FISHERIES IN THE ZARAFSHAN RIVER BASIN (UZBEKISTAN)

by

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Abstract

The Zarafshan River is the third largest river of Uzbekistan. The water quality in the river deteriorated under the impact of the return water from irrigation and waste waters from towns, increasing the water salinity and pollution. The connection of the Zarafshan River with the Amu-Darya through an irrigation canal has enhanced the fish species diversity and improved the water situation in a number of lakes and reservoirs. In Tudakul reservoir a fish catch of 160 t/y (yield 39 kg/ha/y) was achieved, but much lower yields are reported from the other reservoirs, where they do not exceed 10 kg/ha/y. There is much potential for improving the fish yields through a better management.

1. INTRODUCTION

The Zarafshan is the third largest river of Uzbekistan. It originates at 2 750 m a.s.l. where it is born from a glacier. The total river basin covers 4 000 km^2, the river length is 781 km. At its source the river is called Mostchokh-Darya. Further downstream, after taking several tributaries, the name is changed to Zarafshan. For the first 300 km the river flows through Tajikistan, then it enters Zarafshan Valley, situated in the Samarkand region of Uzbekistan. In its whole catchment the Zarafshan receives 70 tributaries.

On entering Uzbekistan from Tajikistan, the annual river discharge is 5.3 km^3. Further downstream the discharge increases only to 5.5. km^3. Tajikistan at present utilizes only 0.3 km^3, i.e. 8% of the discharge. The rest of the water is used in Uzbekistan.

The river has a number of dams and barrages: Pervomai, Akdarin, Damkhodzhin, Narpai, Karmarin, Shafrikan, Kharkhur, Babkent, and many large and medium canals for irrigation and water supply. In the middle Zarafshan are situated the reservoirs Tudakul (22 000 ha), Kuyumazar (l 600 ha), and Shurkul (1 600 ha). There are also several reservoirs which contain highly saline water. Four lakes receive drainage water through collector canals: Dengizkul (25 000 ha), Karakyr (12 000 ha), Tuzgan (5 700 ha), and Shurgak (1 600 ha). In the Samarkand and Navoi regions the river water is used for irrigating 530 000 ha of land, mainly for agricultural products serving the immediate needs of the fast growing country population. In the past the river disappeared 20 km short of connecting with the Amu-Darya.

The water quality in the river has deteriorated under the impact of the return water from irrigation and waste waters from towns, such as Samarkand, Kattakurgan and Navoi. Water salinity in the river increases from 0.27 g/l at its source to 2.4 g/l in its mouth. The highest pollution level is downstream of the towns Kattakurgan and Navoi, and the maximum allowable levels of oil, phenols, copper, and pesticides are usually considerably exceeded. The river water is classified as having a medium level of pollution.

2. FISH AND FISHERIES

The completion of the Amu-Darya-Bukhara canal (Amu-Bukhara canal) has led to major changes in water quality and in fish fauna. Before the completion, only 14 species were known from the Zarafshan. After

the connection between the Amu-Darya and Zarafshan was established, the following species entered the river: big Amu-Darya shovelnose, pike asp (*Aspiolucius esocinus*), Aral asp (*Aspius aspius*), Aral bream, razorfish (*Pelecus cultratus*), striped bystranka (*Alburnoides taeniatus*). In 1983 two more species, i.e. Amur snakehead (*Channa argus warpachowskii*) and goby "bubyr" (*Pomatoschistus caucasicus*) immigrated from the Aral Sea. At present the Zarafshan River has 36 fish species (Table 1).

At the end of the 1980s, Turkestan barbel and Herat khramulya were intensively fished, while some other fish were already overfished. During the 1970s and 1980s the proportion of predators in the total catch increased. For example while in 1975 only 500 kg of pikeperch were captured from lake Dengizkul, in 1985 it was already 7 t. A similar increase was observed in Tudakul reservoir, where in 1977 the pikeperch catch was

3.6 t, in 1984 17.7 t. In 1984, for the first time, 100 kg of snakehead were captured. On the other hand, there has been a steep decline in catches of Chinese carps. While in 1976, 8.6 t were captured from Tudakul reservoir, and 3.1 t from Dengizkul, by 1984 the catch from both reservoirs dropped to 700 kg. Chinese carps have favourable conditions in Uzbekistan reservoirs and with proper fishery management their stocks could be maintained at a fairly high level.

In the lower Zarafshan, the river, reservoirs and lakes harbour 32 fish species, of which pikeperch, Balkhash perch, asp, Aral barbel, razorfish, silver carp and bighead carp immigrated from the Amu-Darya through the Amu-Bukhara canal. Common carp, Herat khramulya,Turkestan barbel, goldfish, silver carp and bighead carp dominate the lake and reservoir catches. Predators represent only 5.9-8.4% of the catch. Yields do not exceed 10 kg/ha, with the highest annual catch obtained from Tudakul reservoir (160 t/y). Kuyumazar reservoir harvest was 16 t, and Shurkul reservoir 10 t. The total from all reservoirs was 240 t/y. Lakes gave the following catches: Dengizkul - 236 t, Karakyr -

17 t, Tuzgan - 8 t, and the total for all lakes was 261 t/y. The yields ranged from 8 to 10 kg/ha. Fishery managers recommended that Lake Dengizkul fishery could further be developed through annual stocking of grass carp and common carp which should double the current yields. The same approach could also be applied for other lakes and reservoirs situated in Uzbekistan deserts. Zooplankton and zoobenthos of Dengizkul are rich, with a biomass of 48.2 g/m^3 and 25.5 g/m^2 respectively. It is believed that the existing fish stocks do not make full use of the natural food, but this could be achieved if the lake is regularly stocked with grass carp, silver carp, common carp and goldfish. Further increase in catches could be achieved through rationalization of catches of the plankton-feeding Aral shemaya.

Kuyumazar, Tudakul and Shurkul reservoirs (see Fig. 1 in the paper by Kamilov and Urchinov, this publication), situated on the middle Zarafshan, formed outside the river channel. Tudakul and Shurkul were formerly lakes receiving Zarafshan drainage water from irrigated fields through collectors. After the construction of the Amu-Bukhara canal they started receiving the Amu-Darya water. Kuyumazar reservoir at full water level (236.2 m a.s.l.) covers 1 600 ha, and has a maximum depth of 29 m. It is fed mostly by the Amu-Darya water through the Amu-Bukhara canal.

TABLE 1. Zarafshan River Basin - list of fish

ACIPENSERIDAE

Spiny sturgeon *Acipenser nudiventris* (Lov.)

Big Amu-Darya shovelnose *Pseudoscaphirhynchus kaufmanni* (Bogd.)

CYPRINIDAE

Aral roach *Rutilus rutilus aralensis* (Berg)

Zarafshan dace *Leuciscus lehmani* (Brandt)

Aral asp *Aspius aspius taeniatus* (Kessler)

Pike asp *Aspioleucius esocinus* (Kessler)

Tench *Tinca tinca* (L.)

Gudgeon *Gobio lepidolaemus* (Kessler)

Herat khramulya *Varicorhinus heratensis steindachneri* (Kessler)

Turkestan barbel *Barbus capito conocephalus* (Kessler)

Aral barbel *Barbus brachycephalus* (Kessler)

Marinka (snowtrout) *Schizothorax intermedius* (McClelland)

Aral shemaya *Chalcalburnus chalcoides aralensis* (Berg)

Riffle minnow (bystranka) *Alburnoides bipunctatus eichwaldi* (Filippi)

Striped bystranka *Alburnoides taeniatus* (Kessler)

Stone morokos *Pseudorasbora parva* (Schlegel)

Eastern bream *Abramis brama orientalis* (Berg)

Ostroluchka *Capoetobrama kuschakewitschi* (Kessler)

Rasorfish *Pelecus cultratus* (L.)

Goldfish *Carassius auratus gibelio* (Bloch)

Common carp *Cyprinus carpio* L.

Silver carp *Hypophthalmichthys molitrix* (Val.)

Bighead carp *Aristichthys nobilis* (Rich.)

Grass carp *Ctenopharyngodon idella* (Val.)

Black carp *Mylopharyngodon piceus* (Rich.)

COBITIDAE

Tibetan stone loach *Noemacheilus stoliczkai* (Steindachner)

Amu-Darya stone loach *Noemacheilus oxianus* (Kessler)

Bukhara stone loach *Noemacheilus amudarjensis* (Rass)

Stone loach *Noemacheilus malapterurus longicauda* (Kessler)

Golden spiny loach *Cobitis aurata aralensis* (Kessler)

SILURIDAE

Wels *Silurus glanis* L.

PERCIDAE

Balkhash perch *Perca schrenki* (Kessler)

Pikeperch *Stizostedion lucioperca* (L.)

POECILIDAE

Mosquito fish *Gambusia affinis* (Baird et Girard)

CHANNIDAE

Amur snakehead *Channa argus warpachowskii* (Berg)

GOBIIDAE

Bubyr *Pomatoschistus caucasicus* (Kaw.)

Amu-Bukhara canal starts from the Amu-Darya in the Farab district of Turkmenistan. The water of Amu-Darya flows through 14 km of the main canal, before it splits into two branches, one of which keeps the name Amu-Bukhara canal, the other is the Amu-Karakul canal. The length of the Amu-Karakul canal is 40 km, the bottom width canal is 7 m, and the mean width at the surface is 32 m, at 4 m maximum depth.

After the canals were filled with water, they were used by the following fish as a means of colonizing the reservoirs and lakes: the rheophilic Zarafshan dace, pike asp, Aral asp, Aral barbel, razorfish, *Noemacheilus oxianus* and *N. malapterurus longicauda*; rheophilo-limnophilic silver carp and black carp, grass carp and bighead carp; limnophilic Aral roach, riffle minnow (bystranka), striped bystranka, Herat khramulya, Turkestan barbel, Eastern bream, goldfish, gudgeon, ostroluchka, and Aral shemaya.

The reservoir and lake fish can be classified according to their feeding habits and spawning habitats:

- feeding on benthos: bream, common carp, Aral barbel, Zarafshan dace

- feeding on plants, including phytoplankton: bighead carp, grass carp, Turkestan barbel

- feeding on detritus: goldfish, Herat khramulya

- feeding in pelagic zone: Aral shemaya

- predators of the pelagic zone: pike asp, razorfish, pikeperch

- predators of the benthic zone: wels.

Fish of the lower course of the Zarafshan can be divided according to their spawning habits as follows:

- spawning on stony bottom (lithophilic species): Zarafshan dace, Turkestan barbel, Aral barbel, pike asp, shemaya, minnows, ostroluchka

- spawning in pelagic zone: razorfish, grass carp, black carp, bighead carp, silver carp

- spawning on sandy bottoms: gudgeon, stone loaches, spiny loach

- spawning among aquatic macrophytes: Herat khramulya, bream, common carp, goldfish, wels.

Until the construction of the Amu-Bukhara canal, spawning grounds with aquatic macrophytes dried out by mid-June. As a result, the mortality of eggs and fry of Herat khramulya, common carp, goldfish and bream was very high. After the canal was opened the situation improved as a result of a more stable water level.

Fisheries in the lowland water bodies of Zarafshan started in 1950s: in Kuyumazar reservoir in 1950, in Tudakul in 1953. Fisheries statistics have been collected since 1953, and since 1970 lakes Tuzgan, Karakyr, Dengizkul and several others have also been fished.

While predatory fish at present represent a relatively low l4% of the total catch, pikeperch has been on the increase, and snakehead is expected to follow the same trend. However, the Herat khramulya has disappeared from the catches. Fish statistics are rather inaccurate, especially concerning the catches of individual fish species and this contributes to the poor understanding of fish population dynamics in the individual water bodies.

Among the reservoirs, Tudakul, with its yield of 39 kg/ha/y, is the most productive and it is classified as eutrophic. Estimates of potential sustainable catches have been made on basis of zooplankton and zoobenthos production. Zooplankton production is estimated to be 419 kg/ha/y, of which about 60% is used by fish. As the food conversion coefficient is 4:1, this zooplankton biomass should support 63 kg/ha/y of fish. For the zoobenthos, the annual production is estimated at 200 kg/ha/y. Again, 60% is considered to be used by fish, with a food conversion coefficient of 4:1. The benthos should therefore support 30 kg/ha/y of fish. Phytoplankton, aquatic macrophytes and organic matter originating from decaying vegetation should support perhaps another 100 kg/ha/y of fish if suitable fish species are present, and if this food source is not locked out from the aquatic environment for prolonged periods of time, for example as a result of exposing a reservoir or lake bottom by draining away water for irrigation. Hence, in Tudakul reservoir, the total natural fish food resources might support a yield of up to 190 kg/ha/y of fish. The optimal stocking rate is given as 3 700 of one-year-old fingerlings per ha.

The estimated sustainable fish production capacity of Shurkul reservoir is much lower, perhaps only 25 kg/ha/y. Lake Tuzgan has a low productivity, and if it is to be developed for fisheries, a cage and/or pen culture, with artificial feeding, would be more promising than relying on natural fish production or regular stocking. Culture-enhanced fisheries could also be applied in other, more productive reservoirs. The most productive lake is Dengizkul which, with good management and optimal stocking rates could probably exceed the fish yield of Tudakul reservoir.