

The influence of the Mayrbach and the "Kanal" on the phosphorus content of the macrophytes and the sediment in the Mayrbucht.

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1. Introduction

Observations show that most of the phosphorus that enters a body of water, soon becomes absorbed by the sediment (HAYES & PHILLIPS 1958, HOLDEN 1961, HEPHER 1966). During anaerobic conditions (stagnation period) the sediment releases some phosphorus in the assimilable form of orthophosphate. However, the amount released is far less than that sorbed, so that there is a net loss of phosphorus to the sediment (HOLDEN 1961, HEPHER 1966).

In the littoral zone rooted macrophytes are able to take up phosphorus from the sediment. BARKO & SMART (1980) have demonstrated under laboratory conditions the ability of Egeria densa, Hydrilla verticillata and Myriophyllum spicatum to obtain their phosphorus solely from the sediment. MCROY et al. (1972) stated that rooted macrophytes can act as a source of dissolved phosphorus or as its sink in water depending on whether the absorbed phosphorus is quickly released into water or not. As emergents have a considerable part of their stems together with leaves above, only the part in contact with water would take part in phosphorus release during excretion. So they would substantially release their phosphorus back to the water at the end of the growing season when they would die off and be leached. Therefore cropping them at the appropriate time would mean removal phosphorus from the lake ecosystem.

This work is part of the Austrian Eutrophication Programme and seeks to obtain a correlation between the phosphorus content of rooted macrophytes and that in the sediment.

The Mayrbach is a small brook draining past some houses which discharge their domestic water into it making its phosphorus content to about 100 ug/l at its inlet. The Kanal is a man-made

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drainage system that gets its water from the Seebach, an oligotrophic mountain brook, which flows into the Lunzer Untersee. Wastewater discharge from the nearby castle, a restaurant and the Biological station load the "Kanal" to about 20 µgP/l, whilst the parent Seebach has about 5 µg P/l. The two inflows discharge into the Mayrbucht - a small bay on the north eastern part of the oligotrophic Lunzer Untersee in Lower Austria.

Around and between the inlets of the Kanal and the Mayrbach grow macrophytes comprising mainly of emergent Schoenoplectus lacustris and Phragmites australis and submerged Elodea spp. The macrophytes in this area show remarkable differences in both density and growth vigour from those growing in other parts of the lake. It is speculated that probably this difference is due to the higher phosphorus input in the Mayrbucht brought in by the two inflows mentioned above.

## 2. Materials and methods

At the beginning samples of the sediment and of different macrophytes were taken on separate dates and from different places. Later, for the purpose of correlation only samples of Schoenoplectus lacustris were taken and a pair of sediment and macrophyte samples were from the same place.

Samples of sediment were taken with a corer of 2,5 cm diameter and the first 5 cm column being collected. A whole plant of Sch. lacustris was uprooted adjacent to the place where the sediment samples had been taken. The samples were then dried at 95° C for two days.

Dried sediment was pulverized using a Retsch ballmill which predominantly crushes hard fragile material leaving flexible one such as macrophyte roots virtually intact. A Mellert M9 coffee mill served the purpose for the macrophytes. About 0,005 g of the pulverized material was measured in duplicates for each sample and its total phosphorus determined by the AMBÜHL & SCHMID method (1965). Spectrophotometric measurements were done with a Perkin-Elmer Coleman 55 spectrophotometer at 720 nm extinction.

## 3. Results and discussion

Preliminary results of the phosphorus concentration in the sediment and the macrophytes show a higher content in the latter

(table 1). A plot of milligramm P/g dry weight of macrophyte (Sch. lacustris) against the corresponding values of the sediment of subsequent samples yields points which are scattered in a manner that does not reveal any correlations between them (i. e. neither linear, logarithmic nor exponential and correlation factors ranged from 0,03 to 0,11). An attempt to plot total mg P in the plant against the mg P/g dry weight of sediment was made but also did not give any correlation between them.

Statistical analysis of the total results (n = 68) for the sediment gives a regular phosphorus distribution with a mean of 0,66  $\pm$  0,07 mg P/g dry weight at 95 % confidence limits. This pattern of phosphorus distribution was also found to apply to the sediment of the Seebach by working with data from LEICHTFRIED & BRETSCHKO (1980) and there was no significant difference between the two sediments (table 1). This shows that, apparently, the high phosphorus concentration in the Mayrbucht inlets does not influence its sediments.

On the average macrophytes from the Mayrbucht always have a higher phosphorus concentration than those from other parts of the lake (MALICKY & SCHLOTT, personal communication). Since rooted emergent macrophytes derive most of their phosphorus requirement from the sediment (WETZEL 1975), it seems that the phosphorus brought into the Mayrbucht by its inflows is quickly taken up from the sediment by the macrophytes. It can also be said that during the course of this work (July / August) the rate of uptake from the sediment and that of phosphorus absorption by it were not significantly different as its concentration in the sediment was more or less constant throughout.

It is possible that the parameter of total phosphorus concentration in the sediment did not reveal the available phosphorus fraction to the macrophytes thus giving no correlation between its content in the macrophytes and the sediment. The rate of phosphorus uptake by eelgrass (Zostera marina) was found to depend on the concentration of available phosphorus in the medium (MCROY et al. 1972). Probably the same could be the case with Sch. lacustris or any other freshwater macrophyte if the same parameters were to be compared.

Taking into account the fact that phosphorus is commonly the growth limiting nutrient (WETZEL 1975), the effect of its higher concentration in the Mayrbucht macrophytes is reflected in their higher

Tab. 1 Comparison between the phosphorus content of the Mayrbucht and the Seebach sediments

Sediment	Date of sampling	n	mg P/g dw (95 % CL)
Mayrbucht	July - August 1980	68	0,66 ± 0,07
Seebach	July - December 1979	64	0,75 ± 0,09

vigour and density as compared to those growing in other parts of the lake. It thus can be concluded that the Mayrbach and the "Kanal" inflows have an influence on the phosphorus content of the macrophytes in the Mayrbucht though the same is not directly shown by a correspondingly higher phosphorus content in the sediment from where the former mostly obtain the element. The two inflows indirectly influence the sediment by constantly feeding it with more phosphorus as soon as it is taken by the macrophytes. So in one way or another both the macrophytes and the sediment of the Mayrbucht are influenced by its inlets on their phosphorus content.

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