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SPECIES COMPOSITION OF FISH FAUNA IN THE BIOMONITORING SYSTEM OF THE MYKOLAIV OBLAST RIVERS

Abstract. The aim *of the study is to determine changes in the species composition of the ichthyofauna as an object of biomonitoring to assess the ecological status of small rivers in the Mykolaiv region.* ***The research methods*** *were based on the use of a standard set of tools recommended for field ichthyological and hydroecological surveys of river water bodies.* ***The scientific novelty*** *of the work is the following: the results of using data on the transformation of the species structure of the ichthyofauna of rivers (on the example of Mykolaiv region) as a bioindicative object for a generalized assessment of their ecological status. The essence of the analysis corresponds to the principle of bioindicative control of the state of large-scale ecosystems based on the reaction of certain biota communities to their changes. The analytical generalizations are primarily aimed at controlling the fish fauna of small rivers, which are most sensitive to environmental changes. The consequences of these changes over the past 70 years are extremely different – from the complete disappearance of fish fauna to the integral preservation of the primary species core and its expansion due to introductions. The transformation of local communities of aquatic organisms is adjusted to the hydrological regime of rivers and the level of their anthropogenic transformation. The greatest species diversity belongs to the fish communities of medium-sized full-flowing rivers (Kodyma, Sinyukha, Ingul, and Ingulets). The current aquatic fish fauna within the region (excluding the Southern Bug) contains 38 species, including 27 native species, 8 aliens (introduction and invasion), and the status of 3 species is not detailed. Between 1950 and 2020, 8 aquatic species of native origin, which included 6 passage forms, became extinct. The ichthyofauna of small rivers is represented mainly by pond-type communities based on introductions, allotments and 2-4 species of the native group.* ***Conclusions.*** *It has been established that in general survey studies of small water bodies, the use of bioindicators based on freshwater ichthyofauna is more effective than when using macrophyte plants. Certain limits of the rational use of ichthyofauna as a test object for bioindication have been identified – its suitability is adequate only in generalizing studies and loses effectiveness with the degree of reduction in size and increase in homogeneity of the studied water bodies.*

Key words: *biomonitoring, small rivers, ichthyofauna, bioindication, aquatic communities.*

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ВИДОВИЙ СКЛАД ІХТІОФАУНИ В СИСТЕМІ БІОМОНІТОРИНГУ РІЧОК МИКОЛАЇВСЬКОЇ ОБЛАСТІ

***Анотація. Метою роботи** є визначення змін видового складу іхтіофауни як об'єкта біомоніторингу для оцінки екологічного стану малих річок Миколаївської області. **Методи дослідження** базувалися на використанні стандартного набору інструментів, рекомендованих для польових іхтіологічних та гідроекологічних досліджень річкових водних об'єктів. **Наукова новизна:** представлено результати використання даних щодо трансформації видової структури іхтіофауни річок (на прикладі Миколаївської області) в якості біоіндикаційного об'єкту для узагальненої оцінки їх екологічного стану. Сутність аналізу відповідає принципу біоіндикаційного контролю стану об'ємних екосистем за реакцією на їх зміни певних угруповань біоти. Аналітичні узагальнення первинно спрямовані на контроль іхтіофауни малих річок, найбільш чутливих до змін природного середовища. Наслідки цих змін за останні 70 років украй різні – від повного зникнення іхтіофауни до цілісного збереження первинного видового ядра та його розширення за рахунок інтродуцентів. Трансформація місцевих угруповань гідробіонтів коригує з гідрологічним режимом річок та рівнем їх антропогенного перетворення. Найбільше видове різноманіття належить іхтіоценозам середніх за розмірами повноводних річок (Кодима, Синюха, Інгул та Інгулець). Сучасна туводна іхтіофауна в межах області (без Південного Бугу) містить 38 видів, у тому числі 27 аборигенних, 8 вселенців (інтродукція та інвазія), статус 3 видів не деталізований. Зниклими за період 1950–2020 рр. є 8 туводних видів аборигенного походження, у складі яких існували 6 прохідних форм. Іхтіофауна малих річок представлена переважно угрупованнями ставкового типу на основі інтродуцентів, вселенців та 2–4 видів аборигенної групи. **Висновки.** Встановлено, що в загально-оглядових дослідженнях малих водойм використання біоіндикаторів на основі прісноводної іхтіофауни є більш результативним, ніж при використанні рослин-макрофітів. Виявлені певні межі раціонального використання іхтіофауни в якості тест-об'єкта для біоіндикації – її придатність адекватна лише при узагальнюючих дослідженнях і втрачає результативність зі ступенем зменшення розмірів та зростання однорідності досліджуваних водойм.*

***Ключові слова:** біомоніторинг, малі річки, іхтіофауна, біоіндикація, угруповання гідробіонтів.*

Statement of the problem. The current state of the rivers of Mykolaiv region is characterised by a significant level of anthropogenic degradation, with most of them (113 out of 121) belonging to the category of "small rivers". The latter are extremely sensitive to changes in environmental conditions, and many of them are already at critical levels. In addition, small rivers have hardly been studied, with researchers traditionally focusing on large and medium-sized rivers such as the Southern Bug, Sinyukha, Ingul and Ingults, while there are virtually no recent publications on the ecology of small rivers in the Lower Pobuzhia region.

One of the objectives of the study was to conduct a biomonitoring assessment, the key issue of which was an attempt to determine the ecological status of small rivers based on changes in the species composition of their ichthyofauna. Changes in the species structure of ichthyocenoses can be successfully used in the biomonitoring system for retrospective and operational assessment of the hydroecological state of water bodies. From this point of view, biomonitoring of small rivers by the composition of their fish fauna can be defined as a methodological tool for assessing the state of water bodies existing under the conditions of long-term exposure to destabilising factors of natural and anthropogenic origin.

In contrast to the classical bioindication, which is focused on the search for the manifestation of the impact of pollutants and toxicants [1], in this study, the characteristics of the bioindication tool (species composition of the ichthyofauna) are purely monitoring, with complete distancing from the issues of aquatic toxicology. Thus, the adequacy is maintained between the used indication tool (discrete ichthyocenosis) and the dynamically changing monitoring object, which is the integral hydrosystem of a small river.

Analysis of sources and recent studies. At present, there are almost no publications on specialised, general ecological biomonitoring of small rivers by faunal communities, although research, purely ichthyological, on the transformation of the species composition of ichthyocenoses in the rivers of southern Ukraine is quite numerous and

extensive. And there is little research on small rivers in general, including ichthyological studies. At the same time, most publications on the ichthyological features of rivers in Kherson Province, and then Mykolaiv Province, in one way or another contain elements of biomonitoring. Even the first, purely descriptive works of K.F. Kessler (1860) on the composition of the local fish fauna already contain full-fledged hydroecological excursions and assessments of the state of water bodies as habitats for certain species of commercial fish.

Among the recent publications on the transformation of fish fauna, ecology and biomonitoring of freshwater bodies in the South of Ukraine, we should highlight the works of the Kherson Fish Hatchery School – Y. Pylypenko [2], I. Sherman and colleagues [3], V. Shevchenko and P. Kutishchev [4]. Numerous publications by A. Shcherbukha [5], V. Demchenko and A. Smirnov [6], N. Demchenko [7, 8], and Y. Heina [9]. In addition, elements of data analysis in the coordinates "species composition – water body ecology" are present in most modern publications on ichthyology in one way or another. Research work in this area continues to develop mainly in terms of operational assessment of water bodies based on integral (scoring) indicators containing ichthyological components. The latter are based on the bioindication significance of several specialised species from among the native communities of aquatic organisms, including representatives of zoobenthos and freshwater malacofauna [10].

The purpose of the study is to determine changes in the species composition of the ichthyofauna as an object of biomonitoring to assess the ecological status of small rivers in the Mykolaiv region.

Materials and methods of the study. The modern Mykolaiv region is an integral historical and economic arena formed in the lower part of the Southern Bug River basin (Fig. 1). The southwestern regions belong to the Black Sea River basin, and the south-eastern regions to the Lower Dnipro river basin.

The source materials are the results of our own studies of small rivers in the Mykolaiv region, carried out in 2020–2022. During environmental studies of 17 watercourses at once, it became

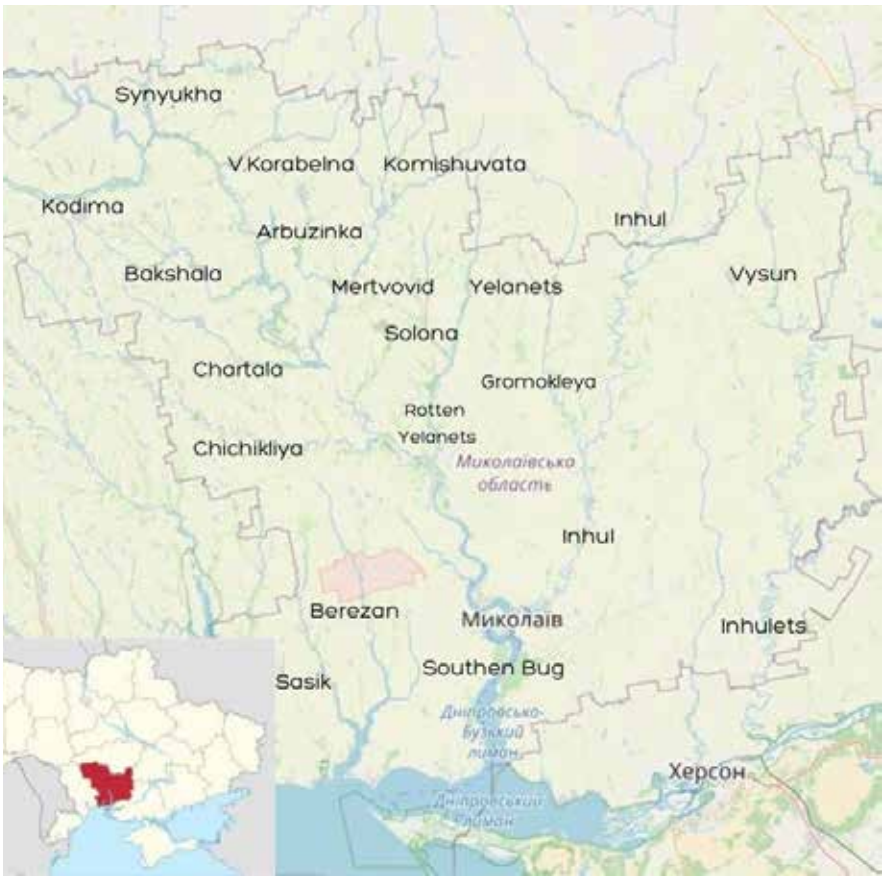

Fig. 1. Hydrographic network of Mykolaiv region

necessary to classify them, for which we chose a conditional division of water bodies into three geographically dependent groups: the right-bank Bug, the northern left-bank Bug and the southern left-bank Bug. During multi-seasonal field surveys of these water bodies, their condition and species composition of the local fish fauna were studied, based on commercial sampling, fishermen's catch and surveys of pond owners. Species lists for individual water bodies, their changes (1950–2020), and the relative number and species structure, which was reflected in a 5-point system (-/++++), were of primary information value. Materials from specialised literature and reports on the subject were also used.

The research methods were based on the use of a standard set of tools recommended for field ichthyological and hydroecological surveys of river water bodies [11, 12]. Species identification of fish was performed based on the "Identifier of fish of continental water bodies and watercourses of Ukraine" [13]. The Ukrainian species names of fish and aquatic organisms are given after Yu. Movchan [14], and their Latin names are given by T. Kotelat and J. Freyhof [15]. The obtained actual materials were compared with a block of retrospective materials, trying to trace certain effects of the action of, first, anthropogenic factors (reclamation, formation of reservoirs, ponds, afforestation, etc.).

Summary of the main material. The species structure of the ichthyofauna of the studied rivers and the general dynamics of its changes during the study period (1950–2020) were established, as shown in Tables 1–3. Small rivers with no natural fish fauna are not shown in the tables.

The species composition of the fish fauna of the right-bank rivers in terms of basin specificity combines the small rivers of the Black Sea region (Tsaryhol and Malyi Tsaryhol, Sasyk, Berezan), the rivers of the lower reaches of the Southern Bug basin (Chychyklia, Chartaly, Bakshala) and the medium-sized Kodyma River, whose valley is the dividing line between the Middle and Lower Pobuzhzhia (Table 1).

In the purely steppe rivers of the Black Sea region, due to the unstable flow regime, fish fauna is present in the lower reaches and in ponds and is represented by carp and silver carp, roach, rudd, roach and small perch.

The fish fauna of the flowing channel is currently preserved only for the Berezan River, the left branch of which is connected to the discharge collectors of the South Bug irrigation system.

It is natural that the primary species composition of the Black Sea rivers, which have access to the sea through the Tiligul and Berezan estuaries, was and still is dependent on their brackish water fish communities. As of 1950, these estuaries retained their freshwater character and served as important spawning grounds for migratory species. The salinisation of the waters caused by large-scale hydraulic works (deepening of the channel, construction of dams, etc.) led to disturbances in the natural state and caused the division into brackish and freshwater parts with the corresponding composition of fish communities.

The latter are currently not stabilised, combining components of marine, estuarine and partially freshwater ichthyocenoses, the influence of which is spread over the lower reaches of the Tsarygol, Sasyk and Berezan rivers. Accordingly, the transformation of the ichthyocenoses of these rivers is a consequence of profound changes in the state of the biota reserves – the Tiligul and Berezan estuaries.

The rivers that feed into the Southern Bug (Chychyklia, Chartaly and Bakshala) are also characterised by the steppe specificity of the seasonal flow regime, complicated by natural and anthropogenic destruction of watercourses. For example, the upper reaches of the Chichiklia,

Chartaly and Bakshaly are practically waterless, with fish present only in some ponds and represented by carp, silver crucian carp, sometimes silver carp and white cupid. The subpopulations of common crucian carp that existed in some parts of the waterlogged channel were assimilated by silver carp, which, together with carp and white silver carp, became background species. Even the lower reaches of the Chichiklia River, which until recently was characterised by significant species diversity and high numbers of native fish, is now also represented by "synthetic" communities dominated by ecologically plastic universalists.

For the last 50 years, the Chartaly River has been preserving its fish fauna only in the lower reaches, where the Prybuzhansky reservoir is located, separated from the Southern Bug by a non-flowing dam. This reservoir contains mainly native species such as roach, roach, rudd, pike, perch, but background species include goby, silver crucian carp, carp, silver carp and white amur. The reservoir itself is heavily silted (up to 2 m thick) and, with

Table 1

Species composition of the ichthyofauna of the right-bank rivers of the Bug Lowlands

List of species	Berezan			Bakshala			Chychyklia			Kodyma		
	1950	1985	2020	1950	1985	2020	1950	1985	2020	1950	1985	2020
Anguilla anguilla	+	–	–	–	–	–	–	–	–	–	–	–
Salmo trutta labrax	1–2	–	–	1–2	–	–	–	–	–	–	–	–
Acipenser ruthenus	+	–	–	–	–	–	5–7	–	–	–	–	–
Barbus borysthenicus	–	–	–	–/+	–	–	–	–	–	+	–/+	–
Rutilus. frisii	+*	–	–	+	–	–	+	–	–	+	–	–
Ballerus ballerus	–	–	–	+	+	–	+	–	–	+	+	+
Ballerus sapa	+	–	–	+	–	–	+	–	–	+	+	+
Abramis brama	++	–	–	+	–	–/+	–/+	–/+	–	+	+	+
Blicca bjoerkna	+++	+++	+	–/+	–/+	–/+	+	+	–/+	++	++	+
Scardinius erythrophthalmus	++	++	+/+	++	+	+	++	–/++	–	++	+	+
Rutilus rutilus	+	+	–/+	+	+	+	–/+	–/+	–/+	+	+	–/+
Carassius carassius	+++	++	–	+++	+++	–	+++	++	–	+++	+++	–
Tinca tinca	+	+	+?	+	+	+	+	+	–/+?	++	+	+
Rhodeus amarus	+	–	–	+	+	–	–	–	–	++	++	++
Alburnus alburnus	+	+	+	+	+	+	+	+	–/+	+++	++	++
Misgurnus fossilis	+++	++	–	++	++	+	+++	+	+	++++	+++	+
Aspius aspius	+	+	–	+	+	–	–/+	–/+	–/+	+	+	+
Squalius cephalus	–	–	–	–/+	–/+	–/+	–/+	–/+	–	++	++	–
Esox lucius	+	+	+	+	+	+	++	+	+	+++	++	+
Silurus glanis	–	–	–	–	–	–	+	+	+	++	+	+
Perca fluviatilis	++	+	+	+	+	++	+	+	+	++	++	++
Sander lucioperca	+	+	–	–	–	–	–/+	–/+	–/+	+	+	+
Vimba vimba	+	+	–	–	–	–	–/+	–	–	/–+	+	–
Chondrostoma nasus	–	–	–	+	–	–	–/+	–	–	++	+	–
Leuciscus idus	+	–	–	+	+	–/+	–/+	–/+	–	+	+	+
Pelecus cultratus	–/+	–	–	+	–	–	+	–	–	–	–	–
Leucaspius delineatus	–	–	–	+	+	+	+	+	–/+	++	++	+
Petroleuciscus borysthenicus	+	+	+	++	++	+	+	+	+	+++	++	+
Alburnoides bipunctatus	–	–	–	–	–	–	–	–	–	++/–	++/–	+/–
Gymnocephalus cernua	–	+	+	+	+	+	+	+	+	+	+	+
Gobio gobio	–	–	–	+	+	–?	–	–	–	+	+	+
*Eudontomyzon mariae***	–	–	–	+	+	–	+	+	–?	+	+	+?
Cobitis taenia	–	–	–	+	–	–	+	–	–	+	+	+
Atherina	–	–/+	–/++	–	–/+	–/+	–	–/+	–/++	–	–/+	–/+
Carassius gibelio	+	+	++	–	–	++	–	–	++	–	_	+++
Cyprinus carpio	+	+	+	+	+	+	+	+	+	+	+	+
Hypophthalmichthys molitrix	–	–	–	+	–	–	–	–	+	–	–	+
Ctenopharyngodon. idella	–	–	+	–	–	+	–	–	++	–	–	++
Lepomis gibbosus	–	–	+	–	–	+	–	–	+	–	–	+
Gasterosteus aculeatus	–	–	+	–	–	+	–	–	+	–	–	+
Pseudorasbora parva	–	–	+	–	–	+	–	–	+	–	–	+
Perccottus glenii	–	–	+	–	–	+	–	–	+	–	–	+
In general	24	18	17	29	22	23	28	22	23	30	30	31

*Note: -/+ absent in the upper reaches and present in the lower reaches; +/- present in the upper reaches but absent in the lower reaches; ? – situation unknown; * dubious; ** species or ecological form typification is dubious.*

a large area (36.3 ha), the water level decreases by 1.5–1.8 m due to drying out in summer.

The Bakshala River is quite specific, with its modern fish communities demonstrating a diverse composition – natural floodplain and riverbed (dominated by silver carp, silver bream and small perch), pond (dominated by carp, silver carp, silver carp and silver carp) and reservoir (dominated by roach, carp, bream, pike and perch). The species composition of Bakshalynske Reservoir, built in 2004 at the mouth of the river, is the richest, and it is now a separate right bay of Oleksandrivske Res-

ervoir (Southern Bug). The species composition of both reservoirs is almost identical – bream, roach, chub, elm, rudd, silver carp, roach, silver perch, pike, perch, pike perch, carp, silver carp, bluegill, silver carp, bittern, burbot and minnow are found.

The distinction of the fish fauna of the medium-sized Kodyma River is related to the specifics of this watercourse, which is a low-flow lake and river system. Its connection with the Southern Bug naturally determines the affinity of fish communities, but upstream of the Kodyma, bream, roach, roach, bleak, chub, elm and perch disappear, while the number of tench, crucian carp, tench and pike increases. Bivalves such as toothless mollusks and pearl mollusks are typical for the entire Kodyma, along with bittern, topsy-turvy, and the common bullhead. Thus, the Kodyma's flow, predominantly sandy bed and the presence of floodplain lakes in the absence of large hydraulic structures have ensured the relative environmental sustainability of the river and its natural fish fauna.

According to the literature, in the nineteenth and early twentieth centuries, the right-bank Bug rivers, especially in the lower reaches, were characterised by a strong fishery value [16] and served as important spawning and feeding grounds for juveniles of migratory and native species. However, by 1950, due to the transformation of watersheds and river valleys, these watercourses had virtually lost their fisheries, and only the Chichiklia and Kodyma in the lower reaches still retained some fishery value [17].

The data on the species composition of the fish fauna of the northern left-bank rivers (Sinyukha-Mertvovod interfluve), which originated in the central regions of the South Prydniprovska Upland and flow to the Southern Bug, are presented in Table 2. These watercourses are distinguished by their common origin in the South Prydniprovska Upland, high water salinity (2–4 thousand mg/dm3), the presence of fast-flowing canyon sections and a direct hydrographic connection with the Southern Bug.

The most authentic is the fish fauna of the Sinyukha River and the lower reaches of the Black Tashlyk River, where a group of native species is almost completely preserved. By the end of the 70s of the last century, cases of sterlet, ribefish, pufferfish, virezub, maren and sabrefish were recorded in the Sinyukha [5]. It is no longer possible to establish whether these were representatives of tuvid forms or sedentary individuals of migratory forms. However, even today there are some cases of catching marauders and large catfish, and common species of the rheophilic complex are bleak, chub, elm, bittern, oatmeal, burbot, minnow and bobber, i.e. typical species of the rheophilic complex.

The fish fauna of the small Korabelna, Garbuzynka and Mertvovod rivers, which have been transformed into a cascade of flowing ponds, is a "mixture" of natives, introductions and aliens with a complete absence of migratory fish. Representatives of the cultural group (carp, silver carp, silver bream, rudd, pike and perch) have become background species along with roach, bittern, sucker, rudd, and silver carp. Invasive species such as goby, silver crucian carp, atherina, sunfish, three-needle stickleback and the previously absent ruff are numerous and in some places very abundant. The newest complex of species has not yet been stabilised, as evidenced by periodic fluctuations in the abundance of some universal species such as sunfish, atherina, stickleback and predators (pike, pike perch, chub and burbot). This indicates a relatively satisfactory ecological condition of the rivers, the main stabilising factor being their year-round flow and the presence of numerous ponds and reservoirs. Their satisfactory condition is also evidenced by the presence of specialised species, such as bittern, oatmeal, dace, narrow-toed crayfish, and bivalves (pearl mussels and toothless molluscs). Marsh turtles are also common and are particularly numerous in Mertvovod.

For example, the basic conditions for a satisfactory hydroecological condition of the left-bank northern rivers are the flowing regime throughout the year, the rocky-canyon character of valleys and channel rifts, a significant number of biota reserves in the form of deep narrow reservoirs and the absence of wastewater discharges. The hydrographic unity of these watercourses with the Southern Bug, whose fish communities serve as the basis for restoring and maintaining the species structure of small river hydrobiocenoses, also plays a positive role.

The rivers of the left-bank northern watercourses are similar in terms of their origins and hydrochemical characteristics to those of the southern, more flat territory of Mykolaiv Oblast within the Yelanets-Ingulets interfluve. The latter are distinguished by their belonging to different basins (Southern Bug and Dnipro), significant water management transformation of river valleys, and a high

Table 2

Species composition of the ichthyofauna of the left-bank rivers of the Lower Pobuzhye (Sinyukha-Mertvovod)

List of species	Sinyukha			Black Tashlyk			Garbuzinka			Mertvovod		
	1950	1985	2020	1950	1985	2020	1950	1985	2020	1950	1985	2020
Anguilla anguilla	+ (3)	–	–	–	–	–	+	–	–	+ (1)	–	–
Salmo trutta labrax	–	–	–	–	–	–	–	–	–	(2)	–	–
Acipenser ruthenus	+	–	–	–/+	–	–	+	–	–	–/+	–	–
Barbus borysthenicus	+	–	–	+	–	–	–	–	–	+?	–	–
Rutilus. frisii	+	–	–	–/+	–	–	–	–	–	+	–	–
Ballerus ballerus	++	+	+	–/+	–/+	–/+	–	–	–	+	–	–
Ballerus sapa	++	+	+	–	–	–	–	–	–	+	–	–
Abramis brama	++	+	+	–/+	–/+	–/+	–	–	–	++	+	–
Blicca bjoerkna	++	++	+	+	+	+	+	+	–	–/++	–/++	_–/+
Scardinius erythrophthalmus	+	+	+	+	+	+	+	+	+	++	++	+
Rutilus rutilus	++	++	+	+	+	+	–/+	–/+	–/+	++	+	+
Carassius carassius	+++	+++	–	++	+	–	+	+	–	++	++	–
Tinca tinca	+	+	+	+	+	+	–	–	–	+	+	+
Rhodeus amarus	+	+	+	+	+	+	–/+	–/+	–/+	++	++	++
Alburnus alburnus	+	+	+	+	+	+	+	+	+	++	++	+
Misgurnus fossilis	+	+	+	+	+	+	+	+	+	+	+	–/+
Aspius aspius	+	+	+	+	+	+	+	–	–/+	+	+	–/+
Squalius cephalus	++	+	+	+	+	+	–/+	–/+	–/+	++	+	+
Esox lucius	++	++	+	++	++	+	+	+	+	+++	++	++
Silurus glanis	+	+	+	+	+	+	–	–	–	–/+	–/+	–/+
Perca fluviatilis	+	+	+	+	+	+	+	+	+	+	+	++
Sander lucioperca	+	+	+	+	+	–/+	–	–	–	+	+	+
Vimba vimba	++	+	–	+	–	–	–	–	–	+*	+*	–
Chondrostoma nasus	++	+	–	++	+	–	–	–	–	+	+*	–
Leuciscus idus	+	+	+	+	+	+	–	–	–	+	+	+
Pelecus cultratus	+	+	–	+	–	–	–	—	–	+	–	–
Leucaspius delineatus	+	+	+	+	+	+	–	–	–	–/+*	–	–
Petroleuciscus borysthenicus	+	+	+	+	–	–	+	+	+	+	+	–
Alburnoides bipunctatus	+	+	+	+	+	+	–	–	–	+?	–	–
Gymnocephalus cernua	–	+	+	–	+	+	–	–	–	–	+	–
Gobio gobio	+	+	+	+	+	+	–	–	+?	–	–	–
*Eudontomyzon mariae***	+	+	+	+	+	+	–	–	–	+	+	+
Cobitis taenia	+	–	–	–	+	–	–	–	–	+	–	–
Атерина Atherina	–	–	+	–	–	–/+	–	–	–	–	–	+
Carassius gibelio	–	–	++	–	–	++	–	–	+	–	–	++
Cyprinus carpio	–	+	++	–	+	++	–	+	++	–	+	++
Товстолоб білий Hypophthalmichthys molitrix	–	–	++	–	–	++	–	–	+	–	–	+++
Ctenopharyngodon. idella	–	–	+	–	–	+	–	–	+	–	–	+
Lepomis gibbosus	–	–	+	–	+	+	–	+	+	–	+	+++
Gasterosteus aculeatus	–	+	+	–	+	+	–	–	–	–	+	+
Pseudorasbora parva	–	–	+	–	–	+	–	–	–	–	–	+
Глена Perccottus glenii	–	–	+	–	–	+	–	–	–	–	–	+
In general	32	30	33	29	28	31	14	13	16	31	25	25

*Note: -/+ absent in the upper reaches and present in the lower reaches; +/- present in the upper reaches but absent in the lower reaches; ? – unconfirmed data; * doubtful reliability; ** species and phase stage data are doubtful; *** exact species differentiation based on inspection is doubtful.*

level of anthropogenic impact. The current and retrospective composition of the fish fauna of these rivers is shown in Table 3.

The closest eastern "neighbour" of Mertvovod is the Hnylyi Yelanets River, which in the second half of the twentieth century almost lost its nat-

Table 3

Species composition of the ichthyofauna of the rivers of the Yelanets-Ingulets interfluve

List of species	Rotten Yelanets			Gromokliya			Ingul			Vysun			Ingulets		
	1950	1985	2020	1950	1985	2020	1950	1985	2020	1950	1985	2020	1950	1985	2020
Anguilla anguilla	–	–	–	–	–	–	+	–	–(1)	–	–	–	+	–	–
Salmo trutta labrax	–	–	–	–	–	–	5–7	1–3	–	–	–	–	–	–	–
Acipenser ruthenus	++	–	–	–	–	–	+	–/+	–	–	–	–	+	–	–
Barbus borysthenicus	–	–	–	–	–	–	+	–	–	–	–	–	+	–/+	–
Rutilus. frisii	–	–	–	–	–	–	+++	–	–	–	–	–	+++	–	–
Ballerus ballerus	–	–	–	+	–	–	++	+	–	–	–	–	+	+	+
Ballerus sapa	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+
Abramis brama	+	+	–	++	+	–	+++	++	++	–	–	–	+++	++	+
Blicca bjoerkna	++	++	+	+++	++	+	+++	+++	++	++	++	+	++	++	++
Scardinius erythrophthalmus	++	++	+	+/++	–/+	–/+	+	+	+	++	+	–	++	++	++
Rutilus rutilus	++	++	–/+	–/+	–/+	+	++++	++	++	–	–	–	+++	+++	+
Carassius carassius	+++	+++	–	++	+	–	+++	++	–	+++	+++	–	+++	+++	–
Tinca tinca	+	+	+	+	+	–/+	+	+	+	–	–	–	++	+	+
Rhodeus amarus	++	++	–	++	++	+	+++	+	+	++	++	+	+++	++	+
Alburnus alburnus	+	–	–	–/+	–/+	–/+	+++	++	+	–	–	–	++	++	+
Misgurnus fossilis	++	++	+	++	++	+	++++	+++	++	++	++	–/+++	+++	++	++
Aspius aspius	+	–	–	+	–/+	–/+	+++	++	++	–	–	–	+	+	+
Squalius cephalus	+	+	–	–	–	–	+++	++	+	–/+	–/+	–/+	+	+	+
Esox lucius	+	+	+	+	+	+	+++	+++	++	+	+	+	+++	++	+
Silurus glanis	+	+	–	–	–	–	+	+	+	–	–	–	++	+	+
Perca fluviatilis	++	++	++	–	–	–	+++	++	+	+	–	–	++	++	++
Sander lucioperca	–/+	–/+	–/+	–	–	–	++	++	+	–	–	–	+	+	+
Vimba vimba	–	–	–	+/–	–	–	+/–	+/–	+	–	–	–	+	+	+
Chondrostoma nasus	+	+	+	–	–	–	+	+	–	–	–	+	+	+	+
Leuciscus idus	–	–	–	–	–	–	+	+	+	–	–	–	+	+	+
Pelecus cultratus	–	+	–	–	–	–	+	+	+	+	+	+	+	+	+
Leucaspius delineatus	–	–	–	–	–	–	+	+	+?	–	–	–	+	+	+
Petroleuciscus borysthenicus	+	+	–?	–	–	–	+	+	+?	–	–	–	+	+	+?
Alburnoides bipunctatus	–	–	–	–	–	–	+	+	+	+	–	–	+	+	+
Gymnocephalus cernua	+	+	–	–/+	–/+	–	–	–	–	–	–	–	++++	++	+?
Gobio gobio	+	–	–	+	+	–	+++	++	+?	–	–	–	++	–	–
*Eudontomyzon mariae***	+	+	–	–/+	–/+	–/+	–	–	–	–	–	–	+	+	+
Cobitis taenia	–/+	–	–	+	–	–	++	+	–	–/+	–	–	+	–	–
Атерина *Atherina*	–	–	–/+	–	–	–	–	–	++	–	–	–	–	–	++
Carassius gibelio	–	–	+++	–	–	++	–	–	+++	–	–	++	–	–	+++
Cyprinus carpio	–	+	+++	–	–	–	+	++	+++	–	–	–	–	++	+++
Hypophthalmichthys molitrix	–	+	+++	–	–	–	+	++	+++	–	–	–	–	++	++
Ctenopharyngodon. idella	–	+	++	–	–	–	+	++	+++	–	–	–	–	++	++
Lepomis gibbosus	–	–	++	–	–	–	–	–	++	–	–	+	–	–	++
Gasterosteus aculeatus	–	+	+	–	–	–	–	–/+	++	–	–	–	–	–	++
Pseudorasbora parva	–	–	+	–	–	+	–	–	+	–	–	+	–	–	++
Perccottus glenii	–	–	+	–	–	+	–	–	++	–	–	+	–	–	++
In general	22	23	19		17	14	14	32	32	11	8	12	33	31	35

*Note: -/+ absent in the upper reaches and present in the lower reaches; +/- present in the upper reaches but absent in the lower reaches; ? – unconfirmed data; * doubtful reliability; ** species and phase stage data are doubtful; *** exact species differentiation based on inspection is doubtful.*

ural state and was subjected to a series of water management changes. During the 60s and 70s of the twentieth century, the Kamianske (upper) and Shcherbanivske (lower) reservoirs were created in the river valley, hydraulic structures of the Yelanets irrigation system were built, some sections of the riverbed were partially canalised, and the flat areas of the estuary zone were drained. These two reservoirs have become the habitat of the modern ichthyofish complex, with water that is highly saline in summer (4–5 thousand mg/dm3). Their background species are white amur, carp, silver carp, pike, pike perch and perch, with numerous universal species such as goby, silver crucian carp, Amur chub, sun perch, Glen's chub, stickleback, ruff and its mixtures with perch. Chub, burbot, roach, roach, and bindweed are extremely rare.

Within the natural channel, there is virtually no fish fauna, and only in the lower reaches of the river do roach, bream, roach, pike and perch migrate from the Southern Bug in spring.

Until the beginning of the twentieth century, the mouth area of the Rotten Yelanets was the main area of commercial fishing in the Lower Pobuzhzhia, where pre-spawning concentrations of sterlet, migratory chub, roach, bream and cutthroat trout occurred. The construction of the Shcherbanivske Reservoir dam in 1974 blocked the migration routes of migratory fish and led to a complete restructuring of the river's flow regime, which has since been directed to irrigation needs [18–20].

The most abundant in the lower reaches of the Southern Bug is its leftmost tributary, the Ingul River, which is significantly distinguished by its rich fish fauna, the composition of which varies in different parts of the river. The latter allow us to divide this river into two hydroecologically different parts – the upper and lower. The first, from its source to the gauging station in the village of Starohorodyno, Bashtanka district, flows through rocky banks with numerous rifts, a height difference of 2 m/km of the channel, and a fast flow. The fish fauna here is represented mainly by rheophilic species of the native group – roach, rudd, bream, flathead, whitewater, chub, there are also large catfish, pike, perch, bluegill, and according to unconfirmed reports, there are cases of catching pufferfish and pike. There is a lot of topsy-turvy, bitterroot, oatmeal, borage, and atherina. Skeins of pearl and toothless fish are constantly found, and there are crayfish (narrow-toed). Carp, silver carp, silver crucian carp are quite scarce, sunfish, Glenn's chub, and Amur chub are almost rare. Their number is probably limited by the high density of predators.

The lower part of the Ingul is in a flat area (23.4–1.0 m high), representing a wide (sometimes up to 3.2 km) floodplain with oxbows and a network of meandering channel channels, whose water is characterized by a high level of mineralization (4.0–4.5 thousand mg/dm3). The local fish fauna is also based on representatives of the native group (roach, roach, rudd, bream) with a large proportion of predators, mainly pike. In addition, the Inhul lake and floodplain system is an important reserve for bivalves, such as pearl mussels and toothless mussels.

The powerful placoric plain of the Ingul and Ingults interfluve is bounded in the north by the sublatitude valley of the small Bokovenka River (Ingults basin) and in the meridional direction by the valley of the Vysun River. The upper part of the Vysunia within Mykolaiv region was originally a seasonally flowing land network, which in the 70s. The twentieth century was subjected to water development and partially sewerized. Down from the village. The nearly 50-kilometer-long river valley is a dry ditch that is moistened only in spring. The permanently watered lower part of the Vysunia (76 km along the riverbed) starts from the village of Skobelevo to the junction with the Ingults, and is a natural channel with a number of earthen dams. The local fish fauna of this part of the river has a "synthetic" composition based on silver carp, pike, perch, roach, roach and carp. Background species include silver carp and crucian carp; periodic pond breaches cause some silver carp and white cupid to enter the river.

The Bokovenka River belongs to the Ingulets basin, forming a large Karachunivske water reservoir with it. (3600 hectares of water mirror). The natural state of the watercourse is preserved only in its lower part, from the border of Mykolaiv region to the point where it flows into the Dnipro. Accordingly, the fish fauna of the lower reaches is almost identical to the Dnipro fish complex and is additionally enriched with carp, pike, silver carp and white cupid. The dominant species are natives – roach, roach, rudd, small bream, topminnow, bittern, and oatmeal. Silver crucian carp (small form), goby, catfish, pike, pike-perch, chub, and whiting

are very numerous. Despite constant discharges of mine water from Kryvyi Rih and drainage water from the Ingulets irrigation system, the ecological condition of the lower reaches of the Ingulets is generally satisfactory due to the supply of Dnipro water. This is also confirmed by the high number of pearl mussels and toothless fish, as well as crayfish and various aquatic biota.

Conclusions.

1. In the composition of the ichthyofauna of the rivers of Mykolaiv region (excluding the Southern Bug) in 2020–2022. the presence of 38 species of fish, 6 species of bivalves and 1 species of crayfish was detected. Among them, there are 27 native species, 8 species of universalists (introduction and invasion), and the status of 3 species is not detailed. Disappeared between 1950 and 2020. there are 8 tuvid species of native origin, which include 6 passage forms.

2. Representatives of carp make up 81% of the total river fish fauna, with the greatest species diversity characteristic of medium-sized full-flowing rivers – the Ingul (37), Sinyukha (36), Ingulets (33), Kodyma (28) and the small Mertvovid (19). Currently, the fish fauna of small rivers is essentially a pond-type fish fauna, which combines introduced species (3), universalists (8) and 2–4 species of the native group.

3. According to the results of the study, it is difficult to identify the species structure of river ichthyofauna as a typical bioindicator for assessing the state of small rivers, although the latter is fully consistent with the principle of systematic control on the general scale of changes in the studied object (small river) in time and space.

4. The use of fish species composition in the system of biomonitoring of the hydroecological state of water bodies is successful for medium-sized rivers and difficult for seasonally dynamic small rivers of the steppe zone. The problem lies in operational assessments of the results, which require a number of additional calculations regarding the homogeneity of communities at different stages of their existence within a given watercourse.

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