



SPECIES OF THE DAPHNIA GENUS AND THEIR AQUACULTURE POTENTIAL IN LAKE AMIRJAN (BULBULA)

Nuray Ismayilzadə¹

¹Western Caspian University

Abstract

This study analyzes the species diversity of Cladocera in Lake Amirjan (Bulbula), located on the Absheron Peninsula, and evaluates their aquaculture potential. The research determined the diversity and abundance of Cladocera species in the lake, revealing that some species could serve as valuable resources for aquaculture. The findings indicate the presence of various Cladocera species, with *Daphnia pulex* being the dominant species in terms of both abundance and biomass. Additionally, the study examines the ecological role of these species, their impact on the lake ecosystem, and their relationship with ecological conditions. The results highlight the importance of Cladocera in maintaining biodiversity, supporting the trophic chain, and serving as a key food source for fish in the region. The high nutritional value and rapid reproductive capacity of certain Cladocera species make them well-suited for aquaculture. Furthermore, the study evaluates seasonal variations in species composition and the influence of anthropogenic factors on the lake ecosystem.

Keywords: Cladocera, Lake Amirjan, species diversity, aquaculture, anthropogenic impact

***Corresponding Author:** nurayismayilzad24@gmail.com

Received:28 August 2025; Accepted:6 September 2025;

Published:28 October 2025

DOI:10.54414/WNJJ8235

Introduction:

There are about 250 lakes within the borders of the Republic of Azerbaijan and the majority of these lakes are small in terms of surface area. The lakes in the country are divided into three groups according to their location and origin of formation:

- Kur-Araz Plain Lakes
- Absheron Peninsula Lakes
- Mountain Lakes

There are about 150 lakes in the Absheron Peninsula. Only 6 of these lakes differ from the others in terms of surface area. Large lakes with a surface area of 1 to 13 km² are: Böyükşor, Masazır, Binəqədi, Kurdəxanı, Xoca-Həsən and Krasnoe lakes. These lakes belong to the group of relict (relict) lakes in terms of formation.

All lakes on the peninsula are salty. This is mainly due to the high content of sodium

(Na⁺) and chlorine (Cl-) ions in the water of these lakes. Many lakes in Absheron were used in the past as natural reservoirs for salt production. Until 1960, lake water levels dropped as temperatures rose, and some lakes could dry up completely. During cold periods, the water level would rise again. However, in the 21st century, especially with the rapid development of the oil industry and agricultural activities, the discharge of industrial and domestic wastewater into the lakes has increased, leading to serious pollution of the lake waters.

The lake ecosystem in Absheron is divided into three groups according to the salinity of the water:

- Saline lakes
- Hypersaline lakes

- Slightly saline lakes

Today, the number of saline and hypersaline lakes is smaller than the number of lightly saline lakes. These lakes also vary in depth. Therefore, although water levels decrease as temperatures rise in summer, these lakes do not dry up completely. Lake Amirjan (Bulbul) is one of the shallow water basins located in the centre of Absheron peninsula. Over time, this lake has become one of the saltwater lakes of Azerbaijan [1]. Located on the Absheron Peninsula, between the settlements of Bakyanov and Izmirjan, at an altitude of 8 meters above sea level, this lake is one of the most important natural features of the region, notable for its ecological and hydrological characteristics. Like other lakes, in the past it was recognized as one of the saline lakes of the Absheron Peninsula. The area of the lake is about 3 km², the maximum depth is 4 meters and the average depth is 1.1 meters. Its water is slightly salty, with salinity ranging from 0.8-0.96% (8-9.6 ‰) in summer and 0.15-0.4% (1.5-4 ‰) in winter. The water level and other physicochemical properties of Lake Emircən vary depending on seasonal changes:

In summer, the water level of the lake decreases due to high evaporation rate, and salinity increases accordingly.

In winter, the water level rises and salinity decreases relatively due to increased precipitation and decreased evaporation.

Temperature values:

In summer: 28-33 °C in summer.

In winter: 6-7 °C in winter.

The amount of dissolved oxygen in the water is quite low - in the range of 6.5-9 mg/L. This is due to the high salinity level in the lake, which limits oxygen solubility.

pH value: The pH of the water ranges between 7.24-7.58.

The ecological balance of the lake is threatened by pollution and environmental pressures, especially from industrial activities. In this context, the protection of Lake Emircən is of great importance for the sustainability of the biodiversity and ecosystem integrity of the region. The lake is inhabited by various zooplankton organisms, including Cladocera. These small organisms are zooplankton

organisms that play an important role in the biodiversity of the lake [4]. They act as the main link of the food chain and are considered as indicators of the ecological status of water bodies. Cladocera feed on bacteria, algae and debris and serve as food sources for fish and other predatory organisms, respectively. These creatures are the food objects of fish living in other lakes of the peninsula. Cladocerans are important live food found in seas and lakes. Due to their small size, they are used as live food in the later stages of fish development. In addition, omega-3 fatty acids, which are essential amino acids obtained from unsaturated fatty acids, which are important for the growth and development of fish, are also present in cladocera.

Since these crustaceans are resistant to a wide range of changes in abiotic factors, they can be found in almost all water bodies of the world. In recent years, the increase of ecological problems in the lake, especially in the modern era, has had a great impact on biodiversity. As a result of the intense ecological situation in Lake Amirjan, blue-green algae (cyanobacteria) intensively developed in spring and autumn seasons. Therefore, a decrease in the species composition of Cladocera living in the lake was observed. Thanks to this research study, it is important to investigate these organisms, to evaluate their effects on the ecosystem and to make some suggestions for determining the potential of aquaculture.

Main section:

In this chapter, the species composition and ecological importance of Cladocera in Lake Amirjan, located in the centre of Absheron Peninsula, were investigated. Three species and one subspecies of Cladocera were recorded in Lake Amirjan [2,3]. The main habitat of *D. Pulex*, one of the species recorded here, is plant-rich water layers. In the lake, *D. pulex* species dominate in spring (March-April) and *D. magna* species dominate in May. In June, there is an increase in warm species. Cladocera reach their maximum amount in the lake in late spring and early summer. However, the number of crabs starts to decrease as a result of the increase in temperature in July-August in the summer



season. In autumn (September), as a result of the temperature drop, the most favourable conditions for the development of cladocerans are created. The main plankton composition in autumn is formed due to Cladocera - *D.magna*, *D.Pulex*, *D.middendorfiana* [6]. In 2013, the annual average number of cladocera in Lake

Amirjan was 738 individuals/m³. In April, a large part of the number of crabs consists of their larvae (nauplii). The period from the end of May to the beginning of July is considered to be the peak period of cladocera development [3].



1.*Daphnia Pulex* [14].



2.*Daphnia Magna* [15].



3.*Daphnia middendorfiana* [16]

In 2014, the annual average number of cladocera was 3500 individuals/m³. The number decreased in April and October and reached a maximum in June. The total number in spring and early summer was due to nauplii and metanauplii. In both years, *D. pulex* was the dominant species among the cladocera in Lake Amirjan (Bulbul). The main biomass producing species was *D. magna* [3].

In 2015, the average annual number of cladocera was 4900 individuals/m³ [6]. In the winter season, 15 individuals were studied and this was due to the low temperature in the water basin. With the increase in temperature, the number of cladocera increased to 9820 individuals/m³ in spring. A high increase in cancer development was recorded in May [2,3].

According to the results of the research, the highest diversity of cladocera species in Lake Amirjan was recorded in April-May. Among the dominant species, species belonging to the genera *Daphnia magna* and *Daphnia pulex* were found. The number of cladocera increased in spring and summer due to high temperatures and abundance of food sources. According to the seasonal changes, the number of cladocera increased significantly in spring

(April-May) due to the proliferation of phytoplankton, while the decrease of some species in summer (July-August) was attributed to high temperature and oxygen depletion. However, anthropogenic impacts (pollution, discharge of waste (domestic) water and decrease in water level) caused a decrease in the number of some species. As a result of these effects, the population of more sensitive species has decreased and tolerant species have become dominant. The high nutritional value and rapid reproduction of some cladocera species make them suitable for aquaculture. Especially *D. magna* and *D. pulex* (water flea) species recorded in Lake Amirjan are considered as an ideal source of live feed for fish nauplii, metanauplii and fry. The presence of natural populations of these species in Lake Amirjan in the peninsula creates potential for their utilisation in aquaculture [6].

Materials and Methods:

The research work was carried out in the laboratory of Western Caspian University in spring and summer. In the spring season, samples were collected from different depths and coastal areas of the lake using a plankton

net. Samples were taken from each point twice a month. The collection and processing of materials was carried out in 2 stages: 1st stage samples were collected and 2nd stage samples were analysed in the laboratory. The collected samples were fixed in 4% formalin or 70% alcohol and analysed in the laboratory to determine the species composition and abundance of cladocera. The study of species composition was mainly carried out using a binocular microscope. Samples were added in pieces to a Petri dish and analysed under a microscope. In this way, species composition and morphology were analysed based on specific reference books. Standard plankton analysis methodology was applied to calculate the quantity. At that time, various instruments designed for plankton were in use. Quantification was carried out under a microscope. Bogorov camera was used for counting. Mathematical analysis formulas were used for statistical processing and comparison of the data, seasonal variations and correlation between species were analysed.

Results and Discussions:

The high species diversity of cladocerans in Lake Amirjan (Bulbula) confirms their importance for this ecosystem. The highest amount of *D. pulex* cancer was recorded from the beginning of April to the end of June. It was determined that they play an important role in preserving biodiversity and maintaining ecological balance. Species such as *D. pulex* and *D. magna* were found to be potential resources for aquaculture. Anthropogenic impacts were found to have a negative impact on species diversity and cause species decline. It is therefore recommended that appropriate environmental measures be taken to ensure the conservation of the Lake Amirjan ecosystem. One of my recommendations is to conserve the species in Lake Amirjan, where *D. pulex* grows intensively, and to organise its use as a main resource for crab farming.

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