The Faunal Richness of Headwater Streams

Progress Report for the Period
April 1993 - June 1993

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1. INTRODUCTION

This project is in four stages:-

- A review of existing data.
- Catchment studies.
- An evaluation of the impact of agricultural activities.
- The development of a catchment strategy.

Stage 1 is complete and has been fully documented in previous reports.

All field work and analyses for Stage 2 have been completed and an R & D Note, reporting on this Stage is being completed.

The principal work undertaken during the reporting period has involved the pre-planning and initial implementation of Stage 3.

This report summarizes the outstanding work to be completed for Stage 2 and the progress to date with the third stage.

2. TECHNICAL PROGRESS

2.1 Objectives

The overall and specific objectives of each stage are detailed in the Project Investment Appraisal (PIA) which is Schedule 2 of the Memorandum of Agreement for Research Contract (ref:54015000) between the National Rivers authority (NRA) and the Institute of Freshwater Ecology (IFE)

2.2 Work programme

2.2.1 Stage 2

The Stage 2 work programme has been fully documented in previous progress reports. The production of the relevant R&D Note is the only outstanding element of this programme.

2.2.2 Stage 3

Stage 3 activities outlined in Schedule 2 of the PIA comprise:-

- Establish which agricultural practices have not been sufficiently well covered by the catchment studies for a range of geological and geographical catchments.
- Consult the NRA and other sources of land use/pollution information and in consultation with the project leader establish further headwater stream sites to fill these gaps.
- Utilize the same field methodologies as Stage 2 in order to obtain biological, land cover and river corridor data for these sites.
- Analyse the data as appropriate.
- Identify taxa which may be used as indicators of environmental damage due to agricultural activity.
- Produce an R&D note reporting on this stage of the work.

In earlier discussions between the Project Leader (NRA) and the Project Manager (IFE) an agreed interpretation of the first two elements of the work programme was formulated. This is detailed in the previous report.

In summary a stratified random selection process was devised in order to ensure an adequate coverage of all major agricultural practices in each of the four study catchments. The strata were five major aggregate land cover types. The selection matrix was the national OS 1 km square grid of Great Britain. Further details are given in Appendix I.

2.3 Progress achieved

2.3.1 Stage 2

The first draft of the R&D note was presented to the Project Leader at a Steering Group Meeting held at the IFE River Laboratory on 8th April. The document was taken by the Project Leader for review and comment.

The annotated draft documented and listed comments were received from the Project Leader on the 14th June. Revision of the report is in progress and will be completed in July.

2.3.2 Stage 3

Site selection

A revised site selection policy statement (Appendix I) was prepared and sent to the Project Leader for agreement on 2nd April 1993. The statement included a provisional list of first choice and reserve sites to be sampled (not appended). The policy was agreed by the Project Leader.

Letters outlining the basic objective of Stage 3 and the site selection policy were sent to the Project Leader, Dr.E.A.Chalk (Yorkshire Region), Mr T. Clough (Anglian), Dr G.P. Green (Wessex) and Dr M.J. Mills (Welsh). The letters were accompanied by lists of the selected first choice and reserve sites for the relevant individual NRA Region.

The regional contacts were asked for three forms of help:-

- Comments on the sites selected.
- Information on landowners in the catchment of the selected sites.
- Provision of copies of 1:10,000 OS maps covering the catchments of the selected sites.

The request for comments on sites was a procedure for identifying and avoiding certain types of sites which were likely to be stressed by non-agricultural sources. The NRA contacts were asked to scrutinize the list for urban sites, sites downstream of sewage treatment works, storm sewage overflows, septic tank discharges or industrial effluents, sites that have been subjected to recent acute, rather than chronic, point source pollution, inaccessible sites and sites which are very likely to be dry during the sampling period.

In addition to providing landownership information, the possibility was introduced of NRA staff, particularly Pollution Officers, making advance contact with landowners to obtain permission for future IFE stream sampling and land cover mapping.

As an aid to the provision of maps, each letter was also accompanied by a list of those maps considered, by IFE, to be required for each catchment.

Detailed replies on the suitability of sites were received from Dr.Chalk and Ms.S.Smith (Welsh Region). Each rejected several sites on the basis of the criteria supplied to them. Dr.Chalk also provided considerable information on the landowners of many sites. In addition she made written contact with many of them in order to obtain advance permission and, in some cases, arrange specified dates for sampling.

All regions provided the maps requested.

As a result of the information provided, additional sites were selected to replace those rejected by the NRA regions. Replacement sites were chosen according to the same procedures used to draw up the initial lists. These are detailed in the previous Progress Report. Reserve sites were used to replace those rejected by the NRA and the replacement sites became the new reserves.

During the preparation of Field Assessment Booklets for field sampling, a variety of practical problems were identified for a few of the selected sites. A small number of extra sites were rejected on this basis and replacements chosen using the standard procedures.

Additional 1:10,000 maps covering the catchments of the replacement sites were provided by the NRA regions on request.

Staffing

It had previously been agreed that land cover mapping and river corridor surveys would be undertaken by four temporary staff, to be selected and appointed by IFE on three month contracts.

The timescale for appointment precluded widespread advertisement of the posts. Staff selection was based on personal information already held by IFE and additional invited applications. The four appointees were Ms. Rebecca Dunn, Ms. Ann Daniels, Ms. Susan Matthews and Ms. Jessica Poole. Each was qualified and experienced in the requisite work. Ms.Dunn had previously been employed to carry out Stage 2 surveying.

Appointments were for the period 24th May to 13th August.

Preparation of Field Assessment Booklets

Field Assessment Booklets (FABs) had to be prepared for all sampling sites prior to sampling. Most catchments were sampled by field teams in temporary residence in the study catchments. In view of this, provision had to be made, in advance, for the possibility of access being refused to the site or the site proving to be unsuitable (e.g. dry etc.). Thus FABs were also prepared for all reserve sites as well.

The contents of the FABs were a simplified form of those used for Stage 2 of study and described in the R&D note for that stage.

The principal difference in the land cover procedures was that the range of features to be recorded was reduced to those shown to be important in Stage 2 analyses. No maps were

provided for recording information on parcel boundaries. The number of physiographic features to be recorded was greatly reduced and these were recorded on the perturbations map. Several secondary descriptors of Agriculture/Natural Vegetation, Forestry/Woodland/ Trees and Buildings/Structure/Communications were also dropped from the list of feature codes to be recorded.

A second difference in the land cover procedures was that the size, but not the scale, at which the base maps were reproduced for field annotation was reduced.

The combined effect of these changes was that the number of maps the field surveyors had to annotate was reduced from a maximum of 37 per site in Stage 2 to just five per site in Stage 3.

River corridor survey procedures were also simplified in the light of the extensive amount of redundant data appended to the reach maps in Stage 2. Only three categories of information were required to be annotated.

- Adjacent land cover at a distance of 20 m from the water's edge. Maximum of two feature codes including one obligatory primary code.
- Bank width as one of six categories.
- Perturbations. All possible sources of perturbation within 20 m of the water's edge.

Staff training

Prior to beginning field recording the surveyors spent two weeks at the River Laboratory helping to prepare FABs and undergoing staff training.

Each surveyor was provided with a revised version of the Stage 2 Field Handbook which they were required to study in detail and fully familiarize themselves with the survey procedures.

Detailed discussions were then held between the surveyors and the Project Manager in which all aspects of the procedures, particularly the practical ones were subject to scrutiny. Several changes were made to improve the consistency and operational efficiency of the recommended methods.

Trial field surveys were then undertaken using the full FABs and experimental areas of farmland adjacent to the River Laboratory. The consistency of interpretation and application of the procedures between surveyor was reviewed and final amendments to the Field Booklet were made. The definitive, revised booklet was re-issued to the surveyors for operational use.

Sampling strategy

The order of sampling the four river systems was the Stour first followed, in order, by the Cam, Derwent and Lugg.

Biological sampling was to be undertaken first followed, within the next three weeks later by the land cover and river corridor surveys.

The rationale for this was that the biologists would identify the precise location of the site to be sampled. In almost all cases this would be the location pre-selected for the FABs. They would then identify the relevant landowners of the site and the route to it and obtain permission for both access and sampling. At the same time they would provide advance notice of the forthcoming field survey, obtain permission for it and also names and contact details of other landowners in the catchment to be surveyed.

Details of any changes in the site permission and all useful information on landowners and the state of permission to survey would then be fed back to the field surveyors on order to minimize their administrative load in each catchment.

2.3.3 General and administrative

The Project Leader and Project Manager have liaised, as necessary, throughout the reporting period.

A project Steering Group meeting was held at the River Laboratory on Thursday, 8th April. All aspects of the work were discussed but particular emphasis was placed on the contents and style of the Stage 2 report, Stage 3 site selection and the practical procedures for the Stage 3 field surveys.

3. INTERIM RESULTS

3.1 River Stour

Biological, chemical and instream environmental sampling of the Stour took place between 1st and 17th of June. Land cover and river corridor surveying was undertaken shortly afterwards between 2nd and 17th June.

A variety of practical problems meant that many of the selected main and reserve sites could not be fully sampled. In total, 57 FABs were prepared (including several extra other than those referred to in Section 3), 58 site visits made and 46 samples taken. Of the latter, only 38 were suitable for inclusion in the study.

A breakdown of the sampling successes and failures, including land cover and river corridor surveying, is as follows:-

- Biological, chemical and land cover/river corridor survey data collected - (38 sites).
- Biological and chemical sample taken correctly. Survey permission later refused - (2).
- Biological and chemical samples taken in the incorrect location. No subsequent surveys - (4).
- Biological and chemical samples erroneously collected from standing water. No subsequent surveys - (2).
- Sampling permission refused outright - (4)
- Written request to sample required. Not enough time to do so - (3).
- Sampling permission assumed unlikely to be granted from local knowledge - (2).
- Site found to be unsuitable when visited - (2).
- Site dry - (1)
- Site rejected prior to sampling visit because of additional information on its urban character - (1).
- Reason for not sampling unknown - (1).

As a result of these difficulties additional IFE staff were involved in sample collection in order that the biological sampling could be kept on schedule and ahead of the field surveyors. Despite this one less useable sample was collected than the 39 originally planned. The

additional costs involved and the need for the field surveyors to keep on schedule made further attempts to collect the 39th sample impracticable. Full details of sampling dates and locations are still being collated and will be given in the next Progress Report.

3.2 River Cam

Biological, chemical and instream environmental sampling took place between 14th and 17th June. Land cover and river corridor surveying was undertaken between the 20th and 24th of June.

Seventeen sites were visited in order to acquire the necessary 15 samples. No problems were encountered regarding permission to sample. The two sites which could not be sampled were each dry at the time of visiting.

In addition to 15 biologically-sampled Stage 3 sites, the field surveyors also collected land cover and river corridor data for one of the two replacement Stage 2 sites which could not be surveyed in 1991. This was the site at Down Hall Farm. No attempt was made to survey the other replacement site at Caldecote which was 3 km from source and had a relatively huge catchment.

Details of sampling dates and site locations are still being collated and will be presented in the next Progress Report.

3.3 River Derwent

By the end of June biological, chemical and instream environmental sampling had been completed for 28 sites.

At the request of a landowner, an additional sample was also taken from another small stream, the West Beck, which will not be used in this study. The sample will be analysed and the results supplied to him as part of a verbal agreement allowing the IFE team permission to access the designated site on the same landowner's land.

Land cover and river corridor surveying began on 30th June when four sites were completed.

Full details of sampling dates and site locations will be presented in the next Progress Report.

3.4 River Lugg

No sampling of the River Lugg took place during the reporting period.

3.5 Water analysis

All water samples collected from the Stour and Cam systems were analysed for alkalinity (mg l^{-1} $CaCO_3$) and nitrate (mg l^{-1} NO_3). Full results are being collated and will be presented in the next Progress Report.

4. WORK PROGRAMME FOR THE NEXT REPORTING PERIOD

4.1 Stage 2

- The R&D Note will be revised and re-submitted to the Project Leader and each NRA region for further comments.

4.2 Stage 3

- Biological, chemical and instream environmental sampling of the Derwent and Lugg systems will be completed.
- Land cover and river corridor surveying of the Derwent and Lugg systems will be completed.
- All outstanding water samples from biological sampling sites will be analysed.
- Detailed site lists for all Stage 3 sites will be collated, together with results of chemical analyses.
- Sorting of biological samples may begin.
- Liaison with the Project Leader will be maintained and progress with the project will be reported to the NRA.

5. COST OF WORK DURING THE REPORTING PERIOD

The cost of the work during the reporting period is likely to be generally in line with cost-base adjusted budget in the Memorandum of Agreement. An exception is that difficulties in finding suitable sampling sites in the Stour catchment meant that two extra staff became involved in the sampling and the total staffing input increased by eight man-days.

Detailed costings will be made available to the NRA, via the IFE Finance Office.

6. ESTIMATE OF THE TOTAL COSTS OF THE WORK

The total cost of the work is likely to be generally in line with the cost-adjusted budget listed in Section 10 of the PIA and Schedule 8 of the project contract.

Two possible exceptions to this generality are anticipated with varying degrees of certainty.

The most likely concerns report production costs. In Schedule 8 of the project contract no money was allocated for this purpose in the financial years 1992/93 or 1993/94. Internal IFE budgeting for the project assumed an expenditure of £300, to cover production of the Stage 2 R&D Note. However, this figure anticipated black and white reproduction and the inclusion of many colour figures was subsequently requested by the NRA Project Leader. This has been done but the cost of reproducing large numbers of colour figures for a minimum of 60 reports required by the NRA will greatly increase reproduction costs. The same increased costs will apply to subsequent reports if extensive use of colour is requested by the NRA.

The second possible cause of increased IFE expenditure results from the additional stage introduced into the production of the Stage 2 R&D note. The original schedule anticipated a draft to be selectively circulated within the NRA, for review and comment, followed by a final revision for general circulation. However three drafts are now anticipated. The first has been reviewed by the Project Leader only. The second will be selectively circulated for wider comment and the final document will be the third draft. This extra reporting requirement is likely to increase total staff input by between 5 and 15 days according to the extent of changes required in making the second revision.

7. ESTIMATE OF COSTS FOR THE NEXT REPORTING PERIOD

Stage 3 fieldwork is now on schedule and costs for the next three months will be in line with expectation. However, this assumes that the difficulties encountered in the Stour catchment are not repeated for the Lugg or the remainder of the Derwent sites.

Anticipated overspends on the preparation and production of the Stage 2 R&D Note are referred to in the previous section.

8. FACTORS LIKELY TO AFFECT THE SATISFACTORY COMPLETION OF THE WORK

With the exception of the Stage 2 R&D Note the work is currently on schedule and completion of the work within the stipulated contract period is still anticipated.

APPENDIX I Stage 3 site selection policy document, 2nd April 1993

Policy

An approximate total of 130 sites to be sampled once each. The original costings were based on 120 sites.

There will have to be low intensity sampling on the Cam because of the paucity of streams and small catchment size. Approximately 40% of intensity of other catchments is considered appropriate giving the Cam fifteen sites and the other 39 each.

Eight major land cover types are recognized by Robin Fuller of ITE in his 1990 land cover classification of Great Britain. These are wood/forest, dwarf shrub, herb/grass, agricultural grass, arable, un-vegetated, inland water & maritime. The last two categories occurred in insignificant amounts and were excluded together with un-vegetated (largely urban) which is outside the scope of this study.

The following procedures were implemented to determine the allocation of sampling squares and sites in each catchment:-

1) The dominant land cover, out of the eight major types above, was determined for each 1 km square wholly or partially in one of the four study catchments

2) Squares dominated by the three discarded cover types were excluded.

3) In each catchment the proportion of squares dominated by each of the five remaining cover types was calculated.

4) Cover types dominating in none of the squares in the catchment were allocated no sampling sites.

5) Cover types dominating in between 0% - 12.5% of the squares in the catchment were allocated 5 sites.

6) Cover types dominating in between 12.5% - 25% of the squares in the catchment were allocated 10 sites.

7) The remaining sites were distributed between the remaining cover types in relation to those cover types' relative frequency in the catchment.

8) For each cover type in each catchment, randomly-ordered listings were produced of 1 km squares that were more than 50% inside the catchment boundary and in which the dominant cover type occupied more than 50% of the square in 1990.

9) The requisite number of sampling sites were selected from these listings with squares being considered in the random order in which they appeared on the lists.

10) Reserve sites were also selected, where available, for each cover type, in each catchment.

11) If the allocated number of sites could not be found amongst the eligible squares, the shortfall was allocated, pro-rata, amongst cover types which dominate more than 25% of squares in the catchment.

12) The two predominant criteria in selecting the precise site locations were, primarily, that it be as close as possible to 1 km from the source of the watercourse, and secondarily that it be as near as possible to the point of exit of the square.

Site allocation per major land cover type

The procedures listed above led to the following numbers of sites being allocated to each cover type in each catchment:-

Cam

Wood/forest	=	0
Dwarf shrub	=	0
Herb/grass	=	0
Agricultural grass	=	5
Arable	=	10
TOTAL	=	15

Derwent

Wood/forest	=	5
Dwarf shrub	=	5
Herb/grass	=	5
Agricultural grass	=	10
Arable	=	14
TOTAL	=	39

Lugg

Wood/forest	=	5
Dwarf shrub	=	3
Herb/grass	=	5
Agricultural grass	=	16
Arable	=	10
TOTAL	=	39

Stour

Wood/forest	=	5
Dwarf shrub	=	1
Herb/grass	=	0
Agricultural grass	=	23
Arable	=	10
TOTAL	=	39