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Main Trophic Relationships of Redfishes in the Northwest Atlantic

by

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Atlantic redfish genus Sebastes (subfamily Sebastinae) possessing an interesting and complex life cycle are intensively studied for the period more than thirty years. A great number of papers are dedicated to the distribution and life cycle of redfish (their growth, reproduction, feeding). Up to the last time, the problem of the taxonomic status remained to be the most difficult one in the process of studying redfish due to the difficulty in identifying the species not only of larvae and fry, but, also, of adult individuals. It was considered that two species inhabited on the shelf and continental slope, namely, "golden redfish" Sebastes marinus (Linne) and beaked redfish S.mentella Travin, Commercial concentrations of beaked redfish were encountered in the Labrador and Newfoundland Areas, golden redfish were rarely found there (Travin, Pechenik, 1962; Janulov, 1962, 1963).

During the last decade, fundamental investigations of the redfish systematism conducted by V.V.Barsukov (1968, 1972, 1981) allowed to determine precisely the species status of all 3 redfish species in the Northwest Atlantic, in particular, to distinguish S.fasciatus Storer species, which previously was not separated of S.mentella close to it. Nowadays, it is determined that S.fasciatus inhabit like S.mentella the Labrador and Newfoundland Areas and their stocks are heavily abundant (Barsukov, 1972; Templeman, 1980; Ni, 1981), the habitats of these species and the ranges of depths they are keeping are found to S.mentella and S.fasciatus (Barsukov, Zakharov, 1972; Ni, 1982).

These investigations showed that the areas of S.mentella and S.fasciatus are overlapped significantly in the Northwest Stlantic. The first species inhabit the area lying from the West Greenland up to the Cabot Strait and further to the south (Barsukov, Zakharov, 1972). S.mentella are seldam occurred near the West Greenland, they inhabit only close to the southern extremity of Greenland (Zakhorov, 1962). This fish species quite obviously plevail in their number off Labrador coast, they are mainly concentrated at depth of the upper bathyal, i.e. 200-700 m (Barsukov, 1972). In the North S.mentella inhabit the shelf area and the continental slope of the Baffin Land, Northern and Central Labrador at depth 100 m and lower, on the southern slopes of Newfoundland (the southeastern and southwestern slopes of the Grand Newfoundland Bank), and on the Saint Pierre Bank they are not encountered in the layers higher 300 m (Ni, 1982).

The second species S.fasciatus inhabiting near the North America has more southern distribution, namely, from the South Labrador up to the areas lying southerner Georges Bank (Barsukov, Zakharov, 1972). In the Northwestern Atlantic this species is the most often encountered in its southern part, i.e. on the Banks of Nova Scotia and in the Gulf of Man. S.fasciatus is an ashore fish species, it is mainly found at depth 400 m along the whole area of its habitat, it can be encountered at greater depths only in waters of the southern slope of the Grand Newfoundland Bank and on the Shelf of Nova Scotia (Barsukov, 1972; Ni, 1982).

Thus, the areas and the depth of S.mentella and S.fasciatus habitats differ greatly. Thus, S.mentella inhabit exclusively in the shelf waters and on the continental slope of the Baffin Land, the Northern and the Central Labrador. To the south, S.fasciatus inhabit mainly the areas of the South Labrador, North Newfoundland Bank, Northeastern slope of the Grand Newfoundland Bank and the Flemish Cap Bank in the shelf waters at depth up to 400 m, S.mentella inhabit here the bathyal depths from 200 m up to 800 m. Shelf waters of the southern slopes of the Grand Newfoundland Bank and the Saint Pierre Bank mainly at depth up to 400 m serve as a biotope to S.fasciatus, and, at depth 300 m and more the second species S.mentella inhabit here. Thus, the range of depth of a mutual habitat of S.mentella and S.fasciatus is not large: in the northern areas of the Northwest Atlantic (South Labrador, North Newfoundland Bank, Northeastern slope of the Grand Newfoundland Bank and the Flemish Cap Bank) the both species are encountered together mainly at depths 200-400 m, in the southern areas (the southern slopes of the Grand Newfoundland Bank and the Saint Pierre Bank) the depth of the both species habitats is more overlapped, they are encountered together within the range 300-600 m (Ni, 1982).

The investigations of redfish feeding in the Northwestern Atlantic attracted attention of a number of investigators (Steele, 1957; Lambert, 1960; Kashintsev, 1962; Janulov, 1963; Kohler, 1966; Konchina, 1968, 1970). Unfortunately, these investigations were based on different redfish species. Thus, for example, Lambert (Lambert, 1960) analysed the feeding peculiarities of the "golden redfish" S.marinus, though, as the areas and the depth of the samples collections show that 3 species were taken into its samples including S.mentella and S.fasciatus. Similar to it, the main collections taken in the area of the mutual inhabitance of the both species S.mentella and S.fasciatus not subdivided previously served as a base to scientific papers by Soviet researchers given the analysis of S.mentella feeding (Kashintsev, 1962; Janulov, 1963; Konchina, 1968, 1970).

The studies of the redfish feeding in the Northwestern Atlantic conducted at the level of genus Sebastes resulted in an important conclusion on a high plasticity in their feeding, it was found that the plankton invertebrates served as the main feeding item to them, and the pelagic fish species were used by redfish Sebastes to a less degree. It was determined that the representatives of widely spread crustaceans dominating in a plankton group, i.e. copepods, hyperiids, euphausiids, shrimps were the leading feeding items in a food spectrum of redfish. The representatives of the mesopelagic complex were the most often encountered among other fish in the redfish stomachs.

The author of this paper tried to analyse at the species level the food composition and the peculiarities of the feeding (age, seasonnal, local ones) of young and adult S.mentella and S.fasciatus. First, an attempt was undertaken both to determine the food chains, due to which the biomass of young S.fasciatus is created and to come to the possibility to separate the main trophic steps of adult S.mentella and S.faciatus in the Northwestern Atlantic.

The whole material used to study the redfish feeding was collected during the trips of research vessel of the Polar Research Institute of Marine Fisheries and Oceanography (PINRO). The morphological analysis of the control features in young S.mentella and S.fasciatus caught in 1963/67 was performed under the laboratory conditions with application of a scheme of redfish measurements by V.V.Barsukov (1968, 1972) (Table 1). In total, more than 600 redfish individuals were examined, their length was 12-30 cm in the northern areas (the Baffin Land, the South Labrador, the North Newfoundland Bank) and 10-20 cm in the southern areas of the Northwestern Atlantic (the Southeastern and Southwestern slopes of the Grand Newfoundland Bank, the Saint Pierre Bank). Our samples included 2 species of redfish caught in two areas, namely, in the waters of the North Newfoundland Bank (depth 200-300 m) 25% of young fish were determined as S.fasciatus among youngs of the Southwestern slope of the Grand Newfoundland Bank (depth 200-300 m) and more than 10% appeared to be S.mentella (Table 1). The paper includes only data of the feeding of young S.mentella from the areas of the Baffin Land and the South Labrador, the feeding of young S.fasciatus was studied basing on individuals taken in the areas of the Southeastern slope of the Grand Bank and the Saint Pierre Bank, where all fish taken at depth 200-300 m can be related to species S.fasciatus.

The material to study the feeding of adult S.mentella and S.fasciatus was collected in 1964/66. This paper includes data based on the dissections of 5.000 individuals of S.mentella taken in the areas of the Central, North and South Labrador and the North Newfoundland Bank on board a vessel. In the first two areas fish were caught near the edge of the shelf and on the continental slope (depth 100-500 m), exclusively S.mentella inhabit here (Barsukov, Zakharov, 1972; Ni, 1982). In the areas of South Labrador and North Newfoundland Bank the feeding was investigated only in individuals caught over the continental slope at depths 400-800 m, where S.fasciatus were not encountered. Data on adult S.fasciatus feeding are based on the dissections approximately of 700 individuals of fish caught exclusively at depths 150-300 m in the waters of the southern slopes of the Grand Newfoundland Bank and the Saint-Pierre Bank, where, S.mentella were not found in their turn.

The treatment of stomachs of 2 species of young redfish was performed with application of the weight method under laboratory conditions (Methodic. Handbook..., 1974). If it was possible, the species was determined in the food components found in their stomachs, then these components were measured, calculated and weighed. The renewal weights of different crustacian species were used at the calculations, then they were transformed into actual weight. The indeces of stomachs fullness (in prodecimal) were used to determine the intensity of the fish feeding.

The feeding of adult redfish was treated with the application of the method of the occurence of the number of stomachs full of food (Methodic Handbook..., 1974). Adult individuals whose stomachs teared away food lump or were slipped out were not taken into account like it was in case with the treatment of young fish. The intensity of the adult fish feeding was assessed according to the value of an average point characterizing the stomachs fullness and by number of empty stomachs (percent). To diagram, the percentage of the frequency of the occurence was calculated. The share of some species of food components in the food content of adult redfish was determined according to data got as result of the treatment of 218 stomachs of S.mentella taken in the waters of the North and South Labrador and of 174 stomschs of S.fasciatus taken in the waters of the southern slopes of the Grand Newfoundland Bank and the Saint Pierre Bank.

Our studies allowed to come to a conclusion that young S.mentella and S.fasciatus possess a high plasticity property in their feeding, the spectrum of their food consists of planktonic invertebrates (8 systematic groups not lower than the order level) and fish (Table 2). Young S.mentella fed mainly on euphausiids, small crustaceans, squids Gonatus fabricii (Lichtenstein), the share of hyperiids and fish Myctophum sp. and Cyclothone sp. which are the representatives of the mesopelagic complex is also high in the ration of euphausiids (Parin, 1971, 1979). Two euphausiid species Thysanopoda acutifrons Holt et Tattersal and Meganyctiphanes norvegica (M.Sars) and 3 species of hyperiids of genus Parathemisto, namely, P.libellula (Lichtenstein), P.abyssorum Boeck and P.gaudichaudi (Guerin) were also used as food by S.mentella. Contrary to S.mentella, the food of young S.fasciatus consisted, mainly, only of 2 feeding items namely, euphausiids comprising 2/3 of a food lump and copepods. Of euphaussids, M.norvegica were mainly preferred by S.fasciatus. Two other species Thysanoessa inermis (Kroyer) and T.raschii (M.Sars) were seldom encountered in their food. Of copepods, S.fasciatus preferred mainly Calanus finmarchicus Gunnerus, Pareuchaeta norvegica (Boeck) and Metridia longa Lubbock, the share of C.finmarchicus prevailed twice that one of two other copepod species.

The food composition of young S.mentella, 23-30 cm long was studied in fish caught in waters of the continental slope (depth up to 600 m) only in winter (Table 2). Fish fed on poorly, the value characterizing the index of stomachs fullness did not prevail 23°/ooo. The main materials on the feeding of young S.fasciatus, 10-20 cm long were collected in spring, mainly, near the edge of the shelf (depth 200-300 m). The intensity of these fish feeding was not high, the indices of the stomachs fullness were one order higher compared the youngs of S.mentella and prevailed 250°/ooo. To compare in details the food composition of the youngs of 2 redfish species, we need to have a greater volume of materials. But, the materials available allow us to show both the degree of the plasticity in young redfish and how much are the age and seasonual variations in their food composition.

It appears that as soon as the young S.fasciatus are growing older, their food items become larger and more mobile. This tendency can be demonstrated taking as an example the area of the Southeastern slope of the Grand Newfoundland Bank. In August, S.fasciatus, long 8-20 cm were intensively feeding (the indices of their fullness reached 170°/ooo) (Fig.1), they were caught in the same trawl in this area. Fish up to 10 cm in their length (at age 1-2 years) were feeding almost exclusively on copepods. The main food items to redfish not longer than 15 cm (at age 5 years and older) were copepods and euphausiids M.norvegica. Yearlings of redfish fed on small copepods, C.finmarchicus and M.longa dominated in their food. Large sized copepods P.norvegica were often encountered in the stomachs of redfish at age 5 years and older.

Seasonnal variations of the food composition of young S.fasciatus were significant. The dependence can be surveyed on the Saint Pierre Bank, where the material was collected during 5 months (Fig.2). The intensity of the redfish feeding was low in January, March and April, the indices of the stomachs fullness did not prevail 30°/ooo. During this period the food composition was different, thus, in January the redfish were feeding on euphausiids, in March - by hyperiids and euphausiids, in April the bulk of their food was represented by copepods, euphausiids and shrimps. In May and June, S.fasciatus were intensively feeding, the indices of their stomachs fullness were high and prevailed 250°/ooo. During this period euphausiids M.norvegica are the only source of the redfish feeding. Thus, the young individuals of S.fasciatus are poorly feeding in winter and spring in waters of the Saint-Pierre Bank, they use as their food some groups of the plankton crustaceans, namely, copepods, hyperiids, euphausiids and shrimps. During their fattening and growing period, late in spring and in summer, S.fasciatus are feeding only on euphausiids, mainly, M.norvegica. Copepods and euphausiids are the main food components of young S.fasciatus inhabiting the waters of the Southeastern slope of the Grand Newfoundland Bank like the Saint-Pierre Bank. The material was collected there during three months, namely, in May, June and August. In June and August, the share of euphausiids increased in their feeding spectrum during their feeding and growing period (up to 60% in weight).

We tried to determine in the first approximation the trophic connections due to which the biomass of immature S.fasciatus is created basing both on the different species correlation of feeding components in their food during the growing period (May-August) and also on the ecology data including those on the feeding of the crustaceans - preys. Two connections are distinguished in the trophic grid of the shelf pelagial (Fig.3): 1) herbivorous and 2) carnivore zooplankton. 3 species of euphausiids and 3 species of copepods are related to herbivorous zooplankton. In reality, the phytoplankton prevail in food only of 2 copepod species, namely, C.finmarchicus and C.hyperboreus. Practically, all species of euphausiids and M.longa are omnivorous organisms. It is known that these crustaceans are the filtrators, they use as their food the detritus and small-sized zooplankton besides the phytoplankton (Mauchline, 1966; Mauchline, Fisher, 1969; Zelikman, 1977; Mileykovsky et al., 1977). The predator-plankters in the food of immature S.fasciatus are represented by copepods Pareuchaeta norvegica, hyperiids Parathemisto abyssorum and arrow-worms Sagitta spp. These predator-plankters use as their food the herbivorous zooplankton (Vinogradov et all., 1977; Mileykovsky et al., 1977; Bowman, Gruner, 1973).

The scheme shows (Fig.3) that during the growing period young S.fasciatus get practically their food of the first step, herbivorous (∿ 90% in weight), the share of the predator zooplankton is small in the redfish ration (∿ 10%). Up to $^2/_3$ of the whole food content of S.fasciatus take euphausiids M.norvegica, about 15% in their ration comprise C.finmarchicus, the effect of the rest herbivorous zooplankton is small.

Adult S.mentella and S.fasciatus, like young fish, possess a high plasticity in their feeding. Our studies showed that their feeding spectrum includes invertebrates of 14 systematic groups (not lower than the level of an order) and fish. Besides the plankton crustaceans, the food lump of adult redfish included jellyfish, Actiniaria, Ctenophora, Gastropoda, Bivalvia, Octopoda and Polychaetes. For exception of crustaceans, no one of these organisms was found in the stomachs of young redfish. Adult S.mentella are feeding on fish-preys, the representatives of the neretic ichthyocene (capelin, sand lance) and of the mesopelagic one (Paralepididae, Myctophidae, Stomiatidae and other ones), as well as by young specimens of commercial fish species like cod, redfish, grenadier. In spite of the fact that a large spectrum of feeding organisms is represented relating redfish, the base of their food make only some groups of the feeding components, the composition of the main feeding components used by adult specimens of 2 redfish species differs considerably (Fig.4).

During the whole year, S.mentella feed on crustaceans of 3 groups (hiperiids, euphausiids, srimps) and fish on the continental slope of the South Labrador. Euphausiids serve as the main food item to S.fasciatus on the southern slopes of Grand Newfoundland Bank, Beroe spp. and fish are also numerous in their feeding spectrum. The species composition of euphausiids and fish, i.e. food components consumed by both redfish species is not the similar one 2 species of euphausiids namely Thysanopoda acutifrons and Meganyctiphanes norvegica were used as the food components by adult S.mentella on the continental slope of South Labrador, M.norvegica was consumed only by S.fasciatus near the edge of the southern slopes of Grand Bank (Fig.5).

The main fish-preys represented in the ration of S.mentella are lanternfish (Myctophidae), mainly Myctophum punctatum Rafinesque (Fig.6). Paralepididae are significantly represented in the food of this fish species. S.mentella are active predators thus, for example, an individual of Paralepis coregonoides Risso, more than 30 cm long was found in a redfish of 42 cm long. Fish of the family Chauliodontidae, Stomiatidae and Nemichthydae, i.e. the representatives of the mesopelagic ichthyocenes were registered in small number in S.mentella food. Sand eel (Ammodytes sp.) were encountered in the feeding spectrum of redfish on the shelf of Northern and Central Labrador. Exclusively Myctophidae, mainly M.punctatum serve as the main fish-prey to S.fasciatus keeping in the shelf waters of the Northern and Central Labrador, other representatives of the mesopelagic ichthyocene were not found in S.fasciatus stomachs. Sand eel and young cod were seldom encountered in their food.

Seasonnal dynamics of adult S.mentella feeding can be surveyed in the area of the South Labrador continental slope, where the material collections were performed during the whole year throughout 3 years (Fig.7). In autumn (September-October), the collections of stomachs were performed in other areas, namely, the shelf and the slope of the North and Central Labrador, mainly, in spring and summer - on the continental slope of the North Newfoundland Bank. These data were used as an additional material.

Adult S.mentella ceased to feed in spring, in April-May the points of the stomachs fullness were not higher than 0.2. In summer-spring period, S.mentella were feeding the most intensively (the points of the stomachs fullness were not higher than 1.5), in winter (December) the intensity of the redfish feeding was decreasing (the point of fullness - 0.4).

Figure 7 shows that during the whole year adult S.mentella were feeding on several main food components: hyperiids, euphausiids, shrimps and fish. The rate of fullness of adult S.mentella stomachs with every of these components depended exclusively on the season. Thus, in spring (May), when adult S.mentella were weakly feeding, their main food component made predator shrimps Gennadas sp. of 4-5 cm long. In spring and autumn, i.e. during their growing period, hyperiids, maily Parathemisto gaudichaudi of 1.5-2.0 cm long made the bulk of their food. Besides, during this period fish were heavily represented in adult S.mentella food lump, it consisted mainly of the lantern anchovy, mainly, M.punctatum, of 5-6 cm long, and, in a less number, of P.coregonoides, the length of some individuals of this food component reached 30 cm. During the whole year, especially late in winter (February - March) euphaussiids are largely represented in the food of S.mentella, in particular, M.norvegica and T.acutifrons. Redfish fed on concentrations of small crustaceans, 4-5 cm long. During some months, other food components are also heavily represented in S.mentella food. Thus, for example, in June their stomachs were often full of comb-jellies (Beroe sp.) and arrow-worms (Sagitta spp.), in July redfish were feeding on copepods (Pareuchaeta norvegica), they made $^{2}/_{3}$ of small crustaceans eaten, and at less degree - on Calanus hyperboreus (up to $^{1}/_{3}$). When the intensity of their feeding became lower, redfish used as their food exclusively animals of the demersal complex, namely, in October - octopuses, in December - cumaceans.

Thus, during a year, the energy source to adult S.mentella serve several groups of the pelagic crustaceans (hyperiids, euphausiids, shrimps) and fish of the mesopelagic complex (Myctophidae, Paralepididae). The rate of using fish of the neritic community is not high. Thus, in autumn (October), the sand eel (Ammodites sp.) served as the main species of fish-preys to redfish near the edge of the Central Labrador shelf (depth 100-300 m), in winter (December), redfish fed, mainly, on capelin and their own youngs, the occurrence of which was not high on the slope of the South Labrador.

Materials on the feeding of adult S.fasciatus were got mainly during the spring-summer period, there are also data for some autumn (October) and winter (December) months. The feeding period begins in S.fasciatus earlier than in S.mentella. In March, fish ceased practically to feed (mean point of their stomachs fullness were not higher than 0.2). In May, the intensity of the redfish feeding was high: the points of the stomachs fullness reached 0.2. In summer and winter, adult S.fasciatus continued to feed on though the intensity of their feeding continued to drop (the points of the stomachs fullness - 1.2).

Figure 4 shows that during the growing period, the main food component of S.fasciatus are euphausiids, in reality, only M.norvegica (Fig.5). The meaning of other food components, comb-jellies and fish increased only in some seasons. For example, comb-jellies were heavily represented in the ration of S.fasciatus in March and October, the share of the fish component increased in winter (December). S.fasciatus used as their food mesopelagic migrating fish, mainly, Myctophum punctatum, P.coregonoides were not found in their stomachs. The significance of fish-preys, representatives of the neritic ichthyocene is not great including capelin and sand eel (Fig.6).

Thus, S.fasciatus inhabiting the shelf edge used in reality one energy source - euphaisiids ($^{2}/3$ of the whole food content), other food components served only as an additional food.

According to the principles of the modern ecology on the transferring of the energy along the trophic chain (Odum, 1975; Pianka, 1981; Parsons et al., 1982), a scheme of the trophic connections of adult individuals of 2 redfish species is constructed (Fig.8). Taking into account a proposition that the nekton predators - ichthyoeaters take the 4^{th} ecological level in the food chain on the shelf and in depths of the bathial in the Northwestern Atlantic, and the number of the ecological levels is not higher than 5 (Ryther, 1969; Parin, 1971; Odum, 1975), two ecological levels are given in the first approximation on the scheme: 1) the second level - the plankton - eater zooplankton and 2) the third level - the predator zooplankton and the planktoneater fish. This scheme is a hypothetic one and reflects the quality trophic connections.

The scheme shows that the plankton-eaters include crustaceans, mainly those feeding on the phytoplankton (copepods, euphausiids), as well as those using an organic matter of detritus (mysids, hammariids, Gumacea). As it was already noted, copepods Calanus finmarchicus and C.hyperboreus, used as food items by redfish, are feeding on phytoplankton. Euphasiids, in particular, M.norvegica and Thysanopoda acutifrons are omnivorous, besides phytoplankton they feed on detritus and zooplankton.

Organisms of different communities using animal food as their energy source, mainly plankton - eaters, are related to the third level, but, their predatory variety is different. As a result, some steps are distinguished at this ecological level. For example, according to literary data, Paralepididae feed on heperiids (Konstantinov, Podrazhanskaya, 1972) or euphausiids (Leim, Scott, 1966), or they feed on fish of the mesopelagic complex including lantern anchovy (Borodulina, 1974; Vinogradov et al., 1977). Such fish as slender snipe eel (Nemichthyidae) feed on marcoplankton srimps (Parin, 1971). Comb-jellies of genus Beroe can feed on the specimens similar to them, i.e. medusas and predator zooplankton (Zelikhman, 1977; Swanberg, 1974).

The identity of many organism to any ecological level on the scheme is conventional to a great extent (Fig.8). The last one is connected to different degree of the degree of their systematic determination or the absence of data on their feeding. For example, the predators of the benthos community (sea anemones, gastropods, Octopoda, bevalve molluscs) are determined only up to the level of an order or a class, the predators plankton-eaters (medusas, comb-jellies, polychaetes, shrimps) - only up to the genus level. In spite of the fact that the specific status to the squids, mysids and hammarids is determined, data on the composition of their food are absent in the litterature.

Basing on the adopted principles, redfish can be considered as facultative predators-ichthyoeaters keeping near a lower limit of the fourth ecological level, as fish food composes a considerable, but not the main part of their ration. Literary data show that redfish are related to a nekton grouping, they are growing up to middle sizes: S.fasciatus reach 50 cm in their length, S.mentella are 53-55 cm long in maximum in the Iceland area (Barsukov, Zakharov, 1972). Our collections were represented by S.fasciatus of 42 cm long in maximum S.mentella - 55 cm.

The scheme given (Fig.8) shows that marine redfish use as their food mainly the organisms of the plankton communities.

Using as their food animal from different trophical complexes (Parin, 1971) including the mesopelagic one (migrating, stationary), the neretic one (pelagic, demersal, bottom) one can suppose that the main energy source to marine redfish are the pelagic crustaceans of the second (euphausiids) and the third (hyperiids, shrimps) ecological levels. Besides, other predators of the third level make also an important part in food of marine redfish like lanternfish and comb-jellies. Other connections including some species of the predator plankton invertebrates (medusas, polychaetes Sagittae), as well as small-sized nekton squids and fish of neretic (capelin, sanderling) and mesopelagic (Chaulidus, Stomias, Nemichthys) complexes are only occasional. The rate of the connection to the animals of the benthos communities, i.e. the detritus-eaters (mysids, hammariids, cumaceans) and the predators (octopus, sea anemones) is also low in marine redfish. Food niches of adult individuals S.fasciatus and S.mentella differ greatly. The plasticity of the feeding of 2 redfish species is high, their feeding spectra are very large. The main trophical connections can by apparently explained by the mass character and the availability of a food item at a horizon of redfish hunting. The last conclusion is confirmed by essential seasonnal variations in the composition of their food items. The attention should be paid to the fact that the diversity of the trophical connections is less in food of S.fasciatus compared S.mentella and the animals of the benthos communities are almost absent in S.fasciatus feeding spectrum (Fig.8). Crustaceans of the 2 group are used as the main food component to S.fasciatus, and those of the 3 group - as the main food component to S.mentella. The mesopelagic fish (lanternfish) are important as food to the both redfish species, S.fasciatus are closely connected to coelenterates (comb-jellies).

The results obtained confirm the conclusion of some investigators on the fact that marine redfish perform one day vertical migrations of the trophical character (Sherbino, 1958; Templeman, 1959; Janulov, 1963; Beamish, 1966). S.fasciatus and S.mentella migrate to the upper water layers in evening and feed on the concentrations of numerous crustacean species or fish of the mesopelagic complex. We consider that the availability of one day migrations allow to consider S.fasciatus as a representative of the semi-demersal pelagic ichthyocene of a neritic area. Basing on the results of investigations of the distribution of this coastal fish species one can conclude that they prevail in deep layers of the shelf area (Barsukov, 1972, Ni, 1982).

S.mentella are, apparently, one of the components of the bathypelagic ichthyocene, where water masses over the continental slope serve as their biotope (Parin, Golovagn, 1976). This species inhabits deeper water layers compared S.fasciatus, its main concentrations are keeping at depth of the upper bathyal (200-700 m) (Barsukov, 1972). The identification of S.mentella to the semi-demeral pelagic community in the shelf area has not the main meanings: it is encountered only in the northern part of the area at small depths (in the water column from 100 m and deeper), just, in the areas of Baffin Land, Northern and Central Labrador (Ni, 1982).

Summarizing all above said one can conclude that as a component of the bathypelagic community of fish, S.mentella transport with them the energy to the depths of the upper bathyal while moving for their food to the upper water layers in dark time of the day and they use for this purpose not only crustacians, but, also, fish of the bathypelagic ichthyocene. S.mentella are, in their turn, a prey to top bathyal predators, for example, to Greenland halibut Reinhardtius hippoglossoides (Walbaum) and the black shark Gentroscyllium fabricii (Reinhardt) (Konstantinov, Podrazhanskaya, 1972) ensuring them food due to the energy of the upper ocean layers. To understand the meaning of S.fasciatus in the communities of the neritic area in the Northwestern Atlantic, it is necessary to conduct further investigations.

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Table 1. Distribution of young individuals of two species of redfish (%, %) in the North-western Atlantic

Area	Depth, m	Sebastes fasciatus	Sebastes mentella	Number of fish, specimens
Baffin Land (0)[x]	500-600		100.0	21
South Labrador (2I)	300-600	3.4	96.6	229
North Newfoundland Bank (3K)	200-300	25.0	75.0	28
Southeastern slope of the Grand Newfoundland Bank (3N)	100-500	100.0	-	111
Southwestern slope of the Grand Newfoundland Bank (30)	200-300	89.6	10.4	55
Saint-Pierre Bank (3P)	100-300	95.5	4.5	191

[x] 0, 2I, 3K and so on are given according NAFO division.

Table 2. Food composition of young individuals of two redfish species (% in weight)

Food item	Sebastes mentella	Sebastes fasciatus
Cephalopoda	17.5	-
Copepoda	3.0	32.0
Mysidacea	0.9	0.1
Hyperiidea	11.2	2.9
Cumacea	-	0.0
Euphausiacea	41.9	63.8
Decapoda	5.9	0.3
Chaetognatha	0.0	0.9
Pisces	19.6	0.0
Number of fish studied (individuals)	168	498
Number of empty stomachs (%)	35.1	29.9
Mean index of stomachs fullness (°/ooo)	16.01	91.84

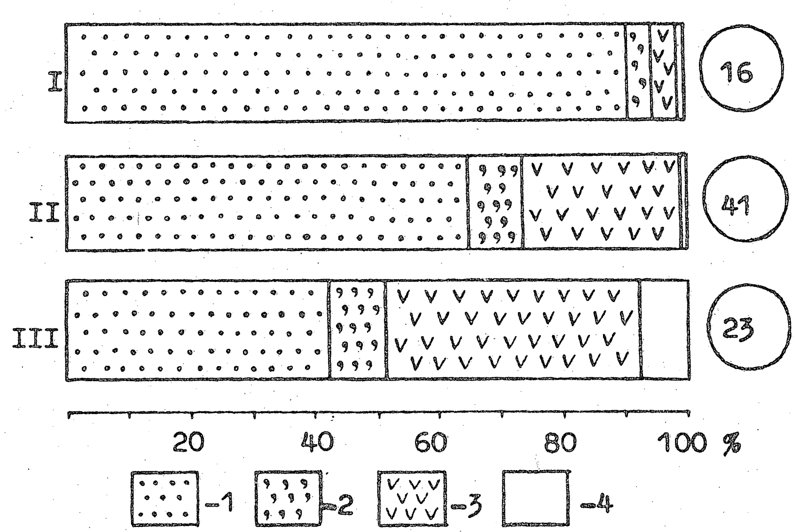

Fig. 1. Food composition of young individuals Sebastes fasciatus of different size groups (August, southeastern slope of Grand Bank) (% in weight): I = up to 9.9 cm, II = 10.0-14.9 cm, III = 15.0 cm and more. Food components are as follows: 1 = Copepoda, 2 = Hyeriidea, 3 = Euphausiacea, 4 = other species. Numbers encircled represent number of feeding fish (specimens).

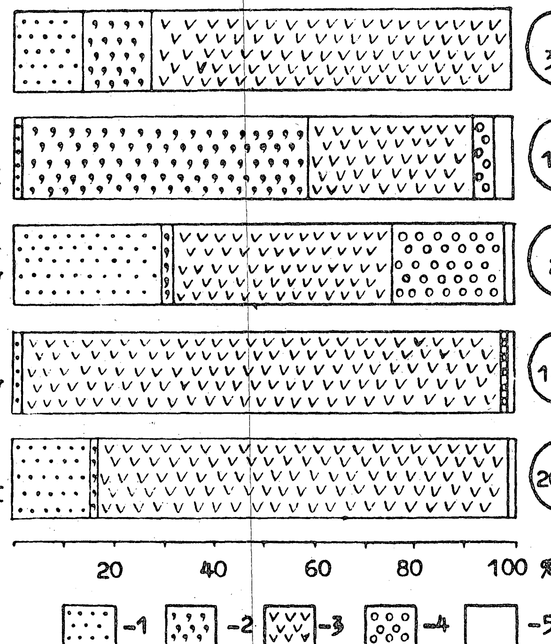

Fig. 2. Seasonnal dynamics of food composition of young specimens Sebastes fasciatus on the Saint Pierre Bank (% in weight): Roman numbers - months. Food components: 1 = Copepoda, 2 = Hyperiidea, 3 = Euphausiacea, 4 = Decapoda, 5 = other specimens. Numbers encircled mean indices of stomachs fullness (in ‰); "n" means number of fish with empty stomachs (specimens).

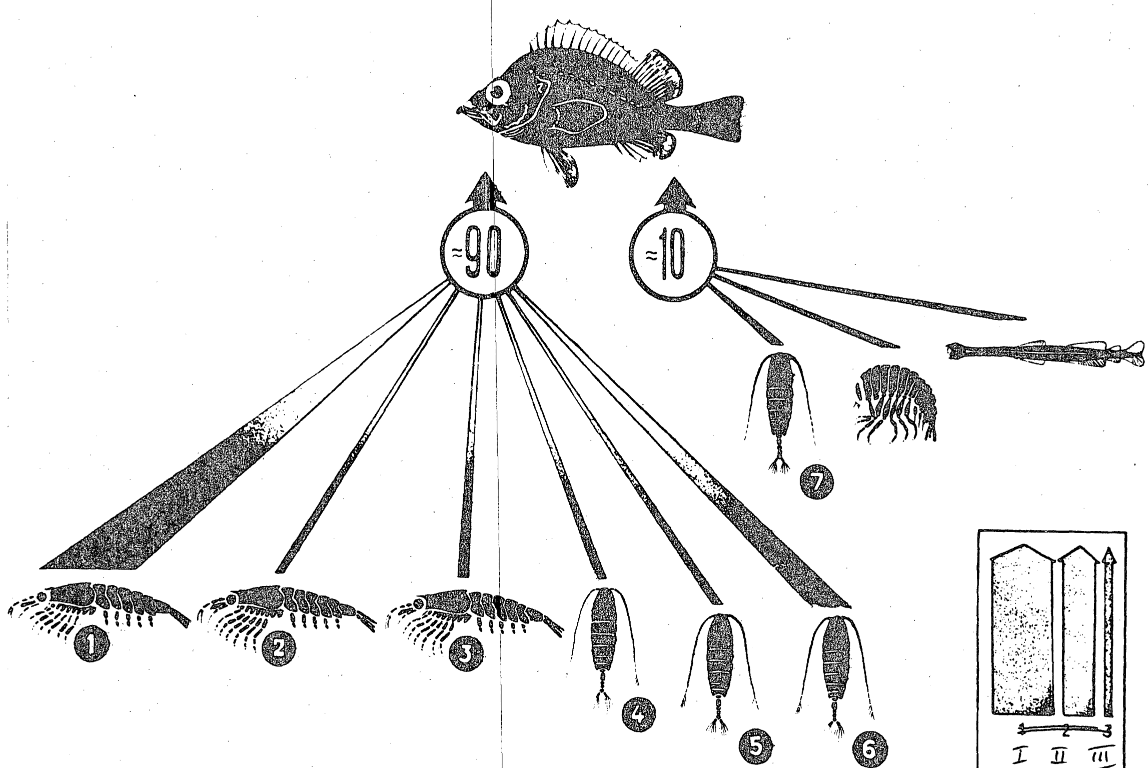

Fig. 3. Scheme of trophic chains due to which the biomass of young Sebastes Fasciatus is formed. The thickness of the arrows corresponds to the value of the total ration of the consumer: I = not more than 50, II = 10-20, III = up to 10% (in weight). 1. Meganyctyphanes norvegica, 2. Thysanoessa inermus, 3. T. raschii, 4. Metridia longa, 5. Calanus hyperboreus, 6. C. finmarchicus, 7. Pareuchaeta norvegica. Large numbers indicate the share of the components of the given chain in the ration.

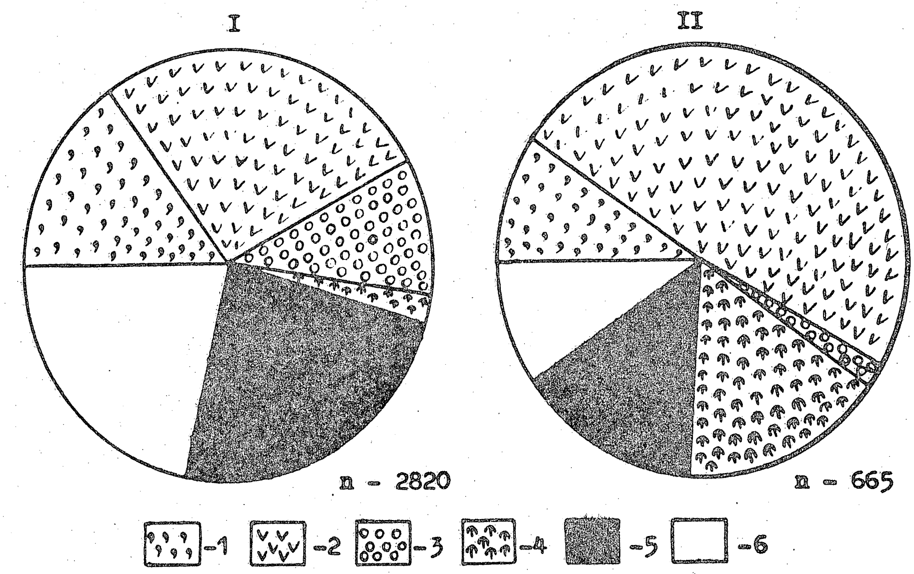

Fig. 4. Composition of food of adult Sebastes mentella (I) and S. fasciatus (II) (occurrence, %): 1 = Hyperiidea, 2 = Euphausiacea, 3 = Decapoda, 4 = Ctenophora, 5 = Pisces, 6 = other species; n = number of fish specimens investigated.

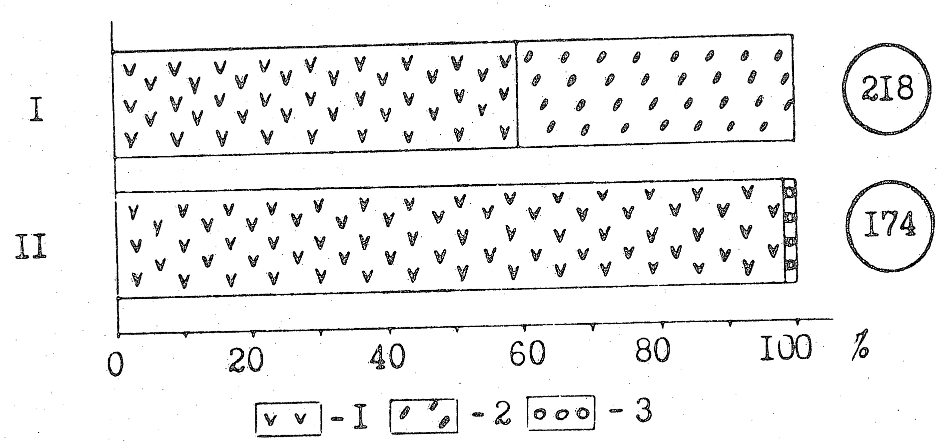

Fig. 5. Value of different Euphausiacea species in the food of adult specimens Sebastes mentella (I) and S. fasciatus (II) (occurrence, %): 1 = Meganyctiphanes norvegica, 2 = Thysanopoda acutifrons, 3 = Thysanoessa raschii. Numbers encircled mean number of feeding redfish specimens.

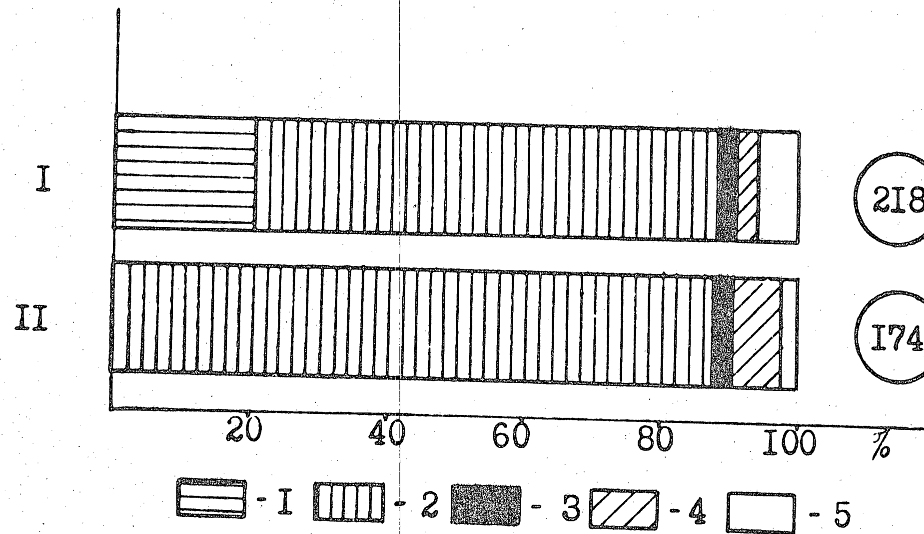

Fig. 6. The share of different fish-prey in the food of adult individuals Sebastes mentella (I) and S. fasciatus (II), (occurrence, %): 1 = Paralepis sp., 2 = Myctophum sp., 3 = Mallotus villosus, 4 = the youngs of commercial fish (in specimens).

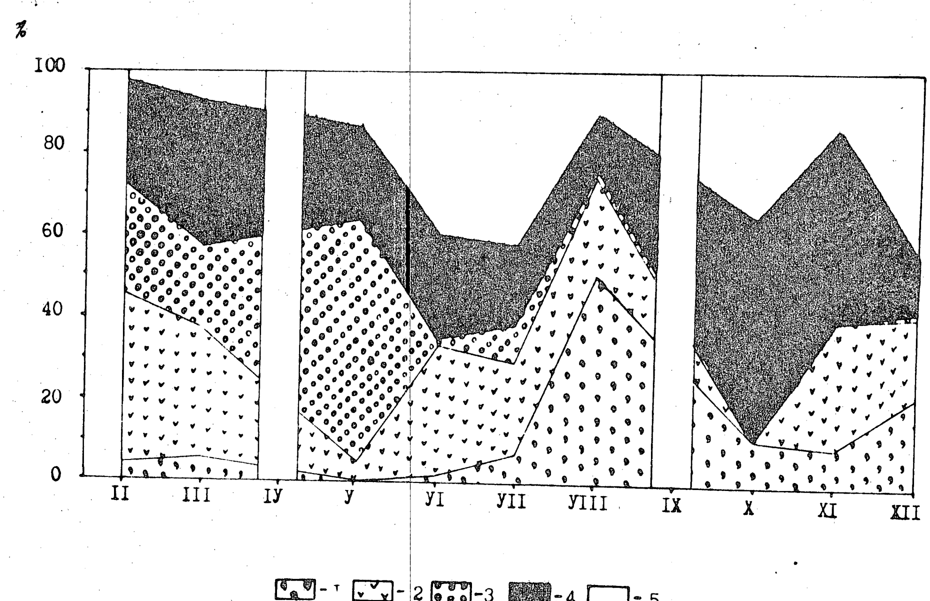

Fig. 7. Seasonal dynamics of the food composition of adult "Sebastes mentella" on the continental slope of the south Labrador (occurrence, %). 1 = Hyperiidea, 2 = Euphausiacea, 3 = Decapods, 4 = Pisces, 5 = other specimens; Roman numbers - months.

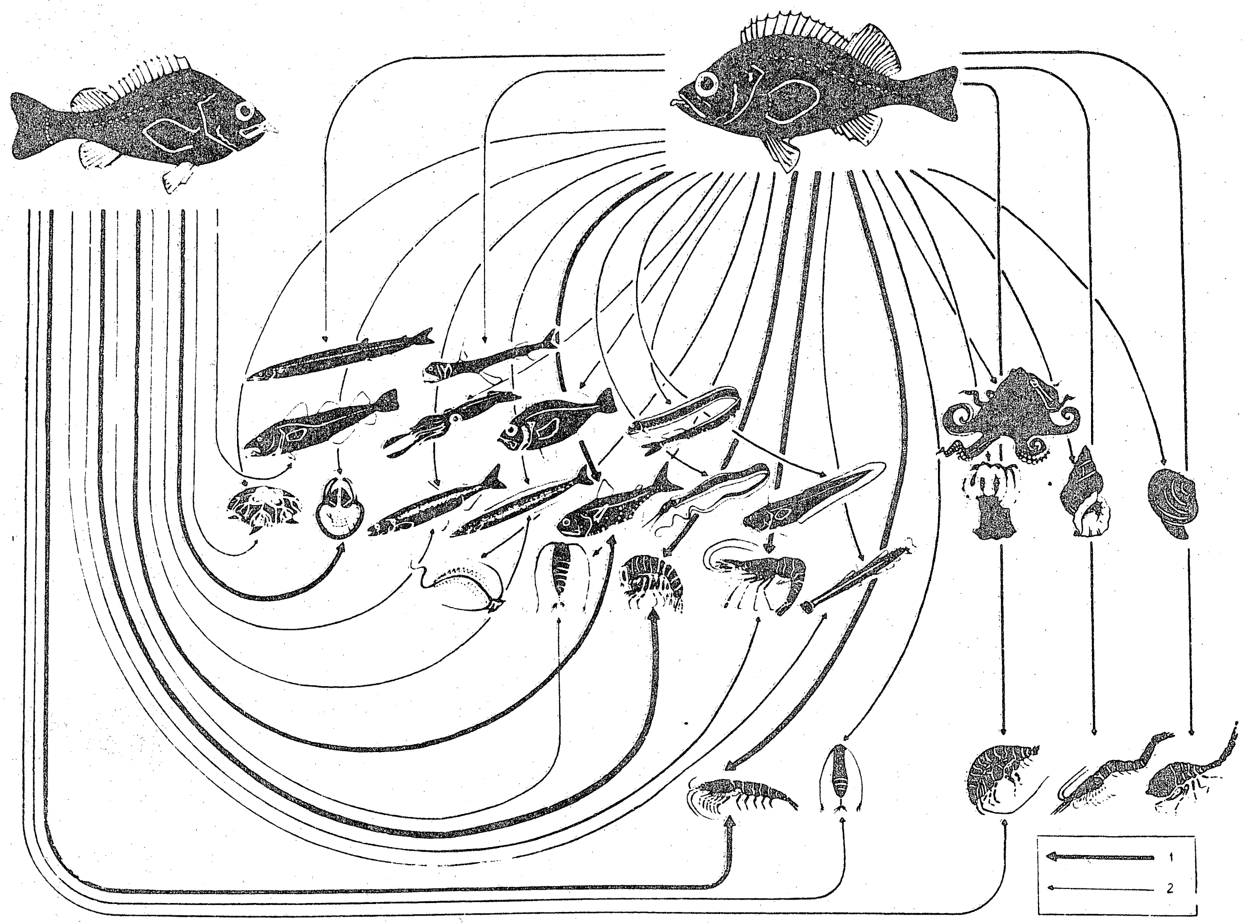

Fig. 8. Scheme of the trophic connections of redfish in the Northwest Atlantic. 1 = mean connections; 2 = occasional connections. Above left = Sebastes fasciatus, above right = S. mentella. Other explanations are given in the text of the paper.