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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

POLICY BRIEF

Eutrophication

WRC-supported eutrophication research and its impacts

A new report investigates the impact of WRC-funded research on the issue of eutrophication in South Africa.

The eutrophication problem

Eutrophication is a phenomenon that has adverse and often dangerous effects on freshwater systems all over the world. A body of water, such as a lake or dam, is deemed eutrophic when an increase in the concentration of chemical nutrients occurs to the extent that increases in primary productivity occur.

Eutrophication often manifests in algal blooms which have negative implications for water quality. Other impacts of eutrophication may be oxygen deficiencies in the system, a lack of fish and other aquatic life and health implications for water users.

South Africa has some of the most nutrient-enriched surface water in the world and thus eutrophication presents a major national problem.

Assessing eutrophication research and its benefits

The WRC is committed to ensuring that the publicly funded research under its management provides both research excellence and public benefit. In line with this commitment, the WRC has embarked upon a number of studies to assess and portray the impact of its research programmes and resulting products, and their benefits to the country.

The WRC has been extensively involved in eutrophication research since its inception and has, to date, published approximately 84 research reports that focus on eutrophication, its treatment and its management. It was deemed necessary to commission a study to provide the WRC and its stakeholders with a concise national assessment of the economic, social and environmental impacts of the WRC's investment in eutrophication research and the resulting benefits of the research products.

The approach followed was to map the full extent of eutrophication research funded and reported on by the WRC since 1984, outline the applications of the research products in South Africa, determine the impact of the research and its products and, where possible, place a monetary value on the impacts. Data and information were gathered firstly, by means of telephone and face-to-face interviews with respondents linked directly to the WRC, university departments, other research organisations, government departments and various water sector organisations and secondly, through studying published reports relating to the research.

Profile of WRC-supported research

Eutrophication research supported by the WRC was placed in six categories, as follows:

- ***The eutrophication phenomenon:*** The emphasis is on characterising eutrophication, the processes that give rise to it, the reasons for its occurrence and policy approaches for addressing the phenomenon.
- ***The sources of eutrophication:*** The causes of eutrophication are addressed in detail. The impacts of factors that cause a system to become eutrophic are analysed in depth with the help of field studies and simulations.
- ***The management of eutrophication:*** Methods and measures for controlling and managing the problem across various freshwater systems are researched. Innovative approaches and their viability in a South African and global context are assessed.
- ***Blue-green algae (cyanobacteria):*** Blue-green algae, potentially a toxic and dangerous indicator and consequence of eutrophication, are studied in detail. Emphasis is placed on monitoring the nature, causes and effects of blue-green algae, as well as their detection and management.
- ***Drinking water treatment adaptations:*** The consequences of eutrophication for drinking water treatment and the adaptation of drinking water treatment processes to remove algae and associated toxins, tastes and odours, are addressed.
- ***Wastewater treatment to remove phosphorus:*** A major cause of eutrophication, namely high phosphate levels in effluent from sewage plants released into freshwater systems, is addressed as a proactive approach to managing the problem and thereby reducing pressure on the symptomatic treatment of eutrophication in already affected systems.

An analysis of research outputs revealed that over time, the research focus shifted from understanding the scope and causes of eutrophication towards its management and treatment. Overall, however, the research focus was almost equally spread among categories, with no one category receiving a disproportionate amount of attention.

Impacts of eutrophication research

The results and applications of eutrophication research across the various categories have potential economic, environmental, social and health-related impacts. A combination of direct and indirect benefits may derive from these impacts.

Assessing impacts, particularly related to research, can be a challenging process as they may often be intangible or too complex to quantify. This project has aimed to utilise a common, quantifiable measure across the impact areas identified. The most effective approach was to assess the potential cost saving attached to the implementation of the WRC research findings. Also, since it was not practical to quantify all impacts attributable to WRC-supported eutrophication research, a number of examples were considered.

Economic impacts were assessed by examining three areas of potential benefit, namely the reduction in costs associated with water treatment, use of alternative water sources and reduced agricultural production due to irrigation from eutrophic sources. In all instances, research applications which successfully limit the extent of eutrophication in South Africa would reduce these costs substantially.

Specific examples considered include:

- The cost of additional powdered activated carbon (PAC) required for water treatment on account of eutrophication (R2 100 million p.a.);
- Actual impacts of eutrophication on tobacco production and potential future losses (industry value R272 million p.a.) due to the sensitivity of the tobacco industry to eutrophication;
- The cost of a water treatment works (at Bospoort Dam) having to obtain water from alternative sources (R4.8 million p.a.);
- Potential losses for aquaculture, particularly trout farming (industry value R12.6 million p.a.);
- Stock losses incurred at Kareedouw as a result of cyanobacteria poisoning in 1996 (R4 million).

Environmental impacts considered relate largely to the value of biodiversity and how it is threatened by eutrophication. In extreme cases, such as the Zeekoevlei in Cape Town, where biodiversity has been seriously impaired by eutrophication, a drastic and expensive measure such as dredging (costing approximately R60-70 million) would be needed to create conditions conducive to restoration of ecological integrity.

The focus on limiting eutrophication in order to sustain biodiversity and conserve desirable species in an area would have far reaching benefits for each ecosystem and the goods and services derived from it. In the long term, this focused approach would significantly reduce rehabilitation costs, such as the estimated R14.7 million it would cost to rehabilitate Hartbeespoort Dam.

Social impacts of eutrophication research that were considered relate to the aesthetic and recreational impacts that eutrophication has had in South Africa. South Africa's reputation among local and international tourists of having good tourism destinations is partly dependent on the many water-based recreational activities available. Benefits of eutrophication research derive largely from research applications which would prevent either potential losses resulting from eutrophication-related curtailment of such activities or losses of aesthetic value of water bodies which become eutrophic. Examples of actual or potential losses due to the following were considered:

- Reduced property values along the Vaal River;
- Curtailment of recreational fishing in the Vaal Dam;
- Reduced popularity of the Dusi canoe marathon due to health threats;
- Cancellation of championsip rowing events on Roodeplaat Dam.

Health impacts of the WRC's eutrophication research that were considered relate mainly to the prevention of illness and fatalities, through the identification of, and warning against, those aspects of eutrophication that have been proven to cause sickness and death. A specific example is that of cyanobacterial poisoning, as illustrated by an outbreak of diarrhoea in 1999 among people who consumed water from the hypertrophic Bospoort Dam.

Implications for policy

All of the impacts identified and analysed reflect potentially positive value of WRC research on eutrophication for the economy, the environment, society and human and animal health. Stakeholder perceptions gauged during the course of the analysis confirm this potential. In essence, these perceptions are that while the research is up to international standard and has already had significant benefits in helping society to make sound choices, greater efforts are needed in applying the research results and in creating public awareness of eutrophication issues.

The conclusion to be reached is that ongoing research, supported by the targeted application of past and future research results by the water, agricultural and industrial sectors, as well as greater efforts to increase public awareness of the problem and its solutions would go a long way in addressing the problem of eutrophication in South Africa.

Further reading:
To obtain the report *Eutrophication Research Impact Assessment* (**Report No: TT 461/10**), contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.