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Eco-Alcocenoses of Fish Ponds in the Samarkand Region and its Ways of Formation

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Today it is important to provide the population with cheap, high-quality and environmentally friendly food, to maintain the sustainability of biodiversity in artificial reservoirs, especially to strengthen the food base for the development of the fishing industry. In this regard, the preservation and enrichment of the biological diversity of artificial reservoirs, ensuring the natural development of hydrobionts and increasing the productivity of fish using inexpensive, environmentally friendly methods are among the most important tasks today. Therefore, it is important to determine the hydrobiological characteristics of artificial fish ponds, determine the current state, conduct an inventory and identify patterns of algoflora formation.

Introduction

Algological studies all over the world are aimed at determining the state of algoflora in artificial reservoirs in areas with a strong anthropogenic impact on the assessment of quantitative and seasonal characteristics of feed algae in fish ponds in order to provide the population with cheap, high-quality and environmentally friendly fish products. It is especially important to preserve the biodiversity of artificial reservoirs in densely populated areas, ensure its sustainability, and develop effective technologies for using local

and environmentally friendly food products when growing fish products. In this regard, in fish ponds with various food sources, which determines the increase in the productivity of herbivorous fish by determining their hydrobiological properties, studying seasonal and quantitative aspects of algoflora and on this basis increasing the biomass feed algae species and reduce harmful species. Accordingly, the study of the composition of the algoflora of fish ponds, the justification of the role of environmental factors in the formation of algoflora in it, the development of recommendations for use in the field to

increase fish productivity by assessing the seasonal and quantitative characteristics of herbivorous species is of important scientific and practical importance.

Materials and Methods.

During the period of research and scientific expeditions (2016-2020), more than 200 (150 phytoplankton, 25 benthos, 25 periphyton) algological samples were collected (Figure. 1). The collection of materials and laboratory analyses were carried out according to generally accepted and modern algological (Gollerbach, Polyansky, 1951). "Taxonomic classification of cyanoprokaryotes (Cyanobacterial genera) 2014" was used to systematize blue – green algae. Diatoms are systematized according to the "System class Fragilariophyceae Round emend. Gogorev et Stepanova (Bacillariophyta)", K. Kgammeg, H. Lange-Bertalot (2011). The systems proposed by M. S. Kulikovsky *et al.*, (2016), euglenic "Higher classification and phylogeny of Euglenozoa (2016)", dinophytes "On dinoflagellate phylogeny and classification (2007)", green algae " Systematics of the green algae: conflict of classic and modern (2008)", "The taxonomy of the Chlorophyta" (2007) were also used. The general analysis of taxa was carried out according to V. Schmidt (1974). When analyzing the ecological and geographical features of algae, widely used works of a number of authors were used (Tashpulatov, 2017; Tashpulatov, *et al.*, 2020).

Results and Discussion

From the studied fish ponds of the Samarkand region, 258 species and varieties (256 species, 2 forms) of algae were identified. According to the analysis, 5 departments were identified (Cyanoprokaryota, Dinophyta, Bacillariophyta, Euglenophyta, Chlorophyta), 10 classes, 31 orders, 59 families, 126 genera

(Table 1). According to the taxonomic analysis, the department of Bacillariophyta is the leading one in terms of the number of species. It includes 97 species and varieties. They account for 37.60% of the algoflora. The next places were taken by Chlorophyta (70 species, 27.13%), Cyanoprokaryota (69 species, 26.74%), Euglenophyta (15 species, 5.81%), Dinophyta (7 species, 2.72%). According to the analysis of the leading taxa, a total of 59 families were identified in the surveyed fish ponds. Of these, 22 (37.28%) families are the leaders in the number of species.

These families include 179 (69.38%) species. Among the families, the clear leaders were Oscillatoriaceae (17 species, 6.59%), Bacillariaceae (16 species, 6.20%), Fragilaraceae (15 species, 5.81%), Cymbellaceae (10 species, 3.87%). Of the remaining 37 (30.62%) families, there are 1-4 species. Of the 126 genera in the algoflora, 18 were the leading ones. Leading births, account for 14.28% of the total number of births. In these genera, it turns off 100 (38.76%) species of algoflora. Among them are *Nitzschia* Hassall (14 species; 5.43%), *Closterium* (8 species; 3.10%), *Cosmarium* (7 species; 2.71%), *Phormidium* Kützing ex Gomont (7 species; 2.71%).

The second part of the chapter is devoted to the floristic analysis of algoflora and the peculiarities of its formation. It was noted that, taking into account the ecological characteristics of fish ponds in the studied territories, the nature of water availability, climate, soil and ground conditions differ significantly from each other.

83 species of algae have been identified in the Akdarya reservoir, which belong to 4 divisions, 8 classes, 24 orders, 36 families and 69 genera (Table 2). *Nitzschia* Hassall (4 species), *Ulothrix* (4 species), *Cosmarium* (4

species), *Spirogyra* Turpin ex Gomont (4 species), *Oscillatoria* Vaucher ex Gomont (3 species) are the leading genera of the algoflora of the reservoir. The 5 leading genera include 19 species (22.89%). The algoflora of the Akdarya reservoir is dominated by such species as: *Oscillatoria limosa* C. Agardh ex Gomont, *Oscillatoria planctonica* Woloszynska, *Spirulina meneghiniana* Zanardini ex Gomont, *Spirulina gomontiana* Kützing, *Synechra ulna* Nitzsch, *Navicula crypula*. The Akdarya reservoir is located directly in the bed of the Zarafshan River, the formation of the algoflora occurred in the following ways: river → reservoir; river → collector → reservoir; river → canal → rice fields → reservoir; domestic effluents → reservoir.

121 species have been identified in the algoflora of the Karasuk reservoir. They belong to 5 departments, 10 classes, 27 orders, 46 families, 84 genera. *Lindavia bodanica* Eulensteini ex Grunow, *Cyclotella meneghiniana* Kützing, *Peridiniopsis quadridens* (F. Stein) Bourrelly, *Peridinium pusillum* (Pénard) Lemmermann, *Euglena caudata* Hübner, *Gonium pectoralee* species are found in the algoflora. Formation of the algoflora of the Karasu reservoir: mountain streams → reservoir; supply channel → reservoirs.

127 species were identified in the algoflora of the Pastdargom fish ponds, including 5 departments, 11 classes, 27 orders, 52 families, 100 genera. *Nitzschia* Hassall (6 species), *Euglena* Ehrenberg (6 species), *Cosmarium* Corda ex Ralfs (5 species), *Oscillatoria* Lemmermann (4 species), *Phormidium* (Meneghini) Gomont in Bornet (4 species), *Fragilaria* Lyngbye (4 species), *Ulnaria* (Kützing) Compère (4 species),

Phacus Dujardin (4 species), *Gomphonema* Kützing (4 species), *Gyrosigma* Hassall (3 species), *Chlamydomonas* Ehrenberg (3 species), *Closterium* Nitzsch ex Ralfs (3 species) *Merismopedia* Meyen (3 species), *Spirulina* Turpin ex Gomont (3 species). The formation of the algoflora of the Pastdargom fish ponds occurs in the following order: river → channel → fish ponds; river → stream → fish ponds; rivers → channels → waste water → fish ponds.

It was established that 164 species were identified in the algoflora of Kattakurgan fish ponds. They consist of 5 departments, 9 classes, 26 orders, 51 families, 98 genera. The following species are intensively developing in the algocenosis: *Melosira varians* Agardh, *Aulacoseira granulata* (Ehrenberg) Simonsen, *Odontidium anceps* (Ehrenberg) Ralfs in Pritchard, *Coccconeis pediculus* in the algocenosis, *Pseudopediastrum boryanum*, *Tetraëdon minimum* (A. Braun) Hrades. The formation of the algoflora of Kattakurgan fish ponds occurs in the following order: river → channels → fish ponds.

106 species have been identified in the algoflora of Payaryk fish ponds, which consist of 5 departments, 11 classes, 25 orders, 44 families and 71 species. *Spiroculeus fragilis*, *Leibleinia epiphytica*, *Calothrix bravissimo*, *Cyclotella meneghiniana*, *Discostella stelligera* Cleve & Grunow, *Odontidium hyemale* (Roth), *Peridiniopsis quadridens*, *Euglena gracilis*, *Chlamydomonas reinhardtii*, *Volvox ehrenbergi*, *Willea apiculata* were identified in these ponds. The algoflora of the Payaryk fish-breeding ponds is formed in the following order: reservoirs → fish-breeding ponds; rivers → channels → fish-breeding ponds; rivers → channels → drains → discharges → fish ponds.

Fig.1 Map-scheme of fish-breeding ponds of the Samarkand region, where algological studies were conducted

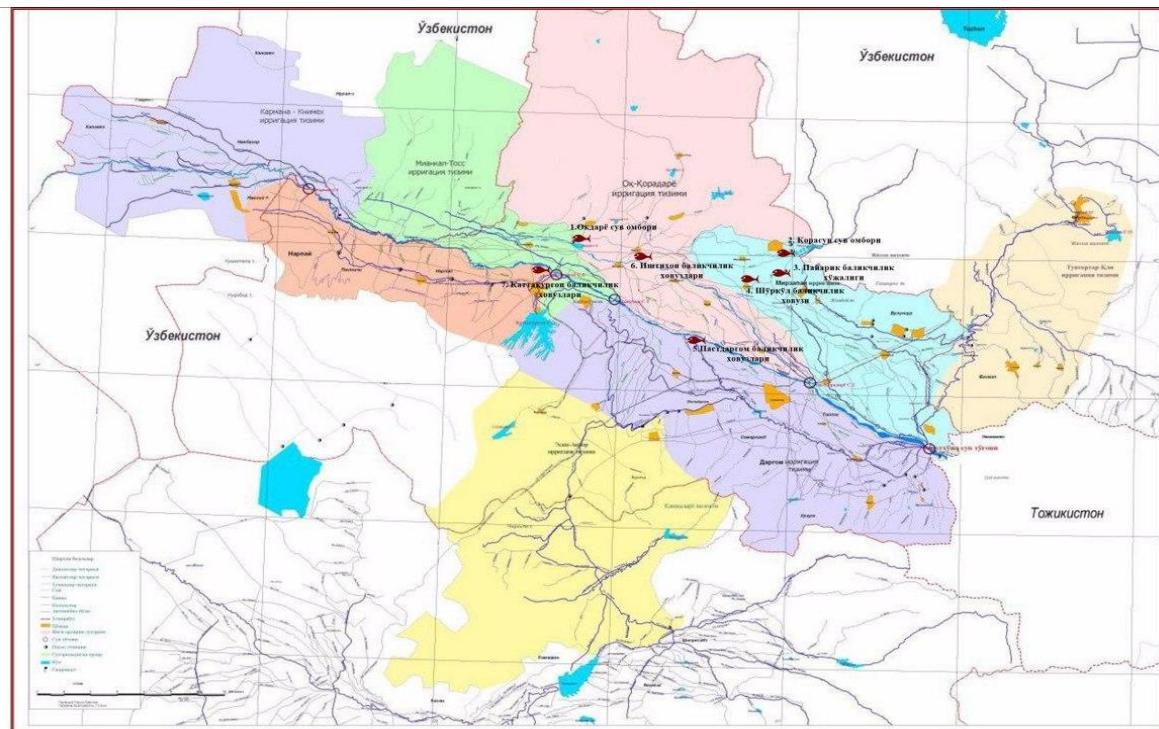


Table.1 Taxonomic composition of algoflora of fish ponds

Division	Number of taxonomic units							Total	%
	Class	Order	Family	Genera	Species	Variety	form		
Cyanoproctyota	1	5	17	38	69	-		69	26,74
Dinophyta	1	2	2	5	7	-		7	2,72
Bacillariophyta	3	11	19	44	95	2		97	37,60
Euglenophyta	1	1	2	5	15	-		15	5,81
Chlorophyta	4	12	19	34	70	-		70	27,13
Bcero:	10	31	59	126	256	2	258	100	

Table.2 Comparative taxonomic structure of algoflora of fish ponds of the Samarkand region

Reservoirs	Division	Class	Order	Family	Genera	Species	%
Karasuk reservoir	5	11	27	46	84	121	46,89
Akdarya reservoir	5	8	24	36	69	83	32,17
Pastdargom	5	11	27	52	100	166	64,34
Kattakurgan	4	9	26	59	98	164	63,56
Payaryk	5	11	25	44	71	106	41,08
Shurkul	5	10	25	40	73	111	41,08
Ishtykhhan	5	10	21	41	57	89	34,49

111 species have been identified in the Shurkul pond. They make up 5 departments, 10 classes, 25 orders, 40 families, 73 genera. They contain such species as: *Leibleinia epiphytica*, *Calothrix brevissima*, *Cyclotella meneghiniana*, *Odontidium hyemale*, *Peridiniopsis quadridens*, *Euglena gracilis* G. A. Klebs, *Chlamydomonas reinhardtii*, *Volvox ehrenberg*, *Merismopedia elegans*, *Spirulina princeps*, *Microcystis protocystis*, *Oscillatoria planctonica* Lemmermann, *Fragilaria capucina* Desmazières, *Ulothrix limnetica* Lemmermann in Heering. The algoflora of these fish ponds is formed in the following order: river → channel → sewage → arable land → pond; river → channel → stream → pond.

4 divisions of 10 classes, 21 orders of 41 families of 57 genera of 89 species were identified in the algoflora of Ishtykhhan fish ponds (Table 2). The following species are found in the algoflora: *Cyclostephanos dubius* Hustedt, *Pantocsekiella kuetzingiana* Thwaites, *Melosira varians* Agardh, *Aulacoseira ambigua* Grunow, *Odontidium anceps* Ehrenberg, *Fragilaria crotonensis* Kitton, *Ceratium hirundinella* O.F. Müller, *Parvordinium pusillum* Penard. The formation of algoflora occurs in the following order: rivers → fish ponds; rivers → channels → ditches → discharges → fish ponds.

The analysis shows that the characteristics, floristic composition, and algocenoses of the studied types of ponds differ depending on the water bodies belonging to each type. This situation depends on the nutrition of the reservoir, the properties of the soil, the water content and the regime of its exchange, a number of environmental factors (temperature, pH, the amount of suspended particles in the water, the content of organic and mineral substances, biogenic elements). The analysis of the peculiarities of the formation of the algoflora of fish ponds in the Samarkand region showed that the algocenoses differ significantly from each other, as well as the floral composition, diversity, and species location of the leading taxa in it. These characteristics include pond power sources, soil properties, pond fertilizers (mineral and organic), operating time, water cycle dynamics, and others. Environmental factors in ponds (temperature, water salinity, pH, suspended particles in water, organic substances) play an important role in its formation.

Due to the high population density around the ponds and the direct discharge of agricultural wastewater into the fish ponds of the Payaryk, Shurkul and Kattakurgan fish ponds, they differ sharply from the algal flora of other types of ponds mentioned above.

According to taxonomic analysis, this algoflora includes 5 divisions, 10 classes, 33 orders, 60 families, 118 genera, 230 species (89.14%). The number of common species for these fish ponds is 116 (50.43%). Common species include *Synechococcus elongatus*, *Merismopedia elegans*, *Anagnostidinema acutissimum*, *Lindavia comta*, *Discostella stelligera*, *Ctenophora pulchella*, *Ulnaria capitata*, *Navicula salinarum*, *Ceratium hirundinella*, *Euglena elongatus*.

The algal flora of these fish ponds is relatively rich in algae of other studied types of ponds due to their feeding on various water sources, relatively high and moderate water temperatures, and almost complete absence of water exchange in the ponds.

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