



SCIENTIFIC COUNCIL MEETING – JUNE 2010

Preliminary review of data on selectivity of square mesh codend of pelagic trawl for redfish (*Sebastes mentella*) and value of by-catch in Russian pelagic fishing of redfish (*Sebastes mentella*) in Div. 3M of the NAFO Regulatory Area

by

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Abstract

The results of the experiment to estimate the selectivity parameters of pelagic trawl with square mesh in codend for the beaked redfish (*Sebastes mentella*) are discussed. The preliminary estimation shows that trawl codend with square mesh is well meshing able by redfish. This circumference influences on the selectivity process of trawl codend and embarrasses the estimating of selectivity parameters.

The statistical data (period 1980-2009) of Russian pelagic fishing of redfish in Div. 3M of the NAFO regulatory area are reviewed. The eventual by-catch of Russian pelagic redfish fishing is estimated. Only in 5% of pelagic hauls the by-catches were occurring. The by-catches were presented mainly by three species: skate (*Rajomorphii*), cod (*Gadus morchua*) and monkfish (*Lophius piscatorius*). Most by-catches were the skate (*Rajomorphii*). The by-catches in relation to total catch consist within 15%.

Introduction

3M redfish is an important target species in the NAFO Regulatory Area. Redfish are harvested with bottom and pelagic trawls.

Over the years, 3 M redfish catches ranged from 81,000 t in 1990 to 1,000 t recorded in 1998-1999 as a bycatch in the Greenland halibut fishery. Such a considerable decrease in the catches was accompanied by a sharp reduction in the redfish stock size and a subsequent change in fishing efforts of the fleet harvesting redfish in this area. A relative increase in the efforts of fishing vessels targeting redfish in the area is reflecting an increase in their fishable stock (A. Ávila de Melo et al, 2009).

In this regard it is important to consider the issue of the optimum mesh size in the redfish (*Sebastes mentella*) fishery in 3M taking into account the different factors. One of them is selectivity parameters of trawl codends with the square mesh. The parameters are important as for target fishes (redfish) as for the fishes of by-catch. In this regard is important to estimate as selectivity as value of by-catch fishes in the pelagic fishing.

Since no new experimental studies into trawl selectivity and assessment of the number of redfish escaped through the codend mesh have been conducted in NAFO 3M up to now, one can use the findings from the similar studies carried out in other areas using similar gear to get an approximate consideration. The

findings from other experiments on the similar target species (*Sebastes mentella*) can be used based on the principle of geometrical similarity of the mesh and similar target species (Baranov, 1914, 1948).

Material and methods

The investigations were conducted by R/V M-0102 “Vilnus” from 17 April to 2 May 2010 in Barents Sea during joint Russia (Murmansk, PINRO laboratory of industrial fishing) and Norway (Bergen, MRI, Fish capture division) research survey. The service was dedicated to investigation of pelagic trawling for cod (*Gadus morhua*) in Barents Sea.

The experiments were conducted by pelagic trawl 78.7/416 m. At towing speed of 3.7 – 4.0 knots, vertical opening of the trawl was 60 m, while the horizontal opening was 40 m.

For estimate selectivity parameters of square mesh codend a “trouser” codend was used. The codend have designed by Fish capture division of Bergen Marine Research Institute, Norway. The codend was made with PE net material. Inner mesh size of left codend was 135 mm, codend panels was made by T90 mesh way, additionally a liner with inner mesh size 55 mm is inserted into the codend. Right codend was made with nets of square and T90 meshes, the average inner mesh size is 132.5 mm.

Selectivity data were processed for each haul and for each series of hauls. Data processing was carried out by ICES methods. Selectivity parameters were calculated by a SELECT model with an estimated “split parameter”.

Data on the selectivity experiment are able apply for the redfish fishery in NAFO Div.3M by reason of assumption of the principle of geometrical similarity (Baranov, 1914, 1948), which states that the selectivity depends only on the relative geometry of the mesh and the fish: “Since all meshes are geometrically similar and all fish of the same species (within a reasonable size range) are also geometrically similar, the selection curves for different mesh sizes must be similar” (quoted, in translation, from Wulff, 1986, p. 101).

Statistical data base of commercial and research vessels for period 1980-2009 was analyzed for determine possibilities of by-catches in pelagic red fish (*Sebastes mentella*) fishing in Div. 3M of the NAFO regulatory area.

Results

Four hauls of selectivity experiment was done. The three of them were unusable for selectivity estimating for catch of redfish was distributed per codends not equal. The catch of one haul is good for estimating selectivity square mesh codend only.

Length distribution of redfish catch and selectivity curve of square mesh codend is presented in Figure 1 and 2.

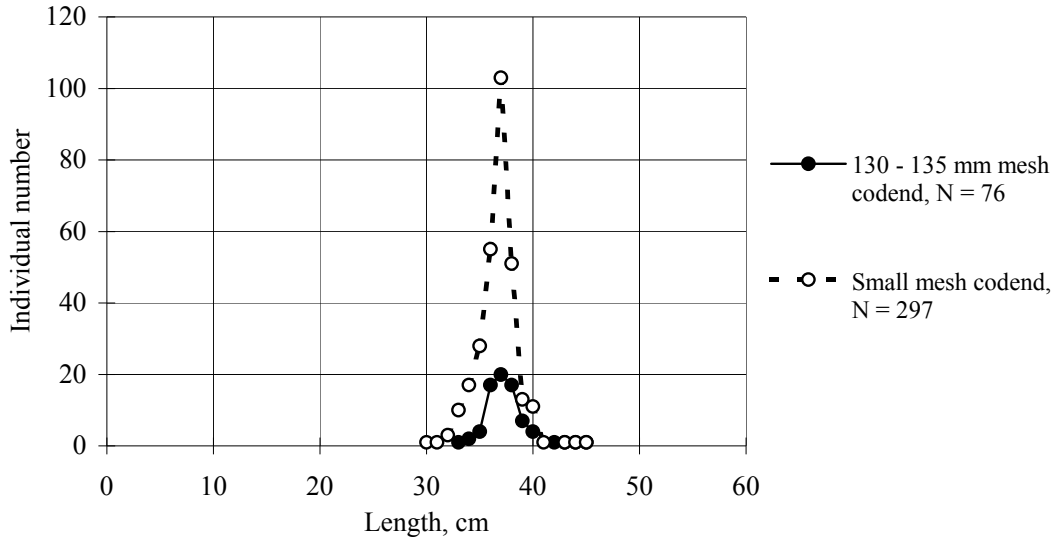


Figure 1. Length distribution of redfish (*Sebastes mentella*) catch in the experimental twin (“trouser”) codend, first codend is made with square mesh (inner mesh size 130-135 mm) and second coded with small mesh (with liner).

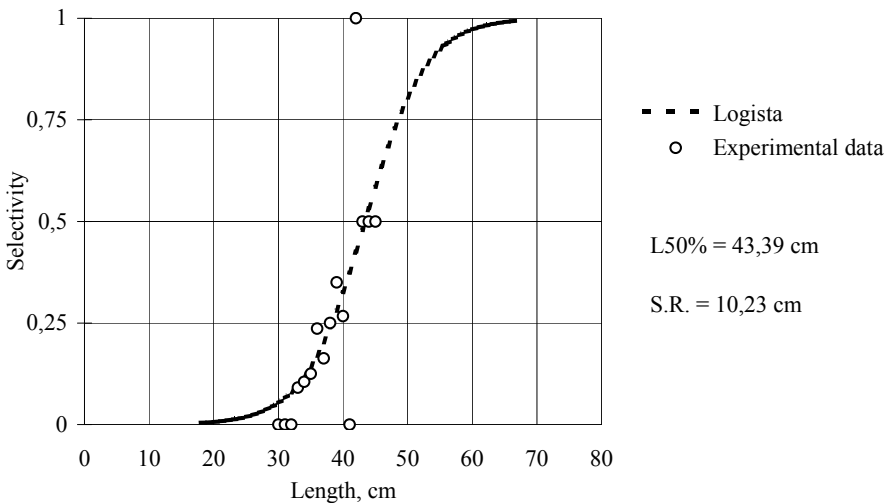


Figure 2. Curve selectivity (logista) of codend of square mesh (inner mesh size 130-135 mm) for redfish (*Sebastes mentella*).

Selectivity parameters of one valid haul for square mesh codend with inner mesh size 130-135 mm are:

- fish length which according to 50% retention, $L_{50\%} = 43,39$ cm;
- selectivity range, S.R. = 10,23 cm;
- selectivity factor, s.f. = 3,27.

The statistical data of Russian pelagic fishing of redfish in Div. 3M of the NAFO regulatory area are reviewed for estimate eventual by-catch. Catches of 23207 pelagic hauls were analyzed for period 1980-2009. The by-catches were indicated in 1162 among 23207 hauls, this is not more then 5% (Figure 3).

The by-catches were presented by skate (*Rajomorphii*) – 77,6%, monkfish (*Lophius piscatorius*) – 19%, cod (*Gadus morchua*) – 3% and Atlantic Halibut (*Hippoglossus hippoglossus*) – less 1%. Average values (%) of observed by-catches of these species in the pelagic hauls are presented in Table 1.

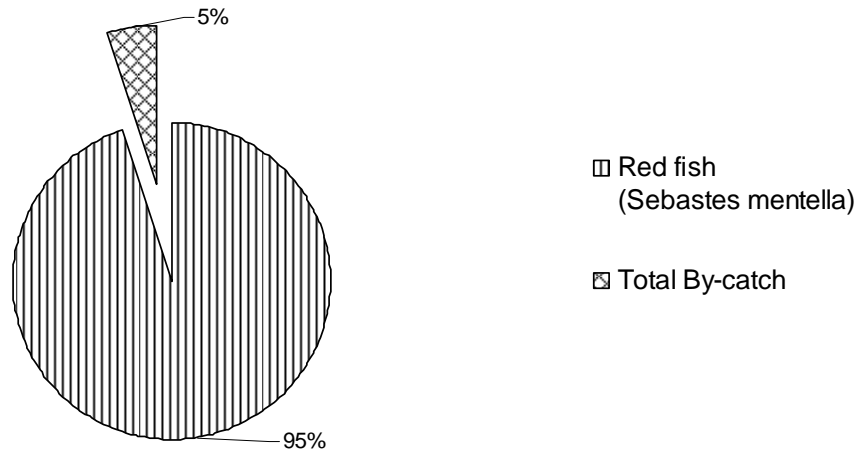


Figure 3. Share of trawls with by-catch in the redfish (*Sebastes mentella*) pelagic fisheries. Div. 3M of the NAFO regulatory area for period 1980-2009.

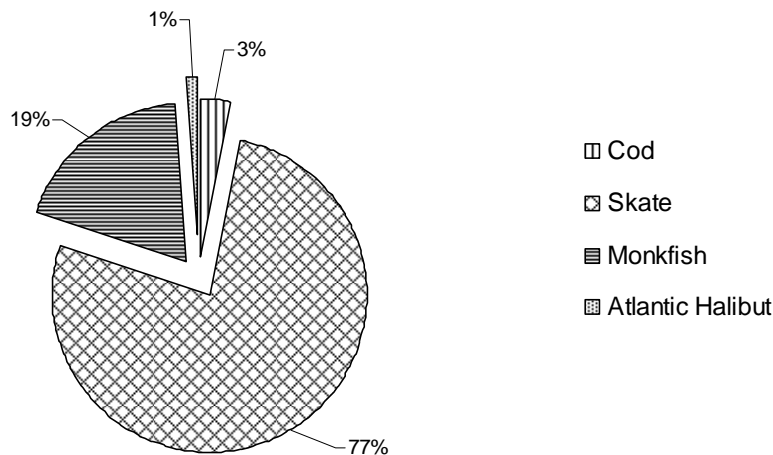


Figure 4. Composition of the by-catch in the pelagic fisheries of redfish (*Sebastes mentella*). Div. 3M of the NAFO regulatory area for period 1980-2009.

Table 1. Average values of the by-catch (%) in the catches of redfish (*Sebastes mentella*) pelagic fisheries in Div. 3M of the NAFO regulatory area for period 1980-2009.

Species	Bycatch, %	Standart error	p - value (95%)
Cod	10,28	0,28	0,0056
Skate	15,13	0,38	0,0074
Atlantic Halibut	10,00	0,00	0,0000
Monkfish	11,86	0,32	0,0063

Conclusion

The obtained selectivity parameters can be accepted like a crude data because one of four experimental hauls was successful only. This result is not enough for statistical confidence and this data is possible to use for approximate estimation only. For improve this data it is necessary continue experimental work in this research field.

Nevertheless it is important to note that the square mesh codend are very well meshed by redfish. This circumference and small size of catches in the three of four hauls maybe cause of unable data for selectivity. Thus is possible to suppose that selectivity parameters of square mesh codend will not stability in following experiments due to its meshing ability.

The by-catch estimating of Russian pelagic fishing of redfish (*Sebastes mentella*) showed that main species of by-catch are: skate (*Rajomorphii*), cod (*Gadus morchua*) and monkfish (*Lophius piscatorius*). By-catch of Atlantic Halibut (*Hippoglossus hippoglossus*) was accidental because it is in three hauls only. Most by-catches were the skate (*Rajomorphii*). By-catch value of these species was not high it is not more then 15.5% (with 95% confidence level). Most by-catches were the skate (*Rajomorphii*). Low values of by-catch in Russian pelagic fishing of redfish (*Sebastes mentella*) bear record to pelagic trawls mostly are fishing far from bottom and far from bottom fish stocks. This behavior of fishing fleet is explaining by fear of fishermen to lose the pelagic trawl due to accident touching of ruff sea bed.

Nevertheless it's known that by-catch in the bottom redfish fishing is more significant than in pelagic fishing. Thus decreasing of the codend mesh size will not negative impact on the by-catch of demersal fishes if strategy of pelagic fishing and pelagic trawl rigged are not special changing for fishing close to the sea bed.

References

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