

Науковий вісник Львівського національного університету  
ветеринарної медицини та біотехнологій імені С.З. Гжицького.  
Серія: Сільськогосподарські науки

Scientific Messenger of Lviv National University  
of Veterinary Medicine and Biotechnologies.  
Series: Agricultural sciences

ISSN 2519-2698 print  
ISSN 2707-5834 online

doi: 10.32718/nvlvet-a9205  
<https://nvlvet.com.ua/index.php/agriculture>

UDC 639.2/.3

## The creation of special commodity fish farm on the black sea lakes of Odesa region

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### Article info

Received 29.01.2020  
Received in revised form  
28.02.2020  
Accepted 29.02.2020

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**Bezyk, K. I., Burhaz, M. I., & Lichna, A. I. (2020). The creation of special commodity fish farm on the black sea lakes of Odesa region. Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Agricultural sciences, 22(92), 23–27. doi: 10.32718/nvlvet-a9205**

Pond fisheries are one of the promising areas of fisheries in Ukraine and the world. The vast resources of the inland waters of our country are a reliable source of valuable fishery products. However, the potential of this source is not fully exhausted. Therefore, a significant increase in the production of commercial fish can be achieved as a result of the construction of new commercial fisheries and factories, whose task is to recreate fish stocks. One of the leading places among all kinds of outdoor activities is sports and amateur fishing. Capture fishing has become a permanent fixture for hundreds of millions of people around the world. It is estimated that in Ukraine sport and recreational fisheries cover about 10 % of the population. The purpose of the work was to find out the current state of fish productivity of the Black Sea ponds of Odesa region for the creation of specialized fisheries. The fish productivity of the Black Sea ponds, the forage base and the ichthyofauna were investigated, the most valuable representatives of the ichthyofauna for amateur fisheries in these reservoirs were identified, the recommendations on the creation of a special cultural fishery on the Black Sea ponds were provided. It is established that the feed base in the Black Sea ponds for fish young is quite rich and varied. The current state of development of the forage base indicates the possibility of successful fishing activities and in particular the development of recreational fisheries. In case of intensification of economic activity there is a need to carry out a certain complex of fish-and-melioration works. As a result of the conducted researches it is established that the Black Sea ponds should be used for the creation of cultural fisheries for the purpose of organizing amateur fisheries, and the formation of ichthyocenosis should be carried out by purposeful fishing of valuable fish species suitable as objects of amateur and sport fisheries. Creating appropriate conditions for amateur fisheries as a popular way of recreational recreation of a large part of the population of Ukraine involves solving a number of biological, environmental and legal issues related to the reproduction and acclimatization of fish, the organization of sports and recreational fisheries, taking into account the characteristics of reservoirs, the impact of ecological and climatic conditions fisheries, etc.

**Key words:** fish productivity, fodder base, ichthyofauna, ponds, amateur and sport fishing, fishing.

## Створення спеціального товарного рибного господарства на чорноморських ставках Одеської області

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Ставове рибництво є одним з перспективних напрямків рибного господарства України та світу. Величезні ресурси внутрішніх водних нашєї країни є надійним джерелом цінної рибної продукції. Втім потенціал цього джерела вичерпаний не повністю. Тому значного приросту виробництва товарної риби можна досягнути в результаті будівництва нових товарних рибних господарств і заводів, завданням яких є відтворення рибних запасів. Одне з провідних місць серед всіх видів активного відпочинку на природі посідає спортивне і любительське рибальство. Рибна ловля із захоплення одиниць перетворилася на постійне заняття сотень

мільйонів людей в усьому світі. Вважається, що в Україні спортивне і любительське рибальство охоплює близько 10 % населення. Мета роботи полягала у з'ясуванні сучасного стану рибопродуктивності Чорноморських ставків Одеської області для створення спеціалізованого рибного господарства. Досліджувалась рибопродуктивність Чорноморських ставків, кормова база та іхтіофауна, виявлені найбільш цінні представники іхтіофауни для любительського рибальства в цих водоймах, надані рекомендації щодо створення спеціального культурного рибного господарства на Чорноморських ставках. Встановлено, що кормова база в Чорноморських ставках для молоді риб досить багата і різноманітна. Сучасний стан розвитку кормової бази свідчить про можливість успішного ведення рибогосподарської діяльності і зокрема розвитку любительського рибальства. У разі інтенсифікації господарської діяльності виникне необхідність проведення певного комплексу рибоводно-меліоративних робіт. В результаті проведених досліджень встановлено, що Чорноморські ставки доцільно використовувати для створення культурного рибного господарства з метою організації любительського рибальства, а формування іхтіоценозу здійснювати шляхом цілеспрямованого зариблення ставка цінними видами риб, придатними як об'єкти любительського і спортивного рибальства. Створення відповідних умов аматорського рибальства як популярного способу рекреаційного відпочинку значної частини населення України передбачає вирішення низки біологічних, екологічних і правових питань, пов'язаних з відтворенням та акліматизацією риби, організацією спортивного і любительського рибальства з урахуванням характеристики водойм, впливу еколого-кліматичних умов, об'єктів рибальства тощо.

**Ключові слова:** рибопродуктивність, кормова база, іхтіофауна, ставки, любительське та спортивне рибальство, зариблення.

## Introduction

Pond fisheries are gaining increasing share in the total volume of fishery production (Martseniuk, 2008; Bobel et al., 2018; Grynevych et al., 2018). In the second half of the twentieth century, there was a significant increase in the productivity of pond farms in the domestic pond fisheries, which was aided by the scientific developments carried out and put into practice during these years. Among these developments are the studies that have provided a successful acclimatization of Far Eastern herbivorous fish. This, in turn, made it possible to move to the development of fish farming technologies in polyculture, thus significantly improving the productivity of reservoirs (Pylypenko, 2007).

The current trend in pond fisheries is based on the use of the offspring production method, high concentration of production and in-house specialization, application of reservoirs of complex purpose, warm wastewater of power plants, as well as the complex mechanization of the main technological processes of fisheries. The successful development and high profitability of modern pond fisheries largely depends on the efficiency of fish and reclamation works, the introduction of modern technologies in the construction of hydraulic structures, complex mechanization of technological processes. In addition, the vast resources of the inland waters of our country are a reliable source of valuable fishery products. However, the potential of this source is not fully exhausted. Therefore, a significant increase in the production of commercial fish can be achieved as a result of the construction of new commercial fisheries and factories, whose task is to recreate fish stocks.

One of the leading places among all kinds of outdoor activities is sports and amateur fishing. Capture fishing has become a permanent fixture for hundreds of millions of people around the world. It is estimated that in Ukraine sport and recreational fisheries cover about 10 % of the population.

The purpose of the work was to find out the current state of fish productivity of the Black Sea ponds of Odesa region for the creation of specialized fisheries.

To achieve this goal, the following tasks were set:

1. to analyze the fish productivity of the studied reservoirs;
2. explore the forage base of the Black Sea ponds;

3. identify representatives of ichthyofauna of greatest interest to recreational fisheries in these reservoirs;

4. make recommendations for the establishment of specialized fisheries on the Black Sea ponds.

## Material and methods

On the basis of specialized literature and own researches the estimation of the current state of fishery productivity, forage base, ichthyofauna of the Black Sea ponds, the own researches of expediency of creation of specialized fishery on the investigated reservoirs were carried out.

## Results and discussion

The Cascade of the Black Sea Ponds is located within the Black Sea town of Limansky district of Odesa region and consists of 4 ponds. The two upper ponds № 1 and № 2 belong to the landscape ponds of the water park port complex, № 3 and № 4 are used for fishery purposes. The studies were conducted in rates № 3 and № 4 (Pylypenko, 2007).

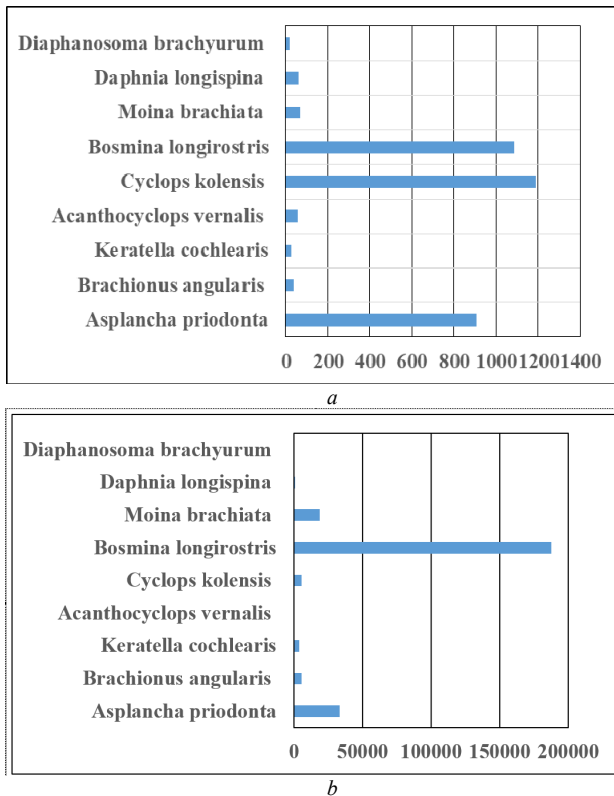
The Black Sea ponds № 3 and № 4 with a total area of 0.621 ha are reservoirs of channel type. The seasonal depth fluctuations range is 1.0 m. The ponds are filled by rain and thawing water and underground sources. This largely forms the hydrologic-hydrochemical regime of the pond. Hydrochemical indices of reservoirs are within acceptable limits for fisheries management (Bessonov & Privezenchev, 1987).

The feed base in the Black Sea ponds for young fish is quite rich and varied (Krazhan & Lupacheva, 1991).

The phytoplankton community is represented mainly by blue-green, green and eugenic freshwater microalgae. In the Black Sea ponds, diatoms occur significantly. The quantitative indicators of the community are low: the number of them in the autumn did not exceed 10765 cells/dm<sup>3</sup>, and the biomass of 2349–2956 mg/dm<sup>3</sup>.

The basis of the abundance and biomass of zooplankton in reservoirs are the octopus crustaceans (mainly cyclopoids) and rotifers. Their numbers and biomass are, of course, low (Fig. 1).

The dominant zooplankton species were the *Asplancha priodonta* rotifers, the crustaceans of the crustaceans - *Vosmina longirostris*, *Moina brachiata*, *Daphnia longispina*, with the copepods – *Cyclops kolensis*.



**Fig. 1.** Species composition and biomass of zooplankton in Black Sea ponds in autumn 2018  
 a – zooplankton biomass, b – amount of zooplankton

Zooplankton is represented mainly by soft forms: chironomid larvae and oligochaetes. The larvae account for up to 70 % of zooplankton biomass. The small number of ostracodes and gastropods, masonry and insect larvae are present. The biomass of the benthic community is usually at a sufficiently high level and averages 30–70 g/m<sup>2</sup>.

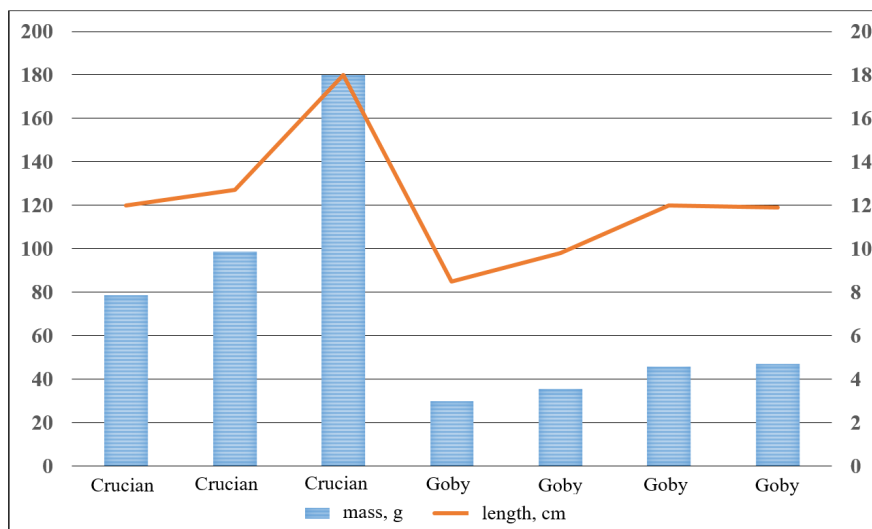
A significant reserve (as a feed base for fish) in the Black Sea ponds are zooplankton organisms (mainly chironomids and oligochaetes), detritus and fouling.

The current state of development of the forage base indicates the possibility of successful fishing activities and in particular the development of recreational fisheries. In case of intensification of economic activity there is a need to carry out a certain complex of fish-and-melioration works (Krazhan & Lupacheva, 1991).

Now the ichthyocomplex of ponds is represented by crucian silver and goby sandstone. Trapped crucian individuals were 12–18 cm in size; goby – 10–12 cm. There are carp in the reservoir (Fig. 2).

Ponds should be used to create cultural fisheries for the purpose of organizing recreational fisheries (Sherman et al., 1992).

The purpose of creating a cultural fishery in these reservoirs is to organize a paid amateur fishing here. Thus, the formation of ichthyocenosis will be carried out by purposefully stocking the pond with valuable species of fish, suitable as objects of amateur and sport fisheries. The reservoirs in this case are used as feeders (Hrynzhovskyi et al., 2001). Depths of reservoirs allow to leave released fish for wintering.



**Fig. 2.** Ichthyofauna of the Black Sea ponds

The most suitable for artificial cultivation in reservoirs of this type are carp, crucian and mullet pilengas. Carp – the main species, grown on natural and artificial feed, crucian – an additional object, uses the free resources of plankton, benthos, macrophytes. Pilengas mullet is a biomeliorator that uses detritus, periphyton, soft aquatic vegetation and other forage. For fishing, especially attractive are the predatory fish. Pike perch can be used in the Black Sea ponds for this purpose (Hrynzhovskyi et al., 2001).

To prevent the flowering of water in the ponds in the summer, as an additional object – a reclamer – it is recommended to use a white silver crucian.

Carp is the main crop grown on natural and artificial feed. It is served by plankton and benthic organisms, organic remains of animal and plant origin, insects and other objects.

For artificial feeding of carp use compound feeds, which include meal, meal and other waste of grain and flour production, animal products (fish meal, etc.), pre-mixes and vitamins (Mel'nychuk, 1982).

The growth of fish in the ponds depends mainly on the temperature regime of the reservoirs, the oxygen content of the water, the quality of the water, the species composition and the density of the landing of the fish, and the availability of adequate feeds (natural and artificial).

For the purposes of recreational fishing, it is recommended to fish carp (and other fish) for fishing in the Black Sea ponds. Older age groups can also be used, as large individuals (two to three years old) are more attractive to amateur anglers. However, taking into account the current state of the reservoirs and the fact that the construction of the crustaceans has not yet begun, it is advisable to carry out a starting fishery this year for carp (a possible admixture of crucian carp and white silver carp), which will allow the full use of the natural forage base.

When growing carp on a natural forage base the planting density of two-year-olds will be 300 pieces/he, peers – 1000 pieces/he. At artificial feeding the planting density can be increased up to 2000 pieces/he. For the purpose of systematic formation of ichthyocenosis, the starting fishery is recommended to start from this year, and in the subsequent fishery to be partially lead by two years or older fish (Mel'nichuk, 1982).

According to the current standards, the stocking volumes for the Black Sea basins № 3 and № 4 will be:

- in the first year of this year – 1 thousand units (0.25–0.30 t);

- from the second year of the biennium – 0.5 thousand units. (0.1–0.15 t)

In the future, the scheme of fish stocking will be adjusted depending on the intensity of fish growth, the percentage of their extraction and the degree of development of natural forage resources of the reservoirs.

This amount of stocking is recommended when growing on natural feeds (Sherman, 1994; Pylypenko, 2007). Considering that during intensive amateur fishing the fish will be withdrawn within one year (mostly from spring to autumn), the number of fish can be increased by 1.5–2 times.

At artificial feeding, according to the standards, the volume of the fill can be increased by 3 times.

The silver crucian and the white silver carp are earning about 10 % of the total weight of the young along with the carp.

The rest of the species are limited in number to create a more diverse and attractive picture of recreational fishing.

Zander belongs to predators, feeds on small fish with a low body (apex, germs, gobies, small crucian, etc.). When fishing in reservoirs, two-year-olds and older age groups of carp and other fish, zander will not be able to use them for food because of their large size.

The zander grows quickly, perennials reach 350–400 g, three-year-olds up to – 1 kg. To increase the zander in the reservoir, it is recommended to install 2–3 spawning artificial cubes in the spring. Zander is a wonderful object for sport fishing. In terms of betting, this is the only object that can be caught spinning on a spinner.

Predatory fish species are recommended to be produced in small quantities due to the limited feed base (Pylypenko, 2007).

The estimation of the profitability of the “tourist component” is rather complicated and poorly predicted. Given the proximity to the settlements and the route “Odesa – Mykolaiv – Kherson” and the attractive enough surrounding landscape, the proximity to the seaside resort area, provided the provision of a certain range of services “fish park” can be a profitable component of business (Pylypenko, 2007).

Therefore, analyzing the experience of managing such facilities, it can be expected that the intensity of the visit, depending on the range of services offered and the period of the year, will average at least 100 people per month in the recreational period of the year – 6 months.

## Conclusions

On the Black Sea ponds № 3 and № 4, it is advisable to create a cultural fisheries (CRF) in order to organize amateur fishing here.

The reservoirs are characterized by a sufficiently high level of development of the natural forage, which can ensure the successful feeding of valuable fish species.

The greatest interest for amateur fishing in these reservoirs are: carp, crucian, mullet pilengas, white silver carp, zander. The farm can be organized as monocultural (for example, fisheries only with carp), and multicultural (a set of fish of different species will be used for fisheries).

Growing fish for recreational fishing can be carried out both on natural feeds and artificial (at high planting density).

A series of measures to prevent flares of fish diseases, as well as protection against poachers and deterrence of fish birds should be carried out at the reservoirs.

Creating appropriate conditions for amateur fisheries as a popular way of recreational recreation of a large part of the population of Ukraine involves solving a number of biological, environmental and legal issues related to the reproduction and acclimatization of fish, the organization of sports and recreational fisheries, taking into account the characteristics of reservoirs, the impact of ecological and climatic conditions fisheries, etc.

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