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THE LATEST METHODS OF REPRODUCTION OF THE OWNER

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Abstract

The object for the research was an oar, grown in LLC WG "Mercury" with. Pultivtsi of Vinnytsia district.

The task of this work was to investigate the evaluation of broodstock, preparation for factory reproduction, the dose of pituitary gland, the duration of incubation of eggs and larval yield depending on temperature conditions, as well as determining the efficiency of economic activity of the economy.

Paddlefish (Latin Polyodon spathula) - a species of freshwater ray-finned fish of the family Paddlefish sturgeon. It lives mainly in the Mississippi River, as well as in a number of rivers flowing into the Gulf of Mexico. The only species of sturgeon that feeds on zoo, phytoplankton and detritus, swimming with its mouth constantly open and draining it with gill bristles.

In the latitudes of Ukraine (Vinnytsia region - 48-50 °) with the sum of temperatures of 1.8-2.2 thousand degrees, reaching the IV completed stage of maturity of the gonads in the oarsman lasts for 10-11 years.

On the basis of complex researches the prospects of cultivation of new for domestic aquaculture object of fish farming in pond farms of Ukraine are proved. For the first time in the country's fish-breeding practice, the offspring of the oarsman was obtained from broodstock raised in ponds. New data on fish - biological characteristics of the oarsman relocated to the ponds of the forest-steppe zone have been obtained. The fishery substantiation is developed and prospects of introduction of an oar-bearer in domestic aquaculture are defined.

The practical significance of the obtained results. The production is offered recommendations for the reproduction of oarsmen in ponds of Ukraine. An old-age repair herd of paddlefish has been formed, which can be used in the process of implementing a long-term program of fishery development of this non-traditional fish farm.

Keywords: rowing, grading, brooding, reproduction, incubation, fish farming.

Topicality. At the present stage of development of domestic fish farming there is a need to identify reserves for its development, in particular the search for new economically viable approaches to fisheries management; reducing the cost of production while improving its quality. The introduction of low-cost resource-saving technologies aimed at improving the efficiency of using the bioproductive potential of aquatic ecosystems has become a priority. Of particular interest in this regard is the possibility of introducing into the ichthyocomplexes of inland waters of fish sestonophages, which do not require artificial feeding, are characterized by accelerated growth combined with high nutritional and dietary quality of meat: One such object is imported to Ukraine North American representative of sturgeon-like fish - paddle (Polyodon spathula (Walb)) [6].

Veslonis is the only representative of a number of sturgeon-like species, the basis of nutrition of which are planktonic organisms, mainly lower crustaceans. It is a fast-growing fish that weighs more than 80 kg and is more than 2 m long. Its natural range is the Mississippi and Missouri river basins. High taste qualities of otter, the meat of which is similar to beluga meat, delicacy caviar, which is equated to sturgeon caviar, lack of bones and scales, high percentage of meat yield (over 60%), give reason to include it among the most valuable freshwater fish [2].

Given the special value of paddlefish, even relatively small volumes of its cultivation will provide significant profits that can be used to economically strengthen enterprises and increase overall production of commercial fish, including for further development of traditional freshwater aquaculture dominated by carp and herbivorous fish [8].

One of the positive consequences of fishery development of otters may be the reduction of the industrial press on the population of sturgeon in their natural distribution [1].

At the same time, fishery development of paddlefish in Ukraine is still in the initial stages of development. There is a lack of scientific data necessary for the development of biotechnology for its cultivation in accordance with the specifics of the functioning of domestic aquaculture, in particular, adapted to the conditions of conventional ponds. The key tasks are to master the methods of artificial reproduction and cultivation of viable youth of this introducer.

These circumstances became a prerequisite for special research, which formed the basis of this master's thesis.

The practical significance of the obtained results lies in the study of the latest methods of reproduction of the oarsman and their introduction into production.

Analysis of recent research and publications. Oystercatcher - Polyodon spathula (Waibaum) belongs to the class of higher fish (Teleostomi), subclass Cartilaginous ganoids (Chondrostei), a number of sturgeons (Acipenseriformes), family Oystercatchers (Polyodontidae). In modern ichthyofauna, Veslonis is the only member of the genus Polyodon [2].

In English literature, paddlefish is known as Paddlefish.

The body of the oarsman is elongated, tapering to the tail. The tail is heterocercal. The color of the back is dark gray, sometimes with a greenish tinge, on the sides and abdomen - lighter. There are individuals with almost solid dark color [5].

The most characteristic morphological feature of the oarsman is the presence on the head of a rostrum - a flat elongated snout of oar shape. The length of the rostrum is about a third of the total length of the body. Its purpose is not fully understood. It has been suggested that a flattened snout can act as a wing that directs the flow of water with food organisms to the mouth during the movement of fish. The rapid increase in linear size due to the growth of rostrum, as well as the presence of a large number of receptors suggest that rostrum allows not only to quickly get the young oars out of the press of a mass predator, but also serves to determine the concentration of forage and orientation in space. acting as a kind of locator. In the case of damage to the surface of the rostrum in the oarsman is violated the ability of orientation, which must be taken into account during fish farming.

Sexual dimorphism in the otter is not very clear. Only in the pre-spawning period do mature males have a well-marked wedding dress in the form of a rough rash on the head and rostrum. Some males are fluid. In females, the area of the genital opening is smooth and compacted. In males, the ingenious hole is surrounded by small, raised papillae of round shape. The oarsman has sexual dimorphism by body weight. Mature females are 20-30% larger than male males.

In the wild, paddlers have once been found along the length of the Mississippi River with tributaries of the Ohio, Missouri, and Illinois, in lakes and reservoirs in the Mississippi Basin, and in some other rivers that flow into the Gulf of Mexico. The paddlefish species has been known in Lake Erie since 1903, but its status in the Great Lakes has not been determined.

The length of the native range of the otter from north to south is about 2000 km, which significantly diversifies the temperature conditions of the environment to which this species of fish has adapted.

Once upon a time in North America, paddling was of great industrial importance. In the first half of the 20th century, its annual catch was up to 1,000 tons. Later, as a result of increased anthropogenic pressure on water ecosystems, the limits of natural distribution and the number of populations of paddlefish were significantly reduced [5].

Veslonis can adapt to life in different types of inland waters: rivers, lakes, reservoirs. As a rule, it is kept in remote areas of rivers, at depths of more than 3 m. With the approach of spawning can form numerous shoals. When the water rises, paddlers migrate upstream and from the river to the lake, and when it falls, they reverse migration. The tendency to active migrations in these fish is noted by most authors [11].

Veslonis is a calm fish, it is easy to catch with net fishing gear. Fish caught in the nets make only weak attempts to break free.

Significant losses in the cultivation of planting material of paddlefish in the conditions of ponds, as well as serious damage to its young in the wild can cause fish-eating birds.

The increased tendency of the oarsman to be affected by small ectoparasites of fish, in particular, lower crustaceans, has been repeatedly noted.

Veslonis is characterized by significant growth potential and reaches large sizes. In North America, the individual weight of the largest fish in industrial catches used to be about 30-40 kg, the absolute maximum exceeding 83 kg for the body length of the fish 216 cm. Recently, the mass of fish recovered from natural reservoirs has decreased significantly [3].

There is a clear dependence of the growth of the paddle on the water temperature and the level of development of the natural forage base [7].

In Russia, in the ponds of the fish breeding plant "Hot Key" (steppe zone) this year's paddlefish reached an average weight of 100-300 g, in some cases their weight exceeded 650 g for fish body lengths up to 67 cm. Biennials grew to 3-4 kg, five-year-olds - up to 78 kg. Sometimes in the south of Russia against the background of the maximum level of development of zooplankton for one season oarsmen gave an increase of about 8 kg. Studies of the dependence of paddlefish growth on food supply have shown that the most intensive growth is observed for zooplankton biomass above 5 g / m3. [6].

Paddlefish withstand wintering well and grow well in central Russia. When grown in the Moscow region, two-year-olds weighed 0.9 kg, three-year-olds - 1.8 kg, four-year-olds - 2.8 kg, five-year-olds - 3.3 kg, six-year-olds - 5.5 kg, seven-year-olds - 6.5 kg, ie, the average seasonal growth of two-year-old fish ranged from 0.5 to 2.2 kg [5].

In the ponds of the Kursk Fish Breeding Plant (Kursk region, two-year-old oarsmen, which were grown in polyculture with carp and Russian fish in different variants of experiments, reached an average weight of 620 to 930 g) (initial weight of annuals is about 50 g). , 2 kg, four-year-olds - 2.7–3.3 kg The average seasonal indicators of zooplankton biomass of ponds were in the range of 2.1–7.2 g / m³ The highest intensity of paddlefish growth was observed at water temperature 21–24ºC.

In pond farms in Poland, in climatic conditions similar to the north-western part of Ukraine, fish of the senior repair group of oarsmen (seven-year-olds) reached an average weight of about 11 kg [2].

Veslonis mage is a gill filtration device that is not typical of sturgeon fish. Completely formed by a number of features, it resembles the filtration apparatus of

the variegated silver carp, which explains the similarity of their power spectra [20].

Veslonis is a sestonophage that consumes zooplankton, phytoplankton and detritus. The area of the filtration apparatus in the oarsman is twice as large as in the variegated silver carp of the same mass. The set of food organisms available for consumption by fish depends on the interstitial intervals, the size of which in the otter varies widely. The intensity of filtration and the quality of filtered food depends on the speed of movement of fish.

There are some differences in the behavior and diet of young paddlers of different ages. In fish up to 80 mm in size, the filtration apparatus is not yet formed and is represented by a cartilaginous plate covered with beetles. At this stage, the fry feed mainly on large forms of zooplankton, capturing them individually. When the length reaches 90 mm, the rudiments of gill stamens appear on the brackets. At a length of 120–130 mm, the filtration apparatus becomes more formed - the stamens occupy about 50% of the area of the cartilaginous plate. During this period, paddling partially passes to the filtration of food. At the size of 200 mm, the paddle carrier already has a well-formed filtration apparatus and food filtration becomes the main way of feeding.

During the first year of life, the oarsman has small teeth on his jaws, this year weighing 160-180 g, they number from 160 to 250 pieces, the size of 200-300 microns. This indicates the ability of the oarsman to capture and retain small prey, in particular, insects, which have been repeatedly found in the food lumps of the examined fish. Oystercatchers are caught on a fishing rod. That is, they combine a filtration method of feeding with the capture of individual larger than lower crustaceans, food organisms.

The basis of the content of the gastrointestinal tract of this year paddlefish are dominant in zooplankton reservoirs lower crustaceans, occurs

a small number of aquatic insects, larvae of dragonflies, plant remains, planktonic larvae of chironomids, the presence of a significant amount of detritus. The size of forage organisms varies widely [8].

During the growing season among the various groups of zooplankton the main role in the nutrition of the otter is played by representatives of crustaceans (over 50% of the mass of food). Crustaceans (8–40%) also play an important role in their diet. Small forms of zooplankton (rotifers, crustacean nauplii), as well as representatives of planktonic algae in the diet of the otter have a subordinate importance. [9].

During the mass development of zooplankton, detritus is of secondary importance in the diet of the otter. With a decrease in zooplankton biomass, Veslonis switches to a predominant detritus diet. At the same time, the number of larvae of dragonflies, planktonic chironomids, algae, remains of higher plants, etc. increases [2].

The digestive system of the paddlefish is quite similar to the digestive system of sturgeon in the main features of its structure.

Like sturgeon, paddlefish belongs to the lithophilic fish. Spawning occurs in April-June in areas of rivers with strong currents and well-washed pebble, gravel and sandy soils at depths of 2–12 m (mainly at depths of 4.5 to 6 m) at water temperatures of 13–16 ° C. During spawning, the broodstock of the otter often clusters in shoals. Females do not spawn every year. Embryonic development in the oarsman at the same water temperature (14 ° C) is slightly longer than in such representatives of sturgeon fish as Russian sturgeon and beluga. At water temperatures ranging from 12 to 18 ° C, it can last from 280 to 130 hours. The development of paddlefish embryos is similar to the development of sturgeon embryos.

Veslonis, like other representatives of a number of sturgeon, belongs to the late-maturing fish. The age of puberty depends on the latitude, ie the amount of heat of the aquatic environment, and according to American researchers, females can vary from 9 to 14 years, males - from 6 to 9 years.

In the conditions of pond farms of the Krasnodar Territory of Russia, which are similar in the amount of heat to the conditions of the south of Ukraine, female oarsmen mature in the tenth year of life [4].

Female oarsmen mature again in 2 years. Sometimes the process of maturation lasts three years [10].

Male oarsmen reach sexual maturity in the Krasnodar Territory at the age of six. There are cases of maturation of males at the age of four. Unlike females, the sexual cycle in male oarsmen is completed within one year, so they can be used for reproduction annually. Males spend the winter with mature sexual products [3].

In 1999, in the process of artificial reproduction of the otter in the south of Russia (Krasnodar Territory), a unique case of a mature female was noted, which was used in the spawning campaign of the previous year. In 1998, it produced benign caviar and offspring [2].

In the United States, the first attempt to artificially produce the offspring of an oar was made at the beginning of the last century (1915), but it was unsuccessful, the caviar was not even inseminated. In subsequent years, there were no reports of such attempts, and it was not until the early 1960s that Purket first artificially fertilized eggs obtained from flowing females from natural bodies of water by the semen of mature oarsmen. In 1963, similar work was carried out by Bollard and Nithemo, who described the stages of embryonic development of the oarsman.

Attempts to artificially reproduce the paddle with the use of hormonal injections have been known since 1962. In 1963–1964, Nitham was the first to induce the maturation of female and male oarsmen by performing intraperitoneal injections with a suspension of acetonated pituitary glands of oarsman and carp. Twice maturation of females was achieved after repeated injections of pituitary oars. After injections of carp pituitary glands, signs of maturation were found only in male oarsmen [6].

In the period 1965–1971, studies on the controlled production of oarsmen offspring using the physiological method of fish reproduction became significantly more active and became more widespread. One such study tested five gonadotropic substances with different ratios of injection doses. Mature broodstock oarsmen were caught from the natural spawning herd by gill nets

and kept in ponds until fish farming began. Among the hormonal drugs that were tested, tested; human chorionic gonadotropin, luteinizing hormone, folliculin-stimulating hormone, pituitary carp and otter. Ovulation of oocytes in female oarsmen weighing 18.1–22.7 kg occurred after intraperitoneal injections of a pituitary suspension of the corona or oarsman. The best results were seen with 2 and three injections with dosages consisting of two pituitary pituitary glands per daily injection. Male otters with a body weight of 11.3–15.9 kg responded positively to a single pituitary injection with a single dose of one pituitary gland or the corresponding number (by weight of substance) of carp pituitary glands. Injections by the pituitary gland of the oarsman were more reliable [7].

In general, it should be noted that in the 60's work on the artificial reproduction of paddlefish in the United States were mainly exploratory, the survival of fish at all stages of development was characterized by low rates. At the same time, the obtained results allowed to draw conclusions about the prospects of artificial reproduction of the oarsman and the need to expand efforts to develop rational methods of such work.

Significant progress has been made in artificial otter reproduction in South Dakota and Tennessee. In the process of testing various hormonal stimulators of fetal maturation, it was determined that the most acceptable are acetonized pituitary gland and luteinizing hormone (LH-RHa). The use of the hormone LH – RHa made it possible to establish that it gives better ovulation indicators of oocytes than the pituitary gland of the oarsman. Therefore, since 1984, this hormone has been used mainly in US fish farms [5].

As a result of research, which has been successfully continued in recent decades, the United States has mastered the methods of artificial reproduction of the paddlefish with the help of broodstock recovered from natural bodies of water. However, a sharp decrease in the number of populations of this species of fish within the native range significantly limits the scale of artificial fish farming.

Currently, work on the artificial reproduction of the paddlefish in the United States is carried out at both private and public fish farms. One such loudspeaker that has been actively involved in artificial otter reproduction in recent years is the University of Kentucky Aqua Center. Catching broods take place in the Ohio River in regular nets in April-May, with the water temperature rising to spawning values (13–16 ° C). After catching from the river, the broodstock selected for fish farming is kept in small concrete ponds. In the process of hormonal stimulation, the uterine material is in plastic pools located directly in the premises of the reproductive complex. Luteinizing hormone is used to stimulate the maturation of the offspring with the use of two intra-abdominal injections for females and one for males. Selection of mature eggs after ovulation is carried out by squeezing after incision of the fallopian tubes. Sexual products from males are selected using a catheter. The fertilized eggs are glued in a talc suspension. Incubation of eggs takes place in modified Mac Donald incubation tanks, which provide constant mixing of eggs with a stream of water. Growing of young to an average weight of 1–2 g is carried out for 20–30 days in plastic pools with feeding with artificial starting feed mixtures and live zooplankton organisms. In the future, the fry are transplanted for additional rearing in small ponds where they continue to be fed artificial and live feed. The viable youth obtained as a result of these works is used to replenish the number of paddlefish populations in natural reservoirs, as well as sold to private farms, mainly for the purpose of further formation of uterine herds intended for the production of edible black caviar [4].

Significant progress in the development of methods of artificial reproduction and cultivation of paddlefish in the last few decades has been achieved in Russia, where he has accumulated extensive experience in sturgeon farming [13]. In contrast to US fish farming, artificial reproduction of otters in Russia, as already mentioned, is based on the use of uterine herds formed in controlled conditions of ponds, which is of particular interest to specialists in the fisheries industry of Ukraine.

The main volume of research on these issues was conducted in Russia on the basis of the fish breeding plant "Hot Key" and a specialized fish breeding plant of herbivorous fish (SRZRR), located in the Krasnodar Territory (Adygea) [5].

It was noted that the breeding material of the otter can be grown in ordinary carp ponds. Mandatory requirements for ponds of all categories are a well-planned bed that provides complete drainage, independent supply and discharge of water.

Separate ponds are used for growing repairs and summer keeping of broodstock. Co-cultivation of paddlefish of different ages is not recommended due to the possible deterioration of growth and development of more demanding to the feeding conditions of older fish. Growing oarsman in monoculture is impractical.

Repair and broodstock paddlefish can be grown together with breeding material of herbivorous fish, black and small-mouthed buffalo, black grass carp, carp and catfish. Given the intense competition in nutrition, it is advisable to remove from the polyculture typical zooplankthophags - variegated silver carp and large-mouthed buffalo. If this is not possible - significantly reduce the planting density of these species. In ponds with different age groups of otters (from the age of two), if necessary, it is possible to use predatory fish - bio-ameliorators. The experience of joint cultivation of otters and sturgeon is of interest.

Among males, individuals with well-defined mating attire and fluid sexual products are preferred.

Work on artificial reproduction of the paddle boat begins from the moment of stable water temperature of 13–14 ° C (optimum about 16 ° C). Acetonized sturgeon pituitary glands are used to stimulate the maturation of broodstock. The technique of preparation of a suspension of acetonized pituitary glands is usual. In work with females apply small (double) injections. It is important to correctly determine the dosage of the pituitary gland during the first (previous) injection. In most cases, the polarization index of the nucleus in oocytes in female oarsmen in the spring varies between 0.04–0.14. The use of the most common dosages of 0.6-1.0

mg / kg of sturgeon pituitary glands during the previous injection without taking into account the polarization index does not always give positive results: there are significant fluctuations in the fertilization rates of eggs (26-87%), sometimes asynchrony in the maturation of females after the second (decisive) injection.

Experimentally revealed a pattern in the selection of the first dose of pituitary glands depending on the polarization of the nucleus. The best results are obtained at a water temperature of 12 to 16 ° C and the interval between the first and second injections of 24 hours at such doses of the pituitary gland during the previous injection are given in (table 1).

Table 1

Introduction of the substance of acetonated pituitary glands during the previous injection depending on the polarization of the nucleus in the oocyte (according to EO Melchenkov, VG Chertykhin, 1992)

Polarization index nucleus in the oocyte	The dose of the pituitary gland during previous injection, mg / kg
0,04–0,06	0,4–0,6
0,06–0,08	0,6–0,8
0,08–0,09	0,8–0,9;
0,10–0,13	1,0

Some overdose of pituitary glands during the decisive injection, as a rule, does not lead to negative results, but contributes to a more complete ovulation of the eggs. Underestimation of the decisive dose of the pituitary gland causes a longer, portion ovulation of eggs, reducing its fish quality. The most effective doses of pituitary glands during the decisive injection for female oarsmen (at optimal spawning temperatures) should be considered 6-7 mg / kg. At water temperatures below 13–14 ° C, doses of about 8 mg / kg are recommended. When working with very well-prepared female oarsmen, when the water temperature rises to 18 ° C, the interval between injections can be reduced to 12 hours, and the dose of the decisive injection of the pituitary gland is reduced to 5–5.5 mg / kg. To stimulate the maturation of males, one pituitary injection is sufficient. A suspension of acetonized sturgeon pituitary glands (3–4 mg / kg) is administered before the decisive injection to females [10].

At a water temperature of 14–16 ° C, females mature in 21–24 hours, and at a temperature of 17–19 ° C in 18–21 hours after the decisive injection. The decrease in water temperature has a negative effect on the course of maturation: delays ovulation, sometimes (in conditions of a sharp decrease in temperature) damages oocytes.

Due to the lack of sturgeon pituitary glands in Russia, the drug surfagon was tested to stimulate the maturation of the otter. Females responded positively to hormonal stimulation and obtained benign eggs

In other experiments conducted in Russia, acetonized cartilage of carp and bream was used to stimulate the maturation of the otter. The experiments also gave positive results.

One of the ways to improve the technology of artificial reproduction of sturgeon-like fish is to develop methods for managing the seasonality of their reproduction, which allows to obtain offspring in a convenient time for fish farming. Studies have established the fundamental possibility of controlling the sexual cycle of the oarsman and obtaining full-fledged offspring in the period from December to June [4].

Due to the special value of otters, as in the work with other sturgeons, it is recommended to use a lifelong method of caviar selection by removing it through an incision in the abdominal wall [3].

To simplify the process of obtaining sexual products, it is proposed to use a special technological table for fixing female oarsmen and lifelong production of eggs from them. With this method of caviar selection there is also no need to anesthetize the offspring [8].

Good results were obtained during lifelong selection of eggs by trimming the oviduct in female oarsmen. In this way, only the eggs of the state of complete ovulation are obtained, which has a positive effect on n quality [1]. Recently, this method of caviar selection has become the main in the artificial reproduction of the otter.

In 1 g of otter caviar there are on average from 90 to 140 eggs. With age and increasing weight of fish, the weight of eggs increases. In females of ten-year-olds (weight of one egg 7.9 mg) and females of sixteen rivers (weight of one egg 8.6 mg) the number of eggs in 1 g of caviar decreases from 126 to 97 pieces.

It is established that the fertility of females depends on their weight and housing conditions. In fish weighing 10 kg the working fertility is 100 thousand (75–155 thousand) eggs, in fish weighing 19 kg this figure increases to 249 thousand (153.4–361.4 thousand eggs). Up to 500,000 pieces were obtained from individual large fish. eggs.

Milk in males is expressed by light massage, abdomen or through a catheter. Sperm in most cases, watery, whey color. Sperm concentration is 0.45–0.8 billion / mm3, less often 0.9 billion / mm3. The average volume of ejaculate is about 70 ml. The fertilizing ability of sperm at a water temperature of 14 ° C is maintained for 5-8 minutes. When storing drained semen, it retains its fertilizing ability in the refrigerator for more than a day.

Insemination of caviar is carried out, as during the artificial reproduction of sturgeon, in a semi-dry way. Before insemination, the cavity fluid is drained from the vessel with the caviar.

For degreasing of caviar use a suspension of talc (100 g of talc, 9.5 g of salt per 10 liters of water). The process of degluing paddle eggs in a suspension of talc lasts about 40 minutes [10].

Other mixtures of disinfectants used in sturgeon farming, in particular a suspension of river silt, are also recommended for decontamination of fertilized otter caviar. However, after treatment of eggs with a suspen-

sion of silt on the surface of their shells there is an increase in the number of bacteria, increases the degree of exposure to the pathogenic fungus saprolegnia [2].

Paddle eggs are incubated in the same apparatus as sturgeon eggs (Yushchenko's apparatus, "Sturgeon"). Weiss devices can be used to incubate eggs after transportation. Up to 250,000 eggs are loaded into one Yushchenko's apparatus. Up to 1.5 kg of caviar - 150-180 thousand eggs - are loaded into one tray of the Sturgeon device. No more than 40,000 eggs are incubated in the Weiss apparatus. Direct sunlight should be avoided.

It was found that for the normal development of paddle-bearing embryos, the concentration of dissolved oxygen in water should be maintained at 8–10 mg / l. With its reduction beyond 5 mg / l, the embryos of the otter begin to experience oxygen starvation, which can cause disruption of the processes of formation of systems and organs, the emergence of a large number of ugly individuals and the death of embryos.

The optimum incubation temperature of eggs is in the range of 14–18 ° C. The period of embryonic development is characterized by a minimal zone of tolerance, the upper pie temperature for paddle-bearing embryos only slightly exceeds 21–22 ° C. At low temperatures (10–11 ° C) the development of embryos slows down to 300 hours and more, the period of hatching of free embryos is significantly prolonged. About 50% of embryos die before hatching, 25% have various defects and later most of them die. Temperature 8 ° C - lethal for oarsmen. At this temperature, a limited number of eggs are fertilized, but its development stops before gastrulation. The most dangerous effects of extreme temperatures are in the early stages of embryonic development. In the future, the thermoresistance of the embryos of the oar gradually increases, while slightly expanding the range of favorable temperatures. Short-term exposure to extreme temperatures during the second half of embryonic development was less dangerous, after the cessation of the adverse effects of adverse temperatures in a significant part of the embryo normal course of embryogenesis. Depending on the water temperature, hatching of free paddle-bearing embryos is observed 5–12 days after loading the devices.

The study of osmoresistance of oar-bearing embryos showed that caviar normally develops in water with salinity up to 3 ‰. The survival of embryos under favorable other environmental factors is about 90%.

Studies of the influence of the hydrogen index (pH) of water on the embryogenesis of the otter allowed to establish that the optimal development of eggs is possible in the range of pH 6.5–7.8. At pH 5.5–6.0, no more than 40% of embryos survive. In an alkaline environment (pH 8.2–8.7), only 30% of free embryos emerge from the eggs, most of which can develop normally in the future. In a more alkaline environment (pH 9.0–9.3) the eggs swell and soon burst.

However, there are literature data from which it follows that the absolutely lethal effect of the aquatic environment on the embryos of the oar occurs at pH = 10 and partial at pH = 9.5.

During the incubation, preventive treatment of caviar with dyes (purple K, malachite green, methylene blue) is carried out. The treatment is carried out starting from the second day of incubation - 2 times, exposure 15-20 minutes. The concentration of violet K-10 mg / l. Caviar can also be treated with formalin: concentrates, 1: 500–1: 1000, exposure 15 minutes [10].

The output of free oars embryos from the shells is quite stretched. The length of the hatching period causes differences in the size and development of free embryos. Even at a water temperature of 17 ° C (optimum), the duration of the hatching period of free paddle-bearing embryos can reach 40–50 hours [7].

The yield of free embryos from eggs of normal quality, incubated in favorable environmental conditions, is usually at least 90%. The number of ugly forms does not exceed 10-15% [5].

Studies show the possibility of transporting fertilized otter eggs in the last stages of development in plastic bags with water and oxygen. To do this, use standard plastic bags, which are used to transport fish larvae and fry. At the rate of loading of 0.5 kg of caviar per package and the duration of transportation of 9–12 hours, embryo departure does not exceed 0.5% [2].

Of interest is the experience of transporting fertilized otter caviar from Russia to Cuba. The total duration of transportation of caviar reached 23 hours. The temperature of the water in the transport tank was 14 ° C. The eggs were incubated in the incubation section of the "Sturgeon" apparatus. No disturbances in embryo development were observed during the incubation period of the eggs. The duration before incubation of eggs (stage 31-36) at an average water temperature of 19.3 ° C was 46 hours. The yield of imported caviar was 94 %.

The age of transition of otter larvae to exogenous food depends on water temperature. At a temperature of 20–22 ° C larvae begin to actively feed in 152–112 hours after hatching, in 17ºC - in 225 hours, at a temperature of 12–14 ° C the duration of transition to exogenous feeding increases to 360–480 hours. The favorable temperature during the period of keeping free embryos is in the range of 17–22 ° C, and the survival before the larvae switch to active feeding is 90–95 %. At a temperature of 12–14 ° C, the survival of free embryos is significantly reduced, the main death (up to 65–95%) is observed before the loss of the yolk plug. In free paddle-bearing embryos, the upper water temperature thresholds are about 25–26 ° C. Prolonged aging of free embryos at higher temperatures is unacceptable. At a temperature of 31–32 ° C, vital activity is suppressed and all free embryos die quickly [6].

As for the embryos in the eggs, for free paddle embryos the optimal concentration of dissolved oxygen in water is at the level of 8–10 mg / l. The oxygen content in the water below 5 mg / l has a detrimental effect on the larvae [9].

Free paddle-bearing embryos feel good in water with salinity up to 3 ‰, and after anterior gradual adaptation - at salinity up to 4 ‰. Survival under such conditions is about 80%. The duration before the larval period at a salinity of 4 ‰ increases per day compared to the control (at a water temperature of 17Cº). More than 60% of free embryos die in water with a salinity of 5 ‰, and 100% in salinity of 6–7 ‰ [6].

Anomalies in the embryonic development of the oar can be divided into several groups [7,9]. The first is disorders associated with polysperm fertilization of eggs. They are manifested in the unnatural fragmentation of embryos in the early stages of development. Under conditions of strict compliance with the technological requirements of artificial reproduction, these violations can be avoided.

The second group of anomalies is a violation of the gastrulation process. As a result, the embryos developed asymmetrically, had disorders of the main department and axial organs. Usually this type of violation is associated with adverse conditions during the incubation period: hyperthermia, overload of incubators and, as a consequence, a significant deterioration of the gas regime.

The third group of developmental anomalies is caused by poor initial quality of eggs, which is primarily due to unsatisfactory conditions for keeping and feeding the brood, does not depend on the incubation conditions. Embryos are lethargic, react weakly to mechanical stimuli, which indicates a violation of neuromuscular motility. Subsequently, weakened embryos die.

It is not necessary to plant for rearing in ponds not under the grown-up larvae of a paddle-nose - results of such rearing happen rather unstable (an exit under the grown-up youth varies in considerable limits - from 0 to 42,5% and in most cases does not exceed 10%) [5].

Much more reliable is the rearing of otter larvae in flowing pools and trays of fish farms [7].

Positive experience in the rearing of otter larvae was obtained, in particular, in the Astrakhan region of Russia at the Alexander Sturgeon Fish Farm.

The results of experiments at this and other sturgeon plants in the Astrakhan region showed the possibility of using for the purpose of rearing larvae of paddlefish, in addition to concrete daphnia pools and installations with closed cycle water supply elements of various structures, as well as plastic pools (LPL, ICA-2) and installed in trees 1.5x2x1m gardens covered with a mesh made of stainless steel, brass or kapron with a mesh size of 1–2 mm. Comparative analysis revealed a significant dependence of the results of growing on water temperature. Where at the time of rearing the temperature was higher, the growth and survival of fish increased [10].

According to researchers, the most acceptable water temperature for the growth of otter larvae should be considered 20-24 ° C. With its increase to 26 ° C, the growth rate of larvae increases, but at the same time significantly increases the cost of feed per unit of growth and reduces the survival rate of fish.

Further increase in water temperature is unacceptable. The upper threshold survival temperatures of otter larvae approach 32–33 ° C. Recently, Amur-type devices have been successfully used to grow paddle larvae to a weight of 200–300 mg. The obtained data show that the rearing of young oarsmen weighing up to 300 mg in Amur devices using LK-5 type feeds will be able to obtain satisfactory results of the initial planting density of larvae in the range of 25–50 specimens / m³ and water exchange of 15–20 l / h. After the young reach a weight of more than 250-300 mg, it is necessary to carry out sorting and thinning of plantings. The best fish-breeding results when raising young otters from 250–300 to 1500 mg were obtained at a planting density of not more than 5 thousand units / m³ and water exchange of 18–20 l / min.

Recently, Russia has developed artificial starter feeds for young young otters. It is also established in principle the possibility of rearing otter larvae on starter feed intended for other fish species, in particular, the recipe LK-5 (for young salmon), as well as on feed mixtures based on fish, minced meat [11].

At the beginning of rearing, in addition to artificial feed, it is desirable to feed the larvae and live zooplankton organisms, the share of which in the diet is subsequently gradually reduced [10].

When choosing artificial starter feed, keep in mind that paddlers most actively eat food while they are in a suspended state. 3 bottoms of fish feed are reluctantly taken. Therefore, the most suitable for otter larvae are feeds with neutral buoyancy, ie those that can stay for a long time in the water column.

An urgent issue is to increase the productive effect of feed through the introduction of additional biologically active substances that promote digestion. This problem acquires special significance in the manufacture of starting feed mixtures for early young fish, in which the enzymatic activity of digestive processes is still quite limited. For this purpose, the drug SGOL was tested in Russia during the rearing of young otters on the starting feed of domestic production. Created on the basis of whey drug SGOL (whey hydrolyzed enriched with lactates) is a biologically active and environmentally friendly product recommended for feeding to young growing animals.

Experiments on the use of the drug in the form of feed additives were carried out in production conditions on the background of feed LK-5 and Art. Paddle larvae were fed by hand - 30 times a day. For experimental purposes, a liquid form of the drug was used, which was dissolved in oil during its addition to the feed in such a way that the level of crude fat in the feed was 14–16%. SGOL was used from the first days of feeding fish. The results of the experiments showed that the addition of the drug SGOL in these feeds had a positive effect on the main production indicators - significantly increased the viability of young paddlefish and significantly reduced feed costs per unit of fish growth. This tendency was especially clear when using less suitable action of young oarsmen. Thus, in the variant of feeding SGOL with food Art.-4 Az, the survival of larvae increased from 13 to 61%, and feed costs decreased from 8.4 to 1.8 units per unit weight gain of fish [2].

One of the obstacles to the development of factory reproduction of valuable fish species is the deterioration of water quality. The way out of this situation, in addition to taking a set of vigorous measures to reduce anthropogenic pressure on water ecosystems, should be sought in the use of new technologies and trends in aquaculture, for example, in the use of incubation and rearing of young most valuable fish farms. water supply cycle (UZV), which allows to control not only the ther-

mal but also the chemical regime of the aquatic environment. According to the experience of using ultrasound, in the reconstruction of incubation shops for a closed cycle of water supply by optimizing the conditions of embryogenesis and suppression

saprolegn fungi with low concentrations of inhibitors, it is possible to increase the survival of one-day sturgeon by at least 20–30% compared to the actual results [10].

The technology of growing paddlefish to a weight of 1-2 g in plants with a closed water supply cycle was developed at the All-Russian Research Institute of Freshwater Fisheries [9].

Transportation of otter larvae is carried out in plastic bags with water with oxygen at a planting density of non-grown larvae (weight 10-20 mg) and duration of transportation up to 24 hours - not more than 15 thousand copies per standard package, young weighing 100 - 150 mg - not more 400–500 copies per package.

When growing paddle-bearing planting material in ponds, the level of overall productivity depends on the structure of polyculture, the quantitative ratio of individual species in polyculture, the quality of the original planting material (larvae, fry), the development of natural fodder base and so on.

The main competitor in the diet in the first year of life for the oarsman is the variegated silver carp. The most successful object for the joint cultivation of this year is the white silver carp, with which the competition of the oarsman is the least. In the case of a limited amount of source material, you can use the monoculture of this rowing [8].

In the production conditions of fish farms in the steppe zone of Russia, the yield of this year paddlefish when grown in polyculture with the same age groups of herbivorous fish, buffalo and catfish on a natural feed base, usually is: from stocking larvae weighing up to 30 mg - not more than 8.5%; from grown to 100-300 mg of young - about 30%; from fry weighing 600 mg - up to 60%. Fish productivity on the oar carrier is from 100 to 300 kg / ha with the total fish productivity of 700–800 kg / ha and the average weight of this year's oar carrier is not less than 100 g. the formation of repair-uterine herds of paddlefish was first started in the conditions of pond farms in the east of the country (Donrybkombinat) simultaneously with similar works in the south of Russia. However, later in the period of various deterioration of the gas regime of winter ponds with older age groups of repair young, this valuable breeding material was unfortunately lost [11].

Later, the work on the formation of the original repair and uterine material of the oar was carried out by the joint efforts of fish farmers, practitioners of fisheries enterprises of the south of the country and scientists of Kherson State Agrarian University under the leadership of Professor IM Sherman.

Among the producers one of the main executors of these works was Onuchenko OV The basis for the formation of breeding material on the basis of the Odessa regional fish factory (now a closed joint-stock company "Odesaribhosp") were fertilized caviar and otter larvae, imported during 1991-1993 from fish farms in the Krasnodar Territory of Russia. In 1996, fertilized otter caviar from the Krasnodar Territory was also imported to the Dnieper Production and Experimental Sturgeon Fish Farm of Pivdenrybvod (DVEORZ) in the Kharkiv Region. In 1997, a consignment of fertilized caviar from the United States arrived there. In the latter case, the material suffered significant losses due to adverse conditions and long transportation times.

Experimental work with oarsmen in the following years at the specified enterprises consisted in formation of initial uterine herds in the conditions of pond maintenance. In particular, in the conditions of the Yaska section of CJSC "Odesarybhosp" the indicators of the environment, against the background of which the different age groups of the introducer were grown, were generally satisfactory, which allowed this year to reach an average weight of 298 g, two-year-olds - 1600 g, three-year-olds - 2200 g. water temperature to 28–30ºC, as well as reducing the content of dissolved oxygen in water to 1.7–2.2 mg / l. The departure of fish of older age groups during the feeding period did not exceed a few percent. Fish overwintered with the same minimal losses. The individual weight of eight-year-olds ranged from 7.9 to 14.2 kg. Mature rowing males in the repair herd began to appear from the age of six.

In 1998, in order to increase the reliability of preservation and eliminate the possibility of negative accidents formed in CJSC "Odesarybhosp" repair material paddle at the age of eight was partially transferred to the ponds DVEORZ and fish farm "Mountain Tikich" JSC "Cherkasyrybhosp".

In the spring of 2001, individual ten-year-old female oarsmen with stage IV ovarian maturity were detected with the help of pike gonads at all fish farms, which became the basis for their experiments on artificial production of offspring.

The first attempts to artificially reproduce the oarsman in the south of the country were unsuccessful. At the Dnieper Sturgeon Plant and Odesarybhosp CJSC, 14 females with an individual weight of 9–13 kg were selected for work. A small amount of low-quality caviar was obtained from the four fish, which, according to the authors, was due to the use of females of the first maturity. The fertilization rates of eggs did not exceed 20%, followed by complete death of embryos.

In fish-breeding works of 2002 in the conditions of DVEORZ the attempt of artificial reception of posterity from for the first time mature eleven-year-old females of a paddler was successfully realized. Stimulation of fetal maturation was carried out by glycerol extraction of sturgeon pituitary gland, dry activated sturgeon pituitary glands and Surfagon. The best results were obtained by stimulating the maturation of the offspring with the drug "Surfagon". After the period of incubation of caviar in “Sturgeon” devices and rearing of young to an average weight of 1 g in ICA-2 pools, a certain number of rowing boats was grown in two ponds with an area of 2 ha each [2].

The first positive practice of artificial reproduction of the otter in Ukraine can be considered conducted in 2001 and then successfully repeated in 2002 experiments on the basis of the farm "Mountain Tikich" OJSC "Cherkasyrybhosp". In contrast to the experimental work carried out in the conditions of DVEORZ, which

belongs to the specialized enterprises for the reproduction of sturgeon-like fish, research at JSC "Cherkasyrybhosp" was carried out in the conditions of a normal full-system pond economy. This circumstance deserves special attention in view of the further expansion of the scale of introduction of paddlefish in the aquaculture of Ukraine. On the basis of the farm "Gorsky Tikich" in recent years, research has also been conducted on the rearing of young paddlefish to viable cultivation of this year in polyculture with traditional objects of pond fish farming. The first in Ukraine marketable products of the oar carrier were received. The results of these studies are covered in the dissertation of Onuchenko OV [1].

In addition to data on the cultivation of otters in farms in the south and central part of the country, the literature contains information on the cultivation of otters in the Sumy region. Floating gardens with a volume of 1 m³ (1.5 × 1 × 0.7 m), made of nylon sieve with a mesh size of 0.7–0.8 mm, were used in experiments on rearing the larvae of the otter on the basis of Sumy of OJSC Sumyrybhosp.

Free paddle-bearing embryos aged 5-6 days were brought from the Gorsky Tikich fish farm.

Short-term rearing of larvae, lasting 7 days, was carried out in gardens set up in a specially prepared winter pond with an area of 0.8 hectares. The planting density of larvae in gardens was 1.2–1.3 thousand specimens / m3. The larvae were fed live zooplankton organisms (mainly daphnia). At the end of the rearing period, the average weight of larvae increased to 31.5 mg with a survival rate of 80%. The cultivation of this year was carried out in the same pond where the young were grown with an initial planting density of 2.5 thousand specimens / ha. At the end of the growing season, this year's oarsmen reached an average weight of 490 g for a survival of about 28% [3].

In the domestic literature there are different statements about the feasibility of the introduction of the oarsman in different types of continental reservoirs of Ukraine (cooling reservoirs, lakes, estuaries, estuarine systems of the Dnieper, Southern Bug and Dniester). However, these works have not yet begun, and their practical implementation requires the preparation of appropriate aquaculture and biological justifications [6].

The analysis of literature sources also allows us to state that at the moment the work with the oarsman in Ukraine was at the initial stage of development and was mainly limited to the formation of the original repair and uterine herds.

It is also possible to draw conclusions about the significant potential for the introduction of this North American sturgeon-like fish into the waters of Europe, due to the similar climatic conditions of the two continents and the diversity of their faunal complexes.

The aim of the study. The purpose of writing this work is to study the latest technological operations in the factory reproduction of the oarsman in the conditions of this farm, to study the influence of various factors and temperatures on the final indicators of productivity and economic efficiency.

Research methodology. The study was conducted on the basis of the experimental farm LLC WG "Mercury" Vinnytsia region.

The whole herd of carp broods grown on this farm served as biological material for research.

The broods on the principle of groups of analogues were formed into two experimental batches depending on the readiness for spawning and incubation time, on which the studies were conducted, which are given in table. 2

Table 2

Scheme of the experiment with the oarsmen

№ party	Breeders	Quantity, copies		Researched indicators
		females	males	
1	oarsman	3	3	fertility of females and males.
2	oarsman	3	3	fertility of caviar, the release of pre-larvae after incubation and release of larvae after incubation

The task of the experiment included:

A) Prepare the broodstock for spawning.

B) To study the technology of the factory method of breeding oarsmen.

C) Analyze the influence of abiotic factors (temperature and annual regime) on the development of eggs and larvae.

D) To give an economic assessment of the method of factory reproduction of the oar and note the prospects for its further use.

Unloading of wintering grounds and selection of broodstock for fish farming was carried out according to the plan of work of the incubation shop. Maintenance of broodstock before spawning was carried out in ponds according to regulations.

Hydrochemical regime of water during fish farming works corresponds to GOST.15 378.87. Mature sexual products were obtained by the method of pituitary injections, developed by ML Gerbilsky.

Determination of oar fertility was performed by taking and weighing on medical scales. Incubation of eggs took place in incubators with a capacity of 10 liters, Weiss type.

Purification of water supplied to the incubation shop was carried out using filters of the system AG Bolotov and IK Malytsky. The content of dissolved oxygen and water temperature was performed using a thermooximeter and a water thermometer.

The study of eggs was carried out in the laboratory, and the larvae were counted by the method of Winner.

In the work on obtaining offspring, in addition to traditional methods of factory reproduction of sturgeon, special recommendations for artificial reproduction of the oarsman were used. Mature sexual products from female oarsmen were selected for life by squeezing them through an incision of the oviducts [10].

During the fish-breeding works, the size and weight indicators of the broodstock were recorded, the efficiency of using different dosages of gonadotropic substances was determined (acetonized pituitary glands of sturgeon and bream, glycerol extract of sturgeon pituitary glands). The effect of changes in water temperature on the effectiveness of hormonal stimulation and the duration of fish maturation was studied. In the course of the experiments, the mass of the obtained caviar was determined by weight. The number of eggs in 1 g of eggs in order to determine the working and relative working fertility was calculated from the breakdown of unfertilized eggs 4-5 g

A biopsy with probe caviar sampling was used to assess the readiness of females for reproduction. The state of maturity of oocytes was determined by the indicator (coefficient) of polarization of the nucleus L (Fig. 1)

$$L = \frac{A}{B},$$

Where: A is the distance from the nucleus to the shell of the animal pole of the oocyte;

B - the greatest distance from the animal to the vegetative pole

In order to assess the reproductive capacity of males, the volume of ejaculate obtained and the duration of translational active sperm motility were determined.

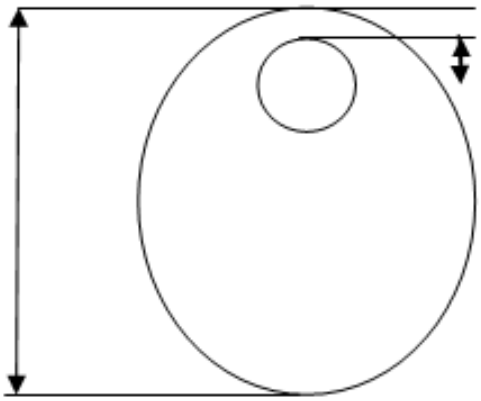

Fig. 1 Schematic representation of an oocyte with a nuclear polarization index of 0.07

Insemination of eggs was carried out in a "semi-dry" way. Decontamination of fertilized eggs was performed in specially prepared devices by bubbling the non-adhesive suspension (talc) with compressed air. Caviar was incubated in "Sturgeon" devices. In order to combat saprolegnia, the eggs were treated with the drug "Purple K".

The percentage of embryo development was calculated at the initial stage of gastrulation and the stage of motile embryo. To study the influence of water temperature on the duration and efficiency of incubation.

After hatching from the eggs of free embryos of the oarsman before their transition to exogenous nutrition was kept in plastic pools ICA-2 (2x2x0.5 m), in which the larvae were subsequently reared. Their yield after hatching from eggs was determined by piecemeal accounting during transplantation into pools.

Due to the need to obtain reliable information on the dynamics of the main physicochemical and hydrobiological indicators of fishponds and experimental ponds, systematic control of water temperature and hydrochemical parameters of the aquatic environment was carried out. In order to obtain quantitative and qualitative characteristics of phytoplankton, zooplankton and zoobenthos, sampling was carried out, the processing of which was performed in-chamber conditions.

Control of abiotic parameters of the aquatic environment was performed using common methods in fish farming. Water temperature was measured using a water thermometer graduated by 0.2 ° C, the content of dissolved oxygen in water was determined by the Winkler method and using a thermooximeter H-20-IOA.

Biological factors of the aquatic environment were studied using generally accepted methods in hydrobiology [7].

Determinants were used to determine the qualitative composition of organisms in the feed base of fish. Biomass calculations of organisms were performed according to the tables of their individual mass [6].

During the entire research period, 43 samples were taken, processed and analyzed for complete hydrochemical analysis, 3.5 thousand measurements of water temperature and 2.3 thousand determinations of the content of dissolved oxygen in water were performed.

94 hydrobiological samples (23 phytoplankton, 55 zooplankton and 16 zoobenthos) were studied.

The digital material obtained as a result of the research was processed by statistical methods according to standard methods [10].

The final evaluation of the efficiency of paddlefish cultivation was carried out both on the set of fish-biological indicators and on the economic analysis of fishery results, which gave a convincing evidence of a number of advantages associated with the introduction of this unconventional fish farm in domestic pond aquaculture.

Research results. The effectiveness of measures to introduce non-traditional fish farming facilities into aquaculture, especially in the initial stages of their fishery development, largely depends on the organization of their effective reproduction in controlled conditions of farms of different types. At the same time, among

the current problems of artificial reproduction of the otter, as a new object of commercial sturgeon farming, the key tasks are the study - the reproductive status of the broodstock and the development of biotechnology for its reproduction in the factory. Given the priority for domestic aquaculture pond direction of fish farming, special interest is in solving these problems in the conditions of conventional carp farms equipped with tools for factory production of fish offspring.

It is known that in the process of fish farming with the first mature females of sturgeon, there are special difficulties associated with the heterogeneity and poor quality of sexual products, as well as significant differences in response to hormonal stimulation of their maturation. At the same time, due to the shortage of uterine material and the peculiarities of the formation of the genital system of the oarsman, such fish for a certain period will predominate in the work on artificial reproduction of this species of fish in Ukraine. In this regard, the experience gained in working with different-aged mature otter females of different ages in our country will be useful, the offspring of this North American introducer were obtained.

Fish-biological characteristics of broodstock. As noted (see section 1.), the initial stage of formation of the uterine herd took place in the south of the country in the ponds of the Yaska section of the plant "Odesaribhosp", where at the age of two years the breeding material of the oar was transported to the farm geographical area.

In the process of transporting fish with an average weight of about 1.5 kg were in the transport tanks of live fish machines for 5-6 hours. with a load of up to 83 kg of fish per 1 m³ of water. The water temperature was 14–15 ° C. Transportation of breeding material took place without leaving. Fish delivered to the northern region successfully withstood the unusually long winter of 2007–2008 pp. [6].

In the spring of 2017, with the help of probe tests of the gonads, individual ten-year-old female oarsmen with stage IV ovarian maturity were identified, which became the basis for their use in experiments on artificial production of offspring.

Mature rowing males in the climatic conditions of the farm began to appear in the breeding herd from the age of six (2013 p.). That is, at the beginning of the experiments to obtain offspring in 2017 in fish-breeding works used the same age as females re-mature males of the oar.

In the spring of 2017, experiments on the reproduction of the paddlefish were continued with the first mature eleven-year-old females of the second wave of maturation taken with the help of probe samples.

Dimensional and mass indicators of broodstock selected for fish farming are shown in Tables 3 and 4. The weight of females ten - and eleven years of age varied between 9.82-12.23 kg and 9.18-13.48 kg at the average values of this indicator, respectively 10.90 and 11.19 kg. Males identical to females (according to age) weighed 7.52–9.72 and 7.92–11.19 kg (average 8.51 and 8.93 kg) - (Table 3).

Table 3

Dimensional mass indicators of females selected for reproduction

Indicators	Age group	
	decades (n = 5)	eleven years (n = 5)
W (mass of fish), kg		
M±m	10,90±0,34	11,19±0,44
min	9,82	9,18
max	12,23	13,48
Cv,%	8,16	12,92
L (absolute length of fish), cm		
M±m		
min	117,61±2,09	121,32±2,06
max	109,20	113,20
Cv,%	123,50	132,30
	4,69	5,62
1 (body length), see		
M±m	106,40±1,58	109,13±1,94
min	101,20	101,10
max	112,10	120,20
Cv,%	3,94	5,90
C (length of the head with rostrum), see		
M±m		
min	43,33±0,46	43,41 ±0,60
max	42,00	41,00
Cv,%	45,20	46,40
	2,81	4,59
R (length of rostrum), see		
M±m	28,63±0,55	29,07±0,51
min	26,50	27,10
max	30,50	31,50
Cv,%	5,09	5,81

These differences in body weight of fish of different ages do not fully reflect the average annual growth of breeding material in the eleventh year of life, as broodstock in fish farming was used selectively, taking into account the degree of maturity of their gonads. At the same time, it was noted that relatively small females were the first to mature in the formed breeding decline. Instead, females with an individual weight of more than 13 kg were mostly still mature, which can be explained by the well-known pattern of significant slowdown in fish growth after reaching puberty. At the same time, the analysis of the above values revealed differences in size and mass indicators of age-old fish of different sexes. The average weight of females was 26–28% higher than that of males. The data are given below in table 4.

Table 4

Size and mass indicators of males selected for reproduction

Indicators	Age group	
	decades (п = 5)	eleven years (n =5)
W (mass of fish), kg		
M±m	8,51±0,35	8,93±0.35
min	7,52	7,92
max	9,72	11,19
Cv,%	10,96	12,29
Cv,%		
L (absolute length of fish), cm		
M±m		
min	113,80±0,69	114,55±1,36
max	111,20	108,30
Cv,%	117,10	123,20
	1,61	3,75
1 (body length), see		
M±m	102,54±0,52	102,66±1,13
min	100,30	97,50
max	105,00	109,50
Cv,%	1,35	3,49
C (length of the head with rostrum), see		
M±m		
min	39,67±0,56	40,13±0,38
max	37,40	38,90
Cv,%	42,00	42,70
	3,71	2,98
R (length of rostrum), see		
M±m	26,23±0,36	26,59±0,27
min	24,50	25,60
max	27,20	28,40
Cv,%	3,64	3,26

Females outnumbered males in average length (L) by 3.8–6.3%, head length (C) by 8.2–9.1%, and rostrum length (R) by 9.1–9 , 4%. The length of the stream from the absolute length of the fish averaged 24.0–24.3% in females and 23.0–23.2% in males. The length of the rostrum from the body length of fish in females averaged 26.6–26.9%, in males 25.6–25.9%.

The identified patterns in the ratio of individual body parts of fish of different sexes can be the basis for further research using different age ichthyological material, the ultimate goal of which is to develop methods for early life determination of the sex of the oarsman by morphological parameters. As already mentioned, this will be useful in the formation of special uterine herds exclusively female, intended for the production of caviar.

Indicators of fertility of female oars that responded to hormonal stimulation of egg maturation are presented in table 5.

The analysis of the given values of reproductive indicators in the first mature females showed that fish of both age groups were characterized by close indicators of the mass of the obtained caviar. They were slightly higher (on average by 19%) in older and larger females of eleven-year-olds. Their average weight was 11.35 kg. The average weight of ten-year-old fish from which sexual products were obtained was 8% inferior to older fish and amounted to 10.43 kg.

The average values of the number of eggs in 1 g of caviar (according to the age of fish 126 and 133 eggs) were also characterized by similar values. The slight excess in eleven-year-olds was not associated with oocyte size and mass and may be due to the presence of more fluid in the sexual products of younger fish.

Table 5 shows some advantages of eleven-year-old fish (on average by 25%) in terms of working fertility (according to the age of fish on average 70.77 and 88.77 thousand eggs). They also had a slightly higher average relative fertility rate - 7.73 thousand eggs against 6.80 thousand eggs in decades. The absolute maximum of working fertility (115.43 thousand eggs) was registered in eleven-year-old females with a body weight of 13.48 kg.

The best indicator of relative working fertility (9.98 thousand eggs) was also observed in an eleven-year-old fish with a body weight of 10.32 kg, from which it was possible to obtain 752 g of eggs (working fertility 103.02 thousand eggs). The lowest values of fertility rates were characteristic of fish, from which sexual products were selected only partially.

Table 5

Female fertility rates

Indicators	Age group	
	decades (п = 3)	eleven years (n =3)
Mass of the received caviar, g		
M±m		672,14±89,38
min	563,40±76,68	210,00
max	335,00	886,00
Cv,%	804,00	35,18
Cv,%	30,43	
Number of eggs in 1 g of caviar, pcs.		
M±m	126,40±2,50	133,86±2,28
min	120,00	123,00
max	134,00	140,00
Cv,%	4,43	4,55
Working fertility, yew eggs		
M±m		
min	70,77±8,81	88,77±11,65
max	43,22	29,40
Cv,%	96,48	115,43
	27,83	34,3
Relative working fertility, thousand eggs / kg		
M±m		
min		
max	6,77±0,77	7,73±0,90
Cv,%	4,13	2,88
	8,72	9,98
	25,50	30,83

With increasing age of fish, there was a slight increase in the size and mass of unfertilized eggs after ovulation. The average values of the diameter of the eggs of the examined broods ranged from 2.28–2.36 mm in decades and 2.31–2.44 mm in eleven years. The average weight of oocytes, according to the age of the fish, increased from 7.6–8.0 mg to 7.7–8.3 mg (Table 6). At the same time, there was no clear dependence of the diameter and weight of eggs on the body weight of females within their age group.

Table 6

Size and mass indicators of unfertilized oocytes

Indicators	Age group	
	decades (п = 3)	eleven years (n =3)
The average diameter of the eggs, mm		
M±m		
min	2,31±0,02	2,38±0,02
max	2,28	2,31
Cv,%	2,36	2,44
	1,55	1,87
The average weight of eggs, mg		
M±m		
min	7,80±0,07	7,99±0,08
max	7,60	7,70
Cv,%	8,00	8,30
	2,03	2,75

Significant differences were observed in the indicators of fish quality of sexual products and survival of embryos during incubation of eggs obtained from broods of different ages.

Among ten-year-old females, five individuals responded to hormonal stimulation with the maximum dose of pituitary injections (8 mg / kg). The use of lower doses of the pituitary gland was ineffective. In two fish that were used in fish farming with a certain delay (2.5 hours after the onset of ovulation of oocytes) were visually detected signs of maturation of sexual products. The eggs were greenish yellow and pale gray. Individual oocytes were deformed with signs of destruction of the membranes. Sexual products are characterized by high fluid and mucus content. Carried out insemination of caviar did not give positive results. In the process of incubation of timely selected eggs, which was visually assessed as of satisfactory quality, at the stage of gastrulation the development of a certain hour of embryos continued in the eggs obtained from only two females. At the same time, the indicators of embryo development were 21 and 29% (working fertility of females, 43.22 and 96.48 thousand eggs, respectively). Subsequently, before the stage of motile embryo, the survival rate of embryos in the studied portions of caviar decreased to 13 and 11%, respectively, which was 62 and 38% of the development of embryos during gastrulation. As a result, 4.75 and 8.68 thousand specimens were obtained from each of the females. free embryos (6.72 thousand copies on average).

As already mentioned (see Section 1), in similar experiments with ten-year-old female oarsmen of the first year of maturation, conducted in 2016 on the basis of fish farms in the south of the country, 4 individuals out of 14 selected fish matured. The eggs were characterized by low quality with fertilization rates of less than 20% and subsequent complete death of embryos.

Compared with ten-year-old females, eleven-year-old first-spawning offspring of the second wave of maturation showed better reproductive capacity in terms of embryo survival and yield of free embryos per female (Table 7).

Table 7

Survival rates of embryos obtained from eleven-year-old females (n = 3)

Indicators		
Development of embryos at the stage of gastrulation,%	Development of embryos at the stage of motile embryo,%	Output of free embryos per female, thousand copies.
M±m 40,83±6,87	M±m 33,17±6,22	M±m 40,83±6,87
min 22,00	min 17,00	min 22,00
max 67,00	max 58,00	max 67,00
Cv,% 41,20	Cv,% 45,90	Cv,% 49,23

Eleven broods with an index (coefficient) of polarization of the nucleus of oocytes 0.08–0.14 (M ± m = 0.10 ± 0.01), Cv = 22.32% were selected for fish farming.

In the combined hormonal injection variant (acetonized sturgeon pituitary gland and glycerol extract of sturgeon pituitary gland), six products of satisfactory quality of the injected fish were obtained from six broodstock. The use of bream pituitary glands in work with female oarsmen was ineffective. One of the females used in fish farming was the last to be characterized by caviar overripeness, it was partially selected (caviar weight - 210 g, working fertility 29.4 thousand eggs). After insemination of this portion of eggs at the fifth hour of incubation at an average water temperature of 16.2 C, single live eggs were found. Subsequently, on the second day of incubation (at the stage of gastrulation) live embryos in the examined eggs were absent. In the process of incubation of eggs selected from other fish at the stage of gastrulation, the indicators of embryo development varied in the range of 22–67% (average 40.83%). Subsequently, before the stage of motile embryo, the survival rate of embryos in the studied portions of caviar decreased to 17–58% (average 33.17%), which was on average about 81% of the development of embryos during gastrulation. As a result, an average of 23.4 thousand specimens were received per eleven-year-old female. free embryos, or 23.7% of the eggs laid for incubation (average working fertility of six females was 98.67 thousand eggs). The share of beautiful postembryos in their total weight did not exceed 10% on average.

Some indicators characterizing the reproductive properties of male oarsmen after pituitary injections are given in Table 8. The average volume of ejaculate of ten- and eleven-year-olds was determined by close values, respectively - 57.60 and 50.86 cm за, with fluctuations in individual values from 34 to 70 cm^3. The bulk of sperm in water retained the ability to actively move for 220-425 seconds. (on the average 326 sec.) From separate offspring sexual blows selected receptions.

Table 8

Reproductive indicators of males

Indicators	Age group	
	Decades (n=3)	Eleven years (n=3)
Ejaculate volume, cm³		
M±m	57,60±4,84	50,86±4,56
min	42.00	34.00
max	70,00	65,00
Cv,%	18,80	23,72
Active movement sperm, sec.		
M±m		326,29±25,15
min		220,00
max	not determined	425,00
Cv,%		20,39

As a result, we note that the issue of fish quality of otter caviar has been repeatedly discussed in the literature. In general, there is a general opinion about the low quality of caviar in first-matured fish compared to respawning broodstock. In this regard, it was pointed out that it is inexpedient to use females for the first time to reproduce mature gonads [6]. Sharing the general opinion, we note that it is due to the use in fish farming for the first time mature females of ten - eleven years of age we were able to obtain the necessary number of viable young paddlefish to form a further group of repair young this year and two years. You should also pay attention to the inherent sturgeon-like stretched in time formation of the reproductive system. In females, depending on the individual characteristics of the organism, this process usually does not end at the same time and can last for 2-3 years or more. In particular, less than half of the females matured in the uterine herds of the otter in Ukraine in the first two years. Moreover, the offspring of the second wave of maturation were of better quality than those that matured at the age of ten. Therefore, the question of the expediency of using in fish-breeding works for the first time mature otters of different ages, in our opinion, needs detailed clarification. At the same time, due to the scarcity and special value of the oar-bearing breeding material, in order to maximize its preservation, the youngest females of the first wave of maturation, which are characterized by low reproductive capacity, should not be used in fish farming.

Of particular interest will be studies of the impact of fish farming with first-matured females and the processes of resorption of mature sexual products in "unworked" fish on the subsequent reproductive properties of broodstock.

Biotechnological aspects of artificial reproduction. Experiments on artificial reproduction of the otter were based on the physiological method of obtaining sexual products from the offspring with the use of hormonal drugs. Fish-breeding works were performed in the conditions of the reproduction complex intended for factory reproduction of carp and herbivorous fish with completion of the incubation shop with the special equipment recommended for incubation of sturgeon embryos.

Taking into account the functional heterogeneity of the reproductive system of first-time mature oarsmen, the primary attention was paid to the selection of broodstock suitable for fish farming manipulations in the optimal time; study of the peculiarities of hormonal stimulation of maturation of sexual gonadotropic substances, in accordance with the conditions before spawning of females and males. The favorable mode of performance of a complex of biotechnical processes connected with reception and maintenance of free embryos before their transition to exogenous food was worked out.

Terms of fish farming, selection and pre-spawning of broodstock. The presence of high-quality broodstock and their use in the optimal spawning period are important elements of artificial reproduction of sturgeon-like fish. It is known from the literature that the broodstock of the otter in the spring become ready for spawning from the time of the onset of a stable average daily water temperature not lower than 13–14 ° C. The optimal temperature is 16Cº. The calendar terms of fish-breeding work with oarsmen in farms that do not have special devices for long-term keeping of fish in a regulated temperature largely depend on the climatic features of the region and weather conditions of a particular year.

In experiments conducted on the basis of the farm LLC WG "Mercury" (forest-steppe zone) in the absence of thermoregulation of the aquatic environment fish farming in 2016-2017 began in the near calendar (last five days of April - the first five days of May), due to similar weather - temperature conditions of the spring period of both years. At the same time, in contrast to 2016, when the work was performed at a water temperature of 17.0–19.5 ºC, in 2017 the experiments were performed against the background of temperature fluctuations in the range of 14.0–18.5 ° C. Fish-breeding work on obtaining mature sexual products of fish was carried out in a short time, which did not exceed 6-7 days.

The fish-breeding manipulations were directly preceded by the spring grading of the broodstock, which was carried out at the end of March and in the first days of April during the unloading of wintering grounds. The oarsman was caught from wintering ponds by a drag made of small-scale deeds. The fish was carefully selected from the tow with the help of

special large sleeves about 1.5 m long with a metal hoop up to 40 cm. The selection of fish from fishing gear was tried to be performed for as short a period as possible, as long-term keeping of the oarsman in the absence of free movement in the water can negatively affect the respiratory function of fish. In order to avoid injury to the broodstock, they should not be transferred by holding the middle part and the end of the rostrum. You can only hold the fish by the rostrum directly near the head in the area of the mouth. During the inspection of measurements, weighing and transport over short distances (in adjacent ponds), the caught fish were kept for a short time (up to 5-7 minutes) in large tarpaulin stretchers filled with water. Their length should exceed the body length of the broodstock (up to 1.5 m). That is, for the successful evaluation of the movement of the oarsmen, it is necessary to have special equipment that exceeds the size of traditional tools, designed to work with the carcasses of carp and herbivorous fish.

Transportation of oarsmen within the farm (duration of keeping in transporting containers up to 30–40 minutes) was carried out in live fish machines.

In order to collect individual fish - biological indicators, the markings of fish used in fish - breeding works were used by trimming the fins.

For reproduction among females, fish with a convex, drooping soft belly were selected first. In males, readiness for spawning was determined by the presence of a wedding dress in the form of a rough ("pearly") rash on the front of the body, in some offspring - also by the fluidity of milk.

To assess the degree of completion of stage IV maturity of eggs used biopsy, followed by determination of the rate of polarization of the nucleus in oocytes. To do this, a special probe (Fig. 2) through a puncture in the abdominal wall from the caudal part of the ovary removed a certain number of oocytes (Fig. 3). The probe was inserted into the abdominal cavity to a depth of 5–6 cm at an acute angle (30 °) to the body surface, which prevents damage to vital organs. Puncture of the abdominal wall (even in the case of re-sampling for one month) did not harm the fish, the wound healed quickly. Before sampling in order to avoid inflammatory processes in the body of fish, the probe and the puncture site are disinfected.

Eggs were removed by biopsy for 1.5–2 min. boiled in a test tube or glass of water. Hardened eggs after boiling were cut with a sharp razor blade along the axis from the animal to the vegetative poles [3].

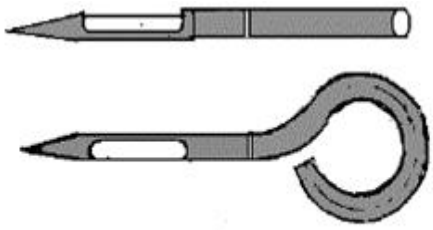

Fig. 2 Probe for express analysis of the condition of the gonads under us, the selection of the oarsmen (material - stainless steel, wire).

The animal pole of mature unfertilized eggs had a noticeable pigment color: lighter in the center with dark concentric rings (Fig. 4.3). By placing the nucleus under the binoculars with an eyepiece-micrometer, the degree of maturity of the eggs was determined, ie the readiness of the female for fish farming.

It is known from the literature that the optimal state of the caviar for work on artificial reproduction of the oarsman is observed at a polarization index of 0.05–0.07. In fish-breeding works it is recommended to use females, in oocytes of which the polarization index of the nucleus does not exceed 0.13–0.14 and is not less than 0.03 [6].

In our experiments, positive results in obtaining mature sexual products were recorded when using females with a nuclear polarization index in oocytes of 0.08–0.14.

Fig. 3. Paddle eggs removed from the gonad with a probe

After the spring grading, small ponds that are easy to catch (area 0.2–0.5 ha, depth 1.5–1.8 m) were used for pre-spawning of oarsmen. Planting density of broodstock did not exceed 100–200 specimens / ha. Catching ponds was carried out using a tow with a partial discharge of water. Examination and final (re-) selection of broodstock for use in the spawning campaign was carried out directly in the pond. For this purpose, the captured broodstock was concentrated for a short time in spacious commercial seedlings established in the coastal zone of the reservoir. Intense water turbidity was avoided at the place of concentration of broodstock.

To keep the brood after pituitary injections, earthen ponds were used, which are used during works on artificial reproduction of herbivorous fish (Fig. 4.4.). Their area was 25–30 m2, depth –1.0–1.2 m. The ponds were located next to the incubation shop, which greatly simplified fish farming. They were divided in half by mesh walls, which made it possible to sort the brood as they matured. The stocking density of fish did not exceed 1 copy. on 4–5m2.

The water temperature between injections and receiving averages 17.7 ° C. During the period after the decisive injection, its medium values were slightly higher than after the previous one, 18.1 ° C and 17.6 ° C, respectively.

As a result, females with a higher dose of gonadotropin matured 12.5–15.0 hours after the decisive injection. At a total pituitary dose of 5.5 mg / kg, both of the injected fish did not respond positively to hormonal stimulation. In one of them, partial ovulation of a small number of oocytes was detected.

In experiments with eleven-year-old female oarsmen, combined dry matter injections of acetonized sturgeon pituitary gland and glycerol extract of sturgeon pituitary gland were tested. Sturgeon pituitary with a dose of 0.7–0.8 mg / kg body weight was used for the previous injection. During the decisive injection, 75–80 frog units of pituitary glycerol extract were injected into one female. Two females were injected with a suspension of dry acetonated bream pituitary glands with a total dose of 7.8–8.3 mg / kg. The interval between the first and second injections varied between 24 and 26 hours.

In fish-breeding works, broodstock was used in two batches, starting their hormonal stimulation from 25.04. and 29.04.2002 p. In the first case, the water temperature between injections and caviar production averaged 16 ° C. During the period after the decisive injection, its mean values were slightly lower than after the previous one, 15.8 ° C and 16.3 ° C, respectively. At the same time, at the final stage of fish maturation (during the last 3–8 hours) there was a significant increase in water temperature (from 14.5 to 17.0 ° C).

During the maturation of females of the second group, among which were fish injected with bream pituitary glands, the average water temperature was 17ºC. The mean values of water temperature during the period between the first and second injections were at the level of 16.7ºC, after the decisive injection water temperatures were observed (on average up to 17.8 ºC).

In the case of combined gonadotropic injections, the fetuses of the first group matured 15.5–21.5 hours after the administration of the decisive dose of the hormone. With increasing water temperature, the ripening period of fish in the second group decreased to 13.5–16.0 hours. Females injected with bream pituitary glands did not respond to hormonal stimulation.

To stimulate the maturation of male oarsmen, a single pituitary injection was used - suspensions of pounded acetonized pituitary glands in saline were injected into the back of the fetal muscle one to three hours before the decisive injection to the females.

Only sturgeon pituitary glands were used in experiments with ten-year-old broodstock. In 2002, gonadotropic effects of acetonated bream pituitary glands were tested in male elephants for injection of eleven-year-old fish along with sturgeon pituitary glands. In both variants of the experiments, the dose of pituitary injection was determined by the number of fetuses used at the rate of 40-50 mg of pituitary dry matter per individual. Per kilogram of live weight, males of both age groups, depending on individual body weight, received 4.2–5.3 mg / kg of dry matter of sturgeon pituitary glands (on average 4.7 mg / kg) and 4.9–5.8 mg / kg of pituitary bream (average 5.4 mg / kg).

As a result, males with signs of spawning readiness (mating attire) responded positively to pituitary injections in all cases except one fish out of four bream-stimulated pituitary glands. In terms of the quality of sexual products and the volume of ejaculate, the fetuses injected with a suspension of bream pituitary glands were generally not inferior to fish after gonadotropic stimulation by sturgeon pituitary glands.

Intramuscular administration of penicillin to females and males (50,000 IU per fish) was used to reduce the likelihood of postoperative and post-injection inflammatory processes.

It should be noted that previously there were no difficulties in harvesting the pituitary gland of sturgeon. In recent years, a sharp decline in the number of their populations has created a problem of pituitary deficiency. In this regard, the task of finding substitutes for sturgeon pituitary glands is becoming increasingly important. In our opinion, taking into account the analysis of literature sources and practical experience of foreign experts in the future, the greatest interest in hormonal stimulation of maturation of oarsmen is associated with attempts to use surfagon and spawning drugs of Russian production, synthetic ovulation stimulant of Hungarian production - ovopel and lutein. The advantages of synthetic substitutes for natural pituitary drugs include the absence of foreign protein substances in the form of remnants of pituitary membranes, which reduces the stress of the fetuses after drug administration, as well as the possibility of long-term storage, lower risk of hormone overdose and simplified preparation. It is important that the main effect of synthetic gonadotropic substances is to physiologically stimulate the production of their own gonadotropic hormones in the pituitary gland of the fetus. It can be assumed that positive results of fish farming will be obtained with the use of certain combinations of natural and synthetic gonadotropic drugs. Further research on the use of natural pituitary preparations of carp fish species to stimulate the maturation of otters is also relevant.

Returning to the discussion of biotechnical aspects of artificial reproduction of oarsmen in our experiments, we note that to prevent injury to offspring, their injection was usually performed in tarpaulins with water, and in some cases directly in earthen ponds used to keep fish. This primarily applies to female oarsmen.

Taking into account the tendency of paddlefish females to the rapid maturation of ovulated eggs revealed in the 2001 studies, in the further works the primary attention was paid to the timely determination of the initial stage of their maturation. Periodic inspection of broodstock (every 1.0–1.5 hours) was started 5–6 h before the possible maturation dates, which were determined according to the graphs of the dependence of the maturation duration of oarsmen on the water temperature after the decisive injection.

It is known that recently, due to the aggravation of the problem of uterine material deficiency, the preservation of the life of broodstock after the selection of sexual products has become an indispensable technology for the conditions of effective artificial reproduction of sturgeon-like fish. This is especially true of work with the least valuable items of commercial sturgeon farming, which includes paddling. There are several methods of lifelong selection of sexual products from sturgeon. In our experiments, the most modern method of survival was used.

Fig. 4. Trimming the oviduct of a mature female oar bearer

Milks from males were obtained without surgical manipulations by light squeezing and massaging the caudal part of the abdomen of fish with a slight curvature of their body. They tried to drain the initial portion of yellow milk with a significant amount of urine and not to use caviar in insemination works. The semen of male oarsmen was mostly the color of whey, which is characteristic of this species of fish.

Mature sexual products from the offspring were selected in a clean dry container, excluding the possibility of contact with eggs and milk water and mucus

fish bodies (Fig. 5). 3-4 fish farmers were involved in the process of extracting sexual products from the broodstock. All work was performed under a roof that protected sexual products from direct sunlight.

All "spent" fish, after a short stay in the ponds, where they matured, were planted in ponds intended for summer keeping of uterine livestock.

Fig. 5. The initial stage of selection of mature eggs after pruning the oviduct of female oarsmen

The survival of female oarsmen, from which sexual products of different quality were selected, was 40 and 86%, respectively, among fish aged ten and eleven years. The survival of males in the post-spawning period averaged about 85%. The departure of broodstock was observed, as a rule, during the first week after fish farming.

It should be noted that the lack of possibility of thermoregulation of water during the work with the broodstock had a negative impact on the mode of their implementation, and directly on the fish farming results. Therefore, during the further expansion of work on the formation and operation of uterine flocks of oarsmen, in order to optimize the process of pre-spawning preparation of broodstock and obtaining quality sexual products in a convenient fish season, it is necessary to complete the breeders with long-term keeping fish in controlled temperature. Similar problems can occur during the stages of incubation of eggs, keeping free embryos and rearing larvae.

Insemination, detachment and incubation of eggs, keeping free embryos. Insemination of caviar was carried out in a semi-dry way, the biotechnology of which was reduced to bulk operations. Sexual products from each of the females and males were selected in separate containers (eggs - in nylon bowls, semen in glassware). The duration of storage of squeezed caviar until insemination did not exceed 15-20 minutes. Before performing the process, the accompanying cavity fluid was carefully drained from the caviar bowls. To inseminate each portion of caviar, we used the milk of 3-4 males at a rate of about 10-12 ml of their total volume per 1 kg of caviar. The calculated amount of sperm immediately before the insemination process was diluted in pure pond water at the rate of 10–12 ml of sperm per 2 liters of water. After rapid stirring, the resulting solution was immediately poured into a bowl with caviar. Then caviar with water and milk for 3-4 minutes. mixed thoroughly with a whisk of goose feathers. During stirring, several short stops (for 10-15 seconds) were made when the eggs were at rest. The procedure of mixing the eggs in the sperm solution was performed carefully, with smooth movements, without pressing the eggs to the bottom of the bowl. After that, the water and semen were drained, and the eggs were carefully washed with an additional portion of water. Attempts were made to maintain the water temperature in the caviar vessels during the fertilization process at the level close to the water temperature in fish farms with broodstock during maturation and in incubators, where the fertilized caviar was subsequently incubated. After washing the fertilized caviar immediately proceeded to the process of its non-gluing.

Decontamination of fertilized caviar was performed in special devices by bubbling the non-adhesive suspension (100 g of talc, 9.5 g of table salt per 10 l of water) with compressed air (Fig. 6). The process of ungluing the otter caviar in talc lasted about 45-50 minutes. After that, the eggs were washed with clean water and placed in an incubator. Sometimes at the initial stage of degreasing of caviar there was a necessity of mechanical beating, by means of a crown of feathers of separate eggs from walls of devices**.**

Fig. 6. Apparatus for degreasing caviar

The eggs were incubated in a modified Sturgeon apparatus. In order to collect data on the results of incubation of embryos obtained from different broodstock, a corresponding portion of eggs was loaded into each tray of the incubation apparatus. The incubator was placed in a place protected from direct sunlight. During the incubation, preventive treatment of caviar with dyes (violet K and malachite green) was carried out. It was performed starting from the second day of incubation with an interval of 1.5–2.5 days (depending on the quality of the eggs and the duration of embryonic development). In the case of collection of dead eggs, its number was counted in order to further determine the yield of live embryos.

Water exchange in the incubator per section loaded with caviar was 2.1–3.2 l / min.

In order to stabilize the oxygen regime in fish tanks during incubation of eggs and rearing of larvae over the filter of the water intake of the incubation shop in the pond of the settling tank was installed easy to make aerator water.

This made it possible to maintain the oxygen concentration in the water supplied to the incubator at a level of not less than 5.4–5.6 mg / l at minimal costs. Other hydrochemical parameters of water during the incubation period of paddle-bearing embryos during both years did not exceed the limits of fish-breeding norms. The hydrogen pH of the water ranged from 7.1 to 7.9, the permanganate oxidation and the total hardness of the water were 8.1–14.3 mg O / l and 3.3–4.2 mg – eq./l, respectively.

The water temperature during the incubation of eggs varied between 13–19 ° C and was mostly at the level of optimal values (15–18 ° C). The daily fluctuations did not exceed 2.0–2.5 ° C.

A clear dependence of the duration of embryonic development of the nasal oars embryos on the water temperature was revealed. The beginning of hatching of embryos from eggs, depending on the water temperature, occurred on the sixth - eighth day of incubation. Hatching was stretched in time and lasted up to 1.5-2.0 days.

In 2001, with water temperature fluctuations in the range of 13.0–19.0 ° C (average 15.2 ° C), hatching of free embryos began at 177 hours of incubation. In 2002, during the incubation of eggs obtained from the first batch of broodstock at a water temperature of 13.0–17.5 ° C (average 15.4 ° C), the embryos began to emerge from the shells at 164 hours of the embryos in the incubator. In the second batch of eggs, in which the development of embryos took place at a water temperature of 15.0–18.0 ° C (average 16.8 ° C), this process began 143 hours after loading the incubator trays.

The length of the hatching period caused some differences in the size and development of free embryos. The formation of more developed individuals in the future determined their earlier transition to active nutrition. Even at the highest water temperature (17–19 ° C), the duration of the embryo exit process from the shells lasted for 32–39 hours. In some cases, this process lasted more than 45 hours.

Free embryos were kept in plastic pools before their transition to exogenous nutrition, in which larvae were subsequently reared. Long-term practice of such works (using material of both local origin and imported to the farm) has shown that in the event of spring colds in the absence of equipment for water thermoregulation can significantly worsen the temperature in fish farms. The decrease in water temperature to 12–13 ° C could be one of the main reasons for the increased waste of free embryos (sometimes up to 40–60%) at the end of the aging period and at the time of their transition to active feeding, which is confirmed in the literature [4]. In the experiments of 2002, under a favorable temperature regime with water temperature fluctuations in the range of 16–20 ° C, the maintenance of free embryos in the pools took place with a small waste that did not exceed 10–15%.

After being released from the shells and transplanted into the pools, the embryos make "candles" by rising to the surface of the water and then slowly descending. The piglets have a dark pigment in the eyes, a wide fin band is not yet differentiated into the rudiments of fins (Fig. 4.12.). the length of embryos is 8.04 ± 0.10 mm (Cv = 6.44%) for body weight 9.58 ± 0.14 mg (Cv = 7.48%).

At an average water temperature of 17.3–18.4 ° C, the majority of free paddle-bearing embryos prevailed and switched to active feeding for 8–9 days in pools. Given the long duration of the period of hatching of embryos from eggs and the resulting differences in their development, feeding of larvae began 1.5–2.0 days before the transition of their bulk to exogenous nutrition. During this period, the larvae become active, move quickly in different directions of the water column, sometimes in the process of capturing food organisms make circular motions near the water surface. Their length is 16.09 ± 0.14 mm (Sv = 4.38%). Characteristic signs of the transition of larvae to active feeding are the ejection of pigment plugs from the digestive tract and the rotation of the ends of the tendrils forward towards the edge of the head (Fig. 4.13). In the case of feeding the larvae of living food organisms through the translucent abdominal wall of fish visible pigmented eyes of captured crustaceans.

Thus, according to the results of the experiments presented in this section of the work, it was found that for the first time mature females paddle nose eleven-year-old in terms of reproductive capacity significantly outweighed for the first time mature decades.

Ordinary breeders designed for factory reproduction of carp fish species are quite suitable for carrying out fish-breeding works to obtain offspring of the nasal paddle, which significantly expands the possibility of fish farming in Ukraine. At the same time, an important condition for improving the efficiency of such works is the additional equipment of hatcheries with appropriate equipment and the creation of water treatment systems, which will optimize the oxygen and temperature regime in fish farms.

Some research materials in this section are published in professional journals.

Economic efficiency of the developed technology. At the present stage of aquaculture development, one of the most important conditions for the successful operation of sturgeon is the presence of mature offspring, from which you can get quality sex products and viable offspring. However, in some cases significant losses to the economy.

The economic efficiency of fisheries should be considered to obtain the maximum number of products per unit area at the lowest cost of labor and money under conditions of high quality products. In this case, the main evaluation criteria, as a rule, are the amount of profit and the level of profitability of this production.

Fish and fish products are a valuable and often indispensable food product that provides human needs primarily for animal proteins, a wide range of vitamins,

a variety of trace elements and biologically active substances.

The economic efficiency of fisheries should be considered to obtain the maximum number of products per unit area at the lowest cost of labor and money under conditions of high quality products. In this case, the main evaluation criteria, as a rule, are the amount of profit and the level of profitability of this production.

The results of the technology of factory reproduction and cultivation of viable oarsmen in the economy of Mercury WG LLC convincingly testify to the prospects of using this method. At the same time, given the existing economic realities of today, there is an urgent need to find the most economically efficient options for the application of technological components of production. In this regard, an analysis of economic efficiency was conducted, aimed at determining the best options for reproduction, both in fisheries and in economic terms. Given the lack of a stable pricing policy over the years, conditional indicators of economic efficiency were determined, with the conditional value of oarsmen was adopted 600.0 UAH / kg, larvae - 500 thousand UAH / 100 thousand units, the cost of 1 g. pituitary gland - 5000.0 UAH. To simplify the calculations they are made in terms of 100 thousand larvae obtained using various hormonal drugs (Table 10).

Table 10

Economic efficiency of reproduction of 100 thousand otter larvae

Indicators	Preparations	
	pituitary	reprogenol
Remuneration, UAH	15600	15600
Costs for hormonal drugs, UAH	3500	7600
Materials: oil products, UAH	5100	5100
Electricity, UAH	2500	2500
Working capital, UAH	4200	4200
Depreciation of fixed assets, UAH	125000	90900
Other expenses, UAH	2500	4100
Cost of goods sold, UAH	158400	130000
Sales price of 100 thousand larvae, UAH	500000	500000
Profit, UAH	341600	370000
Profitability,%	216	284

For the purpose of objectivity and reliability of the analysis, the actual indicators of fishery activity in terms of production costs and production costs obtained on the studied farm were used.

In the analysis of research on the reproduction of the oar by the traditional factory method in the economy, the main part of production costs, which determined the level of profitability accounted for wages and fixed assets, as well as other costs associated with petroleum products and electricity.

Analyzing the indicators of economic efficiency of reproduction of the otter, we can conclude that a significant part of the cost of larvae during reproduction are labor costs with deductions for social costs (27.9-35.1% of the total). These costs combine the remuneration of fish farmers who carry out technological operations for the cultivation and feeding of broodstock, with the remuneration of highly qualified specialists who carry out reproduction in hatcheries. Since the reproduction of the oarsman by the traditional factory method, the main work to control the maturation of females and the selection of sexual products and insemination of eggs are highly skilled workers, so up to 25% are labor costs.

In second place in the cost part is the depreciation of fixed assets, namely: the cost of growing oarsmen and the purchase of devices for incubation of eggs, and other facilities of the incubation complex.

Other costs include the cost of purchasing or procuring the pituitary gland and other working capital of the incubation plant (plastic bags, refueling of oxygen cylinders).

As a result, the profitability of obtaining 100 thousand larvae of otters with the use of reprogenol differed significantly compared with the traditional use of carp pituitary glands.

Conclusions and prospects for further research. As a result of research on the latest methods of reproduction of paddlefish in the forest-steppe zone of Ukraine, namely the impact of hormonal drugs on the working fertility of females, the impact of abiotic factors on them, the conclusion is:

1. In the latitudes of Ukraine (Vinnytsia region - 48-50 °) with the sum of temperatures of 1.8-2.2 thousand degrees days, the achievement of the IV completed stage of maturity of the gonads in the oarsman lasts for 10-11 years.

2. On the example of this farm proved the possibility of organizing the artificial reproduction of the oar on the basis of conventional carp farms.

3. Positive results in hormonal stimulation of maturation of sexual products of female oarsmen were obtained at a water temperature of 14-16 ° C with two hormonal injections with an interval of 24 hours.

4. Male oarsmen responded positively to a single pituitary injection of reprogenol.

5. The level of profitability of factory reproduction of the paddle with the use of the pituitary gland was 216%, with the use of reprogenol - 284%.

According to the research results, the following suggestions can be made:

1. Due to the deficiency and breeding value of otters, dubious hormonal drugs should not be used, which are characterized by low reproductive capacity and increased waste in the post-neurist period.

2. For successful reproduction of the paddle, the incubator should be equipped with devices to optimize the temperature.

3. An important condition for the survival of otter larvae is the development of methods for breeding forage crustaceans in controlled conditions.

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