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Report of the Working Group on Elasmobranch Fishes (WGEF)

14–21 June 2006

ICES Headquarters

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Contents

1 Introduction

1.1 Terms of Reference

The **Working Group Elasmobranch Fishes** [WGEF] (Chair: Maurice Clarke, Ireland) met in ICES Headquarters from 14th–21st June 2006, to:

a) update the description of elasmobranch fisheries (including those on deep-water sharks) in the ICES area and compile landings and discard statistics by ICES Subarea and Division;

b) Conduct and report on investigations of spatial dynamics of survey data for shelf-based species and investigate data from IBTS and other surveys;

c) Assess the status of stocks of spurdog, basking shark, skates and rays, lesser spotted dogfish, deepwater sharks and porbeagle, and provide management options for these stocks.

d) Compile and collate catch data for pelagic sharks in the North Atlantic and attempt to disaggregate generic landings data into more specific groups.

e) Report on the development of a standard exchange format to facilitate the submission of biological, fisheries,discards and survey data to WGEF. This could be based on existing data formats, though there is a need to have at least biological data by sex. The exact data requirements and formats will be finalised when appropriate and acceptable assessment methods are identified for the various stocks.

WGEF will report to ACFM by 14th July 2006 and make its report available for the attention of the Living Resources Committee.

In addition to these terms of reference, generic terms if reference were agreed at the annual meeting of assessment working group chairs (ICES, 2006c). These are presented in Table 1.1. Furthermore, there were three ad hoc requests dealt with by WGEF in 2006 and these are presented in Section 1.9. Table 1.2 shows where, in the report, these terms of reference were dealt with.

Table 1.1. Generic terms of reference for WGEF, as agreed by AMAWGC in 2006.

Term of reference	Year	Comments
(1) based on input from e.g. WGRED and for the North Sea NORSEPP, consider existing knowledge on important environmental drivers for stock productivity and management and if such drivers are considered important for management advice incorporate such knowledge into assessment and prediction, and important impacts of fisheries on the ecosystem;	2007	Low priority. Many of these stocks are long lived. It is less likely that there environmental drivers than for short lived species. *The distribution of some species may be influenced by oceanographic factors*

Term of reference	Year	Comments
(2) Evaluate existing management plans to the extent that they have not yet been evaluated. Develop options for management strategies including target reference points if management has not already agreed strategies or target reference points (or HCRs) and where it is considered relevant review limit reference points (and come forward with new ones where none exist) – following the guidelines from SGMAS (2005, 2006), AGLTA (2005) and AMAWGC (2004, 2005, and 2006); If mixed fisheries are considered important consider the consistence of options for target reference points and management strategies. If the WG is not in a position to perform this evaluation then identify the problems involved and suggest and initiate a process to perform the management evaluation;		There are no existing management plans for elasmobranchs.
(3) where mixed catches are an important feature of the fisheries assess the influence of individual fleet activities on the stocks and the technical interactions;	2006	We will take a qualitative approach in 2006 to identify the interactions with WGDEEP, WGNSSK, NSWG, SSWG, WGSSHMM
(4) update the description of fisheries exploiting the stocks, including major regulatory changes and their potential effects. Comment on the outcome of existing management measures including technical measures, TACs, effort control and management plans. The description of the fisheries should include an enumera-tion of the number, capacity and effort of vessels prosecuting the fishery by country;	2006 2007 2008	This is a routine task of the group
(5) where misreporting is considered significant provide qualitative and where possible quantitative information, for example from inspection schemes, on its distribution on fisheries and the methods used to obtain the information; document the nature of the information and its influence on the assessment and predictions.	2006	We will start the process this year
(6) provide for each stock and fishery information on discards (its composition and distribution in time and space) and the method used to obtain it. Describe how it has been considered in the assessments;	2006	This is a routine task

Term of reference	Year	Comments
(7) report as prescribed by the Secretariat on a national basis an overview of the sampling of the basic assessment data for the stocks considered;	2006	We will start the process in 2006
(8) provide specific information on possible deficiencies in the 2006 assessments including, at least, any major inadequacies in the data on landings, effort or discards; any major inadequacies in research vessel surveys data, and any major difficulties in model formulation; including inadequacies in available software. The consequences of these deficiencies for both the assessment of the status of the stocks and the projection should be clarified.	2006	We will start the process in 2006
(9) Further develop and implement the roadmap for medium and long term strategy of the group as developed by AMAWGC.	2006	
(10) Working Group Chairs will set appropriate deadlines for submission of the basic assessment data. Data submitted after the deadline will be considered at a later meeting at the discretion of the WG Chair.	2006	We have had this system for some time

Table 1.2. Terms of reference addressed in the report.

Type	TOR	Description	Section
Specific	a	fishery description	2-19
	b	spatial dynamics of survey data	12, 15, 16
	c	stock assessment	2, 3
	d	pelagic catch data	1.6, 6,8,9
	e	exchange format	1.8
Generic	1	Environmental drivers	NA
	2	Management plan evaluation	NA
	3	Technical interactions	2,3,4,12,15,16
	4	Fishery description	2-19
	5	Evaluate misreporting	2-19

	6	Information on discarding	2-19
	7	Provision of data by country	
	8	deficiencies in 2006 assessments	2
	9	develop medium and long term strategy	1.4
	10	agreement of deadlines for submission of data	1.8
Ad hoc		Data collection	1.7.1
		CITES listing of porbeagle and spurdog	1.7.2

1.2 Participants

Tom Blasdale	UK
Maurice Clarke (Chair)	Ireland
José De Oliveira	UK (England and Wales)
Guzman Diez	Spain (Basque Country)
Helen Dobby	UK (Scotland)
Jim Ellis	UK (England and Wales)
Ivone Figueiredo	Portugal
Nils-Roar Hariede	Norway
Henk Heessen	The Netherlands
Kristin Helle	Norway
Boris Frentzel-Beyme	Germany
Graham Johnston	Ireland
Dave Kulka	Canada
Mario Pinho	Portugal (Azores)
Charlott Stenberg	Sweden

1.3 Background

The Study Group on Elasmobranch Fishes (SGEF), having been established in 1989, was re-established in 1995 and had meetings in that year, 1997 and 1999. Assessment of elasmobranch species had proved very difficult owing to lack of data. The 1999 meeting was held concurrently with the EC-funded Concerted Action Project meeting (FAIR CT98-4156) allowing for a greater participation from various institutes around Europe. The next meeting of the group was in 2002, where assessments were carried out for the first time. Assessments were attempted for 8 of the 9 case study species considered by the EC-funded DELASS Contract (CT99-055). The success of this meeting was due to the DELASS project, a three-year collaborative effort involving fifteen fisheries research institutes and two sub-contractors. Although much progress was made on methodology, there was still much work to be done. The main gap in the knowledge was a quantification of catches of elasmobranchs in the ICES area.

In 2002, SGEF recommended the group be continued as a Working Group. The medium-term remit of this WG being to adopt and extend the methodologies and assessments for elasmobranchs prepared by the EC-funded DELASS project; to review and define data requirements (fishery, survey and biological parameters) in relation to the needs of these analytical models and stock identity; and to carry out such assessments as are required by ICES' customers. In 2003, the first meeting of this group would review the final DELASS report, consider national and international sampling schemes, including those carried out under the EU Data Collection Regulation, and report to PGCCDBS, and make arrangements to carry out assessments for such elasmobranch stocks.

In 2003, WGEF met in Vigo, Spain and worked to further the stock assessment work carried out under DELASS. In 2003, landings data were collated for the first time. This exercise was based on data from the FAO FISHSTAT database, data from national scientists and other data submitted to ICES.

In 2004, WGEF worked by correspondence to collate and refine catch statistics for all elasmobranchs in the ICES area. This task was complicated by the use, by many countries, of generic reporting categories for sharks, rays and dogfishes. WGEF evaluated sampling plans and their usefulness for providing assessment data.

In 2005, WGEF came under ACFM and was given the task of supporting the advisory process. This was because ICES has been asked by the European Commission to provide advice on certain species. This task was partly achieved by WGEF in that preliminary assessments have been provided for spurdog, kitefin shark, thornback ray (North Sea) and deepwater sharks (combined). ACFM produced advice on these species, basking shark and porbeagle, based on the WGEF report. This advice was adopted only by Norway and only in the case of the basking shark. A standard reporting and presentation format was adopted for catch data and best estimates of catch by species was provided for the first time.

In 2006, work continued on refining catch estimates and compiling available biological data. Progress was made in some eco-regions. Work was begun on developing standard reporting formats for length frequency, maturity and CPUE data. WGEF continued to support the advisory process based on feedback from ACFM. The group developed a “roadmap” presenting an organizational plan for assessing the various stocks over the following 3 years.

Overall the working group has been very successful in maintaining participation from a wide range of countries. Attendance increased and has reached a stable level in the past two meetings.

Stock assessment of deepwater sharks and of pelagic sharks is particularly difficult owing to lack of species-specific catch data and the straddling and/or highly migratory nature of these stocks. In 2004, the International Commission for the Conservation of Atlantic Tunas convened a working group to assess the status of two pelagic species, blue and shortfin mako shark. These are trans-North Atlantic stocks and ICES is unable to conduct any meaningful stock assessments. WGEF will maintain close collaboration with WGDEEP to refine catch and effort data and to support the advisory process. This will require that catch and effort data being made available to WGDEEP is also made available to WGEF.

1.4 Future planning of the work of the group

To satisfy the reqirement that each working group plans its short and medium term WGEF presents a plan for the next four years. It is planned that WGEF will meet every year in the next four years, because this approach keeps the momentum of the group. Assessments of stock status will be conducted on a three-yearly cycle. In order to facilitate the best assessments of each of the main species for which advice is sought, the group will deal with different species in different years. Table 1.3 presents this plan.

Table 1.3. Future planning of the work of the group. Plan for assessment of the main species.

	2007	2008	2009	2010
Spurdog				
Portuguese dogfish and Leafscale gulper shark				
Other deepwater sharks				
Kitefin shark				
Porbeagle				
Basking shark				
Blue shark in the NE Atlantic				
Shortfin mako in the NE Atlantic				
Demersals in Barents Sea				
Demersals in Norwegian Sea				
Demersals in North Sea, Skagerrak, Kattegat and eastern English Channel				
Demersals at Iceland and east Greenland				
Demersals at the Faroe Islands	?	?	?	?
Demersals in the Celtic Seas				
Demersals in Biscay and Iberian waters				
Demersals in the Azores and Mid Atlantic Ridge				
Other rays				
Tope in the NE Atlantic (and Mediterranean?)				

Preparation	
Assessment	
Other	

This plan allows for preparation of datasets in the years between assessments. In the years where an assessment is not planned, data preparation, screening and checking will take place. Not having a scheduled assessment in a given year does not imply that the relevant participants would not attend. Rather it is planned to spend the time preparing for the next scheduled assessment.

For demersal elasmobranchs, it is planned to conduct assessments of stock status in 2007. This will be conducted in tandem with IBTS working group, because this will involve analysis of spatial data from surveys in the North east Atlantic. IBTS will be requested to supply spatial information for demersal elasmobranchs in 2007, for North Sea, Celtic Seas, Biscay and Iberia.

Deepwater sharks are scheduled for next assessment in 2008, in WGEF. In that year, WGEF should work closely with WGDEEP to collate reliable and up to date CPUE and survey data. WGEF will plan to meet in June 2008, and expects to have access to CPUE and other data as reported to WGDEEP. At present the most important time series of data, from French trawlers, is not available in sufficient detail for meaningful analysis. If exchange and storage of data, through Intercatch and other means, is achieved, then WGEF can expect to be able to conduct assessments of deepwater sharks in 2008. At the same time, deepwater rays, including those in the Mid Atlantic Ridge area, should be dealt with.

Pelagic sharks should be dealt with in 2009, at a joint meeting with ICCAT. WGEF recommends that ICES liaise with ICCAT to organise such a meeting in 2009, and spend the intervening period preparing the data required.

For spurdog it is recommended that next formal assessment be conducted in 2009. The intervening period should be used to collate as comprehensive a dataset of length, survey and CPUE data as possible.

An assessment of elasmbranchs in the Faeroe Islands is not currently planned, due to a lack of available data.

Assessments are necessarily experimental in WGEF, so the group does not present its roadmap in the context of benchmark or update assessments. ICES may be asked for advice on particular stocks in particular years, out of synchrony with WGEF's plans. WGEF recommends that ICES draw upon the latest ACFM advice, where available, for such requests.

1.5 Current projects or meetings of relevance to the WG

1.5.1 Working Group on Fish Ecology

In 2005, WGEF recommended that WGFE evaluate the status of rarer elasmobranch species, and preliminary studies were undertaken (see Section 2.5 of ICES, 2006a). These studies focused on nine demersal elasmobranchs (Squatina squatina, Torpedo nobiliana, Dipturus batis, D. oxyrinchus, Leucoraja circularis, L. fullonica, Raja undulata, Rostroraja alba and Dasyatis pastinaca), and WGFE estimated the probability of observing a non-zero haul and the probability of observing at least one individual during a whole survey for these species in various national and international surveys. Analyses were based on the number of individuals encountered and not raised catches.

The proposed methods based on the negative binomial distribution allows the estimation of the probability of observing a given species at a particular population density in a survey taking into account the type of spatial distribution the species shows and the survey design (number of hauls). Based on this, the number of years can be calculated that a species has to be absent from the survey before one can be sure that the true density is really lower than, for example, the average historic density.

1.5.2 International Bottom Trawl Survey Working Group

The distribution and relative abundance of several demersal elasmobranchs were illustrated in the most recent report of the IBTSWG (ICES, 2006b). Given the lack of gear standardisation in the southern and western IBTS surveys, and that not all data are currently available on DATRAS, it would be beneficial in the short-term for WGEF and IBTSWG to work together to examine these survey data. In the absence of species-specific landings data, these surveys may provide the most appropriate for ascertaining the current status of skates and rays and small demersal sharks. A recommendation for IBTSWG to undertake further data collation and preliminary analyses is given (see Section 1.8).

1.5.3 Length based assessment methods group

The third and final meeting of the Study Group on Age-Length Structured Assessment Models (SGASAM) is due to take place in November 2006. Length-structured models are considered useful when problems with age determination do not permit the use of age-structured models or make such models less reliable, and also in cases when it is thought such models provide a better description of the fishery and biological processes. A number of length- and age-length-structured assessment tools of differing complexity have been presented at previous meetings of this SG, and such novel assessment methods may be appropriate for some elasmobranch stocks. One of the ToR for the next meeting of SGASAM which is likely to be of interest to WGEF, is to evaluate the use of age-length structured models for the assessment of stocks for which age-disaggregated data are sparse or unreliable (e.g. Nephrops, elasmobranchs, hake, anglerfish redfish).

1.5.4 Theme Session on Elasmobranch Fisheries Science, 2005

This was the first elasmobranch theme session ever held by ICES, and filled important gaps in our knowledge. It attracted a wide participation, from within the ICES member states, but also from the northwest Atlantic, Mediterranean, South Atlantic, Pacific and Indian Oceans. In total 25 papers and 4 posters representing studies from 16 countries were presented, spanning one and a half days of the ICES Annual Science Conference. The data presented fills important gaps in the information for some species and areas.

1.5.5 Seafish/Supermarket initiative in the UK

As a result of a Greepeace campaign in 2006, several major UK supermarkets decided to remove all dogfish and rays from their stores. The UK Seafish Industry Authority was requested by producers to find a solution which would allow sales of these species to resume. A meeting was held later in 2006, funded by Tescos, to bring together fishermen, processors, buyers, managers, scientists and NGOs examine ways in which these species could be marketed while ensuring they come from sustainable stocks. There was a separate meeting in Devon, UK, at which some fishermen suggested that they preferred a combination of seasonal and gear restrictions as opposed to maximum landing length or TAC management.

A positive outcome of the meeting was an undertaking by the fishermen and processors to improve species identification in landings so that retailers could ensure that the species they are stocking have not been designated as "critically endangered" and to allow scientists to improve management advice. Management tools such as minimum and maximum landing sizes were also discussed and produced a fairly positive response from the industry.

1.5.6 IUCN Redlist Process for the northeast Atlantic

The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been globally evaluated using the IUCN Red List Categories and Criteria to determine their relative risk of extinction. The main purpose of the Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction (i.e. those listed as "**Critically Endangered**", "**Endangered**" and "**Vulnerable**"). The Red List also includes information on taxa that cannot be evaluated because of insufficient information (i.e. are "**Data Deficient**"), and taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation or management programme (i.e. are "**Near Threatened**"). Taxa that have been evaluated to have a low risk of extinction are classified as "**Least Concern**" (Gibson *et al.*, In preparation). All published Red List assessments can be downloaded from www.redlist.org, which is updated annually.

The IUCN Shark Specialist Group (SSG) is currently undertaking a global marine assessment of the red list status of all chondrichthyan species. This is proceeding primarily through a series of regional and generic (e.g. deepwater, batoid) workshops. Results from these workshops are combined to produce global and in some cases regional or population assessments. A peer review process approves assessments prior to publication.

The SSG's Batoid Workshop was held in 2004, and the Northeast Atlantic Red List Workshop in February 2006. Species restricted to the southern edge of the ICES area are being reviewed by a Western African workshop in June 2006. Some of the results from these earlier workshops are still undergoing peer review prior to submission to the Red List Programme, and all other unpublished assessments are now in preparation. All published and submitted chondrichthyan fish assessments (the latter are approved and submitted to the Red List Programme for publication the following year) can be downloaded from http://www.flmnh.ufl.edu/fish/organizations/ssg/redlistdefault.htm

1.5.7 Shark Alliance

The Shark Alliance, a Brussels-based coalition of environmental groups, conservationists and scientists was formed in 2006. It aims to promote collaborative action to improve the conservation and management status of sharks, with a focus on Europe. It activities seem likely to focus initially upon campaigning for the development and adoption of a European Shark Management Plan (as required under the FAO International Plan of Action for the Conservation and Management of Sharks), and other shark conservation and management activity and advice.

1.5.8 Deepwater gillnetting

1.5.8.1 Deepnet

This was an initiative to investigate deepwater gillnet fisheries, targeting sharks, crabs and monkfish, west of UK and Ireland. It was found that most of the vessels involved are registered in UK, Germany, Portugal, France and Panama. Very little data from these fisheries are available. Information collected allowed for better estimation of deepwater shark catches by WGEF in 2005.

In 2006, based on the results of this intiative, the Council for the EU banned gillnetting in waters deeper than 200 metres as an emergency measure. The sub-areas covered were VI,VII, Vb and XII and also in the NEAFC regulatory area. These regulations are leading to major changes in fishing patterns in 2006 and onwards.

Future work will focus on investigations of optimum soak time and retrieval of ghost nets.

1.5.8.2 STECF Working Group on Deep-sea Gillnets, July 2006

This meeting is being convened by the EC Commission STECF. The terms of reference are to

1) Identify the fisheries that use trammel nets, entangling nets and bottom-set gillnets in waters in the ICES statistical areas that have a charted depth of greater than 200 metres, describing their seasonal and spatial distribution, the characteristics and selectivity of the gears used, the species targeted, the major bycatch species, and estimates of discard rates.

2) Suggest appropriate descriptors that would allow the different fisheries to be reliably delimited, with a view to applying appropriate management measures to each of them.

3) Recommend measures to regulate each of the fisheries identified, taking into account the difficulties of monitoring and control, notably to ensure good selectivity, to avoid excessive soak-times and to ensure that lost or abandoned nets can be quickly retrieved.

4) To assess the possible consequences of introducing the new regulatory measures, such as the diversion of effort to other fisheries.

Surveys for ghost gill nets In 2005, UK and Ireland conducted retrieval surveys for lost or abandoned gillnets, follwoing on from the Deepnet initiative. The Irish survey was carried out in ICES areas VIb and VII. Both these surveys used a creeper to retrieve nets. This survey concentrated on retrieving nets in an area where ghost fishing was known to occur, based on information from fishermen and VMS data. Substantial amounts of nets were retrieved, and VMS data indicated that they had been deployed for several months (Rihan *et al.*, 2005). The UK survey (Large *et al*., 2005) used a random stratified design in the Rosemary and Bill Bailey Bank. The survey suggested that abundance of gillnets in these offshore banks was low.

Norwegian retrieval surveys have been conducted since 1980. There is a bycatch of elasmobranchs, espccially R. hyperborean, R. clavata.

1.5.9 Council Regulation on the removal of fins of sharks

Council Regulation (EC) No 1185/2003 on the removal of fins of sharks on board vessels, adopted 26 June 2003, requires EU Member States to provide the Commission with an annual report on its implementation. The Commission is required to review and report on the operation of the Regulation no later than 1 January 2006, and to submit, if appropriate, any amendments. Similar measures to prohibit shark finning practices have since been adopted by ICCAT, IATTC, IOTC and NAFO. The regulation states that if amendments seek to change conversion factors of fins to whole sharks, scientific advice from STECF would be sought.

The Commission's report on the operation of the regulation (COM (2005)700 final) noted the general failure of Member States to present their reports on implementation on time or in sufficient detail. Four States reported issuing vessels with special permits permitting fins to be removed from sharks onboard. Of these, two reported concerns over the permitted fin:carcass ratio under the Regulation. It was unclear whether any vessels landed fins separately from carcasses. The Commission concluded, however, that the Regulation appeared to be achieving its general objectives, that the sector was not experiencing significant difficulties in coping with the legislation, and that no amendment appears necessary at this stage.

Draft reports on the application of the Regulation are being prepared by the Environment and Fisheries Committees of the European Parliament. ICES should note that these reports may not necessarily agree with the Commission's conclusions. If they do not, amendments to the Regulation may be requested, including with respect to the permitted fin:carcass ratio. In this case, STECF advice might be sought.

1.5.10 Convention on International Trade in Endangered Species (CITES)

Three species of shark, two of which occur in the ICES area (basking shark *Cetorhinus maximus* and white shark *Carcharodon carcharias*) are listed on Appendix II of CITES. In addition, CITES Resolution and Decisions are directed to CITES Parties (which include all ICES Member States) and to Regional Fisheries Management Organisations, some of which are advised by ICES. Those still valid are **Conf. Res. 12.6 on the Conservation and Management of Sharks**, and **Decisions 13.42 and 13.43**, adopted in 2004 by the 13th meeting of the Conference of Parties.

Decision 13.42, directed to Parties, encourages data collection, and implementation of the species-specific management recommendations of the Animals Committee (prepared under Decision 13.43). These include recommendations on species that occur in the ICES area, including spurdog *Squalus acanthias*, porbeagle *Lamna nasus*, deepwater sharks of the genus *Centrophorus*, tope *Galeorhinus galeus*, requiem sharks Carcharhinidae, guitarfishes Order Rhinobatiformes, and Family Mobulidae. These are described later in this document. Further recommendations on these species will be considered by the Animals Committee in July 2006 and may be forwarded to the 14th Meeting of the Conference of Parties to CITES in June 2007.

The of Appendix II lisiting is to ensure that international exports of this species are maintained below the level that would be detrimental to its survival in the wild. Exporting States would be required to certify that their exports fell within such limits, and importing States only to accept those imports with appropriate certification. Domestic fisheries, trade and consumption are unaffected. Thus, there would be no requirement to ensure that EU landings, none of which are exported, are sustainable.

1.6 Catch data

In 2005, WGEF collated landings data for all elasmobranchs in the ICES area. This task was hampered by the use by so many countries of "NEI" (not elsewhere identified) categories This was accomplished as follows:

1) Landings data extracted from ICES FishStat Database.
2) These data collated in species species landings tables stored in a WG archive
3) These archives were corrected as follows:

a) Replacement with more accurate data provided by national scientists

b) Expert judgements of WG members to reallocate data to new category, usually from an NEI category to a specific one.

These archive landings tables were updated in 2006 by the WG. The data in these archives are considered to be the most complete data and are presented in tabular and graphical form in the relevant sections of this report. Table 1.4 summarises these data by species group.

Landings data reported to Fishstat in NEI categories, are presented in Table 1.5. Some of these data have been allocated by WGEF and these deductions are also indicated.

WGEF aims to allocate progressively more of the NEI landings data over time, and some statistical approaches have been presented to WGEF 2005 (ICES, 2006d; Johnston *et al.*, 2005). However the working group's best estimates, as presented in Table 1.4 are still considered innacurate for a number of reasons:

a) Quota species may be reported as elasmobranchs to avoid exceeding quota. This would lead to overeporting.

b) Fishermen may not take care when completing landings data records, for a variety of reasons

c) Administrations may not consider that it is important to collect accurate data for these species.

d) Some species could be underreported to avoid highlighting that bycatch is a significant problem in some fisheries.

The data may be imprecise also, due to revisions by reporting parties. WGEF aims to arrive at an agreed set of data for each species and will document any changes to these data sets in the relevant working group report.

WGEF has made progress on TOR d, collation of pelagic shark data. The available data are presented in the relevant sections. They are still considred incomplete however.

WGEF still has problems in disaggregating landings data from France and Spain. This is partly because no scientists with knowledge of the fisheries of these countries are in attendance at WGEF. For WGEF to fulfil its medium term goal of compiling definitive datasets of landings it will be necessary to have the cooperation of these countries.

Table 1.4. Summary of working group estimates of landings of elasmobranchs from the ICES Area (FAO Area 27).

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Spurdog	16709	14959	14090	11200	15533	16015	9138	8808	5086	5636
Siki sharks	7168	8182	7705	6484	7059	10105	8093	10876	9031	5053
Other deepwater sharks	3238	2576	2703	298	894	1340	642	556	586	631
Kitefin shark	220	156	46	45	313	189	40	144	9	47
Porbeagle	490	646	1087	1328	2036	1292	387	404	336	240
Basking shark	1980	1163	138	78	294	201	135	320	180	221
Blue shark	281	12403	9710	10564	9823	10554	9602	16470	17100	963
Shortfin mako	42	111	123	395	622	324	458	1021	1093	12
Demersal rays (I)	27	403	803	589	518	248	199	40	1	4
Demersal rays (II)	218	285	419	504	658	365	184	166	149	141
Demersal rays IV, VIId, III	6367	4564	4606	3398	3992	4011	3649	3778	2484	3027
Demersal rays in Va, XIV	1705	1560	1450	1320	1220	1332	1962	1656	1201	na
Demersal rays Vb	232	205	199	227	166	229	137	191	407	na
Chimeridae at the Faeroe Islands	0	15	29	3	5	2	0	2	5	na
Demersal rays VI, VIIa-c; e-k	19044	20510	19981	19914	19849	17830	18822	17647	13218	13004
Demersal sharks VI, VIIa-c; e-k	3	565	597	5	820	1009	1229	813	27	0
Demersal rays VIII and IX	4415	5172	4800	2623	3863	4225	2516	1885	3219	3396
Demersal sharks VIII and IX	234	211	265	122	404	450	615	337	489	487
Demersal ?? X and XII	71	99	117	103	107	100	71	95	73	50
Thresher	17	22	18	13	107	112	4	3	2	7
Tope	456	509	424	463	568	556	458	528	1018	0
Lesser spotted Dogfish*	5144	5613	5740	5818	6152	7109	6447	5588	5746	0
Total	68062	79928	75050	65496	75003	77597	64789	71328	61459	32918

Table 1.5. Summary of landings of elasmobranchs, reported in NEI categories, that the working group has still not been able to allocate.

* (Excluding categories used in calculations in Table 1.4)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Angelsharks, sand devils nei (ASK)	0	0	0	0	1	0	0	1	0	0
Cartilaginous fishes nei (CAR)	1011	3429	1779	2388	4201	2518	3048	2960	173	0
Catsharks, etc. nei (SYX)	0	0	0	0	11	22	11	303	701	0
Catsharks, nursehounds nei (SCL)	18	6	51	744	826	836	766	835	962	0
Chimaeras, etc. nei (HOL)	0	0	0	0	0	0	0	0	449	0
Crest-tail catsharks nei (GAU)	0	0	0	0	0	0	0	5	7	0
Dogfish sharks nei (DGX)	3007	4065	2169	4138	4929	5420	3810	4482	4172	0
Dogfish sharks, etc. nei (SHX)	0	0	0	0	0	0	0	0	1	0
Dogfishes and hounds nei (DGH)	1633	1649	2790	1696	1945	1753	1810	272	296	0
Dogfishes nei (DGZ)	415	431	365	346	390	398	447	446	466	0
Guitarfishes nei (GUZ)	0	0	0	1	1	1	1	2	1	0
Houndsharks,smoothhounds nei (TRK)	0	0	0	124	141	157	133	131	75	0
Mackerel sharks,porbeagles nei (MSK)	0	0	0	0	0	0	0	0	512	0
Ratfishes nei (HYD)	0	0	1	38	573	840	651	471	551	0
Requiem sharks nei (RSK)	0	0	0	9	26	31	55	145	65	0
Various sharks nei (SKH)	6680	33063	23706	23960	28869	30526	16549	8029	1163	0
Total	12764	42643	30861	33444	41913	42502	27281	18082	9594	0
Less reallocated sums	2272	3625	2960	2771	1936	2667	2434	1685	1950	*400
Total unknown species	10492	39018	27901	30673	39977	39835	24847	16397	7644	-400

1.7 *Ad hoc* requests

1.7.1 Recommendations to NEAFC on pelagic sharks

In 2005, NEAFC requested ICES to propose a sampling scheme and a list of information that should be obtained from the fisheries on “pelagic sharks”, specifically basking shark, porbeagle and spurdog to allow ICES to improve the quality of assessment and advice. In its proposal ICES was asked to take into account the nature of the fisheries, i.e both bycatch and directed fisheries. WGEF makes the following recommendations:

Porbeagle

NEAFC can have an important role in improving catch data for Porbeagle.

Catch of porbeagle and effort from high seas fleets in the regulatory area could be reported to NEAFC. The NEAFC inspectorate could help with obtaining information on pelagic shark bycatch in high seas fleets.

WGEF recommends that complete catch data be reported to ICES for this species. In particular, Spain should provide a complete dataset to ICES. Further data and analyses of French CPUE data are required. All countries having bycatch of this species in tuna and swordfish fisheries should provide ICES with reliable time series of bycatch and discards.

Studies to elucidate stock identity and population structure should proceed, including tagging studies. The biological characteristics of this species in the ICES area are unknown. A study on the biology of this species is required from the NEAFC convention area.

Basking shark

Improved collation of recent catch and effort data in the fishery should be provided.

WGEF recommends that bycatch be recorded. WGEF further recommends that accidental collisions be recorded and the data reported to ICES. Biological sampling of dead bycatch and stranded basking sharks should be initiated.

WGEF suggests that novel means to obtain fisheries independent information be explored, including; observations at oil platforms, observations from whale and dolpin watching programmes, cetacean abundance surveys in the Northern seas. It is noted however that because basking shark is not confined to surface waters, observational data may not provide reliable estimates of abundance.

Studies to elucidate stock structure should proceed, including electronic tagging studies.

Spurdog

WGEF recommends that all countries supply time series of species-specific data for spurdog. In particular WGEF was unable to identify what landings for spurdog were reported by France, because of the use of generic reporting codes. It is recommended that all parties report spurdog landings using the code **DGS.** For landings of mixed dogfishes, the code **DGH** should be used. The **DGH** code should not be used for single species landings or for deepwater sharks. The code **DGX** should not be used for spurdog landings.

WGEF recommends that length frequency data be collected for this species, especially from directed and mixed trawl fisheries These data are required for Ireland, Norway and France.

1.7.2 Recommendations to Germany on CITES listings on porbeagle and spurdog

In 2006, the German Federal Government formally asked ICES to join its common response to the ongoing international trade in shark species, with particular focus on, porbeagle *Lamna nasus* and spurdog *Squalus acanthias*. In particular, Germany is seeking to add these species to the CITES Appendix II.

ICES responded to this request by referring to the ACFM advice of autumn 2005, that both species were depleted and that there should be no catching of either. ICES explained that, being a scientific and advisory organisation it has no management or political competency. Therefore, ICES could not join the proposal, being as it is outside its sphere of competency.

1.8 Provision of data before working group

It was agreed by the group that all data will be submitted to the working group by the 1st May each year.

The group agreed that CPUE should be provided as disaggregated raw data, and not as compiled data.

The group agrred that survey abundance estimates (not currently in the DATRAS database) are provided as raw data by individual countries.

WGEF recommends that MS provide explanations of how natiponal data are raised to species composition and length and to the total catch.

At present WGEF considers that discard data should be brought to the meetings of the group and collated there.

1.9 Recommendations

In its 2005 report, the IBTS WG presented very useful distribution maps for selected elasmobranch species in the western and southern areas. WGEF recommends that IBTSWG prepares similar maps, preferably for presence/absence based on as wide a range of years as possible, for the whole area covered by the survey for all demersal elasmobranchs. Also trends in abundance for elasmobranchs caught in different parts of the area covered by the IBTS survey would be very informative to detect possible trends in abundance of certain species. IBTSWG should collate and provide raw data and, if possible, time-series abundance trends for the following species/stocks:

a) Smoothhounds *Mustelus* spp. (sub-area VII and IVc)
b) *Raja clavata* in the North Sea (IV)
c) *Raja montagui* in the North Sea (IV)
d) *Leucoraja naevus* in the North Sea (IV)
e) *Raja clavata* off North-west Scotland (VIa)
f) *Leucoraja naevus* off North-west Scotland (VIa) and west of Ireland (VIIb)
g) *Raja clavata* in the Irish Sea (VIIa)
h) *Leucoraja naevus* in the Irish Sea (VIIa)
i) *Raja clavata* in the Bristol Channel (VIIf)
j) *Raja microocellata* in the Bristol Channel (VIIf)
k) *Leucoraja naevus* in the Celtic Sea (VIIe-j, and possibly including VIIIa,b)

WGFTFB should be asked to compile all available information on means to reduce bycatch of sharks in longline fisheries. WGFTFB to produce a cocument for WGEF in time to be evaluated by WGEF in June 2006.

WGEF recommends that ICES work closely with ICCAT to convene a joint meeting on the assessment of pelagic sharks in 2009. In the meantime, ICES will continue with progress on disentangling catch data for these species.

WGEF continues to ask that Spanish and French scientists with expertise in elasmobranch issues attend WGEF and provide data to the group.

It is recommended that WGEF continue to deal with deepwater sharks. This is because catch data for these species is often in the same reporting categories as for other sharks and rays. Also the participants that deal with deepwater sharks in WGEF have other responsibilities in WGDEEP. Therefore the current division of labour is more efficient.

WGEF recommends that ICES implements the exchange format for CPUE data in all relevant working groups, but especially WGDEEP and WGEF. These data should be stored in a secure database in ICES that will facilitate further analysis.

The group hopes to use Intercatch to compile length frequency data. It is hoped that two scientists with experience of elasmobranch length frequency data attend a workshop hosted by ICES to learn how the new system works.

WGEF will continue to develop exchange formats, especially for CPUE and length frequency data.

ICES may be asked for advice on particular stocks in particular years, out of synchrony with WGEF's plans. WGEF recommends that ICES draw upon the latest ACFM advice, where available, for such requests.

WGEF recommends that a photo-id key be developed for all emasmobranch species in the ICES area. This should be undertaken in conjuction with IBTS.

WGEF will compile and review all available conversions factors in 2007.

1.10 References

Gibson, C. *et al*. (Eds.) In preparation. The Conservation Status of Chondrichthyan Fishes in the Northeast Atlantic Region. Report of the IUCN Shark Specialist Group's Northeast Atlantic Regional Red List Workshop, UK, February 2006.

ICES 2006a. Report of the Working Group on Fish Ecology (WGFE), 13–17 March 2006, Copenhagen. ICES CM 2006/LRC:06, 154 pp.

ICES 2006b. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 27–31 March 2006, Lysekil, Sweden. ICES CM 2006/RMC:03, 298 pp.

ICES, 2006c. Report of the assessment working group chairs. ICES CM 2006/ACFM:17. 70 pp.

ICES. 2006d. Report of the Working Group on ELasmobranch Fishes (WGEF), 14-21 June 2005, Lisbon, Portugal. ICES CM 2006/ACFM:03, 224 pp.

Johnston, G., Clarke, M., Blasdale, T., Ellis, J., Figueiredo, I., Hareide, N.R., and Machado, P. 2005. Separation of Species Data from National Landings Figures. ICES CM 2005/N:22, 16 pp.

Large, P., Revill, A., Randall, P., Armstrong, M., Houghton, C. and Hareide, N.R. 2005 Western Edge Ghost Nets (Gill net retrieval). Programme 5 Final report. 22 pp.

Rihan, D., Muligan, M., Hareide, N.-R. 2005. Irish gillnet retrieval survey for lost gear MFV India Rose Rockall & Porcupine Bank, August 8th- September 3rd 2005.

1.11 Working documents and presentations made at the group

Biseau, A. 2006a. Deep species CPUE: a mixture of abundance and strategy. Examples of French trawlers fishery.

This paper presents CPUE trends for each species and each zone. Squalid sharks, "sikis", might appear under several different statistical codes in the French database.

Biseau, A. 2006b. French data on the Porbeagle from the fishery.

This communication presented data on landings and number of vessels involved in the fishery. The main landings came from longliners.

Bordalo-Machado, P. and Figueiredo, I. 2006. Skates and rays in the Portuguese continental coast – preliminary results from 26 years of IPIMAR demersal surveys.

This paper presents data on skates and rays species composition by year and depth from IPIMAR demersal surveys. The relative importance of each species in the catches were also analyzed.

Diez, G., Iriondo, A., Ruiz, J., Quincoces, I., Santurtún M., González, I., and Artetxe, I. 2006. Lesser spotted dogfish, rays and spurdog landings per unit effort and preliminary discards data of Basque fleets operating in sub-areas VI, VII and VIII in the period 1994–2005.

The paper presents preliminary data on discards of the main elasmobranch species of Basque fleets (Baka trawler and Very High Vertical Open Pair Trawler-VHVO-P) operating in Sub-areas VI ,VII and VIII during the period of 1994–2005.

Ellis, J. 2006. Recent studies on elasmobranchs.

Four studies were presented in this presentation, i.e. the finding of a pelagic stingray in the North Atlantic, the egg-laying in thornback rays, the fecundity of spurdog and taggings made elasmobranchs on groundfish surveys.

Ellis, J., Warr, K., Brown, D. 2006. Length-weight relationships and size at maturity of skates and rays (Rajidae) around the British Isles

The paper presented new information on the size at maturity for the more commonly observed rajids caught during English groundfish surveys.

Figueiredo, I., Bordalo-Machado, P. 2006. Standardized CPUE for deep-water sharks captured on the Portuguese continental slope.

This paper aims to estimate an index of abundance for each of the two most landed deep-water sharks in mainland Portugal - Portuguese dogfish and Leaf-scale gulper shark - based on CPUE estimates obtained from logbook data.

Figueiredo, I., Bordalo-Machado, P. 2006. Another look at the elasmobranch nei landings from the north-east Atlantic in the period 1973–2004.

This paper is an update on an earlier attempt to disaggregate NEI categories and by that try to reconstruct historical time series. Special focus was put on the analysis of trends of the most important teleostei species by country, region and ICES subareas. Particularly emphasis was put on the analysis of Various Sharks NEI, Cartilaginous Fishes NEI and the Dogfish sharks NEI, all grouped into the UNKNOWN GROUP.

Fowler, S. 2006. Northeast Atlantic region IUCN red list workshop 13th–15th February 2006.

This presentation was about the IUCN SSG workshop held in Peterborough, UK. The participants of the workshop had to evaluate the conservation status of individual species and stocks using Red List Criteria, identify specific threats and processes affecting stocks and species and, where necessary, propose population recovery objectives. 81 species were assessed during the workshop.

Hareide, N-. R. 2006. Norwegian fisheries for basking sharks, porbeagle and Greenland sharks.

This presentation contained information on landing data, prices for liver and fins and CPUE for basking sharks and just landing data for porbeagle and Greenland sharks from the Norwegian fishery since 1700s.

Hareide, Nils-Roar. 2006 Update on retrieval surveys west of Ireland.

Information on lost nets retrieved by an Irish survey in 2005 was presented. One fleet of deepwater nets (7.5 km) was retrieved, from SW Porcupine Bank, VIIk. This fleet was left at sea while the gillnet vessel was landing. A total catch of 6500 kg of deepwater sharks was recorded of which 96% was leafscale gulper shark. About 70% of the catch was decayed and not fit for human consumption. In addition a mature Greenland shark was caught in the net, with an ovarian fecundity of 320.

Jørgensen, O.A. 2006. Elasmobranchs at East Greenland, ICES Division 14B.

This paper presented which elasmobranch species that has been caught in surveys conducted during 1998–2005 off Greenland at depths between 400–1500 m. The species caught were *Somniosus microcephalus, Apristurus laurussonii, Bathyraja spinicauda, Centrocyllium fabricii, Raja bathyphila, Raja hyperborea, Raja radiata, Raja spinacidermis, Raja fyllae.*

Moura, T., Figueiredo, I., Neves, A., Farias, I., Serra Pereira, B., Gordo, L. S. 2006. Reproductive data on Portuguese dogfish *Centroscymnus coelolepis*, Leaf-scale gulper shark *Centrophorus squamosus* and Gulper shark *Centrophorus granulosus* commercially exploited in the Portuguese continental slope.

The paper presents new information on reproduction of deep-water sharks, particularly fecundity and first maturity/pregnancy of Portuguese dogfish, Leaf-scale gulper shark and Gulper shark.

Pinho, M. R. 2006. Elasmobranch statistics from the Azores (ICES Area X).

This paper updates the elasmobranch information from the Azores, ICES area X. Available data from the fisheries (landings) and survey (abundance and length composition) by species were compiled and updated in order to provide it to the WGEF 2006.

Serra-Pereira, B., Moura, T., Figueiredo, I., Farias, I., Gordo, L. S. 2006. Pilot study to estimate fishing effort on rays and skates fisheries in Portugal mainland.

This paper described work since 1994 to separate about ten species of rays and skates landed in Portugal. However there are still misidentifications done. The aim of this pilot study was to characterize the fishing strategy and exploitation pattern and through that get more reasonable estimates of effort.

2 Spurdog in the North East Atlantic

Spurdog, *Squalus acanthias*, has a worldwide distribution in temperate and boreal waters occurring mainly in depths of 10–200 m. In the northeast Atlantic this species is found from Iceland and the Barents Sea southwards to the coast of Northwest Africa (Compagno *et al.*, 2005; McEachran and Branstetter, 1989).

In the ICES area, this species exhibits a complex migratory pattern. Norwegian and British tagging programmes conducted in the 1950s and 60s focused on individuals captured in the northern North Sea. These were regularly recaptured off the coast of Norway, indicating a winter migration from Scotland, returning in the summer (Aasen 1960, 1962). Other tagging studies in the English Channel indicated summer movement into the southern North Sea (Holden, 1965). Few individuals tagged in this more southerly region were recaptured in the north and vice-versa and therefore at this time, distinct Scottish-Norwegian and Channel stocks were believed to exist. A tagging study initiated in the Irish and Celtic Seas in 1966 has yielded recaptures over 20 years from all round the British Isles and suggests that a single Northeast Atlantic stock is more likely (Vince, 1991). Transatlantic migrations have occurred (Holden, 1966; Templeman, 1976), but only occasionally, and therefore it is assumed that there are two separate north Atlantic stocks. The WG therefore concludes that a single ‘northeast Atlantic’ stock from the Barents Sea, Subarea I to Subarea IX is the most appropriate unit for assessment and management within ICES.

No studies have been conducted using parasitic markers or population genetics to identify spurdog stocks, and in addition, the data on morphometrics/meristics are inadequate for stock identification. The conclusions drawn about stock identity are therefore based solely on the tagging studies described above.

The relationships between the main NE Atlantic stock and populations in the Mediterranean are unclear. Spurdog in Subarea IX are considered to be part of the Northeast Atlantic stock, but catches from this area are likely to consist of a mixture of *Squalus* species with increasing numbers of *Squalus blainville* further south.

2.1 The Fishery

Historically, spurdog was a low-value species and in the 1800's was considered as a nuisance to pelagic herring fisheries, both as a predator and through damage to fishing nets. However, during the first half of the 20th century, this small shark became highly valued, both for liver oil and for human consumption, and northeast Atlantic spurdog was increasingly targeted. By the 1950s, targeted spurdog fisheries were operating in the Norwegian Sea, North Sea and Celtic Seas. Landings peaked at over 60 000 tonnes in the 1960s and since then have rapidly declined except for a period during the 1980s when a targeted gillnet and longline fisheries in the Irish Sea and western sea boards of Ireland developed.

In more recent years, increasing amounts of spurdog have been taken as bycatch in mixed demersal trawl fisheries, but they are still taken as bycatch or occasionally a target species in gill net and long-line fisheries, which are often undertaken in seasonal inshore fisheries.

The main fishing grounds for the Northeast Atlantic stock of spurdog are the North Sea (IV), West of Scotland (VIa) and the Celtic Seas (VII) and in some years the Norwegian Sea (II). Outside these areas, landings are generally low. The main exploiters of spurdog are France, Ireland, Norway and the UK.

2.1.1 The fishery in 2005

In the UK (E&W), more than 70% of spurdog landings were taken in line and net fisheries in 2005, with most landings coming from Sub-area VII and in particular the Irish Sea. Such fisheries are likely to be closer inshore and may be targeting aggregating mature female spurdog. Recent reports from the fishing industry also indicate that fleet behaviour has been affected by rising fuel costs (ICES, 2006) with many boats fishing closer to home to reduce costs. Such behaviour may mean that there has been increased fishing effort on inshore aggregations.

A smaller (although still significant) proportion of Scottish landings come from long-line and gillnet fisheries with the remainder coming from mixed demersal trawl fisheries (around 45%). Most landings are taken from the Northern North Sea and West of Scotland. Effort in the Scottish demersal trawl fleet is likely to have reduced in recent years due to decommissioning of vessels and days at sea regulations and therefore effort on spurdog due to this fleet may well have been reduced. However, the WG was unable to quantify the magnitude of this reduction.

The Irish fishery for spurdog mainly consists of bottom otter trawlers, with less than 30% of landings coming from line and gillnet fisheries. Most landings are reported from Division VIa and Division VIIg.

No information was available on Norwegian and French fisheries for spurdog.

2.1.2 ICES advice applicable in 2005 and 2006

Prior to 2005 ICES had never provided advice for this stock.

In 2005, the ICES advice for the fishery in 2006 in terms of single stock exploitation boundaries was as follows**:**

'The stock is depleted and may be in danger of collapse. Target fisheries should not be permitted to continue, and bycatch in mixed fisheries should be reduced to the lowest possible level. A TAC should cover all areas where spurdog are caught in the northeast Atlantic. This TAC should be set at zero for 2006.'

Mixed fisheries advice for 2006:

'Demersal fisheries in Subarea VI should in 2006 be managed according to the following rules, which should be applied simultaneously. They should fish:

- without catch or discards of cod in Subarea VI;
- *without catch or discards of spurdog*;
- no directed fishery for haddock in Division VIb;
- concerning deep water stocks fished in Subarea VI;
- within the biological exploitation limits for all other stocks.

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.'

'The mixed demersal fisheries advice for the North Sea is that they should fish:

- with minimal bycatch or discards of cod;
- within the precautionary exploitation limits for all other stocks (see text table above);
- where stocks extent beyond this area, e.g. into Division VI (saithe and anglerfish) or are widely migratory (Northern hake), taking into account the exploitation of the stocks in these areas so that the overall exploitation remains within precautionary limits.

with minimum bycatch of spurdog, porbeagle and thornback ray and skate.'

2.1.3 Management applicable

The following table summarises ICES advice and actual management applicable for northeast Atlantic spurdog during 2001–2006:

YEAR	SINGLE STOCK EXPLOITATION BOUNDARY (TONNES)	BASIS	TAC (IIA(EC) & IV) (TONNES)	WG LANDINGS (NE ATLANTIC STOCK) (TONNES)
2001	No advice	-	8870	16015 1)
2002	No advice	-	7100	9301
2003	No advice	-	5640	10426
2004	No advice	-	4472	6047
2005	No advice	-	1136	5636
2006	0	Stock depleted & in danger of collapse	1051	

1) The WG estimate of landings in 2001 may include some mis-reported deep-sea sharks or other species.

In recent years the TAC for spurdog has been cut quite dramatically with the TAC in 2006 (1051 t) less than 25% of that which was set for 2004. The TAC for spurdog only covers the EC waters of the North Sea (IV) and IIa - for EC nations and Norway. The Norwegian quota, which in 2006 is 90 t, includes long line catches of other sharks (tope, velvet belly, bird beak dogfish, leafscale gulper shark, greater lantern shark, smooth lantern shark and Portuguese dogfish) that may be taken in ICES Subareas IV, VI and VII. There is no TAC for EC nations for the remaining areas across which this stock is distributed.

Norway has a 70 cm minimum landing size.

2.2 Catch Data

2.2.1 Landings

Total annual landings, as estimated by the WG for the NE Atlantic stock of spurdog are given in Table 2.1 and illustrated in Figure 2.1. The estimated landings for 2005 were 5,600 t which is a decline from over 6000 t in 2004. There were some updates to officially reported data from previous years.

Officially reported landings of spurdog are not tabulated because as well as the species-specific category ‘spurdog’, a number of generic categories are used in the logbooks which may include some spurdog. The estimates of total landings made by the WG are therefore based on expert judgement and the process for obtaining these estimates is described below:

1903–1960: Landings data from the *Bulletin Statistique* for the category “Dogfish etc.” have been assumed to be comprised entirely of spurdog. Landings of other dogfishes (e.g. tope and smooth hound) are assumed to be a negligible component of these catches, as these species are typically discarded in the stock area.

1961–1972: Landings data from the *Bulletin Statistique* for the categories “Picked dogfish” and “Dogfishes and hounds” have been used, and assumed to be comprised almost entirely of spurdog. Landings of other dogfishes (e.g. tope and smooth hound) are assumed to be a negligible component of these catches, as these species are typically discarded in the stock area. No country consistently reported both of these dogfish categories in proportions that would be consistent with the nature of the fisheries. Fisheries for deep-water sharks were not well established in the stock area in this period.

French data were lacking from the ICES database and *Bulletin Statistique* for the years (1966–67 and 1969–1977 inclusive), and these data were estimated from “*Statistique des Peches Maritimes*”. As only aggregated shark landings were available for these years, spurdog landings were assumed to comprise 53% of the total shark landings, as spurdog comprised 50–57% of shark landings in subsequent years.

1973-present: Landings data from the ICES database were used, and these data included species-specific data for spurdog and some of the data from the appropriate generic categories (i.e. *Squalus* spp, Squalidae, Dogfishes and hounds, and Squalidae and Scyliorhinidae). National species-specific data for Iceland (1980–2002), Germany (1995–2002) and Ireland (1995–2002) were used to update data from the ICES database (ICES, 2003). The following assumptions were made regarding generic categories, based on the judgment of WG members.

Belgian landings of *Squalus* spp. were assumed to be spurdog.

Landings of Squalidae from ICES Subareas I–V and VII (except French landings) were assumed to be spurdog on the basis that fisheries for other squaloids (i.e. deep-water species) were not well developed in these areas over the period of reported landings. Landings of Squalidae from ICES sub-area VI were assumed to be spurdog for early period and for nations landings low quantities. The increase in French and German landings of Squalidae in this area after 1991 and 1995 respectively were assumed to be comprised of deep-water squaloid sharks. Similarly, French landings from ICES divisions VIIb–c (all years), VIIg–k (1991 onwards) and VIII (all years) were assumed to be deep-water sharks. Landings of Squalidae from areas further south were excluded as they were out of the stock area and were likely comprised of deep-water species.

Landings of “dogfishes and hounds” from areas VIIa and VIII were assumed to be spurdog. Landings of this category from other areas were generally low and excluded, with the assumption that spurdog contained in this category would be negligible.

2.2.2 Discards

Estimates of total amount of spurdog discarded are not routinely provided although some discard sampling does take place and is discussed further in Section 2.3.2.

2.2.3 Quality of the catch data

In addition to the problems associated with obtaining estimates of the historical total landings of spurdog described above, anecdotal information suggests that widespread misreporting by species may contribute significantly to the uncertainties in the overall level of spurdog landings. Under-reporting may have occurred in certain ICES areas when vessels were trying to build up a track record of other species, for example deepwater species. It has also been suggested that over-reporting may occur where stocks with currently highly restrictive quotas, such as Northern Shelf anglerfish and hake, are recorded as spurdog.

2.3 Commercial length frequencies

2.3.1 Landings length compositions

Sex disaggregated length frequency samples are available from UK (E&W) for the years 1983–2001 and UK (Scotland) for 1991–2004 for all gears combined. The Scottish data are available for the North Sea and West of Scotland separately whilst the English data are all areas combined. The two sets of Scottish length frequency distributions (IV & VIa) are very similar and these have therefore been combined to give a ‘total’ Scottish length frequency distribution. Typically these appear to be quite different to the length frequency distributions obtained from the UK (E&W) landings, with a much higher proportion of small females being landed by the Scottish fleets. The length distributions of the male landings appear to be relatively similar. Figure 2.2 shows landings length frequency distributions averaged over 5 year intervals. All the available data are given in Table 2.2. The Scottish data have been raised to total Scottish reported landings of spurdog while the UK (E&W) data have only been raised to the landings from the sampled boats.

2.3.2 Discard length compositions

There are no international estimates of discards by fleet and metier. Preliminary investigations on discards data supplied by UK (England and Wales) for fisheries operating in the Celtic Seas (Subareas VI-VII) and North Sea (Subarea IV) were undertaken for the years 1999–2006 (Figure 2.3). Discards data for some fisheries (e.g. seines and longlines) are limited. Data for beam trawl, demersal trawl and drift/fixed net fisheries indicate that most spurdog are retained, though juveniles (e.g. individuals < 45–50 cm) tend to be discarded, which agrees with data from market sampling.

Some preliminary elasmobranch discard estimates from the Basque fleets operating in Subareas VI, VII and VIII were presented in Diez *et al*., (2006, WD). Initial studies found no discarding of spurdog by the Baka trawler fleets.

There are no estimates of survivorship of discarded spurdog.

2.3.3 Quality of data

Length frequency samples are only available for UK landings and these are aggregated into broader length categories and used in the preliminary assessment presented in Section 2.7. No data were available from Norway, France or Ireland who are the other main exploiters of this stock. Over the past 20 years, UK landings have on average accounted for approximately 45% of the total. It is not known to what extent the available commercial length-frequency samples are representative of the catches by these other nations.

2.4 Commercial catch-effort data

No commercial effort data were available from the main nations exploiting spurdog (France, Ireland, Norway and UK).

Commercial LPUE (Kg/day) series were obtained for Basque fleets operating in Sub-areas VI, VII and VIII and are presented in Table 2.3. The LPUE calculations were obtained from total landings and effort taken from official logbooks. Effort is presented as total fleet days absent. The fleets are all mixed demersal trawl fleets with generally low officially reported landings. Highest landings have historically come from the BAKA trawl-ON-VIIIa,b,d, but the LPUE for this fleet has declined to very low levels in recent years. The effort in all Basque fleets (except those operating in VIIIc) has substantially declined in recent years. Further details can be found in Diez *et al*. (2006, WD).

2.5 Research vessel surveys

Fishery-independent survey data are available for most regions within the stock area. The following survey data were presented to this WG:

- English first-quarter Celtic Sea groundfish survey: years 1982–2002.
- English fourth-quarter Celtic Sea groundfish survey: years 1983–1988.
- English North Sea third-quarter groundfish survey 1977–2003.
- DARD (mainly quarter 3) Irish Sea groundfish survey 1991–2001.
- Scottish first-quarter west coast groundfish survey: years 1985–2006.
- Scottish fourth-quarter west coast groundfish survey: years 1985–2005.
- Scottish first-quarter North Sea groundfish survey: years 1985–2006.
- Scottish third-quarter North Sea groundfish survey: years 1985–2005.

The main areas covered by the Scottish surveys are Division VIa (West of Scotland) and the central/northern North Sea. There are a few stations in the northern Irish Sea and to the west of Ireland which are also regularly sampled. All recent Scottish surveys follow a fixed station design stratified by ICES rectangle and use a GOV with small mesh liner. In 1998, a change of research vessel took place and at the same time, haul duration was reduced from 1 hour to 30 minutes. A limited comparative fishing trial was conducted and subsequent analysis revealed no significant differences in catch rate for a number of teleost species (Zuur *et al*., 2001).

The Celtic Sea survey has operated since 1982, trawling at fixed stations each March with a Portuguese High Headline Trawl (PHHT). Between 1982 and 1988, the survey also operated in November-December. A tickler chain was used on fine grounds, but not on coarser grounds. The PHHT is fitted with a cod-end liner of 20 mm stretched mesh. Tow duration was 60 minutes over the majority of the survey period, though tows of up to 120 minutes were made before 1987. The station grid and tow duration were most consistent from 1987 onwards. For further details of the survey see Warnes and Jones (1995).

The DARD survey comprises 45 fixed station positions allocated to 7 strata defined by depth and substratum, with survey effort highest in the western Irish, and does not extend south of 53ºN. The survey is undertaken in March and October, and between 1992 and 1994 was also carried out in June. The trawl gear used is a Rockhopper otter trawl with 17 m foot rope of 16–18mm wire covered with 50 mm rubber discs and regularly-spaced non-rotating rubber discs of about 150 mm diameter. The wings and front of the net are constructed from 120 mm nylon, decreasing to 80 mm forward of the cod-end and extension which are fitted with a 20 mm liner. Tow duration is one hour.

This species is very much under-represented in beam-trawl surveys, and although they are sampled by GOV trawls and other otter trawls, it is not clear whether such surveys are able to provide a reliable index of abundance for this species. Spurdog is a relatively large-bodied species (up to 120 cm in the NE Atlantic), and adults are strong swimmers that forage both in pelagic and demersal waters. Furthermore, spurdog is an aggregating species that shoals by size and sex. Hence, survey data generally include a large number of zero catches, but also occasional catches comprising large numbers of individuals which result in a highly skewed distribution of haul catch-rates. Therefore, simple arithmetic mean catch rates are not thought to be good indices of abundance for spurdog and are not presented here. (The raw data can be found in the stock folder).

2.5.1 CPUE

Given the large variance in survey catch rates, using survey CPUE as an index of abundance is therefore problematic. Some initial exploratory analysis of the survey data focused on % of occurrence and % of hauls with 'large' catches. What is apparent is that spurdog occur in proportionately fewer hauls in the Celtic Sea Q1 survey in recent years (Figure 2.4). More striking is that the proportion of hauls in which large catches of spurdog (e.g. with a CPUE ≥ 20 ind.h^{-1}) has declined since the 1980's (Figure 2.5). Although haul duration in the period 1982–1984 were 60–120 minutes, tow duration has been standardised at 60 minutes since 1985. Hence, the decline in large catches does not appear to be an artefact of tow duration. To summarise, there is apparently a trend of decreasing occurrence and decreasing frequency of large catches.

Examination of the Scottish west coast first quarter survey provided comparable results. Spurdog occurs in proportionately fewer hauls in recent years (Figure 2.6), and once again the proportion of hauls with large catches of spurdog (CPUE ≥ 20 ind.h^{-1}) has declined since the 1980's (Figure 2.7). Although haul duration in the period 1985–1998 was 60 minutes, tow duration was reduced to 30 minutes since 1999. The main decline in the proportion of survey hauls with large catches occurred before 1999, and so is not an artefact of tow duration. The overall trends in this survey also indicate a trend of decreasing occurrence and decreasing frequency of large catches.

Statistical modelling

Following last year's meeting and the recommendation made by the ACFM review group some further analysis has been conducted on the Scottish survey data, investigating methods of standardising the survey catch rate to determine whether an appropriate index of abundance can be calculated. A brief description of the analysis is given here. (Further details can be found in Dobby *et al.*, 2005).

Data from the 4 Scottish surveys listed above (1985–2005) were considered in the analysis. The dataset consists of length-frequency distributions at each trawl station, usually one per ICES statistical rectangle (per survey), together with the associated information on gear type, haul time, data, duration and location. Each survey data set used in this analysis contains approximately 1100 hauls except for the North Sea Q3 which contains over 1700. For each haul station, standardised catch-rate was calculated: total number caught divided by the haul duration in hours to obtain a measure of catch-per-unit effort.

The objective of the analysis was to obtain standardised annual indices of CPUE (on which an index of relative abundance can be based) by identifying explanatory variables which help explain the variation in catch-rate which is not a consequence of changes in population size. Due to the highly skewed distribution of catch rates and the presence of the large number of zeros, a 'delta' distribution approach was taken to the statistical modelling. Lo *et al*. (1992) and Stefansson (1996) describe this method which combines two generalized linear models (GLM): one which models the probability of a positive observation and the second which models the catch rate conditioned on it being positive assuming a lognormal distribution. The overall year effect (annual index) can then be calculated by multiplying the year effects estimated by the two models.

The analysis was conducted in stages: initially each survey was considered separately and then the model fitted to all survey data combined. Since the aim was to obtain an index of temporal changes in the CPUE, year was always included as a covariate (factor) in the model. Other explanatory variables included were area (Scottish demersal sampling area) and month (as a quadratic variable). The estimated combined year effect is shown in Figure 2.8 and Table 2.4. Similar models were fitted for the catch rates of small (< 30 cm) and large (>70 cm) individuals.

The standardised index suggests that there has been a significant decrease in the abundance of spurdog around the coast of the UK since 1985 with the greatest declines occurring in the first few years of the time series. A similar pattern is seen in the analysis of the 'large' individuals. Catch rates of 'small' individuals were so low that no useable index could be obtained.

It was considered that this is a potentially useful approach for obtaining an appropriate index of abundance for Northeast Atlantic spurdog. However, there are a number of issues associated with the analysis which should be highlighted:

- the survey data analysed do not cover the whole distribution of the stock
- sensitivity of the results to the distributional assumptions made in the GLM need to be further investigated
- further attempts should be made to obtain sex-specific abundance indices

Despite these reservations, the index illustrated in Table 2.6 has been used in the exploratory assessment conducted in Section 2.7.

2.5.2 Length distributions

The size distribution of spurdog in the North Sea surveys are shown in Figure 2.9. The Scottish data are presented by quarter and indicate that spurdog of 65–85 cm total length are the predominant part of catches in Q3 surveys, with proportionately more pups and juvenile spurdog (20–55 cm) caught in Q1 surveys. The UK (E&W) Q3 survey also catches very few small individuals.

The size distributions of spurdog caught in the Scottish West coast surveys (Q1 and Q4) are predominantly made up of pups and juveniles (20–55 cm), with mature females comparatively infrequent (Figure 2.10). These size classes are also an important component of Celtic Sea survey catches (Q1 and Q4 combined), although there is a higher proportion of both males and females in the 70–80 cm length range. The length frequency distributions obtained from the DARD quarter 3 Irish Sea survey tend to have the greatest proportion of large fish (> 85 cm) which are likely to be mature females (males are smaller). However, these were the only survey data from the 3rd quarter so it is difficult to tell whether this length-frequency distribution is dependent on the location or timing of the survey. The recently initiated UK (E&W) Q4 survey in the Irish Sea may provide further data in the future.

The comparisons presented in this section are based on size distributions combined over a long time period and therefore do not take account of any possible changes in size distribution which may have occurred over the time period.

2.6 Mean length, weight, maturity and natural mortality-at-age

Although there have been several studies in the North Atlantic and elsewhere describing the age and growth of spurdog (Holden and Meadows; 1962; Sosinski; 1977, Hendersen *et al.*, 2001), routine ageing of individual from commercial catches or surveys is not carried out.

WGEF assumes the following sex-specific parameters in the length-weight relationship ($W=aL^b$) for Northeast Atlantic spurdog (Coull *et al.*, 1989):

	a	b
Female	0.00108	3.301
Male	0.00576	2.89

where length is measured in cm and weight in grams.

The proportion mature at length was assumed to follow a logistic ogive with 50% maturity at 80 cm for females and 64 cm for males. Values of female length at 50% maturity from the literature include 74cm (Fahy, 1989), 81cm (Jones and Ugland, 2001) and 83 cm (Gauld, 1979).

The WG has assumed a linear relationship between fecundity (F) and total length (L):

F = 0.344.L – 23.876 (Gauld, 1979).

More recent information on fecundity and spawning grounds can be found in Ellis (2006, WD).

Natural mortality is not known, though estimates ranging from 0.1–0.3 have been described in the scientific literature (Aasen, 1964; Holden, 1968). WGEF has assumed a length dependent natural mortality with a value of 0.1 for a large range of ages, but higher values for both very small (young) and large (old) fish.

See Section 2.7 and Figure 2.11 for more information on the biological assumptions used in the preliminary assessment presented here.

2.7 Exploratory assessment model

2.7.1 Introduction

The exploratory assessment developed last year for spurdog was developed further this year. It now accounts for updated landings data, includes a delta-lognormal GLM-standardised index of abundance (with associated CVs), based on Scottish groundfish surveys (Section 2.5.1, Table 2.4), and assumes two “fleets”, with landings data split to reflect a fleet with Scottish selectivity, and one with England & Wales selectivity. The Scottish and England & Wales selectivities were estimated by fitting to proportions-by-length category data derived from Scottish and England & Wales market sampling data (Section 2.3, Tables 2.2a and b).

The exploratory assessment is based on an approach developed by Punt and Walker (1998) for school shark (*Galeorhinus galeus*) off southern Australia. The approach is essentially age- and sex-structured, but is based on processes that are length-based, such as maturity, pup-production, growth (in terms of weight) and gear selectivity, with a length-age relationship to define the conversion from length to age. Pup-production (recruitment) is closely linked to the numbers of mature females, but the model allows deviations from this relationship to be estimated (subject to a constraint on the amount of deviation).

The implementation for spurdog was coded in AD Model Builder (Otter Research). The approach is similar to Punt and Walker (1998), but ignores density-dependence in pup-production and fits to the Scottish groundfish surveys index of abundance, and proportion-by-category data from both the survey and commercial catches (aggregated across gears). Four categories were considered for the survey proportion-by-category data, namely length-groups 16–31 cm (pups); 32–54 cm (juveniles); 55–69 cm (sub-adults); and 70+ cm (maturing and mature fish). The first two categories were combined for the commercial catch data to avoid zero values.

The only estimable parameters considered are total virgin biomass (B_0), Scottish survey selectivity-by-category (3 parameters), commercial selectivity-by-category for the two fleets (4 parameters two reflecting Scottish selectivity, and two England & Wales selectivity), and constrained recruitment deviations (1905–2005). The model also assumes two commercial catch exploitation patterns that have remained constant since 1905, which is an oversimplification given the number of gears taking spurdog, and the change in the relative contribution of these gears in directed and mixed fisheries over time. Growth is considered invariant, as in the Punt and Walker (1998) approach, but growth variation could be included (Punt *et al*. 2001).

2.7.2 Population dynamic model

The model is largely based on Punt and Walker (1998) and Punt *et al*. (2001).

Basic dynamics

The population dynamics for spurdog are assumed to be governed by:

$$N^s_{y+1,a+1} = \begin{cases} \Phi^s R_{y+1} & a = 0 \\ (N^s_{y,a} e^{-M_a/2} - \sum_j C^s_{j,y,a}) e^{-M_a/2} & 0 < a < A-1 \\ (N^s_{y,A-1} e^{-M_{A-1}/2} - \sum_j C^s_{j,y,A-1}) e^{-M_{A-1}/2} + (N^s_{y,A} e^{-M_A/2} - \sum_j C^s_{j,y,A}) e^{-M_A/2} & a = A \end{cases} \qquad 2.1a$$

where s=f or m, Φ^s is the sex ratio (assumed to be 0.5), R_y the recruitment of pups to the population, $N^s_{y,a}$ the number of animals of sex s and age a at the start of year y, M_a the instantaneous rate of natural mortality at age a, $C^s_{j,y,a}$ the number of animals caught of sex s and age a in year y by fleet j, and A the plus group (60). Total biomass is then calculated as:

$$B_y = \sum_s \sum_a w^s_a N^s_{y,a} \qquad 2.1b$$

where w^s_a is the mean weight of animals of sex s and age a at the start of the year.

Recruitment

The number of pups born each year depends on the number of mature females in the population as follows:

$$N_{pup,y} = \sum_{a=1}^{A} P'_a P''_a N^f_{y,a} \tag{2.2a}$$

where P'_a is the number of pups per pregnant female of age *a*, and P''_a the proportion females of age *a* that become pregnant each year. In order to allow for interannual variation in pup survival rate, "process error" is introduced as follows:

$$R_y = N_{pup,y}\, e^{\varepsilon_{r,y} - \sigma_r^2/2} \tag{2.2b}$$

where the recruitment variability parameter σ_r is assumed known (0.2), and recruitment residuals $\varepsilon_{r,y}$ are estimated.

Estimated fishing proportion and catch-at-age

Catches are assumed to be taken in a pulse in the middle of the year, with the fully selected fishing proportion $F_{j,y}$ being estimated from the observed annual catch (in weight) by fleet $C_{j,y}$ as follows:

$$F_{j,y} = \frac{C_{j,y}}{\sum_a e^{-M_a/2} \sum_s w^s_{a+\frac{1}{2}} S^s_{com,j,a} N^s_{y,a}} \tag{2.3a}$$

where $w^s_{a+\frac{1}{2}}$ is the mid-year mean weight of animals of sex *s* and age *a*, and $S^s_{com,j,a}$ the selectivity-at-age of animals of sex *s* and age *a* caught by fleet *j*. For the purposes of illustrating a fishing proportion trajectory, the mean effective fishing proportion over ages 5-30 is calculated as follows:

$$F_{prop5-30,y} = \frac{1}{26} \sum_{a=5}^{30} \sum_j F_{j,y} \sum_s S^s_{com,j,a} \tag{2.3b}$$

Catch-at-age (in numbers) is estimated as follows:

$$C^s_{j,y,a} = F_{j,y} S^s_{com,j,a} N^s_{y,a} e^{-M_a/2} \tag{2.3c}$$

Commercial selectivity

Commercial selectivity-at-age is calculated from commercial selectivity-by-length category parameters as follows:

$$S^{s*}_{com,j,a} = \begin{cases} S_{c2,j} & 16 \le l^s_a < 55 \\ S_{c3,j} & 55 \le l^s_a < 70 \\ 1 & l^s_a \ge 70 \end{cases} \tag{2.4a}$$

so that:

$$S^{s}_{com,j,a} = S^{s*}_{com,j,a} / \max_{j}(S^{s*}_{com,j,a}) \qquad 2.4b$$

where l^s_a is the length-at-age for animals of sex *s*. Selectivity-by-length category parameters $S_{c2,j}$ and $S_{c3,j}$ (*j=sco* or *e&w*) are estimated in the model.

Survey selectivity

Survey selectivity-at-age $S^s_{sur,a}$ for animals of sex *s* is calculated in the same manner as commercial selectivity, except that there is only one survey abundance series (the index *j* is dropped from the above equations) and one additional length category (the 16–54 cm category is split into 16–31 and 32–54), leading to 3 selectivity parameters to be estimated (S_{s1}, S_{s2} and S_{s3}).

Initial conditions

The model assumes virgin conditions and total biomass (B_0, an estimable parameter in the model) in 1905, the earliest year for which continuous landings data are available (Section 2.2 and Figure 2.1). Taking the model back to 1905 ensures that the assumption of virgin conditions is more appropriate, although it also implies that exploitation patterns estimated for the most recent period (1980+) are taken back to the early 1900s. Virgin conditions are estimated by assuming constant recruitment and taking the basic dynamics equations forward under the assumption of no commercial exploitation. Virgin recruitment (R_0) is then calculated as follows:

$$R_0 = \frac{B_0}{\sum_s \Phi^s \left[\sum_{a=0}^{A-1} w^s_a e^{-\sum_{i=0}^{a-1} M_i} + w^s_A \frac{e^{-\sum_{i=0}^{A-1} M_i}}{1-e^{-M_A}} \right]} \qquad 2.5$$

2.7.3 Life-history parameters

Calculation of the life-history parameters M_a (instantaneous natural mortality rate), l^s_a (mean length-at-age for animals of sex *s*), w^s_a (mean weight-at-age for animals of sex *s*), P'_a (number of pups per pregnant female of age *a*), and P''_a (proportion females of age *a* that become pregnant each year) are summarised in Table 2.5, and described visually in Figure 2.11.

2.7.4 Likelihood function

Survey abundance index

The contribution of the Scottish survey abundance index to the negative log-likelihood function assumes that the index $I_{sur,y}$ is lognormally distributed about its expected value, and is calculated as follows:

$$-\ln L_{sur} = \tfrac{1}{2} \sum_y [\ln(2\pi\sigma^2_{sur,y}) + \varepsilon^2_{sur,y}] \qquad 2.6a$$

where $\sigma_{sur,y}$ is the CV of the untransformed data, q_{sur} the survey catchability (estimated by closed-form solution), and $\varepsilon_{sur,y}$ the normalised residual:

$$\varepsilon_{sur,y} = [\ln(I_{sur,y}) - \ln(q_{sur} N_{sur,y})] / \sigma_{sur,y} \qquad 2.6b$$

$N_{sur,y}$ is the "available" mid-year abundance corresponding to $I_{sur,y}$, and is calculated as follows:

$$N_{sur,y} = \sum_s \sum_a S^s_{sur,a} [N^s_{y,a} e^{-M_a/2} - \sum_j C^s_{j,y,a} / 2] \qquad 2.6c$$

Commercial proportion-by-category

The contribution of the commercial proportion-by-length category data to the negative log-likelihood function assumes that these proportions $p_{j,y,L}$ for fleet j and length category L (combined sex) are multinomially distributed about their expected value, and is calculated as follows (Punt *et al*. 2001):

$$-\ln L_{pcom,j} = k_{pcom,j} \sum_y \sum_L \varepsilon_{pcom,j,y,L} \qquad 2.7a$$

where $k_{pcom,j}$ is the effective sample size, and the multinomial residual $\varepsilon_{pcom,j,y,L}$ is:

$$\varepsilon_{pcom,j,y,L} = -\frac{n_{pcom,j,y}}{\bar{n}_{pcom,j}} p_{j,y,L} [\ln(\hat{p}_{j,y,L}) - \ln(p_{j,y,L})] \qquad 2.7b$$

with $n_{pcom,j,y}$ representing the number of (raised) samples on which estimates of proportions by length category are based, and $\bar{n}_{pcom,j}$ the corresponding average (over y). Three length categories are considered for the commercial proportions-by-length (16–54 cm; 55–69 cm; and 70+ cm), and the model estimates $\hat{p}_{j,L,y}$ are obtained by summing the estimated numbers caught in the relevant length category L and dividing by the total across all the length categories. The effective sample size $k_{pcom,j}$ is assumed to be 50 for all j (after Punt *et al*., 2001).

Survey proportion-by-category

The negative log-likelihood contributions (-lnL_{psur}) for the Scottish survey proportions-by-length category are as for the commercial proportions, except that there is only one survey abundance series (the j index is dropped in the above equations), and one additional length category (the 16–54 cm category is split into 16–31 and 32–54). The effective sample size k_{psur} is assumed to be 25, and reflects the lower sample sizes for surveys relative to commercial catch data (Punt *et al*., 2001).

Recruitment

Recruitment (pups) is assumed to be lognormally distributed about its expected value, with the following contribution to the negative log-likelihood function:

$$-\ln L_r = \tfrac{1}{2} \sum_y [\ln(2\pi\sigma_r^2) + (\varepsilon_{r,y} / \sigma_r)^2] \qquad 2.8$$

Total Likelihood

The total negative log-likelihood is the sum of the individual components:

$$-\ln L_{tot} = -\ln L_{sur} - \sum_j \ln L_{pcom,j} - \ln L_{psur} - \ln L_r \qquad 2.9$$

2.7.5 Results

Time series trends

Model estimates of total biomass (B_y) and mean fishing proportion ($F_{prop5\text{-}30,y}$) are shown in Figure 2.12 together with observed annual catch ($C_y = \sum_j C_{j,y}$). They indicate a strong decline in spurdog total biomass since the early 1900s (to around 5% of pre-exploitation levels – see Table 2.6 later), which appears to be driven by relatively high exploitation levels given the biological characteristics of spurdog. $F_{prop5\text{-}30,y}$ appears to have declined in recent years with B_y levelling off. Figure 2.13 shows total biomass (B_y), recruitment (R_y) and mean fishing proportion ($F_{prop5\text{-}30}$) together with approximate 95% probability intervals. The fluctuations in recruitment towards the end of the time series is driven by information in the proportion-by-length category data.

Estimated parameters

Model estimates of virgin biomass (B_0), current depletion levels relative to 1905 and 1955 (B_{depl05} and B_{depl55}), and survey catchability (q_{sur}) are shown in Table 2.6 together with estimates of precision. Estimated commercial- and selectivity-at-age patterns are shown in Figure 2.14, and reflect the relatively lower proportion of large animals in the survey data when compared to the commercial catch data (see also Figures 2.16–7).

Model fits

Table 2.7 provides a correlation matrix for some of the key estimable parameters (only the last 10 years of recruitment residuals are shown). Apart from the survey selectivity parameters, correlation between estimable parameters are low. Figure 2.15 shows the model fit to the Scottish surveys abundance index, Figure 2.16 to the Scottish and England & Wales commercial proportion-by-length category data, and Figure 2.17 to the Scottish surveys proportion-by-length category data. Model fits appear to be reasonably good with no obvious residual patterns. Figure 2.17 indicates a slightly poorer fit to the survey proportions compared to the commercial proportions. Figure 2.18 compares the deterministic and stochastic versions of recruitment, and plots the estimated recruitment residuals normalised by σ_r.

2.7.6 Retrospective analysis

A 5-year retrospective analysis (the model was re-run, each time omitting a year in the data) was performed, and is shown in Figure 2.19 for the total biomass (B_y), mean fishing proportion ($F_{prop5\text{-}30,y}$) and recruitment (R_y). There is almost no retrospective bias, the 2002–5 retrospective runs being almost identical. The main difference shown is the difference between the 2001 retrospective run and those for 2002–5.

2.7.7 Sensitivity analysis

Two sets of sensitivity analyses were carried out, the first to look at sensitivity to assumptions about recruitment variability σ_r, and the second at sensitivity to fixing B_0 at lower values (instead of estimating it).

Results for the first set (σ_r) are shown in Figure 2.20, which plots B_y, R_y and $F_{prop5\text{-}30,y}$ with associated 95% probability intervals for three values of σ_r, namely 0.1, 0.2 (the base-case assumption) and 0.3. With the lack of information on recruitment strength prior to 1980s, probability intervals for B_y and R_y widen with increasing σ_r, indicating that it is more sensible to reduce σ_r to a small value (0.05, say) for that portion of the time series for which information on recruitment is lacking or very limited, but to continue to use a higher value (0.2 say) for the remaining period to allow sufficient flexibility to fit the data. Estimates of $F_{prop5\text{-}30,y}$ are relatively insensitive to changes in σ_r.

Results for fixing B_0 at 75% and 50% of the base case estimate are shown in Table 2.8 and Figure 2.21 together with the base-case run (100% B_0). Figure 2.21 indicates that with lower B_0, the model compensates by increasing recruitment in the first half of the time series (expensive in likelihood terms) in order for there to be enough animals to account for historic catches, and to fit the data in the second half of the time series. Table 2.8 indicates current depletion levels range from 5.2–6.6% relative to 1905, and from 5.2–7.1% relative to 1955.

2.7.8 Discussion

The exploratory model shows almost no retrospective bias and provides reasonable fits to the available data. The sensitivity test reducing values for B_0 indicate that there doesn't appear to be a scaling problem in the model, but that the high estimate for B_0 relative to observed landings is driven by the catch history and assumptions about underlying population dynamics. The model therefore has potential as an assessment model for spurdog. However, as with any stock assessment model, it relies heavily on the underlying assumptions, particularly with regard to life-history parameters (e.g. natural mortality and growth), and on the quality and appropriateness of input data.

Further refinements of the model are possible, such as including variation in growth, splitting the largest length category up further so that the subsequent largest category includes a smaller proportion of the observed catch and fewer ages, and making more appropriate assumptions about recruitment variability σ_r (sensitivity tests indicate it may make more sense to use a lower value for the period for which information on recruitment is limited). Selectivity curves also cover a range of gears and the entire catch history, and more appropriate assumptions (depending on available data) could be considered.

Preliminary results from the current model confirm that spurdog abundance has declined, and that the decline is driven by high exploitation levels in the past, coupled with biological characteristics that make this species particularly vulnerable to such intense exploitation.

In summary, the model may be appropriate for improving assessments of spurdog, though it could be better developed if the following data were available:

- Selectivity parameters disaggregated by gear for the main fisheries (i.e. for various trawl, long line and gillnets)
- Appropriate indices of relative abundance from fishery-independent surveys, with corresponding estimates of variance
- Improved estimates for biological data (e.g. growth parameters, reproductive biology and natural mortality).

2.8 Comparison with Previous studies

Earlier meetings of SGEF and WGEF have attempted to undertake assessments of NE Atlantic spurdog. The methods employed during the 2002 SGEF meeting (ICES, 2002) and DELASS project (Heessen, 2003) included catch curve analysis and separable VPA using length distributions sliced according to growth parameters from the scientific literature, and a Bayesian assessment using a stock production model, with a prior for the intrinsic rate of increase set by demographic methods.

The former method indicated that the mature population had declined (Figure 2.22), though the conclusions that could be drawn from this study were highly dependent on the growth parameters used for slicing. Further studies are needed to examine the sensitivity to growth model parameter uncertainty.

The Bayesian assessment estimated that spurdog were very likely to be at less than 10% of carrying capacity, and possibly as low as 5% of virgin biomass (Figure 2.23, ICES, 2002; Hammond and Ellis, 2005), though this assessment had several assumptions. Firstly, growth parameters were based on published values, though there is some uncertainty in the ageing of spurdog, especially for larger fish. This assessment also discarded some survey observations (zero catches), the model assumed the stock was at carrying capacity in 1946 and that the parameters r and K have remained constant since 1946, and the model ascribed no uncertainty to the landings data.

Following on from preliminary length-based models developed during the 2002 SGEF meeting, continued studies were undertaken (ICES, 2003) using a length-based approach using a modified catch-at-size analysis (CASA) (see Sullivan *et al* 1990). Estimates of spawning stock biomass and total biomass for both males and females from this model showed a sharp decline, with female spawning biomass appearing lower than male (Figure 2.24).

The preliminary assessment presented in this report shows similar estimates of trends in biomass estimated in previous studies. In particular, the estimates of current stock size as a percentage of virgin biomass are very similar (5.2–6.6% compared to 5%) to those presented in Hammond and Ellis (2005).

2.9 Quality of the Analytic Assessment

This WG has previously attempted analytic assessments of the stock of Northeast Atlantic spurdog using a number of different approaches. (Section 2.7 and Section 2.8). As yet, none have proved entirely satisfactory although good progress has been made in recent years in developing an age-structured model (Punt and Walker, 1998 and Section 2.7 of this report) which is able to incorporate appropriate biological assumptions and makes use of the limited length-structured data available. However, there are still concerns about the quality of the assessment input data and as such the assessment should still be regarded as preliminary. Survey data, however, do provide an indication of the trends in the stock in particular areas.

2.9.1 Catch data

The WG has provided estimates of total landings of Northeast Atlantic spurdog and has used these, together with UK length frequency distributions in the assessment presented above. However, there are still concerns over the quality of these data due to:

- uncertainty in the historical level of catches due to landings being reported by generic dog-fish categories
- uncertainty over the accuracy of the landings data due to species mis-reporting
- lack of commercial length frequency information for countries other than the UK
- low levels of sampling of UK landings and lack of length-frequency data in recent years
- lack of discard information

2.9.2 Survey data

Survey data are particularly important indicators of abundance trends in stocks such as this where an analytic assessment is not available. However, it should be highlighted that

- the survey data presented in this WG report cover only part of the stock distribution – analysis should be extended to additional data covering the rest of the stock distribution.
- spurdog survey data are difficult to interpret due to the typically highly skewed distribution of catch-per-unit effort

2.9.3 Biological information

As well as good commercial and survey data, the analytic assessments require good information on the biology of Northeast Atlantic spurdog. In particular, the WG would like to highlight the need for

- updated and validated growth parameters, in particular maximum size of individuals
- better estimates of natural mortality

2.9.4 Model formulation

The exploratory model shows promise as an assessment approach for spurdog, showing almost no retrospective bias and reasonable fits to the available data. However, as with any assessment model, it relies heavily on the appropriateness of underlying assumptions and quality of input data. Further refinement in the model formulation could be considered:

- Exploitation pattern – the model currently assumes two commercial catch exploitation patterns (based on Scottish and England & Wales data) that have remained constant since 1905, which is an oversimplification given the number of gears taking spurdog, the change in the relative contribution of these gears in directed and mixed fisheries over time, and the number of other important exploiters of the stock (apart from UK). Further refinements depend on available data.
- Growth – growth is currently considered invariant, but, depending on appropriate data, growth variation could be considered (e.g. Punt *et al*., 2001).
- Proportion by length category – currently, the largest length category considered contains the highest proportion of animals caught by commercial fisheries and a large number of ages. The largest length category could be split further so that the subsequent largest category includes a smaller proportion of the observed catch and fewer ages.
- Assumption about recruitment variability – sensitivity tests indicate it may make more sense to use a much lower value (0.05 say) for the period for which information on recruitment is limited. For the bulk of results presented for the exploratory model, a value of 0.2 is used for the whole time period.

2.10 Simulation of effects of Maximum landing length regulations

Earlier demographic studies on elasmobranchs indicate that low fishing mortality on mature females is beneficial to population growth rates (Cortés, 1999; Simpfendorfer, 1999). Hence, measures that afford protection to mature females may be an important element of a management plan for the species. As with many elasmobranchs, female spurdog attain a larger size than males, and larger females are more fecund.

The sex ratio of spurdog at length in commercial catches (from UK (England and Wales) market sampling data for the period 1983–2001) and research vessel catches (from aggregated data from UK (England & Wales) groundfish surveys in the North Sea, Irish Sea and Celtic Sea, 1977–2003) are illustrated in Figure 2.25. This indicates that at length of up to about 65 cm, the sex ratio of spurdog is approximately 1:1, with males predominant at lengths of 70–80 cm, and females predominant at lengths of >85 cm. Data from market sampling had a comparable trend, though there is an indication of some selection of females in these landings, though this could also be a sampling artefact.

The length-structured population model which was used in the catch-at-size analysis described above (Section 2.8) can also be used as a simulation tool with fixed input parameters. At last year's WG some exploratory simulations were conducted too investigate the effects of altering exploitation pattern and rate on stock status.

The model uses a size-transition matrix approach to project the population length distribution forwards in time. The sex specific size-transition matrix is obtained from a stochastic growth model with fixed von Bertalanffy growth parameters. All population dynamics processes, such as recruitment and fishing mortality, are assumed to be dependent on length rather than age. It is further assumed that these processes are independent of sex so that equal numbers of males and females recruit to the fishery, and fishing mortality at length is identical. A fuller description of the population model can be found in Dobby (2004) with the specific assumptions made for spurdog described in ICES (2005).

The results of simulations (carried out last year) with maximum landings sizes of 70 cm, 85 cm and 90 cm are shown in Figure 2.26. Implementing a maximum landing size of 70 cm in 2006 results in a very sudden drop in catch, but the stock biomass and recruitment are predicted to increase very quickly and this results in increasing catches after a few years, although it is approximately 15 years before catches return to their current levels. Only a small proportion of the current catch is above 85 cm and therefore protecting individuals above either 85 or 90 cm has only a small immediate effect on the level of the catch. Consequently the increases in stock biomass and recruitment are slower in these cases. In all simulations it was assumed that there was 100% survival of discards and also that fishing mortality (effort) on the large individuals was not re-allocated to the smaller length-classes. It is not known to what extent the assumption about discard survival is correct.

As the current stock status in terms of length (or age-) structure, total biomass and fishing mortality is actually unknown, the results of these simulations should be viewed as illustrative of what may happen when such management strategies are implemented. In particular, levels of biomass, catch, and rates of change of these quantities should certainly not be regarded as absolute. Such measures are likely to be highly dependent on the assumed initial conditions as well as the assumed biological population model.

2.11 Reference points

No reference points have been proposed for this stock.

2.12 Management considerations

Perception of state of stock

All analyses presented in this report (and at previous meetings of WGEF) have indicated that the Northeast Atlantic stock of spurdog has been declining rapidly and is at its lowest ever level. Preliminary assessments making use of the long time-series of commercial landings data (e.g. Section 2.7 of this report) suggest that this decline has been going on over a long period of time and that the current stock size may only be a small fraction of its virgin biomass (< 10%).

In addition, spurdog are less frequently caught in groundfish surveys than they were 20 years ago, and the preliminary analysis of Scottish survey data presented here (and in Dobby *et al*, 2005) indicate significant declines in catch-rate (> 75% decline in CPUE since 1985). Input data are too limited to give an accurate estimate of current stock status in terms of absolute biomass and fishing mortality, but the illustrated trends in the stock biomass are undeniable.

Stock distribution

Spurdog in the ICES area are considered to be a single stock, ranging from Sub-area I to Sub-area IX, although landings from the southern end of its range are likely also to include other Squalus species. However, the TAC is only for EC waters of the North Sea (IV) and IIa, for EC nations and Norway. **A high priority for management is therefore that the TAC area should be extended to cover the stock distribution area**.

Prior to 2005, this TAC had not restricted the landings in IIa and IV (Figure 2.27). Landings in 2005 for IIa and IV are very low due to an absence of officially reported landings from Denmark.

Biological considerations

Spurdogs are long-lived, slow growing, have a high age-at-maturity, and are particularly vulnerable to high levels of fishing mortality. Population productivity is low, with low fecundity and a protracted gestation period. In addition, they form size- and sex-specific shoals and therefore aggregations of large fish (i.e. mature females) are easily exploited by target long-line and gillnet fisheries.

Fishery and technical considerations

Those fixed gear fisheries that capture spurdog should be reviewed to examine the catch composition, and those taking a high proportion of mature females should be strictly regulated. Additional management measures which would deter the targeting of mature females could include, for example a maximum landings length (MLL). See section 2.10 for simulations on MLL.

Spurdog were historically subject to large targeted fisheries, but are increasingly now taken as a bycatch in mixed trawl fisheries. In these fisheries, measures to reduce overall demersal fishing effort should also benefit spurdog. However, a restrictive TAC in this case would likely result in increased discards of spurdog and so may not have the desired effect on fishing mortality if discard survivorship is low.

There is limited information on the distribution of spurdog pups, though they have been reported to occur in Scottish waters, in the Celtic Sea and off Ireland. The lack of accurate data on the location of pupping and nursery grounds, and their importance to the stock precludes spatial management for this species at the present time.

While there is no EU minimum landing size for spurdog, there is some discarding of smaller fish, and it is likely that spurdog of <40 or 45 cm are discarded in most fisheries. The survivorship of discards of juvenile spurdog is not known.

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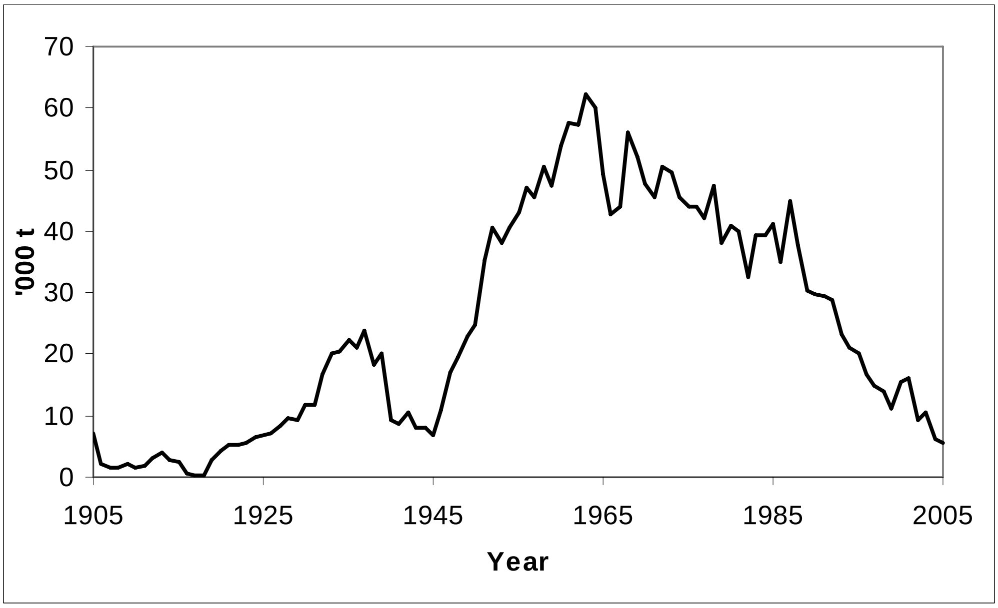


Figure 2.1. Northeast Atlantic spurdog. WG estimates of total international landings of NE Atlantic spurdog (1905–2005).

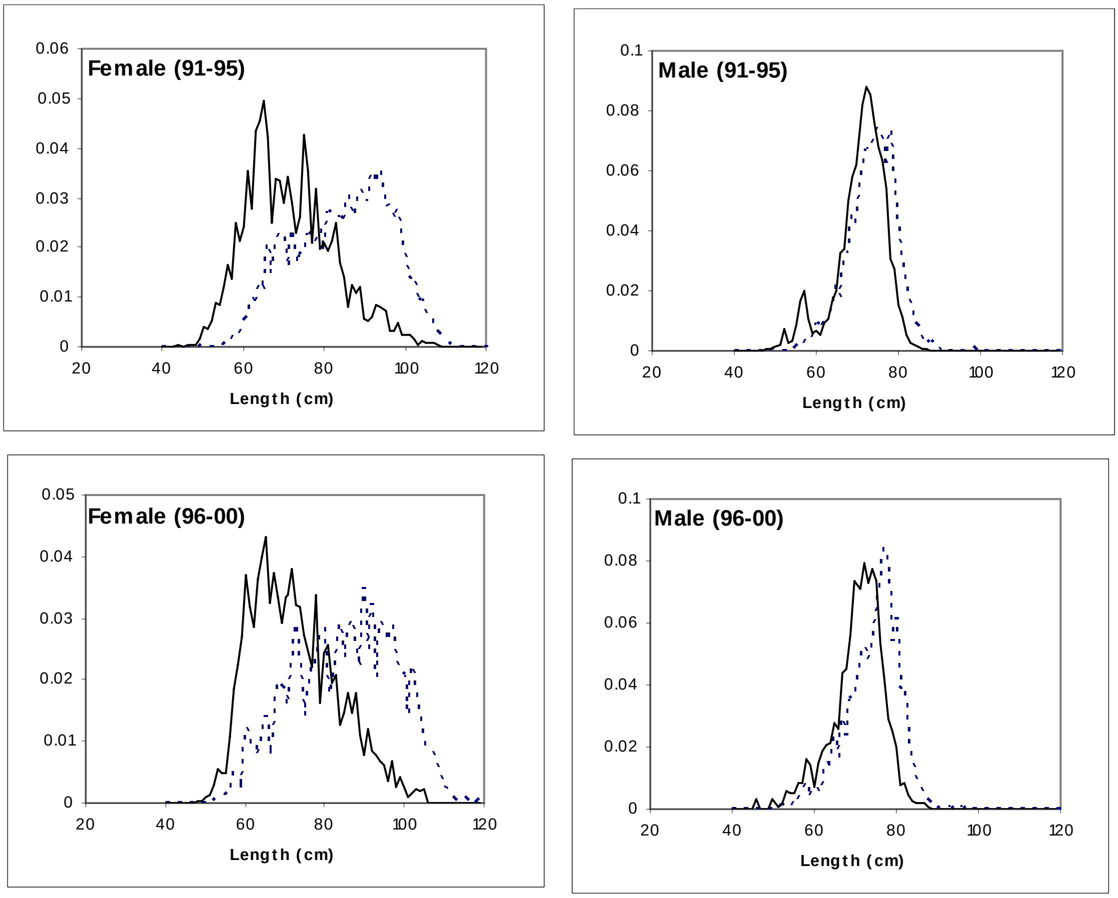


Figure 2.2. Northeast Atlantic spurdog. Comparison of length-frequency distributions (proportions) obtained from market sampling of Scottish (solid line) and UK (E&W) (dashed line) landings data. Data are sex-disaggregated, but averaged over 5 year intervals.

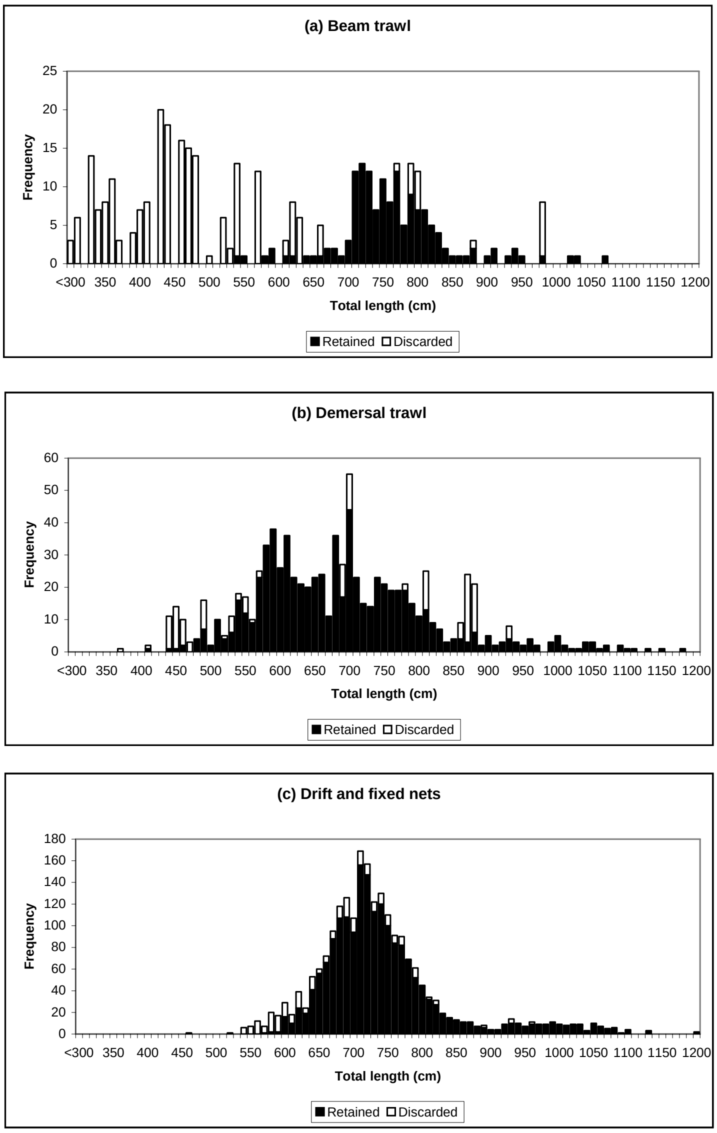


Figure 2.3. Northeast Atlantic spurdog. Length distribution of discarded and retained in fisheries in the North Sea and Celtic Seas eco-regions for (a) beam trawl, (b) demersal trawl and (c) drift and gill nets. These data (1999–2006) are aggregated across individual catch samples (Source: UK (E&W) Discards surveys).

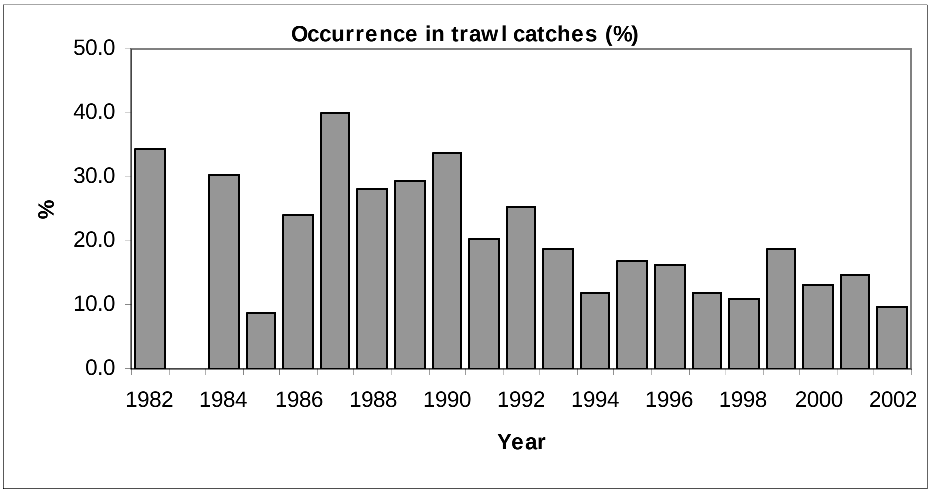


Figure 2.4. Northeast Atlantic spurdog. Frequency of occurrence in survey hauls in the English Q1 Celtic Sea groundfish survey (1982–2002) .

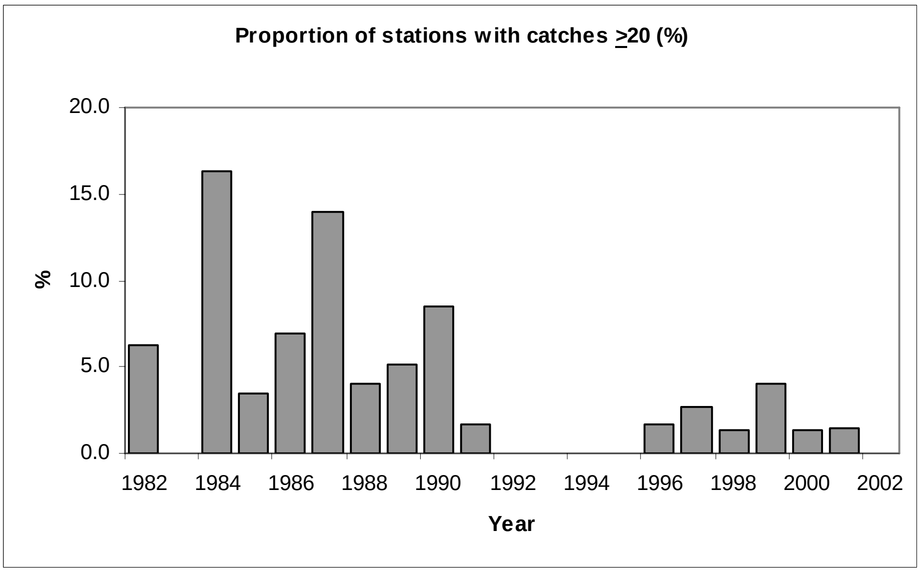


Figure 2.5. Northeast Atlantic spurdog. Proportion of survey hauls in the English Celtic Sea groundfish survey (1982–2002) in which CPUE was ≥ 20 ind.h^{-1}.

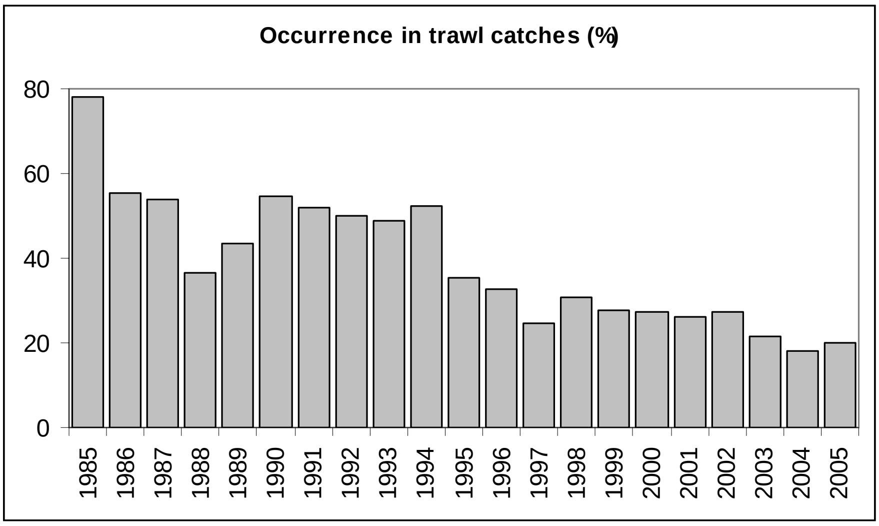


Figure 2.6. Northeast Atlantic spurdog. Frequency of occurrence in survey hauls in the Scottish west coast survey (Q1, 1985–2005).

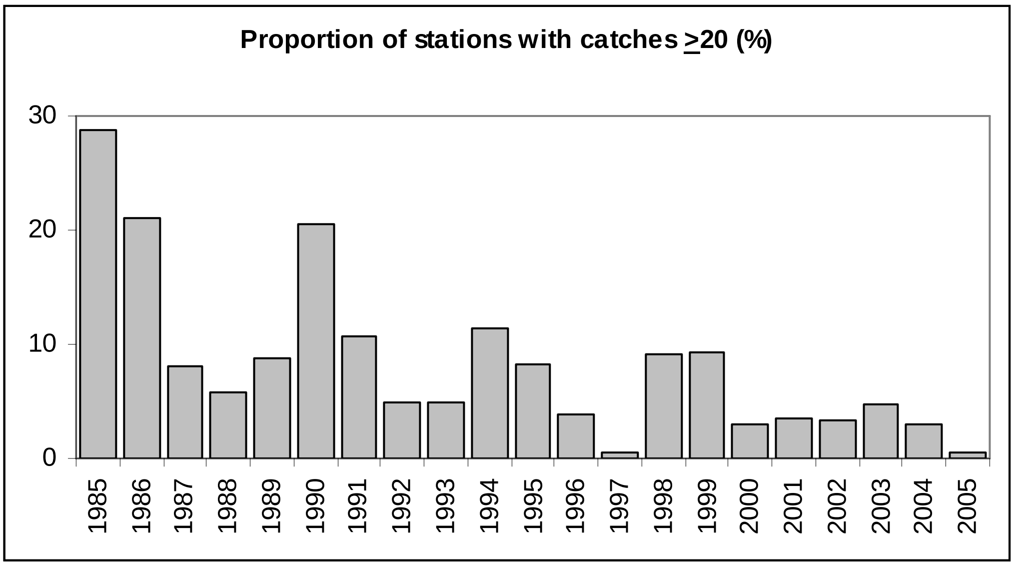


Figure 2.7. Northeast Atlantic spurdog. Proportion of survey hauls in the Scottish west coast survey (Q1, 1985–2005) in which CPUE was ≥ 20 ind.h^{-1}.

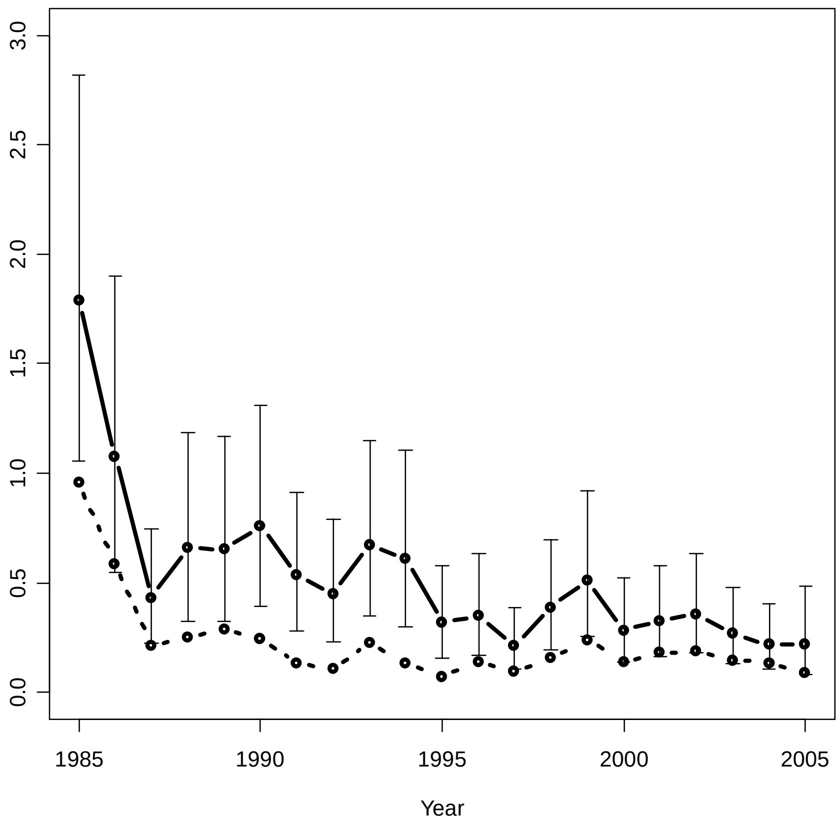


Figure 2.8. Northeast Atlantic spurdog. Year effects (with 95% confidence intervals) from the analysis of the combined Scottish survey data. Dotted line indicates year effects for large (>70 cm) individuals.

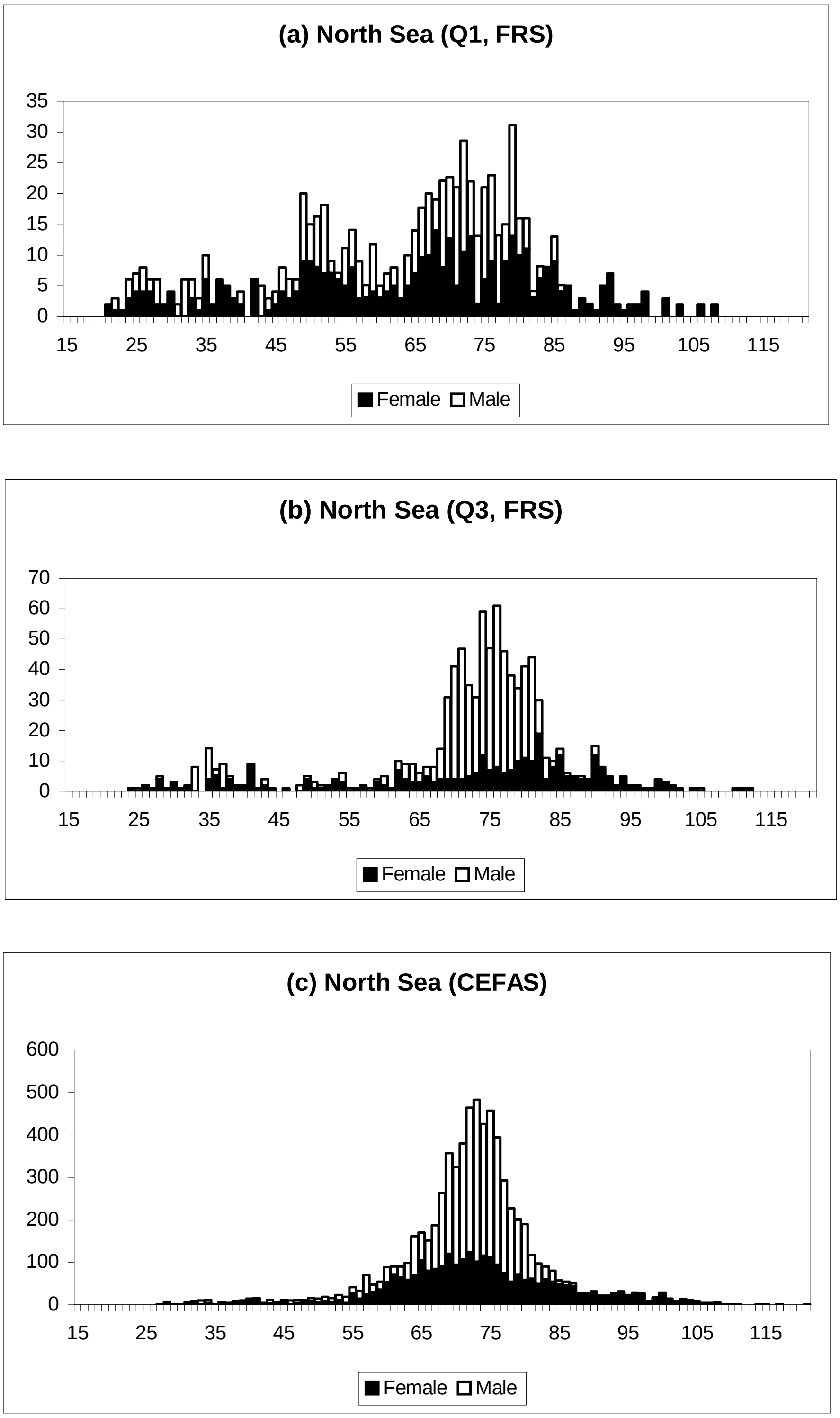


Figure 2.9. Northeast Atlantic spurdog. Size distributions of male and female spurdog in the North Sea from (a) Scottish quarter 1 surveys (1985–2005), (b) Scottish quarter 3 surveys (1985–2004) and (c) English quarter 3 surveys (1977–2003).

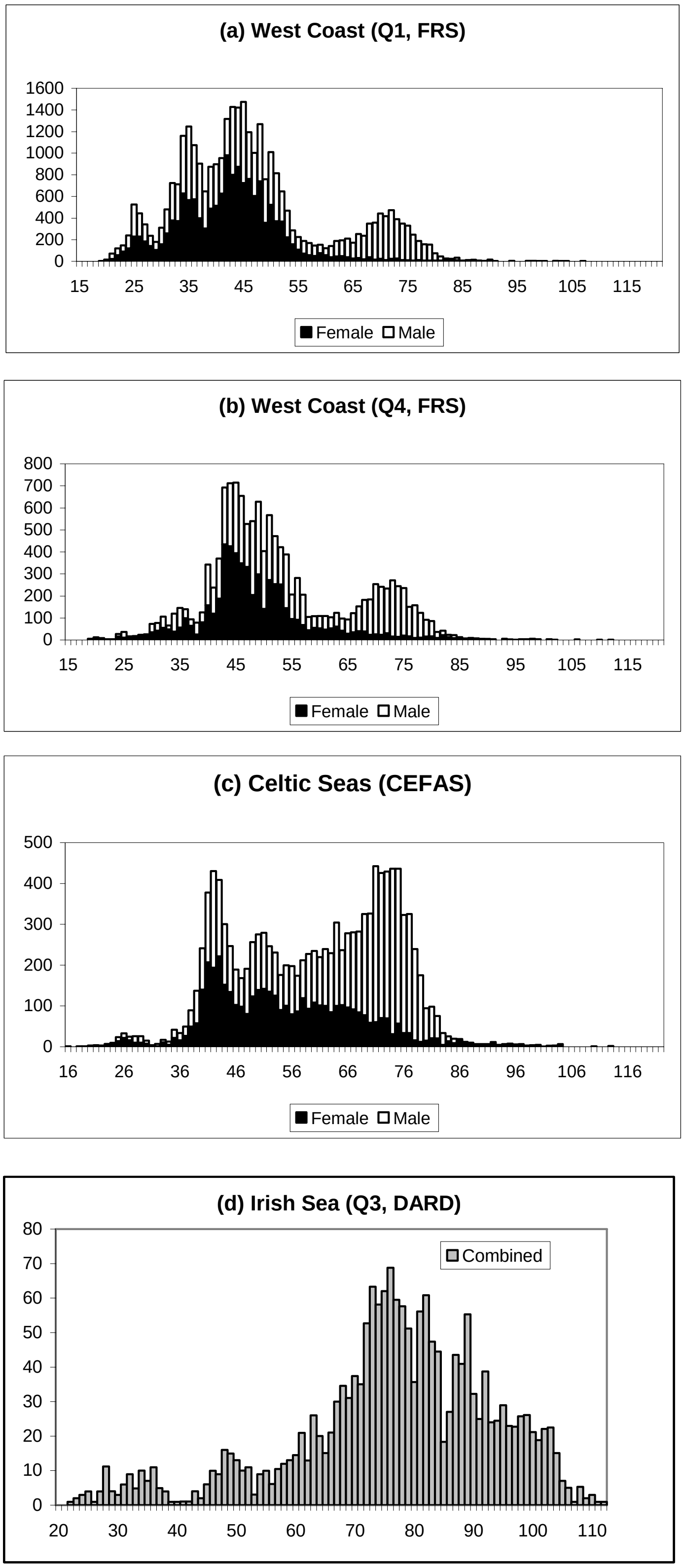


Figure 2.10. Northeast Atlantic spurdog. Size distributions of male and female spurdog in the Celtic Seas region from (a) Scottish west coast quarter 1 surveys (1985–2005), (b) Scottish quarter 4 surveys (1985–2004), (c) English surveys in the Celtic Sea (1982–2002, quarters combined) and (d) DARD surveys in the Irish Sea (Q3, 1991–2001).

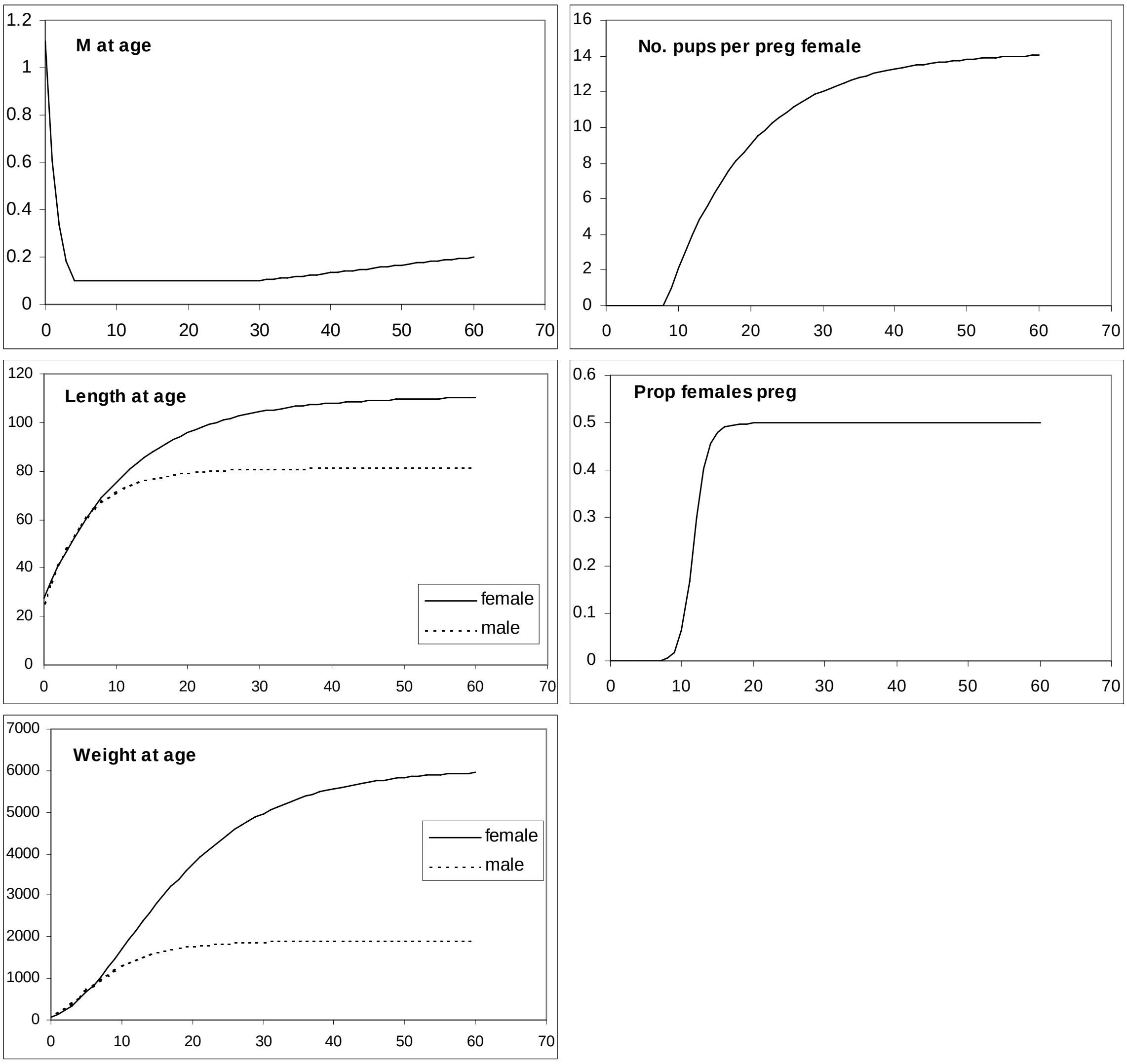


Figure 2.11. Northeast Atlantic spurdog. A visual representation of the life-history parameters described in Table 2.5.

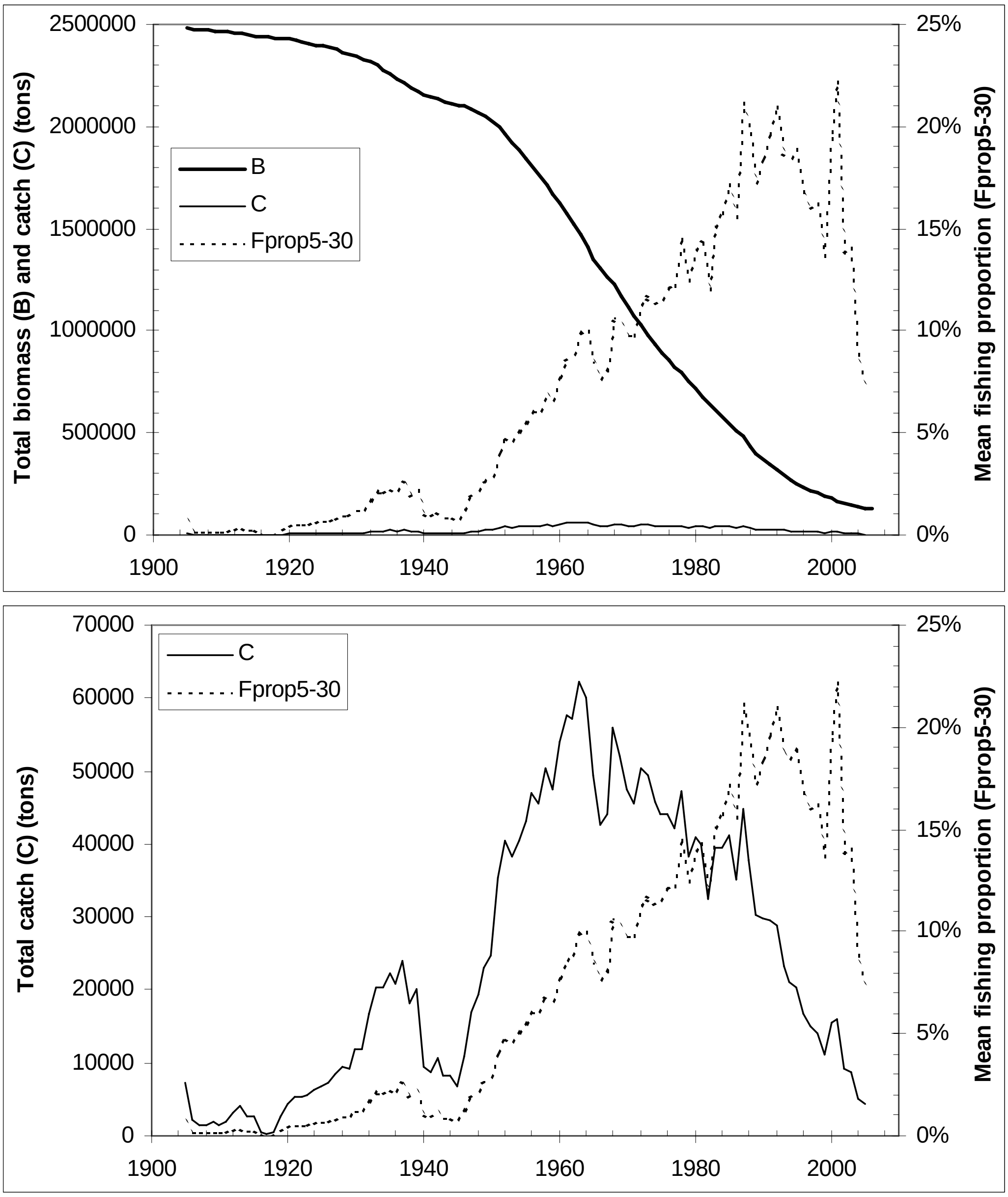


Figure 2.12. Northeast Atlantic spurdog. Base-case model estimates of total biomass (*B*) and mean fishing proportion ($F_{prop5\text{-}30}$) are shown in the top panel together with observed total annual catch (*C*), with the bottom panel repeating the information, but without the total biomass to show more detail in *C*.

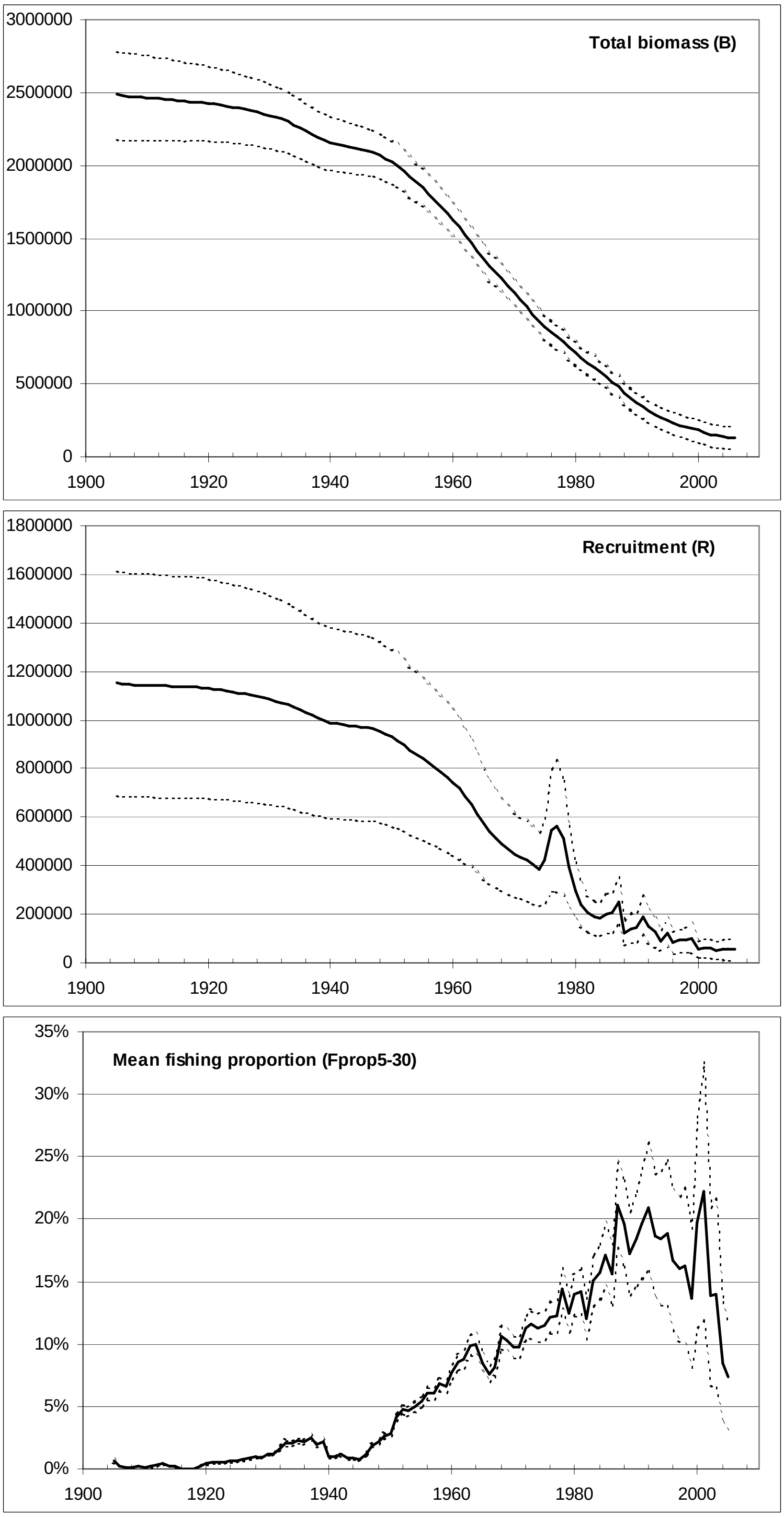


Figure 2.13. Northeast Atlantic spurdog. Base-case model estimates Total biomass (*B*), recruitment (*R*) and mean fishing proportion ($F_{prop5\text{-}30}$) together with approximate 95% probability intervals (±2 Hessian-based standard deviations).

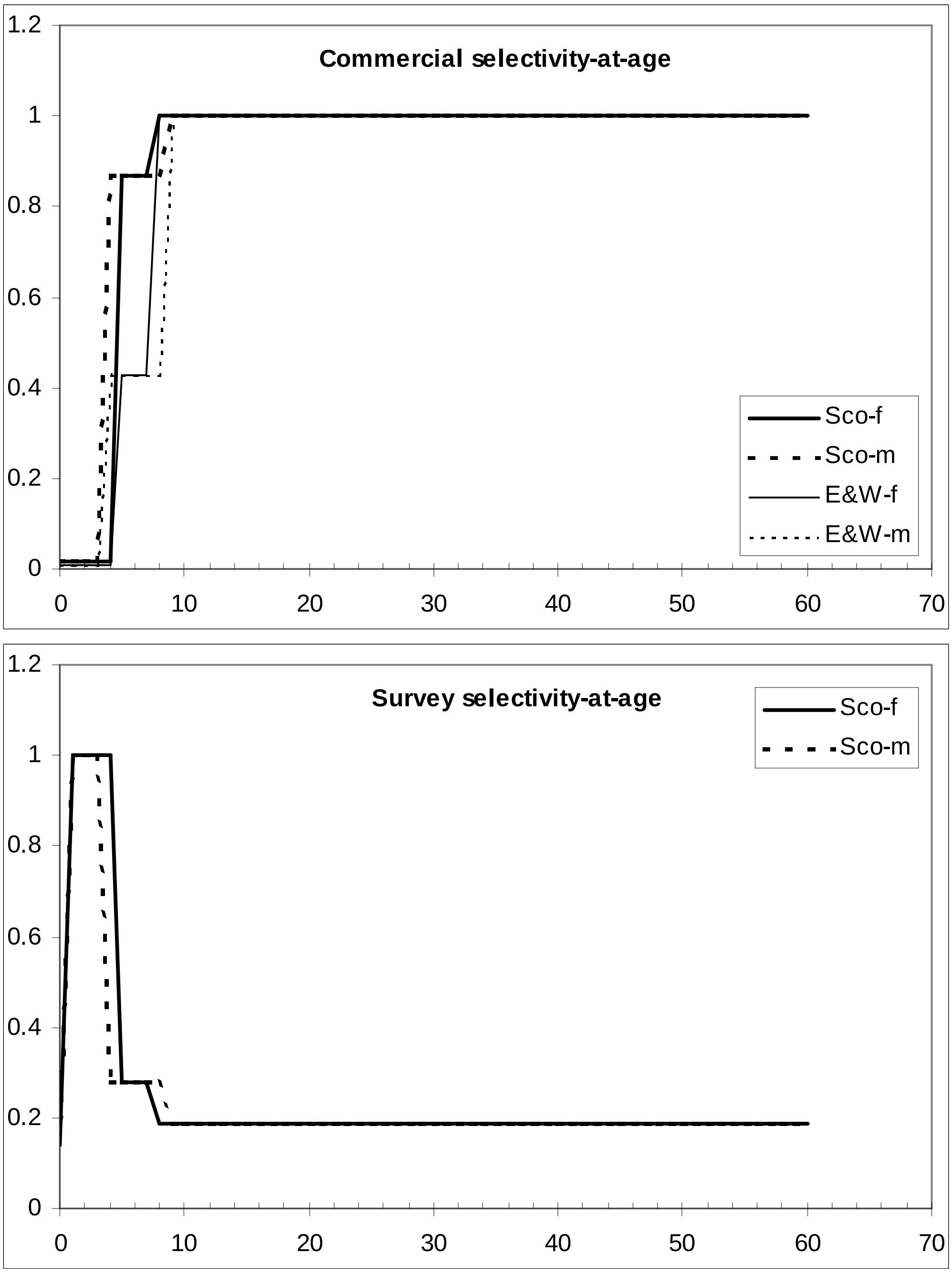


Figure 2.14. Northeast Atlantic spurdog. Estimated commercial (top panel) and survey (bottom) selectivity-at-age curves for the base-case run. The two commercial fleets considered have Scottish (Sco) and England & Wales (E&W) selectivity, which differ by sex because of the life-history parameters for males and females (Table 2.5). The survey selectivity relies on Scottish survey data.

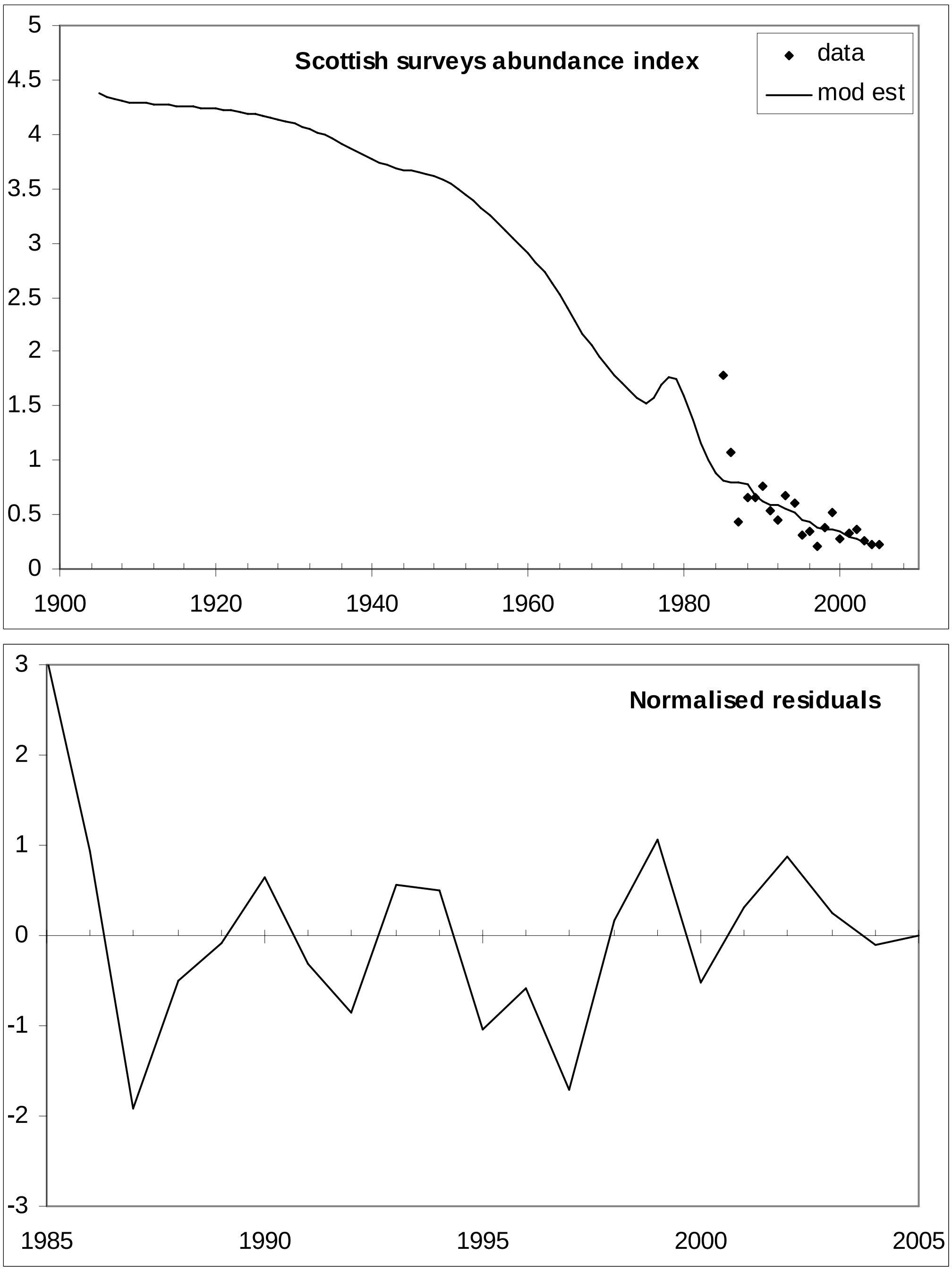


Figure 2.15. Northeast Atlantic spurdog. Model fit to the Scottish surveys abundance index (top panel), with normalised residuals ($\varepsilon_{sur,y}$ in equation 2.6b) (bottom).

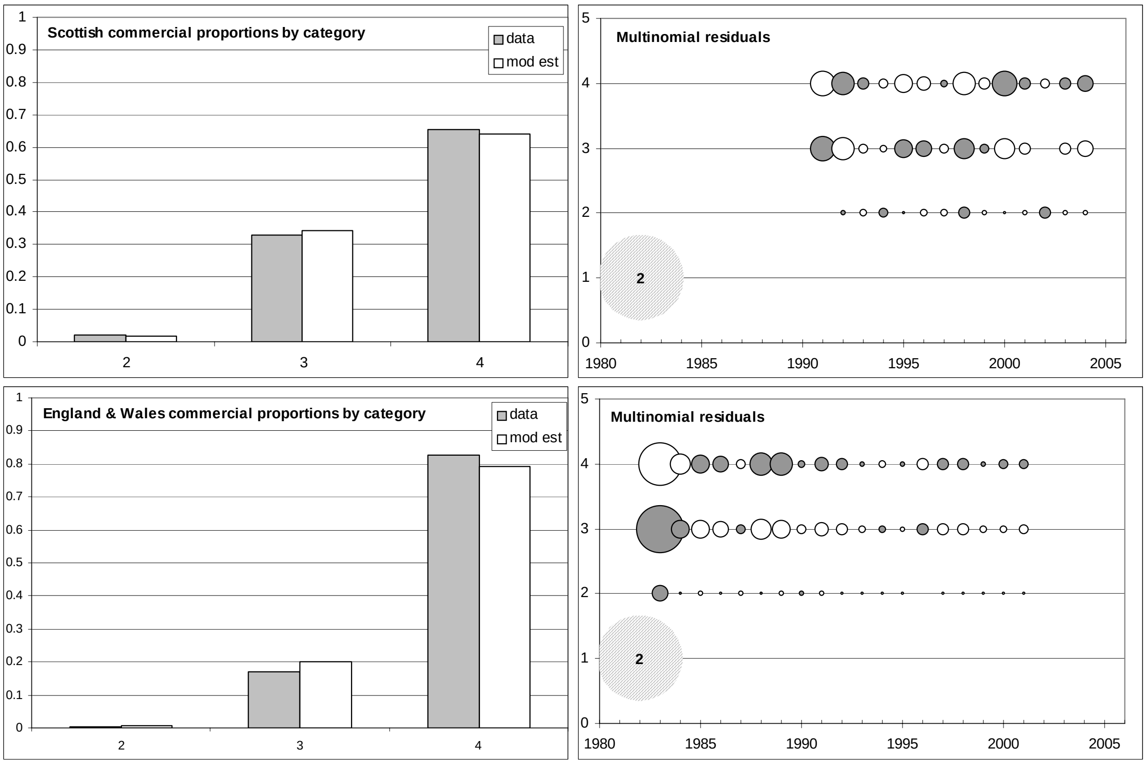


Figure 2.16. Northeast Atlantic spurdog. Model fits to the Scottish (top row) and England & Wales (bottom row) commercial proportions-by-length category data for the base-case run. The left-hand side plots show proportions by length category averaged over the time period for which data are available, with the length category given along the horizontal axis. The right-hand side plots show multinomial residuals ($\varepsilon_{pcom,j,y,L}$ in equation 2.7b), with grey bubbles indicating positive residuals (not the same interpretation as residuals in Figure 2.15), bubble area being proportional to the size of the residual (the light-grey hashed bubble indicates a residual size of 2, and is shown for reference), and length category indicated on the vertical axis. The length categories considered are 2: 16–54 cm; 3: 55–69 cm; 4: 70+ cm.

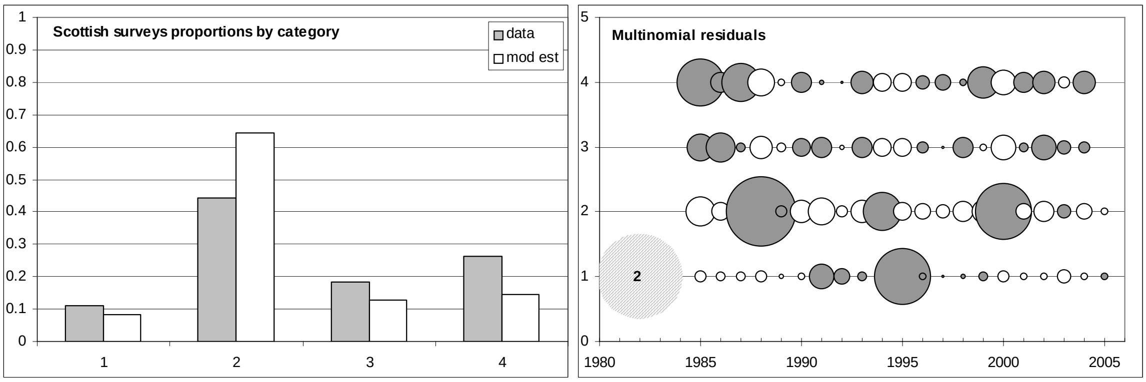


Figure 2.17. Northeast Atlantic spurdog. Model fits to the Scottish survey proportions-by-length category data for the base-case run. A further description of these plots can be found in the caption to Figure 2.16. Length categories considered are 1: 16–31 cm; 2: 32–54 cm; 3: 55–69 cm; 4: 70+ cm.

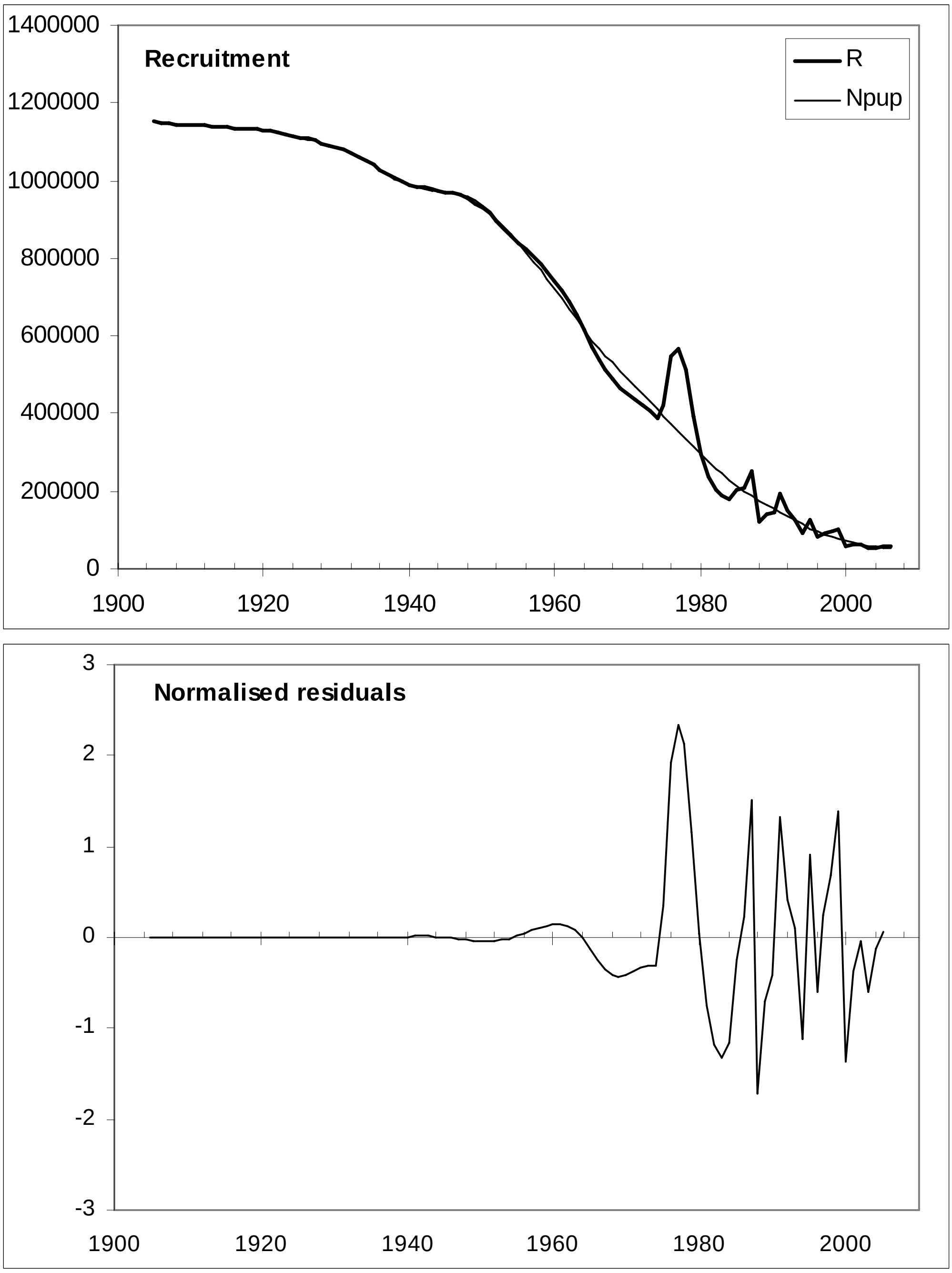


Figure 2.18. Northeast Atlantic spurdog. A comparison of the deterministic (N_{pup}) and stochastic (R) versions of recruitment (equations 7.2a and b) (top panel) with normalised residuals ($\varepsilon_{r,y}/\sigma_r$, where $\varepsilon_{r,y}$ are estimable parameters of the model) (bottom) for the base-case run. The N_{pup} values in the top panel have been adjusted for lognormal bias ($\times e^{-\sigma_r^2/2}$) to make them comparable to R (equation 2b).

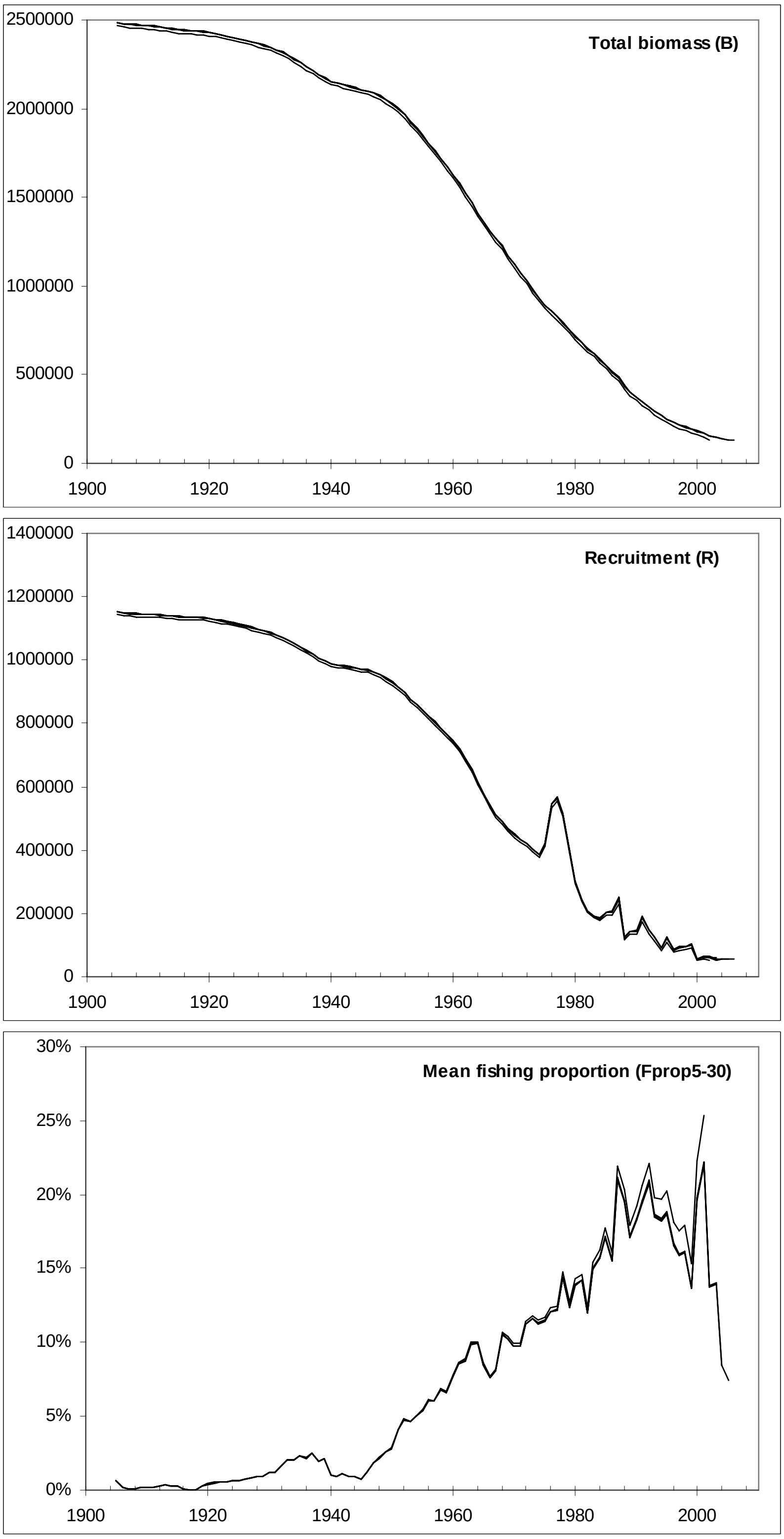


Figure 2.19. Northeast Atlantic spurdog. A repeat of Figure 2.13, giving a 5-year retrospective comparison for the base-case run (the base-case model was re-run, each time omitting a further year in the data).

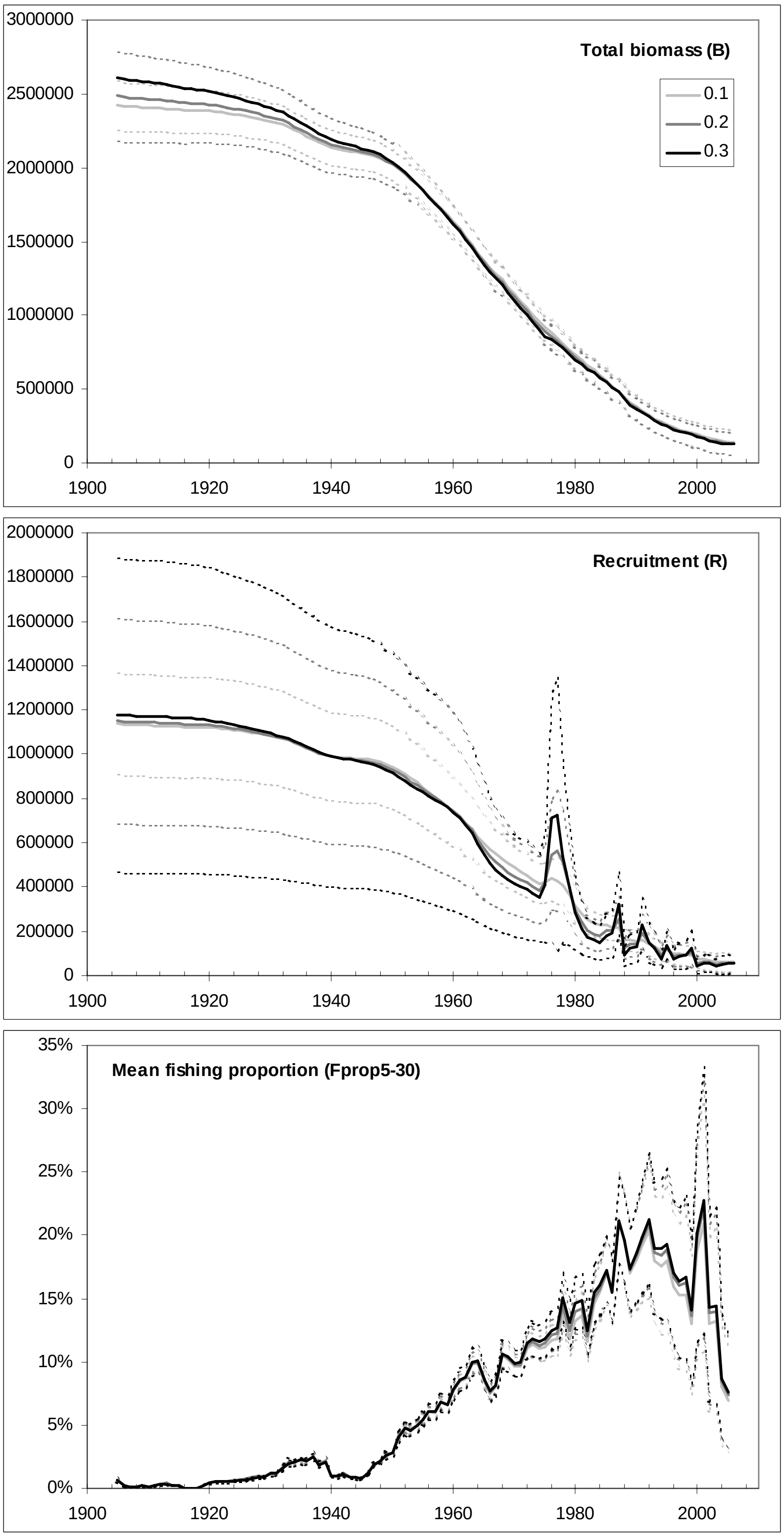


Figure 2.20. Northeast Atlantic spurdog. A sensitivity analysis on recruitment variability (σ_r). Three alternative values are considered: σ_r = 0.1, 0.2 (the base-case option) and 0.3. Point estimates are shown as solid lines, and approximate 95% probability intervals (±2 Hessian-based standard deviations) as broken lines.

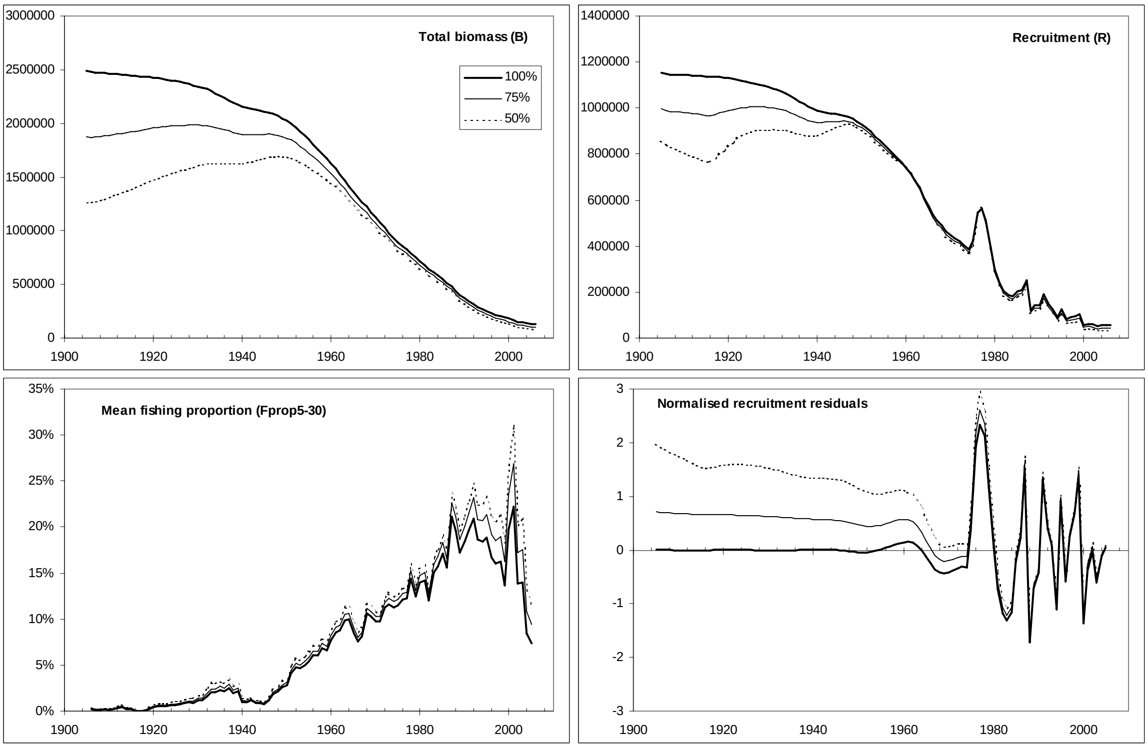


Figure 2.21. Northeast Atlantic spurdog. A sensitivity analysis on virgin total biomass (B_0). The base-case run (for which B_0 is estimated, shown as "100%") is compared to runs where B_0 is fixed at 75% and 50% of the base-case value. The normalised recruitment residual plot (bottom right) is included to show the effect of fixing B_0 at lower levels on recruitment residuals.

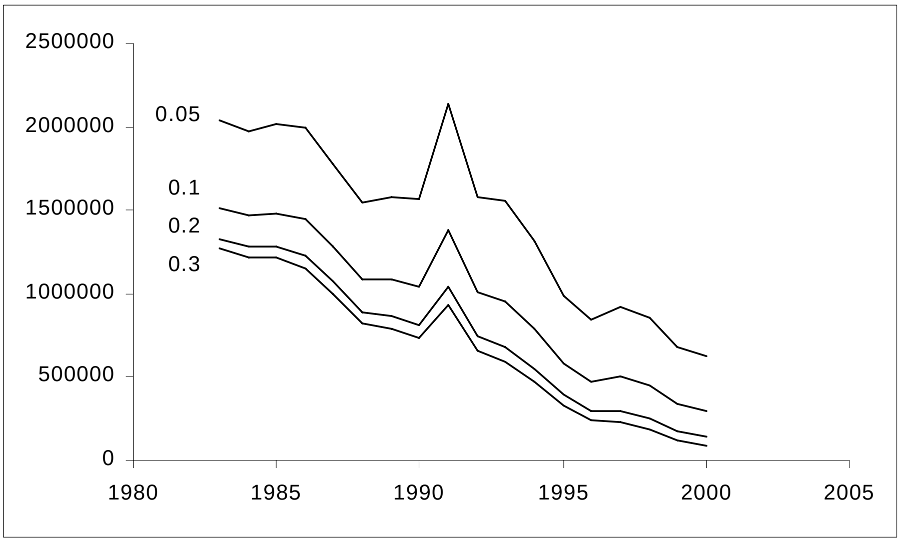


Figure 2.22. Northeast Atlantic spurdog. The trends in total population numbers of mature fish estimated using a Separable VPA analysis of the catch numbers at age data derived from length slicing of the UK (E&W) commercial spurdog landings raised to the total recorded landings for all countries. Each line represents a different assumption for terminal F (0.05–0.3) on the reference age in the final year (From Figure 4.1.13 of ICES (2002)).

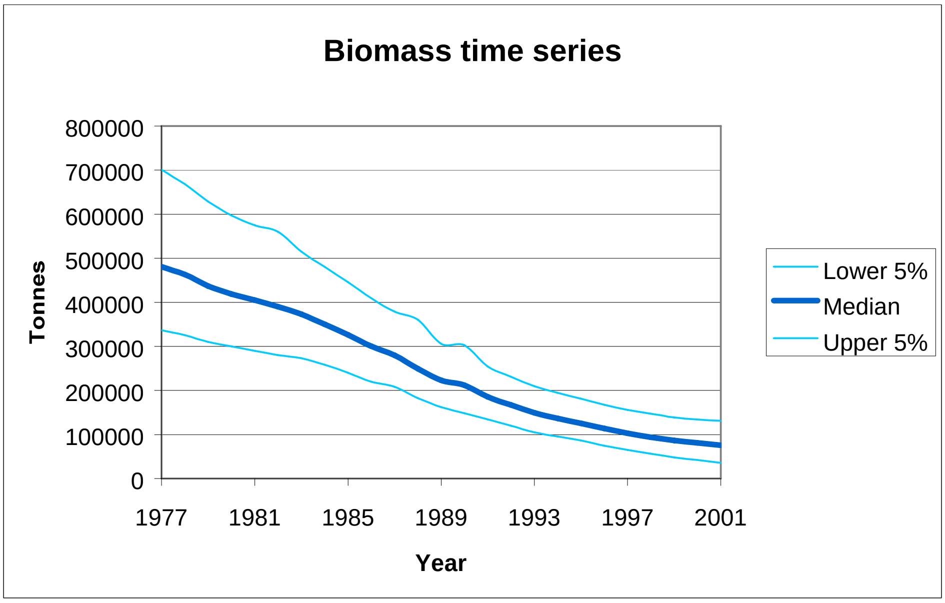


Figure 2.23. Northeast Atlantic spurdog. The biomass time series estimated from a Bayesian assessment (From Figure 4.1.20 of ICES (2002)).

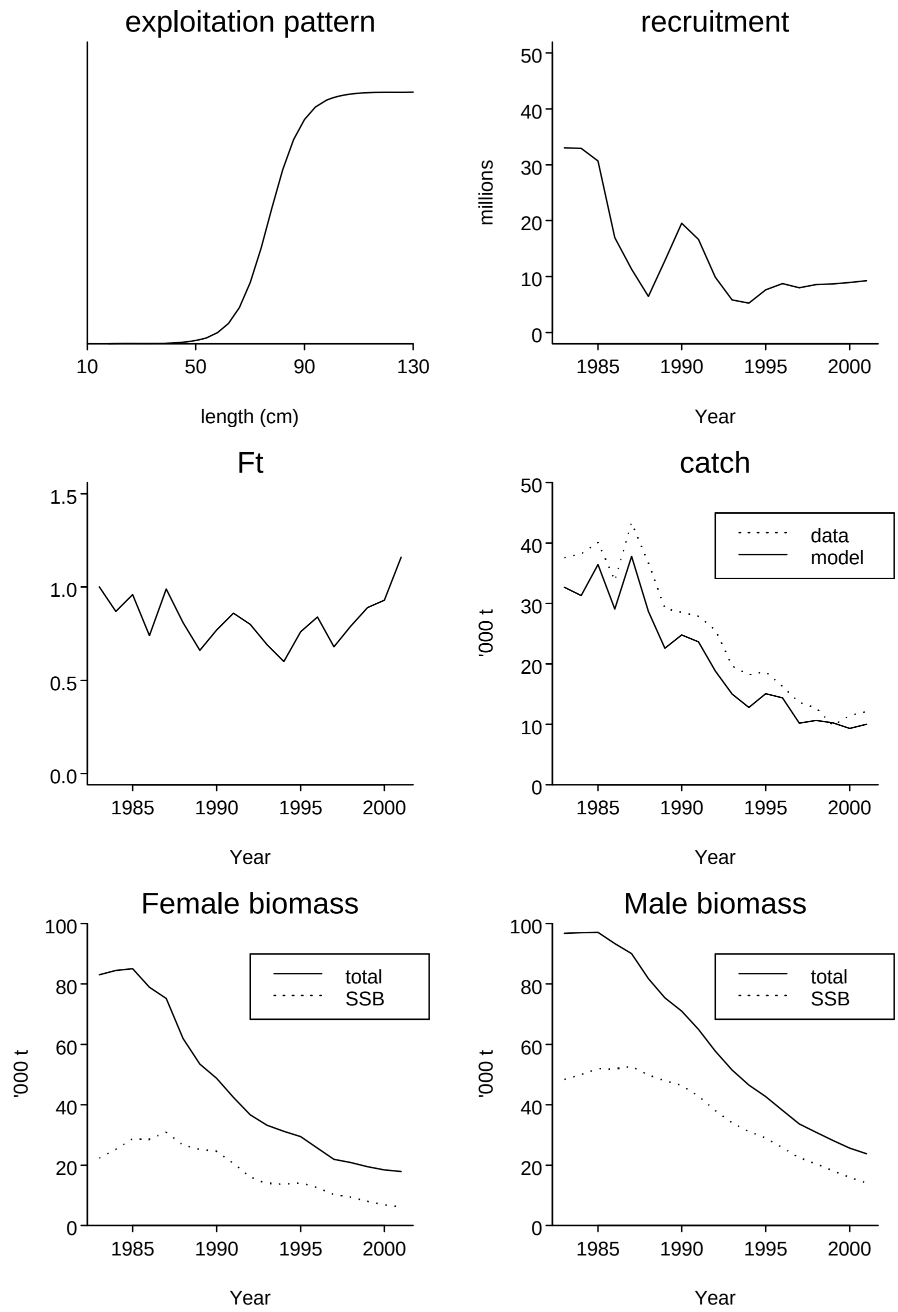


Figure 2.24. Northeast Atlantic spurdog. Summary of model results from a length-based assessment of NE Atlantic spurdog (From Figure 4.1.8 of ICES (2003)).

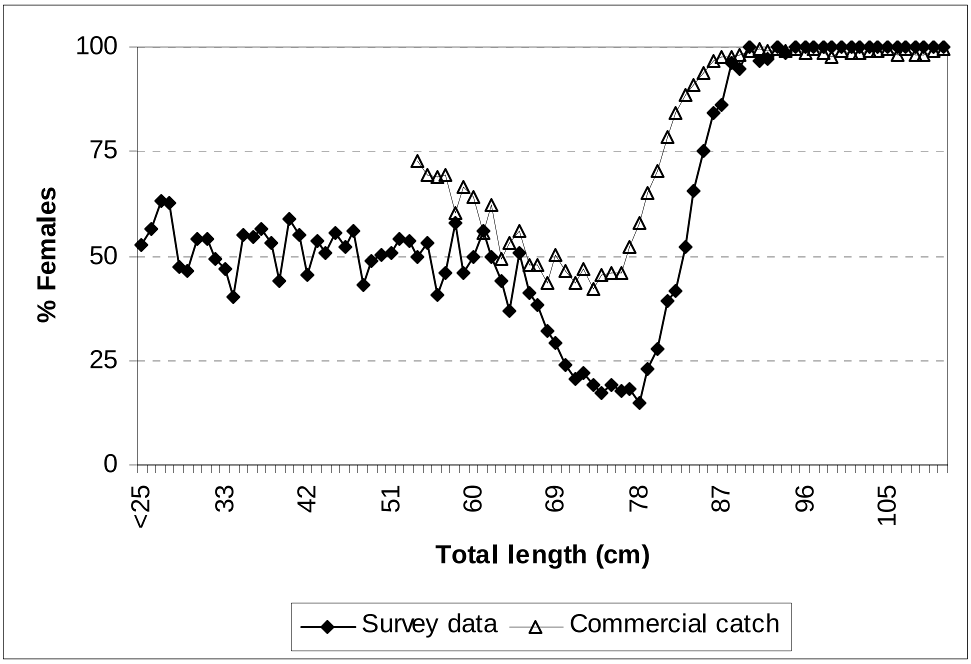
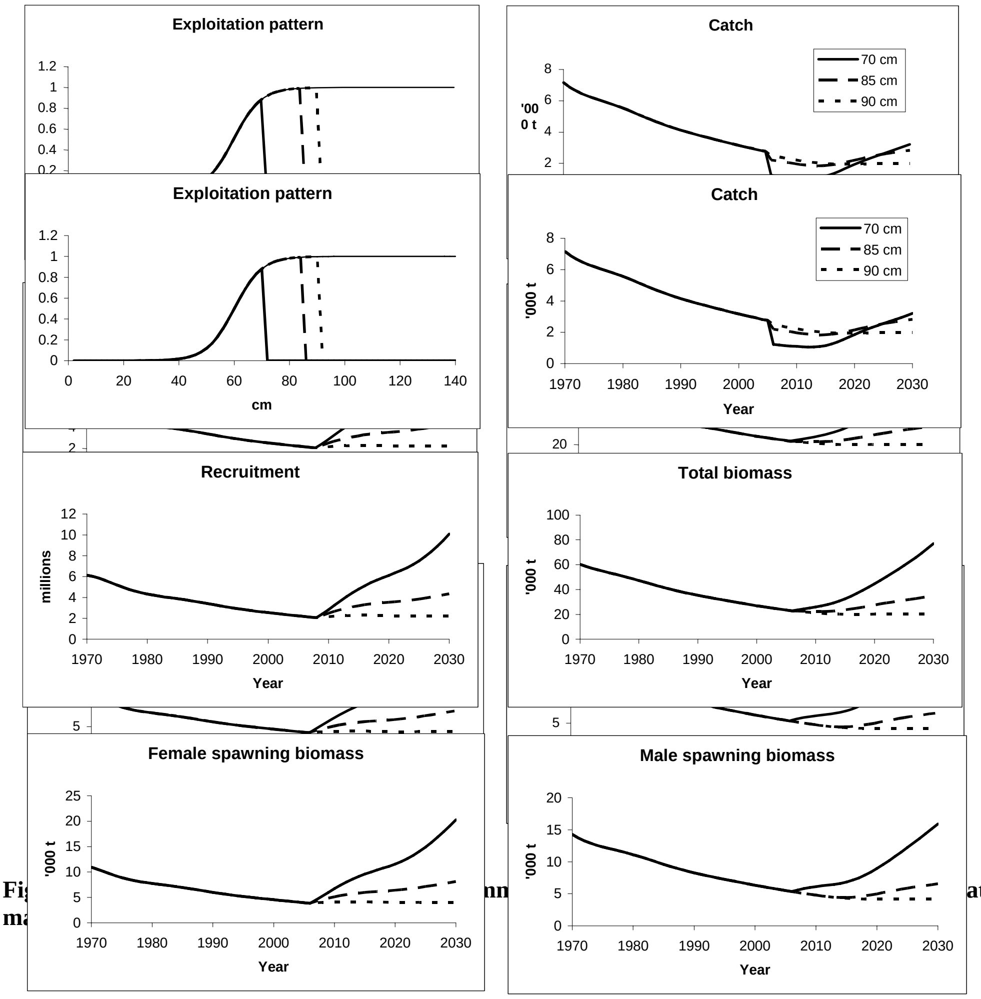


Figure 2.25. Northeast Atlantic spurdog. The sex ratio of spurdog at length in commercial catches (from UK (England and Wales) market sampling data for the period 1983–2001) and research vessel catches (from aggregated data from UK (England & Wales) groundfish surveys in the North Sea, Irish Sea and Celtic Sea, 1977–2003)


Exploitation pattern
cm
Catch
70 cm
85 cm
90 cm
'000 t
Year
Recruitment
millions
Year
Total biomass
'000 t
Year
Female spawning biomass
'000 t
Year
Male spawning biomass
'000 t
Year

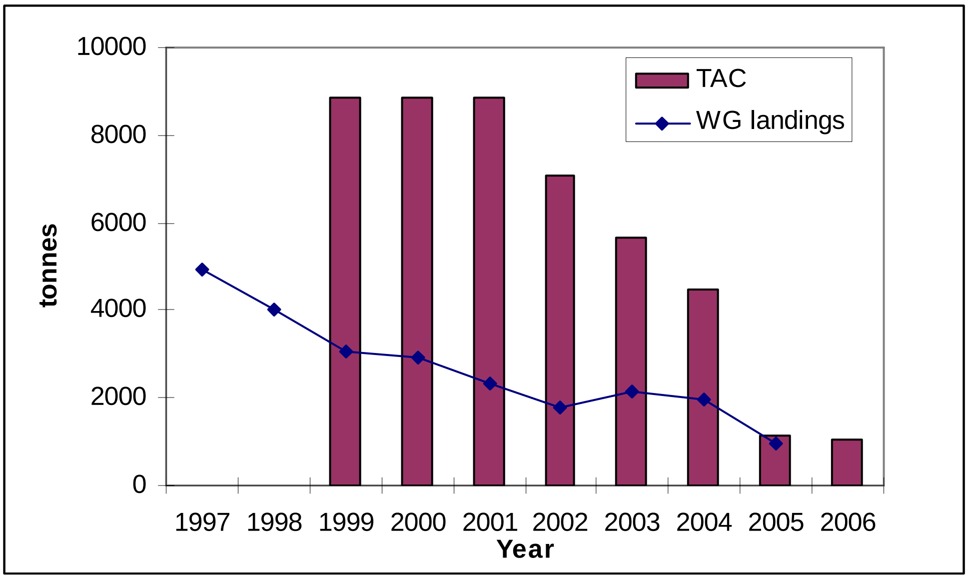


Figure 2.27. Northeast Atlantic spurdog. Estimated landings of spurdog from areas IIa, and IV (line) with TAC (bars) as allocated to Norway and EC nations. Note that the TAC is for EC waters of IIa & IV while landings are for all IIa & IV.

Table 2.1. Northeast Atlantic spurdog. WG estimates of total landings of NE Atlantic spurdog (1947–2005).

Year	Landings (Tonnes)	Year	Landings (Tonnes)	Year	Landings (Tonnes)
1947	16893	1967	44116	1987	44898
1948	19491	1968	56043	1988	37730
1949	23010	1969	52074	1989	30204
1950	24750	1970	47557	1990	29874
1951	35301	1971	45653	1991	29447
1952	40550	1972	50416	1992	28819
1953	38206	1973	49412	1993	23159
1954	40570	1974	45684	1994	21034
1955	43127	1975	44119	1995	20245
1956	46951	1976	44064	1996	16707
1957	45570	1977	42252	1997	14957
1958	50394	1978	47235	1998	14088
1959	47394	1979	38201	1999	11200
1960	53997	1980	40943	2000	15533
1961	57721	1981	39961	2001	16015
1962	57256	1982	32402	2002	9301
1963	62288	1983	39386	2003	10426
1964	60146	1984	39449	2004	6047
1965	49336	1985	41126	2005	5636
1966	42713	1986	35098		

Table 2.2a. Northeast Atlantic spurdog. Length-frequency distributions from sampling of landings from UK (E&W).

	Male																		
L (cm)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
40																			
41								1											
42								0											
43								1											
44						31		0											
45						0		0											
46		10				0		0								2			
47		0				24		0								0			
48	1	0				0		0								0			
49	0	0				0		10							4	0			
50	27	10			1	47	1	1	4			8			0	0			
51	27	52	18	1	0	24	1	21	5			0	2	1	0	0	4		
52	398	73	22	18	0	110	0	11	8			0	0	1	17	0	10		
53	553	14	7	2	4	211	3	36	4	2		0	0	21	7	0	1		6
54	126	85	0	1	43	177	2	35	5	0		2	5	1	0	7	1	1	0
55	335	90	12	13	56	188	8	32	7	2	6	8	21	28	0	55	13	0	1
56	883	30	15	5	86	154	1	11	6	0	16	23	28	24	9	1	23	0	2
57	336	204	54	6	168	71	11	32	2	10	11	22	12	1	25	204	4	1	5
58	1042	426	66	33	231	185	51	35	4	6	43	54	37	77	56	124	14	3	15
59	983	509	18	36	112	138	70	27	4	4	23	65	24	33	39	6	26	0	11
60	1487	480	58	28	245	262	123	42	130	22	67	67	54	62	40	66	33	7	50
61	3496	1038	114	36	257	392	94	128	64	19	36	72	70	41	65	41	16	5	31
62	2530	1003	252	94	285	205	164	14	20	19	61	107	77	50	44	15	42	10	34
63	4262	1468	277	89	496	406	71	128	45	16	67	113	97	184	65	107	30	35	81
64	5207	1596	619	234	423	469	181	197	174	24	82	151	83	188	103	18	20	21	62
65	4174	2049	525	193	505	434	117	225	143	108	112	154	265	393	76	66	65	28	66
66	7053	3254	782	370	574	818	339	257	205	112	112	127	91	94	85	177	40	47	37
67	7039	2754	1086	421	1438	647	502	224	567	104	194	174	368	531	120	58	38	47	145
68	9046	3242	1381	740	1724	1378	545	539	826	175	98	217	269	241	75	45	150	42	117
69	5390	3409	1296	767	1875	1695	1026	637	807	228	212	293	410	173	166	153	226	91	136
70	7359	2835	1889	1433	2407	2647	1083	683	534	398	253	177	357	264	216	224	94	119	154
71	7618	3854	2189	1436	3199	2383	1317	913	1337	524	321	231	435	689	173	152	105	96	130
72	7534	2782	2613	2473	3477	2430	1991	832	1486	601	296	179	763	557	253	349	139	111	132
73	6040	2507	2187	2211	3498	3003	2231	1197	1564	645	231	274	580	305	321	359	175	108	133
74	6228	3050	1923	2435	3203	3325	2538	1154	2073	714	295	189	515	243	355	394	196	155	196
75	7321	2194	1814	1853	3100	2926	2248	1320	1789	659	406	154	735	232	371	482	307	163	231
76	5720	1972	1519	2030	2929	2753	2464	1179	1602	655	309	194	752	173	505	673	245	242	258
77	3684	1515	1434	1165	2231	2886	2232	1276	1289	402	259	206	871	188	575	989	279	237	230
78	3164	1286	1482	1328	1519	1792	1844	808	991	587	276	202	1396	223	478	627	327	235	219

79	2344	807	586	1019	1325	1525	1453	642	788	388	249	111	1043	150	357	531	176	182	260
80	1374	668	575	882	1147	1147	882	862	1172	336	119	149	342	206	336	607	204	222	250
81	1467	692	229	733	511	526	601	228	663	196	133	115	267	99	201	201	221	144	222
82	824	380	184	407	632	222	376	197	475	130	72	113	170	70	521	325	59	115	146
83	581	201	154	251	242	89	292	80	301	86	71	49	210	58	63	255	96	80	134
84	742	138	160	281	102	142	82	110	314	48	51	48	34	25	98	182	42	58	81
85	423	94	64	57	99	92	68	16	361	31	31	34	40	12	55	82	31	38	94
86	211	30	51	32	24	68	52	25	116	40	11	20	15	15	79	63	32	10	62
87	111	37	43	27	7	24	72	2	96	12	7	4	8	5	11	19	9	27	59
88	117	19	13	28	23	2	41	9	128	30	5	20	4	2	33	23	5	8	31
89	12	10	21	37	0	5	32	9	211	9	7	5	3		22	42	1	2	7
90	26	33	39	62	1	0	19	1	1	0	0	0	4		3	5	1	0	36
91	5	6	27	29	20	27	7	4	0	0	0	3	0		5	1	4	1	6
92	63	11	48	11	0	1	16	0	0	0	0	0	4		0	1	1	0	5
93	33	0	27	19	0	0	8	0	0	0	0	3	1		5	6	0	1	7
94	33	2	48	27	1	0	23	0	21	0	0	0	3		0	0	0	1	5
95	22	6	0	8		0	0	0	0	0	5	0	0		0	3	1	4	2
96	22	0	96	1		18	1	37	0	0	0	0	3		1	0	2	3	5
97	37	0	0	3		0	4	0	4	0	0	1	0		0	0	1	3	3
98	38	0	27	2		0	3	0	90	0	0		6		1	0	0	2	2
99	46	0	144	2		1	1	0	0	0	0		0		0	0	2	2	6
100	4	0	48	5			1	0	0	0	0		6		1	0	0	0	2
101	33	0	24	2			0	1	1	0	0		0			0	0	1	5
102	47	0	24	2			0			1	0		3			0	0	1	5
103	33	0	3	2			0			1	0		4			0	1	0	3
104	23	0	3	1			0				0		3			0		0	3
105	0	0	0	2			0				0		2			0		2	3
106	19	0	24	2			3				0		0			0		0	2
107	4	0					0				1		2			0		0	1
108	19	0					3				1		2			0		1	0
109	9	0					3						2			0		0	0
110		0											0			4		0	1
111		0											0					0	
112		0											0					0	
113		0											0					0	
114		0											0					0	
115		0											0					0	
116		0											0					0	
117		2											0					0	
118		0											0					0	
119		0											0					1	
120		0											1						
121		0																	
122		2																	

	Female																		
L (cm)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
40					1														
41					0														
42					0			1											
43					1			0											
44					0			0											
45					0			0											
46	23				0	67		0											
47	0				0	0		10											
48	2				0	8		0											
49	1				0	126		10									3		
50	450	10			1	91	1	10			7	6			10	2	0		
51	597	235	32	2	36	83	38	130	4		3	14	4	40	4	0	3		28
52	48	87	7	0	26	62	1	183	16	2	0	1	0	1	0	5	10		2
53	1130	81	1	2	138	186	22	68	8	0	0	4	9	20	10	0	0		1
54	1051	398	55	0	68	183	44	130	0	2	10	2	17	49	18	0	3		5
55	900	446	31	27	172	227	35	46	8	12	0	11	12	24	31	6	8	1	4
56	1730	323	24	1	222	190	100	105	12	3	29	25	20	28	53	4	15	2	13
57	601	831	47	49	337	152	77	239	2	2	31	34	13	156	45	60	21	1	4
58	2023	395	40	44	429	157	74	123	12	14	61	90	50	60	106	61	34	3	16
59	2324	446	230	53	379	274	134	17	25	31	49	58	37	76	36	8	7	1	19
60	2464	646	152	156	811	275	226	102	19	84	66	128	79	380	191	127	18	5	39
61	2510	2116	240	42	617	424	177	210	16	109	68	87	306	228	137	65	76	7	76
62	3065	1231	361	69	965	323	286	148	51	47	90	169	813	209	133	98	70	20	96
63	2798	1178	627	364	527	541	444	168	47	110	112	149	290	210	122	36	45	8	21
64	3875	2577	752	171	570	608	411	293	51	261	154	170	613	322	118	43	23	33	47
65	3894	2472	981	281	862	939	830	153	53	143	169	222	323	365	231	94	60	45	280
66	3307	2349	882	626	962	915	466	513	94	132	186	213	2097	207	146	56	11	36	214
67	5364	2613	1398	547	1357	1005	457	199	262	173	137	235	602	216	221	54	42	63	13
68	4900	2012	1551	689	1379	1385	842	197	283	293	270	191	1000	276	188	269	187	77	52
69	4740	2314	2488	903	2011	1592	1048	277	513	353	200	209	1243	422	204	146	104	103	249
70	5267	2542	2307	716	1792	2719	1155	388	318	296	307	268	879	362	234	120	128	101	140
71	3645	3007	3210	1116	2614	2793	1201	505	370	192	242	205	416	80	217	249	189	63	400
72	6698	3289	3091	1190	2141	2725	2161	618	700	279	379	194	636	413	162	286	124	131	403
73	3696	2723	2253	1100	2191	2665	1924	380	346	174	316	143	588	299	283	358	328	144	336
74	4679	3465	2674	1178	2101	3452	3060	523	282	272	315	161	688	378	195	363	136	97	274
75	4828	2791	3732	1355	2402	3828	1949	571	316	311	316	180	557	106	294	158	71	148	154
76	2420	2732	2935	1310	2297	4346	2366	460	460	292	349	204	947	134	212	184	127	219	347
77	2862	3053	3440	1374	2329	4166	2418	623	400	289	272	188	1115	130	215	193	275	196	428
78	4348	2966	2565	1444	2797	5381	2209	444	289	297	297	203	1082	146	274	270	219	189	301
79	2864	3003	3051	1586	2583	4889	3096	751	461	424	280	206	988	205	307	352	248	226	656
80	2955	3236	3124	1698	3143	5295	3115	678	271	329	198	219	907	162	359	191	353	243	454

81	2942	2573	2627	1864	3272	5598	2937	894	441	269	318	272	1708	149	355	179	95	185	352
82	2543	3021	2746	1695	3656	6513	3840	882	608	415	287	221	1302	230	310	164	95	164	373
83	1954	2506	2074	1563	2926	6415	2390	890	614	371	299	191	1410	380	387	172	114	183	366
84	2790	2723	2000	1826	2537	6231	3655	1080	534	582	276	203	993	266	414	254	199	321	484
85	1672	3003	2003	1662	2168	6565	3065	848	722	322	257	239	1001	323	262	290	126	213	349
86	2357	3026	1874	1571	3188	5127	3606	949	893	357	345	202	1532	394	724	144	88	210	286
87	1636	2373	1417	1077	2888	5815	3072	1016	855	387	253	203	1065	373	453	323	233	171	340
88	1880	2690	1666	1118	2557	4340	3427	1028	745	539	320	241	594	275	377	206	220	165	387
89	1303	2165	1203	1319	1864	5586	3759	1348	699	574	318	279	1342	193	301	306	138	210	232
90	1539	2343	1390	1188	2522	4683	3264	856	729	504	255	309	1179	274	615	594	223	222	481
91	1533	2253	1505	1145	1442	3814	3940	973	1063	537	314	273	399	170	575	482	48	219	352
92	1762	1910	1433	729	1180	3499	2142	870	1348	565	331	326	745	85	739	597	147	288	421
93	1337	1685	746	568	1078	2611	3018	712	739	668	289	291	1366	207	368	382	61	162	281
94	1144	2116	1026	776	1135	2266	1977	515	1432	572	272	323	880	255	500	386	183	250	421
95	977	1932	893	758	1160	2338	1781	599	798	510	318	281	621	108	836	469	98	212	236
96	973	1690	729	731	769	1897	1408	438	466	623	321	290	998	90	700	429	112	216	256
97	780	1266	676	379	446	1796	1529	401	789	369	239	316	670	114	796	616	101	155	199
98	1119	1279	417	401	1033	1218	837	263	881	547	283	232	677	216	278	573	118	128	451
99	835	888	421	335	473	1441	1083	163	477	376	219	159	819	170	229	454	97	203	351
100	745	869	607	387	505	691	1195	340	171	419	235	249	288	102	247	181	175	274	319
101	364	581	310	228	409	373	496	248	140	295	123	183	533	96	320	256	75	85	215
102	362	619	184	88	460	249	268	66	510	303	53	189	273	82	517	327	78	255	195
103	336	508	205	235	273	507	132	53	98	153	105	149	200	158	318	305	72	148	106
104	251	253	73	275	590	216	261	200	349	182	101	61	249	45	153	198	92	170	118
105	238	423	107	97	260	419	51	103	263	49	50	83	251	27	135	152	31	143	229
106	192	266	78	111	150	127	36	92	198	95	82	47	238	53	143	147	19	116	97
107	126	131	139	11	115	327	85	53	134	10	22	40	244	25	133	230	32	67	82
108	67	132	86	42	231	24	53	13	16	53	58	38	53	23	63	216	21	46	98
109	93	148	70	0	7	24	11	18	5	76	14	29	14	5	39	140	17	43	26
110	41	33	60	44	97	13	5	0	12	3	26	17	9	4	15	28	19	53	94
111	17	6	12	43	3	6	1	6	5	3	2	6	4	1	15	88	9	11	8
112	8	25	23	64	17	1	22	0	28	10	2	9	2	2	12	28	5	7	93
113	0	2	22	19	138	80	0	3	2	8	1	3	2	0	10	8	2	2	0
114	15	5	0	61	4	4	87	0	1	4	1	1	10	0	6	5	0	2	45
115	9	14	1	0	14	12	1	0	0	0	1	0	0	0	11	45	1	1	45
116	7	1		0	85	2	0	0	0	0	0	0	0	0	1	8	0	4	0
117	2	2		0			0	1	0	2	2	0	1	0		1	0	1	8
118	0	6		5			0	2	0	0		2	0	0		0	2	2	0
119	6	0					0		0	1			0	0		42		0	0
120		0					0		5				10	0				0	5
121		2					41						0	0				0	0
122		0					2						0	0				0	0
		6					0						0	1				1	0
							1						0						1

Table 2.2b. Northeast Atlantic spurdog. Length-frequency distributions from sampling of landings from Scotland.

Male	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	836
43	0	0	0	0	0	0	0	86	0	0	0	0	0	0
44	0	0	0	0	0	404	0	0	0	0	0	0	0	0
45	0	670	0	2862	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	29410	0	0	0	0	0	0
47	4682	0	0	0	0	0	0	170	100	0	0	0	0	836
48	4682	0	0	2862	0	810	0	1150	434	0	0	0	0	0
49	14046	1868	0	2862	0	0	0	510	634	0	0	4416	0	836
50	9364	3880	0	8584	0	404	0	28858	766	0	0	4416	0	0
51	14046	15614	0	8584	0	1620	4560	766	634	0	0	8832	0	836
52	18728	13890	0	11444	88046	3550	0	7074	7888	0	0	17666	0	836
53	4682	14446	0	20678	0	1214	7564	40664	1034	0	0	13250	0	2024
54	18728	11496	1748	23540	0	6332	8342	25316	7488	0	0	17666	0	1672
55	16984	17770	16366	20678	88046	2990	7564	34354	2766	0	3268	17856	0	352
56	37672	21534	874	52262	176568	38808	17460	20776	15692	5232	6752	19952	0	7646
57	67650	14474	8164	80122	177044	26730	12608	19376	27444	1782	408	36842	0	836
58	42700	24858	19078	19858	89950	36056	31676	80970	13138	3566	0	27778	0	7432
59	55932	55130	952	12096	1904	35418	24732	55536	24230	3566	1126	1154	0	5428
60	51430	15580	36198	24190	2380	20136	38380	10676	15010	1782	4266	13792	6	11658
61	75348	20382	13892	2862	7344	29328	40978	46428	34202	3566	5826	18398	3188	7052
62	100848	22696	38850	26806	9332	44206	43256	64380	30332	12348	22434	33558	1784	13166
63	121094	50948	47118	3996	22564	99402	48846	54260	35766	0	23676	20224	12840	17954
64	153478	88360	76188	26288	20180	74356	87840	41438	23086	28372	15854	11066	13790	15386
65	169274	113446	62828	39388	38508	94538	84242	80732	43866	10234	55900	15702	35384	34512
66	195244	44536	156278	76554	164874	128912	126890	25368	38010	8636	22112	11326	28114	39686
67	266154	79412	167484	98264	75424	164894	69758	82850	109734	50386	33786	24754	33398	56470
68	337160	105362	159774	118208	271900	221554	129110	82054	74028	32630	80890	19498	51754	56640
69	332848	141872	228174	116484	321172	188950	154122	123966	85752	82550	60026	47288	49768	65586
70	377524	274808	235132	105534	260494	272032	223662	118922	101270	147926	65706	26260	105298	135112
71	413774	200030	344836	200848	414784	274190	228224	52172	102188	194832	43022	38384	45384	104682
72	495054	309962	339632	285016	278920	227584	290800	89384	125904	185994	64148	81858	63448	143326
73	529412	416620	267866	297078	166188	390222	212800	69244	76538	170400	151882	70542	37948	174292
74	364192	338304	362046	191864	217418	283416	298100	61264	101912	195164	119508	73114	81632	156236
75	288942	429182	268848	186748	148682	253372	170634	69930	60348	316896	116040	69824	69006	133260
76	317434	399720	174864	215880	130778	138024	185744	48822	66574	187898	72182	49788	86864	115208
77	192786	287392	204758	190368	134154	100934	103972	68284	56658	137856	90184	48562	56354	88964
78	158282	225646	142320	48108	53072	54662	38180	66254	54964	83626	34284	33882	42520	59928
79	130608	215754	103314	68510	32500	68974	47074	37918	26932	99532	17324	57662	60824	78428
80	99606	86138	74450	25884	33236	24698	34078	14364	25540	113724	25704	21292	23946	43216
81	82210	37224	50868	48802	9216	7584	15744	10232	25784	16560	18270	6994	17814	18896

82	46608	36826	6346	7762	12226	21384	13498	8748	20182	25104	4708	1206	0	10298
83	40538	1552	16024	0	7826	7986	6204	8012	17784	2130	2400	2398	5624	5204
84	10138	9220	1186	7124	11322	2134	1644	9968	6866	0	2308	5898	3194	2294
85	11638	14788	4572	1932	952	0	1644	4352	8060	2130	0	0	0	420
86	5072	1614	4572	0	958	0	0	3948	10430	0	1126	64	0	842
87	15198	3924	0	1020	952	156	0	7896	6866	0	838	0	6890	842
88	0	0	0	0	0	1476	0	3948	346	0	0	0	0	420
89	0	0	0	32	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	890	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	3278	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112	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	0	0	0
114	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Female	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	1431	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	43	167	0	0	0	0	0
46	2341	335	0	1431	0	0	0	0	100	0	0	0	0	0
47	3180	1269	0	0	0	0	0	43	50	0	204	0	0	836
48	4682	0	0	0	0	202	0	43	550	0	611	0	0	418
49	2341	3473	437	3392	1087	266	0	532	533	0	0	0	0	0
50	9461	4143	437	13201	0	407	1891	928	950	0	0	4416	0	836
51	5618	15989	437	1431	0	735	2703	840	1441	0	0	2208	0	2956
52	10569	10875	874	9970	3261	596	8583	2154	2968	0	204	5308	967	1595
53	10004	28283	5583	7153	4799	1624	784	16484	6499	0	538	5335	967	1595
54	22151	9721	0	17748	7610	5413	9984	4140	2766	0	957	16371	0	5799
55	8641	9393	0	40289	14133	3858	3366	13197	2761	0	334	13636	1627	2139
56	36857	12719	7067	32861	18662	6385	18949	9265	9517	3144	1028	10260	967	1721
57	31671	18230	12475	21030	5474	22566	16211	29871	12710	891	1402	13741	3883	1734
58	77870	30032	16829	24417	23813	23135	33350	33137	12563	891	1370	21822	1627	6241
59	67306	12722	15300	30049	21946	25886	32753	30353	22838	4399	3441	20360	3908	2732
60	63225	34849	17291	26398	20325	54010	34840	47881	17845	4918	14241	18099	8757	9624
61	104891	32993	20227	53775	32088	45399	29667	31371	21180	4696	3043	10327	21539	19282
62	78754	39543	26719	32345	10939	15317	48373	24080	26521	9555	3127	10645	28542	24110
63	87248	75630	29300	61531	28918	27812	38344	62655	16580	15822	17522	8243	27882	18583
64	128397	68678	32763	35957	47519	39634	44681	62375	28943	3144	13913	8225	21469	18505
65	82329	30716	75205	59647	52411	41866	55307	42773	28413	15006	11800	14572	34175	23656
66	97336	62204	44879	30600	41652	33347	34225	42821	17845	10856	10530	6527	26713	11032
67	45007	31395	30315	23563	26902	40106	45398	59383	20260	4343	10767	19763	45396	20080
68	64223	36789	56660	21049	30209	31188	37374	61034	15548	7527	28618	13531	28523	22086
69	75797	38019	41537	18607	42665	23608	19570	46333	20625	12909	30173	26303	27807	19594
70	48507	51102	33187	16644	34696	30629	25991	42716	16967	20813	25820	11138	26116	16881
71	29323	52015	46649	28034	45863	19037	28540	27718	33112	22844	15403	9419	36283	32559
72	72778	16559	34378	26445	38476	31788	22003	64233	25004	17569	55524	5195	19034	9964
73	18972	40635	27502	21523	26221	15544	36055	40620	28214	15778	26583	10897	20634	22000
74	60424	14617	27854	16981	53000	23674	17859	49504	25824	14991	39972	19157	21578	51402
75	51532	65237	64376	23540	51432	11499	22923	43999	13280	22617	51628	21668	16489	16949
76	38315	66053	18234	55182	41746	3012	35036	17031	15119	26973	42206	13580	38446	33764
77	53934	13126	11021	19380	44318	8506	13737	27790	20630	16836	32485	2205	17588	33620
78	37515	55213	30279	6825	68889	23683	21373	43803	19327	26531	38875	13063	30973	29166
79	46898	13422	17819	14437	38339	7580	19893	26567	10915	7539	26888	14944	24211	17848
80	44029	37512	7503	20469	30490	5282	27533	22393	19451	22502	18769	18951	29561	17198
81	28125	23142	15593	10428	44734	14457	19131	21822	9484	31107	20416	21295	15580	34969

82	45550	28996	16851	16311	32585	8388	28324	10833	19760	10971	8434	24970	19262	8025
83	20845	7660	16825	48996	53085	5118	26669	31242	15273	12734	10161	17636	17360	15972
84	55089	25782	6171	3820	31422	12809	20344	10669	5423	4880	8437	15659	53544	5372
85	14806	21116	8605	14507	29346	7814	23517	5342	9906	11807	14573	4717	31970	11451
86	12757	2830	6404	10160	18842	5861	27906	3077	6981	23572	9431	16693	27602	10574
87	24139	7499	11421	16661	20431	5162	29935	1749	5629	16030	6430	16399	27316	9591
88	37428	6691	15195	2789	12583	9693	31680	6557	11847	12873	4683	6671	17403	16891
89	29459	18296	11879	7477	12755	623	12302	9532	7224	13348	7797	22605	17503	4436
90	6770	5782	619	3382	19770	2658	14817	10693	6928	1067	974	11937	30052	15760
91	10877	8577	183	8961	6895	424	15120	1149	3921	21305	3433	5081	34288	4813
92	4321	2953	2268	15831	9303	476	13429	9811	1995	9694	2499	9532	4584	2143
93	22438	10620	223	13079	11779	68	19435	2645	4733	6409	8379	3154	9969	3883
94	24996	21105	871	10670	0	68	21647	3066	1781	5513	1398	12130	4009	3950
95	18698	2767	12246	8648	2329	0	14967	1318	2387	6541	1401	6744	6042	9739
96	6377	1318	2079	8416	2818	68	5579	327	2765	4554	9028	7110	14431	359
97	4892	3631	3756	6255	0	0	17422	5930	2478	5428	45	7579	11333	980
98	3647	12854	1660	8972	3409	0	357	2126	2873	3574	1372	263	10042	518
99	83	8016	871	1856	4771	0	445	224	1293	9816	634	4002	2141	3187
100	1222	2787	2173	5643	850	0	0	1682	3006	3471	0	253	5289	52
101	4910	2240	1728	976	5054	0	784	1400	1419	0	0	1973	100	6429
102	0	2787	871	5450	0	0	823	259	1146	3094	0	32	15	1080
103	1005	1680	0	0	591	68	5048	0	360	3764	0	4285	1603	831
104	0	1153	0	5387	0	0	0	4576	2062	1385	3304	571	0	165
105	109	1680	2474	0	259	0	3269	30	1842	3094	0	6	0	772
106	0	0	0	4490	0	0	0	0	0	0	41	6712	0	0
107	0	0	0	848	2818	0	0	0	120	265	73	571	566	72
108	0	0	1570	0	0	0	0	30	0	0	0	0	0	32
109	0	123	0	0	0	0	0	0	0	0	0	0	0	155
110	0	0	0	0	0	0	0	0	120	0	0	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0	65
112	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	0	0	0
114	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3. Northeast Atlantic spurdog. Effective effort (fishing days = trips*(days/trip)) and LPUE (landings in kg/day) of different fleets landing in the Basque Country (Spain) ports in the period 1994–2005.

(a)	BAKA trawl-ON-VIIIa,b,d			BAKA trawl-ON-VII			BAKA trawl-ON-VI		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994	32	5619	6	1	980	1	3	635	5
1995	23	4474	5	0	1214	0	15	624	24
1996	45	4378	10	3	1170	2	8	695	11
1997	34	4286	8	1	540	2	8	710	12
1998	25	3002	8	0	1196	0	6	750	8
1999	12	2337	5	3	1384	2	14	855	16
2000	38	2227	17	6	1850	3	18	763	24
2001	9	2118	4	6	1451	4	13	1123	12
2002	12	2107	5	1	949	1	3	1234	2
2003	3	2296	1	1	1022	1	4	718	6
2004	1	2159	0	1	910	1	20	411	49
2005	3	2263	2	1	544	2	0	337	1

(b)	VHVO P. trawl-ON-VIIIa,b,d			VHVO P. trawl-PA-VIIIa,b,d			VHVO P. trawl-PA-VII		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994									
1995	0	959	0	0	746	0	0		
1996	0	1332	0	0	1367	0	0	57	0
1997	0	1290	0	0	1752	0	0	3	0
1998	1	1482	0	0	1462	0	0	340	0
1999	3	1787	2	0	1180	0	0	476	0
2000	1	1214	1	0	1233	0	0	271	0
2001	1	1153	1	0	587	0	0	253	0
2002	1	1281	1	0	720	0	0	59	0
2003	5	1436	4	0	754	0	0	9	0
2004	2	1288	1	0	733	0	0	35	0
2005	2	1107	2	0	252	0	0	0	

(c)	BAKA trawl-ON-VIIIc			VHVO P. trawl-ON-VIIIc		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
2002	14	99	140	0	321	0
2003	5	96	56	0	330	0
2004	3	114	26	0	368	0
2005	0	106	1	0	328	0

Table 2.4. Northeast Atlantic spurdog. Results of delta-lognormal GLM to standardise Scottish groundfish survey data.

	Year.effect	CV.Yr.effect
1985	1.79	0.25
1986	1.08	0.32
1987	0.43	0.31
1988	0.66	0.34
1989	0.65	0.33
1990	0.76	0.31
1991	0.53	0.31
1992	0.45	0.32
1993	0.67	0.31
1994	0.61	0.34
1995	0.32	0.35
1996	0.35	0.34
1997	0.22	0.33
1998	0.39	0.33
1999	0.51	0.33
2000	0.28	0.35
2001	0.33	0.33
2002	0.36	0.33
2003	0.27	0.33
2004	0.22	0.35
2005	0.22	0.48

Table 2.5. Northeast Atlantic spurdog. Description of life-history equations and parameters.

Parameters	Description/values	Sources
M_a	Instantaneous natural mortality at age *a*: $M_a = \begin{cases} M_{pup} e^{-a \ln(M_{pup}/M_{adult})/a_{M1}} & a < a_{M1} \\ M_{adult} & a_{M1} \le a \le a_{M2} \\ M_{til} / [1 + e^{-M_{gam}(a-(A+a_{M2})/2)}] & a > a_{M2} \end{cases}$	
a_{M1}, a_{M2}	4, 30	expert opinion
M_{pup}, M_{adult}	1.1115, 0.1	expert opinion
M_{til}, M_{gam}	0.3, 0.04621	expert opinion
l_a^s	Mean length at age *a* for animals of sex *s* $l_a^s = L_\infty^s (1 - e^{-\kappa^s (a - t_0^s)})$	
L_∞^f , L_∞^m	110.66, 81.36	average from literature
κ^f, κ^m	0.086, 0.17	average from literature
t_0^f , t_0^m	-3.306, -2.166	average from literature
w_a^s	Mean weight at age *a* for animals of sex *s* $w_a^s = a^s (l_a^s)^{b^s}$	
a^f, b^f	0.00108, 3.301	Bedford *et al.* ,1986
a^m, b^m	0.00576, 2.89	Coull *et al*. 1989
P_a'	Number of pups per pregnant female of age *a* $P_a' = \begin{cases} 0 & l_a^f < l_{mat00}^f \\ a' + b' l_a^f & l_a^f \ge l_{mat00}^f \end{cases}$	
a', *b*'	-23.876, 0.344	Gauld, 1979

l^f_{mat00}	70 cm	average from literature
P''_a	Proportion females of age *a* that become pregnant each year $P''_a = \frac{P''_{max}}{1 + \exp\left[-\ln(19)\frac{l^f_a - l^f_{mat50}}{l^f_{mat95} - l^f_{mat50}}\right]}$ where P''_{max} is the proportion very large females pregnant each year, and l^f_{matx} the length at which *x*% of the maximum proportion of females are pregnant each year	
P''_{max}	0.5	average from literature
l^f_{mat50}, l^f_{mat95}	80 cm, 87 cm	average from literature

Table 2.6. Northeast Atlantic spurdog. Estimates of key model parameters, with associated Hessian-based estimates of precision (CV expressed as a percentage) for the base-case run.

	Mod est	CV
B_0	2486800	6%
B_{depl05}	5.23%	29%
B_{depl55}	7.05%	28%
q_{sur}	4.32E-06	16%

Table 2.7. Northeast Atlantic spurdog. Correlation matrix for some key estimable parameters for the base-case run.

	B_0	$S_{c2,sco}$	$S_{c2,e\&w}$	$S_{c3,sco}$	$S_{c3,e\&w}$	S_{s1}	S_{s2}	S_{s3}	$\varepsilon_{r,96}$	$\varepsilon_{r,97}$	$\varepsilon_{r,98}$	$\varepsilon_{r,99}$	$\varepsilon_{r,00}$	$\varepsilon_{r,01}$	$\varepsilon_{r,02}$	$\varepsilon_{r,03}$	$\varepsilon_{r,04}$	$\varepsilon_{r,05}$
B_0	1																	
$S_{c2,sco}$	0.00	1																
$S_{c2,e\&w}$	0.00	0.00	1															
$S_{c3,sco}$	0.10	0.11	0.00	1														
$S_{c3,e\&w}$	0.08	-0.01	0.05	0.03	1													
S_{s1}	-0.01	0.02	0.01	0.00	-0.02	1												
S_{s2}	0.02	0.02	0.02	0.06	0.00	0.52	1											
S_{s3}	0.04	0.01	0.01	0.09	0.05	0.38	0.61	1										
$\varepsilon_{r,96}$	-0.02	-0.04	-0.01	-0.10	-0.02	-0.01	-0.05	-0.06	1									
$\varepsilon_{r,97}$	-0.02	-0.04	-0.01	-0.11	-0.02	-0.02	-0.07	-0.04	-0.04	1								
$\varepsilon_{r,98}$	-0.02	-0.04	-0.01	-0.10	-0.01	-0.03	-0.08	-0.05	-0.02	-0.08	1							
$\varepsilon_{r,99}$	-0.02	-0.04	-0.01	-0.10	-0.02	-0.04	-0.14	-0.04	0.00	-0.09	-0.15	1						
$\varepsilon_{r,00}$	-0.02	-0.03	0.00	-0.06	-0.02	-0.13	-0.05	-0.02	0.02	0.03	0.03	0.03	1					
$\varepsilon_{r,01}$	-0.03	-0.02	0.00	-0.05	-0.02	-0.01	-0.05	-0.02	0.02	0.03	0.02	0.00	-0.01	1				
$\varepsilon_{r,02}$	-0.03	-0.02	0.00	-0.05	-0.02	-0.01	-0.06	-0.02	0.02	0.03	0.03	0.00	-0.02	-0.04	1			
$\varepsilon_{r,03}$	-0.03	-0.02	0.00	-0.04	-0.02	-0.07	-0.02	-0.02	0.01	0.01	0.01	0.02	0.03	0.02	0.02	1		
$\varepsilon_{r,04}$	-0.01	-0.01	0.00	-0.02	-0.01	-0.01	-0.01	-0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	1	
$\varepsilon_{r,05}$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Table 2.8. Northeast Atlantic spurdog. Results for the sensitivity test fixing B_0 75% and 50% of the value estimated for the base-case run (Table 2.6, shown here as 100% B_0). Where appropriate, Hessian-based estimates of precision (CV expressed as a percentage) are shown in square parentheses.

	B_0	B_{depl05}	B_{depl55}	q_{sur}
100% B_0	2486800 [6%]	5.23% [29%]	7.05% [28%]	4.32E-06 [16%]
75% B_0	1865100 [-]	5.41% [25%]	5.88% [24%]	4.90E-06 [13%]
50% B_0	1243400 [-]	6.62% [24%]	5.23% [23%]	5.35E-06 [11%]

3 Deepwater "siki" sharks in the northeast Atlantic

A number of species of deepwater sharks are exploited in the ICES area. This section deals with *Centrophorus squamosus* and *Centroscymnus coelolepis*, which are of greatest importance to commercial fisheries.

LEAFSCALE GULPER SHARK (*Centrophorus squamosus*) has a wide distribution in the North East Atlantic from Iceland and Atlantic slope south to Senegal, Madeira and the Canary Islands and the mid Atlantic slope as far south as the Azores. On the Mid-Atlantic Ridge it is distributed from Iceland to Azores (Hareide and Garnes, 2001) The species can live as a demersal shark on the continental slopes (depths between 230 and 2400 m) or present a more pelagic behaviour, occurring in the upper 1250 m of oceanic water in areas with depths around 4000 m (Compagno and Niem, 1998). Data on stock identity is inconclusive, though available evidence suggests that this species is highly migratory. Available information shows that pregnant females and pups are found in Portugal, both the mainland (Moura *et al.*, 2006) and Madeira, while only pre-pregnant and spent females are found in the northern areas (Clarke, 2000). In the absence of more clear information on stock identity, a single assessment unit of the Northeast Atlantic has been adopted.

PORTUGUESE DOGFISH (*Centroscymnus coelolepis*) is widely distributed in the Northeast Atlantic. Stock structure and its dynamics are poorly understood. Specimens below 70 cm have been very rarely recorded in the NE Atlantic. There is a lack of knowledge on migrations, though it is known that females move to shallower waters for parturition and vertical migration seems to occur (Clarke *et al.*, 2001). In the absence of more clear information on stock identity, a single assessment unit of the Northeast Atlantic has been adopted.

These two species are often referred to as collectively "siki sharks"

3.1 The fishery

Advice and management applicable to 2005 and 2006

In 2005, ACFM advised that, based on CPUE information, the stocks of Portuguese dogfish and leafscale gulper shark are considered to be depleted and likely to be below any candidate limit reference point. Given their very poor state, ICES recommended a zero catch of deepwater sharks.

The TAC for Subareas V, VI, VII, VIII and IX is 6763 tonnes. In Subarea X, the TAC is 120 tonnes and in Subarea XII, 243 t. These TACs apply to the following list of species: Portuguese dogfish (*Centroscymnus coelolepis*), Leafscale gulper shark (*Centrophorus squamosus*), Birdbeak dogfish (*Deania calceus*), Kitefin shark (*Dalatias licha*), Greater lanternshark (*Etmopterus princeps*), Velvet belly (*Etmopterus spinax*), Black dogfish (*Centroscyllium fabricii*), Gulper shark (*Centrophorus granulosus*), Blackmouth dogfish (*Galeus melastomus*), Mouse catshark (*Galeus murinus*), Iceland catshark (*Apristuris spp.*). In Subarea XII, *Deania histicosa* and *Deania profundorum* are added to this list.

The EU also sets limits on the total effort that can be expended in deep-water fisheries by vessels holding deep-water permits. For 2006 this was set at 80% of the effort recorded in 2003. Setting of deep-water gillnets has also been banned in international waters of the NEAFC regulatory area. In the Azores EEZ, botton trawling is banned by EC regulation 1568/2005

In response to concerns over gillnet fisheries for deep-water sharks and monkfish, the EC banned the setting of gillnets in waters greater than 200m in ICES Divisions VI a, b and VII b, c, j, k and Subarea XII; this regulation will be reviewed during 2006. A subgroup of STECF will meet in July 2006 to review the existing knowledge of gillnet fisheries in depths greater than 200 meters in EU waters.

The fishery

C. squamosus and *C. coelolepis* are both taken in several mixed trawl fisheries in the northeast Atlantic and in mixed and directed longline and gillnet fisheries. Fisheries taking these species were extensively described in ICES (2006).

Working group estimates of total landings of mixed deep-water sharks, believed to be mainly of Portuguese dogfish and leafscale gulper shark but possibly also containing a small component of other species, are presented in Table 3.1. Landings which were specifically identified as either Portuguese dogfish or leafscale gulper shark are shown in Tables 3.2 and 3.3 respectively. The sum of these three tables represents the total combined landings of Portuguese dogfish and leafscale gulper shark. Total landings of both species combined, broken down by ICES subarea or division, are shown in Figure 3.1.

Landings began in 1988 (although an unknown quantity is likely to have been discarded prior to this) and increased rapidly to over 8000 tonnes in 1997 (Figure 3.1). Since 1997 landings have fluctuated with an overall upward trend, reaching a maximum of over 10 000 tonnes in 2003. Since 2003, reported landings have declined, possibly as a result of the introduction of quotas on deepwater sharks and the reduction quotas for other species in the mixed trawl fisheries.

French trawl landings peaked in 2001 at 3500 tonnes and have since declined to about 800 tonnes. Spain (Galicia) began trawling for these species on the Hatton Bank in 2000 and catches peaked at 1400 tonnes in 2002. Norwegian longline fisheries began in 1999. Peak catches were about 400 tonnes in 2001 and this fishery has now ceased. Irish fishing (trawl and longline) began in 2000 and catches have been stable at about 400 tonnes. German fishing began in 1992 using longlines. Recorded landings in the UK (England and Wales) fishery began in 1991 and peaked in 1997 at 2000 tonnes. UK and German fisheries were initially longline but gradually changed to gillnets by 1998. The UK and German longline/gillnet fishery retained only livers before 1998 and therefore landings may be under estimated. Portuguese fisheries have been stable at 500 tonnes of each species since 1988.

The banning of gill-netting in waters deeper than 200 m in 2006 is expected to lead to increased longline effort in deep water.

3.2 Biological composition of the catch

Splitting of catches

The majority of landings of these species are reported in mixed species categories. Table 3.4 shows the proportion of Portuguese Dogfish in the total landings of siki shark by country. Where data were not available for a particular country/year combination, data from the most similar fishery were substituted. The sources of the ratios used to split the catches for each country and year are shown in Table 3.5. Although many assumptions were made in order to reconstruct these catches, the working group is satisfied that they represent the best estimates of recent and historic catches of these species that can be produced.

Landings data

Since the start of the fishery, a number of generic categories have been used to report landings of deep water sharks - these include “various sharks not elsewhere identified (NEI)”, “dogfish sharks NEI” and “cartilaginous fishes NEI”. This has made it very difficult to quantify landings of deep-water sharks, particularly as the same categories are often used to report other species such as pelagic sharks or spurdog. In 2005, WGEF examined the data from all categories likely to include deep-water species and used this data to reconstruct landings of deep-water species (see WGEF 2005 report for further details). The group is satisfied that these estimates are close to actual landings.

Until 1998, UK and German vessels landed only livers and the conversion factor used to convert these to live weight is unknown. Further investigation will be required to establish the accuracy of landings data in those years.

Two Panamanian and one unregistered vessel have been fishing deep-water sharks in international waters at Hatton Bank in 2003. No landings data from this fishery were available to the WG.

Misreporting

There are no reliable estimates of levels of misreporting of these species but it is believed to be a minor problem. Immediately prior to the introduction of quotas for deepwater species in 2001, it is believed that some vessels may have logged deep-water sharks as other species in an effort to build up track record and it is also likely that, before the introduction of quotas for deep-water sharks, some gill-netters may have logged monkfish as sharks. Since the introduction of quotas on deep-water sharks in 2005, it is likely that some under-reporting has occurred.

Discarding

Discarding is negligible in the majority of trawl and longline fisheries although some discarding may have occurred in the earliest years before markets were fully developed. Between 2001 and 2004, Irish trawlers have discarded their entire catch of leafscale gulper sharks.

In UK and German gillnet fisheries, soak times have been reported to be often very long resulting in a large proportion of the catch being discarded as unfit for human consumption (Hareide *et al.*, 2005). In 2005 an Irish retrieval survey for lost gillnets was carried out in ICES areas VIb and VII (Rihan *et al.*, 2005). One fleet of deepwater nets (7.5 km) was retrieved. This fleet was left at sea while the gillnet vessel was landing. A total catch of 6500 kg of deepwater sharks was recorded of which 96% was leafscale gulper shark. About 70% of the catch was decayed and not fit for human consumption.

In contrast, summarised results (made available to WGEF), based on data collected by independent scientific observers on UK long-liners (1 trip) and gillnetters (2 trips) fishing for sharks, indicate that discards of Portuguese dogfish and leafscale gulper shark on the majority of the grounds fished were very low (around 1%) for both gears and were due to damage to fish on hauling. Discard rates in excess of this (up to 20%) were mainly observed in gillnets fished at Porcupine Bank and this was because fish had been attacked by scavenging isopods and amphipods. Soak-times on the observed trips ranged from 2 to 4.5 days for gillnets and were around 6 hrs for longlines. Full results of this observer programme should be available to WGEF in 2007. A UK (England and Wales) gill-net retrieval survey, using the same gear as has been used in the Greenland halibut fishery for the past 10 years, was carried out in 2005. This survey found little evidence of lost and discarded gill nets at Rosemary Bank, an area intensively fished by gill-netters, though the efficiency of retrieval gears has not been quantified.

Length Frequencies

Available length frequency data are presented in Tables 3.8 and 3.9 and the source of the data in Table 3.10 and Table 3.11. It should be noted that survey designs are not standardised and both commercial and survey data are included.

Centroscymnus coelolepis – Length ranges are between 64 and 123 cm in Southern areas and between 29 and 152 cm in Northern areas.. The length of males is smaller than that of females and this evident for the two fishing gears.

Centrophorus squamosus - Length ranges of males are similar between Northern and Southern areas and also between gears. No great differences on female's length seem to exist between the two gears in the Northern area. The proportion of large females seems to be higher in the southern area, where specimens are only caught by longliners.

There is no obvious trend in mean length over time.

3.3 Mean length, weight, maturity, natural mortality and recruitment

New biological information on *C. coelolepis* and *C. squamosus* using samples collected from Portugues longliner commercial landings is presented in Tables 3.12 and 3.13. Length weight relationships have been presented in ICES (2000).

3.4 Catch per unit effort

In 2006, WGEF summarized all the available CPUE series and this is presented in Tables 3.14, 3.15 and 3.16.

A new French CPUE series for the combined species *C. coelelopis* and *C. squamosus*, denominated as "siki" (Figures 3.2 and 3.3) was presented as plots by Biseau (2006 WD). Previous versions of this CPUE series used various thresholds to select 'directed' fishing sequences (Figure 3.2). Absolute values of CPUE are obviously higher when the thresholds used selected more directed fishing sequences, but the relative variation along the period are very similar. Thus, for the new series it was decided not to apply any thresholds and to consider all the 'deep' fishing sequences. The new series separated out statistical rectangles that had been fished since the begining of the fishery (reference area) and those that had been more recently exploited (new grounds). This working group had difficulty explaining the increase in CPUE in 2001 (ICES, 2002, 2003, 2005). However, this is explained by Biseau (2006 WD) as a result of movement of the fleet to new fishing grounds within this subarea (Figure 3.3). It should be noted that the effort in these new areas prior to 2000 was zero, hence the zero values in the figure.

There was an overall decline in CPUE in all ICES subareas exploited by French commercial trawlers since 1995. In 2005 in subareas V and VI, the level of CPUE was about 10% of the level estimated in 1995. In subarea VII the level of CPUE in 2005 was less than 10% of the level estimated in 1995. The decline in CPUE between 2001 and 2005 was consistent across all areas. This is also supported by CPUE data from Irish trawlers (ICES, 2006).

The working group considers that the new CPUE series given by Biseau (2006 WD) gives a more reliable indicator of stock abundance than any previous version.

A new standardized CPUE for the Portuguese longline fishery was presented for *C. coelolepis* (Figure 3.4) and for *C. squamosus* (Figure 3.5). No trend is evident in CPUE by year. (Figueiredo and Machado, 2006).

The Scottish survey CPUE series was revised and it is presented in Tables 3.15 and 3.16. See Jones *et al*. (2005) for further information.

3.5 Data exploration

Fishery dependent data for the deepwater shark species are in most cases presented as combined data for the the two species stocks (siki shark) A major task for the WG has been to split data by species in order to make a foundation for single species assessments. It was expected that data on species composition for UK and German gillnetters would be made available but that did not happen.

Unstandardized CPUE estimates for *C. coelolepis* by ICES subarea and Fishing Gear showed similar trends in ICES subareas V, VI, VII and XII for both trawl and longline. In subarea IX CPUE estimates from the longline fishery are stable (Table 3.15; Figure 3.6).

Unstandardized CPUE estimates for *C. squamosus* by ICES subarea and Fishing Gear showed similar trends for Trawl in different ICES subareas. The trends on CPUE from longliner in IX and VII contrast with the drastic decrease in subarea XII (Table 3.16; Figure 3.7).

The diversity of sources and methods used to estimate the CPUE series available poses serious problems. Due to this diversity a standardization of the CPUE data was tried. The standardization of CPUE series was essayed for each species and each fishing gear, through the adjustment of GLM model using fixed effects for main factors: Year, ICES Subarea (here designated as Area) and Country. A lognormal distribution was assumed for the observation errors. The model is selected by AIC in a Stepwise Algorithm Routine from stats module of R. Version 2.0.1.

Using the standardization results the original CPUE data were standardized acccordingly for each species and fishing gear accordingly.

Further exploration will be carried out next year.

3.6 Assessment

3.6.1 Previous assessments

Two previous assessment on *C. coelolepis* combined with *C. squamosus* were attempted, using the catch and effort data from French reference fleet trawlers (ICES, 2000, 2002). Both assessments were considered to be too unreliable. The explanation of the trends in CPUE presented in Biseau (2006 WD) supports ICES' (2002) decision to exclude data from after 2001 in the assessment.

3.6.2 Exploratory assessment

As an exploratory assessment a nonequilibrium surplus production model incorporating covariates (ASPIC Ver. 5.05; Prager 1994, 1995) was applied to total landing estimates and to survey and commercial standardized CPUE estimates from *C.coelolepis* and from *C. squamosus*.

In the 1st exploratory run - all the different series of CPUE entered into the model. Negative or no correlations detected between some indices were found in both cases. This indicates a strong violation of the model´s assumption that variations of the response of the stock would be reflected in the values of the index of abundance even if they are provided from different sources. Thus if it is just one stock the responses should follow the same trends (Prager, 1994).

In the 2nd exploratory run only French CPUE data was entered into the model. In both species the model adjustment was poor, due probably to the change on fishing pattern of the French fishery.

No further assessments were tried.

3.7 Quality of CPUE data

Reliable catch and effort data at a species-specific level are crucial requisites for the improvement of assessment outputs. In order to explore species-specific trends in abundance, further information is needed on species composition, especially from gill-netters.

The CPUE data available at this WG consisted of unstandardized point estimates, with a deficient description of the sampling designs used to collect effort and landing/catch data either from surveys or commercial landings. There was no other auxiliary information to improve the standardization process. In particularly, data on the dates of collection, changes on the composition fishing fleets or on the exploited fishing grounds usually with an significant importance on CPUE estimates were not available. The most recent French CPUE presented to the group was available only in the form of a graph. If the data used to calculate this series were available, it would greatly improve assessments.

3.8 Management considerations

On the basis of their life-history parameters, being slow-growing and late maturing, these two species are considered highly vulnerable to exploitation.

CPUE of both species has shown a strong decline in northern areas (sub-areas V, VI, VII and XII). WGEF has made great progress in clarifying this trend.

In Subarea IX, CPUE appears to be stable, though the time series is short.

The current TAC and WG estimates of landings are presented in Figure 3.8. It is clear that the quota is restrictive for some countries, if adequately enforced. For other countries, the quotas are not effective in regulating fishing effort. There is information that illegal unregulated and unreported fishing of these species is taking place by non-ICES countries (mainly Panama) in international waters in the ICES area.

The ban on gill-netting in EC and international waters may have diverted fishing effort to other gears.

The technical interactions of these fisheries are shown in Table 3.17.

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Table 3.1. Deepwater "siki" sharks in the northeast Atlantic. Working group estimate of combined landings of Portuguese dogfish and leafscale gulper shark (t). Species-specific landings are not included in these figures but are presented in Tables 3.2 and 3.3.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	140	1288	3104	3468	3812	3186	3630	3095	3177	3079	3519	3684	1656	810	654	492
UK (Scotland)	.	20	14	24	165	469	743	801	576	766	1007	625	623	2429	1159	1419	1050	201
UK (England anc	.	.	.	104	80	174	387	986	1036	2202	1494	1019	413	320	335	4027	3610	85
Ireland	.	.	.	.	.	.	.	33	5	.	3	2	138	454	577	493	764	381
Iceland	.	.	.	.	1	1	.	.	.	.	5	.	.	.	.	.	.	.
Spain (Basque C	.	.	.	.	.	.	.	.	286	473	561	450	280	608	621	719	563	359
Portugal	.	.	6	18	14	.	.	.	.	3	2	.	.	.	.	.	.	.
Germany	.	.	.	.	148	91	358	92	164	106	40	214	265	431	518	640	.	21
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	53	4	.	.
Lithuania	.	.	.	.	.	.	.	.	.	.	.	.	.	14	40	28	.	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	.
Spain (Gallicia)	.	.	.	.	.	.	.	.	.	.	.	.	572	615	1381	737	626	.
Faroe Island	.	.	.	.	.	3	.	60	282	226	158	54	23	.	.	.	.	.
Norway	.	.	.	.	.	.	.	.	.	.	.	5	118	399	75	.	19	.
Total	.	20	160	1434	3512	4206	5300	5158	5979	6871	6447	5448	5951	8954	6423	8877	7286	1539

Table 3.2. Deepwater "siki" sharks in the northeast Atlantic. Working group estimate of species-specific landings of Portuguese dogfish (t).

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	.	.	.	.	.	.	.	.	.	.	.	370	566	364	309
Germany	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22.87
Portugal	.	.	.	651	692	607	576	810	777	927	858	568	632	641	586	572	548.4	509.4
UK (E&W)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	546
UK (Scotland)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	556
Total	.	.	.	651	692	607	576	810	777	927	858	568	632	641	956	1138	912.4	1943.3

Table 3.3. Deepwater "siki" sharks in the northeast Atlantic.Working group estimate of species-specific landings of leafscale gulper shark (t).

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	.	.	.	.	.	.	.	.	.	.	.	77	78	171	65
Germany	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	35.37
Portugal	560	507	475	424	422	339	579	544	412	384	400	468	476	510	612	608	577	524
UK (Scotland)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	175	85	45
UK (E&W)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	901.73
Total	560	507	475	424	422	339	579	544	412	384	400	468	476	510	714	861	833	1571.1

Table 3.4. Deepwater "siki" sharks in the northeast Atlantic.Proportion of Portuguese dogfish in the total landings, used to split combined landings data.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	0.54	0.54	0.54	0.54	0.54	0.6	0.47	0.54	0.58	0.61	0.75	0.67	0.71	0.83	0.88	0.56	0.76
UK (Scotland)	.	0.27	0.27	0.27	0.27	0.27	0.6	0.47	0.54	0.58	0.61	0.75	0.67	0.71	0.83	0.88	0.56	0.76
UK (England and Wales)	.	.	.	0.27	0.27	0.27	0.27	0.27	0.27	0.29	0.29	0.45	0.45	0.45	0.45	0.45	0.45	0.1
Ireland	.	.	.	.	.	.	0.29	0.29	0.29	0.29	0.29	0.24	0.25	0.19	0.19	1	0.56	0.76
Iceland	.	.	.	.	0.54	0.54	.	.	.	.	0.61	.	.	.	.	.	.	.
Spain (Basque C)	.	.	.	.	.	.	.	.	0.29	0.29	0.29	0.24	0.25	0.19	0.19	0.12	0.12	0.12
Portugal	.	.	0.27	0.27	0.27	.	.	.	.	0.29	0.29	.	.	.	.	.	.	.
Germany	.	.	.	.	0.27	0.27	0.27	0.27	0.27	0.29	0.29	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.83	0.88	0.56	.
Latvia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lithuania	.	.	.	.	.	.	.	.	.	.	.	.	.	0.71	0.83	0.88	0.56	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.83	.	.	.
Spain (Gallicia)	.	.	.	.	.	.	.	.	.	.	.	.	0.67	0.71	0.83	0.88	0.56	.
Faroe Island	.	.	.	.	.	0.29	0.29	0.29	0.29	0.29	0.29	0.75	0.67	0.71	0.83	0.88	0.56	.
Norway	.	.	.	.	.	.	.	.	.	.	.	0.57	0.57	0.98	0.98	.	0.98	.

Table 3.5. Deepwater "siki" sharks in the northeast Atlantic. Source of ratios used to split combined landings data.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
France	.	Average of ratios 1994 to 1996 (Gordon 1999)					Gordon 1999 (ed)					Crozier (W D, 2(	
UK (Scotland)	Ratios as used for UK (england and Wales)						Ratios as used						
UK (England and Wales)	Average of ratios for 1997 to 1999 (Clarke et al 2000, Clarke et al 2001, Connoly et al, 1999)									Clarke 2000, Clarke & al 2001, Connolly & al 1999			
Ireland	.	.	.	.	.	.	.	.	.	Clarke 2000, Clarke & al 2001, Connolly & al 1999		Irish private lo(	
Iceland	.		.	.	Gordon 1999 (ed)		.	.	.	.	Gordon 1999 (ed)		.
Spain (Basque C)	.	.	.	.	.	.	.	.	Clarke 2000, Clarke & al 2001, Connolly & al 1999			Irish private logbooks pers inf)	
Portugal	.	.	Ratios as used for UK (England and Wales)						.	Clarke 2000, Clarke & al 2001, Connolly & al 1999		.	.
Germany	.	.	.	.	Ratios as used for UK (England and Wales)								
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	.
Lithuania	.	.	.	.	.	.	.	.	.	.	.	.	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.
Spain (Gallicia)	.	.	.	.	.	.	.	.	.	.	.	.	
Faroe Island	.	.	.	.	.	Clarke 2000, Clarke & al 2001, Connolly & al 1999						R	
Norway	.	.	.	.	.	.	.	.	.	.	.	Langedal et al, 1999,2000	

Table 3.6. Deepwater "siki" sharks in the northeast Atlantic. Working group estimate of total landings Portuguese dogfish (t). These data were erived from combined catches split according to ratios in Table 3.4 added to species-specific landings.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	76	696	1676	1873	2287	1497	1960	1795	1938	2309	2358	2616	1744	1279	730	683
UK (Scotland)	.	5	4	6	45	127	446	376	311	444	614	469	417	1725	962	1249	588	709
UK (England anc	.	.	.	28	22	47	104	266	280	639	433	459	186	144	151	1812	1625	555
Ireland	.	.	.	.	.	.	.	10	1	.	1	.	35	86	110	493	428	290
Iceland	.	.	.	.	1	1	.	.	.	.	3	.	.	.	.	.	.	.
Spain (Basque C	.	.	.	.	.	.	.	.	83	137	163	108	70	116	118	86	68	43
Portugal	.	.	2	656	696	607	576	810	777	928	859	568	632	641	586	572	548	509
Germany	.	.	.	.	40	25	97	25	44	31	12	96	119	194	233	288	.	32
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	4	.	.
Lithuania	.	.	.	.	.	.	.	.	.	.	.	.	.	10	33	25	.	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.
Spain (Gallicia)	.	.	.	.	.	.	.	.	.	.	.	.	383	437	1146	649	351	.
Faroe Island	.	.	.	.	.	1	.	17	82	66	46	41	15	.	.	.	.	.
Norway	.	.	.	.	.	.	.	.	.	.	.	3	67	391	74	.	19	.
Total	.	5	82	1386	2480	2681	3510	3001	3538	4040	4069	4053	4282	6360	5208	6457	4357	2821

Table 3.7. Deepwater "siki" sharks in the northeast Atlantic. Working group estimate of total landings leafscale gulper shark (t). These data were erived from combined catches split according to ratios in Table 3.4 added to species-specific landings.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	64	592	1428	1595	1525	1689	1670	1300	1239	770	1161	1068	359	175	459	183
UK (Scotland)	.	15	10	18	120	342	297	425	265	322	393	156	206	704	222	345	547	93
UK (England anc	.	.	.	76	58	127	283	720	756	1563	1061	560	227	176	184	2215	1986	978.73
Ireland	.	.	.	.	.	.	.	23	4	.	2	2	104	368	467	.	336	91
Iceland	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Spain (Basque C	.	.	.	.	.	.	.	.	203	336	398	342	210	492	503	633	495	316
Portugal	560	507	479	437	432	339	579	544	412	386	401	468	476	510	612	608	577	524
Germany	.	.	.	.	108	66	261	67	120	75	28	118	146	237	285	352	0	47.37
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.
Lithuania	.	.	.	.	.	.	.	.	.	.	.	.	.	4	7	3	.	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Spain (Gallicia)	.	.	.	.	.	.	.	.	.	.	.	.	189	178	235	88	275	.
Faroe Island	.	.	.	.	.	2	.	43	200	160	112	14	8	.	.	.	.	.
Norway	.	.	.	.	.	.	.	.	.	.	.	2	51	8	2	.	.	.
Total	560	522	553	1123	2146	2471	2945	3511	3630	4142	3636	2432	2778	3745	2886	4419	4675	2233.1

Table 3.8. Deepwater "siki" sharks in the northeast Atlantic. Leafscale gulper shark length frequencies (5 cm length classes).

	LONGLINE								Bottom trawl			
TL (cm)	North areas				South areas				North areas			
	Females	Males	Unsex	Total	Females	Males	Unsex	Total	Females	Males	Unsex	Total
35									1			1
40												
45												
50							1	1				
55		2	2	4			1	1				
60		4	1	5			2	2		2		2
65	1		1	2								
70	5		3	8	1	2	1	4				
75	65		6	71			6	6	1			1
80	100	7	6	113	1	2	6	9	1			1
85	67	28	4	99	10	5	48	63	7	5	2	14
90	188	97	4	289	28	22	137	187	31	10	2	43
95	319	164	9	492	26	24	150	200	56	29	6	91
100	288	201	6	495	23	34	96	153	69	57	4	130
105	204	379	6	589	13	81	120	214	60	90	14	164
110	124	336	2	462	8	76	109	193	54	64	8	126
115	50	94		144	6	18	47	71	22	30	7	59
120	35	7		42	10	2	25	37	25	2	7	34
125	34			34	13		27	40	30	1	10	41
130	22			22	5		17	22	35	2	8	45
135	4	1		5	1		5	6	19		3	22
140						1	1	2	7			7
145						1	1	2	1		1	2
150												
155												
160												
165									1			1
Total	1506	1320	50	2876	145	268	800	1213	420	292	72	784
Mean	101	106	90	103	105	106	104	104	111	107	116	110

Table 3.9. Deepwater "siki" sharks in the northeast Atlantic. Portuguese dogfish length frequencies (5 cm length classes)

TL (cm)	LONGLINE								Bottom trawl			
	North areas				South areas				North areas			
	Females	Males	Unsex	Total	Females	Males	Unsex	Total	Females	Males	Unsex	Total
25										1		1
30									1	1		2
35	1			1								0
40												0
45		1		1								0
50			1	1								0
55			2	2							2	2
60			2	2							2	2
65		1	2	3	3	5		8		1		1
70	8	7	1	16	6	6		12	3	5	1	9
75	21	14	2	37	22	32		54	8	4	1	13
80	32	26		58	48	56		104	11	14	1	26
85	45	91	2	138	37	92		129	6	93	2	101
90	66	205	3	274	45	88		133	10	192	4	206
95	81	65	2	148	47	20	1	68	10	51	4	65
100	251	5	12	268	123	1	3	127	30	2	8	40
105	614	4	14	632	301		3	304	102	1	19	122
110	393	7	11	411	254		2	256	75	1	9	85
115	88	1	1	90	67			67	27	1	2	30
120	7		3	10	7			7	2			2
125			1	1								0
130	1		1	2							1	1
135												
140			1	1								
145			1	1								
150			2	2								
Total	1608	427	64	2099	960	300	9	1269	285	367	56	708
Mean	106	91	103	103	105	87	106	101	103	88	98	95

Table 3.10. Deepwater "siki" sharks in the northeast Atlantic. Leafscale gulper shark , source of length frequency data used.

Source	Year	Females	Males	Unsex	Total	Subarea	Mean LT	Min LT	Max LT
France bottom trawl survey	1997	110	14	.	124	Vb, VI, VII	122	87	142
	1998	10	.	.	10	Vb, VI, VII	126	111	136
	Total	120	14	.	134	.	122	87	142
Ireland bottom trawl survey	1996	48	51	2	101	VI, VII	107	85	166
	1997	77	99	9	185	VI, VII	107	85	145
	2005	.	.	.	90	VIIc,VIIk	106	84	175
	Total	125	150	11	376	.	107	84	175
Ireland longline survey	1995	15	11		26	VI, VII, XII	107	89	132
	1997	259	182	16	457	VI, VII, XII	106	83	137
	1999	37	92	1	130	VI, VII, XII	104	77	133
	Total	311	285	17	613	.	106	77	137
Ireland bottom trawl observer	2003	91	.	.	91	VIIc	103	90	118
	Total	91	.	.	91	.	103	90	118
Ireland longline port sampling	2003	181	.	.	181	VIIk	102	81	121
	Total	181	.	.	181	.	102	81	121
Norway botoom longline survey	1996	33	21	42	96	VIIc, X	80	52	149
	1999	617	702	1	1320	VIb	103	77	136
	2000	381	325	8	714	XII	99	64	128
	Total	1031	1048	51	2130	.	101	52	149
Portugal longline fishery	2000	2	2	760	764	IXa	105	75	142
	2001	.	.	4	4	IXa	131	122	139
	2002	68	123	.	191	IXa	105	70	146
	2003	50	73	6	129	IXa	105	83	133
	2004	13	49	15	77	IXa	111	86	140
	2005	11	21	.	32	IXa	106	86	137
	Total	144	268	785	1197	IXa	105	70	146
UK (Scotland) bottom trawl survey	1996	1	.	1	2	VIa	85	39	130
	1997	.	.	60	60	VIa	117	86	138
	1998	30	27	.	57	VIa	109	91	132
	2000	25	45	.	70	VIa	105	82	138
	2002	23	43	.	66	VIa	102	63	117
	2004	5	13	.	18	VIa	103	91	118
	Total	84	128	61	273	.	108	39	138

Table 3.11. Deepwater "siki" sharks in the northeast Atlantic. Portuguese dogfish, source of length frequency data used.

Source	Year	Females	Males	Unsex	Total	Subarea	Mean LT	Min LT	Max LT
Francebottom trawl survey	1997	97	199	1	297	Vb, VI, VII	97	82	118
	1998	62	40		102	Vb, VI, VII	94	72	116
	Total	159	239	1	399		96	72	118
Ireland bottom trawl survey	1996	36	51		87	VI, VII	99	75	116
	1997	53	60		113	VI, VII	100	84	118
	2005	53	6	1	60	VIIc, VIIk	106	75	118
	Total	142	117	1	260		101	75	118
Ireland longline survey	1997	188	87	2	277	VI, VII, XII	101	46	119
	1999	128	73	2	203	VI, VII, XII	95	37	121
	Total	316	160	4	480		98	37	121
Ireland bottom trawl observer	2003	5			5	VIIc	110	100	123
	Total	5			5		110	100	123
Ireland longline port sampling	2003	20			20	VIIk	100	88	123
	Total	20			20		100	88	123
Norway bottom trawl survey	1998	1	2	43	46	VIb	104	72	130
	Total	1	2	43	46		104	72	130
Norway botoom longline survey	1996	2	6	29	37	VIIc, X	101	50	152
	1999	559	80	7	646	VIb	105	74	121
	2000	712	183	31	926	XII	102	66	130
	Total	1273	269	67	1629		103	50	152
Portugal longline fishery	1999	209	71		280	IXa	99	69	119
	2000	551	150	9	710	IXa	100	64	123
	2001	69	32		101	IXa	96	73	117
	2002	6	8		14	IXa	83	67	115
	2003	40			40	IXa	107	87	116
	2004	75	37		112	IXa	95	75	119
	2005	10	2		12	IXa	101	82	118
	Total	960	300	9	1269		99	64	123
UK (Scotland) bottom trawl survey	1996	1	1	2	4	Via	85	75	96
	1997			10	10	Via	82	57	119
	1998	5	1		6	Via	103	74	122
	2000	9	9		18	Via	88	29	115
	2002	10	2		12	Via	87	32	109
	2004	6	2		8	Via	90	32	114
	Total	31	15	12	58		89	29	122

Table 3.12. Deepwater "siki" sharks in the northeast Atlantic. Fecundity (ovarian and uterine), length at first maturity, length-at-first pregnancy and maximal total length sampled for both sexes , measurements in cm (Moura *et al.*, 2006)

	FEMALES							MALES	
	Nº of oocytes	Mean ovarian fecundity	Nº of embryos	Mean uterine fecundity	1st maturity	1st pregnancy	Lmax	1st maturity	Lmax
C. coelolepis	4-30	13.13+-5.35	6-25	11.58+-3.7	102.7 (r^2=0.97) [a]	114.9 (r^2=0.85) [a]	122	95.1 (r^2=0.41) [a]	100
					102.0 (r^2=0.99) [b]	118.3 (r^2=0.83) [b]		94.0 (r^2=0.35) [b]	
C. squamosus	5-17	9.00 ± 1.79	6*	8[d]	125,3 cm (r^2=0.87) [c]	132.6 cm (r^2=0.79) [c]	144	99.2 cm (r^2=0.988) [c]	120

a. Data restricted to the period from March to May

b Data restricted to the period from October to December

c Data restricted to the period from April to November

d Estimated based in one sample

e Probably underestimated

f Minimum length of a mature male registered (maximum length of immature = 105.5 cm)

Table 3.13. Deepwater "siki" sharks in the northeast Atlantic. Length at birth (in mm) and embryos sex-ratio (Moura *et al.*, 2006).

	Length at birth	Embryos sex ratio
C. coelolepis	300	1:1
C. squamosus	440	-

Table 3.14. Deepwater "siki" sharks in the northeast Atlantic. Summary of the CPUE series available

SOURCE	DESCRIPTION	COMMENTS
SGDEEP2000	Standardised CPUE from the commercial French fleet using directed catch and effort data through a multiplicative model with month and area as factors **Period**: 1989-1998 **ICES Subareas**: VI, VII and Division Vb.	In each fishing trip of trawler, the catch in each statistical rectangle visited is considered as a directed catch if it represents more than 10% of the total catch.
WGDEEP2002	CPUE from a reference fleet of French trawlers for the combined species C.coelolepis and C. squamosus, collectively "sikis" **Period**: 1990-2001 **ICES Subareas**: V, VI, VII (all areas combined).	Effort represents total effort, rather than effort directed at deepwater squalid sharks. Deep-water sharks were evaluated at WGDEEP
SGEF2002	Reworked raw data of siki from catch and effort of French trawl fishery presented at WGDEEP2002 **Period**: 1990-2001 **ICES Subareas**: V, VI, VII (all areas combined).	
WGEF2005	CPUE from Portuguese longliner logbooks for each species separately C. coelolepis and C. squamosus. **Period**: 2000-2004 **ICES Subarea**: IX	Preliminary estimates due to gaps on information.
WGEF2005	CPUE from Irish longline surveys for each species separately C. coelolepis and C. squamosus. **Period**: 1997, 1999, 2000 **ICES Subarea**: VII	
WGEF2005	CPUE from Irish commercial trawlers for C. coelolepis. **Period**: 2001-2004 **ICES Subarea**: VII	
WGEF2005	CPUE from Scottish trawl surveys for each species separately C. coelolepis and C. squamosus. **Period**: 2000-2002, 2004 **ICES Subarea**: VI	
WGEF2005	CPUE from Norwegian longliners surveys for each species separately C. coelolepis and C. squamosus. **Period**: 1999-2004 **ICES Subarea**: XII	
WGEF2005	CPUE from Norwegian commercial longliners for each species separately C. coelolepis and C. squamosus. **Period**: 2000-2001 **ICES Subarea**: XII	
WGEF2005	CPUE from Portuguese longliner logbooks for each species separately C. coelolepis and C. squamosus. **Period**: 2000-2004 **ICES Subarea**: IX	
WGEF2006 (Biseau, 2006WD)	French log-books database, all fishing sequences with one of the 'deep water species ' as listed in the EC regulation 2347/2002 **Period**: 1989 to 2005 **ICES Subarea**: V, VI, VII	Overall landings and effort for "sikis", which comprise several species not fully separated in the French statistics. **Presented in graphical form only**
WGEF2006 (Figueiredo and Machado, 2006, WD)	Standardized estimates of CPUE from Portuguese longliner logbooks for each species separately C. coelolepis and C. squamosus **Period**: 1999-2006 **ICES Subarea**: IX	

Table 3.15. Deepwater "siki" shark in the northeast Atlantic. portuguese dogfish CPUE series available to WG by ICES Subarea, Country (PR-Portugal; FR-France; SC- UK(Scotalnd); IR – Ireland; NR- Norway), Fishing Gear (TRAWL, LL – Longline) and source (COM- commercial; SURV- survey). Units for LL – Kg/1000Hooks; Trawl- Kg/hour

ICES Subarea	IX	V	VI	VI	VII	VII	VII	VII	XII	XII	XII
Country	PR	FR	FR	SC	FR	IR	IR	IR	FR	NR	NR
Gear	Longline	Trawl	Trawl	Trawl	Trawl	Longline	Longline	Trawl	Trawl	Longline	Longline
Unit	Kg/1000	Kg/h	Kg/h	Kg/h	Kg/h	Kg/1000	Kg/1000	Kg/h	Kg/h	Kg/1000	Kg/1000
Source	COM	COM	COM	SURV	COM	COM	SURV	COM	COM	COM	SURV
1990	.	.	26	.	.	.	.	.	.	.	.
1991	.	10	57	.	43	.	.	.	43	.	.
1992	.	28	57	.	44	.	.	.	44	.	.
1993	.	42	56	.	61	.	.	.	61	.	.
1994	.	56	42	.	59	.	.	.	59	.	.
1995	.	46	27	.	48	.	.	.	48	.	.
1996	.	68	25	.	49	.	.	.	49	.	.
1997	.	34	30	.	46	.	158	.	46	.	.
1998	.	35	26	.	54	.	.	.	54	.	.
1999	.	26	21	.	55	.	107	.	55	87	83
2000	.	70	40	2	40	.	.	.	40	98	92
2001	1046	18	97	.	40	78	.	21	40	52	.
2002	978	.	.	1	.	48	.	8	.	18	.
2003	906	.	.	.	.	16	.	4	.	15	.
2004	911	.	.	1	.	.	.	2	.	.	.
2005	940	.	.	.	.	.	.	1	.	.	.
2006	973	.	.	.	.	.	.	.	.	.	.

Table 3.16. Deepwater "siki" shark in the northeast Atlantic. Leafscale gulper shark CPUE series available to WG by ICES Subarea, Country (PR-Portugal; FR-France; SC- UK(Scotalnd); IR – Ireland; NR- Norway), Fishing Gear (TRAWL, LL – Longline) and source (COM- commercial; SURV- survey). Units for LL – Kg/1000Hooks; Trawl- Kg/hour

ICES Subarea	IX	V	VI	VI	VII	VII	VII	VII	XII	XII	XII
Country	PR	FR	FR	SC	FR	IR	IR	IR	FR	NR	NR
Gear	Longline	Trawl	Trawl	Trawl	Trawl	Longline	Longline	Trawl	Trawl	Longline	Longline
Unit	Kg/1000	Kg/h	Kg/h	Kg/h	Kg/h	Kg/1000	Kg/1000	Kg/h	Kg/h	Kg/1000	Kg/1000
Source	COM	COM	COM	SURV	COM	COM	SURV	COM	COM	COM	SURV
1990	.	.	18	.	.	.	.	.	.	.	.
1991	.	6	38	.	28	.	.	.	28	.	.
1992	.	19	38	.	30	.	.	.	30	.	.
1993	.	28	38	.	41	.	.	.	41	.	.
1994	.	37	28	.	40	.	.	.	40	.	.
1995	.	51	30	.	53	.	.	.	53	.	.
1996	.	58	21	.	41	.	.	.	41	.	.
1997	.	24	22	.	33	.	56	.	33	.	.
1998	.	23	17	.	35	.	.	.	35	.	.
1999	.	9	7	.	18	.	51	.	18	138	219
2000	.	11	19	7	20	.	.	.	20	14	42
2001	34	8	39	.	16	182	.	35	16	2	.
2002	32	.	.	7	.	192	.	.	.	.	.
2003	74	.	.	.	.	144	.	.	.	.	.
2004	.	.	.	2	.	.	.	5	.	.	.
2005	71	.	.	.	.	.	.	2	.	.	.

Table 3.17. Deepwater "siki" shark in the northeast Atlantic. Technical interactions of deepwater species.

	Ling	Tusk	Blue ling	Roundnose grenadier Vb,VIa, VIb2,VII,XIIa2	Roundnose grenadier VIII, IX	Roundnose grenadier X	Roundnose grenadier VIb1, XIIb	Roundnose grenadier XIVb1, XIVa1, XIIc	Orange roughy V	Orange roughy VI	Orange roughy VII	Orange roughy VIII, IX	Orange roughy X, XII	Black scabbardfish V,VI,VII, XII	Black scabbardfish VIII, IX, X	Greater forkbeard	Mora	Red seabream V,VI and VII	Red seabream IX	Red seabream X	Alfonsinos VI, VII, VIII, IX	Alfonsinos X	Portuguese dogfish NEA	Leafscale gulper shark NEA	Rabbitfish	Wreckfish	Deepwater red crab	Kitefin shark	Anglerfish (N Shelf)	Anglerfish (S shelf)	Anglerfish (Iberia)	Baird's smoothheads (VIb1, XIIb)
Ling	A	B	B	0	0	0	0	0	0	0	0	0	0	0	0	S	S	0	0	0	0	0	S	S	M	0	0	0	B	B	0	0
Tusk	A		B	0	0	0	0	0	0	0	0	0	0	0	0	S	S	0	0	0	0	0	S	S	M	0	0	0	0	0	0	0
Blue ling	A	A	T,G	B	S	S	B	B	B	B	B	S	S	B	S	B	M	0	0	0	0	0	S	S	M	0	0	0	L	L	0	0
Roundnose grenadier Vb,VIa, VIb2,VII,XIIa2			T		0	0	0	0	B	B	B	0	B	B	B	M	S	0	0	0	0	0	B	B	B	0	S	0	0	0	0	0
Roundnose grenadier VIII, IX			T			0	0	0	0	0	0	S	0	0	S	S	S	0	0	0	0	0	S	S	S	0	S	0	0	0	0	0
Roundnose grenadier X			T				0	0	0	0	0	0	B	0	0	M	S	0	0	0	0	0	M	M	M	0	S	0	0	0	0	0
Roundnose grenadier VIb1, XIIb			T				T	0	0	0	0	0	B	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	0	B
Roundnose grenadier XIVb1, XIVa1, XIIc			T						0	0	0	0	B	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	0	0
Orange roughy V			T	T					T	0	0	0	0	B	0	B	S	0	0	0	0	0	M	M	M	0	S	0	0	0	0	0
Orange roughy VI			T	T						T	0	0	0	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	NA	0
Orange roughy VII			T	T							T	0	0	B	0	B	S	0	0	0	0	0	B	B	B	0	S	0	0	0	NA	0
Orange roughy VIII, IX			T		T					O		T	0	0	B	B	S	0	0	0	0	0	B	B	B	0	NA	0	0	0	NA	0
Orange roughy X, XII			T	T		T	T	T		O			T	B	0	M	S	0	0	0	0	0	B	B	B	0	NA	B	0	0	NA	B
Black scabbardfish V,VI,VII, XII			T	T			T	T	T	T	T	T	T		B	B	S	0	0	0	0	0	B	B	B	0	S	B	0	0	NA	B
Black scabbardfish VIII, IX, X			L	T	T	T				O		T	T		T	B	B	0	S	S	S	S	B	B	B	0	0	B	0	0	NA	0
Greater forkbeard	A	A	T, L	T	T	T	NA	NA	T	T	T	T	T	T	L		M	0	S	S	S	S	B	B	B	0	NA	M	M	M	NA	B
Mora	A	A	L	T	T	T	T	T	T	T	T	T	T	T	L	L,G,A		S	S	S	S	S	B	B	M	NA	M	B	L	L	S	S
Red seabream V,VI and VII															L	L	L		0	0	M	0	S	S	S	NA	S	S	0	0	NA	0
Red seabream IX															L	L	L			0	NA	0	S	S	S	NA	NA	S	0	0	NA	0
Red seabream X															L	L	L			L	0	B	S	S	M	NA	NA	S	0	0	NA	0
Alfonsinos VI, VII, VIII, IX															L	L	L	T				0	S	S	S	B	NA	S	0	0	NA	0
Alfonsinos X															L	L	L			L		L	S	S	S	B	NA	S	0	0	NA	0
Portuguese dogfish NEA	A	A	A,T,G	T	T	T	T	T	T	T	T	T	T	T	L	L,T,G,A	L,G,A		T	L		L	L (IXa)	B	B	NA	NA	B	M	M	NA	B
Leafscale gulper shark NEA	A	A	A,T,G	T	T	T	T	T	T	T	T	T	T	T	L	L,T,G,A	L,G,A		T	L		L		L (IXa)	B	NA	NA	B	M	M	NA	B
Rabbitfish	A	A	A,T,G	T	T	T	T	T	T	T	T	T	T	T	L	L,T,G,A	L,G,A		T	L		L	L,T,G,A	L,T,G,A		NA	NA	B	M	M	NA	B
Wreckfish																						L	L	L	L	I	NA	NA	0	1	NA	0
Deepwater red crab																G	G						G	G	G		P	NA	M	M	NA	0
Kitefin shark	A	A	A,T,G	A		T	T	T			T	T	T	L	L	L	L		L	L		L	L,T,G	L,T,G	L,T,G	L,T,G		L,G (X)	0	0	NA	0
Anglerfish (N Shelf)	T		T													T							T,G	T,G	T,G		G			0	0	0
Anglerfish (S shelf)	T		T													T							T,G	T,G	T,G		G				0	0
Anglerfish (Iberia)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		0
Baird's smoothheads (VIb1, XIIb)			T				T						T	T		T							T	T	T							
T = trawl, A = Autoline; L = Artisanal longline; G = Gillnet; P = Crab pots. Target fisheries indicated, by gear in main diagonal	B; the stocks are taken together in most fisheries where they are taken and their fisheries linkage is therefore high; M: the stocks are taken together in some but not all important fisheries and their fisheries linkage is therefore medium; S: the stocks are taken together in some fisheries but are mainly caught independently of each other and their fisheries linkage is therefore low; 0: the stocks are never or only rarely caught together and they are thus not linked in the fisheries; na: information not available.																															

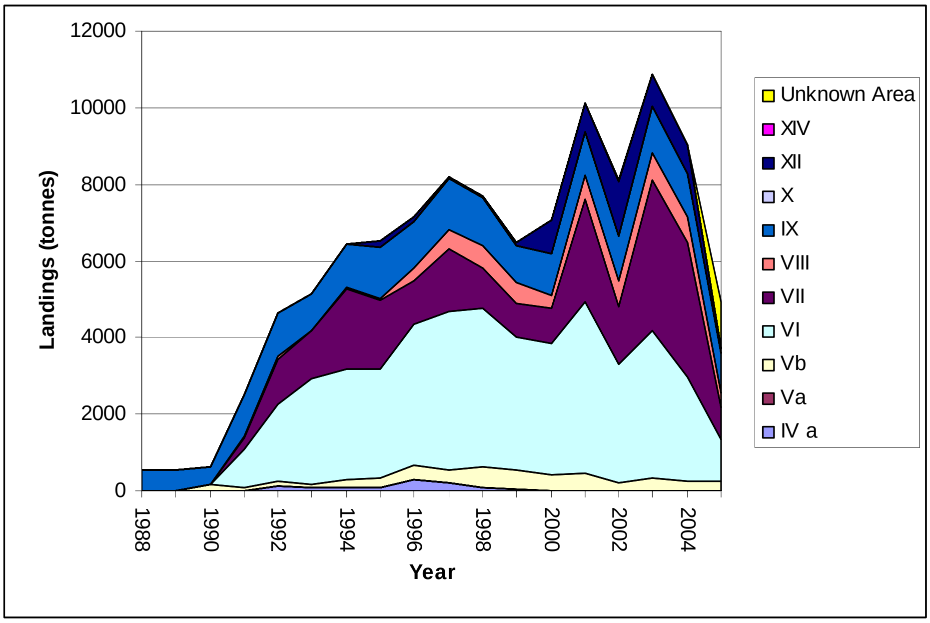

Figure 3.1. Deepwater “siki” shark in the northeast Atlantic. International landings by ICES Subarea or Division.

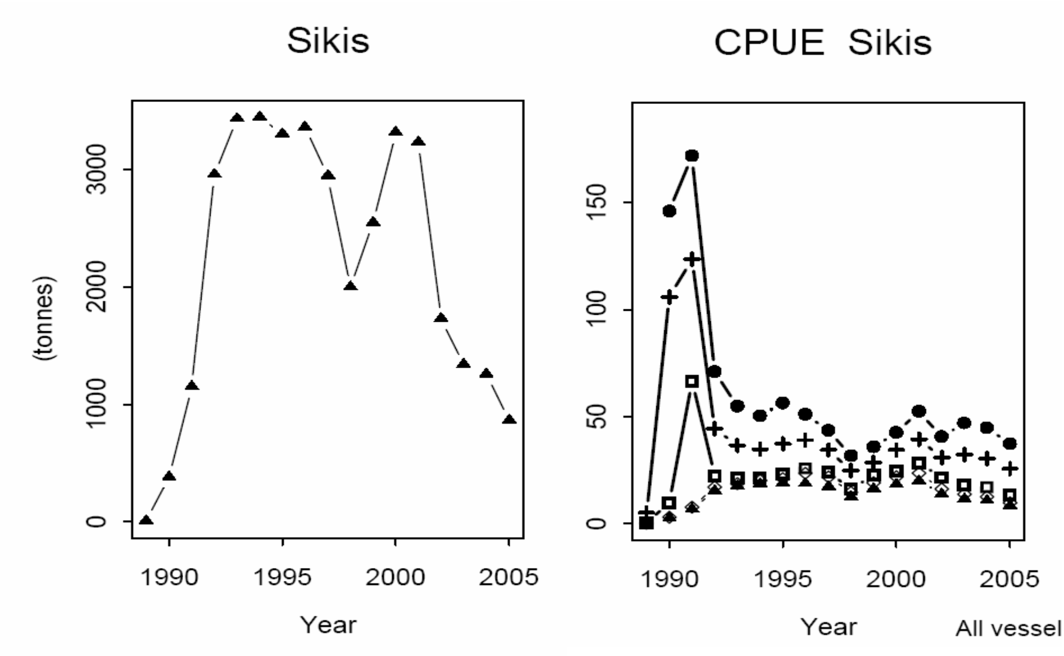

Figure 3.2. Deepwater “siki” shark in the northeast Atlantic. French landings of “sikis” for All vessels in All Areas in All deep waters fishing sequences (1998 partial) (left). In the right French CPUE estimates Black circle = Sequences with Species > 10% Cross = Sequences with Species > 5% White square = Sequences with Species White diamond = Sequences with Grenadier+Blackscabbard+Sikis Black triangle = All deep waters fishing sequences (Biseau, 2006 WD).

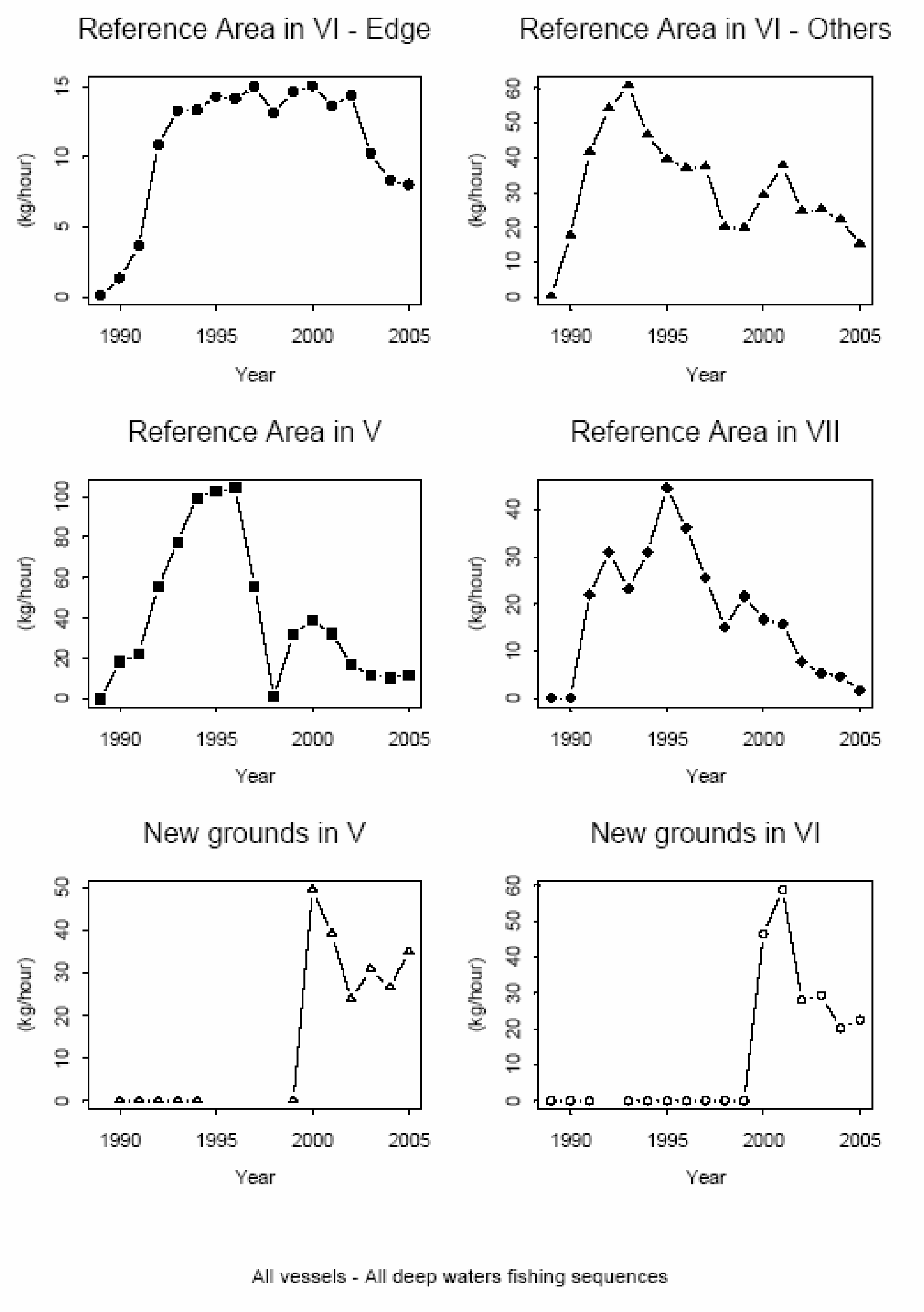

Figure 3.3. Deepwater "siki" shark in the northeast Atlantic. French CPUE of "sikis" by ICES Subarea (Biseau, 2006 WD)

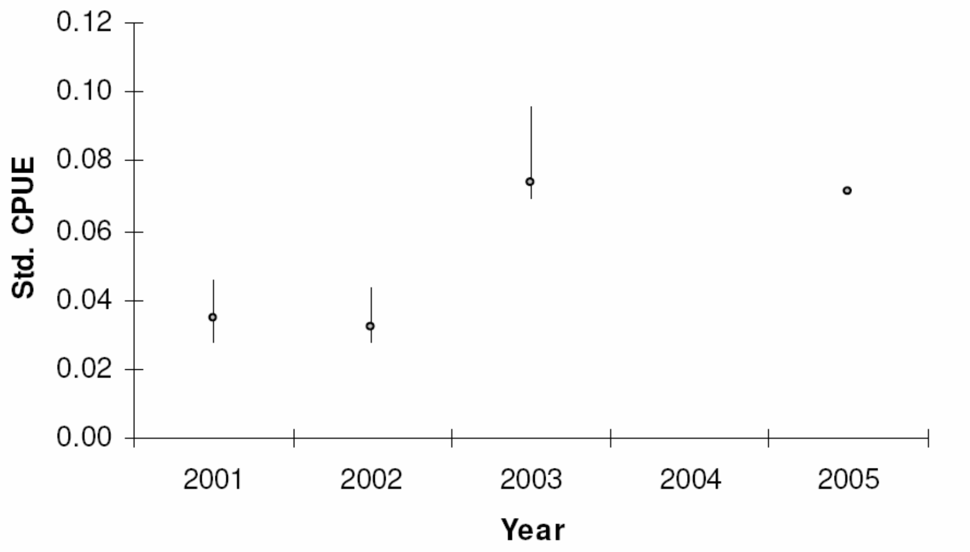

Figure 3.4. Deepwater "siki" shark in the northeast Atlantic. Portuguese dogfish, Portuguese longline standardized and unstandardized CPUE values from ICES Subarea IX (Figueiredo and Machado, 2006 WD)

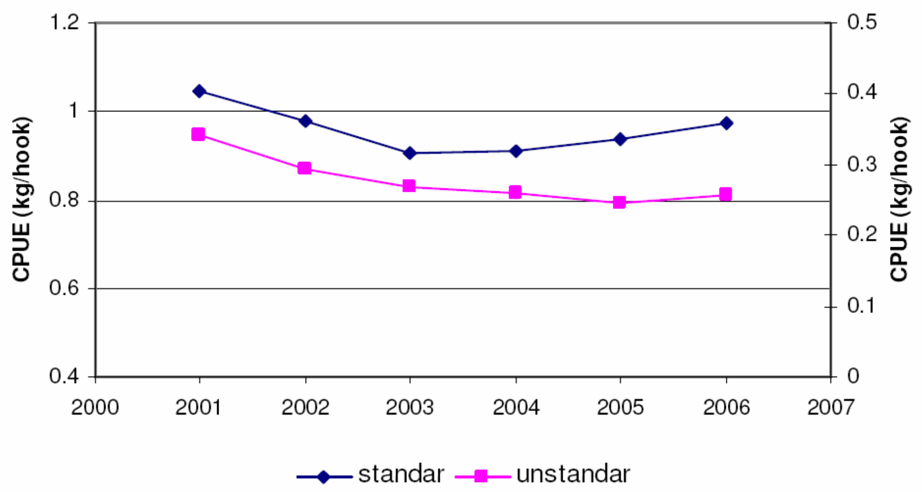

Figure 3.5. Deepwater "siki" shark in the northeast Atlantic. Leafscale gulper shark, Portuguese longline standardized median CPUE values (+/- 75 and 25 % percentiles) from ICES Subarea IX (Figueiredo and Machado, 2006 WD)

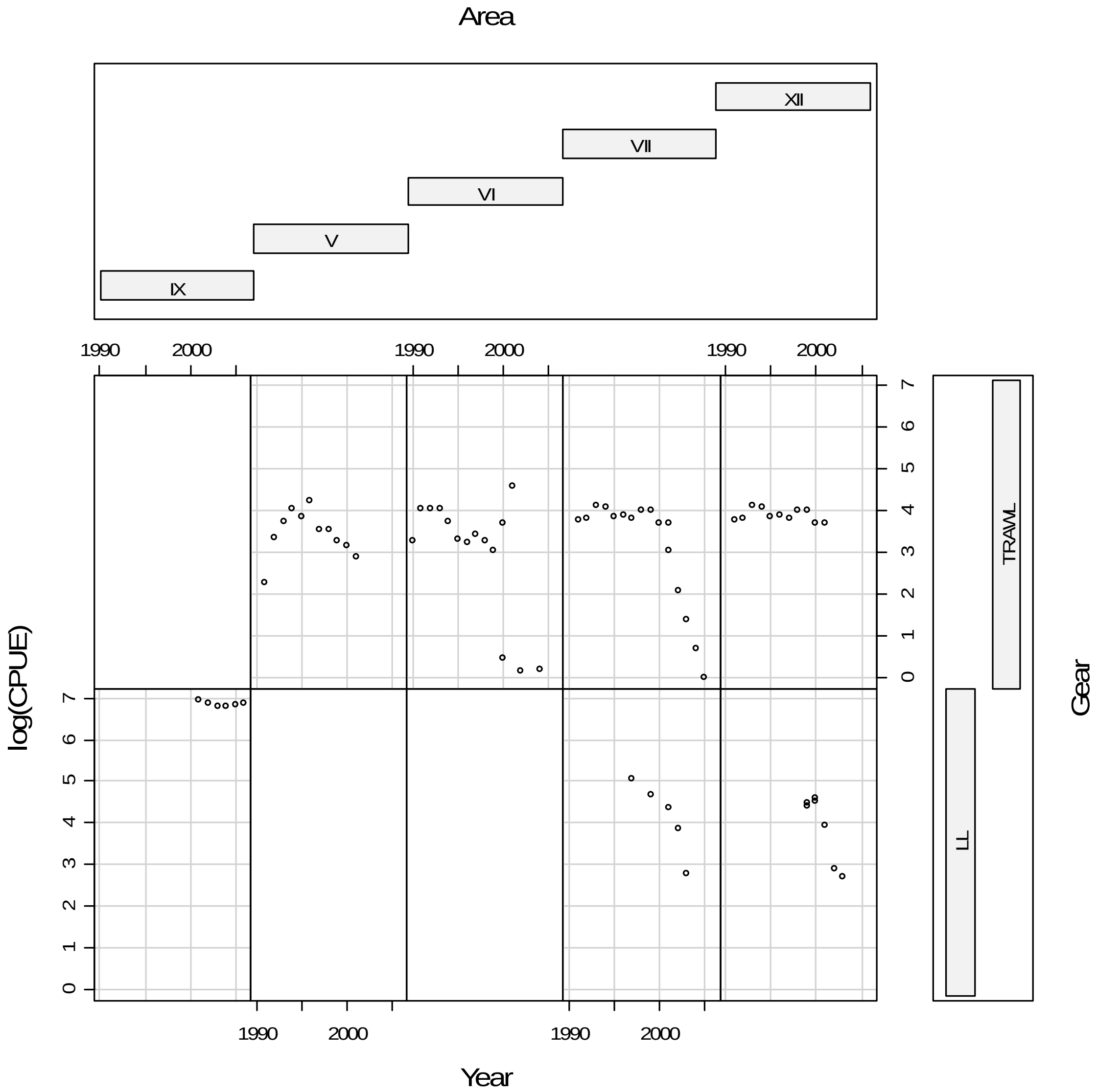

Figure 3.6. Deepwater "siki" shark in the northeast Atlantic. Portuguese dogfish log transformed unstandardized CPUE estimates by year conditioned by Area and by Gear

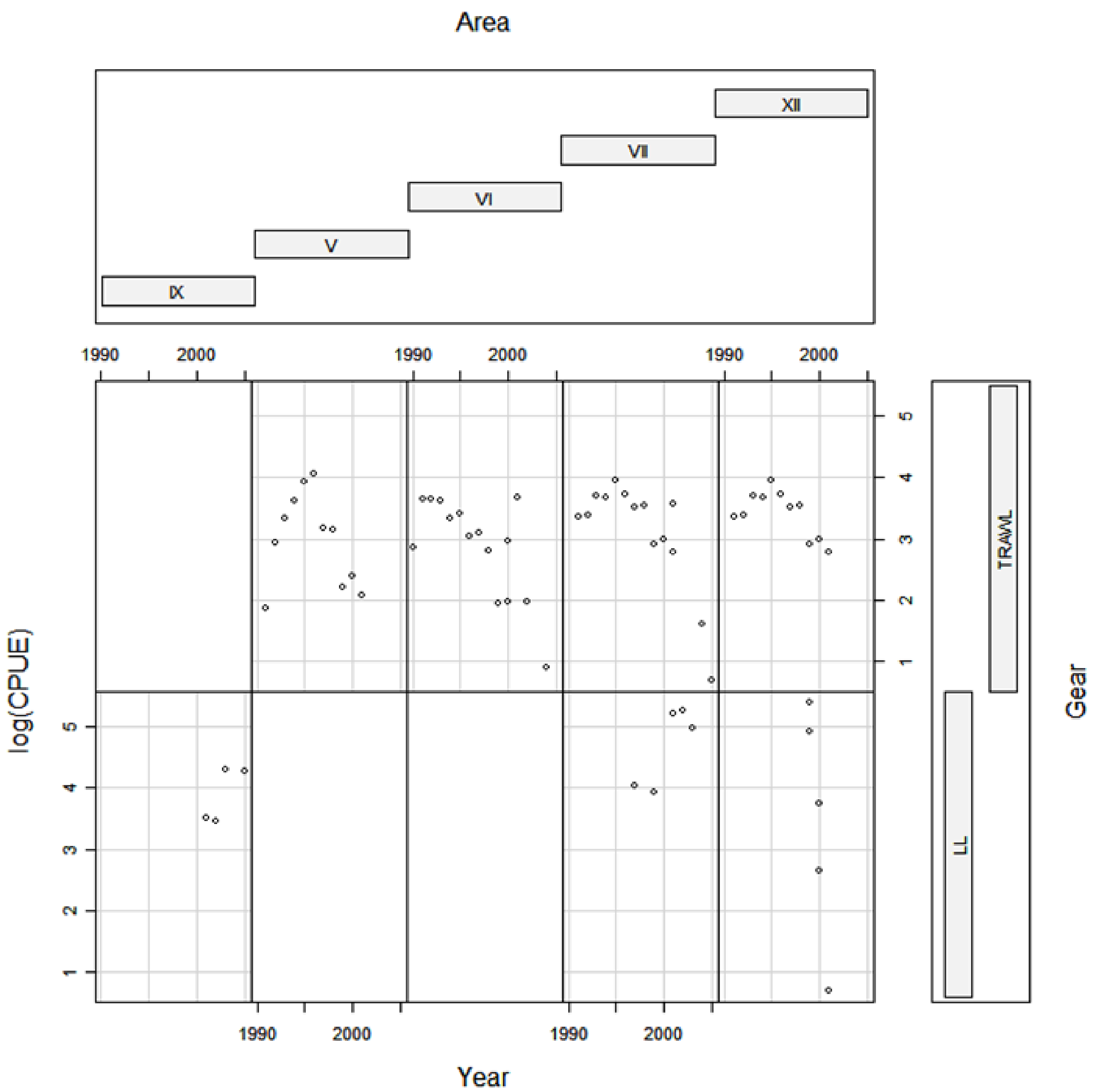

Figure 3.7. Deepwater "siki" shark in the northeast Atlantic. Leafscale gulper sharklog transformed unstandardized CPUE estimates by year conditioned by Area and by Gear

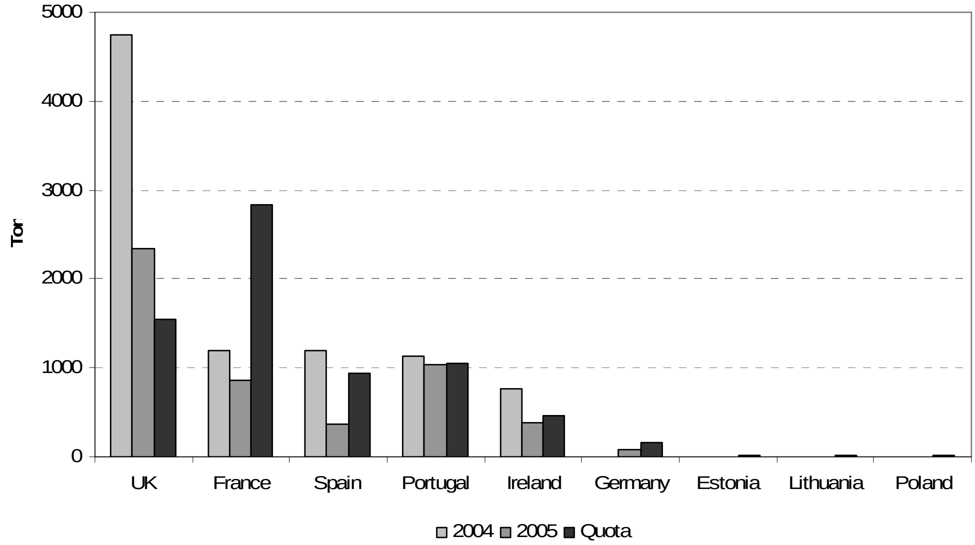

Figure 3.8. Deepwater "siki" shark in the northeast Atlantic. Current quota and WG estimates of landings in 2005.

4 Other deepwater sharks from the northeast Atlantic (ICES Subareas IV–XIV)

The present section includes information about deep-water species other than Portuguese dogfish, leafscale gulper shark and kitefin shark. In general, these species have lower commercial value than the species dealt with in the previous section. Little information exists on the majority of the species presented here other than the annual landings composition data which are probably incomplete.

The species and generic landings categories (includes more than one species) presented are:

Gulper shark (*Centrophorus granulosus*), birdbeak dogfish (*Deania calceus*), longnose velvet dogfish (*Centroscymnus crepidater*), black dogfish (*Centroscyllium fabricii*), velvet belly (*Etmopterus spinax*), blackmouth catshark (*Galeus melastomus*), Greenland shark (*somniosus microcephalus*), lantern sharks NEI (*Etmopterus* spp.), and ‘aiguillat noir’.

4.1 The fishery

4.1.1 Advice and management applicable

ICES advice on deepwater sharks mainly relates to the species mentioned in Section 3 and kitefin shark (Section 5).

In EC waters, a combined TAC is set for a group of deep-water sharks. These include; Portuguese dogfish (*Centroscymnus coelolepis*), Leafscale gulper shark (*Centrophorus squamosus*), Birdbeak dogfish (*Deania calceus*), Kitefin shark (*Dalatias licha*), Greater lanternshark (*Etmopterus princeps*), Velvet belly (*Etmopterus spinax*), Black dogfish (*Centroscyllium fabricii*), Gulper shark (*Centrophorus granulosus*), Blackmouth dogfish (*Galeus melastomus*), Mouse catshark (*Galeus murinus*), Iceland catshark (*Apristuris spp.*). In Subarea XII, *Deania histicosa* and *Deania profundorum* are added to this list.

The TAC for sub-areas V, VI, VII, VIII and IX is 6763 tonnes. In Sub-area X the TAC is 120 tonnes. In Sub-area XII for these and other species is 243 t.

In 2006, the EC banned the setting of gillnets in waters greater than 200m in ICES Divisions VI a, b and VII b, c, j, k and Subarea XII; this regulation will be reviewed during 2006.

4.1.2 Description of the fishery

Most catches of other deepwater shark species are taken in mixed trawl, longline and gillnet fisheries together with Portuguese dogfish and leafscale gulper shark. These fisheries were described in some detail in Section 3 of ICES 2005.

Divisions IXa and X

Gulper shark

Gulper shark *Centrophorus granulosus* was the main target of a directed longline fishery for deep-water sharks, which started in 1983 in northern Portugal (STECF, 2003), but that is now finished. The species is occasionally captured by the Portuguese black scabbardfish longline fishery in Subarea IX.

Other species

The other deep-water species are captured by artisanal fisheries operating in ICES Subareas IX and X. Reference to these fisheries is made in Section 3. The crustacean trawl fishery operating in Subarea IX captures species such as birdbeak dogfish, black mouth catshark and lantern sharks but these are mainly discarded.

Subareas IV, V, VI, VII, VIII and XII

Greenland shark Somniosus microcephalus

In recent years most reported landings are from Iceland (Figure 4.1). Norway conducted a direct fishery for this species between 1800 and 1960 (Moltu, 1932; Rabben 1982). Up to 1900 the fishery was conducted in fjords and coastal areas. After 1900 the fishery was expanded to offshore grounds and in 1927 to distant waters in Denmark Strait and East Greenland. Only the liver was landed by Norway. The landings of liver after 1910 are shown in Figure 4.2 No conversion factor for liver weight to whole weight is established for this species.

The Greenland shark is caught as bycatch mainly in Norwegian, Faroese and Icelandic longline fisheries for ling tusk and Greenland halibut. No further information is available. Biological composition of the catch

Gulper shark *Centrophorus granulosus*

Landings of gulper shark are presented in Table 4.1. Five European countries have reported landings: UK (England and Wales and Scotland), France, Spain and Portugal.

The trend of Portuguese landings in subarea IX reflects the activity of the target longline fishery mentioned above. The Portuguese landings from subarea X are considered underestimated since the species is mainly discarded (Pinho, 2005, 2006). Other countries reported very small landings from sub-areas VI and VII since 2002. Reported landings of this species by UK vessels were considered to be misidentified leafscale gulper sharks.

Birdbeak dogfish *Deania calceus*

Landings of birdbeak dogfish are presented in Table 4.2. Four European countries have reported landings on Birdbeak dogfish: UK (England and Wales and Scotland), Spain and Portugal.

The Portuguese landings from subareas IX and X are considered underestimated since the species is mainly discarded. The majority of Spanish landings are from sub-area XII, where values have been decreasing. No Spanish data are available for 2004.

Longnose velvet dogfish *Centroscymnus crepidater*

Landings of longnose velvet dogfish are presented in Table 4.3. Five European countries have reported landings: UK (England and Wales and Scotland), France, Spain and Portugal.

Landings in 2005 were highest recorded, largely due to the inclusion of catches from UK Gill-netters. France reported landings from almost every sub-area/ division considered, however, the figures were very low. Spain presented annual values over 50 tonnes / year in sub-area XII in 2000 and 2001, but after that no data were made available. The Portuguese landings from subareas IX and X are considered underestimated since the species is mainly discarded.

Black dogfish *Centroscyllium fabricii*

Landings of Black dogfish are presented in Table 4.4. Four European countries have reported landings: UK, Iceland, France and Spain.

France has reported the majority of the landings on black dogfish in the ICES area. This country has started to report landings in 1999. French annual landings on the species have decreased from about 250 tonnes in 2000 to nearly 30 tonnes in 2004. These landings are mainly from Division Vb and Subarea VI. Iceland presented very few landings, being all from Division Va. The largest annual landings reported by Spain came from Subarea XII in 2000 (85 Tonnes) and 2001 (91 Tonnes).

Landings of this species may also be included in the grouped category “Aiguillat noir”

Velvet belly *Etmopterus spinax*

Landings of velvet belly are presented in Table 4.5. Three European countries have reported landings on velvet belly: Denmark, UK (E&W) and Spain.

Greatest landings are from Denmark. Landings began in 1993, peaked in 1998 at 300 tonnes and have since declined to under 10 tonnes.

Blackmouth dogfish *Galeus melastomus*

Landings of blackmouth dogfish are presented in Table 4.6. Three European countries have reported landings on blackmouth catshark: Ireland, Spain and Portugal.

Portuguese landings began in 1990, rose to over 30 tonnes in 1996 and have remained steady at that level. Spanish landings began in 1996, peaked at 35 tonnes in 2002 and have since declined to low levels.

Lantern sharks *NEI* (*Etmopterus* spp)

Landings of lanternsharks NEI are presented in Table 4.7. Three European countries have reported landings on Lantern sharks NEI: France, Spain and Portugal.

Portuguese landings mainly referred to *Etmoptrus spinax* and *Etmopterus pusillus* and both are highly (sub-area IX) or totally (Subarea X) discarded. French landings began in 1994, peaked at 3000 tonnes in 1996 then declined to less than 10 tonnes by 1999. Spanish landings began in 2000, peaked at over 300 tonnes in 2002. Spanish landings data have not been available since 2003.

Landings of these species may also be included in the grouped category “Aiguillat noir”

“Aiguillat noir”

This is a generic category only used by France to register landings on small deepwater squalid sharks, including black dogfish, longnose velvet dogfish and lantern sharks NEI. Landings of aiguillat noir are presented in Table 4.8. Landings of aiguillat noir are presented in Table 4.6. French landings were over 100 tonnes in 2000 and 2001 but have since been less than 40 tonnes.

Quality of catch and biological data

Unknown quantities of deep-water species are landed in grouped categories such as “sharks NEI” and “Dogfish NEI” and so catches presented here are probably under estimated. Landings reported by UK vessels for 2003/2004 were considered to be unreliably identified and were therefore amalgamated into a mixed deepwater sharks (siki) category together with Portuguese dogfish and leafscale gulper shark. In 2005 UK landings, most species were considered to be reliably identified however, reported landings of gulper shark are still considered to be unreliable and have been added to landings of leafscale gulper shark.

Length and age frequencies

No new information is available.

4.2 Fishery-independent information

Azorean demersal longline survey in X

The spring demersal bottom longline survey conducted annually by DOP (1995–2005) showed that *Etmopterus* spp. *and Deania* spp were the most abundant deep-water elasmobranchs (Pinho, 2006 WD). Length compositions of these species from surveys are resumed in Figures 4.3 and 4.4.

Greenland demersal surveys in XIVb

Groundfish research surveys were done by Iceland in SA Va and by Greenland and Germany in XIVb (Jørgensen, 2006 WD). Since 1998, the Greenland surveys have covered the area between 61º45' N and 67º N at depths from 400 to 1500 m and in total 341 trawl hauls have been made. The surveys are conducted with an ALFREDO III trawl.

***Somniosus microcephalus* (Greenland shark)**

Nine specimens were recorded from 532–1112 m and temperatures between 1.4–4.9ºC. The most northern observation was at 65º 17' N. The length ranged between 325 and 420 cm.

***Centrocyllium fabricii* (black dogfish)**

This species was the most commonly captured elasmobranch: 812 specimens at depths of 415–1492 m, mainly between 800–1100 m (Figure 4.5). The species was observed in the temperature range between 0. 6 and 5.1ºC but it was most common at temperatures above 3.5ºC. The length ranged from 16 to 91 cm. (Figure 4.6).

Length frequency information of Greenland sharks, from Norwegian exploratory surveys in east Greenland are presented in Figure 4.7.

Scottish deepwater surveys in Division VIa

FRS has been conducting deepwater surveys (depth range 300–1900 m) to the West of Scotland since 1996. Since 1998, these have been reasonably consistent in terms of survey design, gear and area covered. Chondricthyan species diversity in the survey peaks between 1000–1500 m with 11 species of skate and ray and 6 chimaera species. The most abundant species in terms of catch rate in Kg hr^{-1} are *C. crepidator* and *D. calceus*. A more detailed preliminary analysis of the catch rate data of eight of the Squaliforme species is presented in Jones *et al.* (2005).

4.3 Catch per unit of effort

No new information is available.

4.4 Discards

Birdbeak dogfish

Discard data for west and north of Ireland showed higher rates on the southern slopes of the Rockall Trough and on the south-western slopes of the Porcupine bank (Clarke, 2002).

Other species

Deepwater sharks taken in the Azores are usually processed onboard or discarded. Only the trunks and, in some cases, the livers are used. Whenever these fish are landed, the real weight of the deep-water landings is probably underestimated (Pinho, 2005 2006 WD).

4.5 Mean length, weight, age, maturity, natural mortality

No new information available.

4.6 Stock assessment

No assessment studies were conducted so far.

4.7 Stock status

No new information is available.

4.8 Reference points

No reference points have been proposed for any of these species stocks.

4.9 Management considerations

In the continental slopes of Europe these species should be managed in a multi-species context with particular attention to the management of leafscale gulper shark and Portuguese dogfish (Section 3).

4.10 References

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Table 4.1. Other deepwater sharks. Working group estimates of landings of gulper shark.

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
UK (Scotland)	+	+	+	+	+	+	+	+	+	+	+	+	+	2	n.a.	+
UK (England and Wales)	+	+	+	+	+	+	+	+	+	+	+	+	+	23	17	+
Ireland	+	+	+	+	+	+	+	+	+	+	+	+	+	2	n.a.	n.a.
Portugal	1056	801	958	886	344	423	242	291	187	95	54	96	159	203	89	62
Spain	+	+	+	+	+	+	+	+	+	+	+	+	8	+	n.a.	n.a.
total	1056	801	958	886	344	423	242	291	187	95	54	96	167	230	106	62

Table 4.2. Other deepwater sharks. Working group estimates of landings of birdbeak dogfish.

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Spain	.	.	.	.	.	.	.	.	.	.	.	.	5	n.a.	n.a.	n.a
UK (England and Wales)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	47
UK(Scotland)	.	.	.	.	.	.	.	.	.	.	.	1	+	3	38	2
Portugal	.	.	.	.	.	.	.	.	.	.	13	37	67	72	157	145
Total	.	.	.	.	.	.	.	.	.	.	13	38	72	75	195	194

Table 4.3. Other deepwater sharks. Working group estimates of landings of longnose velvet dogfish.

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	.	.	.	.	.	.	+	+	+	13	10	8	6
UK (Scotland)	.	.	.	.	.	.	.	.	.	+	+	+	+	21	7	97
UK (England and Wales)	.	.	.			.	.	.	.	.	.	.	.	+	+	113
Portugal	.	.	.	.	.	.	.	.	.	.	1	3	4	2	1	.
Spain	.	.	.	.	.	.	.	.	.	.	85	68	n.a.	n.a.	n.a.	n.a.
	.	.	.	.	.	.	.	.	.	+	86	71	17	33	16	216

Table 4.4. Other deepwater sharks. Working group estimates of landings of black dogfish.

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	.	.	.	.	.	.	+	382	395	47	90	49	.
Iceland	.	.	1	.	.	1	4	.	.	.	.	.	+	+	n.a.	.
UK (England and Wales)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	5
Spain	.	.	.	.	.	.	.	.	.	.	85	91	n.a.	n.a.	n.a.	.
											467	486	47	90	49	5

Table 4.5. Other deepwater sharks. Working group estimates of landings of velvet belly.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Denmark	.	.	.	27	+	10	8	32	359	128	25	52	.	.	.	
UK (England and Wales)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
Spain	.	.	.	.	.	.	.	.	.	.	.	.	85	n.a.	n.a.	
	.	.	.	27	+	10	8	32	359	128	25	52	85	n.a.	n.a.	8

Table 4.6. Other deepwater sharks. Working group estimates of landings of blackmouth dogfish.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Ireland	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.
Spain (Basque c.)	.	.	.	.	.	.	.	.	+	.	+	.	.	.	+	.
Spain	.	.	.	.	.	.	4	3	6	2	4	1	35	1	.	4
Portugal	17	17	16	20	37	29	35	29	22	23	39	36	52	29	57	38
	17	17	16	20	37	29	39	32	28	25	43	37	87	30	58	41

Table 4.7. Other deepwater sharks. Working group estimates of landings of lantern sharks NEI.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	.	846	2388	2888	2150	2043	+	+	+	+	+	+	.
Spain	.	.	.	.	.	.	.	.	.	.	38	338	99	n.a.	n.a.	.
Portugal	.	.	.	.	+	+	+	+	.	.	+	.	.	.	+	+
					846	**2388**	**2888**	**2150**	**2043**	**+**	**38**	**338**	**99**	**+**	**+**	**+**

Table 4.8. Other deepwater sharks. Working group estimates of landings of "*aiguillat noir*".

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	.	.	.	.	.	.	.	123	165	11	37	21	5
	.	.	.	.	.	.	.	.	.	.	123	165	11	37	21	5

Table 4.9. Other deepwater sharks. Working group estimates of landings of Greenland sharks.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Iceland	54	58	68	38	42	44	61	71	86	50	45	57	57	61	66	n.a.
	54	58	68	38	42	44	61	71	86	50	45	57	57	61	66	n.a.

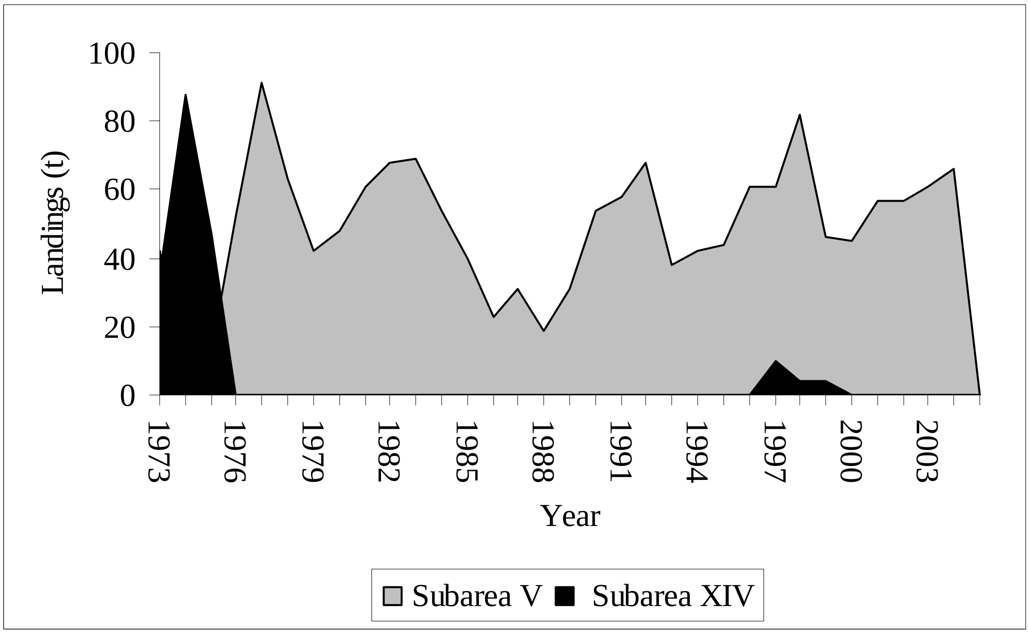


Figure 4.1. Other deepwater sharks. Landings of Greenland shark from Subareas V and XIV.

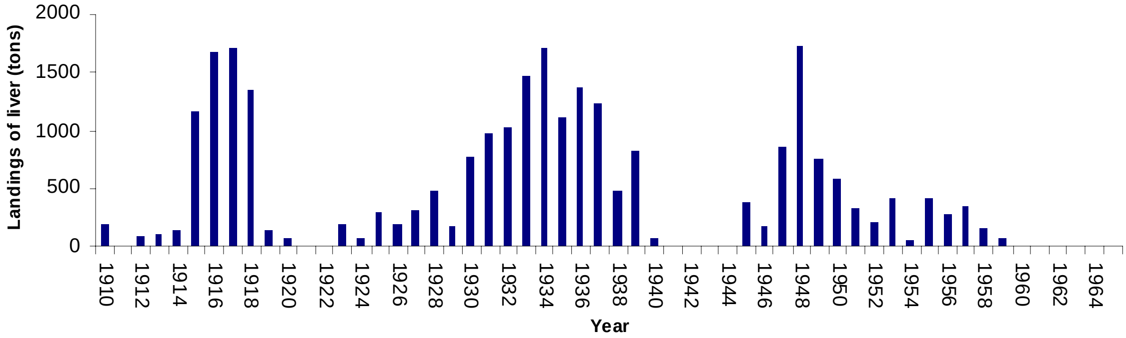


Figure 4.2. Other deepwater sharks. Time series of landings of Greenland shark livers from Norway (Hareide, 2006 WD).

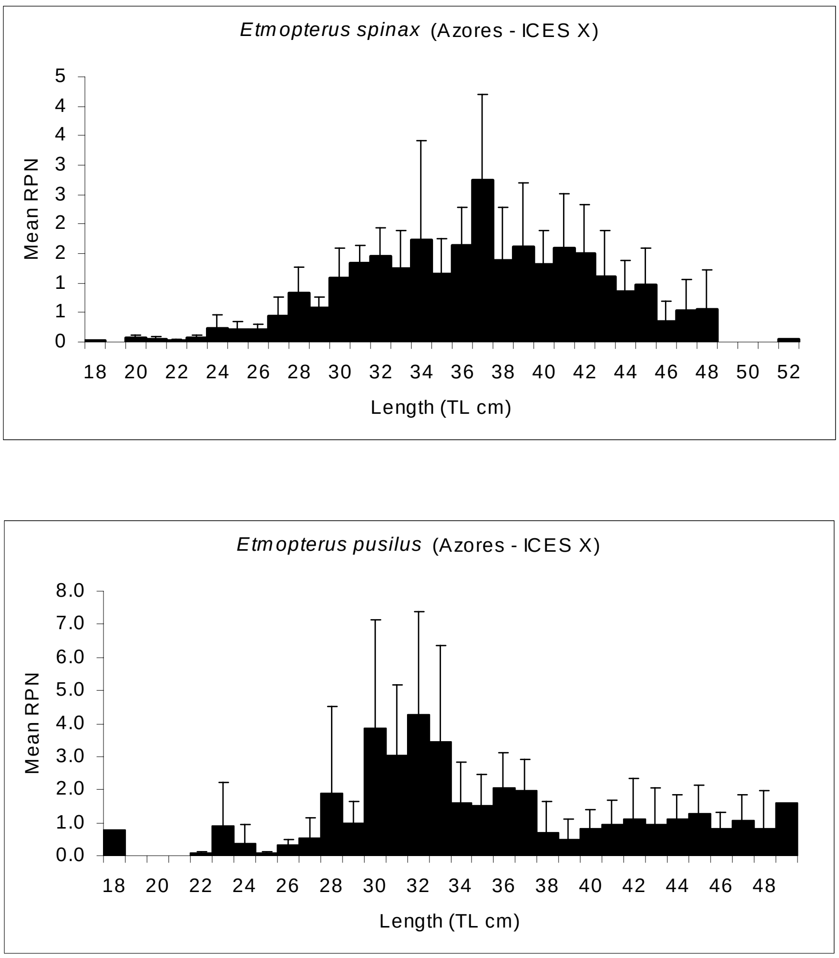
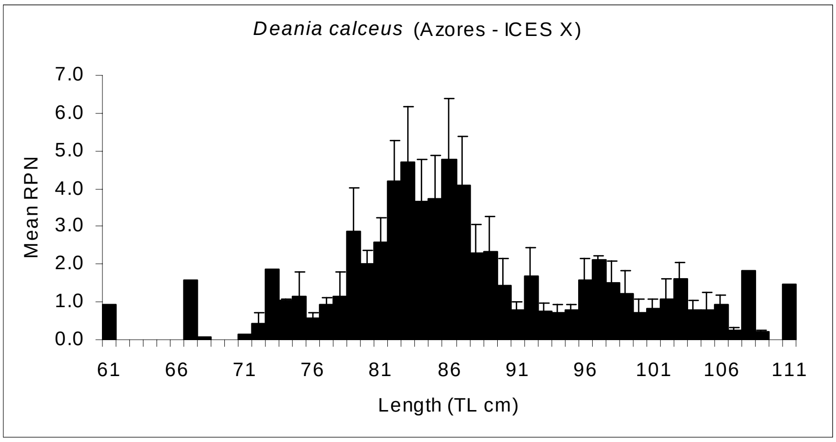


Figure 4.3. Other deepwater sharks. Mean length frequency of *Etmopterus sp.* caught at the Azorean demersal spring bottom longline surveys during the period 1995–2005. RPN is the Relative Population numbers (CPUE by length weighted by the area size).



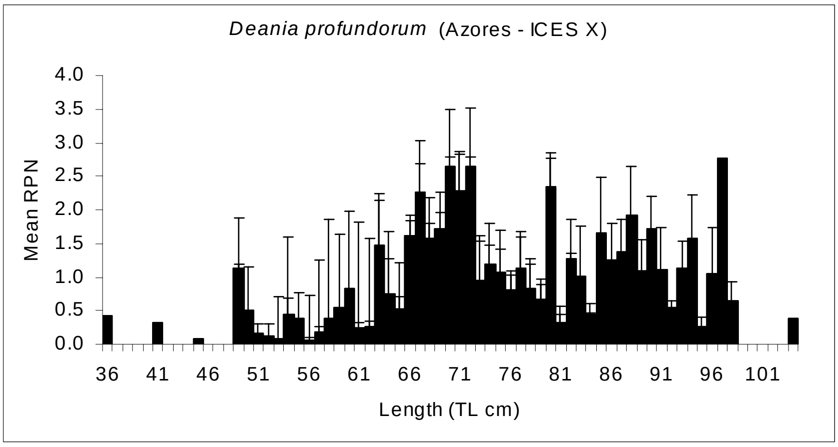


Figure 4.4. Other deepwater sharks. Mean length frequency of *Deania profundorum* caught at the Azorean demersal spring bottom longline surveys during the period 1995–2005. RPN is the Relative Population numbers (CPUE by length weighted by the area size).

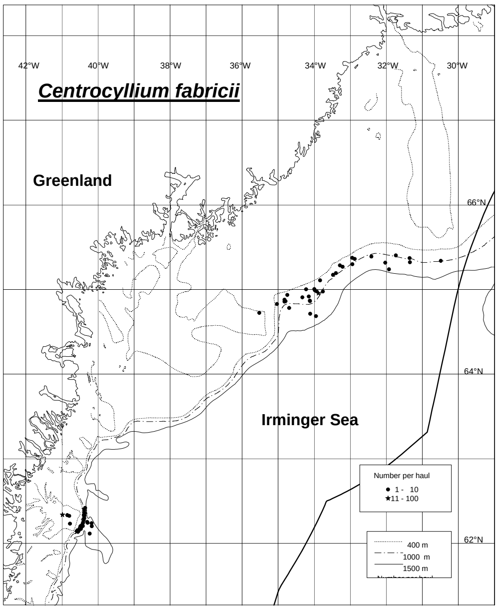


Figure 4.5. Other deepwater sharks. Distribution of catches of *C. fabricii.*

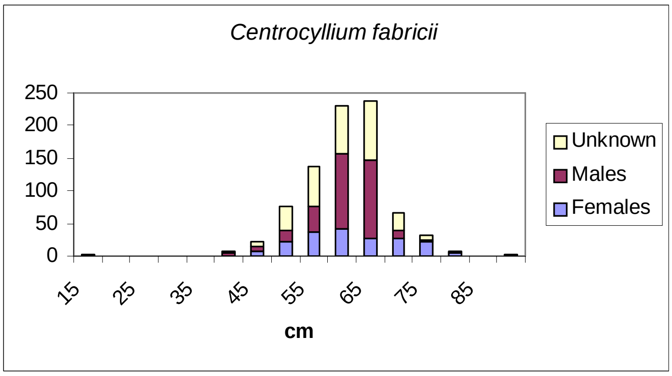


Figure 4.6. Other deepwater sharks. Length distribution of *C. fabricii* (5-cm groups).

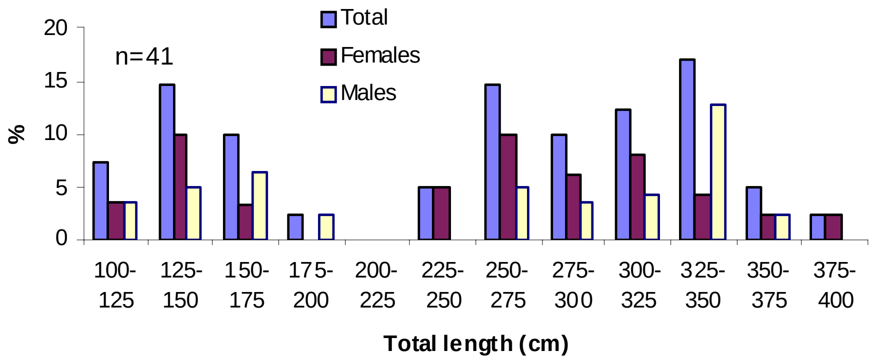


Figure 4.7. Other deepwater sharks. Length distribution of Greenland shark in East Greenland Fjords in Greenland - Norwegian longline survey 1994 (Hareide, 2006 WD).

5 Kitefin shark (entire ICES Area)

Kitefin shark, *Dalatias. licha* is widely distributed in deeper waters of the North Atlantic (from Norway to north-western Africa and the Gulf of Guinea), including the Mediterranean, and Northwest Atlantic). Stock identity of kitefin shark in NE Atlantic is unknown. However the resource seems to be more abundant in the south area of the Mid Atlantic Ridge (ICES Area X). Elsewhere in the NE Atlantic, kitefin shark is infrequently recorded.

For the assessment purpose the Azorean stock is considered as a management unit (ICES Subarea X).

5.1 The fishery

Detailed description of the fisheries can be found in Heessen (2003) and ICES (2003).

The directed fishery on the Azores stopped at the end of 1990s because it was not profitable. Kitefin shark in the North Atlantic is nowadays a bycatch in other fisheries

5.1.1 Advice and management applicable to 2005 and 2006

In 2005, ICES advised that if any fishery be permitted on this species, it should be accompanied by a monitoring system that would allow for an evaluation of stock dynamics.

Deepwater sharks are subject to management in Community waters and in certain non Community waters for stocks of deep-sea species for 2005 and 2006 (EC no 2270/2004 article 1). Fishing opportunities (TAC) for stocks of deep-sea shark species for Community vessels were presented in an Annex (EC no 2270/2004 annex part 2). A list of species was given to be considered in the group of ‘deep sea sharks’.

The TAC for V, VI, VII, VIII and IX for these species is 6 763 t. In Subarea X the TAC is 120 t (EC no 860/2005) and in Subarea XII 243 t.

5.1.2 The fishery in 2005

Historically, landings from the Azores began in the early seventies and increased rapidly to over 947 tonnes in 1981 (Figure 5.1). Since 1981 to 1991 landings fluctuated considerably, following the market fluctuations, peaking 937 tonnes in 1984 and 896 tonnes in 1991. Since

1991 the reported landings have declined linearly, possible as a result of economic problems related to markets. Since 1988 a bycatch have been reported from main land Portugal with 282 tonnes in 2000 and 119 tonnes in 2003.

Kitefin from the Azores is now a bycatch from different deep-water fisheries, with landings in 2004 and 2005 of less than about 15 t (Pinho, 2006).

The catches reported from each country, for the period 1988 to 2005 are given in Tables .1, 5.2 and 5.3 and total historical catches from 1972 to 2005 in Figure 5.1.

While the UK (E&W) and Ireland have official reported landings of kitefin shark in these areas, it is considered by the group that these have been misidentified, and are more likely to be either Portuguese dogfish or leafscale gulper shark.

5.2 Biological composition of the landings

There is no new information.

5.2.1 Quality of catch and biological data

Deepwater sharks taken in the Azores are usually gutted, finned, beheaded and also skinned. Only the trunks and, in some cases, the livers are used. Whenever these fish are landed, the real weight of the landings is clearly underestimated. Data from observers or fishing logbooks are not available. Species misidentification happens mostly with deepwater sharks. Official Landings come exclusively from the commercial first sale of fresh fish on the auctions. Landings that are not sold on the auctions, as the frozen or processed fish, are not taken in account on the statistics provided to ICES.

5.3 Fishery-independent information

There is no information available.

5.4 Mean length, weight, maturity and natural mortality-at-age

There is no information available.

5.5 Recruitment

Individuals less than 98 cm are not observed on the region suggesting that probably spawning and juveniles occurs in deep water or non- exploited areas. Males kitefin shark are more available to the fishery at 100 cm (age 5) and females at 120 (age 6).

5.6 Stock assessment

5.6.1 Previous assessments of stock status

Stock assessments of kitefin fishery were made during the 80s, using equilibrium Fox production model (Silva, 1987). The stock was considered intensively exploited with the average observed total catches (809 t) near the estimated maximum sustainable yield (MSY=933 t). An optimum fishing effort of 281 days fishing bottom nets and 359 man trips fishing with hand lines were suggested, correspondent approximately to the observed effort.

During the DELASS project (Heessen, 2003) a Bayesian stock assessment approach using three cases of the Pella-Tomlinson biomass dynamic model with two fisheries (handline and bottom gillnets) was performed (ICES, 2003, 2005). The stock was considered depleted based on the probability of the Biomass 2001 being less than BMSY.

Stock Assessment

Assessment of the species status was not done during this WGEF 2006 meeting since no new data were available.

5.7 Management considerations

Preliminary assessment results suggest that the stock may be depleted, to about 50% of virgin biomass. However, further analysis is required in to better understand the status of the stock, particularly analysing the effect of liver oil prices on the fishery. The working group considers that the development of a fishery must not be permitted before data become available in order to have a more precise idea about the sustainable catch.

5.8 References

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Pinho, M. R. 2006. Elasmobranch statistics from the Azores (ICES Area X).Working Document (WGEF, 2006).

Silva, H. M. da 1987. An assessment of the Azorean stock of Kitefin Shark, *Dalatias Licha*. ICES Copenhagen.

Table 5.1 Kitefin shark in the Northeast Atlantic. Total Landings (tonnes) of Kitefin Shark *Dalatias licha*

	Sub-area	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
UK Scotland	Vb, VI	.	.	.	.	.	.	.	.	.	.	.
UK (E&W)	VI, VII	.	.	.	.	.	.	.	.	.	.	.
Ireland	X	.	.	.	.	.	.	.	.	.	.	.
Germany	VII	.	.	.	.	.	.	.	.	.	.	.
Portugal	VI, IXa	149	57	7	12	11	11	11	7	4	4	6
Portugal (Azores)	X	549	560	602	896	761	591	309	321	216	152	40
Total		698	617	609	908	772	602	320	328	220	156	46

Table 5.1 continued **Kitefin shark in the Northeast Atlantic. Total Landings (tonnes) of Kitefin Shark *Dalatias licha***

	Sub-area	1999	2000	2001	2002	2003	2004	2005
UK Scotland	Vb, VI	.	.	.	.	+	0	8
UK (E&W)	VI, VII	.	.	.	.	+	+	+
Ireland	X	.	.	.	.	.	.	0
Germany	VII	.	.	.	.	.	.	21
Portugal	VI, IXa	14	282	176	5	119	2	3
Portugal (Azores)	X	31	31	13	35	25	6	14
Total		45	313	189	40	144	9	47

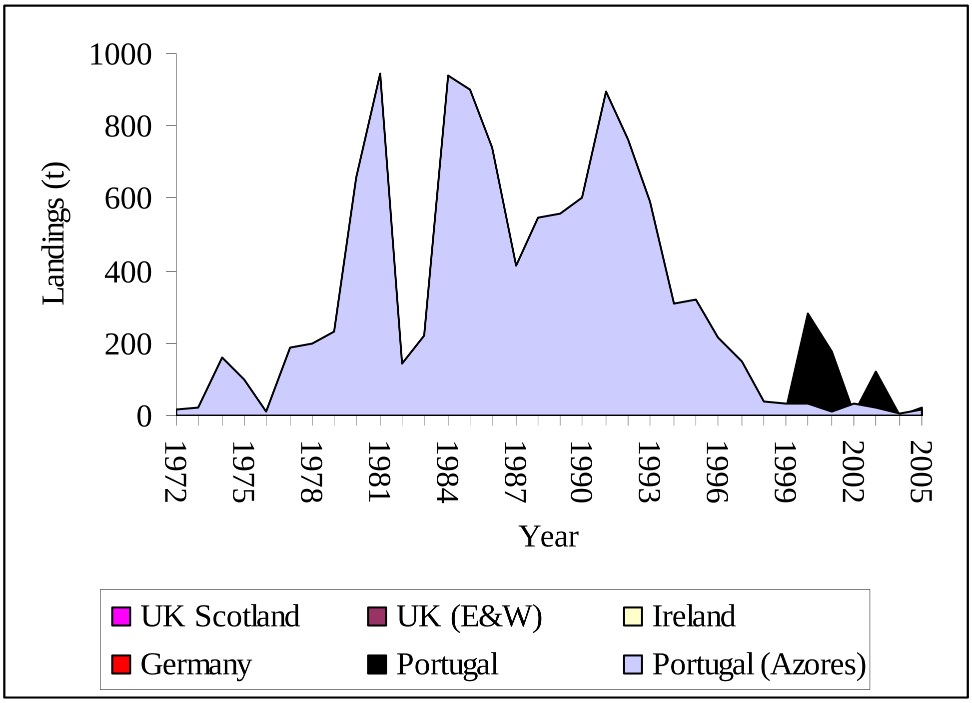

Figure 5.1. Kitefin shark (entire ICES area): Total landings of kitefin by ICES statistical areas.

6 Porbeagle in the North East Atlantic (Subareas I–XIV)

The DELASS project (Heessen, 2003) considered that a single stock of porbeagle occurs in the northeast Atlantic, hence in the entire ICES area. A separate stock is considered to exist in the northwest Atlantic (Campana *et al*., 1999, 2001). However transatlantic migrations for this species are known to occur (Irish Central Fisheries Board, unpubl. data, Campana *et al*., 2002). Further tagging studies are required to better examine stock structure. NW Africa is considered part of this stock but catch data are unavailable.

6.1 The Fishery

Advice and Management Applicable to 2005 and 2006

In 2005, ICES gave management advice for the northeast Atlantic stock, following request by the EU Commission. The ICES advice for NE Atlantic porbeagle was that, given the apparent depleted state of this stock, "no fishery should be permitted on this stock".

There are at present no management measures adopted for this species in the ICES area. However, since December 2004, it is forbidden in Sweden to catch and land porbeagle.

The EU STECF considered the ICES advice and came forward with commentation and further advice for this species (see 6.2). STECF recommends *"that no directed fishing for porbeagle in the NE Atlantic be permitted and that additional measures be taken to prevent bycatch of porbeagles in fisheries targeting other species*."

The fishery

Porbeagle is a highly migratory and schooling species. Sporadic targeted fisheries develop on these schools. Porbeagle fisheries are highly profitable (Gauld, 1989).

The main countries catching or having caught porbeagles are Spain and France. However in the past, important fisheries were prosecuted by Norway, Denmark and Faeroe Islands.

Working group estimates of landings are presented in Tables 6.1 and 6.2 as well as Figure 6.1. Data was retrieved mainly from ICES catch statistics 1973–2005, from ICES website and data extracted with FishStat Plus. For time series dating back further, FAO dataset 1950–2005 was used, also data originating from the ICCAT.

Data were compared for species and combined areas to identify possible deviations. Data for catches over the time 1973–2005 or 1950–2005 for the ICES area and FAO Area 27 and NE Atlantic of ICCAT respectively showed the same data for times and catches given (Figure 6.2).

French data extracted from FISHSTAT, were revised in 2006 with data made available from France. Only very sporadic reports of catch data were available from Spain, though these catches are high. Data in between the reported years is considered by the working group to be not available (n.a.).

The longest time series of catch documentation originates from Norway. The target fishery for porbeagles before WWII was mainly a Norwegian longline fishery in the North Sea, starting at 1926 and landing around 500 t annually in the first years, peaking in 1936 with around 4000 t and declined after that. After WWII, the target fishery resumed with Norwegian, Faeroe Islands and Danish vessels involved. Norway took about 3000 t in 1947. Landings declined to about 500 t per year by the mid 1970s. During the 1950s the main country, Norway, shifted effort further west towards Faeroes, Shetlands, Ireland and the offshore banks. The Norwegian/Faeroese target fishery moved to NW Atlantic from the early 1960s. The

Norwegian fishery yielded about 8000 t in the NW Atlantic in 1964, but this declined rapidly and ceased by 1968. Faeroese effort continued in the NW Atlantic but then moved to west Africa as landings declined. No Norwegian or Faeroese fishery developed in the NW Atlantic.

The Danish target longline fishery in the North Sea displayed declining landings from about 2 000 t in the early 1950s to around 200 t in the 1970s. Landings fluctuated around 80 t in the 1980s. This fishery has now ceased (Table 6.2, Figure 6.1).

The only regular, directed target fishery that still exists is the French fishery (Figure 6.3). Most of the landings take place during the summer (Figure 6.5). Preliminary data suggest that the in number of vessels landing more than 5 t has been stable since 1990, between 8 and 11 vessels (Biseau, 2006 WDb). Landings increased to a peak of over 700 t in 1994, and this was accompanied by a peak in CPUE of about 3 t per vessel (Table 6.3). CPUE declined to about 1 t per vessel by 1999 and has fluctuated around this level (Figure 6.4). In 2005, CPUE was less than 1 t per vessel, the lowest in the series since 1992. Throughout the series the majority of landings came from longliners and the main landings from VII and VIII. These data have not been fully evaluated by the working group in 2006, and further analysis will take place in 2007. Further work should include an appraisal of the French fishery and of Lallemand-Lemoine (1991).

The Spanish landings of porbeagles are thought to be mainly taken in fisheries, using longlines, targeting swordfish and tuna. Reported annual data (Figure 6.1) are sporadic, though they are much higher than other countries, in any given year. It is unclear whether in years of no reported catches, all catches have been documented. Spanish landings in NE Atlantic were over 3500 t in 1970s and varied widely between 30 and 1000 t in recent years. After a peak in landings in 2000 with around 100 t, reported landings were down to around 20 t by 2002. However it is possible that these peaks may reflect misidentification of shortfin mako shark. A recent analysis of bycatch in Spanish swordfish fisheries did not find porbeagle to be an important component. Landings off Spain have tended to be greater during the spring and autumn, with a drop in the summer (Mejuto, 1985).

Several countries have sporadic fisheries taking porbeagles (which also takes occasional tope and blue sharks), in North Sea, west of Ireland and Biscay, as they appear. These include Denmark, UK, and French vessels fishing to the south and west of England (Table 6.1). There is a bycatch by demersal trawlers from many countries, including Ireland, UK, France and Spain.

Catch by non-ICES countries and occurrence of porbeagle in NEI category

Effort has increased in recent years in pelagic longline fisheries for bluefin tuna (Japan, Republic of Korea and Taiwan Province of China) in the North East Atlantic. These fisheries may take porbeagle as a bycatch. Landing data for porbeagle may be reported as porbeagle, as various sharks nei and as Sharks, rays, skates, etc. nei in the official statistics. This means that the landings reported as porbeagle are likely an underestimation of the total landing of porbeagle from the NE Atlantic. So far, only Japan could be found to have reported porbeagle catches from the NE Atlantic, however with minimal values of 2-3 t in 1996 and 1997 (ICCAT Database).

6.2 Management considerations

This species is considered biologically sensitive, being long-lived and with very low fecundity (~4). Therefore it can be considered highly susceptible to over exploitation.

Available information from Norwegian and Faeroese fisheries are that they declined in the ICES area as availability of the stock declined. The fishery did not resume implying that the stock did not recover, at least in the areas where those fisheries took place.

The available information from the French fishery suggests that CPUE reached a peak in 1994 and afterwards has declined to lower levels. The CPUE (kg/vessel) has been stable at a much lower level since 1999, despite relatively constant number of vessels involved. Although more detailed information could be made available, it is likely that this stock has experienced a decline in this area.

WGEF considers that target fishing should not proceed it should only proceed with out a program to evaluate sustainable levels. Maximum landing length may a useful management measure in targeted fisheries and should be evaluated. Jensen *et al.* (2002) report 218 cm FL as L_{50} for females. This may be considered a candidate maximum landing length. In addition measures be taken to mitigate bycatch.

Countries fishing for porbeagle need to provide better data. All fisheries dependent data should be provided by the member states having fisheries for this stock as well as other countries long-lining in the ICES area.

Experience from surface longline fishing shows that porbeagles are usually captured alive. Therefore, a mitigation policy might be implemented by releasing porbeagle.

6.3 References

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Mejuto, J. 1985. Associated catches of sharks, *Prionace glauca, Isurus oxyrinchus* and *Lamna nasus*, with NW and N Spanish swordfish fishery in 1984. ICES C.M. 1985/H:42, 16 pp.

Table 6.1. Porbeagle in the NE Atlantic. Total porbeagle landings (tonnes) by ICES division.

ICES area / Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
I & II	75	13	21	17	46	55	35	17	22	6	4
III & IV	260	276	471	435	251	138	208	232	262	118	81
Va	3	2	4	4	3	.	1	1	1	1	1
Vb	9	1	1	2	6	9	25	8	6	10	12
VI	2	5		3	.	1	7	1	1	8	1
VII	110	102	302	316	554	321	180	210	282	114	370
VIII	.	.	.	.	.	2601	905	689	486	85	422
IX	.	.	.	.	.	.	.	.	.	.	.
X	.	.	.	.	.	.	.	.	.	.	.
XII	.	.	.	.	.	.	.	.	.	.	.
XIV	.	.	.	.	.	.	.	.	.	.	.
Total	459	399	799	777	860	3125	1361	1158	1060	342	891

ICES area / Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
I & II	21	10	9	6		2	2	1	3	9	4
III & IV	95	179	163	114	63	149	195	191	409	232	574
Va	1	1	1	1	1	1	.	.	1	3	5
Vb	.	12	12	33	14	14	20	8	6	63	40
VI	29	1	1	2	2	1	2	2	16		9
VII	156	152	137	192	274	225	339	140	107	169	193
VIII	259	112	126	76	162	129	217	143	381	452	617
IX	.	.	.	3	3	2	2	1	+	1	1
X	.	.	.	.	1	.	.	1	3	3	
XII	.	.	.	.	.	.	.	.	.	.	.
XIV	.	.	.	.	.	.	.	.	.	.	1
Total	561	467	449	427	520	523	777	487	926	932	1444

ICES area / Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
I & II	6	10	7	14	8	11	9	0	6	16	10
III & IV	439	171	170	165	133	87	91	2	23	37	5
Va	6	5	3	4	2	2	3	2	1	0	0
Vb	36	9	9	7	11	13	8	10	14	0	0
VI	10	1	1	+	1	52	11	+	+	+	2
VII	96	115	78	70	92	163	118	216	166	186	130
VIII	465	172	282	189	427	242	188	158	127	95	92
IX	1	7	49	354	723	1086	408	0	0	1	0
X	.	.	30	284	8	376	454	0	65	0	0
XII	.	.	16	0	0	4	1	0	1	0	0
XIV	.	.	1	.	.	.	.	.	.	.	.
Total	1059	490	646	1087	1405	2036	1292	387	404	336	240

Table 6.2. Porbeagle in the NE Atlantic. Total porbeagle landings (tonnes) by country in the ICES area.

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Denmark	87	117	177	187	219	113	136	156	185	84	45
Faeroe Islands	5	0	0	1	7	9	25	8	6	17	12
France	105	97	292	302	554	835	1092	898	768	200	793
Germany	6	3	4	0	0	0	0	0	0	0	0
Iceland	2	2	4	3	3	0	1	1	1	1	1
Ireland	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0
Norway	230	165	304	259	77	76	106	84	93	33	33
Portugal	0	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	2087	0	0	0	0	0
Sweden	0	0	3	0	0	5	1	8	5	6	5
UK (Eng.Wal. Nl.+)	14	15	16	25	0	0	1	3	2	1	2
UK (Scot)	13	0	0	0	0	0	0	0	0	0	0
TOTAL	462	399	800	777	860	3125	1362	1158	1060	342	891

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Denmark	38	72	115	58	34	35	48	87	81	91	94
Faeroe Islands	0	38	35	59	24	99	120	69	302	179	506
France	411	254	260	273	440	341	551	294	496	633	812
Germany	0	0	0	0	0	0	0	0	0	1	0
Iceland	1	1	1	1	1	1	0	0	1	3	4
Ireland	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0
Norway	97	80	24	25	12	27	45	35	43	24	26
Portugal	0	0	0	3	3	2	2	1	0	1	1
Spain	0	0	0	0	0	0	0	0	0	0	0
Sweden	9	10	8	5	3	3	2	2	4	3	0
UK (Eng.Wal. Nl.+)	5	12	6	3	3	15	9	0	0	0	0
UK (Scot)	0	0	0	0	0	0	0	0	0	0	0
TOTAL	561	467	449	427	520	523	777	488	927	935	1443

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Denmark	87	72	69	86	109	74	76	0	21	20.265	3.325
Faeroe Islands	372	82	96	66	10	0	8	10	14	0	0
France	565	267	331	219	237.099	318.739	236.77	353.32	257.736	251.216	220.691
Germany	0	0	0	2	0	16	0	3	5	5.844	4.54
Iceland	6	5	3	4	2	2	3	2	1	0	0
Ireland	0	0	0	0	3	2	6	0	11	18.21	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0.18
Norway	28	31	19	28	34	23	17	0	5	24.43	11
Portugal	1	1	1	1	0	1	0	0	0	1	0
Spain	0	31	125	681	1002	1507	932	16	89	10	0
Sweden	0	1	1	0	0	0	1	0	0	4.681	0.115
UK (Eng.Wal. Nl.+)	0	0	0	1	8	11	11	6	0	0	0
UK (Scot)	0	0	0	0	0	0	1	0	0	0	0
TOTAL	1059	490	645	1088	1405.099	1954.739	1291.8	390.32	403.736	335.646	239.851

Table 6.3. Porbeagle in the NE Atlantic. French information on vessels landings, gear and Catch per Unit Effort (CPUE)

	1990	1991	1992	1993	1994	1995	1996	1997
live weight (kg)	574988	305048	462230	641983	816104	643122	475362	494375
no vessels	320	376	341	325	296	276	278	265
no vessels > 5t	9	7	7	12	9	11	10	12
landings of vessels > 5t (kg)	518053	235688	400904	582832	742300	597631	407293	440334
contribution of these vessels	90%	90%	90%	90%	90%	90%	90%	90%
sales data (kg)	-	-	-	-	-	-	-	-
Longline	87%	71%	87%	78%	88%	65%	65%	59%
fixed net	6%	3%	1%	13%	4%	8%	5%	6%
drift net	1%	7%	4%	4%	2%	4%	4%	3%
bottom trawl	4%	14%	4%	4%	2%	10%	4%	3%
pelagic trawl	1%	4%	3%	2%	4%	2%	2%	2%
others	0%	0%	1%	0%	1%	12%	19%	27%
CPUE (tonnes/ no vessels > 5t)	57561	33670	57272	48569	82478	54330	40729	36695
CPUE (tonnes/ no vessels total)	1797	811	1356	1975	2757	2330	1710	1866

	1998	1999	2000	2001	2002	2003	2004	2005
live weight (kg)	418997	371435	353683	367400	447794	434118	377367	300939
no vessels	204	317	301	323	334	308	361	346
no vessels > 5t	11	10	11	10	9	8	6	9
landings of vessels > 5t (kg)	372438	239682	318210	278206	394167	302988	286039	245102
contribution of these vessels	90%	82%	77%	76%	82%	85%	83%	76%
sales data (kg)	-	303456	271991	287581	365031	367880	314504	228003
Longline	26%	77%	61%	79%	79%	82%	73%	75%
fixed net	6%	8%	21%	5%	11%	11%	16%	11%
drift net	2%	4%	7%	3%	0%	0%	0%	0%
bottom trawl	2%	6%	6%	8%	3%	4%	6%	6%
pelagic trawl	2%	5%	4%	3%	5%	3%	5%	7%
others	62%*	0%	0%	1%	2%	0%	0%	0%
CPUE (tonnes/ no vessels > 5t)	33858	23968	28928	27821	43796	37874	47673	27234
CPUE (tonnes/ no vessels total)	2054	1172	1175	1137	1341	1409	1045	870

* not clear if landings by gear is available in 1998.

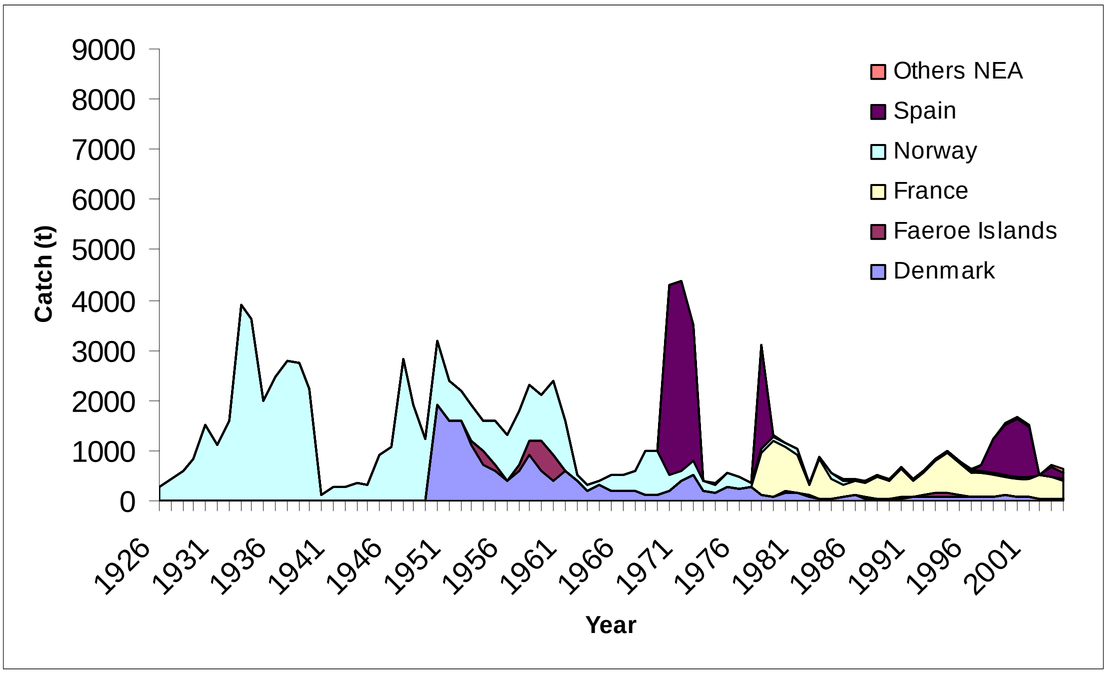

Figure 6.1. Porbeagle (Lamna nasus) in NE Atlantic. Working Group estimate of landings 1926–2005

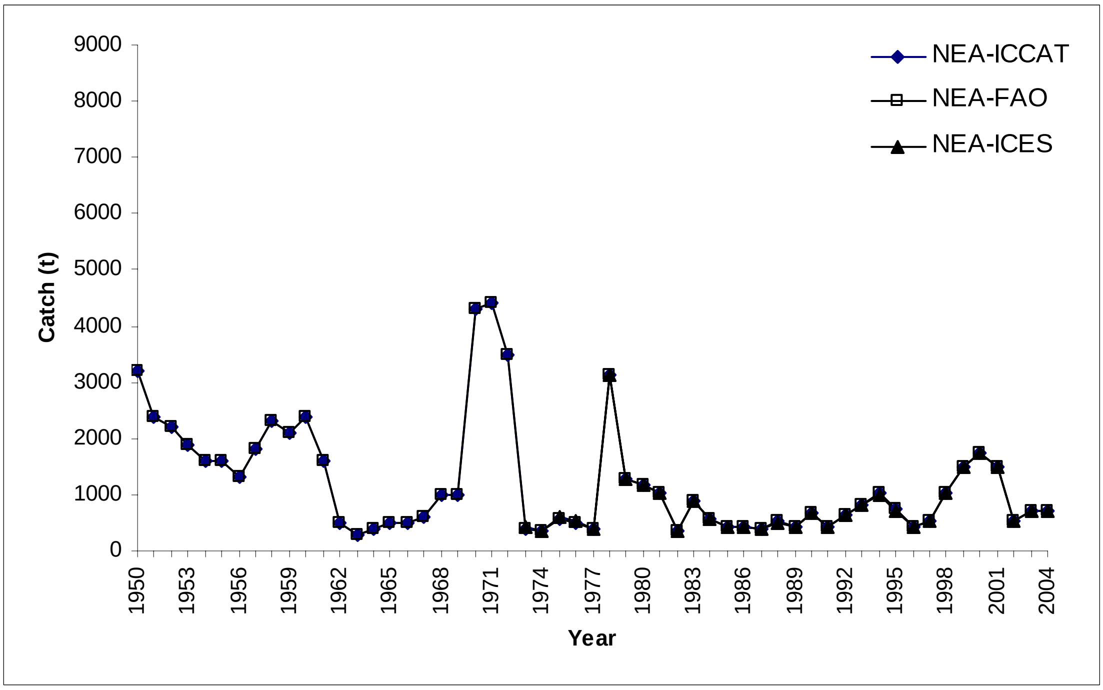

Figure 6.2. Porbeagle in the NE Atlantic. Comparison of data from FishStat-FAO (1950–2005), ICCAT (1950–2005) and FishStat ICES(1973–2005). It is clear that the three data sets are almost identical.

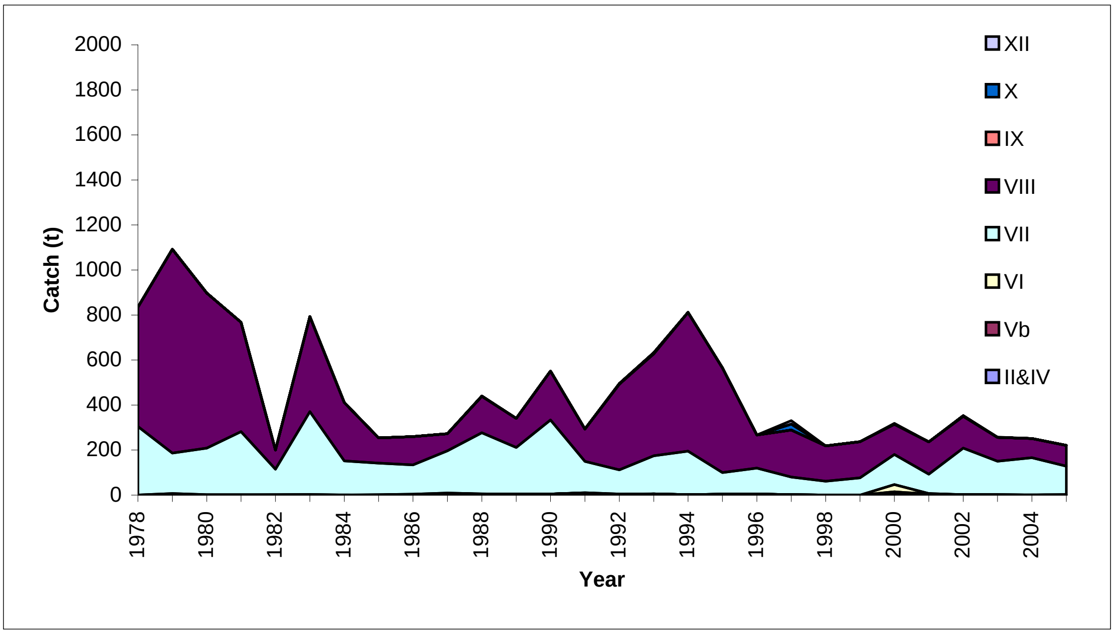

Figure 6.3. Porbeagle in the NE Atlantic. French fishery: trends of landings from NE Atlantic 1978–2005

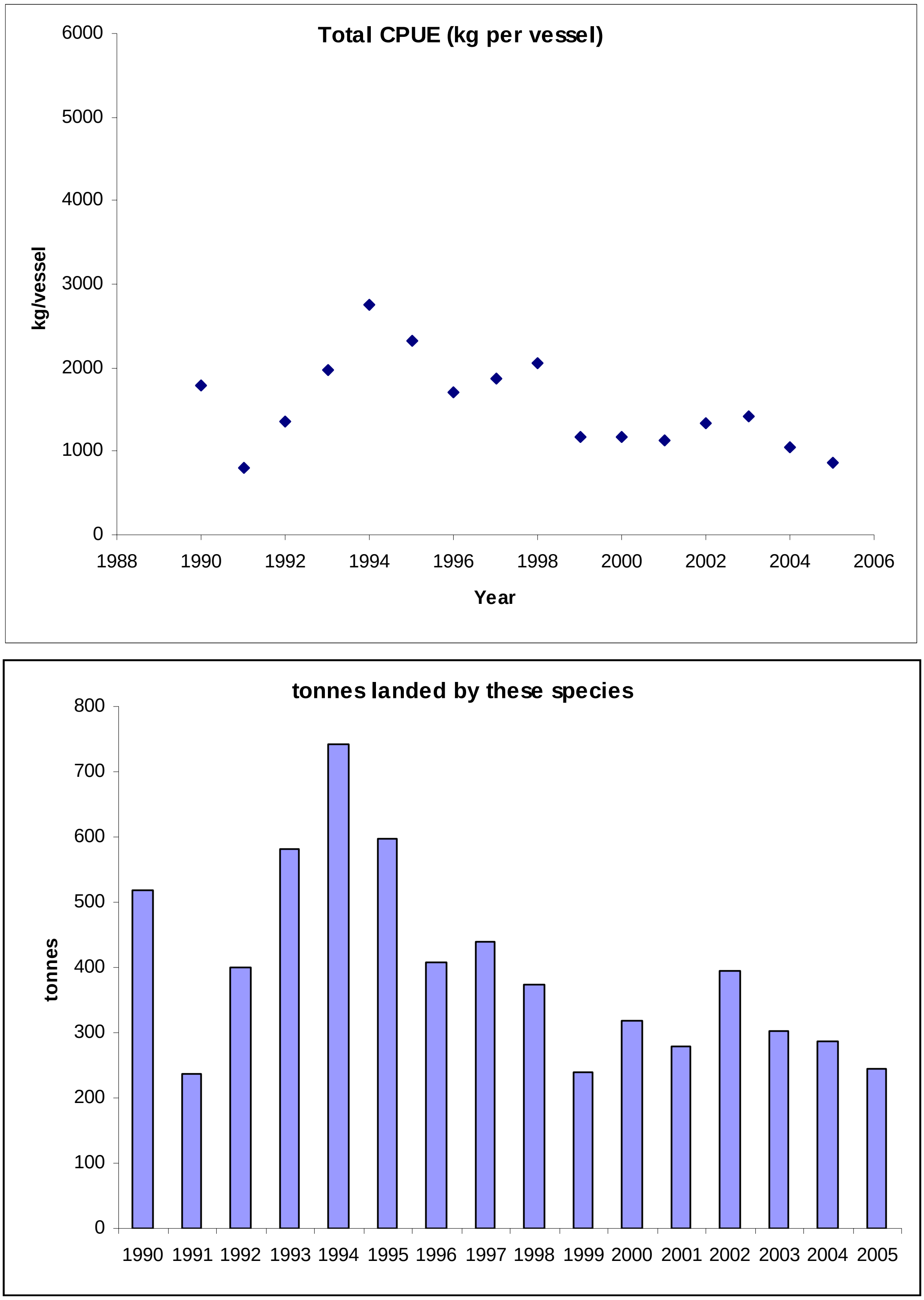

Figure 6.4. Porbeagle in the NE Atlantic. CPUE from French directed fishery (upper panel) and landings from these vessels (lower panel).

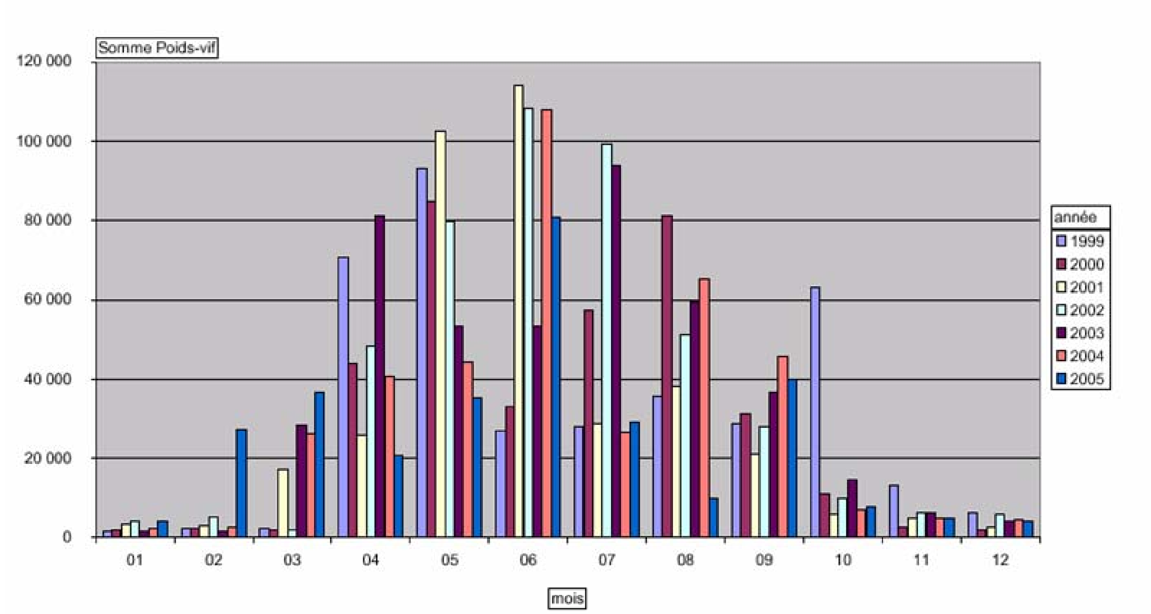

Figure 6.5. Porbeagle in the NE Atlantic. Seasonal pattern in landings (tonnes live weight) in the French fishery, by month.

7 Basking Shark in the northeast Atlantic (ICES Areas I–XIV)

WGEF considers that a single stock of basking sharks *Cetorhinus maximus* exists in the ICES area. There is no information on transatlantic migrations. A genetics study underway in the UK aims to differentiate distinct stocks globally (Sims *et al.*, 2005, Noble *et al*., 2006).

7.1 The fishery

Advice and management applicable

ACFM advice in 2005 was for a zero TAC in 2006.

In 2006 Norway banned all direct fishery for basking shark based on the ICES advice. Live specimens caught as bycatch must be released, while dead or dying specimens can be landed and sold as before.

The current TAC for EU member states in EU waters of ICES Subareas IV, VI and VII is 0 (Annex ID of Council Regulation 2555/2001). This has been in effect since 2002.

In the past, Norway had a quota in EU waters for livers. The EU no longer provides this entitlement.

The basking shark has been protected from killing, taking, disturbance, possession and sale in UK territorial (12 mile) waters since 1998. They are also protected in two UK Crown Dependencies: Isle of Man and Guernsey (Anon., 2002). In Sweden it is forbidden to fish for or to land basking shark.

Basking shark was listed on Appendix II of the Convention on International Trade in Endangered Species (CITES) in 2002. Norway and Iceland have made a reservation on this listing and are therefore treated as ‘States not Party to the Convention’ with respect to trade in the species. For other States, this listing only affects international trade in basking shark products (including scientific samples). Export, re-export or introduction from the high seas requires a CITES permit from the relevant national authorities. Such a permit can only be granted if the exporting State's Scientific Authority has advised that this export will not be detrimental to the survival of the species (for example, because it comes from a sustainably managed stock), and the Management Authority is satisfied that it was not captured illegally. Imports require that an appropriate export or re-export permit be presented and approved by the importing State's CITES Management Authority. Trade inside the EU is controlled under the provisions of EC Regulations Nos. 338/97 and 1808/2001.

Basking shark was listed in 2005 on Appendices I and II of the Convention on the Conservation of Migratory Species (CMS). CMS Parties should strive towards strictly protecting the endangered species on Appendix I, conserving or restoring their habitat, mitigating obstacles to migration and controlling other factors that might endanger them. The Convention encourages the Range States of Appendix II species (migratory species with an unfavourable conservation status that need or would significantly benefit from international co-operation) to conclude global or regional Agreements for their conservation and management. These Agreements are open to accession by all Range States, not just to the CMS Parties. Some Parties, from the ICES area and elsewhere, intimated that they might take out reservations on this listing, in some cases until they had the necessary legislation in place to implement strict protection measures. Reservations are not yet published.

The basking shark is listed on Annex I, Highly Migratory Species, of the UN Convention on the Law of the Sea (UNCLOS).

The basking shark was listed on the OSPAR (Convention on the protection of the marine environment of the north-east Atlantic) list of threatened and / or declining species in 2004.

The fishery

Norwegian fishermen have always been the major catchers of basking sharks in the Northeast Atlantic. The fishery started off Namdalen and Hitra in 1760 Moltu (1932) and spread south to Møre and Romsdal. Strøm (1762) also describes this fishery and he claims that it started before 1750 in north Norway and spread southerly to Møre (Western Norway). The Fishery started close to shore but after a while the landings decreased and the fishery moved farther from shore. According to Moltu (1932) the fishery peaked in 1808 and the best fishing areas were between Romsdal and Storegga. After some years the fishery ceased, and in 1860 it ended. The fishery generally started around April and May, occasionally as early as March, it then reached a peak in June and finished in August or, less commonly, in September (Myklevoll, 1968). The Basking Shark was caught using handheld harpoons from open boats. The fleet was composed of small wooden vessels 15–25 feet in length, which were sometimes used for hunting small whales as well as basking sharks (Kunzlik, 1988).

In 1920 the fishery resumed and the fishery employed more modern fishing gear and vessels. The basking shark was harpooned by cannons mounted on steam vessels or smacks (Rabben,1982–83). This technology was developed for whaling and remained in use for basking sharks until the fishery was temporarily closed in 2006.

The Norwegian fleet conducted local fisheries from the Barents Sea to the Kattegat, as well as more distant fisheries ranging across the North Sea and south and west of Ireland, Iceland and Faeroes. Norwegian fishermen were fishing for porbeagle off the Scottish coast as early as 1934, and they started fishing for basking sharks in the immediate post-war years following the establishment of several native Scottish fisheries. Similarly, Norwegian vessels took basking sharks in Irish waters after the Second World War. The landings increased during the 1930s as the fishery was gradually expanded to offshore waters. The main reason was that new markets were developed and thereby the demand for basking shark oil increased. During 1959–1980, catches ranged between 1266 and 4266 sharks per year, but have since declined (Kunzlik, 1988). The geographical and temporal distribution of the Norwegian domestic basking shark fishery changed markedly from year to year, possibly due to the unpredictable nature of the sharks' inshore migration (Stott, 1982).

McNally (1976) and Parker and Stott (1965) describe two basking shark fisheries off the Irish west coast. Large numbers of basking sharks were taken by small boats on the ‘Sunfish Bank’ for several decades between 1770 and 1830. The season only lasted for a few weeks in April and May, but at least 1000 fish may have been taken each year at the height of the fishery. In the early 1830s, sharks became very scarce. Despite continued high prices for ‘sunfish’ (basking shark) oil, the fishery collapsed in the second half of the 19th Century. Basking sharks were next recorded in abundance around Achill Island in 1941 and a new fishery started in 1947. Between 1000 and 1800 sharks were taken each year from 1951 to 1955 (an average of 1475/year), but a significant decline in catch records occurred from 1956, the last year in which shark catchers were employed. From 1957 onwards, continued declining sightings and catches made the fishery less profitable for the free-lance fishermen who took over from them. Average annual catches were 489 in 1956–1960, 107 in 1961–65, and then about 50–60 *per annum* for the remaining years of the fishery (Figure 7.4).

Fairfax (1998) summarises the limited information available on the earlier 18th and 19th century fisheries in Scotland. These appear, like the Irish fishery, to have ceased by the mid 1830s, with large numbers of sharks not being reported again until the 1930s. Fairfax (1998) and Kunzlik (1988) describe the 20th century Scottish basking shark fisheries, which concentrated on the Firth of Clyde and West coast. Several small fisheries started up in the 1940s, some targeted full time at the basking shark during the summer season and others more opportunistic. These took a total of ~970 sharks between 1946 and 1953 (during a period when Norwegian vessels were also catching in these waters).

Oil prices rose again in the mid 1970s. About 500 sharks were taken off eastern Ireland in 1974–75, Norwegian catchers took several hundred sharks in 1975, some Clyde basking shark bycatch was processed in the late 1970s, and a small target harpoon fishery started again in the Clyde in 1982. Initial yields from the latter were good, but these were extremely short-lived and the fishery ceased at the end of 1994 after several years of poor catches and taking a total of 333 sharks (Fairfax, 1998).

There is in 2006 no targeted fishery for basking sharks in Norway, UK or Ireland.

Landings

Landings data for 1993–2005 are presented in Table 7.1, and Figure 7.1 shows the landings for 1973–2005. These data were extracted from FishStat Plus database for 1973–2001. The table and figure include landings from Portugal (1991–2005) and revised landings data from Norway (2001–2005). Most catches are from Subareas I, II and IV and are taken by Norway.

Table 7.2 shows the Norwegian catches of basking sharks by gear type reported to the Norwegian Directorate of Fisheries during the years 1990 through 2005. This shows that the direct catch with harpoons decreased by the end of the 1990s and has remained at a very low level since 2000 with no reported direct catches for the years 2001 and 2004. The bycatch taken by other gears varies with no obvious trend during this period.

China reported, in its response to CITES Notification 2005/044, that a total of 5538kg of *Cetorhinus maximus* fins were imported into Hong Kong in 2005, in two separate shipments (presumably frozen). The exporting state and the state of origin was Norway (Anon., 2006).

For 2003 through 2005 Portugal reported landings between 1 and 1.5 tonnes.

No official landings data for the Norwegian fishery are available for the fishery before 1926. Records of liver landings are available from 1926 to 1990 and from 1990 to 2005 landings are recorded as round weight (Figure 7.2, Hareide (2006, WD)). Conversion factor used to convert from liver weight to whole fish weight is 10 and 100 for fins. The conversion factor of 10 for liver weight is most likely too low because according to Phillips (1947) and, McNally (1976) the basking shark liver comprises about 17–25% of the total body weight (of up to 7 tonnes)). Therefore, the official live weights reported prior to 1990 probably are overestimations and should be adjusted downwards. Before this adjustment can be done a thorough examination of the landed catches has to be done to find out whether it was liver or fins that were landed.

The price of liver and fins for the period 1965 through the end of the 1980s are given in Figure 7.3. For liver there was a steady increase in the price until the end of the period when the prices dropped dramatically. It is thought that the decline was due to new supply of deepwater shark liver. This price drop was coincided with increase in the price of fins. This increase was a result of rising demand for shark fin in southeast Asia and compensated for the decline in oil prices.

7.2 Biological composition of landings

No new information.

7.3 Fishery-independent information

No information is available at present. However there are a number of possible sources of data that may be utilized better. Several countries, e.g. Norway and Denmark, conduct scientific whale counting surveys. During these surveys observations of basking sharks should also be noted. A number of Norwegian commercial vessels also regularly report observations of whales. A request for reporting the sightings of basking sharks might yield useful effort-related data.

Doyle *et al*. (2005) present the results of a public sightings record scheme for basking sharks, primarily in UK waters. The lack of effort information for the great majority of these records limits the application of these data. Other fishery-independent information currently being collected includes the photo-identification of individual sharks and the use of archival tags to track basking shark movements (e.g. Sims *et al*., 2005; Southall *et al*., 2005).

7.4 Catch per unit of effort

There are no effort or CPUE data available for the latest years. However in Hareide (2006, WD), the numbers of Norwegian vessels involved in this fishery and the landings for 13 of the years between 1965 and 1985 have been used to calculate a simple estimate of effort. The highest number of vessels participating in this fishery was in 1978 with 70 vessels. Based on total landings and number of vessels participating in the fishery an estimate of CPUE was generated for the years1965 through 1985 (Table 7.3). For this time period there was a significant decrease in CPUE. This CPUE series can be considered an underestimation of the decline in the abundance because the area fished was expanding during this time period.

7.5 Discards

Limited quantitative information exists on basking shark discarding in non-directed fisheries. However, anecdotal information is available indicating that this species is caught in gillnet and trawl fisheries in most parts of the ICES area. Most of this bycatch takes place in the summer months as the species moves inshore. The total extent of these catches is unknown. Berrow (1994) extrapolated from very limited observer data to suggest that 77–120 sharks may be taken annually in the bottom set gill net fishery in the Celtic Sea (south of Ireland), though the reliability of this estimate has been questioned. Berrow and Heardman (1994) received 28 records from fishermen of sharks entangled in fishing gear (mostly surface gill-nets) around the Irish coast during 1993, representing nearly 20% of all records of the species that year. At least 22% of basking shark bycatch in fishing nets died. Bycatch in the Isle of Man herring fishery has amounted to 10–15 sharks annually, and a further bycatch source here is entanglement in pot fishermen's ropes, amounting to some 4–5 fish annually. Fairfax (1998) reports that basking sharks are sometimes brought up from deep water trawls near the Scottish coast during winter. Valeiras *et al.* (2001) reported that of 12 reported basking sharks that were incidentally caught in fixed entanglement nets in Spanish waters between 1988 and 1998, three sharks were sold on at landing markets, three live sharks were released, and three dead sharks were discarded at sea. In contrast to the coastal bycatches, extrapolation of observer data from oceanic gill net fleets suggests that bycatch in these fisheries is very small; only about 50 basking sharks were among the several million sharks taken annually offshore in the Pacific Ocean (Bonfil, 1994).

The requirement for EU fleets to discard all basking sharks caught as bycatch means that information cannot be obtained on these catches. A better protocol for recording and obtaining scientific data from bycatches is necessary for assessing the status of the stock.

7.6 Management considerations

At present there is no directed fishery for this species. The Working Group considers that no targeted fishery should be permitted unless a reliable estimate of a sustainable exploitation rate is available.

The TAC area should correspond to the stock's distribution, thus the entire ICES area.

Proper quantification of bycatch and discarding of this species in the ICES area is required.

The objectives behind the listing of this species on CMS included improved regional and international cooperation over the conservation and management of this species, including harmonised data collection, and improved cross-border management of feeding, mating and pupping areas and the migration routes between them (Anon., 2006). The proponents noted that the inclusion of the basking shark in both Appendices of the Convention on the Conservation of Migratory Species of Wild Animals would provide a framework within which to coordinate measures that may be adopted by range states to improve the conservation of the species and to promote protection of this vulnerable species (Anon., 2006).

Where national legislation prohibits landing of by-caught basking sharks, measures should be put in place to ensure that incidental catches are recorded and carcasses made available for research.

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Table 7.1. Basking sharks in the northeast Atlantic. Total landings of basking sharks in ICES Areas I–X (tonnes)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
I & II	2910	1505	105	1979	1054	137	77	293	200	135	319	180	218
III & IV	.	257	4	.	106	.	.	.	.	.	.	.	.
VII	.	.	.	.		.	.	.	.	.	.	.	1
VIII	.	.	.	.	1	.	.	.	0	0	0	0	+
IX	.	.	.	1	1	.	.	.	.	.	1	+	2
X	..	.	.	.	.	.	.	.	1	.	.	.	.
TOTAL	2910	1762	109	1980	1162	137	77	293	201	135	320	180	221

Table 7.2 Basking sharks in the northeast Atlantic. Norwegian catches (tonnes) of basking sharks by gear as reported to the Norwegian Directorate of Fisheries during the years 1990 through 2005

	Area IIa							Area IVa		Total
Year	Harpoon	Gill nets	Drift nets*	Undefined nets	Bottom trawl	Danish seine	Hooks and line	Harpoon	Gillnets	
1990	1622	.	60	.	.	.	.	249	.	1932
1991	1131	.	17	.	.	.	.	475	.	1623
1992	3039	.	218	.	206	.	14	181	.	3658
1993	2885	24	.	.	2	.	.	.	.	2910
1994	1505	0	.	.	.	.	.	257		1762
1995	97	7	.	.	.	.	.	.	4	108
1996	1763	204	.	3	.	8	1	.	.	1979
1997	773	275	.	.	.	.	6	106	.	1159
1998	92	39	.	.	.	.	6	.	.	137
1999	7	63	.	6	1	.	.	.	.	77
2000	98	172	.	.	23	.	.	.	.	293
2001		192	.	.	8	.	.	.	.	200
2002	22	106	.	.	7	.	.	.	.	135
2003	11	286	.	.	23	.	.	.	.	319
2004		181	.	.	.	.	.	.	.	181
2005	118	97	.	1	3	.	.	.	.	218

* These drift nets for salmon was banned after 1992

Table 7.3. Basking sharks in the northeast Atlantic. Norwegian landings of liver (tonnes), number of vessels participating in the fishery and estimate of CPUE.

Year	Tonnes liver	Number of vessels	CPUE
1965	652	31	210
1966	911	30	304
1967	2090	53	394
1968	1580	70	226
1970	1887	57	331
1976	751	26	289
1977	793	32	248
1979	1133	30	378
1981	388	28	139
1982	465	25	186
1983	379	24	158
1984	444	26	171
1985	315	23	137

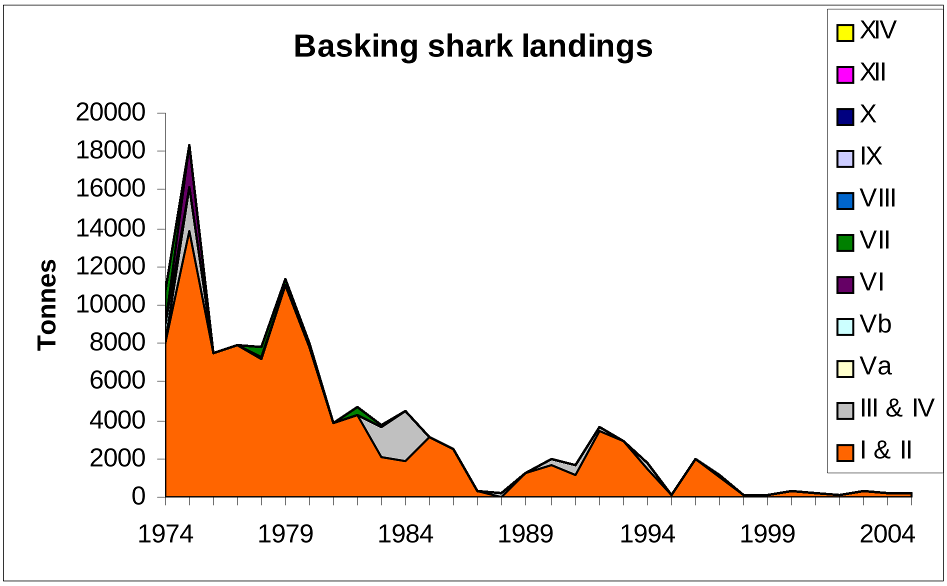

Figure7.1. Basking sharks in the northeast Atlantic. Total landings (tonnes) of basking sharks, 1973–2005.

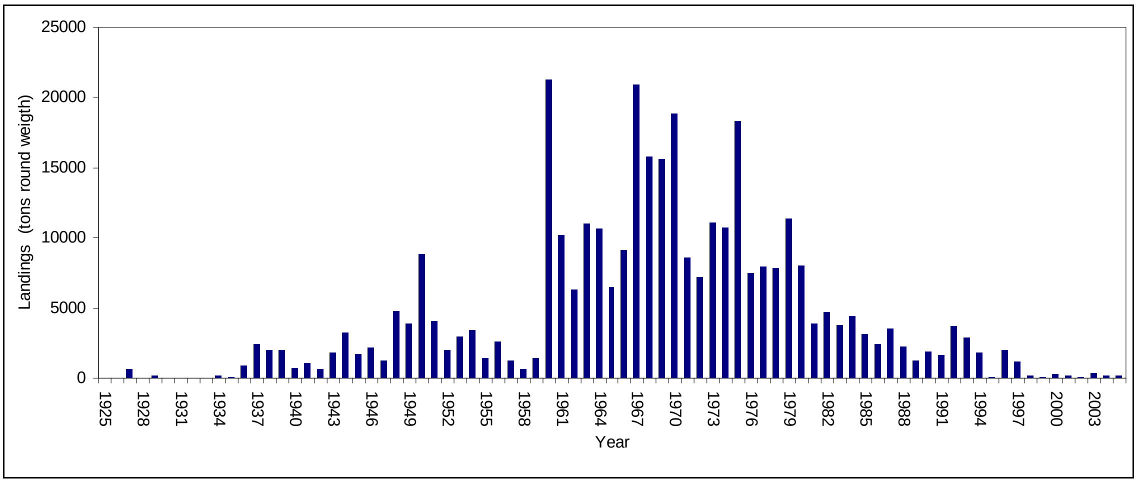

Figure 7.2. Basking sharks in the northeast Atlantic. Official Norwegian landings (tonnes), 1926–2005.

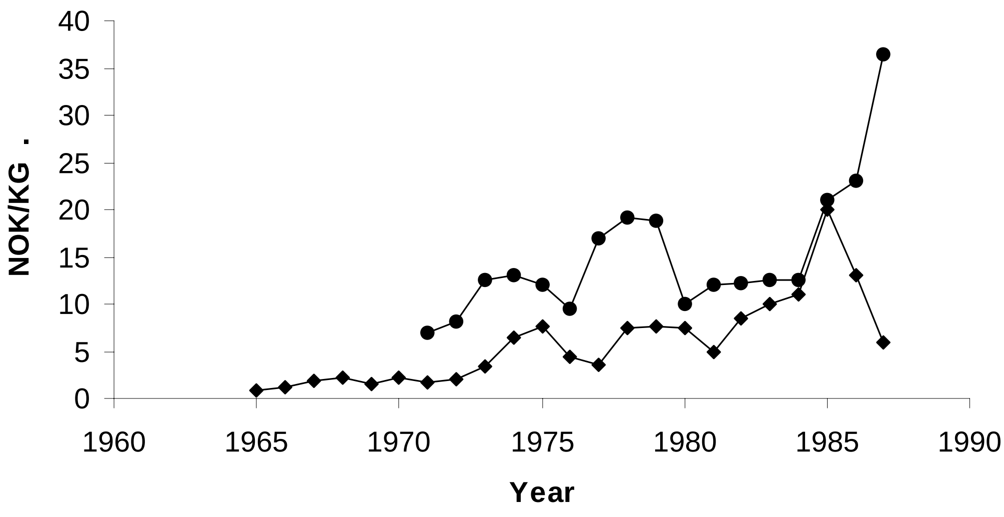

Figure 7.3. Basking sharks in the northeast Atlantic. Prices (NOK/KG) of liver (diamonds) and fins (circles) (Hareide, 2006 WD).

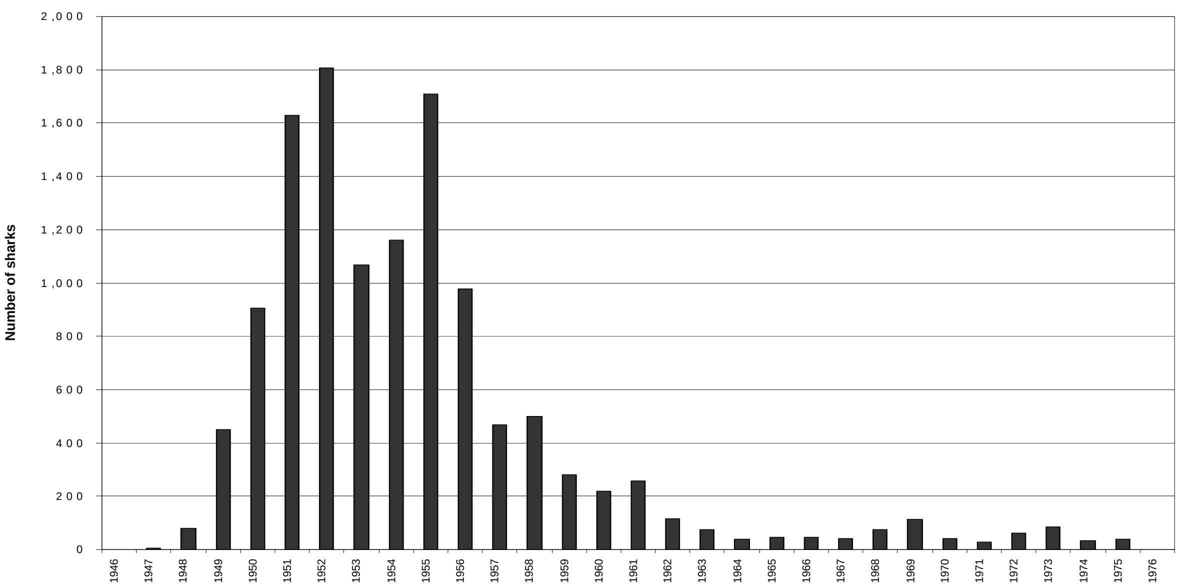

Figure 7.4. Basking sharks in the northeast Atlantic. Catches (number of sharks) at Achill Island, Ireland, 1947–1975.

8 Blue shark in the North Atlantic (FAO Areas 27, 21, 34 and 31)

The DELASS project and the ICCAT pelagic shark assessment working group (Anon., 2005) considers one stock of blue shark in the north Atlantic. Thus the ICES area is only part of the stock (Heessen, 2003; Fitzmaurice *et al*., 2005).

8.1 The fishery

8.1.1 Advice and management applicable

ACFM has never provided advice for blue shark in the ICES area. Because this species is not a unit stock in the ICES area, and because ICES has not access to full data sets, it was decided that ICCAT would be responsible for assessment of this species.

ICCAT completed a stock assessment in 2004 (Section 8.3) but no management recommendations were made.

8.1.2 The fishery

Anon. (2005) reviewed the status of the fishery in the north Atlantic. Although the data available was very limited, it offers some information on the situation in fisheries and trends. Although there are no large-scale directed fisheries for this species, it is a major bycatch in many fisheries for tunas and billfishes where it can comprise up to 70% of the total catches. Spain and Portugal are responsible for the majority of landings within the ICES area and Area 31.

Updated descriptions of fisheries taking blue shark are presented in Anon. (2005). In addition, a detailed description of the Basque fishery was presented in a Working Document by Diez *et al.* (2004) to WGEF 2004. This WD shows that Blue shark is a traditional and rather low bycatch of many Basque (Spanish) fleets operating in the Bay of Biscay (ICES Divisions VIIIa,b,c,d). Blue sharks are caught predominantly in ICES Areas VII, VIII, IX, X and XII.

Available landings data for FAO areas 27, 21 and 34 are presented in Table 8.1 and in Figure 8.1. Catch data for area 31 are not available. Landings rose to about 17 000 t in 2003, after fluctuating around 11 000 t prior to this. The majority of landings are from Area 34. The sudden appearance of blue shark catches in the statistics rather reflects the onset of documentation of these catches then the beginning of catching blue sharks. In addition, it is thought that the landings figures for blue shark may be unreliable due to the amount of pelagic sharks that are thought to be declared under generic “nei” categories (Johnston *et al.,* 2005).

Conservative estimates by ICCAT (Anon., 2005.) calculated from tuna catch ratios indicate catches of blue sharks constantly well above 20 000 t throughout since 1971 (Figure 8.2). These catches peak at over 50 000 t annually in the early 1990’s and decline after that. This evaluation indicates the uncertainty encountered in documentation of this species’ appearance in the tuna longline fishery.

There is also considerable bycatch of blue sharks in Japanese tuna longliners operating in the Atlantic. Documentation is incomplete, estimates given in Matsunaga and Nakano 2005 indicate bycatch levels of 2000 to 6000 t annually for the North Atlantic.

Because blue shark has a low market value, only the fins are usually retained, in tuna and swordfish fisheries. It is difficult to estimate the bycatch of blue sharks because data are limited. Observations on fin trade markets in Asia led to even higher estimates of catch numbers of Atlantic tuna longliners, ranging from 130 000 to 180 000 t of blue shark annually in the recent past (Anon., 2004).

8.2 Management considerations

Catch data of pelagic sharks are considered unreliable as many sharks are not landed whole but are landed as fins. ICCAT uses three sources of data when assessing pelagic shark stocks; reported data, tuna ratios and market data. Reported data is the declared landings made by each member state to ICCAT and the FAO. The tuna ratios are a comparison of the observed bycatch of these shark species in the tuna fisheries with the amount of tuna landings declared. Market data is based on observations on the amount of sharks or fins on sale in the large Asian fish markets. As part of their 2004 assessment, ICCAT compared these three figures (Figure 8.2). Also shown is the Working Group assessment of these species (Figure 8.3).

It is immediately clear that the working group catch estimate is an underestimate. While the broad trends are similar, the catch numbers are much smaller. This can mainly be attributed to the fact that countries supply data to ICCAT that is not available to ICES. For accurate stock assessments of pelagic sharks, data from throughout the North Atlantic must be made available to the Working Group. In addition, reporting procedures must be strengthened so that all landings are reported, and that landings are reported to species level, rather than generic nei categories.

8.3 Previous assessments

ICCAT carried out an assessment of blue shark in the Atlantic in 2004. According to this assessment, blue shark appears to be above the biomass that would support MSY (Anon., 2005). However it is recognised that the quality of the data used in this assessment is poor and therefore theses results should be considered very preliminary. Further research and better resolved data collection for this species was highly recommended.

Some recent studies of the population trends of Atlantic pelagic predatory fishes found that blue sharks have declined over 60% in recent decades (e.g. Baum *et al*., 2003), though this study has attracted some controversy (see Baum *et al*., 2005 and Burgess *et al*., 2005a,b). Other studies on blue shark have shown smaller declines (e.g. Campana *et al*., 2004), or significant declines in males only (Simpfendorfer *et al*., 2002).

8.4 References

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

Table 8.1. Blue shark in the North Atlantic. Available landings data 1995-2005 (Source Fao Fishstat, ICES & NAFO). These data are a considerable underestimate of real landings.

Area 27	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Denmark	2	3	1	1	0	2	0	13	6	1	0
France	285	320	270	238	166	218	69	35	49	42	57
Ireland	0	0	0	0	67	22	66	11	3	0	0
Spain (Basque country)	0	673	439	383	550	442	457	482	367	390	384
Portugal	0	0	0	0	886	1133	1006	1209	2170	323	516
UK (E, W & N.I..)	0	0	0	7	0	84	63	35	28	0	5
Uk (Scotland)	0	0	0	1	0	12	9	5	4	0	0
Area 27 Subtotal	287	996	710	631	1669	1913	1670	1789	2627	756	963

Area 34	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Benin	0	0	6	4	27	0	0	0	9	7	0
China	0	0	0	0	0	0	750	420	600	0	0
Liberia	0	0	0	0	76	70	0	0	0	25	0
Portugal	0	0	0	0	0	351	557	668	1292	661	0
Spain	0	0	12183	9541	9225	7820	7958	7159	10080	9955	0
Area 34 Subtotal	0	0	12189	9545	9328	8241	9265	8247	11981	10648	0

Area 21	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Canada (Maritimes)	0	0	0	0	53	18	0	2	6	0	0
Canada (Newfoundland)	0	0	0	0	0	0	0	3	0	0	0
Area 21 Subtotal	0	0	0	0	53	18	0	5	6	0	0

Combined total	287	996	12899	10176	11050	10172	10935	10041	14614	11404	963

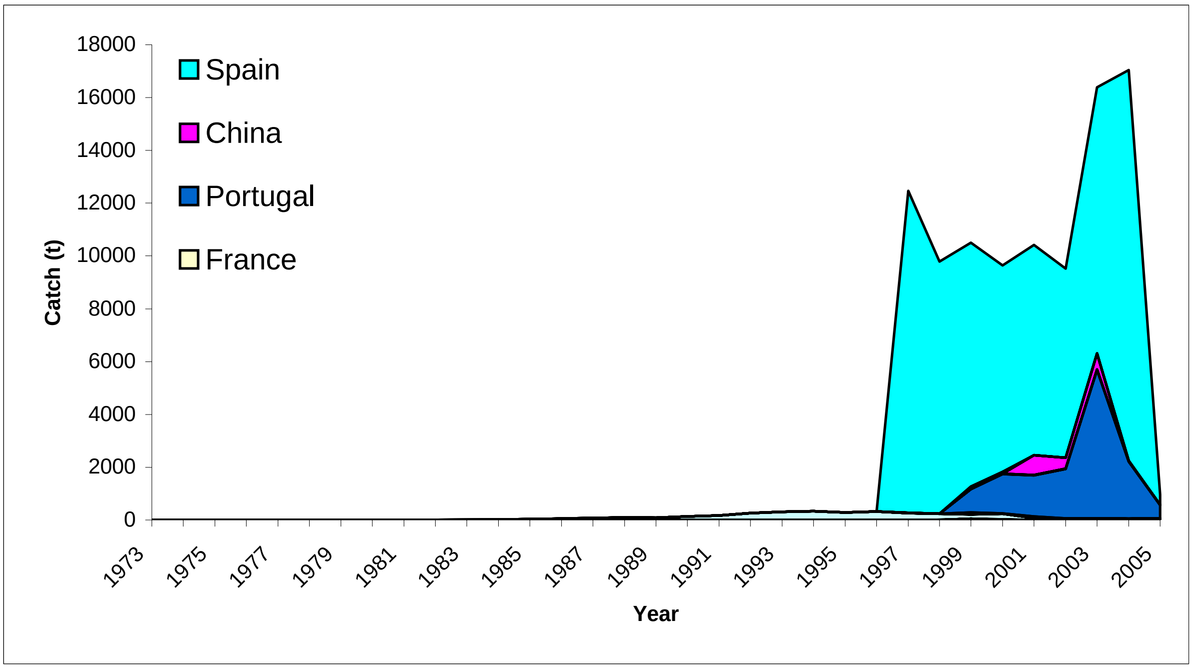

Figure 8.1. Blue Shark in the North Atlantic. Available landings (t) from North Atlantic (Areas 27,21,34). These data must be considered a large underestimate.

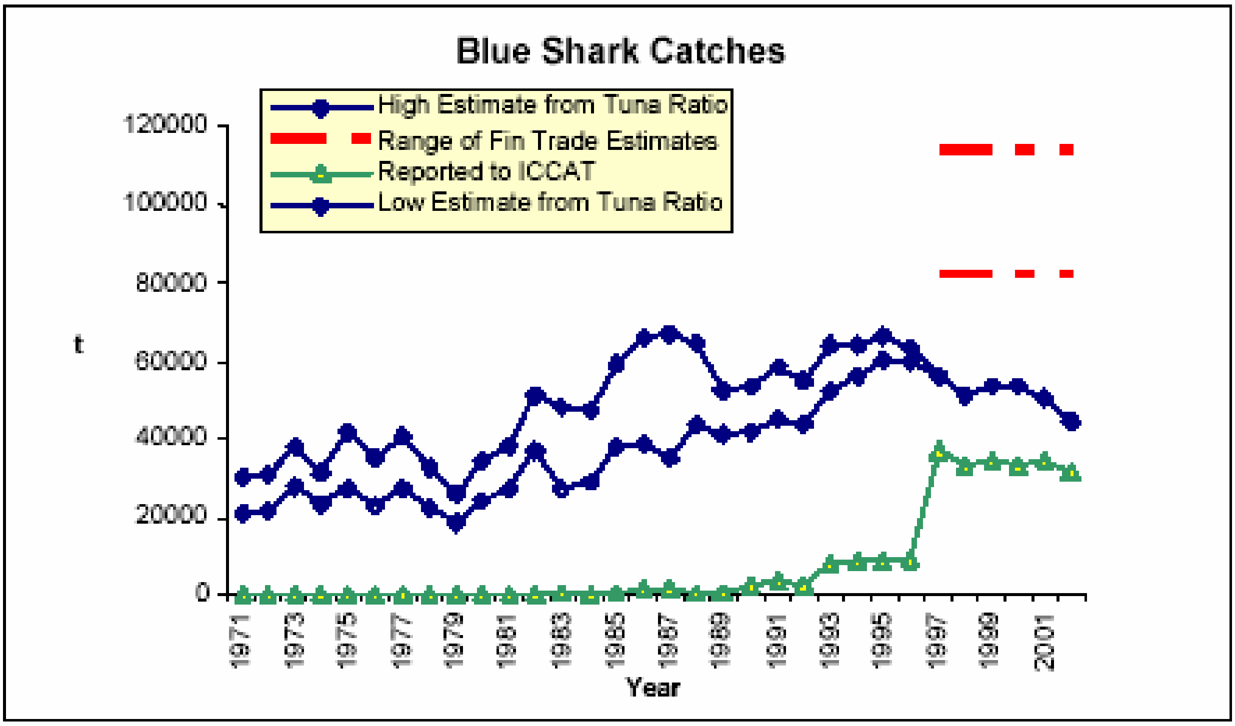

Figure 8.2. Blue shark in the North Atlantic. Comparison of shark catch reported to ICCAT with estimates resulting from tuna to shark ratios and from fin trade data for blue sharks in the Atlantic.

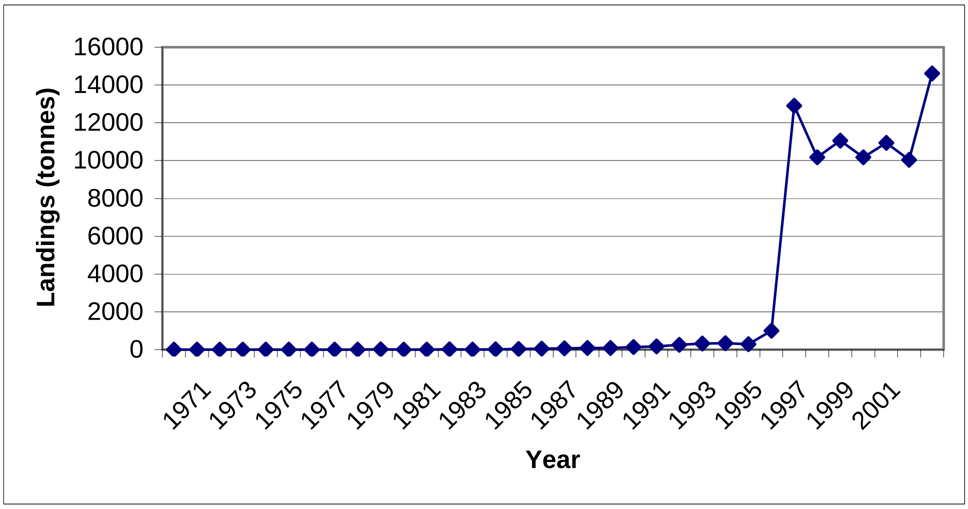

Figure 8.3. Blue shark in the North Atlantic. Available official landings data of blue shark landings in the North Atlantic. These must be considered a large underestimate.

9 Shortfin mako (*Isurus oxyrinchus*) in the north Atlantic (FAO Areas 27, 21, 34 and 31)

The ICCAT pelagic shark assessment working group considers one stock of shortfin mako in the north Atlantic. Data on which this consideration was made is limited however, so it can be regarded as a preliminary conclusion (Anon., 2005). Therefore, the ICES area is only part of the North Atlantic stock.

9.1 The fishery

9.1.1 Advice and management applicable

ACFM has never provided advice for shortfin mako shark in the ICES area. Because this species is not a unit stock in the ICES area, and because ICES has not access to full data sets, it was decided that ICCAT would be responsible for assessment of this species.

ICCAT completed a stock assessment in 2004 (Anon., 2004) but no management recommendations were made.

9.1.2 The fishery

The shortfin mako is a high sea pelagic and highly migratory species being caught frequently as bycatch mostly in longline fisheries targeting tuna and billfish.

Landings data for FAO areas 27, 21 and 34 are presented in Tables 9.1 and 9.2. Figure 9.1 shows the combined catches for these areas. Catch data are unavailable for area 31 are not available. In the ICES area, shortfin mako sharks are caught predominantly by Portuguese and Spanish vessels in Subareas, VIII, IX, and X. However, records from as far north as Hatton Bank, from Japanese tuna longliners are available (Boyd, in prep).

Data used for this report (Table 9.1–9.2 and Figure 9.2) is compiled data from FishStat databases, covering the major part of North Atlantic management areas. The information given in this report therefore is incomplete for the area of the entire North Atlantic.

Landings data were very low before 1997. Recent landings have been above 1000 t (Figure 9.1). The sudden appearance of shortfin mako catches in the statistics reflects the onset of documentation of these catches rather than the beginning of catching this species. Conservative estimates by ICCAT (Anon., 2005) calculated from tuna catch ratios indicate catch rate of shortfin mako constantly well above 4000–6000 t since 1971 (Figure 9.2). These catches peak at over 10 000 t annually in the mid- 1990's and decline after that. These reported catches show an increase from a very low level of reported catches, to about 3000 t in 1985, followed by a decrease to previous levels until the early 1990s. Peak landings of around 5000 t were reported in 1997, landings staying above 4000 t since. These figures are much higher than the values reported to ICES. The comparative evaluation indicates the uncertainty encountered in documentation of this species' appearance in the tuna longline fishery.

There is considerable bycatch of shortfin mako sharks in Japanese tuna longliners operating in the Atlantic. Documentation is incomplete. Estimates given in Matsunaga and Nakano (2005) indicate bycatch levels of 300 to 500 t of shortfin mako bycatch annually for the North Atlantic.

It is difficult to estimate the bycatch of blue sharks because data are limited. Observations on fin trade markets in Asia, e.g. Hong Kong and the numbers of fins traded there, led to even higher estimates of catch numbers of Atlantic tuna longliners, ranging from 130 000 to 180 000 t of blue shark annually in the recent past (Matsunaga and Nakano, 2005).

Observations on fin trade markets in Asia led to even higher estimates of catch numbers of Atlantic tuna longliners, ranging from 15 000 to 18 000 t of shortfin mako annually in the recent past (Figure 6.2).

9.2 Management considerations

Catch data of pelagic sharks are considered unreliable as many sharks are not landed whole but are landed as fins. ICCAT uses three sources of data when assessing pelagic shark stocks; reported data, tuna ratios and market data. Reported data is the declared landings made by each member state to ICCAT and the FAO. The tuna ratios are a comparison of the observed bycatch of these shark species in the tuna fisheries with the amount of tuna landings declared. Market data is based on observations on the amount of sharks or fins on sale in the large Asian fish markets. As part of their 2004 assessment, ICCAT compared these three figures (Figure 9.2). Also shown is the Working Group assessment of these species (Figure 9.3).

It is immediately clear that the working group catch estimate is an underestimate. While the broad trends are similar, the catch numbers are much smaller. This can mainly be attributed to the fact that countries supply data to ICCAT that is not available to ICES. For accurate stock assessments of pelagic sharks, data from throughout the North Atlantic must be made available to the Working Group. In addition, reporting procedures must be strengthened so that all landings are reported, and that landings are reported to species level, rather than generic nei categories.

9.3 Previous assessments

In 2004, ICCAT has held an assessment meeting to assess stock status of shortfin mako (Anon., 2005). Overall data quantity and quality was considered limited and results as very preliminary.

Based on CPUE data, it was likely that the North Atlantic stock of shortfin mako has been depleted to 50% of previous levels. Stock capacity may be below MSY. Further studies are needed of the assumptions underlying the model need to be completed before stronger conclusions can be drawn.

No management recommendations were made

9.4 References

Anon. 2005. Report of the 2004 Inter-Sessional Meeting of the ICCAT Subcommittee on Bycatches: Shark Stock Assessment. SCRS/2004/014

Boyd, J. in prep. Report of observer trip on a Japanese tuna longliner Koshin Maru #8. Irish Fishery Bulletin.

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Table 9.1. Shortfin mako in the NE Atlantic. Available landings (tonnes) of shortfin mako in the NE atlantic by area. Also shown are catches in Area 21 and Area 34. There are no reported catches prior to 1992.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Division I	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Division IV	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Division VI	0	0	0	0	0	0	0	1	3	2	2	2	0	0
Division VII	0	0	0	0	0	0	0	3	2	0	0	0	0	0
Division VIII	0	0	0	0	0	0	0	1	0	0	0	0	30	0
Division IX	0	0	0	0	0	0	0	63	111	121	56	188	237	0
Division X	4	0	0	0	0	0	0	85	69	65	50	344	314	0
Division XII	0	0	0	0	0	0	0	0	1	0	0	9	1	0
Unspecified	0	0	0	0	0	0	0	8	0	0	0	0	0	0
Area 27 Subtotal	4	0	0	0	0	0	0	162	186	188	108	543	583	0
Area 34	13	41	62	35	42	111	112	143	361	80	276	411	510	0
Area 21	0	0	0	0	0	0	11	90	75	56	74	67	0	0
Total	17	41	62	35	42	111	123	395	622	324	458	1021	1093	0

Table 9.2. Shortfin mako in the NE Atlantic. Available landings (tonnes) of shortfin mako by country. (Source FAO Fishstat, ICES & NAFO).

Area 27	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Portugal	4	0	0	0	0	0	0	160	183	186	107	542	328	0
Spain	0	0	0	0	0	0	0	0	0	0	0	0	255	0
UK (E, W & N.I.)	0	0	0	0	0	0	0	2	3	2	1	1	0	0
Area 27 Subtotal	4	0	0	0	0	0	0	162	186	188	108	543	583	0
Area 34														
Portugal	0	0	0	0	0	0	0	0	42	42	68	151	42	0
Spain	0	0	0	0	0	0	0	0	0	0	0	0	468	0
Benin	0	0	0	0	0	0	0	4	3	1	0	0	0	0
China	0	34	45	23	27	19	74	126	191	22	208	260	0	0
Côte d'Ivoire	13	7	17	12	0	92	38	0	0	0	0	0	0	0
Liberia	0	0	0	0	15	0	0	10	9	15	0	0	0	0
Philippines	0	0	0	0	0	0	0	0	116	0	0	0	0	0
Area 34 Subtotal	13	41	62	35	42	111	112	140	361	80	276	411	510	0
Area 31														
Canada (Maritimes)	0	0	0	0	0	0	0	53	54	56	67	67	0	0
Canada (Newfoundland)	0	0	0	0	0	0	11	16	21	0	7	0	0	0
USA	0	0	0	0	0	0	0	21	0	0	0	0	0	0
Area 31 Subtotal	0	0	0	0	0	0	11	90	75	56	74	67	0	0
Total	17	41	62	35	42	111	123	392	622	324	458	1021	1093	0

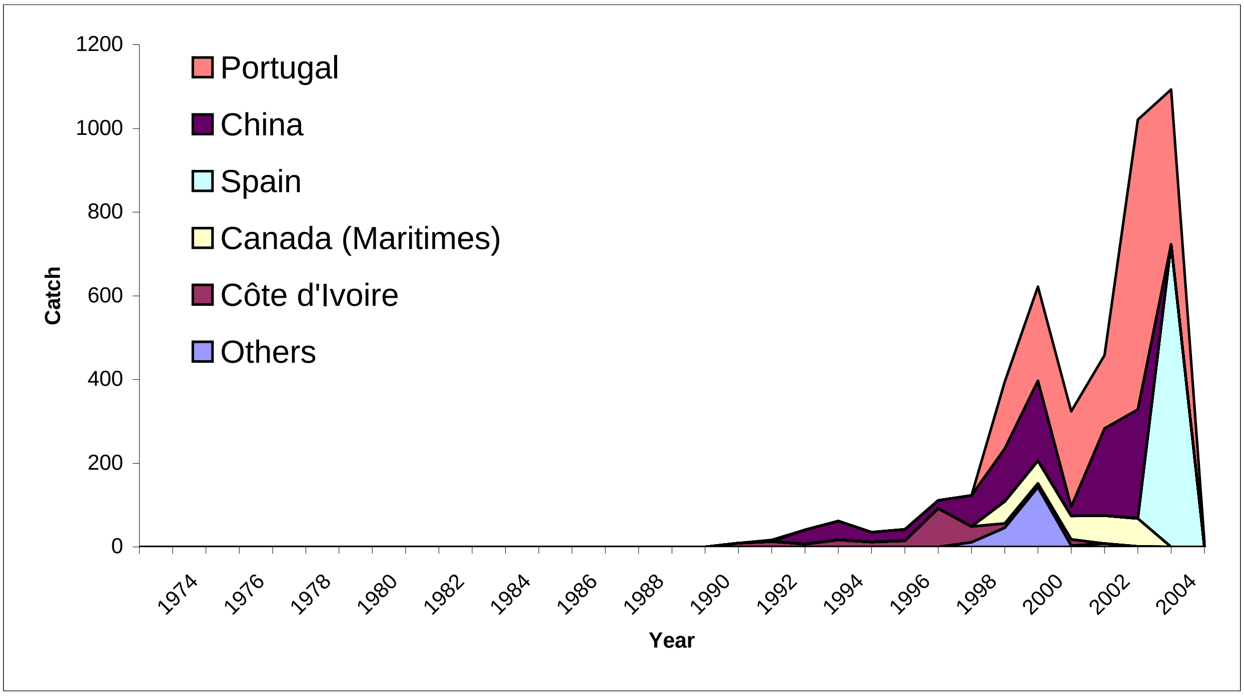

Figure 9.1. Shortfin mako (Isurus oxyrinchus) in the North Atlantic. Available landings (tonnes) from North Atlantic (Areas 27, 21, 34).

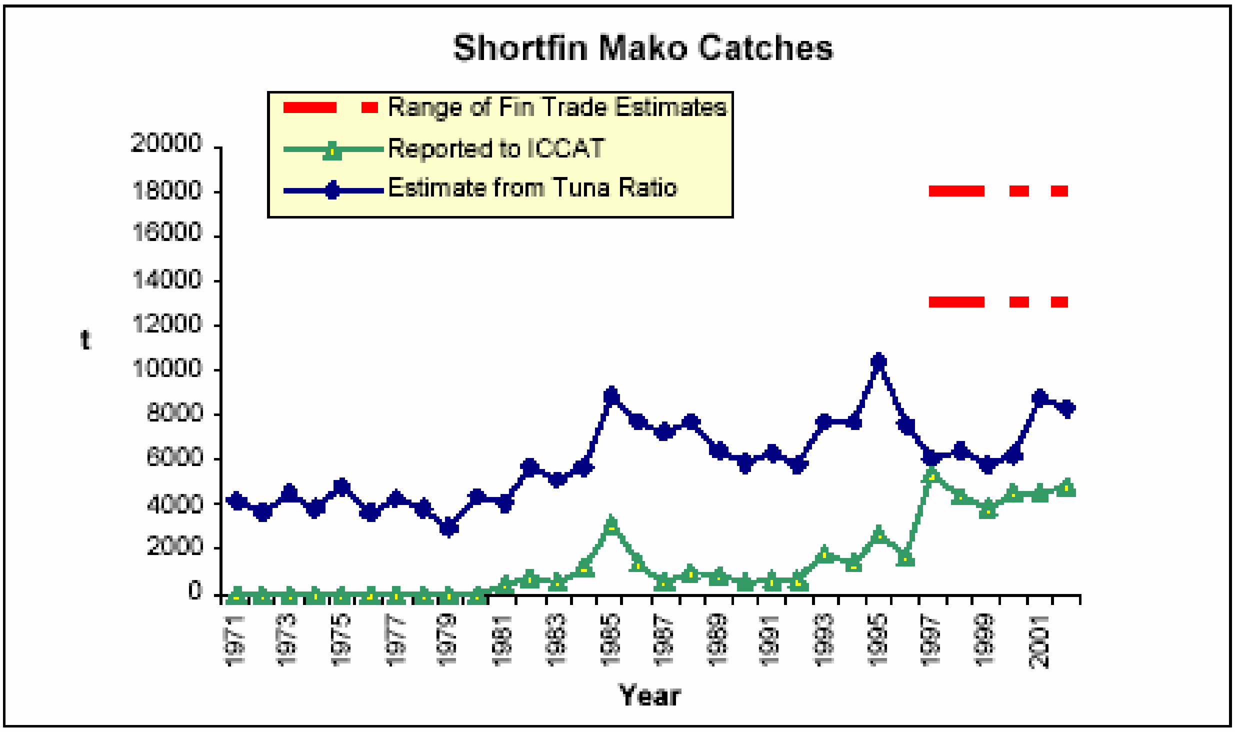

Figure 9.2. Shortfin mako (Isurus oxyrinchus) in the North Atlantic. Comparison of landed weights from data reported to ICCAT, from data raised to catches of tunas and from fin trade estimates (Anon., 2005).

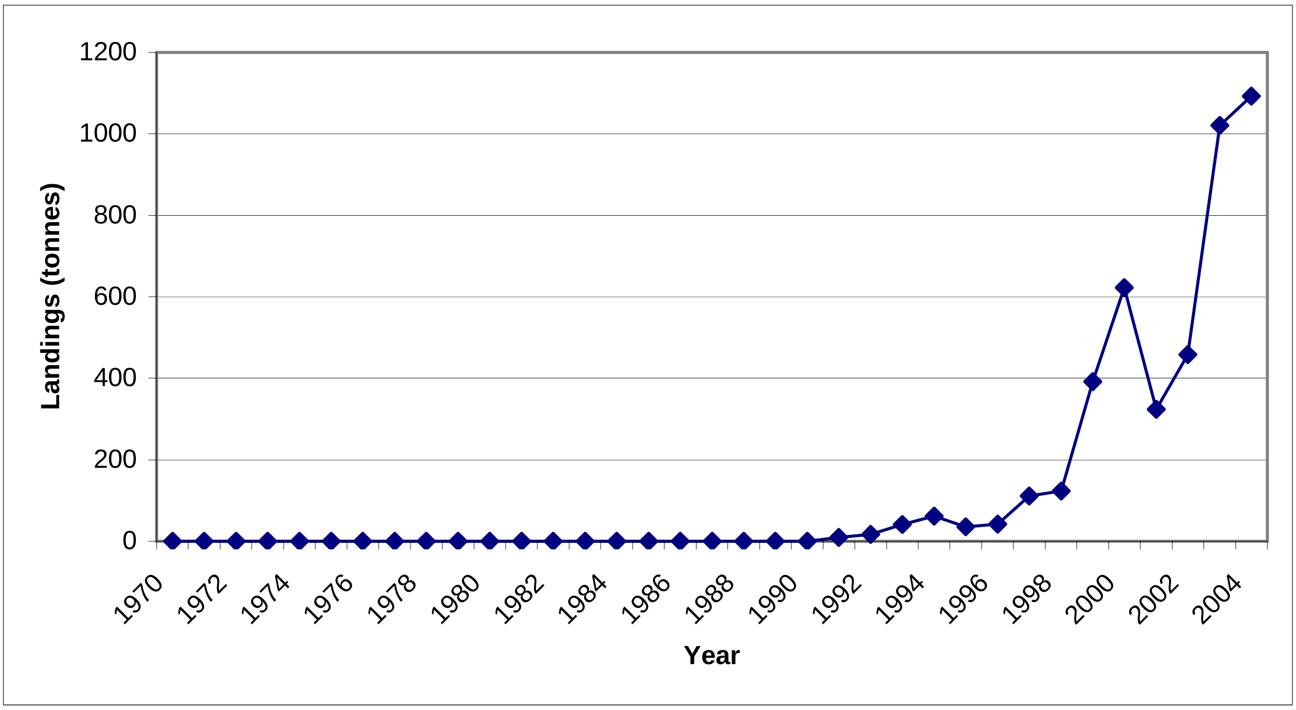

Figure 9.3. Shortfin mako in the NE Atlantic. Working Group estimate of shortfin mako landings in the north Atlantic.

10 Demersal elasmobranchs in the Barents Sea

The eight species inhabiting the Barents Sea are starry ray (or thorny skate) *Amblyraja radiata*, Arctic skate *A. hyperborea*, round skate *Rajella fyllae*, common skate *Dipturus batis*, spinytail skate *Bathyraja spinicauda*, sailray *D. lintea*, long-nose skate *D. oxyrhynchus* and shagreen ray *Leucoraja fullonica* (Andriyashev, 1954; Dolgov, 2000; Dolgov *et al.*, 2004b).

Little information is available on the fauna of demersal elasmobranchs in the Barents Sea. Dolgov *et al*. (2004a) state that 8 species of skates are known to inhabit the Barents Sea and appear regularly and in considerable amounts as bycatch in fisheries. No directed fishery is targeting skates in the Barents Sea.

Of these, few species occur in greater abundace with the thorny skate as the dominant species, comprising 96% by number of total number and about 92% by weight of skates caught in surveys or as bycatch. The following most abundant species are arctic and round skate, with 3% and 2% by number respectively. The rest of the species are scarce in occurrence (Dolgov *et al.*, 2004b; Drevetnyak *et al*., 2005).

10.1 The fishery

10.1.1 Advice and management applicable to 2005 and 2006

ACFM has never provided advice for any of the stocks within this region.

There are no TACs or other management measures for any of the demersal elasmobranch species in this region.

10.1.2 The fishery in 2005

Detailed data on catches of skates from the Barents Sea are only available from bycatch records and surveys form 1996–2001 and 1998–2001, respectively, provided by Dolgov *et al*., 2004a, 2004b. Data for most recent years are either preliminary or unavailable. The summarized catch table can be found at the end of this Report (Figure 10.1 and Table 10.1).

Bottom trawl fisheries mainly targeting cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) as well as longline fisheries for blue catfish (*Anarhichas denticulatus*), cod and Greenland halibut (*Reinhardtius hippoglossoides*) conducted through all seasons are generating the bycatch of skates in the Barents Sea. Skate bycatch is generally not used for food and discarded. Dolgov *et al.* (2004a) estimated the total catch of skates taken by the Russian fishing fleet operating in the Barents Sea and adjacent waters in 1996–2001 ranged from 723–1891 tons, with an average of 1250 tons per year. Thorny skate accounted for 90–95% of the total skate bycatch.

The names and locations of Russian statistical fisheries areas are shown in Figure 10.2 (Anon., 1957, Dolgov *et al.,* 2004a). Dolgov *et al*. calculated total catch composition based on data derived by observers for each fishery area and month. The catch statistics on the total for each month from directed fisheries for demersal fish were distributed on local fishery areas. The biomass of bycatch species was calculated for each area and time period based on the assumption that catch biomass of target fishes from catch data in the area proportionally corresponds to the biomass of this species in the catch composition from the observer data in the same area. This method was stated to be associated with for high uncertainty levels of approximately ±45%. Data obtained by the bycatch assessment reflect distribution and abundance of observed species obtained by surveys in the same area.

Relative CPUE Data are available for *A. radiata*, *A. hyperborea*, *R fyllae* and *D. batis* (Figure 10.3) and *A. radiata*, *A. hyperborea* and *D. batis* in trawl and longline fisheries respectively

(Figure 10.4). Total catches of skates of Russian fisheries in the Barents Sea and adjacent areas for the years 1996–2001 are given in Table 10.4 and Figure 10.17.

10.2 Fishery-independent information

10.2.1 Groundfish surveys

Data from survey cruises are available from Dolgov *et al.* (2004b) and Drevetnyak *et al.* (2005) covering the years from 1998–2001, describing distribution and habitat utilization for six species and abundance and relative biomass estimares of five species of skates in the Barents Sea. Species examined are *A. radiata*, *A. hyperborea*, *R. fyllae*, *D. batis*, *B. spinicauda* and *D. lintea*.

Abundance and distribution as well as depth of capture are documented for the time of 1998–2001 in Figures. 10.5–10.8 and Figure 10.9 respectively. Abundance and biomass estimates for 1997-2003 are given in Table 10.3. Figure 10.16 shows the proportion of skates in the total catch of demersal fish by area in the Barents Sea, average for 1996–2001. (from Dolgov *et al*., 2004b) .

The species composition of skates caught in the Barents Sea differs from those recorded in the Norwegian Deeps and north-eastern Norwegian Sea (Skjaeraasen and Bergstad, 2000, 2001). While thorny skate is the dominant species in both areas, the portion of warm-water species (*B. spinicauda*, *D. Lintea*) is lower and the portion of cold-water species (*A. hyperborea*) is higher in the Barents Sea. Obtained data on stocks of *A. radiata* and *R. fyllae* remained almost unchanged during survey timeframe, possibly suggesting stable stocks in the examined area (Dolgov *et al*., 2004b). The abundance estimate of these authors for *A. radiata* over the period of 1997–2005 varied from 99 × 10^6 animals in 1997 to 161 × 10^6 animals in 2002 and averaged 142 × 10^6 animals. Estimated biomass varied between 72 000 and 122 000 tons with an average of 98 100 tons. The following most abundant skate species were *A. hyperborea* and *R. fyllae*, with an average abundance of 2.4 × 10^6 and 2.6 × 10^6 animals each, and an average biomass of 3 000 tons and 1 400 tons, respectively. The abundance of *D. batis* and *B. spinicauda* was lower (0.6 × 10^6 and 0.7 × 10^6 animals respectively), though the biomass of *D. batis* was estimated at 2 900 tons due to the large size of the fish, while the biomass of *B. spinicauda* did not exceed 800 tons. *A. radiata* were distributed throughout the area of investigation, while the distribution of other species (*R. fyllae*, *D. batis*, *B. spinicauda*, and *D. lintea*) was limited to the areas of distribution of Atlantic water, occurring mainly in the southwestern part of the Barents Sea. The preferred depths and temperatures of these species in the Barents Sea correspond well with the data of Skjaeraasen and Bergstad (2001) for the southern distribution area of skates on the slope of the eastern Norwegian Sea. However, it should be noted that the northern border of some species' distributions in the Barents Sea is much further north than previously described in the literature.

10.3 Mean length, weight, maturity and natural mortality-at-age

Length data are available for *A. radiata, A. hyperborea* and *R. fyllae* (Table 10.2), Length-frequency data also from *D. batis* and *B. spinicauda* (Figures. 10.10–10.13) from bycatch assessments and survey cruises respectively. The abundance and biomass of *A. radiata* by size groups are shown in Figures 10.14 and 10.15 (from Drevetnyak *et al*. 2005).

10.4 Spawning and juvenile fishing area closures

A. radiata, A. hyperborea and *R.fyllae* spawn in the Barents Sea (Berestovsky, 1994; Dolgov field observations) whereas the scarcity of small-sized juvenile blue and spinytail skate and sail ray and the absence of mature specimens of these species suggests that their main spawning areas are outside the Barents Sea. Their stocks presumably must be sustained through emigration of animals from areas to the south.

10.5 Management considerations

The elasmobranch fauna of the Barents Sea is little studied and comprises relatively few species. The most abundant demersal elasmobranch in the area is starry ray, which is widespread and abundant in this and adjacent waters. Further studies to examine the status of some of larger-bodied species (e.g. larger skates, Greenland shark), which may be more vulnerable to over-fishing, may be required.

University of Tromsø, Norway has initiated a study for a master degree with the title: "*Elasmobranchs along the North-Norwegian coast- Diversity, distribution and density*". The tasks for the study will be to assess the quality of available data with respect to accuracy and consistency of species identification. Further more, to assess the distribution and diversity of Elasmobranch species' in North-Norwegian coastal areas and the Barents Sea and finally to investigate how or if the diversity and density of Elasmobranch species have varied during the period for where there are data. A number of data sources from the fisheries and from scientific surveys will be utilized and the thesis will be finished by the spring of 2008. The results of the study are planned to be presented to WGEF in 2008.

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Skjaeraasen, J. E. and Bergstad, O. A. 2001. Notes on the distribution and length composition of *Raja lintea, R. fyllae, R. hyperborea* and *Bathyraja spinicauda* (Pisces: Rajidae) in the deep northeastern North Sea and on the slope of the eastern Norwegian Sea. ICES Journal of Marine Science, 58: 21–28.

Table 10.1. Skates & Rays from ICES Area I, 1973–2005. Total landings (tonnes).

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
France	.	.	.	81	49	44	.	.	.	.	.	.	.	.	.	.
Germany	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Iceland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Norway	.	.	.	1	3	4	8	2	2	2	1	10	11	3	14	7
Portugal	.	.	100	11	1	.	.	.	.	.	.	.	.	.	.	.
Russian Federation	.	.	.	.	.	1126	168	93	3	1	n.a.	563	619	2137	2364	2051
Spain	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
UK - England & Wales	78	46	49	33	70	9	8	4	.	1	.	.	.		2	.
UK – Scotland	.	.	1	2	2	.	.	.	.	.	.	.	.	.	.	.
Total of submitted data	78	46	150	129	125	1183	184	99	5	4	1	573	630	2140	2380	2058

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	.	.	.	.	.	n.a.	n.a.	n.a.	
France	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Germany	n.a.	n.a.	.	.	.	2	.	.	.	.	.	.	.	n.a.	n.a.	n.a.	
Iceland	.	.	.	.	1	.	.	.	1	.	.	4	.	n.a.	n.a.	n.a.	
Norway	4	1	5	24	29	72	9	27	3	13	21	12	30	26	2	1	4
Portugal	.	.	.	.	.	.	.	.	.	.	.	.	.	n.a.	n.a.	n.a.	.
Russian Federation	1235	246	n.a.	399	390	369	.	.	399	790	568	502	218	173	38	n.a.	
Spain	.	.	.	.	.	.	7	.	.	.	.	.	.	n.a.	n.a.	n.a.	.
UK - England & Wales	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.
UK – Scotland	.	.	.	.	.	.	.	.	.	.	.	.	.	n.a.	n.a.	n.a.	.
Total of submitted data	1239	247	5	423	420	443	16	27	403	803	589	518	248	199	40	1	4

Table 10.2. Mean length and sex ratio of some skate species (thorny skate *A. radiata*, arctic skate *A. hyperborea*, round skate *R. fyllae*). (from Dolgov *et al.*, 2004a)

		Fishing Gear			
	Sex	Research bottom trawl (16 mm)	Trawl (125 mm)	Trawl (135 mm)	Longline
Thorny skate					
Mean length, cm	Males	38.0	44.3	43.5	46.8
	Females	37.8	42.8	42.3	46.6
Number of fish	Males	7517	3909	3504	1658
	Females	8075	4972	3834	1721
Sex ratio (M:F)		1:1.1	1:1.3	1:1.1	1:1
Arctic skate					
Mean length, cm	Males	58.4	56.6	52.6	64.5
	Females	55.1	55.0	54.6	68.3
Number of fish	Males	606	215	213	822
	Females	355	123	159	97
Sex ratio (M:F)		1:0.6[1]	1:0.6[1]	1:0.7[1]	1:0.1[1]
Round skate					
Mean length, cm	Males	43.2	46.2	48.2	51.9
	Females	40.4	45.0	45.3	48.7
Number of fish	Males	91	14	19	131
	Females	103	24	32	98
Sex ratio (M:F)		1:1.1	1:1.7[1]	1:1.7[1]	1:0.7

[1] Statistically significant (Chi-square test).

Table 10.3. Estimated abundance (x 10^6 fish) and biomass (x 10^3 tons) of five skate species *Thorny skate, A. radiata,* round skate, *R. fyllae,* arctic skate, *A. hyperborea,* blue skate *D. batis,* spinytail skate, *B. spinicauda* and sail ray in the Barents Sea during 1998–2001. (from Drevetnyak *et al.*, 2005)

Species		Year							
		1997	1998	1999	2000	2001	2002	2003	Average
Thorny skate	Abundance	99.55	167.00	130.57	135.62	140.32	161.31	160.58	142.14
	Biomass	71.71	106.32	88.68	91.56	95.42	121.68	111.29	98.09
Round skate	Abundance	1.00	2.50	0.33	4.18	3.21	3.38	3.81	2.63
	Biomass	0.51	1.34	1.26	2.26	1.24	1.45	1.68	1.39
Arctic skate	Abundance	2.30	1.86	0.78	6.18	1.46	0.83	3.23	2.38
	Biomass	2.49	2.73	1.35	7.42	2.32	1.57	3.28	3.02
Blue skate	Abundance	-	1.41	0.30	0.75	0.27	0.34	0.23	0.55
	Biomass	-	1.25	3.99	2.64	5.17	1.58	2.91	2.92
Spinytail skate	Abundance	-	-	0.05	1.06	0.51	0.98	1.07	0.72
	Biomass	-	-	0.01	1.44	0.41	0.88	1.33	0.81
All skates	Abundance	172.77	132.03	147.47	145.77	166.84	168.92	168.92	148.43
	Biomass	111.64	95.29	105.32	104.56	127.16	120.49	120.49	106.23

Table 10.4. Russian catches of skates in the bottom trawl and longline fisheries by area in the Barents Sea and adjacent waters in 1996–2001 (tonnes, calculated using data on discards). (from Dolgov *et al.*, 2004a)

Year	Russian EEZ	Grey zone	Norwegian EEZ	Spitsbergen area	International waters	Total
1996	305	209	106	99	4	723
1997	543	57	72	135	6	857
1998	860	607	164	236	22	1 891
1999	524	607	233	287	17	1 668
2000	335	491	334	365	14	1 539
2001	337	197	104	191	9	838

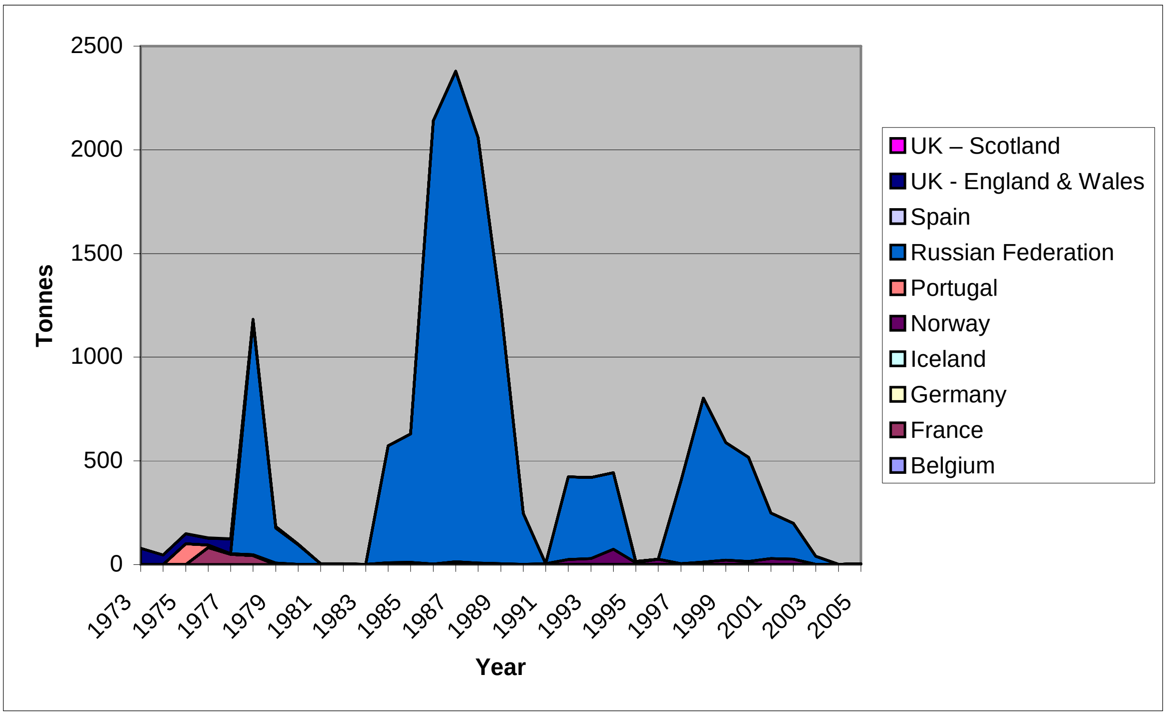

Figure 10.1. Demersal elasmobranchs in the Barents Sea. Skates & Rays from ICES Area I, 1973–2005. Total landings (tonnes).

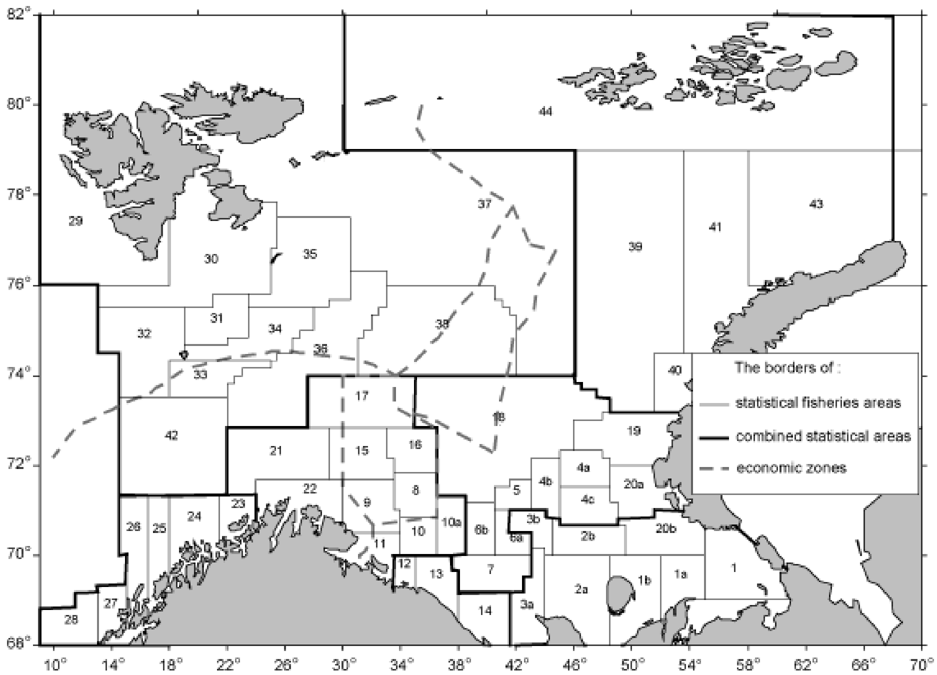

Figure 10.2. Map of Russian statistical fisheries areas in the Barents Sea (from Dolgov *et al.,* 2004a)

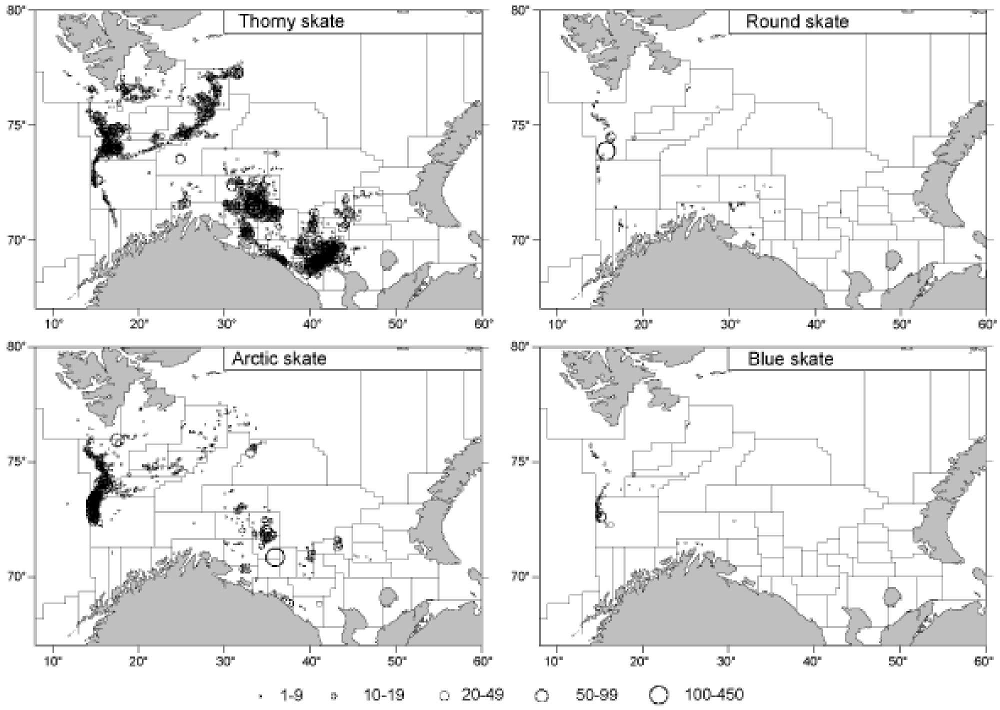

Figure 10.3. Demersal elasmobranchs in the Barents Sea. Distribution of skate bycatch in trawl fisheries (thorny skate *A. radiata*, round skate *R. fyllae*, arctic skate *A. hyperborea*, blue skate *D. batis*). Circle size represents catch rate in kg per hr. (from Dolgov *et al.*, 2004a)

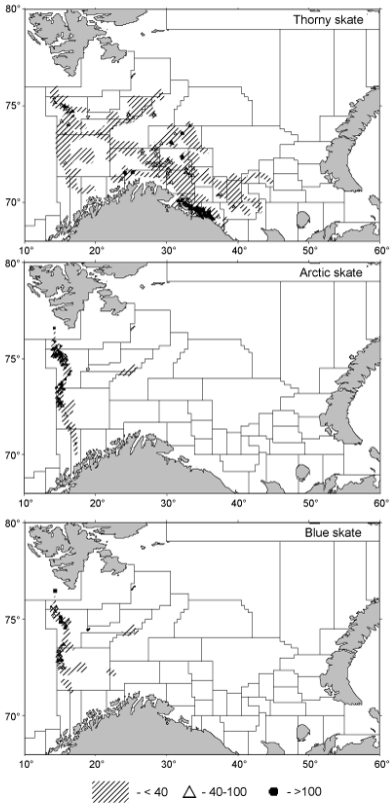

Figure 10.4. Demersal elasmobranchs in the Barents Sea. Distribution of skate bycatch in long-line fishery, kg per 1 000 hooks fisheries (thorny skate *A. radiata, arctic skate A. hyperborea, blue skate D. batis*). (from Dolgov *et al.*, 2004a)

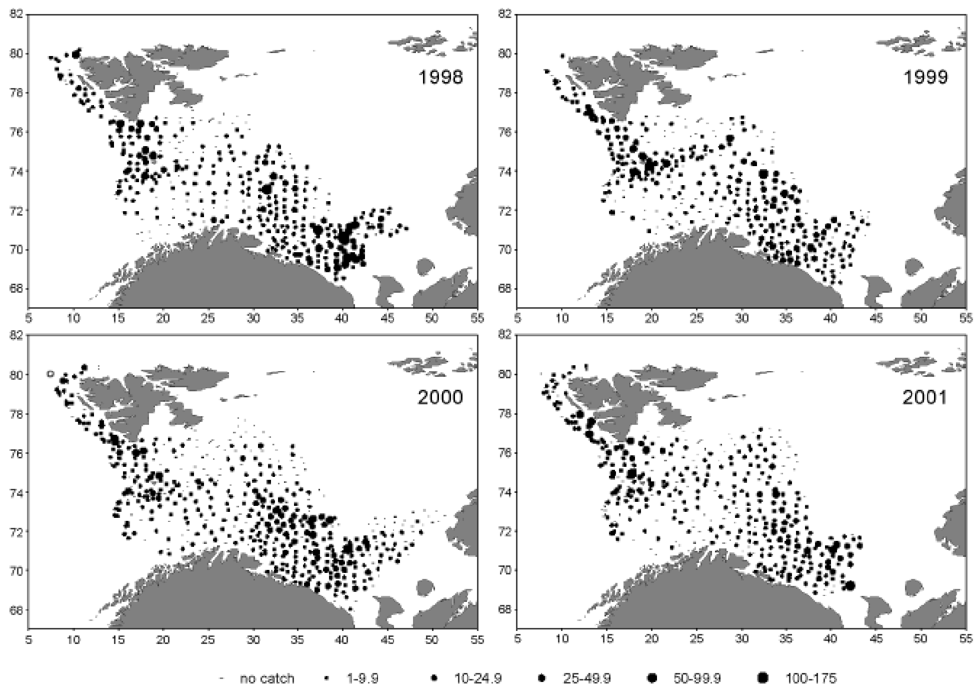

Figure 10.5. Demersal elasmobranchs in the Barents Sea. Distribution of *A.radiata* according to trawl surveys during 1998–2001, specimen per 1 hour trawling. (from Dolgov *et al.*, 2004b)

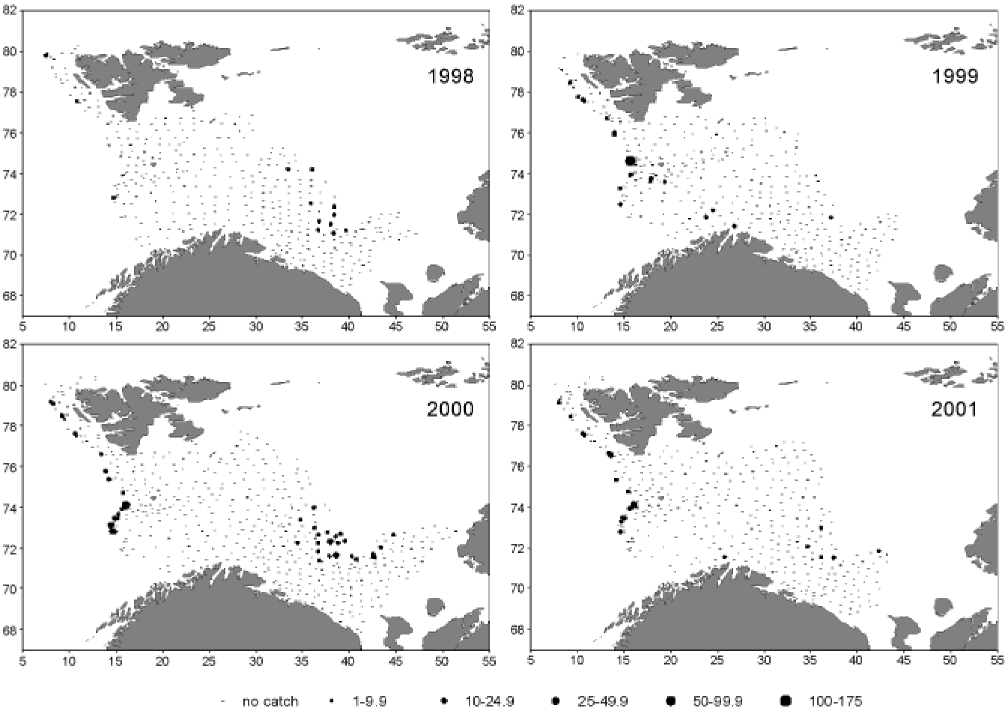

Figure 10.6. Demersal elasmobranchs in the Barents Sea. **Distribution of *A. hyperborea* according to trawl surveys during 1998–2001, specimen per 1 hour trawling. (from Dolgov *et al.*, 2004b)**

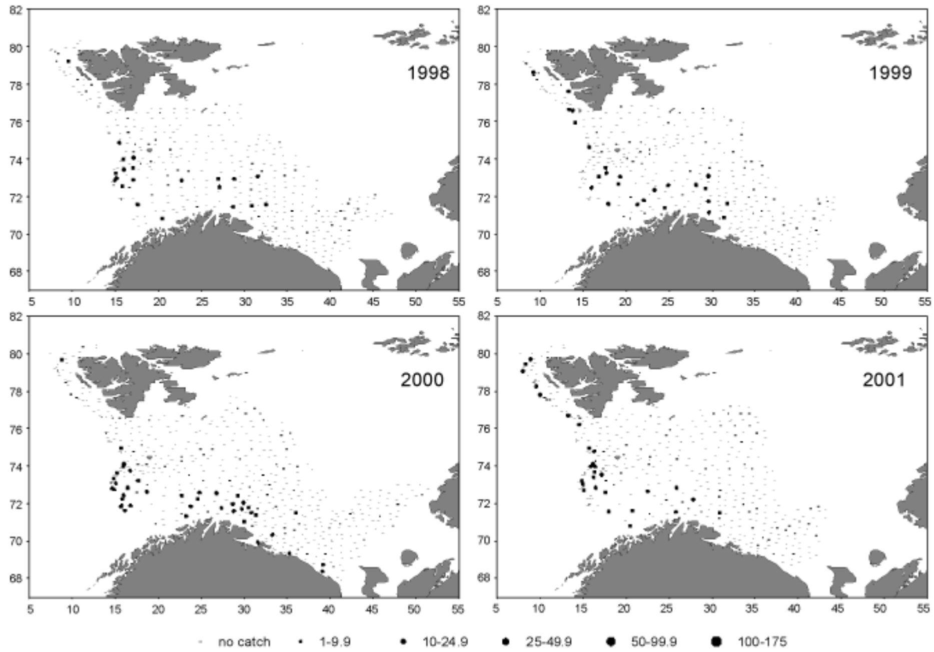

Figure 10.7. Demersal elasmobranchs in the Barents Sea. **Distribution of *R. fyllae* according to trawl surveys during 1998–2001, specimen per 1 hour trawling. (from Dolgov *et al.*, 2004b)**

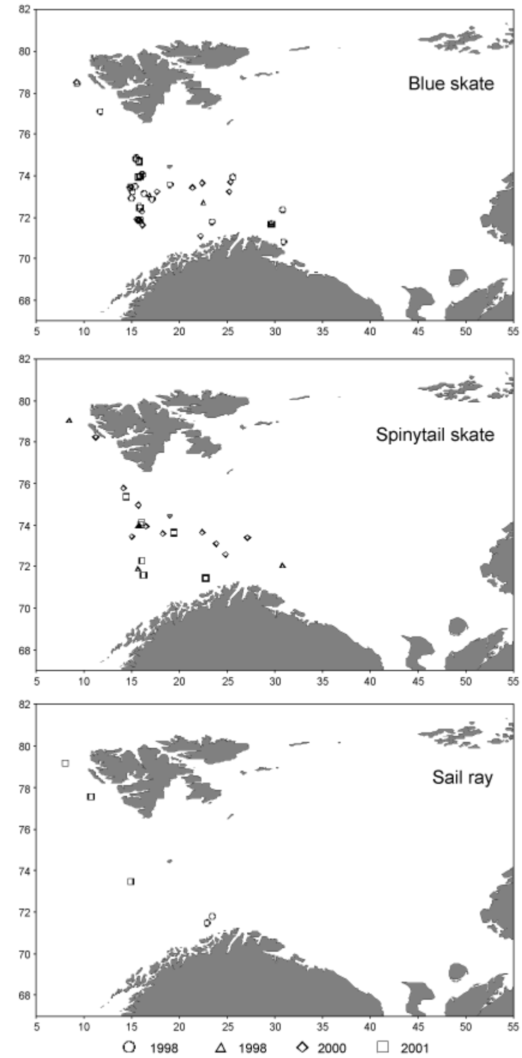

Figure 10.8. Demersal elasmobranchs in the Barents Sea. Capture sites blue skate *D. batis*, spinytail skate *B. spinicauda* and sail ray *D. Lintea* during 1998–2001. (from Dolgov *et al.*, 2004b)

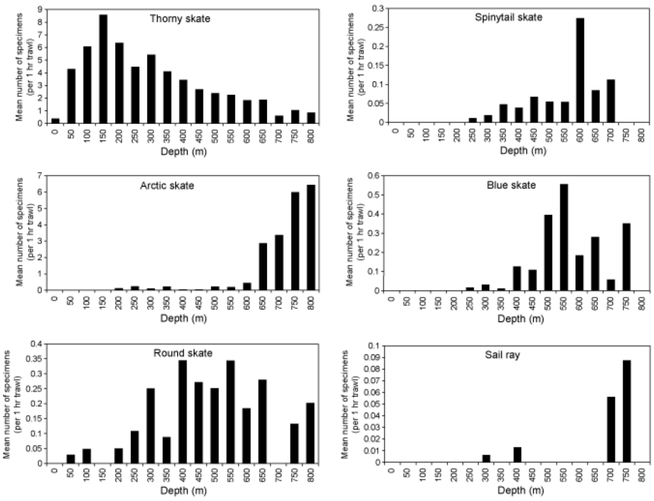

Figure 10.9. Demersal elasmobranchs in the Barents Sea. Bathymetric conditions in the habitat of various skate species in the Barents Sea (t*horny skate A. radiata*, arctic skate *A. hyperborea*, round skate *R. fyllae*, blue skate *D. batis*, spinytail skate *B. spinicauda* and sail ray *D. Lintea*). (from Dolgov *et al.*, 2004b)

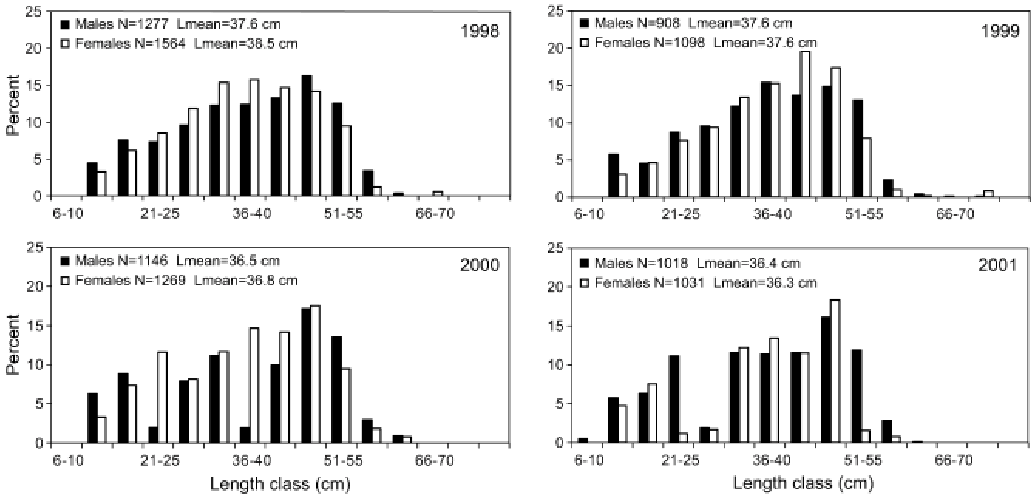

Figure 10.10. Demersal elasmobranchs in the Barents Sea. Size distribution of *A. radiata* during 1998–2001. (from Dolgov *et al.*, 2004b)

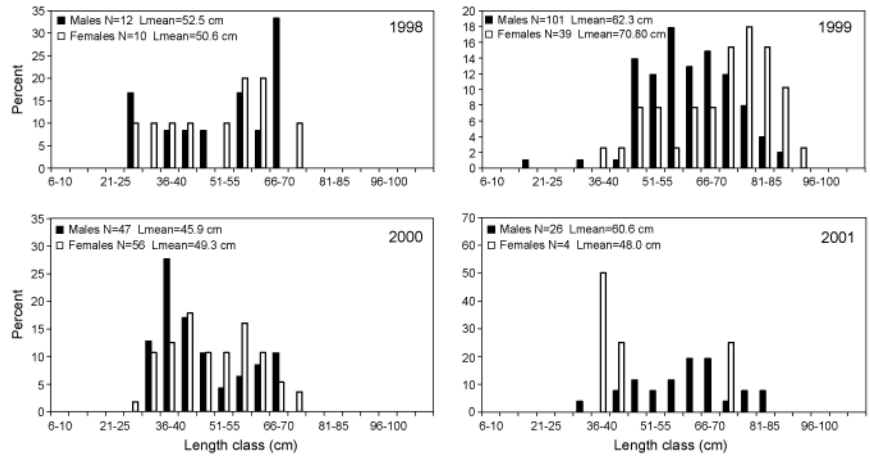

Figure 10.11. Demersal elasmobranchs in the Barents Sea. Size distribution of *A. hyperborea* during 1998–2001. (from Dolgov *et al.*, 2004b)

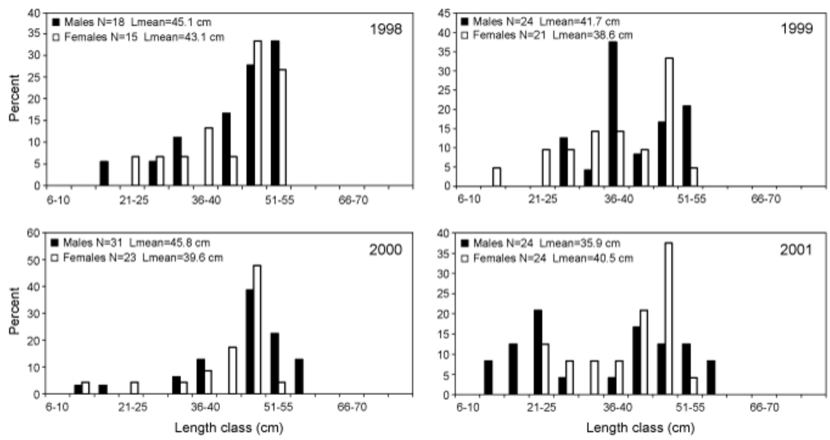

Figure 10.12. Demersal elasmobranchs in the Barents Sea. Size distribution of *R. fyllae* during 1998–2001. (from Dolgov *et al.*, 2004b)

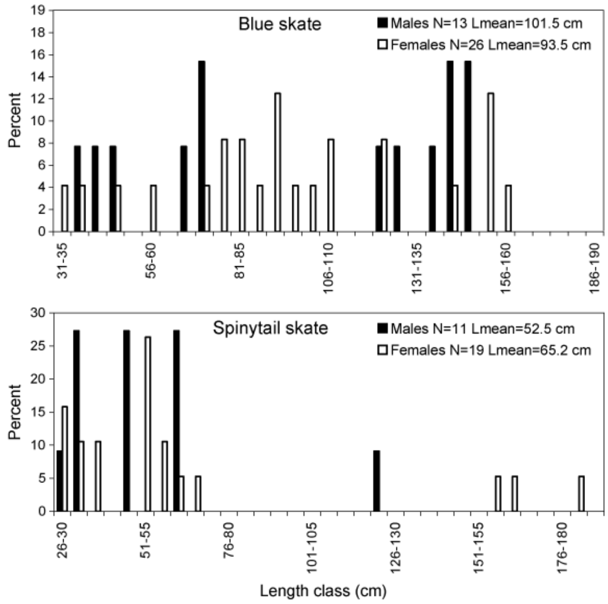

Figure 10.13. Demersal elasmobranchs in the Barents Sea. Size distribution of blue skate *D. batis* and spinytail skate *B. spinicauda* during 1998–2001. (from Dolgov *et al.*, 2004b)

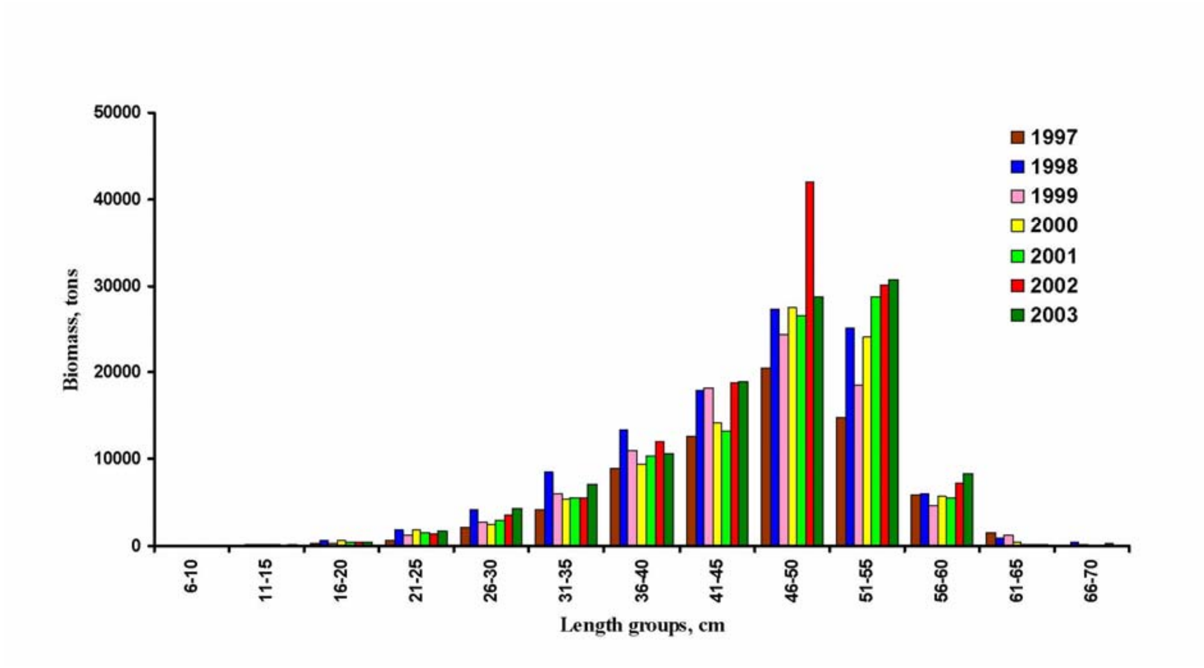

Figure 10.14. Demersal elasmobranchs in the Barents Sea. Dynamics of biomass of thorny skate by size groups (From Drevetnyak *et al.*, 2005).

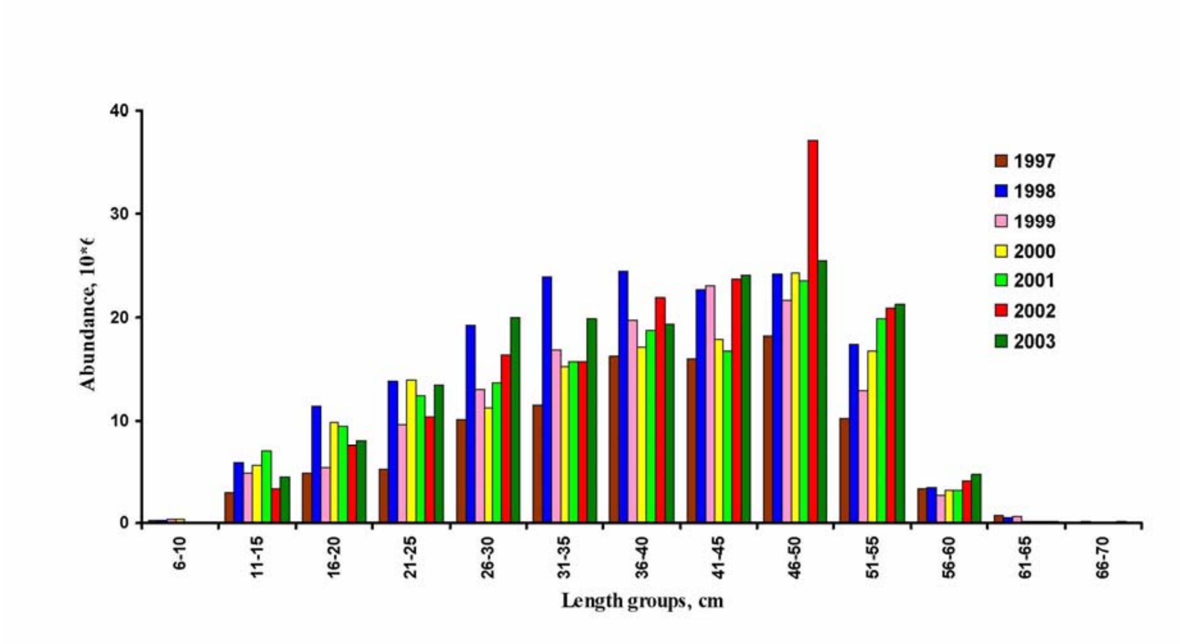

Figure 10.15. Demersal elasmobranchs in the Barents Sea. Dynamics of abundance of thorny skate by size groups (From Drevetnyak *et al.*, 2005).

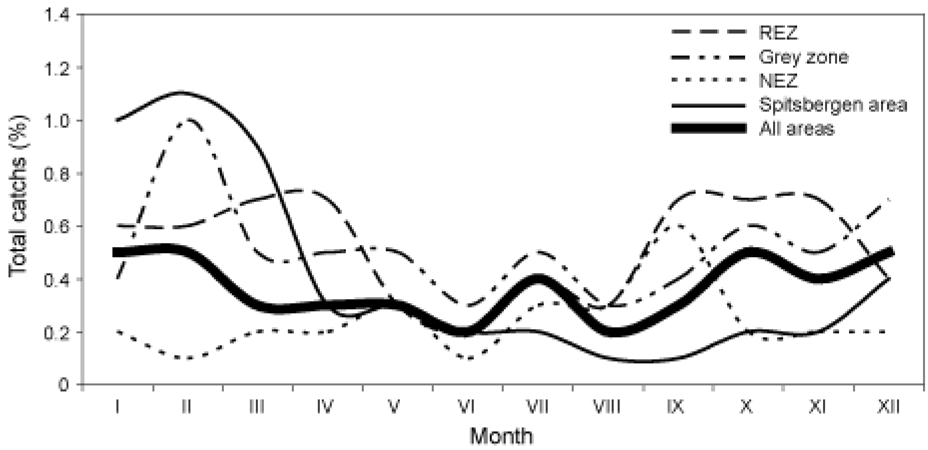

Figure 10.16. Demersal elasmobranchs in the Barents Sea. Proportion of skates in the total catch of demersal fish by area in the Barents Sea, average for 1996–2001. (from Dolgov *et al.*, 2004b)

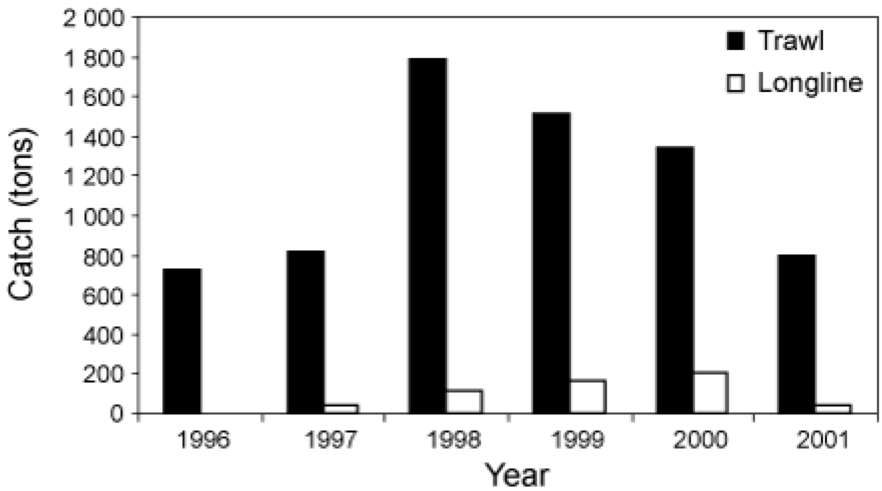

Figure 10.17. Demersal elasmobranchs in the Barents Sea. Catch of skates in trawl and long-line fisheries in the Barents Sea in 1996–2001. (from Dolgov *et al.*, 2004b).

11 Demersal Elasmobranchs in The Norwegian Sea

Little information is available about skate and ray species inhabiting the Norwegian Sea area. Skjaeraasen and Bergstad (2001) noted several species of skates in the Norwegian Sea and Norwegian Deep. Corresponding to ICES Area II, *Amblyraja hyperborea* and *Bathyraja spinicauda* were found in bottom trawls mainly in depths of 800–1400 m and 650–850 m respectively. *A. hyperborea* were caught in considerable numbers with sizes in length from 14–97 cm and a mean of about 60 cm, whereas *B. spinicauda* were scarce in distribution. More species found in the area are *Amblyraja radiata, Dipturus batis, Dipturus lintea, Dipturus nidarosiensis, Dipturus oxyrinchus, Leucoraja circularis, Leucoraja fullonica, Raja clavata,* and *Rajella fyllae*. A more thorough description of rajiform elasmobranchs from the Norwegian Sea can be found in Stehmann and Bürkel (1984).

It seems noteworthy that the once common Greenland shark *Somniosus microcephalus* now is depleted in the area and caught only rarely.

11.1 The Fishery

11.1.1 Advice and management applicable to 2004 and 2005

ACFM has never provided advice for any of the stocks within this region.

11.1.2 The fishery in 2005

There is no directed fishery on skates and rays in the Norwegian Sea, though they are caught in mixed fisheries targeting teleost species. Landings data for skates and rays are shown in Table 11.1 and Figure 11.1 for the years 1973–2005. Overall landings throughout time have been low and totaling around 200–300 mt per year for all fishing countries, with moderate fluctuations and one massive temporal peak in the late 1980s where Russian fisheries landed over 1900 mt of skates and rays in 1987, subsequently dropping to low levels two years later again. Russia and Norway are the most prominent and constant countries landing skates and rays from the Norwegian Sea. Landings data for 2005 are not resolved on taxonomic levels and are provided by Norway (133 t) and France (8 t).

11.2 Biological and fisheries information

Recently there has been growing public awareness that the stocks of certain Elasmobranch species are particularly vulnerable to fishing pressure. For the Norwegian coastal area there is very little knowledge about the biology and status of the stocks.

University of Tromsø, Norway has therefore initiated a study for a master degree with the title: "*Elasmobranchs along the North-Norwegian coast- Diversity, distribution and density*".

The tasks for the study will be to assess the quality of available data with respect to accuracy and consistency of species identification. Further more, to assess the distribution and diversity of Elasmobranch species' in North-Norwegian coastal areas and finally to investigate how or if the diversity and density of Elasmobranch species have varied during the period for where there are data. A number of data sources from the fisheries and from scientific surveys will be utilized and the thesis will be finished by the spring of 2008. The results of the study are planned to be presented to the WGEF in 2008.

11.3 Management considerations

There are no TACs for any of the demersal elasmobranch species in this region. The demersal elasmobranch fauna of the Norwegian Sea comprises several species that occur in the Barents Sea and/or the North Sea. Starry ray is one of the more abundant demersal elasmobranchs in the area, and this species is widespread and abundant in this and adjacent waters. The planned

Norwegian study will examine the status of the demersal elasmobranch species and examine the status of the different stocks.

11.4 References

Skjaeraasen, J. E. *and* Bergstad, O. A. 2001. Notes on the distribution and length composition of *Raja lintea, R. fyllae, R. hyperborea* and *Bathyraja spinicauda* (Pisces: Rajidae) in the deep northeastern North Sea and on the slope of the eastern Norwegian Sea. ICES Journal of Marine Science, 58: 21–28.

Stehmann, M., and Bürkel, D. L.. 1984. Rajidae. *In* Fishes of the north-eastern Atlantic and Mediterranean, Vol 1, pp. 163–196. Ed. by P. J. P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese. UNESCO, Paris, 510 pp.

Table 11.1: Total landings (t) of Skates & Rays from ICES Area27 Subdivision Il+lla+llb

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Faeroe Islands	.	.	.	5	2	1	1		.	.	.	.	.	4	.	15
France	.	.	1	68	61	18	2	1	12	109	2	6	5	11	21	42
Germany	.	.	52	12	59	114	84	85	53	7	2	112	124	102	95	76
Iceland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Netherlands	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Norway	201	158	89	34	99	82	126	191	137	110	96	150	104	133	214	112
Portugal	.	.	.	34	39	.	.	.	.	.	.	.	.	.	.	.
Russian Federation	.	.	.	.	.	302	99	39	.	.	.	537	261	1633	1921	1647
Spain	.	.	.	.	.	.	.	.	.	.	28	.	17	5	.	9
UK - Eng+Wales +N.Irl	65	18	14	20	90	10	6	2	.	.	.	5	1	2	4	.
UK - Scotland	2	1	.	.	1	.	.	.	.	.	.	.	.	.	2	1
Total of Submitted Data	268	177	157	173	351	527	320	318	202	226	128	810	512	1890	2257	1902

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	.	.	.	.	.	n.a.	n.a.	n.a.	0
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5	n.a.	n.a.	.
Faeroe Islands	.	42	.	2	.	.	.	.	.	.	.	n.a.	.	n.a.	2	n.a.	.
France	8	56	11	15	9	7	8	6	8	5	n.a.	5	4	7	2	7	8
Germany	32	52	.	.	.	.	.	.	.	.	.	2		2	2	7	0
Iceland	.	.	.	.	.	.	.	.	.	.	.	.	4		n.a.	n.a.	.
Netherlands	.	.	.	.	.	.	.	.	.	.	.	.		n.a.	n.a.	n.a.	.
Norway	148	216	235	135	286	151	239	198	169	214	239	244	233	118	111	135	133
Portugal	.	.	.	.	22	11	.	10	28	46	10	6	3	n.a.	8	n.a.	.
Russian Federation	867	208	.	181	112	257	.	.	77	139	247	400	113	38	6	n.a.	.
Spain	.	.	.	.	.	.	3	.	3	15	6	.	7	11	32	n.a.	.
UK - Eng+Wales +N.Irl	2	1	.	1	.	.	1	4	.	.	1	.	.	n.a.	n.a.	n.a.	.
UK - Scotland	.	.	.	.	.	.	.	.	.	.	1	1	1	3	3	n.a.	.
Total of Submitted Data	1057	575	246	334	429	426	251	218	285	419	504	658	365	184	166	149	141

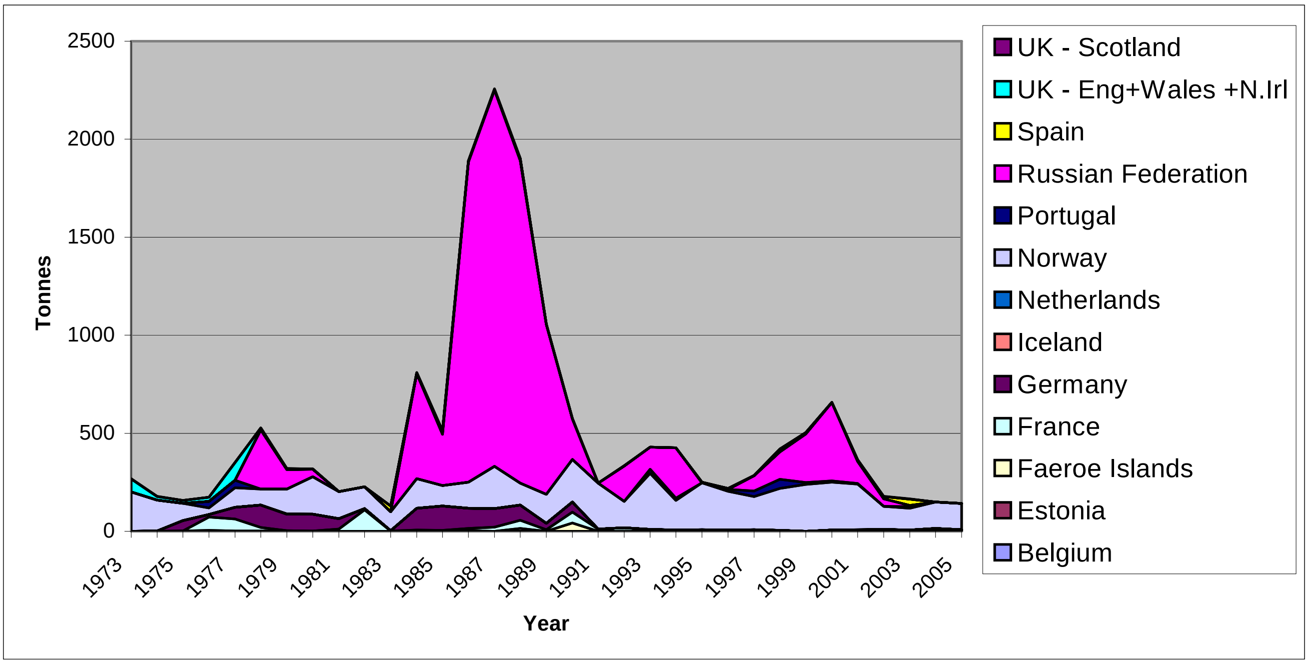

Figure 11.1. Skates & R®ays from ICES Area 27 Subdivision Il+lla+llb 1973-2005. Total landings (tonnes).

12 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel

12.1 Introduction

In the North Sea about 10 ray species occur as well as 7 demersal shark species. Thornback ray *R. clavata,* is probably the most important ray for the commercial fisheries. In last year's report some assessments for this species were presented, based on research vessel surveys. This year mainly landings data have been updated and some new information is presented on length frequency distributions of landings and discards, but no new assessments were done.

12.2 Eco-region and stock boundaries

For most species dealt with in this section the stock boundaries are not well known. The stocks of cuckoo ray *L. naevus*, spotted ray *R. montagui*, *R. clavata* and the lesser spotted dogfish *S. canicula* probably continue into the waters west of Scotland (and for *R. clavata* lesser spotted dogfish also into the western Channel). The stock boundary of common skate *D. batis* is likely to continue to the west of Scotland and into the Norwegian Sea. The stock boundary of *Mustelus mustelus* and *M. asterias* is not known.

12.3 The fishery

12.3.1 Description of the fishery

Demersal elasmobranchs are caught as a bycatch in the mixed demersal fisheries for roundfish and flatfish. A few inshore vessels target skates and rays with tangle nets and long-line. For a description of the demersal fisheries see the Report of the North Sea Demersal Working Group (ICES, 2006a) and the report of the DELASS project (Heessen, 2003).

12.3.2 Advice and management applicable to 2005 and 2006

In 2005 ICES provided advice for 2006 for these stocks. Target fisheries for common skate *D. batis* and thornback ray *R. clavata* should not be permitted, and bycatch in mixed fisheries should be reduced to the lowest possible level. Moreover, ICES advised that if the fisheries for rays continue to be managed with a common TAC for all ray species, this TAC should be set at zero for 2006.

In 1999 the EC introduced a common TAC for skates and rays. In 2006 the EC TAC for skates and rays for areas IIa (EC waters) and IV (EC waters) was set at 2737 t, which was 15% less than the TAC for 2005. The TAC for 2006 is composed of 461 t for Belgium, 18 t for Denmark, 23 t for Germany, 72 t for France, 393 t for the Netherlands and 1770 t for the United Kingdom. Norway does not apply separate quota for skates and rays.

Within the North Sea area, the Kent and Essex Sea Fisheries Committee, England has a minimum size of 40cm disc width for skates and rays.

In Sweden a number of demersal and deep-water elasmobranchs are contained in the Swedish Red List: velvet belly *Etmopterus spinax*, Greenland shark *Somniosus microcephalus*, *D. batis*, and rabbit fish *Chimaera monstrosa*. Furthermore, fishing for and landing of lesser spotted dogfish, *R. clavata* and *D. batis* is prohibited.

12.4 Biological composition of the catch

12.4.1 Landings

The landings tables for all skates and rays combined (Table 12.1–12.4) and for lesser spotted dogfish (Table 12.5) were updated. Figure 12.1 shows the total international landings of rays and skates from IIIa, IV and VIId since 1903. Data from 1973 onwards are WG estimates.

12.4.2 Species and size composition, sex ratio

Only France and Sweden provided landings data by species but these data were not considered to be reliable. For France it was concluded that the species composition was probably based on landings from fisheries to the west of the British Isles rather than on landings from the North Sea. For example, a significant part of the landings is reported to consist of *D. oxyrhinchus* and *Rostroraja alba*. Also a species like *Torpedo marmorata* is reported to be landed in greater quantities than *R. montagui*, whereas from all other sources it is apparent that in the North Sea marbled electric ray only occurs rarely, whereas the spotted ray is one of the most common rays.

Until 2004 Sweden reported small landings of common skate *D. batis*, since December 2004 landings of sailray *D. lintea* were reported.

Some other countries collect information of species composition of the landings based on market sampling programmes (Belgium, UK England, UK Scotland, the Netherlands) but only part of these were available to the WG. Data for the landings by the Dutch beam trawl fleet are presented in Table 12.6. For this fleet *R. clavata* and *R. montagui* are the main species landed, together with some *R. brachyura* and negligable amounts of *L. naevus* and *A. radiata*.

UK (England & Wales) has undertaken some market sampling of North Sea rays, primarily at Lowestoft, but with some limited data for other ports (e.g. Scarborough). Preliminary analyses of these data confirm that *R. clavata* is the dominant species in longline, gillnet and trawl fisheries, with *R. montagui* and *R. brachyura* of secondary importance. *L. naevus,* which occurs in the northwestern part of the North Sea, was only a significant constituent in trawl fisheries (Table 12.7).

In Table 12.8 and 12.9 some length composition data for North Sea rays and skates are presented from UK (England & Wales) (based on discard information) and the Netherlands (based on market sampling).

There are no effort data specifically for North Sea rays and skates.

12.4.3 Discard data

Information on discards in the different demersal fisheries is being collected by several countries. Length frequency distributions of discarded and retained elasmobranchs, covering the period from 1998 to 2006, were provided by UK England.

12.4.4 Quality of catch data

Two countries provided species-specific landings data, based on information from logbooks or auctions, but these were not considered reliable. The WG is of the opinion that only actual sampling will provide reliable data on the species composition of landings and discards. Such data are now being collected by several countries but only part is reported to the WG.

Sampling should cover various regions, gears and seasons to provide reliable species composition data.

The peak in the landings of rays and skates in 1981 is the result of one year with exceptionally high landings reported by France for IV and VIId. This is likely to be caused by misreporting. WGEF is not aware of recent misreporting to take place.

12.5 Fishery-independent information

Fishery-independent data are available for the North Sea, Skagerrak and Kattegat from the International Bottom Trawl Survey (in winter and summer) and from different beam trawl surveys (in summer). An overview of North Sea elasmobranchs based on survey data is presented in Daan *et al.* (2005). Average catch rates for all 21 species of elasmobranchs caught during the quarter 1 IBTS are given in Table 12.10. According to this table starry ray *A. radiata* is by far the most abundant species in this area. Figure 12.2 shows the distribution maps, based on presence absence, for the most common species for which such information was not already presented in the 2005 WGEF report. From the individual maps it is clear that some of the records in the IBTS data base are dubious. For example the catches of *E. spinax* in relatively shallow water in the central northern North Sea, and also the catch of *D. lintea* in the southern North Sea are highly unlikely.

Daan *et al.* (2005) also analysed the time series of abundace for the major species caught for the period 1977-2004 (Figure 12.3). Among the sharks and spurdog have clearly declined markedly over time, whereas lesser spotted dogfish, tope and smoothhounds have increased markedly. The remaining shark species are caught only infrequently and no trend could be detected.

Among the rays, trends are less clear. Starry ray *A. radiata* appear to have increased from the late seventies to the early eighties, possibly followed by a decline. The same pattern also seems to apply to the cuckoo ray *L. naevus* and spotted ray *R. montagui*. Common skate *D. batis* shows an overall decline, supporting the findings of ICES (2006b) while sandy ray *L. circularis* and shagreen ray *L. fullonica* appear to have somewhat increased in abundance, but actch rates are low and interannual variability is high due to many years with zero observations. The thornback ray *R. clavata* has largely remained stable, with one outlier in 1991 owing to a single exceptionally large catch. However, the long term trend in R. clavata is markedly downward and the species is considered depleted (ICES, 2006b). Also the blonde ray *R. brachyura* does not show a specific trend (Daan *et al.*, 2005).

Ellis *et al.* (2005) provide length-frequency data and abundance trends based on survey catches in UK waters. Lesser-spotted dogfish showed a small increase in the eastern Channel. *A. radiata* showed an increase in the North Sea in the period 1982–1991. *D. batis* was not caught in the North Sea since 1991, whereas in the 1980s they were still caught sporadically.

As part of the CHARM-project, Martin *et al.* (2005) used data from the Channel Ground Fish Survey (IFREMER) and the East Channel Beam Trawl Survey (CEFAS) for the years 1989–2004 to study the distribution and essential habitats of thornback ray *R. clavata* and lesser-spotted dogfish in the eastern Channel. Migratory patterns related to spawning and nursery areas are shown. An apparent trend for lesser spotted dogfish distribution to be increasing towards the Straits of Dover and into the North Sea was evident over the period 1990–2004. It is also apparent from these surveys that the SE English coast is an important habitat for *Raja clavata*.

12.6 Age-composition, mean length, weight, maturity and natural mortality-at-age

Elasmobranchs are not routinely aged, although techniques for ageing are available (e.g. Walker, 1999; Serra-Pereira *et al.,* 2005). Limited numbers of some species have been aged in special studies.

Some information on maturity at length exists and should be combined for different countries, while sample sizes are usually rather small.

The WG members agreed to submit all available data on length frequency distributions and maturity for next years meeting.

12.7 Recruitment

No information.

12.8 Stock assessment of *Raja clavata*

ACFM gave some suggestions for further work on the assessments presented last year but this was not done, due to potential problems in species identification. Over the next year the Netherlands (IMARES) has offered to check the IBTS data for rays and skates for inconsistencies in species identification, especially in the earlier years of the survey. As soon as this is done, the analyses of *R. clavata* presented in the WGEF 2005 report should be redone for the revised survey data and the same analyses should also be carried out for the other more common species *A. radiata*, *R. montagui* and *L. naevus.*

12.8.1 Management considerations

Since a TAC was introduced for North Sea skates and rays in 1999 it has always been higher than the landings (Table 12. 11 and Figure 12.4). This TAC, however, has gradually been reduced, for example from 2005 to 2006 by 15%. The 2006 TAC is expected to become restrictive for some countries and therefore discarding is expected to increase. Discard survivorship is not known for skates and rays caught in commercial gears.

Due to effort restrictions, and high fuel prices, effort may divert to small inshore fisheries that may target skates and rays. The main areas of thornback ray occur in the Thames estuary and the Wash in the southwestern North Sea.

The TAC for rays and skates, should only apply to areas IIIa, IV and VIId and not to IIa since this only a part of IIa belongs to the present North Sea eco-region.

Demersal elasmobranchs are being caught in mixed fisheries for demersal teleosts. They are usually landed and reported in mixed categories such as “skates and rays” and “sharks”. For assessment purposes species specific landings data are essential. The examples given above of species-specific landings based on logbook and/or auction data, and similar data based on market-sampling programmes, clearly show that only actual sampling of the catches and landings provides reliable data.

In 2002, SGEF commented on a proposal by OSPAR to include various elasmobranchs in a list of threatened and endangered species and habitats (ICES, 2002). SGEF supported the listing of basking shark and common skate, which were eventually listed by OSPAR. Although SGEF also supported the listing of white skate and angel shark, these were not listed by OSPAR and spotted ray, which was not supported by SGEF was listed by OSPAR.

Technical interactions of fisheries in this eco-region are shown in Table 12.12.

12.9 References

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Table 12.1 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel.
Total landings (tonnes) of Rajidae in III.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.		0
Denmark	27	16	7	11	41	56	22	36	127	62
Germany	+	.	+	.	.	.	+			.
Iceland	.	.	.	.	.	.		.		
Netherlands	n.a.	n.a.	.	.	.	.	.			0
Norway	149	160	134	208	123	154		163	85	94
Sweden	7	5	1	2	2	12	13	9		10
UK (E&W_NI_+)	.	.	.	.	.	.	.	.	.	0
UK (Scotland)	.	.	.	.	.	.	.	.	.	0
Total of submitted data	183	181	142	221	166	222	35	208	212	166

Table 12.2 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel.
Total landings (tonnes) of Rajidae in IV.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	692	428	373	336	332	370	436	323	276	327
Denmark	49	33	20	45	93	65	34	33	23	23
Faroe Islands	.	.	.	.	n.s.	n.s.				
France	76	52	47	n.s.	31	61	62	36	37	34
Germany	10	35	9	16	23	11	22		17	29
Iceland	.	.	.	.	.	.		.		
Ireland	.	.	.	.	.	.		.		0
Netherlands	822	n.a.	609	515	693	834	805	686	561	680
Norway	180	106	180	152	161	173		113	77	87
Poland	.	.	.	.	.	.				
Sweden	+	+	+	+	+	+	+	+	20	0
UK (E&W_NI_+)	1020	1009	794	618	516	476	500	537	550	434
UK (Scotland)	1964	1494	1381	965	860	822	853	741	512	404
Total of submitted data	4813	3157	3413	2647	2709	2812	2711	2469	2073	2018

Table 12.3 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel.
Total landings (tonnes) of Rajidae in VIId.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	126	117	66	93	69	79	113	153	96	94
France	891	896	738	ns	693	729	725	796	695	602
Germany	.	.	.	.	+	.	.	.	0	.
Ireland	.	.	.	.	.	.	.	2	0	0
Netherlands	na	na	.	.	.	.	.	.	.	
Spain	na	na	na	na	na	na	na	na	+	0
UK (E&W_NI_+)	354	213	246	437	355	169	140	186	157	147
UK (Scotland)	+	+	+	.	.	.	.	.	.	0
Total of submitted data	1371	1226	1050	530	1117	977	978	1137	253	254

Table 12.4 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel.
Combined landings (tonnes) of Rajidae in IIIa, IV and VIId.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	818	545	439	429	401	449	548	476	372	422
Denmark	76	49	27	56	134	121	56	69	151	85
Faroe Islands	.	.	.	.	n.s.	n.s.	.	.	.	0
France	967	948	785	n.s.	724	790	725	796	n.s.	636
Germany	10	35	9	16	23	11	22	.	.	29
Iceland	.	.	.	.	.	.	.	.	.	0
Ireland	.	.	.	.	.	.	.	2	0	0
Netherlands	822	n.a.	609	515	693	834	805	686	561	680
Norway	329	266	314	360	284	327	.	276	162	181
Poland	.	.	.	.	.	.	.	.	.	0
Spain	na	na	na	na	na	na	na	na	+	0
Sweden	7	5	1	2	2	12	.	9	20	10
UK (E&W_NI_+)	1374	1222	1040	1055	871	645	640	723	707	580
UK (Scotland)	1964	1494	1381	965	860	822	853	741	512	404
Total of submitted data	6367	4564	4606	3398	3992	4011	3649	3778	2484	3027

Table 12.5 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel.
Landings (tonnes) of lesser spotted dogfish (Scyliorhinus canicula) in IIIa, IV and VIId.

	2000	2001	2002	2003	2004	2005
Belgium					74.3	91.4
France	0.1	6	8		.	
UK (E&W)	NA	NA	NA	13	.	69
UK (Scotland)	.	.	1	5	3	22
Total	0.1	6.0	9.0	13.0	74.3	160.4

Table 12.6. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel.: species specific landings (t) for North Sea rays and skates. Data for the Netherlands beam trawl fishery, based on market sampling.

Year	A. radiata	L. naevus	R. brachyura	R. clavata	R. montagui	Total
2000	1.2	3.2	135.9	264.9	287.6	693
2001	1.7	4.0	115.2	314.5	398.5	834
2002			not yet available			805
2003			not yet available			383
2004	-	-	116.0	217.3	228.0	561
2005	1.0	1.4	168.6	131.6	262.7	565

Table 12.7. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: preliminary quantification of species composition (% in numbers) of rays in UK North Sea fisheries based on market sampling of longline, otter trawl and gillnet catches (From UK (England & Wales) market sampling in 2004).

Species	Longline	Otter trawl	Gillnets
Amblyraja radiata	0	1.9	0
Leucoraja naevus	0.6	5.4	0
Raja brachyura	8.6	8.5	1.9
Raja clavata	78.8	79	97.7
Raja montagui	11.9	5.2	0.5

Table 12.8. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: North Sea rays and skates. Length frequency distributions (numbers in '000).

Country: the Netherlands
Gear: beam trawl
Category: landings

	Raja clavata			*Raja montagui*			*Raja brachyura*		
length	2000	2001	2005	2000	2001	2005	2000	2001	2005
25									
30	0.6	1.9	3.0	3.5	0.5	0.9			
35	9.4	11.2	7.8	34.2	6.3	4.7	1.2	1.0	0.3
40	16.8	19.9	14.2	75.6	33.5	14.0	1.2	1.5	2.1
45	17.5	20.3	11.2	85.9	60.3	36.9	1.2	3.3	6.0
50	23.0	36.4	18.2	58.3	72.5	47.6	2.7	5.6	7.7
55	16.0	35.3	12.9	42.7	54.6	49.9	3.1	4.9	9.6
60	12.1	22.8	14.7	26.1	42.4	44.2	0.6	5.3	6.8
65	5.3	15.3	5.7	10.4	16.1	13.7	1.0	3.6	8.0
70	5.3	5.2	6.2	2.0	2.3	0.9	1.6	2.1	6.1
75	4.7	5.5	5.2	0.3		0.1	1.8	2.7	3.1
80	3.7	3.5	2.2				1.6	1.9	4.2
85	3.4	2.3	1.8				1.1	1.5	3.1
90	1.2	0.6	0.7				0.5	1.9	2.4
95	0.8	0.3	0.1				0.1	0.6	1.6
100							0.1		0.2
105									0.3
110	0.1								
sum	119.8	180.5	103.9	339.2	288.4	212.9	17.7	35.8	61.5

Table 12.9 Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: Length distributions (numbers) of discards and landings from discard observations in the years 1998–2006.

Country: UK England
Gear: all gears combined
Category: discards and landings

	Raja brachyura		*Leucoraja naevus*		*Raja montagui*		*Dipturus batis*		*Amblyraja radiata*		*Raja clavata*	
length	discarded	retained	discarded	retained	discarded	retained	discarded	retained	discarded	retained	discarded	retained
5			2						10		22	
10	4		126		94		8		106		626	
15	43		232		62		55		1224		1911	
20	21		227		106	1	55		6879		994	
25	58		117	19	84	1	15	1	8368	52	1301	2
30	82	15	60	87	108	41	3	8	9005	147	1256	15
35	134	30	246	83	123	32		3	7802	118	636	53
40	16	56	127	38	211	38		1	9882	143	579	145
45	18	40	97	60	76	93			7379	53	779	410
50	12	29	50	88	19	119		1	2105	3	200	651
55	3	35	7	54	21	161			75	4	16	885
60		32	8	14		105			8			814
65		27		1		51				1		546
70		18										570
75		8								2		400
80		2										181
85		2										82
90		2										21
95		3										4
100		4										
105		2										
110												
115												
120												
sum	391	306	1299	444	904	642	136	14	52843	523	8320	4781

Table 12.10. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: average catch rate (N per hour, 1977–2004) for elasmobranchs caught during the quarter 1 IBTS in the North Sea, Skagerrak and Kattegat (from Daan *et al.*, 2005).

Starry ray	*Amblyraja radiata*	*4.1321*
Thornback ray	*Raja clavata*	*1.8511*
Spurdog	*Squalus acanthias*	*1.1554*
Lesser spotted dogfish	*Scyliorhinus canicula*	*0.6167*
Cuckoo ray	*Leucoraja naevus*	*0.3233*
Spotted ray	*Raja montagui*	*0.2554*
Smoothhound	*Mustelus* spp.	*0.2128*
Rabbitfish	*Chimaera monstrosa*	*0.0272*
Common skate	*Dipturus batis*	*0.0151*
Blonde ray	*Raja brachyura*	*0.0107*
Velvet-belly	*Etmopterus spinax*	*0.0062*
Tope	*Galeorhinus galeus*	*0.0038*
Shagreen ray	*Leucoraja fullonica*	*0.0025*
Nursehound	*Scyliorhinus stellaris*	*0.0020*
Sandy ray	*Leucoraja circularis*	*0.0012*
Undulated ray	*Raja undulata*	*0.0007*
Common stingray	*Dasyatis pastinaca*	*0.0006*
Long-nosed skate	*Dipturus lintea*	*0.0006*
Greenland shark	*Somniosus microcephalus*	*0.0005*
Blackmouth dogfish	*Galeus melastomus*	*0.0003*
Porbeagle	*Lamna nasus*	*0.0002*

Table 12.11. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: TAC (tonnes) for North Sea rays and skates, and EC landings.

Year	TAC	Landings
1999	6060	3038
2000	6060	3708
2001	4848	3684
2002	4848	3649
2003	4121	3502
2004	3503	2322
2005	3220	2846
2006	2737	

Table 12.12. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel. Technical interactions.

		Cod 347d	Cod katt.	Had 34	Whg 47d	Sai 346	Ang 346	Ple 4	Ple 7d	Ple 3a	Sol 3a	Sol 4	Sol 7d	San 4	Nop 4	Nep stocks	Pan stocks	DemRays 347	DemSharks 347
Main gears	Cod 347d		L	H	H	M	??	M	M	M	M	M	M	L	L	H	??	L	L
	Cod kattegat	BT, OT		L	0	0	??	0	0	M	M	0	0	0	0	H	??	L	L
	Had 34	OT			H	M	??	L	0	L	L	L	0	L	L	H	??	L	L
	Whg 47d	OT				M	??	M	M	0	0	M	M	L	L	H	??	L	L
	Sai 346	OT					??	L	0	L	L	L	0	L	L	L	??	L	L
	Ang 346																	L	L
	Ple 4	BT		OT	BT	OT	??		0	0	0	H	0	L	L	L	??	H	H
	Ple 7d	BT			BT, OT		??			0	0	0	H	L	L	L	??	H	H
	Ple 3a	BT, OT	BT, OT	OT			??				H	0	0	0	0	L	??	L	L
	Sol 3a	BT,OT,GN	BT,OT,GN	OT	BT, OT					BT		0	0	0	0	L	??	L	L
	Sol 4	BT		OT	BT	OT		BT					0	0	0	L	??	H	H
	Sol 7d	BT			BT				BT					0	0	L	??	H	H
	San 4	Ind		Ind	Ind	Ind									M	0	0	L	L
	Nop 4	Ind		Ind	Ind	Ind								Ind		0	0	L	L
	Nep. stocks																H?	L	L
	Pan. stocks																	L	L
	DemRays 347							BT	BT			BT	BT						H
	DemShar 347																		

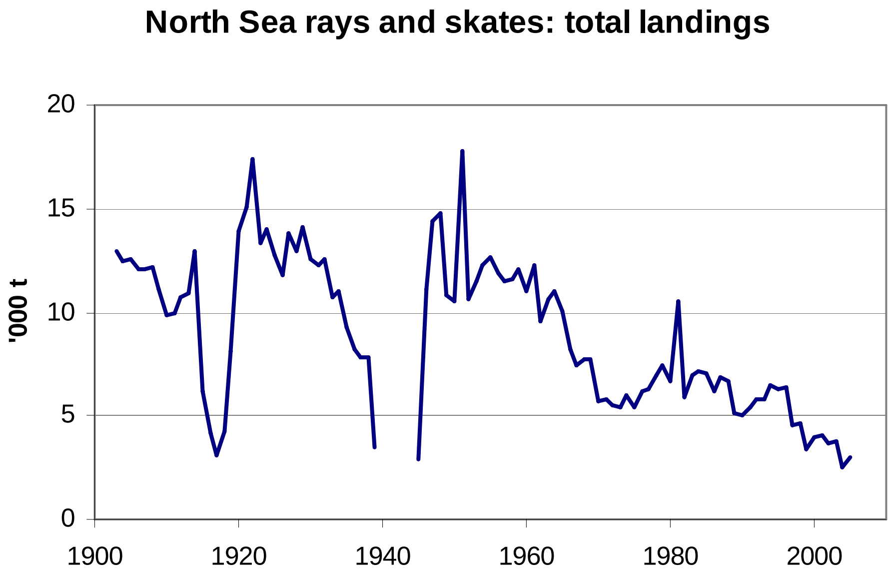


Figure 12.1. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: total international landings of rays and skates since 1903. From 1973 based on WG estimates.

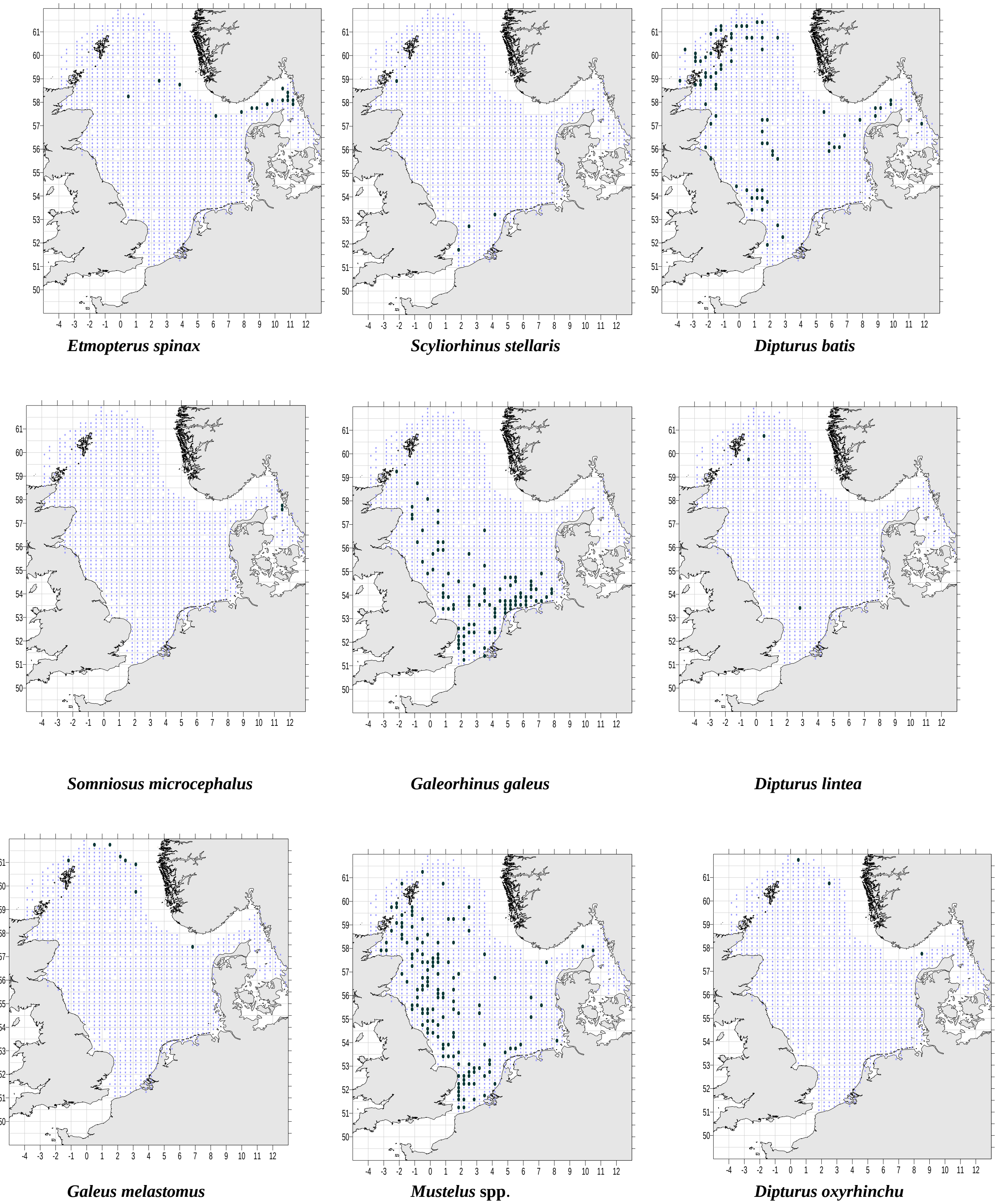
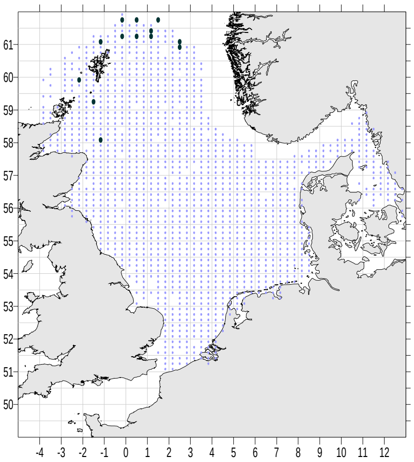
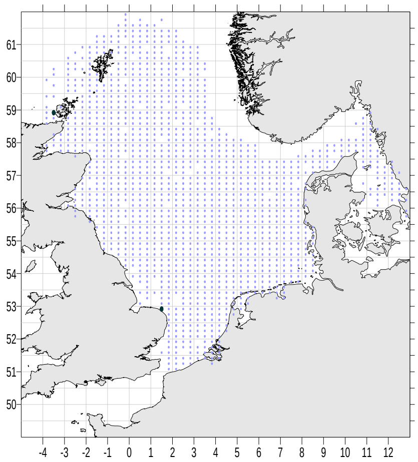


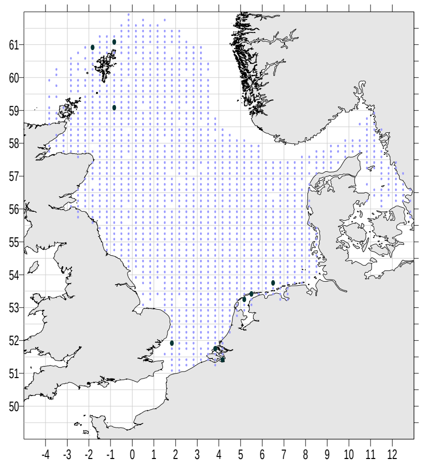
Figure 12.2. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel: distribution expressed as presence-absence, based on catches during four research vessel surveys, 1965–2005 (from Daan *et al.*, 2005).



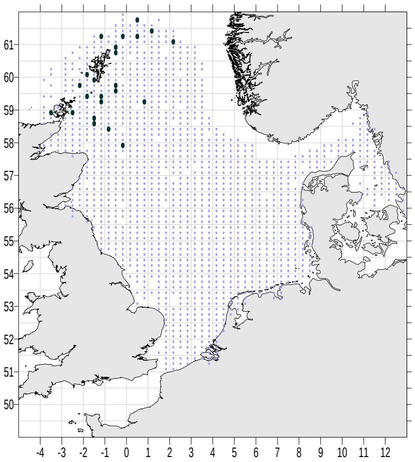
Leucoraja circularis

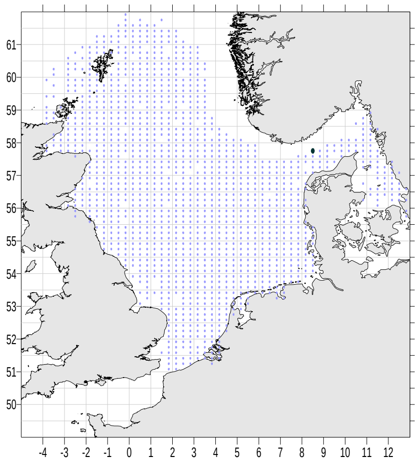


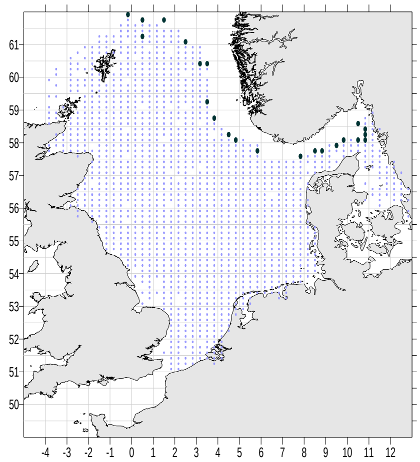
Raja undulate



Dasyatis pastinaca







Leucoraja fullonica

Rajella fyllae

Chimaera monstrosa

Figure 12.2. Continued.

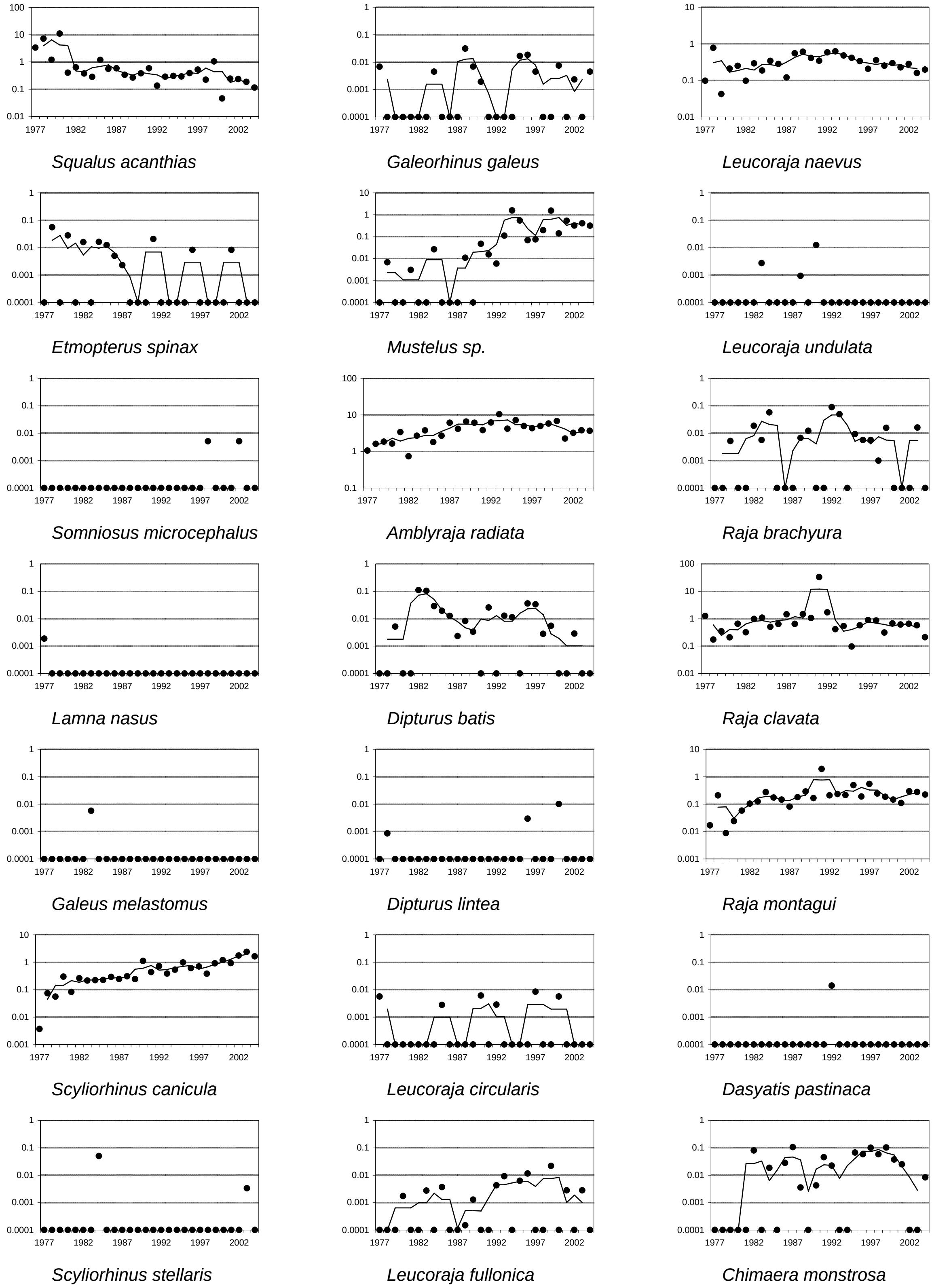


Figure 12.3. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: annual catch rates (on a log-scale) and 3-year moving average during the quarter 1 IBTS, 1977–2004 (from Daan *et al.,* 2005).

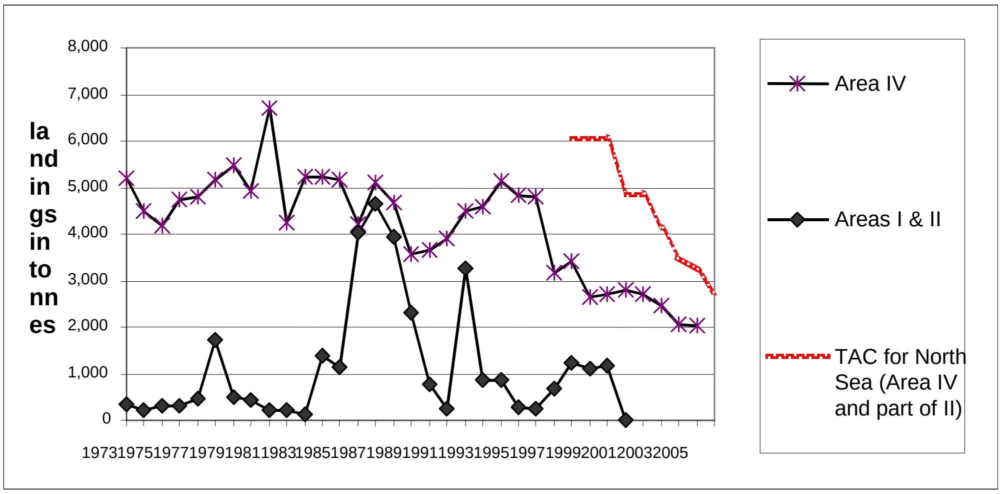


Figure 12.4. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel: total international landings of rays and skates from areas IV and I & II, and EC TAC for the North Sea.

13 Demersal Elasmobranchs at Iceland and East Greenland

13.1 The Fishery

Estimates of landings were derived from the ICES database, with two exceptions. Estimated landings for *Amblyraja radiata* (starry ray) from 1982–2002 and for *Dipturus batis* (common skate) from 1977–2002 are taken from published records. These amounts added, closely approximate what is recorded as Raja rays nei in FishStat in those years. Therefore, Raja rays nei from 1977 to 1991 are calculated by subtracting the FishStat reported amount of Raja rays nei from the published records of *D. batis* and *A. radiata*.

From 1973 to 2004, 13 countries: Belgium, Faroe Island, France, Germany, Greenland. Iceland, Norway, Portugal, Spain and UK – England, Wales, Northern Ireland and Scotland have reported landed skates, rays, demersal sharks and chimeras from Subareas Va (Iceland) and XIVa and b (east Greenland). However, this section deals only with the rays and chimeras as the sharks are dealt with in Sect. 2 (spurdog), 3 (Portuguese dogfish), 4 (other deepwater sharks), 6 (porbeagle) and 7 (basking shark) of this report.

There are no reported landings for elasmobranchs in 2005 (as of June 2006).

Total landings of skates and rays averaged about 400 tonnes in 1973–1990, increased to a peak close to 2100 t in 1995 and have averaged about 1500 tonnes since (Table 13.1, Figure 13.1). Ninety-three percent of the ray catches came from Subarea Va. The share taken by Iceland from this area increased from <50% in the 1970's to 100% from 1999 to 2004. There have been no landings reported in 2005.

Prior to 1992, all rays, with the exception of *Amblyraja radiata* (starry ray) and *Dipturus batis* (common skate) were reported as *Raja* rays nei. *A. radiata* and *D. batis* made up 47% of the catch since 1992 when it is thought that all species were reported to species. Only minor amounts of *Leucoraja fullonica*, (shagreen ray) *Dipurus lintea*, (sail ray) and *Bathyraja spinicauda* (spinytail skate) were reported. The 20 tonnes of spinytail skate reported in 2004 as preliminary statistics in 2005 suggest some expansion of effort in deep water in that year.

As a species, *D. batis* been shown to be vulnerable to exploitation and has been near-extirpated in the Irish and North Seas. Further investigation into *D. batis* and other rays in Iceland and east Greenland is required, including from fishery independent sources (for example trawl surveys).

An average of only 60 t of (Chimaeriformes) (chimeras) were reported from 1991–2004 and were not reported previously to 1993. Catches peaked in 1991 at 499 t.

Information on bycatch of elasmobranches in East Greenland waters is unavailable but several species are probably taken and discarded in the fishery for cod, shrimp and Greenland halibut. Anecdotal information indicate that some Greenland sharks taken in the shrimp fishery are landed in Iceland, but the amount is not known.

Advice and management applicable to 2005 and 2006

No advice was made available to WGEF in 2006.

13.2 Fishery Independent Information

13.2.1 Groundfish Surveys

Groundfish research surveys were done by Iceland in Division Va and by Greenland and Germany in XIVb. The information in this section are derived from the Greenland surveys based on a working paper by O. Jorgenson. Survey set data were also obtained from Germany. However, it was determined that not all sets were included in the file and thus, spatial analyses were not completed on this file.

Since 1998, the Greenland surveys have covered the area between 61º45' N and 67º N at depths from 400 to 1500 m and in total 341 trawl hauls have been made. The area between 63ºN and 64ºN north has not covered by the survey due to steep, rough bottom. The surveys are aimed at Greenland halibut *(Reinhardtius hippoglossoides)* but all fish species have been recorded. The surveys are conducted with an ALFREDO III trawl with a wingspread of about 21 m, a height of 5.8 m, and a mesh size on 30 mm in the codend and rock hopper ground gear.

On the east coast of Greenland, the hydrographic conditions are dominated shoreward by the cooler (0–3ºC) East Greenland Current and offshore by the warmer (3–5ºC) Irminger Current, both flowing southward.

In total, 9 elasmobranch species have been caught during the surveys, 7 of which are reported in this section (Table 2). The two other species, *Somniosus microcephalus* and *Centrocyllium fabricii* are presented in other sections. A summary for each of the 7 species follows.

Three specimens of *Apristurus laurussonii* (Iceland catshark) were recorded between 62º14' N and 65º13' N at depths and temperatures at 836–1255 m and 1.7–4.3ºC. Length range was 54–58 cm.

Eighty-two *Bathyraja spinicauda* (spinytail skate) were caught at temperatures between 0.5ºC–5.6ºC and depths from 547–1455 m, mainly at 700–1000 m (Figure 13.2). The length ranged between 25 and 178 cm. (Figure 13.3).

In total 57 specimens of *Rajella bathyphila* (deepwater ray) were recorded at depth and temperature ranges of 475–1493 m and 0.3–4.1ºC, respectively, but were most common at > 1000 m and below 3.0 ºC (Figure 13.4). The length ranged from 17 to 123 cm. (Figure 13.5).

In total, 117 specimens of *Rajella fyllae* (round ray) were recorded from the depths of 410–1449 and 0.8–5.9ºC, respectively, but it was most common at 650–850 m and 3–4ºC (Figure 13.6). The length ranged from 11 to 53 cm (Figure13.7).

Twelve specimens of *Amblyraja hyperborea* (Arctic skate) were taken in the depth and temperature range 570–1481 m and 0.5–5.4ºC. The most northern position was at 65º28'N. The length ranged from 27–112 cm.

In total 483 specimens of *Amblyraja radiata* (starry ray) were recorded at depths of 410–1280 and temperatures 0.8–6.6ºC, but it was most abundant at depths < 750 m and temperatures above 3.5ºC (Figure 13.8). The length ranged from 11 to 62 cm (Figure 13.9).

Three specimens of *Malcoraja spinacidermis* (roughskin skate) were recorded from depths of 1282–1449 m and temperatures between 2.3 and 2.7ºC. The most northern position was 62º15N. The length ranged from 45 to 78 cm.

A summary list of elasmobranch species recoded at East Greenland during 1998–2005 with observed maximum weight (kg), maximum number, minimum and maximum depth (m) and minimum, maximum bottom temperature ºC and most northern position (decimal degrees), respectively. (Weight < 49g is given as 0.0 kg).

13.3 Management Considerations

The elasmobranch fauna off Iceland and Greenland is little studied and comprises relatively few species. More than 21% of the catch is not reported to species. The most abundant demersal elasmobranch in the southern parts of the area is starry ray. It is widespread and abundant in this and adjacent waters. Landings of starry ray are 3 times greater than spurdog, the second most important species in the area in terms of reported catch. Management considerations for the shark species occurring in Subarea XIV and Division Va are dealt with in Secttion 2, 4, 6 and 7 of this report.

Table 13.1. Demersal Elasmobranchs at Iceland and east Greenland. Reported catches of rays and chimeras from Iceland (Subarea V) and E. Greenland (XIV) that are noted reported in other sections.

WG Estimates of Landings (tonnes) of Sharks in ICES Subarea Va												
		1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Comm. skate	Iceland	183	176	123	112	151	121	84	125	120	145	n/a
Sailray	Iceland	.	.	.	.	.	.	.	.	10	8	n/a
Shagreen ray	Iceland	24	19	16	12	21	27	37	32	17	23	n/a
Starry ray	Iceland	1726	1498	1416	1296	1132	1058	1200	1796	1491	1013	n/a
Raja rays nei	Faeroe Isl.	9	2	2	7	5	.	2	1	.	8	n/a
	Germany[1]	.	.	.	2	1	1	1	.	1	1	n/a
	Portugal	.	.	1	.	.	.	.	.	.	.	n/a
	UK	.	.	.	.	.	.	1	.	.	1	n/a
Raja rays nei	**Total**	9	2	3	9	6	1	4	1	1	10	n/a
Chimera	Iceland	106	.	15	29	3	5	1	.	1	.	n/a
Total		**2048**	**1695**	**1573**	**1458**	**1313**	**1212**	**1326**	**1954**	**1640**	**1199**	n/a
WG Estimates of Total Landings (tonnes) of Sharks in ICES Subarea XIV												
Raja rays nei	Portugal	.	.	.	.	.	.	1	.	.	.	n/a
	UK	.	.	.	.	.	.	.	.	1	.	n/a
Total		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	n/a
WG Estimates of Total Landings (tonnes) of Sharks in ICES Subarea XIVa												
Raja rays nei	Germany	9	.	.	.	.	7	.	.	.	.	n/a
	Norway	.	.	.	.	.	.	.	.	1	.	n/a
Total	**.**	**9**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**1**	**0**	n/a
WG Estimates of Total Landings (t) of Sharks in ICES Subarea XIVb												
Comm. skate	Norway	.	.	.	.	.	3	.	.	.	.	n/a
Raja rays nei	Faeroe Islands	.	.	.	.	.	.	.	1	.	.	n/a
	Germany	.	.	.	1	.	.	.	.	.	.	n/a
	Norway	7	10	2	19	8	3	6	5	.	.	n/a
	Russian Fed.	.	.	.	.	.	.	.	.	.	2	n/a
	Spain	.	.	.	.	.	.	.	.	15	.	n/a
	UK	4	.	.	1	2	.	.	.	.	.	n/a
	Norway	.	.	.	.	.	.	.	2	.	.	n/a
Raja rays nei	**Total**	11	10	2	21	10	3	6	7	15	2	n/a
Chimera	Norway	.	.	.	.	.	.	.	.	1	5	n/a
Spott.ratfish	Ireland	.	.	.	.	.	.	1	.	.	.	n/a
Total	.	11	10	2	21	10	6	7	8	16	7	n/a
Grand Total		**2068**	**1705**	**1575**	**1479**	**1323**	**1225**	**1334**	**1962**	**1658**	**1206**	n/a

[1]Iceland, starry ray - For the years 1977–1992 data are based on published records, could also include *R. lintea*.

[2]Germany and Fed. Rep. of Germany combined.

[3]Since 1993 data are available by gear and by month.

Table 13.2. Demersal Elasmobranchs at Iceland and east Greenland. List of elasmobranch species captured during the surveys and capture statistics.

Species	MAX. WEIGHT (KG)	Max. number	Min. depth (m)	Max. depth (m)	Min. temperature (deg. C)	Max. temperature (deg. C)	Northerly position (lat)
Apristurus laurussonii	0.7	1	837	1255	1.7	4.3	65.2217
Bathyraja spinicauda	61.5	9	548	1455	0.5	5.6	65.4575
Centroscyllium fabricii	127.7	99	415	1493	0.6	5.1	65.4025
Rajella bathyphila	45.3	8	476	1493	0.3	4.1	65.4433
Rajella fyllae	4.8	12	411	1449	0.8	5.9	65.4575
Raja hyperborea	23.4	4	520	1481	0.5	5.4	65.4667
Amblyaja radiata	22.1	25	411	1281	0.8	6.6	66.2133
Malacoraja spinacidermis	3.1	2	1282	1450	2.3	2.7	62.2517
Somniosus microcephalus	500	1	512	1112	1.4	4.9	65.3542

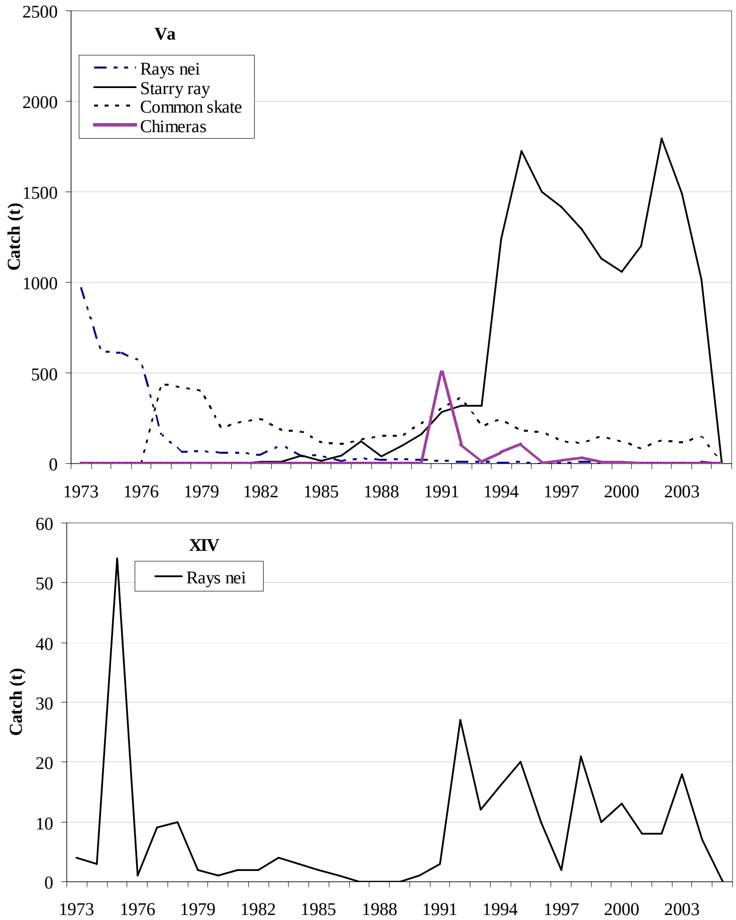


Figure 13.1. Demersal Elasmobranchs at Iceland and east Greenland. WG estimates of the most commonly reported rays and chimeras in Va (upper panel) and in XIV (lower panel), 1973–2004. Data are not yet available for 2005.

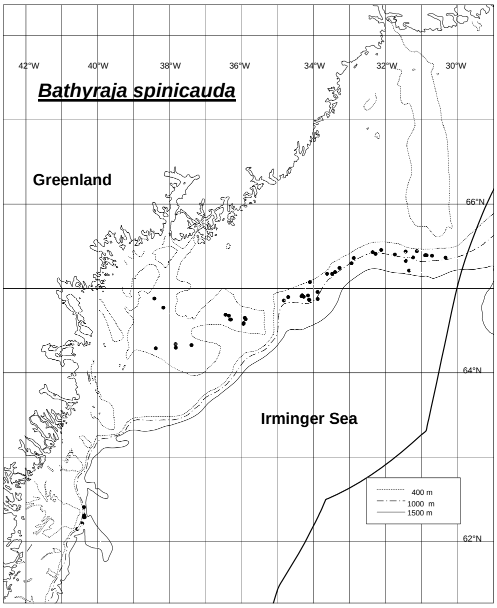


Figure 13.2. Demersal Elasmobranchs at Iceland and east Greenland. Location of survey catches of. *B spincauda*.

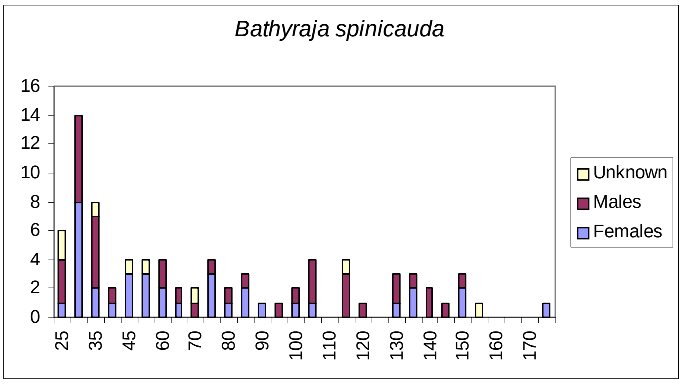


Figure 13.3. Demersal Elasmobranchs at Iceland and east Greenland. Length distribution of *B. spinicauda* (TL by 5-cm groups on the x-axis). Y-axis is count of fish.

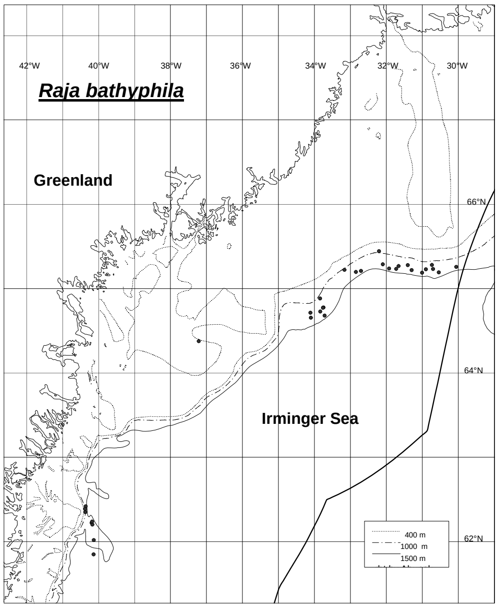


Figure 13.4. Demersal Elasmobranchs at Iceland and east Greenland. Location of survey catches of *R. bathyphila.*

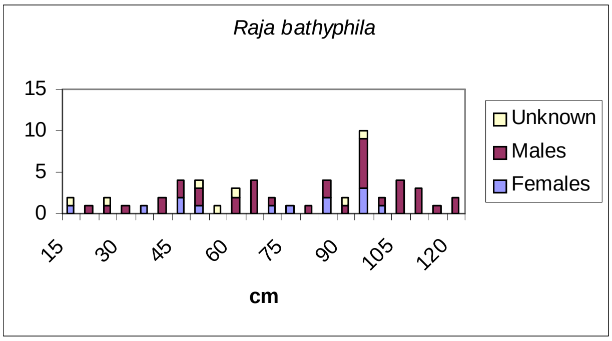


Figure 13.5. Demersal Elasmobranchs at Iceland and east Greenland. Length distribution of *R. bathyphila.*

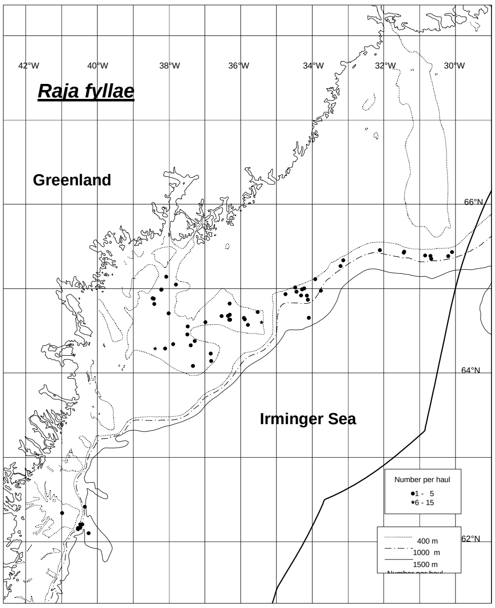


Figure 13.6. Demersal Elasmobranchs at Iceland and east Greenland. Location of survey catches of *R. fyllae.*

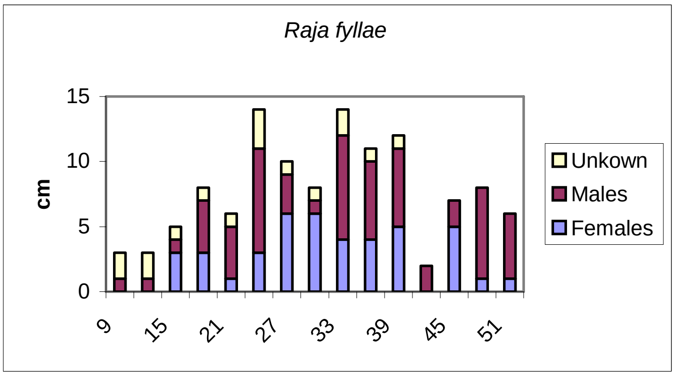


Figure 13.7. Demersal Elasmobranchs at Iceland and east Greenland. Length distribution of *R. fyllae.*

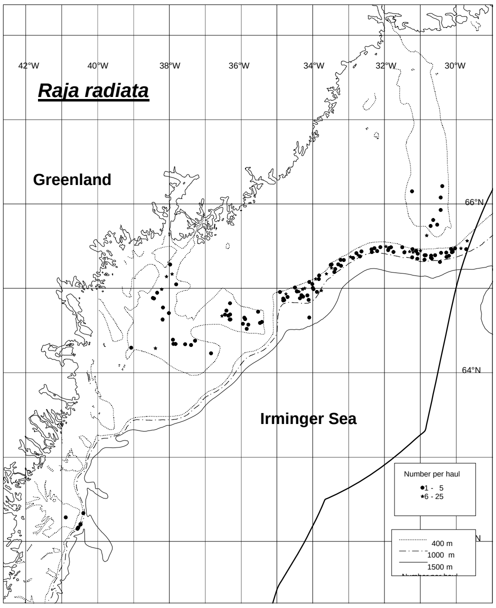


Figure 13.8. Demersal Elasmobranchs at Iceland and east Greenland. Location of survey catches of *A. radiata (genus Raja* labelled on the figure is the former classification).

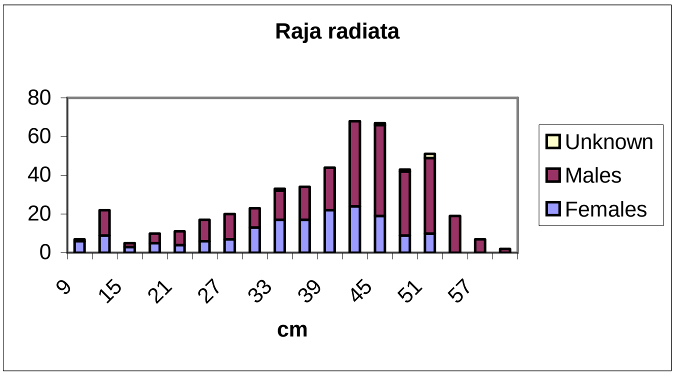


Figure 13.9. Demersal Elasmobranchs at Iceland and east Greenland. Length distribution of *A. radiata*.

14 Demersal elasmobranchs at the Faroe Islands

14.1 The fishery

14.1.1 Advice and management applicable to 2005 and 2006

The first year that ICES has provided advice on the management of demersal elasmobranch fisheries in this area was in 2005. Given the paucity of available data, the advice was based largely on reported catch statistics.

The majority of the area is managed by the Faeroes through an effort based system which restricts days fishing for demersal Gadoids. Some EU vessels have been able to gain access to the Faeroes EEZ where they have been managed under individual quotas for the main target species.

14.1.2 The fishery up to 2004

Since 1973, nine countries, namely Denmark, Faeroes, France, Germany (and Fed. Rep Germany), Netherlands, Norway, Poland, UK (Scotland), UK (England and Wales) and USSR have reported catches of demersal elasmobranchs from Division Vb. Faroese vessels include trawlers and, to a lesser extent, longliners and gillnetters. Norwegian vessels fishing in this area are longliners targeting ling, tusk and cod. UK vessels include a small number of large Scottish trawlers which are occasionally able to obtain quotas to fish in Faroes waters targeting gadoids and deepwater species. French vessels fishing in this area are probably from the same fleet that prosecute the mixed deep-water and shelf fishery west of the UK. In all cases, it is likely that demersal elasmobranchs represent a minor to moderate bycatch in fisheries targeting other species.

Landings of rays, mainly unidentified are presented in Table 14.1 and sharks in Figure 14.2. No reports are available in 2005.French reported landings of *D. batis* (common skate) do not represent the entire catch of this species and an unknown quantity is included in the category of unidentified rays for all counties. Total landings of rays (upper panel) and sharks (lower panel) by all countries are combined in Figure 14.1.

Landings of sharks are dealt with in Section 2, 3, 4, 6 and 7 of this report.

Amounts of discards of rays or sharks from this area are unknown.

14.2 Biological composition of the catch

All rays in Division Vb, with the exception of French landings (2000–2003) and Russian landings (2004) of *Dipturus batis* (common skate), and one record of longnose skate (France, 2001) were reported as Raja rays, not elsewhere identified (nei). There is no port sampling data available to split these catches by species. It is likely that catches included *D. batis, Leucoraja fullonica, Raja clavata* and *Amblyraja radiata.*

14.3 Fishery-independent information

No survey data from this area was available to the working group.

14.4 Management considerations

Total international reported landings of rays declined from 1973 to 2003 but increased to about the average of the time series in 2004. Without further information on the fisheries such as better differentiation of species, amounts of discards, sizes caught, it is not possible to provide information on the pattern of exploitation or on the status of stocks.

The elasmobranch fauna off the Faeroe Islands is little studied in the scientific literature, though it is likely to be somewhat similar to that occurring in the northern North Sea and off Iceland. Further studies to describe the demersal elasmobranch fauna of this region, and to identify what data are available for these species are required.

Table 14.1. Demersal Elasmobranchs at Iceland and East Greenland. Reported catches of rays and chimeras from the Faeroes area (Division Vb).

WG Estimates of Landings (t) of Rays in ICES Division Vb1											
Species	**Country**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Comm. skate	France	.	.	.	.	1	.	2	3		n/a
	Russian Fed.	.	.	.	.	.	.	.	.	35	n/a
Raja rays nei	Faeroe Islands	160	148	121	132	.	41	18	55	113	n/a
	France	.	.	.	.	.	.	.	3	.	n/a
	Germany[1]	.	.	.	1	1	.	.	2	1	n/a
	Norway	40	13	22	43	16	15	9	3	.	n/a
Raja rays nei	All	200	161	143	176	17	56	27	63	114	n/a
Ratfishes nei	France	.	.	.	.	10	.	45	41	.	n/a
Rabbit fish	Norway	.	.	.	.	.	1	13	2	.	n/a
Total Vb1		200	161	143	176	28	57	87	109	149	n/a
WG Estimates of Landings (t) of Rays in ICES Division Vb2											
Comm. skate	France	.	.	.	.	2	.	.	.	.	n/a
Raja rays nei	Faeroe Islands	5	30	23	43		35	7	43	159	n/a
	France	.	.	.	.	.	.	.	2	.	n/a
	Norway	20	1	23	2	34	6	6	2	.	n/a
Raja rays nei	All	25	31	46	45	36	41	13	47	159	n/a
Ratfishes nei	France	.	.	.	.	44	.	21	26	.	n/a
Rabbit fish	Norway	.	.	.	.	.	.	4	.	3	n/a
Total Vb2		25	31	46	45	80	41	38	73	162	n/a
WG Estimates of Landings (t) of Rays in ICES Division Vb unspecified											
Comm. skate	France	1	1	3	.	.	2	.	.	5	n/a
Lnosed skate	France	.	.	.	.	.	3	.	.	.	n/a
Rabbit fish	UK - Scotland	1	.	.	.	.	.	.	1	.	n/a
Raja rays nei	France	1	1	.	.	.	.	.	.	10	n/a
	UK-EngWalesN.Ir	.	6	.	.	23	2	.	2	15	n/a
	UK-Scotland	4	5	7	6	12	25	12	6	5	n/a
	France	.	.	.	.	23	99	.	.	61	n/a
Raja rays nei	All	5	12	7	6	58	126	12	8	91	n/a
Total Vb un	All	12	25	17	12	116	257	24	17	187	n/a
All areas	**All**	**237**	**217**	**206**	**233**	**224**	**355**	**149**	**199**	**498**	n/a

[1]Germany and Fed. Rep. of Germany combined.

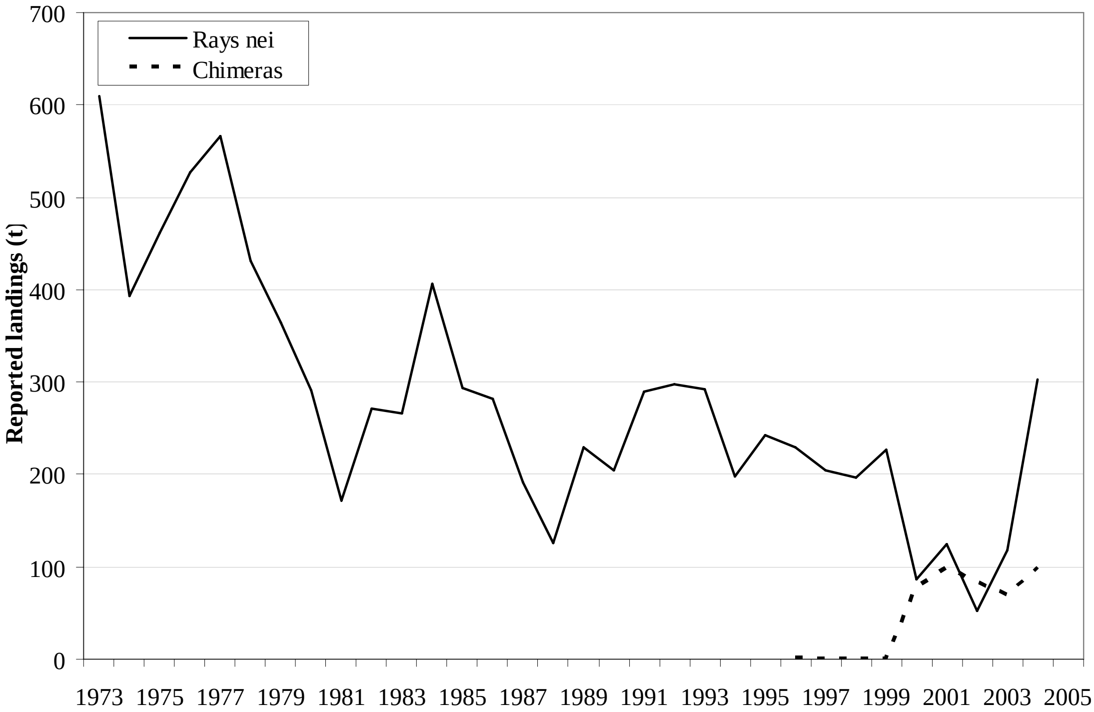


Figure 14.1. Demersal Elasmobranchs at Iceland and East Greenland Reported landings of the most commonly reported rays and chimeras from Division Vb based on ICES FISHSTAT.

15 Demersal elasmobranchs in the Celtic Seas (ICES Subareas VI & VII (Except Division VIId))

The Celtic Seas eco-region covers North-west Scotland and Rockall (ICES Divisions VIa,b), Irish Sea (VIIa), Bristol Channel (VIIf), and the western English Channel, Celtic Sea and west of Ireland (VIIb,c,e,g-k), though the south-western sector of ICES Division VIIk is contained in the oceanic northeast Atlantic eco-region. This eco-region broadly equates with the North-western waters RAC. An overall description of the demersal elasmobranchs in this region was given in ICES (2005).

The following provides a general overview of the different areas within the Celtic Seas eco-region. Whereas some demersal elasmobranchs, such as spurdog *Squalus acanthias* (see Section 2) and lesser-spotted dogfish *Scyliorhinus canicula*, are widespread throughout this region, there are some important regional differences in the distributions of other species, which are described below.

Some species of batoids, notably stingray *Dasyatis pastinaca*, marbled electric ray *Torpedo marmorata* and electric ray *T. nobiliana*, may be observed in this eco-region, though they are more common in more southerly waters. These vagrants are generally discarded if caught in commercial fisheries and are not considered in this report.

Some of the rarer demersal elasmobranch species that previously occurred in this area include white skate *Rostroraja alba* and angel shark *Squatina squatina*, though there are few or no recent records of these species.

North-west Scotland (VIa)

The most commonly occurring demersal elasmobranchs in the shelf waters off North-west Scotland include spurdog, lesser-spotted dogfish and various rays, especially thornback ray *Raja clavata*, cuckoo ray *Leucoraja naevus* and common skate *Dipturus batis.* Offshore species, such as black mouth dogfish *Galeus melastomus,* shagreen ray *L. fullonica* and sandy ray *L. circularis* are distributed mainly towards the edge of the continental shelf.

Rockall (VIb)

Though this division contains extensive deep-water areas (see Sections 3 and 4), many of the species occurring on the continental shelf off mainland Scotland also occur on the Rockall Plateau. It is possible that the shallow water rays on the Rockall Plateau form separate populations.

Irish Sea (VIIa)

The more common demersal elasmobranchs in the Irish Sea include spurdog and lesser-spotted dogfish. *R. clavata* and spotted ray *R. montagui* are also abundant, especially in inshore areas, with spotted ray and *L. naevus* the dominant ray species on the coarser grounds further offshore. Blonde ray *R. brachyura* occur sporadically in the main Irish Sea, though are locally abundant in parts of St George’s Channel. Tope (see Section 19), smooth-hounds *Mustelus* spp. and greater-spotted dogfish *Scyliorhinus stellaris* all occur in this area, with these species locally abundant in Cardigan Bay and off Anglesey.

Bristol Channel (VIIf)

The most abundant demersal elasmobranchs in the Irish Sea include lesser-spotted dogfish, *R. clavata, R. montagui,* and smalleyed ray *Raja microocellata,* which is locally abundant in this area. Although *L. naevus* is one of the dominant ray species in the Celtic Sea, it is rarely observed in the Bristol Channel and only occurs in the western parts of VIIf. Once again, tope, smooth-hounds and greater-spotted dogfish all occur regularly in this area.

Western English Channel, Celtic Sea and west of Ireland (VIIb,c,e,g-k)

The most abundant demersal elasmobranchs in the Celtic Sea include lesser-spotted dogfish, *R. clavata, R. montagui* and *L. naevus*. Tope and smooth-hounds also occur in the area, with juveniles more common inshore and larger individuals also occurring around the offshore sand banks in the Celtic Sea. Greater-spotted dogfish also occur regularly in this area, though is typically restricted to inshore, rocky grounds. Undulate ray *Raja undulata* is found in a very localised population on the south-west coast of Ireland, with occasional records in the English Channel. *R. brachyura* can be locally abundant in parts of the area. Several other species occur on the offshore grounds of the Celtic Sea and along the edge of the continental shelf, including black-mouth dogfish, *D. batis, L. fullonica* and *L. circularis.*

15.1 The fishery

Advice and management applicable to 2005 and 2006

ACFM has never provided advice for any of the stocks within this region.

Under current EU legislation, where a directed fishery for skates takes place, a mesh size in the cod-end of no less than 280 mm is required.

Within UK waters, the South Wales Sea Fisheries Committees has a bylaw stipulating a minimum landing size for skates and rays.

There are no TACs for any of the relevant species in this region.

15.1.1 Fisheries

Skates and rays

Most skate and ray species in the Celtic Seas eco-region are taken as a bycatch in trawl fisheries, though there are some localised fisheries that target *R. clavata* using long line and tangle nets. There is a small fishery off south-east Ireland targeting various ray species in the southern Irish Sea (Area VIIa), using rockhopper otter trawls, and some UK trawlers may target skates and rays in the Bristol Channel (VIIf).

In inshore waters, skates are usually caught as a bycatch in mixed demersal fisheries, which are either directed at flatfish (plaice and sole), particularly in the Irish Sea, or at roundfish (cod, haddock, whiting) elsewhere. The main countries involved in these fisheries are Ireland, UK, France, Spain, with smaller catches by Belgium and Germany. The main gears used are otter trawls and bottom-set gillnets, with the Belgian fishery carried out by a beam-trawl fleet.

There are *Nephrops* fisheries in the Irish Sea (VIIa), Celtic Sea (VIIg), Porcupine Seabight (VIIj) and at the Aran Islands, (VIIb). All of these catch various ray species as bycatch.

In the deepwaters of Area VI and VII there is a ray bycatch in fisheries for monkfish, megrim, hake and orange roughy, and these species include *L. fullonica, L. circularis* and *Dipturus* spp.

There is also a large recreational fishery for skates and rays, particularly for those species close to shore, with some ports having locally important charter boat fisheries.

Coastal sharks

Although there is a targeted spurdog fishery (see Section 2), there are no directed fisheries for other demersal sharks in the Celtic Seas eco-region. Most coastal dogfishes (e.g. tope, smoothounds and catsharks) are taken as a bycatch in various trawl and gill-net fisheries (see above). Due to the low market value of these species, they tend to be discarded by some nations, though some of marketable size are sometimes retained.

Lesser-spotted dogfish is typically discarded, and this species is known to have a high survivorship (Revill *et al.*, 2005). A largely unknown quantity is retained for use as bait in the Irish Sea and Bristol Channel whelk *Buccinum undatum* fishery, and the northwest Ireland crab fishery, but these may not routinely be declared in the landings.

There is also a large recreational fishery for most of the demersal sharks, particularly those close to shore, with some ports having locally important charter boat fisheries.

15.1.2 Commercial landings

Though commercial landings data are available, many of the species under consideration are landed under generic landings categories (e.g. "skates and rays"). In recent years, various laboratories have begun market sampling that will improve estimates of the species composition.

Skates and rays

Landings tables for Rajidae by country are provided in Tables 15.1a–g. Landings for the entire data series available are shown in Figure 15.1. Where species-specific landings have been provided they have been included in the total for the relevant year. Landings appear as a series off peaks and troughs, with lows of approximately 14 000 t in the mid 1970s and 1990s, and highs of just over 20 000 t in the early and late 1980s and late 1990s. There has been a general decline in landings over the past five years. While there have been fifteen countries involved in the fishery, only six of these (Belgium, France, Ireland, UK (England & Wales), UK (Scotland) and Spain) have continuously landed large amounts of these species.

Landings of ray species in the Celtic Seas have varied from approximately 13 000 to 20 000 tonnes per year. Landings have declined gradually during the time series and are currently at their lowest level in the time series. Landings from divisions VIIb–c,j–k increased dramatically in the late 1990s, but have subsequently declined. Similarly, landings from Area VI have also shown a gradual decline. The highest landings have consistently occurred in the southern parts of this eco-region (Divisions VIIegh), and these landings are also declining gradually.

Most skates and rays are landed under the generic landing category, though France, Spain (Basque Country) and Belgium providing some species-specific landings data (Tables 15.2-15.4). These data suggest that the four major commercial species in French fisheries (Table 15.2) in Subarea VI are *R. clavata, L. naevus, D. batis* and *D. oxyrinchus*, with *L. naevus, R. montagui, R. clavata* and *D. batis* the major species in Subarea VII. The importance of *R. clavata* and *L. naevus* is also apparent in Spanish (Basque country) and Belgian landings data (Tables 15.3-15.4).

It should be noted that *R. brachyura* is an important component of Belgian landings (Table 15.4), though this species is absent from French landings data. This suggests that species identification problems (or confusion between names) may occur in some landings data. The near absence of species-specific landings data for *R. brachyura*, a large-bodied species that is subject to localised targeted fisheries, is a cause for concern.

That species identification may be a problem is also highlighted by the high proportion of *L. circularis* reported in VIIf (Table 15.4), as this species is only rarely recorded in this area, and this category is thought to be *R. microocellata*.

Due to concerns over the quality of reported species-specific landings, improved information on the species composition caught by various métiers in space and time (e.g. from observer and market sampling programmes) will be increasingly important.

Coastal sharks

Though there are reasonable landings data for spurdog (Section 2) and tope (Section 19), data for other demersal sharks are more limited. Species-specific landings data for *Mustelus* spp. are provided in Table 15.5.

Landings tables for lesser-spotted dogfish have not been provided as it was not possible to disaggregate this species from the many categories under which it is declared and the lack of consistency by which it is categorised. Due to the lack of species-specific landings data for demersal sharks, and the absence of market sampling, it is not currently possible to identify the landings of demersal shark species in most areas.

Angel shark (or monkfish) *Squatina squatina* is increasingly rare, and this species is now rarely reported in landings data. It is believed that the peak in UK landings in 1997 from VIIj–k (Figure 15.2) are misreported anglerfish (monkfish), as *S. squatina* is more of a coastal species. French landings have declined from > 20 t in 1978 to 1 t in 2000.

15.1.3 Effort data

Most elasmobranchs in this eco-region are caught as a bycatch in demersal fisheries directed at teleosts. Landings per unit effort (LPUE) by Basque Country fisheries in Divisions VI, VII and VIII is presented in Diez *et al.* (2006), and is further examined in Section 16.2.5. For *Rajidae* in VII, LPUE peaked in 1996 at 150 kg/day, decreased to a low of 17 kg/day in 2003, but has been increasing since. This is similar to the trends shown in Biscay waters. However, LPUE in VI has been decreasing since 2002.

LPUE of lesser spotted dogfish in VII has been decreasing slightly since 1999, even though surveys indicate an increase in abundance of this species.

15.2 Biological composition of the catch

15.2.1 Skates and rays

Skates and rays are usually landed by grade (size), which often comprises a mixture of species. Only since the DELASS project has some recent information on species composition become available for various countries (Heessen, 2003). Some countries have continued to provide landings by species but most are supplied as mixed species information. Species breakdown per country (where available) is supplied in Table 15.2–15.4.

Species and size composition

Historical data on species composition are available for some earlier studies, and much of this information has now been collated (Table 15.6). These historical sources including several detailed studies on the ray communities of the Celtic Sea and North-west Scotland (Du Buit, 1966, 1968, 1970, 1972; Quéro and Guéguen, 1981). More recently, there have been several studies of the commercial ray landings from Irish fisheries (Fahy, 1988, 1989a, b, c, 1991; Fahy and O'Reilly, 1990; Gallagher, 2000; Gallagher *et al*., 2005a).

Seasonal changes in species composition of landings have been reported in the Irish Sea (Gallagher, 2000), with either *R. clavata* or L. *naevus* dominating. Changes in the dominant sex of these species were also shown. The exact percentage change in species composition varied from port to port, implying that changes in species composition may be caused by local rather than widespread changes in population structures.

Data from port sampling were available for some nations fishing in the Celtic Seas eco-region. Exploratory analyses of UK (England and Wales) data were undertaken, though results are not presented due to the doubts regarding the species composition.

It is hoped that market-sampling data from all nations will be available for future meetings of WGEF, so that better estimations of species composition can be made.

Hence, national laboratories undertaking market sampling in this eco-region should ensure that market sampling programmes are appropriate for examining seasonal, geographical and gear-related differences in the species composition of skates and ray landings. Improved species identification and sampling protocols, and increased sampling effort may be required.

Discards

Species information on the numbers of rays and skates caught by the Irish discard observer programme is presented in Table 15.7a. Without comparable landings data, however, it cannot be used to split national landings data. Likewise, because of the small number of data points in certain years, this information cannot be used to show trends in ray discarding.

Table 5.7b shows discard rates of rays and skates around Ireland, based on data from the Irish discard observer programme (Borges *et al.*, 2005). Discard rates can be seen to fluctuate between 11–56% of the catch. Similarly, Table 5.7c shows the discard rates of *Scyliorhinid* dogfish. With one exception, it can be seen that most dogfish caught are discarded, with discard rates generally over 60%. The low value (30%) in 1993 may be an artefact of the low number of samples in this year.

Table 15.8 shows the raised weights of different species of *Rajidae* from the Scottish discard programme. It should be noted that these data are based on a small sample size and the raising factors used are very large; the figures presented here should therefore be considered as indicative rather than accurate estimates.

Figures 15.3–15.4 show the discard and retention rates of some common species in beam trawl and demersal trawl fisheries, from UK and Irish discard programmes. Data for other fisheries, such as gill net and long-line fisheries are more limited.

These studies indicate that rays below a certain size tend to be discarded, regardless of species. While this size varies from vessel to vessel, in general, it is around 47 cm, though UK demersal fisheries land *R. clavata* of a smaller size. As rays are usually landed by grade (size) in mixed boxes, there is no size selection between different species. The only exception in some fisheries is *D. batis.* This species is now rarely caught by the Irish demersal trawl fleet, and consequently when caught is usually discarded, regardless of size. However, *D. batis* are still caught and retained by the UK beam trawl fleet. It has been suggested that buyers and processors do not favour the largest skates (e.g. adult *D. batis*), and discarding of this species may also be more prevalent in areas where there are important recreational fisheries targeting common skate.

15.2.2 Coastal sharks

If landed, dogfishes may be landed as a mixture of “dogfishes and hounds” (e.g. smooth-hounds, scyliorhinids, spurdog and tope), “dogfishes and hounds nei”, and other generic categories. Some of these categories are only used by few vessels. The use of “nei” categories is growing and is of a major concern (Johnston *et al.*, 2005). Improved species-specific landings data are required, given that market sampling programmes tend not to monitor these species.

Species and size composition

No market sampling data are available for this species-group. It is recommended that some of species be sampled under national port-sampling programmes in areas where they are landed regularly.

Discards

Some information on the discard patterns of small demersal sharks are available. Lesser-spotted dogfish are generally discarded (Figures 15.4–15.5), and there is also some discarding of smoothhounds, though specimens >50 cm length are retained in some fisheries. Discards sampling in Division VIIg highlights the prevalence of juvenile (<25cm) *Scyliorhinus* spp. in comparison to the other areas in this region (Figure 15.5a). The high proportion of juveniles in the catches suggests that this area may be an important nursery ground for lesser-spotted dogfish, as also suggested from groundfish surveys (Ellis *et al*., 2005).

Figure 5.5b presents data showing the variation in mean size of lesser-spotted dogfish by area (Borges *et al*., 2005). The majority of discarded dogfish on the west coast of Ireland are small individuals. In addition, some temporal variation can be seen. There was a particularly high rate of discarding in 2000 in Subdivisions VIIj and VIIb. The highest rate of discarding in VIIa took place in 1996, while in 1997, very high numbers of dogfish were discarded in VIIb, VIIg and VIIc.

Figure 5.5c shows dogfish Discard Per Unit Effort in the Irish trawl fishery. This also shows the very high discarding rate in 1996, but thereafter shows high fluctuations between years.

15.3 Quality of catch and biological data

Landings data were collated using the ICES Statlant database and data provided by working group members. The Statlant database holds data for the years 1973–2004. France and Belgium provided species specific landings for the Celtic Seas. Where this is not specified, the data are for all species combined is given.

Landings estimates for 2003–-2005 were provided by Ireland, Spain (Basque Country), UK and Belgium. The landings tables provided are different to those supplied in previous years. Area VI has been split into VIa and VIb as it is considered that they are different habitats, and there may be limited mixing between populations. Area VIIb has been combined with Area VIIk as they are considered to be one deepwater area. These figures have been combined with those from Areas VIIb and VIIj to provide landings for one western area. Likewise, figures from Areas VIIe,g and h have been combined as a southern waters grouping. It proved impossible to disaggregate the data for Areas VIIb and c. Data for Division VIId has been included in the North Sea eco-region (Section 12).

Although mis-reporting of quota species as elasmobranchs is known to occur, where anglerfish and hake are reported as “skates and rays” or under generic landings categories for dogfishes, the extent of this problem is unknown.

15.4 Fishery-independent information

There are several potential sources of fishery-independent survey data for demersal elasmobranchs in this eco-region, including UK beam trawl surveys in the Irish Sea, Bristol Channel and western English Channel, westerly IBTS-coordinated surveys and various other national surveys.

15.4.1 Beam trawl surveys

An annual survey with 4m-beam trawl is undertaken in the Irish Sea and Bristol Channel each September on board RV *Corystes*. This survey is described in Ellis *et al.* (2005). The primary target species for the survey are commercial flatfish (plaice and sole) and so most sampling effort occurs in relatively shallow water. Lesser-spotted dogfish, *R. brachyura, R. clavata, R. microocellata, R. montagui* and *L. naevus* are all sampled during this survey. Preliminary studies of survey data indicate that this gear may not sample large rays effectively, though this gear should be suitable for sampling smaller ray species (e.g. *R. montagui* and *L. naevus*) and juveniles and sub-adults of the larger species.

15.4.2 IBTS Q4 Westerly surveys

UK (Scotland), UK (England and Wales), Ireland, France and Spain undertake trawl surveys in the Celtic Seas eco-region, as part of the internationally-coordinated Q4 IBTS surveys for southern and western waters (Figure 15.6). The trawls used in all these surveys are not standardised (see Table 15.9), though individual surveys should be able to provide regional data on the distribution, relative abundance, species composition, size composition and abundance trends for a variety of demersal elasmobranchs.

15.4.3 Other surveys

Northern Ireland: Rockhopper trawl surveys of the Irish Sea are undertaken by DARD, though no recent data were available at the meeting.

UK (England and Wales): A Q1 survey with Portuguese High Headline Trawl (PHHT) was undertaken from 1982 to 2003, though the survey grid was most standardised between 1987 and 2002. Since 2004, the basis of the field programme changed to collecting additional biological data for commercial species, and so is not standardised with previous years.

UK (Scotland): There is also a Q1 west coast survey covering a similar area to the Q4 survey. A Q3 survey of the Rockall Bank has been conducted since 1991. During the period 1998–2004 this survey was conducted only in alternate years, with a deep-water survey along the shelf edge in VIa being carried out in the intervening years. Since 2005, both surveys have been carried out annually.

Ireland: An annual survey to collect maturity data on commercially important species takes place during the peak spawning season in the spring. This survey began in 2004. Different areas are surveyed each year, so annual trends cannot be derived. An annual deepwater trawl survey to the west of Ireland will begin in September 2006.

15.4.4 Species composition of Rajidae in surveys

Several species of skate and ray are recorded in surveys, with catches on the shelf dominated by *R. clavata, R. montagui, R. brachyura* and *L. naevus*. These species are recorded regularly and occasionally in comparatively large numbers, in both otter trawl and beam trawl surveys. Trawl surveys on offshore grounds, such as the Rockall and deepwater surveys carried out by Scotland, sample mostly larger individuals and offshore species (e.g. *Leucoraja* spp. and *Dipturus* spp.).

The species composition (by numbers and biomass) was calculated for some of the surveys described above. The UK survey of the Celtic Sea caught primarily *L. naevus* and *R. clavata*, with *L. fullonica* also relatively frequent in this area. In terms of biomass, *D. batis* is also an important member of the skate fauna in this region (Table 15.10). This survey samples extensively over the Celtic Sea, including near the edge of the continental shelf.

The skates and rays occurring in shallower waters are often markedly different from deeper areas. Beam trawl surveys in the coastal waters of the Bristol Channel, Irish Sea and western English Channel confirm that, numerically, *R. montagui, R. clavata* are the most abundant rays (Table 15.11), with *L. naevus* abundant on the coarse offshore grounds in both the Irish Sea and Celtic Sea. *L. naevus* is rarely observed in the shallower waters of the Bristol Channel, where another piscivorous ray, *R. microocellata*, is abundant. Other species were only observed occasionally.

Data from Irish surveys (Figures 15.7 and 15.8) indicate there are several regional differences in relative abundance of different species, and in relative numbers by area. In particular, the numbers of rays caught in Subdivision VIIj is much lower than in any other part of this eco-region. As also shown by UK surveys, *R. clavata* and *R. montagui* are the dominant species in most parts of the region, with the exception of Subdivision VIa where there is no dominant species amongst the common rays for the area as a whole.

15.4.5 Size composition of demersal elasmobranchs

Preliminary analyses of the size distribution of the demersal elasmobranchs have been undertaken. This study was simply to illustrate the life-history stages that may be represented in the various surveys, and so as to gauge whether existing surveys are likely to be appropriate for examining the pups, juveniles and adults of demersal elasmobranchs.

Several groundfish surveys, such as the earlier CEFAS PHHT survey (Figure 15.9) and the more recent and ongoing CEFAS beam trawl survey (Figure 15.10) and Irish Groundfish Survey (Figures 15.11-15.12), can provide annual data in the Celtic Seas. Of these, the beam trawl survey that takes place in Q3 shows the highest proportion of small (<20%) rays of each species. Within the surveys, some species are only caught in relatively low numbers. Nevertheless, some of these species, such as *R. microocellata*, show several modes in size range. As age data are not available for these species, these modes may possibly be used to estimate relative age abundances for younger age classes.

Other relatively common species show similar size distributions across surveys and areas. For example, *R. clavata* has a similar size distribution in both CEFAS and Irish surveys. Minor differences are apparent in other species, with the length distribtion of *R. montagui* having a peak of 39 cm in division VIa and 47 cm in VIIb (Figure 15.11). Similarly, for *L. naevus*, there is a 4 cm difference in peak frequency between VIa (55 cm) and VIIb (59 cm)

15.4.6 Survey trends

Groundfish surveys may be able to provide some trends on the relative abundance of various demersal elasmobranchs, including the more abundant skates and rays, lesser-spotted dogfish and smoothhounds (Figures 15.13–15.14). It must be noted that catch rates for annual surveys tend to be low for many species and quite variable, with many zero catches. Analyses of more specific areas within the overall survey areas may be more appropriate for some species. Hence, these trends should be viewed with some caution.

Lesser-spotted dogfish is abundant and widespread over most parts of the Celtic Seas eco-region. Like many elasmobranchs, it often aggregates by size and sex, and these aggregations can result in occasional large catches.

Some of the more abundant rays, including *R. clavata, R. montagui, R. microocellata* and *L. naevus*, are also caught in appreciable numbers in various surveys. Preliminary analyses of these survey data indicate that catch rates are quite variable, though most of these species appear stable. There is an apparent decline of cuckoo ray in the Celtic Sea.

In the Celtic Sea, the relative abundance of *R. clavata* appears relatively stable following a decline from the early 1990’s (Figure 15.13), and the relative abundance is stable/increasing in the Irish Sea and Bristol Channel (Figure 15.14).

Catch rates of *L. naevus* declined during the 1990s, though once again tend to have been relatively stable since this decline. The relative abundance in the Celtic Sea/Biscay region has increased in more recent years (Figure 5.15), as reported from the French EVHOE survey (Mahé and Poulard, 2005). The relative abundance of *R. microocellata, R. montagui* and *R. brachyura* appear to be stable in recent years, though catch rates of the latter species are low.

The relative abundance of lesser-spotted dogfish has increased in the Celtic Sea, and this has also been reported by the French EVHOE survey (Mahé and Poulard, 2005), where this increase has been associated with an increase in the abundance of smaller individuals. The UK survey in the Celtic Sea showed a peak in the relative abundance of *Mustelus* spp. in 2000, and though this peak was not apparent in the French survey in 2000, this species has also increased in recent years, peaking in 2004. The 2005 catch data for this survey were not available, it is not known whether this increased abundance has been maintained.

15.4.7 Future studies

WGEF will more rigorously examine the following demersal "stocks" (noting that stock units for many of these species are unclear) in 2007:

a) Smoothhounds *Mustelus* spp. (sub-area VII)

b) *Raja clavata* off North-west Scotland (VIa)

c) *Raja clavata* in the Irish Sea (VIIa)

d) *Raja clavata* in the Bristol Channel (VIIf)

e) *Leucoraja naevus* off North-west Scotland (VIa) and west of Ireland (VIIb)

f) *Leucoraja naevus* in the Irish Sea (VIIa)

g) *Leucoraja naevus* in the Celtic Sea (VIIe-j, and possibly including VIIIa,b)

The genus *Mustelus* is a problematic taxon, and it is likely that there is some confusion between *M. asterias* and *M. mustelus*. Hence, analyses for these species should use aggregated data for the two species.

Several species of demersal elasmobranch that, although occurring sporadically throughout much of the Celtic Seas region, have certain areas where they are locally abundant. Localised depletions of the species at these sites could therefore have a major impact on the population as a whole. Hence, the status of such species may need to be monitored and assessed at a more local scale. WGEF should therefore examine available data for:

a) *Raja undulata* in Tralee Bay (VIIj)

b) *Raja microocellata* in the Bristol Channel (VIIf)

c) *Scyliorhinus stellaris* off Anglesey and the Lleyn Peninsula (VIIa)

Historically, species such as *L. circularis, L. fullonica, D. batis* and *D. oxyrhinchus* may have been more widely distributed in shelf seas. These species are now encountered only infrequently in surveys on the inner continental shelf, though they are still present in deeper waters along the edge of the continental shelf. Hence studies to examine the current status of these species in sub-areas VI and VII should be undertaken next year. Future analyses should examine the long-terms distribution and relative abundance of these species. In the first instance, data on the occurrences of these species should be collated. IBTS should be requested to compile and provide WGEF with any available data for the westerly-IBTS and other national surveys.

There are anecdotal and historical reports suggesting that localised populations of *Rostroraja alba* were targeted in fisheries in the western English Channel, Baie de Douarnanez (Brittany) and off the Isle of Man (ICES, 2002), and this species is now rarely observed in the region.

Localised populations of angel shark in Start Bay (VIIe) and Cardigan Bay (VIIa) have declined severely and this species is now reported only infrequently in the area, though it was previously more common (Rogers and Ellis, 2000). Landings of this species have almost ceased, with only occasional individuals landed. The current status of angel shark in Clew Bay (VIIb) also needs to be ascertained.

Contemporary surveys occasionally record other skate species, such as undulate ray, though catch rates of these species are highly variable. The absence of *R. alba* and angel shark in contemporary surveys, as noted by ICES (2006) is cause for concern.

15.5 Mean length, weight, maturity and natural mortality-at-age

Some length-weight information and maturity information is available from various groundfish surveys. Various published biological studies have also provided maturity and age data for rays in the Celtic Seas (e.g. Gallagher *et al*., 2005b). It is recommended that data from these sources be examined for the next meeting of this working group.

Maturity information from the Irish Biological Surveys from the West of Ireland and Irish Sea are presented in Table 15.12, with corresponding maturity scales used in these and CEFAS surveys summarised in Table 15.13. Though ray catches are low during these surveys, it is hoped that more information will become available as these surveys continue.

CEFAS have also collected information on the maturity stages of various skates and rays during groundfish and beam trawl surveys. Preliminary analyses of these data (which includes data collected in the North Sea and eastern English Channel) are illustrated in Figure 15. 16.

Due to the low catch rates of rays in various national surveys, it is recommended that WGEF examine all recent maturity data available, including both survey and commercial data, from those nations collecting data in the Celtic Seas eco-region in order to come up with more accurate estimates of length at maturity for the dominant species.

15.6 Recruitment

Juveniles of most species are found in most groundfish surveys and in discards, although usually in small numbers. Annual beam trawl surveys in September catch recently hatched thornback rays (10–20 cm total length) (Figure 15.17). Although catches of 0-groups tend to be low and may not be accurate indicators of recruitment, a more critical examination of these data could usefully be undertaken. However for areas where elasmobranch catches are low, such as Rajidae in Area VIIj, it will not be possible to estimate recruitment without dedicated surveys.

15.7 Stock assessment

No new assessments were carried out for any of the stocks in this eco-region.

Preliminary assessments of the Celtic Sea stock of *L. naevus* were made during the DELASS project, using GLM analyses of commercial cpue and survey (EVHOE) data, a surplus production model and catch curve analysis. The results of these exploratory assessments did not give consistent results. Longer-term cpue data and a better knowledge of the stock are required.

15.8 Stock and catch projection

No assessment could be carried out for any of the stocks in this eco-region.

15.9 Reference points

No reference points have been proposed for these stocks.

15.10 Quality of the Assessment

No assessment could be carried out for any of the stocks in this eco-region.

15.11 Spawning and Juvenile fishing area closures

Tralee Bay (Area VIIj) is voluntarily closed to commercial fishing to protect regionally important elasmobranchs such as *R. undulata* and angel shark, which are only found in localised populations on the Irish West coast.

There are no other known specific closed areas for the protection of elasmobranchs.

15.12 Management considerations

There are no TACs for any of the other relevant species in this region.

It has been difficult for WGEF to deal with elasmobranchs in this region adequately. This is due to a lack of species-specific landings data, poor knowledge of the species composition for rays, taxonomic confusion in some data sets, poor knowledge of stock structure and limited time-series of fishery-independent surveys in this eco-region. The participation of French scientists would likely increase the availability of data for species in this area.

Thornback ray *Raja clavata* is one of the most important commercial species in the inshore fishing grounds of the Celtic Seas. It is thought to have been more abundant in the, and more accurate assessments of the status of this species are required. Preliminary analyses of recent survey data indicate that the relative abundance of this species in the Irish Sea is stable at the present time.

Cuckoo ray *Leucoraja naevus* is an important commercial species in the Celtic Sea. Catch rates declined in the Celtic Sea during the 1990's, though have been stable/increased in more recent years.

There are anecdotal and historical reports suggesting that localised populations of white skate *Rostroraja alba* were targeted in fisheries in the western English Channel, Baie de Douarnanez (Brittany) and off the Isle of Man, and this species is now very rarely observed in the region.

Localised populations of angel shark *Squatina squatina* in Start Bay (VIIe) and Cardigan Bay (VIIa) have declined severely and this species is now reported only infrequently in the area. Landings of this species have almost ceased, with only occasional individuals landed. Given the concerm over *S. squatina* in this and adjacent ecoregions, and that it is not subject to any conservation legislation, a zero TAC for Subareas VII–VIII may benefit this species. It is an inshore species, distinctive and relatively sedentary, and may have a relatively good discard survivorship.

The relative abundance of lesser-spotted dogfish *Scyliorhinus canicula*, smoothhounds *Mustelus* spp. and spotted ray *Raja montagui* in this eco-region appear stable/increasing, and assessments for these species are of a lower priority.

Technical interactions for fisheries in this eco-region are shown in Table 15.14.

15.13 References

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Table 15.1. Demersal elasmobranchs in the Celtic Seas. Nominal landings (tonnes) of skates and rays (Source: ICES).

Table 15.1a Total landings (t) of *Rajidae* in Area VIa

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	3	.	2	.	1	2	7	1	2	2	4	2	4	2	8	9	4
Denmark	+	.	+	+	+	+	+	+	.	+	+	.	.	.	.	.	0
Faeroe Islands	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	na
France	724	711	621	603	606	437	553	526	384	333	0	321	278	212	183	149	181
Germany	.	.	.	.	.	2	.	1	4	16	7	1	1	.	3	0	.
Ireland	630	150	200	350	331	265	504	681	596	488	388	274	238	311	364	363	186
Netherlands	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Norway	264	71	38	82	56	9	74	29	20	50	29	49	20	25	2	2	10
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spain	.	.	43	.	.	.	.	47	58	69	34	2	.	9	27	14	14
UK - (E,W&N.I.)	67	57	77	72	70	101	138	101	69	157	67	108	65	114	159	66	26
UK – Scotland	2499	2007	2026	1605	1419	1429	1980	2606	1879	1460	1324	1316	1263	1136	1307	1012	623
Total	4187	2996	3007	2712	2483	2245	3256	3992	3012	2575	1853	2073	1869	1809	2053	1488	1043

Table 15.1b Total Landings (t) of *Rajidae* in Area VIb

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	56	1	.	.	.
Faeroe Islands	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	na	na
France	0	3	13	0	4	0	0	0	0	0	0	7	5	5	2	6	15
Germany	1	.	.	.	6	25	17	49	26	36	67	76	8	1	6	22.3	22
Ireland	.	.	.	.	24	23	60	68	23	15	28	20	10	1	18	7.28	9
Norway	279	203	248	234	170	272	176	95	101	98	59	120	80	44	61	45.95	39
Portugal	.	.	.	.	.	.	56	.	25	26	24	29	17	31	18	na	0
Russian Federation	.	.	.	.	.	.	.	.	.	.	.	5	8	.	.	na	na
Spain	.	.	14	.	.	.	.	328	410	483	322	347	158	36	46	0.5	0
UK - (E,W&N.I.)	4	4	11	12	21	28	73	175	105	134	147	156	120	92	47	47.8	20
UK – Scotland	70	76	67	57	70	98	97	83	91	101	123	204	97	79	146	164	59
Total	354	286	353	303	295	446	479	798	781	893	770	964	559	290	344	294	164

Table 15.1c Total landings (t) of *Rajidae* in area VIIa

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	271	298	209	230	107	224	218	265	298	398	542	504	724	997	830	860	860
France	641	712	890	642	550	330	293	282	151	285	n.s.	163	343	349	322	183	192
Ireland	1808	1811	1400	1301	679	514	438	438	593	692	827	759	807	1032	1086	825	786
Netherlands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4	4	6	+	+	+	+	.
Norway	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
UK - (E,W&N.I.)	1373	1378	1226	1150	1003	748	606	789	824	1009	936	671	983	863	1184	533	1252
UK (Scotland)	171	227	163	107	96	86	42	55	80	52	33	86	80	68	67	38	30
Total	4264	4426	3888	3430	2435	1902	1597	1829	1946	2440	2342	2189	2937	3309	3489	2256	3120

Table 15.1d Total landings (t) of Rajidae in area VIIf

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	268	135	155	128	96	117	108	89	116	121	103	90	91	117	134	210	208
Denmark	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
France	366	326	607	663	565	468	394	432	485	464	453	538	642	526	536	478	429
Germany	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ireland	.	.	.	.	.	.	.	.	.	1	.	.	.	1	1	15	8
Netherlands	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Norway	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spain (b)	.	.	.	.	.	.	.	8	10	12	1	.	3	.	.	.	.
UK - (E,W&N.I.)	710	666	627	705	638	630	589	676	664	624	560	613	691	920	766	609	631
UK (Scotland)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	1344	1127	1389	1497	1299	1215	1091	1205	1275	1222	1117	1241	1427	1564	1437	1312	1276

Table 15.1e Total landings (t) of Rajidae in area VIIegh

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	355	242	97	183	209	172	203	177	293	260	240	223	248	347	576	407	432
Denmark	2	1	.	1	+	0	+	.	.	.	.	.	.	.	.	.	.
France	7566	7734	7077	6477	5873	5836	6029	6425	7093	6114	6098	5710	5603	5273	5588	4261	4517
Germany	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	3	.
Ireland	57	100	68	.	120	106	162	349	479	446	408	203	481	729	838	844	334
Netherlands	na	na	na	na	na	na	na	na	na	9	na	7	7	11	.	.	.
Norway	12	5	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spain (b)	.	.	21	.	.	.	.	312	932	1178	2647	1706	1142	653	31	15	9
UK - (E,W&N.I.)	865	1211	638	751	735	869	997	953	1098	1167	796	932	880	775	804	811	1024
UK (Scotland)	.	.	.	.	1	.	.	.	2	.	2	.	2	.	.	149	3
Total	8857	9293	7901	7412	6938	6983	7391	8216	9897	9173	10191	8781	8374	7788	7837	6490	6318

Table 15.1f Total landings (t) of *Rajidae* in area VIIbcjk

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	0	0	0	0	0	0	0	0	0	0	24	5	0	5	1	na	0
France	427	781	541	546	298	224	297	375	599	500	ns	568	362	272	192	101	257
Germany	0	0	0	0	7	18	3	4	9	17	10	21	7	+	3	15	17.07
Ireland	633	350	400	619	602	625	735	757	811	741	740	653	383	354	435	511	464.7
Spain (b)	0	0	124	0	0	0	0	1341	1676	1978	2419	2573	1205	2939	1281	7	16
UK - (E,W&N.I.)	25	5	53	71	88	201	361	469	468	376	352	597	545	373	350	364	269
UK (Scotland)	13	14	15	10	34	43	73	58	36	67	121	189	162	124	226	70	58
Total	1098	1150	1133	1246	1029	1111	1469	3004	3599	3679	3642	4601	2664	4062	2487	968	1081

Table 15.1g Total landings (t) of *Rajidae* in the Celtic Seas

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	897	675	463	541	413	515	536	532	709	781	913	824	1067	1467	1549	1485	1503
Denmark	2	1	.	2	+	.	+	.	.	.	.	.	.	.	.	.	0
Estonia	.	.	.	.	.	.	.	.	.	.	.	.	56	1	.	.	.
Faeroe Islands	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	na
France	9724	10267	9749	8931	7896	7295	7566	8040	8712	7696	6551	7307	7233	6637	6823	5178	5591
Germany	1	0	0	0	13	45	20	54	39	69	84	98	16	2	12	40	39
Ireland	3128	2411	2068	2270	1756	1533	1898	2294	2502	2382	2390	1909	1919	2428	2742	2565	1787
Netherlands	na	na	na	na	na	na	na	na	na	13	4	13	7	11	na	na	0
Norway	555	279	286	316	226	281	250	124	121	148	88	169	111	69	63	48	49
Poland	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Portugal	.	.	.	.	.	.	56	.	25	26	24	29	17	31	18	na	0
Russian Federation	.	.	.	.	.	.	.	.	.	.	.	5	8	.	.	na	na
Spain	0	0	202	0	0	0	0	2036	3086	3720	5423	4628	2508	3637	1385	37	39
UK - (E,W&N.I.)	3044	3321	2632	2761	2555	2577	2764	3163	3228	3467	2858	3077	3283	3137	3310	2431	3222
UK – Scotland	2753	2324	2271	1779	1620	1656	2192	2802	2088	1680	1603	1795	1604	1407	1746	1433	773
Total	20104	19278	17671	16600	14479	13902	15282	19044	20510	19981	19938	19854	17830	18828	17648	13217	13004

Table 15.2a. Demersal elasmobranchs in the Celtic Seas. Species-Specific French Landings, all areas combined.

Species	1995	1996	1997	1998	1999	2000	2001
T. marmorata	15	16	27	33	24	7	1
D. batis	296	331	344	278	130	468	537
D. oxyrhinchus	366	330	315	356	20	96	47
L. circularis	529	519	537	454	82	327	275
L. fullonica	56	50	43	40	21	21	36
L. naevus	3741	4043	4722	3848	1021	2541	2236
R. clavata	1739	1652	1535	931	478	865	618
R. montagui	882	973	1176	981	551	1062	1071
R. undulata	12	6	10	2	1	0	0
D. pastinaca	1	1	4		2	10	3
M. aquila	3	2	2	1	2	1	0
Various	2066	2507	2830	1111	6657	3558	2680
Total	9706	10430	11544	8035	8989	8956	7504

Table 15.2b. Demersal elasmobranchs in the Celtic Seas. Species-Specific French Landings for Subareas VI and VII.

Year	1999	2000	2001	2002	1999	2000	2001	2002
Area	VI	VI	VI	VI	VII	VII	VII	VII
T. marmorata	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2
D. batis	8.8	73.3	69.9	5.0	118.3	384.6	471.0	263.2
D. oxyrinchus	5.4	39.6	18.3	42.8	15.7	53.4	30.9	73.7
L. circularis	0.3	8.5	7.2	2.4	66.2	264.0	236.4	157.3
L. fullonica	0.0	0.4	0.1	0.3	22.5	45.0	47.3	65.1
L. naevus	5.6	57.0	61.1	43.3	706.8	1728.4	1660.2	1159.1
R. clavata	10.9	60.8	50.4	49.8	450.2	710.8	548.5	506.1
R. microocellata	0.0	0.0	0.0	0.0	7.5	0.5	0.9	0.0
R. montagui	0.1	0.5	0.7	0.8	533.9	1004.7	1065.8	886.2
R. undulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Large rays	0.0	3.5	0.0	0.0	12.0	29.9	12.1	1.5
D. pastinaca	0.0	0.0	0.0	0.0	2.0	8.6	2.8	4.8
M. aquila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total	31.1	243.6	207.6	144.5	1935.2	4229.9	4076.0	3117.3

** IncludingD. batis, R. alba, D. oxyrinchus, D. nidarosiensis*

Table 15.3. Demersal elasmobranchs in the Celtic Seas . Species specific landings from Spain (Basque Country), in Subareas VI, VII and VIII (2000–2003).

Year	2000	2001	2002	2003
L. naevus	330.3	290.9	290.0	287.0
R. asterias	0.0	0.1	0.0	0.0
R. batis	8.3	9.6	0.0	0.0
R. clavata	51.7	107.9	65.1	47.1
R. fullonica	5.3	33.5	0.0	1.5
R. montagui	2.7	6.2	20.9	5.1
R. oxyrhinchus	0.0	0.2	0.0	0.0
R. undulata	0.5	0.0	0.0	0.1
Total	398.8	448.4	376.0	340.9

No data available for 2004

Table 15.4. Demersal elasmobranchs in the Celtic Seas. Belgian Species-Specific Landings by division for the years 2001 and 2002.

	2001	2002	2001	2002	2001	2002
Area	VIIa	VIIa	VIId	VIId	VIIf,g	VIIf,g
*L. circularis**	9.3	22.7	6.0	3.2	104.7	86.5
L. naevus	77.6	137.3	0.0	0.2	27.9	44.3
R. brachyura	137.8	228.0	9.8	11.3	27.4	80.0
R.clavata	382.8	449.7	58.5	68.9	116.1	108.2
R. montagui	99.6	158.9	15.8	31.5	65.1	133.7
Total	707.0	996.6	90.1	115.2	341.2	452.8

* These records are considered by WGEF to be misidentified *R. microocellata*.

Table 15.5a. Demersal elasmobranchs in the Celtic Seas. Nominal landings (tonnes) of smooth hounds (*Mustelus* spp.) in ICES Subareas VI and VII. (These data may include a quantity of tope).

	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	.	.	.	.	.	.	.	8
France	511	590	+	814	989	1205	775	n.a.
Ireland	+	+	+	+	+	+	2	3
Spain (Basque country)	5	7	4	6	20	24	36	17
UK (E&W)	.	.	.	12	74	54	67	56
Total	516	597	4	820	1009	1229	813	27

Table 15.5b. Elasmobranchs in the Celtic Seas. Landings of *Squatina squatina*. French landings from ICES and Bulletin de Statistiques des Peches Maritimes. UK data from ICES and DEFRA. Belgian data from ICES.

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Belgium	0	0	0	0	0	0	0	0	0	0	0
France (Bulletin)	8	3	32	26	29	0	0	18.7	19.5	0	0
France (ICES)	0	0	0	0	0	24	19	0	0	18	13
UK (E,W &N.I.)	0	0	0	0	0	0	0	0	0	0	0
Total	8	3	32	26	29	24	19	18.7	19.5	18	13

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Belgium	0	0	0	0	0	0	0	0	0	0	0
France (Bulletin)	9	11.5	0	8	13	9	5	4	2	2	2
France (ICES)	9	13	14	12	2	2	2	1	1	1	1
UK (E,W &N.I.)	0	0	0	0	0	2	1	1	0	0	0
Total	18	24.5	14	20	15	13	8	6	3	3	3

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	0	0	0	0	0	0	0	0	0	+	+
France (Bulletin)	2	2	2	0	0	0	0	0	0	0	0
France (ICES)	2	1	0	0	1	+	+	+	0	+	+
UK (E,W &N.I.)	0	0	47	0	0	0	0	0	0	0	0
Total	4	3	49	0	1	0	0	0	0	0	0

Table 15.6. Elasmobranchs in the Celtic Seas. Proportion of rays (Rajidae) from earlier studies in the Celtic Seas eco-region.

Study	Year	Area	Category	*D. batis*	*D. oxyrinchus*	*L. circularis*	*L. fullonica*	*L. naevus*	*R. brachyura*	*R. clavata*	*R. microocellata*	*R. montagui*	*R. undulata*	*R. alba*
Du Buit (1966)	1960's	Celtic Sea	All	+	+	0.01	0.01	0.91	-	0.05	-	0.02	-	-
Du Buit (1972)	1971	Celtic Sea	All	0.01	+	0.04	0.20	0.70	+	0.04	-	0.02	-	-
Du Buit (1968)	1964	Douarnenez	All	0.08	+	+	+	+	0.12	0.58	0.02	0.16	+	0.05
	1964	Lorient	All	0.24	0.02	0.03	0.04	0.13	0.03	0.47	-	0.05	-	-
	1964	Concarneau	All	0.27	0.01	0.00	0.08	0.29	+	0.31	+	0.04	+	+
Quero & Gueguen (1981)	1977-1980	Bristol Channel, Celtic Sea, Cardigan Bay	All	+	-	-	0.01	0.08	0.02	0.67	0.04	0.19	+	-
Fahy (1989)	1987-1988	Irish waters	Small	0.01	-	-	+	0.26	0.21	0.25	+	0.28	-	-
	1987-1988	Irish waters	Medium	0.02	-	-	0.02	0.21	0.19	0.27	0.03	0.25	+	+
	1987-1988	Irish waters	Large	0.02	-	-	0.03	0.04	0.45	0.33	0.02	0.11	+	-
Gallagher *et al.* (2005)	1997	VIIa,g	All	-	-	-	-	0.39	0.34	0.05	-	0.22	-	-

Table 15.7a. Demersal elasmobranchs in the Celtic Seas. Ray species (numbers) discarded. These are not raised to fleet. (Source: Irish discard monitoring programme, 1993–2004).

	ICES DIVISION							
Species	**VIa**	**VIb**	**VIIa**	**VIIb**	**VIIc**	**VIIg**	**VIIj**	**Total**
Amblyraja hyperborea	8							8
Raja brachyura	124		3	3		1	28	159
Neoraja caerulea					2			2
Leucoraja naevus	719	1	5	1		18	17	761
Raja spp.	838	59	3072	665	2	384	252	5272
Leucoraja circularis	4				10			14
Leucoraja fullonica	1							1
Dipturus batis	104			128		4	19	255
Raja montagui	776		7	1		87	1	872
Raja clavata	421		6	16		6	27	476
Total numbers	2995	60	3093	814	14	500	344	7820

Table 15.7b. Demersal elasmobranchs in the Celtic Seas. Discard rates of rays and skates in the Celtic Seas. (Source: Irish discard monitoring programme, 1993–2004).

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Number of trips	6	35	33	21	16	12	14
Number of hauls/set	60	193	222	118	163	52	74
Tonnes	1 835	373	1 004	581	920	231	906
Discard rate (% Kg)	56	17	33	23	32	11	33

Table 15.7c. Demersal elasmobranchs in the Celtic Seas. Discard rates of *Scyliorhinid* dogfish in the Celtic Seas. (Source: Irish discard monitoring programme, 1993–2004).

	1995	1996	1997	1998	1999	2000	2001
Number of trips	4	35	34	28	18	14	15
Number of hauls/set	45	260	273	161	181	73	86
Tonnes	638	3 238	2 388	1 467	2 998	2 516	1 371
Discard rate (% Kg)	30	87	75	62	86	86	73

Table 15.8. Demersal elasmobranchs in the Celtic Seas. Estimated weight (tonnes) of rays and skates discarded by the Scottish Fleet to the west of Scotland (Subarea VIa), 1999–2000. (Source: UK (Scotland) Discard Observer Programme).

	1999	2000
L. naevus	205.8	194.1
D. batis	269.1	13.2
R. montagui	98.3	67.4
L. fullonica	0	3.1
A. radiata	0	0
R. clavata	14.3	16.9
L. fullonica	0.2	0
Total	587.7	294.7

Table 15.9. Demersal elasmobranchs in the Celtic Seas. Summary details of western IBTS surveys in Celtic Seas eco-region. Adapted from ICES (2004).

Country	UK (Scot)	France	Spain (Porcupine)	Ireland	UK (E & W)
Institute	MLA	IFREMER	IEO	MI	CEFAS
Survey Area	VI, VIIa	VIIf-j, VIII	Porcupine	VIa, VII	VIIa, e-h
Depth range (m)	20–200	30–400	180–800	15–200	15 - 200
Initiated (as per quarter)	1992	1997	2001	2003	2003
Quarter	4	4	3 & 4	4	4
Research vessel	Scotia	Thalassa	Vizconde de Eza	Celtic Explorer	Endeavour
Gear Type	GOV 36/47	GOV 36/47	Porcupine BACA 40/52	GOV 36/47	GOV 36/47 (fine ground) GOV 35/45 (Rock-hopper)
Exocet Kite	Yes	No	No	No	No
Groundgear	Bobbins	Rubber disks and Chains Rubber and metal disks	Synthetic wrapped wire core double coat	Rubber disks + chain (type A + D)	Groundgear A (fine ground); rubber disks + hoppers (12-16”)

Table 15.10. Demersal elasmobranchs in the Celtic Seas. Proportion of rays in fishery independent surveys in the Celtic Sea (Portuguese High Headline Trawl, all stations north of 48ºN, 1984–2002).

Species	Numbers	Biomass
L. naevus	0.62	0.43
R. clavata	0.13	0.22
L. fullonica	0.10	0.10
R. montagui	0.09	0.08
D. batis	0.03	0.10
R. microocellata	0.02	0.04
R. brachyura	0.01	0.02
D. oxyrhinchus	+	0.01
L. circularis	+	+
D. nidarosiensis	+	+
R. undulata	+	+

Table 15.11. Demersal elasmobranchs in the Celtic Seas. Proportion of rays in fishery independent surveys in the Celtic Seas (CEFAS 4m beam trawl surveys, 1988–2005, all stations).

Species	VIIa	VIIf	VIIg	VIIe
R. brachyura	0.05	0.06	0.02	0.05
L. naevus	0.16	0.01	0.13	0.01
R. microocellata	+	0.30	0.14	0.03
R. montagui	0.30	0.19	0.40	0.39
R. clavata	0.48	0.45	0.32	0.48
R. undulata	+	-	-	0.04
L. circularis	-	+	-	-
L. fullonica	-	-	+	-

Table 15.12. Demersal elasmobranchs in the Celtic Seas. Maturity of male and female ray species from (a) west of Ireland (2005) and (b) Irish Sea (2006) (Source: Irish Biological Survey, March 2005).

		Females						Males			
		Maturity						Maturity			
	Species	1	2	3	4	5	6	1	2	3	4
(a) West of Ireland	*R. brachyura*	-	1	1	1	-	-	1	2		1
	L. naevus	16	-	-	-	-	-	11	3	2	
	R. montagui	10		2	1	-	-	-	2		1
	R. clavata	11	8	4	1	-	-	9	3	3	5
	Total	37	9	7	3	-	-	21	10	5	7
(b) Irish Sea	*R. brachyura*	6	2	2	-	-	-	5	1	8	1
	L. naevus	17	6	1	2	-	-	12	2	3	1
	R. montagui	44	17	6	-	-	1	28	24	15	16
	R. clavata	10	2	2	-	-	-	9	3	2	1
	Total	77	27	11	2	-	1	54	30	28	19

Table 15.13. Demersal elasmobranchs in the Celtic Seas. Maturity keys used on Irish biological surveys and on CEFAS groundfish surveys.

Irish Biological surveys			CEFAS Four-stage key		
Stage	Females	Males	Stage	Females	Males
1	Juvenile	Juvenile	A	Juvenile	Juvenile
2	Maturing virgin	Maturing virgin	B	Maturing	Maturing
3	Mature	Mature	C	Mature	Mature
4	Active	Active	D	Active	Active
5	Laying				
6	Spent				

Table 15.14. Demersal elasmobranchs in the Celtic Seas. Technical interactions.

Stock interaction table	Anglerfish budegassa VIIb-k, VIIIabd	Anglerfish piscatorius VIIb-k, VIIIabd	Cod VIIe-k	Haddock VIIb-k	Hake Northern	Herring Celtic Sea and Division VIIj	Herring VIa(S) and VIIbc	Horse Mackerel Western	Mackerel North East Atlantic	Megrim VII	Nephrops Area L: VIIbcjk	Nephrops Area M: VIIfgh+VIIa	Nephrops VIIIa,b	Plaice VIIbc	Plaice VIIe	Plaice VIIfg	Plaice VIIhjk	Sole VIIbc	Sole VIIe	Sole VIIfg	Sole VIIhjk	Sprat VIIde	Whiting VIIe-k	Seabass	Skates and rays	Pelagic and migratory sharks	Demersal sharks
Anglerfish budegassa VIIb-k, VIIIabd		H	L	L	M	0	0	0	0	M	M	L	M	L	L	L	L	L	L	L	L		L		H	L	H
Anglerfish piscatorius VIIb-k, VIIIabd	T		L	L	M	0	0	0	0	M	M	M	M	L	L	L	L	L	L	L	L		L		H	L	H
Cod VIIe-k	T	T		H	L	0	0	0	0	L	L	M	0	0	L	M	L	0	L	L	L	0	H/M		H	L	H
Haddock VIIb-k	T	T	T		L	0	0	0	0	L	M	M	0	L	L	L	L	L	L	L	L	0	H	0	H	L	H
Hake Northern	T	T	T			0	0	0	0	M	M	L	M	L		0	L	L		0	L		L		H	L	H
Herring Celtic Sea and Division VIIj	N	N	N	N	N		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	I	0
Herring VIa(S) and VIIbc	N	N	N	N	N	N		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	L	0
Horse Mackerel Western	N	N	N	N	N	N	N		H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0
Mackerel North East Atlantic	N	N	N	N	N	N	N			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0
Megrim VII	T, BT	T, BT	T		T	N	N	N	N		H	M	M	L			L	L		L	L		L		H	0	H
Nephrops Area L: VIIbcjk	NT	NT	NT	NT	NT	N	N	N	N	NT		0	0	L	0	0	L	L	0	0	L	0	M		M	0	M
Nephrops Area M: VIIfgh+VIIa	NT	NT	NT	NT	NT	N	N	N	N	NT	N		0	0	0	0	L	0	0	L	L	0	M		M	0	M
Nephrops VIIIa,b	NT	NT	N	N	NT	N	N	N	N	NT	N	N		0	0	0	0	0	0	0	0	0	0		L	0	M
Plaice VIIbc			N			N	N	N	N		NT	N	N		0	0	0	L	0	0	0	0	L	0	H	0	M
Plaice VIIe	OT, BT	OT, BT	OT, BT	N		N	N	N	N		N	N	N	N		0	0	0	H	0	0	0	L		H	0	M
Plaice VIIfg	OT, BT	OT, BT	OT, BT	OT, BT	N	N	N	N	N		N	N	N	N	N		0	0	0	H	0	0	L		H	0	M
Plaice VIIhjk			BT, OT			N	N	N	N		NT	N	N	N	N	N		0	0	0	L	0	L	0	H	0	M
Sole VIIbc			N			N	N	N	N		N	N	N		N	N	N		0	0	0	0	L	0	H	0	M
Sole VIIe	BT, OT	BT, OT	BT, OT	N		N	N	N	N		N	N	N	N	BT, OT	N	N	N		0	0	0	L		H	0	M
Sole VIIfg	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT	N	NT	N	N	N	BT, OT	N	N	N		0	0	L		H	0	M
Sole VIIhjk			DT, OT			N	N	N	N		N	N	N	N	N	N	T, DT	N	N	N		0	L	0	H	0	M
Sprat VIIde	N	N	N	N				N	N		N	N	N	N	N	N	N	N	N	N	N		0				
Whiting VIIe-k	T	T	T	T		N	N	N	N		NT	NT	N	N	N	BT, OT		N	N	BT, OT				0	H	L	H
Seabass						N	N	N	N														0		L	L	L
Skates and rays	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	BT, OT	NT	NT	NT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT,OT	GN		L	H
Pelagic and migratory sharks	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	BT, OT				BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT	BT, OT	N	BT,OT	T, GN	GN, BT		0
Demersal sharks	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	BT, OT	NT	NT	NT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT,OT	GN	BT,OT	N	

H; the stocks are taken together in most fisheries where they are taken and their fisheries linkage is therefore high; M: the stocks are taken together in some but not all important fisheries and their fisheries linkage is therefore medium; L: the stocks

T: Trawl; BT: Beam trawl; OT: Otter trawl; NT: Nephrops trawl; GN: Gillnet; N: none

Figure 15.1a. Demersal elasmobranchs in the Celtic Seas. Total landings (tonnes) of *Rajidae* in the Celtic Seas (ICES Subareas VI and VII (including VIId)), from 1903–-2005 (Source: ICES).

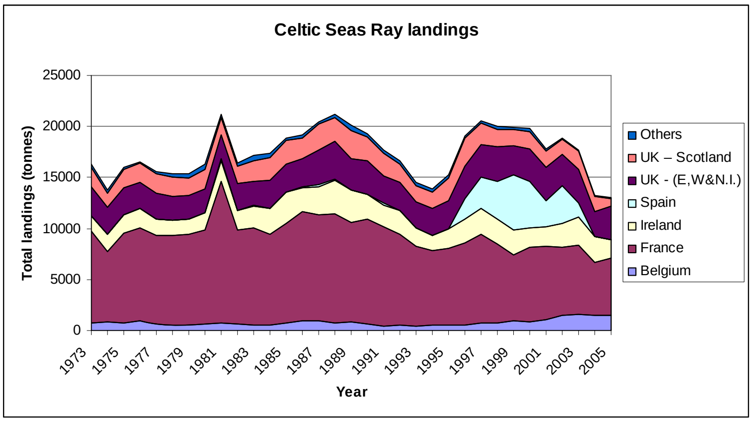


Figure 15.1b. Demersal elasmobranchs in the Celtic Seas. Total landings (tonnes) of *Rajidae* by nation in the Celtic Seas from 1973–2005 (Source: ICES).

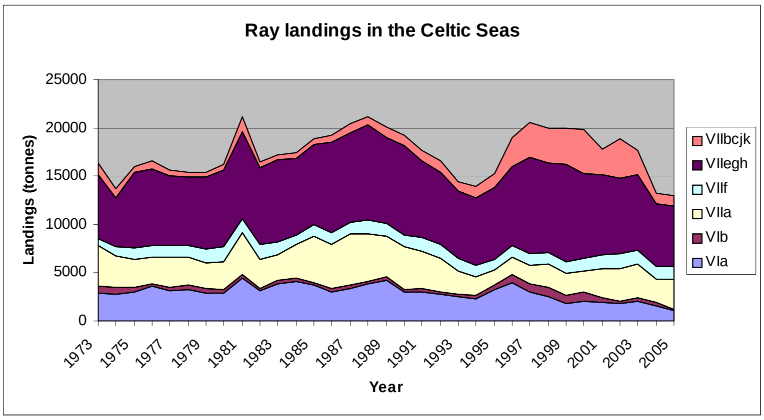
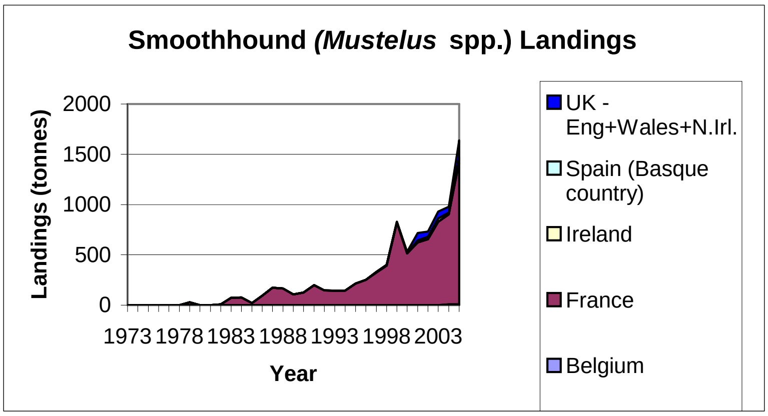


Figure 15.1c. Demersal elasmobranchs in the Celtic Seas. Total landings (tonnes) of *Rajidae* by ICES Division in the Celtic Seas from 1973–2005 (Source: ICES).



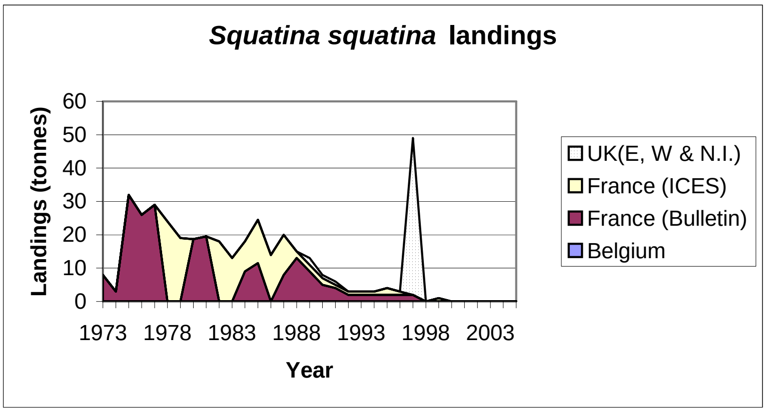


Figure 15.2. Demersal elasmobranchs in the Celtic Seas. Total landings of *Musetlus* spp. and *Squatina squatina* (Source: ICES and Bulletin de Statistiques des Peches Maritimes).

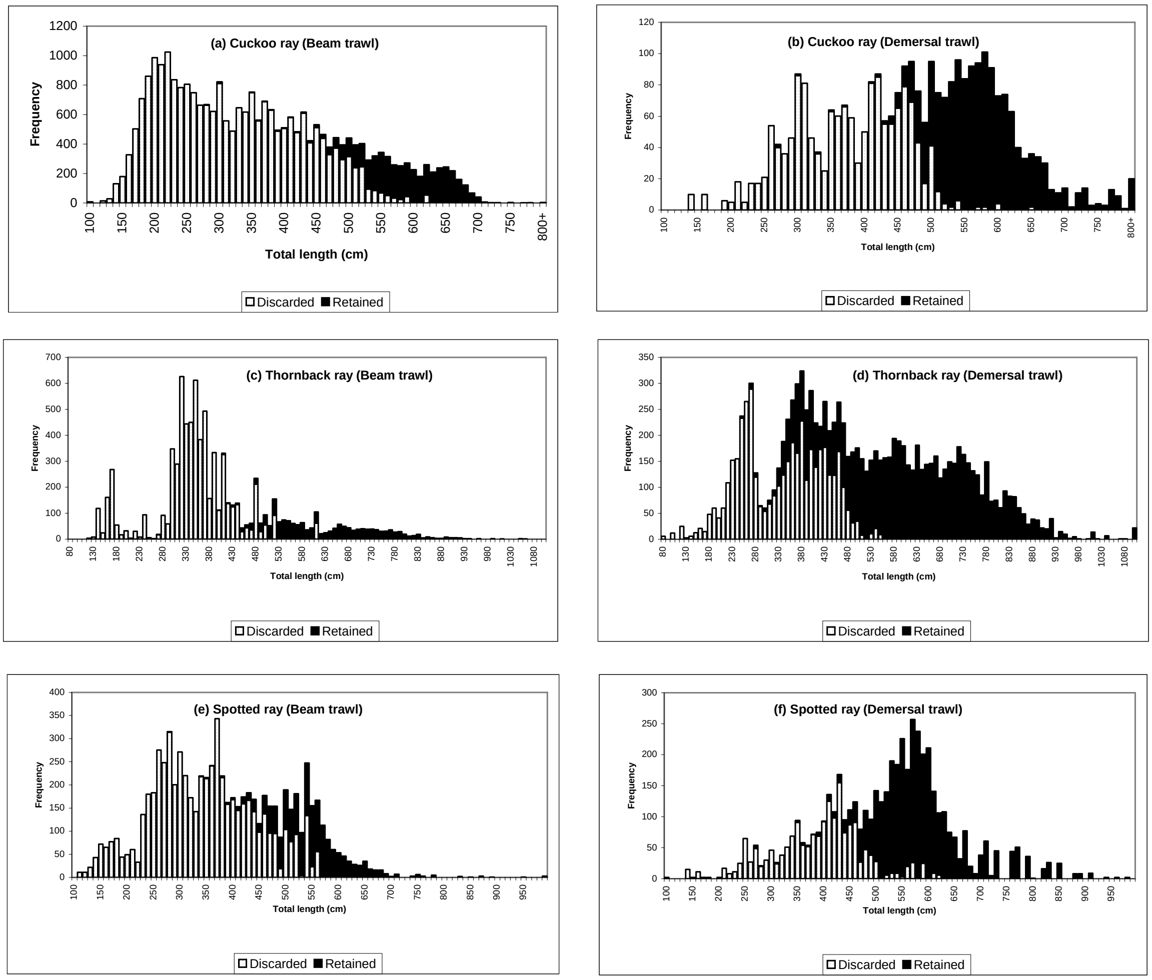


Figure 15.3a. Demersal elasmobranchs in the Celtic Seas. Length distributions of (a–b) cuckoo ray, (c–d) thornback ray and (e–f) spotted ray discarded and retained in beam trawls and demersal trawl fisheries in western waters (ICES Subarea VII). Data aggregated across individual catch samples for the years 1998-2006 (Source: UK (E&W) Discard Surveys).

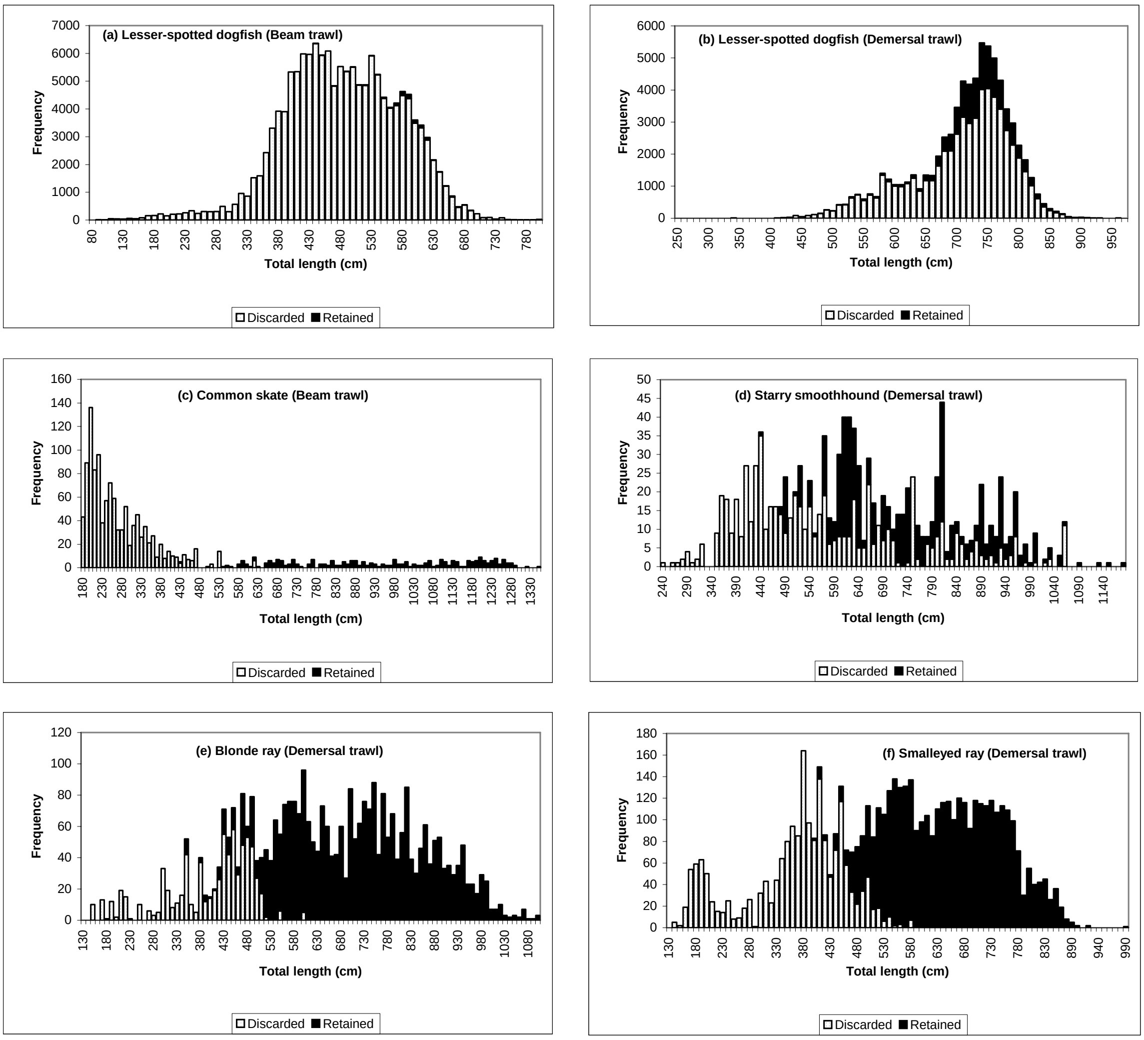


Figure 15.3b. Demersal elasmobranchs in the Celtic Seas. Length distributions of (a-b) lesser-spotted dogfish, (c) common skate, (d) starry smoothhound, (e) blonde ray and (f) smalleyed raypotted ray discarded and retained in beam trawl and demersal trawl fisheries in western waters (ICES Subarea VII). Data aggregated across individual catch samples for the years 1998–2006 (Source: UK (E&W) Discard Surveys).

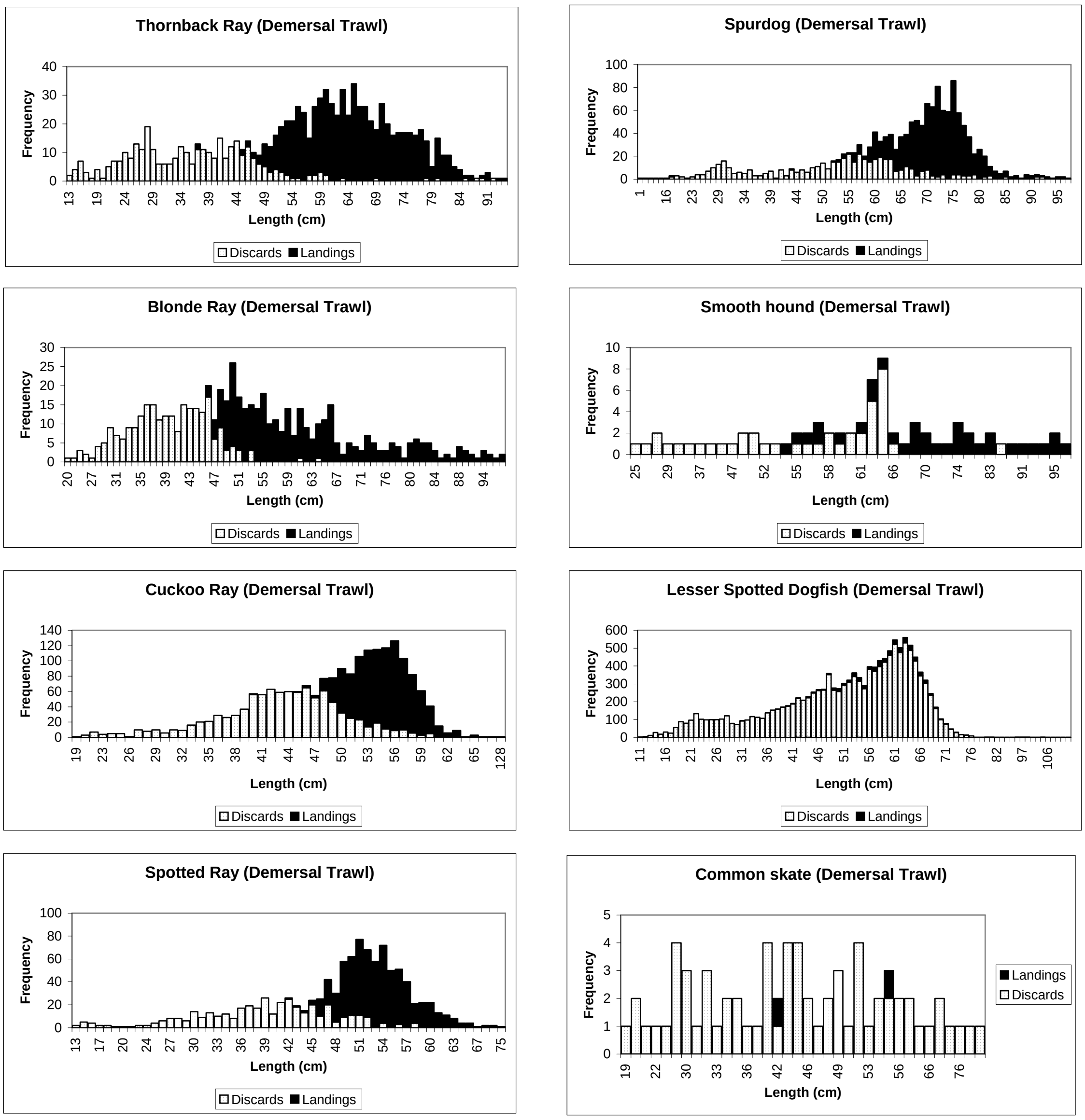


Figure 15.4. Demersal elasmobranchs in the Celtic Seas. Length distribution of elasmobranch species discarded and retained in Irish demersal trawl fisheries in the Celtic Seas. These data are aggregated across individual catch samples for all demersal gears and divisions combined. (Source: Irish Discard Monitoring Programme).

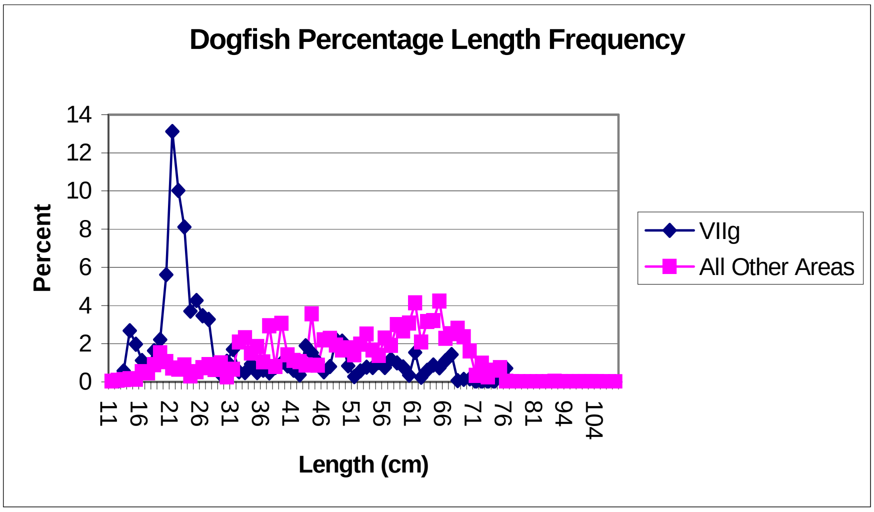


Figure 15.5a. Demersal elasmobranchs in the Celtic Seas. Length frequency of dogfish (*Scyliorhinus* spp.) in Division VIIg in comparison to other areas (Source: Irish Discard Observer Programme).

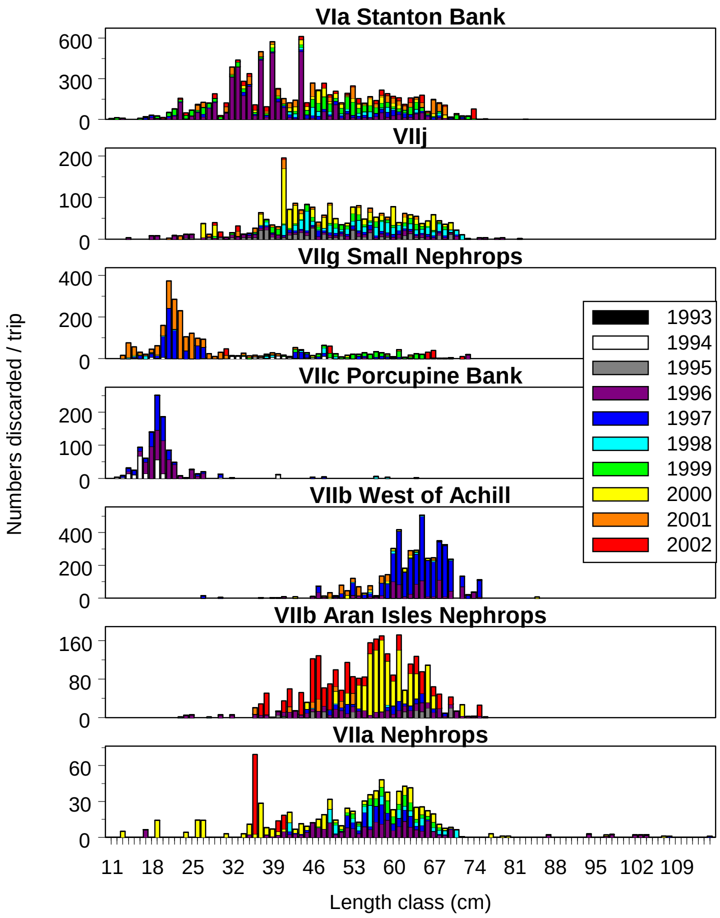


Figure 15.5b. Demersal elasmobranchs in the Celtic Seas. Numbers discarded per trip in ICES Divisions VIa and VIIa–c,g,j. (Source: Irish Discard Observer Programme).

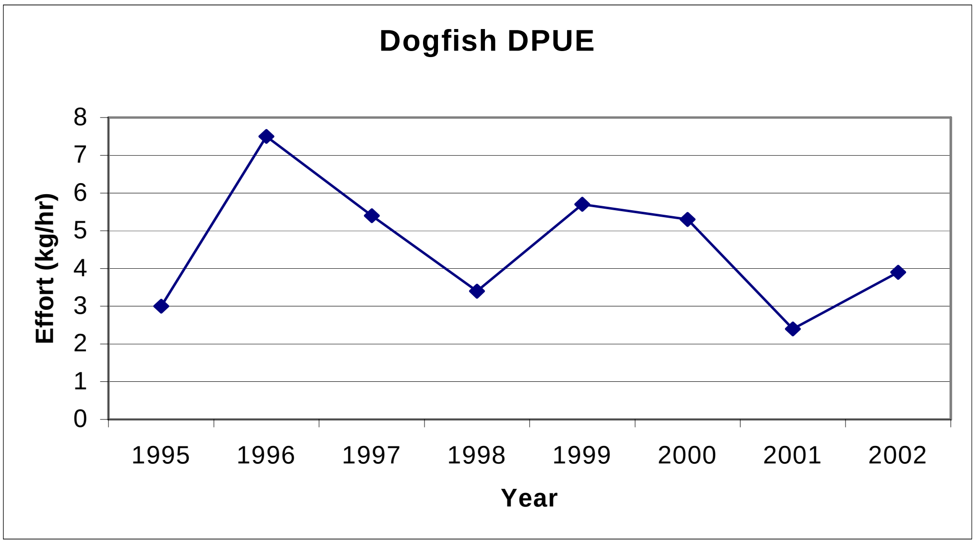


Figure 15.5c. Demersal elasmobranchs in the Celtic Seas. Dogfish Discard Per Unit Effort by the Irish trawl fishery. (Source: Irish Discard Observer Programme).

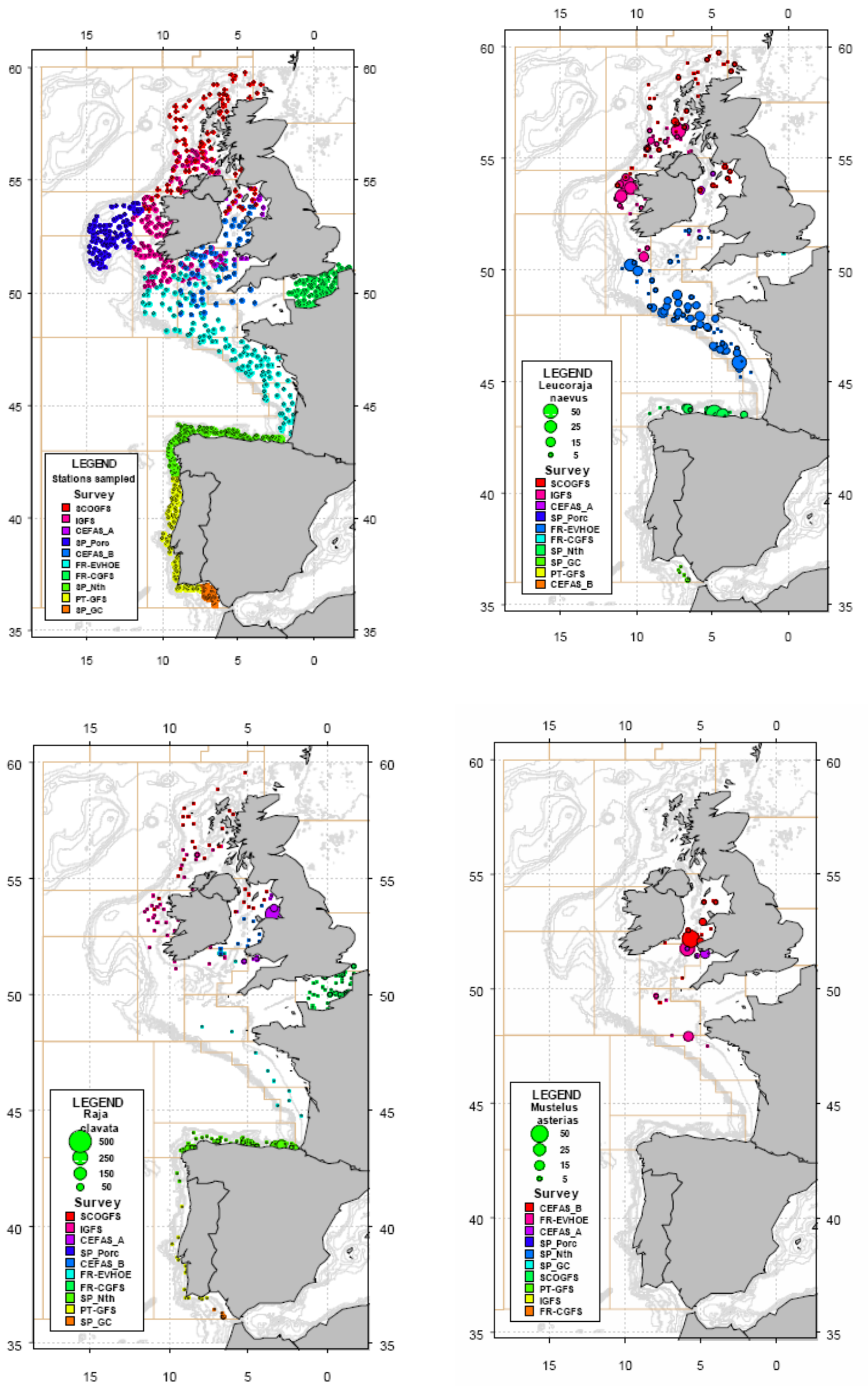


Figure 15.6. Demersal elasmobranchs in the Celtic Seas. Station positions for the IBTS Surveys carried out in the Western and Southern Area in the autumn/winter of 2005, and catches, in numbers per hour, of cuckoo ray *Leucoraja naevus*, thornback ray *Raja clavata* and starry smooth hound *Mustelus asterias* in Q4 IBTS surveys in 2005. The catchability of the different gears used in these surveys is not constant; therefore these maps do not reflect proportional abundance in all the areas but within each survey (Source: ICES, 2006b).

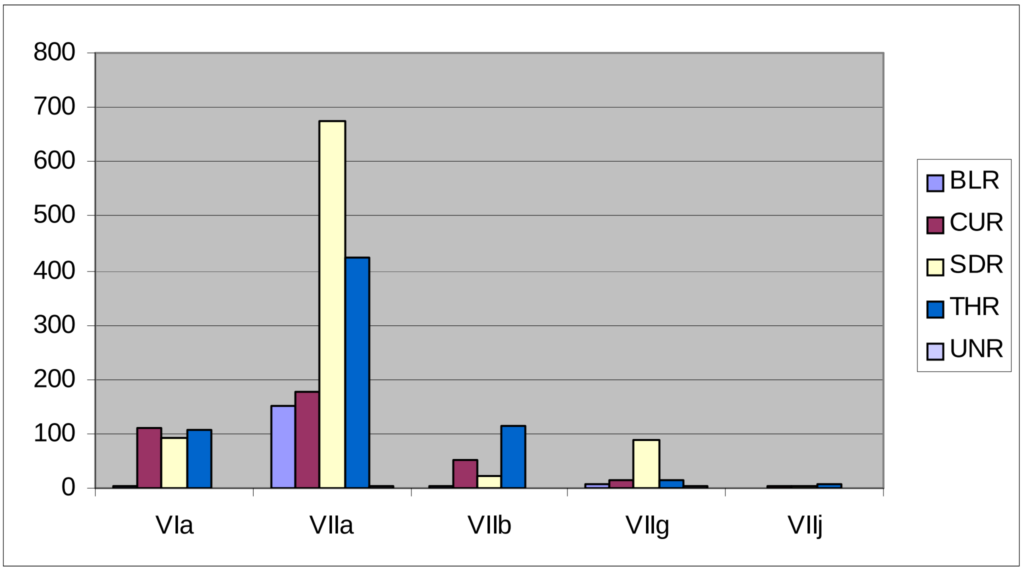


Figure 15.7. Demersal elasmobranchs in the Celtic Seas. Number of *Leucoraja naevus* (CUR), *Raja brachyura* (BLR), *R. clavata* (THR), *R. montagui* (SDR), and *Raja undulata* (UNR) in ICES divisions VIa and VIIa,b,g,j. Data from Irish Groundfish Survey, 1993–2004.

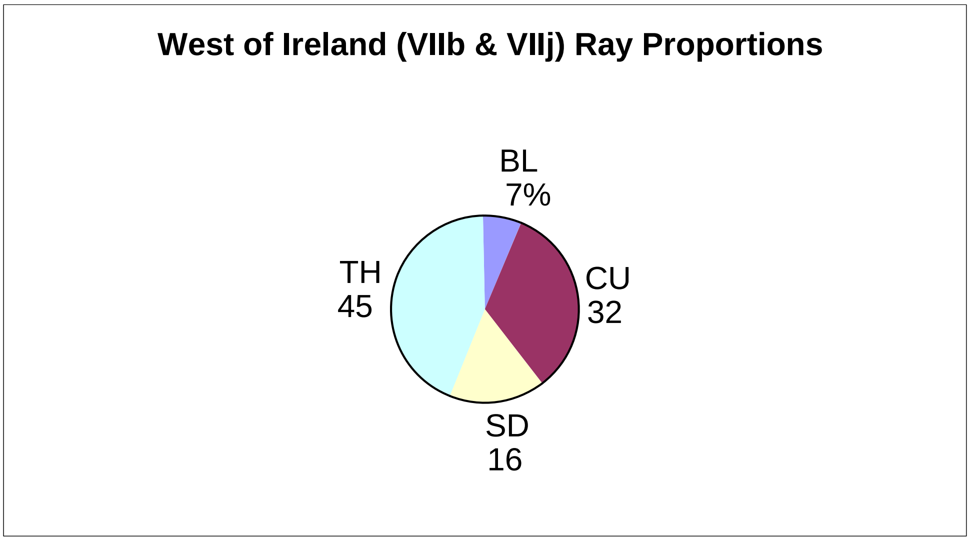


Figure 15.8. Demersal elasmobranchs in the Celtic Seas. Proportions of *Leucoraja naevus* (CUR), *Raja brachyura* (BLR), *R. clavata* (THR), and *R. montagui* (SDR) in ICES Divisions VIIb,j. Data from Irish Biological Survey 2005.

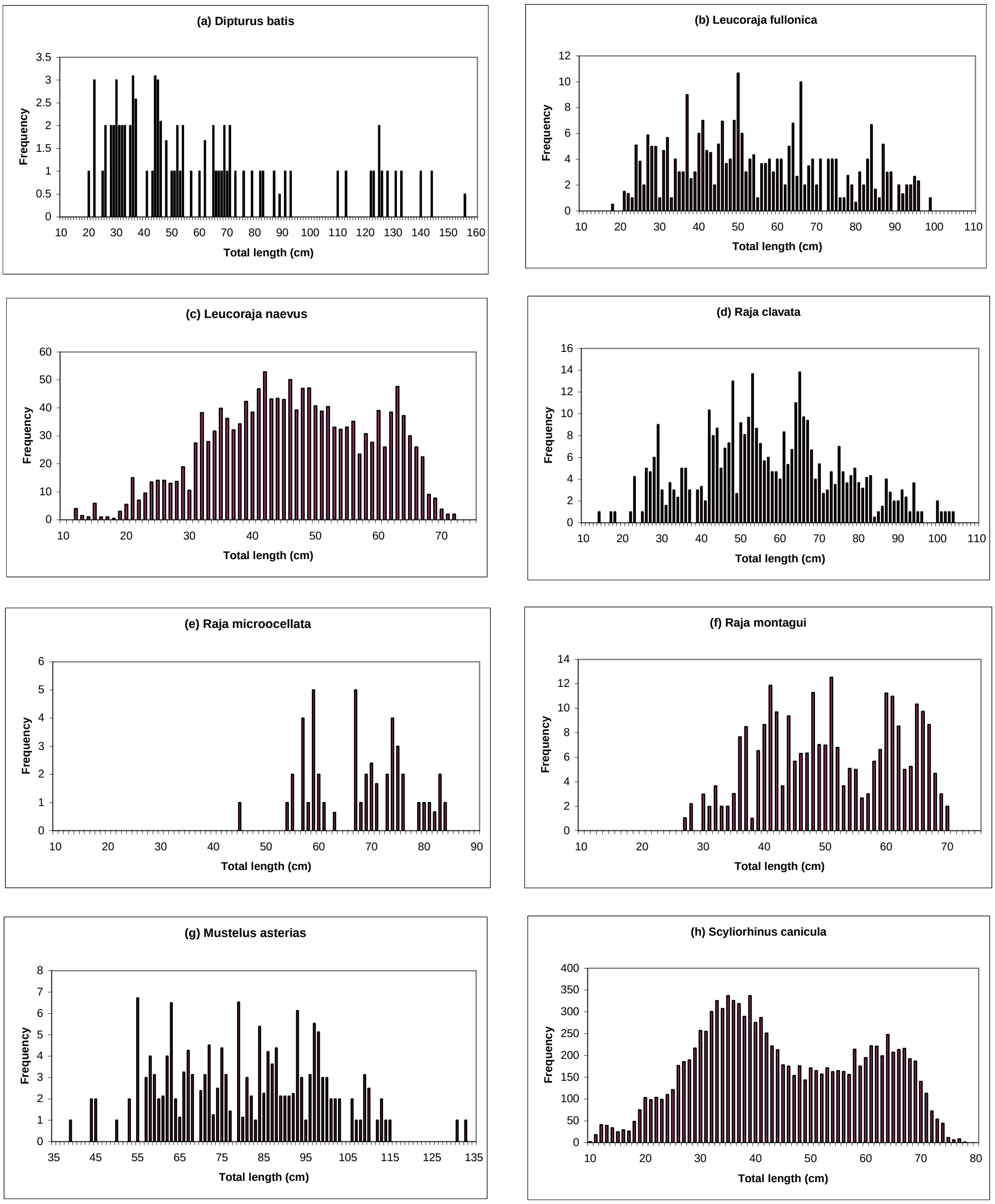


Figure 15.9. Demersal elasmobranchs in the Celtic Seas. Length distribution of (a) Dipturus batis, (b) Leucoraja fullonica, (c) L. naevus, (d) Raja clavata, (e) R. microocellata, (f) R. montagui, (g) Mustelus asterias and (h) Scyliorhinus canicula in the Celtic Sea (Cefas Celtic Sea survey, Q1, PHHT, 1982–2002, all stations in Subarea VII).

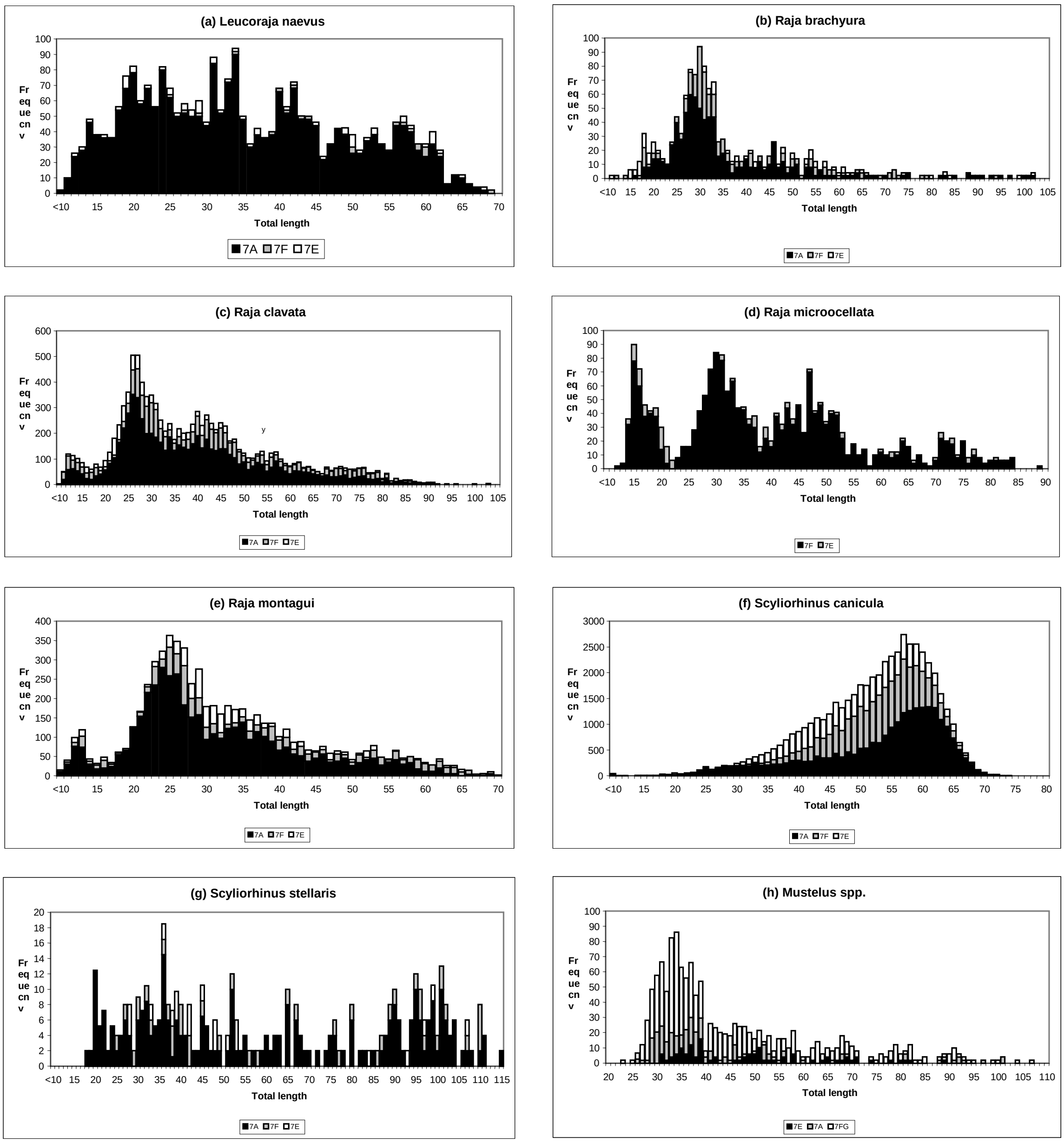


Figure 15.10. Demersal elasmobranchs in the Celtic Seas. Length distribution of (a) *Leucoraja naevuss,* (b) *R. brachyura,* (c) *R. clavata,* (d) *R. microocellata,* (e) *R. montagui,* (f) *Scyliorhinus canicula,* (g) *S. stellaris* and (h) *Mustelus* spp. in the Irish Sea, Bristol Channel and western English Channel (Cefas 4m-beam trawl survey, Q3, 1988–2005, all stations in Divisions VIIa, e, f)Table 13.10. Ray catches from Irish Groundfish Survey per ICES area, 1993–2004. Only rays identified to species level are included.

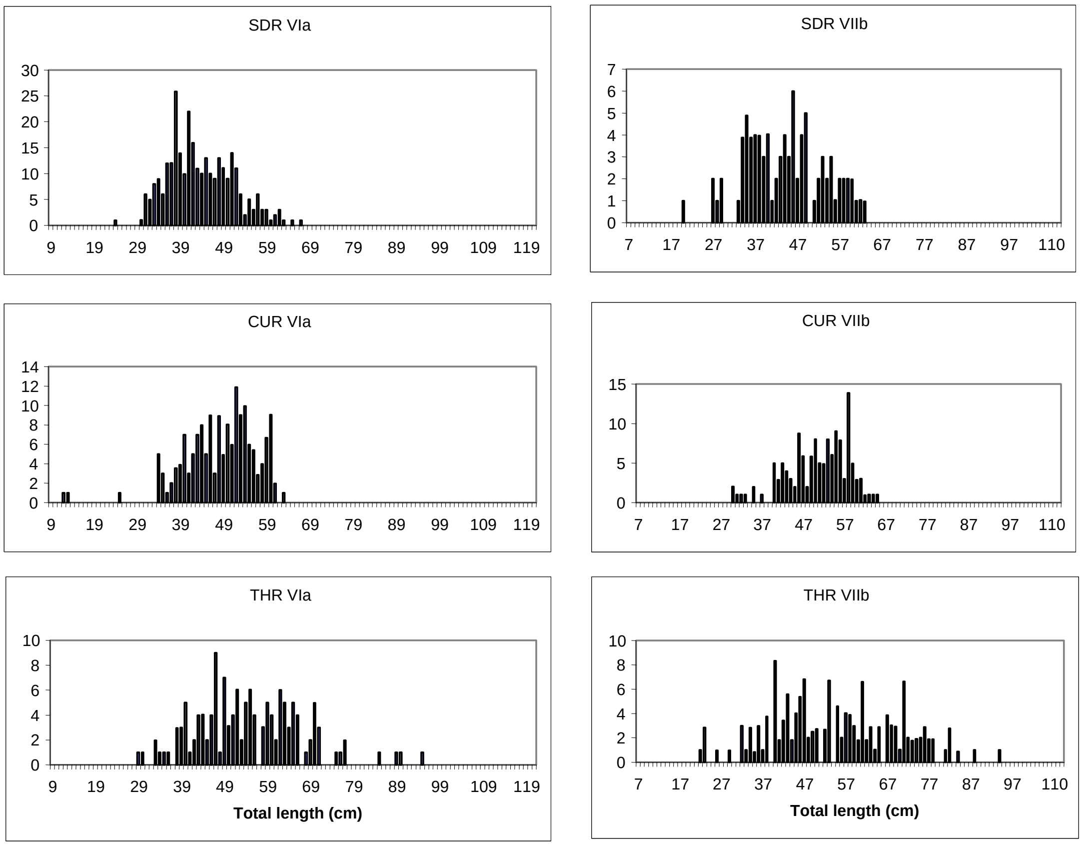


Figure 15.11. Demersal elasmobranchs in the Celtic Seas. Comparison of length distributions and frequencies of three ray species: spotted ray (SDR), cuckoo ray (CUR) and thornback ray (THR) from VIa and VIIb. Data taken from Irish Groundfish Survey, 1999–2005.

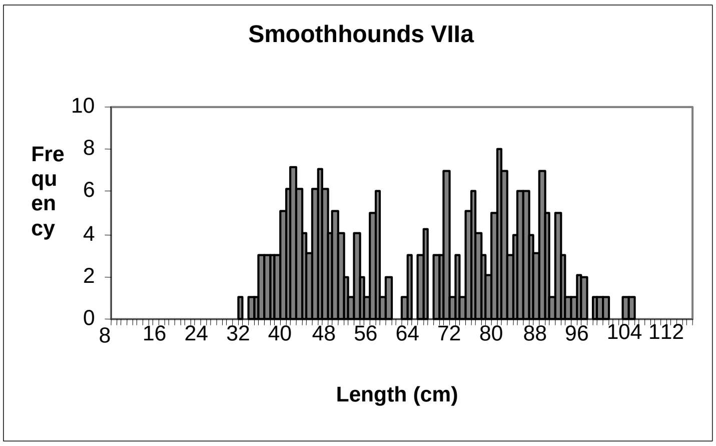


Figure 15.12: Demersal elasmobranchs in the Celtic Seas. Length frequency of smooth-hounds (*Mustelus* spp.) from area VIIa. Data from Irish Groundfish Survey, 1999–2005.

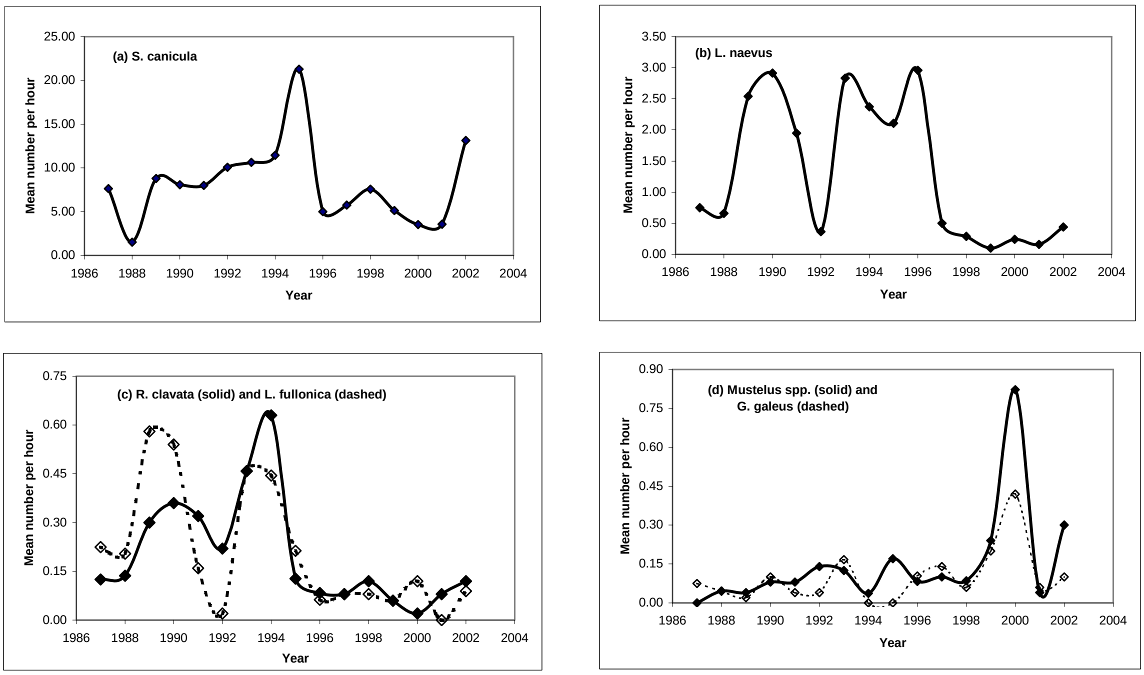


Figure 15.13. Demersal elasmobranchs in the Celtic Seas. Trends in relative abundance (no.h^{-1}) of (a) *Scyliorhinus canicula,* (b) *Leucoraja naevus,* (c) *Raja clavata* and *L. fullonica,* and (d) *Mustelus* spp. and *Galeorhinus galeus* in the Celtic Sea (Cefas Celtic Sea survey, Q1, PHHT, 1987–2002, data from 50 fixed stations that were fished most years).

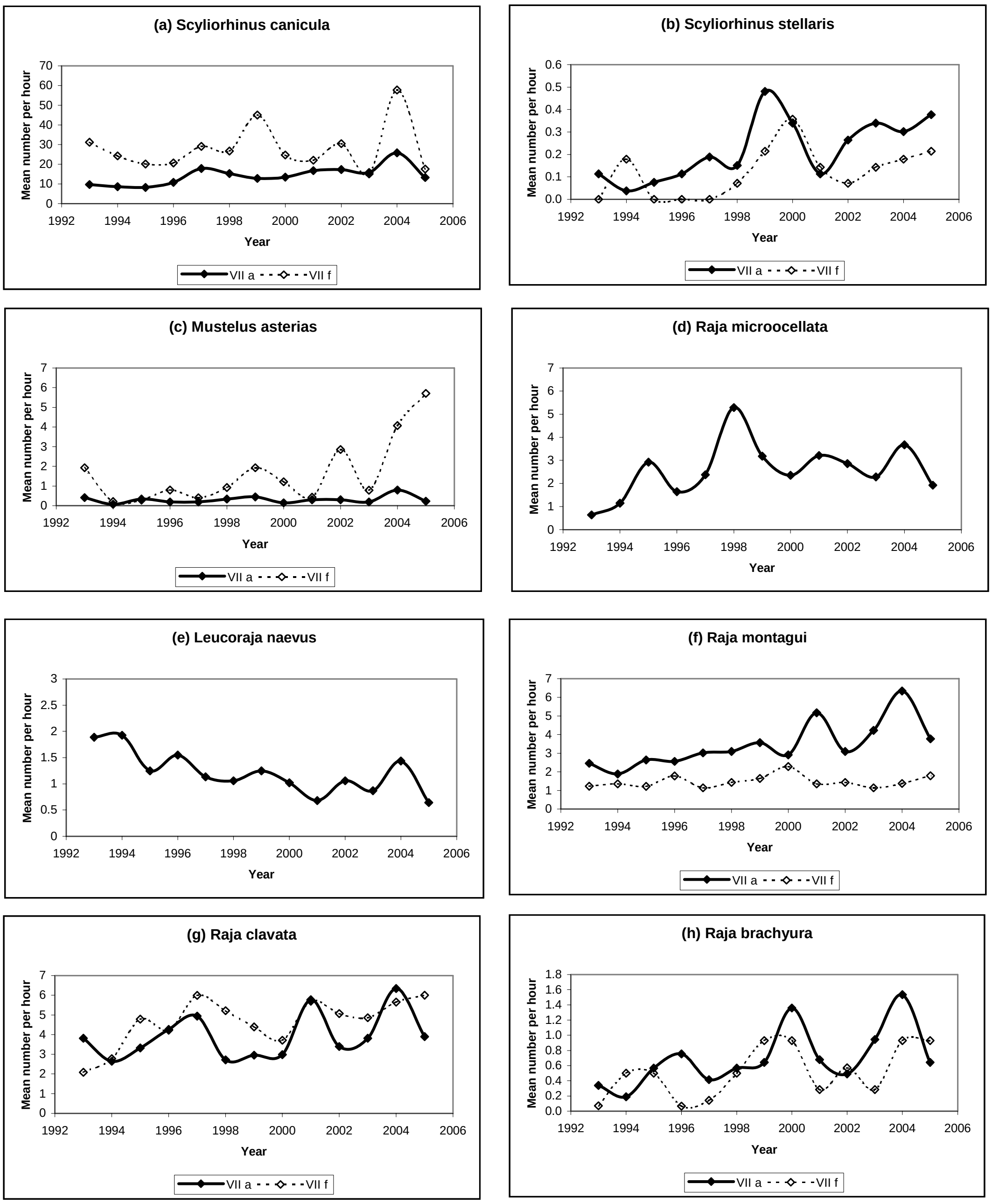


Figure 15.14. Demersal elasmobranchs in the Celtic Seas. Trends in relative abundance (no.h^{-1}) of (a) *Scyliorhinus canicula,* (b) *S. stellaris,* (c) *Mustelus asterias,* (d) *Raja microocellata,* (e) *Leucoraja naevus,* (f) *Raja montagui,*(g) *R. clavata* and (h) *R. brachyura* in the Irish Sea (VIIa) and Bristol Channel (VIIf). (Cefas 4m-beam trawl survey, Q3, 1993–2005, based on those fixed stations fished each year (28 stations in VIIf, 53 stations in VIIa).

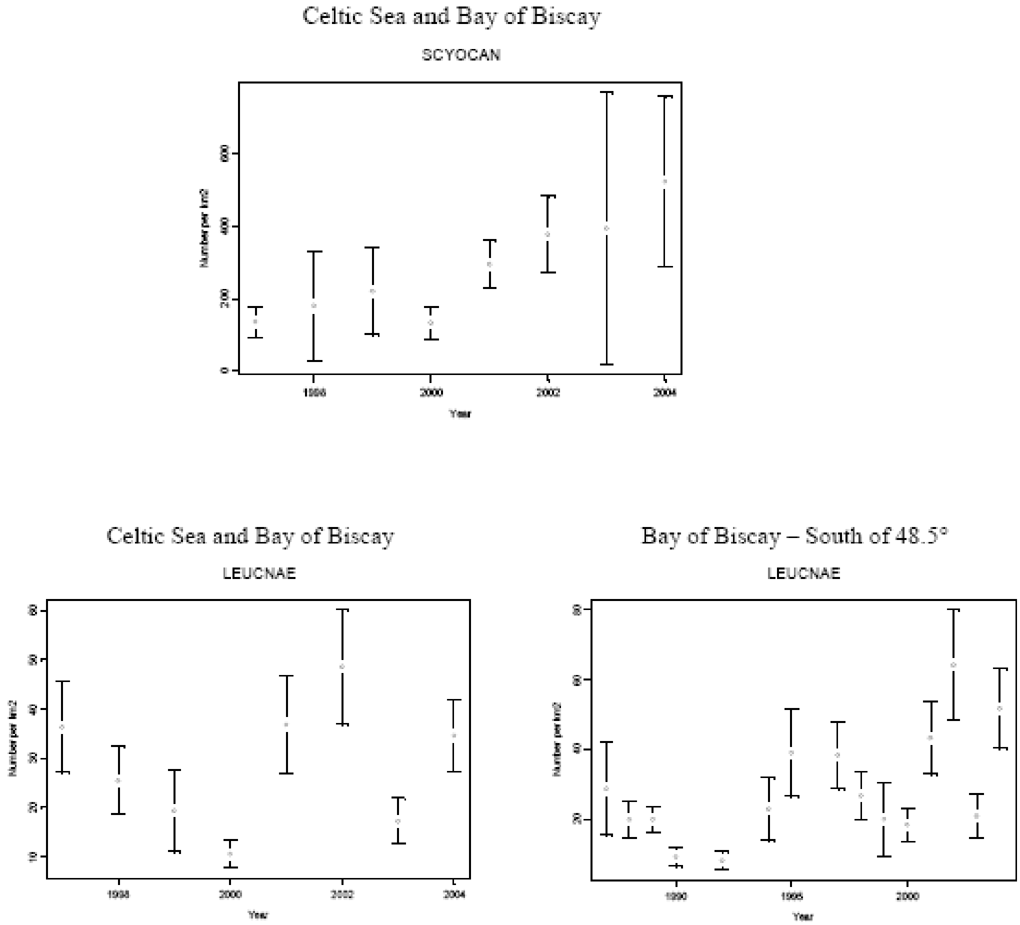


Figure 15.15. Demersal elasmobranchs in the Celtic Seas. Relative abundance of (top) lesser-spotterd dogfish in the Celtic Seas and Bay of Biscay; and (bottom) *Leucoraja naevus* in the Celtic Seas and Bay of Biscay (Source: French EVHOE survey; from Mahé and Poulard, 2005).

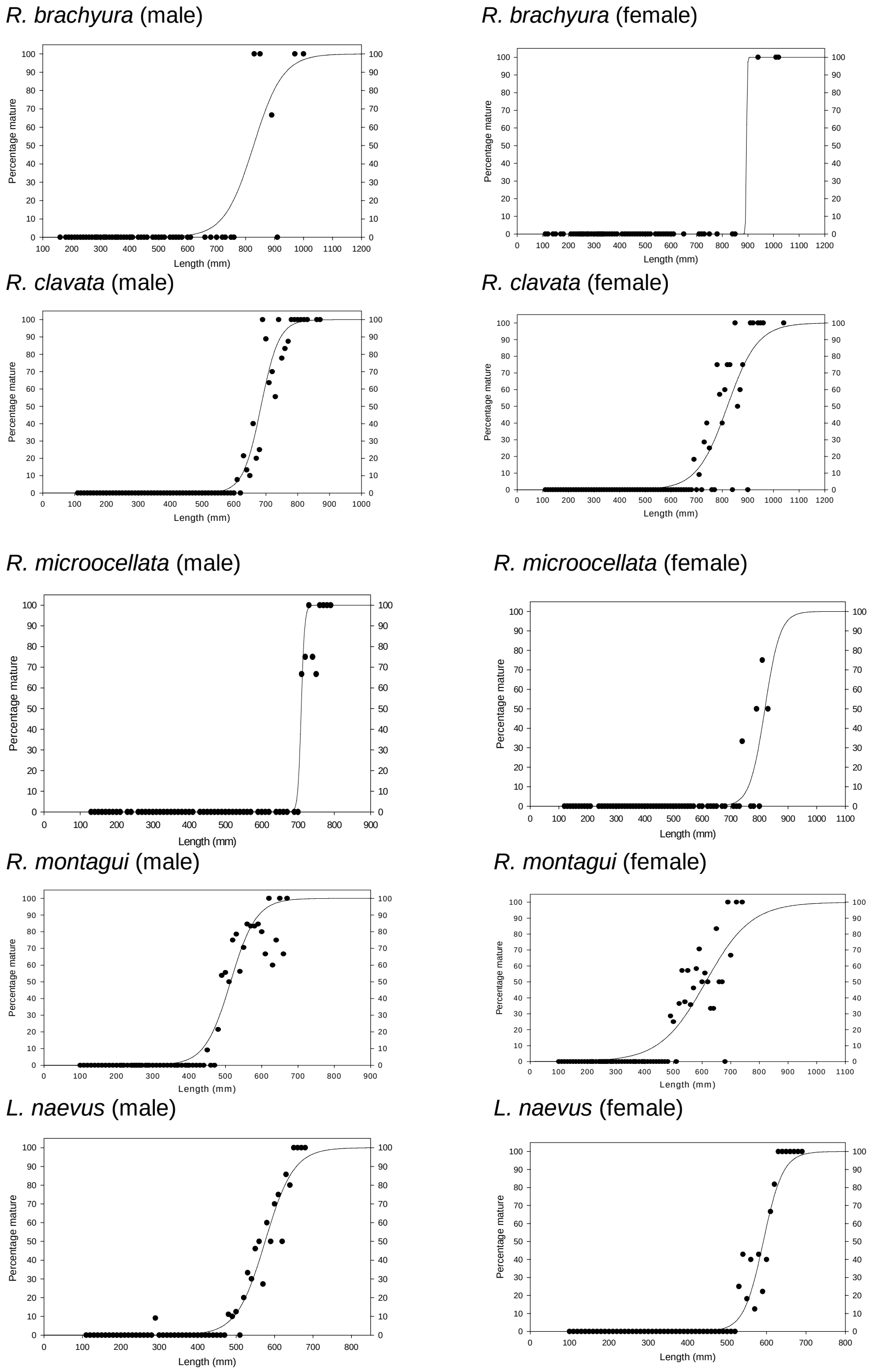


Figure 15.16. Demersal elasmobranchs in the Celtic Seas. Lengths at maturity for *Raja brachyura, R. clavata, R. microocellata, R. montagui* and *Leucoraja naevus*. (Source: CEFAS groundfish and beam trawl surveys, 1995–-2005, ICES Subareas IV and VII combined).

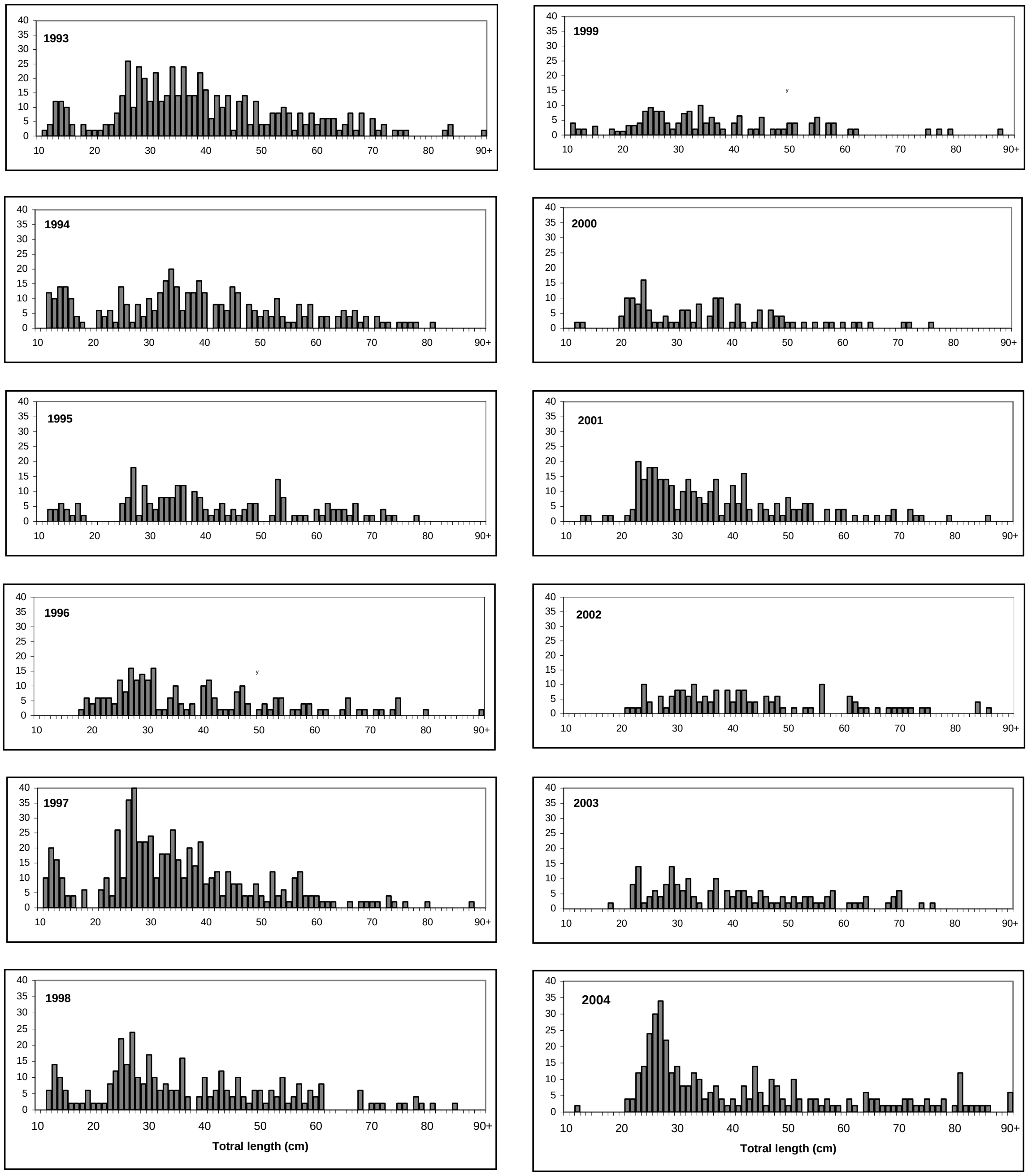


Figure 15.17. Demersal elasmobranchs in the Celtic Seas. Length distribution of *Raja clavata* in the Irish Sea for the years 1993–2004 (Cefas 4m-beam trawl survey, Q3, all stations in Division VIIa included).

16 Demersal elasmobranchs in the Bay of Biscay and Iberian Waters (ICES Subarea VIII and Division IXa)

The Cantabrian Sea (ICES VIIIc Division) is the southern part of the Bay of Biscay (ICES VIIIabd Divisions). Its continental shelf is characterised by its narrowness and by some remarkable bathymetric features (canyons, marginal shelves, etc.) compared to other adjacent areas such as the French coast of Bay of Biscay, which has a by a wide continental shelf with flat and soft bottoms very suitable for trawler fishing activity. In Portugal the artisanal and trawler fleet operates along the Portuguese continental coast (Division IXa), targeting wide number of teleost, crustaceans and deep-water sharks. Several species of rays are also landed mainly in the ports of Matosinhos, Peniche and Portimão.

There are no management stock definitions for any of three main species, either in the Bay of Biscay or Iberian waters. Although the geographical distribution of these species is well known there is not clear evidences to consider the populations of Bay of Biscay or Iberian waters (Subareas VIII and IX) as biological stocks different to the North Atlantic or Mediterranean populations. Trying to describe the distribution of each specie and to identify sef-containing stocks the WGEF have been considered for demersal elasmobranch species in Bay of Biscay and Iberian Waters the following stocks units:

Divisions VIIIab, VIIIc, VIIId and IX.

Two species are considered as the more valuable to be assessed:

<u>Scyliorhinus canicula</u>: *Lesser spotted dogfish populations would best be assessed as local populations, due to the availability of fisheries statistics and biological data, assessing this species within ICES Divisions mentioned*.

<u>Leucoraja naevus</u>: *As biological and fisheries data are most accurate and comprehensive for the Celtic Sea (VIIe-k) and Biscay Bay region (VIII), the same areas should be used in a preliminary assessment of this species.*

The little information available on the distribution and biological parameters of *R. clavata* populations in Bay of Biscay and Iberian waters didn’t allow reaching any conclusion about the stock definition in these areas.

16.1 The fishery

16.1.1 Advice and management

ACFM has never provided advice in this area.

In order to facilitate the reading of this section the structure of text includes a separated fishery description of the three main countries involved in this sea areas: Spain, Mainland Portugal and France.

Spain

The Spanish demersal fishery along the Cantabrian Sea and Bay of Biscay takes many species of rays with a wide variety of gears but most of the landings come from the bycatch of fisheries targeting other demersal species such as hake, monkfish and megrim. Although a wide number of rays and demersal sharks can be found in the landings, historically the most commercial elasmobranchs are two species of rays; *Leucoraja naevus*, *Raja clavata* and the small demersal shark *Scyliorhinus canicula* (lesser-spotted dogfish). The fact that some elasmobranchs have a low commercial value and are taken as a bycatch implies that traditionally these species were landed together in the same category, making it difficult to know the landings by species, as the case is for rays or deep water sharks.

The main gear in the subarea VIIIc is the bottom trawl fleet working on two kinds of fishing grounds: for gadoids and flatfish at depths of 100–300 m over the continental shelf and taking rays *(R. clavata, L. naevus, R. montagui, R. brachyura, R. undulata* and *R. microocellata*) and dogfish . In 1994, a total of 7089 t of elasmobranchs are caught by trawl fleet in Cantabrian Sea, of which 87% was discarded (Perez *et al.*, 1996).

In Spain, lesser-spotted dogfish is, after the Rajidae, the most important elasmobranch species in the bycatch of the trawl fishery in the VIII Subarea. Most of these landings, (from 233 to 405 t per year in the period 1996–2004), come from the VIIIabd Divisions fished by the Basque otter trawler fleet (“baka” type). In the Divisions VIIIabd the annual landings into Basque Country ports amounting on average 382 t of rays in the period from 1996 to 2004 (only 12 t in VIIIc in the same period) but the total rays landings of basque fleet are decreasing from year to year, from 631 t landed in 1998 to 264 t in 2004. As for the lesser spotted dogfish fishery, the otter trawler fleet (“baka” type) targeting hake, monkfish and megrim lands most of the rays (between the 81% and 96% of total rays in the period 1996–2004). The most abundant species are *L. naevus* and *R. clavata* representing respectively the 77% and 17% in the catch composition in the period 2000–2004. Small quantities of other species of rays, in order of decreasing abundance: *L. fullonica, R. montagui, D. batis,* and *D. oxyrinchu* are also often landed.

On the contrary *S. canicula* is a species usually discarded in the Spanish fishery in the Cantabrian Sea (VIIIc) and only 10–25% is actually landed (ICES, 2002). As with rays the highest landings are those from bottom trawls (75%) followed by longline (21%) and gillnet (3%); occasionally there have been landings from purse seine or traps (Fernández *et al.,* 2002).

Mainland Portugal

In mainland Portugal (IXa), lesser-spotted dogfish is mainly caught by coastal trawlers and by the artisanal fishing fleet. Two species, lesser-spotted dogfish *Scyliorhinus canicula* and bull huss *S. stellaris* are landed in the major ports of Division IXa under the generic name of *Scyliorhinus* spp. Although it is believed that *S. canicula* is the dominant species in the landings, the percentage of mixture is not known.

In Portugal mainland rays and skates are mainly captured by the artisanal polyvalent fleet that primarily uses trammel net as fishing gear. The artesanal fleet, that comprises different types of fishing gear such as longline and gillnet, accounts for the highest landing records (75% of the total annual landings).The mixed nature of the fisheries catching rays and skates causes serious problems on the estimation of important fishery parameters.

As the specimens are not discriminated at species level, a pilot sampling programme was carried out during 2001 in the two major ports with landings of *Rajidae* (Matosinhos and Peniche) to get a first estimate of species’ diversity landed in Portugal mainland (Machado *et al.*, 2004). Then in 2003 and 2004, a minimum sampling programme was implemented (according to the EU council regulation 1543/2000) in the two above-mentioned ports and also at Portimão, in the south coast of Portugal. This programme allowed the estimation of the species composition, the number of individuals by length class and sex and individual total weight in the landings. During 2004, the sampling effort comprised a total of 71 samples in Matosinhos, 309 in Peniche and 70 in Portimão. In both years of the minimum sampling programme, the same eight ray species were identified: *Rostroraja alba*, *Raja brachyura*, *Raja microocellata*, *Raja clavata*, *Raja miraletus*, *Raja montagui*, *Raja undulata* and *Leucoraja naevus*. *R. brachyura* and *R. clavata* were the most frequent species while *R. miraletus* was the most infrequent species sampled.

Excluding *Leucoraja naev*us (more than 99% of the specimens are being correctly identified), there are still some problems on species discrimination. In the last three years other categories begin to appear in the official statistics, *Raja brachyura, R. clavata* and *R. montagui*. The precision of *L. naevus* discrimination at Portuguese landings might be related to the small size and soft consistency of the flesh of the species that determines a reduction of its commercial value. Landings of *L. naevus* represent 1 to 8 % of the total annual catch since 2003. Between 1996 and 2002 landings of this species oscillate around 20 tonnes a year. Since 2002 landings tend to increase. However this increase seems only to reflect the effort made at the landing ports to discriminate this species (Pereira, 2006, WD).

France

No new information is available for the WGEF 2006

16.1.2 Landings data

The ray landings by for the period 1996–2005 are given in the Tables 16.1. Historically the main countries reported international landings from 1973 in Subarea VIII are France and Spain and Portugal.

In the Table 16.1e a summary of combined landings for both areas is shown. On average 4020 t of rays by year have been landed in Biscay Gulf and Iberian waters since 1996, with a maximum of 5172 t registered in 1997. French and Spainish (Basque Country) ray landings come mainly from Divisions VIIIab while Spanish landings are more important in Division VIIIc. The annual landings of rays and skates.of Portugal in Subarea IXa were quite stable, around 1500 tonnes between 1996 and 2005. Some other countries such as Belgium, Netherlands and UK, have minor ray landings in these areas.

The landing trend from 1973 shows no clear pattern, although is evident a peak of landings in the first years (1973–1974) and from 1981 to 1991. Since 1998 continous peaks and decreases can be observed but nerver below of 3000 t/year (Figure 16.1).

The lesser-spotted dogfish landings by Division reported to the WG are also shown in the Tables 16.2. As in the case of ray landings French and Spainish (Basque Country) lesser-spotted dogfish landings come mainly from Divisions VIIIab and Spanish landings from Division VIIIc. All the Portuguese landings between 600 and 700 t/year belongs to Division IXa, but an important reduction of Portuguese landings can be observed in 2005.

The historical landings show a quite stable trend since 1996. The slight decrease observed since 2003 could be due to the reduction of Spanish landings in 2003 and 2004 and Portuguese in 2005 respectively, and also due to not reported Spanish landings in 2005. (Figure 16.2).

The information about the historical landing series of other elasmobranch species such as *Mustelus mustelus* and *Mustelus asterias* (smooth hounds), and *Squatina squatina* (angel shark) are poor (Tables 16.3 and 16.4). Of these species, only smooth hounds are landed in significant quantities in subarea VIII, mainly by the French and Spanish fleets from 2000 to 2005 (about 400 t per year both countries combined). There has been a noticable increase of Mustelus spp. French landings in Division VIII sincethe middle nineties.

Angel sharks landings in Subarea VIII have been always very low, and only 4 t have been recorded from 1990 to 2003. In subarea IX 66 t of this species were reported in 2002 by the Spanish fleet, and notdata are available from 2002 onwards (Table 16.4).

Catch landing tables of *Gaeorhinus galeus* (tope shark) can be found in Section 19 - Tope in the NE Atlantic.

Species-specific landings for Subarea VIII and Division IXa have been provided by some countries. According with this table the most important species landed in last 5 years by decreasing order are *L. naevus, R. clavata, R. brachyura, R. montagui, R. undulata,* and *L. circularis* (Table 16.5).

16.2 Biological information

16.2.1 Quality of catch and biological data

Landings were collated from data provided by working group members. Landings estimates for 2005 were provided by Belgium, France, Netherlands, Portugal, Spain (Basque Country), and UK. The landings tables provided are different to those supplied in previous years. Area VIII has been split into VIIIab, VIIId and VIIIc as it is considered that they are different metiers operanting in this Division. Divison IXa remains as in previous years.

Despite last year's advances in the quality samplings, there are still some difficults to get reliable information about especies composition of ray's landings in Divisions IXa and VIII. Missreporting data is not considered a problem in any Division.

16.2.2 Length frequencies

During the French EVHOE surveys covering the Bay of Biscay from 1987 to 2004 length composition and mean length of 26 species of elasmobranchs were recorded (Mahé and Poulard, 2005). Mean length showed a decreasing trend for *Scylorhinus canicula*, *Leucoraja naevus* and *Raja clavata*. The length compositions of *S. canicula* show that the recent increase in abundance is related to an increase in smaller individuals (20–30 cm), and the mean length reflects an increase of smaller individuals rather than a decrease in larger ones. For *L. naevus* the length compositions catches show that the increase in abundance is related to an increase in larger individuals (40–60 cm). Mean length for this especies and for *R. clavata* decreased in Bay of Biscay from 1987 to 2004. The length distribution of *Galeus melastomus* and *Mustelus asterias* variates from year to year and mean length of both species not shows a particular pattern in the same period (Figure 16.3).

16.2.3 Tagging data and biometric relationships

The tagging program carried out since 1993 by the IEO in the Cantabrian Sea is still active. A total of 12159 lesser spotted dogfish have been tagged with T-bar anchor tags and 3% of recaptures received to 2006. (Rodríguez-Cabello *et al.*, 2001, Rodríguez-Cabello and Sanchez, 2005).

16.2.4 Surveys

IPIMAR has been conducting bottom-trawl research surveys since the beginning of the 80's aiming to characterize the demersal fauna from the continental shelf to the fringe of the slope in terms of species composition, distribution and abundance and also to collect biological data that can be used to assess the ecological dynamics of the different species. Information of skates and rays species was compiled in this period. In the first years of the time series, large quantities of *Raja* spp. were recorded. The most important species in the total annual catches was *Raja clavata*, which showed, in almost all the years of the period the highest annual relative proportion both in terms of weight and of number. Other important ray species in landings are *Raja brachyura*, *Raja miraletus* and *Leucoraja naevu*s (Machado and Figueiredo, 2006).

The French EVHOE surveys covering the Bay of Biscay have been collecting data of 26 species of elasmobranchs from 1987 to 2004. An increasing trend in abundance where identified for *Scylorhinus canicula, Galeus melastomus, Mustelus asterias* and *Leucoraja naevus*. However *Squalus acanthias* shows a negative trend in abundance (Figure 16.4).

UK (Scotland), UK (England and Wales), Ireland, France and Spain undertake trawl surveys in the Celtic Seas eco-region (that includes Bay of Biscay), as part of the internationally-coordinated Q4 IBTS surveys for southern and western waters.

16.2.5 Landings per unit of effort

An update of last year LPUEs (Landings Per Unit of Effort) for the main species landed by the Basque Country's Baka otter trawler and Vey High Vertical Open Pair (VHVO P) trawler fleets fishing in subareas VI, VII and VIII are carry out for this WG by G, Diez *et al.* (2006).

Effort for each fleet was obtained from the information provided yearly by the log books filled out by the skippers of most of the ships landing in Ondarroa and Pasaia., Effective fishing effort for each fleet was calculated as in following formula:

Effort = fishing days = trips * (mean days/trip)

The LPUE data are referred to the main elasmobranh species landed by the fleets described above: lesser spotted dogfish, spurdog and Rajidae spp. (mainly *Leucoraja naevus* and *Raja clavata*).

The most important LPUE of *S. canicula* come from a single Baka trawler operating in Division VIIIc since 2002 (Table 16.5c). The highest effort is recorded in 2003 (114 days) and LPUE reached the peak in 2003 (604 kg/day). Historically the most important landings of this specie come from Baka trawler fleet operating in Division VIIIabd (Table 16.5a). On average since 1994 this fleet lands 244 t/year, and in 2002 this fleet registered the highest LPUE (157 kg/day). The trend of LPUE of this fleet shows a constant increase until 2002 and a slight decrease in 2003 and 2004. However, in 2005 the LPUE reach one of the highest value of the series. The trend observed in Baka trawler of Sub-areaVII remains quite stable during the period, even though a slight decrease is observed in last three years (Figure 16.5).

Although the effort of VHVO P fleet is important, the landings and LPUE are much lower than Baka trawler operating in the same areas. No clear trends of LPUE can be observed in these fleets.

The highest LPUE values for *Rajidae* spp.come from Baka trawler in Division VIIIabd. A peak of 199 k/day is reached in 1998 (Table 16.6a). LPUE values of baka trawler in Sub-area VII from 1995 to 1997 were very similar to the baka trawlers operating in VIIIabd in the same years (Figure 16.6). The LPUEs in Baka trawler in sub-areas VI show a slight increase from 1994 to 2001 (Table 16.6a Figure 16.6)). In Division VIIIc the effort remains quite stable in the short data series and the peak is reached in 2004 with 89 kg/day (Table 16.6c).

The VHVO P landings of *Rajidae* are scarce in all areas. The effort in sub-area VII decrease since 2001 but the LPUE is increased since the same year. In sub-area VI no landings are reported 2002 onwards (Table 16.7b and 16.7c).

By far, the highest spurdog' LPUE of all fleets are reached in 2002 and 2003 by the Baka trawler in VIIIc (Table 16.8c). The trend of LPUE in this Division shows and spectacular decrease since the first year, and even the series of effort remains stable few landings were reported in 2005. Baka Trawler LPUEs in the rest of areas are much lower than in VIIIc except for Subarea VI. In 2004 in this Subarea 49 kg/day were reached and this value coincides with one of the lowest effort recorded in the series (Table 16.8c and Figure 16.7)

Spurdog landings and LPUEs of VHVO P fleet are much lower that Baka trawler fleet in all areas. No landings were reported for the fleet landing in Pasaia port in sub-areas VI and VII and Division VIIIc. No clear trends can be observed from Ondarroa fleet in Subarea VIIIabd (Table 16.8a).

A sampling program was implemented at the most important landing port located at the centre of Portugal (Peniche), aiming to characterize the fishing strategy and exploitation pattern, and through that get more reasonable estimates of effort (Pereira, 2006, WD). Under this program a total of 33 enquiries from each selected fishing trip were performed, during the first 5 months of 2006. The collected information from fishing trips were further combined according to fishing(s) gear(s). The trammel net used to target rays and skates showed to be the most effective fishing gear capturing these species, reaching catches of about 191 kg per trip. Fishing vessels catching rays and skates have total length smaller than 25 m and excluding some very small the median is around 20 m. The major differences on the fishing vessel characteristics are related to power, that can vary from 36 up to 600 HP. In addition vessels with higher HP are those that used more than one fishing gear and that stayed at sea longer times. The vessels with higher catches of rays and skates belong to the polyvalent fleet. The length of vessels in this group may vary from less than 10 m long that usually operate near the shore, to those with much longer sizes that are much better equipped and that may stay at sea for more than 3 days (Table 16.9). The fishing grounds of these vessels are located at deeper grounds and at greater distances from shore. Despite the small the number of sampled fishing trips, results obtained up to now clearly suggests that the sampling program will allow getting estimates of nominal effort and by consequence indices of abundance with the spatial and temporal detail essential in these mixed fisheries

16.2.6 Discards

A study carried out since 2003 contributes with new information about elasmobranch discard data from Basque Country baka trawler and VHVO P fleets (Diez *et al.*, 2006). The discards were estimated by observers on board taking a sub-sample of catches of each haul. The species in the sub-sample were identified and weighted and the partial weight of each species was raised to the total catch of the haul and trip. For each fleet the average of biomass discarded by trip was raised to the total annual trips.

The most important specie discarded for Baka trawler fleet is the lesser-spotted dogfish, especially in Division VIIIabd. Maximum discard estimated of 654.4 t was reached in 2004 in this area. In 2005 discard of this species in this division decreased strongly. In Subarea VII the total estimated annual discard is increased until 2004. In 2005 the estimated discard in sub-area VII was similar to the discards in Division VIIIabd (Table 16.10a). Balckmouth catshark was only discarded in significant amounts in 2004. In this year 226,8 t of this species were discarded in Division VIIIabd.

The small individuals of cuckoo ray and thornback ray are usually discarded by the Baka trawler fleet especially in Division VIIIabd. The maximum estimated discard of cuckoo ray of 58,4 t was reached in 2004. A variable amount of “unspecific rays” are also discarded in every area as it can be observed in (Table 16.9a).

In relation to total landings, lesser-spotted dogfish is a species more discarded than retained, mainly in Subareas VI and VII. Although the highest discards take place in Division VIIIabd (smallest individuals are usually discarded due to the little commercial value of this specie), largest individuals are retained and landed in great amounts. On the contrary, several species of Rajidae, mainly cuckoo ray and thornback ray, are usually more retained than discarded in the same areas (Table 16.10b). The samplings data available, (not included in the Table 16.10a), indicates that spurdog is never discarded by this fleet.

The elasmobranch catches and landings of VHVO P operating in Division VIIIc are historically scarce. For instance only in 2005 samplers on board were able to weight some individuals of lesser spotted dogfish. In Division VIIIabd a maximum of 6,9 t were discarded in 2005. The information available indicates that cuckoo ray was discarded only in Division VIIIabd in 2003. No discards or catches were recorded in 2004 and 2005 respectively (Table 16.11a). In relation to total annual landings, lesser spotted dogfish in Division VIIIabd was more retained than discarded in 2003 and 2004 (Table 16.11b).

16.2.7 Growth parameters

No new information is available for the WGEF 2006.

16.3 Stock assessment

16.3.1 Previous assessments

Two previous assessments for *L. naevus* in subareas VII and VIII and for *S. canicula* in VIIIc were attempted in the DELASS project (Heessen, 2003) and in the meeting of SGEF 2002 (ICES, 2002) respectively. In the case of *S. canicula* tagging data, landings and effort for the period 1996–2001, CPUE series since 1991, length distributions and trawl survey abundance indices were available for the analysis. Dynamic surplus production, Separable VPA and Survey-only models were chosen for this assessment.

A summary of data available for the assessment is shown in the Table 16.12.

Although these models were considered as useful tools for the assessment, neither of the results obtained by the models was considered satisfactory for this species due to the shortage of biological information and difficult to collect long time series of landings and effort. More detailed information can be extracted from de final report of the SG (ICES, 2002).

No new assessment was conducted during this WG.

16.4 Management considerations

Survey index and commercial CPUEs for *S. canicula* in Divison VIIIc indicate that the population of this species has increased from 1996 to 2001.

New information of trawler fleet in Division VIIIabd shows that the LPUEs have been also increased since 1996 and keep high values in VIIIc in last 4 years (on average 529 kg/day). In accordance with this data, lesser spotted dogfish catch rates (LPUEs) higher than 1000 kg/hour can be observed in some statistical rectangles of Bay of Biscay in 2004. All this information suggests that in last years the population of *S. canicula* in subarea VIII may be increasing or at least is in a stable condition.

The situation of ray’s abundance in these areas is less clear, but information available indicates a moderate decrease of LPUEs in Bay of Biscay (Division VIIIabd) since the maximum reached in 1998. The other hand French surveys carried out in the same area indicate an increase in the abundance of *L.naevus* and no clear trend in the case of *R. clavata*. Results obtained in the same survey indicate an increase of abundance of smoothhounds (*M. asterias*) and blackmouth catshark (*G. melastomus*) since 1987.

However, in order to clarify these considerations, better information on species composition of landings (especially for rays) in subarea VIII are necessary.

Technical interactions of fisheries in the eco-region are shown in Table 16.13a and 16.13b.

16.5 References

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Table 16.1. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Nominal landings (tonnes) of skates and rays by Division and country (Source: ICES)

Table 16.1a	**Total landings (t) of *Rajidae* in area VIIIab**									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	12	6	11	11	6	11	14	11	8	12
France	1771	2058	1879	1479	1173	991	989	934	1006	1677
Netherlands	.	.	.	.	.	1	.	.	.	.
Spain	872	906	724	677	146	76	323	166	151	n.a.
Spain (Basque Country)	*	*	*	*	*	*	*	252	242	278
UK (E&W_NI_+)	22	76	13	7	2	3	4	4	·	8
UK (Scotland)	.	.	.	.	.	.	.	.	.	1
Total of submitted data	2677	3046	2627	2174	1327	1081	1330	1367	1407	1976

* Included in Spainish Landings

Table 16.1b	**Total landings (t) of *Rajidae* in area VIIId**									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	.	.
France	46	50	60	52	43	66	64	73	63	97
Spain	89	92	74	2	1	1	9	5	40	n.a.
Spain (Basque Country)	*	*	*	*	*	*	*	0	1	0
UK (E&W_NI_+)	.	.	.	.	.	.	.	.	.	.
UK (Scotland)	.	.	.	.	.	.	.	.	.	.
Total of submitted data	135	143	134	54	44	67	73	78	104	97

* Included in Spainish Landings

Table 16.1c	**Total landings (t) of *Rajidae* in area VIIIc**									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	.	.
France	0	0	1	1	1	0	0	0	0	0
Netherlands	.	.	.	.	.	.	.	.	.	.
Portugal	11	7	10	4	4	5	·	·	264	0
Spain	0	321	345	226	734	1059	338	102	38	n.a.
Spain (Basque Country)	*	*	*	*	*	*	*	21	21	20
UK (E&W_NI_+)	.	.	.	.	.	.	.	.	.	.
UK (Scotland)	.	.	.	.	.	.	.	.	.	.
Total of submitted data	11	328	356	231	739	1064	338	123	323	21

* Included in Spainish Landings

Table 16.d	**Total landings (t) of *Rajidae* in area IXa**									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	n.a.	n.a.	n.a.	n.a.	0	0	0	0	0	0
Portugal	1534	1512	1485	1420	1528	1591	1521	1598	1614	1303
Spain	58	143	197	276	226	421	301	n.a.	n.a.	n.a.
Total of submitted data	1592	1655	1682	1696	1754	2012	1822	1598	1614	1303

Table 16.1e	**Combined Landings (t) of *Rajidae* in Biscay and Iberian Waters**									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	12	6	11	11	6	11	14	11	8	12
France	1816	2109	1940	1532	1217	1057	1054	1006	1069	1774
Netherlands	.	.	.	.	.	1	.	.	.	.
Portugal	1545	1519	1495	1424	1532	1596	1521	1598	1878	1303
Spain	1019	1462	1340	1181	1106	1556	971	273	229	n.a.
Spain (Basque Country)	*	*	*	*	*	*	*	273	264	298
UK (E&W_NI_+)	22	76	13	7	2	3	4	4	0	8
UK (Scotland)	.	.	.	.	.	.	.	.	.	1
Total of submitted data	4415	5172	4800	4155	3863	4224	3563	3165	3448	3396

Table 16.2. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Nominal landings (tonnes) of Lesser-spotted dogfish by Division and country (Source: ICES)

Table 16.2a Lesser Spotted Dogfish (*Scyliorhinus canicula*) landings (t) in Area VIIIab

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	9	10
France	568	645	753	399	403	390	330	470	638	651
Spain	0	0	63	0	17	0	369	1	4	n.a.
Spain (Basque Country)	223	270	336	254	247	277	353	318	254	335
UK (E&W)								2		3
Total	791	915	1152	653	667	667	1052	791	904	1000

Table 16.2b Lesser Spotted Dogfish (*Scyliorhinus canicula*) landings (t) in Area VIIId

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	5	4	4	5	5	2	2	4	4	4
Spain	0	0	97	0	78	0	0	0	0	n.a.
Spain (Basque Country)	0	0	0	0	0	0	1	0	1	0
Total	0	4	101	5	84	2	2	4	4	4

Table 16.2c Lesser Spotted Dogfish (*Scyliorhinus canicula*) landings (t) in Area VIIIc

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	0	0	0	1	1	1	1	1	1	3
Spain	417	458	375,6	448	385,78	513	150,97	130	122	n.a.
Spain (Basque Country)	11	8	8	9	5	10	52	65	63	66
Total	417,005	458	375,6	448,6	386,42	513,7	151,72	130,7	122,7	3

Table 16.2d Lesser Spotted Dogfish (*Scyliorhinus canicula*) landings (t) in Area Ixa

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Spain	3	6	19	34	71	39	39	n.a.	n.a.	n.a.
Portugal	667	691	689	882	757	734	673	658	677	385
Total	670	697	708	916	828	773	712	658	677	385

Table 16.2e Combined Landings (t) of Lesser Spotted Dogfish (Scyliorhinus canicula) in Biscay and Iberian Waters

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	9	10
France	573	648	756	405	409	393	333	475	643	658
Spain	420	464	555	482	552	552	559	131	126	n.a
Spain (Basque Country)	234	278	344	263	253	287	405	384	318	401
UK (E&W)	.	.	.	.	.	.	.	2	.	3
Portugal	667	691	689	882	757	734	673	658	677	385
Total	1894	2081	2345	2033	1970	1966	1970	1650	1772	1457

Table 16.3. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Nominal landings (tonnes) of Smooth hounds by Subarea and country (Source: ICES)

Table 16.3a - Smooth hounds nei (*Mustelus* spp.) - ICES Area VIII

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	.	.	.	.	.	.	.	.	.	+	0,1
France	54	98	113	158	+	231	272	351	145	370	359
Portugal	.	.	.	.	.	+	.	.	.	1	.
Spain (Basque Country)	27	53	56	57	46	61	58	85	58	56	54
Total	81	217	230	279	96	359	408	546	296	427	413

Table 16.3b - Smooth hound (*Mustelus mustelus*) - ICES Area IX

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Portugal	5	2	4	4	2	2	2	1	1	10
Total	5	2	4	4	2	2	2	1	1	1

Table 16.4. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Nominal landings (tonnes) of Angel shark by Subarea and country (Source: ICES)

Table 16.4a - Angel shark (*Squatina squatina*) - ICES Area VIII

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
France	.	.	.	+	1	+	+	+	+	+
UK (E&W_NI_+)	.	.	.	.	.	.	.	.	.	.
Total	.	.	.	+	1	+	+	+	+	+

Table 16.4b - Angel shark (*Squatina squatina*) - ICES Area IX

	2002
Spain	66
Total	66

Table 16.5. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Species-specific landings (rays and skates in t) by country in Subareas VIII, and Division XIa, all gears combined. These data are included in theTables 16.1a to 16.1c

Country	year	area	*T. marmorata*	*D. batis*	*D. oxyrinchus*	*L. circularis*	*L. fullonica*	*L. naevus*	*R. clavata*	*R. microocellata*	*R. montagui*	*R. undulata*	*D. pastinaca*	*M. aquila*	*R. asterias*	*R. brachyura*	*Raja miraletus*	*Rostroraja alba*	*miscellaneous*	*Raja spp.*
France	1999	VIII	24	1	0	17	0	319	75	0	46	0	0	2					0	
France	2000	VIII	9	5	1	55	3	749	68	0	53	1	1	0					1	
France	2001	VIII	3	4	0	47	7	637	37	1	62	2	1	0					1	
France	2002	VIII	5	13	16	51	5	614	39	1	47	0	0	0					0	
France	2003	VIII		4	1	44	4	654	49	2	58	0			0					
France	2004	VIII		4	0	46	4	749	97	0	67	0			0					
France	2005	VIII		4	1	61	5	946	104	0	54	0			0					
Belgium	2002	VIIIa,b						15	6		0									
Spain (Basque Country)	2000	VIII		6			4	250	39		2	0								
Spain (Basque Country)	2001	VIII		8	0		26	230	85		5				0					
Spain (Basque Country)	2002	VIII						243	54		18									
Spain (Basque Country)	2003	VIII					12	230	38		4	0								
Spain (Basque Country)*	2004	VIII		3	0	0	9	208	47	0	6	0	0	0	0					
Spain (Basque Country)*	2005	VIII		3	0	0	11	235	53	0	7	0	0	0	0					
Portugal	2002	IXa						13	2											1505
Portugal	2003	IXa						18	351	78	56	126				578	2			
Portugal	2004	IXa						113	516	95	82	108				532	17	5		
Portugal**	2005	IXa						43	480	88	76	100				495	16	5		

* *Provisonal data: 2004 and 2005 landings based in the average species proportion of 2000-2003

* *Provisonal data (except for *L. naevus):* 2005 landings based in the species proportion of 2004

Table 16.6. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Lesser spotted dogfish (t), effective effort (fishing days = trips*(days/trip)) and LPUE (landings in kg/day) of different fleets landing in the Basque Country (Spain) ports in the period 1994–2005.

(a)	BAKA trawl-ON-VIIIa,b,d			BAKA trawl-ON-VII			BAKA trawl-ON-VI		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994	112	5619	20	31	980	31	0	635	0
1995	202	4474	45	40	1214	33	1	624	1
1996	206	4378	47	40	1170	34	0	695	0
1997	242	4286	56	10	540	18	0	710	0
1998	303	3002	101	45	1196	37	0	750	0
1999	231	2337	99	61	1384	44	0	855	0
2000	228	2227	102	63	1850	34	1	763	1
2001	217	2118	103	39	1451	27	2	1123	2
2002	331	2107	157	24	949	26	1	1234	1
2003	303	2296	132	17	1022	17	0	718	0
2004	235	2159	109	17	910	19	0	411	0
2005	320	2263	141	7	544	12	0	337	0
(b)	**VHVO P. trawl-ON-VIIIa,b,d**			**VHVO P. trawl-PA-VIIIa,b,d**			**VHVO P. trawl-PA-VII**		
Year	**Landings (t)**	**Effort (days)**	**LPUE (kg/days)**	**Landings (t)**	**Effort (days)**	**LPUE (kg/days)**	**Landings (t)**	**Effort (days)**	**LPUE (kg/days)**
1994	0	362	0	0	423	0	0		
1995	0	959	0	0	746	0	0		
1996	0	1332	0	1	1367	1	0	57	1
1997	0	1290	0	1	1752	1	0	3	0
1998	1	1482	0	1	1462	1	0	340	0
1999	2	1787	1	1	1180	1	0	476	0
2000	0	1214	0	3	1233	2	1	271	5
2001	4	1153	4	2	587	3	0	253	1
2002	0	1281	0	2	720	3	0	59	0
2003	1	1436	1	4	754	6	0	9	0
2004	6	1288	4	4	733	6	0	35	7
2005	3	1107	2	0	252	0	0	0	0

(c)	BAKA trawl-ON-VIIIc			VHVO P. trawl-ON-VIIIc		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
2002	43	99	430	3	321	8
2003	58	96	604	3	330	10
2004	56	114	487	4	368	11
2005	63	106	595	2	328	5

Table 16.7. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. *Rajidae* spp. (t), effective effort (fishing days = trips*(days/trip)) and LPUE (landings in kg/day) of different fleets landing in the Basque Country (Spain) ports in the period 1994–2005.

(a)	BAKA trawl-ON-VIIIa,b,d			BAKA trawl-ON-VII			BAKA trawl-ON-VI		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994	179	5619	32	68	980	70	1	635	1
1995	505	4474	113	142	1214	117	1	624	2
1996	471	4378	108	175	1170	149	1	695	2
1997	549	4286	128	65	540	120	3	710	5
1998	598	3002	199	107	1196	89	5	750	6
1999	362	2337	155	87	1384	63	9	855	10
2000	272	2227	122	84	1850	45	8	763	11
2001	292	2118	138	40	1451	28	35	1123	31
2002	265	2107	126	24	949	25	17	1234	14
2003	219	2296	95	18	1022	17	11	718	15
2004	177	2159	82	22	910	24	1	411	2
2005	233	2263	103	17	544	31	1	337	3

(b)	VHVO P. trawl-ON-VIIIa,b,d			VHVO P. trawl-PA-VIIIa,b,d			VHVO P. trawl-PA-VII		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994	0	362	0	0	423	0	0		
1995	1	959	1	0	746	0	0		
1996	4	1332	3	1	1367	1	0	57	1
1997	2	1290	2	3	1752	2	0	3	0
1998	3	1482	2	5	1462	4	0	340	1
1999	5	1787	3	2	1180	2	1	476	2
2000	3	1214	3	3	1233	3	1	271	4
2001	6	1153	5	8	587	13	1	253	5
2002	4	1281	3	10	720	14	0	59	2
2003	3	1436	2	8	754	11	0	9	1
2004	4	1288	3	6	733	8	0	35	8
2005	2	1107	2	0	252	1	0	0	0

(c) Year	BAKA trawl-ON-VIIIc			VHVO P. trawl-ON-VIIIc		
	Landings (t)	**Effort (days)**	**LPUE (kg/days)**	**Landings (t)**	**Effort (days)**	**LPUE (kg/days)**
2002	6	99	58	0,0	321	2
2003	7	96	73	0,3	330	4
2004	10	114	89	0,0	368	2
2005	4	106	37	0,1	328	2

Table 16.8. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Spurdog spp. (t), effective effort (fishing days = trips*(days/trip)) and LPUE (landings in kg/day) of different fleets landing in the Basque Country (Spain) ports in the period 1994–2005.

(a)	BAKA trawl-ON-VIIIa,b,d			BAKA trawl-ON-VII			BAKA trawl-ON-VI		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994	32	5619	6	1	980	1	3	635	5
1995	23	4474	5	0	1214	0	15	624	24
1996	45	4378	10	3	1170	2	8	695	11
1997	34	4286	8	1	540	2	8	710	12
1998	25	3002	8	0	1196	0	6	750	8
1999	12	2337	5	3	1384	2	14	855	16
2000	38	2227	17	6	1850	3	18	763	24
2001	9	2118	4	6	1451	4	13	1123	12
2002	12	2107	5	1	949	1	3	1234	2
2003	3	2296	1	1	1022	1	4	718	6
2004	1	2159	0	1	910	1	20	411	49
2005	3	2263	2	1	544	2	0	337	1
(b)	VHVO P. trawl-ON-VIIIa,b,d			VHVO P. trawl-PA-VIIIa,b,d			VHVO P. trawl-PA-VII		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1994									
1995	0	959	0	0	746	0	0		
1996	0	1332	0	0	1367	0	0	57	0
1997	0	1290	0	0	1752	0	0	3	0
1998	1	1482	0	0	1462	0	0	340	0
1999	3	1787	2	0	1180	0	0	476	0
2000	1	1214	1	0	1233	0	0	271	0
2001	1	1153	1	0	587	0	0	253	0
2002	1	1281	1	0	720	0	0	59	0
2003	5	1436	4	0	754	0	0	9	0
2004	2	1288	1	0	733	0	0	35	0
2005	2	1107	2	0	252	0	0	0	

(c) Year	BAKA trawl-ON-VIIIc			VHVO P. trawl-ON-VIIIc		
	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
2002	14	99	140	0	321	0
2003	5	96	56	0	330	0
2004	3	114	26	0	368	0
2005	0	106	1	0	328	0

Table 16.9. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Characterization of Portuguese fishing grounds. Fishing gear, mean depth, bottom type, mean total weight of Raja landed by trip and percentage of each species identified.

Fishing Ground	Nº sampled boats	Fishing Gear	Mean Depth (m)	Bottom type	*R. miraletus*	*R. clavata*	*R. microocellata*	*R. brachyura*	*R. montagui*	*L. naevus*	*R. undulata*
16.5.1.	1	Trammel A & B	73	Coarse sand	---	60.42	---	5.23	22.62	4.38	---
B	13	Trammel A & B	50	Coarse sand, rock	3.22	39.16	10.43	609.03	35.99	56.28	29.47
C	3	Trammel A & B [1]	183	Rock	---	14.33	---	29.10	40.30	41.90	---
D	3	Trammel A & B	96	Sand, rock	2.22	63.64	---	27.05	26.48	19.14	---
E	1	Trammel B	140	Sand	2.00	4.50	---	---	11.20	---	---
F	1	Trammel A & B [1]	NA	Sand	0.12	4.72	---	21.60	16.71	10.50	---
G	1	Trammel A	20	Sand	---	20.48	17.10	36.16	3.63	---	7.92

Table 16.10. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters.Elasmobranch discard estimates of Baka Tralwer fleet in Subareas VI and VII and in Division VIIIabd from 2003 to 2005.

(a)

		baka trawler								
		2003			2004			2005		
Specie	ICES Subareas / Divisions	discard average by trip (kg)	(%) trips sampled	total estimated discard (t)	discard average by trip (kg)	(%) trips sampled	total estimated discard (t)	discard average by trip (kg)	(%) trips sampled	total estimated discard (t)
Lesser-spotted dogfish	VI	162	2,6	19,0	134	4,3	9,4	366	3,1	23,4
	VII	1173	1,4	164,2	1779	2,0	263,3	2576	1,1	244,7
	VIIIabd	714	1,2	348,5	1511	0,9	654,4	544	2,4	274,7
Blackmouth catshark	VI	28	2,6	3,3	43	4,3	3,0	6	3,1	0,4
	VIIIabd	0,4	1,2	0,2	524	0,9	226,8	11	2,4	5,5
Etmopterus spinax	VI	16	2,6	1,9	N.C.	4,3	XXX	N.C.	3,1	XXX
Cuckoo ray	VII	118	1,4	16,5	4	2,0	0,6	41	1,1	3,9
	VIIIabd	54	1,2	26,3	135	0,9	58,4	24	2,4	11,9
Thornback ray	VII	N.C.	1,4	XXX	0	2,0	0	126	1,1	12,0
	VIIIabd	4	1,2	1,9	N.C.	0,9	XXX	0	2,4	0,0
Rajidae spp.	VI	N.C.	2,6	XXX	N.C.	4,3	XXX	0	3,1	0
	VII	N.C.	1,4	XXX	0	2,0	0	78	1,1	7,4
	VIIIabd	98	1,2	47,7	13	0,9	5,8	1	2,4	0,7

N.C.: No catches in the sampling

(b)

		VHVO P								
		2003			2004			2005		
Specie	ICES Subareas / Divisions	discard average by trip (kg)	(%) trips sampled	total estimated discard (t)	discard average by trip (kg)	(%) trips sampled	total estimated discard (t)	discard average by trip (kg)	(%) trips sampled	total estimated discard (t)
Lesser spotted dogfish	VIIIabd	8	1,5	3,3	5	1,9	1,8	21	2,1	6,9
	VIIIc	N.C.	XXX	XXX	N.C.	XXX	XXX	24	2,4	7,8
Cuckoo ray	VIIIabd	10	1,5	4,1	0	1,9	0,0	N.C.	XXX	XXX

N.C.: No catches in the sampling

Table 16.11. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters.Total annual landings and estimates discards of LSD, Blackmouth catshark and Rajidae spp. by the Baka trawler and VHVO P fleets.

a)

		baka trawler					
		2003		2004		2005	
Species	ICES Subareas / Divisions	total landings (t)	total estimated discard (t)	total landings (t)	total estimated discard (t)	total landings (t)	total estimated discard (t)
Lesser spotted dogfish	VI	0,2	19,0	0,0	9,4	0,0	23,4
	VII	17,1	164,2	17,4	263,3	6,7	244,7
	VIIIabd	310,0	348,5	243,9	654,4	332,5	274,7
Blackmouth catshark	VI	0,0	3,3	0,0	3,0	0,0	0,4
	VIIIabd	511,1	0,2	0,0	226,8	126,7	5,5
Rajidae spp.	VI	19,2	XXX	14,3	XXX	14,0	0,0
(included Cuckoo ray and	VII	17,9	16,5	22,5	0,6	17,5	23,3
Thornback ray)	VIIIabd	232,0	75,8	212,3	64,2	268,3	12,5

b)

		VHVO P					
		2003		2004		2005	
Species	ICES Subareas / Divisions	total landings (t)	total estimated discard (t)	total landings (t)	total estimated discard (t)	total landings (t)	total estimated discard (t)
Lesser spotted dogfish	VIIIabd	5,1	3,3	10,3	1,8	2,8	6,9

Table 16.12. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Data available and description of the characterisitics of information used in the assessmet of *Leucoraja naevus* in Subareas IV and VIII in the DELASS project (Heessen, 2003)

Data available	Description of information	source
Catch and effort data	kg and value, and effort (hours) by rectangle, fleet, gear and month. Period: 1986 - 1998	French fleet,
Ray Species Composition	By ICES sub-area for the years 1988 - 98.	French landings
Length frequency data	For areas combined. Period:1989 - 97	French landings
Age compositions	Estimated by using NORMSEP software from the Incremental Growth method. Not separated for discards and landings.	Abrahamson 1971, Charuau and Biseau 1989
Survey data	Weight and number by station (depth and latitude) and sex. Period: 1987 - 2000	French EVHOE survey data
Discards data	50% in numbers or between 13 and 35% in weight	Estimates
Discards data length compositions	For 1997 for all areas	French cuckoo ray discards
Biological data	K (year-1), Linf (cm), t0 (year) by sex. Length-weight relationship:W = 2.36 10-6 * L3.233	Du Buit 1977; Charuau and Biseau 1989

Table 16.13a. Demersal elasmobranchs in the Bay of Biscay and Iberian waters. Technical interactions in Biscay waters.

	Anchovy VIII	Anglerfish budegassa VIIb-k, VIIIabd	Anglerfish piscatorius VIIb-k, VIIIabd	Cod VIIe-k	Haddock VIIb-k	Hake Northern	Herring Celtic Sea and Division VIIj	Herring VIa(S) and VIIbc	Horse Mackerel Southern	Horse Mackerel Western	Mackerel North East Atlantic	Megrim VII, VIIIabd	Nephrops Area L: VIIbcjk	Nephrops Area M: VIIfgh+VIIa	Nephrops VIIIa,b	Nephrops VIIIc	Plaice VIIbc	Plaice VIIe	Plaice VIIfg	Plaice VIIhjk	Sardine VIIIc, IXa	Sole VIIbc	Sole VIIe	Sole VIIfg	Sole VIIhjk	Sole VIIIab	Sprat VIIde	Whiting VIIe-k	Seabass	Skates and rays	Pelagic and migratory sharks	Demersal sharks
Anchovy VIII	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Anglerfish budegassa VIIb-k, VIIIabd	N	—	H	L	L	M	0	0	0	0	0	M	M	L	M		L	L	L	L	0	L	L	L	L	M		L		H		H
Anglerfish piscatorius VIIb-k, VIIIabd	N	T	—	L	L	M	0	0	0	0	0	M	M	M	M		L	L	L	L	0	L	L	L	L	M		L		H		H
Cod VIIe-k	N	T	T	—	H	L	0	0	0	0	0	L	L	M	0	0	0	L	M	L	0	0	L	L	L	0	0	H/M		H	L	H
Haddock VIIb-k	N	T	T	T	—	L	0	0	0	0	0	L	M	M	0	0	L	L	L	L	0	L	L	L	L	0	0	H	0	H	L	H
Hake Northern	N	T	T	T		—	0	0	0	0	0	M	M	L	M		L		0	L	0	L		0	L	L		L		H	L	H
Herring Celtic Sea and Division VIIj	N	N	N	N	N	N	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		0
Herring VIa(S) and VIIbc	N	N	N	N	N	N	N	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		0
Horse Mackerel Southern	N	N	N	N	N	N	N	N	—	0	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Horse Mackerel Western	N	N	N	N	N	N	N	N	N	—	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Mackerel North East Atlantic	N	N	N	N	N	N	N	N			—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Megrim VII, VIIIabd	N	T, BT	T, BT	T		T	N	N	N	N	N	—	H	M	M		L			L	0	L		L	L	0		L		H		H
Nephrops Area L: VIIbcjk	N	NT	NT	NT	NT	NT	N	N	N	N	N	NT	—	0	0	0	L	0	0	L	0	L	0	0	L	0	0	M		L		L
Nephrops Area M: VIIfgh+VIIa	N	NT	NT	NT	NT	NT	N	N	N	N	N	NT	N	—	0	0	0	0	0	L	0	0	0	L	L	0	0	M		L		L
Nephrops VIIIa,b	N	NT	NT	N	N	NT	N	N	N	N	N	NT	N	N	—	0	0	0	0	0	0	0	0	0	0	M	0	0		L		L
Nephrops VIIIc	N			N	N		N	N	N	N	N		N	N	N	—	L		0	0	0	L	0	0	0	0		0		L		L
Plaice VIIbc	N			N			N	N	N	N	N		NT	N	N		—	0	0	0	0	L	0	0	0	0	0	L	0	H		H
Plaice VIIe	N	OT, BT	OT, BT	OT, BT	N		N	N	N	N	N		N	N	N		N	—	0	0	0	0	H	0	0	0	0	L		H		H
Plaice VIIfg	N	OT, BT	OT, BT	OT, BT	OT, BT	N	N	N	N	N	N		N	N	N	N	N	N	—	0	0	0	0	H	0	0	0	L		H		H
Plaice VIIhjk	N			BT, OT			N	N	N	N	N		NT	N	N		N	N	N	—	0	0	0	0	L	0	0	L	0	H		H
Sardine VIIIc, IXa	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	—	0	0	0	0	0	0	0	0	0		0
Sole VIIbc	N			N			N	N	N	N	N		N	N	N			N	N	N	N	—	0	0	0	0	0	L	0	H		H
Sole VIIe	N	BT, OT	BT, OT	BT, OT	N		N	N	N	N	N		N	N	N	N	N	BT, OT	N	N	N	N	—	0	0	0	0	L		H		H
Sole VIIfg	N	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	N	BT	N	NT	N	N	N	N	BT, OT	N	N	N	N	—	0	0	0	L		H		H
Sole VIIhjk	N			BT, OT			N	N	N	N	N		N	N	N		N	N	N	T, BT	N	N	N	N	—	0	0	L	0	H		H
Sole VIIIab	N	BT	BT	N	N	BT	N	N	N	N	N	N	N	N	NT	N	N	N	N	N	N	N	N	N	N	—	0	0	0	H		H
Sprat VIIde	N	N	N	N	N				N	N	N		N	N	N		N	N	N	N	N	N	N	N	N	N	—	0				
Whiting VIIe-k	N	T	T	T	T		N	N	N	N	N		NT	NT	N		N	N	BT, OT		N	N	N	BT, OT		N		—	0	H		H
Seabass	N						N	N	N	N	N										N					N		0	—			
Skates and rays	N	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT, OT	NT	NT	NT	NT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT		BT, OT	BT, OT	BT	N	BT,OT		—	—	—
Pelagic and migratory sharks	NA	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT, OT					BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT		BT, OT	BT, OT	BT	N	BT,OT				
Demersal sharks	N	BT, OT	BT, OT	BT, OT	BT, OT	BT, OT	N	N	N	N	N	BT, OT	NT	NT	NT	NT	BT, OT	BT, OT	BT, OT	BT, OT	N	BT, OT		BT, OT	BT, OT	BT	N	BT,OT				

H; the stocks are taken together in most fisheries where they are taken and their fisheries linkage is therefore high; M: the stocks are taken together in some but not all important fisheries and their fisheries linkage is therefore medium; L: the stocks are taken together in some fisheries but are mainly caught independently of each other and their fisheries linkage is therefore low; 0: the stocks are never or only rarely caught together and they are thus not linked in the fisheries; na: information not available.

T: Trawl; BT: Beam trawl; OT: Otter trawl; NT: Nephrops trawl; N: none

Table 16.13b. Demersal elasmobranchs in the Bay of Biscay and Iberian waters. Technical interactions in Iberian waters.

	Hake	Anglerfish '	Megrims'	Nephrops	Nephrops	Nephrops	Nephrops	Nephrops	Horse mackerel	Blue whiting	Black scabbardfish	Red seabream
	VIIIc+IXa	VIIIc+Ixa	VIIIc+IXa	Cantabrian	North Galiza	West Galiza + North Portugal	SW and South Portugal	Cadiz	IXa	VIIIc+IXa	IXa	IX and X
				FU 31	FU 25	FUs 26+27	FUs 28+29	FU 30				
Hake VIIIc+IXa		**H**	**H**	**L**	**H**	**H**	**H**	**H**	**H**	**M**	**L**	**L**
Anglerfish VIIIc+IXa	PT-SP-trawls and PT-SP-gillnets		**H**	**L**	**H**	**H**	**H**	**0**	**M**	**L**	**0**	**L**
Megrims VIIIc+IXa	PT-trawl, PT-gillnets	PT-trawl, PT-gillnets		**L**	**L**	**L**	**H**	**0**	**M**	**L**	**0**	**L**
Nephrops Cantabrian FU 31	SP-Trawl	SP-Trawl	SP-Trawl		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nephrops North Galiza FU 25	SP-Trawl	SP-Trawl	SP-Trawl	None		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nephrops West Galiza + North Portugal FUs 26+27	SP-Trawl PT- trawl	SP-Trawl PT-trawl	SP-Trawl PT-trawl	None	None		**0**	**0**	**L**	**L**	**0**	**0**
Nephrops SW and South Portugal Fus 28+29	Crustacean PT-trawl	Crustacean PT-trawl	Crustacean PT-trawl	None	None	None		**0**	1.1 **L**	1.2 **M**	**0**	**0**
Nephrops Cadiz FU 30	SP-Trawl	None	None	None	None	None	None		**M**	**H**	**0**	**0**
Horse mackerel Ixa	PT-trawls, PT-artisanal, SP-trawl- H SP GOV -L	PT-trawl, PT-gillnets SP-trawl- H SP GOV -L	PT-trawl, PT-gillnets SP-trawl- H SP GOV -L	None	None	SP-Trawl PT-trawl	Crustacean PT-trawl	SP-Trawl		**M**	**0**	**0**
Blue whiting VIIIc+Ixa	PT-trawls SP-trawl SP pair trawl	Crustacean PT-trawl SP-trawl	Crustacean PT-trawl SP-trawl	SP-Trawl-L	SP-Trawl-L	SP-Trawl-L	Crustacean PT-trawl	SP-Trawl	PT-trawls SP-trawl SP-pair Trawl SP GOV -L		**0**	**0**
Black scabbardfish Ixa	PT-Longline	None	None	None	None	None	None	None	None	None		**0**
Red seabream IX and X	PT-artisanal	PT-artisanal	PT-artisanal	None	None	None	None	None	PT-artisanal	None	None	

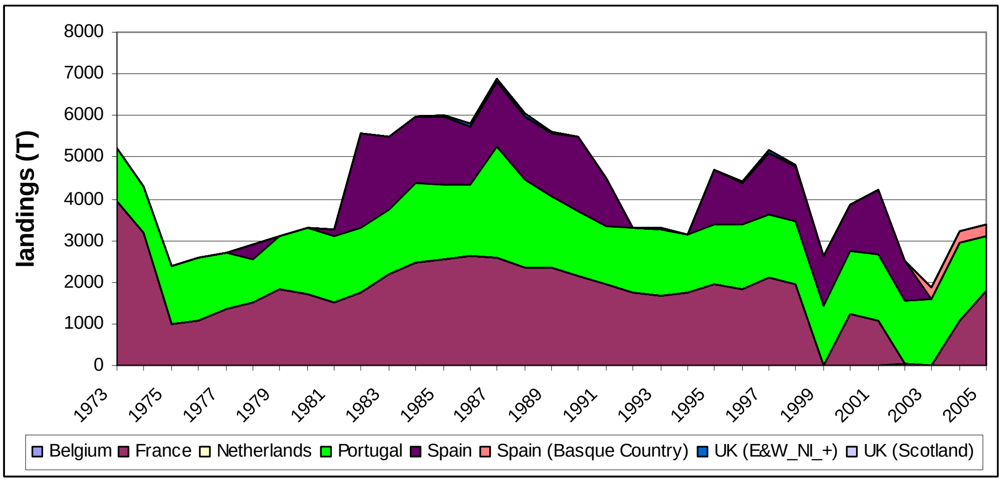

Figure 16.1. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Historical trend landings of Rajidae spp in Divisions VIIIab, VIIId, VIIIc and IXa.

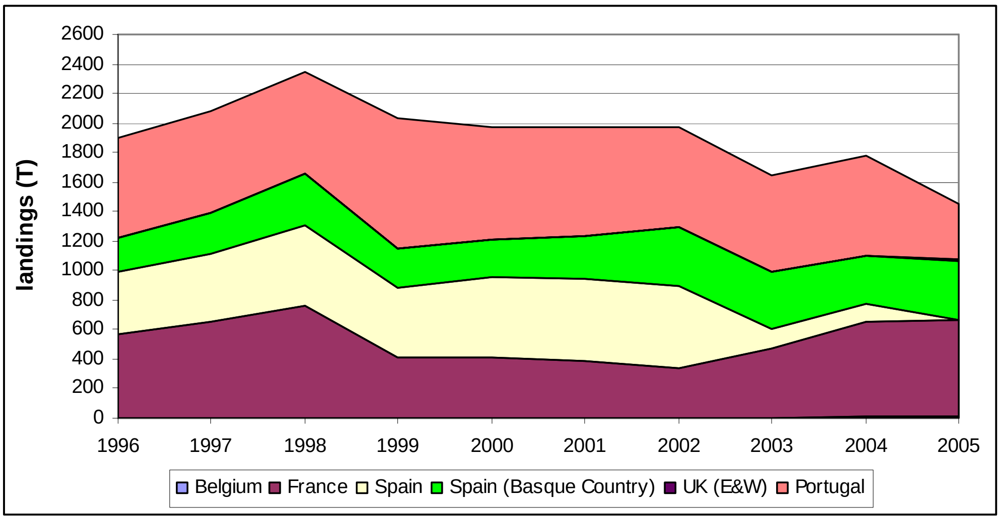

Figure 16.2. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Historical trend landings of Lesser-spotted dogfish Divisions VIIIab, VIIId, VIIIc and IXa..

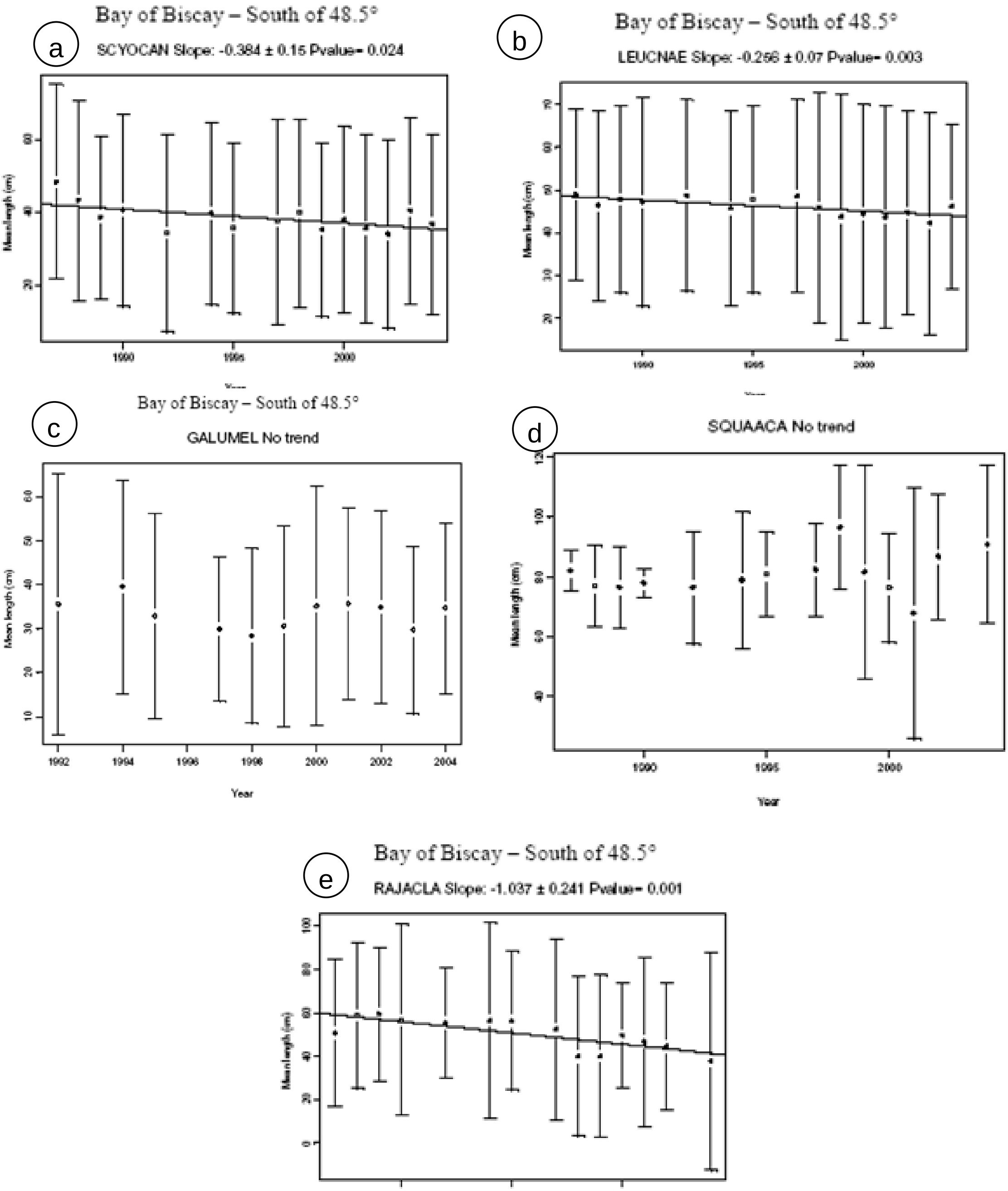

Figure 16.3. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Time trend in mean length of *a) S. canicula , b) L. naevus, c) G. melastomus, d) S. acanthias* and *e) R. clavata* in the area of Bay of Biscay south of 48.5° from 1987 to 2004 (error bars indicate +/- 2SD of the length distribution, not the confidence intervals of the i bar L estimates)..

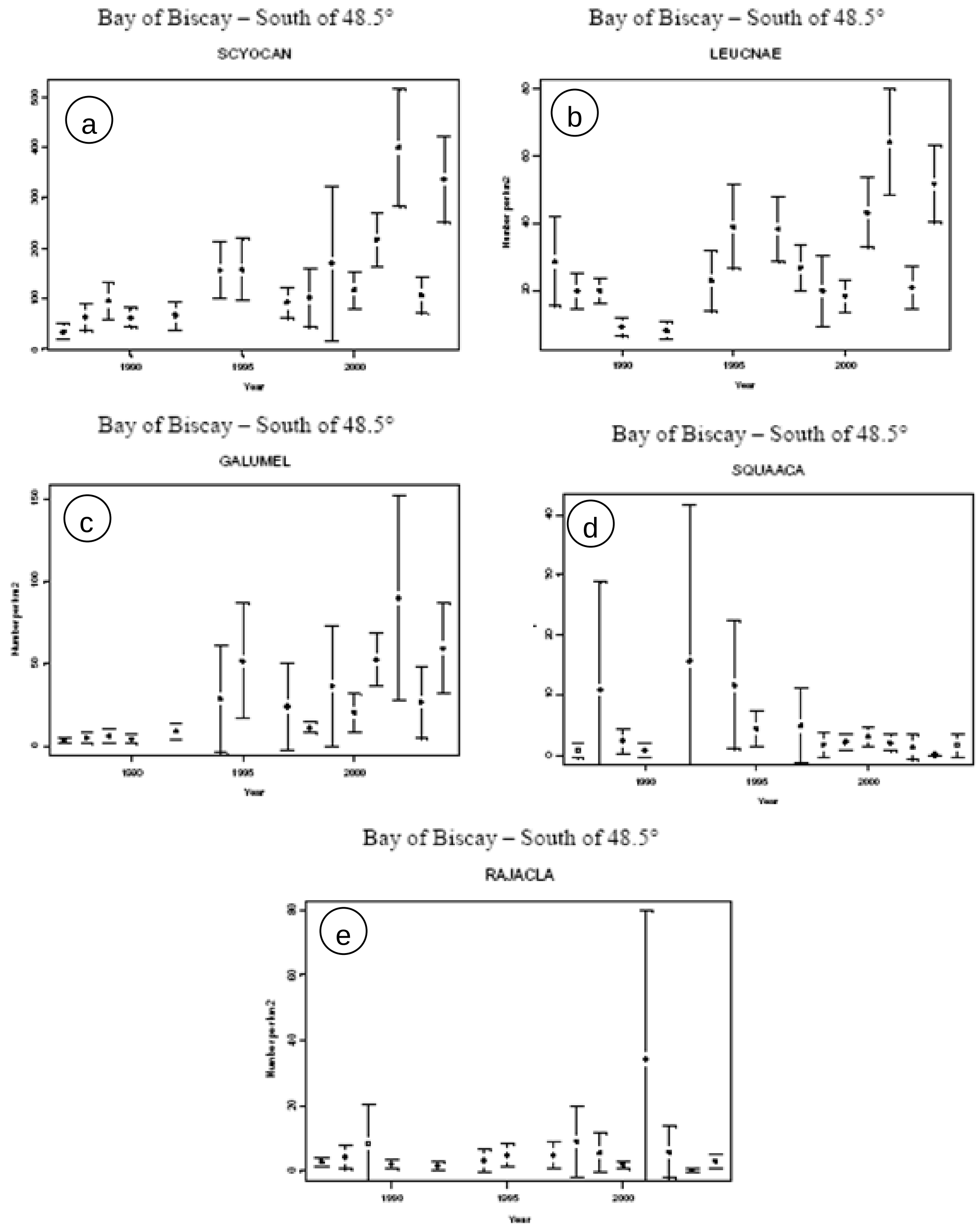

Figure 16.4. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Evolution of the abundance of *a) S. canicula , b) L. naevus, c) G. melastomus, d) S. acanthias* and *e) R. clavata* in the area of Bay of Biscay south of 48.5° from 1987 to 2004 (error bars show 95% confidence intervals).

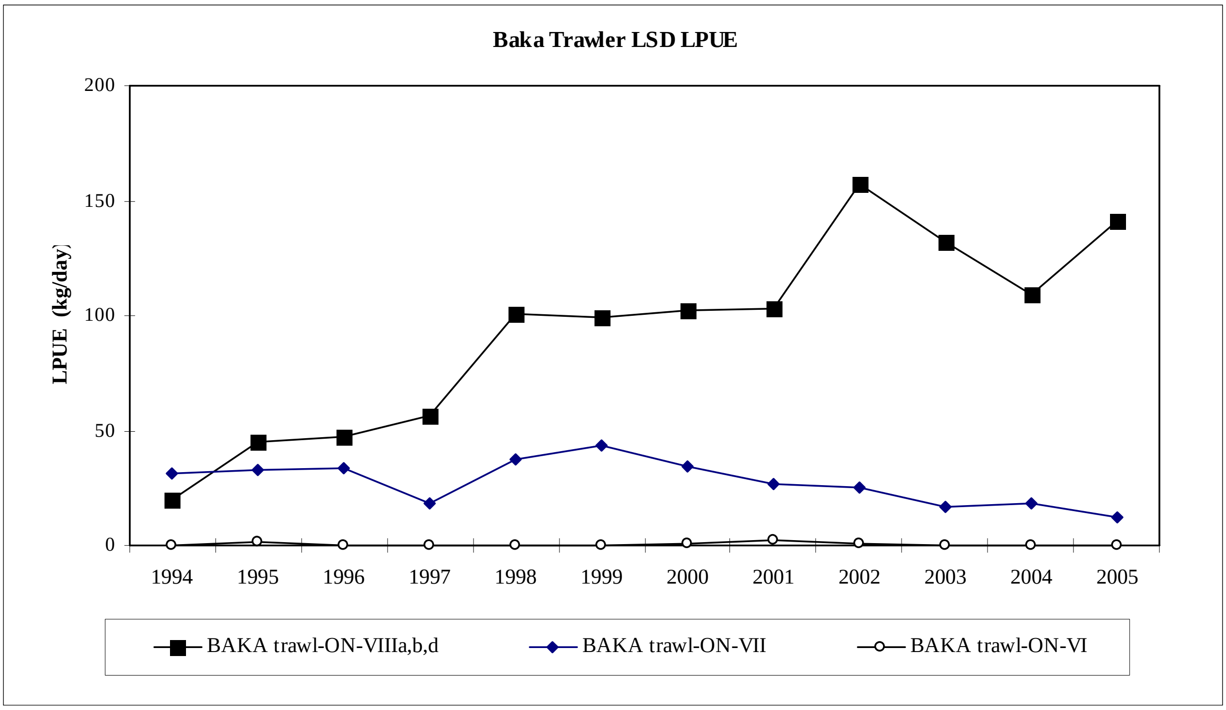

Figure 16.5. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Lesser spotted dogfish LPUE (landings in kg/day) trends of Baka Trawler landing in Ondarroa (Basque Country –Spain-) port in the period 1994–2005.

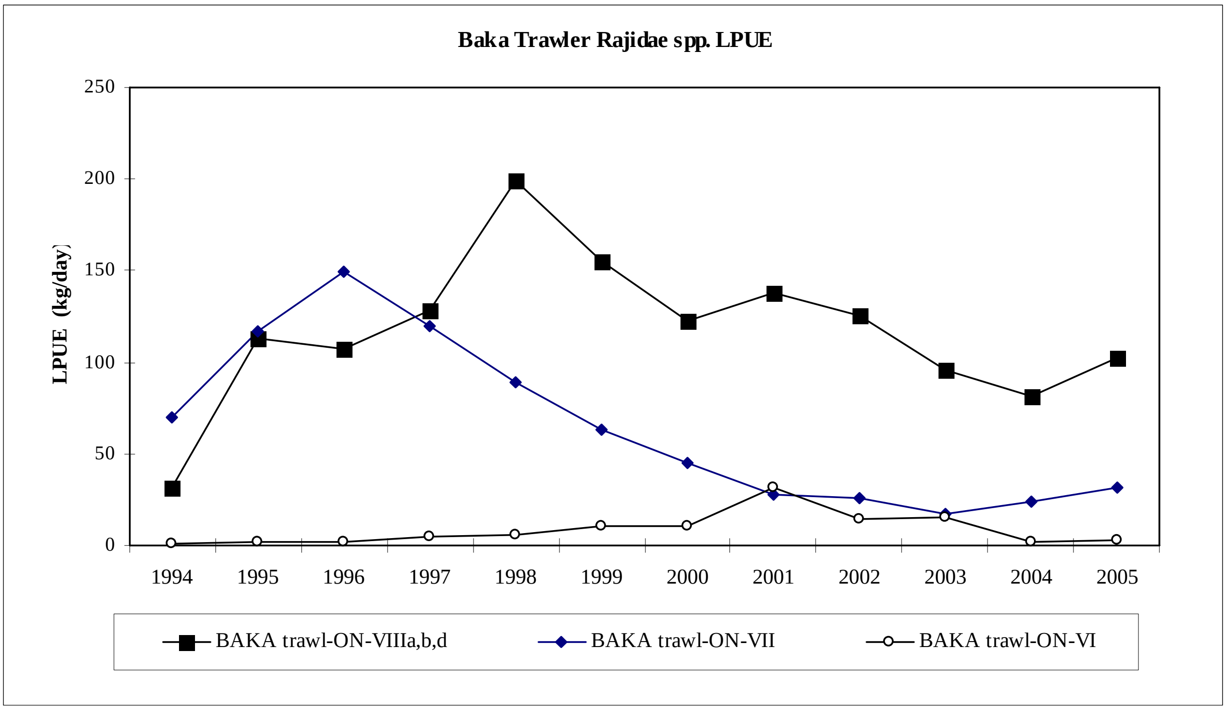

Figure 16.6. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Rajidae spp. LPUE (landings in kg/day) trends of Baka Trawler landing in Ondarroa (Basque Country –Spain) port in the period 1994–2005.

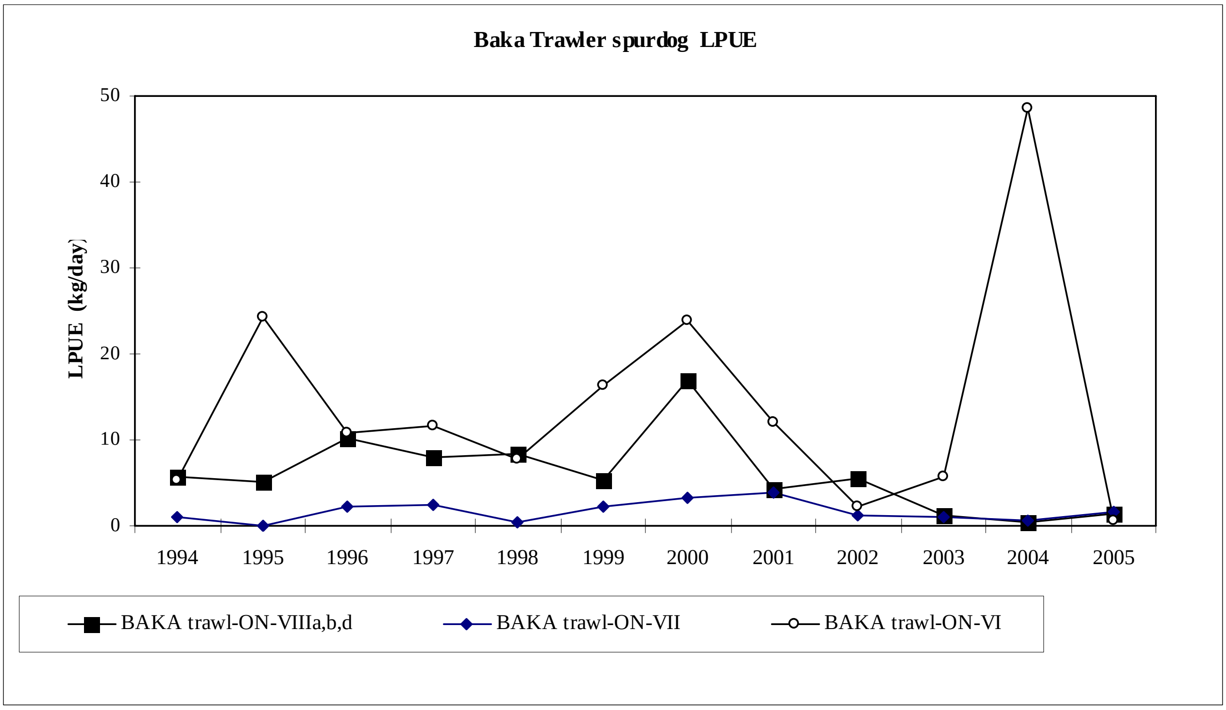

Figure 16.7. Demersal elasmobranchs in the Bay of Biscay and Iberian Waters. Spurdog LPUE (landings in kg/day) trends of Baka Trawler landing in Ondarroa (Basque Country –Spain-) port in the period 1994–2005.

17 Demersal rays in the Azores and Mid-Atlantic Ridge

17.1 The Fishery

The Mid-Atlantic Ridge (MAR) (ICES Area X, XII, XIV) is an extensive and varied area, which includes several types of ecosystems, abyssal plains, seamounts, active underwater volcanoes, chemosynthetic ecosystems and islands, as a natural extension of this large ecosystem. Thus, in the context of this report, this is mainly a natural deep-water environment where predominate the small-scale fisheries in the islands EEZ and industrial deep-sea fisheries in the international waters. Landings from the Azores fleets have been reported to ICES. Landings from MAR remains very small and variable and few vessels find the MAR fisheries profitable.

17.1.1 Advice and Management Applicable to 2005 and 2006

ACFM has never provided advice for these stocks.

17.1.2 The fishery in 2005

Demersal elasmobranches species are caught in the Azores EEZ by a multispecies demersal fishery, using hand-lines and bottom longlines, and by the black scabbarfish fishery using bottom longlines (Pinho, 2005).

The most commercially important elasmobranches species caught and landed from these fisheries is *Raja clavata and G. galeus* (Pinho, 2005, 2006).

There is no new reported information from MAR.

The catches reported from each country and by subarea are given in Tables 17.1, 17.2 and 17.3. Historical landings of rays reported for area X and XII are presented in Figure 17.1

17.2 Biological composition of the Landings

In the Azores there is no systematic fishery sampling information for these species, because they have very low priority on the port sampling. Length samples began to be collected for *Raja clavata* during 2004 under the Port Minimum Sampling Program. However, few individuals have been sampled on this species. Landings statistics of *R. clavata* are not reported by species but mixed on a general ray category.

17.3 Fishery-independent information

There is a spring demersal bottom longline survey running on the Azores annually (1995–2005). A comprehensive resume of the elasmobranches species occurring in the Azores (ICES subarea X) and fisheries associated as well as the available information on species distribution by depth, was presented to the working group (Pinho, 2005; ICES, 2005).

Raja clavata is one of demersal elasmobranch species more represented on this survey. Relevant biological information available from surveys for this species are updated annually and provided to the working group (Pinho, 2006). Annual abundance index are presented in Figure 17.2; Abundance indices by depth strata in Figure 17.3 and length composition in Figure 17.4.

Information on elasmobranchs species recorded on MAR available on the literature (Hareide and Garnes, 2001) was resumed on the 2005 report (ICES, 2005). There is no new information reported to the working group.

17.4 Discards

Although the different commercial and recreational fleets may catch a relatively high number of elasmobranches species only a few number of them are landed in the Azorean ports, including the pelagic ones. This shortcoming in the Azorean elasmobranches landing statistics may be responsible for major underestimations of the Azorean statistics.

17.5 Mean length, weight, maturity and natural mortality-at-age

No new information.

17.6 Management considerations

The Azorean government implemented since 1998 management actions in order to reduce effort on shallow areas of the islands, including a licence threshold based on the requirement of the minimum value of sales and a creation of a box of three miles around the islands areas with fishing restrictions by gear (only hand lines are permitted) and vessel type. Under the Fisheries Common Policy of the E. U. a box of 100 miles was created on the Azorean EEZ where almost only the Azorean fleets are permitted to fishing deep-sea species (Reg EC 1954/2003). TAC´s for deep-water sharks were implemented for ICES areas V, VI, VII, VIII, IX, X and XII**.**

WGEF considers that the elasmobranch fauna of Mid-Atlantic Ridge in Subareas X and XII is poorly understood. The species of demersal elasmobranchs are probably little exploited in comparison to continental Europe. The eco-region is considered to be a sensitive area. Consequently, commercial fisheries taking elasmobranchs in this area should not be allowed to proceed unless studies are conducted that can demonstrate what sustainable exploitation levels should be.

17.7 References

Hareide, N. R. and Garnes, G. 2001. The distribution and catch rates of deep water fish along the Mid-Atlantic Ridge from 43 to 61 N. Fisheries Research, 519: 297–310.

ICES. 2005. Report of the Study Group on Elasmobranch Fishes. ICES CM 2006/ACFM:03, 224 pp.

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Pinho, M. R. 2006. Elasmobranch statistics from the Azores (ICES Area X).Working Document (WGEF, 2006).

Table 17.1 Total landings (t) of *Rajidae* in area X

Country	Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Azores	Rajidae	86	74	46	44	38	25	27	37	48	29	35
France	Rajidae											
Spain	Rajidae											
Azores	Blutenose six-gill shark	4	30	2	1	2	1	+	1	+	1	1
Azores	Sharks	n.a.	n.a.	n.a.	+	n.a.	+	+	+	+	0.5	4
Total		86	74	46	44	38	25	27	37	48	29	35

Table 17.1 Total landings (t) of *Rajidae* in area X

Country	Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Azores	Rajidae	52	43	32	55	62	71	99	117	103	83	68	70	89	72	50
France	Rajidae	.	.	.	1	.	.	.	.	.	.	2	.	.	.	.
Spain	Rajidae	.	.	.	.	.	.	.	.	.	24	29	.	.	.	.
Azores	Blutenose six-gill shark	1	n.a	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	7	2	1	1
Azores	Sharks	12	+	+	138	256	328	n.a.	n.a.	6	18	22	n.a.	n.a	n.a.	3
Total		52	43	32	56	62	71	99	117	103	107	99	70	89	72	49.6

Table 17.2 Total landings (t) area XII

Country	Species	2001	2002	2003	2004	2005
UK	Rays and skates	1.1	0.5	5.9	0.8	.
UK	Sharks	.	6.7	.	.	113
Total		1	7	6	0.8	113

Table 17.3 Total landings (t) area XIV

Country	Species	2001	2002	2003	2004	2005
UK	Rays and skates	0.3	0.4	.	.	.
Total		0.3	0.4	.	.	.

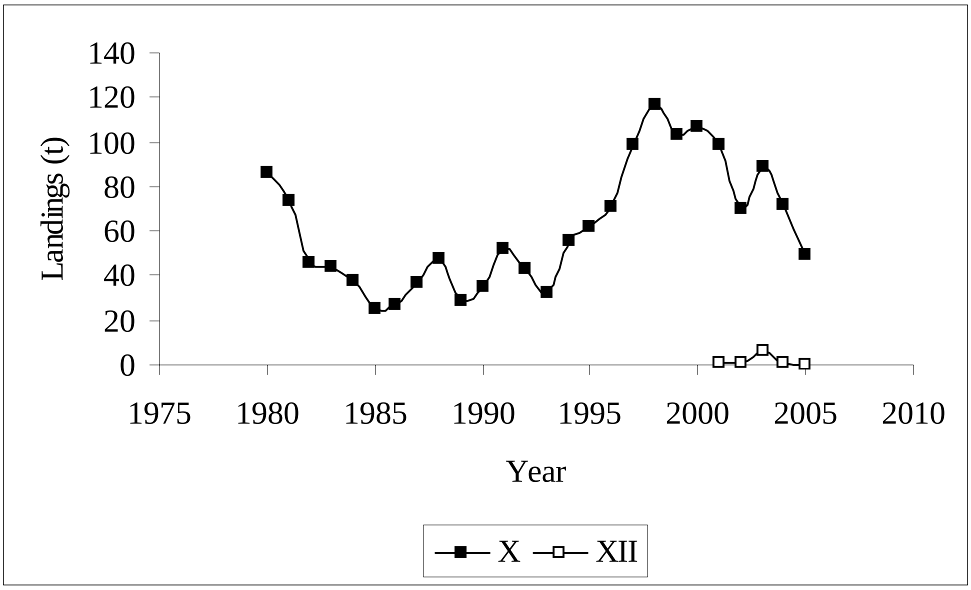

Figure 17.1. Demersal rays in the Azores and Mid-Atlantic Ridge Historical landings of rays from Azores (Ices subarea X) amd MAR (ICES Subarea XII). (data on Catch Tables\chap. 17).

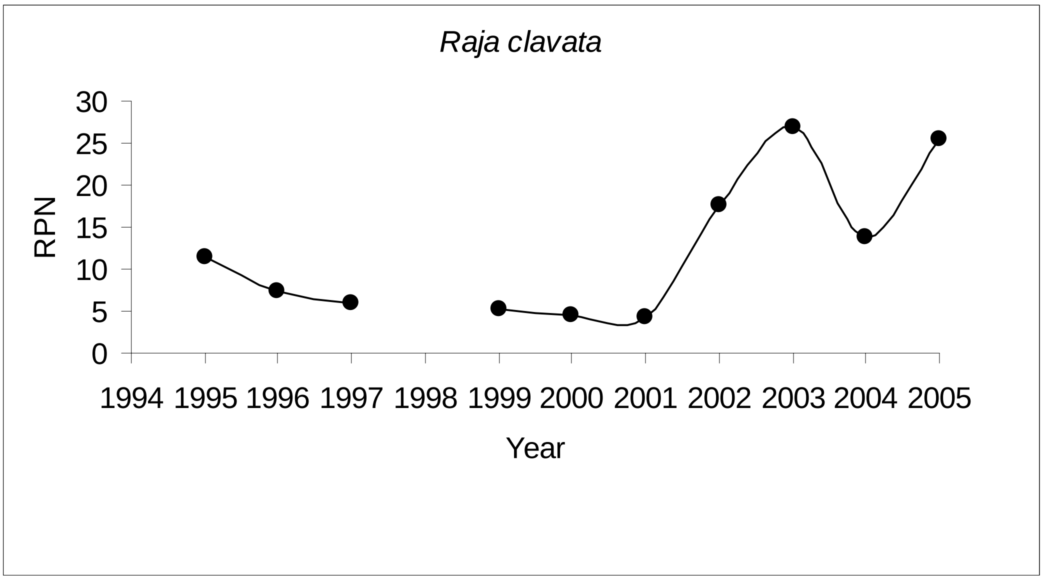

Figure 17.2. Demersal rays in the Azores and Mid-Atlantic Ridge Demersal rays in the Azores and Mid-Atlantic Ridge Annual Relative Population Numbers (RPN) of Raja clavata from the Azores (ICES X).

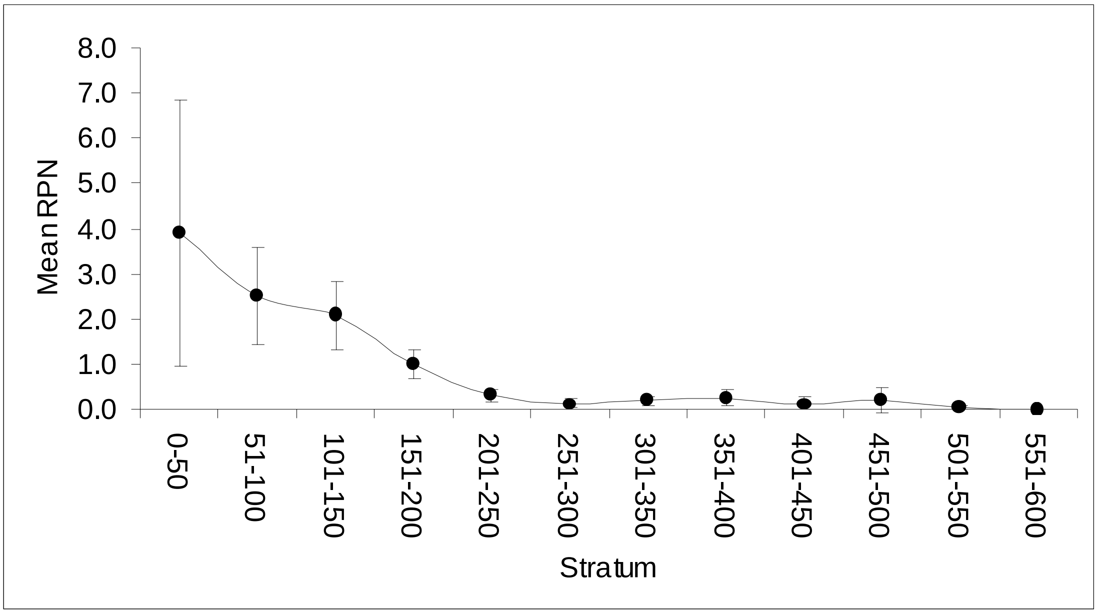

Figure 17.3. Demersal rays in the Azores and Mid-Atlantic Ridge Mean Relative Population Numbers (RPN), for the period 1995–2005, of Raja clavata by depth from the Azores (ICES X).

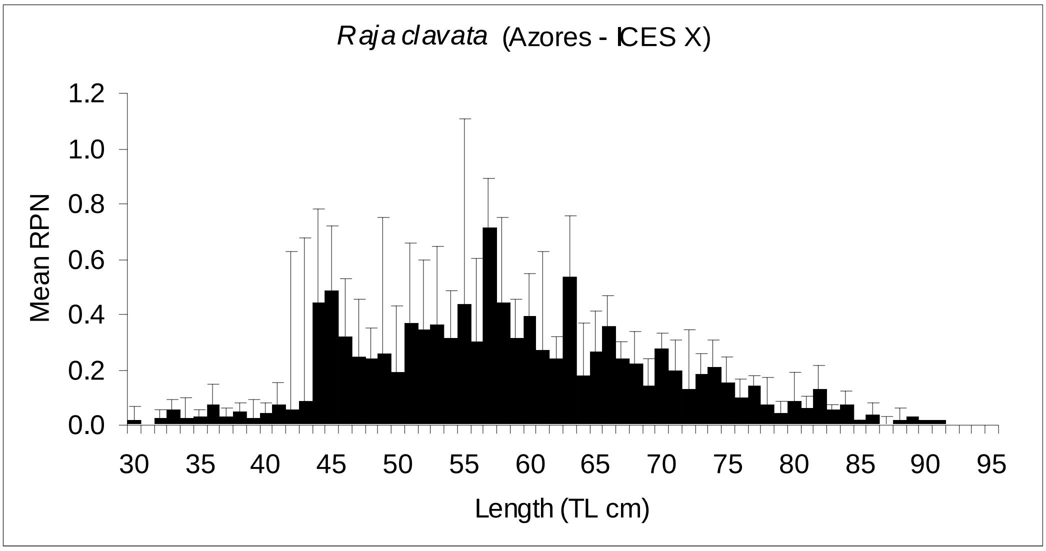

Figure 17.4. Demersal rays in the Azores and Mid-Atlantic Ridge Length frequency of *Raja clavata* caught at the Azorean demersal spring bottom longline surveys during the period 1995-2005. RPN is the Reltive Population numbers (CPUE by length weighted by the area size).

18 Other rays

Almost 50 batoids have been recorded in the ICES area, including some undescribed species (Stehmann, 1990). Around 25% of the species listed occur only at the southern fringe of the area (which coincides with the very northern or western edge of their range) or are probably vagrants from adjacent seas, possible misidentifications, or are the subject of unresolved taxonomic or identification issues. The remaining 35 species are considered to be resident in the ICES Area.

A significant proportion (~40%) of these residents are restricted to deepwater habitat. These are often rare, or at least only rarely recorded, probably because of a lack of survey and observed commercial fisheries inside their range. The majority of ICES batoids are coastal and shelf species and most of these are important in fisheries; these are described in Sections 10–17. Others, however, are bycatch of low or no commercial importance, either because they are small-bodied and/or low value, or because they have been so heavily depleted by target and bycatch fisheries that they are now only rarely seen.

There is a shortage of life history and population trend data for most rays in the ICES area. There are several reasons for this: many species are not of commercial importance; species-specific catch, discard and landings records are inadequate, and many deepwater species are largely unfished. This makes it difficult to appraise the stock status even of commercially important species (see Sections 11–17). For other species, Dulvy and Reynolds (2002) warn that large body size tends to be correlated with increased extinction risk arising from population depletion caused by high mortality in fisheries combined with life history parameters such as slow growth, late maturity and low fecundity. These are some of the factors being taken into consideration during a review of the status of all chondrichthyans of the Northeast Atlantic that is currently under development as part of the global IUCN Red List Programme (Gibson *et al.*, in preparation). Table 18.2 lists all batoids recorded from the ICES Area (excluding undescribed species). The summary information that it presents is largely extracted from the above report, which includes data from many unpublished sources, personal communications and expert judgements compiled by the numerous contributors and species assessors.

Some rare, depleted or rarely recorded species of batoids are considered to be of biodiversity conservation significance, particularly the large-bodied coastal and shelf endemics that have been depleted by target and bycatch fisheries (Dulvy and Reynolds, 2002). Some of these species have been reviewed by the ICES WGEF in former years and are now beginning to appear on national or regional lists of threatened or protected species (for example, the OSPAR List of Threatened and/or Declining Species and Habitats, or the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean).

18.1 Deepwater skates

A significant proportion (40%) of the batoids resident in the ICES area are deepwater species of the family Rajidae (Table 18.1). This excludes undescribed species and the list is likely to increase as deeper regions are explored.

This species list does not include species such as *Dipturus batis* and *Leucoraja fullonica*, whose main area of distribution (which formerly extended to much shallower waters) is apparently now largely restricted to the continental slope and shelf edge of shelf.

Deepwater skates, as classified here, are mainly distributed from the mid shelf slope and rises to adjacent deep plains, although they may occasionally be taken in shallower water. It is likely that the centres of distribution of many of these species lie not only outside current commercial fishing zones (currently extending to 1400–1500m in the Rockall Trough, somewhat deeper on seamounts), but also outside the current range of most research cruises. For some species, population density appears to increase with depth, to the greatest depths surveyed of ~2000–4000m. This is probably why several skates (e.g. *Malacoraja kreffti*) appear to be very rare (they are probably more accurately described as 'rarely recorded'). Nevertheless, skate population densities, particularly for large-bodied species, are likely to be low even in their centres of distribution in their low energy deepwater environment.

Other deepwater skates are apparently widespread and even common. Those appearing occasionally in landing statistics either as target or utilised bycatch species include *Dipturus lintea* (see 12.4.1) and *Dipturus nidarosiensis*.

Some rarely recorded deepwater skates appear to be ICES endemics, not occurring elsewhere (e.g. *Malacoraja kreffti, Rajella kukujevii* and *Bathyraja pallida*, Figures 18.1–18.3). While the restricted number and geographic distribution of records for these species may partly be due to the very small number of surveys of this habitat, levels of endemism in deepwater skate are likely to be fairly high. Some species only very rarely recorded in the ICES area are more commonly reported from the Northwest Atlantic (e.g. *Amblyraja jenseni*, Figure 18.4). The majority of the ICES deepwater skate fauna is probably restricted globally to the North Atlantic. Exceptions include *Bathyraja richardsoni*, with one record (the holotype) in the Pacific (Figure 18.5), and possibly *Rajella bigelowi* (Figure 18.6).

The centre of distribution of most deepwater skates in the ICES area is apparently deeper than current fisheries (>1500m). Gibson *et al*. (in preparation) determined, therefore, that most deepwater skates are 'Least Concern' (with no heightened risk of extinction). There are a few exceptions. Due, for example, to the large size and limited geographical distribution of *Dipturus nidarosiensis*, Dulvy and Reynolds (2002) considered this species to be 'a good candidate for being under threat' (other large bodied deepwater species identified by these authors, but which are currently not considered to be threatened with depletion by fisheries are *Bathyraja pallida*¸ *B. richardsoni* and *B. spinicauda*). It is uncertain whether *D. oxyrhinchus* did once occur in coastal and shelf waters, as described by these authors, but it now appears to be restricted to deepwater and its status warrants review. Other factors significantly predisposing deepwater species to risk of depletion are a very narrow geographical or vertical (depth) distribution that falls within the current range of deepwater fisheries, or which may in future be affected by expanding fisheries. Thus, the ICES endemic blue pygmy skate *Neoraja caerulea* is potentially of concern, despite its small size (often associated with a higher rate of population increase), since its entire distribution appears to lie within the range of deepwater fisheries in the ICES area.

It will be important to review carefully the range and depth distribution of all ICES endemics and to compare these with current and developing deepwater fisheries activities in order to assess the possible risk posed to endemics in the area.

Table 18.1. Ray species restricted to deepwater in the ICES area

- Amblyraja hyperborea Arctic skate
- Amblyraja jenseni Jensen's skate
- Malacoraja kreffti Krefft's skate
- Malacoraja spinacidermis Prickled or roughskin skate
- Rajella bathyphila Deepwater skate
- Bathyraja pallida Pallid skate
- Bathyraja richardsoni Richardson's skate
- Rajella bigelowi Bigelow's skate
- Rajella fyllae Round skate
- Rajella kukujevi Mid-Atlantic skate
- Bathyraja spinicauda Spinetail skate
- Dipturus lintea Sailskate or sailray
- Dipturus nidarosiensis Norwegian skate
- Neoraja caerulea Blue pygmy skate

18.2 Mediterranean, African and tropical species

Many species whose main centre of distribution lies within the Mediterranean, on the African shelf, or in the tropical Atlantic also occur (some only as vagrants) at or near the edge of their range in the ICES Area.

Examples of vagrants, which may only venture seasonally or even less frequently into the ICES area, include two Mediterranean endemics (*Raja polystigma* speckled ray and *Mobula mobular* giant devilray), the sawfishes (*Pristis pectinata* and *P. pristis*), some offshore tropical pelagics (*Mobula japanica* spinetail mobula and *Pteroplatytrygon violacea* pelagic stingray) and a few tropical stingray species (*Dasyatis marmorata* and *Taeniura grabata*).

Southern species that are resident in the ICES area include the guitarfishes, cownose, bull and butterfly rays. Some of these southern species occur (or have occurred) in coastal and shelf fisheries off the Iberian Peninsula and in the Azores, but intensive commercial and artisanal fisheries within their main Mediterranean and African range are of much greater conservation and management concern than activities within the fringe of their distribution in the ICES area.

The WGEF noted that some of these southern species, for example the guitarfishes, were likely formerly more regularly recorded in coastal fisheries before their distribution and abundance contracted. The sawfishes may once have been regular seasonal visitors or were possibly resident in southern estuaries, lagoons and adjacent coastal waters. These species were extirpated from European waters long ago, but may still survive in a few locations in north and northwest Africa where they were formerly very common. The sawfishes are increasingly being recognised as threatened globally and of very high species conservation importance (e.g. Simpfendorfer, 2000). They could become a future biodiversity conservation priority in waters adjacent to the ICES Area.

18.3 Coastal and shelf batoids

Sections 10–17 consider fisheries, stocks and management considerations for the more abundant and important commercial ray species. This section focuses upon species that are no longer or have never been important in fisheries, but for which it is possible that management advice may in future be required as a result of initiatives in other fora (see 18.4). Examples of batoids already listed or under consideration for listing on national or regional biodiversity species lists are the common skate *Dipturus batis*, spotted ray *Raja montagui*, white skate

Rostroraja alba and devil ray *Mobula mobular* (the latter two in the Mediterranean only). Some ICES States are also considering national measures to protect threatened species of elasmobranch (e.g. Sweden, using measures for species on its national Red List, and the UK through its Wildlife and Countryside Act).

The coastal and shelf batoids that are most likely to be viewed as a high biodiversity conservation priority over the coming years will include those highlighted by Dulvy and Reynolds (2002) as already having undergone local extinctions. Those occurring in the ICES area are *D. batis* and *R. alba*, both of which are likely, therefore, to be of concern both to fisheries and biodiversity management bodies. Indeed, the status of *D. batis* has already been reviewed by ICES (2002) and this species is now listed by OSPAR (2004). Dulvy and Reynolds (2002) extrapolated from these case histories to other species with similar life history constraints, body sizes and restricted depth or geographic range. These were mainly deepwater species (see 18.1). The disappearance of *Raja clavata* from the Netherlands coast has been highlighted by earlier Working Group reports and described by Walker and Heessen 1996; Dulvy and Reynolds (2002) noted with concern that the status of this species 'should be watched carefully'.

Gibson *et al*. (in preparation) present a review of the status of virtually all Northeast Atlantic chondrichthyans. This review applied expert analyses of population, fisheries and landings trends, geographical and depth distribution, combined with evaluation of distribution and the life history characteristics identified by Dulvy and Reynolds (2002) that appear to increase vulnerability to fisheries.

Coastal and shelf species highlighted by these analyses and which warrant further study include *Raja undulata*, the apparently declining ICES endemic *Leucoraja circularis*, *L. fullonica* shagreen skate, *Raja brachyura* blonde ray, and *Dasyatis pastinaca* common stingray. The status of the torpedo rays is unknown.

18.4 Management considerations

This section anticipates the likelihood that ICES may continue to be asked to provide information on potentially threatened ray species for consideration for listing on biodiversity instruments such as OSPAR and Appendix II of Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the Natura 2000 list). For example, the common skate *Dipturus batis* and spotted ray *Raja montagui* are already on the Initial OSPAR List of threatened and Declining Species and Habitats (OSPAR, 2004), which is intended for regular review, and several skates have been proposed for legal protection in British waters. It is possible that the white skate *Rostroraja alba*, already listed on the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention), may also be proposed for conservation management in ICES waters.

The Working Group considered that ICES endemics whose entire range lies within areas that are currently fished, or which may be affected as fisheries continue to expand into deeper water, should be afforded the highest priority for more detailed review in order that such advice may be provided.

The Working Group also noted the tendency for larger-bodied species to be less resilient to the impact of fisheries exploitation, and that protection of the largest reproductively active females, which may make a bigger contribution to recruitment than smaller females, has been found to aid stock rebuilding for some elasmobranchs. Where there are practical difficulties associated with implementing species-specific conservation and management in mixed fisheries, technical measures that protect the larger individuals may be of benefit.

18.5 References

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Table 18.1. Batoid species and their distribution in the ICES area. From Gibson *et al.* (in preparation).

Family	Species	Common name	Distribution in ICES area	Habitat
Pristidae	*Pristis pectinata*	Smalltooth sawfish	Formerly present (seasonally?) in the south, now extirpated from most of former range, including the ICES area	C/Sh
	Pristis pristis	Common sawfish	Formerly present (seasonally?) in the south, now extirpated from most of former range, including the ICES area	C/Sh
Rhinobatoidei	*Rhinobatos cemiculus*	Blackchin guitarfish	Coastal and shelf. Recorded only on the southern sections of the ICES area, to northern Portugal	C/Sh
	Rhinobatos rhinobatos	Common guitarfish	Coastal and shelf. Occurs only in the southern part of the ICES area	C/Sh
Torpedinidae	*Torpedo marmorata*	Spotted torpedo	Widely distributed in coastal and shelf waters, occurs in south of ICES area as far north as the Kattegat and northern UK	C/Sh
	Torpedo nobiliana	Great or Atlantic torpedo	Eastern Atlantic coastal and slope waters, in ICES area as far north as the northern UK (but rare in the North Sea)	C/Sl
	Torpedo torpedo	Ocellate or common torpedo	Occurs in the south of the ICES area, north to the southern Bay of Biscay	C/Sh/Sl
Arhynchobatidae	*Bathyraja pallida*	Pallid skate	ICES endemic? Lower shelf slope and mid Atlantic Ridge (>1900m). Known from only a few records.	D
	Bathyraja richardsoni	Richardson's skate	North Atlantic lower shelf and island slopes and mid Atlantic ridge, mostly >1000m, records infrequent. One Pacific record.	D
	Bathyraja spinicauda	Spinetail skate	Upper/middle slope, northern North Atlantic. Mainly recorded 400–850m in ICES area, but may be under-recorded in deeper water (most abundant at 1500m in the Northwest Atlantic)	D
Rajidae	*Amblyraja hyperborea*	Arctic skate	Deepwater (260-2500m), widely distributed across the North Atlantic, mainly below commercial fishing depths.	D
	Amblyraja jenseni	Jensen's skate	Deepwater (167-2548m – the deepest fished, with density increasing with depth). Sparse records in the ICES area, much larger numbers recorded in the Northwest Atlantic.	D
	Amblyraja radiata	Starry ray/ Thorny skate	Common and abundant from coastal waters to upper slope (18-1400m, most common in 27-439m). Most abundant North Sea skate, significant increase since the 1970s. Considered a deepwater species in the Northwest Atlantic.	C/Sl
	Dipturus batis	Common skate	Endemic to ICES area and Mediterranean. Originally most common in coastal and shelf waters. Also occurs on upper slope. Seriously depleted in or extirpated from most of former shallow water range.	C/Sl
	Dipturus lintea	Sailskate or sailray	Widespread but sporadic on North Atlantic slopes: 316-1455m (deepest fished) in the northwest, 196 to >635m in the northeast. Density increases with depth. Range overlaps with fishing effort in ICES area.	Sl/D
	Dipturus nidarosiensis	Norwegian skate	NE Atlantic fjords, slopes and submarine rises from 200m to >1000m depth. Recorded in commercial landings data (as a target or utilised bycatch).	Sl/D
	Dipturus oxyrhinchus	Sharpnose skate	Northeast & East Central Atlantic, deep shelf to slope.	Sh/D
	Leucoraja circularis	Sandy skate or ray	ICES endemic of the outer shelf & upper slope, 50–500m. Declining trend in landings data. Now only recorded in small numbers in surveys, apparently rare in shallower part of range.	Sh/Sl
	Leucoraja fullonica	Shagreen ray	Northeast Atlantic and Mediterranean offshore shelf to upper slope (30–550m). Reported landings show a declining trend. Survey trends unclear. Now comparatively rare in the ICES area. Main distribution may now be in deeper water, along shelf edge.	Sh/Sl
	Leucoraja naevus	Cuckoo skate or ray	Widespread and abundant on shelf & upper slope of ICES area.	Sh/Sl
	Malacoraja kreffti	Krefft's skate or ray	ICES endemic. Deepwater (>1000m). Four specimens recorded from northern part of the ICES area. May prove to occur south into Bay of Biscay and to Mid-Atlantic-Ridge.	D
	Malacoraja spinacidermis	Prickled or roughskin skate	Deep North Atlantic slope & below, 450-1569m. Also SE Atlantic. Rare. May be more common in deeper water below current fishing depths.	D

Habitat key: C: coastal, Sh: shelf; Sl: slope; D: deep; V: vagrant.

Family	Species	Common name	Distribution in ICES area	Habitat
	Neoraja caerulea	Blue pygmy skate	ICES endemic on mid to deep NE Atlantic slopes and rises. Occasional bycatch in Rockall Trough 600-1200m, Bay of Biscay and mid-Atlantic-Ridge.	D
	Raja brachyura	Blonde skate or ray	Coastal, shelf, to upper slope, broad but fragmented distribution, fairly abundant in some areas.	C/Sh
	Raja clavata	Thornback ray	Coastal and shelf, mainly 10–60m, to 300m on upper slope.	C/Sh
	Raja microocellata	Smalleyed or painted ray	ICES endemic, patchy distribution in coastal & shelf waters <100m. Locally abundant in sandy areas.	C/Sh
	Raja miraletus	Brown or twineye ray	In southern part of ICES area (to Northern Portugal). Coastal to upper slope, Atlantic and Indian Oceans. Relatively abundant and widely distributed in some areas.	C/Sh
	Raja montagui	Spotted ray	Widespread on Northeast Atlantic and Mediterranean shelf, 8-283m, mostly <100m. Common in fisheries and surveys, populations stable or increasing.	Sh
	Raja polystigma	Speckled ray	Mediterranean endemic (ICES vagrant?)	V
	Raja undulata	Undulate ray	Shelf, to 200m but most common <30m. Centre of distribution in southern half of ICES area (to S. Ireland and Channel), also Mediterranean and West Africa.	Sh
	Rajella bathyphila	Deepwater skate or ray	North Atlantic middle & lower continental slopes to deep sea plains & submarine elevations, 650-2050 m, mainly >1400 m.	D
	Rajella bigelowi	Bigelow's skate or ray	North and Central Atlantic, slopes and rises, 367-4156m. Likely to extend into even deeper water.	D
	Rajella fyllae	Round skate	North Atlantic deeper shelf and upper slope, 170–2050m, average capture depth 400-800m..	D
	Rajella kukujevi	Mid-Atlantic skate	Endemic to ICES area, Mid-Atlantic ridge to Iceland, Faroes and Ireland, 775-1500m. Most frequent off the Rockall Trough and >1000m.	D
	Rostroraja alba	White skate	Eastern Atlantic and Indian Ocean. Coastal to upper slope, 40-400m. Seriously depleted and extremely rare.	C/Sh
Dasyatidae	*Dasyatis centroura*	Roughtail stingray	Coastal and shelf	C/Sh
	Dasyatis chrysonota	Blue stingray	Likely misidentification of *D. marmorata*	V
	Dasyatis marmorata	Marbled stingray	Shelf, tropical, ICES vagrant?	V
	Dasyatis pastinaca	Common stingray	E Atlantic coast & shelf, Africa, the Mediterranean to UK & S Norway.	C/Sh
	Pteroplatytrygon violacea	Pelagic stingray	Tropical oceanic epipelagic, vagrant	V
	Taeniura grabata	Round stingray	Shelf & upper slope, ICES area vagrant?	V
Gymnuridae	*Gymnura altavela*	Spiny butterfly ray	Shelf, southern edge of ICES area	Sh
Myliobatidae	*Myliobatis aquila*	Common eagle ray	Shelf & upper slope, southern ICES area	Sh
	Pteromylaeus bovinus	Bull ray	Coastal and shelf, southern edge ICES area	C/Sh
Rhinopteridae	*Rhinoptera marginata*	Lusitanian cownose ray	Coastal & shelf, southern edge ICES area	C/Sh
Mobulidae	*Mobula mobular*	Giant devilray, devil ray	Offshore epipelagic, ICES area vagrant?	V
	Mobula japanica	Spinetail mobula	Offshore epipelagic, ICES area vagrant?	V

Habitat key: C: coastal, Sh: shelf; Sl: slope; D: deep; V: vagrant.

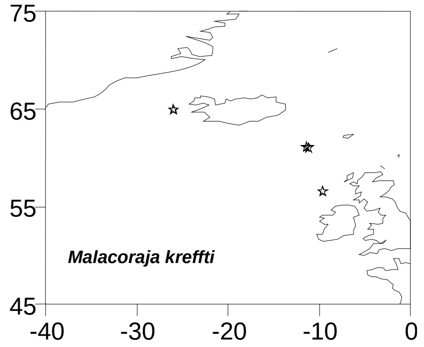

Figure 18.1. Distribution of Krefft's skate *Malacoraja kreffti* records (source A.Orlov, pers. comm.)

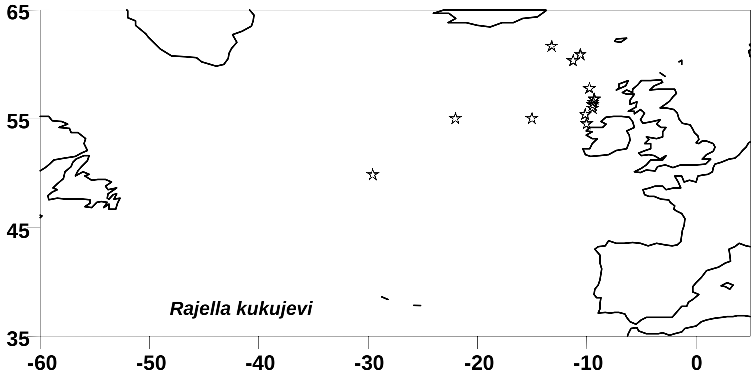

Figure 18.2. Distribution of Mid-Atlantic skate *Raella kukujevi* records (source A.Orlov, pers. comm.)

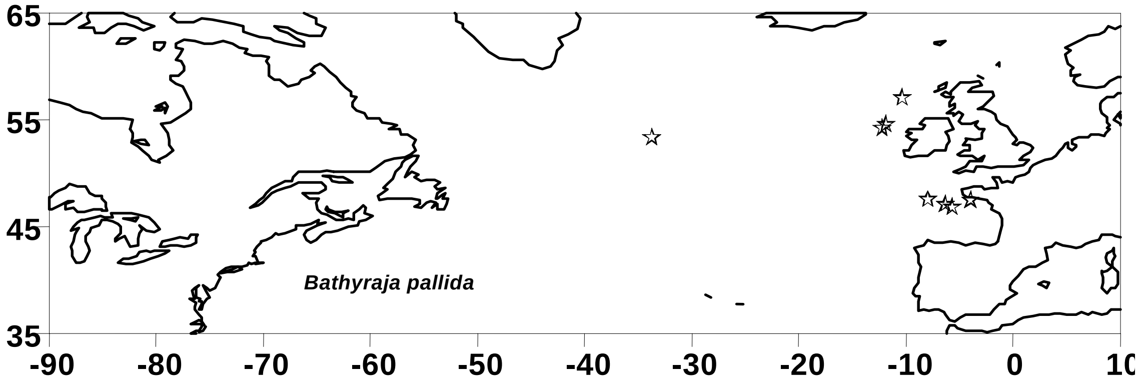

Figure 18.3. Distribution of pallid skate *Bathyraja pallida* records (source A.Orlov, pers. comm.)

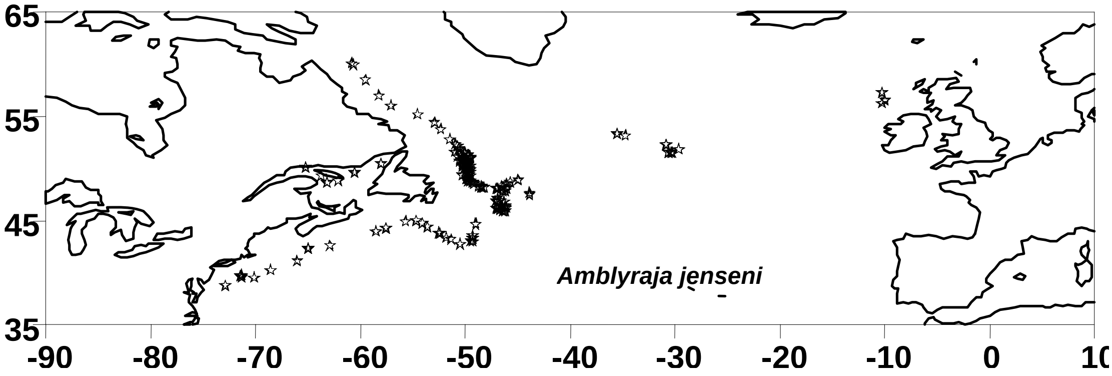

Figure 18.4. Distribution of Jensen's skate *Amblyraja jenseni* records (source A.Orlov, pers. comm.)

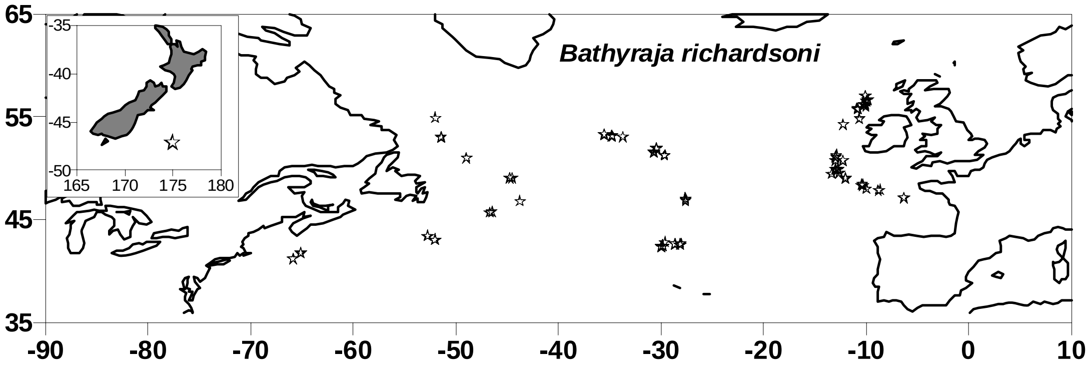

Figure 18.5. Distribution of Richardson's skate *Bathyraja richardsoni* records (source A.Orlov, pers. comm.)

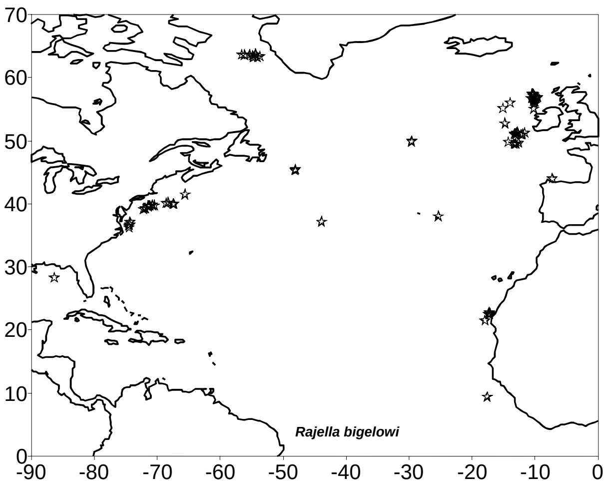

Figure 18.6. Distribution of Bigelow's skate *Bathyraja bigelowi* records (source A.Orlov, pers. comm.)

19 Tope in the North East Atlantic and Mediterranean

WGEF considers that there is a single stock of tope (or school shark) in the ICES area, with the centre of the distribution ranging from Scotland and southern Norway southwards to the coast of north-western Africa and Mediterranean Sea. The stock area therefore, covers ICES Subareas II–X (where Subareas IV and VI–X are important parts of the stock range, and sub-areas II, III and V areas where tope tend to be an occasional vagrant).

This stock, however, extends beyond the ICES area and into the Mediterranean Sea and the CECAF area. Though the distribution of tope along the western sea board of Africa, and the degree of mixing (if any) between North East and South East Atlantic tope stocks are unclear, tope tagged in the ICES area have been recaptured as far south as the Canary Islands. Tope do not occur in the North West Atlantic.

Hence, the North East Atlantic tope stock covers the ICES Area (II–X), Mediterranean Sea (Subareas I–III) and northern part of the CECAF area, and any future assessment of the North-east Atlantic tope stock may need to be undertaken in conjunction with the General Fisheries Commission for the Mediterranean (GFCM) and Fishery Committee for the Eastern Central Atlantic (CECAF).

The stock unit identified by WGEF was based on published tagging studies (e.g. Holden and Horrod, 1979; Stevens, 1976, 1990; Irish Central Fisheries Board, unpublished data), which clearly indicate that tagged fish move widely throughout the north-eastern Atlantic. There are several on-going tagging programmes, which may provide further information on the stock in the future.

Tope tend to most commonly reported in continental shelf waters, though tag returns suggest that they occasionally move further offshore. Tope are primarily piscivorous (Ellis *et al*., 1996; Morato *et al*., 2003), feeding on a variety of pelagic and demersal fish and cephalopods.

19.1 The Fishery

Advice and management applicable in 2006

ACFM has never provided advice for this stock.

The Norwegian quota in EU waters, for spurdog includes long line catches of other sharks (see Section 2), and this includes tope.

The fishery

There are no currently no targeted commercial fisheries for tope in the north-eastern Atlantic, though they are taken as a bycatch in trawl, gillnet and longline fisheries, including demersal and pelagic set gears. Though tope are discarded in some fisheries, due to their low market value, other fisheries land this bycatch. Tope is also an important target species in recreational sea angling and charter boat fishing in several areas, with most anglers and angling clubs following catch and release protocols.

Landings data are limited, as landings data are often included as “dogfishes and hounds” (DGH). Nevertheless, England and France have some species-specific landings data, and there are also limited data from Denmark, Ireland, Portugal and Spain in recent years.

Many of the reported landings are from the English Channel, Celtic Sea and northern Bay of Biscay (Bonfil, 1994). Tope is also caught in Spanish fisheries in the western Cantabrian Sea (Galicia), where about 80% of the landings are from longline vessels, with the remainder from trawl and small gillnets (Anon., 2003). Tope also feature in the catches off mainland Portugal, and are an important component of Azorean bottom long line fisheries (Heessen, 2003;

Morato *et al*., 2003). Tope are also caught in offshore long-line fisheries is this area (Pinho, 2005).

19.2 Biological composition of the catch

19.2.1 Landings

No accurate estimates of catch are available, as many nations that land tope will report an unknown proportion of landings in aggregated landings categories (e.g. dogfishes and hounds). Reported species-specific landings, which commenced in 1978 for French fisheries, are given in Table 19.1, with these landings relatively stable in recent years, at about 500 tonnes.y^{-1} (Figure 19.2).

No species-specific catch data for those parts of the stock in the Mediterranean Sea and off North-west Africa are available. The degree of any mis-reporting or under-reporting is not known.

Landings indicate that France is one of the main nations landings tope (though data for 1980 and 1981 were not available). The United Kingdom also land tope, though species-specific data are not available prior to 1989. Since 2001, Ireland, Portugal and Spain have also declared species-specific landings, though recent data were not available for Spanish fisheries.

19.2.2 Quality of catch and biological data

Catch data are of poor quality, and biological data are not collected under the Data Collection Regulations. Some generic biological data are available (see Section 19.4).

19.2.3 Bycatch and discards information

Though some discards information is available from various nations, data are limited for most nations and fisheries. The length-frequency of tope observed in UK (England and Wales) discard sampling for demersal trawl fisheries and drift and fixed net fisheries are illustrated in Figure 19.1. These are raw data that, due to the small sample size of fish involved, have been aggregated across years (2001–2006) and ICES Divisions (IV b–c, VII a, d–k) and have not been raised to fleet level. It indicates that juvenile tope tend to be discarded in demersal trawl fisheries, though larger individuals are usually retained, with tope caught in drift and fixed net fisheries usually retained. Smaller individuals (<60 cm total length) were not recorded during observer trips in the fixed and drift net fisheries, which could be due to gear selectivity or that these fisheries do not overlap with juvenile tope in space/time

19.3 Fishery-independent information

Although several fishery-independent surveys operate in the stock area, data are limited for most of these. This species is not sampled appropriately in beam-trawl surveys, though they are caught in GOV trawls and other otter trawls.

The size distributions of fish caught in surveys around the British Isles are illustrated in Figure 19.2. These data are aggregated across years for the various surveys, and all surveys are described in Ellis *et al*. (2005a,b). Survey data from 4m beam trawl surveys operating in the English Channel (July, 1990–2005), and Bristol Channel and Irish Sea (September, 1990–2005) only catch tope very infrequently. Surveys in the North Sea (Granton trawl and GOV trawl, August, 1977–2005) sample a large part of the overall size range, including pups 31–45 cm long, and other juveniles. Surveys in the Celtic Sea (Portuguese high headline trawl, March, 1982–2003) sampled mostly larger individuals and comparatively few juveniles were recorded during this survey. Though this survey no longer operates as a groundfish survey, Q4 IBTS surveys in the Irish and Celtic Seas (November, modified GOV with rockhopper ground gear, 2004–2005) also sample small numbers of tope, with specimens tagged and released wherever possible.

Analyses of catch data need would need to be undertaken with care, as tope is a relatively large-bodied species (up to 200 cm in the north-eastern Atlantic), and adults are strong swimmers that forage both in pelagic and demersal waters. Hence, they are probably not sampled effectively in IBTS surveys, and survey data generally include a large number of zero hauls. The tendency for many surveys to now have short trawl durations (e.g. of less than one hour) may also affect the likelihood of catching tope. Nevertheless, survey data may provide useful indications of areas where juvenile tope are caught.

19.4 Mean length, weight, maturity and natural mortality-at-age

There have been few studies describing the age and growth and reproduction of tope in the north-eastern Atlantic (e.g. Capapé and Mellinger, 1988), and there is no routine monitoring of length, weight and maturity at age for either survey or commercial catches. Due to the importance of tope in Australian and South American fisheries, there have been several biological studies of these stocks (e.g. Peres and Vooren, 1991; Ward and Gardner, 1997; Hurst *et al*., 1999; West and Stevens, 2001; Lucifora *et al*., 2004).

Tope is an aplacentally viviparous shark, with gestation lasting approximately one year, and may therefore have an annual reproductive cycle, though it is unknown whether tope in the north-eastern Atlantic have resting periods between pregnancies. Studies on the South West Atlantic tope stock indicate that it has a triennial reproductive cycle (Peres and Vooren, 1991). Tope is a long-lived species, with longevity of at least 36 years, based on tag returns and age and growth studies (e.g. Moulton *et al*., 1989; Peres and Vooren, 1991).

The ovarian and uterine fecundity has been estimated as 14–44 and 10–41 for specimens in the Mediterranean Sea (Capapé and Mellinger, 1988), and litter size increases with maternal length. Pups are born after a twelve month gestation period at a size of about 30–40 cm (Compagno, 1984).

Males and females mature at lengths of about 125–158 cm and 140+ cm respectively (Capapé and Mellinger, 1988), with first spawning occurring at a length of about 150 cm. Though no age at maturity data are available for the North East Atlantic stock, 50% maturity in males and females in the South West Atlantic occurs at about 11 years (111 cm) and 15 years (123 cm) (Peres and Vooren, 1991)

Though there are no published age and growth studies of the North East Atlantic tope stock, tope from other areas have been aged successfully using vertebrae (e.g. Ferreira & Vooren, 1991; Francis and Mulligan, 1998) and tag returns (Grant *et al*., 1979).

19.5 Recruitment

Pups (24–45 cm length) are occasionally taken in groundfish surveys, and such data might be able to assist in the preliminary identification of general pupping and/or nursery areas (Figure 19.3). Most of the records for pups recorded in UK surveys are from the southern North Sea (IV c), though they have also been recorded in the northern Bristol Channel (VII f), and fishermen in this area have reported catching large numbers of juvenile tope in this area. Given the low catch rates and high variability of pups and juveniles in surveys, these data are unlikely to be sufficiently robust to estimate annual recruitment. Other sources of information regarding pupping grounds may be available from the commercial and recreational fishing sectors.

19.6 Stock assessment

19.6.1 Previous studies

No previous assessments have been made of tope in the north-east Atlantic, though several assessment methods have been applied to the South Australian stock (e.g. Punt and Walker, 1998; Punt *et al*., 2000; Xiao and Walker, 2000).

19.6.2 Data exploration and preliminary modelling

Landings data (see Section 19.2) and survey data (see Section 19.3) are insufficient to allow for an assessment of this species.

19.6.3 Stock assessment

No assessment was undertaken, due to insufficient data.

19.7 Reference points

No reference points have been proposed for this stock.

19.8 Quality of the assessment

No assessment was undertaken, due to insufficient data.

19.9 Pupping and juvenile fishing area closures

There is limited information on the distribution of tope pups, though they have been reported to occur in certain inshore areas (e.g. southen North Sea, Bristol Channel). The lack of more precise data on the location of pupping and nursery grounds, and their importance to the stock, precludes spatial management for this species at the present time. Nevertheless, protecting pupping and nursery habitats has been considered an important tool for the Australian stock, where seasonal closures and gear restrictions to protect pregnant females migrating to pupping grounds have been used (Walker, 1999).

19.10 Management considerations

Tope is considered highly vulnerable to over-exploitation, as they have a low population productivity, relatively low fecundity and protracted reproductive cycle. Furthermore, unmanaged, targeted fisheries elsewhere in the world have resulted in stock collapse (e.g. off California and in South America).

Tope are currently a non-target species in commercial fisheries, though some of the bycatch is discarded, due to the low market value in many areas. There has, however, been the suggestion of developing a targeted commercial fishery in the southern North Sea (e.g. *Fishing News*, 17 and 24 June 2005), though this is unlikely to proceed at the present time.

Tope are also an important target species in recreational fisheries; though there are insufficient data to examine the relative economic importance of tope in the recreational angling sector, this may be high in some regions.

Tope is, or has been, a targeted species elsewhere in the world, including Australia/New Zealand, South America and off California (Ripley, 1946; Walker, 1999; Paul and Sanders, 2001). Evidence from these fisheries suggest that targeted fisheries would need to be managed quite conservatively, as targeted fisheries off California collapsed, the Australian fishery's long history of management has only very recently enabled some stock recovery to begin (Olsen, 1954, 1959, 1984; Walker, 1999), and there is concern over the seriously depleted status of the south-western Atlantic stock (Eilia *et al*., 2005). Australian fisheries managers have used a combination of a legal minimum length, a legal maximum length, legal minimum and maximum gill-net mesh-sizes, closed seasons and closed nursery areas. However as the species is mainly taken in mixed fisheries in the ICES area, many of these measures are of less utility.

At least one unsustainable tope fishery has supplied export markets, particularly to Europe. The CITES Animals Committee has recognised the impact of international trade on tope stocks and recommended a workshop on the subject (Anon., 2004).

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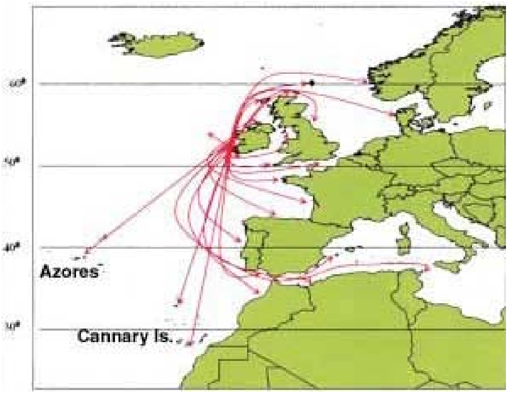

Figure 19.1. Tope in the North East Atlantic and Mediterranean. Location of tag returns from the tope tagging programme coordinated by the Central Fisheries Board (Ireland). Source: http://www.cfb.ie/fisheries_research/tagging/tope.htm.

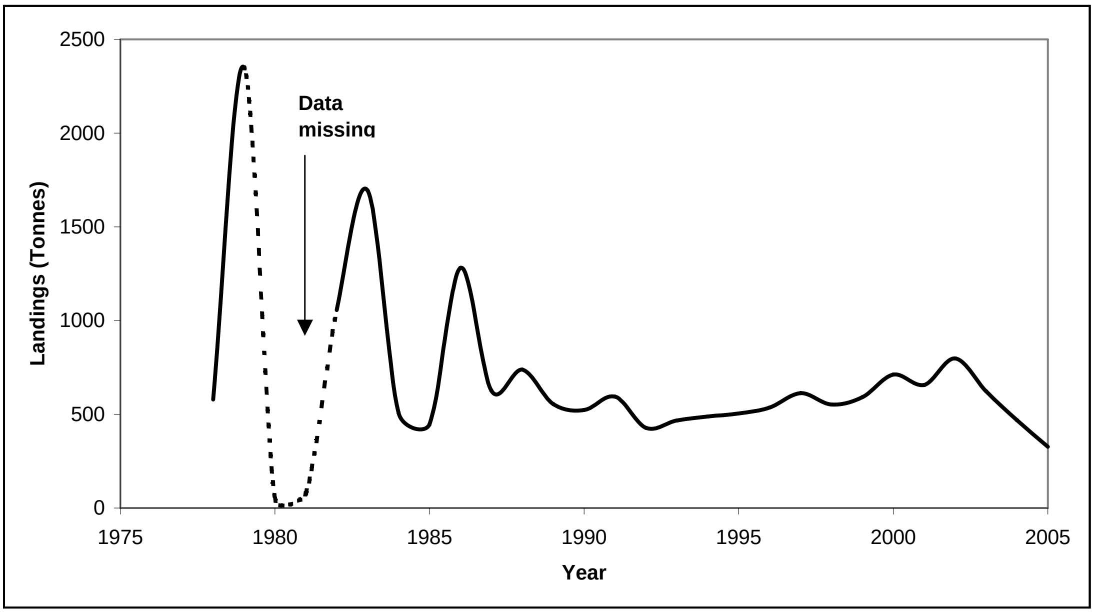

Figure 19.2. Tope in the North East Atlantic and Mediterranean. Annual landings of tope. These data are considered an under-estimate as some tope are landed under generic landings categories, and no species-specific landings data are available for the Mediterranean Sea and North-west African waters.

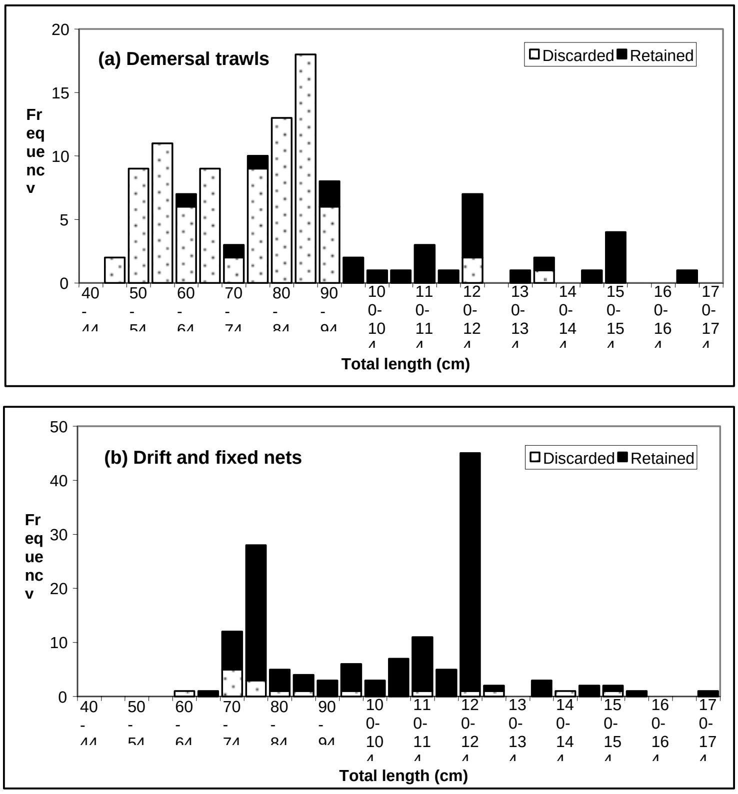

Figure 19.3. Tope in the North East Atlantic and Mediterranean. Length frequency of discarded and retained tope in (a) demersal trawl and (b) drift and fixed net fisheries as observed in UK (England and Wales) discard sampling.

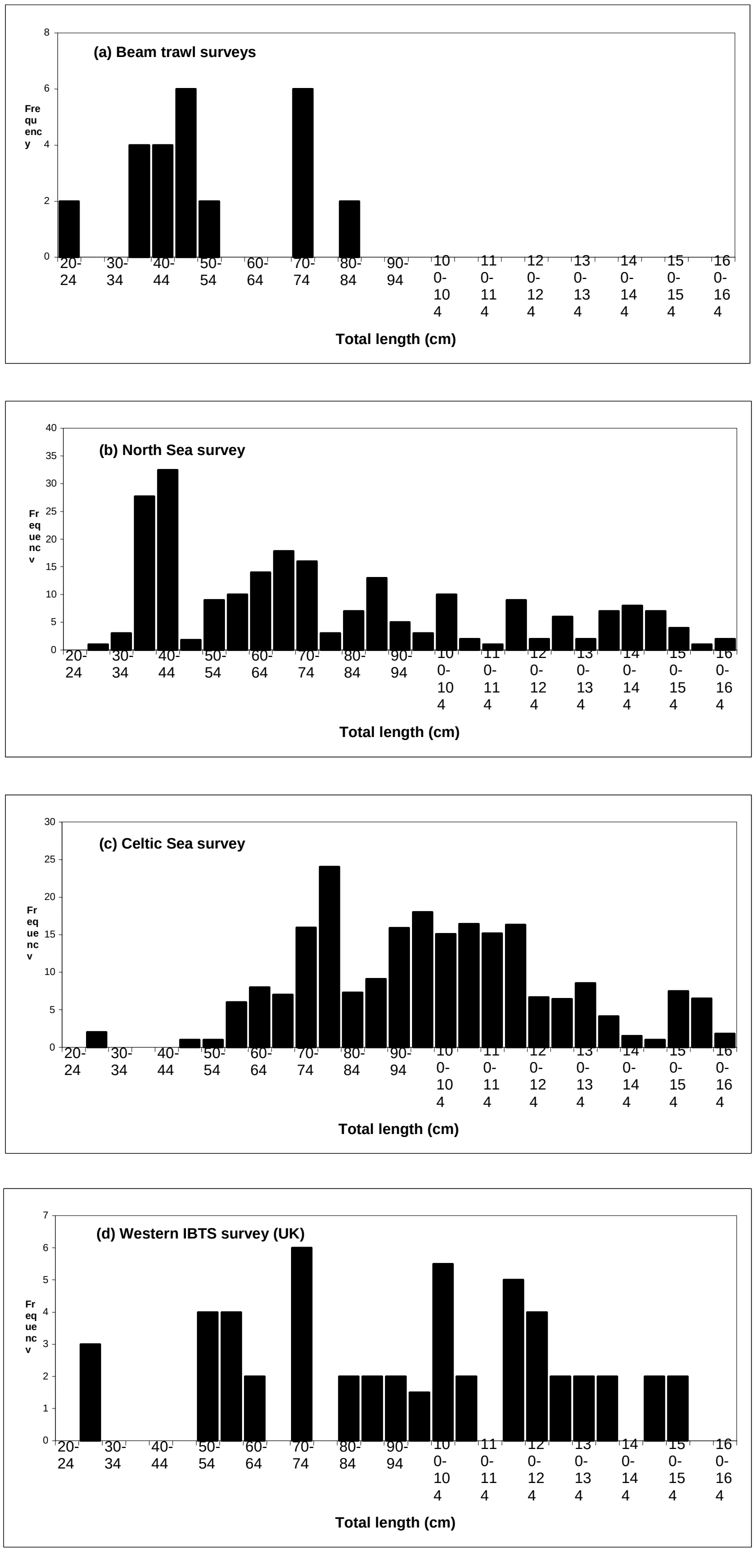

Figure 19.4. Tope in the North East Atlantic and Mediterranean. Length frequency graphs for UK surveys including (a) beam trawl surveys in the English Channel, Bristol Channel and Irish Sea; (b) North Sea; (c) Celtic Sea and (d) Irish Sea and Celtic Sea. For further information on these surveys see Sections X and Y.

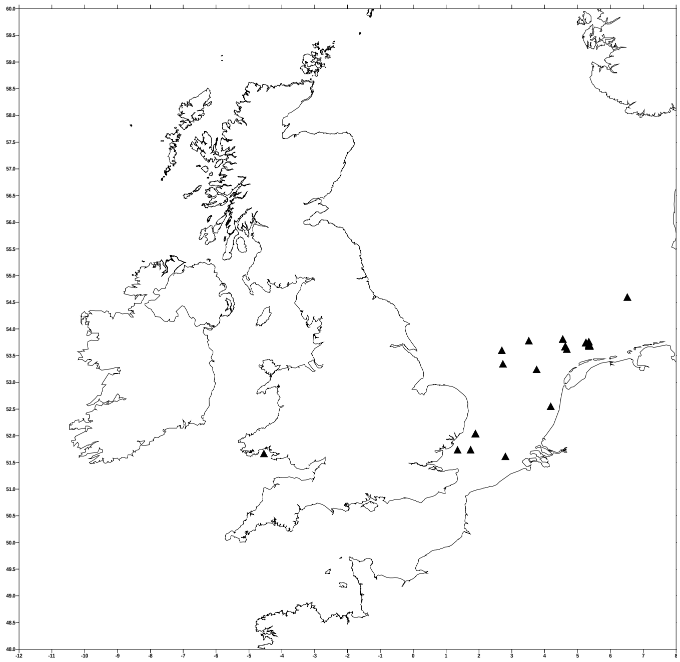

Figure 19.5: Tope in the North East Atlantic and Mediterranean. Sites where tope pups (24–45 cm total length) have been reported during UK surveys.

Table 19.1. Tope in the North East Atlantic and Mediterranean. Reported species-specific landings (Tonnes) for the period 1978–2005. These data are considered an under-estimate as some tope are landed under generic landings categories, and species-specific landings data are not available for the Mediterranean Sea and limited for North-west African waters. No reported landings from ICES Subarea V.

ICES Division IIIa-IV	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	32	22	Na	na	26	26	13	31	13	14	18	12	17	16
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	na	na	Na	na	na	na	na	na	na	na	na	18	14	21
Total (IIIa-IV)	32	22	0	0	26	26	13	31	13	14	18	30	31	37
ICES Division VI-VII														
France	522	2076	Na	na	988	1580	346	339	1141	491	621	407	357	391
Ireland	na	na	Na	na	na	na	na	na	na	na	na	na	na	na
Spain	na	na	Na	na	na	na	na	na	na	na	na	na	na	na
Spain (Basque country)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	na	na	Na	na	na	na	na	na	na	na	na	56	45	47
Total (VI-VII)	522	2076	0	0	988	1580	346	339	1141	491	621	463	402	438
ICES Division VIII														
France	na	237	Na	na	na	63	119	52	103	97	66	39	34	38
Spain	na	na	Na	na	na	na	na	na	na	na	na	na	na	na
Spain (Basque country)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	+	+	+	+	+	+	+	+	+	+	+	-	-	-
Total (VIII)	0	237	0	0	0	63	119	52	103	97	66	39	34	38
ICES Division IX														
Spain	na	na	Na	na	na	na	na	na	na	na	na	na	na	na
Total (IX)														
ICES Division X														
Portugal	23.7	15.4	50.5	77.4	42.4	23.6	29.3	24.1	24.1	24.1	33.8	23	55.7	80.6
Total (X)	23.7	15.4	50.5	77.4	42.4	23.6	29.3	24.1	24.1	24.1	33.8	23	55.7	80.6
Other														
France	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Area 34 (Central East Atlantic)														
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL LANDINGS	**577.7**	**2350**	**50.5**	**77.4**	**1056**	**1693**	**507**	**446**	**1281**	**626**	**739**	**555**	**523**	**594**

Table 19.1. (continued). Tope in the North East Atlantic and Mediterranean. Reported species-specific landings (Tonnes) for the period 1978–2005. These data are considered an under-estimate as some tope are landed under generic landings categories, and species-specific landings data are not available for the Mediterranean Sea and limited for North-west African waters. No reported landings from ICES Subarea V.

ICES Division IIIa-IV	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Denmark	-	-	-	-	-	-	-	3	8	4	5	5	5	8
France	10	11	12	8	11	5	11		11	11	6	6	3	3
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	+
UK	15	15	20	25	14	22	13	13	13	11	13	12	8	10
Total (IIIa-IV)	25	26	32	33	25	27	24	16	32	26	24	23	16	21
ICES Division VI-VII														
France	235	240	235	265	314	409	312		368	394	324	284	209	181
Ireland	na	na	na	na	na	na	na	na	na	4	1	6	4	na
Spain	na	na	na	na	na	na	na	na	na	+	242	3	na	na
Spain (Basque country)	-	-	-	-	-	-	-	-	-	+	+	3	15	10
UK	53	47	51	38	39	33	42	61	97	71	60	55	64	66
Total (VI-VII)	288	287	286	303	353	442	354	61	465	469	627	351	292	257
ICES Division VIII														
France	34	40	54	44	78	40	46	+	71	58	49	60	16	29
Spain	na	na	na	na	na	na	na	na	na	9	13	10	na	na
Spain (Basque country)	-	-	-	-	-	-	-	-	-	9	6	10	10	14
UK	-	-	-	-	-	-	-	-	-	1	+	3	8	6
Total (VIII)	34	40	54	44	78	40	46	0	71	77	68	83	34	49
ICES Division IX														
Spain	na	na	na	na	na	na	na	na	na	na	na	na	76	na
Total (IX)														
ICES Division X														
Portugal	80.3	115	116	124	79.6	104	128	129	142	81.7	77.3	69	51	na
Total (X)	80.3	115	116	124	79.6	104	128	129	142	81.7	77.3	69	51	0
Other														
France	-	-	-	-	-	-	-	386	-	2	-	-	-	-
Area 34 (Central East Atlantic)														
Portugal	-	-	-	-	-	-	-	-	2	1	2	98	na	na
TOTAL LANDINGS	**427**	**468**	**488**	**504**	**536**	**613**	**552**	**592**	**712**	**657**	**798**	**624**	**469**	**327**

Annex 1: Participants

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Annex 2: Draft 2007 Resolutions

2005/2/ACFM25 The **Working Group Elasmobranch Fishes** [WGEF] (Chair: Jim Ellis, UK) will meet in Galway, Ireland from 22nd–28th June 2007, to:

a) Update the description of elasmobranch fisheries (including those on deep-water sharks) in the ICES area and compile landings and discard statistics by ICES Subarea and Division;

b) Assess the stock status of demersal elasmobranchs in the following eco-regions; North Sea, Skagerrak and Eastern Channel, Celtic Seas, Biscay and Iberia.

c) Make preparations for assessmets of stock status, of other species/stocks scheduled for consideration in 2008 and 2009.

d) Make preparations for a potential assessment working group with ICCAT, in 2009, on blue shark and shortfin mako shark.

e) Obtain from IBTSWG collated raw data and, if possible, time-series of abundance for the following species, stocks: *Mustelus* spp. in VII and Ivc; *Raja clavata* in IV, VIIf and VIa; *Leucoraja naevus* in IV, VIa, VIIa, VIIbcej and VIIIa,b and *Raja microocellata* in VIIf.

f) Report on the development of a standard exchange format to facilitate the submission of biological, fisheries,discards and survey data to WGEF.

g) Work with IBTSWG to produce a photo-ID key for elasmobranchs in the ICES area.

h) Begin to compile all available conversion factors for elasmobranch species.

i) Work towards the production of an ICES Cooperative Research Report on the "Status of Elasmobranchs in the NE Atlantic"

j) WGEF will report to ACFM by 20th July 2007 and make its report available for the attention of the Living Resources Committee.

Priority:	High. The work of the Group is essential if ICES is to provide advice on elasmobranch stocks, as required by the MOU with the EU.
Justification	The work done within WGEF has included development of assessment methodology for a selection of elasmobranch case study species, which have very different population and reproductive dynamics from the con-ventionally assessed teleosts. ICES is expected to give management advice for elasmobranch stocks (MoU between ICES and EC), and the scientific remit of this Group will be to adopt and extend these methods and review and define data requirements (fishery, survey and biological parameters) in relation to the needs of these analytical models and stock identity, and to carry out such assessments as are required by ICES cus-tomers. Spurdog, skates and rays, lesser spotted dogfish and Porbeagle mentioned as new species EC wants advice on according to the new EC-ICES MOU. It is important that the progress made by WGEF through the EU-funded DELASS project is maintained and built upon. b) is particularly relevant in relation to the EC data collection regulation [Action Numbers a): 2 b): 1.2.1 c): 1.2.2 d): 4.2
Relation to Strategic Plan:	Directly relevant it allows ICES to respond to requested advice on elasmobranch fisheries. It is also necessary to ensure that elasmobranchs are considered in the ecosystem approach and in fleet-based forecasts that ICES will be carry-ing

	out.
Resource Requirements:	**No specific resource requirements, beyond the need for members to prepare for and participate in the meeting.**
Participants:	**Most countries are now participating in the group and membership includes biologists, mathematicians, fisheries specialists and environmentalists. There is a wide variety of interests represented. However some countries having the major elasmobranch fisheries are not participating in the group, namely France and Spain.**
Secretariat Facilities:	Support is required to extract survey data from ICES databases. Otherwise very little input required from secretariat.
Financial:	**It is hoped to publish the work of WGEF as a CRR.**
Linkages To Advisory Committees:	**WGEF reports to ACFM**
Linkages To other Committees or Groups:	**Close cooperation with LRC is essential. This should include presentation of WGEF report at LRC meetings.** IBTSWG to provide time series of elasmobranch abundance as specified above. WGFTFB to provide information on mitigation of shark by-catch in longline fisheries. Continue liaison with WGDEEP in refining data and information on deepwater sharks. But these species should continue to be dealt with by WGEF. Link with SGLTA for framing precautionary reference points. WKSAD to advise on appropriate methods for examining catch rates for species that are often only encountered occasionally in hauls (i.e. the majority of trawl stations have zero catches), but may have comparatively high catch rates at occasional sites. Measures to reduce by-catch of sharks, especially in tuna and swordfish fisheries should be evaluated by WGFTFB.
Linkages to other Organisations	ICES should collaborate with ICCAT on assessments of pelagic sharks. ICES **should extend its brief as far as possible in order to collate and refine landings data on pelagic sharks.** WGEF recommends to work towards a pelagic assessment working group with ICCAT in 2009.

Annex 3: ACFM Sub-group Review of the Working group on Elasmobranch Fishes [RGEF]

Riga, 21-23 August 2006

Composition of the review group

ACFM sub-group chair: Massimiliano Cardinale (Sweden)

ICES WGEF chair: Maurice Clarke (Ireland)

Reviewers: Dave Reid (UK-Scotland) and Maris Plikshs (Latvia)

General considerations

This is the first time that WGEF report has been reviewed in a meeting while last year this was done by correspondence. The members of ACFM review group (RGEF) considers that the WG has answered those TORs relevant to providing advice. RGEF commended the WGEF for their progress in the compilation and validation of basic data and for the appropriateness of the assessment methods used for those stocks (e.g. Spurdog) for which sufficient information was available to model stock dynamics. However, several species are still facing the problem of multi-species aggregated landings data that impede even a basic assessment of the status of the stock. Effort has been deployed to disaggregate those data although it is not exhaustive for all the stocks considered here and more work is needed. RGEF noticed that the WG has improved the discussion around both data quality and stock identity. However, particularly for the latter issue, effort should be devoted to collate all available information, both quantitative and qualitative, and, also recommendations for future studies should be highlighted by the WG.

Considering the difficulties linked to the data quality, the RGEF consider that all available information on the general biology, especially reproductive biology, and ecology of the species should be provided. Moreover, crucial information for stock status evaluation should be represented by trends in mean length, average maximum length and diversity index of size, areas occupied, changes in length/maturity, and other viable indexes of stock status from both survey and landings data and that information should be collated into species specific stock annex. Moreover, the RGEF consider that distribution maps, when data are available, of the species should be provided for all species using available survey data. *Biological and ecological information should constitute the core of the advice in case of data poor situation as for several elasmobranches species. In such cases, more importance for the advice should be given to evaluate life trait history of the exploited species more than on the landings or catch statistics itself, especially when considering the low productivity, high longevity, aggregation behaviour of those species and hence vulnerability to fishing.* This could be achieved by using the approach of SGRESP, compiling “ID-cards” for each stock. These would then be incorporated into the Stock Annex and also appear in the planned Cooperative Research Report.

A great deal of effort has been deployed to improve the format and editing of the report as pointed out by the former RG. However, there are still formatting issues to be solved (e.g. biomass unit in 2.21 for spurdog; 2.24 vertical axis is missing; 2.26 legend is missing) and the RGEF consider that the WG dedicate further attention to the formatting of the report.

Most of the species covered in the report have a wide distribution across the ICES area. As such they are likely to be relatively unaffected by ongoing climate change. In the case of some of the demersal shark and ray species, there may however be local climate change effects.

Generally, although further effort should be deployed to solve multi-species aggregated landings data and stock identity and, collate basic biological and ecological information of the assessed species, RGEF considers that presented information are robust enough to form the base of the advice for elasmobranches in the North Atlantic waters.

1 Introduction

The introduction gives a wide overview of the report. Sources of the basic landings data are given in Section 1.5 and related tables although for several species difficulties arises since landings statistics are given by group of species. Effort is dedicated to provide data for individual species although for many groups of species this need to be addressed in future reports. Nevertheless, specific splitting procedures are given in the relevant sections. Lack of cooperation from certain countries is now explicitly addressed through the report. Recommendations are considered appropriate.

2 Spurdog in the North East Atlantic

The WG has highlighted the main concerns related to the data quality (i.e. landings and discard) and stock identity (see also General considerations) and this is now well considered and explained in the report. Also, the WG has addressed most of the concerns raised by the RG in 2005.

In general presentation of the modelling part is well structured and critically considered even though considering the concerns highlighted above. However, as already pointed out by the former RG, more deal of attention should be give to improve the quality of the index of abundance and validate the life history parameters more than on the statistical modelling in the future.

Before further analysis is conducted it will be necessary to make a proper collation of available IBTS data that allows coverage of the entire distribution area of this migratory stock within the shortest time window (e.g. based around the Q4 western IBTS). Those data could also be used to elucidate the migratory patterns of this species over the North East Atlantic.

The model used here is able to fit the observed data with adequate accuracy and the statistical treatment of the data is appropriate here. However, concerns are raised in the way survey data and historical data are combined. Recent survey data consists of standardized abundance data (n/h^{-1}). The RGEF consider that, in the light of the large differences in size of this species, the WG should also explore CPUE biomass indices when modelling spurdog dynamic. Results of the single surveys should also be briefly presented. Month is modelled as a quadratic variable but the rationale for this is not given in the report.

The crucial points in the models are selectivity estimates of the surveys, historical exploitation patterns and growth rates. RGEF consider that more details should be give on how selectivity of the surveys was derived by fitting proportions-by-length data. The assumption of similar historical exploitation patterns is probably too forceful and should be tested thoroughly. Also growth consistency could be easily addressed testing for yearly growth rates variations with the available data. Sensitivity analysis should be extended to those parameters and not only be focused on recruitment variability. The choice of M 0.1 for most of the ages needs to be explained given the literature range of 0.1-0.3.

Length information should be used more extensively and presenting trends in average maximum length and diversity index of size could be useful.

Simulation of the maximum length regulation is a useful exercise although it is heavily dependent on the assumptions of high survival rates of discarded individuals. Effort should be devoted to develop specific projects able to assess this assumption instead to further develop the modelling part.

Management considerations are vague and indeed difficult to interpret. This section is more a description of the stock status more than a message for the managers. The RGEF has preferred that the WG to be more specific in expressing their management considerations for this stock.

3 Deepwater "siki" sharks in the Northeast Atlantic

WG provides valuable insights into the state of the stocks. However, the RG noted that little use was made of the survey data (e.g. Scottish trawl survey from 1998), beyond treating them as CPUE series together with the commercial data.

Detailed information on the species distribution is provided for leafscale gulper shark but not Portuguese dogfish. It would be useful to have the information at the same level for both species and if possible distribution maps for both. Some indication of proportion of the two species compared to all other sharks would be useful. The Hareide reference is wrong and the Clarke refs should be the relevant peer-reviewed papers not an unpublished thesis.

The text says that landings have declined since 2003 due to quotas and mixed species restrictions. But later there is clear evidence of CPUE decline and this will obviously affect landings when effort is constrained or reduced or when the stock is reduced as well. The landings data in Figure 3.1 are difficult to use in order to isolate trends by area. It is questionable to say that landings have declined since 2003. It could be argued for a period of expansion of the fisheries in 90–97, a stable in 98–2001 and fluctuation since 2002. The different temporal patterns in countries fisheries are important and the paragraph describing it is confusing, again suggesting graphing by country.

The splitting of catches is very useful in understanding the basis of the catches for both species. However, given that the French CPUE is for "siki" and that the broad trends are similar for the two species, the WG could also plot the common landings data. Some idea of the sensitivity of their analysis to these splits would be useful. The WG should also consider whether it would be better to work with the two species combined.

Given the long life of these species and the clear evolution in national involvement and areas, there is a need to obtain information on gear/vessel/area changes for this fishery, possibly via WGFTFB.

The text on logging deep water sharks should make clear that this is *over* reporting of these species to establish track record. The WG should also note that there is some evidence for illegal landings available. The WG suggests that discarding is a minor problem but lists a range of more serious discarding examples. These do not suggest that this is a minor problem indeed and definitely needs better data to quantify this.

Ghost fishing is not a discarding problem, and should be treated separately. WGEF should provide an estimate of the induced mortality and comparison to M. There is probably also a trend here as more nets are abandoned and lost, given the long life of these gears.

The French CPUE analysis is very useful, and illustrates the importance of understanding the fishery and its dynamics. The unit of effort in longliners is a concern. The analysis does not consider soak time, although this may increase as catch rates drop. While data on this may not be recoverable, interviews with fishers may help to show whether or not they leave lines out longer now than at the start of the fishery.

It is to be regretted that there is still data that is not being made available to the WG. The previous RG suggested that GLM using possible changes in fleets and fishing patterns was required. This has been done but no results were presented.

It would seem strange to exclude the post 2001 data when an explanation for the anomalies has been found. The WG should investigate ways that this new data can be incorporated, for example, by including categorical variables in the GLM for areas fished or fishing pattern.

The conclusions of exploratory assessment seem sensible, but not enough details are provided. It would be useful to know how the models were set up, what the covariates were and why. Also it is a very strong constraint to reject the model because all the indices do not correlate, especially when combining fishery-dependent and fishery-independent CPUE data. There are likely to be many changes in fishing pattern in this type of fishery over 20 years, so these need to be handled and/or encompassed.

The longline data in IX suggests a quite stable fishery, as compared to the decline in say XII. However, this is a relatively small component of the fishery, and the WG should not overemphasise trends in IX versus the other areas.

4 Other deepwater sharks from the Northeast Atlantic (ICES Subareas IV–XIV)

The reviewers noted that little information is available and hence no stock assessment was performed.

There is still the need to develop liver weight conversion factor for those species. The RG also recommends that existing national landings and biological data as well as discard estimates should be made available to the next WGEF meeting.

As some surveys (Azorean demersal longine, Greenland demersal and Scottish Deepwater surveys) are available, the CPUE trends based on abundance index or frequency of occurrence for some species in some areas could be useful in order to evaluate the stock status. In that context, it is not stated why survey data are not used to develop CPUE time series although biological information from surveys is presented.

It is stated that special attention should be made for management of Portuguese dogfish and leafscale gulper shark. In this context, at least the information on bycatches ratios should be presented.

See general comment on the use of biological and ecological information (in *italics* in General considerations).

5 Kitefin shark (entire ICES area)

The RG noted that no new information was available. As the fishery is driven by market (fish oil price), directed fishery is stopped already since 2 years. In such situation only fisheries independent surveys could reveal stock development trends. Survey information is not presented in the report although a longline survey in the Azores is conducted.

See general comment on the use of biological and ecological information (in *italics* in General considerations).

6 Porbeagle in the North East Atlantic (ICES Subareas I–XIV)

As for most of the elasmobranches treated here, both landings data quality and stocks identity are a major problem in assessing this stock. The WG has obtained for the first time fishery dependent CPUE time-series that could help to elucidate the status of the stock. However, more work will be devoted during the next years to evaluate both landings and CPUE data. Although useful, the CPUE time series is short especially when considering that porbeagle fishery has a long tradition and the species is particularly sensitive to exploitation.

See general comment on the use of biological and ecological information (in *italics* in General considerations).

7 Basking shark in the North East Atlantic (ICES Subareas I–XIV)

The WG was able to provide a more detailed description of the history of this fishery, particularly from Norwegian sources. The RG consider that it is important to know which types of fishery have currently the higher discard rates of basking shark. The RG is concerned at the suggestion of sustainable fishing on a stock which is listed as endangered in numbers of international conventions.

The liver weight conversion is a problem here as for many other shark species, and the value used should be investigated further. The reported Portuguese landings of 1–1.5 tonnes are suspect given the size of this animal and these values perhaps refer to livers or fins only.

On a broader scale, the RG was concerned that the high value attached to shark fins might encourage an increase in targeting of this species, and encouraged further investigation of the market conditions and evidence for targeting.

See general comment on the use of biological and ecological information (in *italics* in General considerations).

8 Blue shark in the North Atlantic (FAO areas 21, 27, 34 and 31)

It is the first time that blue shark is included in the report. The WG devoted a good effort to summarize existing knowledge on fisheries and landings. However the landing estimates are unreliable and insufficient and more data need to be available to the working group to elucidate stock trends.

See general comment on the use of biological and ecological information (in *italics* in General considerations).

9 Shortfin mako in the North Atlantic (FAO Areas 27, 21, 34 and 31)

It is the first time that shortfin mako is included in the report. The only available data are by catch data from longline fisheries that are likely to show either that the species has increasingly reported in the landings or that the fisheries is expanding in the latest years. There is any biological and ecological information that could be used to make advice on the stock.

See general comment on the use of biological and ecological information (in *italics* in General considerations).

10 Demersal elasmobranchs in the Barents Sea

New fishery-dependent and surveys information were presented at the WG on length frequency and spatial distribution of several species of skates. However, the time series is too short and last years are missing in order to allow the WG to draw any conclusions on the state of the stocks. The data compilation and analysis are planned to be finalized and presented in 2008. Time series of both CPUE and mean length mean maximum length information should be also included in the future.

11 Demersal elasmobranchs in the Norwegian Sea

The WG devoted a good effort to summarize existing knowledge on fisheries and landings. However the landing estimates are unreliable and insufficient and more data need to be available to the working group to elucidate stock trends. A study has been initiated by the University of Trømso and it will possibly deliver information on the status of the different stocks in the area in the future.

12 Demersal elasmobranches in the North Sea, Skagerrak, Kattegat and eastern Channel

The RG consider that although the biological sampling of demersal elasmobranches is available, data were not presented at the WG. National data should be made available for the next WGEF meeting. The same applies for discards.

The RG acknowledge the WG attempt to present new information on the distribution of demersal elasmobranches in the North Sea and trends in abundance using IBTS data. However it would be useful if for example, deep-sea species were presented in the relevant section and not in this one. RG also noted that presented information on *R.. clavata* differ from last years report with a decreasing trend instead of a stable situation. More explanation on this would be useful.

In the last year's report assessment of *R. clavata* was based on IBTS survey in the North Sea. This year the assessment was not updated because of potential species identification problem. In this respect it would be useful if the WG could address how reliable is the new information presented in the Section 12.5, that also are based on IBTS survey data, in the context of species identification problems.

13 Demersal elasmobranchs in Iceland and East Greenland

No major comment except that more data need to be made available to the WG. The WG appear to have access to survey series in Iceland, Greenland and from Germany. These were used for current distributions and length frequency, but not to develop time series of distribution changes, catch rates or presence/absence of the species. This should be completed for the next meeting.

14 Demersal elasmobranchs at Faroe Islands

No major comment except that more data need to be made available to the WG. The increase in catches in recent years is a concern in the absence of species data. No survey information was available, although there is a bottom trawl survey effort conducted by Faroe on the Faroes Bank. Much of this data is published and available on line.

15 Demersal elasmobranchs in the Celtic Seas (ICES Subareas VI & VII (except Division VIId))

The situation in this area is broadly as it was in the last report. It would be useful if the WG could report clearly on which new information has become available and how this might have changed the perception of the stocks. The overall structure of the report makes it read more as a catalogue of information rather than a collation of data and conclusions there from. In part this is inevitable, given the range of areas in the ecoregion and the many species, but this makes focus a priority. It is difficult to draw conclusions from the available survey data. The proposal of the WG to focus on a small number of demersal "stocks" is the correct approach, and would help considerably. The WG should consider the proposal of the 2005 RG to look at distribution areas and densities and also presence/absence data from these surveys.

There are clear problems with species identification, and solutions to this need to be sought. The problem of using generic categories is also of major concern. The impression is that this is getting worse not better. Discards often show high variability, possibly due to low sample size and focusing on a few stocks may help. It is frustrating that Irish discard rate data could not be used for splitting due to lack of comparable landings data.

16 Demersal elasmobranches in the Bay of Biscay and Iberian waters (ICES Subareas VIII and Division IXa)

The landings are mainly reported in groups of species and it remains important to obtain some information on how to split these.

The interpretations of figures 16.1 and 16.2 are a little too optimistic. Yes there is noise in the Rajidae, but the overall pattern could be decline from a peak of around 6000 tonnes in the late 1980s to 3000 tonnes more recently. The *S. canicula* also shows a gentle decline from 1998 (2200 t) to now (1600 t).

Given the long *S. canicula* tagging programme, some results and interpretations would have been useful. Distribution maps and catch trends for the Portuguese surveys would help with interpretation, as would maps from the French surveys. The Spanish Cantabrian surveys were not included and those have been analysed for elasmobranches.

The interpretations of the LPUE series (Figure 16.5) are selective. For example, *S. canicula* in VIII increases and is noted, but goes down in VII and is ignored.

The Management Considerations are also selective in this use of data. The same choice of data on leafscale gulper shark is made. The Rajidae interpretation is also suspect. This looks like a steady and major decline from 1998 in VIII (200–100 kg/day), and in VII from 1996, 150 to 30 kg/day in the latest years. There is no figure in the report for French survey results for *M. asterias*.

17 Demersal rays in the Azores and Mid-Atlantic Ridge

Information is scarce in this area apart from the Azores. Survey indicates that the population of rays may be being exploited sustainably, although landings have declined in recent years. Neither data set is commented on by the WG. As in many of these fisheries species identification is a problem, and there is little market or discard information. The WG should consider the results of the surveys in more details as these are probably the best data for managing these stocks.

18 Other rays

This Section represents a useful round up of other species which are or may be in the future, implicated in commercial fisheries. It includes advice on which species may be of importance and why. It is difficult to see what further can be done in the assessment forum for these species, beyond updating the information and bibliography in this section.

19 Tope in the North East Atlantic and Mediterranean

It is the first time that tope is included in the report. The WG devoted a good effort to summarize existing knowledge on fisheries and landings. However the landing estimates are unreliable and insufficient and, more data need to be available to the working group to elucidate stock trends.

See general comment on the use of biological and ecological information (in *italics* in General considerations).