Use of low-cost equipment for growing commercial sturgeon fish

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Abstract. The paper describes alternative low-cost equipment (in-ground pools) for keeping juvenile sturgeon fish. The results of the study of the hydrochemical regime of the compared fish breeding tanks, growth rates, and fish breeding and biological indicators of the juvenile fish contained in them are described. The object of the research was the juvenile bester (yearlings). As a result of growing fish in the compared containers, it was revealed that when using traditional type and frame pools there was no significant difference between fish breeding indicators. Compared fish breeding tanks provide the necessary hydrochemical regime for the cultivation of physiologically valuable juveniles of sturgeon fish with high growth rates. However, when keeping a yearling of the bester in the developed in-ground pool, there was a certain tendency to increase the intensity of fish growth. The concrete in-ground pool, in comparison with the compared fish breeding tanks, is not only the most reliable, but also close to the natural habitat of the fish (ponds) due to its high noise isolation and low vibration from fish life support system elements. It can be designed in any shape and size, placed anywhere. From a sanitary and environmental point of view, concrete pools are the most preferred option.

1. Introduction

Due to human activity, the number of sturgeon fishes in natural reservoirs is steadily decreasing; therefore, the role of their reproduction in the conditions of pedigree and commercial farms is growing. Scientists and practitioners are creating measures to improve the biotechnology of sturgeon breeding to increase the profitability of the fish farming industry and the availability of products, developing techniques for the technical re-equipment of fish breeding enterprises based on reducing the cost of meat and caviar [2].

Industrial sturgeon breeding in the modern aspect does not solve the problem of renewing the population of valuable species living in natural conditions, but to some extent relieves pressure from natural resources in terms of poaching, and also allows the population to legally acquire meat and caviar obtained from sturgeon hybrids, sometimes not inferior in taste from individuals living in the natural environment.

A significant contribution to the development of the industry was made by domestic researchers. On an industrial basis, sturgeon cultivation began to be actively applied at the end of the last century in the USA, Israel and Western Europe. In the modern time span, commercial sturgeon breeding is the most intensively introduced in China and the Russian Federation. Currently, with commercial cultivation of sturgeon fish, all known methods are used: pasture, pond, cage, pool and in installations with a closed water supply. Few farms cover the entire production cycle and sell all possible sturgeon...
products. Some produce only hatching eggs or fry (underyearlings, yearlings); others specialize in raising fish for meat; in many farms, commercial caviar from sturgeon hybrids has become their main goal [2-4, 7].

Ponds for sturgeon rearing can be non-drained and drained. Non-drained ponds do not have special drainage structures. In the drained pond, it is possible to completely drain it. For this purpose, hydraulic structures are arranged. The drainage of the pond makes it possible to fully take out fish in the autumn, reduces operating costs and increases the profitability of the economy. In addition, in the autumn-winter period, the bed of the drained pond is aired, frozen, the silt in it is mineralized - all this has a positive effect on the development of small aquatic organisms, which creates favorable conditions for the life and development of fish. The extensive technology for sturgeon cultivation has long been replaced by intensive methods, including basin cultivation.

Pools can be made of metal, fiberglass, plastic, concrete, wood or made directly in the ground. They can be of different shapes (round, square, rectangular) [5, 7].

Equipment for pools should be selected taking into account its technical characteristics. Since the devices cannot work for a long time at the maximum of their capabilities, they should be purchased with some power reserve.

In this regard, their alternative commercial cultivation in aquaculture conditions: in pools and cages, becomes relevant. The most promising way of sturgeon conservation is their artificial reproduction [1, 4, 7].

2. Materials and methods
The purpose of the work is to compare the indicators of the hydrochemical regime and growth rate when using the ICA-2, INTEX and deep-type concrete pools for the cultivation of juvenile sturgeon fish.

The object of the study is juvenile bester (yearlings). Subject of study - pools of different designs.

Research Objectives:
1) to study the hydrochemical regime of the compared fish breeding tanks;
2) to analyze the fish breeding and biological indicators of the growth of bester yearlings in the compared pools.

Research Methods. To achieve this goal, an experiment was conducted in the conditions of LLC Albashi of the Leningrad District of the Krasnodar Territory. Water intake for pools was carried out on a section of the Albashi River from 54.0 to 58.5 km from the mouth. In the experiments, the technology of keeping sturgeon fish in the pools was used.

The studies were performed according to the scheme presented in table 1.

| Groups       | Fish-breeding pools           |
|--------------|------------------------------|
| 1 (control)  | ICA-2                        |
| 2 (experiment)| framed «INTEX»              |
| 3 (experiment)| In-ground pool              |

ICA-2 pools are made of composite materials and are a one-piece design, have the property of self-cleaning even with low water circulation. The term of use is up to 50 years [7].

INTEX frame pools have recently gained great popularity. They are a real affordable alternative to installing stationary expensive pools. Their advantages include low cost, ease of installation. The disadvantages are the short term of use (up to 6 years), as well as the lack of self-cleaning.

In-ground pools are submerged in the ground, have a rectangular shape, separated from each other by the bank. The pool can be in the open air, canopy or indoors. In-ground pools are made of concrete, which is practical and durable (up to 100 years). In the construction of concrete structures, a multilayer structure of external and internal waterproofing is used. The thickness directly depends on the dimensions of the structure, but should not be less than 10 cm. The thickness of the walls of the pool bowl must withstand the pressure of water on the one hand, the pressure of the dense soil - on the other.
The cost of acquiring and installing an ICA pool (equal volume) is 46 thousand rubles, a frame pool is 12 thousand rubles, and an in-ground pool is 20 thousand rubles.

Compared fish breeding tanks were equipped with identical installation equipment - cranes, aeration systems, water intake, water discharge, compressors with a capacity of 120 liters per minute. Water supply was carried out by flutter spraying. Spillway - through the level hole.

Each group (experimental pool) contained 150 individuals of Bester yearlings, which were selected by the method of pair analogues from juveniles of the same brood, the same weight. The duration of the experiment was 60 days.

Bester is a hybrid of beluga and sterlet, characterized by a high growth rate, early puberty (males at 3-4 years old, females at 6-8 years old), delicious meat and high-quality commercial black caviar. Obtaining a hybrid of beluga and sterlet opens up broad prospects for its cultivation in many sturgeon farms of any form of ownership for the production of marketable products. Bester fish is capable of breeding, but under aquaculture conditions this hybrid is artificially bred. Offspring are always obtained by artificial insemination of beluga caviar with the sperm of a male sterlet [3].

Compound feeds for fish, especially for sturgeon, should contain high levels of protein and fat [5]. Feed for sturgeon fish was purchased at the Perspektiva LLC of the Krasnodar Territory of the Seversky District, Ilsky settlement.

The nutritional value of feed for juvenile bester is shown in table 2.

| Components                  | Values |
|-----------------------------|--------|
| Metabolizable energy, kcal per 1 kg | 3558.7 |
| Crude protein, %            | 54.6   |
| Crude fat, %                | 11.0   |
| Crude fibre, %              | 0.95   |

In the course of the experiment, we determined the weight of the fish individually at the beginning and at the end of the experiment. The length of the fish was measured from the top of the snout to the vertical of the end of the longest lobe of the caudal fin with its horizontal position. The feed coefficient (feed costs per 1 kg of weight gain) was calculated as the ratio of feed consumed to gross growth. The coefficient of fatness was calculated as the ratio of mass to body length in a cube. Survival rate was determined as a percentage of live fish to dead and rejected.

Hydrochemical parameters during the experiment were within the limits allowed for sturgeon cultivation in accordance with the requirements of OST (branch standard) 155 372-87.

The data obtained during the study were processed by the biometric method (Lakin, 1990) [6].

3. Results and its discussion

The physiological well-being of aquatic organisms living in the aquatic environment is highly dependent on environmental factors and, above all, on the purity of the water in which they live [3]. Water quality analyses were conducted in all types of pools. Their results are shown in table 3.

| Item             | Units | Group 1          | Group 2          | Group 3          | Optimum and MPC |
|------------------|-------|------------------|------------------|------------------|-----------------|
| pH               | Un.   | 7.50±0.08        | 7.44±0.07        | 7.51±0.06        | 7.2-9.0         |
| Oxygen           | mg/l  | 8.92±0.09        | 8.89±0.08        | 9.01±0.07        | 5-10            |
| Ammonium         | mg N/l| 0.30             | 0.31             | 0.29             | 0.8             |
| Nitrite Nitrogen | mg N/l| 0.01             | 0.01             | 0.01             | 0.02            |
| Nitrogen nitrates| mg N/l| 0.85             | 0.86             | 0.84             | 1.0             |
| Phosphates       | mg P/l| 0.30             | 0.30             | 0.30             | 0.3             |
The acidity of the water, the content of dissolved oxygen, ammonium nitrogen, nitrogen nitrates and nitrites, phosphates in it were within normal limits in all pools.

The initial weight of the fish in the first group was 385.02 ± 5.81 g; in the second - 384.86 ± 6.12; in the third - 383.86 ± 6.88 g. At the end of the experiment there were 520.12 ± 7.10 g; 519.65 ± 8.55 and 528.36 ± 9.12 g, respectively, in groups.

When using ICA-2 and INTEX containers, there was practically no difference in fish growth. When comparing the use of ICA-2 in the control and the in-ground pool, it was found that in the third experimental group the weight of the fish was 1.6%, the average daily gain - 7.1%, the length of the fish - 0.4%, and the fatness ratio - 0.3% higher, the survival rate remained at the same level. Therefore, in the concrete in-ground pool, the fish grew slightly better compared to ICA-2 and the INTEX frame pool.

The concrete in-ground pool, in comparison with the compared fish breeding tanks, is not only the most reliable, but also close to the natural habitat of the fish (ponds) due to its high noise isolation and low vibration from fish life support system elements (in the ICA-2 and INTEX pools, the vibration and noise are more noticeable, the fish is in a more excited state), which can explain a slight increase in fish-breeding and biological indicators. It can be designed in any shape and size, placed anywhere. From a sanitary and environmental point of view, concrete pools are the most preferred option.

4. Conclusion

Compared fish breeding tanks provide the necessary hydrochemical regime for the cultivation of physiologically valuable juveniles of sturgeon fish with high growth rates. An in-ground concrete pool can be used as an alternative to ICA-2.

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