3.4. HYDROECOLOGICAL INVESTIGATION IN THE KISKÖRE-RESERVOIR

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3.4.1. INTRODUCTION

The Kisköre-reservoir with its area of 127 km^2 is the second largest lake of Hungary. Besides its primary water management functions its welfare utility and its role in tourism has a stressed significance. It also has considerable nature protection values.

In the present-day ecological state of the reservoir a big problem is the filling and, in connection with that, the spread of the macrovegetation. During our investigation, we took more points of view into consideration: We held it important to make a water-and material balance for the whole reservoir. This primarily determines the water quality standards.The phytocenological surveys can give us information about the changes in the quantitative and qualitative composition of the macrovegetation also inform us about the intensity of the growth of certain associations, about the conditions influencing the spread of the plants.

To follow the seasonal changes, we pointed out a biomonitoring area in the Poroszló-basin, in which we wish to registrate the changes of the different physical, chemical and biological parameters. Our purpose is that the results of the investigation of the biomonitoring area would be useable to recognise and value the changes occurring in different associations.

This project is the first phase of a more-year program, on the basis of which we can describe the ecological circumstances of the Kisköre-reservoir.

3.4.2. MATERIAL AND METHODS

The sampling was held in the plant-covered *(Trapa natans, Nymphoides peltata,* Typha angustifolia, Phargmites australis, Nymphaea alba) and open-water areas in the region of the Poroszló-basin, at 14 investigation points. The water depth was between 0.6-1.8 m.

The material balance calculations included the investigation of the yearly output of the total floating material, the total dissolved material, the dissolved orto-phosphate-phosphorus, the formed phosphorus, the inorganic and organic nitrogen. We investigated the yearly and seasonal formation of the above mentioned components as well as their changes in case of flood and low-water periods.

During the investigation of the water-and swamp vegetation of the Kisköre-reservoir an air-photo series and a vegetation map were made, besides the phytocenological survey and ranging over the spot. We value the air photos of 1987, 1993 and 1997, and the experience of the ranging over summarised.

In the 14 sampling points of the Poroszló-basin we held field measurements once per month from may to September with the GRANT ISY 3800 type water quality data collecting system. The parameters were the following. Water depth, water temperature, pH, conductivity, oxygen saturation, dissolved oxygen, turbidity, redox potential, sunshine intensity.

The components of the laboratory water-chemical and biological investigations: the chemical oxygen demand (COD_{KMnO4}) of the original sample, ammonium-N (NH_4-N), nitrate-nitrogen (NO_3-N), nitrite-nitrogen (NO_2-N), total-nitrogen, dissolved orto-phosphate-phosphorus, total phosphorus, and a-chlorophyll content. We held the investigations according to the Hungarian standards. For determining the bacteria number and its biomass we applied the fluorescent microscopic technology after biological dying.

To investigate the biodiversity, algological, zooplankton dragonfly fauna and periphyton examinations were held.

Sediment sampling and investigation was held twice. We took the samples with Eijkelkamp sampler. During the analysis total organic carbon (TOC), total nitrogen and total phosphorus were determined.

3.4.3. Results

The turnover of substances in the Kisköre-reservoir is mainly determined by the qualitative and quantitative circumstances of the incoming and leaving waters. Among the incoming waters we distinguish waters that nourish the reservoir and waters burden the reservoir. Nourishing water is the River Tisza. Burdening waters are the Eger- and Laskó creeks and the trench drains. The turnover of water in the reservoir is partly determined by natural factors (evaporation, river regime), mainly determined by artificially directed factors (filling, emptying, water outtake). On the basis of the water balance data the incoming waters consist of Tisza-water (98.7 %), water the Laskó-and Eger creeks (1.1 %), and water from the trench drains (only 0.2 %). From the leaving water annual 97.1% leaves the reservoir through the River Tisza, 2.4 % goes to irrigation, the evaporation loss is 0.5 %. The variations of the salt content and the floating material is similar to the above mentioned. As for the phosphorus and nitrogen content, the burden coming from the Laskó- and Eger creeks is significant, it is much more than the plant nutriment coming from the River Tisza and from the trench drains. The main part of the 116 tons of phosphorus and 1518 tons of nitrogen remaining in the reservoir goes to the organisms in the water. From that 45.4 tons of phosphorus and 417 tons of nitrogen leaves the system infiltrated into the phytoplankton. The remainder accumulates in the macrovegetation and stays in the system for a long time (Bancsi and Végvári 1998).

In area of the Kisköre-reservoir the spreading of the water and swamp vegetation were significant in the past few years. The spreading macrovegetation hinders the utility of the water surface (fishery, ecotourism, traffic, etc.). This will probably increase in the future, supposing a similar rate of spreading. According to the macrovegetation surveys the presence of 87 plant species is proved. This is 29 more than the result of the survey of 1993-94.

53.9 % of the area of the reservoir (i.e. 68.44 km^2) is covered with macrovegetation, from that 22.03 km^2 is the pondweed association. This is 4.29 km^2 larger compared to the survey of 1994 – this shows an 1.07 km^2 growth per year. The growth in area is striking on the side if the Kis-Tisza at the Sarud-basin and Poroszló-basin, mainly in the protected bays. The main species is the Trapa natans. The swamp vegetation has an area of 22.4 km2. This value did not change significantly compared to the amount of 1994 (Pomogyi and Szalma 1998).

During the field measurements it became proved that the dissolved oxygen content in the areas covered with vegetation is very low during the summer, near to the bed it is close to zero. In the case of the other parameters there was not a significant difference in depth or between different sampling areas.

According to the laboratory measurements the water of the River Tisza is I-II. category in quality according to the limits of the MSZ 12749:1993. Compared to each other the higher concentration values can be found next to the exit at the Kis-Tisza. This suggests that the area is more burdened (waters coming from the Kis-Tisza and from the Eger-creek). On the basis of the concentration values of the nitrogen forms (NH_4-N, NO_2-N, NO_3-N) the sampled area of the Poroszló-basin is also favourable, I-II. category in water quality. In case of both the a-chlorophyll and the bacteria number and biomass the area of the *Trapa natans* association proved to be the most unfavourable in water quality. These are relatively shallow, quickly warming up, stagnant water areas.

According to the results of the algological investigations, considering the water quality the most important question is the optimality of the size of the *Trapa natans* association as well as the providing of the optimal water quality for the open water areas. The worst water quality is characteristic to the middle of the *Trapa natans* association while the most favourable water quality forms in the *Typha angustifolia,* and *Phragmites australis* associations (Grigorszky 1998).

According to the zooplankton surveys the highest fluctuation is characteristic to the *Trapa natans* associations. The most stable community was formed in the *Typha angustifolia* and *Nymphoides peltata* associations. The diversity rate was the highest in the areas adjacent to open-water areas. The maintenance of these regions would be favourable in the future for ensuring the biological variety.

The dragonfly-investigations (Odonata-fauna) prove that the extended open-water areas and the connected, homogenous *Trapa natans* associations do not favour the biodiversity (Dévai, Jakab and Müller 1998).

On the basis of the coating-investigations the macrophyta-periphyton complex has an important nutriment sting feature. From the point of view of biomonitoring the vegetation adjacent to open-water areas can be appropriate (Lakatos et al. 1998).

According to the measurement the spatial changes of total nitrogen content of the sediment is similar to the change in the TOC values. The highest values were measured usually in the upper, the lowest values were measured in the lower regions. On the basis of the *total phosphorus* investigations it can be stated that in May the differences between the three layers of sediment are higher than in the autumn. From the measurements it can be seen that the values of the investigated parameters decrease from the "upper" layer (5 cm) to the "lower" layer (15 cm). This change can be regarded as tendency, it does not occur consistently in every sampling area, sometimes the change is vice versa, e.g. in the *Trapa natans - Potamogeton nodosus* mixed association.

3.4.4. Summary

The Kisköre-reservoir is an artificially established and operated water system. The water turnover is periodical, it repeats yearly. During the winter the largest part of the bed becomes dry after emptying, after spring filling and the formation of macrophyte stands the open-water and the vegetation covered surface areas are formed.

The result prove that the fulfilled investigations bring lots of new information but the biggest part of these are single results. It multitude of questions and hypothesis require further surveys that we would like to continue. Both the chemical and biological investigations prove that the selected area is appropriate for biomonitoring, where the long-term changes can be well observed.

The last year, rich in precipitation proves that for gaining overall knowledge we need more years as the investigation of one vegetation period is in sufficient for getting information about tendencies and regularities.

3.4.5. References

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