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Ecological features of reptile fauna formation in strongly urbanized territories of Absheron peninsula

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Abstract
Absheron peninsula belongs to Azerbaijan's one of the highly urbanized regions on the example of which it is possible to solve a number of questions of ecology, human and animal biology. In recent years, Absheron peninsula has been overpopulated; the refugees from Armenia, Zangezur and Nagorno-Karabakh settled down in the cities and settlements of this zone. The subject of this research is the study of reptile ecology in the urbanized territories of Azerbaijan, particulary, in the territory of Absheron, which has been poorly studied according to the analysis of currently available literature.

Keywords: absheron, urbanization, ecology, ecosystems, reptiles, fauna, landscapes, nature

Introduction
Urbanization of individual cities and towns in the world is widely discussed among biologists, environmentalists and professionals involved in this field. In recent years, fundamental works have been carried out on urbanization of different cities of Russia, Georgia, Ukraine and other countries (Iskenderov 2012; Berdzenishvili N.M.; Davitashvili M.D. 2016; Shlyakhtin, Golikova 1986) [8, 2, 13] and number of dissertations have been written (Zakharov, 2005; Federova, 2005, Tolkachev, 2007; Khairutdinov 2010, Losev, 2011) [5, 12, 10, 11, 7]. However, in Azerbaijan no one has paid attention to this question. It is known that in recent years, one of the new and rapidly developing fields of ecology is considered to be the studies on natural resources in urban territories. Strong process of urbanization in the Absheron Peninsula of Azerbaijan emerged after the collapse of the Soviet Union. As a result of unfair aggression of Armenians, more than a million people- Azerbaijanis moved to Azerbaijan leaving their mother lands and the vast majority of them settled down in the territory of Absheron peninsula. This process has severely damaged the ecosystem of the area and generated completely new landscape and fauna of different groups of animals. Insights into the evolutionary history of Absheron peninsula show that it is one of the richest areas in terms of the composition and abundance of reptiles. It is worth pointing that not long ago one of the greatest breeding ground for reptiles of the world acted successfully in Absheron keeping more than four thousand Levantine vipers and producing poison. This breeding ground has been the main supplier of snake venom for the pharmaceutical industry of the former Soviet Union.

The aim of this work is to study the specific features of reptile ecology during urbanization of Absheron Peninsula. Specifically, this work is one of the first, which is devoted to the study of the formation of herpetofauna in heavily urbanized areas of the country, based on the example of Absheron Peninsula (9).

Materials and methods
The materials of the research were characteristic species of reptiles collected in the territory of Absheron peninsula during 2015-2016 years. The method used during the expedition route was accounting (Shlyakhtin, Golikova, 1986; Darevskii *et al.* 1989) [3, 13]. Zoning investigated regions was determined by the nature of anthropogenic impacts. These regions were divided into 6 zones: 1- Low-rise buildings zone (the village of Gala, Mardakan, Shuvalan, Bilgah, Fatmai); 2- Mixed buildings zone (Mehdiabad, Jeyranbatan, Lokbatan); 3- High-rise buildings zone (Baku, Khirdalan and Sumgait); 4- Industrial Zone (the area of oil and gas refineries and municipal solid waste sorting plant of Baku); 5- Suburban forests (forests around Jeyranbatan reservoir and along the main roads); 6- Clean Zone (the area of Absheron National Park). The following indicators were calculated in the investigated zones: an average indicator of species in 1 kilometer of chosen route, an average number of reptiles marked in a unit of a route, richness index of species, common coefficient Chekovsky-Sorensen (Yakovlev, 2002) [14]. In addition, the percentage (%) and relative abundance of species (ind/km) were determined. As for the population density of certain species of reptiles, the width of bands ranged from two to five meters and the length of the route depending on the size of settlements was 100-1000 meters.

Results and discussion
Absheron is a model area which can be used to characterize the process of urbanization and the relationship between wild animals and humans. Furthermore, this peninsula is a unique place for the study of adaptation process happening in an animal world, especially in reptiles.

It is known that reptiles are a great part of different biocenoses. Although their role is small in the cycle of substances, they are known for being useful in agriculture and forestry by eating insects, snails, rodents. In addition, the meat of reptiles, including lizards (iguanas, monitor lizards), turtles

(green, giant land and sea tortoises and their eggs) and snakes are used in many countries as food delicacies. In some countries farms, reserves, breeding grounds and serpentarium are created where these animals breed and are protected in order to obtain the venom for pharmaceutical and food industries. Snake venom has a therapeutic effect and is widely used in medicine for the treatment of diseases like haemophilia, rheumatism and epilepsy. Besides, the skin of reptiles especially of snake, crocodiles, lizards and the shell of tortoise are used in light industry for the preparation of a variety of footwear and clothing accessories. On the other hand, some species of reptiles, including crocodiles and snakes are dangerous to human health and life. Sometimes, people become victims of poisonous snakes as a result of careless handling. Such cases happen frequently in Absheron peninsula inhabited by Levantine viper.

The number of different species of reptiles decreases each year in the territory of our country including in the area of Absheron peninsula (1,6). Taking this reason into account, besides conservation, the species of reptiles listed below are also included in the Red Book of Azerbaijan (1). This list entails – Mediterranean tortoise, sunwatchertoadhead agama, golden grass mabuya, horny-scaled agama, twin-striped skink, Asian snake-eyed skink, Persian ratsnake, Blotched snake, Transcaucasian or South Caucasian ratsnake, black-headed ground snake, Radde's mountain viper, Eastern viper (12 in total).

According to the results of expeditionary analysis, among mature individuals of sand lizards, four or five-year-old animals dominated; they made up the core of the population and provided reproduction. It was observed that in the zone of high-rise buildings three- and four-year-old species of geckos dominated, but five-year-old members were rare. The data on the occurrence of reptiles in the above-mentioned areas of Absheron peninsula revealed that predominantly passive reptiles like Mediterranean tortoise, blind or worm snake, cat snake, Schneider's skink, Montpellier snake and Dahl's whip snake were found in the first area.

The zone of suburban forests (26 species observed) and the clean zone (24 species) were characterized by the greatest diversity of species. Sand lizard and water snakes were among the common species. This was explained with the abundance of water reservoirs including canals (for snakes), nutrients and diversity of flora protecting them from natural enemies and the lowest transformation. Compared to these areas, the industrial zone and the zone of high-rise buildings of peninsula were poor in terms of the composition of reptile species. Apparently, in these zones the degree of urbanization was higher and accordingly their food supply was insufficient. The incidence of injured species increased due to the influence of urbanization. Species such as Mediterranean tortoise, Levantine viper and other reptiles are often attacked by people of this region. The information described above is confirmed by the fact that mostly young species of different reptiles are found in densely populated areas. In this case, the main factors causing disparity in ages of reptiles in urban areas are anthropogenic. While such species were prevalent in the area of high-rise buildings (0.76), the frequency of injured species was about 0.21 in the clean zone. Apparently, this was due to the fact that the conditions of urbanization of the peninsula were not the same for the selected areas, so their number was great in the zone of low-rise buildings. It is no coincidence that in recent years different types of snakes, some of which are poisonous, have been encountered in many areas of low-rise residential buildings. These facts once again prove that a strong urbanization of the peninsula leads to the occupation of the habitats of reptiles by humans and ultimately, these reptiles start to live together with humans.

It was found that as a result of industrial development the number of some species of reptiles such as Mediterranean tortoise-Testudo graeca L. 1758 decreased sharply. On the contrary, a Caspian gecko- C. caspius E. 1831, became abundant species. Especially, in densely populated towns and suburban regions geckos were quite a lot, sometimes 15-20 animals were found per 10 km^2.Steppe runner lizard, Asian snake-eyed skink, rapid fringe toed lizard, eumeces, water snake, Levantine viper, collared dwarf snake and others are often found in the investigated areas.

Conclusion

Due to the strong urbanization of Absheron peninsula herpetofauna is subject to significant human impact and as a result, the ecosystem of reptiles of these regions are regenerated. It was revealed that the suburban forest areas are rich in the number of reptiles, the zone of low-rise buildings and the zone of mixed buildings are in intermediate position, and practically there are not any members of reptiles except for the exotic ones, such as Mediterranean tortoise, in the zone of high-rise buildings.

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