Assessment of the aggressiveness of invasive plants is important because they are potentially more damaging to environmental habitats than even toxic compounds. Once introduced, they are able to exponentially increase both their numbers and geographic distribution with adverse consequences to the natural environment. Effective control methods depend on a sound knowledge of the biology and life strategies of successful aquatic and riparian invasive plants of areas to determine the most likely methods to limit their invasion potential in vulnerable areas.

Programme 6 Control of Pests and Diseases

Figure 33. A newly discovered ecotype or sub-species of Crassula helmsii.

Effective control methods for aquatic and riparian plants should be based on a sound knowledge of their ecological requirements.

Invasive aquatic plants

Floating Pennywort, *Hydrocotyle ranunculoides*, an emergent bankside water plant, is the most recently-found introduction. It is a native of the Americas but it became established in Britain about 1990 and has been found in 27 sites mainly in the south east and central southern area where it has been found in a range of water bodies, particularly rivers, ditches and ponds but also in a stream, a lake and a canal. In these typically slow-flowing and eutrophic waters, the plant forms dense interwoven mats of floating vegetation which grow across the surface, altering the ecology and interfering with amenity uses of the water body.

Joint studies with the IACR-Centre for Aquatic Plant Management has shown it may become a major weed problem particularly impeding water-flow in land-drainage channels in which it is dispersed as small fragments. Initial iso-enzyme studies of the British population show that this invasion probably resulted from a single population made available through aquatic garden centres and nurseries where it was often sold under the misnomer 'Marsh Pennywort', the common name of *H. vulgaris*, a native British species. The current estimate for its control by herbicides is £30 000, whilst mechanical control of its effects in the 20km of channel currently invaded is about £10 000 per kilometre.

Monitoring the changes that occur with the ever increasing populations and sites of the Australian Swamp Stonecrop *Crassula helmsii* continues with the number of new sites reaching the predicted 1000 by the year 2000. The legislative mechanism to reduce the spread of this invasive plant has proved inadequate and suppression of native vegetation in vulnerable conservation areas continues. Opportunities have been sought to study its further spread by contrasting British with Australian and New Zealand populations. This has resulted in the resolution of details of the seedling development, an alternative

Figure 34. Impatiens glandulifera – *mature seeds are propelled 3-5 m from parent plant.*

mechanism to the spread of small propagules, other mechanisms of dispersal and in two new ecotypes or subspecies being discovered. Opportunities have been taken to confirm the effectiveness of a control strategy previously developed. However the current cost of implementation is estimated to be about £3 000 000 but with the discovery of populations in two Cumbrian lakes total control in Britain is now unlikely.

The effectiveness of potential control strategies have been made by the analysis of the distribution and habitat requirements of the generally widespread bankside riparian invasive plants, Japanese Knotweed, *Fallopia japonica*, Giant Hogweed *Heracleum mantegazzianum*, and Himalayan Balsam, *Impatiens glandulifera*. The characteristic habitat requirements including flow regime, channel and bank substrates, were combined with the locations and circumstance of colonisation, and allowed the characteristics of sites of higher-vulnerability-to-invasion to be identified. Comparisons were made with populations of large stands of native plants of similar habit, particularly nettle, bracken and rhododendron, and often less frequent, were recorded during 1994-96 River Habitat Surveys for the Environment Agency and in which the IFE undertook a major role.

Further joint analysis of the control techniques applied in one region of the EA, where these plants are all widely distributed, showed extreme adverse consequences of the accidental introductions to river banks from locations away from the river, and then of their further dispersal by the downstream drift of seed or fragments. The most important control methods involve the use of chemicals applied to populations in the upstream parts of the affected catchments. Subsequent effort can then be made progressively downstream. This is more effective than applying a widespread and thin effort to a catchment. A principle of handling new invasions is to start immediately, whilst the scale of the problem is relatively small.

Crassula helmsii – Australian swamp stronecrop frequently grows from small fragments easily transferred by man's activities. The unusual conditions of seed germination have recently been determined.

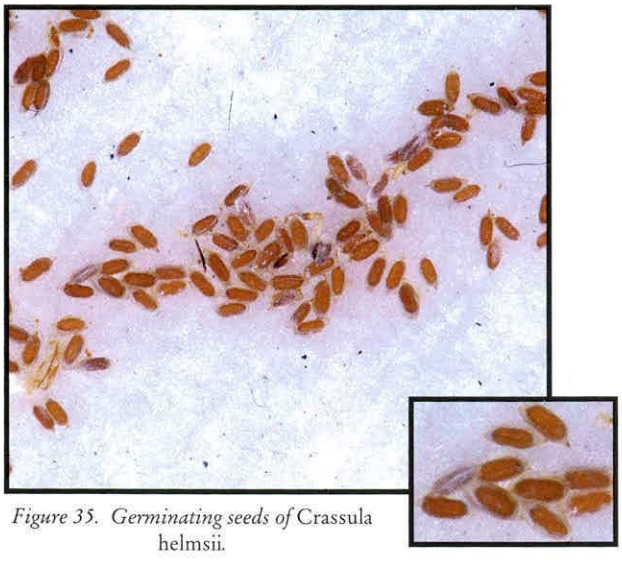


Figure 35. Germinating seeds of Crassula helmsii.

Pollution of fresh waters occurs by direct discharge, run-off from the land and by atmospheric deposition. The processes (physicochemical and biological) controlling the dynamics and impacts of all major pollutants need to be measured and modelled if, ultimately, we are to develop realistic hazard and risk assessment procedures for the natural environment. This approach includes the development of new biological methods for detecting pollution through investigation of behavioural, physiological, cellular and genetic responses of a range of organisms.

Programme 7 Pollution Assessment and Control

Reversal of surface water acidification in the Lake District

Lakes and streams whose catchments lie on metamorphosed igneous rocks of the central part of the Lake District (Cumbria) are acidified due to the effects of atmospheric pollution – "acid rain". Such acidification threatens fish, invertebrates and other organisms.

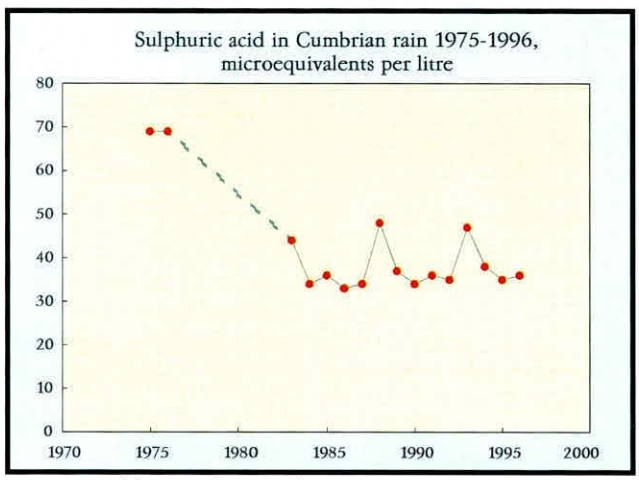


Figure 36. Sulphuric acid in Cumbrian rainwater, 1975-1996. Monitoring was not carried out during the period indicated by the dotted line.

Since variations in atmospheric pollution levels take place on a time-scale of decades, and catchment responses may not be immediate, long-term monitoring of surface water and rainfall chemistry are needed to determine the extent and direction of any changes in surface water quality. The chemical compositions of a number of the waters were surveyed in the 1970s, and routine monitoring of several representative examples has been performed since the early 1980s. The chemical composition of Cumbrian rainwater has been followed over the same period.

The main change in rainwater chemistry was the substantial decrease in sulphuric acid concentration between the mid-1970s and the early 1980s (Figure 36). Other components of rainwater have varied from year to year, but have shown no systematic changes. The observations for Cumbria are in line with those for rural sites in other parts of western Britain.

Figure 37a. Devoke Water.

Figure 37b. Levers Water.

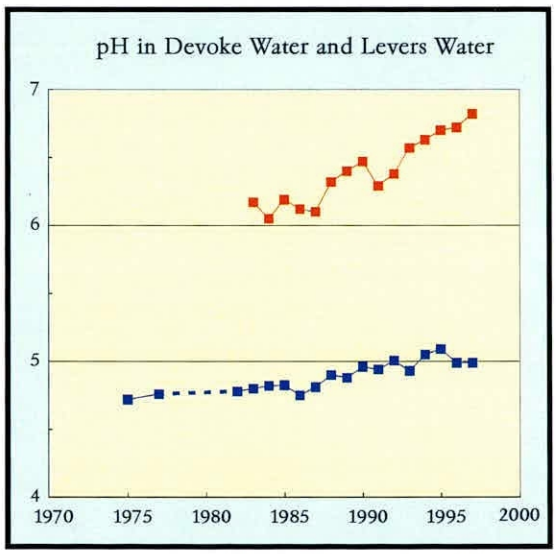


Figure 38. The pH of Devoke Water and Levers Water, 1975-1997. The higher is the pH value the less acid is the water: a value of 7 represents neutrality.

Surface water quality is improving following the decline in atmospheric pollution.

It is now apparent that the surface waters are responding to the decline in pollutant inputs, as exemplified by two of the monitored lakes, Devoke Water and Levers Water (Figures 37a,b). In each lake, the concentration of sulphate originating from acid deposition has decreased, while there have been increases in pH, indicating that the waters have become less acid (Figure 38). The improvement was not immediate, possibly because catchment soils retained sulphate during the period of high deposition and released it slowly in response to the decreased inputs. The mildly acidified Devoke Water appears to have completely recovered from the effects of acid rain, while the more sensitive Levers Water still has some way to go.

Temporal change in fallout ^{137}Cs in terrestrial and aquatic systems: a whole ecosystem approach

During the years after a nuclear accident the bioavailability and environmental mobility of radiocaesium (^{137}Cs) declines markedly, resulting in large changes in contamination of foodstuffs, vegetation, and surface waters. Predicting such changes is crucial to the determination of potential doses to affected populations and therefore to the implementation of radiological countermeasures. We have studied the changes with time in ^{137}Cs activity concentrations in terrestrial and aquatic ecosystems during the years following the Chernobyl accident. The study was carried out in collaboration

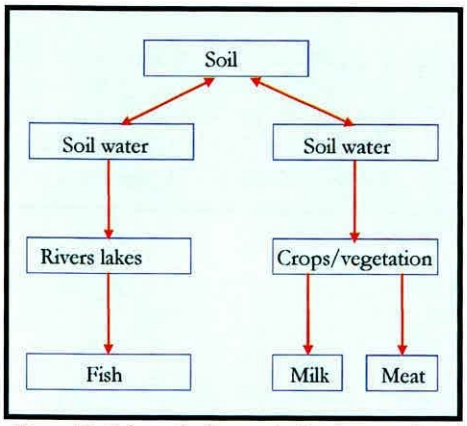


Figure 39. Schematic diagram indicating transfers of radiocaesium from soils to terrestrial and aquatic ecosystems during the years after a radioactive fallout event. In the long term, changes in the soil – soil water partitioning of activity control changes in activity in surface waters, vegetation etc.

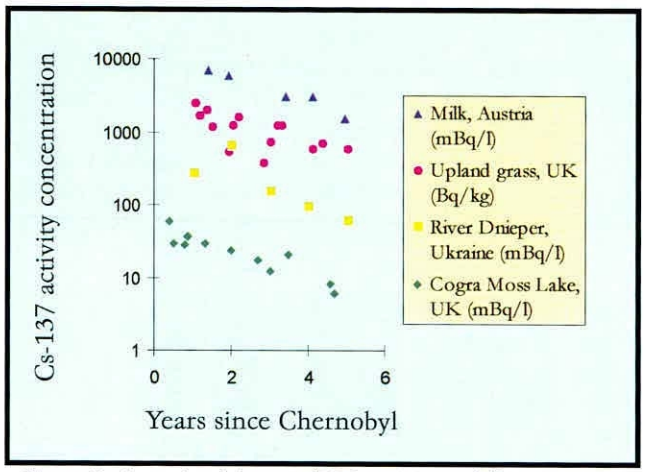


Figure 40. Examples of changes of ^{137}Cs activity in different ecosystem components after Chernobyl. Rates of change in contamination in different ecosystem components are similar because of the controlling influence of slow immobilisation in the soil.

with ITE Merlewood and the Russian Institute of Agricultural Radiology.

After a nuclear accident, ^{137}Cs activity concentrations in different parts of the ecosystem decline as a result of physical and chemical changes in its environmental mobility. Using data from 77 separate studies, we have shown that the rates of decline in ^{137}Cs activity concentrations in three different ecosystem components (milk, vegetation, surface waters) are remarkably similar. The analyses have shown that the long-term availability of radiocaesium to both aquatic and terrestrial ecosystems is controlled by slow immobilisation by clay minerals in the soil. This is, we believe, the first time that this immobilisation mechanism has been quantitatively linked to changes in ^{137}Cs activity concentrations in the environment. The observed rates of decline in activity concentrations varied remarkably little between studies carried out in many different European countries (results from 11 countries were included in the analysis) confirming the generality of this result.

The results of this study have important implications for long-term planning and dose assessment following a nuclear incident. After Chernobyl, ^{137}Cs activity concentrations were found to be much higher in vegetation growing on organic upland soils than on more mineral soils. We have shown that organic soils also have slower rates of decline in ^{137}Cs availability than mineral soils. The results explain the persistence of radiocaesium contamination in upland ecosystems after Chernobyl.

The long term radioactive contamination of both terrestrial and aquatic ecosystems was found to be controlled by slow diffusion of ^{137}Cs into the clay mineral lattice.

Micro-organic distributions in river sediments in the Humber catchment

Research by IFE, River Laboratory and the Postgraduate Research Institute for Sedimentology at the University of Reading has examined the distribution of over 30 micro-organic compounds including a range of synthetic pyrethroids, industrial chemicals and polyaromatic hydrocarbons in river water, river-bed sediment and suspended sediment. The major effort has concentrated on the rivers in the south of the Humber catchment and includes the rivers Aire, Calder, Don, Trent and Ouse as well as the Swale, a less polluted river draining the north of the catchment. The research has

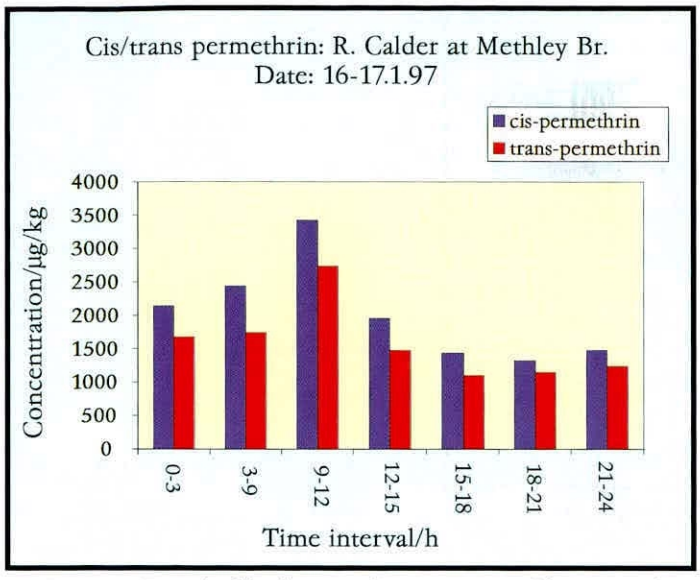


Figure 41. Example of the changes in the concentration of the isomers of permethrin found in suspended river sediments during a sampling campaign on the river Calder in Yorkshire. Samples were collected over 3 hour periods and the results are expressed as the concentration of the individual isomer in µg/kg (dry sediment).

Chemical measurements have provided unique and detailed information about the occurrence of over 30 contaminants in the river sediments of the Humber catchment.

examined seasonal changes in occurrence of the contaminants in the catchment as well as short-term changes during high river-flow in the Aire and Calder.

- New methods have been tested and found suitable for the collecting suspended sediments from rivers and extracting their associated pesticides and some other micro-organic compounds using super-critical fluid extraction with CO_2.
- The results show that many pesticides and micro-organic compounds occur in the bottom sediments and also in suspension in river water. These compounds are often missed when water samples are routinely analysed. Only when the sediments are separated from the river water and undergo a rigorous chemical extraction are the compounds reliable identified and measured.
- The concentration of contaminants associated with suspended sediments generally exceeds that seen in the river bottom sediments. Exceptions to this probably reflect temporal and spatial variations in sediment characteristics.
- Some contaminants, such as the polyaromatic hydrocarbons and synthetic pyrethroid insecticides, were found at high concentrations in river-bottom sediments, e.g. the insecticide permethrin was measured at concentrations greater than 1000 µg/kg of sediment (or ppb).
- There is no doubt that micro-organic contaminants especially the pyrethroids in the more industrial rivers such as the Aire and Calder, have an effect on invertebrates living and feeding in the sediments.
- Intensive studies measuring micro-organic concentrations in river water and suspended sediments at 1-3 h intervals during high river-flow showed large changes in concentrations.

Predicting the potential for natural attenuation of organic pollutants in groundwater

Many present and former industrial sites are a major source of soil and groundwater contamination by organic pollutants that comprise a diverse range of organic and inorganic compounds, typically found at high concentrations. Our understanding of the fate of pollutants in these systems is poor. In a project with the University of Sheffield and the British Geological Survey, together with several industrial collaborators, practical methods are being developed which will enable the potential for natural contaminant attenuation, which exploits natural biodegradation processes in an aquifer, to be robustly and reliably determined. The project is designed to meet these needs by examining the fate or organic chemicals in groundwater beneath an operational coal-tar processing plant in the U.K. Groundwater in the vicinity

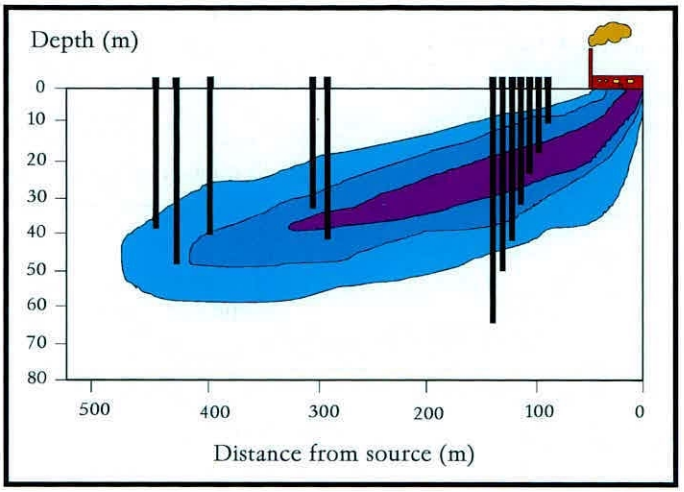


Figure 42. Schematic of plume of contaminants in groundwater showing boreholes sunk into the contaminant plume. Contours indicate the degree of contamination.

of the plant has been heavily contaminated with a range of coal-tar compounds, including phenol, cresols, xylenols and BTEX, some at concentrations up to 12,000mg/L. A large contaminant plume (3Mm^3 volume) which developed as a result has dived 60m over a distance of 500m from the plant (Figure 42). The role of the IFE in this multi-disciplinary project is to assess the diversity and activity of aquifer microorganisms and their population dynamics in response to changing environmental factors and pollutant matrix. The construction of boreholes enabled sampling to be carried out at a number of sites and at various depths (up to 80m below the surface) within the contaminant plume. Preliminary results show that the total numbers of bacteria, their culturability and microbial activity, based on ^{14}C-phenol degradation, generally decreased as phenol concentration in the groundwater increased. Of all the chemical parameters measured, phenol degradation potential appeared to be linked only to sulphate availability, although the relationship is not clear. Interestingly, bacterial numbers greater than 10^4 cells ml^{-1} were detected in phenol concentrations over 2600 mg/L. Despite high pollutant levels, some of these bacteria were culturable, showing the extraordinary adaptability of the bacterial community under exceptional conditions (Figure 43). Moreover, biodegradative potential was found to exist throughout the plume. The first stage of the project was to show that the potential for natural attenuation existed, it will now focus on the factors that control the degradative processes.

Potential for bioremediation exists despite high levels of pollutants.

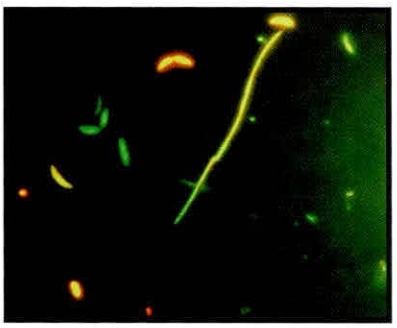


Figure 43. Bacteria from groundwater containing 2.7 gL^{-1} phenol. Sample taken from 50 m below ground.

The issue of climate change is now moving from the hypothesis stage to reality, and GCM predictions of the magnitude and speed of change are large enough to suggest that there will be major impacts in the UK. However, the full nature of the biotic feedbacks involved is not understood but is likely to be important in conditioning the eventual impacts and responses. Thus, a better understanding of the links between the physical and biological processes, using both field experiments and modelling, is critical to the advancement of this area of science.

Programme 9 Global Change

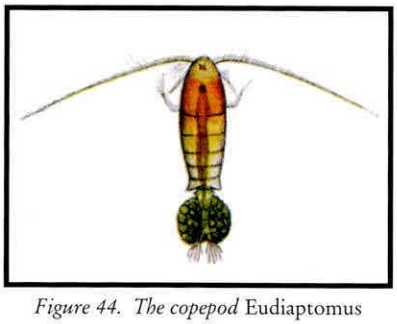


Figure 44. The copepod Eudiaptomus gracilis.

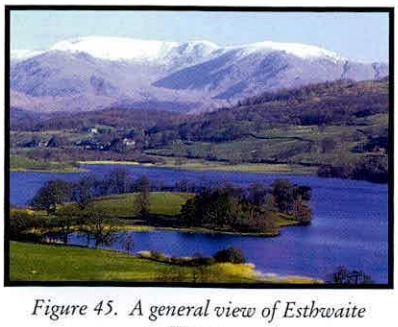


Figure 45. A general view of Esthwaite Water.

The influence of long-term changes in the weather on the overwintering performance of lake zooplankton.

The microcrustacea that dominate the plankton of lakes can tolerate quite high summer temperatures but small changes in the winter temperature can have a significant effect on their seasonal dynamics. One of the most important factors influencing the winter survival of these microscopic animals is the rate at which they acquire and store energy. Some genera, like *Eudiaptomus* (Figure 44), can feed on very low concentrations of phytoplankton but others, like *Daphnia*, require much higher 'threshold' concentrations of food. Recent studies in Esthwaite Water (Figure 45), a productive lake in Cumbria, have shown that year-to-year changes in the weather have a major effect on the overwintering performance of these common animals. *Daphnia* numbers tended to be higher in cold winters when their metabolic rate was low and the concentration of small flagellates relatively high. *Eudiaptomus* numbers were always higher in mild winters when there was a strong growth of colonial diatoms. Throughout the eighteen year period of study, the most important factor influencing the overwintering performance of the two animals was the water temperature.

Figure 46a shows the relationship between the average number of *Eudiaptomus* recorded in Esthwaite Water during the winter and the average water temperature recorded over the same period. Although the number of animals present in the open water during the winter was relatively low, there was a significant positive correlation ($r = 0.53$, $p < 0.05$) between this overwintering stock and water temperature. A number of climatic factors can influence the winter temperatures recorded in the UK, but

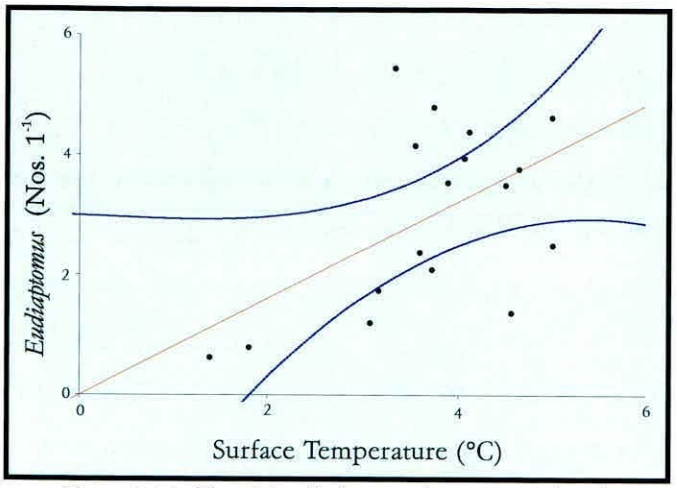


Figure 46 (a). The relationship between the average number of Eudiaptomus *recorded in Esthwaite Water during the winter and the average water temperatures recorded over the same period.*

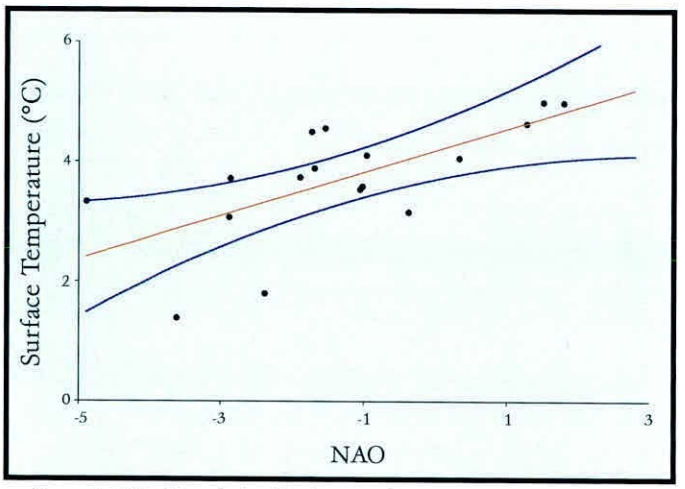


Figure 46 (b). The relationship between the average water temperatures recorded in Esthwaite Water during the winter and the NAO index.

one of the most important is the atmospheric pressure gradient known as the North Atlantic Oscillation (NAO). The NAO index is a measure of the atmospheric pressure difference recorded in winter between Lisbon in Portugal and Stykkisholmur in Iceland. Positive values of the index are associated with mild winters over north west Europe that have tended to recur every 6-10 years over recent decades. Figure 46b shows the relationship between the average water temperatures recorded in Esthwaite Water during the winter and the NAO index. There was a significant positive correlation ($r = 0.67$, $p < 0.01$) between the measured water temperature and this regional index and the fitted linear regression explained 44 % of the recorded variability in the winter temperature.

Results of this kind show the extent to which biological conditions within an apparently 'isolated' lake can be influenced by factors operating on a truly global scale. The strength of these teleconnections are all the more remarkable when we consider the errors associated with the population estimates and the empirical nature of the NAO index. Climatologists have recently shown that temperature changes associated with the NAO account for 31 % of the inter-annual variations recorded in the Northern Hemisphere. It is not yet clear whether these fluctuations are a response to greenhouse gas forcing or form part of a longer-term pattern of change. Whatever the source of these fluctuations, the results presented here demonstrate that the NAO index provides a useful means of identifying the critical driving variables in a lake that is very sensitive to changes in the weather.

Winter water temperatures in a Cumbrian lake correlated with the North Atlantic Oscillation.

Several of our activities cut across all research areas and are essential to the overall success of the Core Strategic Programme. These include: environmental assessment, economics and history; remote sensing; instrumentation and technology development; analytical chemistry; databases and reference collections. Whilst interacting throughout the different programme areas, the scientists involved in these activities also develop their own subject areas to ensure that the research programmes have access to the best available information and techniques.

Programme 10 Integrating Generic Science

Automatic Water Quality Monitoring

Automatic Water Quality Monitoring Stations (AWQMS) designed and built by the IFE and installed in Ireland, Spain and the UK have produced high-resolution time-series of meteorological and water quality parameters at each site. The three year project to develop these stations was commissioned by the European Union under its LIFE programme with the Environment Agency providing additional support. Sample data sets acquired by the systems illustrating the value of such continuous measurements were presented in some detail in a Final Report to the European Commission (George and Rouen, 1997).

An example of the data acquired by the systems located on Esthwaite Water (Cumbria, UK) is shown in Figures 47 and 48. Figure 47a and 47b show mean daily solar radiation and square of the mean daily wind speed (proportional to the wind stress) respectively, recorded in the spring and early summer of 1997. Figure 48 shows the temperature structure of the lake, recorded by the AWQMS over the same period. Notice how the high winds accompanied by low levels of solar radiation that occurred at the end of June dramatically mix the upper half of the lake in a 24 hour period.

High Resolution data acquired by the Automatic Water Quality Monitoring Station.

Expanding the Network of Automatic Water Quality Monitoring Stations.

The network will be expanded in 1999 to include a further five European countries as part of a new project commissioned under the European Union's Framework IV programme. This new project 'The Response of European Freshwater Lakes to Environmental and Climatic Change (REFLECT) combines instrumental studies using the AWQMS systems with water quality modelling and the construction a series of high resolution spatial and temporal climate change scenarios. Conventional biological and

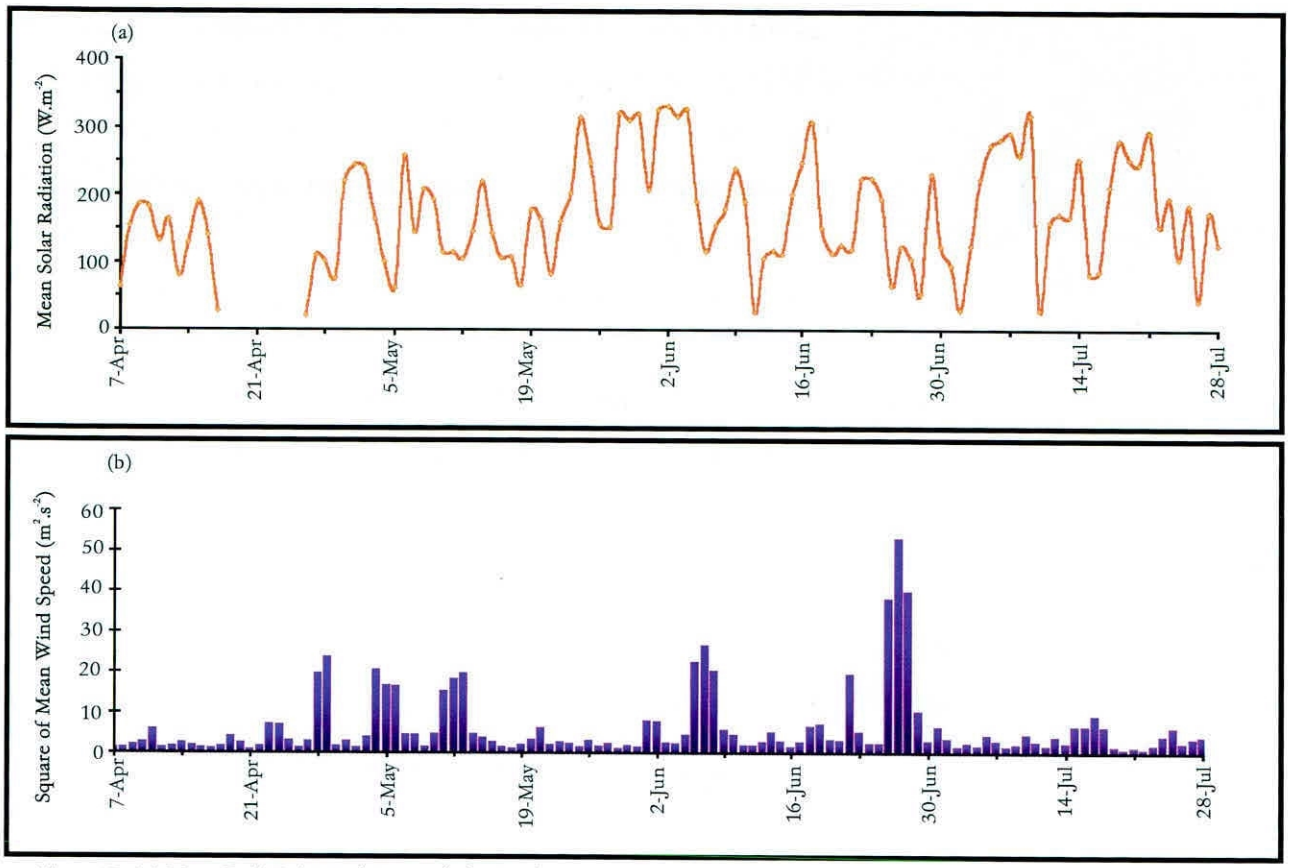


Figure 47. (a) Mean Daily Solar Radiation and (b) Wind Stress recorded by the Automatic Water Quality Monitoring Station (AWQMS) at Esthwaite Water in the Spring and Summer of 1997.

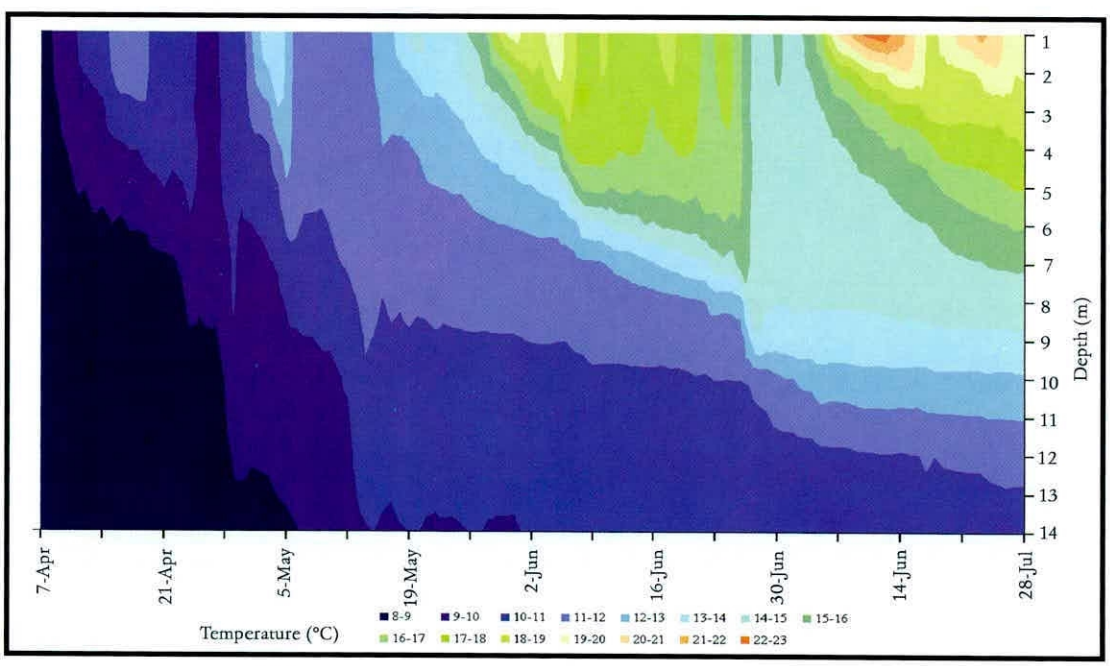


Figure 48. The temperature structure recorded by the Automatic Water Quality Monitoring Station (AWQMS) at Esthwaite Water in the Spring and Summer of 1997.

chemical sampling will also be carried out to validate the instrumental studies. It aims to improve our understanding of how both local changes in the catchment and regional changes in the weather affect the lakes. This should enable us to predict how the lakes are likely to respond to a change in climate.

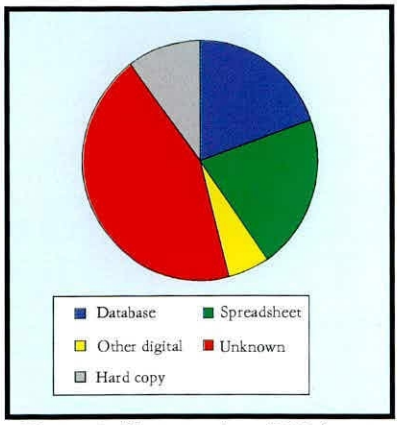


Figure 49. The proportion of IFE datasets held in each storage medium; at present less than 20% are held in a secure database structure.

Establishing an IFE data centre

The IFE holds many unique and nationally important freshwater datasets. These include long-term records, and regional and national survey data. However, many of these are at risk of permanent loss because they are not held within a secure database structure. Current storage media include crumbling and fading hardcopy (especially the older datasets) and a range of digital formats some of which are now obsolete (Figure 49). These problems also make the data difficult to access in response to internal and external requests for data.

Over the past year, the IFE has begun to address these problems under the Stewardship and Exploitation of Environmental Data (SEEDCORN) initiative. A Freshwater Data Centre, with close links to other Data Centres within the CEH, has been established at the River Laboratory. Also, the current data holdings of the IFE have been catalogued and there are plans to publish this information on the World Wide Web (WWW). Information about each dataset held will include:

- Time period & frequency of collection
- Geographical coverage
- Parameter list
- Information on quality assurance
- Ownership and availability

The IFE begins to rescue nationally important freshwater datasets.

Table 1. Prioritised list of datasets that the IFE plans to rescue over the next two years.

Dataset	Description
1. Algal data from lakes within the catchment of Lake Windermere	Algal populations, and associated parameters, monitored at weekly/ fortnightly intervals since 1945.
2. Biological monitoring data for the River Great Ouse	Fish, macro-invertebrates, zooplankton and phytoplankton populations monitored in the River Great Ouse since 1987.
3. Plankton communities in Loch Leven	Phytoplankton, zooplankton and related information collected at weekly/fortnightly intervals since 1968.
4. Perch and pike in Lake Windermere	Data on perch (*Perca fluviatilis*) and pike (*Esox lucius*) collected annually since 1940; parameters include length, weight, sex, reproductive stage and age for each fish caught.
5. Fish populations in Cow Green Reservoir	Biology and population dynamics of brown trout (*Salmo trutta* L.), bullhead (*Cottus gobio* L.) and minnow (*Phoxinus phoxinus* L.) in Cow Green Reservoir 1967 to 1980, i.e. before and after impoundment.

The next phase of this work is to load data into the central database. As the IFE's data holdings are extensive, this is a major undertaking. A prioritised list of datasets for rescue over the next two years is shown in Table 1.

Mayflies new to Great Britain

Over the past 20 years, invertebrate zoologists at the IFE River Laboratory have had unrivalled opportunities to examine collections of freshwater macroinvertebrates from field samples throughout Great Britain. Data from several extensive research programmes have now been collated into a National Database for the macroinvertebrate fauna of British Rivers.

The combination of a restricted freshwater fauna compared to the Continent of Europe, and an excellent series of keys to invertebrates published by the Freshwater Biological Association, have enabled biologists in Britain to obtain more detailed information on the species composition of running-water assemblages than is possible for many of our colleagues in mainland Europe.

Nevertheless, even in important groups of freshwater macroinvertebrates such as the Ephemeroptera (mayflies), which attract the interest of fishermen and scientists alike, there can still be surprises. The most recent key to the larvae of the British Ephemeroptera was published by Elliott, Humpesch and Macan in 1988. They listed 48 species for Great Britain, of which one, *Caenis pusilla*, had been recorded in Britain for the first time just two years earlier.

Since 1988, a further three species of mayflies new to Britain have been recorded by the IFE team at the River Laboratory. Two of these species, *Caenis pseudorivulorum* and C. *beskidensis*, are small and unobtrusive.

Figure 50. Larva of a mayfly new to Britain, Electrogena affinis.

Caenis pseudorivulorum, a northern European species, is now known from many locations in Britain but C. *beskidensis*, which is widespread from Poland to Spain, has only been found at one site on a tributary of the R. Wye.

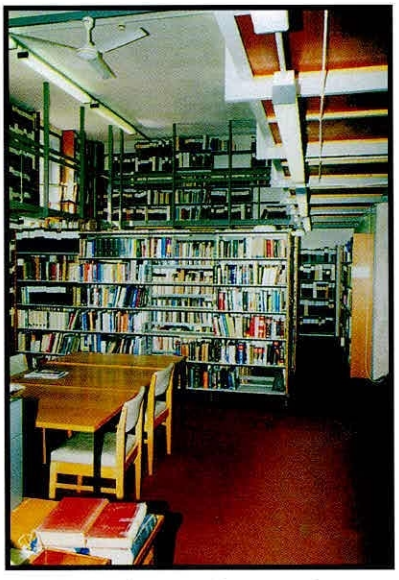
Perhaps more spectacular has been the discovery of *Electrogena affinis* in the lower reaches of the R. Derwent in Yorkshire. Figures 50 and 51 are photographs of the larva and the adult (imago) of *E. affinis*, taken by Mr Mike Hammett. It is possible that this species occurs at other suitable locations on large lowland rivers in England.

In the last 10 years three mayflies new to Great Britain have been discovered by IFE staff.

Figure 51. Adult (imago) of Electrogena affinis.

The Library, Laboratory Steward's office, Electrical, Electronics and Mechanical Workshops provide valuable support for the Institute's scientific programme. Not only do these sections provide day-to-day support to the scientific staff, but they are also increasingly working alongside scientists on major projects. Here we describe the changes to the Library and information services, the work undertaken to maintain the laboratory buildings and major facilities, and some of the new instrumentation developed by the Institute's Electronics Workshop.

Laboratory Services



The Windermere Laboratory Library.

Implementation of new library management system.

The library and information service

The library and information service is currently implementing Unicorn, a Library Management System which will run across all of the CEH libraries. We can now check the stock of all the other libraries within CEH, and the staff can find out whether a book is on the shelf in one of the ten branch libraries or out on loan. The library housekeeping functions (ordering, inter-library loans, etc.) will facilitate efficient management of our resources. In preparation for the conversion of our old catalogue system, we have digitised the catalogue records for all of the older books in the Windermere library.

The library

The library continues to catalogue about 5,000 items each year, and older catalogue records are being converted to digital form in batches. The online catalogue now holds 150,000 records, with a similar number still waiting to be converted. Our exchange programme continues to supply us with journal series and reprints, in return for the FBA publications we send to our partners in 77 different countries.

We thank the Institute of Terrestrial Ecology library staff for their continued support of our Edinburgh and Monks Wood staff.

The information service

Access to the library catalogue and other databases is provided through CDS/ISIS for Windows, which we have been beta-testing for Unesco. The official release (version 1.0) has now been installed at Windermere, including many of the improvements we requested. It is hoped to extend this service to the regional laboratories in the coming year.

National and international networks

We are continuing to provide bibliographic records for the Aquatic Sciences and Fisheries Abstracts service. International links have been maintained through the European and international aquatic librarians' organizations EURASLIC and IAMSLIC, and national links through the Water Industry Librarians' Group and Aslib.

Laboratory services

Windermere Laboratory:

Three main areas of renovation took place this year. Firstly, the beams straddling the bay window of the dining room on the north elevation of Ferry House needed to be replaced. Secondly, with all the disruption caused by this work, the dining room itself was renovated and restyled to give an Edwardian flavour to the room, reflecting the period of the original building. Thirdly, the remaining original wooden windows (119 in number) were giving cause for concern and these were replaced in uPVC and double-glazed units constructed to mimic the originals. During this work many cracked stone lintels and sills were replaced with new ones, carved to the original design. A number of windows were also replaced in the Pearsall Building. This completed the long running replacement programme.

River Laboratory

The new mains water system was completed and this has resulted in vast savings on the water bills. The fluvarium was connected to the new main later in the year.

The programme of window replacement was continued with eight first floor windows at the Farmhouse and four windows at the main building being replaced. The computer room was also fitted with an extractor fan to reduce the high temperature in summer.

The large fibreglass recirculating channels which were brought onto site with the closure of Waterston, were laid out in two ovals to recreate how they actually looked when operational.

Some work was carried out to the drain under the library to prevent continual blockages occurring.

New walkways were installed in the fluvarium as recommended by the HSE representative who paid an unannounced visit to the site.

Electronics and Instrumentation

As well as the major developments described in the section 'Integrating Generic Science', the department has been engaged in several smaller projects. Two examples are presented here.

Evaluation of Backpack Electric-Fishing gear.

A technical and ergonomic evaluation of Backpack Electric Fishing equipment available world-wide was undertaken in a joint project with the Environment Agency. The aims of the project were to identify the manufacturers of Backpack Electric Fishing Equipment in the UK and the rest of the world, and to evaluate samples of their equipment in a series of field and laboratory tests. The requirements and opinions of the users of Electric Fishing Equipment within the Environment Agency were canvassed and compared with the equipment available.

A total of 15 manufacturers were identified, from which 10 sets of equipment were formally tested. The results of this evaluation will be used by the Environment Agency in a future review of their specifications for electric fishing equipment laid down in the Environment Agency Code of Practice for Safety in Electric Fishing Operations.

Further enhancements to the Smolt Counter

The Smolt counter (originally described in the 1996 report, page 36) has been further enhanced. The operator is now able to adjust the sensitivity of each channel to minimise false triggering and determine the minimum size of fish that will be recorded.

The newly decorated dining room.

Instrumentation to support the Institute's scientific programme.