Ekoloji 26(99): 1-8 (2017)

Biological Features of Sturgeon in Breeding Process in Pond Fish Farms of Almaty Region

Kenesbai Kairullaev [1], Gulzhan Kulmanova [1], Banu Nurgazy [2], Kuat Nurgazy [1*], Fatima Turganbayeva [1]

[1] Department of the Technologies of production of livestock and fish farming products, Kazakh National Agrarian University, Almaty, KAZAKHSTAN

[2] Department of Biological Safety, Kazakh National Agrarian University, Almaty, KAZAKHSTAN

[*] Corresponding author: nyrgazu_kyat@hotmail.com

Abstract

The purpose of this article is to investigate the optimal environment for (chemical and physical properties of water, feeding type), and biological indicators (growth, development and sustainability) of, sturgeon breeding in pond adopted to natural environmental conditions. The research resulted in data on productive (vital capacity) and biological indicators (weight, length, maximum, nominal and daily average growth of biomass) of four species of sturgeon: Russian sturgeon (Acipenser gueldenstaedtii), Siberian sturgeon (Acipenser baerii Brandt), stellate sturgeon (Acipenser stellatus Pallas), and paddlefish (Polyodon spathula Walbaum). The water analysis has shown the following physical and chemical parameters of water in the reservoirs: pH – 3.8-6.6, total hardness – 2.8-4.8 mg-equ/dm^3. This research shows that the highest rates of daily average growth for the five-month period had the paddlefish fry (24.44 g), Russian (22.13 g) and Siberian sturgeon fry (19.28 g). Final weighting shown that paddlefish fry had the best indicators among all studied species (m=1.8 kg). The coefficient of variation (C_v > 7) indicates high phenotypic variation in all studied species of sturgeon. Ichtyopathological study of experiments revealed that none of stellate sturgeon, Russian and Siberian sturgeon and paddlefish were infected. As it was revealed, feed with higher protein (56% relative to 50 %) causes greater increase in weight (+0.2 kg).

Obtained results show that paddlefish and stellate sturgeon have the best parameters for breeding in ponds. Research results can be applied for sturgeon breeding in ponds with similar chemical and physical properties.

Keywords: sturgeon, Acipenseriformes, aquaculture, hydrochemical composition of water, growth and development of sturgeon, feed for sturgeon, fish diseases

Kairullaev K, Kulmanova G, Nurgazy B, Nurgazy K, Turganbayeva F (2017) Biological Features of Sturgeon in Breeding Process in Pond Fish Farms of Almaty Region. Ekoloji 26(99): 1-8.

INTRODUCTION

Fish culture is one of the profitable sectors of agriculture. It provides the population with one of the most edible valuable product – fish (Mikodina and Hrisanfov 2007).

Every year there is a growing demand for sturgeon, since besides caviar, sturgeon meat, skin, swim bladder are highly appreciated (Podushka and Shebanin 2001). Sturgeons are appreciated not only economically, but also environmentally, because they are an indicator of the purity of the ecosystem. Due to various human activities, sturgeons are now standing on the verge of extinction. Such critical decrease in the magnitude of sturgeon population made the sturgeon culture the only way of producing such a valuable product (Duke et al. 1999, Kazarnikova and Shestakova 2005).

Acipenseri formes belong to chondrostean include family Acipenseridae and family Polyodontidae. Representatives of order are migratory, catadromous and freshwater fish inhabiting the waters of Europe, northern Asia and North America (Billard et al. 2001, Burtzev 1999).

Most of the sturgeons are large, long-living, valuable industrial fish. Sturgeon are taken from natural waterbodies and grown in commercial farms. Therefore, there is an information about the fish growth taken not only as a result of age determination by sectioning dorsal fin rays, but also by tracking the growth during the experimental and commercial cultivation, as well as cultivation of fry as stocking material. The interest to sturgeons hasn't reduced in recent years, and the publications on this topic continue

 Received: 22 Sep 2016 / Accepted: 5 Jan 2017

to emerge both in Russia and abroad (Fedorov 2009Gershanovich et al. 1987, Sulak et al. 2002).

According to available statistics, world's fish rearing for sale will probably supersede fishing in the years to come (Bronzi 2014) at a time of stagnation in the world economy in the conditions of the ongoing economic crisis. Kazakhstan has rich fishery and water resources and favorable conditions for intensive development of fish culture (Fedorov 2006). Considering the predictable increase of the population of the republic and, on the basis of the recommended science standards (14.6 kg per person per year), in order to satisfy the needs of the population in fish and fish products, it is necessary to increase the capacity of catching, cultivation of commercial fish and fish import to 272.0 thousand tons per year (Kobayashia 2015, Mel'nichenko 1992).

This is why fororming, preserving, reproducing and using fish and other aquatic biological resources in fishery water bodies efficiently is so important. Contribution to fishing and fish-processing industries and commercial fish culture development are the main purpose and objectives of the research. The research takes into account the latest methods and modern technologies in the field of world fisheries development (Bronzi 2014).

The purpose of this article is to investigate the optimal environment for (water properties, feeding type) for sturgeon breeding in ponds, as well as to assess the rates of sturgeon growth, development and sustainability, and to conduct ichthyopathological studies. At the end of the research, we found out which of the four species of sturgeon has the best biometrics and is more resistant when it comes to survival. Growth rates were assessed by measuring body length and weight, assuming that length-weight relationship (LWR) plays a significant role in fisheries sciences.

The obtained data on the biological and productive qualities of the four species of sturgeon can be used as a test for the expansion of sturgeon breeding and as practical recommendations for further cultivation in conditions of aquaculture.

METHODS

Study area. The scientific study was conducted at Limited liability partnership (LLP) "Irada balyk", Panfilov district, Almaty region, which is engaged in breeding of trouts and sturgeons since 2008. The production capacity of the fish farm is 500 tons per year. The area of ponds is about 25240 m^2, the area for growing fry – 1800 m2, incubation unit – 1300 m^2.

The objects of the research were valuable commercial fish species (Russian sturgeon (*Acipenser gueldenstaedtii*), Siberian sturgeon (*Acipenser baerii Brandt*), stellate sturgeon (*Acipenser stellatus Pallas*), and paddlefish (*Polyodon spathula Walbaum*)). The optimal temperature for cultivation of this group of eurythermal fish is 17-26 ° C (Billard 2001). Our research has been conducted in the sixth area of aquaculture southern region is characterized by longer growth season (250 – 260 days), ponds are located mainly on rough soils which are watered mainly from mountain streams with low biological productivity (Fedorov 2009). Collection, processing and analysis of informational material were carried out according to established procedure (Lakin 1990, Pravdin 1966). We analyzed water samples from some water bodies located in the Zharkent District (Almaty Region). Water samples were taken in May and June 2014 and analyzed for chemical composition in order to determine hydro-chemical pond regime. The water analysis was performed in the Water Quality Evaluation Laboratory of Kazakhstan-Japan Innovation Center at the Kazakh National Agrarian University. Atomic absorption spectrometer NOVA 350 (Japan) and spectrophotometer SPEKOL 1300 (Germany) were performed for analysis. Determination of physical and chemical parameters of water (Alekin 1959, Lur'e 1973) and ichtiopathological fish evaluation were carried out according to established procedures (Byhovskaja-Pavlovskaja 1985, Golovina et al. 2003). We also assessed the rates of sturgeon growth, development and sustainability, as well as the role of feeding in the change of fish growth rates. We also conducted ichthyopathological studies.

Fishing operations were performed at the control and final stages of the research in order to assess and investigate the sturgeon growth rates. Fish length and weight were measured during the period from May to September. Depending on the live weight, fish were divided up into small/medium/big populations. The main parameters for assessing sturgeon growth and development rates (for each population) were: monthly average weight, weight gain (average daily, absolute, relative), coefficient of variation (Cv), average weight, Fulton's condition factor (Nash, 2006). The coefficient of variation (Cv) was calculated according to Herv'e Abdi (Herv'e Abdi 2010). Measurement of linear and weight growth of fish during bonitation were carried out in accordance with the guidelines for the study of fish (Allaman et al. 2013, Jenkins et al. 2014).

Table 1. Data on the hydrochemical regime of separate waterbodies (May-June 2014)

The name of the water body	pH	Chloride, ppm	Carbonate, ppm	Sulfate, ppm	Nitrate, ppm	Nitrite, ppm	Total hardness, mg-equ/dm^3
pond №1	6.6	85.09	329.5	86.46	0.8	0.22	2.8
pond №2	3.8	92.18	615.0	105.6	1.2	0.01	3.8
pond №3	6.6	120.5	610.2	72.5	0.7	low	4.8
pond №4	6.6	78.0	329.5	120.0	1.2	0.02	2.8
fisheries waters	6.5-8.5				40.0	0.08	no applicable regulations

Death loss was calculated to make estimate of sturgeon survival. In order to assess the vital capacity of sturgeon fry, a daily record keeping of dead fish was carried out at different stages of cultivation in ponds and periodically during the sorting and final seining, a direct method of direct census was applied.

We took two types of feed with different protein content: 48% protein feed OT-6 (Gross energy: 20.1 MJ/kg; Kazahstan) and 56% protein feed "Aller Performa" (Gross energy: 20.3 MJ/kg; Dania) – to analyze the effect of feeding on sturgeon growth. The feeding was done manually according to the calculated norms. The feed was added in portions, according to palatability. Control weighing was carried out regularly (once a month), at which the biomass was measured. Calculation of daily food consumption of sturgeons in pools, ponds, and keep nets was carried out according to established procedures in aquaculture (Ponomarev 2002, Vinogradov 1985). Ichthyopathological studies were conducted using epizootic, clinical and pathoanatomical method, according to the procedure described in (Golovina 2003). All data are expressed as means ± SE; all statistical analyses (calculation of arithmetic mean (X), standard deviation (δ), coefficient of variability (Cv) and mean error (mx)) were performed in the "Biomet" program.

RESULTS

The water analysis has shown the following physical and chemical parameters of water in the reservoirs: pH – 3.8-6.6, total hardness – 2.8-4.8 mg-equ/dm^3, and these rates are significantly lower than those in the Akmola region (Kashulin 2000). The research results of physical and chemical properties of water in reservoirs of Zharkent region showed that all the parameters of the water are favorable for the growth and development of sturgeons. Gaseous regime varies depending on the water temperature. When the water temperature increases – O_2 concentration reduces (from 7.7 mg/l to 5.6 mg/l) and CO_2 concentration increases (from 15mg/l no 27 mg/l), the pH of the water remains on the permissible level.

Table 2. The content of major ions and water salinity (May-June 2014)

Place of sampling	Ca^{2+} ppm	Mg^{2+} ppm	$Na^{+}+K^{+}$ ppm	HCO_3^- ppm	SO_4^{2-} ppm	Cl^- ppm	The amount of ions
pond №1	40.1	9.7	114.9	299.5	86.5	85.1	636
pond №2	60.1	9.7	91.9	615.0	105.6	92.2	975
pond №3	68.1	1.4	193.9	610.2	72.5	120.5	1067
pond №4	36.1	12.1	46.0	329.5	120	78.0	622

Results of the study of individual waterbodies hydrochemical regime of the second year of experiment are presented in **Table 1**.

Content of chloride in the water of studied waterbodies was much lower compared with carbonates and sulfates.

Table 2 shows the content of major ions and the amount of ions in each experimental pond studied in May 2014. Carbonates dominated in the studied waterbodies, sulfates were on second place, chlorides – on the third. Water in investigated waterbodies has medium hardness, neutral pH, no heavy metals Pb, Zn, Cu, Mn. Iron and aluminum salts were absent.

The physical composition – water is clear, transparent, scentless, tasteless and without pollution. The chemical composition – water from different sources is different, carbonate composition of the water dominates, all the waters are neutral, heavy metals are absent.

Mineralization of water in studied reservoirs ranged from 622 ppm (pond №4) up to 1067 ppm (pond №3).

In general, the growth and development of sturgeons at cultivation in ponds (according to size and weight) are shown in **Tables 3-7**.

Table 3. The growth and development of Russian sturgeon fry at cultivation in ponds

Month	Size group,g	n	Average weight gain to the end of month, (X ± mx) g	Growth, g		
				daily average, g	maximum, g	nominal, %
May	Small (75≤)	159	70.1±0.25	0.5	15	24
	Medium (76-94)	212	80.2±0.34	0.63	19	26.9
	Big (95≥)	158	100.1±0.25	0.85	25.5	29.1
June	Small (125≤)	159	120.1±0.25	1.66	50	52.6
	Medium (126-180)	212	160.2±1.22	2.66	80	66.6
	Big (181≥)	158	190.1±0.43	3.0	90	62.0
July	Small (215≤)	159	210.1±0.25	3.0	90	54.5
	Medium (216-225)	212	220.2±0.20	2.0	60	31.5
	Big (226≥)	158	230.0±0.20	1.33	40	19.04
August	Small (245≤)	159	240.1±0.25	1.0	30	13.3
	Medium (246-255)	210	250.0±0.18	1.1	30	12.76
	Big (256≥)	158	260.0±0.20	1.2	30	12.2
September	Small (275≤)	159	270.1±0.25	1.0	30	11.76
	Medium (276-285)	210	280.0±0.18	1.1	30	11.3
	Big (286≥)	158	290.0±0.20	1.1	30	10.9

Table 4. The growth and development of Siberian sturgeon fry at cultivation in ponds

Month	Size group	n	Average weight gain to the end of month, (X ± mx), g	Growth, g		
				daily average, g	maximum, g	nominal, %
May	Small (80≤)	70	75.1±0.38	0.5	15	22.2
	Medium (81-90)	137	85.0±0.22	0.65	20	26.6
	Big (91≥)	132	95.0±0.22	0.85	25	30.3
June	Small(120≤)	70	110.1±0.73	1.16	35	37.8
	Medium (121-170)	137	140.0±1.22	1.83	55	48.8
	Big (171≥)	132	180.1±0.48	2.83	85	61.8
July	Small (210≤)	70	200.1±0.73	2.0	90	58.06
	Medium (211-225)	137	218.0±0.37	2.66	80	44.4
	Big (226≥)	132	235.1±0.48	1.83	55	26.5
August	Small (225≤)	70	220.0±0.37	0.66	20	9.52
	Medium (226-260)	137	245.0±0.85	1.0	30	12.76
	Big (261≥)	130	275.0±0.70	1.33	40	15.6
September	Small (250≤)	70	240.1±0.73	0.65	20	8.69
	Medium (251-285)	137	268.2±0.87	0.83	25	9.52
	Big (286≥)	130	290.0±0.87	0.5	15	5.3

Indices of maximum growth of body weight cannot be the definitive result of the determination of the fry growth rate. In order to get a complete picture of the intensity of growth, daily average and nominal indicators of weight gain of sturgeon fry have been identified (**Tables 3-7**).

The highest rates of daily average growth for the five-month period according dates in **Tables 3-6** had paddlefish fry (24,44 g), Russian (22,13 g) and Siberian sturgeon fry (19,28 g). Their advantage in comparison with the fry of other species is 0.7 g, or 35% ($P< 0.01$). It should be noted that there is a certain tendency of predominance in the daily average growth of all fry in June-July compared with the other months. The lowest

Table 5. The growth and development of stellate sturgeon fry at cultivation in ponds

Month	Size group	n	Average weight gain to the end of month, (X ± mx), g	Growth, g		
				daily average, g	maximum, g	nominal, %
May	Small (55≤)	39	50.1±0.51	0.36	11	24.5
	Medium (56-65)	59	60.0±0.33	0.43	13	24.2
	Big (66≥)	29	70.1±0.48	0.63	19	31.6
June	Small (100≤)	39	90.2±0.92	1.33	40	57.1
	Medium (101-140)	59	122.2±1.30	1.66	50	58.8
	Big (141≥)	29	150.3±0.86	2.66	80	72.2
July	Small (165≤)	39	160.2±0.49	2.33	70	56
	Medium (166-175)	59	170.0±0.33	2.0	60	42.8
	Big (176≥)	29	180.0±0.46	1.0	30	18.1
August	Small (195≤)	39	190.2±0.49	1.1	30	17.1
	Medium (196-205)	59	200.1±0.33	1.0	30	16.2
	Big (206≥)	29	210.1±0.45	1.1	30	15.3
September	Small (225≤)	39	220.2±0.49	1.1	30	14.6
	Medium (226-235)	59	230.1±0.33	1.0	30	13.9
	Big (236≥)	29	240.1±0.45	1.2	30	13.3

Table 6. The growth and development of paddlefish fry at cultivation in ponds

Month	Size group	n	Average weight gain to the end of month, (X ± mx), g	Growth, g		
				daily average, g	maximum, g	nominal, %
May	Small (95≤)	25	90.0±0.59	0.66	20	25
	Medium (96-110)	29	100.1±0.45	0.83	25	28.5
	Big (111>)	27	120.3±0.88	1.0	30	40.0
June	Small (140≤)	25	130.0±0.99	1.33	40	38.09
	Medium (141-165)	29	150.3±0.86	2.33	70	51.8
	Big (166≥)	27	180.0±1.53	2.66	80	50.0
July	Small (225≤)	25	220.2±0.56	3.0	90	51.4
	Medium (225-235)	29	230.1±0.45	2.0	60	30.0
	Big (236≥)	27	240.0±0.50	1.33	40	18.1
August	Small (255≤)	25	250.0±0.61	1.0	30	12.7
	Medium (256-265)	29	260.0±0.61	1.0	30	12.2
	Big (266≥)	27	270.0±0.50	1.0	30	11.76
September	Small (285≤)	25	280.0±0.61	1.1	30	11.3
	Medium (285-295)	29	290.1±0.45	1.2	30	10.9
	Big (296≥)	27	300.0±0.51	1.0	30	10.5

index of daily average growth has stellate sturgeon fry (18.9 g).

Table 7 indicates that we have not found any regularity associated with specific species or season of the year. Siberian sturgeon fry and paddlefish fry had the greatest average length in April and October: they were bigger by 0.1-0.2 cm, or by 2.5-3.5%, ($P<0.01$). At the same time, their average weight for the same period was the smallest compared to Russian sturgeon (1.2 g relative to 01.g and 03.g), ($P <0.01$).

Table 7. The dynamics of growth of sturgeon fry grown at LLP "Irada balyk"

Date of control seining	Fish species	n	Average weight, kg ($X \pm m_x$)	δ	C_v	Average length, cm ($X \pm m_x$)	δ	C_v
17.04.14.	Russian sturgeon	529	1.3±0.01	0.12	9.2	0.48±0.01	0.02	4.2
	Siberian sturgeon	339	1.2±0.01	0.16	13.3	0.50±0.01	0.05	10.0
	stellate sturgeon	127	1.2±0.02	0.19	15.8	0.48±0.01	0.05	10.4
	paddlefish	81	1.5±0.02	0.22	14.7	0.50±0.01	0.05	10.4
15.10.14.	Russian sturgeon	527	1.6±0.01	0.12	7.6	0.58±0.01	0.03	5.2
	Siberian sturgeon	337	1.5±0.01	0.13	8.7	0.59±0.01	0.03	5.1
	stellate sturgeon	124	1.4±0.02	0.19	13.6	0.57±0.01	0.05	8.8
	paddlefish	80	1.8±0.06	0.54	30.0	0.59±0.01	0.05	8.8

Table 8. The growth and survival rate of the sturgeon at cultivation in ponds

Index	Fish species			
	Russian sturgeon	Siberian sturgeon	Stellate sturgeon	Paddlefish
growing period (days)	150	150	150	150
Counted (pcs)	529	339	127	81
initial weight (kg)	1.3	1.2	1.2	1.5
survival rate (%)	97.4	98.3	95.8	99.2
final weight (kg)	1.6	1.5	1.4	1.8
Fulton's condition factor (ea)	0.8	0.7	0.8	0.8
maximum growth (g)	300	300	200	300
daily average growth (g)	2	2	1.3	2
nominal growth (%)	20.6	22.2	18.5	19.3

Table 9. The fish culture indicators of sturgeons at cultivation in ponds with different feed

Type of feed	Fish species					
	Russian sturgeon		Siberian sturgeon		Stellate sturgeon	
	initial weight, kg	final weight, kg	initial weight, kg	final weight, kg	initial weight, kg	final weight, kg
Aller Performa» (Dania) (56% of protein)	1.2	1.4	1.1	1.3	1.1	1.3
OT-6 (Kazahstan) (46-50% of protein	1.2	1.25	1.1	1.15	1.1	1.15

Fish cultural and biological indicators of sturgeon fry at cultivation in ponds for the whole period are shown in **Table 8**.

Analyzing fluctuations of sturgeon fry percent alive at cultivation in ponds it was revealed that this figure ranges from 95.8 to 99.2%. At the same time, paddlefish has a high vital capacity, its death loss among was 0.8%. Comparatively, the highest mortality rate was observed among the stellate sturgeon (4.2%).

The results obtained after two kinds of feed were used for growing sturgeons fry in the ponds are given in **Table 9**.

DISCUSSION

Water testing results (согласно hydrophysical and hydrochemical parameters) obtained for water samples from some water bodies located in the Zharkent District (Almaty Region) satisfy the requirements for fishery waterbodies (Fashtomi 2006).

As can be seen from **Tables 3-6**, average daily weight gain of fry of compared sturgeons depends on species and months of the year. A somewhat different situation is observed in indices of nominal growth of body weight. Stellate sturgeon takes the priority over other species: in June, relative gain in weight was 72 % in big population, while the lowest rate of nominal growth was common for paddlefish fry (50 %). The maximum gain in sturgeon weight was observed in June and July. Of these species, the greatest gain was shown by Russian sturgeon fry (by 90% in June and by 90% in July), and paddlefish fry (by 80% in June and by 90%). The lowest growth peak was shown by stellate sturgeon fry (by 80% in June and by 70%).

Final weighting shown that paddlefish fry had the best indicators among all studied species (m=1.8 kg). Analysis of the body weight of different species of sturgeons shows that in spring and autumn periods paddlefish had the largest proportions than the rest. Difference in weight was 0.2-0.3 kg in spring ($P < 0.05$) and 0.2-0.4 kg in autumn ($P < 0.05$). This result is positive because paddlefish species are endangered (Billard 2001). Russian and Siberian sturgeon stably occupied an intermediate position (1.6 kg and 1.5 kg, respectively). This clearly shows that all kinds of sturgeon have adapted well to the ponds conditions of Zharkent region, because fry body weight is determined by the interaction of genotype with the habitat conditions (Chebanova 2001).

Higher coefficients of variation in body weight (**Tables 3-6**) in the spring and autumn periods are observed in stellate sturgeon and paddlefish, in comparison with other species. This can be explained by that fact that the sturgeon and paddlefish living in ponds of Zharkent region under the same conditions and feeding showed more intensive growth and development (Fashtomi 2006). Siberian sturgeon and stellate sturgeon have shown the lowest average body weight in the spring and autumn periods (**Table 4-5**).

From the **Tables 3-6** we can observe some stable regularity inherent in all studied groups. Within each comparison group, fry of all four species have better growth energy in the summer months. Their superiority of daily average weight gain was 0.2-0.5 g, or 1.3-1.5%, ($P<0.01$) and the nominal growth on 1.0-5.3%. The superiority in body weight and growth rate of fry of all species in this period is determined by water temperature regime.

Analysis of published data shows that the most obvious phenotypic consequence of changes in habitat conditions are change of rate of growth of individuals, their size limits and morphological characters determined by the differences in changes of the growth rate (Kashulin et al. 1999, Nikanorov and Zhulidov 1991).

The coefficient of variation (C_v > 7) (**Table 7**) indicates that all studied species of sturgeon are characterized by a high degree of phenotypic variation (Johnson 2014).

Modern technologies of breeding and rearing of sturgeons allow us to achieve a multiple increase in overall production. Creating of broodstock, lifetime use of broodstock, all-season obtaining of eggs in incubation units, the use of natural and combined feeds are actual problems of artificial cultivation of fry (Bogeruk 2006, Williot et al. 2005, Williot et al. 2007).

Diseases are known to cause significant economic damage for hatcheries both in natural and artificial ponds, Fight with various fish diseases in aquaculture is a rather serious problem today (Lafferty 2015).During ichtiopathological study of scientific experiments, no diseases of stellate sturgeon, Russian and Siberian sturgeon and paddlefish in LLP "Irada balyk" were noted. Acipenseriformes is to a lesser extent than other fish exposed to severe parasitic diseases. Sturgeons are frequently infected by mycobacterial species Mycobacterium marinum, Mycobacterium fortuitum and Mycobacterium chelonae (Novotny et al., 2004). Chinese and Amur sturgeons, for example, were found to be infected by M. Marinum that was strongly pathogenic to fish compared to other bacteria (Mycobacterium chelonae, Mycobacterium marinum, ycobacterium gordonae): it killed 100% of fish in 28 days at 103 cfu/fish (De Feng Zhang 2013). Sturgeons are subjected to such external parasites as Trichodina, Trichodonella, Ichthyophthirius multifiliis, Ichthyobodo, sometimes Ambiphrya, *Amphilina foliacea (*Noei 2011*)*. Gills may be affected monogenea Diclybothrium armatum. The extent of invasion is 12.5% in the Kazakhstan sector of the Caspian Sea (Kahovskij 1991, Noei 2011). Amphilina foliacea parasitizes in body cavity between the internal organs of sturgeons. This parasite is found in 3% of sturgeon in the Kazakhstan sector of Caspian Sea. Metacercaria trematode Diplostomum spathaceum parasitizes in the crystalline lens of an eye of a large number of fish species, including sturgeons (Noei 2011).

It is known that the fish growth rate largely depends on the content protein in feed. During development of effective recipe of combined feed, including combined feed for sturgeon, one of the main objectives is to reduce the cost of feed (DiLauro 1998, Yun et al. 2014). Differences in final survival between treatments were not statistically significant (P>0.05). The acceptance of prepared diets by sturgeon larvae depends on species, size and feeding behaviour of larvae and that these feeds were accepted by the fish, is at least an encouraging result (Kasumyan 2002). Our research revealed that high-protein (56%) feed (Aller Performa) causes 0.15 kg greater gain in weight than the 50% protein feed. Unlike 52% and 50^ protein feeds, 56% protein feed caused the most rapid growth of Persian sturgeon (Pourali Fashtomi et al. 2006).

Thus, according to the results of these studies, it was found that fry of all fish species of the Zharkent region depending on the length of the body are not inferior to standard, length 23-87.2 mm, for fry released into the pond after 10-20 days (Burtsev 2009).

CONCLUSION

In conclusion, this study provides new information on sturgeon breeding for the case of four species: Russian sturgeon (Acipenser gueldenstaedtii), Siberian sturgeon (Acipenser baerii Brandt), stellate sturgeon (Acipenser stellatus Pallas), and paddlefish (Polyodon spathula Walbaum). This information will be useful for fishery research.

By ion composition of water in studied waterbodies, it belongs to the category of calcium bicarbonate water. Hydrophysical and hydrochemical parameters of the aquatic compartment satisfy the requirements for fishery waterbodies.

Depending on the species and season, high variability of fry body length of all species of sturgeon was set. In spring, the fry body length ranged from 0.48 to 0.50 cm (P< 0.01). The highest phenotypic variation (C_v) of the characteristic is observed in fry of stellate sturgeon (in spring C_v = 15.8 and paddlefish (at autumn C_v=30), the lowest – in the Russian sturgeon (in spring C_v = 7.6)

Paddlefish fry had high levels of body weight growth in all periods (spring and autumn) and significantly surpasses stellate sturgeon. Difference in weight was 0.2-0.3 kg in spring (P <0.05) and 0.2-0.4 kg in autumn (P <0.05). As it was revealed, feed with higher protein (56% relative to 50 %) causes greater increase in weight (+0.2 kg).

The survival rate of sturgeons fry at cultivation in ponds is variable from 95.8% to 99.2%. The figures of vital capacity of cultivated sturgeons indicates a good adaptation to the conditions of ponds in Zharkent district. During ichtiopathological study of scientific experiments, no diseases of stellate sturgeon, Russian and Siberian sturgeon and paddlefish in LLP "Irada balyk" were noted.

All species of sturgeon have adapted well to the ponds conditions of Zharkent region. During scientific experiments, no diseases were noted in the studied waterbodies.

REFERENCES

Alekin OA (1959) Methods for studying organic properties and chemical composition of water. Life of USSR Freshwater. USSR Academy of Sciences, Moscow, 4: 213-298.

Allaman IB, Reis RV, de Freitas TF, Freato TA, de Lago A, Costa AC, de Lima RR (2013) Weight and morphometric growth of different strains of tilapia Z. Bras. Zootec, 42(5): 305-311.

Billard R (2001) Guillaume Lecointre Biology and conservation of sturgeon and paddlefish. Reviews in Fish Biology and Fisheries, 10: 355–392.

Bogeruk AK (2006) Biotechnologies in Aquaculture: theory and practice. Federal State Budgetary Scientific Institution "Rosinformagroteh", Moscow, 232.

Bronzi P, Rosenthal H (2014) Present and future sturgeon and caviar production and marketing: A global market overview. J. Appl. Ichthyol., 30: 1536–1546.

Byhovskaja-Pavlovskaja IE (1985) Fish parasites. Study Guide. Nauka. Leningrad, 121.

Burtzev LA (1999) The History of Global Sturgeon Aquaculture. Journal of Applied Ichthyology, 15 (4-5): 325–325.

Burtsev IA (2009) Towards the Definition of Optimal Size-Weight Standards of Hatchery-Reared Sturgeon Fry for Restoration. Biology, Conservation and Sustainable Development of Sturgeons: 359-368.

Chebanova M, Billard R (2001) The culture of sturgeons in Russia: production of juveniles for stocking and meat for human consumption Aquat. Living Resour., 14: 375−381.

De Feng Z, Cheng J, Xu JZ, Tong TL, Li AH, Gong XN (2013) Mixed mycobacterial infections in farmed sturgeons. Aquaculture Research: 1–10.

DiLauro MN, Krise WF, Fynn-Aikins K (1998) Growth and Survival of Lake Sturgeon Larvae Fed Formulated Diets. The Progressive Fish-Culturist, 60(4): 293-296,

Duke S, Anders P, Ennis G, Hallock R, Hammond J, Ireland S, Laufle J, Lauzier R, Lockhard L, Marotz B, Paragamian VL, Westerhof R (1999) Recovery plan for Kootenai River white sturgeon (Acipenser transmontanus). Journal of Applied Ichthyology, 15(4-5): 157–163.

Fashtomi HR, Mohseni M (2006) Survival and growth of larval and juvenile Persian sturgeon (Acipenser persicus) using formulated diets and live food. J. Appl. Ichthyol., 22(Suppl. 1): 303-306

Fedorov EV (2009) Best practices of commercial fish farming in Kazakhstan in market-driven economy. Bulletin of Agricultural Science of Kazakhstan, 1: 59-61.

Gershanovich AD, Pegasov VA, Shatunovskij MI (1987) Ecology and physiology of sturgeons fry. Agropromizdat, Moscow, 215.

Golovina NA, Strelkov JuA, Voronin VN (2003) Ichtyopathology. Mir, Moscow, 448.

Herv´e Abdi Coefficient of Variation (2010) Encyclopedia of Research Design. T housand Oaks, CA: Sage.

Johnson DW, Grorud-Colvert K, Sponaugle S, Semmens BX (2014) Phenotypic variation and selective mortality as major drivers of recruitment variability in fishes. Ecology Letters, 17, 743–755

Kazarnikova AV, Shestakovskaja EV (2005) The main sturgeon diseases in the aquaculture. VNIRO, Moscow, 104.

Kahovskij AE (1991) Disease prevention of bacterial etiology in intensively exploited fishponds. Extended abstract of candidate's thesis. Moscow, 20.

Kashulin NA (2000) Organizational principles of ichthyological monitoring of surface water quality. ECWATECH – 2000: 4th International Congress "Water: Ecology and Technology", 30 May - 2 June, 2000 Moscow, Russia: 622-623.

Kashulin NA, Lukin AA, Amundsen PA (1999) Freshwater Fish of Subarctic as biological indicator of anthropogenic pollution. KSC RAS. Kola Scientific Center, Russian Academy of Sciences, Apatity, 142.

Kasumyan AO (2002) Sturgeon food searching behaviour evoked by chemical stimuli: a reliable sensory mechanism. Journal of Applied Ichthyology, 18: 685-690.

Kobayashi M, Msangi S, Batka M, Vannuccini S, Dey MM, Anderson JL (2015) Fish to 2030: the role and opportunity for aquaculture. Aquaculture economics & management, 19(3): 282-300.

Lafferty K, Harvell C, Conrad J, Friedman C (2015) Infectious Diseases Affect Marine Fisheries and Aquaculture Economics. Annual Review of Marine Science, 7: 471-496.

Lakin GF (1990) Biometry. Moscow, 352.

Lur'e JuJu (1973) Standardized methods of water analysis. Chemistry. Moscow, 376.

Mel'chenkov EA (1992) Paddlefish as a breeding object: Overview "Sturgeons as promising subjectof aquaculture". CRIITEFS, Moscow, 2: 1-12.

Mikodina EV, Hrisanfov VE (2008) Sakhalin sturgeon: a brief chronology of studies on its biology, the development of technology of artificial reproduction and reacclimatization in natural habitat. Scientific and practical conference "The results and prospects of acclimatization", Klyazma. Russia: 79-86.

Nash R, Valencia A, Geffen A (2006) The Origin of Fulton's Condition Factor—Setting the Record Straight. Fisheries, 31(5): 236-238.

Nikanorov AM, Zhulidov AV (1991) Biomonitoring of metals in freshwater ecosystems. Gidrometeoizdat, Leningrad, 312.

Noei MR (2011) Parasitic worms of Acipenser stellatus, A. gueldenstaedtii, A. nudiventris and Huso huso (Chondrostei: Acipenseridae) from the southwest shores of the Caspian Sea. Caspian J. Env. Sci., 9(2): 257-266

Novotny L, Dvorska L, Lorencova A, Beran V, Pavlik I (2004) Fish: a potential source of bacterial pathogens for human beings. Veterinary Medicine, 49: 343–358.

Podushka SB, Shebanin VM (2001) Production of offspring from the manufacturers of the Acipenser nudiventris, kept in fish farms. Scientific and technical bulletin of ichthyology laboratory, 5: 5-9.

Ponomarev S, Gamygin EA, Nikonorov SI, Ponomareva EN, Grozesku JuN, Bahareva A (2002) Technologies of cultivation and feeding of aquaculture species in southern Russia. Nova Plus. Astrakhan, 264.

Pourali Fashtomi H, Mohseni M (2006) Survival and growth of larval and juvenile Persian sturgeon (Acipenser persicus) using formulated diets and live food. J. Appl. Ichthyol., 22 (Suppl. 1): 303-306.

Pravdin I (1966) Guide to fish studying. Moscow: 7-179.

Sulak KJ, Edwards RE, Hill GW, Randall MT (2002) Why do sturgeons jump? Insights from acoustic investigations of the Gulf sturgeon in the Suwannee River, Florida, USA. Journal of Applied Ichthyology, 18(4-6): 617–620.

Yun B, Xue M, Wang J, Sheng H, Zheng Y, Wu X, Li J (2014) Fishmeal can be totally replaced by plant protein blend at two protein levels in diets of juvenile Siberian sturgeon, Acipenser baerii Brandt. Aquaculture Nutrition, 20(1): 69–78.

Vinogradov VK (1985) Biological basis of breeding and rearing of herbivorous fish and the new fish culture objects and acclimatization. Extended abstract of Doctor's thesis. All-Russian research institute of landlocked fish culture, Moscow, 60.

Williot P, Rouault T, Pelard M, Mercier D, Lepage M, Davail-Cuisset B, ... Ludwig A (2007) Building a broodstock of the critically endangered sturgeon Acipenser sturio: problems and observations associated with the adaptation of wild-caught fish to hatchery conditions. Cybium, 31(1): 3-11.

Williot P, Brun R, Rouault T, Pelard M, Mercier D (2005) Attempts at larval rearing of the endangered western European sturgeon, Acipenser sturio (Acipenseridae), in France. Cybium, 29(4): 381-387.