

A Review of Ecological Features of Fishes Inhabiting Chatkal Biosphere Reserve in Uzbekistan

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Abstract: This paper provides brief data on the distribution, morphology, biology and way of life of the fishes inhabiting rivers located in Chatkal Biosphere Reserve. The rivers of this reserve are inhabited by cold-loving fishes adapted to mountain conditions. These fishes are characterized by low fecundity, bigger size of eggs and a slower growth. Most of these fishes are small inhabitants of stony-pebble parts of the rivers and are capable of pressing themselves to the bottom and hiding themselves behind stones.

Key Words: ichthyofauna, nature reserve, fish, fecundity, spawning, coloration, fin, ecosystem.

Çatkal Biosfer Milli Parkı İrmaklarında Yaşayan Balıkların Ekolojik Özellikleri

Özet: Makale'de Çatlak biosfer milli parkı ırmaklarında yaşayan balıkların yaşam tarzı, biyolojisi ve dağılımı ile ilgili özet bilgiler yer almaktadır. Bu milli parkta bulunan ırmaklarda dağ koşullarına uyum sağlamış soğuk su seven balıklar yaşamaktadırlar. Bu balıklar düşük yumurta verimi, iri yumurta, ve yavaş büyüme özellikleri gösterirler. Bunlar, küçük balıklar olup, ırmak dibinde taşların arasına saklanarak yaşamlarını sürdürürler.

Anahtar Sözcükler: İhtiyofauna, koruma alanı, balık, yumurta verimi, renk deseni, yüzgeç, ekosistem

Introduction

The fish fauna of nature reserves in Uzbekistan evidently has not received the attention it deserves, for even annotated lists of fish species are unavailable, as yet. Adequate data on the fishes of Chatkal Biosphere Reserve have not been available, nor have any special ichthyological studies ever been conducted there the literature provides only patchy information on the fishes inhabiting in the river systems of the Chatkal Ridge (9).

Thus, the aim of this research was to study the ecological features of the fishes inhabiting the river systems of the Chatkal ridge, which are not subject to any direct anthropogenic effect.

Materials and Methods

The material was collected in April-August, 1996-1997, in the rivers situated in the area of Chatkal Biosphere Reserve. Fish individuals were collected using 12-18 mesh net, landing nets and hook tackle. Analyses were made using the newly-caught fish individuals and those fixed in 4% formalin solution, as described by

Pravdin (8). The fish age was determined by fish scales (3) and vertebrae.

Characteristics of Areas Survey

Chatkal Biosphere Reserve was founded in 1947 for the protection of a natural complex of mountain juniper forests, its diverse ecosystems and the gene pool of rare and vanishing animal and plant species. This reserve is situated on the offshoots of the Chatkal Ridge, the Western Tien Shan, occupying an area of 35,000 ha. The geomorphologic area of this reserve is divided into two separate sites: Bashkyzylsai and Maidantal. The Maidantal site is situated on the northern slopes of the Chatkal Ridge, at altitudes of 1200-3800 m above sea level, and lies over 50 km from the former site. The major river systems in this reserve are the rivers Bashkyzylsai and Tereklsai, respectively. They both have a developed river network.

The River Bashkyzylsai starts as a spring at an altitude of 3040 m above sea level, and runs across the whole territory of the Bashkyzylsai site of Chatkal Biosphere Reserve. It has nineteen tributaries, the largest of which is the Kyzylolma.

The River Tereklsai with its numerous tributaries lying in the Maidantal site is a source, located at an altitude of 3700 m above sea level, of the River Akbulak, one of the largest tributaries of the River Chatkal.

All of these rivers and rivulets are characterized by the prevailing low water temperature, excessive oxygen content, swift flow, shallow depth, mobile bottom ground, significant changes in the runoff and, finally, a qualitatively and quantitatively poor forage basis.

Such severe dynamic conditions warrant a necessity for the fish to develop corresponding adaptive features. The fish fauna has been significantly impoverished and consists of only a few adapted fish species.

Some ecological questions (morphology, biology and way of life) of the fishes inhabiting Chatkal Biosphere Reserve are considered below.

Description of fishes

Schizothorax intermedius McCLELLAND, 1842. These fish inhabit all the rivers and rivulets, including some springs, located in this reserve, being more numerous in the lower parts of the rivers and scarcer in the upper reaches. No individuals of this species have been recorded in small brooks, or tributaries of Tereklsai and Bashkyzysai.

Sch. intermedius prefers cool, rapid, but not rough, flows with a bottom of stone or pebbles. They usually gather in shoals in small pits and gullies and do not migrate far. We collected 98 individuals of body length ranging from 10 to 30 cm and weight from 16 to 400 g.

The population of *Sch. Intermedius* is a wide-mouthed form with a horn cover on the lower lip. Rays in the dorsal fin III¹ 7-8²; anal fin III 5; pectoral fin I 15-17; ventral fin I 8-9; in the lateral line 90-100 scales; transverse rows of scales 110-145; gill rakers 12-14; vertebrae 40-43.

The background coloration grayish-brownish. The back dark grayish-brown; the head olive-green, sides and abdomen light yellow.

In the rivers of Chatkal Biosphere Reserve, *Sch. Intermedius* reaches maturation at an age of 3-4 years and at a body length of 15-20 cm. Males usually mature one year earlier than females. When spawning, the fish move upstream until they reach the mid-part of the river, also swimming into the large tributaries. The spawning takes place only once and lasts from May to June when

the water temperature reaches 10-12°C; the spawning ground is usually sandy-stony with a slow flow.

Individual absolute fecundity (IAF) of *Sch. Intermedius* in the Tereklsai ranged from 5,700 to 12,500 eggs, as the body length ranged from 22 to 29.5 cm and body weight from 136 to 380 g.

In the Bashkyzysai, *S. Intermedius* shows lower fecundity: 2.7 to 8.3 eggs, as the body length ranges from 20 to 28 cm and body weight from 100 to 260 g. The eggs are large, the diameter measuring 0.8 to 1.9 mm, and sticky. The food for *Sch. Intermedius* consists of small aquatic fauna, aquatic vegetation and detritus.

Diptychus dybowskii KESSLER, 1874. This species inhabits high-mountain rivers and lakes. In Chatkal Biosphere Reserve, it has been recorded in the rivers Tereklsai and Kainsai (a big tributary of the Tereklsai), but not in the River Bashkyzysai. It abounds in the mid-parts of the rivers, rivulets and brooks.

Individuals of this species prefer parts of rivers with rather swift, but not rough flow, cool and transparent water rich in oxygen, and ground of stone and pebbles.

Small shoals of *D. dybowskii* can be usually observed in pits below waterfalls, in sandy river channels and small recesses by large stones. They often make short movements around, either alone or in groups of three or four individuals. Twenty-nine individuals measuring 11-23 cm and weighing 15-67 g were collected.

Rays in the dorsal fin II-III 9; anal fin II-III 5; pectoral fin I 16; ventral fin II 8-9; in the lateral line 84-94 scales; gill rakers 10-12; vertebrae 42-44.

Body coloration dark brownish-gray or yellowish (in brooks) shot with green. Sides and abdomen silvery-yellow, covered with numerous dark violet dots. The dorsal fin dark with yellowish tinge and black dots, other fins pink of varying intensity, more often orange-yellowish.

D. dybowskii matures at an age of three years, as the body length reaches 10-15 cm. Mass maturation takes place only when the fish are four years of age. Females usually mature one year later than males as they reach 15-18 cm in length.

In spring these fish form small pre-spawning groups to move to the upper reaches of the rivers and their tributaries. The spawning takes place only once; however, it is very prolonged—from early April to September. The

¹ Roman numbers stand for bony ray number.

² Arabic numbers stand for cartilaginous number.

prolonged spawning is due to different time of maturation and spawning of these fish. By the time of breeding, they are divided into early- and late-spawning groups. The pre-spawning migrations of the early-spawning fish begin in April and last until June. They spawn in the tributaries of the rivers Terekklisai and Kainsai, on stony and pebble beds, not far from water sources, at a water temperature of 7-8° C. The spawning migration of the late-spawning group begins in late June-early July, immediately after snow-patches have melted. The roe is cast in the same spawning ground in July-August, at a water temperature of 10-12° C.

IAF of *D. dybowskii* in the River Kainsai reaches 2,300 to 4,100 eggs, as the females reach 19.5-21 cm. The same indices in the River Terekklisai ranged between from 3,000 to 4,700 eggs, the body length of the females reaching 20-22 cm. The eggs are large, ranging from 1.7 to 2.8 mm in diameter. *D. dybowskii* feeds on insect larvae, *Trichoptera* and water weeds.

Noemacheilus stoliczkai elegans (KESSLER, 1874). This is a typical representative of the mountain fish fauna and endemic to the basins of the River Syr Darya, Chu and Lake Issyk Kul. In the Chatkal Biosphere Reserve, these fish inhabit in the River Terekklisai and its tributaries including small rivulets and brooks. No records of this fish are available from the River Bashkyzylsai.

N. stoliczkai elegans prefers fast-flowing parts of rivers with cold water and a river bottom of stone and pebbles. They usually keep to the very bottom in shallow parts of the river, lying most of the time amongst and below stones. Adult individuals can form groups of varying numbers (from 2-3 to 8-10 individuals) or keep alone, and sometimes lead a migratory way of life. Juneniles never migrate and prefer living in small shoals. Sixty-nine individuals collected by us had a body length from 39 to 118 mm and body weight from 0.5 to 13.7 g.

Rays in the dorsal fin III 6-7; anal fin III 5; pectoral fin 1.9-10. Pores in the lateral line 86-88. The number of gill rakers 12-14; vertebrae 39-41.

Body coloration light-brownish with dark horse-cloth-like dots at sides. Dorsal and caudal fin covered with dark dots.

N. stoliczkai elegans matures at an age of 2 or 3 years, as their body length reaches 60-70 cm. In spring these fish migrate for breeding to the upper reaches of rivers and their tributaries. The breeding of these fish usually takes place as the water temperature reaches 8-10°C. The spawning takes place from April through

August. Such a long spawning is due to portioned egg shed and different time of spawning among various groups. The roe is usually cast on the sand-stony bottom, at sites with quiet water flow, sandbanks and shallows (5).

In the River Terekklisai, the absolute fecundity of *N. stoliczkai elegans* being between 75-118 mm, ranged from 987 to 6031 eggs; in the Kainsai, 68-110 mm, 867-4659 eggs as the their body length reached 0.7-1.2 mm. *N. stoliczkai elegans* feeds mainly on the *Chironomidae* larvae, *Trichoptera*, *Ephemera* and weeds.

Noemacheilus kuschakewitschi HERZENSTEIN, 1890 is endemic to the basin of the River Syr Darya, inhabiting semi-mountain type rivers with clean and transparent, rather fast-flowing water and bed of sand and pebbles. This species, individuals prefer sites with relatively slow water flow and most of their life keep to well-warmed parts of the river, lying inactively amongst stones.

N. kuschakewitschi inhabiting the Syr Darya change their habitats for the mountain zone only during the period of fattening and breeding. Therefore, they only irregularly come to the rivers of Chatkal Biosphere Reserve. They are seldom encountered in separate parts of the lower reaches of the rivers. Terekklisai and Bashkyzylsai. We collected thirty-two individuals measuring from 39 to 100 mm and weighing from 0.7 to 9 g.

Rays in the dorsal fin II-III 7; in the anal fin II-III 5; in the pectoral fin I 8; in the abdominal fin II 7; 103-108 tubules in the lateral line; gill rakers 13-14; vertebrae 40-42.

The body is yellowish-gray in color with dark-brown spots at the sides which form cross lines at the tail trunk.

N. kuschakewitschi matures at the age of 2 or 3 years. In the rivers of Chatkal Nature Reserve the size of the first spawning fish reach 45-50 mm. In mid-June, they start migrating for spawning to the mid-parts of rivers. They usually migrate in small groups consisting of 10-15 individuals, sometimes alone. A signal for spawning appears to be a change of hydrothermic changes in the rivers due to the inflow of the cold water from the upper reaches as a result of snow melting. They spawn in late June-July on sand-stony or pebble beds at water temperatures of 15-17° C. The spawning is repeated.

The fecundity is not high. Therefore, in the River Terekklisai, the fish 61 to 95 mm in size spawn only 93-160 eggs. The absolute fecundity of *N. kuschakewitschi*

from the River Bashkyzylsai ranged from 89 to 115 eggs, as their size reached 55 to 83 mm. The diameter of eggs reached 1.0-1.7 mm.

These fish usually feed on small bottom invertebrates and detritus.

Glyptosternum reticulatum McCLELLAND, 1842. These fish inhabit clean mountain and foothill parts of rivers, smaller streams and rivulets. They are seldom encountered in the rivers flowing into the Chatkal Biosphere Reserve and are seasonal migrants to the Terekklisai, into which they come in insignificant numbers for spawning. In the Bashkyzylsai, however, these fish show a fragmentary distribution in separate lower and mid-parts, but do not migrate to the high-mountain part of the river. These fish mainly keep to fast-flowing parts of the river with a stony ground. However, they cannot resist the current of muddy flows and are drifted downstream. Most of their time they spend motionless.

G. reticulatum is a nocturnal fish living on the river bottom. During the daytime they hide beneath stones and in the evening move in search for food within a restricted station. Local shoals of *G. reticulatum* restricted to certain habitats have been reported in Chatkal Biosphere Reserve. The sizes of the collected individuals of *G. reticulatum* ranged from 5.9-15.7 cm and the weight from 7.8-53.5 g.

In the dorsal fin I 6 rays; anal fin II-III 5; pectoral fin I 11; abdominal fin I 5; gill rakers 10; vertebrae 33.

The body coloration yellowish-brown; abdomen light in color.

G. reticulatum matures at an age of 2-3 years, as the body size reaches 10-12 cm. In spring spawners migrate to the upper reaches of rivers and their tributaries. The spawning migration begins in late May-early June and finishes by mid-June. The portioned spawning takes place in mid-June through July, at a water temperature of 14-15° C, mainly on stony and stony-pebble ground.

The absolute fecundity of *G. reticulatum* in the Terekklisai ranged from 120-297 eggs, as the body length of the females reached 10.2-15.1 cm, whereas in the Bashkyzylsai the females with the length of 11.7-14.9 cm had 147-235 eggs. The eggs are sticky and large, of diameter 1.2-2.6 mm.

G. reticulatum feeds mainly on the *Chironomidae* larvae, *Ephemera*, *Trichoptera*, and very seldom on small fish, mostly *N. kuschakewitschi*.

Cottus jaxartensis BERG, 1916 is a cold-loving bottom fish inhabiting the mountain and foothill rivers, streams and rivulets. This fish is endemic to the basin of the River Syr Darya. In Chatkal Biosphere Reserve, *C. jaxartensis*, inhabits parts of rivers with pure, transparent water and fast current and stony and stony-pebble, more seldom with sandy-stony ground on the river bottom. These fishes are scarce in the Terekklisai and Kainsai and not found in the Bashkyzylsai.

C. jaxartensis is inactive and does not gather in shoals. Most of their time they spend hiding below stones and leave their shelter in search of food. Their movements are restricted to a small area. The individuals that we caught were 33-90 mm in length and 0.2-13.5 g in weight.

Rays in first dorsal fin VII-VIII; in second, 16-18; in anal fin 11-13; in pectoral fin 13-14; in abdominal fin I 4. In lateral line 32-35 pores; gill rakers 5; vertebrae 32.

The body coloration grayish-brown or light grayish-brown or light grayish-brown with dark small spots forming 4-5 cross stripes at sides. All the fins but the abdominal ones dark. The abdomen light in color.

C. jaxartensis matures at an age of two years when 40 mm in length. In spring (mid-April) they gather in small shoals and migrate slowly to the upper reaches for spawning. In the rivers flowing in the territory of Chatkal Biosphere Reserve, the spawning, which takes place only once, continues from early May until June as the water temperature reaches 6-8° C. Males protect the roe until juveniles appear from them.

The absolute fecundity of *C. jaxartensis* in the Terekklisai varies from 97 to 280 eggs as the body length of the females reaches 53-87 mm. The fecundity of the females in the Kainsai ranged from 84 to 350 eggs, the diameter of the latter reaching 1.6-2.2 mm.

C. jaxartensis feeds on the larvae of *Ephemera*, *Trichoptera*, *Chironomidae*, and sometimes on fish fry.

Conclusions

In mountain river ecosystems, severe abiotic factors in large quantities predetermine the morphologic and ecological traits of the fish inhabiting them. The mountain community includes cold-loving fish that are extremely resistant to the severe and variable effects of the external factors. Most of these fishes are able to attach themselves to the substratum, move by jerks, press themselves to the bottom and hide in shelter amongst stones from powerful

currents (*G. reticulatum*, *C. jaxartensis*, *N. stoliczkai* and *N. kuschakewitschi*) (2,7). Also reported here are excellent swimmers with elongated bodies and strong tail trunks and fins that are able to move across swift current and small waterfalls (*Sch. intermedius*, *D. dybowskii*). All of them lead, more or less, a settled life. Migrations (*Sch. intermedius*, *D. dybowskii*) are not typical of these fishes—they only make seasonal movements to a greater (*Sch. intermedius*, *D. dybowskii*) or to a lesser (*N. stoliczkai*, *N. kuschakewitschi*, *G. reticulatum*, *C. jaxartensis*) span due to the peculiarities of their reproduction and wintering. The movements of the fishes when searching for food are limited to small stations (1,4,6,7,9).

The fish species composition varies over stations. A shallow-water pebble (pebble-sandy) zone, where the depth of water is insignificant, is inhabited by *N. stoliczkai*, *N. kuschakewitschi*. Sometimes *G. reticulatum* can be observed in this zone.

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