Eutrophication: A New Look at an Old Problem

A Forgotten Anniversary

It has been nearly 25 years since the first attempts were made to control eutrophication in the Great Lakes. This endeavour, which began around 1969, culminated in the signing of the 1972 Great Lakes Water Quality Agreement (GLWQA) between Canada and the U.S. Since then, major wastewater treatment programs have been implemented. Industrial controls and phosphate limitations in detergents have produced a reduction and even a reversal of the eutrophication process. It has been stopped completely in the upper Great Lakes and reversed in the two most eutrophic lower lakes (Erie and Ontario). Nuisance algae blooms are no longer common, and Cladophora tissue phosphorus concentrations indicate a nutrient deficiency. The «good news» apply only to open water of the Great Lakes as stipulated in the GLWQA. The situation in some near-shore areas and embayments (Green and Saginaw bays, Hamilton Harbour) is not so good. Here, concentrated efforts under the Remedial Action Plans for all 43 designated Areas of Concern are aimed at removing the remaining traces of a dirty past.

It took only ten years to reach the loading reduction targets. Long-term trends of both chlorophyll and total and soluble reactive phosphorus have been convincingly going down. The «anniversary» of this success story has gone by unnoticed. More serious problems facing the Great Lakes have arisen in the last decade. Toxic contaminants with all their potential health hazards for lake biota and the human population consuming water from the lakes have captured the attention of the public, the research community and environmental agencies. Eutrophication has disappeared from the list of priority issues. However, there are still some unanswered questions: Why are fish from Lake Erie, a more eutrophic lake, less contaminated than fish from oligotrophic Lake Ontario? The whole area of nutrient-contaminant interactions under new conditions is still poorly understood. Have we overdone the phosphorus reductions in Lake Ontario to have negative impact on fish productivity? In any case, eutrophication in the Great Lakes is believed to be under control. This demonstrates that the basin-wide ecosystem approach to water quality management with focus on both prevention and remediation was the right strategy to address the eutrophication issue.

To be cautious with this sense of accomplishment, we have to look at the roots of the eutrophication in the Great Lakes from a historic perspective. Here, the eutrophication coincided with the expansion of European settlement. The number of inhabitants in the basin region, particularly around lakes Erie and Ontario, accelerated in the first half of this century, reflecting the exponential growth of human population and industry, which was characteristic for this period. Over the past two decades, the population growth rate has levelled off, thereby slowing down the eutrophication process. There are presently 40 million people living on both sides of the
border in the Great Lakes basin, covering an area roughly comparable to the size of Central Europe, with a population of about 150 million! And Central Europe does not have the benefit of large water bodies and their diluting effect that the Great Lakes Basin has. Despite the difficulties encountered in the Great Lakes water quality, we have been relatively fortunate. (The Great Lakes represent 20% of all freshwater resources on Earth — what an advantage!)

**Beyond the Great Lakes**

According to recent estimates from the United Nations Population Fund, the world population is increasing by almost 100 million annually. This is the equivalent of adding a new U.S.A. every 2.5 years. At the same time, large urban centres, including those of North America, continue to grow even more rapidly. Half of the world population is expected to live in urban areas by the turn of the century. In Canada, 62 per cent of the population already lives in urban centres of over 100,000 inhabitants. All these «additions» will require at least 200 liters of water per day per capita to sustain their existence. Also, everyone’s waste will generate about 4 grams of phosphorus, 15 grams of nitrogen and 100 grams of carbon (as BOD) per day. In contrast to industrial toxic contaminants, there is no zero discharge policy for humans and animals! Someone will have to find a solution to dispose of all this waste, treat it, and remove and recycle the nutrients to a maximum extent or else we face catastrophic scenarios like the ones we have experienced from neglected hypereutrophic water bodies, where the eutrophication process has reached an irreversible stage (development of toxic algal blooms, unsuitability of water for human consumption, massive fish kills, etc.).

The euphoria about the successes of eutrophication control in the Great Lakes could be misleading and its generalization short-sighted. Everywhere else in the world, with the exception of the Great Lakes basin, eutrophication is still the most acute environmental problem. In Eastern Europe, China and the developing countries (and also in Western Canada and Quebec), it has reached dangerous levels. Sanitation programs cannot cope with the magnitude of the population growth, particularly in the new mega-cities of the developing world. We are facing a whole new dimension for finding ways to accommodate human waste, and we will have to use all available venues, including legislation, urban planning, reuse and recycling policies, and, last but not least, the development of ultra-effective wastewater treatment technologies. On the other hand, we will have to conduct more research on overstressed ecosystems and their remediation, establish ecological limits relative to their sustainability, and study trophic dynamics of known ecosystems under new conditions (e.g., Lake Erie following the zebra mussel invasion).

It is foolish and will be damaging in the long run to pretend we know enough about the eutrophication process and its control. We should not be misguided by parochial thinking and allow another gap to form in our knowledge of aquatic ecosystems. I certainly hope our journal will remain at the forefront of this endeavour.

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