Current state of juvenile roach (*Rutilus rutilus caspicus*)

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Abstract. Fluctuations in water temperature in the Northern Caspian Sea, especially in the shallow zone, are mainly due to fluctuations in air temperature and during the trawling period, in the fall, the water temperature at observation stations showed a decrease in water temperature, which caused the formation of dense aggregations in juvenile roach. To study the nutritional status of juvenile fish living in the Kazakh part of the Caspian Sea, material was selected from different depths of the sea from trawl catches during comprehensive research in the fall of 2022. In the course of studies conducted to assess nutrition using quantitative and qualitative indicators, it was determined that the nutritional spectrum of juvenile roach in the water Caspian Sea is represented mainly by the same bottom organisms with a dominance of crustaceans, with their preference for bivalves, which give a good growth rate. A parasitological study of juvenile roach showed the absence of pathogen circulation in the ecosystem of this reservoir. Based on the results of pathomorphological studies of fish gills, it was found that fragmentary hyperplasia is caused by the presence of protozoal invasion rather than by the influence of environmental factors.

1 Introductıon

Changes in environmental conditions and human economic activity cause fluctuations in the reserves of Caspian hydrobionts; the species composition of the commercial ichthyofauna of the sea is represented by both commercial and low-value ichthyofauna. According to ichthyological studies, the dominant species among commercial fish is the roach, which is very widespread, forming several subspecies [1]. In the waters Caspian Sea, adult roach and its juveniles are found almost everywhere with the highest density in the zone influenced by the flow of the Kigach and Ural rivers [2]. The distribution of commercial fish, including roach, changes in the autumn, which is associated with feeding for all age categories of fish and under the influence of migration processes increases to maximum concentrations [3,4]. In general, the increase in the number of commercial fish in the autumn period occurs due to the growing juveniles of commercial fish, and in areas of low and medium fish density, the importance of juvenile commercial fish decreases, respectively [5].

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The purpose of this work was to assess the feeding habits, infestation by parasites and the pathomorphological state of juvenile roach, as a bioindicator of ongoing changes in the habitat.

2 Materials and Methods

The catch of juvenile fish was carried out with a 4,5-meter juvenile trawl in the fall of 2022 on the research vessel of Kazekoproekt LLP – Zaisan. Ichthyologists carried out 30 trawls (Fig. 1). For each trawling, the exposure was equal to 15 minutes with registration of the coordinates of the beginning and end of the trawling, trawling speed, trawling duration and trawling length in meters along the actual path traveled. Samples were taken to determine fish nutrition and pathomorphological analysis.

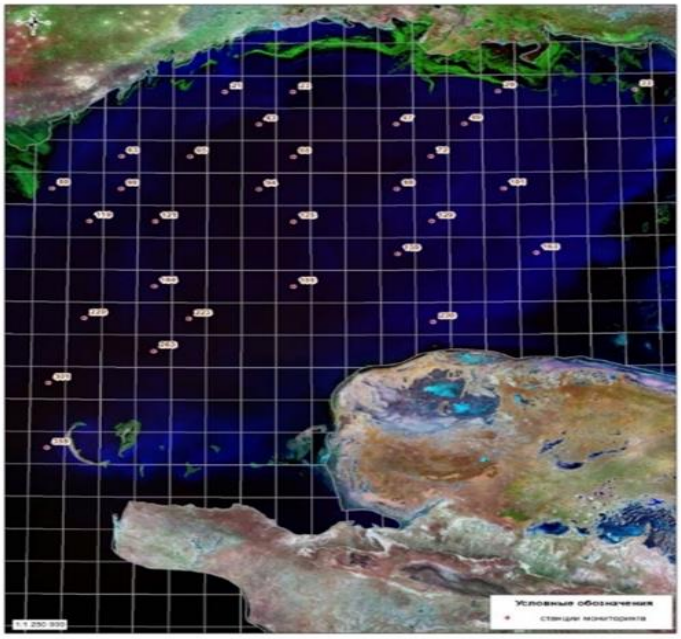

Fig. 1. Schematic map of the work area during the research.

Processing of the caught fish was carried out according to generally accepted methods, followed by fixation in a 10% formaldehyde solution to study nutrition, juvenile fish, in laboratory conditions [6]. During the work, an incomplete parasitological dissection of 15 specimens was performed. Fish according to the classical method of ichthyoparasitological research [7]. When studying fish nutrition, the weight method was used. To determine the systematic affiliation of organisms found in food, the key to invertebrates of the Caspian Sea was used [8]. The organisms were counted, dehydrated on filter paper and weighed on an EP613C torsion scale; the nutritional spectrum diagram was made in Microsoft Excel. For pathomorphological examination, in the absence of clinical signs of fish pathology, 15 specimens of juvenile roach were randomly selected (Figure 2).

Fig. 2. Juvenile roach (Rutilus rutilus caspicus).

Gills, muscles, intestines, and kidneys were selected for histological examination. The material was processed according to the method of histological examination of fish proposed by VNIRO specialists [9]. Analysis and microphotography of organ sections stained with hematoxylin-eosin was carried out using a Leica DM LB2 light optical microscope with a SONI DSC-W7 photo attachment. At magnifications of 10x, 20x, 40x and 100x, a total of 140 sections of organs from 15 specimens were made and examined. Juvenile roach.

3 Results and Discussion

Autumn studies took place in fairly stable weather. The largest number of juvenile roach in the study areas ranged from 7,5 to 987,6 specimens/ha, with an average value of 265,1 specimens/ha. Juvenile roach reached maximum concentrations in the central squares of the study area, which indicates favorable feeding conditions for all age categories of fish. The distribution and maximum concentrations of juvenile roach noted in the south and northeast of the study area in the autumn are presented in Fig. 3.

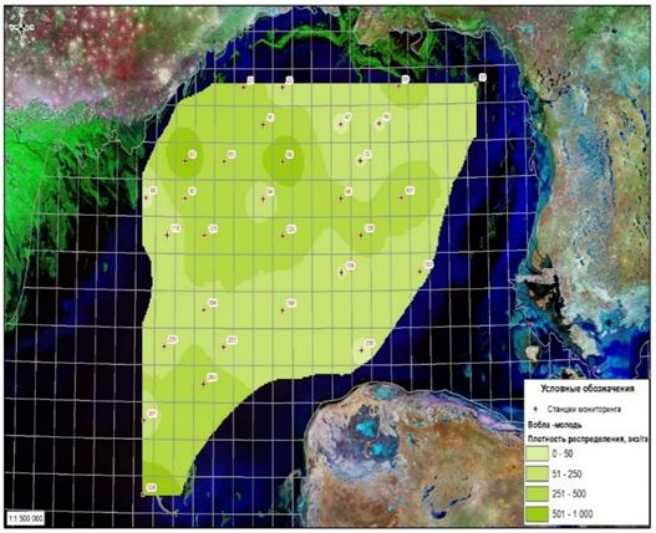

Fig. 3. Distribution of juvenile roach in autumn 2022 according to the results trawl catches, specimens/ha.

3.1 Feeding of juvenile roach

The fish taken for analysis from autumn samples were of different sizes, their length varied from 8.3 to 11.0 cm, weight - from 10.24 to 3.0 g. Fatness was high and averaged -1.84 according to Fulton , according to Clark 1.58 (Table 1).

Table 1. Biological parameters of juvenile roach.

Lengths, cm		CV.,%	The masses, g		CV, %	Fatness, %		n
lim	lim $\bar{x} \pm S_{\bar{x}}$		lim	lim $\bar{x} \pm S_{\bar{x}}$		Fulton	Clark	
8,3-10,0	9,59±0,20	7,9	10,24-24,6	16,58±1,09	4,23	1,84	1,58	15

All sections of the digestive tract of 15 fish contained digested mass, and (GIN) - the general index of filling of their stomachs was equal to 98 o/ooo.

Active feeding of fish can be determined by the degree of fullness of the 3 sections of the digestive tract. The roach's nutritional spectrum itself was represented by crustaceans (Crustacea) – 79,7% Molluska (Bivalvia) accounted for 18,9% and 1,4% - soil (Figure 4).

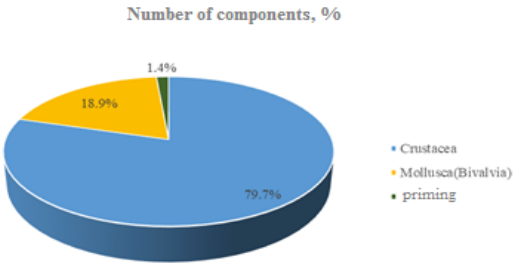

Fig. 4. Roach feeding spectrum, in%

An incomplete parasitological study conducted to assess the intensity and extent of parasitic infestation of juvenile roach showed the absence of helminthes [11] .

In the 15 specimens of juvenile fish studied, no clinical or pathological signs of disease were detected. Hyperplasia of the respiratory epithelium noted in the gills [12] was local in nature and was caused by protozoal invasion (Fig. 5).

x10 **x40**

Fig. 5. Images of histological section of Rutilus rutilus caspicus gills colored by hematoxylin and eosin

4 Conclusion

The rational use of biological resources is based on the implementation of a set of measures, including ichthyotrophological and pathomorphological studies. Research trawling of fish was carried out over a vast area of the sea and covered shallow water areas; therefore, the determining features of the distribution of zoobenthos in the autumn period were the depth and nature of the soil in the sampling sites where Crustacea and Bivalvia noted in food boluses live. In the roach, a typical benthophage, competition in nutrition is not high, which is associated with indiscriminateness and passivity in finding food. This pattern in roach nutrition stems from the biological characteristics characteristic of the species - low nutritional activity and wide nutritional plasticity. Thanks to this, the roach consumes those organisms that are consumed to a lesser extent by other fish and do not require active searches. Ichthyotrophological analysis of the nutrition of juvenile roach showed that the analized fish had gastrointestinal tracts filled with food, the basis of which was digested food, but from its individual fragments it was possible to determine the dominance of crustaceans over other components. There were no fish with empty stomachs, which indicates that the fish were well fed. The fish productivity of the sea can also be negatively affected by a parasitological factor, which is closely related to the hydrological and hydrochemical characteristics of the reservoir [10]. A parasitological study to assess the pathogenic effect of parasites on the organs and tissues of the studied fish showed the absence of invasion. A histological examination of the respiratory system of juvenile roach revealed slight damage to the gills by protozoa causing hyperplasia of the secondary epithelium. The obtained research results for the water area Caspian Sea require further study to determine the food supply of Caspian Sea in modern conditions.

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