The synopsis of the main results of biomonitoring in the Szigetköz area in 1994 and 1995 (prepared for those who are not biologists)

Introduction

The results of any biomonitoring can be presented and interpreted in several ways, and hence they can be used differently in order to answer real or interest oriented questions.
The aim of the biomonitoring in the Szigetköz area to reveal the effects on the biota (the natural values) of the unilateral diversion of the Danube by the Slovakians (Version C).
Succinctly expressed: did happen, does happen any destruction of the natural values, and if the answer is positive, in what extent do these damages occur?
It is evident that the vulnerability and the damages of the natural values of this area are an important component of the case in Hague, and also the possibilities of reconstruction measures and investments in order to reconstruct the environmental state as it was prior to the diversion. This short study would like to help to support the Hungarian point of view, to an extent that might be achieved by the valid, real and scientific interpretation of the results of the biomonitoring, trying to keep clear from any extremities.
I would like to stress that the "for the non-biologists" in the title refers to the fact the decisions and the verdict in the Hague will be given by -in the best scenario- by well-informed lawyers. Therefore it is our best interest to present our proofs (findings, experiences) in an unequivocal, convincing and persuading manner. I think this aim can be achieved by the well-thought after presentation of the results of the biomonitoring, according to the requirements of the present situation and also by the good reasoning based on our findings.
For this reason it is detrimental to understand the basics about biomonitoring, and to know the possibilities offered by this method. Both the underestimation of the results of a biomonitoring program and the unreasonable demands should be avoided.
This study is divided into three main sections:

- *biomonitoring (expectations and reality),*
- *the results of the biomonitoring in the Szigetköz,*
- *a subjective summary.*

Biomonitoring (expectations and reality)

One of the central questions of ecology is how can we sustain the ever-increasing requirements of mankind on the long run with due to their over exploitation constantly diminishing natural resources? The central problem is that an ever-increasing human population uses and damages more and more intensely the natural resources that might sustain the coming generations, and also ruins the biological diversity which is indispensable for the normal functioning and long-term survival of life on earth.
Biodiversity became one of the central concerns of mankind in the last decades (it is enough to refer to the United Nations Convention on Biodiversity, Rio de Janeiro, 1992).
If we want to sustain our biological resources and values on the long run, and we would like to manage them, we have to constantly monitor its state and follow its changes regularly.
This task can only be completed via the proper use of biomonitoring - or more precisely by the monitoring of biodiversity.
The extant organisms became adapted to an environment thaht enables them to live normally. If these environmental factors change considerably from the point of view of the given organisms they might react on different ways. The occurrence, population size and reproduction rate of species is shaped and determined by the limiting relation between their ecological needs (or we might say tolerance) and the limiting factors of the environment. All the characteristic features of an organism are well adapted answers or reactions to the limiting ecological factors which shaped the given feature (in another words these features are the indications of these limiting factors).
The deterioration of the natural environment (biota) is usually not detected easily right at the beginning of the beginning of the environmental changes, usually they become visible after a longer period of time, when irreversible changes took place.

Biomonitoring detects and follows the changes of the state of the biota. The degradation process of the environment is indicated both by qualitative (for example the increase or decrease of the number of species) and quantitative (for example the decrease or increase in the number of individuals of a population) changes. All these changes effect biodiversity also causing its increase or decrease.

Between the biologist (ecologists) politicians (decision-makers) there is more and more dispute on the expected and already detected effects of human impacts on the natural environment. What kind of processes take place? What are the possible effects? Are the caused changes significant, reversible or irreversible? The arising questions are innumerable.

All these questions are centred around the need of generalisation. The honest answer is usually very uncertain. The resource of this uncertainty is lying in the very complex nature of the monitored phenomenon, namely the high complexity of living organisms, the high number of species, and the intricate connection among the interacting species. The great time and spatial scale of these processes, and the fastly and constantly changing environment also decrease predictability. The supraindividual processes usually take place and hence can be detected on longer time-scales, and consequently the methods of biomonitoring are designed for studying longer time periods.

After summarising the very essence of biomonitoring the following questions can not be avoided: is this method suitable to be used in the Hague Case, what results can be used to what extents if we want to avoid the unnecessary pseudoscientific disputes?

In my opinion the following "ten commandments" can be given:

1. Nowadays the value or natural resources and biodiversity is becoming more and more a concern both in politics and economics. There are two types of values recognised: resource-like material values, and higher estimated immaterial "existence" value of a species or community or landscape.

2. Biodiversity on its own is not a category indicating any material value.

3. The environmental risks or endangering factors (ecological hazards) that lead the Hungarian Party to quit the Gabcikovo-Bös Water Barrage System are still existing today.

4. It is certain that as a consequence of the diversion of the Danube (Version C) in the affected region - on both sides of the former Main-Channel - the most important limiting factors of the environment - and hence the most important in sustaining the biota - have changed abruptly, very fast and drastically. The most important changes are the following: the decrease of water charge in the Main-branch, in the Upper- and Lower Szigetköz the decrease of the ground-water level, the formerly existing connections between the Main-channel and the braided side-branch systems are lost, the loss of regular inundation by natural floods and the hydrological changes of the side-branches.

5. The above mentioned changes inevitably lead to the drastic changes of the biota (limitation-tolerance).

6. Most of the changes take place on long time-scales, and hence the results of the biomonitoring will show and can be generalised only after longer periods of time. This general truth is not contradicting with the fact, that certain reference organisms - characterised by their narrow ecological tolerance towards a given limiting factor - react very fast (for example the planctonic crustaceans to the decrease of the water level). As in the case of every change here the question of reversibility-irreversibility also arises, but here it is even more important.

7. The already achieved results of the biomonitoring are indicating presently the initial phase of biotic changes compared to the state before the diversion of the Danube. Of course the results are a bit different as a consequence of several facts such as the sampling points, monitored taxa (species, populations, associations), the applied methods, the received signs and not to forget the scientific quality of the researchers. The expected consequent changes (for example the biotic succession) can be predicted to a certain extent. But the already existing results can not be presented a proofs of the expected changes. Therefore the Slovakian opinion that the already lapsed three years did not bring any significant change and hence the expectable changes will not be important either is rejectable.

8. It is absolutely impossible that the biomonitoring projects carried out on the two sides of the Danube yield basically different results. It might happen only if the interpretation of the data is different.

9. The details of the biomonitoring projects carried out on the two sides might be different. The correct analysis and interpretation of these differences can be carried out with the participation of specialist, and by the thorough study of the circumstances.

10. The new habitats (for example the stagnant water body of the storage-lake) and their biota created by the construction of Version C, is not more valuable than the state before the diversion, but different.

The results of the biomonitoring in the Szigetköz area

In the Szigetköz several different monitoring scheme is operated, which is connected to biology. These a monitoring projects have started at different times. Consequently, even if we hypothetise the best possible theoretical planning and practical preparations, which is far from being true, the possibility of generalising the results till 1995 is very different in these different scientific fields.

The biomonitoring in the Szigetköz is performed in the following topics, of which the main results are shortly summarised afterwards:

1. Hydrobiological studies.
2. The monitoring of cryptogam plants.
3. Botanical monitoring.
4. The study of weed communities.
5. Forestry inventories.
6. Zoological monitoring.
7. Agricultural observations.
8. The monitoring of the fish fauna of the Danube.

1. Hydrobiological studies.

The topics of hydrological monitoring:

1.1. Water and sediment chemistry observations.
1.2. Phytoplankton studies.
1.3. Protozoological studies.
1.4. Zooplankton studies.
1.5. Macrophyte studies.
1.6. The study of the leech fauna (Hirudinea).
1.7. The ecological study of fish-harvesting.

Results:

1.1. Water and sediment chemistry observations.

Sampling was carried out in the Main channel of the Danube, inside and outside the dikes. The results of the past two years were published in tables and figures. The thorough interpretation and biological generalisation of the material has not been performed yet.

1.2. Phytoplankton studies.

Sampling was carried out in the Main channel of the Danube, in the side branches inside the dikes, and outside the dikes in the Szigetköz and also near Göd, on a river section downstream of the Szigetköz region. [*The results are strongly influenced by not only the sampling points, sampling times, but also by the construction and operation of Version C and the various water recharge systems. These influences make difficult the interpretation of the results.*] In the shaping of the phytoplankton of the Main Channel in the Szigetköz several factors play an important role: compared to the pre-dammed period the water level is lower, the lower velocity of flow, the loss of inundations, and the effects of the reservoir at Cunovo. We can also guess the trends of the changes.
In the Main channel the species-composition of the phytoplankton community is very similar to the results of the pre dammed period. The presence and high abundance of the warmth-preferring species (*Skeletonema potamos, Microcystis flos-aquae, Stephanodiscus binderanus*) early in the fall is explained by the effects of the reservoir at Cunovo. The trophic level of the main channel was characterised as eutrophic, polytrophyc, or hypertrophic at

the different sampling times. It is remarkable that the Main channel was still polytrophic in November (the effects of the reservoir at Cunovo?). A similar case was observed in 1983 and 1986 when extremely low water levels were found.

[*The hydrobiological conditions of the side-branches of the flood plain were very variable prior to the diversion of the Danube. After October 1992 unpredictable and not-expected conditions, never observed before, happened as a consequence of the diversion and different water-recharge systems.*]

The phytoplankton (species composition and quantity) of the side-branches of the flood plain is determined by the phytoplankton of the reservoir(from 1995 the effects of the underwater weir and the caused water-level rising might also have an effect). The transformation of the phytoplankton of the side-branches of the flood plain was determined by the extent of artificial water-recharge, the distance from the water-recharge system, and from the invasion of macrovegetation. In general we can say that in the species composition of side-branches of the flood plain from 1995 the river elements and Danube elements became dominant and the overall number of phytoplancton is decreasing. the bottom weir water-recharge system has created completely new circumstances in the flood plain. The higher water level and faster current can not be regarded as the reconstruction of former conditions.

In the channels outside the dikes (for example Zátonyi-Duna) at the examined sections changes were not shown.

At the beginning of the Zátonyi-Duna channel the species composition of the phytoplankton community was found similar to that of the Main-channel. This composition gradually changed alongside the channel, the number of species increased, the number of Centrales species decreased while the number of Chlorococcales species increased.

The species composition of the Lipóti -dead-branch has considerably changed. The once species-rich diverse phytoplankton became impoverished, the unique elements disappeared. The number of species has decreased constantly, and the community lost its former character. The quantitative characteristics of the community have also changed. Planctonic eutrophisation took place.

Although the water recharge has improved the water supply and water coverage of the dead-branches and side-branches outside the dikes, but at the same time it ruins the special biological and environmental conditions that made possible the existence of protected biota.

1.3. Protozoological studies.

Results from the Protozoa studies are available from 1994. In the Main channel the appearance of such Ciliate Protozoa was detected that were formerly present only in the side-branches, or unknown for the fauna of the Danube. In the flood plain the conditions were characteristic of extreme situations: low number of species and high number of individuals were recorded.
Outside the dikes, just like in the flood-plain, the protozoa community is being transformed. Formerly in these waterbodies their characteristic constant species were present, now the so-called K-strategist species became dominant.

1.4. Zooplankton studies.

In the Main-channel the zooplankton community was characterised by low number of species and low number of individuals. Along the longitudinal section there was not any trend detected. The former characteristic species-rich and abundant Crustacean zooplankton community of the side-branch systems inside the dikes became impoverished, and both the number of zooplankton taxa and the number of individuals decreased as a consequence of the diversion of the Danube and the operation of the water-recharge systems (rise of water-level increase of flow velocities).
Both the habitats and their zooplankton communities became more uniform.
Outside the dikes: the study of the Lipót dead-branch if of outstanding importance. The total number of species found has constantly increased (from 27 to 35). The probable explanation is that the environmental conditions has constantly changed for the planktonic Crustaceans (desiccation, drought, slow mud deposit accumulation, water level rise after water recharge and the change of the shore-line vegetation).
At the moment the Lipót dead-branch is in a transitional, changing state. The quality quantity and continuity of the water recharge system is questionable, the formerly diverse water-bodies are getting more uniform, the number of individuals decrease. ,

1.5. Macrophyte studies.

In the Main-channel the slower current, the decrease in the water level and mud accumulation on the bottom facilitated the intrusion of water macrophytes. But as a consequence of the ever-changing and sometimes extrem conditions their stands are quite poor in species. At the beginning of the mud accumulation the resistant, and readily invading submers species (e.g. *Elodea canadensis*) become more widespread. At a more advanced stage submerse and floating macrophytes (*Ceratophyllum demersum, Lemna minor*), characteristic of stagnant water-bodies become dominant.
Prior to the diversion of the Danube the flood plain was the most prominent habitat of the natural aquatic vegetation. After the diversion these stands practically ceased as a consequence of the drying process taking place in these habitats. In the initial year of the operation of the water-recharge measures (1994) the vegetatively fastly reproducing species (*Elodea canadensis, Potamogeton spp.*) and species characterised by short reproduction cycles (*Najas marina*)were characteristic. From 1995, after the operation of the underwater-weir had started) in the branches with fast current the threat of desiccation ceased, but in the smaller branches and at the ends of the branches this problem is still posing a threat.
Outside the dikes the value decrease of the stands of floating macrophytes is getting larger and larger. As a consequence of the water recharge (1993, 1994) the species sensitive to the change of environment disappeared or their number reduced. In 1995 following the increase of water recharge into the area outside the dikes the loss of floating and submersed aquatic macrophytes reached 50-100 % at certain sampling sites. The vitality of the remaining species is severely reduced.

1.6. The study of the leech fauna (*Hirudinea*).

The number of leech species did not change in the strictly protected areas compared to 1994,
in other areas significant decrease was observed. The feeding strategy distribution shows remarkable changes. In 1994 the ratio of predator parasite ratio was 5 to 8, in 1995 this ratio changed to 2 to 8 in the Szigetköz area. The dominance of species also changed considerably. Since the diversion of the Danube the relative abundance of the associations have become erratically changing as a consequence of disappearance and then appearance of certain species.

It is remarkable, that in the whole area of the Szigetköz in 1995 seven species were not found that were present in 1994 (for example *Hirudo medicinalis*, which is listed in the International Red Data book).

1.7. The ecological study of fish-harvesting.

In the Main-channel of the Danube depending on the sampling localities during the past two years the fish fauna exhibited considerable transitions. Yet the rheofil character of the fish fauna remained. The fishfry of the flood-plain is characterised by the dominance of eutrophyl species. As a consequence of the discontinuity of the Main-channel and the side-branches the rheophyl species did not reinvade the water-bodies. The similarity of species distributions of the sampling points indicates the uniformization of these habitats. Outside the dikes in the Gazfüi-Duna the formerly dominant limnophyl species became scarce, and new, neutrophyl species appeared. The two most valuable elements of the fish fauna *Umbra crameri* and *Misgurnus fossilis* disappeared. After the desiccation of the Lipót-dead-branch the reintroduction was performed by the species present in the artificially led recharge waters, the neutrophyl species became dominant here. The habitat character of the Mosoni-Duna did not change significantly, as a consequence of the water-recharge the species composition the rheophyl character is getting stronger.

[*In the 8th chapter there is more information on the fish fauna of the Szigetköz region using a different viewpoint.*]

2. The monitoring of cryptogam plants.

The monitoring is carried out on two groups of plants: on perifitic /surface forming/ algae (2.1.) and on mosses (2.2.). The observations are carried out in the Cikolai and Ásványi side-branch system, and alongside the main river-bed.

2.1. Prior the diversion of the Danube the role of perifitic algae was subdominant compared to the role of phytoplankton. The alga communities of formerly completely separated side-branches mingled and as regards to the perifitic algae these biotopes became more uniform. After the diversion in both of the monitored side-branches the number of individuals of perifitic algae became higher. The average rise in numbers is continuous, and was observed everywhere, it can not be attributed to a single peak in abundance. Parallel with this phenomenon the number of species decreased, in every year a single species gave 50-90 % of the individuals.

2.2. At the beginning of the 1990-ies the moss communities of the Szigetköz were quite species-rich. During the two years drought after the diversion the moss assemblage became less species-rich. In 1994 a further problem was how to select the sampling sites. As a consequence of the water recharges the moss-coverage started to increase again. The reinvasion of mosses at points covered during the drought by weeds pose a new problem to study. With the appearance of drought-tolerant species the total number of mosses increased from 45 to 63. 30 new species were found in the Szigetköz, and 10 disappeared in the region (among them several valuable and rare species). Most of the new species are so-called colonist species (these species occupy vacant, empty niches), their weighted ratio increased from 25% to 30%. The colonist moss species were always represented with high numbers in the Szigetköz. But the new colonists are coming from the drought-tolerant, non shore-line species that are characterised with lower water-requirement. The water-requirement spectrum of mosses shifted towards the medium value, and even among the more water-demanding species the flood or inundation tolerant species became more scarce.

3. Botanical monitoring.

The studied topics:

3.1. The study of ecological indications.
3.1.1. The indications of populations: the leaf size and anatomy of *Nuphar luteum,*
the average height, length of inflorescence of reed (*Phragmites australis*) stands, the inflorescence length and leaf area of *Plantago altissima.*
3.1.2. Phytocoenological studies. Species composition and ratios of species with Braun-Blanquet method.
3.1.3. Leaf area measurements on *Quercus robur, Alnus incana, Fraxinus pennsylvanica, Salix alba.*
3.2. The long-term monitoring study of biocoenoses, community tally the survey of distribution of communities and the study of the succession of the former river-bed.

3.2.1. The comparative study of some plant associations.
3.2.2. The study of the succession of the former river-bed.
3.3. The continuous monitoring of higher plants.

Results:

3.1.1. The characteristics of the indicator populations showed considerable differences when compared to the control areas. In *Nuphar luteum* the difference was shown in the decrease of the average leaf area, in the change of the anatomical structure of the leaves, and in *Plantago altissima* it was evident in the decrease of the average leaf area and in the shortened floral axes. These changes indicate the inadequate water supply.
The study of reed-beds did not yield straight forward results, with the exception of the Cvek depression, situated in the Upper-Szigetköz, which became invaded by weeds.
[*With the exception of the study of reed-beds a clear tendency was shown by the populations indicating the inadequate water supply. It is important to remember that the yearly rainfall and its distribution through the year can be different in the control and in the water-deprived experimental sites, and it might alter the data. In the case of the reed-beds several factors might made it difficult to get the expected results such as: the unknown ecological requirements related to the monitored parameters, the choice of inadequate monitored parameters, the differences in the habitats of the monitored and control populations, the choice of study sites that were later unexpectedly inundated (for example the dead-branch at Lipót). Therefore the selection of new sites and more appropriate monitored features is desirable.*]
3.1.2. The Szigetköz area is characterised by the high number (80) and high diversity of plant associations. The majority of associations (60) is indicating high degree of naturalness. The degradation processes (drying and weed invasion) started in 1993 continued in most of the monitored study areas between Ásványráró and Dunakiliti in the later years. Among the dominant species of the associations there is more and more dry tolerant species, characteristic of drier habitats. The process of weed invasion (*Urtica dioica, Impatiens glandulifera*) does continues. In 1995 as a consequence of heavy rainfalls the pace of drying process along the Main-river-bed slowed down. The botanical composition of gallery forests along the Mosoni-Duna seems to get stabilised.

3.1.3. From 1993 on the average leaf-size of the investigated trees significantly decreased, especially so in *Quercus robur, Alnus incana* (21-27%), *Salix alba* (30%), and to a smaller extent in *Fraxinus pennsylvanicus* (10%). k m . When the vegetation period is more rainy the rate of decrease in leaf-size is slowed down. The study of willow leaves indicates that even with the higher amount rain these trees remained in their pessimum, and hence they can be expected to die soon.

3.2.1. The survey of the hard-wood gallery forests showed that during the last 50 years in their species composition ash species became dominant, and the number of Fagetalia species (characteristic of beech forests) decreased. The water transport of these hard-wood gallery forests became more extreme, the percentages of both the drought-tolerant and the strongly water-dependent species has increased. From these results there is no clear indication of the effects of the diversion of the Danube. The coenological survey of the mesophilic meadows, marsh meadows and reed-beds also continues (at the moment the gathered data is being analysed).

3.2.2. After the diversion of the Danube most of the river-bed of the former main-channel became dry. The secunder succession started with the invasion and appearance of weed communities, and it will probably advance towards the willow thickets. The prediction of the dynamics and the exact steps of species-composition transformation
is difficult.

In the flood-plain river-bed succession is characterised by the intense invasion of weeds, and the spatial pattern of vegetation is arranged along the wetness axis. At the beginning the vegetation was very mixed, as the species of the weed vegetation and sand reef species were mixed the representatives of the willow thicket and willow forest species. During the last two years the vegetation cover has slightly increased. The increase in poplar and willow stand is very pronounced. Three years were enough for the formation of a simply-structured willow thicket.

A different kind of succession was observed after the drying out of a former dead-branch. The starting point was the former submerged macrophyte vegetation, with high abundance of *Nuphar luteum*, *Phragmites sp.* and *Carex sp.* In the spring of 1994 the total coverage of vegetation was 60-90%, in June it increased to 100%, with the dominance of *Polygonum sp.* The better condition of the soil in the dead-branch was indicated by the higher

abundance and dominance of water-dependent plant species. In 1995 this area was inundated by the artificial water-recharge. For example the land form of *Nuphar luteum* was transformed into an aquatic stage.
There are considerable differences in the naturalness of the vegetation of the two sampled habitat. While in the former river-bed the weeds became dominant, in the dried out dead-branch natural disturbance-resistant species became widespread. The seeds of the former plants were carried here by the water while the latter were present in the reed stands before.

3.3. Up to now 1008 species of higher plants were recorded in the Szigetköz area. This constitute 47% of the Hungarian flora. The number of strictly protected species is 4, there are 88 protected species and 6 Pannonic endemism. 58 species can be regarded as endangered to a certain extent. In 1995 three new species were added to the list: *Rudbeckia hirta, Cerastium arvense, Isatis tinctoria.*

4. The study of weed communities.

The segetal weed vegetation of the Szigetköz is very well-known. The monitoring of these plants is aimed at the better understanding of the role of weeds in the degradative succession that started as a consequence of the drying after the diversion of the Danube. The study started a year ago, there are only preliminary results. The side-branch system, dead-ends and the gravel covered, silty main river-bed that lost water cover completely became a perfect habitat for the weeds and adventive plants. The invasion of these species considerably increased the diversity of the higher plants of the region, but at the same time the equitability decreased, both the number of species and the dominance of weeds and adventive plant species increased, and this phenomenon unequivocally indicates degradation.
If we group the weeds of the Szigetköz according their water-needs (this is shown by their W_B value, which is an eleven step scale, at the beginning there are the drought-tolerant species, at the end of the scale we can find the water-dependent species) and also take into account the number of species of weeds and their coverage the following conclusions can be presented:

a) In 1990-1991 the highest dominance and cover was achieved by the characteristic weed species of the semi-dry soils (W_B=4). There is a second peak in species number between (W_B=7-10).

b) If the ground water-level decrease the number and coverage of the above mentioned species decreases, the distribution of weed species along the W_B axis will become single peaked.

5. Forestry inventories.

There are two main fields studied where data is continuously gathered.
5.1. The monitoring of annual forest stand, and wood quantity increment (tree height, diameter at breast height). The data gathered in a given year is reflecting the former year.
5.2. The measurement of the growth of individual trees (the measurement of weekly girth-growth increment and related to ground-water data).
5.3. The above described studies are supplemented with short remarks and notes on the health of the forests.
The most important -but not only- habitat characteristic of the habitats in the Szigetköz is water. The forestry investigations are based on the well-known fact that the forests of this region can grow considerably faster than in the average habitats of the country, as these forests can utilise the fertile. element rich alluvial soil and regular inundations of the Danube.

Results:

5.1. Till 1992 the current annual increment of poplar stands was constantly increasing, then after the diversion of the Danube it started to decrease significantly. At certain places depending on the habitat characteristics, geographical location, the subspecies of planted stock the increment was equal or even better then in the former years. The most significant damage was detected in the natural, not-planted, willow forests. Along the affected Danube section approximately 20 hectares died. In the remaining stands the current annual increment was found strongly reduced. In the hard-wood gallery forests, which require less water, no significant change was observed.

5.2. Expect a few study plot in 1993 the girth-growth of the poplar plantations decreased, it constituted only 60-80% of the former years. In the willow stands the decrease is at least 50%. There is no available data for 1994.
[*The trends probably remained the same, there might be differences in the actual values.*]

5.3. In 1993-1994 as a compensation of the drought early leaf shedding was observed. The phenomenon was mainly taking place along the Danube at places of higher elevation, that were most affected by the diversion and the resulting water-table decrease.

6. Zoological monitoring.

The zoological (mainly terrestrial zoological) inventory of the Szigetköz, which was aimed at the recording the presence of the taxa, was only completed only in 1990-1992. Not any biomonitoring oriented zoological was carried out in the region before. If we take into account the uncertainty of sampling methods of the animal taxa, it is understandable that the interpretation of the results is treated with extra caution and contains elements of uncertainty.
The monitored groups changed a little bit during the years of the monitoring programme, in the last two years the followings were studied: soil-dwelling nematodes, molluscs, crustaceans, dragonflies, ortoptherans, neuropterans, lepidopterans, coleopterans, mayflies, oribatids, fishes, toads, birds, small mammals. The collected data was mainly presence-absence data, but more and more increased the proportion of quantitative and semiquantitative data. The high number of indications of these highly diverse groups are summarised in the following points, highlighting the most important features.

- The number of registered animal species in the Szigetköz is increasing every year. It is partly attributed to the appearance of new species in the changing habitats, but partly is a consequence of the intense research, as the zoological knowledge on an are of the size of the Szigetköz is never absolutely complete.

- In many animal taxa the formerly main-channel inhabiting species moved to the Mosoni-Duna and other side-branches, and increased in number there.
- The transformation of areas of the fauna is a still ongoing process, the species and their populations are often replaced or pushed out from their former habitats, they disappear or reappear in new places.

The giving of too intense water recharge into the Mosoni-Duna and other channels outside the dikes, is disadvantageous for the taxa preferring slowly flowing water-bodies.

The disappeared dragonflies of the Lipóti-Holt-Duna (a disconnected former side-branch) did not reoccur even after the implementation of the water-recharge remedial measures. On the long run the artificial water-recharge might result in a very pronounced change as opposed to the state prior the diversion of the river.

- On the dry river-bed of the former main-channel a succession process started, very similar to the succession of the plant communities.

- The not-expected high motility of the water-preferring insects (species of marsh-meadows, mesophylic meadows, reed-beds), which might be aimed at the active search for appropriate habitats, does continue.

- As a consequence of the creation of new habitats in the Upper-Szigetköz several arthropod species appeared that were formerly only known from the Lower-Szigetköz.

[*All these findings support our former prognostics on the expectable faunal changes of the region.*]

7. Agricultural observations.

The agricultural production was monitored in the area affected by the diversion of the Danube. The yearly reports for example in 1995 give detailed data on 16 agricultural corporations, a village and 11 crop species. The soil characteristics, climatic factors, ground-water regime, and technology (fertilisation, crop species choice, soil desinfection, agrochemical measures) are also treated in a detailed manner in these reports.
[*But it is only possible for the editors of these reports to estimate to what extent was responsible for the changes of production figures (production decline, technological changes) the change of ground-water regime and the other factors of agricultural techniques.*]

8. The monitoring of the fish fauna of the Danube.

8.1. The changes of fish habitat characteristics
8.2. The study of spawning sites
8.3. The analysis of catching figures.
8.4. The effects of the underwater weir water-recharge on the fish fauna.

8.1. As a result of the remedial measures the quality of fish habitats became more preferable at certain places. It is not yet clear how much the fish-stock of the Upper- and Middle-Szigetköz was affected by the loss of water and the consequent fish-demise. It is expectable with high certainty that the ratio of flowing-water preferring species (chub, asp, barbel, pikeperch, perch, nase) will decrease and the ratio of stagnant-water preferring species (bream species, common carp, wels) will increase.
Any amount of water given in the side-branch system increase the survival chance of the fish-fauna. After the diversion the third of the water covered area of the Szigetköz (3350 hectares) can be regarded as unsuitable or ceased habitat for fish. The years passed since did not bring real changes in the circumstances in these areas.

8.2. The spawning sites situated at the areas which became dry after the diversion were not recreated in 1994. A decade ago 53 spawning site were known in The whole of the Szigetköz. In 1994 sixteen of them were impossible to use, and in ten occasions under the changed circumstances new spawning sites were chosen by the fish.
In the area affected by the mouth of the main work channel the unnatural changes and movement of the water level cause intolerable conditions for the fish preparing for spawning. The fact that the fish catching activity continues at the former levels even with the present lower reproduction rate is alarming.

8.3. The damage of the spawning sites were not reduced considerably. The continuous decline from 1989 stopped in 1994, and from the ever-lowest point it moved up 8%. The possible explanations are the following:

- A great mass of fish was carried into the side-branch system with the flood in April 1994. After the fast fall of the water level these fish were trapped in the branches. In the Main-Channel between Dunakiliti and the dam the catch was very successful. After the flood on the reduced water surfaces it was easier to catch the oversized fish mass.

- The fish devastating effect of the damming was mainly exerted on the bigger, older specimens, and at the beginning of the 1990ies there were some successful spawning, from which the fry became big enough to catch in 1994. From these tendencies it is clear that the Szigetköz lost its former fish stocking role, as it is not even able to sustain itself successfully. The artificial stocking of fish into the Mosoni-Danube and other side-branches might also have a significant positive effect. In 1994 the number of anglers decreased with 16%, but their catch increased with 14%.

8.4. The underwater weir system gave till the summer water to the former spawning sites equivalent to the former middle water levels. If the water recharge will create circumstances appropriate for the reproduction of fish, the former spawning sites might work again as stocking sources. But the fact that the side-branches are separated from the Main-channel might still be a problem.

A Subjective Summary

I am aware of the fact that a summarising work might suffer from subjectiveness. But I hope that I succeeded in substracting from the available mosaic of data the most important knowledge summarising the biological changes of the Szigetköz during the two years. As all the summaries this work also does not contain a lot of minute details that might support or contradict my views. We can not rule out the real essence is hidden in these small details.

After thoroughly analysing the sometimes contradicting, heterogeneous and diverse results of the biomonitoring, I can conclude without any exaggeration that the changes are detrimental for the future survival for the biota of the Szigetköz.

To illustrate the tragic of these findings I would like to mention the difference between the coenological results (the visible state of the flora) and the ecological processes (the invisible driving force behind coenological processes).

If someone did not know the Szigetköz before or visits this area only infrequently he can not perceive the changes from this visible phenomena, and even less the background processes, which might be pieced together from the mosaic of the results of the biomonitoring.

From the results found up to now it is easy to see the change of the biota. This does not mean anything special, as every biological entity changes (there is a series of steps of natural succession going on in any biotic community).

But the changes must be characterised here:

-The changes experienced in the Szigetköz are unanimously indicating degradation, an abnormal succession fastly advancing towards the demise of the biota.

- The changes are relatively quite fast. Unfortunately there is no enough thorough data on the state prior the diversion (there was no detailed biomonitoring before the diversion). But I take the risk of stating that if the changes would have taken place from the 1960ies with this speed -when the Szigetköz was not already functioning well according to some experts- we would not be able to recognise this region at all.

- The degradation, started after the diversion of the Danube, might advance into several directions, this totally unpredictable at the moment.

- From the results of the biomonitoring there is not a single fact, which would contradict these unfortunate trends. Only processes natural values were found, there is no example for the contrary. The fact can not be denied that there were even earlier (from the 1970ies) negative changes harming the biota of this region (the water barrages on the Upper-Danube, and the deepening of the river-bed).

We have to realise that there is no any near natural area in Europe worth of protecting that can be sustained without well-designed and thought-after management. It is no wonder that nature protection is moving away from the reserve-attitude.

This approach is true for the Szigetköz also, it would have been necessary to intervene in order to protect the nature, giving priority to the protection of natural values, even if these remedial measures would have been quite expensive.

We have to keep in mind two facts:

1.,) The former functional problems of the Szigetköz did not induce as fast environment degradation which can be observed nowadays.

2.) The reasoning that the construction and operation of the planned and realised version of the Water Barrage Systems is environmental friendly and serves the preservation of natural values is simply false. The barrage system was designed to yield energy and serve the security of shipping

(?), and the protection of natural values was not scientifically supported. There is no any known example in Europe that a similarly designed water Barrage could sustain and protect the natural values. Unfortunately he opposite statement is backed by several examples.

It is evident that through supplementary (remedial) measures (artificial water recharge) the reduction of damages and slow down of deterioration could be achieved. But on the long run the biota is being transformed, the radical change of structural and functional connections inevitably take place. The creation of a completely different Szigetköz, with most of its natural values lost, is impossible to stop through these remedial trials.

I probably do not tell any news -for example to the lawyers- that the dispute over the advantages and disadvantages of the construction of the water-barrage is not a discussion of Slovak and Hungary. The roots reach much deeper. The disagreement is centred around the management of the non-renewable resources of the Earth, and the short-sighted, economy oriented unreasonable exploitation of these resources.

Which of these two views should get priority? Both of these views have supporters and opposers in both of these countries. It is our unfortunate fate that such a dispute is taking place on the very boundary of our countries.

Budapest, 13th April, 1996.

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