch Fish, concerns their potential impact as a predator and/or food competitor with other (commercial) species. In order to determine the nature of these interactions and to quantify their levels, information is required on the following:

* abundance of elasmobranch species, in relation to potential prey and competitors;
* distribution of elasmobranch species, ditto;
* rate of change of populations, in relation to environmental change and prey variability;

* feeding behaviour; dietary range and preference (inferred from stomach analyses);
* availability of prey species.

Few studies have been published on the feeding habits of elasmobranchs, in relation to predation on commercial species (Bouwman, 1984; Daan *et al.*, 1993; Ellis *et al.*, 1995). Daan *et al.* (1993) observed that the length at which Raja species in the North Sea switch from benthic feeding to piscivory is species specific. Raja naevus switches at 15 cm, Raja radiata at 25cm, Raja montagui at 50 cm and Raja clavata at 80 cm. The conclusion of these authors was that Raja radiata will probably have the highest impact on commercial teleost species as it is the most abundant ray species in the North Sea (comprising approximately 80% of the rajid biomass). In contrast, Ellis *et al.* (1995) recorded very little predation by 10 elasmobranch species on commercial species in the Irish Sea.

Murawski & Idoine (1990) discussed the apparent replacement of cod and flounders by dogfish and skates on Georges Bank, following the selective removal of the former by fisheries, and considered that this was related to the dietary overlap between cod and dogfish and between flounder and skate (Grosslein *et al.*, 1980 in Murawski & Idoine, 1990).

As well as actively catching prey, many elasmobranchs are also scavengers and may, therefore, be beneficiaries of high levels of discarding by commercial fleets. For example up to 14% of the stomach content of Raja radiata larger than 61 cm was composed of fish offal (Templeman, 1984).

7. REPRODUCTIVE DYNAMICS

After some revision of the available information on this topic the SG considered that there is insufficient knowledge about reproductive dynamics of elasmobranchs on a species by species basis. Many studies on elasmobranch reproduction have often been based on oportunistic observations in the field and many aspects of elasmobranch reproductive dynamics are still uncertain. The number of studies focused on shark or ray reproduction is very small. Consequently, many key aspects of elasmobranch reproduction such as the total duration of the reproductive cycle, exact age/lenght at first maturity, and even the number of offspring per female remain uncertain. Furthermore, most of these studies provide reproductive parameters only for single stocks, consequently geographical variation in reproduction is poorly understood. There is a strong need for more directed investigation in the reproductive dynamics of elasmobranch stocks. Some general comments and information from the best studied elasmobranch follow.

Elasmobranchs are considered K-strategists, which are characterized by slow development, late maturity, small reproductive investment, few young, and long life (Pianka, 1970; Stearns, 1976). However, the flat growth curves exhibited by many elasmobranchs once they have riched maturity suggest that their reproductive investment is actually high. Indeed, this is the form of the growth curve for most small pelagic fish species (Ni, 1978). Unlike small pelagic species, elasmobranchs allocate energy to quality (large size) rather than quantity of offspring, consequently increasing the survival rate of the young fish. Thus, mortality, which plays a trade-off with reproduction and growth (Stearns, 1976; Stearns and Crandall, 1981), is reduced. This reduced mortality is evidenced by the high longevity and iteroparity exhibited by elasmobranchs (Hoenig and Gruber, 1990; Anderson, 1990).

7.1 Fecundity

Reproductive dynamics are better understood for the spiny dogfish than most other elasmobranchs. Holden (1974) compared the fecundity of the Scottish-Norwegian stock (5.78 eggs/female) with the fecundity estimates given by Templeman for the Northwest Atlantic stock (4.20 eggs/female), and suggested that the differences could reflect a response by the European stock to decreased abundance caused by fishing. Compensatory increases in the fecundity of the Scottish-Norwegian stock of spiny dogfish were later reported to be 42% (Gauld, 1979).

Fecundity studie of spiny dogfish in British Columbia waters showed much smaller changes with an increase from 6.2 (Ketchen, 1972) to 7.3 embryos per breeding female (Jones and Geen, 1977). When compared with earlier estimates of 7.3 embryos per female from the 1940s (Bonham et al., 1949), these changes are probably of little significance. However, the Northeast Pacific population, contrary to the Scottish-Norwegian stock, was subject to a very high level of exploitation during the 1940s, which was later reduced by at least 90% (Wood *et al.*, 1979).

Changes in fecundity were also detected in the Northwest Atlantic population. Fecundity increased until 1976/1978. In 1980-1981 a general decrease was observed, followed by an increase again in 1985-1986. Then fecundity decreased to 1991, when it reached a level generally lower than the 1961 level. Mean fecundities and abundance were negatively correlated, whereas positive correlations were detected between fecundity and mean mature female weight (Silva and Ross, 1993 and 1993).

7.2 Length and age at maturity

Another important reproductive parameter with implications for lifetime fecundity is the length (and/or age) at 50% maturity. In the Northeast Pacific, Bonham *et al.* (1949) estimated that the length at 50% female maturity was 92 cm for the spiny dogfish, which is close to the estimate of 93.5 cm reported by Ketchen (1972). The length at 50% maturity of 82 cm reported for females of the Scottish-Norwegian stock by Holden and Meadows (1964) is also similar to the 83 cm reported 15 years later by Gauld (1979). Fifty-percent maturity estimates from Southwest Ireland over a lag of 60 years show a small decrease from 75-80 cm reported by Hickling (1930) to 74 cm reported by Fahy (1989*b*).

Analyses of female size at 50% maturity in the Northwest Atlantic showed that maturity in 1942 was achieved at a length close to the one in 1980-1981 (80.9 and 80.6 cm, respectively). Then, size at maturity increased to 85.9 cm in 1985-1986 and decreased after to 82.2 and 84.1 cm in 1987-1988 and 1991, respectively (Silva and Ross, 1993; Silva, 1993). This author argued that these changes in size at maturity should not represent a direct density-dependent mechanism. More likely, both variables were correlated with growth, the increasing growth rate of the juveniles during 1968 to 1979 (Silva, 1992 and 1993) resulting in increased size at maturity. Male size at maturity showed a similar trend to the one observed in the changes in female size at maturity.

Not much is known about the strategy of these species concerning changes in length *vs* age at maturity but the aforementioned studies on the Northwest Atlantic population of spiny dogfish have given indications of a possible strategy of maturing at a fixed age, thus length being the varying parameter.

7.3 Sex-ratio

No studies have been identified addressing the impact of changes in sex-ratio on population fertilities. The abundance of females is usually taken as the limiting factor. It is, however, logical that male abundance could also influence fertility given the fact that this group of fish exhibits internal fertility.

7.4 Methodological considerations

Changes in the methodologies used in the analyses of either length at 50% maturity or fecundity may mask the existence of compensatory changes in these parameters, the underlying relationships between them, and between these parameters and growth.

Several problems are associated with looking for changes in fecundity though. A simple comparison of mean fecundities for pooled size-classes will often be meaningless since larger-sized fish will tend to have a higher fecundity than smaller-sized fish. On the other hand, regressing fecundity on fish length, as usually done on teleosts, is not advisable since the variance associated with fecundity estimates in elasmobranchs is high. Unless size-classes are grouped in the analyses, changes will either remain undetected or spurious changes will be perceived. Fecundity is usually analyzed by grouping samples by embryo size. If these sizes are not consistently chosen through time, any differences that may be detected will be hard to interpret. Fecundity may change with sampling site, as a result of the existence of sub-populations and one should carefully fix this variable when analyzing changes in another variable, like time or indices of abundance. Finally, one of the difficulties with fecundity estimations results from the high frequency of abortions and this should also be carefully considered during an analysis of changes in fecundity.

One of the difficulties in analyzing the reproductive dynamics of an elasmobranch fish population results from the different criteria used by each author for the establishment of a maturity scale. In view of this fact, a proposal is made for a standardised method for reporting maturity stages for elasmobranchs (Appendix 1) which could be considered for adoption as a reporting standard.

Clasper lengths increase rapidly at maturity (Ford, 1921). The logistic model describing the relationship between proportion mature and body length can be changed to incorporate clasper length instead of proportion mature (Silva and Ross, 1993; Silva, 1993). Though two extra parameters are incorporated, making it harder to fit the model, the model can be used as either a validation tool or as an alternative to the individual classification of fish as mature or immature on the basis of the inspection of the gonads, usually very time-consuming and imprecise.

8. TECHNIQUES FOR AGE DETERMINATION AND VERIFICATION IN ELASMOBRANCHS

Age determination in elasmobranchs, both from tropical and temperate waters, has been based mainly on the reading and interpretation of growth marks (opaque/hyaline bands) on hard structures, namely vertebrae and spines. However, given the diversity of elasmobranchs, there is no particular technique that can be universally applied for their age determination. In particular, the most effective method of processing the structure, the staining technique, and the area of the hard structure where the rings are counted, can vary from species to species. Furthermore, for a few species, poorly calcified structures have defied all methodologies so far tested for age determination (Cailliet 1990).

The diversity of techniques applied for the enhancement and reading of growth marks on elasmobranch hard structures include direct reading without any enhancement, band enhancement with lead pencil, staining with various compounds (silver nitrate and red alizarin being the most frequently used), and x-radiography. Different enhancement techniques can be applied to alternate areas of the centra/spine: face of the centra, sectioned/thin slice of the centrum or spine (either whole or resine-embedded), and histologically prepared sections of centra or spines. The group considered that although an analysis of the advantages/disadvantages of each technique would be very useful, this would imply a literature review which falls outside the scope and time available to this meeting. Perhaps the task of undertaking such a review could be given to a small sub-group of participants prior to a second meeting.

According to Cailliet *et al.* (1986), verification of age, understood to be the process of confirming an age estimate by independent means, can be done in elasmobranchs by six types of methods: 1) size frequency analysis; 2) centrum or spine edge analysis, elemental composition analysis, or histological characteristics; 3) radiometric dating; 4) laboratory growth studies; 5) tag-recapture estimates of growth from the field; and 6) tetracycline marking. Back-calculation and growth model fitting are not considered as useful verification methods. These authors further define validation as the conclusion, after sufficient testing hypothesis about the temporal periodicity of band deposition, that the bands counted are deposited predictably.

The group agreed that, if age determinations in elasmobranchs are to be used as inputs to assessment and management models, these need to be fully validated. An additional requirement is that growth parameters derived from age determinations should be preferably based on studies including representative samples over the range of ages of the particular stock in question. Many of the studies published on elasmobranch age and growth suffer from some kind of bias or non-representativeness in their samples.

9. MODELING AND ASSESSMENT

Most attempts at assessing elasmobranch stocks have been based on the application of production models. Examples include, applications to spiny dogfish in European waters (Aasen, 1964), to pelagic sharks in the Northwest Atlantic (Otto *et al.*, 1977; reviewed in Anderson, 1990a) and in the Gulf of Mexico (GMFMC, 1980; reviewed in Anderson, 1990a). This group of models is only useful to provide preliminary assessment information, given the lack of age-structure and the very crude way in which compensatory mechanisms are incorporated. Moreover, in the above examples it is implied that the populations were at equilibrium which, in most cases, was probably invalid. Applications of modified versions of these models included a study of the Northwest Atlantic sharks (Anderson, 1980), where the equilibrium conditions were approximated by averaging fishing effort over the number of years that a year class contributes significantly to the fishery, and a study of the kitefin shark in the Azores (Silva, 1987), which treated males and females both separately and in combination.

The work of Holden (1968) focused on the effect of fishing on the Scottish-Norwegian stock of spiny dogfish. His study examined the relationship between mean length at entry into the fishery and the instantaneous total mortality rate (Z) at constant recruitment. Holden (1974) 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. The first age-structured compensatory model developed for an elasmobranch population was provided by Wood *et al.* (1979), and applied to spiny dogfish in British Columbia waters. Recently, a generalized age-structured model was developed for elasmobranch populations and illustrated with applications to the sandbar shark, shortfin mako and blue shark (Fogarty *et al.*, 1989). This model allows the estimation of critical levels of net pup production, as a function of both median age of recruitment to the fishery and fishing mortality in populations exhibiting density-independent but age-dependent fecundity, maturity and mortality rates. An extension incorporating compensatory dynamics is also provided. Examples of the application of different models for the Northwest Atlantic population of spiny dogfish were considered above.

Several difficulties in assessing elasmobranch stocks were identified by the SG, and were considered to extend to most elasmobranchs; the first being the difficulty in obtaining catch information at a species level. Information on stock identity and stock delimitation comes next, this information being nounexistent for most elasmobranchs and of dubious value for a few others. It is also necessary to have a good knowledge of the fishery(ies) exploiting the stock. For many species, fisheries data have to be collected for the separate sexes, due to the dimorphism exhibited by most elasmobranchs and the selectivity associated with the fishing gears used. Also, in many fisheries which catch elasmobranchs through trawling, mortality due to discards is unquantified, although this problem applies also to many teleosts. However, mortality on discarded blue sharks, caught with longlines is known to be low (about 10% or less, Nakano, pers. comm.).

Since the assessment methods briefly described above have their own characteristics and different data requirements, as does the variability of data available in each case study, the Group decided that, rather than attempt to coordinate methods, it should recommend an evaluation of the models potentially applicable to elasmobranchs from those currently used for teleosts.

Age-based VPA

As long as the appropriate data are available, the method can be applied to elasmobranchs. However, ageing of elasmobranchs is difficult and particularly time consuming. Even when ageing information is available, the data are seldom validated, and VPA is known to be sensitive to errors in the catch at age input matrices. Errors in adult age readings may not be so important if the growth curve is flat for adults, i.e., if growth in length is close to zero in the mature components of the stock. The method could be applied with some success for fishing mortality estimation by taking larger fish as a plus-group. This would, however, require that the exploitation rate is lower at ages smaller than that of the plus-group. Nevertheless, since elasmobranchs are long-lived species, a long time series of data is required for a robust analysis.

Length cohort analysis

The method is applicable so long as the length frequency samples can be assumed to represent the whole population (many populations tend to be patchily distributed, by size and sex, which may make the method non-applicable) and, for many populations, data collected for sexes. The method will also require discernible year-class modes, which are seldom observed in large-sized fish, or some prior knowledge of the growth parameters, which implies some ability to age the fish.

Stock biomass estimates from egg surveys

The method is not applicable. However, in populations where there is a knowledge of the nursery areas and the fecundity relationship, surveys on early juveniles could be used as a means to estimate Spawning Stock Biomass. The method will also require information on fertility.

Stock biomass estimates from acoustic surveys

The SG doubted its applicability due to elasmobranchs lacking gas bladder and bony skeleton, and consequently having a low target strength, and because many species have a benthic behavior.

Stock biomass estimates from fishing surveys

This method could have an application for some demersal species. Other devices should be attempted in such surveys to adjust to the specificities of the target species. Longline surveys could be attempted for coastal pelagic species that distribute over restricted areas, although it might pose some extra difficulties as a result of being a passive gear. Also, there are problems with variances associated with estimates of abundance as a result of the long time required for one single set. The same limitations would apply to gillnets, although in this case the difficulty resulting from the "bait attraction power" would not be invoked. The method could be very usefull to detect trends in relative abundance, mostly when trawls can be used. Nevertheless, in many elasmobranch species, difficulties would result from their patchy distribution. Also, problems with the small area usually covered by surveys directed towards teleosts.

Production models

These have been attempted for some species. The method can be used, but non-equilibrium models should be chosen due to the long life usually exhibited by this group of fish. 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, although this also applies to many teleosts. One characteristic of elasmobranchs that makes the application of the method more suited than to teleosts, is their deterministic stock/recruitment relationship. This enables incorporation of compensation in production models, although this is treated as a 'black box'.

Other models

In the face of the many difficulties posed by elasmobranchs for the application of the classic methods discussed above, the SG suggests that other methods should be implemented and tried on elasmobranch populations. Simulation models have recently been applied to elasmobranchs. Where some preliminary biological information is available, these models can be helpful in either providing advice in the early stages of management, or simply in gaining understanding of the dynamics of the population under study. It is also suggested that bioeconomic models should be attempted in some of these populations. Observed changes in catches are often the result of changes in the market demands for elasmobranch fish products and the concomitant fluctuations in the value of those products. In other cases, it may be that the availability of higher value fish during a certain period may result in decreased effort directed towards species of lower value, such as elasmobranchs. These processes need to be understood in order to better interpret those changes.

Mark-recapture

This method could have an application for some species. There is probably no major problem with mortality due to tagging, compared with teleosts. For the method to be applicable for population size estimation, good estimations of the return rates are required or, at the very least, the errors on those estimates need to be consistent throughout the period of the experiment.

Depletion methods

For particularly sedentary species, and in certain areas where isolation can be assumed, it might be used for abundance estimation, and may provide estimates of catchability of survey gear which can be used with CPUE from a wider area to estimate abundance.

10. COMPENSATORY MECHANISMS

After a review of the available information for this topic, the Group could find only a few relevant studies. Some of these studies related to theoretical models and, consequently, give no evidence of the existence of or, how, these mechanisms act on elasmobranch populations. Some other studies were weakly supported. Given the importance of understanding the nature of these mechanisms the SG concluded that there is a big need for reviewing those few studies that were done and for the development of new ones.

Some of the room for compensation in fish populations derives from growth and reproduction and was already fully discussed above. Under this topic the Group decided to investigate compensatory mechanisms exhibited by fish populations by examining the stock-recruitment relationship.

Stock-recruitment models are of major importance in fisheries science because the response of fish populations to exploitation will be greatly influenced by the response in recruitment to different levels of spawning stock biomass. Some fishery models, like Yield-per-Recruit and Virtual Population Analysis do not require any assumptions about this relationship. Unlike VPA and Yield-per-Recruit analysis, production models imply different compensatory mechanisms and consequently different stock-recruitment relationships and/or compensatory changes in other life-history parameters. In any case, predicting the effect that changes in exploitation patterns will have upon future generations always requires that the life-cycle of the population under study is closed, i.e., that the stock-recruitment relationship is taken into account.

The study of the stock-recruitment relationship in numerous teleost fish species has posed several problems, namely the stochastic nature of these processes and the micro-time scale at which recruitment is determined. Factors like prey availability and predator abundance play an important role in these processes, but their impacts are usually difficult to describe.

Though little is known about the nature of recruitment in elasmobranch fish populations, their large size at birth, and consequent lower variability in mortality rates, should result in more deterministic processes than the processes observed in 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. However, the time scale at which these processes occur should be larger; e.g., while teleost fish larvae may die after a few days of starvation due to the temporal and (or) spatial availability of food (the "match-mismatch" hypothesis), a larger recently-born elasmobranch may survive under similar stresses for periods of weeks. However, Wood *et al.* (1979) did suggest that compensatory changes in natural mortality represent the principal factor determining the recruitment-stock relationship of British Columbia spiny dogfish. There is some evidence that the fecundity of some elasmobranch populations has changed in a compensatory way (Holden, 1977). Spiny dogfish fecundity in particular has been shown to increase with decreasing stock abundance. Gauld (1979) reported an increase in individual fecundity by 42% since the early 1960s (Holden and Meadows, 1964) in the Scottish-Norwegian population. An increase in fecundity of 78% was also reported for the Northwest Atlantic since the early 1940s (Templeman, 1944; Nammack, 1982; Silva and Ross, 1993). In any case, the plasticity of an elasmobranch population for changes in fecundity should be small. In ovoviviparous and viviparous species the size of the maternal body cavity sets an upper limit on compensation, but oviparous species will also be limited by the maximum possible rate of egg laying and the length of the spawning season (Holden, 1973).

All these factors made Holden (1973) suggest that changes in the biomass of mature females in elasmobranch populations should be followed by positively-correlated changes in recruitment, with the relationship influenced only slightly by compensatory mechanisms. Compensation will have great influence only if mortality plays an important role in determining the recruitment success in a given year. The compensatory mechanism could be strong if cannibalism of young by the mature stock exists but, for many species of elasmobranchs, there is segregation by size and/or sex, which reduces the likelihood of cannibalism.

The only stock-recruitment analysis that the Group has knowledge of refers to an application to the Northwest Atlantic population of spiny dogfish (Silva 1993 and 1993). This was a first analysis of stock-recruitment in an elasmobranch fish population, but its results suggested that recruitment in elasmobranchs is a much more predictable process than in most teleost fish species. Recruitment and mature stock biomass have been suggested to be closely linked, with changes in the mature stock followed by almost directly proportional changes in recruitment (i.e., there is very little room for compensation) though it has been fully recognized that some compensatory mechanisms must exist in order for these populations to survive in changing environments (Holden, 1974; Holden, 1977; Fogarty *et al.*, 1989). The results of that study indicated that the Northwest Atlantic population of spiny dogfish has compensatory mechanisms strong enough to inflect the stock-recruitment relationship. However, these results should not be extrapolated to other elasmobranchs, and other sharks in particular, since the spiny dogfish is known to be one of the few species that has sustained long-term exploitation.

11. RECOMMENDATIONS

Species identification in survey cruises

The Study Group recommends that skates and sharks (including deep-water sharks) should be identified to species level during all survey cruises. An identification sheet, for the most relevant skate and deep-water shark species, will be prepared by Dr M. Stehmann and sent to ICES for further distribution, in order to assist on the identification of those groups of species.

Species classification from commercial catches

In view of the relative importance of skates in the landing statistics of several nations, the Group recommends that the following should be identified to the species level: *Raja batis, Raja clavata, Raja montagui, Raja fullonica, Raja naevus* and *Raja oxyrinchus*. It is also recommended that the group included under the heading 'Hypotremata' should be excluded and that two other headings should be created instead: 'All other skates and Sting rays'. This identification should be extended to skates landed as 'wings'. In order to assist on the identification of those wings, an identification sheet will be prepared by Dr M. Stehmann and sent to ICES for further distribution to each country's Governmental Department/Office responsible for fisheries statistics.

Concerning classification of sharks, the Study Group recommends that two new headings should be adopted next to the heading that includes the large pelagics. One heading for 'All other large pelagics', as described under Scope of the work of the Study Group, and another one for '*Galeorhinus galeus*'. The Group further recommends that the heading 'Squalidae' should move up hierarchically, next to the 'Squalidae/Scyliorhinidae' (dogfishes and hounds), this heading becoming simply 'Scyliorhinidae'. Under 'Scyliorhinidae' should only exist one heading, '*Scyliorhinus canicula*', as under 'Squalidae'.

In view of the recent expansion of deep-water fisheries directed towards squalid sharks, and the increasing importance of landings of *Centrophorus squamosus* and *Centrophorus granulosus*, the Study Group also suggested that these become identified to the species. As these fisheries are likely to continue expanding it may be necessary to further review this group. This Group refers to the Deep-water Study Group for further revision, when needed.

Conversion factors

The Study Group reinstates the need to remind member countries to check the conversion factors used to raise species to live weight.

Discards

The Group recommends that the pattern of discarding of elasmobranchs from other fisheries is examined. The level of discards should then be quantified. Studies on discards and survival are also needed.

Stock identification

This Group refers to the Study Group on Stock Identification to take into account the need to include elasmobranchs in their remit.

Predation

The Study Group recommends that a Workshop should be held under ICES to look at availability of data and samples on stomach contents of elasmobranchs.

Aging

The Group recommends that a Workshop should be held under ICES to establish methodologies on age determination as well as validation and verification in elasmobranchs.

Assessment methods

The Study Group recommends that a case population for which there is a good data set should be used to attempt different methodological assessments as a way to test their validity in elasmobranch fish populations. The Group suggests that the Methodology Working Group look at this possibility.

Management advice

There is no quota allocation for elasmobranchs. As this is likely to be the basis for member states allocation of fishing effort, should this take place, it is important that the exploitation of elasmobranchs is also included in these control measures.

Should there be strong evidence of decreasing abundance in a fishery, particularly on those directed towards elasmobranchs, precautionary measures should be considered. These may take a form of direct catch or effort controls in a particular fishery, or may be technical conservation measures (e.g., minimum landing sizes, restrictions on a particular fishing gear or nursery areas).

Cooperation between ICES and ICCAT

The Study Group recommends that contact should be maintained between the two organizations, in view of the room for further cooperation. The possibility of data exchange, in addition to the exchange of ideas, was considered.

Future work of the Group

The Group recognized the need for future work and proposed that there should be a second meeting, sometime in 1997, to assemble and analyze data available on a few selected species. Time series of length frequencies (e.g., from cruise surveys) may be used to look at possible changes. Information on distribution of a few species is known to exist for several years and in some areas. This type of information can be useful as an aid to interpret apparent shifts in abundance. Mortality estimation and simple approaches to evaluate the status of exploitation of those selected species would also be used. The meeting could be organized on a case study basis, each species being used to illustrate the application of a particular analysis.

Until the next meeting, the Group recognized the need to maintain contact by correspondence. During that period, the availability of data should be fully investigated and its potential use evaluated.

12. ACTION PLAN

Given the restricted number of participants in this meeting and the possibility that a few more may join the Group, should the next meeting be approved, the Study Group decided to defer the preparation of a more detailed action plan to mid-1996.

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Table 4.1.1.1 Landings (tonnes) of spiny dogfish by Denmark

Year	Area			
	IV	IIIa	other	total
1985	320	841	1	1162
1986	359	388	1	748
1987	559	679	3	1241
1988	836	621	0	1457
1989	492	574	0	1066
1990	781	582	0	1363
1991	633	338	1	972
1992	457	338	5	800
1993	268	217	1	486
1994	143	67	1	211

Table 4.1.1.2 Landings (tonnes) of porbeagle by Denmark

Year	Area			
	IV	IIIa	other	total
1985	22	42	0	64
1986	40	51	1	92
1987	31	24	1	56
1988	22	10	0	32
1989	23	11	0	34
1990	29	10	0	39
1991	59	4	1	64
1992	70	10	0	80
1993	87	4	0	91
1994	92	2	0	94

Table 4.1.2.1 Landings from several fisheries in France for 1993.

	S.acanthias	*Scyliorhinus canicula*	*Scyliorhinus stellaris*	*Galeorhinus galeus*	*Mustelus sp*	*Lamna nasus*	*Centroscymnus* ++	*Prionace glauca*	*Alopias vulpinus*	Divers squales	*Raja batis* ++ (TG)	*Raja batis* ++ (G M P	*Raja clavata* ++	*Raja montagui* ++	*Raja naevus*	*Raja fullonica*	*Raja circularis*	*Raja undulata*	Divers raies	Divers pocheteaux	*Squatina squatina*	*Torpedo marmorata*	*Myliobatis aquila*	*Dasyatis pastinaca*	Divers elasmobranches	
Weight (in tonnes)																										
Gears																										**TOTAL**
Trawls	1232	3823	190	162	248	35	10	26	16	3431	251	334	1392	923	2915	77	418	0	2121	10	2	9	2	1	0	17628
Nets	19	303	13	23	17	110	0	187	3	10	7	36	100	134	7	1	4	0	122	0	1	8	1	0	0	1108
Longline	506	265	99	94	14	495	0	97	0	0	0	0	28	22	13	0	0	0	168	0	0	0	0	0	0	1803
divers	3	53	1	2	2	0	0	4	0	0	0	0	11	11	1	0	0	1	28	0	0	0	0	0	0	119
TOTAL	**1760**	**4445**	**304**	**281**	**281**	**640**	**10**	**314**	**19**	**3442**	**259**	**370**	**1531**	**1090**	**2936**	**78**	**422**	**1**	**2439**	**10**	**3**	**17**	**4**	**1**	**0**	**20659**
En % :																										
Gears																										**TOTAL**
Trawls	70.0	86.0	62.7	57.8	88.2	5.4	100.0	8.3	82.3	99.7	97.1	90.2	90.9	84.7	99.3	99.2	99.0	2.0	86.9	99.7	64.2	51.7	56.2	63.4	100.0	85.3
Nets	1.1	6.8	4.4	8.3	6.2	17.2	0.0	59.5	15.8	0.3	2.7	9.7	6.5	12.3	0.2	0.8	1.0	12.5	5.0	0.3	22.9	45.7	37.8	24.2	0.0	5.4
Longline	28.7	6.0	32.5	33.3	4.9	77.4	0.0	30.8	1.9	0.0	0.0	0.0	1.8	2.0	0.5	0.0	0.0	7.3	6.9	0.0	12.9	0.0	5.2	4.9	0.0	8.7
divers	0.2	1.2	0.4	0.6	0.7	0.0	0.0	1.4	0.0	0.0	0.2	0.1	0.7	1.0	0.0	0.0	0.0	78.2	1.2	0.0	0.0	2.6	0.9	7.5	0.0	0.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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Table 4.1.2.2 Landings from various fisheries in France for 1978

Weight (in tonnes)

Name	I	IIa	IIb	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias		43		1359	1765	221		79	1888	2	339	142	10	827	167	278	803	85	13	1	12								8034	29.6
Scyliorhinus sp/canicula				6	11	24			246		189	37	16	684	990	503	590	236	13		123	9							3677	13.5
Scyliorhinus stellaris														43	50	3													96	0.4
Galeorhinus galeus				1	1	30							205		298	19													554	2
Mustelus sp																						8							8	0
Lamna nasus											13			57	17	2	67	138	10		363	165	2						834	3.1
Prionace glauca															1							3							4	0
Alopias vulpinus																													0	0
various sharks				91		7			245		384	3	1	246	544	36	115	43			116	30							1861	6.9
R. batis + + +	43	14	1	44	5	7	0	5	153	6	2	1	0	521	166	7	4	2	0	0	2	0	0	0	0	0	0	0	983	3.6
Raja clavata														239	312						28	4							583	2.1
Raja montagui	1		2										76				10	1			4								94	0.3
Raja naevus																													0	0
R. fullonica + R.circularis																													0	0
various skates																													0	0
various rays				73	5	112		7	686	14	965	75	43	669	2335	663	945	2329	24		1424	30							10399	38.3
Squatina squatina									2		3				1	10	8				1								25	0.1
Torpedo marmorata																													0	0
Dasyatis pastinaca																					5								5	0
Myliobatis aquila																													0	0
TOTAL	44	57	3	1574	1787	401	0	91	3220	22	1895	258	351	3286	4881	1521	2542	2834	60	1	2078	249	2	0	0	0	0	0	27157	99.9
%	0.2	0.2	0	5.8	6.6	1.5	0	0.3	11.9	0.1	7	1	1.3	12.1	18	5.6	9.4	10.4	0.2	0	7.7	0.9	0	0	0	0	0	0	100.2	

Table 4.1.2.3 Landings from various fisheries in France for 1979

Weight (in tonnes)

Name	I	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	Total	%
Squalus acanthias		2	1141	1282	148		13	2115		620	493		309	593	568	1198	221	114		174	25							9016	28.6
Scyliorhinus sp/canicula			58	8	25			307		394	49		790	1739	267	915	768	8	1	284	8							5621	17.8
Scyliorhinus stellaris										12	1		316	65	9	36				41	1							481	1.5
Galeorhinus galeus			2		20			44		2	16		1375	378	77	44	140			236	1							2335	7.4
Mustelus sp					2								30	29							11							72	0.2
Lamna nasus					1			7			6		22	16	8	42	51	34		635	249	21						1092	3.5
Prionace glauca														2						10								12	0
Alopias vulpinus																												0	0
Cetorhinus maximus																				7								7	0
various sharks								16		9	4			158	12	9	15	1		63	22							309	1
R. batis	1	1	33	0	4	0	0	54	1	1	1	0	77	9	66	55	3	0	0	0	0	0	0	0	0	0	0	306	1
R. clavata +			24	4	58		10						432	1390	173					144	25							2260	7.2
Raja montagui										2				70	4	4												80	0.3
Raja naevus			10				1	80		12	8	3			109	138	43	26		49								479	1.5
R. fullonica +R. circularis																												0	0
various skates																												0	0
various rays			46				3	596		545	60	9	1109	1638	513	861	2315	81		1632								9408	29.9
Squatina squatina								4						1	8	6												19	0.1
Torpedo marmorata																												0	0
Dasyatis pastinaca																												0	0
Myliobatis aquila																												0	0
TOTAL	1	3	1314	1294	258	0	27	3223	1	1597	638	12	4460	6088	1814	3308	3556	264	1	3275	342	21	0	0	0	0	0	31497	100
%	0	0	4.2	4.1	0.8	0	0.1	10.2	0	5.1	2	0	14.2	19.3	5.8	10.5	11.3	0.8	0	10.4	1.1	0.1	0	0	0	0	0	100	

Table 4.1.2.4 Landings from various fisheries in France for 1980

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	Total	%
Squalus acanthias	2	1890	245	242		7	1456		1133	588	7	890	749	988	2643	262	174		242	40							11558	33.7
Scyliorhinus sp/canicula		43	9	19			459		386	85	11	1499	837	305	949	379	50		428	16							5475	16
Scyliorhinus stellaris												121	63	17													201	0.6
Galeorhinus galeus		7	3	28			52		10	3		1389	252	42	34	123	2		143								2088	6.1
Mustelus sp												224	46							10							280	0.8
Lamna nasus									7			27	49	14	22	49	39		401	288							896	2.6
Prionace glauca																2			6	4							12	0
Alopias vulpinus																											0	0
Various sharks		1		10			13		15	14			926	9	44	30	2		109	7							1180	3.4
Raja batis + +	1	27	0	0	0	0	24	0	19	6	1	0	8	32	55	73	8	0	4	0	0	0	0	0	0	0	258	0.8
Raja clavata+ R. brachyura			4	89								719	982	134					12	11							1951	5.7
Raja montagui																											0	0
Raja naevus							34			6	4		32	4	40	332	32		9								493	1.4
R. fullonica + R. circularis																											0	0
various rays		79					525		573	134	20	715	1534	726	1301	2439	129		1585	59	1						9820	28.7
various skates																											0	0
Squatina squatina									1				3	14	1				6								25	0.1
Torpedo marmorata																											0	0
Dasyatis pastinaca																				8							8	0
Myliobatis aquila									1										5	2							8	0
TOTAL	3	2047	261	388	0	7	2563	0	2145	836	43	5584	5481	2285	5089	3689	436	0	2950	445	1	0	0	0	0	0	34253	99.9
%	0	6	0.8	1.1	0	0	7.5	0	6.3	2.4	0.1	16.3	16	6.7	14.9	10.8	1.3	0	8.6	1.3	0	0	0	0	0	0	100.1	

Table 4.1.2.5 Landings from various fisheries in France for 1981

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb,c	VIId	VIIe	VIIf	VIIg,k	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	13	1587	857	188			1251		1153	779	179	1629	1335	4643	325	18							13957	35.2
Scyliorhinus sp/canicula											519	567			108	15							1209	3
Scyliorhinus stellaris																							0	0
Galeorhinus galeus									7		18	6			1								32	0.1
Mustelus sp									386		50				2	18							456	1.1
Lamna nasus				1			1		33	3	49	53	26	116	486								768	1.9
Prionace glauca									10														10	0
Alopias vulpinus																							0	0
various sharks		21	11	22			355	1	372	118	216	1129	26	300	328	14							2913	7.3
R. batis + +		0	0	0	0	0	0	0	0	0	61	477	0	0	0	0	0	0	0	0	0	0	538	1.4
Raja clavata											445	291			102	24							862	2.2
Raja montagui											2	10			13								25	0.1
Raja naevus	1																						1	0
R. fullonica + R. circularis																							0	0
various rays	12	1550	796	226		4	2318	4	1985	1120	2624	3170	856	2854	1342	29							18890	47.6
various skates												2	1	2									5	0
Squatina squatina															8								8	0
Torpedo marmorata																							0	0
Dasyatis pastinaca																							0	0
Myliobatis aquila																							0	0
TOTAL	26	3158	1664	437	0	4	3925	5	3946	2020	4163	7334	2244	7915	2715	118	0	0	0	0	0	0	39674	99.9
%	0.1	8	4.2	1.1	0	0	9.9	0	9.9	5.1	10.5	18.5	5.7	20	6.8	0.3	0	0	0	0	0	0	100.1	

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Table 4.1.2.6 Landings from various fisheries in France for 1982

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb,c	VIId	VIIe	VIIf	VIIg,k	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	1	834	62	94		3	1580	1	1238	405	146	1301	2568	3399	333	9							11974	36.9
Scyliorhinus sp/canicula		20	12	29			284	1	200	110	1459	2027	301	1360	514								6317	19.5
Scyliorhinus stellaris															1								1	0.0
Galeorhinus galeus		1	1	25			2		8	1	442	486	16	34	1								1017	3.1
Mustelus sp							1			1	222	2	1	6	14								247	0.8
Lamna nasus				1			1		1	1	52	45	6	8	85								200	0.6
Prionace glauca												1			9								10	0.0
Alopias vulpinus																							0	0.0
various sharks																							0	0.0
R. batis + + +	1	22	0	4	0	0	86	3	1	28	0	6	3	42	2	0	0	0	0	0	0	0	198	0.61
Raja clavata	109	19	3	58		1	134		129	56	760	897	297	323	207	12							3005	9.3
Raja montagui		1					16		8	1		30	8	52									116	0.4
Raja naevus		1					127		4	27		239	15	1110	120								1643	5.1
R. fullonica + R. circularis											1	164	8										173	0.5
various rays		24				2	364	5	475	91	542	1804	509	2264	1401								7481	23.1
various skates							14		1														15	0.0
Squatina squatina							1		2	1		3	5	6	3								21	0.1
Torpedo marmorata																							0	0.0
Dasyatis pastinaca																							0	0.0
Myliobatis aquila															6								6	0.0
TOTAL	111	922	78	211	0	6	2610	10	2067	722	3624	7005	3737	8604	2690	21	0	0	0	0	0	0	32418	100.0
%	0.3	2.8	0.2	0.7	0.0	0.0	8.1	0.0	6.4	2.2	11.2	21.6	11.5	26.5	8.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	

Table 4.1.2.7 Landings from various fisheries in France for 1983

Weight (in tonnes)

Names	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb,c	VIId	VIIe	VIIf	VIIg,k	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	2	1096	270	194		30	1910		1147	453	124	1407	1810	6073	290	32							14838	38.5
Scyliorhinus sp/canicula		33	12	31			382		196	96	1739	2247	307	1380	664	48							7135	18.5
Scyliorhinus stellaris											42	205	5										252	0.7
Galeorhinus galeus		6	1	19			16		4	2	832	584	27	115	63								1669	4.3
Mustelus sp							3			1	218	16	1	52	39	17							347	0.9
Lamna nasus				1			1		1		129	38	105	94	267	155							791	2.1
Prionace glauca												1			2	5							8	0
Alopias vulpinus																							0	0
various sharks		3					29		8	17		1	22	42	26	19							167	0.4
R. batis + +	1	39	0	12	0	0	37	0	0	12	0	3	3	35	1	0	0	0	0	0	0	0	143	0.4
R. clavata + R.brachyura	1	25	4	65		6	179		93	28	566	554	51	379	29	38							2018	5.2
Raja montagui		3					20		4	1		31	39	93	8								199	0.5
Raja naevus		41					350		52	43	63	265	117	1424	374	7							2736	7.1
R. fullonica+R. circularis		5					27	1	1	6		27	10	239	57								373	1
various rays		16					196	7	290	68	729	2197	424	2074	1605	81							7687	20
various skates		10					76	2		11		2	1	2									104	0.3
Squatina squatina							1			1		1	3	7	2								15	0
Torpedo marmorata																							0	0
Dasyatis pastinaca																							0	0
Myliobatis aquila														10	3	8							21	0.1
TOTAL	4	1277	287	322	0	36	3227	10	1796	739	4442	7579	2925	12019	3430	410	0	0	0	0	0	0	38503	100
%	0	3.3	0.7	0.8	0	0.1	8.4	0	4.7	1.9	11.5	19.7	7.6	31.2	8.9	1.1	0	0	0	0	0	0	99.9	

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Table 4.1.2.8 Landings from various fisheries in France for 1984

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb,c	VIId	VIIe	VIIf	VIIg,k	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	14	1188	80	109		16	2305	1	1340	596	124	435	685	5187	236	41							12357	37.6
Scyliorhinus sp/canicula		47	10	20			452	2	249	96	1391	1273	156	1502	718	58							5974	18.2
Scyliorhinus stellaris											43	18											61	0.2
Galeorhinus galeus			2	11			7		7	3	48	257	1	23	118	1							478	1.5
Mustelus sp							3			2	66	28	2	40	20	24							185	0.6
Lamna nasus				1					23		13	11	21	83	191	68							411	1.2
Prionace glauca									1					4	4	5							14	0
Alopias vulpinus															1	2							3	0
various sharks		7					36		24	14		45	18	57	57	8							266	0.8
R. batis++	1	39	0	11	0	0	54	2	0	16	0	3	4	45	2	0	0	0	0	0	0	0	177	0.5
Raja clavata	5	31	4	65		23	205		96	40	686	46	21	535	132	21							1910	5.8
Raja montagui		2					20		6	2		111	18	211	68								438	1.3
Raja naevus		89					424	1	86	55		239	70	2095	870	19							3948	12
R. fullonica+R.circularis		12					18		2	2			2	40	37								113	0.3
various rays		21					168	2	598	73	753	1607	260	1624	1260	69							6435	19.6
divers pocheteaux		18					66	1		10				6	1								102	0.3
Squatina squatina									1			1	2	5	4	1							14	0
Torpedo marmorata															1								1	0
Dasyatis pastinaca																							0	0
Myliobatis aquila															5	6							11	0
TOTAL	20	1454	96	217	0	39	3758	9	2433	909	3124	4074	1260	11457	3725	323	0	0	0	0	0	0	32898	99.9
%	0.1	4.4	0.3	0.7	0	0.1	11.4	0	7.4	2.8	9.5	12.4	3.8	34.8	11.3	1	0	0	0	0	0	0	100	

Table 4.1.2.9 Landings from various fisheries in France for 1985																												
Weight (in tonnes)																												
Names	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	Viiic	VIIId	III	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	29	968	94	96		1	2554	12	858	828	26	167	406	326	3656	575	309	3	198			3					11109	34.3
Scyliorhinus sp/canicula		38	9	20			458	2	323	102	20	1429	1126	131	1047	452	55	11	735	57		2					6017	18.6
Scyliorhinus stellaris												65	27							1							93	0.3
Galeorhinus galeus		14		17			25		8	4		39	141	2	27	88	5		52								422	1.3
Mustelus sp												143	9		5	7	1		10	15							190	0.6
Lamna nasus				1			1		8			10	6	19	51	32	14		63	18	5	26					254	0.8
Prionace glauca													1	1	5	4			20	8							39	0.1
Alopias vulpinus																			5	1							6	0
various sharks		6					44	1	21	4	1		1	8	43	1	1		85	32							248	0.8
R. batis + +	1	63	0	9	0	0	95	0	2	13	9	45	6	3	48	17	12	1	2	0	0	0	0	0	0	0	326	1
R. clavata + R.brachyura	4	29	1	102		38	299	2	863	47	15	577	38	131	813	144	42	2	221	49							3417	10.6
Raja montagui		1					46		13	3	2		337	46	127	234	4		124			2					939	2.9
Raja naevus		49					435	1	139	19	31		537	84	378	2437	84		1578	54		8				1	5835	18
R.fullonica+R.circularis		7					17		7	1	1		2	2	19	17			16								89	0.3
various rays		13					53	1	170	28	7	678	969	39	474	292	12	3	423	79		1					3242	10
various skates		10					51	2		5	1				1		1										71	0.2
Squatina squatina							1			1			2	1	4	3	1		17	1							31	0.1
Torpedo marmorata																			5	1							6	0
Dasyatis pastinaca																											0	0
Myliobatis aquila																			3	6							9	0
TOTAL	34	1198	104	245	0	39	4079	21	2412	1055	113	3153	3608	793	6698	4303	541	20	3557	322	5	42	0	0	0	1	32343	99.9
%	0.1	3.7	0.3	0.8	0	0.1	12.6	0.1	7.5	3.3	0.3	9.7	11.2	2.5	20.7	13.3	1.7	0.1	11	1	0	0.1	0	0	0	0	100.1	

Table 4.1.2.10 Landings from various fisheries in France for 1986

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	2	301	9	114		2	1671	1	964	566	26	214	2836	260	2546	901	173	1	315	37		2					10941	30.6
Scyliorhinus sp/canicula		53		18		3	499	1	372	112	36	1619	2234	154	950	449	52	3	848	113		3					7519	21.1
Scyliorhinus stellaris																											0	0
Galeorhinus galeus				13			19		9	8		585	323	6	17	164	10		98	4		1					1257	3.5
Mustelus sp							1					167	36	2	7	48	1		47								309	0.9
Lamna nasus		1		2			1		3			14	16	21	50	6	20		76	27		23					260	0.7
Raja montagui							17		29	4	1		418	74	176	258	4		108	91							1180	3.3
Prionace glauca													2	2	4	2	1		29	7		3					50	0.1
Alopias vulpinus																				2							2	0
various skates		3					28		27	2	2		19	11	40	1	1		147	45							326	0.9
R. batis + +	6	36	1	0	0	5	145	3	2	17	28	59	40	5	57	22	9	1	1	0	0	0	0	0	0	1	438	1.2
Raja clavata		5					154		1101	44	24	609	201	86	866	149	28		241	34		2					3544	9.9
Raja naevus		46					260	1	221	26	48		575	112	333	2521	76		###	79		24					5862	16.4
R.fullonica+R.circularis		10					14		5	1	1			2	8				2								43	0.1
various rays	1	11	1	92		1	55		220	24	1	804	1611	50	342	193	8	1	451	64		2					3932	11
various skates																											0	0
Squatina squatina							1		2	1			2	1	5	2			3	1							18	0.1
Torpedo marmorata																			7	4							11	0
Dasyatis pastinaca																											0	0
Myliobatis aquila																			4	5							9	0
TOTAL	9	466	11	239	0	11	2865	6	2955	805	167	4071	8313	786	5401	4716	383	6	###	513	0	60	0	0	0	1	35701	99.8
%	0	1.3	0	0.7	0	0	8	0	8.3	2.3	0.5	11.4	23.3	2.2	15.1	13.2	1.1	0	11	1.4	0	0	0	0	0	0	100	

Table 4.1.2.11 Landings from various fisheries in France for 1987

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIII	IXa	Xa	XIIa	TOTAL	%
Squalus acanthias	3	414	42	52		36	1541		1589	372	12	471	1099	582	5556	1084	150	1	498	20		1					13523	37.1
Scyliorhinus sp/canicula		45		21		1	424	1	504	107	28	1461	1656	171	1037	440	57	2	699	108	2	2				1	6767	18.6
Scyliorhinus stellaris												61	36			4											101	0.3
Galeorhinus galeus				14			14		15	7		181	107	6	34	110	17		94	2		1					602	1.7
Mustelus sp							1					119	87	1	6	76	2		59								351	1
Lamna nasus		1		6		1	2		3			31	27	24	70	3	36		44	6		26					280	0.8
Prionace glauca													1	2	7	2			35	16		4					67	0.2
Alopias vulpinus																			3	4							7	0
various sharks		7					24		29	2	1		33	11	52	1	1		60	15							236	0.6
R. batis + +	11	53	2	0	0	6	175	1	1	22	22	156	10	4	81	25	11	1	3	0	0	0	0	0	0	2	586	1.6
Raja clavata + R.brachyura		8		8			160		815	75	20	299	325	68	895	111	37		219	38		1					3079	8.4
Raja montagui		1					13		34	4	1		123	27	190	232	3		116	13							757	2.1
Raja naevus		46				2	294		172	41	43	1	216	60	337	2300	136		1553	94	3	17					5315	14.6
R.fullonica + R.circularis		13					21		6		1			2	16	1			4	3							67	0.2
various rays	10	25	3	93		6	63		290	23	2	725	2196	85	407	228	13	1	373	134		1					4678	12.8
various skates							1																				1	0
Squatina squatina							1		1	2			1	1	5	1			4	2							18	0
Torpedo marmorata																			1								1	0
Dasyatis pastinaca																											0	0
Myliobatis aquila																			3	9							12	0
TOTAL	24	613	47	194	0	52	2734	2	3459	655	130	3505	5917	1044	8693	4618	463	5	3768	464	5	53	0	0	0	3	36448	100
%	0.1	1.7	0.1	0.5	0	0.1	7.5	0	9.5	1.8	0.4	9.6	16.2	2.9	23.9	12.7	1.3	0	10.3	1.3	0	0.1	0	0	0	0	100	

Table 4.1.2.12 Landings from various fisheries in France for 1988

Weight (in tonnes)

Name	IIa	4A	4B	4C	5B	6A	6B	7A	7B	7C	7D	7E	7 F	7G	7H	7J	7K	8A	8B	8C	8D	8E	10A	12A	TOTAL	%
Squalus acanthias	3	198	22	56	2	972	0	1144	174	23	381	863	567	3924	1222	132	2	173	34	0	0			0	9891	28.7
Scyliorhinus sp/canicula		24	0	25	1	401	0	538	68	19	1986	2146	249	887	514	56	4	701	85	1	2				7707	22.4
Scyliorhinus stellaris											176	27													203	0.6
Galeorhinus galeus	0	0	0	18	0	12	0	12	4	0	155	333	8	22	70	9	0	58	8	0	0				710	2.1
Mustelus sp						1	0	0	0	0	64	104	3	4	51	2		66			0				295	0.9
Lamna nasus	0	1	0	4		1		2	0	0	21	56	44	118	3	33	0	100	50	2	10	0	1		446	1.3
Prionace glauca												2	2	6	2			46	31	1	0	1			91	0.3
Alopias vulpinus															0			7	5	0					12	0.0
various sharks		1			0	19		29	2	1	0	21	21	48	2	2	0	39	19	0	0			0	204	0.6
R. batis++	9	33	1	0	7	188	2	2	19	24	0	13	5	85	38	15	0	4	0	0	0	0	0	1	450	1
Raja clavata		3			0	158	0	485	47	22	653	376	70	782	127	41	0	190	14	1	1				2970	8.6
Raja montagui		0			0	8		62	1	0	74	115	21	169	265	1		215	12	0	0				945	2.7
Raja naevus		29			2	327	0	139	38	37	2	318	82	309	2394	134	0	1290	28	2	14				5145	14.9
R. fullonica+R. circularis		7			0	22	0	6	0	1		1	3	20	0	0		3	0		0				65	0.2
various skates																		0	0						0	0.0
various rays	18	24	2	82	5	63	0	315	28	4	881	2075	281	482	415	48	1	517	51	0	2				5295	15.4
Squatina squatina						1		1	1			1	2	3	2	0		3	1		0				15	0.0
Torpedo marmorata																		4	0						5	0.0
Myliobatis aquila																		3	0						4	0.0
TOTAL	31	320	26	185	18	2172	3	2736	384	132	4393	6451	1358	6860	5106	471	7	3421	339	8	31	1	1	1	34453	100.0
%	0.1	0.9	0.1	0.5	0.1	6.3	0.0	7.9	1.1	0.4	12.7	18.7	3.9	19.9	14.8	1.4	0.0	9.9	1.0	0.0	0.1	0.0	0.0	0.0	100.0	

Table 4.1.2.13 Landings for various fisheries in France for 1989																											
Weight (in tonnes)																											
Name	IIa	IVa	IVb	IVc	Va	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	Xa	XIIa	TOTAL	%
Squalus acanthias	9	108	12	57		55	842	0	761	210	17	63	625	207	2204	1598	150	1	132	16	0	1			0	7067	23.8
Scyliorhinus canicula +sp	0	12	1	42	0	0	270	0	367	45	28	1476	2064	217	888	625	69	2	733	99	0	3	0	0	0	6943	19
Scyliorhinus stellaris	0	0	0	18		0			42	0		133	117	9	4	11	0									334	1.1
Galeorhinus galeus	0	1	1	14		0	13	0	17	4	1	280	97	10	28	61	10	0	48	9		0			0	593	2.0
Mustelus sp							0		0	0	0	107	102	5	4	34	1	0	26			0				278	0.9
Lamna nasus	0	1	0	5		0	1		1	0	0	15	14	3	18	63	115	1	30	16	1	83	0	1	0	369	1.2
Prionace glauca									0				6	1	2	9	4		34	24	0	3		0	0	84	0.3
Alpias vulpinus															0				6	6		1		0		14	0.0
various sharks		1				0	14	0	14	1	2	292	2	5	32	1	4	1	20	12	1	0	0			402	1.4
R. batis++	8	30	2	0	0	18	208	1	1	17	29	0	17	4	118	53	23	0	1	0	0	0	0	0	0	530	2
Raja clavata		1					157	0	290	36	25	6	398	93	690	130	55	0	214	36	0	2				2133	7.2
Raja montagui		0					5		23	0	0	1	146	27	139	318	3		202	14		1				878	3.0
Raja naevus		15				0	274	0	107	22	52	19	307	97	335	2252	83	0	1380	23	1	15				4983	16.8
R. fullonica+R.circularis		4				0	24	0	4	1	3		0	3	25	1	1	0	5	0	0	0				73	0.2
various skates													0		3	0	0		0	0						3	0.0
various rays	6	15	7	62		10	58	0	290	22	2	637	2048	190	581	438	62	1	370	140	0	1			0	4940	16.7
Squatina squatina							2		1	1		0	1	0	2	1	1	0	2	1						11	0.0
Torpedo marmorata																			8	8						16	0.1
Mybiobatis aquila																			7	2						10	0.0
TOTAL	23	187	23	197	0	83	1868	1	1921	360	159	3031	5943	871	5071	5596	579	7	3219	408	3	109	0	1	1	29660	100.0
%	0.1	0.6	0.1	0.7	0.0	0.3	6.3	0.0	6.5	1.2	0.5	10.2	20.0	2.9	17.1	18.9	2.0	0.0	10.9	1.4	0.0	0.4	0.0	0.0	0.0	100.0	

Table 4.1.2.14 Landings from various fisheries in France for 1990																												
Weight (in tonnes)																												
Name	IIb	IIa	IVa	IVb	IVc	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXb	Xa	XIIa	TOTAL	%
Squalus acanthias		1	94	11	11	2	418	1	619	109	5	74	163	350	1401	786	157	1	76	25	0	5			0	0	4309	18.0
Scyliorhinus sp/canicula			15	1	40	0	293	1	389	74	12	977	948	197	835	512	60	2	580	85	1	9				0	5030	21.0
Scyliorhinus stellaris		0	2	0	11	1	2		40			470	74	7	2	1			0	0							612	2.5
Galeorhinus galeus		0	1	1	16	0	9	0	16	1	0	60	34	14	21	47	4		25	8	0	2	0		0		259	1.1
Mustelus sp			0	0	0		0		1	0		99	71	4	12	52	0		20	1		2					264	1.1
Lamna nasus		0	1	0	5	0	1		9	0	5	17	56	11	74	37	141	5	88	40	1	95	3	0	1		587	2.4
Prionace glauca									0				2	1	6	11	8	1	32	40	4	16	3		0	0	126	0.5
Alopias vulpinus																			6	5	0	0					12	0.0
Cetorhinus maximus																			1	0							1	0.0
various sharks		1	7	2		128	255	4	19	1	1	2	0	3	32	1	2	1	15	22	0	4				0	501	2.1
R. Batis + +	0	9	30	2	0	16	207	3	3	16	20	0	16	6	147	71	16	1	2	0	0	0	0	0	0	0	566	2
Raja clavata +			3		4	0	148	0	330	29	10	232	43	156	833	120	27	1	233	10	0	3			0		2183	9.1
Raja montagui			0		0		5		45	0	0	29	188	39	191	278	1		101	22		5					905	3.8
Raja naevus			16	0		0	286	1	104	15	28	24	250	99	347	2206	155	2	1248	11	1	77					4871	20.3
Raja fullonica			4	0		0	19	0	10	0	2		5	4	29	20	1	0	17	1		1					112	0.5
Raja circularis							11	0	1	2	1		9	5	90	349	33	0	100	2		10					611	2.5
various skates										3	0				2	0			1								6	0.0
various rays	6	9	26	8	63	7	56	1	319	24	5	515	752	221	564	85	24	1	220	96	0	5					3006	12.5
Squatina squatina			0				1	0	1	0			1	0	2	1	0		1	1	0	0					7	0.0
Torpedo marmorata																			11	7							18	0.1
Dasyatis pastinaca																			2	1							3	0.0
Myliobatis aquila																0			3	1							4	0.0
TOTAL	6	20	200	24	150	154	1710	10	1905	275	89	2498	2613	1116	4588	4578	631	16	2781	377	7	234	7	0	1	0	23991	100.0
%	0.0	0.1	0.8	0.1	0.6	0.6	7.1	0.0	7.9	1.1	0.4	10.4	10.9	4.7	19.1	19.1	2.6	0.1	11.6	1.6	0.0	1.0	0.0	0.0	0.0	0.0	100.0	

Table 4.1.2.15 Landings from various fisheries in France for 1991

Weight (in tonnes)

Name	IIa	IVa	IVb	IVc	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	Xa	XIIa	TOTAL	%
Squalus acanthias	2	48	5	11	4	370	0	731	56	17	77	223	288	848	581	45	4	116	31	0	5			0	3462	14.4
Scyliorhinus sp/canicula		14	1	30	0	341	5	410	50	23	1120	1091	272	730	433	65	3	572	96	0	13			0	5270	21.9
Scyliorhinus stellaris		0	0	9	0	0		34	0		538	81	5	1	0			1	0						670	2.8
Galeorhinus galeus	0	1	0	17	0	17	0	27	2	2	52	33	13	27	50	4		33	6		1	0	0	0	286	1.2
Mustelus sp		0		0		2		1	0		103	72	4	6	100	1		45	4		3				341	1.4
Lamna nasus	0	1	0	11	0	2		3	0	0	19	16	0	65	16	22	2	48	38	1	56	3	1	0	306	1.3
Prionace glauca		0				0		0				2	1	4	7	5	5	60	53	4	9	31	6	0	188	0.8
Alopias Vulpinus																0		7	9	0	0	0			17	0.1
Cetorhinus maximus																		0	0						0	0.0
various sharks	0	3	1		69	852	14	16	0	7	1	0	2	19	1	2	217	17	9	0	1	0	1	1	1233	5.1
R. batis + +	14	39	2	0	6	202	13	2	17	34	0	23	23	119	102	16	13	2	0	0	0	0	0	1	628	3
Raja clavata		3		5	0	152	1	329	19	20	335	290	324	729	112	23	0	198	13	1	3			0	2559	10.6
Raja montagui		0		1		6		39	1	0	43	378	117	230	229	3		87	16		6				1157	4.8
Raja naevus		8			0	194	2	95	13	57	41	246	105	222	1866	257	0	1119	8	0	85			0	4319	18.0
Raja circularis					0	32		1	2	2		12	5	65	336	45	0	108	2		10			1	618	2.6
Raja fullonica		2			0	10	0	2	0	0		4	5	23	17	3	0	7	1		0			0	76	0.3
various skates		1						0	2			0	0	2			0	12	0						17	0.1
various rays	3	30	9	70	1	49	0	428	24	3	664	556	189	484	45	13	3	171	126		5			0	2873	11.9
various sharks, rays, chimaeras		1			0	5																			5	0.0
Squatina squatina						0		1	0		0	0	1	2	1	0		1	0		0				5	0.0
Torpedo marmorata																		13	8						21	0.1
Dasyatis pastinaca																		1	2						3	0.0
Myliobatis aquila																		2	3						6	0.0
TOTAL	20	152	18	153	81	2235	36	2120	186	165	2994	3027	1355	3577	3895	504	248	2617	421	6	198	35	8	3	24054	100.0
%	0.1	0.6	0.1	0.6	0.3	9.3	0.2	8.8	0.8	0.7	12.4	12.6	5.6	14.9	16.2	2.1	1.0	10.9	1.7	0.0	0.8	0.1	0.0	0.0	100.0	

Table 4.1.2.16 Landings from various fisheries in France for 1992

Weight (in tonnes)

Name	IIa	IIb	IVa	IVb	IVc	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXb	Xa	XIIa	TOTAL	%
Squalus acanthias	0		18	2	11	2	379	1	454	68	9	46	140	87	632	323	47	9	68	34	0	11	0				2341	10.2
Scyliorhinus sp/canicula			8	1	19	0	289	1	292	35	14	936	1023	255	771	368	73	3	583	102	1	16	0		0		4790	20.8
Scyliorhinus stellaris	0		0	0	1				45			446	64	14	2	0			2	1							576	2.5
Galeorhinus galeus	0		0	0	10	0	19	0	21	3	5	50	36	14	27	37	4	0	30	4	0	1	0	0	0	0	262	1.1
Mustelus sp			0	0	0		3		0	0	0	89	75	5	7	51	3		33	3	0	2					272	1.2
Lamna nasus	0		1	0	4	0	2	0	5	0	0	13	5	0	13	11	49	6	65	26	4	253	1	0	3	1	462	2.0
Prionace glauca							0		1			0	1	0	7	3	18	35	68	44	13	21	12	1	22	11	258	1.1
Alopias vulpinus													0		0				8	10		0	0	0	0		18	0.1
Cetorhinus maximus																			0								0	0.0
Centroscymnus, ... (spp)								4																			4	0.0
various sharks	1		127	1		112	1854	19	7	15	96	1	34	2	11	15	262	499	29	6		5	0	0	0	2	3098	13.5
R. batis ++	18	0	41	1	0	3	218	2	2	9	32	0	23	18	155	114	37	19	3	0	0	1	0	0	0	0	695	3
R. clavata +			4	0	2	0	144	0	220	11	8	223	226	205	789	76	31	1	183	43	0	5	0		0	0	2170	9.4
Raja montagui			1		1		4		47	0	0	25	346	87	302	190	1	0	120	55		4					1182	5.1
Raja naevus			11	0		0	172	0	55	7	26	23	219	100	257	1519	304	2	937	8	1	33	0				3675	16.0
Raja fullonica			2				5	0	2	0	1		4	5	53	13	5	0	4	0		0				0	94	0.4
Raja circularis			1			0	26	0	1	1	3		12	6	77	272	48	2	75	0		4	0				528	2.3
various skates									0	0			0		4				3	0	0	0					8	0.0
various rays	3	1	33	2	48	1	53	1	322	10	3	483	519	224	476	40	15	3	137	126	0	11	0		0		2510	10.9
Squatina squatina							0		0	0			0	0	1	0	0		1	0		0					3	0.0
Torpedo marmorata																			10	6							15	0.1
Dasyatis pastinaca																			1	2		0					3	0.0
Myliobatis aquila																			2	3					0		6	0.0
various sharks, rays, chimaeras			1				10	0		0	0					0	0	0	0	5		0				0	17	0.1
TOTAL	23	1	249	8	95	119	3179	29	1474	159	198	2335	2728	1022	3582	3032	898	578	2361	476	20	368	14	1	25	14	22988	100.0
%	##	0.0	1.1	0.0	0.4	0.5	13.8	0.1	6.4	0.7	0.9	10.2	11.9	4.4	15.6	13.2	3.9	2.5	10.3	2.1	0.1	1.6	0.1	0.0	0.1	0.1	100.0	

Table 4.1.2.17 Landings from various fisheries in France for 1993

Weight (in tonnes)

Name	IIa	IIb	IVa	IVb	IVc	Vb	VIa	VIb	VIIa	VIIb	VIIc	VIId	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXb	Xa	XIIa	TOTAL	%
Squalus acanthias	0		69	0	9	0	182	0	315	39	9	65	159	92	362	355	28	2	42	26	0	5	0		0	0	1760	8.5
Scyliorhinus sp/canicula			6	0	34	0	186	0	237	23	11	1080	923	233	744	328	38	3	494	92	0	9	0			0	4443	21.5
Scyliorhinus stellaris	0		1	0	0				62			181	49	7	3	0			0	0							304	1.5
Galeorhinus galeus	0		1	1	11	0	16	0	20	1	1	89	35	12	32	19	1	0	34	7	0	2		0	0	0	281	1.4
Mustelus sp							5		2	0		101	71	5	7	38	1	0	46	3		2					281	1.4
Lamna nasus	0		1	0	7	0	0	0	5	0	0	10	4	13	17	89	28	6	305	34	2	103	10	3	3	0	640	3.1
Prionace glauca									3	0		1	8	1	10	5	5	11	92	48	2	17	71	7	32	3	314	1.5
Alopias vulpinus													0				0	0	7	12	0	0	0				19	0.1
Centroscymnus, ... (spp)						0	0	0			1				0		8	1		0							10	0.0
various sharks			51			82	2348	12	1	11	196	1	0	0	5	9	340	346	17	11	1	3	1	0	0	6	3442	16.7
R. batis + +	4	0	20	1	0	1	190	5	1	7	53	0	17	14	154	110	32	17	3	0	0	1	0	0	0	1	628	3
Raja clavata			3			0	159	0	129	14	12	185	153	109	463	50	24	3	174	45	0	7				0	1531	7.4
Raja montagui			0				7		55	1	0	18	230	70	264	217	4	0	185	34		5					1090	5.3
Raja naevus			5			0	168		57	7	24	23	183	71	231	1270	69	1	798	5	0	22				0	2936	14.2
Raja fullonica			1			0	8	0	1	0	1		2	5	44	9	1	0	6			0					78	0.4
Raja circularis			1				24	1	0	1	1	0	7	5	62	237	15	2	63	0		2				0	422	2.0
Raja undulata																				1							1	0.0
various skates									0	0			0	0	4	0			4			0					10	0.0
various rays	10	1	26	2	88	0	10	1	269	3	9	483	512	198	518	34	18	2	134	121		1				0	2439	11.8
Squatina squatina							0		0	0			0	0	1	0	0		1	0							3	0.0
Torpedo marmorata																			12	5							17	0.1
Dasyatis pastinaca													0						1	0							1	0.0
Myliobatis aquila																			1	2		0					4	0.0
various sharks, rays, chimaeras									0						0												0	0.6
TOTAL	15	1	185	4	149	85	3303	20	1156	106	319	2239	2352	836	2919	2771	612	394	2418	449	6	180	82	10	35	10	20654	100.0
%	0.1	0.0	0.9	0.0	0.7	0.4	16.0	0.1	5.6	0.5	1.5	10.8	11.4	4.0	14.1	13.4	3.0	1.9	11.7	2.2	0.0	0.9	0.4	0.0	0.2	0.0	100.0	

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Table 4.1.3.1 Elasmobranch landings Germany, 1990-1994, by ICES areas and in tonnes					
Species, or group of species	**1990**	**1991**	**1992**	**1993**	**1994**
			area NAFO 3L		
skates	1		28.2		
			area NAFO 1D		
skates					1.7
			area XIV		
skates	0.8	2.9	1.7	2	
			area XII		
various sharks				0.6	1.3
skates				0.3	
			area IIa		
Squalus acanthias			0.1		0.2
skates	0.3		0.1	0.4	0.3
			area IIb		
skates			2.1		
			area IVa		
Squalus acanthias	42	9.6	44.3	4.3	11.5
other sharks	0.7	2	9.8	4.4	0.1
skates	3.6	2.5	0.8	2	2.1
			area IVb		
Squalus acanthias	1.9	0.7	3.8	3.7	9.6
other sharks	29.7	2.6	2	1.5	1.3
skates	0.3	0.2	0.1	1	1.1
			area IVc		
skates					4.4
			area Vb+c		
Squalus acanthias	0.3		4.7		
other sharks			1.8	2.4	42.8
skates		0.4	0.4	1.5	2.7
			area VIa+b		
Squalus acanthias	0.4				
other sharks			5.5	76.8	257.5
skates	0.1		1.9	5.9	27.1
			area VII		
various sharks				47.2	136
skates		0.3	3.6	6.7	17.7
			Total all areas		
Squalus acanthias	44.9	10.4	53.1	8.1	21.6
other sharks	30.6	4.7	19.6	133.4	440.3
skates	6.3	6.3	40.9	20.1	57.2
Individual amounts by area not necessarily summing up to 100% totals, because registration in kg and and amounts of less than 100 kg were ignored here.					

Table 4.1.4.1 Landing data from all ports - kg					Landin data from Den Helder - kg		
Year	Rays	Rays&Skates	Skates	Sharks	Rays	Sharks	
1930	382482		246175				
1931	354619		215940				
1932	249882		239795				
1933	175207		106280				
1934	217376		153950				
1935	168812		97910				
1936	175719		110392				
1937	164837		92750				
1938	156638		120281				
1939	75795		62279				
1940							
1941							
1942							
1943							
1944							
1945							
1946	188645		75691	48018			
1947	66265		37228	26550			
1948	153701		58390	265322			
1949	155824		85018	246364			
1950	109949		58146	117853			
1951	92890		42183	162100			
1952	130246		59788	190384			
1953	150563		61718	111189			
1954	109249		60131	61280			
1955	134704		54101	122018			
1956	117981		60127	165125			
1957	142221		68970	166185			
1958	89712		57439	221354			
1959	99818		53389	281237			
1960	95792		50446	266467			
1961	102915		49137	201632			
1962	97716		44081	203176			
1963	213116		37338	288621			
1964	99836		38292	250080			
1965	172435		46085	446287			
1966	94081		37011	222853			
1967	71827		26480	315012			
1968	69471		18369	444585	1335	304	
1969	94531		12878	361137	853	1323	
1970	81095		7115	309514	876	2770	
1971		103808		552102	2125	2355	
1972		134908		550620	3480	6259	
1973		148372		522917	7536	5917	
1974		223958		616747	22909	16404	
1975		219495		315407	26731	22946	
1976		257149		183701	34840	10625	
1977		246111		219738	25732	22460	
1978		225583		210998	15940	26998	
1979		503095		194122	56104	26890	
1980		245536		206817	33165	40380	
1981		220942		227753	24072	36380	
1982		269059		173427	40695	27766	
1983		327279		297668	30209	32045	
1984					23623	32185	
1985					54423	19462	
1986					36672	22452	
1987					34244	24602	
1988					33484	27020	
1989					24930	18310	
1990					29891	14144	
1991					28463	17112	
1992					40889	14852	
1993					45565	9840	
1994					60882	11406	

Table 4.1.5.1 NORWAY Spring dogfish (*Squalus acanthias*) landings 1970-1994 by area

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
I															2								2		1
IIa	324	142	304	789	1187	555	277	195	154	137	132	7	20	105	38	82	135	414	1555	2776	4665	6597	5056	5079	3097
IIb																					10	4	+	1	
IIIa	98	105	149	322	513	422	475	514	807	1091	723	548	633	738	726	897	879	798	723	610	546	546	601	361	192
IVa	16356	9882	21913	16347	10736	11539	11898	5780	4899	4020	4886	3376	2812	3140	3059	2503	1969	2400	1861	1683	2808	1929	974	1199	1259
IVb					5815	2856	2846	5960	6129	2003	175	5	327	474	449	2				259	3	510	467	1	1
IVc							1		6																
Va											1														
Vb1				506	91	2	690	1													6	1	+		
Vb2							1														11	1			
VIa	6321	10870	702	668	397	73	76	780	633	64	8	5	200	183	5	3					27	19	4	3	
VIb								1										2			15	16	10		
VIIa				991																					
VIIbc																	3				11	6	+		
?																						4		291	
Total	23099	20299	23068	19623	17739	15447	16264	13231	12628	7315	5925	3941	3992	4659	4279	3487	2986	3614	4139	5328	8102	9634	7114	6934	4552

Table 4.1.5.2 NORWAY Porbeagle (*Lamna nasus*) landings 1970-1994 by areas

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
IIa				75	13	20	17	46	55	35	17	22	6	4	21	10	9	6		+	1+	2+	3+	9+	3+
IIIa				5		37	29	18	16	9	7	16	4	11	10	5	4	12	9	16	17	3	13	2	2
IVa				150	152	247	135	13	5	61	46	4	15	18	36	65	11	7	2	6	21	26	26+	11+	16+
IVb							78				14	51	8								+	+			
Vb																						+	+		+
VIa															29					+	1		+		
VIb																					+	+			+
VIIbc																				+					
XIVb																									+
Total	207	160	292	230	165	304	259	77	76	105	84	93	33	33	96	80	24	25	11	26	44	32	42	24	25

Table 4.1.5.3 NORWAY Basking shark (*Cetorhinus maximus*) landings 1970–1994 by area (tonnes)

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
I				100			70	27		3					7	7									
IIa				9250	7990	13880	7440	7905	7217	11032	7850	3820	4246	2082	1874	3149	2465	352	13		355	514	1103	2460	1762
IVa				750		2220								1582	2650				215	1278	1577	1109	2554	450	
Vb[1]					1000				30		178	60													
VIa						2250																			
VIIb–c				800	1750				600	300			400	130											
Total	18870	8540	7190	10900	10740	18350	7510	7932	7847	11335	8028	3880	4646	3794	4441	3156	2465	352	228	1278	1932	1623	3658	2910	1762

Table 4.1.5.4 NORWAY Skate and ray landings 1970–1994 by area tonnes

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
I							1	3	4	8	2	2	2	1	10	11	3	14	7	5	1	4	23	13	72
IIa	221	183	217	201	158	89	34	99	82	126	191	137	110	96	150	104	133	214	112	166	237	201	134	279	142
b																					5	31		+	7
IIIa	18	23	15	47	39	45	52	48	50	63	67	79	91	91	100	122	128	127	91	87	114	55	78	90	116
IVa	}222	}194	}206	377	205	444	465	342	294	679	777	544	401	476	503	608	263	417	304	432	371	251	271	384	308
b	}	}	}		18	10	13	20	10	1	2	7	1	2	9					2	2	3	9	1	1
c							1																		+
Va				1		9	4	2	3	2	3	6	1	10	3	5									
b^1			}10	29	27	37	38	43	21	28	11	9	8	25	6	10	7	3	8	75	73	65	28	55	12
b^2			}				4	3	43	9	7	12	5	7	29	4	15	8	21	9	23	16	9	20	9
VIa	125	194	49	116	105	70	77	96	226	81	253	119	146	217	99	67	44	93	144	264	71	38	82	56	9
b					22	123	45	60	145	217	222	117	147	332	364	164	231	200	132	279	203	248	234	170	272
VIIa				4																					
b–e						1		4						57	1	2	125			40	34	83	87	+	92
g–k														12			25			12					
XII						3	9																		
XIVa						}54																	+		
b						}																	26	8	8
W. Greenl.																							1	7	
Flem.Cap																						30			
?																					6			15	
Total	586	594	497	775	574	885	743	720	878	1214	1535	1032	912	1326	1274	1097	974	1076	819	1371	1036	1029	990	1110	1060

Table 4.1.6.1 Landings of rays/skates (all mixed) from several demersal fisheries in mainland Portugal (ICES Div. Ixa).

Year	Coastal trawlers	Offshore trawlers	Hook and line	Total
1986	551	18	1237	1806
1987	565	1677	2258	4500
1988	552	1096	1681	3329
1989	513	-	1307	2301
1990	503	-	1120	1691
1991	389	67	982	1481
1992	348	31	1202	1619
1993	369	16	1239	1664

Table 4.1.6.2 Landings of sharks in tonnes (mostly the catshark, *Scyliorhinus canicula*, the tope and, to a lesser extent, smoothhounds) from several demersal fisheries in mainland Portugal (ICES Div. Ixa).

Year	Coastal trawlers	Offshore trawlers	Hook and line	Total
1986	375	95	1087	1557
1987	372	2	1040	1414
1988	267	19	894	1180
1989	355	-	844	1244
1990	22	-	809	906
1991	15	70	62	294
1992	5	31	77	237
1993	1487	74	76	237

Table 4.1.6.3 Starting in 1990 several deep-water shark species started to be separated. Landings of those sharks in tonnes from several fisheries in mainland Portugal (ICES Div. Ixa) are give below.

Year	Blackmouth catshark	Catshark	Kitefin shark	Gulter shark
1990	17	626	8	1200
1991	18	598	13	803
1992	17	556	24	959
1993	23	596	12	886

Table 4.1.6.4 Landings (tonnes) of kitefin shark from the Azores (ICES Area X).

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985
Landings	188	170	216	615	947	139	203	855	831
Year	1986	1987	1988	1989	1990	1991	1992	1993	1994
Landings	741	357	549	560	602	896	761	591	309

Table 4.1.6.5 Landings, in tonnes, of pelagic sharks (as by-catch from the swordfish fishery) by the azorean fleet in ICES Area X.

Year	Blue sharks	Shortfin makos	Other sharks
1987	11	14	2
1988	10	11	1
1989	1	5	1
1990	0	4	2
1991	23	9	3
1992	170	10	2
1993	140	6	1
1994	138	8	-

Table 4.1.8.1 Landings (100kg nominal live weight) of various species in Scotland by UK registered vessels from 1960 to 1994

All Areas by All Gears

Year	Sharks	Porbeagle	Spurdogs	Lesser spotted dogfish	Skate
1960		80	35552		66670
1961		78	39213		66122
1962		159	23193		53987
1963		159	28155		50513
1964		40	45438		60611
1965		63	39391		59780
1966		35	54318		58319
1967		45	70108		56719
1968		53	74434		56729
1969		30	59039		54223
1970		44	58089		45436
1971		59	75196		47118
1972		126	82184		50291
1973		93	89686		40482
1974			94378	438	34525
1975			101738	428	34681
1976			111013	784	37384
1977			98507	150	38765
1978			85518	322	38339
1979			73487	21	34123
1980			49935	8	35094
1981			39684	4	31272
1982			36540	2	31740
1983			43668	14	35792
1984			49580	7	40248
1985			67475	1	42044
1986			62564	4	39894
1987			80431	10	50786
1988			78317	2121	49256
1989	153		80146	407	43222
1990	118		74953	132	38654
1991	176		85170	158	39239
1992	264		96437	134	36701
1993	465		64482	1092	32311
1994	499		46251	327	33639

Notes

1) From 1960 to 1973 the figures given under the heading "all gears" are in fact the sums of all the gears entered into the database and are not necessarily the total of every gear being used by Scottish fishermen.

2) Sharks were introduced as a separate species from 1 January, 1989.

3) Porbeagles were dropped as an individual species from 1 January, 1974.

4) Spotted dogfish were introduced as a separate species from 1 January, 1974.

5) Prior to 1974 Spur dogfish may include small amounts of spotted dogfish.

6) Conversion factors - Sharks and porbeagles are landed whole. For spur dogfish and spotted dogfish a conversion factor of 1.125 was used prior to 1986 and from 1 January of that year a factor of 1.37 has been used. For skate a conversion factor of 1.2 was used prior to 1986 and from 1 January of that year a conversion factor of 1.13 has been used.

Table 4.1.8.2 Commercial landings (tonnes) of elasmobranchs by UK (Eng. and Wales) vessels, 1981-1994

species	ICES Div.	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Dogs and hounds	IVa,b+c	4639	3308	2807	2289	2487	1861	1881	2078	2577	2624	1455	1359	559	513
	VIa+b	281	204	111	49	29	27	84	51	19	81	13	9	33	38
	VIIa	818	1231	1531	2500	3232	3315	3941	3070	1351	1244	843	1241	1337	702
	VIId+e	244	286	384	306	191	246	491	366	263	361	322	271	251	253
	VIIf+g	1358	1414	1384	1090	272	421	516	627	437	486	430	722	642	539
	VIIb,c,h-k	19	35	10	6	7	11	11	23	19	14	19	28	31	117
	total	**7360**	**6478**	**6217**	**6240**	**6218**	**5881**	**6924**	**6215**	**4666**	**4810**	**3082**	**3630**	**2853**	**2162**
Skates & rays	IVa,b+c	1246	1192	1270	1130	1075	1077	1035	967	970	1016	1127	1424	1413	1516
	VIa+b	97	98	119	129	64	58	60	57	64	54	58	35	29	22
	VIIa	975	1182	1066	966	932	818	1356	1287	1240	1224	1052	1048	925	636
	VIId+e	484	520	713	733	712	621	765	702	594	807	551	570	585	613
	VIIf+g	590	588	601	653	795	902	992	1022	864	786	786	882	826	790
	VIIb,c,h-k	97	143	58	111	164	206	285	427	203	383	94	189	158	245
	total	**3489**	**3723**	**3827**	**3722**	**3744**	**3682**	**4493**	**4462**	**3935**	**4270**	**3668**	**4148**	**3936**	**3822**
Sharks	IVa,b+c	1	4	3	3	2	2	3	2	1	1	1	1		3
	VIa+b										1			4	7
	VIIa				1	1	2		1	1	1	7	2	1	1
	VIId+e	1	4	8	3	2	4	5	6	6	12	9	8	9	10
	VIIf+g	2	10	5	6	2	4	6	11	14	17	10	13	12	14
	VIIb,c,h-k	1	5					1	1		1	1	2	10	6
	total	**5**	**23**	**16**	**13**	**7**	**12**	**15**	**21**	**22**	**33**	**28**	**26**	**36**	**41**

Table 4.1.9.1Landing data for Iceland, Ireland and Spain from ICES Fisheries Statistics - tonnes													
	Iceland	Iceland	Iceland	Iceland	Iceland	Iceland	Icelan	Ireland	Ireland	Ireland	Ireland	Spain	Spain
	'Squalu	Skates&	Dogs&	Greenla	Porbeag	Commo	Shagr	'Squalu	Skates&	Dogs&	Various	Skates&	Dogs&H
1993	109	295	1	41	3	274	2		1755	17	3424		
1992	181	317	2	68	1	363		1100	2101	319	133		
1991	53	588		58				1000	2068	213			
1990	15	383		54				1443	2411	300			
1989	17	252		31				3063	3128				
1988	4	191						5612	3248			1649	
1987	5	255						8706	2726			1719	
1986	7	150						5012	2333			1573	
1985	9	134						8791	3026			1657	
1984	5	221						6930	2502			1691	
1983	25	200						4658	2148			1840	653
1982	13	257						1268	1902			2361	8
1981	22	229						476	2041			339	
1980	36	196						108	1736				
1979	17	402						134	1538				34
1978	26	424						33	1451			445	
1977	13	442						167	1624				
1976	15	333						17	1922				
1975	10	188							1758				
1974	16	275							1731				
1973	31	364							1516				
1972	20	323							1537			6408	
1971													
1970	19	471							1708			3580	3763
1969	14	631							1679			4126	2770
1968	31	603							1576			4639	3120
1967	22	387							1350			4596	2750
1966		260	58						1310			4996	2551
1965		334	63						1395			4961	2961
1964		482							1524			6040	3390
1963		388							1537			5125	2443
1962		453							1501			5444	1843
1961		470							1574			9294	
1960		936							1295			9859	
1959		658							1471			10563	
1958		1274							1487			14211	
1957		761	207						1534			14102	
1956		494							1438			11707	
1955		65							1234			6671	
1954		468							1113			6771	
1953		333							786			7204	
1952		756							846			5947	
1951		289							840			7003	
1950		244							807			10795	
1949		282							1106			10614	
1948		281							1105			10450	
1947		113							966			10260	
1946		186							901			6729	
1945		110							934			5539	
1944		186							809			5607	
1943		236							739			6006	
1942		501							811			7525	
1941		338							682			7885	
1940		409							557			6892	
1939		135							583				
1938		127	5						355				

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Table 4.1.9.2 Landing data from ICES Fisheries Statistics - tonnes

	Belgium 'Squalu	Belgium Dogs&H	Belgium Skates&	Belgium Various	Belgium Sharks
1993	46	289	1429	21	
1992	58	391	1386	23	
1991	68	325	1322	15	
1990	100	483	1299	17	
1989	188	564	1479	25	
1988	135	522	1572		657
1987	339	640	1816		979
1986	469	579	1789		1048
1985	447	473	2197		920
1984	590	549	2180		1139
1983	547	525	1869		1072
1982	623	487	1466		1110
1981	567	518	1444		1085
1980	646	451	1448		1097
1979	896	424	1630		1320
1978	1262	431	1612		1693
1977	652	422	1541		1074
1976	589	538	1759		1127
1975	1037	480	1372		1517
1974	1135	485	1709		1620
1973	1888	518	1908		2406
1972	1193		1765		1193
1971					
1970	1101	459	2514		1560
1969	1394	419	2962		1813
1968	1535	436	2873		1971
1967	1322	413	2450		1735
1966	1276	406	2664		1682
1965	871	552	4066		1423
1964	891	594	4892		1485
1963	975	440	4213		1415
1962	744	518	4509		1262
1961	936	602	5070		1538

Table 4.2.1.1 Nominal catches of skates in Divisions 3LNO and Sub-division 3Ps from the time of extended jurisdiction.

Year	Div. 3L	Div. 3N	Div. 3O	Subdiv. 3Ps	Cdn. TAC
1977	418	962	437	881	
1978	225	1,237	369	710	
1979	393	91	555	666	
1980	396	711	271	1,163	
1981	353	1,224	134	1,078	
1982	112	313	383	512	
1983	170	1,004	107	516	
1984	412	803	798	623	
1985	918	7,591	1,890	965	
1986	3,048	9,451	1,830	1,583	
1987	6,244	10,086	2,166	839	
1988	4,156	14,541	69	783	
1989	3,618	10,493	132	1,685	
1990	9,779	4,796	168	5	
1991	15,587	12,694	125	1	
1992[2]	1,491	3,140	366		
1993[2]					
1994[2]					
1995					6,000[1]

[1] 1995 TAC is split with 5,000 t for 3LNO and 1,000 t for 3Ps
[2] Provisional

Table 4.2.1.2 Reported nominal landings of skates (all species combined in Divisions 4Vn, 4Vs, 4W, 4X.

Year	4Vn				4Vs				4W				4X			
	Canada	USSR	Others	Total	Canada	USSR	Others	Total	Canada	USSR	Others	Total	Canada	USSR	Others	Total
1961	-	-	-	0	-	-	-	0	1	-	-	1	177	-	-	177
1962	-	-	-	0	-	-	-	0	4	-	-	4	104	-	2	106
1963	-	-	-	0	-	-	-	0	-	-	-	0	95	-	2	97
1964	1	-	22	23	-	-	-	0	-	-	1	1	52	-	-	52
1965	-	-	-	0	17	-	4	21	51	-	-	51	94	-	-	94
1966	-	-	9	9	-	-	1	1	14	-	-	14	36	-	-	36
1967	-	-	-	0	-	-	-	0	16	-	-	16	61	-	-	61
1968	-	-	4	4	3	780	4	787	56	5397	-	5453	45	-	-	45
1969	-	-	4	4	4	269	8	281	10	4122	-	4132	9	15	-	24
1970	-	-	10	10	2	60	6	68	24	3802	-	3826	6	-	-	6
1971	2	-	7	9	12	1519	3	1534	1	15970	-	15971	3	149	-	152
1972	-	-	8	8	1	894	10	905	-	4325	5	4330	-	22	-	22
1973	1	-	55	56	3	364	38	405	2	6287	1	6290	-	821	1	822
1974	17	-	41	58	-	-	89	89	61	8323	18	8402	-	553	-	553
1975	-	-	66	66	2	633	81	716	-	15451	5	15456	-	2103	-	2103
1976	72	78	15	165	705	6026	108	6839	57	1738	-	1795	126	253	-	379
1977	101	-	5	106	382	-	-	382	52	489	-	541	48	105	-	153
1978	20	-	9	29	109	-	20	129	26	755	29	810	44	-	-	44
1979	48	-	3	51	52	-	-	52	36	287	5	328	27	-	-	27
1980	92	-	14	106	59	-	-	59	12	756	6	774	15	21	-	36
1981	53	-	10	63	7	5	-	12	2	297	-	299	1	-	-	1
1982	-	-	-	0	-	-	-	0	-	-	-	0	17	-	1	18
1983	-	-	5	5	-	-	-	0	9	130	18	157	1	26	5	32
1984	-	-	4	4	7	-	-	7	9	141	-	150	49	-	9	58
1985	1	-	9	10	7	-	-	7	-	421	5	426	2	-	-	2
1986	-	-	19	19	6	-	-	6	6	1467	-	1473	17	-	-	17
1987	9	-	-	9	17	-	-	17	28	1632	*107	1767	27	4	-	31
1988	1	-	-	1	3	-	-	3	4	2580	*29	2613	14	45	-	59
1989	1	-	-	1	3	-	-	3	7	1364	*167	1538	17	21	-	38
1990	0	-	-	0	0	-	-	0	2	1655	*315	1972	15	28	-	43
1991	3	-	-	3	5	-	-	5	8	1112	*721	1841	5	36	-	41
1992	0	-	-	0	0	-	-	0	2	279	*158	439	1	11	-	12
1993	1	-	-	1	66	-	-	66	101	*117	*658	876	27	-	-	27
1994	2	-	-	2	1971	-	-	1971	181	*0	*20	201	95	-	-	95

1961-1988 NAFO data
1989-present ZIF data (Canadian)
* - IOP data

Table 4.2.1.3 Skate by-catch in the Canadian and foreign fisheries in Divisions 4VsW as estimated by the International Observer Program.

	Foreign 4W			Canadian Groundfish(4VsW)			Canadian Flatfish(4Vs)				Total Skates
	USSR	Others	Total	Landings(t)	Bycatch estimate	Est. skate removals	Landings	Actual	Estimate	Est. skate removals	(Cdn.+For.)
1989	1364	167	1531	62051	0.03	1862	3424	0.09	0.3	1027	3830
1990	1655	315	1970	58549	0.03	1756	4246	0.34	0.3	1274	5002
1991	1112	721	1833	56002	0.03	1680	2506	2.57	0.3	752	4278
1992	279	158	437	47420	0.02	948	3149	0.46	0.3	945	2332
1993	117	658	775	8578	0.03	257	2916	0.77	0.3	875	2074
1994	0	20	20	8218	0.03	247	2226	0.9	0.3	668	3087

Note: Foreign IOP coverage 100% 1989 -1994
Canadian skate landings as a percentage of all cod,haddock,pollock,redfish landings
Percentage of skates observed in the flatfish fishery

Table 4.2.1.4 Spring dogfish in Scotian Shelf and Bay of Fundy area. The Fishery - Landings (thousands of tonnes)

Year	70-77 Avg.	78-79 Avg.	1990	1991	1992	1993	1994
Canada	0.1	0.1	0.6	0.1	0.5	0.7	0.5
USA	0.1	3.3	11.7	9.0	10.2	15.1	n/a
Other	9.0	0.1	0.0	0.0	0.0	0.0	n/a
TOTAL	9.1	3.4	12.3	9.1	10.8	15.8	-

Table 4.2.1.5 **Total Landings (Canadian and Foreign) of Spiny Dogfish and Dogfish Unspecified in NAFO Subareas 2-6.**

(NOTE: Final NAFO statistics including foreign landings are not yet available for 1991-94).
(* - The landings for 1991-93 are provisional landings obtained from the latest U.S. assessment of this stock (N.E.F.S.C. Ref. Doc. 94-

YEAR	2G	2H	2J	2NK	3K	3L	3M	3N	3O	3Pn	3Ps	3NK	4R	4S	4T	4Vn	4Vs	4W	4X	4NK
1960	0	0	43	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	7	8	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	10	0	0	12	0	10	0	0	0	0	0	0	34	0	0
1966	0	0	0	0	0	39	0	0	0	0	0	0	0	0	0	79	0	1451	4	0
1967	0	0	0	0	0	7	0	3	15	0	0	0	0	0	0	0	3	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	223	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	686	0	0	0	0	0	12	6	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	258	2194	16	0
1973	0	0	5	0	2	0	0	0	0	0	23	0	0	0	0	0	437	2288	746	0
1974	0	0	8	0	5	30	3	0	0	0	88	0	0	0	0	0	0	4324	2504	0
1975	0	0	0	0	0	2	0	0	5	0	109	0	0	0	3	0	146	3529	533	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	1605	954	284	0
1977	0	0	0	0	0	10	0	0	25	0	19	0	0	0	0	8	8	326	92	0
1978	0	0	0	0	0	25	0	0	15	1	81	0	0	0	0	0	0	9	9	0
1979	0	0	0	0	0	18	0	0	0	1	1295	0	0	0	0	1	7	38	2	0
1980	0	0	0	0	0	28	0	0	0	1	612	0	0	0	0	0	0	367	27	0
1981	0	0	0	0	6	2	15	23	0	0	557	0	0	0	0	0	5	467	29	0
1982	0	0	0	0	1	3	0	1	0	0	362	0	0	0	0	0	0	27	25	0
1983	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0	0	334	47	0
1984	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	36	2	286	1	0
1985	0	0	0	0	13	166	0	0	146	0	0	0	0	0	0	2	2	372	11	0
1986	0	0	0	0	0	8	0	0	3	0	0	0	0	0	11	14	2	221	8	[illegible]
1987	0	2	1	0	34	1	0	0	0	0	0	0	0	0	11	9	5	85	264	0
1988	0	1	4	0	2	0	0	25	0	0	0	0	0	0	0	1	1	545	0	0
1989	1	3	4	0	4	36	2	17	2	0	0	0	0	0	4	1	3	157	166	0
1990	5	3	0	0	0	0	0	0	0	0	1	0	0	9	615	41	1	329	724	0
1991	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1992	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1993	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1994	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 4.2.1.6

YEAR	5Y	5Ze	5Zw	5Zc	5Zu	5ZNK	6A	6B	6C	6D	6E	6F	6G	6H	6NK	Totals for NAFO SA's 2-6 Only
1960	455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	519
1961	438	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438
1962	296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	296
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1964	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	16
1965	0	0	0	141	0	0	0	0	0	0	0	0	0	0	0	207
1966	0	0	0	5254	0	0	0	0	0	0	0	0	0	0	2601	9428
1967	0	0	0	2058	0	0	9	0	0	0	0	0	0	0	634	2729
1968	0	1801	1630	0	0	0	0	0	0	0	0	0	0	0	677	4108
1969	78	378	6499	0	0	0	716	790	480	0	0	0	0	0	112	9302
1970	3	2321	2043	0	0	0	289	231	68	0	0	0	0	0	0	5659
1971	4	3182	4844	0	0	0	2006	1438	83	0	0	0	0	0	0	11560
1972	200	8303	4339	0	0	0	6693	1429	562	0	0	0	0	0	0	23994
1973	4	9109	2796	0	0	0	1940	1428	57	0	0	0	0	0	0	18835
1974	1	9051	3202	0	0	0	3943	1476	16	0	0	0	0	0	0	24651
1975	2	11206	5104	0	0	0	1955	96	2	0	0	0	0	0	0	22692
1976	433	10214	2244	0	0	0	1565	24	1	0	0	0	0	0	0	17340
1977	829	3223	1729	0	0	0	1256	227	364	0	0	0	0	0	13	8129
1978	725	90	391	0	0	0	177	31	1	3	0	0	0	0	0	1558
1979	4089	83	60	0	0	0	253	409	13	0	0	0	0	0	0	6269
1980	3492	103	30	0	0	0	154	410	205	0	0	0	0	0	0	5429
1981	5031	145	68	0	0	0	126	1115	812	0	0	0	0	0	0	8401
1982	3157	58	63	0	0	10	163	2022	1491	0	0	0	0	0	0	7383
1983	4755	7	0	0	0	0	41	141	14	0	0	0	0	0	0	5370
1984	4269	19	14	0	0	0	67	136	9	0	0	0	0	0	0	4844
1985	3872	80	8	0	0	0	137	219	28	0	0	0	0	0	0	5056
1986	2415	0	7	0	138	0	191	18	18	0	0	0	0	0	0	3054
1987	2565	0	24	0	44	0	69	36	3	0	0	0	0	0	1	3154
1988	2784	0	3	0	85	0	148	31	137	0	0	0	0	0	0	3767
1989	4546	0	3	0	10	0	46	19	0	0	0	0	0	0	0	5024
1990	9459	0	2196	1	68	0	98	3010	20	0	0	0	0	0	0	16580
1991	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	15831
1992	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	19012
1993	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	22572
1994	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	N/A

Table 4.2.1.7 **Landings (t) of Spiny Dogfish in NAFO Div. 4T by NAFO unit area.**

U-AREA	Year						PERCENT 1994	PERCENT 1989-94
	1989	1990	1991	1992	1993	1994		
4TF	0.0	36.6	0.0	0.2	0.0	29.4	3.0	2.9
4TG	4.2	399.6	0.6	190.3	107.9	108.2	11.2	36.0
4TH	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.1
4TJ	0.0	32.1	0.7	1.8	18.7	8.3	0.9	2.7
4TK	0.0	0.2	0.0	0.0	0.0	0.5	0.1	0.0
4TL	0.0	34.1	0.0	0.0	352.3	717.1	73.9	48.9
4TM	0.0	8.6	0.0	0.0	13.6	4.8	0.5	1.2
4TN	0.0	15.7	0.0	0.0	42.8	99.5	10.3	7.0
4TO	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
4TP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4TQ	0.0	0.0	0.0	0.0	0.0	2.1	0.2	0.1
4T?	0.3	22.4	0.0	0.0	0.0	0.0	0.0	1.0
TOTALS	4.4	549.2	1.3	192.3	537.4	970.0	100.0	100.0
	TOTAL LANDINGS 1989-94:					2254.7		

Table 4.2.1.8 **Landings of Spiny Dogfish (t) in NAFO Div. 4T by Fishery Statistical District:1989-94.**

Stat. Dist.	Year						Totals	1994 Percent	1989-94 Percent
	1989	1990	1991	1992	1993	1994			
101	0.0	38.7	0.0	0.0	5.5	0.1	44.3	0.0	2.0
102	4.2	186.3	0.5	173.9	0.0	0.0	364.9	0.0	16.2
103	0.0	0.4	0.0	16.6	0.0	5.3	22.3	0.5	1.0
109	0.0	0.0	0.0	0.0	0.0	7.7	7.7	0.8	0.3
112	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
113	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0
264	0.0	0.0	0.0	0.0	13.6	0.0	13.6	0.0	0.6
265	0.0	14.0	0.0	0.0	0.0	0.0	14.0	0.0	0.6
266	0.0	12.8	0.0	0.0	38.6	0.0	51.4	0.0	2.3
267	0.0	0.0	0.0	0.0	4.2	0.0	4.2	0.0	0.2
268	0.0	0.0	0.0	0.0	162.0	0.0	162.0	0.0	7.2
382	0.0	5.7	0.0	0.0	72.7	347.2	425.6	35.8	18.9
385	0.0	0.0	0.0	0.0	1.2	0.0	1.2	0.0	0.1
387	0.3	147.8	0.0	0.0	2.6	0.0	150.7	0.0	6.7
388	0.0	69.9	0.1	0.0	106.1	102.6	278.7	10.6	12.4
392	0.0	41.5	0.0	0.0	112.7	370.0	524.2	38.1	23.2
395	0.0	13.6	0.7	1.8	14.4	2.5	33.0	0.3	1.5
396	0.0	18.5	0.0	0.0	3.8	5.8	28.1	0.6	1.2
398	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
403	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
404	0.0	0.0	0.0	0.0	0.0	2.1	2.1	0.2	0.1
405	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
409	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
410	0.0	0.0	0.0	0.0	0.0	56.6	56.6	5.8	2.5
411	0.0	0.0	0.0	0.0	0.0	46.9	46.9	4.8	2.1
413	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.1	0.1
426	0.0	0.0	0.0	0.0	0.0	2.3	2.3	0.2	0.1
427	0.0	0.0	0.0	0.0	0.0	9.9	9.9	1.0	0.4
428	0.0	0.0	0.0	0.0	0.0	9.3	9.3	1.0	0.4
TOTALS	4.4	549.2	1.3	192.3	537.4	970.0	2254.7	100.0	100.0

NOTE: The ZIFF (Zonal Interchange File Format) landings data on which the table (above) are based do not include landings of Dogfish Unspecified and will not agree with the totals in Table 1 for some years.

Table 4.2.1.9 Landings of Spiny Dogfish (t) in NAFO Div. 4T by Gear:1989-94.

Year	GNS	LLS	OTB	SNU	MISC	TOTALS
1989	4.2		0.3			4.4
1990	321.1	47.1	153.4	6.4	21.2	549.2
1991	0.2	1.1	0.0	0.0	0.0	1.3
1992	126.0	64.0	1.0	1.0	0.4	192.3
1993	482.0	31.8	12.6	1.5	9.5	537.4
1994	869.5	54.3	12.8	8.1	25.4	970.0
TOTALS	1798.8	198.2	179.8	17.0	56.5	2250.3
PERCENT	79.9	8.8	8.0	0.8	2.5	100.0

Table 4.2.1.10 Landings of Spiny Dogfish (t) in NAFO Div. 4T by Month:1989-94.

Year	April	May	June	July	Aug	Sept	Oct	Nov	Totals
1989	0.0	0.0	0.0	0.0	0.0	4.2	0.3	0.0	4.4
1990	0.0	0.0	0.0	0.1	0.0	166.3	242.8	140.0	549.2
1991	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.5	1.3
1992	1.1	0.0	0.0	0.0	0.0	4.2	87.6	99.4	192.3
1993	0.0	0.0	3.5	72.8	130.1	244.6	86.5	0.0	537.4
1994	0.0	0.0	1.5	21.8	157.2	427.5	362.0	0.0	970.0
1994 PERCENT	0.0	0.0	0.2	2.2	16.2	44.1	37.3	0.0	100.0
1989-94 PERCENT	0.0	0.0	0.2	4.2	12.7	37.6	34.6	10.6	100.0

NOTE: The ZIFF landings data on which the two tables (above) are based do not include landings of Dogfish Unspecified and will not agree with the totals in Table 1 for some years.

Table 4.2.2.1 Commercial landings (mt) of spiny dogfish in NAFO Sub-areas 2-6, 1960-1993

Year	Canada	US	USSR	Other foreign	US rec	Total
1960	-	455	-	64	na	519
1961	-	438	-	-	na	438
1962	-	296	-	-	na	296
1963	-	-	-	1	na	1
1964	-	102	-	16	na	118
1965	9	181	188	10	na	388
1966	39	261	9,389	-	na	9,689
1967	-	90	2,436	-	na	2,526
1968	-	158	4,404	-	621	5,183
1969	-	112	8,827	363	453	9,755
1970	19	3	4,924	716	705	6,367
1971	4	< 1	10,802	764	561	12,131
1972	3	9	23,302	689	820	24,823
1973	20	16	14,219	4,574	890	19,719
1974	36	102	20,444	4,069	969	25,620
1975	1	168	22,331	192	789	23,481
1976	3	549	16,681	107	707	18,047
1977	1	929	6,942	257	563	8,692
1978	84	852	577	45	700	2,258
1979	1,331	4,751	105	82	426	6,695
1980	670	4,171	351	248	284	5,723
1981	564	6,865	516	458	1,856	10,257
1982	953	6,633	27	337	700	8,647
1983	-	4,906	359	105	745	6,115
1984	4	4,451	291	100	663	5,509
1985	13	4,031	694	318	1,591	6,647
1986	21	2,665	214	154	1,438	4,492
1987	280	2,735	116	23	1,053	4,207
1988	-	3,257	574	73	1,336	5,103
1989	166	4,603	169	87	1,829	6,854
1990	1,316	14,870	383	10	1,662	18,222
1991	292	13,353	218	16	1,677	15,831
1992	829	17,160	26	41	1,197	19,012
1993	[1]1,000	20,360	-	-	1,212	22,572

[1]Estimated.

Figure 4.2.2.2 Recreational catches and commercial landings (thousand metric ton) of skates.

Category	1974-83 Average	1984	1985	1986	1987	Year 1988	1989	1990	1991	1992	1993
U.S. recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	1.6	4.1	4.0	4.2	5.1	5.9	6.6	11.3	11.2	12.3	8.1
Canada	<0.1	-	<0.1	-	<0.1	<0.1	-	-	-	-	-
Other	0.6	-	-	0.1	-	-	-	-	-	-	-
Total nominal catch	2.2	4.1	4.0	4.3	5.1	5.9	6.6	11.3	11.2	12.3	8.1

Table 4.2.2.3 Summary of the landings for all sharks species in the management unit (ie. excluding dogfish)

Year	All species	Large coastal species	
	Commercial landings ('000 t)	Commercial landings ('000 t)	Recreational landings
79	135		
80	458		
81	666		
82	590		
83	724		
84	846		
85	969		
86	1618	1301	755
87	3603	2451	907
88	5276	4057	668
89	7122	5013	616
90	5950	3830	637
91	--	4010	310

Figure 4.1.4.1

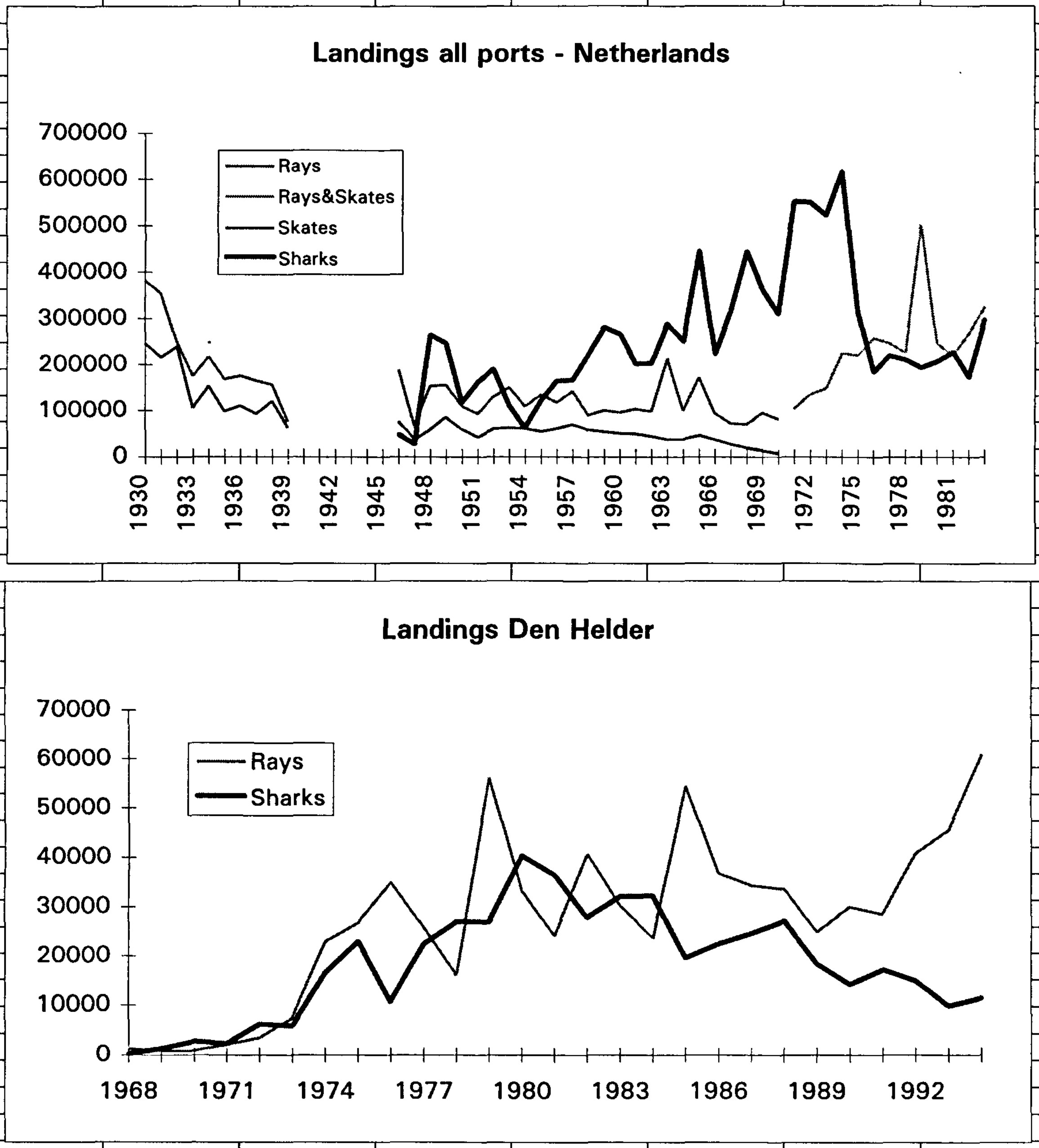

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Figure 4.1.9.1

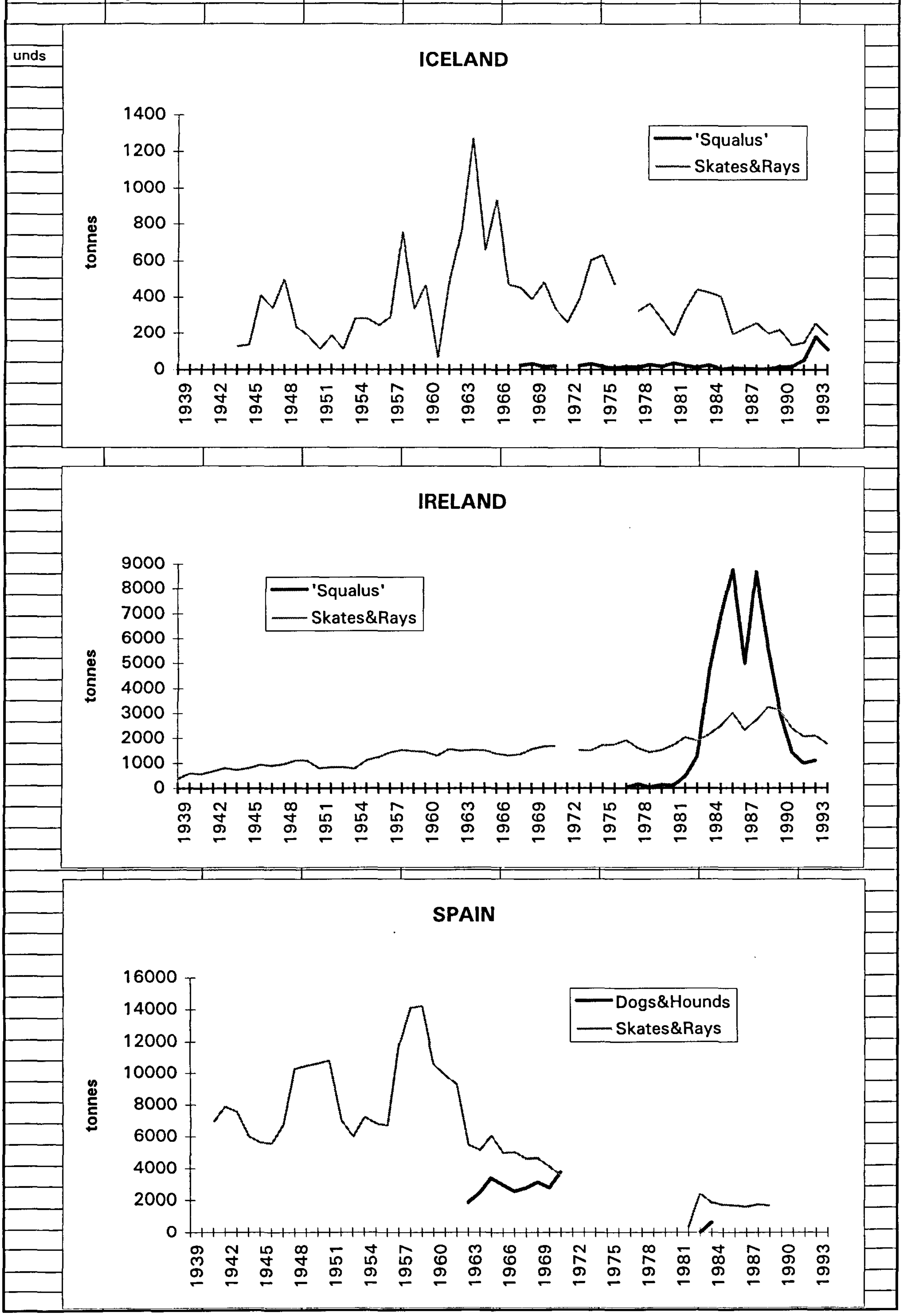
unds
ICELAND
tonnes
'Squalus'
Skates&Rays
IRELAND
tonnes
'Squalus'
Skates&Rays
SPAIN
tonnes
Dogs&Hounds
Skates&Rays

Figure 4.1.9.2

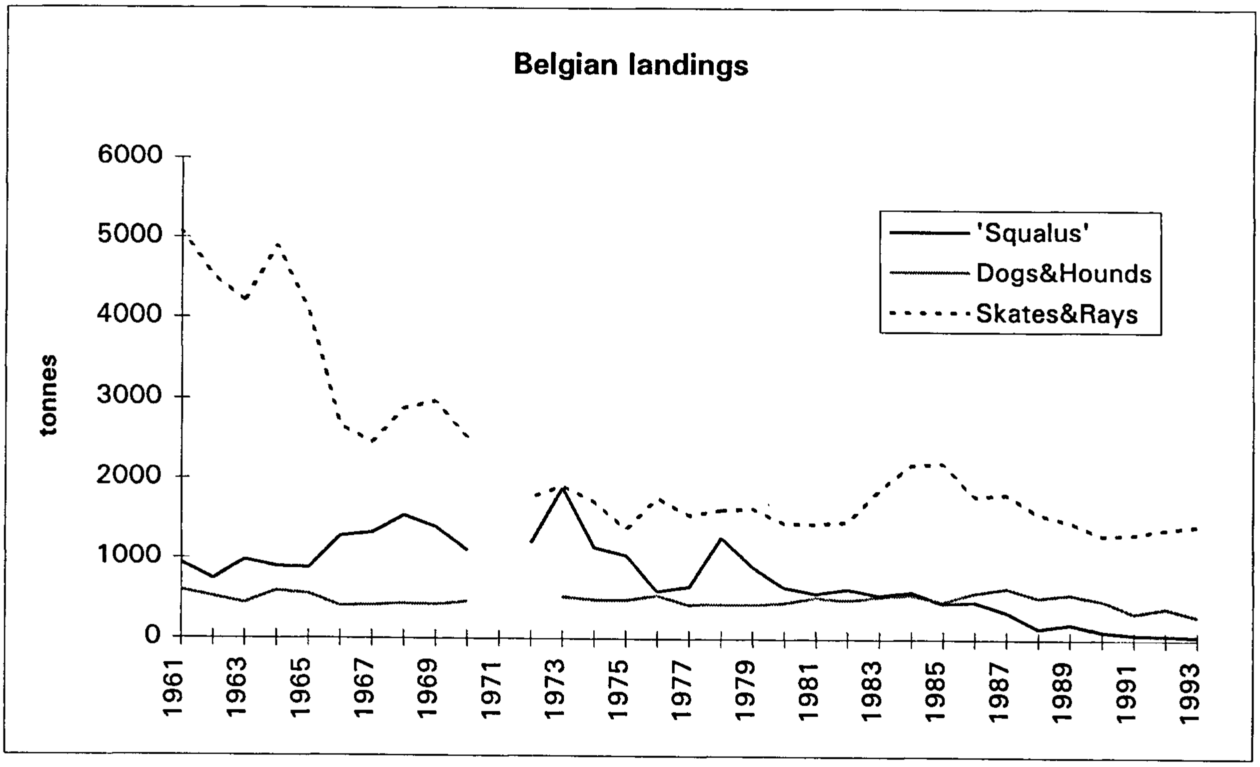

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Figure 5.1.1 Landings data from ICES fisheries statistics.

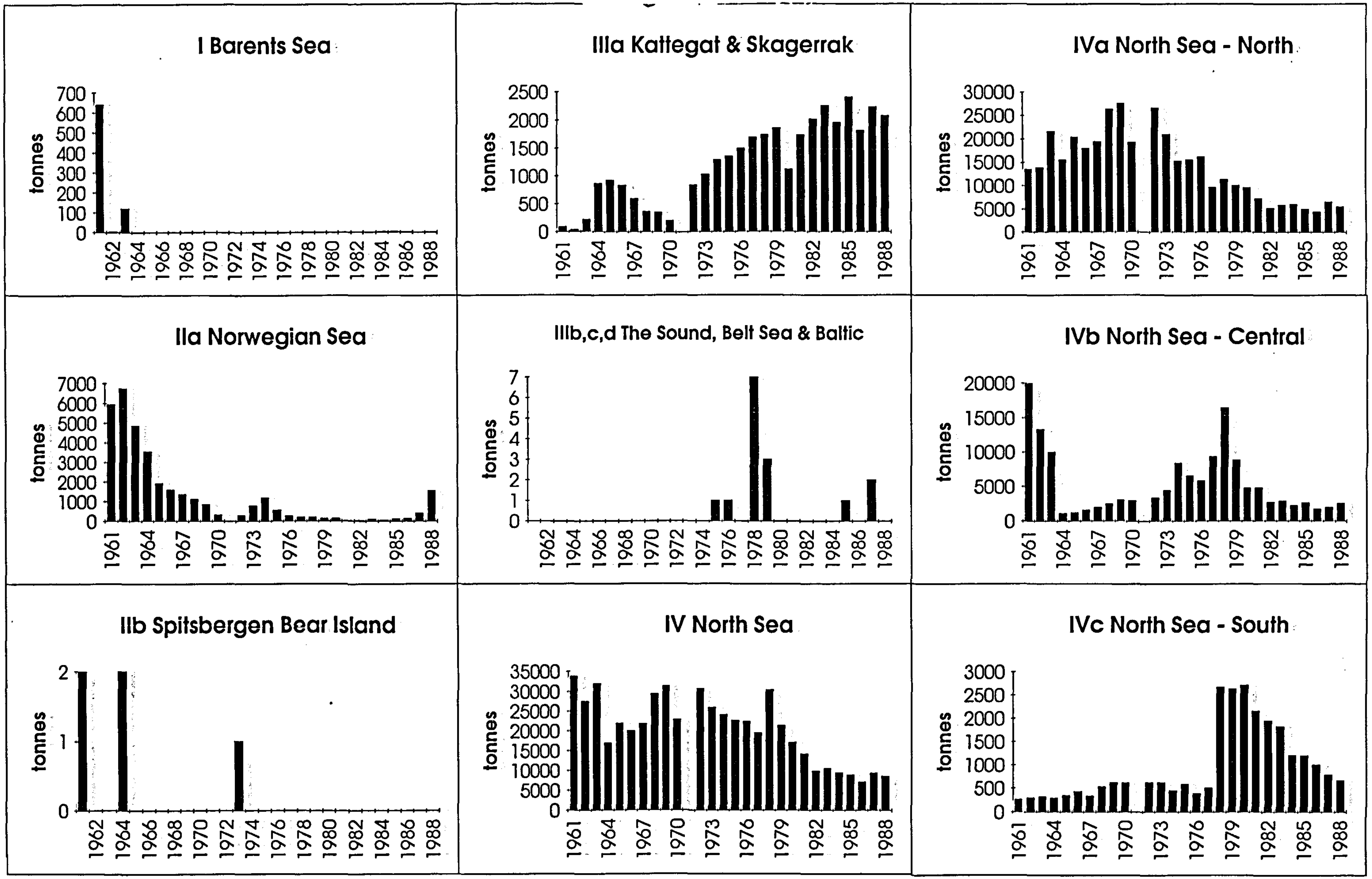


Figure 5.1.1 (Cont'd)

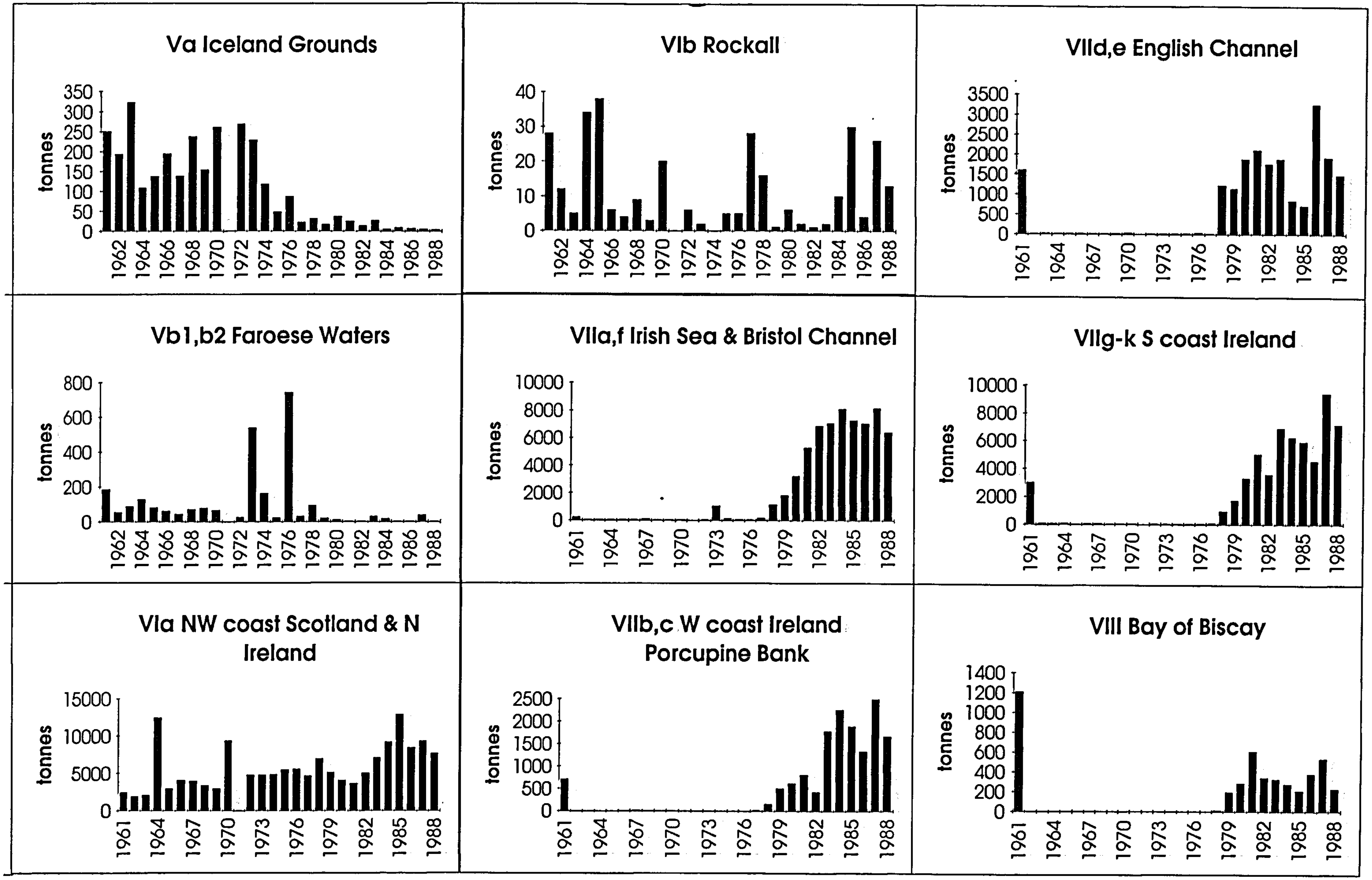


Figure 5.1.1 (Cont'd)

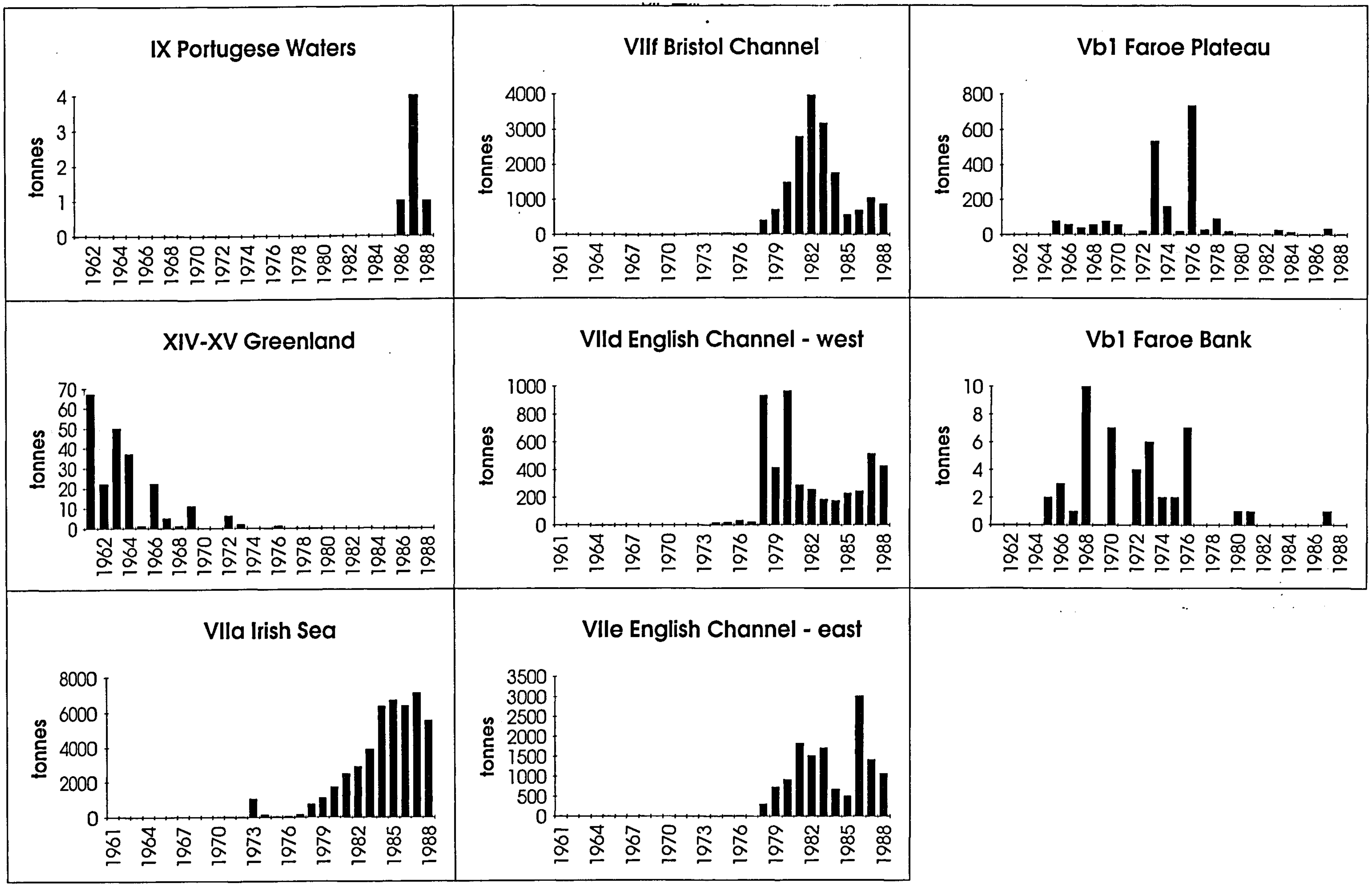


Figure 5.1.2

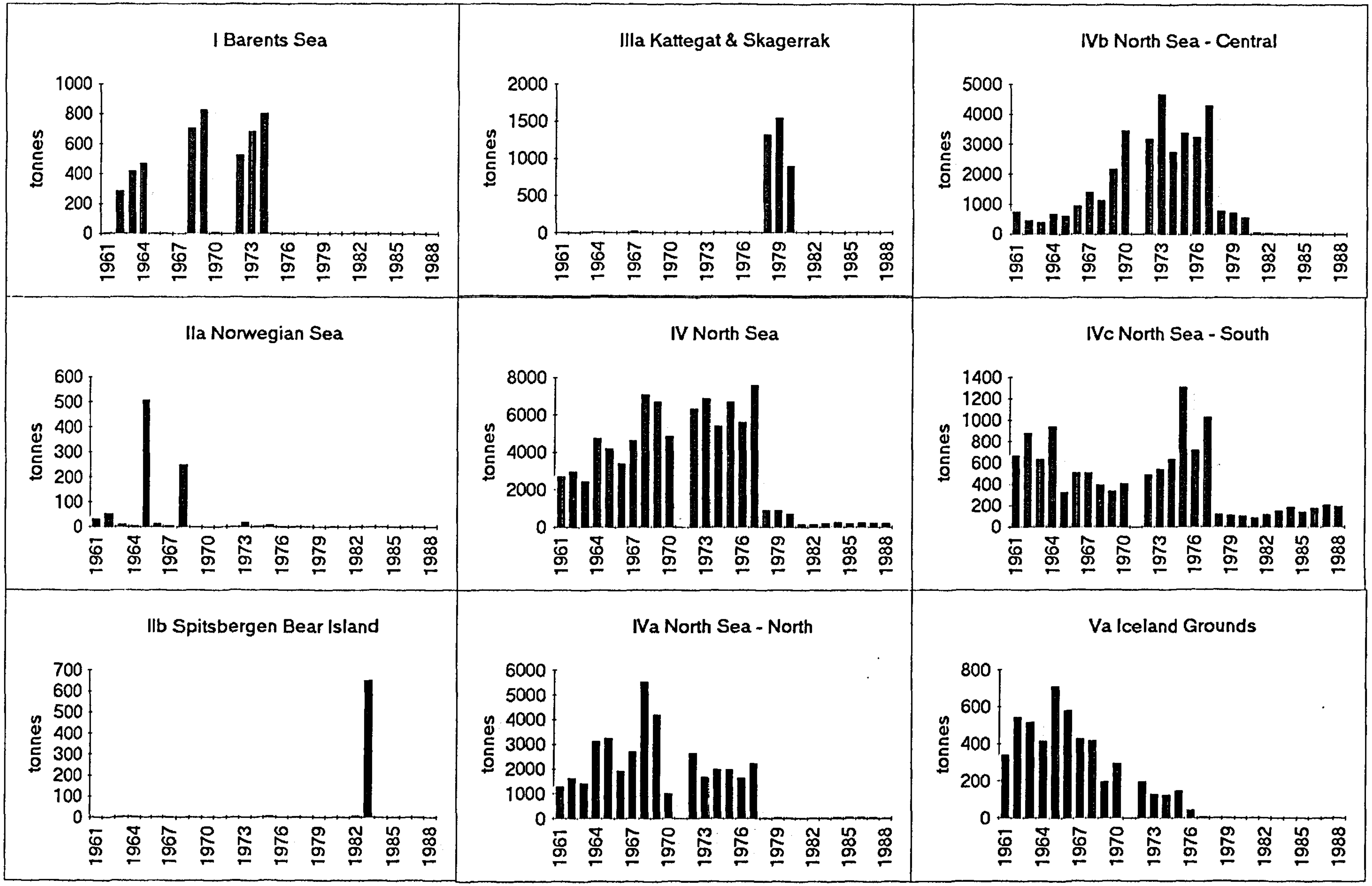

I Barents Sea
IIIa Kattegat & Skagerrak
IVb North Sea - Central
IIa Norwegian Sea
IV North Sea
IVc North Sea - South
IIb Spitsbergen Bear Island
IVa North Sea - North
Va Iceland Grounds
tonnes
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988

Figure 5.1.2 (Cont'd)

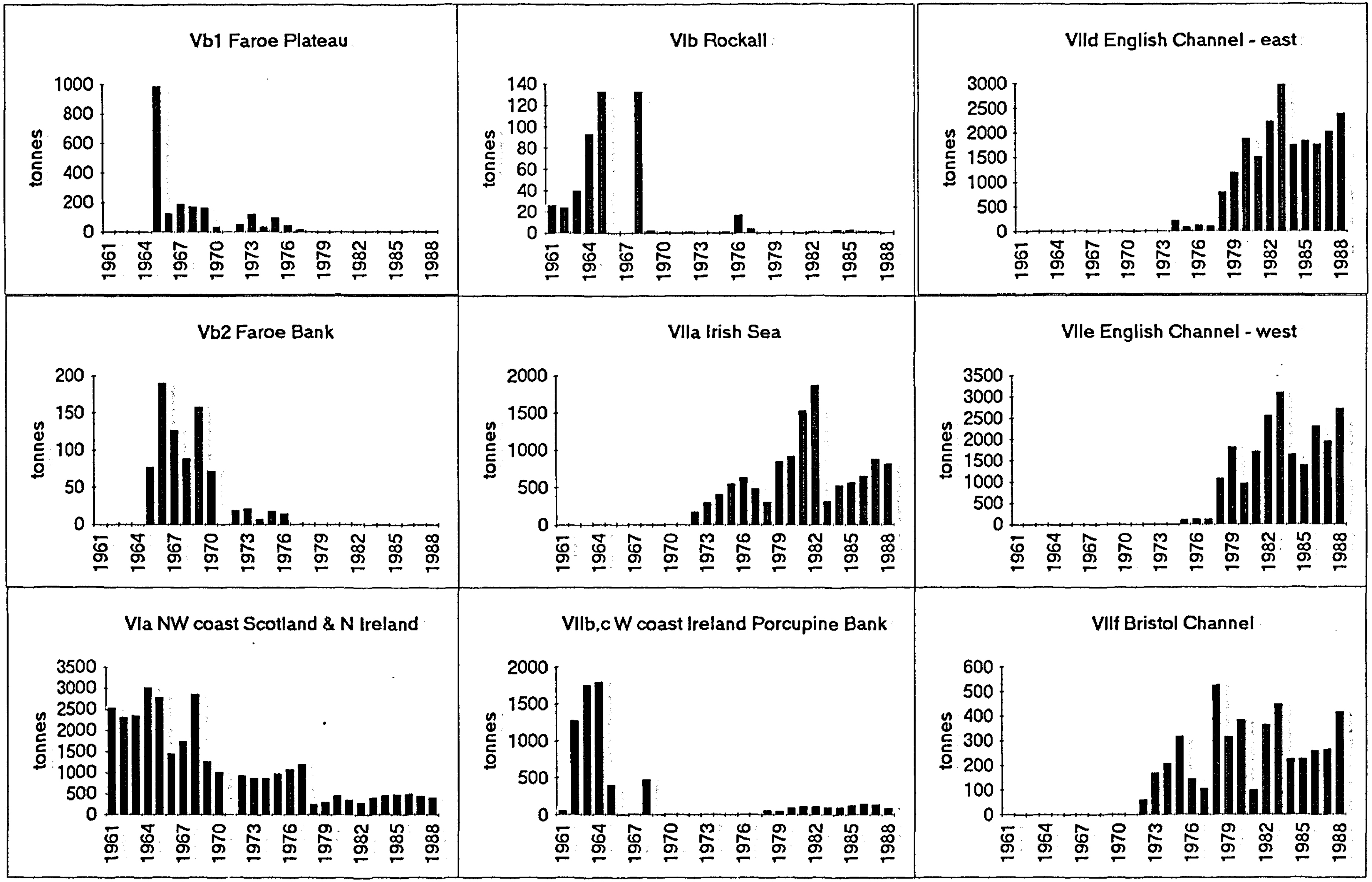


Figure 5.1.2(Cont'd)

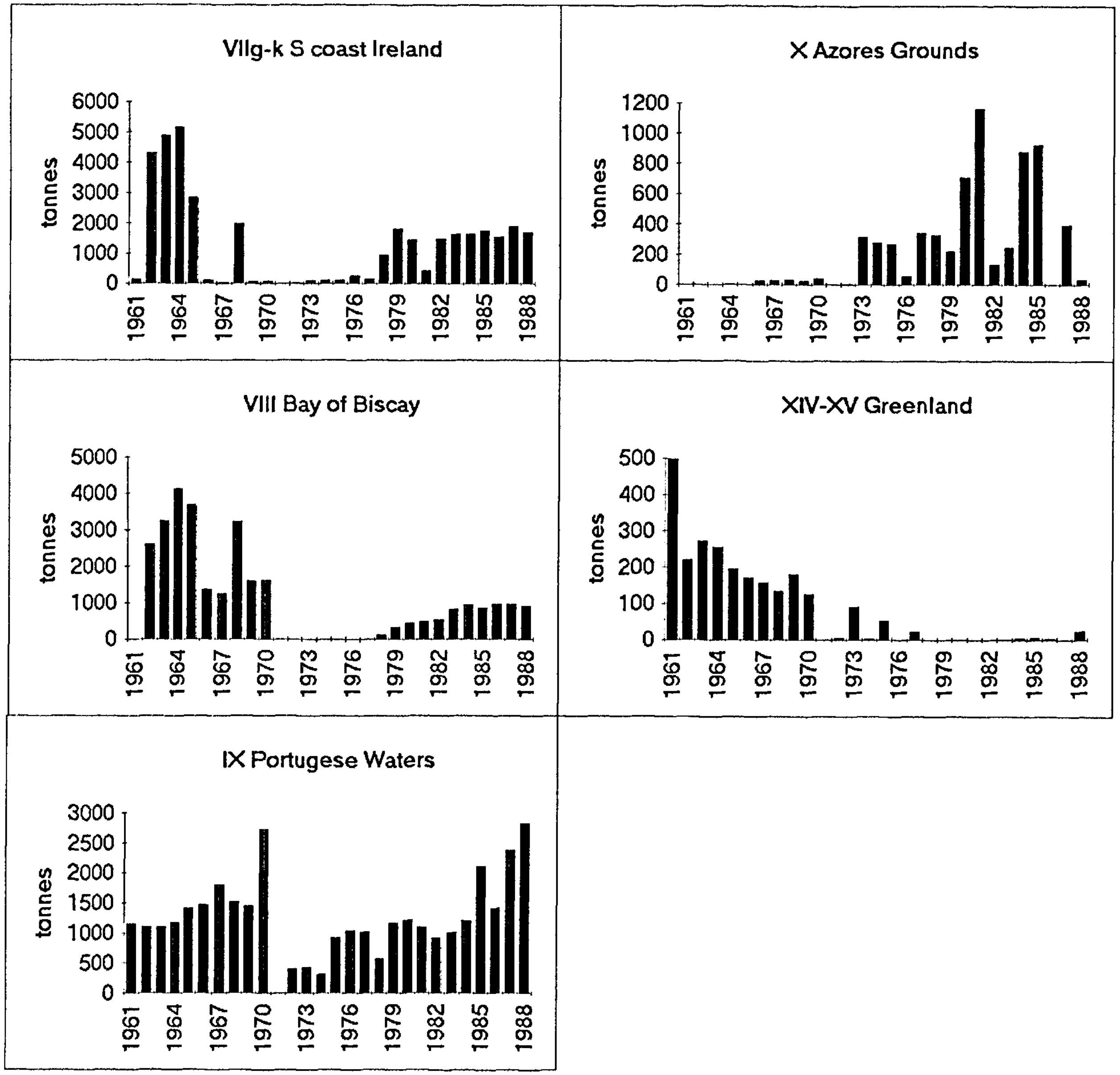
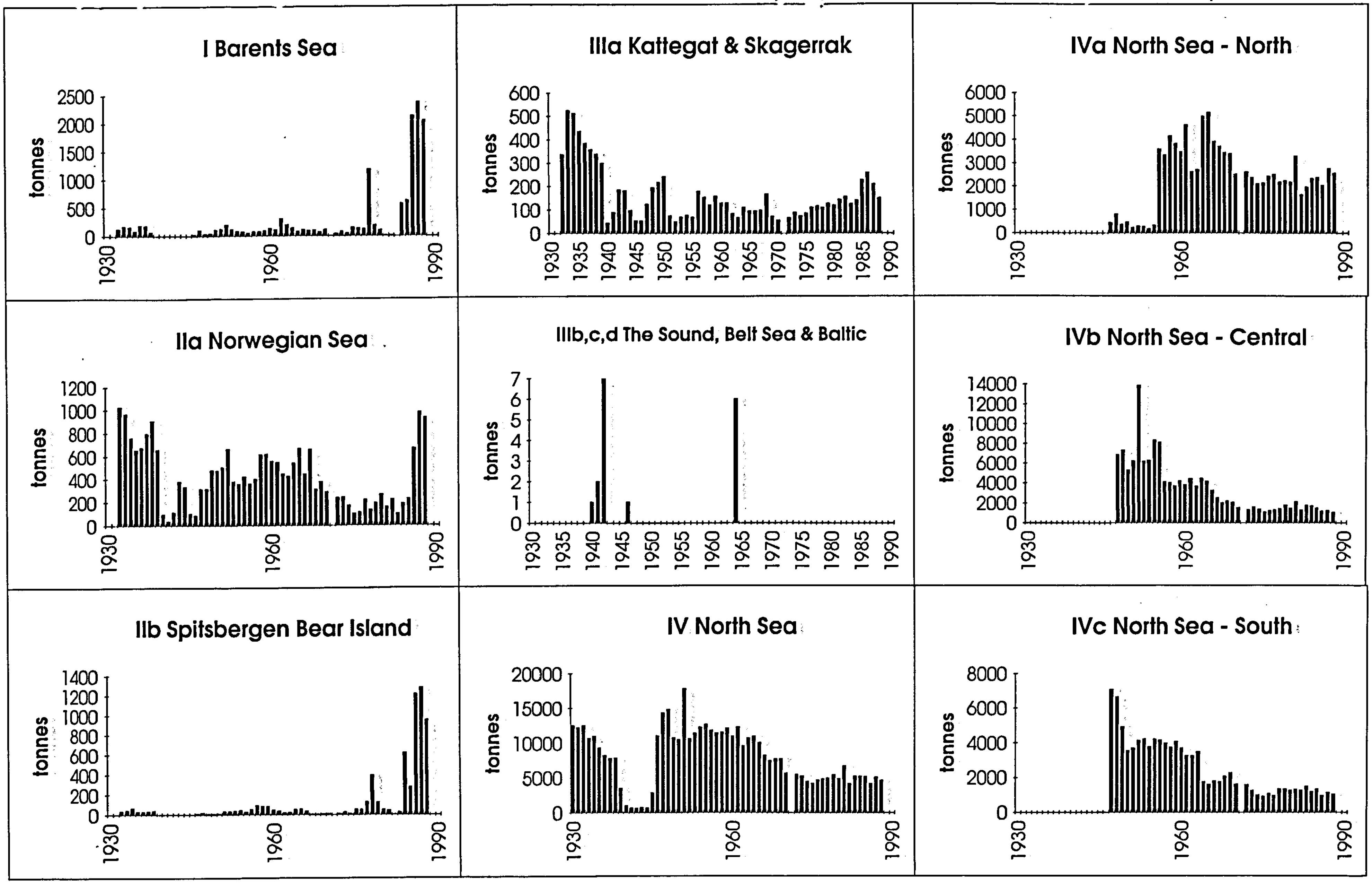
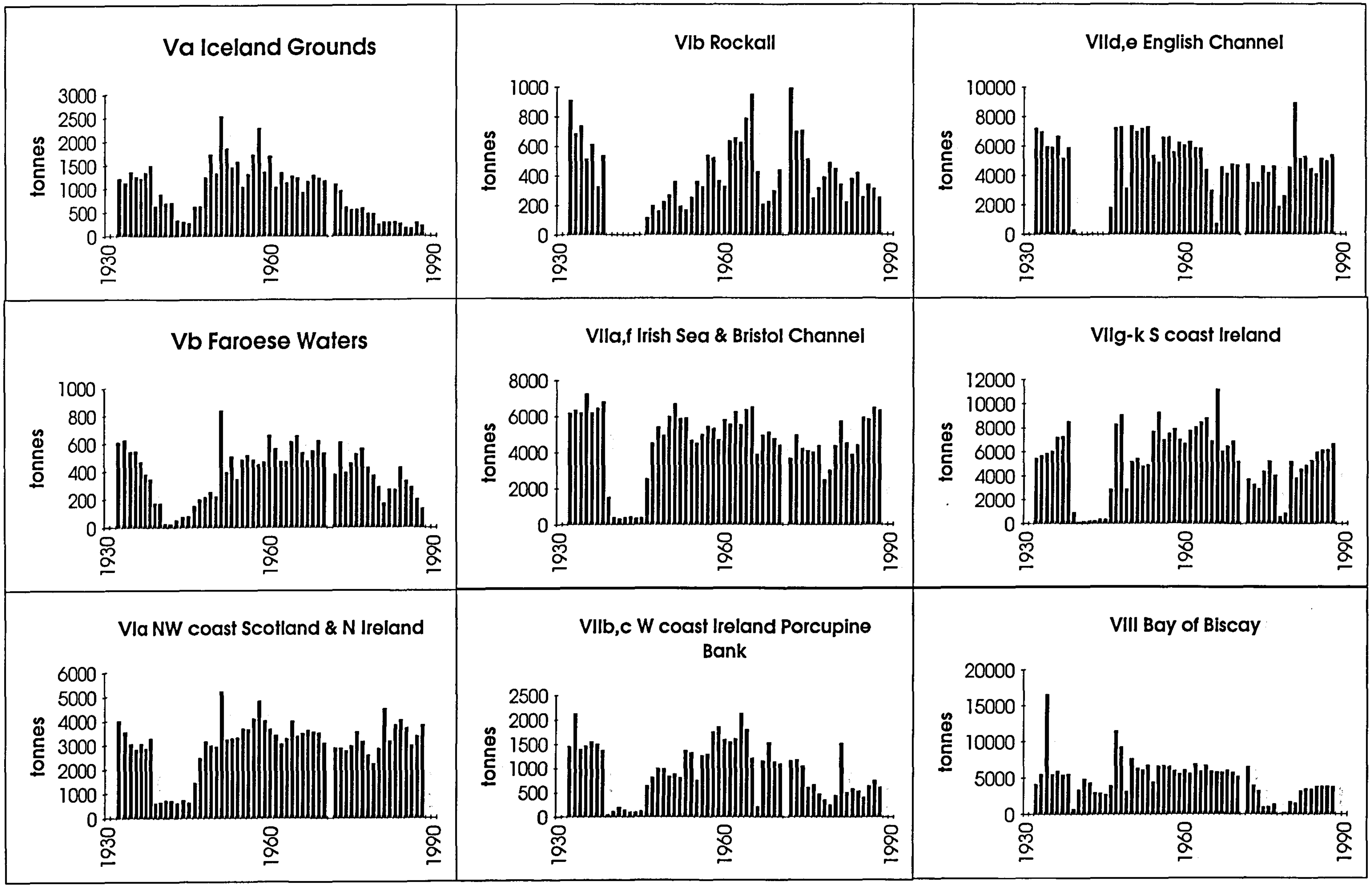


Figure 5.1.3



I Barents Sea
IIIa Kattegat & Skagerrak
IVa North Sea - North
IIa Norwegian Sea
IIIb,c,d The Sound, Belt Sea & Baltic
IVb North Sea - Central
IIb Spitsbergen Bear Island
IV North Sea
IVc North Sea - South
tonnes
1930
1960
1990

Figure 5.1.3 (Cont'd)



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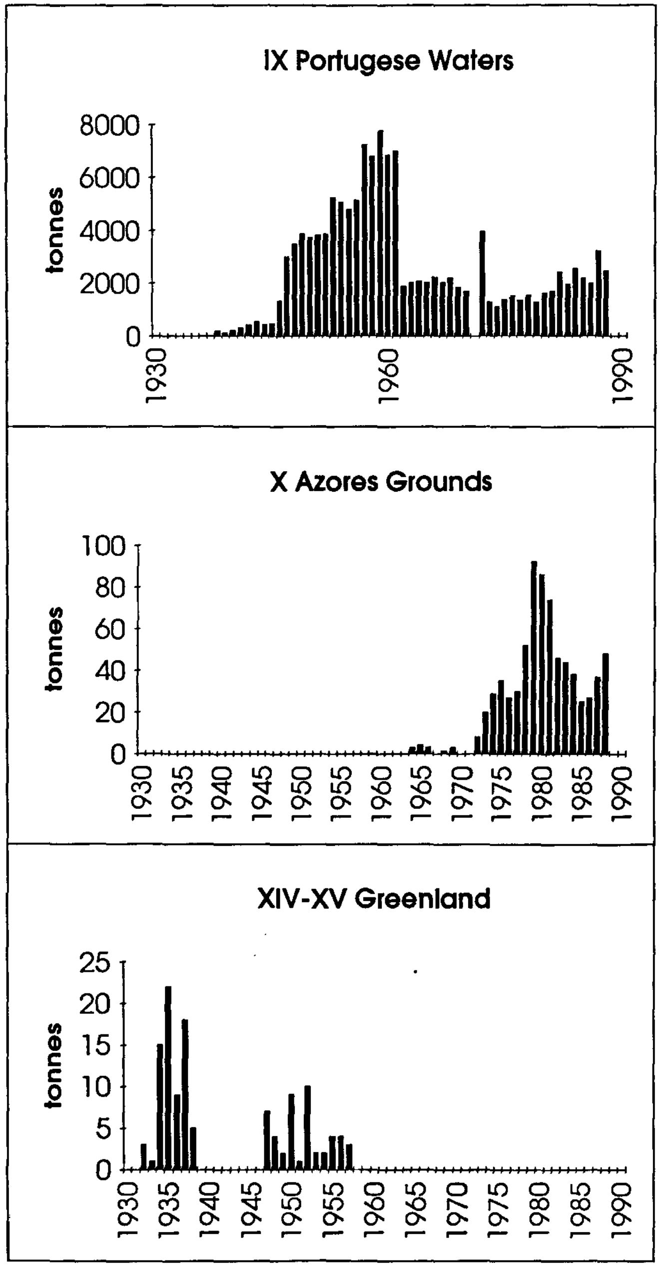
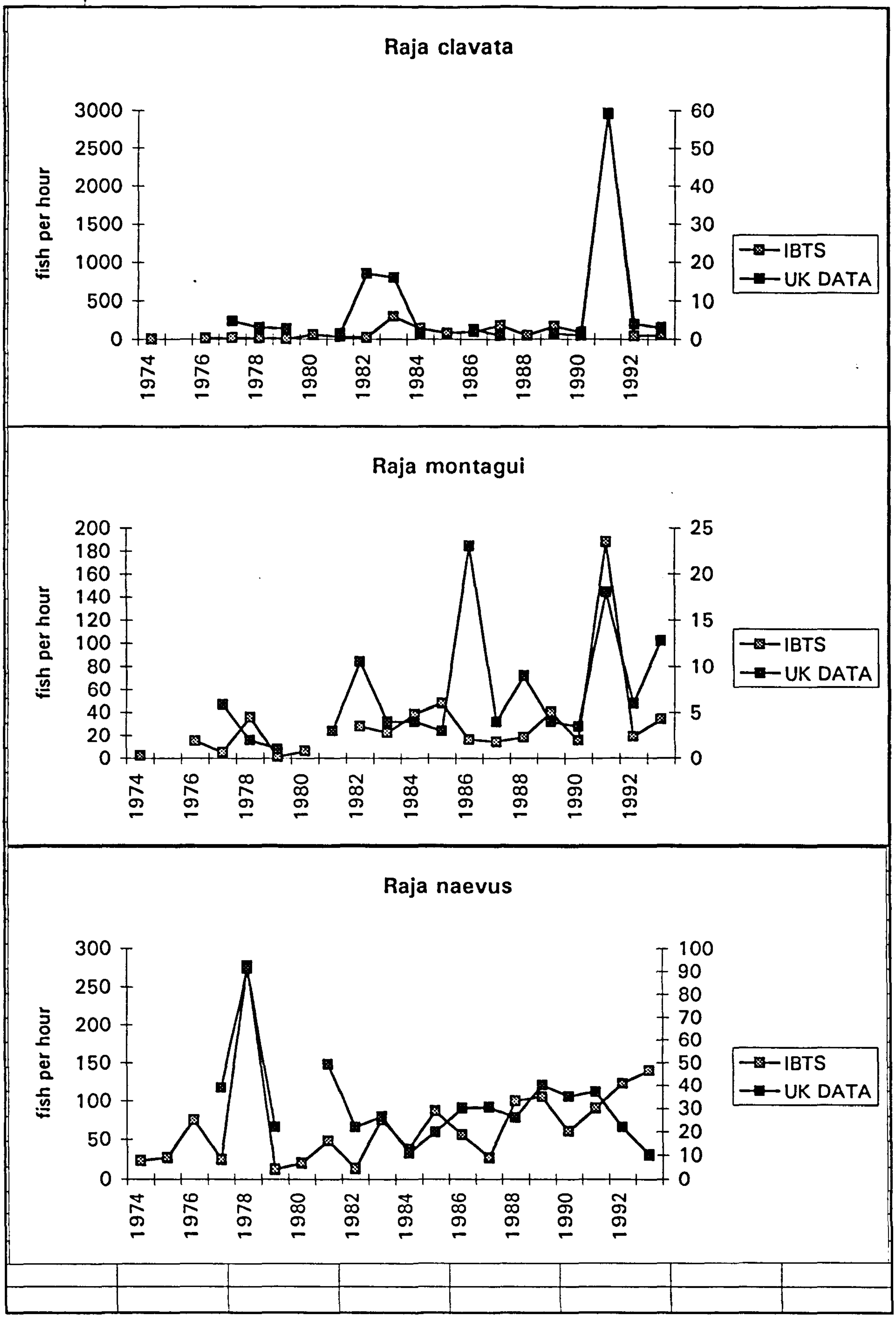
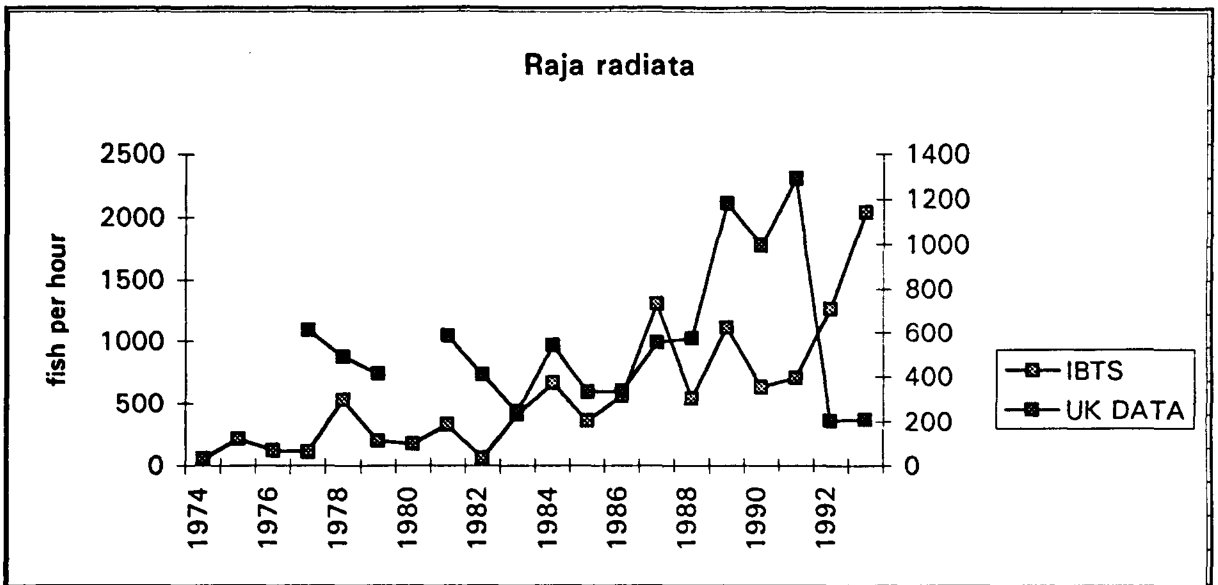


Figure 5.2.1



Raja clavata
fish per hour
3000
2500
2000
1500
1000
500
0
60
50
40
30
20
10
0
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
IBTS
UK DATA
Raja montagui
fish per hour
200
180
160
140
120
100
80
60
40
20
0
25
20
15
10
5
0
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
IBTS
UK DATA
Raja naevus
fish per hour
300
250
200
150
100
50
0
100
90
80
70
60
50
40
30
20
10
0
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
IBTS
UK DATA

Figure 5.2.1 (Cont'd)



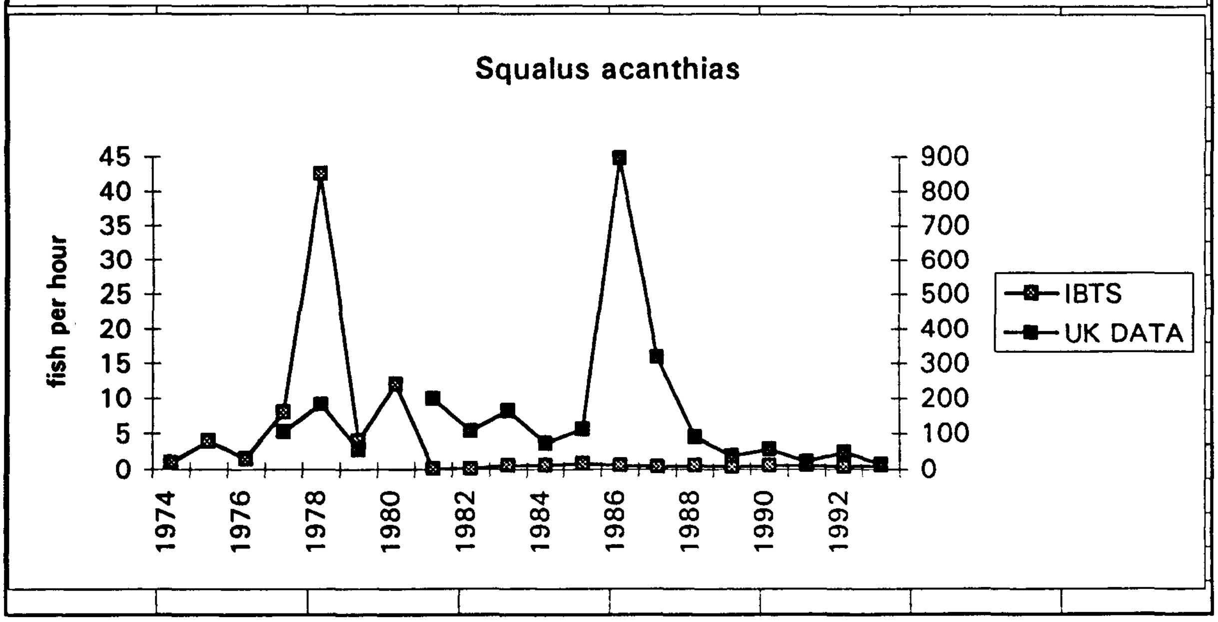


Figure 5.3.1

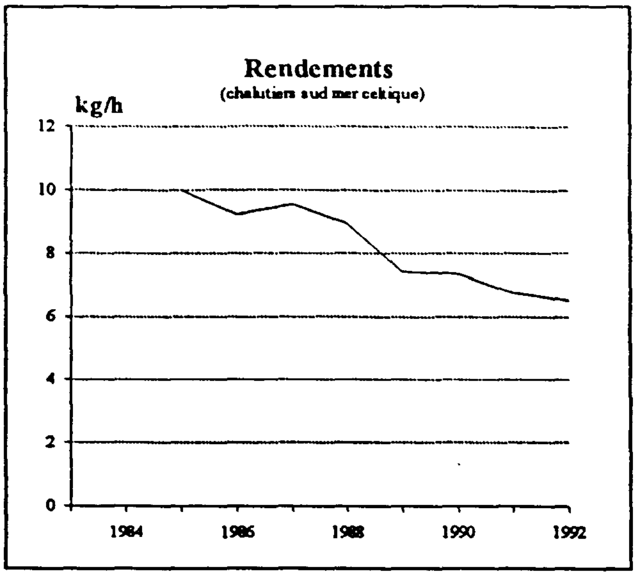


Figure 5.3.2

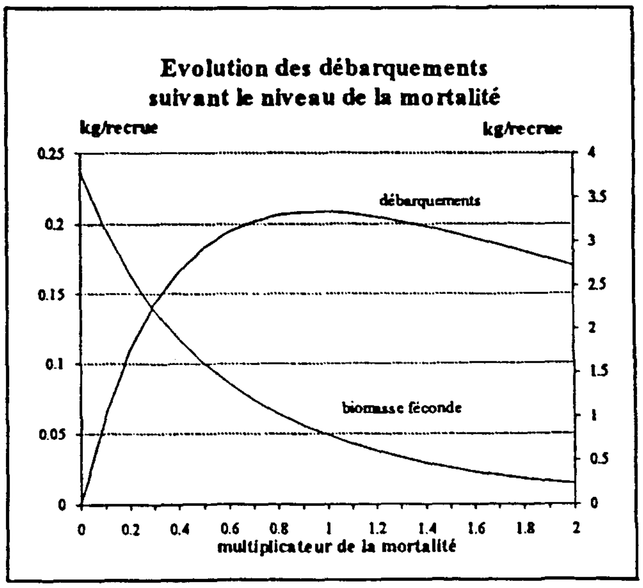


Figure 5.3.3

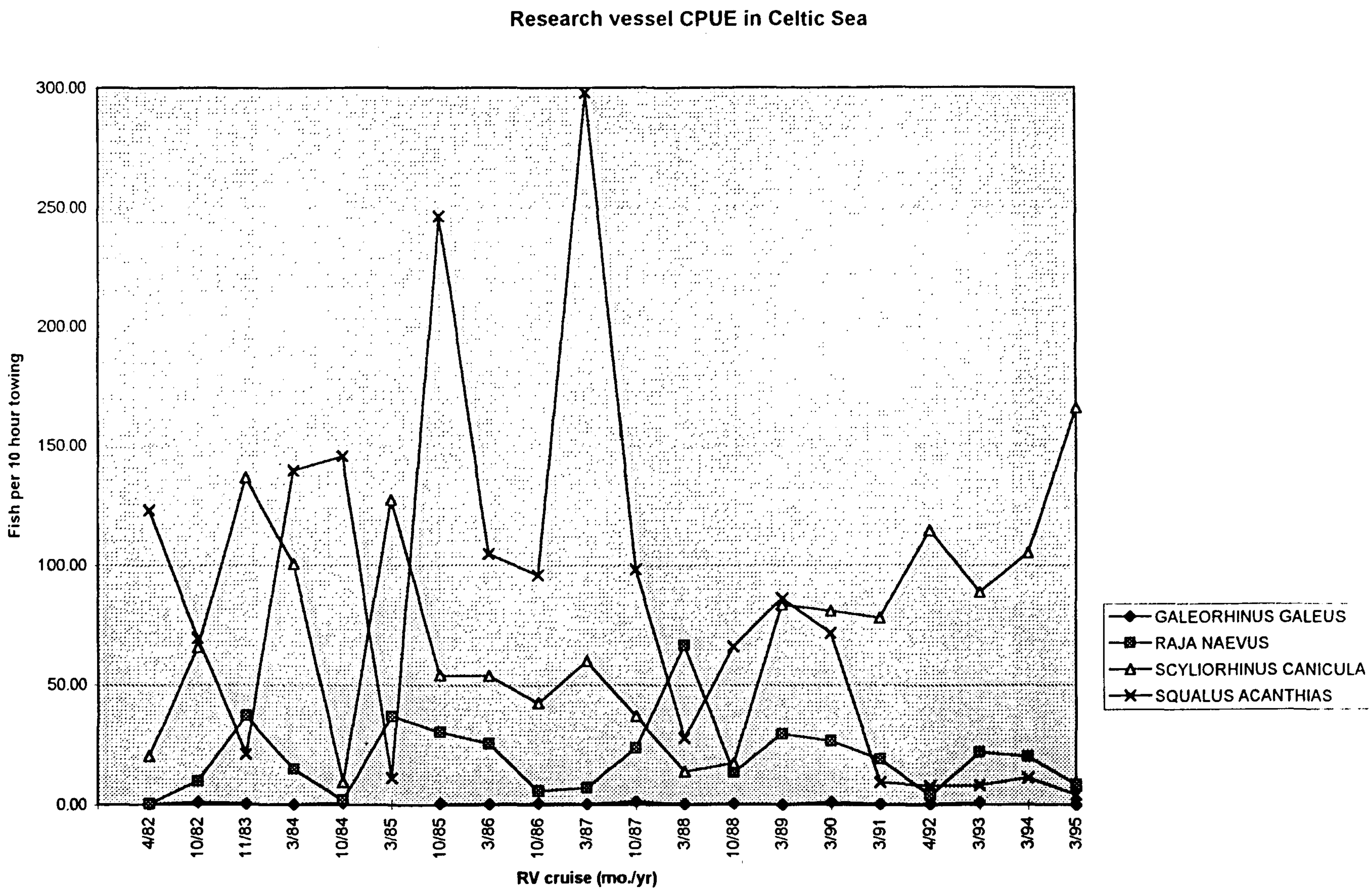
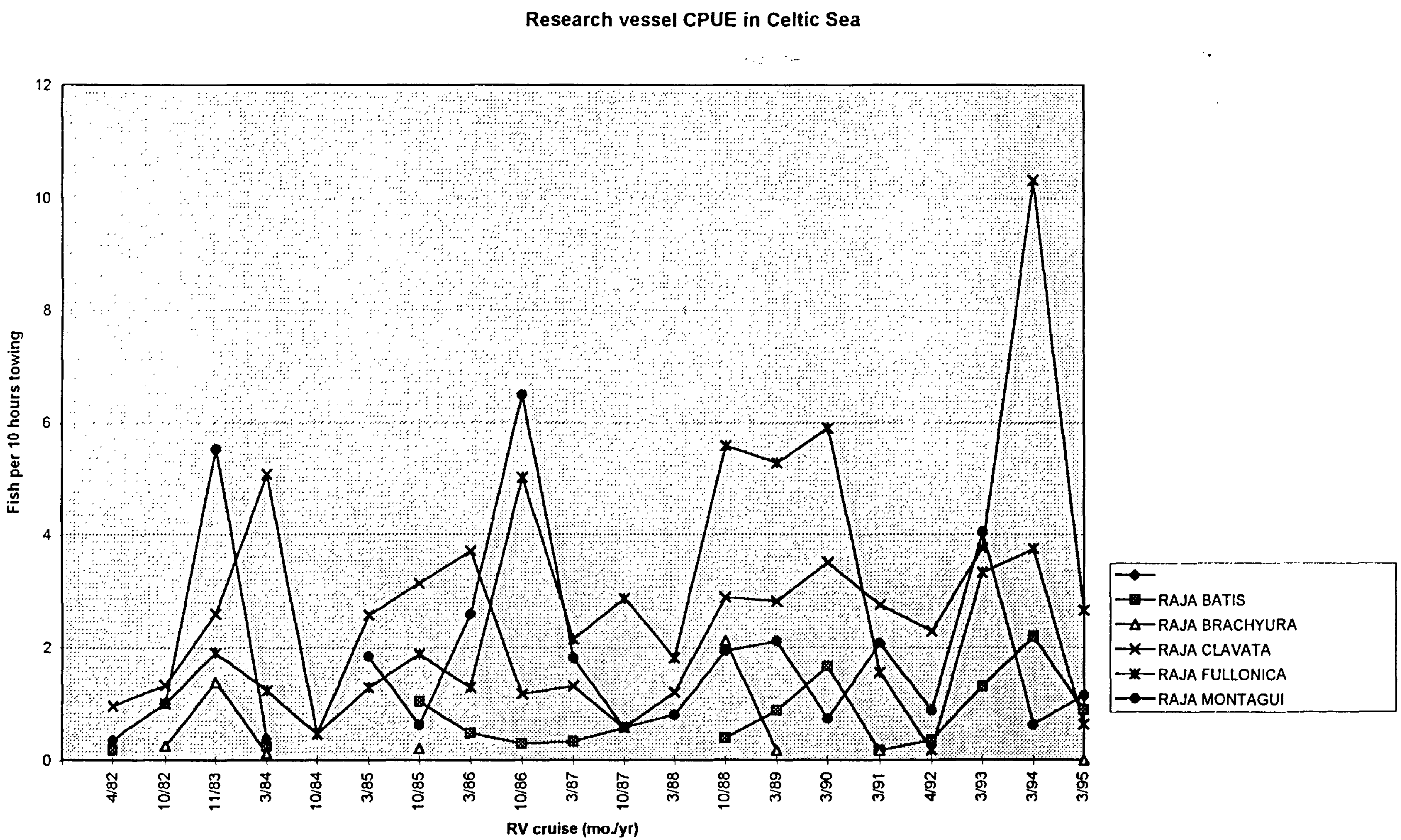

Research vessel CPUE in Celtic Sea
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Fish per 10 hour towing
4/82
10/82
11/83
3/84
10/84
3/85
10/85
3/86
10/86
3/87
10/87
3/88
10/88
3/89
3/90
3/91
4/92
3/93
3/94
3/95
RV cruise (mo./yr)
GALEORHINUS GALEUS
RAJA NAEVUS
SCYLIORHINUS CANICULA
SQUALUS ACANTHIAS

Figure 5.4.1



Research vessel CPUE in Celtic Sea
12
10
8
6
4
2
0
Fish per 10 hours towing
4/82
10/82
11/83
3/84
10/84
3/85
10/85
3/86
10/86
3/87
10/87
3/88
10/88
3/89
3/90
3/91
4/92
3/93
3/94
3/95
RV cruise (mo./yr)
RAJA BATIS
RAJA BRACHYURA
RAJA CLAVATA
RAJA FULLONICA
RAJA MONTAGUI

Figure 5.7.1

Fig. 5**. Commercial CPUE for *Sq. acanthias* in North sea and west of Scotland

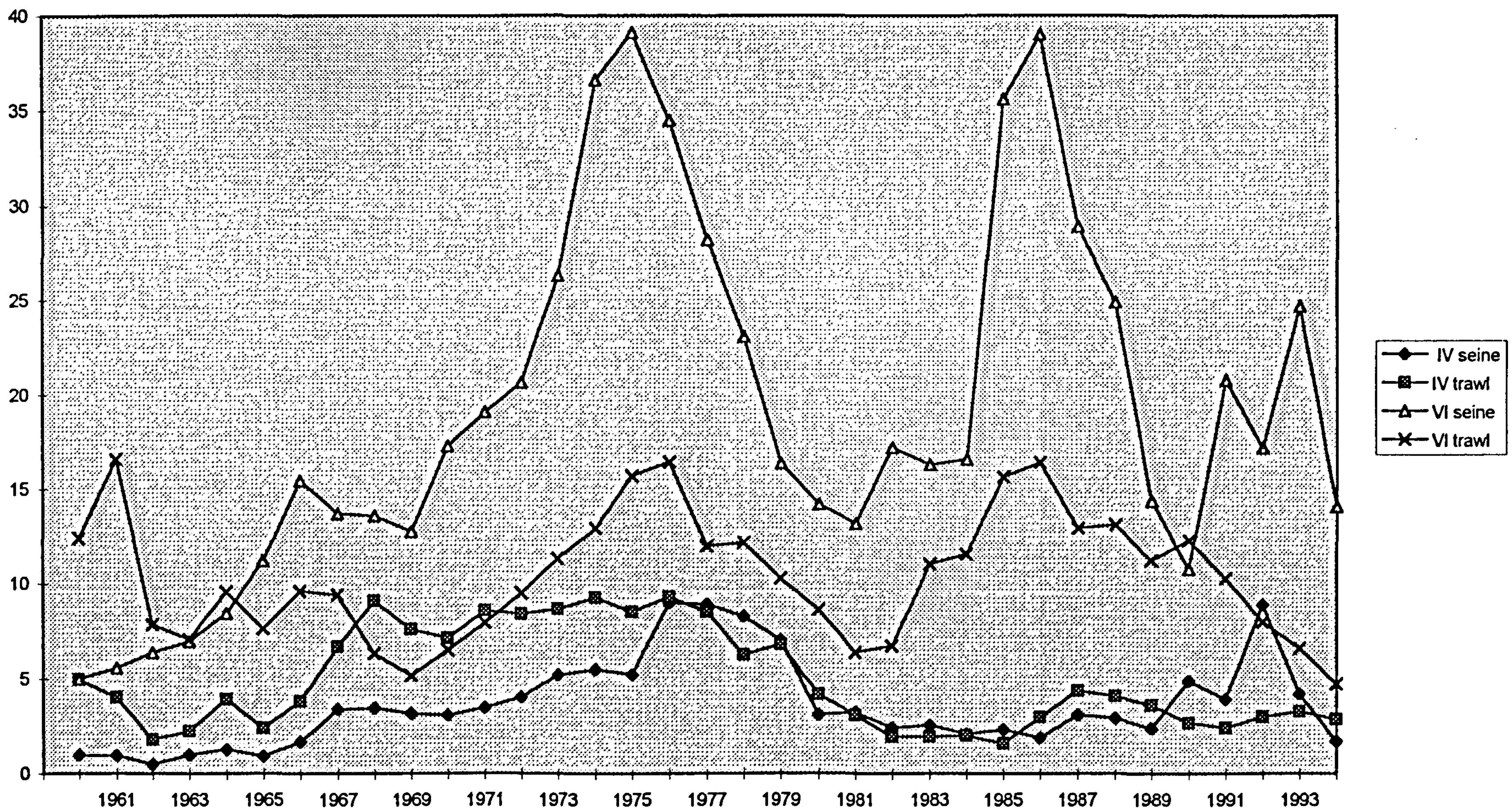


Figure 5.7.2

England and Wales commercial CPUE of spurdog and rays in Irish Sea

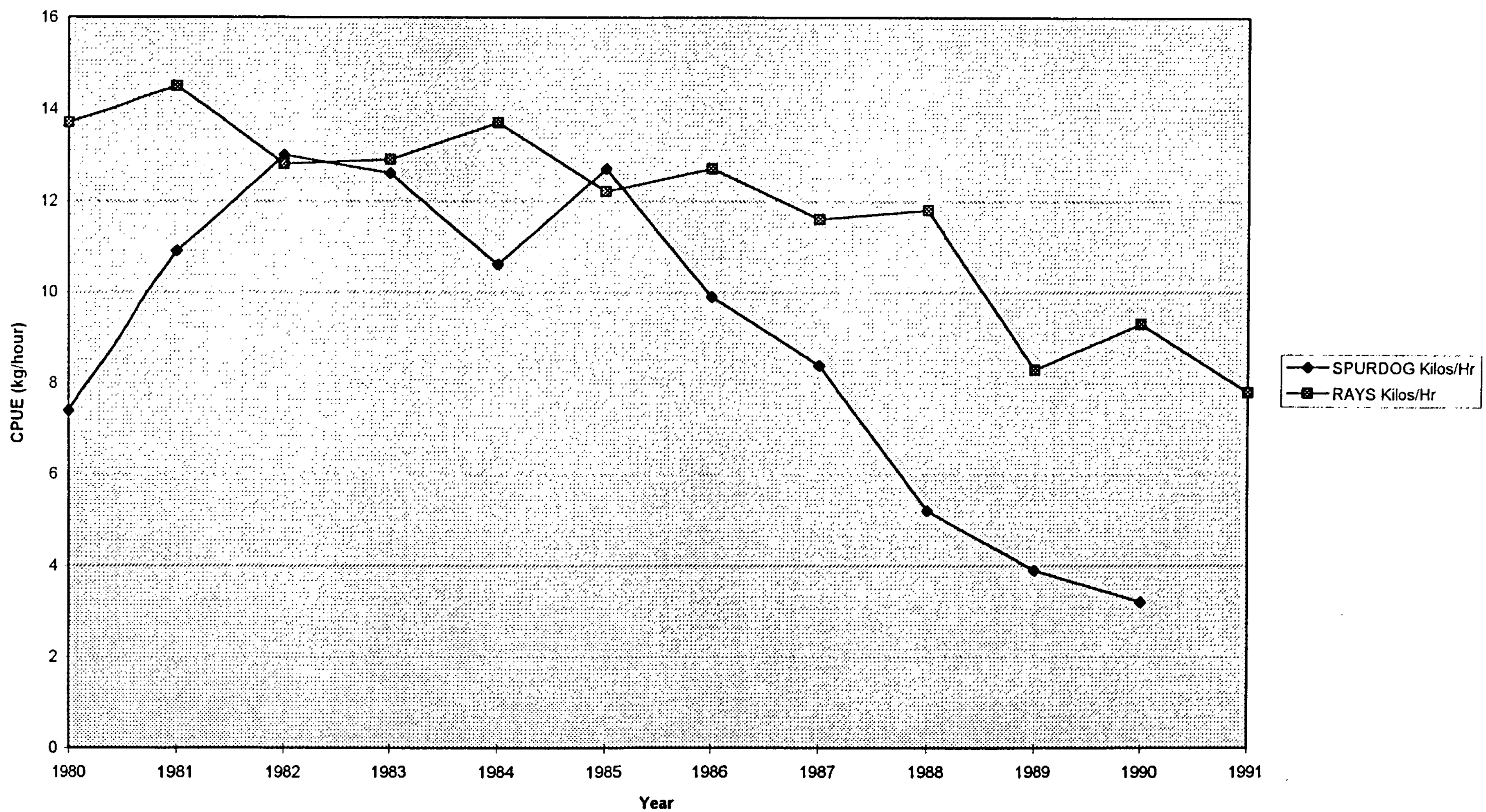


Figure 5.10.1

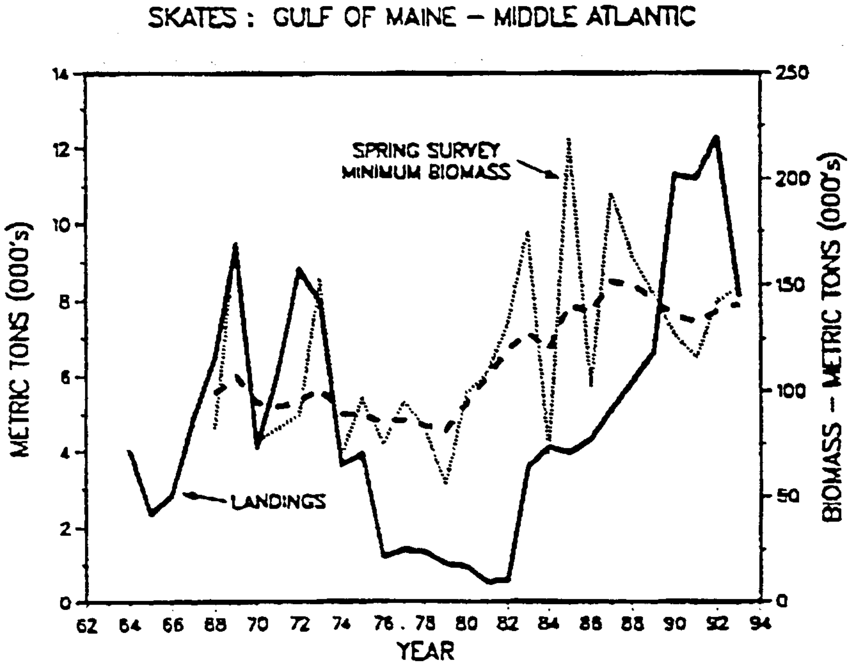
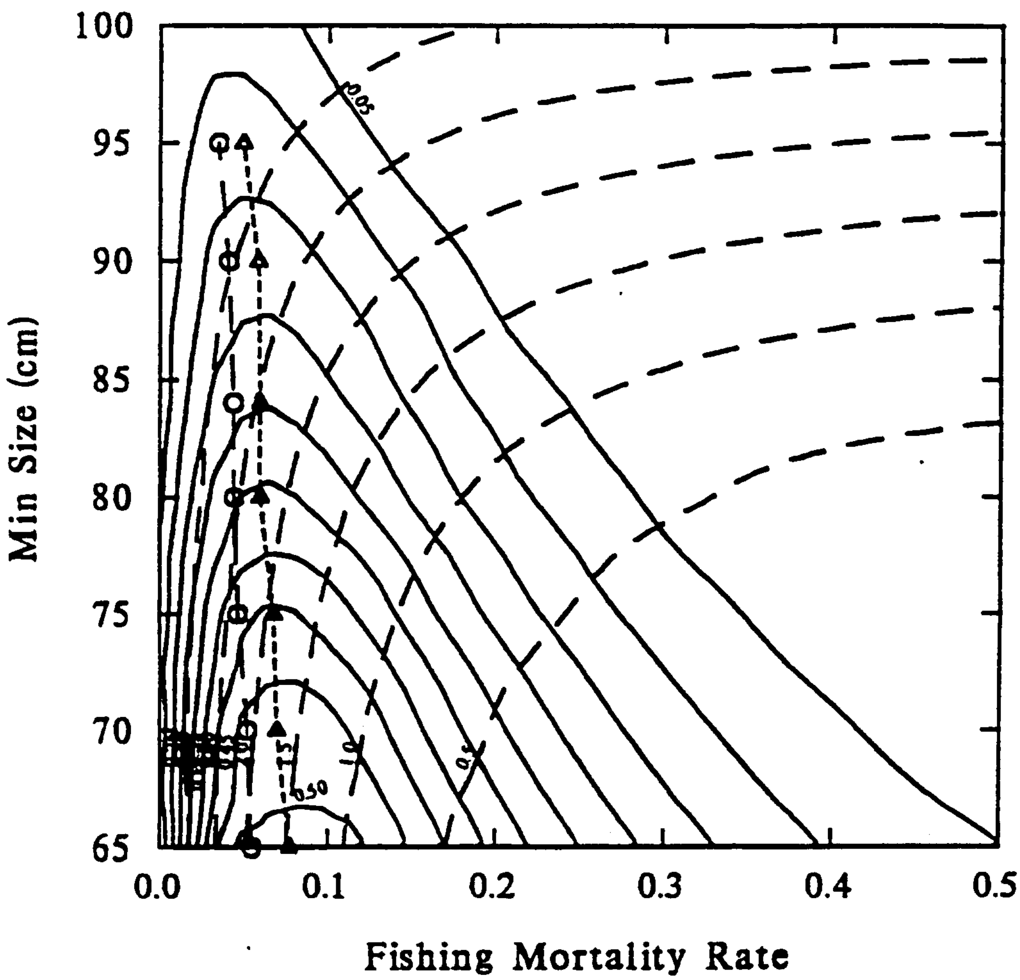


Figure 5.11.1



APPENDIX 1

Proposal for a quick and dirty tabulation of stomach contents and maturity stages for skates (rajidae), squaloid and other ovoviparous and viviparous species of sharks (Matthias Stehmannn).

This informal summary is offered toward a desirable goal of standardizing observation and reportability of gonadal maturity stages and stomach contents in skates and ovoviviparous and viviparous sharks. The data sheets have proven reliable for many hundreds of individuals, and can be marked quickly both on shipboard and in the laboratory. Of course, the data sheet for stomach contents may be used generally.

The proposed criteria are given in Tables 1 and 2 and the sample data sheets in Table 3 and 4. Figure 1 shows diagrams of the reproductive organs at different stages of maturity.

Table 1

Maturity Stages for Skates (Rajidae)

Males

A = juvenile	Claspers undeveloped , shorter than extreme tips of posterior pelvic lobes. Gonads (testes) small, thread-shaped.
B = adolescent, maturing	Claspers more or less extended, longer than tips of posterior pelvic lobes, their tips (glans) more or less already structured, but skeleton still flexible, soft. Gonads enlarged, sperm ducts (ducti deferentes) beginning to meander.
C = adult, mature	Claspers full length, glans structures fully formed, skeleton hardened so that claspers stiff. Gonads greatly enlarged, sperm ducts meandering and tightly filled with flowing sperm.
D = active, copulating	Glans clasper often dilated, its structures reddish and swollen. Sperm flowing on pressure from cloaca and/or present in clasper groove or glans. For chimaeroids, scyliorhinids and other oviparous species of sharks, stage D does not mean that the glans is spread open. The fleshy pads are obviously enlarged and sperm is present in clasper grooves.

Females

A = immature, juvenile	Ovaries small, their internal structure gelatinous or granulated. No oocytes differentiated, or all evenly small, granular. Uteri (oviducts) small and thread-shaped.
B = adolescent, maturing	Ovaries enlarged and with more transparent walls. Oocytes differentiated in various small sizes. Uteri similar to stage A.
C = adult, mature	Ovaries large and tight. Oocytes enlarged, with some being very large. Uteri enlarged and widening.

Females, Uterine Stages

D = active	A distinctly enlarged yolk-egg present in one or both Fallopian tubes. No egg capsule yet visible in shell gland, or beginning formation of egg capsule at most.
E = advanced	Large yolk-eggs in Fallopian tubes, or already passing through into egg capsules. Egg capsules about fully completed in one or both oviducts, but still soft at upper end and located very close to Fallopian tubes.
F = extruding	Completed, hardened egg capsules in one or both oviducts, more or less separated from Fallopian tubes. Capsule surface covered with dense silky fibers within the shell integument. Either no enlarged oocytes in Fallopian tubes or one or two in position. If oviducts are empty but still much enlarged and wide, capsules have probably just been extruded - this corresponds with stages D or E.

Table 2

Maturity Stages for Ovoviviparous and Viviparous Sharks

Males

A = juvenile	Claspers undeveloped sticks; gonads tiny and threadlike, whitish; sperm ducts straight.
B = subadult	Claspers formed but soft, flexible. Gonads enlarged, sperm ducts meandering.
C = adult	Claspers fully formed and stiff. Gonads well rounded, reddish and filled with flowing sperm. Sperm ducts tightly coiled.
D = active	Glans clasper(s) often dilated and swollen; sperm flowing from cloacal papilla under pressure on belly, and/or present in clasper groove.

Females, Ovarian Stages

A = juvenile	Ovaries small, gelatinous or granulated. Eggs not yet differentiated, or evenly small, granular. Uteri thread-shaped.
B = ripening	Ovaries enlarged, walls transparent. Eggs differentiated to various sizes. Uteri similar to stage A.
C = ripe	Ovaries large, well rounded. Eggs enlarged, all about the same size so that they can be counted and measured easily.

Females, Uterine Stages

D = developing	Uteri well filled and rounded with unsegmented yolk content.
E = differentiating	Uteri well filled and rounded with unsegmented content of yolk balls. Embryos small, unpigmented and with large yolk sacs, but can be counted.
F = "expecting"	Embryos fully formed and pigmented, yolk sacs obviously reduced. Can be counted and measured easily.
G = postnatal	Ovaries at resting stage, similar to stage A. Uteri empty but still widened considerably in comparison with stages A and B.

Table 3 Sample Data Sheet for Maturity Stages (Lgth-abbrev.)

Species: Total weight kg:

Vessel: Cruise: Date:

Station: Geogr. area:

n females: n males: Collector:

TL cm/mm	Weight kg/g	Sex	Maturity stages ♂♂ A-D, ♀♀ A-G A	B	C	D	E	F	G	Counts left/right Ovaries OR	OL	Uteri UR	UL	Remarks

NOTES:

M. STEHMANN, sexual maturity data sheet: squaloid sharks

Table 4 Sample Data Sheet for Stomach Contents (Lgth-abbrev.)

SPECIES: Total weight kg:

Vessel: Cruise: Date:

Station: Geogr. area:

n females: n males: Collector:

TL cm/mm	Weight kg/g	Sex	Fill stage	STOMACH CONTENTS Coelenterata	Annelida	Crustac. Nat.	Dec.	Mollusca G. B. C.	Echinod.	Pisces	Mammal.	REMARKS

NOTES:

M. STEHMANN, stomach contents data sheet

Figure 1 Reproductive organs of squalid sharks in different stages of maturity. Ventral view, guts removed. Simplified presentation, no scale.