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BOTANY

PHYSIOLOGY OF ANIMALS

FISHERY-BIOLOGICAL SUBSTANTIATION FOR THE PROJECT OF A FULL-SYSTEM FISHERIES FOR THE CULTIVATION OF CHANNEL CATFISH IN POLYCULTURE IN THE CONDITIONS OF THE FH "RURENKO" OF THE NEMIROVSKY DISTRICT

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Abstract

The possibility of designing a full-system fish farm for the cultivation of channel catfish in polyculture in the conditions of the FH "Rurenko" of the Nemirovsky district was investigated. On the basis of this farm, a project for the cultivation of channel catfish in polyculture was developed, where calculations of the total area of the farm and the areas of ponds of various categories of a full-system economy were carried out, the calculation of the needs of producers and replacement young catfish of channel catfish and carp was also carried out, the economic efficiency of growing channel catfish in polyculture was carried out.

Keywords: channel catfish, carp, polyculture, ponds, compound feed.

Relevance. Fish farms are going through hard times due to financial difficulties in the state, namely: disruption of economic ties, deterioration of the ecological state of inland water bodies, insufficient work on the reproduction of fish stocks. Therefore, there is a significant decrease in the volume of marketable fish farming in inland waters. A number of problems that hinder the further development of fisheries have been identified: the state of reproduction and protection of aquatic biological resources; restoration of functioning of existing inland water bodies of the country for their effective use for their intended purpose; government regulation and support of the industry. To overcome the crisis in fish farming, to ensure sustainable development of the industry, to strengthen the country's food independence, it is necessary, first of all, to resolve issues related to the environmental and economic problems of the development of the fishery complex, improve the economic mechanism for managing the fish industry, activate investment processes and innovations, rational use of natural aquatic living resources.

The priority areas will be: scientific substantiation of the volume of the raw material base and rational fishing, protection of aquatic ecosystems, technologies for processing aquatic fish resources, which will positively affect the food security of Ukraine.

The state of aquaculture in Ukraine today is characterized by a significant decrease in the cultivation of various types of fish. That is why it is important to grow fish in polyculture. Several types of fish can be raised in polyculture, which is economically feasible and beneficial for farms.

In Ukraine quite intensively they use the cultivation of channel catfish, which has been acclimatized in our reservoirs.

Channel catfish currently occupies a leading position in commercial fish farming. The value of the channel catfish is determined by good growth, effective feed payment, the ability to adapt to various conditions of keeping and high nutritional quality [4]. The greatest effect in commercial fish farming is achieved due to the joint cultivation of fish in polyculture, differing in the way of feeding and the nature of food consumed and in the zones of existence in the reservoir [6].

Therefore, channel catfish can be grown together with carp or silver carp. For growing groups of different ages of channel catfish in polyculture, it is advisable to use feed with a high protein content, apply fertilizers that will improve water quality, all this will lead to an increase in the efficiency of cultivation.

Therefore, the fish-biological substantiation of designing the cultivation of channel catfish in polyculture for a full-system fishery, taking into account specific environmental conditions, is valuable.

Analysis of recent researches and publications. Such scientists as A. Andryushchenko, S. Alimov, M. Zakharchenko, N. Dotsenko, O. Vaschenko and others were studying the technology of channel growing both in mono and in polyculture. According to O. Vashchenko, the use of new fish farming objects and their acclimatization is one of the important elements that ensure the intensive development of various forms of fish farming in inland waters. As practice has shown, among such objects, the channel catfish, a representative of the North American ichthyofauna, which was introduced into the country in the early 70s of the last century, is of considerable interest [1].

Channel catfish (Ictalurus punctatus) is one of the main commercial fish farms in the United States, where it is raised in ponds, pools and cages. The value of the channel catfish is determined by its high growth rate, efficient feed payment, and the ability to adapt to various growing conditions. In the conditions of Ukrainian farms, it has shown itself as a fast-growing species that effectively uses artificial feed and has high taste. In modern industrial warm-water fish farms, 60-80% of the cost of fish is the cost of feed. In this regard, the organization of complete and rational feeding of channel catfish is one of the urgent problems of fish farming [2, 3]. The scientifically based use of vitamin, mineral and enzyme preparations in combination with other biologically active substances can significantly increase the efficiency of fish feeding by increasing the availability and digestibility of feed nutrients. At the same time, considerable attention is paid to the study of cheap feed components that increase the biological value of artificial fish feed, since the main factor currently limiting the development of commercial fish farming is the shortage and high cost of protein components in the composition of complete feed. One of the most promising ways to compensate for the deficiency of feed protein in fish diets is the use of microbiological synthesis products: feed yeast and products of their processing.

N. Svechkova and others. [5] studied the effect of biologically active feed additives of sodium humate, potassium humate, Vitaton preparation on the fertility and growth of groups of different ages in the channel catfish (Ictalurus punctatus).

It is substantiated that the use of biologically active substances contributes to an increase in the safety of channel catfish larvae by 16-25%. Feeding the larvae of feed with biologically active preparations increases their growth rates and increases the average daily weight gain by 26-63%.

The purpose of the research. Give a fish-biological rationale for the project of a full-system fish farm for the cultivation of channel catfish in polyculture in the conditions of the specified farm.

Material and methods of research. Research and design were carried out on the basis of the FH "Rurenko" farm in the village of Ometintsy, Nemirovsky district, Vinnitsa region. The farm is engaged in the cultivation of channel catfish and carp. The farm is located 80 km from Vinnitsa, 41 km from the regional center. On this farm, fish such as channel catfish, silver carp and carp are bred. The farm is 49 hectares. The village flows the river Kravchik, the left tributary of the Southern Bug. The climate of the region is temperate continental, average January temperature: -1 °C, average July temperature: 25 °C, annual precipitation is 525 -590 millimeters, of which 80% falls during the warm period. Subzero temperatures generally occur in mid-November. The growing season is 110 days. The relief is flat, soils are mainly black and sandy. The snow cover is about 10 centimeters high. Ice on the reservoirs of this farm lasts from early December to late March. This area is characterized by moderate winters with an average amount of precipitation. Summers are warm with a lot of precipitation.

FH "Rurenko" is full-system. The source of water supply is surface water, formed due to atmospheric precipitation. Another important source of water supply is the Kravchik River - the left tributary of the Southern Bug River.

In the course of the study, the technology of growing channel catfish in polyculture was studied, and a farm project was developed for growing channel catfish in polyculture. An analysis of the water quality of the farm was also carried out, the temperature and the content of dissolved oxygen of various types of pond categories were constantly measured. In the study of the cultivation of channel catfish in polyculture, ponds, tools, hydraulic equipment, transport and groups of different age groups of channel catfish and carp were used.

Research results and their discussion. FH "Rurenko" is full-system. The source of water supply is surface water, formed due to atmospheric precipitation. Another important source of water supply is the Kravchik River - the left tributary of the Southern Bug River. Water indicators of the water supply source are presented in table 1.

Table 1

Water indicators of the water supply source of the ponds of the Kravchik river

Index	Standard values of water quality for fishery ponds	Hydrochemical indicators of water quality in fishery ponds
Hydrogen index of water, pH	6,5 – 8,5	6,9 – 7,8
Soluble oxygen, mg / l	4,0 – 6,0	4,3 – 5,5
Free ammonia NH_3, mg N / l	0,05	0,02 – 0,03
Phosphates PO_4, mg R / l	0,3 – 0,5	0,1 – 0,4
NO_3, mg N / l Nitrates	up to 2	0,02 – 0,04
Permanganate oxidizability, mg O / l	up to 15	7,0 – 9,2
Bichromate oxidizability, mg O / l	up to 50	24 – 47
Mineralization degree, mg / l	up to 1000	700 – 822

Analysis of the water quality of this farm, the source of water supply for which is the river Kravchik, showed that all indicators are within the permissible limits. Also, the analysis did not reveal other hydrochemical elements and pathogenic microflora. These indicators indicate that the water in the state arts and crafts FH "Rurenko" meets the requirements for the quality of water, which should be supplied to fish farms, table 1.

It can be concluded from the output of the above-described data that this farm is located in a good natural climatic zone and this allows for the cultivation of various types of fish. The total area of the water surface is 49 hectares, of which: spawning, nursery, feeding, wintering, brood and quarantine ponds. The farm has a hatchery for fish reproduction. The structure of the water fund of the state is presented in table 2.

Table 2

Explication of the design pond of the farm FH "Rurenko"

Categories of reservoirs	Pond area, hectares	%
Ponds, total	49	100
Foraging	45	91,1
Growing	3,4	6,9
Wintering	0,4	0,8
Uterine	0,3	0,6
Spawning	0,2	0,4
Quarantine	0,1	0,2

Table 2 shows that the farm FH "Rurenko" is a full-system farm with all the necessary categories of ponds (Figure 1).

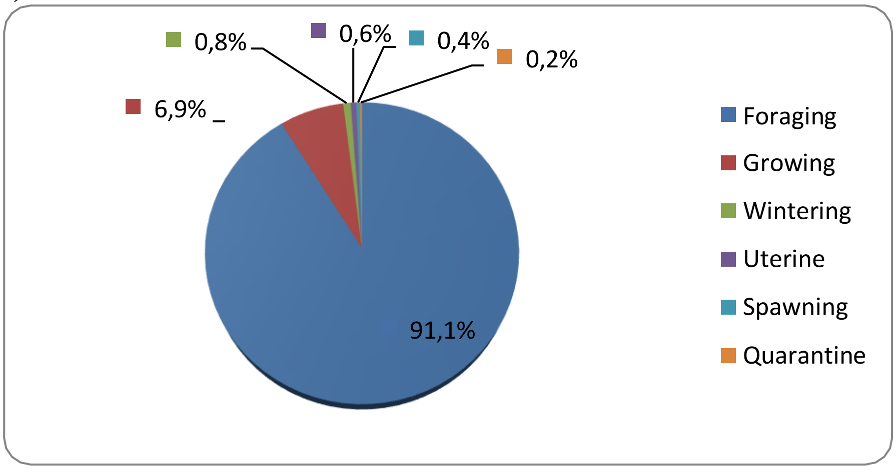

Figure 1. Percentage of different pond categories

The farm is engaged in the cultivation of channel catfish in polyculture with carp. High efficiency of intensification is achieved when using polyculture. To maintain the average seasonal biomass of the feeding base of the feeding ponds at the required level, organic and mineral fertilizers should be applied.

In the conditions of industrial fish farming, stocking density is the most important environmental factor. The higher the concentration of farmed fish, the higher the economic return of the fish breeding area. As the fish stocking density increases, the need for oxygen and the need to remove metabolic products increase, that is, the need for increased water supply and flow rate increases [3].

During the study period which was conducted from 2018 to 2019. a full-system fish farm project was developed on the basis of FH "Rurenko". In the farm FH "Rurenko", the average monthly temperature of the feeding ponds was measured, the data are presented in Table 3.

Table 3

Average monthly temperature of pond No. 3

Year	Months					
	May	June	July	August	September	October
	Average monthly temperature, °C					
2018	20,2	22,2	22,0	19,5	22,0	23,1
2019	18,5	22,7	20,5	23,6	23,0	21,2

Among the main indicators of water quality for the life of fish and other aquatic animals in water bodies is the concentration of dissolved oxygen. Oxygen enters the water from the atmosphere and is partially released in the reservoir itself as a result of the vital activity of plant organisms. With the help of chlorophyll, green plants secrete carbon dioxide from carbon dioxide, carbon necessary for the construction of living matter, releasing oxygen into the surrounding space through photosynthesis, but this process takes place only during daylight hours.

The penetration of oxygen into water from the atmosphere is facilitated by wind, currents, atmospheric precipitation, sudden changes in temperature and other reasons that enhance the mixing of water layers. Oxygen dissolved in water is consumed for the respiration of animals and the oxidation of organic substances. At a low concentration of oxygen dissolved in water, fish are killed, dying from suffocation.

Dissolved oxygen rates in fishery reservoirs are shown in Table 4.

Table 4

Dissolved Oxygen Norms in Fisheries

Index	Period of the year	fishery use
Dissolved oxygen	Summer	7 mg / l
Dissolved oxygen	Winter	6 mg / l

In this farm, a study of the content of dissolved oxygen in feeding pond No. 3 was carried out using an oximeter during April - October, the results of the content of dissolved oxygen are shown in Table 5.

Table 5

Temperature indicators and the content of dissolved oxygen in the water of pond No. 3

Date	O_2 content, mg / l	water tº, ºC
1	2	3
10.04.2019	6,0	11
25.04.2019	5,9	13
10.05.2019	5,9	15
25.05.2019	5,6	17
10.06.2019	5,5	22
25.06.2019	5,3	23
10.07.2019	4,9	24
25.07.2019	4,6	25
10.08.2019	4,5	25
25.08.2019	4,7	23
10.09.2019	5,1	21
25.09.2019	5,3	18
10.10.2019	5,5	15
25.10.2019	5,9	10

The study showed (Table 5) that the oxygen content of the feeding pond in some months differed from the norm of fishery reservoirs. The decrease in oxygen occurred due to an increase in temperature from June to August.

The first and most effective method of dealing with suffocation is aeration (saturation) of water with oxygen and constant monitoring of the state of oxygen dissolved in the water. On water bodies where marketable fish is grown, the flow rate is increased in the pond or lime lime is carried out.

When designing a full-system economy, the following calculations were carried out:

- calculation of the total area of the economy and the areas of ponds of various categories of a full-system economy;
- calculation of the needs of producers and replacement young stock of channel catfish and carp.

The calculations are based on the capacity of the farm and the fish-breeding and biological standards for the breeding and rearing of channel catfish.

Fish breeding - biological standards:

- the number of channel catfish - 650 pieces. / hectares.

Standard areas of ponds of certain categories,% for a two-year turnover:

- spawning ponds - from 0.1 to 0.5 hectares,
- nursery ponds - from 3 to 7 hectares,
- feeding ponds - from 60 to 62 hectares,
- wintering ponds - 0.2 - 1 hectares,
- repair and brood ponds - 1 - 1.5 hectares and more,
- quarantine ponds - 0.2 hectares.

Fish productivity of ponds:

- growing - 20 centner / hectares,
- feeding -3 centner / hectares.

Average mass:

- underyearlings -45g,
- weight of annuals -42g,
- weight of two-year-olds - 550 g.

The decrease in the mass of one-year-olds over the winter is 12%.

- The yield of underyearlings from the larva is 65%.
- Output of one-year-olds from fingerlings - 75%.
- The yield of two-year-olds from one-year-olds is 85%.
- Density of planting in wintering ponds - 600 thousand / hectares.
- The number of matured larvae per female - 10 thousand pieces.
- The ratio of females and males is 1: 1.

The capacity of the farm is 2.4 centner / hectares.

According to the standards for the stocking of reservoirs with channel catfish, it needs to be planted 650 pieces / hectares. From this it follows that the number of channel catfish that need to be zaribited the farm of FH "Rurenko" with an area of 8 hectares will be 8 × 650 = 5200 pieces.

The standard weight of a one-year-old channel catfish is 42 g. Thus, the capacity of the farm is 5200 / 0.55 = 9455 pieces.

Calculation of the total area of the farm FH "Rurenko" and the area of ponds of various categories of full-system farms with a capacity of 2.4 kg / hectares. commercial channel catfish (two years old). The farm is located in 4 fish farming zones:

- emergence of larvae from one socket breeders - 10 thousand pieces.

- spawning area for one socket breeders - 0.01 hectares.

- stocking density of underyearlings in wintering ponds - 600 thousand pieces / hectares.

1. Let us determine the number of two-year-olds, for this we need to divide the capacity of the economy by the mass of two-year-olds - 9455 / 0.55 = 17190 pieces.

2. calculate the number of one-year-olds, for this you need the number of one-year-olds × 100 / yield of two-year-olds. Number of one-year-olds - 17190 × 100/85 = 20223 pieces.

3. Determine the number of one-year-olds, for this you need the number of one-year-olds × 100 / output of one-year-olds. The number of underyearlings - 20223 × 100/75 = 26964 pieces.

(4) The number of larvae is recoverable; this requires the number of underyearlings × 100 / underyearling yield. The number of larvae is 26964 × 100/65) = 41483 pieces.

5. Determine the number of spawners, this requires the number of larvae / larvae output from one nest. The number of breeders (nests) - 41483/10000 = 5 pieces.

6. Let's calculate the area of spawning ponds, for this we need the number of spawners × 0.01 × 1.1. The area of spawning ponds is (5 × 0.01) × 1.1 = 0.05 hectares.

7. Let us calculate the area of rearing ponds; this requires the number of underyearlings × weight of underyearlings / fish productivity of rearing ponds. The area of nursery ponds is 41483 × 0.045 / 2000 = 0.93 hectares.

8. Let us determine the area of wintering ponds; this requires the number of underyearlings / stocking density of underyearlings in wintering ponds. The area of wintering ponds is 26964/600000 = 0.04 hectares.

9. Let's calculate the growth of two-year-olds, for this we need a mass of two-year-olds - the mass of one-year-olds. The growth of two-year-olds in feeding ponds is 0.55 - 0.042 = 0.50 g.

10. The mass of one-year-olds is calculated as the difference: the mass of the underyearlings - the mass of the decrease in the underyearlings over the winter - the weight of the one-year-old = (0.045 × 12) / 100 = 0.5 g.

11. Determine the area of the feeding ponds, for this you need the number of two-year-olds × the growth of two-year-olds / fish productivity of the feeding ponds. The area of the feeding ponds is (17190 × 0.50) / 240 = 35.81 hectares.

The age groups of the channel catfish of the full-system fishery are presented in Table 6.

Table 6

The number of age groups of channel catfish

Age groups	Number of fish, specimen
Channel catfish larvae	41483
This year's channel catfish	26964
Annual catfish	20223
Commodity biennials of the channel catfish	17190

The calculation of the needs of producers and replacement young stock was carried out taking into account the capacity of the farm and other technological indicators.

The capacity of the farm is 20 centners of marketable fish. The farmoperates under the following standards:

1. The output: underyearlings - 70%; peers - 80%; two years - 85%.

2. The average weight of two years is 550 g.

3. The output of larvae from one female - 10 thousand pieces.

To determine the number of two years, the capacity of the farm must be divided by the average weight of two years - 2000 / 0.55 = 3637 pieces.

In order to determine the number of two years, you need the number of two years × 100/85, the number of one year olds - 3637 × 100/85 = 4278 pieces.

The number of underyearlings is calculated as follows: the number of annuals × 100/80 - 4278 × 100/80 = 5347 pieces.

To determine the number of larvae, you need the number of underyearlings × 100/70 - the number of larvae = 5347 × 100/70 = 7638 pieces.

In order to determine the number of females, the number of larvae / larva output from one female is needed - the number of females = 7638/10000 = 1 Further technological calculations were carried out as follows:

1. The number of males - 1 × 1 = 1

2. The number of producers - 1 + 1 = 2

3. The total number of breeders, taking into account the 50% reserve, is:

4. Females - (1 × 150) / 100 = 2

5. Males - (1 × 150) / 100 = 2

6. In general, breeders = 2+ 2 = 4

When 25% of the herd is culled, the number of broodstock will change annually = 4 × 25/100 = 1, or nests will be replaced = 1/3 = 1

Repair livestock under the following conditions will be as follows:

Number of repair biennials = 1 × 90 = 90 pieces.

Number of repair three-year = 1 × 8 = 80 pieces.

Number of repair four-year = 1 × 8 = 80 pieces.

The total number of repair young stock = 90 + 80+ 80 = 250 pieces.

The determination of the required number of eggs for the planned capacity of the economy is carried out as follows, namely, the number of larvae must be divided by the standard output from the incubation apparatus, which is 70%. The required number of caviar is 7638 / 0.7 = 10911 pieces.

Channel catfish caviar is incubated in Weiss apparatus. Calculations of the required number of incubators are based on the required number of fertilized caviar of catfish and the rate of loading caviar into one device (250 thousand):

10911 caviar / 250,000 = 0.04 (one incubator).

Therefore, in this farm for incubation of caviar and obtaining the planned capacity it is necessary to have 1 device "Weiss".

The calculation of the need for broodstock and repair young channel catfish is presented in table 7.

Table 7

Number of broodstock and repair young channel catfish

Index	Number of broodstock. pieces.	Index	Number of repair young stock, pieces.
Females	1	Repair biennials	90
Males	1	Repair three years	80
Reserve	4	Repair four years	80
Total	6	Total	250

The farm of FH "Rurenko" together with the channel catfish also grows carp, so it is necessary to calculate the norms of stocking ponds with carp. To do this, we use fish-biological primitives.

Standards for stocking natural reservoirs with carp - 750 pcs / hectares.

Normative areas of ponds of separate categories,% for two-year turnover:

- fish productivity of ponds: growing - 20 kg / hectares, feeding - 16 kg / hectares.

The average weight of underyearlings is 25g.

Weight of annuals -35g.

Weight of commodity biennial fish 430 g.

The decrease in the weight of annuals over the winter is 12%.

The yield of underyearlings from the larva is 65%.

The yield of one-year-olds from underyearlings is 75%.

The yield of two-year-olds from one-year-olds is 85%.

Planting density in wintering ponds - 650 thousand / hectares.

The ratio of females to males is 1: 2.

The capacity of the farm is 5.2 centner / hectares.

According to the standards for the stocking of reservoirs with carp, 750 pieces must be planted. / hectares. Hence it follows that the number of carp that need to be harvested is the farm of FH "Rurenko" with an area of 8 hectares. will equal 8 × 750 = 6000 pieces.

The standard weight of a one-year-old channel catfish is 35 g.

So the capacity of the farm is: 6000 / 0.43 = 13953 pieces.

The output of larvae from one nest of breeders is 50 thousand pieces.

Spawning area for one nest of breeders is 0.04 hectares.

The stocking density of underyearlings in wintering ponds is 650 thousand. / hectares.

The number of two-year-olds (farm capacity / weight of two-year-olds) - 13953 / 0.43 = 32448 pieces.

Number of one-year-olds (number of two-year-olds × 100 / yield of two-year-olds) - 32448 × 100/85 = 38174 pieces.

Number of underyearlings (number of one-year-olds × 100 / yield of one-year-olds) - 38174 × 100/75 = 50898 pieces.

Number of breeders (number of ts'ogorichok × 100 / type of ts'ogorichok) - 50898 × 100/65 = 78304 pieces.

Number of larvae (nests) (number of larvae / larvae from one nest) - 78304/50 000 = 2 pieces.

Table 8 presents the development of the group of bark.

Table 8

Groups of different ages of carp

Age groups	Number of fish, specimen
Carp larvae	78304
Carp fingerlings	50898
Peer carp	38174
Commercial two-year-old carp	32448

Calculation of the need for broodstock and repair of young carp.

The capacity of the farm is 40 quintals of marketable fish. The farm operates at the following standards:

Yield: this year - 70%; one-year-old - 80%; biennials - 85%.

The average weight of two-year-olds is 430 g. The yield of larvae from one female - 100 thousand pieces.

For the output data, the capacity of the farm is taken and then it is determined:

1. The number of two-year-olds (farm capacity / average weight of two-year-olds) - 4000 / 0.43 = 9302 pieces.
2. The number of one-year-olds (number of two-year-olds × 100/85) - 9302 × 100/85 = 10943 pieces.
3. The number of underyearlings (number of annuals × 100/80) - 10943 × 100/80 = 13678 pieces.
4. The number of larvae (number of underyearlings × 100/70) - 13678 × 100/70 = 19540 pieces.
5. The number of females (number of larvae / larva emergence from one female) - 19540/100000 = 1.
6. The number of males - 1 × 2 = 2
7. The number of broodstock - 1 + 2 = 3
8. The total number of offspring, taking into account the reserve of 50% is:
9. Females - (1 × 150) / 100 = 2
10. Males - (2 × 150) / 100 = 3
11. In general, broodstock = 3+ 3 = 5

When culling 25% of the herd, the following number of broodstock will be updated annually - 5 × 25/100 = 2, or nests will be replaced - 2/3 = 1

Repair livestock under the following conditions will be as follows:

Number of repair biennials - 1 × 90 = 90 pieces.

Number of repair three years - 1 × 8 = 80 pieces.

The number of repair four-year - 1 × 8 = 80 pieces.

The total number of repair young stock - 90 +80+ 80 = 250 pieces.

Determining the required number of caviar for the planned capacity of the farm is as follows, namely the number of larvae must be divided by the standard output from the incubator, which is 70%.

Number of caviar - 19540 / 0,7 = 27914 pieces.

Calculations of the required number of incubators are based on the required number of fertilized carp caviar and the rate of loading caviar into one device:

27914 caviar / 250 000 = 0.1 (one incubator). Therefore, in this farm for incubation of carp caviar and obtaining the planned capacity it is necessary to have 1 device "IVL-2".

In the table. 9 presents the number of broodstock and repair young carp.

Table 9

Number of broodstock and repair young carp

Index	Number of broodstock. pieces.	Index	Number of repair young stock, pieces.
Females	1	Repair biennials	90
Males	2	Repair three years	80
Reserve	5	Repair four years	80
Total	8	Total	250

Feeding is one of the main factors in the formation of the productive traits of channel catfish. For feeding the young catfish, compound feed SB-1 will be used, which includes components of both animal and plant origin (Table 10).

Table 10

Composition and nutritional value of compound feeds for growing channel catfish, %

Component	SB-1	SB-2
Fish meal	18	11
Sunflower meal	12	15
Soybean meal	21	-
Feed yeast	45	15
Wheat flour	3	28
Meat and bone meal	-	8
Peas	-	22
Premix	1	1
Crude protein	42,76	35 3,4%
Crude fat	5,51	3,4
Metabolic energy, calories / 100 grams	341,10	378,6

The feasibility of fishery exploitation and production efficiency are determined not only by indicators of the volume of products produced, but also by the amount of profit received through its sale. The economic efficiency of fishery production means getting the maximum amount of products per unit area with the minimum cost of money and labor per unit of production.

Analyzing the indicators of economic efficiency in the design of a full-system fish farm for growing channel catfish in polyculture, we can conclude that the costs of designing a farm will be the cost of building various categories of ponds, wages and fish feeding. Other costs are the rearing of channel catfish and carp larva.

Sales price: commodity channel catfish - 80 hryvnia per 1 kg, commodity carp - 45 hryvnia per 1 kg.

Table 11 shows the costs of the project economy and a certain level of its profitability.

Table 11

Production costs and profitability levels

Index	Funds, hryvnia
Costs of growing channel catfish and carp larvae	9350
Fish feeding	48000
Construction costs of ponds and hatchery	143628
Electricity, hryvnia	14100
Remuneration to employees, hryvnia	23800
Depreciation of fixed assets, hryvnia	3250
Total expenses, hryvnia	242128
Selling price for 1 kg. channel catfish	80
Selling price for 1 kg. carp	45
Income, hryvnia	327200
Profit, hryvnia	85072
Profitability, hryvnia	35 %

So, the cultivation of channel catfish in polyculture with carp is economically profitable, since it allows you to make a profit of UAH 85,072 and provides a profitability level of 35%.

Conclusions. 1. For the implementation of the developed project of growing 17 thousand pieces. commodity catfish on 8 hectares of pond must have 41483 pcs. larvae, 26964 pcs. this year, 20223 pcs. one-year-old. In order to provide the farm with larvae in the planned year it is planned to have 2 broodstock.

2. Taking into account the fact that catfish was planned to be grown in polyculture, the required number of carp larvae is 78,304 pieces, this year - 50,898 pieces, annuals - 38,174 pieces. Thus the exit of commodity biennials will make 32448 pieces.

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