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ABOUT ARTIFICIAL GROWING OF AFRICAN CATFISH - *CLARIAS GARIEPINUS* (BURCHELL, 1822) IN THE CONDITIONS OF AZERBAIJAN

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SUMMARY

Purpose. The African catfish – *Clarias gariepinus* (Burchell, 1822) was brought to Azerbaijan and since 2016 began to be kept in individual farms. At present, it is brought to a marketable mass in a number of fish farms in the country. At the same time, before our research, there was not a single publication on the scientific basis for growing this fish here. The purpose of this article is to fill this gap to a certain extent, approbation and selection of methods for growing African catfish in Azerbaijan under closed conditions.

Design / methodology. The research was carried out in 2019-20 in the "Laboratory of closed and open fish farming" of the Azerbaijan State Agrarian University" in the city of Ganja and in the village of Novkhani, which is part of the city of Baku. For the experiments, juvenile African catfish obtained in June and September from individual fish farms used. Determination of the main biological indicators of fish and processing of the obtained data carried out by generally accepted ichthyologic methods.

Applied significance of the study. As a result of the study, the choice of the optimal technology for growing African catfish in Azerbaijan under closed conditions was made. This will make it possible to develop the most expedient and cost-effective ways of keeping this fish in fish farms.

Scientific novelty of the research. For the first time, the full development cycle of the African catfish in conditions of closed keeping was traced, from the incubation of eggs to the production of sexually mature individuals with high commercial qualities. The same individuals are used to obtain caviar for the purpose of incubation.

Results and discussion. The studies have shown that under artificial rearing conditions, most African catfish reach sexual maturity at 7 months of age, and only a small proportion at 6 months of age. Under artificial conditions, it is possible to obtain offspring of this fish and most of the larvae are viable. The growth rate of African catfish is highly dependent on the stocking density of fish in the tank. Thus, fish kept in concrete tanks with a volume of 10-15 m^3 grow more than twice as fast as fish kept in tanks with a volume of 0.5-1 m^3.

Keywords. fish farming, growth rate of fish, aquarium, fish larvae, fish fry.

Introduction

African catfish – *Clarias gariepinus* (Burchell, 1822) is distributed in most inland waters of African countries such as Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Egypt, Ghana, Mali and others, as well as in the reservoirs of the Sahara, in the Jordan River basin, in the waters of South and Southeast Asia [6, 8.]. This fish is very resistant to water pollution and has a high growth rate. Without the use of any additional facilities (systems of recirculating water supply, filtration, etc.), it can be kept with a planting density of 60-70 kg or more per one m^3 of water. According to the literature [2, 7], African catfish under conditions of intensive rearing can reach a weight of 1.5-2.5 kg at the age of 1 year, and 6-8 kg at the age of 2 years. Such a growth rate does not have almost any other fish species. In addition, African catfish meat has a high palatability.

Fish of this species was brought to Azerbaijan and since 2016 began to be kept in individual farms. At present, it is reaching to marketable mass in a number of fish farms in the country. At the same time, before our research, there was not a single publication on the

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scientific basis for growing this fish here. The purpose of this article is to fill this gap to some extent.

Materıal and methods

The research was carried out in 2019-20 in the "Laboratory of closed and open fish farming" of the Azerbaijan State Agrarian University in the city of Ganja and in the village of Novkhani, which is part of the city of Baku. For the experiments, juvenile African catfish obtained in June and September from individual fish farms were used. These fish were kept in concrete pools 8x2.8x1 and 3x2x2 m, plastic tanks 1x0.85x1 m and aquariums 0.90x0.45x0.45 m.

Water from an artesian well was used to keep the fish, and the amount of oxygen dissolved in the water was regulated by air compressors. In order to prevent a decrease in water quality from fish excretions and decomposition of food residues during rearing, the water in concrete pools, plastic tanks and aquariums was gradually or periodically replaced with fresh water, and various filters were used. The containers in which the spawners were kept, the eggs, larvae and fry received from them, were heated by various electric and gas heaters.

For feeding adult fish, chicken, mutton or beef liver, waste (mainly chicken intestines) from poultry farms, sausages, the expiration date of which was coming to an end, were used, and for larvae and fry - fresh blood, yolks of chicken eggs, liver and spleen of various domestic animals and birds.

Determination of the main biological indicators of fish and processing of the obtained data was carried out by generally accepted ichthyological methods [1, 3, 4, 5].

Results and its discussion

On September 18, 2019, 20 four-month-old African catfish were placed in a concrete pool measuring 8x2.8x1 m and kept there for 15 days. The body length of the fish was 27.4-39.6 cm, weight – 250.2-428.7 g. However, due to the fact that the water temperature in the concrete pool was low (17-20ºC), the fish were soon transferred to plastic tanks measuring 1x0.85x1 m, the water in which was heated with electric heaters and brought to 25-27ºC. Once a day, the water in the tank was gradually replaced by fresh water. The fish kept under these conditions were fed with fresh lamb and beef liver, unsuitable for human consumption.

It became possible to determine the gender of the fish by November 12th. Thus, the presence of a process 4-5 mm long near the anus makes it possible to diagnose this individual as a male. At this time, we dissected 2 males and 2 females, whose body length was 38.2-46.4 cm, and body weight - 436.8-872.9 g. The gonads of males were at stage II, and females - at stage III or IV of maturity (Fig. 1).

Fig. 1. Fish eggs sacks of maturity stage IV of 6-month-old African catfish females.

Starting from January 5, 2020, males and females were kept separately, in different aquariums. Each aquarium had 120-125 liters of water kept at a temperature of around 25ºC. The water in the aquarium was constantly changed at a rate of 5 liters per day. After 10 days, males and females were placed in pairs in different aquariums, and the water temperature was raised to 28°C. Two brooms made of polyethylene material were placed in each aquarium. Approximately 12 hours later, the fish began spawning, which lasted 1.5-2 hours. The eggs that the females spawned under artificial conditions were naturally inseminated by the males. After the completion of spawning and fertilization of eggs, the fish were carefully caught and moved to other aquariums. One part of the fertilized eggs stuck to the brooms, and the other part sank to the bottom of the aquarium. Therefore, in order to avoid excessive planting density, plastic brooms with eggs stuck to them were transferred to other aquariums. After 25-30 hours, fish larvae began to emerge from eggs located both on brooms and at the bottom of the aquariums. Most of the fertilized eggs hatched into larvae, 80-90% of which were viable.

A day after the larvae hatched from the eggs, they were given fresh cow blood 6-7 times a day. The total amount of this blood per day was approximately 20-25% of the weight of the larvae. A day later, the larvae, along with blood, began to receive the yolks of hard-boiled chicken eggs. Boiled yolks wrapped in 3-4 layers of gauze, which carried back and forth in water. 3 days after the larvae switched to exogenous nutrition, they fed 5-6 times a day with boiled and ground fresh beef liver and spleen. When 10–15 days had passed after the transition of the larvae to active feeding, pieces of the liver, cut into cubes with side sizes of 2 cm, thrown into the aquarium. The larvae actively tore them off and ate small pieces (Fig. 2).

Fig. 2. Feeding 10-15 day old African catfish larvae with pieces of liver.

In this period, the amount of food eaten by the larvae per day was about 50-60% of their body weight. Subsequently, in order to avoid excessive density of the fish, they were moved to other aquariums and plastic tanks. When carrying out such a resettlement, each time the fish were sorted. This was done for two reasons: firstly, due to the presence of cannibalism in the African catfish, relatively large individuals could devour small ones; secondly, large individuals intercept food from small ones, preventing them from eating normally.

Under laboratory conditions, the stocking density of fish in 1 m^3 was up to 50-60 kg. The various foods listed above were used to feed the fish. It must be assumed that the relatively small size of aquariums and plastic tanks had a negative effect on the growth of the

fish contained in them. The length and body weight of fry and adult African catfish grown during the 1 year of the study in aquariums and tanks are shown in Table 1.

Table1. Length and body weight of fry and mature specimens of African catfish grown for 1 year in aquariums and tanks

Age (months)	Body length (cm)	Body weight (g)
1	4-9	24-56
2	8-16	48-124
3	16-23	110-183
4	21-25	156-234
5	24-29	217-391
6	30-36	324-487
7	34-39	452-619
8	37-42	580-817
9	41-46	672-989
10	45-51	876-1281
11	50-56	1156-1593
12	55-62	1232-1879

Source: authors' own data.

According to the literature [2, 3], at the age of 1 year, the body weight of African catfish can reach 1.5-2.5 kg. The body weight of catfish grown by us in aquariums and tanks reached 1.2-1.9 kg in 1 year.

1-1.5-month-old fry grown in concrete pools 3x2x2 m in size, located on individual farms, were fed with beef liver and spleen, chicken intestines, sausages that had become unsuitable for human consumption, and other food. These pools were supplied with water, which was heated in the combi's water heating system and changed every 3 days. The stocking density of fish was 70-80 kg per 1 m^3. The length and body weight of fry and adult African catfish grown for 1 year in concrete tanks are shown in Table 2.

Table2. Length and body weight of fry and mature specimens of African catfish grown for 1 year in concrete pools

Age (months)	Body length (cm)	Body weight (g)
1	8-12	50-90
2	13-21	120-280
3	21-28	180-420
4	25-33	230-680
5	30-39	345-910
6	38-42	420-1490
7	45-49	670-2090
8	51-58	840-2470
9	57-69	1120-2840
10	65-77	1360-3250
11	72-89	1870-3860
12	79-98	2160-4470

Source: authors' own data.

A comparison of the data given in the two tables shows that the growth rate of catfish in concrete pools is more than twice as high as in aquariums and tanks. Apparently, this is due

to the fact that in aquariums and tanks the stocking density of fish is higher than in concrete pools.

Thus studies have shown that under artificial rearing conditions, most African catfish reach sexual maturity at 7 months of age, and only a small proportion at 6 months of age. Under artificial conditions, it is possible to obtain offspring of this fish and most of the larvae are viable. The growth rate of African catfish is highly dependent on the stocking density of fish in the tank. Thus, fish kept in concrete tanks with a volume of 10-15 m^3 grow more than twice as fast as fish kept in tanks with a volume of 0.5-1 m^3.

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AFRİKA NAXASININ – *CLARIAS GARIEPINUS* (BURCHELL, 1822) AZƏRBAYCAN ŞƏRAİTİNDƏ SÜNİ YETİŞDİRİLMƏSİ

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Xülasə

Tədqiqatın məqsədi. Afrika naxası – *Clarias gariepinus* (Burchell, 1822) 2016-cı ildə Azərbaycana gətirilmiş və burada fərdi balıqçılıq təsərrüfatlarında yetişdirilir. Hazırkı zamanda bu balıq ölkənin bir sıra balırçılıq təsərrüfatlarında saxlanılıb əmtəə ökçülərinə qədər çatdırılır. Buna baxmayaraq bizim apardığımız tədqiqatlara qədər bu balığın Azərbaycanda yetişdirilməsinin elmi əsaslarına həsr olunmuş heç bir əsər çap olunmamışdı. Bu məqalənin məqsədi tədqiqatlarda olan həmin boşluğu aradan qaldırmaq, Azərbaycanda Afrika nərəsini qapalı şəraitdə saclamaq yetişdirilməsinin aprobasiyasını həyata keçirmək və məqsədəuyğun yetişdirilmə üsullarının seçilməsi olmuşdur.

Tədqiqatın metodologiyası. Tədqiqatlar 2019-20-ci illərdə Gəncə şəhərində Azərbaycan Dövlət Aqrar Universitetinin "Qapalı və açıq balıqyetişdirmə laboratoriyası"nda və Bakının Novxanı kəndindəki fərdi təsərrüfatda yerinə yetirilmişdir. Tədqiqat üçün Afrika naxasının iyun və sentyabr aylarında fərdi əmtəə balıqçılığı təsərrüfatlarından əldə edilmiş körpələri istifadə olunmuşdur. Balıqların əsas bioloji göstəricilərinin müəyyən olunması və əldə edilmiş məlumatların emalı ixtiologiya sahəsində ümumi qəbul olunmuş üsullarla həyata keçirilmişdir.

Tədqiqatın tətbiqi əhəmiyyəti. Aparılmış tədqiqatlar nəticəsində Afrika naxasının Azərbaycanda qapalı saxlama şəraitində yetişdirilməsinin optimal texnologiyasının seçilməsi həyata keçirilmişdir. Bu, gələcəkdə

həmin balığın balıqçılıq təsərrüfatlarında saxlanılmasının məqsədəuyğun və iqtisadi cəhətdən sərfəli üsullarının işlənib hazırlanmasına imkan verəcəkdir.
Tədqiqatın elmi yeniliyi. İlk dəfə olaraq Afrika naxasının qapalı saxlanma şəraitində kürünün inkubasiyasından yüksək əmtəə xassələrinə malik yetkinfərdlərə qədər tam inkişaf tsikli tədqiq olunmuşdur. Cinsiyyət yetkinliyinə çatmış bu fərdlər inkubasiya məqsədi ilə kürünün əldə olunması və süni mayalandırılması üçün istifadə oluna bilərlər.
Nəticələr və müzakirə. Tədqiqatlar göstərdi ki, süni yetişdirmə şəraitində naxaların əksəriyyəti 7 aylığında və yalnız az bir hissəsi 6 aylığında cinsiyyət yetkinliyinə çatır. Süni şəraitdə bu balıqdan nəsil əldə etmək olur və əldə olunmuş sürfələrin əksəriyyəti həyati qabiliyyətlidir. Afrika naxasının böyümə sürəti balıqların su tutarında yerləşmə sıxlığından asılıdır. Belə ki, 10-15 m^3 həcmli beton hovuzlarda saxlanılan balıqlar 0,5-1 m^3 tutumlu hovuzlarda saxlanılan balıqlardan iki dəfə çox sürətlə böyüyürlər.
Açar sözlər. balıqartırma, balıqların böyümə sürəti, akvarium, balıq sürfələri, balıq körpələri.

ОБ ИСКУССТВЕННОМ ВЫРАЩИВАНИИ АФРИКАНСКОГО СОМА – *CLARIAS GARIEPINUS* (BURCHELL, 1822) В УСЛОВИЯХ АЗЕРБАЙДЖАНА

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Резюме

Цель исследования. Африканский сом – *Clarias gariepinus* (Burchell, 1822) был привезен в Азербайджан в 2016 г. и начал содержаться в индивидуальных рыбоводных хозяйствах. В настоящее время она доводится до товарной массы в целом ряде рыбоводных хозяйств страны. Вместе с тем, до проведенных нами исследований не было ни одной публикации, посвященной научным основам выращивания этой рыбы здесь. Целью настоящей статьи является заполнение, в определенной степени, этого пробела, апробация и выбор способов выращивания Африканского сома в условиях Азербайджане при замкнутых условиях содержания.
Методология исследования. Исследования проводились в 2019-20 гг. в «Лаборатории замкнутого и отрытого выращивания рыб» Азербайджанского Государственного Аграрного Университета» в г. Гянджа и в селе Новханы, входяшего в состав г. Баку. Для опытов использовалась молодь африканского сома, полученная в июне и сентябре от индивидуальных рыботоварных хозяйств. Определение основных биологических показателей рыб и обработку полученных данных проводили общепринятыми ихтиологическими методами.
Прикладное значение исследования. В результате проведенного исследования осуществлен выбор оптимальной технологии выращивания Африканского сома в условиях Азербайджане при замкнутых условиях содержания. Это позволит разработать наиболее целесообразные и экономически выгодные способы содержания этой рыбы в рыбоводных хозяйствах.
Научная новизна исследования. Впервые прослежен полный цикл развития Африканского сома в условиях замкнутого содержания, начиная от инкубации икры до получения половозрелых особей, обладающих высокими товарными качествами. Эти же особи используются для получения и искусственного оплодотворения икры с целью инкубации.
Выводы и обсуждение. Исследования показали, что в условиях искусственного выращивания большинство африканских сомов достигают половой зрелости в 7-месячном возрасте и лишь небольшая их часть в 6-месячном возрасте. В искусственных условиях можно получить потомство этой рыбы и большинство личинок жизнеспособны. Скорость роста африканского сома сильно зависит от плотности посадки рыбы в водоеме. Так, рыбы, содержащиеся в бетонных резервуарах объемом 10-15 $м^3$, растут более чем в два раза быстрее, чем рыбы, содержащиеся в резервуарах объемом 0,5-1 $м^3$.
Ключевые слова. рыбоводство, скорость роста рыб, аквариум, личинки рыб, мальки рыб.