SCIENTIFIC REPORT

on

MEETING of COST 869

Mitigation options for nutrient reduction in surface water and groundwaters

Working Group 2

ECOLOGICAL RESPONSE TO SYSTEM MANIPULATION

Keszthely (Hungary), 6-8 May, 2009

by

Vera Istvánovics
(local organizer)

Petri Ekholm, Ken Irvine, Penny Johnes & Wim Chardon
(co-organizers)

Participation

The 37 official delegates of the meeting represented 18 countries. Specific efforts were made during the organization to promote active participation of East European countries in the meeting. This was successful with good participation of scientists from Bulgaria, Romania and Estonia. Since in many East European countries internal flow of information can be problematic, we suggest to the organizers of future meetings that the extra effort of informing appropriate East European experts about the possibilities of participation is very worthwhile.

Another successful feature of the meeting was the relatively large number of presentations by PhD students from Austria (1), the Czech Republic (1), Estonia (1), Finland (2) and Hungary (2).

The Mediterranean region was under-represented. Experts were present only from France and Israel.

Scientific summary

Case studies were presented from a series of European lakes including small and large, shallow and deep lakes with various histories of eutrophication. Lotic ecosystems were also well represented from floodplain lakes to small streams and large trans-boundary rivers. Projects involved a wide range of approaches to restoration. Important summary points raised in the presentations were:

(i) The reduction of the external loads should ideally precede the application of internal manipulation techniques (Søndergaard, Kleeberg, Istvánovics, Ventelä, Tadonléké, Johnes, Aanes, Mathes).

(ii) The most common way of reducing the external loads is the control of point sources. Consequently, the relative importance of diffuse sources increases within the total load during eutrophication management. In several cases, pre-reservoirs, wetlands, buffer zones, sedimentation ponds, filtering ditches were found to efficiently decrease the emission from agricultural sources (Clement, Kovács, Ventelä, Johnes, Sammalkorpi). In the same time, clear-cutting of forests significantly increased the external load (Barry).

(iii) When manipulating nutrient loads from diffuse sources, one should consider water quality effects of other materials with which nutrients move together

from the catchment. Thus, even though clear-cutting of coniferous forests in a sub-catchment of Lake Melvin detectably elevated the P concentration in the lake, the biomass of phytoplankton has not changed because the simultaneously elevated load of humic matter enhanced light deficiency (Barry). Ekholm called the attention to the fact that no comprehensive analysis is available about the effect of erosion control on aquatic systems. It is possible that iron in the eroded particles prevent sulphate reduction in such systems as the coastal zone of the Baltic Sea. In the case of lotic systems, erosion and sediment trapping in the channel demonstrably deteriorates the habitat of benthic fauna (Aanes, Sárkány-Kiss).

(iv) Internal manipulation techniques must supplement the reduction of external loads for both speeding up the recovery process and fine-tuning the managed aquatic ecosystem. The success of these techniques strongly depends on a thorough knowledge of the behavior of the individual systems down to the level of eco-physiology of their various components (Čižková, Krolová). A common feature of these measures is that they must be sufficiently intense and continuous (Søndergaard, Kleeberg, Järvalt, Loeb, Ventelä, Bankowska, Dokulil). Eutrophication control, and particularly internal manipulation techniques, will be successful only if the ecological response is properly monitored and monitoring information is fed back into the management process (each presentation). Unfortunately, this is often not the case (Järvalt, Loeb, Sárkány-Kiss, Nishri, Ollesch). Successful management may often depend on a single open-minded decision maker who accepts the risk of uncertainties inevitably included in system manipulations (Dokulil).

(vi) Aluminum and iron treatment was applied in many lakes to decrease internal phosphorus load. This measure was successful in the majority of cases even when the external load could not be sufficiently reduced (Søndergaard, Mathes, Rydin, Dokulil). Cases of failure (due to high external load and the relatively large size of the lake), however, were also reported (Kleeberg).

(vii) Removal of planktivorous fish and manipulation of the ratio of predator/prey fish is another common management practice in European lakes, particularly in shallow ones. This is an efficient tool to create clear water with cascading effects on most trophic levels, but repeated fish removal seems to be required to maintain the positive effects (Søndergaard, Järvalt, Ventelä, Johnes, Sammalkorpi, Panksep).

(viii) Manipulation of the hydrology is a particularly important restoration measure in floodplain lakes and lotic systems, which is also applied in other types of lakes (van Geest, Aanes, Sárkány-Kiss, Bankowska, Nishri, Ollesch, Dokulil, Bondar-Kunze, Beshkova, Panksep). Restoration of lateral connectivity between the river and its floodplain is a key for managing large rivers (van Geest, Aanes, Sárkány-Kiss, Bondar-Kunze, Beshkova). In her comprehensive evaluation of Dutch stream restoration projects, Loeb pointed out that most projects only address a small part of the stream.

(ix) Climate change introduces a new dimension of uncertainty into managing aquatic ecosystems and often hampers the efficiency of restoration efforts (Clement, Istvánovics, Ventelä, Tadonléké, Nishri, Ollesch).

(x) High costs and long-term sustainability of restoring ecosystems were repeatedly emphasized (Kleeberg, Johnes, Mathes, Dokulil, Sammalkorpi). The question arises whether we can afford to support the necessary long-term restoration measures given the large number of water bodies that must be brought to a good ecological status according to the Water Framework Directive (Johnes). This question should be thoroughly explored to obtain a realistic answer considering that water bodies, their catchments and people living in these catchments constitute the functional unit that should be managed as a whole system (Tadonléké).

(xi) In East-European countries, the collapse of economy, including that of agriculture following the political changes in the early 1990s resulted in a drastic reduction of nutrient loads and other pollutants. This, along with planned management measures that mostly aimed at controlling point sources clearly resulted in an improvement of water quality and ecological status of water bodies (Sárkány-Kiss, Clement, Kovács, Istvánovics, Čižková, Beshkova). The results of this long-term "experiment" may provide important lessons about the water quality consequences of an extreme reduction of diffuse nutrient loads that went far beyond the level achievable by planned management practices in West-European countries (and which is unsustainable in a long run).

(xii) During the excursion, we visited the Kis-Balaton wetlands that were reconstructed as part of eutrophication management of Lake Balaton. Benefits and drawbacks of this measure were shortly presented and discussed.

Main conclusions

(i) Clear objectives must be set prior to expending resources on restoration, and interaction is needed with stakeholders. Uncertainties and the time scale of expected recovery must be shared with stakeholders.

(ii) Strategies for restoration are dependent on a firm understanding of the system in question.

(iii) It often takes a decade or more from the initial identification of a problem to any action. In the meanwhile, the situation may have deteriorated substantially. Prevention is better than cure, and much less costly. In addition, a decade or more is needed for recovery of the managed ecosystem provided that the appropriate measures have been found and implemented.

(iv) It is often difficult and costly to maintain sustainable results, following encouraging immediate to short-term results.

(v) An understanding of mass-balances of nutrients, including organic fractions, in aquatic systems is crucial for design of restoration, including total loadings and source of loadings; which includes point and non-point diffuse sources. Clear and realistic targets for phosphorus and nitrogen loads and in-lake concentrations should be set. In lotic systems and oxbow lakes, hydrology and its interactions with nutrient levels are crucial.

(vi) In general high levels of diffuse nutrient supply hinder sustainable restoration, and in all cases attempts to reduce external loads from all sources are required. This usually requires a catchment approach.

(vii) A general conclusion is that restoration of water bodies that is not accompanied by significant reduction of nutrient supply will fail. This is a critically important point for E.U. Programmes of Measures under the Water Framework Directive. The number of individual lakes for which restoration can be attempted is inevitably limited, and much less than the number affected by current high nutrient loads.

Topics for future meetings of WG2

Two topics were suggested for further discussion during future meetings.

(i) Societal aspects of managing the ecological status of water bodies as mentioned in (x) under the section, “Scientific summary”.

(ii) Systematic overview of the large-scale “experiment” of the drastic reduction in nutrient and pollutant emission in Eastern Europe with the aim of exploring the potential for managed emission control in Western Europe as described in (xi) under the section, “Scientific summary”.