KAPITEL 9 / *CHAPTER 9* [9]
SCIENTIFIC AND PRACTICAL ANALYSIS OF THE STATE OF THE NATURAL FEED BASE IN PONDS OF SOUTHERN UKRAINE UNDER CONDITIONS OF TRANSFORMATION OF ABIOTIC AND BIOTIC FACTORS

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Introduction

The state of the natural resource base forms the potential and rational use of resources in the fish farm. The nutritional security of young carp in polyculture in breeding ponds largely depends on the qualitative and quantitative composition of feed hydrobionts, which, forming a food chain, ensure energy transformation at each trophic level. As is known, the structure of ichthyofauna for effective use must correspond to the presence of zooplankton, phytoplankton and zoobenthos. Monitoring the state of hydrobiology and hydrochemistry makes it possible to increase the efficient use of this resource.

Practical basis of scientific and experimental research.

In modern conditions, the Kherson Production And Experimental Plant For Breeding Of The Ordinary Fish (Kherson, Ukraine) has different categories of ponds in which carp species of fish are grown together (Fig.1). Ensuring the restoration of the number of partial species of fish *(Cyprinus Hypophthalmichthys, Ctenopharyngodon)* is carried out with the aim of curbing eutrophication, replenishing the reserves of aquatic biological resources, increasing fishing and obtaining high-quality fish products in the conditions of the transformed flow of the Dnipro.

The Kherson Production And Experimental Plant For Breeding Of The Ordinary Fish is intended for the production of stocking material of herbivorous fish and carp for the stocking of the Dnipro-Buh estuary ecosystem. It is located on the border of the V and VI fish farming zones. The total pond area of the farm is 473.93 hectares, of which 424.3 hectares are cultivated.

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Figure 1 - The Kherson Production And Experimental Plant For Breeding Of The Ordinary Fish

Among the exploited ponds, the 1st-order breeding ponds have the largest area, which make up 45.95 %, and the 2nd-order breeding ponds – 44.69 %. But the number and category of ponds may change depending on the planned needs of the farm. The main task of the farm is to obtain the planned amount of high-quality fish planting material using semi-intensive cultivation technology, due to the natural fodder base, the introduction of organo-mineral fertilizers, without the use of feeding.

Research methodology. The selection of hydrobiological water samples was carried out during the growing season of 2021–2022 using generally accepted methods [8, 9]. Phytoplankton samples were taken in the area of the water supply source, the spillway, the coastal part of the pond and its central part from the water surface (h–0.5 m), the samples were merged into one container from which an integrated sample with a volume of 1 dm^3 was taken, fixation was carried out with a formaldehyde solution. Thickening of the samples was carried out by settling in a dark place for 15–20 days by siphoning off the middle layer of water, after which it was finally measured and transferred to a smaller vessel [10]. The species composition was determined using generally accepted determinants [11-20]. Laboratory analysis of samples was carried out using a light microscope on a counter plate. Biomass was determined by the calculation-volumetric method [8, 21].

The material for the study of zooplankton development was obtained by filtering

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water (50 liter) through a Jeddi mesh with an inlet ring diameter of 25 cm. After that, the selected material was fixed, and camera processing of the samples was carried out using binoculars on a counter plate. Biomass was determined by the calculation-volumetric method based on the average volumes and established individual biomasses of zooplankton organisms, depending on the dimensional characteristics from literary sources [8, 22]. The qualitative composition of zooplankton was determined using special determinants [23-28]. Zoobenthos was sampled using a medium model Petersen dredger with a capture area of 0.025 m^2. Organisms were sorted into taxonomic groups and species affiliation was determined [29, 30]. Soft benthos was weighed on BT-500 torsion scales.

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Discussion of topical issues

The latest studies devoted to determining the level of development of the natural feed base in the ponds of the Kherson Production And Experimental Plant For Breeding Of The Ordinary Fish were conducted in 2008–2012. Over the years, the average seasonal level of phytoplankton biomass in the experimental ponds was 17.1 - 32.7 g/m^3, zooplankton from 0.78 to 2.17 g/m^3, and zoobenthos – 0.07 to 2.85 g/m^3, which in general can be considered satisfactory for the cultivation of stocking material of carp fish species under conditions of shortage of organic-mineral fertilizers [1, 2].

The dynamics of the biomass of food hydrobionts during the growing season of the breeding ponds of Kherson Production And Experimental Plant For Breeding Of The Ordinary Fish shows the sufficient level of provision of fish planting material with a natural feed base, the level of phytoplankton development was from 18.1 to 31.9 g/m^3, zooplankton from 0.6 to 2.1 g/m^3, zoobenthos from 0.9 to 5.1 g/m^2 [3]. The level of development of phytoplankton biomass during 2008-2010 varied in different ponds from 9.0 to 24.3 g/m^3 with an average seasonal indicator of 15.2–18.7 g/m^3. The biomass of zooplankton ranged from 1.0 to 34.8 g/m^3, zoobenthos from 0.01 to 13.83 g/m^3, the seasonal average was 3.8 to 16.8 g/m^3 and 0.12 to 2 .09 g/m^3 [4, 5].

The natural forage base of ponds has a directly proportional effect on the productivity of rearing ponds. Among the components of the fodder base, zooplankton, its species composition, quantitative and qualitative indicators play an important role. In the researched rearing ponds of the Rudnyki fish farm, the dominant position of branch-tailed crustaceans was noted, which prevailed both in terms of number and biomass, especially at the beginning of the growing season. The minimum indicators of zooplankton biomass did not decrease below 3.35 g/m^3. The average seasonal biomass of zooplankton during the growing season was 9.14 g/m^3 [6]. One of the effective measures to stimulate the development of the natural feed base is the introduction of organo-mineral fertilizers, which primarily affect the autotrophic component - phytoplankton, which comprehensively creates conditions for the active development of almost all components of the trophic chain of the natural feed base of fish [7].

Setting objectives

To carry out complex scientific and research work, to analyze the leading parameters. Expand and supplement modern hypotheses, ideas about the transformation of climatic parameters, correlations of abiotic and biotic indicators. To carry out an analysis, taking into account modern global climate transformations.

The main results

Biota components such as phytoplankton, zooplankton and zoobenthos play an important role in the life of reservoirs. The development of the natural fodder base, its species composition, the dynamics of numbers and biomass, the ability to satisfy the nutritional needs of consumers at each trophic level with the formed organic matter are the main conditions for obtaining high-quality fish stocking material in traditional fish farms.

The phytoplankton of the breeding ponds was characterized by a significant species richness, the total number of species identified during the growing season was 246 representatives. Phytoplankton in ponds is the primary link of the trophic chain and is food for both zooplankton and herbivorous fish. In breeding ponds, the development of phytoplankton is very specific and has wide fluctuations in quantitative and qualitative indicators. (Fig.2).

Figure 2 - Fragment of sample analysis in the laboratory (under a microscope)

The species composition of planktonic algae is primarily determined by a complex of environmental factors currently prevailing in the reservoir – temperature conditions, intensification measures, radiation intensity, water exchange rate, simultaneous cultivation of various types of fish, use of compacted plantings. However, the development of planktonic algae significantly depends on the efficiency of their consumption by *Hypophthalmichthys*. The taxonomic diversity of algae shows the largest share of representatives of *Chlorophyta* during the entire period of research according to the period of the growing season (Table 1.).

Spring phytoplankton was characterized by a greater share in quantitative terms of representatives of green algae, ranging from 31 to 50 % in ponds. Among the dominant species, *Pediastrum duplex Meyen, Scenedesmus ellipticus Corda, Scenedesmus obtusus Meyen, Schroederia setigera (Schröder) Lemmermann, Pseudopediastrum boryanum (Turpin) E.Hegewald, Pandorina morum (O.F.Müller) Bory, Oocystis lacustris Chodat, Oedogonium sp., Monoraphidium*.

In second place, the quantitative share was occupied by representatives of the department of blue-green algae *(Cyanobacteria)*, ranging from 3 to 11 %. *Anabaena sphaerica Bornet & Flahault, Merismopedia convolute Brébisson ex Kützing, Microcystis aeruginosa (Kützing) Kützing, Microcystis pulverea (H.C.Wood) Forti, Planktothrix agardhii (Gomont) Anagnostidis & Komárek* were the most common and quantitatively dominant. Diatom algae *(Bacillariophyta)* were of secondary importance, ranging from 1 to 3% in the ponds, except for pond № 5 where they occupied a dominant place by quantitative indicators – 17 %. *Achnanthidium minutissimum (Kützing) Czarnecki, Aulacoseira granulata (Ehrenberg) Simonsen, Melosira varians C. Agardh, Navicula radiosa Kützing, Nitzschia intermedia Hantzsch* dominated the species composition in terms of quantity.

Summer phytoplankton was characterized by intensive development of all algae divisions. Green algae *(Chlorophyta)* were dominant, accounting for a quantitative share of 28 to 50 %, in second place were diatom algae *(Bacillariophyta)* ranging from 10 to 52 %, and representatives of blue-green algae *(Cyanobacteria)* were in third place, making up during the growing season at different rates from 10 to 20 %. It should be noted that in the summer period, euglenoid algae *(Euglenozoa)* begin to develop intensively in ponds, the number of representatives reached up to 25 species, occupying a quantitative share among other divisions of algae from 5 to 10%. Euglena clara Skuja, Euglena granulata *(G.A.Klebs) F. Schmitz, Euglena korshikovii Gojdics, Euglena viridis (O.F.Müller) Ehrenberg, Lepocinclis fusiformis (H.J. Carter) Lemmermann, Phacus caudata var. minor Drezepolski, Trachelomonas volvocina (Ehrenberg) Ehrenberg.* In the autumn phytoplankton, the value of blue-green algae (19–30 %) and green algae (35–51 %) increased. On the other hand, the presence of diatoms decreased sharply, the fluctuation in the number of ponds was from 10 to 15 %. *Euglena* algae varied from 3 to 15 %.

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Table 1 - Species and taxonomic diversity of phytoplankton of the studied ponds

Representative	spring / №						summer / №							autumn / №				Total	Total in all ponds
	4	5	9	10	11	16	2	9	10	11	12	15	16	1	3	14	15		
Cyanobacteria	3/21	3/9	5/28	2/12	11/46	7/33	2/10	7/18	7/15	5/12	4/15	8/20	6/10	14/30	10/20	11/28	9/19	32/15	34/14
Bacillariophyta	1/7	17/49	3/17	3/18	1/4	3/14	2/10	9/23	11/23	12/29	6/23	13/33	31/52	6/13	7/14	6/15	5/10	62/28	67/27
Cryptophyta	1/7	–	2/11	2/12	1/4	1/5	2/10	3/8	2/4	1/2	3/12	2/5	–	–	–	–	1/2	4/2	4/2
Miozoa	–	–	–	–	–	–	–	1/3	–	–	–	–	2/3	1/2	–	–	–	3/1	3/1
Ochrophyta	–	3/9	2/11	3/18	1/4	1/5	2/10	1/3	2/4	1/2	2/8	1/3	2/3	–	1/2	1/3	3/6	12/6	14/6
Charophyta	1/7	1/3	–	–	1/4	1/5	–	2/5	–	–	–	–	–	–	1/2	3/8	1/2	7/3	8/3
Chlorophyta	7/50	11/31	6/33	7/41	9/38	8/38	10/50	11/28	21/45	19/45	11/42	14/35	18/30	20/43	25/51	18/45	22/46	77/35	91/37
Euglenozoa	1/7	–	–	–	–	–	2/10	5/13	4/9	4/10	–	2/5	1/2	5/11	5/10	1/3	7/15	21/10	25/10
Сума	14/100	35/100	18/100	17/100	24/100	21/100	20/100	39/100	47/100	42/100	26/100	40/100	60/100	46/100	49/100	40/100	48/100	218/100	246/100

Above the line - the number of species and intraspecific taxa of this division, below the line - % of the total number

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In general, assessing the quantitative dominance of different groups of algae in ponds during the growing season, it was established that the dominant position belongs to green algae *(Chlorophyta)* – 91 %, the second place belongs to diatom algae *(Bacillariophyta)* – 67 %, and the third place is occupied by blue-green algae *(Cyanobacteria)* – 34 %, to a lesser extent, euglenozoa *(Euglenozoa)* were found – 25 %. Other divisions of algae *(Cryptophyta, Miozoa, Ochrophyta, Charophyta)* occupied a minimal share by number ranging from 3 to 14 %.

Evaluating the dynamics of phytoplankton biomass during the growing season, the highest indicators were noted in the autumn period (Table 2). Pond № 3 and № 4 had the lowest values, being 20.03 – 23.85 g/m^3, respectively. The largest biomass of phytoplankton was noted in pond № 16, amounting to 102.54 g/m^3. Such high biomass was provided by the intensive development of green and blue-green algae during this period, the share of which was 30–42 %, respectively. The main dominant species that formed high indicators were *Aphanizomenon flosaquae Ralfs ex Bornet & Flahault, Microcystis aeruginosa (Kützing) Kützing, Merismopedia convolute Brébisson ex Kützing, Oscillatoria planktonica Woloszynska, Oscillatoria tenuis C. Agardh ex Gomont, Oocystis lacustris Chodat, Pandorina morum (O.F. Müller) Bory, Pediastrum duplex Meyen, Pseudopediastrum boryanum (Turpin) E. Hegewald, Scenedesmus ellipticus Corda, Scenedesmus obtusus Meyen.* Taking into account the high biomass of algae in the autumn period against the background of the intensive development of the corresponding phytoplankton groups, there is a problem of a significant unused feed resource for growing fish planting material, which may be related to the anatomical structure of the gill apparatus of large carp in this period in view of their filtering properties and dimensional a number of dominant species of planktonic algae, which are not effectively used in feeding fish planting material, which requires additional research and clarification. The biomass of spring phytoplankton in ponds ranged slightly from 0.81 to 2.26 g/m^3. The largest share of biomass in this period belongs to green algae ranging from 30 to 87 %, blue-green algae always had secondary importance, making up, respectively, from 22 to 85 %. In some cases, the dominant position was occupied by diatom algae, reaching up to 60 % by biomass (pond № 5).

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The biomass of phytoplankton in the ponds in the summer period varied greatly. The lowest concentrations of phytoplankton communities were noted in ponds: № 2 (0.5 g/m^3), pond № 12 (0.797 g/m^3) and pond № 15 (1.68 g/m^3), which are extremely low indicators for growing fish stock and requires additional stimulation of the development of algae as a fodder object due to the introduction of organo-mineral fertilizers. Other ponds were characterized by average values of phytoplankton biomass at the level of 4.14 – 14.43 g/m^3.

Table 2 - Phytoplankton dynamics during the growing season

Ponds, №	Biomass phytoplankton, g/m^3	Phytoplankton	% structure biomass
spring (11–12.05.2021)			
4	0,899	Chlrophyta Cyanobacteria other	54% (0,482) 39% (0,355) 7% (0,062)
5	1,128	Bacillariophyta Chrlophyta other	60% (0,674) 30% (0,339) 10% (0,115)
9	1,467	Cyanobacteria other	85% (1,244) 15% (0,223)
10	0,517	Chlorophyta Cyanobacteria other	58% (0,300) 22% (0,116) 20% (0,101)
11	2,257	Chlorophyta other	87% (1,967) 13% (0,290)
16	0,818	Chlorophyta other	67% (0,548) 33% (0,270)
summer (24.06.2021)			
2	0,649	Chlorophyta other	75% (0,487) 25% (0,162)
9	9,960	Cyanobacteria other	71% (7,119) 29% (2,841)
10	9,251	Euglenozoa Chlorophyta other	44% (4,047) 31% (2,897) 25% (2,307)
11	14,430	Chlorophyta other	64% (9,253) 36% (5,175)
12	0,797	Chlorophyta other	77% (0,612) 23% (0,185)

Ponds, №	Biomass phytoplankton, g/m^3	Phytoplankton	% structure biomass
15	1,680	Bacillariophyta Cyanobacteria other	44% (0,741) 33% (0,556) 23% (0,383)
16	4,140	Chlorophyta Bacillariophyta other	39% (1,625) 38% (1,565) 23% (0,953)
autumn (03.09.2021)			
1	63,227	Cyanobacteria other	61% (38,476) 39% (24,751)
3	23,846	Chlorophyta Cyanobacteria other	40% (9,618) 27% (6,444) 33% (7,784)
14	20,031	Bacillariophyta Cyanobacteria Euglenozoa other	35% (6,968) 32% (6,380) 28% (5,571) 5% (1,112)
16	102,542	Chlorophyta Cyanobacteria other	42% (43,226) 30% (30,597) 28% (28,719)

In general, assessing the dynamics of phytoplankton development in breeding ponds during the growing season, spring-summer phytoplankton in terms of biomass does not correspond to the normative values for the cultivation of fish stocking material for this climatic zone of southern Ukraine. Instead, in autumn, phytoplankton biomass has excessive values of more than 60 g/m^3, reaching the maximum values of 102.54 g/m^3 in pond № 16, which, on the one hand, indicates the low efficiency of the use of the feed base by consumers, and on the other hand, there is a threat of deterioration of the ecological state and quality water, which can lead to negative consequences - eutrophication and tiring phenomena.

The importance of zooplankton in the transformation of energy and the biotic cycle of substances that determine the productivity of water bodies is very important. Planktonic invertebrates form the basis of food for the young of all types of fish, and are also the basis of food for zooplanktonophage fish, peaceful zooplankton invertebrates feed on bacteria, detritus and algae. Thus, zooplankton acts as a natural bacterial filter. It significantly affects the abundance of phytoplankton photosynthesizing algae, regulating the oxygen regime. Zooplankton organisms are the main food for larvae, juveniles and adult fish - zooplanktonophages, balanced in terms of nutrient content, therefore their value in ponds is very important in view of obtaining high-quality fish stocking material for the next introduction into natural reservoirs of Ukraine.

The species composition of the zooplankton of the studied ponds during the growing season was almost uniform and included 28 representatives of different departments of zooplankton, not including nauplii forms and eggs of zooplankton (Table 3). Rotifers were most present in the composition of zooplankton – 12 species, followed by copepods and bivalve crustaceans, 10 and 5 specimens, respectively and branchial crustaceans were the least abundant – 2 specimens.

The presence of branchial crustaceans during the season *(Harpacticus Milne Edwards H., 1840, Diaptomus Westwood 1836, Nauplius)* was noted in all ponds in different numbers and biomass. At the beginning of the growing season, 13 representatives of different departments of zooplankton were developing in the ponds, the largest number of species was noted in the summer period – 26 specimens. At the end of the growing season, crustaceans lost their importance, copepods were found to a lesser extent. Unlike other representatives of zooplankton, from the beginning to the end of the growing season, rotifers had a tendency to increase their presence.

At the beginning of the growing season, copepod crustaceans dominated in the rearing ponds both in terms of quantity and mass indicators. The largest share was *Bosmina coregoni P.E. Müller, 1867, Moina macrocopa (Straus, 1820) and Daphnia longispina (O.F. Müller, 1776),* occupying 60.6%, 23.01% and 6.34% of the biomass, respectively. At the same time, representatives of rotifers – *Polyarthra platyptera Ehrenberg, 1838* – took a significant share in terms of quantitative indicators – 14.0 %, but due to their small size, their biomass occupied a small share – 0.1%, but their presence is important when stocking ponds with carp larvae, mouth the apparatus of which is not yet able to capture large forms of copepods and branchial crustaceans.

Table 3 - Species composition of zooplankton in breeding ponds

Copepoda	Spring	Summer	Autumn
Harpacticus (Milne Edwards H., 1840)	+	+	+
Diaptomus Westwood, 1836	+	+	+
Nauplius	+	+	+
ROTIFERA			
Lecane bulla (Gosse, 1851)		+	+
Brachionus leydigii (Cohn, 1862)		+	+
Brachionus quadridentatus (Hermann, 1783)		+	+
Brachionus urceus (Linnaeus, 1758)			+
Mytilina ventralis (Ehrenberg, 1830)		+	+
Philodina citrina (Ehrenberg, 1832)		+	+
Synchaeta pectinata (Ehrenberg 1832)		+	+
Polyarthra platyptera Ehrenberg, 1838	+	+	+
Keratella cochlearis (Gosse, 1851)	+		+
Asplanchna priodonta (Gosse, 1850)	+	+	+
Resticula melandocus (Gosse, 1887)		+	+
Filinia longiseta (Ehrenberg, 1834)	+	+	+
CLADOCERA			
Polyphemus pediculus (Linnaeus, 1761)		+	
Eurycercus lamellatus (O.F.Müller, 1776)		+	+
Bosmina longirostris (O.F.Müller, 1776)	+		+
Bosmina coregoni P.E.Müller, 1867	+	+	
Ceriodaphnia quadrangula (O.F.Müller, 1785)	+	+	+
Chydorus sphaericus (OF Müller, 1776)	+	+	+
Daphnia longispina (O.F.Müller, 1776)	+	+	
Moina macrocopa (Straus, 1820)	+	+	
Moina brachiata (Jurine, 1820)			+
Leydigia leydigi (Schödler, 1863)	+	+	
OSTRACODA			
Candona candida (O.F.Müller, 1776)		+	
Notodromas monacha (OFMüller, 1776)		+	
Cypridopsis vidua O. F. Müller, 1776		+	
Dolerocypris sinensis G.O.Sars, 1903		+	
zooplankton eggs		+	

In the summer period of intensive development of zooplankton (July – June), intensive development of branchial crustaceans, rotifers, copepods, and nauplial forms of branchial crustaceans was observed, but the largest share in the biomass belonged to zooplankter eggs. Compared to the spring-summer period, the nauplial forms of zooplankton reached their maximum numbers and biomass in the autumn period, accounting for 26.6 % by mass, and 58.2 % by number. Rotifers almost completely disappeared in the summer, reaching 15.6 % by weight of the total zooplankton, in autumn their share decreased to 1 %. Instead, copepod crustaceans made up the largest share of biomass – 58.6 % due to *Bosmina longirostris (O.F. Müller, 1776)* – 31.9 %, *Eurycercus lamellatus (O.F. Müller, 1776)* – 16.4 %, *Chydorus sphaericus (O.F. Müller, 1776))* – 10.2 %.

Biomasses of zooplankton in breeding ponds varied greatly, in the spring period of intensive vegetation, zooplankton biomasses ranged from 7.83 to 96.37 g/m^3. Such high biomass is caused by the massive development of copepod crustaceans – *Bosmina coregoni P.E. Müller, 1867*, reaching in ponds from 3.96 to 41.07 g/m^3 of the total biomass (Table 4).

The maximum biomass of zooplankton was noted in pond № 16, where along with Bosmina coregoni *P.E. Müller, 1867 – 41.07 g/m^3, Moina macrocopa (Straus, 1820) – 16.18 g/m^3, Daphnia longispina (O.F. Müller, 1776) – 14.79 g/m^3, Harpacticus Milne Edwards H.* had high biomasses, 1840 – 8.95 g/m^3, *Diaptomus Westwood,* 1836 – 1.59 g/m^3.

During the summer period, after stocking the ponds with larvae of carp fish species, the concentration of zooplankton in the ponds was more even and ranged from 5.68 to 72.51 g/m^3, but still had very atypically high indicators, which is evidence of highly productive conditions of existence (hydrological -hydrochemical regime, hydrobiological regime, food supply) and on the other hand – insufficient number of effective consumers in the form of Hypophthalmichthys, which in the early ontogeny mainly consume phytoplankton and zooplankton.

In July, there was a noticeable decrease in the concentration of zooplankton at the level of 13.62 g/m^3, which clearly demonstrates the transition of fry to intensive consumption of zooplankton, but despite this, the final biomass remained at a high level. Fluctuations of the average biomass in the ponds ranged from 5.68 to 96.37 g/m^3, making an average of 44.43 g/m^3 in the ponds in the summer. At the end of the growing season, the level of zooplankton development had the lowest biomass indicators compared to the spring-summer period, decreasing to 1.23 - 14.08 g/m^3, which is typical for this period. It should be noted that representatives of copepod crustaceans, which during the spring-summer period formed the basis of the biomass, were almost completely excluded from the composition of zooplankton, and in autumn they were replaced by spiny crustaceans, accounting for up to 5.85 g/m^3.

The species composition of the zoobenthos of the rearing ponds was quite uniform and formed mainly due to the larvae of dipterous insects - chironomids, and oligochaete worms. The presence of larvae of water beetles and dragonflies in some samples was sporadic and of no significant importance.

Biomasses were characterized by very close, almost identical values. In all rearing ponds, a natural gradual decrease in zoobenthos biomass was observed from May to August. This particularly affected chironomid larvae due to the flight of the imaginal stages of insects and their intensive consumption by carp.

The zoobenthos of the rearing ponds was represented by larvae of chironomids, oligochaetes, larvae of diopters and dragonflies. The average seasonal biomass varied from 1.9 g/m^2 to 5.0 g/m^2 (Table 4).

The maximum indicators were recorded in June, which was achieved due to the massive development of *Chironomus plumosus (Linnaeus, 1758).*

However, already at the beginning of July, when the intensity of consumption of zoobenthos by carp begins to increase, the biomass sharply decreased, which had a corresponding effect on the quantitative composition.

Biomass fluctuations during this period ranged from 3.2 to 7.8 g/m^2, with an average of 5.66 g/m^2. In July, the zoobenthos biomass ranged from 2.5 to 6.0 g/m^2, with an average of 4.01 g/m^2.

The reduction of zoobenthos biomass is noticeable in August, ranging from 1.4 to 4.5 g/m^2, and their minimum values are noted in September from 0.7 to 2.4 g/m^2.

Table 4 - Biomass dynamics (g/m^3) of zoobenthos in breeding ponds

Ponds	Period				Average season
	June	July	August	September	
№1	6,8	4,3	2,5	1,2	3,7
№2	4,5	3,9	2,0	0,8	2,8
№3	7,3	5,8	4,4	1,3	4,7
№4	5,5	3,6	1,8	0,7	2,9
№5	7,0	3,8	2,4	1,2	3,6
№6	5,5	4,2	3,1	0,8	3,4
№7	7,8	6,0	3,8	2,1	4,9
№8	3,2	2,5	1,4	0,35	1,9
№9	6,4	4,4	1,85	1,32	3,5
№10	7,4	5,6	4,5	2,4	5,0
№12	5,2	2,6	1,5	0,45	2,4
№13	4,3	4,0	3,4	1,56	3,3
№14	4,8	2,6	1,58	0,56	2,4
№15	3,6	2,8	1,64	1,2	2,3

Comparing the dynamics of the development of zoobenthos in ponds during the vegetation period, it should be noted the uniform nature of the concentration of benthic organisms, in contrast to planktonic ones, which had atypical indicators of biomass dynamics both during the vegetation period and in ponds.

The phytoplankton of the breeding ponds was characterized by a significant species richness, the total number of species identified during the growing season was 246 representatives. The dominant position of different groups of algae in ponds during the growing season belongs to green algae *(Chlorophyta)* – 91 %, the second place – diatom algae *(Bacillariophyta)* – 67 %, the third place is occupied by blue-green algae

(Cyanobacteria) – 34 %, in to a lesser extent, euglenozoa *(Euglenozoa)* were found – 25 %.

Other divisions of algae *(Cryptophyta, Miozoa, Ochrophyta, Charophyta)* occupied a minimal share by number ranging from 3 to 14 %. Considering the high biomass of algae in the autumn period against the background of the intensive development of the corresponding phytoplankton groups, there is a problem of a significant unused feed resource for growing fish stock. This may be related to the anatomical structure of the gill apparatus of large carp during this period due to their filtering properties and the size range of the dominant species of planktonic algae, which are not effectively used in feeding fish planting material, which requires additional research and clarification.

The biomass of spring-summer phytoplankton does not correspond to the normative values for the cultivation of fish stocking material for this climatic zone of southern Ukraine. In autumn, the biomass of phytoplankton had excessive values of more than 60 g/m^3, reaching the maximum values of 102.54 60 g/m^3 in pond № 16, which, on the one hand, indicates the low efficiency of the use of the feed base by consumers and its transformation into ichthyomas, and on the other hand, there is a threat of deterioration environmental condition and water quality, which can lead to negative consequences – eutrophication and tiring phenomena.

Biomasses of zooplankton in breeding ponds varied greatly, in the spring period of intensive vegetation, zooplankton biomasses ranged from 7.83 to 96.37 g/m^3. During the summer period, after stocking the ponds with larvae of carp fish species, the concentration of zooplankton in the ponds was more even and ranged from 5.68 to 72.51 g/m^3, but still had very atypically high indicators, which is evidence of highly productive conditions of existence (hydrological - hydrochemical regime, hydrobiological regime, food supply), and on the other hand - insufficient number of effective consumers in the form of Hypophthalmichthys, which in the early ontogeny mainly consume phytoplankton and zooplankton. At the end of the growing season, the level of zooplankton development had the lowest biomass indicators compared to the spring-summer period, decreasing to 1.23 – 14.08 g/m^3.

The zoobenthos of the rearing ponds was represented by larvae of chironomids, oligochaetes, larvae of diopters and dragonflies. The average seasonal biomass varied from 1.9 g/m^2 to 5.0 g/m^2. In all rearing ponds, a natural gradual decrease in zoobenthos biomass was observed from June to September. This particularly affected chironomid larvae due to the flight of the imaginal stages of insects and their intensive consumption by carp. Comparing the dynamics of the development of zoobenthos in ponds during the vegetation period, it should be noted the uniform nature of the concentration of benthic organisms, in contrast to planktonic ones, which had atypical indicators of biomass dynamics both during the vegetation period and in ponds.

Conclusions

Conducted research on the basis of the breeding ponds of the Kherson production and experimental plant for breeding of the ordinary fish indicate atypical dynamics of the development of the components of the natural feed base. Such aspects form a low fodder potential, as a result of which they create a threat to ensure obtaining high-quality fish planting material for introduction into the lower Dnipro, which is the main criterion for the adaptation period in new living conditions.

Analysis of the results of the level of development of fodder resources during the growing season indicates low biomass of phytoplankton in ponds in the spring-summer period, respectively 0.517– 2.257 g/m^3, 4.14 – 14.43 g/m^3. In autumn, excessive values of more than 60 g/m^3 were noted, reaching maximum values 102.54 g/m^3. The results of practical studies show that the biomass of zooplankton in breeding ponds varied greatly, in the spring period of intensive vegetation, the biomass of zooplankton ranged from 7.83 to 96.37 g/m^3. At the end of the growing season, the level of zooplankton development had the lowest biomass indicators compared to the spring-summer period, decreasing to 1.23 – 14.08 g/m^3. The average seasonal biomass of zoobenthos varied from 1.9 g/m^2 to 5.0 g/m^2, characterizing the uniform dynamics of benthic organisms, in contrast to planktonic ones, which had atypical indicators of biomass dynamics both during the growing season and after ponds.

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The results of the conducted research indicate the need to stimulate the natural fodder base by adding organic-mineral fertilizers to low-productivity ponds in the spring-summer period, changing the strategy of forming the composition of the polyculture in accordance with the productivity of the breeding ponds according to the level of development of fodder hydrobionts.

Macrophytes, phytoplankton, zooplankton and zoobenthos are the main feed objects in fish breeding ponds. They are the main food objects for herbivorous carp species of fish. The viability of larvae and younger age groups is determined by the level of metabolism, which reflects the living conditions and the level of provisioning of the food base of fish. The natural fodder base of ponds is a part of fodder resources and is a collection of hydrobionts, products of their decay (detritus), which are in the reservoir and are used directly as food for hydrobionts. Taking into account the obtained results, it was noted that the main task of specialists of fish farming enterprises is to optimally and tirelessly use feed resources with the aim of transforming them into a fodder base of ponds by simultaneously growing different types of fish – polyculture, using compacted plantings, intensification measures.