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Interannual changeability of hydrometeorological conditions in the beginning of 21st century and their connections with CPUE of redfish in North Atlantic.

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Abstract

One of basic commercial objects of North Atlantic is beaked redfish (*Sebastes mentella*), widely dwelling in the opened waters both inside and outside 200-mile EEZ. Places of forming of fish concentrations, terms and directions of migrations, the periods of connubium and spawning depend on many factors, one of basic from which there are hydrometeorological conditions.

Introduction

Beaked redfish (*Sebastes mentella*) is one of major commercial species; dwell both in Northeast (NEA) and Northwest (NWA) Atlantic. Redfish fishery is conducted about one hundred years, from the beginning of 20th century, and usually basic commercial species of redfish was beaked redfish. At the beginning of 80th of the last century commercial redfish fishery began outside EEZ in the Irminger Sea (NEA), at the end of 90th – in the Labrador Sea (NWA), from 2005 – in the Norwegian Sea (NEA). Presently fishery in all regions is regulated (accordingly, NEAFC and NAFO).

Dependence from hydrometeorological conditions is obvious for all of types of redfish, but especially characteristic for beaked redfish, which unlike from other three dwellings in North Atlantic species of redfish accomplishes the extensive and long migrations. Influence of hydrometeorological parameters is further considered on forming of accumulations in different regions and in different periods.

Material and Methods

All need information was got by an author aboard the Latvian commercial fishing ship of «Dorado» for period of 2002 - 2011 years during implementation of duties of observer in the NAFO and NEAFC regions. As a ship is commercial, the special scientific equipment was absent; a standard ship equipment was therefore utilized: barometer-aneroid, air thermometer, anemometer et al. The Sea Surface Temperature (SST) of water was measured a surface thermometer on which the measurements of SST of device on a bridge were corrected.

A temperature in the layer of trawling was determined on the sensor of temperature located on headrope of trawl. On the basis of this information the maps of distributing of temperature were built on horizons (700 m usually at Irminger Sea and 300 m in the Labrador Sea and Norwegian Sea). As the real depth of trawling usually some deviated from these depths, the proper amendments were entered (usually they made a 0,1 degree on 25 or 33 m). Rejections, exceedings 100 m, were usually ignored.

Mass measurements and incomplete biological analyses of redfish were executed with the use of methods, accepted in YUGNIRO . Total length was measured a tapeline through 1 cm. Weight of fish was determined on electronic scales within 5 gr exactness. All of measurements were made separately for females and males.

All information, got in fishing regions was averaging, monthly and seasonally.

Results

Atmospheric pressure.

Atmosphere pressure is rendered by indirect influence on the conduct of fishery. As is generally known, the change of the field of pressure forms the dynamics of air masses, origin, moving and destruction of cyclones, anticyclones, atmospheric fronts et cetera Therefore it influences on forming of accumulations of redfish through the wind and other elements of weather.

The change of atmosphere pressure with regions and years is presented on Fig.1. Average for years pressure changed from 1003,8 to 1017,4 Mb. Interestingly to mark that since 2005 of tendencies to the change of pressure in different regions were coincided practically.
There was weak positive trend of growth of pressure in all of regions.

The correlation coefficient between pressure at Irminger Sea (NEA) and Norwegian sea (NEA) was most high - 0,72, between pressure at Irminger Sea (NEA) and Labrador Sea (NWA) – 0,67 and between pressure in the Labrador Sea (NWA) and Norwegian Sea (NEA) – 0,59. It does not cause a surprise, because pressure is determined the general system of circulation of atmosphere, and correlation between two nearby regions was higher, than between distance.

Direct connection between catches on effort (Fig.2) and atmosphere pressure is not traced. Tendencies to the change between these rows coincide sometimes, and sometimes are in opposite. The highest correlation coefficient was marked between pressure and CPUE in Irminger Sea (0,53) – that catches increase with the increase of pressure. In two other seas this coefficient is small.

Air Temperature.

The average annual temperature of air (Fig.3) changed within the limits of 6,4-11,6°. The warmest air was observed in the Labrador Sea, most cold – in the Norwegian Sea, that, possibly, it is related to the seasonal changes: works in the Labrador Sea were conducted in July-August, and in Norwegian – in September. It is possible to mark the small decline of temperature of air in Irminger Sea and Labrador Sea and increase in the Norwegian Sea.

Coefficients of correlations between the temperatures of air in nearby seas were enough high – 0,58-0,65, that again can be explained the general system of circulation of atmosphere at North Atlantic. Connection between Labrador Sea and Norwegian Sea was practically zero.

Connection of temperature of air and CPUE was most high in the Norwegian Sea (besides, negative correlation coefficient -0,42, i.e. with growth of air temperature catches went down); in the Labrador Sea he was below and positive (0,37), and at Irminger Sea it was small.

Sea Surface Temperature (SST).

The average year SST variated within the limits of 8,5-13,1°. The surface water of the Labrador Sea appeared most warm, the Norwegian Sea and sea of Irminger follow further. At Irminger Sea the most high temperature was observed in 2004 (10,9°), most low in 2011 (8,5°). There was a year of maximum in Labrador Sea - 2005 (13,1°), year of minimum – 2011 (8,8°). There was a year of maximum in the Norwegian Sea - 2009 (11,8°), year of minimum – 2011 (8,9°) On the whole there is small negative trend in all of regions.

The most high coefficient of correlation between SST of different regions, strangely enough, was observed between Labrador Sea and Norwegian Sea (0,86), the coefficient of correlation was enough high also between Irminger Sea and Labrador Sea (0,69); connection between Irminger Sea and Norwegian Sea was more weak (0,24).

Connection between SST and CPUE was mainly negative (coefficient of correlation was in Irminger Sea -0,45, in Norwegian Sea -0,66), i.e. with a drop in a temperature catches are increased. In the Labrador Sea this dependence was absented practically.

A temperature in the layer of trawling.

Information about temperature in the layer of trawling is limited and present not on every year. Present information is generalized in a table 4. Thus, a temperature in the layer of trawling in Irminger Sea was 2,8-8,0°, the optimum was 3,8-7,6°. In Labrador Sea analogical indexes made accordingly 2,9-6,6° and 3,4-5,2°; in Norwegian Sea – 2,0-6,6° and 3,2-5,6°. Temperature are enough close, obviously, it is explained that a redfish dwells in the system of flows of Gulfstream – North Atlantic, Irminger and Norwegian Currents, being warm on a background of surrounding waters. On the whole, a redfish in the opened part North Atlantic dwells at a temperature 2-8°.

The similar values of temperature of dwelling of redfish are described in literature. So, Pavlov (1992) informs, that redfish of Irminger Sea forms spring schools at a temperature 5,3-5,8°, summer schools at 5,5-7,0°, autumn school in September – at 4,5-6,0°. Melnikov and other (2001) are marked optimum temperature at the spring spawning 3,7-6,2°; from data of Pedchenko (2001) feeding accumulations more frequent meet at a temperature 2,9-6,0°. From data of survey of 2009 (Anon., 2009), an optimum temperature for redfish made 3,6- 4,5°. Information from other regions is unknown to author.

Usually accumulations are close to the gradient zones. Depending on the value of temperature, accumulation of redfish could be present from the warm or cold side of gradient zone.

Conclusions

Thus, in North Atlantic at the beginning of 21st Century weak tendencies were marked to the increase of atmospheric pressure and drop in the temperature of air (except for the Norwegian Sea) and SST. It, probably, natural interannual changeability of meteorological and hydrological elements, not relating to the global warning.

Most high positive correlation was marked between pressure and catches at Irminger Sea, negative – between SST and CPUE – in Norwegian Sea and Irminger Sea.

Redfish in the opened waters of North Atlantic was caught in the system of warm flows of Gulfstream at a temperature 2-8°; optimum temperature – 3,2-7,6°.

Small volume of present information does not allow doing detailer conclusions.

Literature

Anon. 2009. Report of the Planning Grope of Redfish Survey (PGRS). ICES CM 2009/RMC: 05, 56 p.

Melnikov S.P., Pedchenko A.P., and Shibanov V.N. 2001. Results from Russian Investigations on Pelagic Redfish (*Sebastes mentella*, Travin) in the Irminger Sea and in NAFO Division 1F. NAFO.SCR Doc 01/20, 16 p.

Pavlov A.I. 1992. Biology, consisting of stocks and fishery of beaked Redfish (*Sebastes mentella*, Travin) of Irminger Sea. Abstract of thesis of dissertation of candidate of biological sciences. M.: PINRO, 23 p (In Russian)

Pedchenko A.P. 2001. The Effect of Oceanographic Conditions on the Spatial Distribution of Redfish in the Irminger Sea. NAFO. SCR Doc 01/154, 8 p.

Table. 1. Extreme and average multiyear values of separate meteorological and hydrological elements in the basic Redfish fishery Regions of North Atlantic (2003-2011).

Region	Atmospheric pressure, mb			Temperature of air, degree			Sea Surface Temperature, degree		
	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.
Irminger Sea	1017,4	1007,1	1012,4	9,0	6,7	7,8	10,9	8,5	10,1
Labrador Sea	1017,3	1009,5	1013,5	11,6	8,1	9,6	13,1	8,8	11,7
Norwegian Sea	1016,1	1003,8	1008,9	8,2	5,9	7,3	11,8	8,9	10,3

Table. 2. Coefficients of correlation between separate meteorological and hydrological elements in the basic Redfish fishery Regions of North Atlantic (2003-2011).

	Irminger Sea – Labrador Sea	Irminger Sea – Norwegian Sea	Labrador Sea – Norwegian Sea
Atmospheric pressure	0,67125	0,71783	0,58546
Temperature of air	0,58327	0,64549	-0,06150
SST	0,68982	0,23952	0,85934

Table. 3. Coefficients of correlation between separate meteorological and hydrological elements and CPUE (t/hour) in the basic Redfish fishery Regions of North Atlantic (2003-2011).

	Irminger Sea	Labrador Sea	Norwegian Sea
Atmospheric pressure	0,53030	0,04795	0,04634
Temperature of air	0,07833	0,36650	-0,41784
SST	-0,44810	0,01603	-0,65523

Table. 4. A temperature of water in the layer of catch of Redfish in the basic Redfish fishery Regions of North Atlantic in different years.

Region	Tempe-rature	YEAR							
		2002	2003	2004	2005	2006	2007	2010	2011
Irminger Sea	Total		3,5-5,5	3,7-7,6	3,0-7,6	2,8-5,9	5,6-8,0	5,0-6,5	3,7-6,8
	Optim.			3,9-6,5	5,9-7,6	3,8-5,6			4,0-6.2
Labrador Sea	Total	2,9-6,0	<5,5	4,2-6,6					3,4-4,5
	Optim.			4,6-5,2					3,4-3,7 4,0-4,2
Norwegian Sea	Total								2,0-6,6
	Optim.								3,2-4,0 4,5-5,6

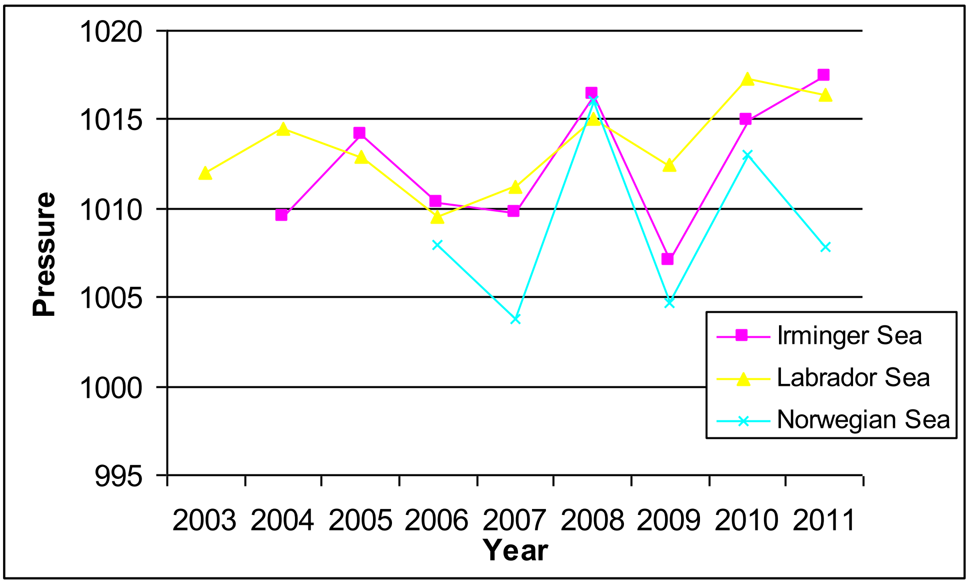

Fig. 1 Interannual changeability of atmosphere pressure in the different Regions of North Atlantic.

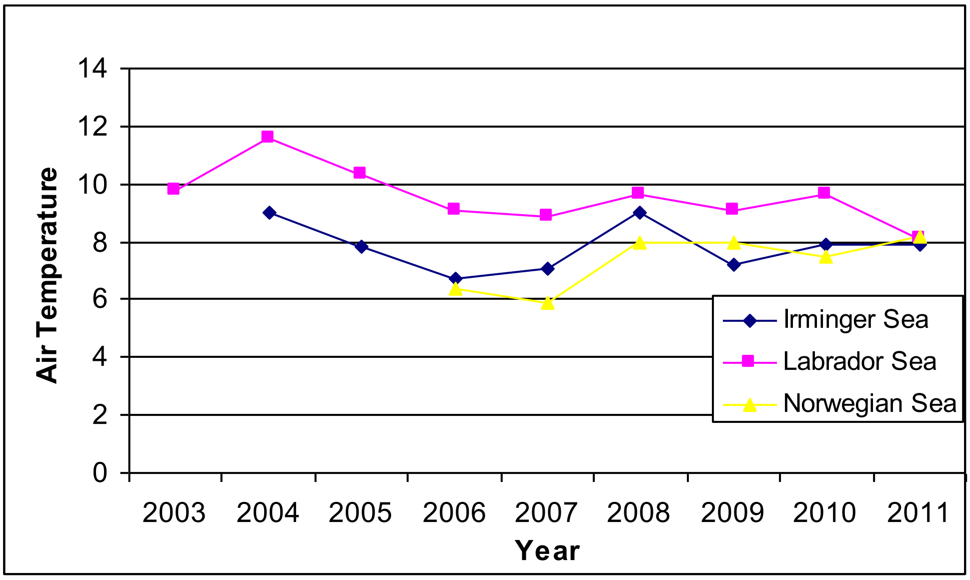

Fig. 2 Interannual changeability of air temperature in the different Regions of North Atlantic.

Fig. 3 Interannual changeability of Sea Surface Temperature (SST) in the different Regions of North Atlantic.

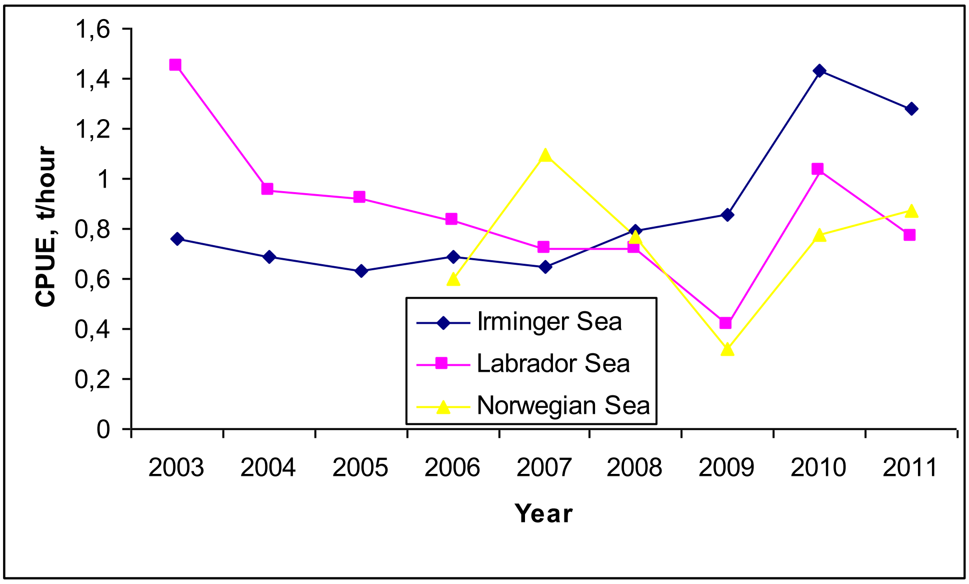

Fig. 4 Interannual changeability of CPUE (t/hour) in the different Regions of North Atlantic.