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Depth of catch of redfish (*Sebastes mentella*) and dependence of CPUE and length-weight characteristics from the depth of catch in North Atlantic.

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Abstract

One of major fisheries commercial objects of North Atlantic is beaked redfish *Sebastes mentella.* Author generalized information of the own measurements of depth of fishing, CPUE, sizes and weight of redfish in 2003-2010 in three basic fishing regions in the opened part of ocean: Irminger Sea, Labrador Sea and Norwegian Sea. Conclusions are done about the features of seasonal, interannual and regional changeability of CPUE and length-weight characteristics in dependence of depth.

Introduction

Beaked redfish (*Sebastes mentella*) is one of major commercial kinds, dwellings both in Northeastern (NEA) and in Northwestern (NWA) Atlantic. Redfish fishery is conducted practically from the beginning of XX century, and practically always basic commercial type 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). For the last 30 years of XX century the total catch of redfish in NWA was about 2,5 million t (Chepel, 2001). Presently fishery in all regions is regulated.

Depth is one of most important parameters, which has a big influence both dwelling of redfish and fishery at whole. In this work information by depth, CPUE, length and weight *of Sebastes mentella* from the different regions of North Atlantic for the last 8 years was generalized.

Material and Methods

In basis of work materials are fixed collected an author aboard the Latvian f/v "Dorado", on which he worked as a scientific observer NAFO and NEAFC in North Atlantic from 2002 to 2010. Aboard a ship mass measurements and biological analyses of redfish was executed in obedience to methods accepted in YUGNIRO.

Depth of towing was determined with depth sensor situated on headrope and fixed several times during the trawling. First question is-what is the depth of fishing? Usual time of towing of commercial ships is 12-24 hours. During this period depth of towing changes many times according to shifting fish concentrations. So it was decided to take middle mean between maximum and minimum depths of towing for all period.

$$H = \frac{Hmax + Hmin}{2}$$

Of course, it is not ideal decision of this problem, but it is more suitable variant. With the increase of number of members of row average rejection must diminish and at sufficient length of row to aspire to the zero.

It was analyzed 472 towing in Irminger Sea, 162 in Labrador Sea and 66 in Norwegian Sea. Part of towing was made inside EEZ of Greenland but accordingly in NEA (NEAFC Region) or in NWA (NAFO Region).

Total length (TL) of fish was measured by a tapeline within 1 cm. Length distribution was summarized with an interval in 1 cm. Weight of fish was measured by electronic scales within 5 g. All measurements were made separately for females and males.

The order of consideration of regions corresponds fishery motion – at first the Irminger Sea, after the Labrador Sea and last the Norwegian Sea.

Results

Depth distribution

Irminger Sea.. This is the basic region of redfish fishery. Most statistical material is collected exactly on this region. It is characterized most seasonal scope – a period from March to September is observed. Spatial scope, opposite, not very many great - almost all measured individuals behaved to the division XIVb, and only small part behaves to the division XII (in September and May).

In this Region depth of fishing was changed from 69 to 930 m, and, taking into account vertical opening of trawl approximately 120 m, footrope was at the depth up to 1050 m. So we can say that adult redfish is dwelling at least on the depth 69-1050 m.

The generalized depth distribution is presented in table 1-4. Depths were divided to 25-m intervals (sometimes later – to 100 m intervals). Look firstly to total average depth. Most widespread depths of fishing were 626-650 and 675-700 m, in a whole 600-700 m. (fig.1)

Spatial changeability. To compare depth of fishery in NEA is possible only between XIVb and XII divisions. In May 2009 fishery was executed both XIVb and XII divisions (near Reykjanes Ridge). Average depth of fishing in XIVb division was 692 m, while in XII division it was 718 m. In September 2003, when fishery was conducted near to NEAFC/NAFO border, depth of fishing was 276-300 m. It is nearer to depth of fishing in NAFO Region (see below) than in NEAFC Region. So we can do suggestion that depth of fishing in NEAFC increases from west to east, and length and weight of redfish do so. (Paramonov, 2009)

Seasonal changeability was estimated by generalized for 8 years by months in XIVb division and presented in table 1-2 (fig.2). Most wide range of fishing was in summer months – June and July, most narrow – in March and September. Average depth of fishing was almost stable in March-May (676-682 m), then it decreases in June-July and also almost stable in August – September (595-599 m). If we take most frequent depth of fishing it decreases from March to September with small exceptions.

Interannual changeability. Information was generalized by 8 years and presented in table 3-4 (fig.3). In a whole we can see with small exceptions diminishing average depth of fishing during the revising period. Most frequent depth of fishing also does so.

Labrador Sea. Here both general volume of information and temporal scope (June-September) is less. But here information succeeded to be broken up by divisions (1F, 2J and 2H).

The generalized depth distribution is presented in table 5-12. Depth of fishing was 208-501 m. In 1F it was the same depth of fishing, in 2J – 226-350 m and in 2H – 249-312 m (only one trawling).

Spatial changeability. In tables 5-12 generalized data are presented by divisions 1F and 2J. There are no big differences between 1F and 2J Region, but average depth of fishing in 1F was 316 m, and in 2J – 295 m. Most frequent depths of fishing also were different: 251 – 300 m and 326-350 m in 1F and 276-325 m in 2J. Also it is possible to note, that depth of fishing inside EEZ of Greenland is more than outside, i.e. fishing depth is less in open sea than nearer to coast.

Seasonal changeability is presented in tables 5-6 (division 1F) and 7-8 (division 2J). In both divisions average depths of fishing changed a little (284-290 m) and only in August they were bigger (300 m in 2J and 343 in 1F).

Interannual changeability. Average depth of fishing for NAFO divisions 1F and 2J presented in table 9-12. Datum from 1F covers all-8 year's period, datum from 2J - only for 4 years (fig.4). Nevertheless first years we cannot see big difference between these divisions (271-304 m). Later average depth of fishing increases in 1F up to 388 m in 2010. Most frequent depth in 1F has a minimum in 2005 – 2006 (251-275 m), later it increases up to 2010 (376-400 m, in EEZ of Greenland).

Norwegian Sea. On this region the least amount of information is collected. Direct redfish fishery began in the opened waters from 2005; however information from catches were collected in 2006-2010. The generalized depth of fishing is presented in table 13-14. Depth of fishing in Norwegian Sea was 326-450 m.

Estimating **spatial and seasonal changeability** is impossible, because all information behaves to September and region of trawling is not so big. **Interannual changeability** has a minimum of average depth in 2006 (363 m), maximum of depth in 2007 (412 m) and later gradual decreasing of depth up to 382 m in 2010 (fig.4). Most frequent depth changed accordingly average depth.

CPUE and depth.

CPUE unit in this work is ton/hour (t/h). For all period of fishing CPUE changed from 0 to 10 - 20 t/h (very rarely and in very small areas). Really CPUE changed from 0, 3 (if CPUE is less, fishing usually was finished) to 1, 5 t/h. Average CPUE for last 8-years period for all regions is 0, 93 t/h.

Spatial changeability. Looking to average CPUE for all divisions (table 15) we can see the highest CPUE in 2J division, follow further XIVb, 1F, IIa and 2H. It is necessary to note, that main fishery division (namely XIVb, 1F and IIa) have very close CPUE (accordingly 0, 93, 0, 88 and 0, 87 t/h). Highest CPUE in 2J can be explained that fishery here was conducted only when fishery condition was good; lowest CPUE in 2H because of only 1 towing was here.

Concern to XII division, which is absent in table 15, this division is very big. Near the border XII/XIVb divisions CPUE is approximately the same, and the same situation is near the border XII NEAFC/ 1F NAFO.

Seasonal changeability is presented in tables 15 (fig.5). Only in XIVb we have full 7-month period. Common tendency is increasing of CPUE from March to September.

CPUE both in 1F and 2J is stable and almost equal in June and July (0, 88-0, 96 t/h), while there is a big difference in September: 0, 33 t/h in 1F and 1, 35 t/h in 2J.

No datum to evaluate seasonal changeability in 2H, XII and IIa divisions.

Seasonal changeability of total CPUE for all regions is next (fig.6): increasing CPUE from March to May and late almost stable fishery (0, 93-1, 01 t/h).

Interannual changeability. Average depth of fishing for NAFO divisions 1F and 2J presented in table 16 (fig.7). Datum from XIVb and 1F cover all-8 year's period, datum from 2J - only for 4 years, datum from IIa – for five years. CPUE in XIVb slightly decreased up to 2005-2006 and increased later, up to 2010. In 1F after 2003-2004 we can see strong decreasing up to 2009 and increasing in 2010 (only in EEZ of Greenland). In 2J after strong decreasing in 2004 CPUE was almost stable up to 2007 (last year of fishing here). In IIa we can see maximum CPUE in 2007 and minimum in 2009. Looking to total CPUE for all regions (fig.8) we see almost correct arc with 2 maximums in 2003 and 2010 and minimum in 2006.

Vertical distribution. Vertical distribution of CPUE is very unstable in time and space. Only averaging with one hundred meter intervals and taking datum for all 8-years period allow us to evaluate vertical distribution of CPUE (table 17).

In XIVb NEAFC divisions we can see maximum CPUE at depth 401-500 m. Lower CPUE decreased slightly to depth 701-900 m (fig.9), where it is stable.

In 1F and 2J CPUE decreased at layer 201-400 m and increased at depth 401-500 m (only in 1F inside Greenland EEZ). In IIa CPUE decreased at layer 301-500 m.

Length-weight distribution and depth.

Length-weight features of redfish and their spatial, seasonal and interannual changeability were analyzed by author before (Paramonov, 2009). So we shall describe here only their vertical distribution. Only 100-m averaging of datum allows us to receive some results.

There is an increase of average length and weight of both females and males, with the increase of depth in XIVb division (table 18-21, fig.10-11). Thus the sharpest increase is observed between the layers of 301- 400 and 401-500 m: - 2, 8 cm and 153 g for females and 4 cm and 212 g for males. Below an increase with a depth took a place more slowly: 0, 6-1, 6 cm and 29-72 g on each 100 m for females and 0, 3-1, 3 cm and a 19-56 g for males.

In XII division we see an increase length and weight of both females and males also, with the increase of depth. On the whole, length and weight of redfish here less, than in XIVb, that can be explained the lack of datum.

In 1F and IIa divisions we, opposite, see diminishing of length and weight of both females and males, with the increase of depth (table 18-21, fig.12-13, 16-17).

In 2J division increase of depth was accompanied diminishing of average of females and increase of average length of males, and also average weight of both females and males (table 18-21, fig.14-15). However, distinctions here are small.

Discussion and Conclusion

Idea to take middle mean between maximum and minimum depths of towing for all period allow to determine some regularities of vertical distributions of several parameters, but, unfortunately, not everywhere and not always. For divisions XIVb, 1F and IIa, where rows of observations is enough long, regularities are more correct; for divisions with short rows (2G, 2H, XII) – less correct.

Widest range of depth is, of course, in XIVb – 351-825 m, i.e. 475 m. Most widespread depths of fishing were 626-650 and 675-700 m, in a whole 600-700 m. As we can see, at this range no maximum of CPUE or size/weight of redfish. Widest range of depth is in June and July. June-July period is also time of changing average depth of fishing from 676-682 m in March - May to 595-599 m in August – September. By author's opinion, in may be explained taking into account migration of redfish (Paramonov, 2007, Paramonov, 2008) and seasonal changeability of size and weight of redfish (Paramonov, 2009) – firstly to Irminger Sea large fish come, which is catch at bigger depth, and later more small fish come, which is catch at smaller depth. June-July is intermediate period, when both large and small fish can be catch, which can give big CPUE sometimes at this period.

As to interannual changeability, diminishing average depth of fishing during consider revising period can be explained with diminishing of average size/weight of redfish for this period (Paramonov, 2009). The reason of this, unfortunately, can be aimed of fishery fleet mainly to possible large fish jointly with natural mortality.

In other divisions range of depth is less: in 1F – 225 m (226-450 m); in 2G – 125 m (226-350 m); in IIa - 125 m (326-450 m).

Comparison average depth of fishing in different divisions gives us result that it diminishes from East to West (more correct from northeast to southwest approximately by line XIIeast-XIVb-XIIwest-1F-2J). Average length/weight of redfish in a whole also does so (Paramonov, 2009). Distribution of CPUE is very unstable, both vertical and horizontal and temporal.

Main fishery divisions (namely XIVb, 1F and IIa) have very close average for 8 years CPUE – 0, 87-0, 93 t/h. Common tendency in XIVb is increasing of CPUE from March to September. But really fishing ships cannot always work in the best fishing months – August and September because of different reason – ban of fishing, full utilization of quota etc. So ships were enforced to work at other divisions with different tendency of CPUE. But seasonal changeability of total CPUE for all regions is almost stable in June-September (0, 93-1, 01 t/h).

Interannual changeability of CPUE in redfish fishery is very interesting. In XIVb division (and total for all regions) first (2003) and last (2010) years have maximum of CPUE. It is very interesting that 2002-2003 and 2009-2010 years are the years of El Niño. Maximum CPUE were in El Niño years. So this phenomena can be predictor of good fishing (big CPUE), as in some other regions. (Paramonov, 1992).

Other divisions have other changeability of CPUE. In NAFO region (1F and 2J) CPUE decreases in a whole (except 1F division in 2010). In IIa CPUE oscillates up and down from average value.

As for vertical distribution, we can constant as a whole decreasing CPUE with rise depth with small excluding for the depth 401-500 m, there are maximum of CPUE at these depths of main regions (XIVb and 1F).

In the main regions of fishery (XIVb and XII) length and weight of redfish increase with the depth. It was constant by many scientists and does not doubt. Main difference is between 301-400 and 401-500 m, i.e. so called border between small and large fish is approximately at depth 400 m, no 500 m, as it was usually assumed before. It is necessary to underline, that maximum CPUE is at nearest depth – 401-500 m.

In divisions 1F and IIa we see opposite picture - diminishing of length and weight of both females and males, with the increase of depth. Author cannot correctly explain this, but it can be connect with migrations of redfish.

Now it is proposed to divide all fishing grounds at permanent (where fishing is possible every year) and temporal (where fishery is possible not every year) ones. To permanent we can take only XIVb and part of XII divisions, to temporal - all other (1F, 2J, 2H and IIa). So it is possible to propose some signs of temporal region:

1. Episodically or periodically CPUE decreases up to non-profitable fishery (less 0, 3 t/hour) for enough large period (at least one year).
2. Narrow range of fishing depths.
3. Diminishing of length and weight of both females and males, with the increase of depth.
4. Difference of average length and weight between females and males. Usually females are larger.

It is interesting to underline opinion of Alekseev (2002), that Irminger Sea (XIVb, XII) is reproductive area of redfish population, while other regions (1F, 2J, 2H and IIa) are vegetative areas.

It would like to check above said with scientific ship which can make towing at different depth in spite of commercial aspects.

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Table 1. Depth, m, of fishery by months in NEAFC XIVb division in 2003-2010.

Depth	March		April		May		June		July		August		September		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
351-375									2	2,3					2	0,4
376-400							1	0,8	0	0					1	0,2
401-425							2	1,6	0	0					2	0,4
426-450							1	0,8	0	0					1	0,2
451-475							2	1,6	1	1,2					3	0,6
476-500			1	1,3			0	0	0	0					1	0,2
501-525			1	1,3	1	0,8	1	0,8	2	2,3					5	1,1
526-550			0	0	3	2,3	0	0	3	3,5	4	10,0			10	2,1
551-575			1	1,3	4	3,1	2	1,6	5	5,8	10	25,0	1	9,1	23	4,9
576-600			3	3,9	5	3,8	12	9,8	21	24,5	6	15,0	5	45,4	52	11,0
601-625	2	33,3	3	3,9	9	6,9	17	13,9	16	18,6	12	30,0	4	36,4	63	13,3
626-650	0	0	8	10,5	16	12,2	23	19,0	17	19,8	7	17,5	1	9,1	72	15,3
651-675	0	0	14	18,4	16	12,2	13	10,7	10	11,6	0	0	0	0	53	11,3
676-700	1	16,7	23	30,4	26	19,8	16	13,1	5	5,8	1	2,5	0	0	72	15,3
701-725	3	50,0	11	14,5	25	19,1	9	7,4	2	2,3	0	0	0	0	50	10,6
726-750	0	0	4	5,3	8	6,1	12	9,8	0	0	0	0	0	0	24	5,1
751-775			6	7,9	7	5,3	5	4,1	2	2,3	0	0	0	0	20	4,2
776-800			1	1,3	7	5,3	3	2,5	0	0	0	0	0	0	11	2,3
801-825			0	0	4	3,1	3	2,5	0	0	0	0	0	0	7	1,5
Total	6	100	76	100	131	100	122	100	86	100	40	100	11	100	472	100

Table 2. Total, middle and most frequent depth, m, of fishery by months in NEAFC XIVb division in 2003-2010.

	March	April	May	June	July	August	September	Total
Total depth	601-725	476-800	501-825	376-825	351-775	526-700	551-650	351-825
Average depth	676	678	682	655	612	595	599	674
Most frequent depth	701-725	676-700	676-725	626-650	576-600	601-625	576-600	626-650, 676-700

Table 3. Depth, m, of fishery by years in NEAFC XIVb division in 2003-2010.

Depth	2003		2004		2005		2006		2007		2008		2009		2010	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
351-375									2	2,0						
376-400			1	4,5					0	0						
401-425			0	0					2	2,0						
426-450			0	0					1	1,0						
451-475			0	0	2	5,0			0	0	1	2,0				
476-500			0	0	0	0			1	1,0	0	0				
501-525			0	0	2	5,0			1	1,0	1	2,0	1	0,9		
526-550			1	4,5	1	2,5			6	5,9	1	2,0	1	0,9		
551-575			0	0	3	7,5			5	4,9	2	4,1	12	10,7	1	1,3
576-600			0	0	2	5,0			9	8,8	6	12,2	25	22,3	10	12,7
601-625			0	0	2	5,0	3	6,1	9	8,8	8	16,4	23	20,5	18	22,8
626-650			3	13,6	1	2,5	2	4,1	17	16,6	13	26,6	17	15,2	19	23,9
651-675	1	5,2	2	9,1	4	10,0	6	12,2	9	8,8	6	12,2	12	10,7	13	16,5
676-700	3	15,8	1	4,5	7	17,5	12	24,5	16	15,6	8	16,4	10	8,9	15	19,0
701-725	2	10,5	4	18,3	5	12,5	14	28,6	13	12,7	3	6,1	7	6,3	2	2,5
726-750	2	10,5	3	13,6	4	10,0	4	8,2	7	6,9	0	0	3	2,7	1	1,3
751-775	4	21,1	4	18,3	3	7,5	7	14,3	1	1,0	0	0	1	0,9		
776-800	3	15,8	3	13,6	3	7,5	0	0	2	2,0	0	0	0	0		
801-825	4	21,1	0	0	1	2,5	1	2,0	1	1,0	0	0	0	0		
Total	19	100	22	100	40	100	49	100	102	100	49	100	112	100	79	100

Table 4 Total, middle and most frequent depth, m, of fishery by years in NEAFC XIVb division in 2003-2010.

	2003	2004	2005	2006	2007	2008	2009	2010
Total depth	651-825	526-800	451-825	601-825	351-825	451-725	501-775	551-750
Average depth	752	697	668	703	640	632	627	642
Most frequent depth	751-775, 801-825	701-725, 751-775	676-700	676-725	626-650, 676-700	626-650	576-625	601-650

Table 5. Depth, m, of fishery by months in NAFO 1F division in 2003-2010.

Depth	July		August		September		Total	
	N	%	N	%	N	%	N	%
226-250	5	9,8	2	3,0	0	0	7	5,6
251-275	22	43,1	1	1,5	1	16,7	24	19,4
276-300	10	19,6	10	15,0	4	66,6	24	19,4
301-325	3	5,9	7	10,4	1	16,7	11	8,9
326-350	10	19,6	19	28,3	0	0	29	23,3
351-375	1	2,0	13	19,4	0	0	14	11,3
376-400	0	0	9	13,4	0	0	9	7,3
401-425	0	0	4	6,0	0	0	4	3,2
426-450	0	0	2	3,0	0	0	2	1,6
Total	51	100	67	100	6	100	124	100

Table 6. Total, middle and most frequent depth, m, of fishery by months in NAFO 1F division in 2003-2010.

	July	August	September	Total
Total depth	226-375	226-450	251-325	226-450
Average depth	285	343	288	316
Most frequent depth	251-275	326-350	276-300	251-300, 326-350

Table 7. Depth, m, of fishery by months in NAFO 2J division in 2003-2010.

Depth	July		August		September		Total	
	N	%	N	%	N	%	N	%
226-250	1	8,3	0	0	0	0	1	2,7
251-275	1	8,3	2	10,5	0	0	3	8,1
276-300	7	58,3	6	31,6	5	83,3	18	48,7
301-325	2	16,8	11	57,9	1	16,7	14	37,8
326-350	1	8,3	0	0	0	0	1	2,7
Total	12	100	19	100	6	100	37	100

Table 8 Total, middle and most frequent depth, m, of fishery by months in NAFO 2J division in 2003-2010.

	July	August	September	Total
Total depth	226-350	251-325	276-325	226-350
Average depth	290	300	284	295
Most frequent depth	276-300	301-325	276-300	276-325

Table 9. Depth, m, of fishery by years in NAFO 1F division in 2003-2010.

Depth	2003		2004		2005		2006		2007		2008		2009		2010	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
226-250					3	20,0	3	10,3								
251-275			3	42,9	7	46,7	8	27,7	5	31,2						
276-300	5	62,5	3	42,9	0	0	3	10,3	7	43,8						
301-325	3	37,5	0	0	2	13,3	3	10,3	2	12,5	1	3,8				
326-350			1	14,2	3	20,0	6	20,7	2	12,5	16	61,5			3	15,0
351-375				0	0	0	6	20,7	0	0	9	34,6	3	100	2	10,0
375-400				0	0	0	0	0	0	0	0	0			9	45,0
401-425				0	0	0	0	0	0	0	0	0			4	20,0
425-450				0			0	0	0	0	0	0			2	10,0
Total	8	100	7	100	15	100	29	100	16	100	26	100	3	100	20	100

Table 10 Total, middle and most frequent depth, m, of fishery by years in NAFO 1F division in 2003-2010.

	2003	2004	2005	2006	2007	2008	2009	2010
Total depth	276-325	251-350	226-350	226-375	251-350	301-375	351-375	326-450
Average depth	297	292	271	304	290	346	363	388
Most frequent depth	276-300	251-300	251-275	251-275	276-300	326-350	351-375	376-400

Table 11. Depth, m, of fishery by years in NAFO 2J division in 2003-2007.

Depth	2003		2004		2005		2006		2007	
	N	%	N	%	N	%	N	%	N	%
226-250					1	10,0	-	-		
251-275			2	22,2	0	0	-	-	1	12,5
276-300	6	75,0	6	66,7	3	30,0	-	-	3	25,0
301-325	2	25,0	1	11,1	6	60,0	-	-	5	56,3
326-350					0	0	-	-	1	6,2
Total	8	100	9	100	10	100	-	-	10	100

Table 12 Total, middle and most frequent depth, m, of fishery by years in NAFO 2J division in 2003-2007

	2003	2004	2005	2006	2007
Total depth	276-325	251-325	226-325	-	251-350
Average depth	294	285	298	-	303
Most frequent depth	276-300	276-300	301-325	-	301-325

Table 13. Depth, m, of fishery by years in NEAFC IIa division in 2006-2010.

Depth	2006		2007		2008		2009		2010		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
326-350	1	16,7			1	4,2					2	3,0
351-375	4	66,6	1	5,9	1	4,2			6	33,3	12	18,2
376-400	1	16,7	6	35,3	11	45,8	1	100	10	55,6	29	44,0
401-425	0	0	3	17,6	9	37,5			2	11,1	14	21,2
425-450	0	0	7	41,2	2	8,3				0	9	13,6
Total	6	100	17	100	24	100	1	100	18	100	66	100

Table 14. Total, middle and most frequent depth, m, of fishery by years in NEAFC IIa division in 2006-2010.

	2006	2007	2008	2009	2010
Total depth	326-400	351-450	326-450	376-400	351-425
Average depth	363	412	399	388	382
Most frequent depth	351-375	375-400, 425-450	376-400	376-400	376-400

Table 15. Change of average CPUE by months in NEAFC/NAFO divisions in 2003-2010.

Division	Month							Average
	March	April	May	June	July	August	September	
XIVb	0,12	0,62	0,95	0,95	1,00	1,27	1,40	0,93
1F					0,94	0,88	0,33	0,88
2J					0,96	0,95	1,35	1,02
2H					0,42			0,42
IIa							0,87	0,87
Total	0,12	0,62	0,95	0,95	0,97	1,01	0,93	0,93

Table 16. Change of average CPUE by years in NEAFC/NAFO divisions in 2003-2010.

Division	Year							
	2003	2004	2005	2006	2007	2008	2009	2010
XIVb	0,81	0,72	0,67	0,68	0,74	0,87	0,98	1,57
1F	1,50	1,58	0,97	0,74	0,72	0,69	0,40	1,03
2J	1,64	0,84	0,87		0,83			
2H					0,42			
IIa				0,68	1,16	0,87	0,22	0,71
Total	1,15	0,93	0,77	0,70	0,79	0,82	0,96	1,34

Table 17 Vertical distribution of average CPUE in NEAFC/NAFO divisions in 2003-2010.

Depth	Division				
	XIVb	1F	2J	2H	IIa
201-300		0,95	1,15	0,42	
301-400	0,82	0,78	0,82		0,96
401-500	1,28	1,20			0,75
501-600	1,02				
601-700	0,95				
701-800	0,80				
801-900	0,82				
Total	0,93	0,88	1,02	0,42	0,87

Table 18 Vertical distribution of average length of redfish female in NEAFC/NAFO divisions in 2003-2010.

Depth	Division					
	XIVb	XII	1F	2J	2H	IIa
201-300			36,0	35,7	34,7	
301-400	34,5		35,0	35,5		36,9
401-500	37,3		35,1			36,5
501-600	37,9					
601-700	38,5	35,5				
701-800	40,1	37,4				
801-900	41,7					
Total	38.7	37,1	35,5	35,6	34,7	36,7

Table 19 Vertical distribution of average length of redfish male in NEAFC/NAFO divisions in 2003-2010.

Depth	Division					
	XIVb	XII	1F	2J	2H	IIa
201-300			35,2	34,8	33,9	
301-400	33.6		34,5	34,9		35,9
401-500	37.6		33,8			35,7
501-600	38,1					
601-700	38,4	34,9				
701-800	39,7	37,8				
801-900	41,0					
Total	38,7	37,4	34,8	34,8	33,9	35,8

Table 20 Vertical distribution of average weight of redfish female in NEAFC/NAFO divisions in 2003-2010.

Depth	Division					
	XIVb	XII	1F	2J	2H	IIa
201-300			564	553	550	
301-400	515		542	562		618
401-500	668		517			600
501-600	701					
601-700	730	567				
701-800	798	674				
801-900	870					
Total	739	659	550	556	550	610

Table 21 Vertical distribution of average weight of redfish male in NEAFC/NAFO divisions in 2003-2010.

Depth	Division					
	XIVb	XII	1F	2J	2H	IIa
201-300			522	505	518	
301-400	477		510	527		561
401-500	689		453			548
501-600	708					
601-700	730	551				
701-800	772	706				
801-900	828					
Total	734	685	513	514	518	555

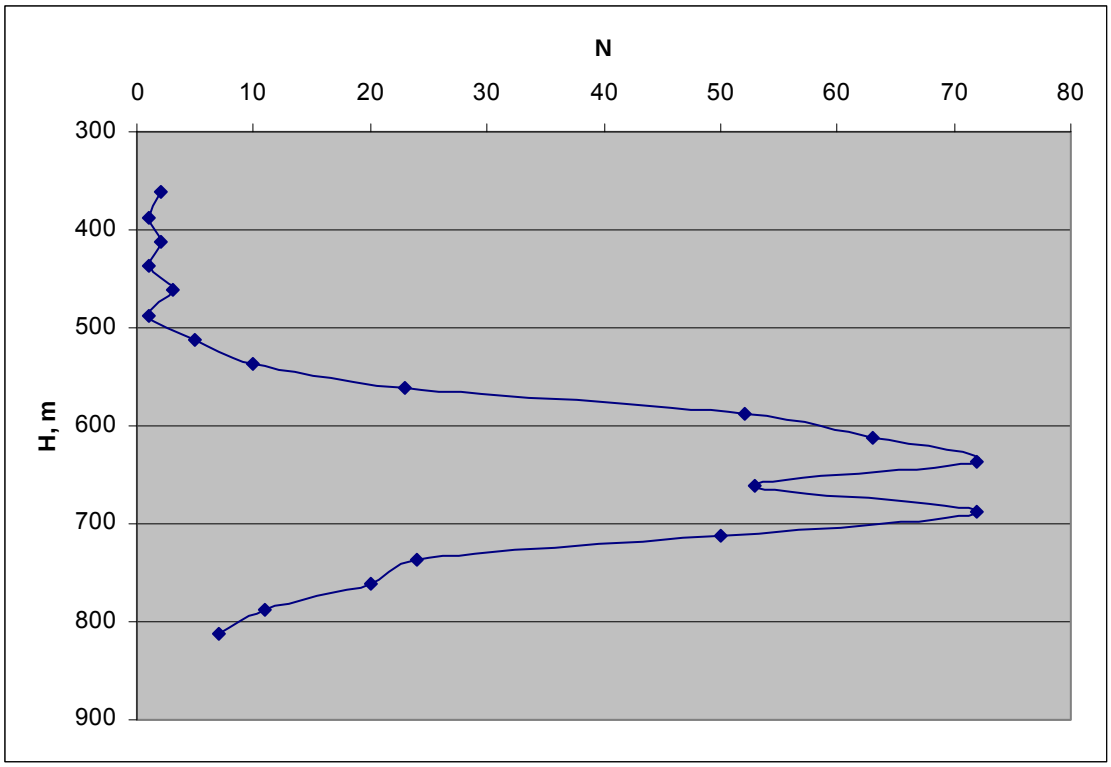

Fig.1 Total distribution of average depths of fishing in XIVb division ICES (2003-2010).

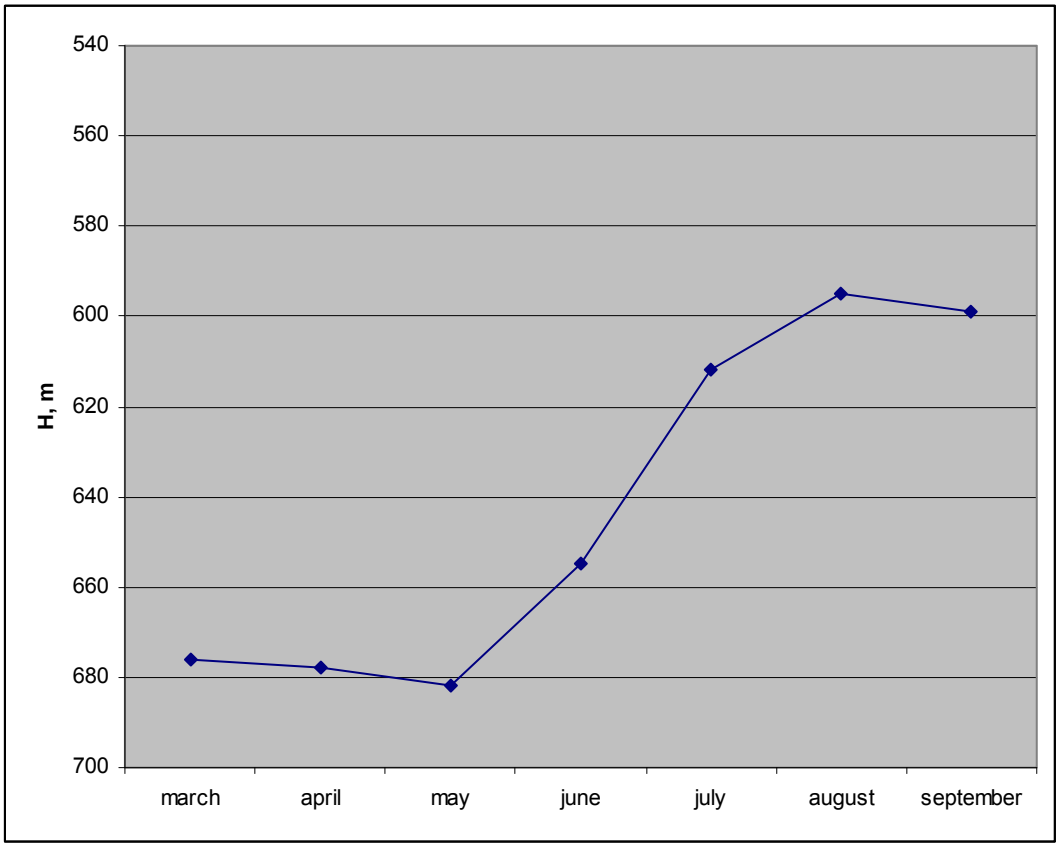

Fig.2 Seasonal distribution of average depths of fishing in XIVb division ICES (2003-2010).

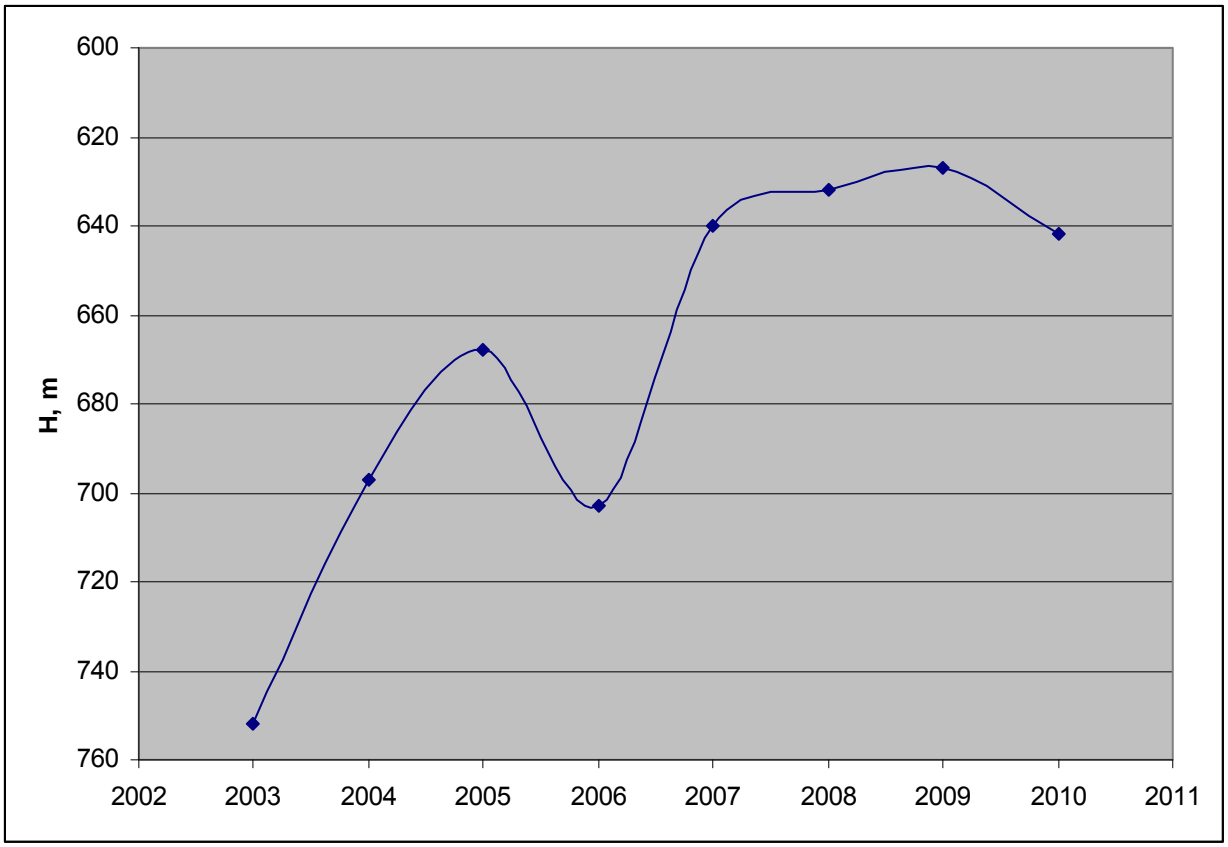

Fig.3 Interannual distribution of average depths of fishing in XIVb division ICES (2003-2010).

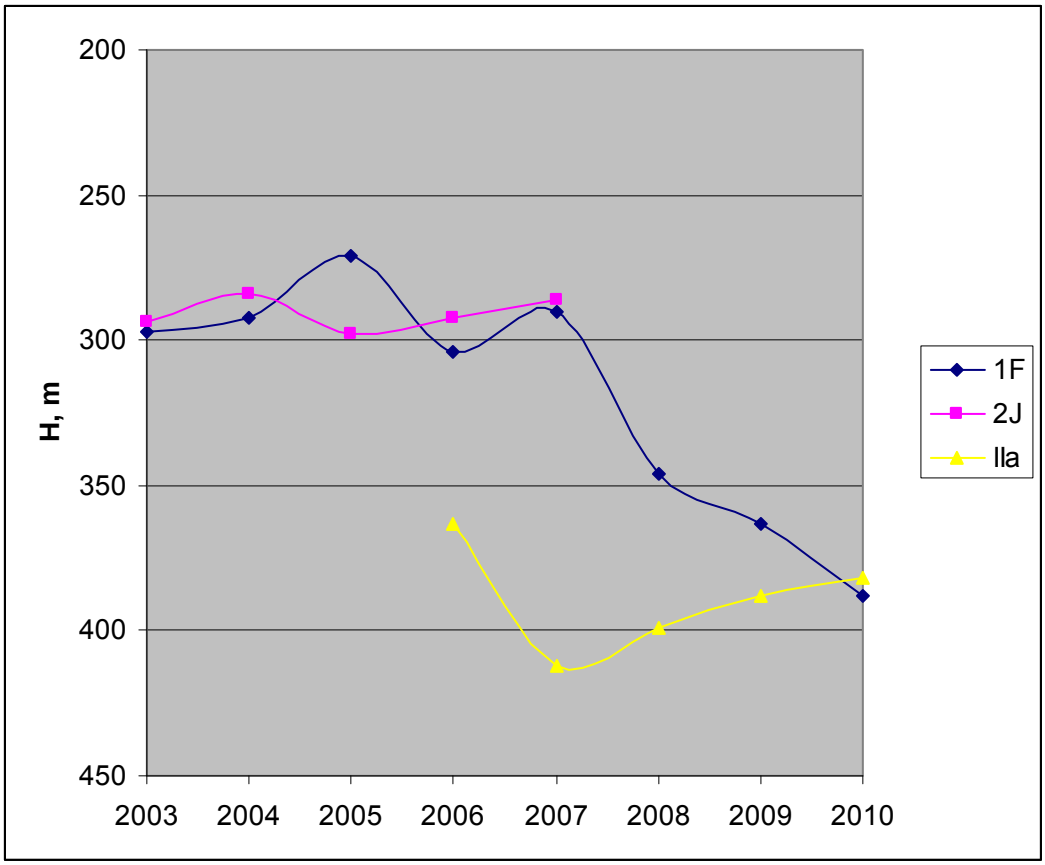

Fig.4 Interannual distribution of average depth of fishing in 1F and 2J division NAFO and IIa ICES (2003-2010).

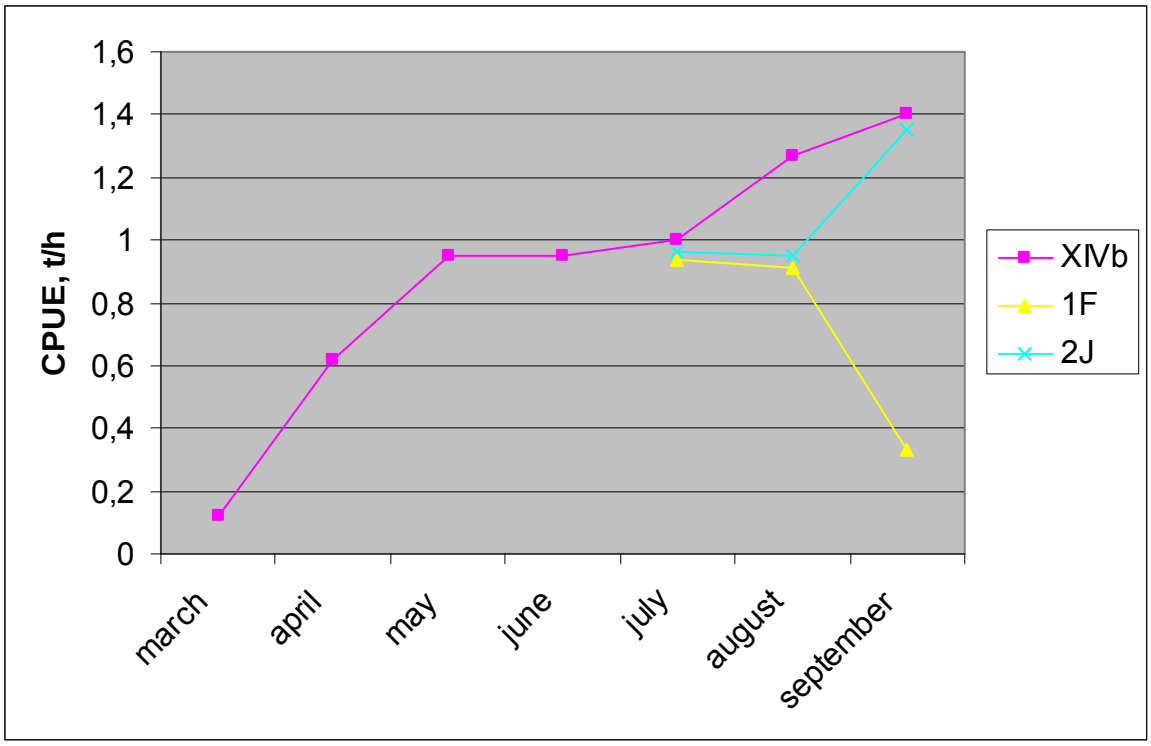

Fig.5 Seasonal changeability of CPUE (t/h) in XIVb division ICES and 1F and 2J division NAFO (2003-2010).

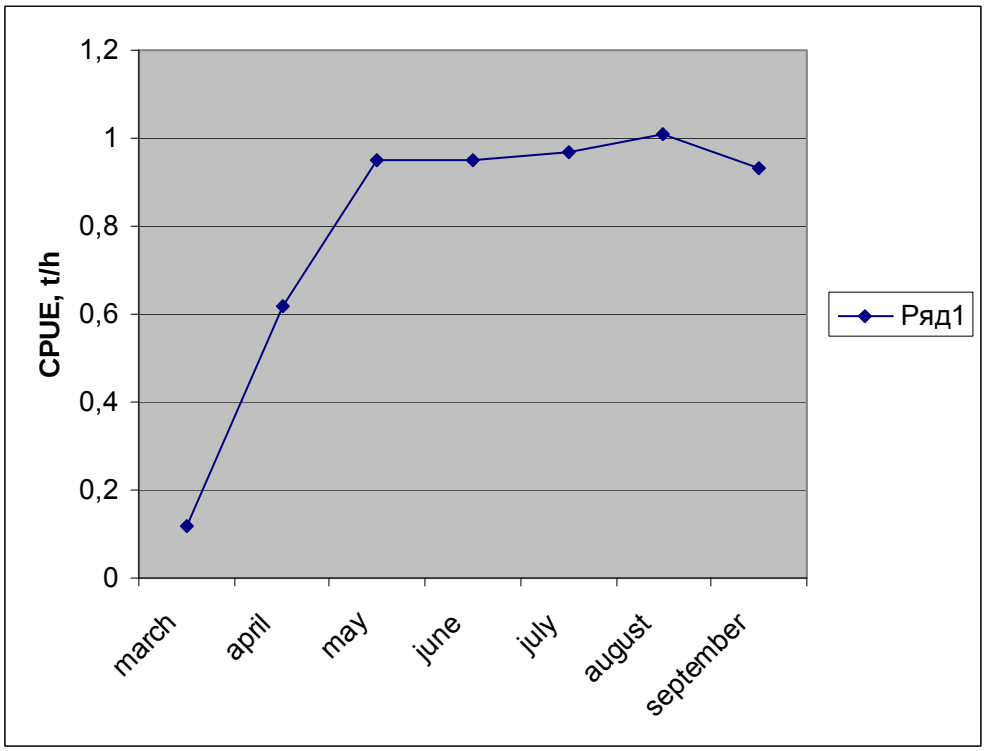

Fig.6 Seasonal changeability of CPUE (t/h) for all divisions of fishery (2003-2010).

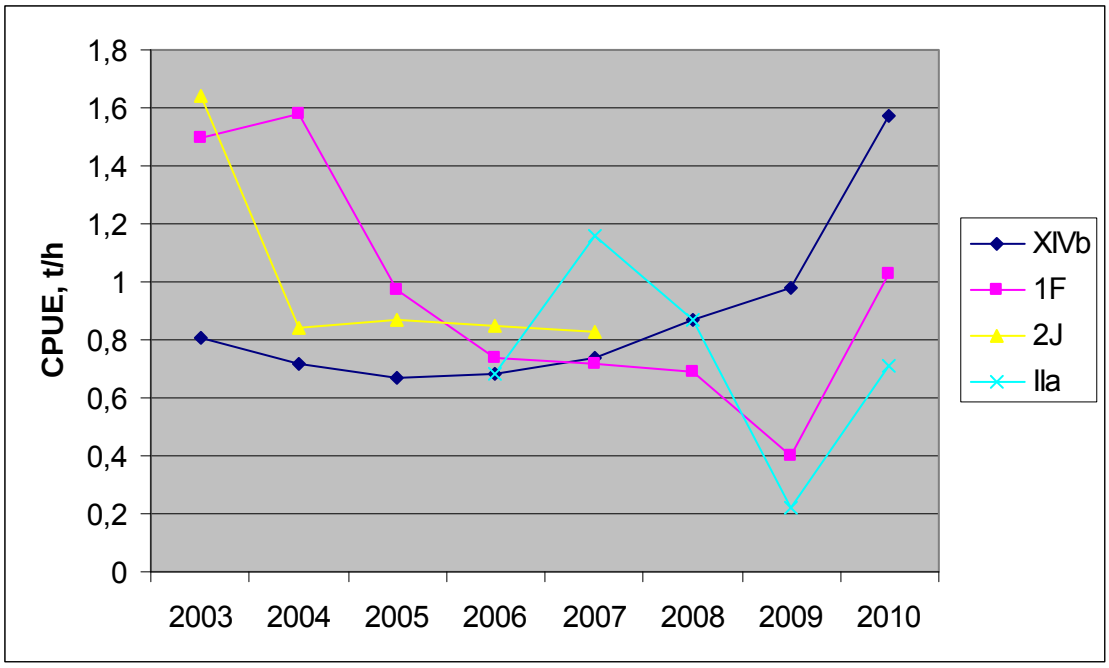

Fig.7 Interannual changeability of CPUE (t/h) in XIVb division ICES, 1F and 2J divisions NAFO and IIa division ICES (2003-2010).

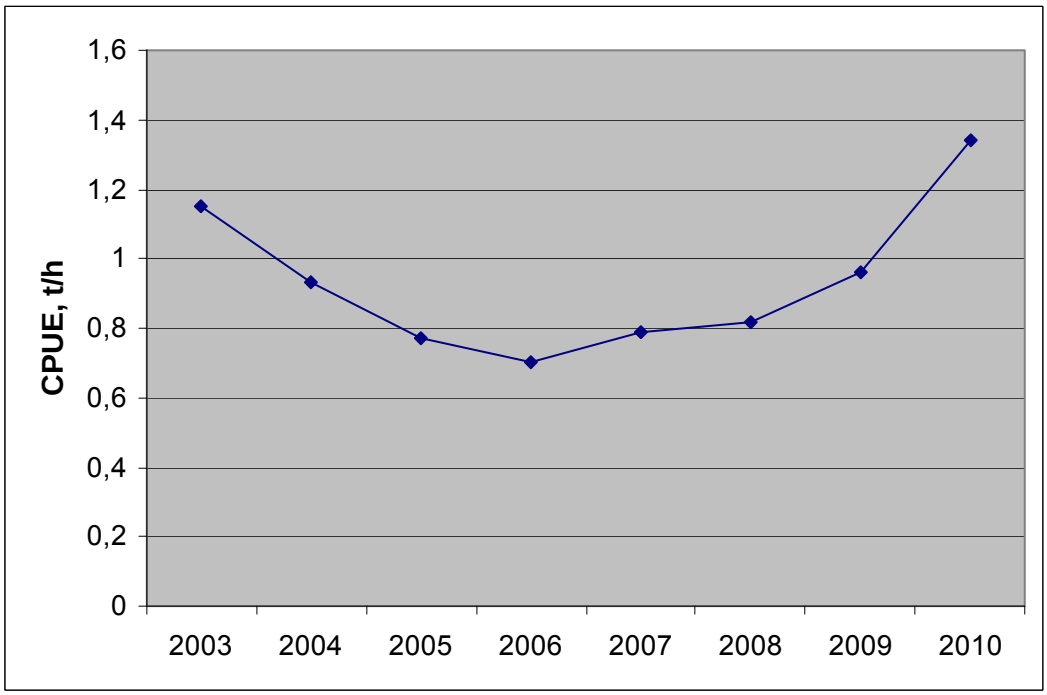

Fig. 8. Total interannual changeability of CPUE (t/h) for all fishery divisions (2003-2010).

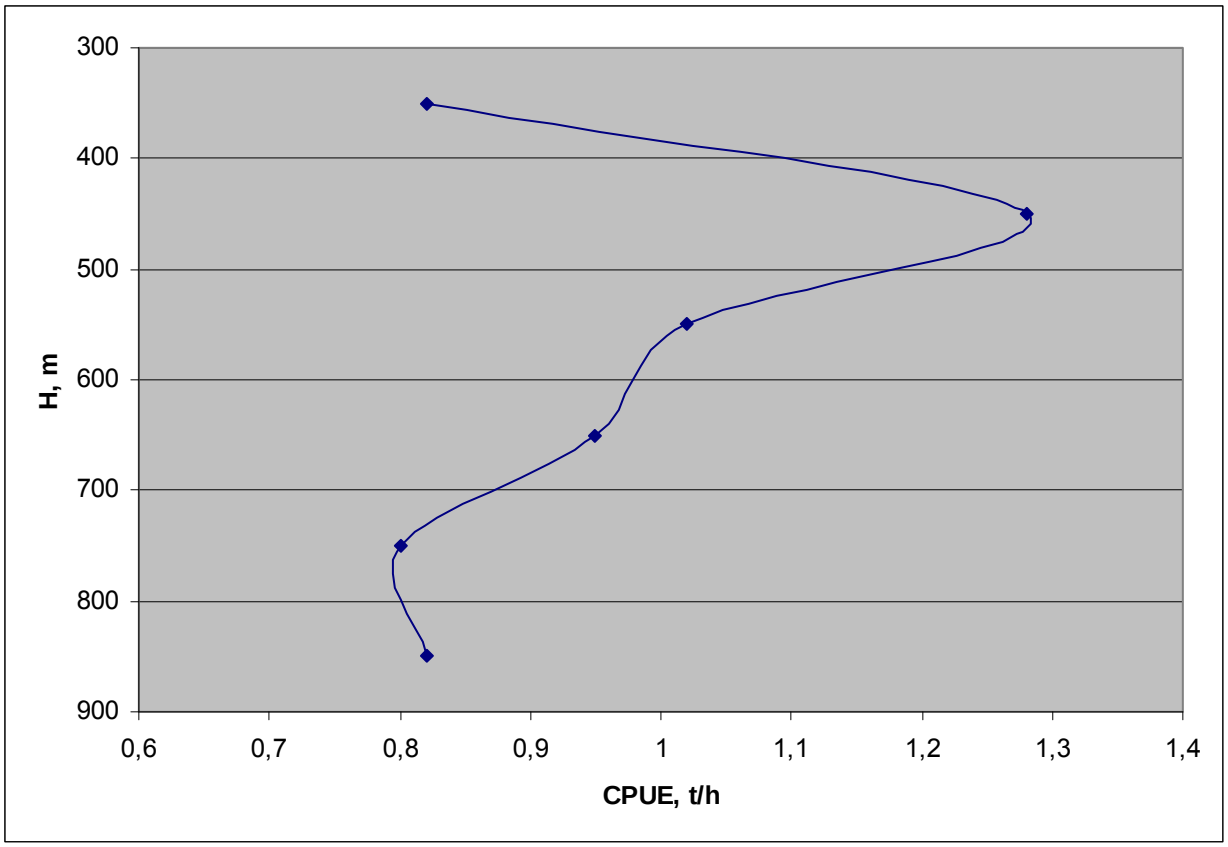

Fig.9. Vertical distribution of CPUE (t/h) in XIVb division ICES (2003-2010).

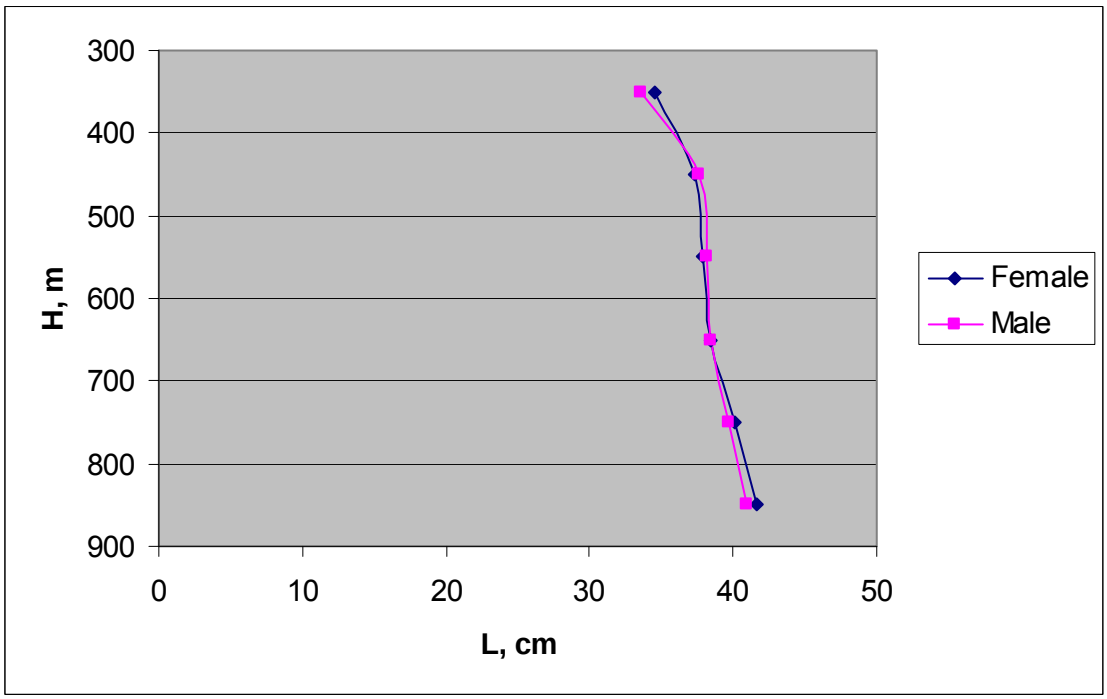

Fig.10 Vertical distribution of female/male length in XIVb division ICES (2003-2010).

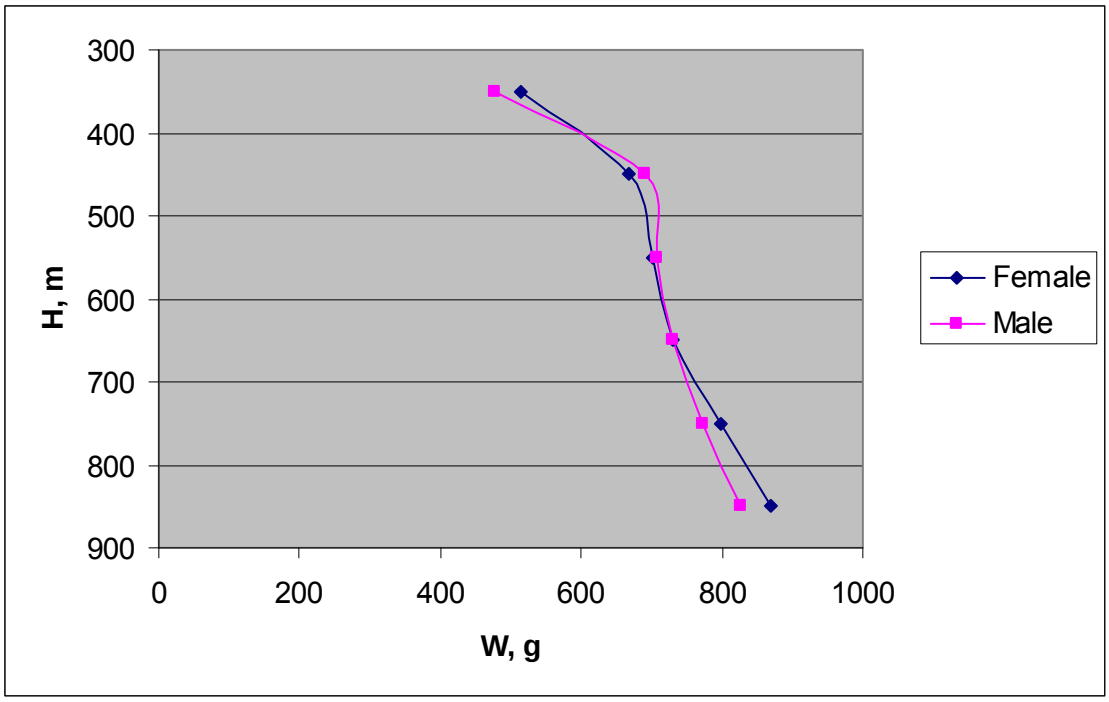

Fig.11 Vertical distribution of female/male weight in XIVb division ICES (2003-2010).

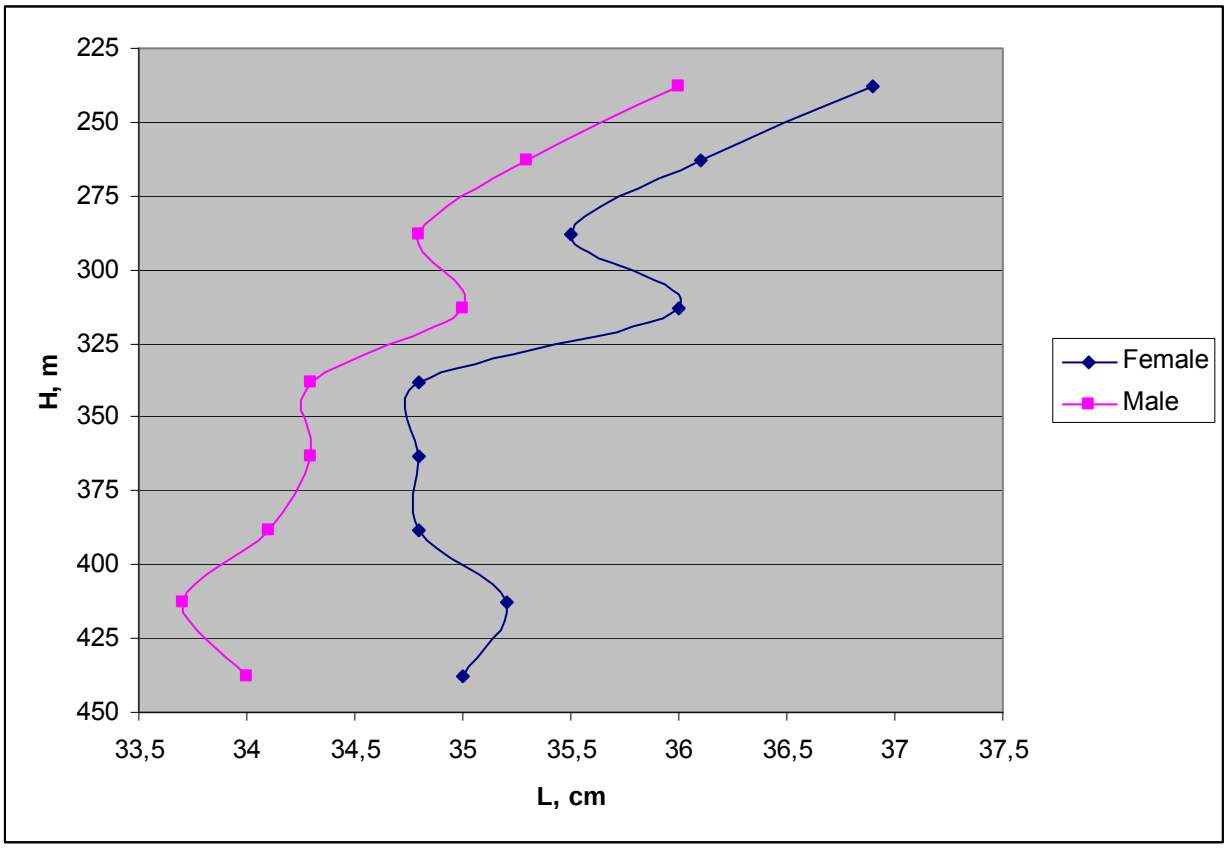

Fig.12 Vertical distribution of female/male length in 1F division NAFO (2003-2010).

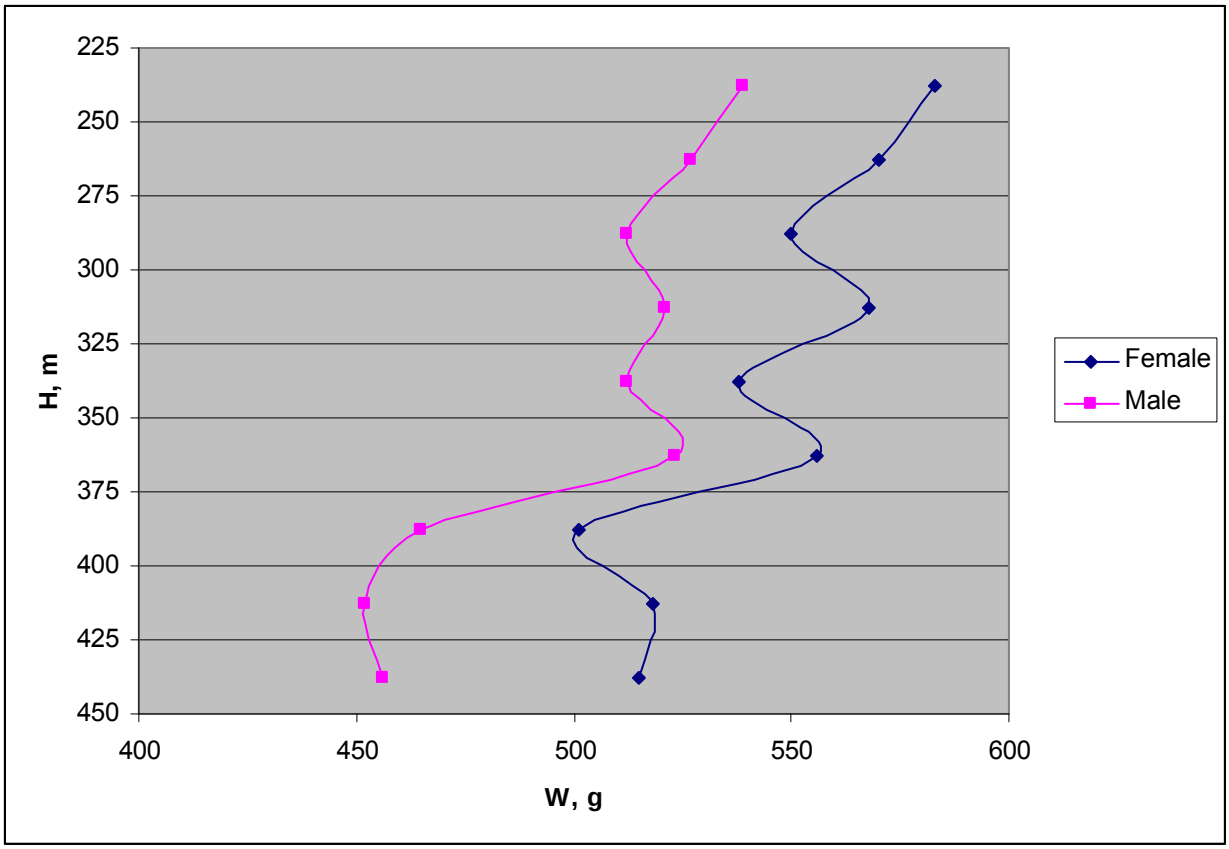

Fig.13 Vertical distribution of female/male weight in 1F division NAFO (2003-2010).

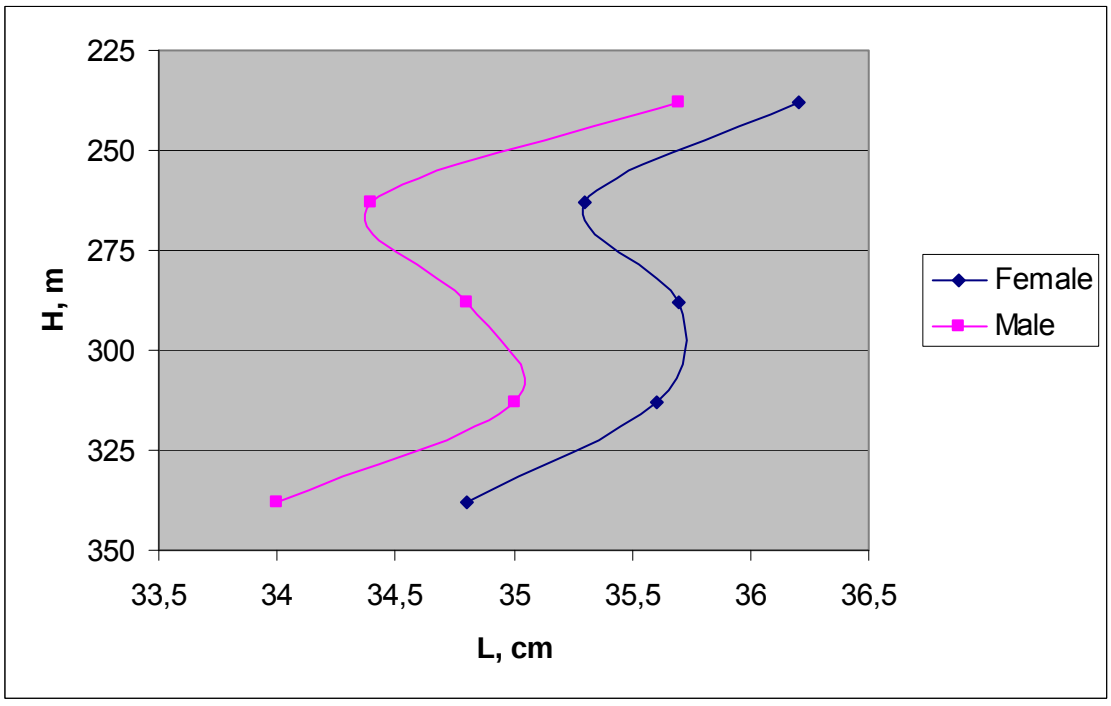

Fig.14 Vertical distribution of female/male length in 2J division NAFO (2003-2010).

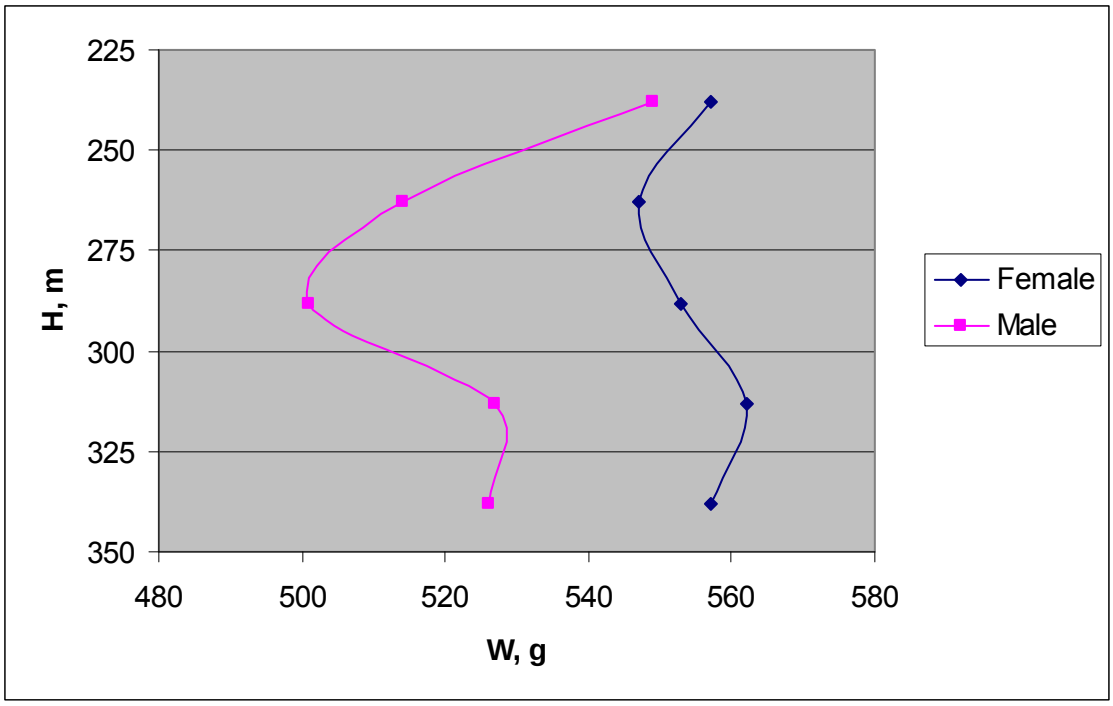

Fig.15 Vertical distribution of female/male weight in 2J division NAFO (2003-2010).

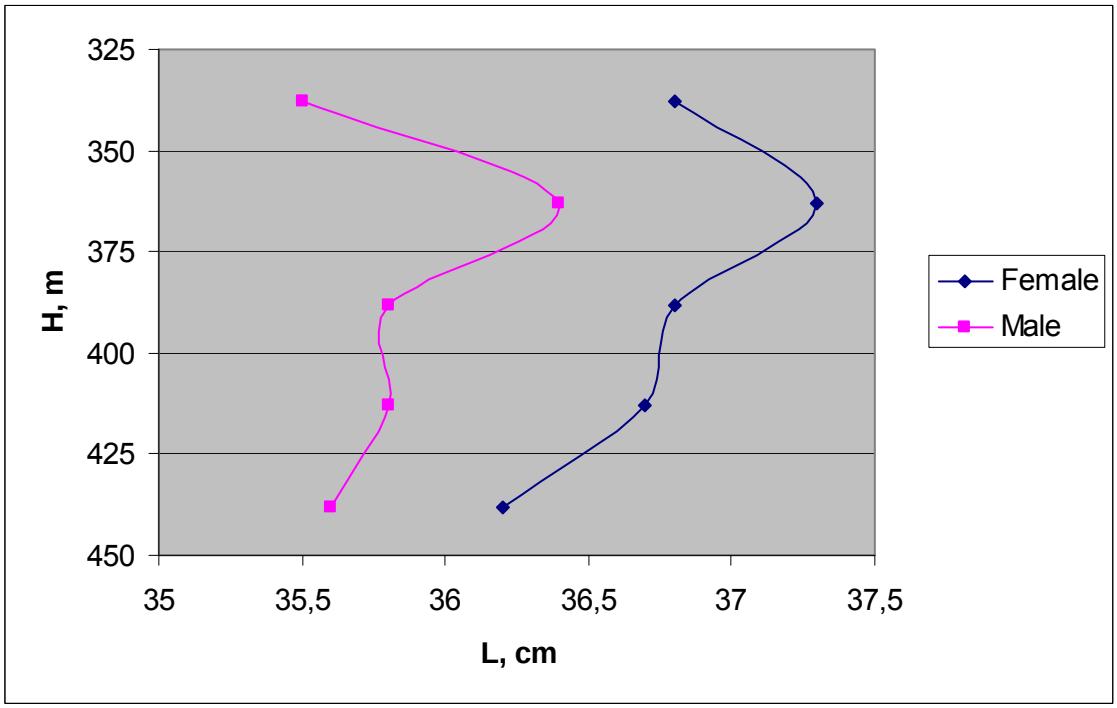

Fig.16 Vertical distribution of female/male length in IIa division NAFO (2003-2010).

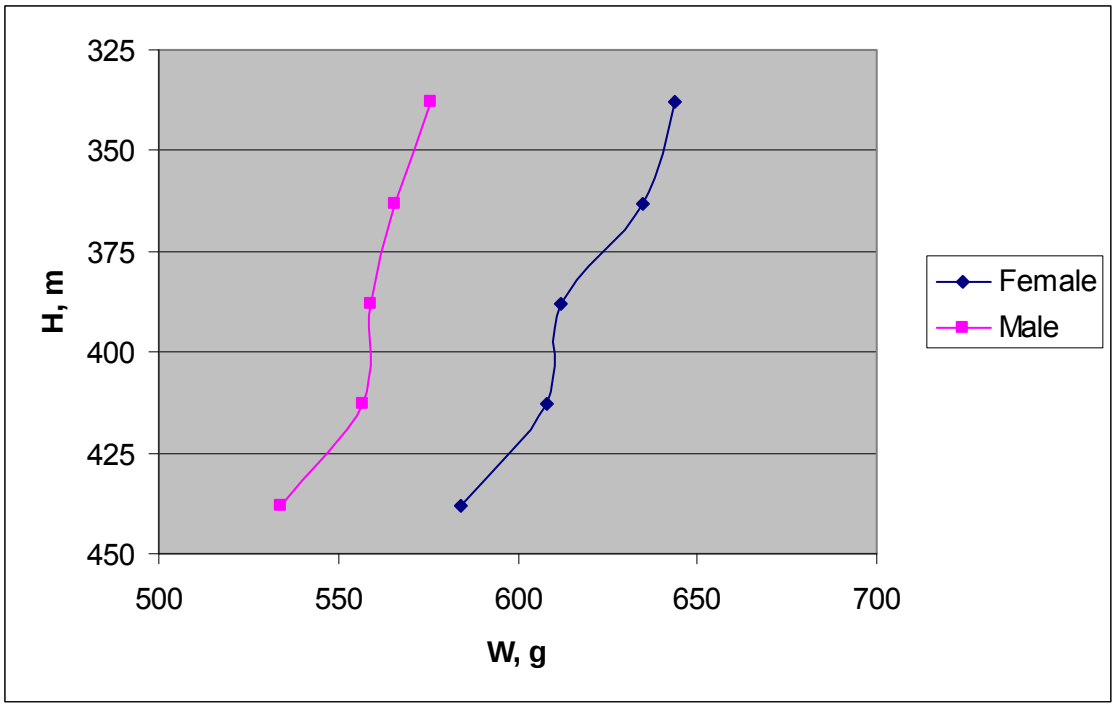

Fig.17 Vertical distribution of female/male weight in IIa division NAFO (2003-2010).