RIVPACS III©
(River InVertebrate Prediction and Classification System)

Great Britain
(Beta release version)

User Manual

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Important Note

This manual and the associated software are essentially the same as the version of RIVPACS III developed by the Institute of Freshwater Ecology in 1995 for use in England and Wales by the National Rivers Authority (now the Environment Agency) and in Scotland by the Scottish River Purification Boards (now the Scottish Environment Protection Agency).

This version lacks the section relating to Northern Ireland and should therefore only be used within Great Britain.

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Statement of use

This document supports the RIVPACS III software and should be consulted when running RIVPACS to ensure that correct predictions are obtained. Special attention is drawn to section 1.6 on the validity of use of RIVPACS III. We strongly recommend that users undertake a one day accreditation course held at the IFE River Laboratory before using RIVPACS for commercial purposes.

Disclaimer

The officers, servants and agents of the Environment Agency and the Institute of Freshwater Ecology accept no liability for any loss or damage arising from the use or interpretation of RIVPACS.

PREFACE

CONDITIONS OF USE

1. The copyright of the RIVPACS III computer program is jointly vested in the Institute of Freshwater Ecology and the Environment Agency.

2. RIVPACS III has been developed for use within the Environment Agency and the Scottish Environment Protection Agency. The above-named organisations have unrestricted use of RIVPACS III for their own purposes.

3. Purchasers of RIVPACS III hereby agree that no copies of the program shall be made available, lent or sold for private use, or for transfer to other individuals, institutions, authorities, educational establishments or commercial organisations.

SOFTWARE

This PC version is written in Microsoft FORTRAN (Version 5.0) Microsoft Corporation, and PANEL (Version 6.20) Roundhill Computer Systems Ltd.

SOFTWARE SUPPORT

Software support for this product is being provided by the Institute of Hydrology. In case of difficulty contact 'Software Sales and Support' by telephone (01491 838800), by fax (01491 692424) or e-mail (softdev@IH.ac.uk).

Please note that although data files may be held in ASCII or dBASE format, software support for dBASE is NOT available within this package.

FUTURE DEVELOPMENT

Please note that this is a prototype release of the Great Britain section of RIVPACS III, as used within the Environment Agency and the Scottish Environment Protection Agency.

Your comments on changes which would make the system more user friendly and useful would be welcome. Upgraded versions, optimized for the commercial market, will be released in due course in response to customer demand.

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1. BACKGROUND

1.1 Introduction

RIVPACS (River InVertebrate Prediction and Classification System) is a microcomputer-based system developed by the Institute of Freshwater Ecology (IFE) with applications in river management, conservation and environmental impact assessment. It has two distinct components. First, it offers site-specific predictions of the macroinvertebrate fauna based on environmental features, and sets a "target" of the fauna to be expected in the absence of environmental stress (eg pollution or habitat degradation). Comparison of this target with the fauna observed at the site is the basis of the biological assessment. Second, it includes a procedure for locating sites of high biological quality within a national classification of sites, using the macroinvertebrate fauna.

RIVPACS I, a prototype version based on just 370 reference sites, was produced in the mid-1980's for use on the BBC B microcomputer and was tested by biologists in the regional Water Authorities of England and Wales and the River Purification Boards in Scotland.

RIVPACS II, based on 438 reference sites, was an operational system developed for use by the newly formed National Rivers Authority (NRA), and the River Purification Boards (RPB's) in time for the 1990 River Quality Survey. The system was also used, on a more experimental basis, by the Department of the Environment (Northern Ireland) during the same survey. RIVPACS II, which came in both a PC and a mainframe version was a major advance on RIVPACS I in terms of its mode of operation and by virtue of the many new features and options on offer.

Thorough testing of RIVPACS II was undertaken, first by the IFE using high quality independent data-sets (Wright et al 1991) and also by the NRA, RPBs and the DoE (NI) during the 1990 River Quality Survey. As a result of these assessments, it was concluded that there was merit in producing a new version (RIVPACS III) in order to have more comprehensive geographical coverage, generate a more robust system and improve the methodology for classification and prediction.

RIVPACS III was used in the 1995 General Quality Assessment (GQA) survey and is now used by Environment Agency and Scottish Environment Protection Agency staff in local river management operations within Great Britain. This manual gives practical guidance on the RIVPACS III software.

1.2 RIVPACS III

It was agreed that the new software should be similar in operation to RIVPACS II, so that current users would find it easy to adjust to the new system. However, entirely new classification and prediction systems have been installed in RIVPACS III, and the new software incorporates a number of additional changes and improvements as follows:

1. The reference data-set is now much more comprehensive, both geographically and through the incorporation of more small stream sites.

2. The enlarged reference data-set for Great Britain has 614 sites (previously 438 sites).

3. (Sentence relating to reference sites in Northern Ireland - deleted.)

4. RIVPACS III now offers predictions and site classifications throughout Great Britain.

5. A new index has been developed which compares the observed and expected family level abundance category values in an attempt to give an early indication of response to stress before substantial loss of taxa has occurred.

6. The new batch file procedure accepts requests for predictions at several taxonomic levels on a single run.

7. New default settings allow the user to specify paths for input/output files.

8. The Monte Carlo simulation technique used in RIVPACS II to estimate the expected mean and standard deviation of the BMWP indices has been replaced by the mathematical formula given in Clarke et al (1994). This eliminates small random variation in the predicted values of E in repeated runs of RIVPACS on the same data.

9. The sequence and appearance of the panels has been simplified and improved.

10. In response to customer requirements, RIVPACS III does not include prediction option 6 in which Chloride is one of the environmental variables, and the new system has been developed for use on PC only.

1.3 Classification

The biological classification of the reference sites in Great Britain in order to develop RIVPACS III was undertaken using TWINSPAN (Hill 1979). The biological data for site classification included standardized species level data plus family level abundance category data (Wright et al 1995). The data-set for Great Britain with 614 sites was divided into 35 classification groups (See Appendix 1 for further details).

In order to use macroinvertebrate data to place a new site within the existing RIVPACS III classification, the standard sampling procedure (Environment Agency 1996) must be undertaken in each of spring, summer and autumn to generate the required taxon list. As in RIVPACS II, site classification may be undertaken using either species level or BMWP family level data.

The methodology for assigning a new site to the 35 group classification for Great Britain takes account of the full taxon list for the site to be classified and uses a probabilistic technique in order to generate the statistical likelihood that the site belongs to each of the classification groups (Rushton 1987). See Chapter 4 for specific instructions on classifying new sites.

1.4 Prediction

As in earlier versions of RIVPACS, the current system uses multiple discriminant analysis (MDA) to construct and operate the prediction system (Moss et al 1987).

RIVPACS III offers predictions at all the taxonomic levels previously available in RIVPACS II - that is BMWP families, all families, species level and the customisation option. Similarly, predictions can be made for single seasons, paired seasons or 3 seasons combined (spring, summer and autumn).

Predictions of the BMWP index values (BMWP score, Number of Taxa and Average Score Per Taxon) are available for comparison with the observed values obtained by the standard sampling procedures in the appropriate season or seasons.

A new index which compares the observed and expected log category abundance values for the BMWP families occurring on the site is offered for the first time. (See Section 1.4.3).

When comparing any faunal prediction with the taxa captured at the site, it is essential that standard sampling procedures have been adopted and that the level of identification and season(s) of sampling of the prediction and observation are perfectly matched.

Specific instructions for making predictions using RIVPACS III are given in Chapter 3.

1.4.1 Prediction of taxa

A simple procedure is offered for predicting the probability of capture of aquatic macro-invertebrates for a site at the taxonomic level requested. The prediction is of the taxa to be expected if the site is of high biological quality. Thus, it offers a 'target' against which the fauna observed at the site can be assessed. Each site-specific prediction is based on the recorded values of a small set of environmental features which must be acquired using the standard procedures. (See Chapter 3 for the environmental options available for prediction).

If biological data are held on file, then RIVPACS III will link the observed fauna with the predicted (= expected) fauna. As the taxa expected at the site are printed out, those taxa observed in the sample(s) are shown with an asterisk against them.

Examples of predictions at both species and BMWP family level may be found in Wright et al (1994).

1.4.2. Prediction of biological index values

The environmental data used to predict the probability of capture of taxa may also be used in order to generate the expected values of the BMWP score, number of scoring taxa and Average Score Per Taxon (ASPT) that should be obtained by standard sampling if the biological condition of the site is high. The expected mean and standard deviation of these indices is now derived using a mathematical procedure given by Clarke et al (1994), which ensures constant values in the predicted values of E in repeated runs of RIVPACS III on the same data.

Observed values of BMWP score, number of taxa and ASPT obtained at a site of interest can then be compared with the expected values obtained by RIVPACS prediction. The observed (O) to expected (E) ratio (O/E ratio) gives a measure of the biological quality of the site. (A new banding system for categorising O/E ratios has been devised by the Environment Agency for use in the 1995 General Quality Assessment (GQA) survey.)

1.4.3 Prediction of family abundance

RIVPACS III, like RIVPACS II, offers predictions of family abundance (log categories) for single seasons only (ie Spring, Summer or Autumn). However, a number of new features have been added which should make this part of the prediction system more useful than the simple listing of the families offered in RIVPACS II.

RIVPACS III displays the families in sequence from the most to the least abundant including the expected abundance levels for each family. Where abundance data for a site are held on computer file, the observed abundance values are presented alongside the predicted abundances for each family.

Recently, a number of different indices involving a comparison of the observed and expected log abundances of BMWP families have been devised and assessed (Wright et al 1995). Several of these have useful attributes and one which shows promise (named Q14) has been incorporated in RIVPACS III to allow users to test it and comment on its value. Note that, whereas the family abundance predictions apply to all families, the Q14 index is applied at BMWP family level (see below).

Q14 is a measure of the overall proportional loss of expected abundance of taxa with a BMWP score of 4 or more. (BMWP families used in the Q14 index have a `B' against them in the output, whilst other BMWP families are identified with a `b'). The index appears to be highly discriminatory amongst sites at the higher end of the quality spectrum, which suggests that it may be effective at detecting the early effects of stress before loss of taxa leads to lower O/E ratios. A lower limit has been devised to distinguish sites of high biological quality from all others. If the value of Q14 falls below the stated value, this is taken as indicative of environmental stress.

1.5 Scope of RIVPACS III

A number of sites accepted in the RIVPACS II data-set were rejected for use in RIVPACS III under more stringent criteria for site acceptability. Biological and environmental data from 614 reference sites in Great Britain were used to construct the new classification and prediction systems. Further details on site locations and the environmental characteristics of each group are given in Appendix 1.

Although RIVPACS III has a comprehensive geographical coverage of running-water sites throughout Great Britain, the system does not include ditches, drains or canals. Progress has been made in the incorporation of small stream sites in England and Wales but in Scotland the first priority was the establishment of comprehensive geographical cover and therefore representation of small stream sites in these regions is limited.

1.6 Validity of use of RIVPACS III

The classification and prediction procedures should only be used when the appropriate biological and/or environmental data have been obtained using the recommended sampling procedures.

The most recent and comprehensive data collection manual available, which draws on information given in the original RIVPACS procedures manual (Furse et al 1986) is:

Environment Agency (1996) Procedure for collecting and analysing macroinvertebrate samples for RIVPACS. Quality Management Systems for Environmental Monitoring: Biological Techniques. BT001. Bristol, Environment Agency.

Listings of the taxa in RIVPACS III at each of BMWP family, family and species level have been made available, by the IFE, for inclusion in the above manual. When undertaking either a classification or a prediction in which you supply the observed biological data, the level of identification in the biological data-input file must conform to that used in the RIVPACS III listings. Discrepancies are more likely to occur at species level and you should be aware of the use of `species groups' in the listing and how they are derived.

1.6.1 Classification

To classify a new site using the macro-invertebrate fauna, the site must be sampled using the standard methodology in each of spring (March-May), summer (June -August) and autumn (September-November). The taxa captured in each season must then be combined into a full site list for the year prior to use for site classification.

A site may be classified using presence/absence data at either species or BMWP family level.

1.6.2 Prediction

To predict the fauna at a running-water site, environmental data are required for eight core variables plus a small number of additional variables, depending on the environmental option chosen (See section 3.2.6). Some variables, for example those acquired from maps, have fixed

values whilst others eg width, depth, substratum composition and alkalinity, obtained from site visits, may vary during the year. A minimum of three separate seasonal measurements is recommended for all environmental features which vary during the year. Note that this recommendation applies in the case of single and paired season predictions, in addition to predictions for three seasons combined.

Any attempt to use environmental data which has been obtained in a manner which differs substantially from the recommended procedures is liable to reduce the accuracy of the prediction and should be avoided.

Safeguards have been built into the system to notify the user when the environmental characteristics of a site place it outside the operational scope of RIVPACS III. Predictions made for sites of this type should be treated with caution (See section 3.4).

2. OPERATION

2.1 Introduction

In the text of Chapters 2 to 4, four forms of parentheses have been used to indicate the type of action required from, or available to the user. These conventions are:

<<.....>>	press the named key, eg <<Enter>>
<.....>	choose this item from a menu
[.....]	indicates this item is optional
{.....}	indicates this item is provided by the user.

2.2 Getting started

This manual is written on the assumption that users are familiar with their own computer systems and associated software.

The RIVPACS program will run on any IBM compatible computer fitted with a hard disk (a floppy disk has insufficient capacity) running MS-DOS Version 2.1 or later. If your system operates under MS-Windows then RIVPACS may be invoked by using the MS-DOS command prompt (in a full-screen window) or by setting up a non-Windows application. Refer to your Windows User Guide for information on how to do this.

2.2.1 Installing RIVPACS

The package is supplied on a 3.5" diskette on which you will find a single file, INSTALLR.EXE. This is a self-extracting file containing the executable file RIVPACS.EXE, the 77 data files required to run RIVPACS and 20 example input data files (Appendix 3).

At the MS-DOS prompt change to the directory where you wish to install the RIVPACS software. Assuming the diskette containing the RIVPACS software has been inserted into drive *A:* type

A:\INSTALLR <<Enter>>

You will need 3.7Mb of disk space for the extracted files.

2.2.2 Interactive mode

To run RIVPACS interactively type

RIVPACS <<Enter>>

After the title screen and two screens displaying the conditions of use, the first menu appears. The user can then select which procedure (<Prediction> or <Classification>) or utility (<Defaults setup> or <Batch setup>) is required. There then follows a series of panels which enable the

user to select options and declare any input or output files (see Appendix 4 for Prediction panels and Appendix 6 for classification panels).

A selection is made from a menu by EITHER typing the first character of the required option OR by moving the highlight bar up or down using the arrow keys and then pressing <<Enter>>.

Most panels allow only one selection to be made. In some cases more than one option is available from a menu on a single run. In such cases the <selection COMPLETED> bar should be used to progress to the next panel. The options are described in Chapters 3 & 4.

2.2.3 Batch mode

To run RIVPACS in batch mode (ie supply the information required by the program from file) type

RIVPACS AUTO [{filename}] <<Enter>>

All messages produced by the batch job are directed to the ASCII file AUTO.LOG, which should be checked after the batch run.

The optional filename allows the user to specify a batch file other than the default file, AUTO.DAT. The information required by the program is provided in this batch file (see 5.2 for format) and the options are described in Chapters 3 & 4. The <Batch setup> option of the main menu can be used to create or edit batch files (see Section 2.6).

More than one run can be requested in a batch file. If the declared input files are not found for a particular run then RIVPACS proceeds to the next run requested. If the declared output files already exist and the instruction is not to overwrite, then RIVPACS generates file names, as required, of the form R0000001.LST - R9999999.LST which are listed in the file AUTO.LOG.

2.3 Input/Output files

The user is provided with options to access data from existing input files and/or to create output files to receive the results of predictions or classifications. Input data files can be in ASCII or dBASE format. Output files are ASCII format only. The structures of input and output files are described in Chapter 5. At installation, the program expects to find all input and output files in the same directory as the software, but the user has the option to change this (see Section 2.5).

Running RIVPACS can change two of the 'required' data files: DEFAULTS.DAT which can be changed interactively by the <Defaults setup> utility option; and CUSTNAME.DRC which keeps track of the user's customisations created by the <New customisation> option available within the prediction procedure.

Permanent files for the user's customised taxonomic lists are created by RIVPACS of the form CxxxNAME.DRC, CxxxNUMB.DRC and CxxxPROB.DRC and should only be deleted from within the <Existing customisation > option of the prediction procedure.

2.4 Site/Sample codes

All input and output files (Chapter 5) require samples to be identified by a unique 20 character sample code. The same code may also be used during manual data entry using the site reference box.

No structure is imposed upon the sample code. This is deliberate to allow users maximum flexibility in matching their existing coding systems. Factors such as Environment Agency region or division, hydrometric area, river and site code (or names), date and season or any other identifier the user requires, may all be encoded within the 20 character string. The user should be aware that if biological data are available for the prediction procedure, then the codes must exactly match those for the corresponding sites in the environmental data for the full 20 characters.

2.5 Defaults file

The defaults file contains the paths for the user's input and output files. This file is in ASCII format (see Section 5.3).

The defaults file is DEFAULTS.DAT when running RIVPACS interactively, unless it has been changed using the <Defaults setup> utility option. Similarly, in batch mode, the defaults file is DEFAULTS.DAT unless there is a user specified filename entered in columns 56-67 of the batch file instruction line (see Section 5.2).

At installation, the default paths are null and the program will expect to find the input files in the RIVPACS software directory. There is an alternate defaults file supplied with the example data files, DEF2.DAT. In this case the paths are as follows: biological files, C:\RIVPACS\BIO; environmental files, C:\RIVPACS\ENV; and output files, C:\RIVPACS\OUT.

2.5.1 Defaults setup menu option

This option is available from the main menu when RIVPACS is run interactively and allows the user to create and edit defaults files. On selecting the <Defaults setup> option the user is first prompted for the name of the defaults file (which can be left blank). There is then a choice of editing the specified file or using it to set the file paths. If the option to edit the file is chosen the user is then prompted for the 3 paths. If the file exists the program will read and display the paths from that file.

By pressing the appropriate function key at the end of the input screen the user can choose to: quit out of <Defaults setup>, <<Esc>>; continue, <<Enter>>; go back to the previous screen, <<F4>>; or edit the current screen, <<F5>>. After the input screen the user then has the option to <Save> the changes. Any changes can be saved to either the same file or a new file.

Note that if the defaults file has been edited any changes will only take effect in the current run of RIVPACS if the <Use as defaults file> option is chosen after the edited file has been saved.

In summary, the options available in interactive mode are as follows:

a) From the main panel select <Prediction> or <Classification> without reference to the <Defaults set-up>. In this case DEFAULTS.DAT is used. If DEFAULTS.DAT has not been modified since the installation of the RIVPACS software then the input files will be taken from, and the output files sent to, the RIVPACS software directory.

b) From the Main panel select <Defaults set-up> and check through the existing paths of an alternate defaults file, eg DEF2.DAT or edit and save a new version as required. Note that on the next RIVPACS run, DEFAULTS.DAT will still be used unless you return to the beginning of the <Defaults set-up>, type in an alternate defaults file name, eg DEF2.DAT, at the <Enter defaults file name> prompt and then press <Use as defaults file>.

c) On completion of a RIVPACS run, using an alternate defaults file, eg DEF2.DAT, the main panel is displayed. Further RIVPACS runs from the main panel will also use the alternate defaults file, eg DEF2.DAT. However, if you exit from RIVPACS, back to the DOS prompt, then DEFAULTS.DAT is automatically selected for the next interactive run, as in a) above.

d) Additional defaults files can be created using the <Defaults set-up> menu if, for example, you wish to collect input files from one directory and send output files to another directory.

e) If you wish to keep input and output files permanently separated from the RIVPACS software directory, then create an alternative defaults file using the <Defaults set-up> menu and rename it as DEFAULTS.DAT.

2.6 Batch file

The batch file structure is described in Section 5.2. It is advisable to become familiar with the details of this file structure before attempting a batch file operation. In particular, note the sequence in which the biological data files are requested when undertaking multiple predictions involving different seasons/taxonomic levels. The default batch filename is AUTO.DAT but an alternative filename can be specified in the batch mode instruction line (2.2.3).

In batch mode, as in the interactive mode, the defaults file (see Section 2.5) is DEFAULTS.DAT. However an alternative defaults file can be used by specifying the file name in columns 56-67 of the batch file instruction line (see Section 5.2). The format of the defaults file is described in Section 5.3. Although a defaults file can be created or modified using a text editor the user may find it more convenient to run RIVPACS in interactive mode and use the <Defaults set-up> option in the main menu (see Section 2.5.1).

2.6.1 Batch setup menu option

This option is available from the main menu when RIVPACS is run interactively and allows the user to create and edit batch files. On selecting the <Batch setup> option the user is first prompted for the batch file name (which can be left blank). If the file exists then the current file contents will be displayed in the appropriate input field as the user progresses.

The number of sets of instructions in the batch file is then displayed. The second prompt displays `Edit set {1}'. By default the first set of instructions will be edited. The user can change this number in order to edit the required instruction set. If this number is one greater than the number of sets in the batch file then a new set of instructions will be added to the batch file.

A choice of <Edit> or <Delete> is available at the third prompt. Choosing <Delete> will remove the whole instruction set from the batch file. Alternatively <Edit> will take the user through a series of input prompts. Which prompts are displayed is dependent on the responses to previous input prompts, eg if the <Classification> procedure is chosen then only prompts relevant to classification are shown. Accept the displayed entry by pressing <<Enter>>.

The creation of output files is not declared explicitly. If the filename is left blank then the program assumes the file should not be created.

By pressing the appropriate function key at the end of each input screen the user can choose to quit out of <Batch setup>, <<Esc>>; continue, <<Enter>>; go back to the previous input screen, <<F4>>; or edit the current screen, <<F5>>. After the last input screen the user then has the option to <Save> the changes.

Going back to previous screens, or editing the current screen, still displays any changes the user has made. The exception to this is the first screen because the batch file is read in again after the prompt for the batch file name. This means a <Save> operation must be carried out before going on to edit another instruction set within the same batch file.

2.7 Troubleshooting

This section is designed to help you by offering solutions to some common problems which may be encountered when using the RIVPACS software.

2.7.1 Installation

Error message on installation: `disk full or write protected'.

Check that there is enough free disk space on the hard drive.

Ensure that you are attempting to install from the directory into which the RIVPACS software files are to be stored and not from the *A:* drive. That is, the DOS prompt should look something like *C:\RIVPACS>* and not *A:\>* before typing the command *A:\INSTALLR*.

2.7.2 Interactive mode

Biological data not used during the prediction process.

Have you specified a biological input file for that season and taxonomic level?

Were the filenames specified correctly? (See Section 2.7.4.)

Are the sample reference codes in the environmental and biological data files identical? The full 20 characters must correspond exactly for RIVPACS to match up the biological and environmental data.

2.7.3 Batch mode

RIVPACS fails to run in batch mode.

Did you enter the command from the RIVPACS software directory?

Is the batch file in the RIVPACS software directory?

If you specified an alternative batch file rather than the default file AUTO.DAT, is the filename entered correctly (including extension)?

Cannot terminate batch process once started.

If you discover during a long batch process that, for example, the wrong options or data files were specified, you may wish to terminate the batch process as follows.

If you are running RIVPACS from within a window, first open the Control menu. In full-screen mode this is done either by pressing <<Alt+Esc>> to iconise the window and then clicking on the icon, or by pressing <<Alt+Enter>> to switch to window mode and then clicking on the Control-menu box in the top-left corner of the window. Select the <Settings...> option from the Control menu and then press the <Terminate> button on the displayed dialog box.

Alternatively you will need to either reset your computer if it has a reset button or reboot by pressing <<Ctrl+Alt+Del>>.

This procedure will terminate the RIVPACS session but you will lose any unsaved data. Note also that terminating a window may not close files that were open at the time. In addition, scratch files created by RIVPACS may not be deleted.

2.7.4 Input/Output files

Error message: *Input files not found.*

Have you entered the correct file name and extension?

Are the file pathways defined in the defaults file correct? Use the <Defaults setup> utility option of the main menu to check and edit if necessary (see Section 2.5).

Should you have opted to use an alternative defaults file? In batch mode this is specified in the batch file instruction line (see Section 2.6). For interactive mode use the <Defaults setup> utility option of the main menu (see Section 2.5).

3. PREDICTION

3.1 Introduction

This chapter provides details of the various sequences of panels encountered during an interactive prediction run. At the same time it serves as a detailed account of all the prediction options available in RIVPACS III, each one of which is also available in batch mode. To implement batch mode predictions, read Section 2.6 and then refer to data file structure in Section 5.2.

The full lay-out of each panel is shown in Appendix 4 and should be referred to in association with the following notes on each individual panel. The exact sequence of panels will depend on the options selected at each stage.

3.2 The prediction panels

3.2.1 Main panel: Procedure

Select <Prediction> from the Procedure menu and the program will then proceed to (Panel P2). Choosing <Exit> at the main panel will halt the program.

3.2.2 Panel P1: This option has been deleted.

3.2.3 Panel P2 (+ P25, P26, P27 & P28): Taxonomic level

There is a choice of 5 taxonomic levels, any number of which may be selected. RIVPACS allows each level to be selected once. There is also the option to set up a new customisation.

BMWP families and BMWP indices

The taxa predicted will be BMWP families. Any listings of the taxa will include the probability of capture. Predictions will be made of BMWP score, number of taxa and ASPT with 95% confidence intervals. If biological data are also available on file, comparisons will be made between the observed and expected index values.

Abundance for all families and abundance index

The predicted taxa will be at the family level. Any listings of the taxa will be ranked in descending order of expected abundance. If biological data are also available on file with log. abundance values for the taxa, the family abundance (Q14) index will be calculated (Section 1.4.3). This is a measure of the overall proportional loss of expected abundance of taxa with a BMWP score of 4 or more.

Presence/absence for all families

The predicted taxa will be at the family level. Any listings of the taxa will include the probability of capture.

Presence/absence for species

The predicted taxa will be at the species level. Any listings of the taxa will include the probability of capture.

Existing customisation

If this option is selected Panel P25 is displayed. This provides a list of all the user-defined customisations available. These are created by selecting the <New customisation> option of the taxonomic level menu (Panel P2).

To highlight the required customisation in the list, choose <Up> or <Down> from the menu then press <<Enter>> to move up or down the list. Having highlighted the required customisation choose <Select> from the menu followed by <<Enter>> and the program will display Panel P26. In this panel choosing <Select> will assign the highlighted customisation to be used in the prediction procedure.

The <Delete> option in Panel P26 is a file management option for the customisations. This will not only delete the data files created by the <New customisation> procedure (see below) for the highlighted customisation but will also remove the entry from the list of existing customisations.

New customisation

If this option is chosen Panel P27 is displayed. First it is necessary to enter a NAME to identify the customisation. This can be up to 8 alphanumeric characters. The text of NAME will identify any output which the program produces using this customisation. The DESCRIPTION (45 alphanumeric characters) can be used to give more information about the customisation. This DESCRIPTION is only used in Panels P25 & P26.

After the name and description have been entered the current taxon (the revised "Maitland" code and name, see Section 5.7) is displayed as well as a list of the component taxa at the subordinate taxonomic level. You will be asked if you want to select the current taxon displayed. If you answer <No> each subordinate taxon will be displayed in turn and the question repeated. If there are no subordinate taxa then the current taxon is automatically selected.

The answer <Yes> will mean that the taxon listed in the "current taxon" box will be given in predictions but that none of the taxa subordinate to it will be predicted.

In this way it is possible to specify to what level you wish to identify each taxon. When this is completed Panel P28 is displayed which summarises the customisation. Each new customisation creates a set of files of the form:

CxxxNAME.DRC
CxxxNUMB.DRC
CxxxPROB.DRC

where "xxx" represents a 3 digit number which the program generates to uniquely identify each customisation. This means you can have up to 999 attempts at creating customisations. The maximum number of customisations that can be held at any one time is 99. The table of available customisations is held in the file CUSTNAME.DRC.

3.2.4 Panel P3: Season

RIVPACS allows each of the 7 "seasons" to be selected once. The only valid choices for the family abundance taxonomic level are the individual seasons (1-3) and any other choice will be ignored when predictions are made for this taxonomic level. The initial digits (1-7) of the 7 "season" options correspond to the "Season codes" used in the ASCII files (see 5.2, 5.4, 5.9, & 5.10).

The seasons are defined as follows:

Spring (March-May)
Summer (June-August)
Autumn (September-November)

and RIVPACS predictions should normally be restricted to these months. If it becomes essential to obtain a prediction during the winter, then samples taken in February should be classed as Spring and those taken in December/January as Autumn (see Panel 3). However, predictions made for these months should be treated with caution and avoided where possible.

3.2.5 Panel P4 (+ P5): Biological data source

Biological data can only be accessed from a file. There is no facility for manual input. The formats for the biological data are given in Sections 5.7 & 5.8. The type of file (ASCII or dBASE) must be the same as for the environmental data which is declared at a subsequent panel (Panel P9).

The names of the files containing biological data will be requested for each season in turn for each of the selected taxonomic levels (Panel P5). If biological data are not held for all of the selected seasons enter "***" and press <<Enter>> when prompted for the unavailable file name.

3.2.6 Panel P6: Predictive variable selection

There are 5 possible combinations of predictive variables for Great Britain. The variables listed for each option are supplemented by the eight core variables listed at the top of the panel. Only one variable option can be chosen for each run of the program. Option 1 is recommended for normal use.

Latitude, longitude, mean air temperature and annual air temperature range are determined within the program from the user-supplied National Grid Reference.

3.2.7 Panel P7: Continue?

This gives the opportunity to backtrack to earlier panels.

3.2.8 Panel P8 (+ P9, P10, P11 & P12): Environmental data source

Environmental data must be provided to enable the predictions to be made. Data may be accessed from a previously created file or entered directly into the program. If data are available in a file then Panel P9 allows the user either to specify the data file format or to return to Panel P8. The names of the data files are requested at Panel P10 for ASCII format or Panels P11 & P12 for dBASE format. See Sections 5.4, 5.5, & 5.6 for ASCII and dBASE file formats.

The alternative option of manual data input takes place after the full sequence of prediction panels has been displayed.

3.2.9 Panel P13 (+ P14): Output

Selection of the option to proceed automatically means that once this initial sequence of panels is complete and environmental data have been entered either from file(s) or manually, no further action is required from the user. Site reference and season will be displayed to let the user know how RIVPACS is progressing, but not environmental data, probability of group membership or taxon lists. This will speed up the program if the primary objective is to output to a disk file.

If you do not wish to proceed automatically you will be asked if taxa are to be listed on the screen (Panel P14). The environmental data, probability of group membership, BMWP indices (if the BMWP taxonomic level has been chosen) and the Q14 index value (if the family abundance taxonomic level has been chosen) are displayed by default.

3.2.10 Panel P15 (+ P16 & P17): Output

Selection of the option for output to a disk file enables the user to create a text file similar to the screen display, ie environmental data, probability of group membership, taxon lists (optional) and BMWP and family abundance index values, if appropriate for the taxonomic level. Panels P16 & P17 allow the user to set this up.

3.2.11 Panels P18/P19: Output

Panel P19 will be displayed if the BMWP family taxonomic level has been chosen, otherwise Panel P18 will be shown.

There are several reasons why it may be useful to create one of these files. See Section 5.4 for the file format.

If the environmental data are to be entered manually then this option will save the data for further program runs. Two of the variables (alkalinity and discharge category) allow surrogates to be used and this file will contain the estimated values for these (this will only be true for alkalinity if it has been chosen as a predictive variable). However, note that a separate record is created for each of the seasons you select.

The predicted BMWP index values are appended, although there are alternate output files for them (see Panels P20 & P21 below & Sections 5.9 & 5.10).

The file also includes a suitability code for each site. Essentially, the suitability code indicates how well each site fits in with the classification groups derived from the 614 sample sites in Great Britain each used to develop RIVPACS. The suitability code is expressed as the probability that the site "belongs" to any of the existing classification groups on the basis of its measured environmental characteristics. It therefore offers an indication of the reliability of the prediction. The suitability coding is explained in Section 5.4.1.

3.2.12 Panel P20: Output

This panel will be displayed only if the BMWP family level has been chosen and biological data are held, for at least some of the sites being predicted, in a named input file (see Panels P4 & P5).

In addition to the observed values of BMWP score, number of taxa and ASPT calculated from the biological data file and the expected values computed by RIVPACS, the ratio of the observed/expected values is also included for each of the statistics. If biological data are not provided for some sites in the input file then the observed values for these sites are given as zero in the output file and the ratio field is left blank. See Section 5.9 for format.

3.2.13 Panel P21: Output

This panel will be displayed only if the BMWP family level has been chosen.

This output file provides more information about the BMWP index values. As well as the mean value for the predicted BMWP score, number of taxa and ASPT, the standard deviation and the 95% confidence limits for the mean are also written to the file. See Section 5.10 for the file format.

3.2.14 Panel P22: Output

This panel will be displayed only if the family abundance level has been chosen and biological data are held, for at least some of the sites being predicted, in a named input file (see Panels P4 and P5).

This output file contains the calculated values of the family abundance (Q14) index. If biological data are not provided for some sites in the input file then the values of the Q14 index will be set to -99.99 in the output file. See Section 5.11 for the file format.

3.2.15 Panel P23: Probability level

This panel will be displayed only if taxon lists have been requested. Different cut-off levels can now be requested for different taxonomic levels. The taxon list will be truncated at the requested probability level (log. abundance level in the case of family abundance). However, the full list of predicted taxa will still be used to compute expected index values when these have been requested.

Note that a cut-off level of 0.1% at species level will result in several hundred species being predicted for each site.

3.2.16 Panel P24: Continue?

This provides an opportunity to return to Panel P7 and either amend instructions within the Panel P8 to Panel P23 sequence or even to return to Panel P4 by selecting <Previous menu> at Panel P7. If <Continue> is chosen manual data input now takes place if no environmental data file has been specified.

3.3 Manual data input

The manual data input page is presented in proforma style. Labelled boxes are provided for typing in values of each of the eight core and five optional variables (or their surrogates) presented in Panel P6.

Each data entry box is large enough to enter the maximum acceptable value for each named variable. Decimal point positions are also shown, where appropriate, by use of the character string "0.0". The characters "X", "0" and "." shown initially in the boxes are overwritten by data entry.

The initial display of the data entry page highlights the data entry boxes of the eight core variables in blue and the variable names in white. Once the values of a variable have been entered, pressing <<Enter>> advances the cursor to the next requisite variable.

The site reference box enables any combination of up to 20 alphanumeric characters to be entered which identify the sample. In normal circumstances this would probably be the 20-character string identifying the sample and termed "sample code" in the input and output files shown in Sections 5.3-5.11. It is essential to use the sample code if the predictions are being compared with a biological input file.

The entry for NGR is in the form of two grid letters, a three figure easting and then a three figure northing.

RIVPACS uses the NGR to calculate the core variables latitude and longitude and, if required, the optional variables mean air temperature and air temperature range.

Data entry for altitude, distance from source, water width and water depth is straightforward as is data entry for the core variable discharge category if the value is known.

If no discharge information is available then a value for the surrogate variable velocity category must be entered. In this case "-9" should be typed in the discharge box followed by <<Enter>>. At this stage the data entry box for velocity category will appear in blue and the variable name will be emphasised in white. The required information should then be entered in the standard manner. Discharge category values must lie in the range 1-10 and velocity categories must be in the range 1-5. Values outside these ranges will not be accepted.

Substratum composition requires percentage cover data in the form of four particle size categories which should be entered in turn. The sum of the four values must lie in the range 98-101. A total value outside the range will activate a warning message and re-entry of values whose sum is within the range is required.

Once values for all core variables have been entered, the names and data entry boxes of the selected optional variables will be highlighted and values must be entered.

If alkalinity is included in the variable combination selected at Panel P6 but no alkalinity values are held, a surrogate must be used. Three possible surrogates are offered in descending order of effectiveness for prediction. If a surrogate is required "-9." should be entered in the data entry box for alkalinity. The surrogates are then offered in turn and a value or "-9." (no information) must be entered. A value must be entered for either alkalinity or one of the surrogates if alkalinity is a selected variable.

Data entry for slope is straightforward.

After entering the data for a site there is an opportunity to correct any errors. In response to the question type <<Y>> if the data are correct or <<N>> if you need to correct an entry. If <<N>>, then the entered values are offered in turn for confirmation or correction. Re-type an entry if there is an error or press <<Enter>> if correct. Once data for a site is confirmed as correct, the user is asked if information on another site is to be entered.

On confirmation that no further sites are to be entered, the prediction sequence begins and progress is indicated on screen. Dependant upon responses to earlier panels, which specify what is to appear on screen, the user may be required to press <<Enter>> several times during the prediction sequence. For this reason the user should attend the PC during an interactive run.

3.4 Warnings

Various warning messages may be displayed on screen during the predictive sequence.

3.4.1 Outside range

A warning appears if a value for an environmental variable has been entered which is outside the range found in the 614 RIVPACS sites in Great Britain. Minimum and maximum values for each reference data-set are given in Appendix 5. If the extreme value is not due to an error, this should alert the user to treat the predictions with caution.

In cases where the value of an environmental variable falls below the value given below, it is reset to the minimum value shown and a warning message is given. This avoids zero or negative values in the calculation, but note that this problem would only be expected if there was an error in the input data.

Variable	(Minimum value)
Distance	(0.1)
Altitude	(1.0)
Slope	(0.1)
Width	(0.1)
Depth	(1.0)
Discharge	(1.0)
Alkalinity	(0.1)
Velocity	(1)

3.4.2 Low probability

A warning may appear indicating that the site has a low probability of belonging to any classification group in RIVPACS.

Although the individual values of each environmental variable at the current site of interest may lie well within the ranges found within the RIVPACS reference sites, the particular combination of values at the site may be quite different from any held in the system. Consequently the probability of belonging to any of the RIVPACS groups would be low. If the probability is <5% the user is warned and if <1% there is an opportunity to abandon the procedure. Even if the user chooses to continue, RIVPACS will abandon the procedure if all of the probabilities are very small.

3.5 Output

Some, or all, of the following information is written to the output file for each site predicted. The precise range of data stored depends on the options selected during either an interactive or batch run.

3.5.1 Files

The names of associated files to which environmental data and biological index values have been sent, on request, are listed.

3.5.2 Environmental data

The set of environmental variables used for the current prediction is listed. This may include latitude, longitude, mean air temperature and annual air temperature range, depending on the option chosen plus estimated values for alkalinity and discharge category, if surrogates have been selected.

3.5.3 Site and season

The character string entered in the site reference box is printed together with the season or seasonal combination being predicted. The site reference name also appears before the list of associated files and environmental data.

3.5.4 Probability of group membership

This is the probability that the current site belongs to each of the 35 groups for Great Britain (Appendix 1) resulting from the classification of the reference sites on which RIVPACS is based. The probabilities have been scaled so that the sum of the probabilities for all of the groups is 100%. The list is arranged in descending order of probability and is truncated at the 1% level.

3.5.5 Predicted taxa

Taxa are listed in descending order of probability of capture. The list is truncated at the user-specified probability cut-off level. The taxonomic level being predicted is given before the list of predicted taxa. If biological information was available for the site then observed taxa are flagged with "*" in the left-hand margin and separate lists are given of unexpected absences (ie taxa not captured but with a predicted probability of capture >50%) and unexpected presences (captured taxa but with a predicted probability of capture <50%). Unexpected absences are listed in descending order of probability of capture but unexpected presences are listed in ascending order.

In the case of a prediction at family abundance level and where observed abundance data are available, the observed abundance values are presented alongside the predicted abundances for each family. BMWP families are distinguished from all other families by a letter "B" (or "b") before the family name. The use of upper and lower case letters denotes whether the family is (upper case) or is not (lower case) used to calculate the Q14 index values (see Section 3.5.7).

3.5.6 BMWP score predictions

If BMWP family level has been requested then the predicted BMWP score, number of taxa and ASPT are displayed. If biological data were available the observed values are also given plus the observed/expected ratios.

3.5.7 Family abundance index (Q14)

The family abundance index (Q14) aims to detect the early effects of environmental stress before loss of taxa leads to lower O/E ratios.

The value of Q14 is displayed after the list of taxa when the family abundance level has been chosen and observed abundance values are available. The BMWP families used in the Q14 index (those which have a BMWP score of 4 or more) are distinguished by a "B" against them in the taxonomic list (see Section 3.5.5). Values of Q14 below the pre-determined limit given on screen may indicate environmental stress.

3.5.8 End

When RIVPACS has completed the predictions for all of the sites, taxonomic levels and seasons specified, it returns to the main panel.

4. CLASSIFICATION

4.1 Introduction

The classification component of RIVPACS III offers a procedure for allocating new sites of high biological quality to their position within the existing RIVPACS III classification, based on their macroinvertebrate fauna.

This chapter provides details of the sequence of panels encountered during an interactive classification run. It also forms a useful introduction to the options available to those wishing to classify sites using the batch mode procedure. For further details on batch mode refer to Sections 2.6 and 5.2.

The full lay-out of each panel is shown in Appendix 6 and should be referred to in association with the following notes on each individual panel.

4.2 The classification panels

4.2.1 Main panel: Procedure

Select <Classification> from the Procedure menu and the program will then proceed to (Panel C2). Choosing <Exit> at the main panel will halt the program.

4.2.2 Panel C1: This option has been deleted.

4.2.3 Panel C2: Taxonomic level

There is a choice of two taxonomic levels, BMWP families or species. Only one option can be chosen for a given classification run.

4.2.4 Panel C3: Data source

Choose <ASCII> or <DBASE III/IV> depending on the format of your biological data file. The biological data must include the combined taxon list from all three seasons. They must be held in a file since there is no option for manual input. The format for the biological files is given in Section 5.7 (ASCII) and 5.8 (dBASE).

4.2.5 Panel C4: Data source

Enter the name of the file holding the biological data. The directory where this file can be found is specified in the file DEFAULTS.DAT. You may change the path for biological files by selecting the <Defaults setup> option (see Section 2.5) from the Procedure menu (main panel).

4.2.6 Panel C5 (+ C6): Output

The format for the output files is given in Section 5.12. If file output is requested then the user is prompted for the file name (Panel C6). The directory where the output file will be created is specified in the file DEFAULTS.DAT. You may change the path for biological files by selecting the <Defaults setup> option (see Section 2.5) from the Procedure menu (main panel).

4.2.7 Panel C7: Output

Selection of the option to proceed automatically means that once this initial sequence of panels is complete no further action is required from the user. The site reference will be displayed to let the user know how RIVPACS is progressing but not the probability of group membership. This will speed up the program if the primary objective is to output to disk file.

4.2.8 Panel C8: Continue?

This provides the user with an opportunity to return to the main menu. If <Continue> is chosen the site is then classified using the taxa present. The sample codes, taken from the ASCII or dBASE biological file, are also listed for each site.

4.3 Output

The classification of the site is displayed in terms of the probabilities of the site belonging to particular groups within the classification. The groups are displayed in descending order of probability truncated at the 5% level. See Appendix 1 (Great Britain) for further details of each classification group.

5. DATA FILES AND STRUCTURES

5.1 Introduction

This chapter provides the generalised structure of all the user input and output files associated with RIVPACS. These structures have been tabulated and descriptions of columns common to either ASCII or dBASE files are shown below.

5.1.1 ASCII file conventions

Columns: indicates the precise character positions in the record occupied by the data field.

Format: indicates the field length (consistent with the *Columns* range), the type of data that a particular field can accept (x = numeric character; a = alphanumeric character), and the position of the decimal point (if required).

Description: A text summary of the data field contents.

5.1.2 dBASE file conventions

Field name: the name of the field contained in a record of a database file.

Type: the type of data that a particular field can accept, eg numeric (fixed or floating point) and character.

Width: the maximum number of digits or characters in the field.

Dec: the number of decimal places for numeric fields.

5.2 ASCII input file for batch mode

This file contains sets of information, each one of which corresponds to a single run of RIVPACS. Thus, set 1 may be a prediction for a series of sites on a river and set 2 a classification exercise on the same sites. Alternatively, a single batch run may include a series of sets, which are predictions or classifications for sites on different rivers. As many sets as required may be included in the batch file and the sets are processed sequentially. The only limitation is the disk space required for the output.

Each set of information contains two types of record: a single instruction line; and file names in a specified order. The structure of an instruction line in this type of file is given in 5.2.1. The input file is fixed format and it is essential that each coded instruction is in the position indicated. The sequence in which file names should be entered is also given in 5.2.1.

Although the file can be created using a text editor the user may find it more convenient to use the `Batch set-up' option in the main menu (see Section 2.6) to ensure that the correct format and valid instruction codes are used.

An example of a batch file is provided, AUTO.DAT.

5.2.1 File structure

Instruction Line

Procedure	*Columns*	*Format*	*Instruction*	*Codes*	*Code definition*
*	1	x	procedure	1	prediction
				2	classification
C	3	x	taxonomic	1	BMWP families
			level	2	species
*	5	x	data file type	1	ASCII
				2	dBASE
P	7	x	biological	1	yes
			data file	2	no
P	9	x	predictive	1	alk, slope, MAT, AATR †
			variables	2	alk, MAT, AATR
				3	slope, MAT, AATR
				4	alk, slope
				5	MAT, AATR
P	11-17	xxxxxxx	season	1	"spring"
				2	"summer"
				3	"autumn"
				4	"spring" and "summer"
				5	"spring" and "autumn"
				6	"summer" and "autumn"
				7	all three seasons combined
P	19	x	Q14 index to file	1	yes
				2	no
P	21	x	append scores	1	yes
			to raw data	2	no
P	23	x	scores to file	1	yes
				2	no
P	25	x	statistics to file	1	yes
				2	no
*	27	x	listing file	1	yes
				2	no
P	29	x	include predicted	1	yes
			spp	2	no
P	31-35	xxx.x	unused		
*	37	x	overwrite existing	1	yes
			files	2	no
P	39-46	aaaaaaaa	customisation		name of pre-set customisation
*	48	x	country	0	determine from grid ref
				1	Great Britain
P	50-54	xxxxx	taxonomic	1	BMWP families
			level	2	abundance) for
				3	presence/absence) families
				4	species presence/absence
				5	customisation - pre-set
*	56-67	aaaaaaaaaaaa	defaults filename		
P	71-75	xxx.x	taxon list cut-off		BMWP families
P	76-80	x.xxx	abundance cut-off		Family abundance
P	81-85	xxx.x	taxon list cut-off		Family presence/absence
P	86-90	xxx.x	taxon list cut-off		Species presence/absence
P	91-95	xxx.x	taxon list cut-off		Customisation

† alk = alkalinity; MAT = mean air temperature, AATR = annual air temperature range.

Instruction: a name given to a panel response when running RIVPACS interactively.

Procedure: indicates whether an entry is required for running a prediction (P), classification (C) or for both (*). Valid codes, and their definition, are given for each instruction. Leave blank where an entry is inappropriate (eg no entry required in column 3 when a prediction is being made).

Codes: valid values for an instruction.

Code definition: a text description of *Codes*.

Where multiple choice is permitted, ie season and taxonomic level in the prediction procedure, the available columns should be filled from left to right leaving any remaining columns blank. Thus, up to seven seasonal options and five taxonomic levels can be requested within each set in the batch file.

If data are entered using a text editor, then the user should type <<return>> at the end of the instruction line

File Names

The file names are placed in the first 12 columns, each name on a new line.

There are two filenames required by the classification procedure. The name of the biological input file should be entered first followed by the name of the output listing file.

The filenames required by the prediction procedure are dependent on the options chosen. The appropriate filenames should be entered in the following order:

Input files
- Biological file(s)
- Environmental data file(s)

Output files
- Listing file (text)
- ASCII environmental data output file
- ASCII file of BMWP index values - observed and expected
- ASCII file of BMWP index values and statistics
- ASCII file of family abundance index values (Q14)

The order of the biological data file names for the prediction procedure is seasons within taxonomic levels. The order of the taxonomic levels and seasons must be the same as in their respective instruction codes (columns 50-54 and 11-17 in the instruction line).

For example: if the taxonomic level instruction is `14' and the season instruction is set to `23' then enter the biological file name for "summer" followed by "autumn" for BMWP families and then the corresponding two season files for species. If data are unavailable for a particular combination of taxonomic level and season enter `**********' (ie twelve asterisks) as the file name.

If the environmental data is in dBASE format, then the file containing site (time invariant) variables must precede that for sample (time variant) variables as a pair of entries for each data-set in sequence.

5.3 ASCII defaults file

This is a fixed format file. There are three records, each specifying a path with a maximum length of 50 characters. The paths define where a particular type of file can be found or created and must be in the following order:

biological data files for input
environmental data files for input
output files.

Although a default file can be created or modified using a text editor the user may find it more convenient to use the <Defaults set-up> option in the main menu (Section 2.5).

An example of a defaults file (DEF2.DAT) is provided.

5.3.1 File structure

Columns	*Description*
1-50	Path

5.4 ASCII file for input/output of environmental data

This is a fixed format file. The values of each variable must be placed in the position indicated. The input file has a line length of 113 characters while the output file is 134 characters long. Entries can be made for all variables in the input file although this is not obligatory. Missing values can be entered as `-9' or `-9.' depending upon whether a decimal point is indicated in the *Format* column. Output files containing biotic index information, season and suitability codes can be requested (Sections 5.9, 5.10 & 5.11).

Examples of ASCII environmental data files are provided: TSTENVGB.ASC (three sites).

5.4.1 File structure

Columns	*Format*	*Description*
1-20		Sample code
22-23	aa	National Grid Reference letters
25-27	xxx	NGR easting
29-31	xxx	NGR northing
33-36	xxxx	Altitude (m)
38-41	xx.x	Slope (m km^{-1})
43-44	xx	Discharge category
46-47	xx	Velocity category
49-53	xxx.x	Distance from source (km)
55-59	xxx.x	Mean width (m)
61-65	xxx.x	Mean depth (cm)
74-78	xxx.x	Alkalinity (mg l^{-1} $CaCO_3$)
80-84	xxx.x	Total hardness (mg l^{-1} $CaCO_3$)
86-90	xxx.x	Calcium (mg l^{-1} Ca)
92-97	xxxx.x	Conductivity (µs cm^{-1})
99-101	xxx	Mean substratum : % cover of boulders & cobbles
103-105	xxx	: % cover of pebbles & gravel
107-109	xxx	: % cover of sand
111-113	xxx	: % cover of silt and clay
Output file only		
115-119	xxx.x	Predicted BMWP score
121-124	xx.x	Predicted number of taxa
126-130	xx.xx	Predicted ASPT
132-132	x	Season code (1-7)
134-134	x	Suitability code : 1 OK : 2 <5%) probability the : 3 <2%) site belongs to : 4 <1%) any group : 5 <0.1%) : 7 <1%) probability the site belongs : 8 <0.1%) to any group - abandoned : 9 unable to calculate probabilities of group membership

5.5 dBASE file for input of environmental data for sites (time invariant)

This file contains that part of the information given in the ASCII environmental input file (see Section 5.4) which is not considered to vary with time.

There is no extended output version of this file (see Section 5.4.2) to which biological index values, season and suitability codes can be appended.

Examples of dBASE site environmental data files are provided: TSTESTGB.DBF (three sites).

5.5.1 File structure

Field name	*Type*	*Width*	*Dec*
SAMPLECODE	Character	20	
GRID_REF	Character	8	
ALTITUDE	Numeric	4	
SLOPE	Numeric	4	1
DISCHARGE	Numeric	2	
DISTANCE	Numeric	5	1

The fields do not have to be arranged in the order shown. The dBASE file can contain other fields which RIVPACS will ignore.

5.6 dBASE file for input of environmental data for samples (time variant)

This file contains that part of the information given in the ASCII environmental input file (see Section 5.4) which is considered to vary with time.

There is no extended output version of this file (see Section 5.4.2) to which biological index values, season and suitability codes can be appended..

Examples of dBASE sample environmental data files are provided: TSTESMGB.DBF (three sites).

5.6.1 File structure

Field name	*Type*	*Width*	*Dec*
SAMPLECODE	Character	20	
VELOCITY	Numeric	2	
WIDTH	Numeric	5	1
DEPTH	Numeric	5	1
ALKALINITY	Numeric	5	1
HARDNESS	Numeric	5	1
CALCIUM	Numeric	5	1
CONDUCTIVITY	Numeric	6	1
BOULDERS	Numeric	3	
GRAVEL	Numeric	3	
SAND	Numeric	3	
SILT	Numeric	3	

The fields do not have to be arranged in the order shown. The dBASE file can contain other fields which RIVPACS will ignore.

5.7 ASCII file for input of biological data

Each line of data comprises a sample code which must be identical to that used to identify the site in all other input/output files, followed by up to six 8-digit codes representing individual aquatic taxa. Refer to the Environment Agency (1996) manual (BT001) entitled `Procedure for collecting and analysing macroinvertebrate samples for RIVPACS' for the RIVPACS III listings of taxa at BMWP family, family and species level. It is important to ensure that data are input at the appropriate taxonomic level, as given in the RIVPACS III listings. In particular, at `species level' take care to input data at the precise taxonomic level given in the listing, even when this means downgrading species to `species group'. (A list of the component species in species groups is given in the manual.) Optionally, log. abundance can be appended to the taxonomic codes. Data for as many samples as required can be entered.

The taxonomic codes used in RIVPACS are the amended versions of the original "Maitland" codes published by the Institute of Terrestrial Ecology in 1977. Copies of the revised codings are held by the Institute of Freshwater Ecology. Requests should be addressed to Mr M.T. Furse (IFE River Laboratory, East Stoke, Wareham, Dorset BH20 6BB).

Examples of ASCII biological data files are provided: TSTFAMGB.ASC (three sites) for taxa identified at the family level; TSTSPPGB.ASC (three sites) for taxa identified to species level; and TSTSPRGB.ASC (three sites) for taxa identified at the family level which have log. abundance values.

5.7.1 File structure

Columns	*Description*
1-20	Sample code
21-28	Taxonomic code
29	Log. abundance
31-38	Taxonomic code
39	Log. abundance
41-48	Taxonomic code
49	Log. abundance
51-58	Taxonomic code
59	Log. abundance
61-68	Taxonomic code
69	Log. abundance
71-78	Taxonomic code
79	Log. abundance

5.8 dBASE file for input of biological data

This is the dBASE version of the ASCII input file for biological data (Section 5.7). As before, the amended 8-digit taxon codes are used.

Examples of dBASE biological data files are provided: TSTFAMGB.DBF (three sites) for taxa identified at the family level; TSTSPPGB.DBF (three sites) for taxa identified to species level; and TSTSPRGB.DBF (three sites) for taxa identified at the family level which have log. abundance values.

5.8.1 File structure

Field name	*Type*	*Width*	*Dec*
SAMPLECODE	Character	20	
SPECIES	Character	8	
ABUNDANCE	Character	1	

The fields do not have to be arranged in the order shown. The dBASE file can contain other fields which RIVPACS will ignore.

5.9 ASCII output file for observed and predicted values of BMWP score, number of taxa and ASPT

This type of file can only be created if the BMWP family taxonomic level has been chosen and biological data are available.

5.9.1 File structure

Columns	*Format*	*Description*	
1-20		Sample code	
22-24	xxx	Observed (Obs)	BMWP score
26-27	xx		number of taxa
29-33	xx.xx		ASPT
35-39	xxx.x	Expected (Exp)	BMWP score
41-44	xx.x		number of taxa
46-50	xx.xx		ASPT
52-57	xxx.xx	Obs/Exp	BMWP score
59-64	xxx.xx		number of taxa
66-71	xxx.xx		ASPT
73-73	x	Season code	(valid codes 1-7)
75-75	x	Suitability code	(valid codes 1-5, 7-9)

5.10 ASCII output file for predicted values of BMWP score, number of taxa and ASPT statistics

This type of file can only be created if the chosen predictions include the BMWP family taxonomic level.

5.10.1 File structure

Columns	*Format*	*Description*	
1-20		Sample code	
22-26	xxx.x	BMWP score	mean
28-34	xxx.xxx		standard deviation
36-40	xxx.x		lower 95% confidence limit
42-46	xxx.x		upper 95% confidence limit
48-51	xx.x	number of taxa	mean
53-58	xx.xxx		standard deviation
60-63	xx.x		lower 95% confidence limit
65-68	xx.x		upper 95% confidence limit
70-73	x.xx	ASPT	mean
75-80	x.xxxx		standard deviation
82-85	x.xx		lower 95% confidence limit
87-90	x.xx		upper 95% confidence limit
92-92	x	season code	(valid codes 1-7)
94-94	x	suitability code	(valid codes 1-5, 7-9)

5.11 ASCII output file of family abundance index (Q14)

This type of file can only be created if the family abundance taxonomic level has been chosen and biological data are available.

5.11.1 File structure

Columns	*Format*	*Description*
1-20		Sample code
22-27	xxx.xx	Family abundance index
29-29	x	Season code (valid codes 1-7)
31-31	x	Suitability code (valid codes 1-5, 7-9)

5.12 ASCII output file of site classification

This is the only type of file that can be created during the classification procedure.

5.12.1 File structure

Columns	*Format*	*Description*
1-20		Sample code
21-23	aaa	Group code
24-28	xxx.x	Probability
33-35	aaa	Group code
36-40	xxx.x	Probability

This example shows only two biological group codes, but more are possible. Therefore the line length is not fixed.

6. REFERENCES

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APPENDIX 1. Classification of the 614 reference sites in Great Britain.

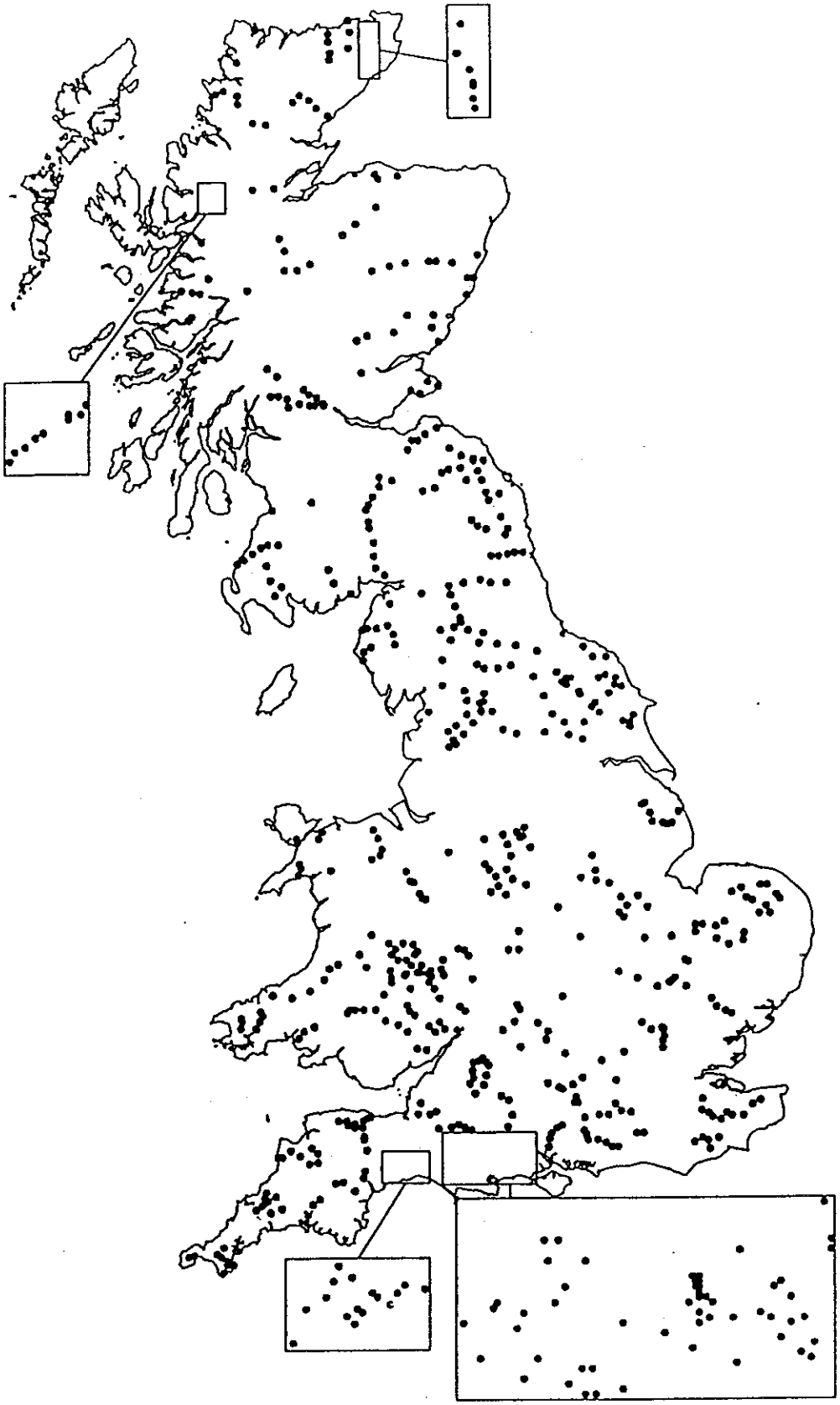
This Appendix provides detailed information on the 35 group classification for Great Britain and is divided into four major sections:

1. A map of Great Britain with the location of the 614 reference sites in RIVPACS III.

2. A dendrogram showing the progressive division of the sites into the 35 end-groups of RIVPACS III. The classification groups are numbered 1 to 35 from left to right across the dendrogram (numbers in brackets) and the number of reference sites in any classification group is the number immediately above the bracketed classification group number.

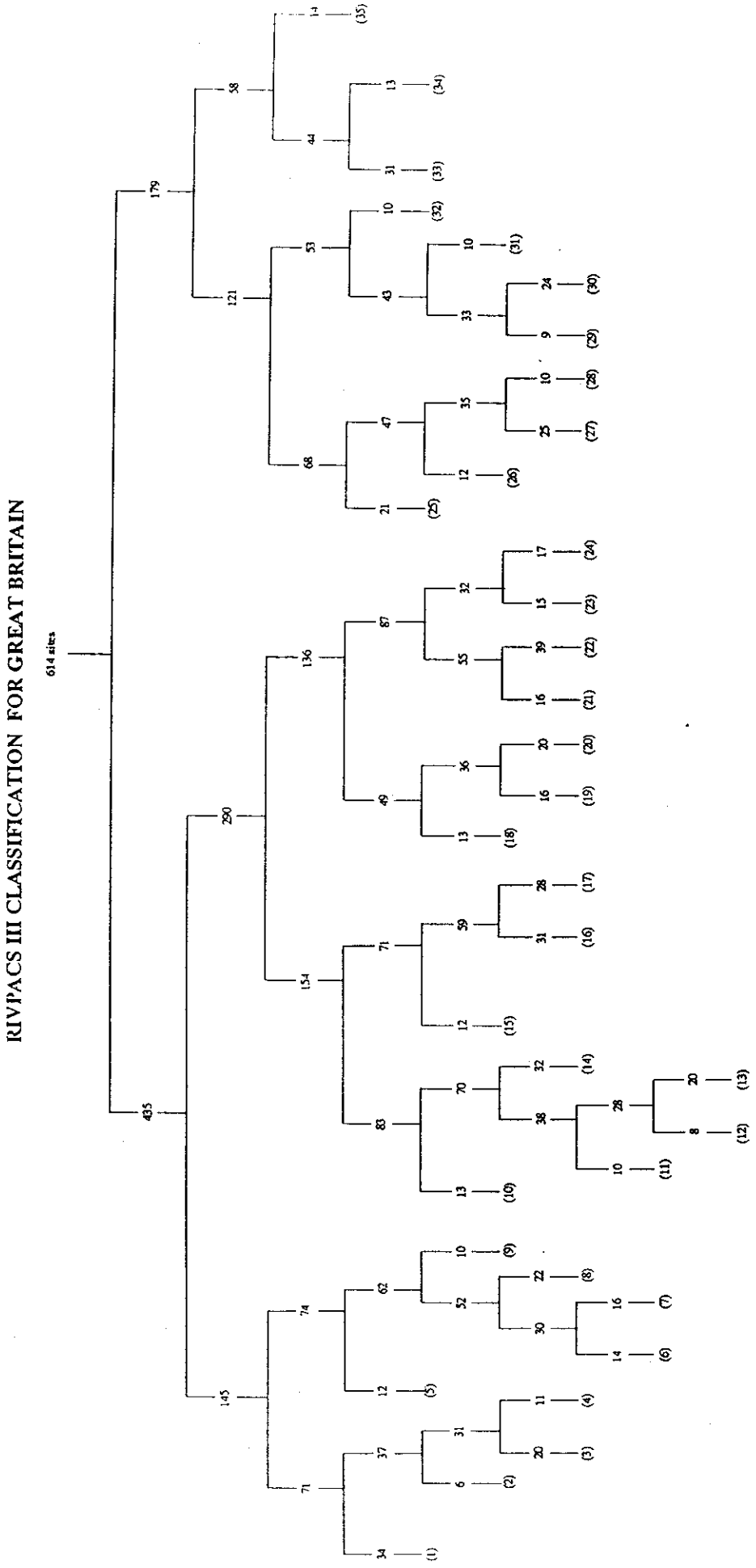
3. A simplified dendrogram to provide a means of navigating the main structure of the RIVPACS III classification. The 145 sites in classification groups 1-9 are from small stream sites and occur throughout Great Britain. The 154 sites in groups 10-17 are from upland streams and rivers predominantly in Scotland and northern England, but with some representation in Wales and the south-west. The 136 sites in groups 18-24 are intermediate in character between groups 10-17 and 25-35 and are mainly from northern England, Wales and the south-west. Finally, groups 25-35 predominantly comprises sites on lowland streams and rivers which are most frequent in southern England, but also include three groups of mainly small stream sites.

4. A double page spread devoted to each of the 35 classification groups. On the left hand side of the page is a map of Great Britain with all reference sites marked as small dots but with the sites in the group under consideration as larger black circles. On the right hand side of the page are three blocks of reference data - information on the sites in the group, their environmental features and some basic biological characteristics. The sites are ordered by grid reference, that is "N", followed by "S" and then "T". The "N" and "S" sequence is essentially from north to south through Scotland, England and Wales but sites starting with a T are in the eastern part of England. The environmental characteristics presented for each group are those used in RIVPACS III. Finally, information on the mean (and range) of the BMWP score, number of taxa and Average Score Per Taxon (ASPT) is given for the reference sites. Values are derived from combined taxon lists based on standard sampling in each of three seasons. This provides some basic information on what to expect from a site of high quality with the stated environmental features.

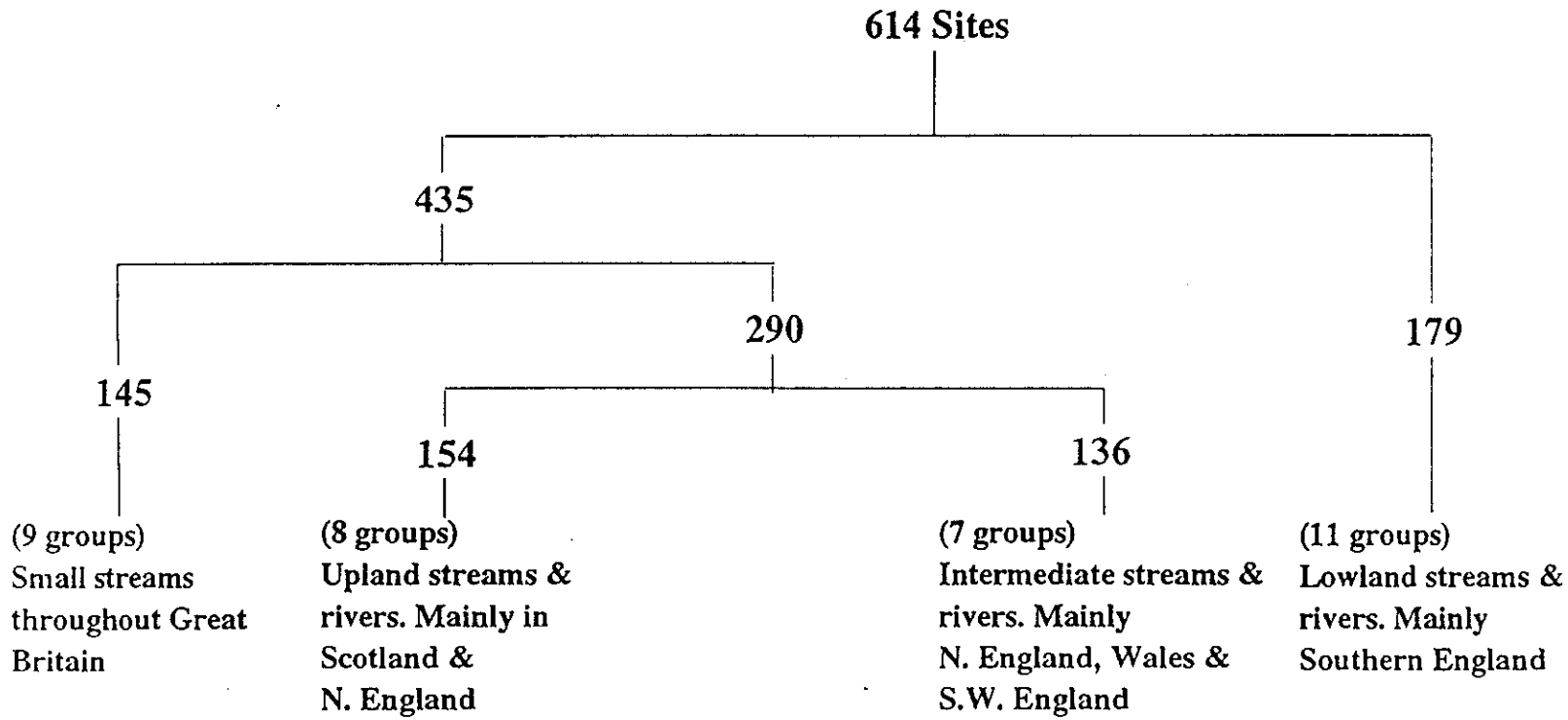


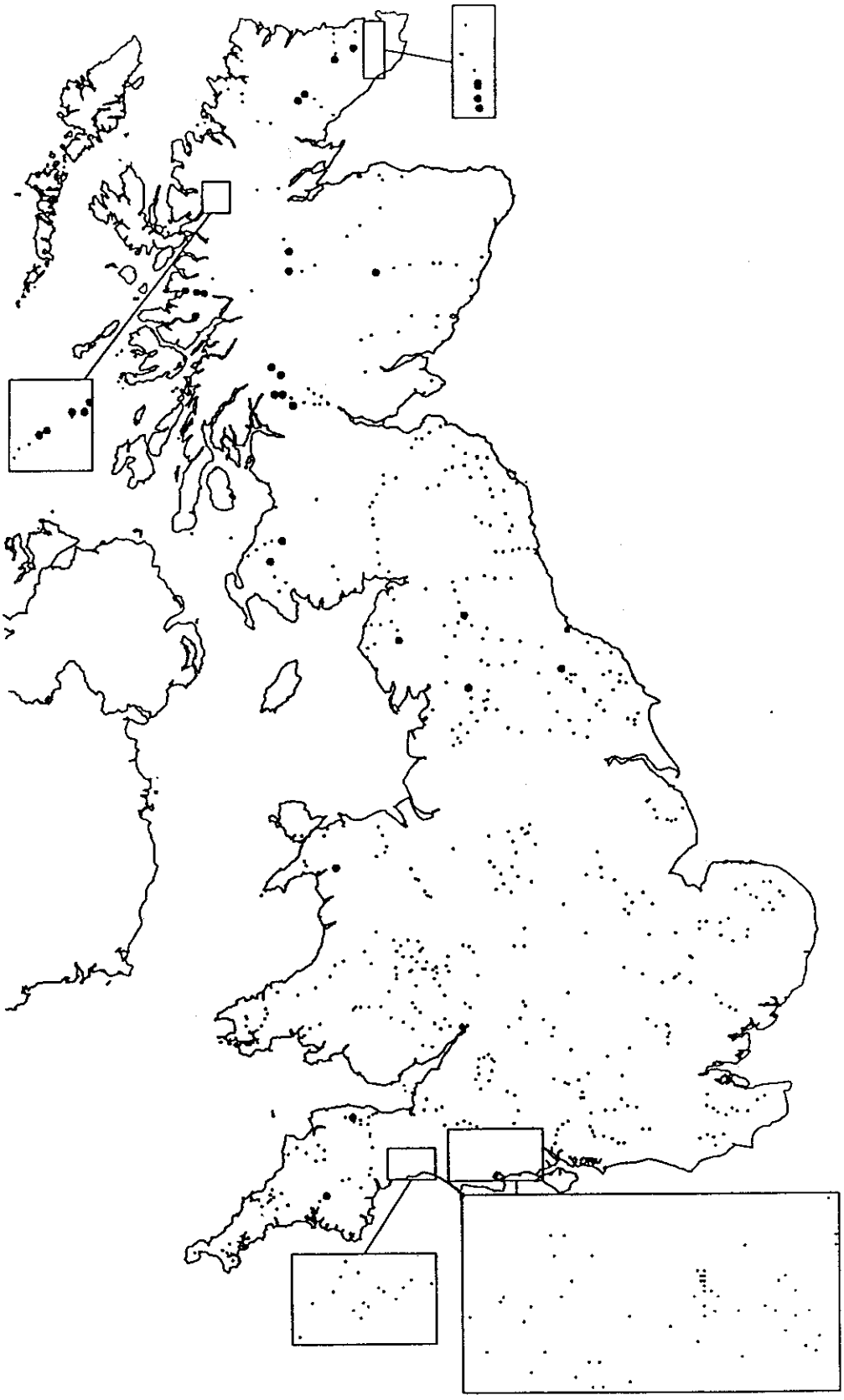
The location of the 614 reference sites in Great Britain used in the development of RIVPACS III.

RIVPACS III CLASSIFICATION FOR GREAT BRITAIN



RIVPACS III CLASSIFICATION FOR GREAT BRITAIN





Group 1

GB - Group 1

34 Sites

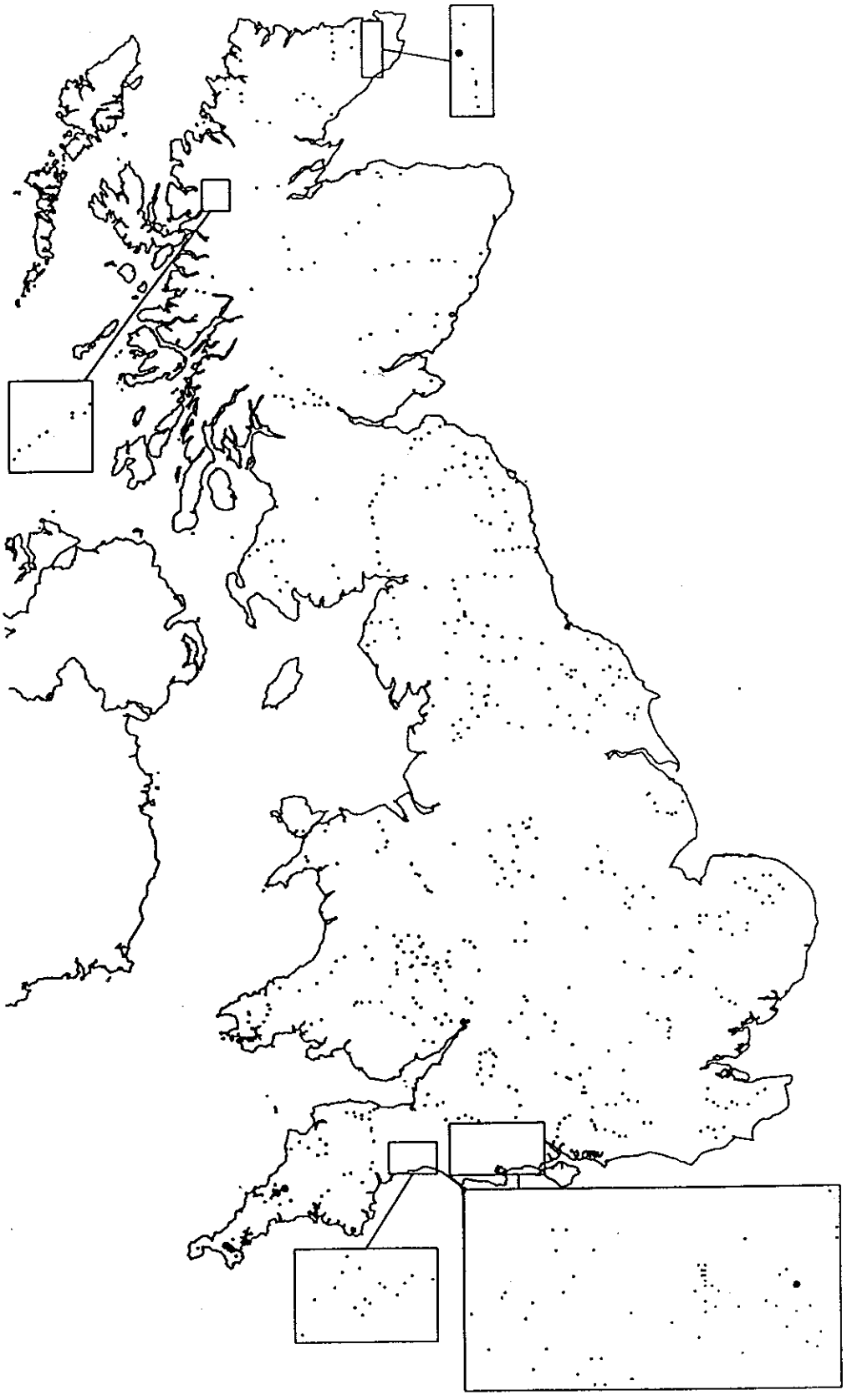
R.BRORA	DALNESSIE	NC 631 155
R.BLACKWATER	CREAG DHUBH	NC 684 202
R.HALLADALE	FORSINARD LODGE	NC 893 438
CNOCLOISGTE WATER	U/S LOCH CALUIM	ND 025 511
BURN OF LATHERONWHEEL	DEN MOSS	ND 179 360
R.THURSO TRIBUTARY A	ACHAVANICH	ND 180 408
BURN OF AULTACHLEVEN	U/S LOCH RANGAG	ND 180 420
BURN OF LATHERONWHEEL	LANDHALLOW	ND 184 332
R.LAIR	ACHNASHELLACH LODGE	NH 002 481
R.CARRON	CRAIG	NH 023 488
ALLT COIRE CRUBAIDH	ALLT COIRE CRUBAIDH	NH 086 531
R.CARRON	U/S LOCH SGAMHAIN	NH 116 537
R.BRAN	LEDGOWAN	NH 128 553
R. KILLIN	KILLIN LODGE	NH 530 093
R. AILORT	MON	NM 774 830
R.STRONTIAN	ARIUNDLE OAKWOOD NNR	NM 843 641
R. AILORT	CRAIG GHOBHAIR	NM 853 817
R. FINNAN	GLEN FINNAN	NM 907 808
R. FALLOCH	KEILATOR	NN 370 238
CAORUNN ACHAIDH	COMER	NN 386 043
R.LARIG	BLAIRCREICH	NN 437 181
ALLT TAIRBH	TEAPOT	NN 440 032
R.SPEY	GARVA BRIDGE	NN 522 947
R.DEE	BRAEMAR	NO 143 915
GREEN BURN	DALMARY	NS 515 955
R.CREE	WHEEB BRIDGE	NX 302 806
R.STINCHAR	HIGHBRIDGE	NX 395 956
R.DERWENT	GRANGE-IN-BORROWDALE	NY 255 176
R.SOUTH TYNE	SOUTH TYNE HEAD	NY 755 361
GAYLE BECK	CAM END	SD 785 803
WHEAT BECK	DALE HEAD	SE 496 950
R. CYNFAL	PONT NEWYDD	SH 714 409
R.EXE	WARREN FARM	SS 791 407
R.WALKHAM	MERRIVALE	SX 550 751

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	168.59	120.09	5.00	518.00
Distance from source (km)	6.59	5.17	0.80	27.00
Slope (m km^{-1})	26.63	32.01	0.60	150.00
Discharge category	3.09	1.78	1.00	7.00
Latitude (^{o} North)	56.37	1.98	50.56	58.44
Longitude (^{o} West)	-4.20	1.01	-5.65	-1.24
Mean air temp. (^{o}C)	8.68	0.67	7.98	10.73
Air temp. range (^{o}C)	11.02	0.83	9.88	12.65
Mean width (m)	9.33	8.84	0.90	39.00
Mean depth (cm)	25.70	11.65	7.10	51.30
Mean substratum (phi)	-5.76	1.17	-7.66	-2.93
Alkalinity (mg $l^{-1}CaCO_3$)	21.59	26.94	1.20	90.40

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	151.53	25.40	113.00	219.00
Number of taxa	22.59	3.55	17.00	32.00
ASPT	6.71	0.30	5.80	7.27



Group 2

GB - Group 2

6 Sites

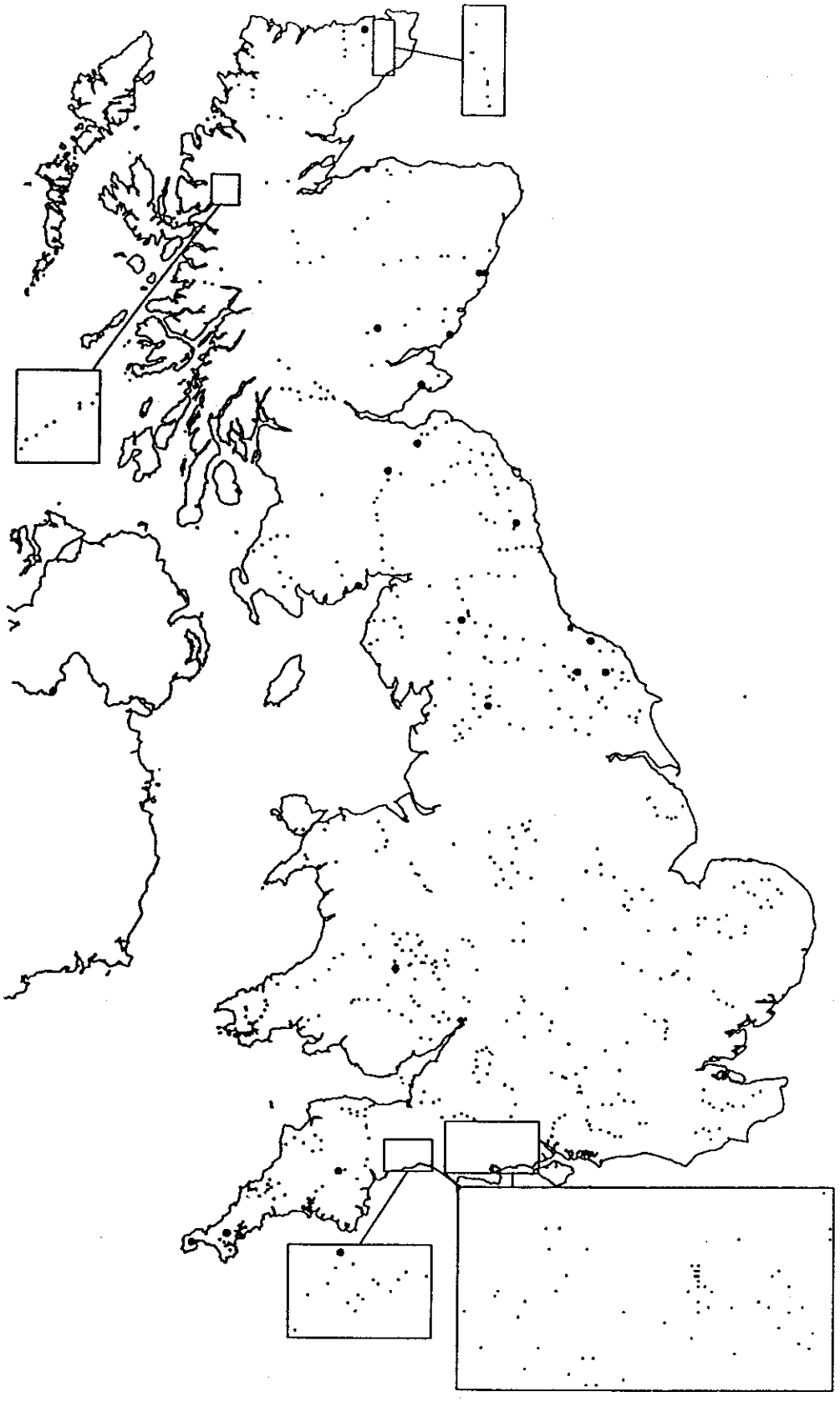
R.THURSO TRIBUTARY C	WESTERDALE	ND 123 517
HIGHLAND WATER	MILLYFORD BRIDGE	SU 268 079
BODILLY STREAM	BODILLY BRIDGE	SW 670 318
GWEEK RIVER	METHER-UNY-MILL BRIDGE	SW 704 292
DE LANK	BRADFORD	SX 114 758
R.FOWEY	CODDA FORD	SX 183 786

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	121.00	84.60	33.00	242.00
Distance from source (km)	4.65	2.83	0.60	9.00
Slope (m km^{-1})	9.70	7.63	4.00	25.00
Discharge category	1.50	1.22	1.00	4.00
Latitude (^{o} North)	51.79	3.28	50.12	58.45
Longitude (^{o} West)	-4.14	1.39	-5.26	-1.62
Mean air temp. (^{o}C)	10.49	1.29	7.93	11.38
Air temp. range (^{o}C)	10.22	1.14	9.38	12.45
Mean width (m)	2.73	1.68	0.80	5.80
Mean depth (cm)	26.47	9.83	18.20	44.50
Mean substratum (phi)	-3.64	2.48	-6.81	-1.07
Alkalinity (mg $l^{-1}CaCO_3$)	17.20	15.15	5.70	41.60

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	216.50	43.39	176.00	293.00
Number of taxa	32.50	5.61	28.00	43.00
ASPT	6.64	0.32	6.07	6.94



Group 3

GB - Group 3

20 Sites

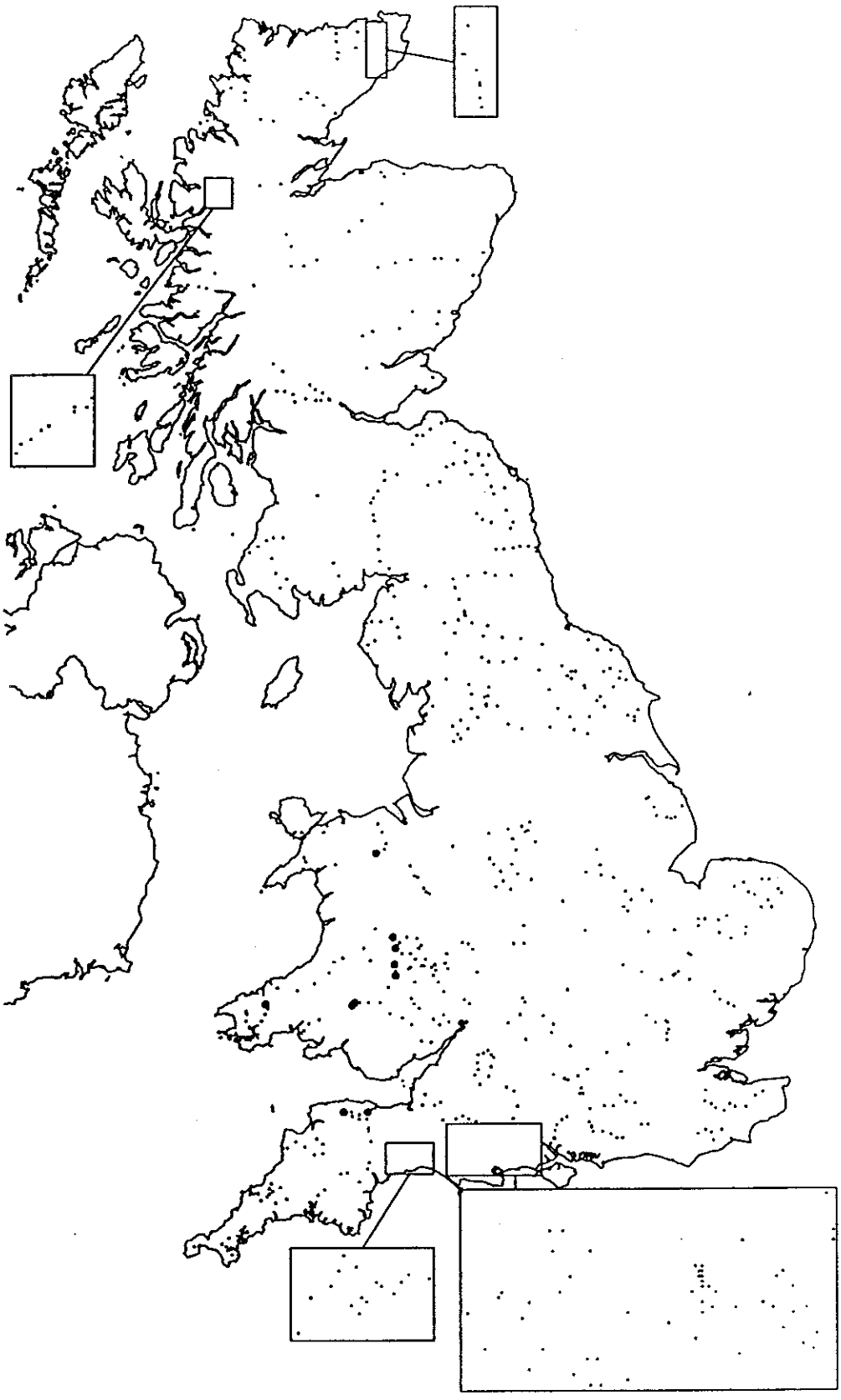
FORSS WATER	ACHALONE	ND 041 630
LUNAN BURN	FORNETH	NO 097 452
KEIL BURN	PITCRUVIE CASTLE	NO 413 045
ELLIOT WATER	ELLIOT	NO 620 394
R. CARRON	TEWEL FORD	NO 828 853
R. CARRON	STONEHAVEN	NO 874 858
TARTH WATER	TARTH WATER FOOT	NT 165 429
R.TYNE	CRICHTON	NT 378 618
GATE BURN	FRAMLINGTON GATE	NU 118 037
SOUTHWICK BURN	NR. SOUTHWICK HOUSE	NX 929 574
KNOCK ORE GILL	GREEN CASTLE	NY 711 306
KILTON BECK	LODGE WOOD	NZ 695 160
GORDALE BECK	GORDALE BRIDGE	SD 914 636
COWHOUSE BECK	SNAPER HOUSE	SE 598 912
PICKERING BECK	LEVISHAM	SE 816 911
R.ARROW	KESTY	SO 179 539
R.OTTER	FAIRHOUSE FARM	ST 223 122
NEWLYN RIVER	SKIMMEL BRIDGE	SW 433 302
STITHIANS STREAM	SEARAUGH MOOR	SW 734 374
R.TEIGN	LEIGH BRIDGE	SX 683 879

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	139.55	134.43	4.00	590.00
Distance from source (km)	7.84	6.82	1.00	31.10
Slope (m km^{-1})	21.31	25.01	1.80	100.00
Discharge category	1.80	1.06	1.00	4.00
Latitude (^{o} North)	54.48	2.46	50.12	58.54
Longitude (^{o} West)	-2.86	1.25	-5.59	-0.75
Mean air temp. (^{o}C)	9.33	0.98	7.99	11.45
Air temp. range (^{o}C)	11.46	0.92	9.15	12.53
Mean width (m)	4.51	3.03	1.00	12.80
Mean depth (cm)	18.92	10.85	7.00	45.10
Mean substratum (phi)	-4.46	1.50	-6.76	-1.97
Alkalinity (mg $l^{-1}CaCO_3$)	67.49	46.75	6.90	179.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	182.55	21.77	153.00	228.00
Number of taxa	28.05	3.19	23.00	35.00
ASPT	6.51	0.25	6.11	7.13



Group 4

GB - Group 4

11 Sites

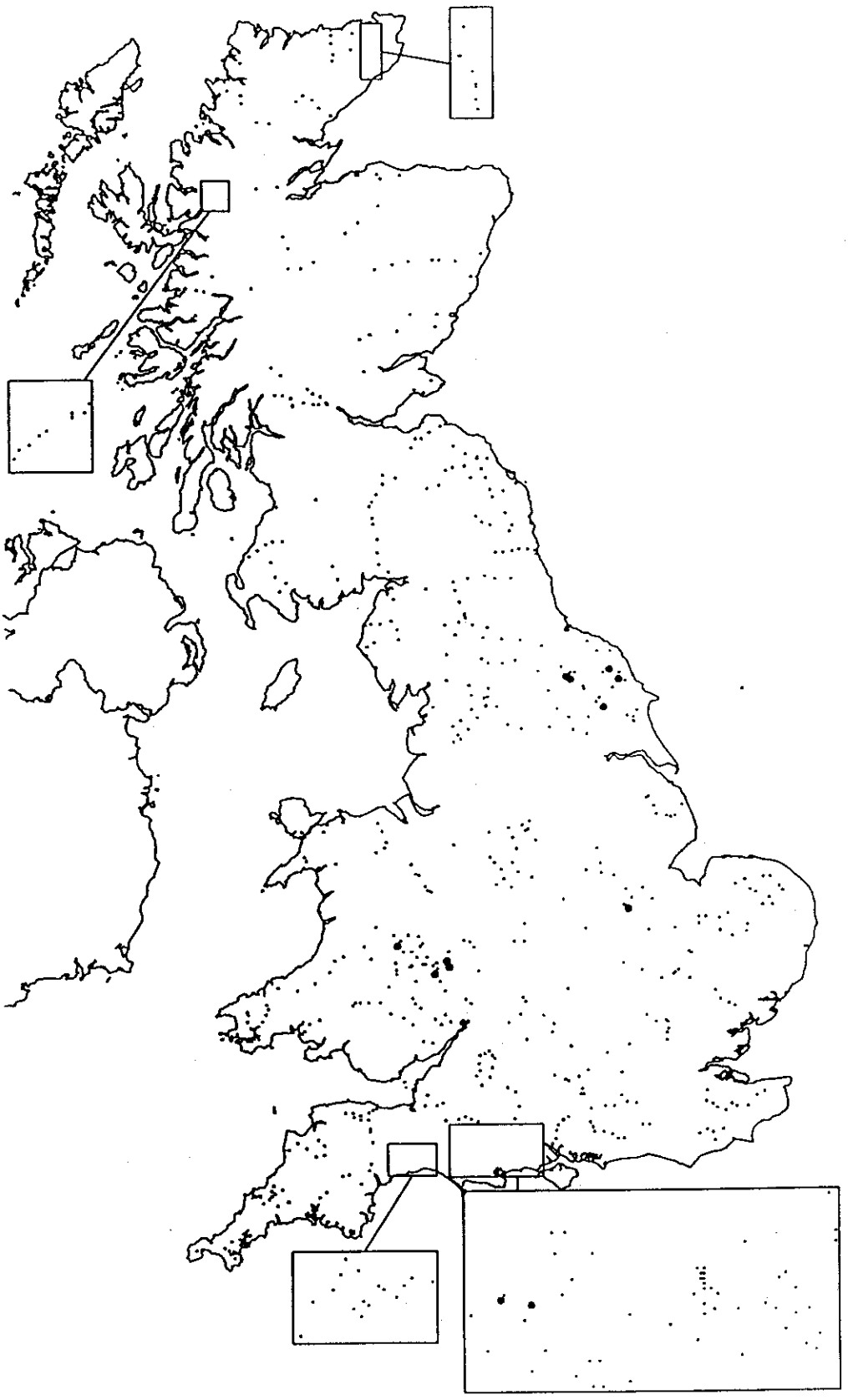
DURNESS STREAM	U/S DURNESS	NC 403 669
R.CLWYD	MELIN-Y-WIG	SJ 040 488
AFON WERN TRIBUTARY	MYNACHLOG-DDU	SN 118 307
R.USK	U/S USK RESERVOIR	SN 820 271
R.USK	D/S USK RESERVOIR	SN 839 291
R.TEME	FELINDRE	SO 162 821
UN-NAMED WATERCOURSE	CRINFYNYDD	SO 176 602
UN-NAMED WATERCOURSE	GLASNANT	SO 182 508
R.LUGG	CRUG	SO 184 730
R.BARLE	GOAT HILL	SS 724 406
R.AVILL	WHEDDON CROSS	SS 925 398

Environmental Charcteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	266.09	101.97	30.00	390.00
Distance from source (km)	3.05	2.40	1.00	8.00
Slope (m km^{-1})	29.01	27.13	5.50	100.00
Discharge category	1.09	0.30	1.00	2.00
Latitude (^{o} North)	52.62	2.04	51.15	58.56
Longitude (^{o} West)	-3.68	0.57	-4.75	-3.20
Mean air temp. (^{o}C)	10.04	0.60	8.48	10.78
Air temp. range (^{o}C)	11.39	1.24	8.37	12.50
Mean width (m)	2.75	1.73	0.80	6.30
Mean depth (cm)	14.84	6.72	5.10	26.70
Mean substratum (phi)	-6.04	0.87	-6.85	-4.10
Alkalinity (mg $l^{-1}CaCO_3$)	68.31	53.81	8.70	167.60

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	206.00	27.44	148.00	248.00
Number of taxa	31.00	3.55	25.00	37.00
ASPT	6.64	0.33	5.92	6.97



Group 5

GB- Group 5

12 Sites

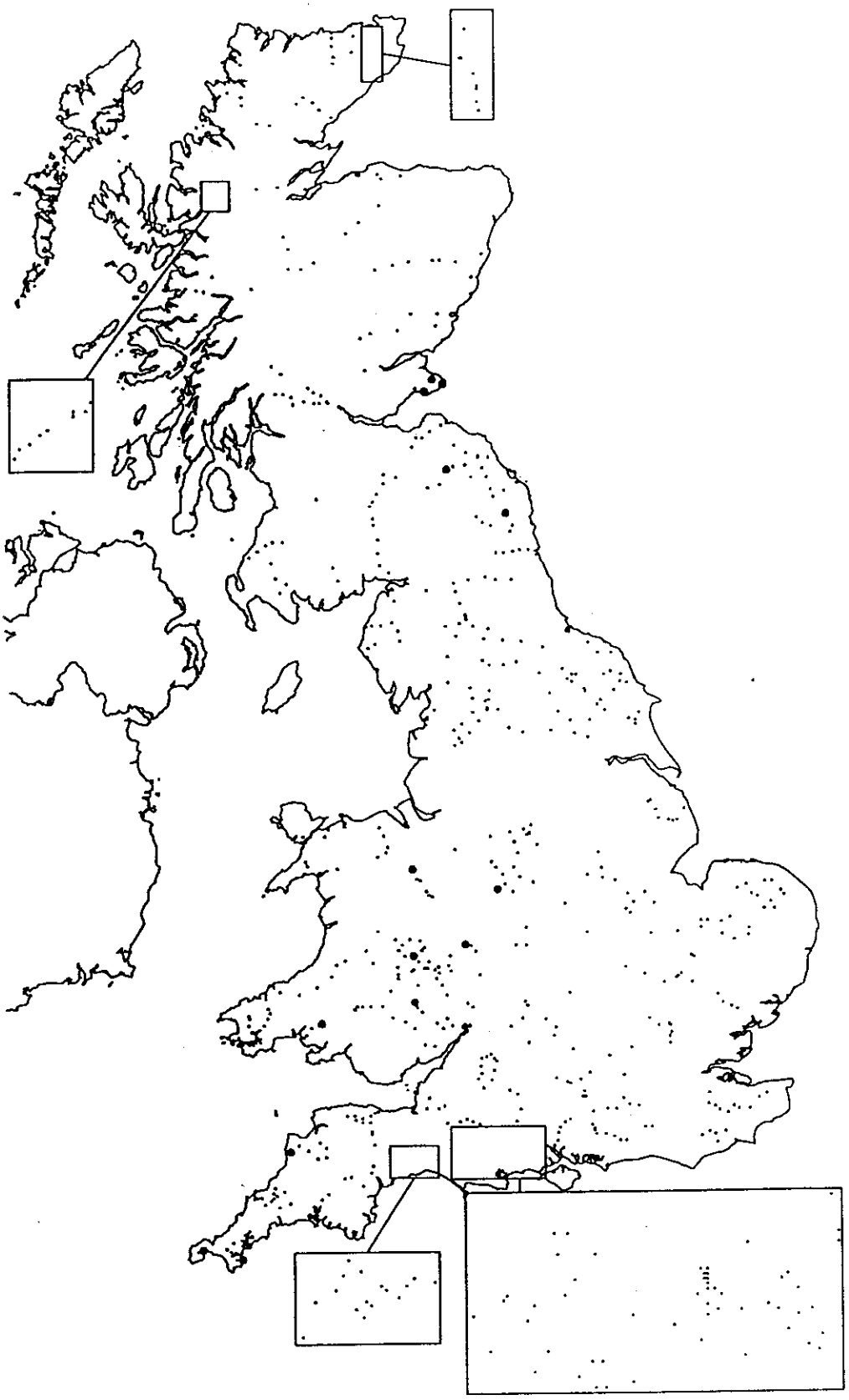
UN-NAMED WATERCOURSE	PEN-TWYN	SO 187 729
SLEDHILL GILL	YOWLASS WOOD	SE 531 870
MIREFALLS GILL	REINS WOOD	SE 566 853
MILL BECK	BATHINGWELL WOOD	SE 822 638
LONG GILL	NEWGATE FOOT	SE 866 935
HALLEYKELD SPRING STREAM	HALLEYKELD RIGG	SE 939 860
UN-NAMED WATERCOURSE	DINMORE MANOR	SO 490 503
UN-NAMED WATERCOURSE	DUNHAMPTON FARM	SO 586 603
UN-NAMED WATERCOURSE	BREDENBURY	SO 603 558
UN-NAMED WATERCOURSE	LYON'S GATE	ST 656 055
UN-NAMED WATERCOURSE	ALTON COMMON	ST 717 047
R.NENE TRIB.	BONEMILLS HOLLOW	TF 042 023

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	148.25	62.43	45.00	300.00
Distance from source (km)	0.60	0.48	0.10	1.70
Slope (m km^{-1})	42.53	18.76	7.70	66.70
Discharge category	1.00	0.00	1.00	1.00
Latitude (^{o} North)	52.87	1.32	50.84	54.33
Longitude (^{o} West)	-1.73	1.02	-3.19	-0.46
Mean air temp. (^{o}C)	9.88	0.43	9.38	10.53
Air temp. range (^{o}C)	12.48	0.41	11.97	13.29
Mean width (m)	0.62	0.18	0.40	1.10
Mean depth (cm)	5.99	4.01	1.70	16.20
Mean substratum (phi)	0.15	3.63	-5.79	6.65
Alkalinity (mg $l^{-1}CaCO_3$)	178.28	58.54	88.00	267.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	123.50	18.44	102.00	169.00
Number of taxa	20.75	1.91	18.00	24.00
ASPT	5.94	0.47	5.37	7.04



Group 6

GB - Group 6

14 Sites

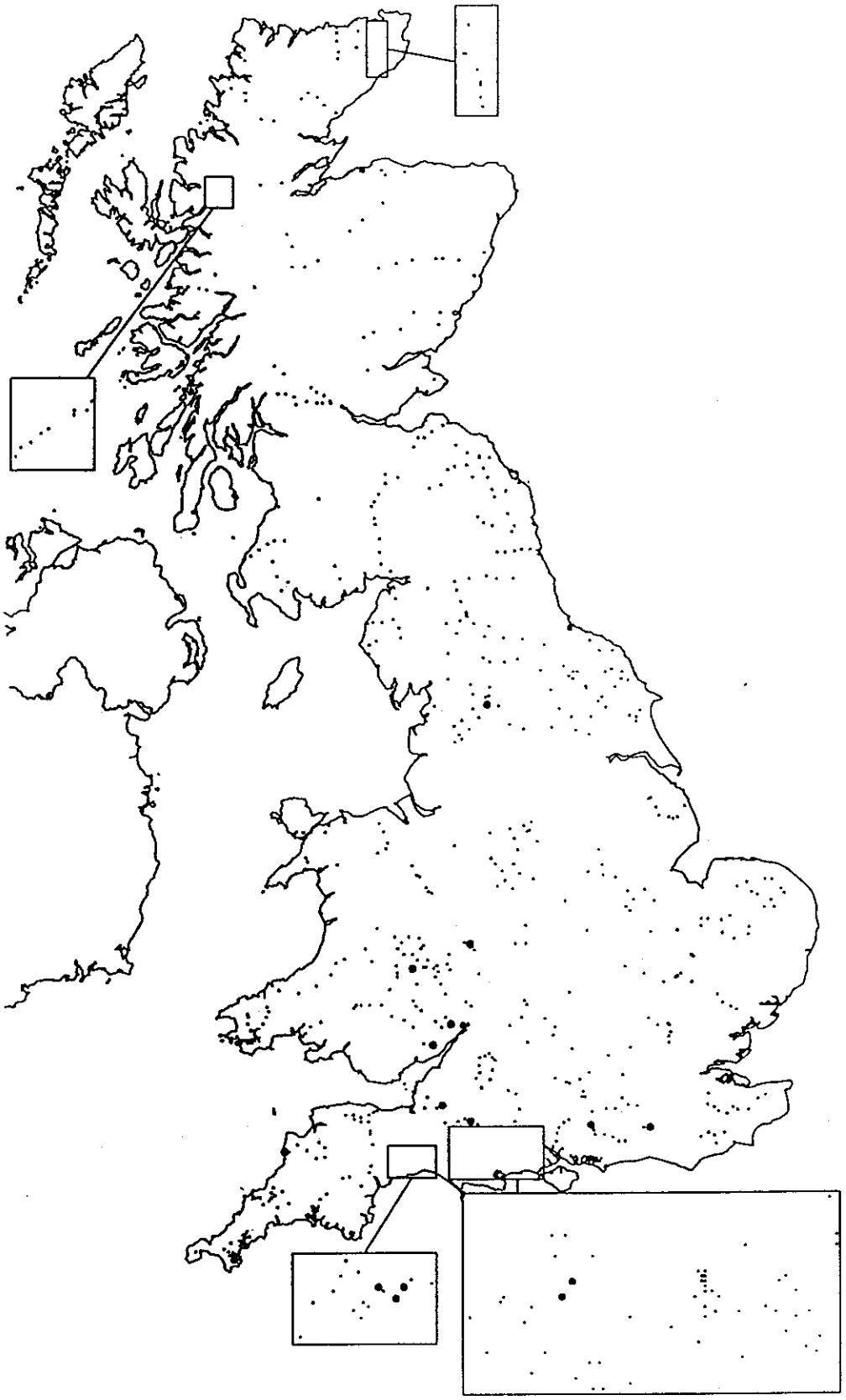
COCKLEMILL BURN	KILL CONQUHAR MILL	NO 482 025
KENLY WATER	STRAVITHIE	NO 537 112
CRAIL BURN	A917 ROAD BRIDGE	NO 611 079
EDEN BURN	A6089 BRIDGE	NT 627 451
GLANTON BURN	ROTHILL	NU 069 126
MORLAS BROOK	D/S GLYN MORLAS	SJ 312 381
SHER BROOK	SHUGBOROUGH	SJ 988 213
GWENDRAETH FACH	GARN-LWYD	SN 543 163
UN-NAMED WATERCOURSE	HILL HOUSE DINGLE	SO 303 685
R.MONNOW	LLANVEYNOE	SO 309 318
DOWLES BROOK	D/S LEM BROOK	SO 723 766
COOMBE VALLEY STREAM	KILKHAMPTON	SS 246 116
TREVAYLOR STREAM	TRYTHOGGA	SW 476 318
ST. KEVERNE STREAM	PORTHOUSTOCK BRIDGE	SW 805 218

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	85.21	65.13	6.00	225.00
Distance from source (km)	5.02	2.83	1.50	10.00
Slope (m km^{-1})	21.32	15.01	0.10	50.00
Discharge category	1.07	0.27	1.00	2.00
Latitude (^{o} North)	53.23	2.30	50.06	56.29
Longitude (^{o} West)	-3.24	1.12	-5.53	-1.89
Mean air temp. (^{o}C)	9.82	0.96	8.65	11.41
Air temp. range (^{o}C)	11.37	1.21	9.08	12.65
Mean width (m)	3.44	3.13	1.20	12.00
Mean depth (cm)	13.86	6.80	6.60	31.30
Mean substratum (phi)	-4.68	1.57	-6.42	-1.82
Alkalinity (mg $l^{-1}CaCO_3$)	109.44	57.31	12.10	224.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	176.79	29.83	130.00	222.00
Number of taxa	28.86	3.74	23.00	34.00
ASPT	6.10	0.39	5.42	6.53



Group 7

GB - Group 7

16 sites

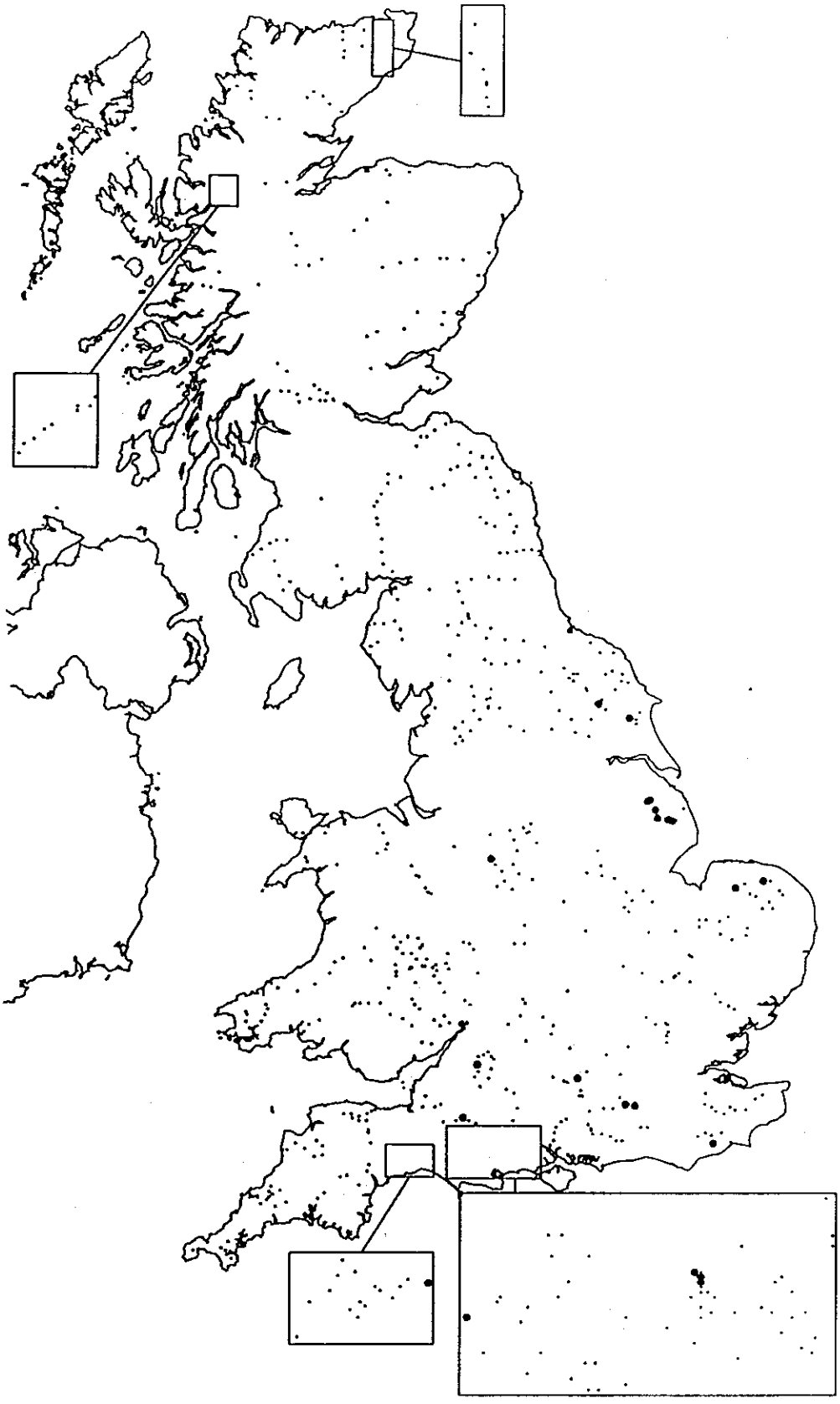
GORDALE BECK	SEATY HILL	SD 912 654
BACK BROOK	KINGTON	SO 303 570
CANNOP BROOK	SPECULATION	SO 610 128
DOWLES BROOK	U/S DOWLES MANOR	SO 770 763
COOMBE VALLEY STREAM	COOMBE	SS 215 116
KIT BROOK	KIT BRIDGE	ST 308 039
BLACKWATER RIVER	BEERHALL	ST 358 010
R.SYNDERFORD	VENN HILL	ST 383 037
MOUNTON BROOK	BULLY HOLE BOTTOM	ST 460 962
R.AXE	WOOKEY HOLE	ST 531 473
UN-NAMED WATERCOURSE	GASPER	ST 763 335
UN-NAMED WATERCOURSE	WOOLLAND	ST 782 069
UN-NAMED WATERCOURSE	OKEFORD FITZPAINE	ST 801 105
R.ROTHER	HAWKLEY MILL	SU 749 307
MANACCAN RIVER	POLKANOGGO	SW 755 222
HAMMER'S POND TRIBUTARY	CARTER'S LODGE	TQ 242 293

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	106.31	81.39	27.00	350.00
Distance from source (km)	3.69	4.35	0.30	15.30
Slope (m km^{-1})	15.11	12.04	1.70	46.90
Discharge category	1.19	0.40	1.00	2.00
Latitude (^{o} North)	51.36	0.93	50.06	54.08
Longitude (^{o} West)	-2.63	1.15	-5.14	-0.23
Mean air temp. (^{o}C)	10.38	0.44	9.27	11.39
Air temp. range (^{o}C)	11.86	1.10	9.02	12.88
Mean width (m)	2.84	1.56	0.80	6.10
Mean depth (cm)	12.83	6.68	4.20	29.20
Mean substratum (phi)	-2.73	2.16	-5.50	3.69
Alkalinity (mg $l^{-1}CaCO_3$)	109.91	66.87	22.80	247.50

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	184.31	23.27	138.00	223.00
Number of taxa	29.06	3.26	23.00	35.00
ASPT	6.34	0.28	5.94	6.76



Group 8

GB - Group 8

22 sites

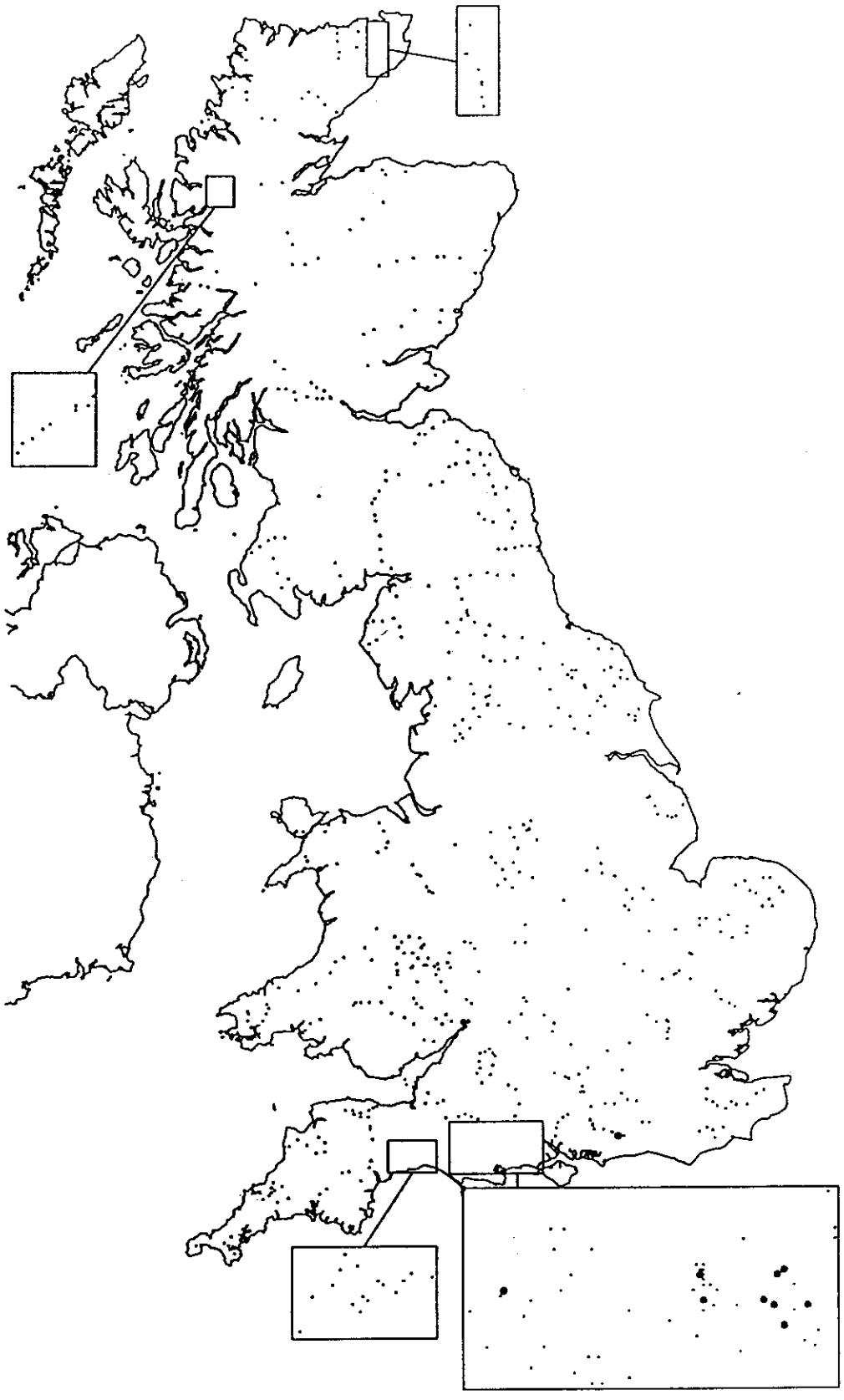
MENETHORPE BECK	MENETHORPE	SE 768 676
R.BLITHE	COOKSHILL	SJ 942 435
R.AXE	MOSTERTON	ST 457 053
R.FROME	CHANTMARLE	ST 589 023
R.BRUE	SOUTH BREWHAM	ST 716 363
BY BROOK	GATCOMBE HILL	ST 834 789
R.CRANE	D/S CRANBORNE	SU 062 129
BIRCHES COPSE	D/S WOOD	SU 074 098
R.CRANE	PINNOCKS MOOR	SU 077 112
CLAYHILL BROOK	U/S BURGHFIELD STW	SU 655 684
R.HULL	LITTLE DRIFFIELD	TA 010 576
R. RASE	BULLY HILLS	TF 168 918
ORFORD BECK	KIRMOND LE MIRE	TF 189 926
R. BAIN	BISCATHORPE	TF 231 849
GOULCEBY BECK	GOULCEBY	TF 254 791
GREAT EAU	RUCKLAND	TF 332 779
GREAT EAU	SWABY	TF 370 768
R.WENSUM	SOUTH RAYNHAM	TF 885 240
R.BURE	CORPUSTY	TG 105 305
R.TILLINGBOURNE	U/S ALBURY VILLAGE	TQ 053 479
R.TILLINGBOURNE	WOTTON	TQ 130 470
R.BREDE	SEDLESCOMBE STREET	TQ 783 177

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	67.14	41.17	16.00	180.00
Distance from source (km)	5.24	3.02	1.40	12.00
Slope (m km^{-1})	7.07	4.62	0.70	20.00
Discharge category	1.14	0.47	1.00	3.00
Latitude (^{o} North)	52.20	1.21	50.82	54.10
Longitude (^{o} West)	-0.87	1.16	-2.77	1.13
Mean air temp. (^{o}C)	9.98	0.46	9.44	10.60
Air temp. range (^{o}C)	12.75	0.49	11.48	13.32
Mean width (m)	2.87	1.61	0.50	6.00
Mean depth (cm)	19.53	12.23	4.20	58.20
Mean substratum (phi)	-0.63	2.33	-3.91	4.69
Alkalinity (mg $l^{-1}CaCO_3$)	171.82	61.44	41.50	240.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	163.05	30.24	120.00	245.00
Number of taxa	28.55	4.40	23.00	41.00
ASPT	5.69	0.35	5.00	6.35



Group 9

GB - Group 9

10 sites

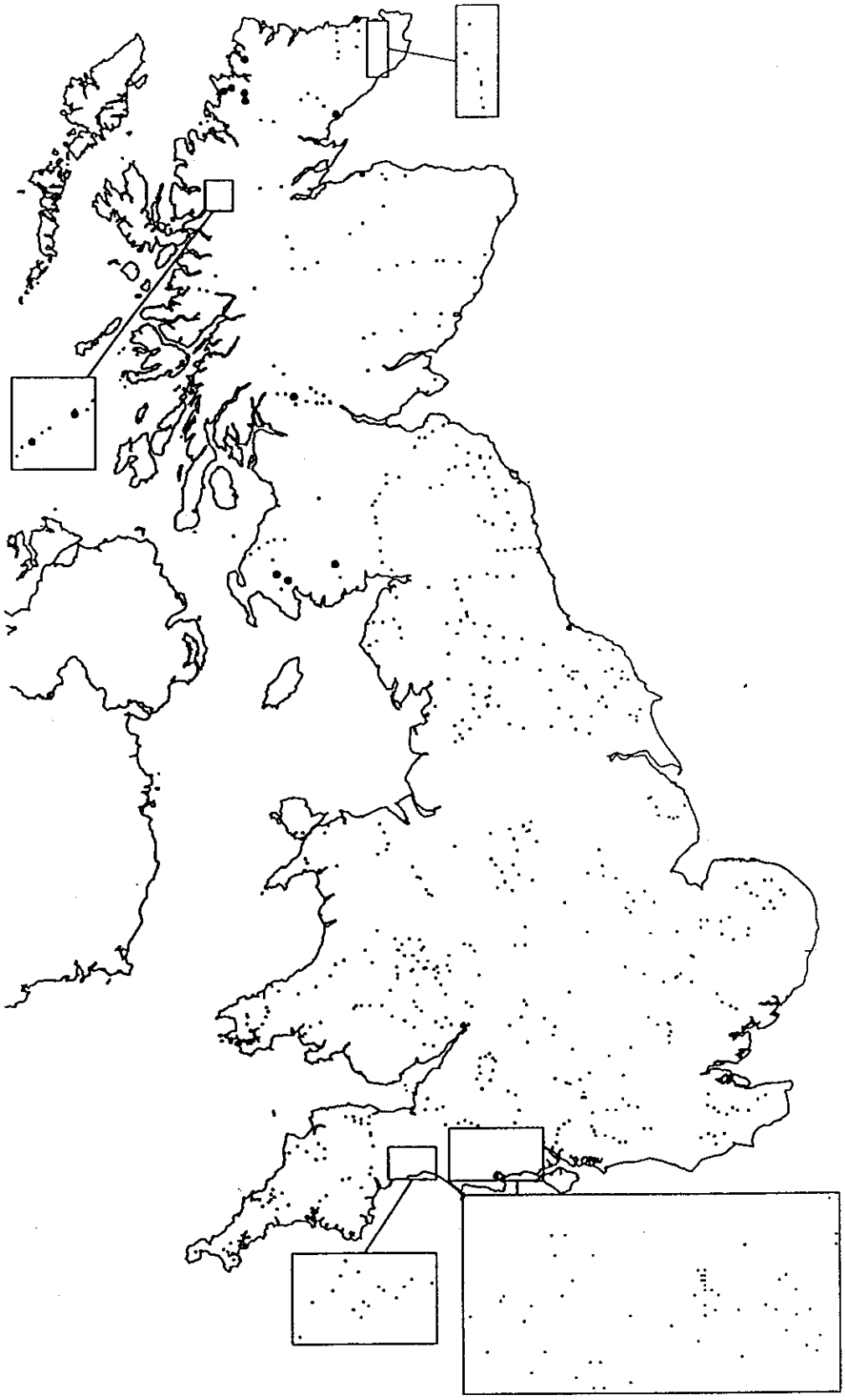
MIDDLEMARSH STREAM	GRANGE WOOD	ST 665 073
BIRCHES COPSE	IN WOOD, U/S TRIBUTARY	SU 069 099
MANNINGTON BROOK	NEWMAN'S LANE	SU 077 042
OBERWATER	VERELEY	SU 205 050
OBERWATER	MILL LAWN	SU 227 036
BRATLEY WATER	BRATLEY	SU 231 098
HIGHLAND WATER	OCKNELL	SU 245 112
R.LYMINGTON	BALMER LAWN	SU 297 036
SUTTON STREAM	ROAD BRIDGE	SU 986 175
AVONWATER	WOOTTON BRIDGE	SZ 250 996

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	44.40	27.66	12.00	100.00
Distance from source (km)	4.15	2.99	1.10	10.00
Slope (m km^{-1})	6.98	4.00	2.60	14.30
Discharge category	1.20	0.63	1.00	3.00
Latitude (^{o} North)	50.86	0.05	50.79	50.95
Longitude (^{o} West)	-1.68	0.46	-2.48	-0.60
Mean air temp. (^{o}C)	10.56	0.13	10.20	10.68
Air temp. range (^{o}C)	12.38	0.15	12.04	12.65
Mean width (m)	2.93	2.47	0.70	8.20
Mean depth (cm)	16.96	8.57	6.80	33.20
Mean substratum (phi)	0.14	3.56	-3.04	6.00
Alkalinity (mg $l^{-1}CaCO_3$)	63.99	61.23	6.00	183.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	207.20	41.98	127.00	265.00
Number of taxa	33.00	6.04	22.00	43.00
ASPT	6.26	0.28	5.77	6.60



Group 10

GB - Group 10

13 sites

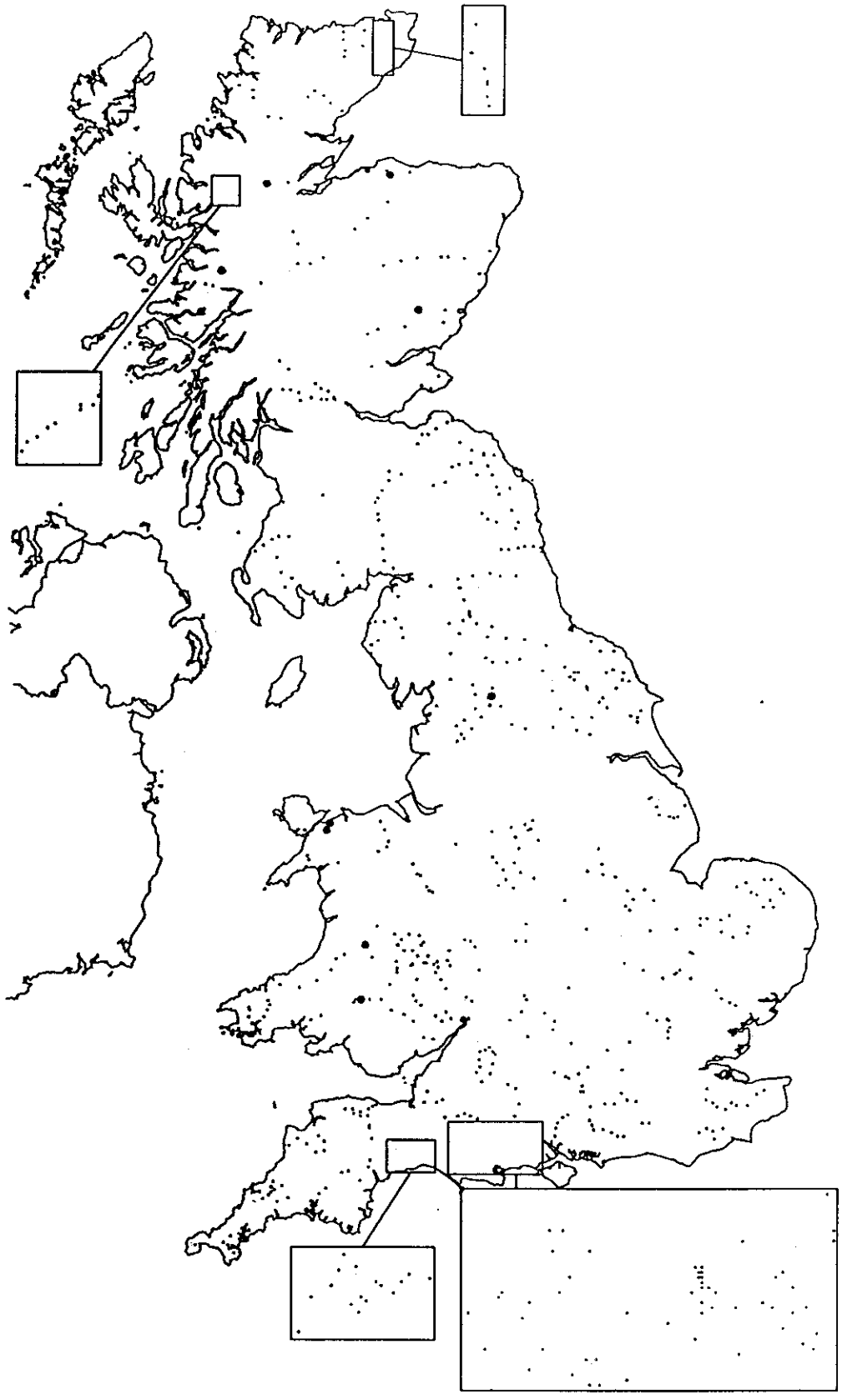
R.INVER	LOCHINVER	NC 097 232
R.INVER	LITTLE ASSYNT	NC 154 250
R.LOANAN	INCHNADAMPH	NC 246 216
R.LOANAN	D/S LOCH AWE	NC 250 162
R.LAXFORD	D/S LOCH STACK	NC 259 447
R.BRORA	D/S LOCH BRORA	NC 870 046
FORSS WATER	CROSSKIRK	ND 029 699
R.CARRON	BALNACRA	NG 978 458
R.CARRON	D/S LOCH DAMHAIN	NH 081 520
R.FORTH	ABERFOYLE BRIDGE	NN 507 014
R.BLADNOCH	GLASSOCH BRIDGE	NX 333 695
R.CREE	NEWTON STEWART	NX 415 648
R. URR	CORSOCK	NX 766 757

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	58.69	53.77	3.00	160.00
Distance from source (km)	20.27	13.95	1.00	44.00
Slope (m km^{-1})	4.69	5.35	0.70	20.00
Discharge category	5.08	1.55	2.00	7.00
Latitude (^{o} North)	57.21	1.39	54.95	58.61
Longitude (^{o} West)	-4.68	0.56	-5.37	-3.67
Mean air temp. (^{o}C)	8.53	0.28	7.97	8.99
Air temp. range (^{o}C)	10.31	1.14	8.61	12.32
Mean width (m)	17.36	9.16	4.00	38.60
Mean depth (cm)	55.05	37.29	29.70	172.20
Mean substratum (phi)	-5.50	1.18	-7.71	-3.26
Alkalinity (mg $l^{-1}CaCO_3$)	15.16	12.13	2.30	44.70

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	198.31	31.25	129.00	245.00
Number of taxa	30.15	4.58	21.00	37.00
ASPT	6.57	0.20	6.14	6.94



Group 11

GB - Group 11

10 sites

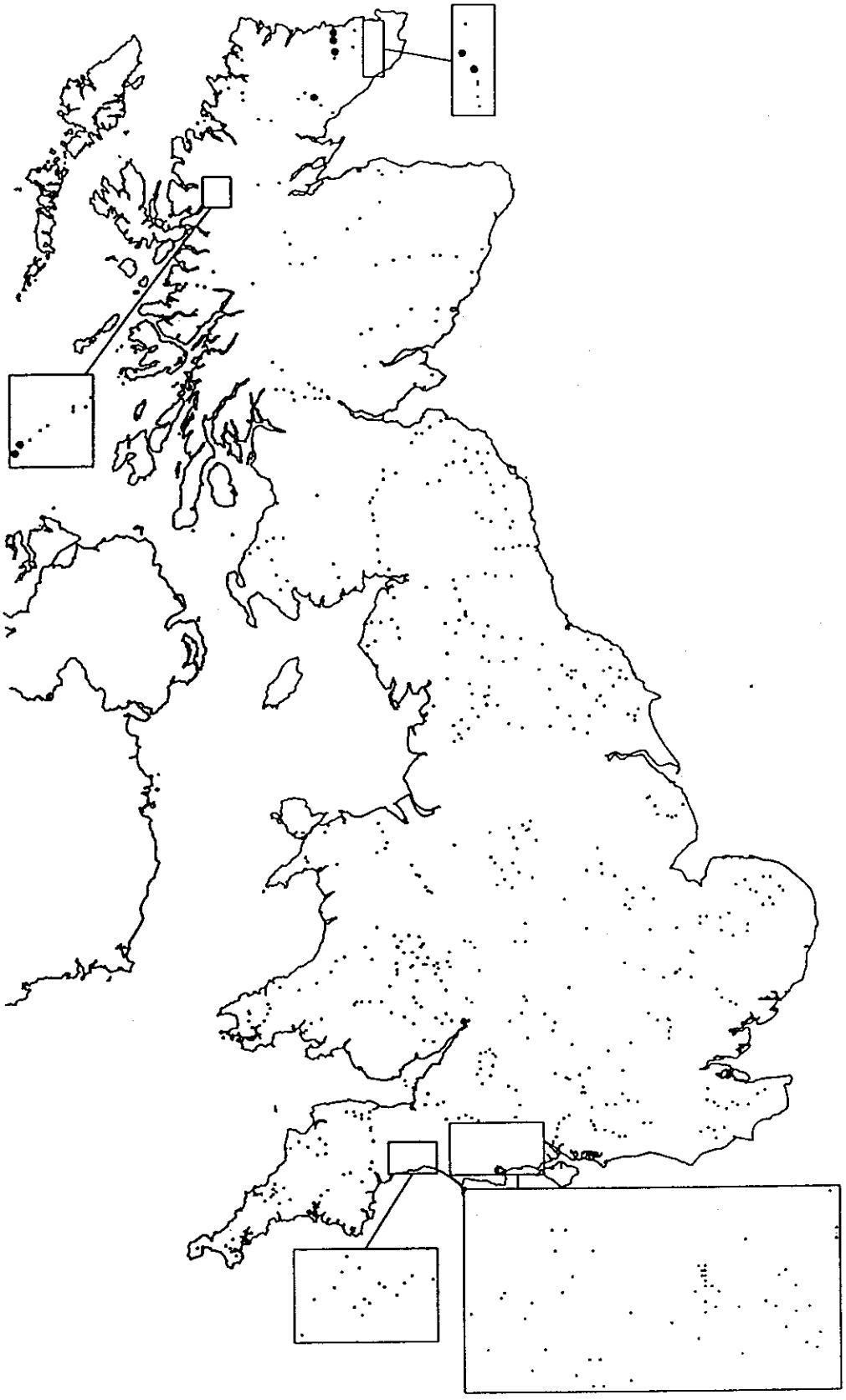
R. MEIG	BRIDGEND	NH 323 549
R. LOSSIE	CLODDACH	NJ 203 584
R.STRONTIAN	ANAHEILT	NM 816 624
R. ARKAIG	STRATHAN	NM 979 913
PROSEN WATER	PROSEN BRIDGE	NO 394 586
COWSIDE BECK	ARNCLIFFE	SD 930 719
R. CASEG	BRAICHMELYN	SH 630 663
ABER	ABERGWYNGREGYN	SH 657 727
R.USK	TRECASTLE	SN 882 287
R.WYE	DOLHELFA	SN 921 738

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	118.20	86.20	6.00	242.00
Distance from source (km)	15.76	9.26	6.00	29.00
Slope (m km^{-1})	18.06	20.15	3.30	66.70
Discharge category	4.10	1.79	1.00	7.00
Latitude (^{o} North)	55.04	2.27	51.95	57.61
Longitude (^{o} West)	-3.94	1.06	-5.57	-2.11
Mean air temp. (^{o}C)	9.25	0.84	8.26	10.29
Air temp. range (^{o}C)	11.14	0.73	10.22	12.06
Mean width (m)	17.23	9.88	5.00	40.00
Mean depth (cm)	24.43	4.48	18.00	31.10
Mean substratum (phi)	-5.79	1.44	-7.35	-3.68
Alkalinity (mg $l^{-1}CaCO_3$)	27.32	29.93	3.50	103.34

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	194.60	14.15	174.00	219.00
Number of taxa	27.90	2.23	25.00	32.00
ASPT	6.98	0.20	6.70	7.27



Group 12

GB - Group 12

8 sites

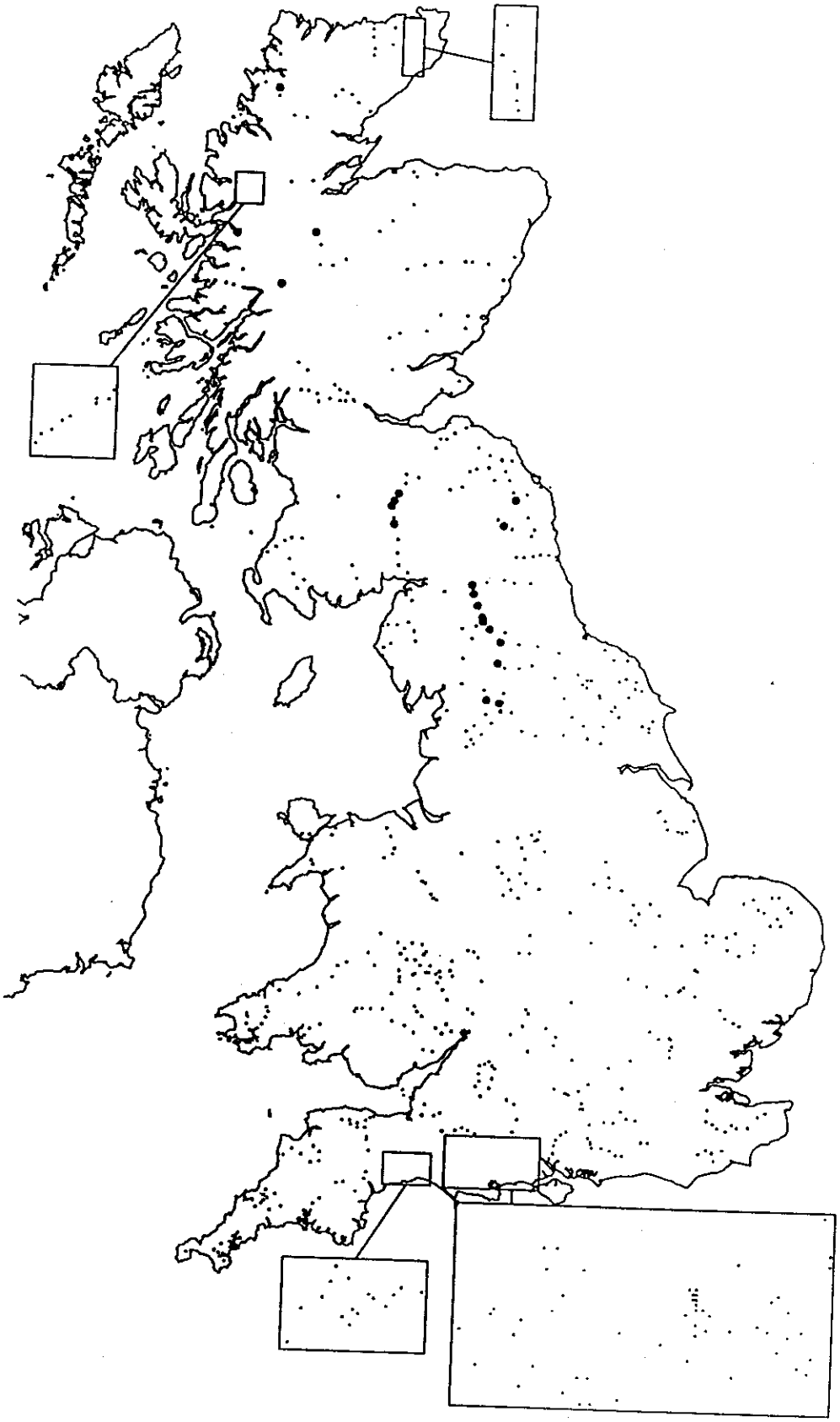
R.BLACKWATER	POLLIE	NC 747 160
R.HALLADALE	MILLBURN	NC 890 560
R.HALLADALE	GOLVAL	NC 896 618
R.HALLADALE	FORSINAIN	NC 903 486
R.THURSO	WESTERDALE	ND 130 518
LITTLE RIVER	TACHER	ND 170 469
R.CARRON	NEW KELSO	NG 940 425
FIONN-ABHAINN	FIONN-ABHAINN	NG 957 453

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	50.00	40.03	2.00	120.00
Distance from source (km)	15.88	6.03	8.00	25.00
Slope (m km^{-1})	5.83	5.16	1.30	13.30
Discharge category	5.25	1.39	3.00	7.00
Latitude (° North)	58.16	0.46	57.43	58.53
Longitude (° West)	-4.20	0.79	-5.43	-3.42
Mean air temp. (°C)	8.17	0.25	7.93	8.57
Air temp. range (°C)	10.38	0.23	10.00	10.82
Mean width (m)	18.03	6.23	8.20	25.30
Mean depth (cm)	46.96	14.11	31.70	71.10
Mean substratum (phi)	-6.22	1.16	-7.61	-3.94
Alkalinity (mg $l^{-1}CaCO_3$)	13.79	9.31	5.00	35.20

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	175.88	28.83	116.00	201.00
Number of taxa	25.75	3.92	18.00	30.00
ASPT	6.82	0.21	6.44	7.07



Group 13

GB - Group 13

20 sites

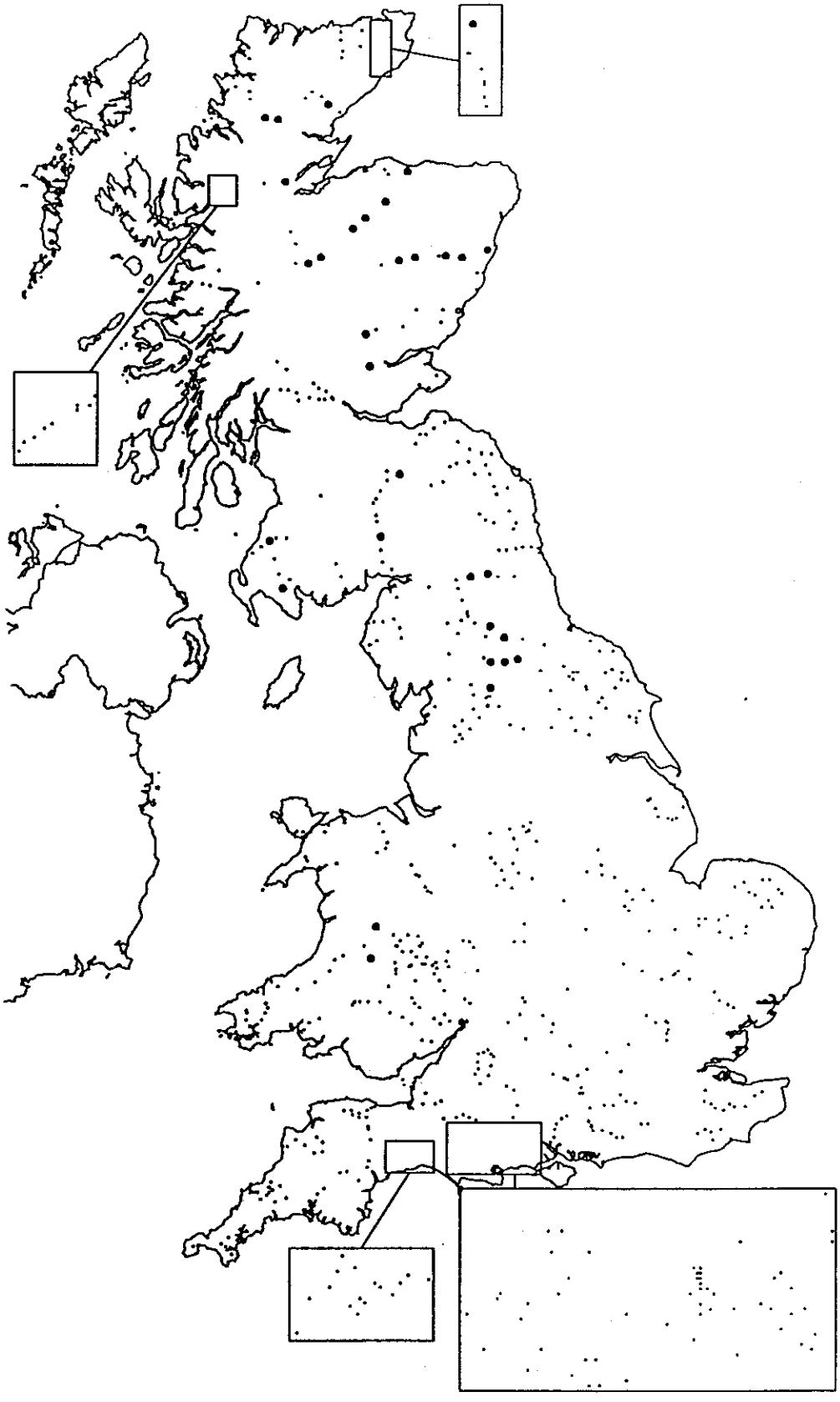
R.TRALIGILL	GLENBAIN	NC 250 218
R. SHIEL	SHIEL BRIDGE	NG 940 188
R. FOYERS	DALCRAG	NH 495 187
R. SPEAN	CORRIE COILLE	NN 252 808
R.TWEED	FINGLAND	NT 055 194
R.ANNAN	MOFFAT	NT 079 058
R.TWEED	NETHER RIGS	NT 080 230
R.TWEED	KINGLEDORES	NT 109 285
R.COQUET	LINSHIELS	NT 894 062
HARTHORPE BURN	CORONATION WOOD	NT 973 248
SOUTH TYNE	FEATHERSTONE	NY 674 617
SOUTH TYNE	D/S KNARSDALE	NY 683 554
SOUTH TYNE	ALSTON	NY 717 459
SOUTH TYNE	DIPPER BRIDGE	NY 758 372
R.TEES	MOORHOUSE	NY 762 338
R.TEES	CAULDRON SNOUT	NY 814 288
R.SWALE	KELD	NY 885 015
R. BALDER	U/S BALDERHEAD RESERVOIR	NY 899 182
R.RIBBLE	HORTON IN RIBBLESDALE	SD 806 726
COWSIDE BECK	NAB END	SD 903 700

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	241.80	152.06	2.00	550.00
Distance from source (km)	14.98	12.87	2.00	59.00
Slope (m km^{-1})	12.79	13.20	2.90	60.00
Discharge category	4.30	1.53	1.00	7.00
Latitude (^{o} North)	55.41	1.12	54.13	58.15
Longitude (^{o} West)	-3.05	1.09	-5.41	-2.04
Mean air temp. (^{o}C)	8.77	0.25	8.33	9.22
Air temp. range (^{o}C)	11.85	0.79	9.47	12.68
Mean width (m)	13.79	8.65	2.70	33.30
Mean depth (cm)	26.47	8.23	11.40	41.70
Mean substratum (phi)	-6.07	1.05	-7.66	-4.27
Alkalinity (mg $l^{-1}CaCO_3$)	49.24	30.02	5.30	103.34

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	151.55	16.70	127.00	187.00
Number of taxa	22.90	2.75	18.00	28.00
ASPT	6.63	0.32	5.77	7.17



Group 14

GB - Group 14

32 sites

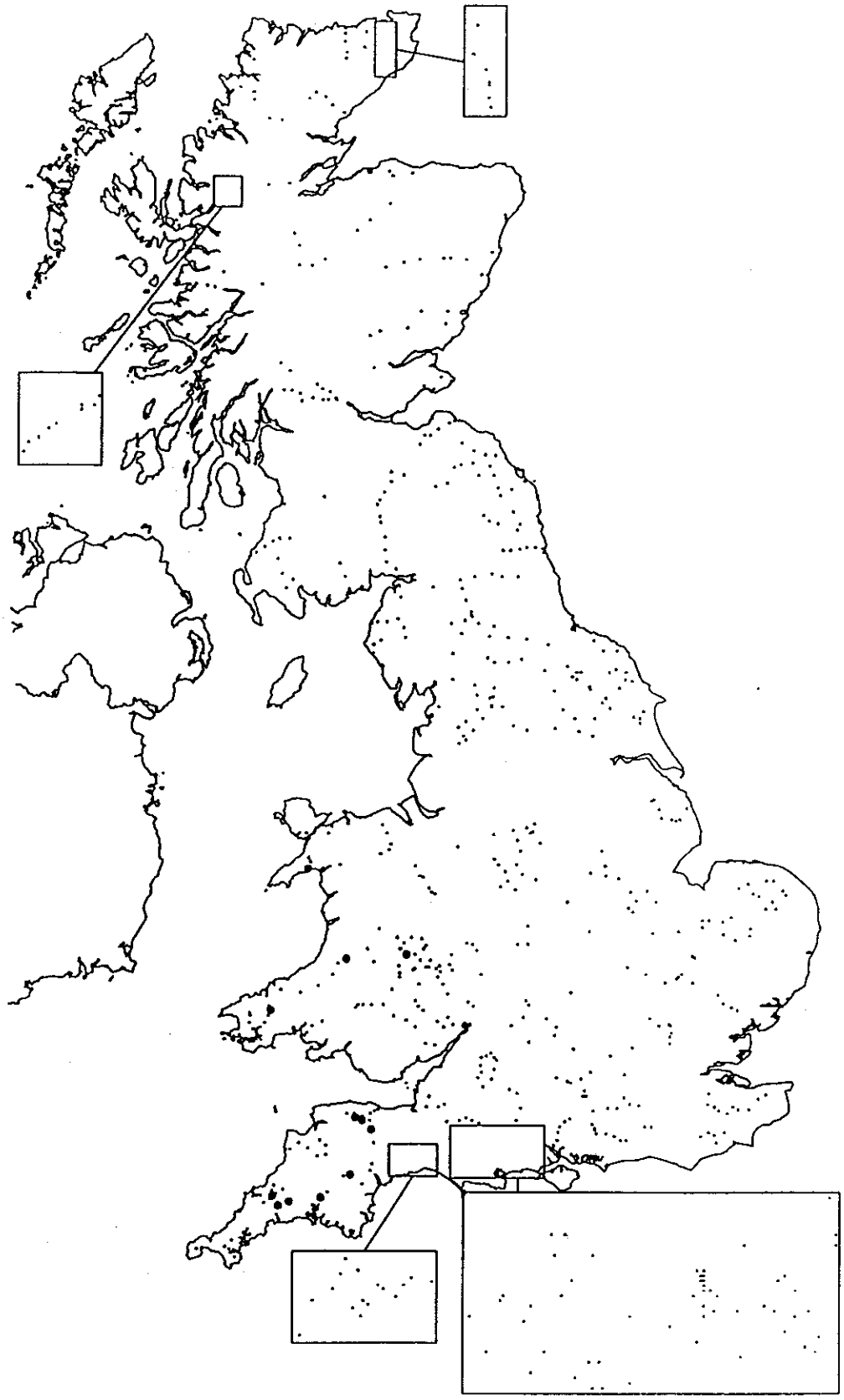
R.OYKEL	CAPLICH	NC 351 028
R.OYKEL	STRATH OYKEL	NC 438 014
R.BRORA	U/S BALNACOIL	NC 789 106
R.THURSO	SORDALE	ND 143 621
R. CONON	MOY BRIDGE	NH 477 547
R.SPEY	BOAT OF GARTEN	NH 946 188
R.SPEY	GRANTOWN	NJ 038 264
R.SPEY	MARYPARK	NJ 183 388
R.SPEY	GARMOUTH	NJ 343 610
R.DEE	CULTS	NJ 904 023
R.SPEY	LAGGAN BRIDGE	NN 614 943
R.SPEY	NEWTONMORE	NN 708 980
R. BRAAN	U/S TAY CONFLUENCE	NO 023 423
R. EARN	FORTEVIOT	NO 048 184
R.DEE	BALMORAL	NO 271 944
R.DEE	D/S BALLATER	NO 385 965
R.DEE	POTARCH BRIDGE	NO 608 973
R.DEE	D/S BANCHORY	NO 719 964
R.TWEED	PEEBLES GAUGE	NT 258 400
R.STINCHAR	D/S BARR	NX 272 937
R.BLADNOCH	SPITTAL	NX 360 579
R.ANNAN	NEWTON BRIDGE	NY 109 949
SOUTH TYNE	BARDON MILL	NY 781 643
SOUTH TYNE	WARDEN BRIDGE	NY 910 659
R.TEES	DENT BANK	NY 931 259
R.TEES	BARNARD CASTLE	NZ 042 172
R.SWALE	U/S RICHMOND	NZ 146 007
R.WHARFE	HUBBERHOLME	SD 933 783
R.SWALE	OXNOP	SD 933 978
R.SWALE	GRINTON	SE 046 985
R.WYE	LLANWRTHWL	SN 976 640
R. SEVERN	LLANDINAM	SO 025 885

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	116.00	83.54	5.00	250.00
Distance from source (km)	49.53	32.40	12.00	140.00
Slope (m km^{-1})	3.05	2.08	0.20	9.10
Discharge category	6.97	1.33	4.00	9.00
Latitude (^{o} North)	56.07	1.64	52.26	58.54
Longitude (^{o} West)	-3.24	0.93	-4.79	-1.78
Mean air temp. (^{o}C)	8.70	0.49	7.97	10.11
Air temp. range (^{o}C)	11.77	0.76	10.03	12.91
Mean width (m)	34.57	16.04	7.00	75.00
Mean depth (cm)	47.82	25.81	16.70	113.20
Mean substratum (phi)	-5.99	1.13	-7.71	-2.92
Alkalinity (mg $l^{-1}CaCO_3$)	33.08	23.65	3.30	83.30

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	176.81	24.74	129.00	229.00
Number of taxa	26.66	3.62	20.00	35.00
ASPT	6.64	0.32	5.82	7.25



Group 15

GB - Group 15

12 sites

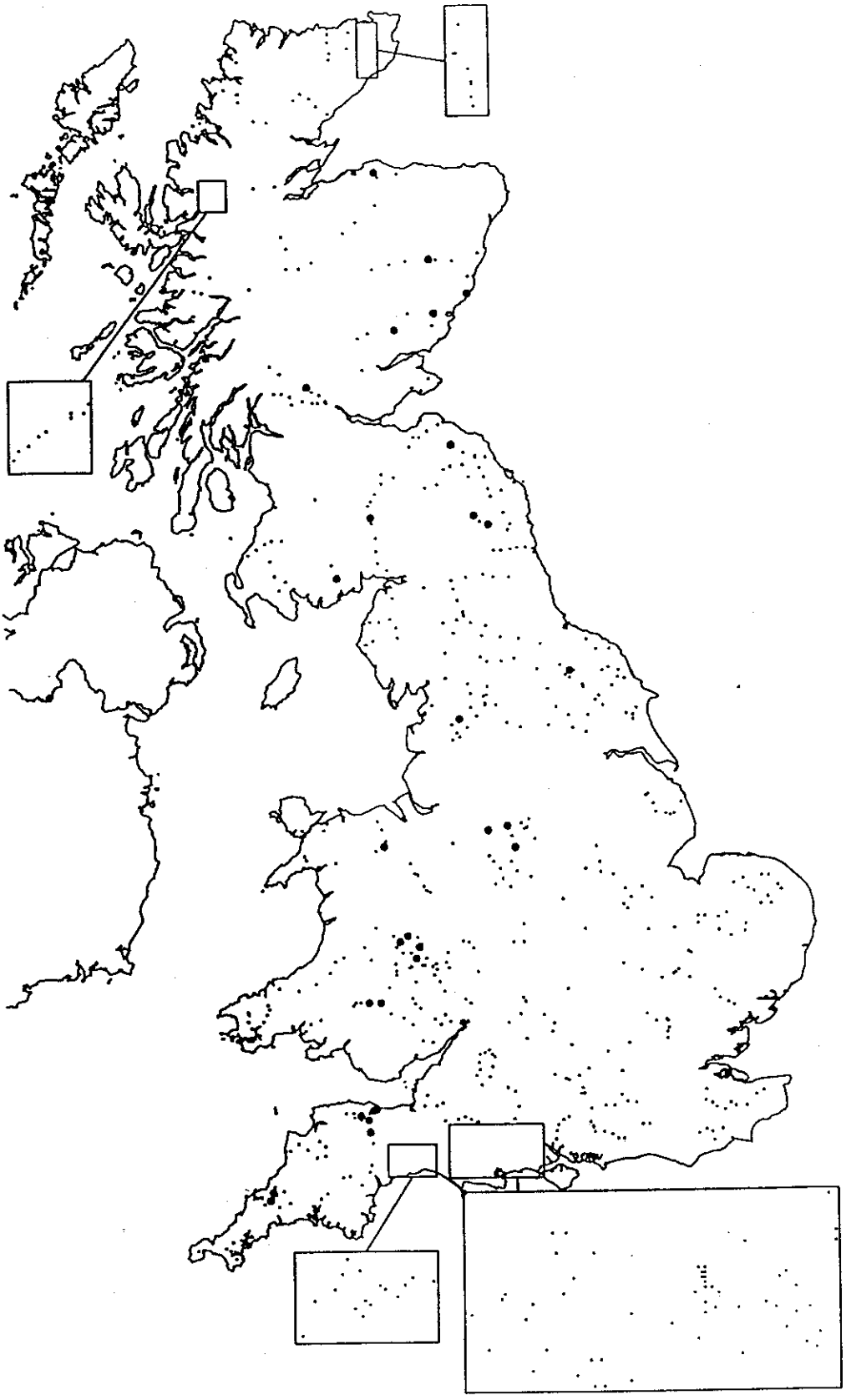
AFON DWYFACH	BONT FECHAN	SH 460 380
EASTERN CLEDDAU	PLASYMEIBION	SN 129 274
AFON TYFI	STRATA FLORIDA	SN 749 659
R.LUGG	MONAUGHTY	SO 238 681
R.BARLE	COW CASTLE	SS 798 369
R.BARLE	SOUTH HILL	SS 852 349
R.BARLE	PIXTON HILL	SS 925 263
DE LANK	KEYBRIDGE	SX 089 739
R.FOWEY	LEBALL BRIDGE	SX 134 653
R.FOWEY	DRAYNES BRIDGE	SX 228 689
R.WALKHAM	GRENOFEN	SX 489 710
R.TEIGN	FINGLE BRIDGE	SX 745 898

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	135.33	85.16	5.00	275.00
Distance from source (km)	16.75	8.68	5.00	36.50
Slope (m km^{-1})	6.10	2.88	2.40	13.30
Discharge category	3.50	1.45	1.00	5.00
Latitude (^{o} North)	51.28	0.86	50.46	52.92
Longitude (^{o} West)	-4.05	0.52	-4.72	-3.12
Mean air temp. (^{o}C)	10.52	0.37	9.99	10.99
Air temp. range (^{o}C)	10.83	0.77	9.73	12.57
Mean width (m)	11.40	3.74	6.70	18.00
Mean depth (cm)	29.73	12.59	10.00	50.50
Mean substratum (phi)	-5.58	1.30	-7.20	-2.85
Alkalinity (mg $l^{-1}CaCO_3$)	21.11	29.17	5.80	110.80

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	219.92	22.24	185.00	262.00
Number of taxa	32.58	3.42	28.00	39.00
ASPT	6.75	0.18	6.54	7.03



Group 16

GB - Group 16

31 sites

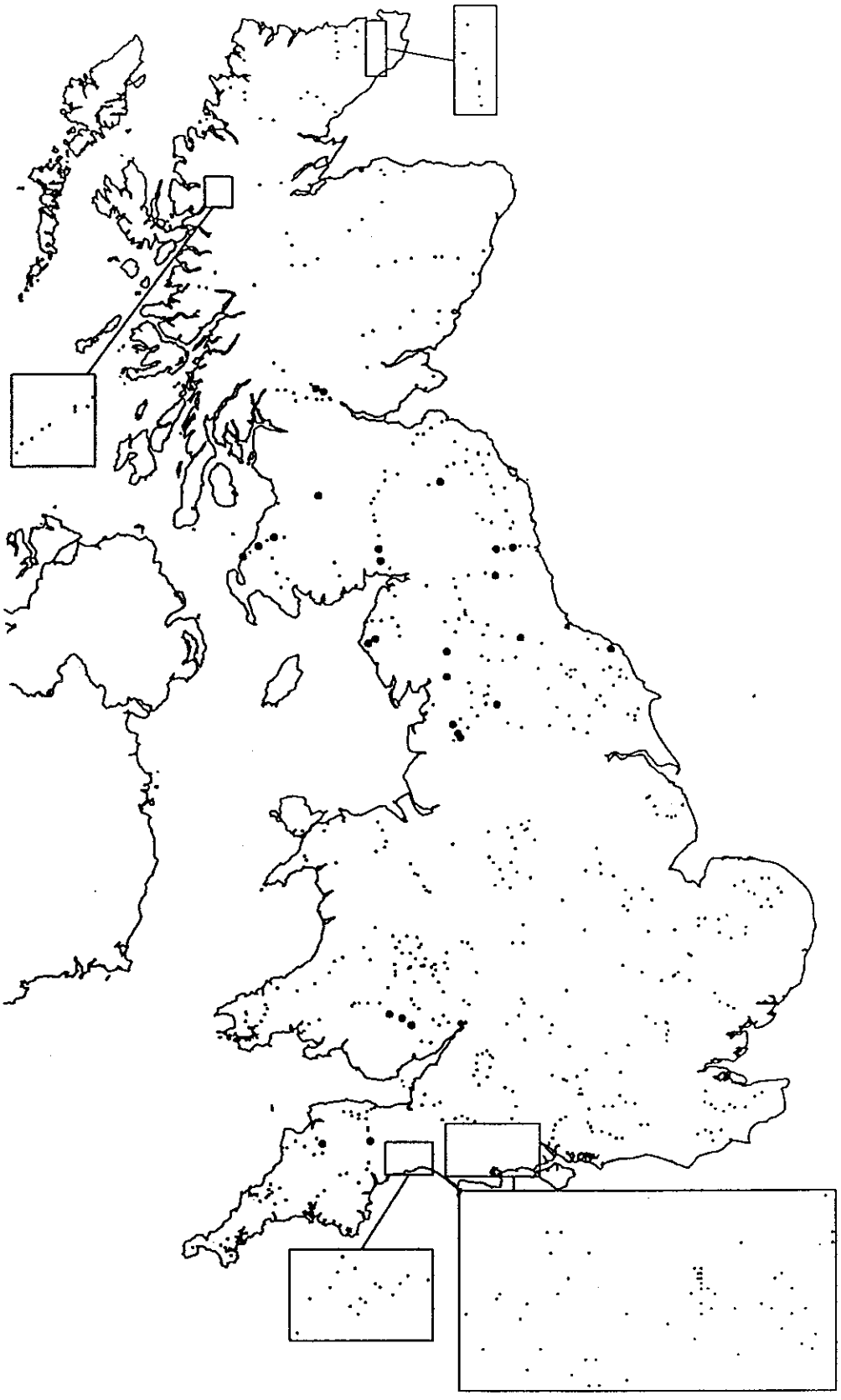
R. LOSSIE	U/S BLACKBURN	NJ 185 620
LUSRAGAN BURN	CLUNY VILLA	NM 908 327
R.TEITH	TEITH BRIDGE, CALLANDER	NN 628 078
R. ISLA	WESTER CARDEAN	NO 294 466
R.DEE	D/S ABOYNE	NO 557 980
SOUTH ESK	STANNOCHY BRIDGE	NO 584 592
R. BERVIE	INVERBERVIE G.S.	NO 824 735
R.ANNAN	ABOVE ERICSTANE	NT 073 110
WHITEADDER	CRANSHAWS	NT 689 626
R.COQUET	CARSHOPE	NT 851 109
R.COQUET	SHARPERTON	NT 954 038
R. URR	HAUGH OF URR	NX 806 660
R.HODDER	SLAIDBURN	SD 715 524
RIVER SEPH	LASKILL	SE 563 907
R.CLWYD	NANTCLWYD HALL	SJ 109 519
R.DANE	HUG BRIDGE	SJ 930 636
R.DOVE	GLUTTON BRIDGE	SK 084 665
R.DOVE	DOVE DALE	SK 146 504
R.USK	TRALLONG	SN 948 296
R.USK	BRECON TOWN BRIDGE	SO 043 285
R.TEME	PENNANT POUND	SO 215 773
R.CLUN	WHITCOTT KEYSETT	SO 279 822
HINDWELL BROOK	COMBE	SO 345 635
R.TEME	BRAMPTON BRYAN	SO 372 729
R.EXE	EXFORD	SS 853 383
R.EXE	EDBROOKE	SS 912 342
R.EXE	EXEBRIDGE	SS 930 245
R.AVILL	TIMBERSCOMBE	SS 960 428
R.AVILL	DUNSTER	SS 984 432
R.CAMEL	HELLAND BRIDGE	SX 065 715
R.CAMEL	TUCKINGMILL	SX 088 778

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	120.19	75.78	9.00	275.00
Distance from source (km)	22.35	17.64	4.00	80.90
Slope (m km^{-1})	6.32	5.37	0.50	30.00
Discharge category	4.26	1.69	1.00	8.00
Latitude (^{o} North)	53.72	2.25	50.51	57.64
Longitude (^{o} West)	-3.12	0.92	-5.39	-1.13
Mean air temp. (^{o}C)	9.60	0.84	8.35	10.90
Air temp. range (^{o}C)	11.74	0.83	9.66	12.73
Mean width (m)	12.33	11.77	1.90	50.00
Mean depth (cm)	24.63	12.88	10.10	76.00
Mean substratum (phi)	-5.47	1.36	-7.44	-0.76
Alkalinity (mg $l^{-1}CaCO_3$)	60.89	44.05	9.20	191.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	206.87	23.11	147.00	238.00
Number of taxa	31.68	3.57	22.00	36.00
ASPT	6.53	0.21	6.17	6.91



Group 17

GB - Group 17

28 sites

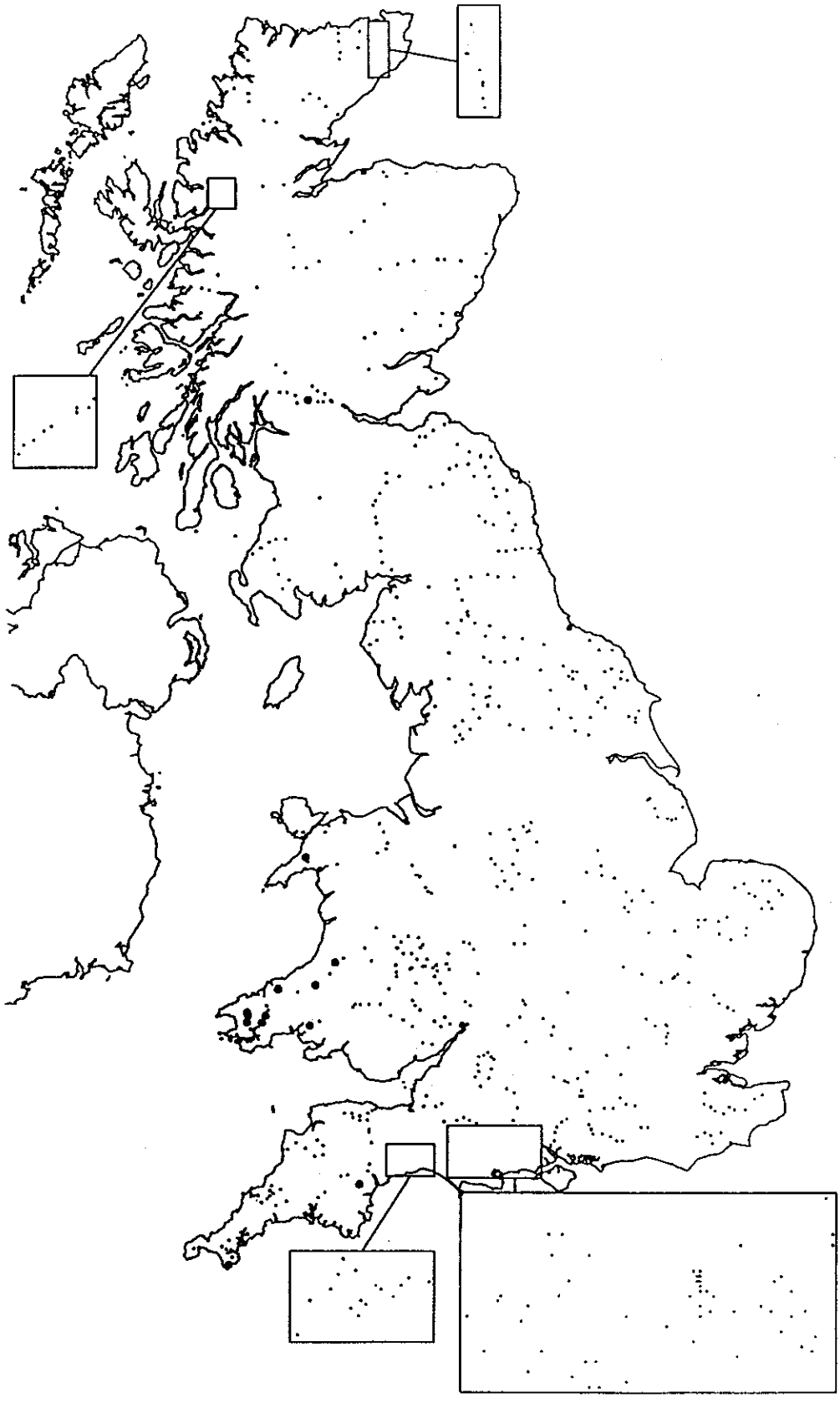
R.TEITH	LAIGHLANDS	NN 668 045
R.TEITH	BRIDGE OF TEITH, DOUNE	NN 723 013
R. AYR	NETHER WELLWOOD	NS 659 262
R.TWEED	DRY GRANGE BRIDGE	NT 576 347
R.STINCHAR	BALLANTRAE	NX 089 825
R.STINCHAR	PINMORE BRIDGE	NX 204 899
R.STINCHAR	D/S DALQUHAIRN	NX 321 957
R.EHEN	D/S KEEKLE	NY 012 125
R.EHEN	U/S KEEKLE	NY 014 130
R.EHEN	ENNERDALE BRIDGE	NY 068 159
R.ANNAN	MILLHOUSE BRIDGE	NY 105 854
R.ANNAN	WILLIAMWATH BRIDGE	NY 118 760
R. LUNE	OLD TEBAY	NY 618 056
R.TYNE	CORBRIDGE	NY 990 641
R.WANSBECK	KIRKWHELPINGTON	NY 996 844
R.WANSBECK	MELDON	NZ 119 850
R.TEES	GAINFORD	NZ 178 163
R.ESK	BRIGGSWATH	NZ 869 082
R. LUNE	RIGMADEN	SD 616 848
R.HODDER	D/S LANGDEN BROOK	SD 658 479
R.HODDER	HIGHER HODDER BRIDGE	SD 697 411
R.RIBBLE	MITTON BRIDGE	SD 715 387
R.WHARFE	GRASSINGTON	SD 997 639
R.USK	LLANDETTY	SO 127 204
R.USK	CRICKHOWELL	SO 229 169
R.USK	LLANELLEN BRIDGE	SO 306 110
R.TORRIDGE	BEAFORD BRIDGE	SS 543 143
R.EXE	LYTHECOURT	SS 948 153

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	74.46	49.89	5.00	191.00
Distance from source (km)	37.66	20.63	5.00	84.90
Slope (m km^{-1})	3.37	2.75	0.80	15.00
Discharge category	6.36	1.54	2.00	9.00
Latitude (^{o} North)	54.24	1.46	50.91	56.21
Longitude (^{o} West)	-3.09	1.03	-5.00	-0.66
Mean air temp. (^{o}C)	9.35	0.53	8.70	10.54
Air temp. range (^{o}C)	11.71	0.69	10.28	12.77
Mean width (m)	24.64	23.02	6.70	116.70
Mean depth (cm)	36.40	20.93	15.60	106.70
Mean substratum (phi)	-5.87	1.07	-7.43	-2.97
Alkalinity (mg $l^{-1}CaCO_3$)	62.69	32.60	10.50	132.60

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	178.11	25.51	133.00	214.00
Number of taxa	27.96	3.23	21.00	32.00
ASPT	6.35	0.33	5.54	6.78



Group 18

GB - Group 18

13 sites

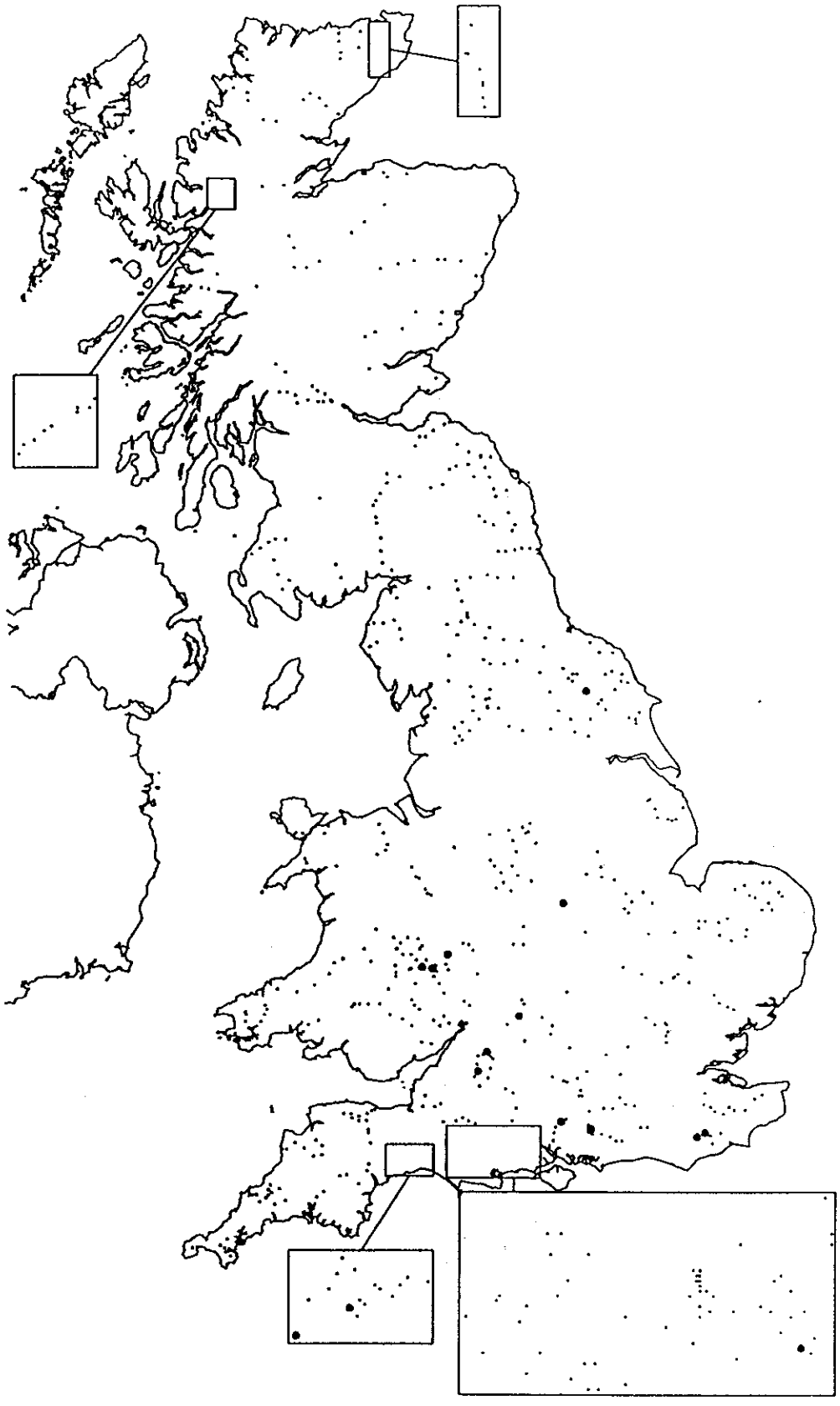
R.FORTH	PARKS OF GARDEN	NS 599 974
AFON DWYFACH	PANT GLAS	SH 468 472
WESTERN CLEDDAU	CROW HILL	SM 954 177
WESTERN CLEDDAU	WOLFS CASTLE	SM 956 256
WESTERN CLEDDAU	TREFFGARNE	SM 959 230
EASTERN CLEDDAU	LLAWHADEN	SN 075 172
EASTERN CLEDDAU	WEST OF LLANDISSILIO	SN 106 224
AFON TYFI	LLECHRYD	SN 217 437
GWENDRAETH FACH	LLANGENDEIRNE	SN 460 139
AFON TYFI	ALLTYBLACCA	SN 523 454
AFON TYFI	TREGARON BOG	SN 684 628
POLTESCO RIVER	POLTESCO BRIDGE	SW 724 157
R.TEIGN	WHETCOMBE BARTON	SX 843 817

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	47.62	48.22	7.00	160.00
Distance from source (km)	23.83	18.43	4.00	74.00
Slope (m km^{-1})	7.10	13.90	0.30	50.00
Discharge category	5.00	2.00	1.00	8.00
Latitude (^{o} North)	52.10	1.42	50.00	56.15
Longitude (^{o} West)	-4.52	0.47	-5.18	-3.64
Mean air temp. (^{o}C)	10.18	0.56	8.82	11.39
Air temp. range (^{o}C)	10.67	0.80	8.95	12.42
Mean width (m)	15.06	12.43	3.20	50.10
Mean depth (cm)	31.28	16.21	14.10	77.60
Mean substratum (phi)	-3.61	1.95	-6.84	0.06
Alkalinity (mg $l^{-1}CaCO_3$)	52.72	43.76	13.00	153.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	255.23	17.96	229.00	291.00
Number of taxa	40.00	2.71	36.00	45.00
ASPT	6.38	0.17	6.05	6.66



Group 19

GB - Group 19

16 sites

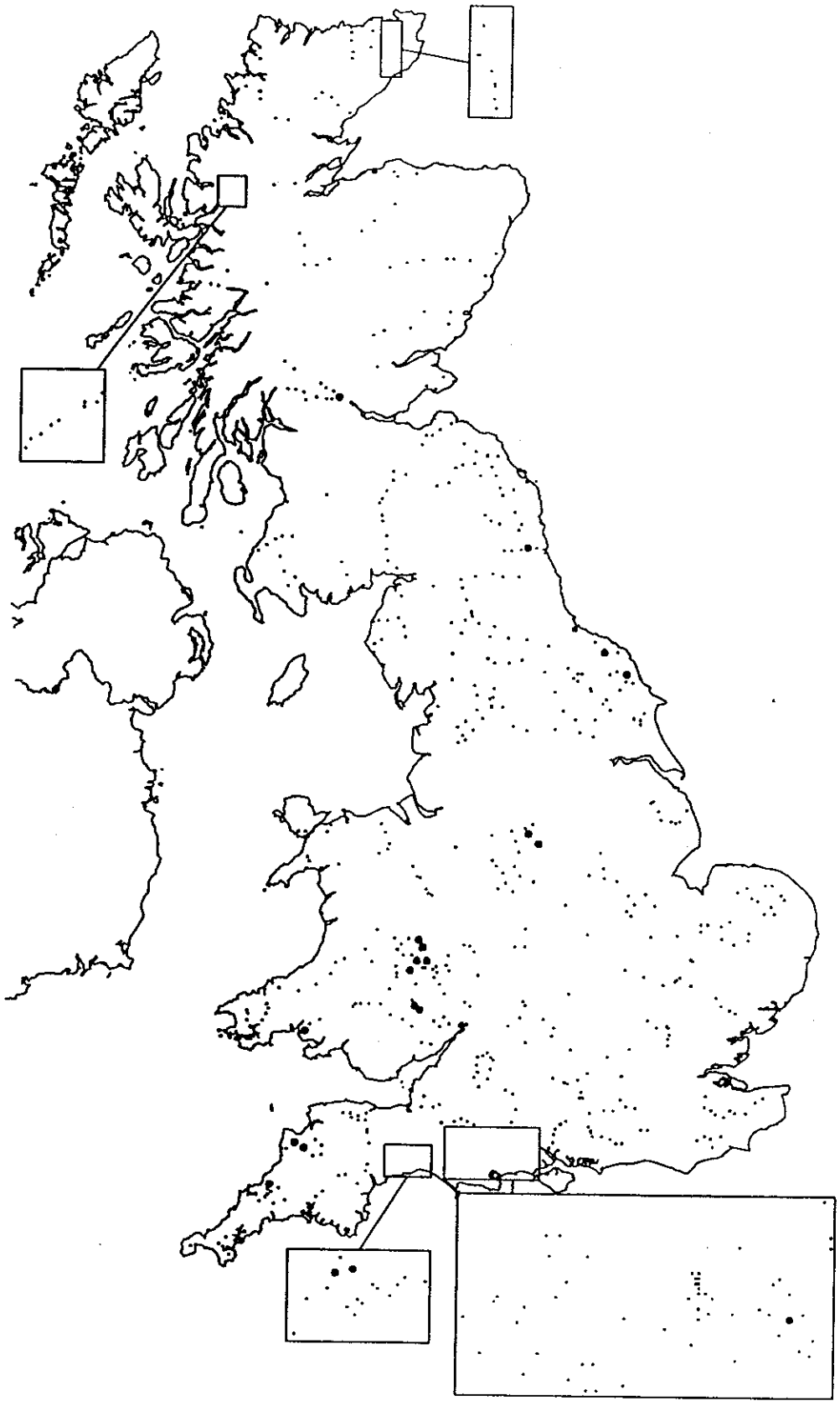
HOLBECK	HOVINGHAM CARRS	SE 669 773
BRADGATE BROOK	NEWTON LINFORD	SK 523 098
CURL BROOK	PEMBRIDGE	SO 390 585
R.ARROW	IVINGTON	SO 477 572
R.TEME	TENBURY	SO 595 685
R. WINDRUSH	D/S DICKLER	SP 178 177
BY BROOK	SLAUGHTERFORD	ST 837 738
TETBURY AVON	BROCKENBOROUGH	ST 915 893
R.ITCHEN	CHILLAND	SU 523 325
R.ROTHER	STODHAM PARK	SU 769 260
R.ROTHER	U/S LISS STW	SU 773 273
R.OTTER	NEWTON POPPLEFORD	SY 088 900
UMBORNE BROOK	EASY BRIDGE	SY 240 969
AVONWATER	GORDLETON MILL	SZ 292 961
R.DUDWELL	BURWASH WEALD	TQ 655 224
R.ROTHER (E.SUSSEX)	ETCHINGHAM	TQ 720 262

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	54.06	31.95	12.00	120.00
Distance from source (km)	19.54	18.71	5.00	74.00
Slope (m km^{-1})	3.46	2.61	0.70	10.00
Discharge category	3.06	1.77	1.00	7.00
Latitude (^{o} North)	51.62	0.93	50.70	54.19
Longitude (^{o} West)	-1.67	1.14	-3.29	0.45
Mean air temp. (^{o}C)	10.22	0.32	9.44	10.72
Air temp. range (^{o}C)	12.61	0.60	11.16	13.24
Mean width (m)	8.24	7.43	3.00	31.70
Mean depth (cm)	28.11	14.17	8.30	55.80
Mean substratum (phi)	-2.05	2.80	-6.12	5.80
Alkalinity (mg $l^{-1}CaCO_3$)	140.78	47.91	73.10	224.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	217.00	25.71	176.00	276.00
Number of taxa	35.56	3.97	29.00	44.00
ASPT	6.10	0.22	5.69	6.44



Group 20

GB - Group 20

20 sites

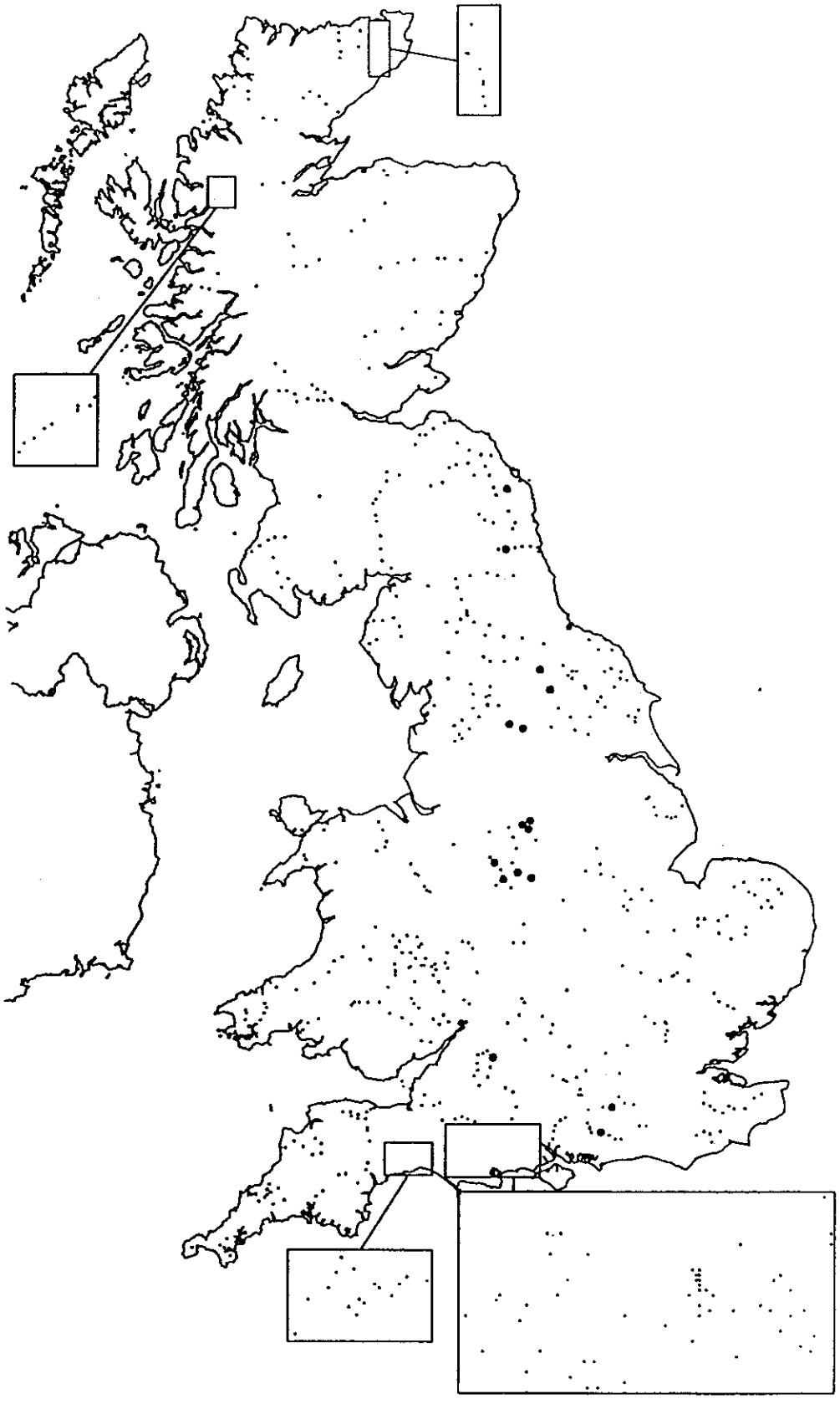
R.TEITH	BLACKDUB	NS 763 966
R.WANSBECK	MITFORD GAUGING STATION	NZ 174 858
R.ESK	LEALHOLM	NZ 762 076
R.DERWENT	LANGDALE END	SE 942 910
R.LATHKILL	ALPORT	SK 220 646
R. DERWENT	CROMFORD MEADOWS	SK 301 572
GWENDRAETH FACH	U/S KIDWELLY	SN 419 077
R.ARROW	KINGTON URBAN	SO 288 561
R.MONNOW	CLODOCK	SO 327 278
R.LUGG	COMBE	SO 348 640
R.CLUN	PURSLOW	SO 358 807
R.MONNOW	GREAT GOYTRE	SO 365 245
R.CLUN	JAY	SO 394 754
R.LUGG	MORTIMER'S CROSS	SO 427 637
R.TORRIDGE	FORDMILL FARM	SS 324 178
R.TORRIDGE	WOODFORD BRIDGE	SS 399 126
R.OTTER	BIDWELL FARM	ST 203 073
R.YARTY	CRAWLEY BRIDGE	ST 256 080
OBERWATER	PUTTLES BRIDGE	SU 268 027
R.CAMEL	PENCARROW BRIDGE	SX 104 827

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	98.35	47.55	12.00	170.00
Distance from source (km)	21.77	15.10	6.00	60.80
Slope (m km^{-1})	4.43	2.69	0.20	12.00
Discharge category	4.05	1.47	1.00	8.00
Latitude (^{o} North)	52.42	1.56	50.61	56.15
Longitude (^{o} West)	-2.82	1.18	-4.68	-0.55
Mean air temp. (^{o}C)	10.08	0.55	8.86	10.82
Air temp. range (^{o}C)	11.91	0.97	9.76	12.79
Mean width (m)	10.29	6.68	3.40	30.00
Mean depth (cm)	28.80	19.34	10.70	100.00
Mean substratum (phi)	-4.38	1.73	-7.16	-0.33
Alkalinity (mg $l^{-1}CaCO_3$)	88.57	56.71	11.50	194.60

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	226.65	31.65	171.00	282.00
Number of taxa	35.00	4.55	26.00	42.00
ASPT	6.47	0.19	6.03	6.78



Group 21

GB - Group 21

16 sites

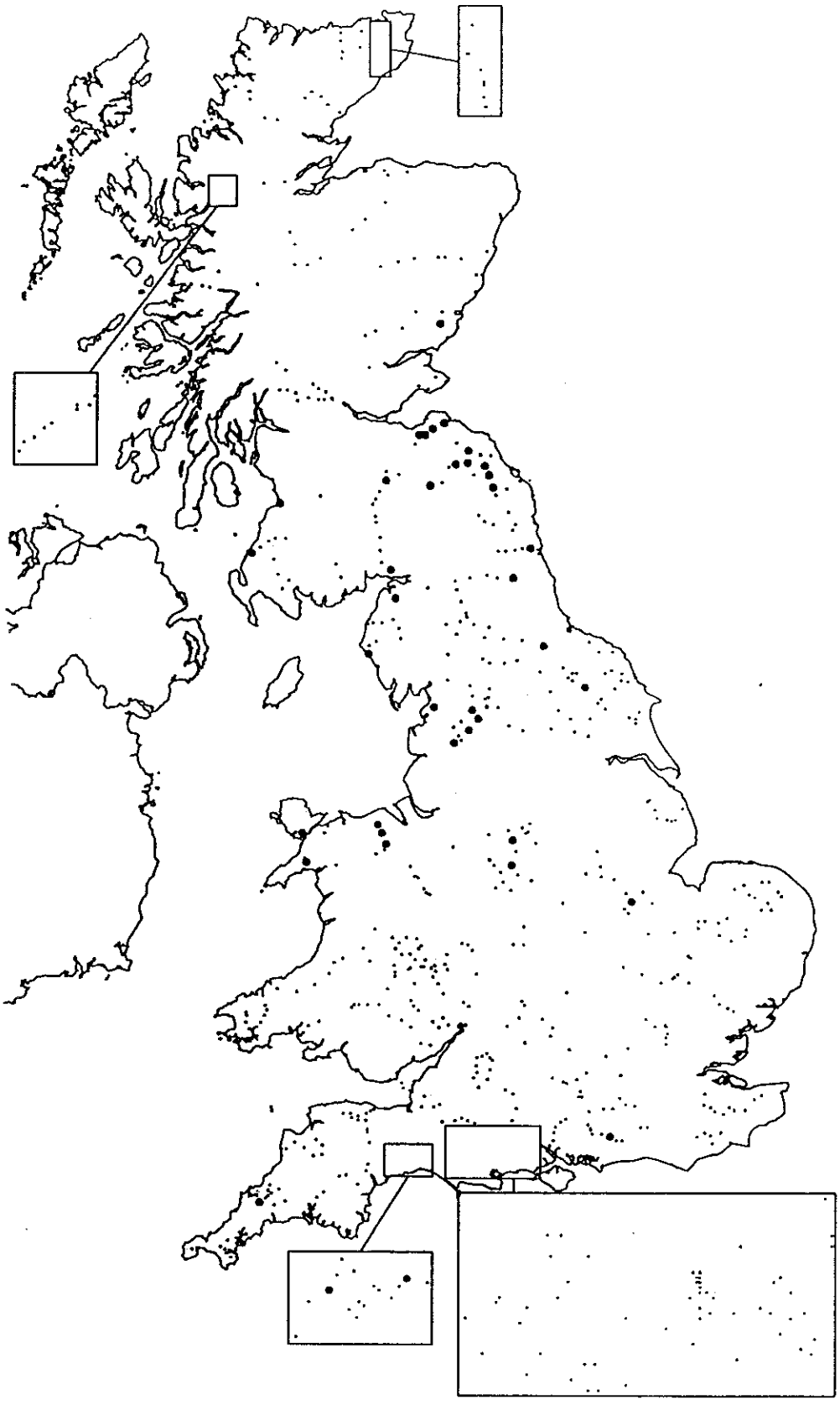
R. TILL	CHATTON	NU 059 299
R.WANSBECK	MIDDLETON	NZ 053 842
R.WHARFE	ADDINGHAM	SE 084 499
R.WHARFE	OTLEY	SE 188 455
R.SWALE	MORTON-ON-SWALE	SE 319 918
R.SWALE	TOPCLIFFE	SE 398 759
R.BLITHE	CRESSWELL	SJ 975 393
R.BLITHE	NEWTON	SK 048 259
R.DOVE	SUDBURY	SK 163 312
R. WYE	ASHFORD	SK 195 697
R.LATHKILL	CONGREAVE	SK 242 657
R. DERWENT	BASLOW	SK 252 722
R.DOVE	MONK'S BRIDGE	SK 268 270
BRISTOL AVON	GREAT SOMERFORD	ST 965 831
R.ROTHER	STEDHAM	SU 863 226
R.WEY	EASHING	SU 947 438

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	72.06	41.33	18.00	155.00
Distance from source (km)	39.02	24.95	9.00	94.00
Slope (m km^{-1})	1.97	1.58	0.30	5.00
Discharge category	5.06	1.81	2.00	7.00
Latitude (^{o} North)	53.25	1.28	51.00	55.56
Longitude (^{o} West)	-1.63	0.41	-2.05	-0.64
Mean air temp. (^{o}C)	9.62	0.40	8.83	10.24
Air temp. range (^{o}C)	12.63	0.45	11.25	13.16
Mean width (m)	15.86	8.47	5.00	30.00
Mean depth (cm)	29.54	13.33	8.30	51.70
Mean substratum (phi)	-3.80	2.78	-6.86	3.98
Alkalinity (mg $l^{-1}CaCO_3$)	141.00	47.36	59.40	237.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	190.25	27.29	145.00	232.00
Number of taxa	30.13	3.98	24.00	37.00
ASPT	6.31	0.32	5.79	6.79



Group 22

GB - Group 22

39 sites

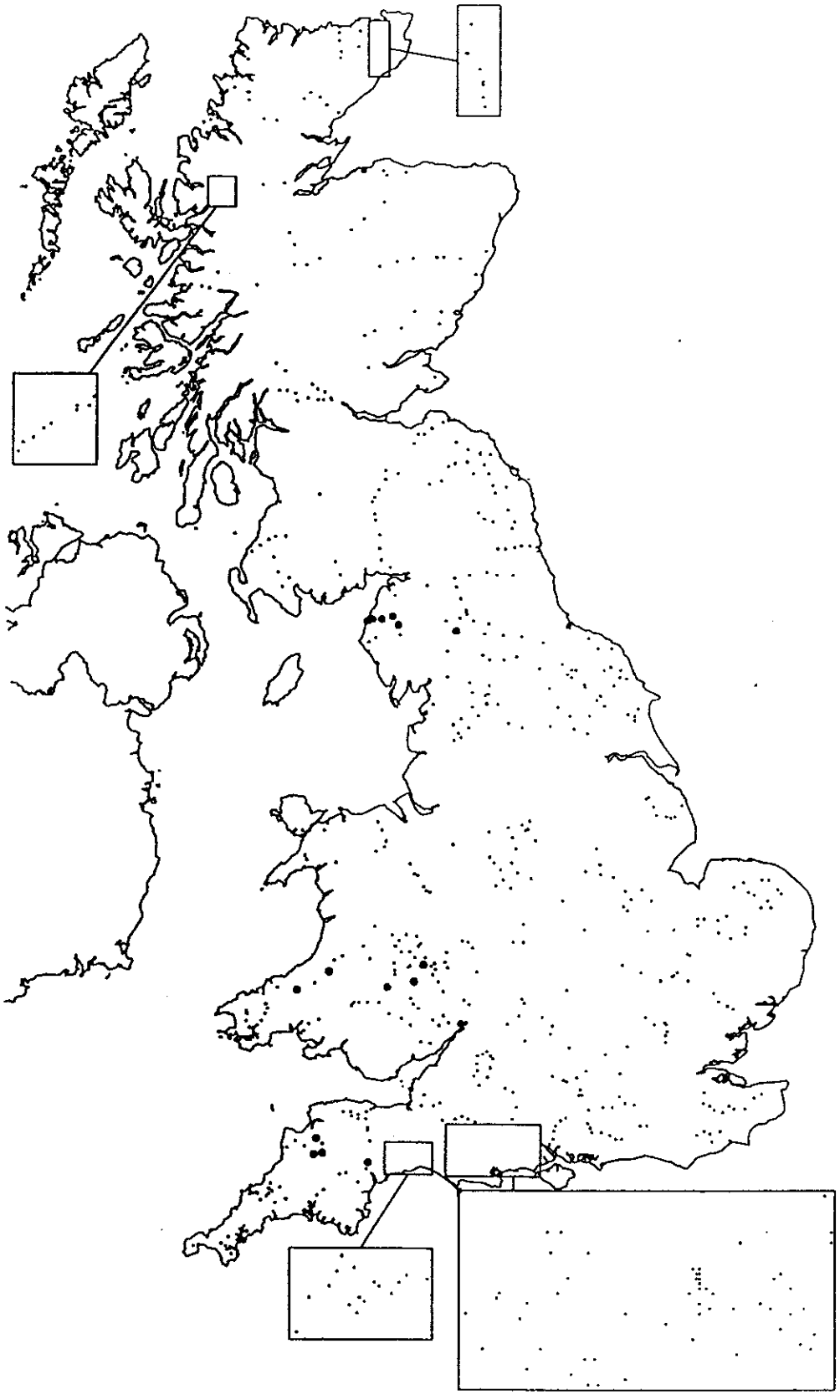
VINNY WATER	PITMUIES	NO 568 496
R. AYR	MAINHOLM FORD	NS 363 215
R.TWEED	CROWNHEAD BRIDGE	NT 165 355
R.TYNE	ORMISTON	NT 413 689
R.TYNE	EASTER PENCAITLAND	NT 459 690
R.TWEED	OLD TWEED BRIDGE	NT 488 323
R.TYNE	HADDINGTON WEIR	NT 513 733
R.TYNE	EAST LINTON	NT 593 772
BLACKADDER	HALLIBURTON BRIDGE	NT 677 478
BLACKADDER	FOGO	NT 770 491
WHITEADDER	PRESTON HAUGH	NT 774 577
R.TWEED	CANNY ISLAND	NT 893 465
R. TILL	ETAL	NT 926 395
R. GLEN	EWART	NT 955 302
R.STINCHAR	D/S COLMONELL	NX 140 858
R.EHEN	BRAYSTONES	NY 007 061
R.ANNAN	BRYDEKIRK	NY 187 707
R. WAVER	WAVER BRIDGE	NY 223 491
R.TYNE	WYLAM	NZ 111 643
R.WANSBECK	BOTHAL	NZ 236 862
R.TEES	OVER DINSDALE	NZ 346 114
R. LUNE	FORGE WEAR	SD 512 646
R.RIBBLE	RIBCHESTER BRIDGE	SD 662 356
R.RIBBLE	SAWLEY BRIDGE	SD 775 466
R.RIBBLE	CLEATOP BARNS	SD 806 614
R.RIBBLE	HALTON BRIDGE	SD 851 551
RIVER RYE	NUNNINGTON	SE 664 794
R. BRAINT	PONT MYNACH	SH 455 668
AFON DWYFACH	PONT Y FELIN	SH 481 435
R.CLWYD	PONT LLANERCH	SJ 060 719
R.CLWYD	GLAN-Y-WERN	SJ 091 658
R.CLWYD	ABOVE RUTHIN	SJ 124 571
R.DOVE	U/S ROCESTER	SK 115 392
R.DOVE	HARTINGTON	SK 121 598
R.OTTER	MONKTON	ST 184 030
R.AXE	OATHILL FARM	ST 402 060
R.ROTHER	SELHAM	SU 935 213
R.CAMEL	BROCTON	SX 015 685
R.GLEN	BANTHORPE LODGE	TF 068 112

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	56.62	53.37	4.00	214.00
Distance from source (km)	38.71	28.06	9.00	138.00
Slope (m km^{-1})	2.47	1.45	0.40	6.00
Discharge category	5.15	2.15	1.00	9.00
Latitude (° North)	54.28	1.61	50.48	56.64
Longitude (° West)	-2.70	1.03	-4.92	-0.42
Mean air temp. (°C)	9.37	0.54	8.56	10.95
Air temp. range (°C)	11.58	0.72	9.52	13.23
Mean width (m)	23.46	24.60	2.30	106.70
Mean depth (cm)	34.62	32.23	7.90	200.00
Mean substratum (phi)	-4.94	1.61	-7.17	-1.08
Alkalinity (mg $l^{-1}CaCO_3$)	105.11	47.01	14.60	219.60

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	189.49	27.74	131.00	235.00
Number of taxa	31.79	3.81	25.00	39.00
ASPT	5.95	0.34	4.68	6.60



Group 23

GB - Group 23

15 sites

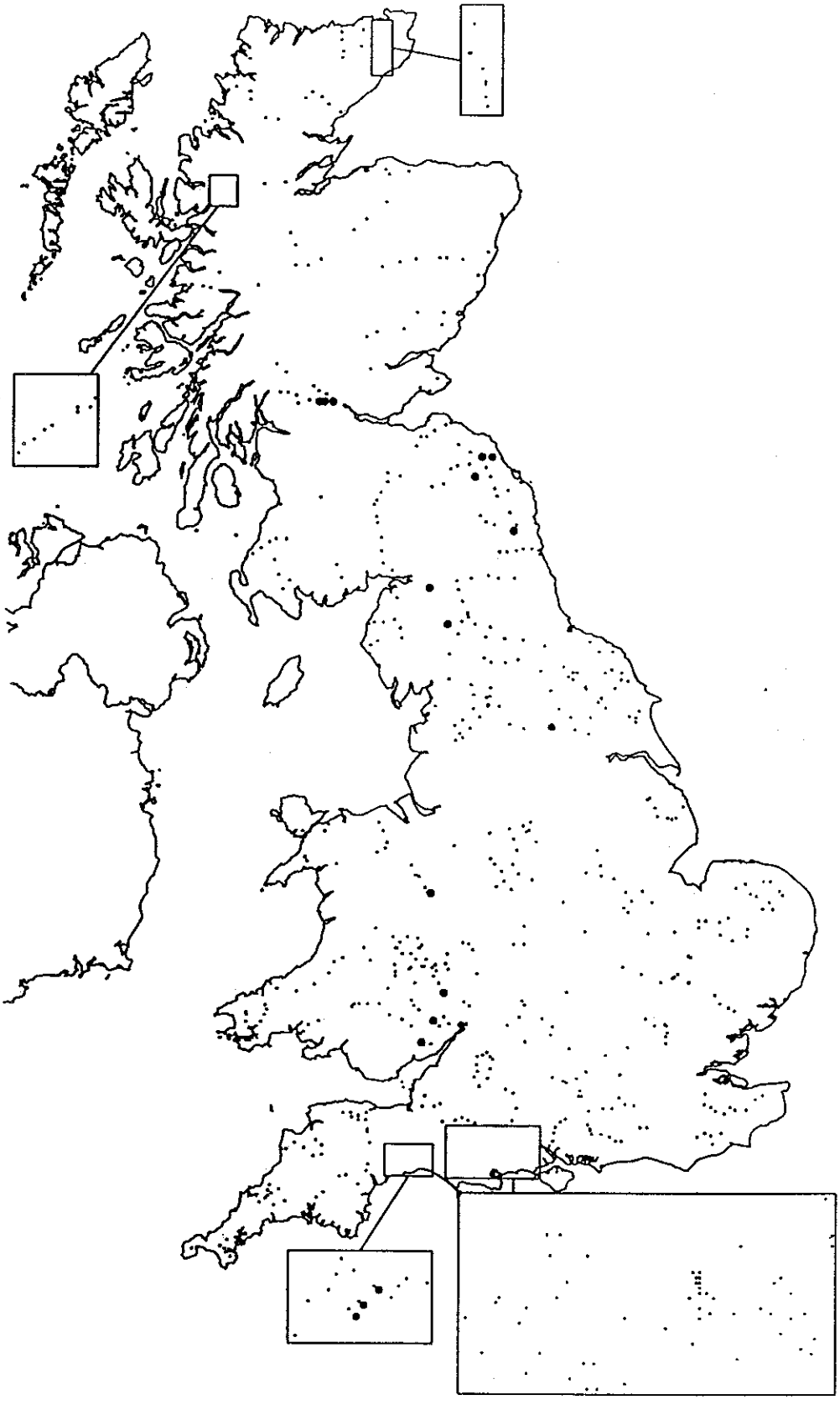
R.DERWENT	WORKINGTON	NY 009 293
R.DERWENT	RIBTON HALL	NY 046 304
R.DERWENT	COCKERMOUTH	NY 116 307
R.DERWENT	OUSE BRIDGE	NY 200 321
R.DERWENT	HIGH STOCK BRIDGE	NY 243 260
R. EDEN	APPLEBY	NY 683 206
AFON TYFI	BANGOR TYFI	SN 373 403
AFON TYFI	PONT GOGOYAN	SN 642 547
R.WYE	HAFODYGARREG	SO 115 414
R.WYE	BREDWARDINE	SO 336 446
R.ARROW	FOLLY FARM	SO 413 588
R.TORRIDGE	KINGSLEY MILL	SS 470 061
R.TORRIDGE	GREAT TORRINGTON TOWN MILLS	SS 499 185
R.TORRIDGE	HELE BRIDGE	SS 542 064
R.EXE	BRAMFORD SPEKE	SX 929 984

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	64.20	37.68	12.00	140.00
Distance from source (km)	46.01	21.44	18.00	100.90
Slope (m km^{-1})	2.21	1.67	0.60	7.50
Discharge category	7.00	1.07	5.00	9.00
Latitude (^{o} North)	52.79	1.65	50.77	54.68
Longitude (^{o} West)	-3.51	0.54	-4.37	-2.49
Mean air temp. (^{o}C)	9.92	0.52	9.01	10.61
Air temp. range (^{o}C)	11.44	0.76	10.57	12.80
Mean width (m)	28.05	16.56	6.20	70.00
Mean depth (cm)	35.81	14.97	14.40	65.80
Mean substratum (phi)	-4.90	1.26	-6.72	-2.83
Alkalinity (mg $l^{-1}CaCO_3$)	44.65	35.81	17.40	138.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	212.60	34.12	172.00	284.00
Number of taxa	33.40	4.87	28.00	43.00
ASPT	6.36	0.23	5.87	6.69



Group 24

GB - Group 24

17 sites

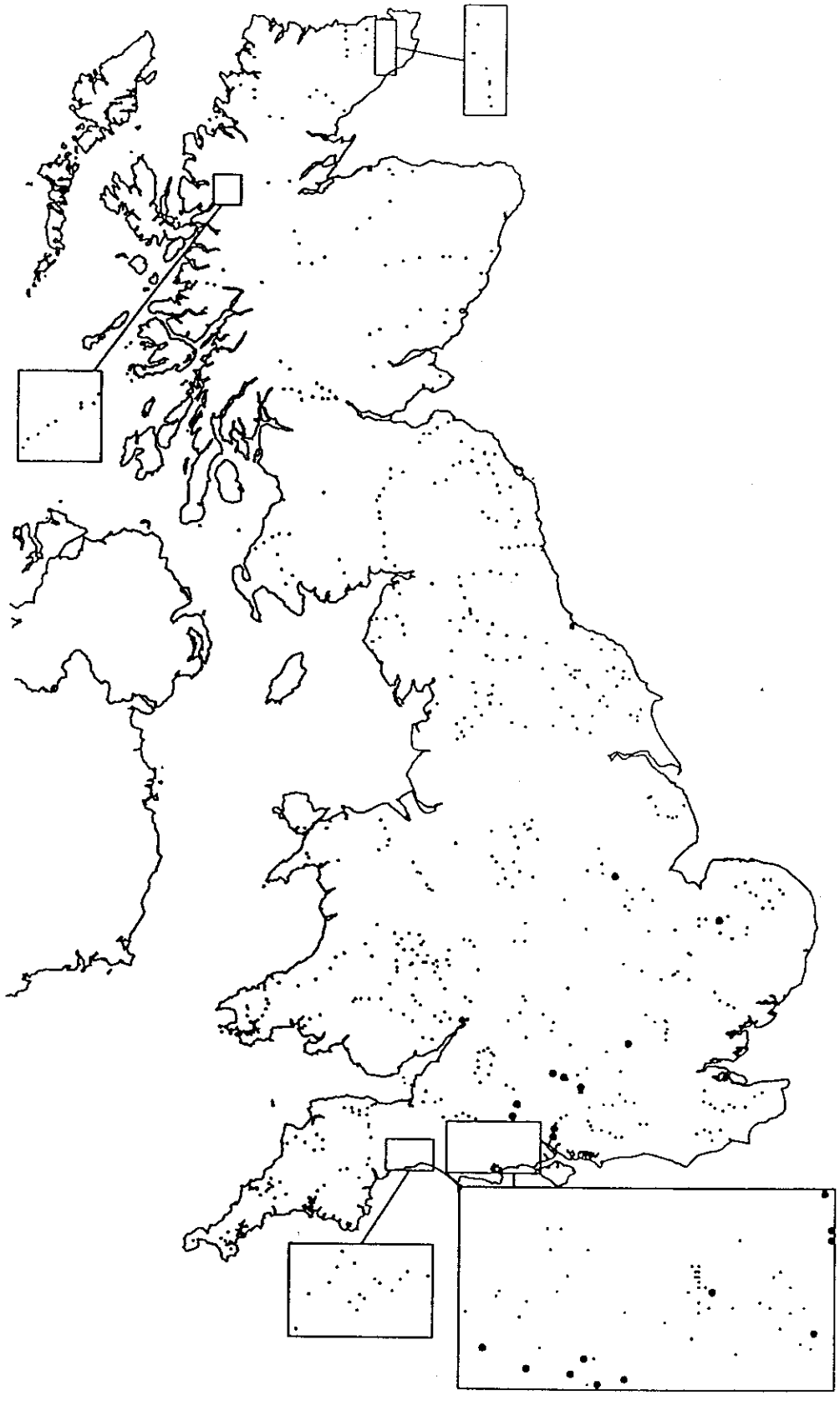
R.FORTH	KIPPEN BRIDGE	NS 669 960
R.FORTH	GARGUNNOCK BRIDGE	NS 710 956
R.FORTH	DRIP BRIDGE	NS 770 955
R.TWEED	D/S BIRGHAM	NT 814 393
BLACKADDER	BLACKADDER WATER FOOT	NT 864 545
WHITEADDER	CHESTERFIELD FORD	NT 937 536
R. EDEN	WARWICK BRIDGE	NY 470 567
R. EDEN	TEMPLE SOWERBY	NY 604 282
R.COQUET	PAUPERHAUGH	NZ 101 995
R.WHARFE	WETHERBY	SE 406 477
R. SEVERN	ISLE OF BICTON	SJ 468 164
R.MONNOW	ROCKFIELD	SO 483 153
RIVER LUGG	MORDIFORD	SO 570 375
R.AXE	BROOM	ST 326 025
R.USK	LLANTRISSANT	ST 386 971
R.AXE	WHITFORD BRIDGE	SY 262 953
R.YARTY	GAMMONS HILL	SY 283 983

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	28.29	23.71	5.00	93.00
Distance from source (km)	65.20	36.55	20.00	133.00
Slope (m km^{-1})	1.43	1.19	0.30	3.80
Discharge category	6.47	1.50	4.00	9.00
Latitude (^{o} North)	53.82	2.12	50.75	56.14
Longitude (^{o} West)	-2.80	0.75	-4.14	-1.38
Mean air temp. (^{o}C)	9.54	0.73	8.84	10.65
Air temp. range (^{o}C)	11.98	0.68	10.78	12.99
Mean width (m)	25.41	13.12	6.50	50.00
Mean depth (cm)	38.25	15.82	17.00	76.70
Mean substratum (phi)	-4.27	1.47	-6.33	-1.48
Alkalinity (mg $l^{-1}CaCO_3$)	105.02	50.07	16.00	183.30

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	206.71	26.93	152.00	263.00
Number of taxa	34.82	3.83	28.00	43.00
ASPT	5.93	0.28	5.24	6.49



Group 25

GB - Group 25

21 sites

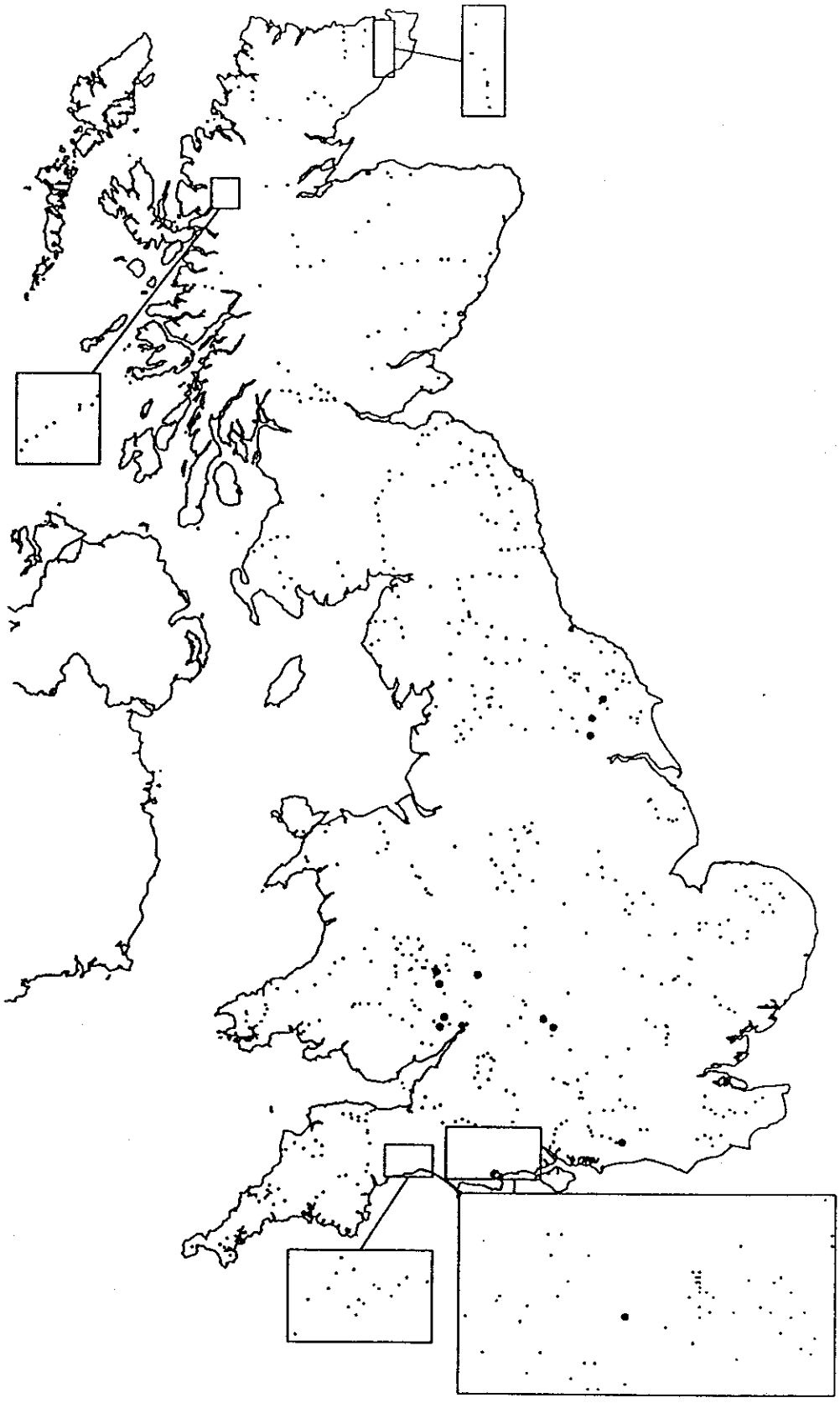
CRINGLE BROOK	THUNDERBRIDGE	SK 920 287
MOORS RIVER	KING'S FARM	SU 105 064
R.AVON	STRATFORD-SUB-CASTLE	SU 129 330
R.AVON	BULFORD	SU 163 437
R.TEST	LOWER BROOK	SU 338 276
R.TEST	ROMSEY	SU 352 204
R.TEST	SKIDMORE	SU 354 178
R. LAMBOURN	BAGNOR	SU 453 691
R.ITCHEN	D/S CHICKENHALL SDW	SU 466 175
R.ITCHEN	OTTERBOURNE WATER WORKS	SU 470 233
R. KENNET	U/S ALDERSHOT WATER	SU 544 659
R.LODDON	SHERFIELD ON LODDON	SU 683 583
R.FROME	FRAMPTON	SY 623 949
R.FROME	LOWER BOCKHAMPTON	SY 721 904
R.FROME	MORETON	SY 806 895
R.PIDDLE	BROCKHILL BRIDGE	SY 839 928
R.FROME	EAST STOKE	SY 866 867
R.PIDDLE	WAREHAM	SY 919 876
R.LYMINGTON	BOLDRE BRIDGE	SZ 320 984
R.WISSEY	DIDLINGTON LODGE	TL 771 967
R. CHESS	U/S R. COLNE	TQ 066 947

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	35.86	27.42	2.00	80.00
Distance from source (km)	29.83	14.44	9.40	63.60
Slope (m km^{-1})	2.00	2.02	0.40	10.00
Discharge category	4.52	1.57	1.00	7.00
Latitude (^{o} North)	51.16	0.58	50.68	52.85
Longitude (^{o} West)	-1.52	0.74	-2.53	0.61
Mean air temp. (^{o}C)	10.50	0.32	9.66	10.86
Air temp. range (^{o}C)	12.58	0.66	11.53	13.73
Mean width (m)	14.86	9.94	3.90	45.80
Mean depth (cm)	48.73	23.49	25.70	107.20
Mean substratum (phi)	-0.51	2.38	-4.20	6.01
Alkalinity (mg $l^{-1}CaCO_3$)	203.86	47.15	51.80	253.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	236.00	25.25	185.00	281.00
Number of taxa	40.14	3.31	33.00	46.00
ASPT	5.87	0.20	5.43	6.12



Group 26

GB - Group 26

12 sites

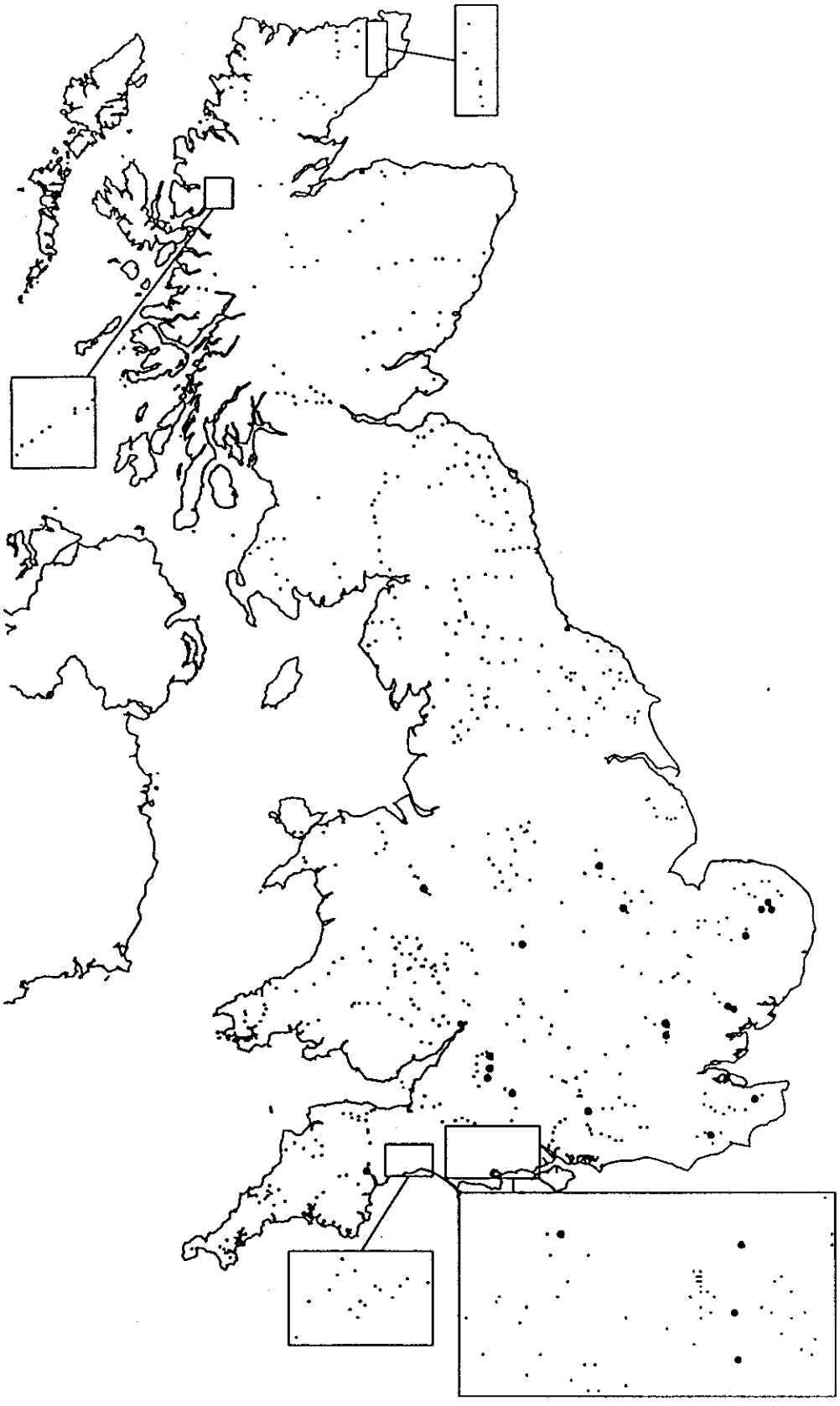
R.DERWENT	THORGANBY	SE 697 424
R.DERWENT	STAMFORD BRIDGE	SE 710 555
R.DERWENT	NORTON	SE 790 715
R.LUGG	MARLBROOK	SO 510 551
R.LUGG	WERGIN'S BRIDGE	SO 529 446
R.WYE	REDBROOK	SO 534 100
R.WYE	HUNTSHAM BRIDGE	SO 567 182
R.TEME	POWICK BRIDGE	SO 837 524
R.EVENLODE	FAWLER	SP 366 173
R.EVENLODE	CASSINGTON	SP 448 102
RIVER STOUR	SPETISBURY	ST 919 020
R.ROTHER	HARDHAM	TQ 034 178

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	32.00	27.49	5.00	87.00
Distance from source (km)	81.44	46.43	30.00	173.00
Slope (m km^{-1})	0.64	0.27	0.30	1.10
Discharge category	6.58	1.51	4.00	9.00
Latitude (^{o} North)	52.29	1.11	50.82	54.13
Longitude (^{o} West)	-1.76	0.84	-2.72	-0.53
Mean air temp. (^{o}C)	10.06	0.40	9.39	10.60
Air temp. range (^{o}C)	12.74	0.34	12.10	13.26
Mean width (m)	25.24	12.50	9.50	50.00
Mean depth (cm)	87.79	56.74	23.70	183.20
Mean substratum (phi)	-1.86	3.79	-6.10	5.94
Alkalinity (mg $l^{-1}CaCO_3$)	168.12	59.71	112.00	314.10

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	220.42	34.67	134.00	269.00
Number of taxa	37.75	5.34	24.00	45.00
ASPT	5.83	0.21	5.58	6.32



Group 27

GB - Group 27

25 sites

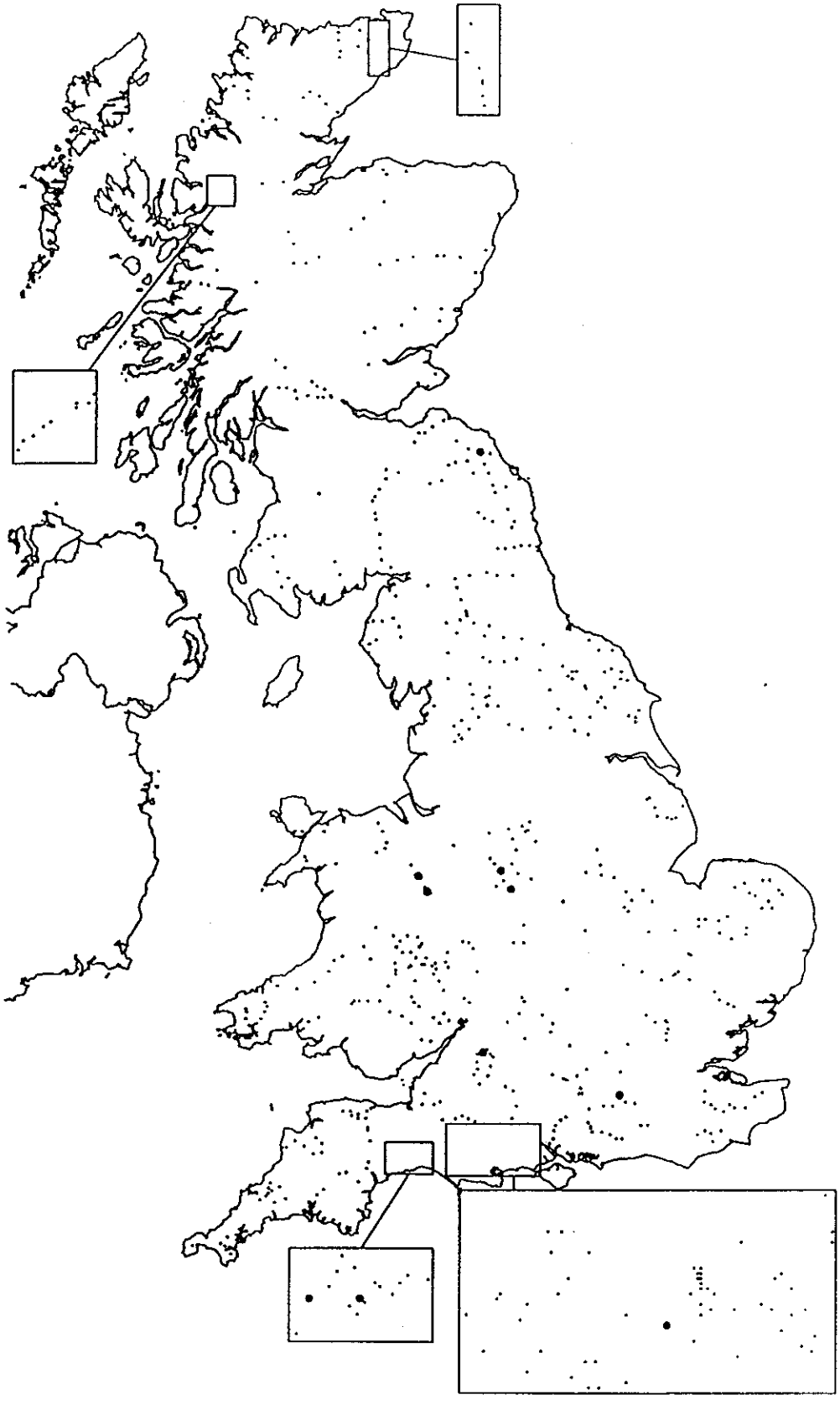
R.PERRY	MILFORD	SJ 422 210
R.DEVON	BOTTESFORD	SK 812 390
R.BLYTHE	TEMPLE BALSALL	SP 208 763
RIVER STOUR	TRILL BRIDGE	ST 790 205
BRISTOL AVON	LACOCK	ST 922 681
BRISTOL AVON	COW BRIDGE	ST 943 862
BRISTOL AVON	KELLAWAY'S WEIR	ST 947 758
WESTERN AVON	RUSHALL	SU 132 558
R.AVON	MOORTOWN	SU 149 035
R.AVON	BREAMORE	SU 163 174
R.WEY	WYCK	SU 756 417
R.EXE	FLOWERPOT	SX 913 928
R.AVON (HANTS)	CHRISTCHURCH	SZ 158 933
R.WELLAND	TINWELL	TF 007 063
R.YARE	NORTH OF BARFORD	TG 108 084
R.WENSUM	TAVERHAM	TG 161 137
R.YARE	EARLHAM	TG 190 082
R.LEE	WARE WEIR	TL 365 143
R.LEE	FISHER'S GREEN	TL 374 044
R. ASH	EASNEYE	TL 377 133
R.COLNE	EARL'S COLNE	TL 867 289
R.COLNE	FORDSTREET BRIDGE	TL 921 272
R.THET	EAST HARLING	TL 989 867
R.ROTHER	UDIAM	TQ 771 243
GREAT STOUR	MILTON BRIDGE	TR 121 561

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	34.04	28.66	2.00	95.00
Distance from source (km)	34.08	23.57	9.00	94.00
Slope (m km^{-1})	1.32	0.84	0.50	3.80
Discharge category	4.44	1.66	2.00	8.00
Latitude (^{o} North)	51.75	0.72	50.72	52.94
Longitude (^{o} West)	-0.74	1.45	-3.54	1.24
Mean air temp. (^{o}C)	10.15	0.27	9.77	10.65
Air temp. range (^{o}C)	13.00	0.59	11.34	13.87
Mean width (m)	12.56	12.61	3.00	66.70
Mean depth (cm)	36.98	25.95	12.60	143.90
Mean substratum (phi)	-2.18	1.34	-5.31	1.39
Alkalinity (mg $l^{-1}CaCO_3$)	210.79	49.11	62.60	267.70

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	175.52	20.47	135.00	218.00
Number of taxa	33.04	2.86	27.00	39.00
ASPT	5.30	0.27	4.90	5.78



Group 28

GB - Group 28

10 sites

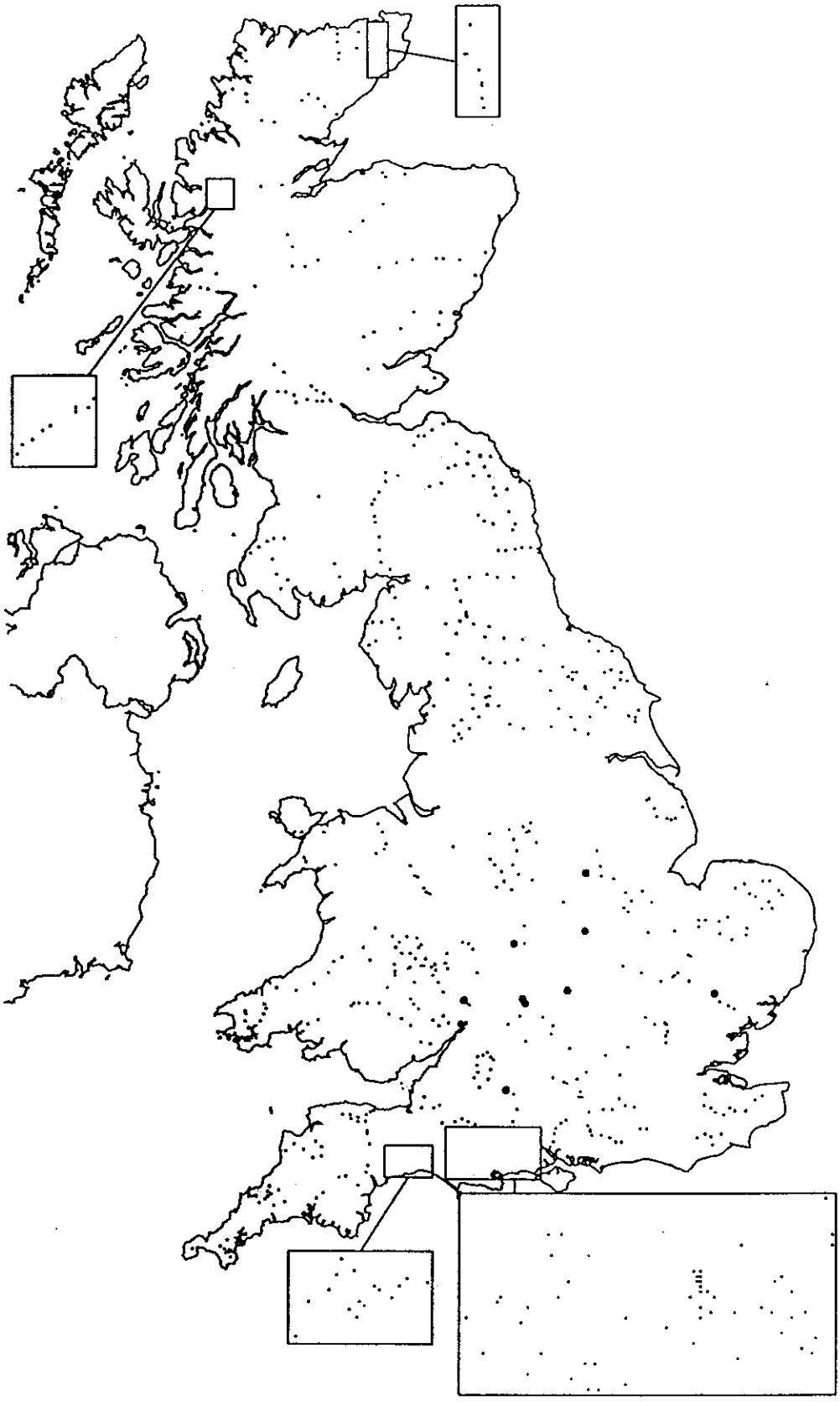
WHITEADDER	U/S ALLANTON	NT 864 547
R.PERRY	REDNAL MILL	SJ 374 294
R.PERRY	MYTTON	SJ 439 171
R.BLITHE	FIELD	SK 024 334
R.BLITHE	HAMSTALL RIDWARE	SK 109 190
SHERSTON AVON	EASTON GREY	ST 880 873
RIVER ALLEN	WALFORD MILL	SU 010 006
R.OTTER	COLHAYES FARM	SY 123 993
CORRY BROOK	CORYTON	SY 270 991
R.WEY	BURPHAM	TQ 005 532

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	60.00	32.64	20.00	125.00
Distance from source (km)	23.97	14.74	8.00	50.00
Slope (m km^{-1})	2.73	1.97	0.40	7.10
Discharge category	3.70	1.16	2.00	6.00
Latitude (^{o} North)	52.23	1.55	50.79	55.79
Longitude (^{o} West)	-2.28	0.79	-3.24	-0.56
Mean air temp. (^{o}C)	10.05	0.54	8.94	10.62
Air temp. range (^{o}C)	12.22	0.79	11.02	13.42
Mean width (m)	10.38	5.55	3.30	20.00
Mean depth (cm)	21.71	10.54	9.20	43.70
Mean substratum (phi)	-2.98	2.13	-6.64	-0.48
Alkalinity (mg $l^{-1}CaCO_3$)	149.53	54.66	67.00	208.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	183.40	33.36	146.00	259.00
Number of taxa	32.50	4.58	27.00	43.00
ASPT	5.62	0.30	5.16	6.02



Group 29

GB - Group 29

9 sites

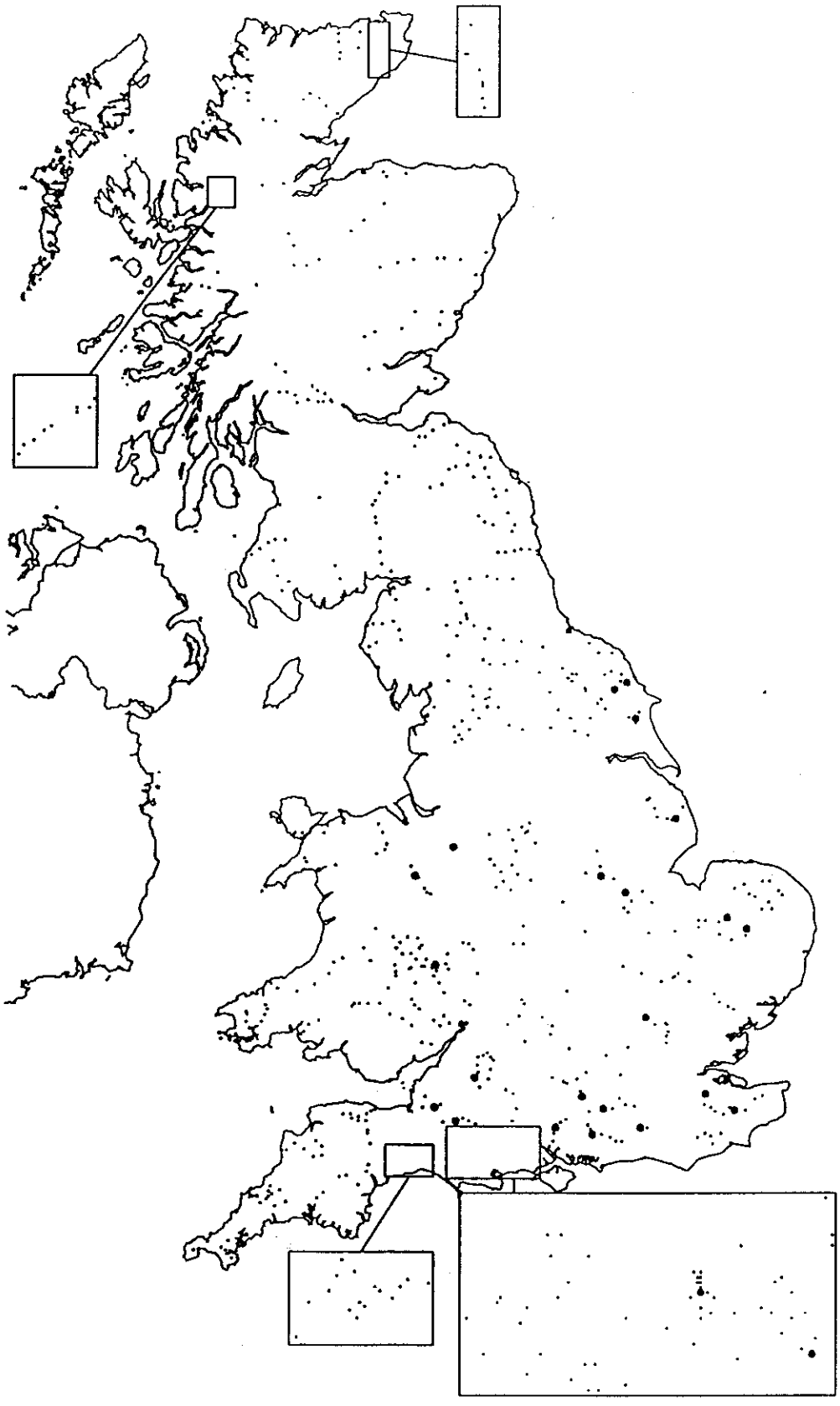
R.SMITE	COLSTON BASSETT	SK 697 333
R.LEADON	KETFORD	SO 730 307
R.BLYTHE	CHESWICK GREEN	SP 127 753
R.EVENLODE	MORETON-IN-THE-MARSH	SP 202 312
R EVENLODE	EVENLODE	SP 220 281
GREAT OUSE	U/S BRACKLEY	SP 562 380
R.WELLAND	MARSTON TRUSSEL	SP 697 864
WESTERN AVON	PATNEY	SU 071 585
STAMBOURNE BROOK	GREAT YELDHAM	TL 759 384

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	88.00	38.99	28.00	127.00
Distance from source (km)	7.60	6.66	1.40	23.00
Slope (m km^{-1})	4.68	4.50	0.80	14.30
Discharge category	1.56	0.73	1.00	3.00
Latitude (^{o} North)	52.11	0.43	51.33	52.89
Longitude (^{o} West)	-1.34	0.85	-2.39	0.56
Mean air temp. (^{o}C)	10.14	0.19	9.92	10.39
Air temp. range (^{o}C)	13.14	0.29	12.74	13.62
Mean width (m)	3.11	1.90	1.40	7.30
Mean depth (cm)	13.76	7.89	7.60	32.80
Mean substratum (phi)	-0.89	3.19	-5.87	4.16
Alkalinity (mg $l^{-1}CaCO_3$)	231.00	30.32	178.80	270.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	132.11	16.32	107.00	166.00
Number of taxa	26.44	3.05	21.00	32.00
ASPT	5.00	0.12	4.79	5.19



Group 30

GB - Group 30

24 sites

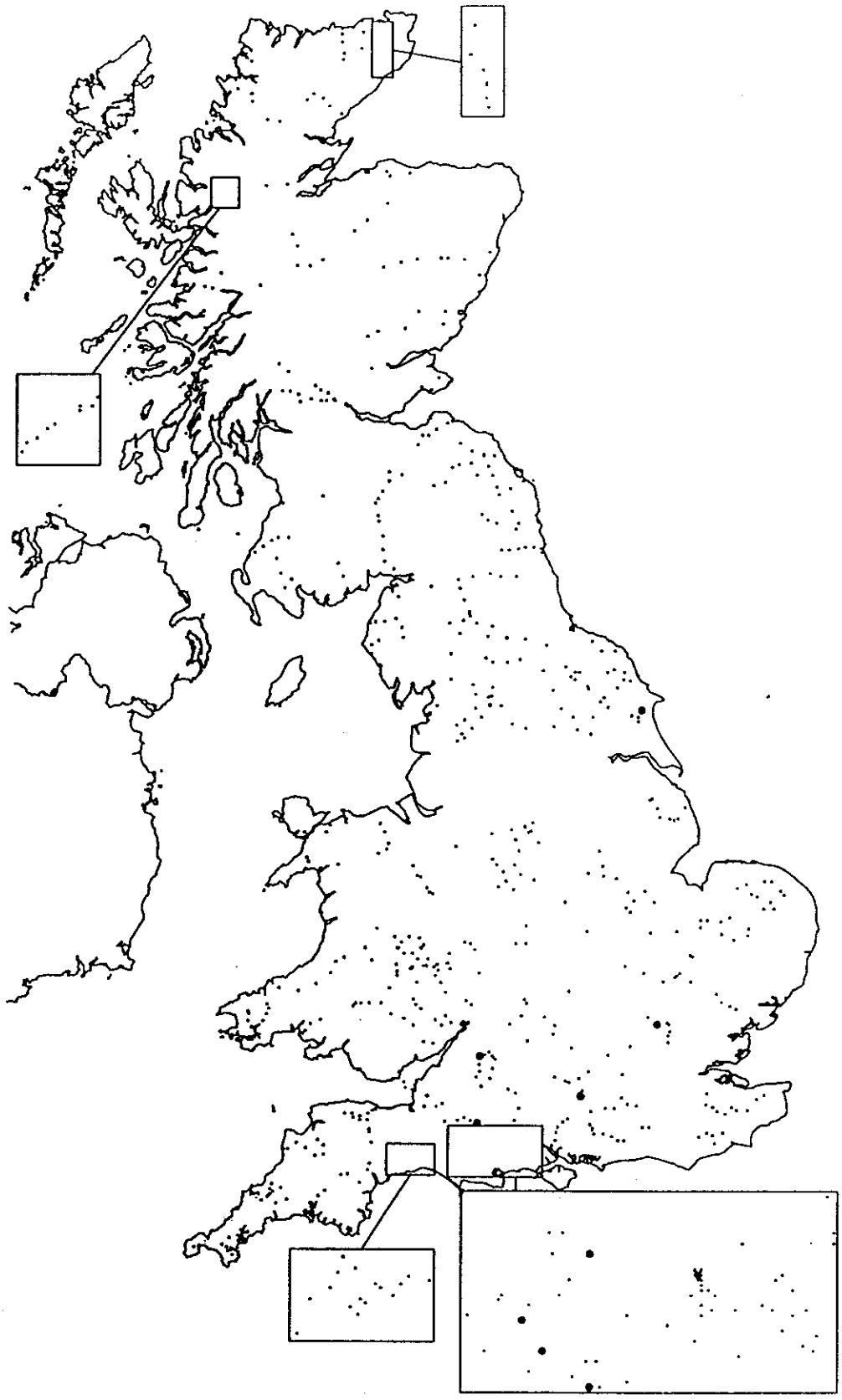
R.DERWENT	YEDINGHAM	SE 892 795
R.DERWENT	WEST AYTON	SE 988 848
R.PERRY	PERRY FARM	SJ 347 302
R.WEAVER	BEAM BRIDGE	SJ 651 536
R.DEVON	KNIPTON	SK 822 315
MAIN DITCH	LEOMINSTER	SO 501 597
R.AXE	BLEADNEY	ST 481 454
R.BRUE	WYKE	ST 656 340
BY BROOK	ASHLEY	ST 815 687
R.CRANE	REDMANS HILL	SU 074 079
R.ITCHEN	ITCHEN ST. CROSS	SU 481 282
R. LYDE	DEANLANDS FARM	SU 696 542
R.ROTHER	DURFORD BRIDGE	SU 783 233
R.WEY	TILFORD	SU 873 437
AVONWATER	EFFORD BRIDGE	SZ 307 941
R.HULL	WANSFORD	TA 064 559
R.GLEN	LITTLE BYTHAM	TF 019 177
GREAT EAU	BELLEAU	TF 403 777
R.WISSEY	LINGHILLS FARM	TF 834 009
R.MIMRAM	CODICOTE BOTTOM	TL 208 180
R.THET	RED BRIDGE, SHROPHAM	TL 996 924
R.ARUN	MAGPIE BRIDGE	TQ 187 292
DITTON STREAM	DITTON	TQ 710 585
GREAT STOUR	LITTLE CHART FORSTAL	TQ 958 460

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	37.88	22.78	6.00	84.00
Distance from source (km)	15.35	10.79	1.50	45.00
Slope (m km^{-1})	2.28	1.47	0.30	7.10
Discharge category	2.54	1.41	1.00	5.00
Latitude (^{o} North)	52.08	1.12	50.75	54.25
Longitude (^{o} West)	-0.98	1.19	-2.97	0.94
Mean air temp. (^{o}C)	10.03	0.36	9.44	10.74
Air temp. range (^{o}C)	12.81	0.50	11.97	13.91
Mean width (m)	5.89	2.97	1.30	12.20
Mean depth (cm)	33.48	18.14	7.20	82.80
Mean substratum (phi)	-0.88	2.76	-5.33	4.63
Alkalinity (mg $l^{-1}CaCO_3$)	191.02	62.87	44.00	276.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	169.67	28.29	107.00	227.00
Number of taxa	31.67	4.10	24.00	41.00
ASPT	5.34	0.35	4.46	5.94



Group 31

10 sites

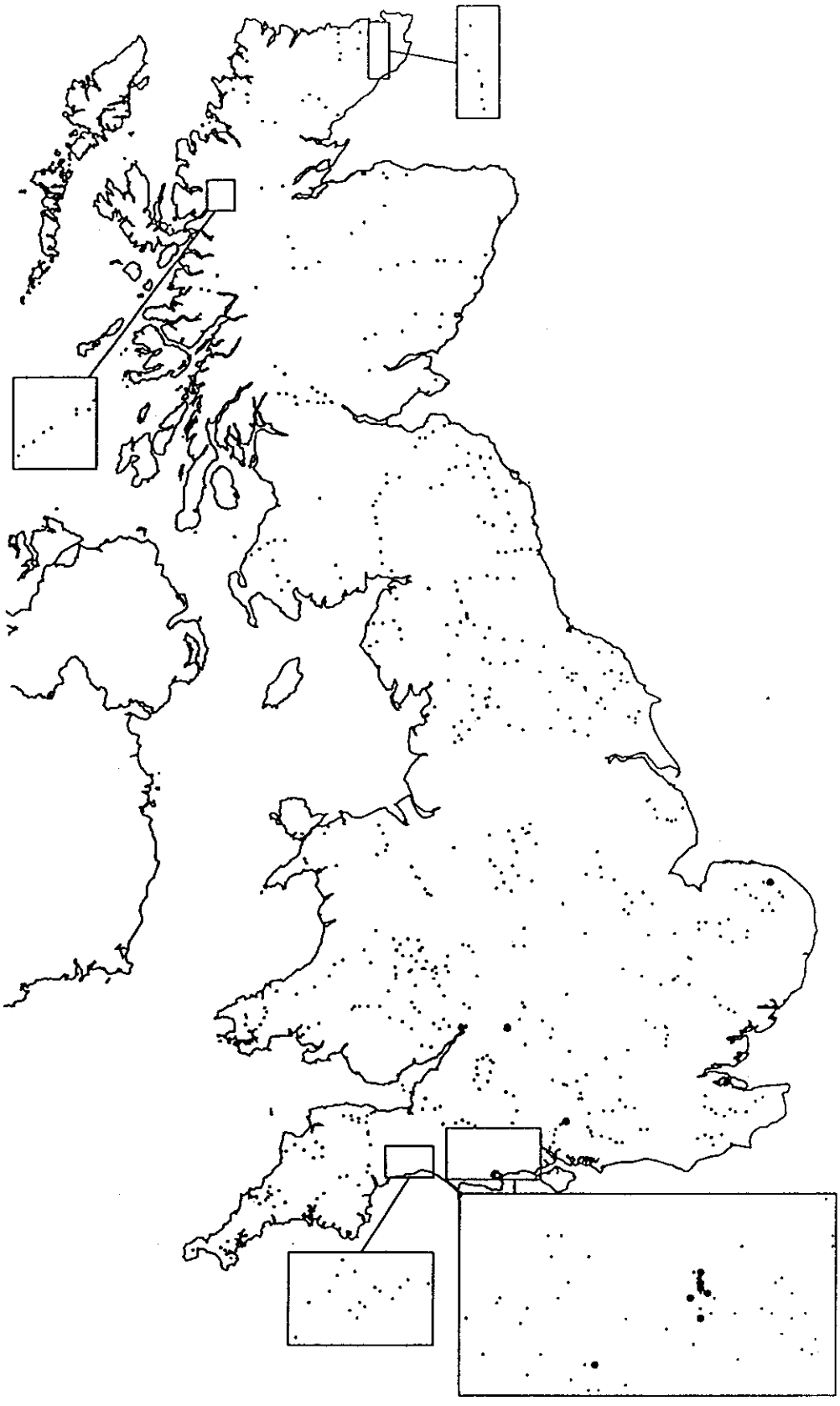
R.PIDDLE	PIDDLETRENTHIDE	ST 703 010
UN-NAMED WATERCOURSE	WOODLANDS MANOR	ST 816 309
SHERSTON STREAM	WASHPOOL BRIDGE	ST 841 860
UN-NAMED WATERCOURSE	FARRINGTON	ST 846 152
R.ED	UPPER FARM	SU 067 112
R.LODDON	OLIVER'S BATTERY	SU 667 537
R.PIDDLE	DRUCE	SY 744 951
WOOL STREAM	WOOL	SY 848 869
KELK BECK	HARPHAM	TA 084 614
R.MIMRAM	PANSHANGER	TL 282 134

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	61.10	33.12	14.00	107.00
Distance from source (km)	4.56	5.23	0.60	17.00
Slope (m km^{-1})	4.47	2.14	1.10	7.40
Discharge category	1.60	0.84	1.00	3.00
Latitude (^{o} North)	51.39	1.00	50.68	54.04
Longitude (^{o} West)	-1.71	0.87	-2.42	-0.14
Mean air temp. (^{o}C)	10.38	0.39	9.47	10.86
Air temp. range (^{o}C)	12.41	0.58	11.62	13.34
Mean width (m)	4.19	3.52	1.00	11.80
Mean depth (cm)	26.84	19.79	12.20	65.00
Mean substratum (phi)	2.15	3.13	-1.81	6.91
Alkalinity (mg $l^{-1}CaCO_3$)	227.21	33.32	135.99	254.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	146.70	23.96	107.00	177.00
Number of taxa	29.00	3.83	22.00	34.00
ASPT	5.04	0.27	4.70	5.53



Group 32

GB - Group 32

10 sites

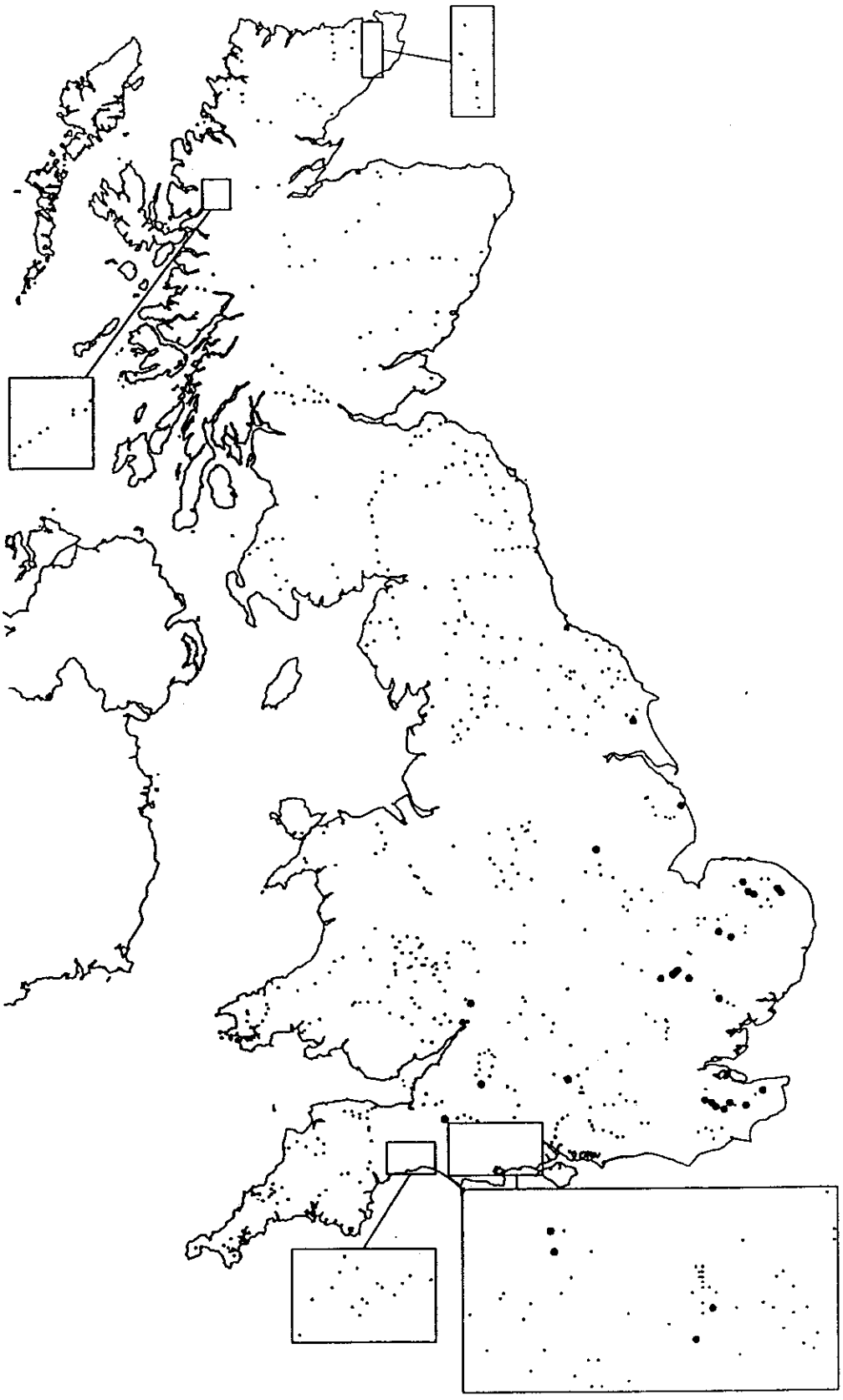
R. COLN	FOSSE BRIDGE	SP 081 112
MANNINGTON BROOK	HORTON HEATH	SU 054 067
R.ED	PAINS MOOR	SU 074 105
MANNINGTON BROOK	PENNINGSTON'S COPSE	SU 075 026
R.CRANE	ROMFORD BRIDGE	SU 075 094
R.CRANE	GREAT RHYMES COPSE	SU 077 121
R.CRANE	VERWOOD	SU 088 075
CANDOVER BROOK	ABBOTSTONE	SU 565 345
BERE STREAM	MIDDLE BERE	SY 858 923
R.BURE	WHITEHOUSE FARM FORD	TG 164 305

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	40.70	30.90	15.00	118.00
Distance from source (km)	9.57	5.37	1.80	17.00
Slope (m km^{-1})	3.01	1.18	1.70	5.50
Discharge category	1.60	0.52	1.00	2.00
Latitude (^{o} North)	51.17	0.66	50.73	52.83
Longitude (^{o} West)	-1.54	1.00	-2.20	1.21
Mean air temp. (^{o}C)	10.47	0.24	9.85	10.69
Air temp. range (^{o}C)	12.56	0.38	11.89	13.20
Mean width (m)	4.85	2.68	1.80	9.80
Mean depth (cm)	30.52	12.85	8.60	49.00
Mean substratum (phi)	0.90	2.48	-2.60	3.77
Alkalinity (mg $l^{-1}CaCO_3$)	179.75	46.91	85.00	225.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	221.30	26.10	187.00	263.00
Number of taxa	37.90	3.84	33.00	44.00
ASPT	5.83	0.18	5.50	6.08



Group 33

31 sites

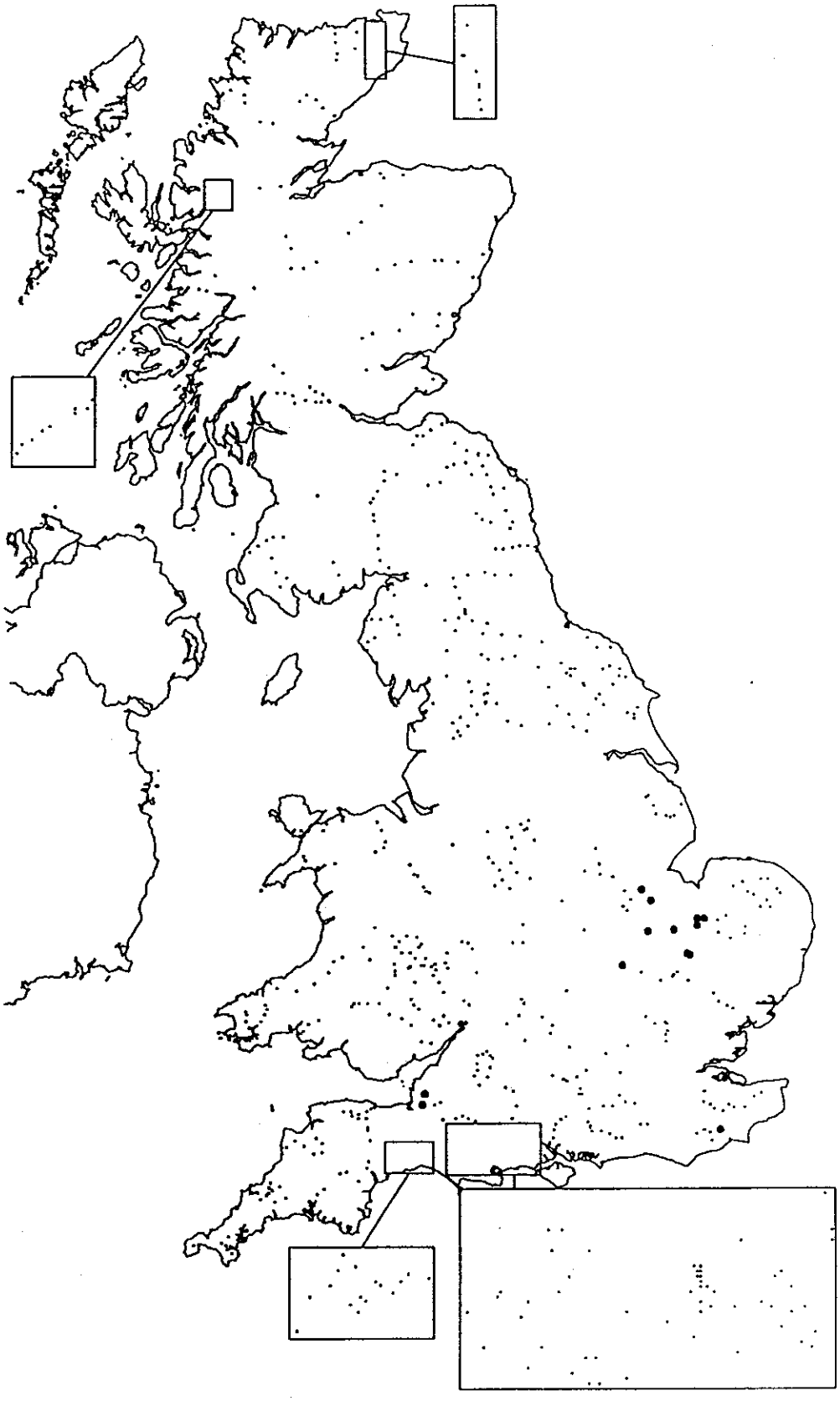
R DEVON	HAWTON	SK 785 511
R.LEADON	UPLEADON	SO 770 270
R.BRUE	TOOTLE BRIDGE	ST 551 327
RIVER CALE	SYLES FARM	ST 759 199
RIVER LYDDEN	BAGBER BRIDGE	ST 765 157
BRISTOL AVON	STAVERTON WEIR	ST 856 609
MOORS RIVER	EAST MOORS FARM	SU 101 029
R.ENBORNE	BRIMPTON	SU 568 648
R.STOUR	LONGHAM	SZ 065 973
R.HULL	CORPSLANDING	TA 066 529
GREAT EAU	THEDDLETHORPE-ALL-SAINTS	TF 452 867
R.WENSUM	GREAT RYBURGH	TF 964 273
R.WENSUM	WORTHING	TG 005 202
R.WENSUM	NORTH OF ELSING	TG 052 178
R.BURE	BUXTON MILL	TG 243 231
R.BURE	COLTISHALL BRIDGE	TG 267 198
MILL RIVER	WENDY	TL 321 475
RIVER RHEE	HARSTON	TL 417 511
RIVER CAM	HAUXTON MILL	TL 432 527
NINE WELLS SPRING	NINE WELLS	TL 460 542
RIVER GRANTA	HILDERSHAM	TL 545 485
LITTLE OUSE	BRANDON	TL 783 868
R.COLNE	D/S HEDINGHAM STW	TL 798 323
R.THET	NUNS BRIDGE, THETFORD	TL 875 826
R.BEULT	HUNTON	TQ 706 495
R.BEULT	STILE BRIDGE	TQ 759 477
R.BEULT	SLANEY PLACE	TQ 798 445
R.BEULT	HADMAN'S PLACE	TQ 865 425
GREAT STOUR	STONEBRIDGE GREEN	TQ 917 485
GREAT STOUR	WYE	TR 048 469
GREAT STOUR	FORDWICH	TR 179 597

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	21.55	17.95	1.00	76.00
Distance from source (km)	26.48	15.73	0.20	80.90
Slope (m km^{-1})	1.09	1.00	0.20	5.00
Discharge category	3.65	1.40	1.00	7.00
Latitude (^{o} North)	51.91	0.84	50.77	53.96
Longitude (^{o} West)	-0.15	1.27	-2.64	1.36
Mean air temp. (^{o}C)	10.04	0.31	9.50	10.63
Air temp. range (^{o}C)	13.05	0.51	12.07	13.74
Mean width (m)	10.18	7.06	2.10	26.70
Mean depth (cm)	78.03	54.57	10.00	200.00
Mean substratum (phi)	2.94	3.65	-3.08	8.00
Alkalinity (mg $l^{-1}CaCO_3$)	206.42	47.72	105.80	284.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	161.13	32.35	101.00	221.00
Number of taxa	31.71	4.63	21.00	40.00
ASPT	5.05	0.34	4.50	5.79



Group 34

GB - Group 34

13 sites

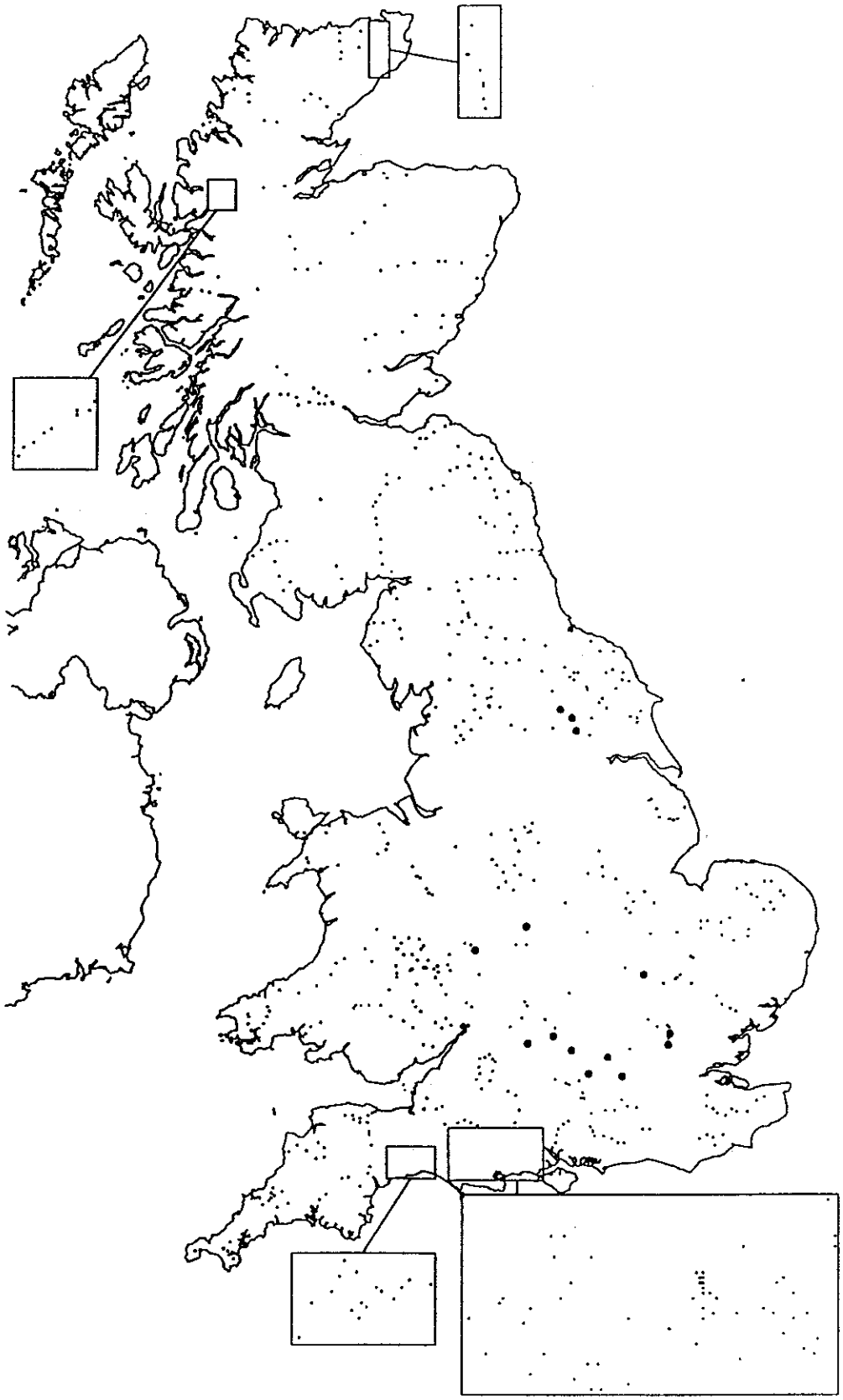
R.BRUE	LIBERTY FARM	ST 384 446
R.AXE	LOWER WEARE	ST 406 537
R.GLEN	SOUTH OF TWENTY	TF 156 190
R.WELLAND	CROWLAND	TF 228 106
GREAT OUSE	SHARNBROOK	TL 010 590
MONKS LODE	ETERNITY HALL BRIDGE	TL 212 858
16 FOOT DRAIN	HORSEWAYS CORNER	TL 421 875
REACH LODE	UPWARE LOCK	TL 537 698
REACH LODE	HALLARDS FEN ROAD	TL 557 678
TEN MILE RIVER	HILGAY BRIDGE	TL 604 970
LITTLE OUSE	BRANDON CREEK	TL 607 917
R.WISSEY	FIVE MILE HOUSE	TL 664 977
R.ROTHER	D/S NEWENDEN	TQ 850 270

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	4.85	9.15	1.00	35.00
Distance from source (km)	43.02	27.51	4.00	89.90
Slope (m km^{-1})	0.54	0.66	0.10	2.50
Discharge category	3.69	2.06	1.00	7.00
Latitude (^{o} North)	52.17	0.60	51.01	52.76
Longitude (^{o} West)	-0.35	1.17	-2.88	0.64
Mean air temp. (^{o}C)	9.90	0.31	9.63	10.52
Air temp. range (^{o}C)	13.24	0.47	12.21	13.64
Mean width (m)	17.16	11.57	5.30	40.00
Mean depth (cm)	145.71	62.07	91.70	299.90
Mean substratum (phi)	6.85	1.28	4.65	8.00
Alkalinity (mg $l^{-1}CaCO_3$)	229.00	63.85	102.40	365.50

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	152.08	23.08	116.00	185.00
Number of taxa	31.46	3.64	26.00	37.00
ASPT	4.82	0.21	4.46	5.18



Group 35

GB - Group 35

14 sites

R.URE	ALDWARK TOLL BRIDGE	SE 467 621
R.OUSE	NETHER POPPLETON	SE 556 552
R.OUSE	ACASTER MALBIS	SE 591 455
R.SEVERN	STOURPORT	SO 805 710
R.BLYTHE	BLYTHE BRIDGE	SP 211 898
R.THAMES	BABLOCK HYTHE	SP 435 042
R.THAMES	MALTHOUSE	SU 225 984
R.THAMES	SHILLINGFORD	SU 590 932
R.THAMES	READING	SU 726 740
R.THAMES	SPADE OAK	SU 884 875
GREAT OUSE	ROXTON LOCK	TL 160 535
R.LEE	MEADGATE	TL 384 076
R.THAMES	RUNNYMEDE	TQ 008 725
R.LEE	ENFIELD WEIR	TQ 374 983

Environmental Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
Altitude (m)	31.93	23.23	7.00	75.00
Distance from source (km)	112.06	60.93	32.00	202.80
Slope (m km^{-1})	0.49	0.30	0.30	1.40
Discharge category	7.50	1.70	4.00	9.00
Latitude (^{o} North)	52.28	0.97	51.44	54.05
Longitude (^{o} West)	-1.02	0.66	-2.29	0.01
Mean air temp. (^{o}C)	10.06	0.40	9.37	10.70
Air temp. range (^{o}C)	13.26	0.22	12.83	13.60
Mean width (m)	44.09	20.41	12.30	80.00
Mean depth (cm)	163.44	51.05	36.90	238.80
Mean substratum (phi)	1.21	3.70	-2.68	8.00
Alkalinity (mg $l^{-1}CaCO_3$)	188.64	45.79	124.10	252.00

Biological Characteristics

Variable	Mean	Std Dev	Minimum	Maximum
BMWP score	183.50	31.09	145.00	235.00
Number of taxa	33.64	4.60	27.00	42.00
ASPT	5.44	0.25	5.00	5.87

APPENDIX 2 - DELETED

APPENDIX 3 Files required to run the RIVPACS III software plus 11 example input data files.

The 52 datafiles together with the executable file RIVPACS.EXE are listed below:

BGPM_GB.DAT
BMWPNAMG.DRC
BMWPNUMG.DRC
BMWPPROG.DRC
BMWPSCOG.DRC
BSPEC_GB.SCR
COEF_RP1.DAT
COEF_RP2.DAT
COEF_RP3.DAT
COEF_RP4.DAT
COEF_RP5.DAT
CUSTNAME.DRC
DEFAULTS.DAT
FMLPPROG.DRC
FMLQNAMG.DRC
FMLQNUMG.DRC
FMLQPROG.DRC
FMLYA_G.TAX
FMLYNAMG.DRC
FMLYNUMG.DRC
GB_SIZE.DAT
GPM_GB.DAT
HELVB.FON
HELP1.TXT
HELP10.TXT
HELP11.TXT
HELP12.TXT
HELP13.TXT
HELP14.TXT
HELP15.TXT
HELP16.TXT
HELP17.TXT
HELP2.TXT
HELP3.TXT
HELP4.TXT
HELP5.TXT
HELP6.TXT
HELP7.TXT
LETTERS.DAT
MEANTEMP.DRC
RIVPACS.EXE
RPC614_S.GPM
SCOR_RP1.DAT
SCOR_RP2.DAT
SCOR_RP3.DAT
SCOR_RP4.DAT
SCOR_RP5.DAT
SPECNAMG.DRC
SPECNUMG.DRC
SPECPROG.DRC
SPEC_GB.SCR
TAXONG.DRC
TEMPRANG.DRC

Example files provided with the RIVPACS III software

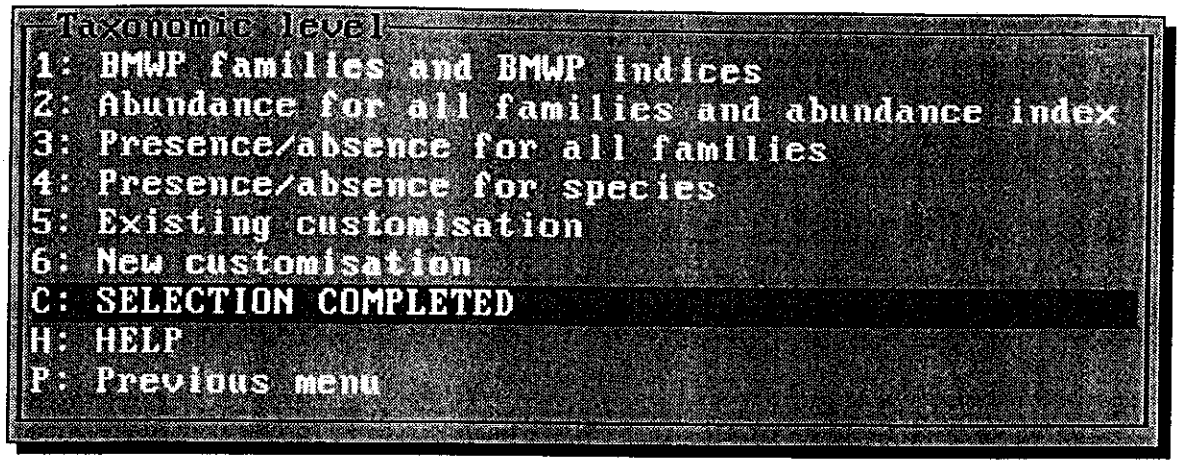
File	*Format*	*Description*	
AUTO.DAT	ASCII	Batch file	
DEF2.DAT	ASCII	Defaults file	
TSTENVGB.ASC	ASCII	Environmental data :	Great Britain
TSTESMGB.DBF	dBASE	Environmental data : time variant	Great Britain
TSTESTGB.DBF	dBASE	Environmental data : time invariant	Great Britain
TSTFAMGB.DBF	dBASE	Biological data: Family level	Great Britain
TSTFAMGB.ASC	ASCII		
TSTSPPGB.DBF	dBASE	Biological data: Species level	Great Britain
TSTSPPGB.ASC	ASCII		
TSTSPRGB.DBF	dBASE	Biological data: Family level with Spring abundance values	Great Britain
TSTSPRGB.ASC	ASCII		

APPENDIX 4

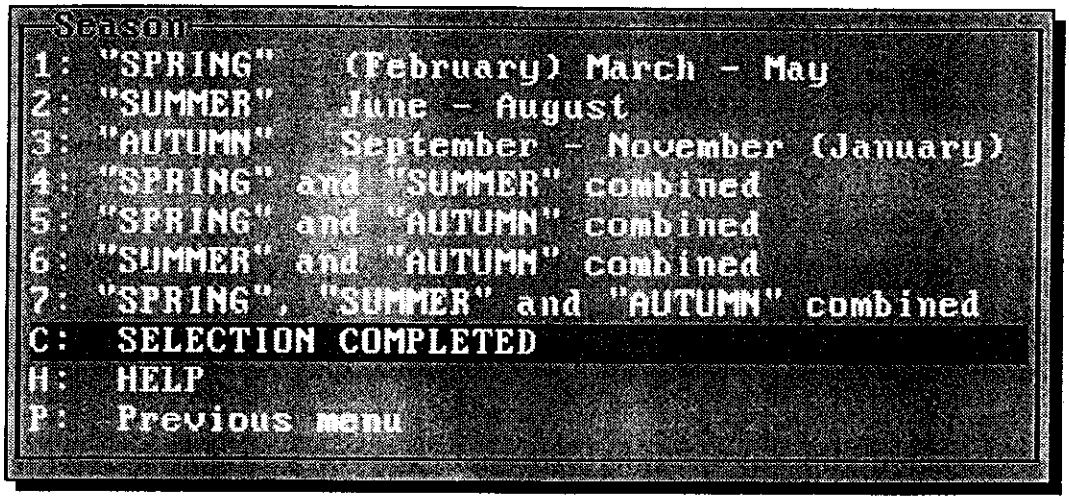
PANEL SEQUENCE FOR PREDICTION

P1

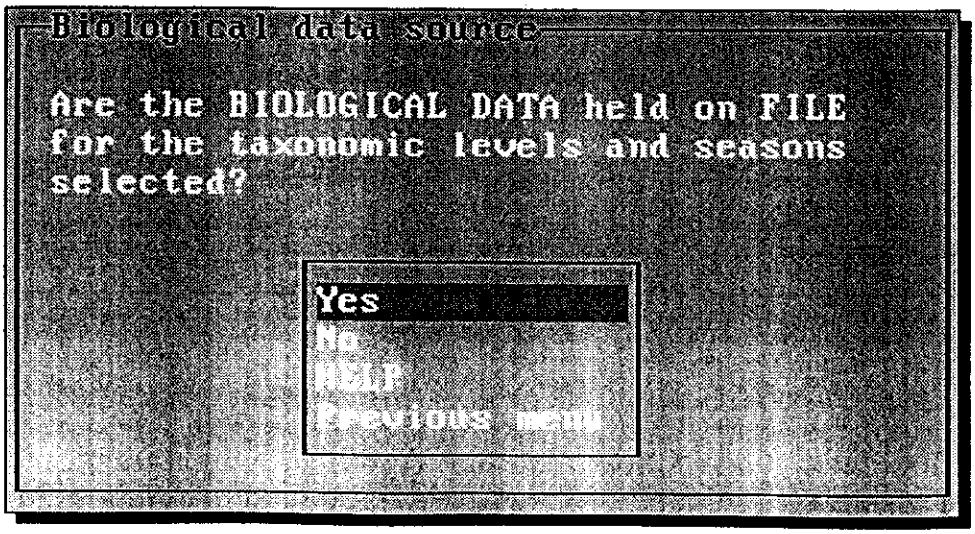
P2


Taxonomic level
1: BMWP families and BMWP indices
2: Abundance for all families and abundance index
3: Presence/absence for all families
4: Presence/absence for species
5: Existing customisation
6: New customisation
C: SELECTION COMPLETED
H: HELP
P: Previous menu

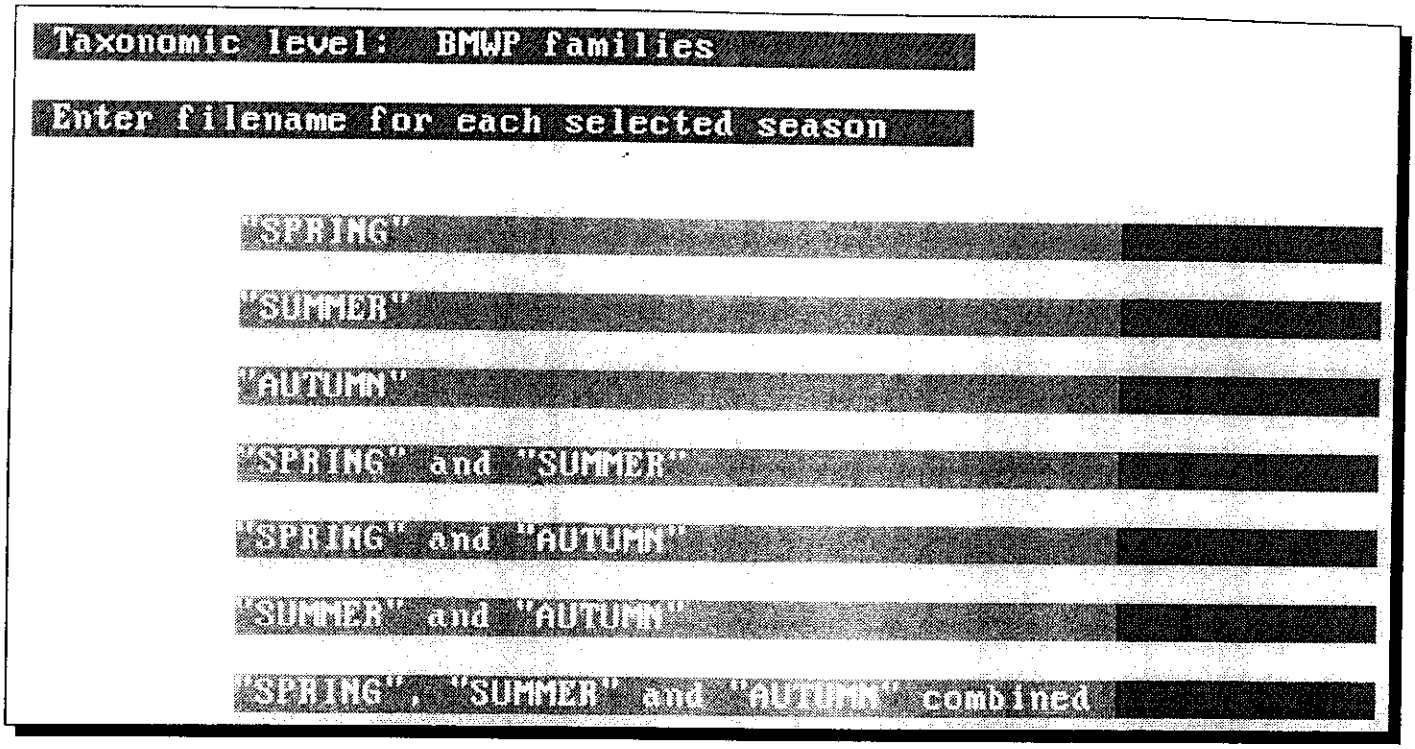
P3


Season
1: "SPRING" (February) March - May
2: "SUMMER" June - August
3: "AUTUMN" September - November (January)
4: "SPRING" and "SUMMER" combined
5: "SPRING" and "AUTUMN" combined
6: "SUMMER" and "AUTUMN" combined
7: "SPRING", "SUMMER" and "AUTUMN" combined
C: SELECTION COMPLETED
H: HELP
P: Previous menu

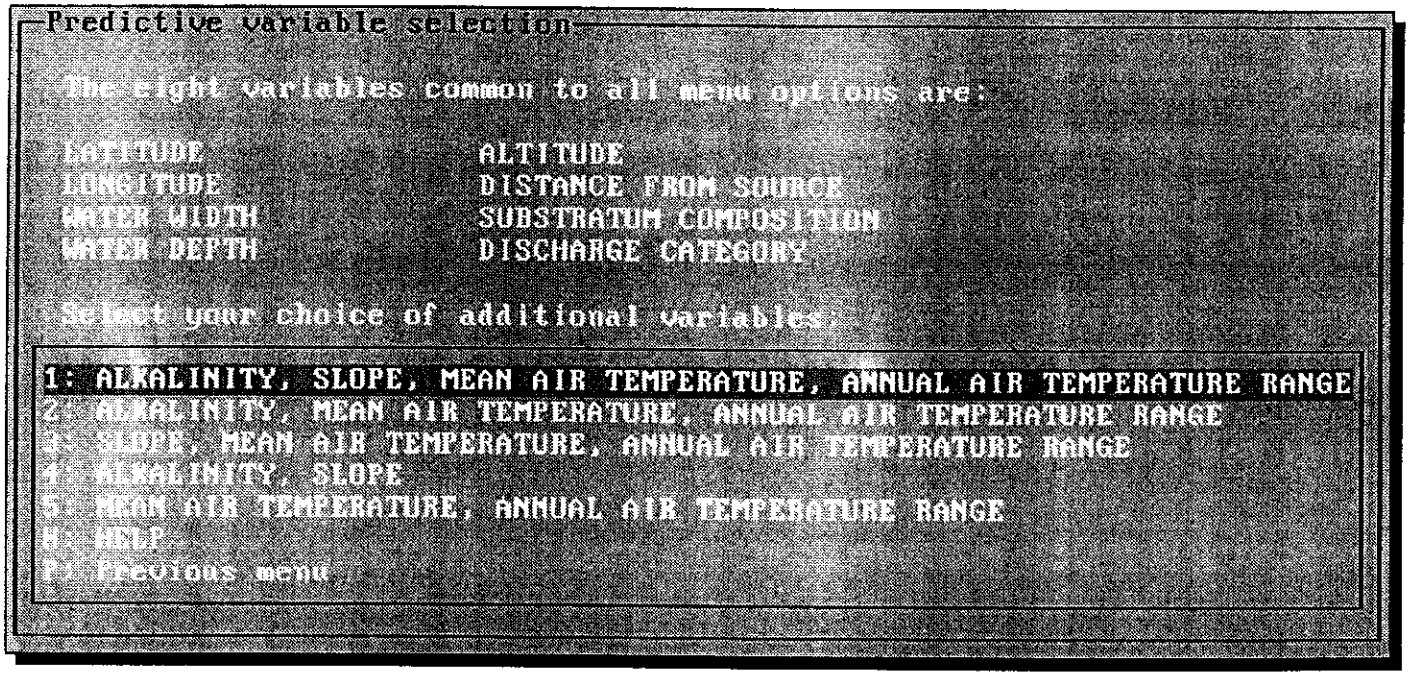
P4


Biological data source
Are the BIOLOGICAL DATA held on FILE
for the taxonomic levels and seasons
selected?
Yes
No
HELP
Previous menu

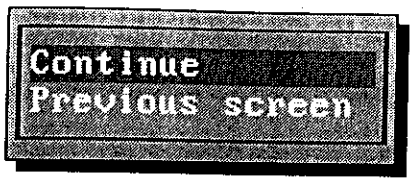
P5


Taxonomic level: BMWP families
Enter filename for each selected season
"SPRING"
"SUMMER"
"AUTUMN"
"SPRING" and "SUMMER"
"SPRING" and "AUTUMN"
"SUMMER" and "AUTUMN"
"SPRING", "SUMMER" and "AUTUMN" combined

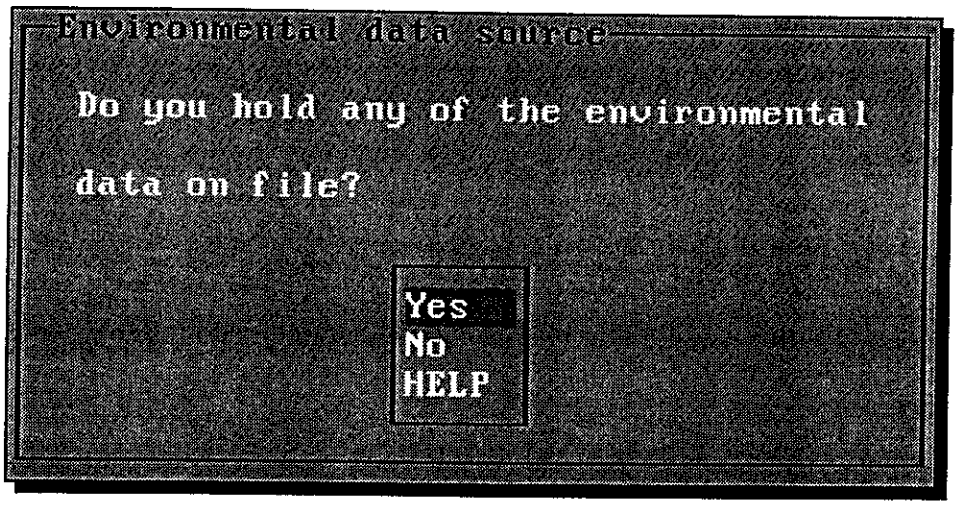
P6


Predictive variable selection
The eight variables common to all menu options are:
LATITUDE
LONGITUDE
WATER WIDTH
WATER DEPTH
ALTITUDE
DISTANCE FROM SOURCE
SUBSTRATUM COMPOSITION
DISCHARGE CATEGORY
Select your choice of additional variables:
1: ALKALINITY, SLOPE, MEAN AIR TEMPERATURE, ANNUAL AIR TEMPERATURE RANGE
2: ALKALINITY, MEAN AIR TEMPERATURE, ANNUAL AIR TEMPERATURE RANGE
3: SLOPE, MEAN AIR TEMPERATURE, ANNUAL AIR TEMPERATURE RANGE
4: ALKALINITY, SLOPE
5: MEAN AIR TEMPERATURE, ANNUAL AIR TEMPERATURE RANGE
N: NONE
P: Previous menu

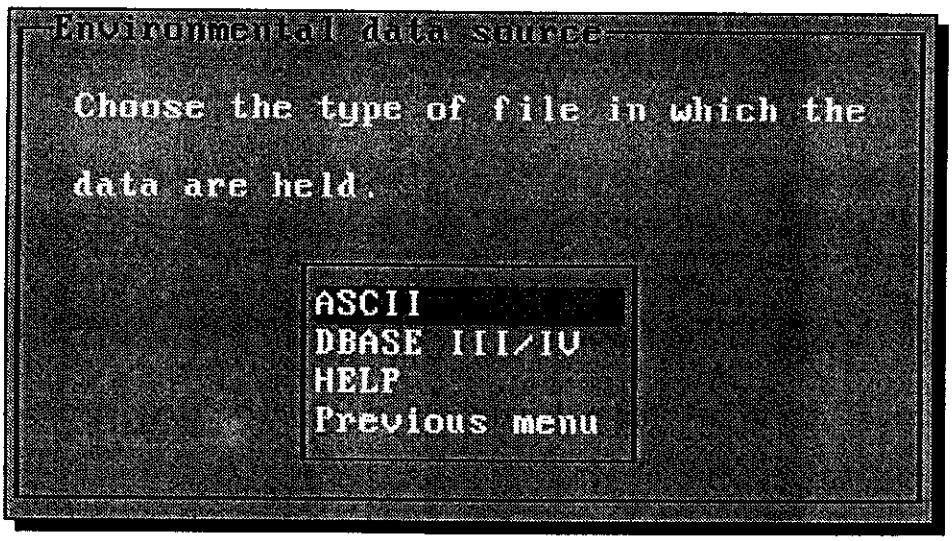
P7


Continue
Previous screen

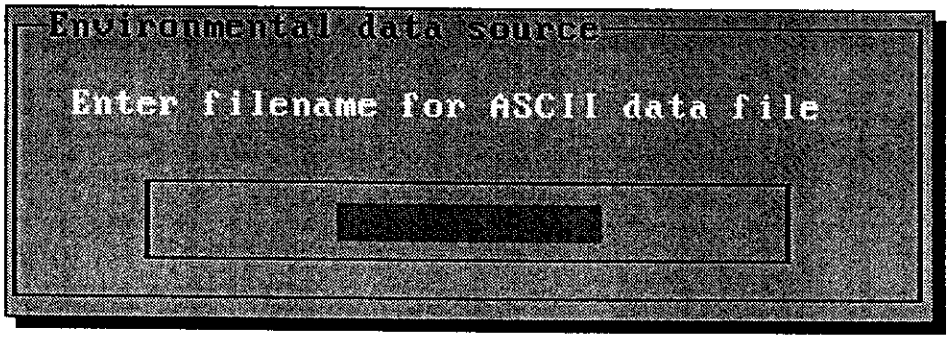
P8


Environmental data source
Do you hold any of the environmental data on file?
Yes
No
HELP

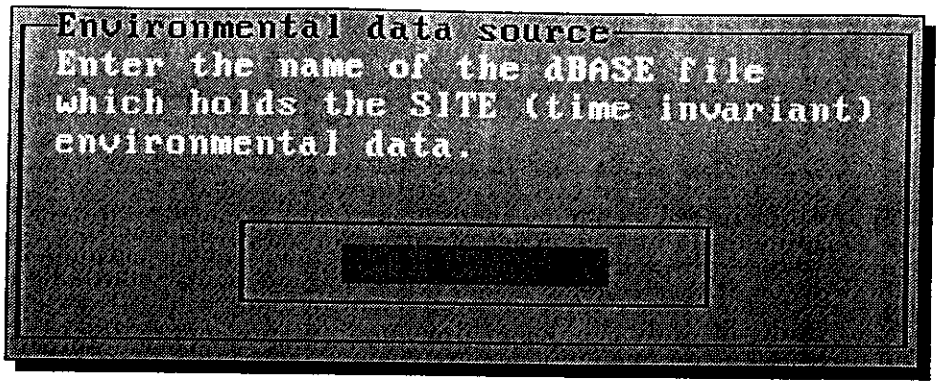
P9


Environmental data source
Choose the type of file in which the data are held.
ASCII
DBASE III/IV
HELP
Previous menu

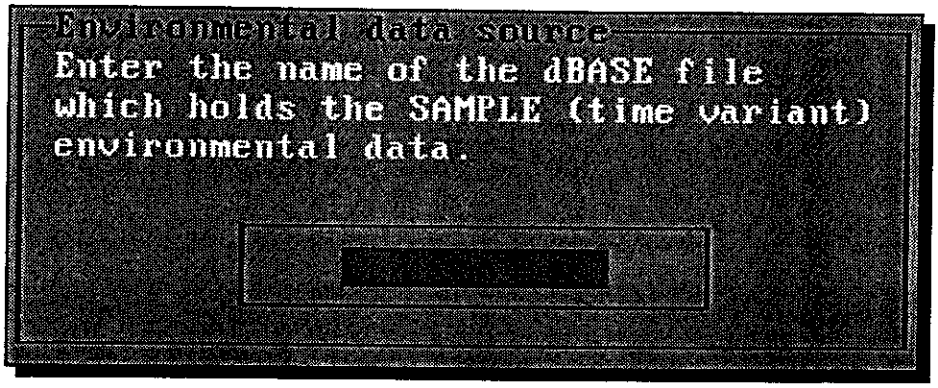
P10


Environmental data source
Enter filename for ASCII data file

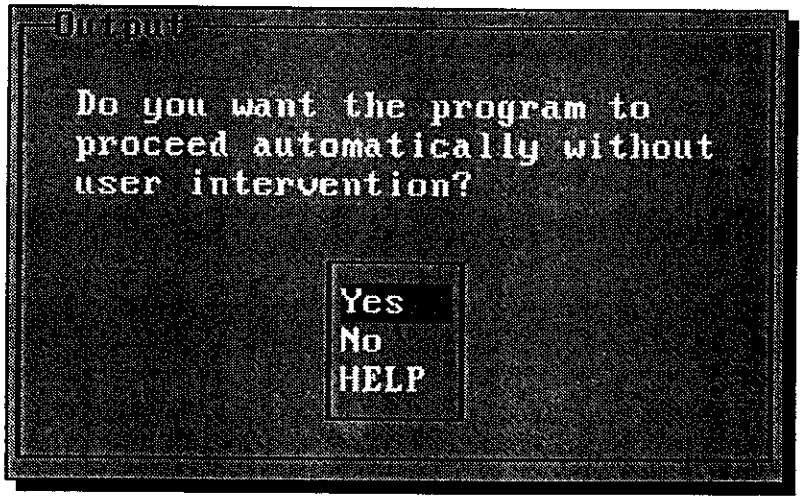
P11



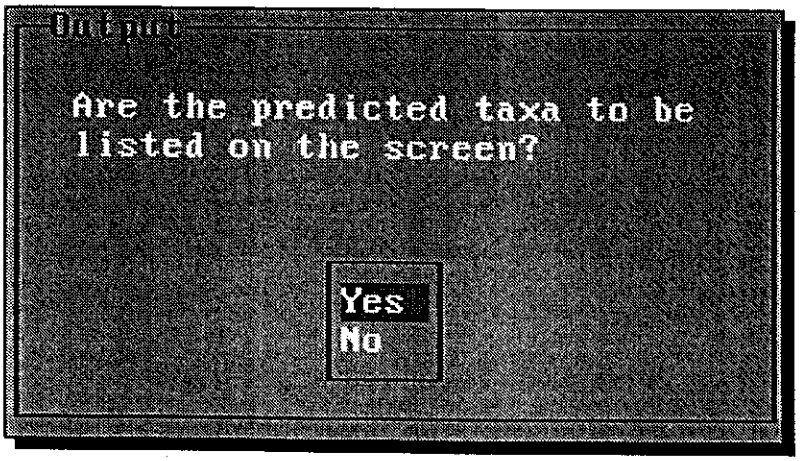
P12



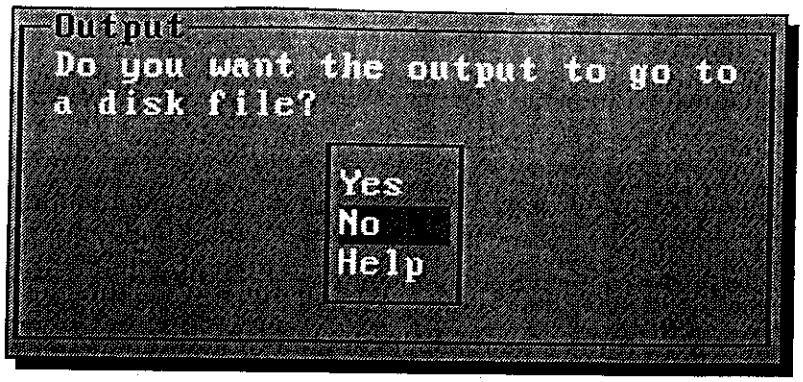
P13



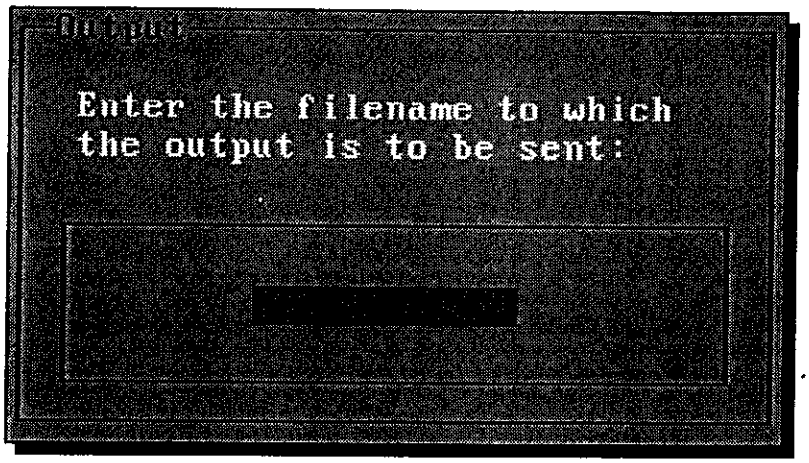
P14



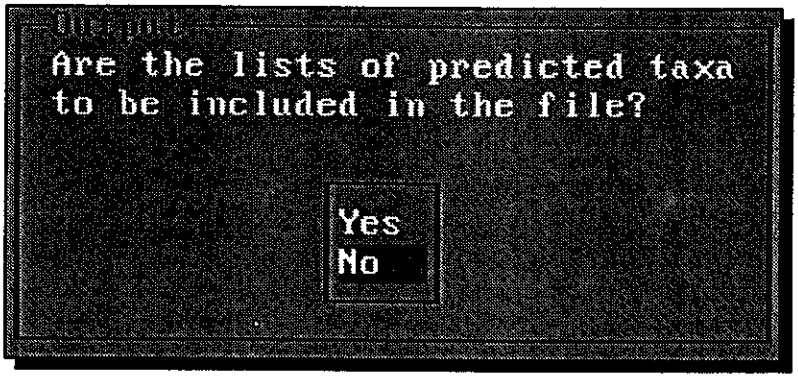
P15



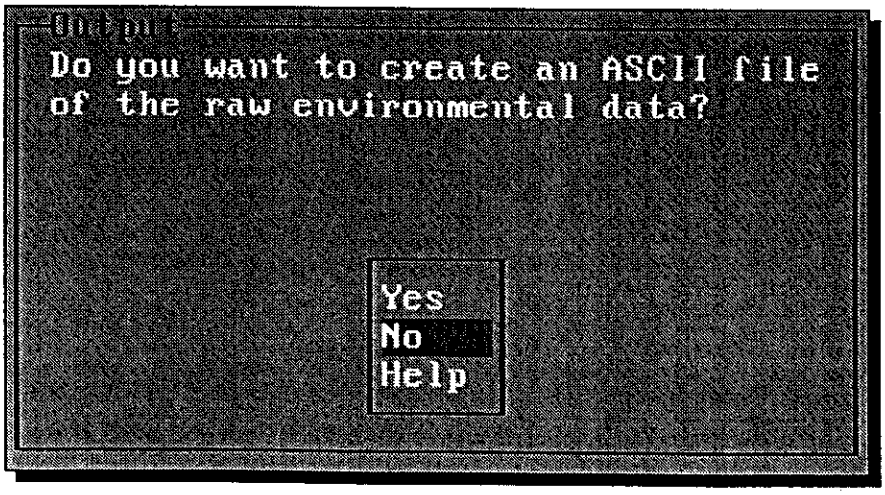
P16



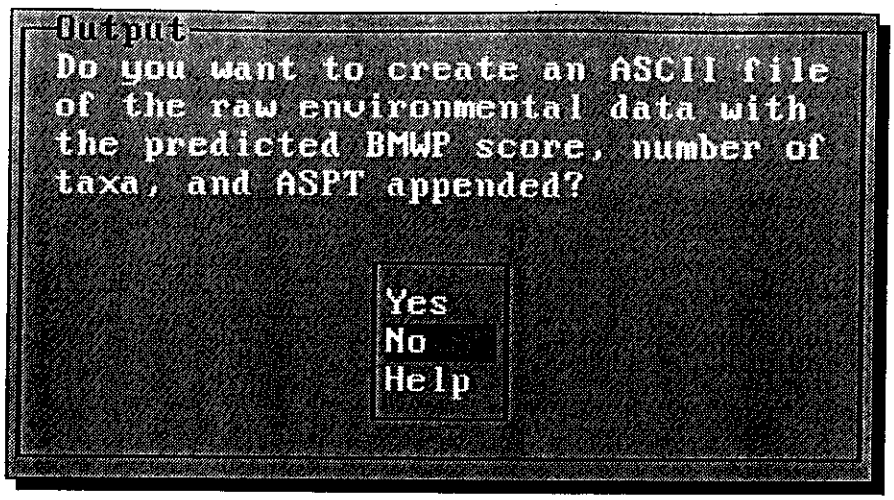
P17



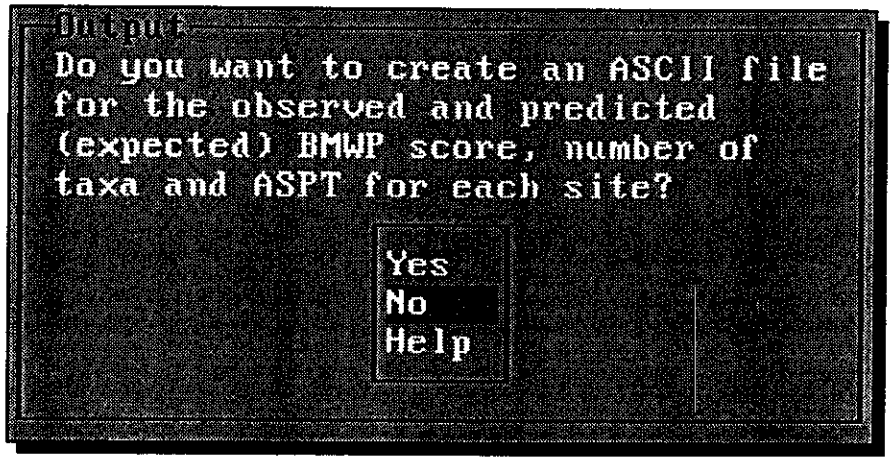
P18



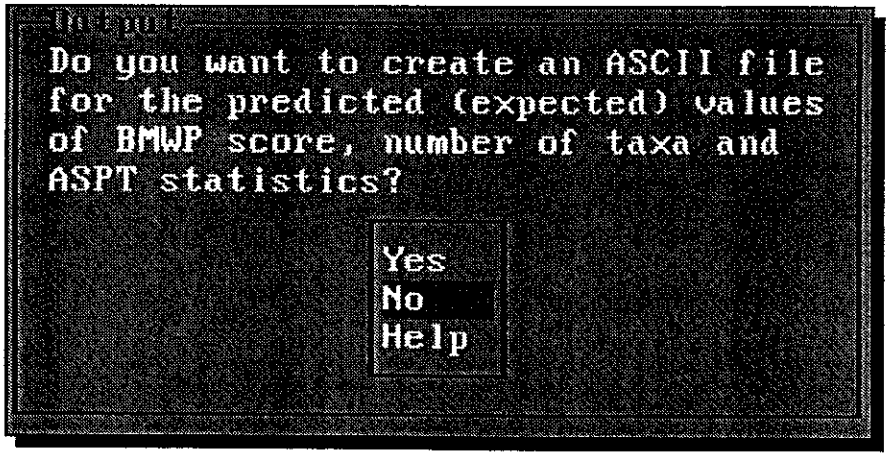
P19


Output
Do you want to create an ASCII file of the raw environmental data with the predicted BMWP score, number of taxa, and ASPT appended?
Yes
No
Help

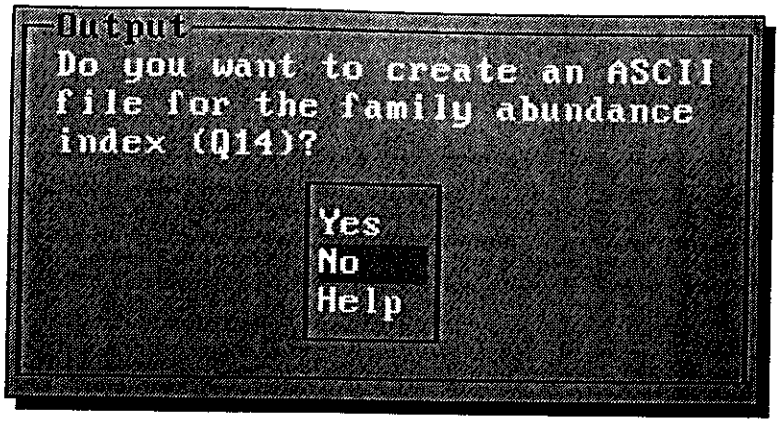
P20


Output
Do you want to create an ASCII file for the observed and predicted (expected) BMWP score, number of taxa and ASPT for each site?
Yes
No
Help

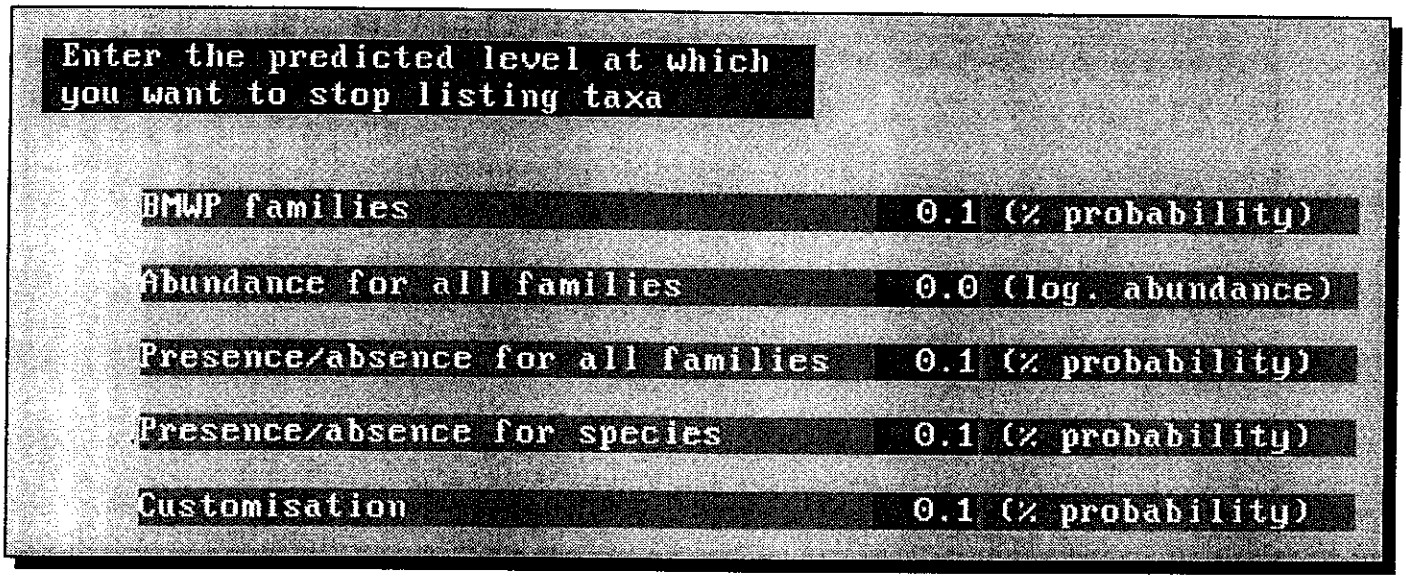
P21


Output
Do you want to create an ASCII file for the predicted (expected) values of BMWP score, number of taxa and ASPT statistics?
Yes
No
Help

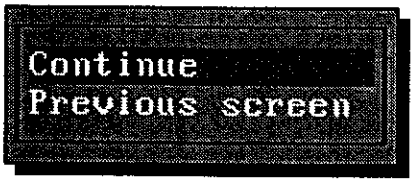
P22


Output
Do you want to create an ASCII file for the family abundance index (Q14)?
Yes
No
Help

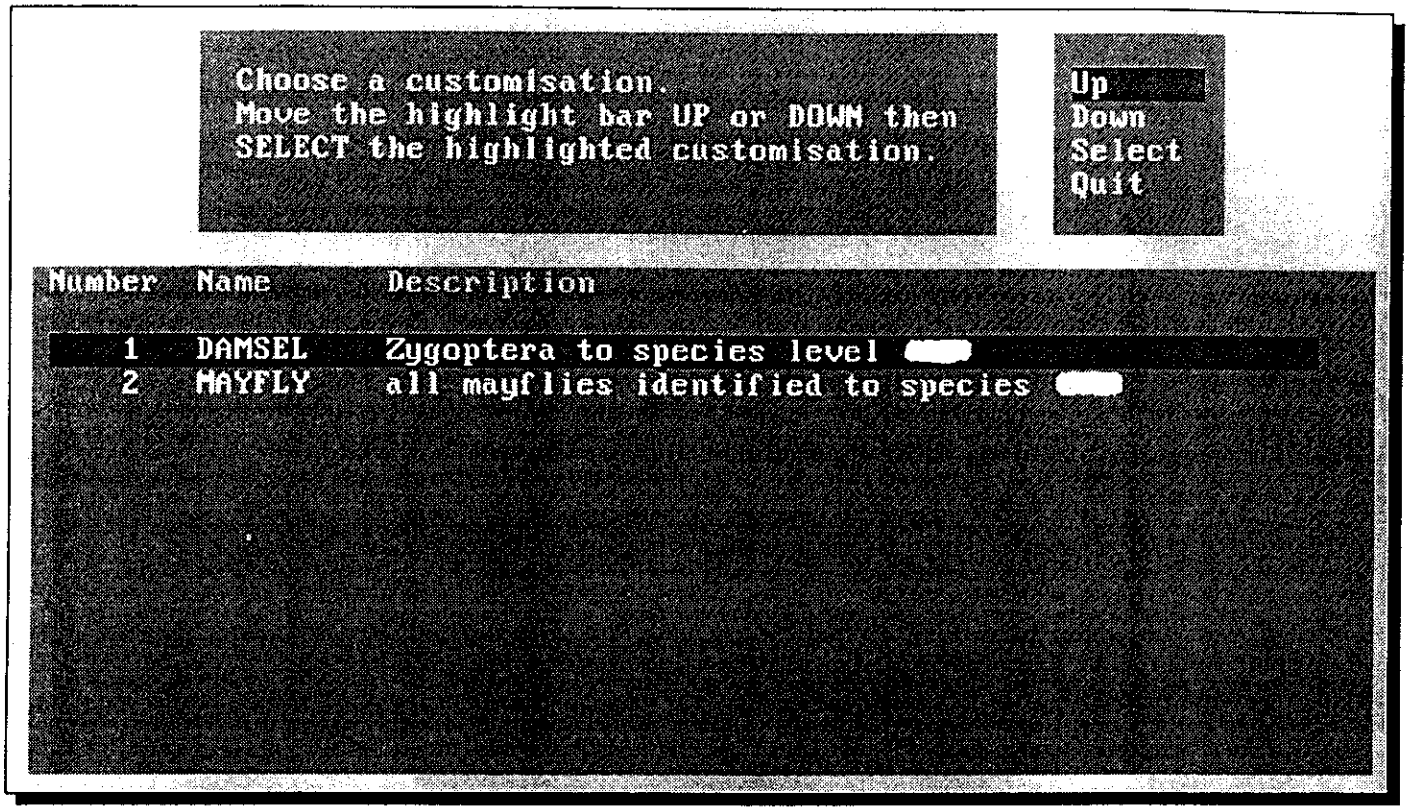
P23


Enter the predicted level at which you want to stop listing taxa
BMWP families 0.1 (% probability)
Abundance for all families 0.0 (log. abundance)
Presence/absence for all families 0.1 (% probability)
Presence/absence for species 0.1 (% probability)
Customisation 0.1 (% probability)

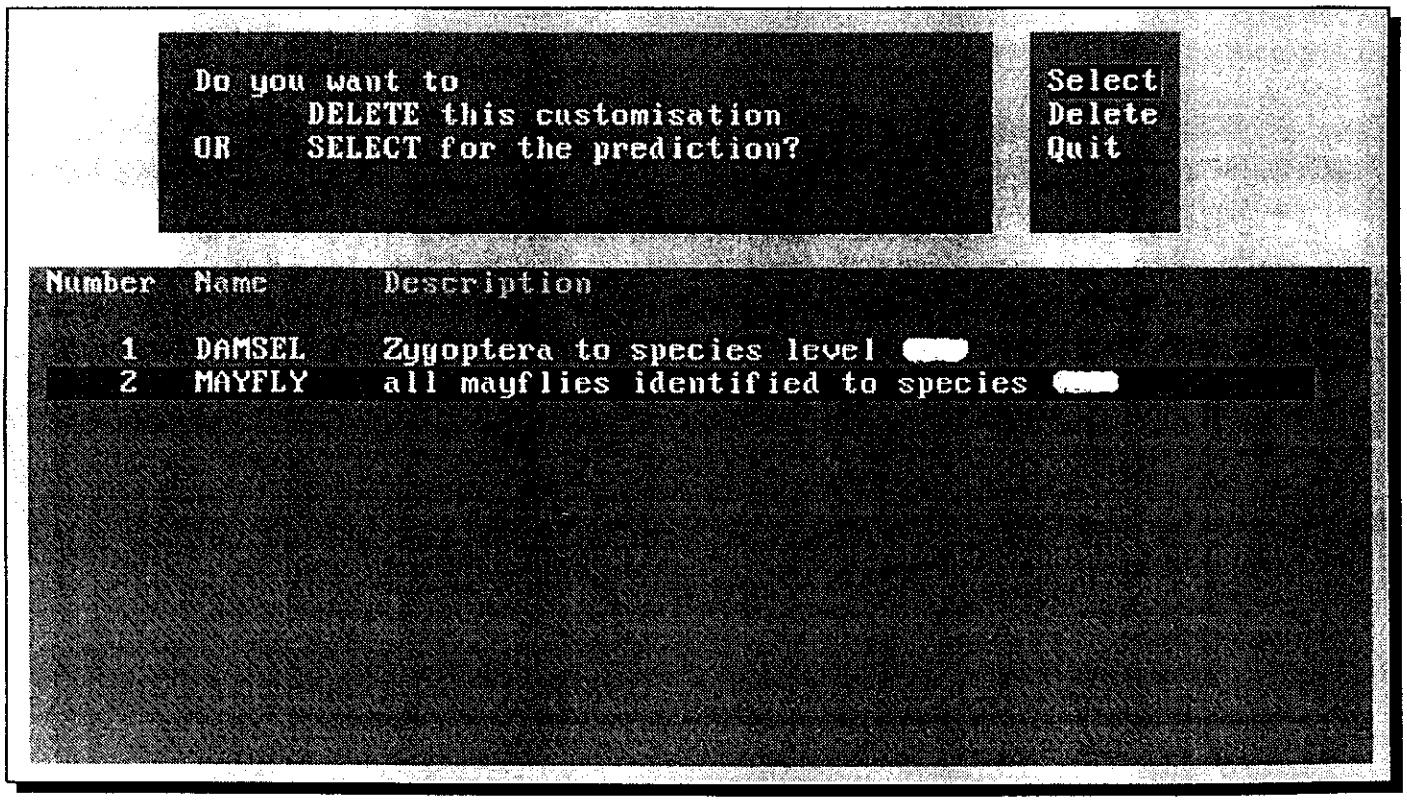
P24


Continue
Previous screen

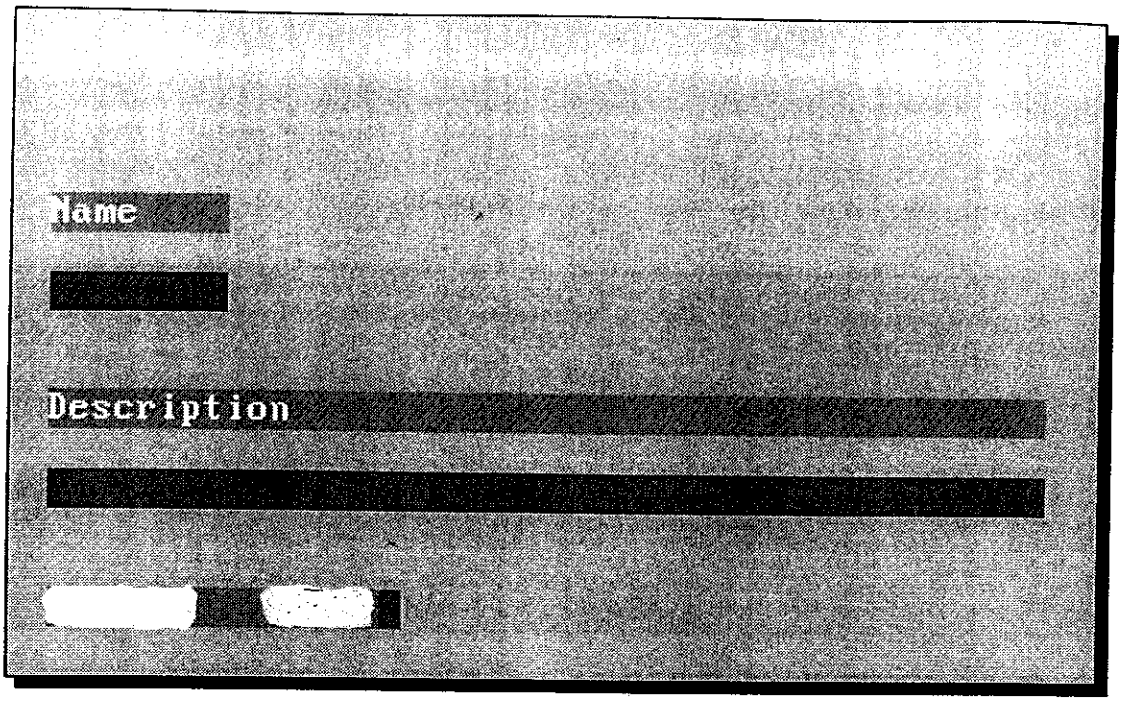
P25


Choose a customisation.
Move the highlight bar UP or DOWN then
SELECT the highlighted customisation.
Up
Down
Select
Quit
Number Name Description
1 DAMSEL Zygoptera to species level
2 MAYFLY all mayflies identified to species

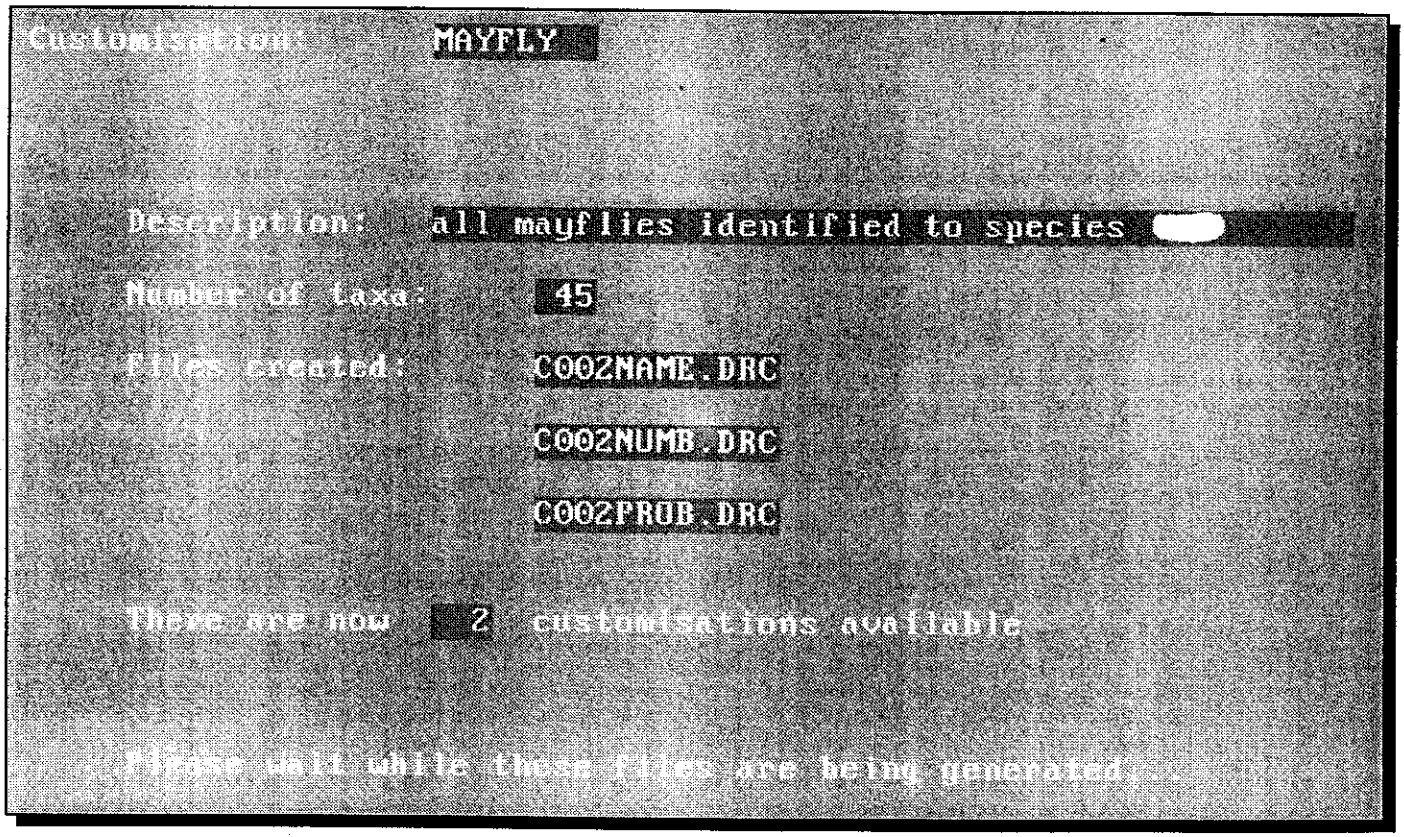
P26


Do you want to
DELETE this customisation
OR SELECT for the prediction?
Select
Delete
Quit
Number Name Description
1 DAMSEL Zygoptera to species level
2 MAYFLY all mayflies identified to species

P27


Name
Description

P28


Customisation: MAYFLY
Description: all mayflies identified to species
Number of taxa: 45
Files created: C002NAME.DRC
C002NUMB.DRC
C002PROB.DRC
There are now 2 customisations available
Please wait while these files are being generated.

APPENDIX 5. Minimum and maximum values of environmental variables recorded at the 614 sites in Great Britain.

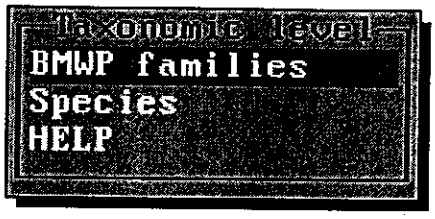
Variable	*Units*	*Min*	*Max*
Altitude	m	1	590
Distance from source	km	0.1	202.8
Slope	m km^{-1}	0.1	150.0
Discharge category		1	9
Latitude	° North	50.00	58.61
Longitude	° West	-5.65	1.36
Mean air temperature	°C	7.93	11.45
Air temperature range	°C	8.37	13.91
Mean width	m	0.4	116.7
Mean depth	cm	1.7	299.9
Mean substratum	phi	-7.71	8.00
Alkalinity	mg l^{-1} $CaCO_3$	1.2	365.5

APPENDIX 6

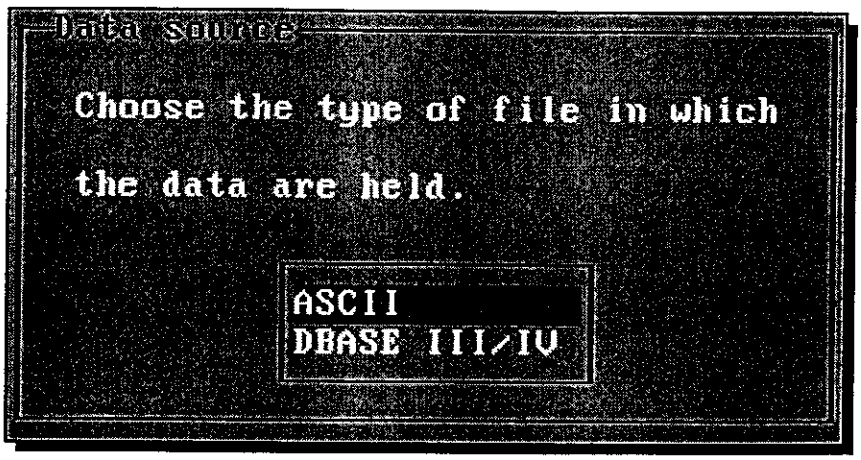
PANEL SEQUENCE FOR CLASSIFICATION

C1

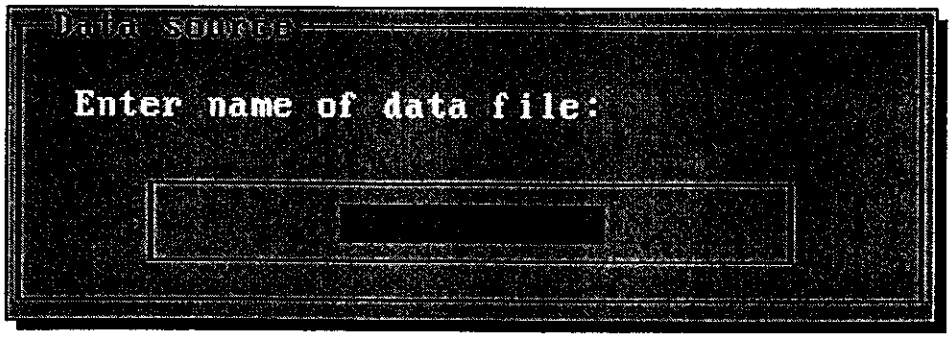
C2


Taxonomic level
BMWP families
Species
HELP

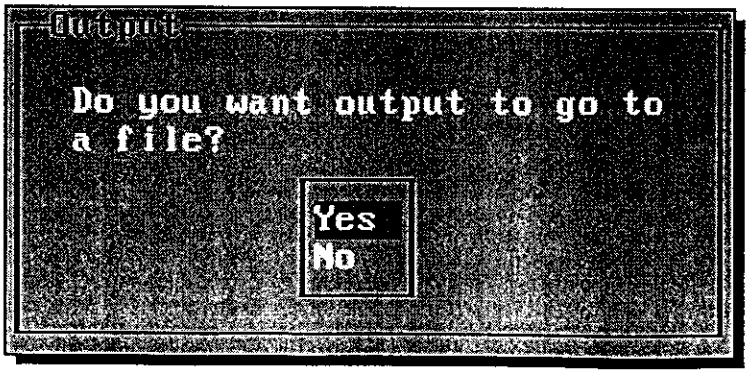
C3


Data source
Choose the type of file in which the data are held.
ASCII
DBASE III/IV

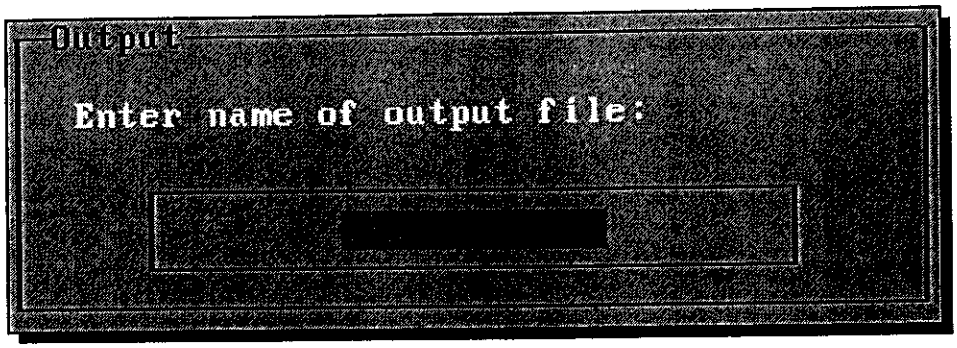
C4


Data source
Enter name of data file:

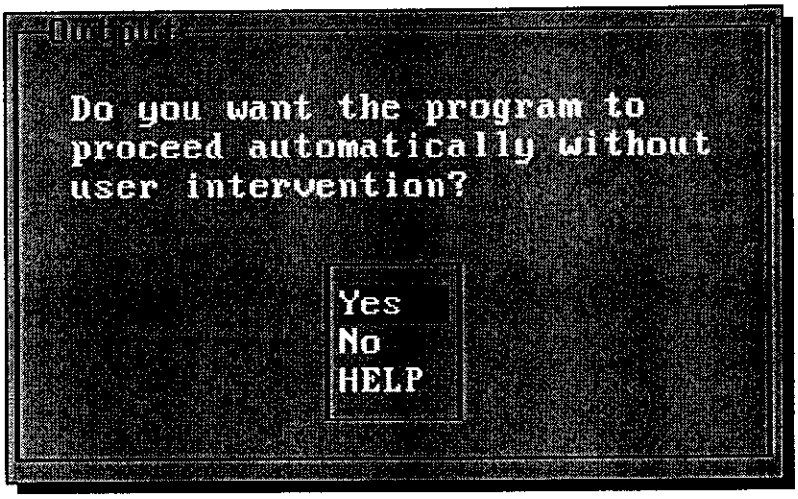
C5


Output
Do you want output to go to a file?
Yes
No

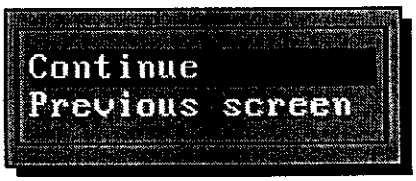
C6


Output
Enter name of output file:

C7


Output
Do you want the program to proceed automatically without user intervention?
Yes
No
HELP

C8


Continue
Previous screen