

3.2. PREVIOUS SURVEY OF THE ECOLOGICAL STATE OF MIDDLE-TISZA BACKWATERS

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3.2.1. INTRODUCTION

The protection and reconstruction of backwaters is an urgent and current task of nowadays as backwaters are in a senile state, the water supply is often uncertain and incidental. The existing backwaters, as wetlands were upgraded. However, their manifold usage accelerates their destruction. The wetlands belong to the most endangered ecological systems in the world (Gopal and Sah, 1995). They represent a significant natural value, so their survey, the knowledge of their water quality and the protection of their biodiversity is very important.

During the investigations of the „Tasks concerning the protection of water quality of backwaters”, coordinated by the Environmental Ministry in 1998 we carried out the survey and ecological qualification of three Middle Tisza backwaters (Tiszaugi Holt-Tisza, Cibakházi Holt-Tisza, Alpári Holt-Tisza).

3.2.2. MATERIAL AND METHODS

The examined backwaters and sampling areas were the following: Tiszaugi Holt-Tisza: the area under the village, 1300 m segment, Cibakházi Holt-Tisza: Dóra-farm, Alpári Holt-Tisza: beach area, 6200 m segment.

The evaluation was based on the previous data and result of a tour of the backwaters by boat. Besides this we examined the macrovegetation, we sampled water and sediment for the purpose of chemical, biological and sediment investigation. We characterised the dead arms generally and we valued the sediment investigations. At last, we prepared the reference ecological qualification of the three backwaters based on the Dévai *et al.* (1992) works.

The samples of sediment were taken with an Eijkelkamp-Beeker-type sampling instrument. We made the separation according to the MSZ 12739/4-78.

The metal investigations were held on a VARIAN 20 BQ-type atomabsorption spectrophotometer. The determination of Cu, Cd, Cr, Ni, Zn, and Pb were carried out with the vaporisation of air-acetylene into flame, the determination of Hg was carried out by VGA-76 hydride system. During the physical and chemical investigation of the sediment we determined the dry content by torrefaction on 105 oC. We determined the collfaction loss by heating on 600 oC from dried, homogenised sample. The preparation of the determination of N and P-content of the sediment was carried out according to the MSZ 12739/2-78. Destruction and the processing of the destructed sample was carried out according to the MSZ 448/27-85. For the determination of the phosphorus content of the sample we used the MSZ 318/19-81. For the COD determination we used prepared sediment sample. We diluted 0,1 g of sample with 10 ml distilled water and we measured according to the MSZ 260/16-82 used at the sewage investigation.

3.2.3. RESULTS

3.2.3.1. Tiszaugi Holt-Tisza

The backwater can be found on the left bank of the River Tisza. It is not divided by culvert. Its length is 3,4 km, its area is 50 ha. The region isn't under environmental protection. The backwater receives precipitation and inland water primarily, furthermore, it is used as irrigation water. Moreover, it is utilised for fish raising. On a short part it serves as holiday resort and bathing area. The outskirts of Tiszaug touches the shore of the backwater here. The right shore of the horseshoe-shape is less visited and built. The reed and the avenue are boundary to an agricultural area.

From the point of view of backwaters the small water depths are quite unfavourable. By the end of summer the water depth doesn't reach 1 m in the midline and there's hardly any area deeper than 2 m. The two ends of the backwater with their depth of 0,3-0,5 m are critical parts of the riverbed.

A huge open-water area and a macrovegetation with small species and individual are characteristic of the backwater. Two discovered, protected plant species of the water are the *Nymphaea alba* and the *Trapa natans*. The *Nymphaea alba* association is extensive on the Lower-end. During the summer, at dawn the huge biomass can result in the water being backing in oxygen or having a low oxygen content.

By the distillery seeds of grape and plum and remainders of peel cover the silt in a thick layer. The dark colour of the water suggests eutroph state, sometimes it bubbles (anaerobe gas production). The accumulated huge amount of organic matter provides a favourable nutriment supply to the alga vegetation.

On the former left shore the reed zone unfortunately became disconnected at many places, it is incomplete at the plots, at the angling zones and at the beaches. In a few places the reed (*Phragmites australis*) is replaced by pavement.

At the Lower-end a less extensive reed association can be observed, whereas at the Upper-end the reed is connected and widespread, with some signs of swamping. The attendant plant of the reed in some spots is the *Typha angustifolia* and the *Typha latifolia*. Next to the reed the *Utricularia vulgaris* occurs in some spots. In the open water the floating reed-grass association is negligible. The rooting reed-grass species are the *Myriophyllum spicatum*, the *Potamogeton crispus* and the *Potamogeton lucens* that submerge into the water.

During the irrigation season the water pumping without water compensation can damage the biological life of the backwater. The signs of natural growing old can be observed in the backwater, its bed contains silt in large amounts.

Aesthetically the backwater provides a beautiful spectacle although it doesn't possess significant ideal values. Botanically the backwater is less valuable, besides the *Nymphaea alba* occurring in large numbers we cannot find significant plant associations.

The thickness of the sediment of the Tiszaugi Holt-Tisza is 66 cm. From above downwards: the upper 35,5 cm is a loose, black, fine-grained silt with a high water content, then between 39-95 cm the sample is graphite grey. Compared to the sediment of other backwaters there are quite high amounts of $\text{COD}_{\text{K}_2\text{Cr}_2\text{O}_7}$, $\text{COD}_{\text{KMnO}_4}$, total N and total P found during the investigations (Fig. 1.). The measured amounts suggest a quite high level of organic matter content (e.g. total N 7000 mg/kg dry content). This indicates an eutroph

water. Among the examined backwaters the values are the most extreme here, which suggests the most unfavourable states. The ratio of inorganic and organic matters is also the worst here, the heating loss from the three backwaters is the lowest here.

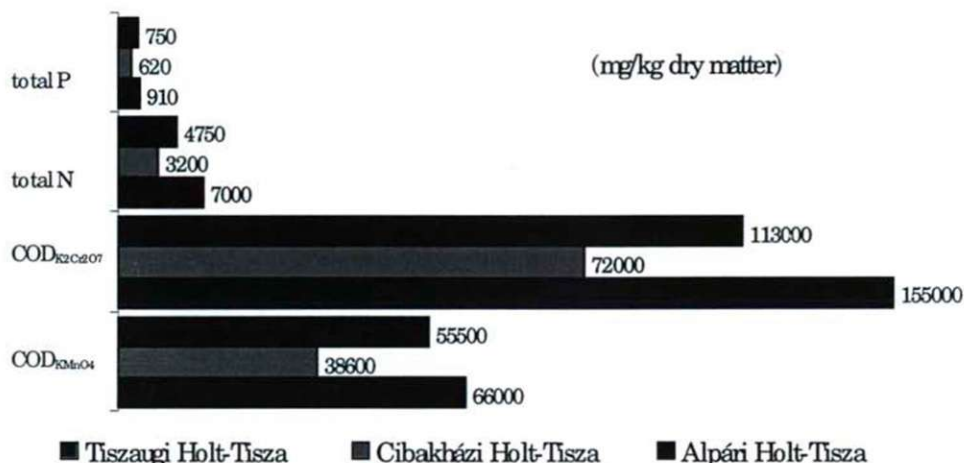


Fig. 1. Examinations in the sediment of dead arms

3.2.3.2. Cibakházi Holt-Tisza

It was formed during the regulation of the River Tisza in 1856. It is located on the left bank of the River Tisza. On the evidence of the air photos the dead arm has an area of 272 ha. From that the open water area is 194 ha (71,3%) and the plant surface is 78 ha (28,7%). Its length is 16,9 km. The two dams are separated by a culvert not precluding the water flow.

On its upper (next to the dam-keeper house) end there extends a long swamp zone, hardly any open-water surface can be found there. The species forming the swamp, in order of the extent of the area they cover, are the following: *Phragmites australis*, *Typha angustifolia*, *Schoenoplectus lacustris*, *Carex* sp., *Glyceria maxima*.

From the village of Cibakháza the backwater can be divided into two different water areas, habitually and botanically. From the beach of Cibakháza until the Dóra-farm the reed stands occur in knots in front of the connected reed association. For the other end of the dead arm a smaller plant individual number and increasing rate of building is characteristic. As for the amount of pondweed, the most significant is the submerging pondweed, this mainly consists of *Ceratophyllum demersum*. Along the shore the *Myriophyllum spicatum* occurs in large amounts. The *Utricularia vulgaris* and *Potamogeton natans* occur in spots. *Potamogeton lucens* and *Potamogeton crispus* can be found in smaller amounts. The floating pondweed is represented by the so-called Lemnetum associations that consist of the following species: *Salvinia natans*, *Lemna minor*, *Spirodela polyrrhiza*, *Butomus umbellatus*, *Iris pseudacorus*, *Lythrum salicaria*, *Polygonum amphibium*, *Alisma plantago-aquatica*.

The thickness of the sediment of the Cibakházi Holt-Tisza is 90 cm. From beginning to end it is greyish black, a bit smelly. The sediment has a high water content, it is quite soft and has a loose structure. At the pig farm in Dóra-farm the high N, P, COD values

suggest an accumulated organic matter amount (Fig. 1). The available N and P content can maintain plankton organisms in a great mass.

3.2.3.3. Alpári Holt-Tisza

It is located on the right bank of the River Tisza in a flood area protected by a summer dam, it is divided by one culvert. Its length is 9,9 km, its area is 147 ha. From the Upper-end until the culvert the water depth is 1,2-1,5 m, the water is in eutroph state. The species occurring here: *Hydrocharis morsus-ranae*, *Wolffia arrhiza*, *Lemna minor*, *Lemna trisulca*, *Salvinia natans*, *Nuphar lutea*, *Stratiotes aloides*.

On the right bank of the former flow direction there is no reed, the water is flanked by trees. On this bank the primarily occurring species is the *Nuphar lutea*, on the opposite bank the *Nymphaea alba* lives. Until the section of the beach the water is similar in appearance and the water depth is 1,6-2 m. The nearly 2 m deep water is almost totally grown in by the *Ceratophyllum demersum*. This huge biomass results in a nearly 200% oxygen saturation. The water is dark brown, bubbling, with a huge biomass. For decades it was burdened by the organic impurities of the nearby pig farm. At the section of the beach both banks are flanked by trees, there is no closed reed association. From the beach until the lower end on the right bank of the former flow direction - usually in shady areas - flourished the *Nuphar lutea* fields. In dead arms of the Middle Tisza such *Nuphar lutea* fields can rarely be found. On the opposite, sunny bank the *Nymphaea alba* lived. Towards the Flower-end at the island only the left branch can be visited by boat. During the summer, at maximal biomass, the „traffic” is impossible in both branches, the area can only be approached in September. In this water area the main species are *Ceratophyllum demersum* and *Nymphaea alba*. The other branch is covered with *Stratiotes aloides* in 100% so it so impassable.

The species found in the Alpári Holt-Tisza: *Lemna trisulca*, *L. minor*, *Spirodela polyrrhiza*, *Salvinia natans*, *Hydrocharis morsus-ranae*, *Potamogeton pectinatus*, *P. crispus*, *Ranunculus* sp., *Utricularia vulgaris*, *U. australis*, *Myriophyllum spicatum*, *M. verticillatum*, *Ceratophyllum demersum*, *Stratiotes aloides*, *Trapa natans*, *Nymphaea alba*, *Nuphar lutea*, *Nymphoides peltata*, *Polygonum amphibium*, *Wolffia arrhiza*.

The thickness of the sediment of the Alpári Holt-Tisza is 65 cm. From up downwards: the upper 13-15 cm is black, loose silt containing plant remainders. Under that: dark grey, clayey silt, consistent, soft. The part between 60-65 cm is grey, harder, clayey silt. The quite high $COD_{K2Cr2O7}$ suggests high amount of organic matter.

Although they are not chemical components, we discuss the results of the toxic tests done from the sediment here. The result of the *Daphnia*-test and Seedling plant test was negative on all three backwaters, so the sediment is non-toxic.

3.2.4. SUMMARY

For the Tiszaugi Holt-Tisza a huge open water area and less plant association is characteristic. The macrovegetation is poor in species and individual number. We found two protected plant species the *Nymphaea alba* in huge biomass and the *Trapa natans* occurring one by one. The investigations prove that the Tiszaugi Holt-Tisza needs fresh

water supply and sweeping from time to time because after a few dry years there can be a serious danger for the backwater and its associations.

For the Cibakházi Holt-Tisza 70% open water area and 30% plant area is characteristic. It can be divided into two parts, habitually and botanically. The reed is perishing. The welfare utilising and the building have important role.

The Alpári Holt-Tisza is rich in natural and landscape values, botanically valuable backwater. The found protected plant species: *Nymphaea alba*, *Trapa natans*, *Salvinia natans*.

The examined backwaters are not protected at present but they deserve to be protected.

3.2.5. REFERENCES

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- MSZ 318/19-81: *Szennyvíz-iszap vizsgálata - Összes foszfor meghatározása* (Sewage sludge test - Determination of total phosphate).
- MSZ 260/16-82: *Szennyvizek vizsgálata - Kémiai oxigénigény meghatározása* (Wastewaters analysis - Determination of demand for chemical oxygen /KOI/).
- MSZ 448/27-85: *Ivóvízvizsgálat - A szerves és az összes nitrogén meghatározása* (Drinking water analysis - Determination of organic and total nitrogen).

APPENDIX

Preliminary qualification of Tiszaugi Holt-Tisza**Type of water body**

The Tiszaugi Holt-Tisza is standing water by the comprehensive type of water bodies (code=1), and it is „kopolya” type dead arm by the concrete type of water body (code=22)

The group of the static attributes**Characters of the bed morphology**

-Typology by the water depth

The dead arm is a tempered shallow water (average water depth is between 0,5-2,5 m) (code=2)

The group of the dynamic attributes**The group determined by the lifeless nature**

-Reity-typology (by the flowing circumstance):

Water body without considerable horizontal and vertical flow (code=1)

-Loticity-typology (by the fluctuation and whirling circumstance):

Slowly fluctuating water surface (code=2)

-Thermity-typology (by the temperature circumstance):

Water temperature: 18,9 °C (code=5)

-Halobity-typology (by the salt content and salt composition):

Specific conductivity: 355 µS/cm (code=2)

Dominant cation: Ca-Mg-ion (code=6)

Dominant anion: HCO₃-ion (code=1)

pH: 8,75 (code=4)

The group determined by the life and the lifeless nature

-Lucidity-typology (by the light circumstance): *Secchi-transparency: 20 cm (code=6)*

-Aerobity-typology (by the oxygen circumstance): *Dissolved oxygen: 9,7 mg/l (code=6)*

Oxygen saturation: 105 % (code=7)

-Trofity-typology (by the inorganic nutrient): *Dissolved o. PO₄: 0,02 mg/l (code=2)*

Inorganic N: 0,13 mg/l (code=2)

-Saprobity-typology (by the organic nutrient):

Chemical oxygen (KOI_{SM}): 21 mg/l (code=6)

-Toxicity-typology (by the toxicant): *By Seedling plant test: Non-toxic (code=1)*

The group determined by the life nature

-Constructivity-typology: *Chlorophyll-a: 151 µg/l (code=5)*

-Destructivity-typology: *Number of the planktonic bacteria: 1,31x10⁶ ind/ml (code=2)*

Biomass of the planktonic bacteria: 0,085 mg/l (code=3)

Biomass of the zooplankton: 7,9054 g/m³ (code=6)

Preliminary qualification of Cibakházi Holt-Tisza**Type of water body**

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The group of the static attributes**Characters of the bed morphology**

-Typology by the water depth

The dead arm is a tempered shallow water (average water depth is between 0,5-2,5 m) (code=2)

The group of the dynamic attributes**The group determined by the lifeless nature**

-Reity-typology (by the flowing circumstance):

Water body without considerable horizontal and vertical flow (code=1)

-Loticity-typology (by the fluctuation and whirling circumstance):

Slowly fluctuating water surface (code=2)

-Thermity-typology (by the temperature circumstance):

Water temperature: 18,8 °C (code=5)

-Halobity-typology (by the salt content and salt composition):

Specific conductivity: 1210 µS/cm (code=4)

Dominant cation: Na-Mg-ion (code=5)

Dominant anion: HCO₃-ion (code=1)

pH: 8,55 (code=4)

The group determined by the life and the lifeless nature

-Lucidity-typology (by the light circumstance): *Secchi-transparency: 80 cm (code=3)*

-Aerobity-typology (by the oxygen circumstance): *Dissolved oxygen: 8,1 mg/l (code=6)*

Oxygen saturation: 88 % (code=6)

-Trofity-typology (by the inorganic nutrient): *Dissolved o. PO₄: 0,01 mg/l (code=2)*

Inorganic N: 0,02 mg/l (code=1)

-Saprobity-typology (by the organic nutrient):

Chemical oxygen (KOI_{SM}): 14,8 mg/l (code=5)

-Toxicity-typology (by the toxicant): *By Seedling plant test: Non-toxic (code=1)*

The group determined by the life nature

-Constructivity-typology: *Chlorophyll-a: 68 µg/l (code=4)*

-Destructivity-typology: *Number of the planktonic bacteria: 8,19x10⁶ ind/ml (code=3)*

Biomass of the planktonic bacteria: 0,398 mg/l (code=5)

Biomass of the zooplankton: 0,574 g/m³ (code=1)

Preliminary qualification of Alpári Holt-Tisza

Type of water body

The Alpári Holt-Tisza is standing water by the comprehensive type of water bodies (code=1), and it is „kopolya” type dead arm by the concrete type of water body (code=22)

The group of the static attributes

Characters of the bed morphology

-Typology by the water depth

The dead arm is a tempered shallow water (average water depth is between 0,5-2,5 m) (code=2)

The group of the dynamic attributes

The group determined by the lifeless nature

-Reity-typology (by the flowing circumstance):

Water body without considerable horizontal and vertical flow (code=1)

-Loticity-typology (by the fluctuation and whirling circumstance):

Smooth or dimple surface of the water respectively stagnant state (code=2)

-Thermity-typology (by the temperature circumstance):

Water temperature: 20,6 °C (code=5)

-Halobity-typology (by the salt content and salt composition):

Specific conductivity: 620 µS/cm (code=3)

Dominant cation: Ca-Mg-ion (code=6)

Dominant anion: HCO₃-ion (code=1)

pH: 8,55 (code=4)

The group determined by the life and the lifeless nature

-Lucidity-typology (by the light circumstance): *Secchi-transparency: 80 cm (code=3)*

-Aerobity-typology (by the oxygen circumstance): *Dissolved oxygen: 10,4 mg/l (code=6)*

Oxygen saturation: 117 % (code=8)

-Trofity-typology (by the inorganic nutrient): *Dissolved o. PO₄: 0,005 mg/l (code=1)*

Inorganic N: 0,13 mg/l (code=2)

-Saprobity-typology (by the organic nutrient):

Chemical oxygen (KOI_{5Mn}): 15,6 mg/l (code=5)

-Toxicity-typology (by the toxicant): *By Seedling plant test: Non-toxic (code=1)*

The group determined by the life nature

-Constructivity-typology: *Chlorophyll-a: 29 µg/l (code=3)*

-Destructivity-typology: *Number of the planktonic bacteria: 5,6x10⁶ ind/ml (code=3)*

Biomass of the planktonic bacteria: 0,289 mg/l (code=5)

Biomass of the zooplankton: 4,2911 g/m³ (code=6)