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By-catch of Skates in Trawl and Long-Line Fisheries in the Barents Sea
(Elasmobranch Fisheries – Poster)

by

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Abstract

On the basis of data on by-catch of skates in trawl and long-line fisheries of bottom fish in the Barents Sea the paper reviews some biological characteristics of a number of skate species. Areas of skate occurrence and their by-catch in percentage and by weight are given. Data on the size composition of skates in catch by various fishing gears are presented. Besides, potential catch of skates in trawl and long-line fisheries is estimated.

Introduction

The Barents Sea, as any other Arctic sea, is characterized by a relatively poor biodiversity and by a large biomass of the majority of species living there, which predetermines a considerable scale of man's fishing activities. Of main bottom fish species in the Barents Sea and adjacent waters the key species are cod (*Gadus morhua L.*) and haddock (*Melanogrammus aeglefinus L.*).

In the bottom trawl fishery targeted, primarily, at these two species unavoidable is a harvest of a number of other species as by-catch. A considerable part of the by-catch is composed of skates. The catch of skates could be quite considerable, however, they are practically not used for food.

Main objectives of this paper are to review the distribution of catch of various skate species by area, estimate their by-catch in percentage and by weight, to analyze size and sex composition in catch by various fishing gears and to assess the catch of skates in trawl and long-line fisheries in the Barents Sea.

Materials and Methods

Used in the paper are data from the Russian trawl and long-line fisheries in 1997-2001 as well as materials collected by PINRO scientists on fishing vessels.

To assess the by-catch and size and sex composition of skates in commercial catch data from those fishing vessels which had scientific observers on board, who collected biological material, were used. Catch per standard effort (kg per hour haul for trawlers and kg per 1000 hooks for long-liners) and percentage of the total catch were used as indices of skate catch.

Length of skates was measured individually for males and females from the tip of snout to the tip of the caudal fin.

The total catch of all skate species was assessed using the methods developed at PINRO (Shevelev and Sokolov, 1995). As this was done, the species composition in catch from each individual area by season (usually month) was

determined on the basis of data collected by scientific observers. After that, statistical catch data from directed fishery of bottom fish (usually cod and haddock, in some years also *Sebastes mentella* and Greenland halibut) were adjusted on the basis of true catch composition, and a by-catch of individual species taken in a given fishery was estimated.

Results

Distribution and fishery

Thorny skate *(Raja radiata)*

This species occurred in trawl and long-line catch everywhere (Fig. 1 and 2). It was found in trawl catch taken in depth from 100 to 750 m, however, the most common depth interval where the largest by-catches were fished was 100-300 m. In long-line fishery thorny skate was most often fished as by-catch along 300-500 m depth contours and off the Murman Coast, it was scarce in catch from depth 600-700 m and only single individuals occurred in deeper water or it was not found at all.

Areas where large by-catch of thorny skate was taken were the same in trawl and long-line fishery. In trawl fishery the average catch rate was 6-10 kg per hour haul, maximal catch was as large as 200-400 kg per hour haul (northwestern slope of the Murmansk bank). Large aggregations of thorny skate were also found on the Finnmarks grounds, East Coastal area and Murmansk shallows. In long-line fishery most dense aggregations were identified on the Nordkin and Finnmarks grounds, Murmansk Deep and western slope of the Bear Island bank, where its catch was 100 kg and more per 1 000 hooks. Maximal by-catches (up to 250 kg per 1 000 hooks) were reported from coastal areas (Rybachaya and Kildin banks, West Coastal area) and taken in depth less than 300 m. In the total trawl catch the proportion of this species was up to 9% and it reached 36% in individual catches (usually small and containing no targeted commercial species). In the total long-line catch thorny skate constituted up to 19%, and in individual catches its proportion was often as large as 50-100%. It occurred in long-line catch the whole year round, however, the largest by-catches of thorny skate were fished in January to June (24-40 kg per 1000 hooks), when its proportion was 13-37 % of the total catch.

Northern skate *(R. hyperborea)*

This species occurred mainly in trawl catch fished along the continental shelf and in areas with low water temperature, and in long-line catch on continental slope only (Fig. 1-2). Both in trawl and long-line catch it was most frequent in the western part of the South Cape Deep, on the western slope of the Bear Island bank, less frequent in the west of the Kopytov area and it occurred as single fish at a junction between the southern and eastern slope of the Bear Island bank. This species was also found in trawl catch from the north-western slope of the Murmansk bank and Central bank. The largest by-catches of northern skate (up to 60-100 kg per hour haul and 50 fish and more per 1 000 hooks) were fished in the depth interval from 600 to 850 m. Average catch in trawl fishery was 6-10 kg per hour haul (or 1% of catch), in the long-line catch 10-25 fish (or 35-75 kg) per 1000 hooks. In the trawl fishery maximum catch rate was 156 kg per hour haul. In the long-line fishery the proportion of this species was as large as 99% in individual catches, and catch rate reached 368 kg per 1 000 hooks, giving a catch per vessel per day of fishing of up to 9 tons. The average percentage of northern skate in long-line catch was about 20%.

Blue skate (*R. batis*)

Blue skate occurred in small numbers in both trawl and long-line catch, most often sporadically as single individuals. Sites of its capture were located at the edge of the continental slope (Kopytov area, western slope of the Bear Island bank and western part of the South Cape Deep) (Fig. 1-2). Single individuals were found in catch fished at the junction between the Nordkin bank and Kopytov area, southern and eastern slopes of the Bear Island bank. This species occurred in catch taken deeper than 300-350 m, most often in depth interval from 550 to 800 m. In the trawl fishery the average catch rate was 2-3 kg per hour haul (0.2% of the catch), maximal catch rate was less than 20 kg per hour haul. Catch rates for this species in the long-line fishery usually did not exceed 40 kg per 1 000 hooks (less than 1 ton per vessel per day of fishing), although in some cases a daily catch of blue skate was as large as 3.6 tons.

Round skate *(R. fyllae*)

This species was mainly found in trawl catch fished along the slope of the continental shelf and near the coast of Norway and Murman (Fig. 1). In the long-line catch it occurred in small numbers in the Kopytov area (1-3 fish per 1000 hooks) and as single individuals on the western slope of the Bear Island bank. Round skate was found in trawl and long-line catch taken in depth less than 500-600 m, it was not represented in catch from deeper than 700 m. The average catch rate for this species in the trawl fishery was 3 kg per hour haul (0.3% of the catch), maximal catch rate did not exceed 40 kg per hour haul.

Sail ray *(R. lintea)*

It occurred as single individuals in trawl and long-line catch, mainly, in areas influenced by warm Atlantic water (Søre bank, Fugløya bank, Kopytov area).

Size distribution

Thorny skate

The size of thorny skate in commercial trawl catch (bag mesh 125 and 135 mm) was 15-66 cm in males and 17-68 cm in females (Fig. 3). Fish with the length of 46-50 cm prevailed, mean length of males and females was 44.3-43.5 cm and 42.8-42.3 cm, respectively (Table 1). No difference was found in the size distribution of males and females. Females prevailed only slightly in catch (sex ratio 1:1.1).

The size of thorny skate in long-line catch was 31-62 cm in males and 27-62 cm in females (Fig. 3). Fish with the length of 46-50 cm prevailed, mean length of males and females was 46.8 cm and 46.9 cm, respectively (Table 1). No difference was found in the size distribution of males and females. Sex ratio was close to 1:1.

Northern skate

The size of northern skate in commercial trawl catch (bag mesh 125 and 135 mm) was 31-81 cm in males and 28-85 cm in females (Fig. 4). In the catch fished with 125 mm mesh 46-55 cm fish prevailed. The catch fished with 135 mm mesh contained smaller fish, males of 46-50 cm and females of 31-35 cm and 46-50 cm. Mean length of males and females was 56.6-52.6 cm and 55.0-54.6 cm, respectively (Table 1). Catch was dominated by males (sex ratio 1:0.7).

The size of northern skate in long-line catch was 42-85 cm in males and 44-85 cm in females (Fig. 4). Males of 66-70 cm and females of 76-80 cm prevailed. Females were much larger than males, mean length of males and females was 65.5 cm and 69.3 cm, respectively (Table 1). Males prevailed, with their proportion in catch being as large as 90% of the total number of fish, except in the South Cape Deep, where it reduced to 29% in individual catches.

Round skate

The size of round skate in commercial trawl catch (bag mesh 125 and 135 mm) was 28-54 cm in males and 28-53 cm in females (Fig. 5). Males of 41-45 cm (in catch fished with 125 mm mesh) and 46-50 cm (in catch fished with 135 mm mesh) and females of 46-50 cm prevailed, mean length of males and females was 46.2-48.2 cm and 45.0-45.3 cm, respectively (Table 1). No difference was found in the size distribution of males and females. Females were much more plentiful (sex ratio 1:1.7).

The size of round skate in long-line catch was 38-57 cm in males and 32-53 cm in females (Fig. 5). Males of 51-55 cm and females of 46-50 cm prevailed, mean length of males and females was 51.9 cm and 48.7 cm, respectively (Table 1). Males prevailed, sex ratio was 1:0.7.

Blue skate

Data on the size distribution collected for this species were scarce. Trawl catch contained males of 25-116 cm and females of 32-110 cm. In long-line catch larger fish were found, up to 147 cm in length.

Catch

The proportion of skates in the total catch of bottom fish in the Barents Sea in 1996-2001 was small, less than 0.4% by weight, on the average. Over the year the proportion of skates in catch was the largest at the beginning of the year (January-April) and in the end (September-November) (Fig. 6).

The total catch of skates fished by the Russian fishing fleet, which operated in the Barents Sea and adjacent waters in 1996-2001 varied from 723 tons to 1 891 tons, and averaged 1 250 tons (Table 2). In 1996-2001 the largest catch of skates was fished by the Russian fleet in the Russian EEZ (up to 41% of the total catch) and Russia/Norway joint fisheries area (grey zone) (27%). In the Norwegian EEZ and Svalbard area no more than 13% and 18% were fished.

A major part of skate catch was taken in the trawl fishery (Fig. 7). The proportion of the total skate catch fished in the long-line fishery was small (6.4% on the average).

Discussion

Of 6 skate species, most plentiful in the Barents Sea (Dolgov *et al*., in prep.), all were found in trawl and long-line catch, however, thorny skate prevailed, amounting up to 90-95% of the total catch of all skate species.

Overall, fishing for skates with long-line was more efficient than with trawl. For the whole Barents Sea the average by-catch of skates in the trawl fishery was 10 kg per hour haul, in other words, about 150-160 kg per day of fishing. The average by-catch of thorny skate by long-line for the whole sea was 20.6 kg per 1 000 hooks, about 0.5 ton per vessel per day of fishing.

There was observed an explicit selection of skates by size by various fishing gears. Represented in research catch fished with a fine-meshed netting smaller skates of all species (21-25 cm and less) were practically absent in commercial catch. In trawl catch there was no distinct difference in the size distribution of skate caught with the 125 mm and 135 mm mesh. In long-line catch larger skates prevailed, with the difference in the mean length of fish in trawl catch and long-line catch increasing for species having larger maximal size. Selection by sex was only noted for the long-line fishery of northern skate, while for other species sex ratio was, in general, 1:1.

The total catch of skates in the Barents Sea is relatively small if compared both to the stock size which is as large as 116 000 tons for thorny skate only (Dolgov, 1997), and the catch taken in other areas of the ocean, for instance, 4 000-6 000 tons near the Falkland Islands (Agnew *et al*., 2000). Worth mentioning is a reduced catch of skates in 2000-2001 compared to previous years. This could, probably, be linked to the processes in their populations unknown to us yet (poor survival, low abundance of new year-classes, etc.) or unhealthy status of their stocks caused by harvesting as by-catch in the bottom fisheries of cods.

Although all skate species are valuable for use as food, fodder and for industrial purposes and targeted by directed fisheries in other areas of the ocean (Bonfil, 1994), they are practically not harvested in the Barents Sea, but discarded. The major reason for that is a low demand for skates in the Russian market and unwillingness to seek for other markets, however, in 2000 a small catch (about 200 tons) of thorny and northern skate was landed.

Harvesting of skates as well as other poorly exploited fish species in the Barents Sea will enable to enhance the profitability of fisheries, to better use the resources exploited by the bottom fishery and to reduce, to a certain extent, the pressure on stocks of major commercially-important fish in the Barents Sea.

References

AGNEW, D.J., C.P. NOLAN, J.R. BEDDINGTON, and R. BARANOWSKI. 2000. Approaches to the assessment and management of multispecies skate and ray fisheries using the Falkland Islands fishery as an example. *Can. J. Fish. Aquat. Sci*. 57: 429–440.

BONFIL, R. 1994. Overview of world elasmobranch fisheries. *FAO Fish. Tech. Pap*. No.341.

DOLGOV, A.V. MS 1997. Distribution, abundance, biomass and feeding of thorny skate *Raja radiata* in the Barents Sea. *ICES C.M. 1997/GG:04*. 21 pp.

SHEVELEV, M.S., K.M.SOKOLOV. 1997. On actual catch of bottom fish harvested as by-catch in the trawl fishery in the Barents Sea in 1993-1995. Rybnoye khozyaistvo, No. 3, p.38-40. (in Russian)

TABLE 1. Mean length and sex ratio of some skates species in catch by different fishing gears

		Fishing gear			
	Sex	Research bottom trawl (16 mm)	Trawl 125 mm	Trawl 135 mm	Long-line
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		1:1.1	1:1.3	1:1.1	1:1
Northern 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		1:0.6	1:0.6	1:0.7	1:0.1
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		1:1.1	1:1.7	1:1.7	1:0.7

TABLE 2. Russian catch of skates in the bottom trawl and long-line fisheries by area in the Barents Sea and adjacent waters in 1996-2001, t

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	1891
1999	524	607	233	287	17	1668
2000	335	491	334	365	14	1539
2001	337	197	104	191	9	838

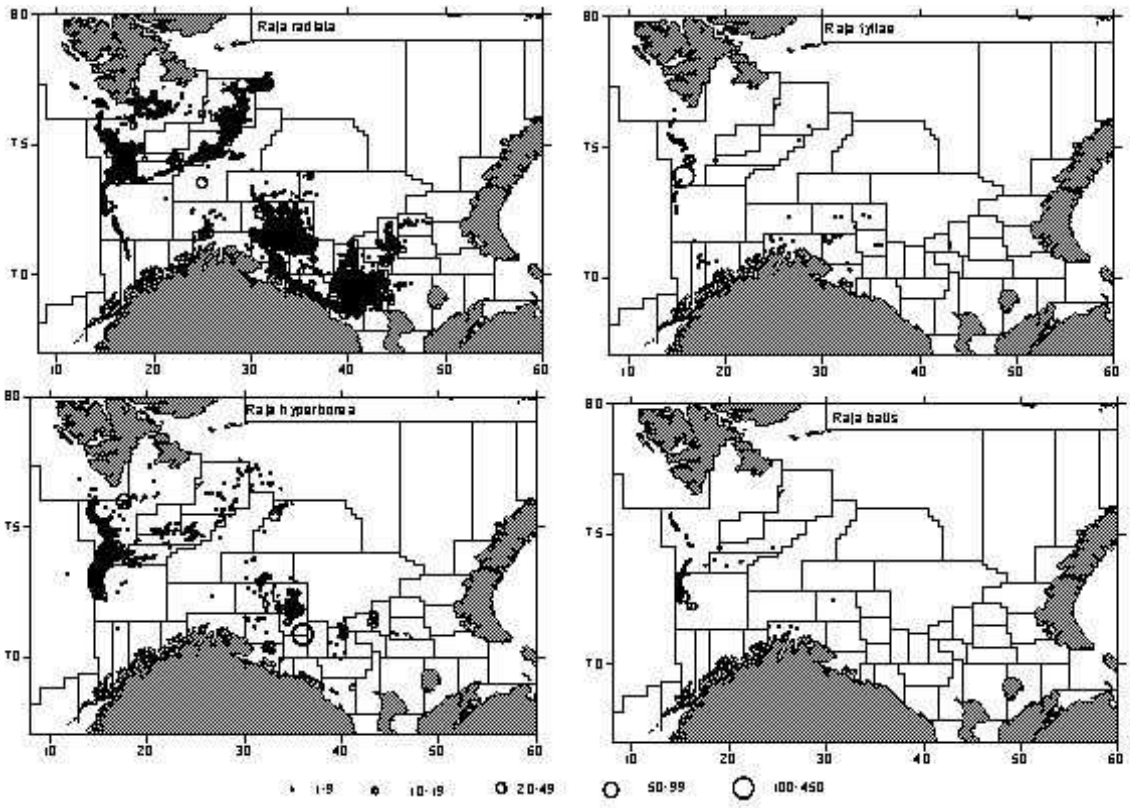

Fig. 1. Distribution of skate by-catch in trawl fishery, kg per hour haul

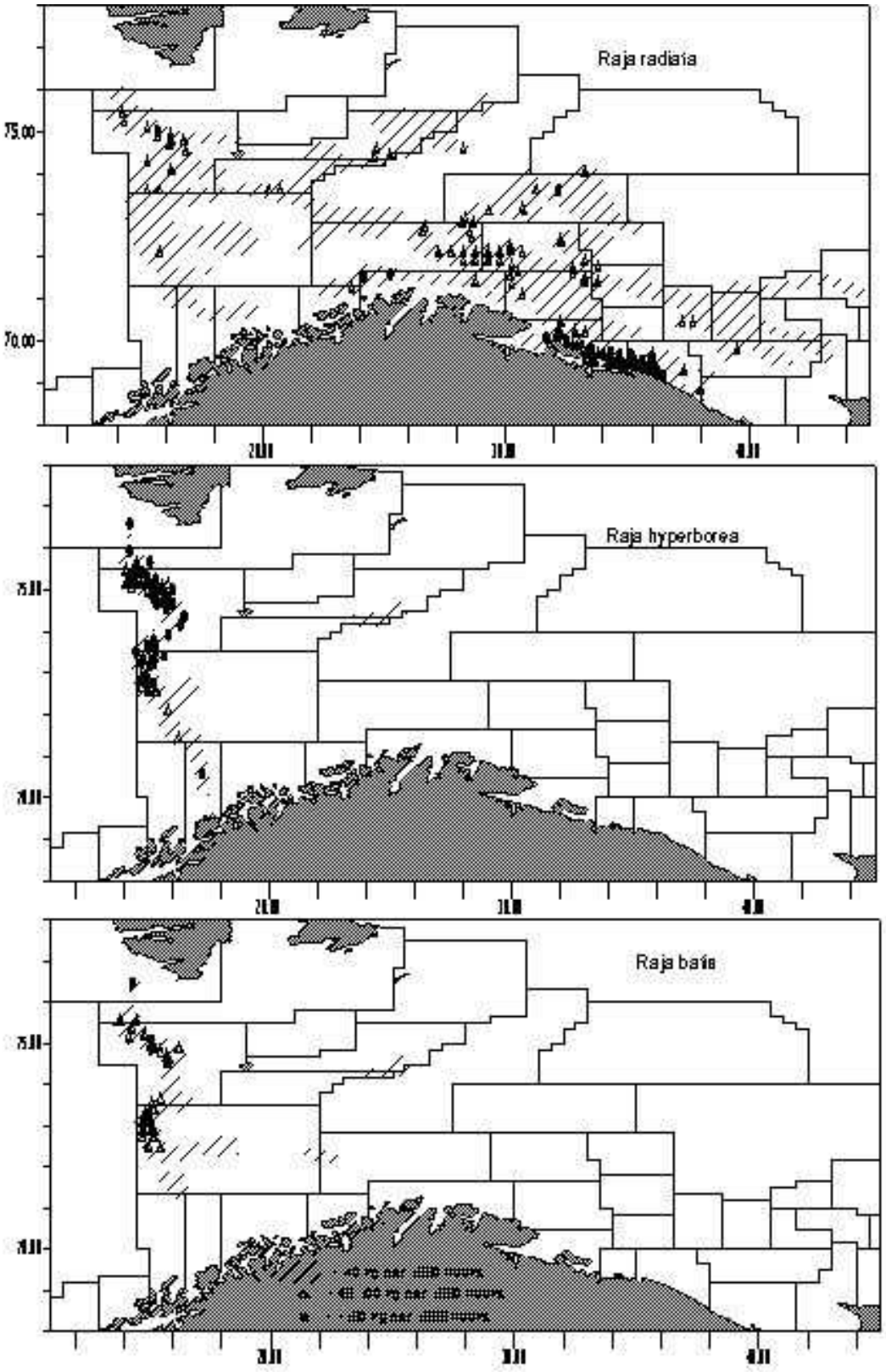

Fig. 2. Distribution of skate by-catch in long-line fishery, kg per 1000 hooks

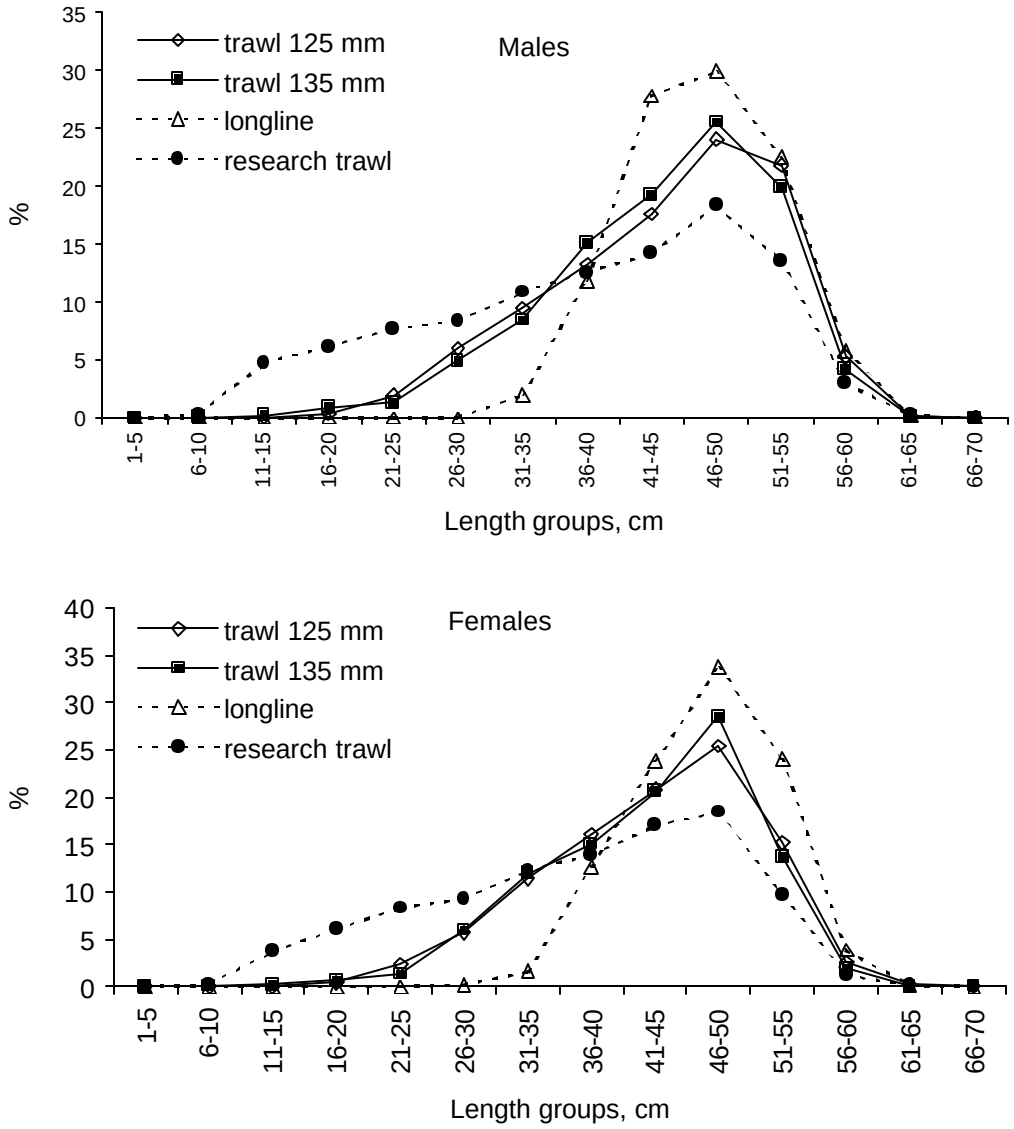

Fig. 3. Size distribution of thorny skate in catch by various fishing gears

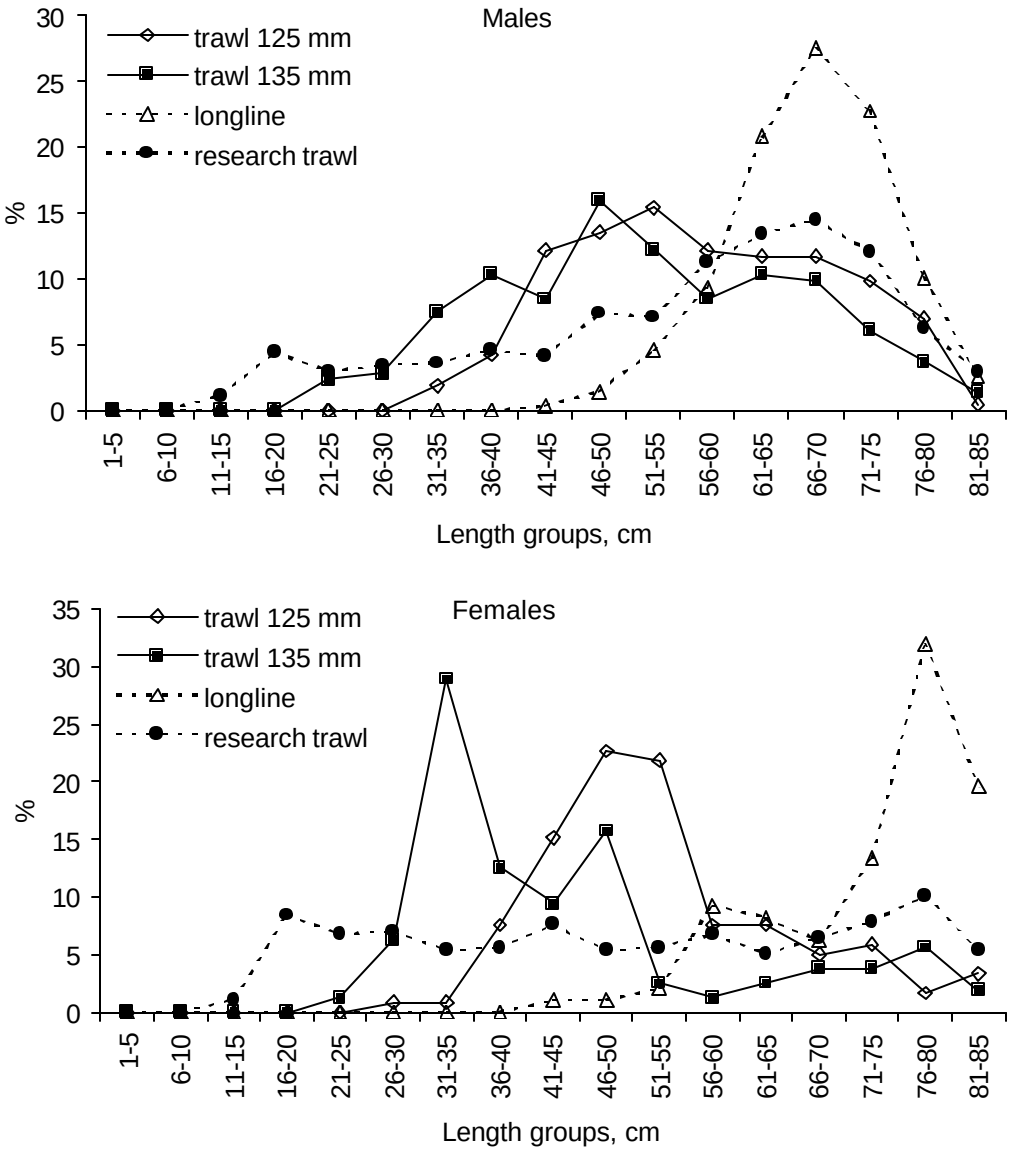

Fig. 4. Size distribution of northern skate in catch by various fishing gears

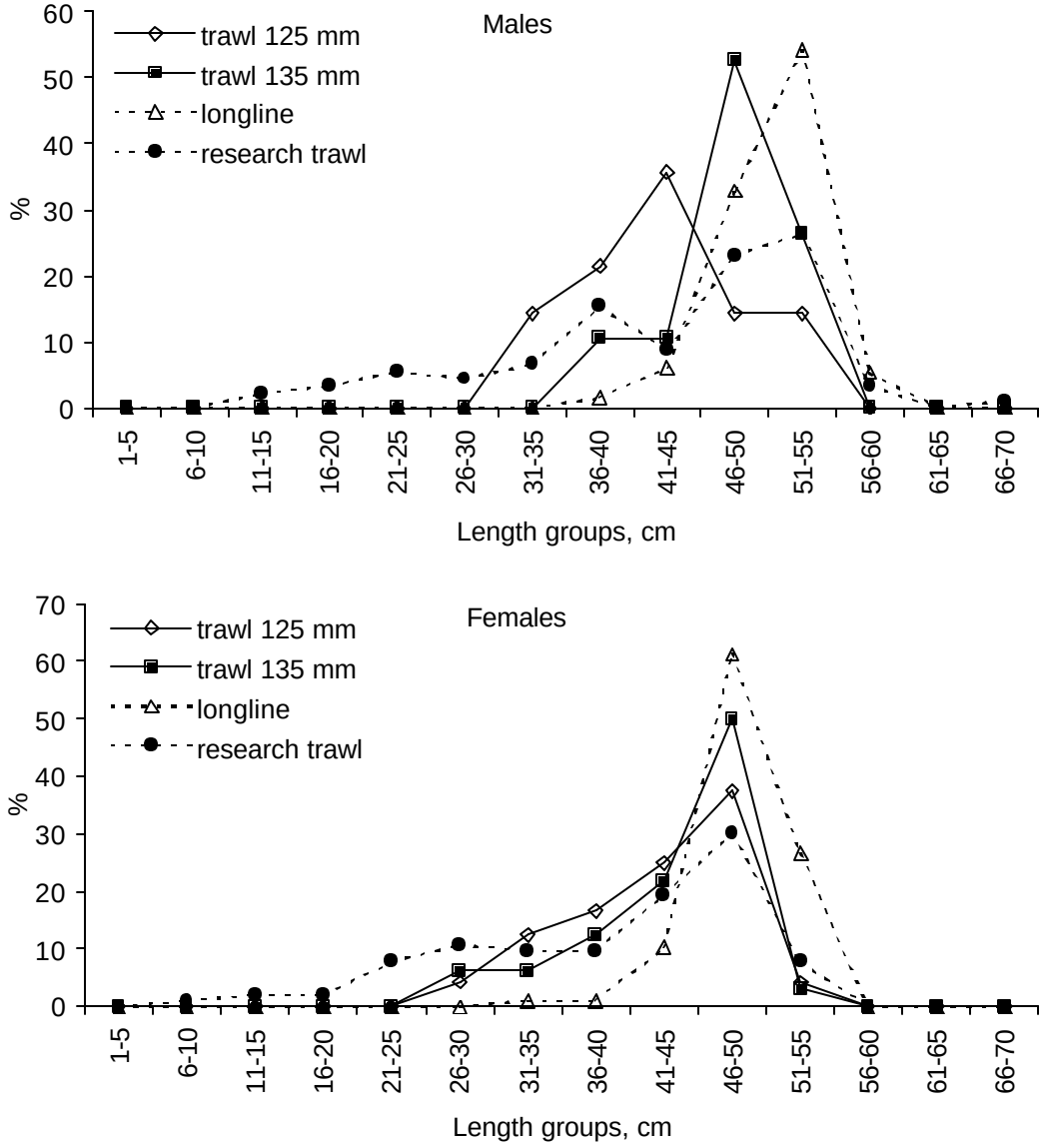

Fig. 5. Size distribution of round skate in catch by various fishing gears

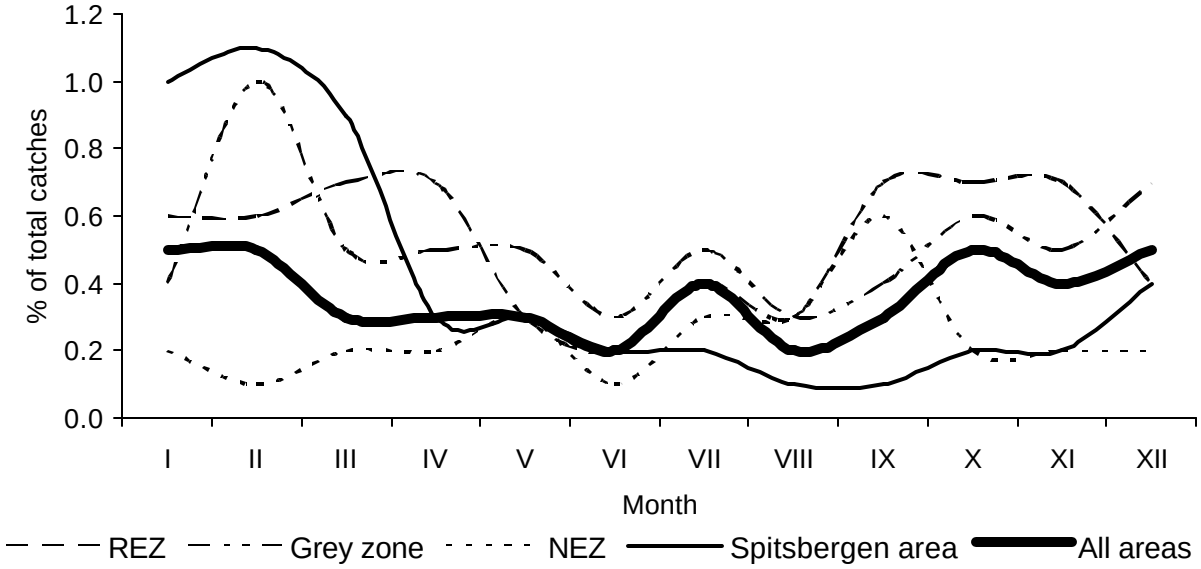

Fig. 6. Proportion of skates in the total catch of bottom fish by area in the Barents Sea, average for 1996-2001

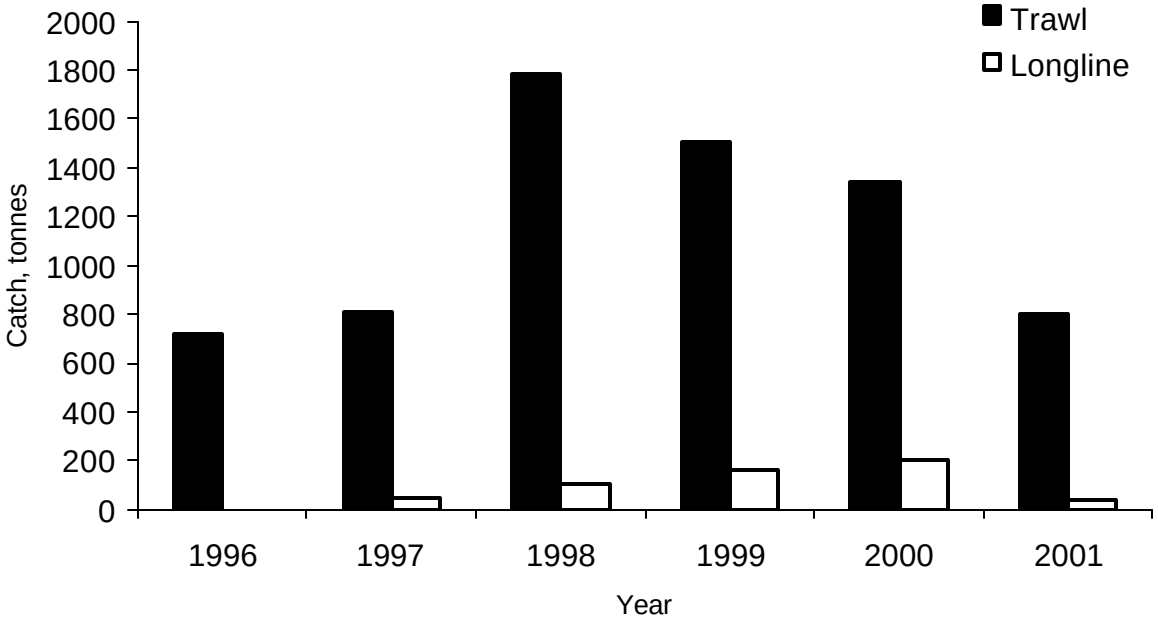

Fig. 7. Catch of skates in trawl and long-line fisheries in the Barents Sea in 1996-2001