Fish occurrence in the Kuban River Basin (Russia)

Oleg Artaev‡, Andrey Pashkov§, Dmitriy Vekhov¶, Maksim Saprykin#, Maksim Shapovalov†, Marina Levina‡, Boris Levin‡,¶,#

‡ Papanin Institute for Biology of Inland Waters Russian Academy of Sciences, Borok, Russia
§ Azov-Black Sea branch of “VNIRO” (“AZNIIRKH”), Rostov-on-Don, Russia
¶ Research Institute for Complex Problems at Adyghe State University, Maykop, Russia
# Zoological Institute, Russian Academy of Sciences, Saint-Petersburg, Russia
# Cherepovets State University, Cherepovets, Russia

Corresponding author: Oleg Artaev (artaev@gmail.com)

Academic editor: Rupert Collins

Received: 18 Oct 2021 | Accepted: 26 Nov 2021 | Published: 06 Dec 2021

Citation: Artaev O, Pashkov A, Vekhov D, Saprykin M, Shapovalov M, Levina M, Levin B (2021) Fish occurrence in the Kuban River Basin (Russia). Biodiversity Data Journal 9: e76701. https://doi.org/10.3897/BDJ.9.e76701

Abstract

Background

This publication describes a dataset containing information on 1328 occurrences of fishes in the Kuban River Basin, the longest river of Northern Caucasus and representing its own freshwater ecoregion (428 Kuban Ecoregion). All observations have precise geo-referencing with the names of water bodies (rivers, lakes etc.). The dataset is based on both literature data (509 occurrences) and our own sampling (814 occurrences). Observations were carried out between 1889 and 2020.

New information

The majority (> 61%) of occurrences in the presented data are published for the first time. This extended dataset contributes significantly to fish fauna survey in the Kuban River ecoregion.
Keywords

fish fauna, database, Kuban River, Sea of Azov, Caucasus

Introduction

Ichthyofauna of the Kuban River system is comprised of three groups: the species also inhabiting other European rivers, the species inhabiting brackish waters of the Azov Sea and migrated to the Kuban, as well as by the endemic species found only in the Kuban Basin. The fish fauna of the Kuban River Basin is one of the most distinct amongst river basins of European Russia. In total, 94 fish species have been recorded in the Kuban Basin (Bogutskaya and Naseka 2002, Abell et al. 2008, our data) including 11 endemic species and evolutionary significant units: *Alburnoides kubanicus* Bănărescu, 1964, *Barbus kubanicus* Berg, 1912, *Chondrostoma kubanicum* Berg, 1914, *Eudontomyzon cf. mariae* (Berg, 1931), *Gobio kubanicus* Vasil'eva, 2004, *Petroleuciscus aphipsi* (Aleksandrov, 1927), *Phoxinus sp.*, *Ponticola cf. constructor* (Nordmann, 1840), *Romanogobio parvus* Naseka et Freyhof, 2004, *R. pentatrichus* Naseka et Bogutskaya, 1998, *Sabanejewia kubanica* Vasil'eva & Vasil'ev, 1988 (Naseka 2010) (see photographs of some Kuban endemic fish species in Fig. 1). All endemic fish species are listed in the dataset presented.

The Middle Kuban River is considered an important place for the conservation of freshwater fishes in the Caucasus (Freyhof et al. 2020). The Kuban Basin is a separate ecoregion (428 in Abell et al. 2008), fish fauna of which is distinct from other ecoregions of the Caucasus. The native fauna is also clearly distinct from that of Don (ecoregion 427), which is geographically close, but has a different geological history (Bogutskaya and Hales 2021). In addition to new occurrence records, the dataset presented contains information on the type localities of the endemic species with data on museum numbers of type specimens. The basin of the Kuban River is located in Northern Caucasus, a highly populated region with developed agriculture. High anthropogenic activity resulted in numerous alien fish invasions, some of which are now naturalised. Most of the alien species are from East and South-eastern Asia (*Ctenopharyngodon idella* (Valenciennes, 1844); *Hypophthalmichthys molitrix* (Valenciennes, 1844); *Hypophthalmichthys nobilis* (Richardson, 1845); *Oryzias sinensis* Chen, Uwa & Chu, 1989; *Pseudorasbora parva* (Temminck & Schlegel, 1846)); North America (*Gambusia holbrooki* Girard, 1859; *Ictalurus punctatus* (Rafinesque, 1818); *Ictiobus bubalus* (Rafinesque, 1818); *I. cyprinellus* (Valenciennes, 1844); *I. niger* (Rafinesque, 1819); *Piaractus brachypomus* (Cuvier, 1818); *Polyodon spathula* (Walbaum, 1792); *Rocio octofasciata* (Regan, 1903)) and a few species from Africa (*Oreochromis aureus* (Steindachner, 1864) and *O. mossambicus* (Peters, 1852)) (Moskul 1998, Moskul et al. 2012). The fish fauna of the Kuban Basin has been studied for a long time (e.g. Aleksandrov 1927, Berg 1949, Sukhanova and Troitskiy 1949, Tamanskaya and Troitskiy 1957, Troitskiy and Tsunikova 1988), but few publications contained data for certain localities. The goal of the study was to collect comprehensive data on occurrences of the Kuban fish species and to make these data available using GBIF (Artaev et al. 2021). The information on species distributions can be used by
ichthyologists, ecologists, conservation biologists and managers of areas of nature protection.

Sampling methods

Study extent: The dataset contains information on 1328 occurrence records (one species in a definite place at a definite time) of 63 taxa, 58 of which were identified at species level, while six taxa were identified at generic level. The occurrences were recorded between 1889 and 2020. The study area is ~ 57900 km².

Sampling description: Occurrences retrieved from literature are based mainly on data from the fish elevator of the Krasnodar Reservoir (Akseleva 2017, Polin and Strelchenko 2018, Mischenko 2019, Polin and Strelchenko 2019). Our data are based on fish sampling using various fishing gear (frame net, seine net, gill net and cast net).
Quality control: Each observation contains fundamental information, such as locality (coordinates), date, name of water body, name of observer and name of identifier. Geographical latitude/longitude coordinates for the majority of localities were obtained using hand-held GPS devices, while coordinates for localities extracted from literature and those missing coordinates were determined using the Google Maps service. Species were identified, based on morphological characters (Berg 1949, Bogutskaya and Poznyak 1994, Naseka and Bogutskaya 1998, Naseka and Freyhof 2004, Vasil'eva et al. 2004).

Step description: First, we analysed published data on fish records. Second, we added our data on fish occurrences.

Geographic coverage

Description: All occurrences were recorded within the Kuban River Basin which drains the North-western Caucasus and discharges into the Azov Sea and within the Large Stavropol' irrigation canal draining the the eastern part of the Kuban Basin and parts of the Kuma and Terek Rivers (both belong to Caspian Sea drainage – Fig. 2; the three most eastern localities out of the Kuban Basin belong to the Large Stavropol irrigation canal) and the upper part of Stavropol' canal discharging waters to the Manych-Don system. The length of the Kuban River is 870 km and watershed area is ca. 57900 km². The Basin can be subdivided into three geographical zones: highlands, submontane and lowlands. The main drainage area is the northern slopes of the Caucasus with 2600 mm precipitation (Kupriyanov 1973). Lower reaches of the Kuban are located in agricultural landscapes and a significant volume of the Kuban water is taken for irrigation. There is one reservoir on the Kuban River, the Krasnodar Reservoir, located in its lower reach. This is the largest reservoir in the Northern Caucasus. It was built at 1973 with an area around 400 km²; its length is 46 km and 8-11 km wide (Pogorelov and Laguta 2019). Climate is mild in the middle and lower reaches of Kuban Basin with sub-zero daily temperature only during December-March (Kupriyanov 1973).

Coordinates: 43.23 and 45.76 Latitude; 36.77 and 42.33 Longitude.

Taxonomic coverage

Description: The dataset contains information on 63 taxa, of which 57 were identified at the species level and six at the genus level (Table 1). The species detected belong to 47 genera, 18 families and two classes. A few taxa need further commentaries on their taxonomic status. Individuals identified as *Rutilus rutilus* (Linnaeus, 1758) were replaced by *R. lacustris* (Pallas, 1814) according to results from genetic studies (Levin et al. 2017, Artaev et al. 2021). For a long time, the Kuban was thought to be home to only one *Barbus* species, endemic to the Kuban system, *B. kubanicus*. A recent genetic study (Levin et al. 2019) revealed that the upper reach of the Abin River, a left tributary of the Kuban River, is additionally inhabited by *B. tauricus* with hybridisation observed between these *Barbus* spp.
Table 1. Occurrences of fish taxa in the Kuban Basin represented in the dataset.

| Taxa                        | Number of occurrences |
|-----------------------------|-----------------------|
| **Acipenseridae**           |                       |
| *Acipenser gueldenstaedtii* Brandt & Ratzeburg, 1833 | 1                     |
| *Acipenser nudiventris* Lovetsky, 1828 | 1                     |
| *Acipenser ruthenus* Linnaeus, 1758 | 21                    |
| *Acipenser stellatus* Pallas, 1771 | 6                     |
| *Huso huso* (Linnaeus, 1758) | 1                     |
| **Cichlidae**               |                       |
| *Oreochromis aureus* (Steindachner, 1864) | 4                     |
| *Rocio octofasciata* (Regan, 1903) | 3                     |
| **Clupeidae**               |                       |
| *Alosa immaculata* Bennett, 1835 | 8                     |
| *Alosa maeotica* (Grimm, 1901) | 7                     |

Figure 2. Map of sampling sites in the Kuban River Basin. Map was created in ArcGIS 10.8 software (www.esri.com). Author's data are designated by the red circles, while literature data are designated by yellow circles.
| Taxa                                           | Number of occurrences |
|------------------------------------------------|-----------------------|
| *Alosa tanaica* (Grimm, 1901)                  | 17                    |
| Cobitidae                                      |                       |
| *Sabanejewia kubanica* Vasil'eva & Vasil'ev, 1988 | 30                    |
| Cyprinidae                                     |                       |
| *Abramis brama* (Linnaeus, 1758)               | 53                    |
| *Alburnoides kubanicus* Banarescu, 1964        | 85                    |
| *Alburnus alburnus* (Linnaeus, 1758)           | 73                    |
| *Alburnus leobergi* Freyhof & Kottelat, 2007   | 37                    |
| *Barbus* Daudin, 1805                          | 16                    |
| *Barbus kubanicus* Berg, 1912                  | 47                    |
| *Blicca bjoerkna* (Linnaeus, 1758)             | 39                    |
| *Carassius auratus* (Linnaeus, 1758)           | 20                    |
| *Carassius Jarocki*, 1822                      | 31                    |
| *Chondrostoma kubanicum* Berg, 1914            | 12                    |
| *Ctenopharyngodon idella* (Valenciennes, 1844) | 18                    |
| *Cyprinus carpio* Linnaeus, 1758               | 33                    |
| *Gobio caucasicus* Kamensky, 1901              | 21                    |
| *Gobio Cuvier*, 1816                           | 67                    |
| *Gobio holurus* Fowler, 1976                   | 1                     |
| *Gobio kubanicus* Vasil'eva, 2004              | 1                     |
| *Leucaspius delineatus* (Heckel, 1843)         | 3                     |
| *Leuciscus aspius* (Linnaeus, 1758)            | 32                    |
| *Leuciscus idus* (Linnaeus, 1758)              | 1                     |
| *Pelecus cultratus* (Linnaeus, 1758)           | 35                    |
| *Petroleuciscus aphpsi* (Aleksandrov, 1927)    | 45                    |
| *Petroleuciscus borysthenicus* (Kessler, 1859) | 1                     |
| *Phoxinus* Rafinesque, 1820                    | 17                    |
| *Pseudorasbora parva* (Temminck & Schlegel, 1846) | 7                    |
| *Rhodeus amarus* (Bloch, 1782)                 | 17                    |
| *Romanogobio parvus* Naseka & Freyhof, 2004    | 1                     |
| Taxa                                      | Number of occurrences |
|-------------------------------------------|-----------------------|
| Romanogobio pentatrichus Naseka & Bogutskaya, 1998 | 2                     |
| Rutilus lacustris (Pallas, 1814)           | 87                    |
| Scardinius erythrophthalmus (Linnaeus, 1758) | 13                    |
| Squalius cephalus (Linnaeus, 1758)        | 71                    |
| Vimba vimba (Linnaeus, 1758)              | 29                    |
| **Esocidae**                              |                       |
| *Esox lucius* Linnaeus, 1758               | 17                    |
| **Gasterosteidae**                        |                       |
| *Pungitius platygaster* (Kessler, 1859)    | 3                     |
| **Gobiidae**                              |                       |
| *Knipowitschia* Iljin, 1927               | 1                     |
| *Neogobius fluviatilis* (Pallas, 1814)     | 31                    |
| *Pomatoschistus* Gill, 1863               | 2                     |
| *Ponticola cf. constructor* (Nordmann, 1840) | 9                     |
| *Proterorhinus semipellucidus* (Kessler, 1877) | 4                     |
| *Proterorhinus* Smitt, 1900               | 13                    |
| **Ictaluridae**                           |                       |
| *Ictalurus punctatus* (Rafinesque, 1818)   | 15                    |
| **Mugilidae**                             |                       |
| *Planiliza haematocheila* (Temminck & Schlegel, 1845) | 2                     |
| **Nemacheilidae**                         |                       |
| *Barbatula barbatula* (Linnaeus, 1758)     | 28                    |
| **Percidae**                              |                       |
| *Gymnocephalus cernua* (Linnaeus, 1758)    | 21                    |
| *Perca fluviatilis* Linnaeus, 1758         | 48                    |
| *Sander lucioperca* (Linnaeus, 1758)       | 57                    |
| *Sander volgensis* (Gmelin, 1789)          | 5                     |
| **Petromyzontidae**                       |                       |
| *Eudontomyzon cf. mariae* (Berg, 1931)     | 1                     |
| **Poeciliidae**                           |                       |
The connection of the Kuban system with the Kuma and Terek riverine systems via the Large Stavropol’ irrigation canal, as well as with the Manych-Don system via the Nevinnomysk irrigation canal, may facilitate exchange of fish fauna as exemplified by *B. kubanicus* occurrences in the Manych system (Poznyak 1987). We consider the Prussian carp as *Carassius auratus* (Linnaeus 1758) species complex since its taxonomic status is still under debate (Wouters et al. 2012, Rylková et al. 2013, Vekhov 2013, Šimková et al. 2015).

**Temporal coverage**

**Notes:** Data can be divided into three periods: i) 1889-1911 - data on the type localities of endemic species of the Kuban Basin; ii) 1974-2001 - data on the occurrences solely from literature sources; and iii) 2003-2020 - author's data and further literature data.

**Usage licence**

**Usage licence:** Creative Commons Public Domain Waiver (CC-Zero)

**Data resources**

**Data package title:** Fish occurrences in the Kuban River Basin

**Resource link:** [https://www.gbif.org/dataset/8d8218b1-835d-43ef-ac2d-34c746277528](https://www.gbif.org/dataset/8d8218b1-835d-43ef-ac2d-34c746277528)

**Alternative identifiers:** [https://doi.org/10.15468/82j8u8](https://doi.org/10.15468/82j8u8)

**Number of data sets:** 1

**Data set name:** Fish occurrence in the Kuban River Basin
**Data format:** Darwin Core

**Description:** Dataset is a compilation of data as a contemporary faunistic research (2003-2020) and literature data (1974-1987) with indication of locality.

| Column label       | Column description                                                                 |
|--------------------|-------------------------------------------------------------------------------------|
| occurrenceID       | The Globally Unique Identifier number for the recorded.                              |
| basisOfRecord      | The specific nature of the data record: HumanObservation.                            |
| eventDate          | Date format as YYYY-MM-DD.                                                           |
| scientificName     | The full scientific name including the genus name and the lowest level of taxonomic rank with the authority. |
| kingdom            | The full scientific name of the kingdom in which the taxon is classified.            |
| phylum             | The full scientific name of the phylum or division in which the taxon is classified.|
| class              | The full scientific name of the class in which the taxon is classified.              |
| order              | The full scientific name of the order in which the taxon is classified.              |
| family             | The full scientific name of the family in which the taxon is classified.             |
| decimalLatitude    | The geographic latitude of location in decimal degrees.                              |
| decimalLongitude   | The geographic longitude of location in decimal degrees.                             |
| Country            | The name of the country (Russia).                                                    |
| countryCode        | The standard code for the country in which the Location occurs.                     |
| individualCount    | The number of individuals represented present at the time of the Occurrence.        |
| year               | Year of the event was recorded.                                                     |
| month              | The month of the event was recorded.                                                |
| day                | The integer day of the month on which the Event occurred.                           |
| recordedBy         | A person or group responsible for recording the original Occurrence.                |
| identifiedBy       | A list of names of people, who assigned the Taxon to the subject.                   |
| locality           | The specific description of the place.                                              |
| associatedReferences| Bibliographic reference of literature associated with the Occurrence.               |
| coordinatePrecision| A decimal representation of the precision of the coordinates given in the decimalLatitude and decimalLongitude. |
| catalogNumber      | An identifier (unique) for the record within the dataset or collection (only for type specimens). |
| occurrenceRemarks  | Comments or notes about the Occurrence - what types of specimens were caught in this place. |
| identificationRemarks | Comments or notes about the Identification - what Latin name was given when describing a species from this locality. |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| institutionCode       | The name (or acronym) in use by the institution having custody of the object(s) or information referred to in the record.       |
| geodeticDatum         | The ellipsoid, geodetic datum or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude are based. |
| identificationQualifier | A brief phrase or a standard term ("cf.", "aff.") to express the determiner's doubts about the Identification.                |
| taxonRank             | The taxonomic rank of the most specific name in the scientificName.                                                               |
| taxonRemarks          | Comments or notes about the taxon or name.                                                                                       |

**Author contributions**

Oleg Artaev - investigation, dataset preparation, original draft preparation; Andrey Pashkov - investigation, Dmitriy Vekhov - investigation; Maksim Saprykin - investigation; Maksim Shapovalov - investigation; Marina Levina - investigation; Boris Levin - investigation, original draft preparation, editing.

**References**

- Abell R, Thieme M, Revenga C, Bryer M, Kottelat M, Bogutskaya N, Coad B, Mandrak N, Balderas SC, Bussing W, Stiassny MJ, Skelton P, Allen G, Unmack P, Naseka A, Ng R, Sindorf N, Robertson J, Armijo E, Higgins J, Heibel T, Wikramanayake E, Olson D, López H, Reis R, Lundberg J, Sabaj Pérez M, Petry P (2008) Freshwater ecoregions of the world: A new map of biogeographic units for freshwater biodiversity conservation. BioScience 58 (5): 403-414. [https://doi.org/10.1641/b580507](https://doi.org/10.1641/b580507)
- Aksel'eva YY (2017) Population dynamics and fish species composition of the fish-passing construction of Fedorov dam from 2011 to 2015. In: Pavlov SI (Ed.) Bioecological study of local lore: world, Russian, regional problems. 118-122 pp. [In Russian].
- Aleksandrov AI (1927) Materials on the fauna of the Kuban River Basin. Proceedings of the Kerch Ichthyological Laboratory 1 (2-3): 151-177. [In Russian].
- Artaev O, Pashkov A, Vekhov D, Shapovalov M, Saprykin M, Levin B (2021) Fish occurrence in Kuban River Basin. Papanin Institute for Biology of Inland Waters Russian Academy of Sciences. Version 1.10. URL: [https://www.gbif.org/dataset/8d8218b1-835d-43ef-ac2d-34c746277528](https://www.gbif.org/dataset/8d8218b1-835d-43ef-ac2d-34c746277528)
- Artaev O, Ermakov OA, Vekhov DA, Konovalov AF, Levina MA, Pozdeev IV, Ruchin AB, Alyushin IV, Iljin VY, Levin BA (2021) Genetic screening of distribution pattern of roaches *Rutilus rutilus* and *R. lacustris* (Cyprinidae) in broad range of secondary contact (Volga Basin). Inland Water Biology 14 (2): 205-214. [https://doi.org/10.1134/s1995082921020024](https://doi.org/10.1134/s1995082921020024)
Berg LS (1949) *Рыбы пресных вод СССР и сопредельных стран*. [Freshwater fishes of the U.S.S.R. and adjacent countries]. 4, 2. Izdatelstvo Akademii nauk SSSR, Leningrad, 456 pp. [In Russian].

Bogutskaya N, Hales J (2021) FEOW. https://www.few.org/ecoregions/details/428

Bogutskaya NG, Poznyak VG (1994) Redescription of *Leuciscus aphipsi* Aleksandrov (Leuciscinae, Cyprinidae). Voprosy Ikhtiologii 34 (3): 308-315.

Bogutskaya NG, Naseka AM (2002) Freshwater fish species list. Kuban. URL: https://www.zin.ru/animalia/pisces/rus/taxbase_r/fauna_r/srchresultreg_r.asp?region=K

Freyhof J, Pipoyan S, Mustafayev N, brahimov S, Japoshvili B, Sedighi O, Levin B, Pashkov A, Turan D (2020) Freshwater fish and lampreys of the Caucasus. In: Zazanashvili N, Garforth M, Bitsadze M (Eds) Ecoregional Conservation Plan for the Caucasus, 2020 Edition: Supplementary Reports. WWF, KfW, Tbilisi. 97-105 pp.

Kupriyanov VV (Ed.) (1973) *Ресурсы поверхностных вод СССР*. [Resources of surface waters of the USSR]. 8. North Caucasus. Gidrometeoizdat, Leningrad, 446 pp. [In Russian].

Levin B, Gandlin A, Simonov E, Levina M, Barmintseva A, Japoshvili B, Mugue N, Mumladze L, Mustafayev NJ, Pashkov A, Roubenyan H, Shapovalov M, Doadrio I (2019) Phylogeny, phylogeography and hybridization of Caucasian barbels of the genus *Barbus* (Actinopterygii, Cyprinidae). Molecular Phylogenetics and Evolution 135: 31-44. https://doi.org/10.1016/j.ympev.2019.02.025

Levin BA, Simonov EP, Ermakov OA, Levina MA, Interesova EA, Kovalchuk OM, Malinina YA, Mamilov NS, Mustafayev NJ, Pilin DV, Pozdeev IV, Prostakov NI, Roubenyan HR, Titov SV, Vekhov DA (2017) Phylogeny and phylogeography of the roaches, genus *Rutilus* (Cyprinidae), at the Eastern part of its range as inferred from mtDNA analysis. Hydrobiologia 788 (1): 33-46. https://doi.org/10.1007/s10750-016-2984-3

Mischenko MV (2019) Reduction of the number, species diversity of fishes in river Kuban. In: Mamas’ NN (Ed.) Ecology of river landscapes. III International Scientific Ecological Conference, Krasnodar. 213-221 pp.

Moskul GA (1998) *Рыбы водоемов бассейна Кубани (определитель)*. KrasNIIRKH, Krasnodar, 177 pp. [In Russian].

Moskul GA, Kovalenko YI, Pashinova NG, Bolkunov OA (2012) Current status and prospects for fisheries use of the Azov-Kubanian limans. Modern Fisheries and Ecological Problems of the Azov-Black Sea Region, Kerch, 20-23 June 2012. [In Russian].

Naseka AM, Bogutskaya NG (1998) A new gudgeon species *Romanogobio pentatrichus* (Gobioninae, Cyprinidae) from the basin of the Kuban River. Voprosy Ikhtiologii 38 (2): 173-181.

Naseka AM, Freyhof J (2004) *Romanogobio parvus*, a new gudgeon from River Kuban, southern Russia (Cyprinidae, Gobioninae). Ichthyological Exploration of Freshwaters 15 (1): 17-24.

Naseka AM (2010) Zoogeographical freshwater divisions of the Caucasus as a part of the West Asian Transitional Region. Proceedings of the Zoological Institute RAS 314 (4): 469-492.

Pogorelov AV, Laguta AA (2019) Krasnodar Reservoir: state and transformation during the period of exploitation [Краснодарское водохранилище: состояние и
трансформация за период эксплуатации]. Regional Geographic Research [Региональные географические исследования] (2)34-42. [In Russian].

- Polin AA, Strelchenko OV (2018) Species composition, dynamics of the fish population, fish ladder transplanted Krasnodar Reservoir in 2017. In: Bogachev AN, Belousov VN, Kornienko GG, Boyko NE (Eds) Topical issues of fishing, fish farming (aquaculture), ecological monitoring of aquatic ecosystems. Materials of the International Scientific, Practical Conference dedicated to the 90th anniversary of the Azov Research Institute of Fisheries. 206-210 pp. [In Russian].

- Polin AA, Strelchenko OV (2019) Species composition, dynamics of the fish population, fish ladder transplanted Krasnodar Reservoir in 2018. In: Belousov VN (Ed.) Proceedings of AzNIIRKH. 80-84 pp. [In Russian].

- Poznyak VG (1987) Fauna of Kalmykia. Fishes. Животный мир Калмыкии. Рыбы. Kalmytskoye Knizhnoye Izdatelstvo, Elista, 58 pp. [In Russia].

- Rylková K, Kalous L, Bohlen J, Lamatsch D, Petrtylí M (2013) Phylogeny and biogeographic history of the cyprinid fish genus Carassius (Teleostei: Cyprinidae) with focus on natural and anthropogenic arrivals in Europe. Aquaculture 13-20. https://doi.org/10.1016/j.aquaculture.2012.11.027

- Šimková A, Hyršl P, Halačka K, Vetešník L (2015) Physiological and condition-related traits in the gynogenetic-sexual Carassius auratus complex: different investments promoting the coexistence of two reproductive forms? BMC Evolutionary Biology 15 (1). https://doi.org/10.1186/s12862-015-0438-6

- Sukhanova ER, Troitskiy SK (1949) Ichthyofauna at the sites of spawning of Vimba bream and Bleak in Psecups river. Proceedings of the fish-biological laboratory AZCHERRYBVOD (1)151-181. [In Russian].

- Tamanskaya GG, Troitskiy SK (1957) Ichthyofauna and fishery significance of the Belaya River (Kuban River Basin). Proceedings of Fish-Breeding Biological Laboratory of AZCHERGOSRYBVOD (2)163-174. [In Russian].

- Troitskiy SK, Tsunikova EP (1988) Рыбы бассейнов нижнего Дона и Кубани. [Fish of basins of lower Don and Kuban]. Rostov Publishing House, Rostov-on-Don, 112 pp. [In Russian].

- Vasil'eva ED, Vasil'ev VP, Kuga TI (2004) On taxonomy of gudgeons of the genus Gobio (Gobioninae, Cyprinidae) of Europe: a new species of gudgeon Gobio kubanicus sp. nova from the Kuban River Basin. Voprosy Ikhtiologii 44 (6): 766-78.

- Vekhov DA (2013) Some problematic issues of biology goldfish Carassius auratus s. lato. Scientific and Technical Bulletin of Laboratory of Ichthyology INENKO (19)5-38. [In Russian].

- Wouters J, Janson S, Lusková V, Olsén KH (2012) Molecular identification of hybrids of the invasive gibel carp Carassius auratus gibelio and crucian carp Carassius carassius in Swedish waters. Journal of Fish Biology 80 (7): 2595-2604. https://doi.org/10.1111/j.1095-8649.2012.03312.x