AUSRIVAS SOFTWARE USER MANUAL

AUSRIVAS
Australian River Assessment System

UNIVERSITY OF CANBERRA | CENTRE FOR APPLIED WATER SCIENCE

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Cover photo: Murrumbidgee River, April 2021. Photo by Lea Knight, Centre for Applied Water Science, Canberra.

Cover image: Plecoptera - Gripopterygidae and Trichoptera - Hydropsychidae. Photos by Lea Knight, Centre for Applied Water Science, Canberra.

ACKNOWLEDGEMENT OF COUNTRY

The Centre for Applied Water Science staff and students acknowledge the Indigenous people of the lands on which they live and work and express their respect for Elders past, present and emerging. We commit ourselves to working in partnership to care for Country including all lands and waters.

Contents

CHAPTER 1. INTRODUCTION

1.1 What is AUSRIVAS?

In response to the growing concern in Australia for maintaining ecological values, the National River Health Program (NRHP) was formed. A major component of the NRHP was the development of the Australian River Assessment System (AUSRIVAS) to fulfill the need for a nationally standardised method to assess the ecological condition of Australia's rivers. It is based on the River Invertebrate Prediction and Classification System (RIVPACS), which is used nationally in Britain.

AUSRIVAS is a standardised national system for assessment of river condition that uses benthic macroinvertebrates and includes standardised data analysis using sets of predictive models. AUSRIVAS provides a site-specific, biological assessment of river condition. AUSRIVAS consists of mathematical models that can be tailor made for use in different aquatic habitats and for different times of the year. These models predict the aquatic macroinvertebrate fauna expected to occur at a site in the absence of environmental stress, such as pollution or habitat degradation.

The AUSRIVAS approach offers several advantages over earlier assessment techniques and is an easy-to-use tool that provides easy-to-interpret biological assessment outputs. The sampling methods are standardised, easy to perform and require minimal equipment. Rapid turnaround of results is possible and the outputs from the AUSRIVAS models are tailored for a range of users including community groups, managers and ecologists. The outputs such as the Observed/Expected (O/E) scores are comparable all over Australia.

Sampling methods are standardised by States and/or Territories and all have collected the reference site data used to create the predictive models. Although standardised, a degree of regionalisation is needed to cover the range of stream types and climatic ranges experienced Australia wide. AUSRIVAS models have been developed for each State/Territory, for the main habitat types that can be found in Australian river systems. These habitats include the edge/backwater, main channel, riffle and pools. The models have been constructed from single season data and from several seasons combined to provide more robust predictions. When a new test site is sampled, it will be compared to the many reference sites that were used to create the predictive model. To date, the AUSRIVAS predictive system has been developed primarily for lotic environments. Future research and development of the AUSRIVAS system is aimed at widening its scope for use in estuarine and wetland environments.

1.2 What is the macroinvertebrate predictive modelling software?

The AUSRIVAS macroinvertebrate predictive modelling software implements the predictive modelling system described in Section 1.1. The user enters test site taxonomic and physical/chemical data into the software (see Sections 3.2 and 3.3). This information is used, along with model data located on a central server (see Section 1.3) to produce a variety of information about the condition of the test site. The outputs of the software are tabular data, ordered in 'sheets'. The sheets that provide information that can be used to assess the condition of a test site are:

1. Group probabilities
2. Taxa probabilities
3. Predicted/collected
4. Unused bugs

Detailed descriptions of these and other outputs from the software can be found in Chapter 5.

1.3 How the software uses the Internet

The AUSRIVAS Macroinvertebrate Predictive Modelling software requires Internet access in order to run a model. Model data is maintained at a central site and stored on a server at this site (currently at the eWater University of Canberra site). When an authorised user runs AUSRIVAS, the software connects to this central server to access the latest model information and uses this to produce an assessment of the condition of a test site.

If you do not have Internet access, you can still run the software and load previously saved data, but you won't be able to access information about the models and you won't be able to run a model.

There are two ways of running AUSRIVAS. You can work **off-line**, where the program does not access the Internet, or you can run AUSRIVAS over the **Internet**.

AUSRIVAS needs to access the Internet in order to:

- Run a model;
- Access information about models, such as required predictor variables and model bands.

If you run the AUSRIVAS Macroinvertebrate Predictive Modelling Software without an Internet connection, you can only load and view previously saved data. You cannot run a model or access model information in an off-line mode.

Further information

For information on how to set up AUSRIVAS to run over your Internet connection, see Section 2.3.

CHAPTER 2. GETTING STARTED

2.1 Gaining access to the models

To access AUSRIVAS models from the AUSRIVAS software package, you need to have a username and password.

There is a charge for creating an AUSRIVAS username and password to access the models. This charge is calculated on a *cost recovery basis* and covers the costs of creating your username and password only. The cost is $99 (50% discount for non-profit organisations), which you will be invoiced for after your AUSRIVAS account is created.

2.1.1 To get an AUSRIVAS account (currently via eWater Toolkit)

To run the AUSRIVAS predictive modelling software each user requires an eWater Toolkit membership (free). If you are not already a toolkit member, please go to: https://toolkit.ewater.org.au/member/CreateUser.asp to create an account.

Once you have successfully created an account you will be able to sign into the AUSRIVAS website https://ausrivas.ewater.org.au/ with your Toolkit username and password.

Request access to model groups

To run the AUSRIVAS predictive modelling software each user requires access to a model group. Access to models is restricted to eWater Toolkit members.

Once you signed into the AUSRIVAS website with your Toolkit username and password go to the **'My Models'** tab on the menu and under **'My Account'** request access to the model groups that you

require. Once your request is submitted it will be reviewed and sent to the designated AUSRIVAS technical team for approval. Your will also receive an invoice for payment.

You will be notified of your access to the requested model groups once payment is received and the AUSRIVAS technical team has confirmed your access (usually within 2 weeks). If you need your AUSRIVAS account sooner than this, please make sure the technical team knows this by contacting them directly at ausrivas@canberra.edu.au

Note: To approve access evidence of your AUSRIVAS training and experience (for that state) is required before approval can be granted. Please provide this information to accompany your model access request. If requesting access where you have not been trained and accredited in a particular State/Territory, you should provide accreditation documentation for other states and also demonstrate your understanding of the differences regarding sampling methods between each state.

Further information

If you need further information about obtaining AUSRIVAS software, please contact ausrivas@canberra.edu.au

2.1.2 Conditions of use

Please note that your AUSRIVAS username and password are confidential and are to be used by yourself only. New members of an organisation, including research staff and students, **must** obtain their own AUSRIVAS username and password.

Why can't I give my password to someone else to use?

The restrictions on the transferral of AUSRIVAS accounts has come about for two reasons:

1. **AUSRIVAS Training and accreditation.** At the workshop for the AUSRIVAS Training and Accreditation project, State and Territory representatives, along with Environment Australia and CRCFE representatives, decided that passwords would be issued to individual users, rather than to groups of users, as had previously been the case. It was also decided that State and Territory representatives would authorise account requests from their relevant State or Territory.
2. **AUSRIVAS mapping and reference site screening module.** The AUSRIVAS Mapping and Reference Site Screening Module, due for release in 2003, makes use of 3rd party data - the 1:250k streamline data from AUSLIG. In order to allow use of this module without all users needing to have an AUSLIG license for the 1:250k streamline data, we reached an agreement with AUSLIG, which defines several conditions. One of these conditions is that access to the maps produced with the streamline data is password protected, where each authorised individual is known and has a **non-transferable password**.

2.1.3 I don't have an AUSRIVAS account. Can I still use the software?

An AUSRIVAS username and password restricts access to AUSRIVAS models only. You cannot run data through an AUSRIVAS model if you don't have an AUSRIVAS account. However, you can make use of the software and utilise some of its functionality, as described below:

1. Download the AUSRIVAS software.
2. Run the AUSRIVAS Macroinvertebrate Predictive Modelling software and:
   - Load and view previously saved data;
   - Find out which models are available;

- Find out which predictor variables are used by a model;
- Edit, print and save loaded data.

3. Access the AUSRIVAS manuals.
4. Request help. See Chapter 9, or email ausrivas@canberra.edu.au.

2.2 Obtaining the software

The AUSRIVAS Macroinvertebrate Predictive Modelling software is available via download from the AUSRIVAS website. Go to: https://ausrivas.ewater.org.au/index.php/get-the-predictive-modelling-software

For information on how to use the AUSRIVAS program, refer to the AUSRIVAS Predictive Modelling manual at: https://ausrivas.ewater.org.au/index.php/manuals-a-datasheets

2.3 Configuring the software for Internet access

2.3.1 Running AUSRIVAS with or without Internet access.

There are two ways of running AUSRIVAS (called 'run options'). You can work off-line, where the program does not access the Internet, or you can run AUSRIVAS over the Internet (in on-line mode).

Running AUSRIVAS over the Internet (On-line mode).

AUSRIVAS needs to access the Internet in order to

- Run a model;
- Access information about models, such as required predictor variables and model bands.

You can access the Internet in two ways, either directly or through a proxy server. To find out which Internet access method you need to use, contact your local systems administrator. To access the Internet through a proxy server, you will need two pieces of information about your proxy server:

1. The name of your proxy server, and
2. The port your proxy server runs on.

If you access the Internet through a proxy server, you will need to know if your proxy server requires authentication. You can get this information from your systems administrator. If your proxy server does require authentication, you will need to know:

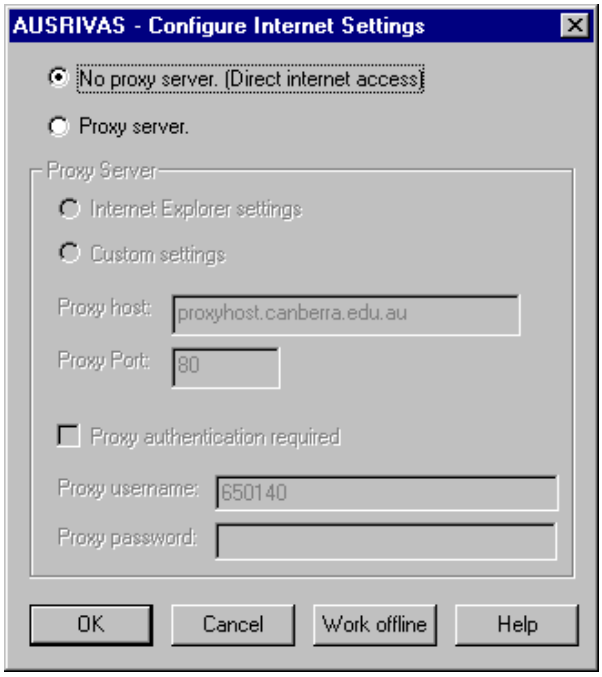
1. Your Internet username, and
2. Your Internet password.

Running AUSRIVAS off-line.

Alternately, you can choose to work off-line. In off-line mode, you can load and view previously saved data. You cannot run a model or access model information in off-line mode.

2.3.2 Selecting your run options

When you run the AUSRIVAS Predictive Modelling Software (see Section 3.1), a dialog box for setting up the software for Internet access will be shown:



To work *off-line*:

Click on the 'Work Offline' button at the bottom of the dialog.

To access the Internet *directly*:

Select the 'No proxy server' option and click on 'OK'.

To access the Internet through a *proxy server*:

Click on the 'Proxy server' option at the top of the dialog box. You now need to fill in your proxy server settings, as described in the next section.

2.3.3 Proxy server settings

If you want to run AUSRIVAS over the Internet through a proxy server, you need to provide AUSRIVAS with information about your proxy server. AUSRIVAS needs to know:

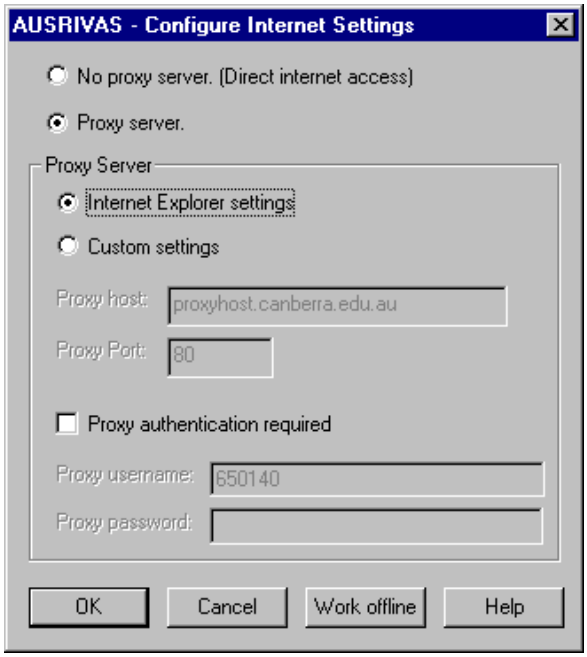
- The name of your proxy server, and
- The port your proxy server runs on.

The **name** of your proxy server is made up of a machine name followed by your Internet domain. For example, the proxy server at the University of Canberra is called `proxyhost.canberra.edu.au`.

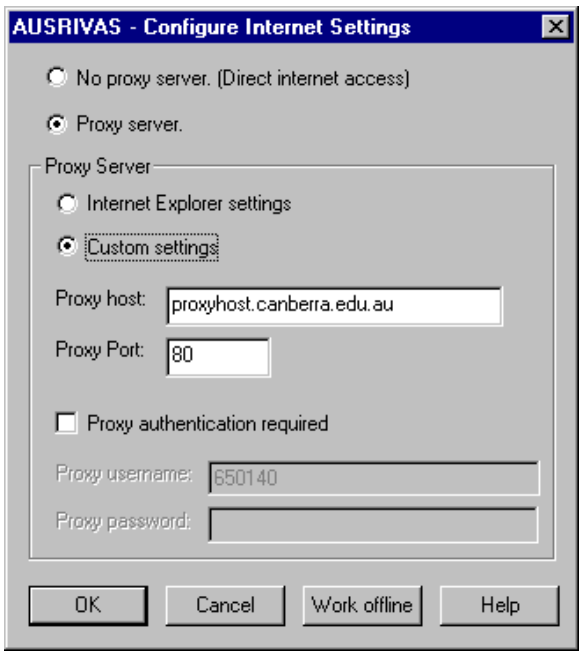
The **port** number your proxy server runs on is an integer. Many proxy servers run on port 80.

There are two ways you can provide AUSRIVAS with this information:

1. If you have previously set up your proxy server in Internet Explorer, you can select the 'Internet Explorer settings' option, and AUSRIVAS will get your proxy server settings from your saved Internet Explorer settings.



2. Alternately, you can enter the proxy name and port information yourself. To do this, select the 'Custom settings' option, and then type in your proxy server name in the 'Proxy host' text box, and your proxy server port number in the 'Proxy Port' text box.



If you do not need to provide proxy authentication details, you can now select 'OK' to run AUSRIVAS.

Note: If you haven't selected 'Custom settings', the proxy host and proxy port text boxes will be disabled. Your local Systems Administrator can tell you your proxy server name and port number.

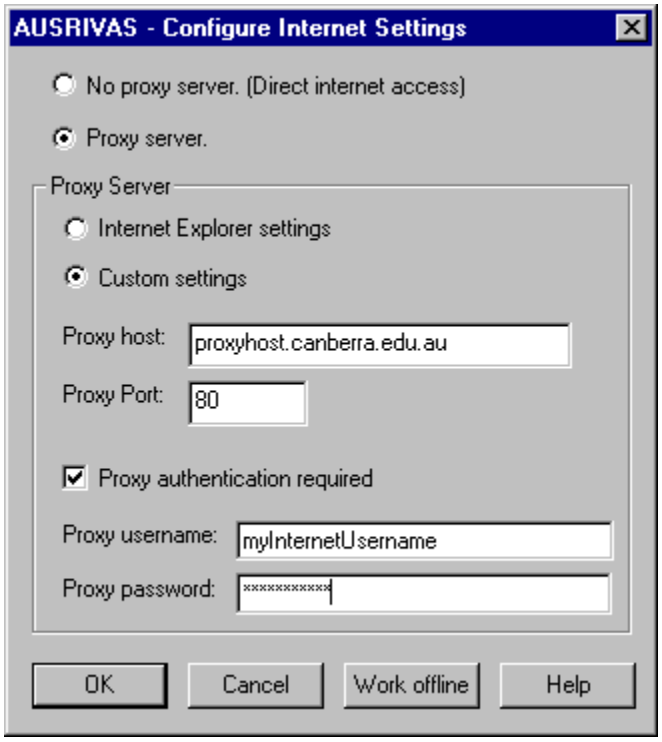
2.3.4 Proxy authentication

If your proxy server requires authentication (i.e. you enter a username/password to access the Internet), you will need to provide your proxy server username and password to AUSRIVAS.

To do this, check the 'Proxy authentication' check box, and type your proxy username and proxy password into the 'Proxy username' and 'Proxy password' text boxes.

When you have provided your Proxy Authentication details you can select 'OK' to run AUSRIVAS.

Note: If you haven't selected 'Custom settings', the proxy host and proxy port text boxes will be disabled. If you do not know what your proxy username and password are, or if you do not know if you need one, ask your local Systems Administrator.



2.3.5 Saving settings

When you click on 'OK', AUSRIVAS will save all of your proxy settings, except your proxy password, for use the next time you run AUSRIVAS.

2.3.6 Altering your Internet settings

You can change your Internet settings while you are running AUSRIVAS, by opening the 'Internet Settings' dialog from the 'Options/Proxy server settings ...' menu. You will also always be shown the 'Internet Settings' dialog each time you run the program in case you need to change your options.

Note: Once you have selected to run in either offline or online mode, you cannot change this while you are running the program. To go from offline to online mode or vice versa, you will need to quit the AUSRIVAS program and restart.

CHAPTER 3. USING THE AUSRIVAS SOFTWARE

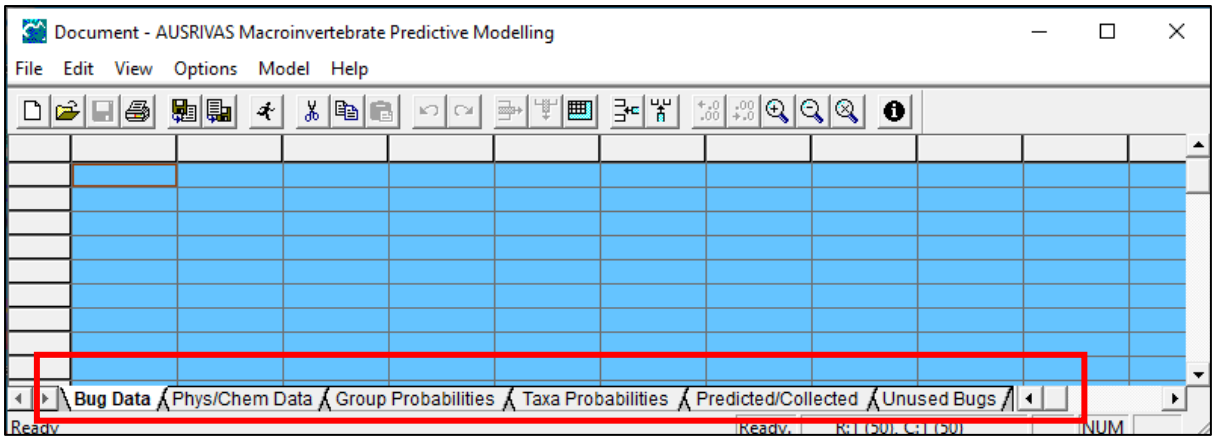
3.1 Starting the AUSRIVAS program

By double-clicking on the AUSRIVAS icon, (either in Explorer or on the Desktop if you have set up a shortcut) the AUSRIVAS program will open. It has a series of labelled overlying sheets with menus and a toolbar across the top of the page and a status indicator at the base.

The first sheet is for the entry of invertebrate data, the second sheet for entry of habitat data. The remaining sheets will contain various outputs from the model once it has been run. The complete list of data sheets is:

1. **'Bug Data'** This is where you enter your invertebrate data.
2. **'Phys/Chem Data'** - This is where you enter your predictor variables.
3. **'Group Probabilities'** - Shows group probabilities after a model has been run.
4. **'Taxon Probabilities'** - Shows taxon probabilities after a model has been run.
5. **'Predicted/Collected'** - Shows output statistics after a model has been run.
6. **'Unused Bugs'** - The taxa that were not used when the model was run are moved to this sheet.

The toolbar includes some standard Microsoft Windows menu items along with a few new ones for importing and exporting text format data.



3.2 Preparing data

AUSRIVAS requires the use of specific codes for the macroinvertebrate taxa and habitat variables. Family level taxonomic codes for macroinvertebrate taxa are available from the AUSRIVAS website: https://ausrivas.ewater.org.au/index.php/taxonomy, listed in alphabetical order by both codes and family name. Macroinvertebrate data may be entered as either totals or as presence/absence data, however, AUSRIVAS will convert all macroinvertebrate data to presence absence form for analysis when a model is run.

Note: To combine data for entry into a combined season model the habitat data should be averaged and the macroinvertebrate data summed for the same site sampled in both spring and autumn.

Which predictor variables do I need?

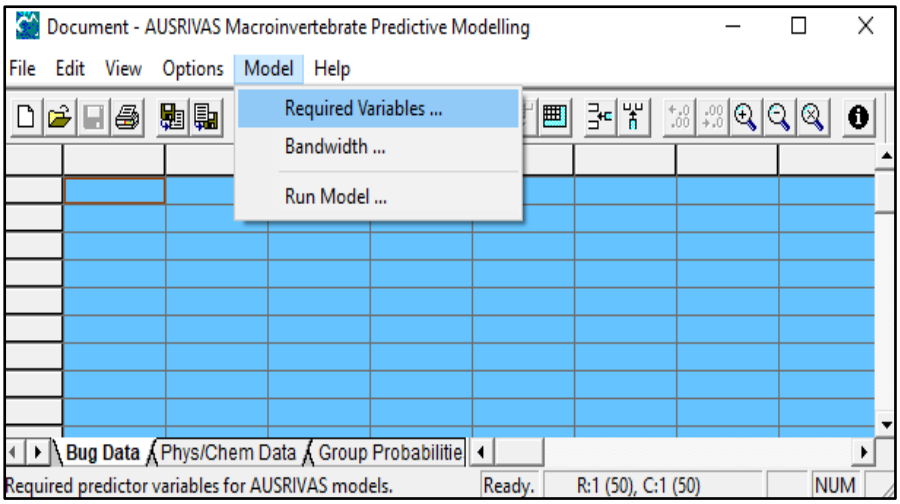
The predictor variables required may be different for each model. A list of the habitat variable codes required for each model can be obtained through the AUSRIVAS predictive modelling software, as described below.

Note: You must be running in online mode to access the list of habitat variables.
Note: You do not need to have a password to view the list of habitat variables.

Viewing required predictor variables

To open the list of required variables, first select the model you are interested in by following these steps.

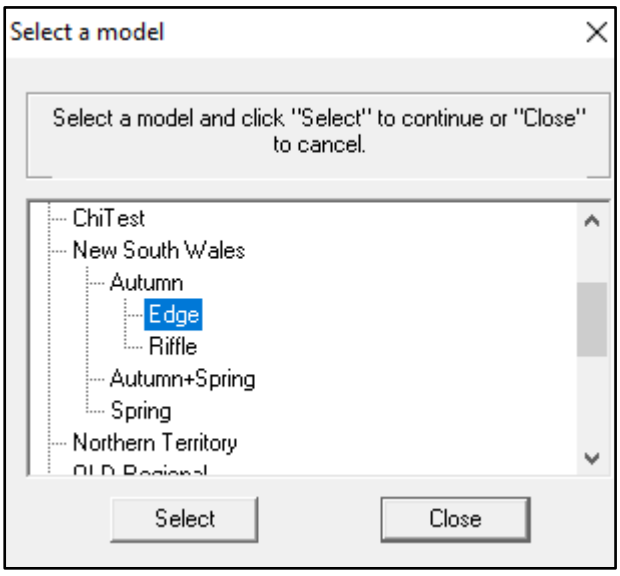
1. Open the **'Select a model'** dialog box by clicking on **'Required variables'** from the **'Model'** menu.



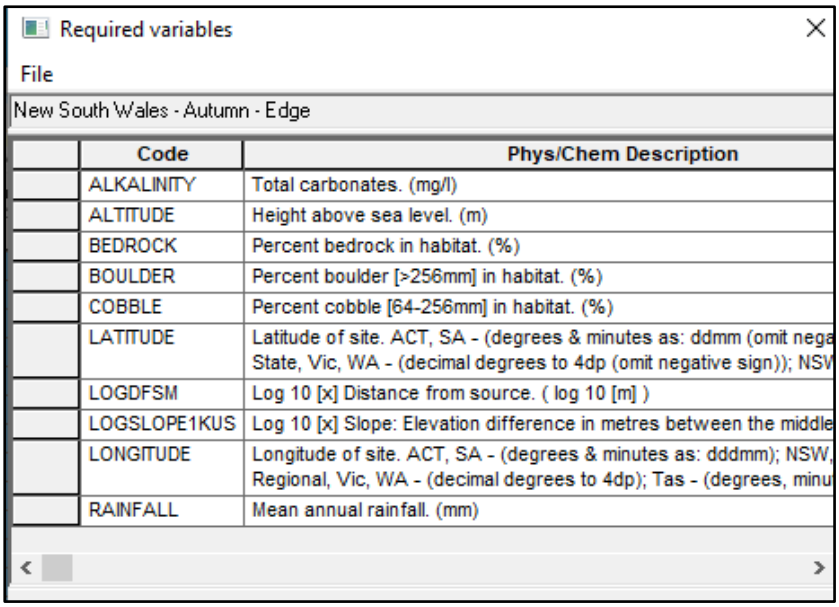
2. Double-click on the **region** for the model you are interested in. This will open up a list of seasons for that model.

3. Double-click on the **season** you want. A list of habitats will now be visible.

4. Finish the selection of your model by either double-clicking on the **habitat**, or selecting the habitat with a single mouse click, and hitting the **'Select'** button.



A **'Required variables'** dialog box will then open, which lists the model name, the variable code and a description of the required predictor variables for that model.



	Code	Phys/Chem Description
	ALKALINITY	Total carbonates. (mg/l)
	ALTITUDE	Height above sea level. (m)
	BEDROCK	Percent bedrock in habitat. (%)
	BOULDER	Percent boulder [>256mm] in habitat. (%)
	COBBLE	Percent cobble [64-256mm] in habitat. (%)
	LATITUDE	Latitude of site. ACT, SA - (degrees & minutes as: ddmm (omit nega State, Vic, WA - (decimal degrees to 4dp (omit negative sign)); NSW
	LOGDFSM	Log 10 [x] Distance from source. (log 10 [m])
	LOGSLOPE1KUS	Log 10 [x] Slope: Elevation difference in metres between the middle
	LONGITUDE	Longitude of site. ACT, SA - (degrees & minutes as: dddmm); NSW, Regional, Vic, WA - (decimal degrees to 4dp); Tas - (degrees, minu
	RAINFALL	Mean annual rainfall. (mm)

3.2.1 Further information

For more information on using the **'Required Variables'** dialog box, see Section 3.8.

3.3 Entering data

Data can be entered into AUSRIVAS either by importing it from another location or entering it directly.

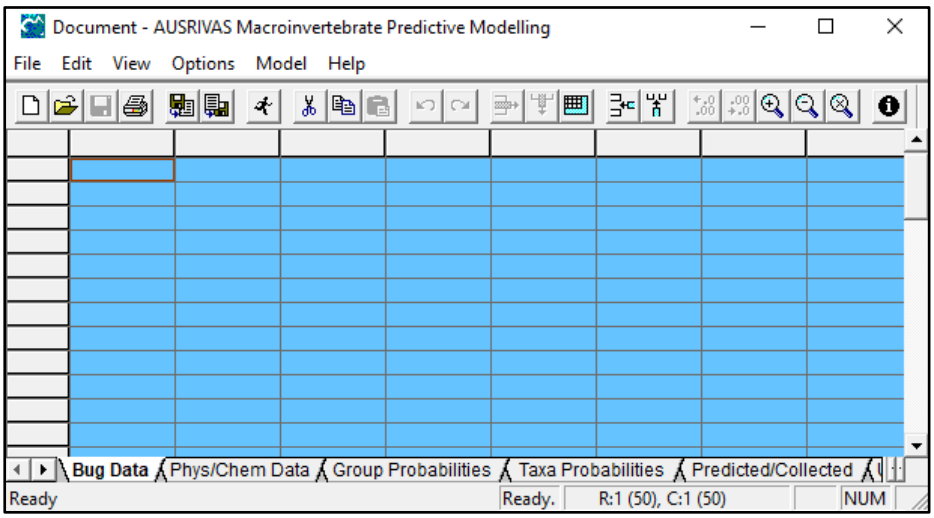
3.3.1 Importing data from another application

Invertebrate and habitat data files that are to be imported must be delimited text files. Any text delimiter can be used, but the most common are:

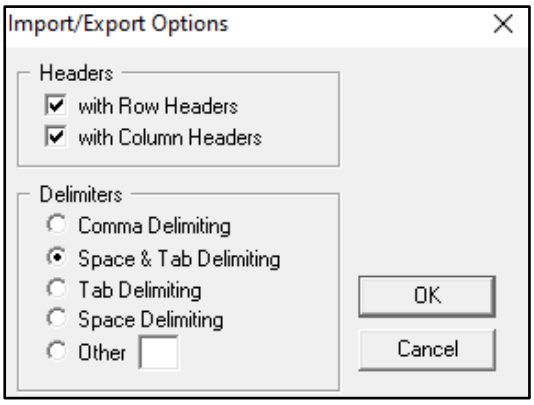
- Comma delimited (.csv files)
- Space and/or tab delimited (e.g. you can save an MS Excel spreadsheet as a *.txt file).

Importing invertebrate data

AUSRIVAS will automatically open on the **'Bug Data'** sheet.



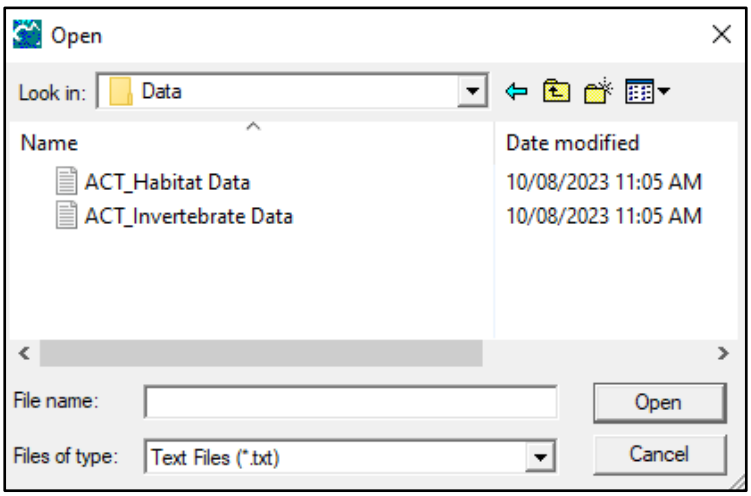
To import your macroinvertebrate data file, open the **'File'** menu and select **'Import'** or click on the import button on the toolbar  . An options box listing possible file formats and attributes will appear. If the first data item in each of the rows in your macroinvertebrate data file is the site code, select the **'with Row Headers'** option, and the site codes will be used as row headings in AUSRIVAS. The same applies to column headers. If the first row in your macroinvertebrate data file contains taxa codes, select the **'with Column Headers'** options and the taxa codes will be imported into your AUSRIVAS spreadsheet.



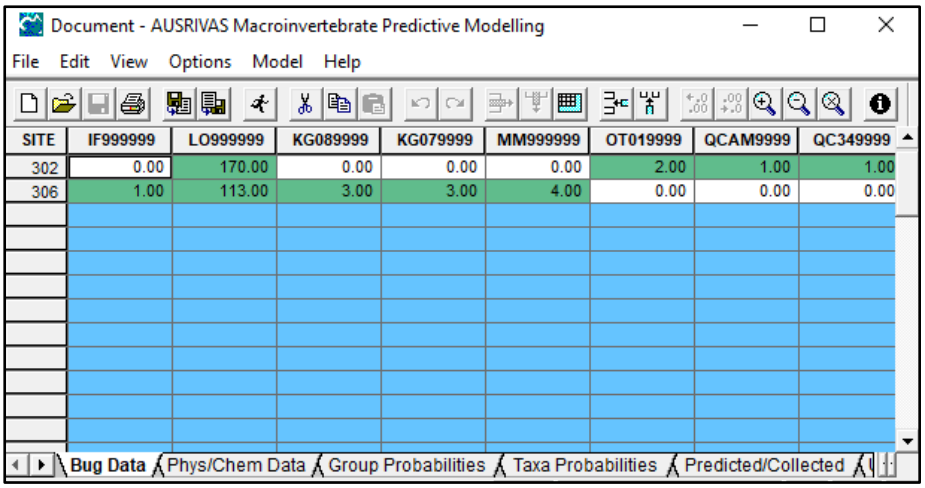
Now you need to let AUSRIVAS know about the format of your file. As discussed above, your file must be in a text-delimited format, so you just need to specify the delimiter used in your file. In the diagram above, the delimiter is specified as **'Space & Tab Delimiting'**. This means that the gaps between each data item in a row of data are made up of spaces and/or tabs.

You can separate your data with other delimiters if you wish. To specify that your data collection is a .csv file (separated with commas) the option **'Other'** is selected for delimiter type, and the delimiter itself (a comma) is entered into the text box beside the **'Other'** option.

When you have specified the type of delimiter in the text file you wish to import, click **'OK'**. A directory box will open allowing you to browse and select the file to be imported.

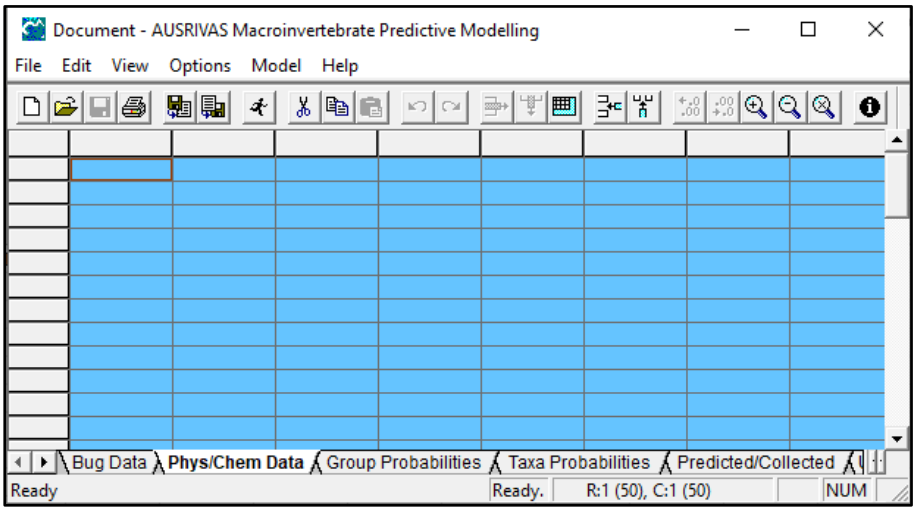


When you have selected your file, click **'Open'**, and your data will appear on the **'Bug Data'** sheet with taxa listed across the top, and site codes listed down the side (as shown below).



Importing Phys/Chem data

To import the file containing your physical and chemical data (predictor variables), click on the tab labelled **'Phys/Chem Data'** to make this sheet active.



The procedure is now the same as used for the macroinvertebrate data. Once the data are entered, both spreadsheets should be trimmed to ensure no blank rows or columns, using the 'delete blank rows and columns' button on the toolbar  .

Note: The 'trimming' procedure will also indicate any extraneous data in rows and columns, which will require deletion.

3.3.2 Entering data directly into AUSRIVAS

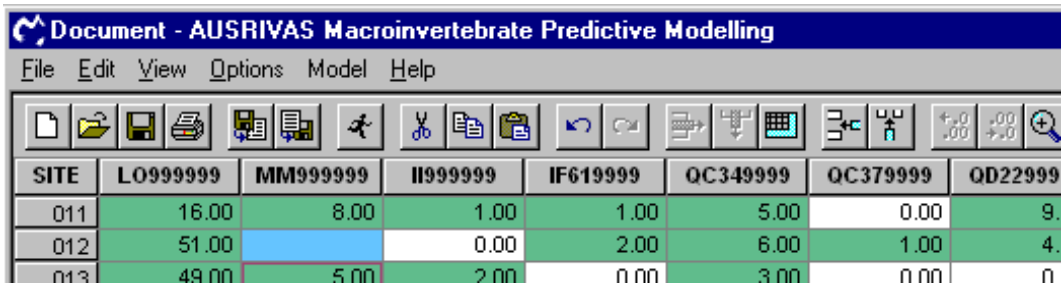
To enter the invertebrate codes and site codes into the **'Bug Data'** sheet, double click on the desired header box. A cursor will appear allowing the headers to be entered. To enter the data simply click on the desired cell. If at a later date you wish to modify an entry, a single click will allow replacing an entry while a double click will allow the entry to be modified. Once the invertebrate data has been entered click on the tab at the bottom of the screen for the **'Phys/Chem Data'** sheet. A blank sheet will open to enter the physical and chemical variables that are required to run the model. Again, once the data is entered, both spreadsheets should be trimmed to ensure no blank rows or columns, using the 'delete blank rows and columns' button on the toolbar  .

Note: Before proceeding to run the AUSRIVAS model you should save the AUSRIVAS file with your input data. If errors are encountered from this point on you can easily re-open the saved file and correct any errors, which may save you the time of importing the data again.

3.3.3 Checking your input data for errors

Invertebrate data

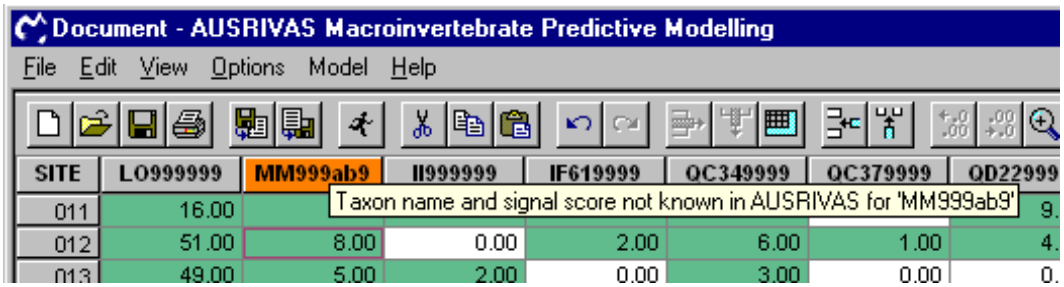
It is important that there are no blank cells, as a site assessment cannot be produced for sites with blank cells in the invertebrate data. AUSRIVAS will highlight any cells with blank data in blue (as shown below).



AUSRIVAS will also warn you when it does not recognise a taxon code. The causes of this will be either:

- **The taxon code is incorrect**. In this case check the list of valid invertebrate codes.
  Note: taxa codes and habitat variable names are case sensitive.
- **The taxon is not known to AUSRIVAS**. It is not necessary to delete the column if the taxon code is correct but simply not known to AUSRIVAS. Instead you are advised to retain the column and AUSRIVAS will move it to the '**Unused Bugs**' output sheet when running the model.

A warning message and orange highlight will occur when a taxon has an incorrect code and/or the models do not cover that taxon (as shown below).



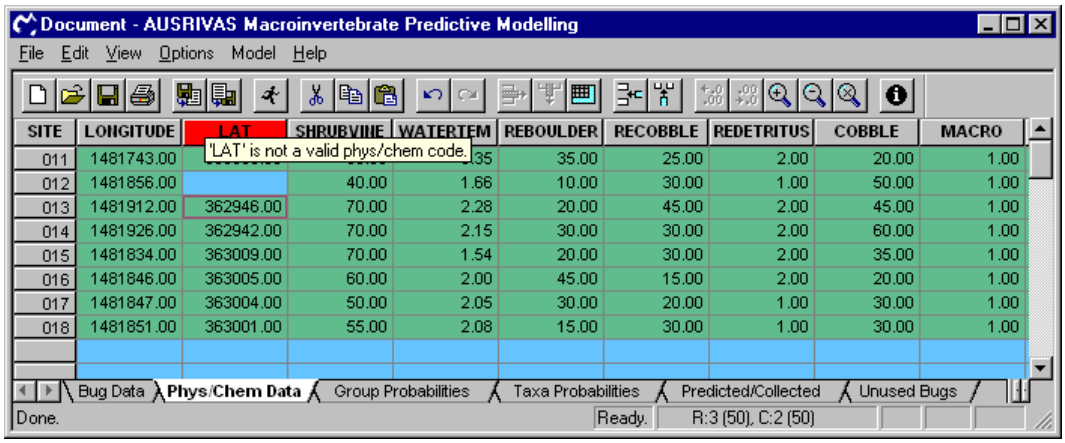
Predictor variables

As for the invertebrate data, it is important that there are **no blank cells**, as a site assessment cannot be produced for sites with blank cells in the predictor variable data.

If AUSRIVAS does not recognise a **predictor variable code**, it will highlight the variable code as an error. Note that this is different from the Invertebrate data, where only a warning is given and the model can still be run. If AUSRIVAS does not recognise a predictor variable code it cannot run the model.

AUSRIVAS may not recognise your predictor variable code if you have spelled the code incorrectly, or if the variable itself is not known to AUSRIVAS. When a predictor variable has an incorrect code or is not known by AUSRIVAS an error message and red highlight will occur (as shown below). In this

example, the variable 'LATITUDE' has been incorrectly called 'LAT' and the blue highlighting indicates a blank cell.



SITE	LONGITUDE	LAT	SHRUBVINE	WATERTEM	REBOULDER	RECOBBLE	REDETRITUS	COBBLE	MACRO
011	1481743.00			35	35.00	25.00	2.00	20.00	1.00
012	1481856.00		40.00	1.66	10.00	30.00	1.00	50.00	1.00
013	1481912.00	362946.00	70.00	2.28	20.00	45.00	2.00	45.00	1.00
014	1481926.00	362942.00	70.00	2.15	30.00	30.00	2.00	60.00	1.00
015	1481834.00	363009.00	70.00	1.54	20.00	30.00	2.00	35.00	1.00
016	1481846.00	363005.00	60.00	2.00	45.00	15.00	2.00	20.00	1.00
017	1481847.00	363004.00	50.00	2.05	30.00	20.00	1.00	30.00	1.00
018	1481851.00	363001.00	55.00	2.08	15.00	30.00	1.00	30.00	1.00

If you have an unknown predictor variable code in your data, it **must** be removed or rectified before running a model.

3.3.4 Removing/editing data

If you want to change your data because of an error or warning, you can do so by either:

- Editing and re-importing the original data file, or
- Entering the correct values directly into the **'Bug Data'** or **'Phys/Chem Data'** sheets.

Deleting a data column

To delete a data column, click in the header box of that column and the column will be highlighted. Next click on the **'Edit'** menu and select **'Remove Column'** and the selected column will be deleted.

Care should be taken when removing taxa that any taxa required by the model are not deleted. If you do omit taxa that are required by the model, a dialog box that appears after running a model will identify any missing taxa and habitat variables.

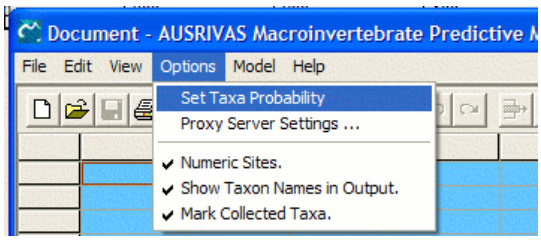
3.4 Setting options

3.4.1 Taxa probability

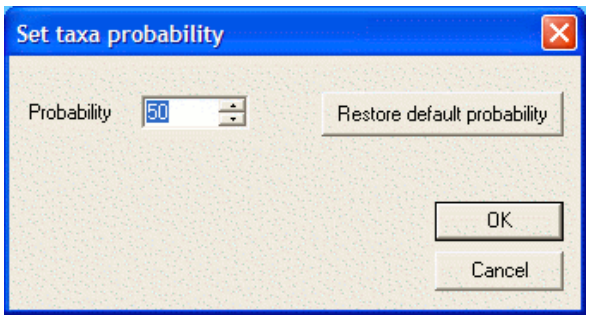
The O/E x score, where x is a probability between 0 and 100, is derived using only taxa that were calculated to have a probability of x% or greater of occurring at a test site. Thus an O/E 0 score considers all predicted taxa regardless of their probability of occurrence, while an O/E 99 score considers only taxa that had a 100% chance of occurring at a test site.

The use of a probability cut-off enables users to exclude rare taxa and thus affect the precision and sensitivity of an AUSRIVAS model. The default cut-off is 50%. This be modified to set the cut-off in a range from anywhere between 0 and 100, allowing you to decide on the level of precision and sensitivity you want from your model.

To set the probability cut-off, go to **'Set Taxa Probability'** in the **'Options'** menu (as shown below).



This will open the 'Set taxa probability' dialog box (as shown below). To change the default probability cut-off, type the probability (an integer between 0 and 100) into the edit box and click **'OK'** to save your changes, or **'Cancel'** to retain previous settings.



To restore the default probability, click on the **'Restore default probability'** button.

3.5 Choosing a model

3.5.1 Which model do I use?

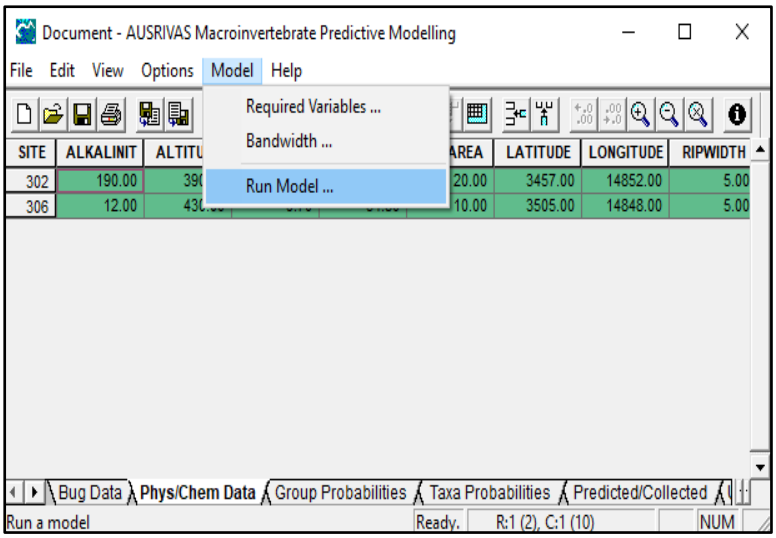
For each State/Territory a minimum choice of 6 models is available; 2 habitats and 2 seasons, plus a combined seasons model for each habitat. Where and how the test site data were collected will determine the model required to provide a site assessment. Test data can only be run though a model created for the same state, territory or region your data has been collected in, and it must have been collected using the same methods (please refer to the relevant sampling and processing manual available at: https://ausrivas.ewater.org.au/index.php/manuals-a-datasheets, as this will affect the results obtained.

For example, a test site sampled in the ACT according to territory protocols could not be assessed using a NSW model, as macroinvertebrate sample processing for ACT models is done in a laboratory, whereas NSW models use a field live-pick protocol. Habitat predictor variables are also likely to be measured differently in different states and territories, which will also affect the results obtained. Similarly, the habitat sampled will affect the biota collected, therefore a riffle model can only be used to assess data collected in a riffle habitat in the same region, sampled in the same way as the data used to create the model.

When selecting a season, use the seasonal model closest to the season your test site was sampled in (check the appropriate State/Territory sampling manual for definition of sampling seasons). However, if both an autumn and spring sample of a test site are available, it is preferable to combine the data and choose the combined **Autumn+Spring** season model, ensuring the taxa list for the test site is maximised.

3.5.2 Selecting and running a model in the program

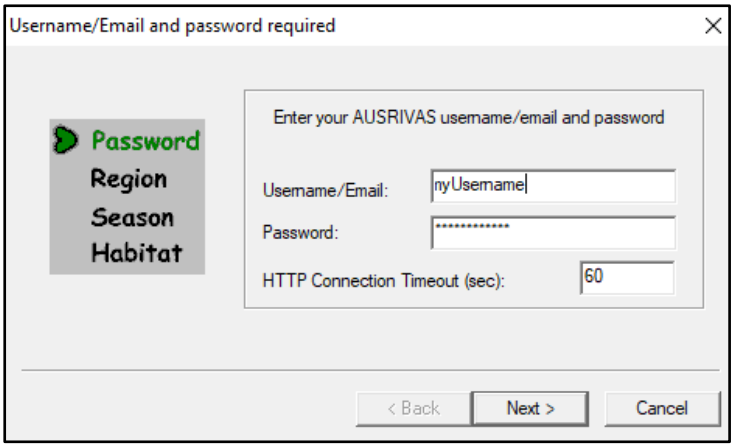
To select and run a model once data entry is complete, click on the **'Run Model'** option under the **'Model'** menu or click on the 'run model' button on the toolbar  .



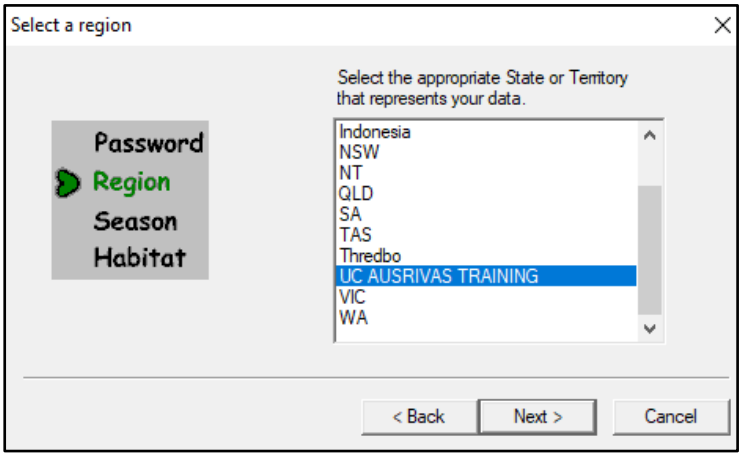
A **'wizard'** will now appear. This lets you (in order):

1. Enter your AUSRIVAS **username** and **password**,
2. Select the **region** your data were sampled in,
3. Select the **season** your data were sampled in, and
4. Select the **habitat** your data were sampled from.

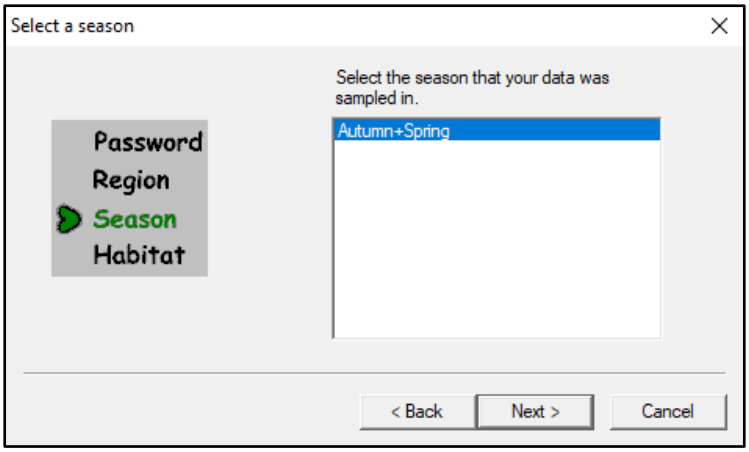
To run a model using this wizard, first enter your AUSRIVAS username and password and click **'Next'**.



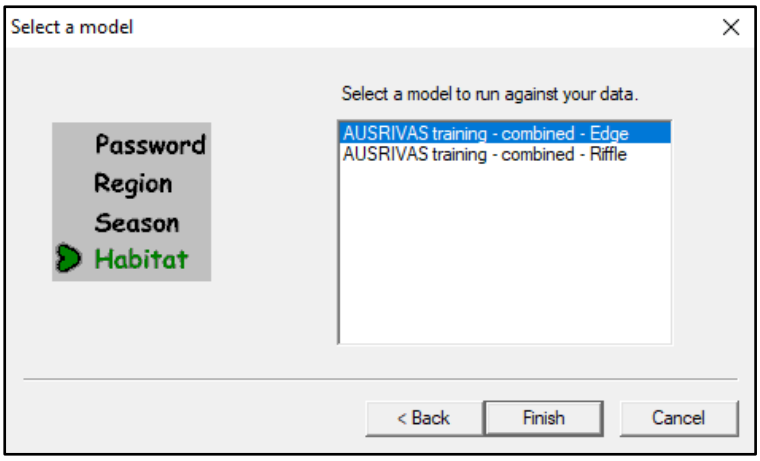
Then select the State/Territory or region your test sites were sampled in and click **'Next'.**



Now select the season(s) your test sites were sampled in and click **'Next'.**



Finally, select the habitat sampled at your test sites and click **'Finish'**. AUSRIVAS is now running your chosen model.



Note: If you do not have an AUSRIVAS username and password available via the eWater Toolkit, please contact ausrivas@canberra.edu.au for assistance.

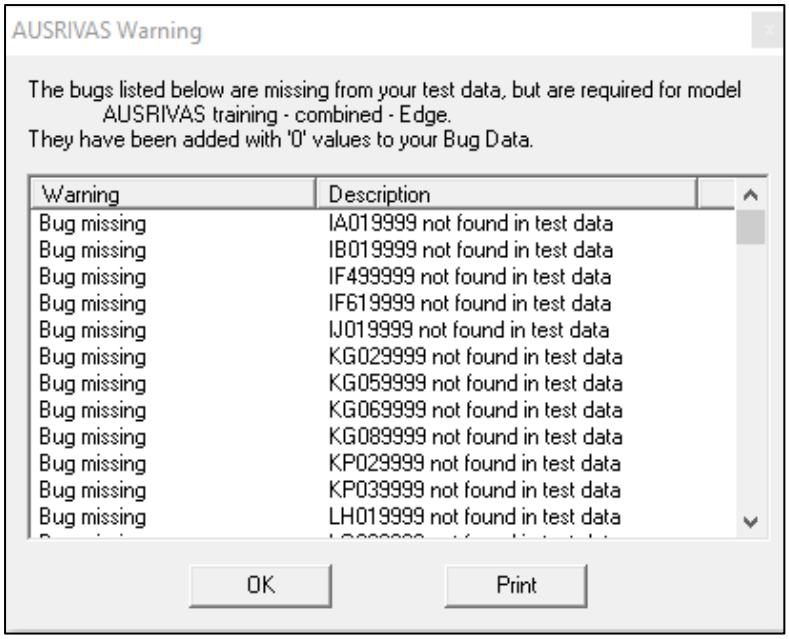
3.6 AUSRIVAS is running

The first step AUSRIVAS will perform is validating your data. Typical errors encountered at this stage may include missing data, incorrect invertebrate codes, misspelled habitat variable names, missing some required invertebrate taxon codes and missing predictor variables. If AUSRIVAS detects any errors in the variable names or in the data, the program will stop and the list of detected errors will appear. A more detailed explanation of some typical errors and the resulting windows follows.

3.6.1 Errors/warnings in input data

Warning - missing taxa

A window similar to the following will appear if your bug data set does not contain all the taxa codes required by a particular model. Your data set may not contain certain taxa because they were not collected, in this case AUSRIVAS will add them (with zero values) to your data set before running the model, and will inform you in a 'warning' dialog (as shown below).

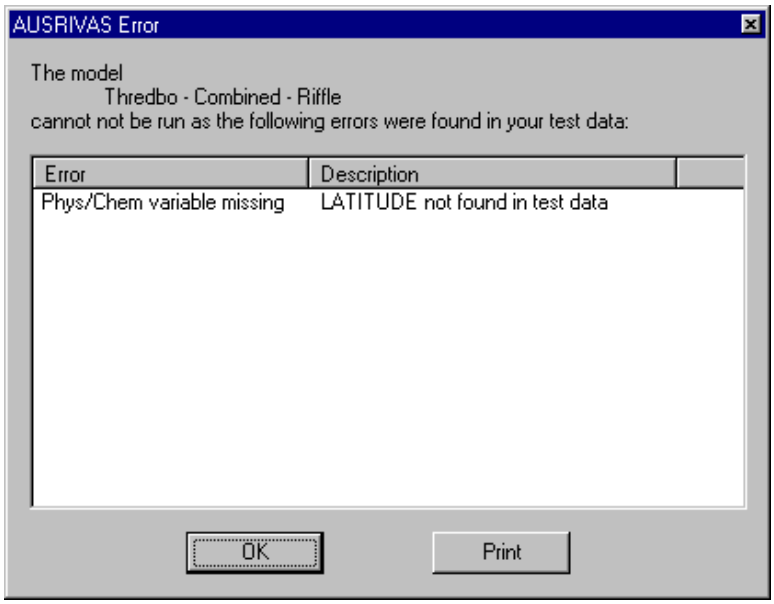


Note: While you have the above window in view, print out the list of missing taxa and check that they are indeed missing from your dataset, not simply coded incorrectly. Note that coding problems may arise where taxonomic name changes have occurred since construction of the models. For example, many Odonata families have now been subdivided into several families since constructing some models; in cases like this the previous family name will need to be used. So be on the watch and check for this type of error.

Error - missing predictor variable

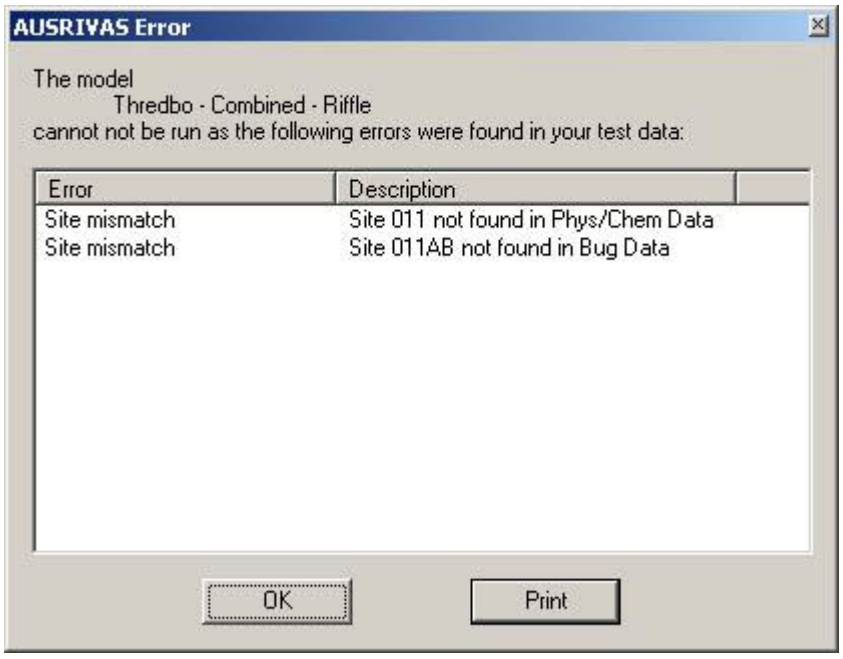
If a predictor variable required by a model is missing, the model cannot run and you will get an error dialog similar to that shown below. A predictor variable can be deemed 'missing' if you have omitted it from your data set, or if you have spelled the variable name incorrectly. Changing the (correct) spelling of the 'LATITUDE' variable to 'LAT' generated the example below.

A list of the required predictor variables for each model can be obtained via the **'Required Variables'** option in the **'Model'** menu. More information on this is given in Section 3.3.



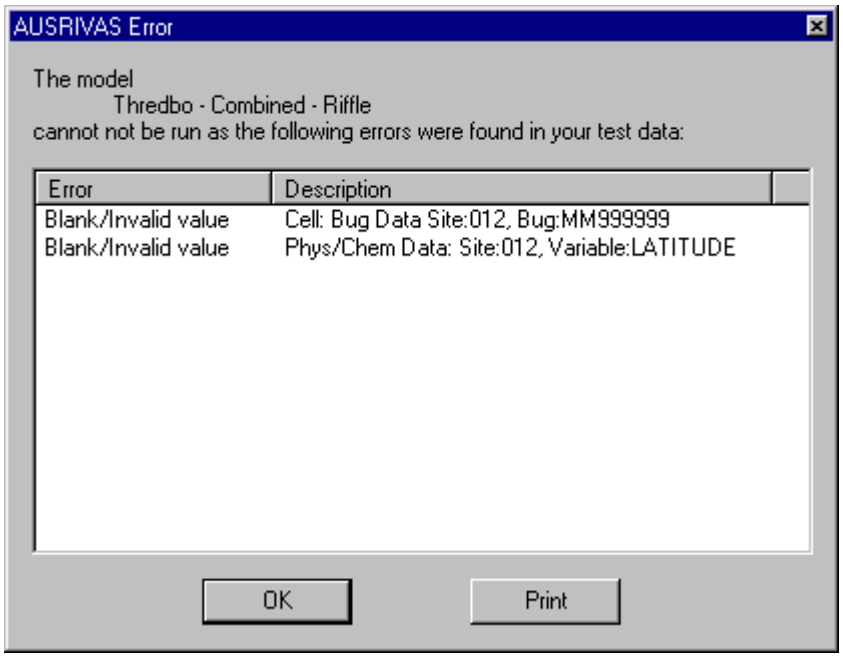
Error - site mismatch

If the site codes listed in the Bug Data file do not match exactly those in the Phys/Chem data file a window similar to the following will appear explaining the error.



Error - blank data cells

It is important that there are no blank cells, as a site assessment cannot be produced for sites with blank cells in either the macroinvertebrate data or the predictor variables. AUSRIVAS highlights any cells with blank data in the input data sheets in blue. If data is not inserted in these blank cells before a model is run, you will get an error as shown below. The error description tells you in which sheet (**'Bug Data'**) and which row (**Site 012**) and column (**MM999999**) the blank/invalid cell occurs.

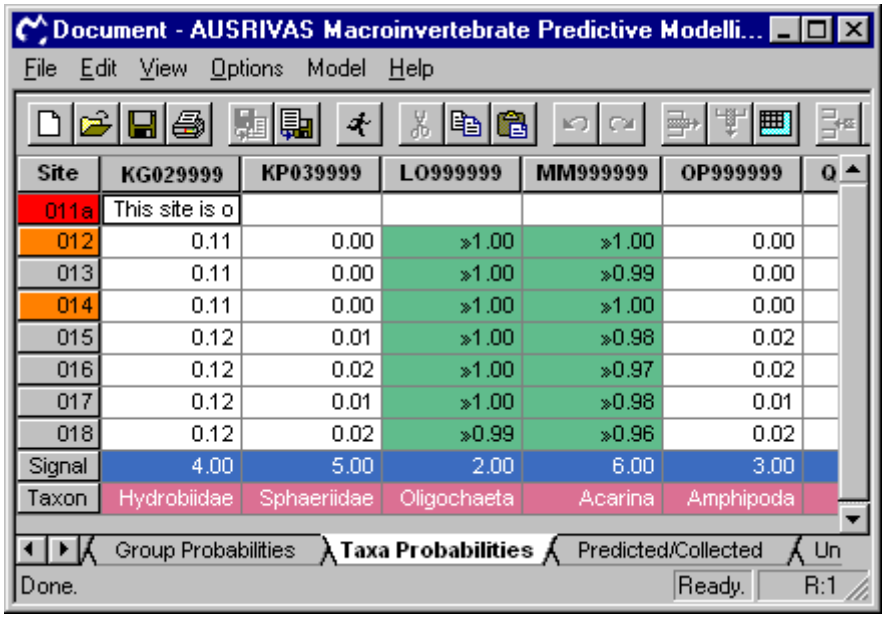


3.6.2 Is your data within the experience of the model?

Once the errors in the input data have been corrected the model can be restarted. If your data then pass the validation checks AUSRIVAS will proceed to the predictive calculations.

AUSRIVAS will now check if the test data are within the experience of the model you have chosen. That is, are there suitable reference sites with which your test sites can be compared? Your test sites may appear to be outside the experience of the model if;

- The wrong model for the season of sampling was chosen (or two seasonal data sets were combined incorrectly for a combined season model, which will result in incorrect values for the predictor variables),
- Incorrect values (e.g. incorrect units of measurement used) have been entered for the predictor variables or,
- It may be that the model has no suitable reference sites with which to compare the test data, AUSRIVAS will provide a warning (as shown below).



In the example above, **Site 011a** is highlighted red and the text beside the site code reads *'This site is outside the experience of the model (Chi2 0.001)'* and no output is provided for that site. **Site 012** and **Site 014** are highlighted orange and when the curser is placed over the site code a text box appears with the words *'Warning: This site is nearly outside the experience of the model (Chi2 0.01)'*. For these sites an output is provided but interpretation should proceed with caution because the site data is nearing the limitations of the model. Chi^2 0.001 and 0.001 relate to the Chi squared test performed on the data. For further information on the Chi squared test, refer to Chapter 7.

Note: If your site is unexpectedly outside the experience of the model, check the Phys/Chem input data for errors, such as:

- Typographic errors,
- Incorrect units of measurement used for predictor variables,
- Incorrect format used for LATITUDE or LONGITUDE predictor variables.

Note: Each time a model is run the **existing data in the spreadsheet should be cleared** to ensure that this data does not remain when new data are run through the model. There are several ways to **clear data**:

1. Select the entire spreadsheet by clicking in the top left corner of the spreadsheet and then select **'Clear'** from the **'Edit'** menu.
2. Click on the new icon in the toolbar.
3. Select 'New' from the 'File' menu.

3.7 Saving AUSRIVAS outputs

3.7.1 Exporting data sheets

Each of the AUSRIVAS output sheets can be exported separately as a text file by selecting the desired sheet and using the **'Export'** function in the **'File'** menu or the 'export' button on the toolbar . A box will appear listing format options for the exported text file. Select the desired option and click **'OK'**. A box enabling you to name the text file and save it to a specified directory will then appear. Name the file, select a directory and click **'Save'** to complete exporting.

When you export a datasheet, you get a delimited text file only. All non-text information in the data sheets such as colours and pop-up information will be lost. You can import your exported files into other programs, such as spreadsheets, that recognise delimited text formats.

3.7.2 Saving a document

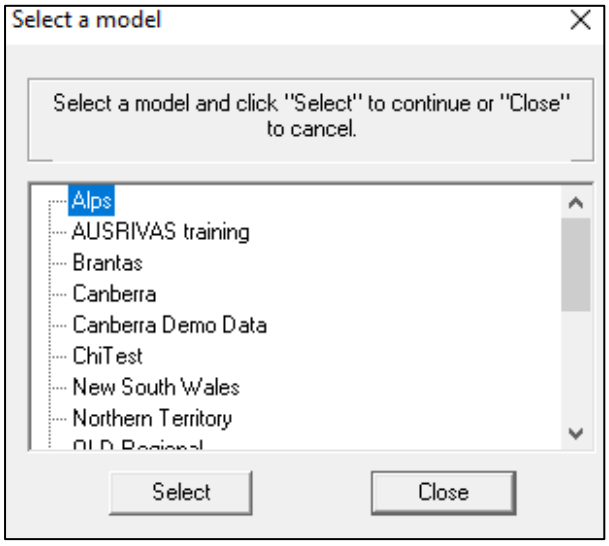
The whole document (all of the data and output sheets) can also be saved as an AUSRIVAS file, which has the file extension '.AUS'. In this case the file is saved in a binary, rather than a text, format and it contains all of the information you see when you run the software. A file saved in this format can only be opened again using the AUSRIVAS software. To save an .AUS file either use the **'Save As'** option under the **'File'** menu or click on the 'save' button in the toolbar .

This file can then be viewed at a later date by choosing **'Open'** from the **'File'** menu or clicking on the 'open' button in the toolbar .

3.8. Working with dialogs

3.8.1 Model select dialog

When you select the menu items to view either the model **'Required Variables'**, or **'Bandwidths'** you will firstly be presented with the **'Model Select'** dialog box to choose the model you want information on (as shown below).

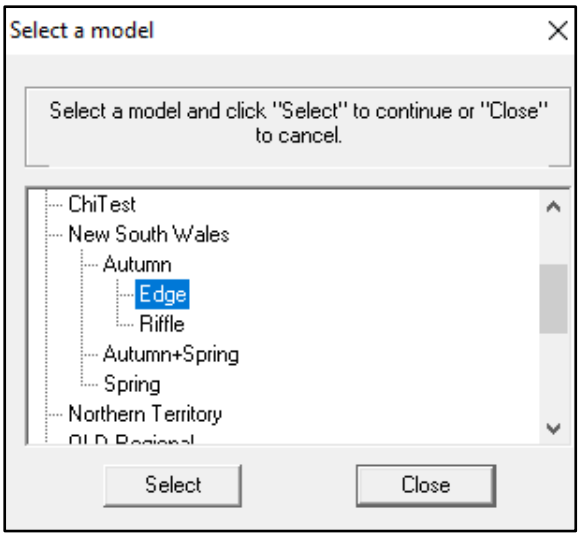


Follow the steps below to select a model.

1. Double-click on the **region** for the model you are interested in. This will open up a list of seasons for that model.

2. Double-click on the **season** you want. A list of habitats will now be visible.

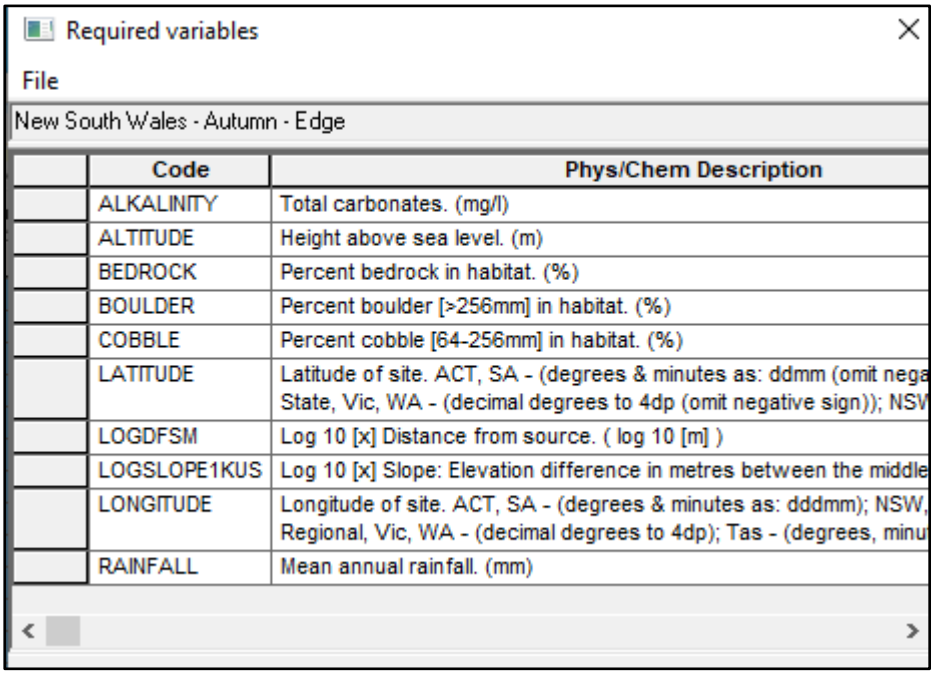
3. Finish the selection of your model by either double-clicking on the **habitat**, or selecting the habitat with a single mouse click, and hitting the **'Select'** button.



3.8.2 Required variables dialog

The **'Required Variables'** dialog box can be opened from the **'Model'** menu. When you have selected the model you are interested in, the **'Required variables'** dialog box will open for the model you have chosen (see below). This dialog box lists the:

- Model name,
- Variable codes for that models' required variables, and
- A description of the variables.



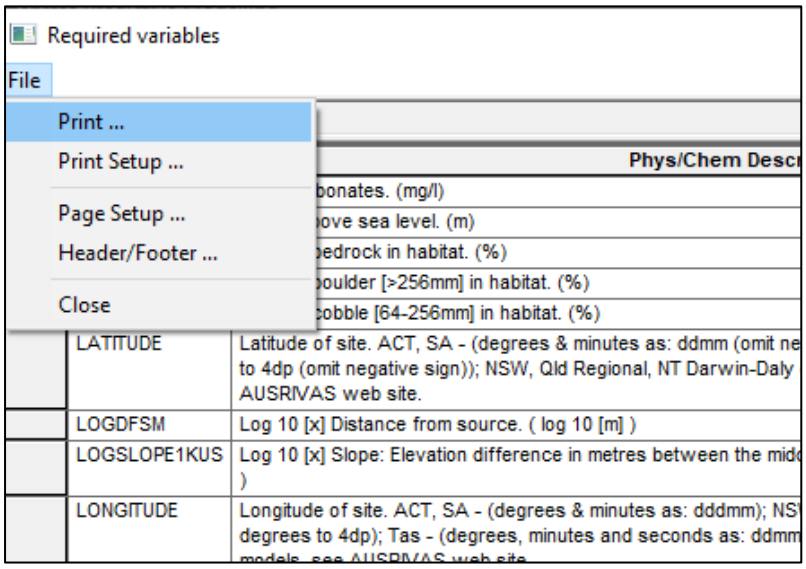
Code	Phys/Chem Description
ALKALINITY	Total carbonates. (mg/l)
ALTITUDE	Height above sea level. (m)
BEDROCK	Percent bedrock in habitat. (%)
BOULDER	Percent boulder [>256mm] in habitat. (%)
COBBLE	Percent cobble [64-256mm] in habitat. (%)
LATITUDE	Latitude of site. ACT, SA - (degrees & minutes as: ddmm (omit nega State, Vic, WA - (decimal degrees to 4dp (omit negative sign)); NSW
LOGDFSM	Log 10 [x] Distance from source. (log 10 [m])
LOGSLOPE1KUS	Log 10 [x] Slope: Elevation difference in metres between the middle
LONGITUDE	Longitude of site. ACT, SA - (degrees & minutes as: dddmm); NSW, Regional, Vic, WA - (decimal degrees to 4dp); Tas - (degrees, minu
RAINFALL	Mean annual rainfall. (mm)

Viewing data

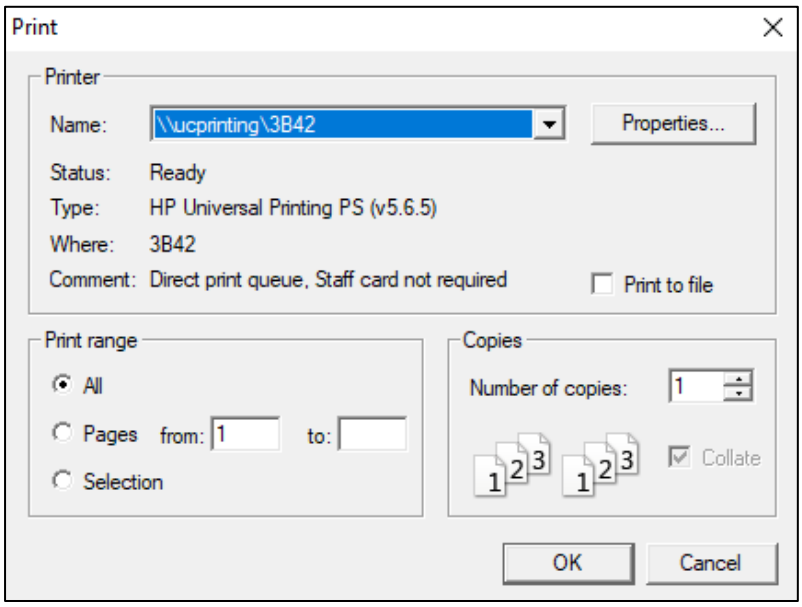
The **'Required variables'** dialog box is **scrollable** and **resizable**, so you can either scroll to view items that do not fit in the dialog, or you can make the dialog box bigger.

Printing

You can print data shown in the **'Required variables'** dialog box. Select **'Print'** from the **'File'** menu:

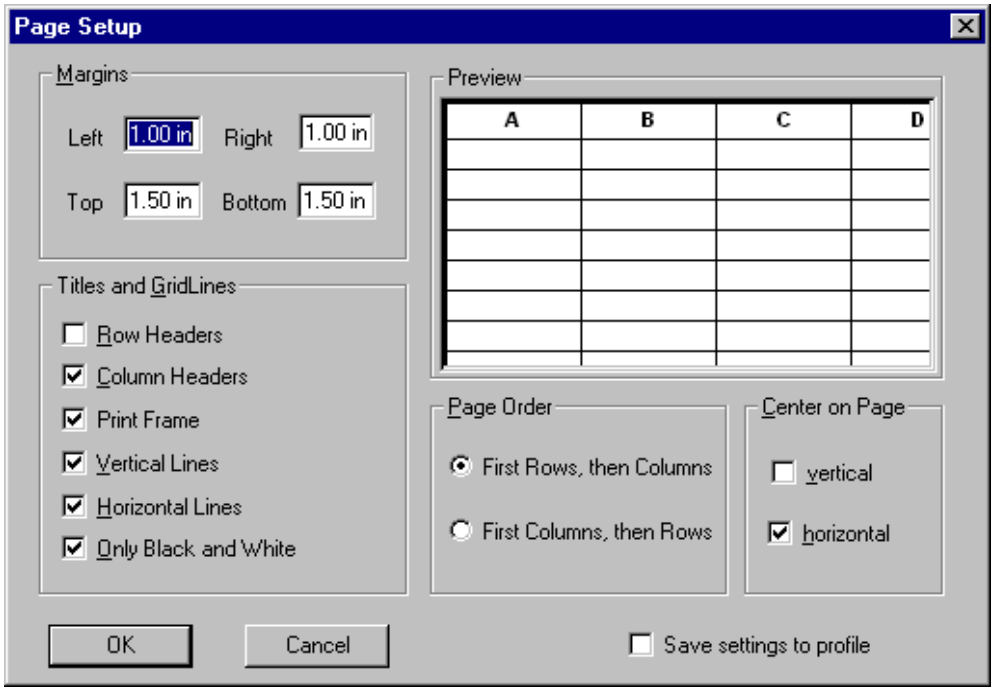


A standard format **'Print'** dialog box will open, as shown below, which allows you to select your printer, set printer properties, and print to either a printer or to file.



Page setup

You can control various aspects of how the required variables data is printed to the page using the **'Page Setup'** dialog box (as shown below). You will usually want to print column headings but omit row headings (as these are blank in the dialog) and may want to set margins and choose whether to draw grid-lines or not.

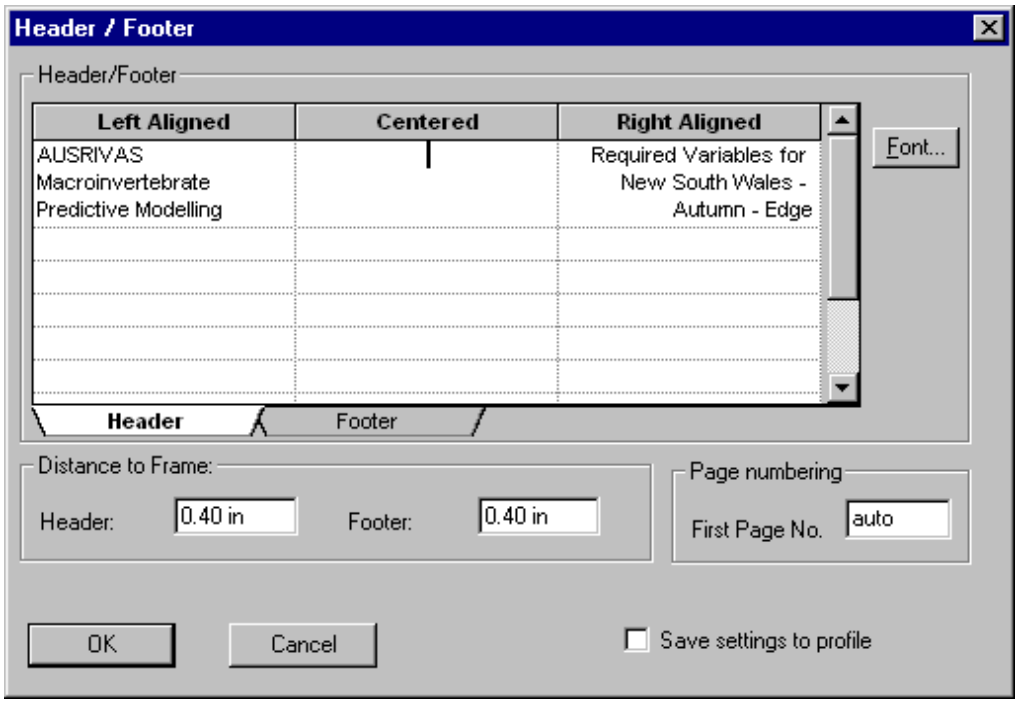


Note: To save your **'Page Setup'** settings, so that they are used by default whenever you run AUSRIVAS, tick the **'Save settings to profile'** box.

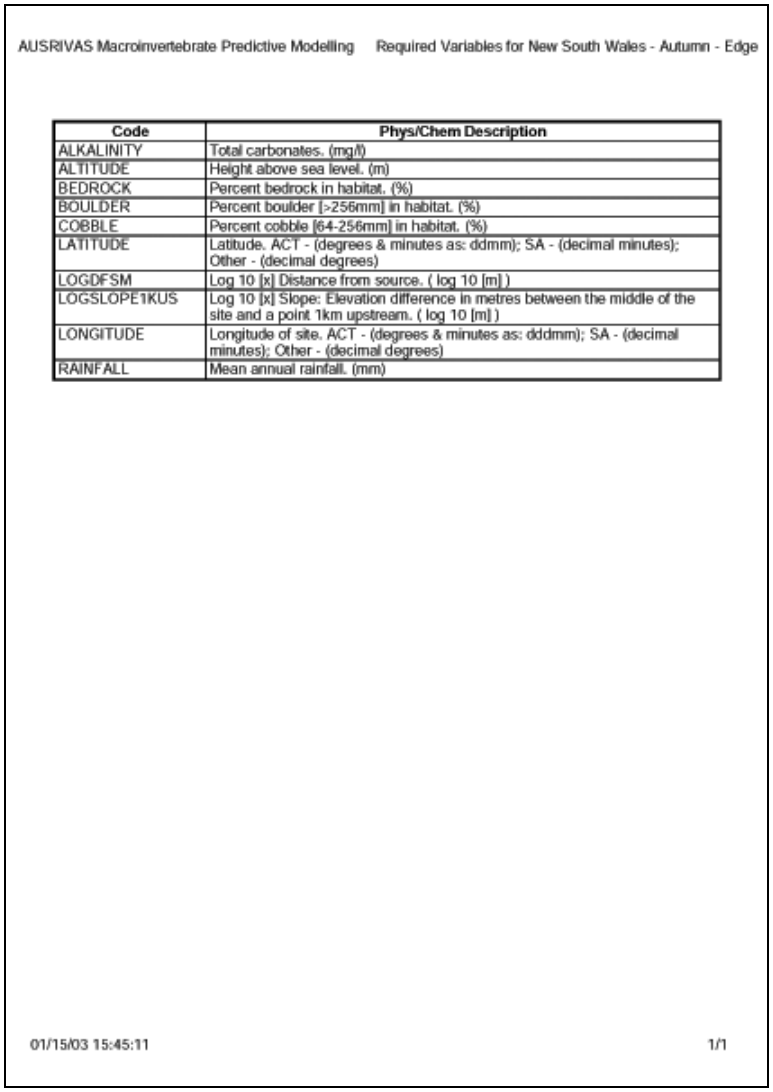
Header and Footer setup

You can also control the information that is displayed in the header and footer of your output, by using the **'Header / footer' dialog**, available from the 'File' menu (pictured below).

The AUSRIVAS program will provide you with a default header and footer, so you only need to change settings if you want to alter the default. The settings that AUSRIVAS provides in the **header** are program name and model name, as shown in the dialog pictured below. The **footer** contains the date and the page number in the 'Page n of N' format.



A sample printed output from the 'Required Variables' dialog is shown below.



AUSRIVAS Macroinvertebrate Predictive Modelling Required Variables for New South Wales - Autumn - Edge

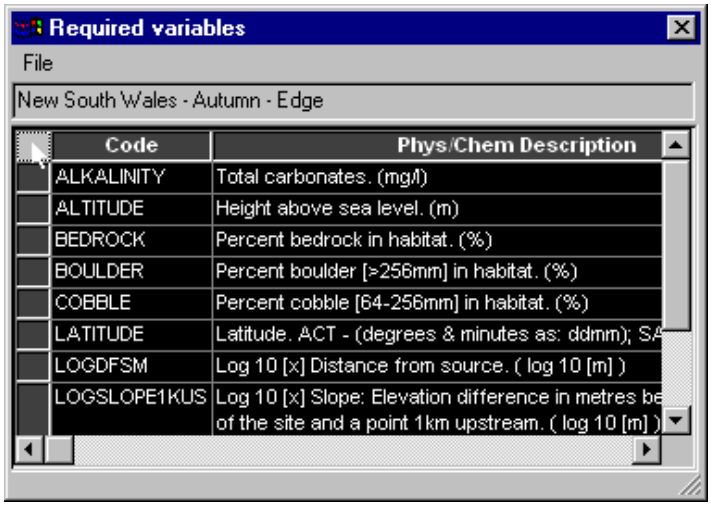
Code	Phys/Chem Description
ALKALINITY	Total carbonates. (mg/l)
ALTITUDE	Height above sea level. (m)
BEDROCK	Percent bedrock in habitat. (%)
BOULDER	Percent boulder [>256mm] in habitat. (%)
COBBLE	Percent cobble [64-256mm] in habitat. (%)
LATITUDE	Latitude. ACT - (degrees & minutes as: ddmm); SA - (decimal minutes); Other - (decimal degrees)
LOGDFSM	Log 10 [x] Distance from source. (log 10 [m])
LOGSLOPE1KUS	Log 10 [x] Slope: Elevation difference in metres between the middle of the site and a point 1km upstream. (log 10 [m])
LONGITUDE	Longitude of site. ACT - (degrees & minutes as: dddmm); SA - (decimal minutes); Other - (decimal degrees)
RAINFALL	Mean annual rainfall. (mm)

01/15/03 15:45:11 1/1

Saving/exporting

You cannot save the information in the 'Required Variables' dialog directly from the dialog. You can however copy and paste the data into another application, such as a spreadsheet, where it can then be saved or exported into another format.

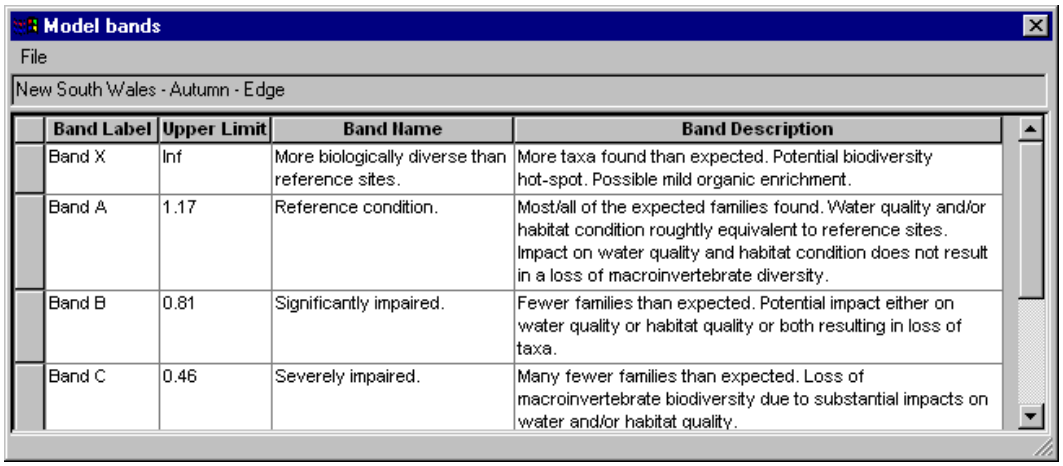
Note: To select all the cells in the dialog box, click on the top left-hand cell (as shown below).



3.8.3 Model bands dialog

The **'Model Bands'** dialog box can be opened from the **'Model/Bandwidth'** menu. When you have selected the model you are interested in, the **'Model bands'** dialog box will open for the model you have chosen. This dialog lists the:

- Model name,
- Band label,
- Band upper limit,
- Band name, and
- Band description.



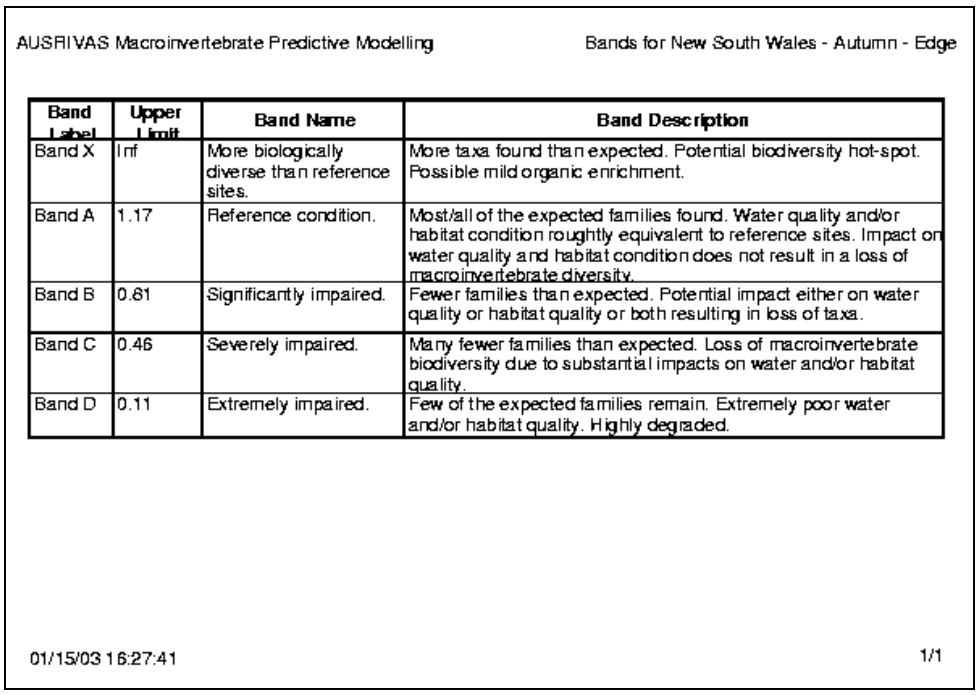
Band Label	Upper Limit	Band Name	Band Description
Band X	Inf	More biologically diverse than reference sites.	More taxa found than expected. Potential biodiversity hot-spot. Possible mild organic enrichment.
Band A	1.17	Reference condition.	Most/all of the expected families found. Water quality and/or habitat condition roughtly equivalent to reference sites. Impact on water quality and habitat condition does not result in a loss of macroinvertebrate diversity.
Band B	0.81	Significantly impaired.	Fewer families than expected. Potential impact either on water quality or habitat quality or both resulting in loss of taxa.
Band C	0.46	Severely impaired.	Many fewer families than expected. Loss of macroinvertebrate biodiversity due to substantial impacts on water and/or habitat quality.

Viewing data

The **'Model Bands'** dialog box is **scrollable** and **resizable**, so you can either scroll to view items that do not fit in the dialog, or you can make the dialog bigger.

Printing

You can print data shown in the **'Model Bands'** dialogs, using the same method for the **'Required Variables'** dialog box, described above.



AUSRIVAS Macroinvertebrate Predictive Modelling — Bands for New South Wales - Autumn - Edge

Band Label	Upper Limit	Band Name	Band Description
Band X	Inf	More biologically diverse than reference sites.	More taxa found than expected. Potential biodiversity hot-spot. Possible mild organic enrichment.
Band A	1.17	Reference condition.	Most/all of the expected families found. Water quality and/or habitat condition roughtly equivalent to reference sites. Impact on water quality and habitat condition does not result in a loss of macroinvertebrate diversity.
Band B	0.81	Significantly impaired.	Fewer families than expected. Potential impact either on water quality or habitat quality or both resulting in loss of taxa.
Band C	0.46	Severely impaired.	Many fewer families than expected. Loss of macroinvertebrate biodiversity due to substantial impacts on water and/or habitat quality.
Band D	0.11	Extremely impaired.	Few of the expected families remain. Extremely poor water and/or habitat quality. Highly degraded.

01/15/03 16:27:41 — 1/1

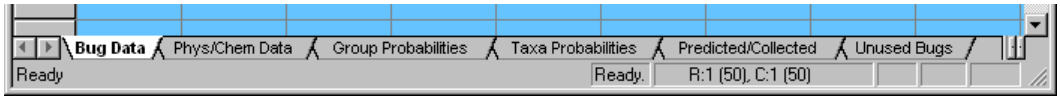
Saving/exporting

The method used for saving and exporting is the same as for the **'Required variables'** dialog box, described above.

CHAPTER 4. AUSRIVAS OUTPUTS

4.1 Introduction

The AUSRIVAS predictive system produces a variety of information about the condition of a test site. Not all the output produced will be of interest to all users because some output may be too technical or have little relevance for the intended level of reporting. For this reason, the AUSRIVAS output is structured so that users can extract only the level of information required. First, the probability of group membership for your test sites will be calculated. Next, the individual taxon probabilities of occurrence at each test site will be calculated. These results are then used to produce the observed to expected taxa scores and also observed to expected scores for the SIGNAL index. The outputs of these steps are presented on separate sheets that are opened by clicking the name tab at the bottom of each sheet.



AUSRIVAS may also modify your input data if necessary.

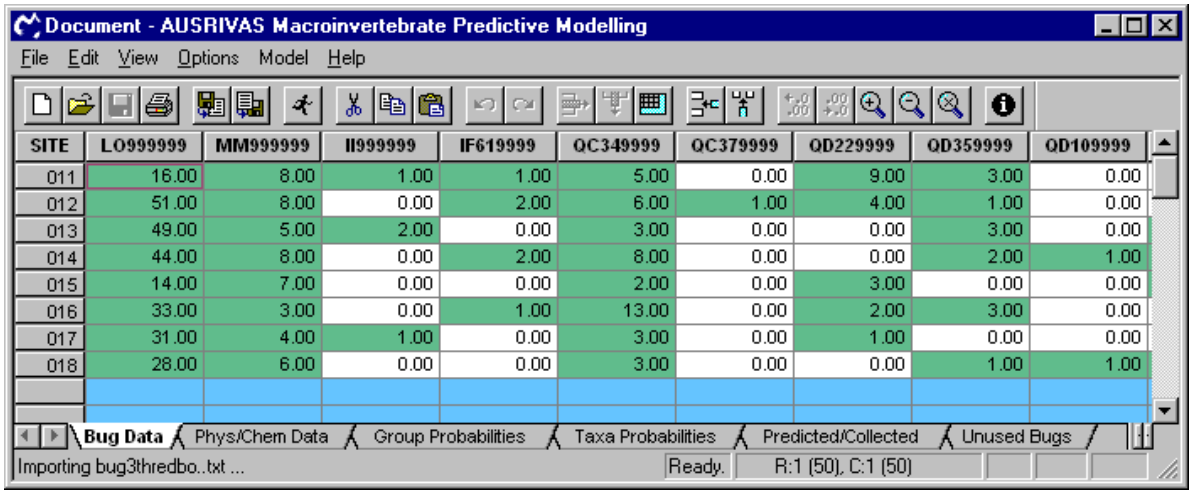
Each of these datasheets is explained further in the following sections.

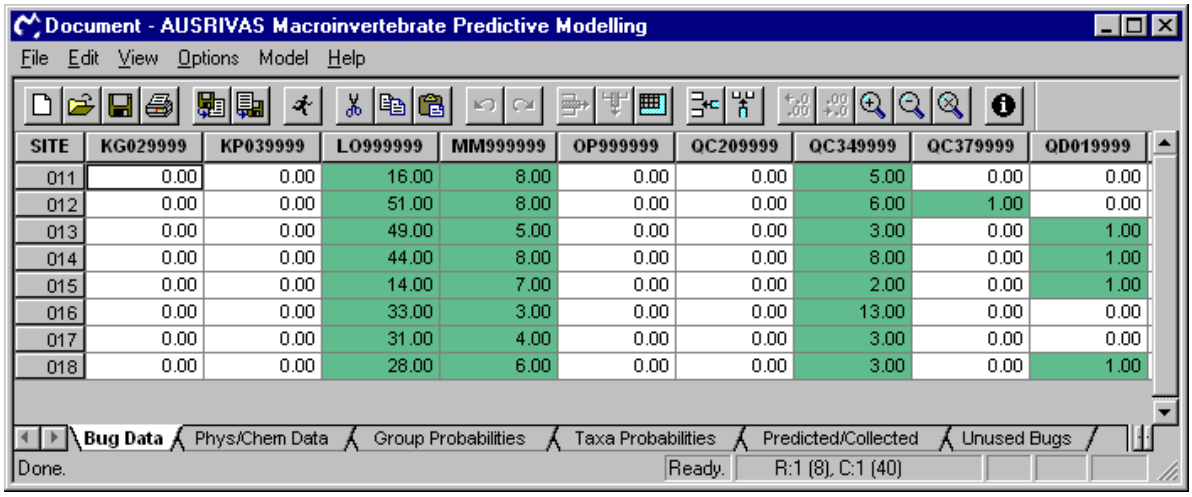
4.2 Input data sheets

4.2.1 Invertebrate data sheet

Missing taxa added

After running the model, you may see on the bug data sheet that the invertebrate data has been modified where necessary to contain all taxa codes required by the model. These added taxa all have a value of 0.0 indicating absence of the taxa. The screen shots below show the 'Bug Data' datasheet before running the model, and then after running the model where missing taxa such as **KG029999** have been added.



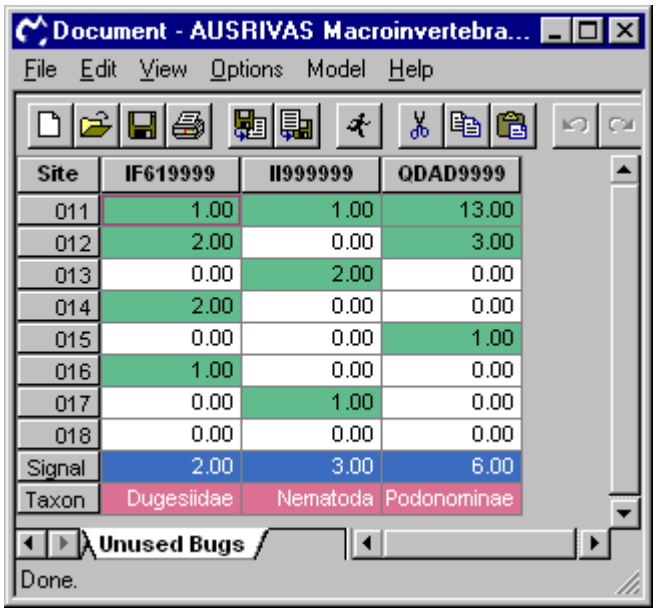


SITE	KG029999	KP039999	LO999999	MM999999	OP999999	QC209999	QC349999	QC379999	QD019999
011	0.00	0.00	16.00	8.00	0.00	0.00	5.00	0.00	0.00
012	0.00	0.00	51.00	8.00	0.00	0.00	6.00	1.00	0.00
013	0.00	0.00	49.00	5.00	0.00	0.00	3.00	0.00	1.00
014	0.00	0.00	44.00	8.00	0.00	0.00	8.00	0.00	1.00
015	0.00	0.00	14.00	7.00	0.00	0.00	2.00	0.00	1.00
016	0.00	0.00	33.00	3.00	0.00	0.00	13.00	0.00	0.00
017	0.00	0.00	31.00	4.00	0.00	0.00	3.00	0.00	0.00
018	0.00	0.00	28.00	6.00	0.00	0.00	3.00	0.00	1.00

Unused taxa moved to 'Unused Bugs' datasheet

After the model has run, any taxa in your bug data file that were not required by the model have now been moved to the 'Unused Bugs' datasheet.

Note: these taxa will no longer exist in the 'Bug Data' datasheet.



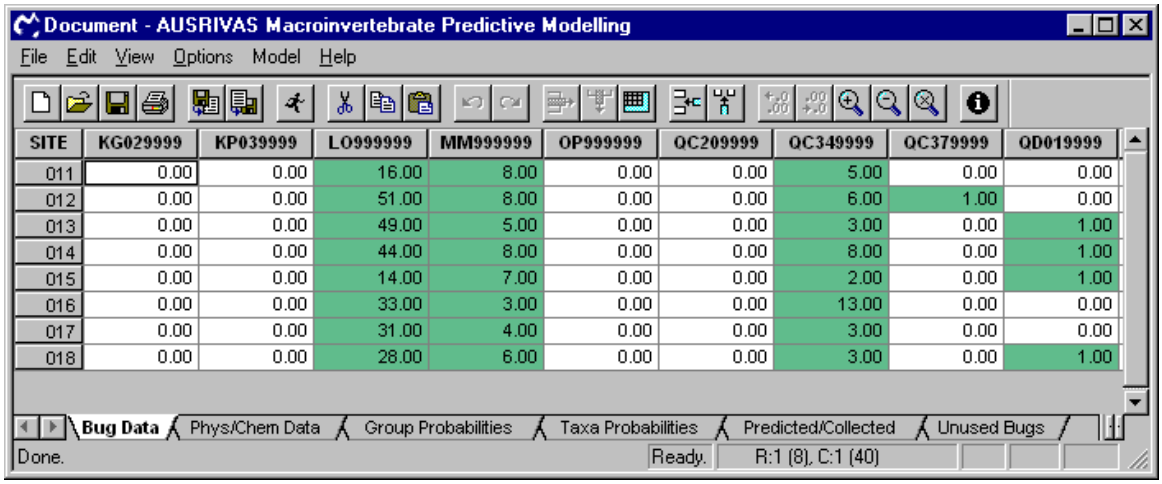
Site	IF619999	II999999	QDAD9999
011	1.00	1.00	13.00
012	2.00	0.00	3.00
013	0.00	2.00	0.00
014	2.00	0.00	0.00
015	0.00	0.00	1.00
016	1.00	0.00	0.00
017	0.00	1.00	0.00
018	0.00	0.00	0.00
Signal	2.00	3.00	6.00
Taxon	Dugesiidae	Nematoda	Podonominae

Data ordered

After you have run a model, your macroinvertebrate data will be ordered alphabetically by taxon names. An example below (in Section 5.2.2) shows the 'Phys/Chem' datasheet before and after a model has been run.

Presence/absence highlighting

You will see on the 'Bug Data' datasheet that all macroinvertebrate data are colour coded, with presences highlighted in green and absences highlighted in white. This highlighting is actually done when you enter data rather than after the model is run but is included here for completeness.

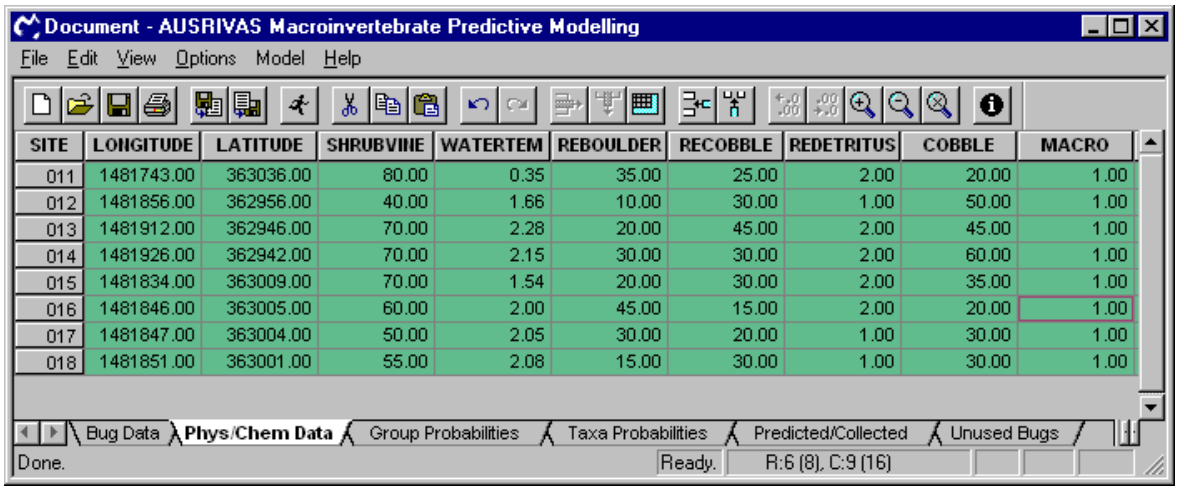


SITE	KG029999	KP039999	LO999999	MM999999	OP999999	QC209999	QC349999	QC379999	QD019999
011	0.00	0.00	16.00	8.00	0.00	0.00	5.00	0.00	0.00
012	0.00	0.00	51.00	8.00	0.00	0.00	6.00	1.00	0.00
013	0.00	0.00	49.00	5.00	0.00	0.00	3.00	0.00	1.00
014	0.00	0.00	44.00	8.00	0.00	0.00	8.00	0.00	1.00
015	0.00	0.00	14.00	7.00	0.00	0.00	2.00	0.00	1.00
016	0.00	0.00	33.00	3.00	0.00	0.00	13.00	0.00	0.00
017	0.00	0.00	31.00	4.00	0.00	0.00	3.00	0.00	0.00
018	0.00	0.00	28.00	6.00	0.00	0.00	3.00	0.00	1.00

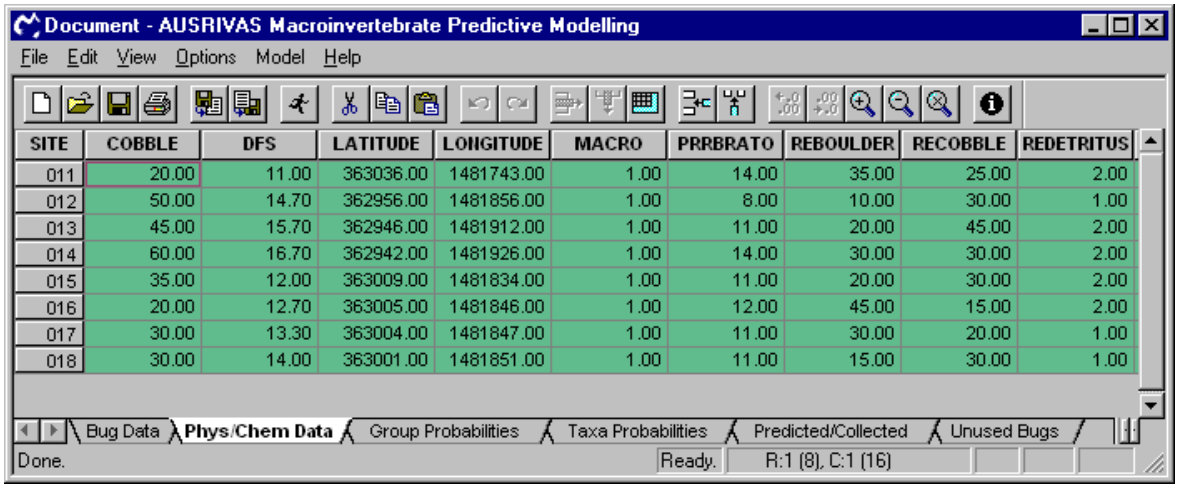
4.2.2 Phys/chem data sheet

Data ordered

After you have run a model, your 'Phys/Chem Data' will be ordered alphabetically by variable name. 'Phys/Chem Data' are also ordered, and the examples below show the 'Phys/Chem Data' datasheet before and after a model has been run.



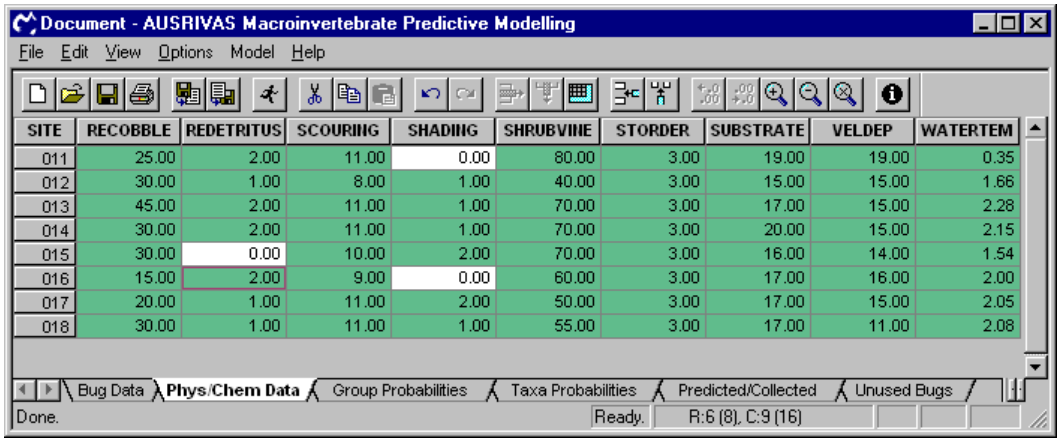
SITE	LONGITUDE	LATITUDE	SHRUBVINE	WATERTEM	REBOULDER	RECOBBLE	REDETRITUS	COBBLE	MACRO
011	1481743.00	363036.00	80.00	0.35	35.00	25.00	2.00	20.00	1.00
012	1481856.00	362956.00	40.00	1.66	10.00	30.00	1.00	50.00	1.00
013	1481912.00	362946.00	70.00	2.28	20.00	45.00	2.00	45.00	1.00
014	1481926.00	362942.00	70.00	2.15	30.00	30.00	2.00	60.00	1.00
015	1481834.00	363009.00	70.00	1.54	20.00	30.00	2.00	35.00	1.00
016	1481846.00	363005.00	60.00	2.00	45.00	15.00	2.00	20.00	1.00
017	1481847.00	363004.00	50.00	2.05	30.00	20.00	1.00	30.00	1.00
018	1481851.00	363001.00	55.00	2.08	15.00	30.00	1.00	30.00	1.00



SITE	COBBLE	DFS	LATITUDE	LONGITUDE	MACRO	PRRBRATO	REBOULDER	RECOBBLE	REDETRITUS
011	20.00	11.00	363036.00	1481743.00	1.00	14.00	35.00	25.00	2.00
012	50.00	14.70	362956.00	1481856.00	1.00	8.00	10.00	30.00	1.00
013	45.00	15.70	362946.00	1481912.00	1.00	11.00	20.00	45.00	2.00
014	60.00	16.70	362942.00	1481926.00	1.00	14.00	30.00	30.00	2.00
015	35.00	12.00	363009.00	1481834.00	1.00	11.00	20.00	30.00	2.00
016	20.00	12.70	363005.00	1481846.00	1.00	12.00	45.00	15.00	2.00
017	30.00	13.30	363004.00	1481847.00	1.00	11.00	30.00	20.00	1.00
018	30.00	14.00	363001.00	1481851.00	1.00	11.00	15.00	30.00	1.00

4.2.3 Presence/absence highlighting

The 'Phys/Chem Data' also highlighted to indicate presence/absence. Zero values are highlighted in white, while non-zero values are shown as green.

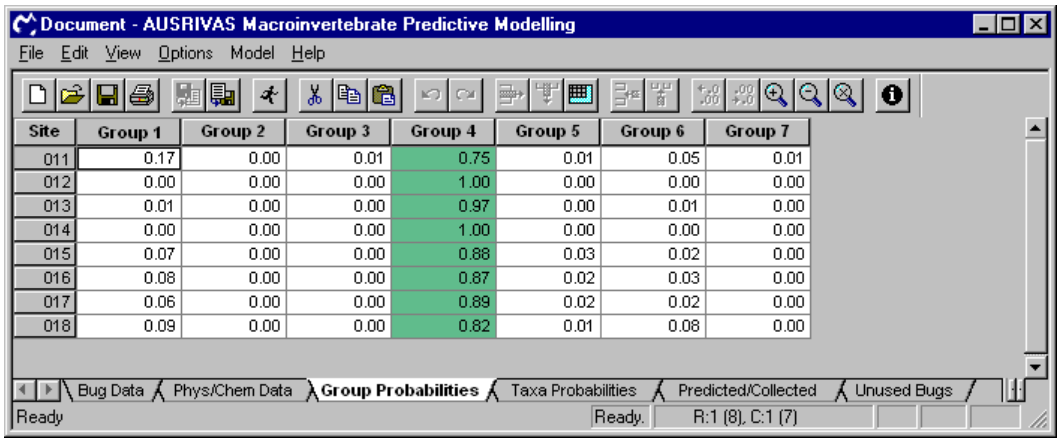


SITE	RECOBBLE	REDETRITUS	SCOURING	SHADING	SHRUBVINE	STORDER	SUBSTRATE	VELDEP	WATERTEM
011	25.00	2.00	11.00	0.00	80.00	3.00	19.00	19.00	0.35
012	30.00	1.00	8.00	1.00	40.00	3.00	15.00	15.00	1.66
013	45.00	2.00	11.00	1.00	70.00	3.00	17.00	15.00	2.28
014	30.00	2.00	11.00	1.00	70.00	3.00	20.00	15.00	2.15
015	30.00	0.00	10.00	2.00	70.00	3.00	16.00	14.00	1.54
016	15.00	2.00	9.00	0.00	60.00	3.00	17.00	16.00	2.00
017	20.00	1.00	11.00	2.00	50.00	3.00	17.00	15.00	2.05
018	30.00	1.00	11.00	1.00	55.00	3.00	17.00	11.00	2.08

4.3 Group probabilities

The first AUSRIVAS output sheet, labelled Group Probabilities, lists the probability of your test site belonging to each of the reference site classification groups. This output is useful for determining to which group of reference sites your test site is most similar in physical and chemical character.

A probability of group membership of ≥0.5 is highlighted in green, with the rest of the data (probability of group membership <0.5) is highlighted in white.



Site	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
011	0.17	0.00	0.01	0.75	0.01	0.05	0.01
012	0.00	0.00	0.00	1.00	0.00	0.00	0.00
013	0.01	0.00	0.00	0.97	0.00	0.01	0.00
014	0.00	0.00	0.00	1.00	0.00	0.00	0.00
015	0.07	0.00	0.00	0.88	0.03	0.02	0.00
016	0.08	0.00	0.00	0.87	0.02	0.03	0.00
017	0.06	0.00	0.00	0.89	0.02	0.02	0.00
018	0.09	0.00	0.00	0.82	0.01	0.08	0.00

4.4 Taxa probabilities

The Taxa Probabilities output sheet lists the **probability of each taxon being found at a tested site**.

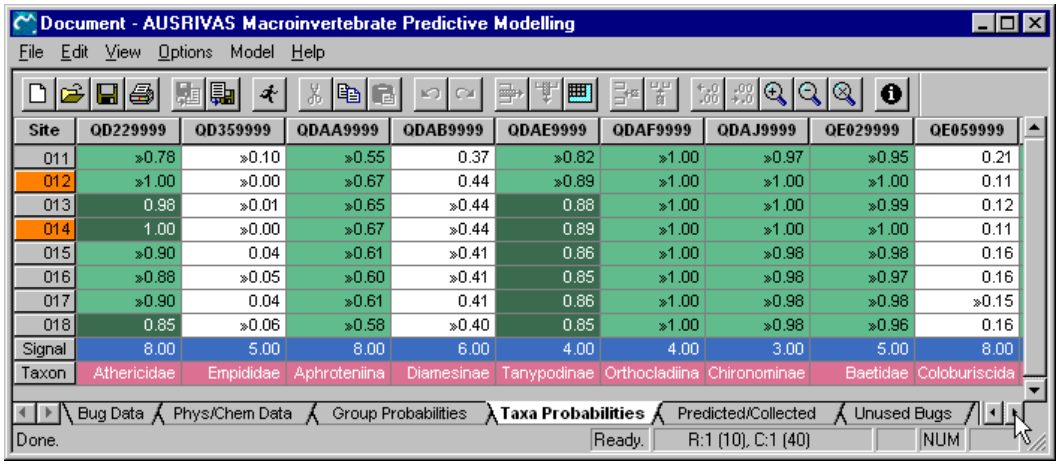
In the following section, *x* denotes the user set probability (a value between 0 and 100), or the default probability of 50%, if the user has not defined one.

Taxa that were present (collected) at the test site are flagged (») and those with >*x* probability of occurrence are highlighted in light green. Taxa that were predicted with >*x* probability of occurrence **but not collected** are highlighted in dark green. Other taxa that were not collected at a site are shown in white on the AUSRIVAS screen.

This output can be used to determine what taxa you would expect to find at the test site and whether they were actually collected. A taxon with a 0.12 probability of occurrence that was not collected would not be cause for concern because it would rarely be found, even if the site were equivalent to reference. However, if a taxon with a 0.95 probability of occurrence was not collected it is reasonable to assume that some impact may have caused its absence.

The **SIGNAL grades** for these families are also provided at the end of the spreadsheet to give a general indication of the sensitivity of each of the families to pollution. Biological information about that taxon may then indicate the type of impact the test site could be experiencing, providing a focus for further investigation. The signal grades are highlighted in blue.

Taxon names are also provided on this data sheet. They are highlighted in pink.



Site	QD229999	QD359999	QDAA9999	QDAB9999	QDAE9999	QDAF9999	QDAJ9999	QE029999	QE059999
011	»0.78	»0.10	»0.55	0.37	»0.82	»1.00	»0.97	»0.95	0.21
012	»1.00	»0.00	»0.67	0.44	»0.89	»1.00	»1.00	»1.00	0.11
013	0.98	»0.01	»0.65	»0.44	0.88	»1.00	»1.00	»0.99	0.12
014	1.00	»0.00	»0.67	»0.44	0.89	»1.00	»1.00	»1.00	0.11
015	»0.90	0.04	»0.61	»0.41	0.86	»1.00	»0.98	»0.98	0.16
016	»0.88	»0.05	»0.60	»0.41	0.85	»1.00	»0.98	»0.97	0.16
017	»0.90	0.04	»0.61	0.41	0.86	»1.00	»0.98	»0.98	»0.15
018	0.85	»0.06	»0.58	»0.40	0.85	»1.00	»0.98	»0.96	0.16
Signal	8.00	5.00	8.00	6.00	4.00	4.00	3.00	5.00	8.00
Taxon	Athericidae	Empididae	Aphroteniina	Diamesinae	Tanypodinae	Orthocladiina	Chironominae	Baetidae	Coloburiscida

Note: The orange highlighting of sites 012 and 014 in this example indicate that these sites are **'nearly outside the experience of the model'**. More information on this can be found in Section 3.6.3 and Chapter 7.

4.5 Predicted/collected

The 'Predicted/Collected' output sheet provides an assessment of biological condition of a test site. The indices produced here are described in the following sections.

4.5.1 Predicted, expected and observed taxa

The first four columns of the 'Predicted/Collected' output sheet give information on the predicted, expected and observed numbers of taxa.

NTEx

The **N**umber of inver**T**ebrate families **E**xpected with greater than a *x*% probability of occurrence, NTE*x*, is the sum of the probabilities of all the families predicted with greater than a *x*% chance of occurrence.

NTPx

NTP*x* is a count of the **N**umber of inver**T**ebrate families **P**redicted with greater than a *x*% probability of occurrence .

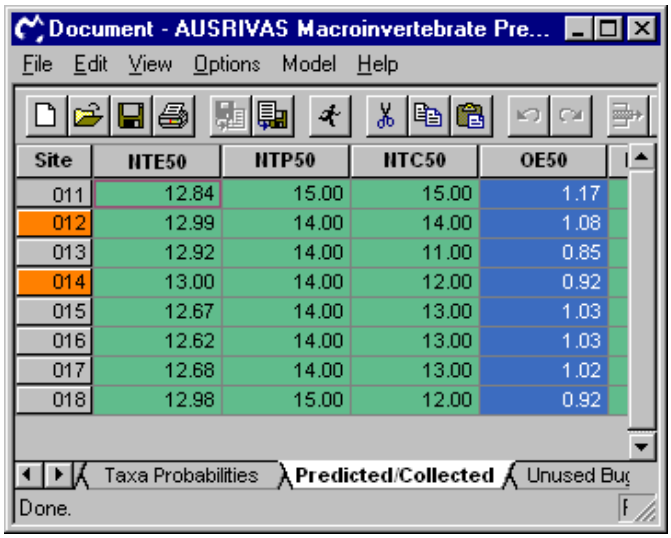
NTCx

The inver**T**ebrate families that were predicted above the threshold probability of *x*% and which were also **C**ollected at the test site are counted to form the observed (collected) value, NTC*x*.

OEx

The **O**bserved to **E**xpected ratio, OE*x*, is the ratio of the number of invertebrate families observed at a site (NTC*x*) to the number of families expected (NTE*x*) at that site. OE*x* provides a measure of biological impairment at the test site.

The output of these four indices is shown below for an *x* value of 50%.



Note: See Section 0 for information on how to set the value of *x.*

4.5.2 Predicted, expected and observed signal

In addition to calculating the expected number of taxa at a test site, AUSRIVAS also calculates the **SIGNAL scores** for a site. Calculation of the SIGNAL scores uses SIGNAL grades, an assigned value given to each invertebrate family that indicates their sensitivity to pollution. Columns 5 to 10 in the 'Predicted/Collected' output sheet contain the calculated signal scores, each of which is explained below.

ExSignal

E*x*Signal is the expected signal score for taxa that have a probability of occurrence of greater than or equal to *x*%. It is calculated by weighting the probability of occurrence of each **predicted** taxa (those taxa that have a probability of occurrence of greater than or equal to *x*%) by the taxon's SIGNAL Grade, summing these and then dividing the total by the sum of the (unweighted) probabilities of occurrence.

$$E_x Signal = \frac{\sum_{i-1}^{N_p(x)} P(Taxa_i) \times SignalGrade_i}{\sum_{i-1}^{N_p(x)}}$$

OxSignal

O*x*Signal is the observed signal score for taxa that have a probability of occurrence of greater than or equal to *x*%. It is calculated by averaging the SIGNAL Grade's for all observed taxa with P(Taxa) ≥*x/100*.

$$O_x Signal = \frac{\sum_{j-1}^{N_o(x)} SignalGrade_j}{N_o(x)}$$

OExSignal

The observed to expected SIGNAL ratio, OE*x*Signal, is the ratio of E*x*Signal to O*x*Signal.

E0Signal

E0Signal is calculated the same way as E*x*Signal, except all taxa that have a probability of occurrence of greater than 0% are included in the calculation.

$$E_o Signal = \frac{\sum_{i-1}^{N_p(0)} P(Taxa_i) \times SignalGrade_i}{\sum_{i-1}^{N_p(0)} P(Taxa_i)}$$

O0Signal

O0Signal is the observed signal score for taxa that have a probability of occurrence (*P(Taxa)*) of greater than 0%. It is calculated by averaging the SIGNAL Grade's for all observed taxa. O0Signal is equivalent to the 'raw' SIGNAL score (Chessman, 1995).

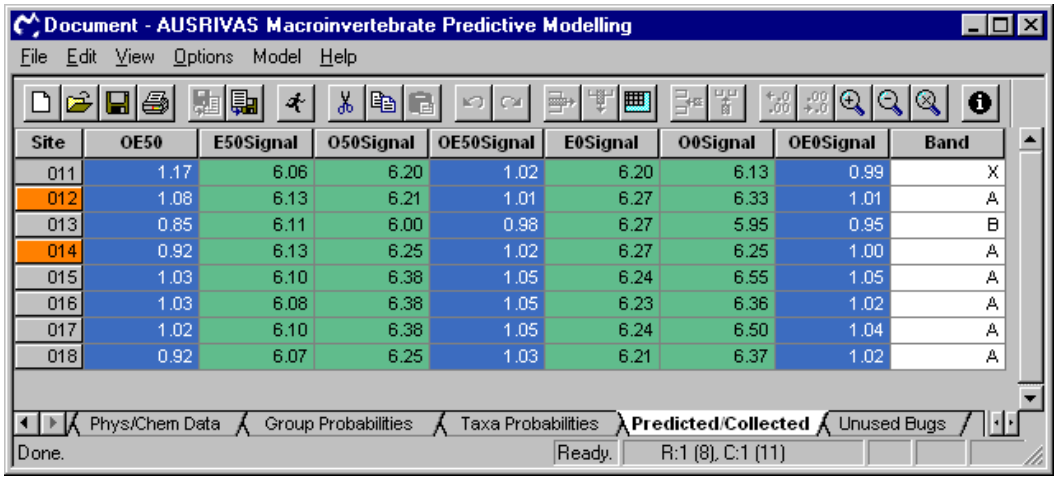
$$O_0 Signal = \frac{\sum_{j-1}^{N_0} SignalGrade_j}{N_0}$$

OE0Signal

The observed to expected SIGNAL ratio, OE0Signal, is the ratio of E0Signal to O0Signal.

$$OExSignal = \frac{ExSignal}{OxSignal}$$

The calculated SIGNAL Scores are shown in the screen shot below, for a value of *x* = 50.



Site	OE50	E50Signal	O50Signal	OE50Signal	E0Signal	O0Signal	OE0Signal	Band
011	1.17	6.06	6.20	1.02	6.20	6.13	0.99	X
012	1.08	6.13	6.21	1.01	6.27	6.33	1.01	A
013	0.85	6.11	6.00	0.98	6.27	5.95	0.95	B
014	0.92	6.13	6.25	1.02	6.27	6.25	1.00	A
015	1.03	6.10	6.38	1.05	6.24	6.55	1.05	A
016	1.03	6.08	6.38	1.05	6.23	6.36	1.02	A
017	1.02	6.10	6.38	1.05	6.24	6.50	1.04	A
018	0.92	6.07	6.25	1.03	6.21	6.37	1.02	A

4.5.3 The banding scheme

For each model the O/E taxa ratios are divided into bands representing different levels of impairment. Band X represents a richer invertebrate community than reference, band A is considered equivalent to reference; band B represents sites below reference condition; band C represents sites well below reference condition; and band D represents impoverished sites. The band for each site is listed in the last column on the 'Predicted/Collected' output sheet, as shown in the screenshot above.

4.5.4 Further information

For further explanation of how indices and bands are calculated, refer to Chapter 3 in the AUSRIVAS Predictive Modelling Manual.

4.6 EPT Predicted/collected

The EPT predicted/collected data sheet provides an assessment of biological condition of a test site, using only EPT taxa. The indices produced here are described in the following sections.

4.6.1 EPT Predicted, expected and observed taxa

The three columns of the 'EPT Predicted/Collected' datasheet give information on the predicted, expected and observed numbers of EPT taxa.

OE0EPT is calculated as for OE0 with the restriction that the only taxa considered are EPT taxa.

Count

Count is the number of **different** EPT taxa sampled. All collected taxa are included in this count, regardless of whether they are included in the model.

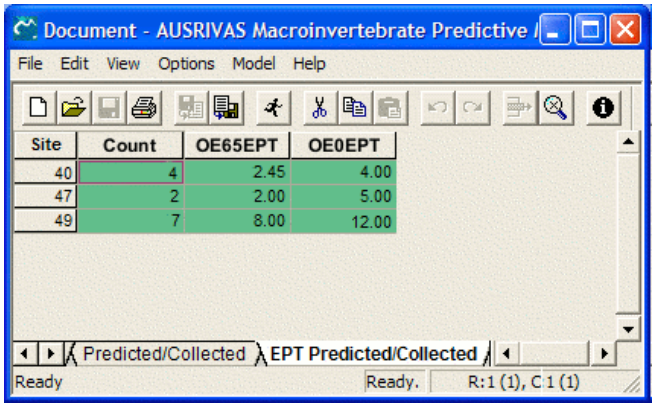
OExEPT

The **O**bserved to **E**xpected ratio, OExEPT, is the ratio of the number of EPT invertebrate families observed at a site to the number of EPT families expected at that site. The index is derived using only taxa that were calculated to have a probability of **x%** or greater of occurring at a test site. OExEPT is calculated as for OEx (see Section 0) with the restriction that the only taxa considered are EPT taxa.

OE0EPT

The **O**bserved to **E**xpected ratio, OE0EPT, is the ratio of the number of EPT invertebrate families observed at a site to the number of EPT families expected at that site. The index is derived using only taxa that were calculated to have a probability of **0%** or greater of occurring at a test site. OE0EPT is calculated as for OEx (see Section 0) with the restrictions that the only taxa considered are EPT taxa, and that all taxa predicted to occur are included in the calculations.

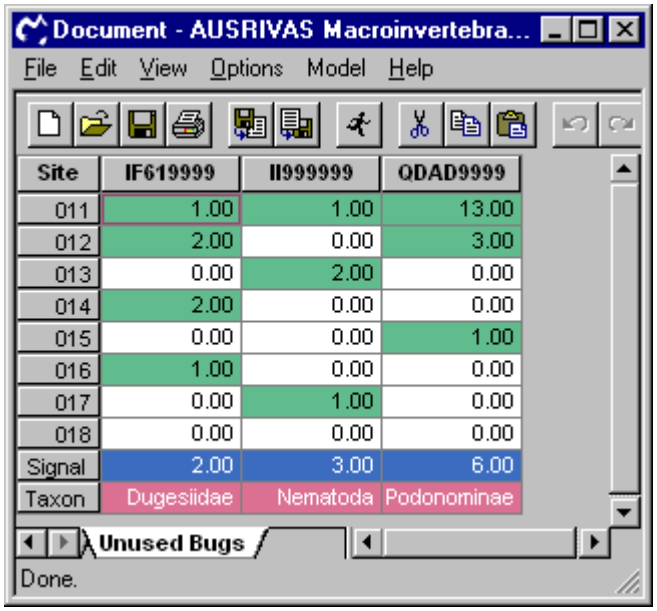
The output of these three indices is shown below for an *x* value of 65%:



Note: See Section 0 for information on how to set the value of *x.*

4.7 Unused taxa

The last data sheet in AUSRIVAS, Unused Bugs, contains the macroinvertebrate families that were present and collected at the site but not used by the model as seen below. These taxa are generally rarer families that cannot be incorporated into the analysis. However, their presence may provide further information for interpretation of the type of impact or the severity of biological impairment at the test site.



Note: Always check that the taxon codes listed in the 'Unused Bugs' sheet are spelled correctly. If the taxon codes are incorrect, your data will have been unintentionally omitted.

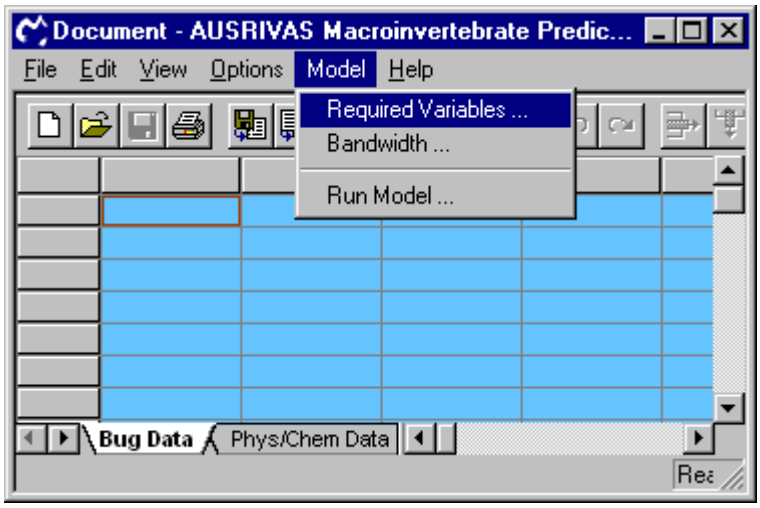
Note: The data shown in the 'Unused Bugs' sheet has been moved here from the input datasheet 'Bug Data', so if you export the 'Bug Data' sheet after running a model, it will not include the macroinvertebrates listed in the 'Unused Bugs' sheet in it.

4.8 Model information

Along with the output data sheets produced by AUSRIVAS, you can also obtain information about the models. The information available is:

- Required predictor variables for each model, and
- O/E bands for each model.

Both sets of information can be obtained from the **'Model'** menu. Select **'Required Variables ...'** to view lists of predictor variables, or **'Bandwidth ...'** to view O/E-taxa bands as seen below:



4.8.1 Required predictor variables

Information on how to view and use the **'Required Variables'** dialog can be found in Section 3.2 and also in Section 3.8.

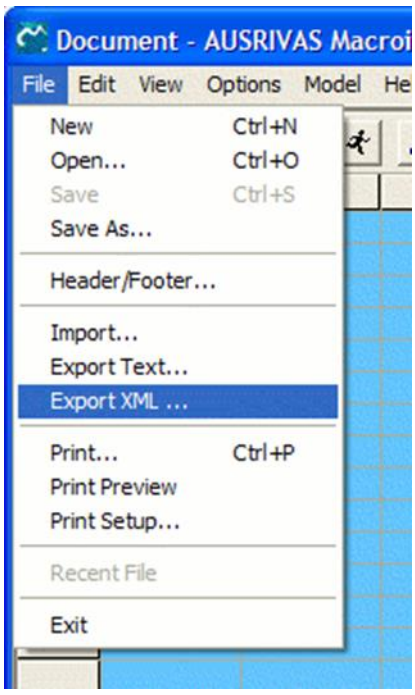
4.8.2 O/E bands

Information on how to use the O/E Bands dialog is given in Section 3.8.3

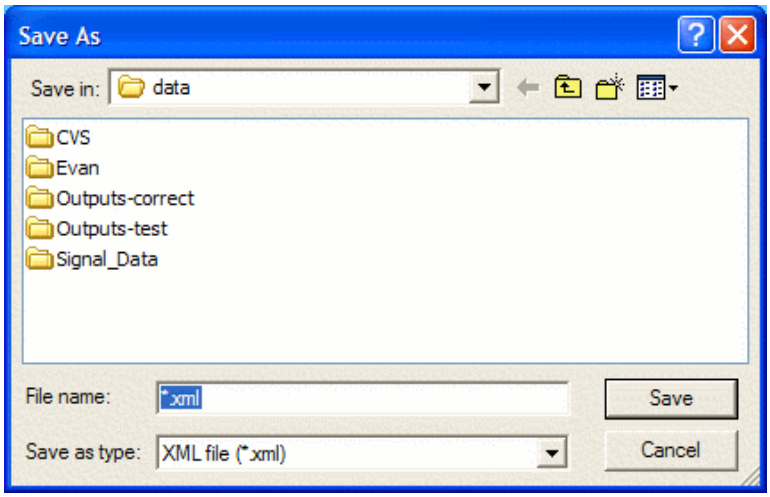
CHAPTER 5. SAVING AUSRIVAS DATA

5.1 XML output

Users can export AUSRIVAS inputs and outputs in XML format. Both inputs and outputs are saved to the same file. To export to XML, open the **'File'** menu, and select **'Export XML'** (as shown below).



When the user clicks on **'Export XML'** in the **'File'** menu, a dialog box will open to allow the user to select or input a name for the XML file (as shown below).



CHAPTER 6. TROUBLESHOOTING GUIDE

6.1 Internet access problems

6.1.1 Cannot connect to AUSRIVAS server

Symptoms

When attempting to run AUSRIVAS v3.0 or below, an error message similar to one of the following is generated:

- `Unable to create empty document`
- `AUSRIVAS error: cannot connect to the AUSRIVAS server`

Description of problem

Incorrect Proxy Settings

Your proxy settings may not be correct. When the AUSRIVAS program starts, it attempts to connect to the AUSRIVAS server. If this attempt fails, and you have selected to work in online mode you may get an error similar to the above.

Network down

Part of the network at your site, or at the University of Canberra, where the AUSRIVAS data server is located, may be temporarily down.

Solution

Incorrect Proxy Settings

Find out the details of and configure your proxy server settings as described in Section 3.4. Consult your local systems administrator if the problem persists.

Network down

Try the software again later. Consult your local systems administrator and contact ausrivas@canberra.edu.au if the problem persists.

6.1.2 Proxy authentication required

Symptoms

When attempting to run AUSRIVAS v2.2 or below, an error message similar to one of the following is generated:

- `HTTP error 407: Proxy authentication required`

Description of problem

AUSRIVAS Version 2.2 and below

AUSRIVAS 2.2 and below does not support proxy authentication. If your proxy server requires authentication (i.e. you have to provide a username and password to access the Internet) then you will need to upgrade to version 3.0 or above.

AUSRIVAS Version 3.0 and above

Your proxy authentication settings in AUSRIVAS are possibly not correct.

Solution

AUSRIVAS Version 2.2 and below

Upgrade the AUSRIVAS Macroinvertebrate Predictive Modelling Software to version 3.0 or above, as described in Chapter 3.

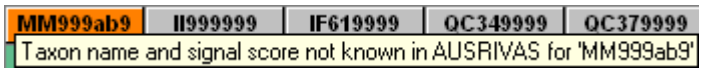
AUSRIVAS Version 3.0 and above

Following the procedure outlined in Section 3.4 make sure that your proxy server settings and your Internet username and password are correct. Consult your local systems administrator if the problem persists.

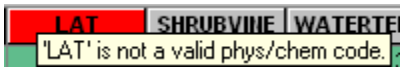
6.2 Errors or warnings in your input data

Errors and Warnings in your input data are discussed in earlier chapters in this manual. Refer to the Sections below to find information on the error/warning you are interested in.

6.2.1 Warnings

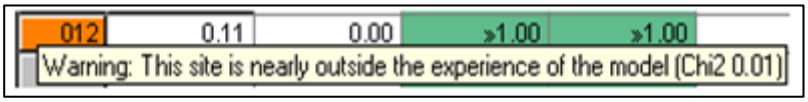
Warning	Refer to
Missing Taxa	Section 3.6.1
Taxon name and signal score not known in AUSRIVAS 	Section 3.3.3
Site is nearly outside the experience of the model (Chi2 0.01)	Section 3.6.2 and Chapter 7

6.2.2 Errors

Warning	Refer to
Missing predictor variable	Section 3.6.1
Site Mismatch	Section 3.6.1
Blank data cells	Section 3.6.1
Not a valid phys/chem code 	Section 3.3.3
Site is outside the experience of the model (Chi2 0.001)	Section 3.6.2 and Chapter 7

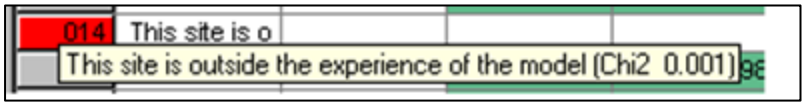
6.3 Errors in your outputs

6.3.1 Site is nearly outside the experience of the model



For information on this warning, refer to Section 3.6.2 and Chapter 7.

6.3.2 Site is outside the experience of the model



For information on this warning, refer to Section 3.6.2 and Chapter7.

6.3.3 Site is unexpectedly outside the experience of the model

If your site is unexpectedly outside the experience of the model, check the Phys/Chem input data for errors, such as:

- Typographic errors;
- Incorrect units of measurement used for predictor variables;
- Incorrect format used for LATITUDE or LONGITUDE predictor variables.

6.3.4 Extra output or incorrect colour coding of output

Each time a model is run the **existing data in the spreadsheet should be cleared** to ensure that this data does not remain when new data are run through the model. There are several ways to **clear data**:

1. Select the entire spreadsheet by clicking in the top left corner of the spreadsheet and then select 'Clear' from the 'Edit' menu.
2. Click on the new icon  in the toolbar.
3. Select 'New' from the 'File' menu.

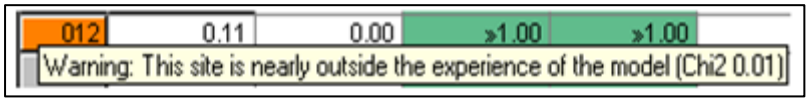
CHAPTER 7. WHAT IS THE CHI^2 TEST?

7.1 What is the Chi^2 test?

The Chi2 test is used to determine if a test site falls within the experience of the AUSRIVAS model. Any test sites with no appropriate reference group for comparison are identified as being **'outside the experience of the model'**.

AUSRIVAS determines that a site **is 'outside the experience of the model'** if its critical value is within the 0.1 percent area (alpha = 0.001) in the tail of the Chi2 distribution. In the case of a site being outside the model's experience, the site is colour coded in red, the error message detailed below is shown and no output is produced for that site (shown below).

AUSRIVAS also determines when a site is **'nearly outside the experience of the model'**. In this case, the critical value falls within the 1 percent area (alpha = 0.01) in the tail of the Chi2 distribution. If a site is **'nearly outside the experience of the model'** as determined by the above test, the site is colour coded in orange and a warning message is given (shown below). In this case, output data for the site are still produced but should be interpreted with caution.



7.1.1 Is the site unexpectedly outside the experience of the model?

If your site is unexpectedly outside the experience of the model, check the **'Phys/Chem'** input data for errors, such as:

- typographic errors,
- incorrect units of measurement used for predictor variables, or
- incorrect format used for LATITUDE or LONGITUDE predictor variables.

7.1.2 Further information

For further information see:

Clarke, R.T., Furse, M.T., Wright, J.F. and Moss, D. (1996). Derivation of a biological quality index for river sites: comparison of the observed with the expected fauna. *Journal of Applied Statistics* **23**, 311-332.

CHAPTER 8. HELP

For all questions and help with the following subjects please contact: ausrivas@canberra.edu.au

- *Software or technical problems*
- *Errors running the model*
- *Construction of a new model*
- *For information on coverage of models* - https://ausrivas.ewater.org.au/index.php/models
- *Manuals* - https://ausrivas.ewater.org.au/index.php/manuals-a-datasheets
- *Problems with your password*

REFERENCES

Chessman, B.C. (1995). Rapid river assessment using macroinvertebrates: a procedure based on habitat specific sampling, family level identification and a biotic index. *Australian Journal of Ecology* **20**, 122-129.