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Migrations of Adult Beaked Redfish (*Sebastes mentella*) in North Atlantic in Periods of Fishing

by

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Abstract

One of major commercial objects of North Atlantic – beaked redfish *Sebastes mentella* - accomplishes the prolonged and extensive migrations from North-Eastern to North-Western Atlantic and back. These migrations were studied on movement of fishing ship, following after the redfish concentrations. Redfish coming in the Labrador Sea mainly comes from the Irminger Sea; approach of redfish is possible also from Canadian offshore waters and from the Grand Bank and Flemish-Cap.

Introduction

4 types of redfish dwell in North Atlantic: golden redfish *Sebastes marinus*, beaked redfish *Sebastes mentella*, Acadian redfish *Sebastes fasciatus* and Norwegian redfish *Sebastes viviparus*.

Beaked redfish (*Sebastes mentella*) is one of major commercial fish, dwellings both in North-Eastern and in North-Western Atlantic. Unlike other types of redfish, beaked redfish accomplishes the long and extensive migrations in North Atlantic, including migration from North-Eastern to North-Western Atlantic and back [Vaskov et al., 2002; Ratz and Shibanov, 2000; Junquera and Gonzales, 2001; Ratz and Stransky, 2001; Chepel, 2001; Alekseev, 2002]. Knowledge of migrations is needed for an effective management of fishing.

Redfish fishery is conducted practically from the beginning of XX century, and practically the always-basic commercial redfish was beaked redfish. At the beginning of 80th of the last century global fishery of beaked redfish began outside EEZ in the Irminger Sea (North-Eastern Atlantic - NEA), and at the end of 90th - in the Labrador Sea (North-Western Atlantic - NWA). For the last 30 years of XX century the total catch of redfish in NWA was about 2.5 million tons. [Chepel, 2001].

Historically fishery of redfish began on banks and shelf of Farer, Iceland and East Greenland. Further fishery was displaced in the open waters firstly Irminger Sea, and later Labrador Sea. Was there a question – is it separate stocks of redfish or part of single general stock? The hypothesis of 3 stocks was pulled out:

1. Deep-water stock (slopes of Iceland, Farer, to Greenland)
2. Ocean stock (open waters of ocean, depths less 500 m)
3. Deep-water ocean stock (open waters of ocean deeper 500 m) [Magnusson et al., 1995]

Some scientists are predisposed to the hypothesis of single stock [Saborido-Rey et al., 2001; Melnikov et al., 2001; Bakay and Melnikov, 2002; Melnikov and Bakay, 2002; Gonzales and Power, 2002]. In this case during a year there is a substantial redistribution of this single stock on areas of North Atlantic, that is confirmed seasonal changeability

of redfish fishery. In behalf on the last hypothesis usually given circumstance that in none of areas of North Atlantic the complete life cycle of this kind is incorporated from impregnation to the adult individuals.

Melnikov and other [Melnikov and al, 2001] show that redfish are coupled in August-November, but sperm remains in females idle to February-March, when eggs impregnate spermatozoa. Larvae appear in April-May. Further follow period of feeding (June-middle August), again impregnation and wintering (December-March). Larvae thrown out near the western slope of Reykjanes Ridge, are carried westward by the Irminger current, achieve East Greenland, where settled. Other part of larvae continuing to drift with West Greenland Current within the subarctic gyre can achieve the banks of Western Greenland and, possibly, Baffin Island [Trojanovsky, 1992]. Growings up at shores of East Greenland of individual go back into the Irminger Sea. The return of growing up individuals is possible and from other areas of North Atlantic [Alekseev, 2002].

The spatial distributing of bass and his migrations substantially depend on oceanographic terms [Pedchenko, 2001].

Adult individuals accomplish alike, but more difficult migrations. Especially little information is about migrations in North-Western Atlantic. And this work is devoted to attempt to generalize datum about migration of adult beaked redfish.

Material and Methods

The author took part in the commercial trips of Latvian fishing vessel "Dorado" as NAFO observer and NEAFC scientific observer to North Atlantic from 2002 to 2006. Aboard a ship mass measurements and biological analyses of redfish were executed.

The ways of migrations of redfish were estimated indirect a way, on displacement of fishing ship, following after the school of redfish. Except that weight and biological characteristic of catches were taken into account: middle length and weight, female/male correlations, stage of maturity of gonad, degree of extensiveness of infection by vermin. If the indicated parameters differentiated no more than on 10-15%, it was assumed that displacement of ship corresponded the real migration of accumulations of redfish. On the pictures resulted below such displacements were marked a continuous line.

If one or a few parameters differentiated substantially, such displacement had been considered supposed and on pictures it is marked the dotted line. If an accumulation, proper on initial parameters to previous, was revealed in a few days, but not traced directly on displacement of ship because of row of reasons (for example, unloading, bunkering), such displacement was also considered supposed.

The analysis of obvious and supposed migrations in combination with literary information allowed getting certain results and drawing some conclusions.

Results

Northeastern Atlantic. A few last years (2002-2006 years) fishing began in the first ten-day period of April on the area of crossing of EEZ of Iceland and Reykjanes Ridge in subdivision XIVb ICES. It is needed to mark that at favourable hydrometeorological conditions the separate accumulations of redfish can go out from Iceland EEZ in the second half of March, but their amount is small, and they cannot be basic for good fishing.

Redfish fishing was carried out from April for July. As a rule, commercial fishing ships were displaced along the border of EEZ of Iceland, sometimes deviating to the southwest from Reykjanes Ridge. Moving of fleet along the Reykjanes Ridge, to our opinion, corresponds the real migrations of redfish schools, what cannot be said about displacement to northwest. Possibly, water on a northwest is later warmed up to the necessary for the beginning of migrations temperature.

Only in 2004 in June-July fishing ships stepped back from the border of EEZ of Iceland and followed after the accumulations of redfish southward to 61°40' N., then changed direction to east, where near 29°W entered in EEZ of Iceland. Other part of accumulations went away southward and was lost a fleet. Thus, an accumulation probably accomplished displacement anticlockwise, going out from Iceland EEZ and entering in her, but south-easterner.

In throughout the year, since June, the accumulations of redfish are usually observed near the border of EEZ of East Greenland and in its limits.

In separate years redfish fishing recommenced in September in subdivision XII ICES. Displacements of redfish were marked in northeastern direction.

The results of observing and analyses enable to define the structure of migrant schools. As a rule, large females (long more 40 cm) head the process of migration; more shallow females follow by them, after before not spawning (II and the III stages of maturity). With small lateness large males (more 40 cm) begin migrations, after males of less sizes, and lock a process again large males (it is a sign that an accumulation leaves). Most catches were marked on leaving of more shallow fish, at almost equal correlation of female/male and at approximately equal middle length of males and females.

In a mass amount the large exemplars of redfish (bulk of 42-45 cm for females and 40-43 cm for males) meet only in open part of Irminger Sea and not meet in NWA except for separate copies. More small fish accomplish the long and extensive migrations to NWA.

Northwestern Atlantic. Here fishing was conducted on wider area, than in NEA, and to trace migrations of fish it was more difficult.

In 2002 (fig.1) the well expressed displacement of accumulations is marked at first on a southeast, and then on a northeast, Here migrations on a northeast proceeded and after the transition of accumulations from the area of NAFO to the area of NEAFC, up to beginning of September, when they entered in the EEZ of Greenland.

In 2003 (fig.2) migrations prevailed the mainly sent westwards, northwest and southwest. However also marked migrations were on a southeast in the division 1F, possibly to the district of Grand Bank and Flemish-Cap.

In 2004 (fig.3) migrations registered in straight opposite directions. In division 1F accumulation of redfish displaced mainly to east, after to the northeast, and in division 2J - to west, to the northwest.

2005 a year in all divisions is marked migrations in northeastern direction (fig.4).

In 2006 (fig.5) in 1F, 2H and 2J divisions was observed general migrations westward. On the south of EEZ of Greenland fish on the whole moved east.

So considerable changing of ways of migrations is explained the lack of coincidence of periods of supervisions and substantial changeability of hydro meteorological conditions in different years.

It should be noted that previous sizes of females (36-39 cm) and males (35-38 cm) fishing in Labrador Sea (NWA) practically correspond such the females and males, dwelling in upper 500-meter layer of Irminger Sea.

Discussion and Conclusion

On the basis of supervisions of author and literary information the next scheme of migrations of adult redfish is offered.

Adult redfish begins mass leave EEZ of Iceland in the first ten-day period of April. Large females, after smaller, after before not spawning, go out in the beginning. Large males, after more small and at the end again large, go out with some delay. Accumulations go out separate "waves"; sometimes one output is laid to another. At first accumulations go out from a southeast area, after from northwestern. Migration is orientated on a southwest, but a fleet usually does not follow by the first schools, because new accumulations go out from EEZ. Intensity of outputs is changeable, usually marked 2-3 mass output, in intervals, which the catches of ships go down between. Outputs proceed approximately to the middle of June. Approximately at the beginning of June reverse migrations of large redfish begin to the area of Iceland. In the first ten-day period of June going out more small and returning more large individuals are mixed up, what provides good catches in this period. On the terms of reverse migration made an exception only 2005 year, when large fish returned a little before (in the third ten-day period of May).

Large fish, dwelling mainly deeper 500 m, accomplishing migrations in direction anticlockwise, in July returns in EEZ of Iceland. Part of more shallow fish acts similarly. The other fish passes to NWA.

In June the accumulations of perch begin to appear near-EEZ of East Greenland or directly in its limits. Redfish continues to displace on a southwest partly inside EEZ of Greenland, partly outside. The route of migrations depends from special hydro meteorological conditions of current year. So, in 2003-2005 fish migrated mainly outside the EEZ of Greenland that is confirmed the low catches of ships inside EEZ. Before 2003 years and in 2006 fish moved largely through EEZ of Greenland.

Approximately in the middle of July fish achieves the area of NAFO and forms commercial accumulations in divisions 1F, 2J, 2H and possibly, in other divisions. In our view, most part of redfish comes here from Irminger Sea, but not all. Most catches of redfish usually register in the first ten-day period of August, on the border of divisions 1F and 2J, that can be explained connection of migratory streams of redfish from NEA (Irminger Sea) and from Canadian offshore waters (probably with Hamilton Bank). Migrations of 2004, in particular, are well explained the return of redfish from division 1F to NEA, and from 2J - in the area of Canada.

We were made an attempt to differentiate a redfish, coming from Canada. It is yet more shallow fish, than coming from NEA (bulk of females of 32-35 cm against 36-39 cm, males 34-36 against 35-38). In addition, among "Canadian" fish in July and even in August meet female on IX stage, which does not almost meet for fish from NEA even in June (in NEA IX stage passes before, than in SZA).

By our estimations, usually fish from the area of Canada does not exceed 10% from common amount of redfish even near the border of EEZ of Canada. Further to east its amount diminishes, and "Canadian" fish practically is not marked in 1F, that does not exclude its separate appearances in big quantities in separate years.

At meeting of accumulations of "Irminger" and "Canadian" fishes first as more large and more numerous partly drive back, partly assimilate the second. Fully possibly, that part of the "Canadian" redfish accomplishes recurrent migrations with "Irminger" fish.

Some works [Anon., 2001; Alekseev, 2002] mark that "Irminger" and "Canadian" stocks can be part of single stock.

In addition, as said before, the local limited approaches are possible to Labrador Sea on feeding and subsequent return back redfish from Grand Bank and Flemish-Cap. As marked in one of works [Roques et al, 2000], between the specimens of redfish from divisions 3LNO and SA2+3K there are not genetic distinctions.

Thus, to feeding to Labrador Sea the accumulations of redfish come from Irminger Sea and, probably, from Hamilton Bank, Flemish-Cap and Grand Bank.

In September, and sometimes and since the middle of August, recurrent migrations of redfish begin into places of wintering. Recurrent migrations of perch from NEA also can be carried out either through EEZ of Greenland or on the open part of NEA. In 2002 and 2003 years a fleet worked on such accumulations in a division XII ICES. However fishing on such accumulations is not stable because of their scattered ness and high mobility.

Offered by us the general chart of the supposed migrations of beaked redfish in North Atlantic is presented on fig.6. She is logically written into charts, offered by other authors [Alekseev, 2002; Chepel, 2001], and also complements and specifies them. In particular, it is need to mark the coincidence of chart of migration of larvae [Alekseev, 2002; fig.7] and adult individuals within the limits of subarctic cyclonic gyre. The drift of larvae in waters of Western Greenland makes an exception. Presently unknown, whether adults migrate from NEA to this district. In particular, Alekseev assumes that adults redfish does not migrate to this region. It is also not confirmed by work of fleet in 2002-2006.

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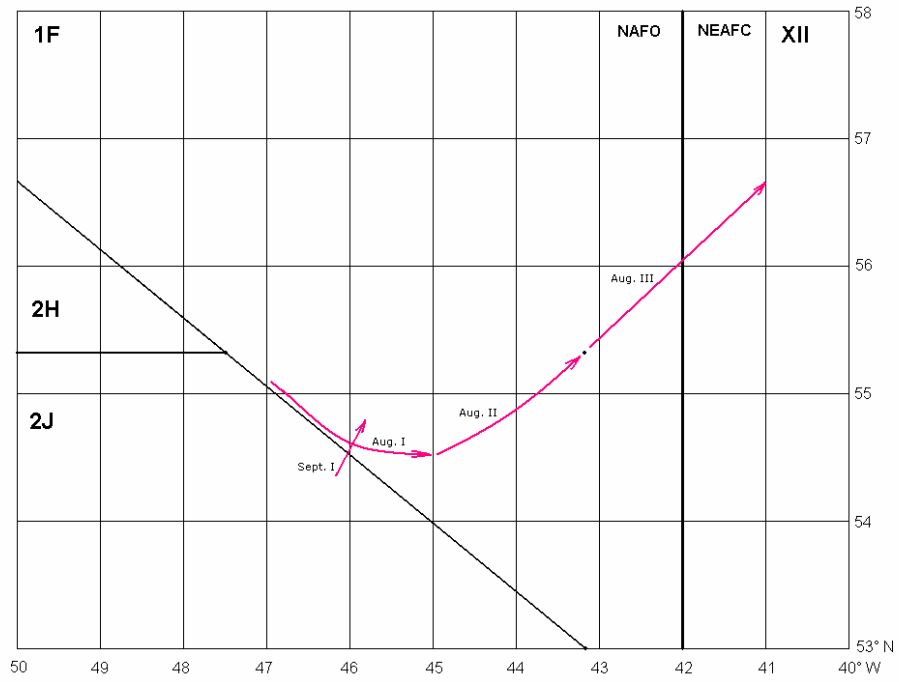


Fig. 1. Migration of adult Redfish in North-Western Atlantic in 2002

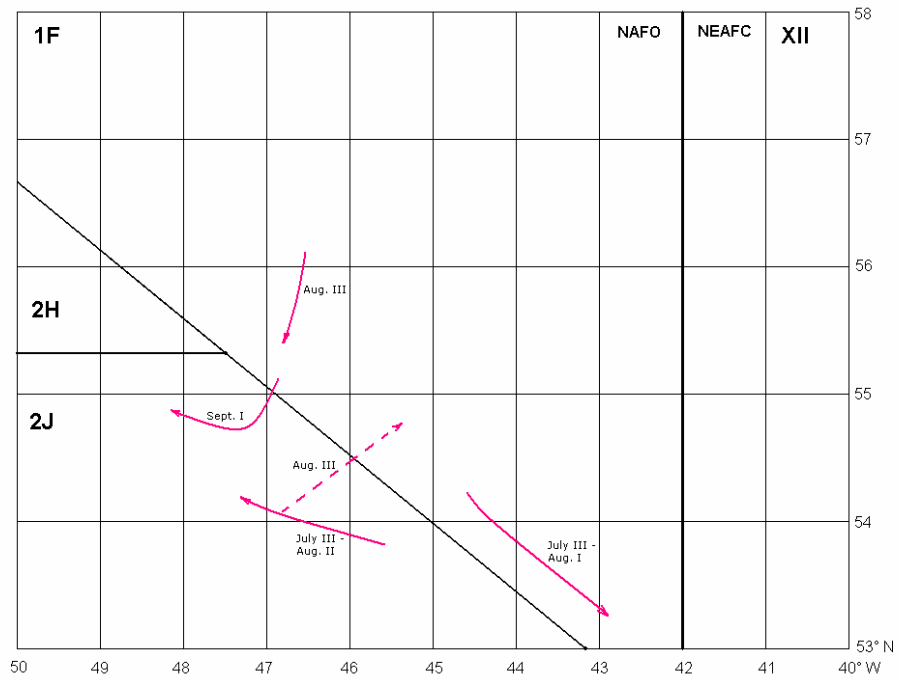


Fig. 2. Migration of adult Redfish in North-Western Atlantic in 2003

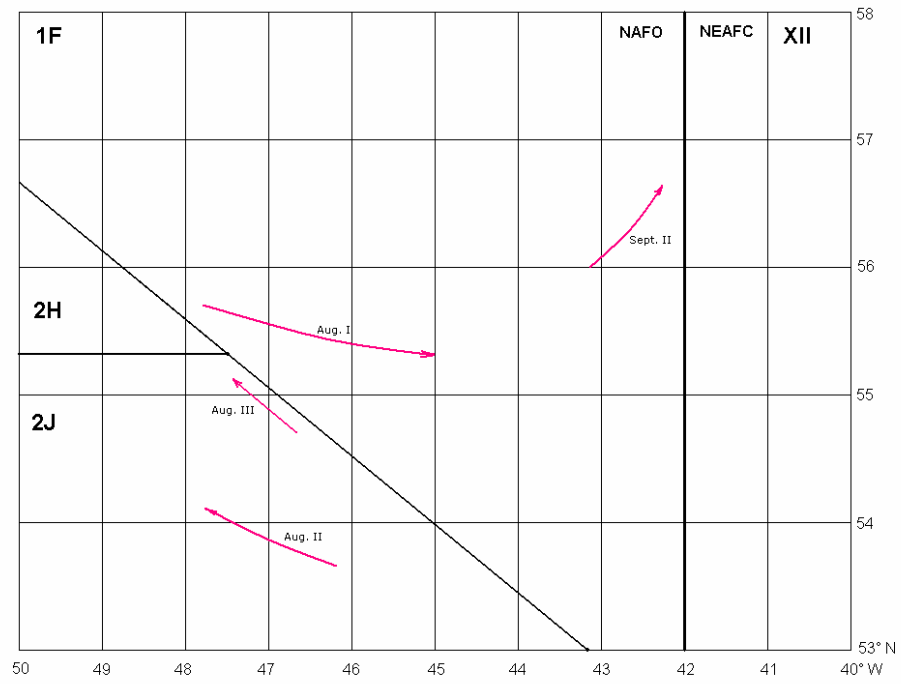


Fig. 3. Migration of adult Redfish in North-Western Atlantic in 2004

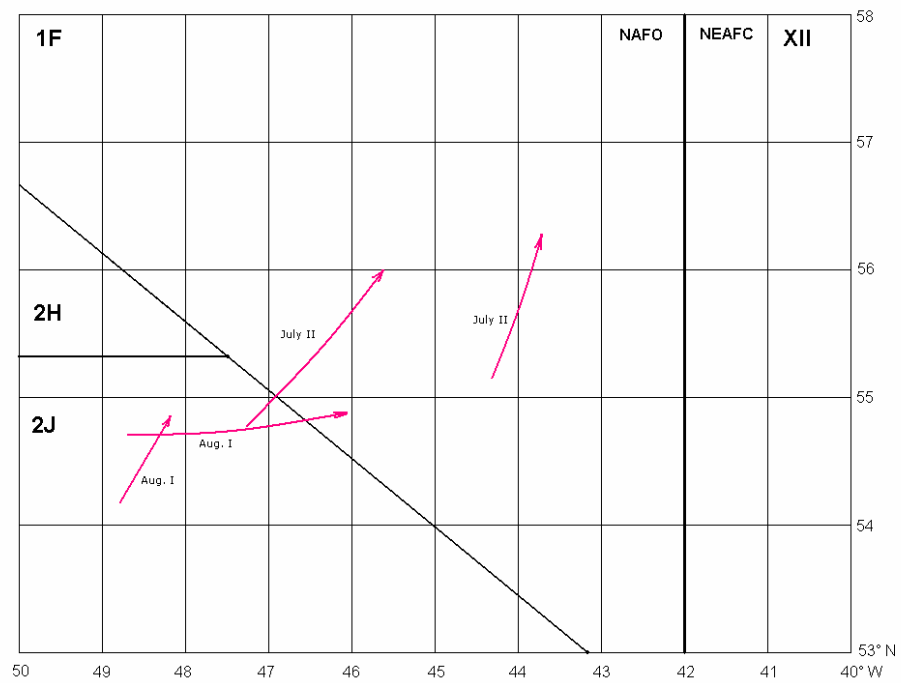


Fig. 4. Migration of adult Redfish in North-Western Atlantic in 2005

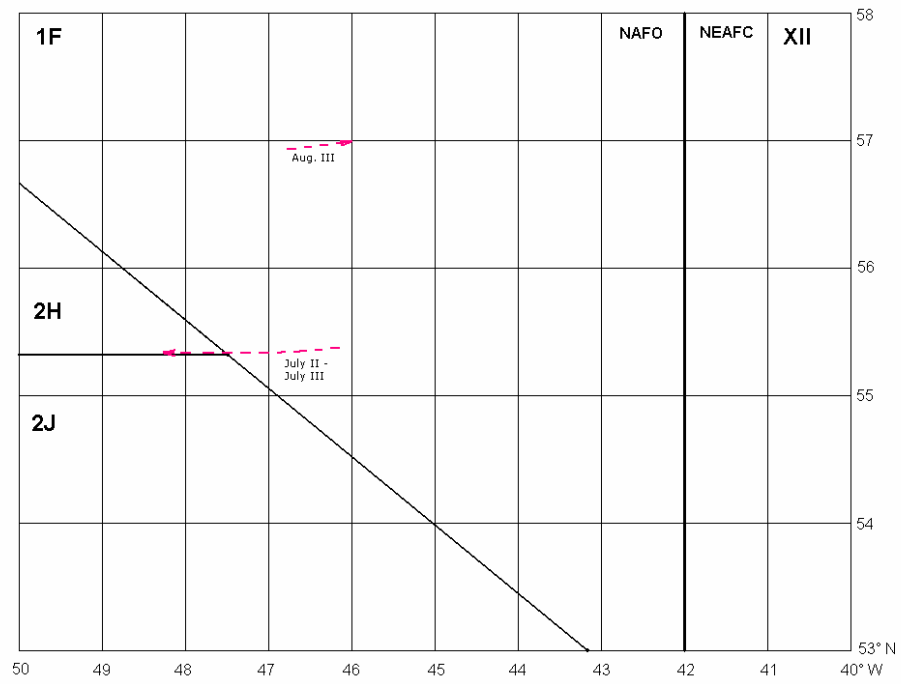


Fig. 5. Migration of adult Redfish in North-Western Atlantic in 2006

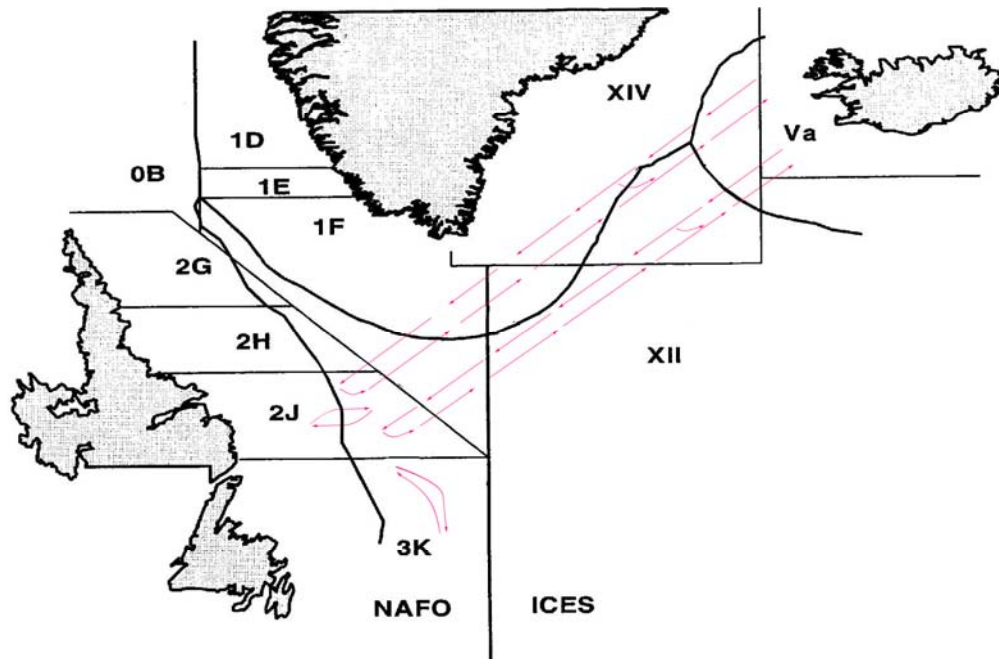


Fig. 6. Total scheme of adult Redfish migration by data of Redfish fishery in 2002–2006.

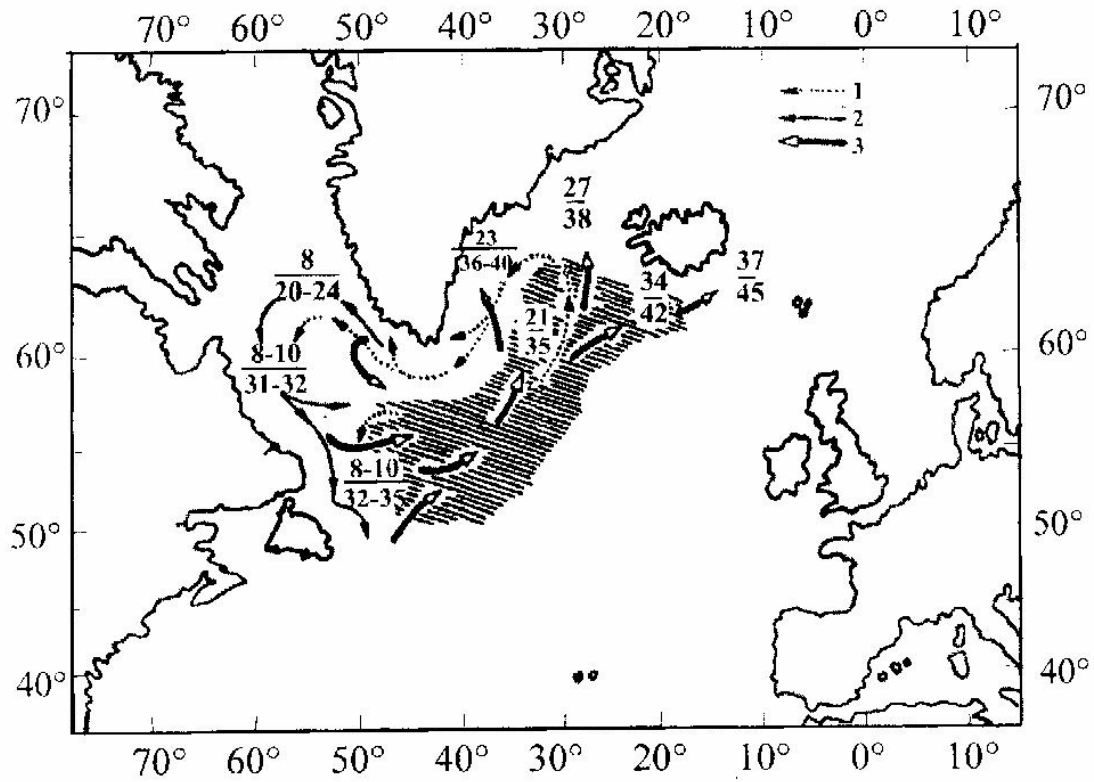


Fig. 7. Functional structure for *Sebastes mentella* area in the Northwest Atlantic. 1- direction of larvae and fry drifting, 2 - direction of immature specimens migration, 3 - direction of migration for *Sebastes mentella* firstly maturing and mature females. The area where the larvae are spawned is dashed. The figures mean minimum length values (numerator) and mean length and mode by area.