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Fisheries ecology of the Danube in the Szigetköz floodplain

By

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Abstract. The paper presents the natural fish assemblages in the Szigetköz floodplain and summarizes the most important human impacts on the fishes such as water management, the Gabčikovo River Barrage System and fishery.

Natural waters in the Szigetköz floodplain

The primary hydraulic system of the Carpathian Basin developed in the Upper Pliocene after the Pannonian Sea had receded. In that period the Little Hungarian Plain was covered by a large lake. The primordial Danube gradually formed a large dome-shaped talus pile here by putting down some of its sediment in the area. At the beginning of the Ice Age the lake was silted up. The main arm of the Danube flows through the middle of the talus pile, which is surrounded by two long side arms, the Little Danube and the Mosoni Danube. As the loose alluvial and partly diluvial material of the talus pile is more water permeable than the hard rock forming river bed upstream a considerable amount of the water infiltrates into the ground. The water discharge decreases together with the sediment transport capacity of the river. In the loose talus pile river arms of small hydraulic radius were formed. These arms had wide and shallow river beds, which were soon filled up with the deposited sediment. As a result the water did not flow in one main arm but in a beam like anastomising side arm network uniting again at the edges of the talus pile, where the ground was less permeable. This system meant a continuous water supply for the ground water in the Bratislava—Gönyü section. The Szigetköz is the smaller geographical unit of the talus pile of the Little Hungarian Plain on the right side of the Danube. Its borders are clearly marked by a 59 km section of the Danube and the 129 km Mosoni Danube meandering on hard ground (IHRIG, 1973; GÖCSEY, 1979).

The longitudinal, vertical and lateral hydrological variability of the Szigetköz section of the Danube made possible the development of a diverse potamic biocenoses unique in Europe. There are three different sections longitudinally: a high gradient (25—35 cm.km^{-1}), turbulent upstream section, a shallow, braided channel in the Szigetköz area and a low gradient (8—10 cm.km^{-1}), narrow and deeper downstream

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section. The Holocene floodplain of the Danube continues southwards the Mosoni Danube and merges into the floodplains of river Lajta, Rába and Rábca. The Szigetköz floodplain can be divided into lower and higher regions. The lower one is 1—2 m above the mean water level of the Danube and consists of a network of branches, old channels, oxbow lakes and raised flats that are flooded annually. The higher region of the floodplain is 3—5 m above the average level of the Danube. Its surface is covered with a 0.5—1.5 m thick sand and silt sediment accumulated during the centuries (PÉCSI, 1959; GÖCSEI, 1979). The lateral variability manifests itself in the patterns of the geomorphologically different branches. On the basis of their geomorphology we can differentiate constantly flowing *eupotamic* channels; temporarily flowing *parapotamic* arms, which have a permanent connection with the river through their lower mouth; temporarily disconnected *plesiopotamic* branches; and completely disconnected *paleopotamic* waters, which have lost their direct connection with the river.

Natural fish assemblages in the Szigetköz floodplain

In accordance with the longitudinal variability of the Szigetköz section of the Danube fishes drifted from the upper stretch of the Danube and its tributaries (eg. *Salmo trutta, Hucho hucho*, etc.) relatively often occured in this area, but they have not had permanent populations in the Hungarian–Slovak floodplain. In the original fish communities there were some anadromous species, which migrate from the Lower Danube or the Black Sea to the upper stretch of the potamic zone in order to spawn (eg. *Huso huso, Acipenser gueldenstaedti, Acipenser stellatus, Acipenser nudiventris, Pelecus cultratus*, etc.)

Depending on the geomorphological features of the waters in the Szigetköz the species composition of the fish assemblages of the particular habitats can clearly be distinguished. Eupotamic river beds are characterised by rheophilic species (eg. *Acipenser ruthenus, Barbus barbus, Gymnocephalus schraetzer, Cottus gobio*, etc.). Besides rheophilic species parapotamic branches are characterised by semi-reheophilic species (eg. *Rutilus rutilus, Gobio, gobio, Stizostedion lucioperca, Perca fluviatilis*, etc.). Plesiopotamic side-arms are characterised by semi-rheophilic and limnophilic species (eg. *Esox lucius, Abramis brama, Rhodeus sericeus amarus, Gymnocephalus cernuus*, etc.). Paleopotamic waters are inhabited by limnophilic species (eg. *Umbra krameri, Tinca tinca, Carassius carassius, Misgurnus fossilis*, etc.) (see Table 1).

The hydrological variety in the Szigetköz was not favourable only for the establishment of a diverse fish fauna. In the spawning period several fluvial fishes migrate instinctively against the current, sometimes covering a distance of 100—200 km, before they find a suitable habitat for reproduction. The high gradient section of the Danube above the Szigetköz was a barrier for most of the migrating fishes. Due to the Alpine flood regime character of the Danube, the low region of the Szigetköz area was flooded during the summer inundations, where migrating fishes could spread out. The slow flowing, warm and large branch-systems functioned as ideal spawning and nursery habitats and provided a rich feeding area for the fish species of the Middle Danube for several thousand years.

The most important human impacts on the fishes in the Szigetköz

Water management

In the XIXth century the extensive regulation of the Szigetköz became necessary because of navigational problems and damages caused by inundations. The first reason was more important. The river regulation consisted of the regulation of the river bed, flood control and inland drainage. As a result of the river bed regulation a main channel was created by cutting off several bends. This allowed the unobstructed passage of ice, however the navigational problems were only partially solved, because the main channel was full of navigational obstacles during the low water period. Wingdams were built in the main channel and the upper mouth of the arms were blocked by cross-dams causing more intensive sedimentation in them then before because of the high suspended matter content of the water flushing them during floods. As a consequence of the river bed regulation five branch systems were separated (Doborgazszigeti branch system, Cikolaszigeti branch system, Bodaki branch system, Ásványrárói branch system and Bagoméri branch system).

At the turn of the century flood protection dikes were built for the prevention of flood damages. Dikes were usually raised along the outer branches, only a few large arms were cut off (eg. Gazfűi Danube arm). The dikes divided the Szigetköz floodplain into a protected area and an inundated floodplain which had an area of only 6% of the former one. The rolling and suspended alluvial sediment having been deposited on the former floodplain accumulated on the narrow (breadth 1.1—5.7 km) inundated area. This process accelerated the silting up of the branch systems (DUNAI et al., 1992).

During the high-water period of the Danube a lot of water infiltrated through the permeable layers of the floodplain to the flood free-area. To prevent damages caused by the water table increased an extensive canal network was created, some times by dredging old river beds. The system leads the water back from the flood protected area to the Danube.

Due to the geological rising of the river beds on the Hungarian—Slovak floodplain another extensive channel regulation became necessary from the mid-1960s. After the regulations due to the operations of the hydroelectric dams on the Upper Danube and the large scale dredging of the river at Bratislava decreasing the bed load discharge and the kinetic energy of the water increased at low and mean water level. These interventions resulted in the deepening of the Danube-bed in the Szigetköz section from the end of the 1960s. As a result of the silting up of the inundated area and of the deepening of the river bed the flushing of the branches significantly shortened. The same discharge of the Danube meant a lower water level than formerly decreasing the water cover of the floodplain. The flushing of the two branch systems of the Lower Szigetköz lasted 35 days annually at 50% probability (water level at Dunaremete 420 cm). The flushing of the three branch systems over the higher cross-dams of the Upper Szigetköz lasted 10 days annually at 50% probability (water level at Dunaremete 460 cm) (DUNAI et al., 1992).

The Gabčikovo River Barrage System

Despite the regulation of the Danube in the Hungarian—Slovak floodplain from the end of the last century the navigational problems could not completely been solved. This was one of the reasons for the construction of the Gabčikovo—Nagymaros River Barrage System. The original conception was worked out from a hydrological point of view to improve the navigation and to exploit water power. The ecological aspects of the conception were not evaluated. During the construction of the dam system the original plan was improved several times, and it resulted in the suspension of the construction works at Nagymaros. The international negotiations concerning the operation of the Gabčikovo hydroelectric power station did not result in a mutually accepted solution, and finally the Slovakian government made an arbitrary decision, carrying out the 'C' variant of the Gabčikovo River Barrage System, i.e. the damming and diversion of the Danube at Čunovo.

The dam at Čunovo was put into operation at the end of October 1992. During the first three days after the diversion, the discharge of the river decreased by 85% to 200—300 $m^3.s^{-1}$ and the water level became particularly low between river km 1850—1811, it fell 2 m at Rajka and Dunaremete. The surface of the branch systems in the Szigetköz was about 2000 ha at a mean water discharge and it diminished to 400 ha after the diversion. The connection between the main channel and the branch systems was disconnected. Most of the arms dried up, only the deeper beds remained watered (DUNAI et al., 1992).

In November 1992 a high Danubian flood wave filled up the branch systems. In the middle of January the arms dried up again and the environmental conditions became unsuitable for the wintering of aquatic organisms since the shallow waters froze again. In March another flood passed. The discharge curve was "thorn-shaped" in the Szigetköz section (i.e. the discharge rose for 1—2 days and after another 2 days the previous was restored, faster than usually). At the beginning of the growing season most of the branch systems were practically dry in the Upper Szigetköz. However, the condition of the branch systems in the Lower Szigetköz was less disadvantageous since the damming-effect of the power-canal was perceptible. The water level of the branch systems did not change downstream the lower mouth of the power-canal, though a 30—40 cm thick silt layer deposted in th Bagoméri branch system in the first half of 1993.

At the end of 1992, the North-Transdanubian Water Authority prepared a plan for mitigating the damages. This plan was based on the optimal water-level claimed by forestry and nature conservation and on former conceptions regarding irrigation, the melioration of the soil and the water-supply of the flood protection area and the floodplain. From February 1993 as a result of the water engineering works, the permanent water-supply of the Mosoni Danube (20 $m^3.s^{-1}$, from August 1993 10—12 $m^3.s^{-1}$) and the canal system in the flood protection area (5—6 $m^3.s^{-1}$) was solved. From August 1993 the branch systems also got a small amount of water (8—10 $m^3.s^{-1}$). The technical details of a more favourable watersupply of the branch systems (50—70 $m^3.s^{-1}$), claimed by fishery and nature conservation was also worked out.

Fishery

The waters of the Szigetköz used to provide safe jobs for hundreds of fishermen for centuries. Despite the considerable fishery in the XVI—XVIIIth century, there is no information about the fishing guild centres in the Szigetköz, only in Bratislava, Samorin and Komarno. Two commercial fishing companies were formed at the end of the XIXth century (the Győr-Region Commercial Fishing Company and the Mosoni Danube Commercial Fishing Company). The Győr-Region Company had 4200 ha and the Mosoni Danube Company had 750—800 ha fishing area. Presumably because of the complicated water system, the area was divided and leased to many tenants. The waters of the Szigetköz provided good fishing conditions for fishermen working with different kinds of small equipment, but were less or not suitable for groups of fishermen working with larger equipment. After the First World War the Győr-Region Commercial Fishing Company prospered, however, the number of tenants decreased. There is only little information about their catch (94.9 ton fish from 3500 ha in 1940; 0.6% pikeperch, 1.8% carp and 88% other cyprinid fish) (SOLYMOSI, 1965).

The natural waters of the Szigetköz have belonged to the "Előre" Commercial Fishing Company of Győr from 1951 till today. The company has 2418 ha fishing area on the Danube (river km 1850—1770) and its branch systems, and 730 ha on the Mosoni Danube. As a part of the Danube connected water network another 646 ha is utilised for fishing on the lower section of the tributaties of the Mosoni Danube (Rába, Marcal, Rábca) (JANCSÓ and TÓTH, 1987). Besides the commercial company 28 local sport-fishing clubs have fishing rights in the Szigetköz and another 96 ha fishing area belongs only to the sport-fishermen (BERTALAN, 1987).

The catch of the company and the fishing clubs have been documented since 1967 and 1968, respectively. The statistical data collected for fishery considerations are not suitable for the scientific analysis of the composition of the fish communities. However, as a result of a continuous and extensive sampling, they provide an opportunity for a moderate evaluation of fish abundance and distribution. Regarding the importance of fishing, the Szigetköz area was similar to the Baja region of the Danube, which is well-known for its diverse and abundant fish communities.

The statistical data of fishing between 1967 and 1992 indicated a decreasing trend of catch in the Szigetköz. The catch of the commercial company was 207.5 ton in 1967, it was only 77.4 ton in 1992 and it showed a significant decline especially from 1988. The total catch of the sport-fishing clubs increased by 75% between 1968 and 1986, but this was, above all, due to the fact that the number of sport-fishermen doubled in the Szigetköz. In this period the number of the sport-fishermen increased by 76% on the Szigetköz section of the Danube, while their catch increased only by 43%. Consequently, the annual catch per person decreased from 8.52 kg to 6.93 kg (BERTALAN, 1987).

Some species showed a declining trend, others became more common. The most striking was the decrease in carp *(Cyprinus carpio)* catching. Considering that the stocking of juveniles was the similar in each year, the population decline referred to the deterioration of the natural reproduction. The economical importance of pike *(Esox lucius)* is the same as the carp's. Its catching showed a relative stability for several years. However, pike declined from 1982. Its low density is due to the inssufficiency of spawning as well as the intensive fishing. The abundance of pikeperch *(Stizostedion lucioperca)*, which is the most popular fish on the market, varies annually, but it is relatively stable on the whole. In the last few years, a decreasing trend can be seen in the pikeperch catch of the commercial fishing company (i.e. 0 kg in 1992). However, this rather reflected a "change in the way of selling" and not the population dynamics. The catfish *(Silurus glanis)* sharply declined at the end 1960s and the beginning of the 1970s, then from 1975 it became more common, but in the 1990s it declined again. The asp *(Aspius aspius)* catch is usually rather low, though the haul was quite good at the end of the 1960s and in the second half of the 1970s. Its density propaply depended on the changes on the bleak *(Alburnus alburnus)* population, which is its main prey. The significant growth in the barbel *(Barbus barbus)* catch referred to the increase in its population density, a result of an improvement of the environmental conditions in its habitat. The sterlet *(Acipenser ruthenus)* is very sensitive to river pollution, nevertheless, its catch rose significantly from the 1980s, similarly to barbel's. Formerly the natural occurrence of the eel *(Anguilla anguilla)* in the catchment area of the Danube was sporadic. However, it has been stocked regularly into the Austrian part of Lake Fertő and Lake Balaton since 1958 and 1960 respectively. Since then, some migrating specimens were found in the fishermen's catch. The grass carp *(Ctenopharyngodon idella)* and silver carp *(Hypophtalmicthys molitrix, H. nobilis)* are important, relevant species in the fishery management of backwaters and irrigation canals. Their density depends on their stocking.

Statistical data about fishing intensity in the Szigetköz area are reserved by the Commercial Fishing Company and are not available for ichthyologists. However, it deserves attention that the fish in the catch became younger, i.e. small and young specimens got more frequent. The decline of the older age-groups of commercial fish shows that the balance between recruitment and the mortality of te older age-classes was distrubed, i.e. the populations were overfished.

Present evinronmental conditions for fish in The Szigetköz area

The century old regulation of the Danube changed the hydrological regime. It solved navigation problems and helped flood protection but restricted the habitats of the potamic communities. From the turn of the century, the standing stock diminished and the structure of fish populations was modified. Some species became rare (*Acipenser gueldenstaedti, Hucho hucho, Pelecus cultratus,* etc.) or extinct (*Huso huso, Acipenser stellatus, Acipenser nudiventris,* etc.) and a few "new' species immigrated in large number (*Carassius auratus, Lepomis gibbosus,* etc.) in the Szigetköz area. From the end of the last century the main reasons of the modifications for the fish communities have been the following:

1. Flood passes faster, consequently the spawning and nursery habitats are inundated for a shorter time.
2. Flood protection dikes diminshed the area of spawning and nursery habitats, by separating most of the original floodplain from the Danube.
3. The deposition of fine alluvial sediments was more intensive in the inundated areas and by this process the remaining spawning and nursery habitats lost their diversity.

Changes in the quantity and quality of the spawning and nursery habitats resulted in a drastic decline of the natural reproduction of fish populations. Most of the species could not find suitable habitats for spawning, so the hatch of the eggs was insufficient, and the available food sources of fries became unfavourable.

Despite the changes in the original fish assemblages, the threatened populations of the Szigetköz floodplain are extremely valuable to nature conservation. The characteristic aquatic habitats of the area form a worthy Middle Danubian unit of protection. The waters in the Szigetköz constitute an open system, in consequence, they do not have a separate fish fauna. The occurrence of 60 species (75% of Hungarian fish fauna) was documented in the area in the last few decades (Table 1). In the Carpathian basin 4 of them are endangered *(Eudontomyzon mariae, Acipenser gueldenstaedti, Hucho hucho, Gobio uranoscopus)*, 10 are vulnerable *(Umbra krameri, Rutilus pigus virgo, Alburnus bipunctatus, Pelecus cultratus, Gobio kessleri, Sabanejewia aurata, Gymnocephalus schraetzer, Zingel zingel, Zingel streber, Cottus gobio)* and 7 are rare (*Salmo trutta, Pararutilus frisii meidingeri, Abramis sapa, Vimba vimba, Lota lota, Gymnocephalus baloni, Stizostedion volgense)* (Tóth, 1970, 1972, Vida, 1990; Guti, 1993).

The biomass of fish in the particular habitats was estimated on the Slovak side of the Danube. The icthyomass of assemblages depended on the flood regime of the river.

Table 1. Fish species in the Szigetköz floodplain. I Eupotamon, II Parapotamon, III Plesiopotamon, IV Paleopotamon (+++ Dominant, ++ Abundant, + Sporadic, ? Probable); V Preference of current velocity (R Rheophils, S Semirheophils, L Limnophils); VI Reproductive guild (Li Lithophils, F Phytophils, I Indifferent, P Pelagophils, Ps Psammophils, O Ostracophils); VII Evaluation of conservation status (E Endangered, V Vulnerable, R Rare, C Common, M Immigrant, X Exotic, • Endemic): VIII Commercial value (•• primary, • secondary)

Species	I	II	III	IV	V	VI	VII	VIII
Eudontomyzon mariae Berg	?	—	—	—	R	Li	E•	—
Acipenser ruthenus L.	++	+	—	—	R	Li	R	••
Acipenser gueldenstaedti Marti	+	—	—	—	R	Li	E	—
Salmo trutta L.	+	+	—	—	R	Li	R	—
Oncorhyncus mykiss Walbaum	+	+	—	—	R	Li	X	—
Hucho hucho L.	+	—	—	—	R	Li	E•	—
Umbra krameri Walbaum	—	—	—	++	L	F	V•	—
Esox lucius L.	—	++	++	++	L	F	C	••
Rutilus rutilus L.	++	+++	+++	+++	S	I	C	•
Rutilus pigo virgo Heckel	+	+	—	—	R	F	V•	—
Pararutilus frisii meidingeri Heckel	?	—	—	—	R	Li	M	—
Ctenopharyngodon idella Valenciennes	+	+	+	—	R	F	X	••
Scardinius erythrophthalmus L.	—	+	++	+++	L	F	C	•
Leuciscus leuciscus L.	+	++	—	—	R	I	R	—
Luciscus cephalus L.	++	+++	++	—	R	Li	C	•
Leuciscus idus L.	++	++	+	—	R	Li	R	•
Aspius aspius L.	++	++	+	—	R	Li	R	••
Leucaspius delineatus Heckel	—	?	+	?	L	F	V	—
Alburnus alburnus L.	++	+++	+++	++	S	I	C	•
Alburnoides bipunctatus Bloch	+	—	—	—	R	Li	V	—
Blicca bjoerkna L.	++	+++	+++	++	S	F	C	•
Abramis brama L.	++	++	++	+	S	I	C	•
Abramis ballerus L.	++	++	+	—	R	I	R	•
Abramis sapa Pallas	+	+	—	—	R	Li	R	—
Vimba vimba L.	+	++	—	—	R	I	V	•
Pelecus cultratus L.	+	+	—	—	R	P	R	—
Tinca tinca L.	—	+	+	++	L	F	C	•
Chondrostoma nasus L.	++	++	—	—	R	Li	R	•
Barbus barbus L.	+++	+	—	—	R	Li	C	••
Gobio gobio L.	++	+++	++	—	S	Ps	C	—
Gobio albipinnatus Lukasch	++	++	+	—	R	ps	R	—
Gobio uranoscopus Agassiz	+	—	—	—	R	Ps	E•	—
Gobio kessleri Dybowsky	+	—	—	—	R	Ps	V•	—
Pseudorasbora parva Bioch	—	?	+	?	N	Li	X	—
Rhodeus sericeus amarus Bloch	+	++	+++	+++	L	O	C	—
Carassius carassius L.	—	+	++	++	L	F	R	•
Carassius auratus L.	++	+++	+++	++	S	F	C	•
Cyprinus carpio L.	+	++	++	++	S	F	C	••
Hypophtalmichthys molitrix Valenciennes	+	+	+	—	R	P	X	••
Arisichthys nobilis Richardson	+	+	+	—	R	P	X	••
Barbatula barbatula L.	+	+	—	—	R	Ps	R	—
Misgurnus fossilis L.	—	+	++	++	L	F	R	—
Cobitis taenia L.	+	+	++	++	S	F	R	—
Sabanejewia aurata Filippi	+	+	—	—	R	F	V	—
Silurus glanis L.	++	++	+	+	S	F	R	••
Ictalurus nebulosus Le Sueur	—	—	—	+	L	I	X	—
Anguilla anguilla L.	+	+	+	?	S	P	M	••
Lota lota L.	+	++	—	—	R	Li	V	•
Gasterosteus aculeatus L.	+	++	?	—	S	F	X	—
Lepomis gibbosus L.	+	+	++	+++	L	I	X	—
Perca fluviatilis L.	+	++	+++	++	S	I	C	—
Gymnocephalus cernuus L.	+	++	++	+	S	I	C	—
Gymnocephalus baloni Holcik & Hensel	+	++	—	—	R	Li	R•	—
Gymnocephalus schraetzer L.	++	+	—	—	R	Li	V•	—
Stizostedion lucioperca L.	++	++	+	—	S	I	R	••
Stizostedion volgense Gmelin	+	+	+	—	S	F	V	—
Zingel zingel L.	+	—	—	—	R	Li	V•	—
Zingel streber Siebold	+	—	—	—	R	Li	V•	—
Proterorhinus marmoratus Pallas	++	+++	+++	+	S	I	R	—
Cottus gobio L.	++	+	—	—	R	Li	V	—

In eupotamic branches, the mean ichthyomass was rather low, only between 30—40 $kg.ha^{-1}$. In parapotamic arms the ichthyomass was moderate, fluctuating between 200—370 $kg.ha^{-1}$. In plesiopotamic branches the ichthyomass was very high, usually fluctuating between 600 and 1400 $kg.ha^{-1}$ with a 3000 $kg.ha^{-1}$ the maximal value. In paleopotamic waters the ichthyomass fluctuated between 200—300 $kg.ha^{-1}$, inaverage. In general, the diversity of fish species was the greatest in the eupotamon and parapotamon and tend to decrease in the plesio- and paleopotamon but the ichthyomass showed an opposite trend (HOLČIK, 1991).

In the second half ot the XX. century the abiotic environment of fish has become more unfavourable in the Szigetköz floodplain. The most important human impacts were the following.:

1. As a consequence of the bed deepening of the Danube in the Szigetköz the water level of the river has become lower than it had been before at the same discharge, therefore the flood-period of the inundated floodplain is flooded les frequently and for periods. The bed deepening characteristic for nearly the complete Hungarian Danube section and it results in the deterioration of the reproduction and feeding conditions of fish.

2. In the 1980s water engineering works connected with the construction of the Gabčikovo—Nagymaros Rive Barrage System caused disadvantageous changes in the aquatic habitats. Construction works related to the planned water supply canal of the Szigetköz branch system (cross dams, ditches, etc.), made the flushing of the side armss more difficult and accelerating their siltation.

3. In consequence of the "ring-dam" at Nagymaros, which surrounds the construction area of the planned power plant, the Danube bed became narrower and the higher current velocity caused an unsuitable condition for fish passage.

4. In November 1992, when the Danube was diverted to the Gabčikovo power canal, fish populations which assembled in their winter habitats could not always follow the recession of the water. During the first three weeks after the diversion, the estimated quantity of fish that perished in the Szigetköz branch system was at least 60 ton (80% small cyprinid fish, 10% pikeperch, 5% carp, 3% pike, 2% catfisch) (NAGY, 1992; TÓTH, 1993).

5. As the side arms gradually dried out, fishes remaining in the crowded muddy pools became easy preys for water birds and wild-boars and an accessible catch for the occasional poachers. According to the moderate estimations 40 ton of fisch died because of the above mentioned reasons during the winter 1992 (NAGY, 1992). In the second half of the winter the shallow pools froze solid because of the long lasting cold, which considerably harmed the over wintering chances of fisches.

6. The water supply of the branchs systems in the Szigetköz changed significantly after the diversion of the Danube. The diversity and the nature conservation value of the fish assemblages decreased in the particular habitats.

7. Since the divesion of the Danube, the "thorn-shape" floods in the former main channel were very unfavourable for the fluvial communities.

8. In 1993 the water-cover of the floodplain did not make possible the large-scale spawning of fishes, therefore the natural recruitment of the populations considerably decreased. No improvement can be expected unless the present situation is changed. The flow through of the branch systems is only 1.5—2 days annually at a 25% probability and the full inundation is to be expected once in every 12—13 years (F. DUNAI — personal communication).

9. The operation of the Gabčikovo hydroelectric power station had another negative effects on the shoals of fish during their spawning migration. The high discharge of the power canal diverts the shoals to the hydroelectric dam, which is an insurmountable barrier for them. The downstream section of the canal is an unsuitable habitat for spawning, yet it is an ideal area for fishing (TÓTH, 1993).
10. Commercial fishing does not consider the quantity of the timely standing stock, the overfishing also contributed to the decrease of the recruitment of the fish populations.

The ichthyological and ecological prognosis of fishery in the Szigetköz can be predicted primarily on the basis of long term studies on juvenile fish communities. Researches in this field have been carried out by the Danube Research Station of the Institute of Ecology and Botany of the Hungarian Academy of Sciences. The results of the survey constitute the basis of habitat reconstructions and the rehabilitation of fishery in the Szigetköz floodplain.

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