

CONTACTS:

THE ENVIRONMENT AGENCY HEAD OFFICE

Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS32 4UD.
Tel: 01454 624 400 Fax: 01454 624 409

www.environment-agency.gov.uk
www.environment-agency.wales.gov.uk

ENVIRONMENT AGENCY REGIONAL OFFICES

ANGLIAN

Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 5ZR
Tel: 01733 371 811
Fax: 01733 231 840

MIDLANDS

Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: 0121 711 2324
Fax: 0121 711 5824

NORTH EAST

Rivers House
21 Park Square South
Leeds LS1 2QG
Tel: 0113 244 0191
Fax: 0113 246 1889

NORTH WEST

Richard Fairclough House
Knutsford Road
Warrington WA4 1HG
Tel: 01925 653 999
Fax: 01925 415 961

SOUTHERN

Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 832 000
Fax: 01903 821 832

SOUTH WEST

Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 01392 444 000
Fax: 01392 444 238

THAMES

Kings Meadow House
Kings Meadow Road
Reading RG1 8DQ
Tel: 0118 953 5000
Fax: 0118 950 0388

WALLES

Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0EY
Tel: 029 2077 0088
Fax: 029 2079 8555



ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE

0845 933 3111

ENVIRONMENT AGENCY
FLOODLINE

0845 988 1188

ENVIRONMENT AGENCY
EMERGENCY HOTLINE

0800 80 70 60



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HO-3/00-3K-C-03/10
Printed on Cyclan Print - a 100% recycled 1st paper

EA-NCEHS BOX 2

Aquatic Eutrophication



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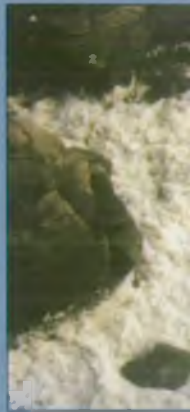
WHAT IS EUTROPHICATION?

All plants and animals need small amounts of nutrients to grow and reproduce. However, an excess of nutrients in the environment can lead to problems. The term eutrophication (from the Greek meaning well nourished) is used to describe this process of nutrient enrichment and its adverse effects in the environment. Although this enrichment occurs in both terrestrial and aquatic ecosystems, this leaflet focuses on the water environment.

As a result of eutrophication, waters which are nutrient-poor (oligotrophic) or medium-nourished (mesotrophic) move towards a nutrient-rich (eutrophic) state, by a series of inter-linked steps. Human activities in the catchment area may lead to increased inputs of plant nutrients and elevated nutrient concentrations in the water body, causing accelerated growth of algae and/or higher plants. This can result in physical, chemical and biological changes in the water and its plant and animal communities, causing adverse effects on biological diversity, water quality and water uses.

Although both phosphorus and nitrogen contribute to eutrophication, phosphorus is generally the main nutrient limiting biological growth in fresh waters, whereas in estuarine and coastal environments it is more often nitrogen. Prevention of eutrophication in fresh waters is usually through targeted action to control phosphorus inputs and in estuarine and coastal waters action is usually aimed at controlling nitrogen inputs. The main sources of phosphorus and nitrogen include:

- discharges from sewage treatment works and factories.
- runoff and leaching from agricultural land.
- contributions from rural populations.
- atmospheric nitrogen deposition.



Why should we be concerned?

Eutrophication may have temporary and more irreversible adverse effects on aquatic ecosystems and water uses such as water supply, livestock watering, irrigation, fisheries, navigation, water sports, angling and conservation. Specific problems include:



Coastal algal scum

- excessive growth of algae resulting in blooms and scums. These blooms cloud the water and block sunlight, often preventing aquatic plant growth. They can also cause unpleasant smells. Some algae, particularly blue-greens, produce toxins that may cause death of livestock, pets and wildlife, and sickness in humans.
- de-oxygenation caused by increased oxygen demand of plants and algae, particularly when they die and decompose. In extreme cases, fish and other plant and animal life may die.
- reduction in the level of biological diversity as sensitive plant and animal species disappear to be replaced by more nutrient tolerant species.

What is the extent of the problem?

In England and Wales, the problem of nutrient enrichment is now recognised as one of the main freshwater quality issues, and there are concerns about some of our marine waters. From 1989 to 1997, around 3,000 different freshwater bodies were found to be affected by algal blooms. Under an EC Directive on urban wastewater treatment, some 80 waters receiving discharges from large sewage treatment works have now been designated by the Government as affected by eutrophication (Figure 1). Investigations are continuing into the need for further designations.

Eutrophication is also implicated in reducing the wildlife conservation interest of some of the country's more pristine lakes and rivers, including Sites of Special Scientific Interest (SSSIs).

What is being done?

Several initiatives exist to overcome the problem of eutrophication, at international, national and local level. The most important of these are the EC Urban Waste Water Treatment (UWWT) and Nitrate Directives. These require the designation of areas sensitive to eutrophication induced by excess phosphates and/or nitrates, and the implementation of nutrient control

The Environment Agency's eutrophication strategy

All these initiatives are helpful in controlling eutrophication, but most deal only with specific elements of the overall problem. In order to ensure a more co-ordinated approach, and in response to the impacts and risks associated with eutrophication, the Agency has developed a strategy for managing eutrophication in England and Wales. The key elements of the strategy include:

- promotion of a partnership approach, both at local and national level.
- across-the-board measures to reduce nutrient inputs to the water environment nationally.
- local catchment-based action for affected waters.

At the national level, we intend to work with others to



Shoreline accumulation of filamentous algae

improve co-ordination of the various regulatory initiatives. We also intend to investigate what further reduction of nutrient inputs can be achieved in the industrial sectors that contribute the greatest quantities of nutrients to the water environment – the water industry, phosphate and soap & detergent industries and the agricultural sector.

The assessment and management of local problems is to be addressed through the introduction of catchment-based 'eutrophication control action plans', initially via a pilot scheme. These plans recognise the need for case-specific management. To achieve environmental improvements, it may be necessary for the Agency or others to use regulatory control powers. Other approaches such as developing community ownership of the problem and promoting voluntary action, may also be appropriate.

Tackling the problem of eutrophication is not a simple task and often there are no quick and easy solutions. Through encouraging 'prevention rather than cure' and the 'partnership approach', we believe that the effects of eutrophication in our fresh and marine waters can be reduced, to benefit water users and biodiversity.

Further information

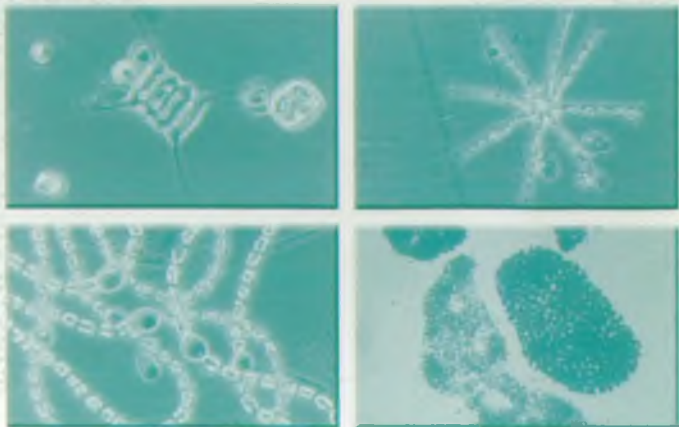
The report *Aquatic Eutrophication in England and Wales: a management strategy* and leaflets on freshwater 'Blue-green algae', 'Marine Algae' and 'Nitrate Vulnerable Zones' are available from the Environment Agency.

For further information please contact the National Centre for Ecotoxicology and Hazardous Substances.

Ecotox@environment-agency.gov.uk

01491 828544

National Centre for Ecotoxicology
and Hazardous Substances



Types of freshwater algae under the microscope

action in these areas. Under the UWWT Directive, nutrient reduction treatment is already in place at around 50 large sewage treatment works, and is required at a further 100 works by 2005. The Nitrate Directive focuses on reducing nitrate losses from agriculture through restricting the application of fertilisers and manure in areas draining to waters affected by nitrate



Figure 1. Sensitive Areas (Eutrophic) designated under the Urban Waste Water Treatment Directive in 1998

pollution. To date there have been no eutrophication-related designations under the Nitrate Directive, although a number of estuaries are currently being assessed. Some 600,000 hectares have been designated to protect drinking water sources.

Where eutrophication threatens the wildlife conservation interest of sites designated under the EC Habitats Directive, or as SSSIs, nutrient reduction requirements may be imposed on discharges. Nutrient removal at approximately 65 sewage treatment works affecting wildlife sites has been agreed for implementation by 2005 and further sites are subject to ongoing investigation.

Other initiatives such as international agreements and national priorities are also resulting in action. Under the



Freshwater blue-green algal scum

UK Biodiversity Action Plan, the implementation of Habitat Action Plans for mesotrophic lakes and eutrophic standing waters will require action at both local and national level to reduce nutrient losses and manage affected waters. For marine waters, the UK government is committed to action required under a strategy to combat eutrophication agreed under the Oslo and Paris (OSPAR) Convention.

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