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PARASITES AND PIGMENTED PATCHES AS INDICATORS OF INTRASPECIFIC STRUCTURE OF *SEBASTES MENTELLA* IN. THE IRMINGER SEA

by

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ABSTRACT

The paper gives results from studies on parasite fauna of *Sebastes mentella* obtained during different years; as well as occurrence of pigmented patches on skin and in muscular tissue of fish caught at different depths in pelagial of the Irminger Sea. A conclusion has been drawn of inexpediency of using minor differences in occurrence of fish with pigmented patches as a criterion for intraspecific differentiation of *S.mentella*. Absolute similarity of parasite fauna composition, equal rate of infestation by parasites of most species, similar peculiarities of infestation by *Sphyrion lumpi* and pigmented patches indicate the common conditions of redfish habitation during a period foregoing the studies, and, thus, give evidence in favour of the same origin and integrity of *S.mentella* stock, of the upper (0-500m) and lower (500-1000m) layers of its dwelling in the Irminger Sea.

INTRODUCTION

In the 90s, the assumption of Icelandic researchers appeared that two stocks (types) of redfish (*Sebastes mentella* Travin), i.e. "oceanic" and "deep-sea", inhabit a layer up to 1000m in the pelagial of the Irminger Sea (ICES CM 1998/G:3, Ref.H). In this event, the first ("oceanic *S.mentella*") inhabits a wide. range of depth from 50 to 700m, and the second one ("pelagic deep-sea *S.mentella*") dwells only at the depth below 500m. Icelandic scientists (Magnusson 1991; Magnusson et al. 1995) based their opinion of availability of two types of *S.mentella* on five criteria of difference in: 1) intensity of red colour of fish body; 2) length composition; 3) length of first-maturing fish; thickness of neck; 5) infestation by *Sphyrion lumpi*, occurrence of pigmented patches on skin and in muscular tissue of fish.

The paper presents results from studies on parasite fauna of *S.mentella*, as well as analysis for condition of the fifth criterion suggested by Icelandic scientists to differentiate the redfish stocks, i.e. infestation by *S.lumpi*, occurrence of pigmented patches on skin and availability of melanin (melanocytes) in muscular tissue of fish caught at different depth in the Irminger Sea pelagial.

Positive experience of applying the parasitologic data when studying intraspecific structure of marine fish has been accumulated during recent decades. Such data and other natural marks were used to distinguish local groupings of redfish from *Sebastes* genus in the Northwest Atlantic (Perlmutter 1953; Templeman 1959; Templeman, Squires 1960; Sindermann 196 1; Yanulov 1962), intraspecific differentiation of *S.mentella* over most area (from the Barents Sea to the coast of Canada) (Bakay 1997; Bakay 1999), as well as *S.mentella* from the Irminger Sea and adjacent areas Templeman 1967; Gaevskaya 1984; Bakay 1988, 1989).

MATERIALS AND METHODS

Results from parasitologic studies on *S.mentella* from the Irminger Sea performed by the author since 1983 are used in the paper. All organs and tissue (except for blood) of fish were studied by method of complete parasitologic dissection (Dogiel 1933; Bykhovskaya-Pavlovskaya 1985). In 1983 and 1999, to compare parasite fauna of *S.mentella* from the depth above 500m and below 500m in the Irminger Sea pelagial, the samples were taken at the same site and with a minimum interval in time. In total, 250 individuals of redfish were examined. In June-July 1999, during the international trawl-acoustic survey (TAS) on redfish stock in the Irminger Sea, 2532 indiv. of *S.mentella* (963 indiv. were caught from the depth above 500m and 1569 indiv. - below 500m) to study occurrence of *Sphyrion lumpi* and pigmented patches on skin and to elucidate peculiarities of infestation by *S.lumpi*. Location of alive copepods of *S.lumpi* and remains of the parasite presence were considered for each of the four zones of redfish body examined according to the scheme described (Fig. 1) (Bakay, Karasev 1995). To determine occurrence of *S.mentella* with melanin (melanocytes) in muscular tissue, 1037 indiv. of fish were examined. In order to exclude methodical errors when estimating occurrence of these phenomena by different researchers, the paper presents the materials gathered only by the author. *S.lumpi* prevalence - a proportion (%) of fish, infested by the parasite, of the total amount of the fish examined and abundance index - the number of the parasite/l fish examined, were used as indicators for a level of invasion by parasites.

RESULTS AND DISCUSSION'

As a result of the studies on parasite fauna of *S.mentella* from the upper and lower layers of dwelling, there were found 17 species of parasites referring to five taxonomic groups, i.e. *Myxosporea* - 4, *Cestoda* - 6, *Trematoda* - 4, *Nematoda* -2, *Crustacea* -1 (Table 1). The obtained data indicate a complete similarity of parasite fauna composition of *S.mentella* inhabiting the upper and lower layers in each pair of the samples compared and obtained both in the 80s and in the year of 1999. Infestation (prevalence and abundance index) of redfish by parasites of most species, that are from both layers, is also at the same level. Higher level of invasion in redfish from the lower level by helminths of only some widely spread species (*Bothriocephalus scorpii*, *Phyllobothrium sp.pl.*, *Lecithophyllum_bothriophoron*, *Anisakis simplex* I.), acquired with food, is accounted for by a traditional accumulation of these parasites in fish from older age groups.

The materials pooled according to *S.mentella* infestation by *S.lumpi*, obtained from three vessels during the international TAS in 1999 (Sigurdsson et al. 1999), do not prove the Icelandic researchers' opinion of a considerable difference in infestation by *S.lumpi* in redfish from the upper and lower layers in the Irminger Sea pelagial. Besides, the Russian data given in Tables 1-3 indicate a similar level of the parasite invasion of redfish small specimens from the upper layer and of large ones from the lower one at different sites of the area investigated. Minor differences registered by us are not statistically reliable.

A comparison between the infestation by *S.lumpi* in different parts of redfish body indicates an essential similarity of indicators for infestation of fish from the upper and lower layers (Table 3). Some differences in the infestation of the third zone examined are accounted for by a very rare occurrence of parasite in this zone and from difficulties in revealing the remains of *S.lumpi* presence there. Besides, infestation by *S.lumpi* in redfish females always exceeded that in males from both layers in all sub-areas of the TAS area (Table 2).

The assumption that infestation by *S.lumpi* is less in large specimens of redfish from the lower layer should be considered incorrect. Underestimation of remains of the copepod presence, remaining on redfish body surface for a long time, is obvious. It is rather difficult to determine their presence on body, however they are easily found as dark-brown concretions when dissecting a muscular tissue (Bakay, Karasev 1995). In our opinion, reliability of using *S.lumpi* as a natural mark consists just in this; once settled the parasite remains in fish for a Jong time and, probably, up to the end of host's life.

Slightly lower infestation by alive *S.lumpi* is registered at 600-1000m depth (Table 1), where the largest specimens of *S.mentella* are predominant, results from a higher resistance of adults as far as their integument and scale are less accessible to penetration of slow-moving nauplii of the parasite females with a short period of this life cycle stage. Besides, no optimum conditions for the parasite existence are available at large depths (Squires 1966; Pedchenko 1992).

As for the second condition of the fifth criterion used to distinguish "deep-sea" redfish, i.e. low occurrence of *S.mentella* with pigmented patches on skin at the depth below 500m, then this phenomenon results, in our opinion, from the following. Occurrence of redfish with pigmented patches on skin has been established to increase with age and attains maximum in fish at 39-42cm length according to the data for 1983-1986 and in fish at 37-38cm length - by the data for 1999 (Fig.2). In this case, a proportion of large (above $20cm^2$) pigmented patches increases, in the background of which tumors of pigmentary tissue can occur, probably contributing to fish death. This circumstance is one of the reasons of a sharp drop in occurrence of pigmented patches in large specimens of *S.mentella* (Figs.2-3). Prevalence of large pigmented patches in large specimens (Fig.4) indicates their ability to increase in size during redfish life. It is undoubted that senescence of fish contributes to tumor development of pigmentary tissue (Bogovski, Bakay, Karasev 1986; Bakay, Bogovski, Karasev 1987; Bogovski, Bakay 1989; Bogovski, Bakay 1989). These data are in line with a conception of stages of origin of tumor growth in the background of pre-tumorous variations (Shabad 1967).

Compared to 1983-1986, higher occurrence of anomalous pigmentation of skin in fish at 31-36cm length in O-500m layer was observed in 1999, as well as an earlier commencement of rise and drop of its occurrence (Figs.2-3). In 1999, the author managed to compare a dynamics of this phenomenon in the redfish caught in the upper and lower layers in the Irminger Sea (Fig.3). It was established that at the depth below 500m peak of occurrence of anomalous pigmentation on skin begins in fish at 37-38cm length and this index does not exceed 25%. The second peak of occurrence is accounted for, in the author's opinion, by a migration of large specimens above 39-40cm long from the upper layer to the lower one. Migration to deep water is especially pronounced in redfish having large (above $10cm^2$) pigmented patches (Fig.5). The second reason of a sharp drop, at the depth above 500m, of occurrence of *S.mentella* with anomalous pigmentation of skin among fish above 39-40cm in 1999 and above 41-42cm in 1983-1986, consists in this.

Peculiarities of pigmented lesions on redfish skin are the same in the upper and lower layers of dwelling. Thus, in males they are mainly localized on head (gill covers) and caudal fin, in females - along lateral sides (mainly under the first dorsal fin). Pigmented patches occur by 1.9 times more frequently in *S.mentella* males than in females both in deep and in shallow waters.

As for the reasons of occurring the melanomas (black pigmented patches) and pterinophores (red pigmented patches) in fish, no common opinion is available in literature or, probably, this item is not considered (Mawdesley-Thomas 1971). Melanomas in some tropical fish species from *Cyprinodontae* family have properly been studied. Formation of melanomas in these fish species, has been proved to be determined by a specific gene (Anders et al. 1984). Thus, the most probable reason for a high frequency of anomalies in growth of pigmentary tissue in reproductive proportion of *S.mentella* population in the Irminger Sea is, in our opinion, recombinations of gene complexes caused by a pattern of reproduction of the population (Bakay, Bogovski, Karasev 1987; Bogovski, Bakay 1989; Bogovski, Bakay 1989).

The third condition of the 5th criterion, i.e. a low occurrence, at the depths below 500m, of *S.mentella* specimens with an availability of melanin (melanocytes) in muscular tissue, was also noted by us compared to that registered in the upper layers (Table 2). However, the results obtained from analysis have indicated a relationship between the occurrence of this phenomenon and length (age) of redfish (Fig.6). Thus, a proportion of fish below 3 1 cm long with melanocytes in muscular tissue makes up 25%, attains maximum (42-43%) at 32-33cm legth and reduces up to 8-6% at 40-4 1 cm length of fish. No melanocytes were found in muscular tissue of redfish above 4 1 cm long. It is known that *S.mentella* specimens below 3 lcm (under 10 yr) are represented by maturing for the first time or immature fish newly moved to the pelagial of the Irminger Sea from the slope on which they inhabited the layers at the bottom under other biotic and abiotic conditions, compared to the pelagial. Redfish of 32-39cm long (at age 1 0-16), in which melanocytes in muscular tissue occur most frequently, constitute the bulk of reproductive proportion of the population inhabiting the pelagial. Plankton crustaceans (*Copepoda Amphipoda*, *Euphausiida*) are mainly predominant in its feeding (Fig.6), however, a proportion of fish objects, shrimps and young scallops increases with age. The latter serves as the bulk of feeding for *S.mentella* above 39cm long (above 16 yr) when plankton crustaceans occur seldom.

The mentioned above indicates that a low occurrence of redfish with melanocytes in muscular tissue at the depths below 500m, where a proportion of the largest fish species grows essentially, is a consequence of changing by redfish its ecological conditions and variations in age, but not the index of belonging of *S.mentella* from elder age groups to other type ("oceanic deep-sea *S.mentella*) or to another population as some researchers believe (ICES C.M. 1998/G:3).

Different intensity of red colour of *S.mentella* body that, as Icelandic scientists believe, serves as the first from the criteria for distinguishing the redfish from the Irminger Sea pelagial into two types ("oceanic" and "deep-sea"), is, in our opinion, also a consequence of age variations typical of the redfish from this population.

Results from studies on parasite fauna of *S.mentella*, obtained during the 80s (Bakay 1988; 1989), and later data indicate a close similarity of parasite fauna of redfish from the northern, central and southern areas of the Irminger Sea that gives an evidence of close interrelation and integrity of

S.mentella stock inhabiting the vast area (above 300 thou. square miles) of the Irminger Sea pelagial and adjacent site of the Labrador Sea.

CONCLUSIONS

1. Results from studies on *S.mentella*, obtained both during the 80s and in the year of 1999, indicate a complete similarity of parasite fauna composition and infestation by species most parasites of redfish from the upper (above 500m) and lower (500-1000m) layers of its dwelling in the h-n-ringer Sea pelagial.

2. According to the results from long-term studies, availability of *Sphyrion_lumpi* in fish is a rather reliable parasitologic mark when considering not only alive copepods, but also the remains of their presence, as far as they remain in fish, probably, up to the end of host's life. The data available on infestation by *S.lumpi* indicate the level of invasion and peculiarities of infestation of *S.mentella* from both layers of its dwelling to be the same at different sites of the area.

3. Slight decrease in occurrence of *S.mentella* specimens with pigmented patches on skin is, in the author's opinion, a consequence of age variations in fish and obvious pathology of this phenomenon. Therefore, it is inexpedient to use it as criterion for intraspecific differentiation of fish.

4. Somewhat drop in occurrence of *S.mentella* specimens with melanin in muscular tissue at the depth below 500m is also related, in our opinion, to age variations and changing of ecological conditions for redfish habitation, and, therefore, cannot give evidence of belonging of *S.mentella* specimens from elder age groups (registered, as other fish species, in deep waters) to another "type" or another population.

5. Thus, results from parasitologic studies, as well as similar peculiarities of infestation by *S.lumpi* and availability of pigmented patches, indicate similar conditions for dwelling of redfish from the upper and lower layers during the period foregoing the studies, and, so, give avidence in favour of the same origin and integrity of *S.mentella* stock caught at different depths in the Irminger Sea pelagiai.

REFERENCES

ANDERS, F., SCHARTL, M., BARNEKOW, A. 1984. Xiphohorus as an in vivo model for studies on oncogenes. -In: Use of Small Fish Species in Carcinogenicity Testing. NCI Monograph, -Vol. 65.- P.97-109.

BAKAY, Yu.I., BOGOVSKI, S.P., KARASEV, A.B. 1987. Pigmented patches on skin of redfish. – In: Parasites and deseases of marine organisms. - In: VNIRO/PINRO Proceedings. - Murmansk. - P. 18-29 (in Russian).

BAKAY, Yu.I. 1988. Application of results from parasitological investigations in redfish (*Sebastes mentella* Travin) population structure studies. ICES CM 1988/G:35.- P. 1-14.

BAKAY, Yu.I. 1989. On infestation of marine redfishes (*Sebastes* genus) of the North Atlantic by the coipepod *Sphyrion lumpi* (Krøyer, 1845). Proc. of the Workshop on "*Sphyrion lumpi*".- Gustrow (GDR). - P.29-36.

BAKAY, Yu.I., KARASEV, A.B. 1995. Diagnostics and Registration of Ectolesions in Redfishes of the *Sebastes* Genus (Metodic Recommendations). ICES.- Study Group on Redfish Stocks. - 22pp. (Working document).- ICES C.M. 1995/G: 1.

BAKAY, Yu.I. 1997. On results of applying the parasitologic data when studying intraspecific structure of redfish (*Sebastes mentella* Travin) of the North Atlantic. The 1st Congress of Ichthyologists of Russia: Theses of Reports. - VNIRO Press, Moscow. -35pp. (in Russian).

BAKAY, Yu.I. 1999. Ecological and geographical analysis of *Sebastes mentella* parasite fauna in the North Atlantic. Bull. of the 19th"Symp. Scand. Soc.for Parasitology, 1999.- Vol.9, No. 1.- P.28.

BOGOVSIU, S.P., BAKAY, Yu.I., KARASEV, A.B. 1986. Histological studies on black patches and melanomas in marine redfish. -In: Experimental and clinical oncology.- Tallinn, 1986. - 7: 114-120 (in Russian).

BOGOVSKI, S.P., BAKAY, Yu.I. 1989. Pigmented patches in redfish *Sebastes mentella*. – *In:* Experimental oncology, 1989.- Vol. 11, No.3. P. 18-2 1 (in Russian).

BOGOVSIU, S.P., BAKAY, Yu.I. 1989. Chromatoblastomas and related pigmented lesions in deepwater redfish, *Sebastes mentella* (Travin), from the North Atlantic areas, specially from the Irminger Sea. – In: Journal of Fish Deseases, 1989, 12.- P. 1 - 13.

BYKHOVSKAYA-PAVLOVSKYA, I.E. 1985. Parasites of fish. Manual for studying. - NAUKA Press, Leningrad. - P. 120. (in Russian).

DOGIEL, V.A. 1933. Problems of investigating the parasite fauna of fish. – In: Methods and problems of ichthyological and parasitological studies. Proceedings of Leningrad Society of natural scientists. - Vo1.62, 3:247-268 (in Russian).

GAEVSKAYA, A.V. 1984. Copepod *Sphyrion lumpi* as the mark in the population studies of

redfish. -In: Intraspecific differentiation of marine commercial fish and invertebrates-Trudy of AtlantNIRO.- Kaliningrad. P.90-99 (in Russian).

MAGNUSSON, J. 1991. Eitt og annad urn uthafskarfa. Egir, I.Tbl. 1991.

MAGNUSSON, J., MAGNUSSON,. J.V. and SIGURDSSON, P. 1995.On the distribution and biology of the oceanic redfish in March 1995. ICES CM. 1995/G:40.

MAWDESLEY-THOMAS, L.E. 1971. *Neoplasia* in fish: a review. – In: Current Topics in Comparative Pathobiology. Ed.Cheng T.C.- Vol.I, Academic Press, N.Y., London, 1971.- P.87-170.

PEDCHENKO, A.P. 1992. The condition of redfish aggregations for moution in spring in the Irminger Sea. -ICES CM. 1992/G:58.- 8pp.

PERLMUTTER, A. 1953. Population studies of the Rosefish. -Trans.N.Y. Acad.Sci., 1953.- Vol.15, No.3.-P.189-199.

REPORT on the Study group on redfish stocks. -ICES C.M. 1993/G:6. - 12pp.

REPORT on the Study group on redfish stocks. ICES CM. 1998/G:3, Ref.H.

SHABAD, L.M. 1967. Pre-cancer in experimental and morphological aspect.- "Meditsina", Moscow, 1967. - 382p. (in Russian).

SIGURDSSON, T., RATZ, H.-J., PEDCHENKO, A., MAMYLOV, V., MORTENSEN, J., BETHKE, E., STRANSKY, C, MELNIKOV, S., BAKAY, Yu. and K.DREVETNYAK. 1999. Report on the Joint Icelandic/German/Russian Trawl-Acoustic Survey on Pelagic Redfish in the Irminger Sea and Adjacent Waters in June/July 1999. -ICES C.M. 1999/ACFM:17.- 38pp.

SINDERMANN, C.J. 1961. Parasitological tags for redfish of the western North Atlantic. Rapp.et proces-vernaux reunions. - Conseil Perman. Intern. Explor. Mer., 1961.- Vol. 150.- P. 11 l-l 17.

SQUIRES, H.J. 1966. Reproduction in *Sphyrion lumpi* a copepod parasitic on redfish (Sebastes spp.). –In: J.Fish. Res. Bd. Canada, 1966.- Vo1.23, No.4.- P. 521-526.

TEMPLEMAN, W. 1959. Redfish distribution in the North Atlantic.-Bull. Fish. Res. Bd. Canada, 1959, No. 120. - 173pp.

TEMPLEMAN, W. 1967. Adult redfish, *Sebastes mentella*, pelagic over oceanic depths in the Labrador Sea. -In: J. Fish. Res. Bd. Canada, 1967. - Vol.6, No.34. - P. 1275-1290.

TEMPLEMAN, W., SQUIRES, H. 1960.Incidence and distribution of infestation by *Sphyrion lumpi* (Krøyer) on the redfish, *Sebastes marinus* (L.), of the Western North Atlantic, – In: J. Fish, Res. Bd. Canada, 1960. - Vol. 17, No. 1. - P.9-31.

YANULOV, K.P. 1962. On groupings of the redfish (*Sebastes mentella* Travin) in the Labrador/Newfoundland area. – In: Soviet fisheries investigations in the Northwest Atlantic. • Moscow, 1962.- P.285-296 (in Russian).

Table 1. Parasite fauna of S.mentella from different layers in the Erminger Sea by the data for 1983, 1986 and 1999.

Parasites	27 June 1999				July 1986				April 1983			
	190-290 M		550-805 M		120-200 M		650-700 M		200-400 M		510-600 M	
	n=25, l=30-38 cm L=35,2 cm		n=30, l=40-47 cm L=42,4 cm		n=20, l=29-40 cm L=34,7		n=16, l=36-43 cm L=39,4 cm		n=139, l=28-40 cm L=35,0 cm		n=20, l=35-43 cm L=38,6 cm	
	57°57' N, 36°42' W				59°18'N, 36°14'W		Reykjanes Ridge		60°44'-62°05' N 29°07'-32°55' W		61°40'N, 29°10'W	
	P.p.	A.i.	P.p.	A.i.	P.p.	A.i.	P.p.	A.i.	P.p..	A.i	P.p.	A.i.
Myxidium incurvatum	8,0	+	6,7	+	5,0	+	6,25	+	5,0	+	5,0	+
M. obliquelineolatum	4,0	+	6,7	+	10,0	+	6,25	+	2,2	+	5,0	+
Leptotheca adeli	8,0	+	6,7	+	-							
Pseudalataspora sebastei	4,0	+	3,3	+					-			
Bothriocephalus scorpii	8,0	0,08	16,7	0,17	15,0	0,15	12,5	0,19	13,7	0,16	10,0	0,10
Hepatoxylon trichiuri pl.								-	1,4	0,01	5,0	0,05
Scolex pleuronectis pl.	8,0	0,08	6,7	0,10	30,0	0,75	12,5	0,25	10,8	0,16	10,0	0,15
Phyllobothrium sp. pl.	8,0	0,20	26,7	0,67	-				3,6	0,06	5,0	0,10
Diphyllobothrium sp. Pl.	4,0	0,04	3,3	0,03	-			-				
Grillotia sp. pl.	4,0	0,04	6,7	0,07	5,0	0,05			1,4	0,01	5,0	0,05
Derogenes varicus									1,4	0,01	5,0	0,05
Podocotyle reflexa	4,0	0,04	3,3	0,03	5,0	0,05	6,25	0,12				
Anomalotrema koiae	4,0	0,04	3,3	0,03	-		-			-		
Lecithophyllum bothriophoron	4,0	0,04	26,7	0,40	-			-	4,3	0,06	5,0	0,05
Anisakis simplex 1.	100,0	11,00	100,0	12,0	65,0	4,25	93,7	5,69	76,3	5,68	90,0	6,60
Hysterothylacium aduncum	8,0	0,08	6,7	0,07	15,0	0,15	18,7	0,25	4,3	0,05	10,0	0,10
Sphyrion lumpi[1]	14,0	0,22	10,1	0,12	15,0	0,20	12,5	0,19	12,2	0,16	10,0	0,15

NOTE: P.p - Prevalence of parasite, %; A.i - Abundance index; [1] - infestation by alive copepods of S. *lumpi*; [2] - infestation with alive *S.lumpi* and remains of its presence.

Table 2. Occurrence of *Sphyrion lumpi*, pigmented patches on skin and availability of melanin in muscular tissue of *Sebastes mentella* at different depth of the Irminger Sea pelagial (by the data from RV "AtlantNIRO", June/July 1999)

External lesions	Subarea A			Subarea B			Subarea D			Subarea E			The entire area		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
Fish examined, indiv.	- 97	- 65	- 162	447 729	316 498	763 1227	57 86	43 71	100 157	58 15	42 8	100 23	562 927	401 642	963 1569
% of fish with external lesions	- 34,0	- 61,5	- 45,1	40,5 41,3	68,7 61,6	52,2 49,6	43,8 50,0	65,1 57,7	53,0 53,0	39,6 33,3	69,0 75,0	52,0 47,8	40,7 41,2	68,3 61,4	52,2 49,5
% of fish with pigmented patches	- 11,3	- 23,1	- 16,0	16,3 10,6	31,3 19,3	22,5 14,1	14,0 17,4	34,9 31,0	23,0 23,6	19,0 6,7	30,9 75,0	24,0 30,4	16,4 11,2	31,7 21,7	22,7 15,5
% of fish infested by *S. lumpi*	- 28,9	- 46,1	- 35,8	31,1 36,5	53,2 48,0	40,2 41,2	31,6 34,9	53,5 42,2	41,0 38,2	31,0 26,7	52,4 37,5	40,0 30,4	31,1 35,4	53,1 47,0	40,3 40,2
Melanocytes in musculas															
Fish examined, indiv.	- 42	- 30	- 72	137 229	95 124	232 353	17 29	8 21	25 50	9 15	17 8	26 23	163 315	120 183	283 498
% of fish with melanocytes	- 23,8	- 16,7	- 20,8	28,5 16,2	27,4 19,4	28,0 17,3	23,5 34,5	25,0 23,8	24,0 30,0	22,2 13,3	23,5 25,0	23,1 17,4	27,6 18,7	26,7 19,7	27,2 19,1

Note: Subareas are given according to the ICES areas (ICES CM 1993/G:6); at the depths above 500 m – over line; at the depths below 500 m – under line; no investigations were done – minus over line.

Table 3. Prevalence of parasite in *Sebastes mentella* with *Sphyrion lumpi* by zones of fish investigations (by the data for 1999)

Zones investigated*	Prevalence of parasite, %			Abundance index		
	Males	Females	Total	Males	Females	Total
I	25,3 28,9	34,8 32,8	29,1 30,5	0,4 0,4	0,6 0,6	0,5 0,5
II	6,0 9,5	13,0 11,6	8,8 10,4	0,1 0,1	0,2 0,2	0,1 0,1
III	0,7 0,2	1,8 0,8	1,1 0,4	0,002 0,001	0,018 0,010	0,010 0,005
IV	2,1 1,0	17,1 14,9	8,2 6,7	0,02 0,01	0,3 0,3	0,1 0,1
All the fish examined	31,1 35,4	53,1 47,0	40,3 40,2	0,5 0,5	1,1 1,0	0,7 0,7

Note: Prevalence of infestation with *S.lumpi* is given with allowance for its presence. At the depths above 500 m – over line; at the depths below 500 m – under line; * see Fig. 1.

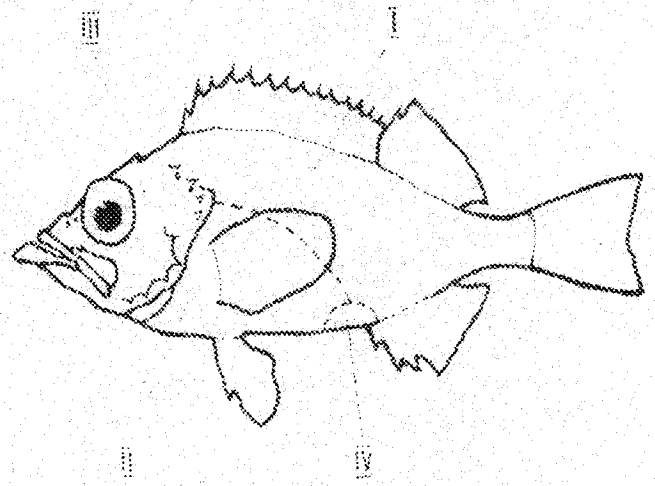

Fig. 1. Phrcelling the body surface out the zones of lesion localization:
I – dorsal ("fillet ") and caudal part, II – ventral part, III – head, IV – anal part

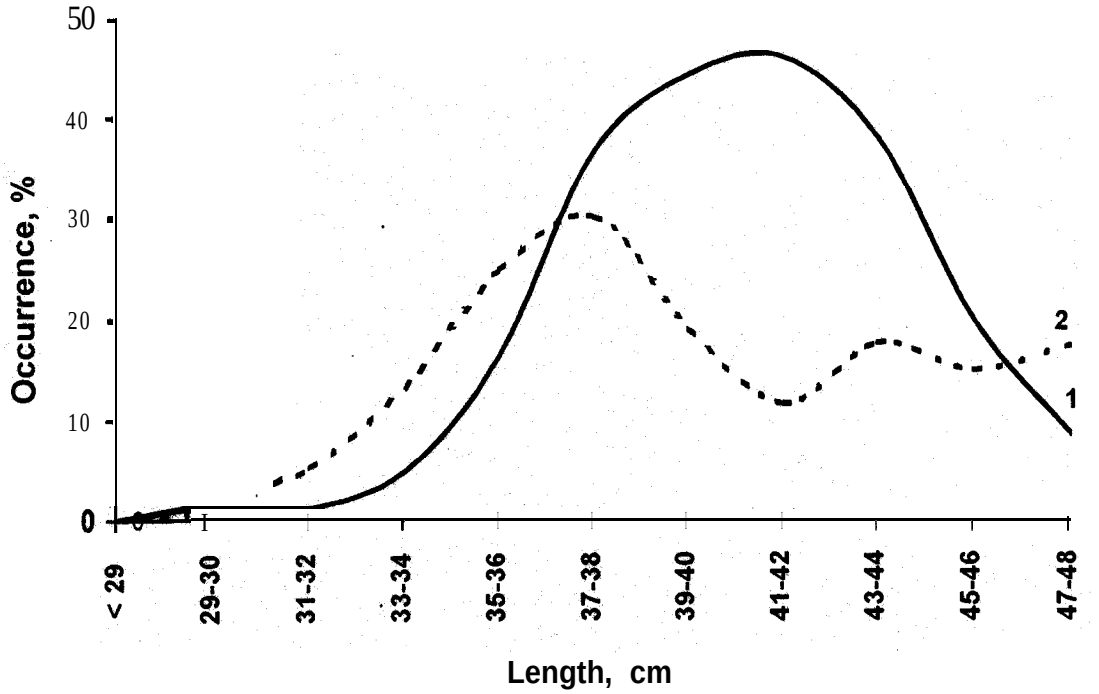

Fig. 2. Occurrence of *S.mentella* with pigmented patches on skin at different lengths in the Irminger Sea in 1983- 1986 in O-500 m layer (1) and in 1999 in 0- 1000 m layer (2)

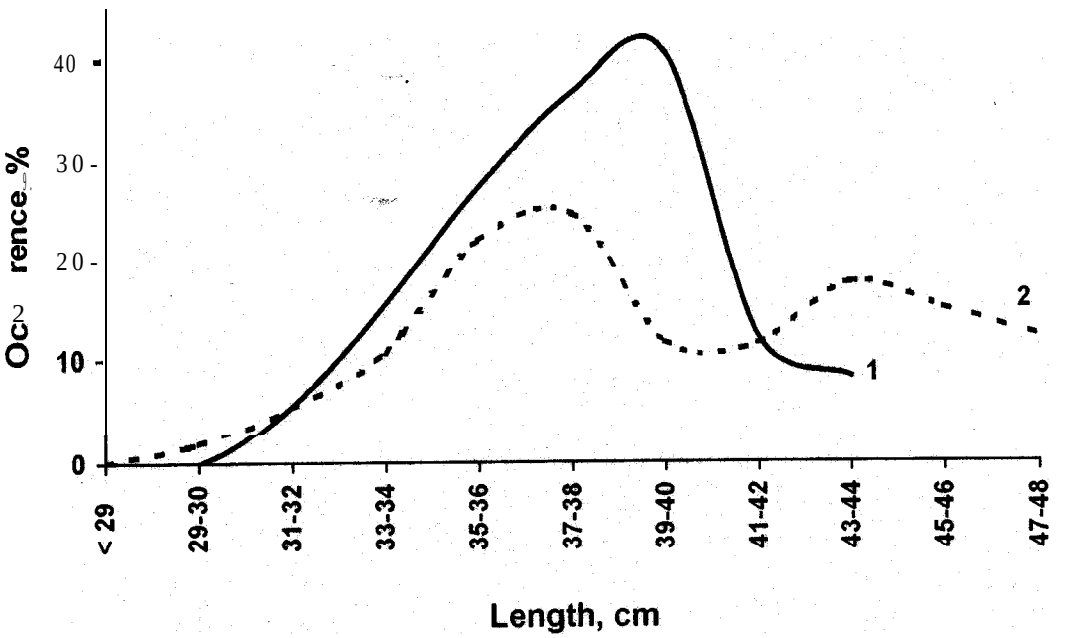

Fig.3. Occurrence of *S.mentella* with pigmented patches on skin at different length caught at the depths above 500 m (1) and below 500 m (2) in the Irminger Sea during the year of 1999

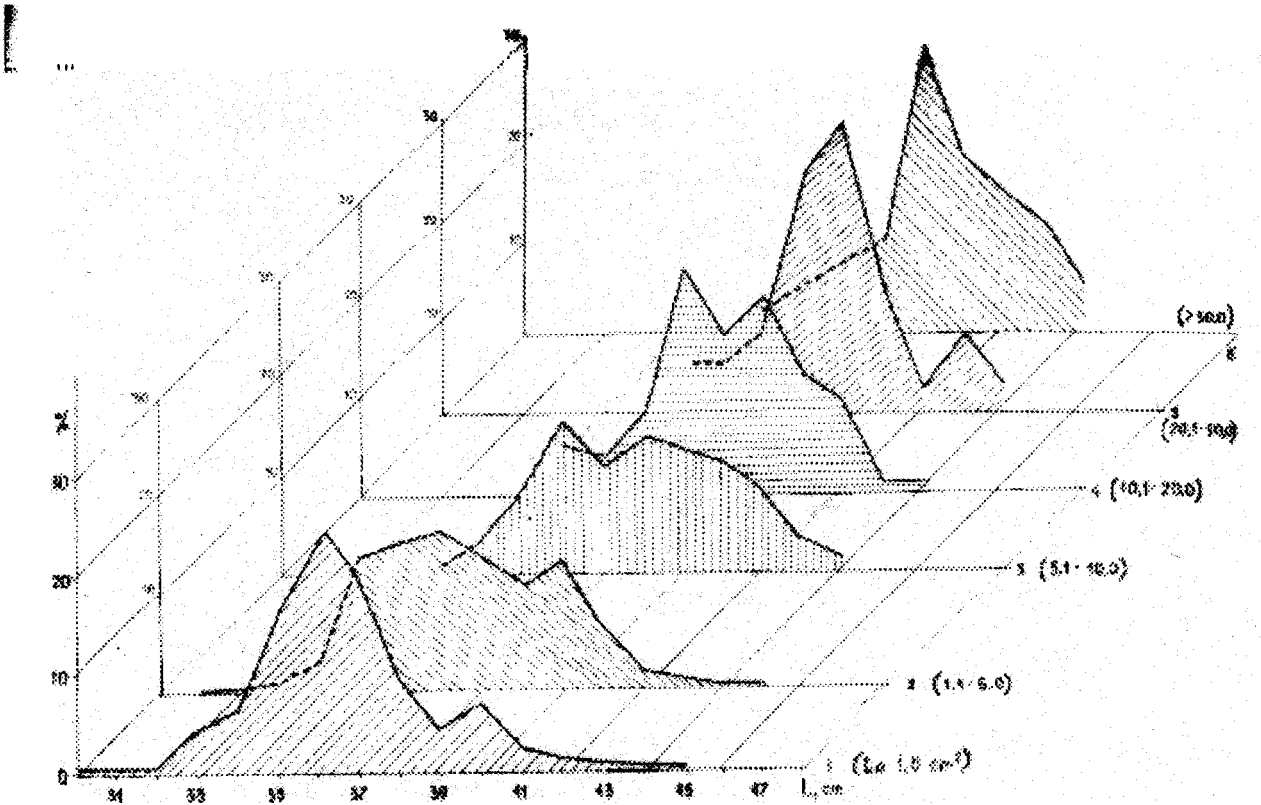

Fig.4. Occurrence of different-size pigmented patches on skin of *S.mentella* from the Irminger Sea depending on fish length (by the data for 1983-1986)

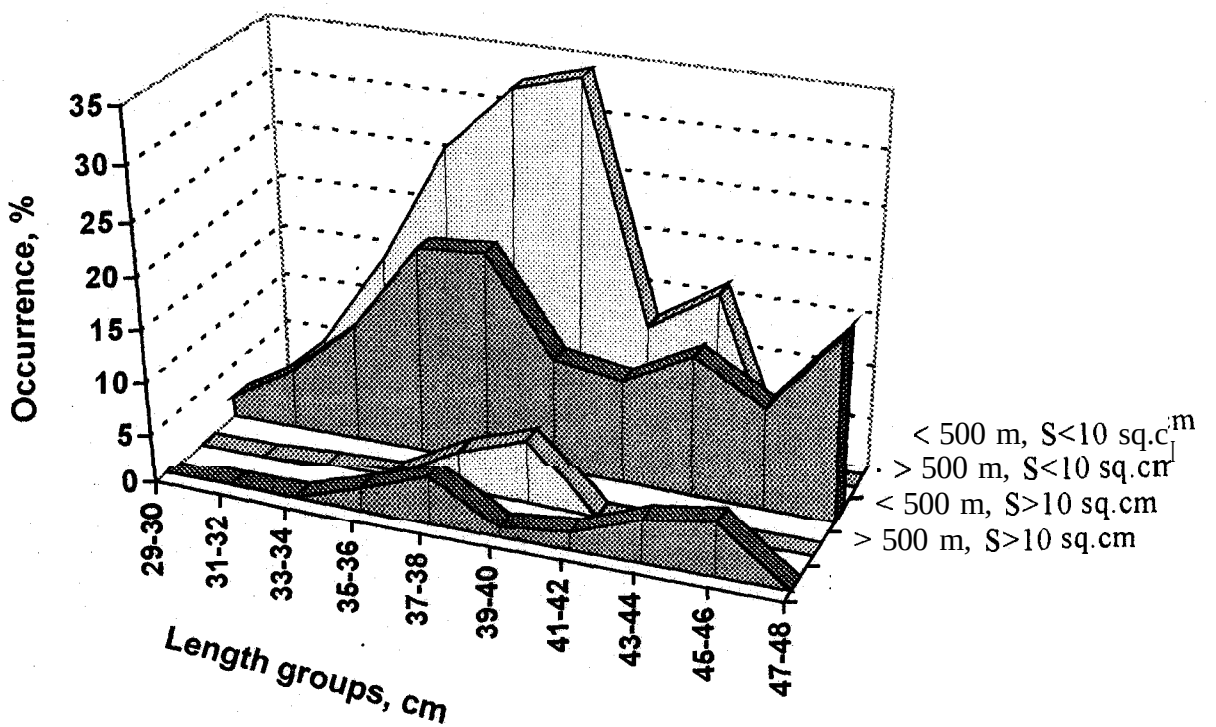

Fig.5 Occurrence of *S.mentella* specimens with pigmented patches of different size depending on fish length at different depths of the Irminger Sea (1999)

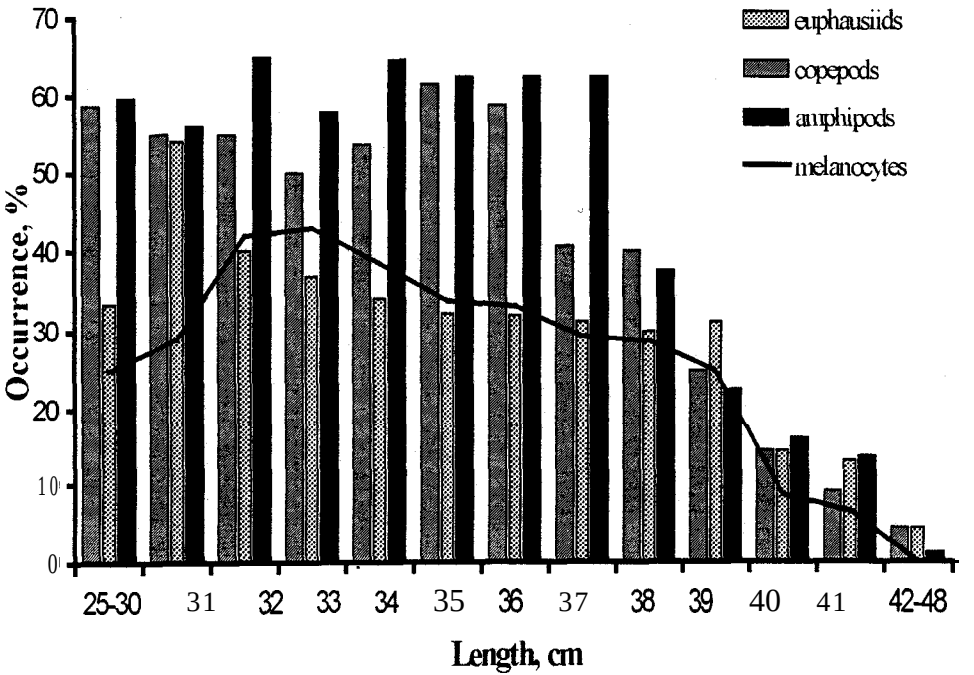

Fig.6. Occurrence of *S.mentella* with melanocytes in muscular tissue and of some components in its feeding depending on fish length