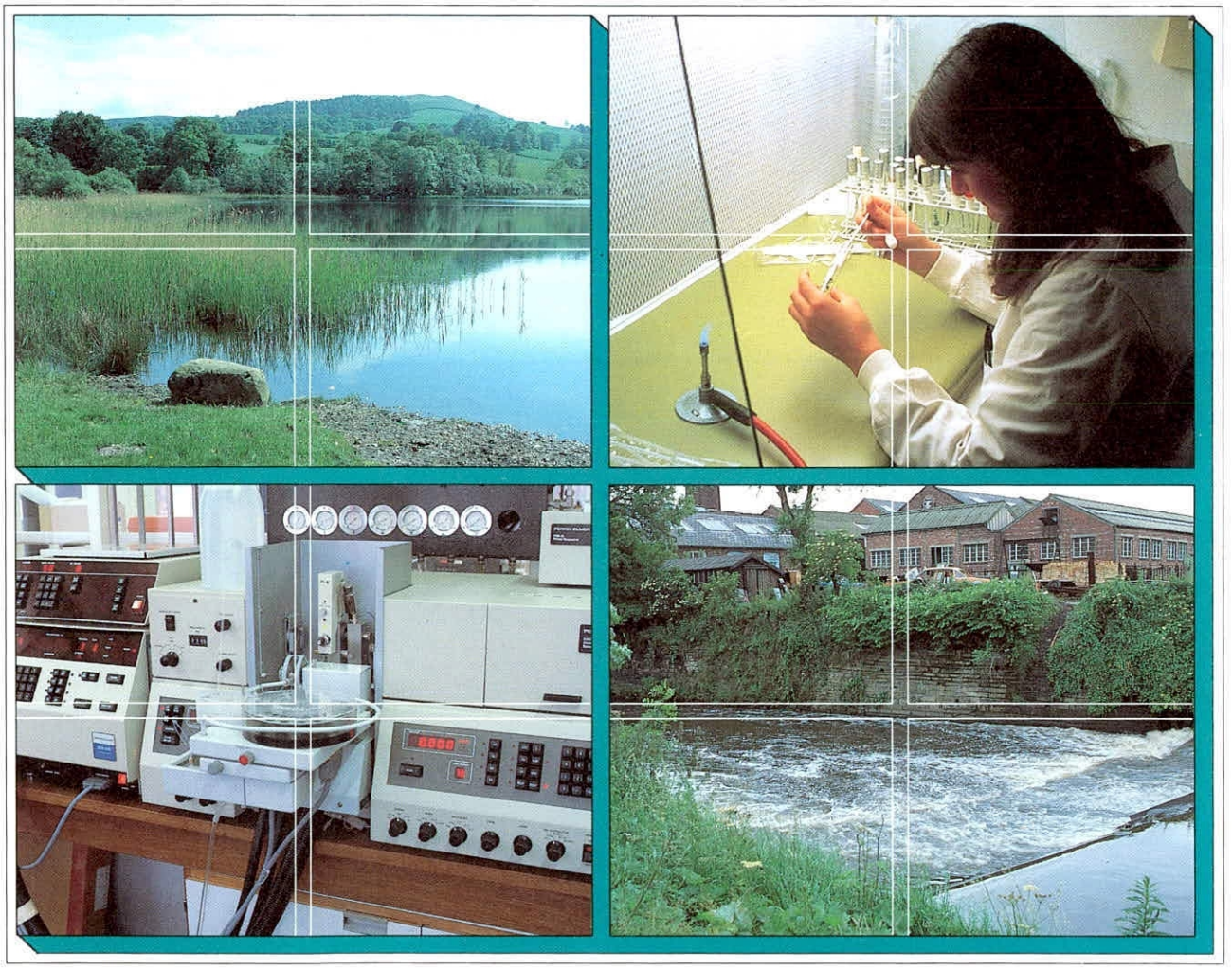
ED/T11060k5/2

Institute of Freshwater Ecology

ROMANIAN FISH POND ENVIRONMENTAL STUDY: A freshwater ecological programme to assess the effects of carp pond farming on water quality

A E Bailey-Watts BSc PhD MIWEM

Summary report to the Natural Resources Institute (Bucharest Project Office)
(September 1994)



Natural Environment Research Council

Institute of Freshwater Ecology
Edinburgh Laboratory, Bush Estate, Penicuik
Midlothian EH26 OQB, Scotland
Telephone 031 445 4343; Fax 031 445 3943

ROMANIAN FISH POND ENVIRONMENTAL STUDY:
a freshwater ecological programme to assess the effects of carp pond farming on water quality

Project Manager and Principal Investigator: A E Bailey-Watts BSc PhD MIWEM

Summary report to Natural Resources Institute
(Bucharest Project Office)
September 1994

Contract Completion Date: 25 September 1994
TFS Project No.: T11060k5

ED/T11060k5/2

The Institute of Freshwater Ecology is part of the Natural Environment Research Council's Centre for Ecology and Hydrology.

A freshwater ecological programme to assess the effects of carp pond farming on water quality in Romania

Background and rationale

Fish producers in Romania pay significant amounts of money to the Ministry of the Environment (MoE) for the water they abstract from, and eventually return to, the main rivers (as 'effluent'). Yet, it is possible that carp ponds may act as filters and actually purify the water. The ultimate aim of this mission is to design a monitoring programme to assess whether ponds lead to cleaner water. The terms of reference of the mission are as follows:

- to establish, from existing data, the extent to which fish ponds may purify water

- to decide whether a new monitoring/surveillance programme is firstly, warranted, and secondly, feasible

- to visit a range of commercial carp farms to the east of the Carpathian Mountains, and discuss with farmers the schedules and methods used for managing the ponds

- to visit a selection of fishery research institutes involved in physical, chemical and biological analysis of freshwaters

- to select the sites for intensive environmental monitoring

- to select the most appropriate scientists/consultants to carry out the monitoring and co-ordinate the programmes in different parts of the country.

- to design a survey programme for local consultants to monitor changes in inlet water, pond water, and effluent quality over a full year

- to advise on the field, laboratory and data analytical methods and scope of analyses required to assess whether water quality differs between fish farm inlets and outlets

This draft report summarises the findings of a three-week tour in September 1994 to address these aspects.

A detailed final report, including some details on the sampling and analytical procedures envisaged for the project, will be submitted for approval by the project manager, within four weeks of my return to UK. In collaboration with the project field manager, contracts will also be drawn up for the local consultants selected for the work.

Main activities

The following commercial farms were visited: Crevidia consisting basically of two dammed systems above Lake Buftea; the Trifesti and Bidesti series of ponds; the Tiganasi ponds; Vladeni; two ponds at Brates; and Ianca (from Vermatta s.a. in Braila). I gained information on management strategies. I was particularly keen to learn about the timing of pond filling and draw down/evacuation (for fish harvesting) - because these operations will have a bearing on sampling schedules to be operated in any field project, and they determine the periods over which 'effluent' is discharged. The enrichment (eutrophication) of many ponds is not due solely to fish-rearing practices; diffuse run-off of material from agricultural land, and waste from intensive livestock holdings, and undoubtedly households, also occurs.

I visited - in addition to the Ministry of Water, Forests and Environmental Protection which co-ordinates a nation-wide programme of water quality monitoring - the following fishery research institutes involved in physical, chemical and biological analyses of freshwaters: the Fish Culture

Research Station at Nucet; the Piatra Neamt and Galati laboratories of the Centre of Research and Production in Fisheries, Fish Culture and Fish Processing (CCPPPIP), and the Station of Research and Production of Fish (ACVARES) at Iasi. I met key research staff, and saw laboratory facilities, field equipment and libraries.

Findings and recommendations

A considerable body of data on surface water quality in Romania already exists in MoE. However, it appears so far that the specific questions over whether ponds lead to better water quality, cannot be answered by these data. A KHF project would include an appraisal/review of this information, but it is plain that a new monitoring/surveillance programme specifically designed for assessing carp pond effects is needed. The outputs envisaged from such an exercise would include information on the following environmental aspects, which would be related to the various activities in the pond managers' calendar: seasonal changes in the quality of feeder water, pond water and outlet (effluent) - as and when these exist - as indicated by physico-chemical analyses, and assessments of the species composition and abundance of planktonic algae (phytoplankton), rotifers and micro-Crustacea (zooplankton), and the invertebrate communities associated with pond and stream sediments (zoobenthos).

It is emphasised that, while the quality of water passing through a fish pond may improve as a result of the filter-feeding activities of e.g. certain zooplankton and fish species, there are many more mechanisms whereby ponds are likely to impair water quality. The attached Table gives some indication of this. However, by enhancing knowledge about the dynamics of the various physical, chemical and biotic components of ponds, the new project could initiate management strategies that maximise the chances of releasing water ('effluent') that is of better quality than the feeder water.

The best sites for intensive monitoring have not yet been identified, but proximity to research institutes will be an important consideration (saving on time and money for travel). Ponds and management strategies vary considerably from farm to farm - partly as a result of shifting availability of funds for e.g. feed, fertilisers and pumping equipment, and partly in response to seasonal and inter-annual variation in the weather and especially, water availability. Thus, no two ponds are treated similarly in regard to e.g. stocking rates or mixes/proportions of fish species; or harvesting methods (with/without water draw down or pond emptying); or harvesting and recruitment schedules.

Each of the research centres has its special strengths in practical science and/or project co-ordination, and the new project would draw on these. The following personnel in particular should be involved:

- from the Fish Culture Research Station at Nucet, Dr. Dan Visitu (Director) and Mr Christian Stoicescu (freshwater scientist) in co-ordinating roles; the invertebrate ecologists, and the library at this site will also be a valuable assets to the project

- from the Piatra Neamt laboratories of CCPPPIP, Drs. Ioan Caraus and M A Porumb (algology), Dr. Rodica-Ileana Rujinschi (zooplankton); the chemical laboratories and library facilities should be used too

- from the Galati laboratories of CCPPPIP, Mrs Maria Fetecau (phytoplankton ecology) and Miss Liliana Pana (zooplankton)

- from the ACVARES station at Iasi, Dr Florin Seiler and Mr Catalin Platon (hydro-chemistry) and Miss Rodica Palade (zoobenthos)

A survey programme focussing (initially at least)on no more than 4 sites will be designed for, and in consultation with, these scientists/investigators. It is essential that major physical, chemical and biological conditions are monitored at as frequently as possible; it is hoped that sites could be visited 15 times over a 12-month period (i.e. including the ice-over season) - with for example,

weekly sampling in the first month of pond filling, and perhaps monthly sampling thereafter (bearing in mind that during some periods, feeder streams, inlet pipes, and outfalls may not be flowing, and ponds are empty) .

The systems selected for study should be simple i.e. with a single inflow and outflow, and affected largely by fish-farming, not significantly by e.g. domestic waste, poultry units. At each of the ponds, samples will be collected in duplicate at the inflow and the outflow whenever these are running, and from no more than 3 points within the ponds themselves. Wherever possible, all 4 sites will be sampled on the same dates. It is hoped that the whole spectrum of analyses envisaged can be carried out at each of the participating laboratories. Thus, carriage/posting of samples between laboratories will be kept to a minimum - except perhaps for *ad hoc* inter-laboratory analytical comparisons, for example.

It is likely that the ponds will contrast considerably as regards the timing and nature of the introduction of fingerlings, the application of dung or fertilisers, and the harvesting of fish. It is thus essential that a monthly record of these activities is maintained for each site. It is also essential that the teams within each laboratory work closely together, and that scientists from the different laboratories meet frequently (every 6 weeks?) to maintain consistency in approach, and to discuss progress and problems over sampling schedules, analyses and data handling.

Discussions have been initiated with the personnel listed above, over field, laboratory and data analytical methods, and the scope of analyses required to assess whether water quality differs between fish farm inlets and outlets. Some literature on chemical methods is availablefrom the Project Manager. Some techniques which may be quicker, yet statistically more robust, than the procedures currently used in Romania for the estimation of phytoplankton, zooplankton and zoobenthos are under consideration. Financial support (external to the KHF) is being sought for a workshop on all of these aspects, to be held in UK or Romania, before the project starts.

Areas of work that might be incorporated in a study of the effects of fish farming on water quality

Parameters to be measured	Possible reasons for changes in these parameters
Physical:	
Turbidity	increased disturbance of mud by fish; decreased sedimentation;
Colour	increased disturbance of mud by fish; decreased sedimentation; increased algal growth
Odour	algae; fish; fish products
Chemical:	
Nutrients	waste feed and excretory products; inorganic fertilisation?; increased re-cycling from algae and/or macrophytes;
Pesticides	fish medicaments;
Vitamins and other food additives	waste feed and excretory products;
Biological:	
Bacteria	organic and inorganic enrichment;
Algae (including toxic species)	organic and inorganic enrichment;
Zooplankton	increased algal (food) biomass;
Benthic invertebrates	increases in organic particles and enhanced primary productivity and algal biomass formation;
Fish parasites	increased numbers of fish;


Natural
Environment
Research
Council