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The Adaptive Abilities of the Natural and the Hatchery Juvenile of Kura Sturgeon (*Acipenser Güldenstadti Persicus Natio Kurensis Borodin*) to Various Environmental Factors in Early Ontogeny

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The present study explores the effects of the growth conditions on food-getting and protective behavioral skills of the juvenile fish of Kura sturgeon *(Acipenser guldenstadti persicus natio Kurensis Belyaeff)* grown in hatchery for 70 days and the wild juvenile fishes of the same age caught in the Kura river. Especial stress is placed on identification of the most sensitive periods of early ontogenesis in development of those vital behavioral responses. It is recommended to release juvenile fish from hatcheries in earlier periods of ontogenesis.

Keywords: *Living conditions, critical periods of development, keeping of the juvenile fish in ponds*

INTRODUCTION

Biodiversity conservation is among the top priorities of the modern science. In recent years there has been a dramatic decrease in abundance of the most ancient fish species – sturgeons in the Caspian Sea.

The dramatic decline in the stocks of sturgeon in natural water bodies is caused by a number of factors including the uncontrolled poaching of the fish irrespective of the age and size, contamination of the fish natural habitats, reduction in effectiveness of natural spawning, decrease in numbers of juvenile fish released from hatcheries etc. (Barannikova et al., 2000; Gerbilsky, 1967; Gorbunov et al., 2002; Hadjiyev, Kasimov, 2005; Ivanov, 2000; Kasimov, 1980; Vlasenko et al., 2002).

At present time, the main area of accumulation of sturgeons in the wild is the Caspian Sea. The majority species of this family are the anadromous fish, that spend most of their life in sea waters before travelling to breed in the upper reaches of rivers, while the offspring born in river waters slip back into sea waters and live there up to the age of sexual maturity.

Since the 50s of the last century, the natural reproduction rate of sturgeon has remarkably reduced as a result of construction of hydraulic facilities on the fish spawning routes in the rivers. At the present time, the natural reproduction of sturgeons occurs only in small areas downstream of those structures.

In order to compensate for the loss of natural spawning grounds in the lower reaches of rivers, sturgeon hatcheries have been built in which eggs gotten from mature sturgeon species are cultivated in hatcheries up to the so-called viable age (2-3 months), after which they are released into natural reservoirs to maintain the natural stocks of the fish. The main idea of fish reproduction in hatchery conditions is to get more offspring and to release larger number of juvenile fish into natural water bodies. By now a great number of dedicated research has been conducted to study the morpho-physiological and biochemical indices of hatchery-grown juvenile fish (Kokoza, 1971; Kokoza, Lukyanenko, 1970; Korzhuev, 1967; Krayushkina, 1968; Lagunova, 1981). However, the survival rate and the level of adaptation of hatchery-grown juvenile fish in natural conditions are poorly understood (Makhmudbekov et al., 1966; Soldatova, 1968; Vodovozova, Kasimov, Soldatova, 1974). Furthermore, the degree of adaptation to particular conditions of rivers of juvenile fish has practically not been taken into account. Probably for this reason, the supposed commercial profit of sturgeons to the released juvenile fish appeared to be by 100 and 1000 times lower than expected.

The point is that, while identifying the period of time required for cultivation of juvenile fish in hatcheries, some important biological characteristics of the fish and the specific environmental conditions of particular region were not fully taken into account including the development of vital behavioral responses ensuring survival in the wild. According to literature data (A.N. Derzhavin, 1956; Ginzburg, 1957; R.V. Hajiyev, R.Y. Kasimov, 2005), in the wild, the juvenile sturgeon slip into the Kura river from the natural spawning areas at age of larvae or when the body weight is between 50 to 800 mg. The bigger individuals rarely occur in catches. Therefore, it was important to carry out the comparative study of the adaptation potential of wild and hatchery-grown juvenile sturgeon of the same age.

It is well known that the protective and food-getting responses play an important role in adaptive reactions of organism, which largely depend on the environmental conditions. In this regard, it was necessary to study the degree of manifestation of these responses in hatchery and wild juvenile fish of different ages comparatively, which would allow to reveal the influence of environmental conditions on development of those responses in early periods of ontogenesis. For this reason, we have studied the degree of formation of protective and food-getting behavioral responses and the effect of environmental conditions on these responses in juvenile sturgeons of different age grown in the hatchery and in the wild. In addition, the resistance to starvation of juvenile sturgeons of natural and artificial generation was studied in order to identify the adaptive potential of juvenile fish grown in the hatchery as compared to those grown in the natural conditions.

MATERIALS AND METHODS

The present study was carried on larvae and juvenile specimen of sturgeon (*Acipenser güldenstadti persicus natio Kurensis Belyaeff*) of different age and size, grown in the hatchery conditions and caught from the Kura river.

The hatchery-grown specimen were taken from the pools of the Kura Experimental Sturgeon Fish Hatchery. The wild juvenile fish was caught in late May - early June with the trawl net employed from motor boat. The caught specimen was examined to indentify the species identity, and to measure the body length and weight.

Trawl caught was conducted at 40-50 km upstream the mouth of Kura river, near Uzunbabaly and Abbasaly villages of Neftchala region of Azerbaijan, in distance of 10-15 km away from the Kura Experimental Sturgeon Fish Hatchery. The areas were selected because normally no hatchery juvenile fish occur in those areas since the juvenile fish released from hatcheries cannot reach those sites. In that particular stage of the development the juvenile sturgeons manifest the instinct to slip downstream in the estuary. Therefore, all the sturgeon larvae and juvenile fish which were caught in that part of the river, were the offspring of natural spawning. In total, trawling caught was conducted 10 times during 3 days. The duration of trawling was 20-35 minutes. In total, 44 specimen of juvenile fish of wild generation were caught.

The caught larvae and juvenile fish were placed into special pans and were transported to the experimental plant where they were replaced into pools with the running water and were grouped into three age groups in accordance with their body size and weight (Table 1).

The wild juvenile sturgeon species were placed into the pools for adaptation for 4-5 days. They were fed daphnia (*D. maqna*) and white flour worms - oligohetams. The hatchery-grown fish was given the same food. The food-getting behavioral reactions of juvenile sturgeons were studied under conditions of free movement in circular pans. The diameter of each pan was 80 cm (Fig. 1).

Two pans (**A** and **B**, see *Fig. 1*) connected by a passage were used in experiments. The left pan (**A**) was divided into two parts by a partition (**a** and **б)**. The partition has a door so that the fish can move from one part (**a**) to another one (**б**). In no-experimental days the fish were fed in the pan **Б**.

In that pans, were placed the fish which were out of the experiment, they did not see experimental fishes as the partition was non-transparant.

Experiments were carried out according to the following schemes: every specimen was taken through the door (з) from the part "**a**" into the part "**б**". The fish were not fed in the day of experiment. In order to ensure the development of conditional feeding reflexes it was nessesary to ensure that the juvenile fish swim to another pan (**Б**) and approch the point of conditional feeding (Г). When the juvenile fish were approaching the point they were given 2-3 worms and simultaneosly a conditional stimulus was presented (light illumination of 40 lux) (Fig. 1).

During the experiment, the conditioned illumination stimulus was followed by the food supply. Eventually the conditioned stimulus was presented at the time when the appeared in the part "б" (pan A).

The manifestation of conditioned food-getting reflex was recorded when the fish in the part "б" (pan A) responded to conditioned stimulus and moved towards the point of food supply (pan Б). A stable conditioned food reflex was recorded if the juvenile fish repeatedly (by 5-6 times) responded to the conditioned stimulus and swam to the feeding point.

During the experiment the conditioned stimulus was presented 7-8 times with interval of 2 minutes. The duration of provocation was 15-30 seconds.

The manifestation of defensive response to predator was studied by placing a few fish specimen to area with predator (river perch). The fish behavior was monitored during 30 minutes (Fig. 2).

Table 1. Body weight and length of the juvenile fish of different generations.

Growth conditions	Age (days)	Fluctuation range	
Hatchery	18-20	140-150	2.8-3.0
	28-35	350-360	4.5-6.1
	50-55	720-1.100	6.2-7.0
	70-80	3.900- 4.500	13.9-14.0
Wild	18-20	90-130	2.9-3.0
	28-35	280-310	4.3-6.2
	50-55	610-900	6.2-6.9
	70-80	–	–

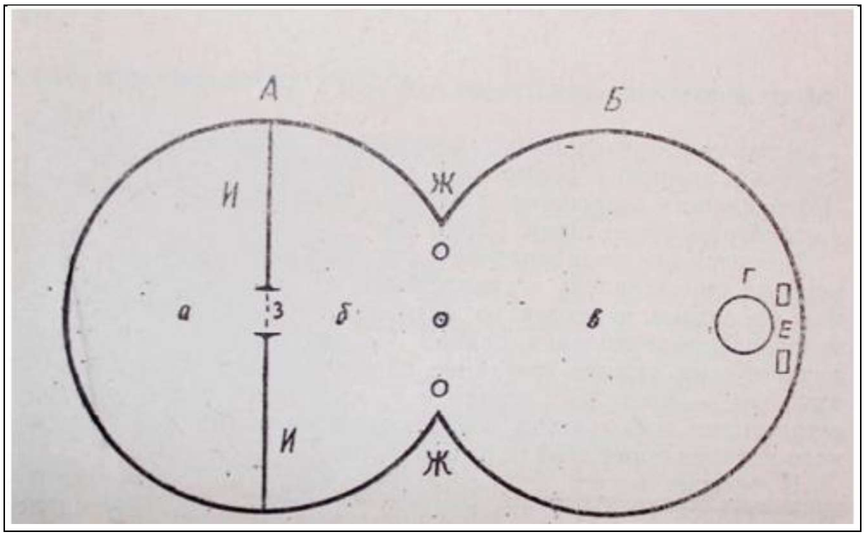

Fig. 1. Scheme of experemental piscicultural pans for development of food conditional responses in the sturgeon larvae and fry

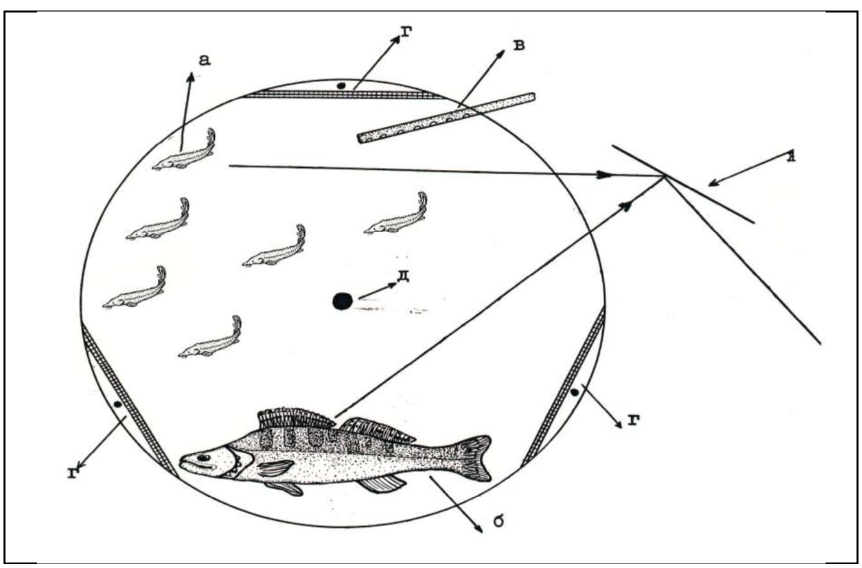

Fig. 2. The fish behavior monitoring during 30 minutes.

Also, was recorded the time of avoidance and hiding of juvenile fish in the presence of predator in their surroundings. To one pan were placed 2 specimen of perch (of sizes of 22 and 36 cm) and 10 specimen of wild or hatchery juvenile fish of the same age. On the next day, i.e. 24 hours later the number of survived juvenile fish was recorded. In total, 4-5 series of experiments were carried out with each age group.

RESULTS AND DISCUSSION

The findings of the present study show that, at the age of 18-25 days, both the hatchery and wild juvenile sturgeons are able to develop the conditioned responses to combination of a neutral stimulus (e.g. light illumination) and biologically important stimulus (food) (Fig. 3). At this age, the hatchery-grown juvenile fish develop the food-getting skills even faster than the wild ones. One possible explanation is the high level of development of orientation responses in the hatchery-grown fish. As to wild juveniles, our point is that the new surroundings causes agitation and anxiety in the wild juvenile fish placed in artificial conditions of pans and it takes some time for the wild fish to get adapted to new conditions.

At the age of 30-35 days, the conditioned food reflex in juvenile fish of both the wild and the hatchery generations is developed faster as compared to the age group of 18-25 days. In the age group of 30-35 days, no differences were recorded between the wild and the hatchery juvenile fish with regard to the rate of formation of the conditioned food responses.

At the age of 50-55 days, the significant differences in the rate of formation of food conditioned responses were recorded between the wild and the hatchery juvenile fish. In particular, the wild juvenile fish develop the responses by 2 times faster as compared to the hatchery species. Also, in hatchery juvenile fish of the age of 50-55 days, the formation of the conditioned food responses required more time as compared to the hatchery juvenile fish of earlier ages (Fig. 3).

We suppose that the abovementioned differences are assosiated with the habitat conditions in the natural and artificial environments, which are reflected in development of the fish nervous cells.

It should be noted that there were differences in manifestation of the protective responses between the wild juvenile sturgeon placed into the hatchery pools, and the hatchery juvenile fish of the same age. To identify the nature of these differences we conducted the comparative study of the behavior patterns of the wild and hatchery juvenile fish in presence of predators. As predator we used the river perch (*Stizostedion lucioperca)* of 22-36 cm. The findings revealed that, at the age of 18-25 days, there were no difference in the survival rate between the hatchery and the wild juvenile sturgeon. Piscicultural pans were used to study the behavior of juvenile fish of different generations in the presense of predator: a - young sturgeons; б– predator; в - tube for water supply; г - source of the conditioned stimulus -light illumination; д - tube for outflow of water; and ж - mirror for observation (*see* Fig 2).

As to the next age group of 40-35 days, during 24 hours the predator managed to catch only 1-3 specimen of the wild fish (50% in average), while this figure was about 20% with regard to the hatchery fish.

Important to note that at the age group of 50-55 days, no case of catch by predator of the wild specimen was recorded while in average 30% of the hatchery juvenile fish got eaten by predator.

At the age of 70-80 days, 25% of the hatchery sturgeon got eaten by predator. The juvenile fish of natural generation of this age were not recorded in the river catches, because normally at this age the juvenile sturgeon move back to the sea waters.

The findings of these experiments allow to conclude that starting from the age of 50-55 days, there is a remarkable difference between the wild and hatchery juvenile sturgeon in manifestation of defensive responses to presence of predator. Specifically, while the wild fish respond to presence of predator by hiding or by rapid swimming away, the hatchery juvenile sturgeon remain neutral to the predator's presense, sometimes even swim towards the predator eventually getting into the jaws (*see* Fig. 2).

The findings of observations of the food-getting activity of the hatchery and the wild sturgeon in the studied age groups reveal no difference for the age groups of 18-20 days and 28-35 days, while at the age of 50-55 days the wild fish find the food by 2 times faster as compared to the hatchery fish (*see* Table 2).

Analysis of the data presented in Table 2 shows that at the age of 18-20 days the fish of both generations need more time to find the food as compared to those at the age of 28-35 days.

One of the distinguishing indicators of habitat of the hatchery and the wild juvenile sturgeon in the Kura river is turbidity of water. Waters of the Kura river becomes muddy after getting the flow from the Araz river. It should be noted that the hatchery-grown juvenile sturgeon that live in clean water up to release from hatcheries, after the release find themselves in the river waters where the visibility is practically equal to zero. The wild juvenile sturgeon which get out from eggs under the Mingechaur reservoir live in clean waters for a few days and then slip downstream into the muddy waters. In areas, where hatcheries release the juvenile fish, the water is muddy. Therefore, the comparison of the behavior of hatchery fish with the wild ones in muddy water was important in order to find out the influence of water conditions upon the development of vital functions of the fish.

The findings of our laboratory research dedicated to the comparative study of behavioral patterns of the wild and the hatchery juvenile sturgeon at different ages, show that, irrespective of the age, the juvenile fish grown in the hatchery, after being transplanted from clean water to muddy water, remain motionless for 60-100 seconds. They do not respond to tactile stimulation, switching of light and other provocations. Only after 2-3 minutes the fish start taking slow swimming movements in different directions. On the 8-10th minute the movement and orientation in the space get normalized, but juvenile fish do not always respond to knocking on the aquarium and to change of light conditions. At the same time, those juvenile specimens that remain in clean water, adequately respond to knocking and changing of the light conditions. In general, the behavioral responses of the hatchery juvenile fish transplanted from the clean water to the muddy water get normalized only after a day.

With consideration of the change in behavioral responses of the hatchery juvenile fish in muddy water, it was important to study the intensity of feeding of the hatchery and wild juvenile fish in muddy and clean water.

The findings of our research showed that the intensity of feeding of the hatchery and the wild juvenile fishes significantly decreased in muddy water (*see* Table 3).

The findings show that the replacement of the hatchery juvenile fish from the clean to the muddy water affect to a considerable extent the intensity of feeding, resulting in its rapid decrease, as compared to the wild juvenile fish in the same conditions. One possible explanation of this difference is that the wild juvenile fish while in the river waters can encounter the turbidity conditions of water while the hatchery sturgeon live in the clean water from the very first days up to the release to the river waters. Therefore, the conditions of muddy water for the hatchery juvenile fish are more significant provocation than the clean waters for the wild juvenile sturgeon.

Our findings allow to suggest that the hatchery juvenile sturgeon, getting into the muddy river waters, may starve for some time and even die due to break-up of the food-getting activity. Therefore, it was important to explore the resistance of the hatchery juvenile sturgeon to starvation.

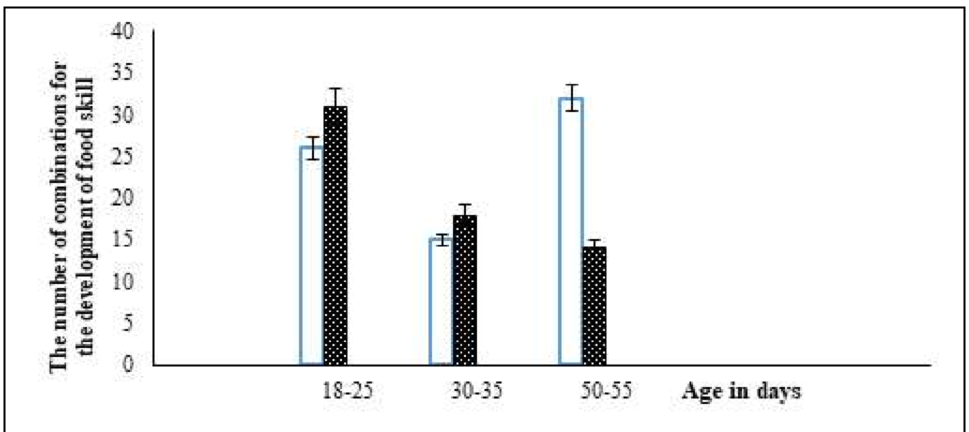

Fig. 3. Development of food skills in juvenile of sturgeon: □ – hatchery; ▒ – wild.

Table 2. Food-getting activity of hatchery-grown sturgeon at different ages.

Age, days	Length, mm	Averages in seconds (*m*±*p*) of food finding by juvenile sturgeon (*p*=5)	
		Wild	Hatchery
18-20	2.8-3.0	42.40±6.18	47.90±5.95
28-35	4.4-6.0	34.20±3.59	32.50±1.98
50-55	6.2-6.8	16.20±2.04	39.60±3.11
70-80	12.0-13.5	-	35.20±4.23

Table 3. The intensity of feeding of the wild* and the hatchery juvenile sturgeon in clean and muddy water.

Age, days	Length (mm)	The average amount of food eaten (mg) in 2 hours by 5 juvenile fishes of sturgeon (experiments were carried out 3 times)			
		Clean water		Muddy water	
		Wild	Hatchery	Wild	Hatchery
18-20	2.8-3.0	14.60±0.88	25.30±0.42	34.60± 0.42	4.00±0.11
28-35	4.4-6.0	276.30±2.18	291.00±3.04	302.00± 1.06	14.30±1.33
50-55	6.2-6.8	312.60±3.16	424.30±1.43	545.00± 1.99	18.60±4.05

* After being caught from the river the wild juvenile fish were transplanted into the pools with muddy water and after 1 day were taken to the experiment.

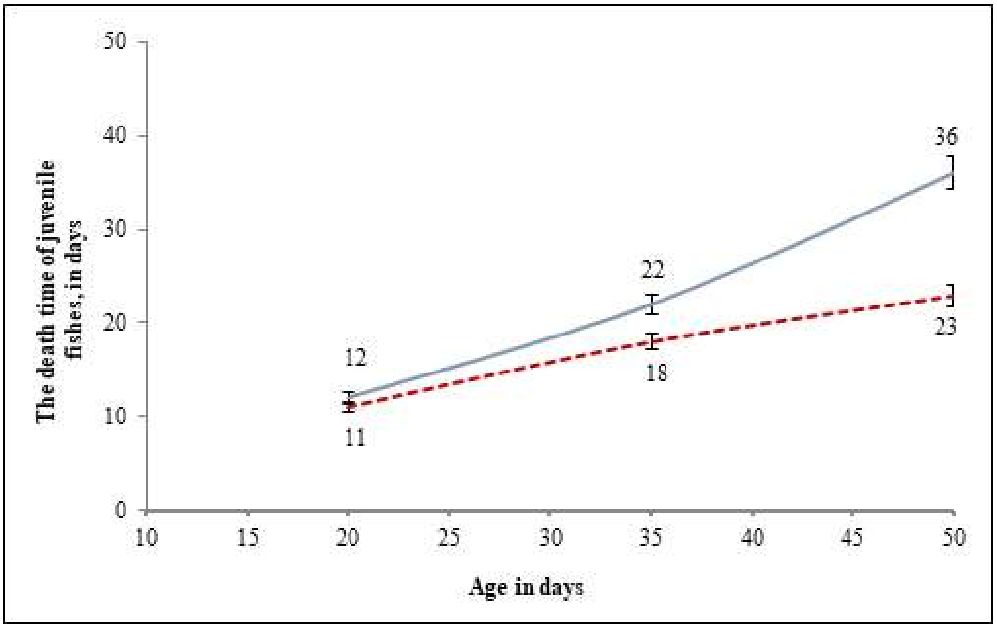

Fig. 4. The averages of death time of the wild (—) and hatchery (---) juvenile sturgeon at different ages after complete deprivation of food.

Three series of experiments have been carried out to explore the adaptive potential of the sturgeon juvenile fish of different age, both the wild and hatchery generations, to survive the full food deprivation. The findings showed that all specimen of both generations at the age of 20 days died after 11-12 days of starvation (*see* Fig. 4). The resistance of both the wild and the hatchery juvenile fish increased in the advanced age groups. In particular, the juvenile sturgeon of age of 35-50 days could survive starvation for a longer time. At the age of 35 days, the specimen of the wild sturgeon appeared to be more resistant to starvation than the hatchery ones (*see* Fig. 4). It should be noted that the same-aged wild juvenile sturgeon is less well-fed in comparison with the hatchery ones, but they are able to survive for a longer time under the conditions of the full food deprivation.

Thus, the findings of the conducted research are indicative of the differences in the level of development of the vital behavioral responses between the hatchery-grown sturgeon juvenile fish released into the natural environment of the river waters, and the wild sturgeon juvenile fish of the same age caught from the river.

We consider this as the reflection of the difference in the informational contents between the natural habitats of sturgeons and the artificial environment of the sturgeon hatcheries.

So far the biological characteristics of sturgeon species grown in hatchery and the direct influence of environmental conditions on development of the most important functions of the fish including the behavioral responses have not been fully studied. At the same it is well known that the structural and functional development of the central nervous system in animals is largely defined by the intensity of sensory stimulation (Nikonorov, 1982; Nikonorov, Obukhov, 1983; Obukhov, Klyuyev, 1988; Vitvitskaya, 1991).

In this regard, it was important to identify the sensitive periods of early ontogenesis in the development of vital behavioral responses of juvenile sturgeon.

The findings of our earlier research reveal that the process of formation of the vital behavioral responses in juvenile sturgeons starts at the age of 18-22 days, and ends at the age of 35-45 days. By the age of 35-45 days the juvenile sturgeon manages to develop the sustainable food and protective behavioral responses (Kasimov, 1980, Kasimov, Obukhov, Rustamov, 1986; Obukhov, 1996).

The comparative study of behavioral patterns of juvenile specimen of different age of the wild and the hatchery sturgeons showed that at the age of 18-25 days there were no significant differences in the nature of manifestation of the food-getting and protective behavioral responses. Apparently, after hatching and up to the age of 18-25 days, the behavioral responses of the fish is determined mostly by the inborn reactions, while in more advanced age periods, the environmental conditions play the dominant role in the formation of both neuronal structures of the central nervous system and the most important behavioral reactions.

In more sensitive periods of ontogenesis (age of 25-55 days), the formation of the most vital functions is influenced by both the internal i.e. the genetically inherent, and the external i.e. the environmental factors. Among the latter we should note such environment parameters as temperature, salinity, illumination, oxygen content, pH of environment, food organisms, natural enemies etc.

The findings of comparative study of food-getting and protective behavioral responses of hatchery and wild juvenile fishes of sturgeon in these sensitive stages of development show that the formation and manifestation of these responses significantly differ between the natural and artificial generation of sturgeons.

During the period of ontogenesis when the most important morpho-functional functions of the fish are developing, the juvenile sturgeon grown in the hatchery can easily find the sufficient amount of food in the surrounding habitat only in the absence of predators, while the juvenile of the same age caught from the river waters can manage finding the food in the presence of predators as well. In other words, the hatchery and natural environments differ from each other with regard to intensity of sensory stimuli. Probably, that is why the abovementioned responses are less manifested in the hatchery juvenile fish in comparison with the wild ones.

Previously, it was shown that the cultivation of the juvenile fish in the sensory-depleted environments slows down the brain development, decreases the intensity of DNA/RNA synthesis in the neurons, affects the CNS-adaptive potential, and eventually led to change in the development rate of a number of conditioned reflexes and in ability to preserve the acquired skills (Kasimov, 1970; Kasimov, 1980; Nikonorov, etc., 1988; Vitvitskaya, 1991).

Our data suggest that, for better adaptation to the river conditions, it is necessary to release the juvenile sturgeon at the age of 28-35 days, when the morpho-functional responses of the fish are developing. This facilitates the process of formation of these functions in accordance with the conditions of the habitat, ensuring thereby the formation of behavioral responses required for better survival and adaptation to natural conditions.

More prolonged cultivation of juvenile sturgeon in the hatchery conditions (for 70 or more days) results in development of behavioral responses that ensure the survival of the fish in the hatchery conditions and those of aquaculture. In the artificial conditions of hatcheries and aquaculture, the fish are more well-fed, grow better and have high survival rates due to the better food supply and the absence of predators. However, the hatchery juvenile fish when get into the natural environment have a great loss due to difficulties in getting adapted to new conditions.

Probably, when food is enough in the surrounding environment, the metabolism processes in the hatchery juvenile fish are accelerated in comparison with the wild ones, which encounter challenges to find the food. Accordingly, the metabolism of the wild juvenile fish goes in a more efficiently way, in accordance with the conditions of their habitat.

It was shown that the biochemical indicators of caviar of the wild Black sea perches and hatchery ones differ considerably from each other (Seaborn et al., 2009). The significant differences in the level of highly unsaturated fatty acids in muscles, liver, ovaries and eggs of the wild and domesticated silver eels were also found by Japanese scientists (Ozaki et al., 2008).

The difference in various indicators between the wild and the hatchery generations of different fish species of fish are noted in other studies as well (Theriault et al., 2010; Usova, 2009; Velyansky et al., 2009; Vokota Takashi, et al., 2007).

CONCLUSION

The findings of our research allow to conclude that while cultivating sturgeon species in the hatchery conditions, it is necessary to take into consideration the biological peculiarities of development in the natural conditions, especially during the critical periods of formation of the most important physiological functions.

In this regard, especial consideration should be given to identifying the age periods, during which formation of most important morphological and functional indicators takes place that ensure the survival of the fish in a particular habitat conditions.

Our findings show, for that for the Kura sturgeon, the age of 28-45 days is a sensitive period of ontogenesis, when the most important functions of the fish organism are being formed. In this particular period of ontogenesis, the habitat conditions play especially important role. Therefore, the natural environment conditions present a number of challenges for the sturgeon juvenile cultivated in the artificial environment of hatcheries, with sufficient food and in absence of predators.

With consideration of all abovementioned, we would recommend to release the juvenile fish of the Kura sturgeon from hatcheries into the river waters at the age of 28-30 days, with the body weight of no less than 1 g., when the fish most important morphological and functional characteristics just start to get their shape, to ensure the further development of these functions in accordance with the conditions of the natural habitat. Our understanding is that the release of juvenile fish at this age will facilitate better adaptation to natural conditions and contribute to efficiency of hatchery breeding of sturgeons in the Kura-Caspian region.

Thus, our research has shown that the natural (wild) juvenile fishes of age up to 20 days do not differ in their adaptive abilities from the hatchery ones. However, the wild fishes of older age (more than 45-50 days) differ markedly from the hatchery ones in high adaptive abilities (resistance to starvation and fluctuations in environmental factors).

We consider that in order to effectively replenish the sturgeon population in the Kura-Caspian region and to improve their gene pool, it is recommended that the natural reproduction of these fish in Kura be maintained and expanded by prohibiting fishing during their spawning in the river (May and October) to ensure the admission of producers to existing spawning grounds. During this period, it is necessary to strengthen protection measures from the mouth of the rivers to spawning grounds of sturgeon.

It is necessary to release the juvenile fishes of sturgeon, grown in the hatchery, into the river or sea at the age of 35-45 days, when food-getting and protective behavioral responses begin to form. Delay of the juvenile sturgeons in the hatchery after the age of 45 days leads to weakening of their protective and food-getting responses which are necessary for better survival in the wild (natural) environment.

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Təbii Və Zavod Şəraitində Böyüdülmüş Kür Nərə Balığı (*Acipenser Gueldenstaedtii Persicus Natio Kurensis Borodin*) Körpələrinin Erkən Ontogenezdə Mühitin Müxtəlif Amillərinə Uyğunlaşma Qabiliyyəti

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Məqalədə Kür çayından ovlanmış və zavod şəraitində nəsil alınıb böyüdülən eyni yaşlı nərə körpələrinin qida tapma və müdafiə davranış reaksiyalarını və aclığa dözümlülüyü, yaşama qabiliyyəti müqayisəli öyrənilmişdir. Məlum olmuşdur ki, 20 günlük yaşa qədər bu göstəricilərdə, təbii şəraitdən ovlanmış və süni-zavod şəraitində böyüdülmüş körpələrdə fərq müşahidə olunmur. Bu dövrdən sonra qida tapma və müdafiə davranış reaksiyaların formalaşması mühitdən asılı olaraq 30-45 günlük yaş dövründə püxtələşir və göstərdiyimiz davranış reaksiyaları zavod şəraitində böyüdülən körpələrdə, təbii şəraitdən ovlanmış eyni yaşda olan fərdlərdə daha zəif olur. Bunları nəzərə alaraq zavod şəraitində böyüdülən körpələri 30-45 günlük yaşında təbii şəraitə buraxılması tövsiyə olunur. Təbii şəraitdə böyüdülmüş körpələrin yüksək uyğunlaşma qabiliyyətini nəzərə alaraq nərəkimilərin təbii yolla nəsil verib, böyüməsini təmin etmək üçün təkliflər verilir. Bütün bunlar nərənin genofondunun qorunmasına və onların Xəzər dənizində ehtiyatlarının artırılmasına kömək edə bilər.

Açar sözlər: *Həyat şəraiti, inkişafin böhranlı periodları, körpə balıqların hovuzlarda saxlanılması*

Адаптационные Способности Естественной И Заводской Молоди Куринского Осетра (*Acipenser güldenstadti persicus natio Kurensis Borodin*) К Различным Факторам Среды В Раннем Онтогенезе

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В статье приведены данные о сравнительном изучении пищедобывательных и оборонительных поведенческих реакциях, а также устойчивости к голоданию и жизнеспособности у молоди осетровых, выловленных из р. Кура, и потомства рыб, которое было выращено в заводских условиях. Все изучаемые образцы относились к одной возрастной группе.Установлено, что в возрасте до 20 дней не наблюдается разницы в вышеперечисленных показателях между особями, выращенными в естественных и искусственно-заводских условиях. По истечении этого периода происходит усовершенствование пищедобывательных и оборонительных поведенческих реакций в зависимости от среды обитания, и по этой причине у осетровых в возрасте 30-45 дней, выращенных в заводских условиях, показанные поведенческие реакции бывают слабее, чем аналогичные у рыб этой возрастной группы, выловленных из естественной среды. Принимая во внимание вышесказанное, рекомендуется выпускать осетровых, выращенных в заводских условиях, в естественную среду обитания в возрасте 30-45 дней. Учитывая, что особи, выращенные в естественных условиях имеют высокую приспособляемость, в данной работе даются предложения по естественному приросту осетровых. Всё вышеизложенное может способствовать охране генофонда и воспроизводству их запасов в Каспийском море.

Ключевые слова: *Условия жизни, кризисные периоды развития, содержание молоди в водных бассейнах*