

2-бөлім
ЗООЛОГИЯ

Раздел 2
ЗООЛОГИЯ

Section 2
ZOOLOGY

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THE FEEDING HABITS OF BREAM (*ABRAMIS BRAMA* L.) AND ROACH (*RUTILUS RUTILUS CASPICUS* OAK.) IN THE NORTHERN PART OF THE CASPIAN SEA

The research is devoted to definition of degree of feeding provision of the different-sized bream and roach groups, and to identification of their trophic relations in the Northern part of the Caspian Sea. The material for food research of 2 fish species has been collected during Caspian survey, in autumn, 2016. In total 32 digestive tracts of fish are analyzed for studying of food structure. It is established that feeding of bream and roach consists of the main and numerous small organisms of a microbenthos a foraminifer (Foraminifera) and the ostracods (Ostracoda). It has been established that character of feeding of bream and roach depended on structure and availability of fodder organisms on the particular site of the sea. So in a square 21 breams ate generally chironomid larva which left 88,29 % of mass of all food, and the index of nourishness was equal – 93,01 ‰ that is rather high rate. In other areas the main food of bream is presented by worms (Vermes), cancrioid (Crustacea) and mollusks. It has been established that food of roach was characterized only on one square by primary consumption of mollusks (Mollusca), and generally qualitative structure of food of roach of other areas was made by worms (Vermes) and cancrioid (Crustacea). Comparison of indicators of the general index of filling of intestines at fish only from the 72nd square, has shown that roach has made 72,05 ‰, and bream only 40,13 ‰. Estimating degree of food similarity it is possible to tell that a variety of a food supply and a diet of fish, in the explored site of the sea, smoothes tension of the food relations.

Key words: North Caspian, bream, roach, food, food relations, food organisms.

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Каспий теңізінің Солтүстік бөлігіндегі тыран (*Abramis brama* L.) мен тарта (*Rutilus rutilus caspicus* Oak.) балықтарының қоректену ерекшеліктері

Жұмыс тыран және тарта балықтарының түрлі өлшемдегі топтарының қорекпен қамтамасыз етілу дәрежесі мен Каспий теңізінің солтүстік бөлігіндегі трофикалық арақатынасты анықтауға бағытталған. Аталмыш екі түрдің қоректенуін зерттеуге арналған материалдар 2016 жылдың күз мезгілінде Бүкілкаспийлік аулау кезінде алынған. Қорек құрамын анықтау мақсатында барлығы 32 балықтың асқорыту жолына талдау жүргізілді. Тыран мен тарта қорегі микробентоста кең таралған ұсақ жәндіктерден: фораминифералар (Foraminifera) мен бақалшақты шаяндардан (Ostracoda) тұратындығы анықталды. Тыран мен тортаның қоректену сипаты теңіздің белгілі бір участогында жемдік организмдердің қол жетімділігі мен олардың құрамына байланысты болатындығы анықталды. Мысалы, 21 квадратта тыран хирономидтердің (Chironomidae) дернәсілдерімен қоректенген, дене салмағының 88,29 %-ды құрайды, ал ішектің толу индексі – 93,01 ‰, бұл өте үлкен көрсеткіш боп есептеледі. Басқа аудандағы тыранның негізгі қорегі құрттар (Vermes) мен шаянтәрізділерден (Crustacea), моллюскалардан (Mollusca) тұрады. Тортаның қоректенуінде бір квадратта ғана моллюскалар (Mollusca) басым болды, ал қалғандарында құрттар (Vermes) мен шаяндар (Crustacea). Ішектің толуының жалпы индексінің салыстырмасы тек 72 квадратта ғана тартада 72,05 ‰, ал тыранда жалпы 40,13 ‰ көрсетті. Тағамдық ұқсастықтарының деңгейін салыстырып айтуға болады, зерттелген теңіз аймағындағы балықтардың рационы мен жем базасының түрлілігі тағамдық қарым-қатынаста қарбалас туғызады.

Түйін сөздер: Солтүстік Каспий, тыран, тарта, қоректену, қоректік байланыс, жемдік организмдер.

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Особенности питания леща (*Abramis brama* L.) и воблы (*Rutilus rutilus caspicus* Oak.) в Северной части Каспийского моря

Работа посвящена определению степени обеспеченности пищей разновозрастных групп леща и воблы, и выявлению их трофических отношений в северной части Каспийского моря. Материал для исследования питания 2 видов рыб был собран во время всекаспийской съемки, осенью 2016 года. Всего проанализировано 32 пищеварительного тракта рыб, для изучения состава пищи. Установлено, что пища леща и воблы состоит из основных и многочисленных мелких организмов микробентоса фораминифер (Foraminifera) и ракушковых рачков (Ostracoda). Было установлено, что характер питания леща и воблы зависит от состава и доступности кормовых организмов на конкретном участке моря. Так, в квадрате 21 лещ питался в основном личинками хирономид, которые оставили 88,29 % массы всей пищи, а индекс накормленности был равен – 93,01 ‰, что является достаточно высоким показателем. В других районах основная пища леща представлена червями (Vermes), ракообразными (Crustacea) и моллюсками. Было установлено, что питание воблы характеризовалось лишь на одном квадрате преимущественным потреблением моллюсков (Mollusca), а в основном качественный состав пищи воблы из остальных районов составили черви (Vermes) и ракообразные (Crustacea). Сравнение показателей общего индекса наполнения кишечника у рыб только из 72 квадрата, показало, что у воблы он составил 72,05 ‰, а у леща всего 40,13 ‰. Оценивая степень пищевого сходства можно сказать, что разнообразие кормовой базы и рацион рыб, в исследуемом участке моря, сглаживает напряженность пищевых отношений.

Ключевые слова: Северный Каспий, лещ, вобла, питание, пищевые отношения, кормовые организмы.

The Caspian Sea is known for the fact that there is a small amount of types in comparison with the regions having an exit to the open ocean – only 76 types and subspecies relating to 17 families lives.

As it is known, a northern part of the Caspian Sea is allocated with the high efficiency. One of the major factors causing such efficiency – intensive impact on the mode and waters of the Northern Caspian Sea of the Volga drain delivering a large amount of various mineral and organic nutrients. These substances come to the Caspian Sea in dissolved and suspension conditions. Used by organisms they join in cycles of the trophic relations characteristic of the Northern Caspian Sea, and provide creation of a food supply, favorable for development of many food fish. Between the western and eastern parts of the Northern Caspian Sea, on the border there is shallow water traced in the direction of the islands Novinsky – the archipelago of Seal islands. The largest depths within this shallow water don't exceed 3,6-3,8 m. The western and eastern parts of the Northern Caspian Sea on the area are almost equal, however the main volume of waters is concentrated in more deep-water western part (63 %), mainly within a zone with depths of 0-5 m (59 %) and 5-10 m (25,4 %). In eastern part the largest volumes of waters fall on areas with depths of 0-5 m (more than 88 % of volume of waters of this part of the sea).

In a quantitative sense the most part of population is presented by Karpov (33 %), bull-calves (28 %) and the North Caspian shads (14 %) (Ivanov V.P., 2008: 140). The majority of types are autochthonic, including representatives of the Mediterranean community (Ivanov V.P., 2000: 55). *Cyprinidae* by quantity of types take the first place as a part of the Caspian fish fauna. Fresh-water by origin, these fish have found in the saltish Caspian Sea favorable conditions for the development, and their area covers, besides river reservoirs, considerable sea spaces. The main stock of the most valuable food fish – roach, bream, and carp – is concentrated in the Northern Caspian Sea. Carps breed mainly in deltas, estuarial zones, channels and inundated reservoirs of the Volga Rivers and the Urals. Carp juveniles of a fall onto on growing to desalinated sea shallow water where finds favorable fodder conditions in desalinated highly productive zones (Malysheva G.K., 2003: 88). From total number of the Caspian fish only 40 types and subspecies have trade value (Sokolskij A.F., 2002: 128).

Bream - bottom-dwelling fish. Found at depths up to 9 m. the Greatest number of juvenile and adult bream kept at depths up to 6 m (Krupa E.G., 2001:121). Bream – vitofil, batched when the temperature reaches 12 – 15 C. In the Kazakh sector of the Caspian sea bream is portioned spawning. The maximum age of bream is considered to be 20 years

with a body length of 45 cm and weight 3 kg (1990). In most waters it does not exceed the age of 12-15 years (Malkin E.M., 1990: 111). Bream is a typical benthic feeder, but along with the can consume benthic plants and plankton (Krupa E.G., 2001: 125). The onset of puberty does not take place simultaneously and for each generation stretched to 4-5 years (Abakumov V.A., 1983: 201), the average for the Eastern part of the Northern Caspian sea in 3-5 years (Sokolsky A.F., 2001: 131). Bream is a valuable trade object. Found in the North-Eastern part of the sea much more often than most other species and are second only roach (Sokolsky A.F., 2001: 129). Is one of the most numerous fishes.

Roach is widespread. It forms several subspecies (Malkin E.M., 1990: 104). In the water area of the Kazakhstan part of the Caspian sea roach can be found almost everywhere to ezogelin 10-12 ‰ (Malkin E.M., 1990: 111). Breeds in rivers near the mouth. The onset of puberty stretched for several years and occurs in ages 2 to 5 years (Malkin E.M., 1990: 111; Sokolsky A.F., 2001: 129), the average for the Eastern part of the Northern Caspian sea in 3-4 years (2007). Some authors have noted that the age limit of roach 11-12 years and age migratory 2-11 years (2008; 2011). Other authors argue that currently in the natural habitat of fish older than 9 years are not found, and spawning migration do individuals aged 2-7 years with a predominance of the 3-5 year-old fish (Malkin E.M., 1990: 111). Roach are omnivorous fish. In her diet find more than 40 components (Malkin E.M., 1990: 111). In the areas of research in the water area of the Kazakhstan part of the Caspian sea roach can be found almost everywhere. This fish is a valuable commercial object. Its frequency of occurrence in the North-Eastern part of the sea is much higher than other species (Sokolsky A.F., 2001: 129).

Fodder resources in the Northern Caspian Sea, the main region of juveniles on growing and adult sturgeon, and also other fish semi-through passage, will be underused because of small number of fish herds (Zheltchenkova M.V., 2001: 125). Low biomass of a benthos is characteristic of a considerable part of the water area of the Northern Caspian Sea. With increase in depth biomass of animals increases in the Northern Caspian Sea and reaches a maximum (to 100 g/m²) in the deep-water area at a depth over 6 meters (Polyaninova A.A., 2000: 205; Malyshева G.K., 2003: 17). Value of separate types of ground fauna in formation of the general efficiency of a bottom of the Caspian Sea is not equivalent, therefore, studying of security with food of fish, can show not only nourishness of hydrobionts but also fodder potential of sea pastures (Stepanova T.G., 2000: 111; Ustarbekov A.K., 2002: 99; Sokolsky A.F., 2010: 198). The purpose of this work was the qualitative and quantitative research of food of bream and roach from the Northern part of the Caspian Sea, in autumn, 2016.

Materials and methods of a research

The water area of the Caspian Sea is broken into trade squares which have expansion on latitude of 10 miles and on the longitude of 7 miles (figure 1). One nautical mile is equal to 1852 m. Each square is characterized by constant geographical coordinates and for convenience of use has constant number. When specifying the place of sampling in the operation used above the stated numbering of squares of the Caspian Sea. It begins in northern part of the sea and in the direction to the south numbers of squares increase. In the figure 1 the region of the research with specifying of numbers of squares is provided.



Figure 1 – The schematic map Caspian sea

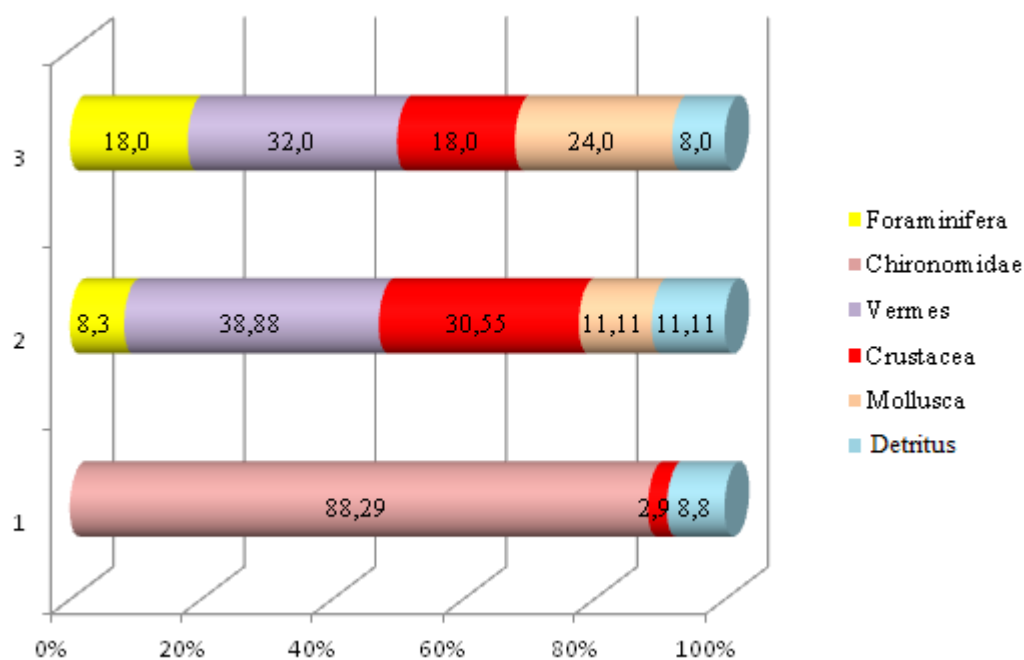
In November, 2016, during the expedition, by use of a trawl, selection of intestinal paths at 12 samples of bream with an absolute length of 235-345 mm was made, and weighing from 107 g. to 392 g, and 20 samples of roach with an absolute length of 175-250 mm., and weighing from 76 g. to 236 g. The morphometric analysis was carried out by the technique offered for carp fish by Ustarbekov (Ustarbekov A.K., 2006: 51). The food relations between fish and provision with their food were evaluated by method offered by A.A. Shorygin (Shorygin A.A., 1952: 188) and used an exponent of likeness of composition of food of fish (SP - coefficient) and standard quantitative and weight techniques (Ustarbekov A.K., 2006: 51). Systematic accessory of the organisms found in food then organisms miscalculated, dehydrated on filter paper was defined and were weighed on torsion weights. All probed fish had the significant amount of soil. The relative value of separate groups of fodder organisms in a range of a supply was estimated on occurrence frequency (at % of number of the eating fish in test) and on a share of separate components in the general contents of a food bolus (in weight %). Calculated the general indexes of filling of stomachs (OIN, ‰) and a share of fish (%) with empty stomachs.

Research results and discussion

The study of the digestive tract 12 copies of bream (*Abramis brama* L.) (figure 2) it was found that in 2 samples of breams from 21 squares had average length equaling 374 mm, with an average weight 320 g, *Chironimidae* larvae (88,29 %) were the main component of a food bolus, and as a minor forage served detrit (8,8 %) and *Crustacea* (2,9 %). The general index of intestine filling equaled 93,01 ‰ that is an indicator of existence of a good food supply of fish.



Figure 2 – Bream



Type codes: 1 – 21 square, 2 – 72 square, 3-150 square

Figure 3 – Percentage ratio of components in a food bolus of bream from different stations

Also found that 5 breams from the 72nd square had average length equaling 212,4 mm., average weight has made 282,2 g. At the same time one intestine contained detrit and one intestine was empty. The food bolus of 3 copies of breams contained *Vermes* – 38,88 of %, *Crustacea* – 30,55 of %, *Mollusca* – 11,1 of %, *Foraminifera* of 8,3 % and 11,1 % has made detrit. The general index of

filling of intestines, has made 40,13 ‰. Study of fish with from the 150th square intestines at 4 breams, with average length of 279 mm have been selected, and average weight 311 g. The food bolus had *Vermes* occupying 32,65 %, *Mollusca* – 24,5 %, *Crustacea* -18,4 of %, *Foraminifera* – 18,36 % and detrit is presented to 8,1 %. The general index of filling of the bream's stomach made 39,44 ‰.

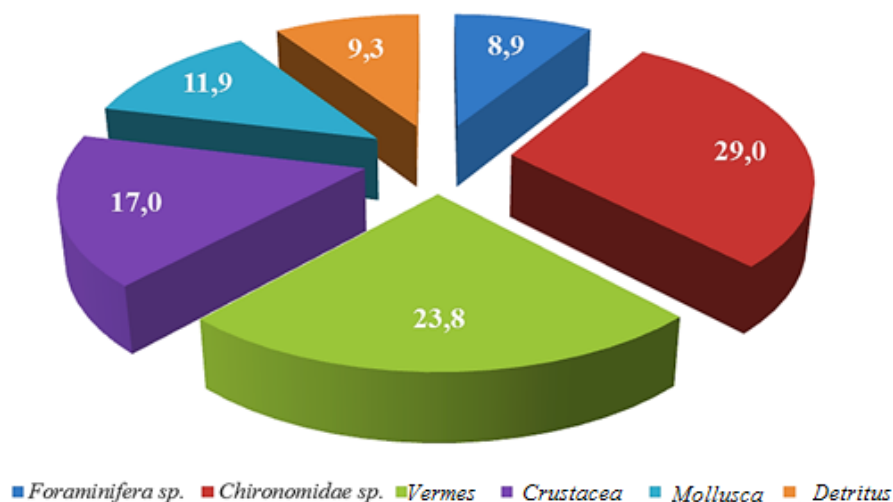


Figure 4 – Average percentage value of qualitative structure of food of a bream in autumn, 2016

The analysis the general index of intestine filling of research breams fluctuated from 39,44 to 93,01 ‰, average has made 57,52 ‰, which is a good indicator of availability of components of a benthos as well as presence of a fatty layer on intestines at one and all the studied fish (figure 3).

It has been established that the qualitative structure of food of a bream from different squares changed considerably that affected their sizes, for example fish from the 21 square, a basis of its diet contained chironomids (figure 4).

The study of the digestive tract 20 copies of roach – (*Rutilus rutilus caspicus* Oak.) (figure 5). The studied fish from the square 47 had average length equaling 110 mm with an average weight of 196 g. In a food bolus *Vermes* dominated – 53,33 %, *Crustacea* had 30 % of food, *Mollusca* – 10 % and detritus 6,66 % The index of filling was equal to 57,10 ‰.

The roach from the square 72 had average length equaling 116 mm with an average weight 228 g, in a food bolus *Vermes* dominated – 35 %, *Crustacea* made 25 %, *Mollusca* – 17,5 %, *Foramenifera* – 10 % and detritus – 12,5%. The index of filling has made 72,05 ‰.

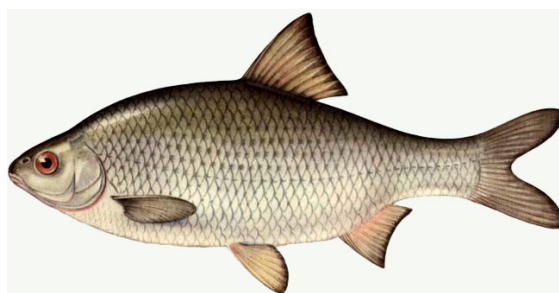


Figure 5 – Roach (*Rutilus rutilus caspicus* Oak.)

The roach from the square 101 had average length of 161 mm with an average weight 234 g, in a food bolus *Vermes* had 32,25 % of all weight, *Crustacea* made 29,03 %, *Mollusca* – 19,4 %, detritus – 16,12 %, *Foramenifera* (3,2%). The index of filling has made 44,97 ‰.

The roach from the square 263 had average length equaling 100 mm., with an average weight 216 g, also in food bolus of fish *mollusca* dominated (53,84 %), *Crustacea* (30,76 %), *Vermes* (6.15 %) and detritus (9,2 %). The index of filling has made 57,10 ‰.

The qualitative food composition of roach from different squares set the heterogeneity of food organisms in the benthos feeding fish based food made up of *Vermes*, *Crustacea*, *Mollusca* *Foramenifera* and detritus (figure 6). It is established that the general

index of nourishment fluctuated from 44,97 ‰ to 174,54 ‰, the average value of nourishment index – 93,48 ‰ that reflects existence and availability of fodder objects in the particular site of a bottom at the time of sampling (figure 7).

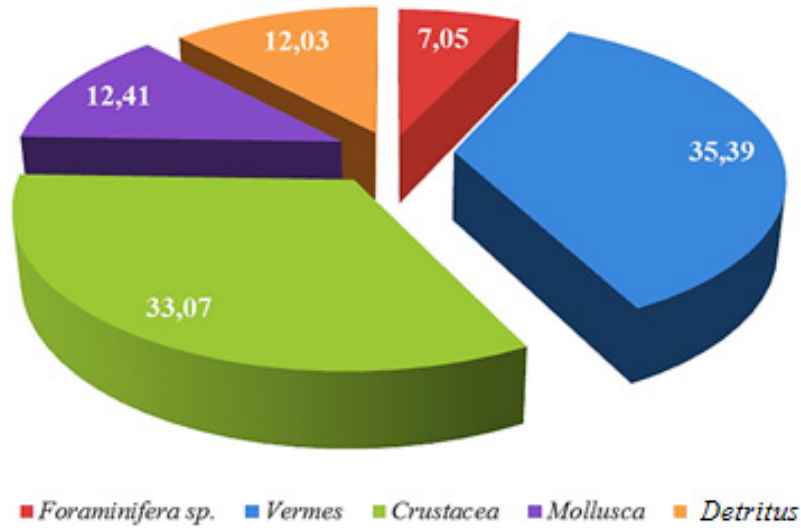
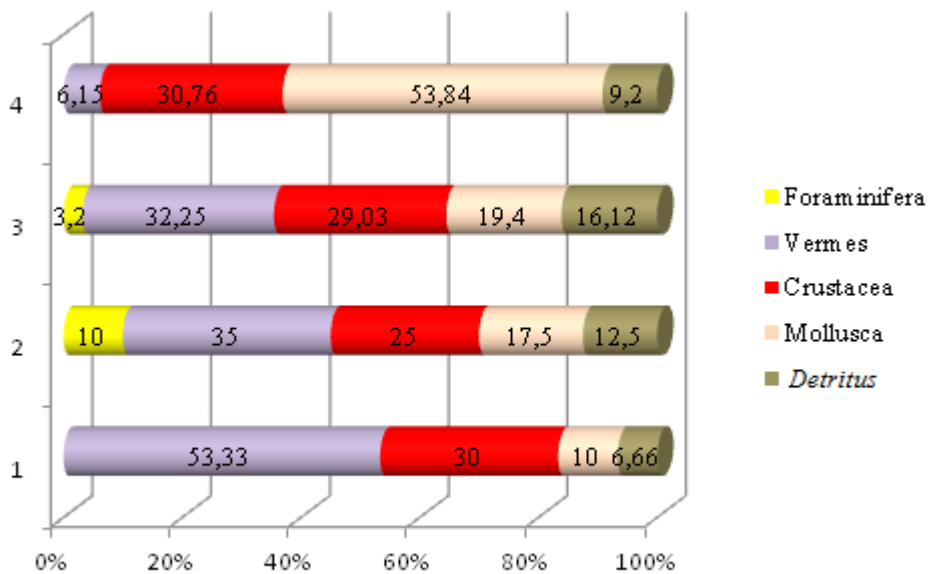


Figure 6 – Average percentage value of qualitative structure of roach feeding in autumn, 2016



Type codes: 1 – 1 station, 2 – 2 station, 3 – 3 station, 4 – 4 station.

Figure 7 – Percent ratio of components in a food bolus of a roach from different stations

Considering that during autumn shooting the bream and roach had the same food supply, especially, it was possible to assume that they can be potential food competitors, but estimating degree of food similarity it is possible to tell that a variety of a food supply and a diet of fish, in the explored site of the sea, smoothies tension of the

food relations. Comparison of indicators of the general index of filling of fish intestines has shown that a roach has it higher in comparison with a bream around the 72nd square that can be tracked on indexes of filling of intestines where roach has made 72,05 ‰, and bream of all 40,13 ‰ (figure 7).

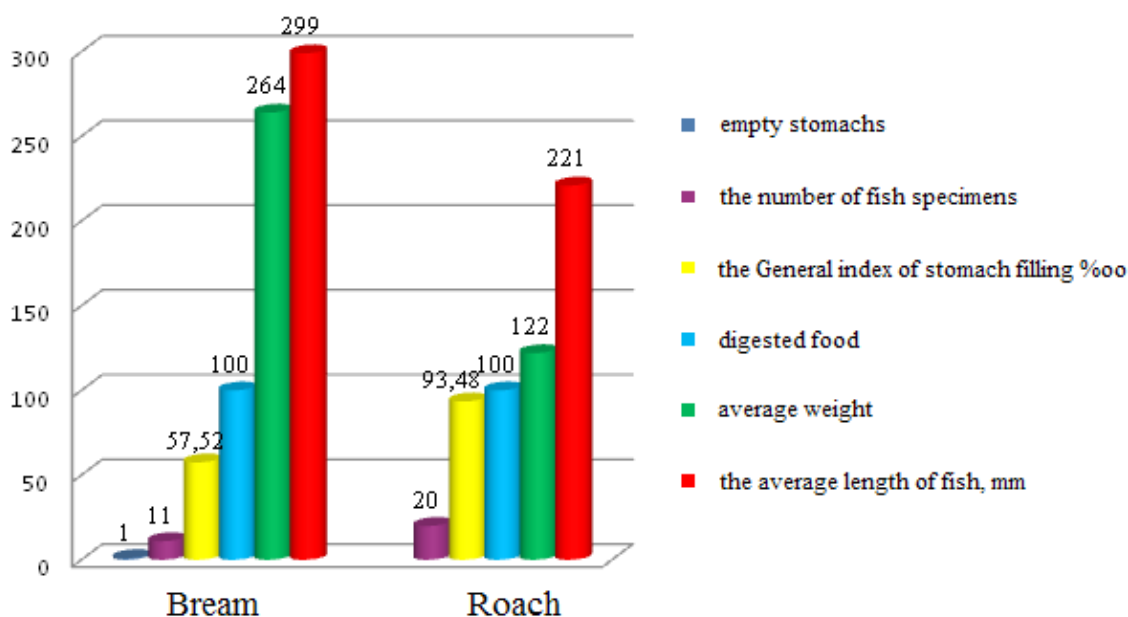


Figure 8 – Bream and roach filling indexes in autumn, 2016.

As research on fish feeding has shown from 7 areas, trophic conditions for a bream and a roach in the autumn of 2016 were favorable and the factors limiting the number of these types were absent. It has been established that a bream and a roach in the competitive food relations were only in the one 72nd square, in other areas it was absent. For each species of fish of a forage was enough on quality and by quantity. Food of a roach was characterized by primary consumption of mollusks, worms and

Crustacea, in food of a bream *chironomid* larvae dominated and worms, mollusks occupied an insignificant share. Fish had the highest rates of weight from the 21st square intensity of food of a bream was higher, than at other stations as fish used *chironomid* larvae which were the type dominating on biomass. A variety of forms of ground fauna, and high plasticity in food of a bream and roach provides a trophic optimum for existence of these species of fish in Northern the Caspian Sea.

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