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Exploration of the Sea

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**REPORT OF THE STEERING GROUP FOR THE PRODUCTION AND PUBLICATION
OF AN ATLAS OF NORTH SEA FISHES**

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During the Council Meeting in La Rochelle in 1991, ICES adopted the following resolution (C. Res. 1991/2:16):

The Steering Group for the Production and Publication of an Atlas of North Sea Fishes will meet from 29 April to 1 May to prepare a draft version of the Atlas.

The meeting was attended by:	Trevor Boon	UK, England
	Henk Heessen	Netherlands
	John Hislop	UK, Scotland
	Ruud Knijn	Netherlands

The proposal to produce an Atlas was first discussed in 1988 during the Statutory Meeting in Bergen (Heessen *et al.*, 1988). In 1989 a Study Group met for three days in Lowestoft to investigate the feasibility of the project (Anon., 1989) and in the same year a Steering Group was formed to organise the necessary work (ICES C. Res. 1989/4:8). This Steering Group had two meetings: on 7 and 8 May 1991 in Lowestoft and from 29 April to 1 May 1992 in IJmuiden. In addition to the members of the Steering Group R. Knijn worked on the Atlas at the IJmuiden Institute during most of 1991 funded by the Dutch Government and during 1992 his salary was funded by the European Community as part of the FAR programme.

Aim of the Atlas

The aim of the Atlas of North Sea Fishes is to draw the attention of a wider public to the existence of an enormous amount of information that is collected during routine bottom trawl surveys. This information is hiding in various data bases, and for the greater part, remains unused.

Data used

The survey data used for the Atlas are taken from the ICES coordinated International Young Fish Survey (IYFS), the English Groundfish Survey (EGFS), the Scottish Groundfish Survey (SGFS), and some additional Dutch bottom trawl surveys. Three year's data (1985-1987) are used to describe the winter and summer distribution of all 98 fish species, or species groups, caught in a total of 2264 hauls. The IYFS data for February cover the whole North Sea, Skagerrak and Kattegat, the summer surveys are restricted to the North Sea.

Analysis

Originally it was expected that most of the data would be extracted from the IYFS data base at the ICES Secretariat, but for logistic reasons the analyses were done at the institutes in IJmuiden and in Lowestoft. At the Lowestoft Laboratory particular attention was given to the combination of catch data from dissimilar gears as used during the summer surveys: Aberdeen, Granton- and GOV-trawls. The summer catches of 15 common species were corrected for differences in catchability. For the less abundant species the gears were regarded as having equal catchability.

Contents of the Atlas

In a number of introductory chapters the general purpose of recruitment surveys is explained and some details are given on the surveys from which data are used. The gear, fishing methods and sampling procedures are described. Some background information is provided on the physical and biological environment in the North Sea and in a brief overview the developments in the fisheries during this century are described. Finally the presentation of the data is explained and what limitations the Atlas data have.

The 98 species are grouped in three categories: 15 common and or commercially important A-species, 48 frequently caught B-species, and 35 C-species of which in all less than 20 individuals were caught.

For A- and B-species four charts give the distribution of mature fish in winter and summer, and of immatures in winter and in summer. To obtain the distribution of mature and immature individuals the L50 for females is used to split the length composition of the common A-species into juveniles and adults. For the B-species the length compositions are split at 40% of the maximum observed length. Two charts are given for the C-species, one with all winter catches combined, and one with all summer catches.

The distributions in mean number per hour fishing over the years 1985-1987, are shown as

expanding dots. The categories used are: ≥ 10000 , ≥ 1000 , ≥ 100 , ≥ 10 , ≥ 0 and 0.

Additional information is given on: spatial distribution, length frequency distribution, the individual and the population. The amount of text will again vary by species category: 3 pages for A-species, 1 page for B-species and half a page for C-species. The text is based on a number of relevant publications. References are given at the end of each species description.

Apart from the scientific name, the fishnames will be given in English, French, German, Danish, Norwegian, Dutch and Swedish. A line drawing by Peter Stebbing (as used in Wheeler's "Key to the Fishes of Northern Europe") will be added.

Three representative examples, of an A-, a B- and a C-species, are added to this report. Unfortunately, the distribution maps are not yet in their final version.

Especially with the aim of reaching a wider distribution, a glossary will be added, as well as indices with the fishnames in the different languages.

Publication

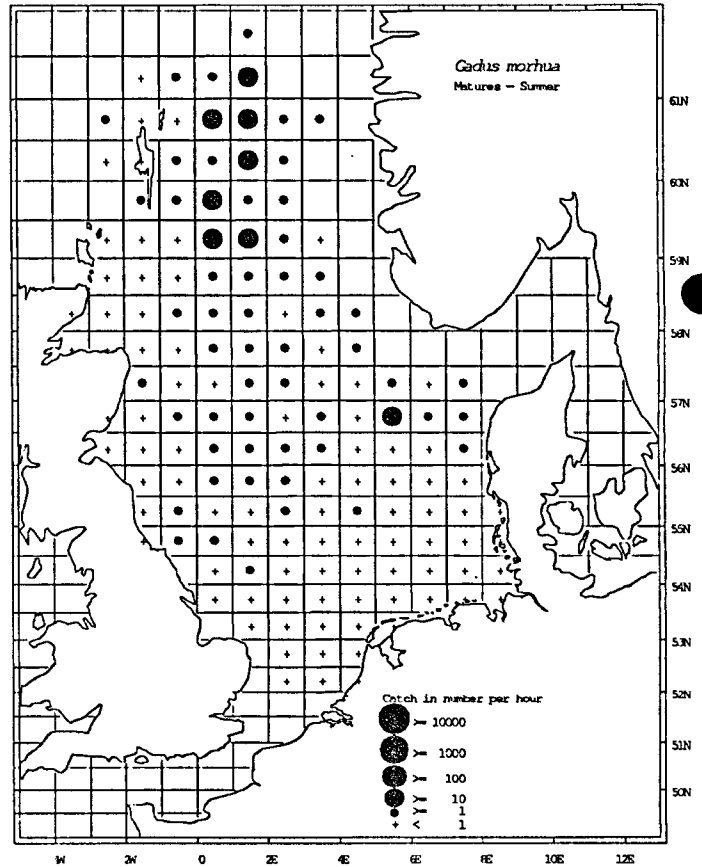
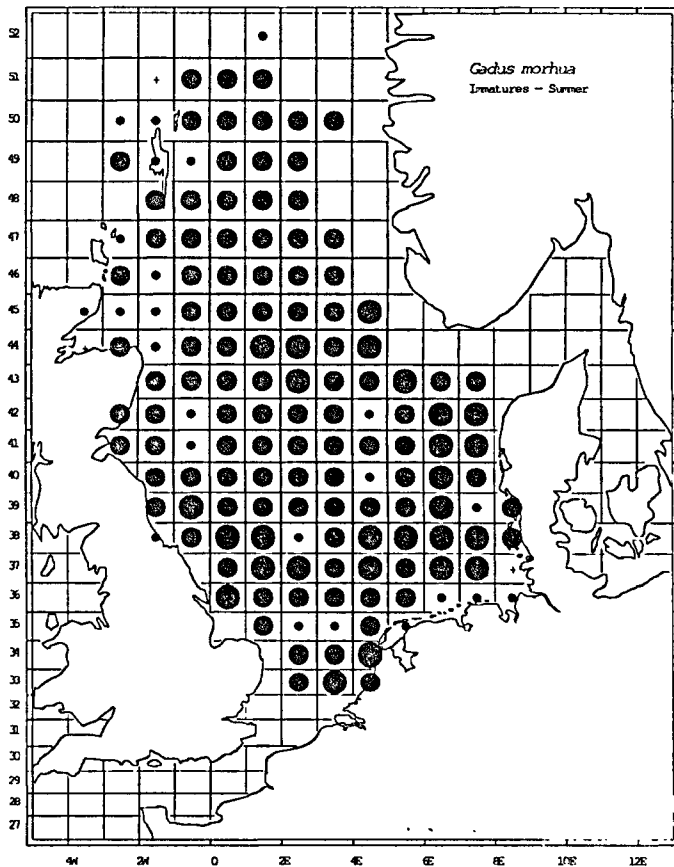
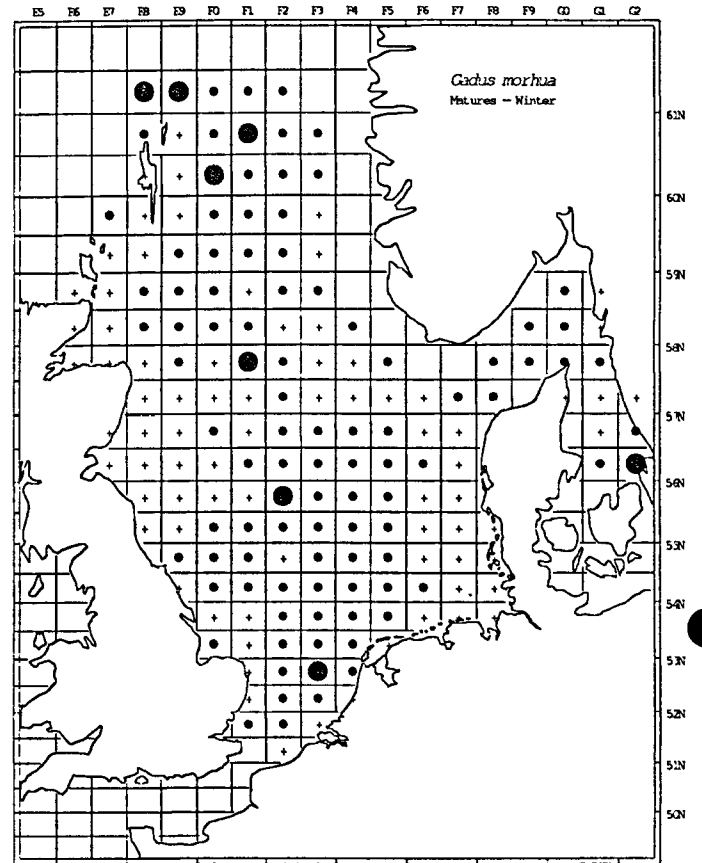
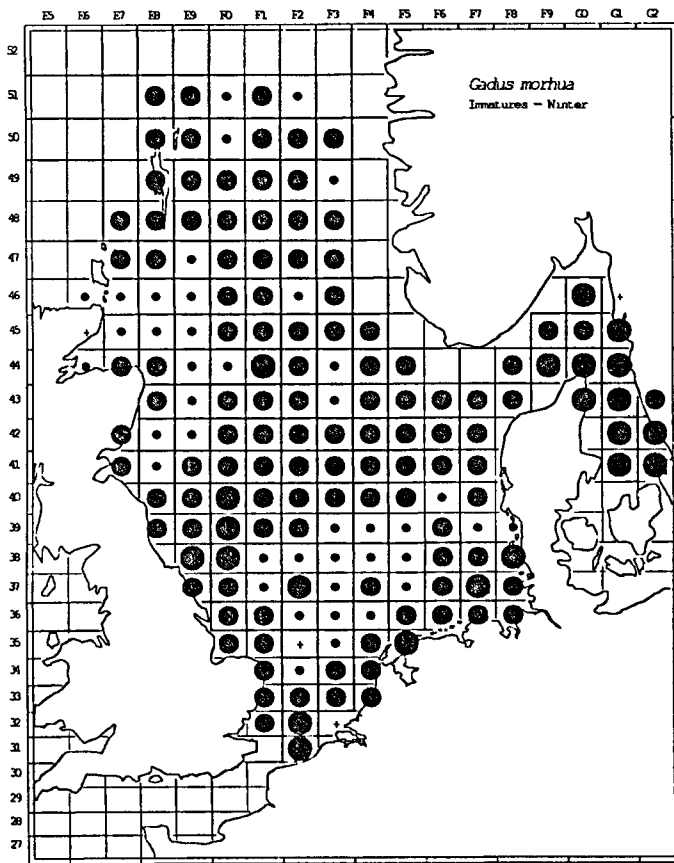
It is intended to publish the Atlas in the ICES Cooperative Report series. The number of pages will be approximately 255.

Digitized data

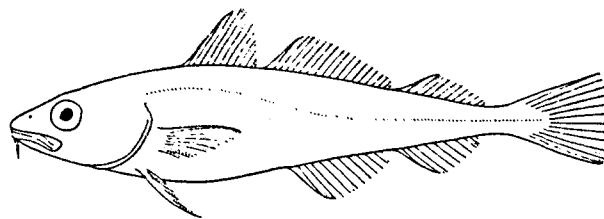
Several people have expressed their interest in the Atlas data in a digitized format. Although the Steering Group realises that these data are valuable to several scientists it is the remit of the group to produce a paper edition of an Atlas. To whom and how these data could be made available in a digitized format should be discussed within ICES.

References

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31. *Gadus morhua* (Family Gadidae)



GB. Cod, F. Cabillaud, D. Kabeljau, DK. Torsk,
N. Torsk, NL. Kabeljauw, S. Torsk

Spatial distribution

Juvenile Cod occur throughout the entire North Sea. During winter, densely populated areas are found in the Skagerrak and Kattegat, along the entire south-eastern continental coast and off the English coast. Densities are low in the central part of the southern North Sea and off the east coast of Scotland. These low-density areas are not seen during the summer surveys, when the juveniles occur more evenly dispersed over the area.

Adults specimens were caught in minor quantities, but their main area of occurrence seems to be situated in the North, between the Shetland Islands and Norway. The total absence of adult Cod in the southern North Sea during summer is striking.

Length-frequency distribution

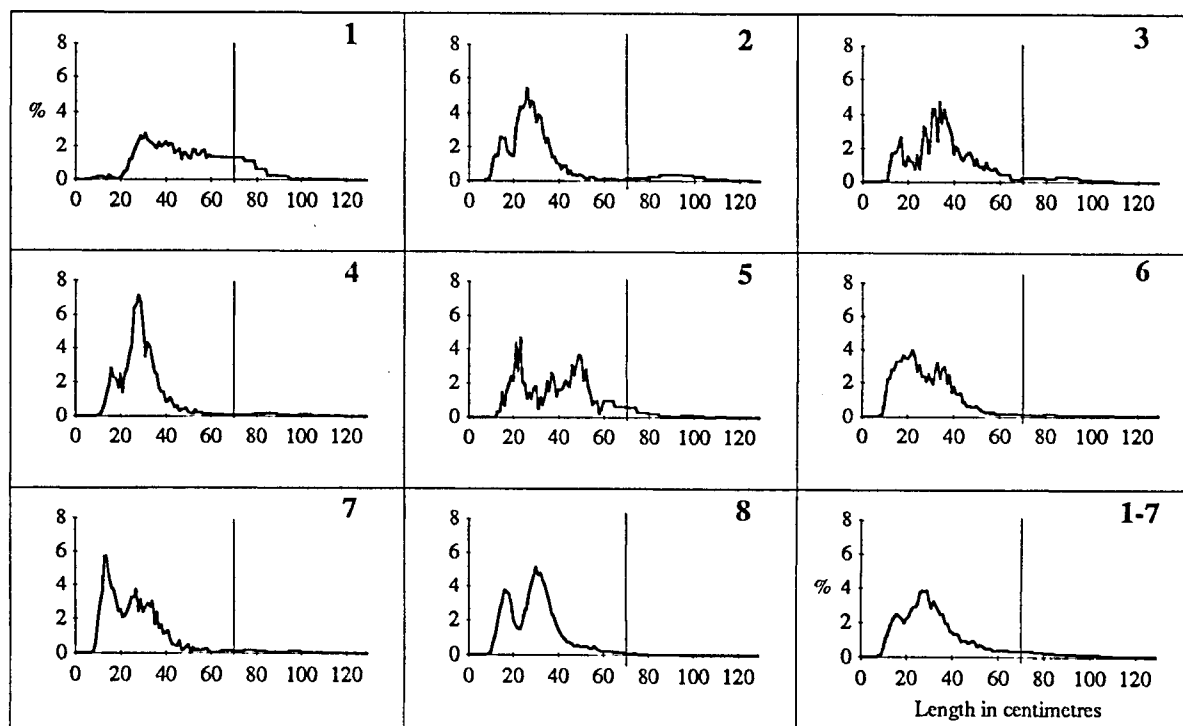
Catches in the eight roundfish areas during winter consist mainly of the two youngest age classes. The catches are either dominated by 10-25cm-individuals, for instance in the south-eastern North Sea (area 6) and off Jutland (area 7), or by individuals that measure 25-40cm. Examples of such areas are the English coast (area 4) and the Skagerrak and Kattegat (area 8).

Only in the northernmost part of the North Sea (area 1) do Cod larger than 40cm equal the numbers of the smaller size classes.

The individual

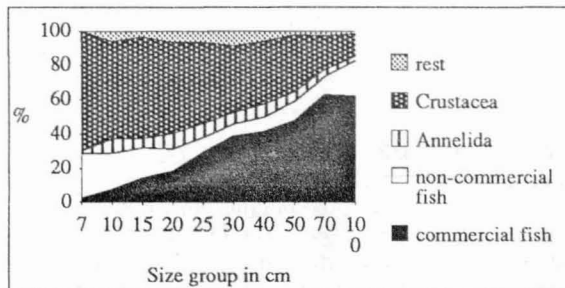
An average running female carries around five hundred ripe eggs per gram body weight, which equals five million eggs for a 10kg (1m length) individual. Fecundity varies with time and place [1]. Spawning is in mid-water or near the bottom and the pelagic eggs take ten to thirty days to hatch in the laboratory [2,3]. Larvae of 2-8mm length, caught pelagically during February and March, principally fed on the nauplii and copepodite stages of copepods [4].

The 0-group individuals continue to feed pelagically after metamorphosis but their diet changes as they grow to a larger size. Five-centimetre specimens, collected in the northern North Sea during July, had already changed from a diet that consisted mainly of copepods and euphausiids to a diet that was dominated by fish [5].



Relative length-frequency distribution of Cod by roundfish area during winter (length split indicated)

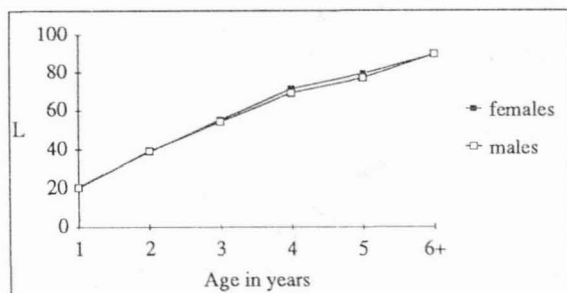
From a length of 7cm onwards, the juveniles are not to be found in pelagic catches any more. At this size the demersal stage commences, somewhere between June and autumn [6]. The demersal nature of Cod is mirrored in its diet: crustacean prey (eg *Crangon crangon*, crabs) dominate the menu of the smaller individuals, while larger specimens feed predominantly on fish. Most of the prey fish are of commercial importance and include gadoids, sandeels, flatfish and clupeids.



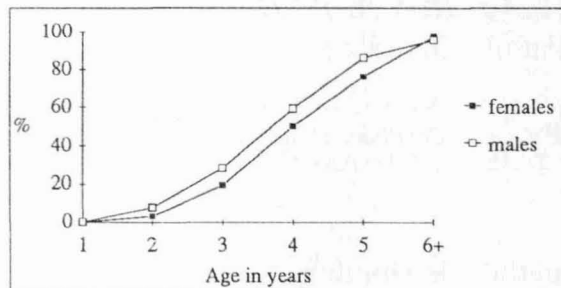
Average stomach contents as percentage weight by size group in 1981 [data from 7]

Considerable spatial differences in size at age exists. For example, during the IYFS 1970-1980 mean length of two-year-old specimens varied between 32cm and 44cm [8]. Growth rate differs by area. For instance, Cod in the southern North Sea initially grow somewhat faster than those in the north but they reach a smaller maximum length [9]. Sex and maturity have been found to influence growth rate as well.

Some Cod mature in their second year of life, but it is not before they are six years old that they are all mature. Similar to growth, length at first maturity shows variation due to sex, and there is a tendency that Cod in the southern North Sea mature at a slightly younger age than in the northern North Sea [1,10].



Mean length (cm) per age group in February 1981-83 [IYFS data]



Percentage mature fish per age group in February 1981-89 [IYFS data]

The population

Spawning aggregations are found off-shore all over the North Sea, but their relative importance may shift from year to year. After spawning, which peaks in February-March, the pelagic 0-group Cod is distributed over a large part of the central and northern North Sea [13]. High concentrations are found off the coast of Jutland and in the central part of the northern area during June-July [14]. Absence of pelagic 0-group Cod in the German and Southern Bight, of which the coastal areas serve as major nurseries for demersal juveniles, suggests that the duration of the pelagic phase is extremely short in the southern North Sea [6].

Older Cod do not disperse at random throughout the entire North Sea, but their feeding and spawning are limited. The following regional groupings are distinguished [16]:

- the Norwegian side of the Skagerrak;
- the Danish side of the Skagerrak;
- one or possibly several coastal regions, from Flamborough to the Scottish east and north coasts;
- the central North Sea;
- the Southern Bight, from the Straits of Dover to latitude 54°N;
- the English Channel, south and west of the Straits of Dover.

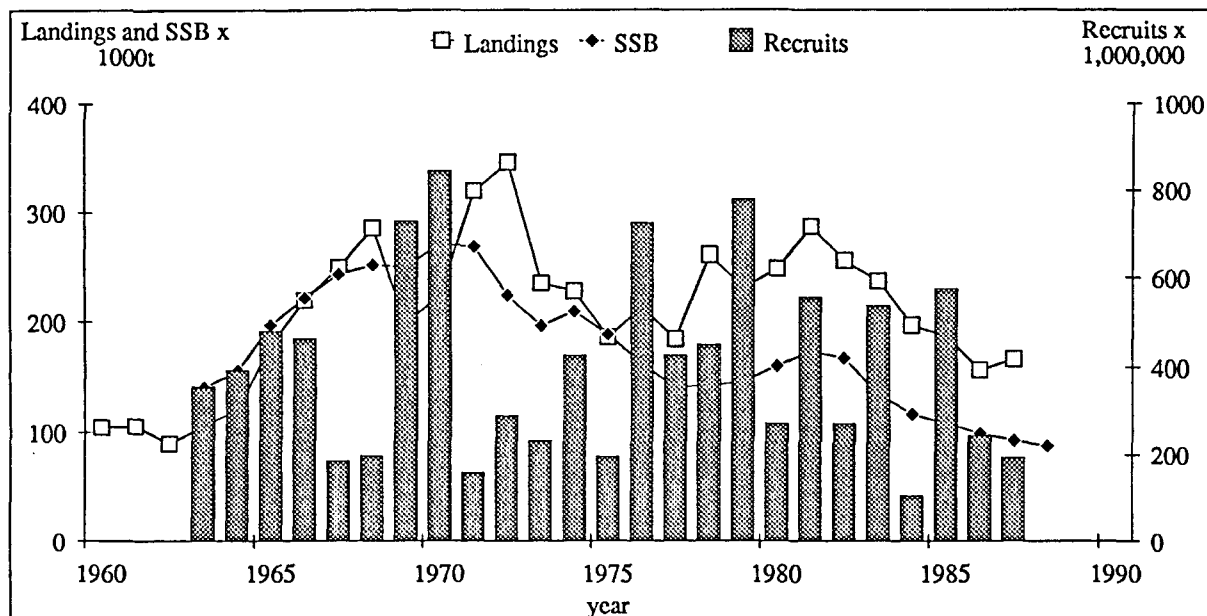
A clear seasonal migration is found in 1- and 2-group Cod of the south-eastern North Sea. These age classes aggregate in shallow coastal areas during the winter period and disperse in north-westerly direction over deeper parts of the central North Sea in summer, as is nicely illustrated by the Atlas data [12]. In the Norwegian Deep seasonal migrations (up and down the slope) are likely to occur as well [15]. The total absence of adult specimens from the southern part of the North Sea during the Atlas summer surveys may be related to a seasonal, temperature-induced migration or perhaps to a reduced catchability due to behavioural changes.

Yearly North Sea landings of Cod, one of the most important commercial species in the area, fluctuated between 50,000 and 100,000t during the first sixty years of this century. After this period, landings increased to a maximum of 345,000t in 1972, and have steadily decreased since 1981. Estimated 1990 landings were the lowest since 1962 [11]. The spawning stock biomass shows a similar trend: a steady increase until 1970 followed by a decline down to around 90,000 tonnes, which is well below the considered safe biological limit (150,000t) needed for the production of good recruitment.

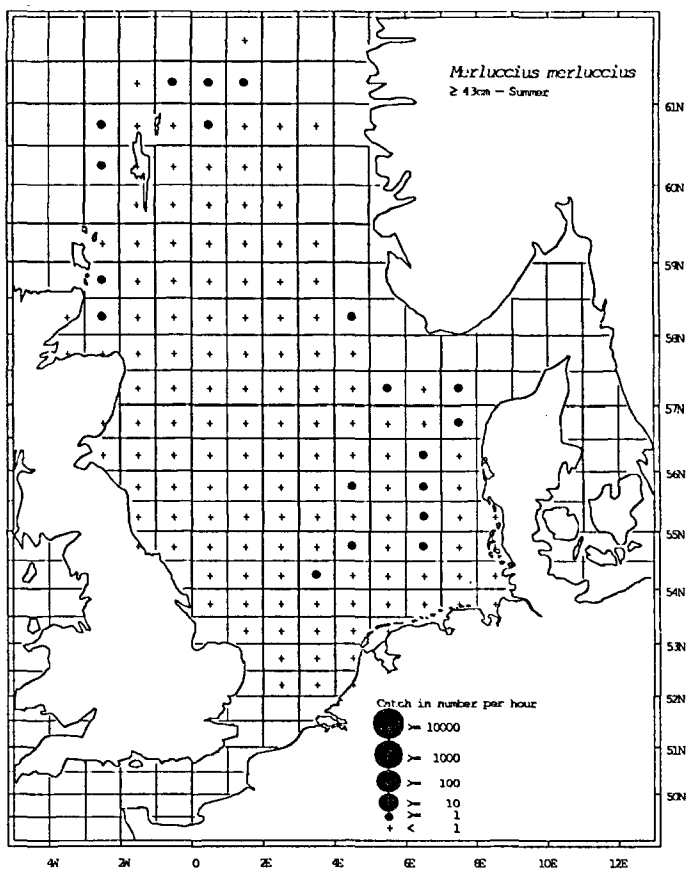
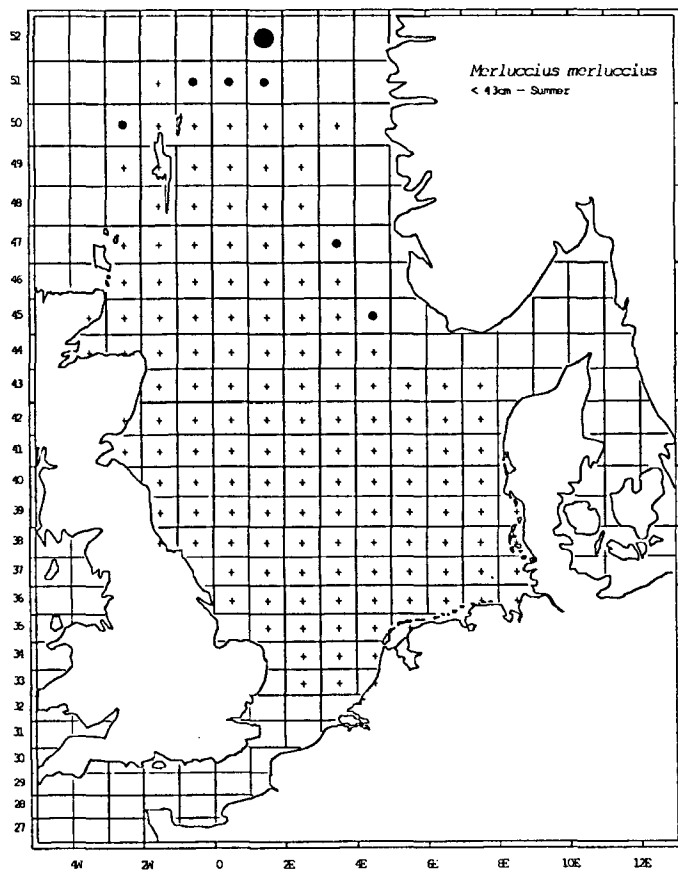
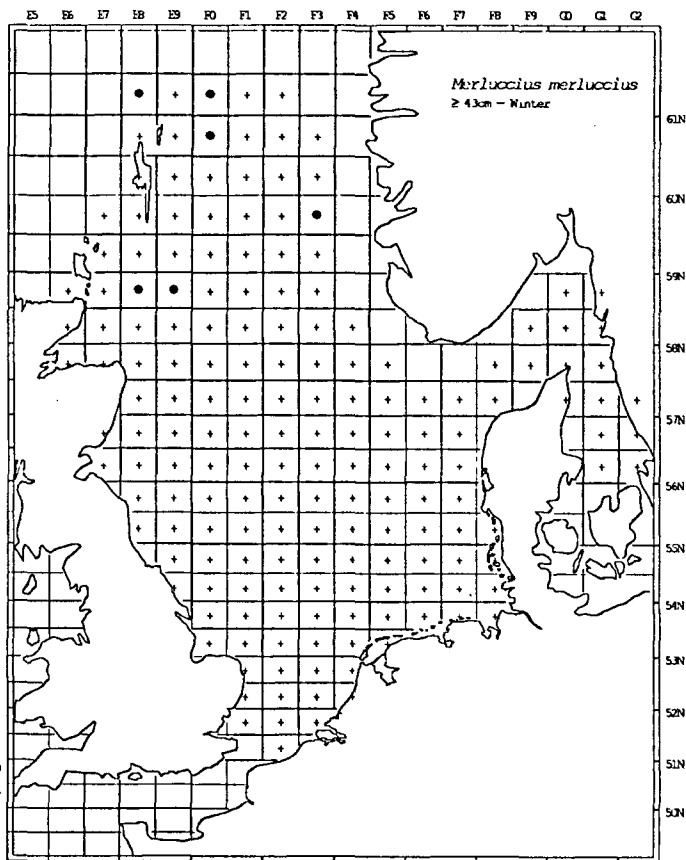
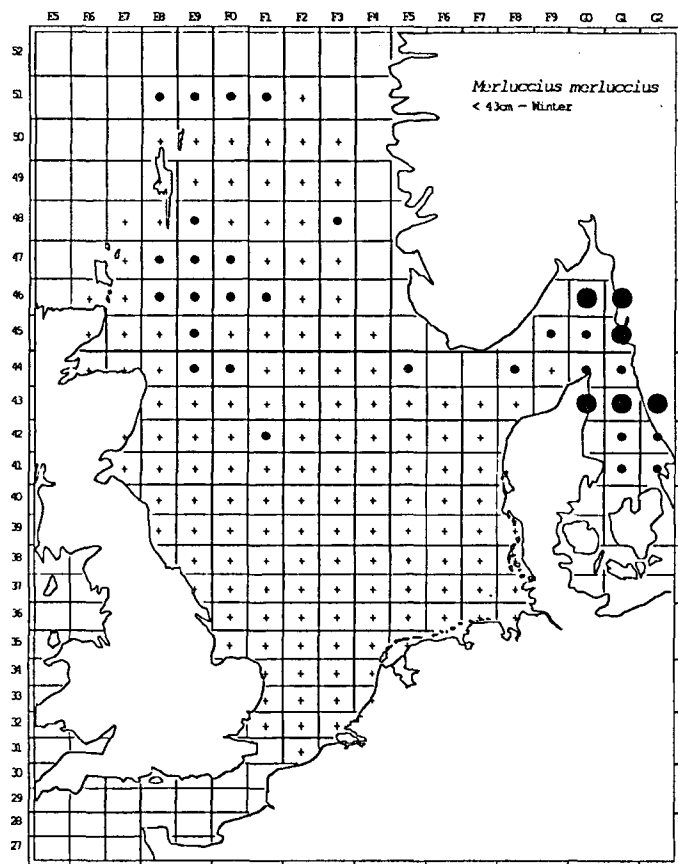
The cause of the rapid increase in both biomass and landings in the 1960s is probably related to a sequence of strong year classes, whereas the decline of the standing stock biomass since 1970 may be linked to the ever increasing fishing mortality during the last two decades.

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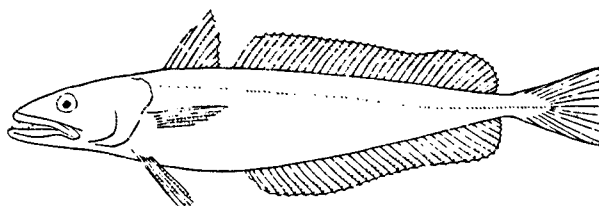


Total North Sea landings, spawning stock biomass and recruitment of one-year-old-individuals to the stock during 1960-1990 [data from 1 and 11]



48. *Merluccius merluccius* (Family Merluccidae)

GB. Hake, F. Merlu, D. Seehecht, DK. Kulmule,
N. Lysing, NL. Heek, S. Kummel



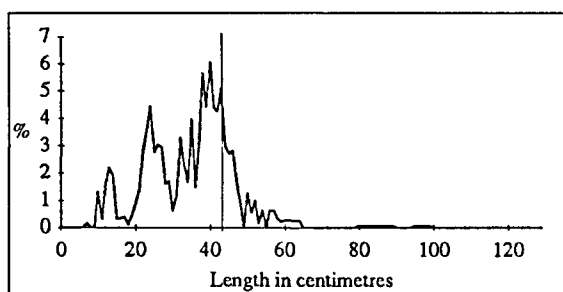
Spatial distribution

During winter, both large and small Hake have been caught in the northern part of the North Sea, whereas in the Skagerrak and Kattegat only the smaller size classes have been caught (in rather higher numbers, though).

Hake was taken in the northern part during the summer months as well. However, the presence of large individuals in the south-eastern part of the North Sea is obviously seasonally-related.

Length-frequency distribution

Winter catches contain mostly Hake in the size range of 10 to 50cm, larger individuals being rare. The largest Hake was caught during summer and measured 105cm, which is exactly the same maximum size as measured during a 1959 survey [1].



Relative length-frequency distribution of Hake during winter (length split indicated)

The individual

Adult Hake are found near, or more likely, on the sea bed during the day and at night they swim up to feed in mid water. Food of Hake from the western shelf waters of Britain consists almost entirely of pelagic fish; blue whiting is by far the most important prey. Mackerel, silvery pout, Hake itself, clupeids and squid are part of the menu, as are argentine, horse mackerel and some demersal fish (such as poor cod, megrim and witch) [3].

There are no reliable age-length keys for North Sea Hake, but the distinct 10-20, 20-30 and 30-60cm classes in the Atlas length distribution probably represent age groups 1, 2 and 3-7 respectively. Fifty percent of the 3-year-old Hake are sexually mature [2].

The population

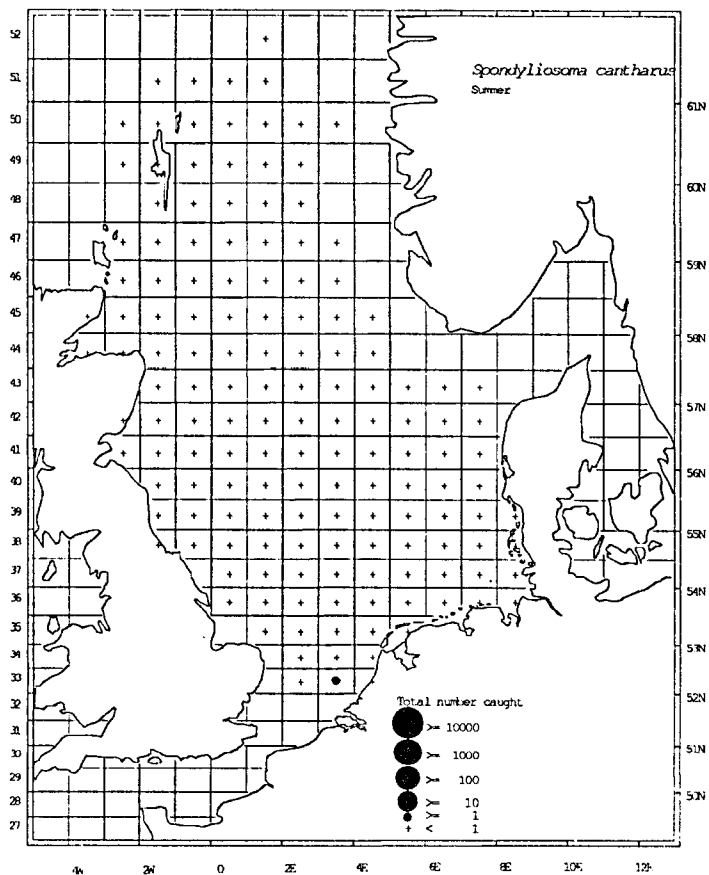
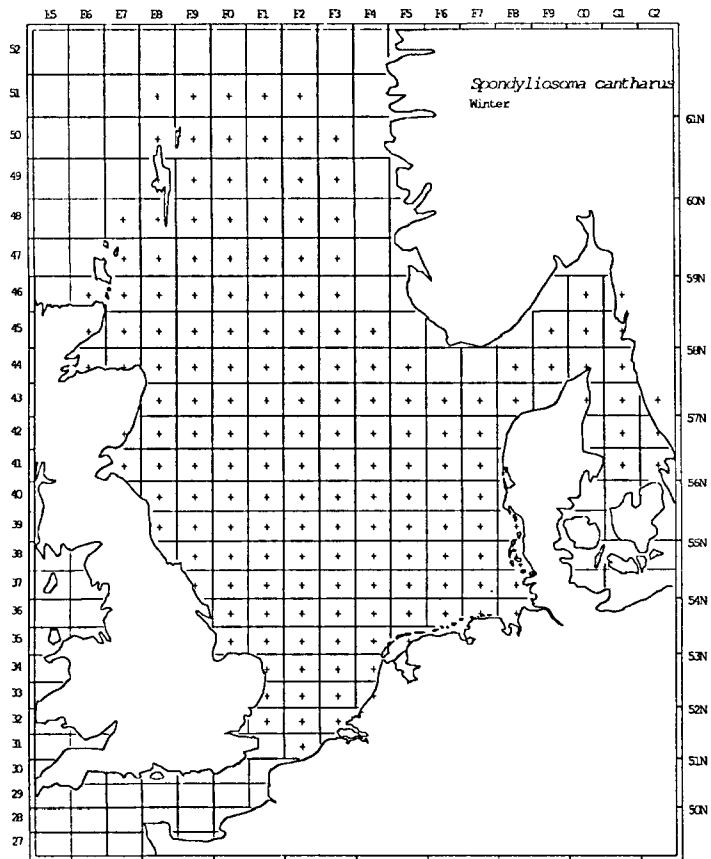
These cod-like fish inhabit the middle and lower slope of the continental shelf in depths of over 180m, but may move into less deep waters during summer to spawn [3]. Spawning to the west of Scotland occurs from May to August [4].

The situation in the Atlas area is a bit obscure. It is not known whether North Sea Hake are stationary residents or migrating visitors. No immigration through the English Channel into the North Sea has been described to date [2], and therefore the summer appearance of Hake in the south-eastern North Sea probably originates from either northern or Kattegat/Skagerrak stocks.

Hake is a species of considerable economic importance. However, North Sea catches are low compared with catches in the Atlantic by Spanish, French and Portuguese vessels. After the Second World War, North Sea catches have steadily dropped from 8000 to 2000t in the 1980s.

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43. *Spondyllosoma cantharus* (Family Sparidae)

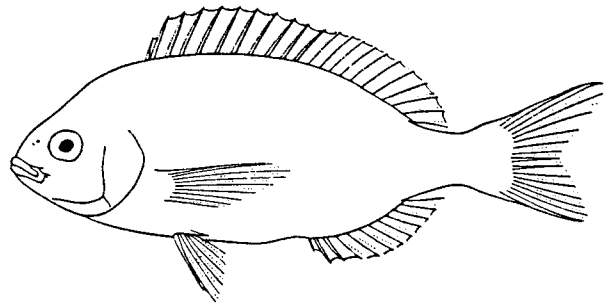
GB. Black sea-bream, F. Dorade grise,
D. Streifenbrasse, DK. Havrude, N. Havkaruss,
NL. Zwarte zeebrasem, S. Havsruda

Spatial distribution

A 19cm individual has been caught during the summer of 1986. This species is most probably a summertime migrant, entering the survey area through Dover Strait.

The individual

Black sea-bream is regularly caught by anglers in southern waters (for instance the Canary Islands), where this species has its main distribution.



The population

A school of 17-24cm-sized Black sea-bream, weighing 100kg in total, was caught by a commercial vessel in the western part of the English Channel in early April 1992. The gonads of most of these animals were in an advanced stage of maturation, confirming that the local spawning period is in April and May [1]. Other species in this haul were mackerel, horse mackerel and pilchard.

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