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Growth of Commercial African Catfish (Clarias Garie Pinus) When Feeding Broiler Chicken By-Products

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Summary: In October 2023, for 15 days, in 60-liter plastic containers with aeration at a temperature of 25-26 ° C, African catfish larvae were fed with live food: zooplankton (collected in the Tuyabuguz reservoir), Daphnia magna, common tubifex and aulophorus. The fry grew to an average of 0.63 g, 0.87 g, 1.13 g and 1.07 g, respectively. The recovery was 58%, 61%, 71.5% and 45.6%, respectively. Indicators of growth and quality of feed are given.

Key words: African catfish, Clarias gariepinus, fish feeding, chicken by-products, fish cages, Uzbekistan.

African catfish, Clarias gariepinus, a member of the Clariidae family, is a typical tropical fish that naturally cannot overwinter in temperate climates, including in Uzbekistan. However, in the period from May to October, the conditions of the lentic reservoirs of the republic correspond to the requirements of the species for the environment. African catfish have rapid development and growth, as a result of which during the specified growing season they can reach commercial sizes when fed with high-protein balanced feed. However, the global trend in the production of such feeds shows a stagnation in their production due to the danger of overfishing as raw fish in the world's oceans for the production of fishmeal (Stadtlander et al 2013; Basri et al 2015). As a result of this, many studies are aimed at finding alternative fish feeds. For predatory fish, which includes the African catfish, they search among other products of animal origin (Akiwanda et al., 2002). In the conditions of Uzbekistan, with the increase in the production of broiler chickens, such an alternative can be by-products of chicken processing. The purpose of this work was to analyze the growth of commercial African catfish when fed chick frames, legs, entrails and heads in cage conditions.

Material and methodology

The work was carried out in 2023 in the cage installation of the FishBerg LLC fish farm in the western part of the Tuyabuguz reservoir in the flat part of the Syrdarya basin in the Tashkent region of Uzbekistan.

The offspring of African catfish were obtained under the conditions of a closed water supply installation at the Institute of Zoology in early March, grown to 25 - 120 g and stocked in floating fish cages (Fig. 1).

During the growing season, water temperature was determined as a limiting factor day and night after 6 hours, and the average daily water temperature in the cage was calculated.

The experiment began on June 10 after sorting the juveniles: fish with an individual weight of 80–100 g were planted in 3 experimental cages. The fish were fed minced meat from by-products (broiler processing waste) obtained from the slaughterhouse of poultry farms in the Pskent district of the Tashkent region. Two types of by-products were used: frozen blocks from carcasses of broiler chickens (75%) and a mixture of entrails, legs, and heads (25%). Having mixed both types of feed, they made minced meat in a meat grinder and added it to the feeding tank for African catfish.

Control fisheries were carried out weekly; based on the results of measurements of 25 random fish, the average individual weight of the fish was determined and the diet was adjusted. The experiment was completed on October 10, with the last control fishing.

Rice. 1. Floating fish cages, Tuyabuguz reservoir

The growth of fish and the quality of feed were judged by the following indicators, calculated based on individual indicators of fish in the variants:

• body weight gain: dw (g) = w2 – w1; (where w1 (g) is the initial average individual body weight of fish; w2 (g) is the final average individual body weight of fish);

• body weight growth rate (g/day): dw/t; (where t is the duration of feeding in days);

• specific growth rate of fish (Specific growth rate): SGR (% per day) = [(lnw2 – lnw1)/t] * 100; (where ln is the natural logarithm);

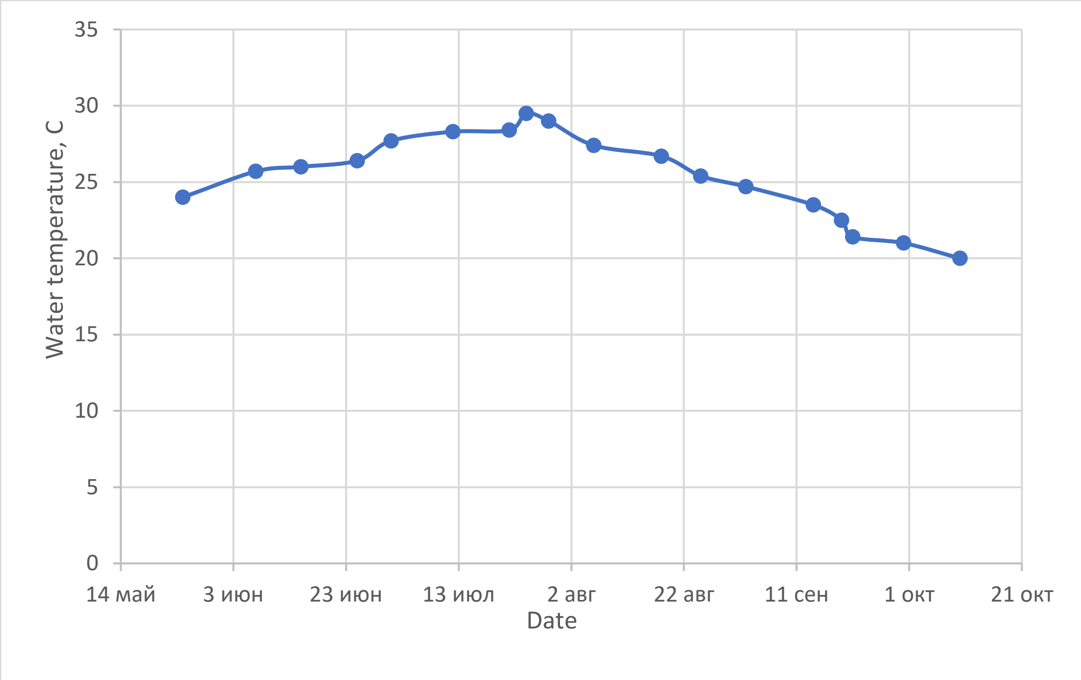
• feed conversion rate (FCR, feed conversion rate): K = amount of feed introduced (g) / DW (g) (Where DW is the increase in the total biomass of fish in the cage);

• Protein efficiency rate: PER = DW (g) / amount of protein added (g).

Numerical data were processed using variation statistics methods.

Results

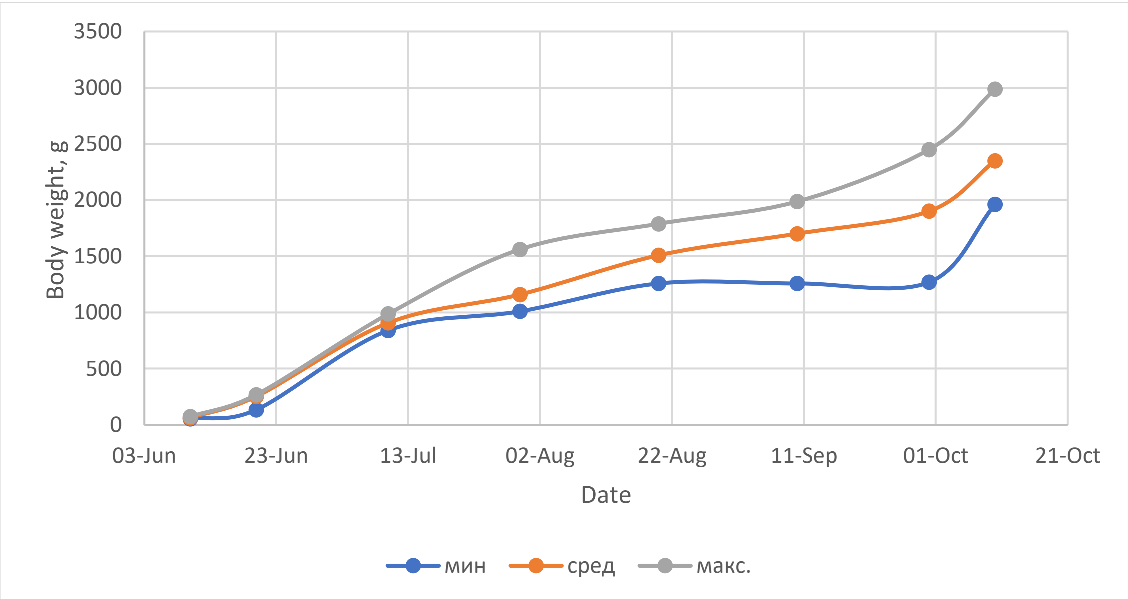
The most important indicator when growing tropical fish is water temperature. A graph of the average daily water temperature in the Tuyabuguz reservoir is shown in Figure 2. Thus, the water temperature in the cages installed in the Tuyabuguz reservoir in the period from May to the second half of October is warm enough for the life and growth of African catfish.



Rice. 2. Dynamics of water temperature in the Tuyabuguz reservoir, 2023

No African catfish were recorded in the cages during the experiment.

The fish have grown significantly. The average growth rate of fish in cages is shown in Figure 3. It can be seen that African catfish reaches marketable weight from early June to early October, which makes its cultivation promising.



Rice. 2. Growth of African catfish in floating fish cages, Tuyabuguz reservoir, Tashkent region

The average individual weight of catfish at the beginning of the experiment was 63 g. During the experiment, the figure increased to 2035 g, which is a high indicator (by analogy with other fish farming objects, African catfish weighing 1 kg and above are considered marketable.

The increase in the average individual body weight of catfish averaged 1972 g per growing season.

The average growth rate of African catfish individuals during the experiment was 16.2 g/day.

The specific growth rate of African catfish in cages during experimental feeding was 2.85% per day.

The biomass of fish in the experimental cages also increased significantly. At the beginning of the experiment, the total biomass was 810 kg. At the end of the experiment, the total biomass of African catfish increased to 21,000 kg, i.e. 26 times.

The increase in the total biomass of African catfish in the experiment was 20,190 kg.

The duration of the experiment in our case was 122 days.

During the entire period of experimental cultivation, 81,000 kg were added to the cages. The feed ratio of the feed used was 3.9.

Calculation of the efficiency of protein use of experimental feeds showed that the indicator was 1.66.

Discussion

The success of a significant global increase in fish production is associated with the use of high-protein balanced feeds in industrial systems (cages, swimming pools, closed water supply installations). The protein content in such feeds exceeds 35%, often exceeds 40%. However, an analysis of the harvest of fish as raw material for the production of fishmeal (the basis of such industrial feeds) showed that fishing is approaching the theoretical limit. With a further increase in fishing, the self-reproduction of fish stocks may be disrupted, which will cause overfishing and a further crisis in the fishery. The growth of fishmeal production in the world is stalling. Finding protein-rich sources from raw materials available in local markets in sufficient quantities to partially replace fishmeal in feed formulations is a trend in fisheries science research for further development of aquaculture (Goda et al 2007; Stadtlander et al 2013; Basri et al 2015 ; Mustafa, 2021). Conducting research programs on the use of alternative sources of fish feed, and for industrial conditions. Research is being conducted with algae, metabolic products of microorganisms that can be cultivated and have a high protein content and balance. One of the directions is the use of animal by-products, poultry farming, and other technological production products.

Studies have shown that the growth rate of fish in industrial fish farming is directly related to the higher protein content in balanced feeds (Hossain, Jauncey, 1989; Attala, Mikhail, 2008; Fa Kayode, Ugwumba, 2013).

Also, a number of studies have shown that for the cultivation of African catfish, feed with a protein content of 40% or higher is more preferable to ensure rapid growth (Faturati et al., 1986; Akiwanda et al., 2002).

It should be noted that a number of studies have shown that a mixture of ingredients in the formulation of feed (including protein sources) is more effective for fish growth than feed from a single ingredient (protein source) (Attala, Mikhail, 2008; Hu et al, 2008; Fa Kayode, Ugwumba, 2013; Kurbanov, Kamilov, 2016).

In recent years, African catfish has become a widespread object of industrial fish farming in Uzbekistan (Kurbanov, Kamilov, 2017). However, until now, its main production is carried out in well-heated earthen ponds of a small area or in pools with slow water exchange. Meanwhile, the bulk of water under the conditions of modern regulated flow of water resources in Uzbekistan is located in lentic reservoirs - in reservoirs and in lakes that store drainage water. The water in them does not warm up as quickly as in ponds, so this approach has not yet been widely developed. Our data showed that the water temperature in the reservoirs of the lowland zone (using the example of the Tuyabuguz reservoir) is sufficient to consider the potential growing season for tropical fish to be 5.5 - 6 months. Cultivation of African catfish, provided that fish seeding material is provided by the beginning of the growing season (by May) in reservoirs, allows one to obtain a high marketable sample of fish.

Poultry by-products can be considered as potential sources of food for the predator, which is the African catfish. In our country in the 2000–2010s there has been a constant increase in the production of broiler chickens. Thus, in 2021, in poultry farms of the Parrandasanoat Association, the production of broiler chickens exceeded 320 thousand tons of meat, thus, broiler processing waste exceeds 80 thousand tons per year. It can also be noted that there are private poultry farms, which in addition produce more than 200 thousand tons of broiler chicken meat. A network of slaughterhouses for processing broiler chickens into semi-finished products has been established in Uzbekistan. The indicated scale of poultry farming raises the problem of disposal of poultry cutting by-products to prevent environmental pollution. A real solution to the problem (as an option) could be to use this waste to grow African catfish. The issue of using by-products of cutting poultry products attracts the attention of fisheries science. A number of researchers show that the protein content of chicken entrails is 35-37% (Cayen et al., 2016). A number of studies are looking at using dried chicken entrails meal to partially replace fishmeal. (Goda et al., 2007; Olaniyi, Amusan, 2016). This is a promising direction for industrial aquaculture.

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There is a direction to use by-products from the processing of broiler chickens to feed African catfish as a basis. Previously, we carried out experiments of this type in cages on the Tuyabuguz reservoir: growing omnivorous predatory catfish almost entirely on fresh offal from the slaughterhouses of poultry farms (Mullabaev et al. 2022). As our research has shown, this direction allows us to obtain high-quality fish products during the growing season in the conditions of the flat zone of Uzbekistan. However, with this approach, the frame of broiler chickens remains unclaimed. 100 g of broiler chicken carcass usually contains 15 g of protein and about 8 g of fat, i.e. This is not such a quality product as minced entrails. But it can also be used to produce African catfish. In this experiment, we obtained results that are important for comparing two types of chicken by-products in feeding catfish. When using minced meat from the entrails of chickens for 50 days (fish grew from 500 grams of body weight to 1000 grams), the average growth rate was 10.18 g/day, in this experiment the figure was 16.2 g/day. Also, the average specific rate was lower than the experiment conducted in this year: 1.41%/day, and 285%/day, respectively. At the same time, the feed coefficient of both types of feed was approximately the same: 4.1 and 3.9.

Thus, minced meat from the frame of slaughtered broiler chickens with the addition of minced meat from heads and legs in a ratio of 3: 1 can be successfully used for growing marketable African catfish in cage conditions in lentic reservoirs of Uzbekistan. Please note that the quality of water in the cages is maintained by the construction of the cages themselves. For the conditions of ponds or low-flow pools, the experimental feed should still be carefully studied.

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