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Some data on the distribution of young S. mentella Tr. in the Labrador-Newfoundland area

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From April - January 1964, in ICNAF Div. 2Y, 3K, 3L, 3M, 3O and 3P, i.e. in the areas of distribution of the main local stocks of Sebastes mentella Tr., several investigations were undertaken which revealed some distribution patterns of the immature portion of these stocks. The material obtained should serve as a basis for the rational fishing of redfish.

As is known, in the northern Div. 2Y, 3K, 3L and in the southern Div. 3O, 3P and 3M, redfish do not mature at the same time. Therefore to have an idea of the part of the redfish stock to be considered "immature", it was necessary to determine the length and age of specimens at first maturity in each of the above mentioned divisions during autumn, winter and spring of 1959 to 1962.

It was found (Tables 1 and 2) that, in the south Labrador area (Div. 2Y) in the most northern region of our investigations, the males apparently mature at a length of 26 cm, being mainly 8 years old. When 35 cm long and 13 years old 82% of the males are mature.

Females also begin maturing at the age of 8 years, but only 5% are mature at a length of 27 cm, while 60% are mature at 13 years of age.

To the south of Labrador, the length and age of both males and females at first maturity decreases. Thus in Div. 3O (southern slope of the Newfoundland Bank) the males begin to mature at the age of 6 years being 21 to 22 cm long (25%). By 11 years, all the males 30 cm long have become mature. Females also mature at the age of 6 years but in fewer numbers (9%) and at larger sizes, 23 - 24 cm length. Females become mature at a length of 31 cm.

In the Flemish Cap area (Div. 3M) males begin maturing at the age of 6 years, but in fewer numbers than in Div. 3O. At the age of 14 years, 95% of the males are mature. Females mature at the age of 7 years at a length of 23 cm. At the age of 14 years 88% of the females are mature.

Thus, the immature portion of the northern local stock, apparentl consists of males and females up to the age of 10 years with lengths to 30 cm. In the Flemish Cap area (3M), the immature portion consists of males and females with lengths to 25 cm and ages to 7 years, while on the southwestern slope of the Newfoundland bank (3O) and the Saint Pierre bank (3P) which the southern local stock inhabits, the males and females with a length of up to 20 cm and at the age of up to 6 years form the immature portion.

Furthermore, by analogy with the Barents Sea, we have called, "the young", the redfish specimens with lengths to 15 cm, while specimens of 16 - 30 cm in the northern areas and 20 - 25 cm in the southern areas were called "small redfish".

The investigations have demonstrated that in the northern (3K and 3L) and southern (3O and 3P) Div., the number of immature redfish decreases in catches with depth (Fig. 1, Table 3). In the north (3K, 3L) the richest catches of these redfish took place at depths to 300 m and in the south (3O and 3P) at depths to 200 m. In the Flemish Cap area, however, the bulk of immature redfish were at 250 - 300 m. At all depths below or above this level, they were found in very small numbers. Because

in the northern areas, fishing for S. mentella Tr. during the January to March period is carried out at depths greater than 350 m, it follows from Fig. 1 that the by-catch of immature fish does not exceed 20%. In the Flemish Cap area, the main fishing for redfish is conducted during the same period at 250-400m, i.e. in the places of greatest concentration of young redfish (Fig. 1) which, undoubtedly, is bound to tell on the level of their stocks.

A more detailed examination of the data on the distribution of immature redfish by depths according to length of fish is of great interest.

Since the size range of immature redfish was very great, the "young" and "small-sized redfish" in the catches were combined into size groups with a class interval of 5 cm. Such a division, to a considerable extent, simplified the analysis of the available materials.

Table 3 shows that young fish of 6 - 15 cm length in the northern divisions (3K, 3L) predominated at depths of 200 to 250 m at water temperature of 2°C. The "small-sized fish" more than 15 cm long were found at greater depths and at higher temperatures (+3°C).

On the south slope of the Newfoundland Bank (3O) and Saint Pierre Bank (3P) the immature redfish were distributed, as a rule, at lesser depths comparing with the large fish (Table 3). However such a clear attachment of the immature redfish to the definite depths depending on the size noted in the northern areas, was not observed here.

In the Flemish Cap area (3M) no correlation was observed between the distribution of immature redfish of different sizes and the depths they occupied (Table 3). The temperature at all depths during the period of our investigations was 3.8°C.

Thus, in all of the areas examined, except Flemish Cap Bank, it was possible to trace a definite trend towards a reduction of the quantity of immature redfish with the increase of depth. Also, in the northern areas, there was noted a direct correlation between the distribution of "young" and "small-sized redfish" of different lengths and the depths and temperatures.

Similar distribution of redfish was observed in 1963 (Table 4).

But the bottom temperature at different depths changes with years (Table 3 and 4), while the distribution of redfish by depths in relation to the size of fish remains steady annually. In this connection the temperature apparently should be considered not in its absolute meaning, but as an indicator of water masses of different origin. All the plankton and benthos organisms which serve as food for the redfish of the Labrador-Newfoundland area are also very closely connected in their distribution with different water masses (Nesis, 1962; Semyonova, 1962).

The presence of Arctic and Atlantic water masses moving southward and forming a frontal zone in their interaction creates different living conditions for young redfish at different stages of their development. So, the mass larvae extrusion takes place at the depths of more than 300-350m in the near-bottom water layers at temperatures of not less than 3°C which apparently owe their origin to the Atlantic Current. After extrusion the larvae ascend into the upper cooler water layers and drift until they settle at the fry stage. The largest concentrations of the smallest redfish (up to 15 cm) are also found in the lesser depths at lower temperatures (Table 3).

During the growing period, the young fish move to the frontal, most productive zone (Elizarov, 1963), where they stay for a long time (in the northern areas, apparently, even for 7 to 8 years) (Table 3). Later the grown redfish descend to more than 300 m where the Atlantic Current water predominates with the near-bottom temperature optimal for their spawning.

In the northern areas, a considerable time interval elapses (up to 10 years) between the period of the settling of young fish when the redfish are more connected with the cold Labrador Current and their growth in the mixed waters and their spawning in the waters of the Atlantic origin. During this time the redfish of different ages and lengths are connected with definite depths in accordance with the character of the water masses.

On the south slope of the Newfoundland Bank (3O) and Saint Pierre Bank (3P) there is an interaction of waters of the polar and tropical origin. But the most important for the formation of the regime in that area is the last factor.

Here, the immature redfish, as in the north, are found in lesser depths. But the bulk of young and small-sized redfish was found there in the frontal zone at 150 - 200 m depth.

The effect of tropical waters at these depths is extremely high, the temperature in winter sometimes reaches 6 - 7°C.

Thus, the young fish of the southern stock, before recruitment, are under relatively homogeneous conditions. They are associated less with the Arctic waters in comparison with the northern areas and are relatively less attached to definite depths.

Flemish Cap Bank is washed on its north, west and east sides by the comparitively warm waters of the Atlantic Current. Its southern slopes are under the influence of the warm mixed waters. The hydrological regime here displays a higher consistency and no difference in the distribution of immature redfish with length was observed, as was the case in the northern area.

Thus, the redfish of the northern area develop under lower temperatures than on Flemish Cap Bank and in Div. 3O and 3P. They mature here considerably later (at 10 years), than in the south (at 6 - 7 years). The pecularities of development of redfish to the onset of maturity in all the indicated Divisions (2Y, 3K, 3L, 3O, 3P and 3M) apparently form one of the requisites for the formation of their local stocks. Also, because the redfish mature later in the northern areas, their life span increases which means that the redfish, apparently, will be available to the fishery for longer periods (Table 5).

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TABLE 1. PERCENTAGE NUMBER OF MATURE S. MENTELLA TR. OF DIFFERENT SIZES IN AUTUMN, WINTER AND SPRING OF 1959 - 1962

ICNAF DIV.		LENGTH (CM) 21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
2Y	♂						20	30	40	50	55	54	60	64	66	82
	♀							5	20	31	37	42	42	50	54	60
3K	♂					9	15	20	50	68	70	78	80	84	87	94
3L	♀						13	18	30	60	63	66	70	73	78	89
3M	♂		2		15	37	40	50	48	55	64	82	87	90	93	95
	♀			10				37	36	49	57	76	80	88	87	88
30	♂	20	25	50	76	80	88	90	95	93	100					
	♀		9	30	40	56	63	90	93	95	97	100				

TABLE 2. NUMBER OF MATURE S. MENTELLA TR. BY AGE (SIZE FROM 21 - 35 CM)

ICNAF DIV.		AGE (YEARS) 6	7	8	9	10	11	12	13	14
2Y	♂			25	45	55	58	64	76	
	♀			5	25	39	42	53	60	
3K	♂		9	24	47	70	79	84	90	
3L	♀			15	30	40	70	76	89	
3M	♂	2	15	38	49	59	82	88	93	95
	♀		10		36	53	78	88	87	88
30	♂	16	63	86	90	94	100			
	♀	9	35	59	90	95	97	100		

TABLE 3. MEAN CATCH OF IMMATURE S. MENTELLA TR. (SPECIMENS PER HOUR OF HAULING) BY ICNAF DIVISIONS, JANUARY - APRIL, 1964 (DATA FROM VNIRO)

DEPTH (M)	NUMBER OF HAULS	NEAR BOTTOM TEMPERATURE (°C)	PERCENTAGE OF YOUNG AND SMALL REDFISH IN CATCHES			LENGTH-GROUPS (CM) 6-10:	11-15:	16-20:	21-25:	26-30	MEAN CATCH OF SPECIMENS PER HOUR OF HAULING.
				♂	♀						
DIV.3K											
200-250	4	2.0	79.5	60	40	4.5	20.0	10.0	6.5	4.0	9.0
250-300	8	3.0	78.5	58	42	3.6	6.2	21.7	30.5	14.7	15.3
300-350	13	3.2	39.0	52	48	3.0	1.0	4.3	32.0	157.5	12.1
400-500	5	3.5	-			-	-	-	-	-	-
DIV.3L											
190-200	5	-1.0 TO 2.1	100	72	28	1.3	2.0	1.3	0.3	0.3	1.0
200-250	5	1.3 TO 3.4	100	62	38	0.6	3.6	5.6	7.6	1.3	3.7
250-300	10	0.5 TO 3.1	66.0	68	32	0.3	0.6	18.3	24.1	18.1	12.3
300-350	6	0.8 TO 3.4	34.0	66	34	-	-	2.6	30.0	22.0	10.6
350-400	3	3.1	20.0	64	36	-	-	-	5.0	23.0	5.0
400-420	4	3.2	14.0	58	42	-	-	-	7.9	28.0	7.2
DIV.3M											
100-150	2	3.9	0.9			-	-	-	3.0	-	0.7
150-200	3	3.8	-			-	-	-	-	-	-
200-250	5	3.7	1.5	61	39	-	1.4	1.6	1.0	-	1.0
250-300	5	3.2 TO 4.5	60.0	59	41	-	3.7	23.2	49.2	-	19.0
300-350	7	3.7	10.0	70	30	-	3.6	12.4	2.0	-	4.5
350-400	3	3.9	2.0	100	-	-	-	-	1.0	-	0.2
400-450	3	3.8	0.5	60	40	-	-	0.2	1.2	-	0.3
450-600	9	-	5.0	60	40	-	-	7.5	11.5	-	4.7
DIV.3P											
50-100	5	-0.2 TO -1.0	-	-	-	-	-	-	-	-	-
100-150	5	-0.4 TO -1.0	100	JW		1.0	0.4	0.6			0.7
150-200	5	0.2 TO 2.3	80.0	56	44	3.0	31.0	100.5			44.8
200-250	2	3.0	45.0	72	28	2.5	26.5	36.0			21.6
250-300	3	-1.2 TO 1.7	10.0	100	-	-	3.3	2.7			2.0
350-400	3	3.8	-	-	-	-	-	-			-
DIV.3O											
50-100	14	0.1	100	89	11	-	1.2	0.8			0.6
100-150	4	0.8	100	JW		1.0	1.0	-			0.7
150-200	4	1.0	84	55	45	210.0	516.0	733.5			486.5
200-250	3	1.3	-	-	-	-	-	-			-
250-300	2	1.8	1.0	100	-	-	3.0	3.0			2.0
300-350	2	3.2	1.0	83	17	-	6.0	12.0			6.0

TABLE 4. MEAN NUMBERS OF INMATURE S. MENTELLA TR. PER HOUR OF HAULING BY ICNAF DIVISIONS DECEMBER - MARCH, 1963.

DEPTH (M)	NUMBER OF HAULS	NEAR BOTTOM TEMPERATURES (°C)	LENGTH - GROUPS (CM) 6-10:	11-15:	16-20:	21-25:	26-30	MEAN CATCH OF SPECIMENS PER HOUR OF HAULING
DIV. 3K								
200-250	1	1.0	18.0	29.0		6.0	2.0	14.4
250-300	2	2.4	-	-	17.0	-	0.5	0.1
300-350	3	2.7	-	0.3	1.1	17.6	14.3	6.6
400-500	-	-	-	-	-	-	-	-
DIV. 3L								
200	1	-0.1		0.3	-	-	-	0.6
200-250	1	0.5	-	-	4.0	1.0	3.0	1.6
250-300	2	1.5	-	-	7.5	8.5	15.0	6.2
300-350	1	3.8	-	-	-	7.0	44.0	10.2
350-400	2	3.8	-	-	0.5	0.5	4.0	1.0
DIV. 3M								
200-250	1	3.9	-	17.0	4.0	2.0	-	5.7
250-300	2	3.9	5.0	55.0	105.0	178.0	-	85.7
300-350	1	4.9	-	12.0	28.0	4.0	-	11.0
300-500	1	4.0	2.0	3.0	23.0	23.0	-	12.7
DIV. 3P								
100-150	2	-0.2	182.0	116.0	16.0	-	-	103.0
150-200	2	3.5	112.0	9.5	0.5			
250-300	2	5.4	-	-	18.5			6.1
500-550	1	2.3	-	-	10.7			3.2
50-100	1	2.1	11.0	-	-			3.3
100-150	1	3.2	5.0	12.0	-			5.6
150-200	2	5.4	74.0	96.0	34.5			68.1
200-250	1	4.9	1.0	26.0	14.0			13.6
300-475	1	4.4	-	4.0	16.0			6.3

TABLE 5. MEAN AGE OF S. MENTELLA TR. IN ICNAF DIVISIONS IN DIFFERENT YEARS.

ICNAF DIV.	MEAN AGE IN 1960 ♂♂	1960 ♀♀	1961 ♂♂	1961 ♀♀	1962 ♂♂	1962 ♀♀
2Y	-	-	15.0	16.8	13.2	1.6 ?
3K	14.1	16.1	14.3	17.7	14.6	17.7
3L	15.3	18.2	14.6	18.0	11.7	13.0
3M	13.2	14.2	11.9	13.6	12.5	14.0
3O	13.3	14.9	8.9	10.9	11.5	14.0
3P	10.4	11.4	9.7	10.4	8.0	10.2

N.B. THUS, FROM THE REDFISH DATA, THERE IS FURTHER EVIDENCE THAT THE LIFE SPAN OF FISH AND THE PERIOD OF THEIR MORTALITY BY FISHING IS CONNECTED WITH THEIR DIFFERENT MATURITY RATES.

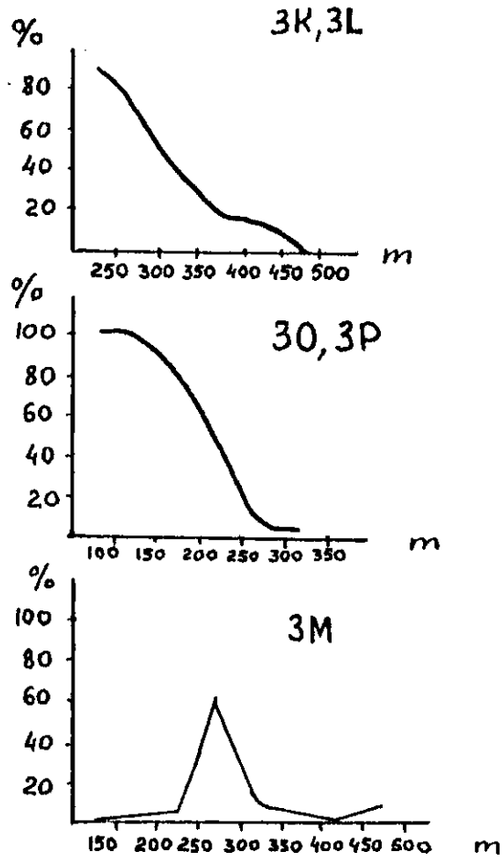

Fig. 1. Number of immature redfish in catches (percentage of mature fish) at different depths, January-March, 1964