



Current state of Aral bastard sturgeon, *Acipenser nudiventris* Lovetsky, 1828 populations as a rare and endangered species distributed in native water bodies and domestication in artificial conditions

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ABSTRACT

At present, as a result of human activities, the relic valuable species of sturgeons – Aral bastard sturgeon, *Acipenser nudiventris* Lovetsky, 1828 in its natural habitat has died out, and in the acclimatization reservoir is on the verge of extinction, the only effective measure to restore its abundance and stocks can only be its artificial reproduction.

Keywords: Bastard sturgeon, Natural range, Biodiversity, Restoration, Domestication, Artificial reproduction.

Article type: Research Article.

INTRODUCTION

Preservation of biodiversity is one of the priority tasks of our time. This was reflected in the development of the international Convention "On Biological Diversity" (Law of the Republic of Kazakhstan 2004) which has been ratified by 189 countries of the world, including the Republic of Kazakhstan. The large-scale exploitation of natural resources over the past century has changed some of our country's landscapes beyond recognition. In recent years, Kazakhstan has entered a period of rapid economic development, which will lead to an increase in the anthropogenic pressure on natural resources. Subsequently, if adequate measures are not taken to reduce the anthropogenic impact on natural resources, including the ichthyofauna, this will lead to a reduction in the biodiversity of the animal world, and will primarily affect valuable fish species. To date, the above factors have led to the disappearance of the relict bastard sturgeon species from the Aral-Syrdarya basin and sharply limited its abundance in the Balkhash-Alakol basin, where it is acclimatized. Therefore, bastard sturgeon was included in the Red Book of the Republic of Kazakhstan in 2002 (Alekin *et al.* 1959). Notably, all sturgeons are included in the IUCN Red List, including bastard sturgeon as a species that is in a dangerous state. The Red Book of the Republic of Kazakhstan, as a measure to protect the Aral and Balkhash populations, suggests: "Creation of a cryobank of gametes, organization of artificial breeding, improvement of fish protection devices." According to the Law of the Republic of Kazakhstan dated July 9, 2004, N 593-II "On the Protection, Reproduction, and Use of Wildlife" (Guidelines for the chemical analysis of land surface waters, 1977), the removal of rare and endangered species of animals is allowed in exceptional cases by decision of the Government of the Republic of Kazakhstan for:

- 1) breeding in specially created conditions for scientific, reproductive, and commercial purposes, as well as for subsequent release into the environment;
- 2) development of national types of hunting;
- 3) scientific research;
- 4) selection.

In this regard, given that the preservation of the gene pool of such a valuable relic species as a bastard sturgeon is an exceptional need, it is urgent to take a set of measures to preserve and increase its numbers. In this case, a practical solution to the problem at hand is possible only with the removal of the minimum required amount of bastard sturgeon from the natural habitat, followed by artificial reproduction in the fish farms of the republic in two directions:

- reacclimatization (reintroduction) of the obtained juveniles into the restored habitat of the Small Aral Sea, as well as other water bodies of the Aral-Syrdarya and Balkash-Alakol basins;
- artificial rearing of the resulting juveniles to a commercial mass, to obtain valuable competitive commercial products with a high final cost, which in turn will reduce the commercial pressure on the remaining natural sturgeon populations in nature.

Bastard sturgeon (*Acipenser nudiventris* Lovetsky, 1828) belongs to the Sturgeon family. Relic, rare and valuable species of fish. Two populations of the species (Aral and Ili populations) out of three are listed in the Red Book of the Republic of Kazakhstan in category I, as endangered populations (Alekin *et al.* 1959). Bastard sturgeon is also included in the Red List of the International Union for the Conservation of Wildlife (IUCN 1994), as well as Turkmenistan and Uzbekistan. Bastard sturgeon belongs to the Ponto-Caspian-Aral faunistic complex. The natural distribution area is the rivers of the Black, Azov and Caspian Seas, the Aral Sea and its tributaries, acclimatized in the Balkhash basin (1933-1934). Currently, in Kazakhstan, it is distributed in the Ural-Caspian and Balkash-Alakol basins. After the construction of the Kapshagai hydroelectric power station, a single Balkash-Alakol herd was divided into two parts (populations): Kapshagai and Balkhash. The third Ural-Caspian population is rapidly declining and is currently only allowed to be caught for scientific and reproductive purposes. However, even in this case, it is not possible to catch in the required number of producers for subsequent artificial reproduction (Key to freshwater invertebrates, 1977). Despite the official recognition that the Ural and Aral populations of bastard sturgeon belong to a single species, some morphological features indicate noticeable differences between them. There are significant differences between the Aral and Caspian bastard sturgeons in the number of lateral scutes, rays in the dorsal fin, head length, and maximum body height, which characterize the greater propulsion of the Aral bastard sturgeon. The bastard sturgeons of Caspian and Aral origin, even being grown in identical conditions, on the same fish farm differ markedly from each other.

General characteristics of the habitat (water bodies)

The most important indicators of the state of the habitat for sturgeons are the hydrological, hydrochemical regime and food base of the reservoirs in which they live, as well as those reservoirs in which they will subsequently be stocked with fish (Aral-Syrdarya and Balkash-Alakol basins). The proposed place for the preparation of bastard sturgeons for the formation of the broodstock and the start of work on its artificial reproduction are such reservoirs of the Balkash-Alakol basin as the Ili River from the state border to the confluence with the Kapshagai reservoir, directly the Kapshagai reservoir, the Ili River from the downstream of the Kapshagai reservoir to the confluence to Lake Balkhash, Lake Balkhash itself and the Karatal River. Below are the characteristics of these reservoirs.

Bastard sturgeon of the Aral-Syrdarya basin

In the Aral Sea, it was distributed everywhere, except the saline bays of the eastern coast (Chernovsky 1949), with the highest abundance in the northern part (Pankratova 1977). The main spawning river was the Syrdarya, along which bastard sturgeon rose to the village of Chinaz and the Begovat rapids (Uzbekistan, 1800 km) and higher (Chugunova 1952), some specimens - to Leninabad and higher (Rules for the preparation of a biological justification 2004). In the Amudarya it was found in smaller numbers than in the Syrdarya, it rose to Baumanabad (Red Book of the Republic of Kazakhstan 2008). The course of bastard sturgeon into the rivers began with the beginning of the spring flood, as a rule, in the second half of April. The mass move fell in the period from mid-May to early July, sometimes until the end of July. The course ended, as a rule, in September, when the last producers entered the delta (Musayev & Magomedov 1997). The most intense course in the area of the city of Kazaly (180 km from the

sea) occurred from late May to mid-July (Musayev & Magomedov 1997). Before the construction of Farkhad Dam in 1946, bastard sturgeon rose up the river to a distance of up to 2600 km (Musayev & Magomedov 1997). Males reached sexual maturity at the age of 12–14 years, and females later. According to other data (Pankratova 1977), males mature at the age of 10-12 years, females - 14-15. According to R.T. Tleuova (Musayev 1997), males of bastard sturgeon reached sexual maturity at 7–9 years, females at 9–10, and not at 12–14 years, according to G.V. Nikolsky (Chernovsky 1949). He explained the acceleration of maturation by the transition of bastard sturgeon to predation in connection with the acclimatization of gobies. By the age of maturity, males reach a weight of 7 kg, and females 12 kg (Table 1). The increase in the growth rate in the 1960s, according to N.V. Pechnikova (Pravdin 1966) is explained by the low number of spines after the epizootic. The fecundity of individuals 126–150 cm long at the age of 16–19 years was 162–342.3 thousand eggs (Chernovsky 1949). A.N. Probatov (Askerov & Dadashov 2000) for females of the same size and age indicated a high fecundity (216.2-387.7 thousand eggs). N.V. Pechnikova cited higher fertility values of 279-942 thousand eggs (610.9 thousand on average) for bastard sturgeon in 1960-1963. The larger female sturgeons possibly had a fecundity of over 1 million eggs (Pankratova 1977). In individuals 143-173 cm long in the 1970s fecundity ranged from 280.7 to 574.7 thousand eggs. Perhaps the increase in fecundity is a reaction of the population to a decrease in numbers. The age structure of the Aral Sea bastard sturgeon in 1926-1928 included individuals up to 30 years of age (Askerov 2000).

Table 1. Weight growth of the Aral bastard sturgeon, Aral Sea.

Age, years	1926-1928 (Askerov 2000)	1961-1963 (Ushivtsev <i>et al.</i> 2001)	1964-1969 (Aleksperov 2000)
7	4.6	-	3.6
8	3.6	5.5	5.1
9	3.5	6.6	7.8
10	7.5	10.2	7.1
11	7.5	9.7	9.7
12	8.7	11.9	12.1
13	9.2	16.6	11.2
14	-	14.5	14.2
15	12.7	17.0	15.2
16	11.3	15.8	17.2
17	14.5	20.1	15.9
18	15.3	16.0	18.8
19	17.7	18.1	22.3
20	17.2	22.5	23.7
21	17.0	25.7	27.4
22	16.0	25.2	25.0
23	-	17.0	30.5
24	16.0	-	31.0
25	19.2	-	33.2
30	-	-	31.0

Until 1935, thorn catches in the Aral Sea ranged from 300-400 tons. P.V. Tsikulenko (Pravdin 1966) already in 1925 wrote about the need to protect "... this valuable species closes to extinction". At the height of the epizootic (1936-1937), catches increased sharply due to the acceptance of sick individuals. On June 1, 1940, a ban was introduced on the fishing of the thorn, and since its "by-catch" was allowed, the fishing statistics took into account its catches in the range of several tons (4-10 tons) until 1969 (Aleksperov 2000; Grudtsin 1981; Fig. 1). In the late 1970s, single specimens of bastard sturgeon were only occasionally found in catches (Konstantinov *et al.* 1990). After regulation of the river flow, the natural reproduction of bastard sturgeon became impossible in the Aral-Syrdarya basin. The main reasons limiting the number of bastard sturgeons in the Aral basin were hydro construction, irretreivable water consumption, biologically and economically unjustified and irrational fishing and poaching.

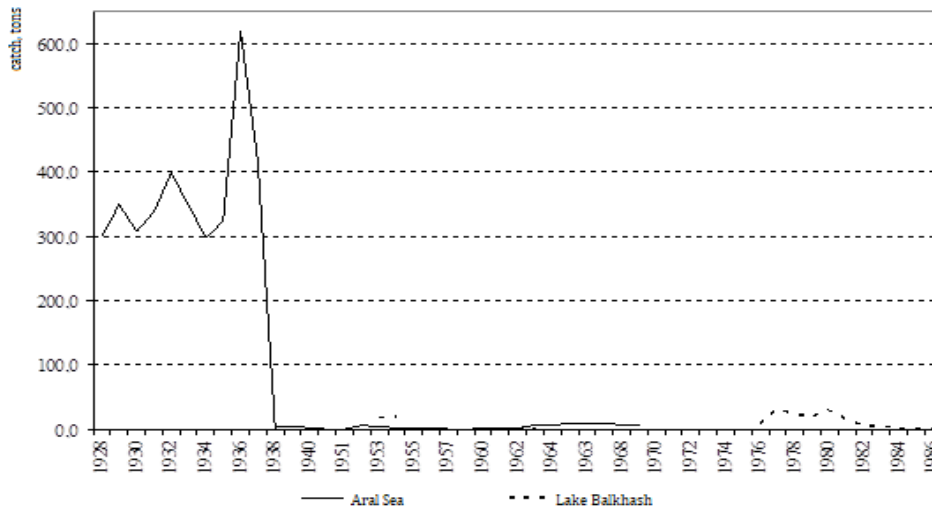


Fig. 1. Catches of the Aral bastard sturgeon in Kazakhstan (tons).

The complete destruction of the system of natural reproduction of anadromous fish, bastard sturgeon and barbel, was written at the initial stage of large-scale hydro construction in the basin, but it was assumed that recruitment could be supported by artificial reproduction at fish hatcheries (Yefimova & Artyukhin 2000). However, as we now see, this did not happen.

Bastard sturgeon of the Balkash-Alakol basin

Bastard sturgeon was brought to the Balkash-Alakol basin from the mouth of the river Syrdarya (Levin 1989) in 6 steps. A total of 291 specimens were delivered, 114-136 cm long, weighing 6.7-30.0 kg. The first three parties in the amount of 91 individuals were transported between November 01 and 29, 1933. The second three batches in the amount of 200 individuals - November 10-23, 1934 (Popova *et al.* 1995). Bastard sturgeons were produced in Ili River beside the village of Ili (Podushka 1997). By 1970, adult bastard sturgeons and their juveniles were found in all areas of the lake. Adult bastard sturgeons and juveniles were encountered in summer along the entire length of the Ili River from the fore-delta to the border with PRC. Bastard sturgeons do not enter the Ayaguz, Lepsy and Aksu rivers; Adult bastard sturgeons were periodically caught by poachers in Karatal, but there are no data on the capture of juvenile bastard sturgeons here (Podushka 1996). After the construction of the Kapshagai hydroelectric power station, a single Ili herd was divided into two parts: Kapshagai and Balkhash. In the 1970s, the main habitats of bastard sturgeon were areas of the Western Balkhash adjacent to the Ili delta and in the Ili River delta itself, between the islands of Ultrakhty, Kerzhuk, in the Red October Bay, in the areas of Turangalyk, Adzhartas, on the eastern side of the Mynaral Islands. In the East, bastard sturgeon was less numerous. Winter concentrations of this fish were found between the islands of Ultrakhty and Korzhun, in the Red October Bay, in the areas of Torangalyk, Akzhartas, Tasaral, on the eastern side of the Mynaral Islands (Mynaral, Otaryl, Ayakaral), in the bays of Akkeme and Ozhubek, in the lakes of the Ili delta: Koskozul, Kugalykum, Babushin (Vasilyeva 2000; Vasilyeva 2005). By the mid-1980s, the number of bastard sturgeons has significantly decreased, which is primarily due to a sharp deterioration in the conditions for the development of juveniles and a reduction in the area of spawning grounds (Primak 2002). Currently, a bastard sturgeon in Balkhash is very rare. In some areas of the Western Balkhash, in recent years, apparently, it has been practically destroyed, since in the 90s the fishing gear set "for sturgeon" could be seen quite often, but now there are almost none. The destruction of bastard sturgeon can also be judged by a sharp increase in the number of older groups of gipania mollusks, which, as a food object, are available only to sturgeons and large carps. In the delta of Ili River, bastard sturgeon is very rare and its habitats are concentrated in the groups of lakes Ainakol (where the Baimenei channel begins), Shagyray, etc. In Eastern Balkhash, bastard sturgeon is found in some bays and parts of the lake adjacent to the mouths of the Karatal and Lepsy rivers, as well as in the Karatal River itself. In the river, adults and juveniles up to 30 cm long are caught. Bastard sturgeon rises along the Karatal River up to the dam of the Ushtobe hydroelectric complex (Franklin 1980), where they are constantly caught in the downstream. Below this dam throughout the Karatal River has only one area with pebble soil, favorable for bastard sturgeon spawning. Considering that there is a

massive spawning of asp here, the question of the possibility of effective reproduction of the asp in the Karatal River remains open (Nunney & Elam 1994). In 2003, in Lake Balkhash, for the first time in the last 15 years, we caught a bastard sturgeon during research fishing, 3+ in age and 52 cm in length (age was determined by recalculation according to the length-age ratio) and also 550 g in weight released alive into the lake. Initially, the migration of an adult bastard sturgeon in Ili River lasted for 7 months - from mid-April to the second half of November - with two peaks: the first - spring-summer (June) and the second, weaker in autumn (October - November; Frankham 1996). During the entire course, the gonads were in stages III, III-IV and less often in stage IV of maturity. Later Shekhodanov *et al.* (1999) noted migratory spawners in the river delta from May to August with sexual products of stage II-III of maturity. The peak of the course was observed in June - August. The entry of fish stopped in September, when the gonads reached the III-IV stages of maturity. The maturation of the gonads occurred during migration and wintering. About 8% of the running bastard sturgeon was females of the spring form, entering the Ili in April with gonads at maturity stages III-IV and IV (Pankratova 1997). The most powerful spawning grounds of bastard sturgeon were located below, above and in the Kapshagai gorge itself, above the Ili station, in the area of the Chulak tract and above the Dubun pier. Small spawning grounds were near the top of the river delta Ili - the Sixth fishing point of the Ili fish factory (207 km from the mouth), near Bakanas (249 km) and Aktogay (about 300 km from the mouth). The spawning grounds located below the Kapshagai gorge had a small area of 0.5-3.0 km². The upper boundary of the spawning grounds was located in the river and flowing lakes beyond the state border of the USSR (Shekhodanov *et al.* 1999). According to Pechnikova (1997), before the construction of the Kapshagai HPP, 30% of bastard sturgeon was reproduced in the spawning grounds of the Kapshagai Gorge; another 35% of breeders bred in the area from Kapshagai to the state border, 20% in the territory of the PRC; the remaining 15% were below the Kapshagai Gorge. After regulating the flow of Ili River the main places of reproduction of bastard sturgeon are sections of Ili River below the Kapshagai dam with a length of 70-80 km with characteristic hard soils (stone, pebbles and coarse sand; Frankham 1996). A bastard sturgeon in the Balkash-Alakol basin becomes sexually mature at the age of 9-11, less often 8 years (males) and 12-14 years (females; Pankratova 1997). Presumably, bastard sturgeon breeds in Ili River once every 2 years (Vasilyeva 2000). Based on the age composition of the Balkash-Alakol herd of the bastard sturgeon, most of it has time to spawn 1-3 times in a lifetime (Frankham 1996). During the pre-spawning course of bastard sturgeon, the sex ratio was 1.8:1 in favor of males. However, in the age group of 9-14 years, females accounted for 23%, and in fish of 15-19 years, 89% (Pankratova 1997). Data on the fertility of the Balkhash bastard sturgeon are very scarce. According to Shekhodanov *et al.* (1999), the fecundity of thorns at the age of 17-18 years ranged from 177876-511000 eggs, bastard sturgeons had a weight of 31-36 kg. By age, absolute fecundity increases. Maximum fecundity, according to N.V. Pechnikova (Frankham, 1996) was 740.5 thousand eggs (Table 9) and, probably, may exceeded 1 million eggs. In 1971, the population of bastard sturgeon in the water bodies of the delta was represented by individuals with a length of 26 to 79 cm, an average length of 50.4 cm. In 1972, the herd consisted of bastard sturgeons ranging in size from 38 to 59 cm equal to 1.1 kg, while in 1972 to 0.95. Above 3 kg, bastard sturgeons in net catches were found sporadically (Frankham 1996). The maximum weight of a bastard sturgeon mined in the delta Ili by collective farm fishermen. "Achievement" in 1955 was 97 kg (Shekhodanov *et al.* 1999). Individuals weighing 24-42 kg were common in catches. In the second half of the 1970s, the herd of bastard sturgeon of the Balkash-Alakol system was composed of individuals of different ages (1+-13+) and different sizes (30-143 cm in length). The largest specimen of bastard sturgeon caught during this period weighed 64 kg (Western Balkhash; Tyapugin *et al.* 1999). In the 1950s, the herd of bastard sturgeon was represented by individuals under the age of 20+. In the mature part of the population, the majority of catches were individuals 16+-17+ in age. In the 1960s, the number of bastard sturgeons in catches decreased, but its age structure still retained the same picture. Subsequently, the catches consisted mainly of juveniles under the age of 7+ with single captures of adults. Females had a higher rate of linear and weight growth (Frankham 1996). During the naturalization of bastard sturgeon in the Balkash-Alakol basin, the relative abundance of the mature part of the population decreased by a stable age composition and abundance of juveniles under the age of 7+, followed by reducing the abundance of juveniles. Commercial fishing for bastard sturgeon has never been carried out in the Balkash-Alakol basin, however, it was allowed as by-catch. Catches of thorn never exceeded 30 tons. In 1955, Kazglavrybvod permitted the catch of 1000 individuals of bastard sturgeon (~ 20 tons). Officially, 10 tons were caught, while the actual catch was 60 tons (Frankham 1996). However, the greatest damage to the bastard sturgeon population was caused not so much by the commercial removal of adults, but by the death of juveniles in the fishing gear. Calculations show that even

with a minimum average weight of 15 kg, in the Balkash-Alakol basin in 1976-1982, 370-1550 measured individuals were caught per year. According to G.V. Dombrovsky *et al.* in 22-23.5 thousand nets set in the Western Balkhash and in the reservoirs of Ili delta, at least 9-11 thousand specimens of bastard sturgeon juveniles died annually, reaching such sizes when their natural mortality was not exceeding 4-5%. As can be seen, the number of dead individuals exceeded the official by-catch by 7-30 times, which is essentially the main reason for the low abundance of the Lake Balkhash bastard sturgeon.

Table 2. Fertility of the Balkhash bastard sturgeon, delta of Ili River during 1957-1958.

Indicator	14 (p = 3)	15 (p = 1)	16 (p = 3)	17 (p = 3)
Absolute length (cm)				
M	161.3	164.5	166.3	167.2
min-max	158.0-164.0	-	160.0-178.5	167.0-187.5
Weight (g)				
M	25317	35870	35917	38156
min-max	19920-29400	-	29270-46920	28220-48138
Gonad weight (g)				
M	1657	2850	4190	3730
min-max	600-2850	-	2900-5670	2760-5000
Absolute individual fecundity (thousand pieces eggs)				
M	380.02	614.45	660.32	560.53
min-max	234.60-672.60	-	437.60-740.50	415.00-634.55

It is quite possible that timely measures taken to introduce a fishing regime conducive to the conservation of juveniles would have made it possible to create a fairly large self-reproducing herd of bastard sturgeon in Lake Balkhash. The effectiveness of such measures was proved by the example of the restoration of the number of sturgeons in the Caspian Sea after the introduction in 1965 of a ban on marine net fishing. Along with this, significant damage to the reproduction of bastard sturgeon in Lake Balkhash was also caused by the construction of the Kapshagai hydroelectric complex, which blocked the path of bastard sturgeon to the main places of its reproduction. In 1987, the number of bastard sturgeon decreased significantly, which was primarily due to a sharp deterioration in the conditions for the development of juveniles and a reduction in the area of spawning grounds (Primak 2002). In 1991, the Aral population was included in the Red Book of Kazakhstan. In 2002, the Balkash-Alakol population of bastard sturgeon was included in the list of protected species. According to our field sampling in the seasons of 2015, 2 bastard sturgeons were found. The first copy was caught in Ili River at 126 km in June. Its length was 50 cm and weight 1.2 kg (Fig. 2).



Fig. 2. Photo of a bastard sturgeon 50 cm long, weighing 1.2 kg caught in Ili River (2015).

The second specimen was caught in the area of the retaining zone of the reservoir on October 11 with rafting nets. The length of juvenile bastard sturgeon caught in the retaining zone was 27 cm and body weight 158 g (Fig. 3). Marked individuals after the removal of intravital parameters were released alive back into the water. According to previous years, e.g. in 2009, in the area of "Salt Lakes" in the reservoir, several specimens of thorn juveniles

got into the scientific networks. In addition, in November 2010 in Ili River one specimen was caught with a body length of 27 cm and a mass of 142 g.



a)



b)

Fig. 3. Photo of a bastard sturgeon 27 cm long, weighing 158 g, caught in the retaining zone of the reservoir, 2015.

However, we have collected some information based on survey data among commercial fishermen and amateur fishermen. So, according to the fishermen, in April of this year, in the area of the mouth of Kaskelen River, two specimens of a bastard sturgeon with an approximate weight of 4 kg each were caught in a 55-mm net, which, according to them, were released alive, since this fish is prohibited for catching. In the area of "Salt Lakes", the upper reaches of the reservoir – fishermen in April of this year when clearing the bed of the fishing area (No. 24), they pulled out an abandoned Chinese net, i.e., a veined cobweb, in which, along with other species, about 10 kg of a rotten and half-decomposed bastard sturgeon were found. According to the surveys of fishermen and amateurs, as well as local residents, it was found that in Kapshagai reservoir (right bank) and Ili River in the area of Ayak-Kalkan, Dubuni, Onopko and others, poachers periodically caught immature individuals of the bastard sturgeon. After lengthy negotiations, photos of bastard sturgeon were obtained (Fig. 4).



Fig. 4. Photo of a bastard sturgeon more than 1 m long, weighing 12 kg, caught in Kapshagai reservoir (area 96 km) in 2015.

RESULTS

By the Permit issued to catch bastard sturgeon for research purposes, on May 26, 2022, in Kapshagai reservoir at station No. 5 (Karakol Bay), 1 copy of the thorn was caught during research fishing on fixed nets (Fig. 5). The length of bastard sturgeon was 127 cm, and weight 8.9 kg.



Fig. 5. Bastard sturgeon from Kapshagai reservoir, caught according to the Permit issued for research purposes.

Based on the Kapshagai HPP, chipping of the caught bastard sturgeon was carried out (Fig. 6). In addition, ultrasound examinations of the abdominal cavity of bastard sturgeon were performed to determine the fish sex (Fig. 7). The captured specimen after scanning was identified as a female. At the same time, biological material (a piece of the pectoral fin) was taken for genetic identification (Fig. 8).

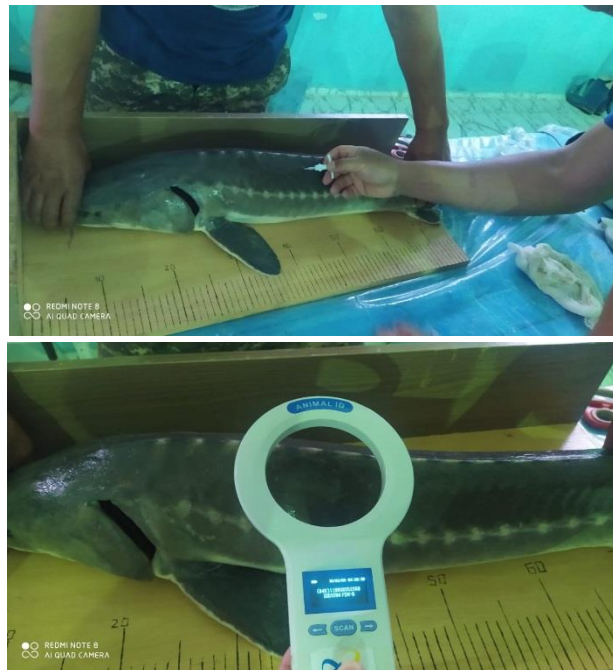


Fig. 6. Chipping of bastard sturgeon *Acipenser nudiventris* (Lovetsky 1928).

Currently, bastard sturgeon is undergoing a stage of adaptation to new habitat conditions in RAS conditions. After passing the quarantine, the process of feeding with various feeds of animal and artificial origin has begun. To speed up adaptation, on June 8, 2022, 3 specimens of the Lena sturgeon were planted to the bastard sturgeon. It was noted that after the feeding, bastard sturgeon became more willing to consume artificial feed. In other words, the development of the bastard sturgeon domestication technology has begun. Later, on June 15, 2022, during the research fishing, 5 specimens of juvenile bastard sturgeon were caught on the right bank of the Kapshagai (96 km along the ship's channel). The average length of the fish was 30.0 cm, weight 106.3 g (Fig. 10). The next day,

June 16, 2022, in the same area, 4 specimens of juvenile bastard sturgeons with a total weight of 0.5 kg were caught. The length of the fish was 25.0 - 29.5 cm, weight 103.4 - 182.5 g (Table 9).



Fig. 7. Determination of the bastard sturgeon sex using an ultrasound machine.



Fig. 8. Selected sample of the biological material of bastard sturgeon for genetic research.

The fish after live measurements was sent to the Balkash branch of "RPCF" LLP (Balkash) for further research. On May 27 of the current year, a bastard sturgeon was released into one of the RAS pools in the fish breeding area (Fig. 9).

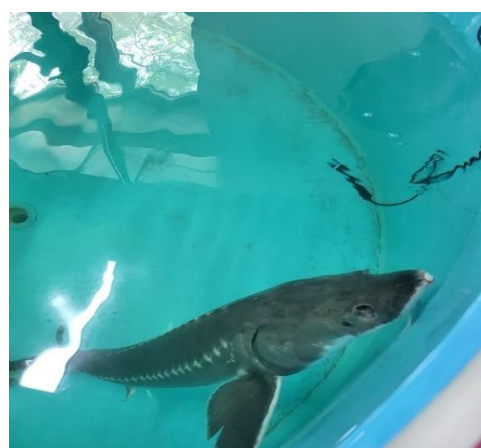


Fig. 9. Bastard sturgeon in the RAS basin of the Balkhash fish-breeding area of "RPCF" LLP.

During the research fishing on June 18 of the current year in the backwater zone of the Kapshagai reservoir, 4 specimens of bastard sturgeon juveniles with a total weight of 0.4 kg were also caught. The length and weight of the fish varied within the limits of 21.5–28.0 cm and 67.7–148.9 g, respectively. On July 04 of the current year, on the right bank in the backwater zone, another 1 copy of bastard sturgeon was caught. The length of the fish

was 42.5 cm, body weight 461 g. In the autumn of September 10 and 12, 2022, 4 bastard sturgeons with a total weight of 3.8 kg were caught in the backwater zone. On September 13, in the net catches in the backwater zone, 1 bastard sturgeon, 52.7 cm long, weighing 1134.0 g, was found. All caught bastard sturgeon juveniles were sent for temporary keeping to the Kapshagai HPP (Fig. 11).



Fig. 10. Juvenile bastard sturgeon from the Kapshagai Reservoir (96 km), June 2022.

Table 3. Dimensional and weight indicators of a bastard sturgeon from Kapshagai reservoir and Ili River.

Fishing place	Fishing date	№	Fish length (L; cm)	Fish length (l; cm)	Weight of fish (g)	Body girth (cm)
In the backwater zone	26.05.2022	1	127.0	108.0	8930.0	42.0
96 km	15.06.2022	2	32.0	27.0	109.0	11.0
96 km	15.06.2022	3	29.5	25.0	99.7	10.5
96 km	15.06.2022	4	29.0	25.0	100.9	11.0
96 km	15.06.2022	5	30.0	27.0	103.5	11.1
96 km	15.06.2022	6	29.5	25.0	118.6	10.6
96 km	16.06.2022	7	31.0	28.0	127.4	11.8
96 km	16.06.2022	8	29.0	25.0	103.4	10.7
96 km	16.06.2022	9	30.5	27.0	120.1	11.2
96 km	16.06.2022	10	35.0	29.5	182.5	12.0
In the backwater zone	18.06.2022	11	31.5	28.0	148.9	11.8
In the backwater zone	18.06.2022	12	29.0	25.0	99.9	10.5
In the backwater zone	18.06.2022	13	29.0	25.0	104.2	11.0
In the backwater zone	18.06.2022	14	25.0	21.5	67.7	10.8
In the backwater zone	19.06.2022	15	41.0	37.0	300.0	16.0
In the backwater zone	04.07.2022	16	47.0	42.5	461.0	19.3
In the backwater zone	10.09.2022	17	62.0	-	1150.0	-
In the backwater zone	10.09.2022	18	55.0	-	630.0	-
In the backwater zone	12.09.2022	19	55.0	-	866.0	-
In the backwater zone	12.09.2022	20	60.0	-	1054.0	-
In the backwater zone	13.09.2022	21	62.5	52.7	1134.0	24.1



Fig. 11. Release of juvenile bastard sturgeon into the basin of the Kapshagai HPP.

When kept in quarantine in the basins of the Kapshagai HPP, the smallest bastard sturgeons were shed. After

temporary holding in the Kapshagai HPP (preparation for transportation), the remaining fish in the amount of 8 individuals were sent alive to the fish breeding site of the Balkhash branch of “RPCF” LLP. At present, bastard sturgeons from the Kapshagai reservoir have adapted to the conditions of RAS at the fish breeding site of the Balkhash branch of “RPCF” LLP. As part of the fulfillment of the tasks set in the R&D Work Program for 2022, work was continued to develop the technology for the domestication of wild bastard sturgeons in the industrial conditions of RAS. So, for instance, an adult bastard sturgeon brought from the Kapshagai reservoir, 127 cm long, weighing 8930 g after 10 days of fasting, gradually began to take artificial food after adding 2 artificially grown Lena sturgeons to it. According to preliminary weighing, bastard sturgeon is actively gaining weight. The absolute increase for the month was 1100 g, and the average daily 37 g. At the same time, the feed coefficient was relatively low (1.7). After another month, its weight increased to 11495 g (an increase from June was 2565), and length to 136 cm (an increase in body length was 9 cm). Sturgeon juveniles caught in Kapshagai reservoir after several days of starvation also gradually began to switch to eating artificial feed. Here, the impetus for a more active diet was the inclusion of the Californian worm mixed with dry compound feed in the diet. In September of this year, 2 bastard sturgeons were caught in the delta lakes of Ili River with following parameters: fish length 98-100 cm and weight 4585-4850 g, which are now undergoing adaptation in the industrial conditions of RAS (Fig. 12). All these facts indicate that the Ili population of Aral bastard sturgeon, previously acclimatized in Lake Balkhash lives in Kapshagai reservoir and Ili River, where its reproduction takes place. However, the extremely limited number of juveniles from reproduction, as well as the constant pressure on them of the widely used net fishing in the reservoir, does not make it possible to increase its numbers.



Fig. 12. Bastard sturgeons caught in the lower reaches of the Ili River.

Thus, the conducted studies have shown the fundamental possibility of wild thorn domestication in industrial conditions. In scientific and commercial catches, only sturgeon juveniles occasionally come across. One of the main ways to preserve the "Red Book" species is the artificial reproduction and stocking of water bodies. Thus, in Kapshagai reservoir and Ili River (upper course), to restore the population of the bastard sturgeon, it is necessary to artificially reproduce it and create conditions under which the mortality of juveniles in the nets reduces. However, given the low probability of capturing sexually mature specimens of bastard sturgeon in this reservoir, it is not possible to obtain mass offspring from them artificially soon. We believe that the most likely and possible way out of this situation is to carry out activities for the purchase of spawners or fertilized bastard sturgeon eggs with further incubation in the conditions of domestic fish farms. For example, in neighboring countries, some fish farms are successfully engaged in artificial breeding of sturgeon, including the cultivation of sturgeon. The bred viable juveniles of bastard sturgeon will make it possible to create repair and broodstocks at the fish farms of the Aral-Syrdarya and Balkash-Alakol basins.

CONCLUSION

The Aral bastard sturgeon, which lives in the reservoirs of the Balkash-Alakol basin, is the only representative of the sturgeon family here. The genetic structure of the bastard sturgeons of the Balkhash and Kapshagai herds needs to be clarified. Until this issue is clarified, it is undesirable to use the planting material of the Ural (North Caspian) bastard sturgeon, as well as to purchase bastard sturgeons from the Russian Federation, for stocking the reservoirs of the Aral-Syrdarya and Balkash-Alakol basins. For the same reason, if a decision is made on the directed formation of the ichthyofauna of the Aral-Syrdarya basin when developing a biological justification for

reintroduction, it is necessary to use the gene pool of bastard sturgeon of the Balkash-Alakol population, since it was previously introduced from the Aral-Syrdarya basin. The suitability of the reservoirs of the Aral-Syrdarya and Balkash-Alakol basins for the naturalization of the Aral bastard sturgeon and even the formation of some commercial stock is confirmed by the actual material of fishery observations, as well as the experience of successful acclimatization work in the Balkash-Alakol basin in 1933-1934. The ecological situation that is developing today in the Aral-Syrdarya and Balkash-Alakol basins (reduction in the stocks of food competitors of bastard sturgeon due to commercial removal, an increase in the proportion of mollusks in the biomass of benthos and the proportion of weed fish in the ichthyofauna) allows us to hope that the introduction of the bastard sturgeon of artificial origin into these water bodies will take place successfully. Notably from an economic point of view, bastard sturgeon is a more valuable species than Russian sturgeon, as it produces caviar of a larger size and lighter shade, which has a higher value on the world market. The factors limiting the number of bastard sturgeons in the water bodies of the Aral-Syrdarya and Balkash-Alakol basins are primarily recognized by all authors as the deterioration of reproduction conditions as a result of hydroconstruction, as well as the high mortality of eggs and juveniles as a result of the influence of predatory fish and irrational fishing. Consequently, the organization of artificial reproduction and rearing of juveniles to viable stages in fish farming conditions should be recognized as a logical measure to preserve the gene pool of this species. The biotechnology of the artificial reproduction of bastard sturgeon differs from other sturgeons only in detail. In general, the same methodological approaches and the same fish-breeding equipment are used for the artificial reproduction of the sturgeon as for other sturgeons. For more than 10 years, Kazakh sturgeon hatcheries in Atyrau have been engaged in the artificial reproduction of the Ural bastard sturgeon. The most suitable of the existing fish farms for the implementation of this project at the initial stage in the Aral-Syrdarya basin is the fish-breeding site Tastak of the State Enterprise "Kamystybas fish hatchery", which has sufficient pond funds suitable for long-term keeping of sturgeon fish, as well as modern fish-breeding equipment, and in Balkash - to the Alakol basin - the production base of the Balkhash branch of "NPC of fisheries" LLP, which has a RAS, long-distance live-fish transport, an incubation shop, and qualified personnel. The study was funded by the Ministry of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan (Grant No. BR10264205). Artificial reproduction in the conditions of fish farming can become a real opportunity to preserve biodiversity and increase the stocks of bastard sturgeon in the water bodies of the Balkash-Alakol basin, as well as provide an opportunity to start work on restoring the stocks of this species in the Aral-Syrdarya basin.

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