The species composition and nutrition of dominant species of fish of Absheron Gulfs of the Caspian Sea

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Abstract

The analysis of net catches made in Absheron Gulfs of the Caspian Sea during 2011-2012 is provided. The ichthyofauna of Absheron Gulfs, including 26 species found in the North Gulf, and 33 species and subspecies found in the South Gulf was studied for the first time. A taxonomical and ecological diversity of the fish fauna of North and South Absheron Gulfs is characterized. The peculiarities of distribution and population densities of all species of fishes from different families within the studied territories were analyzed. For each of hydrological seasons, numerous, common, infrequent and rare species were revealed. On migration patterns and catch, the lowest biomass of fishes was observed in the warm season, while the highest was in the winter and spring seasons. The tendency of expansion of ranges of some marine fishes-Gasankuli herring *Alosa braschnikowi kisselewitschi,* Sara herring *A. braschnikowi sarensis,* big-eyed herring *A. braschnikowi autumnalis,* Sara shad *A.caspia knipowitschi*- to the north was recorded.

Keywords: Absheron Gulfs, Ichthyofauna, Biodiversity, Distribution, Density, Dominant Species, Food.

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Introduction

The problem of studying and conserving the diversity of fish fauna is very actual at the present time, considering the recent intensive multiple-factor anthropogenic impacts on the ecosystems of the basin of the Caspian Sea, including the Absheron Gulfs. A considerable number of works are devoted to the study of the ichthyofauna of the Caspian Sea, some of which are of special historical importance and still the main source of information on species composition and systematics of fishes of this region (Berg, 1948, 1949a, 1949b; Kazancheyev, 1981). During the last decades the ecosystems of the Caspian Sea and their fish populations were subject to considerable changes (Fazli and Moghim, 2001; Suleymanov *et al*., 2006; Azizov, 2008; Fazli *et al*., 2009; Roohi *et al*., 2010; Sapozhnikov *et al*., 2011). However, the fauna of the North and South Absheron Gulfs have not been studied for many decades, with the exception of a few works dealing with the benthos of the northern part of the Absheron Gulf (Agamaliyev and Suleymanova, 2004; Suleymanova, 2006; Azizov, 2008). Yet, investigations of ichthyofauna of the Absheron Gulfs present considerable interest for evolutionary-biological and ecological research, as this region has much importance for conservation of diversity of fishes of the entire Caspian Sea. Therefore, the purpose of the present work was to characterize taxonomical and ecological diversity of ichthyofauna of the North and South Absheron Gulfs of the Caspian Sea and to generalize the data on density, distribution, structure of populations and food of local fish species.

Materials and Methods

In the Caspian Sea, to the east from the Absheron peninsula there are many islands and reefs which are continuations of the peninsula and constitute the so-called Absheron archipelago. In the past, the former Absheron Strait which was situated between the east coast of the Absheron peninsula and the west shore of Pirallakhi island was important for navigation because it considerably reduced the route for ships. However, with recession of the level of the Caspian Sea the strait has shoaled, and after construction of the Absheron dam it actually turned into two Absheron Gulfs– Northern and Southern. The North Absheron Gulf is larger (24,0 km^2) than the South Absheron Gulf (11,3 km^2). Now both these gulfs are very similar in their hydrological-hydrochemical regimes, and have a similar fauna of aquatic organisms, including fishes.

The material was collected in the spring, summer and autumn seasons of 2011 - 2012 in the North and South Absheron Gulfs. Additional information was obtained from amateur fishers and fishing managers.

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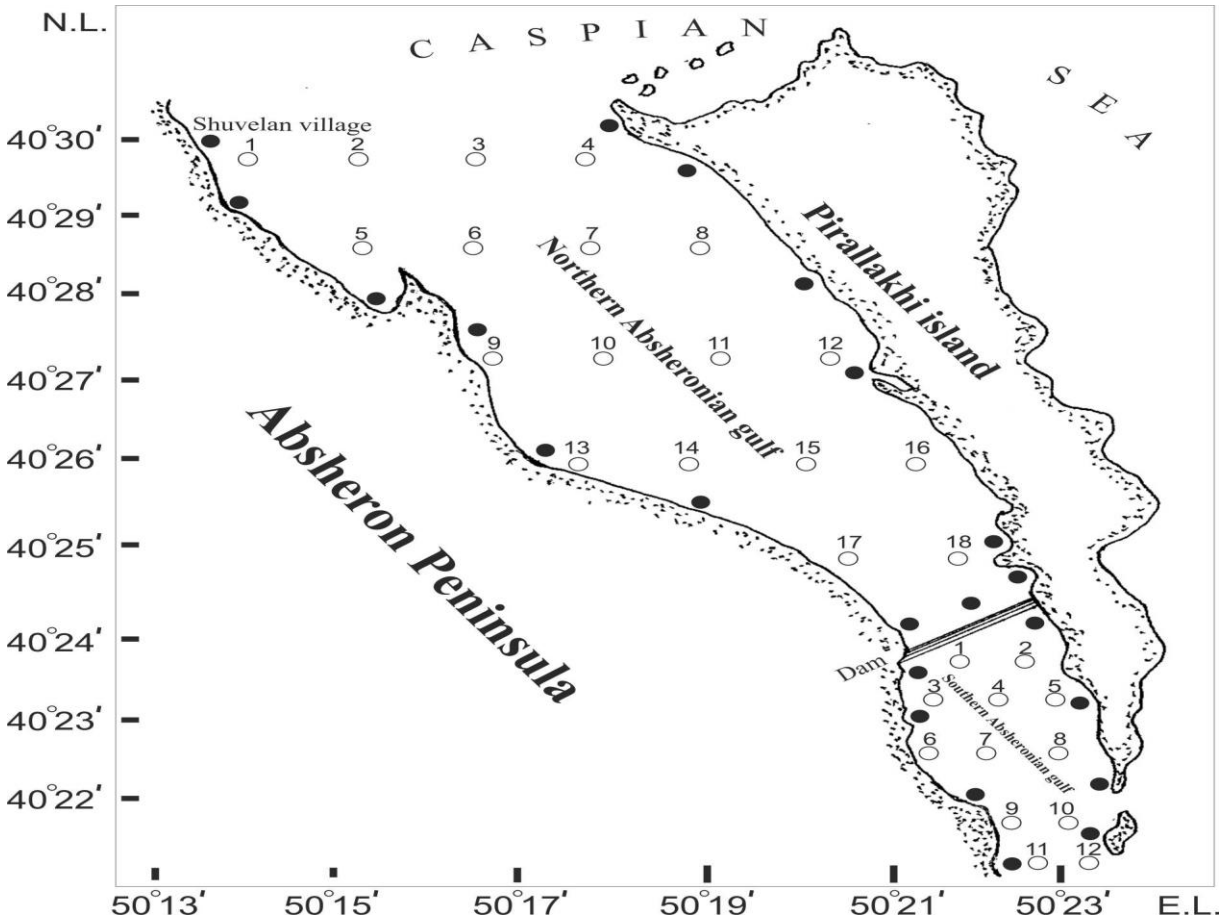

Figure 1: Schematic map of sections and sample points in North and South Absheron Gulfs.
• - coastal (shoal) sample points
o– points of sections

Fishes were caught with set nets (mesh size from 10 to 70 mm) and with fingerling experienced scraper nets (mesh size 6 mm) at depths from 0, 5 to 11 m. To catch and analyse the material, standard techniques accepted in ichthyological literature were used (Pravdin, 1966; Methodical practice, 1974). The following characters of individuals of sampled fishes were determined: total length (TL), standard length (SL), length by Smith (LS), total mass (W), fatness coefficient by Fulton (CF). The age of fishes was determined using bones, scales and otoliths.

The collected fishes were identified to the species level using identification key by Berg (1948, 1949a, 1949b) and Kazancheyev (1981) taking into account some modern taxonomical and nomenclature changes (Kottelat, 1997; Bogutsky and Nasekea, 2004). In total, ca. 4,500 individuals of fishes were used for analysis.

At the same time samples of zooplankton and benthos were collected from depths between 2 and 11 m, and some physical characteristics such as temperature, level, transparency, pH, and salinity of water were measured and estimated with Multi 350i device (Fig. 1).

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Results

During the investigation 26 species of fishes (16 marine and 10 migratory and semi-migratory) were found in the North Absheron Gulf and 33 species and subspecies (19 marine and 14 migratory and semi-migratory) in the South Absheron Gulf. According to our data, the dominant species in these areas were Caspian shad *A. caspia*, kutum *R. frisii kutum*, Caspian sand smelt *Aterina boyeri caspia*, and golden grey mullet *Liza aurata*.

Periodically considerable proportions of samples in both gulfs constituted species such as big-eyed shad *A. saposchnikowii*, Dolgin herring *A.braschnikowi braschnikowi*, black backed herring *A.kessleri*, and roach *R. caspicus* and also some non-commercial fishes -round goby *Neogobius melanostomus* and Ilin goby *N.iljini*. Below we provide a brief data on species composition and the peculiarities of distribution and biology of all recorded species within each family (Table 1).

Sturgeons (Acipenseridae)

During this investigation the Russian sturgeon *Acipenser guldenstaedtii*, the Persian sturgeon *A.persicus* and starred sturgeon *A.stellatus* were caught in separate areas in the southern part of the South Gulf. The most abundant was Persian sturgeon (63.6% of all specimens sampled). Only young individuals of Russian sturgeon and starred sturgeon were present in the samples. The mean values of the total length (TL) and weight (W) were 35.9±0.29 cm and 280±4.3 g in juveniles of Persian sturgeon, 34.6±0.23 cm and 265±3.9 g, in the Russian sturgeon and 38,3±0,31cm and 180±3.4 g in starred sturgeon -. In the North Absheron Gulf the Persian sturgeon and a starred sturgeon were caught in the northern part of the gulf. Mean length and weight values of juveniles of Persian sturgeon were 34.7±0.19 cm and 250±3.7 g, and 37.8±0.36 cm and 170±3.7 g in starred sturgeon.

Herrings (Clupeidae)

Herrings (Clupeidae) are the most abundant group of fishes, which are widespread everywhere and make the basis of the fish fauna of the studied area. In both gulfs we constantly sampled the Caspian shad *A.caspia*, big-eyed shad *A. saposchnikowii*, common kilka *C.c.caspia*, while other representatives of this family such as Dolgin herring *A. braschnikowi braschnikowi*, Agrakhan herring *A. braschnikowi agrachanica*, Gasankuli herring *A. braschnikowi kisselewitschi*, Sara herring *A.b.sarensis*, etc. were found only during the summer and autumn seasons and mostly as juveniles. In the North Absheron Gulf the dominant species were *A.caspia* (43.3 %) and *A. braschnikowi braschnikowi* (31.7 %), whereas in the South Gulf- *A.caspia* (37.2%), *A.saposchnikowii* (24.3%), and *A.kessleri* (24.3 %), *A. braschnikowi braschnikowi* (16.4%) and *A.kessleri* (12.6 %). Populations of Caspian shad in both gulfs were represented by individuals of 1 to 4 years of age, length by Smitt (LS) 13.2 – 20.7 (mean 16.9±0.17) cm, weight (W) 32.3-99,3 (mean 63.9±3.5) g., and fat

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content coefficient by Fulton (CF) 0.61 – 1.86 (1.23±0.03). At the same time the studied individuals of big-eyed shad were 1 -5 years of age; 15.0 – 23.6 in LS (19.3 ±0.21±0.03) cm, 49.4–119.3g in W (84.3±5.30g) and 0.88 – 1.67 in CF (1.26±0.06).

In the gulfs studied the Caspian shad feeds on zooplankton, mainly copepods (*Eurytemora grimmi, Calanipeda aquae dulcis, Heterocope caspia, Halicyclops sarsi*), while the big-eyed shad eats both fishes (kilkas and gobies) and crustaceans which make up 40,5% of their total food in stomach. Over half of the crustacean prey was constituted of misids – 22%, with most often captured species being *Paramysis loxolepis* and *P.intermedia*. Gammarids are also a common prey (10 %) with *Pontogammarus maeoticus, P. robustoides, Niphargoides obessus* and *Gammarus ischnus* being most frequently taken. The proportion of decapods and cumaceans is insignificant and varies from 3.9% (*Palaemon elegans, P.adspersus, Rhitropanopeus harrisii*) to 4.4% (*Stenocuma diastyloides, S. graciloides, Pterocuma rostrata*). The specimens of Dolgin herring in our samples were represented by individuals with the following coefficients: LS– 14. 6 – 35.5 (23.7±1.2) cm, W - 26.7–546.5 (286.3±8.2) g; CF–0.77–1.34 (1.12±0.04). According to the samples of 2011 - 2012 the population of Dolgin herring consisted of individuals of age from 2 to 6 years. In the gulfs gulfs this species eats fishes (*Clupeonella, Aterina, Neogobius*) and crustaceans (*Amphipoda, Misidacea, Decapoda*). During the postspawning period the Dolgin herring feeds mainly on kilkas and gobies. Black backed herring rarely comes to shoaliness. Sometimes it approached the western coasts of the Middle Caspian, including the South Absheron Gulf in large numbers. But generally it migrates to a far distance from the west shores of the Sea. The coefficients of individuals of this species that we measured were: LS – 17.4–41.5 (34.2±2.3) cm, W- 66.3– 972.4 (512.3±11.2) g; CF– 1.02–1.69 (1.31±0.04). The age structure of the population of the black backed herring consisted of five groups from 2 to 6 years. Its main food consists of small fishes (*Clupeonella, Aterina, Neogobius*) as well as young individuals of other fishes, and to a lesser extent of crustaceans and insect larvae. It should be noted that Gasankuli, Sara and big-eyed herrings and Sara shad have considerably expanded their ranges in the western part of the Middle Caspian Sea, including Absheron Gulfs.

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Table 1: Composition of ichthyofauna of Absheron Gulfs of the Caspian Sea.

n/n	Family, species	Frequency		
		North Absheron Gulf	South Gulf	Absheron
	Fam. *Acipenseridae - Sturgeons*			
1	*Acipenser guldenstaedtii* Brandt, 1833 – Russian sturgeon	-		r
2	*A.persicus* Borodin, 1897 – Persian sturgeon	+		+
3	*A.stellatus* Pallas, 1771 – starred sturgeon	+		+
	Fam. *Clupeidae - Herrings*			
4	*Alosa braschnikowi agrachanica* (Michailowskaja, 1941) – Agrachan herring	+		+
5	*A.b.autumnalis* (Berg, 1915) – big-eyed herring	-		r
6	*A.b.braschnikowi* (Borodin, 1904) – Dolgin herring	++		++
7	*A.b.kisselewitschi* (Bulgakov, 1928) – Gasankuli herring	r		r
8	*A.b.sarensis* (Michailowskaja, 1941) –Sara herring	+		+
9	*A.caspia* (Eichwald, 1838) – Caspian shad	++		+++
10	*A.c.knipowitschi* (Iljin, 1927) – Sara shad	-		r
11	*A.kessleri* (Grimm, 1887) – black backed herring	+		++
12	*A.volgensis* (Berg, 1913) – Volga shad	-		r
13	*A.saposchnikowii* (Grimm, 1887) – big-eyed shad	+		++
14	*Clupeonella cultriventris caspia* (Svetovidov, 1973) – common kilka	+		+
15	*C.engrauliformis* (Borodin, 1904) – anchovy kilka	-		r
	Fam. *Cyprinidae - Carps*			
16	*Abramis brama* (Linnaeus, 1758) –Eastern bream	r		r
17	*Aspius aspius taeniatus* (Eichwald, 1831) – Caspian asp	-		r
18	*Alburnus chalcoides* (Guldenstadt, 1772) – shemaya	+		+
19	*Cyprinus carpio* Linnaeus, 1758 – European carp	r		r
20	*Rutilus frisii kutum* (Kamensky, 1901) – kutum	++		+++
21	*R.caspicus* (Jakovlev, 1870) - roach	++		++
22	*Vimba vimba persa* (Pallas, 1774) – Caspian vimba	+		+
	Fam. *Siluridae - Sheatfishes*			
23	*Silurus glanis* Linnaeus, 1758 – catfish	r		r
	Fam. *Atherinidae - Silversides*			
24	*Atherina boyeri caspia* (Eichwald, 1831) – Caspian sand smelt	+++		+++
	Fam. *Syngnathidae - Seahorses*			
25	*Syngnathus nigrolineatus caspius* Eichwald, 1831 –black-striped pipefish	r		r
	Fam. *Mugilidae – Grey mullets*			
26	*Liza aurata* (Risso, 1810) – golgen grey mullet	+++		+++
27	*L. saliens* (Risso, 1810) – leaping mullet	+		+
	Fam. *Percidae - Darters*			
28	*Sander lucioperca* (Linnaeus, 1758) – fresh-water sander	-		r
	Fam. *Gobiidae - Gobies*			
29	*Neogobius caspius* (Eichwald, 1831) –Khvalin goby	+		+
30	*N.fluviatilis* (Pallas, 1814) –monkey goby	+		+
31	*N.bathybius*(Kessler, 1877) – deep-water goby	r		+
32	*N.iljini* Vasiljeva et Vasiljev, 1996 – Ilin goby	++		++
33	*N.melanostomus* (Pallas, 1814) – round goby	++		++

Note: «+» - presence of species; «+++»-abundant «++» - common «+» - infrequent, «r»-rare

Carps (Cyprinidae)

After herrings, it is the second most diverse family of fishes widespread in the whole reservoir (North and South Absheron Gulfs), but these fishes are mostly concentrated in the silted, shelly,

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shallow sites. In recent years the sharp increase in the number of kutum *R.f. kutum* has been reported, but by number of individuals captured in our sampling the dominant species were kutum, *R. frisii kutum* (42.8 %) and roach, *R. caspicus* (33.6%). Also shemaya *A. chalcoides* (13.3%) and Caspian vimba, *V. vimba persa* (7.4%) constituted considerable fractions. The specimens of kutum in our samples in 2011- 2012 were represented by individuals from 2 to 4 years of age, with standard length (SL)–17.5–37.4 (29.3±1,2) cm, W- 93.4–612.7 (348.1±6.1) g; CF–1.12–1.96 (1.49±0.03). The food of adult kutum were benthic organisms, mostly mollusks, and to a lesser extent amphipods, shrimps, etc. The main mollusk prey during the period of our studies were cerastoderms, but *Mytilaster lineatus* and *Didacna trigonoides* mollusks were likewise found in intestines of kutum. Percentages of crabs (1.8 %), shrimps (1.3 %) and amphipods (1.2 %) were insignificant.

The age of the studied roach varied from 2 to 5 years, SL–13.2–23.0 (18.5±0.7) cm; W– 38.4– 167.2 (107.3±4.9) g; CF–1.31–2.39 (1.82±0.03). Juveniles of roach eat various crustaceans. In their stomach we found remains of misids–24%, corophids–23%, amphipods–14%, cumaceans–13%, decapods–8%, and also mollusks from which the most frequently found species belonged to the genera *Dreissena, Didacna* and *Monodacna*. The adults of roach eat mainly mollusks (*Dreissena elata, D.caspia, Cerastoderma lamarcki, Didacna trigonoides, D.longipes, Hypanis angusticostata, H.semipellucida, Abra ovata, M.lineatus*) which made up 91.5% of their total food. The percentage of crustaceans in their diet is 10 time lesser than in juveniles and constitutes only 8.5%. Among crustacean prey predominated cophorids – 2.9%.

The proportions of shemaya, *C.chalcoides* and Caspian vimba, *V. vimba persa* in our samples constituted 8.4 and 6.2% respectively, and other species less than 1.0%. According to our observations in North and South Absheron Gulfs the shemaya is most often caught in silted and shelly shoal sites. The studied fishes 2-4 years of age, SL- 16.2 – 26.4 (22.9±1.2) cm; W- 41.6– 274 (160.1±6.2) g; CF-0.70–1.43(1.08±0,03). *V. vimba persa* in the gulfs occur everywhere, but are especially numerous in habitats with rich vegetation and silty ground. The spring and summer samples were represented by individuals aged 2 to 5 years with values of SL - 15.0-21.7 (18.2±0.9) cm; W- 58.5–181.3 (120.4±4.9) g; CF -1.22 – 2.11(1.69±0.03). The percentages of Eastern bream *A.brama*, European carps *C.carpio* and Caspian asp *A.aspius taeniatus* did not exceed 3.0%.

Sheat fishes (Siluridae)

In North and South Absheron Gulfs the catfish *S.glanis* is a fairly rare species. During investigation it was found only in areas with oozy ground. It should be noted that in net samples this species mainly are entrained by young specimens. One-year aged individuals had SL of 28–40 (33.5±2.7) cm and mean W of 225 ±11.2 g.

Silversides (Atherinidae)

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Caspian sand smelt *A. boyeri* frequents in a pelagic and gregarious form. It is distributed in all coastal zones of the gulfs. By population density it takes the first place among non-commercial species of fishes in the study area.

Seahorses (Syngnathidae)

The black-striped pipefish *Syngnathus nigrolineatus caspius* has never been observed in large numbers in either the North or South Gulf, nevertheless in the northern part of the South Gulf this species was more common than in other parts of both gulfs.

Grey mullets (Mugilidae)

Fishes are not autochthonous in the Caspian Sea. Juveniles of two species – golden grey mullet *Liza auratus* and leaping mullet *L. saliensis* - were introduced from the Black Sea to the Caspian Sea from 1930 to 1934, and acclimatization was successful (Kazancheyev, 1981). During period of our study in the North and South Absheron Gulfs, golden grey and leaping mullets were captured only during spring and summer seasons, and at that time they were especially numerous in the sites where oozy soil usually prevailed. Among representatives of this family – golden grey mullet predominated by the number of captured individuals (74.7 %). It was represented by individuals from 2 to 7 year-olds. In the samples the main part constituted females (76 %), with values of length LS –19.7-38.1 (28.4±1.7) cm; W - 169.5-712.5 (432±12.7) g; CF–1.09-1.53 (1.28±0.04). The population of leaping mullet consisted of fishes of three age groups with values of LS- 14.6-26.5 (21.6 ±1.1) cm; W - 37-214 (124.8±5.7) g; CF- 0.96-1.47 (1.22±0.02). We did not found any preferable food of mullets in the study areas. Their food supply is a little subject to seasonal and between years fluctuations that forms a basis for maintenance of their population densities. The Caspian mullets intensively feed throughout the year irrespective of the season and their functional condition and consume detritus (51.3 %), amphipods (*P.maeoticus, P.robustoides, N.similis,* etc.*)* - 27.6% and mollusks *(M.lineatus, D.trignoides, D.longipes, A.ovata*) - 17.3% and other organisms.

Darters (Percidae)

In the North Absheron Gulf the fresh-water sander *S. lucioperca* was not found during the study period, and in the South Absheron Gulf it is a very infrequent and rare species. Individuals of this species in our samples had values of SL- 21.0- 26.5 (23.3±2.0) cm; W- 131.1- 201.0 (170.0±5.6) g; CF- 1.08– 1.63 (1.39±0.04).

Gobies (Gobiidae)

Five species of goby fishes - round goby *Neogobius melanostomus*, Ilin goby *N.iljini*, deep-water goby *N.bathybius*, Khvalin goby *N.caspius*, and monkey goby *N. fluviatilis*) were found during our investigation in the North and South Absheron Gulfs. The most widespread and abundant species were round goby (45.7 %) and the Ilin goby (30.4 %). The proportion of Khvalin goby constituted

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16.7%, and remaining two species were 7.2%.

Discussion

Thus, according to the results of present study 16 species of marine fishes, and 10 species migratory and semi-migratory fishes were found in the North Absheron Gulf and 19 species of marine fishes, and 14 migratory and semi-migratory species were found in the South Absheron Gulf. Among these the dominant species are the typical marine fishes - Caspian shad *A.caspia*, golden grey mullet, *L. aurata*, Caspian sand smelt, *A. boyeri caspia* and one migratory fish – kutum, *R. frisii kutum.* Some other marine species – Dolgin herring, *A. braschnikowi braschnikowi* , big-eyed shad, *A. saposchnikowii*, black backed herring, *A. kessleri*, round goby, *Neogobius melanostomus*, Ilin goby, *N.iljini* and semi-migratory fishes-roach, *R.caspicus* also constitute a considerable portion in net samples. In different ecosystems of the Absheron Gulf the most common food of fishes was represented by mollusks, amphipods, shrimps, misids, cumacean crustaceans and to a lesser extent by crabs. Abundance of prey and their diversity is comparable to those in the Southern Caspian Sea as a whole and provides favorable conditions for growth and development of fishes and for the commercial production of fishes at high level.

It could be concluded that gasankuli, sarin and big-eyed shads have considerably expanded their ranges in the western part of the Middle Caspian Sea, including the Absheron Gulfs.

References

Agamaliyev, F.G. and Suleymanova, I.A., 2004. New data on fauna of infusorians of a microbenthos of the North Absheron Gulf and adjacent islands of the Caspian Sea. *Journal of Zoology*, 1, 5–11.

Azizov, A.P., 2008. Structurally functional characteristic of population of *Astacus leptodactylus* Esch. in the western shelf of the Azerbaijanian sector of the Caspian Sea. *Proceedings of Azerbaijan Society of Zoologists*, 1, 417– 421.

Berg, L.S., 1948. Fishes of fresh waters of the USSR and adjacent countries. Moscow - Leningrad: Publishing house of Academy of Sciences of the USSR. Part 1: 466P.

Berg, L.S., 1949a. Fishes of fresh waters of the USSR and adjacent countries. Moscow- Leningrad: Publishing house of Academy of Sciences of the USSR. Part 2: 456P.

Berg, L.S., 1949b. Fishes of fresh waters of the USSR and adjacent countries. Moscow- Leningrad: Publishing house of Academy of Sciences of the USSR. Part 3: 402P.

Bogutsky, N.G. and Naseka, A.M., 2004. The catalog agnathans and fishes of fresh and saltish waters of Russia with nomenclature and taxonomical remarks. Moscow. 389P.

Fazli, H. and Moghim, M., 2001. Age, growth and maturity stages of *Acipenser stellatus* in the Iranian coastal zone (91-99). 4th International Symposium on sturgeon, Oshkosh, Wisconsin, USA. 8-13 July 2001.

[Downloaded from jifro.ir on 2026-09-12]

[DOR: 20.1001.1.15622916.2015.14.2.4.3]

Fazli, H., Zhang, C.I., Hay, D.E. and Lee, C.W., 2009. Stock assessment and management implications of anchovy kilka *(Clupeonella engrauliformis)* in Iranian waters of the Caspian Sea. *Fisheries Research,* 100, 103-108.

Kazancheyev, E.N., 1981. Fishes of the Caspian Sea. Moscow. 168P.

Kottelat, M., 1997. European freshwater fishes. An heuristic checklist of the freshwater fishes of Europe (exclusive of former USSR) of with an introduction for non-sistematists and comments on nomenclature and conservation. *Biologia*, 52(**5**), 1-271.

Methodical textbook on studying of a food and food relationship of fishes under natural conditions., 1974. Moscow. 254P.

Pravdin, I.F., 1966. Textbook for studying fishes. Moscow. 376P.

Roohi, R., Kideys, A.E., Sajjadi, A., Hashemian, 1., Pourgholam, R., Fazli, H., Ganjian, A.K. and Eker-Develi, E., 2010. Changes in biodiversity of phytoplankton, zooplankton, fishes and macrobenthos in the southern Caspian Sea after the invasion of the ctenophore *Mnemiopsis leidyi*. Biological Invasions, 12, 2343-2361

Sapozhnikov, V.V., Metreveli, M.P. and Mordasova, N.V., 2011. Current state of ecosystem of the Caspian Sea and forecasts of further changes. Problems of preservation of an ecosystem of the Caspian Sea in the conditions of development of oil and gas fields. Astrakhan. pp. 206–209.

Suleymanova, I.A., 2006. Species composition, distribution and dynamics of development of macrozoobenthos of the North Absheron gulf of the Caspian Sea. *Proceedings of the Institute of Zoology of NAS of Azerbaijan*, 28, 855-864.

Suleymanov, S.S., Hazhiyev, R.V. and Akhundov, M.M., 2006. Ecological state of herrings on the western coast of Middle and South Caspian. Fishery studies in the Caspian Sea: Results of Scien. Invest. Works for 2005. Astrakhan. pp. 302-308.

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[DOR: 20.1001.1.15622916.2015.14.2.4.3]