БІОРЕСУРСИ ТА ЕКОЛОГІЯ ВОДОЙМ

BIOLOGICAL CHARACTERISTICS OF SILVER BREAM (*BLICCA BJOERKNA*) IN COMMERCIAL FISHERY IN THE KYIV RESERVOIR

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Purpose. The determination and analysis of main biological characteristics of silver bream from the point of view of the formation and exploitation of its commercial stock in the Kyiv reservoir.

Methodology. The work is based the results of monitoring field studies carried out on the Kyiv reservoir during 2012–2014. Ichthyological materials were collected from standard commercial gill nets with mesh sizes of 30–80 mm, which were set in different habitats and depths of the reservoir. Collection and processing of samples was carried out using conventional ichthyological methods adapted for the Dnieper reservoirs.

Findings. According to the data of monitoring gill nets, silver bream population in 2014 was composed of 10 age groups. The majority of their population (70.8%) in catches was composed of age-5 to age-7 fish, i.e. the number of modal classes increased due to the right wing of the older age groups. The frequency distribution of silver bream had a shape of a curve with wide, however broken (due to the reduction in age-5 fish) peak and gradual decrease. Age-length properties, fatness parameters and condition factor of silver bream in the Kiev reservoir during last years remained on the stable high level indicating on favorable fattening conditions and forming the ichthyomass of this species.

At the present time, silver bream of the Kyiv reservoir formed a commercial stock with such qualitative and quantitative characteristics, which allow exploiting it in the mode of traditional commercial harvest and specialized harvest of silver bream concentrations with the use of gill nets with mesh sizes of 50, 60 mm.

Originality. We obtained and analyzed the new data on the current state of silver bream (Blicca bjoerkna) in Kyiv reservoir as an important element of commercial fish production.

Practical value. The results of the work allows increasing qualitative and quantitative characteristics of silver bream catches and will be used for the preparation of commercial fishery regime for the Kyiv reservoir.

Keywords: Kyiv reservoir, Silver bream (Blicca bjoerkna), age structure, fish stock, commercial harvest.

PROBLEM STATEMENT AND ANALYSIS OF LAST ACHIEVEMENTS AND PUBLICATIONS

Ukraine has a significant fund of inland fishery water bodies with developed fish fauna, quantitative and qualitative parameters of which indicate on the possibility of their rational fishery exploitation [1, 2]. According to current legal and regulatory framework, all inland water bodies of Ukraine of national importance belong to the category of commercial areas of fishery water bodies that supposes their special status

regarding the provision of favorable conditions for forming resources for commercial fishery. At the same time, large reservoirs were in fact multi-purpose water bodies, the diversified fishery exploitation of which is a potent factor defining the direction and intensity of successive processes in them. In this context, the conditions for forming the population of commercial valuable species (which are characterized by increased requirements to the quality of environment) can be estimated as unfavorable that can significantly affect the qualitative and quantitative parameters of commercial catches [2–4].

During a sufficiently long period, fishery regulations in the Dnieper reservoirs were aimed at ensuring the restoration and maintenance of the stocks of major, the most valuable commercial species. However, current conditions of the reorganization of commercial fishery due to political and socioeconomic changes in Ukraine against the background of the stress state of the stocks of traditional species of commercial fishery requires the development of a multi-species commercial fishery with the involvement of the entire fish fauna to commercial fish harvest. Intensification of the exploitation of the stocks of alternative species, except ensuring the maximum yield, allows partially reducing the fishery press on fish populations, which are in non-stable state [5, 6].

Fisheries management including such strategies as commercial fishery, recreational fishery, and fish stocking can have effects on the processes of species succession by selective harvest of abundant cyprinids in the combination with intensive stocking with piscivorous fishes and implementation of measures on their protection for creating more stable multiple-species ichthyocenoses [2, 7].

Fishery exploitation of the Kyiv reservoir has been carried out practically during the entire period of its existence according the standard scheme: rare stockings, local amelioration activities and large-scale commercial fish harvest [7, 8]. In this case, the commercial harvest in the Kyiv reservoir is based on natural reproduction in a higher degree than in other reservoirs of the cascade, i.e. native fish populations are characterized by an increased level of elimination [2]. This situation becomes complicated for silver bream because its commercial harvest depends in a high degree from the use of partially allowed fishing gears that results in an additional necessity in the detailed study of commercial and biological characteristics of this species.

HIGHLIGHT OF THE EARLIER UNRESOLVED PARTS OF THE GENERAL PROBLEM. AIM OF THE STUDY

Last years, studies of fish fauna of the Kyiv reservoir have been carried out mainly in general resource aspect without taking into account individual species [9, 10]. Purely ichthyological works regarding the Kyiv reservoir have not been defended for more than a 30-year period, while the majority of studies were focused on radioecological and hydrobiological characteristics of this water body. An analysis of available publications indicates on the absence of special studies on the biological state of silver bream populations in the Kyiv reservoir, i.e. the state of knowledge on this species is currently insufficient.

Accordingly, there is a need in the studies of silver bream populations of the Kyiv reservoir from the point of view of its current biological state and conditions of the
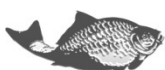
formation of its commercial stock as well as scientific justification of measures aimed at its rational exploitation within the concept of balanced natural resource use.

MATERIALS AND METHODS

The work is based the results of monitoring field studies carried out on the Kyiv reservoir during 2012–2014. Ichthyological materials were collected from standard commercial gill nets with mesh sizes of 30, 36, 40, 45, 50, 55, 60, 65, 70, 75, 80 mm, lengths of 70 m, heights of 1–4 m, which were set in different habitats and depths of the reservoir. In total, during the study period, catches from 3.05 thousand net-days and 42.7 thousand fish of different species were analyzed. Amounts of commercial catches were determined based on the data of official fishery statistics of the State Agency of Fisheries of Ukraine. Collection and processing of samples was carried out using conventional ichthyological methods adapted for the Dnieper reservoirs [10, 11]. Statistical data processing was carried in MS Excel.

STUDY RESULTS AND THEIR DISCUSSION

The commercial catch dynamics in the Kyiv reservoir during last 10 years was characterized by a stable growth (with some decrease in 2013) (Fig. 1). In 2014, commercial landings reached 900 tons that was significantly higher of the average annual value for 2001–2010 (550 tons). This 15% increase in catches was due to silver bream (*Blicca bjoerkna*), which is currently the first most abundant species in commercial fishery in the Kyiv reservoir by weight. The total share of valuable large size fish species in the increase in commercial fish productivity was 13.4% that taking into account their specific stock is a high enough value.
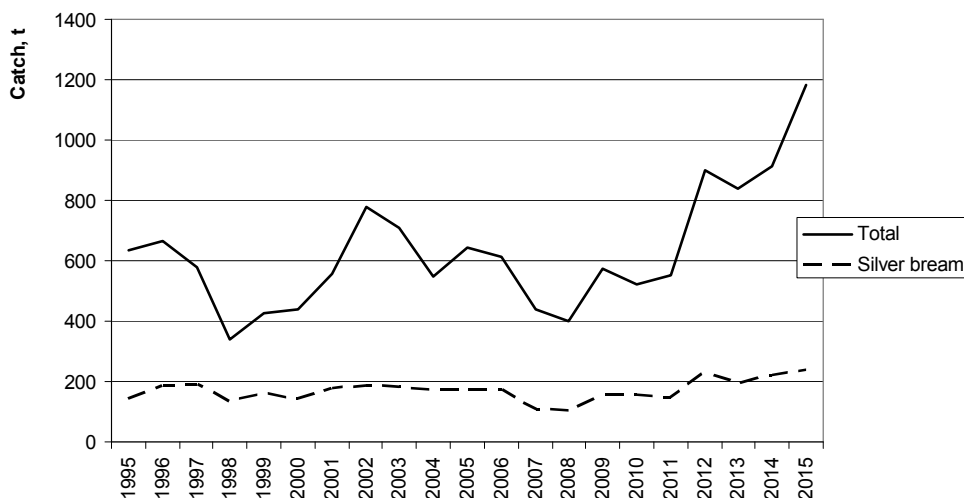

Figure 1. **Commercial catch dynamics in the Kyiv reservoir**

Fish productivity in the Kyiv reservoir during last years increased to the level, which corresponded to the mean level for all Dnieper reservoirs. However, it is necessary to note that the technical intensity of fish harvest in the Kiev reservoir is characterized by certain stability — the number of officially allowed commercial gill nets ranged within 4.2–5.0 thousand nets during last 10 years.
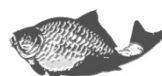
Currently, 15 fish species have commercial value in the Kyiv reservoir and seven of them are considered highly valuable. The majority of 30–40 mm gill net catches in 2014 was composed of silver bream (28.3% by number and 26.9% by weight), roach (*Rutilus rutilus*) (22.2% and 22.0%, respectively), and blue bream (*Abramis ballerus*) (24.7% and 18.5%, respectively). In 50–60 mm gill nets, the most abundant were roach (18.8% by number and 26.3% by weight), silver bream (16.8% and 11.6%, respectively) and bream (*Abramis brama*) (14.6% and 18.0%, respectively). The majority of catches in large mesh gill nets was composed of bream (53.5% by number and 54.4% by weight), pikeperch (*Sander lucioperca*) (22.2% and 22.0%, respectively) and European catfish (*Silurus glanis*) (4.8% and 17.7%, respectively).

Thus, silver bream form a significant segment of fishery resources, which is accessible for effective fish harvest with 50 mm mesh gill nets and which can be considered as optimal for harvesting small sized fish in the Kyiv reservoir. A decrease in the fishing pressure on middle age groups (due to the limitation of the use of gill nets with mesh sizes below 50 mm) will ensure a more complete filling of the right wing of the frequency distribution for silver bream that will create prerequisites for harvesting this species with gill nets with a mesh size of 60 mm. E.g., mean length of silver bream in gill nets with a mesh size of 40 mm is 20.0$\pm$1.3 cm, in 50 mm gill nets – 23.1$\pm$1.5 cm; in 60 mm gill nets — 25.3$\pm$1.5 cm.

According to the data of monitoring gill nets, silver bream population in 2014 was composed of 10 age groups with maximum age of 12 years. The majority of their population (70.8%) in catches was composed of age-5 to age-7 fish with the length of 17–24 cm, i.e. the number of modal classes increased due to the right wing of the frequency distribution.

A positive trend of the optimization of the age structure of silver bream population, which was noted in 2012–2013, is also observed in the current year — the frequency distribution of silver bream had a shape of a curve with wide, however broken (due to the reduction in age-5 fish) peak and gradual decrease (Fig. 2).
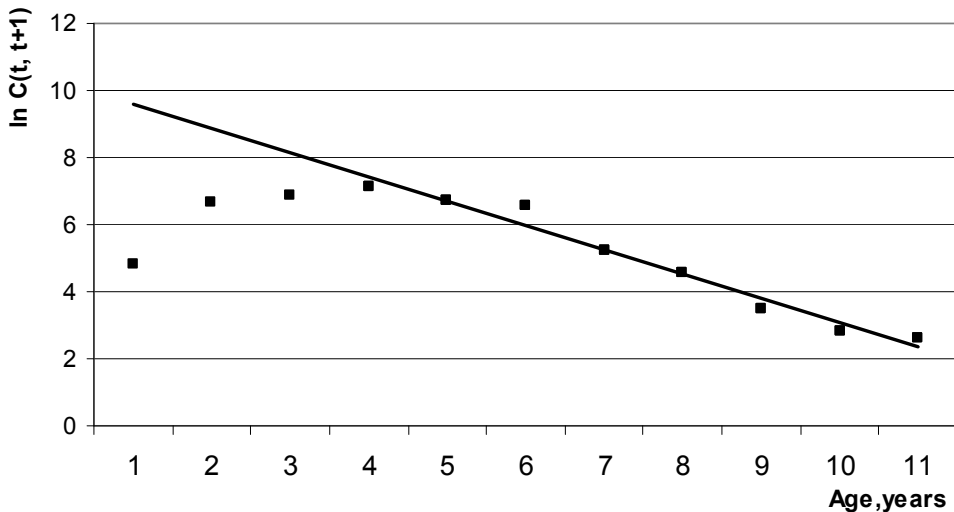

Figure 2. **Catches of silver bream in monitoring gill nets in the Kyiv reservoir, 2014**

The share of older age groups was high enough — 11.9% that taking into account a sharp increase in gill net catches per unit effort indicates on normal conditions for forming and exploiting the most productive age-length groups. The share of younger age groups in 2014 composed 17.3% that caused a certain increase in the average weighted age to 6.0 years (versus 3.9 years in 2012), i.e. the structural parameters of silver bream population became typical for this species in the Kyiv reservoir.

Age-length properties, fatness parameters and condition factor of silver bream in the Kyiv reservoir during last years remained on the stable high level indicating on favorable fattening conditions and forming the ichthyomass of this species (Table 1).

Table 1. **Age-length parameters of modal age groups of silver bream in the Kyiv reservoir (average for 2012–2014)**

Parameter	Age classes, years				
	4	**5**	**6**	**7**	**8**
Length, cm	17.3±0.6	19.4±0.9	20.9±1.1	22.3±0.8	24.2±0.5
Weight, g	132±19	180±21	219±37	284±41	351±32
Fulton's condition factor	2.59	2.45	2.40	2.57	2.49

The absolute catch of silver bream per unit effort in monitoring gill nets in 2014 increased compared to previous years up to 5169 fish (1300 kg) versus 2517 fish (809 kg) mainly due to gill nets with mesh size of 40 mm that also indicates on an increase in the number of the generations, which entered the commercial stock.

The majority of silver bream by number (68.2%) and by weight (65.2%) in 2014 were caught by 36–40 mm gill nets, i.e. the majority of ichthyomass was formed by age-length groups, which will be fully accessible for commercial harvest in 2015. High absolute parameters of catches in this gill nets indicate on the possibility (if maintained during 2014) of forming the sufficient stock of average age groups of this species, which can be effectively harvested with the traditional scheme of commercial fishery. High enough parameters of specific catch in gill nets with mesh size of 50 mm and higher (19.5% in 2014 of the total catch weight) indicate on the presence of certain reserves for fish harvest by large mesh size gill nets, however, the same as in previous years, silver bream were not recorded at all in gill nets with mesh sizes larger than 70 mm. Taking into account the characteristics of fishing gears allowed for fish harvest in the Kyiv reservoir (gill nets with mesh sizes of 36–48 mm and >70 mm), a conclusion on high selectivity of middle age groups (age-5–6) can be drawn. This cannot be considered as rational from the point of view of the rational use of aquatic living resources because the maximum yield per recruit (with average natural mortality $M=0.27$) corresponds to the beginning of intensive commercial exploitation of silver bream starting from the age-7–8. Accordingly, for increasing the efficiency of silver bream harvest, it is advisable to use locally the gill nets with mesh size of 50–60 mm, which can catch older age groups of this species. In the conditions of fixed fishing limit it will contribute to a reduction in the number of fish caught with significant improvement of qualitative characteristics of fish catches (average weight of silver bream in 36–40 mm gill net catches is 210 g, in 50–60 mm gill net catches — 377 g). In addition, the actual average number of spawnings of silver bream is 2.1, while if the fishing pressure is shifted to age-7–9, this number can increase to 4.0.
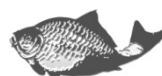
Thus, at the present time, silver bream of the Kyiv reservoir formed a commercial stock with such qualitative and quantitative characteristics, which allow exploiting it in the mode of traditional commercial harvest of small sized species. At the same time, for ensuring the maximum efficiency of commercial harvest it is necessary to provide the possibility for implementing (upon condition of preventing the negative effect on younger age groups of other species) the specialized harvest of silver bream concentrations with the use of gill nets with mesh sizes of 50, 60 mm.

CONCLUSION AND PERSPECTIVES
OF FURTHER DEVELOPMENT

Silver bream is currently the main commercial species on the Kyiv reservoir, which ensures 20.9% of the total annual catch.

According to the data of monitoring gill nets, silver bream population in 2014 was composed of 10 age groups. The structural population indices of the silver bream of the Kyiv reservoir are characterized by significant improvement, in particular by an increase in the share of middle and elder age groups against the background of their stably high total number.

Age-length properties, fatness parameters and condition factor of silver bream in the Kyiv reservoir during last years remained on the stable high level indicating on favorable fattening conditions and forming the ichthyomass of this species.

Currently, silver bream of the Kyiv reservoir formed a commercial stock with qualitative and quantitative characteristics, which allow exploiting it in the mode of traditional commercial harvest and specialized harvest of silver bream concentrations with the use of gill nets with mesh sizes of 50, 60 mm.

In the conditions of the reorganization of commercial fish harvest on the Kyiv reservoir with further limitation of the application of small mesh size gill nets, a promising trend in the studies is an analysis of the reaction of silver bream population on the transfer of fishing pressure to the right wing of the frequency distribution with the determination of biological and fishery aspects of such type of harvest regime.

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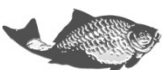
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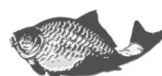
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БІОЛОГІЧНА ХАРАКТЕРИСТИКА ПЛОСКИРКИ (*BLICCA BJOERKNA*) ЯК ОБ'ЄКТА ПРОМИСЛОВОГО РИБАЛЬСТВА У КИЇВСЬКОМУ ВОДОСХОВИЩІ

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Мета. Визначення та аналіз основних біологічних характеристик плоскирки з точки зору формування та експлуатації її промислового запасу в Київському водосховищі.

Методика. В основу роботи покладені результати польових досліджень, які здійснювались на Київському водосховищі протягом 2012–2014 рр. Іхтіологічний матеріал відбирався з уловів контрольного порядку сіток з кроком вічка a=30–120 мм та стандартних промислових сіток, які використовуються на Київському водосховищі. Відбір та обробка проб здійснювались за загальноприйнятими при проведенні іхтіологічних досліджень на дніпровських водосховищах методиками.

Результати. Плоскирка на сьогодні є основним промисловим видом Київського водосховища, за рахунок якого забезпечується 20,9% загального річного улову. Популяція цього виду в уловах представлена 10 віковими групами, її основу (70,8%) складали п'яти–семирічні особини. Розмірно-вагові характеристики плоскирки протягом останніх років залишаються на стабільно високому рівні. Структурно-функціональні показники популяції плоскирки вказують на сприятливі умови існування даного виду у Київському водосховищі і свідчать про можливість здійснення його ефективного промислового вилучення як в звичайному режимі, так і режимі спеціалізованого лову сітками з кроком вічка 50, 60 мм.

Наукова новизна. Отримані і проаналізовані нові дані щодо сучасного стану плоскирки Київського водосховища як важливого елементу формування промислової рибопродукції.

Практична значимість. Результати роботи дозволяють підвищити якісні і кількісні характеристики уловів плоскирки, і будуть використані при підготовці режиму промислового рибальства в Київському водосховищі.

Ключові слова: Київське водосховище, плоскирка (Blicca bjoerkna), вікова структура, промисловий запас, рибальство.
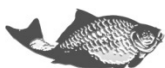
БИОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА ГУСТЕРЫ (*BLICCA BJOERKNA*) КАК ОБЪЕКТА ПРОМЫСЛОВОГО РЫБОЛОВСТВА В КИЕВСКОМ ВОДОХРАНИЛИЩЕ

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Цель. Определение и анализ основных биологических характеристик густеры с точки зрения формирования и эксплуатации ее промыслового запаса в Киевском водохранилище.

Методика. В основу работы положены результаты полевых исследований, которые осуществлялись на Киевском водохранилище в течение 2012–2014 гг. Ихтиологический материал отбирался из уловов контрольного порядка сетей с шагом ячеи а=30–120 мм и стандартных промысловых сетей, которые используются на Киевском водохранилище. Отбор и обработка проб осуществлялись по общепринятым при проведении ихтиологических исследований на днепровских водохранилищах методикам.

Результаты. Густера на сегодня является основным промысловым видом Киевского водохранилища, за счет которого обеспечивается 20,9% общего годового улова. Популяция этого вида в уловах представлена 10 возрастными группами, ее основу (70,8%) составляли пяти-семигодовалые особи. Размерно-весовые характеристики густеры в течение последних лет остаются на стабильно высоком уровне. Структурно-функциональные показатели популяции густеры указывают на благоприятные условиях существования данного вида в Киевском водохранилище и свидетельствуют о возможности осуществления его эффективного промыслового изъятия как в обычном режиме, так и режиме специализированного лова сетями с шагом ячеи 50, 60 мм.

Научная новизна. Получены и проанализированы новые данные относительно современного состояния густеры Киевского водохранилища, как важного элемента формирования промысловой рыбопродукции.

Практическая значимость. Результаты работы позволяют повысить качественные и количественные характеристики уловов густеры и будут использованы при подготовке режима промыслового рыболовства в Киевском водохранилище.

Ключевые слова: Киевское водохранилище, густера (Blicca bjoerkna), возрастная структура, промысловый запас, рыболовство.