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Brief Results of Russian Investigations and Fishery for Thorny Skate (*Raja radiata*)
in NAFO Regulatory Area in 2000-2001

by

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Abstract

The major part of the Russian catch of skate, which constituted in 2000-2001 3.6-2.6 thou. tons, was taken in May-December during the directed fishery in Division 3N (fishing depth was 40-80 m). Catches consisted of fish 25-92 cm long, mainly, 32-60 cm. Length compositions of skate caught by trawls with minimum mesh size of 136 mm and 240-320 mm differed greatly. The majority of specimens were mature. In autumn/winter period, the number of specimens ready to coupling increased. Skate fed intensively on sand eel and benthos. Skate were distributed everywhere in the shallow waters of the southern part of the Grand Bank; this and high fishing efficiency can indirectly justify on good status of skate stock.

Introduction

Directed fishery for thorny skate has been developed actively in the NAFO Regulatory Area in the recent decade. The largest numbers of this species are caught by vessels of Canada, Spain and Portugal (Table 1). Trawlers of Russia have been conducted the directed fishery for skate since the year of 2000. Till recent time, the fishery for skate in the international waters of the Northwest Atlantic has not been regulated.

In cruises of some Russian vessels, NAFO observers investigated thorny skate. For the past period, a certain number of scientific and fishery data was collected, which can fill out the knowledge on biology, distribution and status of this species stock.

The aim of the given paper is to present to NAFO the results of recent Russian investigations and fishery for thorny skate.

Materials and Methods

Fishery for skate carried out in 2000-2001 by trawlers "Maraonkhoka" (main engine capacity is 1 270 kWt) and "Matrioska" (main engine capacity is 1 360 kWt). In 2000, catches of skate were taken by bottom trawls with minimum mesh size of 136 mm, and in 2001 the minimum mesh size used was 240 mm and in some cases 320 mm. Investigations of skate were carried out in August/October 2000 and September/December 2001. Collection and primary processing of biological materials in 2001 were performed in accordance with methods accepted in PINRO. Total length of fish was measured with differentiation by sex. Intensity of feeding was determined by 5-point scale. To determine maturity stages of skates, a simple scale developed by A. V. Dolgov was used:

- Males: 2 – fish with length to 30 cm, the volume of testicles is small;
 3 – fish with length more than 30 cm, testicles are larger;
 4 – testicles are faveolate, pterigopodia are large, but their ends are not open;
 5 – the same but pterigopodia ends are open.
- Females: 2 – ovaries are small;
 3 – ovaries are larger and faveolate;
 4 – there are many yolk disks in ovaries with diameter 2-3 cm;
 5 – ovum capsules in hard black cover are in ovaries.

In the year of 2000, length of skate was measured without differentiation by sex, and maturity and feeding were not analyzed.

Data on collected material are in Table 2.

Fisheries and distribution

The largest Russian catch of skate was taken in 2000, it constituted about 3.6 thou. tons. In 2001 the catch decreased (Table 1), that was caused by the diminishing of fishing effort and periods of fishery for skate because of dislocation of vessels to other fishing grounds.

The main catch of skate was taken during the directed fishery in the southern part of the Grand Bank (42°54'-45°40'N, 48°10'-51°30'W), predominantly, in Div. 3N and, at a less extent, in Div. 3O (Fig. 1 and 2). Besides, some number of this species was taken during the fishery for redfish and Greenland halibut in Div. 3LMO (Table 3).

Directed fishery for skate was carried out from May to December, however, maximum catch and the best working efficiency were registered in September/December (Table 4), that agrees well with results of Spanish vessels fishery in former years (del Rio and Junquera, 2000). It should be mentioned that in 2000, Russian trawlers obtained good catches of skates in June either (Table 4). There are data showing that fishery for skate is also possible in spring (Junquera and Paz, 1998).

During the skate fishing season, dislocation of fleet on the fishing ground changed insufficiently, and there was a tendency of vessels to shift eastwards from summer to winter (Fig. 1 and 2).

Directed fishery was carried out in a relatively narrow range of depths from 40 to 80 m, predominantly, 48-60 m. Trawling speed was within 3.0–3.2 knots.

The main limiting factor during fishery for skate is a large, sometimes exceeding allowable values (5%), by-catch of the other bottom fish species (Table 5), mainly, long rough dab (*Hippoglossoides platessoides limandoides*) and yellowtail flounder (*Limanda ferruginea*). The negative influence of this factor was especially seen in 2000 when Russian vessels used trawls with minimum mesh size of 136 mm. Trawlers wasted a lot of time to find areas free from concentrations of flounders that, finally, influenced negatively the efficiency of their work (Table 3).

In 2001, vessels began to use trawls with minimum mesh size of 240 and 320 mm that made possible to fish mixed concentrations of skate and flounders without exceeding of allowable by-catch. Besides, various tactics were used. In particular, lifting of trawls was done at low speed that favoured the relatively small flounders to escape through the mesh and from the trawl. All the mentioned measures positively influenced the operation of trawlers (Table 3).

Biological characteristics

In August/October 2000, length of skate in catches varied from 20 to 72 cm and constituted predominantly 32-55 cm (Fig. 3). It was observed that mean length increased from August (41.4 cm) to October (45.8 cm).

In October/December 2001, specimens 25-92 cm long, mainly 48-60 cm were caught (Fig. 4). Length of males was larger by 3-4 cm, on the average, than that of females. Sufficient differences in length composition of skate from catches taken in 2000 and 2001 are evidently explained by different selectivity of trawls with minimum mesh size of 136 and 240-320 mm, correspondingly. Probably by the same reasons, skate caught by Russian vessels in 2001 had

larger length compared to fish from Spain catches of 1997 when their length was mainly 38-55 cm (Junguera and Paz, 1998).

Sex ratio of thorny skate in October and December was equal, whereas in November there was some predomination in number of males over females (1:0.6). Mature males predominated in catches, and a portion of immature specimens did not exceed 5%. The majority of females was not mature yet, however, with coming of winter the decrease of a portion of immature fish in catches was registered (from 79% in October to 66% in December). A number of males ready to couple was higher than that of females and grew gradually from 37% in October to 50.7% in December. Females with capsules appeared in catches only in November (4%), and in December their number increased to 14%.

Intensity of skate feeding was high that can justify on good food supply in autumn/winter period. Mean fullness of stomach constituted in October 1.4, in November – 2.2, and in December – 2.4. Food range was quite wide and counted 11 components (Table 6). The main object of feeding was sand eel, the importance of which in feeding did not change during October/December (the occurrence constituted on the average 92%). The other organisms (euphausiids, polychaetes, crabs) occurred in stomachs in small number (from 2 to 12%).

Conclusion

Results of work of the Russian vessels in 2000-2001 show that thorny skate were practically distributed everywhere in the shallow waters of the southern part of the Grand Bank that, together with relatively high efficiency of fishery, is indirect sign of good food supply of this species.

By the present moment, there is a possibility of the effective fishing for skate in autumn months. However, there are prerequisites to find commercial concentrations in the other seasons. A possibility of fishery for skate all the year round is not excluded.

Many aspects of biology, behavior and distribution, as well as status of thorny skate stock, are still weakly studied that stipulates the necessity to investigate this species actively considering the increasing importance of it.

References

- DEL RIO, J. L., and S. JUNGUERA. 2000. Seasonally and reproductive parameters of the thorny skate (*Raja radiata* Donovan, 1808) in NAFO Division 3N. *NAFO SCR Doc.*, No. 18, 8 p.
- JUNGUERA, S., and X. PAZ. 1998. Non-traditional resources: skate fishery and survey results in Divisions 3NO. *NAFO SCR Doc.*, No. 26, 6 p.

Table 1. Catch of skate on the Grand Bank by vessels of various states in 1998-2001 (STATLANT21A data).

State	1998	1999	2000	2001
Russia	2	155	3567	2582
Spain	7503	8727	13367	No data
Portugal	993	1980	648	No data
Canada	1013	1081	490	No data
Other	3	2	240	No data
Total	9514	11945	18312	No data

Table 2. The collected biological material on thorny skate in cruises of Russian trawlers in 2000-2001.

Year	2000	2001
NO. OF HAULS	249	125
NO. OF FISH MEASURED	14876	4568
FIELD ANALYSES OF MATURITY AND FEEDING	-	810

Table 3. By-catch of thorny skate (t) at the fishery for redfishes and Grenland halibut (preliminary data)

Year	Division				Total
	3L	3M	3N	3O	
2000	12,5	6,9	26,2	56,3	101,9
2001	21,9	0,1	26,2	46,1	94,3

Table 4. Results of directed fishery of Russian vessels for thorny skate on the Grand Newfoundland Bank (Div. 3NO) in 2000-2001 (preliminary data).

Year	Month	May	June	July	August	September	October	November	December
2000	Total catch, t	47,6	1096,0	136,2	195,8	1114,0	1231,7	84,8	-
	Catch per vessel-days, t	6,8	23,5	18,6	13,7	25,0	30,1	21,2	-
	Portion of skate (%)	90,8	88,6	90,1	87,7	88,7	88,3	86,9	-
2001	Total catch, t	-	-	-	224,5	698,2	251,0	949,0	193,0
	Catch per vessel-days, t	-	-	-	14,9	27,4	22,8	31,6	38,6
	Portion of skate (%)	-	-	-	50,3	84,1	90,0	85,0	85,0

Table 5. Species composition of catches (%) during directed fishery for thorny skate.

Species	Year	
	2000	2001
Thorny skate (<i>Raja radiata</i>)	88.5	87.4
Cod (<i>Gadus morhua morhua</i>)	2.5	3.0
Dep-see redfish (<i>Sebastes mentella</i>)	0.1	0.0
Longrough dab (<i>Hippoglossoides platessoides limandoides</i>)	5.2	4.4
Yellow-tail flounder (<i>Limanda ferruginea</i>)	3.6	5.0
Other	0.1	0.2

Table 6. Feeding range of thorny skate in October-December, 2001.

Feeding components	Occurrence, %		
	October	November	December
Sand eel	72,8	64,9	75,7
Euphausiids	12,2	1,6	1,9
Polychates	1,4	7,2	2,8
Demersal crustaceans	0,7	11,8	9,3
Shrimp	1,4	-	-
Cumaceans	-	-	1,9
Bivalves	-	1,2	-
Gastropods	-	0,6	-
Young flounders	-	0,8	1,9
Spider-crab	-	1,0	-
Hermit-crab	-	0,6	-
Other benthos	-	0,4	0,9
Digested fish	4,1	5,7	5,6
Digested food	7,5	4,3	

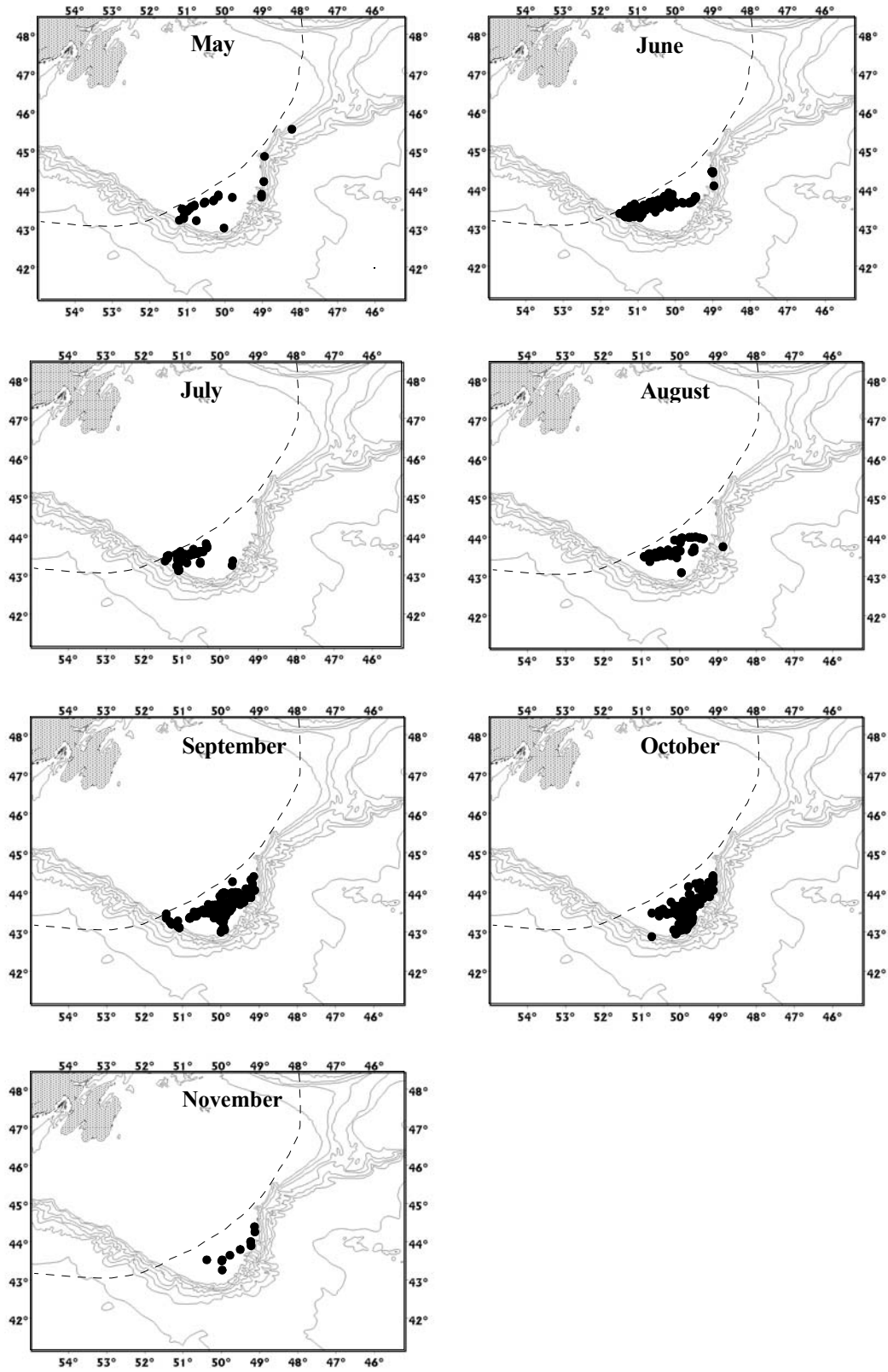


Fig. 1. Dislocation of the Russian fleet at fishery for thorny skate in 2000.

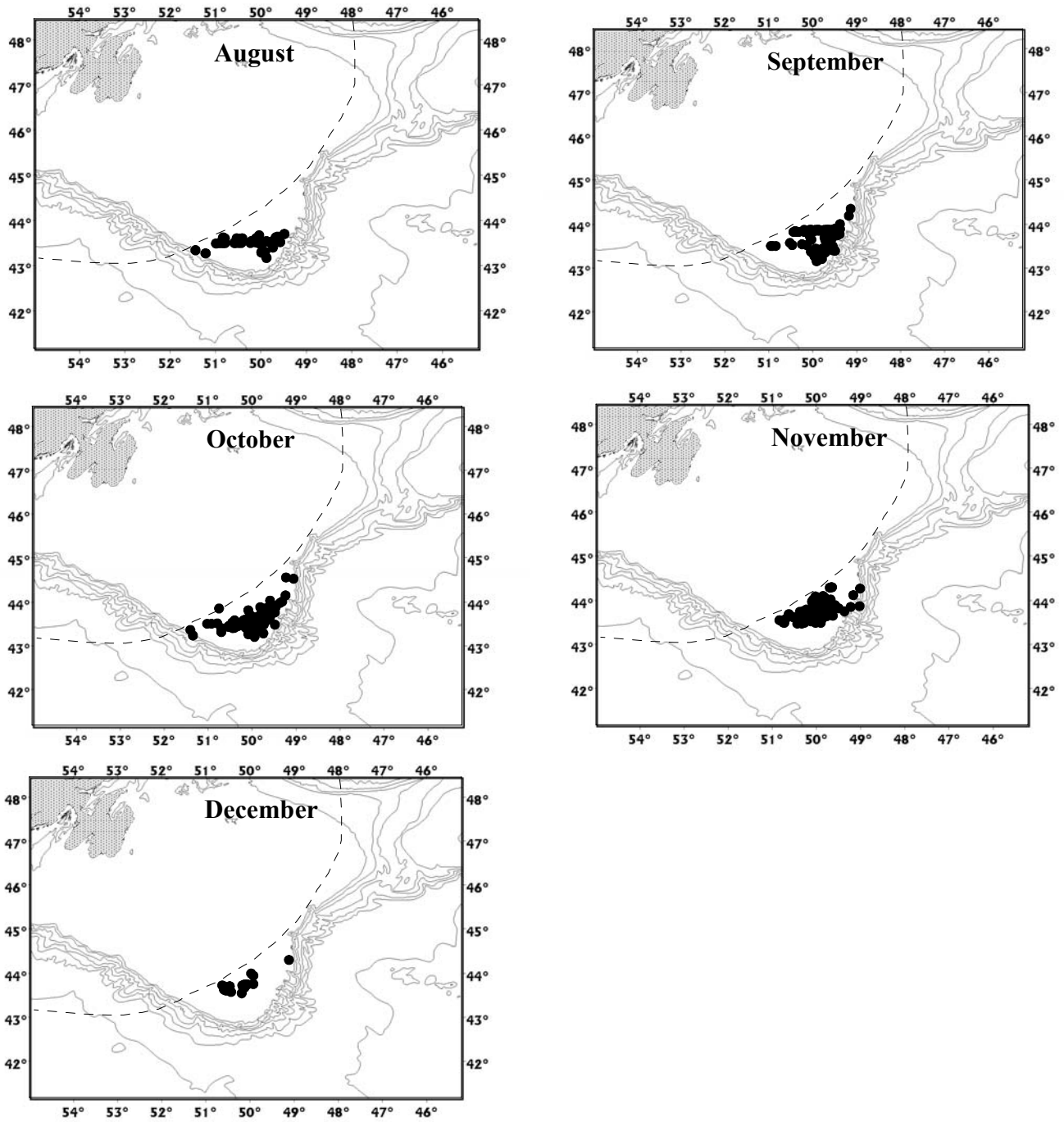


Fig. 2. Dislocation of the Russian fleet at fishery for thorny skate in 2001.

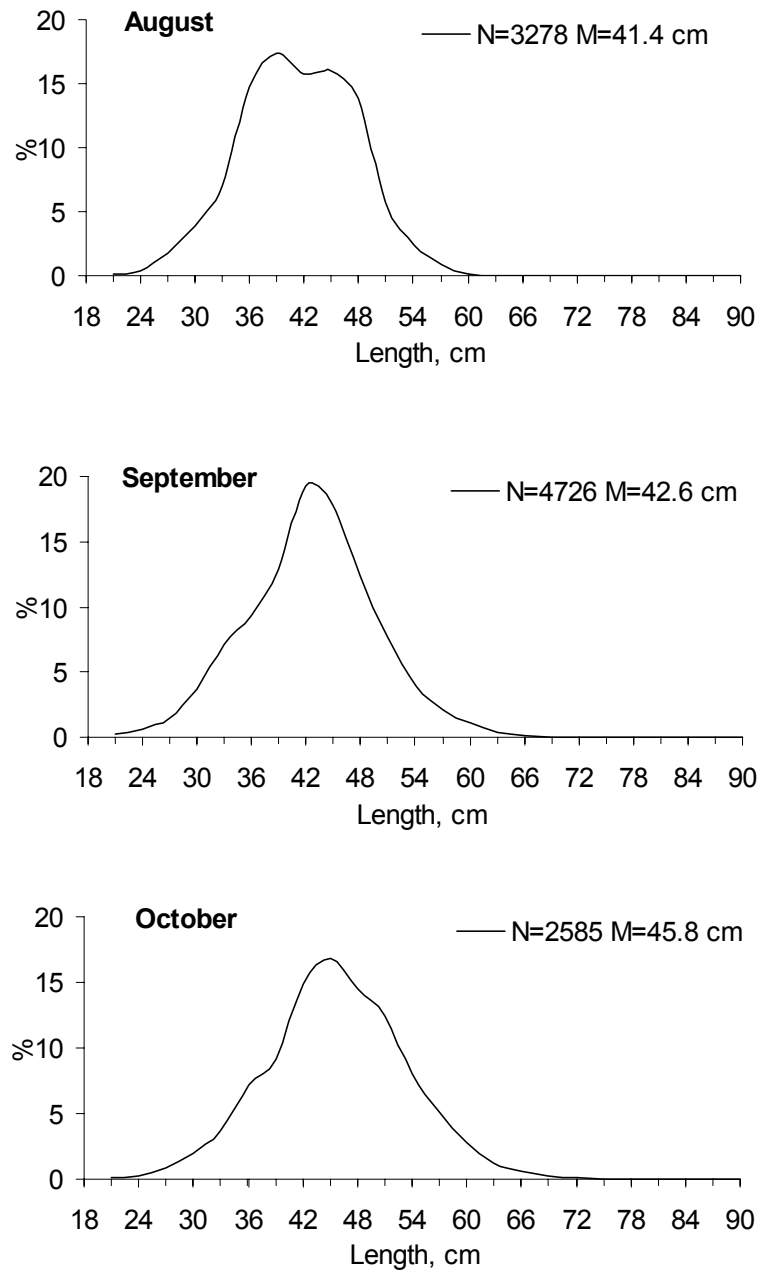


Fig. 3. Length composition of thorny skate on the Grand Newfoundland Bank (Div. 3N) in 2000.

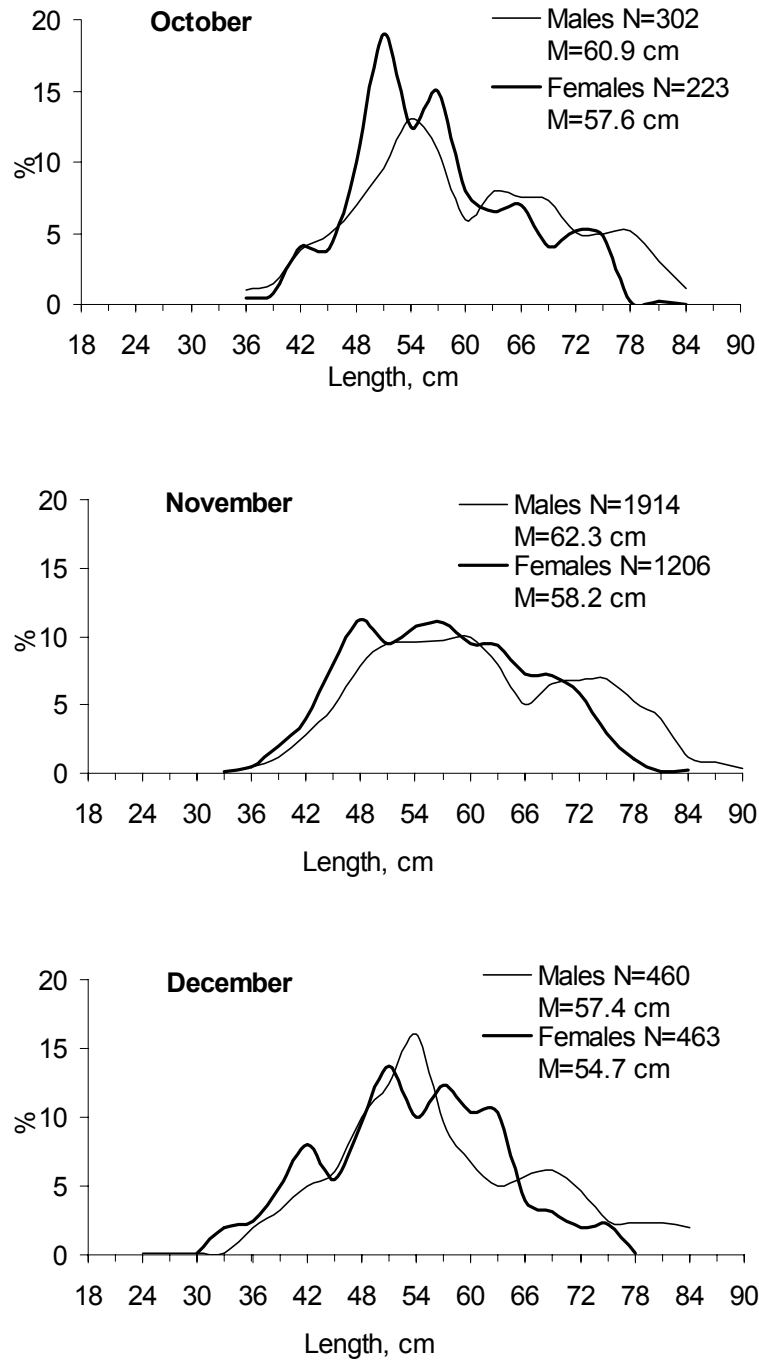


Fig. 4. Length composition of thorny skate on the Grand Newfoundland Bank (Div. 3N) in 2001.