

About the Biological Diversity of Inland Water Ecosystems in Azerbaijan

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The article presents the number of species by groups registered by individual researchers in inland waters of the country (springs, rivers, reservoirs, lakes, etc.). Detailed information on the most common and dominant species in our water resources, their role in the ecosystem, etc. are provided. Since the beginning of scientific and zoological research, more than 1000 species of protozoan animals (mainly ciliated infusoria), more than 1350 species of invertebrate animals (mainly rotatory (more than 300 species) and insect larvae (more than 586 species)), 190 species of vertebrates [mainly birds (97 species) and fish (67 + 1 species) and 332 species of fish parasites (mainly myxosea (59 species), flatworms (69 species) and trematodes (81 species))] have been revealed. Indicating the species number of hydrobionts, will be changed as a result of future studies, since some groups of hydrabionts still remain unexplored, or only 1-2 species were accidentally recorded in the study. In addition to unicellular animals, cervical worms, nematodes, crustaceans, tusks, and other insect larvae can be included.

Keywords: *Water resources of Azerbaijan, biodiversity, Protozoa, invertebrates, vertebrates*

INTRODUCTION

Despite our country owns the least water resources among the countries of the South Caucasus, it is in a leading position in the region in terms of importance, wealth and study level of hidrofauuna formed in its watercourses. It is likely due to the the extent of the countries territory, its natural wealth, landscape and climate diversity, availability of highly qualified national experts and their skills.

Also the richness of the rivers of Kura and Araz as well as the Caspian Sea are the most important factors contributing to this process. That is why since far from the past, Azerbaijan was in the loop of the various travelers (english, russian, french, german, dutch, etc) of the leading countries, and the similar situation occurs our days. Along with the underground and surface resources of Azerbaijan, the valuable living nature of the Caspian sea do consist of this interest's base.

There are more than 8350 small and large rivers on the territory of the country (Kura, Araz, Arpachay, Tartarchay, Hakichay, Lenkoranchay, Girdimançay, Ganix, Gabirry, Tala, Gangachay, Aghsuchay, Goychay, Astarachay, Mazımchay, Aghstafachay, Katexchay etc.), more than 800 lakes and confined water courses (Geygel, Maralgel, Garagel, Alagels', Aghgel, Mehman, the network of the Sarisu lakes, Hacıgabul, Mahmudchala, Aghchala, Acınohur, Jandar, Masazır, Mirzaladi,

Boyükhshor, Batabat lakes and confined watercourses etc.), formed ponds in the vicinity of the Kura and Araz (Aynalı, Garaoghlan, Yetim Kura, Marzli, Varvara, Ganikh, Mammadzamanlı etc.), more than 100 water reservoirs (Mıngechaur, Shamkir, Varvara, Araz (Nakhchivan), Uzunoba, Nehram, Ashıgbayramlı, Yekakhana, Arpachay, Aghstafachay, Shamkirchay, Tahtakorpu, Jeyranbatan, Khanbulanchay, Vilash, Behramtepe water junction etc.), more than 60km of irrigation canals (upper Shirvan, upper Garabagh highway canals etc.) and here is a drainage system, generating and a close the network.

The majority (7900) of our rivers are short (Rustamov, 1960) with lenth which less than 10km, when only 24 rivers are longer than 100km. Most of our small rivers are formed within the country territories, when the hugest and transboundary rivers (Kura and Araz and others) are formed and subjected to a strong human within the 3-5 countries those are crossing through and are.

The biggest parts of the Caucasus's largest rivers before they reach the Caspian sea are located within the Azerbaijany territory and are of the huge fishery importance. So, these rivers are the most valuable fish breeding and development locations of the Caspian.

The greatest lakes of the country (Aghgol, Sarysu lakes systems, Mehman, Hacıgabul, Mahmudchala, Mehman, Alagels, Gey-gel, Maralgel) and dozens small size lakes and ponds (Aynalı,

Garaoghlan, Marzli an others.) are the important fishery facilities.

Scaly fishes are habiting in the ponds and lakes, when also the caspian salmon and sturgeon fish species beside to the scaly species do exist in the downstream of the rivers directly connected with the Caspian sea.

The followings are the water reservoirs with the huge fishery importance and the significant watercourses forming the fish and water reservs of our country: Mingechaur water reservoir (WR) - built on the river Kura (functioning since 1953), Varvara wr (since 1956), Shamkir WR (since 1982), Araz WR (or Nakhchivan) built jointly with the government of Iran Islamic Republic on the river Araz (since 1972), Sarsang WR (since 1976) built on the Tartar river, Arpachay WR (since 1970) built on Arpachay river, Agstafachay WR (since 1970) built on the Agstafachay river, Ashygbayramly WR (since 1953) built on the Devebatan river, the water reservoirs Yekakhana and dozens of other small size ones (Kondalanchay, Nohurghislaq, Javanshir, Khanbulanchay etc.).

Both of the natural (rivers, lakes, ponds etc.) and human made (water reservoirs, canals, swimming pools, artificial lakes, etc) are characterized with rich flora and fauna along with thier fish resources. In this respect, regardless of its size, strength and origin each water course is considered as standalone ecosystem.

The study of inland water ecosystems of the Republic is settled in a leading position among the countries of the Caucasus (not only the Southern Caucasus). More than 600 (some sources indicate 750) single-celled animal species and (mostly infuzorlar) and more than 1500 species of (data might vary by $\pm 1-3\%$) invertebrate animals are currently registered in the fresh water basins hydrofauna.

The key place (more than 500-600 species) belongs to Ciliata - free-living infuzors (Oligohymenophorea) as per living in the natural water basins and biodiversity. The following groups are *Rotatoria* (more than 200-300 species), *Chironomidae* (up to 150 species), *Cladocera* (up to 95-126 species), insects (124 species), the annelids (109 species), *Odonata* lavraes (more than 60 species), *Copepoda* (60 species), Molluscs (63 species), *Phryganeidae* (45 species), mayfly lavraes (40 species), *Plecoptera* lavraes (up to 32 species), other *Diptera* lavraes (more than 150 species), ostracodes (19 species), *Hirudinea* (15 species), *Anostraca* (5 species), isopods (3 species), triops (2 species), mysids (2 species) and *Tardigrada* (3 species) etc.

Among the listed main components of the water ecosystems the comparatively deeper inves-

tigated (i.e. with identified species composition) gropus are *Oligohymenophorea* - free living infuzors (A.R.Aliev 1971-2012 years; I.Kh.Alekperov, 1972-2014 yeras), annelids (A.H. Gasimov, 1965), *Rotatoria* species (A.H.Gasimov, 1972), *Entomostraca* (A.N.Alizadeh, 1940, N.Talibov, 1965, I.Akhmedov 1971), *Anostraca* (A.R.Aliev, K.Tapdigova, 2014), *Chironomidae* (A.H.Gasimov, 1965, Z.Abdurrahmanova 1982).

Other groups of the partucular importance - hirudineas, tardigradas, mayflies, trichopteras, plecopteras and others are still awaiting own investigators. That is why the special investigations towards this direction is one of the nearest future targets. And the investigation researchers still conducting research in this direction is and will be one of the main targets of the nearest future!

And now let us seperately review the groups which are attractive from the formation of biodiversity and in freshwater ecosystems.

To be noted that the species composition during the hydrobiological studies till now were highlighting peculiarities of mostly investigated species from food (as fish feed) perspective rather than from their theoretical value. That is a reason why the organismz amount (number or biomass) per the definite single territory or volume was in a forefront during the hydrobiological studies until the recent times. But now the main focus of the reserches are population number, their structure, the ratio of individuals etc. As a hidrobiological research object of the coutries fresh water ecosystems, the animals of three large groups of two differing from each other by their structure and life activities - semi-kingdoms (single-cellular and multicellular organizms) are most attractive. It includes the a single-celled, invertebrate and vertebrate animals. Via taking into account the animals natural development peculiarities we decided to start this review with the protozoa.

Protozoa semi-kingdom representatives are very widespread on the planet. Those are encountered in the seas and oceans, freshwater courses and land, and in the stage of cyst in atmosphere air, in animals - in the gaps between their organs and tissues. We intend to provide here a brief summary on the relatively detailed studied from species composition perspective group - free-living infuzors (*Oligohymenophora*) and other groups.

SINGLE-CELLULAR ORGANISMS SEMI-KINGDOM (PROTOZOA)

Currently, more than 200 thousand species of single-celled organisms are known and 20 thousand species of those are having parasites lifestyle.

I. Amoebas and Infusoria

More than 80 years have elapsed since the establishment of the Institute of Zoology of the Academy of Azerbaijan in 1936. Over the years, a number of scientific areas have emerged, not previously represented only in Azerbaijan, but also at the level of the former USSR. One of the firsts was the development of domestic protozoology, ichthyology, ornithology and other directions of Zoology.

Since then, the Institute of Zoology has been replaced by several generations of researchers who have contributed to the study of the animal world of Azerbaijan. It should be noted, however, that almost all of our scientists' publications have always focused only on their facilities and general articles, which gave an idea of the overall level of biodiversity in the animal world, have not yet been published.

In this paper, we have tried to combine the current results of many years of research into the most successful areas of domestic zoology-protozoology, parasitology, hydrobiology, as well as herpetology, ornithology and others. Accordingly, each of these sections is written by experts in these groups.

At present, some 200 thousand are known. The simplest organisms, of which more than 20 thousand lead a parasitic way of life, including by causing and being carriers of dangerous diseases of animals and humans. No less species diversity and importance are free-living basic inlands in the seas, fresh waters and soils. Of the 200 thousand protozoa species today the 40,000 are the inhabitants of the seas and the oceans. Their role in the Earth's biological processes is enormous. Researches were carried out primarily on parasitic groups of the simplest - Coccidias. Different groups of animals-primarily rodents-were surveyed, of which 22 were found in only 125 species of *Coccidia*, 86 of which were described for the first time for science.

Data on free-living protozoans of Azerbaijan in the works of early authors is extremely small. The main source of literature is the chubar of S.Ya.Veisig (1940) "Microfauna of the Caucasus". In summing up the early authors, it is possible to say that before the modern period of research from the marine and freshwater waters of Azerbaijan, only 85 species of infusoria and 43 species of amoebas, both nude and sink, were known. The beginning of the current period of study free-living the simplest in Azerbaijan laid down the work of Agamaliyev on the Infuzoria of the Caspian Sea, which began in the mid-1960s. His multi-year studies have expanded our knowledge of the free-living infusorias of the Caspian - if only a few species were known according to the data of Grimm and

Veisig, then a monograph of Agamaliyev, "The infuzoria of the Caspian sea", published in 1983, lists 439 species, of which 1 genus and 20 species were described for the first time in science. In the 1980s, several more complex studies were conducted on the simplest pedobiontov of several taxonomic groups (flagellates, amoebas, infusoria). The simplest soils of citrus groves in Lankaran (R. Ibadov, 1983) and cultivated soils in Apsheron (N. Mirza-Zadeh, 1989) were investigated. It should be noted that these work are largely not fauna, but the environmental nature of the protozoa-pedobionts studies.

Since 1986, Azerbaijan has for the first time conducted a special study of soil shells amoebas. In the forest soils of northwest Azerbaijan, a total of 93 species of testacid were found, of which 39 species were first registered for the Caucasus fauna and 66 species for the fauna of Azerbaijan. In the 1970s, several complex hydrobiological studies were carried out (Aliyev, 1971, 1990) microbentos of freshwaters, where, along with other hydrobionts groups, free-living eat, of which about 20 species were first described for science.

However, the special studies of infusoria in water reservoirs of Azerbaijan were started by Alekperov in 1972. The taxonomic results of these years of work were published in 2005 in his monograph - "Atlas of free-living infusoria" which, on the basis of modern PAP methods impregnation silver, shows the illustrated descriptions of 230 infusoria species, of which 2 families, 8 genera and 90 species were described for the first time. A full summary of the results of 40-year studies on the species diversity of marine, freshwater and soil infusoria of Azerbaijan and other regions of the world, as well as environmental studies, including the use of some types of infusoria for biotesting at the cellular and population levels, were summarized in the second monograph - "Free-living infusorias of Azerbaijan" of Alekperov published in 2012. At present, our research on the species diversity of the free-living Infusoria of Azerbaijan is estimated at about 750 species, and for the first time, 3 families, 11 genera and 104 species were described for science. After more than 60 years break, at the beginning of the new millennium, studies of the freshwater sinks of the amoebas of Azerbaijan were resumed and the results showed the high diversity of the group. The fauna of the testacid freshwater of Azerbaijan is now represented by more than 120 species, of which two families, eight genera and 47 species were first described for science (N. Snegovaya, I. Alekperov, 2005).

Thus, the multiyear research of the Azerbaijani protozoologists, both in the field of parasitic protozoologii and in the study of the free-living simplest

have made a great and recognized contribution to the study of the biodiversity of the simplest, the best evidence of the 86 of new species in the Coccidia, as well as 5 families, 18 genera and 176 new types of free-living infusoria and shell amoebas.

Natural water basins of a free-living ciliates (*Ciliata*). As mentioned above, there is no water course where no infusoria representative (species) is found during the various seasons of the year or various temperature conditions any representatives not found (species) ciliates tutarı ahead. In freshwaters of Azerbaijan more than 600 infusoria species were recorded, of them 30 species are described for the science for the first time (A.Aliyev, 1987, 1990, 1991 and others). The following infusors are taken the key role in forming the biodiversity accordingly in various ecosystems: in stagnant watercourses, primarily lakes and ponds – the representatives of the genera *Coleps*, *Lacrymaria*, *Holophrya*, *Spirostomum*, *Metopus*, *Paramecium*, *Frontonia*, *Euplotes*, *Oxytricha*, in flowing watercourses – rivers springs the representatives of genera *Nassula*, *Zosterodasys*, *Euplotes* etc. are having the predominant development. *Paramecium caudatum*, *P.dragescoi*, *Frontonia leucas*, *F.acuminata*, *Spirostomum teres*, *S. minus*, *Metopus es*, *M. are frequently found in our fauna*.

Not only in water ecosystems, also in all inhabiting environment the infusors play key role in matter and energy cycle, in restoration of environments natural quality and forming of natural-biological indicators of it. There are many species with economic and epidemiological value among them - *Paramecium Frontonia Euplotes, Condilostoma, Metopus and a number of other species*.

MULTI- CELLULAR ORGANISMS SEMI-KINGDOM (METAZOA)

II. Invertebrates (*Invertebrata*). This group's species covers more than 98% of all animals. It is one of the main components of water-course hydrofauna and the representatives are formed in 20-30 groups. This figure varies depending on the type, features of watercourses as well as the water chemical composition. They play key role in energy flow in ecosystems, food chain, in forming of qualitative indicators of water and in its saprobic performance etc. .

Now let us go through some stand alone groups:

1. Sponges (*Porifera*) – no special research studies were conducted on this group, has been investigated not deeply. Three species (*Spongilla lacustris*, *S.carteri*, *Ephydatia fluviatilis*) were registered in watercourses (Derjavin, 1951; Gasimov, 1972).

Playing role in the energy exchange. These are active filtrators of water in the environment. Climate activists filtratorlarıdır water.

2. Coelenterates (*Coelenterata*) – no special research studies were conducted on this group as well. 3-4 species are known in our fauna. The majority of them were registered during the hydrobiological surveys. In stagnant waters *Hidra oligactis* və *H.vulgaris* are common inhabitants. *Microhydra sowerbii* is spread in Kura river and Jandar lake (Gasimov, 1972, 2002). Has a rol in food chain and biological treatment of the water.

3. Turbellaria – despite being very important component of mountain rivers' ecosystems the species composition of this group is studies very weak. In water courses (particularly in river mountains) five species (*Dugesia gonocephala*, *D.polychroa*, *Dendrocoelum lacteum*, *Mesostoma productum*, *Microstomum lineare*) and three subspecies (*Dugesia g.transcaucasica*, *D.g.bakurianica*, *D.g.praecaucasica*) were registered (Gasimov, 1972, 2002). It is spread on the stones and plants in the stony biotopes rich with water plants. The widespread species is *Dugesia gonocephala* (Animal world of Azerbaijan, 2002).

4. Hairybacks (*Gastrotricha*) – not deeply studied group of the watercourses microfauna. Only two species (*Polymerus nodicaudus* və *Lepidoderma aguamata*) are registered (Aliyev, 1971) in freshwaters of our country, particularly in the areas rich with plant in Jeyranbatan water reservoir. Mostly found in plant communities with sphagnum.

5. Nematods (*Nematoda*) – are free-living mesobentic organisms. No specific reserches were conducted on this group in the freshwaters of the country. Three species in total (*Tripula papillata*, *Rhabdolaimus aquaticus*, *Diplogaster rivalis*) were registered (Aliyev, 1971) during the reserch studies conducted at microbentos Jeyranbatan water reservoir. Also as per info of A.Gasimov (1972) two species (*Tripula papillata* and *Dorilamus stagnalis*) were found in Khalifachay river in the vicinity of Shusha city. So, four species of this group is known from our country. In 1970s a resercher so called Sakharova conducted special reserch studies in this direction in Mingechaur water reservoir, however we have no info in species composition.

6. Oligochaetes (*Oligochaeta*) – an important component of water ecosystems, plays role in fish food, forming of soil and biological treatment of the water. 90-109 species were registered in waters of Azerbaijan. (Gasimov, 1965, 1972, Animal world of Azerbaijan, 2002; Aliyev, 1971, 2010). The widespread species are from the genera of *Stylaria*, *Nais*, *Chaetogaster*, *Limnodrilus*, *Tubifex*

etc. Playing role in matter and energy cycle as well as the saprobic conditions determination in the environment.

7. Leeches (*Hirudinea*) – no special research studies were conducted on this group. 15 (± 2) species were registered in our water courses (Animal world of Azerbaijan, 2002). The most common species are *Haementeria costata* and *Hirudo medicinalis* and close to them species. Currently (2017) experiments are being conducted for reproduction of medical leeches (*H.m.orientalis*) in the lab conditions. The results were promising.

8. Rotatoria – is the multi-species group of the plankton - organisms living in the water columns. More than 289 species (300 species) have been registered in Azerbaijan (Gasimov, 1984). From species number perspective *Barchionus* (33 species), *Trichocerca* (27 species), *Lecane* (26 species) *Keratella* (10 species) and other genera are differing. *Rotatorias* have a role in ecosystem's food chain, matter and energy exchange.

9. Molluscs (*Mollusca*) – so far 63 species (in some sources 47 species) were registered in Azerbaijani waters. Most of these species belong to gastropods ($\approx 85\%$), the some (12-15%) to bivalves (Gasimov, 1972, Animal world of Azerbaijan, 2002). The widespread species are from the genera *Lymnaea* (25 species), *Costatella*, *Planorbis*, *Theodoxus*, *Melanopsis*, *Unio*, *Anodonta*, *Corbicula* etc. This group species are contributors to the ecosystem's matter and energy exchange, water purification and to reproduction of parasite worms. Many species are of economic value.

10. Briozoa – species composition has been poorly investigated and consist of only four species (Animal world of Azerbaijan, 2002). *Plumatella fungosa* və *P.punctata*, *P.emarginata* are frequently encountered in republic water bodies.

11. Anostraca – representatives are widespread in salty waters. 5 species (Animal world of Azerbaijan, 2002) are inhabiting in Azerbaijan. *A.salina* species of *Artemia* genus is the key species which is the permanent inhabitant of salty and hyperthick water bodies. *Branchinecta media* and *Branchinecta ferox*- species are also specific to salty lakes in Absheron. *Chirocephalus skorikowi* and *Ch.weisigi* are endemics of the Caucasus. This group representatives are having a role in biological purification of the environment, matter and energy exchange. *A.salina* cancer is considered as the most valuable organic food in aquaculture.

12. Notostraca - poorly investigated group with two species (*Triopis concoloriformis* and *T.c.transcaucasicus*) in water bodies. The latter is the endemic of the Caucasus (Gasimov, 2002). Molluscs are having a role in biological purification of the environment, matter and energy exchange.

13. Water fleas (*Cladocera*) – are the plankton species and represented by 95-126 species in country water bodies (Animal world of Azerbaijan, 2004). *Daphnia magna*, *D.longispina*, *Simocephalus vetulus*, *Chidorus sphaericus* are the predominant species. From the tropic species *Diaphanosoma sarsi*, *D.atkinsoni*, *D.carinata*, *Ceriodaphnia reticulata*, *C.coronata*, *Macrothrix spinosa*, *Chidorus barroisi* and others widespread in our water bodies. **Water fleas are developing in our water bodies massively and are the main main food for fish.**

14. Copepods (*Copepoda*) – are one of the significant components of planktonic community Planktonik and are represented by 60 species from 3 orders - *Calanipeda*, *Cyclopeoidea* and *Harpacticoida*. In terms of biodiversity the order *Cyclopoida* with its 43 species comes first and is being followed by orders *Calanipeda* (14 species) and *Harpacticoida* (6 species). The widespread species in our water bodies belong to genera *Calanipeda* (predominant species is *C.aqual-dulsis*), *Sinodiaptomus*, *Acantocyclops* and *Cyclops*. *Sinodiaptomus sarsi* is widespread in water bodies of plains, *Hemidiaptomus monticola* (an endemic species of Azerbaijan) of mountains, şortəhər sulu göllərdə isə *Arctodiaptomus salinus* is widespread in medium salty lakes (Animal world of Azerbaijan, 2004). Copepods are contributors to the ecosystem's matter and energy exchange, water purification and to reproduction of some parasite worms.

15. Ostracodes (*Ostracoda*) – 19 species are registered in Azerbaijani water bodies. The dominant species are from genera *Ilyocypris* (*I.biplicata*, *I.getica*, *I.gibba*), *Cypris* (*C.bispinosa*, *C.pubera*), *Cyclocypris* (*C.ovum*), *Limnocytera* (*L.inopinata*, *L.stationis*). Ostracodes are contributors to the ecosystem's matter and energy exchange (Animal world of Azerbaijan, 2004).

16. Mysids (*Mysidacea*) – 2 species (*Paramysis lacustris* and *Lymnomyxis benedeni*) exist in freshwater courses. It is one of the poorly investigated groups. Mysids are having role in energy and matter exchange of ecosystems. the weak. Water basin in matter and energy in the role.

17. Isopods (*Isopoda*) – 3 species (*Asellus aquaticus*, *A.monticola*, *A.infirmis*) are registered in our water bodies (Animal world of Azerbaijan, 2004). Isopods are having role in biodiversity and food chain. *A.aquaticus* is the aquaculture object.

18. Amphipods (*Amphipoda*) – are represented by 32 species in our freshwater courses (Aliyev, 2000). Species of genera *Gammarus* and *Pontogammarus* are the predominant ones. The amphipods of freshwater courses are originated from the autochthonous species of the Caspian sea (*Gammarus matienus*, *G.komareki*, *Synurella*

apscheronica, *Pontogammarus sarsi*, *P.robustoides*, *Dikerogammarus haemobaphes*), endemics of the Caucasus (*Niphargus abricossovi*, *N.komareki araxensis*) and Azerbaijan (*Gammarus balkanicus talysahensis*, *Lyurella hyrcana*, *Synurella apscheronica* vø b.). Amphipods play a significant role in ecosystem, biodiversity, and food chain and are widely used in aquacultures.

19. Decapods - (Decapoda) – are represented by up to 10 species in water courses, rivers, lakes, water reservoirs (Gasimov, 1972, Animal world of Azerbaijan, 2004). The key species are (*Astacus leptodactylus*, *A.pylzowi*), shrimps (*Paleomon adspersus*, *P.elegans* and some forms), crumps (*Potamon magnum*, *P.albanicum*, *P.ibericum* etc.). *A.pylzowi* is an endemic species. The most of the species of high crustaceans resistered in azerbaijani waters are of economic importance.

20. Tardigrades - (Tardigrada) – 3 species were regsieterd in the middle of the 20th centry–*Macrobotus hufelandi*, *Milnesium tardigradum* and *Macrobotus* sp. (Animal world of Azerbaijan, 2004; Aliyev, 1971). Uncommon organizms physically tolerant to high radiation (570000 x-ray) and maximum dehydration (up to 99 %), and may stay in long time anabiosis. Currently world wide reserch extensive studies (endurance to genetic and deteriorating conditions) are being conducted on these group representatives.

21. Mayfly larvae (Ephemeroptera, larva) – 40 species (33 larvae species, 7 adult species) are registered in water courses (Animal world of Azerbaijan, 2004). The widespread specieas are: *Isonychia ignota*, *Ameletus inopinatus*, *Syphlonurus linnaeus*, *Ordella macrura*, *Caenis macrura*, *Palingenia fluginosa*, *Ephemera vulgata*, *Potomanthus eluteus*, *Cloeon dipterum* etc. Among the mayfly larvae *Ecdyonurus znojkoii*, *E.flater*, *E.ornatipennis*, *Cinugra caucasis*, *Iron zojkoi* are the endemic species for the Caucasus. The group representatives are significant parts of food chain and matter exchange.

22. Dragonflies larvae Odonata, larva) –60 species were registered in our water courses, of them only 41 species were found in the waters of Lenkoran natural province (Animal world of Azerbaijan, 2004). The widespread species of Republic's water bodies are – *Ischnura elegans*, *I.pumilio*, *Coenagrion concinnum*, *C.hastulatum*, *C.pulchellum*, *C.puella*, *C.scitulum*, *Anax imperator*, *Orthetrum brunneum* etc. Are valuble organizms and food for birds and reptiles. Are feeding on the trees during the mature/adult stage.

23. Stoneflies (Plecoptera, larva) – 32 species were registered (Animal world of Azerbaijan, 2004). Are inhabitants of pure water courses with lower temperature and rich O₂ conditions –

particularly in mountain rivers, stony biotopes. *Perla pallida*, *Isoperla caucasica*, *Chloroperla tripunctata*, *Ch.grammatica* etc. Are widespread in mountain rivers. More than 60% (about 20 species) of stoneflies registered in Azerbaijan are endemics of the Caucasus. This includes *Perla kiritshenkovi*, *P.caucasica*, *P.pallida*, *Isoperla caucasica*, *I.pulchra*, *Chloroperla tripunctata*, *Ch.teberdinica*, *Ch.grammatica*, *Leuctra minuta*, *L.simplex*, *Nemura brevipennis*, *Protonemura bitida*, *P.alti cola*, *P.vernalis*, *P.viridis*, *Capnia arensi*, *C.tyberculata*, *Esera caucasica* etc.. Stonflies have significant role in ecosystem's food chain and are indicators to determine the level of water contaminatin by organic substances.

24. Caddisfly larvae (Trichoptera, larva) – 45 species were registered in internal water bodies (Animal world of Azerbaijan, 2004), are inhabitants of mountain rivers and springs.

Are encountererd in stagnant and pure water bodies, mostly rheophilic species. The most common species are: *Ryacophila talyschica*, *Hydropsyche gracilis*, *H.ornatula*, *H.acuta*, *Ecnomus tenellus*, *Limnophilus affinis*, *L.znojkoii*, *L.fluvicornis* etc. *Psychomia shelkovnikovi*, *Cyrnus trimaculatus* species are dominating in small rivers in the territory of the Gey-Gel Natioanal Park, when *Polycentropus flavomaculatus*, *Hydropsyche pellicidula* species are dominating by number in the rivers of the Greater Caucasus. 14 of the registered species (*Ryacophila talyschica*, *Rh.cupressorum*, *Glossosoma unquiculatum*, *G.capitatum*, *Hydropsyche acuta*, *H.gracilis*, *H.subguttata*, *Lithax incanus*, *Ernodes palpata*, *Lymnophilus flavicornis*, *L.znojkoii*, *Glyphotaelius selysi*, *Psiloptera perzovi*, *Micrasema bifoliatum*) in Azerbaijan territory are the endemics of the Caucasus. As an indicator of the clean waters this group also has a role in ecosystem's matter and energy exchange.

25. True bugs (Hemiptera). 870 species of 23 families are known in fauna of Azerbaijan (Animal world of Azerbaijan, 2004). 30 species (*Corixidae*, *Nepidae*, *Naucoridae*, *Aphelochiridae*, *Pleidae*, *Hydrometridae*, *Vellidae*, *Gerridae*) of 8 families (Gasimov,1972) were registered in the water courses. No special studies were conducted over the species inhabiting the water bodies. The up to date species number (30 species) of this group has been established based on the materials collected during the hidrobiological surveys. The most common species of our watercourses are: *Corixa punctata*, *C.dentipes*, *C.affinis*, *Notonecta glauca*, *N.lutea*, *N.viridis*, *Nepa cinerea*, *Ranatra linearis*, *Hydrometra stagnorum*, *Gerris Lacustris*, *G.thoracicus*, *Limnopus rufoscutellatus*, *Aquarius paludum*. The group representatives as one of the

links in food chain are contributing to matter and energy exchange.

26. Beetles (Coleoptera). 4000 species are known in Azerbaijan (Animal world of Azerbaijan, 2004), of them 124 are registered in larvae and mature stages in watercourses (Gasimov, 1972). All known species belong to 6 families (*Halplidae*, *Ditiscidae*, *Girinidae*, *Hydrophilidae*, *Dryopidae*, *Chrysomelidae*) (Gasimov, 1972). Those are reaching their mass development in the parts rich with water plants in mostly stagnant waters. These species are frequently encountered in the lakes and ponds along the Kura river as well as in watercourses of the Lenkoran natural province. Su tutarlarımızda rast gəlmə intensivliyinə görə (*Halplus ruficollis*, *H. fluviatilis*, *H. flavicollis*, *Noterus clavicornis*, *Laccophilus hyalinus*, *L. minutus*, *L. variegatus*, *Hydrovatus cuspidatus*, *Hydroporus planus*, *H. palustris*, *H. tessellatus*, *Cybister lateralis marginalis*, *C. tripunctatus*, *Gyrinus columbus*, *G. minutus*, *G. caspius*, *Hydrous piscus*, *Enochrus testaceus*, *Laccobius pallidissimus*, *Heteroserus flavidus* etc.) are the in leading position in terms of encountering intensity in the watercourses. Most of the larvae have predator type of life. Group representatives play role in productivity of watercourses, as well as in matter and energy exchange.

27. True flies (Diptera) – has got reach species composition in the watercourses' ecosystems and the most important families encountered during the hydrobiological surveys are: - biting midges, black flies and chironomid larvae.

biting midges larvae (Ceratopogonidae, larva) were studied comprehensively by Sh. Jafarov (1964). More than 15 genera of this family were investigated. The most valuable genus in terms of hydrobiological peculiarities is *Culicoides*. 62 species were determined (Animal world of Azerbaijan, 2004). Most of the representatives in larvae stage in water habitat (wetlands) feed on detritus and decay, in mature stage suck the blood. These are the permanent inhabitants of the swamps/wetlands. The most common species are the following: *Culicoides nubiculosus*, *C. puncticollis*, *C. circumscriptus*, *C. salinarius*, *C. polycaris*, *C. picipennis*, *C. caspius* etc. The group representatives participants of ecosystem's matter and energy exchange and have an epidemiological importance.

Black flies, larvae (Simuliidae larva). 43 species have been determined in Azerbaijan. Key reproduction areas of them are in the Central Aran and Kura river valley. Feed on blood (sucks) in the stage of larvae, lead to sickness and mortality of cows, buffalos and other livestock. Key pests are kura black fly - *Simulium kurenze* and znoyka black fly - *Cnephia znoikoi* (Jafarov, 1960). The representatives of genera *Odagmia* (*Od. varegata*,

Od. caucasica, *Od. alasensis hiemalis*, *Od. monticola*) and *Obuchova* (*Ob. popovae*) predominate in the mountainous and lower zones of the Greater and Minor Caucasus, when in Talysh zone *Od. caucasica*, *Ob. popovae*, *Odagmia variegata* species are widespread (Animal world of Azerbaijan, 2004).

Nonbiting midges larvae (*Chironomidae larva*). This family has the highest species diversity among dipteras, 2000 species are known in globe, up to 150 species (basically 139 species) were identified in fresh waters of Azerbaijan, (Animal world of Azerbaijan, 2004) növü qeydə. Nonbiting midges larvae are the main components in the benthic community in the water bodies and have particular importance in the matter and energy exchange of the ecosystems. .

The massive reproduction of the following species were recorded accordingly in the indicated locations: *Cryptochironomus defectus*, *Psectrocladius psilopterus*, *Cricotopus silvestris* – in downstream of Kura river, *Tanytarsus gregarius*, *Chironomus plumosus*, *Ch. salinus*, *Einfeldia pagana*, *Limnochironomus nervosus* – in Hajigabul lake *C. mancus*, *M. lobatifrons*, *Glyptotendipes gripekoveni*, *Ch. plumosus*, *Diamesia longiper* – *Geoy-Geol*, *Harnischia burganadzeae*, *P. coniectum*, *P. scalaenumi*, *Procladius ferrugineus* etc. – Jeyranbatan water reservoir (Animal world of Azerbaijan, 2004; Aliyev, 1971).

10 species of the known *Chironomid* larvae from the republic's water bodies (*Tanytarsus sevanicus*, *Harnischia burganadzeae*, *Cryptochironomus pankratovae*, *Eukiefferella quadridentata*, *E. popovae*, *Synorthcladius murvanidzei* və s.) are the endemics of the Caucasus (Animal world of Azerbaijan, 2004).

Microzoobentos of the rivers. 248 species of microbenthic organisms form 25 taxonomic groups have been revealed from the waters of Azerbaijan. 160 species of 22 taxonomic groups have been registered from the Kura river. Of them 21 species belong to molluscs, 20 – to odonatas larvae, 16- oligochets and 15 to mayfly larvae.

95 macrobenthic organism species were determined from the Araz river and its branches. 79 species of them belong to water insects, and 19 to mollusks. The key position belongs to odonatas' larvae (11 species), mayfly larvae (10 species), Phryganea larvae (8 species) and others.

134 species of microbenthic organisms form 18 taxonomic groups were identified in rivers of Nakhchivan AR (Nakhchivan river – 77, Eastern Arpachay – 68, Salarsuchay – 27, Jahrichay river – 21, Bichanakchay – 35, Gilanchay – 55, Ordubadchay – 54, Eylisichay – 60). The sequence based on the encountering intensity of the revealed species

in the study watercourses is listed below: *Dero dorsalis*, *Ilyocypris getica*, *Dikerogammarus haemobaphes*, *Gammarus lacustris*, *Costatella acuta*, *Aplexa hypnorum*, *Agrion virgo*, *Coenagrion scitulum*, *Palingenia longiscauda*, *Ordella macrura*, *Micronecta pusilla*, *Hydrometra stagnorum*, *Hydropsyche ornatula*, *Leptocerus tineiformis*, *Culex pipiens*, *Tanutarsus gregarius*, *Chironomus thummi*, *Leptoconops caucasicus* etc.

The following macrobenthic organism were revealed in the rivers of the north-eastern zone of the Greater Caucasus (Gusarchay 49, Gudyalchay 44, Aghchay 50, Garachay 53, Velvelachay 29, Shabbranchay 28, Devachichay 34, Atachay 12, Gilgilchay 16). Molluscs, mayflies, and odonata larvae predominate in studied rivers.

The benthic fauna in the rivers of the north-western part of the Greater Caucasus (Alazan, Katekhchay, Kurmukchay, Eyrichay, Kishchay, Shinchay, Silbanchay, Balakanchay), of the southern part (Turyanchay, Vendamchay, Geoychay, Girdimanchay, Demiraparanchay, Bumchay, Akhsuchay, Akhokhchay) have been revealed. 60 species from the north-western zone rivers, and 102 species of benthic organisms were determined from the southern slope rivers. The species number varies between 32-64 in the rivers of the area. The sequence on species encountering frequency is the following: *Nais communus*, *Branchiura soverbyi*, *Hydrobia longiscata*, *Ecnomus tenellus*, *Hydropsyche ornatula*, *Limnophilus flavicornis*, *Leptocerus tineiformis*, *Oecetis furva*, *Procladius choereus*, etc. The literofil species are dominant in the rivers.

The revealed species numbers are shown accordingly per the rivers in the southern regions of Azerbaijan: - Astarachay 56 species, Lenkaranchay 64, Girdanichay 48, Veravulchay 42, Boladichay 54, Gumbashichay 68, Vilashchay 56 species of organisms. Most of the determined species in the rivers belong to and fito- and litoreofil types. 48 benthic organism species were identified in the Absheron-Gobustan region rivers (Jeyran-kechmezchay, Pirsaaatchay, Sumqayitchay). The species split is the following: 42 in Pirsaaatchay, 36 – in Sumqayitchay, 14 – in Jeyrankechmezchay. Stony habitat is dominating in the rivers.

Kurekchay, Terterchay, Hachinchay, Gargarachay, Injachay rivers flowing in the Karabakh volcanic plateau of the Lesser Caucasus, located in the of 114 species of organisms were found. The split of the found species per rivers is the next: Terterchay - 86 species, 94 species - Khichinchay, 74 species - Gargarachay, 80 species - Kurakchay, 66 species – Injachay. These rivers fauna is based on nonbiting midges larvae, trichopters, mayfly larvae, molluscs.

III. VERTEBRATA

Although vertebrates are inferior to unicellular organisms and invertebrates in terms of their biodiversity they have a significant economic importance and role in the ecosystem. There are representatives of all of their groups in our fauna. Along with sprat and sturgeon fish that are important for fisheries, cyclostomata can also be found in our water resources.

Pisces. One species of cyclostomata and 109 species and subspecies of fish were recorded in the domestic water basins of Azerbaijan (Ibrahimov, Mustafayev, 2015). 9 of the species [*Salmo ischchan*, *Carassius auratus gibelio*, *Pseudorasbora parva*, *Hemiculter leucisculus*, *Gambusia affinis*, *Gasterosteus aculeatus*, *Anguilla anguilla*, *Liza aurata* and *Liza saliens*] were brought either specifically or accidentally. At present, the internal water basins of Azerbaijan have Caspiomyzon wagneri and 67 species and subspecies of fish. 59 of them are of freshwater and 8 are of saltwater origin.

Petromyzontidae family. One representative of the *Petromyzontidae* family – *Caspiomyzon wagneri* lives in the waters of Azerbaijan. *Caspiomyzon wagneri* live in the sea, while mature individuals enter rivers to spawn. Biological indicators of the Kura population of the *Caspiomyzon wagneri* are much higher than those of the Lankaran population. Spawning of the *Caspiomyzon wagneri* occurs in May-June (Mustafayev, 2013).

Acipenseridae family. There are 4 species belonging to 2 genera of the *Acipenseridae* family in the internal water basins of Azerbaijan (lower Kura). One of them – *Acipenser nudiiventris* has been included in the Red List of Azerbaijan since 2013, while industrial hunting of others (*Huso huso*, *Acipenser persicus* and *Acipenser stellatus*) was suspended in 2010.

Salmonidae family. There are 2 species belonging to 1 genus of the *Salmonidae* family in the internal water basins of Azerbaijan. One species (*Salmo ischchan*) is an endemic fish of Lake Goycha. It was released to the mountain lakes of the Kalbajar region (Maral-gol, Boyuk Alagol and Kichik Alagol) in order to acclimatize in 1977-1980. Two years after their release to the lakes, their masses reached 500-700 g. Sex glands of female individuals hunted from Maral-gol in December was at the 4th stage of puberty. The fact that younglings were caught together with large fishes in subsequent years gave reason to believe that this species were adapted to new ecological conditions (Guliyev, 2006). The reserves of each of the 2 subspecies (*Salmo trutta fario* and *S. trutta caspius*) of the other species dropped sharply and they were included in the Red List of Azerbaijan.

Esocidae family. This family is represented by one species (*Esox lucius*) in Azerbaijan's fauna. This species is found in the lower streams of the great rivers and canals, flowing through the territory of Azerbaijan and directly into the Caspian Sea, as well as in the lakes around Kura, Varvara reservoir, Davachi port and Kichik Gizilagaj Gulf.

Cyprinidae family. Until recent years there have been information maintaining that 35 species and subspecies belonging to 22 genera of the *Cyprinidae* family were spread in the domestic water basins of Azerbaijan (Animal World of Azerbaijan, 2004).

Pseudorasbora parva and *Hemiculter leucisculus* that belong to this family were recorded our fauna in 2012 and 2013 respectively (Mustafayev, Ibrahimov, 2012; Mustafayev, 2013). Those species have been brought coincidentally during the acclimatization of herbivore fish in the waters of Azerbaijan and are very widespread today. Both species (especially *Pseudorasbora parva*) have a negative impact on fish resources, since they both compete for food with and eat caviar of the representatives of local fauna.

There are 37 species belonging to 24 genera of the *Cyprinidae* family in the internal water basins of Azerbaijan today. 5 of the species and subspecies (*Rutilus atropatenus*, *Luciobarbus capito*, *Pseudorasbora parva*, *L.brachycephalus caspius*, *Pelecus cultratus*, *Abramis sapa bergi*) were included in Azerbaijan's Red List. There are representatives of this family in almost all of the domestic water basins of Azerbaijan.

Balitoridae family. 3 species [*Barbatula angorae*, *B.merga* and *B.brandti*] and one subspecies [*B.a.lenkoranensis*] of 1 genus of this family are spread in the internal water basins. The *Balitoridae* are typically freshwater fish and live in rivers with rocky-gravel bottom and relatively fast flow.

Cobitidae family. There are representatives of 3 species (*Cobitis taenia satunini*, *Sabanejewia aurata* and *S.caspia*) of 2 genera of this family in the internal water basins. The *Cobitidae* that are typical freshwater species are spread in rivers, lakes around Kura, and reservoirs.

Siluridae family. One species (*Silurus glanis*) of this family inhabits the internal water basins of Azerbaijan. Both semi-anadromous populations and sedentary populations always living in freshwater can be found in Azerbaijan's water courses.

Gasterosteidae family. Representatives of 2 species (*Gasterosteus aculeatus* and *Pungitius platygaster*) of this family live in the Caspian Sea. In order to reproduce they also descend into rivers flowing from the territory of Azerbaijan and into the sea.

Syngnathidae family. This family is represented by one subspecies (*Syngnathus nigrolineatus*

caspius) in the Caspian Sea. *Syngnathus nigrolineatus caspius* is sea fish which approach estuary during the reproduction period. It can live in freshwater for a long time. This fishes are found in rivers flowing into the Caspian Sea, canal mouths, at the Davachi port and in the Kichik Gizilagaj Gulf.

Poeciliidae family. One species (*Gambusia affinis*) of this family was acclimatized in the water basins of Azerbaijan to fight malaria in the 1930s. It is one of the most widespread fishes in the country's inland water basins. It is spread in most water basins (rivers, lakes, water reservoirs, ponds, canals) that have a weak stream, vast plant development and those that became marshy areas.

Mugilidae family. Today young individuals of one of the species (*Liza aurata*) belonging to this family, which was brought into the Caspian Sea to get acclimatized in 1930s, can be found in on the mouths of rivers flowing into the Caspian Sea, at the Davachi port and in the Kichik Gizilagaj Gulf.

Atherinidae family. One species of this family (*Atherina boyeri caspia*) is widely spread in the Caspian Sea. Large quantities can be found in areas close to the coast. They inhabit mouths of the rivers that flow into the Caspian Sea, canal mouths, Davachi port and the Kichik Gizilagaj Gulf.

Percidae family. 2 species (*Perca fluviatilis* and *Sander lucioperca*) of 2 genera of this family can be found in the internal water basins of Azerbaijan. *Perca fluviatilis* is represented only by freshwater populations, while *Sander lucioperca* has both semi-anadromous and freshwater populations in Azerbaijan's the internal water basins.

Gobiidae family. Representatives of 6 species (*Knipowitschia caucasicus*, *Neogobius melanostomus*, *Neogobius platyrostris constructor*, *Neogobius fluviatilis pallasi*, *Neogobius kessleri gorlap*, *Proterorhinus marmoratus*) belonging to 3 genera of this family live in the Caspian Sea. Only one of them (*Neogobius platyrostris constructor*) is freshwater, remaining are saltwater fish. However, they also have populations living in freshwaters.

Part of the cyclostomata and fish spread in the domestic water basins of Azerbaijan are spread in the majority of the water basins, another part lives only in reservoirs in certain areas, while the third group inhabit mouths of the rivers that flow into the Caspian Sea. Therefore, in order to provide detailed information about the fish that live in watercourses isolated with different geographical barriers, Azerbaijan's inland water basins can be conditionally divided into 5 regions (Lower Kura, Middle Kura, Nakhchivan, Northeastern and Southeastern water basins). 56 of all species and subspecies are spread in the Lower Kura, 39 in the Middle Kura, 28 in Nakhchivan, 35 in Northeastern and 47 in Southeastern regions.

Biodiversity of fish parasites. Although fish parasites were first studied in Azerbaijan in 1931-1932 in the vicinity of Sara Island in the Caspian Sea (Dogel and Bihovskii, 1939), ichtioparasitological studies in inland waters only started in 1949 (Nechaeva, 1964), and then successfully continued by a number of researchers (Mikailov, 1958, 1975; Pashaev, 1970; Abdullaeva, 1971; Ibrahimov, 1977, 2012; N.Aghaeva, 1982; Gazieva, 1984; Mehdieva, 1993; B.Agayeva, 2003; Guliev, 2006; Suleymanova, 2007; Badalova, 2011; Abdullayeva, 2013, and others). Here, we will try to list the number of species and characteristic species of parasites in Azerbaijan's fauna recorded in the fishes living in the country's water reservoirs.

Mastigophora division, *Kinetoplastomonada* class – 11 species: *Trypanosoma carassii*, *T. luciopercae*, *T. markewitschi*, *T. percae*, *T. schulmani*, *Cryptobia borelli*, *C.branchialis*, *C. cyprini*, *C. guerneorum*, *C. khaibulaewi*, *Costia necatrix*.

Sporozoa division, *Coccidiomorpha* class – 4 species: *Goussia alburni*, *Eimeria carpelli*, *E. percae*, *E. rutili*.

Microsporidia division, *Microsporidea* class – 5 species: *Glugea anomala*, *G.luciopercae*, *G.schulmani*, *Pleistophora siluri*, *P.sulci*.

Myxozoa division, *Myxosporidia* class – 59 species: *Myxidium lieberkuehni*, *M.macrocapsulare*, *M.pfeifferi*, *M.rhodei*, *Zschokkella nova*, *Z.sturionis*, *Sinuolinea sakin-achanumae*, *Sphaerospora carassii*, *S.elegans*, *Chloromyxum cristatum*, *Ch.fluviatyle*, *Ch.legeri*, *Ch.varicorhini*, *Myxobilatus gasterostei*, *M.medius*, *M.varicorhini*, *Myxosoma ranchiale*, *M.circulus*, *M.dujardini*, *Myxobolus albovae*, *M.alburni*, *M.alievi*, *M.azerbaidzanicus* and others (total of 35 species in this genus), *Henneguya chaibulaevi*, *H.lobosa*, *Thelohanellus isgurni*, *Th.pyriformis*.

Ciliophora division, *Cyrtostomata* class – 2 species: *Chilodonella hexasticha*, *Ch.piscicola*.

Hymenostomata class – 2 species: *Tetrahymena pyriformis*, *Ichthyophthirius multifiliis*.

Suctorina class – 28 species: *Capriniana piscium*, *Scyphidia caligula*, *Epistilis lwoffii*, *Apiosoma amobae*, *A.baueri* and others (a total of 8 species), *Apisoma mikailovi*, *A.piscicolum*, *Trichodina acuta* and others.(a total of 10 species) *Paratrachodina alburni*, *Tripartiella bulbosa*, *T.copiosa*, *Trichodina epizootica*, *T.subtilis*.

Coelenterata division, *Polypodinea* class – 1 species: *Polypodium hydriforme*.

Plathelminthes division, *Monogenea* class – 69 species: *Dactylogyrus chramulii*, *D.lenkorani*, *D.zandti* and others (total of 43 species), *Siluridiscoides magnus*, *S.siluri*, *S.vistulensis*, *Ancyrocephalus paradoxus*, *A.percae*, *Tetraonchus monenteron*,

Gyrodactylus arcuatus, *G.schulmani* and others (total of 12 species), *Paradiplozoon pavlovskii* and others (total of 6 species) *Eudiplozoon nipponicum*, *Diplozoon paradoxum*.

Cestoda class – 18 species: *Caryophyllaeus fimbriceps*, *C.laticeps*, *Biacetabulum appendiculatum*, *Caryophyllaeides fennica*, *Bothriocephalus acheilognathi*, *Ligula colymbi*, *L.intestinalis*, *Digramma interrupta*, *Schistocephalus pungitii*, *Bothrimonus fallax*, *Proteocephalus filicollis*, *P.gobiorum*, *P.ocellata*, *P.osculatus*, *Siluritaenia siluri*, *Gryporhynchus pusillus*, *Neogryporhynchus chaeilancristrotus*, *Paradilepis scolecina*,

Aspidogastrea class – 1 species: *Aspidogaster limacoides*.

Trematoda class – 81 species: *Bucephalus polymorphus*, *Rhipidocotyle companula*, *Rh. kovalae*, *Sanguinicola armata* and others (total of 4species), *Bunocotyle cingulate*, *Monovitella cyclointestina*, *Saccocoelium obesum*, *S. tensum*, *Dicrogaster contracta*, *Asymphyllodora abdurachmanovi* and others (total of 5 species), *Parasymphyllodora markewitschi*, *P. parasquamosa*, *Palaeorchis incognitus*, *Crepidostomum farionis*, *Bunodera luciopercae*, *Phyllodistomum angulatum* and others (total of 5 species), *Skrjabinopsolus semiarmatus*, *Azygia lucii*, *Orientocreadium siluri*, *Allocreadium baueri* and others (total of 7 species), *Acanthocreadium araxicum*, *A. talishensis*, *Nicolla skrjabini*, *Sphaerostomum bramae*, *S. globioporium*, *Pseudosphaerostomum caudotestis*, *Pronoprymna ventricosa*, *Echinochasmus perfoliatus*, *Diplostomum chromatophorum* and others (total of 13 species), *Tylodelphys clavata*, *T. podicipina*, *Bolboforus confuses*, *Hysteromorpha triloba*, *Conodiplostomum perlatum*, *Ornithodiplostomum scardinii*, *Posthodiplostomum brevicaudatum*, *P. cuticola*, *Apharhyngostrigea cornu*, *Ichthyocotylurus erraticus*, *I. pileatus*, *I. variegatus*, *Holostephanus ubinini*, *Mesostephanus appendiculatus*, *Paracoenogonimus ovatus*, *Clinostomum omplanatum*, *Opisthorchis felinus*, *Ascocotyle coleostoma*, *Pygidioopsis genata*, *Metagonimus yakogowai*, *Cryptocotyle concave*, *Apophallus donicus*, *A. muehlingi*.

Nemathelminthes division, *Nematoda* class – 7 species: *Capillaria tomentosa*, *Thominx tuberculata*, *Cystoopsis acipenseris*, *Eustrongylides excisus*, *Rhabdochona denudata*, *Rh.fortunatowi*, *Rh.gnedini*, *Capillarospirura ovotrichuria*, *Cyclozone acipenserina*, *Desmidocercella numidica*, *Camallanus lacustris*, *C.truncatus*, *Molnaria intestinalis*, *M.leucisci*, *Agrachanus scardinii*, *Skrjabillanus tincae*, *Philometra ovate*, *Ph.rischta*, *Cucullanus sphaerocephalus*, *Spiroxis contortus*, *Anisakis schupakovi*, *Porrocoecum reticulatum*, *Raphidascaaris acus*, *Contraecum bidentatum* and others (a total of 3 speices in this genus)

Acanthocephales division, *Acanthocephala* class – 27 species: *Neoechinorhynchus rutilis*, *Quadrigrurus cholodkowskyi*, *Corynosoma capsicum*, *Leptorhynchoides plagicephalus*, *Acanthocephalus anguillae*, *A. lucii*, *Pomphorhynchus laevis*.

Annelida division, *Hirudinea* class – 4 species: *Piscicola fasciata*, *P. geometra*, *Hemiclepsis marginata*, *Limnotrachelobdella turkestanica*.

Mollusca division, *Bivalvia* class – 1 species: *Anodonta cyrea*.

Arthropoda division, *Crustacea* class – 12 species: *Lamproglana compacta*, *L. pulchella*, *Ergasilus briani*, *E. sieboldi*, *Thersitina gasterostei*, *Lernaea elegans*, *L. esocina*, *Caligus lacustris*, *Achtheres percarum*, *Pseudotracheliastes stellatus*, *Argulus coregoni*, *A. foliaceus*.

Overall, as a result of studies conducted by various experts, 332 species of parasites belonging to different classification groups of animals have been recorded in fish species living in Azerbaijan's inland water basins. 202 of those species (with the exception of *Cryptobia branchialis* and *Costia necatrix*) have a complex development cycle and use one or two intermediate hosts during such cycle. 52 species of parasites (including 37 species of trematodes, 14 species of nematodes and 1 species of thorny-headed worms) use the fish only as intermediate hosts and complete their development in fish eating birds and mammals.

77 species of parasites found in fishes of Azerbaijan's inland water basins cause serious diseases in fish, while representatives of 6 species (*Opisthorchis felinus*, *Metagonimus yakogowai*, *Apophallus muehlingi*, *A. donicus*, *Echinochasmus perfoliatus*, *Clinostomum complanatum*) cause disease when falling into people's digestive system. Cercaria of 36 species of trematodes, which use fish as the second intermediate host, attack the person entering the water, form small ulcers in the skin causing non-specific cercariasis.

Amfibia and Reptilia. Species of creatures living in the water basins vary depending on their depth, capacity, salinity, temperature regime and altitude. Amphibians and some species of Reptiles are important components of the aquatic ecosystem and mainly prefer freshwater basins. These freshwater basins are in flowing and stagnant state and are divided into several ecosystems, such as lentic, lotic and marshy areas [Mammadov, 2005].

11 species of Amphibians and 56 species of Reptiles have been recorded in our country. At present, 11 species of Amphibians and 4 species of Reptiles have been recorded in the internal water basins of Azerbaijan. These species are unevenly distributed in the freshwater ecosystems [Alakbarov, 1978; Ganiyev, 2012].

Lentic ecosystems (stagnant waters). There are mainly 2 species of Amphibians and 2 species of Reptile in stagnant water basins. One of them, *Hyla orientalis*, is found in permanent and temporary stagnant waters of the northern and western regions of Azerbaijan. During reproduction, the females spawn in 20-70 cm deep ponds. *Hyla savi-gnyi* on the other hand, found mostly in the permanent and temporary stagnant waters of the southern and south-western regions.

Emys orbicularis and *Mauremys caspica* that belong to Reptiles live in Lakes and other stagnant water basins in the plains and foothills and on their coasts. Both the *Emys orbicularis* and *Mauremys caspica* are recorded in the part of Davachi port which is rich in water plants [Ahmedov et al. 2015].

Lotic ecosystems (flowing waters). 3 species of amphibians live in such ecosystems. One of them, *Rana macrocnemis*, can be found in cold mountain rivers such as Shamkirchay, Gudialchay, Katekhchay as well as waterfalls and springs like Takdam and Laza. However, they prefer transparent and permanent water basins such as Goygol for reproduction. The spawning takes place at a depth of 30-40 cm in the water basins, in layers with the most favorable condition for the development of caviar.

Pelodytes caucasicus also lives in flowing waters like *Rana macrocnemis*. This species is found only in the north-western part of Azerbaijan, on the shores of Katekhchay, which flows through the dense part of the forest. They use springs and rivers with different depths (from 2-3 cm to 30-40 cm) to spawn.

Rivers passing through dense forest areas in the north-western region of Azerbaijan, for example, small ponds formed in the weak flowing part of Katekhchay and Silban rivers also have *Bufo verrucosissimus*. In order to spawn this species use temporary ponds with a depth of 25-30 cm, located on the edge of the river.

In addition to those listed, there are amphibians and reptiles linked to both stagnant and flowing water basins. *Triturus karelinii*, *Bufo variabilis* and *Pelophylax ridibundus* live in both weak flow and stagnant waters. Among them *Triturus karelinii* inhabit permanent stagnant waters on forest edges and in open areas of the forest and are not recorded in temporary water basins. Along with small basins, they can also be found in deep lakes of artificial origin. Chanlibel Lake and Gulustan Lake on the territory of Guba district, as well as other unnamed artificial lakes in Lankaran district are examples of this. During the reproduction period they attach their eggs to the bottom of water plants located at a depth of 10-25 cm, such as *Sparganium* spp. and *Mentha aquatica*.

Bufo variabilis and *Pelophylax ridibundus* live in both permanent and temporary water reservoirs formed from rainwater within the territory of the country. *Bufo variabilis* spawns on water plants, and sometimes on the bottom of the water in the parts of the basins not deeper than 50 cm and well-warmed by sun rays. *Pelophylax ridibundus* on the other hand spawns on water plants like *Potamogeton* spp. and *Sparganium* spp. in water basins with a depth of 30 cm to 1 m.

Pelobates Syriacus live on the sandy shores of the Caspian Sea, as well as on the shores of the flowing and stagnant water basins of Nakhchivan AR [Ganiyev, 2004]. Their reproduction takes place both in natural and artificial water basins, and they do not use temporary and cold water basins. The female members of this species lay caviar in plant rich water basins 5-15 cm deep.

Lissotriton vulgaris and *Bufo eichwaldi* are characteristic only for the flowing and stagnant water basins of the Lankaran natural province. Small dumps up to 40 cm are characteristic for tadpoles of *Bufo eichwaldi* [Kidov et al. 2009].

Natrix natrix and *Natrix tessellata* species that belong to Reptiles live both in flowing and stagnant water basins in plains, mountainous and foothill areas in Azerbaijan [Bunyatova, 2012]. *Natrix tessellata* can be found in Mazimchay in the north-western part of Azerbaijan, Shabbranchay in the northeastern part, in Astarachay in the southern part, in Ghizilagaj and Aggol south-eastern part, as well as in flowing and stagnant waters like Yukhari Shirvan channel and Bash Mil-Qarabagh Collector.

In addition to those listed above, there is a chance to find 1 more species of Reptiles in the water basins in the northwestern part of Azerbaijan. *Natrix megalcephala* was first recorded by Orlov et al. in Oguz district [Orlov et al., 1992]. Compared to other water snakes, it is stated that this species may be found in fast-flowing mountain rivers. However, this species has not been recorded by us.

Marshy areas. No stenobiont species are recorded for these areas. Because along with flowing and stagnant water basins *Pelophylax ridibundus*, *Bufo variabilis* and *Pelobates Syriacus*, as well as *Emys orbicularis*, *Mauremys caspica*, *Natrix natrix* and *Natrix tessellata* of the Reptiles also live in this ecosystem. *Emys orbicularis* is widespread in the marshy areas of the north-eastern and southern-western regions of Azerbaijan.

It should be noted that 6 of 11 species of Amphibians found in domestic water basins of Azerbaijan (*Lissotriton vulgaris*, *Triturus karelinii*, *Pelobates syriacus*, *Pelodytes caucasicus*, *Bufo verrucosissimus*, *Bufo eichwaldi*) were included in the 2nd edition of Azerbaijan's Red List. 10 species of Amphibians and 4 species of Reptiles were also

included in the Red List of the International Union for Conservation of Nature in accordance with different categories and criteria.

Aves. There are 402 species in the fauna of Azerbaijan. The vast majority of them (about 305 species) are associated with the land - forests, woods, shrubs and meadows. A small part of them (≈ 97 species) is adapted to the water lifestyle. The main natural habitats of water and coastal birds in the modern time are Mahmudchala, Goychala, Hajigabul, Sharbat gorge, Boz gorge, Sarisu lake system, Mingachevir (65000 ha) and Varvara (15000 ha) reservoirs, ponds of fishery plants (about 3, 5 ha) in the Kura-Araxes lowland, Kichik Gizilagaj Gulf, Caspian and Aghgush water meadows in the Lankaran lowland.

Water and coastal birds settle down in various habitat biotopes like deep water areas, shallow water areas, reed, giant reed, sedge and reedmace jungles, open marshes and ravines, tamarisk jungles etc. Each of these biotopes has a unique ornithological complex. In total, 169 species of birds were recorded in these biotopes. Of those, 97 species are of water and coastal ecological group, and 73 species belong to open land and forest-bush ecological groups. These species are distributed unevenly on biotopes.

Deep water areas. It is mainly located in the central part of all the inland water basins. The depth of the water (excluding Mingachevir reservoir) varies between 0.6-0.7 m. These areas are big gathering places for the *Podicipediformes*, *Pelecaniform*, *Anseriformes* and *Fulica atra*. Their food facilities (zoobenthos, zooplankton and phytoplankton) are rich. 4 species of the *Podicipediformes* (*Podiceps ruficollis*, *P.cristatus*, *P.nigricollis*, *P.auritus*), 4 species of the *Pelecaniformes* (*Pelecanus onocrotalus*, *Pelecanus crispus*, *Phalacrocorax carbo*, *Phalacrocorax pygmaeus*), 31 species of the *Anseriformes* (*Rufibrenta ruficollis*, *Anser anser*, *A.albifrons*, *A.erythropus*, *Cygnus olor*, *C.cygnus*, *C.bewickii*, *Chen caerulescens*, *Tadorna ferrugine*, *T.tadorna*, *Anas platyrhynchos*, *A.crecca*, *A.strepera*, *A.penelope*, *A.acuta*, *A.querquedula*, *A.clypeata*, *A.angustirostris*, *Netta rufina*, *Aythya ferina*, *A.nyroca*, *A.fuligula*, *A.marila*, *Bucephala clangula*, *Clangula hyemalis*, *Melanitta nigra*, *M.fusca*, *Oxyura leucocephala*, *Mergus albellus*, *M.serrator*, *M.merganser*), only one species of *Gruiformes* (*Fulica atra*) and 1 species of the *Lariidae* (*Larus ichtyaetus*) settle in this biotope in winter and during migration. Three species of predatory birds (*Haliaeetus albicilla*, *Pandion haliaetus*, *Falco peregrinus*) can be found on the flight while searching for food.

Shallow water areas. Such areas are mainly seen in the natural water reservoirs (Aggol, Sarisu,

Sharbat gorge, Mahmudchala, Goychala, Aghzibirchala). Maximum water depth is 40-50 cm. Shallow water areas are rich in water invertebrates, fish younglings and amphibians, which are food for birds.

These areas are massive feeding sites for *Anseriformes*, *Ciconiiformes*, *Charadriiformes*. 9 species of the *Ciconiiformes* (*Ardeola ralloides*, *Bubulcus ibis*, *Egretta alba*, *E.garzetta*, *Nycticorax nycticorax*, *Ardea cinerea*, *A.purpurea*, *Platalea leucorodia*, *Plegadis falcinellus*) can be found in this biotope during the nesting period and when searching for food, as well as 1 species of the *Phoenicopteriformes* (*Phoenicopterus roseus*) during the wintering period, 15 species of *Anseriformes* (*Anser anser*, *A.albifrons*, *A.erythropus*, *Rufibrenta ruficollis*, *Tadorna ferruginea*, *T.tadorna*, *Anas platyrhynchos*, *A.crecca*, *A.penelope*, *A.strepera*, *A.acuta*, *A.angustirostris*, *Netta rufina*, *Aythya ferin*, *A.nyroca*) during the wintering period and migration, 25 species of the *Charadriiformes* (*Vanellus vanellus*, *Vanellochettusia leucura*, *Himantopus himantopus*, *Recurvirostra avosetta*, *Haematopus ostralegus*, *Tringa ochropus*, *T.glareola*, *Limosa limosa*, *T.totanus*, *T.erythropus*, *T.stagnatilis*, *Actitis hypoleucos*, *Xenus cinereus*, *Phalaropus lobatus*, *Philomachus pugnax*, *Calidris minuta*, *C.temmincki*, *C.ferruginea*, *C.alpina*, *Limnocyptes minimus*, *Scolopax rusticola*, *Numenius arquata*, *Limosa limosa*, *Glareola pratincola*, *G.nordmanni*) when searching for food and during migration on the flight, and 2 species (*Limicola falcinellus*, *Gallinago gallinago*) during the wintering period, 2 species of the *Laridae* (*Larus argentatus*, *L.ridibundus*) during the wintering period, 2 species (*L.genei*, *L.minutus*) during migration, and 6 species (*L.melanocephalus*, *Chlidonias hybrida*, *Chlidonias leucopterus*, *C.niger*, *Gelochlidon nilotica*, *Sterna albifrons*) during the nesting period.

Reed, giant reed, sedge and reedmace jungles. They are located in various parts of the inland water basins. A large number of water and coastal birds such as the *Podicipediformes*, *Ciconiiformes*, *Anseriformes* and *Rallidae* can be seen here throughout the year. Large numbers of 4 species of the *Podicipediformes* (*Podiceps ruficollis*, *P.cristatus*, *P.nigricollis*, *P.auritus*), 1 species of the *Pelecaniformes* (*Phalacrocorax pygmaeus*) can be seen in this biotope, as well as 10 species of the *Ciconiiformes* (*Ardea cinerea*, *A.purpurea*, *Ardeola ralloides*, *Bubulcus ibis*, *Egretta alba*, *E.garzetta*, *Ixobrychus minutus*, *Nycticorax nycticorax*, *Platalea leucorodia*, *Plegadis falcinellus*) during the nesting period, and 1 species (*Botaurus stellaris*) during wintering and migration, 5 species of the *Anseriformes* (*Anser anser*, *Anas platyrhynchos*,

A.angustirostris, *Netta rufina*, *Aythya nyroca*) during the nesting period, 1 species of the *Rallidae* (*Crex crex*) during the wintering period, and 6 species (*Rallus aquaticus*, *Porzana porzana*, *P.pusilla*, *Gallinula chloropus*, *Porphyrio porphyrio*, *Fulica atra*) throughout the year, 35 species of birds that belong to forest-bush and open land ecological groups (*Circus pygargus*, *C.cyaneus*, *C.aeruginosus*, *Milvus migrans*, *Accipiter nisus*, *Cuculus canorus*, *Alcedo atthis*, *Merops apiaster*, *M.superciliosus*, *Coracias garrulus*, *Riparia riparia*, *Hirundo rustica*, *Delichon urbica*, *Pica pica*, *Corvus cornix*, *C.frugilegus*, *C.monedula*, *Parus caeruleus*, *P.major*, *Panurus biarmicus*, *Troglodytes troglodytes*, *Muscicapa striata*, *Turdus merula*, *T.pilaris*, *Acrocephalus arundinaceus*, *Acrocephalus schoenobaenus*, *Lanius minor*, *Lanius cristatus*, *Sturnus vulgaris*, *Pastor roseus*, *Emberiza schoeniclus*, *Fringilla coelebs*, *Carduelis carduelis*, *Passer montanus*, *Passer domesticus*).

Open marshes and saline areas. These biotopes are characteristic nesting places for such *Charadriiformes* as *Himantopus himantopus*, *Recurvirostra avosetta*, *Glareola pratincola*, *Chlidonias niger*, *C.leucopterus*, *C.hybrida*. 4 species of the *Ciconiiformes* (*Ardea cinerea*, *Bubulcus ibis*, *Egretta garzetta*, *E.alba*) can be found in these biotopes during migration, as well as 11 species of the *Anseriformes* (*Anser anser*, *A.albifrons*, *A.erythropus*, *Rufibrenta ruficollis*, *Anas platyrhynchos*, *A.crecca*, *A.penelope*, *A.strepera*, *A.acuta*, *A.angustirostris*, *A.querquedula*) during the wintering period, 2 species of the *Gruiformes* (*Grus grus*, *Antropoides virgo*) during migration, 6 species of the *Charadriiformes* (*Charadrius dubius*, *Vanellochettusia leucura*, *Himantopus himantopus*, *Recurvirostra avosetta*, *Actitis hypoleucos*, *Glareola pratincola*) during the nesting period, 7 species (*Vanellus vanellus*, *Haematopus ostralegus*, *Tringa ochropus*, *T.glareola*, *T.nebularia*, *T.totanus*, *Gallinago media*) during the winter period and migration, and 8 species (*Tringa erythropus*, *Xenus cinereus*, *Philomachus pugnax*, *Calidris ferruginea*, *C.alpina*, *Numenius arquata*, *Limosa limosa*, *Glareola nordmanni*) throughout the year, 1 species of the *Laridae* (*Larus ridibundus*) during migration, and *Sterna albifrons* and *S.hirundo* during the nesting period.

Tamarisk jungles They are located as separate strips on the shores of the inland water basins. Tamarisk jungles have unique bird complexes in separate water basins. The main part of such complexes consists of the *Passeriformes*. 26 species of birds have been recorded in this biotope. Thoses include 6 species of predatory birds (*Aguila rapax*, *Circus cyaneus*, *C.pygargus*, *Buteo lagopus*, *Falco tinnunculus*, *F.subbuteo*), 2 species of the *Galli-*

formes (*Coturnix coturnix*, *Francolinus franco-linus*), 1 species of the *Charadriiformes* (*Scolopax rusticola*), 3 species of the *Columbiformes* (*Columba livia*, *C.palumbus*, *Streptopelia turtur*), 3 species of the *Strigiformes* (*Otus scops*, *Athene noctua*, *Asio flammeus*), 2 species of the *Coraciiformes* (*Coracias garrulus*, *Upupa epops*), 9 species of the *Passeriformes* (*Acrocephalus arundinaceus*, *Acrocephalus schoenobaenus*, *Lanius minor*, *L.cristatus*, *Pastor roseus*, *Emberiza schoeniclus*, *Carduelis carduelis*, *Passer montanus*, *P.domesticus*).

31 species of birds recorded in the domestic water basins are included in Azerbaijan's Red List, 12 of which are also included in the Red List of the International Union for Conservation of Nature. Additionally, 7 species are included only in the Red List of the International Union for Conservation of Nature.

Among water and coastal birds the *Podicipediformes*, *Pelecaniformes*, *Anseriformes* and *Charadriiformes* settle in deep and shallow water areas in winter and during migration, the *Ciconiiformes* stay in reed, sedge, reedmace and tamarisk jungles during the nesting period, while forest-bush birds stay in reed, sedge, reedmace and tamarisk jungles throughout the year.

Mammalia. The *Mammalia* class is represented with 144 species in our country. Most are spread on the land, some in the air (bats), and a small part (4-5 species) in or around the water. In this article, we will focus on some species, whose life style is related to water reservoirs (I.K.Rakhmatulina, 2005).

Family: Soricidae

Genus: Sorex L, 1758

Species: Neomys teres Satunin, 1913

It is considered as one of the least studied species in Azerbaijan.

Systematics: has changed twice. The length of the body is usually 80-100 mm, the length of the tail is 53-75 mm, the body mass is 13-25 grams. Its natural habitat covers a very large area. In Azerbaijan it can be found on the territories of Nakhchivan AR, Garabagh, Lankaran, as well as Guba district. Its population is low. *Neomys teres* is spread across different landscapes. Their lives are associated with lakes, rivers, coastlines of small rivers, swamps and the edges of ditches with permanent water supply. It swims well.

Its food consists mainly of animals that live in water. *Neomys teres* eats the food it obtained from the water on the land. It usually eats invertebrates living in water, fish caviar and younglings, and frogs. It has an active lifestyle throughout the day getting more active at night. The representatives of the species dig their setts themselves or settle in already dug ones. They give birth to 4-14 young

ones during spring-summer months. The species damages fish farms (<http://journals.tubitak.gov.tr/zoology/issues/zoo-16-40-6/zoo-40-6-1-1507-46.pdf-su>).

Family: Myocastoridae

Genus: Myocastor Kerr, 1792

Species: Myocastor coypus Molina, 1782

The *Myocastoridae* biology and ecology have been studied poorly in the natural areas of Azerbaijan. There are no changes in their systematics. The length of their body is 60 cm, the length of the tail is 45 cm, the body mass is 5-12 kg.

The *Myocastor* live a half-water life. They settle in weak flowing and stagnant lakes, in the swampy shores of the rivers and on the shores of vegetation and water-rich marshes. The species is spread in the Andean Mountains, considered to be its main natural habitat, in an altitude of 1200 meters above sea level.

It was imported to the territory of the former USSR, including Azerbaijan, from Argentina in 1930-1932 to buy fur.

Farms have been established in the areas where the *Myocastor* is widespread (Garayazi, Aghjabadi, Mingachevir, Davachi, Shamkir, Lankaran). Standard, albino and genera of other colors have been obtained in farms. On the other hand, the species is used to eradicate nutria from the lakes in order to develop fishing. Its food is comprised of plant roots, as well as rhizogenous plants, herbs, reed plants and fruits etc. In some rare cases when there is a lack of plant nutrients, it prefers animal foods. Its mainly active at night. It can reproduce throughout the year. The species gives birth two to three times a year. The gestation period lasts up to 4 months. The species gives birth to 4 to 6 young ones each time. The reproductive ability declines at the age of 3-4. Its natural habitat is limited to the South American continent. It has been acclimatized in North America, Europe, South Caucasus, Kyrgyzstan and Tajikistan. The species has been included in the systematics since its acclimatization in Azerbaijan was completed (Azərbaycanın heyvanlar aləmi, 2004).

Family: Cricetidae

Genus: Arvicola Lacepede, 1801

Species: Arvicola terrestris L., 1758

Morphological and ecological features have not been studied sufficiently. There are no changes in their systematics.

The species is one of the big rodents. The length of their body is 24 cm, the length of the tail is 15 cm, the body mass is 70-180 g. It's spread in Europe, Asia and the Caucasus. Starting from plain regions of Azerbaijan, they can spread to regions up to 3,500 meters above sea level. Two populations that differ in terms of geography, lifestyle, zones

and altitudes were selected to study cytogenetic properties. One population of *Arvicola terrestris* is distinguished for being colonial in subnival meadows of the Greater Caucasus (Guba district, Khinalig village, 2000-2300 m above sea level) and the other one for not being colonial (Bilasuvar district, sea level). Diploid chromosome number was $2n=36$. The main number of chromosomal arms in the colonial population is $NF = 72$; since 3 pairs of chromosomes have one armed (acrocentric) structures in the ones that do not have the colonial way of life, the $NF=66$. The revealed differences confirm differences between colonial and non-colonial hydrophilic populations on the genetic level (Кулиев, Кулиев, Раджабли, 1978).

The life of the *Arvicola terrestris* is associated with the lakes, the coastline of small rivers, the edges of ditches with permanent water supply, swamps and swampy meadows. Starting from the Caspian Sea they are spread to the altitude of 3000-3500 meters above sea level in Azerbaijan.

There are different opinions about how they feed. Some researchers have found the remains of other *Arvicola terrestris* in the species' setts. In their opinion, along with plant food this rodent feeds on animal food. Such feeding causes change in its economic significance. However, in the former Ryazan province only plant food was identified in the stomach's of 30 individuals. Bekshrem believes that the rodent is fed only by plant food. It only uses animal food when hungry (Azərbaycanın heyvanlar aləmi, 2004). The location of the species is easy to identify. Usually tables of food in the form of hills can be seen in the water. The species is active throughout the day.

It reproduces during the hot months of the year. The gestation period lasts for 40 days. The female individual can reproduce 3-5 times a year. The species gives birth to 6 to 8 young ones each time.

Family: Mustelidae

Genus: *Lutra* Brisson, 1762

Species: *Lutra lutra* L., 1758

***Lutra lutra meridionalis* Ognev, 1931**

The *Lutra lutra meridionalis* can be recognized for a number of signs. The length of its body reaches 60-90 cm. Its tail is 50 cm long. The mass is 6-10 kg. There is a special swimming membranes on its paws. The tail is long, muscular, and covered with short hair.

There are no changes in their systematics.

It's spread in Europe, Asia, America and North Africa. Its habitat in the Caucasus is from the Western Caucasus territories to the Lankaran Province. The northern border of the habitat is limited to Kuban and Kume. It is spread throughout the Azerbaijani part of Greater Caucasus, in different rivers of the Lankaran Natural Province. As a result of the

anthropological effects the *Lutra lutra meridionalis* are encountered in separate areas of the natural habitat, not in its entire area. *Lutra lutra meridionalis* has been recorded in 18 rivers of Azerbaijan. Density of individuals: 0.2-0.5 individuals per 10 km coastal zone. The number of *Lutra lutra meridionalis* in the country reaches 1000 individuals.

The *Lutra lutra meridionalis* usually prefers to live in mountainous and foothill rivers that have plenty of fish species (mostly salmon) and flow rapidly. It can be found in rivers located at 2000 meters above sea level. Its biology has been studied poorly. Its food consists mainly of river salmon. The species is mostly active when it's getting dark and at night.

It starts to reproduce in the beginning of winter. The gestation period lasts for 9-10 months. It gives birth to 2-4 young ones (Azərbaycanın Respublikasının Qırmızı Kitabı, 2013, Kasumova, Askerov et al., 2009, <http://www.peterlife.ru/funoffice/redbook/191963.html#WdkSULXwHcs-çay>).

Family: *Suidae*

Genus: *Sus* L, 1758

Species: *Sus scrofa* L., 1758

***Sus scrofa atilla* Thomas, 1912**

There are no changes in their systematics.

The height of the body reaches 1 meter. The mass of male individuals varies from 200 to 340 kg. Sexual dimorphism is clearly expressed. The species differ from domestic pigs in having a more muscular body, relatively longer face, bigger canine tooth and a developed pelage. Its ears are long and wide. The eyes are small and located in the depth of the eye sockets. The tail is thin, short (14-35 cm) and has a bunch of hair at the tip. Its legs are short, the sense of smell and hearing are well developed, while the organs of vision are weak. Individuals of the South Caucasus population are relatively small compared to those in the Carpathians, Belarus and Far East. The species reaches full development at the age of 5-6.

It mainly prefers to live in parts of lakes, wetlands, forests and reed shrubberies with abundant water. It is found in all zones of the mountains up to alpine meadows. It lives in Europe, especially in oak forests, meadows and wetlands, in the Caucasus, especially in the autumn, in the fruit forests and is mostly spread in mixed and broad-leaved forests in Central Asia and Kazakhstan. It often stays in river valleys of the mountain rivers. In the Far East it lives in both cedar forests and mixed forests.

It is one of the most widespread species. It was acclimatized in North and Central America and Argentina. The species can be found in all provinces of Azerbaijan.

Sus scrofa atilla is a species with the most active feeding properties in the *Artiodactyla* fauna

settled in Azerbaijan. It feeds on everything. When the species experience food shortages in places where they live, they make long-distance migrations (60-70 and sometimes 80-100 km). The most abundant food is in the summer (34 species), and the poorest diet is in the winter season (16 species). It should be noted that the food ration of the *Sus scrofa atilla* in Azerbaijan include 68 species of plants belonging to 26 families, as well as 10 species of animal food.

Females usually start to reproduce in the second year of their development, while males do it at the age of 4-5. The gestation period lasts for 124-140 days, 130 days on average. The gestation period in females that reproduce for the first time is shorter. The weight of newborn young ones is 600-1650 grams, 850 grams on average.

Wild boars have been completely eradicated in the Lesser Caucasus natural province by the 1930s (Safarov, 1959, Sokorov, 1959). At present, no individuals are left in the occupied Nagorno-Karabakh region and its surrounding districts (excluding Goygol MP). Formerly the areas where the *Sus scrofa atilla* were most spread were regions in the Kura-Araz natural province. Although there were plenty of boars in the stagnant water areas around Kura, most of these biotopes are now farmland and animals are very rarely found there. There used to be numerous boars in the territory of Lankaran lowland-geographical district of Lankaran natural province. At present, the biotopes, which have a certain number of this species (Hirkan National Park and Hirkan Reserve, the Gizilagaj Park and the Gizilagaj Reserve), are protected (3,6).

To sum up, in more than 80 years since the establishment of the Institute of Zoology our zoologists have recorded more than 1000 species of unicellular organisms, over 1350 species of invertebrates, 190 species of vertebrates and 332 species of fish parasites (more than 100 of which are unicellular) in the flowing and stagnant water reservoirs of our country. However, the registration of new hydrobionts in future is not excluded. Because there are still many species among the aquatic animals that are not fully studied or are very poorly studied. Along with Protozoa this includes worms, mollusca, arthropods, *Plecoptera*, *Trichoptera*, *Hydrachnidia*, *Trypanosomatidae*, larvae of dipterous insects and representatives of other phyla.

REFERENCES

- Azərbaycanın heyvanlar aləmi (2002) **I cild**, Bakı: Elm, 266 səh.
- Azərbaycanın heyvanlar aləmi (2004) **II cild**, Bakı: Elm, 388 səh.
- Azərbaycanın heyvanlar aləmi (2004) **III cild**. Bakı: Elm, s. 620.
- Azərbaycanın Respublikasının Qırmızı Kitabı (2013) Bakı: Şərqi-Qərb, II nəşr, səh. 21.
- Babayev İ.R.** (2001) Kürətrafi göllərin ornitofaunası. *Kürətrafi göllərin biologiyası* kitabı. Bakı: Elm, s. 280-287.
- Bünyatova S.B.** (2012) Cənub – şərqi Azərbaycanın təlxələrinin (*Colubridae*) bioekoloji xüsusiyyətləri: *Biol. elm. nami.avtoref.*, 22s.
- Əliyev A.R., Əliyev R.A., Quliyev S.A.** (2013) Azərbaycanın şirinsu hövzələrinin iynəcə (*Odonata*) sürfələri (növlər tərkibi). *Zoologiya İnstitutunun əsərləri*, **31(1)**: 56-67.
- Əliyev S.İ.** (2014) Şimali-şərqi Azərbaycanın bəzi su hövzələrinin makrozoobentosu. *AMEA-nın Xəbərləri (biologiya və tibb elmləri)*, **69**: 172-177.
- İbrahimov Ş.R., Mustafayev N.C.** (2015) Azərbaycanın ixtiofaunasının müasir vəziyyəti *Zoologiya İnstitutunun əsərləri*, **33(2)**: 58-68.
- Qəniyev F.R., Nuriyev E.R.** (2004) Suda-quruda yaşayanlar sinfi – Amphibia. *Azərbaycan heyvanlar aləmi*, **III**: 166-180.
- Quliyev Z.M.** (2006) Azərbaycanda əmtəə balıqçılığı. Bakı: SEBA, 293 s.
- Quliyev S.M.** (2012) Salyan düzü və ona həmsərhəd olan ərazilərdə çöl donuzunun (*Sus scrofa atilla* Thomas, 1912) bəzi ekoloji xüsusiyyətləri. *Azərbaycan Zooloqlar Cəmiyyətinin əsərləri*, **4(2)**: 26-33.
- Mustafayev N.C.** (2016) Azərbaycanın daxili su hövzələrində dəyirmiağızluların və balıqların yayılmasının qanunauyğunluqları. *Zoologiya İnstitutunun əsərləri*, **34(1)**: 68-87.
- Mustafayev N.C., İbrahimov Ş.R.** (2012) Azərbaycan faunasında yeni balıq növü – Amur enli başı *Pseudorasbora parva* (Temminck et Schlegel, 1846). *Azərbaycan MEA-nın "Məruzələri"*, **LXVII(6)**: 93-98.
- Абдуллаев Х.Г.** (1971) Паразиты и главнейшие паразитозы рыб придаточных водоемов Нижней Куры: *Автореф. Дис. ...канд. биол. наук.* Баку: 22 с.
- Алекперов А.М.** (1978) Земноводные и пресмыкающиеся Азербайджана. Баку: Элм, 264 с.
- Алекперов И.Х.** (2005) Атлас свободноживущих инфузорий (классы *Kinetofragminophora*, *Colpodea*, *Oligohymenophora*, *Polyhymenophora*). Баку: 310 с.
- Алекперов И.Х.** (2012) Свободноживущие инфузории Азербайджана (экология, зоогеография, практическое значение). Баку: Элм, 520 с.
- Алиев А.Р.** (1990) Новые виды инфузорий рода *Zosterodasys* (*Synhymenidae*) из водоемов Азербайджана. *Зоологический журнал*, **69(вып. 3)**: 13-24.

- Алиев С.И.** (2016) Изучение макрозообентоса рек южного склона Большого Кавказа. *Вестник Запорожского Государственного Университета*, № 1: 28 -34.
- Ахмедов С.Б., Новрузов Н.Э., Бунятова С.Н., Гасымова Г.Х.** (2015) К изучению герпетофауны (amphibian: anura; Reptilia: Testudines, Sauria, Serpentes) биоценозов Дивичинского лимана Каспийского моря. *Вестник Московского государственного областного университета, сер. естественные науки*, №4: 6-15.
- Ганиев Ф.Р., Гасымова Г.Х.** (2012) Современный видовой состав батрахофауны Азербайджана и распределение амфибий по биотопам. *Материалы XIV международной науч. конф. «Биологическое разнообразие Кавказа и юга России»*. Махачкала: 129-131.
- Джафаров Ш.М.** (1960) Мошки (сем. Simuliidae) фауны Азербайджана. *Двукрылые. Насекомые*, V(вып. 1): 358-394.
- Догель В.А., Быховский Б.Е.** (1939) Паразиты рыб Каспийского моря. *Труды комиссии по изучению Каспийского моря*, вып. 7: 1-150.
- Ибрагимов Ш.Р.** (1977) Паразиты рыб водоемов Ленкоранской природной области. *Автореф. дисс. ... канд. биол. наук*. Баку: 23 с.
- Ибрагимов Ш.Р.** (2012) Паразиты и болезни рыб Каспийского моря (эколого-географический анализ, эпизоологическая и эпидемиологическая оценка). Баку: Элм, 400 с.
- Казиева Н.Ш.** (2012) Паразитофауна рыб Варваринского водохранилища. *Автореф. дисс. ... канд. биол. наук*. Баку, 20 с.
- Касымов А.Г.** (1965) Гидрофауна Нижней Куры и Мингечаурского водохранилища. Баку: АН Аз.ССР, 372 с.
- Касымов А.Г.** (1972) Пресноводная фауна Кавказа. Баку: Элм, 288 стр.
- Кидов, А.А., Пыхов С.Г., Дернаков В.В.** (2009) Новые находки талышской жабы (*Bufo eichwaldi*), луговой ящерицы (*Darevskia prati-*
cola) и персидского полоза (*Elaphe persica*) в Юго-Восточном Азербайджане. *Праці Українського герпетологічного товариства*. 6(2): 21-26.
- Кулиев Г.Н., Кулиев Г.К., Раджабли С.И.** (1978) Кариотипические различия между популяциями водяной полевки. *Зоологический журнал* (М.), 57(вып. 9): 1409-1411.
- Микаилов Т.К.** (1958) Паразитофауна промысловых рыб р. Куры. *Автореф. дисс. ... канд. биол. наук*. Баку: 23 с.
- Микаилов Т.К.** (1975) Паразиты рыб водоемов Азербайджана (систематика, динамика и происхождения). Баку: Элм, 299 с.
- Мехтиева Э.Д.** (1993) Эколого-географический анализ паразитофауны храмули в водоемах Азербайджана. *Автореф. дисс. ... канд. биол. наук*. Баку: 28 с.
- Нечаева Н.Л.** (1964) Паразитофауна молоди осетровых рыб Каспийско-Куринского района. *Осетровое хозяйство южных морей Советского Союза*. М.: с. 223-238.
- Рустамов С.Г.** (1960) Реки Азербайджанской ССР и их гидрологические особенности (на Аз. языке) Баку: АН. Азерб. ССР, 196 с.
- Туаев Д.Г., Васильев В.И.** (1972) К характеристике орнитофауны основных водоемов и их окрестностей в Кура-Араксинской низменности. *Известия АН Азерб. ССР (сер. биол. наук)*, № 1: 84-90.
- Kasumova N.I., Askerov E., Aidinov T.G., Mamedrzayeva E.T., Mamedov A.A.** (2009) Current status of the Eurasian otter (*Lutra lutra* L.) in Azerbaijan. *Status and Protection of Globally Threatened Species in the Caucasus*, p. 92-98.
<http://sus-scrofa.okis.ru/about.html> - çöl donuzu
<http://journals.tubitak.gov.tr/zoology/issues/zoology-16-40-6/zoology-16-40-6-1-1507-46.pdf> - su kutorası
<http://www.peterlife.ru/funoffice/redbook/191963.html#.WdkSULXwHcs> – çay samuru

Azərbaycanın Daxili Su Ekosistemlərinin Bioloji Müxtəlifliyinə Dair

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Məqalədə ölkəmizin daxili su tutarlarından (bulaqlar, çaylar, su anbarları, göllər və s.) ayrı-ayrı tədqiqatçılar tərəfindən indiyə qədər qeydə alınan qruplar üzrə növlərin sayı təqdim olunub. Su tutarlarımızda ən geniş yayılmış və dominant növlər, onların ekosistemdə rolu və s. haqqında məlumat verilir. Ölkəmizdə elmi-zooloji tədqiqatların aparıldığı ilk vaxtlardan bu günə qədər su tutarlarımızda 1000 növdən çox ibtidai birhüceyrəli heyvan (əsas yerdə kirpikli infuzorlardır), 1350 növdən çox onurğasız heyvan [əsas yerdə rotatorilər (300 növdən çox) və həşərat sürfələridir (586 növdən çox)], 190 növ onurğalı heyvan (əsas yerdə quşlar (97 növ) və balıqlardır (67+1 növ) və 332 növ balıq parazitləri [(əsas yerdə miksozoqlar (59 növ), yastı qurdlar (69 növ) və trematodlardır (81 növ)] qeydə alındığı vurğulanır. Hidrobiontların növ sayını bildirən bu rəqəmlərin çox güman ki, gələcək tədqiqatlarda dəyişilməsi də istisna deyil, çünki hidrobiontlar arasında elə qruplar vardır ki, onların növ tərkibi ya heç öyrənilməmiş, ya da tədqiqatlarda cəmi 1-2 növ təsadüfən qeydə alınmışdır. Buraya birhüceyrəli heyvanlarla yanaşı kirpikli qurdlar, nematodlar, xərçəngkimilər, astagəzənlər, bulaqçı, baharçı və gündəcə sürfələri və digər həşərat sürfələri daxildir.

Açar sözlər: Azərbaycanın su tutarları, biomüxtəliflik, Protozoa, onurğasız heyvanlar, onurğalı heyvanlar

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В статье представлено, зарегистрированное на сегодняшний день отдельными исследователями количество видов по группам, обитающим во внутренних водоемах страны (родники, реки, водохранилища, озера и т.д.). Предоставляется подробная информация о наиболее распространенных и доминирующих видах в наших водных ресурсах, их роль в экосистеме и т.д. С начала научных и зоологических исследований и по сей день в нашей стране отмечено более 1000 видов простейших животных (в основном, ресничные инфузории), более 1350 видов беспозвоночных животных (в основном ротатории, которые представлены более, чем 300 видами, и личинки насекомых - более 586 видов), 190 видов позвоночных (в основном, птицы - 97 видов) и рыбы (67 + 1 вид) и 332 вида рыбных паразитов (в основном, миксоzoи - 59 видов, плоские черви - 69 видов, и трематоды - 81 вид). Цифры, показывающие видовое количество гидробионов, возможно будут изменены в результате будущих исследований, так как некоторые группы гидробионтов или все еще не изучены, или в исследовании случайно зарегистрированы только 1-2 вида. Кроме одноклеточных животных сюда можно отнести ресничных червей, нематод, ракообразных, тихоходок, поденок и прочих личинок насекомых.

Ключевые слова: Водоемы Азербайджана, биоразнообразие, Protozoa, беспозвоночные животные, позвоночные животные