Determining the algoflora of Dengizkol Lake and breeding promising species in laboratory conditions

Feruzjon Shodmonov[1], *Dilbar* Ruzibaeva[2], *Gauhar* Allamuratova[3], *Tulqin* Abdurayimov[2,*] and *Shukhrat* Abdurasulov[2]

[1]Bukhara State University, Bukhara, 200100, Uzbekistan
[2]Tashkent State Agrarian University, Tashkent, 100140, Uzbekistan
[3]Nukus State Pedagogical Institute, Nukus, 230105, Uzbekistan

Abstract. This article found that 123 species and species of microscopic algae, belonging to 4 divisions, 9 classes, 19 orders, 25 families, 32 genera, are distributed in the algal flora of the Dengizkol reservoir. When analyzing microscopic algae of the Dengizkol natural reservoir in contour sections, it was found that the number of species is high in areas where water flows into the lake, and the number of species is low in areas remote from the inflow of water. In particular, 114 species of phytoplankton were found in the 1st circuit of the Dengizkol collector, 100 species in the 2nd contour of the reservoir of the Republic of Turkmenistan, 89 of them in the 3rd circuit of the ABMK-2 outlet canal. Chlorella vulgaris Beijer on 04" nutrient medium cells up to 45.1 million/ml, Scenedesmus obliquus (Turp.) Kütz. on the basis of experiments it was proved that the number of cells increased to 46.4 million/ml.

Keywords. Dengizkol, algoflora, collector, contour, phytoplankton, *Chlorella vulgaris* Beijer., *Scenedesmus obliquus* (Turp.) Kütz., *Hypophthalmichthys molitrix* Val..

1 Introduction

In the face of climate change, depletion of natural resources, and environmental change in the world, providing the human community with quality food, especially fish products, remains one of the most urgent tasks today [1]. Changes in the hydrochemical and hydrological conditions of the inland water bodies located in the plains of Central Asia were determined, and ways of developing fisheries were developed using some hydrobionts, including algae *Chlorella vulgaris* Beijer and *Scenedesmus obliquus* (Turp.) Kütz [2]. From this point of view, increasing fish productivity as a result of using biomass obtained by breeding nutritious species of aquatic plants as additional feed for herbivorous fish is of significant scientific and practical importance [3].

* Corresponding author: abdurayimov2023@bk.ru

Numerous scientists have developed methods for breeding species rich in physiologically active substances from phytoplankton plants and using them as feed for fish in water bodies [4-7].

In the scientific sources of scientists, a number of research works have been carried out on aquatic plants and their beneficial properties, reproduction of species rich in physiologically active substances, obtaining biomass, and using the obtained biomass in various branches of agriculture [8-10].

Although several scientists have conducted scientific research on the hydrobiological condition of the world's water bodies and the distribution of aquatic plants found in them, factors such as the current global warming process, changes in the volume of water in the basins, and the increase in the amount of minerals in the water affect the hydrobiological condition of the water bodies research on the impact is ongoing.

The use of biomass of microscopic algae *Chlorella vulgaris* and *Dunaliella tertiolecta* as promising raw materials for biofuel and bioenergy production due to their high photosynthetic efficiency and rapid growth [8]. When the algoflora of reservoirs in Samarkand region was studied, 102 species and subspecies taxa belonging to 4 sections (Cyanoprocariota, Bacillariophyta, Xantophyta, Chlorophyta) were identified. When studied in terms of seasons, it was found that the richest 51 species of algoflora accounted for 42.25% in the autumn season. It was found that the diversity of algoflora depends on water temperature, environment and the amount of mineralization [11].

In the research carried out in Kara-kyr lake of Bukhara region, it was found that there are 139 species of algae belonging to 4 sections, 9 classes, 19 orders, 26 families, and 35 genera [12]. In the studies conducted on the qualitative and quantitative composition of phytoplankton in surface water bodies of Bukhara region, Bacillariophyta-34 species, Chlorophyta-20 species, Cyanophya-15 species, Dinophyta-5 species, Englenophyta - 1 species encounter has been identified [11]. 389 species and species were identified in the algoflora of Chakmoq A, Sakovich and Mavliyan ditches located in Bukhara region, 163 diatoms, 132 green algae, 72 blue-green algae, 19 euglenas and 3 dianophytes were studied. Depending on the living conditions of the identified algae, 301 species of plankton and benthos have been shown. Among the algae, 345 belong to heat-loving and 44 cold-loving algae. At the end of spring, summer and beginning of autumn, when the water temperature is 18-38ºC, cold-loving species are found from the end of autumn to the beginning of spring, when the air temperature is 8-10ºC [6].

2 Materials and methods

The Dengizkol reservoir is located 75-80 km southwest of the center of Bukhara, 30 km south of the center of the Olot region (coordinates: 39º06′00″ N; 64º12′00″ E), with a total with an area of 45 This is 50 thousand hectares. This natural body of water borders the Republic of Turkmenistan (Figure 1). The Dengizkol reservoir was originally considered the last runoff of the Zarafshan River, with a water saturation of 0.08 - 1.5 billion/m^3, the largest part of 30 m, an average depth of 10 m, a total water content of 5700 million/m^3. At present, the total volume of water in this reservoir is 2800 million/m^3, and the main source of water in the lake is the spillway canal ABMK-1, ABMK-2 and the collector Dengizkol [1].

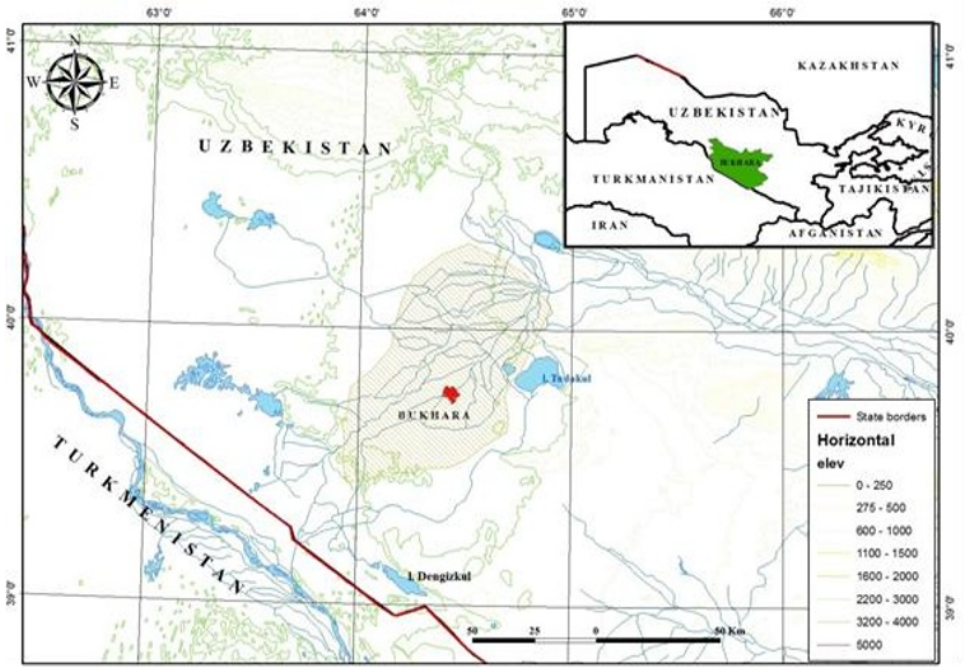

Figure 1. Map of Dengizkol.

When collecting hydrobiological samples from the Dengizkol reservoir, G.K. Plotnikov, I.G. Radchenko and N.A. Lemeza the methods of such scientists as [4-8]. In particular, two different methods were used to collect samples of phytoplankton organisms: 1. Quality; 2. Quantity. Both methods used the Epstein grid. Apshtein grid brand kapron No. 76, water inlet diameter No. 20. A specially prepared glass container was used mainly to determine the amount of microscopic aquatic plants scattered in the pond [11].

Samples of phytoplankton organisms were taken from all contours of the Dengizkol reservoir at a depth of 0.5 to 1.5 m. The collected samples were placed in a 4% formalin solution for laboratory testing and stored in a dark place, protected from sunlight. Phytoplankton in the laboratory is a common method, i.e. V.M. Katanskaya and A.M. Muzafarov's It was divided into types based on methods. Algae species isolated from the water of the lake were observed using light microscopes of the brands KHDS-3, V-380 [1-6].

To reproduce phytoplankton organisms, water samples were brought from different points of the Dengizkol reservoir and placed in nutrient medium 04 under laboratory conditions. To accelerate the reproduction of phytoplankton in the laboratory, additional special lighting lamps were installed to provide constant light (Figure 2). As a result, sufficient illumination and a comfortable temperature (not lower than 20-25^{0}C) were achieved for the growth of chlorella plants.

The temperature in special vessels where phytoplankton is grown was measured 4-5 times a day with a thermometer. After the temperature became moderate, the suspension in special containers with growing phytoplankton was mixed using a Super PUMP SP-780 compressor. The purpose of mixing the suspension is to prevent plants from sinking to the bottom of the water and speed up the process of photosynthesis.

3 Results and discussion

Studies on the analysis of phytoplankton organisms of the Dengizkol reservoir were carried out seasonally for all contours during 2020-2022. As a result, 149 samples were taken from the Dengizkol reservoir and research work was carried out. The results of the taxonomic analysis of the algae of the Dengizkol reservoir are shown in Figure 2.

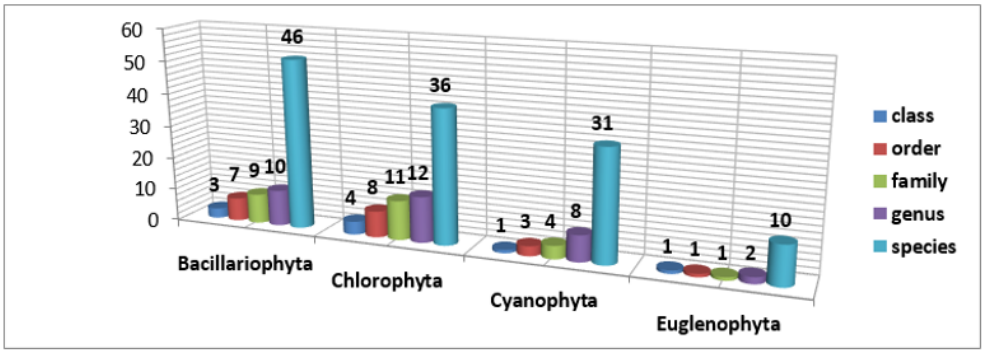

Figure 2. Histogram of taxonomic analysis of algae of the Dengizkol reservoir.

In the Dengizkol reservoir, microscopic algae include 123 species and species belonging to 4 divisions, 9 classes, 19 orders, 25 families and 32 genera.
Also, during 2020-2022, research work was carried out to determine the types of phytoplankton organisms in all contours of the Dengizkol reservoir. The results of the study are shown in Figure 3.

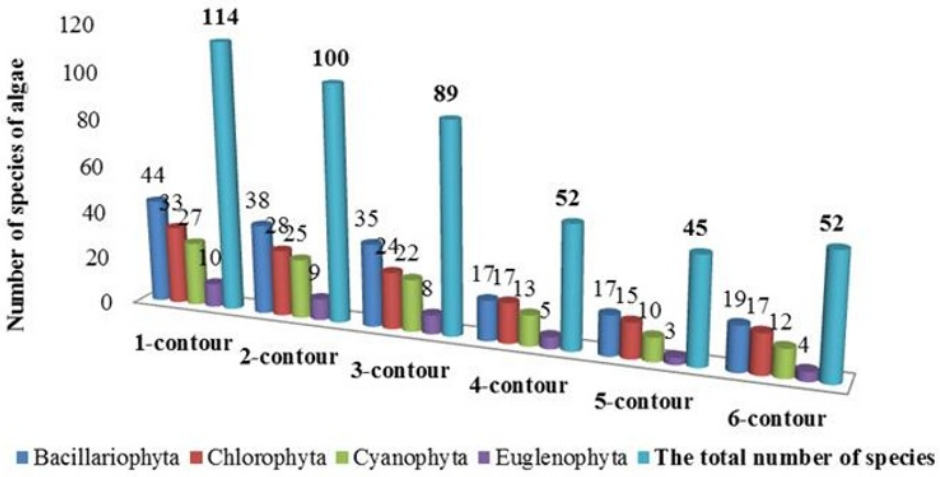

Figure 3. Distribution of microscopic algae of the Dengizkol reservoir along the contours.

When analyzing the microscopic algae of the Dengizkol natural reservoir in the contour section, it was found that the number of species is high in the areas where water flows into the lake, and the number of species is low in areas remote from the shore. In particular, 114 species of phytoplankton were found in the 1st circuit of the Dengizkol collector, 100 species in the 2nd circuit of the reservoir of the Republic of Turkmenistan, of which 89 species were found in the 3rd circuit of the ABMK-2 discharge channel.

The following common phytoplankton species of the Dengizkol reservoir have been identified:

Bacillariophyta - blue-green - Anabaena bergii, A. variabilis, A. Sphaerica, Merismopedia glauca, M. muscicola, M. Tenuissima, Oscillatoria angusta, O. geminota, O. limosa, O. acutissima, O. brevis, O. . tenuis, O.planctonica, O.cortiata. Chlorophyta - from green algae - Scenedesmys obliguus, S.quadricauda, S.acuminatus, Chlorella vulgaris, Ch.pyrenoidoza, Ankistrodesmus acicularis, A.angustus, A.arcuatus, Ulothzix zonata, U.variabilis, Cosmarium angulosum, Pediastrum baryanum. Cyanophyta - from diatoms - Diatoma ebongatum, D. anpers, D. vilgare, Cyclotella comta, C. bodanica, Melosira ambigna, Synedra acus, Navicula cari, N. basta, Cymbella affinus.

Euglenophyta - Eugleno algae - Euglina aculcate, E.deses, E.acus, E.variabilis. Chlorella vulgaris Beijer from algologically pure cells in water brought from Dengizkol reservoirs under laboratory and semi-production conditions and Scenedesmus obliquus (Turp.) Kütz. experiments were carried out to determine growth and reproduction. In laboratory conditions, experiments were carried out in bottles with a volume of 1.5-2.0 liters.

During the experiment, the temperature was 25-30 ºC, the light was around 10-15 thousand lux. For active growth of cells, the suspensions were mixed using microcompressors. Phytoplankton growth rate was taken into account for 5-6 days. The data obtained on the daily reproduction of Chlorella vulgaris Beijer and Scenedesmus obliquus (Turp.) Kütz in the waters of Dengizkol 1, 3 and 5 contours are presented in Table 1.

Table 1. Daily growth rates of Chlorella vulgaris Beijer and Scenedesmus obliquus (Turp.) Kütz in Dengizkol 1st contour (collector) water, 3rd and 5th contour waters of the lake under laboratory conditions.

Algae in the experiment	**Number of cells, million/ml**					
	1st day	**2nd day**	**3rd day**	**4th day**	**5th day**	**6th day**
Control variant "04" nutrient medium						
Chlorella vulgaris Beijer.	2.0 ±0.33	5.1 ±0.03	12.3 ±0.02	23.1±0.06	37.0 ±0.03	45.1 ±0.03
Scenedesmus obliquus (Turp.) Kütz.	2.0 ±0.33	5.5 ±0.24	15.4 ±0.06	26.4±0.12	38.3 ±0.02	46.4 ±0.02
Dengizkol 1st contour (collector) water						
Chlorella vulgaris Beijer.	2.0 ±0.06	3.8 ±0.12	9.5±0.07	15.3 ±0.03	20.6 ±0.04	25.1 ±0.02
Scenedesmus obliquus (Turp.) Kütz.	2.0 ±0.03	4.0 ±0.16	10.0±0.13	14.8 ±0.08	22.4 ±0.04	28.5 ±0.04
Dengizkol 3rd contour water						
Chlorella vulgaris Beijer.	2.0±0.03	3.6 ±0.24	7.2 ±0.12	14.4 ±0.08	20.1 ±0.06	24.2 ±0.05
Scenedesmus obliquus (Turp.) Kütz.	2.0±0.03	3.8 ±0.22	8.3 ±0.08	14.9 ±0.08	21.3 ±0.06	26.6 ±0.04
Dengizkol 5th contour water						
Chlorella vulgaris Beijer.	2.0±0.03	3.4 ±0.35	5.6 ±0.22	10.5 ±0.12	17.6 ±0.06	22.3 ±0.04
Scenedesmus obliquus (Turp.) Kütz.	2.0±0.03	3.5 ±0.38	5.8 ±0.16	9.8 ±0.11	18.8 ±0.04	23.4 ±0.02

According to the results of the experiments carried out in the waters of Dengizkol under laboratory conditions, active development and reproduction of *Chlorella vulgaris* Beijer and *Scenedesmus obliquus* (Turp.) Kütz cells were determined for 5-6 days. According to the results of the experiment, at the end of the experiment, the number of *Chlorella vulgaris* Beijer cells in 1 ml of suspension in Dengizkol 1- contour (collector) water was 25.1 million, and the number of *Scenedesmus obliquus* (Turp.) Kütz. cells in 1 ml were up to 28.5 million increase was noted.

It was found that the number of *Chlorella vulgaris* Beijer cells increased to 24.2 million/ml, *Scenedesmus obliquus* (Turp.) Kütz cells increased to 26.6 million/ml in the water taken from the 3rd contour of Dengizkol.

The number of Chlorella vulgaris Beijer cells grown for 6 days in the water sample taken from the 5th contour of Dengizkol Lake increased to 22.3 million/ml, and Scenedesmus obliquus (Turp.) Kütz cells increased to 23.4 million/ml was studied.

Based on the experiments, it was proved that in the control option, i.e. nutrient medium "04", the number of Chlorella vulgaris Beijer cells increased to 45.1 million/ml, and the number of Scenedesmus obliquus (Turp.) Kütz cells increased to 46.4 million/ml.

4 Conclusions

Zooplankton and fish in a lake can use the microscopic algae found in the lake as food. *Chlorella vulgaris* Beijer from green phytoplankton, rich in physiologically active substances and *Scenedesmus obliquus* (Turp.) Kütz. isolated algologically pure cells of the species, propagated in laboratory and semi-industrial conditions and *Hypophthalmichthys molitrix* Val. used as supplementary food for fish. In the natural reservoir of Dengizkol, 123 species and varieties of microscopic algae were found, belonging to 4 divisions, 9 classes, 19 orders, 25 families and 32 genera. In the analysis of microscopic algae of the lake. Dengizkol in contour sections, it was found that the abundance of species is high in areas where water flows into the lake, and the abundance of species is low in areas remote from the watercourse. In particular, 114 species of phytoplankton were found in the 1st circuit of the Dengizkol collector, 100 species in the 2nd circuit of the reservoir of the Republic of Turkmenistan, of which 89 species were found in the 3rd circuit of the ABMK-2 discharge channel. *Chlorella vulgaris* Beijer on 04" nutrient medium cells up to 45.1 million/ml, *Scenedesmus obliquus* (Turp.) Kütz. it was found that the number of cells increased to 46.4 million/ml.

References

1. Abdullaev M.A., Urchinov D.U. Promыslovыe rыbы vodoemov nizovev p. Zarafshan. – Toshkent: Fan, 2009. 72 p.
2. Anisimova O.V., Gololobova M.A. Kratkiy opredelitel rodov vodorosley. – M.: Universitet, 2006. - 159 p.
3. Esanov H.K., Shodmonov F.Q., Kobilov A.M. High Plant Species Distributed in and aro und Dengizkul, Bukhara Region// American Journal of Plant Sciences, 2021, 12, 266-273 https://www.scirp.org/journal/ajps https://doi.org/10.4236/ajps.2021.122016
4. Hulatt C. J., Lakaniemi A.-M., Thomas D. N., Tuovinen O. H., Puhakka J. A. Biogenichydrogen and methane production from Chlorella vulgaris and Dunaliella tertiolecta biomass // Biotechnol. Biofuels. - 2011. - V. 4. 34-46 pp.
5. Lemeza N.A. Algologiya i mikologiya. Praktikum: Mn.: Vysheyshaya shkola, 2007. 6-50 p.

6. Leng R A, Stambolie J H and Bell R. Duckweed - a potential high-protein feed resource for domestic animals and fish // Livestock Research for Rural Development. - 2019. - V.7, 45-48 pp.
7. Mathew G. Srirangam. Effect of partial replacement of fish meal with duckweed (*Lemna minor* L.), and soybean meal on the growth performance of *Ctenopharyngodon Idella* (grass carp) // International Journal of Fisheries and Aquatic Studies. - 2016. - V. 4(6). 133-137 pp.
8. Watanabe M.M. Freshwater culture media/Algal culturing techniques. Elsevier Academic Press, 2005. 13-20 pp.
9. Shodmonov F.Q., Bo‘riyev S.B., Okilova G.A. Fish fauna of lake Dengizkol // International Conference on Innovations in Applied Sciences, Education and Humanities, Hosted from Barcelona, Spain August 31st 2022 pp. 23-28. https://conferencea.org/index.php/conferences/article/view/1291
10. Bo‘riyev S.B., Yuldoshov L.T. Role of aquatic plants in increase of fish productivity in Dengizkol lake // 6th - International Conference on Research in Humanities, Applied Sciences and Education Hosted from Berlin, Germany. Sep. 30th 2022 pp. 11-14. https://conferencea.org/index.php/conferences/article/view/1329
11. Toshov H.M., Yuldoshov L.T. The Current Condition of Ichthyofauna of DengizkulNatural Water Basin // Jundishapur Journal of Microbiology Vol. 15, No.1 (2022)pp 5933-5944. https://www.jjmicrobiol.com/index.php/jjm/issue/view/1
12. Trifonova S.N. Praktikum po sistematike rasteniy: uchebno- metodicheskoe posobie: - Arzamas: Arzamasskiy filial NNGU, 2014. - 113 p.