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Some Ecological Features of Fish Species Common in the Aidar-Arnasay Lakes System in Uzbekistan

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ABSTRACT

This article presents data from literature sources and field studies on the ecological features of fish species common to the Aidar-Arnasay lakes system, both those with and without hunting significance. It includes information on the distribution, movement patterns, occurrence at various depths and ages, and indicators of the dominant abundance of these fish species. Coordinate points are established based on the locations where these species are found. During the control catches, fishing nets made of silk and artificial fibers were used, measuring 70 to 100 meters in length with a mesh size ranging from 15 to 70mm. The control catch yielded over 2,500 fish specimens, collected through more than 200 deployments and retrievals of the nets.

INTRODUCTION

Researchers-ichthyologists have conducted a large number of scientific studies on the biology and ecology, reproductive characteristics, and morphological parameters of fish species that are of hunting importance and common in the Aidar-Arnasay lakes system **(Gafurov, 1976, 1978; Golubenko, 1978, 1982; Tagaev, 1990; Mirzaev, 2001; Mirzaev & Urchinov, 2009; Namozov, 2022; Quvatov *et al.*, 2022, 2023; Kuvatov, 2023; Kuvatov & Atamuratova, 2023; Mirzaev & Azizov, 2023)**.

Today, the Aidar-Arnasay lakes system is one of the largest natural reservoirs of our republic, and fishing in these lakes is also carried out at a high level. Every year, the system of these lakes is stocked with carp-like fish species and a certain number of their fry. Currently, the study of some ecological features (distribution, location by water level, state of species in flocks) of fish species of hunting significance and widespread in the Aidar-Arnasay lakes system is one of the important tasks in revealing the theoretical aspects of fishing science. This requires studying the ecological features of fish species of hunting significance.

MATERIALS AND METHODS

More than 2.500 fish samples, consisting of 16 species, were used as scientific material, which were visually discovered as a result of scientific and practical visits to the Aydar-Arnasay lakes system during 2019-2023 and collected as a result of more than 200 control catches from various parts of the AALS (Fig. 1), and later, after certainichthyological operations, they were released into nature. When collecting materials, various fishing nets were used (lye fiber, artificial fiber, chameleon). The collection of fry and small fish off the coast was carried out using a fine-grained net and a Breden fishing net. Fish species living in the middle (distance from the shore 15-25km) and deep (25-35m) parts of the lakes were observed using an echo- sounder device (Garmin-2019 equipment indicator within a radius of 3 meters). In addition, the study was conducted using fish specimens caught by local fishermen. Correlation, regression and statistical analysis and processing of materials were carried out according to the method of G.F. Lakin **(Lakin, 1990)**. Standard methods generally accepted in ichthyology were also used **(Berg, 1948, 1949a, b; Pravdin, 1966)**. Digital material was processed using methods of variation-statistical analysis **(Rokitsky, 1967)**. The species composition of fish was determined using general methods **(Kessler, 1872, 1874, 1877; Nikolsky, 1974; Mirabdullaev *et al.*, 2011)**.

Fig. 1. Aidar-Arnasoy lakes system. (The table shows the coordinates of the collection points of ichthyological materials)

The taxonomic list of fish was given according to the identification of **Mirzaev and Kuvatov (2020)**.

Determination of parameters of fish samples, camera processing, counting, and computational work were carried out using data from biological statistics of computer programs **(Microsoft Excel, 2019)**.

RESULTS

Ichthyological studies conducted in the Aidar-Arnasay lakes system revealed 16 fish species, which, in turn, are economically significant commercial fish species, as well as economically insignificant fish species (non-pedigreed).

11 species of fish of hunting significance were studied: the carp (*Cyprinus carpio*, Linnaeus, 1758), sichel (*Pelecus cultratus*, Linnaeus, 1758), the pike perch (*Sander lucioperca*, Linnaeus, 1758), the common catfish (*Silurus glanis*, Linnaeus, 1758), the silver carp (*Hypophthalmichthys molitrix*, Valenciennes, 1844), the snakehead (*Channa argus*, Cantor, 1842), the Danube bleak (*Chalcarburnus chalcaoides aralensis*, Berg, 1923), the Aral roach (*Rutilus aralensis*, Berg, 1916), the eastern bream (*Abramis brama orientalis*, Berg, 1949), the Prussian carp (*Carassius gibelio*, Bloch, 1782), and the Aral asp (*Aspius aspius iblioides*, Kessler, 1872). We also studied 5 species of fish that do not have a hunting value: the amur goby (*Rhinogobius brunneus* (Temminck & Schlegel, 1845)) the stone morokos (*Pseudorasbora parva* (Temminck & Schlegel, 1846)), the common sawbelly (*Hemiculter leucisculus* (Basilewsky, 1855)), the eastern mosquito fish *(Gambusia holbrooki* (Girard, 1859)), and the rRosy bitterling (*Rhodeus ocellatus* (Kner, 1866)) (Table 1).

Table 1. Species composition of the ichthyofauna of the Aidar-Arnasay lakes system

No	Species	Status species	Population status species	Coordinatess
1	*Carassius gibelio* (Bloch, 1782)	Fishing	condition Not satisfactory	41°00'43.03"N 66°03'12.62"E; 41°01'07.30"N 66°00'13.78"E; 41°01'05.40"N 65°59'38.11"E; 41°01'15.90"N 66°06'09.12"E;

				40°56'21.34"N 66°05'06.93"E 40°40'25.65"N 67°33'03.75"E 40°40'54.34"N 67°31'33.75"E 40°41'37.72"N, 67°27'30.89"E 40°41'46.51"N, 67°21'31.46"E 40°48'33.99"N, 67°03'03.56"E 40°51'46.99"N, 67°05'31.66"E 40°52'16.4"N, 66°48'31.27"E 40°58'02.49"N, 66°56'11.29"E 41°04'05.02"N, 66°22'06.77"E 41°01'56.55"N, 66°10'56.29"E.
2	*Cyprinus carpio* (Linnaeus, 1758)	Fishing appearance	Satisfactory	41°01'22.81"N 66°01'51.85"E; 41°00'43.03"N 66°03'12.62"E; 41°01'07.30"N 66°00'13.78"E; 41°01'06.61"N 65°59'55.80"E; 41°01'05.40"N 65°59'38.11"E; 41°01'15.90"N 66°06'09.12"E; 40°59'22.20"N 66°19'49.24"E; 40°56'21.34"N 66°05'06.93"E 40°49'28.81"N,

				67°40'38.53"E 40°50'13.65"N, 67°39'08.15"E 40°55'48.52"N, 67°56'57.73"E 40°52'08.44"N, 67°51'41.72"E 40°39'49.85"N, 67°35'29.72"E 40°39'48.7"N, 67°34'27.43"E 40°40'25.65"N, 67°33'03.75"E 40°40'54.34"N, 67°31'33.75"E 40°35'07.81"N, 67°27'16.03"E 40°41'37.72"N, 67°27'30.89"E 40°41'46.51"N, 67°21'31.46"E 40°43'50.45"N, 67°23'45.82"E 40°48'33.99"N, 67°03'03.56"E 40°51'46.99"N, 67°05'31.66"E 40°52'16.4"N, 66°48'31.27"E 40°58'02.49"N, 66°56'11.29"E 41°04'05.02"N, 66°22'06.77"E 40°56'22.57"N, 66°18'21.11"E 41°01'56.55"N, 66°10'56.29"E
3	*Pseudorasbora parva* (Temminck and Schlegel,	Not aMeaningless	Not satisfactory	40°47'19.84"N, 67°38'2.64"E

	1846)	species		
4	*Sander lucioperca* (Linnaeus, 1758)	Fishing appearance	Uis satisfactory	41°01'33.56"N 66°02'50.72"E; 41°01'22.81"N 66°01'51.85"E; 41°00'43.03"N 66°03'12.62"E; 41°01'07.30"N 66°00'13.78"E; 41°01'06.61"N 65°59'55.80"E; 41°01'05.40"N 65°59'38.11"E; 41°01'15.90"N 66°06'09.12"E; 40°59'22.20"N 66°19'49.24"E; 40°56'21.34"N 66°05'06.93"E 40°47'55.85"N, 67°37'26"E 40°49'28.81"N, 67°40'38.53"E 40°50'13.65"N, 67°39'08.15"E 40°55'48.52"N, 67°56'57.73"E 40°52'08.44"N, 67°51'41.72"E 40°39'49.85"N, 67°35'29.72"E 40°39'48.7"N, 67°34'27.43"E 40°40'25.65"N, 67°33'03.75"E 40°40'54.34"N, 67°31'33.75"E 40°35'07.81"N, 67°27'16.03"

				E40°41'37.72"N 67°27'30.89"E 40°41'46.51"N, 67°21'31.46"E 40°43'50.45"N, 67°23'45.82"E 40°48'33.99"N, 67°03'03.56"E 40°51'46.99"N, 67°05'31.66"E 40°52'16.4"N, 66°48'31.27"E 40°58'02.49"N, 66°56'11.29"E 41°04'05.02"N, 66°22'06.77"E 40°56'22.57"N, 66°18'21.11"E 41°01'56.55"N, 66°10'56.29"E
5	*Rutilus aralensis* (Berg, 1916)	Commercial species (Of hunting significance)	Good	41°01'33.56"N 66°02'50.72"E; 41°01'22.81"N 66°01'51.85"E; 41°00'43.03"N 66°03'12.62"E; 41°01'06.61"N 65°59'55.80"E; 40°59'22.20"N 66°19'49.24"E 40°47'45.01"N, 67°38'34.16"E 40°49'28.81"N, 67°40'38.53" E40°55'48.52"N, 67°56'57.73"E 40°52'08.44"N, 67°51'41.72"E 40°39'49.85"N,

				67°35'29.72"E 40°39'48.7"N, 67°34'27.43"E 40°41'37.72"N, 67°27'30.89"E 40°41'46.51"N, 67°21'31.46"E 40°43'50.45"N, 67°23'45.82"E 40°48'33.99"N, 67°03'03.56"E 40°51'46.99"N, 67°05'31.66"E 40°52'16.4"N, 66°48'31.27"E 40°58'02.49"N, 66°56'11.29"E 41°04'05.02"N, 66°22'06.77"E 40°56'22.57"N, 66°18'21.11"E
6	*Abramis brama orientalis* (Berg, 1949)	Commercial species	Not satisfactory	40°48'24.31"N, 67°39'21.71"E
7	*Chalcarburnus chalcaoides aralensis* (Berg, 1923)	Fishing	condition Not satisfactory	41°00'43.03"N 66°03'12.62"E 40°47'45.01"N, 67°38'34.16"E 40°49'28.81"N, 67°40'38.5353"E 40°50'13.65"N, 67°39'08.15"E
8	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	Commercial species	Not satisfactory	40°47'55.8585"N, 67°37'26"E 40°50'13.65"N, 67°39'08.15"E
9	*Hemiculter leucisculus* (Basilewsky, 1855)	Non-specific species	Ysatisfactory	40°47'45.01"N, 67°38'34.16"E 40°55'48.52"N, 67°56'57.73"E

10	*Rhodeus ocellatus* (Kner, 1866)	Non-commercial species	U:	41°01'33.56"N 66°02'50.72"E; 41°01'22.81"N 66°01'51.85"E
11	*Pelecus cultratus* (Linnaeus, 1758)	Commercial species	Badly	40°32 '17.14"N, 67°36'2.72"E
12	*Aspius aspius iblioides* (Kessler, 1872)	Fishing	condition Not satisfactory	40°43'18.81"N, 67°20'33.50"E
13	*Channa argus* (Cantor, 1842	Fishing	condition Not satisfactory	41°00'43.03"N 66°03'12.62"E 40°47'55.8585"N, 67°37'26"E 40°50'13.65"N, 67°39'08.15"E 40°52'08.44"N, 67°51'41.72"E 40°39'48.77"N, 67°34'27.43"E
14	*Silurus glanis* Linnaeus, 1758	Commercial species	Not satisfactory	40°39'49.85"N, 67°35'29.7272"E
15	*Gambusia holbrooki* (Girard, 1859)	Non-commercial species	Well	40°58'02.4949"N 66°56'11.2929"E 40°39'49.85"N, 67°35'29.7272"E 40°39'48.77"N, 67°34'27.43"E 40°40'25.65"N, 67°33'03.775"E 40°58'02.4949"N, 66°56'11.2929"E
16	*Rhinogobius brunneus* (Temminck and Schlegel, 1845)	Non-commercial species	Well	40°58'02.49"N 66°56'11.29"E 40°47'45.01"N, 67°38'34.16"E 40°39'49.85"N, 67°35'29.72"E 40°39'48.7"N, 67°34'27.43"E

				40°40'25.65"N, 67°33'03.75"E 40°58'02.49"N, 66°56'11.29"E 41°04'05.02"N, 66°22'06.77"E

Note: in the table, on the species status column - information is presented on the current status of the species in the AALS, on the column the state of the species population - the distribution of this species in the AALS, on the coordinates column - information on the number of species identified as a result of control catches.

In Table (1), in the Aidar-Arnasay Lakes system, 11 fish species are of hunting significance. Here is a brief description of 10 of them.

The Prussian carp (*Carassius gibelio*) – occurs in all parts of the lakes system in small quantities. In our studies, in April 2022, a large number of fish of this species were observed at the following coordinates of Lake Tuzkan (40°43'25.22"N, 67°19'0.02"E) as a result of control catches using 5 fishing nets, each of 70 meters long, 2 meters wide, and 32mm in mesh size (15-18 individuals). Individuals of the silver carp aged 1+ mainly live in the coastal part, sexually mature individuals in places with a depth of 5 to 8 meters, and in places with a depth of more than 15 meters there are very few.

The common carp (*Cyprinus carpio*) – as a result of scientific observations in the lakes system in 2019-2023, the occurrence of this species in all parts of the three Lakes was recorded in sufficient numbers. In the course of control catches, 3 to 15 individual fish were caught using 5 fishing nets, each of 70 meters long, 2 meters wide, and 28 to 55mm in size, in any part of the reservoir. At the same time, young individuals were found in places with a water depth of 2-3 meters, and more adult (5+-6+) individuals were found at a depth of 15-20 meters. During some periods of vegetation (mass reproduction) in coastal areas, adult specimens were also observed.

The pike perch (*Sander lucioperca*) – as a result of scientific observations in the Lakes system in 2019-2023, the occurrence of this species in all parts of the three Lakes was recorded in sufficient numbers. In the course of control catches, 3 to 15 individual fish were caught using 5 fishing nets, each of 70 meters long, 2 meters wide, and 28 to 55mm in size, in any part of the reservoir. At the same time, young individuals were found in places with a water depth of 2-3 meters, and more adult (5+-6+) individuals were found at a depth of 15-20 meters. Individuals of the common wall eye aged 2+3+ in the Aidar-Arnasay lakes system make up the main share of fishermen's catch. Specimens with large sizes are found mainly in the deep places of Lakess (20-30m) and make up a small part of the fishermen's catch.

The **Aral roach** (*Rutilus aralensis*) is a species that is caught by recreational fishermen but has no economic importance. As a result of scientific observations in the lake system in 2019-2023, the occurrence of this species in all parts of the three lakes in

the greatest numbers was recorded. During control catches using 5 fishing nets, each of 70 meters long, 2 meters wide, with mesh sizes ranging from 28 to 55mm, an average of 50 to 200 fish individuals were encountered in any part of the reservoir. In places with a water level of 2-5 meters, its main flocks swim, while rarely found in places with water depths of 8-15 meters or more. In the warm summer months, their fry were observed moving in columns in shallow coastal areas. Moving schools (shoals) of the Aral roach were also observed in lakes Aydarkul, Tuzkan, and in some cases in Lake Arnasay. Various populations of this species are found in lakes such as Aydarkul, Tuzkan, and Arnasay. Due to its small size and feeding on hydrobionts, it does not move away from coastal areas covered with large aquatic plants. Individuals of the Aral roach aged 2+3+ years make up the bulk of the catch of fishermen in the Aydar-Arnasay lakes system.

The eastern bream (*Abramis brama orientalis*) – very rare in the lakes of Aydarkul and Arnasay. Since it is a freshwater fish from an ecological point of view, the population status of this species in the eastern part of Arnasay is satisfactory. In the course of our research, in August 2021, in the Eastern Arnasaregion, at coordinates 40°48'10.66"N, 67°41'37.55"E, specimens of this species with a length of 20-25cm, aged 2+-3+, were caught by local fishermen. According to observations, eastern bream moves along the coasts with a water level depth of 3-5 meters.

The Danube bleak (*Chalcarburnus chalcaoides aralensis*) is distributed in all parts of the lakes system in small quantities. In the course of our research, in August 2019, as a result of comprehensive monitoring in the area of Lake Tuzkan at coordinates 40°57'20.24"N, 67°0'34.49"E, in August 2021 in the area of Eastern Arnasay and in August 2022, fish samples were taken from the place where the Qli River flows into Lake Tuzkan. From the point of view of distribution, they are distributed in freshwater parts of the lakes system and the nearest areas from it (500-800 meters). They were found in areas with a water depth of 5-7 meters.

The silver carp (*Hypophthalmichthys molitrix*) – in the lakes system, local fishermen conduct fishing activities. In addition, a certain amount of fish also comes from the channels and rivers that flow into the lakes system. It was observed in the East Arnasay and Tuzk Lakes of the lake system. During our research in the spring of 2022, samples were taken from the confluence of the Qli River with the Tuzkan Lakes. From a distribution perspective, it is widespread in the freshwater parts of the lake system and the surrounding areas. Young fish inhabit the coastal zone of the lakes in regions with aquatic vegetation, while adults are found in areas with water depths ranging from 3 to 6-7 meters.

The Aral asp (*Aspius aspius iblioides*) – found in all parts of the lakes system in very small systems. In the course of our research, as a result of comprehensive monitoring in August 2019, their samples were selected in the area of Lake Tuzkan at coordinates 40°40'39.97"N, 67°34'36.87"E. They were found in control catches off lakes

Aidar and Tuzkan, but they were not found in control catches of lake Vostochny Arnasay; however, they were met by local fishermen. From the point of view of distribution, they were found far from the shores of the Lakes system (from 1 to 10km), in places with a water depth of 5-10 meters.

The snakehead (*Channa argus*) – currently, its abundance in the Aidar-Arnasay lake system is small, they were found only during control catches in the Eastern Arnasay Lake at coordinates 40°47 '8.19" N, 67°36 '43.45" E and 40°47 '18.72" N, 67°38'0.45"E. They are caught by amateur fishermen. During our research in August 2023, samples were taken from coastal areas with a depth of 0.5 meters, covered with reeds or other aquatic plants, using fishing nets and breden. From the point of view of distribution, it is widespread in and near freshwater parts of the lakes system. Young fish live near the shores of the lake and are covered with large aquatic vegetation.

The common catfish (*Silurus glanis*) – currently, a very small number of them live in the Aidar-Arnasay Lakes system. As a result of control catches in the framework of our scientific research, it was not detected. In some cases, they were observed by local fishermen.

Brief ecological description of fish species that are not of hunting importance.

The stone morokos (*Pseudorasbora parva*) – during control catches, their samples were taken from freshwater areas, from the confluence of rivers and channels with the Aidar-Arnasay lakes system. They were not found on the sites of lakes Aydarkul and Tuzkan.

The Rosy bitterling (*Rhodeus ocellatus*) – a large number of its individuals were found in the Vostochny Arnasoy lakes and reservoir of the Aidar-Arnasay lakes system in coastal areas and shallow water (0.5-1m) during control catches.

The common sawbelly (*Hemiculter leucisculus*) – its main population is distributed in Lake Vostochny Arnasoy of the Aidar-Arnasay lakes system, the number of which was numerous. During the control catches in August 2021, a fishing net made of artificial fiber (fishing line) measuring 70 meters in length, 1.5 meters in width, and with a mesh size of 15 mm was used. The net was cast in the evening and retrieved in the morning, set 80-100 meters from the shore in depths of 4-6 meters. Approximately, 120 individuals of the Korean white-bellied fish were caught. Additionally, during our scientific research, its occurrence in small quantities in Lake Tuzkan of the lake system was also noted.

The eastern mosquitofish (*Gambusia holbrooki*) – common in all parts of the Aidar-Arnas lakes systems, and occurs in large numbers in the Tuzkan Lake. In the course of our research, the occurrence of the eastern mosquitofish along the shores of Lake Tuzkan, in areas covered with reeds and other aquatic plants with a depth of 0.5-1 meter, where it forms a community with the Amur goby, but numerically dominates.

The amur goby (*Rhinogobius brunneus*) – like the eastern mosquitofish, is distributed in all parts of the Aidar-Arnasay lakes system, and is found in large numbers

in Lake Tuzkan. They are adapted to life in the same conditions as Gambusia Holbrooki and form communities with them. In addition to coastal areas, the Amur goby can also be found in reed thickets in the middle part of the lake, where it clings to the base of the reeds using a round adhesive organ formed by the modified shape of its pectoral fin. This population also exhibits distinct morphological characteristics and a darker body color compared to other populations found in different reservoirs throughout our republic **(Kuvatov *et al.*, 2022)**.

DISCUSSION

In general, it should be noted that the number of fish species of hunting significance in the Aidar-Arnasay lakes system and their resources are in an unsatisfactory state. Every year, efforts are made to stock the lake system with fry of carp-like (herbivorous) fish species. According to fish catch data from the Aydar-Arnasay lakes system between 1990 and 1999, alongside species such as the pike perch, carp, Aral roach, and prussian carp, other species like the eastern bream, silver carp, Aral asp, common catfish, snakehead, and northern pike were found in equal numbers. Additionally, species like the sichel (*Pelecus cultratus*) and the khramulya (*Varicorhynus capoeta steindachneri*) were identified in very small quantities in some years **(Khurshut, 2001)**.

During our control catches, we primarily found large quantities of the pike perch, carp, Prussian carp, and Aral roach, while northern pike and Khramulya were not found **(Kuvatov *et al.*, 2023)**. Near the coast and at a depth of 3-4 meters, a quantitative dominance of the Aral roach was also observed.

It was revealed that in the Aidar-Arnasay lakes system, Lake East Arnasay has a greater number and volume of fish species of hunting importance compared to lakes Tuzkan and Aidar. The Danube bleak species discovered in Lake East Arnasay has not been identified in other parts of the lake system; this may be related to the degree of freshwater content in the water. While the Aral roach, as a species of hunting significance, is widely distributed in large numbers throughout the Aidar-Arnasay lakes system, whereas the occurrence of the prussian carp was low compared to other fish species. Additionally, some ecological features of fish species that are not of hunting importance were studied.

CONCLUSION

Thus, at present, 16 species of fish are distributed in the ichthyofauna of the Aidar-Arnasay Lakes system, of which 11 species are of hunting significance (9 commercial and 1 non-commercial). Despite the Sichel (*Pelecus cultratus*) being classified as a species of hunting importance, it has not been found in recent catches and requires special protection, with only 2 individuals identified during our research. The remaining 5 species hold special significance.

We described the ecological features of species with and without hunting significance in the Aidar-Arnasay Lakes system, focusing on factors such as water level, distance from the shore, direction of movement, social behavior, and distribution. It was found that adult individuals (ages 5-6 years) of species like carp, pike perch, Prussian carp, and Aral asp are located in the middle and deeper parts of the lakes, while younger specimens and other species are typically found within 1-2 kilometers of the shore. The results of this study, conducted from 2019 to 2023, were based on data from control catches, reports from local fishermen, and external observations.

GRATITUDE

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SHARE OF AUTHORS

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